# HANLEY PARK NORTH DEVELOPMENT

## Preliminary Watermain Design Brief

**January 2020**

**AINLEY GRAHAM & ASSOCIATES**

**CONSULTING ENGINEERS AND PLANNERS**
COLLINGWOOD · BARRIE · BELLEVILLE · KINGSTON · OTTAWA

File No. 18578-1

Ainley GROUP CONSULTING ENGINEERS PLANNERS

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# 1.0 INTRODUCTION

## 1.1 General

Ainley Group has been retained to undertake engineering services necessary for the completion of a watermain design brief to support the proposed Draft Plan of Subdivision application for the Hanley Park North development lands within the City of Belleville.

The proposed development is located at the eastern limits of Mercedes Meadows, east of Spruce Gardens and Tessa Boulevard. The development site is represented in **Figure 1**.

The proposal will incorporate the development of six (6) single family residential units to the immediate east of Spruce Gardens and ninety-three (93) single family residential lots and fifty-seven (57) townhouse lots to the immediate east of Tessa Boulevard.

## 1.2 Criteria

This report has been prepared with consideration of the following documents and guidelines;

- Form 1 – Record of Watermains Authorized as a Future Alteration,
- Ministry of the Environment publication 'Watermain Design Criteria for Future Alterations Authorized under a Drinking Water Works Permit – June 2012',
- Ministry of the Environment publication 'Design Guidelines for Drinking Water Systems, 2008',
- Fire Underwriters Survey 'Water Supply for Public Protection (1999)', and
- The Corporation of the City of Belleville 'Manual of Standard Specifications'.

# 2.0 PROPOSED WATERMAIN WORKS

The proposed works will include the connection to the existing 200mm diameter PVC watermain located within Spruce Gardens and 300mm diameter PVC watermain within Tessa Boulevard. For the entirety of the proposed development (i.e. all phases), the approximate length of new 200mm diameter PVC watermain is 1,200m. **Figure 2** outlines the proposed watermain layout.

# 3.0 EXISTING CONDITIONS

Fire hydrant flow test results were provided by the City of Belleville Water Distribution and Service Department for an existing fire hydrant located at 51 Tessa Boulevard. The results indicated a static pressure of 62 psi. A copy of the test results are enclosed in **Appendix B**.

## 4.0 WATER DEMAND EVALUATION

### 4.1 Domestic Water Demand

An evaluation of the anticipated water demand has been prepared using the guidelines set out in the Ministry of the Environment publication 'Design Guidelines for Drinking Water Systems, 2008'.

Based on the proposed full development unit count and existing demands on the system from the full build-out of Mercedes Meadows, the anticipated demands are;

- Average Day – 3.68 l/s,
- Maximum Day – 10.13 l/s,
- Minimum Hour – 1.47 l/s,
- Peak Hour – 15.21 l/s.

Supporting calculations included in **Appendix C**.

### 4.2 Fire Flow

Fire flow requirements have been evaluated based on the Fire Underwriters Survey 'Water Supply for Public Protection (1999)'.

The resulting Fire Flow + Maximum Day requirement has been determined to be 154.50 L/s.

Supporting calculations are included in **Appendix C**.

### 4.3 Transient Pressure

The proposed 200 mm diameter PVC Class 150 DR 18 pipe has been designed by the manufacturer to withstand pressures up to 150 psi, which is higher than the maximum operating pressure (100 psi) plus any transient pressure it may be subjected to.

The proposed pipes and joints have also been designed to withstand the maximum operating pressure plus the surge pressure that would be created by stopping a water column moving 0.6 m/s. The transient pressure surge in a PVC Class 150 DR 18 pipe with a 0.6 m/s water column is 35 psi.

## 5.0 HYDRAULIC EVALUATION

The MOE Design Guidelines for Drinking Water Systems (2008) state that the normal operating pressures in the water distribution system should be approximately 50 to 70 psi. The maximum pressure in the system should not exceed 100 psi, and the minimum pressure in the system

should be no lower than 40 psi; however, in the case of fire flows, the pressure may drop to a level no lower than 20 psi.

An EPANET model was created to model the watermain pressures for the development. The water source used in the model is based off of the hydrant testing carried out at Tessa Boulevard (**Appendix B**). Inputs into the model included the hydrant pressure and flow data; pipe lengths, friction factors, and diameters; pipe junction elevations; and demand flows. The data input into the model are included in **Appendix D** along with the output generated from the model. The model node used to test the normal demand and fire flow demand flows was node 27, which was considered to be located in the "worst case" position, as it is located at the furthest distance from the source and water is connecting from only two directions.

The model shows that during Maximum Day Flows (normal demand conditions), the minimum pressure in the system will be 61.09 psi (42.96 m head), whereas during the Maximum Day + Fire Flow demand, the minimum pressure in the system will be 24.91 psi (17.52 m head). Two other flows were analyzed for quality control / confidence checks: 1) at 100 l/s, the pressure at the fire flow node will be 48.23 psi (33.92 m head), and 2) the flow that will cause 20 psi pressure (14.06 m head) at the fire flow demand node was determined to be 164.04 l/s. Supporting calculations are included in **Appendix D**. As such, the EPANET model shows that the watermain pressures conform to the guidelines for normal operating pressures and fire flow pressures.

## 6.0 DESIGN CONSIDERATIONS

Notwithstanding the following the Guidelines outlined in The Corporation of the City of Belleville 'Manual of Standard Specifications' shall apply. The following outlines the design considerations to be applied for the hydraulic evaluation and design layout;

Pipe Diameters
The distribution system shall require fire flow throughout; therefore, the minimum pipe diameter shall be 150mm.

Friction Factors
For all watermain 200mm in diameter – 120
For all watermain 300mm in diameter – 120

Pipe Material
All watermain pipe 100mm to 300mm in diameter shall be PVC DR18 (or lower) and be manufactured in accordance with AWWA C900 and certified to NSF/ANSI 61 and to CSA B137.3.

The pressure class of all pipes shall be a minimum of 235psi.

System Pressure

Normal pressures in the distribution system should not go above 100 psi or below 40 psi during normal demand periods. In the case of fire flows, it may be acceptable to allow the pressure in the system to drop to a level no lower than 20 psi.

Service Pipe
Service piping shall be a minimum diameter of 19mm and of copper or polyethylene.

Copper services shall be type K soft copper with an internal working pressure of 175psi and conform to ASTM B88 and be certified to NSF/ANSI 61.

Polyethylene services shall have a standard DR of 11.0 or lower with a pressure class of 160psi or greater and shall conform to AWWA C901 and be certified to NSF/ANSI 61.

Fire Hydrants
Hydrants should be installed at locations agreed to through consultation with the Municipality during the review process.

Hydrants shall conform to AWWA Standard C502: Dry Barrel Fire Hydrants.

Fire hydrant drain holes are anticipated to be at least 1.0 m above the water table at all proposed hydrant locations.

Valves
Valves shall be installed at each intersection (2 at a 'T', 3 at a 'cross') and at minimum separations as requested by the Municipality during detailed design.

All valves shall conform to AWWA standards.

Chambers
There are no chambers proposed in this development.

Depth
All watermain shall be a minimum of 1.8m in depth.

Dead Ends
All locations where a watermain terminates (temporary or permanent) a plug and blow off shall be installed.

Restraints
All joints (at fittings, hydrants, valves and bends greater than 11.25°) shall be mechanically restrained

Separation Distances
- Horizontal – 2.5m clear,
- Vertical – 0.5m clear.

Utility Crossings
When a watermain crosses over or under a utility (other than sanitary or storm) a separation of 0.3m shall be provided.

Permeation by Organic Compounds
There are no know soil contamination concerns on the subject lands, accordingly no consideration for permeation has been considered.

Pipe Encasement
There are no encasement requirements in this phase of the development.

## 7.0 CONCLUSIONS

- The proposed watermain works are anticipated to meet the minimum required 20 psi under maximum day demand plus fire flow.
- Under normal demand conditions, the proposed watermain works are anticipated to meet the minimum required 40 psi. The proposed works are not anticipated to exceed the maximum 100 psi.
- The design layout should conform to the criteria outlined in section 6 of this brief.

We trust that the above meets your guidelines and ask that you contact the undersigned, should you have any queries.

Sincerely,
**AINLEY GRAHAM & ASSOCIATES LIMITED**

Prepared by:
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Engineering Intern

Reviewed by:
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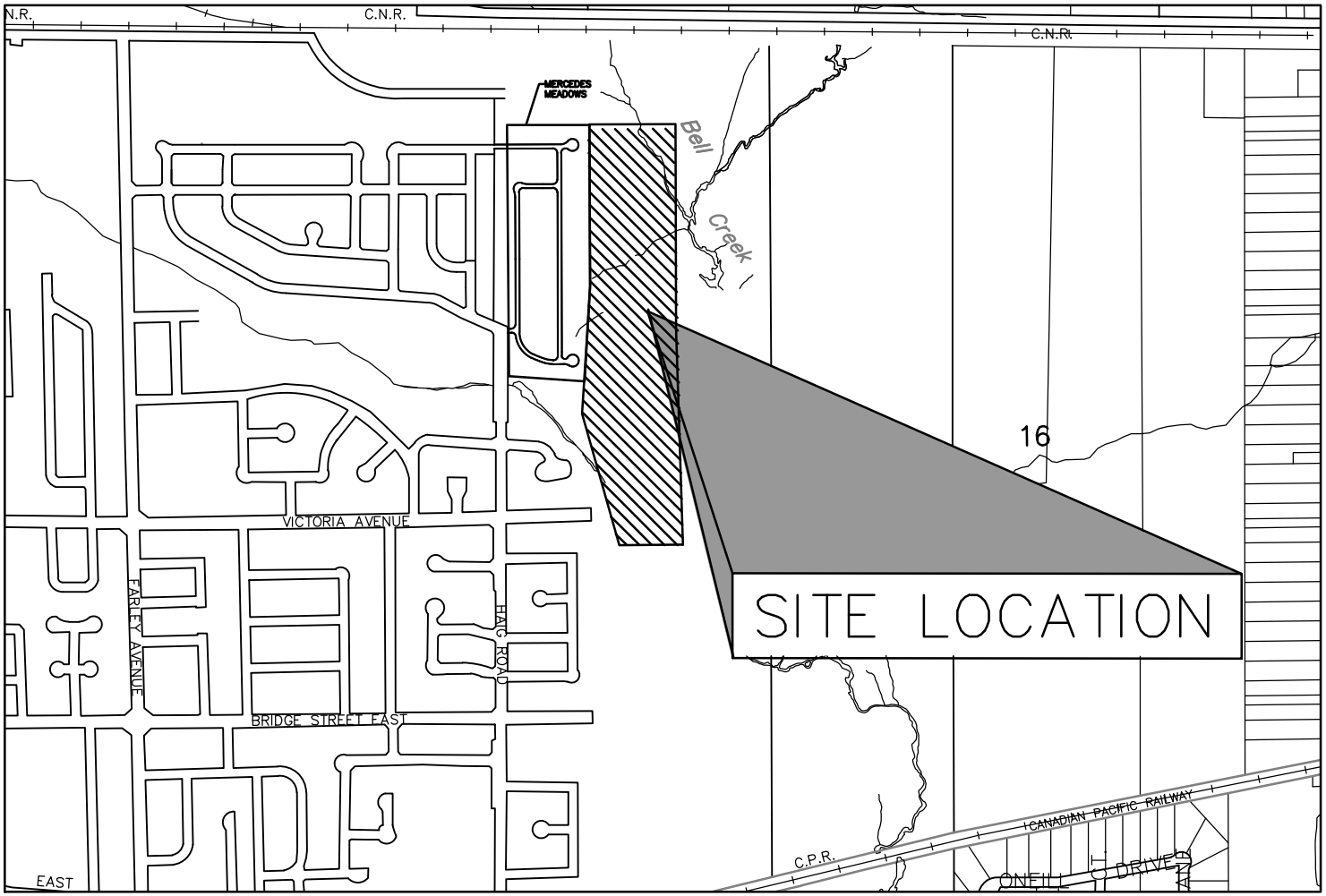
Project Engineer

**APPENDIX A**

**Figures**




HANLEY PARK North
CITY OF BELLEVILLE

FIGURE 1
KEY MAP

Ainley CONSULTING ENGINEERS PLANNERS

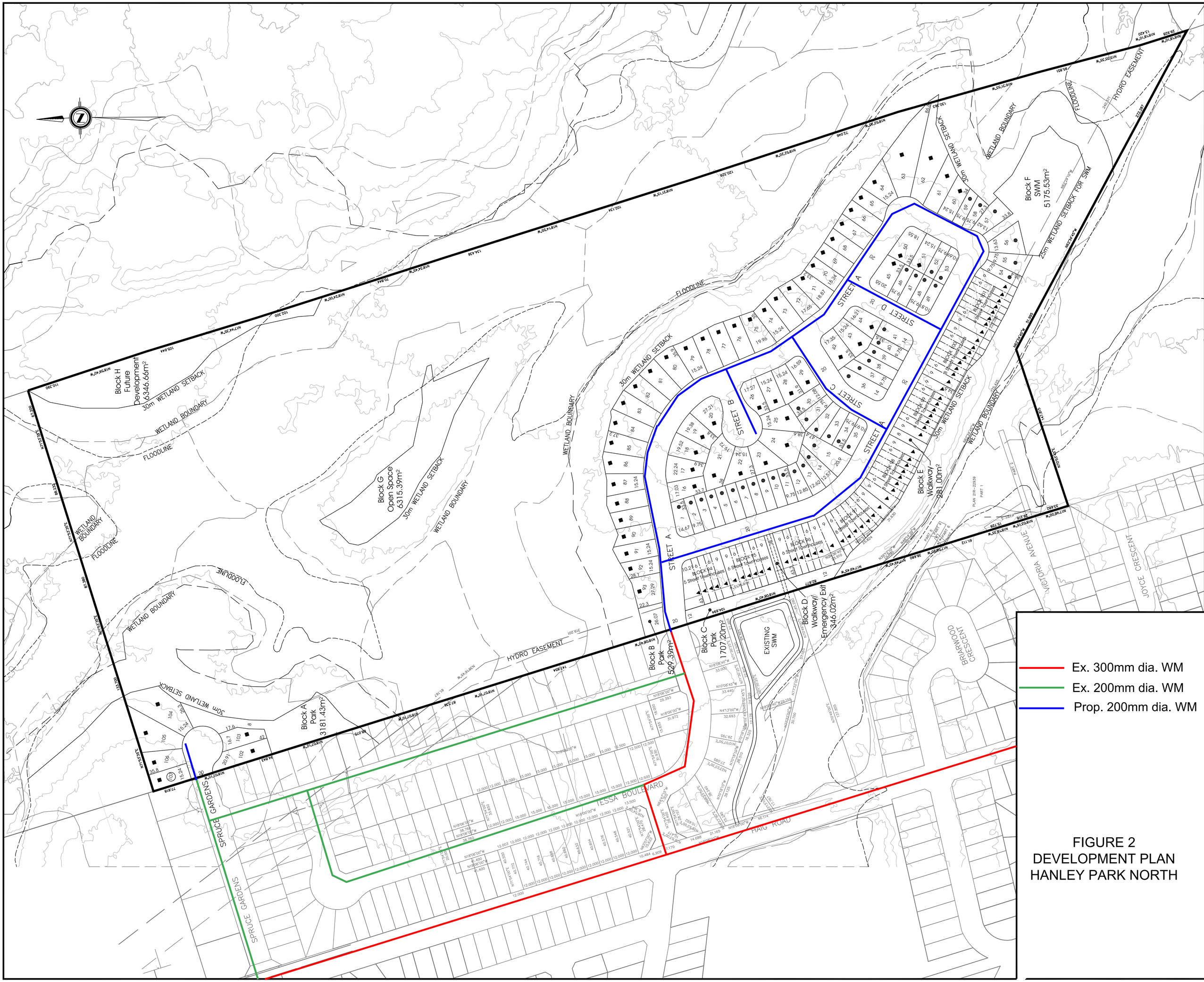



FIGURE 2
DEVELOPMENT PLAN
HANLEY PARK NORTH

**APPENDIX B**

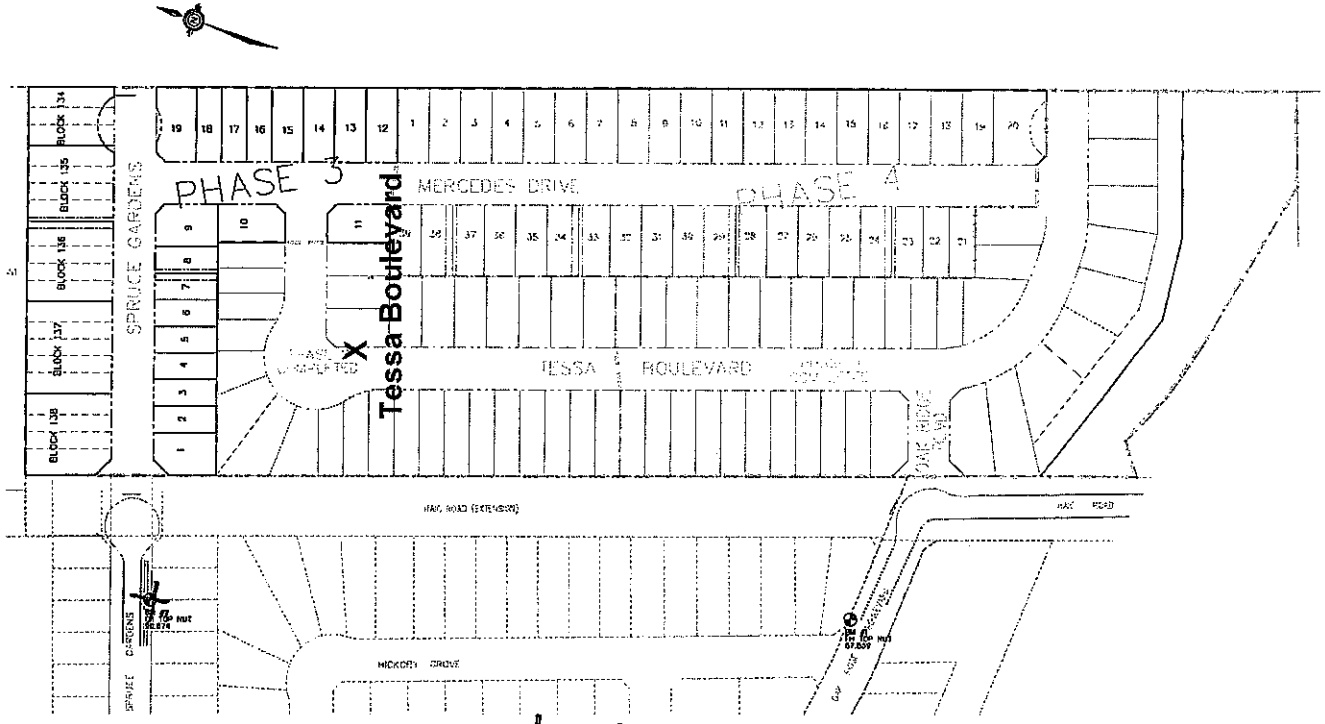
**Fire Hydrant Flow Test Data**

CITY OF BELLEVILLE

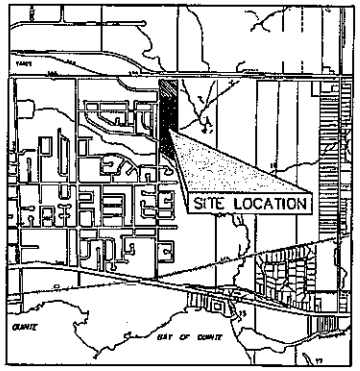
# MERCEDES MEADOWS
# HAIG ROAD SUBDIVISION

## PHASE 3

PROJECT No. 14526-2




65 Spruce Gardens




KEY MAP

GEODETIC BENCHMARKS:
BM #1 – LOCATED ON THE TOP NUT OF THE FIRE HYDRANT LOCATED AT THE N.E. CORNER OF MOSSEY DRIVE AND OAK RIDGE BLVD. GEODETIC ELEVATION = 87.569

BM #2 – LOCATED ON THE TOP NUT OF THE FIRE HYDRANT LOCATED ON THE SOUTH SIDE OF SPRUCE GARDENS. GEODETIC ELEVATION = 90.574

## INDEX


| DWG. No. | DESCRIPTION |
|---|---|
| 14526-C1 | COVER SHEET |
| 14526-GDN | GENERAL NOTES AND DETAILS |
| 14526-GSP1 | GENERAL SERVICING PLAN (NORTHERN HALF) |
| 14526-GSP2 | GENERAL SERVICING PLAN (SOUTHERN HALF) |
| 14526-STM | STORM PLAN AND DRAINAGE AREAS |
| 14526-SAN | SANITARY PLAN AND CATCHMENT AREAS |
| 14526-LG1 | GENERAL LOT GRADING PLAN |
| 14526-LG2 | GENERAL LOT GRADING PLAN |
| | |
| | |
| | |
| | PLAN AND PROFILE |
| | |
| | |
| | |
| | |
| 14526-P6 | SPRUCE GARDENS – STA. 2+000 TO STA. 2+080 PLAN AND PROFILE |
| 14526-P7 | SPRUCE GARDENS – STA. 2+080 TO STA. 2+172.73 PLAN AND PROFILE |
| 14526-P8 | MERCEDES DRIVE – STA. 2+000 TO STA. 2+130 PLAN AND PROFILE |
| 14526-P9 | MERCEDES DRIVE – STA. 2+130 TO STA. 2+230 PLAN AND PROFILE |
| 14526-P10 | MERCEDES DRIVE – STA. 2+330 TO STA. 2+430.63 PLAN AND PROFILE |
| | |
| | |
| 14526-ECP | EROSION AND SEDIMENT CONTROL PLAN |


SUBMITTED: JULY 12/2016, JULY 29/2016, AUG 2/2016

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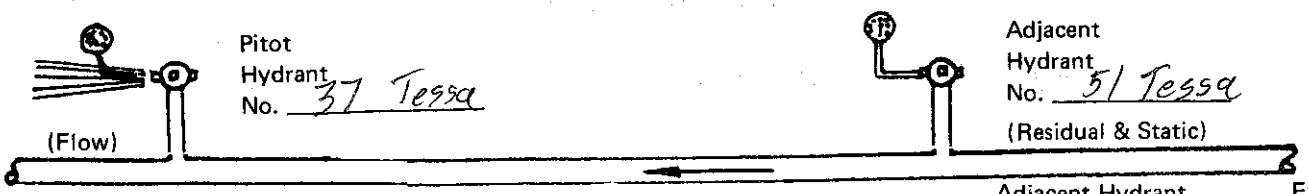
Routing

White - 1. Op. Mgr. 2. Draft. 3. FF bk.
Pink - File 842
Canary - Originator

**Belleville Utilities Commission**
459 SIDNEY STREET
P.O. BOX 939
BELLEVILLE, ONT., K8N 5B6
(613) 966-3651

Date: Sept 12, 16
Time: 118
Performed by QP CEM
File: 842

# FIRE HYDRANT FLOW TEST



Pitot Hydrant No. 37 Tessa
(Flow)

Adjacent Hydrant No. 51 Tessa
(Residual & Static)

Adjacent Hydrant _____ Ft.
Above or Below Pitot Hydrant

Street Name Tessa Blvd
Location on St.
or name of Bldg. _____

Provide Four Pressure Readings:
Select outlets to give 10 psi drop at adjacent hydrant if possible

| | | OUTLETS | | | | | |
|---|---|---|---|---|---|---|---|
| | | one - 1" | one - 1 1/8" | one - 1½" | one - 2½" | two - 2½" | |
| Step One - | Adjacent Hydrant | | | | 62 | 62 | psi (static) |
| Step Two - | Pitot Hydrant | | | | 55 | 40 | psi (flow) |
| Step Three - | Adjacent Hydrant | | | | 60 | 57 | psi (residual) |
| Step Four - | Adjacent Hydrant | | | | 62 | 62 | psi (static check) |

low with 20 psi residual at adjacent hydrant
= measured flow $\left(\frac{\text{available drop}}{\text{test drop}}\right)^{.54}$

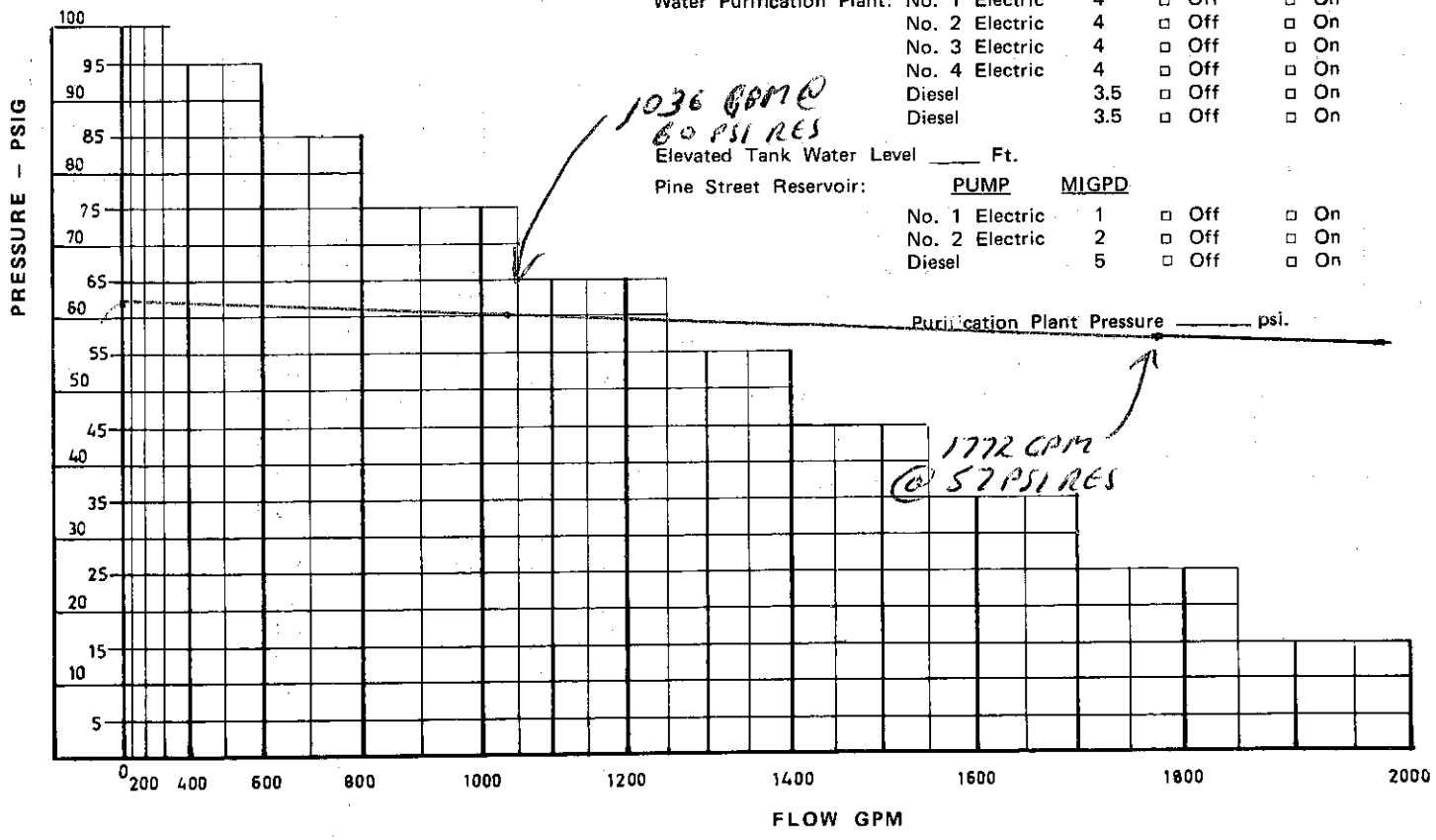
Available drop is static less 20
Test drop is static less residual

Information below can be obtained at a later date from records at Water Purification Plant.

| | | PUMP | MIGPD | | |
|---|---|---|---|---|---|
| Water Purification Plant: | No. 1 Electric | | 4 | ☐ Off | ☐ On |
| | No. 2 Electric | | 4 | ☐ Off | ☐ On |
| | No. 3 Electric | | 4 | ☐ Off | ☐ On |
| | No. 4 Electric | | 4 | ☐ Off | ☐ On |
| | Diesel | | 3.5 | ☐ Off | ☐ On |
| | Diesel | | 3.5 | ☐ Off | ☐ On |

Elevated Tank Water Level ____ Ft.

| | | PUMP | MIGPD | | |
|---|---|---|---|---|---|
| Pine Street Reservoir: | No. 1 Electric | | 1 | ☐ Off | ☐ On |
| | No. 2 Electric | | 2 | ☐ Off | ☐ On |
| | Diesel | | 5 | ☐ Off | ☐ On |




Fm. 109A

**APPENDIX C**

**Water Demand Calculations**

# Hanley Park North
# Evaluation of Water Demand

**Population**

| | | |
|---|---|---|
| #units | 303 | |
| pop/unit | 3 | assumed |
| # people | 909 | |

**Average Day Flow**

| | | |
|---|---|---|
| L/cap*d | 350 | assumed |
| ADF | 318150 | l/d |
| | **3.68** | l/s |

**Maximum Day Flow**

| | | |
|---|---|---|
| factor | 2.75 | MOE Table 3.3 |
| L/cap*d | 350 | |
| MDF | 874912.5 | l/d |
| | **10.13** | l/s |

**Minimum Hour**

| | | |
|---|---|---|
| factor | 0.4 | MOE Table 3.3 |
| ADF | 3.68 | l/d |
| | **1.47** | l/s |

**Peak Hour**

| | | |
|---|---|---|
| factor | 4.13 | MOE Table 3.3 |
| ADF | 3.68 | l/d |
| | **15.21** | l/s |

## Fire Flow - Single Family Units

*Water Supply for Public Fire protection - Guide for Determination of Reguired Fire flow - Fire Underwriters Survey (1999)

Note J - Single Family Dwellings - short Method Applicable

Step

| | | | | | |
|---|---|---|---|---|---|
| A | Construction type | Wood Frame | | | |
| B | Floor Area | 130 $m^2$ | | | |
| C | Height | 2 storey max typ. | | | |
| | | | C | 1.5 | |
| | | | A | 260 | |
| D | F=220CsqrtA | | F | 5321.09 | l/min |
| E | Hazard Adjustment | low (-25%) | | -1330.27 | l/min |
| | | adjusted | | 3990.82 | |
| F | Sprinkler Adjustment | | | NA | |
| G | Exposure Adjustment*** | 75% | | 2993.11 | l/min |
| H | Total | | | **6983.93** | l/min |
| | | | | **116.40** | l/s |

****(sides = 2x25%, front = 10% and rear = 15%)*

## Fire Flow - Townhouse Units

*Water Supply for Public Fire protection - Guide for Determination of Reguired Fire flow - Fire Underwriters Survey (1999)

Step

| | | | | | |
|---|---|---|---|---|---|
| A | Construction type | Wood Frame | | | |
| B | Floor Area | 400 $m^2$ | | | |
| C | Height | 1 storey | | | |
| | | | C | 1.5 | |
| | | | A | 400 | |
| D | F=220CsqrtA | | F | 6600.00 | l/min |
| E | Hazard Adjustment | low (-25%) | | -1650.00 | l/min |
| | | adjusted | | 4950.00 | |
| F | Sprinkler Adjustment | | | NA | |
| G | Exposure Adjustment*** | 75% | | 3712.50 | l/min |
| H | Total | | | **8662.50** | l/min |
| | | | | **144.38** | l/s |

****(sides = 2x25%, front = 10% and rear = 15%)*

**Max Day + Fire Flow** **154.50** l/s

**APPENDIX D**

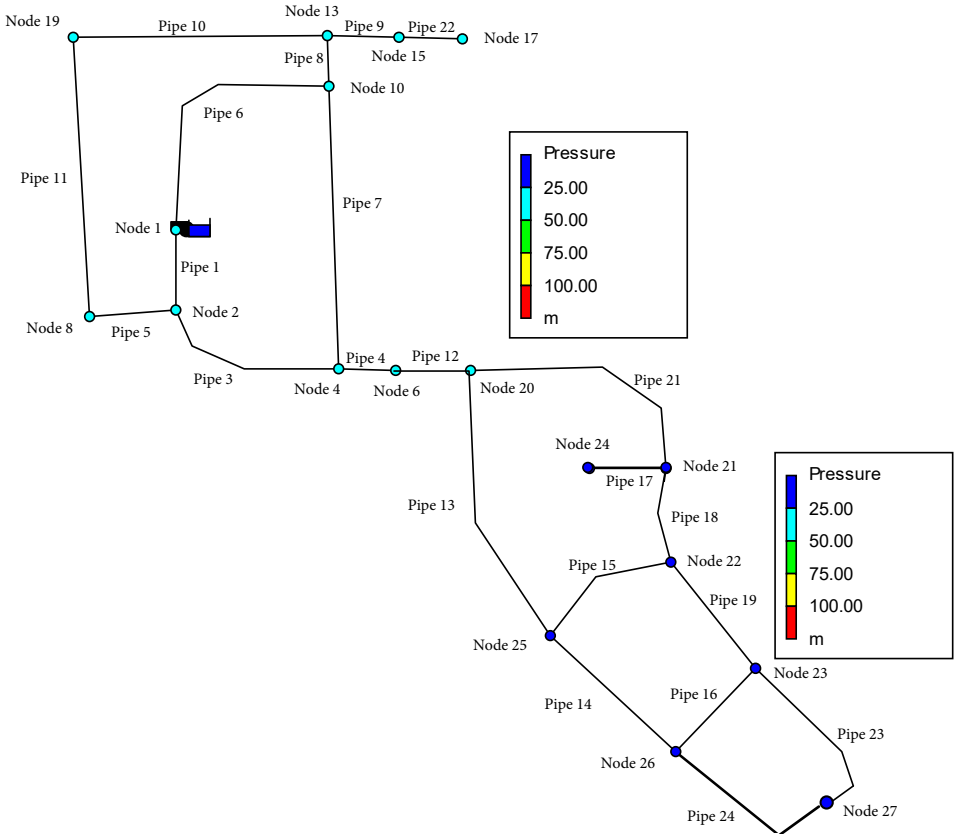
**Hydraulic Calculations**

## Pump Curve - Tessa Boulevard (Elevation 88.8m)

| Flow (L/s) | Head (m) |
|---|---|
| **0** | 43.6 |
| **78.5** | 42.19 |
| **134.26** | 40.1 |

Equation: Head = 43.60-0.000818(Flow)^1.71

Note: Curve Flow (L/s) and Head (m) values taken from Hydrant Testing and Converted from IGPM and PSI (Appendix B)


Node 19
Pipe 10
Node 13
Pipe 9
Pipe 22
Node 17
Pipe 8
Node 15
Node 10
Pipe 6
Pipe 11
Pipe 7
Node 1
Pipe 1
Node 2
Node 8
Pipe 5
Pipe 4
Pipe 12
Pipe 3
Node 4
Node 6
Node 20
Pipe 21
Node 24
Node 21
Pipe 17
Pipe 13
Pipe 18
Pipe 15
Node 22
Pipe 19
Node 25
Node 23
Pipe 16
Pipe 14
Pipe 23
Node 26
Pipe 24
Node 27
Pressure
25.00
50.00
75.00
100.00
m
Pressure
25.00
50.00
75.00
100.00
m

Network Table - Links

| Link ID | Length m | Diameter mm | Roughness |
|---|---|---|---|
| Pipe 1 | 40 | 204 | 120 |
| Pipe 3 | 120.524 | 300 | 120 |
| Pipe 4 | 39.392 | 300 | 120 |
| Pipe 5 | 54.674 | 300 | 120 |
| Pipe 6 | 339.295 | 200 | 120 |
| Pipe 7 | 358.463 | 200 | 120 |
| Pipe 8 | 81.371 | 200 | 120 |
| Pipe 9 | 41.95 | 200 | 120 |
| Pipe 10 | 141.178 | 200 | 120 |
| Pipe 11 | 370.955 | 300 | 120 |
| Pipe 12 | 46.72 | 200 | 120 |
| Pipe 13 | 249.24 | 200 | 120 |
| Pipe 14 | 84.99 | 200 | 120 |
| Pipe 15 | 111.66 | 200 | 120 |
| Pipe 16 | 77.81 | 200 | 120 |
| Pipe 17 | 51.72 | 200 | 120 |
| Pipe 18 | 77.95 | 200 | 120 |
| Pipe 19 | 63.26 | 200 | 120 |
| Pipe 21 | 176.88 | 200 | 120 |
| Pipe 22 | 23 | 200 | 120 |
| Pipe 23 | 125.63 | 200 | 120 |
| Pipe 24 | 125.63 | 200 | 120 |
| Pump 2 | #N/A | #N/A | #N/A |

Maximum Day Flow + Fire Flow
Network Table - Nodes

| Node ID | Elevation m | Base Demand LPS | Pressure m |
|---|---|---|---|
| Junc 1 | 88.216 | 0 | 39.82 |
| Junc 2 | 87.81 | 0 | 37.50 |
| Junc 4 | 87.211 | 0 | 36.67 |
| Junc 6 | 87.403 | 0 | 35.82 |
| Junc 8 | 86.828 | 0 | 38.48 |
| Junc 10 | 88.500 | 0 | 36.97 |
| Junc 13 | 88.78 | 0 | 36.64 |
| Junc 15 | 88.966 | 0 | 36.46 |
| Junc 17 | 89.086 | 0 | 36.34 |
| Junc 19 | 89.460 | 0 | 35.88 |
| Junc 20 | 87.203 | 0 | 30.40 |
| Junc 21 | 86.503 | 0 | 25.27 |
| Junc 22 | 86.153 | 0 | 23.04 |
| Junc 23 | 85.703 | 0 | 21.09 |
| Junc 24 | 86.403 | 0 | 25.37 |
| Junc 25 | 85.953 | 0 | 23.28 |
| Junc 26 | 85.553 | 0 | 21.22 |
| Junc 27 | 85.078 | 154.5 | 17.52 |
| Resvr 3 | 88.88 | #N/A | 0.00 |

Maximum Day Flow
Network Table - Nodes

| Node ID | Elevation m | Base Demand LPS | Pressure m |
|---|---|---|---|
| Junc 1 | 88.216 | 0 | 44.22 |
| Junc 2 | 87.81 | 0 | 44.61 |
| Junc 4 | 87.211 | 0 | 45.20 |
| Junc 6 | 87.403 | 0 | 45.00 |
| Junc 8 | 86.828 | 0 | 45.59 |
| Junc 10 | 88.500 | 0 | 43.92 |
| Junc 13 | 88.78 | 0 | 43.64 |
| Junc 15 | 88.966 | 0 | 43.45 |
| Junc 17 | 89.086 | 0 | 43.33 |
| Junc 19 | 89.460 | 0 | 42.96 |
| Junc 20 | 87.203 | 0 | 45.17 |
| Junc 21 | 86.503 | 0 | 45.83 |
| Junc 22 | 86.153 | 0 | 46.16 |
| Junc 23 | 85.703 | 0 | 46.60 |
| Junc 24 | 86.403 | 0 | 45.93 |
| Junc 25 | 85.953 | 0 | 46.36 |
| Junc 26 | 85.553 | 0 | 46.75 |
| Junc 27 | 85.078 | 10.13 | 47.20 |
| Resvr 3 | 88.88 | #N/A | 0.00 |

100 LPS Base Demand

Network Table - Nodes

| Node ID | Elevation m | Base Demand LPS | Pressure m |
|---|---|---|---|
| Junc 1 | 88.216 | 0 | 42.15 |
| Junc 2 | 87.81 | 0 | 41.34 |
| Junc 4 | 87.211 | 0 | 41.30 |
| Junc 6 | 87.403 | 0 | 40.81 |
| Junc 8 | 86.828 | 0 | 42.32 |
| Junc 10 | 88.500 | 0 | 40.72 |
| Junc 13 | 88.78 | 0 | 40.42 |
| Junc 15 | 88.966 | 0 | 40.23 |
| Junc 17 | 89.086 | 0 | 40.11 |
| Junc 19 | 89.460 | 0 | 39.70 |
| Junc 20 | 87.203 | 0 | 38.50 |
| Junc 21 | 86.503 | 0 | 36.59 |
| Junc 22 | 86.153 | 0 | 35.79 |
| Junc 23 | 85.703 | 0 | 35.17 |
| Junc 24 | 86.403 | 0 | 36.69 |
| Junc 25 | 85.953 | 0 | 36.01 |
| Junc 26 | 85.553 | 0 | 35.31 |
| Junc 27 | 85.078 | 100 | 33.92 |
| Resvr 3 | 88.88 | #N/A | 0.00 |

# Flow Creating 20 PSI (14.06 m Head)
## Network Table - Nodes

| Node ID | Elevation m | Base Demand LPS | Pressure m |
|---|---|---|---|
| Junc 1 | 88.216 | 0 | 39.34 |
| Junc 2 | 87.81 | 0 | 36.70 |
| Junc 4 | 87.211 | 0 | 35.70 |
| Junc 6 | 87.403 | 0 | 34.78 |
| Junc 8 | 86.828 | 0 | 37.69 |
| Junc 10 | 88.500 | 0 | 36.19 |
| Junc 13 | 88.78 | 0 | 35.86 |
| Junc 15 | 88.966 | 0 | 35.67 |
| Junc 17 | 89.086 | 0 | 35.55 |
| Junc 19 | 89.460 | 0 | 35.09 |
| Junc 20 | 87.203 | 0 | 28.70 |
| Junc 21 | 86.503 | 0 | 22.88 |
| Junc 22 | 86.153 | 0 | 20.35 |
| Junc 23 | 85.703 | 0 | 18.12 |
| Junc 24 | 86.403 | 0 | 22.98 |
| Junc 25 | 85.953 | 0 | 20.59 |
| Junc 26 | 85.553 | 0 | 18.25 |
| Junc 27 | 85.078 | 164.04 | 14.06 |
| Resvr 3 | 88.88 | #N/A | 0.00 |