JLR No.: 21464-06
Revision: 0

May 11, 2022

Prepared for:

MORGUARD INVESTMENTS LIMITED
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Mississauga, ON
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Prepared by:

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Ottawa, ON
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Hydraulic Network Analysis Report
1424 Earl Armstrong Road

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS

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1.0 Introduction

1.1 General

In 2021, J.L. Richards & Associates Limited (JLR) was retained by Morguard Investments Limited (Morguard) to carry out a detailed Hydraulic Network Analysis (HNA) for the proposed commercial development at 1424 Earl Armstrong Road in the City of Ottawa. The total area of the subject site is ±6.37 ha and the property will consist of thirteen (13) commercial buildings surrounded by accessways and parking lots. The proposed watermain sizing, layout and hydrants were provided to JLR on the Servicing Plan prepared by Urban Ecosystems Limited dated May 2, 2022.

This report has been prepared to document the findings of the HNA in support of Morguard's Site Plan Application (SPA) to the City of Ottawa. The water design objectives, criteria, servicing constraints and strategies outlined in this report are in accordance with:

i) The City of Ottawa Water Distribution Guidelines (2010);
ii) Water Technical Bulletins ISDTB-2014-02, ISTB-2018-02 and ISTB-2021-03.
iii) Subsequent email correspondences with the Owner (Morguard), their architect, civil engineer and the City.

1.2 Site Description and Proposed Development

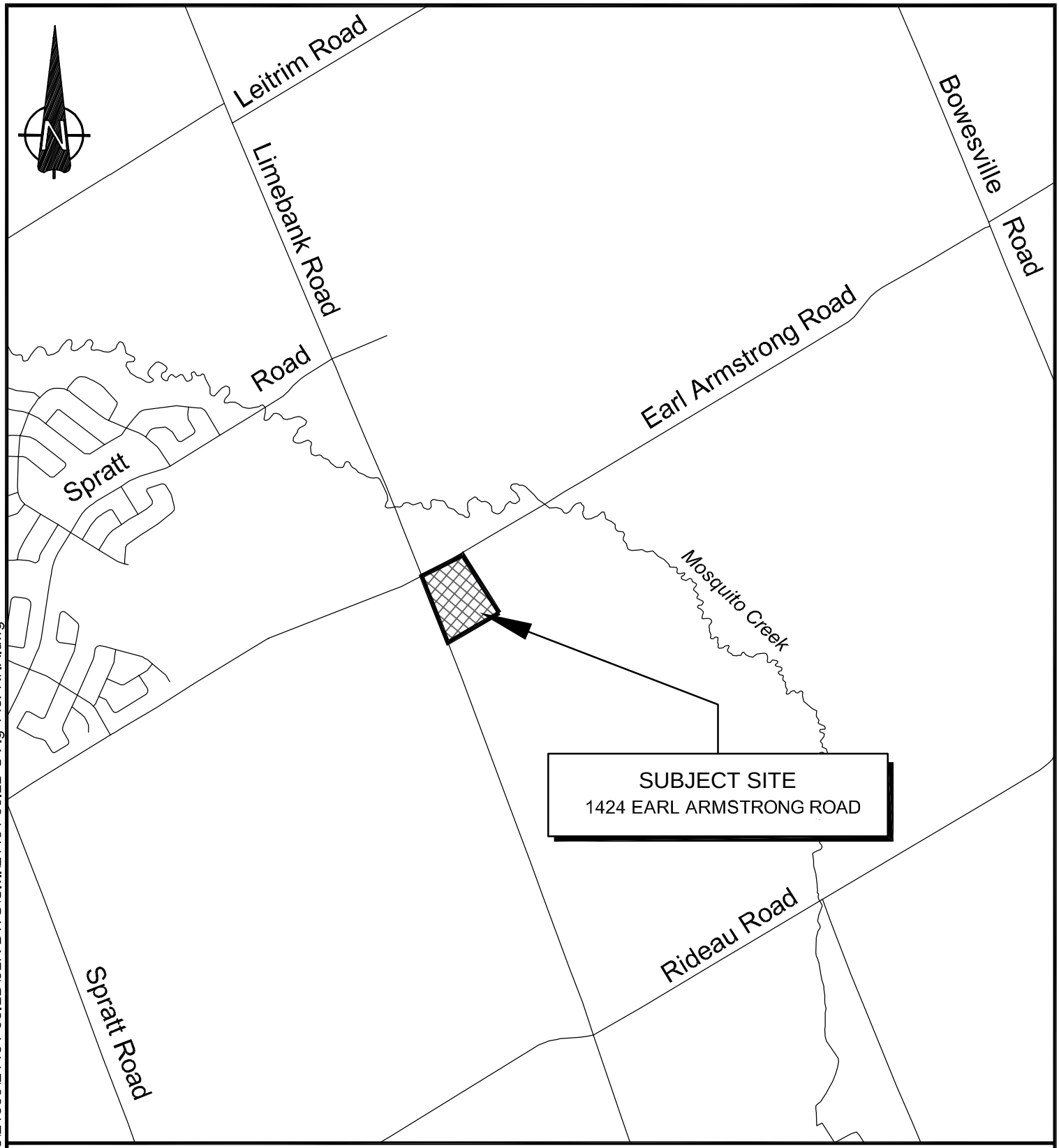
The subject site is bounded by Earl Armstrong Road to the north, Limebank Road to the west, and undeveloped lands to the south and east as depicted on the Location Plan (Figure 1). The site is currently undeveloped and is zoned as GM28 S269.

Morguard intends to have thirteen (13) buildings within the site surrounded by accessways and parking lots (refer to Appendix 'A' for the Site Plan). Each building will have an automatic and fully supervised sprinkler system. This development shall remain under private ownership and will be treated as a Site Plan. Potable water will be supplied to the site via a private watermain loop connected to the existing distribution system on Limebank Road and on Ceremonial Drive.

1.3 Existing Infrastructure

A review of existing services was completed along both frontages of the subject property to identify the existing watermains along Earl Armstrong Road and Limebank Road. The existing water infrastructure bounding the proposed development consists of the following (refer to Appendix B for a copy of the background drawings):

- 610 mm diameter feedermain on Earl Armstrong Road, east of the Earl Armstrong Road and Limebank Road intersection;
- 610 mm diameter feedermain on Limebank Road, south of the Earl Armstrong Road and Limebank Road intersection; and
- 203 mm diameter PVC watermain on Ceremonial Drive.



PROJECT:

SUBJECT SITE FOR HNA

1424 EARL ARMSTRONG ROAD, GLOUCESTER, ONTARIO

DRAWING:

LOCATION PLAN

J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS
www.jlrichards.ca

DESIGN: MM	JLR NO: 21646-006
DRAWN: MM	DRAWING NO.: FIGURE 1
CHECKED:	

File Location: \\projects-cl\projects\21000\21464-06.LD\JLR DWG\Civil\21464-06.LD C Fig 1 for HNA.dwg

PLOT DATE: October 20, 2021 1:53:50 PM

2.0 Water Servicing

2.1 Design Criteria

A Hydraulic Network Analysis (HNA) was carried out to confirm the site's watermain sizing and to demonstrate its compliance to the Ottawa Design Guidelines for Water Distribution (July 2010) and Technical Bulletins ISDTB-2014-02, ISTB-2018-02 and ISTB-2021-03. These documents are herein referred to as the Design Guidelines and TB-2014-02, TB-2018-02, and TB-2021-03 respectively.

Section 4.2.2 of the Design Guidelines states that all new development additions to the public water distribution system be designed such that the minimum and maximum residual pressures, as well as flow rates, comply with the following:

- Under maximum hourly demand conditions (peak hour), the residual pressures are not less than 276 kPa (40 psi);
- During periods of maximum day combined to a fire flow demand, the residual pressure at any point in the distribution system shall not be less than 140 kPa (20 psi);
- In accordance with the Ontario Building Code (OBC) in areas that may be occupied, the static pressure at any fixture shall not exceed 552 kPa (80 psi);
- The maximum pressure at any point in the distribution system in unoccupied areas shall not exceed 689 kPa (100 psi); and
- Feedermains, which have been provided primarily for the purpose of redundancy, shall meet, at a minimum, the basic day plus fire flow demand.

2.2 Domestic Water Demands

The estimated domestic water demands presented in this section are based on the Site Plan provided by Morguard (refer to Appendix 'A'). The plaza will consist of thirteen (13) commercial buildings, complete with parking lots and access routes.

To estimate the average daily demand, each building was assigned a distribution area proportional to the total site area (±6.37 ha). Since this is a commercial site, a consumption rate of 28,000 L/ha/d was then applied to the pro-rated areas as per the Design Guidelines. Table 2-1 summarizes the water consumption rates used for the HNA. Table 2-2 presents the calculated theoretical water demand results based on the proposed site details and the Design Guidelines. The detailed water demand calculations for the site can be found in Appendix 'D1'.

Table 2-1: Water Consumption Unit Rates

Demand Scenario	Commercial Demand
Average Day Demand	28,000 L/ha/d
Maximum Day Demand	1.5 x Avg Day
Peak Hour Demand	1.8 x Max Day

Table 2-2: Water Consumption Unit Rates

Demand Scenario	Residential Demand (L/s)
Average Day Demand	4.11
Maximum Day Demand	6.21
Peak Hour Demand	11.14

2.3 Proposed Watermain Sizing and Roughness

As shown in the Site Plan (Appendix 'A'), the site consists of a private 203 mm watermain loop with connections at Limebank Road and Ceremonial Drive. The commercial buildings are proposed to be serviced with 150 mm diameter water service laterals. As requested by the Owner (refer to Appendix 'C'), these services will be used for domestic and firefighting purposes. Table 2-3 summarizes the watermain roughness coefficients that were set based on friction factors presented in Section 4.2.12. of the Design Guidelines. Similarly, the internal pipe diameters were modelled as per Section 4.3.5 of the Design Guidelines and are summarized in Table 2-4.

Table 2-3: Watermain Roughness Coefficients

Watermain Diameter	C-Factor
150 mm	100
200 to 250 mm	110

Table 2-4: Watermain Internal Diameters

Nominal Diameter	Inside Diameter
150 mm	155 mm
203 mm	204 mm

2.4 Fire Flow Requirements

2.4.1 Methodology and Sprinkler System

The City has specified that the Fire Underwriters Survey (FUS) method shall be used for any public or private site where watermains and fire hydrants are being designed. Hence, the required fire flow (RFF) for the site was calculated using the FUS method. Specifically, the use of the protocol for the application of the FUS method as outlined in Appendix H: Protocol to Clarify the Application of the Fire Flow Calculation Method Published by Fire Underwriters Survey (FUS) of TB-2018-02.

Since the proposed buildings will be equipped with a sprinkler system and the sprinkler systems have yet to be designed by a mechanical engineer, the sprinkler system flow requirement was conservatively estimated using NFPA 13. Specifically, the sprinkler system allowance was estimated using Table 11.2.2.1 and the hose stream allowance

was estimated using Table 11.2.3.1.2. For ordinary hazard buildings, the required sprinkler flow should consist of the following components:

- Sprinkler system flow = 3,200 L/min (Table 11.2.2.1); and
- Hose stream allowance = 950 L/min (Table 11.2.3.1.2).

When both contributions are added, the required sprinkler flow for the buildings is 4,150 L/min (69.2 L/s). Refer to Appendix 'D1' for Tables 11.2.2.1 and 11.2.3.1.2.

2.4.2 Required Fire Flow

The RFF per the FUS for the site was calculated based on the type of unit, exposure to adjacent units, building material, etc. The RFF was calculated at four (4) critical locations to be representative of the entire site. Appendix 'D1' includes the RFF calculations for the four (4) critical fire areas in accordance with the FUS guidelines and TB-2018-02. Based on these guidelines, the calculated RFF for each critical fire area is presented in Table 2-5.

Table 2-5: Fire Flow Requirements per the FUS

Location	Building ID	Calculated Fire Flow L/min (L/s)
Critical Fire Area 1	Building A	6,000 (100)
Critical Fire Area 2	Building F	6,000 (100)
Critical Fire Area 3	Building E	8,000 (133)
Critical Fire Area 4	Building C	6,000 (100)

2.5 Proposed Water Servicing and Boundary Conditions

2.5.1 Proposed Water Servicing

The proposed water network for the development consists of a private 203 mm diameter watermain loop, 150 mm diameter building services and eight (8) hydrants with 150 mm diameter leads as shown in the Site Plan (Appendix 'A'). As directed by the Owner (Appendix 'C'), supply to the proposed development is achieved from the following watermain connections:

- One (1) connection to the 610 mm feedermain on Limebank Road, south of the intersection of Limebank Road and Earl Armstrong Road; and
- Two (2) connections to the 203 mm watermain on Ceremonial Drive, south of the intersection of Ceremonial Drive and Earl Armstrong Road.

2.5.2 Fire Protection

Fire protection to the site will be achieved via eight (8) on-site hydrants with 150 mm diameter hydrant laterals (see Appendix 'A' for Site Plan) and sprinkler systems within

each proposed building. In addition, Section 3.2.5.16 of the OBC requires that each building's siamese connection be located an unobstructed distance of no more than 45 meters from a fire hydrant. Based on review of the Site Plan (Appendix 'A'), it generally appears that each building adheres to this stipulation. It is noted however, that the location of the siamese connection for Building A is not shown on the Site Plan and Building G appears to be located ±45 m from the nearest hydrant. It is the responsibility of the Design Engineer to ensure that the siamese connections meet the hydrant offset requirements specified in the OBC.

Hydrant spacing is in accordance with TB-2018-02, which states that the aggregate fire flow capacity of all fire hydrants within 150 m of a building shall not be less than the required fire flow of the building. Furthermore, TB-2018-02 highlights that the maximum capacity of fire flow for a hydrant is 95 L/s if the hydrant is within 75 m of a building. For hydrants located between 75 m and 150 m from a structure, the hydrant's flow capacity shall be taken as 63 L/s.

Since all the commercial buildings are sprinklered, the required flow from a hydrant for firefighting purposes is the difference between the maximum required fire flow calculated per the FUS in Section 2.4.2 (133 L/s) and the sprinkler system flow of 69.2 L/s. Thus, each building requires an available flow of at least 63.8 L/s from adjacent hydrants.

2.5.3 Boundary Conditions

The performance of the proposed water distribution system was evaluated under various domestic demands and fire flow conditions using the hydraulic boundary conditions provided by the City (refer to Appendix 'D2' for a copy of the City correspondence) for the following two (2) pressure zone configurations:

- Existing Conditions
- South Urban Community (SUC) Pressure Zone Reconfiguration

The boundary conditions provided by the City were based on the RFF which was calculated in accordance with the FUS (refer to Section 2.4.2 for more details). Boundary connections were requested at the connection points described in Section 2.5.1. However, the boundary condition provided by the City for Connection-2 was located at the intersection of Ceremonial Drive and Earl Armstrong Road. Therefore, the existing watermain on Ceremonial Drive was modelled (refer to the WaterCAD Schematics in Appendix 'D3') in order to proceed with the HNA.

Tables 2-6 and 2-7 below summarize the hydraulic boundary conditions received from the City that were used in the HNA.

Table 2-6: Hydraulic Boundary Conditions at Connection 1 on Limebank Road

Demand Scenario	Head (m) under Existing Conditions	Head (m) under SUC Pressure Zone Reconfiguration
Max HGL	132.2	148.7
Peak Hour	124.9	145.6
Max Day plus Fire 1 (4,150 L/min)	126.9	146.0
Max Day plus Fire 2 (8,000 L/min)	125.6	144.2

Table 2-7: Hydraulic Boundary Conditions at Connection 2 on Ceremonial Drive

Demand Scenario	Head (m) under Existing Conditions	Head (m) under SUC Pressure Zone Reconfiguration
Max HGL	132.2	148.7
Peak Hour	124.9	145.6
Max Day plus Fire 1 (4,150 L/min)	126.9	146.0
Max Day plus Fire 2 (8,000 L/min)	125.6	144.2

2.6 Simulation Results

A Hydraulic Network Analysis (HNA) was carried out using the WaterCAD® software platform to assess the proposed water servicing. Boundary conditions provided by the City (Appendix 'D2') were used in this HNA. Simulations were carried out under peak hour, maximum day demand plus fire flow, and maximum HGL conditions.

2.6.1 Peak Hour

Existing Pressure Conditions

The peak hour demand shown in Table 2-2 was distributed throughout the nodes within the site. Using the boundary conditions shown in Tables 2-6 and 2-7, the simulation results found the minimum pressure during the peak hour condition for the existing pressure zone configuration to be 304 kPa (44.1 psi), as shown in Appendix 'D4'. Based on the simulation results, the minimum pressure criterion of 276 kPa (40 psi) is expected to be exceeded everywhere on the site under the existing pressure condition.

SUC Pressure Zone Reconfiguration

The simulation results found the minimum pressure during the peak hour condition under the SUC Pressure Zone Reconfiguration to range between 507 kPa (73.5 psi) and 521 kPa (75.6 psi), as shown in Appendix 'D7'. Based on the simulation results, the minimum pressure criterion of 276 kPa (40 psi) is expected to be exceeded everywhere on the site under the SUC Pressure Zone Reconfiguration.

2.6.2 Maximum Day Plus Fire Flow

To ensure adequate fire protection, the maximum day demand shown in Table 2-2 was analyzed simultaneously with the fire flow requirements. The simulation was conducted using the boundary conditions presented in Tables 2-6 and 2-7. The fire flow simulation was carried out by applying the sprinkler flow (69.2 L/s) and the maximum day demand to each building while allowing WaterCAD® to calculate the maximum fire flow that can be drawn from each hydrant without allowing any part of the system to experience pressures less than 140 kPa (20 psi). As it is unlikely that multiple buildings will be on fire simultaneously, it is assumed that only one (1) building will have the sprinkler flow (69.2 L/s) applied at any given time. Hence, the available fire flows in the simulation results are specific to each individual building while still ensuring that site pressures exceed 140 kPa (20 psi). Similar to the RFF calculations in Section 2.4.2, simulation results are provided for the most critical cases (i.e., largest buildings, shortest exposure distances etc.) which were used to represent the site overall.

As discussed in Sections 2.4 and 2.5, the required fire flow (RFF) for this site is 8,000 L/min (133 L/s) per the FUS. Thus, in order to meet the fire protection requirements, 69.2 L/s will be provided by the sprinkler system and 63.8 L/s of flow must be provided by the proposed hydrants.

Existing Pressure Conditions

Using the boundary conditions provided by the City (refer to Tables 2-6 and 2-7), it is expected that the targeted fire flow of 8,000 L/min (133 L/s) can be provided for all the buildings through the use of the sprinkler system and adjacent hydrants (refer to Appendix 'D5').

SUC Pressure Zone Reconfiguration

Similar to the findings under the existing pressure condition, the modelling results indicate that the targeted fire flow of 8,000 L/min (133 L/s) can be met for all of the buildings within the site under the SUC Pressure Zone Reconfiguration.

As discussed in Section 2.4, and Section 2.5 the sprinkler systems will be designed by a mechanical engineer and the building siamese connection must located an unobstructed distance of at least 45 meters from the nearest hydrant.

2.6.3 Maximum Pressure Check

The Design Guidelines require that a high-pressure check (maximum hydraulic grade elevation) be performed on the proposed system to determine the need to incorporate pressure reducing valves (PRVs).

Existing Pressure Conditions

Based on a zero (0 L/s) demand condition and the applicable boundary conditions (refer to Tables 2-6 and 2-7), the maximum pressure under the existing pressure zone was found to be 390 kPa (56.6 psi) This value is below the maximum pressure constraint of 552 kPa (80 psi), therefore pressure reducing valves (PRVs) are not anticipated to be required under the existing pressure condition.

SUC Pressure Zone Reconfiguration

Based on a zero (0 L/s) demand condition and the applicable boundary conditions (refer to Tables 2-6 and 2-7), the maximum pressure under the SUC Pressure Zone Reconfiguration was found to be 552 kPa (80 psi). As stated in the Design Guidelines, PRVs will be required at locations which exceed the maximum pressure constraint of 552 kPa (80 psi). Therefore, pressure reducing valves (PRVs) are not anticipated to be required under the SUC Pressure Zone Reconfiguration.

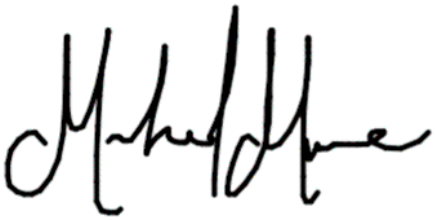
2.7 Water Servicing Conclusions

Based on the water simulation results, it is anticipated that the proposed commercial plaza at 1424 Earl Armstrong Road can be serviced by the proposed watermains illustrated in the Site Plan (Appendix 'A'). Simulation results under peak hour demand and maximum pressure found that the pressure requirements listed in the Design Guidelines were achieved. Furthermore, fire flow requirements are expected to be met for the site, noting that fire protection will be provided by the on-site hydrants and building sprinkler systems.

This report has been prepared for the exclusive use of Morguard Investments Limited, for the stated purpose, for the named facility. Its discussions and conclusions are summary in nature and cannot be properly used, interpreted or extended to other purposes without a detailed understanding and discussions with the client as to its mandated purpose, scope and limitations. This report was prepared for the sole benefit and use of Morguard Investments Limited and may not be used or relied on by any other party without the express written consent of J.L. Richards & Associates Limited.

J.L. RICHARDS & ASSOCIATES LIMITED

Prepared by:



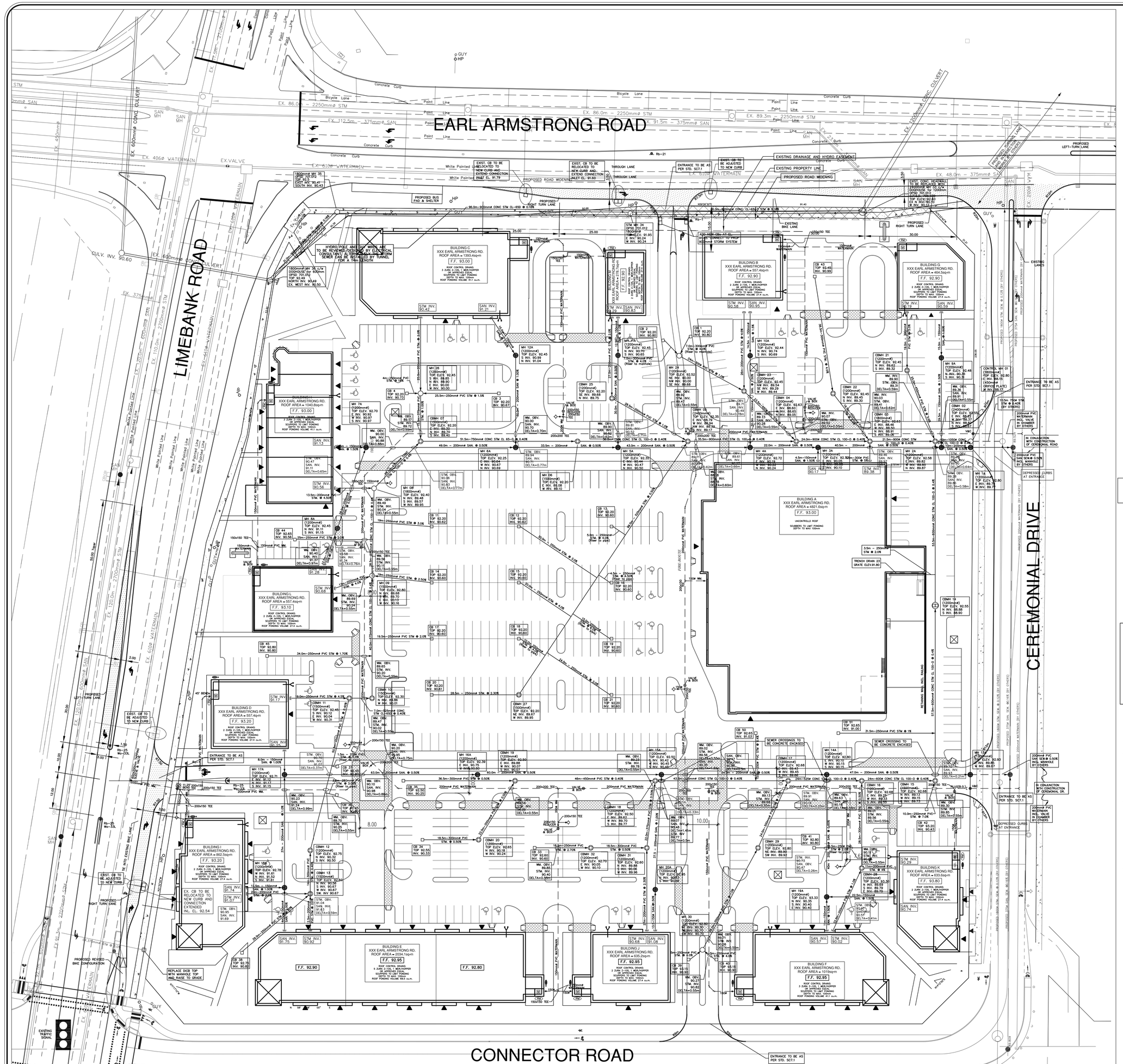
Mahad Musse, EIT

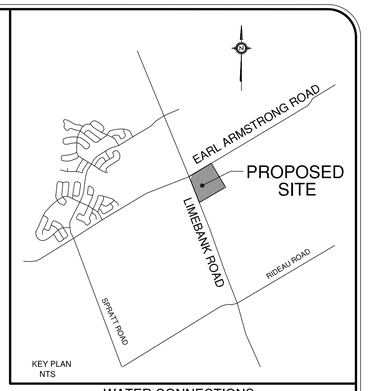
Reviewed by:

Annie Williams, P.Eng.

Appendix ‘A’

Site Plan





WATER CONNECTIONS

BUILDING	FIRE (mm Ø)	DOMESTIC (mm Ø)
A	150	100
B	100	50
C	150	50
D	100	50
E	150	100
F	100	50
G	100	50
H	150	50
I	150	50
J	100	50
K	100	50
L	100	50
M	100	50

THERMAL PIPE INSULATION

SEE DETAIL ON DWG 5 of 8

FROM M.H.	TO M.H.	THICKNESS
5A	6A	50 mm
6A	7A	50 mm
7A	8A	100 mm
8A	BLDG. L	100 mm
7A	BLDG. H	50 mm
5A	11A	50 mm
11A	BLDG. M	50 mm
6A	12A	100 mm
12A	BLDG. C	100 mm
15A	16A	50 mm
16A	17A	50 mm
17A	18A	100 mm
18A	BLDG. E	100 mm
18A	BLDG. I	100 mm
15A	20A	50 mm
20A	BLDG. J	50 mm
33	34	100 mm
34	35	100 mm
35	36	100 mm

NOTES :
- ALL WATERMAIN CROSSINGS TO BE IN CONJUNCTION WITH STANDARDS W25 & W25.2
- WATERMAIN CONNECTIONS BY CITY, EXCAVATION, BACKFILLING AND REINSTATED BY THE CONTRACTOR.

LEGEND

- EXISTING CURB
- EXISTING CURB TO BE REMOVED
- PROPOSED CURB
- PROPOSED SIDEWALK
- OVERLAND FLOW ROUTE
- 1.5% DIRECTION AND SLOPE OF SURFACE DRAINAGE
- PROPOSED PAVEMENT
- 95.45 EXISTING ELEVATION
- M WATER METER
- RM REMOTE READOUT
- SIAMESE CONNECTION
- GAS METER

CLAY SEALS SHALL BE INSTALLED IN THE SERVICE TRENCHES. THE SEALS SHALL BE 1.5m LONG (IN THE TRENCH DIRECTION) AND SHALL EXTEND FROM TRENCH WALL TO TRENCH WALL. THE SEALS SHALL EXTEND FROM THE FROST LINE AND FULLY PENETRATE THE BEDDING, SUBBEDDING AND COVER MATERIAL. SEALS SHALL CONSIST OF RELATIVELY DRY AND COMPACTABLE BROWN SILTY CLAY, COMPACTED TO A MINIMUM OF 95% OF THE SPMDD. THE CLAY SEALS SHALL BE PLACED AT THE SITE BOUNDARIES AND AT STRATEGIC LOCATIONS AT NO MORE THAN 60m INTERVALS ALONG THE SERVICE TRENCHES, AS DIRECTED BY THE GEOTECHNICAL ENGINEER.

NOTE:
THIS DRAWING SHALL BE READ IN CONJUNCTION WITH DRAWING 5 OF 8, NOTES & DETAILS PROJECT 12007

LOCAL BENCHMARK:

CUT CROSS IN CONCRETE TRAFFIC ISLAND AT THE NORTH-EAST CORNER OF EARL ARMSTRONG ROAD AND LIMEBANK ROAD AS ESTABLISHED BY ANNIS, O'SULLIVAN, VOLLEBEKK LTD, O.L.S.

ELEVATION 92.87

No.	By	Date	Revision	Checked
16	D.J.S.	MAY 2/22	ADDED WM CONNECTION to LIMEBANK--INCREASED BLDG WM SIZES	O.B.C.
15	D.J.S.	Aug 27/21	SUBMITTED FOR SITE PLAN APPROVAL	O.B.C.
14.	D.S.	Mar 8/21	SITE PLAN REVISIONS – MINOR BUILDING ADJUSTMENTS	O.B.C.
13.	D.S.	Aug 21/20	SITE PLAN REVISIONS TO LOCATION OF BUILDINGS	O.B.C.
12.	V.T.	Sept. 28/19	SITE PLAN REVISIONS/CITY COMMENTS	O.B.C.
11.	D.S.	Nov 21/18	SITE PLAN REVISIONS/CITY COMMENTS	O.B.C.
10.	D.S.	Nov 27/15	REV. GRADES OF TOWN SQUARE BLVD. AND BLD'S E, F, I, J & K	O.B.C.
9.	O.B.C.	Oct 13/15	HYDRANT LOCATIONS	O.B.C.
8.	D.S.	Aug. 26/15	REVISED AS PER CITY COMMENTS	O.B.C.
7.	D.S.	Aug. 14/15	SITE PLAN REVISIONS	O.B.C.

APPROVED AS TO FORM IN RELIANCE UPON THE PROFESSIONAL SKILL AND ABILITY OF URBAN ECOSYSTEMS LIMITED AS TO DESIGN AND SPECIFICATION.

ROSARIO.SACCO — REGISTERED PROFESSIONAL ENGINEER — PROVINCE OF ONTARIO

MAY 2/2022

Director of Engineering — Date

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RIVERSIDE SOUTH
1424 EARL ARMSTRONG ROAD
CITY OF OTTAWA

MORGUARD INVESTMENTS LTD.
55 CITY CENTER DRIVE
MISSISSAUGA, ONTARIO

FILE No D07-12-14-0067

SERVICING PLAN

Designed By O.B.C.	Date APR 2014	Checked By R.S.	
Drawn By J.H.		Approved By	
Scale: 1: 500	Project No. 12007	Drawing No. 2of8	

Plan Number: 18350

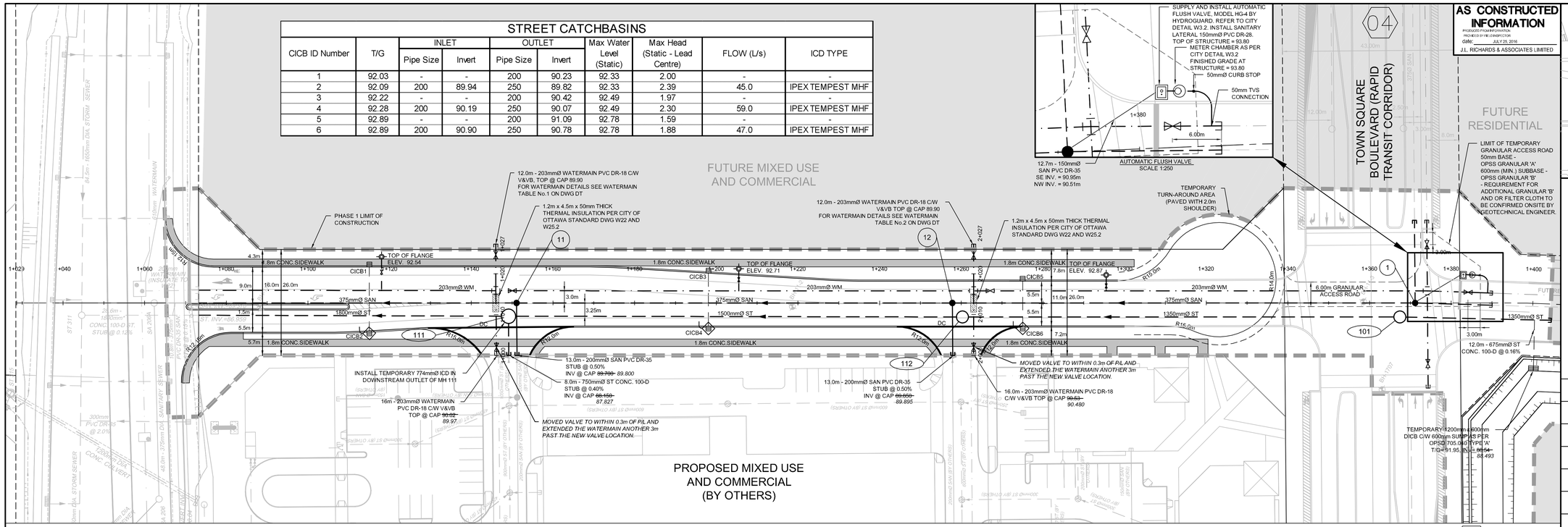
D07-12-21-0005

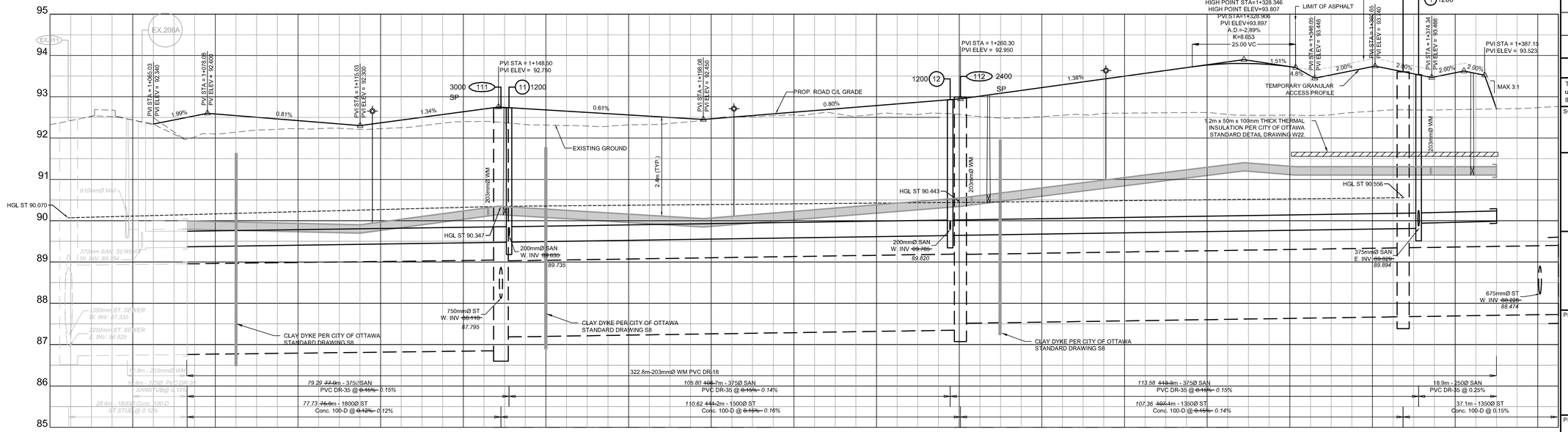
Appendix ‘B’

Background Documents
Existing Infrastructure

STREET CATCHBASINS

CICB ID Number	T/G	INLET		OUTLET		Max Water Level (Static)	Max Head (Static - Lead Centre)	FLOW (L/s)	ICD TYPE
		Pipe Size	Invert	Pipe Size	Invert				
1	92.03	-	-	200	90.23	92.33	2.00	-	-
2	92.09	200	89.94	250	89.82	92.33	2.39	45.0	IPEX TEMPEST MHF
3	92.22	-	-	200	90.42	92.49	1.97	-	-
4	92.28	200	90.19	250	90.07	92.49	2.30	59.0	IPEX TEMPEST MHF
5	92.89	-	-	200	91.09	92.78	1.59	-	-
6	92.89	200	90.90	250	90.78	92.78	1.88	47.0	IPEX TEMPEST MHF

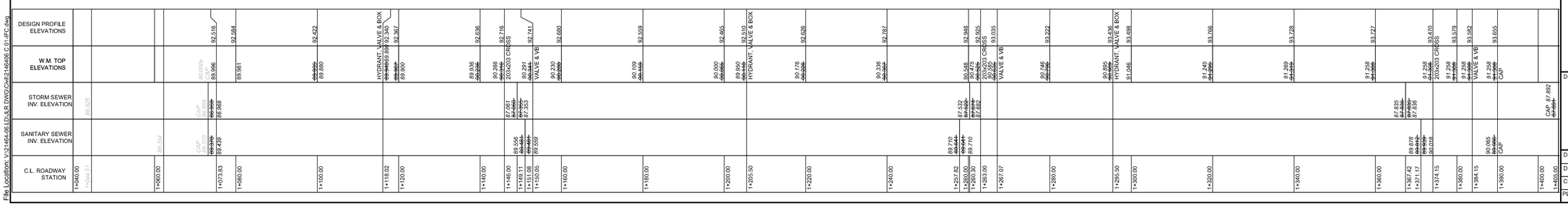




EARL ARMSTRONG ROAD

CEREMONIAL ROAD (COLLECTOR D)

TOWN SQUARE BOULEVARD



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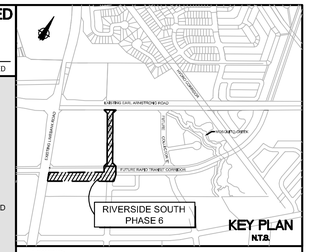

LEGEND:
- EXISTING CATCH BASIN
- CATCH BASIN c/w ICD
- INTERCONNECTED
- PROPOSED CATCH BASIN & LEAD
- PROPOSED WATERMAIN, VALVE & HYDRANT
- PROPOSED VALVE CHAMBER
- EXISTING WATERMAIN, VALVE & HYDRANT
- EXISTING SANITARY SEWER & MANHOLE
- EXISTING STORM SEWER & MANHOLE
- PROPOSED SANITARY SEWER & MANHOLE
- PROPOSED STORM SEWER & MANHOLE
- MANHOLE NUMBER AND SIZE (mm) C/W SAFETY PLATFORM PER OPSD 404.020
- CONC. SIDEWALK
- ASPHALT SIDEWALK
- BOREHOLE

AS CONSTRUCTED INFORMATION
PROVIDED FROM INFORMATION PROVIDED BY THE CONTRACTOR
date: JULY 25, 2016
J.L. RICHARDS & ASSOCIATES LIMITED

NO.	ISSUE	DATE
13	AS CONSTRUCTED INFO ADDED	NOV. 11, 2016
12	AS CONSTRUCTED	JUL. 25, 2016
11	ISSUED FOR CONSTRUCTION	APR. 04, 2016
10	ISSUED FOR MYLARS	MAR. 23, 2016
9	ISSUED TO CITY FOR REVIEW AND APPROVAL 7TH SUBMISSION	JAN. 27, 2016
8	ISSUED TO CITY FOR REVIEW AND APPROVAL 6TH SUBMISSION	JAN. 14, 2016
7	ISSUED TO CITY FOR REVIEW AND APPROVAL 5TH SUBMISSION	DEC. 02, 2015
6	ISSUED FOR TENDER - ADDRESSED CITY COMMENTS	NOV. 27, 2015
5	ISSUED TO CITY FOR REVIEW - 4TH SUBMISSION	AUG. 17, 2015
4	ISSUED TO CITY FOR REVIEW - OFFSITE DRAINAGE	JUNE 11, 2015
3	ISSUED TO CITY FOR REVIEW - 3RD SUBMISSION	MAY 20, 2015

SCALE: 1:500H, 1:50V
0 5 10 20 30 40m

Riverside South Development Corporation (RSDC)
2193 Arch Street
Ottawa, ON
K1G 2H5
(613) 731-6331

J.L. Richards & Associates Limited
864 Lady Ellen Place
Ottawa, ON Canada
K1Z 5M2
Tel: 613 728 3571
Fax: 613 728 6012

PROFESSIONAL STAMP

PROJECT NORTH

PROJECT:
RSDC
RIVERSIDE SOUTH PHASE 6
PART OF 980 & 1420 EARL ARMSTRONG ROAD
CITY OF OTTAWA

DRAWING:
PLAN & PROFILE
CEREMONIAL ROAD
EARL ARMSTRONG ROAD TO STA. 1+380

DESIGN: C.S.
DRAWN: S.K.
CHECKED: L.D.
PLOTTED: Nov 11, 2016

DRAWING NO.: 01
JLR NO: 21464-06

CATCH BASIN DATA					CB LEAD	
NO.	STATION	OFFSET	CATCH BASIN TYPE	T/G ELEV	LENGTH*	INVERT
CB 135	16+250.00	11.75 L	OPSD 705.010 - S3,S22,S23	92.87	10.00	91.27
CB 136	16+265.00	17.77 R	OPSD 705.010 - S3,S22,S23	92.79	2.75	91.19
CB 137	16+289.90	11.75 L	OPSD 705.010 - S3,S22,S23	92.87	13.25	91.27
CB 138	16+317.25	21.50 R	OPSD 705.010 - S3,S22,S23	92.69	5.00	91.06
CB 139	16+351.00	12.50 R	OPSD 705.010 - S3,S22,S23	92.85	21.05	91.25
DICB1	16+297.50	19.40 L	OPSD 705.030,403.010 3H:1V	91.60	13.20	90.20
DICB2	16+324.25	27.75 R	OPSD 705.030,403.010 3H:1V	91.25	5.70	89.85

*LENGTH SHOWN IS PARTIAL LENGTH FROM PROPOSED SEWER TO EDGE OF PAVEMENT.
FUTURE CB INSTALLATION (NOT IN CONTRACT) PARTIAL LEAD INSTALLATION FOR CATCH BASINS ONLY

CATCH BASIN DATA					CATCH BASIN LEAD		ICD
NO.	STATION	OFFSET	CATCH BASIN TYPE	T/G ELEVATION	LENGTH	INVERT	
CB 140	16+345.00	23.2 R	OPSD 705.010 - S3,S22,S23	92.59	12.00	90.99	HV
CB 141	16+375.00	28.4 R	OPSD 705.010 - S3,S22,S23	92.47	17.50	90.87	HV
CB 142	16+388.00	16.6 R	OPSD 705.010 - S3,S22,S23	92.76	6.00	91.16	HV
CB 143	16+438.00	16.7 R	OPSD 705.010 - S3,S22,S23	92.57	7.00	90.97	HV
CB 144	16+442.55	12.75 L	OPSD 705.010 - S3,S22,S23	92.50	20.20	90.90	HV

HV= HYDROVEX VORTEX FLOW REGULATOR MOUNTED ON SLIDING PLATE TO S4.1
F= FRAME TYPE ORIFICE PLATE WITH CUSTOM CIRCULAR OPENING
REFER TO DRAWING 07 FOR FURTHER DETAILS ON THE INLET CONTROL DEVICES

LICENSED PROFESSIONAL ENGINEER
A. BETTE
100059301
Jan 19 - 2010
PROVINCE OF ONTARIO
STORM SEWER, SANITARY SEWER AND WATERMAIN DESIGN

J.L.Richards
ENGINEERS·ARCHITECTS·PLANNERS
J.L. Richards & Associates Limited
864 Lady Ellen Place
Ottawa, ON Canada
K1Z 5M2
Tel: 613 728 3571
Fax: 613 728 6012

NO.	REVISIONS	BY	DATE
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1	ISSUED FOR MOE APPROVAL	JB	01/19/10

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The contractor shall prove the location of utilities and shall be responsible for adequate protection from damage

LIMEBANK ROAD WIDENING AT EARL ARMSTRONG RD.

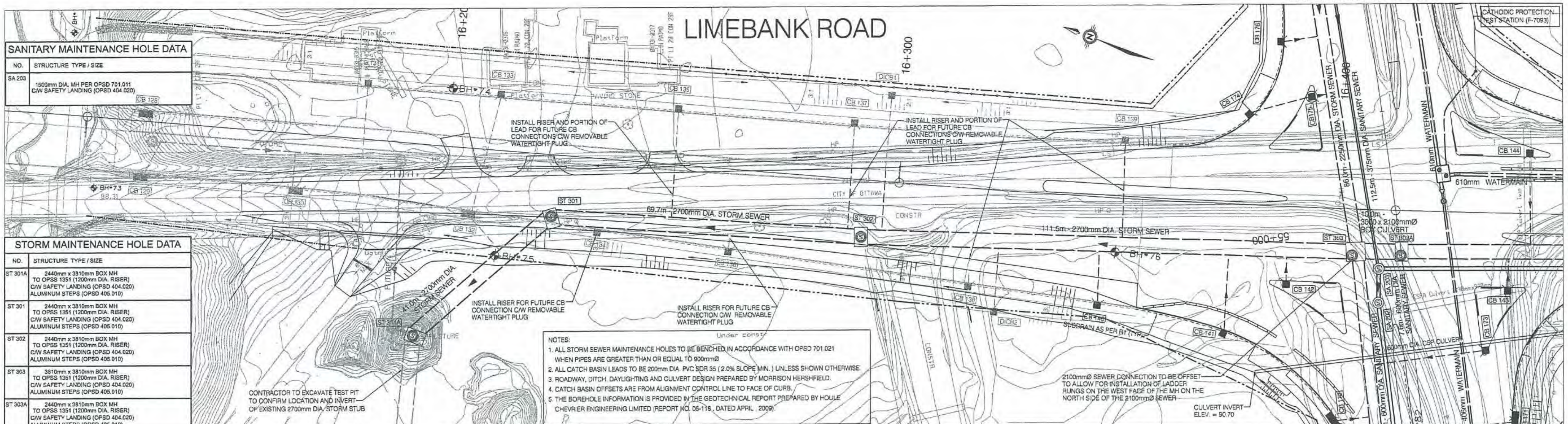
GRADING AND DRAINAGE
STA. 16+100 TO STA. 16+450

Ottawa
CONTRACT NO. ISB07-5055
DWG. NO. GD - 14361 - 01
SHEET 11 OF 45
Date: JUNE 2009
Scale: 0m 5 10 20

W. NEWELL, P. Eng
Director Infrastructure Services
ZIAD A. GHADBAN, P. Eng.
Manager Construction Services - Development

Dwn: MF, MGB Chkd: PDR Des: JB Chkd: PDR

EARL ARMSTRONG ROAD

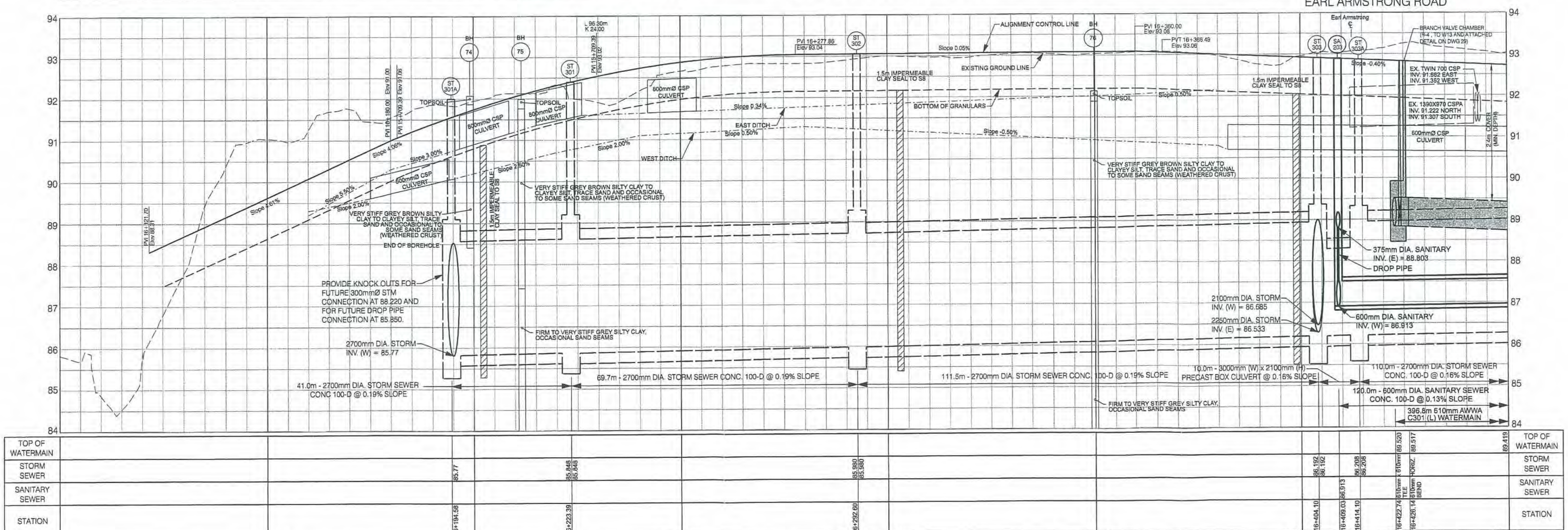


SANITARY MAINTENANCE HOLE DATA	
NO.	STRUCTURE TYPE / SIZE
SA 203	1500mm DIA. MH PER OPSD 701.011 C/W SAFETY LANDING (OPSD 404.020)

STORM MAINTENANCE HOLE DATA	
NO.	STRUCTURE TYPE / SIZE
ST 301A	2440mm x 3810mm BOX MH TO OPSS 1351 (1200mm DIA. RISER) C/W SAFETY LANDING (OPSD 404.020) ALUMINUM STEPS (OPSD 405.010)
ST 301	2440mm x 3810mm BOX MH TO OPSS 1351 (1200mm DIA. RISER) C/W SAFETY LANDING (OPSD 404.020) ALUMINUM STEPS (OPSD 405.010)
ST 302	2440mm x 3810mm BOX MH TO OPSS 1351 (1200mm DIA. RISER) C/W SAFETY LANDING (OPSD 404.020) ALUMINUM STEPS (OPSD 405.010)
ST 303	3810mm x 3810mm BOX MH TO OPSS 1351 (1200mm DIA. RISER) C/W SAFETY LANDING (OPSD 404.020) ALUMINUM STEPS (OPSD 405.010)
ST 303A	2440mm x 3810mm BOX MH TO OPSS 1351 (1200mm DIA. RISER) C/W SAFETY LANDING (OPSD 404.020) ALUMINUM STEPS (OPSD 405.010)

NOTES:
1. ALL STORM SEWER MAINTENANCE HOLES TO BE BENCHED IN ACCORDANCE WITH OPSD 701.021 WHEN PIPES ARE GREATER THAN OR EQUAL TO 900mmØ
2. ALL CATCH BASIN LEADS TO BE 200mm DIA. PVC SDR 35 (2.0% SLOPE MIN.) UNLESS SHOWN OTHERWISE
3. ROADWAY, DITCH, DAYLIGHTING AND CULVERT DESIGN PREPARED BY MORRISON HERSHFIELD.
4. CATCH BASIN OFFSETS ARE FROM ALIGNMENT CONTROL LINE TO FACE OF CURB.
5. THE BOREHOLE INFORMATION IS PROVIDED IN THE GEOTECHNICAL REPORT PREPARED BY HOULE CHEVRIER ENGINEERING LIMITED (REPORT NO. 06-116 , DATED APRIL , 2009).

EARL ARMSTRONG ROAD



CATCH BASIN DATA					CATCH BASIN LEAD		ICD
NO.	STATION	OFFSET	CATCH BASIN TYPE	T/G ELEVATION	LENGTH	INVERT	
CB 145	16+450.00	20.4 L	OPSD 705.010 - S3,S22,S23	92.23	28.0	90.63	F
CB 146	16+460.00	16.3 R	OPSD 705.010 - S3,S22,S23	92.29	6.8	90.69	F
CB 147	16+500.00	4.5 R	OPSD 705.010 - S3,S22,S23	92.38	1.3	90.78	HV
CB 148	16+510.00	14.8 L	OPSD 705.010 - S3,S22,S23	92.23	22.5	90.63	F
CB 149	16+530.00	16.1 R	OPSD 705.020 - S3,S22,S23	92.17	6.3	90.57	F
CB 150	16+540.00	4.3 R	OPSD 705.010 - S3,S22,S23	92.27	1.5	90.67	F
CB 151	16+560.00	12.4 L	OPSD 705.020 - S3,S22,S23	92.19	19.8	90.59	F
CB 152	16+580.00	15.7 R	OPSD 705.020 - S3,S22,S23	92.21	6.5	90.61	F

HV= HYDROVEX VORTEX FLOW REGULATOR MOUNTED ON SLIDING PLATE TO S4.1
F= FRAME TYPE ORIFICE PLATE WITH CUSTOM CIRCULAR OPENING
REFER TO DRAWING 07 FOR FURTHER DETAILS ON THE INLET CONTROL DEVICES

CATCH BASIN DATA					CATCH BASIN LEAD		ICD
NO.	STATION	OFFSET	CATCH BASIN TYPE	T/G ELEV	LENGTH	INVERT	
CB 153	16+590.00	2.50 R	OPSD 705.010 - S3,S22,S23	92.38	2.6	90.78	HV
CB 154	16+610.00	12.8 L	OPSD 705.020 - S3,S22,S23	92.39	18.8	90.79	F
CB 155	16+640.00	14.5 R	OPSD 705.020 - S3,S22,S23	92.47	6.4	90.87	F
CB 156	16+660.00	11.85 L	OPSD 705.020 - S3,S22,S23	92.62	17.5	91.02	F
CB 157	16+700.00	13.2 R	OPSD 705.020 - S3,S22,S23	92.79	6.3	91.19	F
CB 158	16+710.00	11.8 L	OPSD 705.020 - S3,S22,S23	92.87	16.5	91.27	F
CB 159	16+760.00	11.2 L	OPSD 705.010 - S3,S22,S23	92.13	15.3	90.53	HV
CB 160	16+760.00	12.1 R	OPSD 705.010 - S3,S22,S23	92.12	6.2	90.52	HV
DICB 1	16+471.38	20.2 R	OPSD 705.030 - GRATE TYPE' A' (3H:IV)	91.50	13.9	90.30	N/A
DICB2	16+679.78	20.0 L	OPSD 705.030 - GRATE TYPE' A' (3H:IV)	91.70	24.75	89.13	N/A
DICB 3	16+780.23	19.6 R	OPSD 705.030 - GRATE TYPE' A' (3H:IV)	91.80	13.5	90.60	N/A

LIMEBANK ROAD

LICENSED PROFESSIONAL ENGINEER
J. A. BETTEZ
100059301
Jan 19-2010
PROVINCE OF ONTARIO
STORM SEWER, SANITARY SEWER AND WATERMAIN DESIGN

J.L. Richards
ENGINEERS·ARCHITECTS·PLANNERS
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864 Lady Ellen Place
Ottawa, ON Canada
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LIMEBANK ROAD WIDENING AT EARL ARMSTRONG RD.

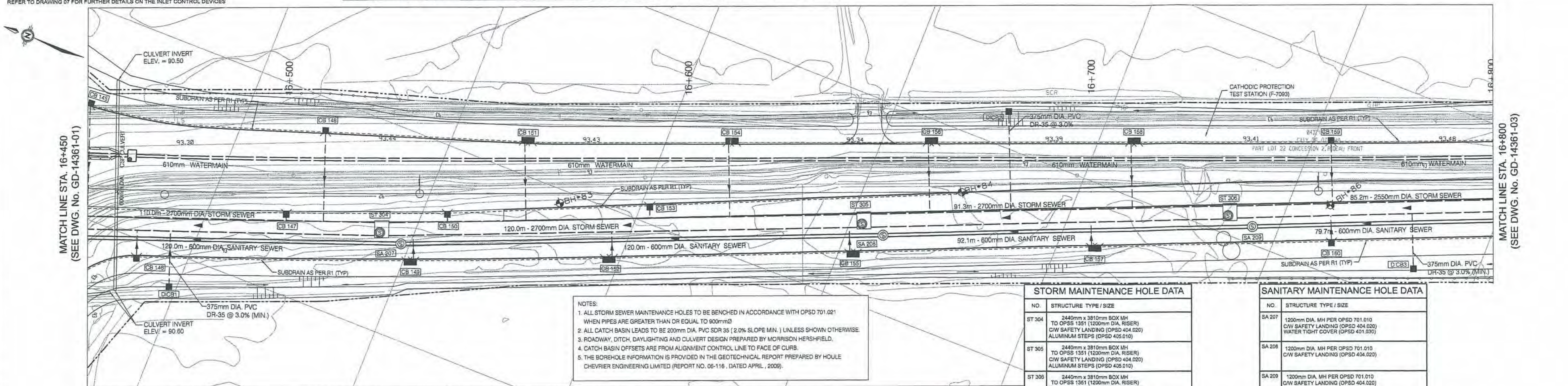
GRADING AND DRAINAGE
STA. 16+450 TO STA. 16+800

W. NEWELL, P. Eng
Director Infrastructure Services

ZIAD A. GHADBAN, P. Eng.
Manager Construction Services - Development

Dwn: MF, MGB | Chkd: PDR | Des: JB | Chkd: PDR

Ottawa
CONTRACT NO. ISB07-5055
DWG. NO. GD - 14361 - 02
SHEET 12 OF 45
Date: JUNE 2009
Scale: 0m 5 10 20



NOTES:
1. ALL STORM SEWER MAINTENANCE HOLES TO BE BENCHED IN ACCORDANCE WITH OPSD 701.021 WHEN PIPES ARE GREATER THAN OR EQUAL TO 900mmØ
2. ALL CATCH BASIN LEADS TO BE 200mm DIA. PVC SDR 35 (2.0% SLOPE MIN.) UNLESS SHOWN OTHERWISE.
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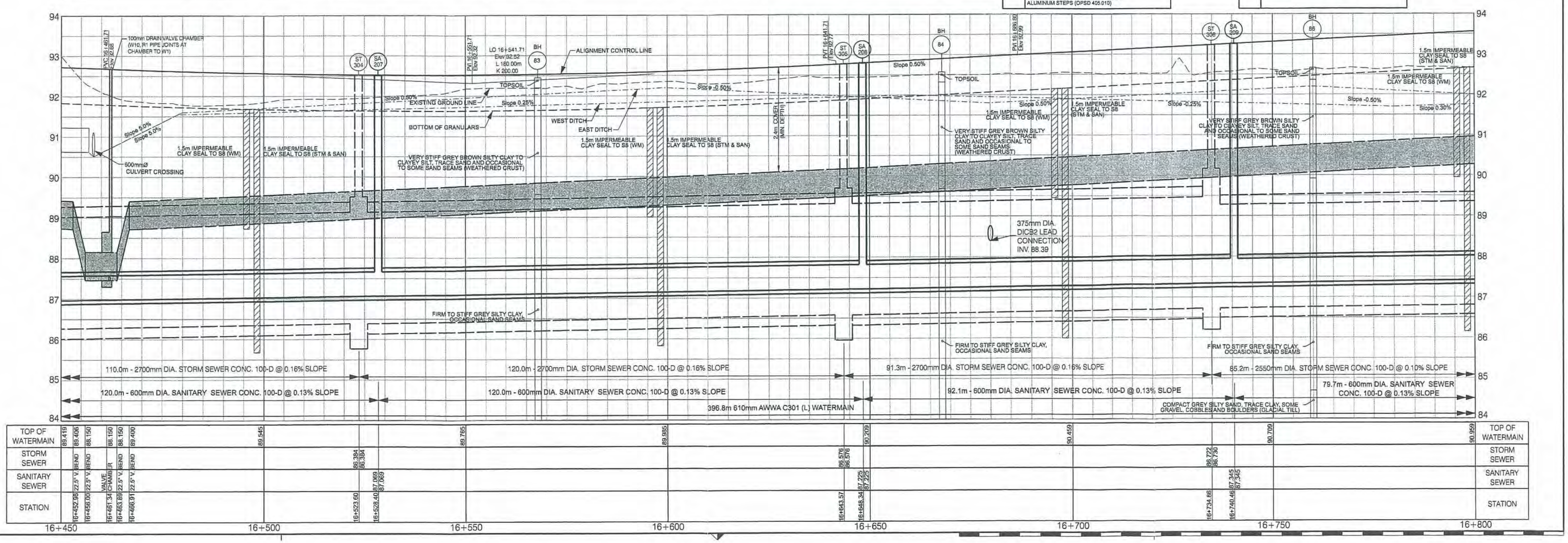
4. CATCH BASIN OFFSETS ARE FROM ALIGNMENT CONTROL LINE TO FACE OF CURB.
5. THE BOREHOLE INFORMATION IS PROVIDED IN THE GEOTECHNICAL REPORT PREPARED BY HOULE CHEVRIER ENGINEERING LIMITED (REPORT NO. 06-116 , DATED APRIL , 2009).

STORM MAINTENANCE HOLE DATA	
NO.	STRUCTURE TYPE / SIZE
ST 304	2440mm x 3810mm BOX MH TO OPSS 1351 (1200mm DIA. RISER) C/W SAFETY LANDING (OPSD 404.020) ALUMINUM STEPS (OPSD 405.010)
ST 305	2440mm x 3810mm BOX MH TO OPSS 1351 (1200mm DIA. RISER) C/W SAFETY LANDING (OPSD 404.020) ALUMINUM STEPS (OPSD 405.010)
ST 306	2440mm x 3810mm BOX MH TO OPSS 1351 (1200mm DIA. RISER) C/W SAFETY LANDING (OPSD 404.020) ALUMINUM STEPS (OPSD 405.010)

SANITARY MAINTENANCE HOLE DATA	
NO.	STRUCTURE TYPE / SIZE
SA 207	1200mm DIA. MH PER OPSD 701.010 C/W SAFETY LANDING (OPSD 404.020) WATER TIGHT COVER (OPSD 401.030)
SA 208	1200mm DIA. MH PER OPSD 701.010 C/W SAFETY LANDING (OPSD 404.020)
SA 209	1200mm DIA. MH PER OPSD 701.010 C/W SAFETY LANDING (OPSD 404.020)



DWG. FRAME 790mm x 534mm RMOC-06/93-RG

STORM MAINTENANCE HOLE DATA	
NO.	STRUCTURE TYPE / SIZE
ST 310	1676mm x 3048mm BOX MH TO OPSS 1351 (1200mm DIA. RISER) C/W SAFETY LANDING (OPSD 404.020) ALUMINUM STEPS (OPSD 405.010)
ST 311	2438mm x 3048mm BOX MH TO OPSS 1351 (1200mm DIA. RISER) C/W SAFETY LANDING (OPSD 404.020) ALUMINUM STEPS (OPSD 405.010)
ST 312	1524mm x 1829mm BOX MH TO OPSS 1351 (1200mm DIA. RISER) C/W SAFETY LANDING (OPSD 404.020) ALUMINUM STEPS (OPSD 405.010)
ST 313	1524mm x 1829mm BOX MH TO OPSS 1351 (1200mm DIA. RISER) C/W SAFETY LANDING (OPSD 404.020) ALUMINUM STEPS (OPSD 405.010)

CATCH BASIN DATA					CATCH BASIN LEAD		ICD
NO.	STATION	OFFSET	CATCH BASIN TYPE	T/G ELEVATION	LENGTH	INVERT	
CB 180	55+100.00	14.7 R	OPSD 705.010 - S3,S22,S23	91.83	24.0	90.23	F
CB 181	55+120.00	17.25 L	OPSD 705.010 - S3,S22,S23	91.73	6.5	90.13	F
CB 182	55+130.00	14.7 R	OPSD 705.020 - S3,S22,S23	91.77	23.4	90.17	F
CB 183	55+140.00	17.1 L	OPSD 705.010 - S3,S22,S23	91.73	6.5	90.13	F
CB 184	55+160.00	17.0 L	OPSD 705.020 - S3,S22,S23	91.77	6.5	90.17	F
CB 185	55+160.00	14.5 R	OPSD 705.010 - S3,S22,S23	91.82	23.0	90.22	F
CB 186	55+185.00	16.5 L	OPSD 705.020 - S3,S22,S23	91.89	6.5	90.29	F
CB 187	55+196.00	13.8 R	OPSD 705.010 - S3,S22,S23	91.99	22.0	90.39	HV
CB 188	55+210.00	16.2 L	OPSD 705.020 - S3,S22,S23	92.01	6.5	90.41	F
CB 189	55+235.00	15.6 L	OPSD 705.010 - S3,S22,S23	92.14	6.0	90.54	HV
CB 190	55+240.00	12.5 R	OPSD 705.010 - S3,S22,S23	92.23	20.1	90.63	HV
CB 191	55+260.00	14.8 L	OPSD 705.010 - S3,S22,S23	92.28	5.7	90.68	HV
CB 192	55+280.00	11.9 R	OPSD 705.010 - S3,S22,S23	92.44	19.1	90.84	HV
CB 193	55+290.00	13.6 L	OPSD 705.010 - S3,S22,S23	92.46	4.7	90.86	HV
CB 194	55+320.00	11.8 R	OPSD 705.010 - S3,S22,S23	92.64	19.0	91.04	HV
CB 195	55+320.00	12.0 L	OPSD 705.010 - S3,S22,S23	92.64	3.5	91.04	HV
DICB 8	55+340.50	16.6 R	OPSD 705.030 - GRATE TYPE 'A' (3H:V)	91.55	23.7	89.02	N/A

HV= HYDROVEX VORTEX FLOW REGULATOR MOUNTED ON SLIDING PLATE TO S4.1
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SANITARY MAINTENANCE HOLE DATA	
NO.	STRUCTURE TYPE / SIZE
SA 204	1200mm DIA. MH PER OPSD 701.010
SA 205	1200mm DIA. MH PER OPSD 701.010
SA 206	1200mm DIA. MH PER OPSD 701.010
SA 207	1200mm DIA. MH PER OPSD 701.010

LICENSED PROFESSIONAL ENGINEER — J. BETZ — 100059301 — Jan 19-2010 — PROVINCE OF ONTARIO — STORM SEWER, SANITARY SEWER AND WATERMAIN DESIGN

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ENGINEERS ARCHITECTS PLANNERS
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864 Lady Ellen Place
Ottawa, ON Canada
K1Z 5M2
Tel: 613 728 3571
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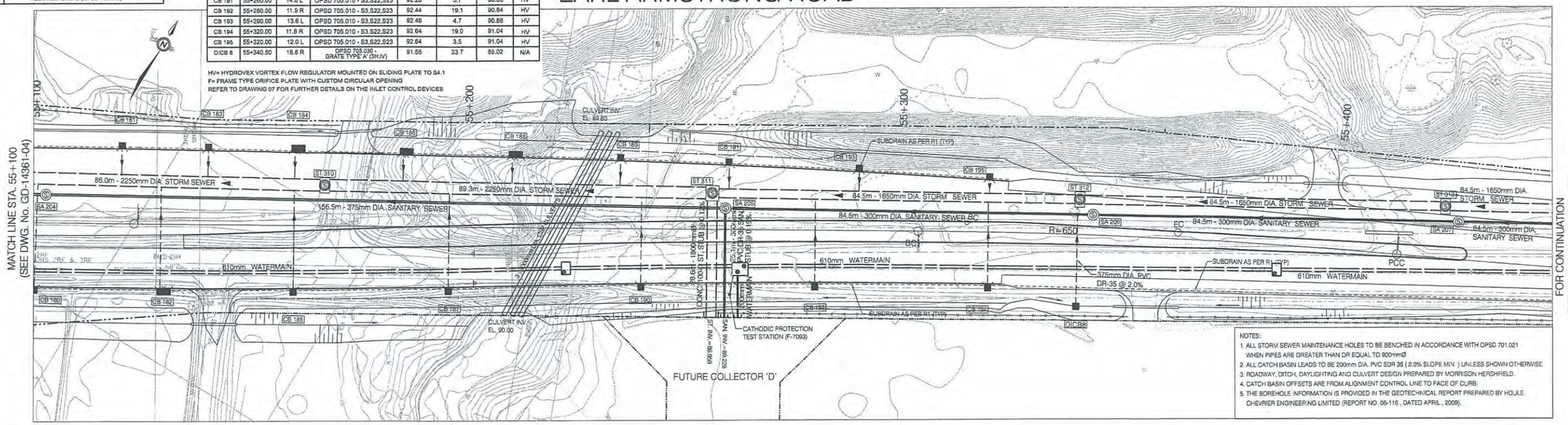
EARL ARMSTRONG ROAD



NOTES:
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LIMEBANK ROAD WIDENING
AT EARL ARMSTRONG RD.

GRADING AND DRAINAGE
STA. 55+100 TO STA. 55+375

W. NEWELL, P. Eng — Director Infrastructure Services
ZIAD A. GHADBAN, P. Eng. — Manager Construction Services - Development

Dwn: MF, MGB | Chkd: PDR | Des: JB | Chkd: PDR

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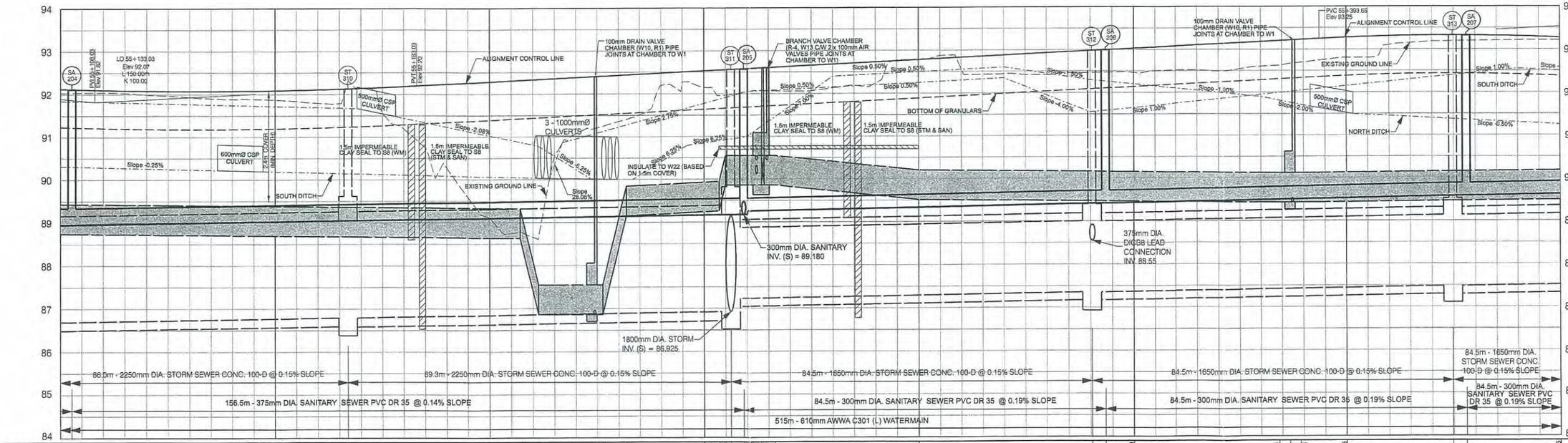

	55+100	55+150	55+200	55+250	55+300	55+350	55+400	55+450
TOP OF WATERMAIN	89.430	89.380	89.330	89.930	90.200	90.150	90.114	90.125
STORM SEWER	88.791	88.791	87.550	87.225	87.352	87.352	87.479	87.479
SANITARY SEWER	88.961	88.961	87.550	89.180	89.416	89.416	89.576	89.576
STATION	55+102.68	55+166.95	54+207.05 @ 22.5° V. BEND 54+211.33 @ 22.5° V. BEND	54+253.57 @ 22.5° V. BEND 54+255.00 @ 22.5° V. BEND 55+258.22 55+259.22 55+263.28	55+266.47 VERTICAL DEFLECTION	55+340.31 55+343.48	55+384.30 VERTICAL DEFLECTION 55+386.80 VALVE CHAMBER 55+389.30 VERTICAL DEFLECTION	55+424.91 55+427.29

DWG. FRAME: 790mm x 534mm RMDC-06/93-WC

Appendix ‘C’

Email Correspondences

Mahad Musse

From: Annie Williams
Sent: April 29, 2022 4:25 PM
To: Daniel Schembri
Cc: Margaret Knowles; Mahad Musse; Rosario; Arif Uddin
Subject: RE: 12007 RE: 1424 Earl Armstrong - Water Servicing HNA

Hi Daniel,

Per our phone conversation earlier today, we will proceed with our HNA and modelling as follows:

- One single 150 mm water service up to each building, with the total demand (max day + sprinkler) input at a single node at each building.
- Two (2) watermain connections to Ceremonial, and one (1) watermain connection to Limebank.

Thank you,
Annie

From: Daniel Schembri <daniel@urbanecosystems.com>
Sent: Friday, April 29, 2022 10:09 AM
To: Annie Williams <awilliams@jlrichards.ca>
Cc: Margaret Knowles <MKnowles@morguard.com>; Mahad Musse <mmusse@jlrichards.ca>; Rosario <rosario@urbanecosystems.com>; Arif Uddin <auddin@petroff.com>
Subject: RE: 12007 RE: 1424 Earl Armstrong - Water Servicing HNA

Hello Annie, please find our base drawing attached with grading information. I agree with Arif, lets proceed with the conservative assumptions on fire flows. Let us assume 150mm for the fire line and only 100mm domestic.

Regards,

Daniel Schembri

From: Annie Williams [mailto:awilliams@jlrichards.ca]
Sent: April-28-22 3:31 PM
To: Daniel Schembri <daniel@urbanecosystems.com>
Cc: Margaret Knowles <MKnowles@morguard.com>; Mahad Musse <mmusse@jlrichards.ca>; Rosario <rosario@urbanecosystems.com>; Arif Uddin <auddin@petroff.com>
Subject: RE: 12007 RE: 1424 Earl Armstrong - Water Servicing HNA

Hi Daniel,

Yes, we can assess having two (2) water service laterals into each building (1 for fire, 1 for domestic) and we can make each lateral 150 mm in diameter.

In order to complete our model and provide these answers, we require the information requested previously including the grading plan, and the location of the second service lateral (or confirm they will be parallel to each other).

In the absence of sprinkler flows from a mechanical engineer, we can use our conservative assumption of 69.2 L/s (1096 gpm) based on OBC but note that this number is often higher than needed. Would you like us to proceed with this assumption?

Please confirm/provide the remaining items noted above and then we can finalize our assessment.

Thank you,
Annie

Annie Williams, P.Eng.

Civil Engineer

J.L. Richards & Associates Limited
700 - 1565 Carling Avenue, Ottawa, ON K1Z 8R1
Direct: 343-803-4523

From: Daniel Schembri <daniel@urbanecosystems.com>
Sent: Wednesday, April 20, 2022 4:34 PM
To: Annie Williams <awilliams@jlrichards.ca>
Cc: Margaret Knowles <MKnowles@morguard.com>; Mahad Musse <mmusse@jlrichards.ca>; Rosario <rosario@urbanecosystems.com>; Arif Uddin <auddin@petroff.com>
Subject: 12007 RE: 1424 Earl Armstrong - Water Servicing HNA

Hello Annie, I have made the connection to the 600 diameter on Limebank and yes we will carry a 200 in to meet our internal 200 diameter loop. The buildings are so preliminary that we do not have a mechanical engineer working on this file as yet. We would like to provide sizing such that each building can potentially have a fire and domestic service. Can you please review the sizing on the attached and confirm if the connections off of the loop were to be no smaller than 150mm diameter would that provide adequate fire flows for protection.

Regards,

Daniel Schembri

From: Annie Williams [mailto:awilliams@jlrichards.ca]
Sent: April-11-22 11:06 AM
To: Daniel Schembri <daniel@urbanecosystems.com>
Cc: Margaret Knowles <MKnowles@morguard.com>; Mahad Musse <mmusse@jlrichards.ca>
Subject: 1424 Earl Armstrong - Water Servicing HNA

Hi Daniel,

We have made good progress with the water servicing hydraulic network analysis (HNA) for 1424 Earl Armstrong and we are looking for the following items to complete our report:

1. Could we obtain a copy of the latest grading plan to verify our model elevations? If the plan shows hydrant top of flange elevations this would be helpful too. If not, can we set the hydrant flanges to be 0.15m above proposed ground?
2. The Servicing Plan provided and attached indicates in the table that there will be two (2) water connections for each building (fire + domestic). The plan view only shows one (1) water service to each building. Please confirm how many water service laterals each building will have and where the second lateral will be located if applicable.
3. Please confirm the sprinkler flow required at each building. We will account for this in our model. Note that it is preferable to have the actual flows from the mechanical engineer rather than making an assumption as the assumption could be over-conservative and unnecessarily increase your pipe sizes.
4. Since we will be connecting to Limebank per the City's direction, we assume the intent is to have a 200mm watermain looped connection between Limebank and Ceremonial. We will model as such, feel free to provide any comments on this approach.

Please let us know at your earliest convenience and feel free to call me with any questions. We should be able to complete our report with this information.

Thank you,
Annie

Annie Williams, P.Eng.
Civil Engineer

J.L. Richards & Associates Limited
700 - 1565 Carling Avenue, Ottawa, ON K1Z 8R1
Direct: 343-803-4523

Mahad Musse

From: Annie Williams
Sent: October 18, 2021 8:28 AM
To: Mahad Musse
Subject: FW: 12007 FW: 1424 Earl Armstrong - HNA Questions
Attachments: SP-100_(21-08-12).pdf

See below Fyi and let me know if we are missing anything.

From: Arif Uddin <auddin@petroff.com>
Sent: Friday, October 15, 2021 3:48 PM
To: Daniel <daniel@urbanecosystems.com>
Cc: Annie Williams <awilliams@jlrichards.ca>; Margaret <MKnowles@morguard.com>; rosario@urbanecosystems.com; Orjan Carlson (E-mail) <uel@urbanecosystems.com>
Subject: Re: 12007 FW: 1424 Earl Armstrong - HNA Questions

HI Daniel, Our response to the questions from Annie Williams.
- Their are total of 13 buildings on site , buildings A to M., as per enclosed copy of the site plan.
Please refer to Stats on the site plan for correct building area,s .
[I am not aware of excel sheet you are referring to] .
Building A, has small mezzanine.
Buildings E, F and J are two story buildings.
All noted on the enclosed site plan.
- All buildings will be fully sprinklered and sprinkler system will be automatic and fully supervised.
- We do not have sprinkler flow demand load. System not yet designed.
- All buildings will be of non combustible construction.
Buildings A,B.C,D,J,K and M are are being designed for single tenant , no fire rated demising walls.
Buildings H, I,E, F are designed to be multi tenant buildings , all demising walls will be one hour rated , unless future leasing requires any of the walls to be 2 hours rated.
All two level buildings will have floor rating of two hours , including columns supporting floor.
Rest of the questions can be answered by your office.

Regards

Arif Uddin
Executive Associate
Petroff Partnership Architects

cellular: 416-986-9413
office: 905-470-7000 X 3409
direct: 905-754-3409
fax: 905-470-2500

Visit our web site at: www.petroff.com
- -

>>> Daniel Schembri <daniel@urbanecosystems.com> 10/15/2021 10:34 AM >>>
Hello Arif, can you please have someone assist Annie with the information required below in the two emails ASAP.

Regards,
Daniel Schembri

From: Annie Williams [mailto:awilliams@jlrichards.ca]
Sent: October-15-21 10:30 AM
To: Daniel Schembri <daniel@urbanecosystems.com>
Cc: mknowles@morguard.com; Mahad Musse <mmusse@jlrichards.ca>
Subject: RE: 1424 Earl Armstrong - HNA Questions

Hi Daniel,

Just following up on this as we require this information in order to request boundary conditions from the City (2-3 week turnaround typically).

We are also looking for the location of the siamese connection on Building A.

Thank you kindly,
Annie

Annie Williams, P.Eng.
Civil Engineer

J.L. Richards & Associates Limited
700 - 1565 Carling Avenue, Ottawa, ON K1Z 8R1
Direct: 343-803-4523

From: Annie Williams
Sent: Friday, October 8, 2021 9:01 AM
To: daniel@urbanecosystems.com
Cc: mknowles@morguard.com; Mahad Musse <mmusse@jlrichards.ca>
Subject: 1424 Earl Armstrong - HNA Questions

Hi Daniel,

We are undertaking the water study for the Riverside South Phase 6 project at 1424 Earl Armstrong Road.

As part of the detailed design for water services, we will need to calculate the domestic demands and required fire flow in accordance with the OBC based on City Technical Bulletins ISTB-2021-03 and ISTB-2018-02.

We are currently preparing our request for boundary conditions to the City. We have reviewed the information you provided on September 21, 2021 and we noted that there are some inconsistencies between the excel spreadsheet (dated Feb 2014) and the latest Site Plan. Therefore, in order to finalize our request to the City we will need confirmation on the following:

- Confirm that there are 13 buildings (A to M) as shown on the site plan and verify the gross floor area and number of storeys for all 13 buildings. The excel file only shows buildings A to K and also shows buildings H1 & H2, which we do not see on the Site Plan.
- Confirm that all 13 buildings (A to M) will have a sprinkler system and please indicate if it will be an automatic fully supervised sprinkler system. We received an email from Arif Uddin on September 21, 2021 indicating that all buildings will be sprinklered but the excel spreadsheet indicates otherwise.
- If available, verify the estimated sprinkler flow demand for each building. We will make an assumption if this information is not currently available.
- For all 13 buildings, provide the type of construction (combustible, non-combustible) and if applicable, the location of 2-hr firewalls.
- Confirm the estimated domestic water demand and water service lateral size for all 13 buildings.
- Verify that the siamese connection locations on the Site Plan are accurate.
- Confirm where you intend to connect to the existing water distribution system (i.e. Will this be a P-loop off Ceremonial Drive as we modelled previously? Will there be connections to Limebank and/or Earl Armstrong?)

For reference, I have attached the Site Plan and excel file we received.

If you have any questions, please do not hesitate to ask.

Thank you,
Annie

Appendix ‘D1’

Water Demands and
Fire Flow Requirements

RFF Exposures (per the FUS)

Critical Fire Area 4 (with sprinkler)
RFF (FUS) = 6,000 L/min (100 L/s)

Critical Fire Area 1 (with sprinkler)
RFF (FUS) = 6,000 L/min (100 L/s)

Critical Fire Area 3 (with sprinkler)
RFF (FUS) = 8,000 L/min (133 L/s)

Critical Fire Area 2 (with sprinkler)
RFF (FUS) = 6,000 L/min (100 L/s)

EARL ARMSTRONG ROAD

LIMEBANK ROAD

CONNECTOR ROAD

CEREMONIAL DRIVE

BUILDING A — XXX EARL ARMSTRONG RD. — ROOF AREA = 4021.6sq-m — F.F. 93.00 — UNCONTROLLED ROOF — SCUPPERS TO LIMIT PONDING DEPTH TO MAX. 150mm

BUILDING B — XXX EARL ARMSTRONG RD. — ROOF AREA = 557.4sq-m — F.F. 92.90 — ROOF CONTROL DRAINS: 2 ZURN Z-105-1 WEIR/HOPPER OR APPROVED EQUAL — SCUPPERS TO LIMIT PONDING DEPTH TO MAX. 100mm — ROOF PONDING VOLUME 27.4 cu.m.

BUILDING C — XXX EARL ARMSTRONG RD. — ROOF AREA = 1393.4sq-m — F.F. 93.00 — ROOF CONTROL DRAINS: 3 ZURN Z-105-1 WEIR/HOPPER OR APPROVED EQUAL — SCUPPERS TO LIMIT PONDING DEPTH TO MAX. 100mm — ROOF PONDING VOLUME 41.1 cu.m.

BUILDING D — XXX EARL ARMSTRONG RD. — ROOF AREA = 557.4sq-m — F.F. 93.20 — ROOF CONTROL DRAINS: 2 ZURN Z-105-1 WEIR/HOPPER OR APPROVED EQUAL — SCUPPERS TO LIMIT PONDING DEPTH TO MAX. 100mm — ROOF PONDING VOLUME 27.4 cu.m.

BUILDING E — XXX EARL ARMSTRONG RD. — ROOF AREA = 4034.1sq-m — F.F. 92.95 — ROOF CONTROL DRAINS: 5 ZURN Z-105-1 WEIR/HOPPER OR APPROVED EQUAL — SCUPPERS TO LIMIT PONDING DEPTH TO MAX. 100mm — ROOF PONDING VOLUME 68.3 cu.m.

BUILDING F — XXX EARL ARMSTRONG RD. — ROOF AREA = 1019sq-m — F.F. 92.95 — ROOF CONTROL DRAINS: 3 ZURN Z-105-1 WEIR/HOPPER OR APPROVED EQUAL — SCUPPERS TO LIMIT PONDING DEPTH TO MAX. 100mm — ROOF PONDING VOLUME 41.1 cu.m.

BUILDING G — XXX EARL ARMSTRONG RD. — ROOF AREA = 464.5sq-m — F.F. 92.90 — ROOF CONTROL DRAINS: 2 ZURN Z-105-1 WEIR/HOPPER OR APPROVED EQUAL — SCUPPERS TO LIMIT PONDING DEPTH TO MAX. 100mm — ROOF PONDING VOLUME 27.4 cu.m.

BUILDING I — XXX EARL ARMSTRONG RD. — ROOF AREA = 802.5sq-m — F.F. 93.20 — ROOF CONTROL DRAINS: 2 ZURN Z-105-1 WEIR/HOPPER OR APPROVED EQUAL — SCUPPERS TO LIMIT PONDING DEPTH TO MAX. 100mm — ROOF PONDING VOLUME 27.4 cu.m.

BUILDING J — XXX EARL ARMSTRONG RD. — ROOF AREA = 635.2sq-m — F.F. 92.95 — ROOF CONTROL DRAINS: 2 ZURN Z-105-1 WEIR/HOPPER OR APPROVED EQUAL — SCUPPERS TO LIMIT PONDING DEPTH TO MAX. 100mm — ROOF PONDING VOLUME 27.4 cu.m.

BUILDING K — XXX EARL ARMSTRONG RD. — ROOF AREA = 633.6sq-m — F.F. 93.80 — ROOF CONTROL DRAINS: 2 ZURN Z-105-1 WEIR/HOPPER OR APPROVED EQUAL — SCUPPERS TO LIMIT PONDING DEPTH TO MAX. 150mm — ROOF PONDING VOLUME 27.4 cu.m.

BUILDING L — XXX EARL ARMSTRONG RD. — ROOF AREA = 557.4sq-m — F.F. 93.10 — ROOF CONTROL DRAINS: 2 ZURN Z-105-1 WEIR/HOPPER OR APPROVED EQUAL — SCUPPERS TO LIMIT PONDING DEPTH TO MAX. 100mm — ROOF PONDING VOLUME 27.4 cu.m.

25.00 m

19.00 m

10.00 m

14.93 m

11.00 m

22.00 m

10.00 m

KEY PLAN
NTS

EARL ARMSTRONG ROAD
PROPOSED SITE
LIMEBANK ROAD
RIDEAU ROAD
SPRATT ROAD

WATER CONNECTIONS

BUILDING	FIRE (mm Ø)	DOMESTIC (mm Ø)
A	150	100
B	100	50
C	150	50
D	100	50
E	150	100
F	100	50
G	100	50
H	150	50
I	150	50
J	100	50
K	100	50
L	100	50
M	100	50

THERMAL PIPE INSULATION

SEE DETAIL ON DWG 5 of 8

FROM M.H.	TO M.H.	THICKNESS
5A	6A	50 mm
6A	7A	50 mm
7A	8A	100 mm
8A	BLDG. L	100 mm
20A	BLDG. J	50 mm
33	34	100 mm
34	35	100 mm
35	36	100 mm

NOTES :
- ALL WATERMAIN CROSSINGS TO BE IN CONJUNCTION WITH STANDARDS W25 & W25.2
- WATERMAIN CONNECTIONS BY CITY, EXCAVATION, BACKFILLING AND REINSTATED BY THE CONTRACTOR.

LEGEND

- EXISTING CURB
- EXISTING CURB TO BE REMOVED
- PROPOSED CURB
- PROPOSED SIDEWALK
- OVERLAND FLOW ROUTE
- 1.5% — DIRECTION AND SLOPE OF SURFACE DRAINAGE
- PROPOSED PAVEMENT
- 95.45 — EXISTING ELEVATION
- WM — WATER METER
- RM — REMOTE READOUT
- SIAMESE CONNECTION
- GAS METER

CLAY SEALS SHALL BE INSTALLED IN THE SERVICE TRENCHES. THE SEALS SHALL BE 1.5m LONG (IN THE TRENCH DIRECTION) AND SHALL EXTEND FROM TRENCH WALL TO TRENCH WALL. THE SEALS SHALL EXTEND FROM THE FROST LINE AND FULLY PENETRATE THE BEDDING, SUBBEDDING AND COVER MATERIAL. SEALS SHALL CONSIST OF RELATIVELY DRY AND COMPACTABLE BROWN SILTY CLAY, COMPACTED TO A MINIMUM OF 95% OF THE SPMDD. THE CLAY SEALS SHALL BE PLACED AT THE SITE BOUNDARIES AND AT STRATEGIC LOCATIONS AT NO MORE THAN 60m INTERVALS ALONG THE SERVICE TRENCHES, AS DIRECTED BY THE GEOTECHNICAL ENGINEER.

NOTE:
THIS DRAWING SHALL BE READ IN CONJUNCTION WITH DRAWING 5 OF 8, NOTES & DETAILS PROJECT 12007

LOCAL BENCHMARK:
CUT CROSS IN CONCRETE TRAFFIC ISLAND AT THE NORTH-EAST CORNER OF EARL ARMSTRONG ROAD AND LIMEBANK ROAD AS ESTABLISHED BY ANNIS, O'SULLIVAN, VOLLEBEKK LTD, O.L.S.

ELEVATION 92.87

No.	By	Date	Revision	Checked
15	D.J.S.	Aug 27/21	SUBMITTED FOR SITE PLAN APPROVAL	O.B.C.
14.	D.S.	Mar 8/21	SITE PLAN REVISIONS – MINOR BUILDING ADJUSTMENTS	O.B.C.
13.	D.S.	Aug 21/20	SITE PLAN REVISIONS TO LOCATION OF BUILDINGS	O.B.C.
12.	V.T.	Sept. 28/19	SITE PLAN REVISIONS/CITY COMMENTS	O.B.C.
11.	D.S.	Nov 21/16	SITE PLAN REVISIONS/CITY COMMENTS	O.B.C.
10.	D.S.	Nov 27/15	REV. GRADES OF TOWN SQUARE BLVD. AND BLD's E, F, I, J & K	O.B.C.
9.	O.B.C.	Oct 13/15	HYDRANT LOCATIONS	O.B.C.
8.	D.S.	Aug 26/15	REVISED AS PER CITY COMMENTS	O.B.C.
7.	D.S.	Aug. 14/15	SITE PLAN REVISIONS	O.B.C.
6.	C.R.M.	Jan 28/15	REVISED AS PER CITY COMMENTS	O.B.C.

APPROVED AS TO FORM IN RELIANCE UPON THE PROFESSIONAL SKILL AND ABILITY OF URBAN ECOSYSTEMS LIMITED AS TO DESIGN AND SPECIFICATION.

REGISTERED PROFESSIONAL ENGINEER — ROSARIO.SACCO — AUG 27/2021 — PROVINCE OF ONTARIO

Director of Engineering — Date

URBAN ECOSYSTEMS LIMITED
7050 WESTON ROAD, SUITE 705
WOODBRIDGE, ONTARIO L4L 8G7
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f. (905)856-0698

TOWN SQUARE CENTRE
RIVERSIDE SOUTH
1424 EARL ARMSTRONG ROAD
CITY OF OTTAWA

MORGUARD INVESTMENTS LTD.
55 CITY CENTER DRIVE
MISSISSAUGA, ONTARIO

FILE No D07-12-14-0067

SERVICING PLAN

Designed By O.B.C.	Date APR 2014	Checked By R.S.	
Drawn By J.H.		Approved By	
Scale: 1:500	Project No. 12007	Drawing No. 2of8	

Plan Number: 18350

D07-12-21-0005

FUS Fire Flow Calculations

MORGUARD HNA - 1424 EARL ARMSTRONG ROAD - Building A - Commercial Building
(JLR 21464-006)

Step	Parameter	Value		Note
A	Type of Construction	Non-combustible		Building - A (Proposed Supermarket)
	Coefficient (C)	0.8		
B	Ground Floor Area	4923	m^2	Building - A (Proposed Supermarket with Mezzanine)
C	Height in storeys	1	storeys	Basements are excluded.
	Total Floor Area	4923	m^2	
D	Fire Flow Formula	$F=220C\sqrt{A}$		
	Fire Flow	12349	L/min	
	Rounded Fire Flow	12000	L/min	Flow rounded to nearest 1000 L/min.
E	Occupancy Class	Combustible		Supermarkets have a combustible occupancy.
	Occupancy Charge	0%		
	Occupancy Increase or Decrease	0		
	Fire Flow	12000	L/min	No rounding applied.
F	Sprinkler Protection	Automatic Fully Supervised		
	Sprinkler Credit	-50%		
	Decrease for Sprinkler	-6000	L/min	
G	*North Side Exposure*			
	Exposing Wall:	Wood Frame		Building - A (Proposed Supermarket)
	Exposed Wall:	Wood Frame		No structure within 50 meters
	Length of Exposed Wall:	0.0	m	
	Height of Exposed Wall:	0	storeys	
	Length-Height Factor	0.0	m-storeys	
	Separation Distance	50	m	
	North Side Exposure Charge	0%		
	East Side Exposure			
	Exposing Wall:	Wood Frame		Building - A (Proposed Supermarket)
	Exposed Wall:	Wood Frame		No structure within 50 meters
	Length of Exposed Wall:	0.0	m	
	Height of Exposed Wall:	0	storeys	
	Length-Height Factor	0.0	m-storeys	
	Separation Distance	50	m	
	East Side Exposure Charge	0%		
	South Side Exposure			
	Exposing Wall:	Wood Frame		Building - A (Proposed Supermarket)
	Exposed Wall:	Wood Frame		No structure within 50 meters
	Length of Exposed Wall:	0.0	m	
	Height of Exposed Wall:	0	storeys	
	Length-Height Factor	0.0	m-storeys	
	Separation Distance	50	m	
	South Side Exposure Charge	0%		
	West Side Exposure			
	Exposing Wall:	Wood Frame		Building - A (Proposed Supermarket)
	Exposed Wall:	Wood Frame		No structure within 50 meters
	Length of Exposed Wall:	0.0	m	
	Height of Exposed Wall:	0	storeys	
	Length-Height Factor	0.0	m-storeys	
	Separation Distance	50	m	
	West Side Exposure Charge	0%		
	Total Exposure Charge	0%		The total exposure charge is below the maximum value of 75%.
	Increase for Exposures	0	L/min	
H	Fire Flow	6000	L/min	
	Rounded Fire Flow	6000	L/min	Flow rounded to nearest 1000 L/min.
City Cap	**Required Fire Flow (RFF)**	**6000**	**L/min**	
		100	**L/s**	

Fire Underwriters Survey (FUS) Fire Flow Calculations
In accordance with City of Ottawa Technical Bulletin ISTB-2018-02 dated March 21, 2018

FUS Fire Flow Calculations

MORGUARD HNA - 1424 EARL ARMSTRONG ROAD - Building F - Commercial Building

(JLR 21464-006)

Step	Parameter	Value		Note
A	Type of Construction	Non-combustible		Building - F
	Coefficient (C)	0.8		
B	Ground Floor Area	1018.5	m^2	Building - F (2 storey commercial building)
C	Height in storeys	2	storeys	Basements are excluded.
	Total Floor Area	2037	m^2	
D	Fire Flow Formula	$F=220C\sqrt{A}$		
	Fire Flow	7943	L/min	
	Rounded Fire Flow	8000	L/min	Flow rounded to nearest 1000 L/min.
E	Occupancy Class	Combustible		Retail buildings have a combustible occupancy.
	Occupancy Charge	0%		
	Occupancy Increase or Decrease	0		
	Fire Flow	8000	L/min	No rounding applied.
F	Sprinkler Protection	Automatic Fully Supervised		
	Sprinkler Credit	-50%		
	Decrease for Sprinkler	-4000	L/min	
G	*North Side Exposure*			
	Exposing Wall:	Wood Frame		Building - F (2 storey commercial building)
	Exposed Wall:	Wood Frame		No structure within 50 meters
	Length of Exposed Wall:	0.0	m	
	Height of Exposed Wall:	0	storeys	
	Length-Height Factor	0.0	m-storeys	
	Separation Distance	50	m	
	North Side Exposure Charge	0%		
	East Side Exposure			
	Exposing Wall:	Wood Frame		Building - F (2 storey commercial building)
	Exposed Wall:	Wood Frame		Building - K (1 storey commercial building)
	Length of Exposed Wall:	11.0	m	
	Height of Exposed Wall:	1	storeys	
	Length-Height Factor	11.0	m-storeys	
	Separation Distance	13	m	Additional 3m seperation because at a diagonal
	East Side Exposure Charge	12%		
	South Side Exposure			
	Exposing Wall:	Wood Frame		Building - F (2 storey commercial building)
	Exposed Wall:	Wood Frame		No structure within 50 meters
	Length of Exposed Wall:	0.0	m	
	Height of Exposed Wall:	0	storeys	
	Length-Height Factor	0.0	m-storeys	
	Separation Distance	50	m	
	South Side Exposure Charge	0%		
	West Side Exposure			
	Exposing Wall:	Wood Frame		Building - F (2 storey commercial building)
	Exposed Wall:	Wood Frame		Building - J (2 storey commercial buidling)
	Length of Exposed Wall:	22.0	m	
	Height of Exposed Wall:	2	storeys	
	Length-Height Factor	44.0	m-storeys	
	Separation Distance	21	m	
	West Side Exposure Charge	8%		
	Total Exposure Charge	20%		The total exposure charge is below the maximum value of 75%.
	Increase for Exposures	1600	L/min	
H	Fire Flow	5600	L/min	
	Rounded Fire Flow	6000	L/min	Flow rounded to nearest 1000 L/min.
City Cap	**Required Fire Flow (RFF)**	**6000**	**L/min**	
		100	**L/s**	

Fire Underwriters Survey (FUS) Fire Flow Calculations
In accordance with City of Ottawa Technical Bulletin ISTB-2018-02 dated March 21, 2018

FUS Fire Flow Calculations

MORGUARD HNA - 1424 EARL ARMSTRONG ROAD - Building C - Commercial Building

(JLR 21464-006)

Step	Parameter	Value		Note
A	Type of Construction	Non-combustible		Building - C
	Coefficient (C)	0.8		
B	Ground Floor Area	1394	m^2	Building - C (1 storey commercial building)
C	Height in storeys	1	storeys	Basements are excluded.
	Total Floor Area	1394	m^2	
D	Fire Flow Formula	$F=220C\sqrt{A}$		
	Fire Flow	6571	L/min	
	Rounded Fire Flow	7000	L/min	Flow rounded to nearest 1000 L/min.
E	Occupancy Class	Combustible		Retail buildings have a combustible occupancy.
	Occupancy Charge	0%		
	Occupancy Increase or Decrease	0		
	Fire Flow	7000	L/min	No rounding applied.
F	Sprinkler Protection	Automatic Fully Supervised		
	Sprinkler Credit	-50%		
	Decrease for Sprinkler	-3500	L/min	
G	*North Side Exposure*			
	Exposing Wall:	Wood Frame		Building - C (1 storey commercial building)
	Exposed Wall:	Wood Frame		Building - H (1 storey commercial building)
	Length of Exposed Wall:	19.0	m	
	Height of Exposed Wall:	0	storeys	
	Length-Height Factor	0.0	m-storeys	
	Separation Distance	22	m	Additional 3m separation because at a diagonal
	North Side Exposure Charge	8%		
	East Side Exposure			
	Exposing Wall:	Wood Frame		Building - C (1 storey commercial building)
	Exposed Wall:	Wood Frame		Building - M (1 storey commercial building)
	Length of Exposed Wall:	20.0	m	
	Height of Exposed Wall:	1	storeys	
	Length-Height Factor	20.0	m-storeys	
	Separation Distance	25	m	
	East Side Exposure Charge	8%		
	South Side Exposure			
	Exposing Wall:	Wood Frame		Building - C (1 storey commercial building)
	Exposed Wall:	Wood Frame		No structure within 50 meters
	Length of Exposed Wall:	0.0	m	
	Height of Exposed Wall:	0	storeys	
	Length-Height Factor	0.0	m-storeys	
	Separation Distance	50	m	
	South Side Exposure Charge	0%		
	West Side Exposure			
	Exposing Wall:	Wood Frame		Building - C (1 storey commercial building)
	Exposed Wall:	Wood Frame		No structure within 50 meters
	Length of Exposed Wall:	0.0	m	
	Height of Exposed Wall:	0	storeys	
	Length-Height Factor	0.0	m-storeys	
	Separation Distance	0	m	
	West Side Exposure Charge	22%		
	Total Exposure Charge	38%		The total exposure charge is below the maximum value of 75%.
	Increase for Exposures	2660	L/min	
H	Fire Flow	6160	L/min	
	Rounded Fire Flow	6000	L/min	Flow rounded to nearest 1000 L/min.
City Cap	**Required Fire Flow (RFF)**	**6000**	**L/min**	
		100	**L/s**	

Fire Underwriters Survey (FUS) Fire Flow Calculations
In accordance with City of Ottawa Technical Bulletin ISTB-2018-02 dated March 21, 2018

FUS Fire Flow Calculations

MORGUARD HNA - 1424 EARL ARMSTRONG ROAD - Building E - Commercial Building

(JLR 21464-006)

Step	Parameter	Value		Note
A	Type of Construction	Non-combustible		Building - E
	Coefficient (C)	0.8		
B	Ground Floor Area	2034	m^2	Building - E (2 storey commercial building)
C	Height in storeys	2	storeys	Basements are excluded.
	Total Floor Area	4068	m^2	
D	Fire Flow Formula	$F=220C\sqrt{A}$		
	Fire Flow	11225	L/min	
	Rounded Fire Flow	11000	L/min	Flow rounded to nearest 1000 L/min.
E	Occupancy Class	Combustible		Retail buildings have a combustible occupancy.
	Occupancy Charge	0%		
	Occupancy Increase or Decrease	0		
	Fire Flow	11000	L/min	No rounding applied.
F	Sprinkler Protection	Automatic Fully Supervised		
	Sprinkler Credit	-50%		
	Decrease for Sprinkler	-5500	L/min	
G	*North Side Exposure*			
	Exposing Wall:	Wood Frame		Building - E (2 storey commercial building)
	Exposed Wall:	Wood Frame		No structure within 50 meters
	Length of Exposed Wall:	0.0	m	
	Height of Exposed Wall:	0	storeys	
	Length-Height Factor	0.0	m-storeys	
	Separation Distance	50	m	
	North Side Exposure Charge	0%		
	East Side Exposure			
	Exposing Wall:	Wood Frame		Building - E (2 storey commercial building)
	Exposed Wall:	Wood Frame		Building - J (2 storey commercial building)
	Length of Exposed Wall:	22.0	m	
	Height of Exposed Wall:	1	storeys	
	Length-Height Factor	22.0	m-storeys	
	Separation Distance	11	m	
	East Side Exposure Charge	12%		
	South Side Exposure			
	Exposing Wall:	Wood Frame		Building - E (2 storey commercial building)
	Exposed Wall:	Wood Frame		No structure within 50 meters
	Length of Exposed Wall:	0.0	m	
	Height of Exposed Wall:	0	storeys	
	Length-Height Factor	0.0	m-storeys	
	Separation Distance	50	m	
	South Side Exposure Charge	0%		
	West Side Exposure			
	Exposing Wall:	Wood Frame		Building - E (2 storey commercial building)
	Exposed Wall:	Wood Frame		Building - I (1 storey commercial buidling)
	Length of Exposed Wall:	10.0	m	
	Height of Exposed Wall:	1	storeys	
	Length-Height Factor	10.0	m-storeys	
	Separation Distance	13	m	Additional 3m seperation because at a diagonal
	West Side Exposure Charge	12%		
	Total Exposure Charge	24%		The total exposure charge is below the maximum value of 75%.
	Increase for Exposures	2640	L/min	
H	Fire Flow	8140	L/min	
	Rounded Fire Flow	8000	L/min	Flow rounded to nearest 1000 L/min.
City Cap	**Required Fire Flow (RFF)**	**8000**	**L/min**	
		133	**L/s**	

Fire Underwriters Survey (FUS) Fire Flow Calculations
In accordance with City of Ottawa Technical Bulletin ISTB-2018-02 dated March 21, 2018

MORGUARD HNA
1424 EARL ARMSTRONG ROAD

2022-05-09

BUILDING ID	BLDG FOOTPRINT (ft2)	BLDG FOOTPRINT (m2)	BLDG AREA DISTRIBUTION (ha)	AREA DISTRIBUTION FACTOR	DEMAND (L/s)		
					Avg Day	Max Day	Peak Hour
A	52,990	4,923	1.68	0.26	1.09	1.64	2.94
B	6,000	557	0.19	0.03	0.12	0.19	0.33
C	15,000	1,394	0.48	0.07	0.31	0.46	0.83
D	6,000	557	0.19	0.03	0.12	0.19	0.33
E	43,790	4,068	1.39	0.22	0.90	1.35	2.43
F	21,936	2,038	0.70	0.11	0.45	0.68	1.22
G	5,000	465	0.16	0.02	0.10	0.15	0.28
H	11,203	1,041	0.36	0.06	0.23	0.35	0.62
I	9,284	863	0.29	0.05	0.19	0.29	0.52
J	13,674	1,270	0.43	0.07	0.28	0.42	0.76
K	6,820	634	0.22	0.03	0.14	0.21	0.38
L	6,000	557	0.19	0.03	0.12	0.19	0.33
M	3,000	279	0.10	0.01	0.06	0.09	0.17
TOTAL	**200,697**	**18,645**	**6.37**	**1.00**	**4.11**	**6.21**	**11.14**

Commercial Consumption			
Total Site Area	6.37	ha	
Average Day Demand	28,000	L/ha/day	ODG TABLE 4.2
Maximum Day Demand (1.5 x Avg Day)	42,000	L/ha/day	ODG TABLE 4.2
Peak Hour Demand (1.8 x Max Day)	75,600	L/ha/day	ODG TABLE 4.2

*NOTE - A 12 hour business day was assumed.

11.2.2 Water Demand Requirements — Pipe Schedule Method.

11.2.2.1 Table 11.2.2.1 shall be used in determining the minimum water supply requirements for light and ordinary hazard occupancies protected by systems with pipe sized according to the pipe schedules of Section 23.7.

Table 11.2.2.1 Water Supply Requirements for Pipe Schedule Sprinkler Systems

Occupancy Classification	Minimum Residual Pressure Required		Acceptable Flow at Base of Riser (Including Hose Stream Allowance)		Duration (minutes)
	psi	bar	gpm	L/min	
Light hazard	15	1	500–750	1900–2850	30–60
Ordinary hazard	20	1.4	850–1500	3200–5700	60–90

11.2.2.2 Pressure and flow requirements for extra hazard occupancies shall be based on the hydraulic calculation methods of 11.2.3.

11.2.2.3 The pipe schedule method shall be permitted as follows:

(1) Additions or modifications to existing pipe schedule systems sized according to the pipe schedules of Section 23.7
(2) Additions or modifications to existing extra hazard pipe schedule systems
(3) New systems of 5000 ft^2 (465 m^2) or less
(4) New systems exceeding 5000 ft^2 (465 m^2) where the flows required in Table 11.2.2.1 are available at a minimum residual pressure of 50 psi (3.4 bar) at the highest elevation of sprinkler

11.2.2.4 Table 11.2.2.1 shall be used in determining the minimum water supply requirements.

11.2.2.5 The lower duration value of Table 11.2.2.1 shall be acceptable only where the sprinkler system waterflow alarm device(s) and supervisory device(s) are electrically supervised and such supervision is monitored at an approved, constantly attended location.

11.2.2.6* Residual Pressure.

11.2.2.6.1 The residual pressure requirement of Table 11.2.2.1 shall be met at the elevation of the highest sprinkler.

11.2.2.6.2 Friction Loss Due to Backflow Prevention Valves.

11.2.2.6.2.1 When backflow prevention valves are installed on pipe schedule systems, the friction losses of the device shall be accounted for when determining acceptable residual pressure at the top level of sprinklers.

11.2.2.6.2.2 The friction loss of this device [in psi (bar)] shall be added to the elevation loss and the residual pressure at the top row of sprinklers to determine the total pressure needed at the water supply.

11.2.2.7 The lower flow figure of Table 11.2.2.1 shall be permitted only where the building is of noncombustible construction or the potential areas of fire are limited by building size or compartmentation such that no open areas exceed 3000 ft^2 (280 m^2) for light hazard or 4000 ft^2 (370 m^2) for ordinary hazard.

11.2.3 Water Demand Requirements — Hydraulic Calculation Methods.

11.2.3.1 General.

11.2.3.1.1 The water demand for sprinklers shall be determined only from one of the following, at the discretion of the designer:

(1) Density/area curves of Figure 11.2.3.1.1 in accordance with the density/area method of 11.2.3.2
(2) The room that creates the greatest demand in accordance with the room design method of 11.2.3.3
(3) Special design areas in accordance with 11.2.3.4

11.2.3.1.2 The minimum water supply shall be available for the minimum duration specified in Table 11.2.3.1.2.

11.2.3.1.3 The lower duration values in Table 11.2.3.1.2 shall be permitted where the sprinkler system waterflow alarm device(s) and supervisory device(s) are electrically supervised and such supervision is monitored at an approved, constantly attended location.

11.2.3.1.4 Restrictions. When either the density/area method or room design method is used, the following shall apply:

(1)*For areas of sprinkler operation less than 1500 ft^2 (139 m^2) used for light and ordinary hazard occupancies, the density for 1500 ft^2 (139 m^2) shall be used.
(2) For areas of sprinkler operation less than 2500 ft^2 (232 m^2) for extra hazard occupancies, the density for 2500 ft^2 (232 m^2) shall be used.

11.2.3.1.5 Unsprinklered Combustible Concealed Spaces.

11.2.3.1.5.1* When using the density/area or room design method, unless the requirements of 11.2.3.1.5.2 are met for buildings having unsprinklered combustible concealed spaces, as described in 8.15.1.2 and 8.15.6, the minimum area of sprinkler operation for that portion of the building shall be 3000 ft^2 (280 m^2).

(A) The design area of 3000 ft^2 (280 m^2) shall be applied only to the sprinkler system or portions of the sprinkler system that are adjacent to the qualifying combustible concealed space.

(B) The term *adjacent* shall apply to any sprinkler system protecting a space above, below, or next to the qualifying concealed space except where a barrier with a fire resistance rating at least equivalent to the water supply duration completely separates the concealed space from the sprinklered area.

11.2.3.1.5.2 The following unsprinklered concealed spaces shall not require a minimum area of sprinkler operation of 3000 ft^2 (280 m^2):

(1) Noncombustible and limited-combustible concealed spaces with minimal combustible loading having no access. The space shall be considered a concealed space even with small openings such as those used as return air for a plenum.
(2) Noncombustible and limited-combustible concealed spaces with limited access and not permitting occupancy or storage of combustibles. The space shall be considered a concealed space even with small openings such as those used as return air for a plenum.
(3) Combustible concealed spaces filled entirely with noncombustible insulation.
(4)*Light or ordinary hazard occupancies where noncombustible or limited-combustible ceilings are directly attached

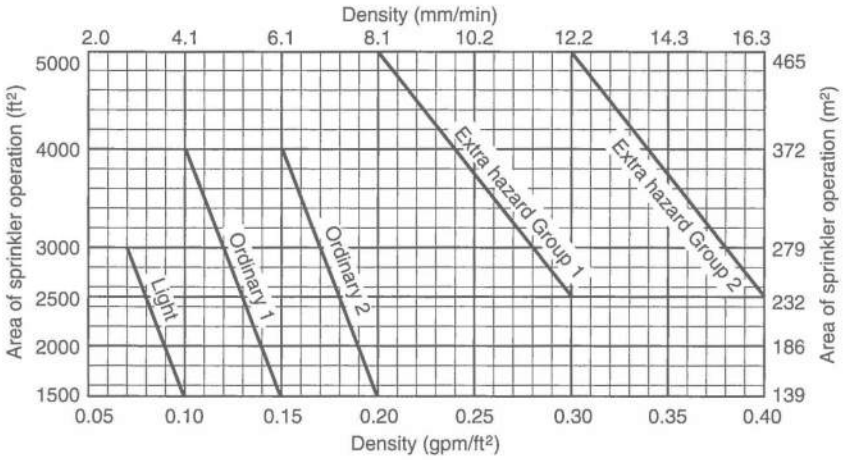


FIGURE 11.2.3.1.1 Density/Area Curves.

Table 11.2.3.1.2 Hose Stream Allowance and Water Supply Duration Requirements for Hydraulically Calculated Systems

Occupancy	Inside Hose		Total Combined Inside and Outside Hose		Duration (minutes)
	gpm	L/min	gpm	L/min	
Light hazard	0, 50, or 100	0, 190, or 380	100	380	30
Ordinary hazard	0, 50, or 100	0, 190, or 380	250	950	60–90
Extra hazard	0, 50, or 100	0, 190, or 380	500	1900	90–120

to the bottom of solid wood joists or solid limited-combustible construction or noncombustible construction so as to create enclosed joist spaces 160 ft^3 (4.5 m^3) or less in volume, including space below insulation that is laid directly on top or within the ceiling joists in an otherwise sprinklered concealed space.

(5) Concealed spaces where rigid materials are used and the exposed surfaces have a flame spread index of 25 or less and the materials have been demonstrated to not propagate fire more than 10.5 ft (3.2 m) when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or ANSI/UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials*, extended for an additional 20 minutes in the form in which they are installed in the space.

(6) Concealed spaces in which the exposed materials are constructed entirely of fire-retardant-treated wood as defined by NFPA 703.

(7) Concealed spaces over isolated small rooms not exceeding 55 ft^2 (5.1 m^2) in area.

(8) Vertical pipe chases under 10 ft^2 (0.9 m^2), provided that in multifloor buildings the chases are firestopped at each floor using materials equivalent to the floor construction, and where such pipe chases contain no sources of ignition, piping shall be noncombustible, and pipe penetrations at each floor shall be properly sealed.

(9) Exterior columns under 10 ft^2 (0.9 m^2) in area formed by studs or wood joists, supporting exterior canopies that are fully protected with a sprinkler system.

(10)*Light or ordinary hazard occupancies where noncombustible or limited-combustible ceilings are attached to the bottom of composite wood joists either directly or on to metal channels not exceeding 1 in. (25 mm) in depth, provided the adjacent joist channels are firestopped into volumes not exceeding 160 ft^3 (4.5 m^3) using materials equivalent to ½ in. (13 mm) gypsum board, and at least 3½ in. (90 mm) of batt insulation is installed at the bottom of the joist channels when the ceiling is attached utilizing metal channels.

11.2.3.2 Density/Area Method.

11.2.3.2.1 Water Supply.

11.2.3.2.1.1 The water supply requirement for sprinklers only shall be calculated from the density/area curves of Figure 11.2.3.1.1 or from Chapter 22 where density/area criteria are specified for special occupancy hazards.

11.2.3.2.1.2 When using Figure 11.2.3.1.1, the calculations shall satisfy any single point on the appropriate density/area curve.

11.2.3.2.1.3 When using Figure 11.2.3.1.1, it shall not be necessary to meet all points on the selected curves.

11.2.3.2.2 Sprinklers.

11.2.3.2.2.1 The densities and areas provided in Figure 11.2.3.1.1 shall be for use only with spray sprinklers.

11.2.3.2.2.2 Quick-response sprinklers shall not be permitted for use in extra hazard occupancies or other occupancies where there are substantial amounts of flammable liquids or combustible dusts.

11.2.3.2.2.3 For extended coverage sprinklers, the minimum design area shall be that corresponding to the hazard in Figure 11.2.3.1.1 or the area protected by five sprinklers, whichever is greater.

11.2.3.2.2.4 Extended coverage sprinklers shall be listed with and designed for the minimum flow corresponding to the density for the hazard as specified in Figure 11.2.3.1.1.

Appendix ‘D2’

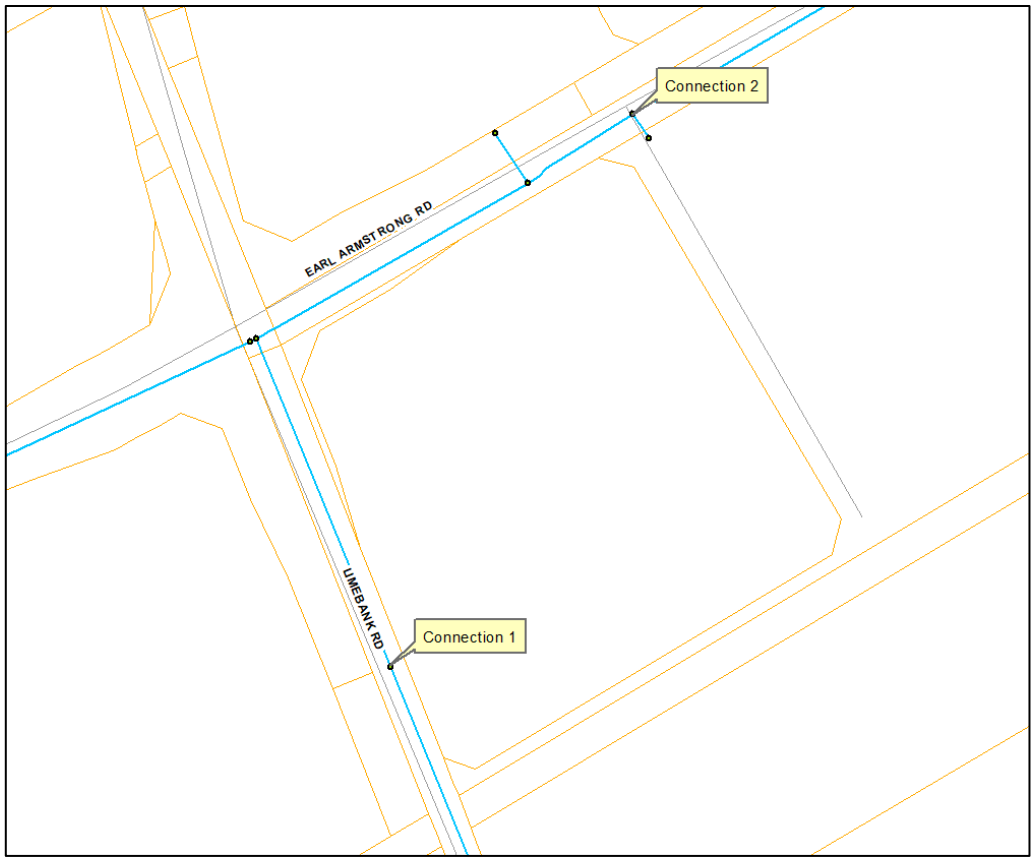
City Correspondence -
Boundary Conditions

Boundary Conditions
1424 Earl Armstrong Road

Provided Information

Scenario	Demand	
	L/min	L/s
Average Daily Demand	247	4.11
Maximum Daily Demand	373	6.21
Peak Hour	668	11.14
Fire Flow Demand #1	4,150	69.17
Fire Flow Demand #2	8,000	133.33

Location



Results – Existing Conditions

Connection 1 – Limebank Rd.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	132.2	55.6
Peak Hour	124.9	45.2
Max Day plus Fire 1	126.9	48.1
Max Day plus Fire 2	125.6	46.2

Ground Elevation = 93.1 m

Connection 2 – Earl Armstrong Rd.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	132.2	56.6
Peak Hour	124.9	46.2
Max Day plus Fire 1	126.9	49.1
Max Day plus Fire 2	125.6	47.1

Ground Elevation = 92.4 m

Results – SUC Zone Reconfiguration

Connection 1 – Limebank Rd.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	148.7	79.1
Peak Hour	145.6	74.7
Max Day plus Fire 1	146.0	75.3
Max Day plus Fire 2	144.2	72.6

Ground Elevation = 93.1 m

Connection 2 – Earl Armstrong Rd.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	148.7	80.1
Peak Hour	145.6	75.7
Max Day plus Fire 1	146.0	76.3
Max Day plus Fire 2	144.2	73.6

Ground Elevation = 92.4 m

Notes

1. As per the Ontario Building Code in areas that may be occupied, the static pressure at any fixture shall not exceed 552 kPa (80 psi.) Pressure control measures to be considered are as follows, in order of preference:
    a. If possible, systems to be designed to residual pressures of 345 to 552 kPa (50 to 80 psi) in all occupied areas outside of the public right-of-way without special pressure control equipment.
    b. Pressure reducing valves to be installed immediately downstream of the isolation valve in the home/ building, located downstream of the meter so it is owner maintained.

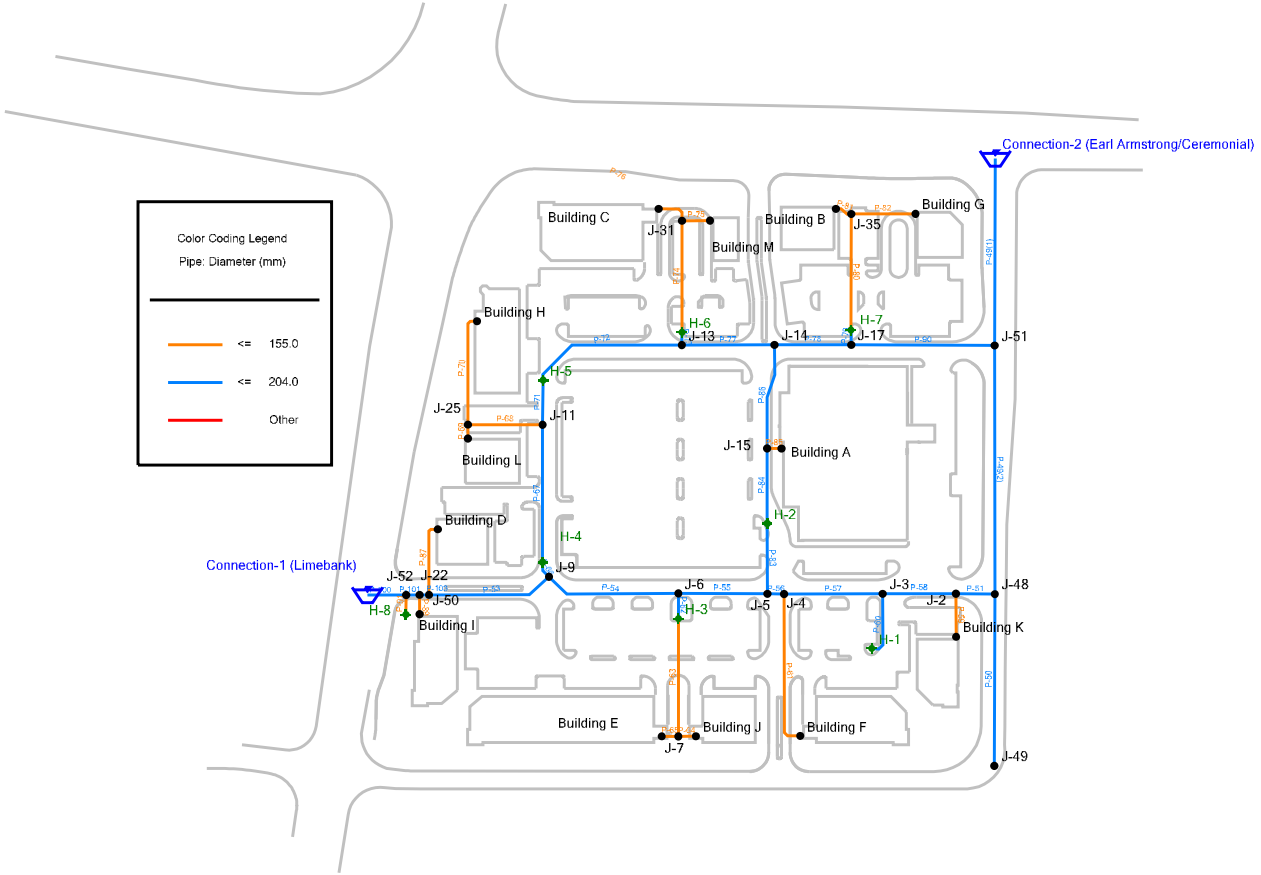
Disclaimer

The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation. Fire Flow analysis is a reflection of available flow in the watermain; there may be additional restrictions that occur between the watermain and the hydrant that the model cannot take into account.

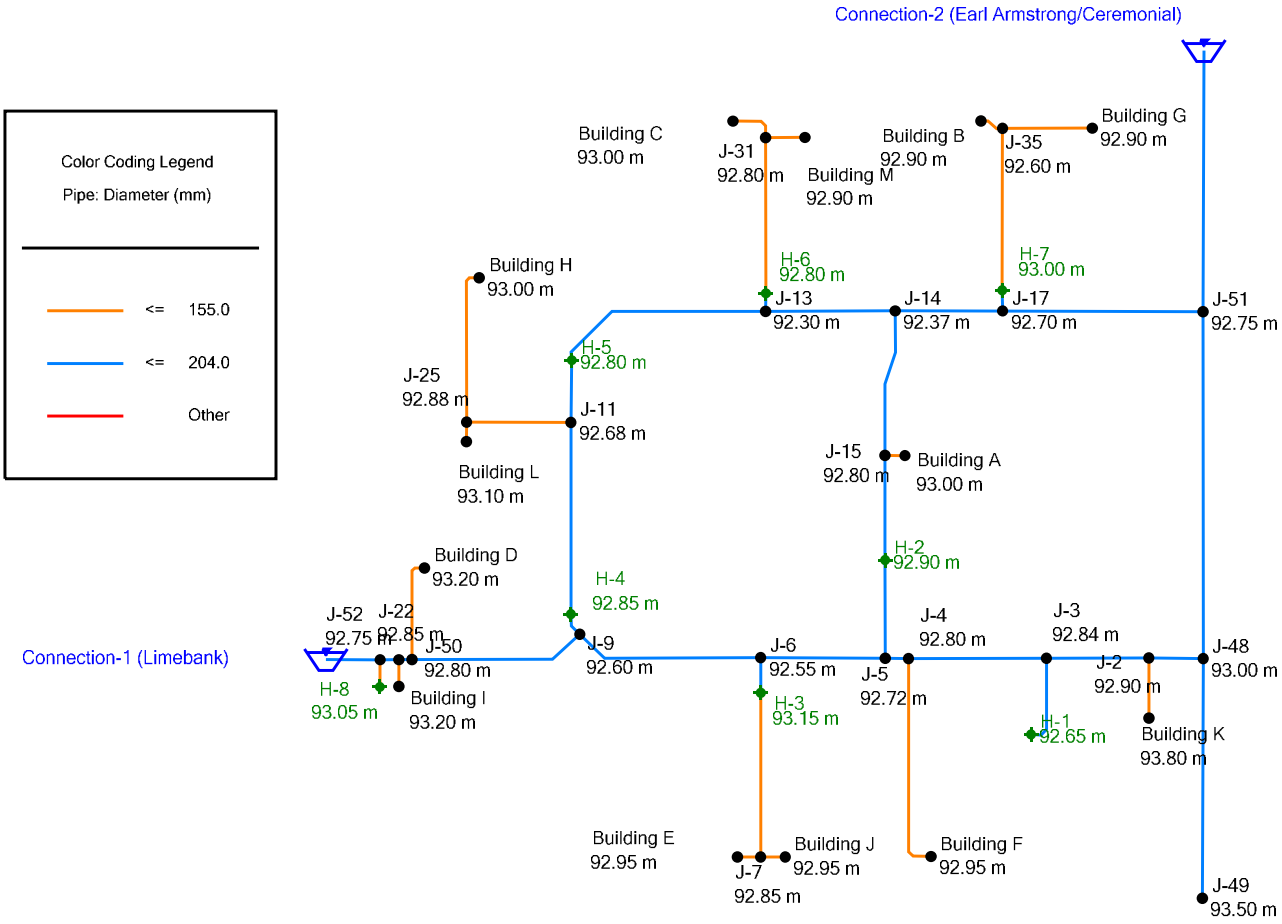
Appendix ‘D3’

WaterCAD Schematics

HNA - 1424 Earl Armstrong Road
Model Schematic



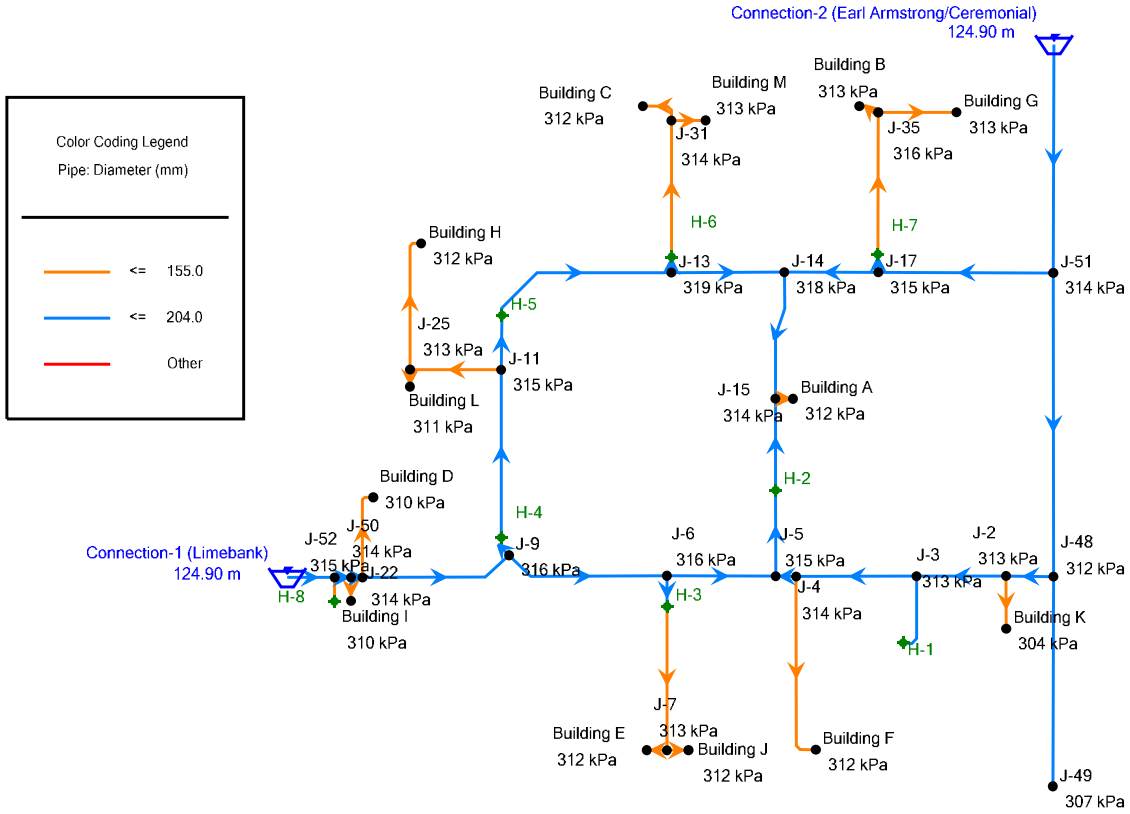
HNA - 1424 Earl Armstrong Road
Model Schematic
Elevation Model



Appendix ‘D4’

Simulation Results -
Existing Pressure Condition -
Peak Hour Demand

HNA - 1424 Earl Armstrong Road
Existing Conditions
Peak Hour Demand



HNA - 1424 Earl Armstrong Road
Existing Conditions
Peak Hour Demand
Junction Table

Label	ID	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
Building K	70	93.80	0.38	124.87	304
J-49	155	93.50	0.00	124.87	307
Building D	85	93.20	0.33	124.89	310
Building I	83	93.20	0.52	124.89	310
Building L	93	93.10	0.33	124.87	311
Building A	139	93.00	2.94	124.87	312
Building C	99	93.00	0.83	124.87	312
Building H	95	93.00	0.62	124.87	312
J-48	153	93.00	0.00	124.87	312
Building E	119	92.95	2.43	124.84	312
Building J	77	92.95	0.76	124.85	312
Building F	75	92.95	1.22	124.87	312
Building M	101	92.90	0.17	124.87	313
Building G	112	92.90	0.28	124.87	313
J-2	36	92.90	0.00	124.87	313
Building B	109	92.90	0.33	124.87	313
J-25	91	92.88	0.00	124.87	313
J-7	46	92.85	0.00	124.85	313
J-3	38	92.84	0.00	124.87	313
J-22	82	92.85	0.00	124.89	314
J-31	100	92.80	0.00	124.87	314
J-15	62	92.80	0.00	124.87	314
J-4	40	92.80	0.00	124.87	314
J-50	195	92.80	0.00	124.89	314
J-51	211	92.75	0.00	124.88	314
J-52	224	92.75	0.00	124.89	315
J-5	42	92.72	0.00	124.87	315
J-17	67	92.70	0.00	124.87	315
J-11	54	92.68	0.00	124.87	315
J-35	110	92.60	0.00	124.87	316
J-9	50	92.60	0.00	124.88	316
J-6	44	92.55	0.00	124.87	316
J-14	60	92.37	0.00	124.87	318
J-13	58	92.30	0.00	124.87	319

HNA - 1424 Earl Armstrong Road
Existing Conditions
Peak Hour Demand
Pipe Table

Label	Length (Scaled) (m)	Diameter (mm)	Material	Hazen-Williams C	Hydraulic Grade (Start) (m)	Hydraulic Grade (Stop) (m)	Flow (L/s)	Velocity (m/s)
P-65	8	155.0	PVC	100.0	124.85	124.84	2.43	0.13
P-64	8	155.0	PVC	100.0	124.85	124.85	0.76	0.04
P-63	55	155.0	PVC	100.0	124.87	124.85	3.19	0.17
P-61	72	155.0	PVC	100.0	124.87	124.87	1.22	0.06
P-85	7	155.0	PVC	100.0	124.87	124.87	2.94	0.16
P-62	12	204.0	PVC	110.0	124.87	124.87	3.19	0.10
P-76	15	155.0	PVC	100.0	124.87	124.87	0.83	0.04
P-75	13	155.0	PVC	100.0	124.87	124.87	0.17	0.01
P-74	52	155.0	PVC	100.0	124.87	124.87	1.00	0.05
P-84	35	204.0	PVC	110.0	124.87	124.87	0.64	0.02
P-83	33	204.0	PVC	110.0	124.87	124.87	0.64	0.02
P-54	64	204.0	PVC	110.0	124.88	124.87	3.22	0.10
P-55	41	204.0	PVC	110.0	124.87	124.87	0.03	0.00
P-56	8	204.0	PVC	110.0	124.87	124.87	-0.61	0.02
P-70	52	155.0	PVC	100.0	124.87	124.87	0.62	0.03
P-57	46	204.0	PVC	110.0	124.87	124.87	-1.83	0.06
P-60	30	204.0	PVC	110.0	124.87	124.87	0.00	0.00
P-69	6	155.0	PVC	100.0	124.87	124.87	0.33	0.02
P-68	35	155.0	PVC	100.0	124.87	124.87	0.95	0.05
P-73	6	204.0	PVC	110.0	124.87	124.87	1.00	0.03
P-72	73	204.0	PVC	110.0	124.87	124.87	1.04	0.03
P-77	43	204.0	PVC	110.0	124.87	124.87	0.04	0.00
P-86	49	204.0	PVC	110.0	124.87	124.87	-2.30	0.07
P-59	20	155.0	PVC	100.0	124.87	124.87	0.38	0.02
P-82	30	155.0	PVC	100.0	124.87	124.87	0.28	0.01
P-51	18	204.0	PVC	110.0	124.87	124.87	2.21	0.07
P-58	34	204.0	PVC	110.0	124.87	124.87	-1.83	0.06
P-81	8	155.0	PVC	100.0	124.87	124.87	0.33	0.02
P-80	54	155.0	PVC	100.0	124.87	124.87	0.61	0.03
P-71	21	204.0	PVC	110.0	124.87	124.87	1.04	0.03
P-67	64	204.0	PVC	110.0	124.88	124.87	1.99	0.06
P-50	80	204.0	PVC	110.0	124.87	124.87	0.00	0.00
P-49 (2)	116	204.0	PVC	110.0	124.88	124.87	2.21	0.07
P-79	7	204.0	PVC	110.0	124.87	124.87	0.61	0.02
P-78	36	204.0	PVC	110.0	124.87	124.87	-2.26	0.07
P-66	8	204.0	PVC	110.0	124.88	124.88	1.99	0.06
P-53	59	204.0	PVC	110.0	124.89	124.88	5.21	0.16
P-49 (1)	87	204.0	PVC	110.0	124.90	124.88	5.08	0.16
P-90	67	204.0	PVC	110.0	124.87	124.88	-2.87	0.09
P-87	34	155.0	PVC	100.0	124.89	124.89	0.33	0.02
P-103	4	204.0	PVC	110.0	124.89	124.89	5.54	0.17
P-89	9	155.0	PVC	100.0	124.89	124.89	0.52	0.03

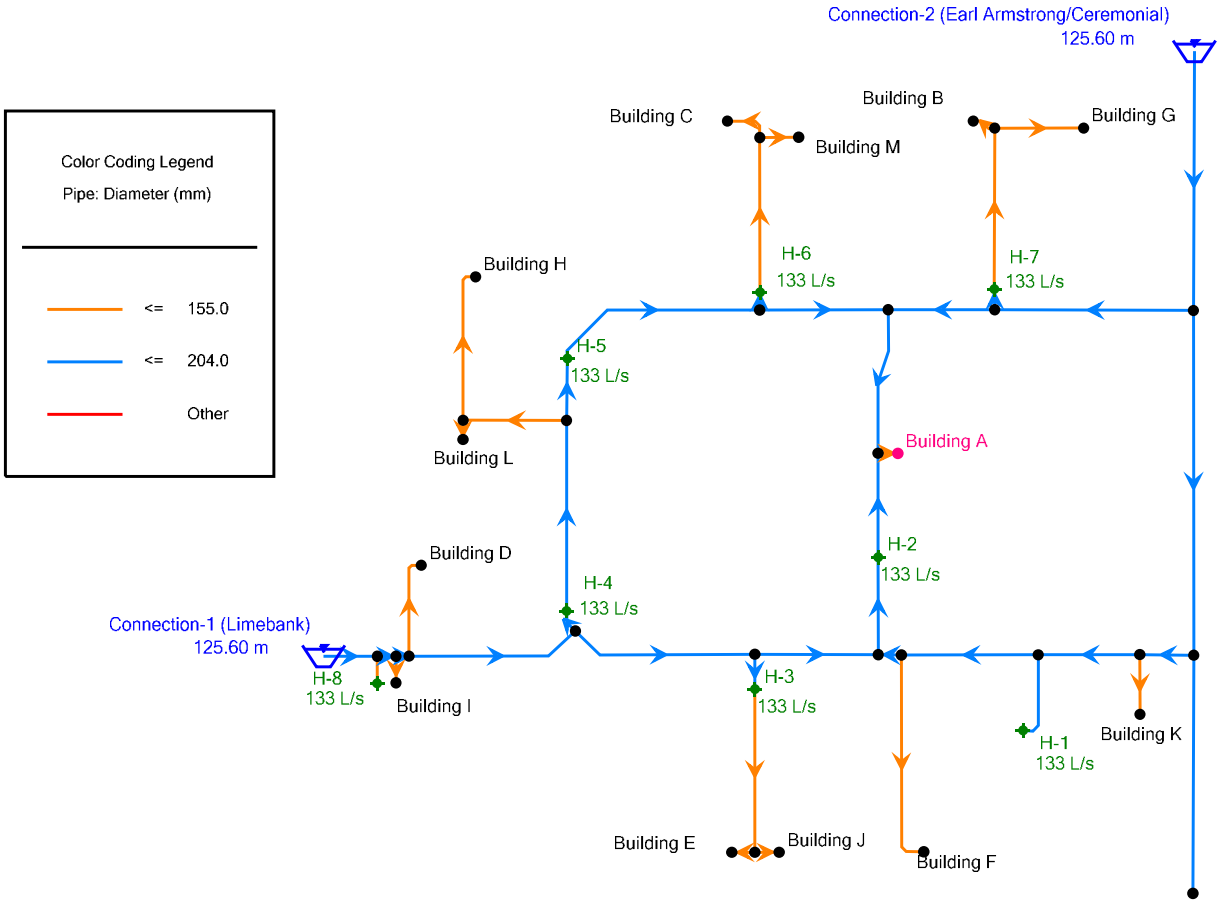
HNA - 1424 Earl Armstrong Road
Existing Conditions
Peak Hour Demand
Pipe Table

Label	Length (Scaled) (m)	Diameter (mm)	Material	Hazen-Williams C	Hydraulic Grade (Start) (m)	Hydraulic Grade (Stop) (m)	Flow (L/s)	Velocity (m/s)
P-101	6	204.0	PVC	110.0	124.89	124.89	6.06	0.19
P-100	18	204.0	PVC	110.0	124.90	124.89	6.06	0.19
P-91	9	155.0	PVC	100.0	124.89	124.89	0.00	0.00

Appendix ‘D5’

Simulation Results -
Existing Pressure Condition -
Max Day + Fire Flow

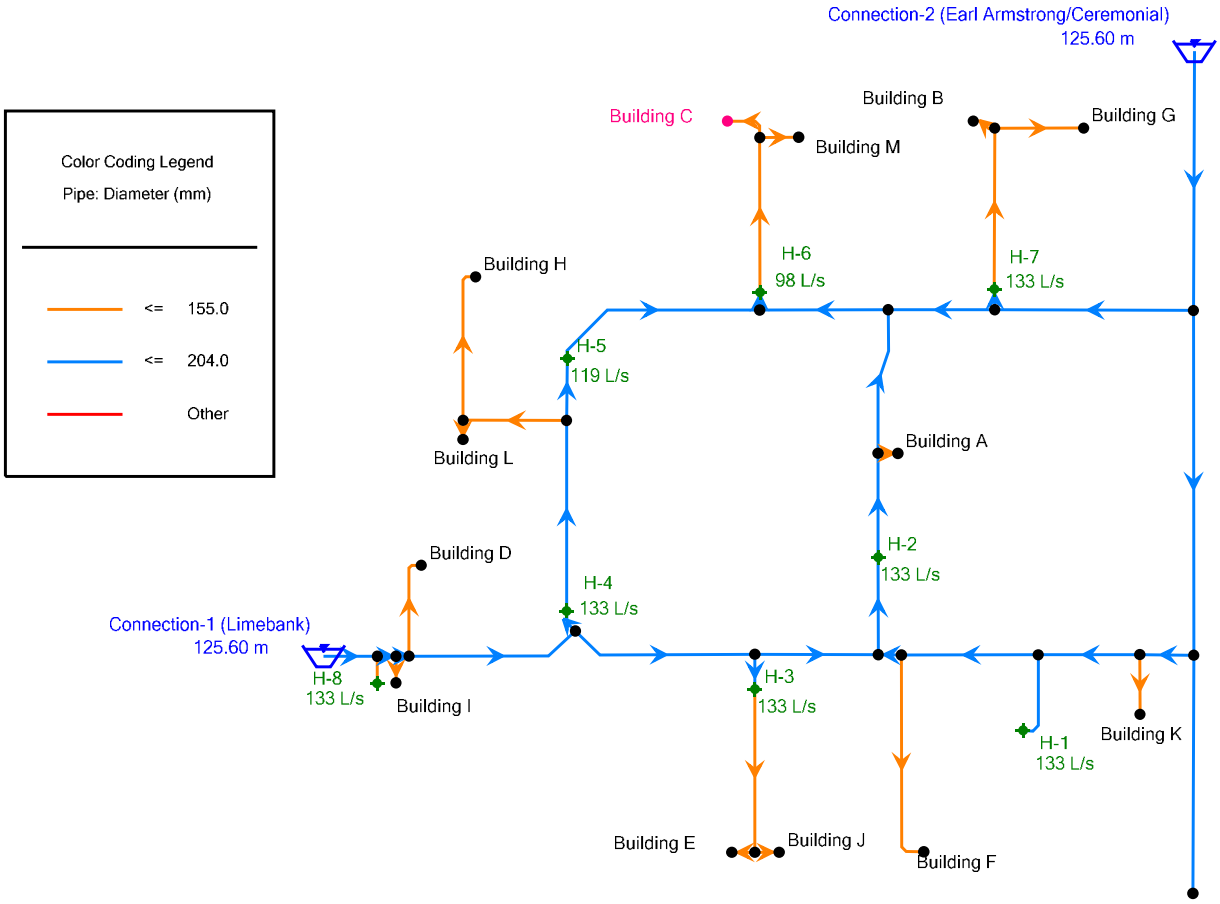
HNA - 1424 Earl Armstrong Road
Existing Conditions
Max Day + Fire Flow Requirement (133 L/s)
Critical Fire Area: Building A



HNA - 1424 Earl Armstrong Road
Existing Conditions
Max Day + Fire Flow Requirement (133 L/s)
Critical Fire Area: Building A

Label	Fire Flow (Available) (L/s)	Flow (Total Available) (L/s)	Satisfies Fire Flow Constraints?	Pressure (Residual Lower Limit) (kPa)	Pressure (Calculated System Lower Limit) (kPa)	Pressure (Calculated Residual) (kPa)	Junction w/ Minimum Pressure (System)
H-1	133	133	True	140	224	198	Building K
H-2	133	133	True	140	211	209	Building A
H-3	133	133	True	140	223	213	Building E
H-4	133	133	True	140	242	236	Building A
H-5	133	133	True	140	232	206	Building L
H-6	133	133	True	140	218	212	Building C
H-7	133	133	True	140	227	218	Building G
H-8	133	133	True	140	281	257	Building A

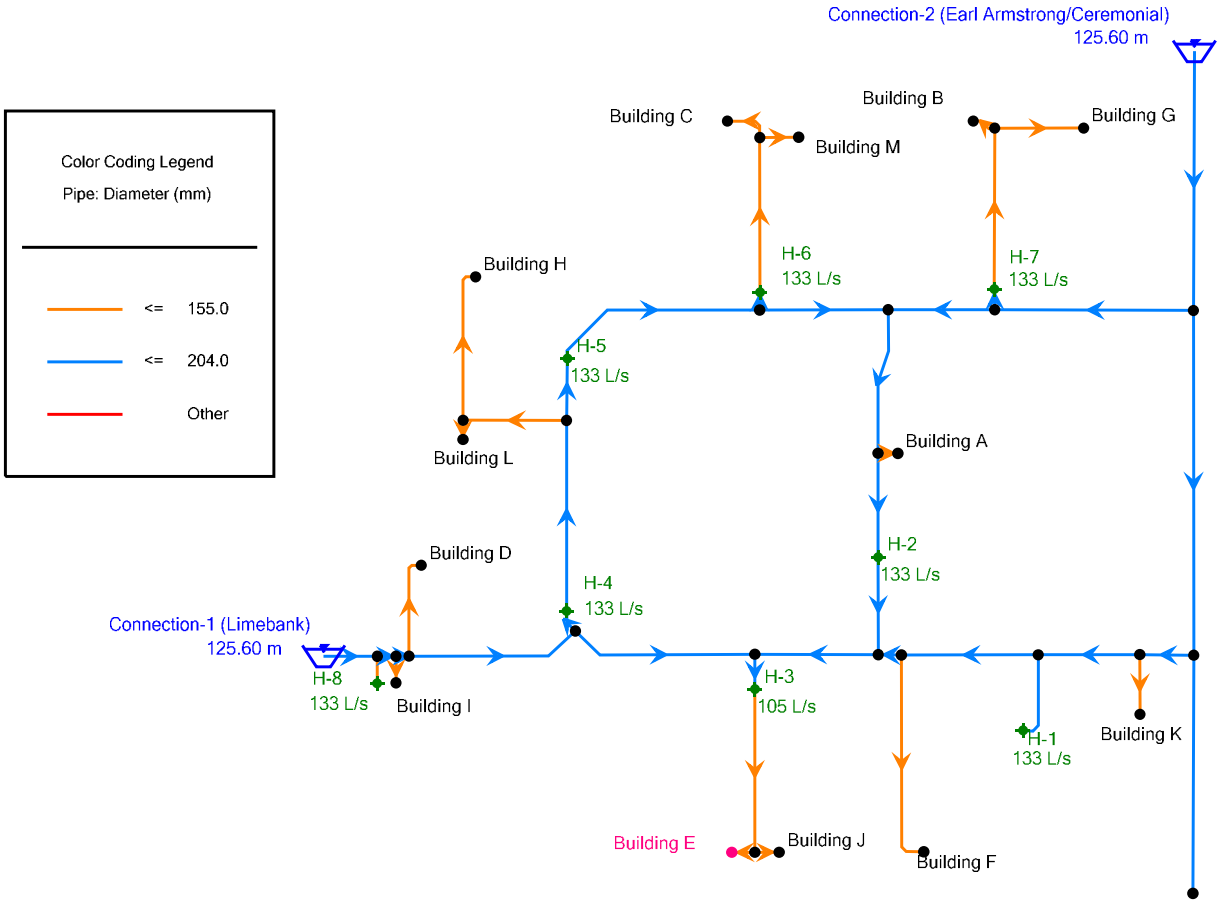
HNA - 1424 Earl Armstrong Road
Existing Conditions
Max Day + Fire Flow Requirement (133 L/s)
Critical Fire Area: Building C



HNA - 1424 Earl Armstrong Road
Existing Conditions
Max Day + Fire Flow Requirement (133 L/s)
Critical Fire Area: Building C

Label	Fire Flow (Available) (L/s)	Flow (Total Available) (L/s)	Satisfies Fire Flow Constraints?	Pressure (Residual Lower Limit) (kPa)	Pressure (Calculated System Lower Limit) (kPa)	Pressure (Calculated Residual) (kPa)	Junction w/ Minimum Pressure (System)
H-6	98	98	True	140	140	226	Building C
H-5	119	119	True	140	140	210	Building C
H-1	133	133	True	140	158	205	Building C
H-4	133	133	True	140	156	232	Building C
H-7	133	133	True	140	146	217	Building C
H-2	133	133	True	140	150	222	Building C
H-3	133	133	True	140	158	218	Building C
H-8	133	133	True	140	199	257	Building C

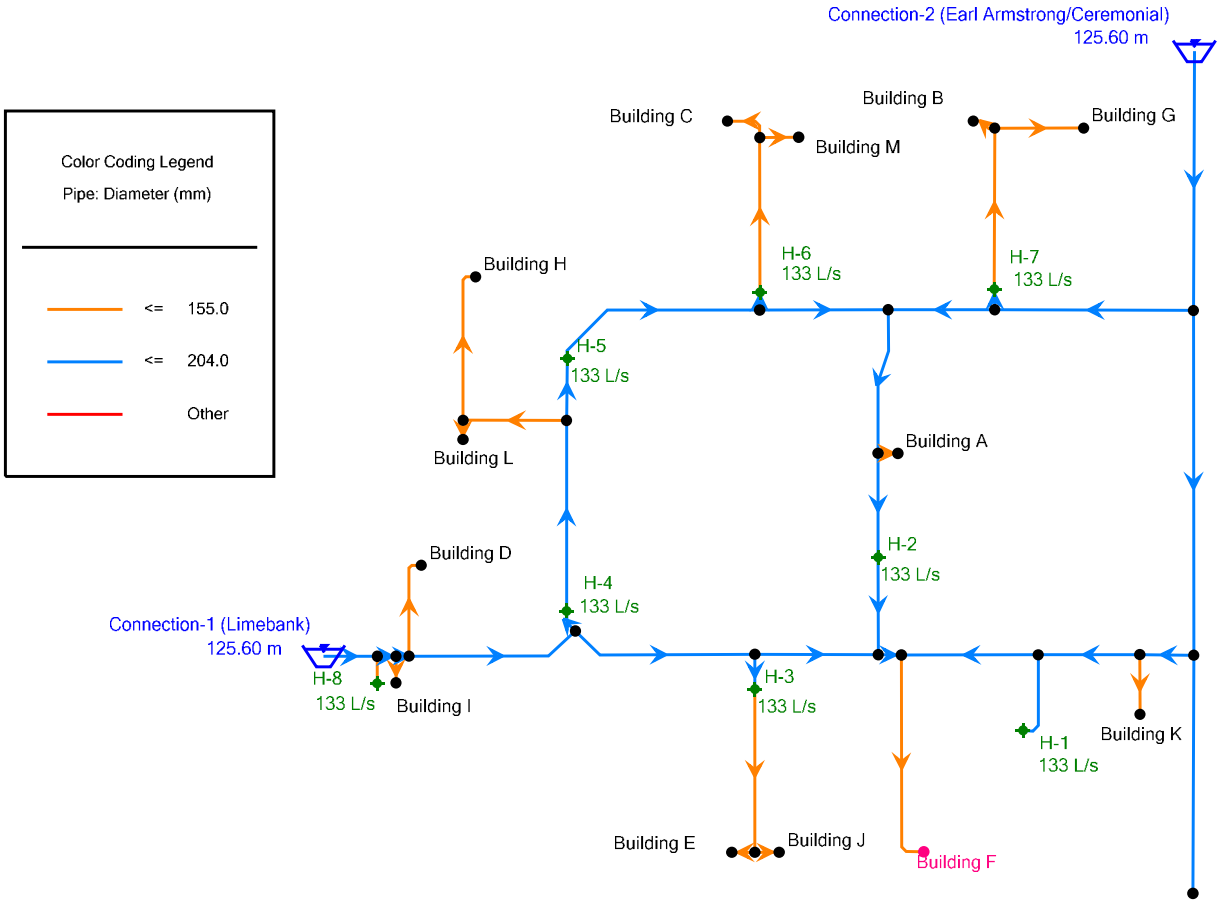
HNA - 1424 Earl Armstrong Road
Existing Conditions
Max Day + Fire Flow Requirement (133 L/s)
Critical Fire Area: Building E



HNA - 1424 Earl Armstrong Road
Existing Conditions
Max Day + Fire Flow Requirement (133 L/s)
Critical Fire Area: Building E

Label	Fire Flow (Available) (L/s)	Flow (Total Available) (L/s)	Satisfies Fire Flow Constraints?	Pressure (Residual Lower Limit) (kPa)	Pressure (Calculated System Lower Limit) (kPa)	Pressure (Calculated Residual) (kPa)	Junction w/ Minimum Pressure (System)
H-3	105	105	True	140	140	217	Building E
H-1	133	133	True	140	151	199	Building E
H-4	133	133	True	140	164	233	Building E
H-7	133	133	True	140	165	227	Building E
H-6	133	133	True	140	163	220	Building E
H-2	133	133	True	140	149	219	Building E
H-5	133	133	True	140	164	209	Building E
H-8	133	133	True	140	203	257	Building E

HNA - 1424 Earl Armstrong Road
Existing Conditions
Max Day + Fire Flow Requirement (133 L/s)
Critical Fire Area: Building F



HNA - 1424 Earl Armstrong Road
Existing Conditions
Max Day + Fire Flow Requirement (133 L/s)
Critical Fire Area: Building F

Label	Fire Flow (Available) (L/s)	Flow (Total Available) (L/s)	Satisfies Fire Flow Constraints?	Pressure (Residual Lower Limit) (kPa)	Pressure (Calculated System Lower Limit) (kPa)	Pressure (Calculated Residual) (kPa)	Junction w/ Minimum Pressure (System)
H-1	122	122	True	140	140	206	Building F
H-2	127	127	True	140	140	220	Building F
H-3	132	132	True	140	140	210	Building F
H-4	133	133	True	140	159	235	Building F
H-7	133	133	True	140	154	225	Building F
H-6	133	133	True	140	153	219	Building F
H-5	133	133	True	140	157	209	Building F
H-8	133	133	True	140	196	257	Building F

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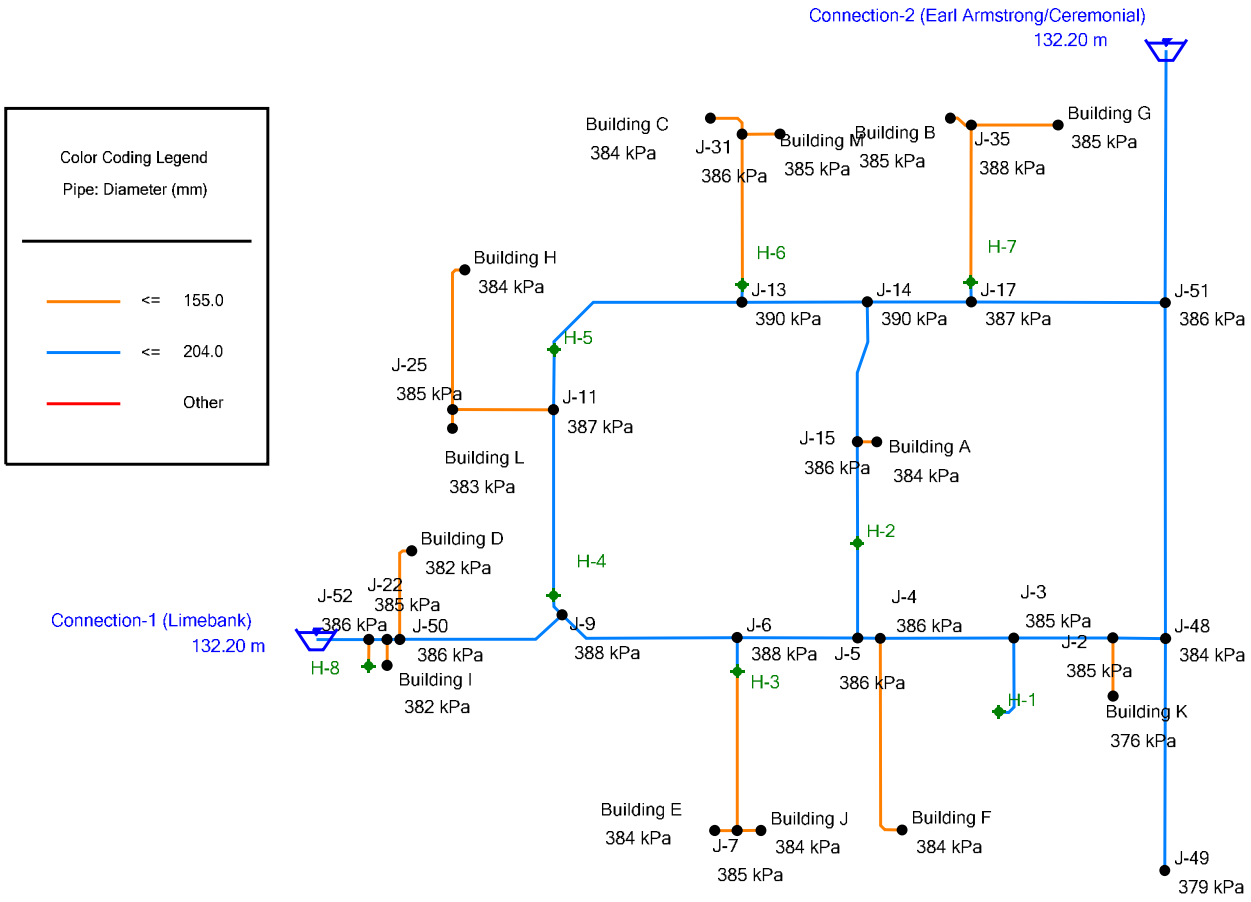
Appendix ‘D6’

Simulation Results -
Existing Pressure Condition -
Max Pressure Analysis

HNA - 1424 Earl Armstrong Road
Existing Conditions
Maximum Pressure Analysis



HNA - 1424 Earl Armstrong Road

Existing Condition

Maximum Pressure Analysis

Junction Table

Label	ID	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
Building K	70	93.80	0.00	132.20	376
J-49	155	93.50	0.00	132.20	379
Building I	83	93.20	0.00	132.20	382
Building D	85	93.20	0.00	132.20	382
Building L	93	93.10	0.00	132.20	383
Building H	95	93.00	0.00	132.20	384
Building C	99	93.00	0.00	132.20	384
Building A	139	93.00	0.00	132.20	384
J-48	153	93.00	0.00	132.20	384
Building F	75	92.95	0.00	132.20	384
Building J	77	92.95	0.00	132.20	384
Building E	119	92.95	0.00	132.20	384
J-2	36	92.90	0.00	132.20	385
Building M	101	92.90	0.00	132.20	385
Building B	109	92.90	0.00	132.20	385
Building G	112	92.90	0.00	132.20	385
J-25	91	92.88	0.00	132.20	385
J-7	46	92.85	0.00	132.20	385
J-22	82	92.85	0.00	132.20	385
J-3	38	92.84	0.00	132.20	385
J-4	40	92.80	0.00	132.20	386
J-15	62	92.80	0.00	132.20	386
J-31	100	92.80	0.00	132.20	386
J-50	195	92.80	0.00	132.20	386
J-51	211	92.75	0.00	132.20	386
J-52	224	92.75	0.00	132.20	386
J-5	42	92.72	0.00	132.20	386
J-17	67	92.70	0.00	132.20	387
J-11	54	92.68	0.00	132.20	387
J-9	50	92.60	0.00	132.20	388
J-35	110	92.60	0.00	132.20	388
J-6	44	92.55	0.00	132.20	388
J-14	60	92.37	0.00	132.20	390
J-13	58	92.30	0.00	132.20	390

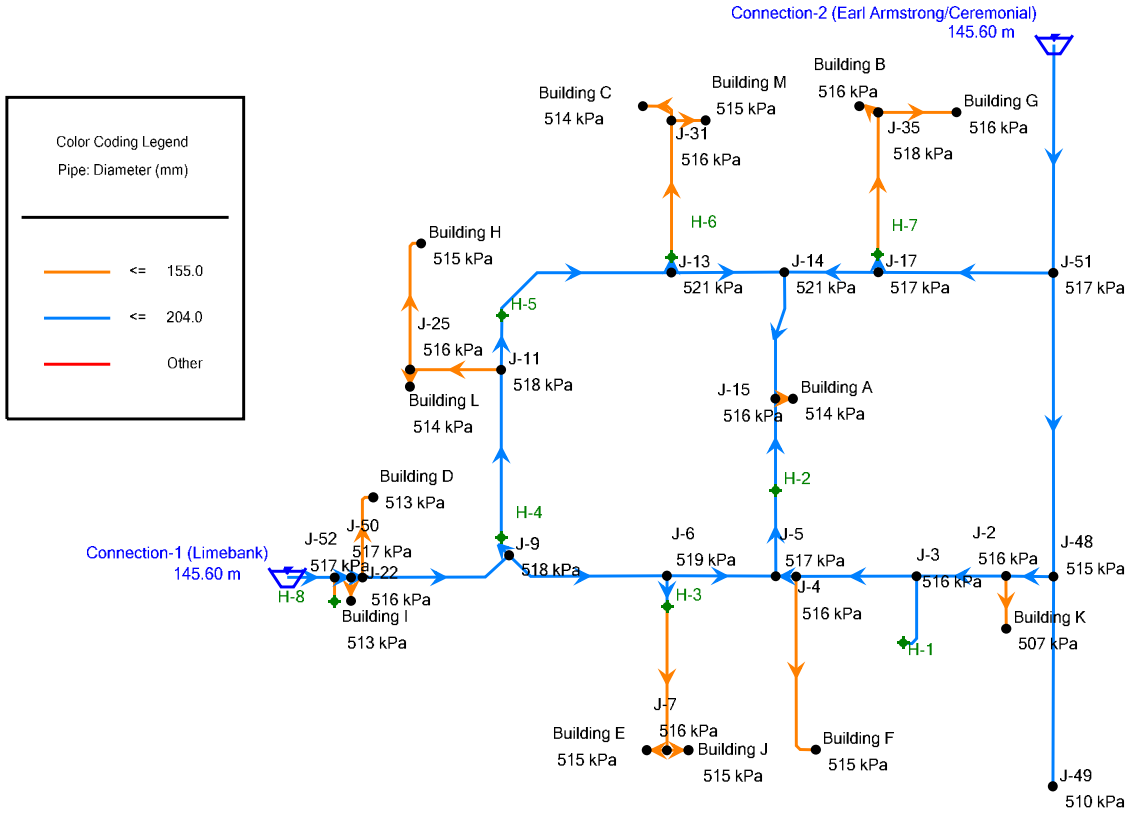
HNA - 1424 Earl Armstrong Road
Existing Condition
Maximum Pressure Analysis
Pipe Table

Label	Length (Scaled) (m)	Diameter (mm)	Material	Hazen-Williams C	Hydraulic Grade (Start) (m)	Hydraulic Grade (Stop) (m)	Flow (L/s)	Velocity (m/s)
P-50	80	204.0	PVC	110.0	132.20	132.20	0.00	0.00
P-51	18	204.0	PVC	110.0	132.20	132.20	0.00	0.00
P-53	59	204.0	PVC	110.0	132.20	132.20	0.00	0.00
P-54	64	204.0	PVC	110.0	132.20	132.20	0.00	0.00
P-55	41	204.0	PVC	110.0	132.20	132.20	0.00	0.00
P-56	8	204.0	PVC	110.0	132.20	132.20	0.00	0.00
P-57	46	204.0	PVC	110.0	132.20	132.20	0.00	0.00
P-58	34	204.0	PVC	110.0	132.20	132.20	0.00	0.00
P-59	20	155.0	PVC	100.0	132.20	132.20	0.00	0.00
P-60	30	204.0	PVC	110.0	132.20	132.20	0.00	0.00
P-61	72	155.0	PVC	100.0	132.20	132.20	0.00	0.00
P-62	12	204.0	PVC	110.0	132.20	132.20	0.00	0.00
P-63	55	155.0	PVC	100.0	132.20	132.20	0.00	0.00
P-64	8	155.0	PVC	100.0	132.20	132.20	0.00	0.00
P-65	8	155.0	PVC	100.0	132.20	132.20	0.00	0.00
P-66	8	204.0	PVC	110.0	132.20	132.20	0.00	0.00
P-67	64	204.0	PVC	110.0	132.20	132.20	0.00	0.00
P-68	35	155.0	PVC	100.0	132.20	132.20	0.00	0.00
P-69	6	155.0	PVC	100.0	132.20	132.20	0.00	0.00
P-70	52	155.0	PVC	100.0	132.20	132.20	0.00	0.00
P-71	21	204.0	PVC	110.0	132.20	132.20	0.00	0.00
P-72	73	204.0	PVC	110.0	132.20	132.20	0.00	0.00
P-73	6	204.0	PVC	110.0	132.20	132.20	0.00	0.00
P-74	52	155.0	PVC	100.0	132.20	132.20	0.00	0.00
P-75	13	155.0	PVC	100.0	132.20	132.20	0.00	0.00
P-76	15	155.0	PVC	100.0	132.20	132.20	0.00	0.00
P-77	43	204.0	PVC	110.0	132.20	132.20	0.00	0.00
P-78	36	204.0	PVC	110.0	132.20	132.20	0.00	0.00
P-79	7	204.0	PVC	110.0	132.20	132.20	0.00	0.00
P-80	54	155.0	PVC	100.0	132.20	132.20	0.00	0.00
P-81	8	155.0	PVC	100.0	132.20	132.20	0.00	0.00
P-82	30	155.0	PVC	100.0	132.20	132.20	0.00	0.00
P-83	33	204.0	PVC	110.0	132.20	132.20	0.00	0.00
P-84	35	204.0	PVC	110.0	132.20	132.20	0.00	0.00
P-85	7	155.0	PVC	100.0	132.20	132.20	0.00	0.00
P-86	49	204.0	PVC	110.0	132.20	132.20	0.00	0.00
P-87	34	155.0	PVC	100.0	132.20	132.20	0.00	0.00
P-103	4	204.0	PVC	110.0	132.20	132.20	0.00	0.00
P-89	9	155.0	PVC	100.0	132.20	132.20	0.00	0.00
P-49 (1)	87	204.0	PVC	110.0	132.20	132.20	0.00	0.00
P-49 (2)	116	204.0	PVC	110.0	132.20	132.20	0.00	0.00
P-90	67	204.0	PVC	110.0	132.20	132.20	0.00	0.00
P-100	18	204.0	PVC	110.0	132.20	132.20	0.00	0.00
P-101	6	204.0	PVC	110.0	132.20	132.20	0.00	0.00
P-91	9	155.0	PVC	100.0	132.20	132.20	0.00	0.00

Appendix ‘D7’

Simulation Results -
SUC Pressure Zone
Reconfiguration -
Peak Hour Demand

HNA - 1424 Earl Armstrong Road
SUC Pressure Zone Reconfiguration
Peak Hour Demand



HNA - 1424 Earl Armstrong Road
SUC Pressure Zone Reconfiguration
Peak Hour Demand
Junction Table

Label	ID	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
Building K	70	93.80	0.38	145.57	507
J-49	155	93.50	0.00	145.57	510
Building D	85	93.20	0.33	145.59	513
Building I	83	93.20	0.52	145.59	513
Building L	93	93.10	0.33	145.57	514
Building A	139	93.00	2.94	145.57	514
Building C	99	93.00	0.83	145.57	514
Building H	95	93.00	0.62	145.57	515
J-48	153	93.00	0.00	145.57	515
Building E	119	92.95	2.43	145.54	515
Building J	77	92.95	0.76	145.55	515
Building F	75	92.95	1.22	145.57	515
Building M	101	92.90	0.17	145.57	515
Building G	112	92.90	0.28	145.57	516
J-2	36	92.90	0.00	145.57	516
Building B	109	92.90	0.33	145.57	516
J-25	91	92.88	0.00	145.57	516
J-7	46	92.85	0.00	145.55	516
J-3	38	92.84	0.00	145.57	516
J-22	82	92.85	0.00	145.59	516
J-31	100	92.80	0.00	145.57	516
J-15	62	92.80	0.00	145.57	516
J-4	40	92.80	0.00	145.57	516
J-50	195	92.80	0.00	145.59	517
J-51	211	92.75	0.00	145.58	517
J-52	224	92.75	0.00	145.59	517
J-5	42	92.72	0.00	145.57	517
J-17	67	92.70	0.00	145.57	517
J-11	54	92.68	0.00	145.57	518
J-35	110	92.60	0.00	145.57	518
J-9	50	92.60	0.00	145.58	518
J-6	44	92.55	0.00	145.57	519
J-14	60	92.37	0.00	145.57	521
J-13	58	92.30	0.00	145.57	521

HNA - 1424 Earl Armstrong Road
SUC Pressure Zone Reconfiguration
Peak Hour Demand
Pipe Table

Label	Length (Scaled) (m)	Diameter (mm)	Material	Hazen-Williams C	Hydraulic Grade (Start) (m)	Hydraulic Grade (Stop) (m)	Flow (L/s)	Velocity (m/s)
P-65	8	155.0	PVC	100.0	145.55	145.54	2.43	0.13
P-64	8	155.0	PVC	100.0	145.55	145.55	0.76	0.04
P-63	55	155.0	PVC	100.0	145.57	145.55	3.19	0.17
P-61	72	155.0	PVC	100.0	145.57	145.57	1.22	0.06
P-85	7	155.0	PVC	100.0	145.57	145.57	2.94	0.16
P-62	12	204.0	PVC	110.0	145.57	145.57	3.19	0.10
P-76	15	155.0	PVC	100.0	145.57	145.57	0.83	0.04
P-75	13	155.0	PVC	100.0	145.57	145.57	0.17	0.01
P-74	52	155.0	PVC	100.0	145.57	145.57	1.00	0.05
P-84	35	204.0	PVC	110.0	145.57	145.57	0.64	0.02
P-83	33	204.0	PVC	110.0	145.57	145.57	0.64	0.02
P-54	64	204.0	PVC	110.0	145.58	145.57	3.22	0.10
P-55	41	204.0	PVC	110.0	145.57	145.57	0.03	0.00
P-56	8	204.0	PVC	110.0	145.57	145.57	-0.61	0.02
P-70	52	155.0	PVC	100.0	145.57	145.57	0.62	0.03
P-57	46	204.0	PVC	110.0	145.57	145.57	-1.83	0.06
P-60	30	204.0	PVC	110.0	145.57	145.57	0.00	0.00
P-69	6	155.0	PVC	100.0	145.57	145.57	0.33	0.02
P-68	35	155.0	PVC	100.0	145.57	145.57	0.95	0.05
P-73	6	204.0	PVC	110.0	145.57	145.57	1.00	0.03
P-72	73	204.0	PVC	110.0	145.57	145.57	1.04	0.03
P-77	43	204.0	PVC	110.0	145.57	145.57	0.04	0.00
P-86	49	204.0	PVC	110.0	145.57	145.57	-2.30	0.07
P-59	20	155.0	PVC	100.0	145.57	145.57	0.38	0.02
P-82	30	155.0	PVC	100.0	145.57	145.57	0.28	0.01
P-51	18	204.0	PVC	110.0	145.57	145.57	2.21	0.07
P-58	34	204.0	PVC	110.0	145.57	145.57	-1.83	0.06
P-81	8	155.0	PVC	100.0	145.57	145.57	0.33	0.02
P-80	54	155.0	PVC	100.0	145.57	145.57	0.61	0.03
P-71	21	204.0	PVC	110.0	145.57	145.57	1.04	0.03
P-67	64	204.0	PVC	110.0	145.58	145.57	1.99	0.06
P-50	80	204.0	PVC	110.0	145.57	145.57	0.00	0.00
P-49 (2)	116	204.0	PVC	110.0	145.58	145.57	2.21	0.07
P-79	7	204.0	PVC	110.0	145.57	145.57	0.61	0.02
P-78	36	204.0	PVC	110.0	145.57	145.57	-2.26	0.07
P-66	8	204.0	PVC	110.0	145.58	145.58	1.99	0.06
P-53	59	204.0	PVC	110.0	145.59	145.58	5.21	0.16
P-49 (1)	87	204.0	PVC	110.0	145.60	145.58	5.08	0.16
P-90	67	204.0	PVC	110.0	145.57	145.58	-2.87	0.09
P-87	34	155.0	PVC	100.0	145.59	145.59	0.33	0.02
P-103	4	204.0	PVC	110.0	145.59	145.59	5.54	0.17
P-89	9	155.0	PVC	100.0	145.59	145.59	0.52	0.03

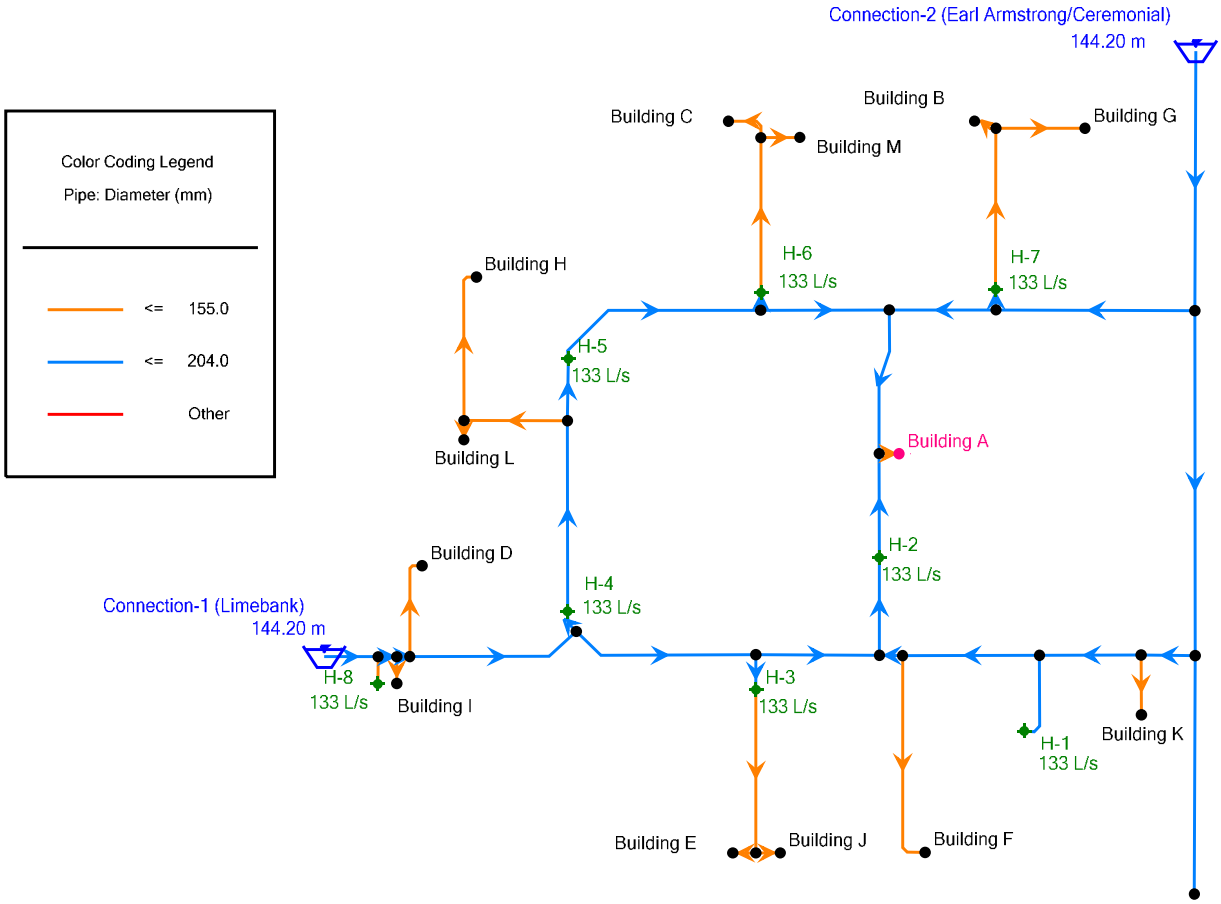
HNA - 1424 Earl Armstrong Road
SUC Pressure Zone Reconfiguration
Peak Hour Demand
Pipe Table

Label	Length (Scaled) (m)	Diameter (mm)	Material	Hazen-Williams C	Hydraulic Grade (Start) (m)	Hydraulic Grade (Stop) (m)	Flow (L/s)	Velocity (m/s)
P-101	6	204.0	PVC	110.0	145.59	145.59	6.06	0.19
P-100	18	204.0	PVC	110.0	145.60	145.59	6.06	0.19
P-91	9	155.0	PVC	100.0	145.59	145.59	0.00	0.00

Appendix ‘D8’

Simulation Results -
SUC Pressure Zone
Reconfiguration -
Max Day + Fire Flow

HNA - 1424 Earl Armstrong Road
SUC Pressure Zone Reconfiguration
Max Day + Fire Flow Requirement (133 L/s)
Critical Fire Area: Building A



HNA - 1424 Earl Armstrong Road
SUC Pressure Zone Reconfiguration
Max Day + Fire Flow Requirement (133 L/s)
Critical Fire Area: Building A

Label	Fire Flow (Available) (L/s)	Flow (Total Available) (L/s)	Satisfies Fire Flow Constraints?	Pressure (Residual Lower Limit) (kPa)	Pressure (Calculated System Lower Limit) (kPa)	Pressure (Calculated Residual) (kPa)	Junction w/ Minimum Pressure (System)
H-1	133	133	True	140	406	380	Building K
H-2	133	133	True	140	393	391	Building A
H-3	133	133	True	140	405	395	Building E
H-4	133	133	True	140	424	418	Building A
H-5	133	133	True	140	414	388	Building L
H-6	133	133	True	140	400	394	Building C
H-7	133	133	True	140	409	400	Building G
H-8	133	133	True	140	463	439	Building A

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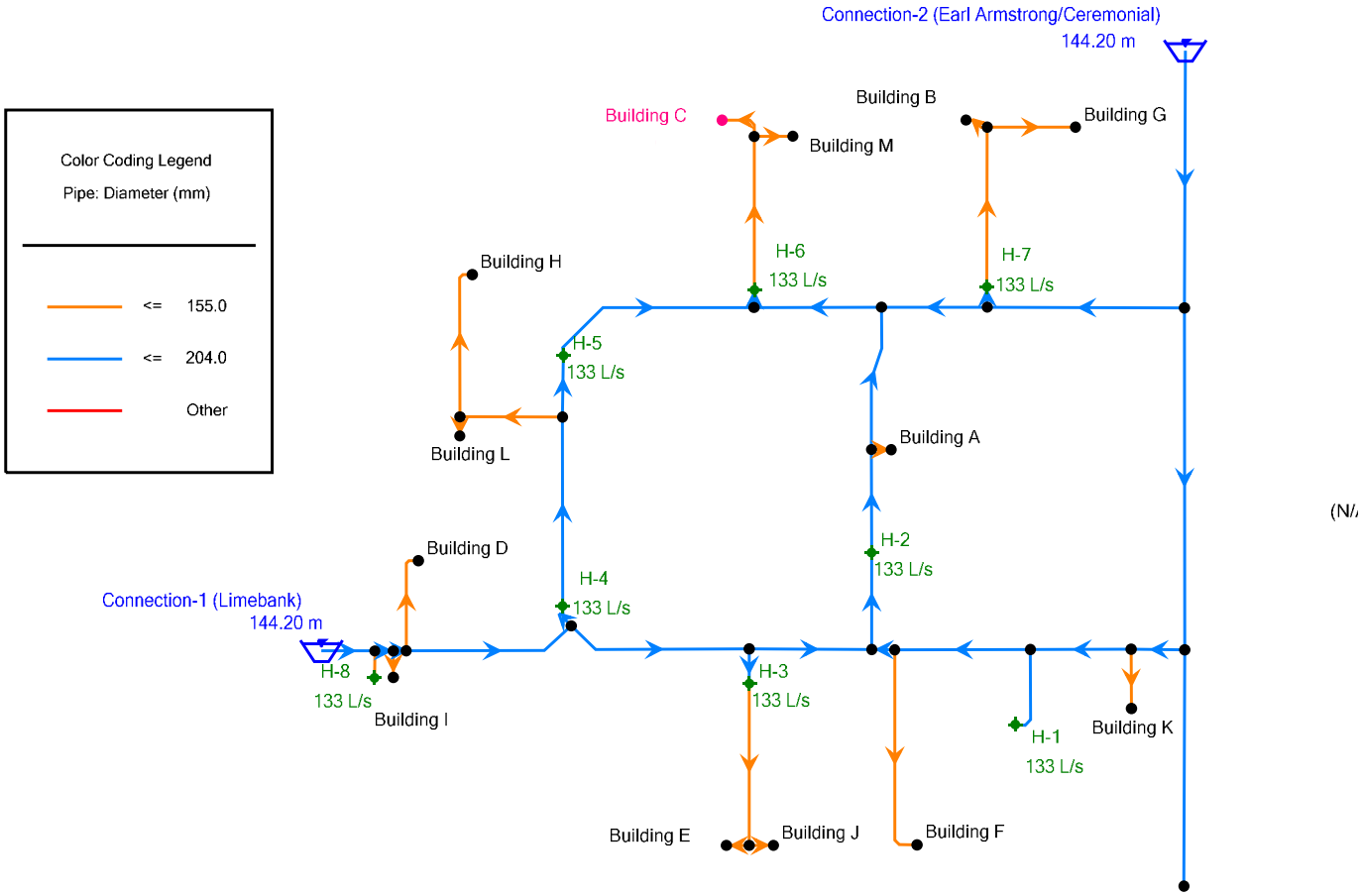
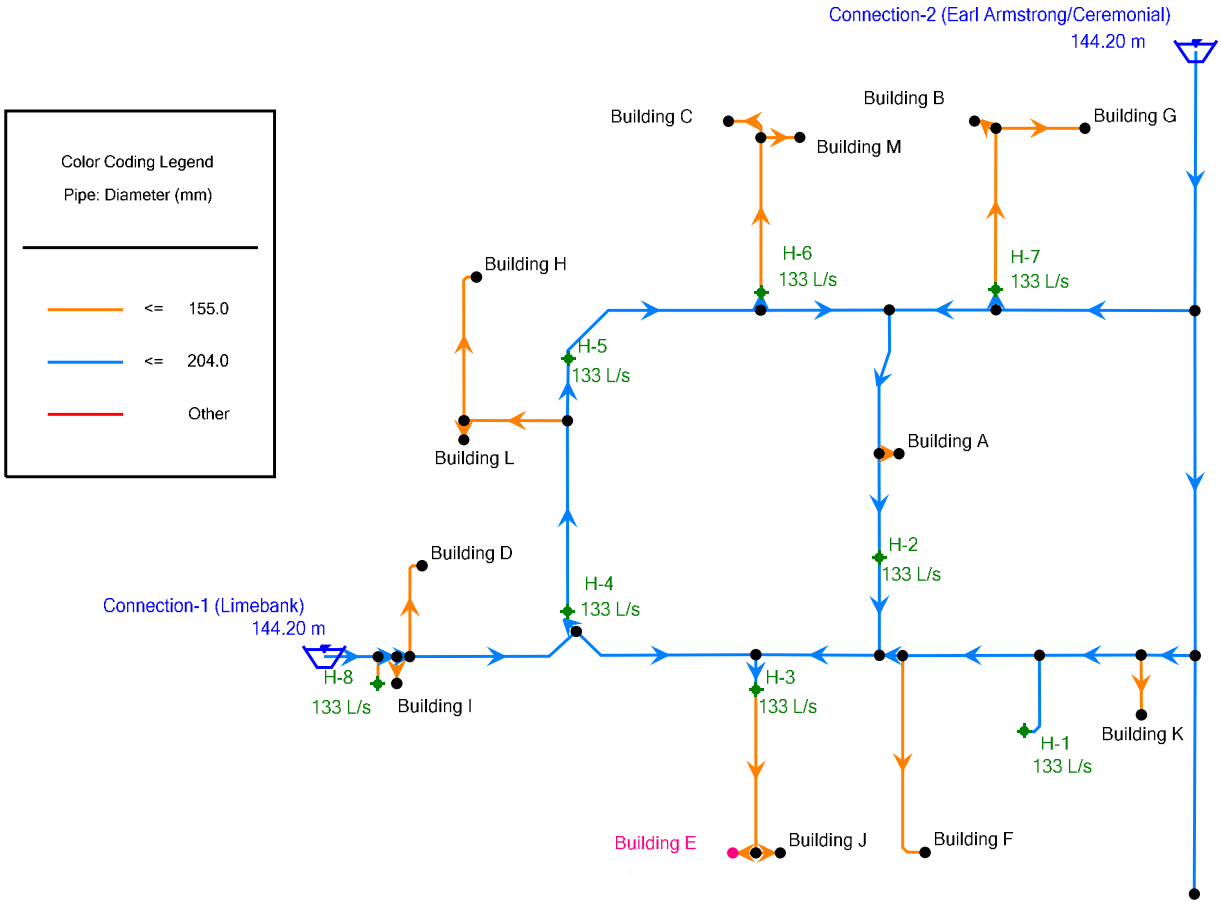
HNA - 1424 Earl Armstrong Road
SUC Pressure Zone Reconfiguration
Max Day + Fire Flow Requirement (133 L/s)
Critical Fire Area: Building C



HNA - 1424 Earl Armstrong Road
SUC Pressure Zone Reconfiguration
Max Day + Fire Flow Requirement (133 L/s)
Critical Fire Area: Building C

Label	Fire Flow (Available) (L/s)	Flow (Total Available) (L/s)	Satisfies Fire Flow Constraints?	Pressure (Residual Lower Limit) (kPa)	Pressure (Calculated System Lower Limit) (kPa)	Pressure (Calculated Residual) (kPa)	Junction w/ Minimum Pressure (System)
H-1	133	133	True	140	340	387	Building C
H-2	133	133	True	140	332	404	Building C
H-3	133	133	True	140	340	400	Building C
H-4	133	133	True	140	338	414	Building C
H-5	133	133	True	140	310	374	Building C
H-6	133	133	True	140	284	366	Building C
H-7	133	133	True	140	328	399	Building C
H-8	133	133	True	140	381	439	Building C

HNA - 1424 Earl Armstrong Road
SUC Pressure Zone Reconfiguration
Max Day + Fire Flow Requirement (133 L/s)
Critical Fire Area: Building E



HNA - 1424 Earl Armstrong Road
SUC Pressure Zone Reconfiguration
Max Day + Fire Flow Requirement (133 L/s)
Critical Fire Area: Building E

Label	Fire Flow (Available) (L/s)	Flow (Total Available) (L/s)	Satisfies Fire Flow Constraints?	Pressure (Residual Lower Limit) (kPa)	Pressure (Calculated System Lower Limit) (kPa)	Pressure (Calculated Residual) (kPa)	Junction w/ Minimum Pressure (System)
H-1	133	133	True	140	333	381	Building E
H-2	133	133	True	140	331	401	Building E
H-3	133	133	True	140	292	367	Building E
H-4	133	133	True	140	346	415	Building E
H-5	133	133	True	140	346	391	Building E
H-6	133	133	True	140	345	402	Building E
H-7	133	133	True	140	347	409	Building E
H-8	133	133	True	140	385	439	Building E

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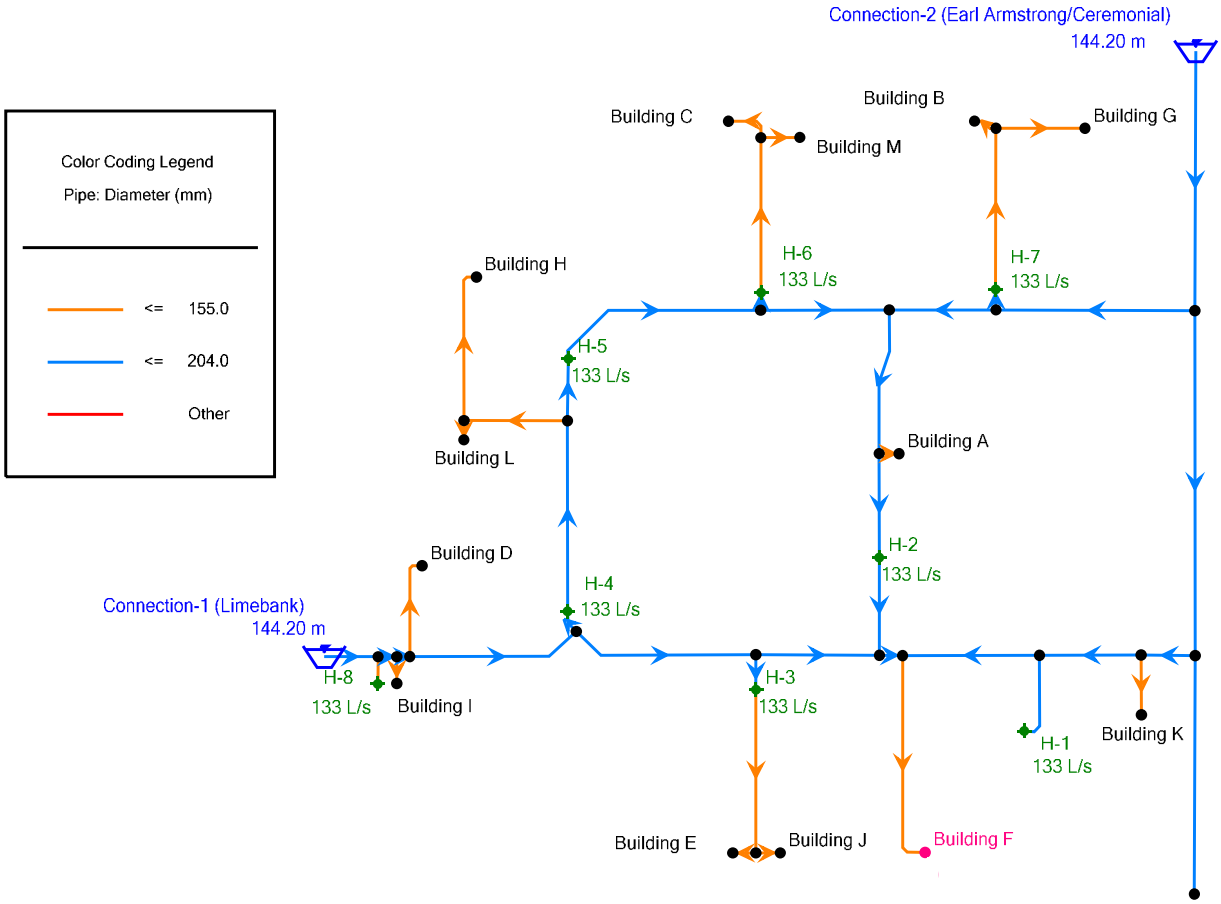
HNA - 1424 Earl Armstrong Road
SUC Pressure Zone Reconfiguration
Max Day + Fire Flow Requirement (133 L/s)
Critical Fire Area: Building F



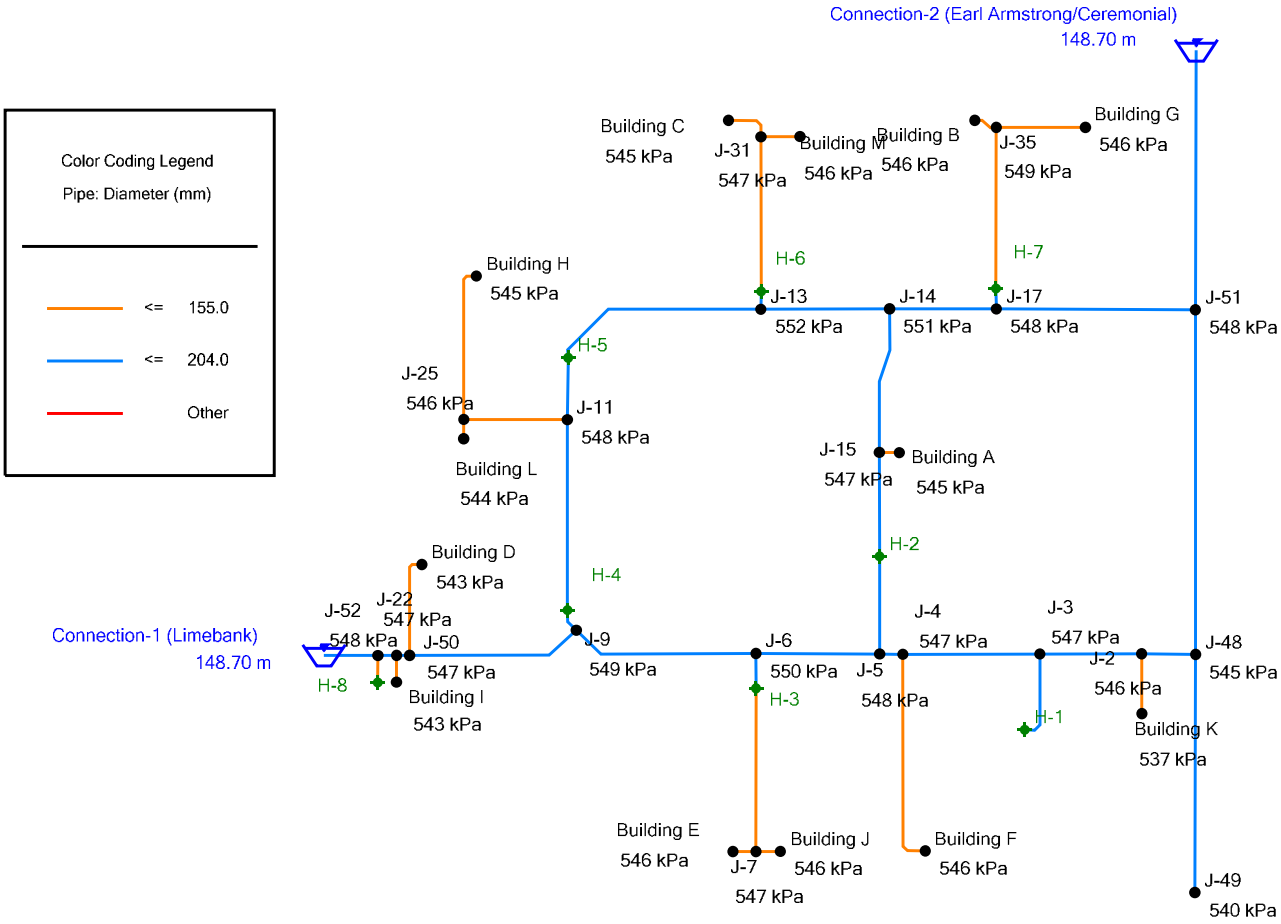
HNA - 1424 Earl Armstrong Road
SUC Pressure Zone Reconfiguration
Max Day + Fire Flow Requirement (133 L/s)
Critical Fire Area: Building F

Label	Fire Flow (Available) (L/s)	Flow (Total Available) (L/s)	Satisfies Fire Flow Constraints?	Pressure (Residual Lower Limit) (kPa)	Pressure (Calculated System Lower Limit) (kPa)	Pressure (Calculated Residual) (kPa)	Junction w/ Minimum Pressure (System)
H-1	133	133	True	140	313	372	Building F
H-2	133	133	True	140	318	396	Building F
H-3	133	133	True	140	321	391	Building F
H-4	133	133	True	140	341	417	Building F
H-5	133	133	True	140	339	391	Building F
H-6	133	133	True	140	335	401	Building F
H-7	133	133	True	140	336	407	Building F
H-8	133	133	True	140	378	439	Building F

Appendix ‘D9’

Simulation Results -
SUC Pressure Zone
Reconfiguration -
Max Pressure Analysis

HNA - 1424 Earl Armstrong Road
SUC Pressure Zone Reconfiguration
Maximum Pressure Analysis



HNA - 1424 Earl Armstrong Road
SUC Pressure Zone Reconfiguration
Maximum Pressure Analysis
Junction Table

Label	ID	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
Building K	70	93.80	0	148.70	537
J-49	155	93.50	0	148.70	540
Building I	83	93.20	0	148.70	543
Building D	85	93.20	0	148.70	543
Building L	93	93.10	0	148.70	544
Building H	95	93.00	0	148.70	545
Building C	99	93.00	0	148.70	545
Building A	139	93.00	0	148.70	545
J-48	153	93.00	0	148.70	545
Building F	75	92.95	0	148.70	546
Building J	77	92.95	0	148.70	546
Building E	119	92.95	0	148.70	546
J-2	36	92.90	0	148.70	546
Building M	101	92.90	0	148.70	546
Building B	109	92.90	0	148.70	546
Building G	112	92.90	0	148.70	546
J-25	91	92.88	0	148.70	546
J-7	46	92.85	0	148.70	547
J-22	82	92.85	0	148.70	547
J-3	38	92.84	0	148.70	547
J-4	40	92.80	0	148.70	547
J-15	62	92.80	0	148.70	547
J-31	100	92.80	0	148.70	547
J-50	195	92.80	0	148.70	547
J-51	211	92.75	0	148.70	548
J-52	224	92.75	0	148.70	548
J-5	42	92.72	0	148.70	548
J-17	67	92.70	0	148.70	548
J-11	54	92.68	0	148.70	548
J-9	50	92.60	0	148.70	549
J-35	110	92.60	0	148.70	549
J-6	44	92.55	0	148.70	550
J-14	60	92.37	0	148.70	551
J-13	58	92.30	0	148.70	552

HNA - 1424 Earl Armstrong Road
SUC Pressure Zone Reconfiguration
Maximum Pressure Analysis
Pipe Table

Label	Length (Scaled) (m)	Diameter (mm)	Material	Hazen-Williams C	Hydraulic Grade (Start) (m)	Hydraulic Grade (Stop) (m)	Flow (L/s)	Velocity (m/s)
P-50	80	204.0	PVC	110.0	148.70	148.70	0	0.00
P-51	18	204.0	PVC	110.0	148.70	148.70	0	0.00
P-53	59	204.0	PVC	110.0	148.70	148.70	0	0.00
P-54	64	204.0	PVC	110.0	148.70	148.70	0	0.00
P-55	41	204.0	PVC	110.0	148.70	148.70	0	0.00
P-56	8	204.0	PVC	110.0	148.70	148.70	0	0.00
P-57	46	204.0	PVC	110.0	148.70	148.70	0	0.00
P-58	34	204.0	PVC	110.0	148.70	148.70	0	0.00
P-59	20	155.0	PVC	100.0	148.70	148.70	0	0.00
P-60	30	204.0	PVC	110.0	148.70	148.70	0	0.00
P-61	72	155.0	PVC	100.0	148.70	148.70	0	0.00
P-62	12	204.0	PVC	110.0	148.70	148.70	0	0.00
P-63	55	155.0	PVC	100.0	148.70	148.70	0	0.00
P-64	8	155.0	PVC	100.0	148.70	148.70	0	0.00
P-65	8	155.0	PVC	100.0	148.70	148.70	0	0.00
P-66	8	204.0	PVC	110.0	148.70	148.70	0	0.00
P-67	64	204.0	PVC	110.0	148.70	148.70	0	0.00
P-68	35	155.0	PVC	100.0	148.70	148.70	0	0.00
P-69	6	155.0	PVC	100.0	148.70	148.70	0	0.00
P-70	52	155.0	PVC	100.0	148.70	148.70	0	0.00
P-71	21	204.0	PVC	110.0	148.70	148.70	0	0.00
P-72	73	204.0	PVC	110.0	148.70	148.70	0	0.00
P-73	6	204.0	PVC	110.0	148.70	148.70	0	0.00
P-74	52	155.0	PVC	100.0	148.70	148.70	0	0.00
P-75	13	155.0	PVC	100.0	148.70	148.70	0	0.00
P-76	15	155.0	PVC	100.0	148.70	148.70	0	0.00
P-77	43	204.0	PVC	110.0	148.70	148.70	0	0.00
P-78	36	204.0	PVC	110.0	148.70	148.70	0	0.00
P-79	7	204.0	PVC	110.0	148.70	148.70	0	0.00
P-80	54	155.0	PVC	100.0	148.70	148.70	0	0.00
P-81	8	155.0	PVC	100.0	148.70	148.70	0	0.00
P-82	30	155.0	PVC	100.0	148.70	148.70	0	0.00
P-83	33	204.0	PVC	110.0	148.70	148.70	0	0.00
P-84	35	204.0	PVC	110.0	148.70	148.70	0	0.00
P-85	7	155.0	PVC	100.0	148.70	148.70	0	0.00
P-86	49	204.0	PVC	110.0	148.70	148.70	0	0.00
P-87	34	155.0	PVC	100.0	148.70	148.70	0	0.00
P-103	4	204.0	PVC	110.0	148.70	148.70	0	0.00
P-89	9	155.0	PVC	100.0	148.70	148.70	0	0.00
P-49 (1)	87	204.0	PVC	110.0	148.70	148.70	0	0.00
P-49 (2)	116	204.0	PVC	110.0	148.70	148.70	0	0.00
P-90	67	204.0	PVC	110.0	148.70	148.70	0	0.00
P-100	18	204.0	PVC	110.0	148.70	148.70	0	0.00
P-101	6	204.0	PVC	110.0	148.70	148.70	0	0.00
P-91	9	155.0	PVC	100.0	148.70	148.70	0	0.00

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