

# Village of Harrison Hot Springs WATER MASTER PLAN







# HARRISON HOT SPRINGS

Naturally Refreshed





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# **STATEMENT OF QUALIFICATIONS & LIMITATIONS**

The Water Master Plan Report (the "Report") contained herein has been prepared by CTQ Consultants Ltd. ("CTQ") for the benefit of The Village of Harrison Hot Springs ("VHS") in accordance with the agreement between CTQ and VHS, including the scope of work detailed therein (the "Agreement").

The information used to prepare the water model and this Report was obtained from record information provided by VHS, site reconnaissance by CTQ and hydrant flow tests to calibrate the model.

The Report has been prepared to assist the VHS to understand the existing condition of the overall water system and to plan for future growth within the community. Possible growth patterns were provided to CTQ by VHS to enable future population scenarios to be included in the water model.

The information contained herein is to be read as a whole and such sections should not be extracted and read out of context.

As the Report is based on possible future population and development growth patterns, trigger points for capital and operational improvements have been identified and should be updated periodically to reflect actual conditions.

Unless expressly stated to the contrary in the Report or the Agreement, CTQ:

- shall not be responsible for any events or circumstances that may have occurred since the date on which the Report was prepared;
- shall not be responsible for any inaccuracies contained in information that was provided to CTQ by other firms or agencies;
- agrees that the Report represents professional judgment for the specific purpose described in the Report and the Agreement, but CTQ makes no other representations with respect to the Report or any part thereof.

The Report is to be treated as confidential and may not be used or relied upon by third parties, except:

- as agreed, in writing, by CTQ and VHS;
- as required by law;
- for use by governmental reviewing agencies.

Any use of this Report is subject to this Statement of Qualifications and Limitations. Any damages arising from improper use of the Report or parts thereof shall be borne by the party making such use.

This Statement of Qualifications and Limitations is attached to and forms part of the Report.

# CTQ



# **LETTER OF SUBMISSION**

Project No.:	12004-13	COST
25 June 201	5	
495 Hot Spri	arrison Hot Springs ngs Road t Springs, BC VOM 1KO	TIME
Attention:	Mr. Ian Gardner, Operations Manager	QUALITY
Dear lan:		
Re: Villag	e of Harrison Hot Springs Water Utility Master Plan	
M.	any time regarding this report.	
Yours truly,		
Yours truly, CTQ CONSU Per: Michelle Sor Municipal Pr	XUNSN .	





# SIGNATURES

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# ACKNOWLEDGEMENTS

As a Resort Municipality, VHS faces the difficulty of constructing and maintaining infrastructure sufficient to serve a large number of day trip and short term visitors sustained by a relatively small tax base. Funding provided through UBCM for the completion of the Water Utility Master Plan is gratefully acknowledged.

The VHS operations personnel were invaluable in finding archived data, responding to inquiries, and providing context. Thanks to:

Ian Gardner, Manager of Operations Tyler Simmonds, Utilities Technician Bruce Malfait, Utilities Chief Operator Mark Yasinski, Utilities Labourer Todd Kafi, Public Works Foreman

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# **EXECUTIVE SUMMARY**

The Harrison Hot Springs water utility supplies treated water for the Village of Harrison Hot Springs (VHS). Over the past decade, upgrades have been undertaken to ensure clean drinking water continues to be available for a growing population of residents and visitors. The system currently includes a main water intake structure in Harrison Lake with two pumping stations, a state-of-the-art membrane treatment facility and a water storage reservoir. The distribution piping infrastructure is approximately 15 km total in length; however it is not fully looped and has several dead ends. VHS recognizes the infrastructure is not complete, and commissioned CTQ Consultants Ltd. (CTQ) to generate a comprehensive Water Utility Master Plan to address current issues and to provide a roadmap for the utility over the coming years.

The purpose of any utility master plan is to establish a strategy for providing the required levels of service to the tax payers of the community both now and into the future. It is very difficult to forecast future needs in a resort-based community like VHS. As such CTQ reviewed several options for projections and based the report on demand flows triggering improvement events rather than timelines based on traditional population growth models.

Existing system infrastructure and demands were reviewed, modeled using WaterGEMS <sup>™</sup> software, and calibrated using historical data and field tests. Scenarios were created to determine necessary improvements as the population increases. It is estimated that 55% of demand within VHS is currently met by private water supplies. The impact of adding all the existing lots and then combining the various growth scenarios was investigated.

The model was used to quantify upgrades to the pipe network, treatment plant, storage reservoir and pump stations based on existing and future demands. Operational issues such as residual chlorine levels during both the summer peaks and winter lows were quantified. This enabled a review of and recommended modifications to the current flushing program.

As the Harrison Hot Springs Resort and Spa is the largest single user of water in VHS and is currently not serviced by the VHS water utility, potential impact to the system of this large customer was reviewed.

The projects identified by the Water Master Plan were itemized as Capital Projects rather than development driven projects. These projects were reviewed based on a "Triple Bottom Line" (Social, Environmental and Economic) assessment.

This Water Master Plan is to be read in conjunction with the Figures and Tables found in the appendices includes recommendations based on CTQ's knowledge and expertise in water systems. It is very much a living document and needs to be revisited from to time to confirm the outcomes based on the increased future demands.

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# **ABBREVIATIONS**

- ADD Average Day Demand. Water consumption in liters per day averaged over a specific time period (usually 12 months). For VHS, ADD was determined for peak (summer) and off-peak (winter) periods.
- AWWA American Water Works Association. The largest non-profit, scientific and educational association dedicated to managing and treating water.
- BCWWA BC Water & Waste Association. A non-profit organization with a mandate to safeguard public health and the environment on matters related to water and wastewater.
- FUS Fire Underwriters Survey. An organization which provides data on public fire protection for fire insurance statistical work and underwriting purposes of subscribing insurance companies.
- FVRD Fraser Valley Regional District.
- GCDWQ Guidelines for Canadian Drinking Water Quality, 2012. Provides guidelines and limits for contaminant concentrations based on current, published scientific research related to health effects, aesthetic effects, and operational considerations.
- HP Horsepower.
- HRS Harrison Hot Springs Resort & Spa.
- MAC Maximum Acceptable Concentration for drinking water parameters according to the GCDWQ.
- MMCD Master Municipal Construction Documents. Documents created by MMCD Association a non-profit society supported by BC municipalities to create improved construction documents for roads, sidewalks, sewers, water, traffic signals and street lighting.
- MDD Maximum Daily Demand. Maximum volume of water in liters per day consumed during a 24 hour period in a given year. For this report, it is calculated as 2xADD.
- OCP Village of Harrison Hot Springs Official Community Plan. Bylaw 864 March, 2007.
- PHD Peak Hour Demand. Maximum volume in liters of water consumed in a one hour period in a given year. For this report, it is calculated based on 1.5xMDD.
- UF Ultrafiltration. A type of membrane filtration (for water treatment in VHS) in which forces such as pressure or concentration gradients lead to a separation through a semipermeable membrane.
- VFD Variable Frequency Drive. A type of adjustable-speed drive used in electromechanical drive systems to control AC motor speed and torque by varying motor input frequency and voltage. The VHS beach pumps have VFDs.
- VHS Village of Harrison Hot Springs.
- WTP Village of Harrison Hot Springs Water Treatment facility, as constructed 2014.



# **1.** Introduction

# **1.1** Water System Background

A reliable supply of clean water is necessary for the environmental, economic and social wellbeing of any community. The function of a safe and dependable water system extends beyond the significant social requirements of basic health and sanitation. A public water system also protects property through adequate fire supply, contributes to the local economy by providing capacity for commercial enterprises, and, through irrigation, enhances the environment surrounding businesses, homes and public spaces. In doing all of this, the system must also be financially sustainable while meeting stringent government standards.

The Harrison Hot Springs water utility supplies treated water for the Village of Harrison Hot Springs (VHS). Over the past decade, upgrades have been undertaken to ensure clean drinking water continues to be available for a growing population of residents and visitors. The system now includes an intake structure, two pumping stations, a state-of-the-art membrane treatment facility, a water storage reservoir, and 15 km of pipeline.

VHS is a destination community with a small full time population. During the summer months, demands on infrastructure increase significantly with seasonal residents and tourist visits. This fluctuation puts immense pressure on the water system. A single large development, or sharp increase or decrease in the number of overnight tourist visits, could greatly impact the system requirements.

VHS recognizes the challenges ahead, and commissioned CTQ Consultants to generate a comprehensive Water Utility Master Plan to review the system in its entirety and provide a roadmap for the utility over the coming years.

# **1.2** Purpose of this Master Plan

The purpose of any utility master plan is to establish a comprehensive strategy for the utility. In the absence of a crystal ball, certain assumptions must be made to predict the future so that the utility is able to respond to the actual needs of the community. This includes long term planning required levels of service and identifying the most cost effective means of delivering the current and future service.

The creation of this Water Utility Master Plan is the first step towards cohesive, long term planning for VHS utilities. It is important that the water utility not be looked at in isolation, that master planning documents for sanitary sewer, drainage and roads be incorporated as they become available. It is recommended that an overall Asset Management Program be developed for VHS.

The objectives of this Plan are to:

- review existing and forecast future water demands
- identify threats to water supply
- review existing infrastructure and identify current deficiencies
- · recommend infrastructure improvements to meet future demand





- make recommendations regarding demand management
- estimate costs of future works.

# 2. Existing System (2014)

## 2.1 Process Overview

The Existing Water Supply and Distribution System are illustrated on FIGURE 1.

- 1. Water enters the VHS system through a 350 mm intake line which extends just over one kilometer north into Harrison Lake.
- 2. Three 40 HP, VFD-controlled pumps located at the Harrison Lake shoreline transport water from the intake to the Water Treatment Plant located on the west side of Hot Springs Road at Balsam Avenue.
- 3. After membrane ultrafiltration and chlorination, two 40-HP pumps lift the water 60 vertical meters across the Miami Slough and through a section of above-ground piping bolted to Agassiz Mountain to the 2,745 m<sup>3</sup> reservoir.
- 4. Treated water is delivered to the consumer via gravity flow through a 15 km of distribution pipes ranging in size from 50 mm to 350 mm. Due to the relatively flat topography and lack of hillside development, the entire Village lies within a single pressure zone.

## 2.2 Water Metering

Only 25 of the properties serviced by the VHS water utility are currently metered. Residential customers pay a flat rate of \$311.00 per year. Condominium developments and a handful of commercial customers have meters and are billed according to consumption. These metered properties are also illustrated on **FIGURE 1**. Any new residential water installation includes a meter but VHS policy is to continue to bill a flat rate until such time as all residences are metered.

## 2.3 Water Utility Customers

There are 754 properties in VHS, 443 properties are serviced by the VHS water utility. Although specific flow rates from the private sources are not available, CTQ estimates that nearly 55% of demand within VHS boundaries is currently met by privately owned and maintained groundwater wells and lake intakes. **FIGURE 1** illustrates the source of water for all VHS properties.





# A Note Regarding the Harrison Hot Springs Resort & Spa

The Harrison Hot Springs Resort & Spa (HRS) is not currently supplied by the VHS water utility, operating an intake, reservoir and treatment facility separate from the VHS system. HRS's water license indicates a withdrawal limit of 500 m<sup>3</sup>/day. Actual usage is estimated between 350-400 m<sup>3</sup>/day at full occupancy, making HRS the largest single consumer of water within VHS. Resort management has indicated the intent to continue to operate the private system for the foreseeable future.

The VHS system currently has the capacity to supply treated water to HRS. However, without capital upgrades to the system this capacity will diminish over time, based on the actual rate of development and population growth the Village experiences combined with Resort expansion. Because of the significant impact the HRS connection would have on the VHS water utility, accounting for an increase in total system demand over 2014 levels in the order of 20%, implications of connection have not been investigated in detail within this report. Should both VHS and HRS management wish to pursue HRS connection in the future, a separate technical memorandum should be issued to address issues such as:

- Detailed HRS demand projections
- Continued use of HRS system components such as intake and reservoir
- VHS reservoir and pumping capacity upgrade requirements
- VHS water license amendment
- Rate structure
- Timing of connection and tie-ins
- Operations and maintenance

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# 3. Water Supply, Quality and Treatment

# 3.1 Water Sources and Supply

In the Village of Harrison Hot Springs, water is supplied to properties one of three ways:

- 1. Harrison Lake surface water VHS water utility
- 2. Harrison Lake surface water privately owned and operated intake
- 3. Groundwater privately owned and operated wells

In British Columbia, water licenses fall under the jurisdiction of the Ministry of Forests, Lands, and Natural Resource Operations. VHS holds a Conditional Water License (#114223) authorizing diversion of up to 100,000,000 gallons per year (454,609 cubic meters) from Harrison Lake. In addition, Permit #23174 allows for the occupation of Crown land for the lake intake pipeline and beach pump station.

## **3.2 Source Water Quality - Harrison Lake**

Raw water quality from the Harrison Lake source is considered excellent. An examination of analytical data between 2012 and 2014 found that without exception all tests for metals, anions and nutrients were well within the Guidelines for Canadian Drinking Water Quality (2009). Turbidity is consistently higher than the Maximum Acceptable Concentration (MAC) of 0.1 NTU limit, and tests regularly indicate some presence of E. Coli and other Coliform bacteria. Raw water quality data can be found in **Appendix A**.

## **3.3 Source Water Treatment - Harrison Lake**

The current membrane microfiltration treatment facility (commissioned in 2014) achieves the 4-3-2-1-0 microbiological treatment objectives outlined by the British Columbia Ministry of Health's Drinking Water Treatment Objectives (Microbiological) for Surface Water Supplies in British Columbia (2012):

- 4-log reduction or inactivation of viruses
- 3-log reduction or inactivation of *Giardia* and *Cryptosporidium*
- Two treatment processes for surface water
- Less than or equal to one nephelometric turbidity unit (NTU) of turbidity
- No detectable E. Coli, fecal coliform and total coliform

## **3.4** Threats to Water Quality, Water Supply, and Watershed Health

The Harrison/Lillooet watershed is part of the Fraser River Basin, originating with meltwater from the Lillooet Glacier high in the Coast Mountains north of Vancouver. The Lillooet River flows south and east past the towns of Pemberton and Mount Currie to the north end of Harrison Lake - the largest lake in the Fraser Valley - that drains by way of the Harrison River 18 km to the Fraser River (Fraser Basin Council, 2014). South of the Village of Harrison Hot Springs, the Miami River flows through a more developed area of the District of Kent and VHS into Harrison Lake. Although the watershed is largely comprised of remote and mountainous areas, several threats to watershed health and potentially to VHS drinking water quality do exist. Water quality is regularly monitored by VHS to provincial standards, but there is at this time no

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"early warning" instrumentation that would provide an indication of changing water quality prior to water entering the system.

## 3.4.1 Natural Disasters

Natural disasters such as earthquakes and landslides have the potential to adversely affect the Harrison Lake source water supply and quality. On August 6, 2010 a landslide in the magnitude of 45,000,000 cubic meters blocked both the Meager and Lillooet Rivers. This was the second largest landslide ever recorded in Canada. For two years the Meager Creek slide resulted in a significant increase in Harrison Lake turbidity levels at the intake of the VHS water utility system.



Meager Creek Slide looking into the Lillooet River Sunday 8 August 2010

Source: landslideblog.org

Earthquakes also pose a risk to water utility infrastructure. The importance of water supply in emergency response resulted in changes to the BC Building Code in 2012 requiring water infrastructure to be built to "post-disaster" standards and increasing the requirements for seismic design. Although the new WTP has been designed to this standard, the vulnerability of other components of the system to seismic events - specifically the reservoir, above ground piping and beach pump station - should be considered during emergency response planning and upgrades undertaken as practical.

#### Recommendations

- Consider the seismic vulnerability of the water utility during emergency response planning.
- Identify seismic upgrades required for the reservoir and beach pump station and undertake improvements as practical.
- Prioritize the upgrade of the critical above-ground piping.





# **3.4.2 Microbial Contamination**

Sources of fecal contamination include wastes from humans, pets, farm animals and wildlife. Septic systems on the recreational properties within the Harrison Lake watershed, as well as contamination from agricultural operations upstream (either in the Lillooet Valley or within the District of Kent) could result in bacterial contamination of surface water supply. VHS currently monitors microbial levels of raw water according to Ministry of Health guidelines in order to detect the presence of these harmful organisms.

## 3.4.3 Land Use

#### Industrial

Historically, industrial land uses within the watershed have included forestry, mining and agriculture. Each industry can have a variety of impacts on the watershed. For example, habitat altered by forestry activities can result in increased runoff and sediment loading of rivers and lakes, contaminants such as fecal matter or chemicals used in agricultural operations can migrate into surface water, and mining operations may contribute to slope destabilization. Log booms transported near the VHS water intake line (which extends nearly a kilometer underwater) increase raw water turbidity and have the potential to damage the intake. It is important for VHS to be identified as a stakeholder on land use issues relating to watershed health, and to have a voice on committees where decisions potentially affecting water quality are made.

#### Recommendation

• Ensure VHS is identified as a stakeholder for projects and activities within the Harrison/Lillooet watersheds

#### Recreational

Water quality may be impacted by waste generated from recreational property users and campers in the watershed. Septic systems that are not properly maintained may result in bacterial and nutrient contamination of nearby waters. Nutrient enrichment in the lake could lead to algae blooms or eutrophication and decrease water quality.

#### Urbanization

Urban development in the watershed is minimal and is concentrated in just a handful of centers (Pemberton, Agassiz, and Harrison Hot Springs). With the growing Lower Mainland population in close vicinity to the watershed, the area is expected to see an increase in both development and recreational users. Urban runoff carries contaminants such as sediments, metals and hydrocarbons into local waterways increasing the concentration of these contaminants in the source water. Increased runoff due to urbanization can also impact stream channels because of increased total flow and velocities.

#### Recommendation

- Investigate upgrades to the VHS drainage system such as filtration and oil separators to minimize contaminants entering the Miami River and Harrison Lake that may affect water quality
- Create a Drainage Master Plan



# 3.4.4 Climate Change

In 2011, Engineers Canada issued the following statement on the subject of climate change:

"Regardless of causes, our climate is changing and it will increasingly affect infrastructure over time, exposing Canada's infrastructure to conditions it was not originally designed to withstand. This can reduce its useable lifespan and may result in economic loss, disruptions to the lives and daily routines of Canadians, and increased risks to public health and safety."

BCWWA expands on this in the 2013 Position Statement on Climate Change:

"Climate change is altering the context in which infrastructure needs to be designed, maintained and renewed to continue to provide water services at desired levels. Older infrastructure was simply not designed or built with such extreme climate variability in mind."

According to the BCWWA Position Statement, climate change impacts that directly affect water infrastructure include:

- rising temperatures and sea level
- reduced snowpack
- more frequent and severe storm events
- more frequent floods and droughts

BCWWA, and parent organization AWWA, encourages water utilities to:

- support regional climate change modeling
- respond proactively to anticipate climate changes
- develop adaptation and mitigation responses for a range of predicted climate change impacts
- reduce energy consumption and greenhouse gas emissions as reasonably feasible

AWWA also reminds us that:

"Water utilities are especially vulnerable to climate induced changes to water quality and quantity. They face risks to their water supplies and critical infrastructure... In spite of these new challenges and limited climate change data and decision support tools available at the local level, water utilities must ensure that an adequate supply of uninterrupted, high-quality and affordable drinking water is available for their customers"

#### Recommendations

- Ensure climate change is emphasized in the decision-making process for water utility infrastructure repair, upgrade, and expansion.
- Reduce energy consumption and greenhouse gas emissions created by the water utility wherever possible.

## 3.4.5 Vandalism

It is important to note the vulnerability of key system components to tampering. Although located 1 km into Harrison Lake, the intake for the VHS system is located in shallow water and unsecured. In addition, the drinking water supply reservoir and above-ground treated water supply lines is accessible to the public from the Campbell Lake trailhead.



## 3.5 Source Water Quality - Groundwater

Generally, there are two types of groundwater supply:

- 1. **GUDI**, or **G**roundwater **U**nder **D**irect Influence of surface water refers to groundwater sources (wells, springs, infiltration galleries, etc.) where microbial pathogens and other contaminants are able to travel from nearby surface water to the groundwater source.
- 2. Non-GUDI water is independent of surface water influence.

A shallow well in close proximity to a surface water source will generally be a GUDI supply.

The provincial register indicates well depths within VHS ranging from 8m to over 19m with water found between 1m and 3m below the ground surface. A series of studies completed in the 1990's by Urban Systems concluded that shallow wells could be affected by activities related to land use south of VHS. In addition, a preliminary water quality sampling program was undertaken in May 2014 by Western Water Associates (WWA) as part of an environmental impact assessment for a landfill site which operated east of McCombs Drive from the 1950's through 1983. The non-intrusive study focused on assessing water quality at selected existing domestic wells and at near-surface groundwater seepage zones into the Miami River, the closest surface water receptor. Water quality sample locations are provided in **Appendix B**. Of note were ambient conditions exceeding the Guidelines for Canadian Drinking Water Quality Guidelines (GCDWQ) for iron, manganese, pH, and temperature. At one location, coliforms were also detected. Nitrate did exceed GCDWQ for the near-surface groundwater at locations presumed to be down-gradient from the landfill site. For this reason, there is concern that nitrate potentially derived from the landfill site has contaminated the groundwater in this area.

The WWA report recommends that, at a minimum, all domestic wells located within the vicinity of "Site 12" be tested for landfill-associated leachate anions and pH. Because of the large number of properties served by shallow groundwater wells throughout the Village, and the potential liability of any contaminants to VHS, it is further recommended that a one-time sampling of all 218 properties listed in the VHS database as supplied by private groundwater wells be completed as soon as possible. Analysis of the samples will provide further guidance for additional groundwater monitoring, alternative water supply, and/or supplementary investigation.

A deep, non-GUDI test well completed to 31 m depth in March 2010 by VHS showed elevated hardness, manganese and sulfides at this location within the Agassiz aquifer. The aquifer is classified by the Province of British Columbia as "highly vulnerable", and there are a considerable number of wells within the aquifer that can serve as a conduit for contamination. A number of similar deep wells are known to exist within the Village, and as with the shallower GUDI wells, the VHS currently has little or no water quality and depth data for these privately owned and operated water supplies. Recognizing that VHS has no jurisdiction over wells on private property, property owners should be advised of the proximity to the VHS water utility. It is recommended that options for those interested in decommissioning groundwater wells in favor of utility connection be investigated.

VHS civic addresses supplied by wells (2014), in addition to a list of provincially registered wells is provided in **APPENDIX B.** 





#### Recommendations

- Test all domestic wells within the vicinity of "Site 12" for landfill-associated anions and pH
- Sample all 218 properties within VHS which use groundwater
- Establish a policy for connecting properties previously served by groundwater to the VHS water utility

# CTQ



# 4. Water Model

Using AutoCAD's WATERGEMS<sup>™</sup> software, average daily demand (ADD) was modeled utilizing a combination of meter data and demand estimates based on land usage for each property within the Village.

Because of the seasonal variability experienced by VHS, "winter" (low flow) and "summer" (high flow) values were determined for ADD. The winter values were utilized in analysis of chlorine decay (**FIGURE 5**) and development of a flushing program. Summer demands, as most conservative, were used to identify current system deficiencies as well as to estimate future system requirements.

The model was calibrated to flow data recorded by VHS operations personnel between 2008 and 2014, and field calibrated in 2014 via hydrant flow tests. Maximum Daily Demand (MDD) and Peak Hourly Demand (PHD) were calculated based on ADD.

It should be noted that during the calibration process the water model flow results differed from the field in one area located in the vicinity of Hot Springs Road and Lillooet Avenue. After discussions with VHS operations staff a suspected restriction at the location of this intersection tee fitting was identified. When this is accounted for in the model the flows and pressures match the field data. All model runs have been completed assuming this fitting has been replaced, making this a top priority project.

VHS bylaws and MMCD Municipal Infrastructure Design Guideline Manual criteria were utilized for the model. Water model parameters are summarized in **APPENDIX C.** 

2014 Water demand calculations are presented in **FIGURE 7**. Future demands are presented in **FIGURE 8** (reflecting the scenario where all properties within are serviced by the water utility) and **FIGURE 9** (full development to current zoning with all properties serviced by the water utility)

Additional criteria are discussed within the relevant sections herein.



# 5. 2014 System Deficiencies

## 5.1 Linear Assets

According to the VHS listing of Tangible Capital Assets, the first piping and valves were installed in 1984 and therefore all distribution infrastructure within VHS has been in service for 30 years or less. Supply and distribution lines are either plastic (PVC and HDPE) or ductile iron (DI), all of which have a theoretical design life span of 80 years.

One of the weaknesses of the VHS distribution system is the lack of readily available information with respect to as-built drawing and construction conditions. Because VHS has not yet adopted development guidelines which include design and installation policies, there has been some inconsistency in the requirements for the design and construction of municipal infrastructure. In 2014, VHS experienced a sanitary line rupture which appeared to be due to inconsistent backfill - a rock in direct contact with the line created a point load, weakening the line at that location. Other underground work within the Village has also revealed installation practices which could adversely impact the service life of underground assets. To address these concerns in the future, it is strongly recommended that MMCD standards be adopted for municipal infrastructure design and construction.

#### Recommendations

- Locate as-built drawings and construction inspection reports in archives, digitize and add to a Water Asset Management database.
- Adopt MMCD Design guidelines, with modifications as necessary, for all construction of Municipal Works within VHS

# 5.2 Fire Flows and Hydrant Coverage

Fire flows were modeled, and the results analyzed for conformance to FUS (Fire Underwriters Survey) and MMCD requirements as outlined in **TABLE 5.1**. Several issues were noted within the existing system when looked at as a whole, which is typical for systems constructed in pieces over several decades. It is recommended that all new development undergo an engineering review which includes a water model analysis to determine the impact of fire flow and demand to the VHS system prior to approval being issued.





Criteria	Units	MMCD	FUS
Flow			
Single Family (R-1, R-2, R-3)	L/s	60	
Apartments, Townhouses (R-4, R-5)	L/s	90	
Commercial (C)	L/s	150	
Institutional (P-1)	L/s	150	
Minimum System Pressure	psi	22	
Maximum Pipe Velocity	m/s	3.5	
Hydrant Spacing			
Single Family (R-1, R-2, R-3)	m		180
All Others	m		90
Hydrant Coverage Radius			
Single Family (R-1, R-2, R-3)	m		69
Apartments, Townhouses (R-4, R-5)	m		67
Commercial (C)	m		66
Institutional (P-1)	m		66

## **TABLE 5.1 Fire Hydrant and Flow Criteria**

#### 5.2.1 Fire Flow and Residual Pressure

Three existing hydrants were unable to provide adequate fire flows and/or maintain the minimum 22psi residual pressure under fire flow conditions. All these hydrants serviced commercially zoned properties at the south end of Hot Springs Road.

Hydrant	Zoning	Required Fire Flow (L/s)	Residual Pressure at Required Fire Flow (psi)	Available Fire Flow at 22psi Residual Pressure (L/s)
H-59	C-4	150	18	144
H-60	C-4, C-7	150	13	139
H-65	C-7	150	7	132

#### TABLE 5.2 Residual Pressure and Available Fire Flow

It is recommended that a section of water main on Hot Springs Road be upgraded from 250mm to 350mm in order to address this issue, with a plan in place to provide adequate firefighting supply through alternate means until such time.

# 5.2.2 Pipe Velocity

The velocity of water within the system under fire flow conditions is limited to 3.5 m/s under MMCD guidelines. Several locations were noted as exceeding this limit. **TABLE 5.3** lists those exceedances, as well as piping upgrades that would address the issue.

Maximum velocity limits in distribution piping are in place to address potential scour (due to the presence of granular material), cavitation, stress fractures (usually due to cycling) and transient forces created when flow conditions change suddenly (valves opening, pumps shutting off, etc). Fire flow conditions represent a deviation from the regular operation of the distribution system. Because pipe velocity under non-fire flow conditions is well under the MMCD limit, it is therefore





recommended that piping upgrades to address velocity should be undertaken as opportunity arises (for example, when a section of line is replaced, or a service added in close proximity) rather than undertaken as a stand-alone project.

#	Hydrant	Zoning	Pipe Velocity at Fire Flow (m/s)	Location of highest recorded velocity	Upgrade required for pipe velocity under 3.5m/s	Upgrade Pipe Details	
1	H-1	C-1	4.87				
2	H-2	C-1	4.87	J-240 to J45 (200mm)	J-240 to J45 (200mm) J-240 to J45		
3	H-3	C-1	4.87				
4	H-6	C-2	4.77	J-50 to J-202 (200mm)	J-50 to J-202	62 m of 250 mm	
5	H-12	R-4	5.24	5.24		17 m of 200 mm	
6	H-13	R-4	5.24	J-53 to J-204 (150mm)	J-53 to J-204	17 111 01 200 11111	
7	H-26	C-5	5.54	J-212 to J-38 (150mm)	J-210 to J-40	20 m of 250 mm	
8	H-27	P-1	5.54	J-210 to J-40 (150mm)	J-37 to J-40	51 m of 200 mm	
9	H-32	P-1	5.54	J-212 to J-38 (150mm)	J-37 to J-36 J-39 to J-38	50 m of 250 mm 61 m of 200 mm	
10	H-34	P-1	3.77	J-37 to J-40 (150mm)	J-38 to J-212	68 m of 250 mm	
11	H-49	C-5	5.93	J-21 to J-217 (150mm)	J-21 to J-217	12 m of 250 mm	

# TABLE 5.3 Pipe Velocity (Fire Flow Conditions)

# 5.2.3 Hydrant Spacing

The maximum FUS spacing of hydrants in commercial, industrial, institutional and multi-family residential areas is 90 meters; in single family residential areas 180 meters is recommended. Several hydrants were found to have spacing exceeding FUS guidelines, and listed in **TABLE 5.4.** It is recommended that VHS review the value to property owners of adding hydrants to the existing system to meet FUS guidelines.





## TABLE 5.4 Hydrant Spacing

#	Hydrant	Zoning	Hydrant Spacing* Yes/No	Distribution Main Section Affected
1	H-1	C-1	No	Between H-1 and H-2
2	H-2	C-1	No	Between H-2 and H-1
3	H-4	P-1, C-1, C-2, C-3	No	Between H-4 and H-5
4	H-5	C-2, C-3	No	Between H-5 and H-4, H-6, H-7
5	H-6	C-2	No	Between H-6 and H-5, H-7
6	H-7	R-2	No	Between H-7 and H-9
7	H-7	C-2	No	Between H-7 and H-6
8	H-9	R-2, R-3	No	Between H-9 and H-7
9	H-12	R-4	No	Between H-12 and H-13
10	H-13	R-4	No	Between H-13 and H-12
11	H-24	C-1	No	Between H-24 and H-25
12	H-25	C-1	No	Between H-25 and H-24
13	H-32	P-1	No	Between H-32 and H-31, H-33
14	H-33	P-1	No	Between H-33 and H-32
15	H-34	P-1	No	Between H-34 and H-33
16	H-44	C-5	No	Between H-44 and H-43, H-45
17	H-45	C-5	No	Between H-45 and H-44, H-46
18	H-46	C-5	No	Between H-46 and H-45, H-49
19	H-49	C-5	No	Between H-49 and H-46, H-54
20	H-53	R-4	No	Between H-53 and H-64
21	H-54	R-4	No	Between H-54 and H-55, H-49
22	H-54	C-5	No	Between H-54 and H-55, H-49
23	H-55	C-5	No	Between H-55 and H-54, H-56
24	H-56	C-4, C-5	No	Between H-56 and H-55, H-57
25	H-63	R-1	No	Between H-63 and H-64
26	H-64	R-1	No	Between H-64 and H-63

\* Max space R-1, R-2, R-3 = 180m, all other zones = 90m

# **5.2.4 Hydrant Coverage Radius**

**FIGURE 2** depicts the properties which do not currently meet the FUS criteria for Hydrant Coverage Radius. Many of these "non-conforming" properties are not fronted by the VHS water utility, but several gaps were also noted for properties serviced by the existing system. Recommended "future" hydrant installations to partially mitigate this concern utilizing the existing distribution system can also be found on Figure 2. Figure 3 identifies the hydrant





coverage upgrades required into the future on a Village-wide scale. A complete list of nonconforming civic addresses can be found in **APPENDIX C** 

In order to bring all properties to FUS standards, new hydrants and associated distribution lines are recommended for the following streets:

- Ramona/Angus/Hadway/Myng/Nyms/Hope (875 m)
- Lillooet/Cedar (250 m)
- Lillooet/Bear (705 m)

- Emerald/Diamond (350 m)
- Rockwell (610 m)
  - Pine/Lakberg (400 m)

• Naismith/Mount (595 m)

Based on current zoning, an upgrade to the existing system is also recommended for a 125 m section of Hot Springs Road between Ramona and the Holiday Park entrance. Construction of the distribution lines will also provide access to the VHS water utility for properties not currently served. Construction cost estimates for each of these locations are provided in **APPENDIX D**.

#### Recommendations

- Upgrade the 250 mm line on Hot Springs Road between Hydrants 59 and 65 to 350 mm line to address inadequate fire flows (125m).
- Add hydrants to the existing system to meet FUS linear spacing guidelines.
- Add hydrants to the existing distribution lines to meet FUS coverage guidelines.
- As opportunity arises, upgrade piping to address velocity concerns.
- Construct new frontage lines and upgrade existing distribution lines as funding is available to meet FUS coverage guidelines and provide water utility service to properties currently on private well systems. Until that time, ensure that residents have information regarding insurance, and that a fire fighting plan is in place to address the issue.
- Require that all new development undergo an engineering review which includes a water model analysis to determine the impact of fire flow and demand to the VHS system prior to issuing approval.

## 5.3 Flow Restrictions

As noted in Section 4, during the model calibration and field testing an undocumented flow restriction was noted at the corner of Cedar Avenue and Hot Springs Road. Further investigation indicates the probability of a damaged tee at this location. Replacement of this section of pipe is recommended as soon as possible in order to provide adequate fire protection to properties within the Village center. A cost estimate for this work is presented in **Appendix D**.

Anecdotal evidence from operations personnel also indicates the presence of significant amounts debris and granular material within the system. Depending on the severity of this problem, this debris could affect system efficiency and flow capabilities. System-wide flushing is recommended. Costs are provided in **TABLE 9.1**.

Note: The model was run assuming this restriction has been rectified.





#### Recommendations

- Replace tee at Cedar Avenue/Hot Springs Road as soon as possible.
- Allocate Funds to flush and clean both the supply and distribution lines.

## 5.4 Water Use Data

Although the amount of water entering the VHS system is measured, and some flow meters are installed on commercial properties, no means currently exists to universally monitor distribution flows. This limits the ability of the VHS water utility to analyze water usage to determine water rates, system losses, and conservation strategies. VHS has recognized the importance of metering as a demand management tool, as evidenced in the Water Conservation Plan, and the benefits of universal metering are discussed in detail in Section 8.

#### Recommendation

• Implement a strategy and a timeline to implement Universal Metering of all properties.

#### 5.5 System Redundancy and Resiliency

Components of the system, specifically the above-ground piping, storage reservoir, beach pump station and below-to-above ground transitions are particularly vulnerable to seismic events. Resiliency of the distribution system to withstand a major disaster is also an issue. Without a fully looped system, should a break occur on one of the dead end legs, service to those properties will be disrupted until a repair can occur. Lack of electronic flow monitoring means that leaks and breaks can go undetected until visible above ground or property owners notice a reduction in flow or pressure.

There is no redundancy in the single intake, supply line and reservoir and if any one of these assets was compromised it would adversely affect the entire system.

#### Recommendation

• When planning expansions to the system and other capital works projects, system resiliency and redundancy should be a priority.

## 5.6 **Emergency Power Supply**

According to the MMCD design guidelines, standby power should be provided to allow the greater of MDD plus fire or PHD during a power outage. A generator was installed at the WTP in 2014 which will come on line automatically in the event of a power interruption. Emergency power for the beach pumps is provided by a generator on a trailer, shared by the VHS wastewater treatment facility, limiting water supply and treatment until manually brought online.

#### Recommendation

• Allocate funds for emergency power generation to be permanently located at the beach pump station, with a contingency plan in place until such time as installation occurs.

СТО



# 5.7 Electrical, Communication, and Instrumentation

VHS currently has water utility instrumentation at the beach pump station, the WTP site, and the reservoir. Efforts are currently underway to establish a Village-wide SCADA system to establish communicate between these sites. As opportunity and funding becomes available, the following improvements should be considered:

- 1. SCADA to oversee raw water pump station, WTP, reservoir with a focus on automated reporting and remote monitoring and control.
- 2. Remote access to SCADA.
- 3. Upgraded instrumentation, including analytics (turbidity specifically) and flow measurement at the beach pump station, allowing for improved detection of raw water quality and more accurate flow measurement.
- 4. Improve control panel at both the beach pump station and old chlorination facility.
- 5. Improve control and power wiring between the reservoir kiosk and the radio enclosure.
- 6. Update and collate all water utility electrical drawings.
- 7. Formalize an asset management plan for the electrical/instrumentation and communications systems.
- 8. The beach pumps currently operate outside of their design parameters (low lift to the WTP instead of high lift to the reservoir under same flow rates). Account for pump/motor replacement and VFD maintenance and repair in the next ten years.
- 9. VFDs at the WTP for power and wear reduction on the 40 HP motors and valve being used for flow restriction on the pump intake.

#### Recommendations

- Implement SCADA, electrical, and instrumentation items 1-5 (Section 5.7) as funding and opportunity allow
- Locate and digitize electrical drawings
- Formalize an Asset Management Plan for all water utility Assets
- Allocate funds for VFDs at the WTP, and maintenance costs at the beach pump station

## **5.8** Chlorine Concentration and Seasonal Flows

Until recently, VHS used chlorine alone for primary disinfection. With the commissioning of the ultrafiltration (UF) water treatment facility in 2014, chlorine is now utilized only as a secondary disinfectant. The purpose of a chlorine residual within the system is twofold:

- 1. To minimize bacterial regrowth in the distribution system with its associated taste, odour and health problems.
- 2. To provide an immediate indication of treatment process malfunction or a break in the integrity of the distribution system (evidenced by a rapid drop in disinfectant residual). (Health Canada, 2009).

Chlorine is injected downstream of the UF membranes at a concentration of 0.9 - 1.1 mg/L. Specific requirements for chlorine residual concentrations are set by regulatory authorities and vary among jurisdictions. A suggested operational range for free chlorine residual is between a





detectable level and 5 mg/L, with most Canadian municipalities in the range of 0.04 to 2.0 mg/L (Health Canada, 2009).

All field measurements of chlorine in the distribution system should be carried out at a freeflowing or flushed sampling location according to appropriate sampling procedures, in order to achieve a fresh sample that is reflective of the system water quality (Health Canada, 2009).

VHS currently samples the distribution system from a number of locations around the Village. Although these sites have been chosen well to provide chlorine residual data, they do not meet Health Canada guidelines for sampling. It is therefore recommended that new free-flowing chlorine sample points be established as per operations requirements.

#### Recommendation

• Establish new Chlorine sampling pedestals as per Health Canada Guidelines.

All communities experience variation in flow between summer and winter. VHS, however, as a resort municipality, has extreme variations due to the influx of seasonal residents and tourists in the summer months. Historic water system flow data recorded by VHS personnel can be found in **APPENDIX A**. **FIGURE 10** illustrates these extremes graphically.

In the upper chart, variation between maximum daily flow rates as high as 2,576 m<sup>3</sup> and minimum daily flow rates as low as 0 m<sup>3</sup> can be seen. Flow is measured on the supply side, and a "zero" flow rate reflects a situation where no raw water was drawn from Harrison Lake, with all demand met by water already in the reservoir that day. The lower chart reflects monthly demands in the summer months (July/Aug) three to four times the winter monthly demand (Nov/Dec/Jan/Feb).

VHS residual chlorine levels were examined under both summer and winter flows, and the chlorine decay results are illustrated in **FIGURES 4** and **5**. In **FIGURE 4**, the red lines represent the very lowest levels of residual chlorine present in the system during summer flow conditions. Chlorine is added at the water treatment plant, so low levels are expected in the supply line between Harrison Lake and the WTP. Levels in this line are of no concern, as the water undergoes treatment prior to entering the distribution system. Low chlorine levels are also evident on the "dead end" legs of the system which service hydrants only along McCombs Drive, McPherson Road, Mount Street and Chehalis Drive. Although dead ends are not ideal, until development necessitates looping the system, chlorine levels in these pipes can be maintained by a regular flushing program. Of greater concern are the orange lines along McPherson Road and a small section at the east end of Driftwood Avenue. At these locations, chlorine levels are low due to long residence time resulting from low residential demand. A regular flushing program that takes into account moving water through at these locations is an absolute necessity to ensure adequate chlorine residuals.

**FIGURE 5** illustrates the chlorine levels under winter flow conditions. In addition to the areas of concern found during the summer, sections of Hot Springs Road, Miami River Drive, Eagle Street, Naismith Avenue and the small development adjacent to Alder Avenue experience low levels. The red line along the beach is also of concern and must either be isolated from rest of the distribution system over the winter months and flushed prior to reconnection, or flushed regularly during the winter.

The manner in which chlorine levels decay over time on the McPherson Road dead leg is illustrated in **FIGURE 11** (Refer to **FIGURES 4** and **5** for junction locations). Junction J-95, at





the corner of McPherson Road and Hot Springs Roads is represented by the blue line in all 4 graphs. There is enough demand at this junction (ie - enough water usage by the surrounding properties) to maintain a chlorine concentration around 0.250 mg/L in the summer (top left graph). A little further east along McPherson Road, however, at J-226 (red line in all four graphs), lower demand results in chlorine levels of 0.100 mg/L. The east end of McPherson Road is a "dead leg". There is no demand at J-96, and the associated green line in top left graph shows how chlorine levels decrease over time as a result.

The effect of flushing on chlorine levels along McPherson Road are presented in the bottom graphs of **FIGURE 11**. The bottom left had graph illustrates the summer flushing program (every 5 days for 20 minutes). The winter flushing program increases to 30 minutes every 3 days due to low demand.

To mitigate the risk to public health associated with low chlorine residuals, a flushing program has been established for both summer and winter months for the entire distribution system and is presented in **FIGURE 12**.

#### Recommendations

- Implement winter and summer flushing program as outlined in FIGURE 12.
- Eliminate dead legs at Mount Street, Lillooet Avenue, Cedar Avenue, McCombs Drive and McPherson Road as funding allows and/or development occurs.

#### 5.9 Above ground piping

To the west of the Miami Slough, the 200 mm reservoir supply and 300 mm distribution lines are located above ground, following the shortest path between the slough bank and reservoir directly up the Agassiz Mountain rock face. The two lines, constructed separately between 20 and 30 years ago, are supported by structural steel bolted to the bedrock.

A 2014 study conducted by Elbury Consulting Ltd. (Structural Engineers) of this above-ground section yielded the following observations:

- Significant surficial corrosion of the support structures.
- Base plates completely buried in organic matter.
- Structural support members deformed due to rock fall impact.
- Significant vegetation surrounding the structures.

Photos of these concerns can be seen in FIGURE 15.

The 2012 British Columbia Building Code requires water systems to be designed as "Post-Disaster". It is expected that these systems remain functional with little or no damage after a seismic event in order to provide adequate supply for both safe drinking water and emergency fire response. Although no seismic analyses of the structures was undertaken by Elbury, it is their opinion that these support structures "would not meet current day seismic standards and it is more probable than not that the system would receive some sort of damage even after a moderate seismic event." The critical nature of these two lines necessitates prioritizing an upgrade to post disaster. Further study will need to be undertaken to determine the best option for VHS: retrofit the existing supports or relocate the existing lines to the access roadway.

The Elbury report is included as **APPENDIX E** 





#### Recommendations

- Allocate funds for an engineering study and cost estimate to determine how to upgrade or replace the above-ground piping section to meet post-disaster requirements.
- Until upgrade/replacement occurs:
  - Scrub all loose rock, debris, and vegetation from the cliff face.
  - Remove all debris and loose soil from the support bases and anchor bolts.
  - Paint the structures to protect from further corrosion.

# 6. Future Development & Demand

## 6.1 **Population Projection**

Population growth is challenging to predict for a community such as Harrison Hot Springs. VHS is heavily tourism-dependent, with a high percentage of seasonal residents. The lack of industry, combined with the single sector job opportunities, aging demographic, and relatively small population within the community mean that typical population growth models cannot be applied.

**TABLE 6.1** compares Statistics Canada population and age data for VHS and the much larger Fraser Valley Regional District.

	1986	1991	1996	2001	2006	2011	Average Annual Growth Rate
Village of Harrison Hot Springs (VHS)	569	655	898	1,343	1,573	1,468	6.3% (1986-2011) 4.2% (1996-2011)
Median Age (VHS)				43.7	49.8	54.0	
Fraser Valley Regional District (FVRD)			222,397	237,550	257,031	277,593	1.7% (1996-2011)
Median Age (FVRD)				36.6	38.2	39.6	

## TABLE 6.1 Census data

Between 1986 and 2011, the population of VHS increased an average of 6.3% per year. During the five year interval between 2006 and 2011, the population **decreased** by 6.5%. In contrast, the population of the FVRD has steadily increased since 1996, at an average of 1.7% per year, with no period of decline. The growth rate for VHS over the same time interval was 4.2% per year.

It is also worth noting that although the median age of residents in both VHS and FVRD increased in the decade between 2001 and 2011, the median age of VHS residents increased by over 10 years, whereas in the FVRD as a whole the difference was a more modest 3 years.

Because the profile of the VHS population is so distinct from FVRD, and indeed from the province of BC, projecting that population 25, 50 or even 10 years into the future is challenging. **FIGURE 13** illustrates several different population projections for VHS. The 1986-2011 census data can be seen as a heavy, bright green line, with the most recent census population (1,468)





noted at year 2011. Statistical analysis of the census data results in a linear regression illustrated by the black dotted line, with a population forecast in the year 2036 of 2,733.

The 1.7% FVRD growth rate is represented by the red dashed line. For VHS, this growth rate underestimates the current population, and does not fit the population profile. Likewise, the blue dashed line, which is based on 3.87% cumulative annual growth (based on the VHS census data between 1986 and 2011), results in a population in the year 2036 which is also out of line with the current declining population.

For resort focused communities, disposable income of people both within and outside the province has a large impact on population growth, and is strongly connected to the economy.

The average annual rate of growth between 1986 and 2011 is 6.3%, and is illustrated by the purple dashed line resulting in an estimated year 2036 population of 2367 people. Similarly, when only the data between 1996 and 2011 is examined, the 2036 population is estimated at 2,417 (orange dashed line).

So where does that leave the VHS population projection over the next two decades? In the absence of a crystal ball, and with the development community subject to highs and lows similar to those experienced over the past 25 years, it is estimated that the 2036 population will be in the range of 2,367-2,733 people. It will be important to re-evaluate this projection when the next census becomes available in 2016. A single large development, or sharp increase or decrease in the number of overnight tourist visits, could greatly impact the projected numbers.

#### Recommendation

• Re-evaluate population projections when then the next census data becomes available in 2016.

#### 6.2 **Development Projections:**

In 2014, a detailed study was conducted by the VHS Department of Development and Community Services which projects ultimate buildout densities for all land within the Village. A copy of this report is included as **APPENDIX F**.

Based on OCP land use designations, except where zoning has been amended to a Comprehensive Development Zone, maximum future development is predicted to be comprised of 15,976 m<sup>2</sup> commercial area, 1,240 potential new redevelopment units, and 45 units of residential infill (construction on vacant lots).

**FIGURE 6** shows the Development Projection areas, as well as a breakdown of the type of development anticipated in each area.

#### 6.3 Demand Projections

As outlined in Section 4, average daily demand (ADD) for summer and winter was modeled in WATERGEMS<sup>™</sup> utilizing a combination of meter data and demand estimates based on OCP land usage for each property within the Village. Maximum Daily Demand (MDD) and Peak Hourly Demand (PHD) were calculated based on ADD. Water demand calculations for current and future scenarios are presented in detail in **FIGURES 7, 8 and 9** and summarized in **TABLE 6.2**.



## TABLE 6.2 System Demands

		ADD L/sec	MDD L/sec	PHD L/sec	System Capacity* L/sec
2014	Existing System	13.4	26.7	40.1	176.7
п	2014 PLUS Unserviced Properties	25	50	75	200
FUTURE	Full Development	46	92	138	288
m	Full Development PLUS Resort	50.4	100.8	151.2	250.8

\*System Capacity is the greater of MDD + Fire Flow (max 150L/sec for VHS) or PHD

Calculating the 2014 existing system demand is relatively straightforward, and is validated by measurable historical data. Three future scenarios were also investigated:

#### 1. 2014 Demand Plus Unserviced Properties

Servicing all properties within VHS boundaries. Approximately 54% of the population is currently served by the VHS water utility, with the other 46% served by private systems.

#### 2. Full Development:

Servicing all properties within VHS boundaries developed to their full potential as per OCP zoning.

#### 3. Full Development plus Resort:

All demand required for Scenario #2, with the very significant addition of the Harrison Hot Springs Resort & Spa (HRS). Please refer to Section 2 for a detailed discussion regarding the impact of HRS connection.

The most challenging aspect of predicting demand is estimating population and development growth rates. For this analysis, we have assumed that:

- VHS will have a goal of servicing all properties within a finite time frame either 10 years or 25 years (Scenario #1 above).
- development will take place in pace with a linear population growth rate between 6.3% and 7.3%, measured from 1986 levels (that translates into the addition of 36-43 people per year or a 2.45%-2.9% linear annual increase over 2011 levels). These ranges were discussed in greater detail in Section 6.1. It is imperative that growth rates be re-evaluated when the 2016 census becomes available, especially in light of the decline in population experienced between 2006 and 2011.

#### Recommendations

- Re-evaluate population growth rate assumptions when the 2016 census data becomes available
- Establish a plan to provide service to all properties within VHS within 10 or 25 years
- Allocate funds for a minor Water Master Plan update in 2017 to incorporate 2016 census data



# 6.4 Impact of Incremental Development:

**TABLE 6.3** has been developed to "put numbers" to the impact that specific future development projects could have on the water system. The concept of Single Family Equivalent (SFE) has been used, allowing for a direct comparison of residential and commercial units for demand and storage requirements. It can be seen from the table that a 40-unit condo development has less of an impact on the system than 40 detached housing lots (single family subdivision).

**Table 6.3** illustrates that commercial development of the size likely to occur in VHS will have minimal impact on the system. Residential development in the form of single or multi-family developments will have significantly more impact.

	Number Units	SFE	ADD L/sec	MDD L/sec	PHD L/sec	Storage m <sup>3</sup>
Single Family Subdivision	40	40	0.80	1.60	2.40	78.40
Multi Family	40	26.7	0.53	1.07	1.60	52.27
Campground Site	40	26.7	0.53	1.07	1.60	52.27
Commercial (C-4) 300 m <sup>2</sup>	N/A	0.9	0.02	0.04	0.05	1.76
Commercial (C-5) 300 m <sup>2</sup>	N/A	1	0.02	0.04	0.06	1.96
Commercial (Other) 300 m <sup>2</sup>	N/A	2	0.04	0.08	0.12	3.92

#### **TABLE 6.3 SFE Demands - Future Development**



# 7. Future System Analysis

# 7.1 Water Supply

VHS licensing allows for a withdrawal of 454,609 m<sup>3</sup> of water per year from Harrison Lake. The maximum annual withdrawal between 2007 and 2013 was 270,861 m<sup>3</sup> - nearly 60% of the maximum allowable limit. **TABLE 6.2** gives an indication of how demand is predicted to increase over time. When all VHS properties are serviced, 2014 demands are predicted to nearly double, which will necessitate either an amendment to the existing license, or development of an additional water source.

#### Recommendation

• Timely application for water license amendment as demand increases

# 7.2 Linear Assets

The National Water and Wastewater Benchmarking Initiative has developed excel-based templates for the assessment of water utility assets available on their website free of charge. The templates were used for a high-level evaluation of the VHS linear assets. Based on service life of 80 years, it is estimated that annual replacement costs for the VHS distribution pipelines will average approximately \$3,000/year for the next 25 years, and \$53,000/year over the next 100. These numbers reflect only the design life span of the pipes based on pipe material. The numbers do not take into account unknown or unforeseen circumstances such as installation conditions, accidental impact or manufacturing defects, but do give an idea of the health and relatively young age of the system. Results of this analysis are presented graphically in **FIGURE 14**. Unlike municipalities with lines that have been in service 50 or even 100 years, VHS has no "backlog" of lines operating beyond the designed service life, and in fact should not require major expenditure in this area due to "normal wear and tear" for decades.

#### Recommendation

• Contribute funds annually to a reserve for both the eventual and unexpected replacement of underground water utility assets.

# 7.3 Distribution and Fire Flow Capacity

There are three scenarios requiring upgrades to the VHS distribution system:

- 1. Analysis of the existing system indicates deficiencies in fire flow capability due to pipe size and hydrant location.
- 2. Additional piping is also necessary to service and provide fire flow and hydrant coverage to properties currently on private well systems.
- 3. Full development, as outlined in the development projections presented in **Appendix F** necessitates additional upgrades.

Future piping and hydrant requirements for #1 and #2 above are illustrated in **FIGURE 3**. **FIGURE 6** depicts the future system at full development (#3 above). **TABLE 7.1** summarizes

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the projects to be completed to achieve full service and fire flow capacity to all VHS properties. Detailed cost estimates and location plans are presented in **APPENDIX D**.

TABLE 7.1 Distribution Improvements for Full Service (	(Including Fire Flow)
--	-----------------------

Project	Description	Purpose	Scenario	Cost	DCC Eligible?
Hot Springs Road 'A'	Upgrade 375 m of watermain to meet commercial fire flow requirements	Provide fire flow for existing development	1	\$377,825	PARTIAL
Hot Springs Road 'B'	Upgrade 125 m of watermain to meet commercial fire flow requirements	Provide fire flow for future development	2 and 3	\$225,450	PARTIAL
Village Center Loop	Add 250 mm of watermain to Lillooet/Cedar	Provide service and hydrant protection to properties on wells	1 and 2	\$173,600	PARTIAL
Lakeshore Residential	Add 605 m of watermain to Lillooet (east) and Bear	Provide service and hydrant protection to properties on wells	1 and 2	\$426,640	PARTIAL
Naismith and Mount	Add 595 m of watermain to Naismith and Mount	Provide service and hydrant protection to properties on wells	1 and 2	\$341,640	NO
Emerald and Diamond	Add 350 m of watermain to Emerald and Diamond	Provide service and hydrant protection to properties on wells	1 and 2	\$206,880	NO
Angus Estates	Add 875 m of watermain to Angus Estates subdivision	Provide service and hydrant protection to properties on wells	1 and 2	\$555,600	NO
Pine and Lakberg	Add 490 m of watermain to Pine and Lakberg	Provide service and hydrant protection to properties on wells	1 and 2	\$230,160	NO
Marine Tourism 'A"*	Add 610 m of watermain to Rockwell	Provide service and hydrant protection to properties on wells	1 and 2	¢510.095	YES
Marine Tourism 'B'*		Provide fire flow for future development	3	- \$512,985	
Water Services**	Add 57 service connections	Connect all existing fronted properties	1 and 2	\$299,250	NO
Water Hydrants**	Add 5 hydrants	Add hydrants to existing fronted properties	1	\$63,000	NO
System Flushing	Improve system performance by flushing and/or pigging 15 km of pipe	Clean debris from system	1	\$75,000+	NO
Sampling Pedestals	Install 6-10 Heath Canada compliant sampling locations	Construct compliant sampling locations	1	\$60,000	NO

Total: 3,548,030

\* Marine Tourism A and B projects have been combined \*\* Water Services and Water Hydrants have been combined into one project for cost estimating, and separated here for illustrative purposes



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Analysis of the future scenarios under fire flow conditions yield residual pressures within acceptable range (with all lines constructed) but the full buildout scenario (#3) results in high velocities throughout the system. These future scenarios will necessitate many changes to the system, including storage, treatment and pumping capacity which will alter these model results. Detailed data is available in **APPENDIX C**.

#### Recommendations

- Determine the feasibility of constructing new watermains to service existing properties.
- Ensure that new developments and OCP amendments are analyzed using the VHS water model prior to final approval.

## 7.4 Pumping Capacity

VHS has two pumping stations, with pumps of similar capacity operating at each. There are three 40 HP pumps at the beach pump station, and two 40 HP pumps at the WTP with room for a third to be installed as flow rates increase. Both pumping stations are designed for one or two pumps to run, depending on demand, with a third as a "backup".

**FIGURE 17** shows the pumping capacity of the 40 HP pumps at both the beach (top) and WTP (bottom) graphically.

A cautionary note is in order when considering the beach pumps **FIGURE 17**. From data collected during a 2013 field flow test (prior to the commissioning of the new WTP), the VFD-controlled beach pumps were individually capable of approximately 25 L/sec. Two pumps resulted in a flow of 38L/sec, and three pumps 44L/sec. Looking at the system pump curve in **FIGURE 17**, the theoretical capacity of any one of the beach pumps is approximately 39.5 L/sec, and two pumps should be able to produce flows of 67.5 L/sec. In other words, two pumps operating in parallel should be capable of producing flows 50% greater than what the field test indicates. It is unclear whether the lower-than-expected flows have to do with pump condition, control logic, or some sort of flow restriction downstream of the pump station. Adding to this uncertainty, the addition of the WTP necessitated a change in control logic to operate the beach pumps at a much lower pressure. This means that the beach pumps are no longer operating under the conditions for which they were originally selected, and could translate into increased wear and maintenance issues over time. Further investigation is necessary to determine the "true" capacity of these pumps and allocate funds for any necessary improvements to the beach pump station.

A Hazen-Williams analysis of the WTP system curve indicates that a single WTP pump is capable of 34 L/sec, and two pumps operating will result in a flow of 66 L/sec. Provision has been made for a third, redundant pump to be added as flow rates increase. In general, pumping capacity should meet maximum day demand (MDD) with largest pump out of service and balancing storage online. MDD for the various flow scenarios are presented in **TABLE 6.2**. As MDD reaches the 34 L/sec level, the third pump at the WTP should be budgeted for. Once MDD demand exceeds 66 L/sec, additional pumping and treatment capacity will be required.





#### **Recommendations**

- Allocate funds for the addition of the third pump at the WTP as demand increases.
- Commission an engineering study to investigate the flow capabilities of the two pump stations with the following focus:
  - investigate the impact of the current operating conditions of the beach pumps (low pressure, high flow vs. high pressure, high flow as originally designed).
  - determine the pumping capacity of both the beach pump station and the system as a whole, including redundancy.
  - perform a cost vs. benefit analysis for the addition of VFD control on the pumps at the WTP.
  - make recommendations for changes to the system if required.

## 7.5 Treatment Capacity

The VHS Ultrafiltration (UF) Membrane System is set for a nominal flow rate of approximately 31.5 L/sec with the expansion capability to bring the total flow up to 63 L/sec. Expansion of the system over time will be accomplished by the addition of membrane pairs and one 40-HP pump as demand increases with connection and/or development. Pumping capacity was discussed in Section 7.4.

Membranes can be added in pairs as needed as MDD exceeds 31.5L/sec, with each pair designed to provide just under 3 L/sec of additional treatment capacity.

A cost estimate for the completion of this work has been provided in **APPENDIX D**.

#### Recommendations

- Allocate funds for the addition of membranes to existing system as demand increases beyond 31.5 L/sec.
- Allocate funds for the design and construction of a second treatment facility as demand increases beyond 63 L/sec.





### 7.6 Storage Capacity

**TABLE 7.2** provides a snapshot of the ability of the existing 2,745 m<sup>3</sup> reservoir to meet storage needs as demand increases over time. The impact of adding the HRS on to the system is also illustrated. The far right column indicates the amount of excess (in black) or deficit (in red) storage under the various development scenarios. VHS will have to add storage as development occurs. When ADD reaches 25 L/sec, less than 2% excess storage capacity will remain, and additional storage will be required. Options to meet future requirements may include recommissioning the existing concrete reservoirs (currently out of service), adding the HRS reservoir to the system, or construction of a new storage facility.

TABLE 7.2 Storage Requirements - E	Existing and Future (M <sup>3</sup> )
------------------------------------	---------------------------------------

		ADD L/sec	Fire Storage	Equalization Storage	Emergency Storage	Total Storage	Existing Storage	EXCESS DEFICIT
2014	Existing System	13.4	1,080	577	414	2,071	2,745	674
_	2014 PLUS Unserviced Properties	25	1,080	1,080	540	2,700	2,745	45
FUTUR	Full Development	46	1,080	1,987	767	3,834	2,745	-1,089
т	Full Development PLUS Resort	50.4	1,080	2,177	814	4,072	2,745	-1,327

all storage values in m<sup>3</sup>

**FIGURE 16** attempts to quantify demand growth over time, with several very significant assumptions:

- Population increases in a linear fashion over time as outlined in Section 6.1.
- connection of unserviced properties to the utility occurs linearly and completely over 10 or 25 years, and
- Development and tourism are linearly correlated with population growth, allowing for a "per capita" estimate of total VHS water usage.

The purpose of **FIGURE 16** is to illustrate visually the limited capacity of the existing reservoir to meet increasing demand, and the numbers presented should not be utilized as the basis for future design without further analysis.

In **FIGURE 16**, the solid black line shows the estimated current population serviced by the water utility. The red line shows the "maximum" population that can be served by the reservoir. The blue lines, referred to as "Scenario #1" represent connection of properties currently unserviced (meaning domestic water is supplied by private wells) at a constant rate over the next 10 years (dashed) or 25 years (solid). The green lines add the most modest population growth figures





from Section 6.1 to the Scenario #1 blue lines. The green diamond shaped markers correspond to the years (2021 and 2026) that the population is predicted to first exceed the storage capacity for the green line scenarios if the assumptions are accurate. This is only 6 -11 years from the time of writing.

It is important to note here that ADD has been determined for both "summer" and "winter" flows due to the extreme seasonal variation in the Village. Because a 12-month ADD is generally used as the basis for reservoir sizing, there is a degree of conservatism in the winter months but summer conditions are better reflected.

The 2016 census will allow for fine-tuning of the population projections, and as demandreduction strategies are put in place, a timeline can be established for the design and construction of additional storage.

#### Recommendations

- Undertake preliminary engineering study be to investigate options for increased storage.
- Monitor population and water usage to establish a timeline to add reservoir capacity.
- Implement demand reduction strategies in order to delay the necessity of adding storage capacity and addition of the third pump at the WTP as demand increases.



## 8. Demand Management

Within this report, most of the discussion regarding the limitations of the VHS water utility is presented in terms of "demand" rather than "timing". Statements such as "when ADD reaches 63 L/sec..." have been utilized as opposed to "in the year 2025...." The reason for this is twofold. First, the difficulty of predicting demand over time for a municipality such as VHS was discussed in Section 6.1. Small size, high seasonal variation due to tourism, census data indicating a declining population (and lack of correlation between VHS and larger-scale FVRD or BC statistical trends), and limited geographical area available for development all make forecasting growth over time challenging. Second, VHS must balance the need for infrastructure investment with a very limited annual budget. The Village often has to strategically pursue alternate funding sources such as grant programs and development fees in order to expand infrastructure - because the money is simply not available in general revenue.

Demand should be monitored over time, using flow data which is already collected by operations personnel. At the end of the year, if demand has increased from the year before, a simple analysis can be performed (Was it an exceptionally "dry" year? Was the environment for development better than in years past? Were new conservation measures put in place?) and demand forecasts adjusted accordingly.

The main reason that demand has been utilized rather than timing is because VHS has opportunities to limit (and even reduce) demand through policy changes which can decrease per capita water consumption. **Demand management**, incorporating water efficient applications, is a comparatively low cost, effective way to get more service out of existing systems, thus delaying or deferring the need to construct new works.

The wide range of water efficiency initiatives currently being undertaken by Canadian municipalities can be grouped under four principal categories (Environment Canada, 2013):

Structural	Operational	Economic	Socio-political
metering	leak detection and	rate structures	public education
metering water recycling systems wastewater re-use flow control devices distribution system pressure reduction water saving devices (efficient fixtures, appliances and retrofits) drought resistant landscaping (xeriscaping) efficient sprinkling/irrigation	leak detection and repair water use restrictions elimination of combined sanitary/storm sewers to reduce loadings on sewage treatment plants plant improvements	rate structures pricing policies incentives through rebates and tax credits other sanctions (fines)	public education information transfer and training regulatory (legislation, codes, standards, by-laws)
technology new process technologies			
plant improvements			

#### TABLE 8.1 Efficiency Initiatives





With the dual priorities of fiscal responsibility and sustainability in mind, there are many ways VHS can decrease demand and potentially delay the need for major improvements to the system, in spite of increasing development and population.

#### 8.1 Quantify Water Usage

In 2012, the BC Water & Waste Association released a comprehensive position paper on metering, advocating that every water utility should actively work towards accurately metering all water taken into its system and all water distributed from its system at its customers' point of service. A cost estimate has been prepared and is included in **APPENDIX D**.

# Excerpt from BCWWA position paper on metering:

Why should a water utility implement a metering program? If metering is tied to an ongoing outreach program, data analysis and conservation-oriented water pricing, then it can provide substantial benefits to a water utility. The benefits of metering fall into three broad categories: operational or system management benefits, water conservation benefits, and benefits to water consumers. Combined, these benefits support triple-bottom line decision-making (balancing social, economic and environmental considerations), long-term system planning and the building of more sustainable and resilient communities.

## 1. Metering programs can improve operational efficiencies, facility planning and evaluation of conservation measures

Metering provides critical data on how much water is flowing at different locations, allowing water managers to more accurately monitor water within their systems. A well-managed metering program that includes comprehensive data analysis can significantly contribute to infrastructure deferral, and the management and mitigation of rising costs of service provision. With metering, data water managers can: identify opportunities to improve efficiency; plan facilities to meet actual water consumption needs, thereby reducing the costs associated with over-sized infrastructure; and assess conservation measures to improve them over time.

## 2. Assists utilities to find and fix leaks, thereby reducing costs for water treatment and distribution of lost water

AWWA cautions that water utilities that do not provide meters to their customers run the risk of losing track of large volumes of water (2012). Since water losses are estimated on unmetered systems and real water losses may be considerably higher, it is important to recognize that high "water loss may have significant short-term operating costs and long-term sustainability issues that may affect the ability of the water utility to meet the long-term water requirements of the community" (FCM & NRC 2003b). A water loss control program that integrates metering at the treatment plant, zone or district metering (of neighborhoods, building complexes, etc.) and end-use metering can substantially reduce leakage (ibid; Brandes, Maas, Reynolds 2006); saving a utility money through reduced operational costs and potential infrastructure deferral.

#### 3. Meters with backflow detection can help to protect public health

Meters are available with backflow detection and alarming capabilities, making it possible to integrate meters into a more comprehensive backflow prevention program.





## 4. Allows for volume-based pricing of water services, which can support water conservation programs

The implementation of water metering programs coupled with volume-based pricing typically results in reduction of consumption by 15-30% (FCM & NRC 2003). The scale of savings varies across user types and is determined in part by the pricing structures put into effect and the commitment of a utility to reduced consumption. While residential users may save water through installation of low flow fixtures and reduced outdoor watering, agricultural water savings depend on irrigation system efficiency and the minimum water requirements of crops.

Water conservation benefits associated with successful metering programs:

- 1. Lower water usage results in lower energy consumption, reducing a utility's costs and energy footprint.
- 2. Lower water usage results in less wastewater to be collected and treated, creating cost savings and environmental benefits.
- 3. Can be used as a tool for drought management.
- 4. Reclaims water for future growth.

Consumer benefits:

- 1. Can help to ensure fair and equitable pricing within categories of water users.
- 2. Charging for metered volumes of water gives some consumers the ability to change their water costs through water conservation.
- 3. Meters create feedback loops to consumers, raising public awareness about water usage.

#### Recommendation

• Develop and implement a Universal Metering Program by 2020.

#### 8.2 Conserve and Reduce

Once demand is quantified through metering, an accurate picture of how water is used and lost can be determined, along with how best to conserve and reduce water usage. **TABLE 8.2** looks at a community water balance in terms of Revenue vs. Non-Revenue consumption and losses.

		Billed Authorized	Billed Metered Consumption	Revenue	
System Input	Authorized Consumption	Consumption	Billed Unmetered Consumption	Water	
		Unbilled Authorized	Unbilled Metered Consumption		
		Consumption	Unbilled Unmetered Consumption		
Volume	Water Losses	Apparent Lossos	Unauthorized Consumption	Non-	
		Apparent Losses	Customer Meter Inaccuracies	Revenue Water	
			Leakage on Transmission & Distribution Mains		
		Real Losses	Leakage & Overflows at Reservoirs		
			Leakage on Service Connections up to Metering Point		

TABLE 8.2 Revenue vs. Non-revenue Water (International Water Association)





Only the blue boxes in **TABLE 8.2** are quantified in VHS. The volume of water in green, otherwise known as the "non-revenue water", is currently not measured. According to Environment Canada's 2011 Municipal Water Use Report, across Canada an average of 13.3% of water is lost from distribution systems before reaching consumers. Between provinces, the percent of water lost through leaks and system maintenance varies from a low of 7.5% in Newfoundland and Labrador to a high of 22.1% in Quebec. Water losses are related to a number of issues, including the condition of distribution infrastructure and level of pressure maintained in the distribution system. Mitigating these losses where possible, as well as analyzing the unbilled authorized consumption, is an important part of reducing overall water demand.

The benefits of water conservation were discussed in the context of metering were discussed in Section 8.1. In 2011, VHS adopted a Water Conservation Plan which includes many of the initiatives outlined in **TABLE 8.1**. It is recommended that this plan be reviewed and updated to determine which of the initiatives have been adopted over the past three years, determine the success of those programs in meeting the stated goals of the plan, update the time horizons, and prioritize implementation of some of the more costly items such as a metering and a leak detection program. The VHS Water Conservation Plan has been included as **APPENDIX G**.

Beyond the scope of this document, it is also recommended that water conservation measures be quantified by undertaking a Water Conservation Study (utilizing readily available and costeffective tools such as the web-based Water Conservation Calculator, available as part of the BC Climate Action Toolkit) in order to focus conservation efforts and get the biggest conservation "bang" for any funds allocated.

#### Recommendations

- Review and update VHS Water Conservation Plan in 2015.
- Quantify water conservation measures by commissioning a water conservation study in accordance with AWWA Manual M36 Water Audits and Loss Control Programs as funds are available.
- Implement demand reduction strategies in order to delay the necessity of adding storage capacity and addition of the third pump at the WTP as demand increases.



## 9. Capital Works Plan and Cost Estimates

## 9.1 Improvements

**TABLE 9.1** identifies and quantifies the capital improvements identified as part of this Water Master Plan. Upgrades to storage, pumping, and treatment will be required as demand increases. Pricing and timing will depend on demand management strategies, preliminary design, and the ability to secure funding. Refer to the relevant sections for discussion and recommendations.

Project	Purpose	Cost	DCC Eligible?	Priority
Above-Ground Supply/Distribution	Repair/replace above ground piping section	TBD (Jun 2015)		
Hot Springs Road 'A'	Provide fire flow for existing development	\$377,825	PARTIAL	
Hot Springs Road 'B'	Provide fire flow for future development	\$225,450	PARTIAL	
Village Center Loop	Provide service and hydrant protection to properties on wells	\$173,600	PARTIAL	
Lakeshore Residential	Provide service and hydrant protection to properties on wells	\$426,640	PARTIAL	
Naismith and Mount	Provide service and hydrant protection to properties on wells	\$341,640	NO	
Emerald and Diamond	Provide service and hydrant protection to properties on wells	\$206,880	NO	
Angus Estates	Provide service and hydrant protection to properties on wells	\$555,600	NO	
Pine and Lakberg	Provide service and hydrant protection to properties on wells	\$230,160	NO	
Marine Tourism 'A"*	Provide service and hydrant protection to properties on wells	\$512,985	YES	
Marine Tourism 'B'*	Provide fire flow for future development	ψ <b>012,30</b> 0	TES	
Water Services	Connect all existing fronted properties	\$299,250	NO	
Water Hydrants	Add hydrants to existing fronted properties	\$63,000	NO	
Tee Replacement	Replace damaged tee at Cedar & Hot Springs	\$26,250	NO	
Water Treatment Capacity Increase	Add Capacity to WTP as demand increases	\$224,000	PARTIAL	
Universal Metering	Meter all existing (2014) serviced properties	\$695,723	NO	
System Flushing	Clean debris from system	\$75,000+	NO	
Sampling Pedestals	Construct compliant sampling locations	\$60,000	NO	

#### TABLE 9.1 Capital Improvements





Utility revenue sources available to VHS include:

- Water Utility Rates
- Development Cost Charges (DCC)
- Developer Funding
- Grants
- Taxes
- Public Private Partnerships (P3)

It is important to examine each capital project in terms of the applicable revenue source(s). For a municipality such as VHS, where there is no industrial base and costs are shouldered by a relatively small commercial and residential population, identifying and pursuing grant funding from higher levels of government is a necessity.

The VHS water utility has undergone numerous improvements over the past 5 years, including a new treatment plant and reservoir; upgrades to the beach pump station and communications system. In addition, underground assets are less than 30 years old. Funds should be placed in reserves annually for eventual replacement of these newer components, but over the next 25 years capital asset renewal will not be the main focus.

## 9.2 Cost Estimates

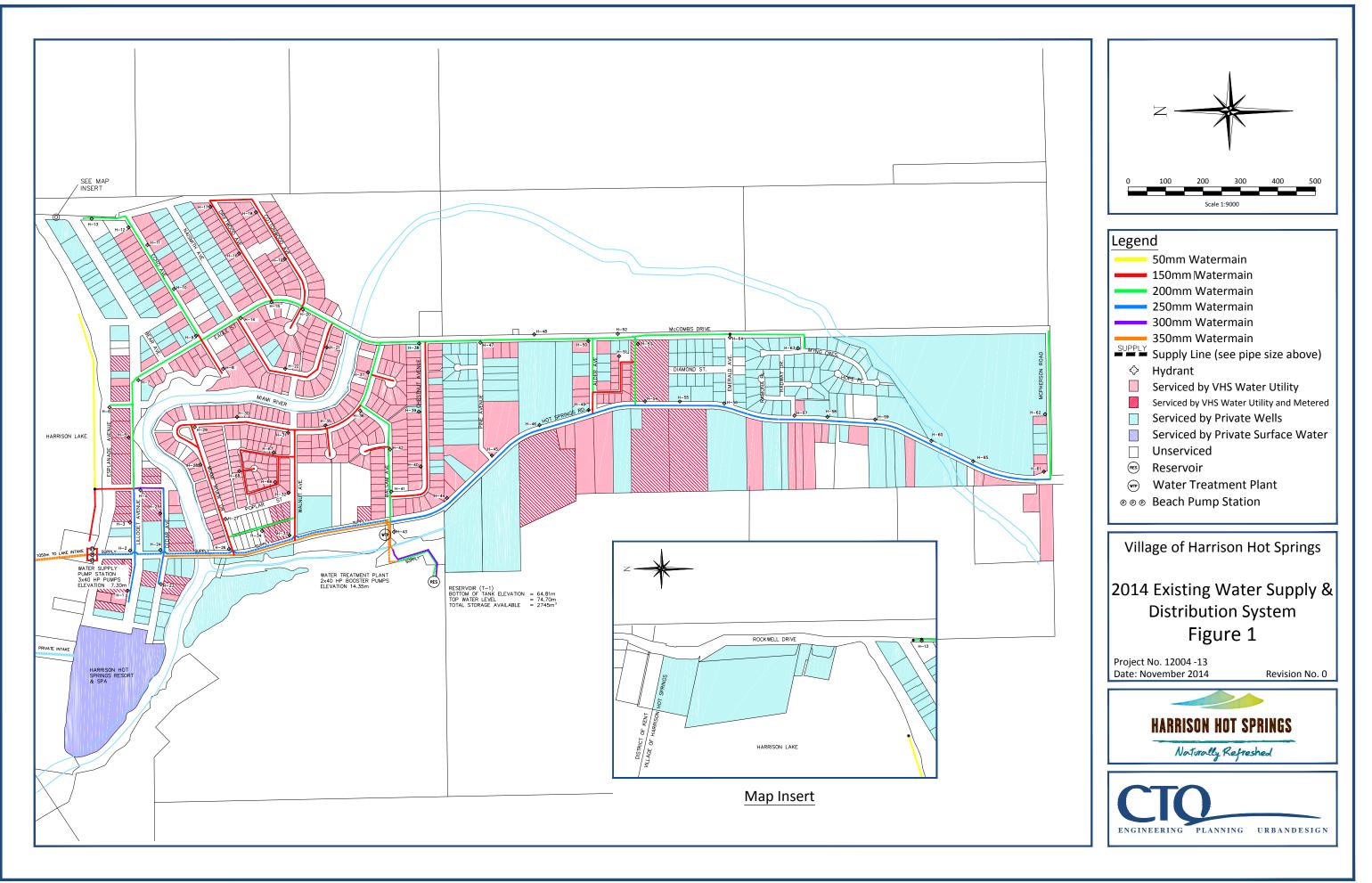
Detailed project cost estimates are presented in APPENDIX D.

## **10. Recommendations**

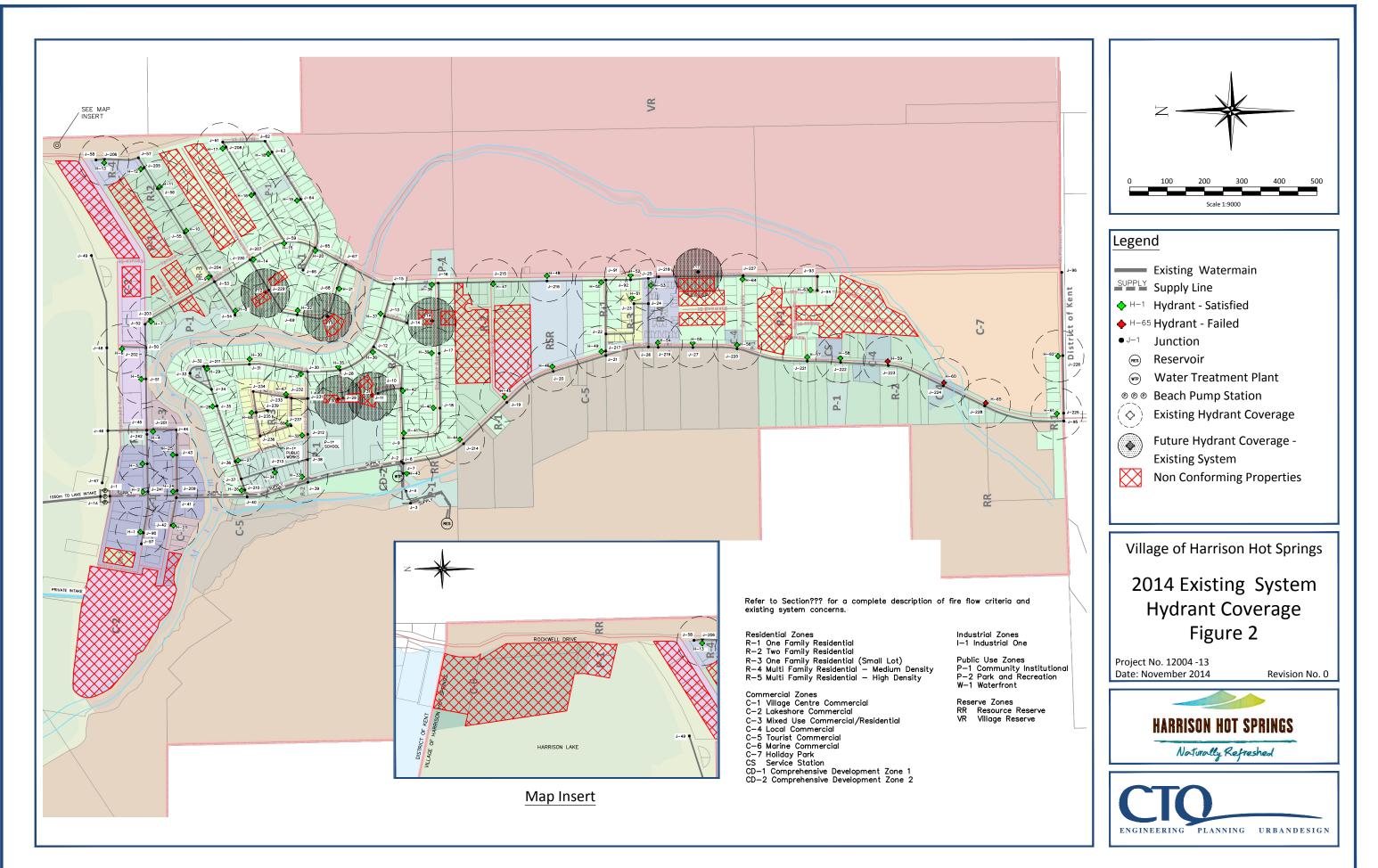
Recommendations are summarized in Figure 18.

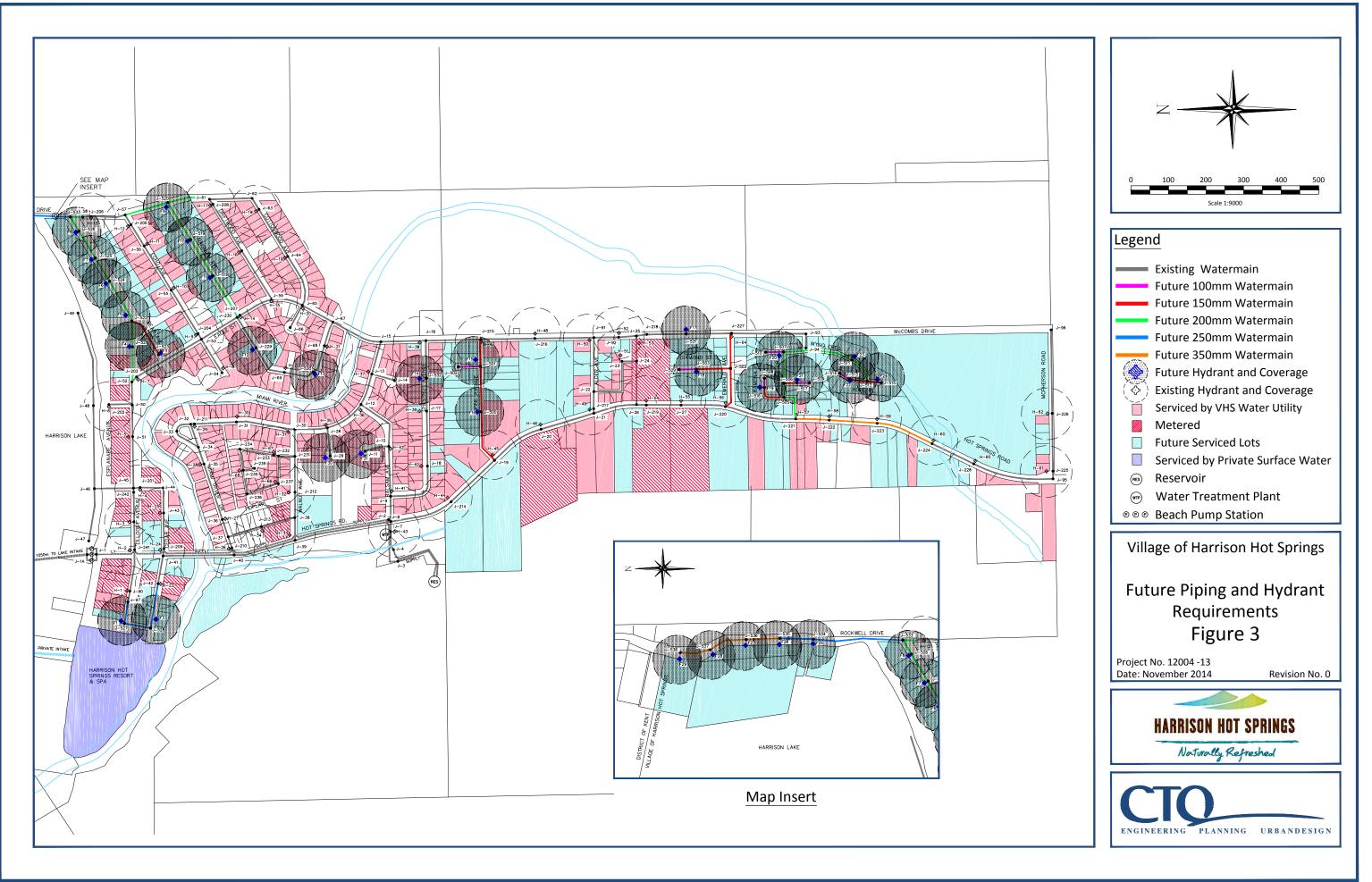
## **11. Figures**

Figures 1 through 18 are included on the following pages.

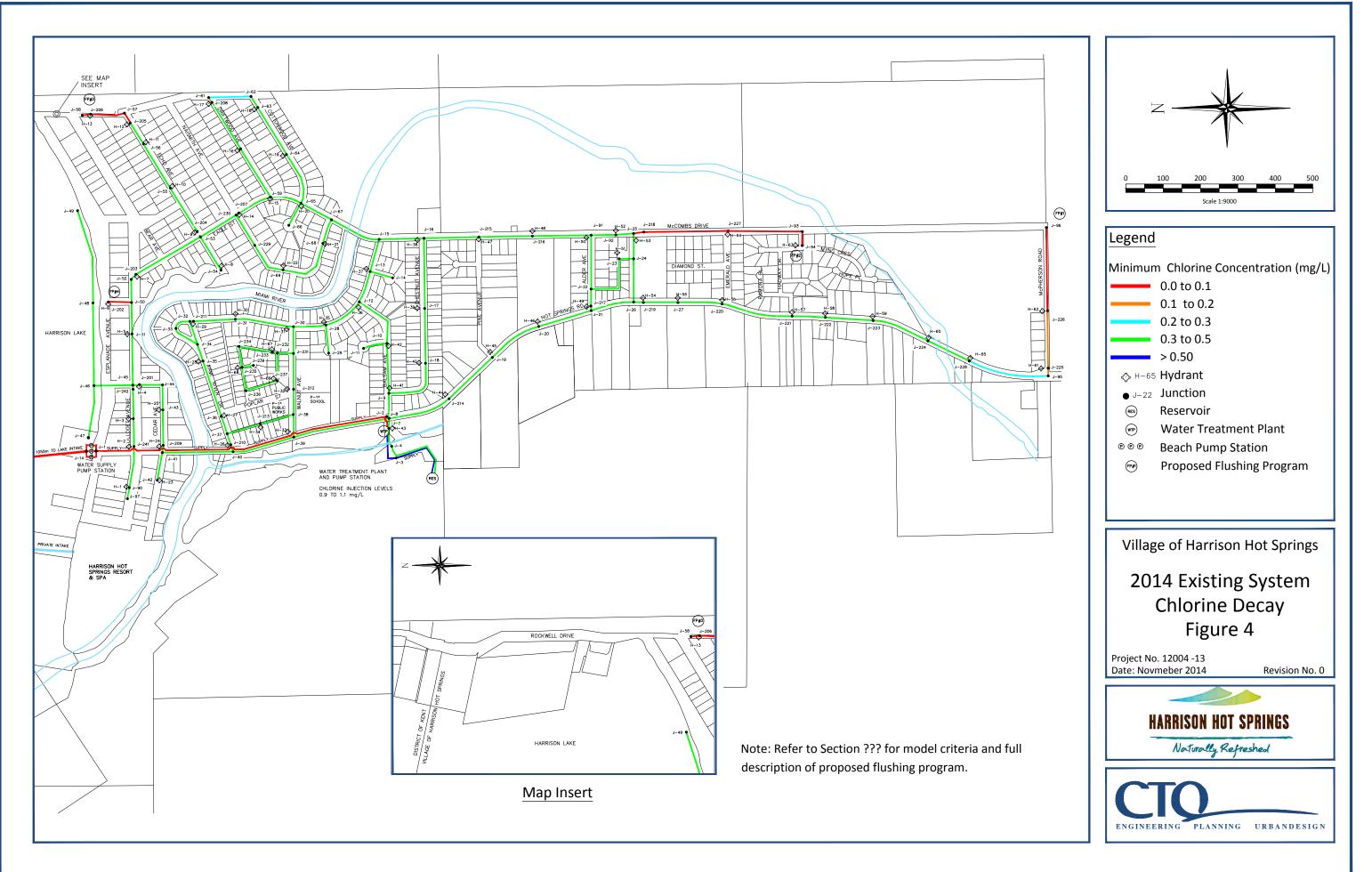


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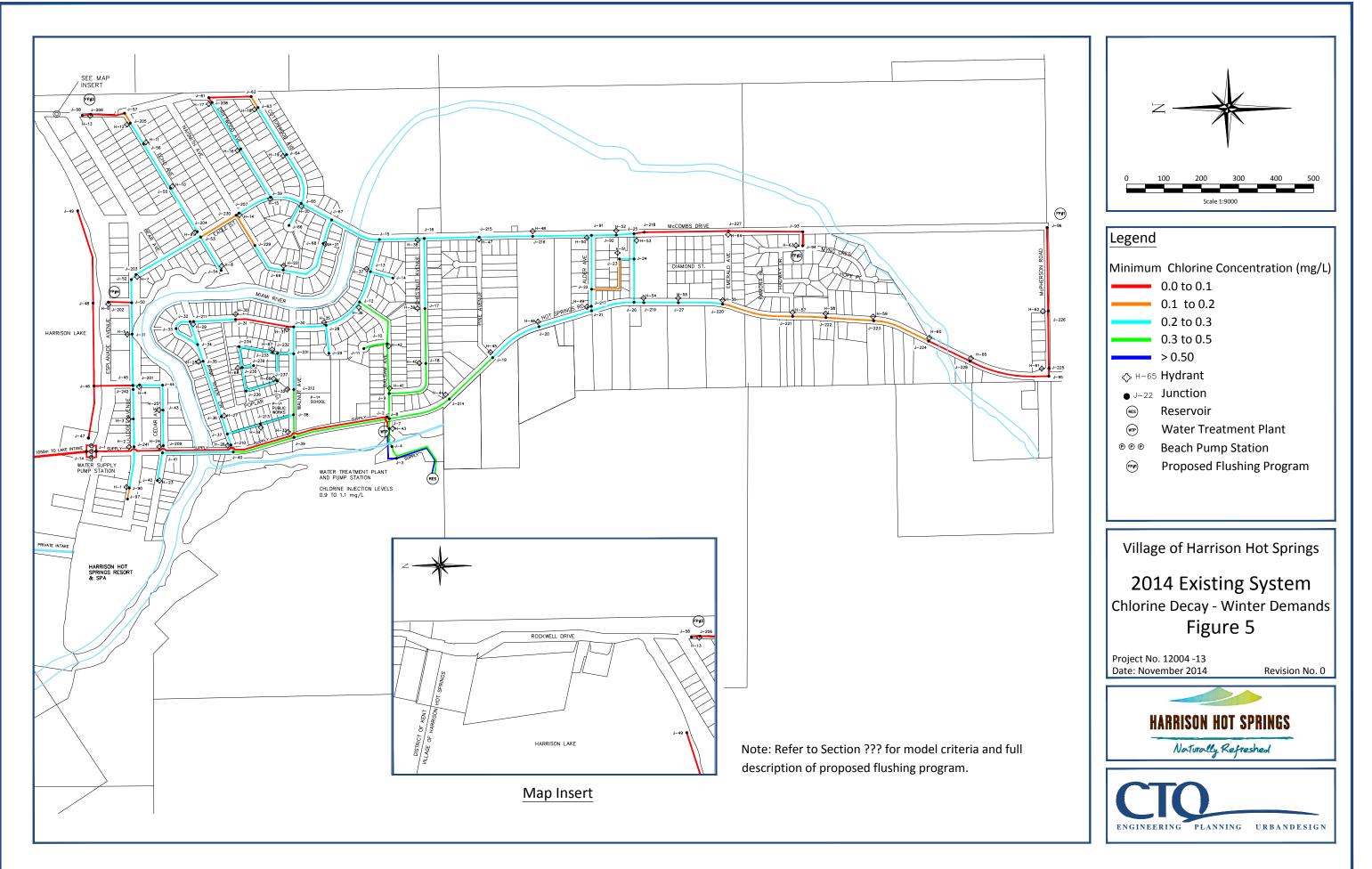




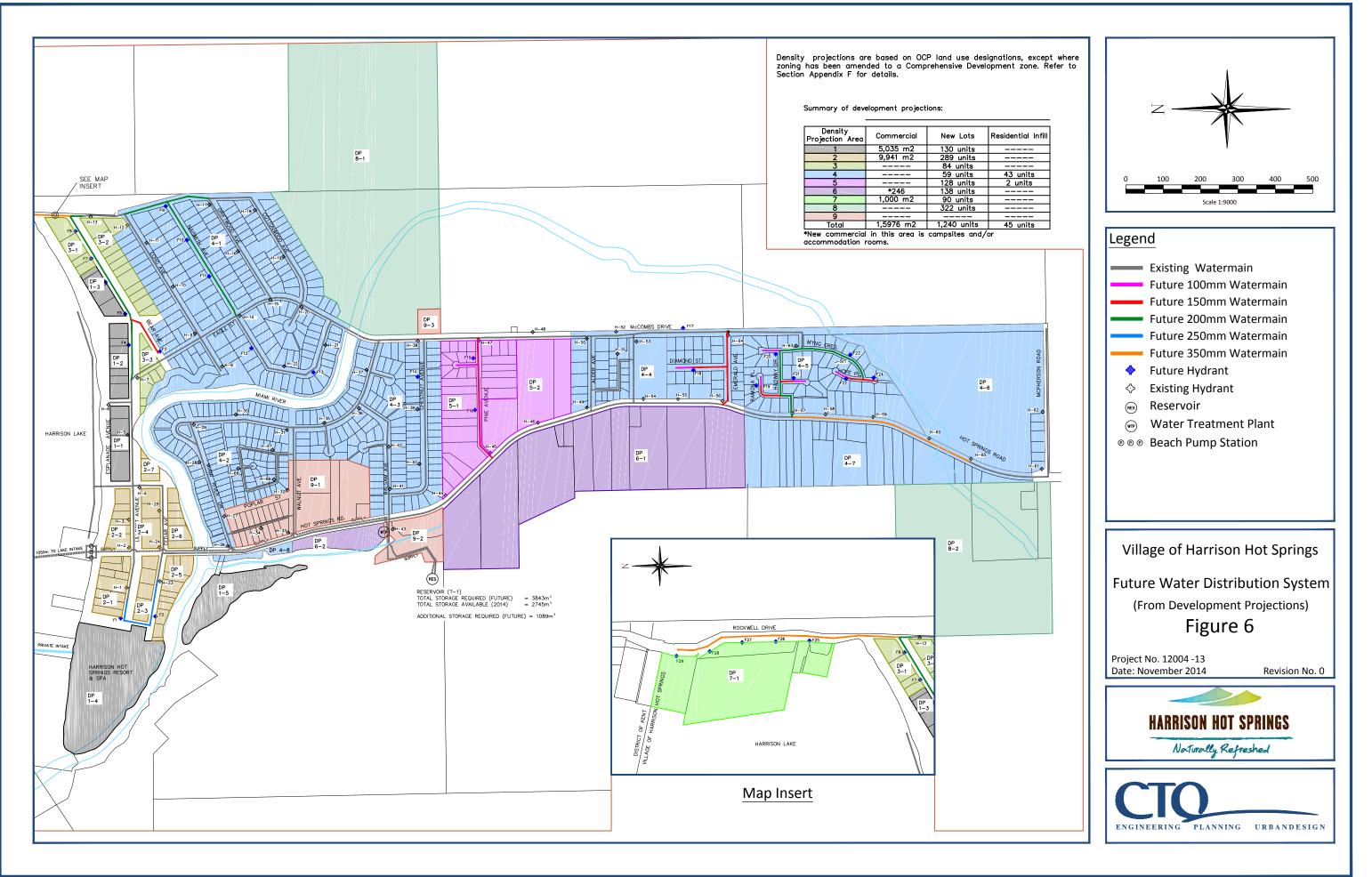
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1 Average Daily Demand (Model) Average Daily Demand, ADD =	<b>13.4</b> LPS <b>1153786</b> L/day
2 Maximum Daily Demand = 2.0 X ADD Maximum Daily Demand, MDD =	26.7 LPS 2307571 L/day
<b>3 Peak Hourly Demand =</b> 1.5 X MDD Peak Hourly Demand, PHD =	40.1 LPS 3461357 L/day
<ul> <li>Fire Storage, A = (Fireflow) * (Duration of fireflow)</li> <li>Fireflow, FF =</li> <li>Fireflow Duration =</li> <li>Fireflow Storage, A =</li> <li>Fireflow Storage, A =</li> </ul>	$ \begin{array}{c} 150 & LPS \\ \hline 2.0 & hrs \\ 1080000 & L \\ \hline 1080 & m^3 \end{array} $
<ul> <li>5 Equalization Storage, B = (25% of Maximum Daily Demand)</li> <li>25% of MDD =</li> <li>Equalization Storage, B =</li> </ul>	<b>576893</b> L <b>577</b> m <sup>3</sup>
6 Emergency Storage, C = (25% of A + B) 25% of A + B Emergency Storage, C =	<b>414223</b> L <b>414</b> m <sup>3</sup>
7 Total Reservoir Storage Requirement = A + B + C Reservoir Storage = Reservoir Storage =	<b>2071116</b> L <b>2071</b> m <sup>3</sup>
8 System Capacity = The greater of PHD or MDD + FF Peak Hourly Demand, PHD = Maximum Daily Demand + Fireflow, MDD + FF =	<u>40</u> LPS <u>177</u> LPS
9 Total Storage Available in Existing Reservoir	
Existing Total Storage = Volume Required = Additonal Storage Available =	$\begin{array}{c} 2745 & m^3 \\ \hline 2071 & m^3 \\ \hline 674 & m^3 \end{array}$
% percentage	

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FIGURE 7: 2014 Existing System Water Demand and Storage Requirements

1 Average Daily Demand (Model) Average Daily Demand, ADD =	<b>25.0</b> LPS <b>2160000</b> L/day
2 Maximum Daily Demand = 2.0 X ADD Maximum Daily Demand, MDD =	<b>50.0</b> LPS <b>4320000</b> L/day
<b>3 Peak Hourly Demand</b> = 1.5 X MDD Peak Hourly Demand, PHD =	<b>75.0</b> LPS <b>6480000</b> L/day
<ul> <li>Fire Storage, A = (Fireflow) * (Duration of fireflow)</li> <li>Fireflow, FF =</li> <li>Fireflow Duration =</li> <li>Fireflow Storage, A =</li> <li>Fireflow Storage, A =</li> </ul>	150 LPS     2.0 hrs     1080000 L     1080 m3
<ul> <li>5 Equalization Storage, B = (25% of Maximum Daily Demand)</li> <li>25% of MDD =</li> <li>Equalization Storage, B =</li> </ul>	<b>1080000</b> L <b>1080</b> m <sup>3</sup>
6 Emergency Storage, C = (25% of A + B) 25% of A + B Emergency Storage, C =	<b>540000</b> L <b>540</b> m <sup>3</sup>
7 Total Reservoir Storage Requirement = A + B + C Reservoir Storage = Reservoir Storage =	<b>2700000</b> L <b>2700</b> m <sup>3</sup>
8 System Capacity = The greater of PHD or MDD + FF Peak Hourly Demand, PHD = Maximum Daily Demand + Fireflow, MDD + FF =	<u>75</u> LPS <u>200</u> LPS
9 Total Storage Available in Existing Reservoir	
Existing Total Storage = Volume Required =	$\begin{array}{c} 2745 m^{3} \\ \hline 2700 m^{3} \end{array}$
Additonal Storage Available = % percentage	<u>45</u> m <sup>3</sup> <u>2%</u>

HARRISON HOT SPRINGS

Naturally Refreshed

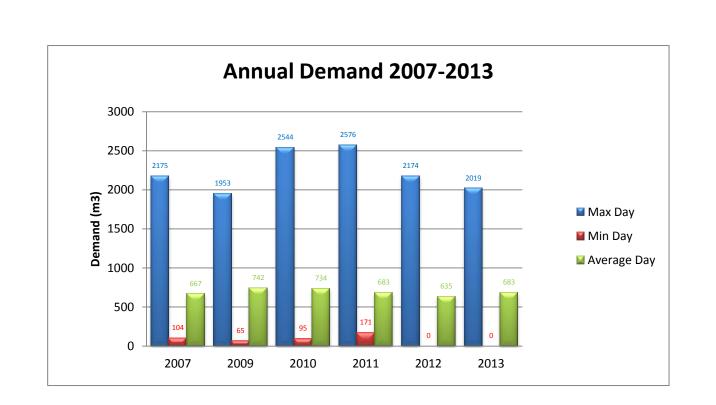
FIGURE 8: Future (All Lots Serviced) System Water Demand and Storage Requirements

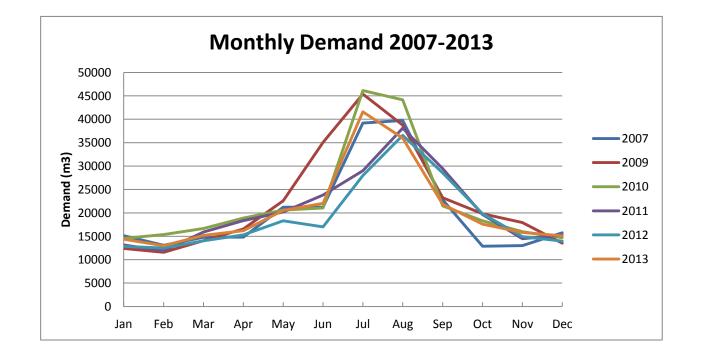
Average Daily Demand (Model) Average Daily Demand, ADD =	<b>46.0</b> LPS <b>3974400</b> L/day
Maximum Daily Demand = 2.0 X ADD	
Maximum Daily Demand, MDD =	<u>92.0</u> LPS
	<b>7948800</b> L/day
<b>Peak Hourly Demand =</b> 1.5 X MDD	
Peak Hourly Demand, PHD =	138.0 LPS
	<b>11923200</b> L/day
<b>Fire Storage, A</b> = (Fireflow) * (Duration of fireflow)	
Fireflow, FF =	<u>150</u> LPS
Fireflow Duration =	hrs
Fireflow Storage, A =	L
Fireflow Storage, A =	<b>1080</b> m <sup>3</sup>
<b>Equalization Storage</b> , <b>B</b> = (25% of Maximum Daily Demand) 25% of MDD =	<b>1987200</b> L
Equalization Storage, $B =$	$\frac{1987200}{1987}$ m <sup>3</sup>
Equalization Storage, $\mathbf{b} =$	<b>190</b> / III
<b>Emergency Storage,</b> $C = (25\% \text{ of } A + B)$	
25% of A + B	<b>766800</b> L
Emergency Storage, C =	<b>767</b> m <sup>3</sup>
<b>Total Reservoir Storage Requirement =</b> A + B + C	
Reservoir Storage =	<b>3834000</b> L
Reservoir Storage =	<b>3834</b> m <sup>3</sup>
System Capacity = The greater of PHD or MDD + FF	
Peak Hourly Demand, PHD =	138 LPS
Maximum Daily Demand + Fireflow, $MDD + FF =$	242 LPS
Maximum Dury Domand + Filonow, MDD + 11 =	
Total Storage Available in Existing Reservoir	
Existing Total Storage =	<b>2745</b> m <sup>3</sup>
Volume Required =	$\frac{110}{3834} \text{ m}^3$
- Statio Required -	
Additonal Storage Available =	<b>-1089</b> m <sup>3</sup>
% percentage	-40%

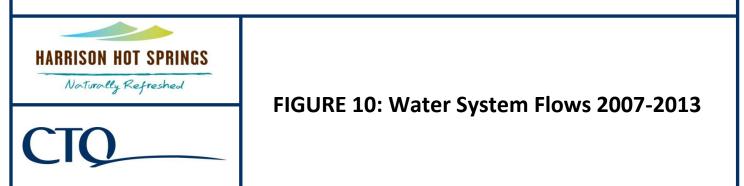
HARRISON HOT SPRINGS

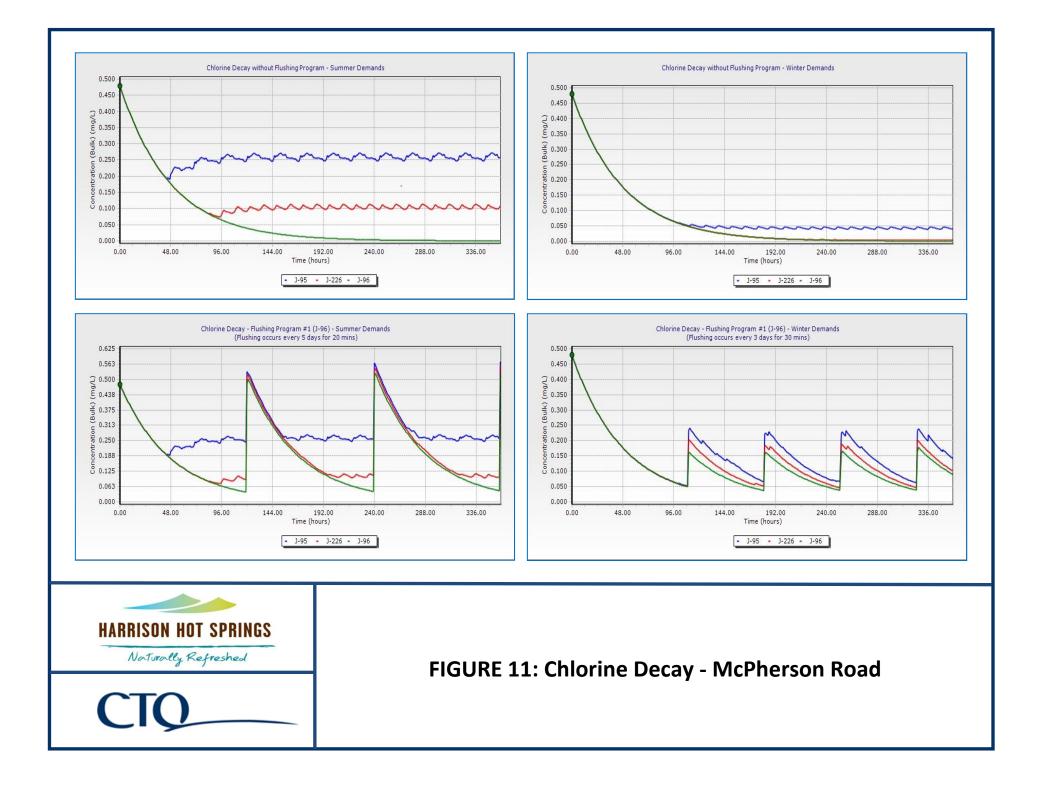
Naturally Refreshed

FIGURE 9: Future (Full Buildout) System Water Demand and Storage Requirements









	Pipe Dia. (mm)	Length (m)	Volume (L)		Minimum Flushing Time (3 X Turnover) (mins)	Flushing Time	Total Flushing Vol. (L)	Min. Flushing Velocity (m/s)	Start Junction	End Junction/ Hydrant	Frequency - Summer	Frequency - Winter
Flushing Plan #1	200	400	12560	63	10	20	75600	2.01	J-95	J-96	5 Days	3 Days
Flushing Plan #2	200	490	15386	63	13	20	75600	2.01	J-25	H-63	5 Days	4 Days
Flushing Plan #3	200	122	3831	63	4	20	75600	2.01	J-205	H-13	5 Days	3 Days
Flushing Plan #4	200	70	2198	63	2	5	18900	2.01	J-50	H-6	5 Days	4 Days

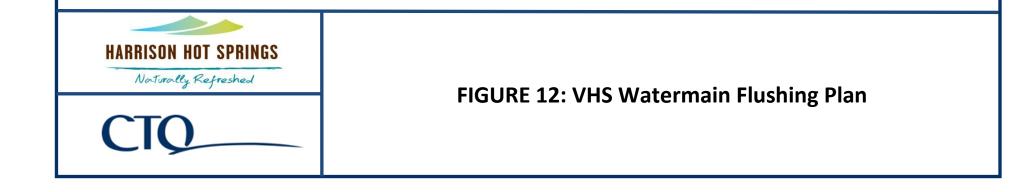
#### Notes:

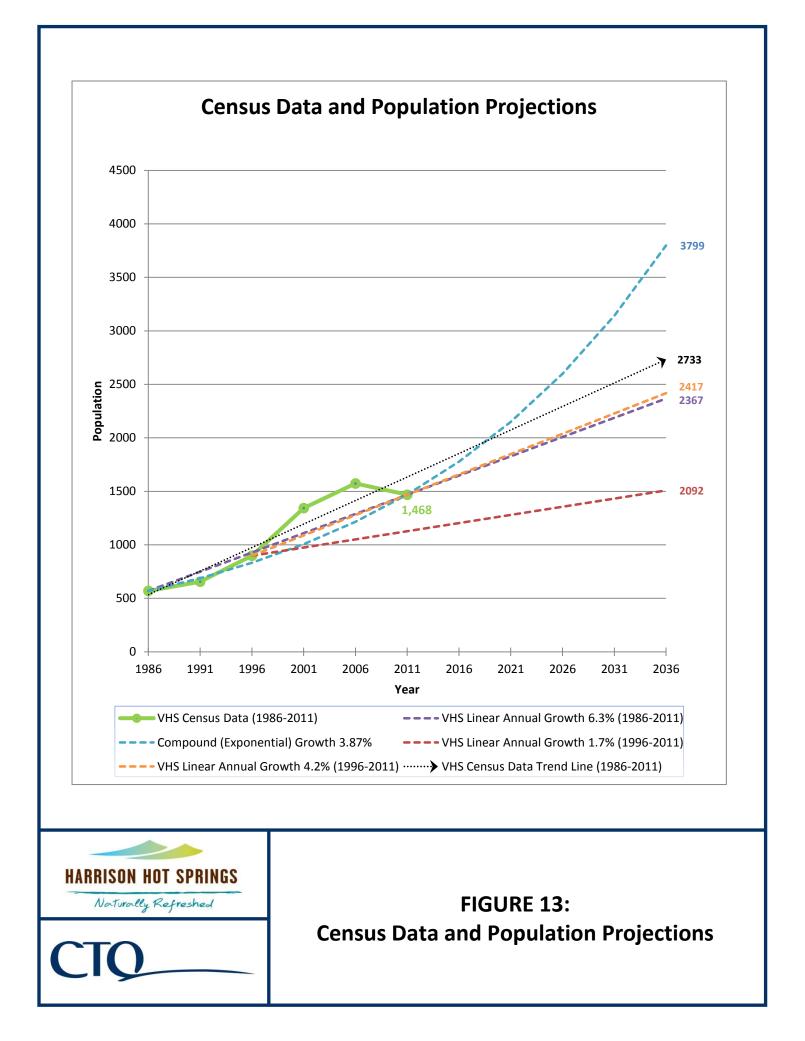
1. Operator must monitored the area to ensure that flooding does not occur during flushing.

2. Notification should be provided to all residents in the area that the water may be cloudy during flushing operations. It may be necessary to implement temporary boil water measures during flushing.

3. Minimum flushing time of 5 minutes used.

4. Flush each hydrant using 2 - 2 1/2" ports unless noted otherwise.





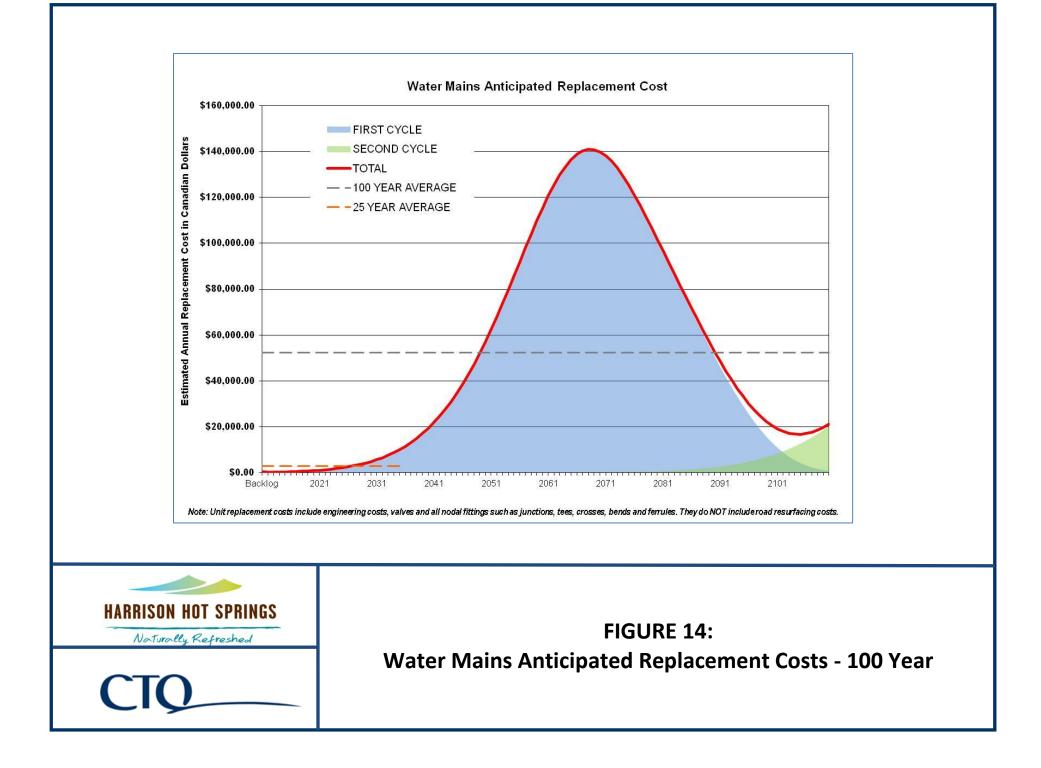




PHOTO 1: Diagonal members damaged



PHOTO 2: Looking up, north pipe is on the right



PHOTO 3: Vegetation growing in and around supports



PHOTO 4: Looking down, north pipe is on the left



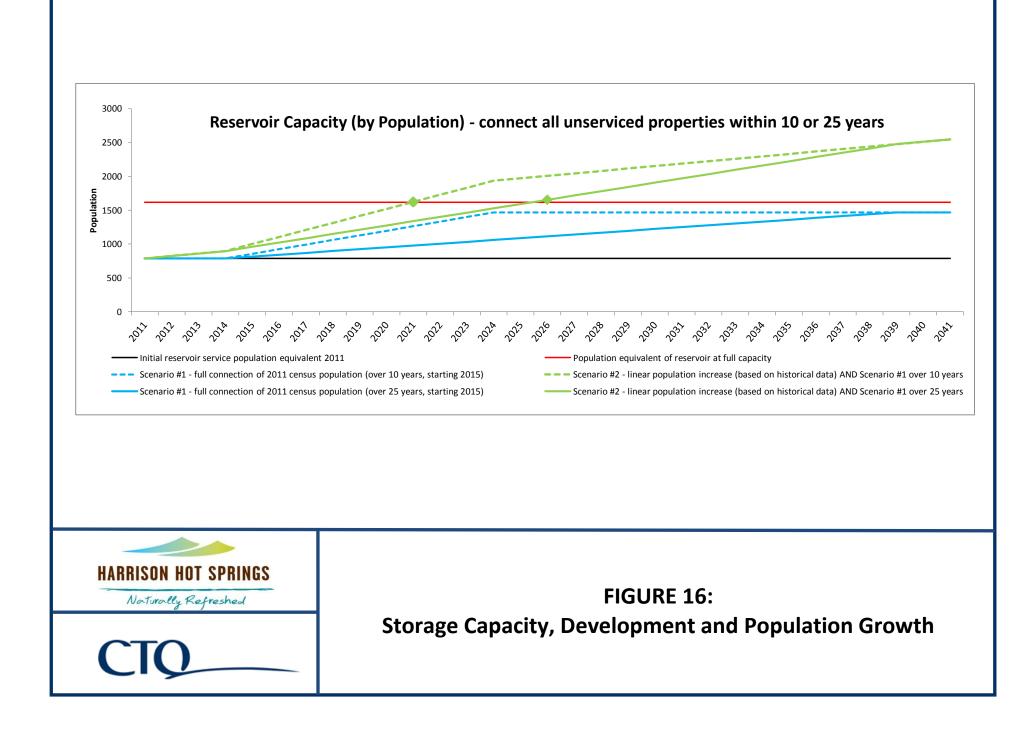
PHOTO 5: Typical supports, north pipe is on the right

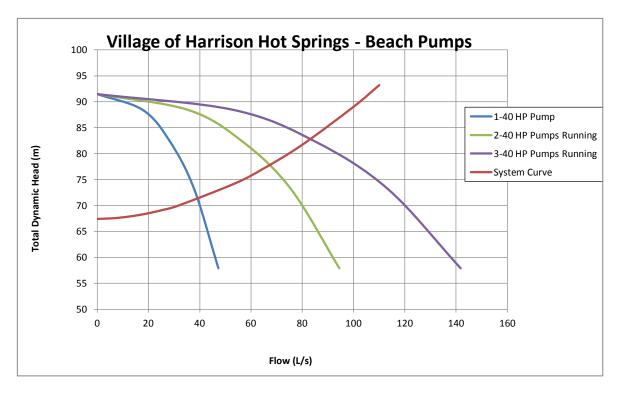


PHOTO 6: Bent support leg, likely from falling rocks



## FIGURE 15: Above-Ground Piping Photos





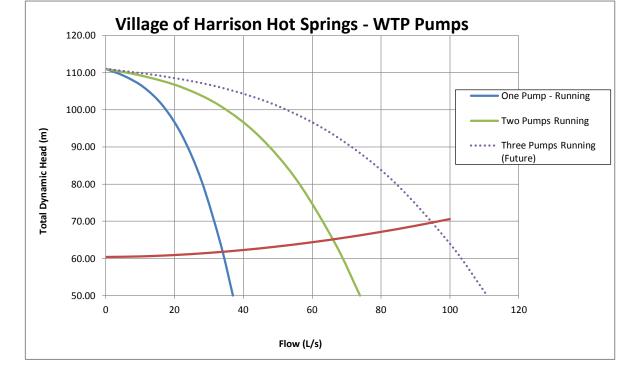




FIGURE 17: System Pumping Capacity

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#### FIGURE 18 - RECOMMENDATIONS SUMMARY TABLE

	Description		Recommendations	Reference
SSUE #1: GROUNDWATE				0.5
	A water quality sampling program undertaken in 2014 indicates the potential presence of contaminants	1.1	All domestic wells located within the vicinity of "Site 12" (Refer to Appendix B) be tested for landfill- associated leachate anions and pH	3.5
Groundwater Quality	There are a large number of properties served by shallow		A one-time sampling of all 218 properties listed in the VHS database be completed in 2015	3.5
	groundwater wells throughout the Village, and a potential liability to VHS relating to water quality	1.3	Analysis of the samples will result in further recommendations which may include additional groundwater monitoring, alternative water supply, and/or further investigation	3.5
		1.4	Property owners currently serviced by private groundwater wells should be advised of the proximity	3.5
Connection to VHS water utility		1 5	to the VHS water utility Options for those property owners interested in decommissioning groundwater wells in favour of	3.5
		1.5	utility connection be investigated (strategy, timeline, funding)	3.5
SSUE #2: 2014 SYSTEM D				
	Inadequate fire flows for current zoning	2.1	Upgrade Hot Springs Road watermain from 250 mm to 350 mm between H-59 and H-65, with a plan in place to provide 150L/sec fire flow to commercial properties until such time	5.2.1
	Pipe velocities exceed MMCD guidelines under fire flow	2.2	Upgrade piping to reduce velocities as budget and opportunity becomes available, rather than as	5.2.2
	conditions Hydrant spacing exceeds FUS guidelines	23	stand-alone projects Review the value to property owners of adding hydrants to the system to meet FUS linear spacing	5.2.3
2014 System Deficiencies -	There is a spacing exceeds to be guidelines		guidelines	0.2.0
Fire Flows		2.4	Add hydrants to the existing distribution lines to meet FUS hydrant radius guidelines for non- conforming properties	5.2.4
	Properties not fronted by the VHS utility exceed FUS	2.5	Construct new frontage lines and upgrade existing distribution lines as budget allows to meet FUS	5.2.4
	guidelines, affecting insurance rates and fire fighting capability		guidelines and provide water utility service to properties currently on private well systems. Until	
	for those properties		that time, ensure that residents have information regarding insurance, and that a fire fighting plan is in place to address the issue.	
	During the model calibration and field testing, an	2.6	Replacement of this section of pipe is recommended as soon as possible in order to provide	5.3
2014 System Deficiencies -	undocumented flow restriction was noted at the corner of Cedar and Hot Springs. Further investigation indicates a		adequate fire protection to properties within the Village center.	
Flow Restriction	damaged tee			
	Anecdotal evidence indicates significant debris within the pipelines	2.7	Budget to flush and clean both supply and distribution lines	5.3
2014 System Deficiencies -	VHS emergency standby power is limited to a single trailer-	2.8	Budget for emergency power generation at the beach pump station, with a contingency plan in	5.6
Emergency Power	mounted generator		place until such time	
2014 System Deficiencies -	Motors experience multiple stop/starts daily and flow control is achieved by a manually set valve	2.9	Budget for VFDs at the WTP	5.7
Electrical/Communication/Instr	Motors are currently being operated outside of design		Budget for VFD and motor maintenance at the beach pump station	5.7
umentation	Electrical components are aging and upgrading communications will increase operational efficiency	2.1	Implement SCADA, electrical, and instrumentation items 1-5 as budget and opportunity allow	5.7
	Sample locations are not sufficient to meet Health Canada	2.1	Establish new Chlorine sampling pedestals as per Operations requirements throughout the Village	5.8
2014 System Deficiencies -	guidelines There is not enough demand in the "dead legs" to maintain	2.1	Eliminate dead legs at Mount, Lillooet, Cedar, McCombs and McPherson as budget allows and/or	5.8
Chlorine	minimum chlorine residuals without a flushing program	2.1	development occurs	5.0
			Implement winter and summer flushing program as outlined in FIGURE 12	5.8
	Limited maintenance over the past 30 years has resulted in corrosion and other damage to the structural supports of the	2.2	Scrub all loose rock, debris, and vegetation from the cliff face Remove all debris and loose soil from the support bases and anchor bolts	5.9 5.9
0014 O stars Deficiencias	reservoir supply and distribution lines		Paint the structures to protect from further corrosion	5.9
2014 System Deficiencies - Above-ground piping T	The age and condition of the pipe supports makes it vulnerable	2.2	Perform a visual inspection of all supports yearly (minimum) Commission an engineering firm to study the problem, and identify option(s) for piping upgrade	5.9 5.9
	to damage during a moderate seismic event. Damage to either			
	of these lines would result in a shortage of drinking water and/or fire flow capability			
SSUE #3: FUTURE SYSTE				
	Unlooped distribution lines and critical components do not	3.1	Consider system resiliency and redundancy when planning capital projects	5.5
	provide redundancy in the event of failure Predicting population and development growth in VHS is	3.2	Re-evaluate population projections when the 2016 census data becomes available	6.1
	challenging	3.3	Budget for a Water Utility Master Plan update in 2017 to incorporate 2016 census data	6.3
uture System Considerations -	Demand will eventually exceed water license withdrawal amounts	3.4	Timely application for water license amendment as demand increases	7.1
General	46% of the population of VHS is not served by the water utility	3.5	Determine the feasibility of constructing new watermains to service existing properties	7.3
	As development occurs, the ability of the water utility to provide	36	Ensure that new developments, and OCP amendments are analyzed using the VHS water model	7.3
	service will decease without upgrades		prior to final approval	1.0
	VHS has limited funds to deal with both expected and unexpected repairs/replacements to system assets	3.7	Contribute funds annually to a reserve for both the eventual and unexpected replacement of underground water utility assets	7.2
	Additional pumping capacity has been pre-piped to address	3.8	Budget for the addition of the third pump at the WTP as demand increases	7.4
uture System Considerations	demand increase			
Pumping	Because the water utility assets have been constructed in isolation, components are operating outside of original design	3.9	Commission an engineering study to investigate system pumping capacity and limitations	7.4
	parameters			
uture System Considerations	Additional treatment capacity has been pre-piped to address demand increase to 31.5 L/sec	3.10	Budget for the addition of membranes to existing system as demand increases beyond 31.5 L/sec	7.5
Treatment		3.1	Budget for the design and construction of a second treatment facility as demand increases beyond 6	7.5
- uture System Considerations -	As demand increases, storage will have to be added to the	3.12	As demand increases, commission a preliminary engineering study be undertaken for to investigate options for increased storage	7.6
Storage	vi io system	3.1	Monitor population and water usage closely to establish a timeline to add reservoir capacity	7.6
		3.1	Implement demand reduction strategies to delay the necessity of adding storage capacity	7.6
SSUE #4: SYSTEM VULNE	<b>ERABILITY</b> Urban runoff within VHS currently does not undergo treatment	4.1	Investigate upgrades to the VHS drainage system to minimize contaminants entering the Miami	3.4.3
	prior to discharge to surface water, potentially carrying		River and Harrison Lake	0.110
Surface Water Quality	contaminants Land use upstream of Harrison Lake can impact water quality	42	Ensure VHS is identified as a stakeholder on land use issues relating to watershed health, and is	3.4.3
			represented where decisions potentially affecting water quality are made.	0.4.0
	Other than the WTP, water utility components are not	4.3	System vulnerability to seismic events - specifically the reservoir, above ground piping and beach	3.4.1
ulnerability to Seismic Events	designed to meet 2014 "post-disaster" standards	4.4	pump station - should be identified. Implement upgrades as funding becomes available	3.4.1
		4.5	Until upgrades can be implemented, address system vulnerability in emergency response plans	3.4.1
	Climate change will impact the water utility by increasing the	4.6	Ensure climate change is emphasized in the decision-making process for water utility infrastructure	3.4.5
Climate Change	severity and unpredictability of weather events		repair, upgrade, and expansion.	
onnate onange	VHS has a policy to reduce the impact of operations on the	4.7	Reduce energy consumption and greenhouse gas emissions created by the water utility wherever possible	3.4.5
SSUE #5: DATA MANAGE	environment MENT	-		
		51	Create a Water Asset Management database to house all data (reports, photos, drawings,	5.1. 5.7, 5

	Limited and/or inaccessible information regarding water utility	5.1	Create a Water Asset Management database to house all data (reports, photos, drawings,	5.1. 5.7, 5.9		
	assets results in additional expenditures to locate information		incidents) relating to the water utility			
	on an "as-needed" basis, or to redo work previously completed	5.2	Locate as-built drawings and construction inspection reports in archives, digitize and add to a	5.1, 5.7, 5.9		
Data and Asset Management			Water Asset Management database.			
Data and Asset Management		5.3	Implement and reference a basic GIS system			
		5.4	Create spreadsheet to track all water-related breaks and leaks. Info regarding location, probable			
			cause, date, pipe size, and conditions noted when repairing (ie - installation/bedding conditions) are			
			all important to track as the system ages.			
ISSUE #6: DEMAND MANA	GEMENT					
	Lack of water use data limits determination of effective	6.1	It is recommended that a program to implement Universal Metering be developed and implemented	5.4, 8.1		
	demand management strategies to decrease water use and		within the next five years			
Demand Management	A reduction in demand through conservation measures could	6.2	Review and update VHS Water Conservation Plan	8.2		
	delay infrastructure upgrades in the face of increasing	6.3	Quantify water conservation measures by commissioning a water conservation study in accordance			
	population, tourism and development		with AWWA Manual M36 - Water Audits and Loss Control Programs			
ISSUE #7: POLICY AND RE	EGULATION					
	Historically, there is inconsistency in the design and		Require all new development to connect to VHS water utility	5.2		
	construction, and integration of water utility infrastructure	7.2	Adopt MMCD Design guidelines, with modifications as necessary, for all construction of Municipal			
Development Design, Approval			Works			
and Construction		7.3	It is recommended that all new development undergo an engineering review which includes a water	5.1		
			model analysis to determine the impact of fire flow and demand to the VHS system prior to approval			
			being issued.			

# CTQ



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## Appendix A – Surface Water Data

- **1. SOURCE WATER QUALITY DATA**
- 2. HISTORIC FLOW

# CTQ



## APPENDIX A-1.. Source Water Quality Data (2014)

			2012 CDWQG MAC	30-Oct-14	22-Sep-14	25-Aug-14	17-Jul-14	18-Jun-14	23-May-14	24-Apr-14	27-Mar-14
Physical Tests:	Colour, True	CU		<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	Conductivity	uS/cm		43.0	45.0	45.0	47.0	47.0	45.0	46.0	49.0
	Hardness (as CaCO3)	mg/L	none required	17.6	19.3		20.8	19.3	18.9	19.0	21.8
	pH	pH	6.5-8.5		7.12	7.12	7.19	6.78	7.49	7.30	7.53
	Total Suspended Solids	mg/L									
	Total Dissolved Solids	mg/L	AO<500	51	51	31	33	45	25	47	31
	Transmittance, UV (254 nm)	%T	110 1000					10	20		
	Tubidity	NTU	<0.1	1.40	<0.1	1.40	0.80	0.80	0.30	0.40	1.10
Anions and Nutrients:	Alkalinity, Total (as CaCO3)	mg/L		19	12	13	15	16	14	15	16
Amons and Machenes.	Chloride (Cl)	mg/L		0.46	0.50	0.48	0.55	0.59	0.50	0.53	0.92
	Fluoride (F)	mg/L		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Nitrate (as N)	mg/L	45	0.0200	0.0290	0.0240	0.0450	0.0650	0.0610	0.0680	0.0700
			10	< 0.0200	< 0.010	<0.0240	< 0.010	< 0.010	<0.010	< 0.010	<0.010
	Nitrite (as N)	mg/L	AO<500								
	Sulfate (SO4)	mg/L	AU<500	4.60	4.60	4.80	4.50	4.80	4.50	4.60	5.40
Bacteriological Tests:	E. coli	MPN/100mL		<1	<1	5	2	1	<1	<1	<1
	Background Colonies	CFU/100mL		1.00		-	_	>200	>200		-
	Coliform Bacteria - Total	MPN/100mL		1	<1	3	6	1	<1	1	2
Total Metals:	Aluminum (AI)-Total	mg/L	OG <0.1	0.061	0.015		0.053	0.043	0.033	0.029	0.039
	Antimony (Sb)-Total	mg/L	0.006	0.0001	0.0003	<0.0001	< 0.0001	< 0.0001	0.0002	<0.0001	< 0.0001
	Arsenic (As)-Total	mg/L	0.01	0.0009	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
	Barium (Ba)-Total	mg/L	1	0.12	0.01		0.013	0.011	0.011	0.011	0.011
	Beryllium - Total	mg/L		< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
	Bismuth - Total	mg/L		< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
	Boron (B)-Total	mg/L	5	0.009	0.006		0.007	0.009	0.007	0.011	0.014
	Cadmium (Cd)-Total	mg/L	0.005	0.00001	< 0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
	Calcium (Ca)-Total	mg/L	none required	6.10	6.60		7.10	6.50	6.40	6.50	7.30
	Chromium (Cr)-Total	mg/L	0.05	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
	Cobalt-Total	mg/L	1.000	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
	Copper (Cu)-Total	mg/L	AO <1.0	0.0005	0.0005		0.0007	0.0005	0.0009	0.0010	0.0017
	Iron (Fe)-Total	mg/L	AO<0.3	0.310	< 0.01		0.030	0.020	0.020	0.010	0.050
	Lead (Pb)-Total	mg/L	0.01	0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0002
	Lithium - Total	mg/L	0.01	0.0007	0.0007	0.0001	0.0008	0.0008	0.0006	0.0007	0.0002
	Magnesium (Mg)-Total		none requiried	0.59	0.68		0.75	0.73	0.69	0.69	0.0007
		mg/L	none required				0.0010	0.0005	0.0005	0.0006	
	Manganese (Mn)-Total	mg/L	AO < 0.05	0.0013	0.0002	10 00000					0.0044
	Mercury (Hg)-Total	mg/L	0.001	0.0000	< 0.00002	<0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002
	Molybdenum- Total	mg/L		0.0008	0.0009		0.0009	0.0007	0.0008	0.0008	0.0008
	Nickel-Total	mg/L		< 0.0002	< 0.0002	< 0.0002	0.0002	< 0.0002	< 0.0002	0.0003	< 0.0002
	Phosphorous-Total	mg/L	<0.020	<0.020	< 0.020	<0.020	<0.020	< 0.020	<0.020	< 0.020	< 0.020
	Potassium (K)-Total	mg/L		0.57	0.59		0.77	0.53	0.62	0.58	0.56
	Selenium (Se)-Total	mg/L	0.01	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
	Silicon-Total	mg/L		2	2		2.7	1.7	2.4	2.4	2.5
	Silver-Total	mg/L		< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	<0.0000
	Sodium (Na)-Total	mg/L	AO<200	1.1	1.21		1.48	1.33	1.19	1.22	1.59
	Strontium-Total	mg/L		0.029	0.03		0.037	0.029	0.03	0.028	0.031
	Sulfer-Total	mg/L		<1	<1	<1	4	<1	<1	<1	<1
	Tellurium-Total	mg/L		< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
	Thalium-Total	mg/L		< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.0000
	Thorium-Total	mg/L		< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
	Tin-Total	mg/L		< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
	Titanium-Total	mg/L		<0.005	< 0.005	<0.005	< 0.005	< 0.005	<0.005	<0.005	< 0.005
	Uranium (U)-Total	mg/L	0.02	0.00003	0.00003	-0.005	0.00004	0.00003	0.00003	0.00003	0.00004
	Vanadium		0.02	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
		mg/L	AO<5.0		< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	
	Zinc (Zn)-Total	mg/L	AU<5.0	< 0.004							< 0.004
	Zirconuim-Total	mg/L		< 0.0001	< 0.0001	< 0.0001	< 0.0001	<0.0001	< 0.0001	< 0.0001	< 0.000



## APPENDIX A-1. Source Water Quality Data (2012-2013)

			2012 CDWQG MAC	7-Feb-13	16-Jan-13	27-Dec-12	22-Nov-12	23-Oct-12	19-Sep-12	2-Aug-12	28-Jun-12	1-Mar-12
Physical Tests:	Colour, True	CU		<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	Conductivity	uS/cm		42.2	42.2	42.7	41.2	41.8	44.4	43.4	45.9	46.2
	Hardness (as CaCO3)	mg/L	none required	18.2	19.0	17.9	18.5	18.5	18.5	18.5	19.9	18.9
	pH	pH	6.5-8.5	7.24	7.46	7.49	7.40	6.72	7.29	7.58	7.39	7.46
	Total Suspended Solids	mg/L	0.0 0.0		,,,,,,	-	-	-	-	<3.0	<3.0	
	Total Dissolved Solids	mg/L	AO<500	19	31	28	22	31	29	34	33	28
	Transmittance, UV (254 nm)	%T	10<300	15	51	20	22	95	25	34	55	20
	Tubidity	NTU	<0.1	1.28	1.67	1.46	2.16	2.49	3.27	4.27	2.16	3.88
Anions and Nutrients:	Alkalinity, Total (as CaCO3)		<0.1	15.3	15.2	15.9	14.8	15.3	14.5	15.4	17.1	15.7
Amons and Nuchents.	Chloride (Cl)	mg/L		0.59	0.58	0.62	0.58	0.56	0.52	0.61	0.68	0.62
		mg/L		< 0.020		<0.020	<0.020	<0.020		0.020		< 0.02
	Fluoride (F)	mg/L			< 0.020				< 0.020		< 0.020	
	Nitrate (as N)	mg/L	45	0.0614	0.0653	0.0758	0.0611	0.0509	0.0150	0.0614	0.0741	0.0732
	Nitrite (as N)	mg/L	10	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
	Sulfate (SO4)	mg/L	AO<500	4.80	4.73	4.83	4.72	4.73	4.46	4.87	5.16	5.13
Bacteriological Tests:	E. coli	MPN/100mL				<2	<2	-	-	<1	<1	
	Background Colonies	CFU/100mL										
	Coliform Bacteria - Total	MPN/100mL				4	2	-	-	5	<1	
Total Metals:	Aluminum (AI)-Total	mg/L	OG < 0.1	0.055	0.073	0.059	0.102	0.135	0.173	0.186	0.146	0.201
	Antimony (Sb)-Total	mg/L	0.006	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
	Arsenic (As)-Total	mg/L	0.01	0.0002	0.00019	0.00019	0.00018	0.00024	0.0002	< 0.00030	0.00018	0.00026
	Barium (Ba)-Total	mg/L	1	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020
	Beryllium - Total	mg/L										
	Bismuth - Total	mg/L										
	Boron (B)-Total	mg/L	5	< 0.10	<0.10	<0.10	< 0.10	< 0.10	<0.10	<0.10	<0.10	<0.10
	Cadmium (Cd)-Total	mg/L	0.005	< 0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
			and a second									
	Calcium (Ca)-Total	mg/L	none required	6.19	6.46	6.09	6.28	6.26	6.21	6.25	6.72	6.41
	Chromium (Cr)-Total	mg/L	0.05	<0.0034	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Cobalt-Total	mg/L								0.000		
	Copper (Cu)-Total	mg/L	AO <1.0	0.0011	<0.0010	0.0011	0.0014	0.0012	0.0012	0.0011	<0.0010	< 0.0014
	Iron (Fe)-Total	mg/L	AO<0.3	0.035	0.030	0.035	0.060	0.072	0.090	0.109	0.075	0.107
	Lead (Pb)-Total	mg/L	0.01	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050
	Lithium - Total	mg/L										
	Magnesium (Mg)-Total	mg/L	none requried	0.66	0.69	0.65	0.68	0.70	0.72	0.70	0.76	0.71
	Manganese (Mn)-Total	mg/L	AO < 0.05	< 0.0020	< 0.0020	< 0.0020	0.0022	< 0.0020	0.0023	0.0024	< 0.0020	< 0.0024
	Mercury (Hg)-Total	mg/L	0.001	< 0.00020	< 0.00020	< 0.00020	< 0.00020	< 0.00020	< 0.00020	< 0.00020	< 0.00020	< 0.00020
	Molybdenum- Total	mg/L										
	Nickel-Total	mg/L										
	Phosphorous-Total	mg/L	< 0.020									
	Potassium (K)-Total	mg/L	201020	0.65	0.60	0.60	0.63	0.61	0.67	0.62	0.64	0.63
	Selenium (Se)-Total		0.01	< 0.0010	<0.0010	<0.0010	< 0.0010	<0.001	<0.0010	< 0.0010	< 0.0010	< 0.0010
	Silicon-Total	mg/L	0.01	<0.0010	<0.0010	<0.0010	C0.0010	<0.0010	0.0010	<0.0010	<0.0010	<0.0010
		mg/L										
	Silver-Total	mg/L	40.000	.2.0	.2.0	.2.0	.2.0	.2.0	.2.0	.2.0	.2.0	.2.0
	Sodium (Na)-Total	mg/L	AO<200	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Strontium-Total	mg/L										
	Sulfer-Total	mg/L										
	Tellurium-Total	mg/L										
	Thalium-Total	mg/L										
	Thorium-Total	mg/L										
	Tin-Total	mg/L										
	Titanium-Total	mg/L										
	Uranium (U)-Total	mg/L	0.02	< 0.00010	<0.00010	<0.00010	< 0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Vanadium		0.02	~0.00010	<0.00010	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010
		mg/L	10.50	10.050	10.050	-0.050	10.050	10.050	10.050	-0.050	10.050	10.050
	Zinc (Zn)-Total	mg/L	AO<5.0	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
	Zirconuim-Total	mg/L		< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050

## CTO



## **APPENDIX A-2** . Historic Average Flow

Γ	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2007 Month total	15144	13065	14795	14816	21200	21208	39184	39724	22797	12883	13025	15738
Daily Avg	488	466	477	493	684	707	1264	1223	760	416	434	508
Daily Max	753	673	688	681	746	1577	2175	1908	1803	644	629	699
Daily Min	250	323	303	208	340	334	698	730	344	110	104	310
2009 Month total	12411	11589	14076	16559	22594	35051	45359	38740	23231	19801	17916	13534
Daily Avg	400	414	454	552	729	1168	1463	1250	774	639	597	437
Daily Max	691	704	653	682	1337	1675	1953	1540	1101	778	1278	817
Daily Min	141	224	302	316	476	720	750	644	501	332	173	65
2010 Month total	14564	15363	16652	18892	20583	21028	46141	44141	21477	18297	16001	14682
Daily Avg	470	549	537	630	664	701	1488	1424	716	590	533	474
Daily Max	745	972	950	1357	1364	1254	2262	2544	1084	716	863	879
Daily Min	154	107	337	147	301	356	833	729	492	330	297	95
2011 Month total	13154	11880	15920	18356	20199	23826	28994	38093	29458	19637	14496	15246
Daily Avg	424	424	514	612	652	794	935	1229	982	633	483	492
Daily Max	737	784	1138	1198	1154	2576	1672	1905	2260	2367	815	722
Daily Min	171	258	209	211	393	212	350	446	401	300	249	268
2012 Month total	12829	12492	14043	15313	18294	17015	27963	36571	28531	19815	14926	13972
Daily Avg	414	446	453	510	590	567	902	1180	951	639	498	451
Daily Max	832	560	575	792	866	805	1316	1706	2174	1199	685	739
Daily Min	325	280	339	272	232	293	638	605	595	25	0	0
2013 Month total	14366	12989	15183	16180	20517	22045	41583	35965	21824	17607	15802	15092
Daily Avg	463	464	490	539	662	735	1341	1160	727	568	527	487
Daily Max	619	769	1065	746	1115	1137	1804	1613	2019	1157	781	814
Daily Min	19	0	72	348	406	483	884	632	330	115	399	257
AVG Month total (2007-2013)	13745	12896	15112	16686	20565	23362	38204	38872	24553	18007	15361	14711
AVG Daily Avg (2007-2013)	443	460	487	556	663	779	1232	1244	818	581	512	475
AVG Daily Max (2007-2013)	730	744	845	909	1097	1504	1252	1869	1740	1144	842	778
AVG Daily Max (2007-2013) AVG Daily Min (2007-2013)	177	199	260	250	358	400	692	631	444	202	204	166
	1//	199	200	250	550	400	092	031		202	204	100

Source: Handwritten Village of Harrison Hot Springs Annual Reports 2007-2013 (2008 missing)

st note that errors have been found in the raw data st





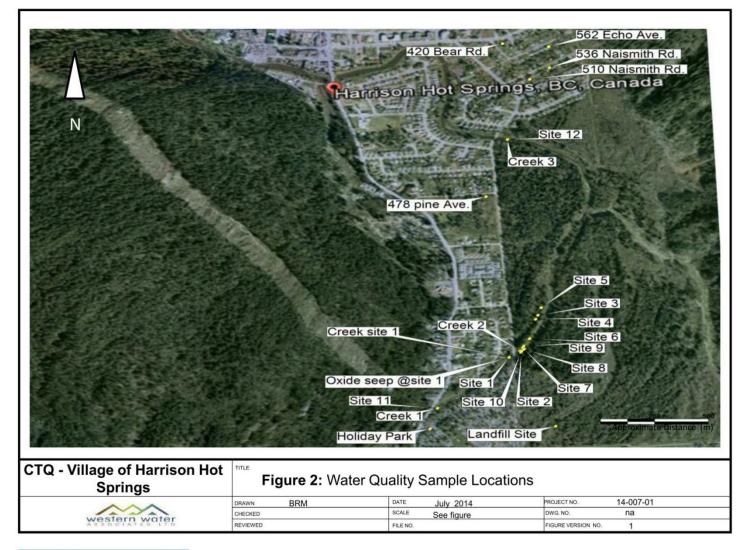
## Appendix B – Groundwater Data

- **1. GROUND WATER QUALITY SAMPLE LOCATIONS**
- 2. 2014 CIVIC ADDRESSES SUPPLIED BY PRIVATE WELLS
- **3. PROVINCIALLY REGISTERED WELLS WITHIN VHS**



## **APPENDIX B-1 - Water Quality Sample Locations**

CTQ

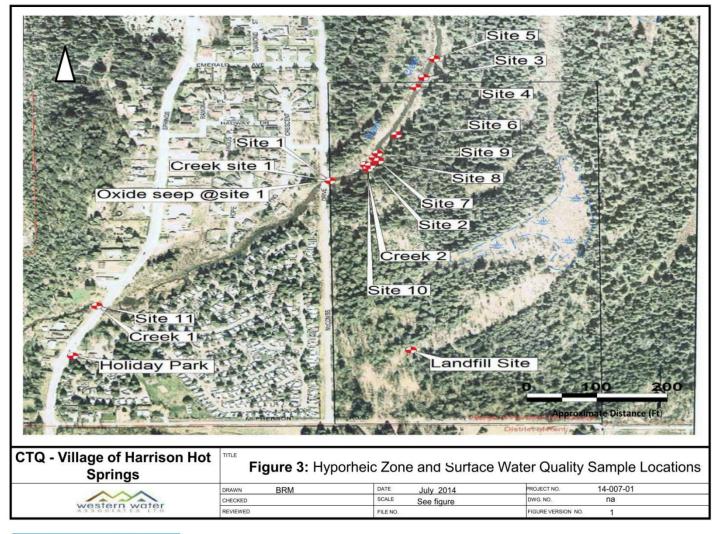


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## **APPENDIX B-1 - Water Quality Sample Locations**



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## **APPENDIX B-2 - 2014 Civic Addresses Supplied by Private Wells**

		Civio	c Addresses on Water s	upply Wells		
Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7
303 McPherson Road	861 Myng Crescent	822 Ramona Place	780 McCombs Drive	607 Lakberg Crescent	560 Naismith Avenue	520 Lillooet Avenue
305 McPherson Road	865 Myng Crescent	826 Ramona Place	770 McCombs Drive	608 Lakberg Crescent	565 Naismith Avenue	526 Lillooet Avenue
307 McPherson Road	866 Myng Crescent	830 Ramona Place	760 McCombs Drive	608 McCombs Drive	566 Naismith Avenue	527 Lillooet Avenue
973 Hot Springs Road	870 Myng Crescent	836 Ramona Place	750 McCombs Drive	606 McCombs Drive	522 Echo Avenue	531 Lillooet Avenue
960 Hot Springs Road	871 Myng Crescent	836 Hot Springs Road	728 Hot Springs Road	604 McCombs Drive	531 Echo Avenue	533 Lillooet Avenue
950 Hot Springs Road	875 Myng Crescent	822 Hot Springs Road	720 Hot Springs Road	602 McCombs Drive	562 Echo Avenue	538 Lillooet Avenue
914 Hot Springs Road	856 Hope Place	791 Hot Springs Road	708 McCombs Drive	618 Hot Springs Drive	415 Eagle Street	544 Lillooet Avenue
912 Hot Springs Road	858 Hope Place	796 Hot Springs Road	704 McCombs Drive	613 Hot Springs Drive	501 Hot Springs Road	549 Lillooet Avenue
978 Hot Springs Road	862 Hope Place	400 Emerald Drive	454 Alder Avenue	464 Naismith Avenue	398 Hot Springs Road	550 Lillooet Avenue
905 Hot Springs Road	866 Hope Place	410 Emerald Drive	464 Alder Avenue	470 Naismith Avenue	410 Bear Avenue	553 Lillooet Avenue
904 Hot Springs Road	868 Hope Place	411 Emerald Drive	474 Alder Avenue	476 Naismith Avenue	420 Bear Avenue	556 Lillooet Avenue
879 Hot Springs Road	870 Hope Place	420 Emerald Drive	479 Alder Avenue	485 Naismith Avenue	430 Bear Avenue	562 Lillooet Avenue
876 Hot Springs Road	872 Hope Place	421 Emerald Drive	489 Alder Avenue	505 Naismith Avenue	114 Cedar Avenue	565 Lillooet Avenue
875 Hot Springs Road	878 Hope Place	430 Emerald Drive	685 Hot Springs Road	510 Naismith Avenue	140 Cedar Avenue	568 Lillooet Avenue
870 Hot Springs Road	881 Hope Place	431 Emerald Drive	673 Hot Springs Road	513 Naismith Avenue	150 Cedar Avenue	574 Lillooet Avenue
853 Hot Springs Road	884 Hope Place	440 Emerald Drive	657 Hot Springs Road	515 Naismith Avenue	160 Cedar Avenue	595 Lillooet Avenue
815 Myng Crescent	885 Hope Place	441 Emerald Drive	389 Pine Avenue	516 Naismith Avenue	318 Hot Springs Road	100 Esplanade Avenue
820 Myng Crescent	892 Hope Place	450 Emerald Drive	395 Pine Avenue	519 Naismith Avenue	316 Hot Springs Road	140 Esplanade Avenue
822 Myng Crescent	401 Hadway Drive	451 Emerald Drive	415 Pine Avenue	520 Naismith Avenue	310 Hot Springs Road	150 Esplanade Avenue
825 Myng Crescent	425 Hadway Drive	460 Emerald Drive	435 Pine Avenue	525 Naismith Avenue	248 Cedar Avenue	101 Hot Springs Road
826 Myng Crescent	835 Angus Place	470 Emerald Drive	442 Pine Avenue	526 Naismith Avenue	260 Cedar Avenue	234 Esplanade Avenue
830 Myng Crescent	836 Angus Place	795 Diamond Street	455 Pine Avenue	529 Naismith Avenue	259 Hot Springs Road	
831 Myng Crescent	841 Angus Place	790 Diamond Street	464 Pine Avenue	530 Naismith Avenue	200 Hot Springs Road	
835 Myng Crescent	844 Angus Place	785 Diamond Street	470 Pine Avenue	535 Naismith Avenue	124 Lillooet Avenue	
836 Myng Crescent	847 Angus Place	780 Diamond Street	473 Pine Avenue	536 Naismith Avenue	134 Lillooet Avenue	
839 Myng Crescent	848 Angus Place	775 Diamond Street	478 Pine Avenue	539 Naismith Avenue	146 Lillooet Avenue	
840 Myng Crescent	849 Angus Place	770 Diamond Street	480 Pine Avenue	540 Naismith Avenue	440 Lillooet Avenue	
846 Myng Crescent	850 Angus Place	765 Diamond Street	601 Lakberg Crescent	545 Naismith Avenue	490 Lillooet Avenue	
847 Myng Crescent	808 Ramona Place	760 Diamond Street		546 Naismith Avenue	498 Lillooet Avenue	
850 Myng Crescent	811 Ramona Place	755 Diamond Street	603 Lakberg Crescent	549 Naismith Avenue	231 Spruce Street	
851 Myng Crescent	812 Ramona Place	750 Diamond Street	604 Lakberg Crescent	550 Naismith Avenue	500 Lillooet Avenue	
856 Myng Crescent	816 Ramona Place	775 Hot Springs Road	605 Lakberg Crescent		511 Lillooet Avenue	
857 Myng Crescent	820 Ramona Place	790 McCombs Drive	606 Lakberg Crescent	556 Naismith Avenue	519 Lillooet Avenue	

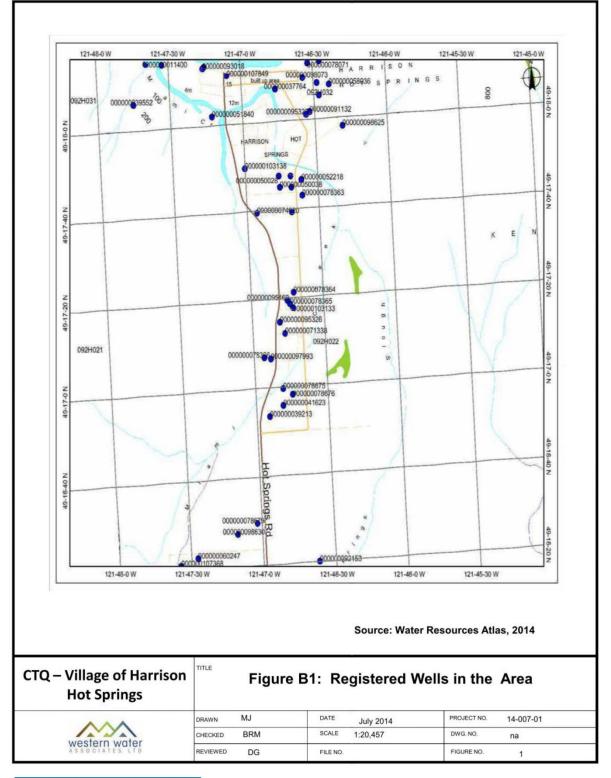
Village of Harrison Hot Springs Civic Addresses on Water supply Wells

> Page 1 As of January 2014





## **APPENDIX B-3 - Provincially Registered Wells within VHS**



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# **Appendix C – Water Model Criteria and Results**

- **1. WATER MODEL CRITERIA**
- 2. PIPE TABLES AND JUNCTION TABLES (EXISTING AND FUTURE SCENARIOS)
- **3. DEMAND PATTERNS**
- 4. METER READING DATA
- 5. JUNCTION DEMANDS (EXISTING AND FUTURE SCENARIOS)
- 6. CIVIC ADDRESSES FOR NON-CONFORMING HYDRANT COVERAGE
- 7. HYDRANT REQUIREMENTS TABLES (EXISTING AND FUTURE SCENARIOS)





#### **Demand Criteria**

Demand	Units	MMCD Design Guide/ VHHS Zoning Bylaw	People/unit	Average Daily Demand L/day (ADD)	Average Daily Demand L/sec (ADD)
Average Daily Demand (ADD)	L/capita/day	600			
Maximum Day Demand (MDD)	L/capita/day	1200			
Peak Hour Demand (PHD)	L/capita/day	1800			
R-1 - Conventional Lot (ADD)	people/unit	N/A	3	1800	0.021
R-2 - Duplex	people/unit	N/A	6	3600	0.042
R-3 - One Family Residental (small lot)	people/unit	n/a	2	1200	0.014
R-4 - Multi-Family - Meduim Density	people/ha	35		21000	0.243
R-5 - Multi-Family - HighDensity	people/ha	100		60000	0.694
CS - Service Station	people		28	16800	0.194
Hotel	people/unit	n/a	2	1200	0.014
Hall per Seat	seat/unit		1	8	0.000093
(All other C Zones) - Commercial	people/ha	200		120000	1.389
C-4	people/ha	90		54000	0.625
C-5	people/ha	100		60000	0.694
Institutional P-1	people/ha	50		30000	0.347
Harrison Holiday Park - C7	people/unit		2	600	0.007

\*Used water meter data for all buildings that are metered by VHHS

\*Summer Domestic Pattern was apply to all average demands

Peaking Factors		MMCD Design Guide
$MDD = PF_1 X ADD$	/	2.00 X ADD
$PHD = PF_1 X ADD$	/	1.50 X MDD

#### **Roughness Criteria**

Pipe	Size	MMCD Design Guide
Roughness (Hazen-Williams)		
PVC		125
DI, Conc., St.		125
Diameter	≥ 250mm	125
Diameter	≥ 200mm	125
Diameter	≤ 200mm	125
Diameter	≤ 150mm	125

#### Pipe Criteria

Ріре	Size	MMCD Design Guide
Minimum Diameter		
Distribution Mains	mm	*200
Fire Hydrant Connections	mm	150
Service Connections	mm	20
With Fire Sprinklers	mm	50

\* For Looped Distribution mains with lengths less than 500m in residential subdivisions, the diameter can be reduced to 150mm, providing that fire flow requirments can be meet





Criteria	Units	MMCD Design Guide
PHD	m/s	3.5
FF	m/s	3.5

#### **Fire Flow Criteria**

Criteria	Units	MMCD Design
		Guide
Fire Flow		
Single Family (R-1, R-2, & R-3)	L/s	60
Apartments, Townhouses (R-4 & R-5)	L/s	90
Commercial (All C Zones)	L/s	150
Institutional (P-1)	L/s	150
Industrial (I-1)	L/s	225

#### Pressure Criteria

Criteria	Units	MMCD Design Guide
Pressure		
Max. Static	psi	123 (850 Kpa)
Min. Static	psi	N/A
Min. System at PHD	psi	44 (300 Kpa)
Min. System at FF	psi	22 (150 Kpa)



#### Appendix C - Pipe Table (2014 Existing Water Supply Distribution System)



Label	Start Node	Stop Node	Diameter (mm)	Material	Hazen-Williams C	Length (m)	Installation Year
E-1	J-97	J-90	250	PVC	130	30	2011
E-2	J-90	J-241	250	PVC	130	111	2003
E-3	J-242	J-241	250	PVC	130	74	1992
E-4	J-240	J-242	250	PVC	130	79	1992
E-5	J-240	J-45	200	PVC	130	11	1992
E-6 E-7	J-46 J-46	J-47 J-48	150 50	PVC PVC	130 130	141 221	
E-8	J-40 J-48	J-48 J-49	50	PVC	130	253	
E-9	J-69	J-229	150	PVC	130	109	2009
E-10	J-229	J-230	150	PVC	130	95	2009
E-11	J-231	J-232	150	PVC	130	43	
E-12	J-232	J-233	150	PVC	130	14	
E-13	J-233	J-234	150	PVC	130	90	
E-14	J-234	J-235	150	PVC	130	57	
E-15	J-235	J-236	150	PVC	130	63	
E-15 E-16	J-238 J-236	J-235 J-237	150 150	PVC PVC	130 130	31 87	
E-10 E-17	J-230	J-237	150	PVC	130	74	
E-18	J-16	J-232 J-215	200	PVC	130	147	2005
E-19	J-215	J-216	200	PVC	130	143	2005
E-20	J-216	J-91	200	PVC	130	157	2005
E-21	J-27	J-220	250	PVC	130	119	2010
E-22	J-220	J-221	250	PVC	130	192	2010
E-23	J-221	J-222	250	PVC	130	89	2010
E-24	J-222	J-223	250	PVC	130	128	2010
E-25	J-223	J-224	250	PVC	130	158	2010
E-26	J-95	J-225	200	PVC	130	21	2010
E-27	J-225	J-226	200	PVC	130	154	2010
E-28 E-30	J-226 J-227	J-96 J-93	200 200	PVC PVC	130 130	223 198	2010 2006
E-30	J-224	J-228	250	PVC	130	198	2008
E-31 E-32	J-224	J-95	250	PVC	130	218	2010
E-33	J-92	J-25	200	PVC	130	48	2006
L-1	H-1	J-90	150	PVC	130	7	
L-2	J-241	H-2	150	PVC	130	13	
L-3	J-242	H-3	150	PVC	130	11	
L-4	H-4	J-201	150	PVC	130	6	
L-5	H-5	J-51	150	PVC	130	12	
L-6	H-6	J-202	150	PVC	130	6	
L-7	H-7	J-203	150	PVC	130	8	
L-8	H-8	J-54	150	PVC	130	12	
L-9 L-10	H-9 H-10	J-204 J-55	150 150	PVC PVC	130 130	7 9	
L-10 L-11	H-11	J-55	150	PVC	130	10	
L-12	H-12	J-205	150	PVC	130	8	
L-13	H-13	J-206	150	PVC	130	4	
L-14	H-14	J-207	150	PVC	130	6	
L-15	H-15	J-59	150	PVC	130	5	
L-16	H-16	J-60	150	PVC	130	8	
L-17	H-17	J-208	150	PVC	130	8	
L-18	H-18	J-63	150	PVC	130	9	
L-19	H-19	J-64	150	PVC	130	8	
L-20 L-21	H-20	J-65	150 150	PVC PVC	130 130	8	
L-21 L-22	H-21 H-22	J-68 J-69	150	PVC PVC	130	12	
L-22	H-23	J-09	150	PVC	130	7	
L-24	H-24	J-42 J-209	150	PVC	130	11	1
L-25	H-25	J-43	150	PVC	130	10	
L-26	H-26	J-210	150	PVC	130	8	
L-27	H-27	J-36	150	PVC	130	9	
L-28	H-28	J-35	150	PVC	130	10	
L-29	H-29	J-211	150	PVC	130	7	
L-30	H-30	J-31	150	PVC	130	15	
L-31	H-31	J-30	150	PVC	130	19	
L-32	H-32	J-212	150	PVC	130	16	
L-33 L-34	H-33 H-34	J-39 J-213	150 150	PVC PVC	130 130	20 11	
L-34 L-35	H-34 H-35	J-213 J-28	150	PVC PVC	130	9	
L-35	H-35	J-28 J-12	150	PVC	130	15	
L-37	J-13	H-37	150	PVC	130	11	
L-38	H-38	J-16	150	PVC	130	17	1
L-39	J-17	H-39	150	PVC	130	19	
L-40	H-40	J-18	150	PVC	130	16	



#### Appendix C - Pipe Table (2014 Existing Water Supply Distribution System)



Lin         J-P3         Heig         J30         PKC         J30         J4           L44         H-44         J-214         J30         PKC         J30         J4           L44         H-44         J-214         J30         PKC         J30         J4           L45         H-46         J30         PKC         J30         J4           L46         H-40         J214         J30         PKC         J30         J4           L46         H-40         J30         PKC         J30         J4         L           L49         H-40         J217         J30         PKC         J30         J4         L           L51         H-52         H-58         J30         PKC         J30         J40         L           L52         H-58         J30         PKC         J30         J10         L         L           L53         J27         H-58         J30         PKC         J30         J10         L           L54         J220         H-58         J30         PKC         J30         J10         L           L54         J220         H-58         J30         PKC         J30 <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th>								
144         84.4         1.7         100         PC         130         10           1.45         H43         1.24         150         PKC         150         14           1.45         H43         1.91         190         PKC         150         15           1.48         H44         1.21         1.10         PKC         130         11           1.48         H44         1.21         1.10         PKC         130         11           1.48         H44         1.21         1.10         PKC         130         11           1.52         H50         J.91         1.10         PKC         130         11           1.54         H51         J.22         H50         PKC         130         11         PKC           1.54         H51         J.22         H53         100         PKC         130         11         PKC           1.55         H27         H58         150         PKC         130         12         PKC           1.54         H22         H58         150         PKC         130         12         PKC           1.54         H41         J.24         J.23	L-41	J-9	H-41	150	PVC	130	14	
144         H-44         1-7.14         150         PPC         130         14.           L45         H-45         190         PPC         130         13           L46         H-46         191         PPC         130         12           L46         H-46         191         100         PPC         130         13           L47         H-48         191         150         PPC         130         14           L51         H-51         192         190         PPC         130         14           L52         H-51         193         190         PPC         130         11           L52         H-51         H-51         190         PPC         130         11           L53         192         H-51         190         PPC         130         10         10           L54         192         H-55         190         PPC         130         10         10         10           L54         190         PPC         130         10         10         10         10           L54         192         H-51         190         PPC         130         10         10	L-42	H-42	J-10	150	PVC	130	8	
144         H-44         1-7.14         150         PPC         130         14.           L45         H-45         190         PPC         130         13           L46         H-46         191         PPC         130         12           L46         H-46         191         100         PPC         130         13           L47         H-48         191         150         PPC         130         14           L51         H-51         192         190         PPC         130         14           L52         H-51         193         190         PPC         130         11           L52         H-51         H-51         190         PPC         130         11           L53         192         H-51         190         PPC         130         10         10           L54         192         H-55         190         PPC         130         10         10         10           L54         190         PPC         130         10         10         10         10           L54         192         H-51         190         PPC         130         10         10	L-43	H-43	J-7	150	PVC	130	10	
1+65         1+36         1+30         PVC         130         151           1-47         1+13         150         PVC         150         7           1-47         1+15         150         PVC         150         7           1-48         1+44         1+216         150         PVC         130         11           1-50         PVC         130         PVC         130         14         14           1-51         H-53         1+31         150         PVC         130         14         14           1-52         H-53         1+32         150         PVC         130         11         14           1-54         1+52         150         PVC         130         12         14           1-53         1-37         H-55         150         PVC         130         10         14           1-54         1-32         H-54         150         PVC         130         10         14           1-54         1-32         H-54         150         PVC         130         14         15           1-54         1-52         H-55         PVC         130         16         16         <								1
1-60         H-43         150         PVC         130         12           L-47         H-47         L-235         150         PVC         130         7           L-48         H-48         L-216         150         PVC         130         11           L-48         H-48         L-217         150         PVC         130         14           L-51         H-54         L-50         PVC         130         14         1           L-54         H-54         L-52         H-52         H-50         PVC         130         11         1           L-55         L-220         H-51         L-50         PVC         130         12         1           L-55         L-220         H-52         L-50         PVC         130         10         1           L-51         L-220         H-54         L-50         PVC         130         10         1           L-51         L-52         H-51         L-50         PVC         130         10         1           L-52         H-52         L-50         PVC         130         10         1         1         1           L-51         H-52								
International system         International system         International system         International system         International system           1-48         H-46         1.212         1150         PVC         130         11           1-50         H-50         1.91         1150         PVC         130         14           1-51         H-52         1.92         1.92         1.90         14         1.91           1-53         H-52         1.92         1.92         1.90         1.91         1.91           1-54         H-52         H-55         1.50         PVC         1.90         1.91         1.91           1-55         J-22         H-55         1.50         PVC         1.90         1.91         1.91           1-55         J-221         H-55         1.50         PVC         1.90         1.91         1.91           1-54         J-223         H-56         1.92         PVC         1.90         1.91         1.91           1-54         J-226         H-61         1.50         PVC         1.90         1.91         1.91           1-54         H-52         J-221         H-50         PVC         1.90         1.91         1.91								
148         143         1238         130         PC         130         111           129         1850         121         150         PVC         150         111           120         1850         123         150         PVC         150         141           124         143         143         150         PVC         130         11           125         127         1453         150         PVC         130         11           125         127         1453         150         PVC         130         10           125         1221         H457         150         PVC         130         10           128         1222         H458         150         PVC         130         10           128         1223         H461         150         PVC         130         10           124         1224         H40         150         PVC         130         10           124         1232         144         150         PVC         130         10           124         1232         150         PVC         130         10         10           124         1232 <td>L-46</td> <td>J-20</td> <td>H-46</td> <td>150</td> <td>PVC</td> <td>130</td> <td>12</td> <td></td>	L-46	J-20	H-46	150	PVC	130	12	
148         143         1238         130         PC         130         111           129         1850         121         150         PVC         150         111           120         1850         123         150         PVC         150         141           124         143         143         150         PVC         130         11           125         127         1453         150         PVC         130         11           125         127         1453         150         PVC         130         10           125         1221         H457         150         PVC         130         10           128         1222         H458         150         PVC         130         10           128         1223         H461         150         PVC         130         10           124         1224         H40         150         PVC         130         10           124         1232         144         150         PVC         130         10           124         1232         150         PVC         130         10         10           124         1232 <td>L-47</td> <td>H-47</td> <td>J-215</td> <td>150</td> <td>PVC</td> <td>130</td> <td>7</td> <td></td>	L-47	H-47	J-215	150	PVC	130	7	
148         H-69         J-27         150         PVC         130         11           155         H-51         J-21         150         PVC         130         14           151         H-51         J-23         150         PVC         130         11           152         H-51         J-23         150         PVC         130         11           155         J-27         J-53         150         PVC         130         11           154         J-27         H-53         150         PVC         130         10           158         J-221         H-54         150         PVC         130         10           158         J-223         H-53         150         PVC         130         10           158         J-223         H-64         150         PVC         130         10           158         H-52         J-223         H-63         PVC         130         9         10           154         H-56         J-228         150         PVC         130         9         10           154         H-66         J-22         150         PVC         130         10								
150         H-50         J-31         J-32         J50         PVC         J30         J4           L52         H-52         J50         PVC         J30         L1           L54         H-64         J-29         J50         PVC         J30         L1           L55         J-32         H-53         J50         PVC         J30         L1           L55         J-32         H-54         J50         PVC         J30         L0           L54         H-64         J29         H-53         J30         L0         L           L55         J-221         H-54         J50         PVC         J30         L0         L           L55         J-224         H-63         J50         PVC         J30         L0         L           L64         J-224         H-61         I50         PVC         J30         L0         L           L64         J-224         H-62         J27         J30         PVC         J30         L0         L           L64         H-63         J27         J30         PVC         J30         L         J20           L65         H-64         J27         J30<								
151         143         130         PVC         130         16           152         142         1452         150         PVC         130         11           154         1454         121         150         PVC         130         12           155         1427         1455         150         PVC         130         10           155         1427         1455         150         PVC         130         10           158         1221         1458         150         PVC         130         12           150         PVC         130         12         150         PVC         130         12           164         1423         146         160         PVC         130         16         16           164         1427         144         160         PVC         130         16         16           164         143         194         160         PVC         130         16         16           164         143         194         150         PVC         130         16         16           164         143         145         150         PVC         130								
IS2         H32         H32         IS0         PVC         IS0         III           L55         H34         H319         IS0         PVC         IS0         III           L55         H37         H55         IS0         PVC         IS0         III           L55         H37         H56         IS0         PVC         IIII         IIII           L53         H321         H57         IS0         PVC         IIIII         IIIII         IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	L-50	H-50	J-91	150	PVC	130	14	
IS2         H32         H32         IS0         PVC         IS0         III           L55         H34         H319         IS0         PVC         IS0         III           L55         H37         H55         IS0         PVC         IS0         III           L55         H37         H56         IS0         PVC         IIII         IIII           L53         H321         H57         IS0         PVC         IIIII         IIIII         IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	L-51	H-51	1-23	150	PVC	130	16	
154         154         152         130         PVC         130         122           155         1-220         1+56         150         PVC         130         10           157         1-221         1+57         130         PVC         130         10           158         1-222         1+58         150         PVC         130         10           159         1-224         1+58         150         PVC         130         10           140         1-224         1+60         150         PVC         130         12           141         1-224         1+64         120         PVC         130         9         1           143         1-224         1+64         130         PVC         130         9         1           144         1+227         1+64         130         PVC         130         10         1           146         1468         1-228         130         PVC         130         10         1           146         1468         1-23         150         PVC         130         10         1           141         140         190         PVC         1								1
155         1-27         1+35         150         PVC         130         12           155         1-230         1+56         150         PVC         130         10           158         1-221         1+57         150         PVC         130         10           159         1-222         1+58         150         PVC         130         10           159         1-224         1+64         150         PVC         130         10           150         1-224         1+64         150         PVC         130         10           154         1-54         150         PVC         130         9         -           154         1-54         150         PVC         130         9         -           154         1-54         150         PVC         130         10         -           154         1-14         150         PVC         130         10         -           154         1-14         150         PVC         130         15         200           154         1-14         150         PVC         130         15         200           154         1-14								
150         120         H 56         150         PVC         130         10           157         1521         H 57         150         PVC         130         10           158         1222         H 58         150         PVC         130         12           164         1255         H 61         150         PVC         130         10           164         1255         H 61         150         PVC         130         12           164         1225         H 61         150         PVC         130         12           164         1226         H 62         150         PVC         130         16           165         H 66         1237         150         PVC         130         10         10           166         H 68         1238         150         PVC         130         10         10           164         MH2         11         150         PVC         130         5         2000           164         MH2         11         150         PVC         130         5         2000           164         MH2         11         150         PVC         130 <td>L-54</td> <td>H-54</td> <td>J-219</td> <td>150</td> <td>PVC</td> <td>130</td> <td>12</td> <td></td>	L-54	H-54	J-219	150	PVC	130	12	
158         1-20         H-50         150         PVC         130         10           157         1-221         H+57         150         PVC         130         10           158         1-222         H+58         150         PVC         130         110           156         1-223         H+59         150         PVC         130         117           164         1-225         H+61         150         PVC         130         12           164         1-226         H+61         150         PVC         130         10           165         H+66         1-237         150         PVC         130         10         10           165         H+66         1-237         150         PVC         130         10         10           164         H+84         1-235         150         PVC         130         150         2000           164         H+1A         350         PVC         130         5         2000           164         HH61         150         PVC         130         5         2000           164         HH61         150         PVC         130         5	L-55	J-27	H-55	150	PVC	130	12	
1-52         1-522         1+53         150         PVC         130         10           1.58         1-522         1+58         150         PVC         130         10           1.60         1-224         1+59         150         PVC         130         112           1.61         1-225         1+61         150         PVC         130         117           1.63         1-326         1+62         150         PVC         130         15           1.64         1-227         1+64         150         PVC         130         16           1.64         1-227         1+64         150         PVC         130         16         16           1.64         1-327         1+64         150         PVC         130         10         10         10           1.64         1-328         150         PVC         130         10         2000         10 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>								
1/22         H-88         150         PVC         130         100           1-59         1-223         H-80         150         PVC         130         10           1-61         1-524         H-61         150         PVC         130         17           1-62         1-225         H-61         150         PVC         130         12           1-63         H-63         150         PVC         130         16         12           1-64         1-527         H-64         150         PVC         130         9         11           1-65         H-55         1-228         155         PVC         130         8         100         10           1-66         H-66         1-237         130         PVC         130         10         100         100         2000           1-67         1-238         H-67         150         PVC         130         15         2000         2000         2000         2000         2000         2000         2000         2000         2000         200         200         200         200         200         200         200         200         200         200         200								++
159         123         H-90         150         PVC         130         12           L60         1-224         H-60         150         PVC         130         10           L61         1-225         H-61         150         PVC         130         12           L63         H-63         1-94         150         PVC         130         16           L64         H-227         H-64         150         PVC         130         9           L64         H-65         1-228         150         PVC         130         9           L66         H-65         1-228         150         PVC         130         10           L66         H-66         1-237         150         PVC         130         1.0         2000           L74         H-74         H50         PVC         130         5         2000           L74         PMP-2         150         PVC         130         5         2000           L74         PMP-2         150         PVC         130         15         2000           L74         PMP-2         150         PVC         130         15         2000								
1-60         1-224         H-60         150         PVC         130         10           1-61         1-225         H-61         150         PVC         130         12           1-63         H-63         130         PVC         130         16           1-64         H-63         130         PVC         130         9           1-64         H-65         1-228         150         PVC         130         9           1-66         H-66         1-227         150         PVC         130         10           1-67         1-233         H-67         150         PVC         130         10           1-67         1-231         H-67         150         PVC         130         5         2000           1-64         H-64         1-235         150         PVC         130         5         2000           1-7         H-1         150         PVC         130         5         2000           1-8         H-1         1-2         200         PVC         130         134         198           1-9         T-1         H-3         200         PVC         130         50         198	L-58	J-222	H-58	150	PVC	130	10	
1-60         1-224         H-60         150         PVC         130         10           1-61         1-225         H-61         150         PVC         130         12           1-63         H-63         130         PVC         130         16           1-64         H-63         130         PVC         130         9           1-64         H-65         1-228         150         PVC         130         9           1-66         H-66         1-227         150         PVC         130         10           1-67         1-233         H-67         150         PVC         130         10           1-67         1-231         H-67         150         PVC         130         5         2000           1-64         H-64         1-235         150         PVC         130         5         2000           1-7         H-1         150         PVC         130         5         2000           1-8         H-1         1-2         200         PVC         130         134         198           1-9         T-1         H-3         200         PVC         130         50         198	L-59	J-223	H-59	150	PVC	130	12	
1-62 $j-225$ H-61         130 $PVC$ 130         17           1-63 $j-226$ H-64         150 $PVC$ 130         16           1-64 $j-227$ H-64         150 $PVC$ 130         9           1-65         H-66 $j-238$ 150 $PVC$ 130         9           1-66         H-66 $j-237$ 150 $PVC$ 130         8           1-67 $j-333$ H-67         150 $PVC$ 130         8           1-68         H-68 $j-235$ 150 $PVC$ 130         5         2000           P-1         R.1 $j-1A$ $PMP1$ 150 $PVC$ 130         5         2000           P-3 $j-1A$ $PMP-2$ 150 $PVC$ 130         5         2000           P-4 $PMP-2$ $j-14$ 150 $PVC$ 130         5         2000           P-5 $j-11$ $j-2$ $j-3$ 200 $PVC$ 130         131         194								1
1-63         H-63         1-94         150         PVC         130         12           1-64         J-227         H-64         150         PVC         130         9           1-65         H-65         J-227         150         PVC         130         9           1-66         H-65         J-227         150         PVC         130         10           1-67         J-233         H-67         150         PVC         130         10         10           1-67         J-233         H-67         150         PVC         130         1.050         2000           P-3         J-1A         PMP-1         150         PVC         130         5         2000           P-4         PMP-2         J-1         150         PVC         130         5         2000           P-5         PMP-1         150         PVC         130         15         2000           P-6         J-1         J-2         200         PVC         130         154         1984           P-7         J-2         J-3         200         Ductle ron         130         109         1984           P-3         T-1								
1-63         H-63         J-94         J130         PVC         I30         9           L-64         H-227         H-64         H50         PVC         I30         9           L-65         H-65         J-228         I50         PVC         I30         10           L-66         H-66         J-237         H-67         I50         PVC         I30         8           L-67         J-33         H-67         I50         PVC         I30         10           L-68         H-68         J-255         I50         PVC         I30         5         2000           P-2         J-3A         PMP-1         I50         PVC         I30         5         2000           P-3         J-3A         PMP-2         I50         PVC         I30         5         2000           P-4         PMP-2         J-3         250         PVC         I30         134         168           P-4         PMP-2         J-3         250         PVC         I30         134         168           P-5         J-4         J-3         200         Dectheron         130         165         168           P-8 <td< td=""><td>L-61</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>	L-61							
163         194         150         PVC         130         16           164         1527         H64         150         PVC         130         9           165         H65         J.238         150         PVC         130         10           166         H66         J.237         150         PVC         130         8           166         H67         J.30         PVC         130         10           167         J.33         H67         150         PVC         130         15           168         H66         J.255         150         PVC         130         5         2000           P3         J.1A         PMP1         150         PVC         130         5         2000           P4         PMP2         150         PVC         130         28         2000         5         2000           P5         P11         12         280         PVC         130         15         160         134           P6         P1         P1         200         PVC         130         15         136           P6         P1         13         200         PVC         <	L-62	J-226	H-62	150	PVC	130	12	
Le6         J-227         H-64         J50         PVC         I30         9           Le6         H-65         J-228         150         PVC         I30         10           Le6         H-66         J-237         150         PVC         I30         8           Le63         H-68         J-235         150         PVC         I30         1,0           P-1         B-1         J-1A         S50         PVC         I30         1,0         2000           P-2         J-1A         PMP-1         150         PVC         I30         5         2000           P-3         J-1A         PMP-2         J-3         S         2000         5         2000           P-5         PMP1         J-1         150         PVC         I30         5         2000           P-6         J-1         J-3         200         Ductle iron         130         134         1384           P-8         T-1         J-3         200         Ductle iron         130         199         1384           P-8         J-1         J-3         200         PVC         130         67         1384           P-9 <t< td=""><td></td><td></td><td></td><td></td><td>PVC</td><td></td><td>16</td><td></td></t<>					PVC		16	
Le6         H-66 $j-237$ TS0         PVC         130         9           Le6         H-68 $j-237$ TS0         PVC         130         10           Le6         H-68 $j-233$ TS0         PVC         130         10           P-1         H-14         H-1A         350         PVC         130         10         2           P-2         I-1A         PMP-1         150         PVC         130         5         2000           P-3         I-1A         PMP-2         TS0         PVC         130         5         2000           P-4         PMP-1         I-1         TS0         PVC         130         5         2000           P-5         P1         I-2         Z50         PVC         130         134         1584           P-6         F-1         I-2         Z50         PVC         130         165         1584           P-7         I-1         I-4         300         Ductile ron         130         165         1584           P-3         F-1         I-4         300         PVC         130         71         1584           P-3								1
Le6 $H-66$ $H-23$ H-67 $150$ PVC         130         10           Le68 $H-68$ $J-23$ 150         PVC         130         10.050         2000 $P-3$ $R-1$ $J-1A$ PMP-1         150         PVC         130         5         2000 $P-3$ $J-1A$ PMP-2         150         PVC         130         5         2000 $P-4$ PMP-2 $J-1$ 150         PVC         130         5         2000 $P-5$ PMP-1 $J-1$ 150         PVC         130         5         2000 $P-5$ PMP-1 $J-1$ 150         PVC         130         134         1984 $P-9$ $T-1$ $J-3$ 200         PVC         130         165         1984 $P-9$ $T-1$ $J-4$ 390         PVC         130         127         1984 $P-21$ $J-7$ $J-4$ 390         PVC         130         133         1384 $P-22         J-10 J-11 $								
1-67 $P23$ $H+67$ $150$ $PVC$ $130$ $10$ P-1         R-1 $J-JA$ $PMP-1$ $150$ $PVC$ $130$ $1.050$ $2000$ P-2 $J-IA$ $PMP-1$ $150$ $PVC$ $130$ $5$ $2000$ P-3 $PMP-1$ $PI1$ $150$ $PVC$ $130$ $5$ $2000$ P-4 $PMP-2$ $I-1$ $150$ $PVC$ $130$ $5$ $2000$ P-5 $I-1$ $J-2$ $250$ $PVC$ $130$ $134$ $1984$ P-6 $I-1$ $J-2$ $250$ $PVC$ $130$ $165$ $1984$ P-7 $J-7$ $J-4$ $390$ $DVC$ $130$ $155$ $1984$ P-17 $J-7$ $J-4$ $390$ $PVC$ $130$ $152$ $1984$ P-19 $J-8$ $J-9$ $D00$ $PVC$ $130$ $15$ P-20 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>								
1-68         H-68         J-1A         S0         PVC         130         10           P-2         J-1A         PMP-1         150         PVC         130         5         2000           P-3         J-1A         PMP-2         150         PVC         130         5         2000           P-4         PMP-2         J-1         150         PVC         130         5         2000           P-4         PMP-2         J-1         150         PVC         130         5         2000           P-5         PMP-1         J-1         150         PVC         130         134         1984           P-7         J-2         J-3         200         PVC         130         134         1984           P-9         T.1         J-4         300         Doutlie ton         130         165         1984           P-9         J-8         J-7         J-4         350         PVC         130         131         1984           P-10         J-8         J-7         130         133         1984         19         1984         19         1984         133         1984         19         1984         133	L-66	H-66	J-237	150	PVC	130	10	
1-68         H-68         J-1A         S0         PVC         130         10           P-2         J-1A         PMP-1         150         PVC         130         5         2000           P-3         J-1A         PMP-2         150         PVC         130         5         2000           P-4         PMP-2         J-1         150         PVC         130         5         2000           P-4         PMP-2         J-1         150         PVC         130         5         2000           P-5         PMP-1         J-1         150         PVC         130         134         1984           P-7         J-2         J-3         200         PVC         130         134         1984           P-9         T.1         J-4         300         Doutlie ton         130         165         1984           P-9         J-8         J-7         J-4         350         PVC         130         131         1984           P-10         J-8         J-7         130         133         1984         19         1984         19         1984         133         1984         19         1984         133	L-67	J-233	H-67	150	PVC	130	8	
P-2         I-IA         PMP-1         150         PVC         130         1.050         2000           P-3         I-IA         PMP-1         150         PVC         130         5         2000           P-4         PMP-2         150         PVC         130         5         2000           P-5         PMP-1         I-1         150         PVC         130         5         2000           P-5         PMP-1         I-1         150         PVC         130         153         2000           P-7         I-2         I-3         250         PVC         130         165         1984           P-6         I-1         I-3         200         Ductle tron         130         165         1984           P-7         I-7         I-4         300         Ductle tron         130         167         1984           P-10         I-7         I-4         350         PVC         130         17         1984           P-20         I-9         I-10         200         PVC         130         17         1984           P-21         I-10         I-11         150         PVC         130         152								<u> </u>
P-3 $i-1A$ PMP-1         150         PVC         130         5         2000           P-4         PMM-2         1-1         150         PVC         130         5         2000           P-5         PMM-1         1-1         150         PVC         130         5         2000           P-5         J-1         J-2         250         PVC         130         789         2000           P-7         J-2         J-3         200         Ductle fron         130         155         1984           P-8         T-1         J-4         300         Ductle fron         130         155         1984           P-9         T-1         J-4         300         Ductle fron         130         50         1984           P-17         J-7         J-4         300         PVC         130         67         1984           P-13         J-8         J-7         T-30         D         PVC         130         71         1984           P-21         J-10         J-11         200         PVC         130         152         1984           P-22         J-10         J-12         200         PVC<								
P-A         PMP-2         150         PVC         130         S         2000           P-5         PMP-1         1-1         150         PVC         130         S         2200           P-5         P-1         1-2         250         PVC         130         789         2000           P-7         1-2         1-3         250         PVC         130         134         1984           P-8         T-1         1-3         200         Ductle ton         130         134         1984           P-8         T-1         1-4         300         Ductle ton         130         155         1984           P-17         1-7         1-4         350         PVC         130         50         1984           P-18         1-8         1-9         200         PVC         130         67         1984           P-20         1-9         1-10         200         PVC         130         171         1984           P-21         1-10         1-11         150         PVC         130         152         1984           P-22         1-10         1-11         150         PVC         130         151								
PA         PMP2         150         PVC         130         5         2000           PA         PMP1 $I-1$ 150         PVC         130         5         2000           P5 $I-1$ $I-2$ 250         PVC         130         789         2000           P7 $I-2$ $I-3$ 250         PVC         130         134         1984           P4         T-1 $I-3$ 200         Ductile tron         130         165         1984           P4         T-1 $I-4$ 350         PVC         130         250         1984           P4         T-1 $I-4$ 350         PVC         130         27         1984           P4 $I+1$ T5         200         PVC         130         67         1984           P20 $I+1$ D4         200         PVC         130         13         1984           P21 $I+10$ $I+11$ 150         PVC         130         152         1984           P22 $I+13$ $I+15$ 200         PVC         130         15	P-2	J-1A	PMP-1	150	PVC	130	5	2000
PA         PMP-1         J-1         150         PVC         130         S         2000           P-5         PMP-1         J-1         150         PVC         130         S         2000           P-6         J-1         J-2         250         PVC         130         134         1984           P-7         J-2         J-3         250         PVC         130         134         1984           P-8         T.1         J-3         200         Ductile fron         130         199         1984           P-9         T.1         J-4         300         PVC         130         20         1984           P-17         J-7         J-4         350         PVC         130         27         1984           P-18         J-8         J-7         350         PVC         130         152         1984           P-20         J-9         J-10         200         PVC         130         152         1984           P-23         J-12         J-13         200         PVC         130         87         1984           P-24         J-13         J-14         150         PVC         130         12	P-3	J-1A	PMP-2	150	PVC	130		2000
P.5         PMP-1         j-1         150         PVC         130         5         2000           P-7         j-2         j-3         250         PVC         130         134         1984           P-8         T-1         j-3         250         PVC         130         165         1984           P-8         T-1         j-3         200         Ductile fron         130         165         1984           P-7         j-7         j-4         300         Ductile fron         130         165         1984           P-17         j-7         j-4         350         PVC         130         50         1984           P-18         j-8         j-7         350         PVC         130         67         1984           P-20         J-9         j-10         200         PVC         130         71         1984           P-21         J-30         j-11         150         PVC         130         72         1984           P-22         j-13         j-14         150         PVC         130         152         1984           P-24         j-13         j-15         j-16         150         PVC								
P-6 $J-1$ $J-2$ $J-3$ $Z50$ $PVC$ $I30$ $T89$ $Z000$ $P-7$ $J-2$ $J-3$ $Z50$ $PVC$ $I30$ $I45$ $I984$ $P-8$ $T-1$ $J-4$ $350$ $Dvcthe tron$ $I30$ $I95$ $I984$ $P-17$ $J-7$ $J-4$ $350$ $PVC$ $I30$ $S0$ $I984$ $P-17$ $J-7$ $J-4$ $350$ $PVC$ $I30$ $S0$ $I984$ $P-17$ $J-8$ $J-9$ $Z00$ $PVC$ $I30$ $I33$ $I984$ $P-19$ $J-10$ $Z00$ $PVC$ $I30$ $I33$ $I984$ $P-21$ $J-10$ $J-12$ $Z00$ $PVC$ $I30$ $I52$ $I984$ $P-23$ $J-12$ $J-13$ $J-14$ $I50$ $PVC$ $I30$ $I52$ $I984$ $P-24$ $J-13$ $J-14$ $I50$ $PVC$ $I30$ $I20$								
P.7 $J.2$ $J.3$ $250$ $PVC$ $130$ $134$ $1944$ $P.8$ T.1 $J.4$ $300$ Ducile ron $130$ $195$ $1984$ $P.9$ T.1 $J.4$ $300$ Ducile ron $130$ $199$ $1984$ $P.17$ $J.4$ $350$ $PVC$ $130$ $50$ $1984$ $P.19$ $J.8$ $J.9$ $200$ $PVC$ $130$ $67$ $1984$ $P.20$ $J.9$ $J.0$ $200$ $PVC$ $130$ $67$ $1984$ $P.21$ $J.10$ $J.11$ $150$ $PVC$ $130$ $152$ $1984$ $P.22$ $J.13$ $J.14$ $150$ $PVC$ $130$ $87$ $1984$ $P.24$ $J.13$ $J.15$ $200$ $PVC$ $130$ $89$ $1984$ $P.24$ $J.13$ $J.15$ $190$ $150$ $120$ $1985$ $P.24$	P-5	PMP-1	J-1	150	PVC	130	5	2000
P.8         T.1         J-3         200         Duckle ron         130         165         1984           P-1         J-7         J-4         350         PvC         130         50         1984           P-17         J-7         J-4         350         PvC         130         50         1984           P-18         J-8         J-7         350         PvC         130         67         1984           P-20         J-9         J-10         200         PvC         130         133         1984           P-21         J-10         J-11         150         PvC         130         152         1984           P-23         J-10         J-11         150         PvC         130         152         1984           P-24         J-13         J-14         150         PvC         130         82         1984           P-23         J-12         J-16         150         PvC         130         164         1984           P-24         J-17         J-18         150         PvC         130         164         1984           P-29         J-17         J-18         150         PvC         130	P-6	J-1	J-2	250	PVC	130	789	2000
P.8         T.1         J-3         200         Duckle ron         130         165         1984           P-1         J-7         J-4         350         PvC         130         50         1984           P-17         J-7         J-4         350         PvC         130         50         1984           P-18         J-8         J-7         350         PvC         130         67         1984           P-20         J-9         J-10         200         PvC         130         133         1984           P-21         J-10         J-11         150         PvC         130         152         1984           P-23         J-10         J-11         150         PvC         130         152         1984           P-24         J-13         J-14         150         PvC         130         82         1984           P-23         J-12         J-16         150         PvC         130         164         1984           P-24         J-17         J-18         150         PvC         130         164         1984           P-29         J-17         J-18         150         PvC         130	P-7	1-2	1-3	250	PVC	130	134	1984
$\begin{array}{c c c c c c c c c c c c c c c c c c c $								
P+17 $1-7$ $1-4$ $350$ $PVC$ $130$ $50$ $1934$ $P-18$ $1-8$ $1-7$ $350$ $PVC$ $130$ $27$ $1984$ $P-19$ $1-8$ $1-9$ $200$ $PVC$ $130$ $67$ $1984$ $P-20$ $1-9$ $1-10$ $200$ $PVC$ $130$ $133$ $1984$ $P-21$ $1-10$ $1-11$ $150$ $PVC$ $130$ $71$ $1984$ $P-23$ $1-12$ $1-13$ $200$ $PVC$ $130$ $87$ $1984$ $P-23$ $1-12$ $1-13$ $200$ $PVC$ $130$ $87$ $1984$ $P-24$ $1-13$ $1-14$ $150$ $PVC$ $130$ $87$ $1984$ $P-24$ $1-13$ $1-15$ $200$ $PVC$ $130$ $89$ $1984$ $P-24$ $1-13$ $1-15$ $200$ $PVC$ $130$ $120$ $1985$ $P-26$ $1-15$ $1-16$ $150$ $PVC$ $130$ $164$ $1984$ $P-26$ $1-17$ $1-18$ $150$ $PVC$ $130$ $164$ $1984$ $P-30$ $1-8$ $i-214$ $250$ $PVC$ $130$ $164$ $1984$ $P-30$ $i-24$ $i-19$ $220$ $PVC$ $130$ $160$ $1995$ $P-30$ $i-24$ $i-24$ $i-25$ $PVC$ $130$ $161$ $1995$ $P-30$ $i-24$ $i-24$ $i-25$ $PVC$ $130$ $161$ $1995$ $P-30$ $i-24$ $i-22$ <								
P+18 $J-7$ $350$ $PVC$ $130$ $27$ $1984$ $P-19$ $J-8$ $J-9$ $200$ $PVC$ $130$ $67$ $1984$ $P-20$ $J-9$ $J-10$ $200$ $PVC$ $130$ $133$ $1984$ $P-21$ $J-10$ $J-11$ $150$ $PVC$ $130$ $71$ $1984$ $P-22$ $J-10$ $J-11$ $150$ $PVC$ $130$ $71$ $1984$ $P-23$ $J-12$ $J-13$ $200$ $PVC$ $130$ $87$ $1984$ $P-24$ $J-13$ $J-15$ $200$ $PVC$ $130$ $87$ $1984$ $P-24$ $J-13$ $J-15$ $200$ $PVC$ $130$ $89$ $1984$ $P-24$ $J-18$ $150$ $PVC$ $130$ $146$ $1984$ $P-23$ $J-18$ $J-91$ $500$ $PVC$ $130$ $147$ $1995$ $P-30A$ <td></td> <td></td> <td>J-4</td> <td>300</td> <td>Ductile Iron</td> <td>130</td> <td>199</td> <td>1984</td>			J-4	300	Ductile Iron	130	199	1984
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	P-17	J-7	J-4	350	PVC	130	50	1984
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	P-18	J-8	J-7	350	PVC	130	27	1984
$\begin{array}{c c c c c c c c c c c c c c c c c c c $								
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	P-19	J-0						
$\begin{array}{c c c c c c c c c c c c c c c c c c c $								
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	P-20				PVC		133	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		J-9	J-10	200	PVC	130	133	1984
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	P-21	J-9 J-10	J-10 J-11	200 150	PVC PVC	130 130	133 71	1984 1984
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	P-21 P-22	J-9 J-10 J-10	J-10 J-11 J-12	200 150 200	PVC PVC PVC	130 130 130	133 71 152	1984 1984 1984
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	P-21 P-22 P-23	J-9 J-10 J-10 J-12	J-10 J-11 J-12 J-13	200 150 200 200	PVC PVC PVC PVC	130 130 130 130	133 71 152 87	1984 1984 1984 1984 1984
P-28         J-17         J-18         150         PVC         130         146         1984           P-29         J-18         J-9         150         PVC         130         164         1984           P-30A         J-8         J-214         250         PVC         130         172         1995           P-30B         J-214         J-19         250         PVC         130         160         1995           P-31         J-19         J-20         250         PVC         130         147         1995           P-32         J-20         J-21         250         PVC         130         147         1995           P-33A         J-21         J-27         150         PVC         130         147         1995           P-335         J-22         J-23         150         PVC         130         154         1995           P-35         J-23         J-24         J-25         200         PVC         130         161         1995           P-35         J-24         J-26         200         PVC         130         116         1995           P-37         J-24         J-26         200	P-21 P-22 P-23	J-9 J-10 J-10 J-12	J-10 J-11 J-12 J-13	200 150 200 200	PVC PVC PVC PVC	130 130 130 130	133 71 152 87	1984 1984 1984 1984 1984
P-28         J-17         J-18         150         PVC         130         146         1984           P-29         J-18         J-9         150         PVC         130         164         1984           P-30A         J-8         J-214         250         PVC         130         172         1995           P-30B         J-214         J-19         250         PVC         130         160         1995           P-31         J-19         J-20         250         PVC         130         147         1995           P-32         J-20         J-21         250         PVC         130         147         1995           P-33A         J-21         J-27         150         PVC         130         147         1995           P-335         J-22         J-23         150         PVC         130         154         1995           P-35         J-23         J-24         J-25         200         PVC         130         161         1995           P-35         J-24         J-26         200         PVC         130         116         1995           P-37         J-24         J-26         200	P-21 P-22 P-23 P-24	J-9 J-10 J-10 J-12 J-13	J-10 J-11 J-12 J-13 J-14	200 150 200 200 150	PVC PVC PVC PVC PVC	130 130 130 130 130 130	133 71 152 87 62	1984 1984 1984 1984 1984 1984
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	P-21 P-22 P-23 P-24 P-25	J-9 J-10 J-10 J-12 J-13 J-13	J-10 J-11 J-12 J-13 J-14 J-15	200 150 200 200 150 200	PVC PVC PVC PVC PVC PVC PVC	130 130 130 130 130 130 130	133 71 152 87 62 89	1984 1984 1984 1984 1984 1984 1984
P-30A         J-8         J-214         250         PVC         130         172         1995           P-30B         J-214         J-19         250         PVC         130         160         1995           P-31         J-19         J-20         250         PVC         130         151         1995           P-32         J-20         J-21         250         PVC         130         147         1995           P-33A         J-21         J-217         150         PVC         130         12         1995           P-338         J-217         J-22         150         PVC         130         154         1995           P-35         J-23         J-24         150         PVC         130         68         1995           P-36         J-24         J-26         200         PVC         130         116         1995           P-37         J-24         J-26         250         PVC         130         117         1995           P-38         J-21         J-26         250         PVC         130         117         1995           P-398         J-219         J-27         250         PVC <t< td=""><td>P-21 P-22 P-23 P-24 P-25 P-26</td><td>J-9 J-10 J-10 J-12 J-13 J-13 J-13 J-15</td><td>J-10 J-11 J-12 J-13 J-14 J-15 J-16</td><td>200 150 200 200 150 200 150</td><td>PVC PVC PVC PVC PVC PVC PVC PVC</td><td>130 130 130 130 130 130 130 130</td><td>133 71 152 87 62 89 120</td><td>1984 1984 1984 1984 1984 1984 1984 1985</td></t<>	P-21 P-22 P-23 P-24 P-25 P-26	J-9 J-10 J-10 J-12 J-13 J-13 J-13 J-15	J-10 J-11 J-12 J-13 J-14 J-15 J-16	200 150 200 200 150 200 150	PVC PVC PVC PVC PVC PVC PVC PVC	130 130 130 130 130 130 130 130	133 71 152 87 62 89 120	1984 1984 1984 1984 1984 1984 1984 1985
P-308         J-214         J-19         250         PVC         130         160         1995           P-31         J-19         J-20         250         PVC         130         151         1995           P-32         J-20         J-21         250         PVC         130         147         1995           P-33A         J-21         J-21         250         PVC         130         12         1995           P-33B         J-21         J-22         150         PVC         130         45         1995           P-34         J-22         J-23         150         PVC         130         154         1995           P-35         J-23         J-24         150         PVC         130         68         1995           P-36         J-24         J-25         200         PVC         130         116         1995           P-37         J-24         J-26         200         PVC         130         117         1995           P-38         J-21         J-26         250         PVC         130         111         1984           P-40         J-12         J-28         150         PVC         130<	P-21 P-22 P-23 P-24 P-25 P-26 P-28	J-9 J-10 J-12 J-13 J-13 J-13 J-15 J-17	J-10 J-11 J-12 J-13 J-14 J-14 J-15 J-16 J-18	200 150 200 150 200 150 200 150 150	PVC	130           130           130           130           130           130           130           130           130           130           130           130           130           130           130           130	133 71 152 87 62 89 120 146	1984 1984 1984 1984 1984 1984 1984 1985 1985
P-308         J-214         J-19         250         PVC         130         160         1995           P-31         J-19         J-20         250         PVC         130         151         1995           P-32         J-20         J-21         250         PVC         130         147         1995           P-33A         J-21         J-21         250         PVC         130         12         1995           P-33B         J-21         J-22         150         PVC         130         45         1995           P-34         J-22         J-23         150         PVC         130         154         1995           P-35         J-23         J-24         150         PVC         130         68         1995           P-36         J-24         J-25         200         PVC         130         116         1995           P-37         J-24         J-26         200         PVC         130         117         1995           P-38         J-21         J-26         250         PVC         130         111         1984           P-40         J-12         J-28         150         PVC         130<	P-21 P-22 P-23 P-24 P-25 P-26 P-28 P-29	J-9 J-10 J-12 J-13 J-13 J-13 J-15 J-17 J-18	J-10 J-11 J-12 J-13 J-14 J-14 J-15 J-16 J-18 J-9	200 150 200 150 200 150 150 150 150	PVC	130           130           130           130           130           130           130           130           130           130           130           130           130           130           130           130           130	133 71 152 87 62 89 120 146 164	1984 1984 1984 1984 1984 1984 1984 1985 1984 1984
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	P-21 P-22 P-23 P-24 P-25 P-26 P-28 P-29	J-9 J-10 J-12 J-13 J-13 J-13 J-15 J-17 J-18	J-10 J-11 J-12 J-13 J-14 J-14 J-15 J-16 J-18 J-9	200 150 200 150 200 150 150 150 150	PVC	130           130           130           130           130           130           130           130           130           130           130           130           130           130           130           130           130	133 71 152 87 62 89 120 146 164	1984 1984 1984 1984 1984 1984 1984 1985 1984 1984
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	P-21 P-22 P-23 P-24 P-25 P-26 P-28 P-29 P-29 P-30A	J-9 J-10 J-12 J-13 J-13 J-13 J-15 J-17 J-18 J-8	J-10 J-11 J-12 J-13 J-14 J-14 J-15 J-16 J-18 J-9 J-214	200 150 200 150 200 150 150 150 150 250	PVC	130           130           130           130           130           130           130           130           130           130           130           130           130           130           130           130           130           130           130           130	133 71 152 87 62 89 120 146 164 172	1984 1984 1984 1984 1984 1984 1985 1985 1984 1984 1985
P-33A         J-21         J-217         150         PVC         130         12         1995           P-33B         J-217         J-22         150         PVC         130         45         1995           P-34         J-22         J-23         150         PVC         130         154         1995           P-35         J-23         J-24         150         PVC         130         39         1995           P-36         J-24         J-25         200         PVC         130         68         1995           P-37         J-24         J-26         200         PVC         130         116         1995           P-38         J-21         J-26         250         PVC         130         117         1995           P-398         J-219         J-27         250         PVC         130         26         1995           P-40         J-12         J-28         150         PVC         130         111         1984           P-41         J-28         J-29         150         PVC         130         87         1984           P-44         J-31         J-211         150         PVC         130<	P-21 P-22 P-23 P-24 P-25 P-26 P-28 P-29 P-30A P-30B	J-9 J-10 J-12 J-13 J-13 J-13 J-15 J-17 J-17 J-18 J-8 J-214	J-10 J-11 J-12 J-13 J-14 J-15 J-16 J-18 J-9 J-214 J-19	200 150 200 150 200 150 150 150 150 250 250	PVC	130           130	133 71 152 87 62 89 120 146 164 172 160	1984 1984 1984 1984 1984 1984 1985 1985 1984 1984 1985 1984 1995
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	P-21 P-22 P-23 P-24 P-25 P-26 P-28 P-29 P-30A P-30B P-31	J-9 J-10 J-12 J-13 J-13 J-13 J-13 J-15 J-17 J-18 J-8 J-8 J-214 J-19	J-10 J-11 J-12 J-13 J-14 J-15 J-16 J-18 J-18 J-9 J-214 J-19 J-20	200 150 200 150 200 150 150 150 150 250 250 250	PVC	130         130	133 71 152 87 62 89 120 146 164 172 160 151	1984 1984 1984 1984 1984 1984 1984 1985 1984 1984 1995 1995
P-34         J-22         J-23         150         PVC         130         154         1995           P-35         J-23         J-24         150         PVC         130         39         1995           P-36         J-24         J-25         200         PVC         130         68         1995           P-36         J-24         J-26         200         PVC         130         116         1995           P-38         J-21         J-26         250         PVC         130         117         1995           P-39A         J-26         J-219         250         PVC         130         26         1995           P-39B         J-219         J-27         250         PVC         130         111         1984           P-40         J-12         J-28         150         PVC         130         111         1984           P-41         J-28         J-29         150         PVC         130         87         1984           P-41         J-28         J-29         150         PVC         130         112         1984           P-44         J-31         J-211         150         PVC         130<	P-21 P-22 P-23 P-24 P-25 P-26 P-28 P-29 P-30A P-30B P-31 P-32	J-9 J-10 J-12 J-13 J-13 J-13 J-15 J-17 J-18 J-8 J-8 J-214 J-19 J-20	J-10 J-11 J-12 J-13 J-14 J-15 J-16 J-16 J-18 J-9 J-214 J-19 J-20 J-21	200 150 200 150 200 150 150 150 150 250 250 250 250 250	PVC	130           130	133 71 152 87 62 89 120 146 164 172 160 151 147	1984 1984 1984 1984 1984 1984 1985 1984 1984 1984 1995 1995 1995
P-34         J-22         J-23         150         PVC         130         154         1995           P-35         J-23         J-24         150         PVC         130         39         1995           P-36         J-24         J-25         200         PVC         130         68         1995           P-36         J-24         J-26         200         PVC         130         116         1995           P-38         J-21         J-26         250         PVC         130         117         1995           P-39A         J-26         J-219         250         PVC         130         26         1995           P-39B         J-219         J-27         250         PVC         130         111         1984           P-40         J-12         J-28         150         PVC         130         111         1984           P-41         J-28         J-29         150         PVC         130         87         1984           P-41         J-28         J-29         150         PVC         130         112         1984           P-44         J-31         J-211         150         PVC         130<	P-21 P-22 P-23 P-24 P-25 P-26 P-28 P-29 P-30A P-30B P-31 P-32	J-9 J-10 J-12 J-13 J-13 J-13 J-15 J-17 J-18 J-8 J-8 J-214 J-19 J-20	J-10 J-11 J-12 J-13 J-14 J-15 J-16 J-16 J-18 J-9 J-214 J-19 J-20 J-21	200 150 200 150 200 150 150 150 150 250 250 250 250 250	PVC	130           130	133 71 152 87 62 89 120 146 164 172 160 151 147	1984 1984 1984 1984 1984 1984 1985 1984 1984 1984 1995 1995 1995
P-35         J-23         J-24         150         PVC         130         39         1995           P-36         J-24         J-25         200         PVC         130         68         1995           P-37         J-24         J-26         200         PVC         130         116         1995           P-38         J-21         J-26         250         PVC         130         117         1995           P-398         J-26         J-219         250         PVC         130         93         1995           P-398         J-21         J-28         150         PVC         130         93         1995           P-40         J-12         J-28         150         PVC         130         93         1995           P-41         J-28         J-29         150         PVC         130         111         1984           P-41         J-28         J-30         150         PVC         130         87         1984           P-41         J-28         J-30         150         PVC         130         10         1984           P-42         J-28         J-33         150         PVC         130	P-21           P-22           P-23           P-24           P-25           P-26           P-28           P-29           P-30A           P-31           P-32           P-33A	J-9 J-10 J-12 J-13 J-13 J-13 J-15 J-17 J-18 J-8 J-8 J-214 J-19 J-20 J-21	J-10 J-11 J-12 J-13 J-14 J-15 J-16 J-16 J-18 J-9 J-21 J-21 J-20 J-21 J-21 J-21 J-217	200 150 200 150 200 150 150 150 150 250 250 250 250 250 250 250 150	PVC	130           130	133 71 152 87 62 89 120 146 164 172 160 151 151 147 12	1984 1984 1984 1984 1984 1984 1985 1984 1985 1984 1995 1995 1995 1995
P-36J-24J-25200PVC130681995P-37J-24J-26200PVC1301161995P-38J-21J-26250PVC1301171995P-39AJ-26J-219250PVC130261995P-39BJ-219J-27250PVC130931995P-40J-12J-28150PVC1301111984P-41J-28J-29150PVC130761984P-42J-28J-30150PVC130871984P-44AJ-31J-211150PVC1301121984P-45J-32J-33150PVC130471984P-46J-33J-34150PVC130651984P-47J-32J-34150PVC130471984P-49J-30J-31150PVC130471984P-49J-30J-31150PVC130471984P-49J-36J-36150PVC1301571984P-49J-36J-36150PVC1301561984P-49J-36J-36150PVC130491984	P-21           P-22           P-23           P-24           P-25           P-26           P-28           P-29           P-308           P-31           P-32           P-33A           P-33B	J-9 J-10 J-12 J-13 J-13 J-13 J-15 J-17 J-18 J-8 J-214 J-20 J-20 J-21 J-217	J-10 J-11 J-12 J-13 J-14 J-15 J-16 J-18 J-9 J-20 J-21 J-20 J-21 J-21 J-217 J-22	200 150 200 150 200 150 150 150 250 250 250 250 250 250 150 150	PVC	130           130	133           71           152           87           62           89           120           146           164           172           160           151           147           12           45	1984           1984           1984           1984           1984           1984           1984           1984           1984           1985           1984           1985           1984           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995
P-37J-24J-26200PVC1301161995P-38J-21J-26250PVC1301171995P-39AJ-26J-219250PVC130261995P-39BJ-219J-27250PVC130931995P-40J-12J-28150PVC1301111984P-41J-28J-29150PVC130871984P-42J-28J-30150PVC130871984P-44AJ-31J-211150PVC1301121984P-45J-32J-33150PVC130471984P-46J-33J-34150PVC130741984P-47J-32J-34150PVC130471984P-49J-30J-31150PVC130471984P-49J-30J-31150PVC130471984P-49J-36J-36150PVC130491984	P-21           P-22           P-23           P-24           P-25           P-26           P-28           P-29           P-300           P-31           P-32           P-33A           P-33B           P-34	J-9 J-10 J-10 J-12 J-13 J-13 J-13 J-15 J-17 J-18 J-8 J-214 J-20 J-21 J-21 J-217 J-22	J-10 J-11 J-12 J-13 J-14 J-14 J-15 J-16 J-18 J-9 J-20 J-214 J-20 J-21 J-21 J-21 J-21 J-22 J-22 J-23	200 150 200 150 200 150 150 150 250 250 250 250 250 250 150 150 150	PVC	130         130	133           71           152           87           62           89           120           146           164           172           160           151           147           12           45           154	1984           1984           1984           1984           1984           1984           1984           1984           1984           1985           1984           1985           1984           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995
P-38J-21J-26250PVC1301171995P-39AJ-26J-219250PVC130261995P-39BJ-219J-27250PVC130931995P-40J-12J-28150PVC1301111984P-41J-28J-29150PVC130761984P-42J-28J-30150PVC130871984P-44AJ-31J-211150PVC1301121984P-44BJ-211J-32150PVC130101984P-45J-32J-33150PVC130741984P-46J-33J-34150PVC130651984P-47J-32J-34150PVC130471984P-49J-30J-31150PVC1301571984P-49J-30J-31150PVC1301571984P-49J-36J-36150PVC1301561984P-50J-36J-37150PVC130491984	P-21           P-22           P-23           P-24           P-25           P-26           P-28           P-29           P-30A           P-31           P-32           P-338           P-338           P-338	J-9 J-10 J-10 J-12 J-13 J-13 J-15 J-17 J-18 J-8 J-214 J-19 J-214 J-20 J-21 J-21 J-217 J-22 J-23	J-10 J-11 J-12 J-13 J-14 J-14 J-15 J-16 J-18 J-9 J-21 J-21 J-20 J-21 J-21 J-21 J-21 J-22 J-22 J-23 J-24	200 150 200 200 150 150 150 150 250 250 250 250 250 150 150 150 150 150 150	PVC	130         130	133         71         152         87         62         89         120         146         164         172         160         151         147         12         45         154         39	1984           1984           1984           1984           1984           1984           1984           1984           1984           1985           1984           1985           1984           1995
P-38J-21J-26250PVC1301171995P-39AJ-26J-219250PVC130261995P-39BJ-219J-27250PVC130931995P-40J-12J-28150PVC1301111984P-41J-28J-29150PVC130761984P-42J-28J-30150PVC130871984P-44AJ-31J-211150PVC1301121984P-44BJ-211J-32150PVC130101984P-45J-32J-33150PVC130741984P-46J-33J-34150PVC130651984P-47J-32J-34150PVC130471984P-49J-30J-31150PVC1301571984P-49J-30J-31150PVC1301571984P-49J-36J-36150PVC1301561984P-50J-36J-37150PVC130491984	P-21           P-22           P-23           P-24           P-25           P-26           P-28           P-29           P-30A           P-31           P-32           P-338           P-338           P-338	J-9 J-10 J-10 J-12 J-13 J-13 J-15 J-17 J-18 J-8 J-214 J-19 J-214 J-20 J-21 J-21 J-217 J-22 J-23	J-10 J-11 J-12 J-13 J-14 J-14 J-15 J-16 J-18 J-9 J-21 J-21 J-20 J-21 J-21 J-21 J-21 J-22 J-22 J-23 J-24	200 150 200 200 150 150 150 150 250 250 250 250 250 150 150 150 150 150 150	PVC	130         130	133           71           152           87           62           89           120           146           164           172           160           151           147           12           45           154           39	1984           1984           1984           1984           1984           1984           1984           1984           1984           1985           1984           1985           1984           1995
P-39A         J-26         J-219         250         PVC         130         26         1995           P-39B         J-219         J-27         250         PVC         130         93         1995           P-40         J-12         J-28         150         PVC         130         111         1984           P-41         J-28         J-29         150         PVC         130         76         1984           P-42         J-28         J-30         150         PVC         130         87         1984           P-44         J-31         J-211         150         PVC         130         112         1984           P-448         J-211         J-32         150         PVC         130         10         1984           P-45         J-32         J-33         150         PVC         130         10         1984           P-46         J-33         J-34         150         PVC         130         47         1984           P-47         J-32         J-34         150         PVC         130         65         1984           P-47         J-32         J-34         150         PVC         130 <td>P-21           P-22           P-23           P-24           P-25           P-26           P-27           P-28           P-300           P-311           P-323A           P-33A           P-33A           P-34           P-35           P-36</td> <td>J-9 J-10 J-10 J-12 J-13 J-13 J-15 J-17 J-18 J-8 J-214 J-19 J-214 J-20 J-211 J-217 J-22 J-22 J-22 J-23 J-24</td> <td>J-10 J-11 J-12 J-13 J-14 J-15 J-16 J-18 J-9 J-214 J-19 J-20 J-21 J-20 J-21 J-21 J-22 J-23 J-22 J-23 J-24 J-25</td> <td>200 150 200 200 150 150 150 150 250 250 250 250 150 150 150 150 150 150 150 200</td> <td>PVC           PVC           PVC</td> <td>130         130</td> <td>133         71         152         87         62         89         120         146         164         151         147         12         45         154         39         68</td> <td>1984           1984           1984           1984           1984           1984           1984           1984           1985           1984           1985           1984           1995</td>	P-21           P-22           P-23           P-24           P-25           P-26           P-27           P-28           P-300           P-311           P-323A           P-33A           P-33A           P-34           P-35           P-36	J-9 J-10 J-10 J-12 J-13 J-13 J-15 J-17 J-18 J-8 J-214 J-19 J-214 J-20 J-211 J-217 J-22 J-22 J-22 J-23 J-24	J-10 J-11 J-12 J-13 J-14 J-15 J-16 J-18 J-9 J-214 J-19 J-20 J-21 J-20 J-21 J-21 J-22 J-23 J-22 J-23 J-24 J-25	200 150 200 200 150 150 150 150 250 250 250 250 150 150 150 150 150 150 150 200	PVC	130         130	133         71         152         87         62         89         120         146         164         151         147         12         45         154         39         68	1984           1984           1984           1984           1984           1984           1984           1984           1985           1984           1985           1984           1995
P-39B         J-219         J-27         250         PVC         130         93         1995           P-40         J-12         J-28         150         PVC         130         111         1984           P-41         J-28         J-29         150         PVC         130         76         1984           P-42         J-28         J-30         150         PVC         130         87         1984           P-44         J-31         J-211         150         PVC         130         112         1984           P-44B         J-211         J-32         150         PVC         130         10         1984           P-44B         J-211         J-32         150         PVC         130         10         1984           P-44B         J-211         J-32         150         PVC         130         10         1984           P-45         J-32         J-33         150         PVC         130         47         1984           P-46         J-33         J-34         150         PVC         130         65         1984           P-47         J-32         J-34         150         PVC         130<	P-21           P-22           P-23           P-24           P-25           P-26           P-27           P-28           P-300           P-31           P-32           P-33A           P-33B           P-34           P-35           P-36           P-37	J-9 J-10 J-12 J-13 J-13 J-15 J-17 J-17 J-18 J-8 J-214 J-214 J-20 J-214 J-20 J-21 J-21 J-22 J-22 J-23 J-24 J-24	J-10 J-11 J-12 J-13 J-14 J-15 J-16 J-18 J-18 J-9 J-214 J-19 J-20 J-21 J-20 J-21 J-21 J-22 J-22 J-22 J-22 J-22 J-22	200 150 200 200 150 150 150 150 250 250 250 250 150 150 150 150 150 150 200 200 200 200 200 200 200 2	PVC	130         130	133           71           152           87           62           89           120           146           164           172           160           151           147           12           45           154           39           68           116	1984           1984           1984           1984           1984           1984           1984           1984           1984           1985           1984           1995
P-40J-12J-28150PVC1301111984P-41J-28J-29150PVC130761984P-42J-28J-30150PVC130871984P-44J-31J-211150PVC1301121984P-448J-211J-32150PVC130101984P-45J-32J-33150PVC130471984P-46J-33J-34150PVC130651984P-48J-35J-34150PVC130471984P-49J-30J-31150PVC1301571984P-49J-36J-36150PVC1301561984P-50J-36J-37150PVC130491984	P-21           P-22           P-23           P-24           P-25           P-26           P-27           P-28           P-30A           P-31           P-32           P-33A           P-33B           P-335           P-36           P-37           P-38	J-9 J-10 J-10 J-12 J-13 J-13 J-15 J-17 J-18 J-8 J-8 J-8 J-8 J-214 J-21 J-20 J-21 J-21 J-21 J-22 J-22 J-24 J-24 J-24 J-21	J-10 J-11 J-12 J-13 J-14 J-15 J-16 J-16 J-18 J-9 J-20 J-21 J-21 J-20 J-21 J-22 J-22 J-23 J-22 J-23 J-24 J-25 J-26 J-26	200 150 200 200 150 200 150 150 150 250 250 250 250 150 150 150 150 150 150 250 250 250 250 250 250 250 2	PVC	130         130	133           71           152           87           62           89           120           146           164           172           160           151           147           12           45           154           39           68           116           117	1984           1984           1984           1984           1984           1984           1984           1984           1984           1985           1984           1995
P-40J-12J-28150PVC1301111984P-41J-28J-29150PVC130761984P-42J-28J-30150PVC130871984P-44J-31J-211150PVC1301121984P-448J-211J-32150PVC130101984P-45J-32J-33150PVC130471984P-46J-33J-34150PVC130651984P-48J-35J-34150PVC130471984P-49J-30J-31150PVC1301571984P-49J-36J-36150PVC1301561984P-50J-36J-37150PVC130491984	P-21           P-22           P-23           P-24           P-25           P-26           P-28           P-29           P-30A           P-31           P-32           P-33A           P-33B           P-34           P-35           P-36           P-37           P-38           P-39A	J-9 J-10 J-10 J-12 J-13 J-13 J-13 J-15 J-17 J-18 J-8 J-21 J-21 J-21 J-21 J-21 J-21 J-22 J-23 J-24 J-24 J-24 J-21 J-26	J-10 J-11 J-12 J-13 J-14 J-15 J-16 J-18 J-9 J-20 J-21 J-20 J-21 J-22 J-23 J-24 J-23 J-24 J-25 J-26 J-26 J-219	200 150 200 200 150 200 150 150 250 250 250 250 150 150 150 150 250 250 250 250 250 250 250 2	PVC	130           130	133           71           152           87           62           89           120           146           164           172           160           151           147           12           45           154           39           68           116           117           26	1984           1984           1984           1984           1984           1984           1984           1984           1984           1985           1984           1995
P-41         J-28         J-29         150         PVC         130         76         1984           P-42         J-28         J-30         150         PVC         130         87         1984           P-44A         J-31         J-211         150         PVC         130         112         1984           P-44B         J-211         J-32         150         PVC         130         10         1984           P-45         J-32         J-33         150         PVC         130         47         1984           P-46         J-33         J-34         150         PVC         130         74         1984           P-47         J-32         J-34         150         PVC         130         65         1984           P-48         J-35         J-34         150         PVC         130         47         1984           P-47         J-32         J-34         150         PVC         130         47         1984           P-48         J-35         J-34         150         PVC         130         47         1984           P-49         J-30         J-31         150         PVC         130	P-21           P-22           P-23           P-24           P-25           P-26           P-28           P-29           P-30A           P-31           P-32           P-33A           P-33B           P-34           P-35           P-36           P-37           P-38           P-39A	J-9 J-10 J-10 J-12 J-13 J-13 J-13 J-15 J-17 J-18 J-8 J-21 J-21 J-21 J-21 J-21 J-21 J-22 J-23 J-24 J-24 J-24 J-21 J-26	J-10 J-11 J-12 J-13 J-14 J-15 J-16 J-18 J-9 J-20 J-21 J-20 J-21 J-22 J-23 J-24 J-23 J-24 J-25 J-26 J-26 J-219	200 150 200 200 150 200 150 150 250 250 250 250 150 150 150 150 250 250 250 250 250 250 250 2	PVC	130           130	133           71           152           87           62           89           120           146           164           172           160           151           147           12           45           154           39           68           116           117           26	1984           1984           1984           1984           1984           1984           1984           1984           1984           1985           1984           1995
P-42         J-28         J-30         150         PVC         130         87         1984           P-44A         J-31         J-211         150         PVC         130         112         1984           P-44B         J-211         J-32         150         PVC         130         10         1984           P-44B         J-211         J-32         150         PVC         130         10         1984           P-45         J-32         J-33         150         PVC         130         47         1984           P-46         J-33         J-34         150         PVC         130         65         1984           P-47         J-32         J-34         150         PVC         130         65         1984           P-48         J-35         J-34         150         PVC         130         47         1984           P-49         J-30         J-31         150         PVC         130         47         1984           P-49         J-30         J-31         150         PVC         130         157         1984           P-49         J-35         J-36         150         PVC         130 <td>P-21           P-22           P-23           P-24           P-25           P-26           P-27           P-30A           P-30B           P-31           P-33A           P-33A           P-35           P-36           P-37           P-38           P-39</td> <td>J-9 J-10 J-10 J-12 J-13 J-13 J-15 J-17 J-18 J-8 J-21 J-21 J-20 J-21 J-20 J-21 J-21 J-20 J-21 J-21 J-22 J-23 J-24 J-24 J-21 J-26 J-219</td> <td>J-10 J-11 J-12 J-13 J-14 J-15 J-16 J-18 J-9 J-20 J-21 J-20 J-21 J-20 J-21 J-22 J-23 J-24 J-23 J-24 J-25 J-26 J-26 J-219 J-27</td> <td>200 150 200 200 150 200 150 150 250 250 250 250 150 150 150 150 150 250 250 250 250 250 250 250 2</td> <td>PVC           PVC           PVC</td> <td>130         130</td> <td>133           71           152           87           62           89           120           146           164           172           160           151           147           12           45           154           39           68           116           117           26           93</td> <td>1984           1984           1984           1984           1984           1984           1984           1984           1984           1985           1984           1995</td>	P-21           P-22           P-23           P-24           P-25           P-26           P-27           P-30A           P-30B           P-31           P-33A           P-33A           P-35           P-36           P-37           P-38           P-39	J-9 J-10 J-10 J-12 J-13 J-13 J-15 J-17 J-18 J-8 J-21 J-21 J-20 J-21 J-20 J-21 J-21 J-20 J-21 J-21 J-22 J-23 J-24 J-24 J-21 J-26 J-219	J-10 J-11 J-12 J-13 J-14 J-15 J-16 J-18 J-9 J-20 J-21 J-20 J-21 J-20 J-21 J-22 J-23 J-24 J-23 J-24 J-25 J-26 J-26 J-219 J-27	200 150 200 200 150 200 150 150 250 250 250 250 150 150 150 150 150 250 250 250 250 250 250 250 2	PVC	130         130	133           71           152           87           62           89           120           146           164           172           160           151           147           12           45           154           39           68           116           117           26           93	1984           1984           1984           1984           1984           1984           1984           1984           1984           1985           1984           1995
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P-50 J-36 J-37 150 PVC 130 49 1984	P-21           P-22           P-23           P-24           P-25           P-26           P-28           P-29           P-30A           P-31           P-332           P-334           P-335           P-36           P-37           P-38A           P-39B           P-40           P-44A           P-445           P-456           P-47           P-48	J-9 J-10 J-10 J-12 J-13 J-13 J-13 J-15 J-17 J-18 J-8 J-214 J-21 J-21 J-21 J-21 J-21 J-22 J-23 J-24 J-21 J-22 J-23 J-24 J-24 J-24 J-21 J-22 J-23 J-24 J-24 J-24 J-24 J-24 J-24 J-24 J-24 J-24 J-24 J-21 J-22 J-23 J-24 J-25 J-24 J-26 J-21 J-26 J-21 J-26 J-21 J-26 J-21 J-26 J-21 J-26 J-21 J-26 J-27 J-28 J-28 J-28 J-31 J-21 J-21 J-28 J-31 J-21 J-21 J-28 J-31 J-21 J-21 J-28 J-31 J-21 J-21 J-28 J-31 J-32 J-33 J-33 J-32 J-35	J-10 J-11 J-12 J-13 J-14 J-15 J-16 J-18 J-9 J-214 J-20 J-214 J-20 J-217 J-22 J-23 J-22 J-23 J-24 J-22 J-23 J-24 J-25 J-26 J-26 J-26 J-26 J-26 J-26 J-27 J-28 J-27 J-28 J-29 J-27 J-28 J-29 J-27 J-28 J-29 J-30 J-30 J-34 J-34 J-34	200 150 200 200 150 150 150 150 250 250 250 250 150 150 150 150 250 250 250 250 150 150 150 150 150 150 150 1	PVC           PVC	130         1	133         71         152         87         62         89         120         146         164         172         160         151         147         12         45         154         39         68         116         117         26         93         111         76         87         112         10         47         74         65         47	1984         1984         1984         1984         1984         1984         1984         1984         1984         1984         1985         1984         1995         1984         1984         1984         1984         1984         1984         1984         1984
	P-21           P-22           P-23           P-24           P-25           P-26           P-28           P-29           P-308           P-31           P-325           P-308           P-31           P-330           P-338           P-34           P-35           P-36           P-37           P-388           P-390           P-390           P-400           P-41           P-448           P-455           P-46           P-47           P-48           P-49	J-9 J-10 J-10 J-12 J-13 J-13 J-15 J-17 J-18 J-8 J-214 J-21 J-20 J-21 J-21 J-22 J-23 J-24 J-24 J-21 J-22 J-24 J-21 J-22 J-24 J-21 J-22 J-24 J-21 J-22 J-24 J-21 J-22 J-24 J-21 J-22 J-23 J-24 J-21 J-22 J-23 J-24 J-21 J-21 J-22 J-23 J-24 J-21 J-22 J-24 J-21 J-22 J-23 J-24 J-21 J-22 J-23 J-24 J-21 J-22 J-23 J-24 J-21 J-22 J-23 J-24 J-21 J-22 J-23 J-24 J-21 J-22 J-23 J-24 J-21 J-22 J-24 J-21 J-22 J-23 J-24 J-21 J-22 J-23 J-24 J-21 J-22 J-23 J-24 J-21 J-22 J-23 J-24 J-21 J-22 J-23 J-24 J-21 J-22 J-23 J-24 J-21 J-22 J-23 J-24 J-21 J-22 J-23 J-24 J-21 J-26 J-21 J-28 J-28 J-31 J-32 J-33 J-32 J-35 J-30	J-10 J-11 J-12 J-13 J-14 J-15 J-16 J-18 J-9 J-20 J-21 J-20 J-21 J-22 J-23 J-22 J-23 J-24 J-25 J-26 J-26 J-26 J-26 J-26 J-27 J-27 J-28 J-27 J-28 J-27 J-27 J-28 J-27 J-27 J-27 J-26 J-26 J-26 J-26 J-26 J-26 J-27 J-27 J-28 J-27 J-28 J-27 J-28 J-28 J-28 J-28 J-29 J-30 J-31 J-34 J-34 J-34 J-34 J-31	200 150 200 200 150 200 150 150 150 250 250 250 250 150 150 150 150 250 250 250 250 250 250 250 150 150 150 150 150 150 150 1	PVC           PVC	130         1	133         71         152         87         62         89         120         146         164         172         160         151         147         12         45         154         39         68         116         117         26         93         111         76         87         112         10         47         74         65         47         157	1984         1984         1984         1984         1984         1984         1984         1984         1984         1984         1985         1984         1995         1984         1984         1984         1984         1984         1984         1984         1984
	P-21           P-22           P-23           P-24           P-25           P-26           P-27           P-30A           P-30A           P-31           P-32           P-33A           P-33A           P-34           P-35           P-36           P-37           P-38           P-39A           P-39B           P-40           P-412           P-444           P-445           P-46           P-47           P-49           P-49	J-9 J-10 J-10 J-12 J-13 J-13 J-13 J-15 J-17 J-18 J-8 J-214 J-214 J-20 J-214 J-217 J-22 J-23 J-22 J-23 J-24 J-24 J-24 J-24 J-24 J-24 J-24 J-24 J-21 J-26 J-219 J-12 J-28 J-28 J-28 J-21 J-21 J-28 J-28 J-21 J-33 J-35 J-30 J-35 J-30 J-35 J-30 J-35 J-30	J-10 J-11 J-12 J-13 J-14 J-15 J-16 J-18 J-9 J-20 J-21 J-20 J-21 J-22 J-23 J-24 J-22 J-23 J-24 J-25 J-26 J-26 J-26 J-26 J-27 J-28 J-27 J-28 J-27 J-28 J-27 J-28 J-27 J-28 J-26 J-21 J-27 J-28 J-26 J-21 J-23 J-24 J-23 J-24 J-24 J-25 J-26 J-26 J-27 J-28 J-27 J-28 J-26 J-27 J-28 J-26 J-27 J-28 J-26 J-27 J-28 J-26 J-27 J-28 J-26 J-27 J-28 J-26 J-26 J-27 J-28 J-26 J-27 J-28 J-27 J-28 J-27 J-28 J-27 J-28 J-26 J-27 J-28 J-27 J-28 J-27 J-28 J-27 J-28 J-27 J-28 J-26 J-27 J-28 J-27 J-28 J-26 J-27 J-28 J-26 J-27 J-28 J-26 J-26 J-27 J-28 J-27 J-28 J-27 J-28 J-26 J-27 J-28 J-26 J-26 J-26 J-27 J-28 J-27 J-28 J-27 J-28 J-27 J-28 J-29 J-30 J-30 J-31 J-34 J-34 J-34 J-34 J-34 J-34 J-34 J-34 J-34 J-34 J-34 J-34 J-31 J-36	200 150 200 200 150 200 150 150 150 250 250 250 250 150 150 150 150 250 250 250 250 250 250 250 150 150 150 150 150 150 150 1	PVC           PVC	130         1	133         71         152         87         62         89         120         146         164         172         160         151         147         12         45         154         39         68         116         117         26         93         1111         76         87         112         10         47         74         65         47         157         156	1984         1984         1984         1984         1984         1984         1984         1984         1984         1984         1985         1984         1995         1984         1984         1984         1984         1984         1984         1984         1984         1984         1984
	P-21           P-22           P-23           P-24           P-25           P-26           P-27           P-30A           P-30A           P-31           P-32           P-33A           P-33A           P-34           P-35           P-36           P-37           P-38           P-39A           P-39B           P-40           P-412           P-444           P-445           P-46           P-47           P-49           P-49	J-9 J-10 J-10 J-12 J-13 J-13 J-13 J-15 J-17 J-18 J-8 J-214 J-214 J-20 J-214 J-217 J-22 J-23 J-22 J-23 J-24 J-24 J-24 J-24 J-24 J-24 J-24 J-24 J-21 J-26 J-219 J-12 J-28 J-28 J-28 J-21 J-21 J-28 J-28 J-21 J-33 J-35 J-30 J-35 J-30 J-35 J-30 J-35 J-30	J-10 J-11 J-12 J-13 J-14 J-15 J-16 J-18 J-9 J-20 J-21 J-20 J-21 J-22 J-23 J-24 J-22 J-23 J-24 J-25 J-26 J-26 J-26 J-26 J-27 J-28 J-27 J-28 J-27 J-28 J-27 J-28 J-27 J-28 J-26 J-21 J-27 J-28 J-26 J-21 J-23 J-24 J-23 J-24 J-24 J-25 J-26 J-26 J-27 J-28 J-27 J-28 J-26 J-27 J-28 J-26 J-27 J-28 J-26 J-27 J-28 J-26 J-27 J-28 J-26 J-27 J-28 J-26 J-26 J-27 J-28 J-26 J-27 J-28 J-27 J-28 J-27 J-28 J-27 J-28 J-26 J-27 J-28 J-27 J-28 J-27 J-28 J-27 J-28 J-27 J-28 J-26 J-27 J-28 J-27 J-28 J-26 J-27 J-28 J-26 J-27 J-28 J-26 J-26 J-27 J-28 J-27 J-28 J-27 J-28 J-26 J-27 J-28 J-26 J-26 J-26 J-27 J-28 J-27 J-28 J-27 J-28 J-27 J-28 J-29 J-30 J-30 J-31 J-34 J-34 J-34 J-34 J-34 J-34 J-34 J-34 J-34 J-34 J-34 J-34 J-31 J-36	200 150 200 200 150 200 150 150 150 250 250 250 250 150 150 150 150 250 250 250 250 250 250 250 150 150 150 150 150 150 150 1	PVC           PVC	130         1	133         71         152         87         62         89         120         146         164         172         160         151         147         12         45         154         39         68         116         117         26         93         1111         76         87         112         10         47         74         65         47         157         156	1984         1984         1984         1984         1984         1984         1984         1984         1984         1984         1985         1984         1995         1984         1984         1984         1984         1984         1984         1984         1984         1984         1984
	P-21           P-22           P-23           P-24           P-25           P-26           P-28           P-29           P-30A           P-31           P-332           P-334           P-335           P-34           P-35           P-36           P-37           P-38           P-398           P-400           P-411           P-425           P-444A           P-445           P-448           P-47           P-489           P-49           P-50	J-9         J-10         J-12         J-13         J-13         J-15         J-17         J-18         J-21         J-21         J-21         J-21         J-21         J-21         J-22         J-23         J-24         J-21         J-22         J-23         J-24         J-21         J-24         J-21         J-24         J-21         J-23         J-24         J-21         J-23         J-24         J-21         J-22         J-31         J-21         J-22         J-31         J-32         J-33         J-32         J-33         J-30         J-35         J-36	J-10 J-11 J-12 J-13 J-14 J-15 J-16 J-18 J-9 J-20 J-21 J-20 J-21 J-22 J-23 J-24 J-22 J-23 J-24 J-25 J-26 J-26 J-26 J-26 J-26 J-27 J-28 J-27 J-28 J-29 J-27 J-28 J-29 J-27 J-28 J-29 J-27 J-28 J-29 J-27 J-28 J-26 J-21 J-26 J-26 J-21 J-27 J-28 J-26 J-27 J-28 J-27 J-28 J-27 J-28 J-27 J-28 J-27 J-28 J-29 J-27 J-28 J-27 J-28 J-27 J-28 J-26 J-26 J-27 J-28 J-27 J-28 J-27 J-28 J-27 J-28 J-27 J-28 J-27 J-28 J-27 J-28 J-27 J-28 J-27 J-28 J-27 J-28 J-27 J-28 J-27 J-28 J-27 J-29 J-27 J-28 J-27 J-28 J-27 J-28 J-27 J-29 J-30 J-21 J-27 J-28 J-26 J-26 J-26 J-26 J-27 J-28 J-27 J-28 J-29 J-30 J-21 J-27 J-28 J-29 J-30 J-21 J-27 J-28 J-29 J-30 J-21 J-31 J-34 J-34 J-34 J-34 J-36 J-36 J-36 J-36 J-36 J-36 J-36 J-34 J-34 J-34 J-36 J-37 J-36 J-37 J-36 J-37 J-37	200 150 200 200 150 200 150 150 250 250 250 250 150 150 150 150 250 250 250 250 250 250 250 150 150 150 150 150 150 150 1	PVC           PVC	130         1	133         71         152         87         62         89         120         146         164         172         160         151         147         12         45         154         39         68         116         117         26         93         1111         76         87         112         10         47         74         65         47         157         156         49	1984           1984           1984           1984           1984           1984           1984           1984           1984           1985           1984           1985           1984           1995           1984           1984           1984           1984           1984           1984           1984           1984           1984           1984           1984           1984           1984           1984           1984           1984



#### Appendix C - Pipe Table (2014 Existing Water Supply Distribution System)



P518         J-212         J-38         Z00         PVC         130         92         1984           P52A         J-212         J-38         150         PVC         130         66         1984           P526         J-31         J-212         150         PVC         130         67         1984           P53         J-38         J-39         150         PVC         130         61         1984           P54         J-37         J-210         150         PVC         130         61         1984           P556         J-210         J-40         150         PVC         130         20         1984           P556         J-41         J-420         250         PVC         130         20         1984           P57         J-41         J-42         250         PVC         130         20         1982           P54         J-41         J-42         250         PVC         130         20         1982           P54         J-41         J-42         250         PVC         130         20         1982           P54         J-41         J-420         250         PVC         130	0.540		1.00	200	5.40	100		4004
P23E         P231         P231         150         PVC         130         96         1984           P532         J-30         L-231         150         PVC         130         72         1984           P543         J-39         L-40         350         Ductiferon         130         168         1992           P544         J-37         L-200         150         Ductiferon         130         260         1992           P554         J-37         L-200         150         PVC         130         131         1984           P556         J-40         L-41         350         Ductiferon         130         189         1992           P554         J-41         L-42         250         PVC         130         75         1995           P584         J-41         L-209         PVC         130         67         1992           P584         J-41         L-42         250         PVC         130         13         1992           P584         J-41         L-44         260         PVC         130         62         1992           P640         L-501         L-701         300         PVC         130 </td <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>								
P>30         P>31         130         PVC         130         72         1984           P>53         1-38         P-32         150         PVC         130         61         1984           P>54         P-39         P-40         350         Ductlle tron         130         260         1992           P554         P-37         P-320         150         PVC         130         31         1984           P555         P-40         150         PVC         130         20         1982           P554         P-41         1.42         250         PVC         130         20         1982           P554         P-41         1.42         250         PVC         130         20         1982           P554         P-43         1.44         250         PVC         130         67         1992           P564         P43         1.44         250         PVC         130         16         1992           P640         P44         1.51         200         PVC         130         16         1992           P63         P45         1.51         200         PVC         130         16         1992								
$F_{54}$ $I_{39}$ $I_{40}$ $I_{50}$ $I_{30}$ $I_{61}$ $I_{984}$ $P_{54}$ $I_{39}$ $I_{40}$ $I_{30}$ $Duclie tron$ $I_{30}$ $I_{61}$ $I_{992}$ $P_{554}$ $I_{37}$ $P_{210}$ $I_{40}$ $I_{50}$ $P_{70}$ $I_{10}$ $I_{10}$ $I_{192}$ $P_{554}$ $I_{40}$ $I_{41}$ $I_{50}$ $D_{10}$ $I_{10}$ $I_{10}$ $I_{192}$ $P_{54}$ $I_{41}$ $I_{42}$ $P_{50}$ $P_{10}$ $I_{10}$ $I_{10}$ $I_{192}$ $P_{54}$ $I_{41}$ $I_{42}$ $P_{50}$ $P_{10}$ $I_{10}$ $I_{10}$ $I_{10}$ $I_{10}$ $I_{10}$ $I_{10}$ $I_{10}$ $I_{10}$ $I_{192}$ $P_{54}$ $I_{41}$ $I_{40}$ $I_{20}$ $P_{10}$ $I_{10}$								
F > 4A $I > 49$ $I > 40$ $350$ $Ductlie Iron$ $130$ $188$ $1992$ $P > 5A$ $I > 37$ $I > 210$ $150$ $PVC$ $130$ $311$ $1984$ $P > 550$ $I > 210$ $I > 40$ $150$ $PVC$ $130$ $20$ $1984$ $P > 56$ $I > 40$ $I > 141$ $350$ $Ductlie Iron$ $130$ $20$ $1982$ $P > 57$ $I > 41$ $I > 209$ $Z > 0$ $PVC$ $130$ $20$ $1982$ $P > 580$ $I < 41$ $I > 209$ $Z > 0$ $PVC$ $130$ $20$ $1982$ $P < 40$ $I < 43$ $Z > 0$ $PVC$ $130$ $61$ $1992$ $P < 40$ $I < 45$ $J > 10$ $J > 0$ $PVC$ $130$ $62$ $1992$ $P < 41$ $I < 50$ $D0$ $PVC$ $130$ $62$ $1992$ $P < 41$ $J > 0$ $PVC$ $I30$ $62$ $1992$					-			
P54A         J-8         J-39         350         Ductle Iron         130         280         1992           P55B         J-210         J-40         150         PVC         130         20         1984           P556         J-40         J-41         350         Ductle Iron         130         20         1984           P55         J-40         J-41         350         Ductle Iron         130         20         1992           P56         J-41         J-42         250         PVC         130         20         1992           P58         J-209         J-43         250         PVC         130         67         1992           P59         J-43         J-44         250         PVC         130         62         1992           P60A         J-201         J-45         300         PVC         130         144         1992           P64         J-45         J-46         150         D-70         130         62         1992           P66         J-50         J-202         200         PVC         130         62         1992           P66         J-51         J-50         200         PVC								
P556         1-37         1-210         150         PVC         130         31         1984           P556         1-40         1-41         350         Docule ton         130         20         1984           P56         1-40         1-41         350         Docule ton         130         20         1989           P57         1-41         1-42         250         PVC         130         20         1992           P588         1-209         2.50         PVC         130         95         1992           P588         1-201         1-44         250         PVC         130         67         1992           P608         1-43         1-44         250         PVC         130         62         1992           P608         1-43         1-451         200         PVC         130         62         1992           P631         1-45         1-51         200         PVC         130         62         1992           P64         1-50         1-52         200         PVC         130         62         1992           P64         1-51         1-52         200         PVC         130         1								
P556         1-210         1-40         150         PVC         130         20         1984           P-57         1-41         1-42         250         PVC         130         75         1995           P-58         1-41         1-209         250         PVC         130         20         1992           P-88         1-209         1-43         250         PVC         130         67         1992           P-80         1-43         1-44         250         PVC         130         67         1992           P-604         1-201         1-45         300         PVC         130         62         1992           P-604         1-45         1-45         1-46         150         PVC         130         104         1992           P-61         1-45         1-46         150         PVC         130         104         1992           P-66         1-50         1-202         200         PVC         130         84         1992           P-66         1-51         1-50         200         PVC         130         102         1992           P-68         1-52         200         PVC         130 </td <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>								
P-56         I-40         I-41         350         Durtle (ron)         130         189         1992           P-57         I-41         I-209         250         PVC         130         75         1995           P-580         I-209         I-43         250         PVC         130         35         1992           P-59         I-43         I-44         250         PVC         130         67         1992           P-608         I-201         I-45         300         PVC         130         18         1992           P-618         I-44         I-201         300         PVC         130         137         1992           P-621         I-45         I-51         200         PVC         130         104         1992           P-637         I-53         I-50         200         PVC         130         62         1992           P-647         I-51         I-50         200         PVC         130         62         1992           P-648         I-52         200         PVC         130         62         1992           P-649         I-33         I-53         150         PVC         130								
P-57 $J-41$ $J-42$ $250$ $PVC$ $130$ $75$ $1995$ $P-58A$ $J-209$ $J-43$ $250$ $PVC$ $130$ $20$ $1992$ $P-58$ $J-43$ $J-44$ $250$ $PVC$ $130$ $67$ $1992$ $P-60A$ $J-201$ $J-45$ $300$ $PVC$ $130$ $62$ $1992$ $P-60A$ $J-44$ $J-201$ $300$ $PVC$ $130$ $62$ $1992$ $P-60A$ $J-45$ $J-46$ $150$ $PVC$ $130$ $104$ $1992$ $P-61$ $J+51$ $J-50$ $200$ $PVC$ $130$ $62$ $1992$ $P-64A$ $J-50$ $J-202$ $200$ $PVC$ $130$ $62$ $1992$ $P-66A$ $J-50$ $J-53$ $200$ $PVC$ $130$ $62$ $1992$ $P-66A$ $J-52$ $J-203$ $200$ $PVC$ $130$ $16$								
P-58A         J-41         J-209         250         PVC         130         20         1992           P-58B         J-209         J-43         250         PVC         130         95         1992           P-58         J-43         J-44         250         PVC         130         67         1992           P-608         J-201         J-45         J-51         200         PVC         130         62         1992           P-61         J-45         J-51         200         PVC         130         104         1992           P-62         J-45         J-50         J-202         200         PVC         130         62         1992           P-66         J-50         J-202         200         PVC         130         62         1992           P-68         J-52         200         PVC         130         18         1992           P-68         J-53         J-03         200         PVC         130         18         1994           P-71         J-53         150         PVC         130         166         2005           P-74         J-53         J-204         J55         200         PVC<								
P-58         1-209         1-43         250         PVC         130         95         1992           P-59         1-43         1-44         250         PVC         130         67         1992           P-60A         1-201         1-45         300         PVC         130         18         1992           P-60B         1-44         1-201         300         PVC         130         62         1992           P-61         1-45         1-46         150         PVC         130         104         1992           P-64A         1-50         1-202         200         PVC         130         62         1992           P-67         1-51         1-50         200         PVC         130         84         1992           P-68         1-52         1-203         200         PVC         130         18         1989           P-70         1-54         1-53         150         PVC         130         105         1994           P-71         1-91         1-92         200         PVC         130         136         1994           P-73         1-53         1.50         PVC         130         136<	P-57	J-41	J-42	250		130		1995
P-59 $J-43$ $J-44$ $250$ $PVC$ $130$ $67$ $1992$ $P-606$ $J-41$ $J-201$ $300$ $PVC$ $130$ $62$ $1992$ $P-616$ $J-45$ $J-51$ $200$ $PVC$ $130$ $62$ $1992$ $P-61$ $J-45$ $J-51$ $200$ $PVC$ $130$ $104$ $1992$ $P-62$ $J-45$ $J-46$ $150$ $PVC$ $130$ $62$ $1992$ $P-667$ $J-50$ $J-202$ $200$ $PVC$ $130$ $62$ $1992$ $P-68$ $J-50$ $J-52$ $200$ $PVC$ $130$ $62$ $1992$ $P-68$ $J-50$ $J-52$ $200$ $PVC$ $130$ $62$ $1992$ $P-68$ $J-53$ $200$ $PVC$ $130$ $188$ $1989$ $P-70$ $J-54$ $J-53$ $200$ $PVC$ $130$ $165$ $1994$ $P-71$ $J-93$ $J-204$ $150$ $PVC$ $130$ $165$ $1994$ $P-72$ $J-55$ $J-56$ $200$ $PVC$ $130$ $136$ $1994$ $P-73$ $J-33$ $J-94$ $200$ $PVC$ $130$ $138$ $1994$ $P-73$ $J-33$ $J-94$ $200$ $PVC$ $130$ $33$ $194$ $P-74$ $J-55$ $J-56$ $200$ $PVC$ $130$ $33$ $194$ $P-73$ $J-33$ $J-94$ $200$ $PVC$ $130$ $318$ $1994$ $P-74$ $J-25$ $J-205$ $20$	P-58A	J-41	J-209	250	PVC	130	20	1992
P608 $J-201$ $J-45$ $300$ $PVC$ $130$ $18$ $1992$ $P-608$ $J-44$ $J-201$ $300$ $PVC$ $130$ $62$ $1992$ $P-61$ $J-45$ $J-51$ $200$ $PVC$ $130$ $1137$ $11992$ $P-62$ $J-45$ $J-46$ $150$ $PVC$ $130$ $104$ $1392$ $P-67$ $J-51$ $J-50$ $200$ $PVC$ $130$ $62$ $1992$ $P-68$ $J-50$ $J-52$ $200$ $PVC$ $130$ $62$ $1992$ $P-68$ $J-50$ $J-52$ $200$ $PVC$ $130$ $62$ $1992$ $P-68$ $J-50$ $J-52$ $200$ $PVC$ $130$ $62$ $1992$ $P-68$ $J-23$ $J-53$ $200$ $PVC$ $130$ $18$ $1999$ $P-70$ $J-54$ $J-53$ $150$ $PVC$ $130$ $105$ $1994$ $P-71$ $J-91$ $J-92$ $200$ $PVC$ $130$ $166$ $2005$ $P.71A$ $J-55$ $J-56$ $200$ $PVC$ $130$ $138$ $1994$ $P-72$ $J-55$ $J-56$ $200$ $PVC$ $130$ $38$ $2006$ $P.73$ $J-93$ $J-44$ $200$ $PVC$ $130$ $38$ $2006$ $P.73$ $J-205$ $J-57$ $200$ $PVC$ $130$ $30$ $1994$ $P-74$ $J-27$ $J-26$ $200$ $PVC$ $130$ $30$ $1994$ $P.74$ $J-27$ $J-$	P-58B	J-209	J-43	250		130	95	
Fe0B $j-44$ $j-201$ $300$ $PVC$ $130$ $62$ $1992$ $P-61$ $j-45$ $j-51$ $200$ $PVC$ $130$ $137$ $1992$ $P-62$ $j-45$ $j-46$ $150$ $PVC$ $130$ $104$ $1992$ $P-66$ $j-50$ $j-50$ $200$ $PVC$ $130$ $62$ $1992$ $P-67$ $j-51$ $j-50$ $200$ $PVC$ $130$ $62$ $1992$ $P-68$ $j-50$ $j-52$ $200$ $PVC$ $130$ $62$ $1992$ $P-69a$ $j-52$ $j-203$ $j-53$ $200$ $PVC$ $130$ $62$ $1992$ $P-69a$ $j-52$ $j-203$ $j-53$ $200$ $PVC$ $130$ $62$ $1992$ $P-69a$ $j-53$ $j-53$ $200$ $PVC$ $130$ $16$ $1994$ $P-71$ $j-93$ $j-93$ $j-94$ $150$ $PVC$ $130$ $136$ $1994$ $P-73$ $j-204$ $j-55$ $200$ $PVC$ $130$ $138$ $1994$ $P-73$ $j-33$ $j-94$ $200$ $PVC$ $130$ $138$ $1994$ $P-73$ $j-25$ $j-56$ $200$ $PVC$ $130$ $33$ $1994$ $P-74$ $j-25$ $j-57$ $200$ $PVC$ $130$ $144$ $2005$ $P-74$ $j-20$ $j-57$ $200$ $PVC$ $130$ $131$ $1994$ $P-74$ $j-20$ $j-20$ $PVC$ $130$ $144$ $2005$ <td< td=""><td>P-59</td><td>J-43</td><td>J-44</td><td>250</td><td>PVC</td><td>130</td><td>67</td><td>1992</td></td<>	P-59	J-43	J-44	250	PVC	130	67	1992
P-61 $J-45$ $J-51$ $200$ $PVC$ $130$ $137$ $1992$ $P-62$ $J-45$ $J-46$ $150$ $PVC$ $130$ $104$ $1992$ $P-67$ $J-50$ $J-202$ $200$ $PVC$ $130$ $62$ $1992$ $P-67$ $J-51$ $J-50$ $200$ $PVC$ $130$ $84$ $1992$ $P-68$ $J-52$ $J-203$ $200$ $PVC$ $130$ $62$ $1992$ $P-68$ $J-52$ $J-203$ $200$ $PVC$ $130$ $62$ $1992$ $P-698$ $J-203$ $J-53$ $200$ $PVC$ $130$ $18$ $1989$ $P-70$ $J-54$ $J-53$ $150$ $PVC$ $130$ $105$ $1994$ $P-71$ $J-53$ $J-204$ $150$ $PVC$ $130$ $105$ $1994$ $P-71$ $J-53$ $J-204$ $155$ $200$ $PVC$ $130$ $136$ $1994$ $P-72$ $J-55$ $J-56$ $200$ $PVC$ $130$ $138$ $1994$ $P-73$ $J-93$ $J-94$ $200$ $PVC$ $130$ $33$ $1994$ $P-73$ $J-93$ $J-94$ $200$ $PVC$ $130$ $33$ $1994$ $P-73$ $J-255$ $J-56$ $200$ $PVC$ $130$ $33$ $1994$ $P-74$ $J-22$ $J-91$ $200$ $PVC$ $130$ $30$ $1994$ $P-74$ $J-22$ $J-91$ $200$ $PVC$ $130$ $144$ $2005$ $P-78$	P-60A	J-201	J-45	300	PVC	130	18	1992
P-62 $J-46$ $J-46$ $J50$ $PVC$ $I30$ $I04$ $1992$ $P-66A$ $J-50$ $J-202$ $200$ $PVC$ $I30$ $62$ $1992$ $P-67$ $J-51$ $J-50$ $200$ $PVC$ $I30$ $62$ $1992$ $P-68$ $J-50$ $J-52$ $200$ $PVC$ $I30$ $62$ $1992$ $P-68$ $J-50$ $J-52$ $200$ $PVC$ $I30$ $62$ $1992$ $P-68$ $J-203$ $J-53$ $200$ $PVC$ $I30$ $62$ $1992$ $P-69$ $J-203$ $J-53$ $200$ $PVC$ $I30$ $105$ $1994$ $P-70$ $J-54$ $J-53$ $150$ $PVC$ $130$ $105$ $1994$ $P-71$ $J-91$ $J-92$ $200$ $PVC$ $130$ $17$ $1994$ $P.71$ $J-93$ $J-204$ $150$ $PVC$ $130$ $136$ $1994$ $P-73$ $J-33$ $J-94$ $200$ $PVC$ $130$ $138$ $2006$ $P.73$ $J-93$ $J-94$ $200$ $PVC$ $130$ $33$ $194$ $P-74$ $J-22$ $J-91$ $200$ $PVC$ $130$ $318$ $2006$ $P.74$ $J-22$ $J-91$ $200$ $PVC$ $130$ $67$ $1994$ $P-74$ $J-22$ $J-91$ $200$ $PVC$ $130$ $144$ $2005$ $P-78$ $J-206$ $I-90$ $PVC$ $130$ $91$ $1994$ $P-78$ $J-206$ $I-90$	P-60B	J-44	J-201	300	PVC	130	62	1992
P-66 $J-50$ $J-202$ $200$ $PVC$ $130$ $62$ $1992$ $P-67$ $J-51$ $J-50$ $200$ $PVC$ $130$ $84$ $1992$ $P-68$ $J-52$ $J-203$ $200$ $PVC$ $130$ $62$ $1992$ $P-69A$ $J-52$ $J-203$ $200$ $PVC$ $130$ $18$ $1989$ $P-69B$ $J-203$ $J-53$ $200$ $PVC$ $130$ $105$ $1994$ $P-70$ $J-54$ $J-53$ $150$ $PVC$ $130$ $105$ $1994$ $P-71$ $J-91$ $J-92$ $200$ $PVC$ $130$ $166$ $2005$ $P-71$ $J-55$ $J-204$ $150$ $PVC$ $130$ $136$ $1994$ $P-71$ $J-93$ $J-94$ $2000$ $PVC$ $130$ $138$ $1994$ $P-73$ $J-93$ $J-94$ $2000$ $PVC$ $130$ $38$ $2006$ $P.73$ $J-93$ $J-94$ $2000$ $PVC$ $130$ $38$ $1994$ $P-73$ $J-55$ $J-205$ $200$ $PVC$ $130$ $33$ $1994$ $P-74$ $J-25$ $J-57$ $200$ $PVC$ $130$ $144$ $2005$ $P.74$ $J-206$ $J-58$ $200$ $PVC$ $130$ $144$ $2005$ $P-74$ $J-206$ $J-53$ $200$ $PVC$ $130$ $96$ $1989$ $P-75$ $J-207$ $J-53$ $200$ $PVC$ $130$ $152$ $1984$ $P-75$ $J-206$ <	P-61	J-45	J-51	200	PVC	130	137	1992
P-67 $J-51$ $J-50$ $200$ $PVC$ $130$ $84$ $1992$ $P-68$ $J-50$ $J-203$ $200$ $PVC$ $130$ $62$ $1992$ $P-69A$ $J-52$ $J-203$ $200$ $PVC$ $130$ $18$ $1989$ $P-70$ $J-54$ $J-53$ $200$ $PVC$ $130$ $200$ $1994$ $P-71$ $J-91$ $J-92$ $200$ $PVC$ $130$ $166$ $2005$ $P-71A$ $J-53$ $J-204$ $150$ $PVC$ $130$ $136$ $1994$ $P-71B$ $J-204$ $J-55$ $200$ $PVC$ $130$ $138$ $1994$ $P-73B$ $J-204$ $J-55$ $200$ $PVC$ $130$ $38$ $2006$ $P-73A$ $J-93$ $J-94$ $200$ $PVC$ $130$ $30$ $194$ $P-74$ $J-57$ $200$ $PVC$ $130$ $30$ $1994$	P-62	J-45	J-46	150	PVC	130	104	1992
P-68 $J-50$ $J-52$ $200$ $PVC$ $130$ $62$ $1992$ $P-69A$ $J-52$ $J-203$ $200$ $PVC$ $130$ $18$ $1989$ $P-69B$ $J-53$ $200$ $PVC$ $130$ $100$ $1989$ $P-70$ $J-54$ $J-53$ $150$ $PVC$ $130$ $105$ $1994$ $P-71$ $J-91$ $J-92$ $200$ $PVC$ $130$ $105$ $1994$ $P-71$ $J-53$ $J-204$ $150$ $PVC$ $130$ $17$ $1994$ $P-71$ $J-55$ $J-56$ $200$ $PVC$ $130$ $136$ $1994$ $P-73$ $J-33$ $J-93$ $J-94$ $200$ $PVC$ $130$ $138$ $1994$ $P-73$ $J-55$ $J-56$ $200$ $PVC$ $130$ $33$ $2006$ $P-73$ $J-55$ $J-205$ $200$ $PVC$ $130$ $33$ $1994$ $P-73$ $J-22$ $J-91$ $200$ $PVC$ $130$ $30$ $1994$ $P-74$ $J-22$ $J-91$ $200$ $PVC$ $130$ $144$ $2005$ $P-75$ $J-206$ $200$ $PVC$ $130$ $144$ $2005$ $P-75$ $J-207$ $J-59$ $200$ $PVC$ $130$ $96$ $1989$ $P-75$ $J-207$ $J-53$ $200$ $PVC$ $130$ $112$ $1989$ $P-75$ $J-207$ $J-53$ $200$ $PVC$ $130$ $152$ $1984$ $P-77$ $J-60$ $J-208$	P-66A	J-50	J-202	200	PVC	130	62	1992
P-69A         J-52         J-203         200         PVC         130         18         1989           P-69B         J-203         J-53         200         PVC         130         200         1889           P-70         J-54         J-53         150         PVC         130         105         1994           P-71         J-91         J-92         200         PVC         130         66         2005           P-71A         J-53         J-204         150         PVC         130         136         1994           P-72         J-55         J-56         200         PVC         130         136         1994           P-73         J-33         J-94         200         PVC         130         38         2006           P-73         J-55         J-205         200         PVC         130         30         1994           P-74         J-52         J-91         200         PVC         130         30         1994           P-74         J-22         J-91         200         PVC         130         31         1994           P-75         J-206         200         PVC         130         91 </td <td>P-67</td> <td>J-51</td> <td>J-50</td> <td>200</td> <td>PVC</td> <td>130</td> <td>84</td> <td>1992</td>	P-67	J-51	J-50	200	PVC	130	84	1992
P-698 $J-203$ $J-53$ $200$ $PVC$ $130$ $200$ $1989$ $P-70$ $J-54$ $J-53$ $150$ $PVC$ $130$ $105$ $1994$ $P-71$ $J-92$ $200$ $PVC$ $130$ $166$ $2005$ $P-71A$ $J-53$ $J-204$ $150$ $PVC$ $130$ $17$ $1994$ $P-71A$ $J-53$ $J-204$ $150$ $PVC$ $130$ $136$ $1994$ $P-71A$ $J-55$ $J-56$ $200$ $PVC$ $130$ $138$ $1994$ $P-73$ $J-93$ $J-94$ $200$ $PVC$ $130$ $38$ $2006$ $P-73A$ $J-56$ $J-205$ $200$ $PVC$ $130$ $30$ $1994$ $P-73A$ $J-25$ $J-57$ $200$ $PVC$ $130$ $30$ $1994$ $P-74$ $J-22$ $J-91$ $200$ $PVC$ $130$ $30$ $1994$ $P-74$ $J-22$ $J-91$ $200$ $PVC$ $130$ $30$ $1994$ $P-74$ $J-22$ $J-91$ $200$ $PVC$ $130$ $144$ $2005$ $P-74$ $J-206$ $J-206$ $200$ $PVC$ $130$ $91$ $1994$ $P-75$ $J-207$ $J-53$ $200$ $PVC$ $130$ $91$ $1994$ $P-75$ $J-207$ $J-53$ $200$ $PVC$ $130$ $152$ $1984$ $P-75$ $J-207$ $J-53$ $200$ $PVC$ $130$ $146$ $1984$ $P-77$ $J-208$ $J-61$	P-68	J-50	J-52	200	PVC	130	62	1992
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	P-69A	J-52	J-203	200	PVC	130	18	1989
P.71 $J.91$ $J.92$ $200$ $PVC$ $130$ $66$ $2005$ $P.71a$ $J.53$ $J.204$ $150$ $PVC$ $130$ $17$ $1994$ $P.71a$ $J.204$ $J.55$ $200$ $PVC$ $130$ $136$ $1994$ $P.72$ $J.55$ $J.56$ $200$ $PVC$ $130$ $138$ $1994$ $P.73$ $J.93$ $J.94$ $200$ $PVC$ $130$ $38$ $2006$ $P.73a$ $J.56$ $J.205$ $200$ $PVC$ $130$ $30$ $1994$ $P.73a$ $J.205$ $J.57$ $200$ $PVC$ $130$ $30$ $1994$ $P.74a$ $J.22$ $J.91$ $200$ $PVC$ $130$ $30$ $1994$ $P.74a$ $J.22$ $J.91$ $200$ $PVC$ $130$ $30$ $1994$ $P.74a$ $J.22$ $J.91$ $200$ $PVC$ $130$ $30$ $1994$ $P.74a$ $J.206$ $J.58$ $200$ $PVC$ $130$ $30$ $1994$ $P.75a$ $J.207$ $J.59$ $200$ $PVC$ $130$ $91$ $1994$ $P.75a$ $J.207$ $J.53$ $200$ $PVC$ $130$ $96$ $1989$ $P.75c$ $J.207$ $J.53$ $200$ $PVC$ $130$ $112$ $1984$ $P.77c$ $J.60$ $J.208$ $150$ $PVC$ $130$ $112$ $1984$ $P.77b$ $J.60$ $J.208$ $150$ $PVC$ $130$ $116$ $1984$ $P.77a$	P-69B	J-203	J-53	200	PVC	130	200	1989
P-71A $J-53$ $J-204$ $150$ $PVC$ $130$ $17$ $1994$ $P-71A$ $J-204$ $J-55$ $200$ $PVC$ $130$ $136$ $1994$ $P-72$ $J-55$ $J-56$ $200$ $PVC$ $130$ $138$ $1994$ $P-73$ $J-93$ $J-94$ $200$ $PVC$ $130$ $38$ $2006$ $P-73A$ $J-56$ $J-205$ $200$ $PVC$ $130$ $36$ $1994$ $P-73A$ $J-56$ $J-205$ $200$ $PVC$ $130$ $30$ $1994$ $P-73A$ $J-22$ $J-91$ $200$ $PVC$ $130$ $30$ $1994$ $P-74$ $J-57$ $J-206$ $200$ $PVC$ $130$ $30$ $1994$ $P-74$ $J-57$ $J-206$ $200$ $PVC$ $130$ $23$ $1994$ $P-74$ $J-206$ $J-58$ $200$ $PVC$ $130$ $23$ $1994$ $P-74$ $J-206$ $J-58$ $200$ $PVC$ $130$ $96$ $1989$ $P-75A$ $J-207$ $J-53$ $200$ $PVC$ $130$ $96$ $1989$ $P-75C$ $J-207$ $J-53$ $200$ $PVC$ $130$ $112$ $1989$ $P-76$ $J-60$ $150$ $PVC$ $130$ $112$ $1984$ $P-77$ $J-60$ $J-208$ $150$ $PVC$ $130$ $146$ $1984$ $P-77$ $J-60$ $J-63$ $150$ $PVC$ $130$ $113$ $1984$ $P-78$ $J-61$ $J-65$	P-70	J-54	J-53	150	PVC	130	105	1994
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	P-71	J-91	J-92	200	PVC	130	66	2005
P-72         J-55         J-56         200         PVC         130         138         1994           P-73         J-93         J-94         200         PVC         130         38         2006           P-73A         J-56         J-205         200         PVC         130         67         1994           P-73B         J-205         J-57         200         PVC         130         30         1994           P-74         J-22         J-91         200         PVC         130         144         2005           P-74A         J-57         J-206         200         PVC         130         91         1994           P-74B         J-206         J-58         200         PVC         130         23         1994           P-75A         J-207         J-59         200         PVC         130         96         1989           P-75C         J-230         J-53         200         PVC         130         112         1984           P-76         J-59         J-60         150         PVC         130         1146         1984           P-778         J-208         J-61         150         PVC	P-71A	J-53	J-204	150	PVC	130	17	1994
P-73         J-93         J-94         200         PVC         130         38         2006           P-73A         J-56         J-205         200         PVC         130         67         1994           P-73B         J-205         J-57         200         PVC         130         30         1994           P-74         J-22         J-91         200         PVC         130         144         2005           P-74A         J-57         J-206         200         PVC         130         144         2005           P-74B         J-206         J-58         200         PVC         130         23         1994           P-75A         J-207         J-59         200         PVC         130         96         1989           P-75C         J-230         200         PVC         130         112         1984           P-75C         J-230         J-53         200         PVC         130         112         1984           P-75C         J-230         J-53         200         PVC         130         112         1984           P-77A         J-60         J-208         150         PVC         130	P-71B	J-204	J-55	200	PVC	130	136	1994
P-73A         J-56         J-205         200         PVC         130         67         1994           P-73B         J-205         J-57         200         PVC         130         30         1994           P-74         J-22         J-91         200         PVC         130         144         2005           P-74A         J-57         J-206         200         PVC         130         91         1994           P-74B         J-206         J-58         200         PVC         130         23         1994           P-75A         J-207         J-59         200         PVC         130         96         1989           P-75B         J-207         J-230         200         PVC         130         112         1989           P-75C         J-230         J-53         200         PVC         130         112         1984           P-76         J-59         J-60         150         PVC         130         146         1984           P-77A         J-60         J-208         150         PVC         130         113         1984           P-78         J-61         J-62         150         PVC	P-72	J-55	J-56	200	PVC	130	138	1994
P-73B         J-205         J-57         200         PVC         130         30         1994           P-74         J-22         J-91         200         PVC         130         144         2005           P-74A         J-57         J-206         200         PVC         130         91         1994           P-74B         J-206         J-58         200         PVC         130         23         1994           P-75A         J-207         J-59         200         PVC         130         96         1989           P-75B         J-207         J-230         200         PVC         130         91         1989           P-75C         J-230         200         PVC         130         112         1989           P-76         J-59         J-60         150         PVC         130         112         1984           P-778         J-60         J-208         150         PVC         130         146         1984           P-778         J-61         J-62         150         PVC         130         113         1984           P-79         J-62         J-63         150         PVC         130	P-73	J-93	J-94	200	PVC	130	38	2006
P-74         J-22         J-91         200         PVC         130         144         2005           P-74A         J-57         J-206         200         PVC         130         91         1994           P-74B         J-206         J-58         200         PVC         130         23         1994           P-75A         J-207         J-59         200         PVC         130         96         1989           P-75B         J-207         J-230         200         PVC         130         9         1989           P-75C         J-230         J-53         200         PVC         130         112         1989           P-76         J-59         J-60         150         PVC         130         152         1984           P-77A         J-60         J-208         150         PVC         130         146         1984           P-77B         J-208         J-61         150         PVC         130         16         1984           P-79         J-62         J-63         150         PVC         130         144         1984           P-80         J-63         J-56         200         PVC	P-73A	J-56	J-205	200	PVC	130	67	1994
P-74A         J-57         J-206         200         PVC         130         91         1994           P-74B         J-206         J-58         200         PVC         130         23         1994           P-75A         J-207         J-59         200         PVC         130         96         1989           P-75B         J-207         J-230         200         PVC         130         9         1989           P-75C         J-230         J-53         200         PVC         130         112         1989           P-75C         J-230         J-53         200         PVC         130         112         1984           P-76         J-59         J-60         150         PVC         130         152         1984           P-77A         J-60         J-208         150         PVC         130         16         1984           P-77B         J-208         J-61         150         PVC         130         113         1984           P-78         J-61         J-62         150         PVC         130         147         1984           P-80         J-63         J-64         150         PVC	P-73B	J-205	J-57	200	PVC	130	30	1994
P-74B         J-206         J-58         200         PVC         130         23         1994           P-75A         J-207         J-59         200         PVC         130         96         1989           P-75B         J-207         J-230         200         PVC         130         9         1989           P-75C         J-230         J-53         200         PVC         130         112         1989           P-75C         J-230         J-53         200         PVC         130         112         1989           P-75C         J-59         J-60         150         PVC         130         112         1984           P-77A         J-60         J-208         150         PVC         130         146         1984           P-77B         J-61         J-62         150         PVC         130         113         1984           P-79         J-62         J-63         150         PVC         130         144         1984           P-81         J-64         J-65         150         PVC         130         144         1984           P-82         J-1A         PMP-3         150         PVC	P-74	J-22	J-91	200	PVC	130	144	2005
P-75A         J-207         J-59         200         PVC         130         96         1989           P-75B         J-207         J-230         200         PVC         130         9         1989           P-75C         J-230         J-53         200         PVC         130         112         1989           P-75C         J-230         J-53         200         PVC         130         112         1989           P-76         J-59         J-60         150         PVC         130         152         1984           P-77A         J-60         J-208         150         PVC         130         146         1984           P-77B         J-208         J-61         150         PVC         130         113         1984           P-77B         J-61         J-62         150         PVC         130         113         1984           P-79         J-62         J-63         150         PVC         130         35         1984           P-80         J-63         J-64         150         PVC         130         144         1984           P-81         J-64         J-65         200         PVC	P-74A	J-57	J-206	200	PVC	130	91	1994
P-75B         J-207         J-230         200         PVC         130         9         1989           P-75C         J-230         J-53         200         PVC         130         112         1989           P-76         J-59         J-60         150         PVC         130         152         1984           P-77A         J-60         J-208         150         PVC         130         146         1984           P-77B         J-60         J-208         150         PVC         130         161         1984           P-77B         J-61         J-62         150         PVC         130         113         1984           P-79         J-62         J-63         150         PVC         130         35         1984           P-79         J-62         J-63         150         PVC         130         35         1984           P-80         J-63         J-64         150         PVC         130         147         1984           P-81         J-64         J-65         150         PVC         130         84         1984           P-82         J-1A         PMP-3         150         PVC <td< td=""><td>P-74B</td><td>J-206</td><td>J-58</td><td>200</td><td>PVC</td><td>130</td><td>23</td><td>1994</td></td<>	P-74B	J-206	J-58	200	PVC	130	23	1994
P-75C         J-230         J-53         200         PVC         130         112         1989           P-76         J-59         J-60         150         PVC         130         152         1984           P-77A         J-60         J-208         150         PVC         130         146         1984           P-77B         J-208         J-61         150         PVC         130         16         1984           P-77B         J-208         J-61         150         PVC         130         16         1984           P-77B         J-208         J-61         1-62         150         PVC         130         113         1984           P-79         J-62         J-63         150         PVC         130         147         1984           P-80         J-63         J-64         150         PVC         130         144         1984           P-81         J-64         J-65         150         PVC         130         144         1984           P-82         J-1A         PMP-3         150         PVC         130         5         2000           P-83         PMP-3         J-67         200	P-75A	J-207	J-59	200	PVC	130	96	1989
P-76         J-59         J-60         150         PVC         130         152         1984           P-77A         J-60         J-208         150         PVC         130         146         1984           P-77B         J-208         J-61         150         PVC         130         16         1984           P-77B         J-208         J-61         150         PVC         130         16         1984           P-78         J-61         J-62         150         PVC         130         113         1984           P-79         J-62         J-63         150         PVC         130         35         1984           P-80         J-63         J-64         150         PVC         130         147         1984           P-81         J-64         J-65         150         PVC         130         144         1984           P-82         J-59         J-65         200         PVC         130         5         2000           P-82         J-1A         PMP-3         150         PVC         130         5         2000           P-83         PMP-3         J-1         150         PVC         130 </td <td>P-75B</td> <td>J-207</td> <td>J-230</td> <td>200</td> <td>PVC</td> <td>130</td> <td>9</td> <td>1989</td>	P-75B	J-207	J-230	200	PVC	130	9	1989
P-77A         J-60         J-208         150         PVC         130         146         1984           P-77B         J-208         J-61         150         PVC         130         16         1984           P-77B         J-208         J-61         150         PVC         130         16         1984           P-78         J-61         J-62         150         PVC         130         113         1984           P-79         J-62         J-63         150         PVC         130         35         1984           P-80         J-63         J-64         150         PVC         130         147         1984           P-81         J-64         J-65         150         PVC         130         144         1984           P-82         J-59         J-65         200         PVC         130         84         1984           P-82         J-1A         PMP-3         150         PVC         130         5         2000           P-83         PMP-3         J-1         150         PVC         130         5         2000           P-84         J-65         J-67         200         PVC         130 <td>P-75C</td> <td>J-230</td> <td>J-53</td> <td>200</td> <td>PVC</td> <td>130</td> <td>112</td> <td>1989</td>	P-75C	J-230	J-53	200	PVC	130	112	1989
P-77B         J-208         J-61         150         PVC         130         16         1984           P-78         J-61         J-62         150         PVC         130         113         1984           P-79         J-62         J-63         150         PVC         130         35         1984           P-80         J-63         J-64         150         PVC         130         147         1984           P-81         J-64         J-65         150         PVC         130         144         1984           P-82         J-59         J-65         200         PVC         130         84         1984           P-82         J-1A         PMP-3         150         PVC         130         5         2000           P-83         PMP-3         J-1         150         PVC         130         5         2000           P-84         J-65         J-67         200         PVC         130         93         1984           P-85         J-15         J-67         200         PVC         130         93         1984           P-86         J-67         200         PVC         130         140	P-76	J-59	J-60	150	PVC	130	152	1984
P-78         J-61         J-62         150         PVC         130         113         1984           P-79         J-62         J-63         150         PVC         130         35         1984           P-80         J-63         J-64         150         PVC         130         147         1984           P-81         J-64         J-65         150         PVC         130         144         1984           P-82         J-59         J-65         200         PVC         130         84         1984           P-82         J-1A         PMP-3         150         PVC         130         5         2000           P-83         PMP-3         J-1         150         PVC         130         5         2000           P-84         J-65         J-67         200         PVC         130         5         2000           P-84         J-65         J-67         200         PVC         130         93         1984           P-85         J-15         J-67         200         PVC         130         140         1984           P-86         J-67         J-68         150         PVC         130	P-77A	J-60	J-208	150	PVC	130	146	1984
P-78         J-61         J-62         150         PVC         130         113         1984           P-79         J-62         J-63         150         PVC         130         35         1984           P-80         J-63         J-64         150         PVC         130         147         1984           P-81         J-64         J-65         150         PVC         130         144         1984           P-82         J-59         J-65         200         PVC         130         84         1984           P-82         J-1A         PMP-3         150         PVC         130         5         2000           P-83         PMP-3         J-1         150         PVC         130         5         2000           P-84         J-65         J-67         200         PVC         130         5         2000           P-84         J-65         J-67         200         PVC         130         93         1984           P-85         J-15         J-67         200         PVC         130         140         1984           P-86         J-67         J-68         150         PVC         130	P-77B	J-208	J-61	150	PVC	130	16	1984
P-79         J-62         J-63         150         PVC         130         35         1984           P-80         J-63         J-64         150         PVC         130         147         1984           P-81         J-64         J-65         150         PVC         130         144         1984           P-82         J-59         J-65         200         PVC         130         84         1984           P-82         J-14         PMP-3         150         PVC         130         5         2000           P-83         PMP-3         J-1         150         PVC         130         5         2000           P-84         J-65         J-67         200         PVC         130         5         2000           P-85         J-15         J-67         200         PVC         130         93         1984           P-85         J-15         J-67         200         PVC         130         140         1984           P-86         J-67         J-68         150         PVC         130         67         1984           P-86         J-65         J-66         150         PVC         130								
P-80         J-63         J-64         150         PVC         130         147         1984           P-81         J-64         J-65         150         PVC         130         144         1984           P-82         J-59         J-65         200         PVC         130         84         1984           P-82         J-1A         PMP-3         150         PVC         130         5         2000           P-83         PMP-3         J-1         150         PVC         130         5         2000           P-84         J-65         J-67         200         PVC         130         93         1984           P-85         J-15         J-67         200         PVC         130         67         1984           P-86         J-67         J-67         200         PVC         130         140         1984           P-86         J-67         J-68         150         PVC         130         67         1984           P-88         J-65         J-66         150         PVC         130         68         1984	P-79	J-62	J-63	150	PVC			1984
P-81         J-64         J-65         150         PVC         130         144         1984           P-82         J-59         J-65         200         PVC         130         84         1984           P-82         J-1A         PMP-3         150         PVC         130         5         2000           P-83         PMP-3         J-1         150         PVC         130         5         2000           P-84         J-65         J-67         200         PVC         130         93         1984           P-85         J-15         J-67         200         PVC         130         140         1984           P-86         J-67         J-68         150         PVC         130         67         1984           P-88         J-65         J-66         150         PVC         130         67         1984								
P-82         J-59         J-65         200         PVC         130         84         1984           P-82         J-1A         PMP-3         150         PVC         130         5         2000           P-83         PMP-3         J-1         150         PVC         130         5         2000           P-84         J-65         J-67         200         PVC         130         93         1984           P-85         J-15         J-67         200         PVC         130         140         1984           P-86         J-67         J-68         150         PVC         130         67         1984           P-88         J-65         J-66         150         PVC         130         68         1984					PVC			
P-82         J-1A         PMP-3         150         PVC         130         5         2000           P-83         PMP-3         J-1         150         PVC         130         5         2000           P-84         J-65         J-67         200         PVC         130         93         1984           P-85         J-15         J-67         200         PVC         130         140         1984           P-86         J-67         J-68         150         PVC         130         67         1984           P-88         J-65         J-66         150         PVC         130         68         1984								
P-83         PMP-3         J-1         150         PVC         130         5         2000           P-84         J-65         J-67         200         PVC         130         93         1984           P-85         J-15         J-67         200         PVC         130         140         1984           P-86         J-67         J-68         150         PVC         130         67         1984           P-88         J-65         J-66         150         PVC         130         68         1984								
P-84         J-65         J-67         200         PVC         130         93         1984           P-85         J-15         J-67         200         PVC         130         140         1984           P-86         J-67         J-68         150         PVC         130         67         1984           P-88         J-65         J-66         150         PVC         130         68         1984								
P-85         J-15         J-67         200         PVC         130         140         1984           P-86         J-67         J-68         150         PVC         130         67         1984           P-88         J-65         J-66         150         PVC         130         68         1984								
P-86         J-67         J-68         150         PVC         130         67         1984           P-88         J-65         J-66         150         PVC         130         68         1984								
P-88 J-65 J-66 150 PVC 130 68 1984								
IP-2/UI H-53 J-25 J 150 J PVC J 130 J 23	P-270	H-53	J-25	150	PVC	130	23	





			r	r			Naturally Kefreshed
Label	Start Node	Stop Node	Diameter (mm)	Material	Hazen-Williams C	Length (m)	Installation Year
E-1	J-97	J-90	250	PVC	130	30	2011
E-2	J-90	J-241	250	PVC	130	111	2003
E-3	J-242	J-241	250	PVC	130	74	1992
E-4	J-240	J-242	250	PVC	130	79	1992
E-5	J-240	J-45	200	PVC	130	11	1992
							1992
E-6	J-46	J-47	150	PVC	130	141	
E-7	J-46	J-48	50	PVC	130	221	
E-8	J-48	J-49	50	PVC	130	253	
E-9	J-69	J-229	150	PVC	130	109	2009
E-10	J-229	J-230	150	PVC	130	95	2009
E-11	J-231	J-232	150	PVC	130	43	
E-12	J-232	J-233	150	PVC	130	14	
							+
E-13	J-233	J-234	150	PVC	130	90	
E-14	J-234	J-235	150	PVC	130	57	_
E-15	J-235	J-236	150	PVC	130	63	
E-15	J-238	J-235	150	PVC	130	31	
E-16	J-236	J-237	150	PVC	130	87	
E-17	J-237	J-232	150	PVC	130	74	1
E-18	J-16	J-215	200	PVC	130	147	2005
E-19	J-215	J-216	200	PVC	130	143	2005
E-20	J-216	J-91	200	PVC	130	157	2005
E-21	J-27	J-220	250	PVC	130	119	2010
E-22	J-220	J-221	250	PVC	130	192	2010
E-23	J-221	J-222	350	PVC	130	89	2010
E-24	J-222	J-223	350	PVC	130	128	2010
E-25	J-223	J-224	350	PVC	130	158	2010
E-26	J-95	J-225	200	PVC	130	21	2010
E-27	J-225	J-226	200	PVC	130	154	2010
E-28	J-226	J-96	200	PVC	130	223	2010
E-30	J-227	J-93	200	PVC	130	198	2006
E-31	J-224	J-228	250	PVC	130	123	2010
E-32	J-228	J-95	250	PVC	130	218	2010
E-33	J-92	J-25	200	PVC	130	48	2006
							2000
L-1	H-1	J-90	150	PVC	130	7	
L-2	J-241	H-2	150	PVC	130	13	
L-3	J-242	H-3	150	PVC	130	11	
L-4	H-4	J-201	150	PVC	130	6	
L-5	H-5	J-51	150	PVC	130	12	
L-6	H-6	J-202	150	PVC	130	6	1
L-7	H-7	J-203	150	PVC	130	8	
L-8	H-8	J-54	150	PVC	130	12	
L-9	H-9	J-204	150	PVC	130	7	
L-10	H-10	J-55	150	PVC	130	9	
L-11	H-11	J-56	150	PVC	130	10	
L-12	H-12	J-205	150	PVC	130	8	
L-13	H-13	J-206	150	PVC	130	4	
L-14	H-14	J-207	150	PVC	130	6	
L-15	H-15	J-59	150	PVC	130	5	
L-16	H-16	J-60	150	PVC	130	8	
L-17	H-17	J-208	150	PVC	130	8	
L-18	H-18	J-63	150	PVC	130	9	
L-19	H-19	J-64	150	PVC	130	8	
L-20	H-20	J-65	150	PVC	130	8	
L-21	H-21	J-68	150	PVC	130	7	T
L-22	H-22	J-69	150	PVC	130	12	1
L-22	H-23	J-42	150	PVC	130	7	-
L-24	H-24	J-209	150	PVC	130	11	
L-25	H-25	J-43	150	PVC	130	10	
L-26	H-26	J-210	150	PVC	130	8	
L-27	H-27	J-36	150	PVC	130	9	
L-28	H-28	J-35	150	PVC	130	10	
L-29	H-29	J-211	150	PVC	130	7	
L-30	H-30	J-31	150	PVC	130	15	1
L-31	H-31	J-30	150	PVC	130	19	
							+
L-32	H-32	J-212	150	PVC	130	16	
L-33	H-33	J-39	150	PVC	130	20	
L-34	H-34	J-213	150	PVC	130	11	
			150	PVC	130	9	
L-34	H-35	J-28					
	H-35	J-28 J-12	150	PVC	130	15	
L-35 L-36	H-35 H-36	J-12	150				
L-35 L-36 L-37	H-35 H-36 J-13	J-12 H-37	150 150	PVC	130	11	
L-35 L-36 L-37 L-38	H-35 H-36 J-13 H-38	J-12 H-37 J-16	150 150 150	PVC PVC	130 130	11 17	
L-35 L-36 L-37 L-38 L-39	H-35 H-36 J-13 H-38 J-17	J-12 H-37 J-16 H-39	150 150 150 150	PVC PVC PVC	130 130 130	11 17 19	
L-35 L-36 L-37 L-38 L-39 L-40	H-35 H-36 J-13 H-38 J-17 H-40	J-12 H-37 J-16 H-39 J-18	150 150 150 150 150	PVC PVC PVC PVC	130 130 130 130	11 17 19 16	
L-35 L-36 L-37 L-38 L-39	H-35 H-36 J-13 H-38 J-17	J-12 H-37 J-16 H-39	150 150 150 150	PVC PVC PVC	130 130 130	11 17 19	





L-43							allacy represhed
	H-43	J-7	150	PVC	130	10	
L-44	H-44	J-214	150	PVC	130	14	
L-45	H-45	J-19	150	PVC	130	15	
L-46	J-20	H-46	150	PVC	130	12	
							+ +
L-47	H-47	J-215	150	PVC	130	7	
L-48	H-48	J-216	150	PVC	130	13	
L-49	H-49	J-217	150	PVC	130	11	
							1
L-50	H-50	J-91	150	PVC	130	14	
L-51	H-51	J-23	150	PVC	130	16	
L-52	J-92	H-52	150	PVC	130	11	
L-54	H-54	J-219	150	PVC	130	12	
L-55	J-27	H-55	150	PVC	130	12	
L-56	J-220	H-56	150	PVC	130	10	
				PVC			
L-57	J-221	H-57	150		130	10	
L-58	J-222	H-58	150	PVC	130	10	
L-59	J-223	H-59	150	PVC	130	12	
L-60	J-224	H-60	150	PVC	130	10	
L-61	J-225	H-61	150	PVC	130	17	
L-62	J-226	H-62	150	PVC	130	12	
L-63	H-63	J-94	150	PVC	130	16	
							+
L-64	J-227	H-64	150	PVC	130	9	
L-65	H-65	J-228	150	PVC	130	9	
L-66	H-66	J-237	150	PVC	130	10	1
							<del>                                     </del>
L-67	J-233	H-67	150	PVC	130	8	
L-68	H-68	J-235	150	PVC	130	10	
P-1	R-1	J-1A	350	PVC	130	1,050	2000
P-2	J-1A	PMP-1	150	PVC	130	5	2000
P-3	J-1A	PMP-2	150	PVC	130	5	2000
P-4	PMP-2	J-1	150	PVC	130	5	2000
P-5	PMP-1	J-1	150	PVC	130	5	2000
P-6	J-1	J-2	250	PVC	130	789	2000
P-7	J-2	J-3	250	PVC	130	134	1984
P-8		J-3	200				
	T-1			Ductile Iron	130	165	1984
P-9	T-1	J-4	300	Ductile Iron	130	199	1984
P-17	J-7	J-4	350	PVC	130	50	1984
P-18	J-8	J-7	350	PVC	130	27	1984
P-19	J-8	J-9	200	PVC	130	67	1984
P-20	J-9	J-10	200	PVC	130	133	1984
P-21	J-10	J-11	150	PVC	130	71	1984
P-22	J-10	J-12	200	PVC	130	152	1984
P-23	J-12	J-13	200	PVC	130	87	1984
P-24	J-13	J-14	150	PVC	130	62	1984
P-25	J-13	J-15	200	PVC	130	89	1984
P-26	J-15	J-16	150	PVC	130	120	1985
P-28	J-17	J-18	150	PVC	130	146	1984
P-29	J-18	J-9	150	PVC	130	164	1984
P-30A	J-8	J-214	250	PVC	130	172	1995
P-30B	J-214	J-19	250	PVC	130	160	
						100	
P-31	J-19	J-20	750			4 = 1	1995
P-32	J-20		250	PVC	130	151	1995
P-33A		J-21	250	PVC PVC		151 147	1995 1995
	J-21		250	PVC	130 130		1995 1995
D 225	J-21	J-217	250 150	PVC PVC	130 130 130	147 12	1995 1995 1995
P-33B	J-217	J-217 J-22	250 150 150	PVC PVC PVC	130 130 130 130	147 12 45	1995 1995 1995 1995 1995
P-33B P-34		J-217	250 150	PVC PVC	130 130 130	147 12	1995 1995 1995
P-34	J-217 J-22	J-217 J-22 J-23	250 150 150 150	PVC PVC PVC PVC	130 130 130 130 130 130	147 12 45 154	1995 1995 1995 1995 1995 1995
P-34 P-35	J-217 J-22 J-23	J-217 J-22 J-23 J-24	250 150 150 150 150 150	PVC PVC PVC PVC PVC PVC	130 130 130 130 130 130 130	147 12 45 154 39	1995 1995 1995 1995 1995 1995 1995
P-34 P-35 P-36	J-217 J-22 J-23 J-24	J-217 J-22 J-23 J-24 J-25	250 150 150 150 150 150 200	PVC PVC PVC PVC PVC PVC PVC	130 130 130 130 130 130 130 130	147 12 45 154 39 68	1995 1995 1995 1995 1995 1995 1995 1995
P-34 P-35 P-36 P-37	J-217 J-22 J-23 J-24 J-24	J-217 J-22 J-23 J-24 J-25 J-26	250 150 150 150 150 200 200	PVC PVC PVC PVC PVC PVC PVC PVC	130           130           130           130           130           130           130           130           130           130           130           130           130           130           130	147 12 45 154 39 68 116	1995 1995 1995 1995 1995 1995 1995 1995
P-34 P-35 P-36	J-217 J-22 J-23 J-24	J-217 J-22 J-23 J-24 J-25	250 150 150 150 150 150 200	PVC PVC PVC PVC PVC PVC PVC	130 130 130 130 130 130 130 130	147 12 45 154 39 68	1995 1995 1995 1995 1995 1995 1995 1995
P-34 P-35 P-36 P-37 P-38	J-217 J-22 J-23 J-24 J-24 J-24 J-21	J-217 J-22 J-23 J-24 J-25 J-26 J-26	250 150 150 150 200 200 250	PVC	130           130           130           130           130           130           130           130           130           130           130           130           130           130           130           130           130	147 12 45 154 39 68 116 117	1995 1995 1995 1995 1995 1995 1995 1995
P-34 P-35 P-36 P-37 P-38 P-39A	J-217 J-22 J-23 J-24 J-24 J-24 J-21 J-26	J-217 J-22 J-23 J-24 J-25 J-26 J-26 J-26 J-219	250 150 150 150 200 200 250 250	PVC	130           130           130           130           130           130           130           130           130           130           130           130           130           130           130           130           130           130           130           130	147 12 45 154 39 68 116 117 26	1995 1995 1995 1995 1995 1995 1995 1995
P-34 P-35 P-36 P-37 P-38 P-39A P-39B	J-217 J-22 J-23 J-24 J-24 J-21 J-26 J-219	J-217 J-22 J-23 J-24 J-25 J-26 J-26 J-219 J-27	250 150 150 150 200 200 250 250 250	PVC	130           130	147 12 45 154 39 68 116 117 26 93	1995 1995 1995 1995 1995 1995 1995 1995
P-34 P-35 P-36 P-37 P-38 P-39A	J-217 J-22 J-23 J-24 J-24 J-24 J-21 J-26	J-217 J-22 J-23 J-24 J-25 J-26 J-26 J-26 J-219	250 150 150 150 200 200 250 250	PVC	130           130           130           130           130           130           130           130           130           130           130           130           130           130           130           130           130           130           130           130	147 12 45 154 39 68 116 117 26	1995 1995 1995 1995 1995 1995 1995 1995
P-34           P-35           P-36           P-37           P-38           P-39A           P-39B           P-40	J-217 J-22 J-23 J-24 J-24 J-21 J-26 J-219 J-219 J-12	J-217 J-22 J-23 J-24 J-25 J-26 J-26 J-26 J-219 J-219 J-27 J-28	250 150 150 200 250 250 250 250 150	PVC	130           130	147 12 45 154 39 68 116 117 26 93 111	1995           1995
P-34           P-35           P-36           P-37           P-38           P-39A           P-39B           P-40           P-41	J-217 J-22 J-23 J-24 J-24 J-24 J-21 J-26 J-219 J-219 J-12 J-28	J-217 J-22 J-23 J-24 J-25 J-26 J-26 J-26 J-219 J-27 J-28 J-28 J-29	250 150 150 150 200 200 250 250 250 250 250 150	PVC	130         130	147 12 45 154 39 68 116 117 26 93 111 76	1995 1995 1995 1995 1995 1995 1995 1995
P-34           P-35           P-36           P-37           P-38           P-39A           P-39B           P-40           P-41           P-42	J-217 J-22 J-23 J-24 J-24 J-21 J-26 J-219 J-219 J-12 J-28 J-28 J-28	J-217 J-22 J-23 J-24 J-25 J-26 J-26 J-26 J-219 J-27 J-28 J-28 J-29 J-30	250 150 150 150 200 200 250 250 250 250 250 150 150	PVC	130           130	147 12 45 154 39 68 116 117 26 93 111 76 87	1995 1995 1995 1995 1995 1995 1995 1995
P-34           P-35           P-36           P-37           P-38           P-39A           P-39B           P-40           P-41	J-217 J-22 J-23 J-24 J-24 J-24 J-21 J-26 J-219 J-219 J-12 J-28	J-217 J-22 J-23 J-24 J-25 J-26 J-26 J-26 J-219 J-27 J-28 J-28 J-29	250 150 150 150 200 200 250 250 250 250 250 150	PVC	130         130	147 12 45 154 39 68 116 117 26 93 111 76	1995 1995 1995 1995 1995 1995 1995 1995
P-34           P-35           P-36           P-37           P-38           P-39A           P-39B           P-40           P-41           P-42           P-44A	J-217 J-22 J-23 J-24 J-24 J-21 J-21 J-26 J-219 J-219 J-12 J-28 J-28 J-28 J-28 J-31	J-217 J-22 J-23 J-24 J-25 J-26 J-26 J-26 J-219 J-27 J-28 J-29 J-30 J-211	250 150 150 200 200 250 250 250 250 150 150 150 150	PVC	130           130	147 12 45 154 39 68 116 117 26 93 111 76 87 112	1995 1995 1995 1995 1995 1995 1995 1995
P-34           P-35           P-36           P-37           P-38           P-39A           P-39B           P-40           P-41           P-42           P-44A           P-44B	J-217 J-22 J-23 J-24 J-24 J-21 J-26 J-219 J-12 J-28 J-28 J-28 J-28 J-31 J-211	J-217 J-22 J-23 J-24 J-25 J-26 J-26 J-219 J-27 J-28 J-27 J-28 J-29 J-30 J-211 J-31	250 150 150 200 250 250 250 150 150 150 150 150	PVC	130         130	147           12           45           154           39           68           116           117           26           93           111           76           87           112           10	1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1984           1984           1984           1984           1984           1984           1984           1984           1984
P-34           P-35           P-36           P-37           P-38           P-39A           P-39B           P-40           P-41           P-42           P-44A           P-448           P-45	J-217 J-22 J-23 J-24 J-24 J-21 J-26 J-219 J-12 J-28 J-21 J-28 J-31 J-31 J-211 J-32	J-217 J-22 J-23 J-24 J-25 J-26 J-26 J-219 J-27 J-28 J-29 J-29 J-30 J-211 J-32 J-33	250 150 150 200 250 250 250 150 150 150 150 150 150	PVC	130         130	147 12 45 154 39 68 116 117 26 93 111 76 87 112 10 47	1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1984           1984           1984           1984           1984           1984           1984           1984
P-34           P-35           P-36           P-37           P-38           P-39A           P-39B           P-40           P-41           P-42           P-44A           P-44B	J-217 J-22 J-23 J-24 J-24 J-21 J-26 J-219 J-12 J-28 J-28 J-28 J-28 J-31 J-211	J-217 J-22 J-23 J-24 J-25 J-26 J-26 J-219 J-27 J-28 J-27 J-28 J-29 J-30 J-211 J-31	250 150 150 200 250 250 250 150 150 150 150 150	PVC	130         130	147           12           45           154           39           68           116           117           26           93           111           76           87           112           10	1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1984           1984           1984           1984           1984           1984           1984           1984           1984
P-34           P-35           P-36           P-37           P-38           P-39A           P-39B           P-40           P-41           P-42           P-44A           P-44B           P-445           P-46	J-217 J-22 J-23 J-24 J-24 J-24 J-26 J-219 J-12 J-28 J-28 J-28 J-31 J-211 J-32 J-33	J-217 J-22 J-23 J-24 J-25 J-26 J-26 J-219 J-27 J-28 J-27 J-28 J-29 J-30 J-211 J-30 J-31 J-32 J-33 J-33 J-34	250 150 150 200 250 250 250 150 150 150 150 150 150 150	PVC	130         130	147         12         45         154         39         68         116         117         26         93         111         76         87         112         10         47         74	1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1984           1984           1984           1984           1984           1984           1984           1984           1984           1984           1984           1984           1984           1984           1984           1984           1984
P-34           P-35           P-36           P-37           P-389           P-398           P-40           P-41           P-42           P-448           P-445           P-46           P-47	J-217 J-22 J-23 J-24 J-24 J-24 J-26 J-219 J-26 J-219 J-28 J-28 J-28 J-28 J-28 J-28 J-31 J-211 J-32 J-33 J-32	J-217 J-22 J-23 J-24 J-25 J-26 J-26 J-27 J-28 J-27 J-28 J-29 J-30 J-211 J-32 J-33 J-34 J-34	250 150 150 200 250 250 250 150 150 150 150 150 150 150 150 150 1	PVC	130         130	147           12           45           154           39           68           116           117           26           93           111           76           87           112           10           47           74           65	1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1984           1984           1984           1984           1984           1984           1984           1984           1984           1984           1984           1984           1984           1984           1984           1984           1984
P-34           P-35           P-36           P-37           P-38           P-39A           P-39A           P-40           P-41           P-42           P-44A           P-45           P-46           P-47           P-48	J-217 J-22 J-23 J-24 J-24 J-26 J-210 J-26 J-219 J-28 J-28 J-28 J-28 J-28 J-28 J-28 J-28	J-217 J-22 J-23 J-24 J-25 J-26 J-26 J-27 J-28 J-27 J-28 J-29 J-29 J-30 J-211 J-32 J-33 J-34 J-34 J-34	250 150 150 200 250 250 250 150 150 150 150 150 150 150 150 150 1	PVC	130         130	147           12           45           154           39           68           116           117           26           93           111           76           87           112           10           47           74           65           47	1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1984
P-34           P-35           P-36           P-37           P-389           P-398           P-40           P-41           P-42           P-448           P-445           P-46           P-47	J-217 J-22 J-23 J-24 J-24 J-24 J-26 J-219 J-26 J-219 J-28 J-28 J-28 J-28 J-28 J-28 J-31 J-211 J-32 J-33 J-32	J-217 J-22 J-23 J-24 J-25 J-26 J-26 J-27 J-28 J-27 J-28 J-29 J-30 J-211 J-32 J-33 J-34 J-34	250 150 150 200 250 250 250 150 150 150 150 150 150 150 150 150 1	PVC	130         130	147           12           45           154           39           68           116           117           26           93           111           76           87           112           10           47           74           65	1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1984           1984           1984           1984           1984           1984           1984           1984           1984           1984           1984           1984           1984           1984           1984           1984           1984
P-34           P-35           P-36           P-37           P-38           P-398           P-40           P-41           P-42           P-448           P-45           P-46           P-47           P-48           P-49	J-217 J-22 J-23 J-24 J-24 J-21 J-26 J-219 J-229 J-219 J-12 J-28 J-28 J-28 J-28 J-28 J-28 J-21 J-21 J-21 J-23 J-31 J-32 J-33 J-32 J-35 J-30	J-217 J-22 J-23 J-24 J-25 J-26 J-26 J-27 J-28 J-27 J-28 J-29 J-30 J-211 J-32 J-33 J-34 J-34 J-34 J-34 J-34 J-31	250 150 150 200 250 250 250 250 150 150 150 150 150 150 150 150 150 1	PVC	130         130	147           12           45           154           39           68           116           117           26           93           111           76           87           112           10           47           74           65           47           157	1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1984
P-34           P-35           P-36           P-37           P-38           P-398           P-40           P-41           P-42           P-44A           P-45           P-46           P-47	J-217 J-22 J-23 J-24 J-24 J-21 J-26 J-219 J-219 J-12 J-28 J-28 J-28 J-31 J-211 J-28 J-31 J-211 J-32 J-33 J-32 J-35 J-30 J-35	J-217 J-22 J-23 J-24 J-25 J-26 J-26 J-27 J-28 J-27 J-28 J-29 J-30 J-211 J-32 J-33 J-34 J-34 J-34 J-34 J-34 J-34 J-34	250 150 150 200 250 250 250 150 150 150 150 150 150 150 150 150 1	PVC	130         130	147           12           45           154           39           68           116           117           26           93           111           76           87           112           10           47           65           47           157           156	1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1994           1984
P-34           P-35           P-36           P-37           P-38           P-398           P-40           P-41           P-42           P-44A           P-45           P-46           P-47           P-48           P-49           P-49	J-217 J-22 J-23 J-24 J-24 J-21 J-26 J-219 J-12 J-28 J-31 J-28 J-31 J-28 J-31 J-211 J-32 J-33 J-32 J-33 J-32 J-35 J-30 J-35 J-36	J-217 J-22 J-23 J-24 J-25 J-26 J-26 J-27 J-28 J-29 J-29 J-30 J-211 J-32 J-33 J-34 J-34 J-34 J-34 J-34 J-34 J-34	250 150 150 200 200 250 250 250 250 150 150 150 150 150 150 150 150 150 1	PVC	130         130	147         12         45         154         39         68         116         117         26         93         111         76         87         112         10         47         74         65         47         157         156         49	1995           1984           1984
P-34           P-35           P-36           P-37           P-38           P-398           P-40           P-41           P-42           P-44A           P-45           P-46           P-47	J-217 J-22 J-23 J-24 J-24 J-21 J-26 J-219 J-219 J-12 J-28 J-28 J-28 J-31 J-211 J-28 J-31 J-211 J-32 J-33 J-32 J-35 J-30 J-35	J-217 J-22 J-23 J-24 J-25 J-26 J-26 J-27 J-28 J-27 J-28 J-29 J-30 J-211 J-32 J-33 J-34 J-34 J-34 J-34 J-34 J-34	250 150 150 200 250 250 250 150 150 150 150 150 150 150 150 150 1	PVC	130         130	147           12           45           154           39           68           116           117           26           93           111           76           87           112           10           47           65           47           157           156	1995           1984           1984
P-34           P-35           P-36           P-37           P-38           P-398           P-40           P-41           P-42           P-448           P-45           P-46           P-47           P-48           P-49           P-50           P-51A	J-217 J-22 J-23 J-24 J-24 J-21 J-26 J-219 J-12 J-28 J-28 J-31 J-28 J-31 J-28 J-31 J-211 J-32 J-33 J-32 J-35 J-36 J-37	J-217 J-22 J-23 J-24 J-25 J-26 J-26 J-219 J-27 J-28 J-29 J-29 J-29 J-30 J-211 J-32 J-33 J-34 J-34 J-34 J-34 J-34 J-34 J-34 J-34 J-36 J-37 J-213	250 150 150 200 250 250 250 150 150 150 150 150 150 150 150 150 1	PVC	130         130	147         12         45         154         39         68         116         117         26         93         111         76         87         112         10         47         74         65         47         157         156         49         92	1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1984
P-34           P-35           P-36           P-37           P-38           P-39A           P-39B           P-40           P-41           P-42           P-44B           P-45           P-46           P-47           P-48           P-49           P-50           P-51A	J-217 J-22 J-23 J-24 J-24 J-24 J-26 J-219 J-12 J-28 J-28 J-31 J-28 J-31 J-211 J-32 J-33 J-32 J-33 J-35 J-36 J-37 J-213	J-217 J-22 J-23 J-24 J-25 J-26 J-26 J-27 J-28 J-27 J-28 J-29 J-27 J-28 J-29 J-211 J-32 J-30 J-31 J-34 J-34 J-34 J-34 J-34 J-31 J-36 J-37 J-213 J-213 J-38	250 150 150 150 200 250 250 250 150 150 150 150 150 150 150 150 150 1	PVC	130         130	147         12         45         154         39         68         116         117         26         93         111         76         87         112         10         47         74         65         47         157         156         49         92         92	1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1984
P-34           P-35           P-36           P-37           P-389           P-398           P-40           P-41           P-42           P-44A           P-45           P-46           P-47           P-48           P-49           P-551           P-518           P-524	J-217 J-22 J-23 J-24 J-24 J-26 J-219 J-26 J-219 J-12 J-28 J-28 J-28 J-31 J-211 J-28 J-31 J-211 J-32 J-33 J-32 J-33 J-35 J-30 J-35 J-36 J-37 J-213 J-212	J-217 J-22 J-23 J-24 J-25 J-26 J-26 J-27 J-28 J-27 J-28 J-29 J-30 J-211 J-32 J-33 J-34 J-34 J-34 J-34 J-34 J-34 J-34 J-34 J-34 J-34 J-34 J-34 J-35 J-37 J-213 J-38 J-38	250 150 150 150 200 200 250 250 250 150 150 150 150 150 150 150 1	PVC           PVC	130         130	147         12         45         154         39         68         116         117         26         93         111         76         87         112         10         47         74         65         47         157         156         49         92         68	1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1984
P-34           P-35           P-36           P-37           P-38           P-39A           P-39B           P-40           P-41           P-42           P-44B           P-45           P-46           P-47           P-48           P-49           P-50           P-51A	J-217 J-22 J-23 J-24 J-24 J-24 J-26 J-219 J-12 J-28 J-28 J-31 J-28 J-31 J-211 J-32 J-33 J-32 J-33 J-35 J-36 J-37 J-213	J-217 J-22 J-23 J-24 J-25 J-26 J-26 J-27 J-28 J-27 J-28 J-29 J-27 J-28 J-29 J-211 J-32 J-30 J-31 J-34 J-34 J-34 J-34 J-34 J-31 J-36 J-37 J-213 J-213 J-38	250 150 150 150 200 250 250 250 150 150 150 150 150 150 150 150 150 1	PVC	130         130	147         12         45         154         39         68         116         117         26         93         111         76         87         112         10         47         74         65         47         157         156         49         92         92	1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1995           1984





P-53	J-38	J-39	150	PVC	130	61	1984
P-54	J-39	J-40	350	Ductile Iron	130	168	1992
P-54A	J-8	J-39	350	Ductile Iron	130	260	1992
P-55A	J-37	J-210	150	PVC	130	31	1984
P-55B		J-210	150	PVC	130	20	1984
P-556	J-210 J-40	J-40 J-41	350	Ductile Iron	130	189	1984
P-50 P-57	J-40 J-41	J-41 J-42	250	PVC	130	75	1992
P-58A	J-41	J-209	250	PVC	130	20	1992
P-58B	J-209	J-43	250	PVC	130	95	1992
P-59	J-43	J-44	250	PVC	130	67	1992
P-60A	J-201	J-45	300	PVC 130		18	1992
P-60B	J-44	J-201	300	PVC	130	62	1992
P-61	J-45	J-51	200	PVC	130	137	1992
P-62	J-45	J-46	150	PVC	130	104	1992
P-66A	J-50	J-202	200	PVC	130	62	1992
P-67	J-51	J-50	200	PVC	130	84	1992
P-68	J-50	J-52	200	PVC	130	62	1992
P-69A	J-52	J-203	200	PVC	130	18	1989
P-69B	J-203	J-53	200	PVC	130	200	1989
P-70	J-54	J-53	150	PVC	130	105	1994
P-71	J-91	J-92	200	PVC	130	66	2005
P-71A	J-53	J-204	150	PVC	130	17	1994
P-71B	J-204	J-55	200	PVC	130	136	1994
P-72	J-55	J-56	200	PVC	130	138	1994
P-73	J-93	J-94	200	PVC	130	38	2006
P-73A	J-56	J-205	200	PVC	130	67	1994
P-73B	J-205	J-57	200	PVC	130	30	1994
P-74	J-22	J-91	200	PVC	130	144	2005
P-74A	J-57	J-206	200	PVC	130	91	1994
P-74B	J-206	J-58	200	PVC	130	23	1994
P-75A	J-207	J-59	200	PVC	130	96	1989
P-75B	J-207	J-230	200	PVC	130	9	1989
P-75C	J-230	J-53	200	PVC	130	112	1989
P-76	J-59	J-60	150	PVC	130	152	1984
P-77A	J-60	J-208	150	PVC	130	146	1984
P-77B	J-208	J-61	150	PVC	130	16	1984
P-78	J-61	J-62	150	PVC	130	113	1984
P-79	J-62	J-63	150	PVC	130	35	1984
P-80	J-63	J-64	150	PVC	130	147	1984
P-81	J-64	J-65	150	PVC	130	144	1984
P-82	J-59	J-65	200	PVC	130	84	1984
P-82	J-1A	PMP-3	150	PVC	130	5	2000
P-83	PMP-3	J-1	150	PVC	130	5	2000
P-84	J-65	J-67	200	PVC	130	93	1984
P-85	J-15	J-67	200	PVC	130	140	1984
P-86	J-67	J-68	150	PVC	130	67	1984
P-88	J-65	J-66	150	PVC	130	68	1984
P-270	H-53	J-25	150	PVC	130	23	
P-500	J-19	J-500	150	PVC	130	144	2040
P-501	J-500	J-501	150	PVC	130	121	2040
P-502	J-502	J-501	100	PVC	130	60	2040
P-503	J-501	J-215	150	PVC	130	72	2040
P-504	F16	J-500	150	PVC	130	6	2040
P-505	J-220	J-503	150	PVC	130	109	2040
P-506	J-503	J-504	150	PVC	130	91	2040
P-507	J-504	F18	150	PVC	130	6	2040
P-508	J-503	J-227	150	PVC	130	95	2040
P-509	J-221	J-505	200	PVC	130	85	2040
P-510	J-505	J-505	200	PVC	130	38	2040
P-511	J-506	J-500	200	PVC	130	83	2040
P-512	J-507	J-94	200	PVC	130	68	2040
P-512	J-510	J-507	100	PVC	130	51	2040
P-513	J-94	J-507	200	PVC	130	135	2040
P-515	J-511	J-511	200	PVC	130	72	2040
P-516	J-512	J-513	150	PVC	130	48	2040
P-517	J-512 J-513	J-515	100	PVC	130	31	2040
P-518	J-512	J-515	150	PVC	130	37	2040
P-519	J-508	J-515	100	PVC	130	25	2040
P-519	J-516	J-510	150	PVC	130	78	2040
P-521	F19	J-505	150	PVC	130	6	2040
P-522	J-509	J-517	100	PVC	130	32	2040
P-523	J-517	J-506	150	PVC	130	35	2040
P-524	J-517	F21	150	PVC	130	6	2040
P-525	F20	J-507	150	PVC	130	6	2040
P-526	F23	J-511	150	PVC	130	6	2040
P-527	F24	J-515	150	PVC	130	6	2040
			100		200	. ~	20.0





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P-528	F22	J-513	150	PVC	130	6	2040
P-529	F11	J-518	150	PVC	130	6	2040
P-530	F10	J-519	150	PVC	130	6	2040
P-531	F9	J-520	150	PVC	130	6	2040
P-532	J-520	J-519	200	PVC	130	119	2040
P-533	J-519	J-518	200	PVC	130	113	2040
P-534	J-518	J-230	200	PVC	130	128	2040
P-535	J-57	J-520	200	PVC	130	116	2040
P-538	J-526	J-525	200	PVC	130	85	2040
P-539	J-525	J-524	200	PVC	130	157	2040
P-540	J-524	J-522	200	PVC	130	115	2040
P-541	J-522	J-521	200	PVC	130	71	2040
P-542	J-521	J-52	200	PVC	130	92	2040
P-543	F4	J-521	150	PVC	130	6	2040
P-544	J-523	J-522	150	PVC	130	115	2040
P-545	F6	J-524	150	PVC	130	6	2040
P-546	F7	J-525	150	PVC	130	6	2040
P-547	F8	J-526	150	PVC	130	6	2040
P-548	J-97	J-527	250	PVC	130	57	2040
P-549	J-527	J-528	250	PVC	130	70	2040
P-550	J-528	J-42	250	PVC	130	121	2040
P-551	F1	J-527	150	PVC	130	121	2040
P-552	F2	J-528	150	PVC	130	6	2040
P-554	J-61	J-520	200	PVC	130	117	2040
P-556	J-529	J-504	100	PVC	130	53	2040
P-582	F5	J-522	150	PVC	130	6	2040
P-584	F15	J-501	150	PVC	130	6	2040
P-585	F12	J-229	150	PVC	130	6	2040
P-586	J-68	J-530	150	PVC	130	80	1984
P-587	J-530	J-69	150	PVC	130	80	1984
P-588	F13	J-530	150	PVC	130	6	2040
P-589	J-25	J-531	200	PVC	130	136	2040
P-590	J-531	J-227	200	PVC	130	117	2040
P-591	F17	J-531	150	PVC	130	6	2040
P-592	J-523	F3	150	PVC	130	6	2040
P-593	J-16	J-532	150	PVC	130	98	1984
P-594	J-532	J-17	150	PVC	130	89	1984
P-595	F14	J-532	150	PVC	130	6	2040
P-596	J-58	J-533	200	PVC	130	27	2040
P-597	J-533	J-526	200	PVC	130	40	2040
P-598	F25	J-534	150	PVC	130	6	2040
P-599	F26	J-535	150	PVC	130	6	2040
P-600	F27	J-536	150	PVC	130	6	2040
P-601	F28	J-537	150	PVC	130	6	2040
P-602	J-533	J-534	250	PVC	130	245	2040
P-603	J-534	J-535	250	PVC	130	90	2040
P-604	J-535	J-536	350	PVC	130	92	2040
P-605	J-536	J-537	350	PVC	130	96	2040
P-606	J-537	J-538	350	PVC	130	87	2040
P-607	F29	J-538	150	PVC	130	6	2040
P-610	F30	J-29	150	PVC	130	6	2040
P-611	F31	J-11	150	PVC	130	6	2040





14         147         199         200         PPC         130         130         2011         2031           13         142         1241         120         PPC         110         111         1302           14         1420         1241         120         PPC         110         14         1392           154         1430         144         120         PPC         130         14         1392           156         146         1447         100         PPC         130         121         1392           156         146         1448         150         PPC         130         140         2000           151         1432         1432         150         PPC         130         140         2000           151         1433         1432         150         PPC         130         161         2000           153         1455         120         PPC         130         161         2000         161         2000         161         2000         161         2000         161         2000         161         2000         161         2000         161         2000         161         200	Label	Start Node	Stop Node	Diameter (mm)	Material	Hazen-Williams C	Length (m)	Installation Year
14         1442         1430         174         1992           15         1240         144         200         PPC         130         71         1992           15         1240         144         200         PPC         130         111         1992           15         1240         144         200         PPC         130         111         1992           16         144         1440         150         PPC         130         130         120           17         1323         1220         150         PPC         130         40         2009           181         1323         1220         150         PPC         130         40         2009           181         1323         1220         120         PPC         130         41         200           181         1333         120         120         PPC         130         130         130         130           181         1345         127         1220         120         120         120         120         120         120         120         120         120         120         120         120         120         120								
14.         j.240         j.242         250         PVC         130         77.         1992           64         j.46         j.47         150         PVC         130         111         1992           64         j.46         j.47         150         PVC         130         120         120           64         j.48         j.47         150         PVC         130         323         120           140         j.49         j.49         j.29         j.230         130         PVC         130         350         2009           151         j.232         j.233         150         PVC         130         40         141           141         j.233         130         PVC         130         40         141           143         j.235         j.236         130         PVC         130         40         141         140 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>								
15         1420         143         200         PCC         130         111         1922           17         146         148         10         PCC         130         141           17         146         148         10         PCC         130         2213           181         1231         1223         1230         1200         PCC         130         200           181         1232         1232         1233         1200         PCC         130         431         200           181         1233         1233         1233         1200         PCC         130         431         200         200           181         1233         1234         130         PCC         130         37         200         PCC         130         37         200         141	E-3	J-242	J-241	250	PVC	130	74	1992
148         147         148         148         150         PVC         130         221           68         148         148         100         PVC         130         221           68         146         1252         120         PVC         130         200           61         123         123         123         120         PVC         130         80         200           61         123 <t< td=""><td>E-4</td><td>J-240</td><td>J-242</td><td>250</td><td>PVC</td><td>130</td><td>79</td><td>1992</td></t<>	E-4	J-240	J-242	250	PVC	130	79	1992
1-7         1-46         1-44         5-9         PVC         130         221           12         1-429         1-239         150         PVC         130         323           12         1-230         1-329         1-230         150         PVC         130         35         2029           11         1-121         1-320         1-50         PVC         130         45         2029           141         1-231         1-323         1-324         150         PVC         130         46         40           154         1-325         1-350         PVC         130         67         110         120         120           154         1-325         1-350         PVC         130         74         120	E-5	J-240	J-45	200	PVC	130	11	1992
IAB         JAB         JAB         JAB         JAB         JAB         JAB           640         JA228         JA230         150         PVC         130         160         JAB           641         JA231         JA232         150         PVC         130         A3         IAB           641         JA33         JABA         JABA         JABA         JABA         JABA           643         JABA         JABA         JABA         JABA         JABA         JABA           644         JABA         JABA         JABA         JABA         JABA         JABA           645         JABA         JABA         JABA         JABA         JABA         JABA           646         JABA         JABA         JABA         JABA         JABA         JABA           647         JABA         JABA         JABAA         JABAA		J-46	J-47	150	PVC	130		
1-9         1-10         1-220         1-30         190         PVC         130         95         2009           511         1-231         1-232         150         PVC         130         4.1           1-231         1-232         150         PVC         130         4.1           1-233         1-233         1-231         120         PVC         130         95           1-234         1-233         1-231         120         PVC         130         97           1-234         1-235         1-236         130         PVC         130         97           1-235         1-236         130         PVC         130         147         2005           1-237         1-235         1-216         200         PVC         130         147         2005           1-231         1-216         200         PVC         130         139         2005           1-231         1-216         200         PVC         130         128         2001           1-232         1-221         230         PVC         130         128         2001           1-231         1-224         3030         PVC         130								
510         J-320         J-30         PVC         H30         PVC         H30         PVC           111         J-321         J-323         J-30         PVC         H30         H4           121         J-323         J-334         J-30         PVC         H30         PUC           131         J-334         J-334         J-30         PVC         H30         PUC           141         J-334         J-235         J-30         PVC         H30         PUC           134         J-336         J-237         J-232         J-30         PVC         H30         PUC           135         J-316         J-207         PL22         PUC         H30         H43         Z005           136         J-116         J-116         Z00         PVC         H30         H19         Z005           121         J-217         J-220         Z00         PVC         H30         H38         Z005           122         J-221         Z00         PVC         H30         H38         Z005           122         J-223         J-224         J-224         J-23         Z000         PVC         H30         H38         Z000								
111         1-221         1-232         150         PVC         130         4.1           121         1-232         1-233         1.23         1.20         PVC         130         90           121         1-233         1.234         1.50         PVC         130         90           1215         1-238         1.235         1.50         PVC         130         0.31           123         1.238         1.230         1.50         PVC         130         141           123         1.238         1.230         1.50         PVC         130         147         2005           124         1.231         1.230         2.00         PVC         130         147         2005           124         1.221         1.201         2.00         PVC         130         143         2.000           124         1.221         1.221         3.00         PVC         130         122         2.010           124         1.221         3.00         PVC         130         128         2.010           124         1.223         3.00         PVC         130         128         2.010           124         1.223								
1212         J-232         J-233         J-234         J-304         PVC         IJ30         PVC           1513         J-234         J-236         IJ50         PVC         IJ30         B0           1515         J-235         J-236         IJ50         PVC         IJ30         B10           1515         J-238         J-236         IJ50         PVC         IJ30         B11           1616         J-246         J-217         J-237         IJ50         PVC         IJ30         B11         J00           1617         J-237         J-230         IJ50         PVC         IJ30         IJ17         J000           162         J-216         J-151         IJ50         PVC         IJ30         IJ17         J000           162         J-220         J-223         IJ22         IJ230         PVC         IJ30         IJ18         J001           162         J-233         J-224         J300         PVC         IJ30         IJ18         J001           163         J-225         J226         IJ00         PVC         IJ30         IJ18         J010           164         J-225         J226         IJ00         PVC </td <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>2009</td>								2009
13         1233         1234         150         PVC         130         90           151         1235         1236         150         PVC         130         63           151         1238         1235         150         PVC         130         63           151         1238         1235         150         PVC         130         131           151         1238         1235         150         PVC         130         131           151         1238         1237         1230         120         130         131         1208           161         111         1236         200         PVC         130         131         1208           152         1237         1220         233         350         PVC         130         132         2010           152         1232         1232         350         PVC         130         138         2010           153         124         1225         200         PVC         130         138         2010           154         1236         126         126         126         126         126         120         120         120         120 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>								
F14         I-234         I-235         I-236         I-30         PVC         I-30         G-37           F15         I-235         I-236         I-30         PVC         I-30         G-31           F15         I-236         I-237         I-327         I-320         PVC         I-30         I-47         2005           F19         I-1215         I-1216         I-200         PVC         I-30         I-121         2000         I-327         I-320         I-327         I-320         I-327         I-320         I-327         I-320         I-327         I-326         I-327         I-326         I-326         I-326         I-326         I-327         I-326         I-326         I-327         I-326         I-326         I-327								
1-151-2361-2361-2361-2371-238								
15.15         12.23         12.23         13.0         PVC         13.0         8.1           15.16         1.5.27         1.5.27         15.0         PVC         13.0         8.7           15.17         1.5.27         1.5.27         1.5.27         1.5.27         1.5.27         1.5.27           15.15         1.5.15         1.5.15         2.00         PVC         1.3.0         1.4.27         2.005           15.21         1.2.16         1.9.1         2.00         PVC         1.3.0         1.1.2         2.005           15.21         1.2.21         1.2.21         2.0.0         PVC         1.3.0         1.1.2         2.0.0           15.23         1.2.21         1.2.21         2.0.0         PVC         1.3.0         1.1.0         2.0.0           15.24         1.2.21         1.2.2.1         3.0.0         PVC         1.3.0         1.1.0         2.0.0           15.25         1.2.21         1.2.2.0         2.0.0         PVC         1.3.0         1.1.0         2.0.0           15.24         1.2.21         2.0.0         PVC         1.3.0         1.1.0         2.0.0           15.3         1.2.21         2.0.0         PVC								
15.16         1-236         1-237         1-237         1-237         1-232         130         PVC         130         147         2005           15.13         1-5.16         1-215         200         PVC         130         147         2005           15.19         1-215         1-216         200         PVC         130         147         2005           120         1-216         1-210         220         PVC         130         119         2001           121         1-220         1-220         380         PVC         130         131         2010           122         1-220         1-221         280         PVC         130         131         2010           123         1-221         1-220         380         PVC         130         131         2010           123         1-221         1-225         200         PVC         130         131         2010           124         1-225         1-226         1-226         2000         PVC         130         132         2010           124         1-227         1-33         2020         PVC         130         121         2010           124								
1211227123712321301941281.415200PVC13014720051291.2251.216200PVC13014120051201.2261.210200PVC13011220051211.2201.220220PVC13011220101221.2211.22122090°C13012820101231.2221.223350PVC13012820101241.2221.223350PVC13012820101251.2331.224350PVC13012820101261.2341.225200PVC13012820101271.2261.2301.24120102120101281.2271.226200PVC13012820101291.2281.236200PVC13012820101291.2281.236200PVC13012820101391.2281.236200PVC13012820101391.2281.236200PVC1301312141401.4291.59200PVC1301312141411.421.50PVC130131214141H421.50PVC130131214142<								
1-16         1-215         1-215         200         PVC         130         147         2005           1-216         1-91         200         PVC         130         1157         2005           1-22         1-220         1-220         250         PVC         130         119         2010           1-22         1-221         1-221         250         PVC         130         192         2010           1-22         1-221         1-221         350         PVC         130         188         2010           1-22         1-223         1-224         350         PVC         130         118         2010           1-22         1-225         1-225         200         PVC         130         128         2010           1-22         1-225         1-226         200         PVC         130         128         2010           1-23         1-226         1-93         200         PVC         130         128         2010           1-23         1-228         1-94         200         PVC         130         128         2010           1-33         1-42         1-23         1-20         190         120								
1-20         1-21         1-21         1-27         1-200         PVC         130         117         2005           1-22         1-220         1-221         1-220         PVC         130         1192         2010           1-23         1-221         1-222         350         PVC         130         138         2010           1-24         1-222         1-23         350         PVC         130         138         2010           1-25         1-223         1-224         350         PVC         130         154         2010           1-26         1-25         1-225         200         PVC         130         121         2010           1-27         1-275         1-226         200         PVC         130         123         2010           1-28         1-226         1-96         200         PVC         130         123         2010           1-21         1-224         1-228         350         PVC         130         48         2010           1-3         1-224         1-230         150         PVC         130         13         14           1-4         H-4         1-200         150								2005
121         1220         1220         1221         2500         PVC         130         119         2010           122         1221         250         PVC         130         89         2010           123         1222         1230         350         PVC         130         128         2010           123         1223         1223         350         PVC         130         128         2010           124         1223         1225         1225         2000         PVC         130         121         2010           127         1252         1226         200         PVC         130         123         2010           123         1224         1428         200         PVC         130         128         2010           123         1224         143         200         PVC         130         128         2010           124         144         142         128         200         PVC         130         128         2010           124         143         150         PVC         130         11         11         11         11         11         11         11         11         11	E-19	J-215	J-216	200	PVC	130	143	2005
121         1220         1220         1221         2500         PVC         130         119         2010           122         1221         250         PVC         130         89         2010           123         1222         1230         350         PVC         130         128         2010           123         1223         1223         350         PVC         130         128         2010           124         1223         1225         1225         2000         PVC         130         121         2010           127         1252         1226         200         PVC         130         123         2010           123         1224         1428         200         PVC         130         128         2010           123         1224         143         200         PVC         130         128         2010           124         144         142         128         200         PVC         130         128         2010           124         143         150         PVC         130         11         11         11         11         11         11         11         11         11								
I+22         I+22         I+22         I+23         I+23         I+24         I+221         I+23         I+20         I+20 <thi+20< th="">         I+20         I+20         <th< td=""><td></td><td></td><td>J-220</td><td>250</td><td>PVC</td><td>130</td><td>119</td><td>2010</td></th<></thi+20<>			J-220	250	PVC	130	119	2010
E24         b-222         b-234         330         PVC         130         128         2010           E25         b-234         1524         350         PVC         130         131         2010           E26         b-255         1-266         200         PVC         130         1314         2010           E28         b-226         1-966         200         PVC         130         123         2010           E30         b-227         1-93         3200         PVC         130         123         2010           E31         1-228         1-95         2200         PVC         130         128         2010           E41         H-1         1-90         150         PVC         130         48         2006           L2         1-92         1-52         200         PVC         130         48         2006           L2         1-941         H-2         150         PVC         130         48         2006           L3         1-92         1-50         PVC         130         6				250		130		2010
I+23         I+24         350         PVC         130         158         2010           I+25         I+25         200         PVC         130         11         2010           I+23         I+226         I+26         200         PVC         130         124         2010           I+23         I+26         I+96         200         PVC         130         123         2010           I+31         I+274         I+93         200         PVC         130         123         2010           I+33         I+224         I+28         350         PVC         130         213         2010           I+33         I+224         I+35         200         PVC         130         48         2006           I+4         I+1         I+90         150         PVC         130         11         110           I+3         I+242         I+3         150         PVC         130         6         110           I+4         I+4         I+201         150         PVC         130         12         111           I+5         I+53         I+50         150         PVC         130         12 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>								
E26         j-95         j-225         j-226         j-227         j-31         j-227         j-31         j-227         j-31         j-228         j-32         j-228         j-32         j-228         j-32         j-226         j-32         j-226         j-32         j-227         j-33         j-228         j-32         j-228         j-32         j-228         j-32         j-226         j-32         j-226         j-32         j-226         j-33         j-227         j-33         j-228         j-35         j-200         PVC         j-30         j-31         j-200         j-31         j-200         j-31         j-32         j-32 <thj-32< th=""> <thj-32< th=""></thj-32<></thj-32<>								
F22         F226         F226         F226         F226         F226         F226         F226         F226         F227         F23         F228         F25         F200         FVC         F130         F233         F228         F228         F228         F228         F228         F228         F200         FVC         F130         F213         F228         F228 <thf28< th=""> <thf28< th="">         F228</thf28<></thf28<>								
E-28         J-26         J-96         200         PVC         130         223         2010           E-31         J-227         J-93         200         PVC         130         198         2006           E-31         J-224         J-28         250         PVC         130         1213         2010           E-32         J-22         J-25         200         PVC         130         48         2006           E-31         J-42         J-43         200         PVC         130         48         2006           L-1         H-1         J-90         150         PVC         130         7            L-2         J-41         H-2         150         PVC         130         13            L-3         H-4         H-3         150         PVC         130         6            L-5         H-5         J-51         150         PVC         130         8            L-6         H-6         J-202         150         PVC         130         6            L-10         H-7         H-7         J-203         150         PVC         130         4								
1-30J-227J-33200PVC13019820061-31J-228J-28350PVC13012322001-33J-28J-28250PVC13021820101-33J-24J-35200PVC1304820061-3J-241H-1J-90150PVC1301311001-2J-241H-2150PVC1301111001-3J-242H-3150PVC1301111001-4H-4J-201150PVC1301121001-5H-5150PVC13061001111-6H-6J-202150PVC13081001-7H-7J-203150PVC13071001-8H-8J-54150PVC13071001-9H-9J-204150PVC13071001-1H-11J-55150PVC13081001-1H-13J-205150PVC13081001-1H-14J-207150PVC13081001-1H-13J-206150PVC13081001-1H-14J-207150PVC13081001-1H-13J-60150PVC1308100								
1-32         1-224         1-28         350         PVC         130         123         2010           5-33         1-92         1-95         200         PVC         130         218         2010           5-33         1-92         1-95         200         PVC         130         48         2006           1-1         H-1         1-90         150         PVC         130         13         -           1-2         1-241         H-2         150         PVC         130         11         -           1-3         1-242         H-3         150         PVC         130         6         -           1-4         H-4         1-201         150         PVC         130         6         -           1-5         H-5         1-51         150         PVC         130         8         -           1-7         H-7         1-203         150         PVC         130         8         -           1-9         H-9         1-204         150         PVC         130         8         -           1-10         1-55         150         PVC         130         8         -								
1-228         1-228         1-258         250         PVC         130         218         2010           1-31         1-92         1-25         200         PVC         130         148         2006           1-1         H+1         1-90         150         PVC         130         131         2006           1-2         1-241         H-2         150         PVC         130         131         1           1-2         1-242         H-3         150         PVC         130         11         1           1-5         H-5         1-51         150         PVC         130         6         1           1-5         H-5         1-50         PVC         130         8         1           1-7         H-7         1-203         150         PVC         130         8         1           1-8         H-8         1-54         150         PVC         130         12         1           1-10         H-10         1-55         150         PVC         130         10         1           1-11         H-11         1-56         150         PVC         130         8         1 <tr< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr<>								
I-32         J-92         J-25         200         PVC         130         48         2006           1-1         H-1         J-90         150         PVC         130         1.3           1-3         J-241         H-2         150         PVC         130         131           1-3         J-242         H-3         150         PVC         130         11           1-4         H-4         J-201         150         PVC         130         11         1.51           1-5         H-5         J-51         150         PVC         130         6.0         1.51           1-6         H-6         J-202         150         PVC         130         8         1.54           1-7         H-7         J-203         150         PVC         130         7         1.51           1-10         H-10         J-55         150         PVC         130         10         1.51           1-11         H-11         J-56         150         PVC         130         8         1.51           1-11         H-12         J-206         150         PVC         130         8         1.51           1-14 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>								
1-1         H-1         H-90         150         PVC         130         7.1           1-2         1-241         H-2         150         PVC         130         111           1-3         1-242         H-3         150         PVC         130         111           1-4         H-4         1-201         150         PVC         130         6           1-5         H-5         1-51         150         PVC         130         6           1-6         H-6         1-202         150         PVC         130         6           1-7         H-7         1-203         150         PVC         130         12           1-9         H-9         1-204         150         PVC         130         12           1-10         H-55         150         PVC         130         10         11           1-11         H-11         1-56         150         PVC         130         4         11           1-12         H-12         1-206         150         PVC         130         8         11           1-13         H-13         1-206         150         PVC         130         8 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>								
1-24         J-241         H-2         150         PVC         130         13           1-3         J-242         H-3         150         PVC         130         6           1-4         H-4         J-201         150         PVC         130         6           1-5         H-5         J-51         150         PVC         130         6           1-6         H-6         J-202         150         PVC         130         8           1-7         H-7         J-203         150         PVC         130         8           1-9         H-9         J-204         150         PVC         130         12           1-9         H-9         J-204         150         PVC         130         10           1-10         H-11         J-56         150         PVC         130         8           1-13         H-14         J-205         150         PVC         130         4           1-14         H-14         J-207         150         PVC         130         8           1-14         H-14         J-207         150         PVC         130         8           1-14 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>2006</td></td<>								2006
1-3         1-242         H-3         150         PVC         130         11           1-4         H-4         1-201         150         PVC         130         6           1-5         H-5         1-51         150         PVC         130         12           1-6         H-6         1-202         150         PVC         130         6           1-7         H-7         1-203         150         PVC         130         8           1-8         H-8         1-54         150         PVC         130         7           1-10         1-55         150         PVC         130         9         1           1-11         H-12         1-266         150         PVC         130         8         1           1-13         H-13         1-206         150         PVC         130         8         1           1-14         H-15         1-59         150         PVC         130         8         1           1-14         H-14         1-206         150         PVC         130         8         1           1-14         H-15         1-50         PVC         130         8								
1-4         H-4         J-201         150         PVC         130         6           L-5         H-5         J-51         150         PVC         130         12           L-6         H-7         J-202         150         PVC         130         6           L-7         H-7         J-203         150         PVC         130         8           L-8         H-8         J-54         150         PVC         130         7           L-9         H-9         J-204         150         PVC         130         9           L-11         H-11         J-56         150         PVC         130         8           L-11         H-12         J-206         150         PVC         130         4           L-13         H-14         J-207         150         PVC         130         6           L-14         H-14         J-206         150         PVC         130         8            L-14         H-15         J-59         150         PVC         130         8            L-14         H-14         J-206         150         PVC         130         8 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>								
1-5         H-5         J-51         150         PVC         130         12           L-6         H-6         J-202         150         PVC         130         6           L-7         H-7         J-203         150         PVC         130         8           L-8         H-8         J-54         150         PVC         130         7           L-10         H-54         150         PVC         130         7           L-10         H-10         J-55         150         PVC         130         9           L-11         H-11         J-56         150         PVC         130         8           L-13         H-13         J-206         150         PVC         130         6           L-14         H-14         J-207         150         PVC         130         6           L-14         H-14         J-207         150         PVC         130         8            L-14         H-14         J-206         150         PVC         130         8            L-16         H-16         J-60         150         PVC         130         8								
1-7 $1-203$ $150$ $PVC$ $130$ $8$ $1-8$ $1+8$ $1-54$ $150$ $PVC$ $130$ $12$ $1-9$ $1+9$ $1-204$ $150$ $PVC$ $130$ $7$ $1-10$ $1+10$ $1+55$ $150$ $PVC$ $130$ $90$ $1-11$ $1+11$ $1+56$ $150$ $PVC$ $130$ $100$ $1-12$ $1-205$ $150$ $PVC$ $130$ $4$ $1-13$ $1+13$ $1-206$ $150$ $PVC$ $130$ $6$ $1-14$ $H-14$ $i-207$ $150$ $PVC$ $130$ $8$ $1-15$ $H-15$ $1-59$ $150$ $PVC$ $130$ $8$ $1-16$ $H-16$ $1-60$ $150$ $PVC$ $130$ $8$ $1-17$ $H-17$ $1-208$ $150$ $PVC$ $130$ $8$ $1-19$ $H-64$ $150$ $PV$								
H-8         H-54         150         PVC         130         12           L-9         H-9         J-204         150         PVC         130         7           L-10         H-10         J-55         150         PVC         130         9           L-11         H-11         J-56         150         PVC         130         8           L-11         H-12         J-205         150         PVC         130         8           L-13         H-13         J-206         150         PVC         130         4           L-14         H-14         J-207         150         PVC         130         6           L-15         H-59         150         PVC         130         5            L-16         H-16         J-60         150         PVC         130         8            L-17         H-17         J-208         150         PVC         130         8            L-18         H-18         I-63         150         PVC         130         8            L-20         H-20         J-64         150         PVC         130         7	L-6	H-6	J-202	150	PVC	130	6	
I-9         H-9         J-204         150         PVC         130         7           L-10         H-10         J-55         150         PVC         130         9           L-11         H-12         J-205         150         PVC         130         8           L-13         H-12         J-206         150         PVC         130         4           L-13         H-13         J-206         150         PVC         130         6           L-14         H-14         J-207         150         PVC         130         6           L-15         H-15         J-59         150         PVC         130         8           L-16         H-16         J-60         150         PVC         130         8           L-17         H-17         J-208         150         PVC         130         8           L-18         H-18         J-63         150         PVC         130         8           L-20         H-20         J-65         150         PVC         130         7           L-21         H-23         J-42         150         PVC         130         12           L-24	L-7	H-7	J-203	150	PVC	130	8	
L-10         H-10         J-55         150         PVC         130         9           L-11         H-11         J-56         150         PVC         130         10           L-12         H-12         J-205         150         PVC         130         8           L-13         H-13         J-206         150         PVC         130         4           L-14         H-14         J-207         150         PVC         130         6           L-15         H-159         J50         PVC         130         6         1           L-16         H-16         J-60         150         PVC         130         8         1           L-18         H-18         J-63         150         PVC         130         8         1           L-19         H-19         J-64         150         PVC         130         8         1           L-11         H-68         150         PVC         130         8         1           L-21         H-23         J-42         150         PVC         130         7         1           L-22         H-23         J-42         150         PVC         130	L-8	H-8	J-54	150	PVC	130	12	
I-11         H-11         J-56         150         PVC         130         10           L-12         H-12         J-205         150         PVC         130         8           L-13         H-13         J-206         150         PVC         130         4           L-14         H-14         J-207         150         PVC         130         6           L-15         H-15         J-59         150         PVC         130         8           L-16         H-16         J-60         150         PVC         130         8           L-17         H-17         J-208         150         PVC         130         8           L-18         H-18         J-63         150         PVC         130         8           L-19         H-19         J-64         150         PVC         130         8           L-20         H-63         150         PVC         130         8            L-21         H-23         J-42         150         PVC         130         12           L-24         H-20         J-56         150         PVC         130         111           L-25								
L·12         H·12         J·205         150         PVC         130         8           L·13         H·13         J·206         150         PVC         130         4           L·14         H·14         J·207         150         PVC         130         6           L·15         H·15         J·59         150         PVC         130         8           L·16         H·16         J·60         150         PVC         130         8           L·16         H·16         J·63         150         PVC         130         8           L·18         H·18         J·63         150         PVC         130         8           L·19         H·19         J·64         150         PVC         130         8           L·20         H·20         J·65         150         PVC         130         8           L·21         H·21         J·68         150         PVC         130         7           L·22         H·22         J·69         150         PVC         130         7           L·22         H·23         J·42         150         PVC         130         111           L·24								
L·13         H·13         J·206         150         PVC         130         4           L·14         H·14         J·207         150         PVC         130         6           L·15         H·15         J·59         150         PVC         130         5           L·16         H·16         J·60         150         PVC         130         8           L·17         H·17         J·208         150         PVC         130         8           L·18         H·18         J·63         150         PVC         130         8           L·19         H·19         J·64         150         PVC         130         8           L·21         H·20         J·65         150         PVC         130         8           L·21         H·21         J·68         150         PVC         130         8           L·22         H·23         J·42         150         PVC         130         12           L·23         H·23         J·42         150         PVC         130         10           L·24         H·24         J·209         150         PVC         130         10           L·24								
L·14         H·14         J·207         150         PVC         130         6           L·15         H·15         J·59         150         PVC         130         5           L·16         H·16         J·50         150         PVC         130         8           L·17         H·17         J·208         150         PVC         130         8           L·18         H·18         J·63         150         PVC         130         8           L·19         H·19         J·64         150         PVC         130         8           L·20         H·20         J·65         150         PVC         130         8           L·21         H·22         J·69         150         PVC         130         7           L·22         H·22         J·69         150         PVC         130         7           L·23         H·24         J·209         150         PVC         130         7           L·24         H·24         J·209         150         PVC         130         11           L·25         H·26         J·210         150         PVC         130         8           L·27								
L15         H15         J.59         150         PVC         130         5           L16         H16         J-60         150         PVC         130         8           L17         H-17         J-208         150         PVC         130         8           L18         H-18         J-63         150         PVC         130         9           L19         H-19         J-64         150         PVC         130         8           L20         H-20         J-65         150         PVC         130         8           L21         H-21         J-68         150         PVC         130         7           L22         H-22         J-69         150         PVC         130         12           L24         H-23         J-42         150         PVC         130         12           L24         H-24         J-209         150         PVC         130         11           L25         H-25         J-43         150         PVC         130         10           L25         H-26         J-210         150         PVC         130         10           L28         H-26								
L16         H-16         J-60         150         PVC         130         8           L17         H-17         J-208         150         PVC         130         8           L18         H-18         J-63         150         PVC         130         9           L19         H-19         J-64         150         PVC         130         8           L20         H-20         J-65         150         PVC         130         8           L21         H-21         J-68         150         PVC         130         7           L22         H-22         J-69         150         PVC         130         7           L23         H-23         J-42         150         PVC         130         7           L24         H-24         J-209         150         PVC         130         11           L25         H-25         J-43         150         PVC         130         10           L27         H-26         J-210         150         PVC         130         10           L27         H-28         J-35         150         PVC         130         7           L30         H-30								
1-17       H-17       J-208       150       PVC       130       8         1-18       H-18       J-63       150       PVC       130       9         1-19       H-19       J-64       150       PVC       130       8         1-20       H-20       J-65       150       PVC       130       8         1-21       H-21       J-68       150       PVC       130       7         1-22       H-22       J-69       150       PVC       130       12         1-23       H-23       J-42       150       PVC       130       11         1-24       H-24       J-209       150       PVC       130       11         1-25       H-23       J-43       150       PVC       130       11         1-26       H-26       J-210       150       PVC       130       8       16         1-27       H-26       J-36       150       PVC       130       9       12         1-28       H-28       J-35       150       PVC       130       10       10         1-30       H-30       J-31       150       PVC       130								
L-18         H-18         J-63         150         PVC         130         9           L-19         H-19         J-64         150         PVC         130         8           L-20         H-20         J-65         150         PVC         130         8           L-21         H-21         J-68         150         PVC         130         7           L-22         H-22         J-69         150         PVC         130         7           L-22         H-23         J-42         150         PVC         130         7           L-24         H-24         J-209         150         PVC         130         11         1           L-25         H-26         J-210         150         PVC         130         11         1           L-26         H-26         J-210         150         PVC         130         8         1           L-27         H-27         J-36         150         PVC         130         10         1           L-28         H-28         J-35         150         PVC         130         15         1           L-30         H-30         J-31         150         <				-				
$1-19$ $H\cdot19$ $I-64$ $150$ $PVC$ $130$ $8$ $1-20$ $H+20$ $I+65$ $150$ $PVC$ $130$ $8$ $1-21$ $H+21$ $I-68$ $150$ $PVC$ $130$ $7$ $1-22$ $H+22$ $I+69$ $150$ $PVC$ $130$ $12$ $1-23$ $H+23$ $I+42$ $150$ $PVC$ $130$ $7$ $1-24$ $H+24$ $I-209$ $150$ $PVC$ $130$ $11$ $1-25$ $H+26$ $I-43$ $150$ $PVC$ $130$ $11$ $1-26$ $H+26$ $I-210$ $150$ $PVC$ $130$ $8$ $1-27$ $H+27$ $I-36$ $150$ $PVC$ $130$ $9$ $1-28$ $H+28$ $I-35$ $150$ $PVC$ $130$ $10$ $1-29$ $H+29$ $I-211$ $150$ $PVC$ $130$ $10$ $1-30$ $H-33$ $150$ $PVC$ $130$ $15$ $1-31$ $H-31$ $I-30$ $150$ $PVC$ $130$ $15$ $1-34$ $H-34$ $I-213$ $150$ $PVC$ $130$ $16$ $1-34$ $H-34$ $I-213$ $150$ $PVC$ $130$ $16$ $1-34$ $H-34$ $I-213$ $150$ $PVC$ $130$ $11$ $1-34$ $H-34$ $I-213$ $150$ $PVC$ $130$ $15$ $1-34$ $H-34$ $I-213$ $150$ $PVC$ $130$ $15$ $1-34$ $H-36$ $I-12$ $150$ $PVC$ $130$ </td <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>   </td>								
I-20         H-20         J-65         150         PVC         130         8           I-21         H-21         J-68         150         PVC         130         7           I-22         H-22         J-69         150         PVC         130         12           I-23         H-23         J-42         150         PVC         130         7           I-24         H-24         J-209         150         PVC         130         7           I-25         H-25         J-43         150         PVC         130         11           I-25         H-26         J-210         150         PVC         130         10           I-26         H-26         J-210         150         PVC         130         8            I-27         H-27         J-36         150         PVC         130         10            I-28         H-28         J-35         150         PVC         130         10            I-30         H-31         J-30         150         PVC         130         15            I-31         H-32         J-212         150         PVC								1
1-21H-21J-68150PVC13071-22H-22J-69150PVC130121-23H-23J-42150PVC13071-24H-24J-209150PVC13071-25H-25J-43150PVC130101-26H-26J-210150PVC13081-27H-27J-36150PVC13091-28H-28J-35150PVC13091-29H-29J-211150PVC1301001-30H-31J-30150PVC130151-31H-31J-30150PVC130151-33H-34J-212150PVC130161-33H-34J-213150PVC130161-34H-34J-213150PVC130111-35H-36J-28150PVC130111-35H-36J-28150PVC130151-36H-36J-12150PVC130151-36H-36J-12150PVC130151-36H-36J-12150PVC130151-37J-13H-37150PVC130151-38H-38J-16150PVC130111-39J-17H-39 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>1</td>								1
I-22       H-22       J-69       150       PVC       130       12         I-23       H-23       J-42       150       PVC       130       7         I-24       H-24       J-209       150       PVC       130       11         I-25       H-26       J-209       150       PVC       130       11         I-25       H-26       J-210       150       PVC       130       8         I-27       H-26       J-210       150       PVC       130       9         I-27       H-27       J-36       150       PVC       130       9         I-28       H-28       J-35       150       PVC       130       10         I-29       H-29       J-211       150       PVC       130       7         I-30       H-30       J-31       150       PVC       130       16         I-31       H-31       J-30       150       PVC       130       16         I-32       H-32       J-212       150       PVC       130       16         I-33       H-34       J-213       150       PVC       130       11         I-34								
1-23H-23J-42150PVC13071-24H-24J-209150PVC130111-25H-25J-43150PVC130101-26H-26J-210150PVC13081-27H-27J-36150PVC13091-28H-28J-35150PVC13091-29H-29J-211150PVC130771-30H-30J-31150PVC130151-31H-31150PVC130161-32H-32J-212150PVC130161-33H-33J-39150PVC130161-34H-34J-213150PVC130111-35H-36J-28150PVC130111-34H-34J-213150PVC130111-35H-36J-12150PVC130111-36H-36J-12150PVC130151-37J-13H-37150PVC130111-38H-38J-16150PVC130111-39J-17H-39150PVC13011							12	1
1-24H-24J-209150PVC130111-25H-25J-43150PVC130101-26H-26J-210150PVC13081-27H-27J-36150PVC13091-28H-28J-35150PVC130101-29H-29J-211150PVC13071-30H-30J-31150PVC130151-31H-31J-30150PVC130161-32H-32J-212150PVC130161-33H-33J-39150PVC130161-34H-34J-213150PVC130111-35H-36J-28150PVC130111-34H-34J-213150PVC130111-35H-36J-12150PVC130111-34H-34J-213150PVC130111-35H-36J-12150PVC130151-37J-13H-37150PVC130111-38H-38J-16150PVC130171-39J-17H-39150PVC13017			J-42					
L-26         H-26         J-210         150         PVC         130         8           L-27         H-27         J-36         150         PVC         130         9           L-28         H-28         J-35         150         PVC         130         10           L-28         H-28         J-35         150         PVC         130         10           L-29         H-29         J-211         150         PVC         130         7           L-30         H-30         J-31         150         PVC         130         15           L-31         H-31         J-30         150         PVC         130         15           L-31         H-31         J-30         150         PVC         130         19           L-32         H-32         J-212         150         PVC         130         16           L-33         H-33         J-39         150         PVC         130         11           L-34         H-34         J-213         150         PVC         130         11           L-35         H-35         J-28         150         PVC         130         15           L-36 </td <td>L-24</td> <td></td> <td></td> <td>150</td> <td></td> <td></td> <td>11</td> <td></td>	L-24			150			11	
I-27         H-27         J-36         150         PVC         130         9           I-28         H-28         J-35         150         PVC         130         10           I-29         H-29         J-211         150         PVC         130         7           I-30         H-30         J-31         150         PVC         130         15           I-31         H-31         J-30         150         PVC         130         15           I-31         H-31         J-30         150         PVC         130         15           I-32         H-32         J-212         150         PVC         130         16           I-32         H-32         J-213         150         PVC         130         16           I-33         H-34         J-213         150         PVC         130         11           I-34         H-34         J-213         150         PVC         130         11           I-35         H-35         J-28         150         PVC         130         11           I-37         J-13         H-37         150         PVC         130         15           I-38								
L-28         H-28         J-35         150         PVC         130         10           L-29         H-29         J-211         150         PVC         130         7           L-30         H-30         J-31         150         PVC         130         15           L-31         H-31         J-30         150         PVC         130         19           L-32         H-32         J-212         150         PVC         130         16           L-33         H-33         J-39         150         PVC         130         16           L-33         H-34         J-213         150         PVC         130         16           L-34         H-35         J-213         150         PVC         130         16           L-34         H-34         J-213         150         PVC         130         11           L-35         H-35         J-28         150         PVC         130         9         11           L-35         H-36         J-12         150         PVC         130         15         11           L-37         J-13         H-37         150         PVC         130         11<								
L-29         H-29         J-211         150         PVC         130         7           L-30         H-30         J-31         150         PVC         130         15           L-31         H-31         J-30         150         PVC         130         19           L-32         H-32         J-212         150         PVC         130         16           L-33         H-32         J-212         150         PVC         130         20           L-34         H-32         J-213         150         PVC         130         20           L-34         H-34         J-213         150         PVC         130         16           L-35         H-36         J-213         150         PVC         130         11           L-35         H-36         J-213         150         PVC         130         9           L-36         H-36         J-12         150         PVC         130         15           L-37         J-13         H-37         150         PVC         130         11           L-38         H-38         J-16         150         PVC         130         17           L-								ļ
L-30         H-30         J-31         150         PVC         130         15           L-31         H-31         J-30         150         PVC         130         19           L-32         H-32         J-212         150         PVC         130         16           L-33         H-32         J-212         150         PVC         130         20           L-33         H-34         J-213         150         PVC         130         20           L-34         H-34         J-213         150         PVC         130         20            L-34         H-34         J-213         150         PVC         130         20            L-35         H-36         J-28         150         PVC         130         9            L-36         H-36         J-12         150         PVC         130         15            L-37         J-13         H-37         150         PVC         130         11            L-38         H-38         J-16         150         PVC         130         11            L-39         J-17         H-39         <								ļ
L-31         H-31         J-30         150         PVC         130         19           L-32         H-32         J-212         150         PVC         130         16           L-33         H-33         J-39         150         PVC         130         20           L-34         H-34         J-213         150         PVC         130         11           L-34         H-34         J-213         150         PVC         130         11           L-35         H-36         J-28         150         PVC         130         9            L-36         H-36         J-12         150         PVC         130         15            L-37         J-13         H-37         150         PVC         130         15            L-37         J-13         H-37         150         PVC         130         11            L-38         H-38         J-16         150         PVC         130         17            L-39         J-17         H-39         150         PVC         130         19								
L-32         H-32         J-212         150         PVC         130         16           L-33         H-33         J-39         150         PVC         130         20           L-34         H-34         J-213         150         PVC         130         11           L-34         H-34         J-213         150         PVC         130         11           L-35         H-35         J-28         150         PVC         130         9           L-36         H-36         J-12         150         PVC         130         15           L-37         J-13         H-37         150         PVC         130         11           L-38         H-38         J-16         150         PVC         130         11           L-38         H-38         J-16         150         PVC         130         17           L-39         J-17         H-39         150         PVC         130         19								
L-33         H-33         J-39         150         PVC         130         20           L-34         H-34         J-213         150         PVC         130         11           L-35         H-35         J-28         150         PVC         130         9           L-36         H-36         J-12         150         PVC         130         15           L-37         J-13         H-37         150         PVC         130         11           L-38         H-38         J-16         150         PVC         130         11           L-38         H-38         J-16         150         PVC         130         117           L-39         J-17         H-39         150         PVC         130         17								
L-34         H-34         J-213         150         PVC         130         11           L-35         H-35         J-28         150         PVC         130         9           L-36         H-36         J-12         150         PVC         130         15           L-37         J-13         H-37         150         PVC         130         11           L-38         H-38         J-16         150         PVC         130         11           L-39         J-17         H-39         150         PVC         130         17								
L-35         H-35         J-28         150         PVC         130         9           L-36         H-36         J-12         150         PVC         130         15           L-37         J-13         H-37         150         PVC         130         11           L-38         H-38         J-16         150         PVC         130         17           L-39         J-17         H-39         150         PVC         130         19								
L-36         H-36         J-12         150         PVC         130         15           L-37         J-13         H-37         150         PVC         130         11           L-38         H-38         J-16         150         PVC         130         17           L-39         J-17         H-39         150         PVC         130         19								+
L-37         J-13         H-37         150         PVC         130         11           L-38         H-38         J-16         150         PVC         130         17           L-39         J-17         H-39         150         PVC         130         19							9 15	
L-38         H-38         J-16         150         PVC         130         17           L-39         J-17         H-39         150         PVC         130         19								
L-39 J-17 H-39 150 PVC 130 19								1
								1





L-41	J-9	H-41	150	PVC	130	14	
L-42	H-42	J-10	150	PVC	130	8	
L-43	H-43	J-7	150	PVC	130	10	
L-44	H-44	J-214	150	PVC	130	14	
L-45		J-19		PVC	130	15	
	H-45		150				
L-46	J-20	H-46	150	PVC	130	12	
L-47	H-47	J-215	150	PVC	130	7	
L-48	H-48	J-216	150	PVC	130	13	
L-49	H-49	J-217	150	PVC	130	11	
L-50	H-50	J-91	150	PVC	130	14	
L-51	H-51	J-23	150	PVC	130	16	
L-52	J-92	H-52	150	PVC	130	11	
L-54	H-54	J-219	150	PVC	130	12	
L-55	J-27	H-55	150	PVC	130	12	
L-56	J-220	H-56	150	PVC	130	10	
L-57	J-221	H-57	150	PVC	130	10	
L-58	J-222	H-58	150	PVC	130	10	
L-59	J-223	H-59	150	PVC	130	12	
L-60	J-224	H-60	150	PVC	130	10	
L-61	J-225	H-61	150	PVC	130	17	
L-62	J-226	H-62	150	PVC	130	12	
L-63	H-63	J-94	150	PVC	130	16	
L-64	J-227	H-64	150	PVC	130	9	
L-65	H-65	J-228	150	PVC	130	9	
L-66	H-66	J-237	150	PVC	130	10	
L-67	J-233	H-67	150	PVC	130	8	
L-68	H-68	J-235	150	PVC	130	10	
P-1	R-1	J-1A	350	PVC	130	1,050	2000
P-2	J-1A	PMP-1	150	PVC	130	5	2000
P-3	J-1A	PMP-2	150	PVC	130	5	2000
P-4	PMP-2	J-1	150	PVC	130	5	2000
P-5	PMP-1	J-1	150	PVC	130	5	2000
P-6	J-1	J-2	250	PVC	130	789	2000
P-7	J-2	J-3	250	PVC	130	134	1984
P-8	T-1	J-3	200	Ductile Iron	130	165	1984
P-9	T-1	J-4	300	Ductile Iron	130	199	1984
P-17	J-7	J-4	350	PVC	130	50	1984
P-18	J-8	J-7	350	PVĆ	130	27	1984
P-19	J-8	J-9	200	PVC	130	67	1984
P-20	J-9	J-10	200	PVC	130	133	1984
P-21	J-10	J-11	150	PVC	130	71	1984
P-22	J-10	J-12	200	PVC	130	152	1984
P-23	J-12	J-13	200	PVC		07	1984
P-24		J-13	200		130	87	1964
	1-13						
P-25	J-13	J-14	150	PVC	130	62	1984
	J-13	J-14 J-15	150 200	PVC PVC	130 130	62 89	1984 1984
P-26		J-14	150	PVC	130	62	1984
	J-13 J-15	J-14 J-15 J-16	150 200 150	PVC PVC PVC	130 130 130	62 89 120	1984 1984 1985
P-28	J-13 J-15 J-17	J-14 J-15 J-16 J-18	150 200 150 150	PVC PVC PVC PVC	130 130 130 130	62 89 120 146	1984 1984 1985 1984
P-28 P-29	J-13 J-15 J-17 J-18	J-14 J-15 J-16 J-18 J-9	150 200 150 150 150	PVC PVC PVC PVC PVC	130 130 130 130 130 130	62 89 120 146 164	1984 1984 1985 1984 1984
P-28	J-13 J-15 J-17	J-14 J-15 J-16 J-18	150 200 150 150	PVC PVC PVC PVC	130 130 130 130	62 89 120 146	1984 1984 1985 1984
P-28 P-29 P-30A	J-13 J-15 J-17 J-18 J-8	J-14 J-15 J-16 J-18 J-9 J-214	150 200 150 150 150 250	PVC PVC PVC PVC PVC	130 130 130 130 130 130 130	62 89 120 146 164 172	1984 1984 1985 1984 1984 1984 1995
P-28 P-29 P-30A P-30B	J-13 J-15 J-17 J-18 J-8 J-214	J-14 J-15 J-16 J-18 J-9 J-214 J-19	150 200 150 150 150 250 250	PVC           PVC           PVC           PVC           PVC           PVC           PVC           PVC           PVC	130 130 130 130 130 130 130 130	62 89 120 146 164 172 160	1984 1984 1985 1984 1984 1984 1995 1995
P-28 P-29 P-30A P-30B P-31	J-13 J-15 J-17 J-18 J-8 J-214 J-19	J-14 J-15 J-16 J-18 J-9 J-214 J-19 J-20	150 200 150 150 150 250 250 250 250	PVC	130 130 130 130 130 130 130 130 130	62 89 120 146 164 172 160 151	1984 1984 1985 1984 1984 1995 1995 1995
P-28 P-29 P-30A P-30B P-31 P-32	J-13 J-15 J-17 J-18 J-8 J-214 J-19 J-20	J-14 J-15 J-16 J-18 J-9 J-214 J-19 J-20 J-20 J-21	150 200 150 150 250 250 250 250 250 250	PVC	130 130 130 130 130 130 130 130 130 130	62 89 120 146 164 172 160 151 147	1984 1984 1985 1984 1984 1995 1995 1995 1995
P-28 P-29 P-30A P-30B P-31	J-13 J-15 J-17 J-18 J-8 J-214 J-19	J-14 J-15 J-16 J-18 J-9 J-214 J-19 J-20	150 200 150 150 150 250 250 250 250	PVC	130 130 130 130 130 130 130 130 130	62 89 120 146 164 172 160 151	1984 1984 1985 1984 1984 1984 1995 1995 1995
P-28 P-29 P-30A P-30B P-31 P-32 P-33A	J-13 J-15 J-17 J-18 J-8 J-214 J-214 J-19 J-20 J-21	J-14 J-15 J-16 J-9 J-214 J-19 J-20 J-20 J-21 J-21 J-217	150 200 150 150 250 250 250 250 250 250 250 150	PVC	130           130           130           130           130           130           130           130           130           130           130           130           130           130           130           130           130           130           130           130	62 89 120 146 164 172 160 151 147 12	1984 1984 1985 1984 1984 1995 1995 1995 1995 1995 1995
P-28 P-29 P-30A P-30B P-31 P-32 P-33A P-33B	J-13 J-15 J-17 J-18 J-8 J-214 J-214 J-20 J-20 J-21 J-21 J-217	J-14 J-15 J-16 J-9 J-214 J-19 J-20 J-21 J-21 J-217 J-22	150 200 150 150 250 250 250 250 250 250 150	PVC	130           130	62 89 120 146 164 172 160 151 147 12 45	1984 1984 1985 1984 1984 1995 1995 1995 1995 1995 1995
P-28           P-29           P-30A           P-30B           P-31           P-32           P-33A           P-33B           P-34	J-13 J-15 J-17 J-18 J-8 J-214 J-19 J-20 J-21 J-21 J-217 J-22	J-14 J-15 J-16 J-18 J-9 J-214 J-19 J-20 J-20 J-21 J-21 J-217 J-22 J-23	150 200 150 150 250 250 250 250 250 250 150 150 150	PVC	130           130	62 89 120 146 164 172 160 151 147 12 45 154	1984 1984 1985 1984 1984 1995 1995 1995 1995 1995 1995 1995
P-28           P-29           P-30A           P-30B           P-31           P-32           P-33A           P-33B           P-34           P-35	J-13 J-15 J-17 J-18 J-8 J-214 J-214 J-20 J-21 J-21 J-217 J-22 J-23	J-14 J-15 J-16 J-9 J-214 J-19 J-20 J-21 J-21 J-217 J-22	150 200 150 150 250 250 250 250 250 250 150	PVC	130           130	62 89 120 146 164 172 160 151 147 12 45 154 39	1984 1984 1985 1984 1984 1995 1995 1995 1995 1995 1995
P-28           P-29           P-30A           P-30B           P-31           P-32           P-33A           P-33B           P-34           P-35	J-13 J-15 J-17 J-18 J-8 J-214 J-214 J-20 J-21 J-21 J-217 J-22 J-23	J-14 J-15 J-16 J-18 J-9 J-214 J-19 J-20 J-20 J-21 J-21 J-217 J-22 J-23 J-23 J-24	150 200 150 150 250 250 250 250 250 150 150 150 150	PVC	130           130	62 89 120 146 164 172 160 151 147 12 45 154 39	1984 1984 1985 1984 1984 1995 1995 1995 1995 1995 1995 1995 199
P-28           P-29           P-30A           P-30B           P-31           P-32           P-33A           P-33B           P-34           P-35           P-36	J-13 J-15 J-17 J-18 J-214 J-214 J-214 J-20 J-20 J-21 J-217 J-22 J-23 J-23 J-24	J-14 J-15 J-16 J-18 J-9 J-214 J-19 J-20 J-21 J-21 J-21 J-21 J-22 J-23 J-24 J-25	150 200 150 150 250 250 250 250 250 150 150 150 150 150 200	PVC	130           130	62 89 120 146 164 172 160 151 147 12 45 154 39 68	1984 1984 1985 1984 1984 1995 1995 1995 1995 1995 1995 1995 199
P-28 P-29 P-30A P-30B P-31 P-32 P-33A P-33B P-34 P-35 P-36 P-37	J-13 J-15 J-17 J-18 J-214 J-19 J-20 J-21 J-21 J-21 J-21 J-22 J-22 J-23 J-24 J-24 J-24	J-14 J-15 J-16 J-18 J-9 J-214 J-19 J-20 J-21 J-21 J-21 J-21 J-22 J-23 J-23 J-24 J-25 J-26	150 200 150 150 250 250 250 250 150 150 150 150 150 200 200	PVC	130         130	62 89 120 146 164 172 160 151 147 12 45 154 39 68 116	1984 1984 1985 1984 1984 1995 1995 1995 1995 1995 1995 1995 199
P-28           P-29           P-30A           P-30B           P-31           P-32           P-33A           P-33B           P-34           P-35           P-36	J-13 J-15 J-17 J-18 J-214 J-214 J-214 J-20 J-20 J-21 J-217 J-22 J-23 J-23 J-24	J-14 J-15 J-16 J-18 J-9 J-214 J-19 J-20 J-21 J-21 J-21 J-21 J-22 J-23 J-24 J-25	150 200 150 150 250 250 250 250 250 150 150 150 150 150 200	PVC	130           130	62 89 120 146 164 172 160 151 147 12 45 154 39 68	1984 1984 1985 1984 1984 1995 1995 1995 1995 1995 1995 1995 199
P-28 P-29 P-30A P-30B P-31 P-32 P-33A P-33B P-33B P-33B P-34 P-35 P-36 P-37 P-38	J-13 J-15 J-17 J-18 J-214 J-214 J-20 J-21 J-20 J-21 J-21 J-22 J-23 J-23 J-24 J-24 J-21	J-14 J-15 J-16 J-18 J-9 J-214 J-19 J-20 J-21 J-21 J-21 J-22 J-23 J-23 J-24 J-24 J-25 J-26 J-26	150 200 150 150 250 250 250 250 150 150 150 150 150 200 200 250	PVC	130         130	62         89         120         146         164         172         160         151         147         12         45         154         39         68         116         117	1984 1984 1985 1984 1984 1995 1995 1995 1995 1995 1995 1995 199
P-28 P-30A P-30B P-31 P-32 P-33A P-334 P-334 P-334 P-335 P-36 P-37 P-38 P-39A	J-13 J-15 J-17 J-18 J-8 J-214 J-214 J-20 J-21 J-21 J-21 J-22 J-23 J-23 J-24 J-24 J-24 J-21 J-21 J-21 J-26	J-14 J-15 J-16 J-9 J-9 J-214 J-19 J-20 J-21 J-21 J-21 J-22 J-23 J-24 J-24 J-25 J-26 J-26 J-219	150 200 150 150 250 250 250 250 150 150 150 150 150 200 200 250 250	PVC	130         130	62         89         120         146         164         172         160         151         147         12         45         154         39         68         116         117         26	1984           1984           1985           1984           1985           1995
P-28 P-30A P-30B P-31 P-32 P-33A P-33B P-33B P-33B P-335 P-36 P-37 P-38 P-39A P-39B	J-13 J-15 J-17 J-18 J-8 J-214 J-214 J-20 J-21 J-21 J-21 J-22 J-23 J-24 J-24 J-24 J-24 J-21 J-26 J-219	J-14 J-15 J-16 J-9 J-214 J-19 J-20 J-21 J-21 J-21 J-22 J-23 J-24 J-23 J-24 J-25 J-26 J-26 J-219 J-27	150           200           150           150           250           250           250           250           250           250           250           250           250           250           250           250           250           250           250           250           250           200           200           250           250           250           250           250	PVC	130           130	62           89           120           146           164           172           160           151           147           12           45           154           39           68           116           117           26           93	1984           1984           1985           1984           1984           1995
P-28 P-30A P-30B P-31 P-32 P-33A P-334 P-334 P-334 P-335 P-36 P-37 P-38 P-39A	J-13 J-15 J-17 J-18 J-8 J-214 J-214 J-20 J-21 J-21 J-21 J-22 J-23 J-23 J-24 J-24 J-24 J-21 J-21 J-21 J-26	J-14 J-15 J-16 J-9 J-9 J-214 J-19 J-20 J-21 J-21 J-21 J-22 J-23 J-24 J-24 J-25 J-26 J-26 J-219	150 200 150 150 250 250 250 250 150 150 150 150 150 200 200 250 250	PVC	130         130	62         89         120         146         164         172         160         151         147         12         45         154         39         68         116         117         26	1984           1984           1985           1984           1985           1995
P-28 P-29 P-30A P-30B P-31 P-32 P-33A P-33A P-33B P-34 P-35 P-36 P-37 P-37 P-39A P-39A P-39B P-39B	J-13 J-15 J-17 J-18 J-8 J-214 J-20 J-20 J-21 J-20 J-21 J-22 J-23 J-24 J-24 J-24 J-24 J-24 J-22 J-23 J-24 J-22 J-23 J-24 J-21 J-26 J-219 J-219 J-219 J-219 J-219 J-219 J-219	J-14 J-15 J-16 J-9 J-9 J-214 J-29 J-20 J-21 J-20 J-21 J-22 J-23 J-24 J-25 J-26 J-26 J-26 J-219 J-27 J-28	150           200           150           150           250           250           250           250           250           250           250           250           250           250           250           250           250           150           150           200           200           250           250           250           250           250           250           250           250           250           250           250           250           250	PVC	130           130	62         89         120         146         164         172         160         151         147         12         45         154         39         68         116         117         26         93         111	1984           1984           1985           1984           1985           1995
P-28 P-29 P-30A P-30B P-31 P-32 P-33A P-33A P-33A P-335 P-36 P-37 P-38 P-398 P-398 P-398 P-398 P-40 P-41	J-13 J-15 J-17 J-18 J-214 J-214 J-214 J-210 J-20 J-21 J-22 J-23 J-23 J-24 J-24 J-24 J-24 J-24 J-24 J-24 J-22 J-22	J-14 J-15 J-16 J-18 J-9 J-214 J-19 J-20 J-21 J-21 J-21 J-22 J-23 J-24 J-23 J-24 J-25 J-26 J-26 J-26 J-26 J-219 J-219 J-27 J-28 J-29	150 200 150 150 250 250 250 250 150 150 150 150 200 200 250 250 250 250 250 250 150	PVC	130         130	62         89         120         146         164         172         160         151         147         12         45         154         39         68         116         117         26         93         111         76	1984 1984 1985 1984 1984 1995 1995 1995 1995 1995 1995 1995 199
P-28 P-30A P-30B P-30B P-31 P-32 P-33A P-33A P-33A P-33A P-35 P-36 P-37 P-38 P-398 P-398 P-40 P-41 P-42	J-13 J-15 J-17 J-18 J-214 J-214 J-20 J-21 J-20 J-21 J-20 J-21 J-22 J-23 J-23 J-24 J-24 J-24 J-24 J-24 J-24 J-24 J-24	J-14 J-15 J-16 J-18 J-9 J-214 J-19 J-20 J-21 J-21 J-21 J-22 J-23 J-24 J-25 J-26 J-26 J-26 J-26 J-26 J-26 J-27 J-28 J-27 J-28 J-29 J-30	150 200 150 150 250 250 250 250 150 150 150 150 200 200 200 250 250 250 250 250 250 2	PVC	130         130	62         89         120         146         164         172         160         151         147         12         45         154         39         68         116         117         26         93         111         76         87	1984           1984           1985           1984           1995           1984           1984
P-28 P-29 P-30A P-30B P-31 P-32 P-33A P-33A P-33A P-335 P-36 P-37 P-38 P-398 P-398 P-398 P-398 P-40 P-41	J-13 J-15 J-17 J-18 J-214 J-214 J-20 J-21 J-20 J-21 J-22 J-23 J-24 J-24 J-24 J-24 J-24 J-24 J-21 J-26 J-219 J-22 J-28 J-28 J-28 J-31	J-14 J-15 J-16 J-18 J-9 J-214 J-19 J-20 J-21 J-21 J-21 J-22 J-23 J-24 J-23 J-24 J-25 J-26 J-26 J-26 J-26 J-219 J-219 J-27 J-28 J-29	150 200 150 150 250 250 250 250 150 150 150 150 200 200 250 250 250 250 250 250 150	PVC	130         130	62         89         120         146         164         172         160         151         147         12         45         154         39         68         116         117         26         93         111         76         87         112	1984 1984 1985 1984 1984 1995 1995 1995 1995 1995 1995 1995 199
P-28           P-29           P-30A           P-30B           P-31           P-32           P-338           P-336           P-37           P-38           P-399A           P-39B           P-401           P-42	J-13 J-15 J-17 J-18 J-214 J-214 J-20 J-21 J-20 J-21 J-22 J-23 J-24 J-24 J-24 J-24 J-24 J-24 J-21 J-26 J-219 J-22 J-28 J-28 J-28 J-31	J-14 J-15 J-16 J-18 J-9 J-214 J-20 J-21 J-21 J-22 J-23 J-24 J-23 J-24 J-25 J-26 J-26 J-26 J-26 J-26 J-27 J-28 J-27 J-28 J-29 J-30 J-211	150           200           150           150           250           250           250           250           250           250           250           250           250           250           250           250           250           250           250           250           200           200           250           250           250           250           250           250           250           250           250           250           250           250           250           250           250           150           150           150           150	PVC	130         130	62         89         120         146         164         172         160         151         147         12         45         154         39         68         116         117         26         93         111         76         87         112	1984           1984           1985           1984           1985           1995           1984           1984           1984
P-28 P-29 P-30A P-30B P-31 P-32 P-33A P-33B P-34 P-35 P-34 P-35 P-37 P-38 P-39A P-39B P-39B P-40 P-41 P-44 P-44B	J-13 J-15 J-17 J-18 J-24 J-214 J-20 J-21 J-20 J-21 J-20 J-21 J-22 J-23 J-24 J-24 J-24 J-24 J-24 J-24 J-24 J-21 J-26 J-219 J-12 J-28 J-28 J-31 J-211	J-14 J-15 J-16 J-18 J-9 J-214 J-19 J-20 J-21 J-21 J-21 J-22 J-23 J-24 J-24 J-25 J-26 J-26 J-26 J-26 J-27 J-28 J-27 J-28 J-29 J-29 J-29 J-20 J-211 J-211 J-211 J-32	150           200           150           150           250           250           250           250           250           250           250           250           250           250           250           250           150           250           250           250           250           250           250           250           250           250           250           150           150           150           150           150           150           150	PVC	130         130	62         89         120         146         164         172         160         151         147         12         45         154         39         68         116         117         26         93         111         76         87         112         10	1984         1984         1985         1984         1995         1984         1984         1984         1984
P-28           P-29           P-30A           P-30B           P-32           P-33A           P-33B           P-34           P-35           P-36           P-37           P-38           P-39A           P-39A           P-39A           P-39A           P-39A           P-39A           P-39A           P-39A           P-39A           P-40           P-41           P-424           P-448           P-45	J-13 J-15 J-17 J-18 J-28 J-214 J-214 J-20 J-21 J-20 J-21 J-22 J-23 J-24 J-24 J-24 J-24 J-24 J-24 J-24 J-21 J-26 J-219 J-12 J-28 J-28 J-31 J-211 J-211 J-211 J-23	J-14 J-15 J-16 J-18 J-9 J-214 J-19 J-20 J-21 J-21 J-21 J-22 J-23 J-24 J-24 J-24 J-25 J-26 J-26 J-26 J-26 J-27 J-28 J-27 J-28 J-29 J-29 J-30 J-211 J-32 J-33	150           200           150           150           250           250           250           250           250           250           250           250           250           250           250           250           250           150           200           200           250           250           250           250           250           250           250           150           150           150           150           150           150           150           150           150           150	PVC	130         130	62         89         120         146         164         172         160         151         147         12         45         154         39         68         116         117         26         93         111         76         87         112         10         47	1984           1984           1985           1984           1995           1984           1984           1984           1984           1984           1984
P-28           P-29           P-30A           P-30B           P-31           P-32           P-33A           P-34           P-35           P-36           P-37           P-38           P-39A           P-39B           P-40           P-41           P-44A           P-44B	J-13 J-15 J-17 J-18 J-24 J-214 J-20 J-21 J-20 J-21 J-20 J-21 J-22 J-23 J-24 J-24 J-24 J-24 J-24 J-24 J-24 J-21 J-26 J-219 J-12 J-28 J-28 J-31 J-211	J-14 J-15 J-16 J-18 J-9 J-214 J-19 J-20 J-21 J-21 J-21 J-22 J-23 J-24 J-24 J-25 J-26 J-26 J-26 J-26 J-27 J-28 J-27 J-28 J-29 J-29 J-29 J-20 J-211 J-211 J-211 J-32	150           200           150           150           250           250           250           250           250           250           250           250           250           250           250           250           150           250           250           250           250           250           250           250           250           250           250           150           150           150           150           150           150           150	PVC	130         130	62         89         120         146         164         172         160         151         147         12         45         154         39         68         116         117         26         93         111         76         87         112         10	1984           1984           1985           1984           1995           1984           1984           1984           1984
P-28           P-29           P-30A           P-30B           P-31           P-32           P-33A           P-34           P-35           P-36           P-37           P-38           P-39A           P-39A           P-39A           P-39A           P-39B           P-40           P-41           P-42           P-44A           P-45           P-46	J-13 J-15 J-17 J-18 J-28 J-214 J-219 J-20 J-21 J-22 J-23 J-24 J-24 J-24 J-24 J-24 J-24 J-21 J-26 J-219 J-26 J-219 J-28 J-28 J-28 J-28 J-21 J-28 J-21 J-22 J-23 J-23 J-21 J-23 J-23 J-21	J-14 J-15 J-16 J-18 J-9 J-214 J-19 J-20 J-21 J-21 J-22 J-23 J-24 J-24 J-25 J-26 J-26 J-26 J-26 J-27 J-28 J-27 J-28 J-27 J-28 J-29 J-20 J-20 J-21 J-21 J-22 J-23 J-24 J-23 J-24 J-23 J-30 J-33 J-34	150           200           150           150           250           150           150           150           150           150           150           150           150           150           150           150           150           150           150           150           150           150           150           150	PVC           PVC	130         130	62         89         120         146         164         172         160         151         147         12         45         154         39         68         116         117         26         93         111         76         87         112         10         47         74	1984           1984           1985           1984           1985           1995           1984           1984           1984           1984           1984           1984           1984
P-28           P-29           P-30A           P-30B           P-31           P-32           P-33A           P-33A           P-34           P-35           P-36           P-37           P-39A           P-39A           P-39A           P-39A           P-40           P-41           P-42           P-44A           P-445           P-466           P-47	J-13 J-15 J-17 J-18 J-20 J-214 J-20 J-21 J-21 J-22 J-23 J-24 J-24 J-24 J-24 J-24 J-24 J-21 J-26 J-21 J-26 J-219 J-22 J-28 J-28 J-31 J-211 J-32 J-33 J-32 J-32	J-14 J-15 J-16 J-18 J-9 J-214 J-19 J-20 J-21 J-21 J-21 J-22 J-23 J-24 J-23 J-24 J-25 J-26 J-26 J-26 J-26 J-26 J-27 J-28 J-29 J-27 J-28 J-29 J-30 J-211 J-32 J-33 J-34 J-34	150           200           150           150           250           250           250           250           250           250           250           250           250           250           250           250           250           250           250           250           250           150           150           150           150           150           150           150           150           150           150           150           150           150           150           150           150           150           150	PVC           PVC	130         130	62         89         120         146         164         172         160         151         147         12         45         154         39         68         116         117         26         93         111         76         87         112         10         47         74	1984           1984           1985           1984           1995           1984           1984           1984           1984           1984           1984           1984           1984           1984
P-28 P-29 P-30A P-30B P-31 P-32 P-33A P-33A P-33A P-335 P-36 P-37 P-38 P-39A P-39A P-39A P-39B P-39A P-39B P-40 P-444 P-444 P-448 P-45 P-46 P-47 P-48	J-13 J-15 J-17 J-18 J-214 J-214 J-20 J-21 J-20 J-21 J-20 J-21 J-22 J-23 J-23 J-24 J-24 J-24 J-24 J-24 J-24 J-24 J-24	J-14 J-15 J-16 J-18 J-9 J-214 J-19 J-20 J-21 J-21 J-21 J-22 J-23 J-24 J-25 J-26 J-26 J-26 J-26 J-26 J-26 J-26 J-27 J-28 J-29 J-27 J-28 J-29 J-23 J-23 J-23 J-30 J-211 J-32 J-33 J-34 J-34 J-34	150           200           150           150           250           250           250           250           250           150           150           250           250           250           250           250           250           250           250           250           250           250           150	PVC           PVC	130         130	62         89         120         146         164         172         160         151         147         12         45         154         39         68         116         117         26         93         111         76         87         112         10         47         74         65         47	1984         1984         1985         1984         1995         1984         1984         1984         1984         1984         1984         1984
P-28           P-29           P-30A           P-30B           P-31           P-32           P-33A           P-33A           P-34           P-35           P-36           P-37           P-39A           P-39A           P-39A           P-39A           P-40           P-41           P-42           P-44A           P-445           P-466           P-47	J-13 J-15 J-17 J-18 J-20 J-214 J-20 J-21 J-21 J-22 J-23 J-24 J-24 J-24 J-24 J-24 J-24 J-21 J-26 J-21 J-26 J-219 J-22 J-28 J-28 J-31 J-211 J-32 J-33 J-32 J-32	J-14 J-15 J-16 J-18 J-9 J-214 J-19 J-20 J-21 J-21 J-21 J-22 J-23 J-24 J-23 J-24 J-25 J-26 J-26 J-26 J-26 J-26 J-27 J-28 J-29 J-27 J-28 J-29 J-30 J-211 J-32 J-33 J-34 J-34	150           200           150           150           250           250           250           250           250           250           250           250           250           250           250           250           250           250           250           250           250           150	PVC           PVC	130         130	62         89         120         146         164         172         160         151         147         12         45         154         39         68         116         117         26         93         111         76         87         112         10         47         74	1984           1984           1985           1984           1995           1984           1984           1984           1984           1984           1984           1984           1984           1984
P-28           P-29           P-30A           P-30B           P-31           P-32           P-33A           P-34           P-35           P-36           P-37           P-38A           P-39B           P-400           P-411           P-422           P-444           P-455           P-456           P-477           P-488           P-499	J-13 J-15 J-17 J-18 J-214 J-214 J-20 J-21 J-20 J-21 J-20 J-21 J-22 J-23 J-24 J-24 J-24 J-24 J-24 J-24 J-24 J-24	J-14 J-15 J-16 J-18 J-9 J-214 J-20 J-21 J-21 J-22 J-23 J-24 J-23 J-24 J-25 J-26 J-26 J-26 J-26 J-26 J-26 J-27 J-28 J-27 J-28 J-27 J-28 J-29 J-27 J-28 J-29 J-30 J-211 J-32 J-34 J-34 J-34 J-34 J-34	150           200           150           150           250           250           250           250           250           150           150           250           250           250           250           250           150           150           250           250           250           250           250           250           150	PVC           PVC	130         130	62         89         120         146         164         172         160         151         147         12         45         154         39         68         116         117         26         93         111         76         87         112         10         47         74         65         47         157	1984         1984         1985         1984         1995         1994         1984         1984         1984         1984         1984         1984         1984         1984         1984
P-28           P-29           P-30A           P-30B           P-31           P-32           P-33A           P-34           P-35           P-36           P-37           P-38           P-39A           P-39B           P-40           P-42           P-44A           P-45           P-46           P-47           P-48           P-49           P-49	J-13 J-15 J-17 J-18 J-214 J-214 J-20 J-21 J-20 J-21 J-22 J-23 J-24 J-24 J-24 J-24 J-24 J-24 J-24 J-24	J-14 J-15 J-16 J-18 J-9 J-214 J-20 J-21 J-21 J-22 J-23 J-24 J-23 J-24 J-25 J-26 J-26 J-26 J-26 J-26 J-26 J-27 J-28 J-27 J-28 J-29 J-27 J-28 J-29 J-30 J-211 J-32 J-33 J-34 J-34 J-34 J-34 J-31 J-36	150           200           150           150           250           150           150           150           150           150           150           150           150           150           150	PVC           PVC	130         1	62         89         120         146         164         172         160         151         147         12         45         154         39         68         116         117         26         93         111         76         87         112         10         47         74         65         47         157         156	1984         1984         1985         1984         1995         1984         1984         1984         1984         1984         1984         1984         1984         1984
P-28           P-29           P-30A           P-30B           P-31           P-32           P-33A           P-34           P-35           P-36           P-37           P-38           P-39A           P-39B           P-40           P-41           P-42           P-44A           P-44B           P-45           P-46           P-47           P-489           P-49           P-50	J-13 J-15 J-17 J-18 J-24 J-214 J-20 J-21 J-20 J-21 J-20 J-21 J-22 J-23 J-24 J-24 J-24 J-24 J-24 J-24 J-24 J-24	J-14 J-15 J-16 J-18 J-9 J-214 J-20 J-21 J-21 J-21 J-22 J-23 J-24 J-23 J-24 J-25 J-26 J-26 J-26 J-26 J-26 J-26 J-27 J-28 J-29 J-29 J-29 J-30 J-211 J-22 J-23 J-23 J-24 J-25 J-26 J-26 J-26 J-26 J-26 J-26 J-26 J-26	150           200           150           150           250           150           150           150           150           150           150           150           150           150           150           150           150           150           150           150	PVC           PVC	130         1	62         89         120         146         164         172         160         151         147         12         45         154         39         68         116         117         26         93         111         76         87         112         10         47         74         65         47         157         156         49	1984         1984         1985         1984         1995         1984         1984         1984         1984         1984         1984         1984         1984         1984         1984         1984         1984
P-28           P-29           P-30A           P-30B           P-31           P-32           P-33A           P-34           P-35           P-36           P-37           P-38           P-39A           P-39B           P-40           P-42           P-44A           P-45           P-46           P-47           P-48           P-49           P-49	J-13 J-15 J-17 J-18 J-214 J-214 J-20 J-21 J-20 J-21 J-22 J-23 J-24 J-24 J-24 J-24 J-24 J-24 J-24 J-24	J-14 J-15 J-16 J-18 J-9 J-214 J-20 J-21 J-21 J-22 J-23 J-24 J-23 J-24 J-25 J-26 J-26 J-26 J-26 J-26 J-26 J-27 J-28 J-27 J-28 J-29 J-27 J-28 J-29 J-30 J-211 J-32 J-33 J-34 J-34 J-34 J-34 J-31 J-36	150           200           150           150           250           150           150           150           150           150           150           150           150           150           150	PVC           PVC	130         1	62         89         120         146         164         172         160         151         147         12         45         154         39         68         116         117         26         93         111         76         87         112         10         47         74         65         47         157         156	1984         1984         1985         1984         1995         1984         1984         1984         1984         1984         1984         1984         1984         1984         1984



#### Appendix C - Pipe Table (Future System - Full Development)



D 51D	1.010	1.20	200	DVC	120	02	1004
P-51B	J-213	J-38	200	PVC	130	92	1984
P-52A	J-212	J-38	150	PVC	130	68	1984
P-52B	J-231	J-212	150	PVC	130	96	1984
P-52C	J-30	J-231	150	PVC	130	72	1984
P-53	J-38	J-39	150	PVC	130	61	1984
P-54	J-39	J-40	350	Ductile Iron	130	168	1992
P-54A	J-8	J-39	350	Ductile Iron	130	260	1992
P-55A	J-37	J-210	150	PVC	130	31	1984
P-55B	J-210	J-40	150	PVC	130	20	1984
P-56	J-40	J-41	350	Ductile Iron	130	189	1992
P-57	J-41	J-42	250	PVC	130	75	1995
P-58A	J-41	J-209	250	PVC	130	20	1992
P-58B	J-209	J-43	250	PVC	130	95	1992
P-59	J-43	J-44	250	PVC	130	67	1992
P-60A	J-201	J-45	300	PVC	130	18	1992
				PVC			
P-60B	J-44	J-201	300		130	62	1992
P-61	J-45	J-51	200	PVC	130	137	1992
P-62	J-45	J-46	150	PVC	130	104	1992
P-66A	J-50	J-202	200	PVC	130	62	1992
P-67	J-51	J-50	200	PVC	130	84	1992
P-68	J-50	J-52	200	PVC	130	62	1992
P-69A	J-52	J-203	200	PVC	130	18	1989
P-69B	J-203	J-53	200	PVC	130	200	1989
P-70	J-54	J-53	150	PVC	130	105	1994
P-71	J-91	J-92	200	PVC	130	66	2005
P-71A	J-53	J-204	150	PVC	130	17	1994
P-71B	J-204	J-55	200	PVC	130	136	1994
P-72	J-55	J-56	200	PVC	130	138	1994
P-73	J-93	J-94	200	PVC	130	38	2006
P-73A	J-56	J-205	200	PVC	130	67	1994
P-73B	J-205	J-57	200	PVC	130	30	1994
P-74	J-22	J-91	200	PVC	130	144	2005
P-74A	J-57	J-206	200	PVC	130	91	1994
P-74B	J-206	J-58	200	PVC	130	23	1994
P-75A	J-207	J-59	200	PVC	130	96	1989
P-75B	J-207	J-230	200	PVC	130	9	1989
P-75C	J-230	J-53	200	PVC	130	112	1989
P-76	J-59	J-60	150	PVC	130	152	1984
P-77A	J-60	J-208	150	PVC	130	146	1984
P-77B	J-208	J-61	150	PVC	130	16	1984
P-78	J-61	J-62	150	PVC	130	113	1984
P-79	J-62	J-63	150	PVC	130	35	1984
P-80	J-63	J-64	150	PVC	130	147	1984
P-81	J-64	J-65	150	PVC	130	144	1984
P-82	J-59	J-65	200	PVC	130	84	1984
P-82	J-1A	PMP-3	150	PVC	130	5	2000
P-83	PMP-3	J-1	150	PVC	130	5	2000
P-84	J-65	J-67	200	PVC	130	93	1984
P-85	J-15	J-67	200	PVC	130	140	1984
P-86	J-67	J-68	150	PVC	130	67	1984
P-88	J-65	J-66	150	PVC	130	68	1984
P-270	H-53	J-25	150	PVC	130	23	
P-500	J-19	J-500	150	PVC	130	144	2040
P-501	J-500	J-501	150	PVC	130	121	2040
P-502	J-502	J-501	100	PVC	130	60	2040
P-503	J-502 J-501	J-215	150	PVC	130	72	2040
P-504	F16	J-500	150	PVC	130	6	2040
P-505	J-220	J-503	150	PVC	130	109	2040
P-506	J-503	J-504	150	PVC	130	91	2040
P-507	J-504	F18	150	PVC	130	6	2040
P-508	J-503	J-227	150	PVC	130	95	2040
P-509	J-221	J-505	200	PVC	130	85	2040
P-510	J-505	J-506	200	PVC	130	38	2040
P-511	J-506	J-507	200	PVC	130	83	2040
						68	
P-512	J-507	J-94	200	PVC	130		2040
P-513	1 540	J-507	100	PVC	130	51	2040
P-514	J-510			PVC	130	135	2040
	J-94	J-511	200				
P-514 P-515			200 200	PVC	130	72	2040
	J-94	J-511			130 130	72 48	2040 2040
P-515 P-516	J-94 J-511 J-512	J-511 J-512 J-513	200 150	PVC PVC	130	48	2040
P-515 P-516 P-517	J-94 J-511 J-512 J-513	J-511 J-512 J-513 J-514	200 150 100	PVC PVC PVC	130 130	48 31	2040 2040
P-515 P-516 P-517 P-518	J-94 J-511 J-512 J-513 J-512	J-511 J-512 J-513 J-514 J-515	200 150 100 150	PVC PVC PVC PVC	130 130 130	48 31 37	2040 2040 2040
P-515 P-516 P-517 P-518 P-519	J-94 J-511 J-512 J-513 J-512 J-508	J-511 J-512 J-513 J-514 J-515 J-516	200 150 100 150 100	PVC PVC PVC PVC PVC PVC	130 130 130 130	48 31 37 25	2040 2040 2040 2040
P-515 P-516 P-517 P-518	J-94 J-511 J-512 J-513 J-512	J-511 J-512 J-513 J-514 J-515	200 150 100 150	PVC PVC PVC PVC	130 130 130	48 31 37	2040 2040 2040





P-522	J-509	J-517	100	PVC	130	32	2040
P-523	J-517	J-506	150	PVC	130	35	2040
P-524	J-517	F21	150	PVC	130	6	2040
P-525	F20	J-507	150	PVC	130	6	2040
P-526	F23	J-511	150	PVC	130	6	2040
P-527	F24	J-515	150	PVC	130	6	2040
P-528	F22	J-513	150	PVC	130	6	2040
P-529	F11	J-518	150	PVC	130	6	2040
P-530	F10	J-519	150	PVC	130	6	2040
P-531	F9	J-520	150	PVC	130	6	2040
P-532	J-520	J-519	200	PVC	130	119	2040
P-533	J-519	J-518	200	PVC	130	113	2040
P-534	J-518	J-230	200	PVC	130	128	2040
P-535	J-57	J-520	200	PVC	130	116	2040
P-538	J-526	J-525	200	PVC	130	85	2040
P-539	J-525	J-524	200	PVC	130	157	2040
P-540	J-524	J-522	200	PVC	130	115	2040
P-541	J-522	J-521	200	PVC	130	71	2040
P-542	J-521	J-52	200	PVC	130	92	2040
P-543	F4	J-521	150	PVC	130	6	2040
P-544	J-523	J-522	150	PVC	130	115	2040
P-545	F6	J-524	150	PVC	130	6	2040
P-546	F7	J-525	150	PVC	130	6	2040
P-547	F8	J-526	150	PVC	130	6	2040
P-548 P-549	J-97 J-527	J-527	250	PVC PVC	130 130	57 70	2040 2040
P-549 P-550	J-527	J-528 J-42	250 250	PVC	130	121	2040
P-550 P-551	F1	J-42 J-527	150	PVC	130	121	2040
P-551 P-552	F1 F2	J-527	150	PVC	130	6	2040
P-554	J-61	J-528	200	PVC	130	117	2040
P-556	J-529	J-504	100	PVC	130	53	2040
P-582	F5	J-522	150	PVC	130	6	2040
P-584	F15	J-501	150	PVC	130	6	2040
P-585	F12	J-229	150	PVC	130	6	2040
P-586	J-68	J-530	150	PVC	130	80	1984
P-587	J-530	J-69	150	PVC	130	80	1984
P-588	F13	J-530	150	PVC	130	6	2040
P-589	J-25	J-531	200	PVC	130	136	2040
P-590	J-531	J-227	200	PVC	130	117	2040
P-591	F17	J-531	150	PVC	130	6	2040
P-592	J-523	F3	150	PVC	130	6	2040
P-593	J-16	J-532	150	PVC	130	98	1984
P-594	J-532	J-17	150	PVC	130	89	1984
P-595	F14	J-532	150	PVC	130	6	2040
P-596	J-58	J-533	200	PVC	130	27	2040
P-597	J-533	J-526	200	PVC	130	40	2040
P-598	F25	J-534	150	PVC	130	6	2040
P-599	F26	J-535	150	PVC	130	6	2040
P-600	F27	J-536	150	PVC	130	6	2040
P-601	F28	J-537	150	PVC	130	6	2040
P-602	J-533	J-534	350	PVC	130	245	2040
P-603	J-534	J-535	350	PVC	130	90	2040
P-604	J-535	J-536	350	PVC	130	92	2040
P-605	J-536	J-537	350	PVC	130	96	2040
P-606	J-537	J-538	350	PVC	130	87	2040
P-607	F29	J-538	150	PVC	130	6	2040
P-609	J-540	J-15	200	PVC	130	6 6	2040
P-610 P-611	F30 F31	J-29 J-11	150 150	PVC PVC	130 130	6	2040 2040
P-011	гэl	1-TT	130	FVL	130	0	2040



#### Appendix C - Junction Table (2014 Existing Water Supply Distribution System)



Label	Elevation (m)	X (m)	Y (m)	Label	Elevation (m)	X (m)	Y (m)
J-1	7.30	588305.68	5461894.43	J-95	14.00	588506.6	5459345.71
J-1A	7.30	588304.99	5461918.59	J-96	12.67	588903.72	5459350.89
J-2	13.61	588398.14	5461115.43	J-97	13.16	588178.08	5461809.91
J-3	20.00	588287.06	5461090.83	J-201	13.15	588483.54	5461777.77
J-4	20.00	588318.35	5461102.74	J-202	12.83	588704.68	5461860.88
J-7	13.60	588366.22	5461110.38	J-203	13.15	588778.39	5461787.32
J-8 J-9	14.08 13.53	588393.09 588460.2	5461109.89 5461110.39	J-204 J-205	12.87 13.59	588893.32 589183.59	5461623.18 5461802.48
J-9 J-10	12.90	588593.31	5461115.51	J-205	14.00	589206.86	5461908.3
J-11	13.23	588580.3	5461178.2	J-207	13.31	588942.7	5461512.32
J-12	13.24	588704.78	5461189.33	J-208	12.80	589238.49	5461583.84
J-13	13.53	588786.07	5461160.5	J-209	12.89	588320.98	5461714.31
J-14	13.43	588769.18	5461100.39	J-210	13.35	588322.63	5461533.33
J-15	12.67	588872.12	5461136.33	J-211	12.78	588652.96	5461633.24
J-16	12.92	588874.89	5461016.45	J-212	12.62	588470.95	5461365.31
J-17	12.77	588687.24	5461014.45	J-213	12.77	588379.25	5461455.04
J-18 J-19	12.95 14.21	588540.77	5461012.38 5460833.48	J-214 J-215	14.63 13.26	588445.72	5460949.14 5460869.62
J-19 J-20	13.92	588556.26 588639.02	5460709.45	J-215 J-216	13.26	588878.14 588880.73	5460726.28
J-20	14.31	588681.34	5460568.83	J-210	14.31	588693.56	5460569.51
J-22	14.04	588738.99	5460568.95	J-219	14.31	588703.29	5460429.27
J-23	13.94	588819.95	5460494.2	J-220	14.49	588699.15	5460218.59
J-24	14.15	588819.93	5460455.38	J-221	14.09	588666.45	5460031.15
J-25	13.84	588887.7	5460455.49	J-222	14.15	588663.19	5459941.85
J-26	14.37	588704.34	5460455.19	J-223	14.51	588654.7	5459814.3
J-27	14.10	588703.1	5460336.7	J-224	13.88	588600.33	5459667.75
J-28	12.92	588642.82	5461278.96	J-225	13.87	588527.47	5459345.98
J-29 J-30	13.17 12.97	588567.54 588638.67	5461271.44 5461365.54	J-226 J-227	12.67 13.92	588681.2 588894.2	5459347.98 5460202.12
J-30	13.30	588658.15	5461521.18	J-227	14.28	588546.59	5459556.97
J-32	12.78	588652.49	5461642.9	J-229	12.95	588855.97	5461469.42
J-33	12.91	588633.88	5461680.02	J-230	13.47	588936.94	5461519.2
J-34	12.69	588590.99	5461622.48	J-231	12.82	588566.76	5461365.5
J-35	12.70	588546.51	5461607.83	J-232	13.13	588567.45	5461408.87
J-36	13.03	588398.33	5461559.13	J-233	13.18	588570.18	5461422.21
J-37	13.29	588351.91	5461543.07	J-234	13.60	588585.48	5461511.26
J-38	13.13	588403.42	5461365.99	J-235	13.79	588529.57	5461503.08
J-39 J-40	13.97 13.50	588342.85 588303.81	5461365.07 5461527.18	J-236 J-237	13.38 13.07	588466.99 588493.9	5461492.73 5461410
J-40	12.93	588301.6	5461716.58	J-237	13.84	588534.9	5461472.88
J-42	12.47	588227.67	5461730.11	J-240	13.12	588470.99	5461794.84
J-43	13.47	588415.81	5461715	J-241	13.08	588317.83	5461792.63
J-44	13.21	588482.63	5461716.01	J-242	13.43	588392.14	5461794.22
J-45	13.22	588481.77	5461795.5	J-530	12.81	588790.35	5461318.13
J-46	14.00	588480.65	5461899.49	J-531	13.89	588890.87	5460319.36
J-47	14.00	588341.36	5461914.47	J-532	12.84	588776.4	5461015.4
J-48 J-49	14.00	588701.93 588948.67	5461902.04				
J-49 J-50	14.00 13.38	588948.67	5461943.35 5461798.85				
J-51	13.44	588619.05	5461797.57				
J-52	13.09	588764.98	5461799.79				
J-53	12.86	588878.59	5461614.41				
J-54	12.11	588789.52	5461559.72				
J-55	13.89	589009.1	5461695.09				
J-56	13.83	589127.28	5461767.06				
J-57	14.00	589209.74	5461817.7				
J-58	14.00	589204.02	5461930.88				
J-59 J-60	13.05 13.02	588985.37 589114.35	5461427.06 5461507.15				
J-60 J-61	12.80	589251.55	5461592.55				
J-62	12.95	589254.32	5461479.43				
J-63	12.95	589224.88	5461460.99				
J-64	13.13	589099.15	5461384.62				
J-65	13.16	588969.14	5461345.65				
J-66	12.86	588909.73	5461378.03				
J-67	13.03	588924.46	5461263.96	┥			
J-68	12.69	588861.25	5461286.79				
J-69	12.92	588790.44	5461393.57				
J-90 J-91	13.07 13.37	588207.61 588883.15	5461804.89 5460568.97				
J-91 J-92	13.68	588883.97	5460503.01				
		588892.83	5460003.64				
J-93	13.38	300092.05	5400005.04			,	





Label	Elevation (m)	X (m)	Y (m)	Label	Elevation (m)	X (m)	Y (m)
J-1	7.30	588305.68	5461894.43	J-95	14.00	588506.6	5459345.71
J-1A	7.30	588304.99	5461918.59	J-96	12.67	588903.72	5459350.89
J-2	13.61	588398.14	5461115.43	J-97	13.16	588178.08	5461809.91
J-3	20.00	588287.06	5461090.83	J-201	13.15	588483.54	5461777.77
J-4	20.00	588318.35	5461102.74	J-202	12.83	588704.68	5461860.88
J-7	13.60	588366.22	5461110.38	J-203	13.15	588778.39	5461787.32
J-8	14.08	588393.09	5461109.89	J-204	12.87	588893.32	5461623.18
J-9	13.53	588460.2	5461110.39	J-205	13.59	589183.59	5461802.48
J-10	12.90	588593.31	5461115.51	J-206	14.00	589206.86	5461908.3
J-11	13.23	588580.3	5461178.2	J-207	13.31	588942.7	5461512.32
J-12	13.24	588704.78	5461189.33	J-208	12.80	589238.49	5461583.84
J-13	13.53	588786.07	5461160.5	J-209	12.89	588320.98	5461714.31
J-14	13.43	588769.18	5461100.39	J-210	13.35	588322.63	5461533.33
J-15	12.67	588872.12	5461136.33	J-211	12.78	588652.96	5461633.24
J-16 J-17	12.92 12.77	588874.89 588687.24	5461016.45 5461014.45	J-212 J-213	12.62 12.77	588470.95 588379.25	5461365.31 5461455.04
J-17 J-18	12.95	588540.77	5461012.38	J-213	14.63	588445.72	5460949.14
J-18 J-19	14.21	588556.26	5460833.48	J-214	13.26	588878.14	5460869.62
J-20	13.92	588639.02	5460709.45	J-215	14.51	588880.73	5460726.28
J-20	14.31	588681.34	5460568.83	J-210	14.27	588693.56	5460569.51
J-22	14.04	588738.99	5460568.95	J-219	14.31	588703.29	5460429.27
J-23	13.94	588819.95	5460494.2	J-220	14.49	588699.15	5460218.59
J-24	14.15	588819.93	5460455.38	J-221	14.09	588666.45	5460031.15
J-25	13.84	588887.7	5460455.49	J-222	14.15	588663.19	5459941.85
J-26	14.37	588704.34	5460455.19	J-223	14.51	588654.7	5459814.3
J-27	14.10	588703.1	5460336.7	J-224	13.88	588600.33	5459667.75
J-28	12.92	588642.82	5461278.96	J-225	13.87	588527.47	5459345.98
J-29	13.17	588567.54	5461271.44	J-226	12.67	588681.2	5459347.98
J-30	12.97	588638.67	5461365.54	J-227	13.92	588894.2	5460202.12
J-31	13.30	588658.15	5461521.18	J-228	14.28	588546.59	5459556.97
J-32	12.78	588652.49	5461642.9	J-229	12.95	588855.97	5461469.42
J-33	12.91	588633.88	5461680.02	J-230	13.47	588936.94	5461519.2
J-34	12.69	588590.99	5461622.48	J-231	12.82	588566.76	5461365.5
J-35	12.70	588546.51	5461607.83	J-232	13.13	588567.45	5461408.87
J-36	13.03	588398.33	5461559.13	J-233	13.18	588570.18	5461422.21
J-37	13.29	588351.91	5461543.07	J-234	13.60	588585.48	5461511.26
J-38	13.13	588403.42	5461365.99	J-235	13.79	588529.57	5461503.08
J-39	13.97	588342.85	5461365.07	J-236	13.38	588466.99	5461492.73
J-40	13.50	588303.81	5461527.18	J-237	13.07	588493.9	5461410
J-41	12.93	588301.6	5461716.58	J-238	13.84	588534.9	5461472.88
J-42	12.47	588227.67	5461730.11	J-240	13.12	588470.99	5461794.84
J-43 J-44	13.47	588415.81	5461715	J-241 J-242	13.08 13.43	588317.83	5461792.63
J-44 J-45	13.21 13.22	588482.63 588481.77	5461716.01 5461795.5	J-242 J-500	13.43	588392.14 588685.41	5461794.22 5460869.14
J-45 J-46	13.22	588481.77	5461795.5	J-500 J-501	13.64	588806.22	5460869.14
J-40 J-47	14.00	588341.36	5461914.47	J-501	13.04	588805.06	5460929.85
J-47	14.00	588701.93	5461902.04	J-502	13.81	588800.04	5460204.57
J-49	14.00	588948.67	5461943.35	J-504	13.88	588798.05	5460295.92
J-50	13.38	588703.03	5461798.85	J-505	14.01	588723.95	5460061.31
J-51	13.44	588619.05	5461797.57	J-506	13.93	588761.44	5460061.91
J-52	13.09	588764.98	5461799.79	J-507	13.62	588844.57	5460064.31
J-53	12.86	588878.59	5461614.41	J-508	14.08	588775.14	5460117.65
J-54	12.11	588789.52	5461559.72	J-509	13.89	588762.2	5459994.79
J-55	13.89	589009.1	5461695.09	J-510	13.68	588843.41	5460114.94
J-56	13.83	589127.28	5461767.06	J-511	13.53	588822.81	5459881.51
J-57	14.00	589209.74	5461817.7	J-512	13.93	588767	5459840.99
J-58	14.00	589204.02	5461930.88	J-513	14.09	588772.71	5459887.86
J-59	13.05	588985.37	5461427.06	J-514	14.05	588788.27	5459914.63
J-60	13.02	589114.35	5461507.15	J-515	13.80	588762.47	5459803.87
J-61	12.80	589251.55	5461592.55	J-516	14.14	588750.63	5460117.27
J-62	12.95	589254.32	5461479.43	J-517	13.80	588762.16	5460027.29
J-63	12.95	589224.88	5461460.99	J-518	13.45	589046.55	5461585.56
J-64	13.13	589099.15	5461384.62	J-519	13.33	589142.92	5461644.28
J-65	13.16	588969.14	5461345.65	J-520	13.40	589243.91	5461706.42
J-66	12.86	588909.73	5461378.03	J-521	13.69	588857	5461800.56
J-67	13.03	588924.46	5461263.96	J-522	13.95	588927.69	5461802.19
J-68	12.69	588861.25	5461286.79	J-523	13.58	588844.64	5461730.4
J-69	12.92	588790.44	5461393.57	J-524	14.49	589027.8	5461853.68
J-90	13.07	588207.61	5461804.89	J-525	15.34	589095.33	5461896.87
J-91	13.37	588883.15	5460568.97	J-526	14.00	589167.53	5461939
J-92	13.68	588883.97	5460503.01	J-527	13.00	588122.02	5461817.45
J-93 J-94	13.38	588892.83	5460003.64 5460004.36	J-528 J-529	13.00 13.88	588108.03	5461748.45 5460348.6
J-94	13.63	588855.32	3400004.30	J-27A	13.88	588796.79	5400348.0





J-530	12.83	588790.35	5461318.13
J-531	13.87	588890.87	5460319.36
J-532	12.84	588776.4	5461015.4
J-533	14.00	589202.64	5461957.39
J-534	12.50	589207.38	5462201.47
J-535	12.50	589207.15	5462291.72
J-536	12.50	589206.18	5462383.29
J-537	12.50	589184.47	5462475.08
J-538	12.50	589169.89	5462559.24





Label	Elevation (m)	X (m)	Y (m)	Label	Elevation (m)	X (m)	Y (m)
J-1	7.30	588305.68	5461894.43	J-95	14.00	588506.6	5459345.71
J-1A	7.30	588304.99	5461918.59	J-96	12.67	588903.72	5459350.89
J-2 J-3	13.61 20.00	588398.14	5461115.43	J-97	13.16	588178.08	5461809.91
J-3 J-4	20.00	588287.06 588318.35	5461090.83 5461102.74	J-201 J-202	13.15 12.83	588483.54 588704.68	5461777.77 5461860.88
J-4 J-7	13.60	588366.22	5461110.38	J-202	13.15	588778.39	5461787.32
J-8	14.08	588393.09	5461109.89	J-203	12.87	588893.32	5461623.18
J-9	13.53	588460.2	5461110.39	J-204	13.59	589183.59	5461802.48
J-10	12.90	588593.31	5461115.51	J-205	14.00	589206.86	5461908.3
J-11	13.23	588580.3	5461178.2	J-207	13.31	588942.7	5461512.32
J-12	13.24	588704.78	5461189.33	J-208	12.80	589238.49	5461583.84
J-13	13.53	588786.07	5461160.5	J-209	12.89	588320.98	5461714.31
J-14	13.43	588769.18	5461100.39	J-210	13.35	588322.63	5461533.33
J-15	12.67	588872.12	5461136.33	J-211	12.78	588652.96	5461633.24
J-16	12.92	588874.89	5461016.45	J-212	12.62	588470.95	5461365.31
J-17	12.77	588687.24	5461014.45	J-213	12.77	588379.25	5461455.04
J-18	12.95	588540.77	5461012.38	J-214	14.63	588445.72	5460949.14
J-19	14.21	588556.26	5460833.48	J-215	13.26	588878.14	5460869.62
J-20	13.92	588639.02	5460709.45	J-216	14.51	588880.73	5460726.28
J-21	14.31	588681.34	5460568.83	J-217	14.27	588693.56	5460569.51
J-22	14.04	588738.99	5460568.95	J-219	14.31	588703.29	5460429.27
J-23	13.94	588819.95	5460494.2	J-220	14.49	588699.15	5460218.59
J-24	14.15	588819.93	5460455.38	J-221	14.09	588666.45	5460031.15
J-25	13.84	588887.7	5460455.49	J-222	14.15	588663.19	5459941.85
J-26	14.37	588704.34	5460455.19	J-223	14.51	588654.7	5459814.3
J-27	14.10	588703.1	5460336.7	J-224	13.88	588600.33	5459667.75
J-28	12.92	588642.82	5461278.96	J-225	13.87	588527.47	5459345.98
J-29	13.17	588567.54	5461271.44	J-226	12.67	588681.2	5459347.98
J-30	12.97	588638.67	5461365.54	J-227	13.92	588894.2	5460202.12
J-31	13.30	588658.15	5461521.18	J-228	14.28	588546.59	5459556.97
J-32	12.78	588652.49	5461642.9	J-229	12.95	588855.97	5461469.42
J-33	12.91	588633.88	5461680.02	J-230	13.47	588936.94	5461519.2
J-34	12.69	588590.99	5461622.48	J-231	12.82	588566.76	5461365.5
J-35 J-36	12.70 13.03	588546.51 588398.33	5461607.83 5461559.13	J-232 J-233	13.13 13.18	588567.45 588570.18	5461408.87 5461422.21
J-30	13.29	588351.91	5461543.07	J-233	13.60	588585.48	5461511.26
J-38	13.13	588403.42	5461365.99	J-234	13.79	588529.57	5461503.08
J-39	13.97	588342.85	5461365.07	J-236	13.38	588466.99	5461492.73
J-40	13.50	588303.81	5461527.18	J-237	13.07	588493.9	5461410
J-41	12.93	588301.6	5461716.58	J-238	13.84	588534.9	5461472.88
J-42	12.47	588227.67	5461730.11	J-240	13.12	588470.99	5461794.84
J-43	13.47	588415.81	5461715	J-241	13.08	588317.83	5461792.63
J-44	13.21	588482.63	5461716.01	J-242	13.43	588392.14	5461794.22
J-45	13.22	588481.77	5461795.5	J-500	13.64	588685.41	5460869.14
J-46	14.00	588480.65	5461899.49	J-501	13.38	588806.22	5460869.99
J-47	14.00	588341.36	5461914.47	J-502	13.04	588805.06	5460929.85
J-48	14.00	588701.93	5461902.04	J-503	13.81	588800.04	5460204.57
J-49	14.00	588948.67	5461943.35	J-504	13.88	588798.05	5460295.92
J-50	13.38	588703.03	5461798.85	J-505	14.01	588723.95	5460061.31
J-51	13.44	588619.05	5461797.57	J-506	13.93	588761.44	5460061.91
J-52	13.09	588764.98	5461799.79	J-507	13.62	588844.57	5460064.31
J-53	12.86	588878.59	5461614.41	J-508	14.08	588775.14	5460117.65
J-54	12.11	588789.52	5461559.72	J-509	13.89	588762.2	5459994.79
J-55	13.89	589009.1	5461695.09	J-510	13.68	588843.41	5460114.94
J-56	13.83	589127.28	5461767.06	J-511	13.53	588822.81	5459881.51
J-57	14.00	589209.74	5461817.7	J-512	13.93	588767	5459840.99
J-58	14.00	589204.02	5461930.88	J-513	14.09	588772.71	5459887.86
J-59	13.05	588985.37	5461427.06	J-514	14.05	588788.27	5459914.63
J-60	13.02	589114.35	5461507.15	J-515	13.80	588762.47	5459803.87
J-61	12.80	589251.55	5461592.55	J-516	14.14	588750.63	5460117.27
J-62	12.95	589254.32	5461479.43 5461460.99	J-517	13.80	588762.16	5460027.29 5461585.56
J-63	12.95	589224.88		J-518	13.45	589046.55	
J-64	13.13	589099.15	5461384.62	J-519	13.33	589142.92	5461644.28
J-65	13.16	588969.14	5461345.65	J-520	13.40	589243.91	5461706.42
J-66	12.86	588909.73	5461378.03	J-521	13.69	588857	5461800.56
J-67	13.03	588924.46	5461263.96	J-522	13.95	588927.69	5461802.19
J-68	12.69	588861.25	5461286.79	J-523	13.58	588844.64	5461730.4
J-69	12.92	588790.44	5461393.57	J-524	14.49	589027.8	5461853.68
J-90	13.07	588207.61	5461804.89	J-525	15.34	589095.33	5461896.87
J-91 J-92	13.37 13.68	588883.15 588883.97	5460568.97 5460503.01	J-526 J-527	14.00 13.00	589167.53 588122.02	5461939 5461817.45
J-32				J-527 J-528	13.00	588122.02	5461748.45
J-93	13.38	588892.83	5460003.64				

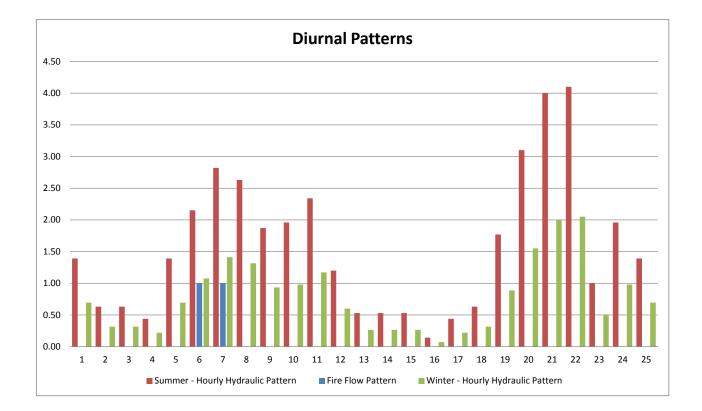




J-530	12.83	588790.35	5461318.13
J-531	13.87	588890.87	5460319.36
J-532	12.84	588776.4	5461015.4
J-533	14.00	589202.64	5461957.39
J-534	12.50	589207.38	5462201.47
J-535	12.50	589207.15	5462291.72
J-536	12.50	589206.18	5462383.29
J-537	12.50	589184.47	5462475.08
J-538	12.50	589169.89	5462559.24
J-540	12.67	588902.16	5461136.02









## Appendix C - Meter Reading Data July 1,2012 - Sept 30,2012 (91 Days)



July 1,2012 - Sept 30,2012 (91 Days)							
Commerical Services	Reading (m <sup>3</sup> )	Last (m <sup>3</sup> )	Total (m <sup>3</sup> )	Total (L)	Total (L/day)	Total (L/sec)	
Black Forest Restaurant	10,727	9,282	1,445	1,445,000	15,879	0.184	
Post Office	298	288	10	10,000	110	0.001	
Harrison Beach Hotel	19,057	17,977	1,080	1,080,000	11,868	0.137	
Echo Beach	121,007	117,245	3,762	3,762,000	41,341	0.478	
Laguana Beach	79,497	77,269	2,228	2,228,000	24,484	0.283	
The Cascades	44,818	44,201	617	616,900	6,779	0.078	
Heritage House	9,870	9,640	230	230,000	2,527	0.029	
Harrison Springs RV & Campground	11,479	11,056	423	423,000	4,648	0.054	
Harrison Lake Estates	12,050	11,673	377	377,100	4,144	0.048	
Cedar Springs Apts	9,698	9,519	179	179,000	1,967	0.023	
Riverwynd Apts	22,798	22,422	376	376,000	4,132	0.048	
Old Settler Pub	44,468	42,833	1,635	1,635,000	17,967	0.208	
Ramada Inn	219,142	211,724	7,418	7,418,000	81,516	0.943	
Harrison on the Lake	55,309	54,907	401	401,400	4,411	0.051	
Hot Springs Villa	9,844	9,216	628	627,600	6,897	0.080	
Inkman's Mall	29,611	25,389	4,222	4,222,000	46,396	0.537	
RV Springs	21,411	17,706	3,705	3,705,000	40,714	0.471	
Hot Springs Campground	538	405	133	133,000	1,462	0.017	
Casia Developments	697	353	344	344,000	3,780	0.044	
Tugboat Junction	960	955	5	5,000	55	0.001	
Harrison Village Motel	1,019	570	449	449,000	4,934	0.057	
Hungry Chef	590	323	267	267,000	2,934	0.034	
Village Owned Facilities	Reading (m <sup>3</sup> )	Last (m <sup>3</sup> )	Total (m <sup>3</sup> )	Total (L)	Total (L/day)	Total (L/sec)	
Boat Launch Bathrooms	31,592	31,440	152	152,300	1,674	0.019	
Fire Hall	2,471	2,418	53	53,000	582	0.007	
Memorial Hall	15,187	15,007	180	180,000	1,978	0.023	
Village Office/Public Works	7,558	7,452	106	106,000	1,165	0.013	
Beach Washrooms	21,168	19,875	1,294	1,293,600	14,215	0.165	
Plaza	16,846	16,599	247	247,200	2,778	0.032	
	•			Total	351,336.87	4.066	

#### July 1.2012 - Sept 30.2012 (91 Days)

These Average Daily Demands from July 1,2012 - Sept 30,2012 are used in the existing water model for Summer Demands. Mutiplier of 0.5 times is used for Winter Demands.



Post Office

Echo Beach

Laguana Beach

Heritage House

**Riverwynd Apts** 

Old Settler Pub

The Cascades

## Appendix C - Meter Reading Data April 1,2013 - June 30,2013 (90 Days)



April 1,2013 - June 30,2013 (90 Days) **Commerical Services** Reading (m<sup>3</sup>) Last (m<sup>3</sup>) Total (m<sup>3</sup>) Total (L) Total (L/day) Total (L/sec) 5,044 11,916 11,462 454 454,000 Black Forest Restaurant 323 315 8 8,000 89 Harrison Beach Hotel 21,347 20,371 976 976,000 10,844 127,060 125,029 2,031 2,031,000 22,567 2,593 86,112 83,519 2,593,000 28,811 45,905 46,405 500 500,000 5,556 10,101 10,234 133 133,000 1,478 Harrison Springs RV & Campground 433 12,061 11,628 433,000 4,811 Harrison Lake Estates 124,300 122,790 1,510 1,510,000 16,778 Cedar Springs Apts 10,261 10,076 185 185,000 2,056 23,870 23,507 363 363,000 4,033 48,119 46,707 1,412 1,412,000 15,689 220 710 225 204 2 226 2 226 000 

46,119	40,707	1,412	1,412,000	15,069	0.182
228,710	225,384	3,326	3,326,000	36,956	0.428
56,796	56,066	730	730,000	8,111	0.094
10,394	10,111	283	282,600	3,140	0.036
38,363	32,610	5,753	5,753,000	63,922	0.740
25,042	22,846	2,196	2,196,000	24,400	0.282
807	695	112	112,000	1,244	0.014
816	761	55	55,000	611	0.007
960	960	0	0	-	-
1,690	1,382	308	308,000	3,422	0.040
1,804	1,529	275	275,000	3,056	0.035
1,222	943	279	279,000	3,100	0.036
167	134	33	33,000	367	0.004
278	0	278	278,000	3,089	0.036
Reading (m <sup>3</sup> )	Last (m <sup>3</sup> )	Total (m <sup>3</sup> )	Total (L)	Total (L/day)	Total (L/sec)
31,831	31,654	176	176,400	1,960	0.023
2,533	2,512	21	21,000	233	0.003
15,345	15,253	92	92,000	1,022	0.012
7,821	7,736	85	85,100	946	0.011
22,076	21,479	597	597,000	6,633	0.077
16 964	16 861	103	102,800	1,142	0.013
10,504	10,001	105	101,000	-)	
	56,796 10,394 38,363 25,042 807 816 960 1,690 1,804 1,222 167 278 <b>Reading (m<sup>3</sup>)</b> 31,831 2,533 15,345 7,821 22,076	228,710         225,384           56,796         56,066           10,394         10,111           38,363         32,610           25,042         22,846           807         695           816         761           960         960           1,690         1,382           1,804         1,529           1,222         943           167         134           278         0           Reading (m³)           31,831         31,654           2,533         2,512           15,345         15,253           7,821         7,736           22,076         21,479	228,710         225,384         3,326           56,796         56,066         730           10,394         10,111         283           38,363         32,610         5,753           25,042         22,846         2,196           807         695         112           816         761         555           960         960         0           1,690         1,382         308           1,804         1,529         275           1,222         943         279           167         134         33           2778         0         278           8         1,831         31,654         176           31,831         31,654         176           2,533         2,512         21           15,345         15,253         92           7,821         7,736         85	228,710         225,384         3,326         3,326,000           56,796         56,066         730         730,000           10,394         10,111         283         282,600           38,363         32,610         5,753         5,753,000           25,042         22,846         2,196         2,196,000           807         695         112         112,000           816         761         55         55,000           960         960         0         0           1,690         1,382         308         308,000           1,804         1,529         275         275,000           1,222         943         279         279,000           1,222         943         279         278,000           1,222         943         279         278,000           1,224         943         279         278,000           1,225         943         279         278,000           1,224         943         279         278,000           278         0         278         0         278           167         134         33         33,000           2,533         2,512 <td>228,710         225,384         3,326         3,326,000         36,956           56,796         56,066         730         730,000         8,111           10,394         10,111         283         282,600         3,140           38,363         32,610         5,753         5,753,000         63,922           25,042         22,846         2,196         2,196,000         24,400           807         695         112         112,000         1,244           816         761         55         55,000         611           960         960         0         0         -           1,690         1,382         308         308,000         3,422           1,804         1,529         275         275,000         3,056           1,222         943         279         279,000         3,000           1,67         134         33         33,000         367           278         0         278         278,000         3,089           2,533         2,512         21         21,000         233           31,831         31,654         176         176,400         1,960           2,533         2,512</td>	228,710         225,384         3,326         3,326,000         36,956           56,796         56,066         730         730,000         8,111           10,394         10,111         283         282,600         3,140           38,363         32,610         5,753         5,753,000         63,922           25,042         22,846         2,196         2,196,000         24,400           807         695         112         112,000         1,244           816         761         55         55,000         611           960         960         0         0         -           1,690         1,382         308         308,000         3,422           1,804         1,529         275         275,000         3,056           1,222         943         279         279,000         3,000           1,67         134         33         33,000         367           278         0         278         278,000         3,089           2,533         2,512         21         21,000         233           31,831         31,654         176         176,400         1,960           2,533         2,512

#### 0.058 0.001

0.126

0.261

0.333

0.064

0.017

0.056

0.194

0.024

0.047

0.182



## Appendix C - Meter Reading Data Jan 1,2013 - March 31,2013 (89 Days)



	Jan 1,2013 - March 31,2013 (89 Days)					
Commerical Services	Reading (m <sup>3</sup> )	Last (m <sup>3</sup> )	Total (m <sup>3</sup> )	Total (L)	Total (L/day)	Total (L/sec)
Black Forest Restaurant	11,462	11,146	316	316,000	3,551	0.041
Post Office	315	306	9	9,000	101	0.001
Harrison Beach Hotel	20,371	19,745	626	626,000	7,034	0.081
Echo Beach	125,029	123,047	1,982	1,982,000	22,270	0.258
Laguana Beach	83,519	81,409	2,110	2,110,000	23,708	0.274
The Cascades	45,905	45,402	504	503,500	5,657	0.065
Heritage House	10,101	10,090	11	11,000	124	0.001
Harrison Springs RV & Campground	11,628	11,626	2	2,000	22	0.000
Harrison Lake Estates	122,790	121,706	1,084	1,084,000	12,180	0.141
Cedar Springs Apts	10,076	9,854	222	222,000	2,494	0.029
Riverwynd Apts	23,507	23,142	365	365,000	4,101	0.047
Old Settler Pub	46,707	45,681	1,026	1,026,000	11,528	0.133
Ramada Inn	225,384	222,478	2,906	2,906,000	32,652	0.378
Harrison on the Lake	56,066	55,610	456	455,600	5,119	0.059
Hot Springs Villa	10,111	10,001	110	110,100	1,237	0.014
Inkman's Mall	32,610	31,787	823	823,000	9,247	0.107
RV Springs	22,846	22,375	471	471,000	5,292	0.061
Hot Springs Campground	695	571	124	124,000	1,393	0.016
Casia Developments	761	742	19	19,000	213	0.002
Tugboat Junction	960	960	0	0	-	-
Harrison Village Motel	1,382	1,142	240	240,000	2,697	0.031
350 Eagle St	1,529	1,230	299	299,000	3,360	0.039
Hungry Chef	943	706	237	237,000	2,663	0.031
215 Miami River Drive	134	91	43	43,000	483	0.006
Comai Building	0	0	0	0	-	-
Village Owned Facilities	Reading (m <sup>3</sup> )	Last (m <sup>3</sup> )	Total (m <sup>3</sup> )	Total (L)	Total (L/day)	Total (L/sec)
Boat Launch Bathrooms	31,654	31,636	19	18,800	211	0.002
Fire Hall	2,512	2,498	14	14,000	157	0.002
Memorial Hall	15,253	15,228	25	25,000	281	0.003
Village Office/Public Works	7,736	7,647	89	89,200	1,002	0.012
Beach Washrooms	21,479	21,260	219	218,600	2,456	0.028
Plaza	16,861	16,861	0	0	-	-
				Total	161,233.71	1.87

### Jan 1,2013 - March 31,2013 (89 Days)

## Appendix C - Junction Demands (2014 Existing Water Supply Distribution System)



Junction #	nction # Number of Unit Unit Demand Unit Demands		Unit Demand		Average Day Demand (Base) (L/s)
J-8	3	R-1	0.062		
J-8	Water Meter Data	Fire Hall	0.007		
J-9	13	R-1	0.270		
J-10	13	R-1	0.270		
J-11	6	R-1	0.125		
J-12	13	R-1	0.270		
J-13	6	R-1	0.125		
J-14	5	R-1	0.104		
J-15	3	R-1	0.062		
J-16	8	R-1	0.166		
J-16	1	R-2	0.042		
J-17	16	R-1	0.333		
J-18	13	R-1	0.270		
J-19	1	R-2	0.042		
J-20	2	R-1	0.042		
J-20	Water Meter Data	RV Springs	0.471		
J-21	2	C-5 (Ex House)	0.042		
J-21	1	C-5 (Ex House)	0.021		
J-22	4	R-1	0.083		
J-22	7	R-3	0.098		
J-23	7	R-3	0.098		
J-24	Water Meter Data	Harrison Lake Estates	0.048		
J-27	Water Meter Data	Tugboat Junction	0.001		
J-28	8	R-1	0.166		
J-29	4	R-1	0.083		
J-30	15	R-1	0.312		
J-31	13	R-1	0.270		
J-32	2	R-1	0.042		
J-33	4	R-1	0.083		
J-34	5	R-1	0.104		
J-35	11	R-1	0.229		
J-36	10	R-1	0.208		
J-37	2	R-1	0.042		
J-38	Water Meter Data	Village Office	0.013		
J-42	1	R-1	0.021		
J-42	Water Meter Data	Cedar Springs Apts	0.023		
J-42	Water Meter Data	Riverwynd Apts	0.048		
J-42	Water Meter Data	Ramada Inn	0.943		
J-42 J-43	1	R-2	0.042		
J-43	Water Meter Data	Hot Springs Campground	0.042		
J-43 J-44	Water Meter Data	Casia Developments	0.017		
J-44 J-45	Water Meter Data	Echo Beach	0.478		
J-43 J-47	Water Meter Data	Beach Washroom	0.165		
J-47	Water Meter Data	Plaza	0.032		
J-47 J-49	Water Meter Data	Boat Launch Bathrooms	0.032		
J-49 J-50	Water Meter Data	The Cascades	0.019		
J-50 J-51	Water Meter Data	Laguna Beach	0.283		
J-51 J-52	1	R-2	0.285		
J-52	Water Meter Data	Harrison on the Lake	0.051		
J-53	6	R-2	0.252		
J-54	4	R-2	0.168		
J-55	10 ×	R-2	0.420		
J-56	8	R-2	0.336		
J-59	8	R-1	0.166		

## Appendix C - Junction Demands (2014 Existing Water Supply Distribution System)



1.62		<b>D</b> 4	0.024
J-62	1	R-1	0.021
J-63	10	R-1	0.208
J-64	11	R-1	0.229
J-65	8	R-1	0.166
J-66	6	R-1	0.125
J-67	6	R-1	0.125
J-68	11	R-1	0.229
J-69	9	R-1	0.187
J-90	Water Meter Data	Harrison Beach Hotel	0.137
J-90	Water Meter Data	Post Office	0.001
J-90	Water Meter Data	Black Forrest Restaurant	0.184
J-91	2	R-1	0.042
J-95	3	R-1	0.062
J-95	1	R-2	0.042
J-97	Water Meter Data	Hungry Chef	0.034
J-201	Water Meter Data	Heritage House	0.029
J-203	6	R-1	0.125
J-204	2	R-2	0.084
J-205	2	R-2	0.084
J-207	3	R-1	0.062
J-208	8	R-1	0.166
J-209	Water Meter Data	Old Settler Pub	0.208
J-211	5	R-1	0.104
J-214	2	R-2	0.084
J-215	3	R-1	0.062
J-216	1	R-1	0.021
J-219	Water Meter Data	Harrison Springs RV & Campground	0.054
J-220	1	R-2	0.042
J-221	3	R-2	0.126
J-221	1	R-1	0.021
J-222	2	R-2	0.084
J-223	1	R-2	0.042
J-224	1	R-2	0.042
J-225	1	R-1	0.021
J-226	1	R-1	0.021
J-228	1	R-2	0.042
J-228	1	C-7 - Holiday Park	0.007
J-229	6	R-1	0.125
J-230	4	R-1	0.083
J-232	6	R-3	0.084
J-233	6	R-3	0.084
J-234	7	R-3	0.098
J-235	8	R-3	0.112
J-236	8	R-3	0.112
J-237	8	R-3	0.112
J-238	3	R-3	0.042
J-240	Water Meter Data	Memorial Hall	0.023
J-241	Water Meter Data	Inkman's Mall	0.537
J-242	Water Meter Data	Hot Springs Villa	0.080
J-242	Water Meter Data	Harrison Village Motel	0.057
		~	i



## Appendix C - Junction Demands (Future System -2014 Existing System PLUS Unserviced Properties)



			Average Day	
Junction #	Number of Unit	Unit Demand	Demand (Base)	
Junction #	Demands	Shit Demand		
1.0	2	D 1	(L/s)	
J-8	3	R-1	0.062	
J-8	Water Meter Data	Fire Hall	0.007	
J-9	13	R-1	0.270	
J-10	13	R-1	0.270	
J-11	6	R-1	0.125	
J-12	13	R-1	0.270	
J-13	6	R-1	0.125	
J-14	5	R-1	0.104	
J-15	3	R-1	0.062	
J-16	8	R-1	0.166	
J-16	1	R-2	0.042	
J-17	16	R-1	0.333	
J-18	13	R-1	0.270	
J-19	1	R-2	0.042	
J-20	2	R-1	0.042	
J-20	Water Meter Data	RV Springs	0.471	
J-20 J-20	2	House (Scenario 2)	0.042	
J-21	2	C-5 (Ex House)	0.042	
J-21	1	C-5 (Ex House)	0.021	
J-22	4	R-1	0.083	
J-22	7	R-3	0.098	
J-23	7	R-3	0.098	
J-24	Water Meter Data	Harrison Lake Estates	0.048	
J-26	2	House (Scenario 2)	0.042	
J-27	Water Meter Data	Tugboat Junction	0.001	
J-28	8	R-1	0.166	
J-29	4	R-1	0.083	
J-30	15	R-1	0.312	
J-31	13	R-1	0.270	
J-32	2	R-1	0.042	
J-33	4	R-1	0.083	
J-34	5	R-1	0.104	
J-35	11	R-1	0.229	
J-35	10		0.223	
	2			
J-37		R-1	0.042	
J-38	Water Meter Data	Village Office	0.013	
J-38	0.86	School	0.298	
J-40	1.33	C-5 (Scenario 2)	0.923	
J-41	0.15	C-1 (Scenario 2)	0.208	
J-41	0.10	C-1 (Scenario 2)	0.139	
J-41	0.18	C-1 (Scenario 2)	0.250	
J-42	1	R-1	0.021	
J-42	Water Meter Data	Cedar Springs Apts	0.023	
J-42	Water Meter Data	Riverwynd Apts	0.048	
J-42	Water Meter Data	Ramada Inn	0.943	
J-43	1	R-2	0.042	
J-43	Water Meter Data	Hot Springs Campground	0.017	
J-43	1	House (Scenario 2)	0.021	
J-44	Water Meter Data	Casia Developments	0.044	
J-44 J-45	Water Meter Data	Echo Beach	0.044	
J-47	Water Meter Data	Beach Washroom	0.165	
J-47	Water Meter Data	Plaza	0.032	
J-49	Water Meter Data	Boat Launch Bathrooms	0.019	
J-50	Water Meter Data	The Cascades	0.078	
J-51	Water Meter Data	Laguna Beach	0.283	
J-51	2	House (Scenario 2)	0.042	



## Appendix C - Junction Demands (Future System -2014 Existing System PLUS Unserviced Properties)



1.50	1	<b>D</b> 2	0.042
J-52 J-52	1 Water Meter Data	R-2 Harrison on the Lake	0.042
J-52	4	House (Scenario 2)	0.083
J-53	6	R-2	0.252
J-54	4	R-2	0.168
J-55	10	R-2	0.420
J-55	1	House (Scenario 2)	0.021
J-56	8	R-2	0.336
J-56	1	House (Scenario 2)	0.021
J-59	8	R-1	0.166
J-60	12	R-1	0.250
J-62	1	R-1	0.021
J-63	10	R-1	0.208
J-64	11	R-1	0.229
J-65	8	R-1	0.166
J-66	6	R-1	0.125
J-67	6	R-1	0.125
J-68	11	R-1	0.229
J-69	9	R-1	0.187
J-69	1	House (Scenario 2)	0.021
J-90	Water Meter Data	Harrison Beach Hotel	0.137
J-90	Water Meter Data	Post Office	0.001
J-90	Water Meter Data	Black Forrest Restaurant	0.184
J-91	2	R-1	0.042
J-91	3	House (Scenario 2)	0.062
J-92	2	House (Scenario 2)	0.042
J-94	5	House (Scenario 2)	0.104
J-95	3	R-1	0.062
J-95	1	R-2	0.042
J-95	1	House (Scenario 2)	0.021
J-97	Water Meter Data	Hungry Chef	0.034
J-201	Water Meter Data	Heritage House	0.029
J-203	6	R-1	0.125
J-204	2	R-2	0.084
J-204	1	House (Scenario 2)	0.021
J-205	2	R-2	0.084
J-207	3	R-1	0.062
J-208	8	R-1	0.166
J-209	Water Meter Data	Old Settler Pub	0.208
J-209	0.40	C-1 (Scenario 2)	0.556
J-203	5	R-1	0.104
J-211 J-214	2	R-1 R-2	0.104
J-214 J-214	2		
		House (Scenario 2)	0.042
J-214	1.25	C-5 (Scenario 2)	0.868
J-215	3	R-1	0.062
J-215	4	House (Scenario 2)	0.083
J-216	1	R-1	0.021
J-219	Water Meter Data	Harrison Springs RV & Campground	0.054
J-220	1	R-2	0.042
J-220	3	House (Scenario 2)	0.062
J-220	0.06	C-4 (Scenario 2)	0.038
J-221	3	R-2	0.126
J-221	1	R-1	0.021
J-221	3	House (Scenario 2)	0.062
J-222	2	R-2	0.084
J-222	1	CS (Scenario 2)	0.194
	4	House (Scenario 2)	0.083
1-222			0.000
J-222 J-223	1	R-2	0.042



## Appendix C - Junction Demands (Future System -2014 Existing System PLUS Unserviced Properties)



J-223	0.24	C-4 (Scenario 2)	0.150
J-224	1	R-2	0.042
J-224	1	House (Scenario 2)	0.021
J-225	1	R-1	0.021
J-226	1	R-1	0.021
J-226	2	House (Scenario 2)	0.042
J-228	1	R-2	0.042
J-227	4	House (Scenario 2)	0.083
J-228	2	House (Scenario 2)	0.042
J-228	411	C-7 - Holiday Park (Scenario 2)	2.877
J-229	6	R-1	0.125
J-229	3	House (Scenario 2)	0.062
J-230	4	R-1	0.083
J-232	6	R-3	0.084
J-233	6	R-3	0.084
J-234	7	R-3	0.098
J-235	8	R-3	0.112
J-236	8	R-3	0.112
J-230	8	R-3	0.112
J-237	3	R-3	0.042
	-	-	
J-240	Water Meter Data	Memorial Hall	0.023
J-241	Water Meter Data	Inkman's Mall	0.537
J-241	0.27	C-1 (Scenario 2)	0.375
J-242	Water Meter Data	Hot Springs Villa	0.080
J-242	Water Meter Data	Harrison Village Motel	0.057
J-241	0.13	C-1 (Scenario 2)	0.181
J-500	5	House (Scenario 2)	0.104
J-501	9	House (Scenario 2)	0.187
J-502	4	House (Scenario 2)	0.083
J-503	5	House (Scenario 2)	0.104
J-504	5	House (Scenario 2)	0.104
J-505	6	House (Scenario 2)	0.125
J-506	3	House (Scenario 2)	0.062
J-507	4	House (Scenario 2)	0.083
J-508	2	House (Scenario 2)	0.042
J-509	4	House (Scenario 2)	0.083
J-510	5	House (Scenario 2)	0.104
J-511	3	House (Scenario 2)	0.062
J-512	2	House (Scenario 2)	0.042
J-513	3	House (Scenario 2)	0.062
J-514	2	House (Scenario 2)	0.042
J-515	2	House (Scenario 2)	0.042
J-515	3	House (Scenario 2)	0.062
J-518	12	House (Scenario 2)	0.250
J-518 J-519	5	House (Scenario 2)	0.230
J-519 J-520	2	House (Scenario 2)	0.104
	2		
J-521		House (Scenario 2)	0.042
J-522	4	House (Scenario 2)	0.083
J-522	0.15	Church (Scenario 2)	0.052
J-523	2	House (Scenario 2)	0.042
J-524	9	House (Scenario 2)	0.187
J-525	10	House (Scenario 2)	0.208
J-526	0.22	C-2 (Scenario 2)	0.306
J-526	0.21	C-2 (Scenario 2)	0.292
J-527	4	House (Scenario 2)	0.083
J-528	8	House (Scenario 2)	0.166
J-529	4	House (Scenario 2)	0.083
J-529 J-531	5	House (Scenario 2) House (Scenario 2) ge Average Day Demand (Base) (L/s)	0.083

# CTQ

## Appendix C - Junction Demands (Future System - Full Developement)



Junction #	ion # Number of Unit Unit Demand Demands		Average Day Demand (Base) (L/s)
J-8	3	R-1	0.062
J-8	Water Meter Data	Fire Hall	0.007
J-9	14	R-1	0.291
J-10	13	R-1	0.270
J-11	6	R-1	0.125
J-12	13	R-1	0.270
J-13	8	R-1	0.166
J-14	5	R-1	0.104
J-15	3	R-1	0.062
J-16	9	R-1	0.187
J-16	1	R-2	0.042
J-17	18	R-1	0.374
J-18	16	R-1	0.333
J-19	1	R-2	0.042
J-20	57	Condo Unit (Scenario 3)	0.798
J-20	117	Campsite (Scenario 3)	0.819
J-20	2	R-1	0.042
J-20	Water Meter Data	RV Springs	0.471
J-20	108	Condo Unit (Scenario 3)	1.512
J-20	2	C-5 (Ex House)	0.042
J-21	1	C-5 (Ex House)	0.042
J-21	7	R-1	0.146
J-22 J-22	7		0.098
J-22 J-23	7	R-3	0.098
J-23 J-24	/ Water Meter Data	Harrison Lake Estates	0.098
J-24 J-26	23	Condo Unit (Scenario 3)	0.322
J-26	47	Campsite (Scenario 3)	0.322
J-20	Water Meter Data	Tugboat Junction	0.001
J-27	10	Small House (Scenario 3)	0.140
J-27	8	R-1	0.140
J-28	4		0.083
J-29 J-30	15		0.312
	13		0.312
J-31 J-32	2		
	5		0.042
J-33 J-34	7		0.104
J-34 J-35	11		0.148
J-35	11		0.229
	3		
J-37		R-1	0.062
J-38	Water Meter Data	Village Office	0.013
J-38	0.86	School	
J-39 J-40	16 1.33	Condo Unit (Scenario 3)	0.224
		C-5 (Scenario 2)	
J-40	1 0.15	Small House (Scenario 3)	0.014
J-41	0.15	C-1 (Scenario 2)	0.208
J-41		C-1 (Scenario 2)	0.139
J-41	0.18	C-1 (Scenario 2)	0.250
J-42	Water Meter Data	Cedar Springs Apts	0.023
J-42	Water Meter Data	Riverwynd Apts	0.048
J-42	Water Meter Data	Ramada Inn	0.943
J-43	78	Condo Unit (Scenario 3)	1.092
J-43	0.28	C-1 (Scenario 3)	0.389
J-44	Water Meter Data	Casia Developments	0.044
J-45	Water Meter Data	Echo Beach	0.478
J-47	Water Meter Data	Beach Washroom	0.165

## Appendix C - Junction Demands (Future System - Full Developement)



J-47	Water Meter Data	Plaza	0.032
J-47	Water Meter Data	Boat Launch Bathrooms	0.032
J-45	Water Meter Data	The Cascades	0.078
J-50	Water Meter Data	Laguna Beach	0.283
J-51	2	House (Scenario 2)	0.042
J-51	35	Condo Unit (Scenario 3)	0.490
J-52	Water Meter Data	Harrison on the Lake	
J-52 J-52	0.10	C-2 (Scenario 3)	0.051
J-52 J-53		R-2	0.139 0.252
	6 4		
J-53 J-54	3	Small House (Scenario 3) R-2	0.056
J-54 J-54	9	Small House (Scenario 3)	0.126
	10	R-2	0.120
J-55 J-55	10	House (Scenario 2)	
J-55 J-56	8	R-2	0.021
J-56	8	House (Scenario 2)	0.021
J-57	31	Condo Unit (Scenario 3)	0.434
J-59	10	R-1	0.208
J-60	14	R-1	0.291
J-62	1	R-1	0.021
J-63	10	R-1	0.208
J-64	11	R-1	0.229
J-65	11	R-1	0.229
J-66	6	R-1	0.125
J-67	6	R-1	0.125
J-68	11	R-1	0.229
J-69	9	R-1	0.187
J-69	1	House (Scenario 2)	0.021
J-90	Water Meter Data	Harrison Beach Hotel	0.137
J-90	Water Meter Data	Post Office	0.001
J-90	Water Meter Data	Black Forrest Restaurant	0.184
J-91	2	R-1	0.042
J-91	3	House (Scenario 2)	0.062
J-92	2	House (Scenario 2)	0.042
J-94	5	House (Scenario 2)	0.104
J-95	3	R-1	0.062
J-95	1	R-2	0.042
J-95	1	House (Scenario 2)	0.021
J-97	89	Condo Unit (Scenario 3)	1.246
J-97	0.30	C-1 (Scenario 3)	0.417
J-201	Water Meter Data	Heritage House	0.029
J-203	6	R-1	0.125
J-204	2	R-2	0.084
J-204	1	House (Scenario 2)	0.021
J-207	4	Small House (Scenario 3)	0.056
J-205	1	R-2	0.042
J-205	4	Small House (Scenario 3)	0.056
J-206	31	Condo Unit (Scenario 3)	0.434
J-207	2	R-1	0.042
J-207	4	Small House (Scenario 3)	0.056
J-208	8	R-1	0.166
J-209	Water Meter Data	Old Settler Pub	0.208
J-209	0.40	C-1 (Scenario 2)	0.556
J-211	5	R-1	0.104
J-214	2	R-2	0.084
J-214	2	House (Scenario 2)	0.042
J-214	1.25	C-5 (Scenario 2)	0.868
J-215	3	R-1	0.062
	4	House (Scenario 2)	0.083

## Appendix C - Junction Demands (Future System - Full Developement)



R-1Harrison Springs RV & CampgroundR-2House (Scenario 2)C-4 (Scenario 2)Condo Unit (Scenario 3)Campsite (Scenario 3)R-2R-1House (Scenario 2)R-2CS (Scenario 2)House (Scenario 2)R-2CS (Scenario 2)House (Scenario 2)R-2CS (Scenario 2)R-2House (Scenario 2)R-2House (Scenario 2)R-2House (Scenario 2)R-1R-1House (Scenario 2)R-1R-1House (Scenario 2)R-1House (Scenario 2)R-1<	0.021 0.054 0.042 0.062 0.038 0.574 0.588 0.126 0.021 0.021 0.042 0.083 0.042 0.042 0.042 0.021 0.021 0.021 0.021 0.021 0.021 0.021 0.021 0.021 0.021 0.021 0.021 0.021 0.042 0.021 0.021 0.021 0.021 0.042 0.021 0.021 0.042 0.021 0.042 0.021 0.021 0.042 0.021 0.021 0.042 0.021 0.021 0.042 0.021 0.042 0.021 0.042 0.
R-2House (Scenario 2)C-4 (Scenario 2)Condo Unit (Scenario 3)Campsite (Scenario 3)R-2R-1House (Scenario 2)R-2CS (Scenario 2)House (Scenario 2)R-2CS (Scenario 2)House (Scenario 2)R-2CS (Scenario 2)R-2House (Scenario 2)R-2House (Scenario 2)Small House (Scenario 3)R-2House (Scenario 2)R-1R-1House (Scenario 2)R-2House (Scenario 2)R-1House (Scenario 2)R-2House (Scenario 2)R-1House (Scenario 2)R-1House (Scenario 2)R-1House (Scenario 2)R-1House (Scenario 2)R-1House (Scenario 3)	0.042 0.062 0.038 0.574 0.588 0.126 0.021 0.104 0.084 0.194 0.083 0.042 0.083 0.150 0.210 0.042 0.021 0.021 0.021 0.021 0.021 0.021 0.021 0.021 0.021 0.0420
House (Scenario 2)C-4 (Scenario 2)Condo Unit (Scenario 3)Campsite (Scenario 3)R-2R-1House (Scenario 2)R-2CS (Scenario 2)House (Scenario 2)R-2CS (Scenario 2)House (Scenario 2)R-2CS (Scenario 2)R-2House (Scenario 2)R-2House (Scenario 2)Small House (Scenario 3)R-2House (Scenario 2)R-1House (Scenario 2)R-1House (Scenario 2)R-2House (Scenario 2)R-1House (Scenario 2)R-2House (Scenario 2)R-1House (Scenario 2)R-1Small House (Scenario 3)	0.062 0.038 0.574 0.588 0.126 0.021 0.104 0.084 0.194 0.083 0.042 0.083 0.150 0.210 0.042 0.021 0.021 0.021 0.021 0.021 0.021 0.021 0.021 0.0420
C-4 (Scenario 2)Condo Unit (Scenario 3)Campsite (Scenario 3)R-2R-1House (Scenario 2)R-2CS (Scenario 2)House (Scenario 2)R-2CS (Scenario 2)R-2CS (Scenario 2)R-2House (Scenario 2)C-4 (Scenario 2)Small House (Scenario 3)R-2House (Scenario 2)R-1R-1House (Scenario 2)R-1R-1House (Scenario 2)R-2House (Scenario 2)R-1House (Scenario 2)C-7 - Holiday ParkHouse (Scenario 2)R-1House (Scenario 2)R-1House (Scenario 3)	0.038 0.574 0.588 0.126 0.021 0.104 0.084 0.194 0.083 0.042 0.083 0.150 0.210 0.042 0.021 0.021 0.021 0.021 0.021 0.021 0.042 0.042 0.083 0.007 0.042 2.877 0.125 0.062
Condo Unit (Scenario 3)Campsite (Scenario 3)R-2R-1House (Scenario 2)R-2CS (Scenario 2)House (Scenario 2)R-2House (Scenario 2)C-4 (Scenario 2)Small House (Scenario 3)R-2House (Scenario 2)Small House (Scenario 2)R-1R-1House (Scenario 2)R-1R-1House (Scenario 2)R-2House (Scenario 2)R-1House (Scenario 2)R-2House (Scenario 2)R-2House (Scenario 2)C-7 - Holiday ParkHouse (Scenario 2)R-1House (Scenario 2)R-1House (Scenario 3)	0.574           0.588           0.126           0.021           0.104           0.084           0.194           0.083           0.042           0.083           0.150           0.210           0.021           0.021           0.021           0.021           0.021           0.042           0.062
Campsite (Scenario 3)R-2R-1House (Scenario 2)R-2CS (Scenario 2)House (Scenario 2)R-2House (Scenario 2)C-4 (Scenario 2)Small House (Scenario 3)R-2House (Scenario 2)Small House (Scenario 2)R-1R-1House (Scenario 2)R-1R-1House (Scenario 2)R-2House (Scenario 2)R-1House (Scenario 2)C-7 - Holiday ParkHouse (Scenario 2)C-7 - Holiday Park (Scenario 2)R-1House (Scenario 2)R-1House (Scenario 3)	0.588           0.126           0.021           0.104           0.084           0.194           0.083           0.042           0.083           0.150           0.210           0.021           0.021           0.021           0.021           0.021           0.021           0.021           0.021           0.021           0.042           0.062
R-2R-1House (Scenario 2)R-2CS (Scenario 2)House (Scenario 2)R-2House (Scenario 2)C-4 (Scenario 2)Small House (Scenario 3)R-2House (Scenario 2)R-1R-1House (Scenario 2)R-2House (Scenario 2)R-1R-1House (Scenario 2)R-2House (Scenario 2)R-2House (Scenario 2)C-7 - Holiday ParkHouse (Scenario 2)C-7 - Holiday Park (Scenario 2)R-1House (Scenario 2)R-1House (Scenario 2)R-1House (Scenario 3)	0.126           0.021           0.104           0.084           0.194           0.083           0.042           0.083           0.150           0.210           0.021           0.021           0.021           0.021           0.042           0.042           0.042           0.021           0.021           0.042           0.062
R-1House (Scenario 2)R-2CS (Scenario 2)House (Scenario 2)R-2House (Scenario 2)C-4 (Scenario 2)Small House (Scenario 3)R-2House (Scenario 2)R-1R-1House (Scenario 2)R-2House (Scenario 2)R-1R-1House (Scenario 2)R-2House (Scenario 2)R-2House (Scenario 2)C-7 - Holiday ParkHouse (Scenario 2)C-7 - Holiday Park (Scenario 2)R-1House (Scenario 2)R-1House (Scenario 2)R-1House (Scenario 2)	0.021 0.104 0.084 0.194 0.083 0.042 0.083 0.150 0.210 0.042 0.021 0.021 0.021 0.021 0.021 0.021 0.042 0.042 0.042 0.042 0.042 0.042 0.042 0.042 0.042 0.042 0.042 0.042 0.042 0.042 0.042 0.042 0.042
House (Scenario 2)R-2CS (Scenario 2)House (Scenario 2)R-2House (Scenario 2)C-4 (Scenario 2)Small House (Scenario 3)R-2House (Scenario 2)R-1R-1House (Scenario 2)R-1House (Scenario 2)R-2House (Scenario 2)R-1House (Scenario 2)C-7 - Holiday ParkHouse (Scenario 2)C-7 - Holiday Park (Scenario 2)R-1House (Scenario 2)R-1House (Scenario 2)R-1House (Scenario 3)	0.104 0.084 0.194 0.083 0.042 0.083 0.150 0.210 0.042 0.021 0.021 0.021 0.021 0.021 0.021 0.042 0.042 0.042 0.042 0.042 0.042 0.042 0.042 0.042 0.042 0.042 0.042 0.042 0.042 0.042 0.063
R-2CS (Scenario 2)House (Scenario 2)R-2House (Scenario 2)C-4 (Scenario 2)Small House (Scenario 3)R-2House (Scenario 2)R-1R-1House (Scenario 2)R-1House (Scenario 2)R-2House (Scenario 2)R-2House (Scenario 2)C-7 - Holiday ParkHouse (Scenario 2)C-7 - Holiday Park (Scenario 2)R-1House (Scenario 2)R-1House (Scenario 2)R-1House (Scenario 2)R-1House (Scenario 3)	0.084 0.194 0.083 0.042 0.083 0.150 0.210 0.042 0.021 0.021 0.021 0.021 0.042 0.042 0.042 0.042 0.042 0.042 0.042 2.877 0.125 0.062
CS (Scenario 2) House (Scenario 2) R-2 House (Scenario 2) C-4 (Scenario 2) Small House (Scenario 3) R-2 House (Scenario 2) R-1 House (Scenario 2) R-2 House (Scenario 2) C-7 - Holiday Park House (Scenario 2) C-7 - Holiday Park House (Scenario 2) C-7 - Holiday Park House (Scenario 2) R-1 House (Scenario 2) R-1 House (Scenario 3)	0.194 0.083 0.042 0.083 0.150 0.210 0.042 0.021 0.021 0.042 0.042 0.042 0.042 0.042 0.042 0.083 0.007 0.042 2.877 0.125 0.062
House(Scenario 2)R-2HouseC-4 (Scenario 2)Small House (Scenario 3)R-2House (Scenario 2)R-1R-1House (Scenario 2)R-2House (Scenario 2)R-2House (Scenario 2)C-7 - Holiday ParkHouse (Scenario 2)C-7 - Holiday Park (Scenario 2)C-7 - Holiday Park (Scenario 2)R-1House (Scenario 2)R-1Small House (Scenario 3)	0.083 0.042 0.083 0.150 0.210 0.042 0.021 0.021 0.021 0.042 0.042 0.042 0.042 0.083 0.007 0.042 2.877 0.125 0.062
R-2House (Scenario 2)C-4 (Scenario 2)Small House (Scenario 3)R-2House (Scenario 2)R-1House (Scenario 2)R-2House (Scenario 2)C-7 - Holiday ParkHouse (Scenario 2)C-7 - Holiday Park (Scenario 2)C-7 - Holiday Park (Scenario 2)R-1House (Scenario 2)R-1Small House (Scenario 3)	0.042 0.083 0.150 0.210 0.042 0.021 0.021 0.021 0.042 0.042 0.042 0.083 0.007 0.042 2.877 0.125 0.062
House (Scenario 2)C-4 (Scenario 2)Small House (Scenario 3)R-2House (Scenario 2)R-1House (Scenario 2)R-2House (Scenario 2)C-7 - Holiday ParkHouse (Scenario 2)C-7 - Holiday ParkHouse (Scenario 2)C-7 - Holiday ParkHouse (Scenario 2)R-1House (Scenario 2)R-1Small House (Scenario 3)	0.083 0.150 0.210 0.042 0.021 0.021 0.021 0.042 0.042 0.083 0.007 0.042 2.877 0.125 0.062
C-4 (Scenario 2)Small House (Scenario 3)R-2House (Scenario 2)R-1House (Scenario 2)R-2House (Scenario 2)C-7 - Holiday ParkHouse (Scenario 2)C-7 - Holiday ParkHouse (Scenario 2)C-7 - Holiday ParkHouse (Scenario 2)R-1House (Scenario 2)R-1Small House (Scenario 3)	0.150 0.210 0.042 0.021 0.021 0.042 0.042 0.042 0.083 0.007 0.042 2.877 0.125 0.062
Small House (Scenario 3)R-2House (Scenario 2)R-1R-1House (Scenario 2)R-2House (Scenario 2)C-7 - Holiday ParkHouse (Scenario 2)C-7 - Holiday Park (Scenario 2)C-7 - Holiday Park (Scenario 2)R-1House (Scenario 2)R-1Small House (Scenario 3)	0.210 0.042 0.021 0.021 0.042 0.042 0.042 0.083 0.007 0.042 2.877 0.125 0.062
R-2House (Scenario 2)R-1R-1House (Scenario 2)R-2House (Scenario 2)C-7 - Holiday ParkHouse (Scenario 2)C-7 - Holiday ParkHouse (Scenario 2)R-1House (Scenario 2)R-1House (Scenario 2)R-1Small House (Scenario 3)	0.210 0.042 0.021 0.021 0.042 0.042 0.042 0.083 0.007 0.042 2.877 0.125 0.062
R-2House (Scenario 2)R-1R-1House (Scenario 2)R-2House (Scenario 2)C-7 - Holiday ParkHouse (Scenario 2)C-7 - Holiday ParkHouse (Scenario 2)R-1House (Scenario 2)R-1House (Scenario 2)R-1Small House (Scenario 3)	0.021 0.021 0.042 0.042 0.083 0.007 0.042 2.877 0.125 0.062
R-1R-1R-1House (Scenario 2)R-2House (Scenario 2)C-7 - Holiday ParkHouse (Scenario 2)C-7 - Holiday Park (Scenario 2)R-1House (Scenario 2)R-1Small House (Scenario 3)	0.021 0.021 0.042 0.042 0.083 0.007 0.042 2.877 0.125 0.062
R-1House (Scenario 2)R-2House (Scenario 2)C-7 - Holiday ParkHouse (Scenario 2)C-7 - Holiday Park (Scenario 2)R-1House (Scenario 2)R-1House (Scenario 2)R-1Small House (Scenario 3)	0.021 0.042 0.042 0.083 0.007 0.042 2.877 0.125 0.062
House (Scenario 2)R-2House (Scenario 2)C-7 - Holiday ParkHouse (Scenario 2)C-7 - Holiday Park (Scenario 2)R-1House (Scenario 2)R-1Small House (Scenario 3)	0.042 0.042 0.083 0.007 0.042 2.877 0.125 0.062
R-2House (Scenario 2)C-7 - Holiday ParkHouse (Scenario 2)C-7 - Holiday Park (Scenario 2)R-1House (Scenario 2)R-1Small House (Scenario 3)	0.042 0.083 0.007 0.042 2.877 0.125 0.062
R-2House (Scenario 2)C-7 - Holiday ParkHouse (Scenario 2)C-7 - Holiday Park (Scenario 2)R-1House (Scenario 2)R-1Small House (Scenario 3)	0.042 0.083 0.007 0.042 2.877 0.125 0.062
House (Scenario 2)C-7 - Holiday ParkHouse (Scenario 2)C-7 - Holiday Park (Scenario 2)R-1House (Scenario 2)R-1Small House (Scenario 3)	0.083 0.007 0.042 2.877 0.125 0.062
C-7 - Holiday Park House (Scenario 2) C-7 - Holiday Park (Scenario 2) R-1 House (Scenario 2) R-1 Small House (Scenario 3)	0.007 0.042 2.877 0.125 0.062
House (Scenario 2) C-7 - Holiday Park (Scenario 2) R-1 House (Scenario 2) R-1 Small House (Scenario 3)	0.042 2.877 0.125 0.062
C-7 - Holiday Park (Scenario 2) R-1 House (Scenario 2) R-1 Small House (Scenario 3)	2.877 0.125 0.062
R-1 House (Scenario 2) R-1 Small House (Scenario 3)	0.125 0.062
House (Scenario 2) R-1 Small House (Scenario 3)	0.062
R-1 Small House (Scenario 3)	
Small House (Scenario 3)	
	0.042
K-3	0.056
	0.084
R-3	0.084
R-3	0.098
R-3	0.112
R-3	0.112
R-3	0.112
R-3	0.042
Memorial Hall	0.023
Inkman's Mall	0.537
C-1 (Scenario 2)	0.375
Hot Springs Villa	0.080
Harrison Village Motel	0.057
Condo Unit (Scenario 3)	0.224
C-1 (Scenario 3)	0.069
C-1 (Scenario 2)	0.181
House (Scenario 2)	0.146
House (Scenario 2)	0.187
	0.083
	0.104
	0.104
	0.125
	0.062
	0.002
House (Scenario 2)	0 1 25
House (Scenario 2)	0.125
House (Scenario 2)	0.042
House (Scenario 2) House (Scenario 2)	0.042 0.104
House (Scenario 2) House (Scenario 2) House (Scenario 2)	0.042 0.104 0.104
House (Scenario 2) House (Scenario 2)	0.042 0.104
	Hot Springs VillaHarrison Village MotelCondo Unit (Scenario 3)C-1 (Scenario 3)C-1 (Scenario 2)House (Scenario 2)

## Appendix C - Junction Demands (Future System - Full Developement)



	Total A	verage Average Day Demand (Base) (L/s)	45.889
J-540	322.00	Kingma Lands R-3 (Scenario 3)	4.508
J-538	0.02	C-1 (Scenario 3)	0.028
J-538	18	Condo Unit (Scenario 3)	0.252
J-537	0.02	C-1 (Scenario 3)	0.028
J-537	18	Condo Unit (Scenario 3)	0.252
J-536	0.02	C-1 (Scenario 3)	0.028
J-536	18	Condo Unit (Scenario 3)	0.252
J-535	0.02	C-1 (Scenario 3)	0.028
J-535	18	Condo Unit (Scenario 3)	0.252
J-534	0.02	C-1 (Scenario 3)	0.028
J-534	18	Condo Unit (Scenario 3)	0.252
J-531	5	House (Scenario 2)	0.104
J-529	4	House (Scenario 2)	0.083
J-528	0.23	C-1 (Scenario 3)	0.319
J-528	64	Condo Unit (Scenario 3)	0.896
J-527	0.14	C-1 (Scenario 3)	0.194
J-527	43	Condo Unit (Scenario 3)	0.602
J-526	0.21	C-2 (Scenario 2)	0.292
J-526	0.22	C-2 (Scenario 2)	0.306
J-525	0.05	C-2 (Scenario 3)	0.069
J-525	21	Condo Unit (Scenario 3)	0.294
J-524	9	House (Scenario 2)	0.187
J-524	0.05	C-2 (Scenario 3)	0.069
J-524	14	Condo Unit (Scenario 3)	0.196
J-523	2	House (Scenario 2)	0.042
J-522	0.15	Church (Scenario 2)	0.052
J-522	0.05	C-2 (Scenario 3)	0.069
J-522	14	Condo Unit (Scenario 3)	0.196
J-521	0.24	C-2 (Scenario 3)	0.333
J-521	70	Condo Unit (Scenario 3)	0.980
J-520	4	Small House (Scenario 3)	0.056
J-520	2	House (Scenario 2)	0.042
J-519	8	House (Scenario 2)	0.166
J-518	12	House (Scenario 2)	0.250
J-516	3	House (Scenario 2)	0.062
J-515	3	House (Scenario 2)	0.062
J-514	2	House (Scenario 2)	0.042

# CTQ

## Appendix C -Civic Addresses for Non Conforming Hydrant Coverage (2014 Existing Water Supply Distribution System)



Naturally Refreshed

Civic Address	Future Hydrant #	Civic Address	Future Hydrant #	Civic Address	Future Hydrant #
100 Esplande Avenue	F1	555 Naismith Avenue	F9	602 Lakberg Crescent	F15
120 Esplande Avenue	F1	565 Naismith Avenue	F9	603 Lakberg Crescent	F15
114 Cedar Avenue	F2	560 Naismith Avenue	F9	604 Lakberg Crescent	F15
140 Cedar Avenue	F2	535 Naismith Avenue	F10	606 Lakberg Crescent	F15
330 Eagle Street	F3	539 Naismith Avenue	F10	606 Lakberg Crescent	F15
340 Eagle Street	F3	545 Naismith Avenue	F10	608 Lakberg Crescent	F15
339 Bear Avenue	F3	549 Naismith Avenue	F10	609 Lakberg Crescent	F15
410 Bear Avenue	F3 F3	540 Naismith Avenue	F10	-	F15
410 Bear Avenue	F3	546 Naismith Avenue	F10	637 Hot Springs Road 389 Pine Avenue	F16
430 Bear Avenue	F3 F3	550 Naismith Avenue	F10	395 Pine Avenue	F16
498 Bear Avenue	F3 F3	556 Naismith Avenue	F10	415 Pine Avenue	F16
498 Bear Avenue	F3 F4	506 Naismith Avenue	F10	435 Pine Avenue	F16
470 Lilloet Avenue	F4	513 Naismith Avenue	F11	455 Pine Avenue	F16
490 Lilloet Avenue	F4	515 Naismith Avenue	F11	473 Pine Avenue	F16
	F4				
511 Lilloet Avenue	F5	519 Naismith Avenue	F11 F11	442 Pine Avenue	F16 F16
231 Lilloet Avenue		525 Naismith Avenue		464 Pine Avenue	
500 Lilloet Avenue	F5 F5	529 Naismith Avenue	F11	470 Pine Avenue	F16
520 Lilloet Avenue		510 Naismith Avenue	F11	478 Pine Avenue	F16
526 Lilloet Avenue	F5	516 Naismith Avenue	F11	750 McCombs Drive	F17
519 Lilloet Avenue	F6	520 Naismith Avenue	F11	760 McCombs Drive	F17
527 Lilloet Avenue	F6	526 Naismith Avenue	F11	770 McCombs Drive	F17
531 Lilloet Avenue	F6	530 Naismith Avenue	F11	780 McCombs Drive	F17
538 Lilloet Avenue	F6	536 Naismith Avenue	F11	750 Diamond Street	F18
544 Lilloet Avenue	F6	479 Cottonwood Place	F12	755 Diamond Street	F18
550 Lilloet Avenue	F6	480 Cottonwood Place	F12	760 Diamond Street	F18
553 Lilloet Avenue	F7	449 Cottonwood Place	F13	765 Diamond Street	F18
549 Lilloet Avenue	F7	451 Cottonwood Place	F13	770 Diamond Street	F18
553 Lilloet Avenue	F7	345 Chestnut Avenuenue	F14	775 Diamond Street	F18
556 Lilloet Avenue	F7	347 Chestnut Avenuenue	F14	780 Diamond Street	F18
562 Lilloet Avenue	F7	350 Chestnut Avenuenue	F14	785 Diamond Street	F18
568 Lilloet Avenue	F7	352 Chestnut Avenuenue	F14	790 Diamond Street	F18
574 Lilloet Avenue	F7	601 Lakberg Crescent	F15	795 Diamond Street	F18
565 Lilloet Avenue	F8	602 Lakberg Crescent	F15	808 Ramona Place	F19
811 Ramona Place	F19	850 Angus Place	F21	881 Hope Place	F24
812 Ramona Place	F19	856 Hope Place	F22	884 Hope Place	F24
816 Ramona Place	F19	858 Hope Place	F22	885 Hope Place	F24
820 Ramona Place	F19	868 Hope Place	F22	892 Hope Place	F24
822 Ramona Place	F19	872 Hope Place	F22	Rockwell Drive	F25
826 Ramona Place	F19	856 Myng Crescent	F23	Rockwell Drive	F26
401 Hadway Drive	F19	857 Myng Crescent	F23	Rockwell Drive	F27
425 Hadway Drive	F19	860 Myng Crescent	F23	Rockwell Drive	F28
822 Myng Crescent	F20	861 Myng Crescent	F23	Rockwell Drive	F29
826 Myng Crescent	F20	866 Myng Crescent	F23	310 Fern Place	F30
835 Angus Place	F21	865 Myng Crescent	F23	315 Fern Place	F30
841 Angus Place	F21	870 Myng Crescent	F23	315 Clover Place	F-31
847 Angus Place	F21	871 Myng Crescent	F23	320 Clover Place	F31
848 Angus Place	F21	875 Myng Crescent	F23	325 Clover Place	F31
849 Angus Place	F21	878 Hope Place	F24		

\*If text is red the address may be incorrect.





Table 1: Existing Model - Hydrant Requirements - Fire Flow + Max Day Demand

Note: Minimum system pressure under Fire Flow Conditions is a 22 PSI as per MMCD Guidelines. Any Failed Hydrants don't meet this requirement. The Fire Flow Flows are based on zone. The following criteria was used:

R-1, R-2, & R-3 minimum fire flow of 60 L/s

P-1 minimum fire flow of 60 L/s

R-4 & R-5 minimum fire flow of 90 L/s

C Zone and P-1\* (Existing School and Public Works Building) minimum fire flow of 150 L/s

Label	Zone	Hydrant Elevation (m)	Static Pressure (psi)	Fire Flow (Required) (L/s)	Residual Pressure (psi)	Fire Flow (Available) (L/s) at 22psi Residual Pressure	Velocity of Pipe (m/s) at Fire Flow	Location of highest record velocity in the system	Hydrant Spacing Yes/No (Max space R-1, R-2, R-3 = 180m, all other zones = 90m)	Distribution Main Section Affected	Upgrade Required - Pipe Velocity under 3.5m/s	Upgrade Pipe Length Required (m)
H-1	C-1	13.02	86	150	46	201	4.87	J-240 to J45 (200mm)	No	Between H-1 and H-2	J-240 to J45 (250mm)	11
H-2	C-1	13.15	86	150	48	208	4.87	J-240 to J45 (200mm)	No	Between H-2 and H-1	J-240 to J45 (250mm)	11
H-3	C-1	13.22	86	150	52	224	4.87	J-240 to J45 (200mm)	Yes		J-240 to J45 (250mm)	11
H-4	P-1, C-1, C-2, C-3	13.36	86	150	61	276	2.32		No	Between H-4 and H-5		
H-5	C-2, C-3	13.47	86	150	50	215	2.32		No	Between H-5 and H-4, H-6, H-7		
H-6	C-2	12.76	87	150	42	189	4.77	J-50 to J-202 (200mm)	No	Between H-6 and H-5, H-7	J-50 to J-202 (250mm)	62
H-7	R-2	13.09	86	60	72	189	2.32	0 00 10 0 202 (2001111)	No	Between H-7 and H-9	0 00 10 0 202 (2001111)	02
H-7	C-2	13.09	86	150	47	205	2.32		No	Between H-7 and H-6		
H-8	R-2	12.22	87	60	61	109	2.32		Yes	Detween IT / and IT 0		
H-9	R-2, R-3	12.67	87	60	70	161	2.32		No	Between H-9 and H-7		
H-10	R-2	13.82	85	60	64	129	2.32		Yes	Detween 11-3 and 11-7		
H-11	R-2	13.75	85	60	60	112	2.32		Yes			
H-12	R-2	13.58	86	60	59	107	2.32		Yes	-		
H-12	R-4	13.58	86	90	37	107	5.24	J-53 to J-204 (150mm)	No	Between H-12 and H-13	J-53 to J-204 (200mm)	17
H-12 H-13	R-4 R-4	13.58	85	90	37	99	5.24	J-53 to J-204 (150mm)	NO	Between H-12 and H-13 Between H-13 and H-12	J-53 to J-204 (200mm)	17
H-13 H-14	R-4 R-1, R-2	14	85 86	90 60	72	99 187	2.32	J-55 (U J-204 (150MM)	Yes	Detween n-13 and n-12	J-53 10 J-204 (200MM)	17
H-14 H-15	R-1, R-2 R-1	13.17	86	60	72	187	2.32		Yes		1	
H-15 H-16	R-1	12.98	86	60	63	188	2.32		Yes			
H-16	R-1	12.83	87	60	61	111	2.32		Yes			
H-17 H-18						110	2.32					
	R-1 R-1	12.96	86	60 60	60 64	110	2.32		Yes			
H-19 H-20	R-1	13.05 13.11	86 86	60		122	2.32		Yes			
					72				Yes			
H-21	R-1	12.73	87	60	70	154	2.32		Yes			
H-22	R-1	12.75	87	60	66	133	2.32		Yes			
H-23	C-1, C-3	12.44	87	150	64	294	3.12		Yes			
H-24	C-1	13.33	86	150	64	300	2.68		No	Between H-24 and H-25		
H-25	C-1	13.63	86	150	61	276	2.68		No	Between H-25 and H-24		
H-26	R-1	13.34	86	60	78	268	2.32		Yes			
H-26	C-5	13.34	86	150	62	285	5.54	J-212 to J-38 (150mm)	Yes		J-210 to J-40 (250mm)	20
H-27	R-1	13.09	86	60	74	183	2.32		Yes			
H-27	P-1	13.09	86	150	43	192	5.54	J-210 to J-40 (150mm)	Yes		J-37 to J-40 (200mm) J-37 to J-36 (250mm)	51 & 50
H-28	R-1	12.84	87	60	68	139	2.32		Yes			
H-29	R-1	12.81	87	60	68	136	2.32		Yes			
H-30	R-1	13.31	86	60	67	135	2.32		Yes			
H-31	R-1	13.11	86	60	72	169	2.32		Yes			
H-32	R-1	12.58	87	60	74	178	2.32		Yes			
H-32	P-1	12.58	87	150	41	186	5.54	J-212 to J-38 (150mm)	No	Between H-32 and H-31, H-33	J-39 to J-38 (200mm) J-38 to J-212 (250mm)	61 & 68
H-33	R-1	14.14	85	60	77	260	2.32		Yes			
H-33	P-1	14.14	85	150	60	273	2.65		No	Between H-33 and H-32		
H-34	P-1	12.92	87	150	57	247	3.77	J-37 to J-40 (150mm)	No	Between H-34 and H-33	J-37 to J-40 (200mm) J-38 to J-39 (200mm)	51 & 61
H-35	R-1	12.99	87	60	73	180	2.32		Yes			
H-36	R-1	13.24	86	60	75	224	2.32		Yes			
H-37	R-1	13.53	86	60	75	223	2.32		Yes			
H-38	R-1	12.84	87	60	75	194	2.32		Yes			
H-39	R-1	12.89	87	60	69	142	2.32		Yes			
H-40	R-1	12.81	87	60	71	150	2.32		Yes			
H-41	R-1	13.38	86	60	78	269	2.32		Yes			
H-42	R-1	12.89	87	60	77	249	2.32		Yes			
H-43	CD-2, P-1	13.4	86	150	70	300	2.32		Yes			
H-44	R-2	14.66	84	60	76	259	2.32		Yes	-		
H-44	C-5	14.66	84	150	59	270	2.65		No	Between H-44 and H-43, H-45		
H-45	R-2	14.07	85	60	76	233	2.32		Yes			
H-45	C-5	14.07	85	150	56	244	2.65		No	Between H-45 and H-44, H-46		
H-46	RSR	13.57	86	60	76	225	2.32		Yes	<b>D</b>		
H-46	C-5	13.57	86	150	55	236	2.65		No	Between H-46 and H-45, H-49		
H-47	R-2	13.17	86	60	75	205	2.32		Yes		1	



H-48	RSR	13.68	86	60	74	192	2.32		Yes			
H-49	R-1, R-3	14.24	85	60	74	204	2.32		Yes			
H-49	C-5	14.24	85	150	49	214	5.93	J-21 to J-217 (150mm)	No	Between H-49 and H-46, H-54	J-21 to J-217 (250mm)	12
H-50	R-1	13.28	86	60	75	200	2.32		Yes			
H-51	R-3	13.89	85	60	72	170	2.32		Yes			
H-52	R-1	13.56	86	60	74	198	2.32		Yes			
H-53	R-4	13.8	86	90	63	178	2.24		No	Between H-53 and H-64		
H-54	R-4	14.43	85	90	66	199	2.24		No	Between H-54 and H-55, H-49		
H-54	C-5	14.43	85	150	48	209	2.32		No	Between H-54 and H-55, H-49		
H-55	R-1	14.01	85	60	73	187	2.32		Yes			
H-55	C-5	14.01	85	150	44	196	2.32		No	Between H-55 and H-54, H-56		
H-56	R-1	14.53	84	60	71	173	2.32		Yes			
H-56	C-4, C-5	14.53	84	150	39	181	2.32		No	Between H-56 and H-55, H-57		
H-57	R-1, R-2	13.96	85	60	70	157	2.32		Yes			
H-58	R-1	14.24	85	60	69	149	2.32		Yes			
H-58	CS	14.24	85	150	26	155	2.32		Yes			
H-59	R-1, R-2	14.85	84	60	67	139	2.32		Yes			
H-59	C-4	14.85	84	150	18	144	3.09		Yes			
H-60	R-2	13.63	86	60	67	134	2.32		Yes			
H-60	C-4, C-7	13.63	86	150	13	139	3.09		Yes			
H-61	R-1	13.87	85	60	63	114	2.32		Yes			
H-62	R-1	12.57	87	60	61	106	2.32		Yes			
H-63	R-1	13.57	86	60	61	108	2.32		No	Between H-63 and H-64		
H-64	R-1	13.89	85	60	68	136	2.32		No	Between H-64 and H-63		
H-65	R-2	14.28	85	60	65	127	2.32		Yes			
H-65	C-7	14.28	85	150	7	132	3.09		Yes			
H-66	R-3	13.14	86	60	63	115	2.32		Yes			
H-67	R-3	13.28	86	60	66	127	2.32		Yes			
H-68	R-3	13.79	85	60	60	108	2.32		Yes			





Table 2: Scenario 2 - Hydrant Requirements - Fire Flow + Max Day Demand

Note: Minimum system pressure under Fire Flow Conditions is a 22 PSI as per MMCD Guidelines. Any Failed Hydrants don't meet this requirement. The Fire Flow Flows are based on zone. The following criteria was used:

R-1, R-2, & R-3 minimum fire flow of 60 L/s

P-1 minimum fire flow of 60 L/s

R-4 & R-5 minimum fire flow of 90 L/s

C Zone and P-1\* (Existing School and Public Works Building) minimum fire flow of 150 L/s

Label	Zone	Hydrant Elevation (m)	Static Pressure (psi)	Fire Flow (Required) (L/s)	Residual Pressure (psi)	Fire Flow (Available) (L/s) at 22psi Residual Pressure	Velocity of Pipe (m/s) at Fire Flow	Location of highest record velocity in the system
 F1	CD-1, C-1	13.00	88	150	57	252	3.12	
F2	C-1, C-3	13.00	88	150	61	282	3.12	
F3	R-2	13.58	87	60	59	107	2.29	
F4	R-2	13.78	86	60	71	193	2.29	
F4	C-2	13.78	86	150	42	193	3.12	
F5	R-2	13.95	86	60	70	183	2.29	
F5	C-2	13.95	86	150	39	183	3.12	
F6	R-2	14.55	85	60	69	174	2.29	
 F6	C-2	14.55	85	150	35	174	3.12	
 F7	R-2	15.34	84	60	68	170	2.29	
 F7	C-2	15.34	84	150	33	170	3.12	
 F8	R-4	14.00	86	90	61	176	2.27	
 F8	C-2	14.00	86	150	36	176	3.12	
 F9	R-1	13.40	87	60	72	197	2.29	
 F10	R-1	13.40	87	60	71 71	188	2.29	
 F11 F12	R-1 R-1	13.49 12.95	87 88	60 60	69	190 156	2.29 2.29	
 F12 F13	R-1 R-1	12.95	88	60	68	148	2.29	
 F13	R-1	12.84	88	60	71	148	2.29	
 F15	R-1	13.38	87	60	71	180	2.29	
 F16	R-2	13.57	87	60	70	169	2.29	
 F17	R-1	13.83	86	60	70	186	2.29	
F18	R-1	13.90	86	60	58	106	2.29	
F19	R-1	14.17	86	60	60	115	2.29	
F20	R-1	13.68	87	60	69	166	2.29	
F21	R-1	13.79	86	60	65	137	2.29	
F22	R-1	14.19	86	60	60	120	2.29	
F23	R-1	13.40	87	60	66	137	2.29	
 F24	R-1	12.50	88	60	59	110	2.29	
 F25	CD	12.50	88	150	27	158	2.29	
 F26	CD	12.50	88	150	23	151	2.29	
 F27	CD CD	12.50	88	150	22	150	2.29	
 F28 F29	CD	12.50 12.50	88 88	150 150	21 20	149 148	2.29 2.29	
 F29 F30	R-1	13.17	87	60	64	200	2.29	
 F31	R-1	13.23	87	60	67	156	2.29	
 H-1	C-1	13.02	86	150	59	269	3.12	
H-2	C-1	13.15	86	150	56	248	3.12	
H-3	C-1	13.22	86	150	57	255	3.12	
H-4	P-1, C-1, C-2, C-3	13.36	86	150	61	292	3.12	
H-5	C-2, C-3	13.47	86	150	50	220	3.35	
 H-6	C-2	12.76	87	150	42	192	4.77	J-50 to J-202 (200mm)
 H-7	R-2	13.09	86	60	73	209	2.29	
 H-7	C-2	13.09	86	150	47	209	3.34	
 H-8 H-9	R-2 R-2, R-3	12.22	87	60	62 73	114 194	2.29	
 H-9 H-10	R-2, R-3 R-2	12.67 13.82	87 85	60 60	73	194	2.29 2.29	
H-10	R-2	13.75	85	60	70	180	2.29	
 H-12	R-2	13.58	86	60	70	188	2.29	
H-12	R-4	13.58	86	90	63	188	2.29	
H-13	R-4	14.00	85	90	62	185	2.29	
H-14	R-1, R-2	13.17	86	60	73	210	2.29	
H-15	R-1	12.98	86	60	73	211	2.29	
H-16	R-1	13.07	86	60	68	149	2.29	
H-17	R-1	12.83	87	60	71	174	2.29	
 H-18	R-1	12.96	86	60	67	139	2.29	
 H-19	R-1	13.05	86	60	67	142	2.29	
 H-20 H-21	R-1 R-1	13.11 12.73	86 87	60 60	73 70	207 165	2.29 2.29	
 H-21 H-22	R-1	12.73	87	60	67	140	2.29	
 H-22 H-23	C-1, C-3	12.75	87	150	63	296	3.12	
H-24	C-1	13.33	86	150	61	288	2.68	
H-25	C-1	13.63	86	150	59	276	2.68	
H-26	R-1	13.34	86	60	76	274	2.29	
H-26	C-5	13.34	86	150	60	274	6.60	J-210 to J-40 (150mm)
H-27	R-1	13.09	86	60	72	186	2.29	· · · · ·
H-27	P-1	13.09	86	150	41	186	6.60	J-210 to J-40 (150mm)





Naturally Refreshed

H-28	R-1	12.84	87	60	68	142	2.29	
H-29	R-1	12.81	87	60	68	139	2.29	
H-30	R-1	13.31	86	60	67	138	2.29	
H-31	R-1	13.11	86	60	71	174	2.29	
H-32	R-1	12.58	87	60	73	180	2.29	
H-32	P-1	12.58	87	150	38	180	5.54	J-212 to J-38 (150mm)
H-33	R-1	14.14	85	60	75	263	2.29	
H-33	P-1	14.14	85	150	58	263	2.65	
H-34	P-1	12.92	87	150	55	239	3.77	J-37 to J-40 (150mm)
H-35	R-1	12.99	87	60	72	185	2.29	
H-36	R-1	13.24	86	60	75	234	2.29	
H-37	R-1	13.53	86	60	74	235	2.29	
H-38	R-1	12.84	87	60	74	207	2.29	
H-39	R-1	12.89	87	60	68	145	2.29	
H-40	R-1	12.81	87	60	70	152	2.29	
H-41	R-1	13.38	86	60	76	274	2.29	
H-42	R-1	12.89	87	60	76	257	2.29	
H-43	CD-2, P-1	13.40	86	150	68	300	2.65	
H-44	R-2	14.66	84	60	74	259	2.29	
H-44	C-5	14.66	84	150	56	259	2.65	
H-45	R-2	14.07	85	60	73	235	2.29	
H-45	C-5	14.07	85	150	53	235	2.65	
H-46	RSR	13.57	86	60	73	223	2.29	
H-46	C-5	13.57	86	150	50	223	2.65	
H-47	R-2	13.17	86	60	74	230	2.29	
H-48	RSR	13.68	86	60	72	200	2.29	
H-49	R-1, R-3	14.24	85	60	71	201	2.29	
H-49	C-5	14.24	85	150	44	201	2.65	
H-50	R-1	13.28	86	60	72	201	2.29	
H-51	R-3	13.89	85	60	69	167	2.29	
H-52	R-1	13.56	86	60	72	199	2.29	
H-53	R-4	13.80	86	90	62	179	2.29	
H-54	R-4	14.43	85	90	63	198	2.29	
H-54	C-5	14.43	85	150	43	198	2.65	
H-55	R-1	14.01	85	60	70	191	2.29	
H-55	C-5	14.01	85	150	41	191	2.65	
H-56	R-1	14.53	84	60	69	184	2.29	
H-56	C-4, C-5	14.53	84	150	38	184	2.65	
H-57	R-1, R-2	13.96	85	60	69	172	2.29	
H-58	R-1	14.24	85	60	68	169	2.29	
H-58	CS	14.24	85	150	33	169	2.65	
H-59	R-1, R-2	14.85	84	60	67	164	2.29	
H-59	C-4	14.85	84	150	30	164	2.65	
H-60	R-2	13.63	86	60	69	165	2.29	
H-60	C-4, C-7	13.63	86	150	31	165	3.09	
H-61	R-1	13.87	85	60	64	131	2.29	
H-62	R-1	12.57	87	60	62	117	2.29	
H-63	R-1	13.57	86	60	68	156	2.29	
H-64	R-1	13.89	85	60	70	177	2.29	
H-65	R-2	14.28	85	60	66	153	2.29	
H-65	C-7	14.28	85	150	24	153	3.09	
H-66	R-3	13.14	86	60	63	117	2.29	
H-67	R-3	13.28	86	60	65	130	2.29	
H-68	R-3	13.79	85	60	60	110	2.29	



#### Table 3: Scenario 3 - Hydrant Requirements - Fire Flow + Max Day Demand

#### Note: Minimum system pressure under Fire Flow Conditions is a 22 PSI as per MMCD Guidelines. Any Failed Hydrants don't meet this requirement. The Fire Flow Flows are based on zone. The following criteria was used:

R-1, R-2, & R-3 minimum fire flow of 60 L/s P-1 minimum fire flow of 60 L/s

R-4 & R-5 minimum fire flow of 90 L/s

C Zone and P-1\* (Existing School and Public Works Building) minimum fire flow of 150 L/s

Label	Zone	Hydrant Elevation (m)	Static Pressure (psi)	Fire Flow (Required) (L/s)	Residual Pressure (psi)	Fire Flow (Available) (L/s) at 22psi Residual Pressure	Velocity of Pipe (m/s) at Fire Flow	Location of highest record velocity in the system	Upgrade Required - Pipe Velocity under 3.5m/s	Upgrade Pipe Length Required (m)
F1	CD-1, C-1	13.00	88	150	49	228	3.89	T-1 to J-4 (300mm)	T-1 to J-4 (350mm)	199
F2	C-1, C-3	13.00	88	150	53	253	3.89	T-1 to J-4 (300mm)	T-1 to J-4 (350mm)	199
F3	R-2	13.58	87	60	52	98	3.40		· · · · · · · · · · · · · · · · · · ·	
F4	R-2	13.78	86	60	64	169	2.62			
F4	C-2	13.78	86	150	31	169	3.89	T-1 to J-4 (300mm)	T-1 to J-4 (350mm)	199
F5 F5	R-2 C-2	13.95 13.95	86 86	60 150	63 28	161 161	2.62 3.89	T-1 to J-4 (300mm)	T-1 to J-4 (350mm)	199
F6	R-2	14.55	85	60	62	153	2.62	1-1 (0 3-4 (3001111)	1-1 (0 3-4 (3301111)	199
F6	C-2	14.55	85	150	24	153	3.89	T-1 to J-4 (300mm)	T-1 to J-4 (350mm)	199
F7	R-2	15.34	84	60	61	149	2.62			
F7	C-2	15.34	84	150	22	149	3.88	T-1 to J-4 (300mm)	T-1 to J-4 (350mm)	199
F8	R-4	14.00	86	90	52	155	3.04			
F8 F9	C-2 R-1	14.00 13.40	86 87	150 60	25	155 174	3.89 2.62	T-1 to J-4 (300mm)	T-1 to J-4 (350mm)	199
F9 F10	R-1	13.40	87	60	65 65	167	2.62			
F10	R-1	13.40	87	60	65	169	2.62			
F12	R-1	12.95	88	60	63	141	2.62			
F13	R-1	12.84	88	60	62	134	2.62			
F14	R-1	12.84	88	60	66	157	2.62			
F15 F16	R-2 R-2	13.38 13.57	87 87	60 60	66 65	165 155	2.62 2.62			
F16 F17	R-2 R-1	13.57	87	60	65	168	2.62			
F18	R-1	13.90	86	60	52	99	3.42			
F19	R-1	14.17	86	60	54	106	3.41			
F20	R-1	13.68	87	60	63	150	2.62			
F21	R-1	13.79	86	60	59	126	3.41			
F22	R-1	14.19	86	60	52	98	3.41			
F23 F24	R-1 R-1	13.40 12.50	87 88	60 60	60 53	126 102	2.62 3.40			
F25	CD	12.50	88	150	25	156	3.89	T-1 to J-4 (300mm)	T-1 to J-4 (350mm)	199
F26	CD	12.50	88	150	24	154	3.89	T-1 to J-4 (300mm)	T-1 to J-4 (350mm)	199
F27	CD	12.50	88	150	24	153	3.89	T-1 to J-4 (300mm)	T-1 to J-4 (350mm)	199
F28	CD	12.50	88	150	23	151	3.89	T-1 to J-4 (300mm)	T-1 to J-4 (350mm)	199
F29	CD	12.50	88	150	22	150	3.89	T-1 to J-4 (300mm)	T-1 to J-4 (350mm)	199
F30 F31	R-1 R-1	13.17 13.23	87 87	60 60	64 67	200 156	2.29 2.29			
H-1	C-1	13.02	86	150	51	242	3.95	T-1 to J-4 (300mm)	T-1 to J-4 (350mm)	199
H-2	C-1	13.15	86	150	48	224	3.89	T-1 to J-4 (300mm)	T-1 to J-4 (350mm)	199
H-3	C-1	13.22	86	150	49	230	3.89	T-1 to J-4 (300mm)	T-1 to J-4 (350mm)	199
H-4	P-1, C-1, C-2, C-3	13.36	86	150	54	261	3.89	T-1 to J-4 (300mm)	T-1 to J-4 (350mm)	199
H-5	C-2, C-3	13.47	86	150	41	196	3.89	T-1 to J-4 (300mm)	T-1 to J-4 (350mm)	199
H-6	C-2	12.76	87	150	33	172	4.77	J-50 to J-202 (200mm)	T-1 to J-4 (350mm) J- 50 to J-202 (250mm)	199 & 66
H-7 H-7	R-2	13.09 13.09	86	60 150	66	184 184	2.62	T 1 to 1 4 (200mm)	T-1 to J-4 (350mm)	100
H-7 H-8	C-2 R-2	13.09	86 87	150 60	37 56	184 105	3.89	T-1 to J-4 (300mm)	1-1 to J-4 (350mm)	199
H-8	R-2, R-3	12.67	87	60	66	172	2.62			
H-10	R-2	13.82	85	60	63	158	2.62			
H-11	R-2	13.75	85	60	64	159	2.62			
H-12	R-2	13.58	86	60	64	166	2.62			
H-12 H-13	R-4 R-4	13.58 14.00	86	90 90	55 54	166 162	3.04 3.10			
H-13 H-14	R-4 R-1, R-2	13.17	85 86	90 60	54 66	185	2.62		+	
H-15	R-1	12.98	86	60	67	186	2.62		1	
H-16	R-1	13.07	86	60	62	135	2.62			
H-17	R-1	12.83	87	60	64	155	2.62			
H-18	R-1	12.96	86	60	60	126	2.62			
H-19 H-20	R-1 R-1	13.05 13.11	86 86	60 60	61 66	129 183	2.62 2.62			
H-20 H-21	R-1 R-1	12.73	86	60	64	183	2.62			
H-22	R-1	12.75	87	60	61	128	2.62		1	
H-23	C-1, C-3	12.44	87	150	55	267	3.89	T-1 to J-4 (300mm)	T-1 to J-4 (350mm)	199
H-24	C-1	13.33	86	150	54	260	3.89	T-1 to J-4 (300mm)	T-1 to J-4 (350mm)	199
H-25	C-1	13.63	86	150	52	248	3.89	T-1 to J-4 (300mm)	T-1 to J-4 (350mm)	199



H-26	R-1	13.34	86	60	71	251	2.62	1		
H-26	C-5	13.34	86	150	53	251	5.79	J-210 to J-40 (150mm)	T-1 to J-4 (350mm) J-210 to J-40 (250mm)	199 & 20
H-27	R-1	13.09	86	60	68	174	2.72		3-21010 3-40 (2301111)	
H-27	P-1	13.09	86	150	34	174	6.61	J-210 to J-40 (150mm)	T-1 to J-4 (350mm) J-37 to J-40 (200mm) J-37 to J-36 (250mm)	199, 51, & 50
H-28	R-1	12.84	87	60	63	133	2.62			
H-29	R-1	12.81	87	60	63	131	2.62			
H-30	R-1	13.31	86	60	62	129	2.62			
H-31	R-1	13.11	86	60	67	162	2.62			
H-32	R-1	12.58	87	60	68	168	2.62			
H-32	P-1	12.58	87	150	32	168	5.57	J-212 to J-38 (150mm)	T-1 to J-4 (350mm) J-38 to J-39 (200mm) J-38 to J-212 (250mm)	199, 61, & 68
H-33	R-1	14.14	85	60	70	242	2.62			
H-33	P-1	14.14	85	150	52	242	3.89	T-1 to J-4 (300mm)	T-1 to J-4 (350mm)	199
H-34	P-1	12.92	87	150	48	220	3.89	J-37 to J-40 (150mm)	T-1 to J-4 (350mm) J-37 to J-40 (200mm) J-38 to J-39 (200mm)	199, 51, & 61
H-35	R-1	12.99	87	60	67	172	2.62			
H-36	R-1	13.24	86	60	69	212	2.62			
H-37	R-1	13.53	86	60	68	211	2.62			
H-38	R-1	12.84	87	60	68	189	2.62			
H-39	R-1	12.89	87	60	64	135	2.62			
H-40	R-1	12.81	87	60	65	142	2.62			
H-41 H-42	R-1 R-1	13.38 12.89	86 87	60 60	71 71	251 235	2.62			
H-42 H-43	CD-2, P-1	12.89	87	150	63	300	2.62 3.89	T-1 to J-4 (300mm)	T 1 to 1 4 (250mm)	199
H-43	R-2	14.66	84	60	69	235	2.62	1-1 10 3-4 (30011111)	T-1 to J-4 (350mm)	199
H-44	C-5	14.66	84	150	50	235	3.89	T-1 to J-4 (300mm)	T-1 to J-4 (350mm)	199
H-45	R-2	14.00	85	60	68	212	2.62	1-110 3-4 (3001111)	1-1 to 3-4 (550mm)	133
H-45	C-5	14.07	85	150	45	212	3.89	T-1 to J-4 (300mm)	T-1 to J-4 (350mm)	199
H-46	RSR	13.57	86	60	68	201	2.62	1 1 10 0 1 (0001111)	1 1 10 0 1 (0001111)	100
H-46	C-5	13.57	86	150	42	201	3.89	T-1 to J-4 (300mm)	T-1 to J-4 (350mm)	199
H-47	R-2	13.17	86	60	69	208	2.62	(		
H-48	RSR	13.68	86	60	66	181	3.40			
H-49	R-1, R-3	14.24	85	60	66	181	2.62			
H-49	C-5	14.24	85	150	36	181	5.93	J-21 to J-217 (150mm)	T-1 to J-4 (350mm) J-21 to J-217 (250mm)	199 & 12
H-50	R-1	13.28	86	60	67	182	3.40			
H-51	R-3	13.89	85	60	64	152	2.62			
H-52	R-1	13.56	86	60	66	179	3.40			
H-53	R-4	13.80	86	90	55	163	3.04			
H-54 H-54	R-4 C-5	14.43 14.43	85 85	90 150	57 35	178 178	3.04 3.89	T-1 to J-4 (300mm)	T-1 to J-4 (350mm)	199
H-54 H-55	R-1	14.43	85	60	65	176	2.62	1-110 3-4 (30011111)	1-1 to 3-4 (330mm)	133
H-55	C-5	14.01	85	150	32	171	3.89	T-1 to J-4 (300mm)	T-1 to J-4 (350mm)	199
H-56	R-1	14.53	84	60	63	165	2.62			
H-56	C-4, C-5	14.53	84	150	29	165	3.89	T-1 to J-4 (300mm)	T-1 to J-4 (350mm)	199
H-57	R-1, R-2	13.96	85	60	63	155	2.62	. ,		
H-58	R-1	14.24	85	60	62	153	2.62			
H-58	CS	14.24	85	150	24	153	3.89	T-1 to J-4 (300mm)	T-1 to J-4 (350mm)	199
H-59	R-1, R-2	14.85	84	60	61	148	2.62			
H-59	C-4	14.85	84	150	21	148	3.86	T-1 to J-4 (300mm)	T-1 to J-4 (350mm)	199
H-60	R-2	13.63	86	60	63	150	2.62	T 4 4 4 (2020	T. 4. 4. 4 (050 )	100
H-60	C-4, C-7	13.63	86	150	22	150	3.89	T-1 to J-4 (300mm)	T-1 to J-4 (350mm)	199
H-61 H-62	R-1 R-1	13.87 12.57	85 87	60 60	59 57	125 112	2.62 2.62			
H-62 H-63	R-1 R-1	12.57	87	60	62	112	2.62			
H-63 H-64	R-1	13.57	85	60	64	142	2.62			
H-65	R-2	14.28	85	60	62	146	2.62			
H-65	C-7	14.28	85	150	20	146	3.84	T-1 to J-4 (300mm)	T-1 to J-4 (350mm)	199
H-66	R-3	13.14	86	60	58	111	3.49			
H-67	R-3	13.28	86	60	61	123	3.49	1		
H-68	R-3	13.79	85	60	55	104	3.49	1	-	
	-									





## **Appendix D - Project Cost Estimates**

Water Master Plan June 2015

	20	1/1 \// ato	r Projoc	ts Cost Estimato	
	20	14 Wale	er Projec	ts Cost Estimate	
HARRISON HOT SPRI		ject:	F	IOT SPRINGS ROAD "A"	
Naturally Refreshed	Loc	ation:		ladway Road to South Miami	
				liver Crossing	Priority:
	Dat	e of Estim	ate: L	December 15, 2014	Target Year:
Project Name:	HOT SPRING	GS ROAL	) "A"	Location:	
Project Description:	Upgrade 375m main from 250 to provide requ commercial zon Springs Road.	mm to 350 uired 150 L	Omm in oro /s fire flov	der v to	
DCC Eligible:	PARTIAL				
Existing Zoning:	C-4, C-7, CS, R-	2			
Project Limits/Address:	Hadway Road t River Crossing 798 - 950 Hot S				
Project Details:					
Pipe Length	•	375 m			
Pipe Size:		350 m			
Tie-ins:			ich		
Land Acquisiton Req'd:	None			Site Photograph:	
Total Land Cost:	\$0.00				
Design Consultants: Drawing Number:	N/A N/A				
Related Road Projects:		TBD			1 an see
Related Sanitary Sewer	Projects:	TBD			
Related Drainage Proje	cts:	TBD			
Cost Est	imate Summary			Notes:	
Construction:	innate Summary ذ		2,250.00		indicates inadequate Fire Flows
Contingency (Level C):	ې \$		5,562.50	(residual pressures) a	
Engineering & CA	\$		,337.50	2. Dewatering & geot	technical specialists may be
Specialists:	Ś		675.00	required	. ,
	Subtotal: \$		,825.00	3. Suitable subgrade assumed	and imported bedding material
Land	Acquisition: \$			4. Area currently serv Utility	viced by private wells or VHS

Land Acquisition: \$

377,825.00

Total Project Cost: \$

5. Ministry of Transportation permitting and Traffic Management Plan required for work on Hot Springs Road

#### Village of Harrison Hot Springs Watermain Upgrade - Hot Springs Road - Part A Requirements to address current (2014) system deficiency Class 'C' Cost Estimate



December 15, 2014

Item	MMCD	Payment	Specification Title - Item Description	Unit	Quantity	Unit Price		Amount
	Section eral MMCI	Item Contract	Requirements		,	l	L	
o ocno		oonnaci	requirements				Ι	
	01 33 01	1.8.1	Project Record Documents	Note		Incidental		
1.1	01 55 00	1.5.1	Traffic Control, Vehicle Access and Parking	Lump Sum	1	\$ 25,000.00	\$	25,000.0
							Ŷ	20,000.0
	01 58 01	1.3.1	Project Identification	Note		Incidental		
ection 1	Sub-Total						\$	25,000.0
) Eart	hworks a	nd Site Pre	paration (MMCD Section 31)					
2.1	31 23 01	1.10.4	Excavating, Trenching and Backfilling Underground Utility Removal and Disposal of Existing 250mm Watermain	Lineal Meter	375	\$ 80.00	\$	30,000.0
				Lindarmotor	0.0	φ 00.00	Ť	00,000.0
	31 24 13		Roadway Excavation, Embankment and Compaction					
2.2		1.8.4	Remove Existing Asphalt, Curbs and Gutters, Sidewalks, Utility Strips, Driveways	Square Meter	1125	\$ 10.00	\$	11,250.0
ction 2	Sub-Total						\$	41,250.0
) Road	ds and Site	e Improvei	nent (MMCD Section 32)					
3.1	32 12 16		Hot-Mix Asphalt Concrete Paving	Lineal Meters	750	¢ 7.50	\$	5,625.0
3.1		1.5.7 1.5.8	Saw Cut Asphalt Permanent Pavement Restoration (including all base gravels and subgrade prep.)	Square Meters	1125	\$ 7.50 \$ 45.00	э \$	50,625.0
			· · · · · · · · · · · · · · · · · · ·			• • • • • •	·	
	32 17 23		Painted Pavement Markings			<b>A 750.00</b>		750.0
3.3		1.5.2	Permanent Painted Pavement Markings	Lump Sum	1	\$ 750.00	\$	750.0
ction 3	Sub-Total						\$	57,000.0
0 Utilit	ies (MMCI	D Section 3	3)					
4.1	33 11 01	1.8.1, 1.8.2	Waterworks 350mm DR18 PVC Watermain - Native Backfill	Lineal Meters	375	\$ 200.00	\$	75,000.0
4.1		1.8.3	350mm Gate Valve	Each	1	\$ 2,500.00	\$	2,500.0
4.3		1.8.3	Tee - 350mm X 350mm X 150mm (includes Hydrant tie-in)	Each	2	\$ 1,500.00	\$	3,000.0
4.4		1.8.4	Water Service Re-Connections	Each	14	\$ 750.00	\$	10,500.0
16		1.8.13						0 000 0
4.5		1.0.10	Watermain Tie-In - Pipe work by Contractor	Each	2	\$ 4,000.00	\$	8,000.C
	Sub-Total		watermain ne-in - Pipe work by Contractor	Each	2	\$ 4,000.00	\$ \$	8,000.0 <b>99,000.0</b>
ction 4	Sub-Total			Each	2	\$ 4,000.00		99,000.0
ction 4 b-Total				Each	2	\$ 4,000.00	\$	99,000.0
ction 4 b-Total	of Section			Each	2	\$ 4,000.00	\$	99,000.0
ction 4 b-Total 0 Soft	of Section		Soft Costs	Each	2		\$	99,000.0 222,250.0
ction 4 b-Total ) Soft 5.1	of Section		Soft Costs Engineering & CA		2	15%	\$ \$	99,000.0 222,250.0 33,337.5
5.1 5.2	of Section		Soft Costs	Each	2		\$	99,000.0 222,250.0 33,337.5 55,562.5
5.1 5.2 5.3	of Section		Soft Costs Engineering & CA Contingency		2	15% 25%	\$ \$	99,000.0 222,250.0 33,337.5 55,562.5
ction 4 b-Total 0 Soft 5.1 5.2 5.3 5.4	of Section		Soft Costs Engineering & CA Contingency Provisonal for Dewatering Cost	c		15% 25% 30%	\$ \$ \$ \$ \$	99,000.0 222,250.0 33,337.5 55,562.5 66,675.0
ction 4 b-Total 0 Soft 5.1 5.2 5.3 5.4	of Section *		Soft Costs Engineering & CA Contingency Provisonal for Dewatering Cost	c		15% 25% 30%	\$ \$ \$ \$ \$	99,000.0 222,250.0 33,337.5 55,562.5 66,675.0 -
ction 4 b-Total 0 Soft 5.2 5.3 5.4 ction 5	of Section *	1 to 4	Soft Costs Engineering & CA Contingency Provisonal for Dewatering Cost	c		15% 25% 30%	\$ \$ \$ \$ \$	99,000.0 222,250.0 33,337.5 55,562.6 66,675.0 -

ASSUMPTIONS:

1. Proposed watermain replacement to be installed on Hot Springs Road from Hadway Drive, South to Miami River

	2014 \	Nater Proj	ects Cost Estimate	
HARRISON HOT SPRI Naturally Refreshed	Location	ı: Estimate:	HOT SPRINGS ROAD "B" South Miami River Crossing to Holiday Park Entrance December 16, 2014	Priority: Target Year:
Project Name:	HOT SPRINGS R	ROAD "B"	Location:	
Project Description:	Upgrade 125m of ex main from 250mm to provide required commercial zoned p Springs Road.	to 350mm in 150 L/s fire f	order low to	
DCC Eligible:	PARTIAL			
Existing Zoning:	C-4, C-7, R-2		A Constant	
Project Limits/Address	: South Miami River ( Holiday Park Entran 950 - 962 Hot Sprin	ce	teministerior Politikation Contractioner Con	
Project Details: Pipe Length Pipe Size: Tie-ins:	n: 125 350 2	m mm each		
Land Acquisiton Req'd:	None		Site Photograph:	
Total Land Cost:	\$0.00			
Design Consultants: Drawing Number:	N/A N/A			
Related Road Projects: Related Sanitary Sewer Related Drainage Proje	Projects: TBD			
	timate Summary		Notes:	
Construction: Contingency (Level C):	\$ ¢	125,250.00 31,312.50		Il drilling at Miami River Il indicates inadequate Fire
Engineering & CA	ې \$	18,787.50	Elever (mestales la meser	res) available for zoning
Specialists:	\$ Subtotal : \$	50,100.00 <b>225,450.00</b>	3. Dewatering, enviro	nmental & geotechnical uired
	σαστοταί τη φ	223,730.00		and imported bedding material
Land	Acquisition: \$	-		ortation permitting and Traffic uired for work on Hot Springs

5. Ministry of Transportation permitting and Traffic Management Plan required for work on Hot Springs Road

Total Project Cost: \$

: \$ 225,450.00

#### Village of Harrison Hot Springs Watermain Upgrade - HOT SPRINGS ROAD "B" Requirements to service full buildout/ development (future) Class 'C' Cost Estimate



December 15, 2014

Itom	MMCD	Payment	Specification Title I tom Description	Linit	Quantity	Linit Price		Amount
Item	Section	Item	Specification Title - Item Description	Unit	Quantity	Unit Price		Amount
Genel		Contract	Requirements				[	
	01 33 01	1.8.1	Project Record Documents	Note		Incidental		
1.1	01 55 00	1.5.1	Traffic Control, Vehicle Access and Parking	Lump Sum	1	\$ 12,500.00	\$	12,500.00
1.2	01 57 01	1.6.1	Environmental Protection (River Crossing)	Lump Sum	1	\$ 10,000.00	\$	10,000.00
	01 58 01	1.3.1	Project Identification	Note		Incidental		
ection 1 S	Sub-Total						\$	22,500.00
.0 Earth	hworks a	nd Site Pre	eparation (MMCD Section 31)	Γ	ſ	I	I	
2.1	31 23 01	1.10.4	Excavating, Trenching and Backfilling Underground Utility Removal and Disposal of Existing 250mm Watermain	Lineal Meter	75	\$ 80.00	\$	6,000.00
2.2	31 24 13	1.8.4	Roadway Excavation, Embankment and Compaction Remove Existing Asphalt, Curbs and Gutters, Sidewalks, Utility Strips, Driveways	Square Meter	300	\$ 10.00	\$	3,000.00
ection 2 S	Sub-Total					I	\$	9,000.00
.0 Road	Is and Site	e Improvei	ment (MMCD Section 32)					
	32 12 16							
3.1	32 12 16	1.5.7	Hot-Mix Asphalt Concrete Paving Saw Cut Asphalt	Lineal Meters	200	\$ 7.50	\$	1,500.0
3.2		1.5.8	Permanent Pavement Restoration (including all base gravels and subgrade prep.)	Square Meters	300	\$ 45.00	\$	13,500.0
3.3	32 17 23	1.5.2	Painted Pavement Markings Permanent Painted Pavement Markings	Lump Sum	1	\$ 250.00	\$	250.00
ection 3 S	Sub-Total						\$	15,250.00
.0 Utiliti	ies (MMCI	D Section 3	33)					
	33 11 01		Waterworks					
4.1		1.8.1, 1.8.2	350mm DR18 PVC Watermain - Native Backfill	Lineal Meters	75	\$ 200.00	\$	15,000.0
4.2		1.8.1, 1.8.2	350mm HDPE Watermain - Maimi River Crossing (including all bends and fittings)	Lineal Meters	50 1	\$ 1,000.00 \$ 2,500.00	\$ \$	50,000.0 2,500.0
4.3 4.4		1.8.3 1.8.3	350mm Gate Valve Tee - 350mm X 350mm X 150mm (includes Hydrant tie-in)	Each Each	1	\$ 2,500.00 \$ 1,500.00	э \$	2,500.0
4.5		1.8.4	Water Service Re-Connections	Each	2	\$ 750.00	\$	1,500.0
4.6		1.8.13	Watermain Tie-In - Pipe work by Contractor	Each	2	\$ 4,000.00	\$	8,000.0
ection 4 S	Sub-Total						\$	78,500.0
ib-Total o	of Section	1 to 4					\$	125,250.0
0 Soft	Costs					ſ	T	
			Soft Costs					
5.1			Engineering & CA			15%	\$	18,787.5
5.2			Contingency	С		25%		31,312.5
5.3 5.4			Environmental Management Plan, Monitoring and Permitting Provisonal for Dewatering Cost			10% 30%		12,525.0 37,575.0
5.5			Land Acquisition	Square Meters	0	\$ -	\$	-
ection 5 S	Sub-Total						\$	100,200.0
								225,450.00
otal (not							\$	

ASSUMPTIONS:

1 Proposed watermain replacement to be installed on Hot Springs Road from Miami River to Harrison Holiday Park entrance

		2014 W	ater Pro	jects Cost Estimate	
HARRISON HOT SPR Naturally Refresh		Project: Location: Date of E		VILLAGE CENTRE LOOP Lilloet Ave., St. Alice Str & Cedar Ave. December 15, 2014	eet, Priority: Target Year:
Project Name:	VILLAGE	CENTRE	LOOP	Location:	
Project Description:	Construct 2 to service a protection and St. Alio	and provid to Lillooet	e adequate Avenue, C	efire edar	
DCC Eligible:	PARTIAL (D	evelopme	nt Dependo	ent)	
Existing Zoning:	C-1, C-2, C-	-3			
Project Limits/Address	s: Lilloet Ave 114 -160 C 140 Lillooe	edar Ave.	Street, & Co	edar Ave	
Project Details:					
Pipe Lengt	h:	250	m		
Pipe Size:		250	mm	C. T. B. S.	9 Harrison Country
Tie-ins:		2	each		Club RV
Fire Hydra	nts:	2	each	ton be	
Water Serv	vices:	10	each		
Land Acquisiton Req'd	: None			Site Photograph:	
Total Land Cost:	\$0.00				
Design Consultants:	N/A			<b>新学校</b>	
Drawing Number:	N/A				Marca De
Related Road Projects		TBD			
Related Sanitary Sewe Related Drainage Proj	•	TBD TBD			
Cost Es	stimate Sumr	nary		Notes:	

1. Hydrant work to be completed as soon as possible to provide adequate fire protection

2. Dewatering and geotechnical specialists may be required

3. Suitable subgrade and imported bedding material assumed

4. Area currently serviced by private wells

Total Project Cost: \$

Construction:

Specialists:

Contingency (Level C):

Engineering & CA

Land Acquisition:

173,600.00

\$

\$

\$

\$

\$

Subtotal A: \$

99,200.00

24,800.00

14,880.00

34,720.00

173,600.00

#### Village of Harrison Hot Springs Village Center Loop Requirements to service all properties (future) Class 'C' Cost Estimate



December 15, 2014

Item	MMCD	Payment	Specification Title - Item Description	Unit	Quantity		Unit Price		Amount
1.0 Gene	eral MMCI	Contract	t Requirements						
	01 33 01	1.8.1	Project Record Documents	Note			Incidental		
1.1	01 55 00	1.5.1	Traffic Control, Vehicle Access and Parking	Lump Sum	1	\$	1,000.00	\$	1,000.00
	01 58 01	1.3.1	Project Identification	Note			Incidental		
Section 1	Sub-Total							\$	1,000.00
2.0 Eart	thworks a	nd Site Pro	eparation (MMCD Section 31)	F		1		r	
	31 24 13		Roadway Excavation, Embankment and Compaction						
2.1	31 24 13	1.8.4	Remove Existing Asphalt, Curbs and Gutters, Sidewalks, Utility Strips, Driveways	Square Meter	750	\$	10.00	\$	7,500.00
		-	······································			·		·	,
Section 2	Sub-Total							\$	7,500.00
3.0 Road	ds and Sit	e Improve	ment (MMCD Section 32)	-	-				
	22 42 46		Hat Mix Ashbak Constate Daving						
3.1	32 12 16	1.5.7	Hot-Mix Asphalt Concrete Paving Saw Cut Asphalt	Lineal Meters	500	\$	7.50	\$	3,750.00
3.2		1.5.8	Permanent Pavement Restoration (including all base gravels and subgrade prep.)	Square Meters	750	\$	35.00	\$	26,250.00
Section 3	Sub-Total							\$	30,000.00
4.0 Utilit	ties (MMC	D Section	33)	Γ	ſ	1		1	
	33 11 01		Waterworks						
4.1	33 11 01	1.8.1, 1.8.2	250mm DR18 PVC Watermain - Native Backfill	Lineal Meters	250	\$	150.00	\$	37,500.00
									3,600.00
4.1		1.8.3	250mm Gate Valve	Each	2	\$	1,800.00	\$	
			250mm Gate Valve Hydrant Assembly - Standard Drawing W4	Each Each	2 1	\$ \$	1,800.00 5,600.00	\$	5,600.00
4.2 4.3 4.4		1.8.3 1.8.4	Hydrant Assembly - Standard Drawing W4 Water Services	Each Each	1 10	\$ \$	5,600.00 1,100.00	\$ \$	5,600.00 11,000.00
4.2 4.3		1.8.3	Hydrant Assembly - Standard Drawing W4	Each	1	\$	5,600.00	\$ \$	5,600.00
4.2 4.3 4.4 4.5	Sub-Total	1.8.3 1.8.4	Hydrant Assembly - Standard Drawing W4 Water Services	Each Each	1 10	\$ \$	5,600.00 1,100.00	\$ \$	5,600.00 11,000.00
4.2 4.3 4.4 4.5 Section 4		1.8.3 1.8.4 1.8.13	Hydrant Assembly - Standard Drawing W4 Water Services	Each Each	1 10	\$ \$	5,600.00 1,100.00	\$ \$ <b>\$</b>	5,600.00 11,000.00 3,000.00 <b>60,700.00</b>
4.2 4.3 4.4 4.5 Section 4	I of Section	1.8.3 1.8.4 1.8.13	Hydrant Assembly - Standard Drawing W4 Water Services	Each Each	1 10	\$ \$	5,600.00 1,100.00	\$ \$ \$	5,600.00 11,000.00 3,000.00
4.2 4.3 4.4 4.5 Section 4	I of Section	1.8.3 1.8.4 1.8.13	Hydrant Assembly - Standard Drawing W4 Water Services	Each Each	1 10	\$ \$	5,600.00 1,100.00	\$ \$ <b>\$</b>	5,600.00 11,000.00 3,000.00 <b>60,700.00</b>
4.2 4.3 4.4 4.5 Section 4	I of Section	1.8.3 1.8.4 1.8.13	Hydrant Assembly - Standard Drawing W4 Water Services Watermain Tie-In - Pipe work by Contractor	Each Each	1 10	\$ \$	5,600.00 1,100.00	\$ \$ <b>\$</b>	5,600.00 11,000.00 3,000.00 <b>60,700.00</b>
4.2 4.3 4.4 4.5 Section 4	I of Section	1.8.3 1.8.4 1.8.13	Hydrant Assembly - Standard Drawing W4 Water Services	Each Each	1 10	\$ \$	5,600.00 1,100.00	\$ \$ \$	5,600.00 11,000.00 3,000.00 <b>60,700.00</b>
4.2 4.3 4.4 4.5 Section 4 Sub-Total 5.0 Soft	I of Section	1.8.3 1.8.4 1.8.13	Hydrant Assembly - Standard Drawing W4 Water Services Watermain Tie-In - Pipe work by Contractor	Each Each	1 10	\$ \$	5,600.00 1,100.00 1,500.00	\$ \$ \$	5,600.00 11,000.00 3,000.00 60,700.00 99,200.00
4.2 4.3 4.4 4.5 Section 4 Sub-Total 5.0 Soft 5.1 5.2 5.3	I of Section	1.8.3 1.8.4 1.8.13	Hydrant Assembly - Standard Drawing W4 Water Services Watermain Tie-In - Pipe work by Contractor	Each Each Each	1 10 2	\$	5,600.00 1,100.00 1,500.00	\$ \$ \$ \$ \$ \$ \$ \$ \$	5,600.00 11,000.00 3,000.00 <b>60,700.00</b> <b>99,200.00</b> 14,880.00
4.2 4.3 4.4 4.5 Section 4 Sub-Total 5.0 Soft 5.1 5.2	I of Section	1.8.3 1.8.4 1.8.13	Hydrant Assembly - Standard Drawing W4 Water Services Watermain Tie-In - Pipe work by Contractor	Each Each Each	1 10	\$ \$	5,600.00 1,100.00 1,500.00 1,500.00	\$ \$ \$ \$ \$	5,600.00 11,000.00 3,000.00 99,200.00 99,200.00 14,880.00 24,800.00
4.2 4.3 4.4 4.5 Section 4 Sub-Total 5.0 Soft 5.1 5.2 5.3 5.4	I of Section	1.8.3 1.8.4 1.8.13	Hydrant Assembly - Standard Drawing W4 Water Services Watermain Tie-In - Pipe work by Contractor	Each Each Each	1 10 2	\$	5,600.00 1,100.00 1,500.00 1500.00 15% 25% 35%	\$ \$ \$ \$ \$ \$ \$ \$ \$	5,600.00 11,000.00 3,000.00 99,200.00 99,200.00 14,880.00 24,800.00
4.2 4.3 4.4 4.5 Section 4 Sub-Total 5.0 Soft 5.1 5.2 5.3 5.4	t Costs	1.8.3 1.8.4 1.8.13	Hydrant Assembly - Standard Drawing W4 Water Services Watermain Tie-In - Pipe work by Contractor	Each Each Each	1 10 2	\$	5,600.00 1,100.00 1,500.00 1500.00 15% 25% 35%	\$ \$ \$ <b>\$</b>	5,600.00 11,000.00 3,000.00 99,200.00 99,200.00 14,880.00 24,800.00 34,720.00
4.2 4.3 4.4 4.5 Section 4 Sub-Total 5.0 Soft 5.1 5.2 5.3 5.4 Section 5	t Costs	1.8.3 1.8.4 1.8.13	Hydrant Assembly - Standard Drawing W4 Water Services Watermain Tie-In - Pipe work by Contractor	Each Each Each	1 10 2	\$	5,600.00 1,100.00 1,500.00 1500.00 15% 25% 35%	\$ \$ \$ <b>\$</b>	5,600.00 11,000.00 3,000.00 99,200.00 99,200.00 14,880.00 24,800.00 34,720.00

ASSUMPTIONS:

1. Proposed watermain to be installed on the following streets: Lillooet Avenue (West), ST. Alice Street, and Cedar Ave.

## 2014 Water Projects Cost Estimate

HARRISON HOT SPRIN Naturally Refreshed	Location:	LAKESHORE RESIDENTIAL Lilloet Ave. & Bear Ave.		
8)			Priority:	
	Date of Estimate:	December 15, 2014	Target Year:	
Project Name:	LAKESHORE RESIDENTIAL	Location:		

#### Project Name: LAKESHORE RESIDENTIAL

Project Description: Construct 705m of 150/200mm watermain to service and provide adequate fire protection to Lillooet Avenue and Bear Avenue

DCC Eligible:	PARTIAL (D	evelopmer	it Dependent)
Existing Zoning:	C-2, R-1, R-4	4	
Project Limits/Address:	440 - 574 Li 339 - 430 B		
Project Details:			
Pipe Length	:	115/590	m
Pipe Size:		150/200	mm
Tie-ins:		0	each
Fire Hydrant	ts:	27	each
Water Servi	ces:	0	each

Land Acquisiton Req'd: None Total Land Cost: \$0.00 Design Consultants: N/A **Drawing Number:** N/A **Related Road Projects:** TBD **Related Sanitary Sewer Projects:** TBD Related Drainage Projects: TBD

Cost Estimate Sumn	nary	
Construction:	\$	266,650.00
Contingency (Level C):	\$	66,662.50
Engineering & CA	\$	39,997.50
Specialists:	\$	53,330.00
Subtotal:	\$	426,640.00
Land Acquisition:	\$	-
Total Project Cost:	\$	426,640.00



## Site Photograph:



#### Notes:

- 1. Hydrant work to be completed as soon as possible to provide adequate fire protection
- 2. Dewatering and geotechnical specialists may be required
- 3. Suitable subgrade and imported bedding material assumed
- 4. Area currently serviced by private wells
- 5. Ministry of Transportation permitting required for work on Lillooet

#### Village of Harrison Hot Springs Lakeshore Residential Requirements to service all properties (future) Class 'C' Cost Estimate



December 15, 2014

Item	MMCD Section	Payment	Specification Title - Item Description	Unit	Quantity		Unit Price		Amount
.0 Gen	eral MMC		Requirements						
	01 22 01	4.0.4	Preiast Descrid Desumants	Nata			Incidental		
	01 33 01	1.8.1	Project Record Documents	Note			Incidental		
1.1	01 55 00	1.5.1	Traffic Control, Vehicle Access and Parking	Lump Sum	1	\$	1,000.00	\$	1,000.0
	04 50 04		Paris of Island Gradien	N1-1-			Incidental		
	01 58 01	1.3.1	Project Identification	Note			Incidental		
ection 1	Sub-Total							\$	1,000.0
.0 Eart	thworks a	nd Site Pre	eparation (MMCD Section 31)						
2.1	31 24 13	1.8.4	Roadway Excavation, Embankment and Compaction Remove Existing Asphalt, Curbs and Gutters, Sidewalks, Utility Strips, Driveways	Square Meter	2115	\$	10.00	\$	21,150.0
2.1		1.0.4	Remove Existing Asphalt, ourbs and outlets, Sidewaiks, ouncy Strips, Driveways	Oquare meter	2110	Ŷ	10.00	Ŷ	21,100.
ection 2	Sub-Total							\$	21,150.0
								Ψ	21,130.0
.0 Roa	ds and Sit	e Improve	ment (MMCD Section 32)			1			
	32 12 16		Hot-Mix Asphalt Concrete Paving						
3.1		1.5.7	Saw Cut Asphalt	Lineal Meters	1410	\$	7.50	\$	10,575.0
3.2		1.5.8	Permanent Pavement Restoration (including all base gravels and subgrade prep.)	Square Meters	2115	\$	35.00	\$	74,025.0
ection 3	Sub-Total							\$	84,600.0
.0 Utilit	ties (MMCI	D Section 3	33)	ſ	1	r			
	33 11 01		Waterworks						
4.1	00 11 01	1.8.1, 1.8.2	200mm DR18 PVC Watermain - Native Backfill	Lineal Meters	590	\$	125.00	\$	73,750.0
4.2		1.8.1, 1.8.2	150mm DR18 PVC Watermain - Native Backfill	Lineal Meters	115	\$	100.00	\$	11,500.0
4.3		1.8.3	200mm Gate Valve	Each	3	\$	1,300.00	\$	3,900.
4.4		1.8.3	150mm Gate Valve	Each	1	\$	1,200.00	\$	1,200.0
4.5		1.8.3	Tee - 200mm X 200mm X 150mm	Each	1	\$	800.00	\$	800.
4.6		1.8.3	Tee - 200mm X 200mm X 200mm	Each	1	\$	950.00	\$	950.
4.7		1.8.3	Blind Flange 200mm diameter	Each	1	\$	500.00	\$	500.
4.8			Hydrant Assembly - Standard Drawing W4	Each	6	\$ \$	5,600.00 1,000.00	\$	33,600.0
4.9 4.10		1.8.5 1.8.4	Blow-Off Assembly - Standard Drawing W8 Water Services	Each Each	1 27	э \$	1,100.00	\$ \$	1,000.0 29,700.0
4.10		1.8.4	Water Services Watermain Tie-In - Pipe work by Contractor	Each	27	э \$	1,500.00	э \$	3,000.
4.11		1.6.15		Edui	2	Ψ	1,300.00	Ψ	5,000.0
ection 4	Sub-Total							\$	159,900.
ub-Total	of Section	1 to 4						\$	266,650.0
.0 Soft	t Costs								
			Soft Costs				150/	•	
5.1 5.2			Engineering & CA	6		1	15% 25%	\$	39,997.
			Contingency	С				\$	66,662.
5.3 5.4			Provisonal for Dewatering Cost Land Acquisition	Square Meters	0	\$	20%	\$ \$	53,330.
0.4			anna , adhioniai.	Square Meters	0	Ŷ	-	Ψ	-
ection 5	Sub-Total							\$	159,990.
									,
otal (n	ot includir	iq taxes)						\$	426,640.0
2.001 (11)		3						*	,
CLIMD									

ASSUMPTIONS:

1 Proposed watermain to be installed on the following streets: Lillooet Avenue (East), Bear Avenue, & Mount Street

		2014 W	/ater Proje	ects Co	ost Estimate	
HARRISON HOT SPR Naturally Refreshe		Project: Location:		Naismi	ITH AND MOUNT th Ave & Mount S	Priority:
		Date of E	stimate:	Decem	ber 15, 2014	Target Year:
Project Name:	NAISMI	TH AND	MOUNT		Location:	
Project Description:	to service protectior	and provid n to Naismi	00mm water le adequate f th Avenue ar op the systen	fire nd		
DCC Eligible:	NO					
Existing Zoning:	R-1					
Project Limits/Address	: 505 -565 N	Naismith Av	ve		A CA	
Project Details:					Provide and a second	
Pipe Lengtl	n:	595	m		HE STATE	
Pipe Size:		200	mm		THAN CON	
Tie-ins:		3	each			
Fire Hydrar		3	each			
Water Serv	ices:	25	each			
Land Acquisiton Req'd	: None				Site Photograph:	
Total Land Cost:	\$0.00					
Design Consultants: Drawing Number:	N/A N/A					
Related Road Projects		TBD				
Related Sanitary Sewe	-	TBD				
Related Drainage Proje	ects:	TBD				-//
Cost_Es	timate Sum	mary			Notes:	
Construction:		\$	213,525.00			rk to be completed as soon as possible
Contingency (Level C):		\$	53,381.25		to provide ade	quate fire protection
Engineering & CA		\$	32,028.75		2. Dewatering	and geotechnical specialists may be
Specialists:		\$	42,705.00		required	

3. Suitable subgrade and imported bedding material assumed

4. Area currently serviced by private wells

Total Project Cost: \$

Land Acquisition: \$

Subtotal: \$

# \$ 341,640.00

341,640.00

#### Village of Harrison Hot Springs Naismith and Mount Requirements to service all properties (future) Class 'C' Cost Estimate



December 15, 2014

Item	MMCD Section	Payment	Specification Title - Item Description	Unit	Quantity	Unit Price		Amount
.0 Gene	eral MMC	O Contract	Requirements					
	01 33 01	1.8.1	Project Record Documents	Note		Incidental		
1.1	01 55 00	1.5.1	Traffic Control, Vehicle Access and Parking	Lump Sum	1	\$ 500.00	\$	500.00
	01 58 01	1.3.1	Project Identification	Note		Incidental		
Section 1	Sub-Total						\$	500.0
0 Eart	hwarko o	ad Site Dr	Anarotion (MMCD Section 24)					
.0 Earl	Inworks a		eparation (MMCD Section 31)				T	
	31 24 13		Roadway Excavation, Embankment and Compaction					
2.1		1.8.4	Remove Existing Asphalt, Curbs and Gutters, Sidewalks, Utility Strips, Driveways	Square Meter	1785	\$ 10.00	\$	17,850.0
ection 2	Sub-Total						\$	17,850.0
.0 Road	ds and Sit	e Improve	ment (MMCD Section 32)					
	00 40 40		Hat Min Analak Osmanda Devina					
3.1	32 12 16	1.5.7	Hot-Mix Asphalt Concrete Paving Saw Cut Asphalt	Lineal Meters	1190	\$ 7.50	\$	8,925.0
3.2		1.5.8	Permanent Pavement Restoration (including all base gravels and subgrade prep.)	Square Meters	1785	\$ 35.00	\$	62,475.0
ection 3	Sub-Total						\$	71,400.00
.0 Utilit	ties (MMCI	D Section 3	33)					
4.1	33 11 01		Waterworks	1.	EOE	\$ 125.00	¢	74,375.0
4.1 4.2		1.8.1, 1.8.2 1.8.3	200mm DR18 PVC Watermain - Native Backfill 200mm Gate Valve	Lineal Meters Each	595 3	\$ 125.00 \$ 1,300.00	\$ \$	74,375.0 3,900.0
4.3		1.8.3	Tee - 200mm X 200mm X 200mm	Each	1	\$ 950.00	\$	950.0
4.4		1.0.5	Hydrant Assembly - Standard Drawing W4	Each	3	\$ 5,600.00	\$	16,800.0
4.5		1.8.4	25mm Water Service Connections	Each	25	\$ 850.00	\$	21,250.0
4.6		1.8.11	200mm Hot Tapping c/w valve	Each	1	\$ 3,500.00	\$	3,500.0
4.7		1.8.13	Watermain Tie-In - Pipe work by Contractor	Each	2	\$ 1,500.00	\$	3,000.0
ection 4	Sub-Total						\$	123,775.0
Sub-Total	l of Section	1 to 4					\$	213,525.00
0.0-4	Casta							
.0 Soft	Costs					[	I –	
			Soft Costs					
5.1			Engineering & CA			15%	\$	32,028.7
5.2			Contingency	С		25%	\$	53,381.2
5.3			Provisonal for Dewatering Cost			20%	\$	42,705.00
5.4			Land Acquisition	Square Meters	0	\$-	\$	-
ection 5	Sub-Total						\$	128,115.0
otal (no	ot includir	ig taxes)					\$	341,640.00
SSUMP	TIONS							

ASSUMPTIONS: 1. Proposed watermain to be installed on the following streets: Naismith Avenue & Mount Street

		2014 W	ater Proj	ects Cost Estimate	е
HARRISON HOT SPRI Naturally Refreshed		Project: Location:		DIAMOND AND EME Emerald Ave & Diam	ond Street Priority:
		Date of Es	timate:	December 15, 2014	Target Year:
Project Name:				Location:	
	DIAMO	ND AND E	EMERALD		
Project Description:	to service a protection	50m of 100/ nd provide a to Emerald A loop the syst	dequate fire ve and Diam	State .	
DCC Eligible:	NO				
Existing Zoning:	R-1			13	
Project Limits/Address:	400 - 470	Emerald Ave	e		
	750 -795 [	Diamond Str	eet		
Project Details: Pipe Length		295/55	m	121.12	
Pipe Size:	•	150/100	mm	B'	
Tie-ins:		2	each		MALER A LA
Fire Hydran	tc·	1	each		
Water Servi		23	each		
			0000		
Land Acquisiton Req'd:	None			Site Photograp	bh:
Total Land Cost:	\$0.00			S. A. M.	
Design Consultants:	N/A				
Drawing Number:	N/A				
Related Road Projects:		TBD			
Related Sanitary Sewer	Projects:	TBD		The second	
Related Drainage Proje	cts:	TBD			
Cost Est	imate Sum	mary		Notes:	
Construction:	annate Sunn		129,300.00		nt work to be completed as soon as possible
Contingency (Level C):		\$	32,325.00		adequate fire protection
		Υ 	10 205 00		aring and gootochnical chasialists may be

19,395.00

25,860.00

206,880.00

206,880.00

\_

\$ \$

Subtotal: \$

2. Dewatering and geotechnical specialists may be required

3. Suitable subgrade and imported bedding material assumed

4. Area currently serviced by private wells

Total Project Cost: \$

Land Acquisition: \$

Engineering & CA

Specialists:

#### Village of Harrison Hot Springs Emerald and Diamond Requirements to service all properties (future) Class 'C' Cost Estimate



December 15, 2014

T	MAG	Dourse				1			
Item	MMCD Section	Payment Item	Specification Title - Item Description	Unit	Quantity		Unit Price		Amount
.0 Gene	ral MMCD	Contract	Requirements		1	1		1	
	01 33 01	1.8.1	Project Record Documents	Note			Incidental		
						•	500.00	•	500.0
1.1	01 55 00	1.5.1	Traffic Control, Vehicle Access and Parking	Lump Sum	1	\$	500.00	\$	500.0
	01 58 01	1.3.1	Project Identification	Note			Incidental		
ection 1 \$	Sub-Total							\$	500.0
.0 Earti	hworks ar	d Site Pre	eparation (MMCD Section 31)						
	31 24 13		Roadway Excavation, Embankment and Compaction						
2.1	51 24 15	1.8.4	Remove Existing Asphalt, Curbs and Gutters, Sidewalks, Utility Strips, Driveways	Square Meter	1050	\$	10.00	\$	10,500.0
ection 2 \$	Sub-Total							\$	10,500.0
.0 Road	Is and Site	e Improvei	ment (MMCD Section 32)		ī	1			
	32 12 16		Hot-Mix Asphalt Concrete Paving						
3.1		1.5.7	Saw Cut Asphalt	Lineal Meters	700	\$	7.50		5,250.0
3.2		1.5.8	Permanent Pavement Restoration (including all base gravels and subgrade prep.)	Square Meters	1050	\$	35.00	\$	36,750.0
ection 3 S	Sub-Total							\$	42,000.0
.0 Utiliti	ies (MMCI	O Section 3	33)						
4.1	33 11 01	1.8.1, 1.8.2	Waterworks 150mm DR18 PVC Watermain - Native Backfill	Lineal Meters	295	\$	100.00	\$	29,500.0
4.2		1.8.1, 1.8.2	100mm DR18 PVC Watermain - Native Backfill	Lineal Meters	55	\$	90.00	\$	4,950.0
4.3		1.8.3	150mm Gate Valve	Each	2	\$	1,000.00	\$	2,000.0
4.4		1.8.3	100mm Gate Valve	Each	1	\$	850.00	\$	850.0
4.5		1.8.3	Tee - 150mm X 150mm X 100mm	Each	1	\$	600.00		600.0
4.6			Hydrant Assembly - Standard Drawing W4	Each	1	\$	5,600.00		5,600.0
4.7 4.8		1.8.3	Reducer - 150mm x 100mm diameter	Each	1	\$ \$	500.00 1,000.00	\$ \$	500.0 1,000.0
4.0 4.9		1.8.5 1.8.4	Blow-Off Assembly - Standard Drawing W8 Water Services	Each Each	1 23	э \$	1,100.00	э \$	25,300.0
4.9		1.8.11	150mm Hot Tapping c/w valve	Each	23	\$	3,000.00	۶ ۶	6,000.0
	Sub-Total							\$	76,300.0
ub-Total	of Section 1	to 4						\$	129,300.0
.0 Soft	Costs			Γ	ſ			I	
			Soft Costs						
5.1			Engineering & CA				15%	\$	19,395.0
5.2			Contingency	с		1	25%		32,325.0
5.3			Provisonal for Dewatering Cost			1	20%	\$	25,860.0
5.4			Land Acquisition	Square Meters	0	\$	-	\$	-
ection 5 s	Sub-Total		1					\$	77,580.
otal (no	t includin	g taxes)						\$	206,880.0

ASSUMPTIONS:

1. Proposed watermain to be installed on the following streets: Emerald Avenue & Diamond Street

		2014 W	/ater Proje	ects Cost Estimate	
HARRISON HOT SPRI Naturally Refreshed		Project: Location: Date of E		ANGUS ESTATES Angus Estates	Priority:
		Date of E	sumate:	December 16, 2014	Target Year:
Project Name:	ANGUS E	STATES	<b>;</b>	Location:	
Project Description:	watermain adequate fi	to service ire protec	00/150/200 r e and provide tion to the Ar nd loop the s	ngus	
DCC Eligible:	NO				
Existing Zoning:	R-1				
Project Limits/Address	-		ona Place, Ha ⁄Iyng Cres., H	CONTRACTOR OF A STATE	
Project Details:					A States
Pipe Length	ı: 14	40/205/53	60 m	1.25/	「日本になる」となった
Pipe Size:	10	00/150/20			
Tie-ins:		2	each		
Fire Hydran		6	each		
Water Servi		56	each		
Land Acquisiton Req'd:				Site Photograph	:
Total Land Cost: Design Consultants: Drawing Number:	\$0.00 N/A N/A				
Related Road Projects: Related Sanitary Sewer Related Drainage Proje	Projects:	TBD TBD TBD			
Cost Est	imate Sumn	nary		Notes:	
Construction:		\$	347,250.00		work to be completed as soon as possible
Contingency (Level C):		\$	86,812.50		dequate fire protection
Engineering & CA		\$	52,087.50	2. Dewateri required	ng and geotechnical specialists may be
Specialists:	Subtotal:	\$ \$	69,450.00 <b>555,600.00</b>	3. Ministry	of Transportation permitting required for Springs Road
				4. Suitable 4	subgrade and imported bedding material

555,600.00

4. Suitable subgrade and imported bedding material assumed

5. Area currently serviced by private wells

Total Project Cost: \$

Land Acquisition: \$

#### Village of Harrison Hot Springs ANGUS ESTATES Requirements to service all properties (future) Class 'C' Cost Estimate



December 16, 2014

Item	MMCD Section	Payment Item	Specification Title - Item Description	Unit	Quantity		Unit Price		Amount
.0 Gen			Requirements						
	01 33 01	1.8.1	Project Record Documents	Note			Incidental		
							mondormal		
1.1	01 55 00	1.5.1	Traffic Control, Vehicle Access and Parking	Lump Sum	1	\$	2,500.00	\$	2,500.00
	01 58 01	1.3.1	Project Identification	Note			Incidental		
Section 1	Sub-Total							\$	2,500.00
2.0 Ear	nworks a	nd Site Pro	eparation (MMCD Section 31)			T			
	31 24 13		Roadway Excavation, Embankment and Compaction						
2.1		1.8.4	Remove Existing Asphalt, Curbs and Gutters, Sidewalks, Utility Strips, Driveways	Square Meter	2700	\$	10.00	\$	27,000.00
Section 2	Sub-Total							\$	27,000.00
3.0 Roa	ds and Sit	e Improve	ment (MMCD Section 32)						
3.1	32 12 16	1.5.7	Hot-Mix Asphalt Concrete Paving Saw Cut Asphalt	Lineal Meters	1800	\$	7.50	\$	13,500.00
3.2		1.5.8	Permanent Pavement Restoration (including all base gravels and subgrade prep.)	Square Meters	2700	\$	35.00	\$	94,500.00
Section 3	Sub-Total							\$	108,000.00
			201						
4.0 Utilit		D Section 3	33)			T			
	33 11 01		Waterworks						
4.1		1.8.1, 1.8.2	200mm DR18 PVC Watermain - Native Backfill	Lineal Meters	530	\$	100.00	\$	53,000.00
4.2 4.3		1.8.1, 1.8.2 1.8.1, 1.8.2	150mm DR18 PVC Watermain - Native Backfill 100mm DR18 PVC Watermain - Native Backfill	Lineal Meters Lineal Meters	205 140	\$ \$	100.00 90.00	\$ \$	20,500.00 12,600.00
4.4		1.8.3	200mm Gate Valve	Each	5	\$	1,300.00	\$	6,500.00
4.5		1.8.3	150mm Gate Valve	Each	2	\$	1,000.00	\$	2,000.00
4.6		1.8.3	100mm Gate Valve	Each	3	\$	850.00	\$	2,550.00
4.7		1.8.3	Tee - 200mm X 200mm X 200mm	Each	3	\$	950.00	\$	2,850.00
4.8		1.8.3	Tee - 200mm X 200mm X 150mm	Each	1	\$	800.00	\$	800.00
4.9		1.8.3	Tee - 150mm X 150mm X 200mm	Each	1	\$	775.00	\$	775.00
4.10			Hydrant Assembly - Standard Drawing W4	Each	6	\$	5,600.00	\$	33,600.00
4.11		1.8.3	Reducer - 200mm x 150mm diameter	Each	1 1	\$	750.00	\$	750.00
4.12 4.13		1.8.3 1.8.3	Reducer - 200mm x 100mm diameter	Each Each	3	\$ \$	725.00 500.00	\$ \$	725.00 1,500.00
4.13		1.8.5	Reducer - 150mm x 100mm diameter Blow-Off Assembly - Standard Drawing W8	Each	5	э \$	1,000.00	գ Տ	5,000.00
4.15		1.8.4	Water Services	Each	56	\$	1,100.00	\$	61,600.00
4.16		1.8.13	Watermain Tie-In - Pipe work by Contractor	Each	1	\$	1,500.00	\$	1,500.00
4.17		1.8.11	200mm Hot Tapping c/w valve	Each	1	\$	3,500.00	\$	3,500.00
Section 4	Sub-Total							\$	209,750.00
Sub Total	of Section	1 to 1						\$	347,250.00
Jab-10tal	SI SECTION	1 10 4						φ	347,230.00
5.0 Soft	Costs	I		ſ		T			
			Saft Casts						
5.1			Soft Costs Engineering & CA				15%	\$	52,087.50
5.2			Contingency	с		1	25%	\$	86,812.50
5.3			Provisonal for Dewatering Cost	-		1	20%	\$	69,450.00
5.4			Land Acquisition	Square Meters	0	\$	-	\$	-
Section 5	Sub-Total							\$	208,350.00
Fotol (m	of in olu-li-	an towar)						¢	EEE 600 00
otal (n	ot includir	ig taxes)						\$	555,600.00

ASSUMPTIONS:

1. Proposed watermain to be installed on the following streets: Hope Place, Ramon Place, Hadway Crive, Angus Place, & Myng Crescent

Image: Construct Spring: Cost Spring: Cost Spring: Cost Spring Cost Spring: Co	
NoticedLy Refreshed       Location:       Priority: Date of Estimate:       December 16, 2014       Priority: Target Year:         Project Name:       PINE AND LAKBERG       Location:         Project Description:       Construct 340m of 150mm watermain on Lakberg to service and provide adequate fire protection for existing development       Location:         DCC Eligible:       NO       NO       Image: Construct Subberg Crescent Subberg Crescent Subberg Crescent Subberg Subberg Ave         Project Limits/Addres:       Pine Ave & Lakberg Crescent Subberg Ave       Pine Ave & Lakberg Crescent Subberg Ave       Pine Ave & Lakberg Crescent Subberg Ave	
Priority:       Date of Estimate:       December 16, 2014       Priority:         Project Name:       PINE AND LAKBERG       Location:         Project Description:       Construct 340m of 150mm watermain on Pine and 60m of 100mm watermain on Lakberg to service and provide adequate fire protection for existing development       Image: Construct 340m of 150mm watermain on Lakberg to service and provide adequate fire protection for existing development       Image: Construct 340m of 150mm watermain on Lakberg to service and provide adequate fire protection for existing development         DCC Eligible:       NO       Image: Construct 340m of 150mm watermain on Lakberg to service and provide adequate fire protection for existing development       Image: Construct 340m of 150mm watermain on Lakberg to service and provide adequate fire protection for existing development         DCC Eligible:       NO       Image: Construct 340m of 150mm watermain on Lakberg to service and provide adequate fire protection for existing development       Image: Construct 340m of 150mm watermain on Lakberg to service and provide adequate fire protection for existing development         DCC Eligible:       NO       Image: Construct 340m of 150mm watermain on Lakberg to service and provide adequate fire protection for existing development       Image: Construct 340m of 150mm watermain on Lakberg to service and provide adequate fire protection for existing development         Project Limits/Address:       Pine Ave & Lakberg Cressent Baberg to service and provide adequate fire protection for existing development       Image: Construct adevelopment	
Project Name:       PINE AND LAKBERG       Location:         Project Description:       Construct 340m of 150mm watermain on Pine and 60m of 100mm watermain on Lakberg to service and provide adequate fire protection for existing development       Location:         DCC Eligible:       NO         Existing Zoning:       R-2         Project Limits/Addres:       Pine Ave & Lakberg Crescent Browne Ave	
Project Name:       PINE AND LAKBERG       Location:         Project Description:       Construct 340m of 150mm watermain on Pine and 60m of 100mm watermain on Lakberg to service and provide adequate fire protection for existing development       Image: Construct 340m of 150mm watermain on Pine and 60m of 100mm watermain on Lakberg to service and provide adequate fire protection for existing development         PCC Eligible:       NO         Existing Zoning:       R-2         Project Limits/Address:       Pine Ave & Lakberg Crescent 38 - 480 Pine Ave	
Project Description:Construct 340m of 150mm watermain on Pine and 60m of 100mm watermain on Lakberg to service and provide adequate fire protection for existing developmentDCC Eligible:NOExisting Zoning:R-2Project Limits/Addres:Pine Ave & Lakberg Crescent 389 - 480 Pine Ave	
A mathematical and 60m of 100mm watermain on Lakberg to service and provide adequate fire protection for existing developmentDCC Eligible:NOExisting Zoning:R-2Project Limits/Address:Pine Ave & Lakberg Crescent 389 - 480 Pine Ave	
And 60m of 100mm watermain on Lakberg to service and provide adequate fire protection for existing developmentDCC Eligible:NOExisting Zoning:R-2Project Limits/Address:Pine Ave & Lakberg Crescent 389 - 480 Pine Ave	
Existing Zoning: R-2 Project Limits/Address: Pine Ave & Lakberg Crescent 389 - 480 Pine Ave	
Project Limits/Address: Pine Ave & Lakberg Crescent 389 - 480 Pine Ave	
389 - 480 Pine Ave	
Project Details:	
Pipe Length: 340/60 m	
Pipe Size: 150/100 mm	
Tie-ins: 2 each	
Fire Hydrants: 2 each	
Water Services: 23 each	
Land Acquisiton Req'd: None Site Photograph:	
Total Land Cost: \$0.00	
Design Consultants: N/A	
Drawing Number: N/A	
	ñ
Related Road Projects: TBD	
Related Sanitary Sewer Projects: TBD	A. C. C.
Related Drainage Projects: TBD	
Cost Estimate Summary Notes:	
Construction: \$ 143,850.00 1. Hydrant work to be completed as soon as poss	ible
Contingency (Level C): \$ 35,962.50 to provide adequate fire protection	
Engineering & CA \$ 21,577.50 2. Dewatering and geotechnical specialists may b	e
Specialists: \$ 28,770.00 required	
Subtotal:       \$       230,160.00       3. Ministry of Transportation permitting required tie in on Hot Springs Road	for
4. Suitable subgrade and imported bedding mate assumed	rial
5 Area currently serviced by private wells	
Total Project Cost: \$ 230,160.00	

#### Village of Harrison Hot Springs PINE AND LAKBERG Requirements to service all properties (future) Class 'C' Cost Estimate



December 16, 2014

Item	MMCD	Payment	Specification Title - Item Description	Unit	Quantity		Unit Price		Amount
.0 Gene	Section eral MMCE	O Contract	Requirements	I		1			
							1 11 11		
	01 33 01	1.8.1	Project Record Documents	Note			Incidental		
1.1	01 55 00	1.5.1	Traffic Control, Vehicle Access and Parking	Lump Sum	1	\$	500.00	\$	500.0
	01 58 01	1.3.1	Project Identification	Note			Incidental		
ection 1	Sub-Total							\$	500.0
0 Eart	hworks ar	nd Site Pre	eparation (MMCD Section 31)	I		1			
	31 24 13		Roadway Excavation, Embankment and Compaction						
2.1	0.20	1.8.4	Remove Existing Asphalt, Curbs and Gutters, Sidewalks, Utility Strips, Driveways	Square Meter	1200	\$	10.00	\$	12,000.0
action 2	Sub-Total					1		\$	12,000.0
								φ	12,000.0
0 Road	ds and Site	e Improve	ment (MMCD Section 32)	1	-	1			
	32 12 16		Hot-Mix Asphalt Concrete Paving						
3.1 3.2		1.5.7 1.5.8	Saw Cut Asphalt Permanent Pavement Restoration (including all base gravels and subgrade prep.)	Lineal Meters Square Meters	800 1200	\$ \$	7.50 35.00	\$ \$	6,000.0 42,000.0
5.2		1.5.6	remanent ravement testoration (including all base gravels and subgrade prep.)	Square meters	1200	Ψ	55.00	Ψ	42,000.0
ction 3	Sub-Total							\$	48,000.0
									-,
0 Utilit	ies (MMCI	J Section 3				1			
	33 11 01		Waterworks						
4.1 4.2		1.8.1, 1.8.2 1.8.1, 1.8.2	150mm DR18 PVC Watermain - Native Backfill 100mm DR18 PVC Watermain - Native Backfill	Lineal Meters Lineal Meters	340 60	\$ \$	100.00 90.00	\$ \$	34,000.0 5,400.0
4.2		1.8.3	150mm Gate Valve	Each	2	\$	1,000.00	գ \$	2,000.0
4.4		1.8.3	100mm Gate Valve	Each	1	\$	850.00	Ψ \$	2,000.0
4.5		1.8.3	Tee - 150mm X 150mm X 100mm	Each	1	\$	600.00	\$	600.0
4.6		1.0.0	Hydrant Assembly - Standard Drawing W4	Each	2	\$	5,600.00	\$	11,200.0
4.7		1.8.5	Blow-Off Assembly - Standard Drawing W8	Each	1	\$	1,000.00	\$	1,000.0
4.8		1.8.4	Water Services	Each	23	\$	1,100.00	\$	25,300.0
4.9		1.8.13	Watermain Tie-In - Pipe work by Contractor	Each	2	\$	1,500.00	\$	3,000.0
	Out Tatal							•	00.050
	Sub-Total							\$	83,350.0
ub-Total	of Section 1	l to 4						\$	143,850.0
0 Soft	Costs					1			
			Soft Costs						
5.1			Engineering & CA				15%	\$	21,577.5
5.2			Contingency	с			25%	\$	35,962.5
5.3			Provisonal for Dewatering Cost	-		1	20%	\$	28,770.0
5.4			Land Acquisition	Square Meters	0	\$	-	\$	-
	0t. T. ( )		l	1		I		•	
ection 5	Sub-Total							\$	86,310.0
	ot includin	g taxes)						\$	230,160.0
otal (no									

ASSUMPTIONS:

1 Proposed watermain to be installed on the following streets: Pine Avenue & Lakberg Crescent

	2	014 W	Vater Proje	ects Cost Estimate	
HARRISON HOT SPRIN Naturally Refreshed		roject: ocation:	:	MARINE TOURISM 'A' Rockwell Drive	Priority:
	D	ate of E	stimate:	December 16, 2014	Target Year:
Droject Name				Location:	
Project Name:	MARINE T	OURIS	SM A		
Project Description:	Construct 61 watermain of service future	n Rockv	vell Drive to		
DCC Eligible:	YES			4	HAAA
Existing Zoning:	C-6, RR, P-1			1.800	
Project Limits/Address:	Rockwell Driv	/e		and the second	
Project Details:				- All	
Pipe Length:		610	m		
Pipe Size:		350	mm		
Tie-ins:		1	each		
Fire Hydrant	s:	5	each		
Water Servio	ces:	7	each		
Land Acquisiton Req'd: Total Land Cost:	None \$0.00			Site Photograph:	
Design Consultants: Drawing Number:	N/A N/A				
Related Road Projects: Related Sanitary Sewer Related Drainage Projec	-	TBD TBD TBD			
Cost Est	imate Summa	ry		Notes:	
Construction: Contingency (Level C):	( ,	5	310,900.00 77,725.00		ng and traffic control will be required for of construction
Engineering & CA Specialists:		\$	46,635.00 77,725.00		f Transportation permitting required for I construction on Rockwell Drive
- F	Subtotal:	5	512,985.00	3. Suitable su assumed	ubgrade and imported bedding material
Land	Acquisition:	\$	-		

Total Project Cost: \$

512,985.00

#### Village of Harrison Hot Springs MARINE TOURISM 'A' Requirements to service full buildout/development (future) Class 'C' Cost Estimate

December 16, 2014

Item	MMCD Section	Payment	Specification Title - Item Description	Unit	Quantity		Unit Price		Amount
0 Gen	Decelon	165-111	Requirements						
	01 33 01	1.8.1	Project Record Documents	Note			Incidental		
	01 33 01	1.0.1	Figet Record Documents	NULE			incidental		
1.1	01 55 00	1.5.1	Traffic Control, Vehicle Access and Parking	Lump Sum	1	\$	25,000.00	\$	25,000.0
	01 58 01	1.3.1	Project Identification	Note			Incidental		
	01 38 01	1.3.1		Note			incidental		
ection 1	Sub-Total							\$	25,000.0
0 Ear	thworks a	nd Site Pre	eparation (MMCD Section 31)					_	
	31 24 13		Readway Everyation Embandment and Composition						
2.1	31 24 13	1.8.4	Roadway Excavation, Embankment and Compaction Remove Existing Asphalt, Curbs and Gutters, Sidewalks, Utility Strips, Driveways	Square Meter	1830	\$	10.00	\$	18,300.
ection 2	Sub-Total							\$	18,300.
0 Roa	ds and Sit	e Improve	ment (MMCD Section 32)						
	32 12 16		Hot-Mix Asphalt Concrete Paving						
3.1	32 12 10	1.5.7	Saw Cut Asphalt	Lineal Meters	1220	\$	7.50	\$	9,150.
3.2		1.5.8	Permanent Pavement Restoration (including all base gravels and subgrade prep.)	Square Meters	1830	\$	45.00	\$	82,350
3.3	32 17 23	1.5.2	Painted Pavement Markings Permanent Painted Pavement Markings	Lump Sum	1	\$	1,000.00	\$	1,000.
5.5		1.3.2	rennanent ranneu ravennent markings	Lump Sum	1	Ψ	1,000.00	Ψ	1,000.
ction 3	Sub-Total							ŝ	92,500.
	Sub-Total							\$	92,500.
		D Section 3	33)					\$	92,500.
		D Section 3	33) Waterworks					\$	92,500.
0 Utili 4.1	ties (MMC	1.8.1, 1.8.2	Waterworks 350mm DR18 PVC Watermain - Native Backfill	Lineal Meters	610	\$	200.00	\$	122,000
0 Utili 4.1 4.2	ties (MMC	1.8.1, 1.8.2 1.8.3	Waterworks 350mm DR18 PVC Watermain - Native Backfill 350mm Gate Valve	Each	3	\$	2,500.00	\$	122,000. 7,500.
0 Utili 4.1 4.2 4.3	ties (MMC	1.8.1, 1.8.2	Waterworks 350mm DR18 PVC Watermain - Native Backfill 350mm Gate Valve Reducer - 200mm x 350mm diameter	Each Each	3 1	\$ \$	2,500.00 1,500.00	\$ \$ \$	122,000. 7,500. 1,500.
0 Utili 4.1 4.2 4.3 4.4	ties (MMC	1.8.1, 1.8.2 1.8.3 1.8.3	Waterworks 350mm DR18 PVC Watermain - Native Backfill 350mm Gate Valve Reducer - 200mm x 350mm diameter Hydrant Assembly - Standard Drawing W4	Each Each Each	3 1 5	\$ \$ \$	2,500.00 1,500.00 5,600.00	\$ \$ \$ \$ \$	122,000. 7,500. 1,500. 28,000.
4.1 4.2 4.3 4.4 4.5	ties (MMC	1.8.1, 1.8.2 1.8.3 1.8.3 1.8.5	Waterworks 350mm DR18 PVC Watermain - Native Backfill 350mm Gate Valve Reducer - 200mm x 350mm diameter Hydrant Assembly - Standard Drawing W4 Blow-Off Assembly - Standard Drawing W8	Each Each Each Each	3 1 5 1	\$ \$ \$ \$	2,500.00 1,500.00 5,600.00 1,000.00	\$ \$ \$ \$ \$	122,000 7,500 1,500 28,000 1,000
0 Utili 4.1 4.2 4.3 4.4	ties (MMC	1.8.1, 1.8.2 1.8.3 1.8.3	Waterworks 350mm DR18 PVC Watermain - Native Backfill 350mm Gate Valve Reducer - 200mm x 350mm diameter Hydrant Assembly - Standard Drawing W4	Each Each Each	3 1 5	\$ \$ \$	2,500.00 1,500.00 5,600.00	\$ \$ \$ \$ \$	122,000 7,500 1,500 28,000 1,000 14,000
0 Utili 4.1 4.2 4.3 4.4 4.5 4.6	ties (MMC	1.8.1, 1.8.2 1.8.3 1.8.3 1.8.5 1.8.5 1.8.4	Waterworks 350mm DR18 PVC Watermain - Native Backfill 350mm Gate Valve Reducer - 200mm x 350mm diameter Hydrant Assembly - Standard Drawing W4 Blow-Off Assembly - Standard Drawing W8 Water Services	Each Each Each Each Each	3 1 5 1 7	\$ \$ \$	2,500.00 1,500.00 5,600.00 1,000.00 2,000.00		122,000. 7,500. 1,500. 28,000. 1,000. 14,000.
4.1 4.2 4.3 4.4 4.5 4.6 4.7	ties (MMC	1.8.1, 1.8.2 1.8.3 1.8.3 1.8.5 1.8.5 1.8.4	Waterworks 350mm DR18 PVC Watermain - Native Backfill 350mm Gate Valve Reducer - 200mm x 350mm diameter Hydrant Assembly - Standard Drawing W4 Blow-Off Assembly - Standard Drawing W8 Water Services	Each Each Each Each Each	3 1 5 1 7	\$ \$ \$	2,500.00 1,500.00 5,600.00 1,000.00 2,000.00		92,500. 122,000. 7,500. 1,500. 28,000. 1,000. 14,000. 1,100. <b>175,100.</b>
0 Utili 4.1 4.2 4.3 4.4 4.5 4.6 4.7	ties (MMC 33 11 01	1.8.1, 1.8.2 1.8.3 1.8.3 1.8.5 1.8.4 1.8.13	Waterworks 350mm DR18 PVC Watermain - Native Backfill 350mm Gate Valve Reducer - 200mm x 350mm diameter Hydrant Assembly - Standard Drawing W4 Blow-Off Assembly - Standard Drawing W8 Water Services	Each Each Each Each Each	3 1 5 1 7	\$ \$ \$	2,500.00 1,500.00 5,600.00 1,000.00 2,000.00	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	122,000. 7,500. 1,500. 28,000. 1,000. 14,000. 1,100.
0 Utili 4.1 4.2 4.3 4.4 4.5 4.6 4.7 ection 4 ub-Tota	ties (MMC 33 11 01	1.8.1, 1.8.2 1.8.3 1.8.3 1.8.5 1.8.4 1.8.13	Waterworks 350mm DR18 PVC Watermain - Native Backfill 350mm Gate Valve Reducer - 200mm x 350mm diameter Hydrant Assembly - Standard Drawing W4 Blow-Off Assembly - Standard Drawing W8 Water Services	Each Each Each Each Each	3 1 5 1 7	\$ \$ \$	2,500.00 1,500.00 5,600.00 1,000.00 2,000.00	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	122,000 7,500 1,500 28,000 1,000 14,000 1,100 <b>175,100</b>
0 Utili 4.1 4.2 4.3 4.4 4.5 4.6 4.7 ection 4 ub-Tota	ties (MMC 33 11 01 Sub-Total	1.8.1, 1.8.2 1.8.3 1.8.3 1.8.5 1.8.4 1.8.13	Waterworks 350mm DR18 PVC Watermain - Native Backfill 350mm Gate Valve Reducer - 200mm x 350mm diameter Hydrant Assembly - Standard Drawing W4 Blow-Off Assembly - Standard Drawing W8 Water Services	Each Each Each Each Each	3 1 5 1 7	\$ \$ \$	2,500.00 1,500.00 5,600.00 1,000.00 2,000.00	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	122,000 7,500 1,500 28,000 1,000 14,000 1,100 <b>175,100</b>
0 Utili 4.1 4.2 4.3 4.4 4.5 4.6 4.7 ection 4 ab-Tota 0 Sof	ties (MMC 33 11 01 Sub-Total	1.8.1, 1.8.2 1.8.3 1.8.3 1.8.5 1.8.4 1.8.13	Waterworks 350mm DR18 PVC Watermain - Native Backfill 350mm Gate Valve Reducer - 200mm x 350mm diameter Hydrant Assembly - Standard Drawing W4 Blow-Off Assembly - Standard Drawing W8 Water Services Watermain Tie-In - Pipe work by Contractor Soft Costs	Each Each Each Each Each	3 1 5 1 7	\$ \$ \$	2,500.00 1,500.00 5,600.00 1,000.00 2,000.00 1,100.00	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	122,000 7,500 1,500 28,000 1,000 14,000 1,100 <b>175,100</b> <b>310,900</b> .
0 Utili 4.1 4.2 4.3 4.4 4.5 4.6 4.7 	ties (MMC 33 11 01 Sub-Total	1.8.1, 1.8.2 1.8.3 1.8.3 1.8.5 1.8.4 1.8.13	Waterworks         350mm DR18 PVC Watermain - Native Backfill         350mm Gate Valve         Reducer - 200mm x 350mm diameter         Hydrant Assembly - Standard Drawing W4         Blow-Off Assembly - Standard Drawing W8         Water Services         Watermain Tie-In - Pipe work by Contractor         Soft Costs         Engineering & CA	Each Each Each Each Each Each	3 1 5 1 7	\$ \$ \$	2,500.00 1,500.00 5,600.00 2,000.00 1,100.00	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	122,000, 7,500, 1,500, 28,000, 1,000, 1,100, 175,100, <b>310,900,</b> 46,635,
0 Utili 4.1 4.2 4.3 4.4 4.5 4.6 4.7 A.4 5.1 5.1 5.2	ties (MMC 33 11 01 Sub-Total	1.8.1, 1.8.2 1.8.3 1.8.3 1.8.5 1.8.4 1.8.13	Waterworks 350mm DR18 PVC Watermain - Native Backfill 350mm Gate Valve Reducer - 200mm x 350mm diameter Hydrant Assembly - Standard Drawing W4 Blow-Off Assembly - Standard Drawing W8 Water Services Watermain Tie-In - Pipe work by Contractor Soft Costs Engineering & CA Contingency	Each Each Each Each Each	3 1 5 1 7	\$ \$ \$	2,500.00 1,500.00 5,600.00 1,000.00 1,100.00 1,100.00 1,100.00	• • • • • • • • • • • • • • • • • • •	122,000 7,500 1,500 1,500 1,000 14,000 1,100 <b>175,100</b> <b>310,900</b> . 46,635 77,725
0 Utili 4.1 4.2 4.3 4.4 4.5 4.6 4.7 • • • • • • • • • • • • • • • • • • •	ties (MMC 33 11 01 Sub-Total	1.8.1, 1.8.2 1.8.3 1.8.3 1.8.5 1.8.4 1.8.13	Waterworks 350mm DR18 PVC Watermain - Native Backfill 350mm Cate Valve Reducer - 200mm x 350mm diameter Hydrant Assembly - Standard Drawing W4 Blow-Off Assembly - Standard Drawing W8 Water Services Watermain Tie-In - Pipe work by Contractor Soft Costs Engineering & CA Contingency Provisonal for Dewatering Cost	Each Each Each Each Each Each	3 1 5 1 7 1	\$ \$ \$ \$ \$	2,500.00 1,500.00 5,600.00 2,000.00 1,100.00	• • • • • • • • • • • • • • • • • • •	122,000 7,500 1,500 28,000 1,000 14,000 1,100 <b>175,100</b> <b>310,900</b> .
0 Utili 4.1 4.2 4.3 4.4 4.5 4.6 4.7 A.4 5.1 5.1 5.2	ties (MMC 33 11 01 Sub-Total	1.8.1, 1.8.2 1.8.3 1.8.3 1.8.5 1.8.4 1.8.13	Waterworks 350mm DR18 PVC Watermain - Native Backfill 350mm Gate Valve Reducer - 200mm x 350mm diameter Hydrant Assembly - Standard Drawing W4 Blow-Off Assembly - Standard Drawing W8 Water Services Watermain Tie-In - Pipe work by Contractor Soft Costs Engineering & CA Contingency	Each Each Each Each Each Each	3 1 5 1 7	\$ \$ \$	2,500.00 1,500.00 5,600.00 1,000.00 1,100.00 1,100.00 1,100.00	• • • • • • • • • • • • • • • • • • •	122,000 7,500 1,500 28,000 1,000 14,000 1,100 <b>175,100</b> <b>310,900</b> . 46,635 77,725
0 Utili 4.1 4.2 4.3 4.4 4.5 4.6 4.7 ***********************************	ties (MMC 33 11 01 Sub-Total I of Section t Costs	1.8.1, 1.8.2 1.8.3 1.8.3 1.8.5 1.8.4 1.8.13	Waterworks 350mm DR18 PVC Watermain - Native Backfill 350mm Cate Valve Reducer - 200mm x 350mm diameter Hydrant Assembly - Standard Drawing W4 Blow-Off Assembly - Standard Drawing W8 Water Services Watermain Tie-In - Pipe work by Contractor Soft Costs Engineering & CA Contingency Provisonal for Dewatering Cost	Each Each Each Each Each Each	3 1 5 1 7 1	\$ \$ \$ \$ \$	2,500.00 1,500.00 5,600.00 1,000.00 1,100.00 1,100.00 1,100.00	• • • • • • • • • • • • • • • • • • •	122,000 7,500 1,500 1,000 14,000 1,100 <b>175,100</b> <b>310,900</b> . 46,635 77,725 77,725
0 Utili 4.1 4.2 4.3 4.4 4.5 4.6 4.7 ***********************************	ties (MMC 33 11 01 Sub-Total	1.8.1, 1.8.2 1.8.3 1.8.3 1.8.5 1.8.4 1.8.13	Waterworks 350mm DR18 PVC Watermain - Native Backfill 350mm Cate Valve Reducer - 200mm x 350mm diameter Hydrant Assembly - Standard Drawing W4 Blow-Off Assembly - Standard Drawing W8 Water Services Watermain Tie-In - Pipe work by Contractor Soft Costs Engineering & CA Contingency Provisonal for Dewatering Cost	Each Each Each Each Each Each	3 1 5 1 7 1	\$ \$ \$ \$ \$	2,500.00 1,500.00 5,600.00 1,000.00 1,100.00 1,100.00 1,100.00	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	122,000 7,500 1,500 28,000 1,000 14,000 1,100 <b>175,100</b> <b>310,900</b> . 46,635 77,725
0 Utili 4.1 4.2 4.3 4.4 4.5 4.6 4.7 ction 4 5.1 5.2 5.3 5.4 ction 5	ties (MMC 33 11 01 Sub-Total I of Section t Costs	1.8.1, 1.8.2 1.8.3 1.8.3 1.8.5 1.8.4 1.8.13 1 to 4	Waterworks 350mm DR18 PVC Watermain - Native Backfill 350mm Cate Valve Reducer - 200mm x 350mm diameter Hydrant Assembly - Standard Drawing W4 Blow-Off Assembly - Standard Drawing W8 Water Services Watermain Tie-In - Pipe work by Contractor Soft Costs Engineering & CA Contingency Provisonal for Dewatering Cost	Each Each Each Each Each Each	3 1 5 1 7 1	\$ \$ \$ \$ \$	2,500.00 1,500.00 5,600.00 1,000.00 1,100.00 1,100.00 1,100.00	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	122,000 7,500 28,000 1,000 14,000 14,000 175,100 310,900 46,635 77,725 77,725

ASSUMPTIONS: 1 Proposed watermain to be installed on Rockwell Drive

	2014	Water Proj	ects Cost Estimate
HARRISON HOT SPRING Naturally Refreshed		:t:	WATER SERVICES AND HYDRANTS Throughout Village Priority:
	Date o	of Estimate:	December 16, 2014 Target Year:
Project Name: Project Description:	WATER SERVE HYDRANTS	ervice to all prope a watermain froi	ntage
	system, and to inst F14, F17, F30 and F adequate fire prote properties	all hydrants F12, I 31 order to provi	F13, ide
DCC Eligible:	NO		
Existing Zoning:	Varies		
Project Limits/Address:	Throughout Villag	je	
Project Details:			
Fire Hydrants: Water Service			
Land Acquisiton Req'd: Total Land Cost:	None \$0.00		
Design Consultants: Drawing Number:	N/A N/A		
Related Road Projects: Related Sanitary Sewer Pr Related Drainage Projects	•	D	
Cost Esti	mate Summary		Notes:
Construction: Contingency (Level C): Engineering & CA Specialists:	\$ \$ \$ Subtotal: \$	241,500.00 60,375.00 36,225.00 24,150.00 <b>362,250.00</b>	<ul> <li>to provide adequate fire protection</li> <li>2. Dewatering and geotechnical specialists may be required</li> <li>3. Ministry of Transportation permitting required for</li> </ul>
Land	Acquisition: \$	work on Hot Springs Road 4. Suitable subgrade and imported bedding material assumed	
Total I	Project Cost: \$	362,250.00	

#### Village of Harrison Hot Springs WATER SERVICES AND HYDRANTS Class 'C' Cost Estimate



December 16, 2014

Item	MMCD Section	Payment Item	Specification Title - Item Description	Unit	Quantity	Unit Price		Amount
1.0 Utili	ties (MMC		33)	1				
	33 11 01		Waterworks					
1.1			Hydrant Assembly - Standard Drawing W4	Each	6	\$ 7,000.00		42,000.00
1.2		1.8.4	Water Services	Each	57	\$ 3,500.00	\$	199,500.00
Section 1	Sub-Total						\$	241,500.00
Sub-Tota	I of Section	1					\$	241,500.00
2.0 Sof	t Costs							
2.0 001	00313			1			1	
			Soft Costs					
2.1			Engineering & CA			15%	\$	36,225.00
2.2			Contingency	С		25%	\$	60,375.00
2.3			Provisonal for Dewatering Cost			10%	\$	24,150.00
2.4			Land Acquisition	Square Meters	0	\$-	\$	-
						1		
Section 2	Sub-Total						\$	120,750.00
Total (n	ot includir	ng taxes)					\$	362,250.00

	2014 \	Nater Proi	ects Cost Estimate	
		Water i i ej		
HARRISON HOT SPRING			UNIVERSAL METERING	
Naturally Refreshed	- Location	1:	Throughout Village	<b>.</b>
	Date of	Estimate:	December 16, 2014	Priority: Target Year:
			December 10, 2014	
Project Name:			Location:	
Project Description:	To provide universal r properties that are cu of Harrison Hot Spring	irrently on the		
DCC Eligible:	NO			
Existing Zoning:	Varies		Map Inset	
Project Limits/Address:	Throughout Village			
Project Details:				
Universal Met	ters: 443	each		
Land Acquisition Req'd: Total Land Cost:	None \$0.00			
Design Consultants: Drawing Number:	N/A N/A			
Related Road Projects: Related Sanitary Sewer Pr Related Drainage Projects	•			
Cost Esti	mate Summary		Notes:	
Construction: Contingency (Level C): Engineering & CA Specialists:	\$ \$ \$ Subtotal: <b>\$</b>	461,815.00 115,453.75 69,272.25 49,181.50 <b>695,722.50</b>	possible to provi 2. Dewatering a required	ters to be completed as soon as de adequate metered readings. nd geotechnical specialists may be
Land	Acquisition: \$	-		
Total I	Project Cost: \$	695,722.50	1	

#### Village of Harrison Hot Springs UNIVERSAL METERING Class 'C' Cost Estimate



December 16, 2014

695,722.50

\$

Item	MMCD Section	Payment Item	Specification Title - Item Description	Unit	Quantity		Unit Price		Amount
0 Utili	ties (MMC	D Section 3	33)						
	33 11 01		Waterworks						
1.1			Supply and Install 3/4" T-10 E-Coder) R900i meter in Plastic Pit (includes fittings, pit, R900 RF Transmitter, Antenna) onto Existing 3/4" or 1" line	Each	379	\$	895.00	\$	339,20
1.2			Pit Provisional Allocation (Concrete H20 static pit, deep excavation, asphalt or concrete cut & restore, sod, etc)	Lump Sum	1	\$	55,000.00	\$	55,00
1.3			Intermediate Meter Cut-In (Condominium). Unknown Size & Location.	Each	1	\$	4,500.00	\$	4,50
1.4			Change Out 3/4" T-10 E-Coder) R900i meter c/w pit antenna in existing meter pit - Average Cost	Each	21	\$	395.00	\$	8,29
1.5			Change Out Intermediate Meter 1" thru 2" (Inside or Pit) - Average Cost	Each	15	\$	875.00	\$	13,12
1.6			Retrofit Existing Meters to Radio (pit or inside) Allocation - Average Cost	Each	38	\$	255.00	\$	9,690
1.7			Public Education/Communication	Lump Sum	1	\$	5,000.00		5,000
1.8			CE Handheld Reading Device (HandHeld Unit, Software, and On Site Training & Implementation)	Each	1	\$	12,000.00	\$	12,00
1.9			Option: MRX Drive By Unit in addition to above for increased reading efficiency. Unit Operates with Village's Supplied Laptop.	Each	1	\$	15,000.00	\$	15,00
						I			
	Sub-Total	1		1	I			\$	
	Sub-Total	1						\$ \$	
ıb-Tota		1			I	1		\$ \$	
b-Tota	I of Section							\$ \$	461,815 461,815
b-Tota	I of Section		Soft Costs					\$	461,815
<b>b-Tota ) Sol</b> 2.1	I of Section		Engineering & CA				15%	\$ \$	<b>461,81</b> 69,27
b-Tota ) Sot 2.1 2.2	I of Section		Engineering & CA Contingency	c			25%	\$ \$ \$	<b>461,81</b> 69,27 115,45
2.1 2.2 2.3	I of Section		Engineering & CA Contingency Laptop & Software Upgrade	C Lump Sum	1	\$	25% 3,000.00	\$ \$ \$ \$	<b>461,81</b> 69,27 115,45 3,00
2.1 2.2 2.3 2.4	I of Section		Engineering & CA Contingency Laptop & Software Upgrade Provisonal for Dewatering Cost	Lump Sum	1		25%	\$ \$ \$ \$ \$ \$ \$ \$ \$	<b>461,81</b> 69,27 115,45 3,00
2.1 2.2 2.3 2.4	I of Section		Engineering & CA Contingency Laptop & Software Upgrade	-	1	\$	25% 3,000.00	\$ \$ \$ \$	<b>461,81</b> 69,27 115,45
b-Tota 2.1 2.2 2.3 2.4 2.5	I of Section		Engineering & CA Contingency Laptop & Software Upgrade Provisonal for Dewatering Cost	Lump Sum	1 0		25% 3,000.00	\$ \$ \$ \$ \$ \$ \$ \$ \$	<b>461,81</b> 69,2 115,4 3,00

#### Total (not including taxes)

ASSUMPTIONS

1 Pricing is for budgetary purposes only. When more information, scope of work and other project details are available, this budgetary quotation can be refined.

 ${\bf 2}~$  The preferred location is a pit immediately downstream of the existing curb stop.

3 All meters to be radio technology through either retrofitting or new meter installations. Neptune E-Coder R900i meter provides leak, no flow/tamper, backflow detection, and 96

4 "Contingency" is to allow for funding for project "unknowns" (e.g. Extraordinary plumbing, larger meters required, misapplied meters requiring full change-out, re-plumbing, higher

5 Project is to be run as a continuous project (i.e. no stop and re-start at a later date).

6 Curb-stops are visible and or accessible via location measurements.

7 Existing meter pit lids have a 45mm diameter hole to accommodate an antenna.

8 Public Education/Communication comprises of an open house, booklets, web site, etc

9 For reading system, Harrison Hot Springs is responsible for costs associated to the "transfer file" that is provided by their Utility Billing Software provider, MAIS. Please contact

10 An option to add an MRX drive-by unit has been provided (item 9). This reading unit would provide further reading efficiencies. This unit works with a lap-top computer supplied 11 For phases II & III (properties not currently on village water system), it is assumed water meters will be added by a contractor at the same time as new service connections or

12 Pricing is for properties currently serviced by Water Utility. It is assumed that properties not serviced will be metered as they are connected

	_	04 4 14 2 5 1				
	2	014 Water Proj	ects C	ost Estimate		
HARRISON HOT SPRIN	PI	roject:	TEF R	EPLACEMENT		
		Location:		Cedar Ave & Hot Springs Road		
Naturally Refreshed				1 0	Priority:	
	D	ate of Estimate:	Decer	nber 16, 2014	Target Year:	
Project Name:	TEE REPLA	CEMENT		Location:		
Project Description:	flow restriction	ne existing tee causin on has been noted. nits available fire flo enter area.	The			
DCC Eligible:	NO					
Existing Zoning:	C-1				A Parton	
Project Limits/Address:	Cedar Ave &	Hot Springs Road			Mami River	
Details:				Distance of the		
Replace Exis	ting Tee	1 each				
Land Acquisiton Req'd:	None			Site Photograph:		
Total Land Cost:	\$0.00					
Design Consultants: Drawing Number: Related Road Projects:	N/A N/A	TBD				
Related Sanitary Sewer	Projects:	TBD				
Related Drainage Projec	-	TBD				
Cost Esti	imate Summaı			Notes:		
Construction:	imate Summar	y 5 17,500.00	1		ffic control will be required for	
Contingency (Level C):	۲ د ۲			the duration of constru		
Engineering & CA	ć			2. Ministry of Transpo	rtation permitting required for	
Specialists:	ç			access to and construc	tion on Hot Springs Road	
	Subtotal:	26,250.00				
Land	Acquisition:	-				
Lanu		-				
Total P	roject Cost:	26,250.00				

<text></text>		20	14 Water Proj	ects Co	st Estimate		
Project Name:     WATER TREATMENT CAPACITY INCREASE     Location:       Project Description:     Increase flow and treatment capacity for the VHS system when Max Day Demand exceeds 31.5 L/sec     Location:       DCC Eligible:     Increase flow and treatment Plant     Increase flow and treatment Plant       Dcc Eligible:     N/A     Increase flow and vere treatment Plant       Details:     \$ 110.000.00       Membranes (11 pairs, \$10.000 ea)     \$ 1 10.000.00       Addition of pump and VFD     \$ 5 0,000.00       (supply and install)     \$ 1 10.000.00       Eand Acquisiton Req'd:     None       Related Road Projects:     None       Related Roa							
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	2014 Water Pro	jects Cost Estimate				
HARRISON HOT SPRIN	GS Project:	Above-Ground Piping Replacement				
Naturally Refreshed	Location:	Between Water Treatm	-			
0 )	Date of Estimate:	June 29, 2015	Priority: Target Year:			
	Date of Estimate.	June 25, 2015				
Project Name:	Alexan Current Disting Dealer	Location:				
Project Description:	Above-Ground Piping Replace Relocate or upgrade the exisiting ground supply lines for post disc system and security.	g above	Wajner Also			
DCC Eligible:	No					
Existing Zoning:	N/A		C R approver			
Project Limits/Address:	Between Water Treatment Plan Reservoir	t &	Cingature Ave			
Details:						
	design complete with cost estima vy June 2015.	te to be				
		Site Photograph:				
Land Acquisiton Req'd: Total Land Cost: Design Consultants: Drawing Number: Related Road Projects: Related Sanitary Sewer I Related Drainage Projec	ts: None					
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Contingency (Level C) Engineering & CA	\$ \$ - \$ -					
	Subtotal: \$ -					

-

Land Acquisition: \$

Total Project Cost: \$





## **Appendix E – Above Ground Piping Report**

Water Master Plan June 2015



ELBURY CONSULTING LTD

STRUCTURAL ENGINEERS

July 29, 2014

File: 14121

CTQ Consultants Ltd. 1334 St. Paul Street Kelowna, BC V1Y 2E1

### Attention: Michelle Sorensen, P.Eng.

Dear Madame:

## Harrison Hot Springs Water Reservoir Pipe Support System Inspection Harrison Hot Springs, BC

At your request, we have completed a visual inspection of the inclined pipe support system feeding the main town water reservoir. Our inspection was conducted on June 13, 2014 in the accompaniment of Mr. Brian Jones of Canada West Mountain School. Mr. Jones provided the necessary equipment and expertise to safely rappel the steep cliff face to complete our inspection.

## **1. REFERENCE DRAWINGS**

A copy of the structural drawings for the original pipe support structure was provided for our reference. These drawings were prepared by Gordon Spratt and Associates Ltd. and are dated June 1984 and we assume the pipe support structure was constructed sometime shortly thereafter. This pipe, which is now approximately 30 years old, is referred to herein as the "north pipe". The second pipe, which was installed sometime in the mid 1990's, runs parallel to and just south of the north pipe. No drawings of this structure were available for our review.

## 2. OBSERVATIONS

A visual inspection was conducted on the above pipe support structures by rappelling down the cliff face with mountain climbing equipment. The support frames were visually inspected but no material sampling or testing was performed. We were unable to inspect the actual water pipe and their connection to the support frames as the piping was encased in insulation and a protective sleeve.

The following issues were noted during our inspection (refer to Photographs in Appendix A):

- a) The north (oldest) support structure has significant superficial corrosion and is in need of paint resurfacing in order to prevent further corrosion.
- b) Both structures have several baseplates that are completely buried in organic matter which will contribute to more rapid steel corrosion.
- c) Several frames on the north pipe have support legs and diagonal bracing that have been bent from rock falls which decreases the strength of the frames.



**BY EMAIL** 



d) Both structures have a significant amount of vegetation growing in and around the support frames. Left unattended, it is possible that the vegetation will damage the support bents.

## 3. SEISMIC CONSIDERATIONS

This initial report is focused mainly on the immediate condition of the structure. We have not completed any seismic analyses of these structures, although it is important to note that the BC Building Code requires all components in water supply system be designed as Post Disaster. It is expected that Post Disaster structures remain functional with little or no damage after a seismic event. In this case, the primary concern would be the ability for the Village to provide adequate supply for expected fire flows.

Based on our cursory review of this section of piping, it is our opinion that these support structures would no meet current day seismic standards and it is more probable than not that the system would receive some sort of damage after even a moderate seismic event.

There are two options to consider in upgrading this portion to a post disaster system. The first option would be to complete a detailed structural seismic assessment of the existing support frames. This would involve obtaining accurate as-built drawings of the system including all geometry, member sizes and connection details. With this information, a detailed seismic review could be completed and retrofit plans and details prepared. Retrofit details may include installing additional anchor bolts and strengthening structural elements as required to meet seismic force demands. We expect the repairs will be costly and difficult to implement given the steep working environment.

The second option would be for the Village to consider decommissioning the existing piping and installing new two new pipes alongside the existing access road to the reservoir. Given the roadway is mostly founded on bedrock, it is likely the most cost effective solution would be to surface mount the pipes on concrete piers anchored into the bedrock. While the pipe distance would be significantly longer than the existing route, the installation would be significantly simpler. In the event that damage did occur after an earthquake, repairs to piping in this location would be significantly easier than in the existing location.

### 4. CONCLUSIONS AND RECOMMENDATIONS

Based on our visual inspection of the supply and return pipe support structures we provide the following conclusions and recommendations:

- 1. In the short term, the cliff face should be scrubbed of all loose rock, debris and vegetation.
- 2. The support bases and anchor bolts should have all loose debris and soil removed, as this contributes to the steel corrosion of the baseplates and anchor bolts.
- The north pipe support structure is in considerably worse condition than the south structure. Several legs have been damaged by falling debris and the complete structure requires paint protection.
- 4. It is very likely a failure would occur in this section of the water delivery system in the event of a moderate to severe earthquake which would seriously compromise the Village's ability to provide adequate supply of water for firefighting and emergency purposes.
- 5. Two options have been presented to upgrade the piping to a post disaster system. The first option would be to retrofit the existing supports which would require a detailed structural seismic assessment. The second option would be to decommission the existing section running





up the cliff face and install two new supply lines running alongside the existing reservoir access roadway.

If you have any questions in regard to this matter, please feel free to contact the undersigned at your convenience.

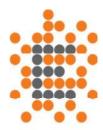
ELBURY CONSULTING LTD.

Per:

Kevin Elbury, M.A.Sc., P.Eng.







## Appendix A Photographs







Photograph 1 Looking down pipe lines. North pipe is the left.



Photograph 2 Top concrete abutments. Concrete work is in average condition.



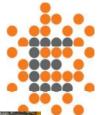


Photograph 3 Typical support bent. North pipe is to the right.



Photograph 4 North bent baseplate and anchor bolts.







Photograph 5 South pipe support anchor bolts.



Photograph 6 Baseplates buried in organic matter.







Photograph 7 Typical support frame – north pipe.



Photograph 8 Bent support leg from falling debris.







# Photograph 9 Diagonal members damaged from falling debris.



Photograph 10 Heavy vegetation in and around bents.





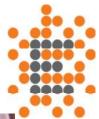


Photograph 11 Vegetation growth is deforming the bent diagonals. Baseplates should have all vegetation removed.



Photograph 12 Looking up, north pipe is on the left.







Photograph 13 Bent leg likely from falling rocks from above. Axial load capacity will be significantly reduced.



Photograph 14 South pipe bent.







Photograph 15 North pipe bent – no diagonals are present.







# **Appendix F – Development Projections**

Water Master Plan June 2015

Village of Harrison Hot Springs

**Development Projections** 

Summer 2014

# **Development Projections – Harrison Hot Springs**

# 9 sub-areas

Density projections will be based on OCP land use designations, except in cases where a zoning was amended to a Comprehensive Development Zone. Generally there are few sites in the Village that may experience significant growth. The majority of the community is developed and the move forward with the east land sector Regional Park will impact development and population growth in Harrison Hot Springs.

In sub-areas where commercial space is built out, development projections will not identify existing commercial space. Only future commercial space will be identified.

Lot size is based on BC assessment data provided by the Regional District.

Summary of development projections:

Area	Commercial	New Lots	Residential Infill
1	5,035 m <sup>2</sup>	130 units	
2	9,941 m <sup>2</sup>	289 units	
3		84 units	
4		59 units	43 units
5		128 units	2 units
6	*246	138 units	
7	1,000 m <sup>2</sup>	90 units	
8		322 units	
9			
Total	1,5976 m <sup>2</sup>	1,240 units	45 units

\*New commercial in this area is campsites and/or accommodation rooms.

#### **Area 1: Waterfront Commercial**

The OCP designates this area as Waterfront Commercial. Tourist commercial is the focus of this area. Permitted uses include: accommodation uses (hotels, motels, and resorts), restaurants, and speciality retail oriented toward tourist based services. Densities in the area are similar to Area 2 allowing up to 150 units per hectare and a maximum floor space ratio of 1.75 for commercial uses. The intention of this designation is to achieve a strong tourism area. While residential development is permissible, the focus should be on the tourism component. The ground floor should be oriented toward tourism commercial uses.

#### Area 2: Village Centre

The OCP designates this area as "Village Centre Area". The following uses are permitted: commercial, residential and public uses. Emphasis is on mixed commercial – residential uses. Commercial uses may include: personal service establishments, banks, business and professional offices, retail and grocery stores. The focus of this area is to provide community-oriented services. Density thresholds are: commercial maximum floor space ratio of 1.5, up to a maximum of 2.0. Residential density is 150 units per hectare.

Generally this area can be characterized as built-out. There is one parcel located at 120 Esplanade Avenue that is currently vacant and may be re-developed. Council adopted a bylaw amendment to allow a seven storey building to be constructed with retail on the ground floor. There are a few other properties that are currently occupied with single family dwellings and are protected with legal non-conforming status. Some type of re-development may take place on these lots. Maximum floor space ratios are based on a figure of 2.0, which is the maximum achievable under the OCP which includes density bonusing.

#### Area 3: Lakeshore Residential

The OCP designates this area as Lakeshore Residential. Medium density multi-family residential is the focus of this designation. Uses will be related to residential uses and will have a maximum density of 35 units per hectare. Consideration must be given to height, form and character, on-site parking and access.

#### Area 4: Low Density Residential

The OCP designates these lands as Low Density Residential. This is a low density designation that envisions single family and duplex dwellings. The maximum density threshold is 20 units per hectare. Creation of new lots is limited to a few larger parcels that can accommodate subdivision into conventional smaller lots. The majority of additional dwelling units will come in the form of construction of a dwelling unit on a vacant lot. This will not yield additional DCCs because the charge was likely paid at the time of original subdivision. Development Projections, Summer 2014

#### Area 5: Neighbourhood Planning Area – Pine Avenue (Low Density Residential)

A Neighbourhood Planning Area guides future land use for this area. It has been identified as an area for small lot subdivision or multi-family residential development in the form of townhomes or other medium density uses. This area is comprised of three large lots (2 of which are vacant) and 14 large single family lots that range in size from 0.2 ha (0.5 acre) to 0.4 ha (1 acre). While these lots could be re-developed if a land assembly were successful, without strong market forces this sub-area is unlikely to generate new subdivisions. These lands generally have no development constraints such as RAR or geotechnical hazards etc.

#### Area 6: Tourist Commercial

The OCP designates this area as Tourist Commercial. It is an area that is in transition with recent applications for OCP and Zoning Bylaw amendments that, if adopted, could allow medium density residential development (townhomes). Other uses in this area include RV camping developments and single family dwellings. The OCP envisioned this as a tourist commercial area that would provide tourism amenities. However, the past uses including a mini golf course were not successful. Because the area is in flux, development projections will utilize both commercial and residential development.

#### Area 7: Marine Tourist Commercial

The OCP designates these lands, located at the northern boundary of the Village, as Marine Tourist Commercial. Uses permitted in this designation are oriented toward marine tourisms uses and may include: marina, marina accommodation, restaurants and related retail uses. Council recently amended the zoning for one site to permit a multi-family residential use that will include a mixed-use commercial/retail building, and houseboat development. The other properties have limited development potential. They are comprised of an art gallery (property is Village owned) and water lot leases that the Village holds.

#### Area 8: Resource

The OCP designates this land as Resource. The intention of this designation is to maintain undeveloped lands in their natural state for uses that include both public and private recreation, public use and agriculture. These lands are also located in the Agricultural Land Reserve and are therefore pursuant to Agricultural Land Commission Act, able to be used for farm use. This permits a broad number of uses that fall within the definition of farming. Any change to the OCP designation would require approval from the Agricultural Land Commission, which adds a level of uncertainty for re-development. Should these privately owned lands be re-developed, it is likely that a clustered development would take place

# Village of Harrison Hot Springs Page 3

that would leave a large portion of the lands in their natural state and develop only one portion of the site. Applying a density calculation consistent with Low Density Residential.

#### Area 9: Public Uses

The OCP designate these lands as public use. A wide range of uses comprise the Public Use designation, including but not limited to: Municipal land and facilities, Fire Hall, School, Water Treatment Facility, etc. For obvious reasons, these lands do not have development potential. They will simply be highlighted on mapping.





# Appendix G – VHS Water Conservation Plan

Water Master Plan June 2015

VILLAGE	VILLAGE OF HARRISON HOT SPRINGS POLICY		
POLICY NAME	POLICY NUMBER	6.3	
WATER CONSERVATION PLAN	DATE ADOPTED	April 28, 2011	

# 1. PURPOSE

The Village is committed to becoming a complete sustainable community with attention to climate change to ensure the Village's carbon footprint meets or exceeds provincial guidelines.

One aspect of the sustainability program is a focus on water conservation and this policy will be incorporated into the overall sustainable plan. The purpose of the policy is to minimize water usage by developing a new way of doing business in terms of water management and conservation.

The Village's water conservation plan will concentrate on reduction in water use, water loss and waste and develop water management practices that include the efficient use of the water source to the benefit of residents, business and the environment.

To realize success in the water conservation program it is paramount to encourage the residents, the business community as well as the visitors to Harrison Hot Springs to reduce their demand on the Village's water sources.

Until recently water supply has been a key issue in the Village and a detriment to the proper management of growth and development. However, with the recently constructed reservoir the Village is in a position to entertain development projects but in doing so must also be cognizant of the demands on the water system and ensure proper conservation matters are addressed through the building process.

In essence this policy, through the adoption of the Water Conservation Plan, will incorporate "Water Efficiency" programs and develop the best practice management plan to prevent waste and overuse. The fundamental object is to do more with less without impacting the public comfort of these requirements or jeopardizing the water systems performance.

# 2. WATER CONSERVATION PLAN

# INTRODUCTION

Objective:

The objectives of the water conservation plan are;

- a) To reduce water consumption from the prevailing levels. Currently the consumption in the Village of Harrison Hot Springs was 207, 861 cubic meters in 2009 and 267,821 cubic meters in 2010.
- b) To reduce the loss and waste of water.
- c) To improve the efficiency and the use of water.
- d) To measure the level of recycling and reuse in the water supply.
- e) Through effective growth management and new technologies reduce the rate of growth and demand on the water system.

# GENERAL

In keeping with council's commitment to sustainability and addressing climate change to reduce the Villages carbon footprint goals of the water conservation plan will include;

- a) Using the consumption figure of 2010 (267,821 cubic meters) as the base line to reduce water consumption over the next 5 years by 10%.
- b) Develop a program over the next 10 years to ensure the level of unaccounted water in the system is below 10% from a current high of an estimated 35%.
- c) Implement and maintain a program of universal metering over the next 10 years in the residential community.
- d) Implement a program for meter testing, replacement and repair.
- e) Increase efficient water usage through water conservation program.
- f) Raise resident awareness of water conservation and encourage responsible behavior through a public education and information program and;
- g) Develop a strategy to conserve water during peak demands during prolonged hot weather.

# METERING

Currently all commercial and institutional users connected to the Village water system are metered and pay on metered use. Until recently, residential users were not metered but rather paid a flat fee on their taxes for the use of Village water. In the past two years the Village has begun a program of ensuring that all new residential development is metered. Although these residents will be metered, their consumption is still billed on a flat rate basis on their annual taxes. This approach does create inefficiencies within the system and also allows for misuse/abuse of water supply.

Currently 95% of residential properties are not metered which leads to higher demand with an increased risk of potential waste and/or misuse.

Goals:

- 1. That the Village continue with its practice to ensure that all commercial, institutional and residential development is metered.
- 2. That a ten year program be developed to ensure that all existing residential properties are metered within ten years.
- 3. That, in the development of a business case to meter existing residents, a consideration is given to P3 opportunities.

- 4. That the Village continues to practice the billing of commercial and institutional users on "metered consumption" and that plans be developed to also incorporate residential meter reading as a basis for billing.
- 5. That the Village develop a financial analysis of the cost of water supply in relation to consumption with a price point being established to encourage conservation.
- 6. That the Village institute quarterly billing for all utility accounts.

### CONTROL OF ALL UNACCOUNTED WATER SUPPLY

An ongoing challenge facing the Village is that the vast majority of residents are not metered and therefore there is a potential loss of water through leakage and waste. Unaccounted water can also happen through inaccuracy in meters; developments connected to the water system but not yet billed, losses to the grates in the water main and water distribution system, loss due to firefighting and losses due to illegal connections and theft. Currently the Village has no method of monitoring or controlling unaccounted water.

Unaccounted water, in addition to unexplained excessive use of water supply, also has financial implications to the Village in terms of both lost revenue and increased operating costs through pumping etc.

While it is difficult to measure unaccounted water due to a lack of universal metering it is an issue that the Village must come to terms with, effective programs can be developed with the aim of reducing the unaccounted water.

### Goals

- 1. Operations crews, when in the field, will test for, observe for and report evidence of leaks in the water distribution system. They will also observe private residence and report any suspected leaks on private property to the Village office and follow up with the owner.
- 2. The Village will develop a leak detection and repair program by the summer of 2013.
- 3. The operations crew will watch for and report signs of water loss and illegal connections to the office so they can be addressed quickly.
- 4. In 2012 the Village will develop a policy, program and procedures for the testing of meters; both residential and commercial usage.

### **COMMUNITY PROGRAMS**

Although there is a growing awareness of water conservation an effective water conservation program will provide information to the general public on how they can participate in the program to assist in achieving "a greener and sustainable community".

The initial approach will be to encourage public participation in the conservation program which will be measured to determine success. Eventually, the volunteer program will evolve into a mandatory program through a series of amendments to Village bylaws. It is also imperative to develop a water conservation strategy at the elementary school level to create an awareness of the need and importance of a water conservation program and encourage the youth to engage their parents in an open discussion about water conservation.

Water conservation success is a community endeavor and must be embraced and supported by the residents to ensure that the desired outcomes are achieved.

Goals:

- 1. Develop pamphlets on water conservation to be included in mail outs commencing with the 2012 tax year providing "hints" on water conservation.
- 2. Develop information pamphlets outlining water conservation technology, their benefits and potential payback to the user, such as two and low flow toilets and shower heads.
- 3. Encourage developers to pursue green building technologies incorporating water conservation technologies within their buildings.
- 4. Develop incentive programs to encourage residents to purchase low flow or two flow toilet replacement and low flow shower heads, pressure reducing valves within the next two to five years.
- 5. Prepare amendments to regulatory bylaws by 2013 to incorporate mandatory requirements for water conservation technology and green buildings.

# 3. WATER CONSERVATION MANAGEMENT

It is important to look beyond the normally accepted practices to curb water consumption in developing the water conservation plan. Consideration will be given to developing a program to reuse and recycle waste water, the use of grey water from roof drains and the implementation of a landscape water management program. The cost of water supply can also be reduced, thus increasing the efficiency of the system by upgrading the wastewater treatment plant and associated pumps. The Village is currently committed to an upgrading program of its wastewater treatment plant involving several phases each producing an added benefit through the reduction of operating costs in pumping, treatment, disinfecting and general maintenance and repair.

Goal:

- During the reconstruction of the wastewater treatment plant every effort is made to capture a
  reduction in costs for treating (chlorination and filtration) with polymel water, cost of pumping
  sewage (lift station), cost of treating sewage, cost of disinfecting and discharging the affluent,
  cost of wear and tear on water piping network and sanitary collection network, and overall cost
  savings and maintenance. It is expected that when the upgrades are completed the plant will
  be 60% more efficient.
- 2. Commence a program to retrofit existing facilities and equipment to environmentally friendly materials and technologies to minimize the impact on the carbon footprint.
- 3. That the Village adopt a water management program that details the how's, when's, where's for watering Village parks and landscape and hanging baskets and flower barrels in 2012.
- 4. In 2011 implement and enforce a residential water action plan as follows:
  - a. Stage 1 effective June 1 September 30 of each year residents and businesses are to practice water conservation and minimize or discontinue water use for non-essential purposes. For residents watering will only be allowed for even numbered houses on Tuesdays and Saturdays between the hours of 5am 8am or 7 pm 10pm and for odd numbered houses on Wednesdays and Sundays for the same hours as noted above.
  - b. Stage 2
    - i. Residents must limit watering of landscape barriers with hose and sprinklers to one day per week Tuesdays for even house numbers and Wednesdays for odd house numbers with the hours of watering to be restricted to the times noted in Stage 1.
    - ii. The washing of motor vehicles will be restricted to the designated watering days as noted in stage 1, when such washing when allowed shall be done with

a hand held bucket or a hand held hose equipped with a positive shut off nozzle for quick rinses. This will not apply to licensed commercial car wash or service station facilities.

- iii. Use fire hydrants for firefighting or related activities only or for construction purposes under special permit from the Village; and
- iv. Not to wash down hard surface areas such as driveways, patios, decks etc. or use water for dust control or wash down buildings.
- c. Stage 3 Residents and businesses in addition to the above noted restrictions must comply with any other regulations that council may impose to enhance the water conservation program from time to time.
- 5. Develop a program within the next two years to provide water and energy audits to residential properties and small businesses.
- 6. Develop a program to ensure water conservation designed principles and technologies are included in an all new capital works projects and maintenance practices undertaken by the Village by 2013.
- 7. Develop a program in 2012 to progressively retrofit Village owned buildings with water efficient fixtures and fittings.