REDLAND WATER

Water Supply Network Master Plan

Rev 0

January 2010

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Notation and Abbreviations

AHR	Alexandra Hills Reservoir complex
DMA	District Meter Area
EP	Equivalent Person
FF	Fire Flow
FF DSS	Fire Flow Desired Standards of Service in the (NRW) Planning Guidelines for Water Supply and Sewerage – Chapter 6 – Network Modelling (June 2007 version)
HLZ	High Level Zone
HRR	Heinemann Road Reservoir complex
ICS	Infrastructure Charges Schedule
LLZ	Low Level Zone
NRW	Department of Natural Resources and Water
PH	Peak Hour (peak diurnal flow on the Maximum Day)
PIP	Priority Infrastructure Plan
MDA	Major Development Area
MUID	Mike Urban Identification Number
NSI	North Stradbroke Island
PLMP	Pressure and Leakage Management Program
PRV	Pressure Reducing Valve
QAO	Queensland Audit Office
RPS	Redland Planning Scheme
SMBI	Southern Moreton Bay Islands
WTP	Water Treatment Plant

Executive Summary

Since the completion of the PIP / ICS planning work undertaken by MWH in 2006 and reviewed by Opus International Consultants (PCA) Ltd in 2007, the water supply network operated by Redland Water has changed significantly. Drought emergency projects such as the Pressure and Leakage Management Program (PLMP) have driven changes to the way the water supply system is operated. The division of the network into discrete areas called District Meter Areas (DMAs) heavily impacts on the validity of some of the augmentations proposed in the MWH 2006 report.

This report details modelling undertaken to confirm the system configuration under ultimate demand (2025) under the DMA configured network. The demand model used in this assessment of the network is the model prepared by MWH for the original version of the PIP.

At this point in time only areas of the network that have been split into DMAs have been remodelled to ultimate (2025) demands. Those areas which have not been reviewed as part of this study are:

- Southern Moreton Bay Islands
- Heinemann Road
- Mount Cotton Area
- Mount Cotton Trunk
- Duncan Road
- Howletts Road
- Alexandra Hills HLZ & LLZ (preliminary modelling has indicated that the areas near the high level zone may not meet the DSS in the future)
- Point Lookout

Further work will be required in these areas, particularly in the Alexandra Hills zones.

Key Assumptions

In developing the study the following key assumptions have been adopted.

- That fire flow augmentations proposed in the *Redland Water – Water Supply System Fire Flow Review*, and currently being designed will be constructed by the time ultimate demands (2025) are reached.
- That the design criteria for demand per Equivalent Person (EP) remains at 300L/EP/day.
- DMAs and their associated PRVs recently installed as part of work completed under the legislated regional project will remain an integral part of the water supply network, particularly for leakage reduction, into the future.
- The network will need to comply with the DSS as outlined in this document.

Major Recommendations

The most significant recommendations included in the report are summarised below.

- Split Serpentine Creek Road DMA into two DMAs (don't augment the Giles Road alignment into the northern part of the current DMA as proposed in the MWH report).
- Further work is required in the southern area of DMA106 when it is known what is planned for the previous "Redland Bay South Investigation Zone".
- Giles Road PRV is removed or remains fully open.
- The submarine main to Coochiemudlo Island is augmented. The timing of the augmentation needs to be reviewed in line with actual demand in the DMA.
- The Victoria Point DMA remains off the Bunker Road South DMA
- The Bunker Road South DMA is split into 3 separate DMAs. The need for pressure reduction in the new DMAs will need to be investigated.
- Ensure sufficient space remains in the road reserve at the Corner of Ziegenfusz Rd and Cleveland – Redland Bay Road so a flow meter and PRV can be installed.
- That a valve be inserted in the 150mm main from Flamingo Crescent to the 300mm main upstream of the Thornlands PRV as soon as possible.
- That the Ronnie Street area in Alexandra Hills LLZ is connected to the Thornlands DMA

- The area around Whitby Place is removed from the Thornlands DMA and connected to the Mt Cotton Trunk DMA.
- When the lot layout for the Kinross Road area is finalised, the proposed water supply reticulation is modelled to ensure its suitability.
- A flow meter is installed at Amity Point so more detailed data is available on the operation of the system and a review is undertaken to confirm which properties are assessed as commercial for fire flow purposes.
- The Tazi Reservoir is abandoned and a new reservoir is constructed at Illawong Crescent. Additional pipework augmentations and the installation of a PRV will be required as part of this work.
- Those areas that have not been reviewed as part of this report are reviewed and included in the next revision. Additional investigation will also be required in Amity Point once better flow data is available.
- Population estimates are reviewed and updated to reflect the current trends.
- That a detailed study of water quality in the Redland City Council distribution system be undertaken with a view to optimising the operation of the system, particularly the larger trunk mains originally intended for transfer of water that are no longer needed (as regularly) under the operations of the SEQ Water Grid

LinkWater Liaison
LinkWater will need to be advised of the outcomes of this study, particularly in relation to the following items:

- The proposed work in the Kinross Road area where connection of a 300mm diameter to their infrastructure at the corner of Taylor Road and Redland Bay Road is proposed and the assumption of water being transferred from south to north underlying the boundary conditions for this report.
- An additional connection off the 750mm trunk main at Redland Bay (to feed the split Serpentine Creek Road DMA).
- The inadequate capacity of the Alexandra Hills HLZ reservoir.

It is also anticipated that LinkWater will undertake a study detailing the intended operation of the Trunk Network System including the Mt Cotton and Alexandra Hills HLZ Reservoirs.

Estimated Costs
Cost estimates have been completed based on the Gold Coast Water Unit Rates Review.

A summary of the costs are included in the tables below.

Summary of Costs

Type of work	Quantity	Establishment Cost ($)	Present Value ($)#
Infrastructure Charges Pipe work	10 905 m	$10,338,228	$8,386,099
Infrastructure Charges Reservoirs	0.25 ML	$135,610	$128,118
Infrastructure Charges Valves	8 No.	$419,273	$385,156
Sub-Total	-	*$10,893,112*	*$8,899,373*
Augmentations	2 796 m	$1,309,734	$1,066,951
Reticulation (developer to construct)*	1 674 m	$583,745	$469,587
	Total	**$12,786,590**	**$10,435,911**

Note: # Includes Discounting and Escalation as per the Redland City Council discounting methodology.
** There is much more reticulation that needs to be constructed. This table only includes the pipework that needs to be constructed by a particular time to ensure the network continues to meet the DSS.*

A break up of costs by ICS zones is included below.

ICS Zone Costs

ICS Zone	Alexandra Hills	Amity Point	Dunwich	Heinemann Road	Mount Cotton	Point Lookout	SMBI	TOTAL
Pipes (Trunk)	$0	$0	$121,311	$7,005,254	$1,247,144	$181,646	$0	$8,555,355
Pump Stations	$0	$0	$0	$0	$0	$0	$0	$0
Reservoirs	$0	$0	$128,118	$0	$0	$0	$0	$128,118
Valves	$49,877	$0	$28,450	$267,643	$39,185	$0	$0	$385,156
Total	$49,877	$0	$277,879	$7,272,897	$1,286,329	$181,646	$0	$9,068,629

Recommendations

It is recommended that the strategies adopted in this report be adopted in future master planning of the water supply network, including a revised PIP / ICS prepared by Council.

1. Introduction

1.1 Background

The Redland City Council water supply network supplies potable water to approximately 96% of the population on the mainland, the Southern Moreton Bay Islands of Russell Island, Macleay Island, Lamb Island and Karragarra Island as well as separate water supply schemes for each of the North Stradbroke Island (NSI) townships of Dunwich, Amity Point and Point Lookout.

The majority of the City is connected to the scheme supplied by the Water Treatment Plant (WTP) at Capalaba and the Herring Lagoon of NSI WTP. Water for the Capalaba WTP is sourced from the Leslie Harrison Dam while water from the NSI WTP can be sourced from either Herring Lagoon or a series of bores on the island.

Historically planning has been based on a relatively 'open' network with the exception of the high level zones throughout the City. The onset of the regional drought (sometimes referred to as the 'Millennium Drought') saw the participation in demand management projects such as the South East Queensland (SEQ) Regional Pressure and Leakage Management Program (PLMP) become legislated by the State Government. This implementation of PLMP in the Redland City water supply network is a fundamental change to the way the system has been operated and how future augmentations for growth have been determined. Coupled with the impacts to the change in the network, Redland Water undertook a complete rebuild of its water supply network model using DHI's software Mike Urban. This new model was a significant improvement on the preceding one in terms of the extent of network elements included and accuracy of their attributes. The data collected as part of the PLMP has also given a good density of network pressure information and reasonable density of network flow information on which the calibration (to a verification level only) of the model has been completed. Model verification information is contained in the individual District Meter Area (DMA) reports prepared as part of the PLMP and referenced in **Section 24**.

The Queensland State Government has also commenced a program of reform in the water industry in SEQ. To date this reform has mainly focussed on the State of Queensland taking control of local council bulk water assets. In Redland's case this has resulted in all the WTPs (Amity Point, Dunwich, Point Lookout, NSI & Capalaba) being transferred to the State owned company Seqwater and the bulk transport mains (broadly described as mains from NSI WTP to Heinemann Road Reservoir (HRR) complex and from there up Mount Cotton Road to Alexandra Hills Reservoir (AHR) complex and from Capalaba WTP up to AHR complex) and well as all mainland reservoirs transferring to LinkWater. These are shown on **Figure 1.2**. As well as the asset takeover, the control of 'water movement' in the region is now controlled by the SEQ Water Grid Manager. This reform program has impacted on the way Redland Water operates its remaining (distribution) assets, particularly the Bunker Road North Control Valve. These changes also significantly change the intent of planning work done, particularly in relation to infrastructure planned for contingency scenarios as well as some trunk infrastructure.

As detailed above there are some significant drivers for completing a review of planning work undertaken for the water supply network. It is acknowledged that there are further issues that this report cannot address, but it is intended that the underlying augmentation strategies that identified in this report are carried forward into future planning work for the Redland water supply network.

1.2 Previous Planning

Within the context of the significant changes to the water supply network as detailed above, this section of the Master Plan details the applicability of the most recent whole of network planning that has been undertaken including a description of the operation of the system both before PLMP and after PLMP.

1.2.1 System Operation Prior to PLMP

NSI Water Treatment Plant

The 750mm ø main which runs from the NSI WTP clear water storages to HRR complex was used to supply parts of the mainland and Southern Moreton Bay Islands (SMBI). The supply was generally gravity fed, but there are booster pumps at NSI which have been used when necessary. The main has a Flow Control Valve (FCV) on Russell Island. The Russell Island FCV is controlled by the levels in the NSI Clear Water Storages and is used to prevent the NSI CWSs from emptying. HRR complex has a float valve which opened and closed based on the levels in the HRR complex reservoir. Its operation was not related to the levels in the NSI clear water storages.

The 750mm ø main from NSI WTP to HRR complex has four off-takes; including three PRVs to supply local zones. On Russell Island alone, there is the Russell Island East PRV, the High St PRV and a 450mm ø main to supply the SMBIs located north of Russell Island. On the mainland there is the Serpentine Ck Rd PRV.

Capalaba Water Treatment Plant

Water from the clear water storages was pumped from the treatment plant part way to the AHR complex via two pipes, a 600mm ø main and a 690mm ø main approximately 5.2km long. The mains are not dedicated as there are off-takes to the reticulation along the route from Capalaba WTP to AHR complex. The rest of the way (from approximately the Ney Road and Redland Bay Road intersection) a single 600mm ø main delivers water to the AHR.

The Capalaba WTP only ran for approximately 9hrs a day from 6:00am to 3:00 pm. As a result the AHR complex could not be totally supplied from the Capalaba WTP, particularly during summer months when the demand was high. During these times, supply was supplemented with water from NSI WTP via HRR complex and the Bunker Road North Control Valve.

Heinemann Road Reservoir Complex (HRR complex)

The HRR complex was capable of servicing a number of zones, depending on how the system was operated:

- When the Russell Island Control Valve was closed it serviced the SMBIs via the 750mm ø main from NSI WTP to HRR complex;
- The Heinemann Road LLZ was supplied directly from the HRR complex;
- The Mt Cotton/Heinemann zone was serviced by the Mt Cotton Reservoir and HRR complex as described below;
- The Victoria Point PRV Zone was supplied from the Heinemann Road LLZ through a number of PRVs;
- The Heinemann Road Boosters pumped from the Heinemann Rd Reservoir to the Mt Cotton Reservoir via a 450 mm ø main (Sanctuary Drive main); and
- The Alexandra Hills LLZ was intermittently serviced from the Heinemann Road LLZ via the Bunker Road North CV.

Heinemann Road Trunk Mains

Twin 600mm ø mains run north from HRR complex along Heinemann and Bunker Roads. The mains serviced the local area via parallel 100mm reticulation mains, and had three major off-takes as follows:

- A main along Giles Road which fed the Victoria Pt PRV Zone via the Giles Road PRV;
- An off-take through the Bunker Road South PRV which fed Victoria Pt PRV Zone; and
- An off-take through the Bunker Road North CV which intermittently serviced the Alexandra Hills LLZ.

Victoria Point PRV Zone

The Victoria Point PRV Zone was fed from the Heinemann Road LLZ via three different PRVs. These were:

- Serpentine Creek Road PRV;
- Giles Road PRV; and

- Bunker Road South PRV.

The Serpentine Creek Road PRV was at the southern end of the zone and provided water to the Victoria Pt PRV Zone directly from the 750mm ø NSI to HRR complex water main. The Giles Road PRV supplied water from the Heinemann Road Supply Zone via a 600mm ø main which was connected to the 675mm ø and a 600mm ø *Heinemann Road Trunk Mains*. Note that the 675mm main reduces to a 600mm main after Giles Road. The PRV supplied the central area of the Victoria Point PRV Zone. The Bunker Road South PRV supplied water to the northern section of the Victoria Point PRV Zone.

Mt Cotton/Heinemann Road
The HRR complex supplied the Mt Cotton Village area via a 375mm ø gravity main.

Mt Cotton PRV
The Mt Cotton PRV is located south of the 450mm ø Sanctuary Drive main and it serviced the western side of the Mt Cotton Area.

Mt Cotton Zone
The Mt Cotton Zone was serviced from the Mt Cotton Reservoir. There are two mains that connect the Mt Cotton Reservoir to the Alexandra Hills Elevated tank. The Mt Cotton reservoir is located at an elevation approximately 20m higher than the Alexandra Hills elevated tank, so it is possible for the Mt Cotton reservoir to supply the Alexandra Hills HLZ. This does not happen on a day-to-day basis though as there is a normally closed valve between the two zones.

Eprapah Creek Pump Station is located on the 375mm ø main along Mt Cotton Road and was used to supply water to the southern zones from Capalaba WTP when supply from NSI WTP is low.

Alexandra Hills HLZ
An elevated tank is located near within the AHR complex, which is filled via a 300mm ø main, via booster pumps which are located off the 600mm ø main which supplies the AHR complex low level reservoirs from Capalaba WTP.

The tank could also be supplied from the Mt Cotton Reservoir during periods of low demand in the Mt Cotton Zone. A Pressure Sustaining Valve connected the Alexandra Hills HLZ and the Mt Cotton Zone to maintain pressures in the Mt Cotton Zone. However there are two sluice valves between these two zones and during normal operation they both remain shut.

Alexandra Hills LLZ
The Alexandra Hills LLZ was serviced from the AHR complex low level reservoirs and the HRR complex depending on how the system is controlled. There are five interconnected reservoirs that service the low level zone.

The south eastern area of the Alexandra Hills LLZ was intermittently supplied via the Bunker Road North Control Valve. The WTP operators were able to specify a desired flow rate through the CV for flows into the Alexandra Hills LLZ. In general the valve was closed if HRR complex was low and opened when the AHR complex low level reservoirs were low.

There is enough elevation to supply the AHR complex low level reservoirs from the HRR complex, so when demands were low and the Bunker Road Nth PRV was open, the AHR complex low level reservoirs were filled from the HRR complex.

Howletts Road HLZ
The Howletts Road HLZ was serviced by a booster pump connected to the local reticulation.

Duncan Road HLZ
The Duncan Road HLZ is part of the Mt Cotton Zone when the booster pumps are not operating, so in general can be considered part of the Mt Cotton Zone.

The pumps only operated when water was pumped south from AHR complex High Level Reservoir to the Mt Cotton Reservoir (using the Eprapah Ck PS). The difference in bottom water levels between the Alexandra Hills High Level Reservoir and the Mt Cotton Reservoir is 20m. The boosters operate based on a pressure sensor at the end of Campbell Road.

Mt Cotton HLZ
There is a small elevated area near the Mt Cotton Reservoir which was serviced via a local booster pump station. There are three pumps at this station, namely a duty pump and standby pump for Ridgewood Downs estate and a third pump, which is a dedicated fire booster pump for this zone.

The previous system zones are shown on **Figure 1.3**.

1.2.2 Priority Infrastructure Plan & Infrastructure Charges Schedule

The preparation of the Priority Infrastructure Plan (PIP) and Infrastructure Charges Schedule (ICS) planning documents was commenced in 2006 by MWH (MWH, Jan 07). MWH completed the entire project from demand projection to modelling and report preparation and charges calculations. A peer review was undertaken by Opus International Consultants (PCA) in 2007 with the March 2007 version (Opus, Mar 07) of the Water Supply Planning report being used in the first Redland City Council PIP document sent to first State interest check.

The planning and augmentations developed in the PIP / ICS master plan were based on the pre-PLMP ‘open’ network as described above and contingency infrastructure provisions planned for before Redlands’ connection to the SEQ Water Grid. The outcomes of the PIP / ICS can be seen on **Figure 1.4**.

1.2.3 Pressure and Leakage Management Program (current system)

At the height of the ‘Millennium Drought’, the Government of the State of Queensland legislated that all Councils in the SEQ Region were to participate in a Pressure and Leakage Management Program (PLMP).

The participation in the regional PLMP in Redlands has seen some major changes made to the way the distribution system is operated. It is no longer an ‘open’ system so the bulk movement of water is now through more defined paths and the other major change is that there is now a definitive limit as to how far water from the HRR complex can travel north up the Cleveland – Redland Bay Road 375mm diameter trunk main.

Although planning of District Meter Areas (DMAs) has been completed across the whole of Redland City Council, the implementation of the DMAs has been nominally limited to the south-eastern part of the City supplied from the HRR complex. With reference to the pre-PLMP system operation as described above this essentially equates to the splitting up of the old Victoria Point PRV zone into five (5) smaller DMAs, including the extension of the HRR WSZ north to South Street (the Cleveland / Thornlands suburb boundary). This work has allowed the 450mm diameter main from Bunker Road North CV to AHR complex to become a dedicated trunk main (it is now separated from the 375mm diameter main which includes all the reticulation connections along Cleveland – Redland Bay Road)

In other work completed as part of the PLMP, pressure management was optimised on the SMBIs and the Thornlands DMA (off the Mt Cotton WSZ) was constructed and commissioned.

In terms of system operation, the following summary broadly describes how the water distribution system has been planned to operate. It is important to note that this philosophy was determined prior to Redland City Council's connection to the SEQ Water Grid. The work undertaken on the PLMP, particularly the separation of the trunk mains from reticulation mains in the Bunker Road South DMA were primarily aimed at being able to increase the amount of water able to be transferred from HRR complex to AHR complex. This meant that there was generally more water produced at NSI WTP and Capalaba WTP was just run during the day to supply peak demands. Since the operation of the SEQ Water Grid commenced there has virtually been a standing order that supply from Capalaba WTP be maximised, implying that minimal water should be transferred from HRR complex to AHR complex through the Bunker Road North CV.

Water produced at the NSI WTP is delivered to the HRR complex. Along the way the off-takes on the SMBIs remain as they were pre-PLMP, with a slight alteration to the Serpentine Creek Road off-take to ensure that all water is metered before heading into the reticulation. Supply to the DMAs on the SMBIs and Serpentine Creek Road DMA are either supplied directly from NSI WTP or from HRR complex (when the Russell Island CV is closed).

Water from HRR complex is supplied into the distribution network's trunk mains to the north of the complex. The mains head towards the Bunker Road North CV and the Bunker Road South PRV. Along the way the water is metered entering the Heinemann Road DMA (201) which supplies the higher elevation, rural-residential areas behind the built-up coastal areas. At Giles Road there is trunk main connection which runs past the Giles Road PRV (unused) which in turn feeds the Benfer Road DMA and the Boundary Street DMA in the vicinity of the intersection of Double Jump Road and Cleveland – Redland Bay Road.

From the Bunker Road South PRV, water is supplied into the Victoria Point (Colburn Avenue) DMA (205) and northwards towards South Street at the suburb boundary between Cleveland and Thornlands. Water from the Bunker Road North CV (when open) flows into the reticulation at the intersection of South and Wellington Streets in Cleveland and directly to the AHR complex. Pressure management is undertaken at all the DMAs mentioned above other than the Heinemann Road DMA.

At HRR complex water is supplied south into the reticulation supplying Mount Cotton Village. Water from here is also pumped through the Sanctuary Drive 450mm diameter main to the Mount Cotton Reservoir (MCR). The Mount Cotton Road PRV separates the 450mm Sanctuary Drive main from the Mount Cotton Village Reticulation where the Sanctuary Drive main meets Mount Cotton Road. The MCR supplies the park-residential development off Sanctuary Drive including a small pump boosted areas immediately around the reservoir. The MCR is the service reservoir for the entire high level zone which extends north to the Alexandra Hills HLZ via trunk mains along Mt Cotton Road, Woodland Drive, Taylor Road and Redland Bay Road.

Water produced at the Capalaba WTP is delivered into the AHR complex to supply the Alexandra Hills LLZ. There are numerous reticulation connections off this trunk main/s and the PLMP has not constructed any DMAs in this zone. As the trunk mains reach the AHR complex, water can be delivered to the Alexandra Hills pump station which supplies the elevated tower and the Alexandra Hills HLZ. A small pump boosted zone, the Howletts Road HLZ, also exists off the reticulation in Ney Road. A series of trunk mains in the Alexandra Hills LLZ essentially provide a ring main through the zone, from the trunk mains at the corner of Redland Bay Road and Ney Road, north and then east into Birkdale, Thorneside and Wellington Point along Old Cleveland Road East and back towards AHR and Cleveland and Ormiston via Main Road, MacDonald Road, and Sturgeon Street.

The operation of the SEQ Water Grid has seen less water transferred north from HRR complex to AHR complex on a day to day basis. This means that the Bunker Road North CV is more often shut than open and the water is generally back-fed from AHR down this 450mm diameter main. There are potential water quality issues associated with this mode of operation for the trunk mains used to transfer water between HRR complex and AHR complex.

The current layout of the network including operational DMAs is shown on **Figure 1.5**.

An index of DMA numbers and names is included in **Appendix A**.

1.2.4 Redland Water – Water Supply System Fire Flow Review

In undertaking the PLMP, a complete fire flow analysis of the network was undertaken. This process identified a significant number of sites in the network where fire flow provisions were not being met. The original estimate for these works was $12M. Subsequent reviews and optimisation of the program of works culminated in the preparation of the Redland Water – Water Supply System Fire Flow Review. This report looked at the augmentations proposed in the Opus International PCA reports undertaken as part of the PLMP to identify the ‘backlog’ (areas of the network that fail at current demands) in order to prioritise the augmentations required to address the failures.

Prioritisation was based on whether network nodes failed at current reduced levels of background demand, and then sized based on planning demands. Additional augmentations were also developed for nodes that only failed when the background demand was increased to planning demands. Prioritisation of works also took into account future development potential of the surrounding land (augmentations in areas of future development were identified on a map for the Development Assessment Group to utilise) and future road widening works as well as the relative cost of the proposed augmentation.

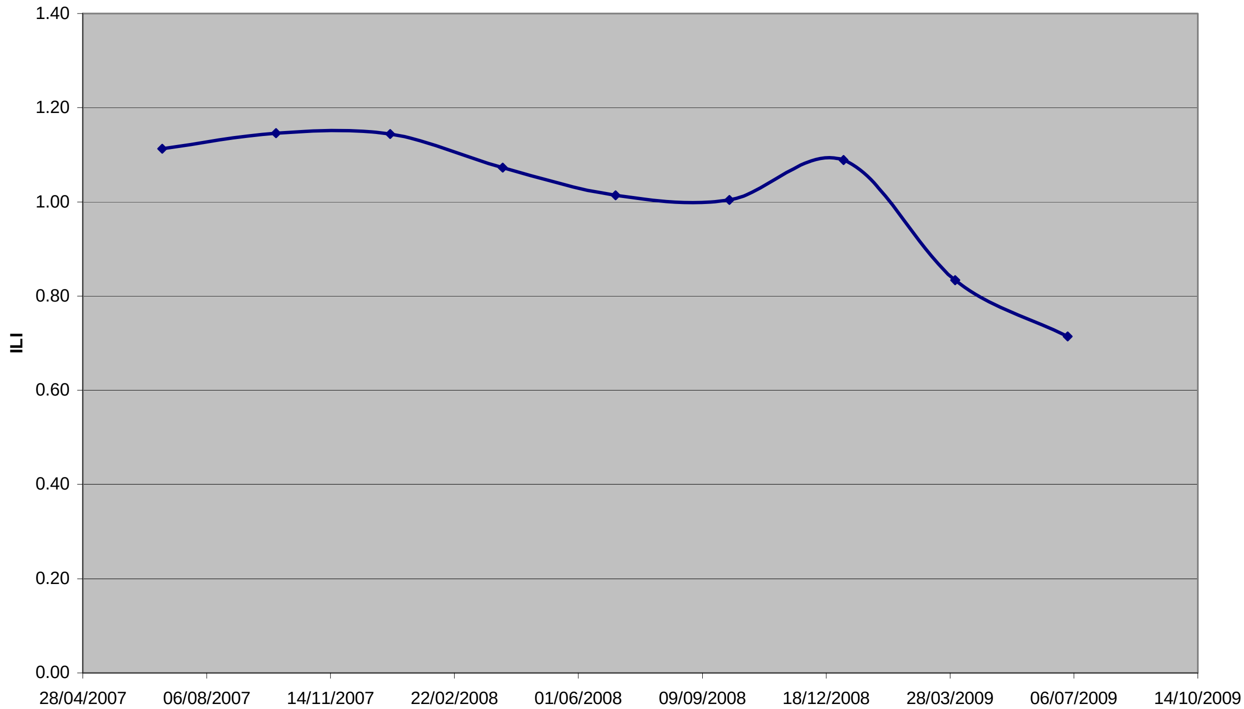
1.3 Pressure and Leakage Management Project Outcomes

International best practice for the measurement of water savings generated in DMAs is generally done on a DMA specific basis. Reporting on this basis was commenced for the Redland PLMP, however a decision was made at a regional level to report on a whole of network water balance methodology using a base point of the year the project was scoped (or in Redlands’ case the base case has been taken as the year in which reliable (water input to the network) data was recorded at the WTPs (particularly the NSI township WTPs)).

Using a whole of network water balance does not necessarily exclude other factors at play over this time period such as reduced consumption due to restrictions and other demand management strategies such as Water Efficiency Management Plans (WEMPs), but it none the less does show a trend in the leakage of the network.

Using this above referenced methodology, it can be seen in **Figure 1.1,** that there has been a substantial drop in the value of the ILI since the commencement of the PLMP. It must also be pointed out that during this time, although Redlands was not necessarily on the same restrictions that the rest of South East Queensland was on, there was certainly at least an overlap of the water conservation message that was being given in other areas of the region.

Figure 1.1 – Redland Water ILI since commencement of PLMP



1.4 Links to Redland City Council Corporate Plan

This master planning exercise supports Council's Essential Services Strategic Priority. The Water Supply Program objective is to design, construct, operate and maintain a high quality water collection, treatment and distribution system. Obviously the impacts of the Water Reform Program will ultimately require a redrafting of the Council's priority, but the focus of this report is on the distribution system aspect of that priority which currently remains under Council control.

The Long Term Objective of the Corporate Plan is:

- ➢ To supply healthy water in an ecologically sustainable manner.

The key strategy that this Master Plan addresses is:

- ➢ Develop and implement management plans for key water supply infrastructure.

1.5 Purpose of the Master Plan

To review the proposed PIP augmentations relative to the current operating philosophy of the water supply system. The output of this report is expected to form the basis for future planning of the water supply network in Redland. It is also expected that the supply strategy for each DMA as detailed in from this report, will utilised in the next revision of Council's PIP / ICS. To assist this utilisation of the outputs from this report in future reports the following naming methodology has been adopted for the proposed augmentations. Note that the focus of the proposed augmentations in this report are identifying trunk network augmentations, but where appropriate recommendations are made about the general or schematic form that reticulation augmentation should take. In the case of reticulation augmentations, it is expected that the developer will undertake detailed network modelling to determine the appropriate augmentations. The intent of this Master Plan should be considered when sizing this reticulation pipework.

The infrastructure has been divided into 3 basic categories:

- PIP_IC – Augmentations that are greater than 300mm dia and are therefore part of the infrastructure charges

- PIP_AUG – Augmentations that are less than 300mm dia that is not require to directly service new connections, but are needed to meet the future demands.
- PIP_RETIC – Infrastructure that will be built as part of future developments as part of the reticulation. This infrastructure is included so the needed cross connections can be included in future development applications.

1.6 Assumptions

The following assumptions have been made in the preparation of this report:

- That fire flow augmentations proposed in the *Redland Water – Water Supply System Fire Flow Review*, and currently being designed will be constructed by the time ultimate demands (2025) are reached.
- That the design criteria for demand per Equivalent Person (EP) remains at 300L/EP/day. Detailed analysis of current and future water consumption will need to be undertaken in coming years to determine if this is an appropriate figure. It is acknowledged that any change to the 'per EP' demand is likely to only result in a change in the timing of the infrastructure, not the actual infrastructure required.
- The intention of the State Government is not entirely clear about the inclusion of bulk water (Seqwater and LinkWater owned) assets and capacity upgrades of these assets in the preparation of PIPs and calculation of infrastructure charges. At this point in time we are working under the direction to include these items of infrastructure in the PIP and ICS.
- The original PIP planning report for the water supply network contained allowances for "contingency" augmentations which were specifically designed to provide extra capacity in the network for the transfer of water between HRR and AHR should one of the WTPs be off-line for an extended period of time. Given that Redlands is now part of the SEQ Water Grid, in which the State authorities are charged with ensuring regional water security these augmentations have not been included. The connection of Redlands to the Logan system through the Eastern Pipeline Interconnector (EPI) should provide this level of security by giving an alternate water source.
- DMAs and their associated PRVs recently installed as part of work completed under the legislated regional project will remain an integral part of the water supply network, particularly for leakage reduction, into the future. In analysing the DMAs controlled by PRVs in this report, we have allowed for a headloss through the PRV of 6m when it is fully open. This is the headloss that manufacturers recommend as a minimum drop across the PRV to ensure that the PRV and the associated modulation systems work adequately. More details of this assumption can be seen in **Appendix B**.

1.7 Format of the Master Plan

This remainder of this report is divided into 23 sections, the first three, Standards of Service, Demand Assessment and Model Set Up being relevant to all sections of the water supply network and the subsequent 16 sections being DMA specific discussions which include the following topics:

- DMA Topography;
- Previous Planning;
- Current System Configuration;
- Existing System Performance at Ultimate Demands;
- Proposed Augmentations;
    a. Option 1 (where applicable)
    b. Option 2 (where applicable)
    c. Option 3 (where applicable)
- Augmentation timing
- Recommendations for the DMA and Further Work

The final four sections include a summary of the proposed works, Cost Estimates, Conclusions and Recommendations and References.

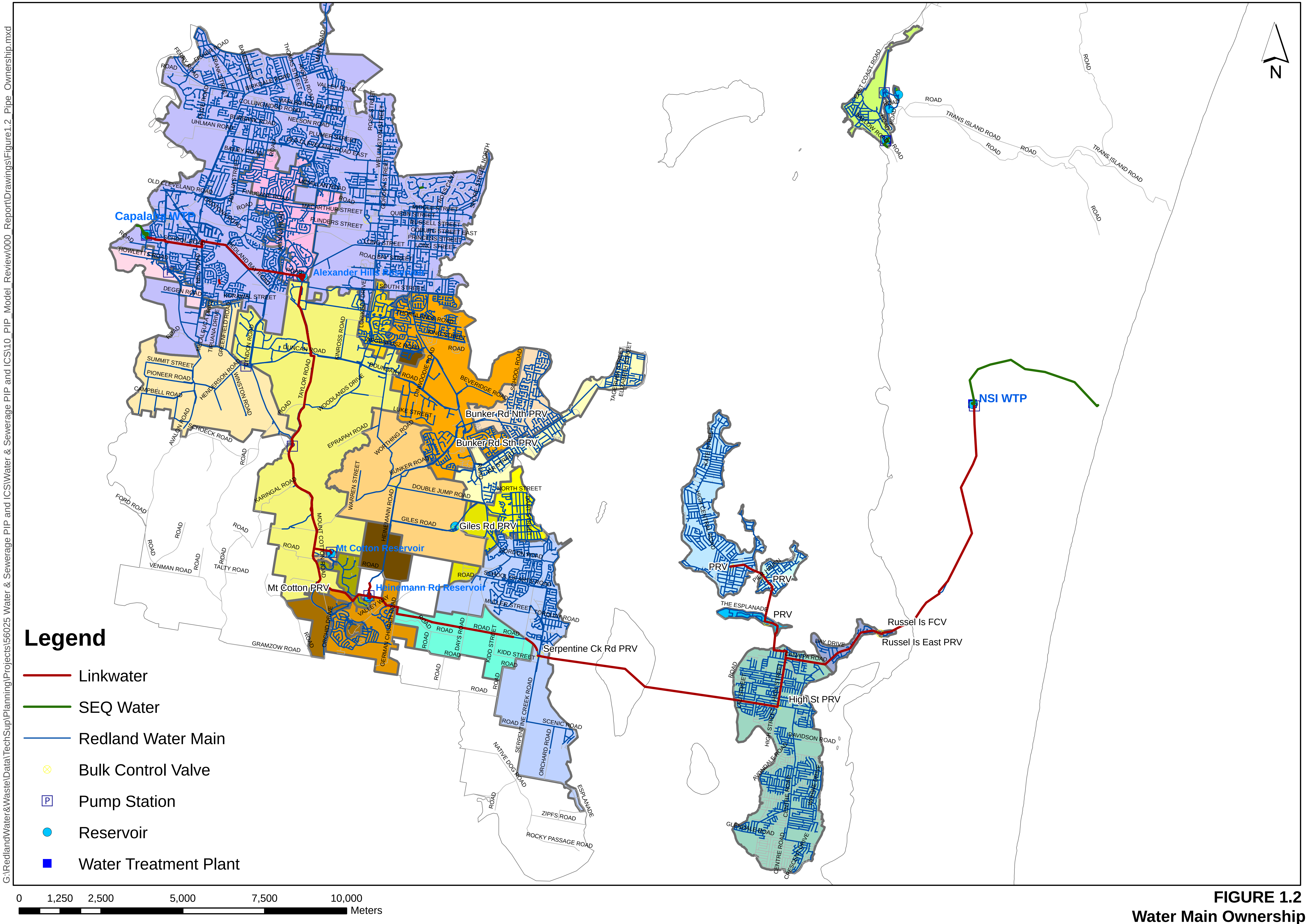


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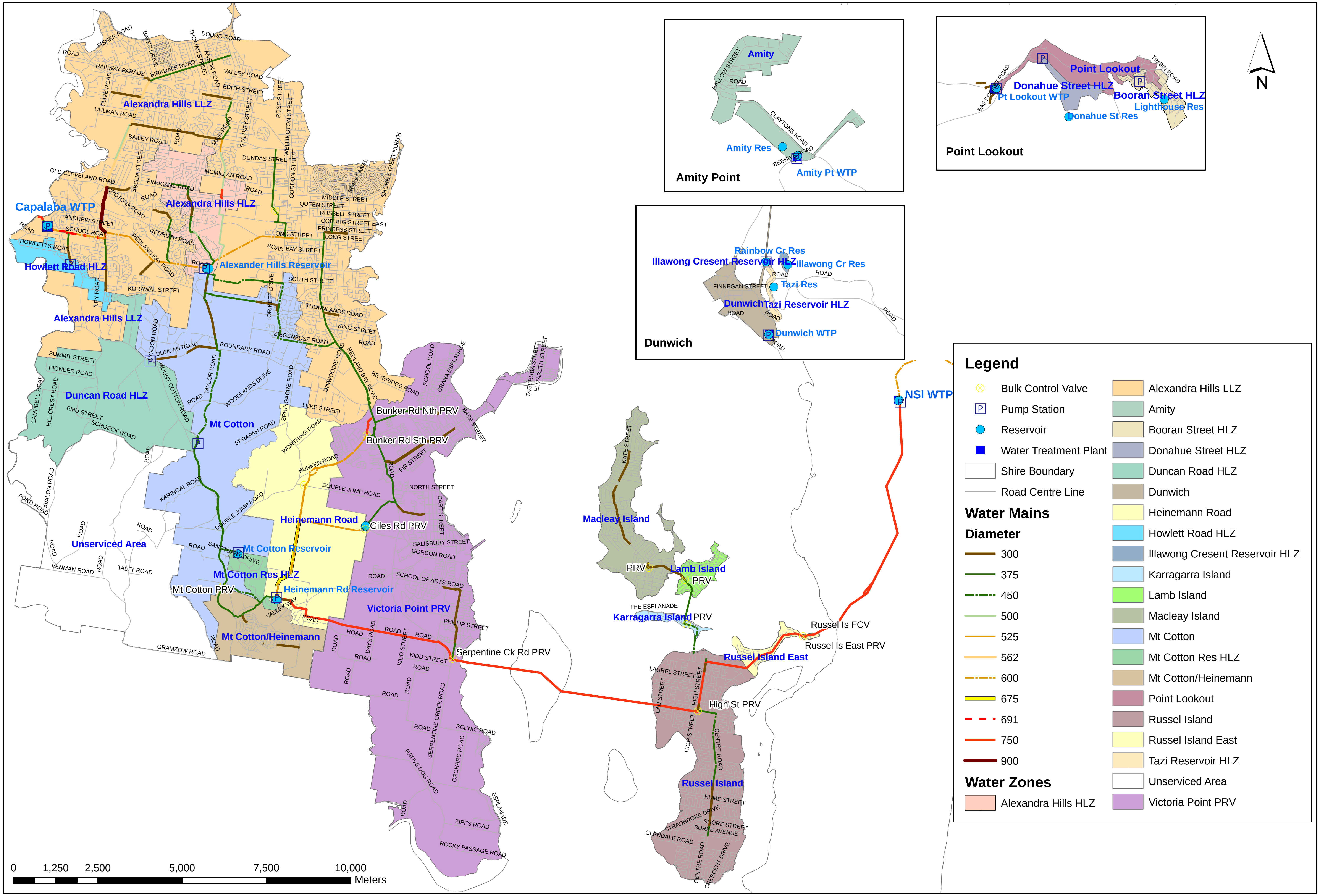
FIGURE 1.2
Water Main Ownership



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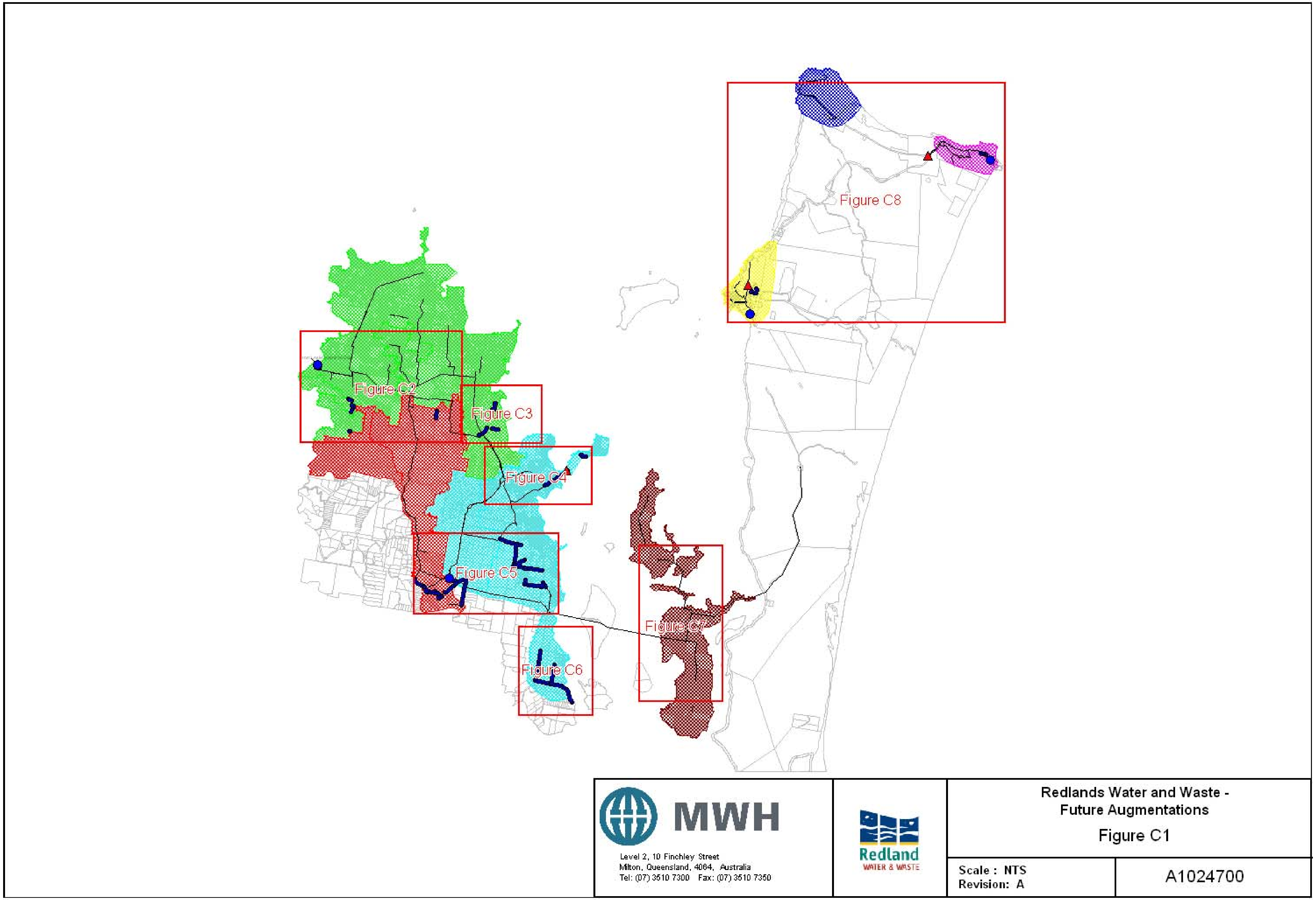
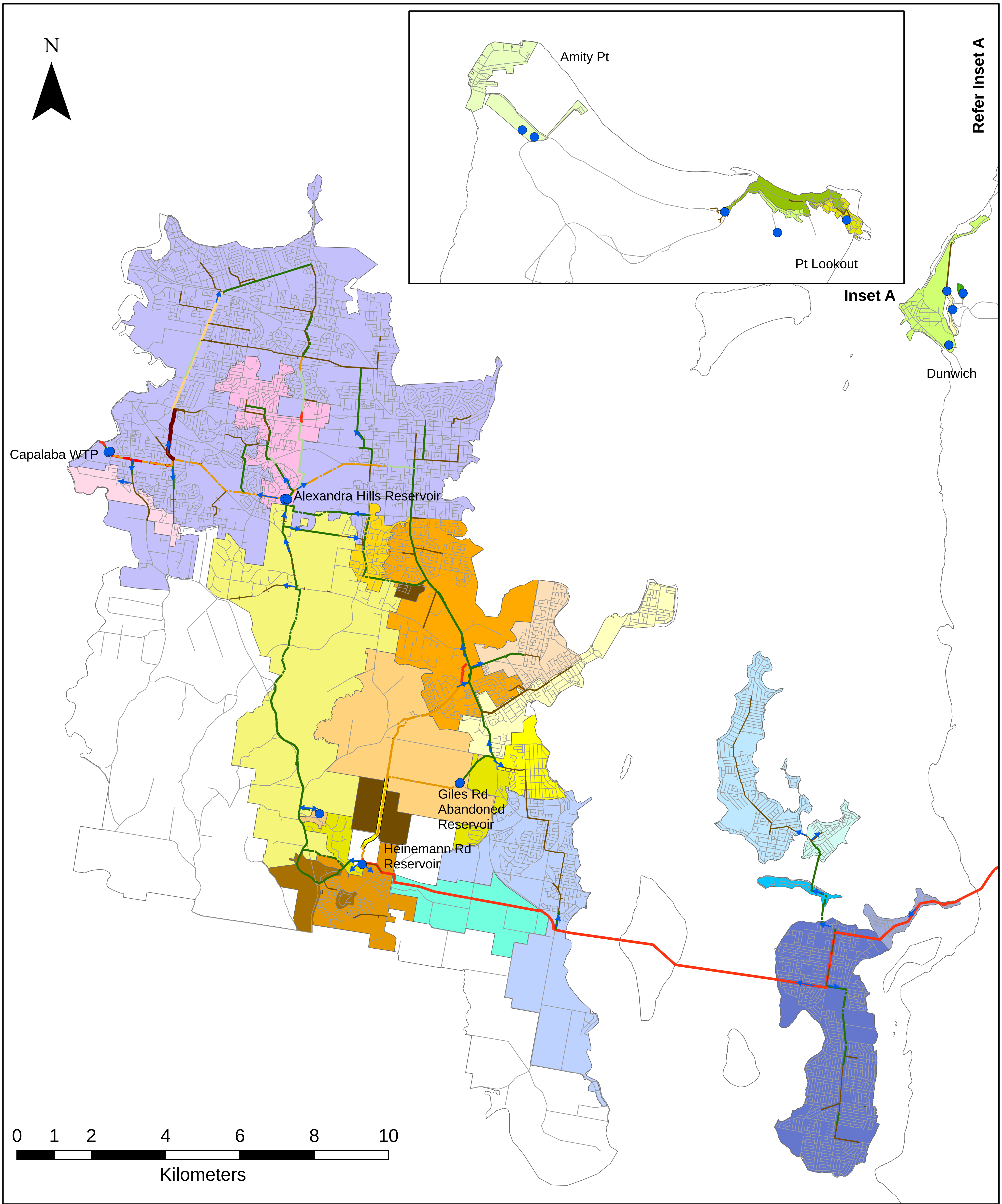
Rev0 22 December 2009

FIGURE 1.3
Original Redland City WS Zones (prior to PLMP)

Figure 1.4 – Original Proposed PIP Augmentations





Legend

- Water Reservoir

Diameter

- 250
- 300
- 375
- 450
- 500
- 525
- 562
- 600
- 675
- 691
- 750
- 900
- Road Center Line

Water Supply Zones

DMA Boundary

- W004 Alexandra Hills LLZ
- 101 Russell Island East
- 102 Russell Island West
- 103 Karragarra Island
- 104 Lamb Island
- 105 Macleay Island
- 106 Serpentine Ck
- 108 NSI to Heinemann Rd Trunk
- 201 Heinemann Rd
- 202 Boundary St
- 203 Benfer Rd
- 204 Bunker Rd South
- 205 Victoria Point
- 206 Mt Cotton Village
- 207A Mt Cotton Booster Pump
- 207B Mt Cotton Res HLZ
- 208 Mt Cotton Trunk
- 209 Duncan Rd HLZ
- 210 Thornlands
- 212 Mt Cotton Road
- 213 Heinemann Rd Trunk
- 250 Heinemann Rd to Alexandra Hills Trunk
- 301 Howletts Rd
- 308 Alexandra Hills HLZ
- 401 Amity Pt
- 402 Dunwich
- 402A Illawong Crescent HLZ
- 402B Tazi Reservoir HLZ
- 403 Point Lookout LLZ
- 403A Booran St HLZ
- 403BTramican St HLZ
- Unserviced Area

G:\RedlandWater&Waste\Data\TechSup\Planning\Projects\56025 Water & Sewerage PIP and ICS\Water & Sewerage PIP and ICS\10_PIP_Model_Review\000_Report\Drawings\Figure1.5_DMA_System_Layout.mxd
Rev2 22 December 09

FIGURE 1.5
Original Redland City Council District Metered Areas

2. Standards of Service

The design criteria adopted for this report are included in **Table 2.1**. The fire flow criteria detailed in **Table 2.1** are not the ones originally adopted with the first revision of the Redland PIP. The adopted criteria are those prepared by the then *Department of Natural Resources and Water* in June 2007. Refer to **Section 3.4** for more detail on the fire flow demand apportionment.

The peaking factors adopted for this report have been simplified as part of the new network model development and since the development of the first revision of the PIP. Global factors included in the original revision of the PIP have been adopted for all demand types except industrial. Where the MWH model identified a demand category of industrial, a multiplication factor of 1.3 (as identified in the water supply planning report, MWH, 2007) has been adopted.

Table 2.1 – Water Supply Design Criteria

<table>
<tr><th>Item</th><th>Description</th><th colspan="5">Design Criteria</th></tr>
<tr><td colspan="7">Water Demand</td></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Average Day Demand (AD)
(L/EP/day) Including NRW</td><td>Existing</td><td>2008</td><td>2013</td><td>2018</td><td>Ultimate</td></tr>
<tr><td>320</td><td>320</td><td>320</td><td>300</td><td>300</td></tr>
<tr><td colspan="7">Global Demand Peaking Factors</td></tr>
<tr><td>2</td><td>Mean Day Maximum Month / Average Day (MDMM / AD)</td><td colspan="5">1.4</td></tr>
<tr><td>3</td><td>Peak Day / Average Day
(PD / AD)</td><td colspan="5">1.9 (all except Industrial)
1.3 (Industrial)</td></tr>
<tr><td colspan="7">Peak Demand Periods</td></tr>
<tr><td>4</td><td>Peak Period Duration</td><td colspan="5">3 x Peak Day</td></tr>
<tr><td colspan="7">System Pressure</td></tr>
<tr><td>5</td><td>Minimum Operating Pressure</td><td colspan="5">22 m at property boundary</td></tr>
<tr><td>6</td><td>Maximum Operating Pressure</td><td colspan="5">60 m at property boundary</td></tr>
<tr><td colspan="7">Fire Fighting Requirements</td></tr>
<tr><td rowspan="5">7</td><td rowspan="5">Residual Pressure</td><td colspan="3">Minimum Residual Pressure – In the main at the hydrant / dedicated fire service</td><td colspan="2">12 metres head</td></tr>
<tr><td colspan="3">Maximum Residual Pressure – In the main at the hydrant</td><td colspan="2">65 metres head (> 65m requires QFRS consultation)</td></tr>
<tr><td colspan="3">Minimum Pressure – Elsewhere in the supply zone during a fire event</td><td colspan="2">6 metres head</td></tr>
<tr><td colspan="3">Risk Hazard</td><td colspan="2">Refer to ‘Risk Assessment’ provision below</td></tr>
<tr><td colspan="5">Positive residual pressure must be provided in the main at PH demand during a fire event.</td></tr>
<tr><td rowspan="3">8</td><td rowspan="3"></td><td colspan="5">Flow Provision – General Urban Category</td></tr>
<tr><td colspan="3">Residential building (3 storeys and below)</td><td colspan="2">15 L/s for 2 hour duration</td></tr>
<tr><td colspan="3">High Density Residential</td><td colspan="2">30 L/s for 4 hour duration</td></tr>
</table>

Item	Description	Design Criteria	
	Flow Provision * Consultation must occur between the service provider and the Rural Fire Service to determine the adopted flow provision. These specified flow rates represent the minimum allowable provision.	building (greater than 3 storeys)	
		Commercial / Industrial building	30 L/s for 4 hour duration
		Risk Hazard building	Refer to 'Risk Assessment' provision below
		Flow Provision – Small Community Category	
		Residential buildings (up to 2 storeys)	7.5 L/s for 2 hour duration*
		Non-Residential buildings (up to 2 storeys)	15 L/s for 4 hour duration*
		Other buildings	Refer 'General Urban' category above
9	Background demand	Predominantly Residential Areas	▪ 2/3 PH ▪ Not to be less than AD ▪ Check for positive pressure at PH
		Predominantly Commercial / Industrial	The assessment is to be conducted for the following scenarios: ▪ PH for localised Commercial / Industrial area ▪ 2/3 PH for total zone The worst case scenario is to be used, which may vary from site-to-site.
10	Risk Hazard	▪ Risk areas to be identified ▪ QFRS to be consulted ▪ Mitigation measures to be utilised to reduce risk	
Reservoir Storage			
11	Ground Level Storage Capacity	Design case - 3 (MD-MDMM) x1.3 Minimum Operating Volume of 30%	
12	Elevated Storage Capacity	6 (PH – 1/12 MDMM) + Fire fighting reserve of 150 kL	
Pumping Capacity			
13	Duty Pump Capacity	24 hour operation with full standby	
14	Pumps serving Elevated Reservoirs	(6 PH – Operating Volume) /(6 x 3600)	
15	Standby Pump Capacity	To match duty, except where more than one duty pump or as determined by risk assessment	
Pipeline Design			
16	Mains Capacity	MDMM for distribution MDMM for mains supplying ground level reservoirs PH for reticulation	
17	Friction Default Values	Hazen Williams formula using the friction factors outlined in Table 4.2.	
18	Maximum Velocity	2.5 m/s	

3. Demand Assessment

3.1 Demand Model

The MWH Demand Model, as used in the preparation of the Redland Water components of the original revision of the PIP / ICS has been used for the preparation of this Master Plan. There have not been significant changes in the RPS since the preparation of this demand model with specific areas of new (greenfield) development included in the demand model being:

- Kinross Road MDA; and
- South East Thornlands MDA.

As part of the preparation of this report, a visual assessment of the growth in demand allocated in the MWH Demand Model has been made relative to the current Redland Planning Scheme (RPS) Version 2.

3.2 Planning Scheme

The Redland Planning Scheme (RPS) Version 2 has been used in assessing the extent of future development potential of land within the water supply service areas with respect to identifying appropriate locations for cross-connections. It has also been used to assess the appropriateness of the MWH Demand Model for the water supply network as detailed above.

3.2.1 Adopted Demands

The adopted demands for each ICS zone in EP at each planning horizon in the MWH Demand model are shown in **Table 3.1** with the adopted ultimate demands in each DMA are shown in **Table 3.2**. The DMAs have been grouped based on the reservoir that services them so reservoir capacities can be estimated.

Table 3.1 – Adopted Demands by ICS zone

Water Supply ICS Zone	2006 (EP)	2008 (EP)	2013 (EP)	2018 (EP)	2025 (EP)
Alexandra Hills	88,431	85,569	97,585	101,679	104,817
Heinemann Road	37,976	41,395	55,909	62,602	68,638
Mt Cotton	8,673	7,346	11,316	12,668	15,364
Southern Moreton Bay Islands	5,334	7,865	15,730	21,180	21,573
Mainland Sub-Total	**140,414**	**142,176**	**180,541**	**198,129**	**210,392**
Pt Lookout	2,700	2,475	3,293	3,777	4,984
Amity Point	1,044	1,082	1,212	1,268	1,378
Dunwich	1,394	1,206	1,727	1,850	2,114
Total All Zones	**145,552**	**146,938**	**186,772**	**205,024**	**218,869**

Table 3.2 – Ultimate (2025) Demands by DMA

DMA	MWH 2025EP	AD Demand (ML/d)	MDMM Demand (ML/d)	MD Demand (ML/d)
Alexandra Hills LLZ Reservoirs				
Alexandra Hills	93370	28.01	39.22	53.22
Howletts Road	1288	0.39	0.54	0.73
Heinemann Road to Alexandra Hills Trunk (North of BRN PRV)(1)	298	0.09	0.13	0.17
Ziegenfusz Road(2)	9119	2.74	3.83	5.20
Sub-Total	***103992***	***31.20***	***43.68***	***59.28***
Alexandra Hills HLZ Reservoirs				
Alexandra Hills HLZ	***10159***	***3.05***	***4.27***	***5.79***
Heinemann Road Reservoir				
Russell Island East	927	0.28	0.39	0.53

DMA	MWH 2025EP	AD Demand (ML/d)	MDMM Demand (ML/d)	MD Demand (ML/d)
Russell Island West	11292	3.39	4.74	6.44
Karragarra Island	595	0.18	0.25	0.34
Lamb Island	1385	0.42	0.58	0.79
Macleay Island	7374	2.21	3.10	4.20
Serpentine Creek West	6759	2.03	2.84	3.85
Serpentine Creek East	9157	2.75	3.85	5.22
NSI to Heinemann Rd Trunk	248	0.07	0.10	0.14
Heinemann Road	1698	0.51	0.71	0.97
Boundary Street	3981	1.19	1.67	2.27
Benfer Road	8255	2.48	3.47	4.71
Bunker Road South	10919	3.28	4.59	6.22
Bunker Road South West	3190	0.96	1.34	1.82
Victoria Point	7024	2.11	2.95	4.00
Mt Cotton Village	7930	2.38	3.33	4.52
Heinemann Road to Alexandra Hills Trunk (South of BRN PRV) (1)	74	0.02	0.03	0.04
Heinemann Road Trunk	45	0.01	0.02	0.03
Sub-Total	***80853***	***24.26***	***33.96***	***46.09***
Mt Cotton HLZ Reservoir				
Mt Cotton Booster Pump	62	0.02	0.03	0.04
Mt Cotton Res HLZ	313	0.09	0.13	0.18
Mt Cotton Trunk	6268	1.88	2.63	3.57
Duncan Rd Booster Pump	1905	0.57	0.80	1.09
Thornlands	5981	1.79	2.51	3.41
Mt Cotton Road	858	0.26	0.36	0.49
Sub-Total	***15388***	***4.62***	***6.46***	***8.77***
Amity Point Reservoir				
Amity Pt	***1378***	***0.41***	***0.58***	***0.79***
Dunwich Rainbow Crescent				
Dunwich	***1648***	***0.49***	***0.69***	***0.94***
Dunwich HLZ				
Illawong Crescent	101	0.03	0.04	0.06
Tazi	365	0.11	0.15	0.21
Sub-Total	***466***	***0.14***	***0.20***	***0.27***
Lighthouse Hill Res Pt Lookout				
Point Lookout	2217	0.66	0.93	1.26
Booran St HLZ	2057	0.62	0.86	1.17
Sub-Total	***4274***	***1.28***	***1.80***	***2.44***
Tramican Street Reservoir				
Tramican Street	710	0.21	0.30	0.40
Total	**218869**	**65.66**	**91.92**	**125.15**

Notes:

(1) The part of this DMA that is south of the Bunker Rd North PRV will receive its supply from Heinemann Road whereas the northern areas are more likely to receive their supply from the Alexandra Hills Reservoir.

(2) It is proposed to split the Bunker Road South DMA into three zones at ultimate demands. Bunker Road South and Bunker Road South West are off Heinemann Road, while Ziegenfusz Road is off either Alexandra Hills or Heinemann Road. Alexandra Hills has been adopted for Ziegenfusz Road as it is likely that LinkWater will close the Bunker Road North PRV.

3.3 Bulk Water Infrastructure Sizing

Although bulk water source, treatment and transport activities are no longer owned or operated by Redland City Council, it is appropriate that a Water Supply Master Plan at least assess the appropriate size of these components of the system as, after all, they form part of an integrated system. It was considered appropriate to complete assessment now and document in one report, before the knowledge base of the integrated water supply network is lost because of the split up of the ownership and operational functions of the water supply network.

3.3.1 Bulk Water Treatment

The bulk water treatment facilities in the Redlands and their capacities are detailed below in **Table 3.3**. Based on the ultimate MDMM demands detailed in **Table 3.4** including allowances for pumping only over 20hours, the estimated ultimate requirements on the system will not require any further capacity upgrades.

Table 3.3 – Bulk Water Treatment Facility Capacities

WTP Facility	Capacity (ML/day)	Comment
NSI WTP – Herring Lagoon	30	Licence = 35.5ML, although is restricted by level in Herring Lagoon
NSI WTP - Groundwater	22.5	Licence = 22.6ML
Capalaba WTP	52	Design capacity is 80ML/day, but operating capacity is limited to 52ML/day limitation in manganese treatment
Total for major water supply scheme	**104.5**	**Major water supply scheme is connected through submarine pipeline between NSI, SMBIs & the mainland**
Dunwich WTP	1.38	
Amity Point WTP	1.38	
Point Lookout WTP	3.02	

Table 3.4 – Bulk Water Treatment Facility Demands (MWH2025)

Scheme Name	Treatment Capacity (ML/day)	MDMM Demand (ML/day)	MDMM Demand over 20hours (ML/day)*	Spare Capacity (ML/day)	Upgrade Requirements
Mainland & SMBI scheme	104.5	88.4	103.7	0.8	N/A
Dunwich WTP	1.38	0.9	1.0	0.38	N/A
Amity Point WTP	1.38	0.6	0.72	0.66	N/A
Point Lookout WTP	3.02	2	2.64	0.38	N/A

* Although it can be debated that the NSI WTP can supply HRR through a gravity supply, calculation of available WTP capacity has been based on the requirement of pumping MDMM over 20hours only, as Herring Lagoon and groundwater bores supply the WTP via pumped systems.

Demand for the Redland City Council area only is allowed for in this summary as the intention of the SEQ WGM, Seqwater and LinkWater is presently unknown with regard to WTP upgrade plans.

3.3.2 Bulk Water Transport

No augmentations of the LinkWater mains have been identified in the areas where PLMP has been implemented, however future connection/s will be required. This has been assessed through the network modelling for each DMA / WSZ, and reported in the relevant DMA / WSZ section of the report.

3.3.3 Bulk Water Storage

The bulk water reservoir storages within the water supply systems are sized based on the DSS criteria of:

Ground Level Reservoirs
Required Storage = 3 x (MD – MDMM) x 1.3

Elevated Storages
Required Storage = 6 x (PH – 1/12xMDMM) + 150kL

An assessment of the storage capacities of the reservoirs in the network are shown below in **Table 3.5**. The table also includes the required reservoir upgrades.

Table 3.5 – Bulk Water Storages – Capacity & Demands (MWH2025)

ICS Zone	Reservoir Complex	Reservoir Owner	2006 Capacity (ML)	MD Demand (ML/day)	MDMM Demand (ML/day)	Storage Required (ML)	Spare Capacity (ML)	Upgrade Requirements
Alexandra Hills	AHR	LinkWater	47.3	59.3	43.7	60.8	-13.5	1 x 20ML
Alexandra Hills	Alex Hills Elevated Tower	LinkWater	0.27	5.79	4.27	1.2	-0.93	1 ML[5]
Heinemann Road	HRR	LinkWater	18.2	46.1	34	47.3	-29.1	2 x 22ML
Heinemann Road	MCR	LinkWater	6.8	8.8	6.5	9	-2.2	6.8ML[1]
Amity Point	Amity Point	Redland Water	1.14	0.8	0.6	0.8	0.34	Nil
Dunwich	Rainbow Crescent	Redland Water	2.2	0.9	0. 7	1.0	1.2	Nil
Dunwich	Illawong Crescent[2]	Redland Water	0.23	0.3	0.2	0.2	0.03	210kL[3]
Point Lookout	Lighthouse Hill	Redland Water	2.27	2.4	1.8	2.5	-0.23	TBA[4]
Point Lookout	Donohue Street	Redland Water	0.15	0.4	0.3	0.4	-0.25	TBA[4]

1. A recommendation has been made for the construction of additional storage at MCR complex equal in size to the current reservoir to allow for operational flexibility. It is recommended that discussions with LinkWater be commenced with a view to understanding their long-term operating plan for the Mt Cotton Road trunk main system & how pressures will be managed in the Kinross Road MDA, which accounts for a significant portion of the growth in demand in that zone (>80%) that triggers additional storage being required at the MCR complex.
2. The Tazi and Illawong Crescent Zones have been combined to be sourced from a single reservoir at Illawong Crescent.
3. Although storage size is appropriate in this zone, an upgrade is planned to improve the levels of service. In this case the present inclusion of a new reservoir in the ICS for Dunwich HLZ is recommended.
4. Given the relatively small additional requirement for the Point Lookout system, upgrades of reservoirs in the Point Lookout Water Supply Scheme have not yet been confirmed as it is intended to calibrate the network model first before commencing network upgrades.
5. This reservoir is no longer owned and operated by Redland Water so LinkWater will need to determine the strategy and operating philosophy for this reservoir, it has therefore not been considered further in this report.

3.4 Fire Flow Demand

The fire flow requirements were developed as part of the Pressure and Leakage Management Project, the methodology used for the project is described below.

The methodology adopted to determine the fire flow requirement for each land parcel in Redland City Council is based on the Building Class descriptions provided by LGIS (refer **Appendix C**) and the DNRM Planning Guidelines for Water Supply and Sewerage, March 2005 (using the updated Chapter 6, dated June 07).

LGIS have advised that buildings of Class 3 or greater should have an available fire flow of at least 30L/s.

The recommend fire flows in the DNRM guidelines for General Urban and Small Communities is included in **Appendix D**.

Although the SMBI Communities are larger than 500 people (thus are not strictly classified as Small Communities) the Islands only have a rural fire service. Initially all the SMBIs (Russell, Macleay, Karragarra and Lamb Island) were assigned rural fire service demands. Subsequent discussions with the fire department resulted in the standard General Urban fire flow categories being adopted for Macleay & Russell Islands.

3.4.1 Existing Fire Flow Requirements

The existing fire flow requirements have been based on the LandUse in the following GIS feature class:

- rsc.GISSU.CUL_BND_OWN_CURRENTLAND_P

The *Property Use Code* in Proclaim and the *Landuse Code* in the above feature class were compared and were found to be the same.

The adopted fire flow requirement for each *Landuse Code* is included in **Appendix E**. Some comments on the reasons for adopting various flow requirements are also included in the appendix.

Where the fire flow requirement for a particular *Landuse Code* was unclear, the land parcel was manually reviewed using the 2006 Aerial photos and local knowledge. A decision was then made based on the apparent size of the dwelling on the land parcel. In these instances a note has been included in the GIS shapefile which states the reason the relevant fire flow was adopted.

It should also be noted that during the visual inspection of the various *Landuse Codes* some anomalies in the landuse codes were identified (eg Vacant land had a dwelling). Those anomalies identified were corrected; however it is likely that there are still many others within the GIS database.

3.4.2 Ultimate Fire Flow Requirements

The ultimate fire flow requirements have been based on the Redland City Council Planning Scheme Zones as included in the following GIS feature class:

- rsc.GISSU.CUL_URB_PLN_RPSZONEBDRYS_P

The adopted fire flow requirement for each *Zone* is included in **Appendix F**. The only sub-zones identified as impacting on the level of service required were those for Community Purpose and Medium Density Residential.

The Community Purpose sub-zones and adopted fire flows are included in **Appendix F**. The adopted fire flows for the medium density zoning was 15L/s for areas where the maximum height is three storeys and 30 L/s for a maximum height greater than three storeys.

4. Model Set Up

The assumptions made in the set up and development of the model, are described below.

4.1 Demand Assignment

The MWH population data was imported into the model and converted to demands based on the Average Day Demand included in **Table 2.1**. The demands were then geocoded to junctions. The demands were geocoded using the “To node by nearest Pipe” function in Mike Urban. This means a point on the pipe closest to the demand point is determined and the demand is then added to the node nearest to the point selected on the pipe. This methodology does assign demands to junctions on Trunk mains, so these were manually moved to the most representative junction for the demand point.

When all the demand points are connected to a junction there is usually more than one demand point at each junction so the demands are “Aggregated” based on the type of demand. The adopted demand types for the Mike Urban model are described in **Table 4.1**.

4.2 Diurnal Patterns

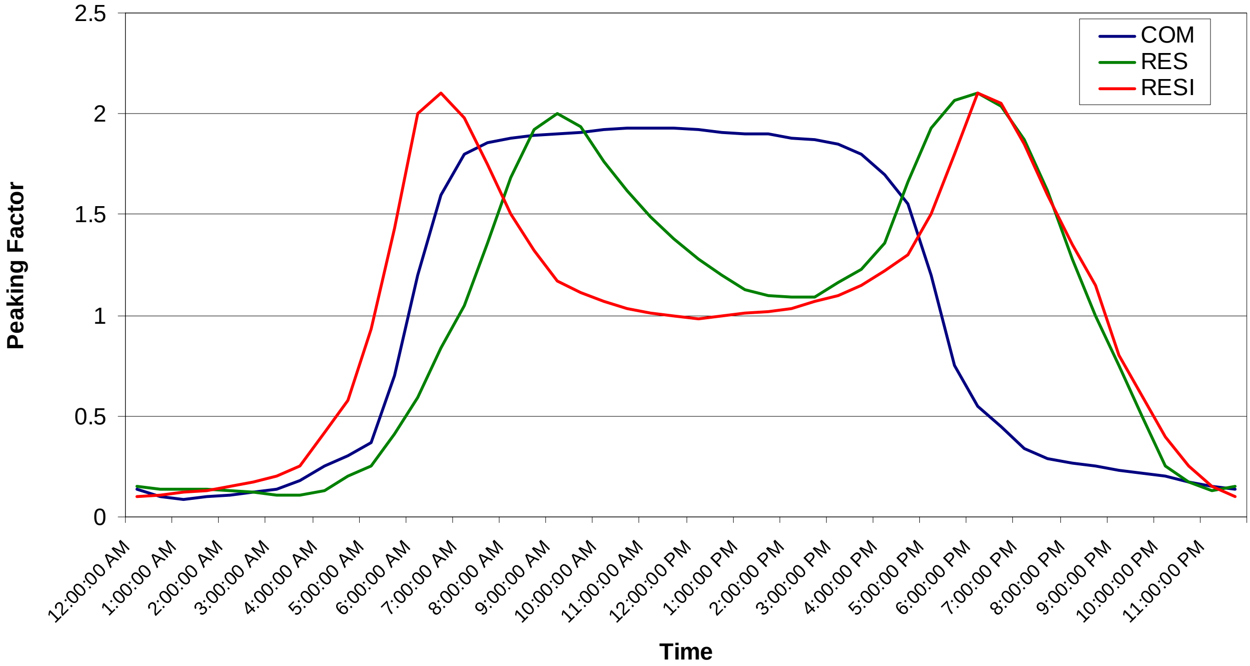
The diurnal patterns adopted in the Mike Urban model are shown in **Table 4.1**. The number of patterns has been reduced to simplify the model. Model verification has shown that this process has not significantly impacted on the model accuracy.

Table 4.1 – Mike Urban Diurnal Patterns

Land Use	Original PIP Allocation	Updated Mike Urban Allocation
Urban Residential	RES_1	RES
Medium Density Residential	RES_2	RES
Low Density Residential	RES_3	RES
Island Residential (Coochie, SMBI, Dunwich, Pt Lookout & Amity Pt)	RES_1, RES_2 & RES_3	RESI
Emerging Local Community	ELC	RES
Commercial	COM	COM
Industrial	IND	COM
Public	PUB	COM
Tourist	TOU	COM
Irrigation	IRR	COM

The patterns adopted diurnal patterns are shown in **Figure 4.1**. A different pattern has been adopted for the island communities because the available data indicated that the peak is earlier and later. This is likely to be because of the extra travel time when travelling to the mainland.

Figure 4.1 – Adopted Diurnal Patterns



4.3 Pipe Friction Factors

The Hazen Williams formula has been used in the model with the following pipe friction factors installed initially. Where the model verification has shown that these friction factors are not appropriate they have been adjusted accordingly.

Table 4.2 – Adopted Hazen Williams Frictions Factors

Diameter (mm)	Adopted 'C' Value
≤ 150	100
200 – 300	110
> 300	120

5. 101 to 105 Southern Moreton Bay Islands

This area consists of five DMAs as follows:

- DMA101 Russell Island East
- DMA102 Russell Island West
- DMA103 Karragarra Island
- DMA104 Lamb Island
- DMA105 Macleay Island

The operation of this area has not been changed since the completion of the original MWH master planning study so this area was not reviewed further.

6. 106 & 107 Serpentine Creek Road DMA

6.1 DMA Topography

The Serpentine Creek Road DMA generally consists of low coastal areas (approximately 20m AHD) rising to higher elevation areas in the western part of the DMA (approximately 35m AHD). The two areas mentioned above are divided by Weinam Creek which traverses the DMA in a north-westerly direction.

The topography of the Serpentine Creek Road DMA is shown on **Figure 6.1**.

6.2 Previous Planning

The area covered by this DMA was originally included in the Victoria Point PRV zone. This zone was essentially an open network supplied by three PRVs as shown on **Figure 1.3**. Planning undertaken for the PIP / ICS determined augmentations on the basis of this zone configuration and included connections to the trunk mains leaving HRR complex to the north through Giles Road (into the north-western corner of this DMA).

Planning work undertaken as part of the PLMP originally had the Serpentine Creek Road DMA split between east and west using the two existing mains running north-south along Collins Street. Detailed fire flow modelling determined that the value (ability to reduce pressure in the lower coastal areas and therefore save additional water) in splitting the DMA in this fashion was unviable as dual feeds were required into each DMA and available pressure reductions were not significantly greater, than the combined DMA. As part of the PLMP it was then decided to maintain the Serpentine Creek Road DMA area as one DMA.

6.3 Current System Configuration & Source of Supply

The Serpentine Creek Road DMA is located in the southern coastal suburb of Redland Bay. The DMA nominally extends from Pitt Street in the north to Scenic Road in the south. It encompasses the most southerly parts of the Redland City Council that are connected to the water supply network and sources its water from an off-take from LinkWater’s 750mm main between NSI WTP and the HRR complex. The PRV is currently modulated on the basis of an outlet pressure of 54m when flow into the DMA is above 15L/s and 49m outlet pressure when the flow into the DMA is less than 15L/s.

6.4 Existing System Performance at Ultimate Demands

The PH model results for the Serpentine Creek Road DMA with the PRV at the current setting of 54m, and with all proposed fire flow augmentations complete, are included in **Figure 6.2**. The figure shows that most of the western (higher) side of the DMA has pressures below 22m. The minimum pressure is negative at junction 2_373 at the end of Kelby Close.

The fire flow results with a PRV setting of 54m are shown in **Figure 6.3**. The results again show that the western side of the zone has difficulty meeting the FF DSS. The southern area near Orchard Road also has problems meeting the FF DSS.

In summary, the north-west strip has higher elevations of around 35m and therefore pressure problems at ultimate demands. The far north-western areas have pressure problems as a result of the distance from the source and the increased friction losses as a result of the higher demands.

6.5 Proposed Augmentations Ultimate

6.5.1 Option 1 – Split Serpentine Creek Road DMA into Two Zones

Given that the maximum elevation in the eastern coastal area is 10m-15m lower than the western side, it is proposed to split the zone into two separate pressure zones as shown on **Figure 6.4**. The western side will be called DMA107 – Serpentine Creek West, the eastern side which will continue to use the existing PRV, will be called DMA106 – Serpentine Creek East.

The preferred option requires an additional off-take and PRV from the 750 mm dia main from NSI to HRR complex. The proposed location is where the main turns off Cleveland Redland Bay Road as this is the closest point to proposed DMA107. This option requires a 450mm main along Cleveland Redland Bay Road from the proposed PRV to School of Arts Road along with some 300 mm diameter off-takes to connect the main to the reticulation.

Figure 6.4 shows the proposed reticulation and PIP infrastructure needed to meet the 2025 demands.

Figure 6.5 shows how the proposed reticulation is related to the existing planning scheme.

The southern area is not shown on **Figure 6.4** as there is no proposed infrastructure for that area because the existing planning scheme has it zoned “Investigation Zone”. This is shown on **Figure 6.5**. Further detailed water supply planning would need to be undertaken if this area is developed in the future.

For the infrastructure described above, the PRV settings and the results for the critical node are included in **Table 6.1**. The results show that the CMP is well above the minimum pressure of 22m, so the PRV settings could be reduced further if needed.

Table 6.1 – Serpentine Creek DMAs Adopted 2025 PRV Settings

DMA	Setting(1)	CMP Location	CMP PH Pressure
106 Serpentine Ck East	49	MU Junction 405	30 m
107 Serpentine Ck West	54	106CMP1	30 m

Note: These settings do not take into account head losses through the PRV as a result of modulation. The actual PRV settings may need to be adjusted to take these into account.

In general the fire flow results are very good with most areas receiving greater than 30L/s except for the area to the south near Orchard Road (refer **Figure 6.6**). This area has existing fire flow problems as outlined in the Water Supply System Fire Flow Review (RW, March 2009). It is not proposed to investigate this area any further until it is known what is planned for the “Investigation Zone”.

It should also be noted that the limiting factor in determining the infrastructure requirements was the PH flows not fire flows. The actual infrastructure could possibly be reduced if pressure and leakage management is no longer a priority or demands prove to be lower than those adopted by MWH. This would need to be investigated further with detailed modelling.

6.5.2 Option 2 – Keep Serpentine Ck as a Single Zone

The option of keeping a single zone with the entire area being supplied by the existing PRV was also investigated. To make this option work the infrastructure is similar except the main along Cleveland Redland Bay Road needs to continue from School of Arts Road all the way to the existing PRV.

It is possible to reduce the diameter of the main from 450 to 375 mm however the PRV setting needs to increase from 49m to 63m to achieve a minimum pressure of 30m at the critical junction

(J11018). If a 450mm dia main is adopted the PRV setting can be reduced from 63m to 61m to provide 30m at J11018.

6.5.3 Option 3 – Giles Road

This option was looked at briefly, however it was not investigated any further for the following reason:

- Development of the German Church Road Integrated Employment Centre as a group title / “closed” development has limited the ability of Council to use the watermains through this development to supplement supply into the Serpentine Creek Road DMA.
- The Serpentine Ck Rd DMA pipes are generally sized for flow from the opposite direction so augmentations would increase;
- The 600mm main along Giles Road needed augmentation to supply sufficient pressures to the zone; and
- There seems little point having the water flow an extra 10 to 13 km (when flow is coming from NSI) to HRR complex and then back again via Giles Road when an off-take can be constructed directly off the 750mm main.

6.6 Augmentation Timing

6.6.1 Existing System at 2013 Demands

The PH results when the 2013 demands are included on the existing system model are shown on **Figure 6.7**.

The critical junction is J11020, which struggles to meet the DSS when flow into the DMA is above 97 L/s.

2013 Augmentations

To meet the PH DSS for the 2013 demands PIP_IC1, PIP_IC2, PIP_IC3, PIP_IC5 & PIP_IC6 need to be constructed, along with the new off-take and PRV from the 750mm from NSI WTP to Heinemann Road. PIP_AUG5 and PIP_AUG1 also need to be constructed to meet PH demands.

When a fire flow analysis of DMA106 and DMA107 is undertaken, with the above augmentations in place, the commercial areas north of German Church Road are not able to receive an available flow of 30L/s. To achieve the DSS for fire flow PIP_IC4 is also needed.

When the system is set up as described above with PRV settings of 54m, J11020 (the critical junction) has an available pressure of 31m.

The augmentations needed to meet the 2013 are shown on **Figure 6.8**.

6.6.2 2013 System at 2018 Demands

The PH results when the 2018 demands are included on the 2013 system (and all reticulation in place) are shown on **Figure 6.8**.

The figure shows that all areas meet the PH DSS except for the northern area near Emperor Drive. When the fire flow analysis is run, the commercial areas north of German Church Road do not receive the DSS of 30L/s.

To meet the DSS for fire flow and PH all remaining augmentations need to be constructed (PIP_AUG6 and Pipe MUID 9705). When these are in place junction 2_374 has a residual pressure of 34m at PH.

6.6.3 Ultimate (2025) Demands

All augmentations need to be constructed by 2018 so there are no additional augmentations required prior to 2025.

6.7 Recommendations

The following master plan recommendations are made for this DMA:

- Option 1 (split the DMA into two DMAs) as detailed above be pursued as the preferred augmentation strategy as it provides a better strategic outcome for the Redland Water. This option allows that if for whatever reason, the HRR complex is off-line but NSI WTP is still operational, water can be supplied into Redland Bay and also transferred north into Victoria Point.
- The fire flow augmentation requirements for the southern area near Orchard Road are investigated when it is known what is planned for the “Investigation Zone”.

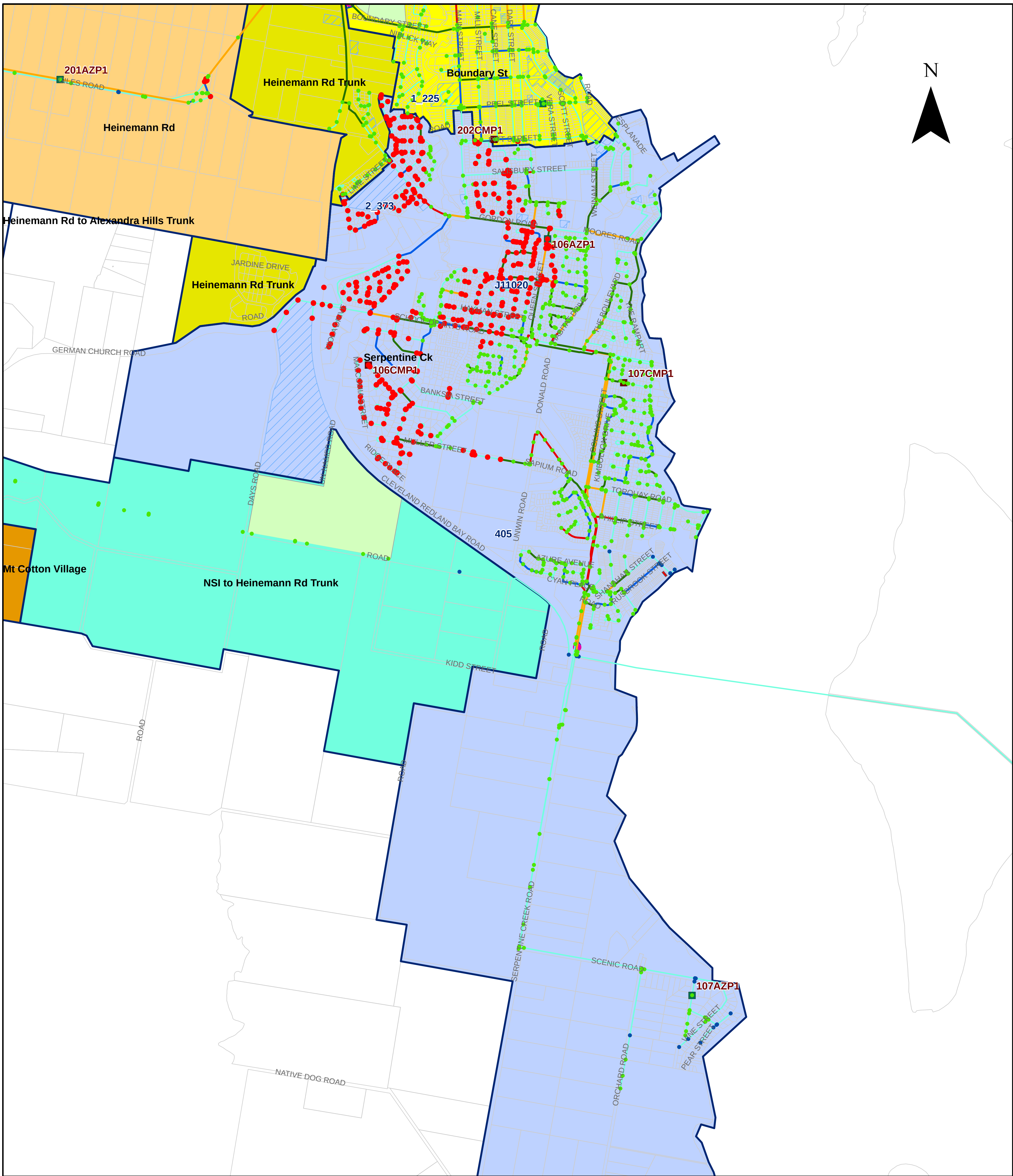
Legend

Existing DMA Boundaries | Serpentine Ck Boundary | 5m Contours | Existing Pipework

0 250 500 1,000 1,500 2,000 2,500 Meters

FIGURE 6.1
106 Serpentine Ck Topography

G:\RedlandWater&Waste\Data\TechSup\Planning\Projects\56025 Water & Sewerage PIP and ICS\Water & Sewerage PIP and ICS\10_PIP_Model_Review\106 & 107 Serpentine Creek Road DMAs\Drawings\Figure6.1_106_Topography.mxd
Rev0 22 December 2009



Legend

Residual Pressure (m)
- <22
- 22-60
- >60
- AZP Logger
- CMP Logger
- PRV and Meter Site

Headloss (m/1000m)
- 0.000000 - 1.000000
- 1.000001 - 2.000000
- 2.000001 - 5.000000
- 5.000001 - 10.000000
- 10.000001 - 4170.875000

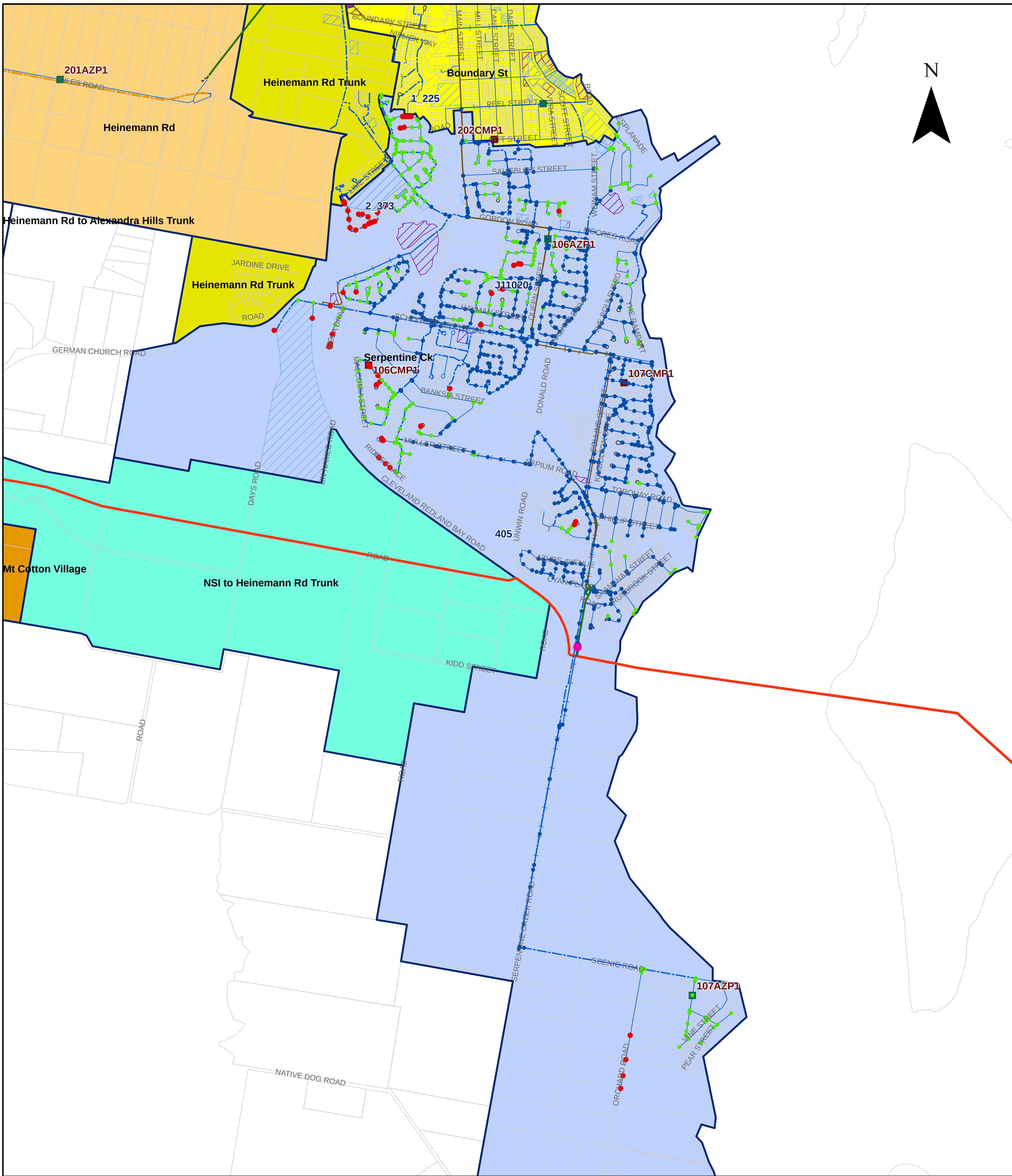
Critical Customers
- Commercial FF (30L/s)
- > 10ML/yr Consumption
- Dialysis Patient

DMA Boundary
- 106 Serpentine Ck
- 108 NSI to Heinemann Rd Trunk
- 201 Heinemann Rd
- 202 Boundary St
- 206 Mt Cotton Village
- 213 Heinemann Rd Trunk

0 250 500 1,000 1,500 2,000 2,500
Meters

FIGURE 6.2
106 Serpentine Ck PH Results (PRV54m)

G:\RedlandWater&Waste\Data\TechSup\Planning\Projects\56025 Water & Sewerage PIP and ICS\Water & Sewerage PIP and ICS\10_PIP_Model_Review\106 & 107 Serpentine Creek Road DMAs\Drawings\Figure6.2_106_SerpentineCk_PH.mxd
Rev0 22 December 2009



Legend

Available FF (L/s)
- 0 - 14
- 15 - 29
- 30 - 273
- AZP Logger
- CMP Logger
- PRV and Meter Site

Fire Flow (30L/s)
- Existing Areas
- Planning Scheme Areas

Diameter
- 63
- 80
- 100
- 150
- 200
- 225
- 250
- 300
- 375
- 450
- 500
- 525
- 600
- 675
- 691
- 750
- 900

DMA Boundary
- 106 Serpentine Ck
- 108 NSI to Heinemann Rd Trunk
- 201 Heinemann Rd
- 202 Boundary St
- 206 Mt Cotton Village
- 213 Heinemann Rd Trunk

0 250 500 1,000 1,500 2,000 2,500
Meters

G:\RedlandWater&Waste\Data\TechSup\Planning\Projects\56025 Water & Sewerage PIP and ICS\Water & Sewerage PIP and ICS\10_PIP_Model_Review\106 & 107 Serpentine Creek Road DMAs\Drawings\Figure6.3_106_ULT_FF0730.mxd
Rev0 22 December 2009

FIGURE 6.3
106 Serpentine Ck Fire Flow Results (PRV54m)

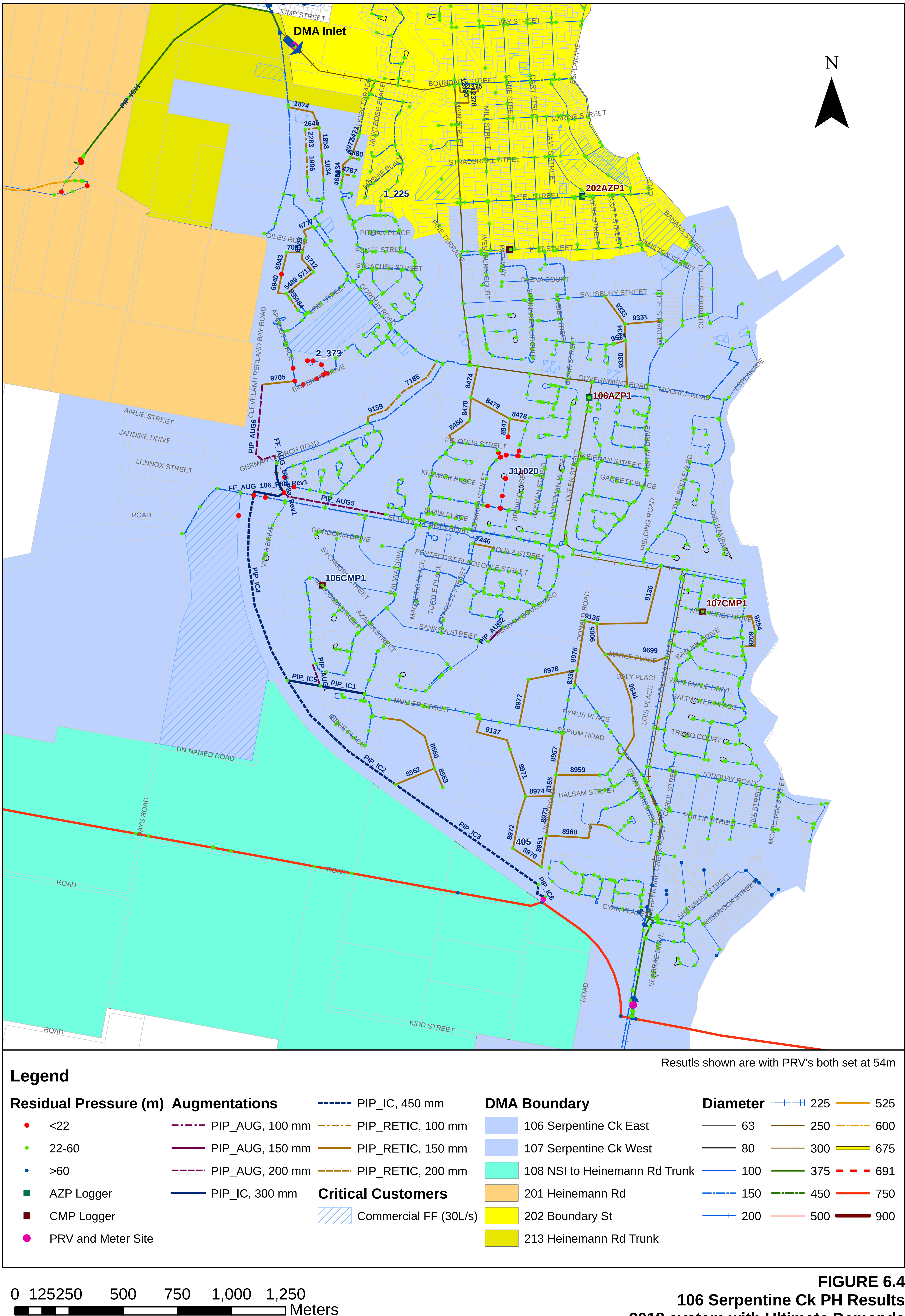
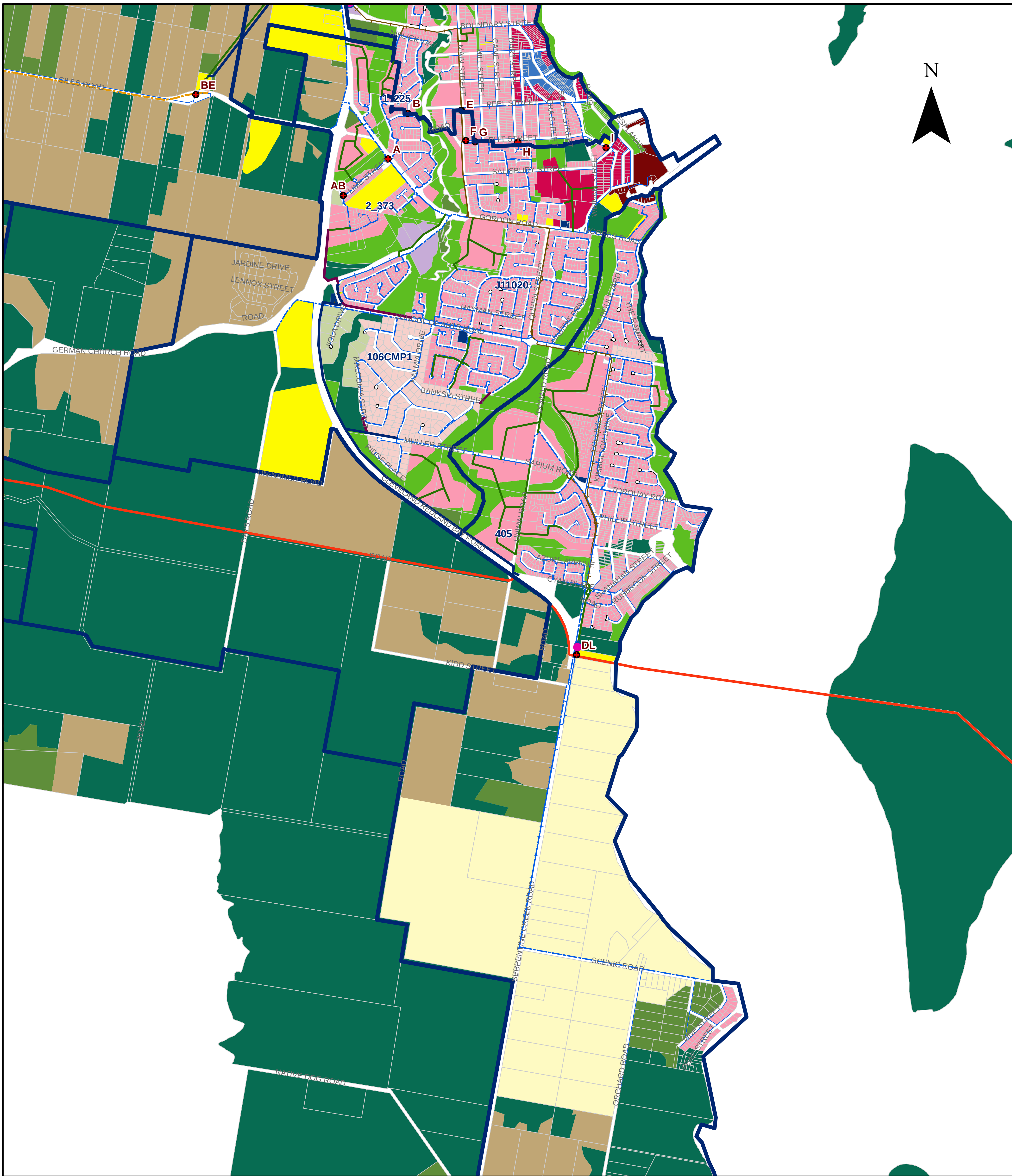


FIGURE 6.4
106 Serpentine Ck PH Results
2018 system with Ultimate Demands

G:\RedlandWater&Waste\Data\TechSup\Planning\Projects\56025 Water & Sewerage PIP and ICS\Water & Sewerage PIP and ICS\10_PIP_Model_Review\106 & 107 Serpentine Creek Road DMAs\Drawings\Figure6.4_106_2025_PH.mxd
Rev0 22 December 2009



Legend

Descriptio
- PIP_AUG
- PIP_IC
- PIP_RETIC
- PIP_Proposed_Water_Zones

Diameter

63	225	500	750
80	250	525	900
100	300	600	
150	375	675	
200	450	691	

RESIDENTIAL
- Urban Residential
- Medium Density Residential
- Low Density Residential

CENTRE
- Major Centre
- District Centre
- Neighbourhood Centre
- Local Centre

INDUSTRY
- Commercial Industry
- General Industry
- Marine Activity

CONSERVATION
- Park Residential
- Environmental Protection
- Conservation

OTHER
- Community Purposes
- Emerging Urban Community
- Open Space
- Rural Non Urban
- Investigation Zone
- Unzoned

0 250 500 1,000 1,500 2,000 2,500
Meters

G:\RedlandWater&Waste\Data\TechSup\Planning\Projects\56025 Water & Sewerage PIP and ICS\Water & Sewerage PIP and ICS\10_PIP_Model_Review\106 & 107 Serpentine Creek Road DMAs\Drawings\Figure6.5_106_wAUG_ULT_PScheme.mxd
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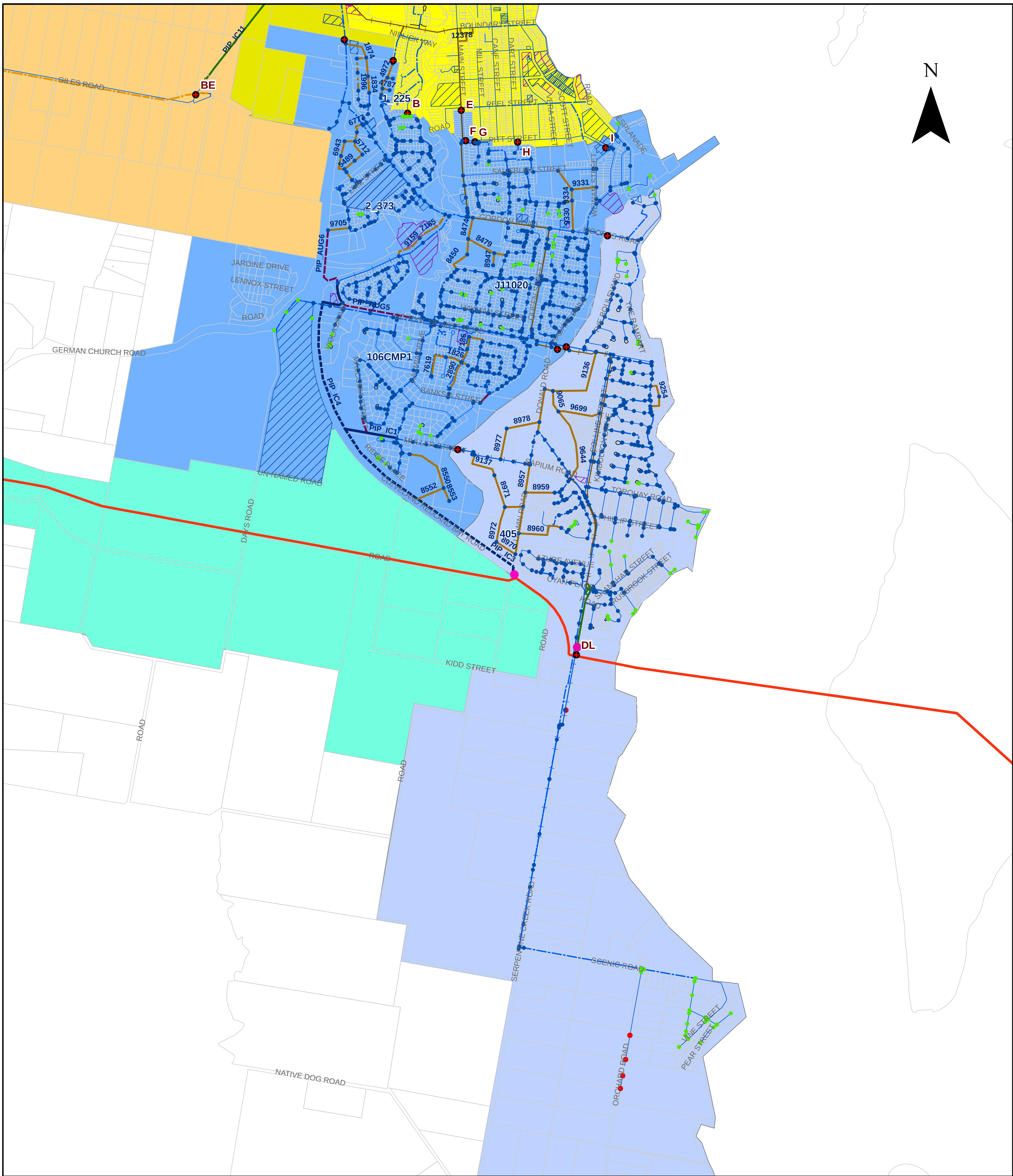
FIGURE 6.5
Serpentine Ck Planning Scheme



Legend

Available FF (L/s)
- < 15
- 15 - 29
- > 30
- PRV and Meter Site

Fire Flow (30L/s)
- Existing Areas
- Planning Scheme Areas

Augmentations
- PIP_AUG, 100 mm
- PIP_AUG, 150 mm
- PIP_AUG, 200 mm
- PIP_Check, 150 mm
- PIP_IC, 300 mm
- PIP_IC, 450 mm
- PIP_RETIC, 100 mm
- PIP_RETIC, 150 mm
- PIP_RETIC, 200 mm

DMA Boundary
- 106 Serpentine Ck East
- 107 Serpentine Ck West
- 108 NSI to Heinemann Rd Trunk
- 201 Heinemann Rd
- 202 Boundary St
- 213 Heinemann Rd Trunk

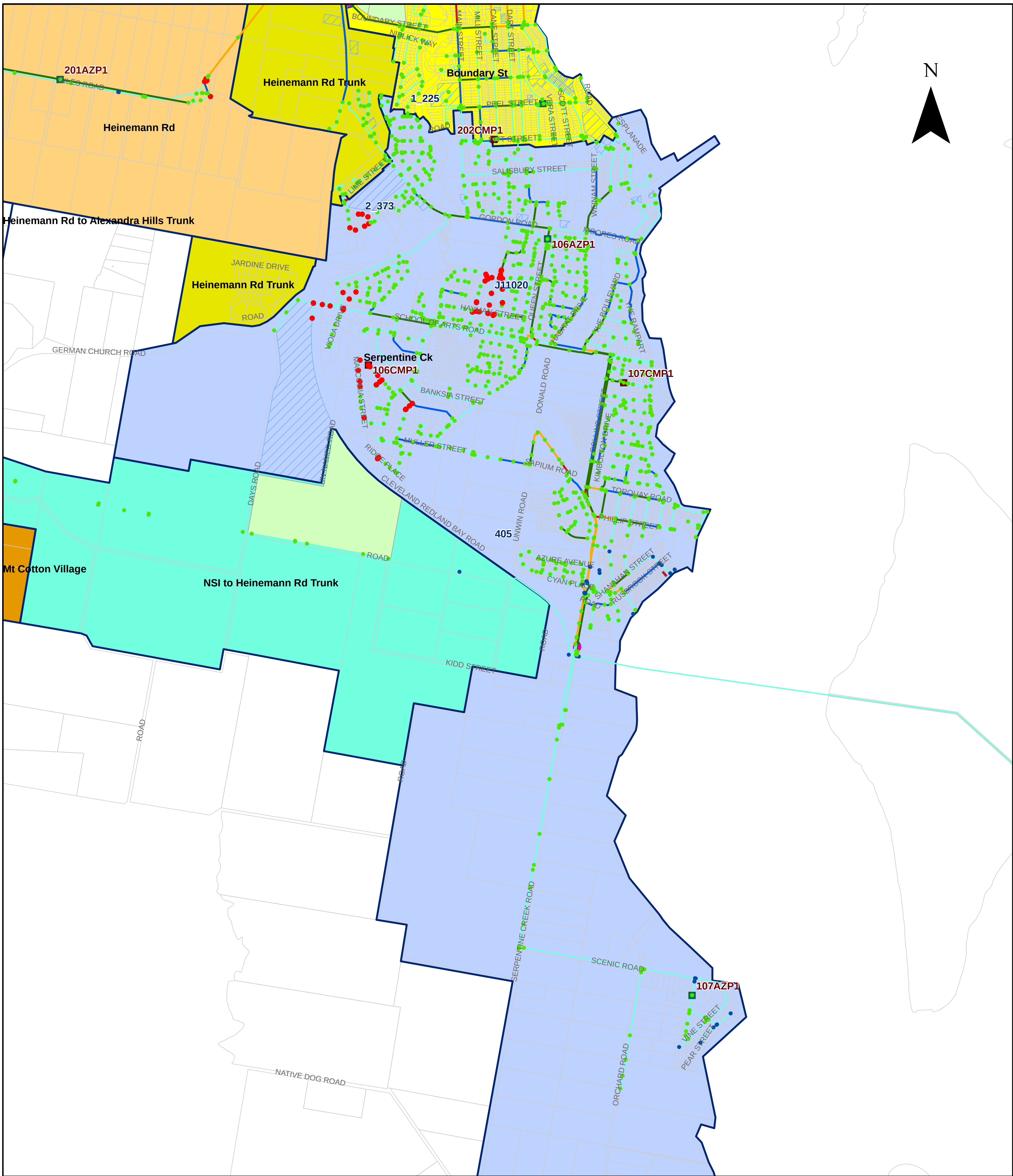
Diameter
- 63
- 80
- 100
- 150
- 200
- 225
- 250
- 300
- 375
- 450
- 500
- 525
- 600
- 675
- 691
- 750
- 900

Note:
DMA106 - PRV setting 54 m
DMA107 - PRV setting 49 m

0 250 500 1,000 1,500 2,000 2,500
Meters

G:\RedlandWater&Waste\Data\TechSup\Planning\Projects\56025 Water & Sewerage PIP and ICS\Water & Sewerage PIP and ICS\10_PIP_Model_Review\106 & 107 Serpentine Creek Road DMAs\Drawings\Figure6.6_106_wAUG_ULT_FF.mxd
Rev0 22 December 2009

FIGURE 6.6
Serpentine Ck FF Results with Augmentations



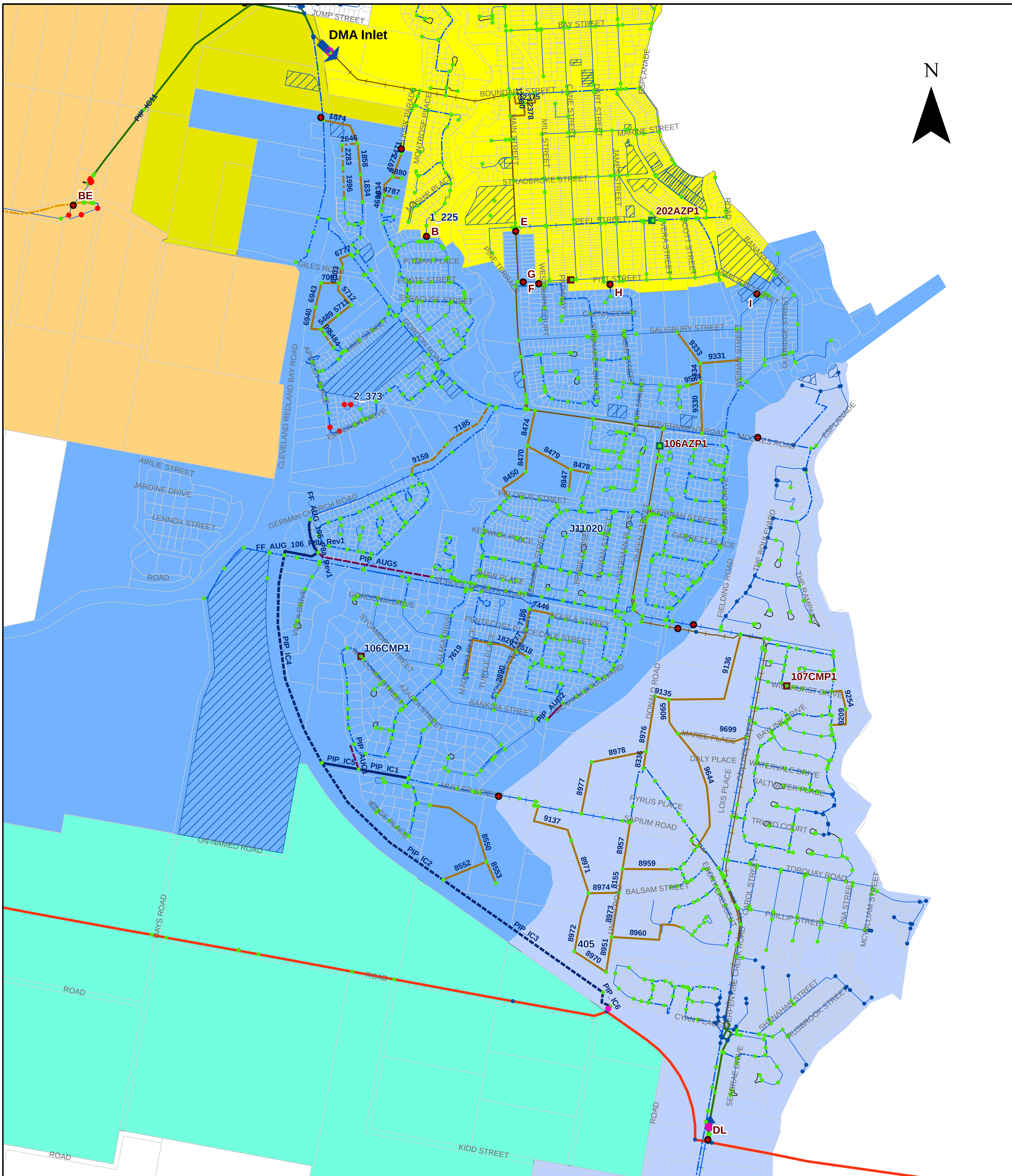
Legend

Residual Pressure (m)	Headloss (m/1000m)	Critical Customers	DMA Boundary
<22	0 - 1	Commercial FF (30L/s)	106 Serpentine Ck
22-60	1 - 2	> 10ML/yr Consumption	108 NSI to Heinemann Rd Trunk
>60	2 - 5	Dialysis Patient	201 Heinemann Rd
AZP Logger	5 - 10		202 Boundary St
CMP Logger	>10		206 Mt Cotton Village
PRV and Meter Site			213 Heinemann Rd Trunk

0 250 500 1,000 1,500 2,000 2,500
Meters

G:\RedlandWater&Waste\Data\TechSup\Planning\Projects\56025 Water & Sewerage PIP and ICS\Water & Sewerage PIP and ICS\10_PIP_Model_Review\106 & 107 Serpentine Creek Road DMAs\Drawings\Figure6.7_106_2013_PH.mxd
Rev0 22 December 2009

FIGURE 6.7
106 Serpentine Ck PH Results PRV54m
Existing System with 2013 Demands



Resutls shown are with PRV's both set at 54m

Legend

Results		Augmentations				DMA Boundary		Diameter			
●	<22	PIP_AUG, 100 mm		PIP_IC, 450 mm			106 Serpentine Ck East	63		225	525
●	22-60	PIP_AUG, 150 mm		PIP_RETIC, 100 mm			107 Serpentine Ck West	80		250	600
●	>60	PIP_AUG, 200 mm		PIP_RETIC, 150 mm			108 NSI to Heinemann Rd Trunk	100		300	675
■	AZP Logger	PIP_IC, 300 mm		PIP_RETIC, 200 mm			201 Heinemann Rd	150		375	691
■	CMP Logger			**Critical Customers**			202 Boundary St	200		450	750
●	PRV and Meter Site			Commercial FF (30L/s)			213 Heinemann Rd Trunk			500	900
●	Closed Valve										

0 125250 500 750 1,000 1,250
Meters

G:\RedlandWater&Waste\Data\TechSup\Planning\Projects\56025 Water & Sewerage PIP and ICS\10_PIP_Model_Review\106 & 107 Serpentine Creek Road DMAs\Drawings\Figure6.8_106_2018_PH.mxd
Rev0 22 December 2009

FIGURE 6.8
Serpentine Ck PH Results
2013 system with 2018 Demands

7. 201 Heinemann Road

The Heinemann Road and NSI to Heinemann Road Trunk DMAs are only slightly different to the Heinemann Road water supply zone in the original master planning study. The majority of changes are related to the adopted boundaries in the rural areas, which have very little influence on the water supply system.

The MWH master planning did include some augmentation near Giles Road however this area has been investigated in detail as part of the Serpentine Creek analysis (refer **Section 6**).

This area has therefore not been reviewed further.

8. 202 Boundary Street DMA

8.1 DMA Topography

The Boundary Street DMA consists of relatively flat, low coastal areas with elevations ranging from zero to approximately 20m AHD. The DMA inlet is located along Boundary Street near the intersection of Gordon Road.

The topography of DMA is shown on **Figure 8.1**.

8.2 Previous Planning

The whole of this DMA was originally included in the Victoria Pt PRV zone. Planning undertaken for the PIP / ICS, was based on the original configuration for this area and did not include any augmentations.

8.3 Current System Configuration and Source of Supply

The Boundary St DMA is fed from the Heinemann Rd Reservoir via 675 and 600 mm dia MSCL pipes along Heinemann Rd, a 600 mm dia uPVC pipe along Giles Rd and a 375 mm dia AC pipe from the abandoned Giles Rd Reservoirs to the PRV and Meter off-take in Boundary Street.

The Boundary Street PRV is currently flow modulated to limit the high pressures that this relatively low lying area can receive from the HRR complex and to provide sufficient flow and pressure in the event of a fire.

8.4 Existing System Performance at Ultimate Demands

8.4.1 Peak Hour Results

At peak hour demands the pressure upstream of the PRV is 50m. To run this scenario the PRV has therefore been set at 44m to take into account the modulation losses through the PRV.

Figure 8.2 shows that the Victoria Point DMA has sufficient infrastructure to provide pressures above 22m at peak hour at ultimate demands, with a minimum pressure of 29 m at the CMP.

8.4.2 Fire Flow

At the time of the fire analysis (7:30 am) with a fire flow of 30L/s within the DMA, the U/S PRV pressure is 52m, allowing for the additional head loss through the PRV as result of the modulation of the valve, a PRV setting of 46 was adopted.

The fire flow results are shown on **Figure 8.3**. The figure shows that the all areas meet the required fire flow except for the area at the end of the main along the Esplanade. The junction at the end of the pipe (J11839) has an available FF of 13L/s. The figure also shows the head loss in the system when a fire flow of 15L/s is added to J11839.

8.5 Proposed Augmentations

Figure 8.4 shows that there are very few areas in the Boundary Street DMA which are yet to be developed. The increased demands in this DMA will largely be the result of infill and higher density development.

8.5.1 Peak Hour

There are no augmentations needed to provide pressures above 22m when the PRV is set at 44m.

8.5.2 Fire flow

The ultimate model was run with the Giles Road PRV set at 25m as it is currently. At 7:30 am the pressure upstream of the Giles Road PRV is 38m. An additional 13m head can therefore be obtained simply by fully opening the Giles Road PRV.

When this scenarios is modelled (ie a Boundary Street PRV setting of 59m (46m plus 13m)) than all areas meet the DSS for fire flow as shown on **Figure 8.5** with J11839 having an available FF of 17L/s.

This scenario does assume that there will be a PRV modulation profile adopted in the future for the DMA. It is an option to include an augmentation to connect the 100mm main along the Esplanade to the main at the corner of North Street and Broadwater Terrace to reduce the pressure needed for fire flow in the DMA (PIP_AUG12). If this augmentation is included the PRV setting can be reduced to 42 m. When the augmentation is in place and the PRV is set at 42m the critical junction is 1_225 which has an available FF of 16L/s.

8.6 Augmentation Timing

When the Giles Road PRV is fully open there are no augmentations needed to meet the Ultimate demands in the Boundary Street DMA. A fire flow of 15.4L/s can be achieved at J11839 at 2018 demands with the Boundary Street PRV set at 46m. It is therefore recommended that the Giles Road PRV is removed or fully open by 2025.

If PIP_AUG12 is completed the PRV modulation profile can be significantly altered. The timing of this augmentation will therefore depend on pressure and leakage management issues.

8.7 Recommendations

The following master plan recommendations are made for this DMA:

- That the Giles Road PRV is removed or opened fully when needed to supply sufficient pressures to the Boundary Street DMA.

Legend

Boundary St

Existing DMA Boundaries

5m Contours

Diameter

80	150	225	300	450	525	675	750		
63	100	200	250	375	500	600	691	900	

0 125 250 500 750 1,000 1,250 Meters

G:\RedlandWater&Waste\Data\TechSup\Planning\Projects\56025 Water & Sewerage PIP and ICS\Water & Sewerage PIP and ICS\10_PIP_Model_Review\202 BoundaryStDMA\Drawings\Figure8.1_202_Topography.mxd

Rev0 22 December 2009

FIGURE 8.1
202 Boundary Street Topography

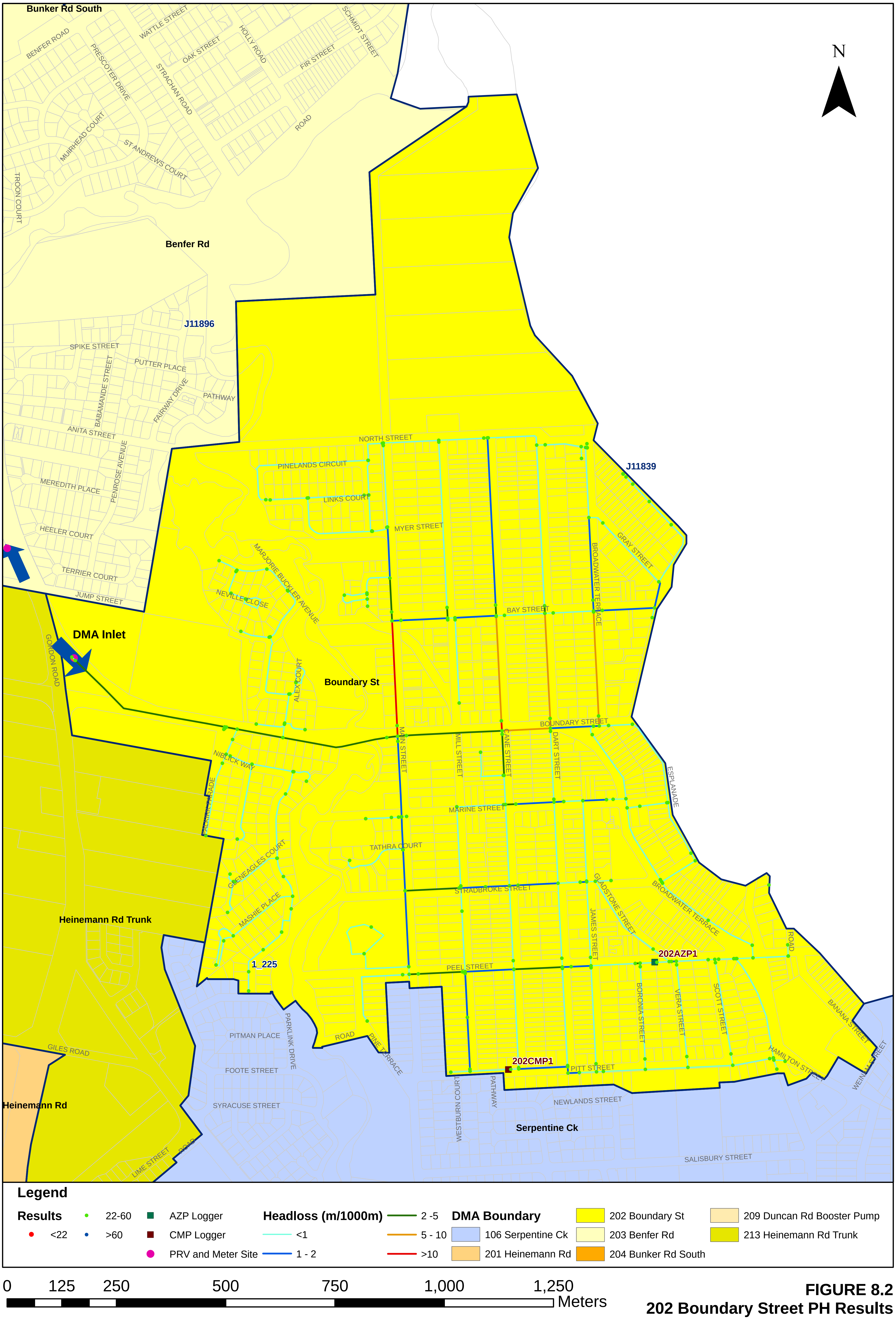


FIGURE 8.2
202 Boundary Street PH Results

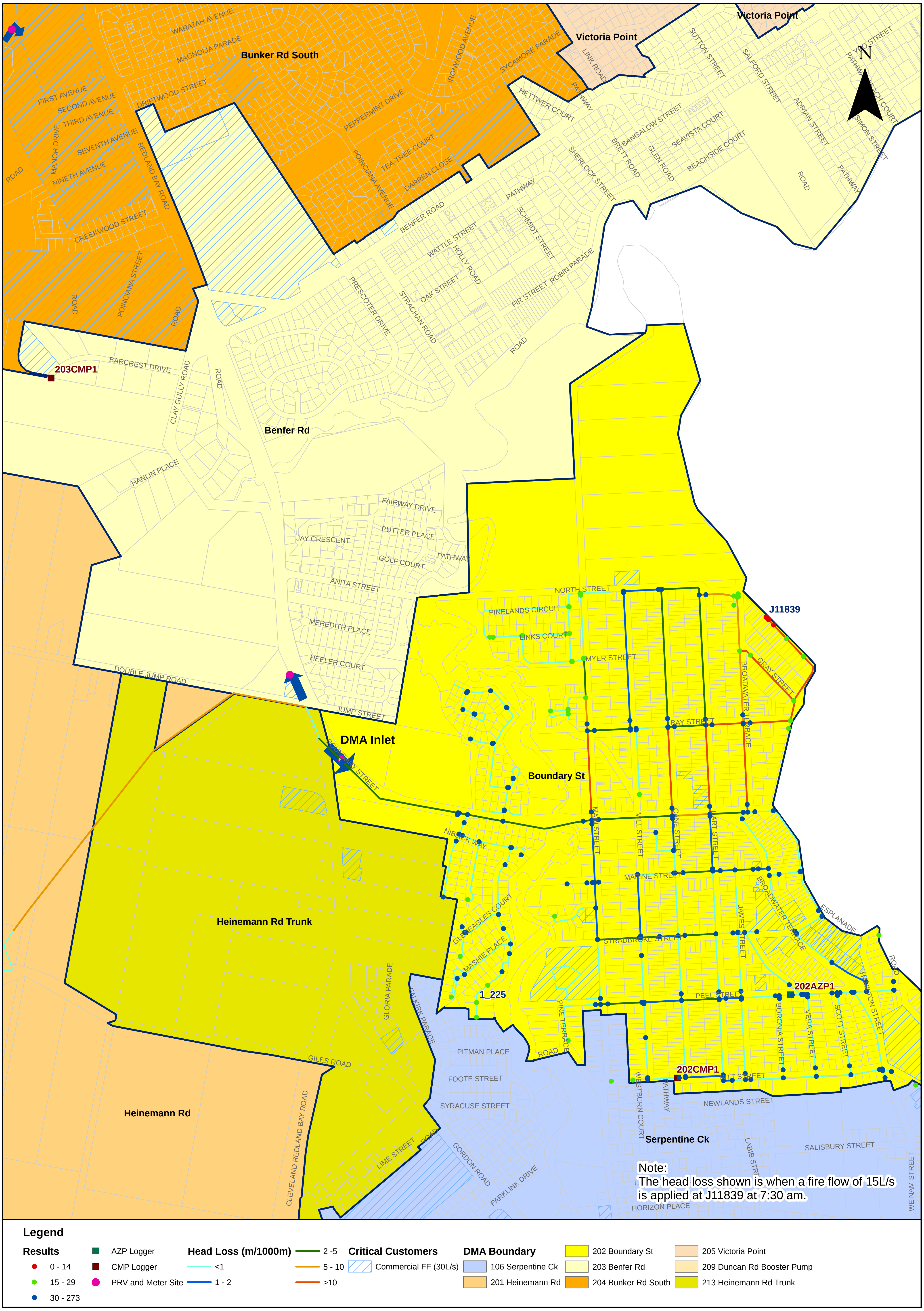


FIGURE 8.3
202 Boundary Street FF Results

G:\RedlandWater&Waste\Data\TechSup\Planning\Projects\56025 Water & Sewerage PIP and ICS\Water & Sewerage PIP and ICS\10_PIP_Model_Review\202 BoundaryStDMA\Drawings\Figure8.3_202_ULT_FF0730.mxd
Rev0 22 December 2009

Legend

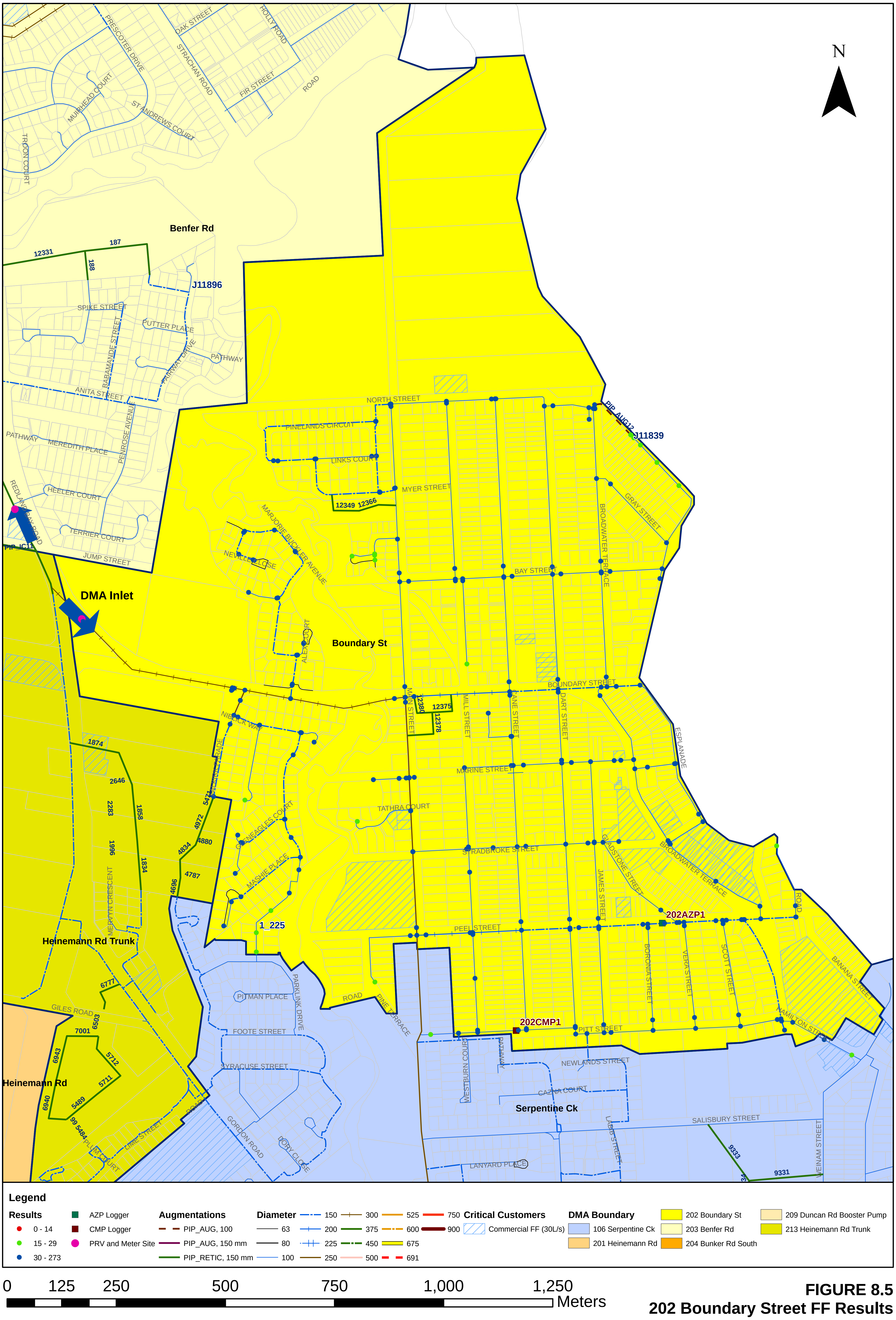
Augmentations PIP_AUG, 150 mm; PIP_IC, 250; PIP_RETIC, 150 mm; BOUNDARY STREET DMA

PIP_AUG, 100; PIP_IC, 200; PIP_IC, 375

0 100 200 400 600 800 1,000 Meters

G:\RedlandWater&Waste\Data\TechSup\Planning\Projects\56025 Water & Sewerage PIP and ICS\Water & Sewerage PIP and ICS\10_PIP_Model_Review\202 BoundaryStDMA\Drawings\Figure8.4_202_wAUG_ULT_PScheme.mxd
Rev0 22 December 2009

FIGURE 8.4
202 Boundary Street Planning Scheme



G:\RedlandWater&Waste\Data\TechSup\Planning\Projects\56025 Water & Sewerage PIP and ICS\10_PIP_Model_Review\202 BoundaryStDMA\Drawings\Figure8.5_202_ULT_FF0730.mxd
Rev0 22 December 2009

FIGURE 8.5
202 Boundary Street FF Results

9. 203 Benfer Road

9.1 DMA Topography

The Benfer Road DMA is a relatively long and narrow DMA. The bulk of the DMA follows Benfer Road to Link Road and includes customers either side of the Benfer Road in that stretch. From there, the DMA follows Colburn Avenue to Victoria Point itself, but only includes customers on the southern side of Colburn Avenue. The DMA also includes the submarine crossing and supply to Cochiemudlo Island and a small area west of Cleveland – Redland Bay Road.

The DMA is primarily low coastal areas with elevations ranging from zero to approximately 20m AHD. The elevation of the highest point in the DMA is 21.9m AHD which is in the small section of the DMA to the west of Cleveland – Redland Bay Road.

The topography of the DMA is shown on **Figure 9.3**.

9.2 Previous Planning

All of this DMA was originally included in the Victoria Pt PRV zone. Planning undertaken for the PIP / ICS, which was based on the original configuration for this area and included augmentations along Link Road and Colburn avenue, the installation of a booster pump at Victoria Pt (at the end of Colburn Avenue) and some further augmentations along the main on Coochiemudlo Island.

In March 2009, water supply needs of Coochiemudlo Island were investigated further to determine augmentation requirements for fire flow (RW, 2009(a)). The report titled "*Coochiemudlo Island Water Supply Investigation*" adopted a different strategy to the MWH report and included the augmentation of the main from the mainland to Coochiemudlo Island (instead of the booster pump station) and a number of minor augmentations on Coochiemudlo Island.

9.3 Current System Configuration and Source of Supply

The Benfer Road DMA is fed from the Heinemann Rd Reservoir via 675 and 600 mm dia MSCL pipes along Heinemann Rd, a 600 mm dia uPVC pipe along Giles Rd and a 375 mm dia AC pipe from the abandoned Giles Rd Reservoirs to the Benfer Road DMA PRV and Meter off-take in Cleveland – Redland Bay Road.

The PRV is modulated with a setting of 32m for flows less than 18L/s and fully open for flows greater than 30L/s. For average day demands, the pressure upstream of the PRV is consistently around 57m. This modulation profile has primarily been set to ensure that sufficient pressure is delivered to Coochiemudlo Island, particularly in a fire flow event.

9.4 Existing System Performance at Ultimate Demands

The PH model results for the Benfer Road DMA with the current modulation profile for the PRV are shown on **Figure 5.4**. The results show that the mainland has sufficient pressures at PH, however all areas on Coochiemudlo Island have pressures less than 22m with some areas showing negative pressures.

The results also show that the pressures in the Benfer Rd DMA are limited by the available pressure upstream of the DMA. **Figure 9.1** shows that at PH the pressures upstream of the PRV reduce by about 10m to 47m at PH. This is because of the head loss from the abandoned Giles Rd Reservoir to the PRV which is around 8m/km. Note that **Figure 9.1** shows the results with the existing modulation profile, with this profile there are pressure problems on Coochiemudlo Island and in the Prescoter Drive and Holly Road areas on the mainland at night.

The pressures in the Benfer Rd DMA are also influenced by the settings of the Giles Rd PRV which are shown on **Figure 9.2**. The figure shows that at PH pressures are reduced by 8m as a result of the PRV setting.

The fire flow results with the current modulation profile for the PRV are shown on **Figure 9.5**.

Figure 9.1 – Benfer Road PRV Pressures

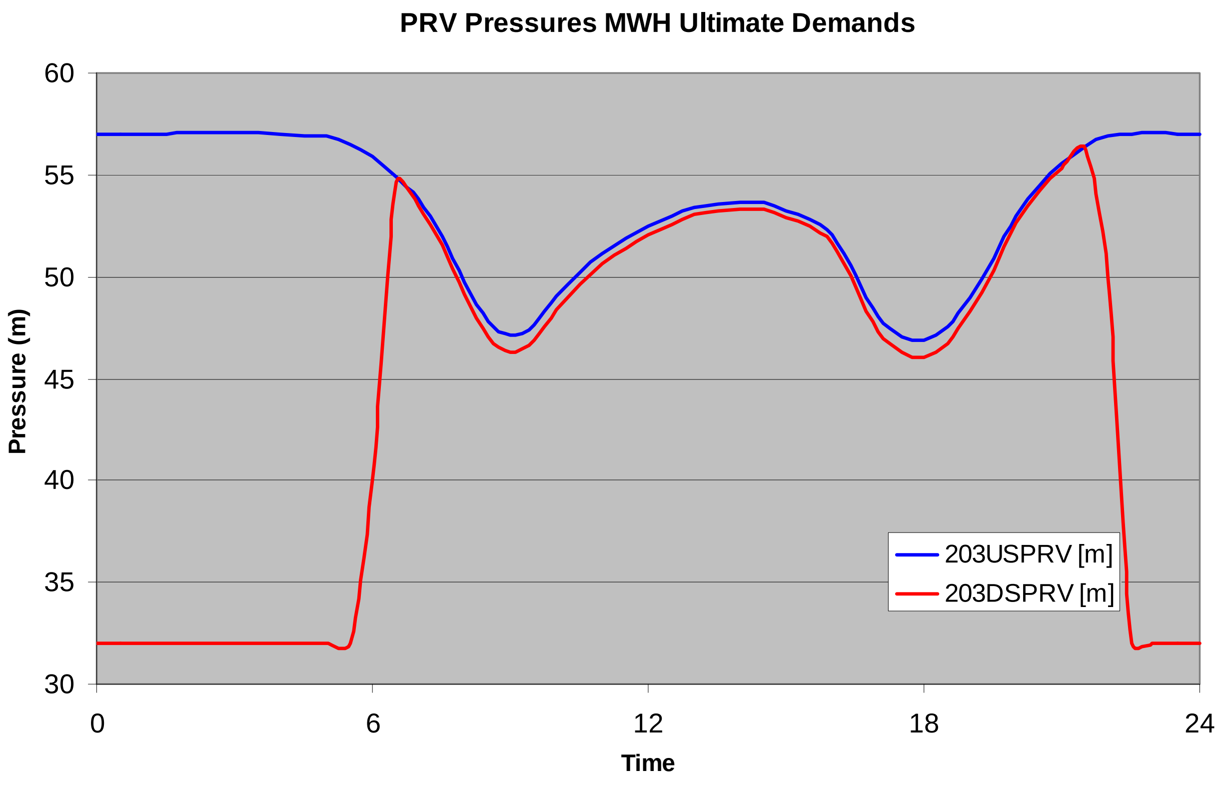
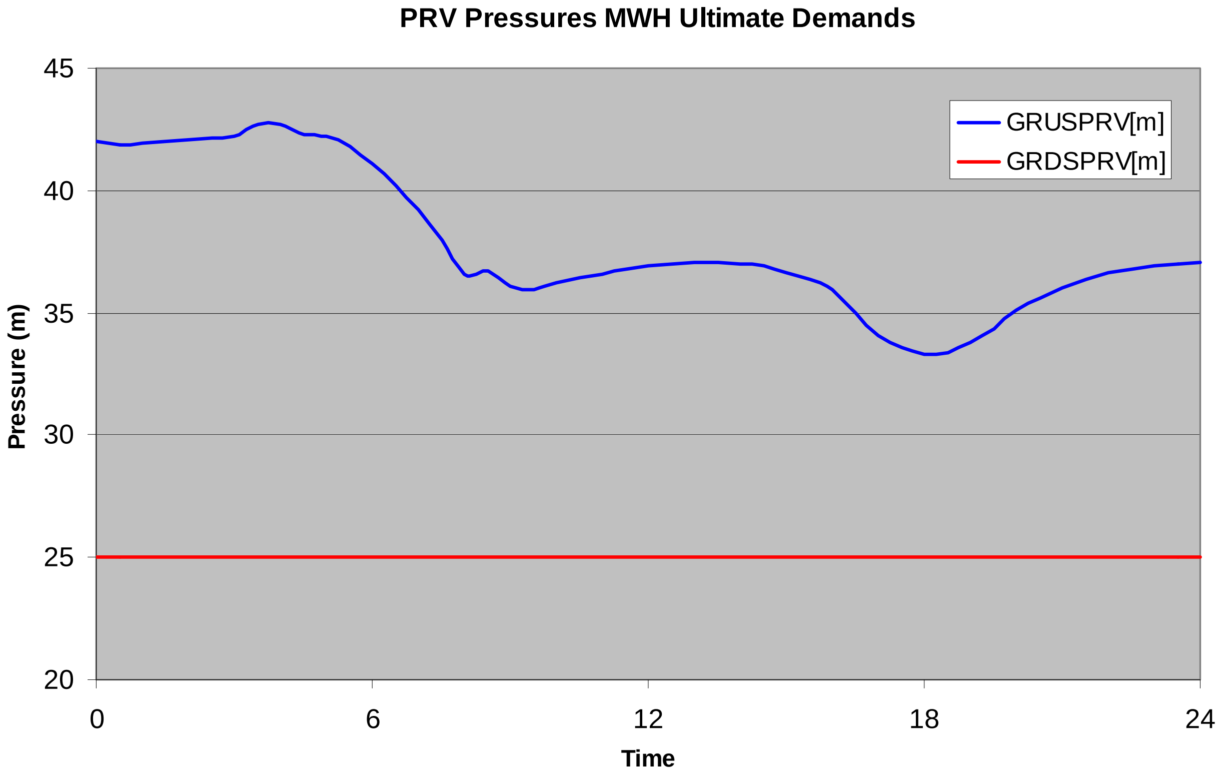


Figure 9.2 – Giles Road PRV Pressures



9.5 Proposed Augmentations

The modulation profile of the Benfer Rd PRV will need to be adjusted for all options. The profile will need to be reviewed regularly to ensure sufficient pressures in the zone.

When the PRV is modulated there is pressure loss of about 6m through the PRV even when it is fully open. This was taken into account in the modelling as follows.

At peak hour the pressure upstream of the Benfer Rd PRV is 66m so a downstream pressure of 60m was adopted to take this into account.

Because Coochie has the Island diurnal pattern, a time of 7:00 am has been adopted as 2/3PH compared to 7:30 am for other DMAs. When a fire flow of 30L/s is added to the DMA at 7:00 am the pressure upstream of the Benfer Rd PRV is 70m. A pressure setting of 64 m has therefore been adopted for the fire flow analysis.

It should also be noted that at PH there is a 4m headloss through the Giles Road PRV by-pass and about 2 meters head loss through the PRV when it is fully open (and not modulated). It is therefore recommended that the PRV removed from the system when it is no longer required.

The future planning scheme and proposed reticulation for undeveloped areas are included on **Figure 9.8**.

9.5.1 Option 1 Combine Victoria Pt and Benfer Rd DMAs

This option was investigated to determine if the DMA structure was impacting on the available pressures on Coochiemudlo Island. When both DMAs were combined to form a single DMA and with both PRVs set to fully open there was only a 3m improvement in pressures on Coochiemudlo Island at PH. This provides a good indication that the DMA structure is not significantly impacting on the available pressures at Coochie and as a result it has not been investigated any further.

9.5.2 Option 2 Only Augment Mains on Land

PH Results

The worst junction on Coochiemudlo Island has a PH pressure of -8m. To obtain a residual pressure of 22m an additional 30m of pressure needs to be obtained. The model results show that it is possible to obtain an additional 43m without augmenting the main from the mainland to Coochiemudlo Island or constructing a booster pump.

The head losses in the system at PH are shown below.

- Giles Rd PRV Setting – 9m
- Giles Rd PRV to Benfer Rd PRV – 9m
- Benfer Rd PRV to Victoria Pt (End of Colburn Avenue) – 21m
- Coochiemudlo Island – 4m

To investigate this option further the following augmentations were adopted:

- Giles Rd PRV fully open
- Augment the main from the Giles Rd PRV to the Benfer Rd PRV with 1.2km of 375mm main (PIP_IC11).
- Augment the main along Colburn Avenue from Wilmot Street to Victoria Pt with 1.3km of 250mm main (PIP_IC7, PIP_IC9_Opt2, PIP_IC8).
- Augment the 200mm main along Victoria Parade South on Coochiemudlo Island with an additional 550mm of 200mm main (PIP_IC10).

These augmentations are sufficient to provide the needed PH pressures on Coochie.

The results of this option are shown on **Figure 9.6**. The results show that even at peak hour there are a large number of areas with pressure above 60m with a maximum pressure of 69m at J11896 at the end of Buggy Place. This is necessary to provide sufficient pressures on Coochie. The maximum pressure at 3:00 in the morning is 80m at J12101 (at the end of Simon St).

Fire Flow Results

The augmentations described above are not sufficient to meet the FF requirements with many areas not receiving the required 15L/s and no areas receiving 30L/s. The augmentations needed in addition to those identified in the Coochiemudlo Island Water Supply Investigation are described below.

- Construct 150mm reticulation in the new development areas as shown on **Figure 9.8**.
- Augment the main along Victoria Parade West from Perulpa Street to Erobin Street with 460m of 150mm main (PIP_AUG18).

Figure 9.8 does show to junctions along Cypress Street that have an available FF of just under 15L/s, however there are no hydrants near these junctions so this is considered acceptable.

9.5.3 Option 3 Booster Pump to Coochiemudlo Island

The option of a Booster Pump station at Victoria Pt (the end of Colburn Avenue), was rejected in the *Coochiemudlo Island Water Supply Investigation*" for the following reasons (RW, March 2009, p10).

- *The pump station will likely never be needed other than possibly to marginally boost a small number of properties in the Cypress Street area but would still require regular operational and maintenance checks. The pump station would be difficult to operate to meet all fire locations and MD demand scenarios on the island and it is likely that the end result would be a variable speed pump station constantly operating at a nominal head to cover all contingencies. .*

This option has therefore not been investigated any further in this study.

9.5.4 Option 4 Augment Main to Coochiemudlo Island

PH Results

To achieve a minimum residual pressure of 22m at the critical Junction J14823 the following augmentations are required.

- Giles Rd PRV fully open
- Benfer Rd PRV fully open
- Augment the main from the Giles Rd PRV to the Benfer Rd PRV with 1.2km of 375mm main (PIP_IC11).
- Augment the existing 200mm main from Master Avenue to the submarine main with 190m of 200mm main (PIP_IC8).
- Augment the existing 200mm submarine main with an additional 1km of 200mm main (PIP_IC9_Opt4)
- Augment the 200mm main along Victoria Parade South on Coochie with an additional 550mm of 200mm main (PIP_IC10).

These augmentations are sufficient to provide the needed PH pressures on Coochie.

The results of this option are not show graphically but they are almost the same as those for Option 2 which are shown on **Figure 9.6** and described previously.

Fire Flow Results

The augmentations described above are not sufficient to meet the FF requirements with many areas not receiving the required 15L/s and no areas receiving 30L/s. The Augmentations needed in addition to those identified in the Coochiemudlo Island Water Supply Investigation are described below.

- Augment the 200mm main along Colburn Avenue from Wilmont to Wilson Street with 286m of 250mm (PIP_IC7).

9.5.5 Preferred Option

As discussed previously Option 1 and Option 3 have not been considered further. **Figure 9.7** shows the fire flow results on Coochiemudlo Island for Option 2 and Option 4. These results show that Option 4 provides the most suitable fire flow for the Island with the two commercial areas along Victoria Parade South receiving a flow of 30L/s for this option.

The differences in augmentations between Option 2 and Option 4 are as follows:

Option 2

- 400m of 250 dia –along Colburn Avenue (Mainland)
- 460m of 150 dia – along Victoria Parade West (Coochie)

Option 4

- 1000m of 200 dia - 1km submarine main

The advantages of each option are summarised in **Table 9.1** below.

Table 9.1 – Benfer Road Proposed Option Comparison

Option	Advantages	Disadvantages
Option 2	• There is only an additional 200 m of 150mm main required and all works are either on the Mainland or Coochiemudlo Island.	• The augmentations along Colburn Avenue would be expensive because of existing driveways and services. • Available fire flows are less than 30L/s in all areas.
Option 4	• Additional security is provided on Coochiemudlo Island because of submarine main duplication • Fire flow of 30L/s is available to some areas on Coochiemudlo Island	• The Submarine main would be considerably more expensive than construction of various mains on land.

Although Option 4 will be more expensive than Option 2, it is considered that the advantages outweigh the additional cost, so Option 4 is presented as the preferred option.

9.6 Augmentation Timing

9.6.1 Existing System at 2013 Demands

The PH results when the 2013 demands are included on the existing system model are shown on **Figure 6.7**. At PH the pressure upstream of the Benfer Road PRV is 67m so a pressure of 61m has been adopted for this analysis to allow for losses due to PRV modulation.

The figure shows that the DSS are met on the mainland but no areas on Coochie meet the DSS. The critical junction is J14823, which has a modelled available pressure of -6m at PH demands. This junction struggles to meet the DSS when flow to Coochie is above 21 L/s and the flow into Benfer Road is above 83L/s. Adopting the general AD/MD ratio of 1.9 this equates to a peak AD flow of 11 and 44 L/s respectively.

It is recommended that a flow meter is installed prior to the submarine main to Coochie so flows to this area can be more accurately determined.

2013 Augmentations

To meet the DSS for the 2013 demands all augmentations identified in **Section 9.5.4** under the sub heading “Peak Hour” need to be adopted.

At 7:00am with a 15L/s FF on Coochie the pressure upstream of the Benfer Rd PRV is 71m. When the PRV is set at 65m to allow for modulation losses, the additional FF Augmentation PIP_IC7 is not needed to meet the 2013 FF demands.

These are shown on **Figure 9.10**.

9.6.2 2013 System at 2018 Demands

This PH scenario did not need to be investigated as all proposed augmentations needed to meet the ultimate PH demands are required for the 2013 scenario.

The fire flow results with the 2018 demands on the 2013 system are shown on **Figure 9.10.** When a fire flow of 30L/s is included on the system the upstream pressure at 7:00 am is 70m. The adopted PRV setting for this analysis was therefore 64 m. The figure shows that all areas meet the DSS for fire flow except for the commercial areas on Coochie with the lowest available Fire Flow being 23L/s at the corner of Victoria Parade South and Dawn Street. To meet the DSS for fire flow PIP_IC7 is needed as described in **Section 9.5.4**.

9.6.3 Ultimate (2025) Demands

There are no additional augmentations required for the 2025 demands as all augmentations are needed before then.

9.7 Recommendations

The following master plan recommendations are made for this DMA:

- Option 4 (augmentation of the submarine main to Coochie) as detailed above be pursued as the preferred augmentation strategy as it provides a better strategic outcome for the Redland Water. The timing of augmentations needs to be reviewed in line with actual demand in the DMA.
- Modulation profile of the DMA is regularly reviewed to ensure sufficient pressures in the zone.
- The Giles Road PRV is removed when it is no longer needed.
- Install a flow meter to measure flow to Coochiemudlo Island

Legend

Benfer Rd | Existing DMA Boundaries | 5m Contours

Diameter

80	150	225	300	450	525	675	750
63	100	200	250	375	500	600	691	900

0 250 500 1,000 1,500 2,000 2,500 Meters

G:\RedlandWater&Waste\Data\TechSup\Planning\Projects\56025 Water & Sewerage PIP and ICS\Water & Sewerage PIP and ICS\10_PIP_Model_Review\
203 Benfer Road DMA\Drawings\Figure9.3_203_Topography.mxd
Rev0 22 December 2009

FIGURE 9.3
203 Benfer Road Topography

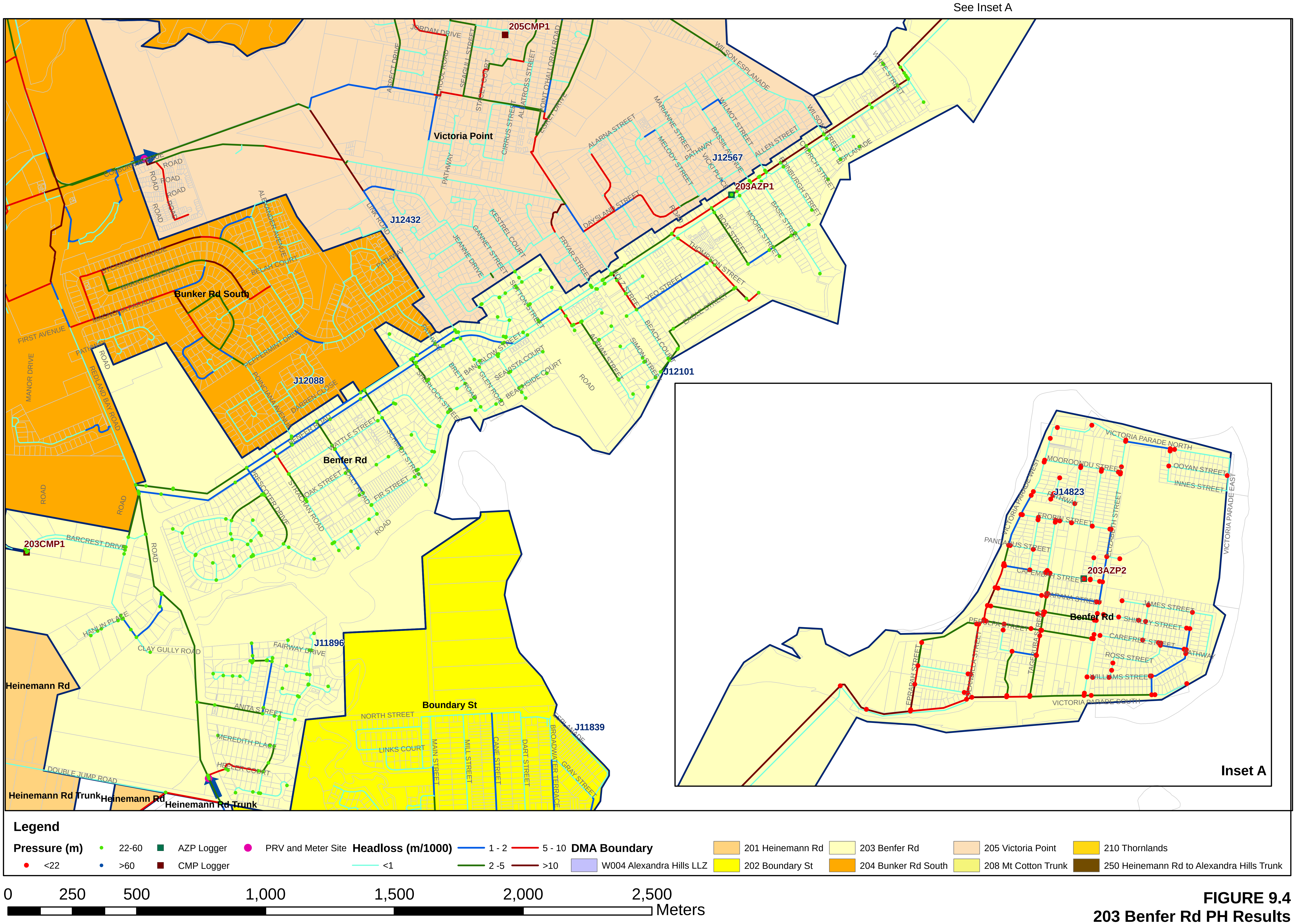


FIGURE 9.4
203 Benfer Rd PH Results

G:\RedlandWater&Waste\Data\TechSup\Planning\Projects\56025 Water & Sewerage PIP and ICS\Water & Sewerage PIP and ICS\10_PIP_Model_Review\203 Benfer Road DMA\Drawings\Figure9.4_203_ULT_PH.mxd
Rev0 22 December 2009

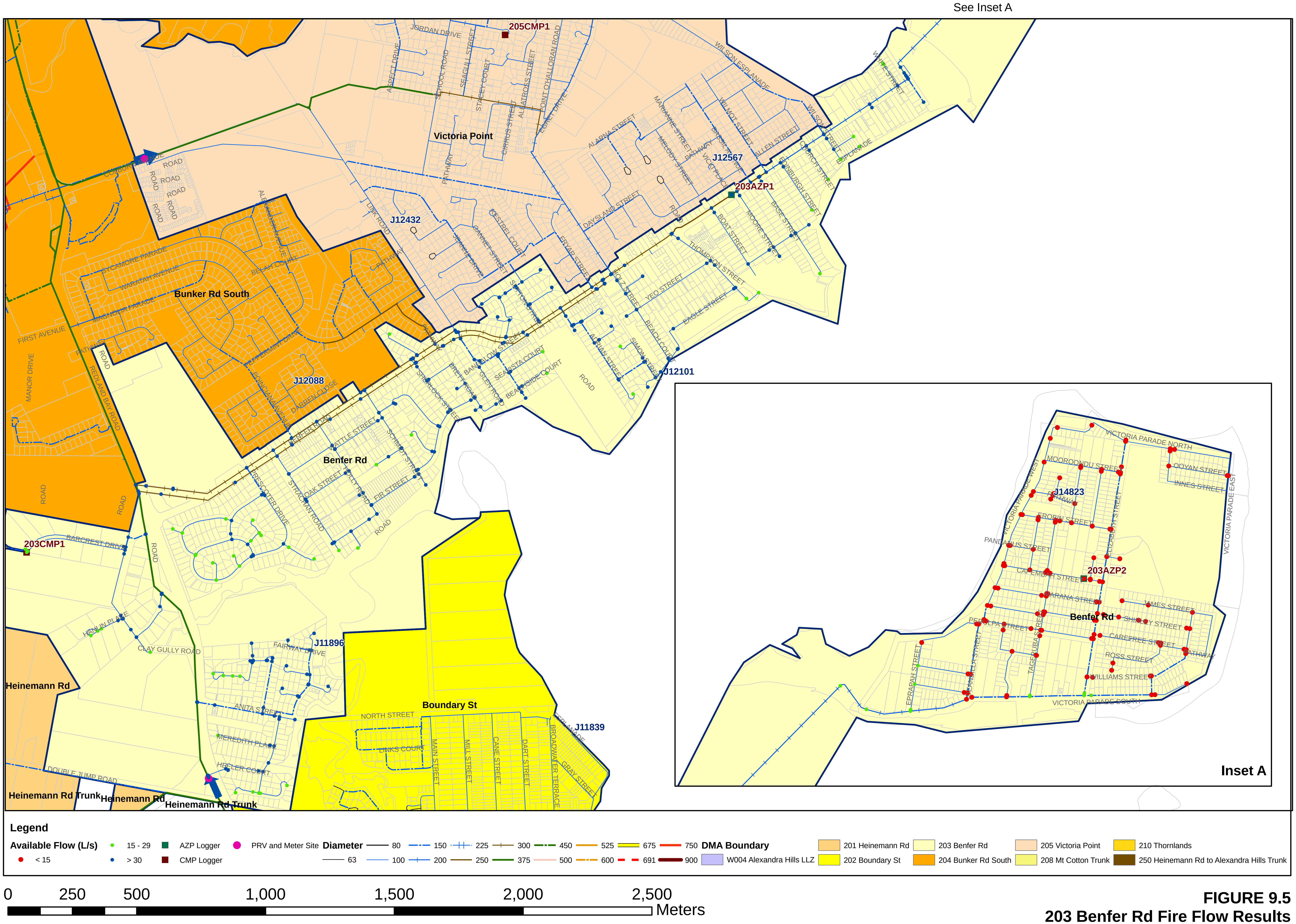


FIGURE 9.5
203 Benfer Rd Fire Flow Results

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10_PIP_Model_Review\203 Benfer Road DMA\Drawings\Figure9.5_203_ULT_PH.mxd
Rev0 22 December 2009

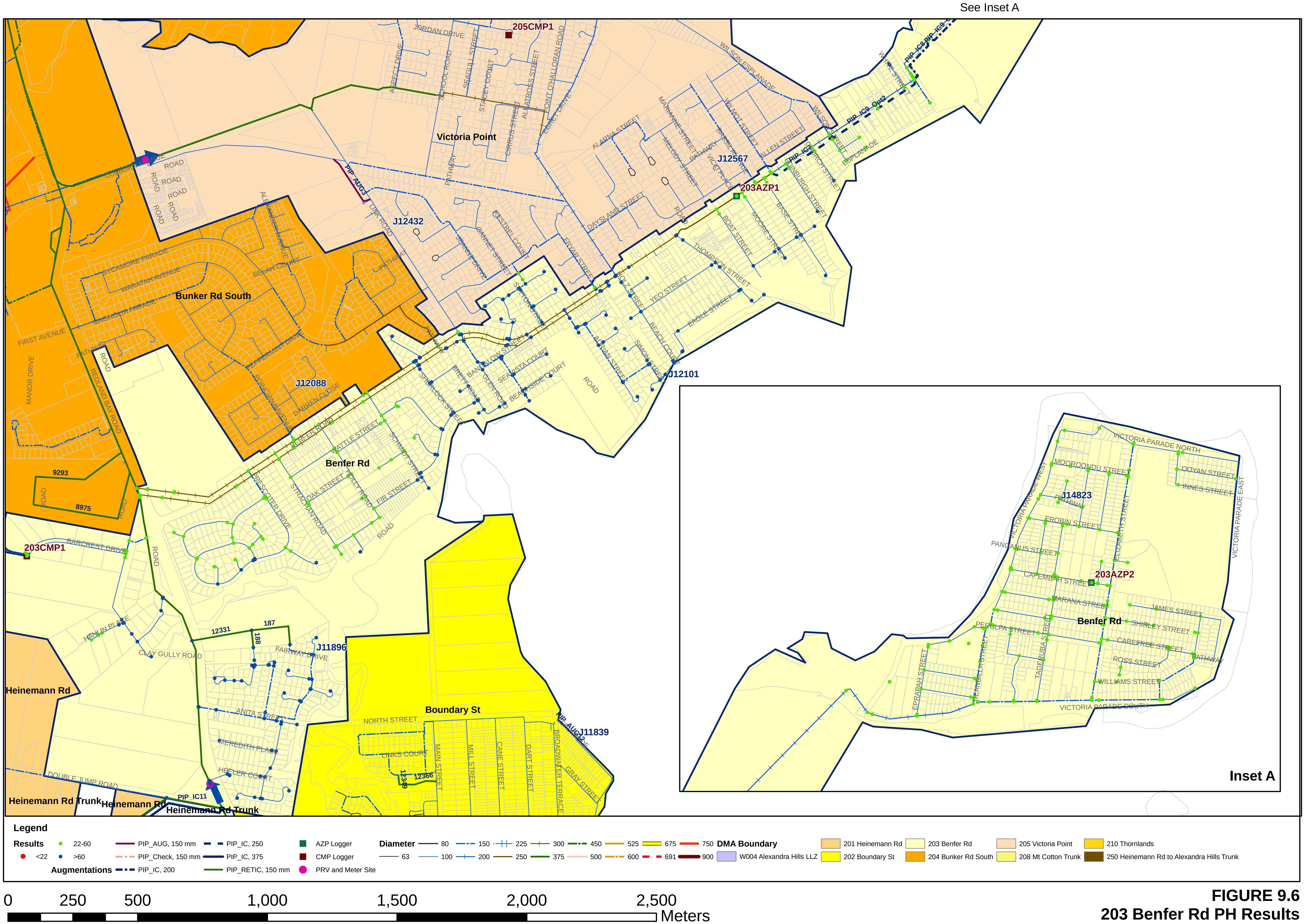


FIGURE 9.6
203 Benfer Rd PH Results
With Augmentations Option2

G:\Redland\Water&Waste\Data\TechSup\Planning\Projects\56025 Water & Sewerage PIP and ICS\Water & Sewerage PIP and ICS\10_PIP_Model_Review\203 Benfer Road DMA\Drawings\Figure9.6_203_ULT_PH.mxd
Rev0 22 December 2009

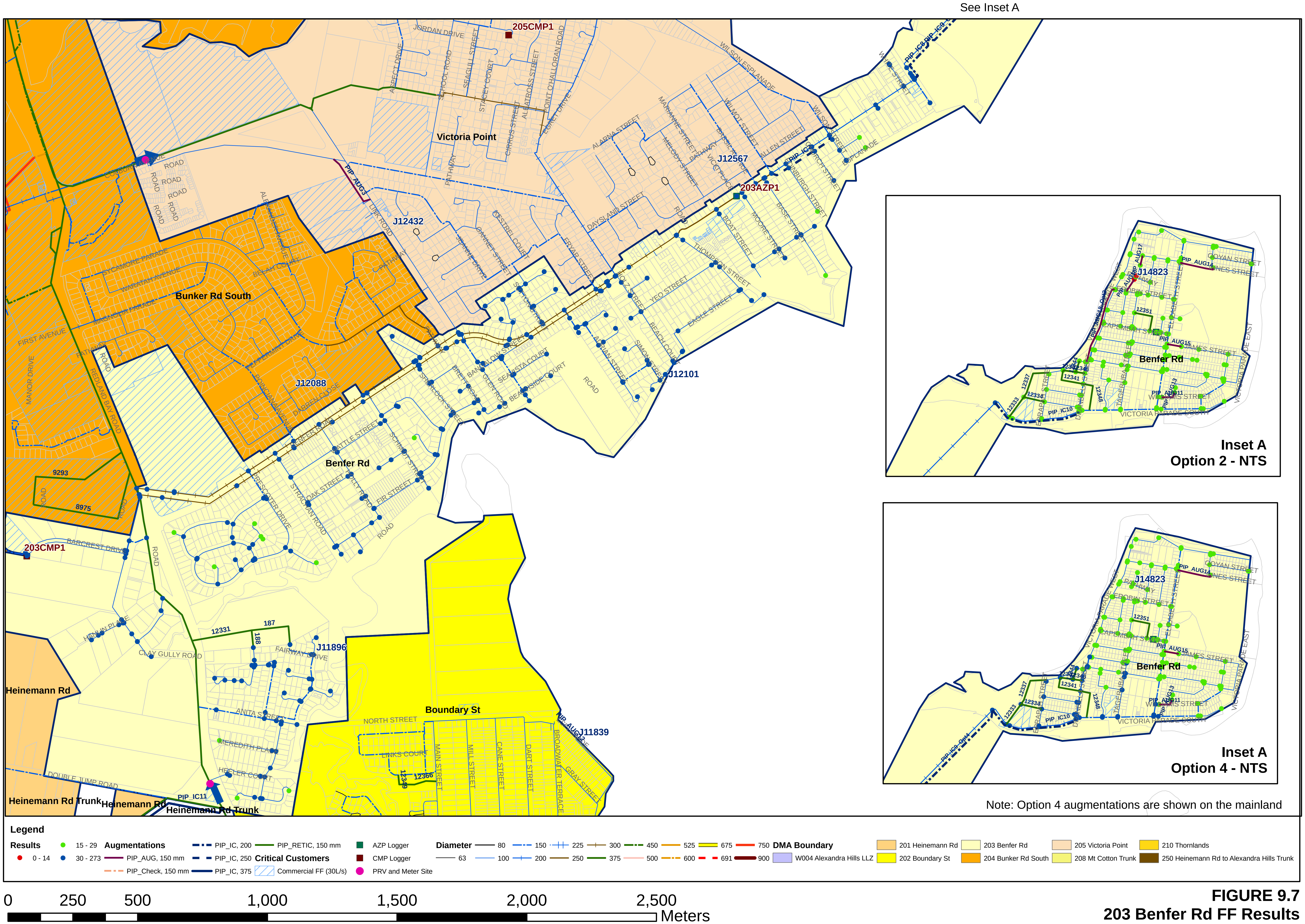


FIGURE 9.7
203 Benfer Rd FF Results
With Augmentations

G:\RedlandWater&Waste\Data\TechSup\Planning\Projects\56025 Water & Sewerage PIP and ICS\Water & Sewerage PIP and ICS\10_PIP_Model_Review\203 Benfer Road DMA\Drawings\Figure9.7_203_ULT_FF0700_wAUG_PRV64.mxd
Rev0 22 December 2009

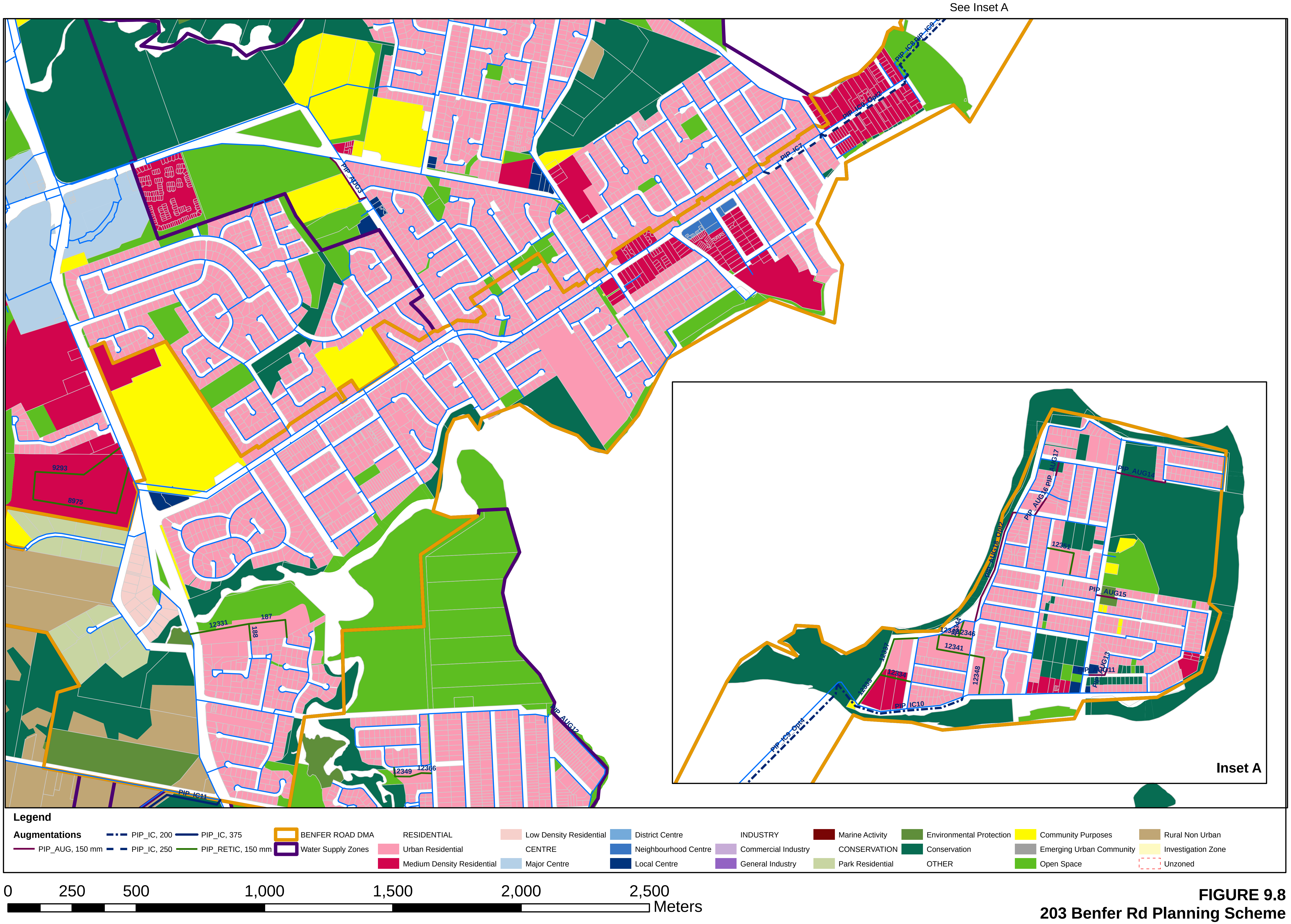
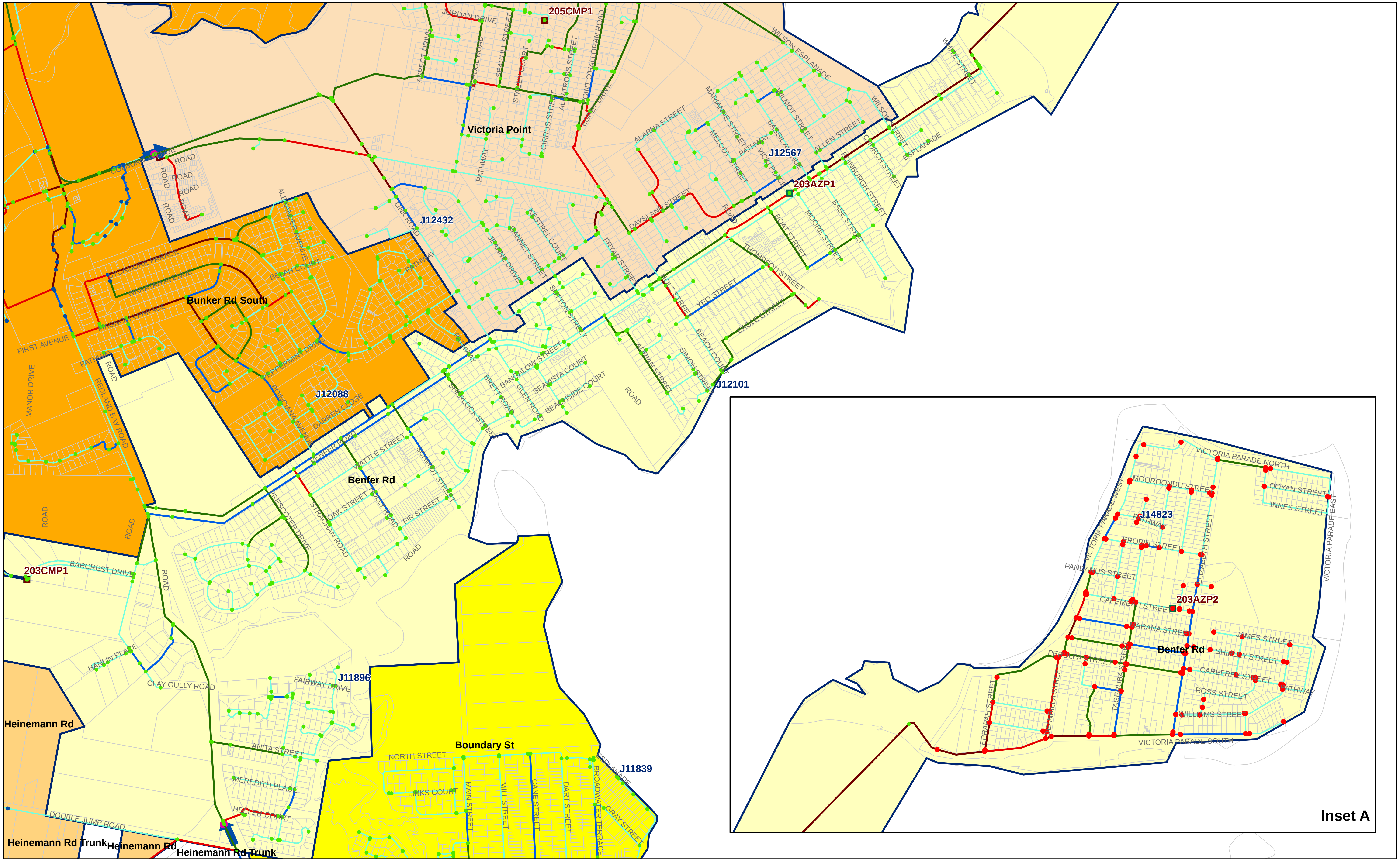


FIGURE 9.8
203 Benfer Rd Planning Scheme

G:\RedlandWater&Waste\Data\TechSup\Planning\Projects\56025 Water & Sewerage PIP and ICS\Water & Sewerage PIP and ICS\10_PIP_Model_Review\203 Benfer Road DMA\Drawings\Figure9.8_203_wAUG_ULT_PScheme.mxd
Rev0 22 December 2009



Legend

Pressure (m)				Headloss (m/1000)		DMA Boundary	
22-60	AZP Logger	PRV and Meter Site		1 - 2	5 - 10	201 Heinemann Rd	203 Benfer Rd
<22	>60	CMP Logger		<1	2 -5	>10	W004 Alexandra Hills LLZ

DMA Boundary (cont.): 205 Victoria Point, 210 Thornlands, 202 Boundary St, 204 Bunker Rd South, 208 Mt Cotton Trunk, 250 Heinemann Rd to Alexandra Hills Trunk

0 250 500 1,000 1,500 2,000 2,500 Meters

G:\RedlandWater&Waste\Data\TechSup\Planning\Projects\56025 Water & Sewerage PIP and ICS\Water & Sewerage PIP and ICS\10_PIP_Model_Review\203 Benfer Road DMA\Drawings\Figure9.9_203_2013_PH.mxd
Rev0 22 December 2009

FIGURE 9.9
203 Benfer Rd
Existing System with 2013 PH Results

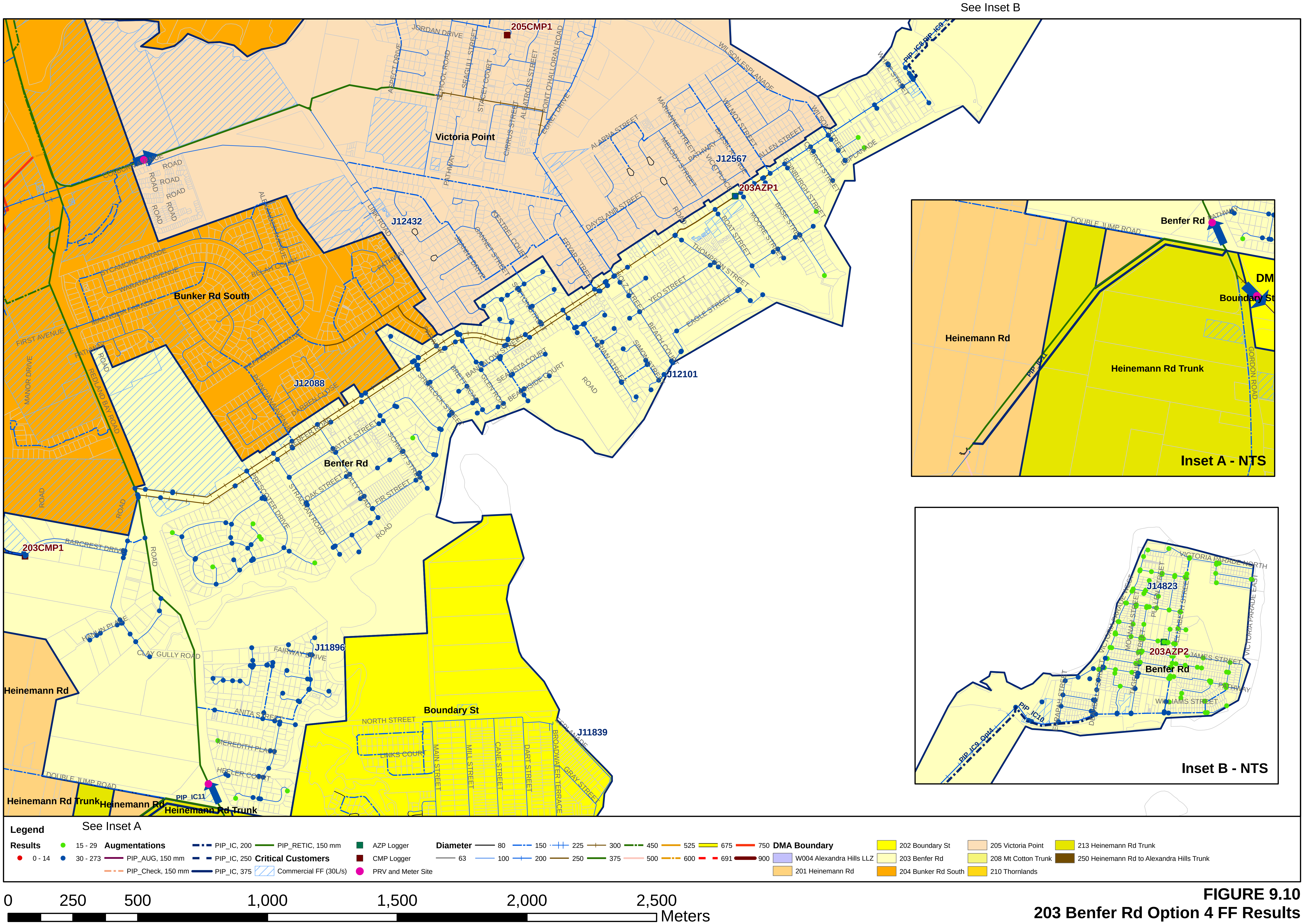


FIGURE 9.10
203 Benfer Rd Option 4 FF Results
2013 system with 2018 Demands

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Rev0 22 December 2009

10. 204 Bunker Road South DMA

10.1 DMA Topography

The Bunker Road South DMA extends from the DMA inlet on the southern side of Bunker Road (behind the shopping centre) and includes the Victoria Point commercial centre in the immediate vicinity. From the DMA inlet, the zone extends south towards Benfer Road and north to South Street. Cleveland – Redland Bay Road runs north-south through the DMA and Eprapah Creek travels from west to east through the DMA. Bunker Road South DMA has lower lying coastal areas ranging from 5m to 20m AHD to the east of Cleveland – Redland Bay Road and higher elevations further inland ranging from 10 to 35m to the west of Cleveland – Redland Bay Road. The highest elevation within the zone is 35m along Bunker Road at the west of the DMA boundary. There are two other areas where the elevation reaches 30m, Trochus Court and Boundary Rd near Meadowland Road.

The topography of the DMA is shown on **Figure 10.1**.

10.2 Previous Planning

About two thirds of the area covered by this DMA was originally included in the Alexandra Hills LLZ with the remaining third in the Victoria Point PRV zone. Planning undertaken for the PIP / ICS, which was based on the original configuration for this area, only included connections in new development areas. There was however a "contingency" augmentation identified in the PIP / ICS which was essentially along the spine of this DMA. ("Contingency" augmentations were developed in a planning study prior to the PIP / ICS and were directed at ensuring sufficient water could be transferred around the City in the event that one of the WTPs was off-line for an extended period of time).

The PLMP created the Bunker Road South DMA and attempted to size the zone based on the optimum use of the existing infrastructure (the Bunker Road South PRV existed before the PLMP was commenced and is a relatively large valve at DN500mm), hence the extension of the DMA north into the original Alexandra Hills LLZ.

Planning work undertaken as part of the PLMP originally had the Victoria Pt DMA supplied off the Bunker Rd North PRV. However, modelling indicated that if SEQ Water Grid operations dictated that the Bunker Rd North PRV be completely closed, then sufficient fire flow could not be provided to some areas of the Victoria Pt DMA without augmentation. The system was then changed so the Victoria Pt DMA receives its supply from the Bunker Road South DMA off the 375mm main along Cleveland – Redland Bay Road.

10.3 Current System Configuration and Source of Supply

The Bunker Road South DMA is supplied from the HRR complex via two mains along Heinemann Rd, 675 and 600 mm dia MSCL until Giles Road and then two 600mm mains to the PRV and flowmeter off-take in Bunker Road (opposite Intrepid Drive and Manor Drive intersections).

Although the Bunker Rd North PRV is located further down the trunk mains, the operation of the Bunker Road North PRV does impact on the upstream pressure at the Bunker Road South off-take (by drawing down the HGL in the trunk mains when fully open).

As mentioned previously the Victoria Pt DMA also receives its supply from the Bunker Road South DMA.

The Bunker Road South PRV is set at 64m and is not currently modulated. A setting of 64m has been adopted as this is the maximum pressure that the PRV can be set at without impacting on the operation of the PRV. Detailed analysis of the significant commercial demand served by this PRV will need to be undertaken before the any further pressure reduction, including modulation, is undertaken in this DMA.

The analysis in this report is based on the assumption that the PRV will not be modulated. If it is modulated then there may be an additional head loss of about 6m through the PRV when it is fully open, so augmentation requirements would need to be reviewed.

10.4 Existing System Performance at Ultimate Demands

10.4.1 With Victoria Pt DMA

The PH model results for Bunker Road South with the PRV at the current setting of 64m, with all proposed fire flow augmentations complete and Victoria Pt DMA off of Bunker Road South DMA, are shown on **Figure 10.2**.

The figure shows that there are pressure problems along the western side of the zone. This is because of the high friction losses from the Bunker Rd South PRV to the Boundary Road off-take.

The critical junctions in each area are:

- North of Ziegenfusz Road – J7921 (9m)
- South of Boundary Street – J7738 (19m)
- Near Bunker Road – J7440 (14m)

10.4.2 Without Victoria Pt DMA

If the Victoria Pt DMA is taken off of the Bunker Rd South DMA the results are significantly better, however there are still pressure problems at the western side of the boundary near the Thornlands DMA and at the end of Bunker Road where the zone connects to the Heinemann Road Zone.

The critical junctions in each area are:

- North of Ziegenfusz Road – J7921 (15m)
- South of Boundary Street – J7738 (26m)
- Near Bunker Road – J7447 (19m)

10.4.3 Fire Flow

The fire flow results with Victoria Pt DMA supplied from Bunker Rd South DMA are shown on **Figure 10.4**. The figure shows that the areas that have problems with fire flow are the same as those at peak hour.

The critical junctions in each area are:

- North of Ziegenfusz Road – J7921 (8L/s near a future school – assumed commercial FF req't)
- South of Boundary Street – J7693 (14L/s)
- Near Bunker Road – 2_119 (8L/s)
- End of Beveridge Road - J12810 (23L/s near a commercial area)

When the Victoria Pt DMA is removed from Bunker Rd South the same areas have problems but the extent of the problem areas is greatly reduced.

10.5 Proposed Augmentations

To improve the performance of the Bunker Rd South DMA it is proposed to remove the low pressure areas from the Bunker Rd South DMA and create two new DMAs as shown on **Figure 10.5** and described below.

This option allows for the Victoria Pt DMA to be sourced from the Bunker Road South DMA rather than Bunker Road North CV, giving Redland Water greater control over the upstream pressures provided to the Victoria Point DMA.

The proposed PIP infrastructure is shown on **Figure 10.5**.

Figure 10.6 shows how the proposed reticulation relates to the existing planning scheme.

A summary of the existing and projected EP for each of the proposed DMAs is included in **Table 10.1**. The range of flows likely to enter each DMA, are included in **Table 10.2**.

Table 10.1 – Bunker Rd South Equivalent Population

DMA	Water Meter Data (08)		EP's			
	kL/yr	EP (215L/EP/d)	MWH2008	MWH2013	MWH2018	MWHULT
Ziegenfusz Road	441683	5695	6790	8223	8223	9059
Bunker Road South West	143942	1844	1685	2509	2734	3194
Victoria Pt	433136	5550	6063	6392	6454	7024
Bunker Road South	367015	4703	3009	6115	7335	10919
TOTAL		**17792**	**17547**	**23239**	**24746**	**30196**

Table 10.2 – Bunker Rd Flows

DMA	Water Meter Data (08)			MWH Ult			
	AD (L/s)	Min Hr (AD) (L/s)	Peak Hr (MD) (L/s)	AD(1) (L/s)	Min Hr(1) (AD) (L/s)	Peak Hr(1) (MD) (L/s)	Min(2) FM size (mm)
Ziegenfusz Road	14.0	1.5	55.9	31.5	3.5	125.5	150
Bunker Road South West	4.6	0.5	18.2	11.1	1.221	44.3	80
Victoria Pt	13.7	1.5	54.8	24.4	2.684	97.3	125
Bunker Road South	11.6	1.3	46.4	37.9	4.169	151.3	n/a
Bunker Rd South with Victoria Pt	25.4	2.8	101.2	62.3	6.853	248.6	200

Note: (1) Assuming 300L/EP/d
(2) The actual size may need to be increased to reduce friction losses through the meter

The analysis in this report assumes that at the "Ultimate" demands the Alexandra Hills LLZ reservoirs are once again operating at their full capacity and higher water levels.

10.5.1 214 Ziegenfusz Road DMA

This DMA will be formed from the northern area of the current Bunker Road South DMA by connecting it to the 450mm trunk main from HRR complex to AHR complex at the corner of Redland Bay Road and Ziegenfusz Road. A flow meter will need to be installed.

Main Roads is currently upgrading this intersection, the current works will allow for a flow meter (and PRV if necessary) to be installed at the intersection, however it is important that sufficient land is retained in the easement for the flow meter and PRV to fit. The proposed detail is included in **Appendix G**.

Most of the area south of Ziegenfusz Road which is currently connected to the 'HRR complex to AHR complex trunk main' can be included in the Ziegenfusz Road DMA.

PH Results

The 450mm flows in both directions depending on the operation of the Bunker Rd North PRV. When the Bunker Rd North PRV is open the DMA has sufficient pressures at PH. However if the

Bunker Road North PRV is fully closed and all flow is coming only from the AHR complex, there are some pressure problems in the area as shown on **Figure 10.5**. The critical junction is on the boundary of the Thornlands DMA and Bunker Road North DMA at J7922 which has an available pressure of 16m.

To supply sufficient pressure to this area a small 150mm dia augmentation is needed at the end of Semillon St to connect into the 150mm main along Champagne Crescent (PIP_AUG8) and a 200mm main needs to connect to the 375 along Redland Bay Road to the 100mm main at the end of Albicore Drive and the continue to the 150mm main in Vintage Drive (PIP_AUG9 & PIP_AUG10). When these augmentations are in place all areas receive suitable pressures except J7922, which has an available pressure of 21m. While this is slightly below the RSC DSS of 22m it is considered acceptable as the junction is located in an elevated area in the far south west corner of the adjacent block which slopes down to lower elevations. Most connection points will have a residual pressure above 22m and if the connection is needed in the South West corner it could be connected to the Thornlands DMA which operates at higher average pressure.

The maximum pressure at PH is 54 m at junction 469 which is located in the future Urban Residential area south of King Street.

A complete understanding of the intended future role of the Bunker Road North control valve within the SEQ Water Grid will be a crucial input into any decision made in relation to this proposed division of the existing DMA. For example if the Bunker Road North valve is no longer required to transfer water between HRR complex and AHR complex, then potentially there could be a valve closed on the 450mm main near AHR complex, which would allow Bunker Road North to remain open full-time to supply Redland's own network

The possibility of not having the Ziegenfusz Road DMA by extending the Alexandra Hills LLZ to include it was investigated. Providing the zone is connected to the 450mm trunk main, at the corner of Ziegenfusz Road and Redland Bay Road, there are sufficient pressures at all junctions except J7922 which has a residual pressure of 17m at PH.

If the there is no connection to the 450mm trunk main the results identified pressure problems in most of the Ziegenfusz Road DMA and in the Alexandra Hills LLZ south of Long Street with pressures at peak hour were below zero in some areas. To make this option work, major augmentations from Alex Hills Reservoir, along Long Street and down Bloomfield Street (and possibly even Redland Bay Road) would be required. This option was therefore not investigated any further.

AD Results

When the model is run on an average day the maximum pressure in the area at 3:00 in the morning (when the flows are at a minimum) is 83 m at junction 469 the minimum pressure at this time is at J7922 which has a residual pressure of 49 m. A pressure reduction of over 20m could therefore be achieved if it was decided to continue with the pressure management of the Redland City system.

Fire Flow Results

The south west section of the DMA is unable to meet the FF DSS without the augmentations as shown on **Figure 10.7**.

The critical junctions in each area are:

- End of Traminer Court – J8043 (13L/s)
- Ziegenfusz Road at the boundary of the Thornlands DMA and Ziegenfusz Rd DMA - J7922 (15L/s near a commercial area)

When the augmentations described above in the PH section, are completed all areas meet the DSS for FF except for J7922 which has an available FF of 20L/s. This junction is near a future school (assumed to have a commercial fire flow requirement), however it is also adjacent to the Thornlands DMA so a FF of 30L/s from two hydrants can easily be achieved in this area. No further augmentations have therefore been proposed.

When the Ziegenfusz Road DMA is removed, by extending the Alexandra Hills LLZ (with the zone connected to the 450mm trunk main, at the corner of Ziegenfusz Road and Redland Bay Road) the fire flow results are very similar to those when Ziegenfusz Road is retained as a separate DMA. The proposed augmentations described previously are still needed to meet the DSS for fire flow. The low available flow at J7922 is also still an issue.

10.5.2 211 Bunker Rd South West DMA

It is proposed to create a new DMA from the area in the Bunker Rd South DMA which is located along Bunker Road. The area would be connected to the 600mm main along Bunker Rd. A flow meter will need to be installed.

PH Results
The pressures in this area are also dependant on the operation of the Bunker Road North PRV. When the PRV is open the pressures in this area drop about 3 m because of the extra friction losses along the main.

The Critical Junction is “445” which is located in the Emerging Urban Community area south of Bunker Road. It has a residual pressure of 34m. This will drop to around 31m when the Bunker Rd North PRV is open.

Even at PH demands pressures in this zone are as high as 71m at J12312 at the corner of Intrepid Drive and Bunker Road. There may be the potential to pressure manage this DMA, however as discussed in **Section 1.3**, it is still unclear as to the cost effectiveness of the DMAs with minimal pressure reduction. It is therefore recommended that the need for pressure reduction is determined when more information is available on the results and implications of the current PLMP.

AD Results
When the model is run on an average day the maximum pressure in the area at 3:00 in the morning is 78 m at J12312 the minimum pressure at this time is at J7738 which has a residual pressure of 41 m. A pressure reduction of around 20m could therefore be achieved if it was decided to continue with the pressure management of the Redland City system.

Fire Flow Results
There are no commercial areas identified in this DMA so the critical junction is J7572 which is located as the end of Kurrewa Court and has an available FF of 19L/s. This result is without the FF_AUG_204_P9 which was identified in the Redland Water, *Water Supply System Fire Flow Review*.

10.5.3 204 Bunker Rd South DMA

The size of this DMA has been considerably reduced by removing the Ziegenfusz Road and the Bunker Road South West DMAs.

PH Results
The critical junction in the new reduced Bunker Rd South DMA is J7738, which is located at the end of Breckenridge Court, and has a residual pressure at PH of 38m.

The maximum pressure at PH is in the Emerging Urban Community along Redland Bay Road which has a residual pressure of 68m at junction 468.

AD Results
When the model is run on an average day the maximum pressure in the area at 3:00 in the morning is 83 m at J12593 the minimum pressure at this time is at J7738 which has a residual pressure of 41 m

Fire Flow Results
All areas meet the fire flow requirements, with the critical commercial junction being J12810 which is located at the end of Beveridge Road which has an available FF of 39L/s.

The critical junction for the residential fire flow is at the end of Darren Close (J12088) with an available FF of 20L/s.

10.5.4 Augmentation Results

The PH results when Bunker Road South is split into three DMAs with all identified augmentations are in place are included on **Figure 10.8**.

The fire flow results when all augmentations are in place are shown on **Figure 10.9**.

10.6 Augmentation Timing

10.6.1 Existing System at 2013 Demands

The PH results when the 2013 demands are included on the existing system model, with Victoria Pt connected, and the Bunker Road South PRV set at 64m are shown on **Figure 10.10**. The results when Victoria Pt is not connected are significantly better, however they still don't meet the DSS.

The critical junctions in each area are:
- North of Ziegenfusz Road – J7922 (9m)
- South of Boundary Street – 2_262(20m)
- Near Bunker Road – J7450 (15m)

The critical Junctions struggle to meet the DSS when flow into Bunker Road South is above 235L/s (this includes 66L/s going into the Victoria Pt DMa). Adopting the general AD/MD ratio of 1.9 this equates to a peak AD flow of 124L/s including the Victoria Pt DMA.

2013 Augmentations
If the Victoria Point DMA remains off of the Bunker Road South DMA, the Bunker Road South DMA needs to be spit up into three separate DMAs to meet the DSS. To meet the DSS for fire flow for this scenario PIP_AUG9, PIP_AUG10 & PIP_AUG8 all need to be constructed. The Lidgard Street area south of Ziegenfusz Road which is currently connected to the '*HRR complex to AHR complex trunk main*' can be included in the Ziegenfusz Road DMA at this time.

If the Victoria Point DMA is kept sperate to the Bunker Road South DMA then only the Bunker Road South West DMA needs to be split from the system to meet the DSS. To meet the DSS for fire flow for this scenario PIP_AUG9 and PIP_AUG10 also need to be constructed. The Lidgard Street area south of Ziegenfusz Road also needs to remain on the '*HRR complex to AHR complex trunk main*' for this scenario to work.

10.6.2 2013 System at 2018 Demands

This scenario only needs to be considered if the Victoria Pt DMA is supplied from the Bunker Rd North PRV, because if it is included on the Bunker Road South PRV all proposed augmentations need to be adopted at 2013.

If the Victoria Pt DMA is supplied from the Bunker Rd North PRV the proposed Ziegenfusz Road DMA area meets the PH and FF DSS when still connected to the Bunker Road South DMA when PIP_AUG8 is constructed.

10.6.3 Ultimate (2025) Demands

At ultimate demands the DMA needs to be split into three regardless of whether or not the Victoria Point DMA is connected or not as described in **Section 10.5**.

10.7 Recommendations

The following master plan recommendations are made for this DMA:

- The DMA is split into 3 DMAs as described above while leaving the Victoria Pt DMA off of the Bunker Road South DMA. If the Bunker Road North PRV is continuously closed this option allows for water to be supplied into all DMAs and meet still meet the DSS. A complete understanding of the intended future role of the Bunker Road North control valve within the SEQ Water Grid will be a crucial input into any decision made in relation to this proposal.
- The need for pressure reduction in the proposed DMA 214 Ziegenfusz Road and 211 Bunker Road South West are investigated after more information is available on the performance of the current PLMP.
- Review the need for FF_AUG_204_P9 as it is not needed in the ultimate scenario option.
- Ensure sufficient space remains in the easement at the Corner of Ziegenfusz Rd and Redland Bay Road so a flow meter and PRV can be installed.
- If it is decided to modulate the PRV in the future, the PRV settings may need to be adjusted to take into account the additional 6m head loss through the PRV when it is fully open.

Legend

Bunker Rd South

Existing DMA Boundaries

5m Contours

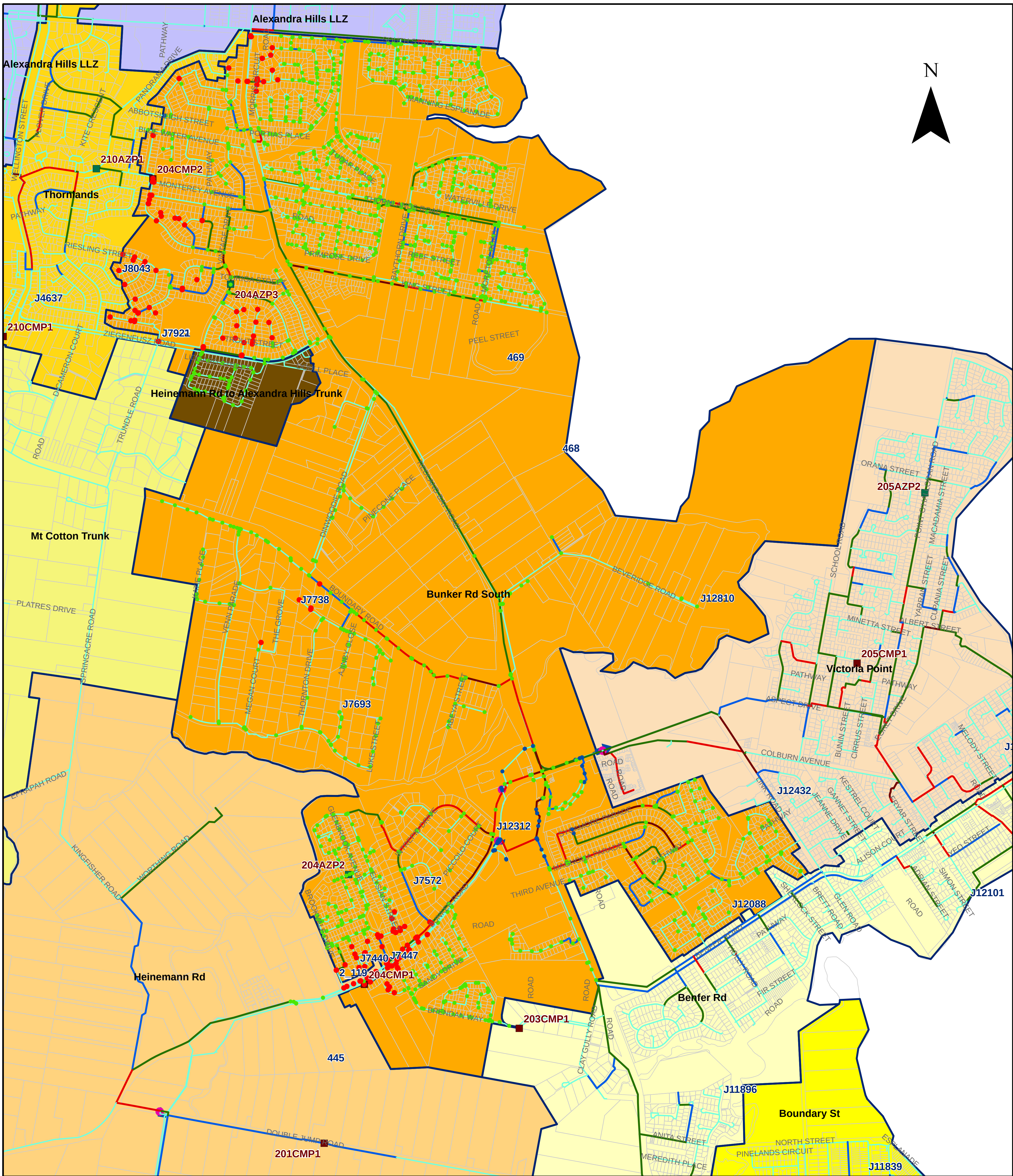
Diameter

63	100	225	375	525	691
	150	250	450	600	750
80	200	300	500	675	900

0 250 500 1,000 1,500 2,000 2,500 Meters

FIGURE 10.1
204 Bunker Road South Topography

G:\RedlandWater&Waste\Data\TechSup\Planning\Projects\56025 Water & Sewerage PIP and ICS\Water & Sewerage PIP and ICS\10_PIP_Model_Review\106 & 107 Serpentine Creek Road DMAs\Drawings\Figure10.1_106_topography.mxd
Rev0 22 December 2009



Legend

Residual Pressure (m)
- <22
- 22-60
- >60
- AZP Logger
- CMP Logger
- PRV and Meter Site

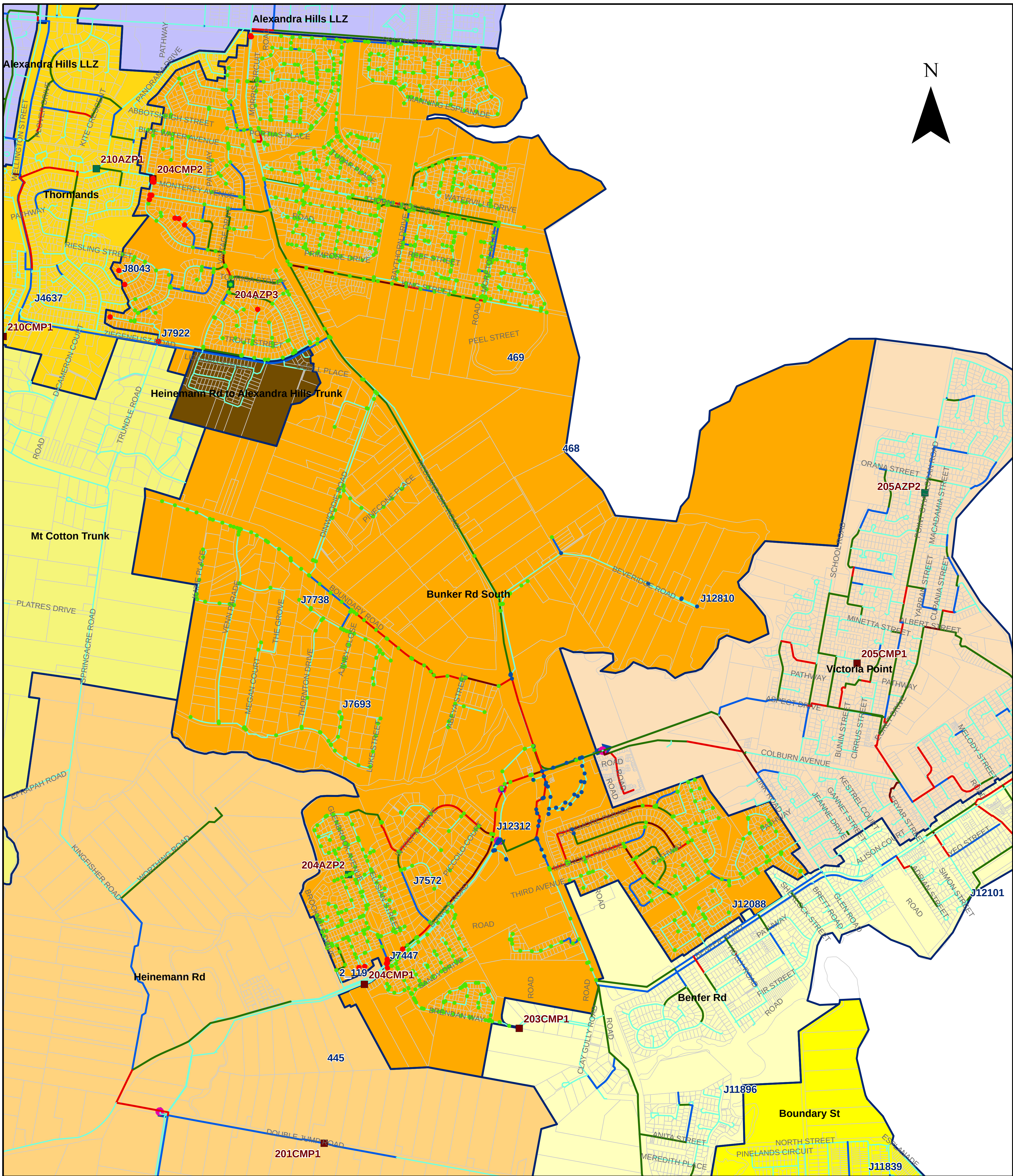
Headloss (m/1000)
- <1
- 1 - 2
- 2 -5
- 5 - 10
- >10

DMA Boundary
- W004 Alexandra Hills LLZ
- 201 Heinemann Rd
- 202 Boundary St
- 203 Benfer Rd
- 204 Bunker Rd South
- 205 Victoria Point
- 208 Mt Cotton Trunk
- 210 Thornlands
- 250 Heinemann Rd to Alexandra Hills Trunk

0 250 500 1,000 1,500 2,000 2,500 Meters

G:\RedlandWater&Waste\Data\TechSup\Planning\Projects\56025 Water & Sewerage PIP and ICS\10_PIP_Model_Review\204 Bunker Road South DMA\Drawings\Figure10.2_204_ULT_PH_wVPt.mxd
Rev0 22 December 2009

FIGURE 10.2
204 Bunker Rd South PH Results PRV64m With Victoria Pt DMA



Legend

- AZP Logger
- CMP Logger
- PRV and Meter Site

Residual Pressure (m)

- <22
- 22-60
- >60

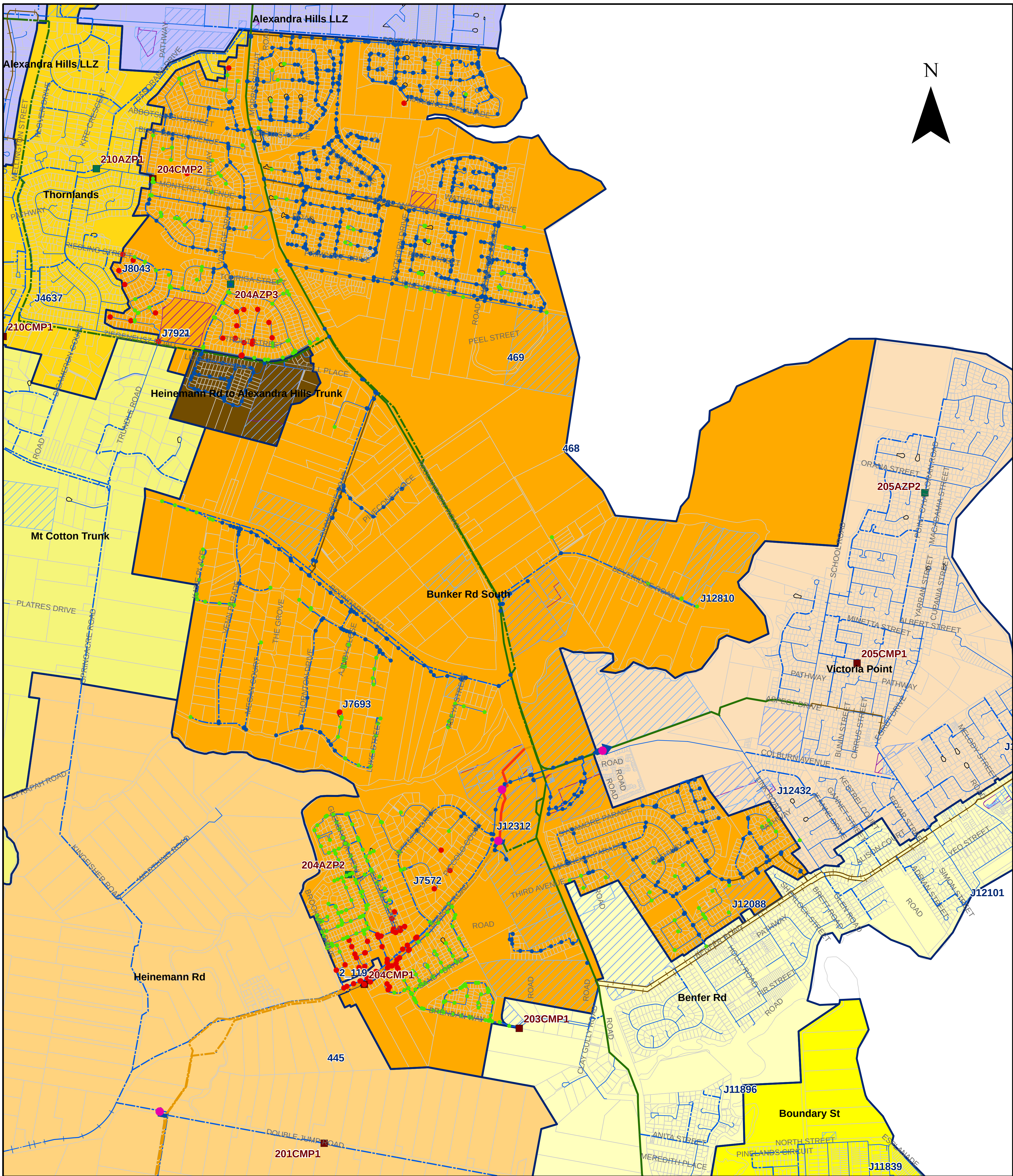
DMA Boundary

- W004 Alexandra Hills LLZ
- 201 Heinemann Rd
- 202 Boundary St
- 203 Benfer Rd
- 204 Bunker Rd South
- 205 Victoria Point
- 208 Mt Cotton Trunk
- 210 Thornlands
- 250 Heinemann Rd to Alexandra Hills Trunk

0 250 500 1,000 1,500 2,000 2,500 Meters

G:\Redland\Water&Waste\Data\TechSup\Planning\Projects\56025 Water & Sewerage PIP and ICS\Water & Sewerage PIP and ICS\10_PIP_Model_Review\204 Bunker Road South DMA\Drawings\Figure10.3_204_ULT_PH.mxd
Rev0 23 December 2009

FIGURE 10.3
204 Bunker Rd South PH Results PRV64m Without Victoria Pt DMA



Legend

Available FF (L/s)
- < 15
- 15 - 29
- > 30
- AZP Logger
- CMP Logger
- PRV and Meter Site

Diameter
63, 80, 100, 150, 200, 225, 250, 300, 375, 450, 500, 525, 600, 675, 691, 750, 900

Fire Flow (30L/s)
- Existing Areas
- Planning Scheme Areas

DMA Boundary
- W004 Alexandra Hills LLZ
- 201 Heinemann Rd
- 202 Boundary St
- 203 Benfer Rd
- 204 Bunker Rd South
- 205 Victoria Point
- 208 Mt Cotton Trunk
- 210 Thornlands
- 250 Heinemann Rd to Alexandra Hills Trunk

0 250 500 1,000 1,500 2,000 2,500 Meters

G:\RedlandWater&Waste\Data\TechSup\Planning\Projects\56025 Water & Sewerage PIP and ICS\Water & Sewerage PIP and ICS\10_PIP_Model_Review\204 Bunker Road South DMA\Drawings\Figure10.4_204_ULT_FF0730_wVPt.mxd
Rev0 23 December 2009

FIGURE 10.4
204 Bunker Rd South FF Results PRV64m With Victoria Pt DMA

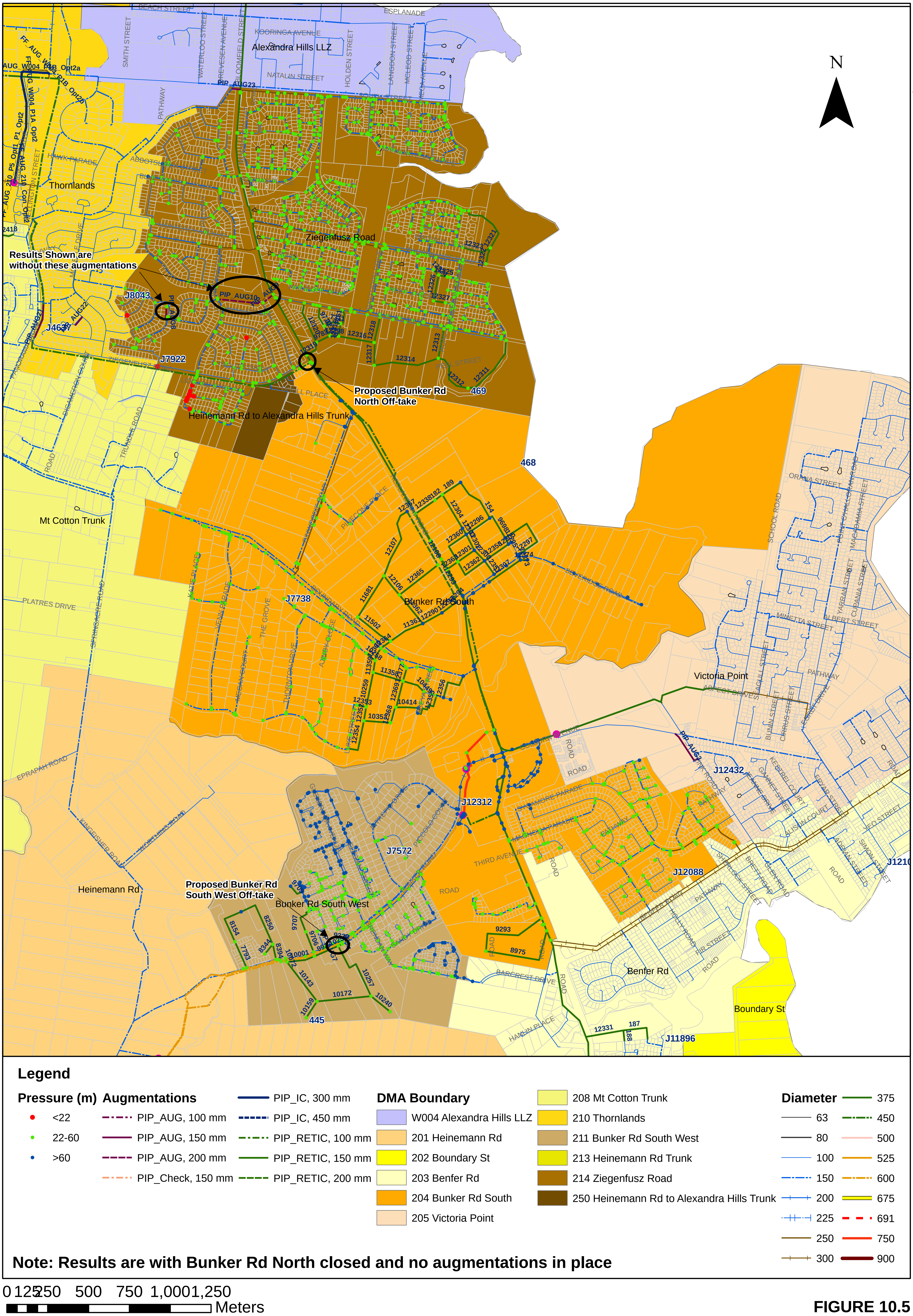
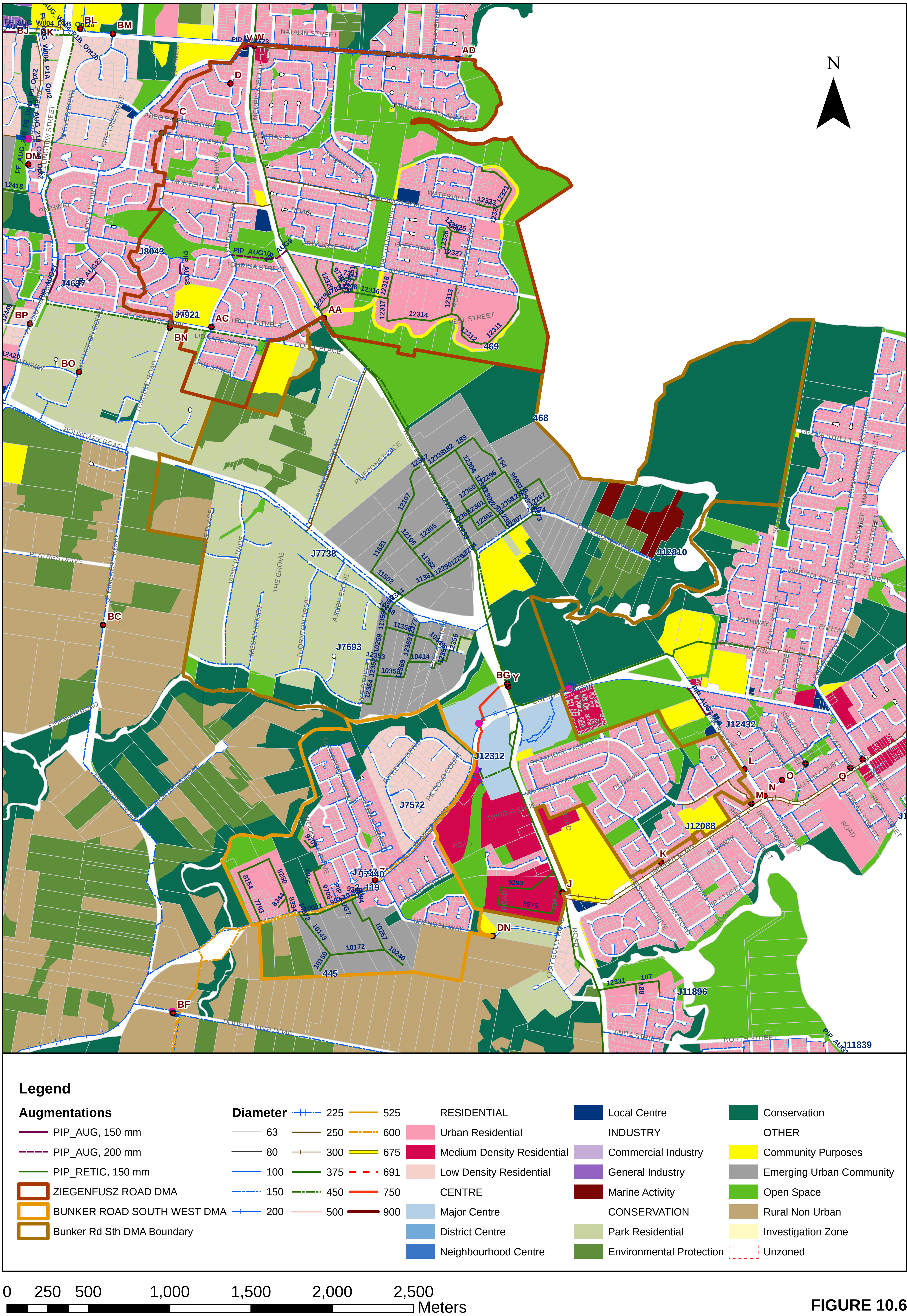


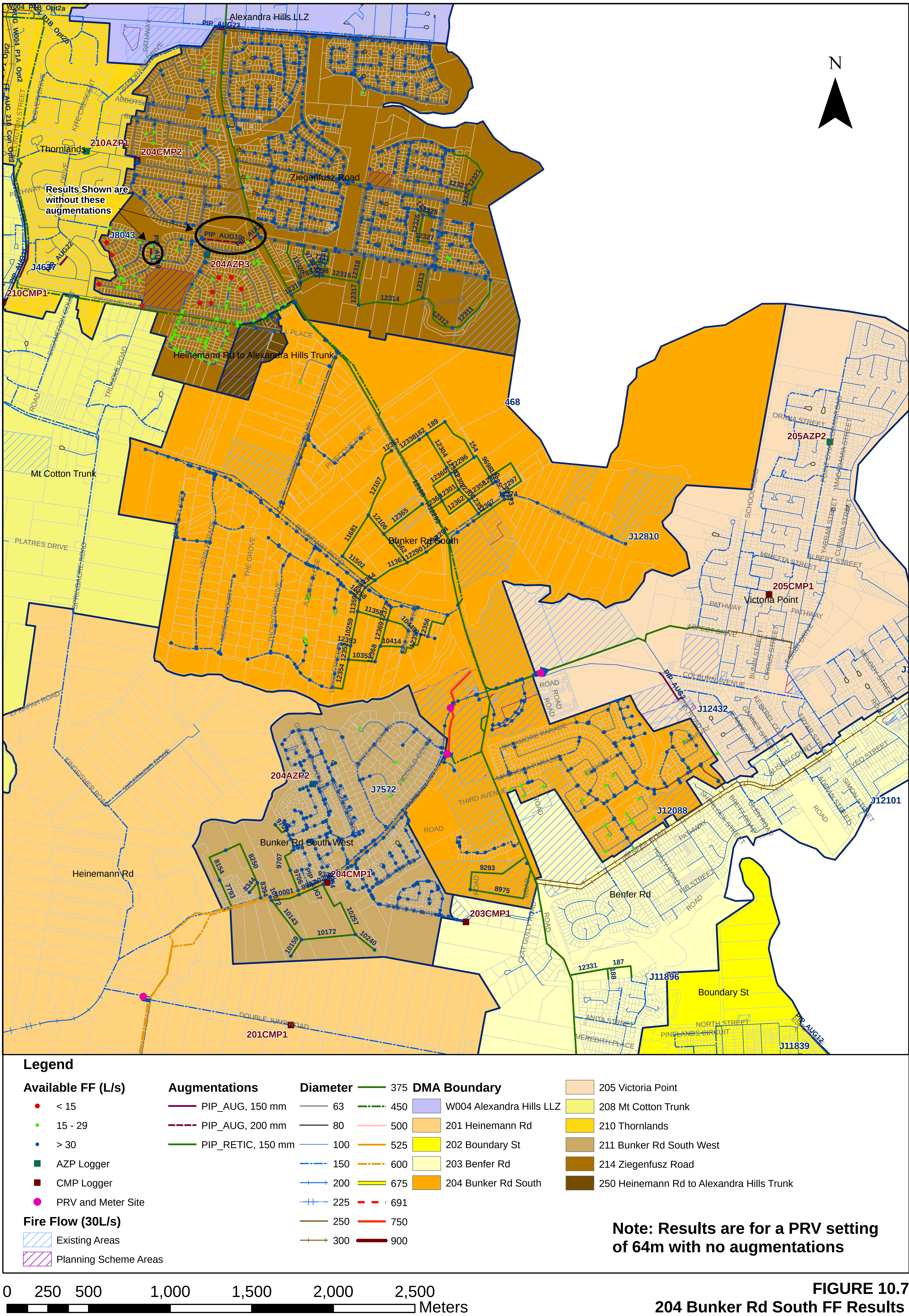
FIGURE 10.5
Bunker Road South PH Results with Proposed DMA Changes

G:\RedlandWater&Waste\Data\TechSup\Planning\Projects\56025 Water & Sewerage PIP and ICS\Water & Sewerage PIP and ICS\10_PIP_Model_Review\204 Bunker Road South DMA\Drawings\Figure10.5_204_3DMAs_ULT_PH.mxd
Rev0 23 December 2009



G:\RedlandWater&Waste\Data\TechSup\Planning\Projects\56025 Water & Sewerage PIP and ICS\10_PIP_Model_Review\204 Bunker Road South DMA\Drawings\Figure10.6_204_wAUG_ULT_PScheme.mxd
Rev0 23 December 2009

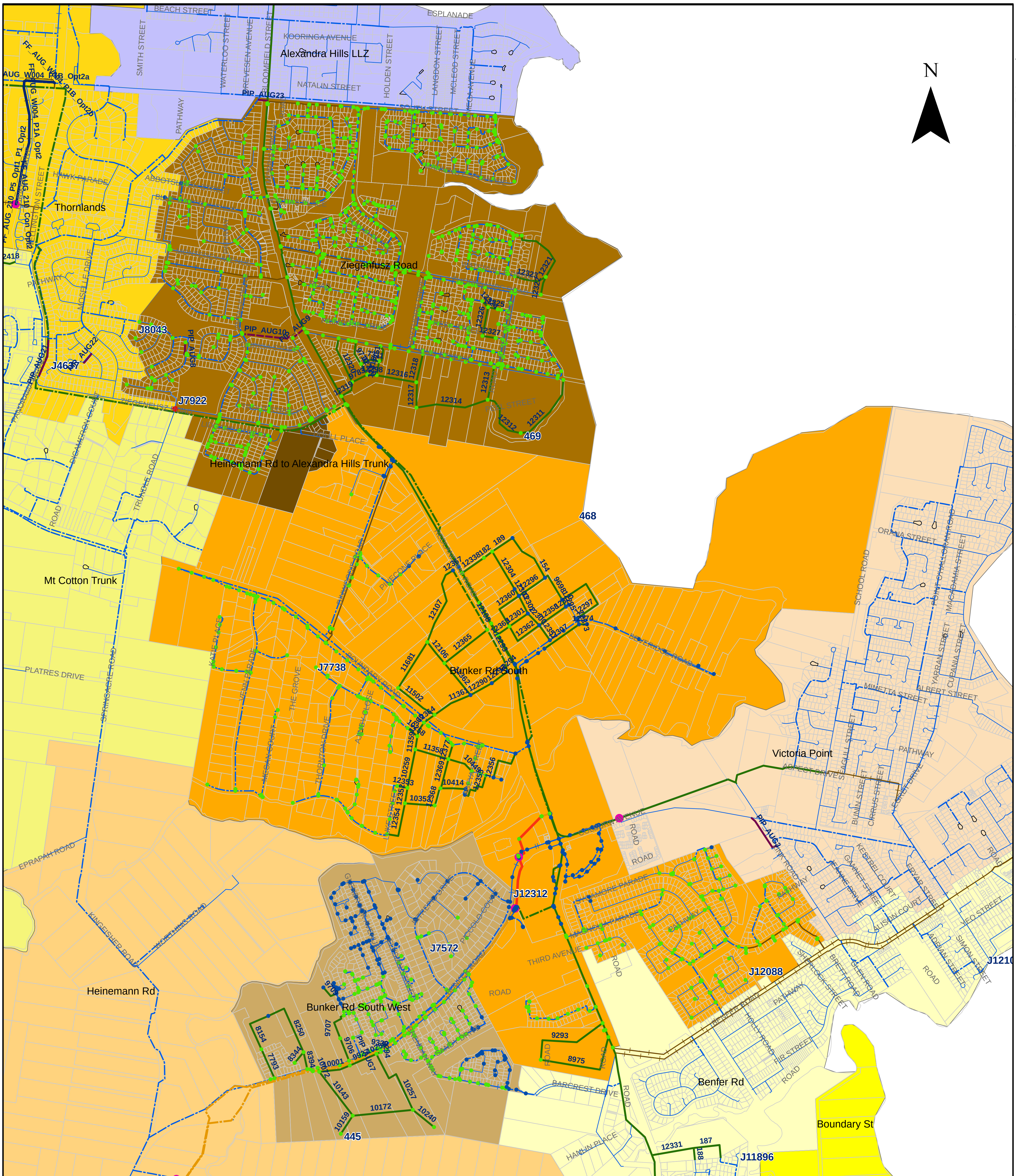
FIGURE 10.6
Bunker Rd South Planning Scheme



Note: Results are for a PRV setting of 64m with no augmentations

FIGURE 10.7
204 Bunker Rd South FF Results
3DMAs no augmentations

G:\RedlandWater&Waste\Data\TechSup\Planning\Projects\56025 Water & Sewerage PIP and ICS\Water & Sewerage PIP and ICS\10_PIP_Model_Review\204 Bunker Road South DMA\Drawings\Figure10.7_204_3DMAs_ULT_FF1600.mxd
Rev0 23 December 2009



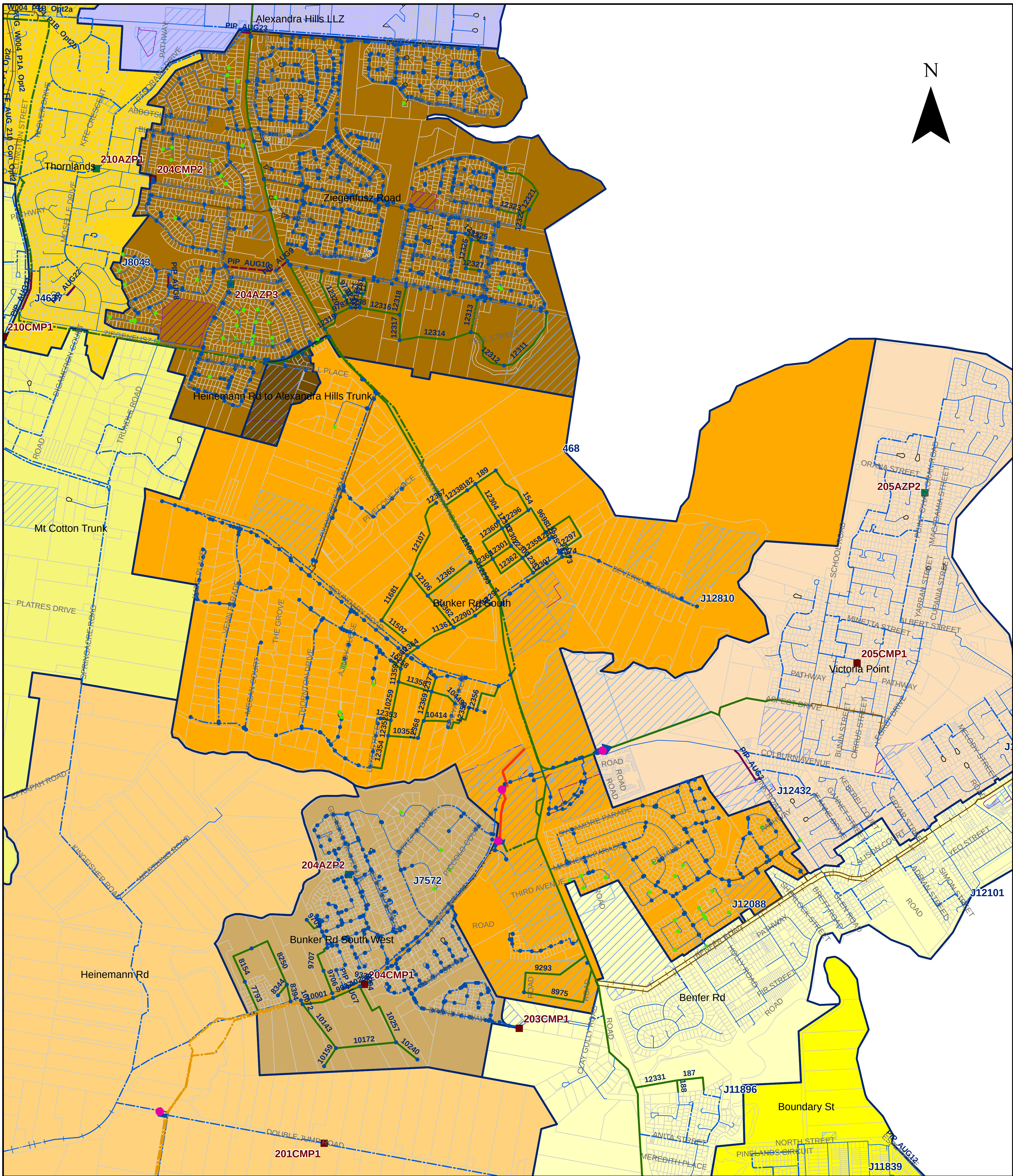
Legend

Available Pressure (m)	Augmentations	DMA Boundary		Diameter	
<22	PIP_AUG, 100 mm	W004 Alexandra Hills LLZ	205 Victoria Point	63	375
22-60	PIP_AUG, 150 mm	201 Heinemann Rd	208 Mt Cotton Trunk	80	450
>60	PIP_AUG, 200 mm	202 Boundary St	210 Thornlands	100	500
	PIP_Check, 150 mm	203 Benfer Rd	211 Bunker Rd South West	150	525
	PIP_IC, 300 mm	204 Bunker Rd South	214 Ziegenfusz Road	200	600
	PIP_IC, 450 mm		250 Heinemann Rd to Alexandra Hills Trunk	225	675
	PIP_RETIC, 100 mm			250	691
	PIP_RETIC, 150 mm			300	750
	PIP_RETIC, 200 mm				900

0 125 250 500 750 1,000 1,250 Meters

FIGURE 10.8
Bunker Road South PH Results 3 DMAs
BRN Closed with Augmentations

G:\RedlandWater&Waste\Data\TechSup\Planning\Projects\56025 Water & Sewerage PIP and ICS\Water & Sewerage PIP and ICS\10_PIP_Model_Review\204 Bunker Road South DMA\Drawings\Figure10.8_204_3DMAs_wAUG_ULT_PH.mxd
Rev0 23 December 2009



Legend

Available FF (L/s)
- < 15
- 15 - 29
- > 30
- AZP Logger
- CMP Logger
- PRV and Meter Site

Fire Flow (30L/s)
- Existing Areas
- Planning Scheme Areas

Augmentations
- PIP_AUG, 150 mm
- PIP_AUG, 200 mm
- PIP_RETIC, 150 mm

Diameter
- 63
- 80
- 100
- 150
- 200
- 225
- 250
- 300
- 375
- 450
- 500
- 525
- 600
- 675
- 691
- 750
- 900

DMA Boundary
- W004 Alexandra Hills LLZ
- 201 Heinemann Rd
- 202 Boundary St
- 203 Benfer Rd
- 204 Bunker Rd South
- 205 Victoria Point
- 208 Mt Cotton Trunk
- 210 Thornlands
- 211 Bunker Rd South West
- 213 Heinemann Rd Trunk
- 214 Ziegenfusz Road
- 250 Heinemann Rd to Alexandra Hills Trunk

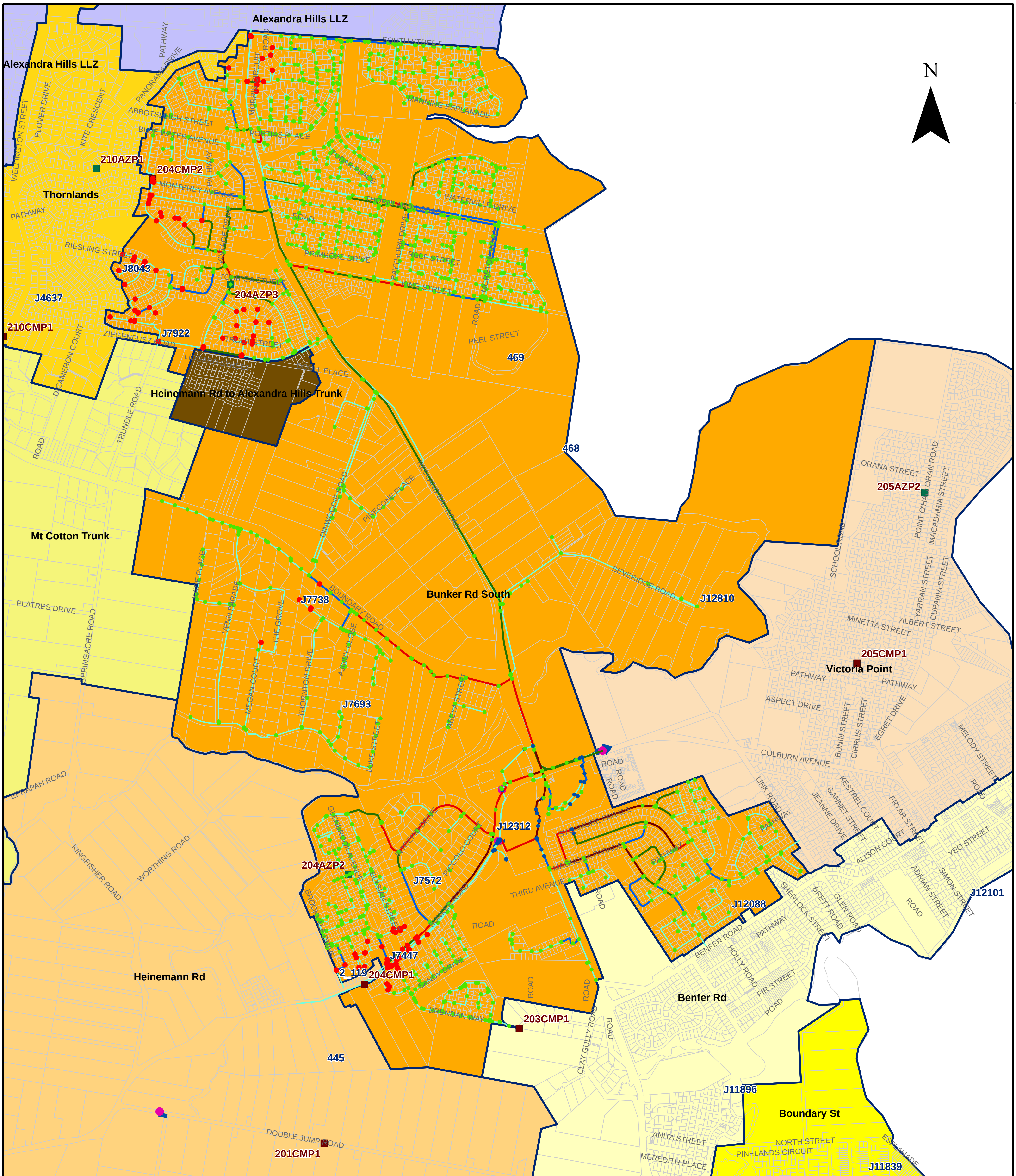
Note: PRV setting is 64m

0 250 500 1,000 1,500 2,000 2,500 Meters

G:\RedlandWater&Waste\Data\TechSup\Planning\Projects\56025 Water & Sewerage PIP and ICS\Water & Sewerage PIP and ICS\10_PIP_Model_Review\204 Bunker Road South DMA\Drawings\Figure10.9_204_3DMAs_wAUG_ULT_FF1600.mxd

Rev0 23 December 2009

FIGURE 10.9
204 Bunker Rd South FF Results
3DMAs with augmentations



Legend

Results		Results		DMA Boundary	
•	<22	—	<1	W004 Alexandra Hills LLZ	204 Bunker Rd South
•	22-60	—	1 - 2	201 Heinemann Rd	205 Victoria Point
•	>60	—	2 -5	202 Boundary St	208 Mt Cotton Trunk
■	AZP Logger	—	5 - 10	203 Benfer Rd	210 Thornlands
■	CMP Logger	—	>10		250 Heinemann Rd to Alexandra Hills Trunk
●	PRV and Meter Site				

Note: System results are with Victoria Pt DMA

0 250 500 1,000 1,500 2,000 2,500 Meters

G:\RedlandWater&Waste\Data\TechSup\Planning\Projects\56025 Water & Sewerage PIP and ICS\10_PIP_Model_Review\204 Bunker Road South DMA\Drawings\Figure10.10_204_2013_PH_wPt.mxd
Rev0 23 December 2009

FIGURE 10.10
204 Bunker Rd South PH Results
Existing System with 2013 Demands

11. 205 Victoria Point DMA

11.1 DMA Topography

The Victoria Point DMA consists of relatively flat, low coastal areas with elevations ranging from zero to approximately 10m AHD. The DMA inlet is located along Colburn Avenue, approximately 350m from Cleveland – Redland Bay Road. The DMA essentially includes Point O'Halloran and the part of Victoria Point (the suburb) north of Colburn Avenue. It also includes Link Road between Colburn Avenue and Benfer Road.

The topography of DMA is shown on **Figure 11.1**.

11.2 Previous Planning

All of this DMA was originally included in the Victoria Pt PRV zone. Planning undertaken for the PIP / ICS, was based on the original configuration for this area and did not include any augmentations.

Planning work undertaken as part of the PLMP originally had the Victoria Pt DMA supplied off the Bunker Rd North PRV. However, modelling indicated that if SEQ Water Grid operations dictated that the Bunker Rd North PRV be completely closed, then sufficient fire flow could not be provided to some areas of the Victoria Pt DMA without augmentation. The system was then changed so the Victoria Pt DMA receives its supply from the Bunker Road South DMA off the 375mm main along Cleveland – Redland Bay Road. Modelling for this report has been completed on this basis.

11.3 Current System Configuration and Source of Supply

The Victoria Pt DMA receives its supply from the Bunker Road South DMA off the 375mm main along Cleveland – Redland Bay Road.

The Victoria Point PRV is currently flow modulated to limit the high pressures that this relatively low lying area can receive from the HRR complex.

11.4 Existing System Performance at Ultimate Demands

The Victoria Pt system was modelled with its off-take connected to the Bunker Road South DMA with the Bunker Road South DMA split into the three separate pressure zones as discussed in **Section 10**.

11.4.1 Peak Hour Results

At peak hour demands the pressure upstream of the PRV is 66m. To run this scenario the PRV has therefore been set at 60m to take into account the modulation losses through the PRV.

Figure 11.2 shows that the Victoria Point DMA has sufficient infrastructure to provide pressures above 22m at peak hour at ultimate demands, with a minimum pressure of 44 m at J12567

11.4.2 Fire Flow

The fire flow results are shown on **Figure 11.3**. The figure shows that the all areas meet the required fire flow except for J12432 which is opposite the child care centre on Link Road and has an available fire flow of 29L/s.

At the time of the fire the U/S PRV pressure is 62m and the PRV is fully open. The model did not allow for the additional head loss through the PRV as result of the modulation of the valve. When the PRV is set at 56m the available fire flow at J12432 is 26L/s.

Figure 11.3 also shows the friction losses in the main when a fire flow of 30L/s is applied to J12432 at 2/3 PH. The figure shows that there a significant losses along Redland Bay Road downstream of the Bunker Road South PRV as well as significant losses along Colburn Avenue and Link Road.

11.5 Proposed Augmentations

There are no augmentations needed to provide pressures above 22m. **Figure 11.4** shows that there are no areas in Victoria Point which are yet to be developed. The increased demands in this DMA will be the result of infill and higher density development.

There are two Options available to provide sufficient FF to the child care centre along Link Road as described below.

11.5.1 Option 1 – Augment the main DS of BRS PRV

There is a head loss of just 4.5 m from just downstream of the Bunker Road South PRV to the end of the loop at the corner of Redland Bay Road and Lakeside Drive. This could be reduced by augmenting these mains, however it is unlikely to be feasible to construct the mains given the number of services and other infrastructure in place.

Cross connecting the mains which "loop" at Colburn Avenue would be feasible but it only reduces head loss by about 2m.

Given the relatively small amount of head loss in this area and the difficulty of constructing augmentations in this area, this option is not considered appropriate and has not been investigated further.

11.5.2 Option 2 – Augment the main along Link Road

There is about 41m head loss from the corner of Link Road and Colburn Avenue to J12432 where a fire flow of 30L/s is applied (opposite the child care centre). When the main is augmented from the Corner of Link Road and Colburn Avenue with about 230m of 150mm main running along Link Road towards the Childcare Centre (PIP_AUG3) the available fire flow is 34L/s at J12432.

There is a lot of infrastructure along the alignment of PIP_AUG3, so the possibility of augmenting Link Road to the north of Colburn Avenue was investigated, however the augmentation could only provide a fire flow of 27L/s at J12432.

It is recommended that PIP_AUG3 is adopted.

11.6 Augmentation Timing

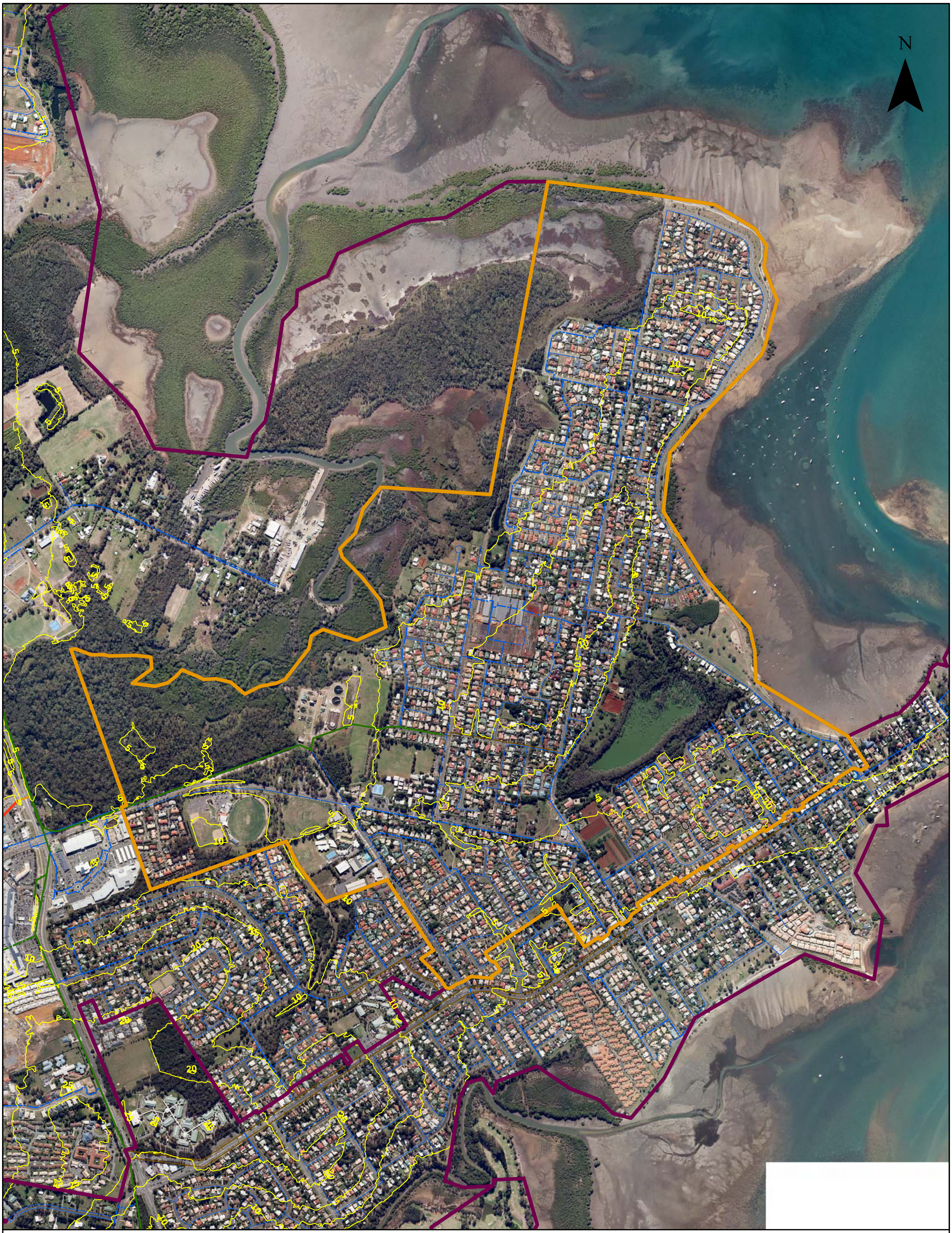
11.6.1 Existing System at 2013 Demands

The Victoria Pt fire flow Augmentation (PIP_AUG3) is needed when the PRV is set at 56m (allowing for modulation losses) to satisfy the DSS for FF at 2013 demands.

11.7 Recommendations

The following master plan recommendations are made for this DMA:

- That the Victoria Point DMA remains off the Bunker Road South DMA.
- That Option 2, to augment the main along Link Road is adopted to provide sufficient fire flow to the area.



Legend

Victoria Point
Existing DMA Boundaries
5m Contours

Diameter

63, 80, 100, 150, 200, 225, 250, 300, 375, 450, 500, 525, 600, 675, 691, 750, 900

0 125 250 500 750 1,000 1,250 Meters

FIGURE 11.1
204 Victoria Point Topography

G:\RedlandWater&Waste\Data\TechSup\Planning\Projects\56025 Water & Sewerage PIP and ICS\Water & Sewerage PIP and ICS\10_PIP_Model_Review\205 Victoria Point DMA\Drawings\Figure11.1_205_Topography.mxd
Rev0 23 December 2009

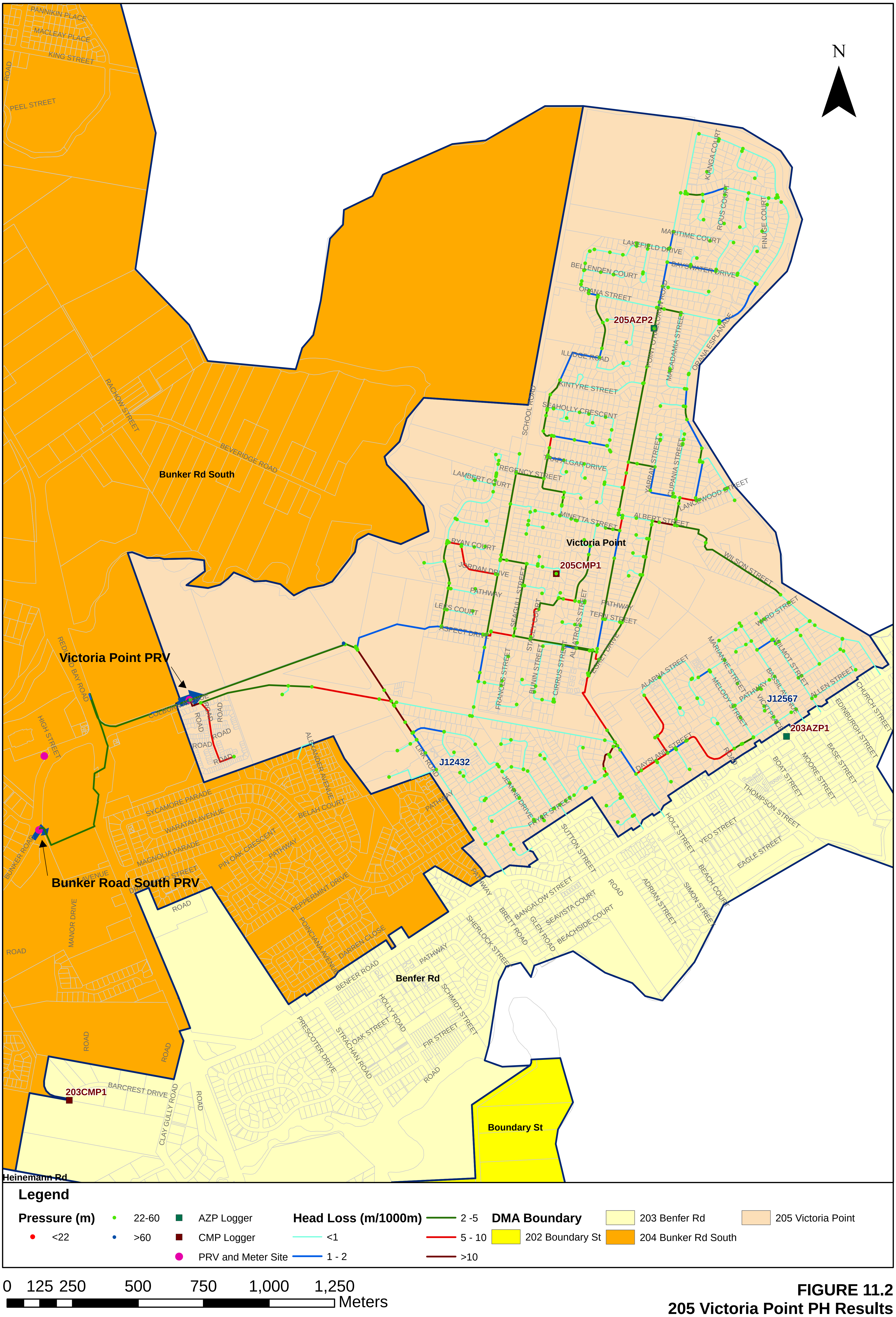


FIGURE 11.2
205 Victoria Point PH Results

G:\RedlandWater&Waste\Data\TechSup\Planning\Projects\56025 Water & Sewerage PIP and ICS\Water & Sewerage PIP and ICS\10_PIP_Model_Review\205 Victoria Point DMA\Drawings\Figure11.2_205_ULT_PH.mxd
Rev0 23 December 2009

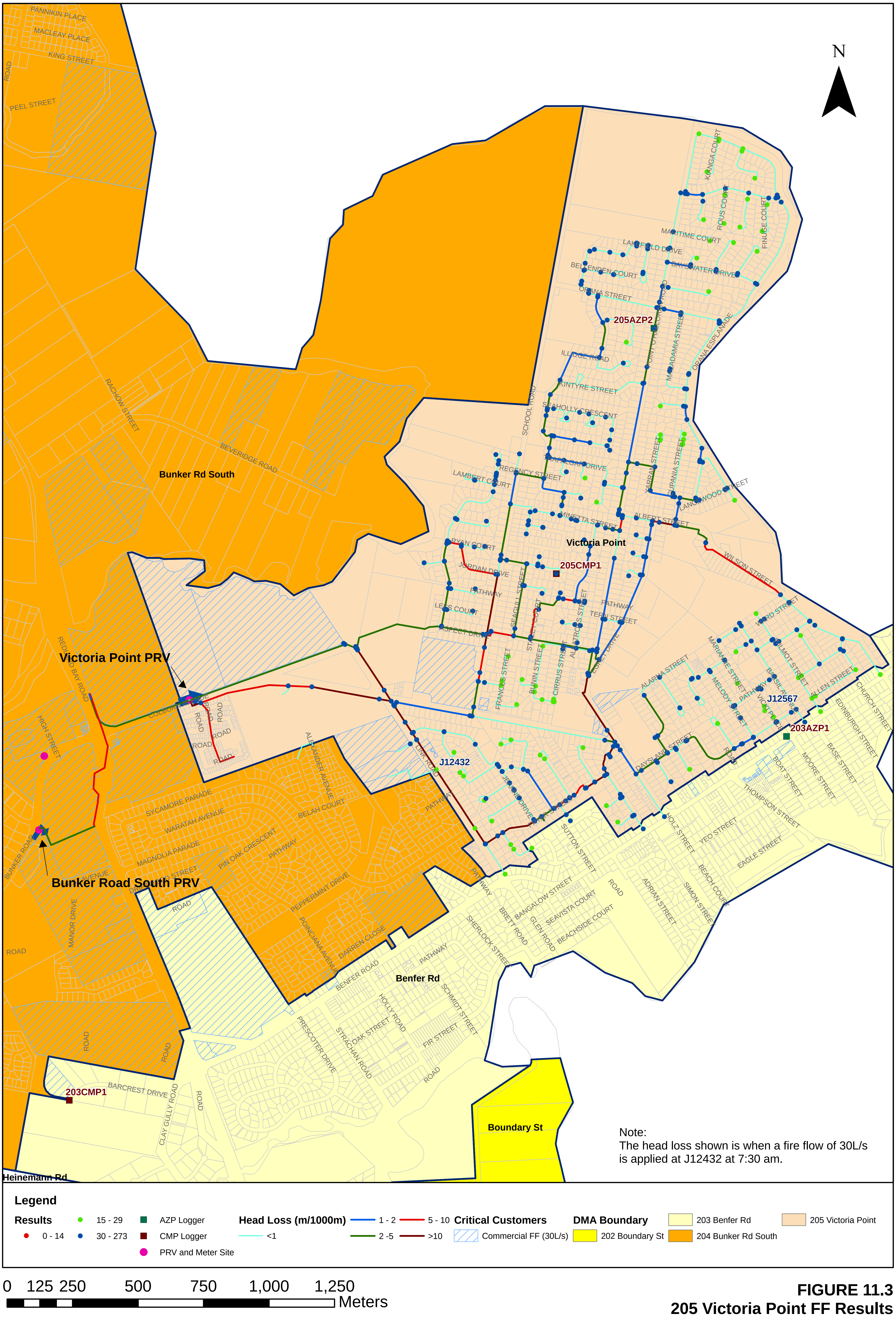
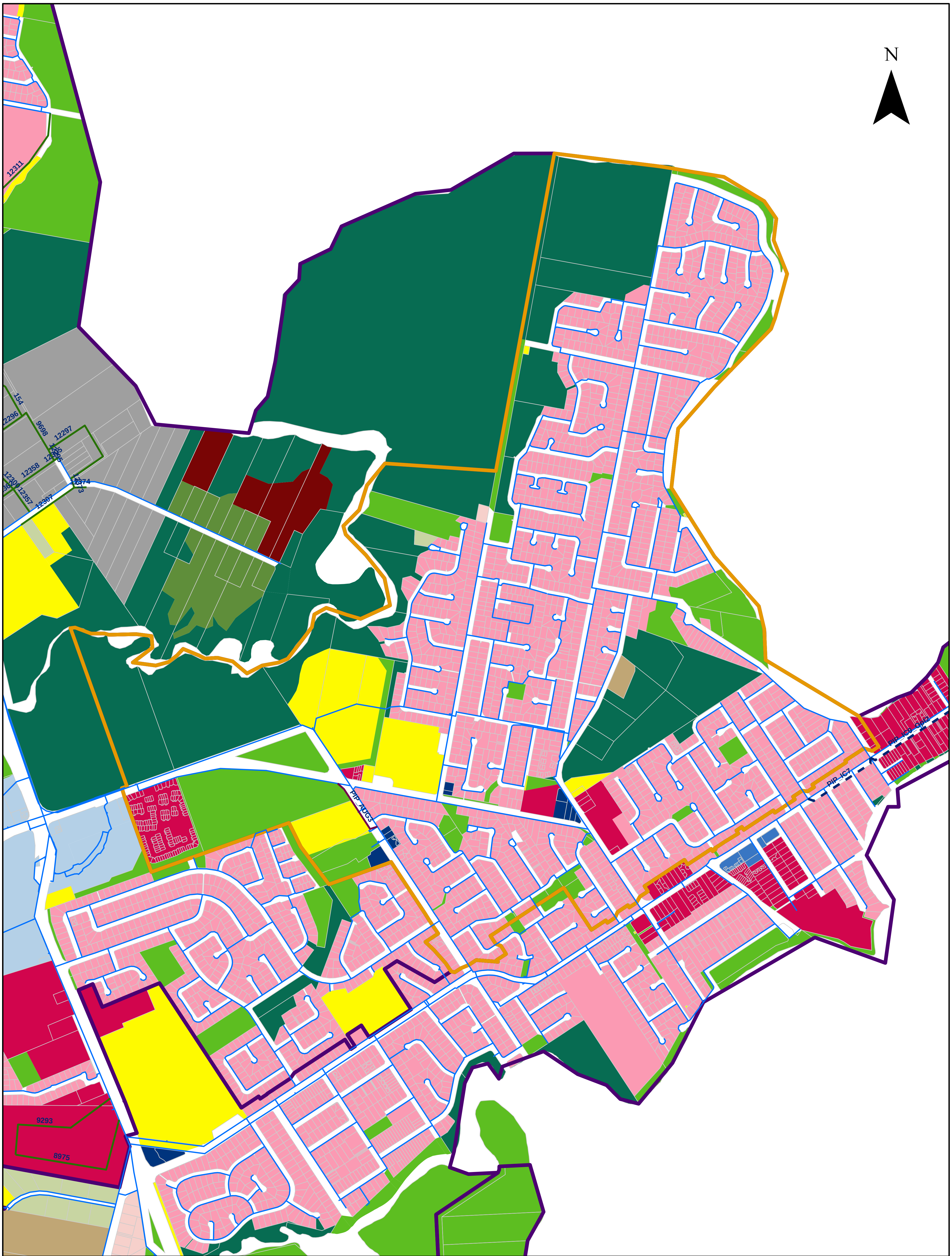


FIGURE 11.3
205 Victoria Point FF Results

G:\RedlandWater&Waste\Data\TechSup\Planning\Projects\56025 Water & Sewerage PIP and ICS\10_PIP_Model_Review\205 Victoria Point DMA\Drawings\Figure11.3_205_ULT_FF0730.mxd
Rev0 23 December 2009



Legend

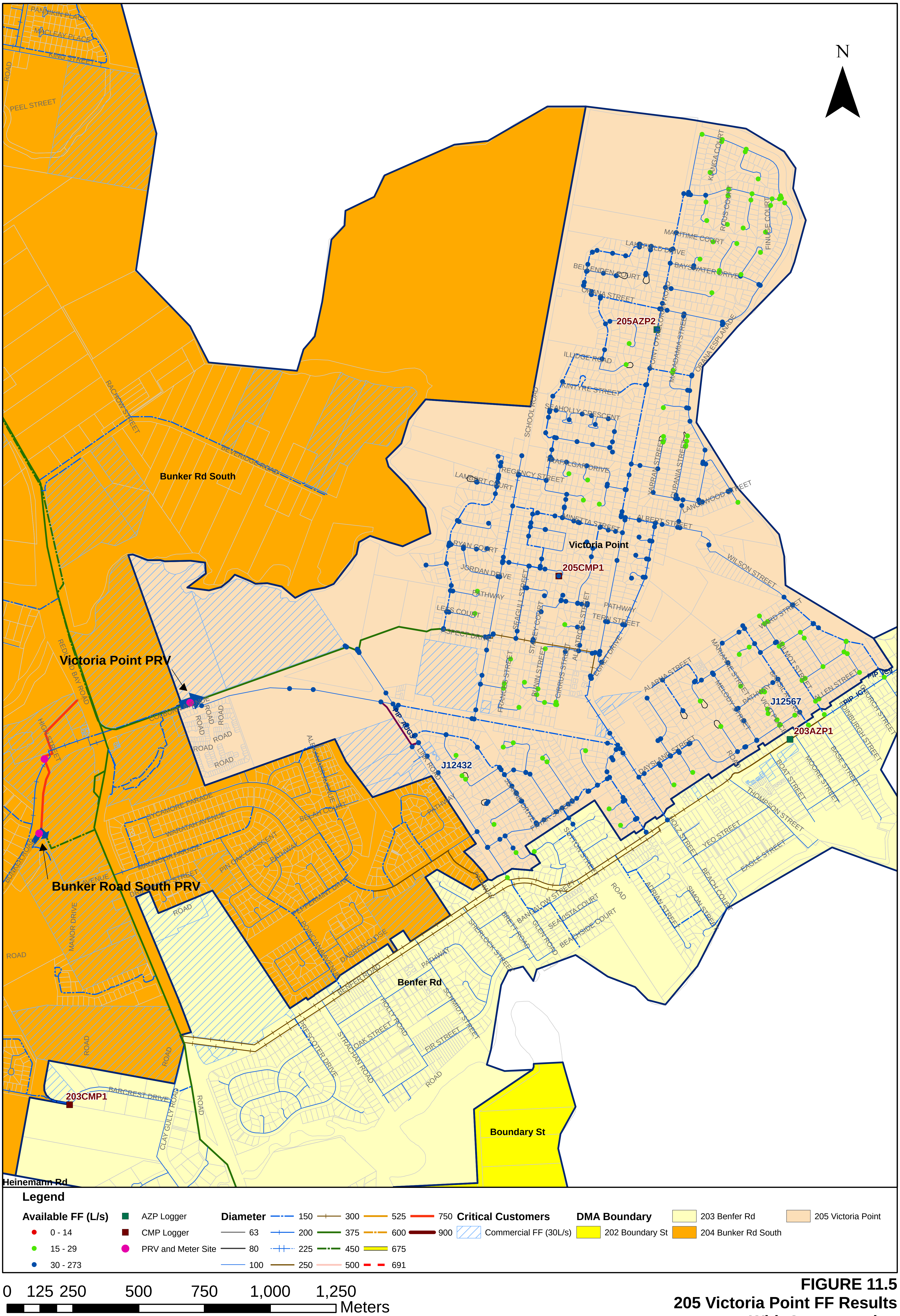
Augmentations

- PIP_AUG, 150 mm
- PIP_IC, 200
- PIP_IC, 250
- PIP_IC, 375
- PIP_RETIC, 150 mm
- VICTORIA POINT DMA

0 125 250 500 750 1,000 1,250 Meters

FIGURE 11.4
205 Victoria Point Planning Scheme

G:\RedlandWater&Waste\Data\TechSup\Planning\Projects\56025 Water & Sewerage PIP and ICS\Water & Sewerage PIP and ICS\10_PIP_Model_Review\205 Victoria Point DMA\Drawings\Figure11.4_205_wAUG_ULT_PScheme.mxd
Rev0 23 December 2009



G:\RedlandWater&Waste\Data\TechSup\Planning\Projects\56025 Water & Sewerage PIP and ICS\Water & Sewerage PIP and ICS\10_PIP_Model_Review\205 Victoria Point DMA\Drawings\Figure11.5-205_ULT_FF0730_wAUG.mxd
Rev0 23 December 2009

FIGURE 11.5
205 Victoria Point FF Results
With Augmentation

12. 206 to 207 & 212 Mt Cotton Area

The Mt Cotton area is made up of the following DMAs.

- 206 – Mt Cotton Village
- 207A – Mt Cotton Booster Pump
- 207B – Mt Cotton High Level Zone
- 212 – Mt Cotton Road

Although there have been some modifications to this area since the development of the MWH master planning study, the changes will not impact on trunk infrastructure requirements of DMAs 207A & 207B.

The infrastructure requirements for 206 and 212 are covered by the Mt Cotton Village Water Supply Master Plan (JWP, 2005), which is being implemented by the developer in that area as part of their infrastructure agreement, so this area has not been considered further in this report.

13. 208 Mt Cotton Trunk

The only significant change to the Mt Cotton Trunk infrastructure since the development of the MWH master planning study is the inclusion of the Thornlands DMA on the zone. As a result only the northern section of the zone was reviewed. This is included in the Thornlands DMA assessment in **Section 15**.

14. 209 Duncan Road

There have been no changes to the Duncan Road zone since the development of the MWH master planning study as such it has not been investigated further.

15. 210 Thornlands DMA (Including Kinross Road)

15.1 DMA Topography

The Thornlands DMA has reasonably consistent topography with elevations ranging from 25m to 55m AHD. The DMA mainly comprises of the higher areas of the suburbs of Cleveland and Thornlands along the ridge line generally followed by Panorama Drive and Wellington Street (up to approximately Weippen Street).

The topography of DMA is shown on **Figure 15.3**.

15.2 Previous Planning

The Thornlands DMA was originally included in the Mt Cotton zone as shown on **Figure 1.3**. Planning undertaken for the PIP / ICS, was based on the original configuration for this area and included about 350 m of 150mm diameter main along Kinross Road from Goddard Road to the 300mm dia main to the north.

Planning work undertaken as part of the PLMP, identified that a separate DMA could be established in the north eastern area of the Mt Cotton zone. This was called the Thornlands DMA. Originally the DMA boundary was located along South Street with Redland City Council's South Street Depot the only area north of South Street included in the DMA. Sizing of the Thornlands DMA inlet flowmeter and PRV took into account the future demand generated by the Kinross Road MDA, i.e. the original intention was to add at least part of the Kinross Road MDA to the Thornlands DMA.

The Weippen Street and Olympus Drive areas have had prolonged pressure problems as a result of their elevation (45m) in comparison to the elevation of the Alexandra Hills LLZ Reservoirs (TWL=70m). The Water Supply System Fire Flow Review (RWW, March 2009) also indicated that these areas had insufficient available fire flow. To address these issues the Thornlands DMA was extended north to include these areas as shown on **Figure 15.4**. This report assumes that these augmentations are complete and in place

15.3 Current System Configuration and Source of Supply

The Thornlands DMA is fed from the Mt Cotton Reservoir. There is a 450mm AC main from the reservoir to Mt Cotton Road. This main is used for both inflow and outflow to and from the reservoir.

A 375mm AC main and 450 DICL main run along Mt Cotton Road, from the reservoir off-take to the junction of Mt Cotton Road and Woodlands Drive, where the 375mm main ends. A single 450mm main continues north until Duncan Road where a 300 AC main connects and runs parallel with a 450mm main all the way to the Alexandra Hills HL Tank. The Thornlands DMA is serviced from a 375mm AC main which connects to the 450mm main along Redland Bay Road near Teesdale Road. The Thornlands DMA feed reduces to 300mm diameter at the rear of properties along Flamingo Crescent.

The Thornlands PRV is currently flow modulated to reduce pressures while providing suitable Fire Flow to the area. The intention of including the Kinross Road MDA in the Thornlands DMA is now not recommended due to the additional demand planned to added to the north of the DMA (Olympus Drive), hence an alternative solution is required.

<u>All work completed in the planning study assumes the Mt Cotton trunk mains flow from south to north</u>. If LinkWater decides to reverse the flow along this main, then further investigations as to the system requirements need to be undertaken.

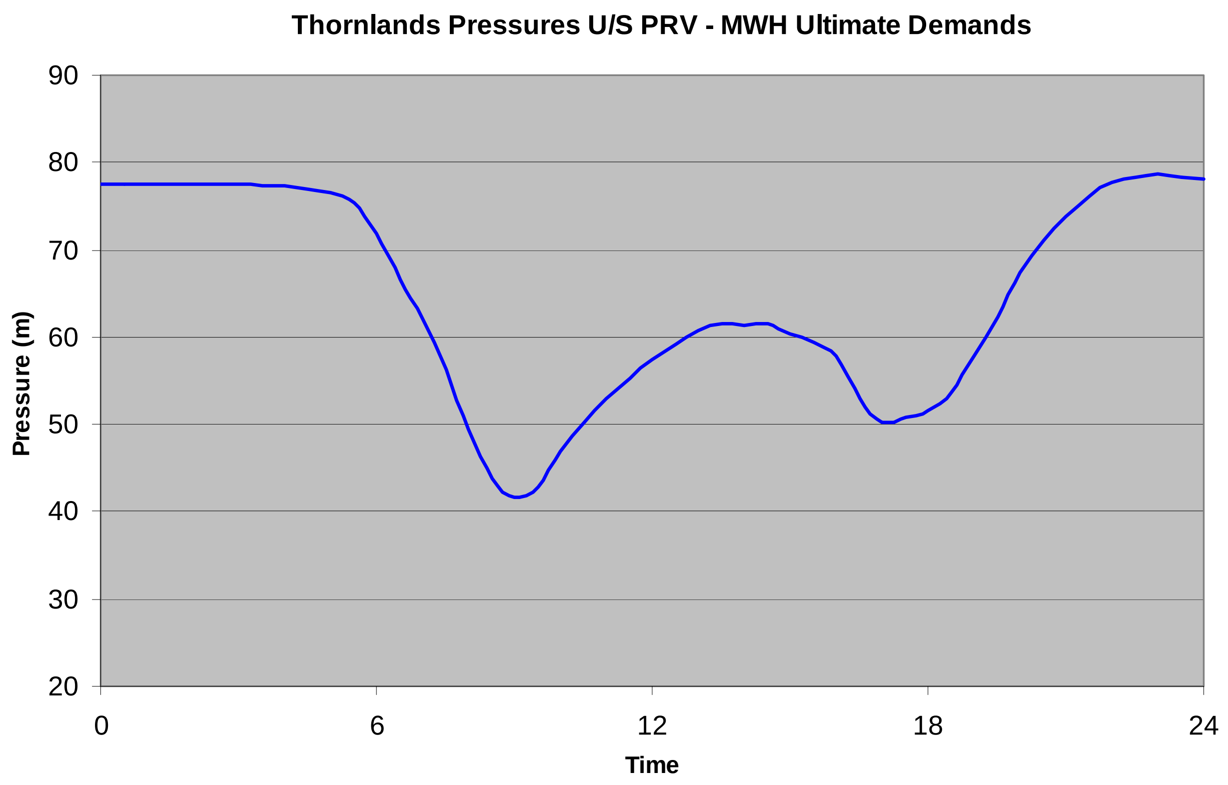
15.4 Existing System Performance at Ultimate Demands

15.4.1 Peak Hour Results

The Thornlands DMA is unique because it contains a high industrial demand (MWH AD demand of 10.9 L/s), as a result Peak Hour occurs at 9:00 am.

At peak hour demands the inflow into the Thornlands DMA is 71L/s. At this time the pressure upstream of the PRV drops to 42 m as shown on **Figure 15.1**. A PRV setting of 36m (allowing for modulation losses) has therefore been adopted.

Figure 15.1 – Thornlands Pressures U/S PRV No Augmentations



There are significant pressure problems in the Thornlands DMA at peak hour, as shown on **Figure 15.4**. The figure shows that there are also pressure problems in the Alexandra Hills LLZ near Ronnie Street and in the Mt Cotton Zone along Kinross Road and at the corner of Boundary Road and Panorama Drive.

When the PRV is set at 36m at PH (9:00 am), the minimum pressure in the Thornlands DMA is 10m at the CMP (Logger ID 210CMP1). The minimum pressure in the northern area of the DMA is 22m at Logger ID 306CMP1.

The minimum pressure in the Mt Cotton Zone is 11 m at J4769. This also occurs at 9:00 am as a result of the high flows entering the Thornlands DMA at this time.

The minimum pressure in the Alexandra Hills LLZ is 15.4m at the end of Ronnie Street (2_335). However these results are with the maximum operational water level of the Alexandra Hills Reservoirs set at 3.08m (at times during the compilation of this report they have been operated at 40% capacity to ensure sufficient turnover of water). This is about 4.6m below the actual TWL of

7.7 m. When the reservoirs are operating to their full capacity the areas north of Bay Street and east of Smith Street all meet the DSS of 22m at Peak Hour (1800).

15.4.2 Fire Flow

The Thornlands DMA includes a large industrial area, as a result the FF analysis needs to be undertaken at PH rather then 2/3PH for the industrial area. At PH (9:00 am) the inflow into the system is 71L/s so inflow at 2/3PH is equal to 47L/s. This occurs at around 6:30 pm.

At PH the DMA is not capable of meeting the DSS for fire flow at any junctions in the industrial area. This is because the available downstream pressure when taking the PRV modulation into account is only 36m. This is not sufficient to provide any substantial fire flow to the area.

At 2/3 PH (6:30 pm), the upstream pressure is 46 m so a pressure of 42 m is available downstream. 6:30 pm has been adopted for both the Kinross Road and the Thornlands DMA residential areas because of the influence of the Industrial area on the results.

The fire flow results for this analysis are shown on **Figure 15.5.** The figure shows that there are several areas of the existing system that will not meet the fire flow requirements at ultimate demands. These are:

- Olympus Drive
- The Flamingo Crescent Area
- The Whitby Place Area
- The cul-de-sac’s near Yalumba Street
- The end of Ziegenfusz Road
- The Thornlands State School (this area has an available FF of only 23L/s when a demand of 15L/s is added to the zone to determine the PRV setting, the flow would be even less for a flow of 30L/s through the PRV)

It should be noted that the fire flow analysis has been based on the assumption that a valve has been inserted in the 150mm dia main from Flamingo Crescent to the 300mm main upstream of the PRV. If the main along Flamingo Crescent is split then sufficient fire flows can not be obtained in that area.

15.5 Proposed Augmentations

15.5.1 Peak Hour

The main reason for the failure of the areas in the Thornlands DMA to meet the DSS at Peak Hour is the large headloss through the 300mm main (42m) which supplies the DMA. However **Figure 15.4** also shows pressure problems in the Kinross Road development area (shown as Emerging Urban Community on **Figure 15.6**).

As the water supply requirements of these areas are interlinked, the Kinross Road development area has been included in the study of the Thornlands DMA.

Thornlands DMA (Whitby Place)

The lowest available pressure in the Thorlands DMA is in the south western area of the DMA which is located adjacent to the future Kinross Road Development. To supply this area water needs to travel up Redland Bay Road, along the 300mm main that supplies the Thornlands DMA and then back down Panorama Drive. It is therefore considered appropriate to remove this area from the Thornlands DMA and connect it directly to the future reticulation of the Kinross Road MDA. The proposed DMA adjustment is shown on **Figure 15.7**.

Ronnie Street Area

This area is located in the Alexandra Hills LLZ directly adjacent to the Olympus Drive area in the Thornlands DMA. To provide suitable pressures in this area it is recommended that the Thornlands DMA is extended to include it as shown on **Figure 15.7**.

Kinross Road MDA

The development layout for this area has not yet been finalised. The proposed reticulation layout is therefore based on a draft development plan. Mains have been included along the proposed major roads. Additional mains have been included to ensure sufficient cross connections and looping of the water network.

There is a 300mm trunk main included from the corner of Boundary and Redland Bay Roads, through the Kinross Road development to Goddard Road. The first portion of this main is needed to supply both the Kinross Road development and the Thornlands DMA while the remaining portion is required to supply the Thornlands DMA. The size of the portion of the main needed to supply the Thornlands DMA could be reduced to 250mm and 200mm in some portions if only Peak Hour flows were being considered, however the fire flow requirements are the critical factor as discussed in the following section.

Results

When the Kinross Road MDA reticulation and the proposed augmentations are included in the model (as shown on **Figure 15.7**) the pressure upstream of the Thornlands PRV increases from 37 to 54m as shown on **Figure 15.2**. Allowing 6m for losses through the PRV as a result of modulation this provides a downstream pressure of 48m.

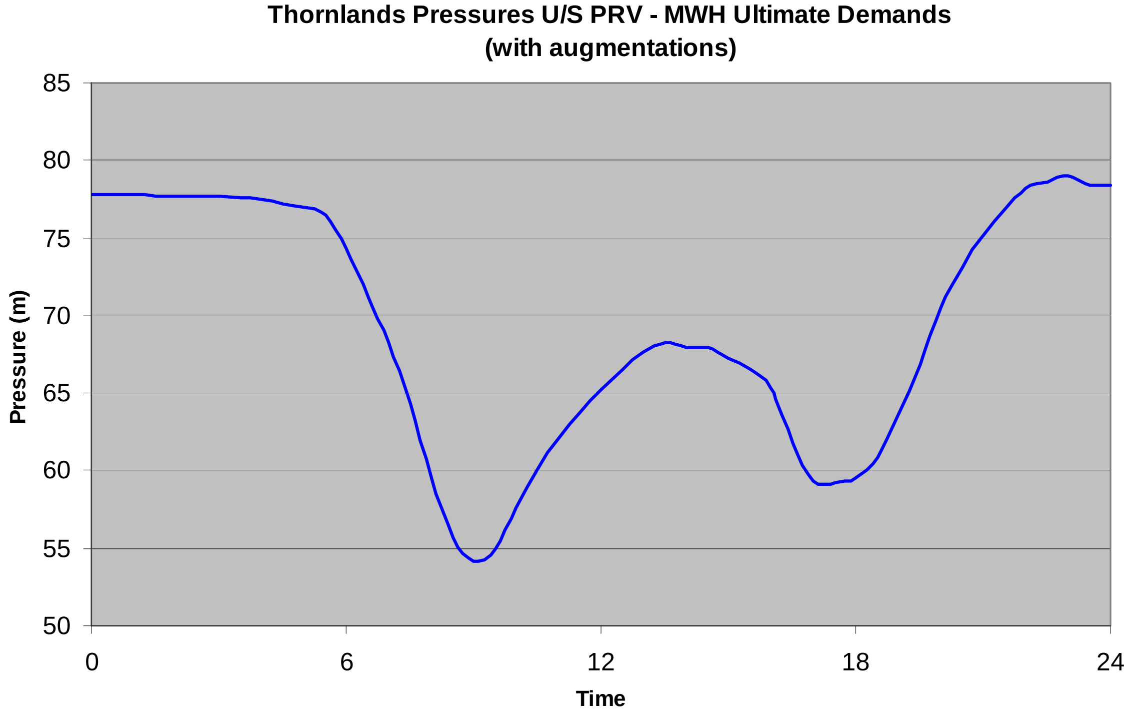
The critical junction in the Thornlands DMA at 9:00 am is J4637 at the end of Claret Court, with an available pressure of 26m (allowing 6m loss through the PRV).

The peak hour demands for the Kinross Road MDA occur at the expected time of 6:00 pm. However, because of the demand placed on the system as a result of the industrial area in the Thornlands DMA the minimum pressures in the area occur at 9:00 am.

The critical junction in the Kinross Road area is J4533 at the corner of Woodlands Drive and Boundary Road. At PH (6:00 pm) this junction has an available pressure of 30m, however at 9:00 am the available pressure is 26m.

The peak hour results are shown on **Figure 15.7**.

Figure 15.2 – Thornlands Pressures U/S PRV with Augmentations



15.5.2 Fire Flow

Thornlands DMA

The five critical areas in the Thornlands DMA in relation to Fire Flow are the Olympus Drive, Flamingo Crescent, Ziegenfusz Rd, Moyston Court and Dicameron Court residential areas, the industrial area in Weippin Street and the Thornlands State School.

At PH (9:00 am) the inflow into the system is 66L/s so inflow at 2/3PH is equal to 44L/s. This occurs at 6:30 pm. Note that the PH flow is reduced for this scenario compared to the system without augmentations because some demands have been taken out of the Thornlands DMA. At this time the U/S pressure is 56m (when an additional fire flow of 15L/s is added to the system) so the PRV was set at 50m for residential fire flow analysis which was undertaken at 6:30pm.

Olympus Drive

To meet the fire flow requirement of 15L/s@12m at 2/3 PH (6:30 pm) and the requirement of the DNRM Guideline for fire flow (DNRM, 2005) of no negative pressures in the system at PH an augmentation from the 150mm main along Wellington Street to the 100mm main at the end of Ronnie Street is also required (PIP_AUG19).

When these augmentations are in place at 9:00 am there is an available pressure of 1m at 306CMP1 when a 15L/s fire is located there, which just meets the no negative pressure requirement. This is for a PRV setting of 43m. This has been adopted because at 9:00 am the U/S pressure is 49m when an additional fire flow of 15L/s is included in Thornlands. An allowance for a 6m head loss through the PRV as a result of modulation has also been taken into account.

Flamingo Crescent Area

To achieve the DSS for fire flow at the end of Cocktail Court a 150mm cross connection along South Street to the 150mm main in Swallow Street is needed (PIP_AUG20).

These results assume a valve is installed in the main from Flamingo Crescent to the 300mm inlet main so no augmentations are required in the Flamingo Crescent Area.

Ziegenfusz Road
The junctions at either end of Ziegenfusz Road are unable to meet the DSS for fire flow. This is because when the Whitby Place area is taken off the Thornlands DMA the cross connection in this area is lost. To restore this cross connection a 150mm main needs to be constructed from the pathway off Panorama Drive to the 100mm main north of Ziegenfusz Road (PIP_AUG21).

Moyson Court
Even with PIP_AUG21 the area at the end of Moyston Court is unable to achieve the DSS for fire flow. To achieve the DSS for fire flow, the 100mm main needs to be replaced (or augmented) with a 150mm main (PIP_AUG22).

Dicameron Court
At 6:30 pm the junction at the end of Dicameron Court has an available FF of 13L/s. To improve the available fire flow to this area it is recommended that this area is removed from the Thornlands DMA and included on the Mt Cotton DMA.

Thornlands State School Area
The FF analysis for this area has been conducted at 2/3PH because it is a single commercial development. At 6:30 pm (2/3PH) the pressure upstream of the PRV is 51m (when a fire flow of 30L/s is added to the system) so the PRV was set at 45m for this analysis. The DSS for FF could not be met.

To achieve the DSS for fire flow to the school it is recommended that an augmentation is constructed from the 150 mm main in Panorama Drive to the 375mm main in Redland Bay Road (PIP_AUG23) and the area is included in the Ziegenfusz Road DMA. When this is in place the available FF at 7:30am (2/3PH for that DMA) in the area is around 59L/s.

Weippin Street Industrial Area
At 9:00 am the U/S pressure is 44m (when a fire flow of 30L/s is added to the system) so the PRV was set at 38m for this analysis. To provide sufficient fire flow to the end of Weippin Street (J5106), at PH (9:00am), the reticulation from Wellington Street to Weippin Street (MUID 12440) is required. The available flow at the end of Weippin Street (J5016) is 24L/s. This is considered satisfactory as a flow of 10L/s is needed from 3 hydrants.

The connection from Weippin to Enterprise Street (MUID 12438) alone is not sufficient to provide suitable fire flow to J5106.

Alternatively, a 150mm main from J5106 at the end of Weippin Street, through the pathway to the 150mm main in Enterprise Street also provides suitable pressures at the end of Weippin Street without pipes 12440 or 12438. This is shown as Alternative-A on **Figure 15.8**.

Kinross Road
When the reticulation layout included in the water model (as shown on **Figure 15.8**) is adopted all areas meet the DSS for fire flow at 6:30pm. A time of 6:30 pm has been adopted because although 2/3 PH is actually at 7:30 am for the Mt Cotton Zone the Thornlands DMA draws the pressures down in the area most at 9:00 am. 6:30 pm is when the flow into the Thornlands DMA is 2/3 PH.

This means that providing the actual reticulation is designed correctly all areas should meet the DSS for fire flow. It is recommended that when the lot layout for the Kinross Road MDA is finalised, the proposed water supply reticulation is modelled to ensure its suitability.

The fire flow results with all augmentations in place are shown on **Figure 15.8**.

15.6 Augmentation Timing

15.6.1 Existing System at 2013 Demands

Peak Hour

The PH results when the 2013 demands are included on the existing system model are shown on **Figure 15.9**. At PH (9:00 am) the inflow is 68L/s and pressure upstream of the Thornlands PRV is 53m so a pressure of 47 m has been adopted for this analysis (to allow for losses due to PRV modulation).

The figure shows that the DSS are met in all areas except for the Ronnie Street area in Alexandra Hills.

Ronnie Street Area

The end of Ronnie Street has a residual pressure of 17m at 9:00 am. This is with the Alexandra Hills reservoirs operating at 40% capacity. If they are operated at full capacity the pressure just makes it to 22m.

Because the Alexandra Hills reservoirs may not be operating at full capacity by 2013 and the results are so close to the DSS (even if they are operating at full capacity), it is recommended that the Ronnie Street area be connected to the Thornlands DMA by 2013.

Fire Flow

When a fire flow of 30L/s is added to the DMA, the pressure upstream of the PRV drops to 35m, so a PRV setting of 29m needs to be adopted. When the pressure is set to 29m even without a fire flow, the area in Panorama Drive south of Ziegenfusz Road is unable to meet the minimum pressure requirement of 6m at PH (9:00 am). Augmentations are therefore required to provide suitable fire flow to the area.

2013 Augmentations

Thornands DMA

To provide suitable fire flow to the Thornlands DMA when adopting 2013 demands the following pipe work needs to be constructed:

- 200mm main along Goodard Road to the 300mm main upstream of the Thornlands PRV (1_4 & 1_5).
- Connection to Weippin Street. This could be either Alternative A or Pipe 12440.
- The 150mm main along Beach Street (PIP_AUG19)
- The 150mm main connecting Swallow Street to Cockateil Court (PIP_AUG20)
- The 1450mm augmentation along Moyston Court (PIP_AUG22)
- The 150mm main from Panorama Drive to Redland Bay Road (PIP_AUG23) and include the Thornlands State School in the Ziegenfusz Road DMA.

With the Goodard Street augmentations in place at 9:00 am the pressure upstream of the PRV drops to 44m when a fire low of 30L/s is added to the DMA. A setting of 38m was therefore adopted for the analysis. When a 15L/s fire flow is on the system at 6:30pm (2/3 PH) the pressure upstream of the PRV is 57m, so a pressure setting of 51 has therefore been adopted for the analysis.

Suitable pressures are provided to Weippin Street with only the Goodard and Weippin St augmentations however if a fire flow of 15L/s is included on 306CMP1 at 9:00 the pressure is negative. The main along Beach Street needs to be constructed to achieve a pressure above zero at 306CMP1 when a fire flow of 15L/s is included at PH.

When a setting of 51m is adopted and the augmentations described above completed, all residential areas meet the fire flow requirement at 6:30 pm.

Mt Cotton DMA (near Kinross Road)
To provide suitable fire flow to the Mt Cotton DMA (in the Kinross Road area) when adopting 2013 demands the following pipe work needs to be constructed.

- Reticulation from Kinross Road to Milner Place (pipe ID's 12402, 12406 & 12453).

This connection is needed to provide sufficient fire flow to the Milner Place area. This area no longer meets the fire flow requirement because of the increased demands in the Kinross Road area.

These are shown on **Figure 15.10**.

15.6.2 2013 System at 2018 Demands

Peak Hour
When the 2018 demands are included on the 2013 system, at PH (9:00am), the pressure upstream of the PRV is 54 m (inflow is 67L/s). A setting of 48m has therefore been adopted.

All areas meet the DSS at peak hour (9:00 am) with the critical junction being at the end of Panorama Drive (junction 176) which has a residual pressure of 22m.

Fire Flow
When a fire flow of 30L/s is added to the Thornlands DMA the pressure upstream of the PRV is 38 m at PH (9:00 am). A setting of 32m has therefore been adopted. When the PRV is set at 32m some areas in the southern part of the zone (Moyston Court, Claret Court, Panarama Drive and Caldwell Close) do not achieve 12 m pressure even without a fire, so the DMA is unable to meet the PH FF requirements for a commercial fire flow.

2018 Augmentations
The augmentations needed to meet the fire flow requirements with 2018 demands (in addition to those needed at 2013) are listed below:

- Construct the 300mm main along Boundary Road and up Kinross Road to Wrightson Road (PIP_IC18, PIP_IC17, PIP_IC12 & PIP_IC13)
- Remove the Whitby Place area from the Thorlands DMA and add it to the Mt Cotton Trunk DMA (the end of Panorama Drive does not achieve 12m residual pressure in the event of a commercial FF in the DMA).
- Construct the 150mm main along Panorama Drive from the 150mm main near the pathway to the corner of Ziegenfusz Road (PIP_AUG21).
- Connect Dicameron Court to the Mt Cotton DMA instead of the Thornlands DMA.
- Cross connect the 300mm and 100mm main in Lorikeet Drive

When the above augmentations are in place at PH (9:00 am), the pressure upstream of the PRV is 58m.

When a fire of 30L/s is added to the Thornlands DMA this reduces the pressure upstream of the PRV to 44m, so a setting of 38m was adopted for the PH fire flow analysis (industrial area). All the industrial estate meets the FF requirements with the above augmentations in place.

At 2/3 PH (6:30pm) with a 15L/s fire demand added to the DMA the upstream pressure is 60m with a 15L/s FF therefore a setting of 54m has been adopted.

The augmentations needed by 2018 are included on **Figure 15.11**.

15.6.3 Ultimate (2025) Demands

When the 2025 demands are included on the 2018 system the pressure upstream of the PRV is 51m at PH (9:00am). A pressure of 45 has therefore been adopted to allow for the 6m modulation losses.

Figure 15.11 shows that the DSS is met at PH when ultimate demands are included on the 2018 system. It is the fire flow requirements that are unable to be met, and therefore require the additional augmentation of (PIP_IC14).

15.7 Recommendations

The following master plan recommendations are made for this DMA:

- That a valve be inserted in the 150mm main from Flamingo Crescent to the 300mm main upstream of the Thornlands PRV as soon as possible.
- That the Ronnie Street area in Alexandra Hills LLZ is connected to the Thornlands DMA
- That area around Whitby Place is removed from the Thornlands DMA and connected to the Mt Cotton Trunk DMA.
- That when the lot layout for the Kinross Road area is finalised, the proposed water supply reticulation is modelled to ensure its suitability.
- LinkWater be advised of the outcomes of this study, particularly in relation to the proposed connection of a 300mm diameter to their infrastructure at the corner of Taylor Road and Redland Bay Road and the assumption of water being transferred from south to north underlying the boundary conditions for this report.

Legend

DMA Boundaries
Thornlands
5m Contours

Diameter

80	150	225	300	450	525	675	750	
63	100	200	250	375	500	600	691	900

0 125 250 500 750 1,000 1,250 Meters

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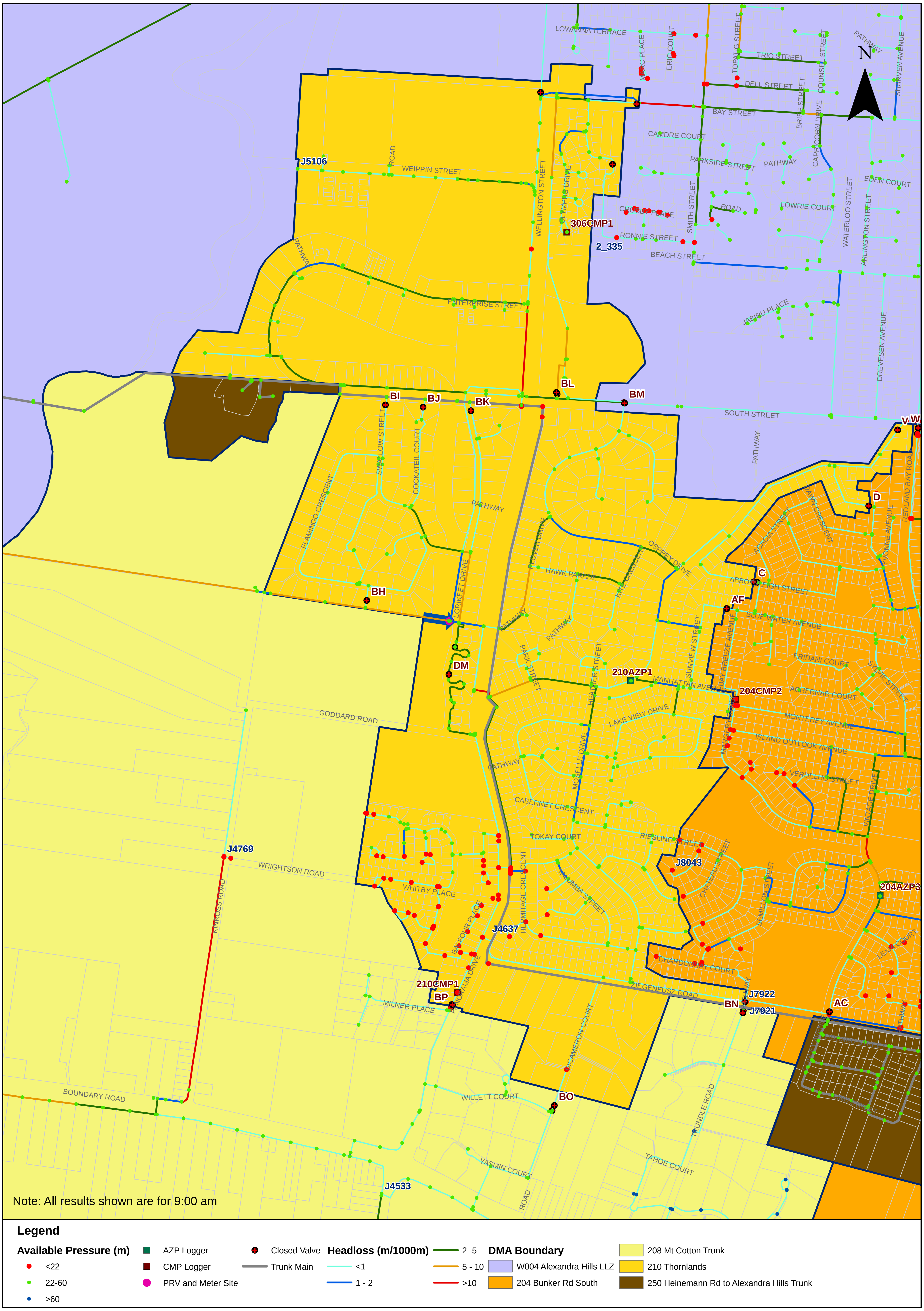
Rev0 23 December 2009

FIGURE 15.3
210 Thornlands Topography



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Rev0 23 December 2009

FIGURE 15.4
210 Thornlands PH Results

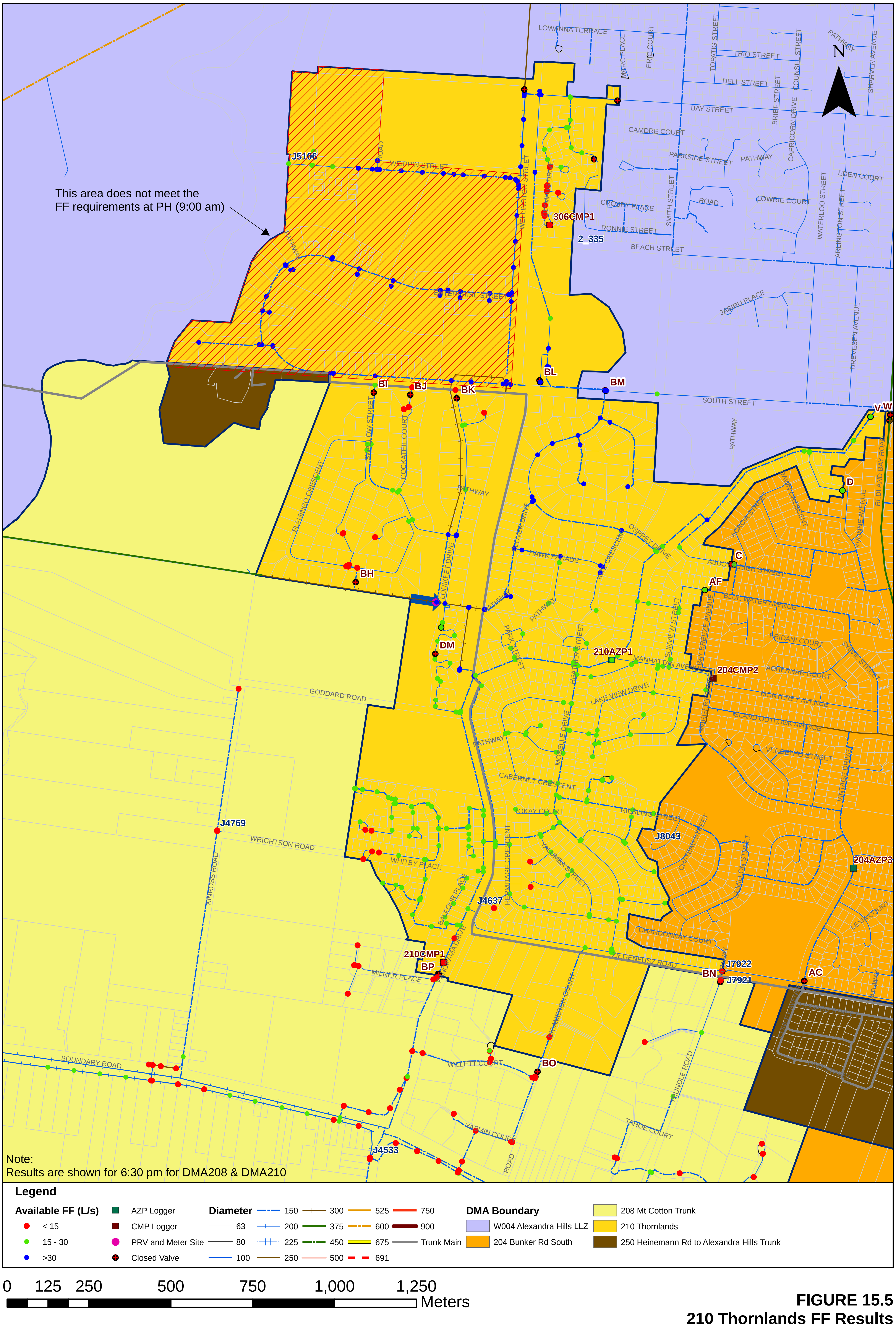

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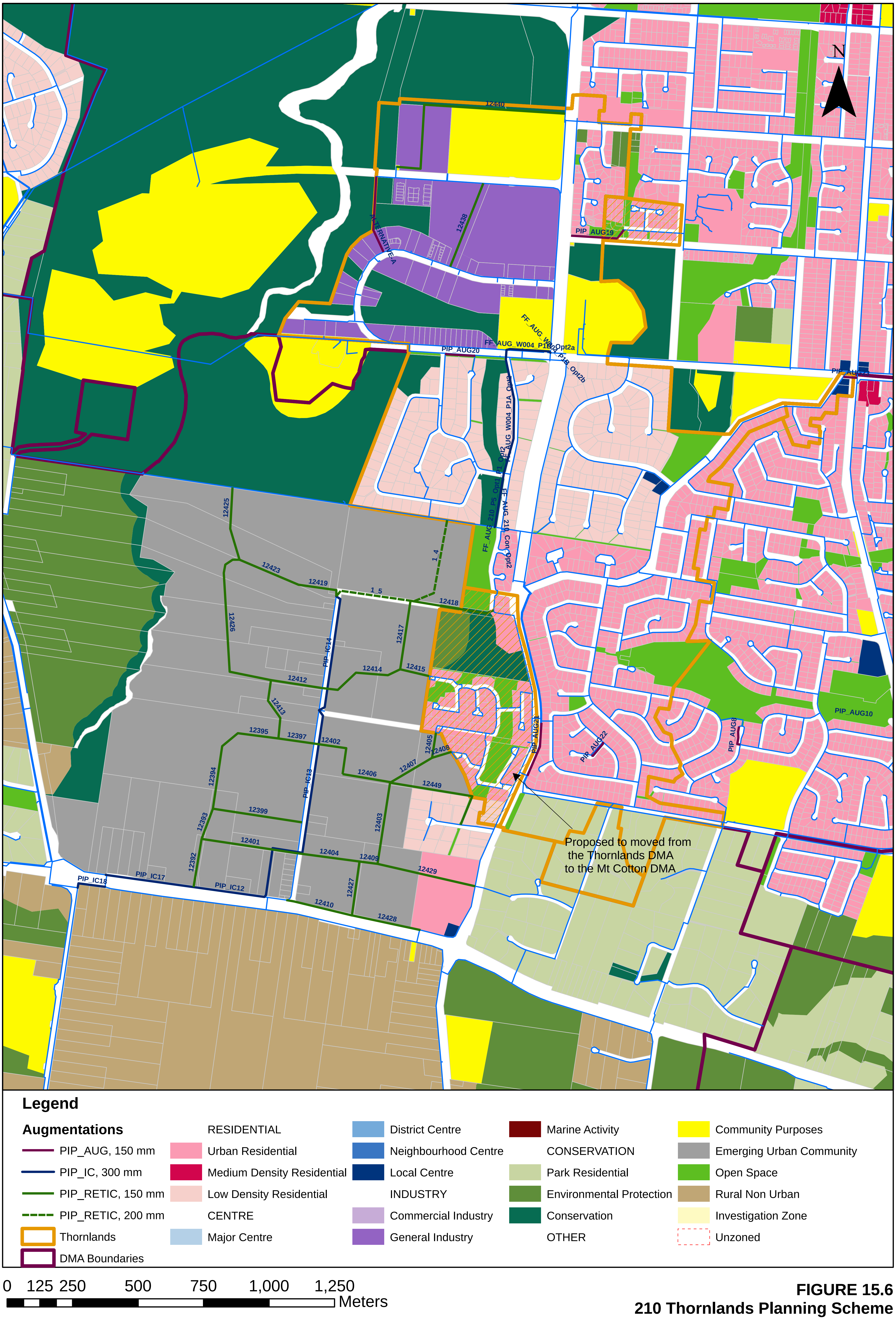
FIGURE 15.5
210 Thornlands FF Results



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Rev0 23 December 2009

FIGURE 15.6
210 Thornlands Planning Scheme

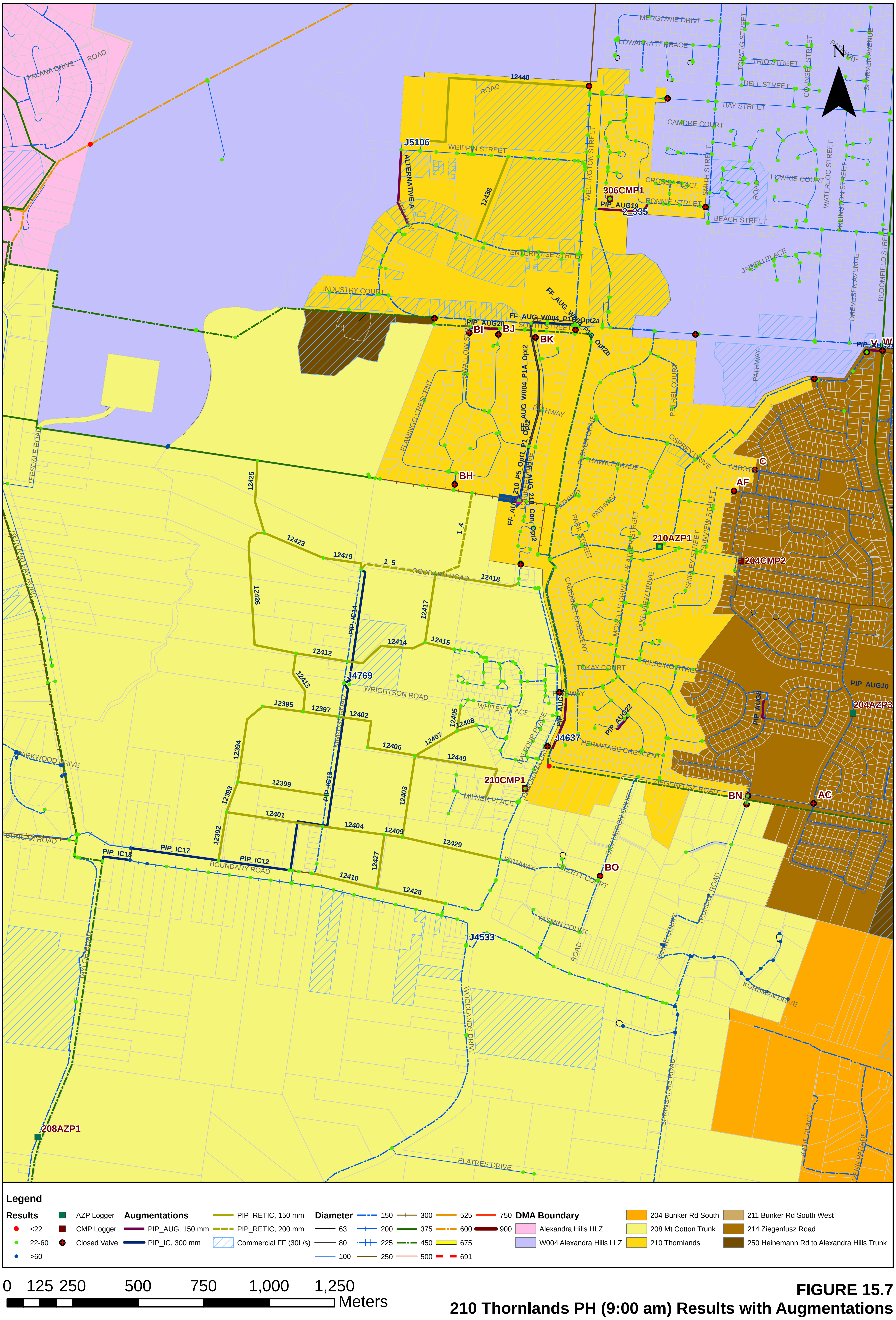

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FIGURE 15.7
210 Thornlands PH (9:00 am) Results with Augmentations

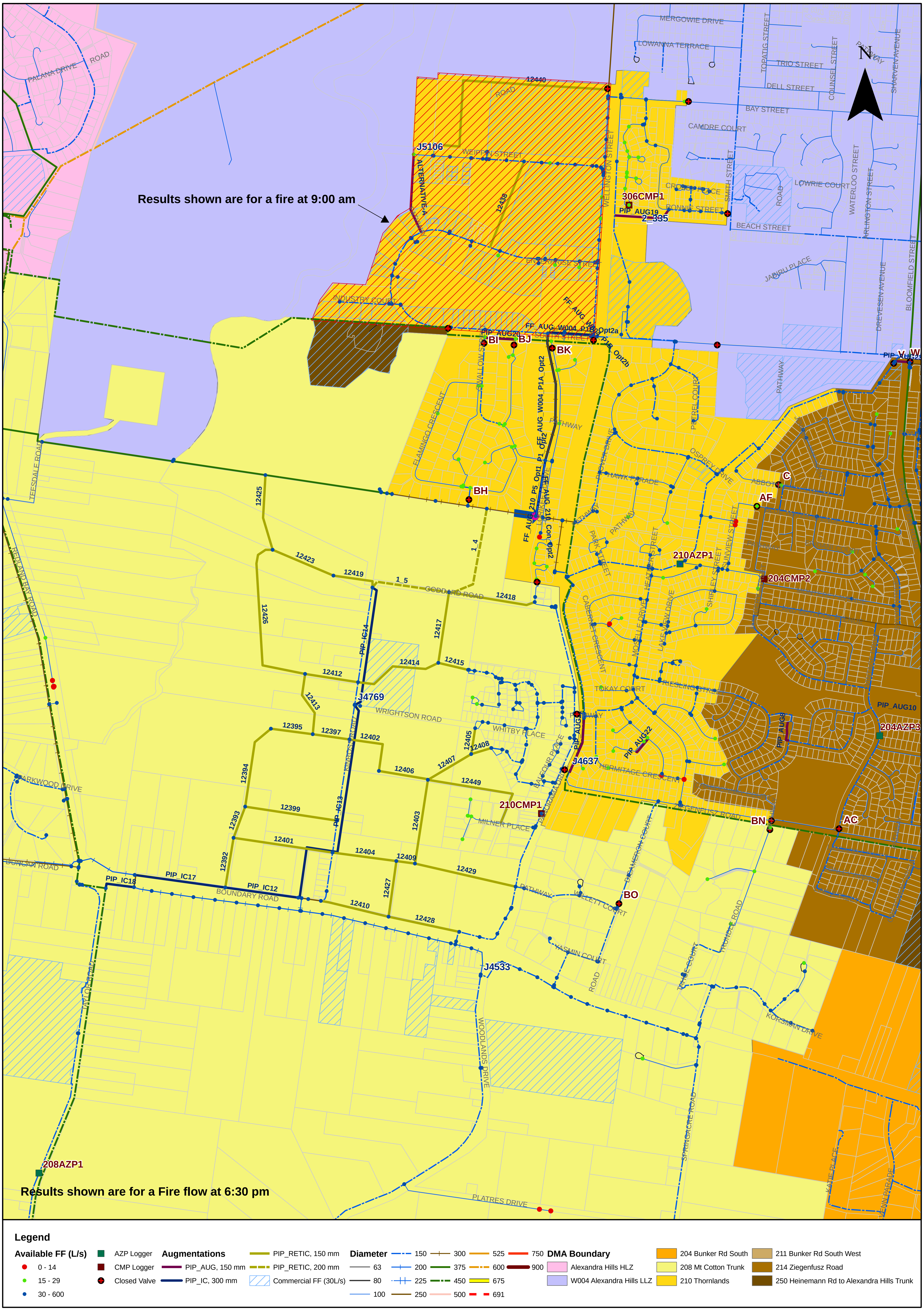

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FIGURE 15.8
210 Thornlands FF Results with Augmentations

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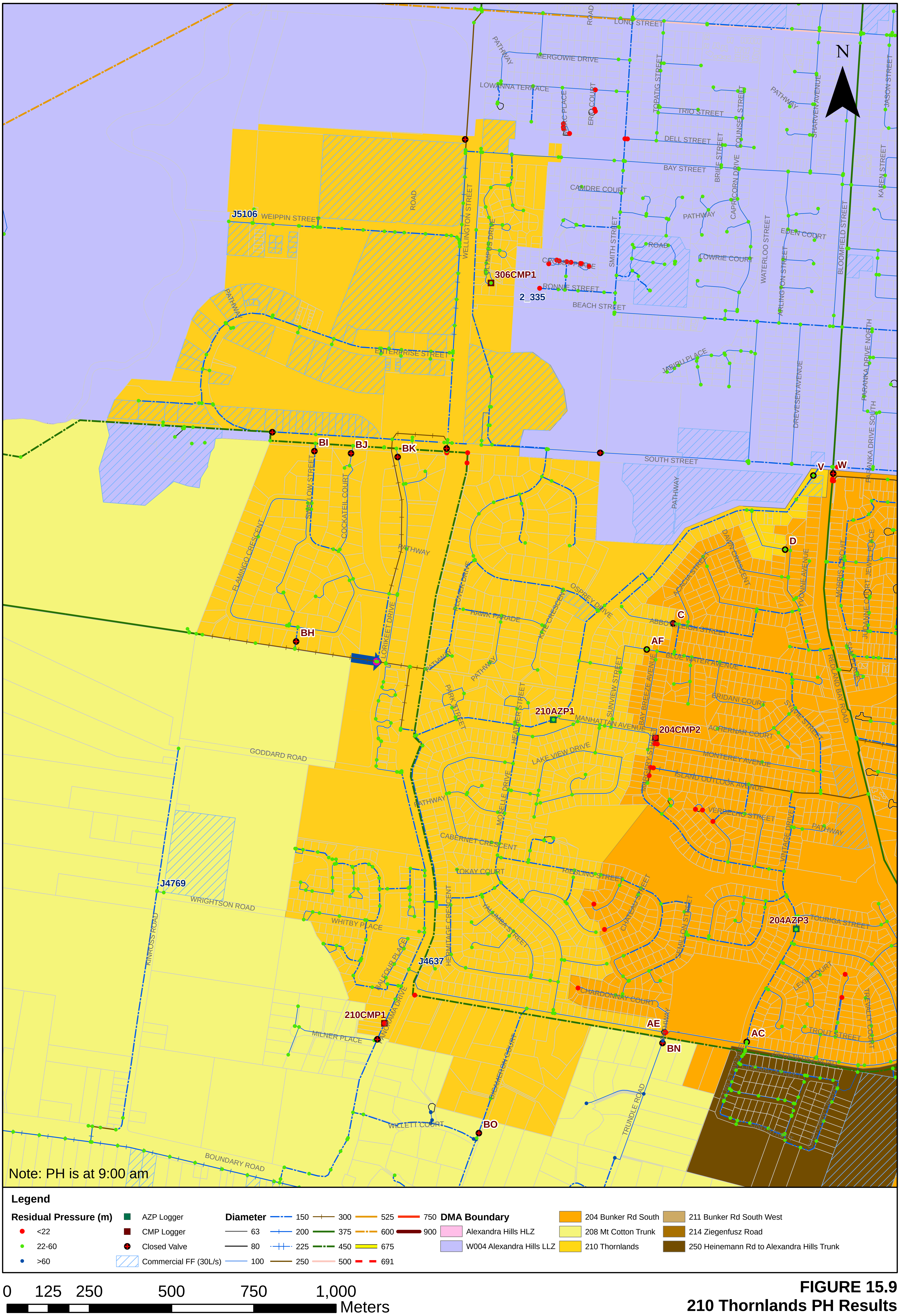
Rev0 23 December 2009



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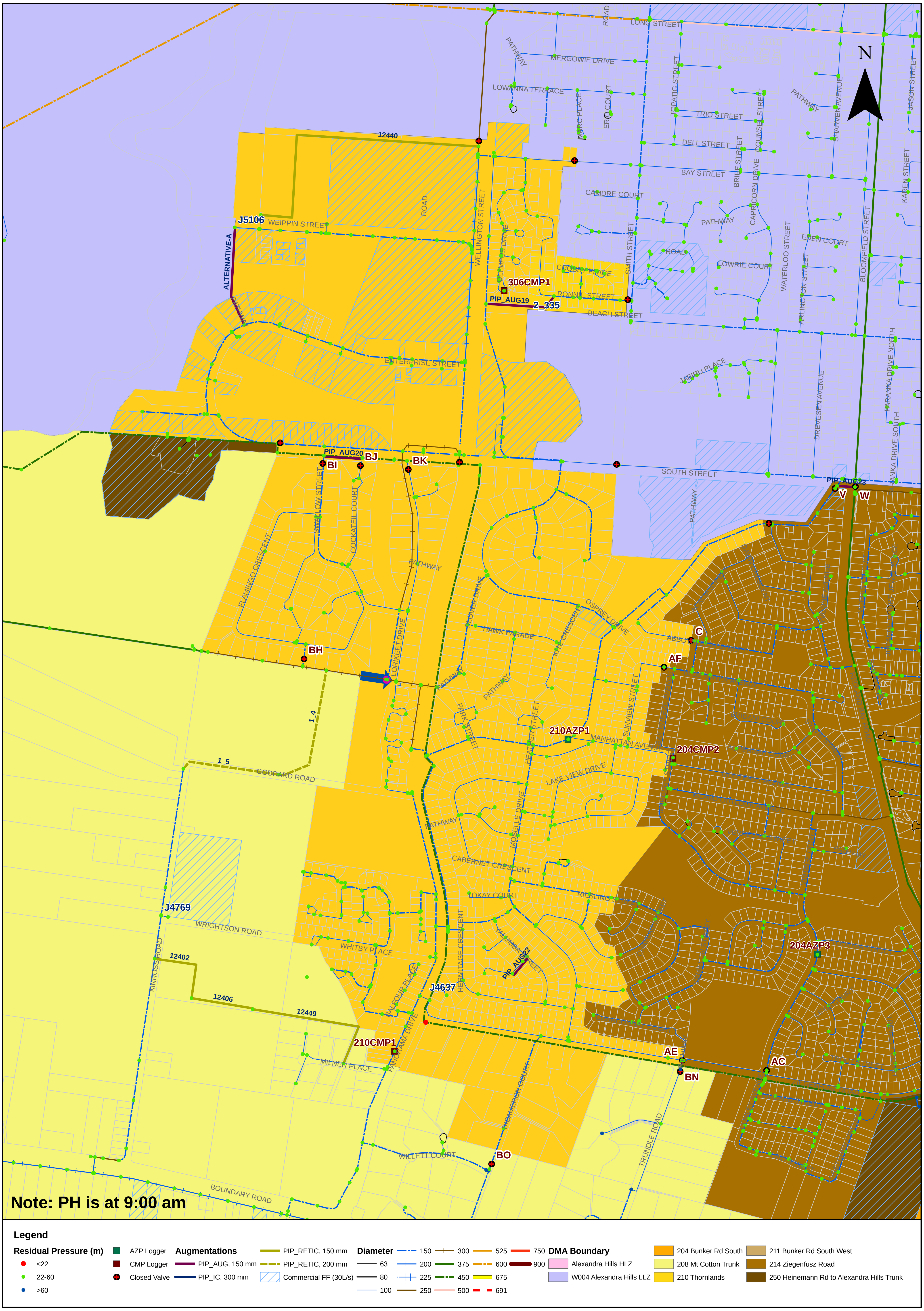
Rev0 23 December 2009

FIGURE 15.9
210 Thornlands PH Results
Existing System with 2013 Demands



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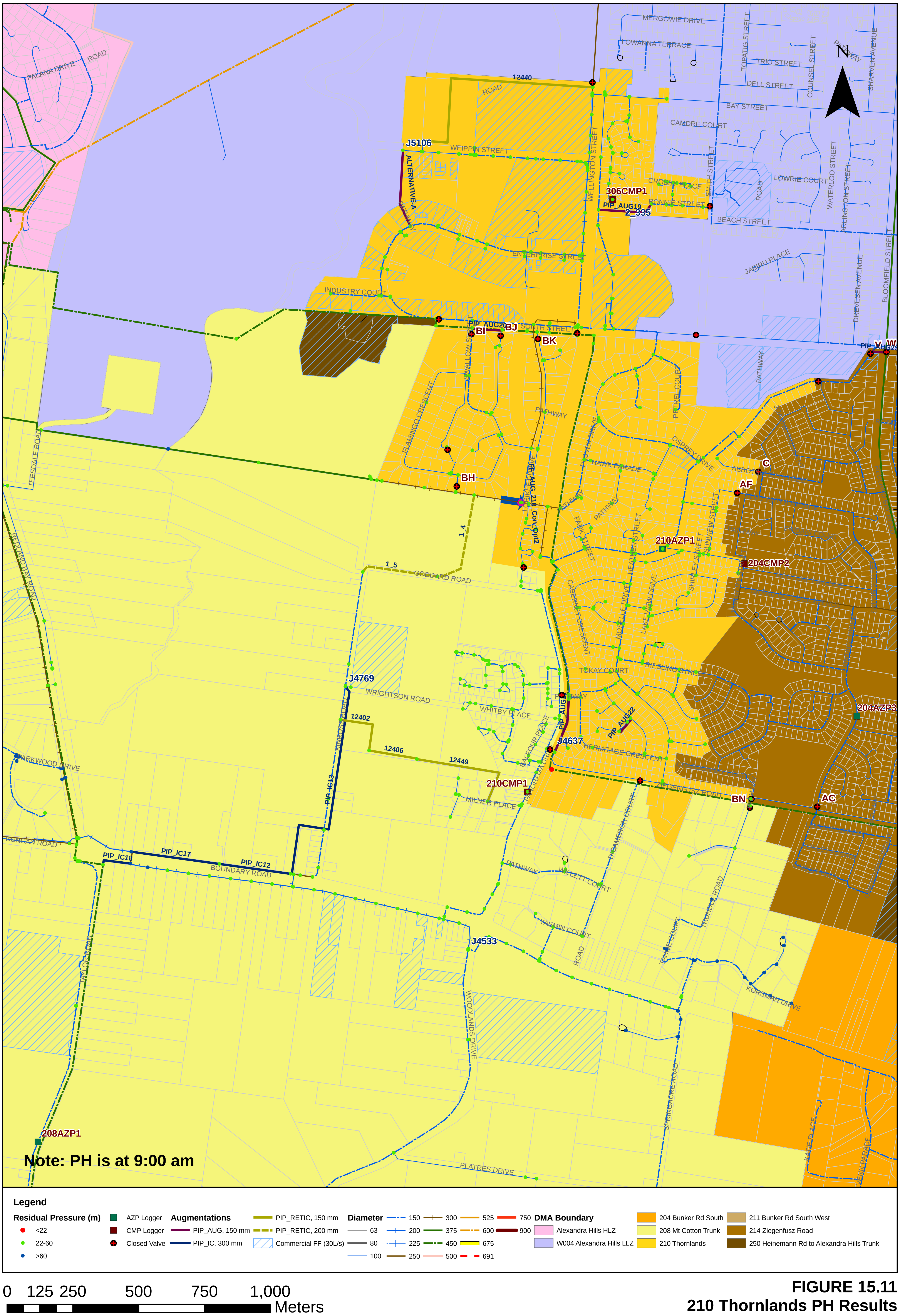
Rev0 23 December 2009

FIGURE 15.10
210 Thornlands PH Results
2013 System with 2018 Demands



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Rev0 23 December 2009

FIGURE 15.11
210 Thornlands PH Results
2018 System with Ultimate Demands

16. 301 Howletts Road

There have been no changes to the Howletts Road zone since the development of the MWH master planning study as such it has not been investigated further.

17. 308 and W004 Alexandra Hills

There have been no changes to the Alexandra Hills HLZ or the Alexandra Hills LLZ since the development of the MWH master planning study as such it has not been investigated further.

18. 401 Amity Point

Amity Point has been investigated as a separate report. This report is included in **Appendix H**.

19. 402 Dunwich

Dunwich has been investigated as a separate report. This report is included in **Appendix I**.

20. 403 Point Lookout

Point lookout is yet to be investigated with a "verified" model, it has therefore been assumed that the augmentation requirements are the same as those identified by the MWH Master Planning Study.

21. Proposed Works

A summary of the proposed works on a DMA basis is included below. All fire flow augmentations identified in the Fire flow Report (RW, July 09) are assumed to have been completed for this report, so this summary only includes fire flow augmentations that need to be included in the Infrastructure Charges Calculations.

21.1 Serpentine Ck DMAs

The proposed works for the Serpentine Creek DMA is summarised below.

2010

- Construct the following Fire flow augmentations as described in the Fire Flow Report (RW, July 2009) that includes the following Infrastructure Charges pipes:

MUID	Diameter	Length	Location
FF_AUG_106_P8a_Rev1	300 mm	146 m	Intersection of School of Arts Rd and German Church Rd
FF_AUG_106_P8b_Rev1	300 mm	161 m	Intersection of School of Arts Rd and German Church Rd
8478B*	375 mm	5 m	Serpentine Creek PRV
8478C*	375 mm	1 m	Serpentine Creek PRV

*Note: *Already constructed as part of the PLMP*

2013

- Construct the Pressure Reducing Valve
- Close Valves to separate Serpentine Ck East and West
- Construct the following pipes:

MUID	Diameter	Length	Location
PIP_IC1	300 mm	209 m	Along Muller Street from PIP_IC5 to Larkspur St
PIP_IC5	300 mm	154 m	Along Muller Street from Cleveland Redland Bay Rd to PIP_IC1
PIP_IC2	450 mm	702 m	Cleveland Redland Bay Rd from Muller Street to PIP_IC3
PIP_IC3	450 mm	807 m	Cleveland Redland Bay Rd from PIP_IC2 to Unwin Rd
PIP_IC4	450 mm	893 m	Cleveland Redland Bay Rd from School of Arts Rd to Muller Street.
PIP_IC6	450 mm	82 m	Unwin Road to New PRV
PIP_AUG2	150 mm	94 m	From Banksia Street to Denham Boulevard
PIP_AUG5	200 mm	484 m	Along School of Arts Road

2018

- Construct the following pipes:

MUID	Diameter	Length	Location
9705 (RETIC)	150 mm	151 m	Connect Cleveland Redland Bay Rd to Apricot Place (Developer to Construct)
PIP_AUG6	200 mm	459 m	Cleveland Redland Bay Rd, North of German Church Rd

21.2 Boundary Street DMA

The proposed works for the Boundary Street DMA is summarised below.

2018

- Fully open or remove the Giles Road PRV
- Construct the following pipe if/when additional pressure reduction is needed in the DMA.

MUID	Diameter	Length	Location
PIP_AUG12	100 mm	113 m	Connection between Broadwater Terrace and Esplanade

21.3 Benfer Road DMA

The proposed works for the Benfer Road DMA are summarised below.

2013

- Fully open or remove the Giles Road PRV
- Fully open the Benfer Rd PRV during PH
- Construct the following pipes:

MUID	Diameter	Length	Location
PIP_IC11	375 mm	1 187 m	Giles Road PRV to Benfer Road PRV
PIP_IC8	200 mm	196 m	Colburn Avenue from Master Avenue to the Submarine Main
PIP_IC9_Opt4	200 mm	977 m	Submarine Main
PIP_IC10	200 mm	545 m	Victoria Parade South on Coochiemudlo Island

2025

- Construct the following pipes:

MUID	Diameter	Length	Location
PIP_IC7	250 mm	286 m	Colburn Avenue from Wilmont to Wilson Street

21.4 Bunker Road South

The proposed works for the Bunker Road South DMA, assuming that Victoria Pt says off Bunker South as recommended in the Victoria Pt investigation, are summarised below.

2013

- Split the Bunker Road South DMA into three different DMAs. This will require:
  - The construction of an off-take and cross connecting pipework to create an off-take for the Bunker Road South West DMA. It is proposed to locate this near 204CMP1.
  - Close relevant valves to create the zones
- Possible construction of PRV's in Ziegenfusz Road and Bunker Road South West to reduce manage pressure in these DMAs.

- Construct the following pipes:

MUID	Diameter	Length	Location
PIP_AUG8	150 mm	80 m	Connection from the 150mm main at the end of Semillon St to the Champagne Crescent 150 mm main
PIP_AUG9	200 mm	80 m	Connection from Redland Bay Road to Albicore Drive
PIP_AUG10	200 mm	286 m	Connection from Albicore Drive to Vintage Drive

21.5 Victoria Point DMA

It is proposed to keep Victoria Pt DMA off of the Bunker Road South DMA. The proposed works for the Victoria Pt DMA are summarised below.

2013

- Construct the following pipes:

MUID	Diameter	Length	Location
PIP_AUG3	150 mm	229 m	From the corner of Link Road and Colburn Avenue south along Link Road.

21.6 Thornlands (Including Kinross Ross Road)

The proposed works for the Thornlands DMA and Kinross Road area in the Mt Cotton Trunk DMA are summarised below.

2010

- Construct the Olympus Drive Fire flow augmentations as described in the Fire Flow Report (RW, July 2009) that includes the following Infrastructure Charges pipes:

MUID	Diameter	Length	Location
FF_AUG_210_P5_Opt1_P1_Opt2	150 mm	210 m	Along north Lorikeet Drive from the 300mm main down stream of PRV210.
FF_AUG_W004_P1A_Opt2	300 mm	478 m	Along Lorikeet Drive from FF_AUG_210_P5_Opt1_P1_Opt2 to South Street.
FF_AUG_W004_P1B_Opt2	300 mm	189 m	Along South Street from FF_AUG_W004_P1A_Opt2 to Wellington Street

2013

- Connect the Alexandra Hills Ronnie Street Area to the Thornlands DMA.
- Close relevant valves to put the Thornlands State School into the Ziegenfusz Road DMA. Note that PIP_AUG23 is needed for this.
- Construct the following pipes:

MUID	Diameter	Length	Location
1_4 (RETIC)	200 mm	379 m	Developer Reticulation from Kinross Raod along Goddard Road.
1_5 (RETIC)	200 mm	296 m	Developer Reticulation from Goddard Road to the 300mm main upstream of PRV210.
Alternative-A **OR**	150 mm 150 mm	297 m 872 m	Weipin Street connection

12440 (RETIC)			
PIP_AUG19	150 mm	219 m	Along Beach Street
PIP_AUG20	150 mm	116 m	Connection from Swallow Street to Cockateil Court (along South Street)
PIP_AUG22	150 mm	73 m	Along Moyston Court
PIP_AUG23	150 mm	53 m	Connection from Panorama Drive to Redland Bay Road (along South Street)
12402 (RETIC)	150 mm	224 m	Developer Reticulation from Kinross Road to Milner Place
12406 (RETIC)	150 mm	187 m	Developer Reticulation from Kinross Road to Milner Place
12449 (RETIC)	150 mm	436 m	Developer Reticulation from Kinross Road to Milner Place

2018

- Remove the Whitby Place area from the Thornlands DMA and add it to the Mt Cotton Trunk DMA.
- Connect Dicameron Court to the Mt Cotton DMA instead of Thornlands DMA.
- Cross connect the 300 mm and 100mm main in Lorikeet Drive (identified as FF_AUG_210_Con_Opt2 in the model).
- Construct the following pipes:

MUID	Diameter	Length	Location
PIP_IC12	300 mm	273 m	Along Boundary Road
PIP_IC13	300 mm	860 m	From PIP_IC12 north along Kinross Road to PIP_IC14
PIP_IC17	300 mm	339 m	Along Boundary Road
PIP_IC18	300 mm	120 m	Near the intersection of Duncan Road, Boundary Road and Taylor Road
PIP_AUG21	150 mm	212 m	Along Panorama Drive from the Pathway to the corner of Ziegenfusz Road

2025

- Construct the following pipe:

MUID	Diameter	Length	Location
PIP_IC14	300 mm	460 m	Along Kinross road from PIP_IC14 to Goddard Road

21.7 Amity Point

The proposed works for Amity Point are as follows:

2010

- Install a flow meter along the trunk main from the reservoir so more accurate data on the system can be determined.
- After collecting at least one years worth of data, review the planning report and required augmentations based on the results of the data collection.

21.8 Dunwich

The proposed works for Dunwich are as follows:

2010

- Construct the Fire flow augmentations as described in the Dunwich Report included in **Appendix I** which includes the following Infrastructure Charges pipes:

MUID	Diameter	Length	Location
272321*	150 mm	1 m	Illawong Reservoir to Tazi Reservoir
272323*	150 mm	89 m	Illawong Reservoir to Tazi Reservoir
272324*	150 mm	77 m	Illawong Reservoir to Tazi Reservoir
272325*	150 mm	80 m	Illawong Reservoir to Tazi Reservoir
272326*	150 mm	70 m	Illawong Reservoir to Tazi Reservoir
272327*	150 mm	84 m	Illawong Reservoir to Tazi Reservoir
272328*	150 mm	75 m	Illawong Reservoir to Tazi Reservoir
272329*	150 mm	66 m	Illawong Reservoir to Tazi Reservoir
272330*	150 mm	3 m	Illawong Reservoir to Tazi Reservoir
FF_AUG_402_P1	100 mm	468 m	Along Rainbow Crescent from the Rainbow Crescent Reservoir to the un-named road to the south
FF_AUG_402_P4	100 mm	166 m	From the proposed PRV to 100mm main in Rainbow Crescent (to the south of the PRV)
FF_AUG_402_P5	100 mm	169 m	From the proposed PRV to 100mm main in Rainbow Crescent (to the north of the PRV)

*Note: * Already constructed*

21.9 Point Lookout

The proposed works for point lookout is as follows.

MUID	Diameter	Length	Location
PIP_IC20	225 mm	293 m	From the D/S side of the Booran Street Booster along Bigoon road to the Waller Court intersection.

22. Cost Estimates

22.1 Methodology

The Infrastructure Charges costs were calculated based on the Gold Coast Water *Unit Rates Review – 2008* (Hyder 2008). The report includes a base cost and then additional adjustment factors depending on estimates of local site conditions. The methodology and assumptions associated with these adjustment factors are described below.

Where Redland Water has infrastructure sizes that are not included in the Gold Coast Water report the values in the report were extrapolated using the closest trendline developed by MS Excel. Where the trend line for the complete data set was not considered representative of the infrastructure size being extrapolated a representative portion of the data was used to obtain a more accurate trend line.

22.1.1 Base Year for Costs

The rates provided in the Gold Coast Water *Unit Rates Review – 2008*, are provided in June 2008 dollars. As the outcomes from this report are being used in the current resubmission of Redland City Council's PIP, the costings in this report have been converted to December 2006 dollars – which is the base year for the costs to be included in the PIP & ICS. The costs were converted from June 2008 to December 2006 using the *General Construction (41) Index Queensland,* available from the ABS website.

http://www.ausstats.abs.gov.au/ausstats/meisubs.nsf/0/5B584978BB426197CA25759B00184806/$File/6427010.xls#A2333709J

The indices used in this discounting exercise are shown in **Table 22.1**.

Table 22.1 – Base Year Indices

Month -Year	Index Number ; General construction (41) Queensland)
Dec – 06	151.3
Jun – 08	166.3

22.1.2 Base Rates (for pipelines)

In selecting the base rate for the construction of potable water mains (reference Table C-2 in the *Unit Rates Review – 2008* report), in has been assumed that any pipes with a nominal diameter less 450mm will be replaced in uPVC and those with a diameter 450mm or greater will be constructed from DICL or MSCL as per the rates provided in Table C-2.

It has also been assumed that, all pipes will be replaced with a standard pipe diameter and the work packaged with other works, so the non-standard diameter and short-pipe length adjustment factors have not been used.

22.1.3 Pipe Depth Adjustment Factor (for pipelines)

The following depth ranges have been assumed:

- Dia <= 550mm – d <1.5m
- Dia > 550mm – 1.5m < d < 3m

From as-constructed drawings of some of the water mains in the network it has been seen that some of the trunk mains are laid with a depth to invert of about 2m. Most of the larger mains in the network are located in Main Roads corridors; therefore it has been assumed that these mains have similar cover. It has been assumed that for pipes less than or equal to 550mm, 600mm of cover is needed (WSAA standard minimum cover). Currently, the largest pipe in the network is a 900mm diameter pipe, therefore no further depth categories have been considered.

22.1.4 Soil Type Adjustment Factor (for pipelines)

The adopted soil type has been calculated using GIS. **Figure 22.1** shows the adopted soil types. The soil type has been allocated based on the location of the centroid of the pipe segment using the adopted soil types shown in **Table 22.2**. The adopted soil types were then manually checked at the soil type boundaries. Where there was no soil type allocated for the pipe using the GIS, the soil type was estimated manually using the soil type map.

Areas shown as being Potential Acid Sulphate Soils (PASS) were then determined using RCC Acid Sulphate Spoils Mapping. Where a soil was shown to be PASS then PASS was adopted as the soil type in preference to any other soil type.

Table 22.2 – Adopted Soil Types

Soil Description	Adopted Soil
Alluvial soils on banks and humic gleys on plains	Good Soil
Differentiated and gleyed soils on basalt in depressions between ridges	Soft Rock
Gilgaied acid clays on high terraces	Poor Soil
Humic gleys on low plains	Poor Soil
Krasnozems and red earths on a gently undulating surface	Good Soil
Krasnozems on crests and prairie-like soils on slopes	Good Soil
Krasnozems, often lateritic, on low hills and ridges	Good Soil
Lateritic podzolics and red-yellow podzolics on moderately high hills with sandy lithosol	Soft Rock
Lateritic podzolics and sandy red-yellow podzolics on gently undulating surfaces	Soft Rock
Lithosols (loam textures) on steep ridges and spurs	Soft Rock
Lithosols (sand textures) on narrow ridge crests and steep slopes	Soft Rock
Lithosols on high quartzite ridges and red clays on fringing slopes	Hard Rock
Meadow podsolics on low terraces, alluvial soils and gleys on floodplains	Poor Soil
Peaty gleys in broad shallow depressed areas	Poor Soil
Prairie-like soils and shallow black earths on low hill crests and gentle slopes	Good Soil
Red earths on a gently undulating surface lateritic podzolics on this and on adjacent ste	Good Soil
Red-yellow podzolics on low hills of metasediments	Soft Rock
Red-yellow podzolics on low hills of sedimentary rocks	Good Soil
Red-yellow podzolics on low hills with lateritic podzolics near crests	Good Soil
Regosols on low beach aridges and gleys on adjacent plains	Poor Soil
Saline gleys on very low plains	Poor Soil
Thin differentiated soils on basalt on low hills and slopes between sandstone	Soft Rock
Tidal solonchak	Poor Soil
Yellow podzolics on low terraces, alluvial soils and gleys on floodplains	Good Soil
** Balance areas of NSI (areas that did not come up with a dominant soil type)*	*Sand*
*** Submarine Pipes*	*Water*

22.1.5 Development Density of site (for pipelines)

The development density was determined using GIS, with the .rsc.GISSU.CUL_URB_PLN_RPSZONEBDRYS_P layer. The Planning Scheme Zones were selected and added to PIP_Pipes using a buffer of 30m around the pipes. The adopted densities for the Planning Scheme Zone are included in **Table 22.3**.

The order of selection was as follows:

1. Green Field
2. Brown Field
3. High Density

The zoning was then checked using the 2008 Mainland, 2008 SMBI and 2009 NSI Towns aerial photography. As a result of the manual check all pipes in the SMBI were changed to Brown Field and some other smaller areas in the remainder of Redland City where development density is low.

Table 22.3 – Adopted Density

Planning Scheme Zone	Adopted Density
Commercial Industry	Brown Field
Community Purposes	Brown Field
Conservation	Green Field
District Centre	Brown Field
Emerging Urban Community	Green Field
Environmental Protection	Green Field
General Industry	Brown Field
Investigation Zone	Green Field
Island Industry	Brown Field
Local Centre	Brown Field
Low Density Residential	Brown Field
Major Centre	High Density
Marine Activity	Brown Field
Medium Density Residential	Brown Field
Neighbourhood Centre	Brown Field
Open Space	Green Field
Park Residential	Brown Field
Point Lookout Centre	Brown Field
Point Lookout Residential	Brown Field
Point Lookout Tourist	Brown Field
Rural Non Urban	Green Field
Rural Non-Urban	Green Field
SMBI Centre	Brown Field
SMBI Residential	Brown Field
Southern Moreton Bay Islands (SMBI) Centre	Brown Field
Southern Moreton Bay Islands (SMBI) Residential	Brown Field
Unzoned	Green Field
Urban Residential	Brown Field

22.1.6 Submarine Adjustment Factor (for pipelines)

Given that part of the Redland Water supply network's trunk system (although now owned by LinkWater) is submarine main, specific adjustment factors have been determined for constructing submarine mains. The original planning report and its addendum for the inclusion of the Southern Moreton Bay Islands in the scheme have been reviewed to identify the actual costs for the construction of these mains. The costs were factored back to the relative base rates (.i.e. Greenfield construction in good soil as per the *GCW Unit Rates Review – 2008*) and plotted in MS Excel. A regression line was then applied and a formula determined for adjustment factors relative to pipe diameter. The adopted submarine adjustment factors are as shown in **Table 22.4**.

Table 22.4 – Submarine Adjustment Factors

Pipe Diameter*	Submarine Adjustment Factor*
200	6.42
225	6.20
250	6.01
300	**5.69**

Pipe Diameter*	Submarine Adjustment Factor*
375	**5.32**
450	**5.04**
500	4.88
600	4.62
750	**4.32**

*Note: * Diameters and factors in* ***bold*** *above are derived from actual construction costs.*

22.1.7 Island Adjustment Factor

Pipes

Redland Water also operates water supply networks on the Southern Moreton Bay Islands and North Stradbroke Island. Specific adjustment factors have been determined for constructing mains on these islands to take into account the extra costs for mobilising labour, plant and materials to site. The original planning report and its addendum for the inclusion of the Southern Moreton Bay Islands in the scheme have been reviewed to identify the costs for the construction of mains on islands. The costs were factored back to the relative base rates (.i.e. Greenfield construction in good soil as per the *GCW Unit Rates Review – 2008*) and plotted in MS Excel. A regression line was then applied and a formula determined for adjustment factors relative to pipe diameter. The adopted island adjustment factors are as shown in **Table 22.4**. The island construction factor is applied in addition to the adjustment factors detailed in the *GCW Unit Rates Review – 2008*.

Table 22.5 – Island Adjustment Factors

Pipe Diameter*	Submarine Adjustment Factor*
100	1.25
150	1.27
200	1.29
225	1.30
250	1.31
300	**1.33**
375	**1.36**
450	**1.39**
500	1.41
600	1.45
750	**1.51**

*Note: * Diameters and factors in* ***bold*** *above are derived from actual construction costs.*

Other Infrastructure (reservoirs, valves and pump stations)

For other infrastructure constructed on the islands, a single adjustment factor has been used. This adjustment factor has been determined by averaging the factors determined from the actual island construction costs only (i.e. not over the whole range of pipe diameters). The adopted island factor is 1.4.

22.1.8 Adjustment for Subsidies

Where the cost of the infrastructure was subsidised by the State Government (i.e. for the PLMP) the subsidised amount has been removed from the costs used in the calculation of the infrastructure charges.

22.1.9 Adjustment for Non-growth related infrastructure

Where future infrastructure also serves to improve the standards of service for existing demand the cost of the future infrastructure was reduced proportionally based on future and existing EP for the relevant infrastructure charges zone.

22.1.10 *Risk Management Contingency Allowance*

With reference to Section 6.1.2 of *GCW Unit Rates Review – 2008*, GCW advised that they included an allowance of 20% for existing infrastructure and 30% for future infrastructure. These values have been accepted by QAO (for GCW's calculation methodology) and have therefore been adopted in this report.

22.1.11 *Administrative Costs*

An administrative allowance of 20% for items such as survey, planning, design, supervision and contract administration has also been adopted as per section 6.1.1 of the *GCW Unit Rates Review – 2008* (Hyder 2008).

22.1.12 *Discounting and Administration Fee*

For the final determination of the infrastructure charges, the infrastructure establishment costs have been discounted in accordance with the Redland City Council discounting methodology. Full details of this can be found in the RPS PIP document.

22.2 Summary of Costs

22.2.1 Infrastructure Charges Costs

The costs estimates for the work identified in this report is summarised in **Table 22.6** to **Table 22.9**. The cost estimates include all work constructed after 1 January 2006 as this is the base line date for the Infrastructure Charges Calculations.

An administration fee of 2% needs to be added to the costs above in accordance with the Redland City Council Infrastructure charges methodology.

Table 22.6 – Future Pipe Costs

MUID	ICS Zone	Diameter (mm)	Length (m)	Establishment Costs ($)	Present Value ($)#
2010 Construction					
8478B*	Heinemann Road ICS Zone	375	5	$4,867	$4,598
8478C*	Heinemann Road ICS Zone	375	1	$1,001	$946
272321*	Dunwich ICS Zone	150	1	$138	$123
272323*	Dunwich ICS Zone	150	89	$9,157	$8,173
272324*	Dunwich ICS Zone	150	77	$7,953	$7,098
272325*	Dunwich ICS Zone	150	80	$8,303	$7,411
272326*	Dunwich ICS Zone	150	70	$7,250	$6,471
272327*	Dunwich ICS Zone	150	84	$8,668	$7,736
272328*	Dunwich ICS Zone	150	75	$7,709	$6,880
272329*	Dunwich ICS Zone	150	66	$6,860	$6,123
272330*	Dunwich ICS Zone	150	3	$275	$245
FF_AUG_402_P1	Dunwich ICS Zone	100	468	$58,738	$52,427
FF_AUG_402_P4	Dunwich ICS Zone	100	166	$10,345	$9,233
FF_AUG_402_P5	Dunwich ICS Zone	100	169	$10,521	$9,391
FF_AUG_106_P8a_Rev1	Heinemann Road ICS Zone	300	146	$111,366	$99,400
FF_AUG_106_P8b_Rev1	Heinemann Road ICS Zone	300	161	$122,594	$109,421
FF_AUG_210_P5_Opt1_P1_Opt2	Mount Cotton ICS Zone	300	210	$158,409	$141,388
FF_AUG_W004_P1A_Opt2	Mount Cotton ICS Zone	300	478	$361,750	$322,881
FF_AUG_W004_P1B_Opt2a	Mount Cotton ICS Zone	300	164	$123,828	$110,523
FF_AUG_W004_P1B_Opt2b	Mount Cotton ICS Zone	300	7	$5,239	$4,676

MUID	ICS Zone	Diameter (mm)	Length (m)	Establishment Costs ($)	Present Value ($)#
2013 Construction					
PIP_IC1	Heinemann Road ICS Zone	300	209	$218,174	$178,818
PIP_IC10	Heinemann Road ICS Zone	200	545	$360,726	$295,656
PIP_IC11	Heinemann Road ICS Zone	375	1 187	$752,412	$616,687
PIP_IC2	Heinemann Road ICS Zone	450	702	$1,239,713	$1,016,086
PIP_IC3	Heinemann Road ICS Zone	450	807	$1,423,569	$1,166,777
PIP_IC4	Heinemann Road ICS Zone	450	893	$1,575,754	$1,291,510
PIP_IC5	Heinemann Road ICS Zone	300	154	$117,182	$96,044
PIP_IC6	Heinemann Road ICS Zone	450	82	$143,929	$117,966
PIP_IC8	Heinemann Road ICS Zone	200	196	$76,641	$62,816
PIP_IC9_Opt4	Heinemann Road ICS Zone	200	977	$2,042,312	$1,673,907
2018 Construction					
FF_AUG_210_Con_Opt2	Mount Cotton ICS Zone	300	2	$1,790	$1,273
PIP_IC12	Mount Cotton ICS Zone	300	273	$130,000	$92,437
PIP_IC13	Mount Cotton ICS Zone	300	860	$409,335	$291,059
PIP_IC17	Mount Cotton ICS Zone	300	339	$161,181	$114,608
PIP_IC18	Mount Cotton ICS Zone	300	120	$57,019	$40,544
2025 Construction					
PIP_IC7	Heinemann Road ICS Zone	250	286	$180,796	$105,366
PIP_IC14	Mount Cotton ICS Zone	300	460	$219,214	$127,756
		Total	**10 905**	**$10,338,228**	**$8,386,099**

Note: # Includes Discounting and Escalation as per the Redland City Council discounting methodology.
** Already constructed*

Table 22.7 – Future Reservoir Costs

Name	ICS Zone	Size (ML)	Estimated Completion	Establishment Costs ($)	Present Value ($)#
Illawong Crescent No. 2	Dunwich ICS Zone	0.25	2008	$135,610	$128,118

Note: # Includes Discounting and Escalation as per the Redland City Council discounting methodology.

Table 22.8 – Future Valve Costs

Name	ICS Zone	Diameter (mm)	Estimated Completion	Establishment Costs ($)	Present Value ($)#
Ormiston PRV*	Alexandra Hills ICS Zone	200	2007	$51,315	$49,877
Boundary St PRV*	Heinemann Road ICS Zone	150	2007	$45,385	$44,113
Benfer Road PRV*	Heinemann Road ICS Zone	200	2008	$51,315	$48,480
Serpentine Ck New PRV*	Heinemann Road ICS Zone	200	2008	$51,315	$48,480
Victoria Pt PRV*	Heinemann Road ICS Zone	200	2008	$51,315	$48,480
Thornlands PRV*	Mt Cotton ICS Zone	100	2008	$41,477	$39,185
Tazi PRV	Dunwich ICS Zone	100	2010	$31,875	$28,450
Serpentine Ck West PRV	Heinemann Road ICS Zone	250	2013	$95,277	$78,090
			Total	**$419,273**	**$385,156**

Note: # Includes Discounting and Escalation as per the Redland City Council discounting methodology.
** Have already been constructed*

Table 22.9 –ICS Zone Costs

ICS Zone	Alexandra Hills	Amity Point	Dunwich	Heinemann Road	Mount Cotton	Point Lookout	SMBI	TOTAL
Pipes (Trunk)	$0	$0	$121,311	$7,005,254	$1,247,144	$181,646	$0	$8,555,355
Pump Stations	$0	$0	$0	$0	$0	$0	$0	$0
Reservoirs	$0	$0	$128,118	$0	$0	$0	$0	$128,118
Valves	$49,877	$0	$28,450	$267,643	$39,185	$0	$0	$385,156
Total	$49,877	$0	$277,879	$7,272,897	$1,286,329	$181,646	$0	$9,068,629

22.2.2 Augmentation Costs

The Augmentation Costs identified in this report are summarised in **Table 22.10**.

Table 22.10 – Future Augmentation Costs

MUID	DMA	ICS Zone	Diameter (mm)	Length (m)	Establishment Costs ($)	Present Value ($)#
2010 Construction						
PIP_AUG12	DMA202	Heinemann Road ICS Zone	100	113	$39,224	$35,009
PIP_AUG8	DMA204	Heinemann Road ICS Zone	150	80	$33,678	$30,059
PIP_AUG10	DMA205	Heinemann Road ICS Zone	200	286	$162,192	$144,765
PIP_AUG3	DMA205	Heinemann Road ICS Zone	150	229	$96,684	$86,296
PIP_AUG9	DMA205	Heinemann Road ICS Zone	200	80	$45,476	$40,589
2013 Construction						
PIP_AUG2	DMA107	Heinemann Road ICS Zone	150	94	$39,800	$32,620
PIP_AUG5	DMA107	Heinemann Road ICS Zone	200	484	$353,512	$289,743
Alternative-A	DMA210	Mount Cotton ICS Zone	150	297	$71,142	$58,309
PIP_AUG19	DMA210	Mount Cotton ICS Zone	150	219	$52,303	$42,868
PIP_AUG20	DMA210	Mount Cotton ICS Zone	150	116	$48,776	$39,978
PIP_AUG22	DMA210	Mount Cotton ICS Zone	150	73	$30,903	$25,329
PIP_AUG23	DMA210	Mount Cotton ICS Zone	150	53	$22,474	$18,420
2018 Construction						
PIP_AUG6	DMA107	Heinemann Road ICS Zone	200	459	$223,972	$159,256
PIP_AUG21	DMA210	Mount Cotton ICS Zone	150	212	$89,600	$63,710
			Total	**2 796**	**$1,309,734**	**$1,066,951**

Note: # Includes Discounting and Escalation as per the Redland City Council discounting methodology.

22.2.3 Reticulation Costs

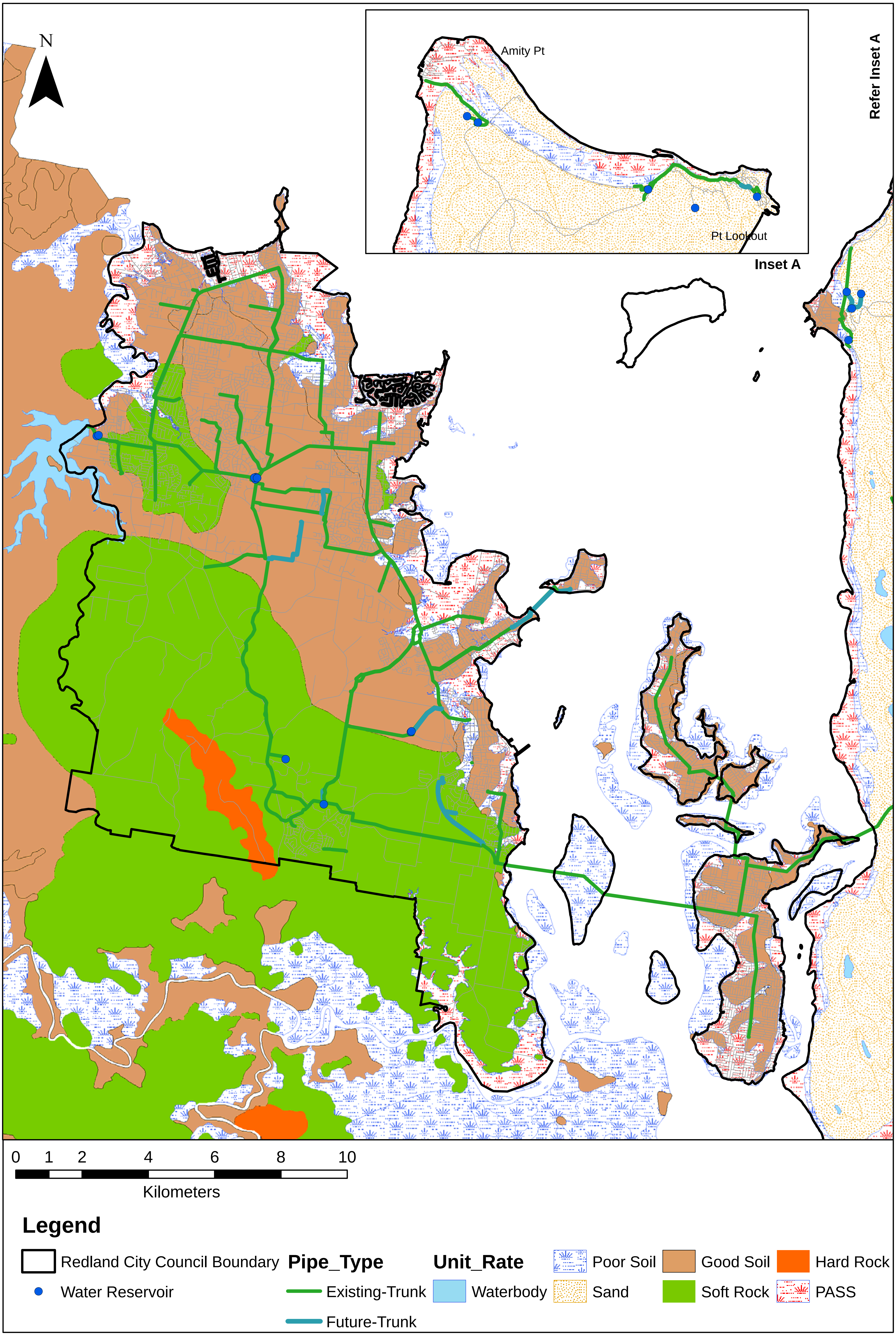
The reticulation that is needed in order to ensure the network meets the RW DSS are summarised in **Table 22.11**.

Table 22.11 – Future Reticulation Costs

MUID	DMA	ICS Zone	Diameter (mm)	Length (m)	Establishment Costs ($)	Present Value ($)#
2013 Construction						
12402	DMA208	Mount Cotton ICS Zone	150	224	$53,649	$43,971
12406	DMA208	Mount Cotton ICS Zone	150	187	$44,621	$36,572
12449	DMA208	Mount Cotton ICS Zone	150	436	$184,118	$150,906
1_4	DMA208	Mount Cotton ICS Zone	200	379	$123,391	$101,133
1_5	DMA208	Mount Cotton ICS Zone	200	296	$96,369	$78,986

MUID	DMA	ICS Zone	Diameter (mm)	Length (m)	Establishment Costs ($)	Present Value ($)#
2018 Construction						
9705	DMA107	Heinemann Road ICS Zone	150	151	$81,596	$58,019
			Total	**1 674**	**$583,745**	**$469,587**

Note: # Includes Discounting and Escalation as per the Redland City Council discounting methodology.



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Rev0 23 December 2009

FIGURE 22.1
Redland City Adopted Soils

23. Conclusions and Recommendations

23.1 Summary of Findings and Conclusions

There are a number of changes which have been detailed in **Section 21** which need to be made to the existing DMA configuration in order to meet the projected future demands for the city. These include splitting up some of the existing DMAs, pipe augmentations, reservoir augmentations, and the installation of additional valves including PRVs.

These works need to be staged from 2010 to 2025. The actual construction dates will need to be determined following detailed analysis of the actual demands in the network, with particular attention to be paid to the consumption patterns of the community on regional restrictions.

23.2 Recommendations

At the next available opportunity, the Redland Water component of the PIP / ICS be revised to include the trunk infrastructure proposed for each DMA.

That a detailed study of water quality in the Redland City Council distribution system be undertaken with a view to optimising the operation of the system, particularly the larger trunk mains originally intended for transfer of water that are no longer needed (as regularly) under the operations of the SEQ Water Grid.

The population projections are updated to more accurately reflect the current trend and the water model is updated to include these updated projections.

23.3 Further Work Required

A detailed review of the network requirements be undertaken for the remaining parts of the network, especially the Alexandra Hills LLZ and HLZ. Additional investigation will also need to be completed in the NSI communities of Amity Point and Point Lookout.

Integrated planning work will need to be undertaken with LinkWater to address the provision of supply to the Kinross Road LDA and the need for provision of an additional connection off the 750mm trunk main at Redland Bay (to feed the split Serpentine Creek Road DMA). LinkWater will also need to undertake a study detailing the intended operation of the Trunk Network System including the Mt Cotton and Alexandra Hills HLZ Reservoirs.

24. References

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Redland Water, *106 Serpentine Creek DMA Report, Rev 0*, April 2009.

Redland Water, 202 *Boundary Street DMA Report, Rev 0*, April 2009.

Redland Water, 203 *Benfer Road DMA Report, Rev 0*, April 2009.

Redland Water, 204 *Bunker Road South DMA Report, Rev 0*, August 2009

Redland Water, 205 *Victoria Point DMA Report, Rev 0*, April 2009

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John Wilson and Partners (JWP), *Redland Water Supply Scheme, Report on Water Supply Headworks contributions,* April 1990.

John Wilson and Partners (JWP), *Redland Water Supply, Augmentation Works to Year 2011, Planning Report Volume 1,* April 1997.

John Wilson and Partners (JWP), *Mt Cotton Village, Water Supply Master Plan, Final Report,* May 2005*.*

Appendix A DMA Names and Numbers

DMA Number	DMA Name
W004	Alexandra Hills LLZ
101	Russell Island East
102	Russell Island West
103	Karragarra Island
104	Lamb Island
105	Macleay Island
106	Serpentine Ck
108	NSI to Heinemann Rd Trunk
201	Heinemann Rd
202	Boundary St
203	Benfer Rd
204	Bunker Rd South
205	Victoria Point
206	Mt Cotton Village
207B	Mt Cotton Res HLZ
207A	Mt Cotton Booster Pump
208	Mt Cotton Trunk
209	Duncan Rd Booster Pump
210	Thornlands
211	Heinemann Rd Trunk
212	Mt Cotton Road
250	Heinemann Rd to Alexandra Hills Trunk
301	Howletts Rd
308	Alexandra Hills HLZ
401	Amity Pt
402	Dunwich
402A	Illawong Crescent HLZ
402B	Tazi Reservoir HLZ
403	Point Lookout LLZ
403B	Tramican St HLZ
403A	Booran St HLZ

Appendix B Pressure Loss through Modulated PRVs

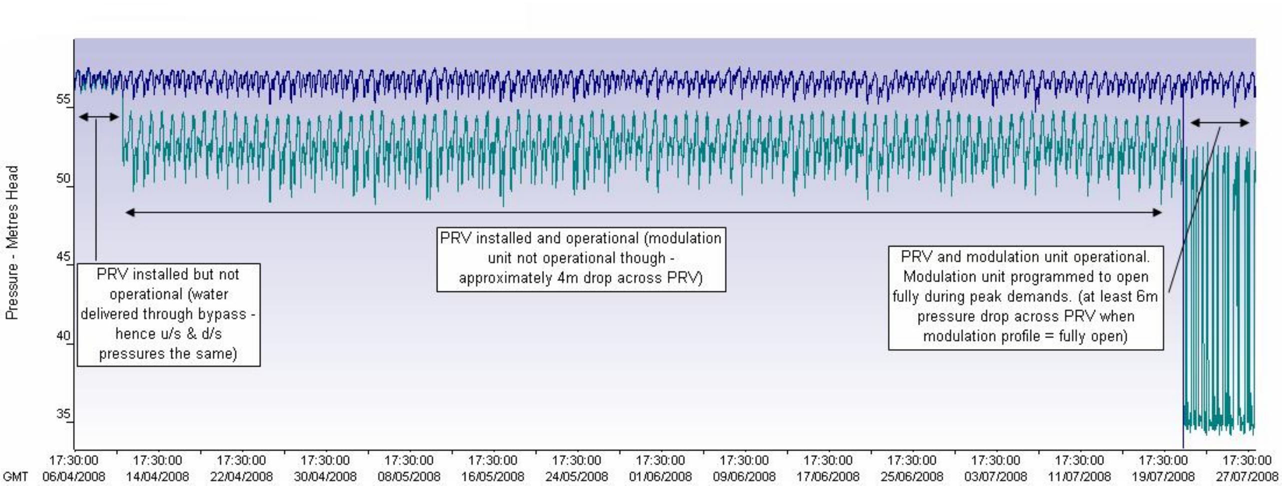
It is assumed that the DMAs and their associated PRVs recently installed as part of work completed under the legislated regional project will remain an integral part of the water supply network, particularly for leakage reduction, into the future.

One of the assumptions used in the preparation of this report is the amount of headloss experienced through the PRVs installed in the system.

Upon commissioning these PRVs it was noticed that a substantial pressure loss occurs through these valves. In analysing the DMAs controlled by PRVs in this report, we have allowed for a headloss through the PRV of 6m when it is fully open, i.e. usually when providing maximum flow and pressure for fire fighting conditions.

This headloss equates to that which the manufacturers recommend as a minimum drop across the PRV to ensure that the PRV and the associated modulation systems work adequately and is most easily demonstrated by the graph below from the Benfer Road DMA. This DMA is controlled by a modulated PRV which is programmed to "open fully" under peak flow conditions. **Figure B.1** shows the various stages of the installation of this PRV. The pressure losses similar to this have been seen at other PRVs throughout the network.

Figure B.24.1 – Benfer Road PRV Pressure Loss through valve



Appendix C Building Class Descriptions

Class 1
Single dwelling 1 level
Single dwelling 2-3 level
Duplex Townhouse 1- 2 levels
Shared Accommodation Units 1 -2 levels
Dormitory Accommodation 1-2 levels

Class 2
Apartments, 1-3 storeys
Apartments, 3 storeys, <25m
Apartments, 3 storeys + Carpark >40 cars, <25m
Apartments > 25m tall
Apartments > 50m tall

Class 3
Hotels and boarding houses, 1-2 storeys
Hotels and boarding houses, >2 storeys <25m
Hotels and boarding houses, >25m
Hotels >50m
Aged accommodation, 1-3 storeys

Class 4
Unit, Apartment part of a another class

Class 5
Offices, 1-2 storeys
Offices, >2 storeys; <25m
Offices > 25m
Offices > 50m

Class 6
Shops, 1-2 storeys <3500m2
Shops, >2 storeys no Mall >3500m2, sprinklered
Shops, <2 storeys or Internal Mall >3500m2, sprinklered
Shops, >25m

Class 7a
Carparks, >2 storeys, <40 cars
Carparks, >2 storeys, >40 cars
Carparks, >8 storeys, >40 cars, >25m
Carparks, <8 storeys, >40 cars Open Deck Class

Class 7b
Warehouses 1 storeys, Industrial <1000m3 racked
Warehouses 2-3 storeys, <5000m2 Type A/B Construction
Warehouses, 2-3 storeys, >5000m2 Type A/B Construction
Warehouses & Dangerous Goods <3 storeys

Class 8
Factories,<2 storeys, Industrial <2000m2 or 12000m3
Factories, 2-3 storeys, <2000m2 Type C or 5000m2 Type A/B
Factories, 2-3 storeys, >2000m2 Type C or 5000m2 Type A/B
Factories, >3 storeys, >2000m2 or 5000m2 Type A <25m
Factories & Dangerous Goods <3 storeys

Class 9a
Health care buildings, 1 storey, <1000m2 Institutional
Health care buildings, 2 storeys, <1,000m2
Health care buildings, >2 storeys or >1000m2
Health care buildings, >25m

Class 9b
Assembly buildings, 1 storey, <1000m2 Public assembly
Assembly buildings, 1 storey, <1000m2, Educational
Assembly buildings, 1 storey, >1000m2
Night Club buildings, 1 storey, >1000m2
Assembly buildings, 1-2 & schools 1-3 storeys, <1000m2
Assembly buildings, >3 storeys & Schools <25m
Assembly buildings, >8 storeys & Schools >25m

Appendix D DNRM Guideline Extract

Section 5.6.6 Minimum Fire Flow (p12)

The minimum fire flow provision will vary dependent on the type of development, and the capability of the community to resource fire protection. The following categories of development should be considered for the design fire flow:

- ***General Urban Category*** *– comprises areas served by an urban fire service. Minimum fire flows for this category are:*
  - *Residential buildings (3 storeys and below) – 15 L/s for 2 hour duration*
  - *High Density Residential buildings (greater than 3 storeys) – 30 L/s for 4 hour duration*
  - *Commercial / Industrial buildings – 30 L/s for 4 hour duration*

- ***Small Community Category*** *– comprises communities with a permanent population of less than 500 people, served by a rural fire service or equivalent. In these communities discussions with the local rural fire service are required to determine minimum fire flows. It is recommended that the following is considered:*
  - *Residential buildings (up to 2 storeys) – The agreed fire flow should not be below 7.5 L/s for a 2 hour duration.*
  - *Non-Residential buildings (up to 2 storeys) - The agreed flow rate should not be below 15 L/s for a 2 hour duration.*

Appendix E Landuse Codes and Adopted Fire Flow

Landuse No.	Description	Fire Flow Allocated Mainland	Fire Flow Allocated SMBI	Notes
25	1 DUPLEX & 1 DWELLING	15	7.5	
1	ABBATOIR	30	30	
120	Aboriginal Display Centre	Manual check	Manual check	
116	Access	15	7.5	
101	ACCESS RESTRICTION STRIP	15	7.5	
97	ADVERTISING SIGN	15	7.5	
177	AGED CARE HOSTEL	30	15	
138	Air Space	15	7.5	
112	Airstrip	30	15	
2	AMBULANCE	30	15	
8	AMENITIES BLOCK (RSC)	15	7.5	
141	Art Gallery	Manual check	Manual check	
95	ARTS COMPLEX	30	15	
152	AUTO WRECKERS	30	15	
3	BAKER	30	15	
4	BANK	30	15	
5	BARRACKS	30	15	
110	Beachfront	15	7.5	Non-rateable - below high water mark
150	BED AND BREAKFAST	15	7.5	Has a RES Property Use - usually a house
123	Bikeway	15	7.5	
6	BOARDING HOUSE	30	15	Boarding houses are Class 3
155	BOAT YARD	30	15	
160	BODY CORPORATE	30	15	Common Area of Body Corporate Complexes
113	Bus Interchange	30	15	
9	BUTCHER	30	15	Shop
11	CABIN (MULTI)	Manual check	Manual check	Has a RES Property Use
14	CAMPING GROUND	Manual check	Manual check	
106	CANAL	15	7.5	
161	CAR PARK (COMMERCIAL)	15	7.5	No multi story car parks in RSC
108	CAR PARK (INFRASTRUCTURE)	15	7.5	No multi story car parks in RSC
17	CAR SALES YARD	30	15	Commercial Use
16	CARAVAN PARK (COMMERCIAL)	Manual check	Manual check	
167	CARAVAN PARK (RSC)	Manual check	Manual check	
115	Cemetery	15	7.5	No infrastructure
18	CHEMIST	30	15	
23	CHILD CARE CENTRE (COM)	30	15	
105	CHURCH	30	15	Assembly building
19	CLUB (LICENCED)	30	15	
146	CLUB (RESTRICTED LICENCE)	30	15	
20	CLUB (UNLICENCED)	30	15	
21	CLUB (VARIOUS)	30	15	
22	COMMERCIAL/INDUSTRIAL	30	15	
132	Communications Tower	15	7.5	
24	COMPLEX (SHOPS/OFFICES)	30	15	
27	COUNCIL METER (PARKS)	15	7.5	
130	Council Water Meter	15	7.5	
26	COURT HOUSE	30	15	
28	DENTIST SURGERY	30	15	
162	DEPOT - BUS	30	15	Has a COM property use

Landuse No.	Description	Fire Flow Allocated Mainland	Fire Flow Allocated SMBI	Notes
31	DEPOT - FUEL	30	15	Has a COM property use
32	DEPOT - MILK	30	15	Has a COM property use
33	DEPOT - TRUCK	30	15	Has a COM property use
118	DEPOT (RSC)	30	15	Has a COM property use
34	DOCTOR SURGERY	30	15	
36	DOMESTIC GARAGE	15	7.5	
145	Drain	15	7.5	
35	DRY CLEANER	30	15	
40	DUPLEX	15	7.5	
37	DWELLING (1 UNIT)	15	7.5	
38	DWELLING (2 UNITS)	15	7.5	
100	DWELLING/MULTIPLE	30	15	
63	DWELLING/NURSERY	Manual check	Manual check	
41	DWELLING/OFFICE	30	15	
30	DWELLING/POULTRY FARM	Manual check	Manual check	
39	DWELLING/RELATIVES APARTMENT	Manual check	Manual check	
43	DWELLING/SHOP	30	15	
42	DWELLING/SHOPS	30	15	
68	DWELLING/VETERINARY SURGERY	30	15	
122	Equestrian Centre	15	7.5	
134	Extractive Industry	15	7.5	
94	FERRY TERMINAL	15	7.5	
170	FERRY TERMINAL (RSC)	15	7.5	
121	Fire Station	15	7.5	
44	FISH MARKET	30	15	
45	FLATS	15	7.5	Flats are usually no more than 2 storeys
159	FLOWER FARM	15	7.5	
158	FOOD MANUFACTURER	30	15	
125	Fuel Filling Station	30	15	
147	Golf Course	30	15	
48	GOVERNMENT (VARIOUS)	Manual check	Manual check	
50	GREENHOUSES/HORTICULTURE	15	7.5	
49	GUEST HOUSE (W/CABINS)	15	7.5	
157	GYMNASIUM	30	15	
173	HALL (CHURCH)	30	15	Assembly building
174	HALL (COMMERCIAL)	30	15	Assembly building
29	HALL (COMMUNITY)	30	15	Assembly building
143	Hard Landfill/Fill Storage Site	15	7.5	
114	Hardware	30	15	
169	HEALTH CLINIC (PRIVATE)	30	15	
139	Health Clinic (Public)	30	15	
126	Helipad	15	7.5	
52	HOME INDUSTRY	15	7.5	Industry from home - has a RES clasification
166	HOSPITAL (PRIVATE)	30	15	
53	HOSPITAL (PUBLIC)	30	15	
54	HOTEL	30	15	
149	KENNEL/CATTERY/DWELLING	15	7.5	Has a RES property use
117	Koala Sanctuary	15	7.5	
140	Lake	15	7.5	
135	Library	30	15	
142	MAJOR SHOPPING CENTRE	30	15	

Landuse No.	Description	Fire Flow Allocated Mainland	Fire Flow Allocated SMBI	Notes
168	MARINA (COMMERCIAL)	30	15	
12	MARINA (INFRASTRUCTURE)	30	15	
59	MEDICAL CENTRE	30	15	
58	MINI STORAGE UNITS	30	15	
62	MOTEL	30	15	
61	MOTOR MECHANICS/AUTO WORKSHOP	30	15	
129	Museum	30	15	
175	Nursery	15	7.5	
127	Nursing Home	30	15	
64	OFFICE/PROFESSIONAL	30	15	
99	ORGANIZATION/VARIOUS	30	15	
65	PANEL BEATING	30	15	
102	PARK	15	7.5	
103	PARK/AMENITIES BLOCK	15	7.5	
109	PIPELINE	15	7.5	
69	POLICE STATION	30	15	
82	PONTOON/JETTY (COMMERCIAL)	15	7.5	No real infrastructure?
92	PONTOON/JETTY (NON-COMMERCIAL)	15	7.5	No real infrastructure?
70	POST OFFICE (OFFICIAL)	30	15	
71	POST OFFICE (RESIDENCE)	15	7.5	Has a RES property use
13	POULTRY FARM	15	7.5	
153	PRINTER	30	15	
46	PUBLIC SHELTER	15	7.5	
15	PUMPING STATION (SEWERAGE)	15	7.5	
131	Reserve	15	7.5	
137	Resort Complex	30	15	
7	RESPITE CENTRE	30	15	
74	RESTAURANT	30	15	
128	Retirement - Single Unit	30	15	Have booster hydrants etc
60	RETIREMENT VILLAGE	30	15	
104	ROAD/ROAD RESERVE	15	7.5	
93	SALES/INFORMATION CENTRE	30	15	
75	SAWMILL	30	15	
111	School - Private	30	15	
78	SCHOOL-HANDICAPPED	30	15	
76	SCHOOL-HIGH	30	15	
79	SCHOOL-OPPORTUNITY	30	15	
80	SCHOOL-PRE/KINDERGARTEN	30	15	
81	SCHOOL-PRIMARY	30	15	
47	SERVICE STATION	30	15	
10	SEWERAGE FARM	15	7.5	
84	SHED	15	7.5	
136	Shed- Landscaping Supplies	15	7.5	
86	SHOP	30	15	
51	SHOWROOMS	30	15	
87	SKATING RINK	30	15	
89	SNACK BAR (TAKEAWAY)	30	15	
85	SPORTING COMPLEX	30	15	
148	SPORTSFIELD	15	7.5	Usually just the field with a stand or small building
90	STORE/WAREHOUSE	30	15	
91	SUBSTATION	15	7.5	

Landuse No.	Description	Fire Flow Allocated Mainland	Fire Flow Allocated SMBI	Notes
171	SWIMMING POOL (COMMERCIAL)	30	15	
72	SWIMMING POOL (PRIVATE)	30	15	
144	SWIMMING POOL (RSC)	30	15	
98	TENNIS COURT - PRIVATE	15	7.5	
119	Tennis Courts (COMMERCIAL)	15	7.5	
172	TENNIS COURTS (SCHOOL)	15	7.5	
66	THEATRE (DRIVE-IN)	30	15	
154	TIMBER YARD	30	15	
96	TOWN HOUSES	15	7.5	
124	Transfer Station/Landfill Site	15	7.5	
176	VACANT (SALES INFORMATION CENTRE)	15	7.5	
57	VACANT LAND	15	7.5	
67	VETERINARY SURGERY	30	15	
133	Walkway/Boardwalk	15	7.5	
73	WATER METER(COMMERCIAL)	15	7.5	
83	WATER METER(RESIDENTIAL)	15	7.5	
88	WATER RESERVOIR	15	7.5	
151	WINERY	15	7.5	
156	WORKSHOP LIGHT INDUSTRIAL	30	15	

Appendix F Planning Scheme Zones Adopted Fire Flows

Planning Scheme Zones

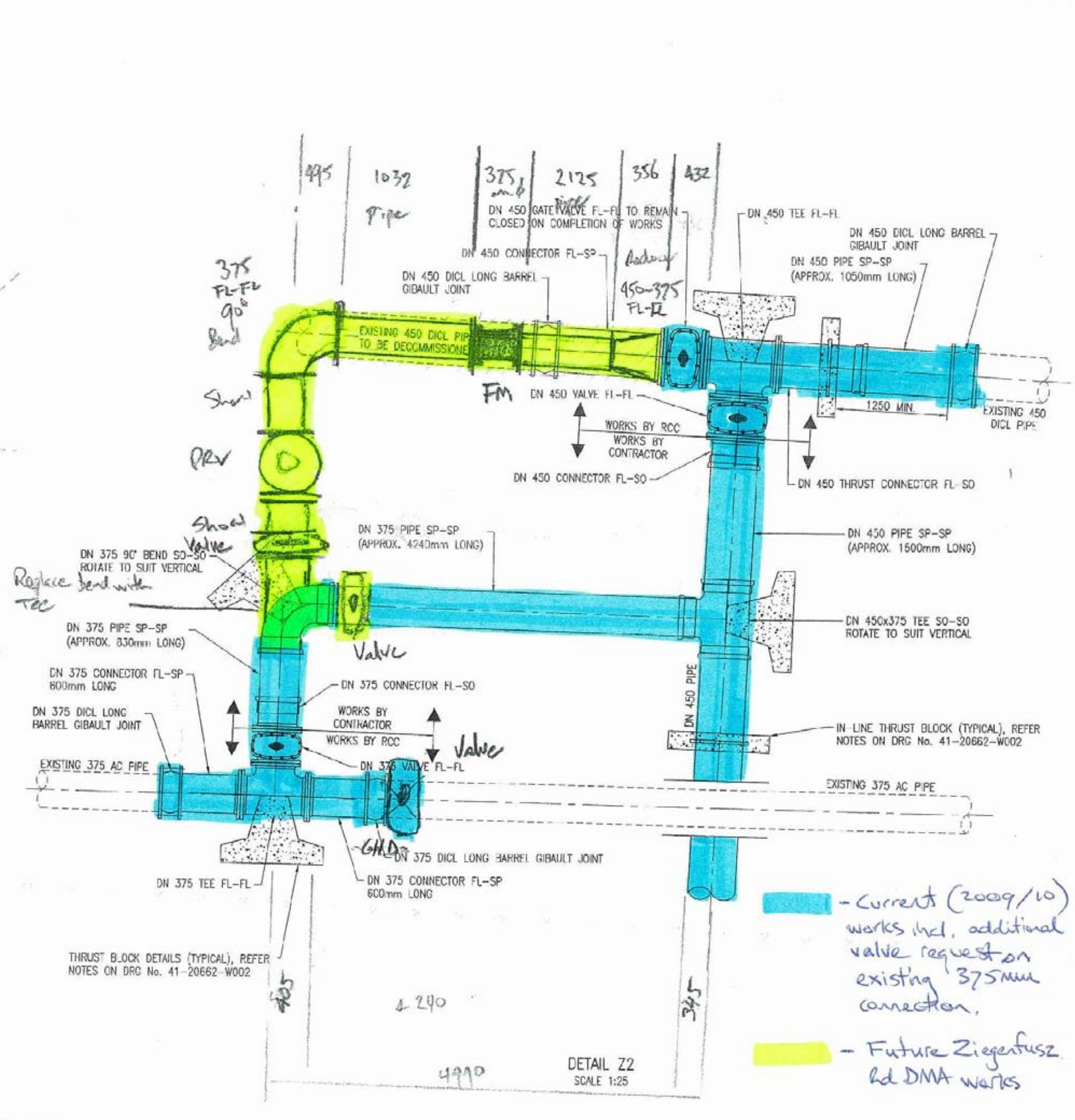
Zone Description	Adopted Fire Flow Mainland	Adopted Fire Flow SMBI
Residential		
Urban Residential	15	7.5
Medium Density Residential	15 30(1)	n/a
Low Density Residential	15	7.5
SMBI Residential	n/a	7.5
Point Lookout Residential	n/a	7.5
Centre		
Major Centre	30	15
District Centre	30	15
Neighbourhood Centre	30	15
Local Centre	30	15
SMBI Centre	n/a	15
Point Lookout Centre	30	15
Point Lookout Tourist	30	15
Industry		
Commercial Industry	30	15
General Industry	30	15
Island Industry	30	15
Marine Activity	30 15(2)	15
Conservation		
Park Residential	15	7.5
Environmental Protection	15	7.5
Conservation	15	7.5
Other		
Community Purposes	Sub-Zone Table Below	Sub-Zone Table Below

Note: (1) Where the sub-zone building height is over 3 meters as identified in *Table 2 – part 4 – zones, Division 14 – Medium Density Residential zone – P31* of the Planning Scheme 30L/s has been adopted.
(2) For low risk areas such as car parks a flow of 15L/s has been adopted.

Planning Scheme Community Purpose Sub-Zones

Zone Sub-Areas	Adopted Fire Flow Mainland	Adopted Fire Flow SMBI
Cemetry	15	7.5
Community Facility	30	15
Education Facility	30	15
Emergency Services	30	15
Hospital	30	15
Place of Worship	30	15
Infrastructure	15	7.5
Future Transport/Greenspace/Trail Corridor	15	7.5
Future land Sale/Exchange Investigation Area	15	7.5
Future land Sale/Exchange Investigation Area - Russell Island South	15	7.5
Commonwealth Facilities - Radio Receivers	15	7.5
Future Integrated Transport and Marine Facilities	30	15

Appendix G Detail (Crn Ziegenfusz and Redland Bay Rds)



Appendix H Amity Point Water Supply Report

Redland
WATER

Amity Point Water Supply Augmentation Works

Rev 1

October 2009

Table of Contents

1 Introduction

1.1 Background

Minimum Standard of Service Reticulation Pressures

In 2005 Montgomery Watson Harza prepared a network analysis for the Redland City Council water supply distribution system (MWH, June 2006, *Redland Water and Waste Final Report, Redland ICS – Water Supply System Planning Study)*. The MWH report identified no augmentation requirements for the Amity Point township water supply.

Fire Fighting Pressures

Opus International Consultants (May, 2008) undertook a fire flow analysis for the Amity Point township, *Redland Waste and Water, Fire Flow Analysis, Amity DMA (401).* That analysis recommended that a number of augmentations be undertaken within the town reticulation system to resolve fire flow demands.

1.2 Purpose of Report

The purpose of this report is to review the augmentation proposals in the two reports outlined above for the Amity Point town water supply, and to determine a schedule of works to be included in Council's Priority Infrastructure Plan (PIP).

2 Amity Point Water Supply Reticulation Area

The majority of township covers a relatively level area fronting the Amity Point western shoreline. A smaller separate portion of the township fronts the eastern shoreline.

The township is supplied from bores, a water treatment plant and high and low level reservoirs. These are located approximately 1.5 kilometres inland. **Figure 2-1** shows the locations of this reservoirs and the existing reticulation system layout. The dark blue lines indicate 150 mm diameter reticulation mains. The light blue lines indicate 100 mm diameter mains.

Figure 2-1 Existing Amity Point Township Water Supply System

3 Investigation Design Criteria

3.1 Average Day Demands

While the Redland City Council area has not been subject to the same water restrictions as elsewhere in SEQ with respect to the recent drought, **Figure 3-1** nevertheless illustrates the reductions in demand (average day calculated over preceding 12 months) that has been experienced within the Amity Point supply system over the last five years.

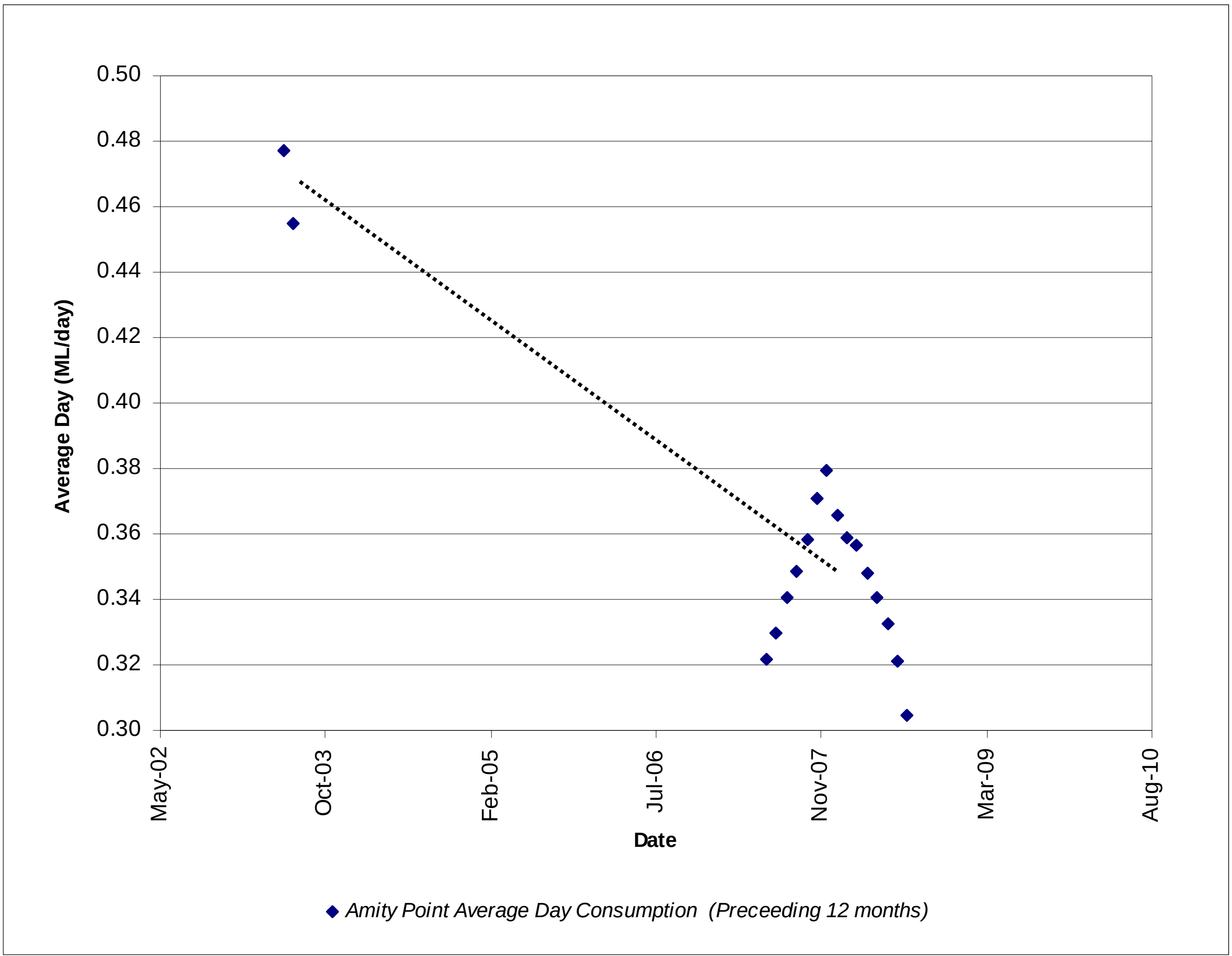


Figure 3-1 Amity Point Average Day Consumption

Figure 3-1 implies that the average day demand has reduced from around 0.47 ML/d in 2002/03 to 0.35 ML/d in 2007/08. Assuming a population of 1,000 equivalent persons (e.p.) in 2002/03 and 1,050 e.p. in 2007/08 (MWH, June 2006, *Redland Water and Waste Final Report, Redland ICS – Water Supply System Planning Study* report advises the 2006 population of Amity Point was 1,044 e.p.), the per capita consumption has fallen from 470 L/c/d in 2002/03 to 330 L/c/d in 2007/08.

The *South East Queensland Water Strategy,* prepared by the Queensland Water Commission (QWC), proposes that future residential water consumption rates will be targeted at 230 L/c/d. For this report, the current demand values of approximately 330 L/c/d have been adopted for the present day demand modelling. The QWC target value of 230 L/c/d has been adopted for the ultimate (2025) modelling assessments. MWH, 2006, have projected the 2025 population for Amity Point to 1,362 e.p. The associated average day demand is 0.31 ML/d.

3.2 Maximum Day Peaking Factors

The available data records (July 2002 to July 2003, and July 2006 to March 2009) show that November to January is generally the peak demand period for Amity Point. Annual maximum metered consumptions for that data period are summarised as follows:

- 21.1 2002 (September)
- 21.6 2003 (January)
- 16.2 2007 (November)
- 9.9 2008 (December)

Peaking factors generally increase as the serviced population decreases. **Figure 3-2** is a plot of Maximum Day (MD) factors for South East Queensland water supplies for 2005, the period which most closely matches a 230 L/c/d demand scenario. Also plotted is the Redland total mainland MD value and the recommended WSAA (*WSA 03-2002-2.3*) values for communities where demand data is not available (1.5 for populations over 10,000 and 2 for populations between 2,000 and 10,000).

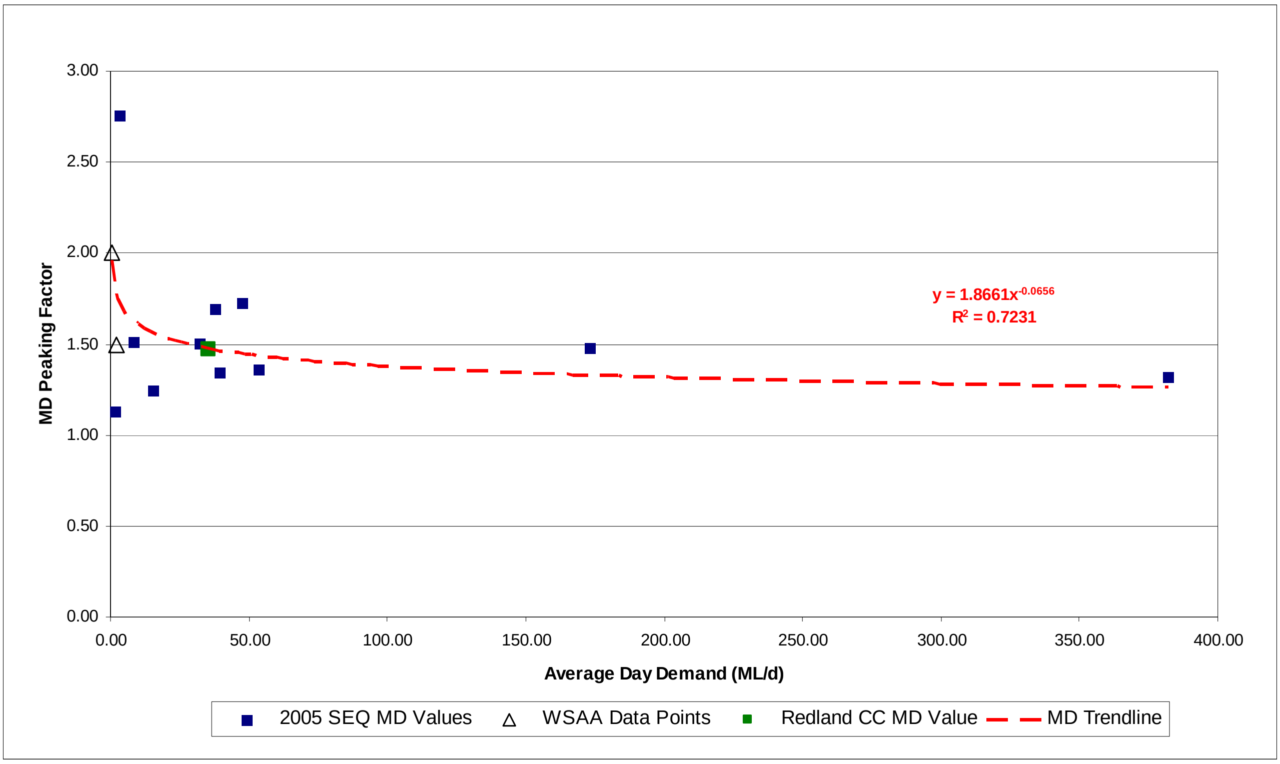


Figure 3-2 Redland City Sub-areas Maximum Day Peaking Factors

Using the trend line relationship in Figure 3-2, the following MD peaking factors have been calculated for this investigation:

- Current (AD demand = 0.35 ML/d) 2.00
- Ultimate (AD demand = 0.31 ML/d) 2.02

3.3 Mean Day Maximum Month Peaking Factors

Mean Day Maximum Month (MDMM) peaking factors for mainland Redland City have fallen since 2002/03 in response to the SEQ drought restrictions. Those values are listed below. There is only limited data available to determine the MDMM peaking factors for Amity Point but three available data points are listed, in brackets, along side the mainland factors:

- 2002/03 1.39 (1.53 based on 2 months of data)
- 2003/04 1.22
- 2004/05 1.28
- 2005/06 1.12
- 2006/07 1.13 (1.55 based on 1 month of data)
- 2007/08 1.08 (1.62 based on 12 months of data)

While the MDMM values shown in brackets would appear to show a consistency, it is noted that from Figure 3-1 that the Average Day demand values at Amity Point have been very variable. A MDMM peaking factor of 1.6 has therefore been adopted for Amity Point but this value could markedly change in the future when water demands stabilise.

3.4 Fire Fighting Demands

The 2007 NDRW guidelines require that the following minimum fire flows are able to be supplied:

- Residential buildings (3 storeys and below) 15 L/s for 2 hour duration
- Commercial / Industrial buildings 30 L/s for 4 hour duration

For a community of less than 2,000 people (Amity Point is projected to achieve an equivalent population of 1,671 by 2025), these flows are to be available in conjunction with a system demand equivalent to 2/3 of maximum hour while retaining a residual pressure of at least 12 metres. **Figures 3-3** show the 2025 designated commercial areas at Amity Point. Those areas have been based on Council land use records and Council's current town planning scheme.

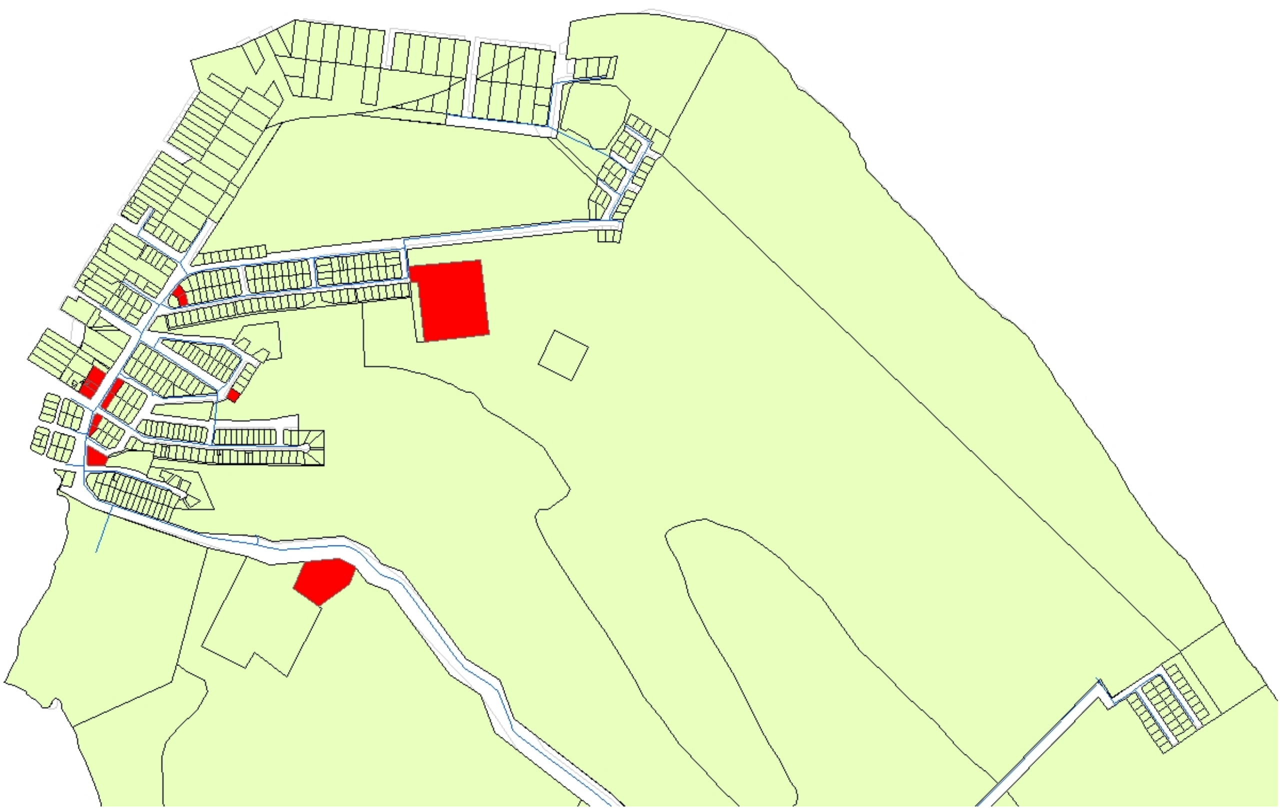


Figure 3-3 Year 2025 Designated Amity Point Township Commercial Areas

3.5 Distribution of Demands

MWH, 2006, advises that the current (2006) and ultimate (2025) water supply demands for Amity Point are as follows:

- 2006 1,001 persons, 1,044 equivalent persons (EP)
- 2025 1,169 persons, 1,362 EP

The differences in residential (persons) and EP demands were distributed to the commercial and industrial areas in the township. The domestic demands were distributed to the residential areas and caravan parks. A residential occupancy of 2.6 persons per household was adopted for 2006, and 2.8 persons per household for 2025.

3.6 Non Revenue Demands

The report, *Redland Water, March 2009, 401 – Amity Point DMA, Pressure and Leakage Management Project*, identified a leakage rate of 291 L/connection per day between September and November, 2009. That rate equates to a non revenue demand of 33.5%.

A non revenue demand equivalent to 8% of the total average day demand was distributed across the system for the ultimate (2025) scenario. This is in line with the desired standards of service set out in MWH, 2006.

4 System Modelling

4.1 Modelling Methodology

A stand alone EPANET network model was prepared for the existing Amity Point Township area. This model was prepared by "cutting down" the total Redlands City mainland model to just cover the Amity Point Township. This allowed trial runs to be quickly completed. The model was run for both the existing and the ultimate development scenarios using the MD peaking factors outlined in Section 3.2.

A 15 L/s fire flow was progressively located throughout the distribution system to identify any area not complying with the residential fire fighting requirements. Similarly, a 30 L/s fire fighting demand was located to the commercial demand areas shown on Figure 3-3 to identify any non complying commercial areas.

4.2 Initial Modelling Results and Proposed Augmentations

The intent of the modelling was to demonstrate that system pressures between 22 m (minimum) and 60 metres (maximum) could be achieved through the system under maximum day conditions, and greater than 12 m head could be achieved under fire fighting conditions (in conjunction with two thirds maximum day conditions. The modelling found that extensive augmentations would be needed to ensure that fire fighting demands could be met in conjunction with the minimum pressure requirements. These results were consistent with previous modelling undertaken by Opus Internal Consultants (Opus, May 2008). Opus recommended that a large part (near 3,500 metres) of the town reticulation system should be duplicated with new 200 mm diameter mains (refer **Figure 4-1**).

Alternative augmentation options were investigated as part of this report. **Figure 4-1** (source: Google Earth) shows one option (shown in red lines) which would require significantly less pipeline than the Opus proposals but would require laying pipelines through native vegetation areas, albeit along existing tracks. The least costly option developed was for the provision of a fire reserve storage and fire fighting booster pump to be located at the eastern of Gonzales Street (shown in blue lines).

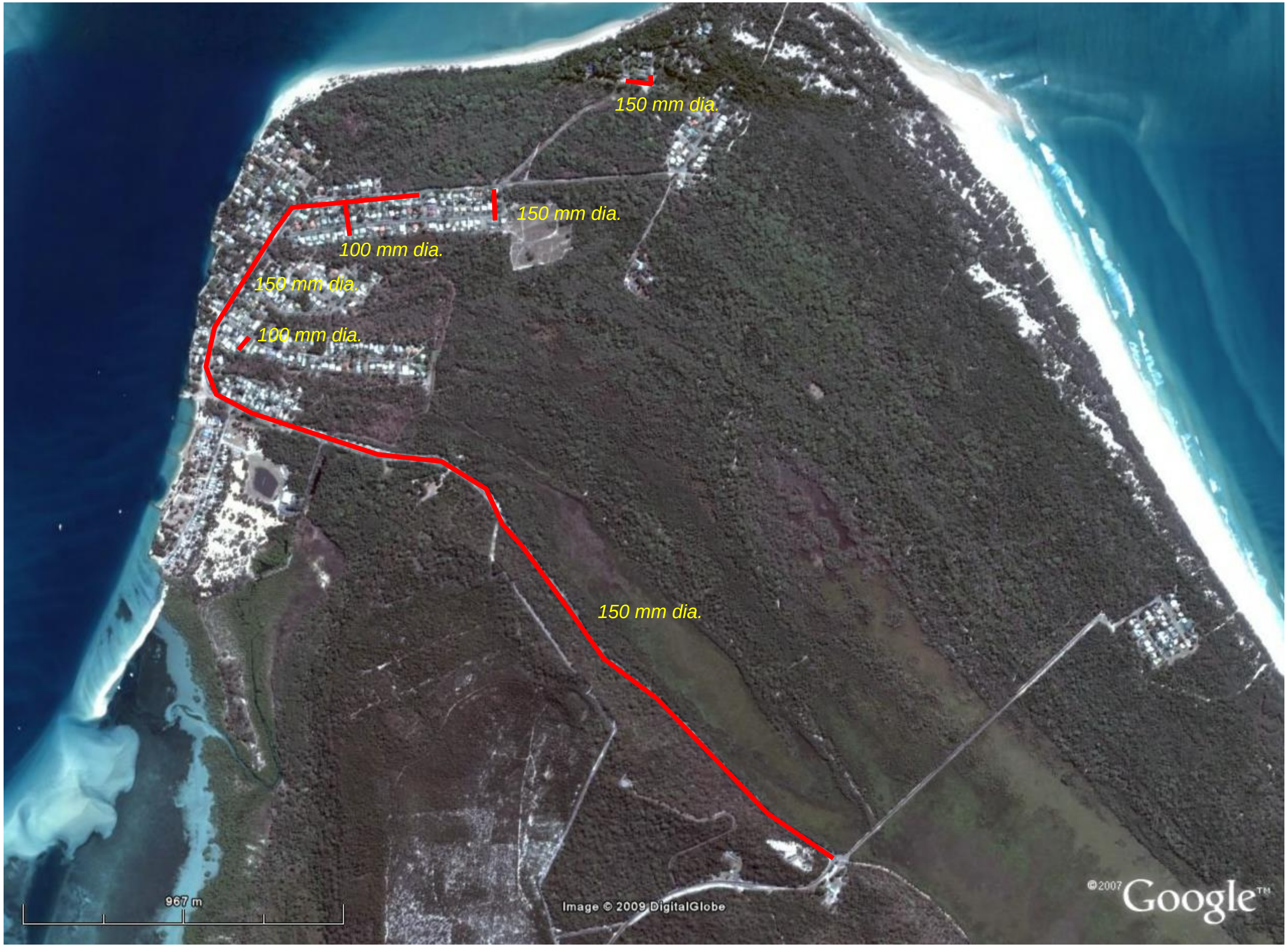


Figure 4-1 **Opus Augmentation Proposal for Amity Point Reticulation System**

Figure 4-2 **Alternative Augmentation Proposals for Amity Point Reticulation System**

4.3 Calibration of Network Model

The State Government has initiated the South East Queensland Regional Pressure & Leakage Management Project under the Water Act 2000 (Water Amendment Regulation (No. 6) 2006). Under this Act it is mandatory for local governments in SEQ to undertake pressure and leakage management to reduce real loss demands on limited water supplies. In the Amity Point area Redland Water established a District Meter Area to allow monitoring of leakage levels and effective targeting of leakage activities. This monitoring required the installation of pressure loggers within the town reticulation area.

A comparison of recorded pressures at the loggers against those derived from Redland water's network model showed that using "typical" Hazen Williams roughness coefficient C factors of 100 for 150 mm mains, and 110 for 200 mm mains, the model shows a significant drop in pressures during peak times when compared to the actual logger data. It was found that if the C factor was increased to about 140 for the trunk mains from the water treatment plant reservoir to the township, the model results were much more like the logger data. (Reference is made to Redland Water, March 2009, *401 – Amity Point DMA, Pressure and Leakage Management Project*.).

However, such C values are well outside the range normally adopted in Queensland. The Water Resources Commission, October 1989, *Guidelines for Planning and Design of Water Supply Schemes*, states, *If the Hazen Williams formula is used for reticulation analysis, then it is recommended that a C value of 100 be used in head loss estimation for pipes up to 150mm diameter, 110 for pipes between 225 and 300mm diameter and 120 for pipes larger than 300mm diameter. These values will take into account losses for fittings such as bends, valves, tees, crosses etc and the effect of ageing.* It is noted that these values have been associated with calibrated water supply schemes in many South east Queensland areas and including the Redland Water mainland areas.

To resolve this apparent disparity, a review of the results obtained in the leakage investigations was therefore undertaken on 6 August 2009 using a flow calibrated hydrant in conjunction with two system pressure loggers. **Figure 4-3** shows the locations of the hydrant and pressure loggers. **Figure 4-4** shows the pressure logger results. The network model prepared using the 2006 Average Day demands outlined in this report was calibrated against these logger and flow values. It was found that a Hazen Williams roughness C value of 150 needed to be adopted for the town trunk mains to achieve matching results in the model.

Table 4-1 summarises the measured data and modelled results.

Table 4-1 Summary of Calibration Investigations

	Logger 15533 *(Metres Pressure)*	**Logger 13966** *(Metres Pressure)*
Logged pressure at 9:30 am	66.0	65.9
Modelled pressure at 9:30 am	66.6	66.4
Logged pressure at 9:45 am	46.7	41.4
Modelled pressure at 9:45 am	46.8	40.8

Figure 4-3 Hydrant Flow Test Locations

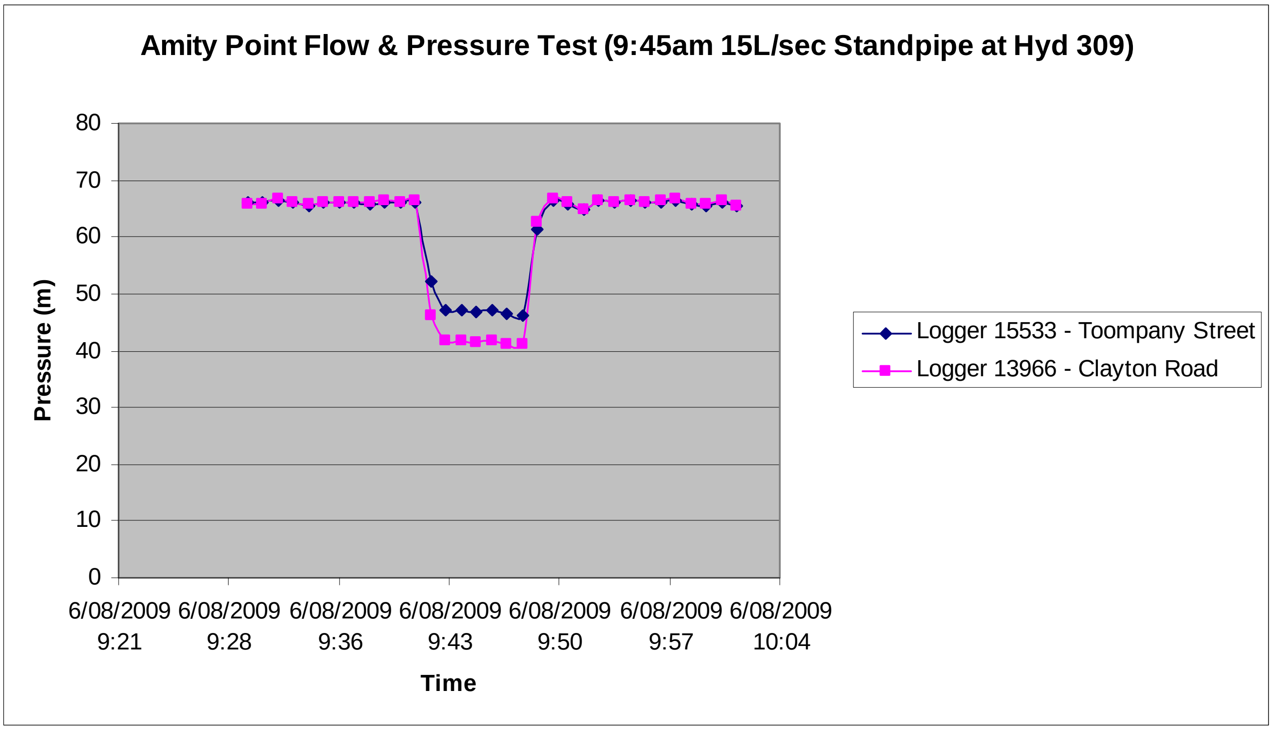


Figure 4-4 Pressure Logger Records

4.4 Revised Modelling Results and Proposed Augmentations

The model was amended to include a Hazen Williams roughness C value of 150 for all pipework and it was found that that the level of augmentation required was markedly reduced from that shown in Figures 4-1 and 4-2.

A number of pipe network augmentation options were investigated. As for the initial modelling, the least costly option developed was for the provision of a fire reserve storage and fire fighting booster pump to be located at the eastern of Gonzales Street. This option includes:

- A fire reserve storage;
- Fire booster pump with back-up generator set;
- A storage re-chlorination system; and
- A recirculation pump.

The advantage of this system is its relatively low capital cost (estimated to be in the order of $400,000) and its capability of meeting both residential and commercial fire fighting demands. However, there would be an associated requirement to maintain a system of chlorination, pumping and diesel generation equipment which might never be needed. The system is also limited by the storage volume provided.

The augmentations shown on **Figure 4-5** are believed to provide a more functional arrangement for the operation of the Amity Point water supply. Those augmentations, once constructed, require no operator interaction other than normal reticulation maintenance.

The Figure 4-5 augmentations have been separated into two stages:

a. Augmentations (shown as a red line) required to meet the residential fire fighting requirements; and

b. Additional augmentations required to meet commercial fire fighting demands (shown as blue lines).

It is proposed that the residential requirements should be implemented as soon as practical. However, it is proposed to defer the additional augmentations to meet the commercial fire fighting requirements. This will allow for:

- Reassessment of whether those areas shown on Figure 3-3 actually require a commercial fire fighting level of service. (Most, if not all, of the properties nominated are single story structures or have not yet been developed); and
- Further calibration of the hydraulics of the reticulation system. It is proposed that an electro-magnetic flow meter be installed in a pit with continuous logging facilities. This, in conjunction with pressure loggers in the reticulation system will allow for a better understanding of the unusually high roughness coefficient values. The flowmeter would be located at the site for *Logger 13966* as shown on Figure 4-3.
- It is proposed that a 12 month monitoring period be undertaken to assess flows and pressures associated with both holiday and normal demand conditions.

  The flow meter pit would be designed to be re-fitted with a pressure reduction valve at the end of the flow monitoring period.

A further report will be brought forward in twelve months.

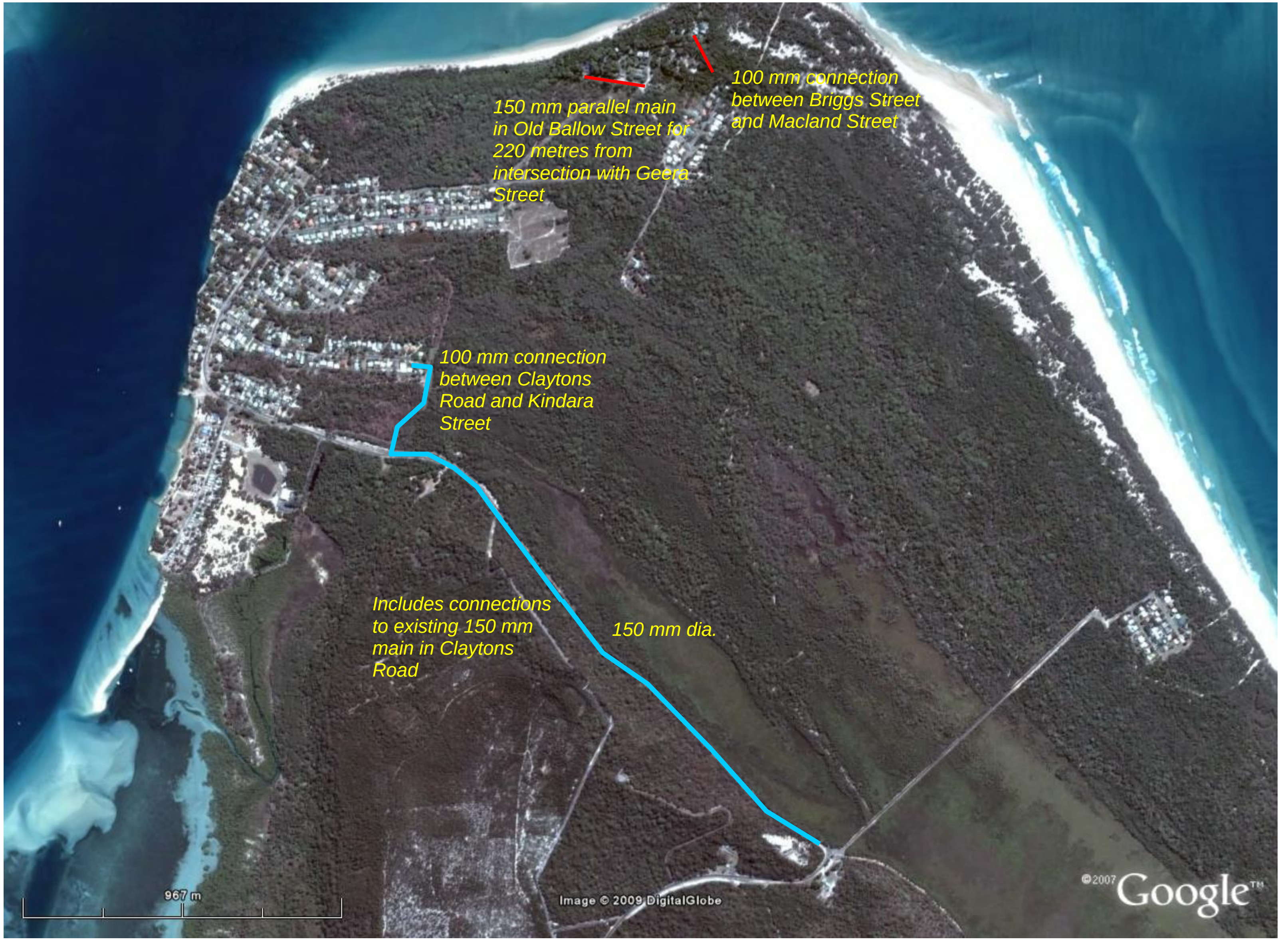


Figure 4-5 Augmentation Proposals for Amity Point Reticulation System Based on C = 150

4.5 Cost Estimates

The estimated costs of undertaking the initial (red line) augmentation works shown on Figure 4-5 follow:

1.	Construct parallel 150 mm Class 12 OPVC main, 220 metres long in Old Ballow Street. Estimated cost:	$72,000
2.	Construct 150 metres long, 100 mm Class 12 OPVC, connection between ends of Briggs Street and Macland Streets. Estimated cost:	$30,000
3.	Construct flowmeter pit in Claytons Road including power supply and data logging station. Estimated cost:	$30,000
	Sub-total	$132,000
	Contingency 20%	$26,400
	Total estimated cost:	**$158,400**

5 Summary and Recommendations

Previous fire fighting investigations for the Amity Point reticulation system have recommended that extensive augmentation works are required. Recent calibration data indicates that the system has an unusually low roughness (high C values). Modelling based on those revised values has found that markedly less augmentation is required.

However, much of the augmentation requirement is being driven by the need to meet commercial fire fighting demands. This report suggests that the need for providing for commercial fire fighting at Amity Point is probably unfounded.

It is recommended that:

- The residential area fire fighting augmentations be implemented as soon as practical;
- A review be undertaken of the nature of those properties in the township which have been assessed as being “commercial”;
- Further investigation be undertaken into the township reticulation hydraulics; and
- A further report will be brought forward in twelve months.

6 References

- Opus International Consultants, May 2008, *Redland Waste and Water, Fire Flow Analysis, Amity DMA (401).*
- MWH, June 2006, *Redland Water and Waste Final Report, Redland ICS – Water Supply System Planning Study*.
- Redland Waste and Water, February 2007, *Water Supply Planning Report*.
- Redland Water, March 2009, *401 – Amity Point DMA, Pressure and Leakage Management Project*.
- Water Resources Commission, October 1989, *Guidelines for Planning and Design of Water Supply Schemes*

Appendix I Dunwich Water Supply Report

Redland
WATER

Dunwich Water Supply Augmentation Works

Final

July 2009

Table of Contents

1 Introduction

1.1 Background

Minimum Standard of Service Reticulation Pressures

In 2005 Montgomery Watson Harza prepared a network analysis for the Redland City Council water supply distribution system (MWH, June 2006, *Redland Water and Waste Final Report, Redland ICS – Water Supply System Planning Study)*. The MWH report identified for the Dunwich township water supply that a number of properties in the high areas of the Tazi water supply zone do not receive Council's minimum standard of service of 22m pressure. The report recommended that the Tazi Reservoir and Illawong Crescent Reservoir zones be combined to form a single water supply zone off the Illawong Crescent reservoir.

In February 2008, Redland Water and Waste (RWW) prepared a report, *Dunwich - Rainbow and Illawong Crescent Water Supply System Planning Report*. That report reviewed a number of options for resolving the inadequate standard of service pressures in the Tazi and Illawong reservoir supply zones. The recommended option was that the Tazi reservoir is discontinued and a new reservoir be constructed at the Illawong reservoir site to service the whole of the existing Tazi and Illawong reservoirs supply zone. It was further recommended that a new rising main should be constructed from the Rainbow Crescent pump station to the new Illawong reservoir. Pressure reduction valves were to be provided to control pressures in the lower areas currently supplied from the Tazi reservoir. Since the preparation of that report, a 150 mm pipeline has been constructed between the two reservoirs. That pipeline has not yet been activated.

Fire Fighting Pressures

Opus International Consultants (May, 2008) undertook a fire flow analysis for the Dunwich township, *Redland Water and Waste, Fire Flow Analysis, Dunwich DMA (402).* That analysis recommended that a number of augmentations be undertaken within the town reticulation system to resolve fire flow demands.

1.2 Purpose of Report

The purpose of this report is to review the augmentation proposals in the two reports outlined above for the Dunwich town water supply, and to determine a schedule of works to be included in Council's Priority Infrastructure Plan (PIP).

2 Dunwich Water Supply Reticulation Area

The majority of the Dunwich Township covers a relatively level area fronting the shoreline. That area is supplied with water from the Rainbow Crescent reservoir. A smaller portion of the township is elevated and is supplied from the Tazi and Illawong reservoirs.

Figure 2-1 shows the locations of these reservoirs and the existing reticulation system layout. The dark blue lines indicate 150 mm diameter reticulation mains. The light blue lines indicate 100 mm diameter mains.

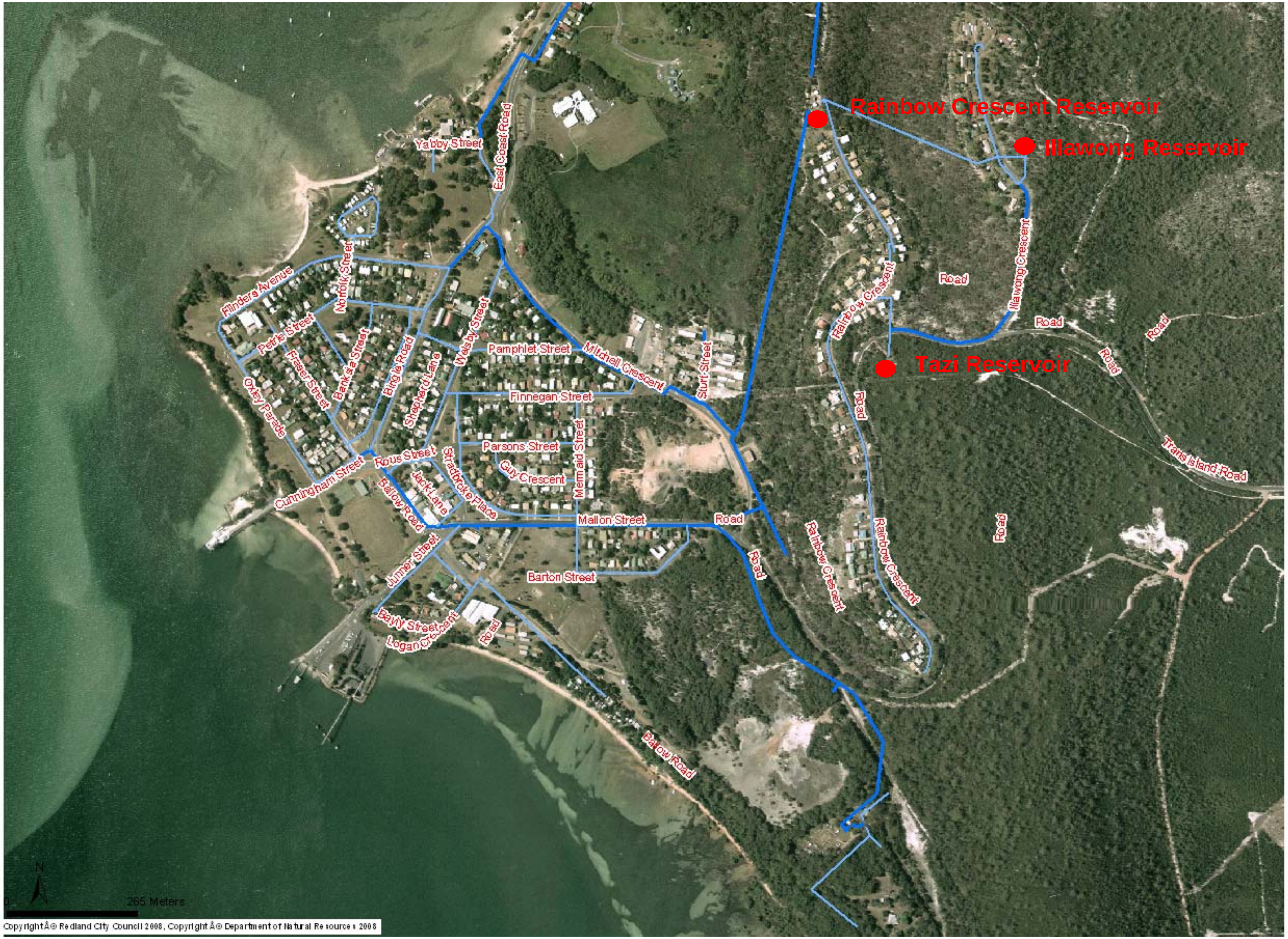


Figure 2-1 **Existing Dunwich Township Water Supply System**

3 Investigation Design Criteria

3.1 Water Supply Demands

The Dunwich town population is predicted to increase from 1,395 in 2006 to 2,035 in 2025 (Redland Water and Waste, February 2007, *Water Supply Planning Report*). Metered consumptions for the whole Dunwich Township for the months of September and October 2008 were respectively 13 and 14 ML (Source: *QWC*). These values equate to daily and per capita consumptions of approximately 0.44 ML/d and 320 L/c/d. (These values include system losses). While the Redland City Council area has not been subject to the same water restrictions as elsewhere in SEQ with respect to the recent drought, **Figure 3-1** nevertheless illustrates the reduction in demand that has been experienced within the Dunwich supply system over the last five years.

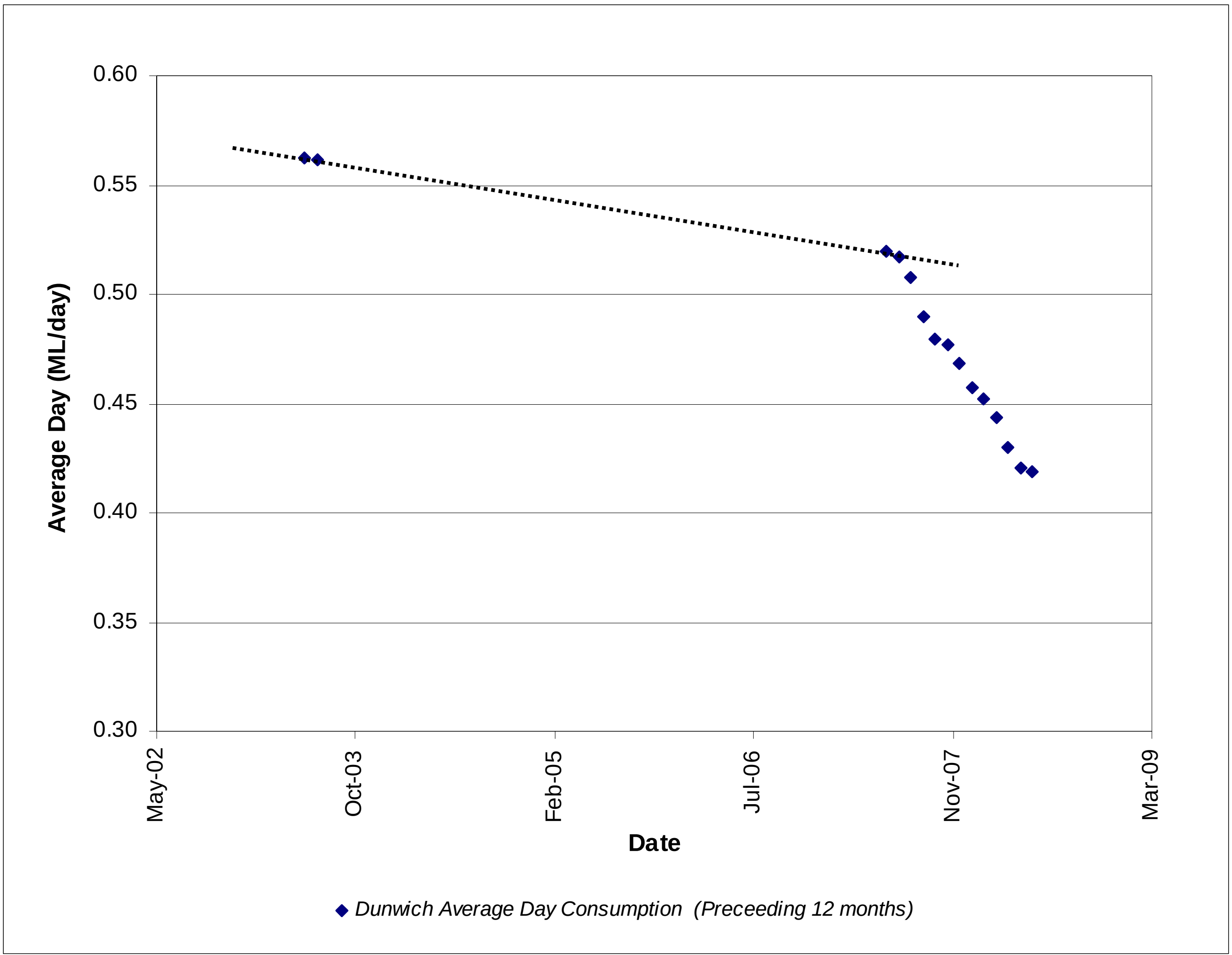


Figure 3-1 Dunwich Average Day Consumption

The *South East Queensland Water Strategy,* prepared by the Queensland Water Commission (QWC), proposes that future residential water consumption rates will be targeted at 230 L/c/d. For this report, the current demand values of approximately 320 L/c/d have been adopted for the present day demand modelling. The QWC target value of 230 L/c/d has been adopted for the long term modelling assessments.

3.2 Mean Day Maximum Month Peaking Factors

Mean Day Maximum Month (MDMM) peaking factors for mainland Redland City have fallen since 2002/03 in response to the SEQ drought restrictions. Those values are listed below. There is only limited data available to determine the MDMM peaking factors for Dunwich (June 2003 – July 2003 and June 2007 – February 2009). The single peaking factor determined from the available data is listed, in brackets, along side the mainland factors. It is noted that the 2008/09 MDMM factor value for Dunwich based on 8 months of data is 1.31.

- 2002/03 1.39
- 2003/04 1.22
- 2004/05 1.28
- 2005/06 1.12
- 2006/07 1.13
- 2007/08 1.08 (1.33)

MDMM peaking factors tend to increase as the serviced population decreases. The second half of 2005 has been found to generally correspond with a 230 Litre per person per day residential water consumption in SEQ. The corresponding Redland mainland and Dunwich MDMM values respectively appear to be near 1.25 and (possibly) 1.45. A conservative MDMM peaking factor of 1.5 has therefore been adopted for Dunwich.

3.3 Maximum Day Peaking Factors

Figure 3-2 is a plot of Maximum Day (MD) factors for South East Queensland water supplies for 2005, the period which most closely matches a 230 L/c/d demand scenario. Also plotted is the Redland total mainland MD value and the recommended WSAA (*WSA 03-2002-2.3*) values for communities where demand data is not available (1.5 for populations over 10,000 and 2 for populations between 2,000 and 10,000).

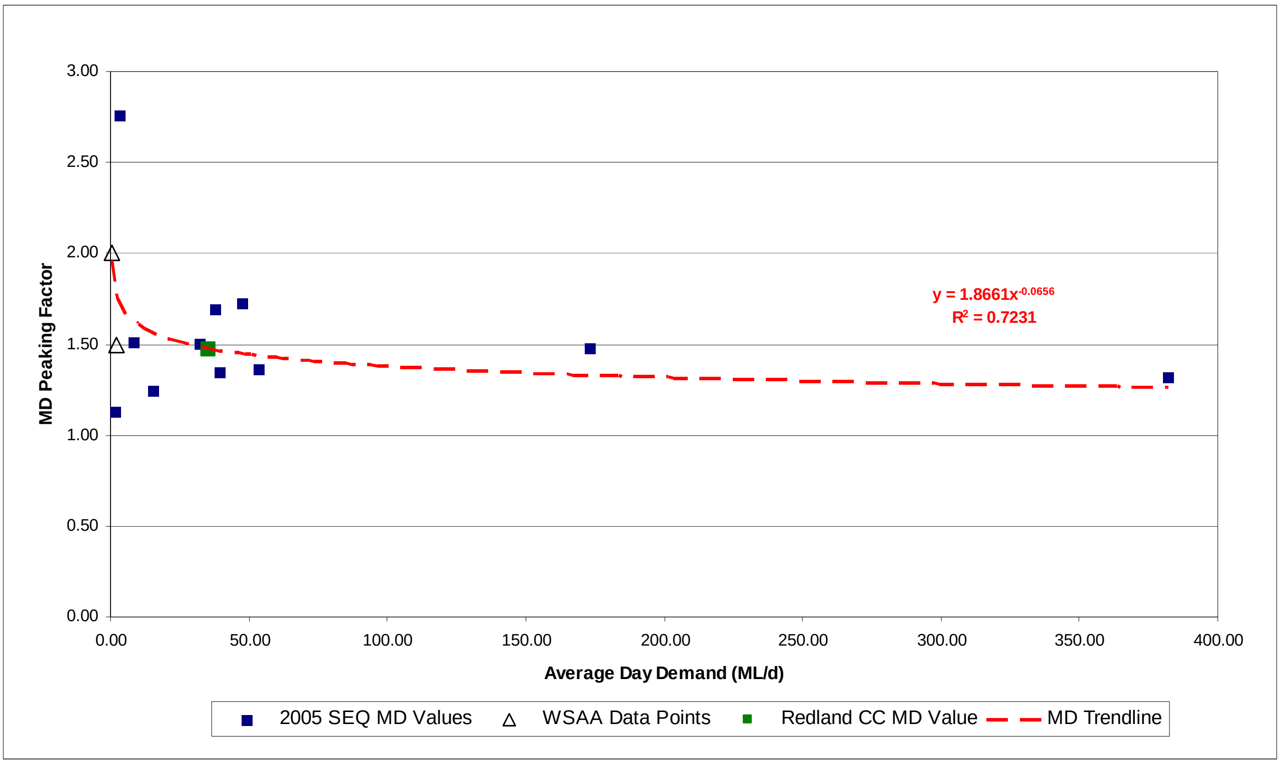


Figure 3-2 Redland City Sub-areas Maximum Day Peaking Factors

Using the trendline relationship in Figure 3-2, the following MD peaking factors have been calculated for this investigation:

Dunwich as a whole

- 2008 (AD demand = 0.41 ML/d) 1.98
- Ultimate (AD demand = 0.41 ML/d) 1.98

Illawong/Tazi supply area

- 2008 (AD demand = 0.10 ML/d) 2.17
- Ultimate (AD demand = 0.086 ML/d) 2.19

3.4 Fire Fighting Demands

The 2007 NDRW guidelines require that the following minimum fire flows are able to be supplied:

- Residential buildings (3 storeys and below) 15 L/s for 2 hour duration
- Commercial / Industrial buildings 30 L/s for 4 hour duration

These flows are to be available in conjunction with a system demand equivalent to 2/3 of maximum hour while retaining a residual pressure of at least 12 metres. **Figures 3-3** show the 2025 designated commercial areas at Dunwich. Those areas have been based on Council land use records and Council's current town planning scheme.

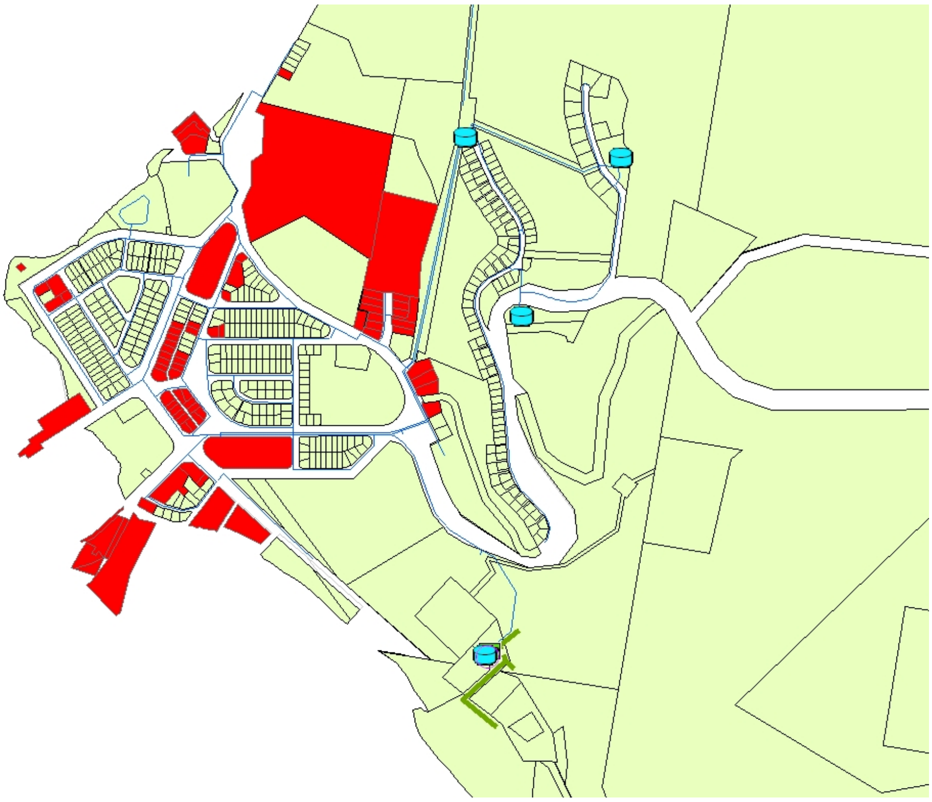


Figure 3-3 Year 2025 Designated Dunwich Township Commercial Areas

3.5 Distribution of Demands

The Redland Water and Waste report advises that the current (2006) and ultimate (2025) water supply demands for Dunwich are as follows:

- 2006 1,057 persons, 1,095 equivalent persons (EP)
- 2025 1,373 persons, 1,671 EP

The differences in residential (persons) and EP demands were distributed to the commercial and industrial areas in the township. The domestic demands were distributed to the residential areas and caravan parks. A residential occupancy of 2.4 persons per household was adopted for 2006, and 3.0 persons per household for 2025. The relatively high value of 3.0 represents an allowance for some medium density redevelopment taking place.

3.6 Non Revenue Demands

The current non-revenue usage of water at Dunwich is approximately 36% (based on Dunwich production treated water production and metered consumption for the period 21 November 2008 to 18 February 2009).

A non revenue demand equivalent to 8% of the total average day demand was distributed across the system for the ultimate scenario. This is in line with the desired standards of service set out in MWH, 2006.

4 System Modelling

4.1 Modelling Methodology

A stand alone EPANET network model was prepared for the existing Dunwich Township area. This model was prepared by "cutting down" the total Redlands City mainland model to just cover the Dunwich Township. This allowed trial runs to be quickly completed. The model was run for both the existing and the ultimate development scenarios using the MD peaking factors outlined in Section 3.2.

A 15 L/s fire flow was progressively located throughout the distribution system to identify any area not complying with the residential fire fighting requirements. Similarly, a 30 L/s fire fighting demand was located to the commercial demand areas shown on Figure 3-3 to identify any non complying commercial areas.

4.2 Modelling Period

A three day modelling period was adopted for the maximum day and fire fighting demands. The fire fighting demands were applied in the last of the three day modelling period.

4.3 System Pressures

The modelling, and augmentation identification, was undertaken to achieve system pressures between 22 m (minimum) and 60 metres (maximum).

4.4 Modelling Outputs for Existing Network

Rainbow Crescent reservoir area

In those areas serviced by the Rainbow Crescent reservoir, two locations could not be adequately supplied under commercial fire fighting conditions:

- The high school off the northern end of Mitchell Crescent and the club facility in Yabby Street.
- The commercial development in the Junner Street/Barlow Road area.

Tazi and Illawong reservoir areas

The modelling of the existing network under current demands found that large portions of the elevated areas serviced by the Tazi and Illawong reservoirs did not meet the required standards of service pressures under normal and/or fire fighting conditions. In particular:

- The properties along Illawong Crescent have normal supply pressures of between approximately 11 and 20 metres. None of these properties can be supplied with the required fire fighting pressures.

- The properties at the southern end of Rainbow Crescent cannot be supplied with the required fire fighting pressures.
- The properties along the elevated parts of Rainbow Crescent cannot be supplied with either the minimum normal pressure of 22 metres, or the required fire fighting pressures.

4.5 Proposed Augmentation Works

Figure 4-1 schematically shows the proposed augmentation works.

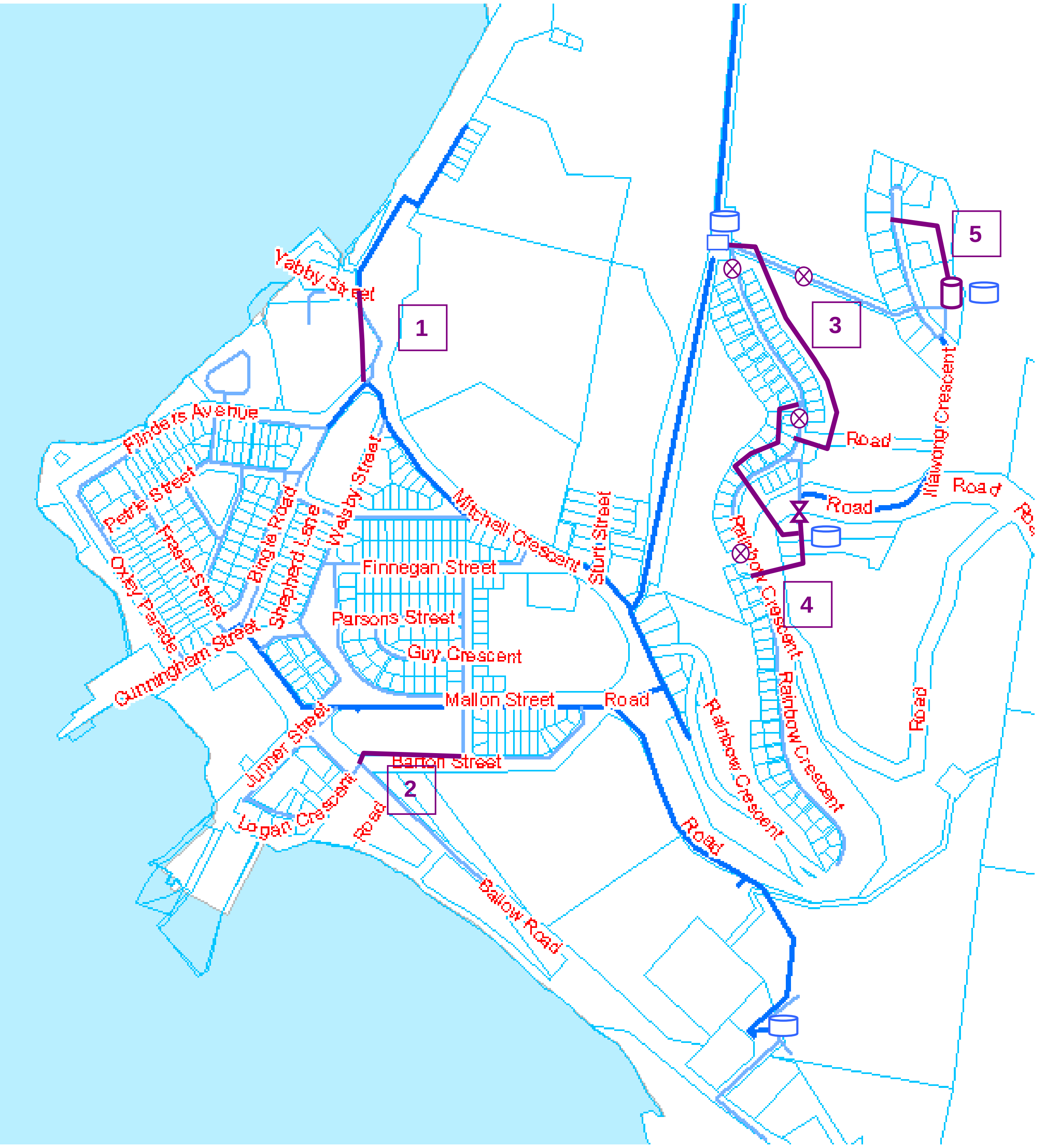


Figure 4-1 Proposed Water Supply Augmentations to Dunwich Township

Details of the proposed augmentation works follow with reference to the numbered notes on Figure 4-1:

Rainbow Crescent reservoir area

- *Note 1* - Augment existing 100 mm main between Yabby Street and the intersection of Flinders Avenue and Mitchell Crescent with a parallel 150 mm connection.
- *Note 2* - Provide a 100 mm connection between western end of the existing 100 mm main in Barton Street and the existing 100 mm main at corner of Logan Crescent and Ballow Road.

Tazi and Illawong reservoir areas

The augmentation works for the Tazi and Illawong reservoir supply areas are based on:

- Incorporating the constructed, but not yet activated, 150 mm main between Illawong Crescent and the Tazi reservoir,
- Decommissioning the existing Illawong and Tazi reservoirs,
- Supplying the whole elevated portion of the Dunwich township from a new reservoir on the Illawong reservoir site, and
- Separating the Rainbow Crescent properties into two pressures zones with the upper zone supplied directly from the new Illawong reservoir and the lower zone supplied through a pressure reducing valve.

The following notes referring to Figure 4-1 expand on this:

- *Note 3* – Decommission the existing rising main to the Illawong reservoir. Separate the northern end of the Rainbow crescent reticulation system from the Illawong pump station rising main. Construct a new 100 mm rising main from the pump station to join the existing Rainbow Crescent reticulation main at where it crosses the RL 68 metre contour on Rainbow Crescent.
- *Note 4* – Separate with valves the Rainbow Crescent reticulation main into three sections with two supply zones. Close off the existing mains to and from the Tazi reservoir. Provide a pressure reducing valve with fire flow bypass capability and make 100 main connections to the two sections of Rainbow Crescent forming its lower supply zone.
- *Note 5* – Construct a new reservoir at the Illawong reservoir site. Provide a 100 mm connection between new reservoir and the northern end of Illawong Crescent. To meet the supply area's MH and fire fighting demands plus ensure a minimum pressure of 16 metres under non-fire supply conditions, the new reservoir will have a diameter between 6.0 and 7.5 metres and a standing top water level (metres Australian Height Datum) of equal to or greater than that shown on Figure 4-2. The minimum volume of water to be held by the reservoir when full is 210 kL. The bottom of the reservoir could therefore be above about 124 metres Australian Height Datum (AHD). However, the existing ground level at the reservoir site is approximately 122.2 metres AHD. It is anticipated that the finished reservoir bottom will be near that ground level.

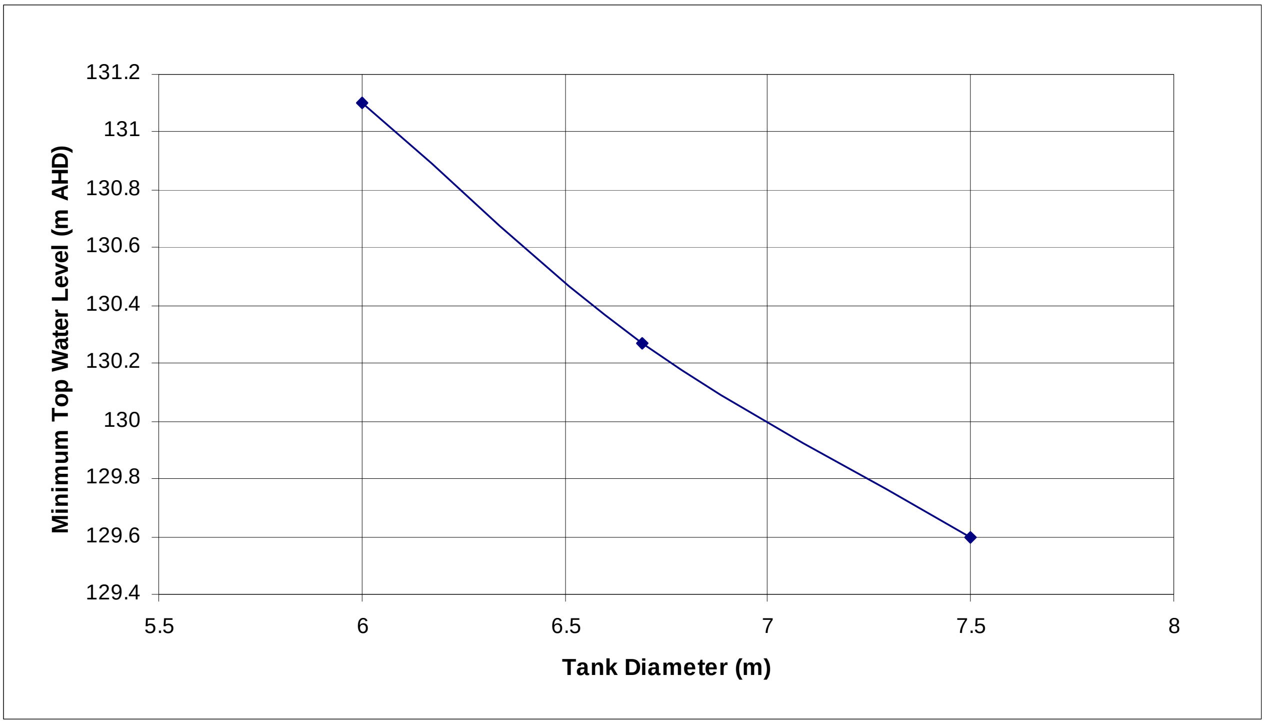


Figure 4-2 Illawong Reservoir Minimum Diameter and Top Water Level

4.6 Modelling of Augmented Network

System Pressures

Modelling of the augmented network has confirmed for both current and 2025 demands that all areas meet normal and fire fighting demand pressures. All but five houses along the southern half of Illawong Crescent would achieve better than the minimum 22 m standard water supply pressure. Those five houses would receive pressures in excess of 16 metres. All areas would experience maximum pressures less than 60 metres.

Illawong Pump Station

The Illawong pump station supply area was modelled under MDMM flow conditions and was found to retain a full reservoir after 24 hours of demand with only one of the existing pumps at the Illawong pump station in operation. These pumps (two Lowarra SV4-14T, 3.0 kW) were installed in mid 2008 and should therefore be retained.

While the modelling was undertaken on the assumption that only the duty pump was available, it is assumed that these pumps would be set up to operate in a duty/duty-assist/standby arrangement.

The existing Tazi reservoir pumps will become redundant and can be removed.

4.7 Cost Estimates

The estimated costs of undertaking the augmentation works outlined above follow:

1. Construct parallel 150 mm Class 12 OPVC connection, 185 metres long between Yabby Street and the intersection of Flinders Avenue and Mitchell Crescent. Estimated cost: $75,000
2. Construct 240 metres long 100 mm Class 12 OPVC connection between western end of the existing 100 mm main in Barton Street and the existing 100 mm main at corner of Logan Crescent and Ballow Road. Estimated cost: $70,000

3. Construct 200 kL standpipe reservoir at Illawong reservoir site including site works and telemetry connections to existing Illawong pump station. Estimated cost:	$160,000
4. Construct 450 metre long 100 mm OPVC rising main between Illawong pump station and Rainbow Crescent. Estimated cost:	$130,000
5. Construct 335 metre long 100 mm Class 12 OPVC connections between existing 150 mm main from Illawong reservoir to Rainbow Crescent including section isolation valves in Rainbow Crescent and pressure reducing valve and containment pit. Estimated cost:	$125,000
6. Construct 165 m long 100 mm Class 12 OPVC connection between new Illawong reservoir and Illawong Crescent. Estimated cost:	$50,000
Sub-total	$610,000
Contingency 20%	$122,000
Total estimated cost:	**$732,000**

4.8 Timing of Augmentations

All of the augmentation works outlined above are needed to provide fire fighting provisions which comply with long standing State Government guidelines. It is recommended that they be implemented as soon as practical.

5 References

- Opus International Consultants, May 2008, *Redland Water and Waste, Fire Flow Analysis, Dunwich DMA (402).*
- MWH, June 2006, *Redland Water and Waste Final Report, Redland ICS – Water Supply System Planning Study*.
- Redland Water and Waste, February 2008, *Dunwich - Rainbow and Illawong Crescent Water Supply System Planning Report*.
- Redland Water and Waste, February 2007, *Water Supply Planning Report*.