Stormwater Management and Servicing Report

1850 Walkley Road
Ottawa, Ontario, K1H 8K3

Prepared for:

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Attention: Mr. Fadi Kachi

LRL File No.: 170757

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1 INTRODUCTION

LRL Associates Ltd. (LRL), consulting engineers have been retained by Moore Design Consultants to prepare a site plan control serviceability report for a proposed new commercial development at 1850 Walkley Road in the City of Ottawa, Ontario. This report discusses the existing conditions of the site and the future site usage with the proposed water, sanitary sewer and stormwater management services.

This report has been prepared in consideration of the existing condition and property boundaries at 1850 Walkley Road, provided by the City of Ottawa. Should there be any important discrepancies in the existing infrastructure that may relate to the site servicing considerations, LRL should be advised in order to review the report recommendations. This report should be read in conjunction with the grading and drainage, site servicing, and stormwater management plans prepared by LRL (see Appendix E – *Engineering Drawings*).

2 SITE DESCRIPTION

The subject property is located within the urban boundary of the City of Ottawa, Ontario. As illustrated in Figure 1, the development will be located South on Walkley Road. The total area of the property measures approximately 0.742 ha.

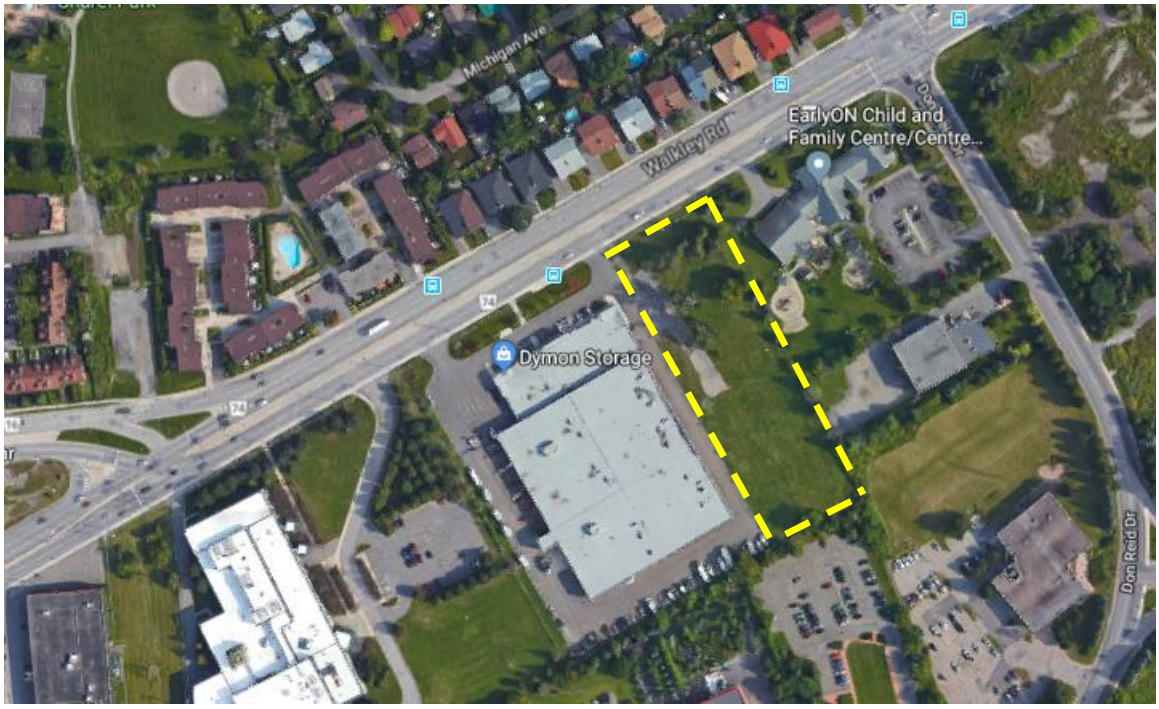

Figure 1 Aerial view of the location of the proposed development (via Google Earth)

The proposed development is located within a commercial area. Commercial developments / businesses surround the West, East and South borders of the property. To the North (across Walkley Road) are residential properties. The site is currently a green field with a gravel access road. The land surface has a minimal grade change with elevations ranging between 86.96m and 85.57m.

The proposed development includes building a new 1-storey restaurant (total footprint area of 700m^2) at the north end of the property and a 2 storeys commercial building (total footprint area of 1,000m^2) at the rear of the property, on the south side.

3 SCOPE OF WORK

As per the applicable design guidelines, the scope of work includes the following:

Water services

- Calculate the expected domestic water demand at average and peaking conditions,
- Calculate the fire flow requirements as per the Fire Underwriters Survey (FUS) method for both proposed buildings,
- Describe the proposed water distribution network on site and the connection to the existing distribution system.

Sanitary services

- Describe the existing sanitary sewers available to receive wastewater from the building.
- Calculate peak flow rates from the development.
- Describe the proposed sanitary sewer system.
- Verify available capacity in the downstream sanitary sewer.
- Verify the capacity of the existing lateral sanitary sewer

Stormwater management

- Calculate the allowable stormwater release rate.
- Calculate the anticipated post development stormwater release rates.
- Demonstrate how the target quality and quantity objectives will be achieved.
- Verify the capacity of the existing lateral storm sewer

4 WATER SUPPLY AND FIRE PROTECTION

4.1 Existing Water Supply Services

It is not known if the site has currently a water service connection. If this is the case, the service connection is too small for the proposed private fire hydrant and sprinklers at both buildings. This service will have to be removed and replaced with a new watermain. There is an existing

fire hydrant located at the northwest corner of the said property. Data obtained from the City of Ottawa indicates that the fire flow available in that sector is 133 L/s at the street level.

4.2 Water Supply Demand

As per the Ministry of Environment and Climate Change (MOECC) standards and the City of Ottawa design guidelines, the average water demand for such a commercial development was calculated using an average water demand of 28 m^3/ha-day and a daily and hourly peaking factors of 1.5 and 1.8, respectively. Thus, the average daily domestic water demand for both proposed buildings is estimated at **0.24 L/s**; the maximum daily demand is **0.36 L/s** and the peak hourly demand is **0.65 L/s**. Refer to Appendix A – *Water Demand and Fire Flow Calculations* for the domestic water demand and fire flow calculations details. The watermain is sized to provide sufficient water flow rate to the proposed private fire hydrant and sprinkler systems at both buildings.

The fire flow demand was estimated in accordance with the Fire Underwriters Survey (FUS). This method is based on the floor area of the building to be protected, type and combustibility of the structural frame and the separation distances with adjoining buildings. The fire flow demand was calculated separately for each building and was evaluated at **83.3 L/s** for Building 1 (restaurant) and **100.0 L/s** for Building 2 (office complex). Refer to Appendix A – *Water Demand and Fire Flow Calculations* for the calculation details.

4.3 Water supply servicing design

The proposed commercial site will be serviced by a new 150mmø watermain. The service will connect to the existing 400mmø watermain under Walkley Road and will enter the southwest corner of Building 1 (restaurant) and the northwest corner of Building 2 (office complex). Both buildings will be serviced from the new 150mmø watermain service to be installed on the property.

An existing fire hydrant is located on the south side of Walkley Road, near the entrance of the property. However, to meet the minimum requirement of a 90m radius distance between the fire hydrant and the building, as required by the City of Ottawa, a new private fire hydrant is required to be added to the property to service Building 2 (office complex). Refer to LRL drawing C401 Rev.01 – *Servicing Plan* for the layout of the proposed water services and connections.

4.4 Boundary Conditions

The existing boundary conditions provided by the City of Ottawa for the site are as follow:

Minimum HGL = 124.4m

Maximum HGL = 131.6m*;*

Available fire flow = 133 L/s at a ground elevation of 126.2m

As the available fire flow provided by the City of Ottawa is above the minimum fire flow requirement for the proposed development, no supplementary fire protection and storage are required for the site.

5 SANITARY DRAINAGE

5.1 Existing Sanitary Sewer Services

Existing infrastructure surrounding the proposed development were reviewed to determine that there is an existing 450 mm dia. sanitary sewer running east along Walkley Road. Wastewater ultimately conveyed east along Walkley until entering being transferred through the Ruisseau Ramsay Creek, north ultimately reaching the Sheffield Park area for treatment before entering the Ottawa River.

5.2 Sanitary Sewer Servicing Design

Proposed Building 1 (restaurant) and Building 2 (office complex) will be serviced with a new 200mmø sanitary service connecting to the existing municipal 450mmø sanitary sewer under Walkley Road. The new service will be located on the west side of the buildings. The proposed 200mmø PVC sanitary service sewer pipe will be installed at a 1.00% gradient. Refer to LRL drawing C401 – *Servicing Plan* for the proposed sanitary servicing layout and connections.

The design parameters used to calculate the expected site sanitary flow are the following; a commercial & institutional flow of 50,000L/ha/day, a commercial & institutional peaking factor of 1.5 and an infiltration rate of 0.28 L/s/ha. Based on these parameters, and the site area of 0.741ha, the total expected sanitary flow was estimated at **0.64 L/s**. Refer to Appendix C – *Sanitary Design Sheet* for the sanitary sewer calculations details.

A new sanitary manhole SAN MH01 will be installed on the site at the southwest corner of the new Building 1 (restaurant). This manhole will capture the sanitary sewer flow coming from both buildings and act as a monitoring manhole before conveying the sanitary flow towards the municipal sanitary sewer network under Walkley Road.

6 STORMWATER MANAGEMENT

6.1 Existing Stormwater Infrastructure

Currently there is an existing 1,950mmø storm sewer under Walkley Road and flowing eastwards. Once the existing sewer reaches Conroy Road, flow is conveyed south to Johnston Road, ultimately being outlet into the Ruisseau McEwan Creek area. The area being impacted by the proposed new development currently drains southeast, towards the existing swale along the south property line. Refer to drawing C701 Rev.01 – *Pre-Development Watershed Plan*. Watershed EWS-01 currently drains uncontrolled towards the southeast corner of the property which appears to be draining most of the neighboring properties and ultimately outlets onto Don Reid Drive.

6.2 Stormwater management Concept

The existing catchment EWS-01 (0.742ha) currently drains towards the rear of the property, before being conveyed towards Don Reid Drive. The post-development conditions will consist of adding two (2) new buildings and a paved parking area, which will ultimately increase the runoff coefficient. In order to regulate and control the increase in the total runoff, stormwater quantity control will be implemented. The stormwater will be captured by multiple catchbasins before being conveyed to the precast concrete structure, CBMH02, and the municipal storm sewer network. In order to throttle the 100-year storm flows, the stormwater will be controlled at structure CBMH02 with the use of an undersized 300mmø diameter pipe, acting as a flow restrictor. With the undersized pipe installed at structure CBMH02, along with the parking lot surface ponding, the stormwater runoff quantity flow rate will be maintained during a 100-year storm event.

Refer to LRL drawings C301 Rev.03 – *Grading and Drainage Plan, C601 Rev.04 – Stormwater Management Plan* and C702 Rev. 01 – *Post-Development Watershed Plan* for the grading/drainage plan and stormwater management plan and Appendices B and D for stormwater management design calculation spreadsheets.

6.3 Design Criteria

Stormwater quantity and quality control measures are proposed for this site to reduce post development stormwater runoff to allowable levels.

6.3.1 Water Quality

On-site water quality will be implemented with a downstream treatment unit which is capable of filtration up to 80% TSS.

6.3.2 Water Quantity

All storm events up to and including the 100-year event will be controlled to the 5-year pre-development level. The site major overland flow route has been designed to ensure that storm events beyond the 100-year design storm can be safely conveyed overland towards the Walkley Road right of way. The minor system (storm sewer) within the site is sized to convey the 5-year storm event flows from the site to the municipal storm sewer on Walkley Road.

6.4 Method of Analysis

The Rational Method was used to calculate the runoff from the development. The Intensity-Duration-Frequency (IDF) curve formulas of the MacDonald Cartier International Airport, City of Ottawa, were used to calculate the peak storm flows for the catchment WS-01, WS-02, WS-03 WS-04, WS-05, WS-06, WS-07, WS-08, WS-09, WS-10, WS-11, WS-12, WS-13 and WS-14.

6.5 Allowable Release Rate

A maximum allowable release rate was calculated from the rational method for the 5-year pre-development. Runoff from the post-development conditions must be controlled to the pre-development runoff coefficient or a maximum runoff coefficient of **C=0.50**, for both the minor and major storms (5-year up to 100-year storms) using a time of concentration not less than 10 minutes.

<u>EWS-01– Walkley Road</u>

C= 0.25
I= 104.2mm/hr calculated with Tc = 10 min.
A_{EWS-01} = 0.742 Ha
Q_{peak} = 2.78 x 0.25 x 104.2 x 0.742 = **53.72 L/s**

6.6 Stormwater Quantity Controls

The proposed stormwater management quantity control for this development will be accomplished by means of an undersized pipe outlet, a pipe, an underground water storage structure and parking lot surface ponding. The proposed site storm sewer and stormwater management system can be seen on drawing C401 Rev.01 – *Servicing Plan* and the detailed calculations, including the design sheet are included in Appendices B and D.

The collected stormwater from WS-01, WS-02, WS-03 WS-04, WS-05, WS-06, WS-07, WS-08, WS-09, WS-10 and W11, with respective areas of 0.040ha, 0.028ha, 0.089ha, 0.025ha, 0.102ha, 0.103ha, 0.036ha, 0.052ha, 0.077ha, 0.033ha and 0.115ha, consist of the roof tops, the parking lots and some of the landscaping. These catchments areas will be captured through multiple catchbasins and controlled using the undersized 300mmø pipe. The undersized pipe in

structure CBMH02 will release **53.72 L/s** with a maximum head of 2.41 m (HWL = 86.14m) during the 100-year storm event. In order to control the 100-year storm event, 231.5m^3 of on-site storage is required. This storage will be provided by means of parking lot surface ponding. At the expected HWL, 86.14m MASL, the ponding will achieve a storage volume of 238.5 m^3. Refer to C401 Rev.01 – *Servicing Plan* and Appendix D - *Supporting Documents and CDS Treatment System* for the stormwater design and calculation details. Therefore, the stormwater outlet onto Walkley Road is capable of achieving the required stormwater quantity control.

Therefore, the stormwater outlet onto Walkley Road is capable of achieving the required stormwater quantity control.

6.7 Stormwater Quality Management

Enhanced 80% TSS (Total Suspended Solids) removal will be provided with a stormwater treatment unit to be installed at the downstream end of the stormwater sewer before outletting into the municipal main. The sediment at the bottom of the stormwater treatment unit will need to be cleaned when and as required. Refer to Appendix D - *Supporting Documents and CDS Treatment System* for the Echelon Environmental analysis and design information.

7 EROSION AND SEDIMENT CONTROL

During the construction, erosion and sediment controls is to be provided primarily via a sediment control fence to be erected along the perimeter of the site where runoff has the potential of leaving the site and property. Inlet sediment control devices are also to be provided in any catchbasin and/or manhole in and around the site that could be impacted by the site construction activities. Construction and maintenance requirements for erosion and sediment controls are to comply with Ontario Provincial Standard Specification OPSS 577. Refer to LRL drawing C101 Rev.01 – *Erosion and Sediment Control Plan* for the details.

8 CONCLUSIONS

In accordance with the report objectives, the analyses of the proposed development can be summarized as follows:

Water Service

- The expected maximum domestic water demand for the site is 0.65 L/s.
- The required fire flow rate is calculated at 100.0 L/s using the FUS method.
- A private fire hydrant is required on the property.
- The watermain size and type on the property is 150mmø PVC DR-18 pipe.

Sanitary Service

- The anticipated sanitary flow from the proposed development is 0.64 L/s.
- New buildings will be serviced with a new 200mmø sanitary service connection to the existing 450mmø sanitary sewer under Walkley Road.

Stormwater Management

- The stormwater release flow rate from the proposed development will meet the pre-development allowable release rate of 53.72 L/s to the municipal sewer.
- Stormwater quantity control objectives will be met with the on-site stormwater storage.
- Stormwater quality control objectives will be achieved by means of a stormwater treatment unit (see details in Appendix D).

9 LIMITATIONS AND USE OF REPORT

The report conclusions are applicable only to the project described in this report. Any important changes require a review by LRL Associates Ltd. to insure the compatibility with the recommendations contained in this report. We trust the information and design presented meet your current requirements. Please do not hesitate to contact us should you have any questions or concerns.

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Nov 22, 2019
PROVINCE OF ONTARIO

APPENDIX A

Water Demand and Fire Flow Calculations

Water Service Calculations

LRL File No. : 170757
Project : 1850 Walkley Rd., Ottawa, ON
Date : November 19, 2019
Designed by : Maxime Longtin

Water Demand

Total site area: 0.741 ha

$Q_{average}$ = 28 m^3 / ha·day (As per MOE guidelines)
$Q_{average}$ = 20.748 m^3 / day
$Q_{average}$ = 20748 L / day
$Q_{average}$ = 0.24 L / s

Maximum daily peak factor: 1.5
Maximum daily demand = 31122 L / day
= 0.36 L / s

Maximum hour peak factor: 1.8
Maximum hour demand = 56020 L / day
= 0.65 L / s

Water Service Pipe Sizing

Q = VA

Where: V = velocity
A = area of watermain pipe
Q = water supply flow rate

By deriving the above formula, we can obtain the diameter of the pipe:

Minimum pipe diameter:

$d = (4Q/\pi V)^{1/2}$
d = 0.021 m
d = 21 mm

Proposed pipe diameter: **150** mm (due to on-site hydrant)

Fire Flow Calculations - Building 1

LRL File No.	170757
Project	1850 Walkley Rd., Ottawa, ON
Date	November 19, 2019
Method	Fire Underwriters Survey (FUS)
Designed by	Maxime Longtin

Step	Task	Term	Options	Multiplier	Choose:	Value	unit	Fire Flow
Structural Framing Material								
1	Choose frame used for building	Coefficient C related to the type of construction	Wood Frame	1.5	Ordinary Construction	1		
			Ordinary Construction	1.0				
			Non-combustible construction	0.8				
			Fire resistive construction <2 hrs	0.7				
			Fire resistive construction >2 hrs	0.6				
Floor Space Area								
2	Choose type of housing	Type of housing	Single family dwelling	0	Building - no. of units per floor	1	unit(s)	
			Townhouse - no. of units	0				
			Building - no. of units per floor	1				
3	Enter area of a unit	Enter floor space area of one unit (excluding basement)		1	700.0		sq.m.	
4	Obtain fire flow before reductions	Required fire flow	**Fire Flow = 220 x C x Area^0.5**				L/min	**6,000**
							L/s	100.0
Reductions or surcharge due to factors affecting burning								
5	Choose combustibility of contents	Occupancy hazard reduction or surcharge	Non-combustible	-0.25	Combustible	0		
			Limited combustible	-0.15				
			Combustible	0				
			Free burning	0.15			L/min	**6,000**
			Rapid burning	0.25			L/s	100.0
6	Choose reduction for sprinklers	Sprinkler reduction	Sprinklers (NFPA13)	-0.30	True	-0.3		
			Water supply is standard for both the system and fire department hose lines	-0.10	True	-0.1	L/min	**3,600**
			Fully supervised system	-0.10	False	0	L/s	60.0
7	Choose separation	Exposure distance between units	North side	Over 45m	0			
			East side	20.1 to 30m	0.1			
			South side	Over 45m	0		L/min	**5,000**
			West side	20.1 to 30m	0.1	0.2	L/s	83.3
Net required fire flow								
8	Obtain fire flow, duration, and volume	Minimum required fire flow rate (rounded to nearest 1000)					L/min	**5,000**
		Minimum required fire flow rate					L/s	**83.3**
		Required duration of fire flow					hr	**2**

Fire Flow Calculations - Building 2

LRL File No.	170757
Project	1850 Walkley Rd., Ottawa, ON
Date	November 19, 2019
Method	Fire Underwriters Survey (FUS)
Designed by	Maxime Longtin

Step	Task	Term	Options	Multiplier	Choose:	Value	unit	Fire Flow
			Structural Framing Material					
1	Choose frame used for building	Coefficient C related to the type of construction	Wood Frame	1.5	Ordinary Construction	1		
			Ordinary Construction	1.0				
			Non-combustible construction	0.8				
			Fire resistive construction <2 hrs	0.7				
			Fire resistive construction >2 hrs	0.6				
			Floor Space Area					
2	Choose type of housing	Type of housing	Single family dwelling	0	Building - no. of units per floor	1	unit(s)	
			Townhouse - no. of units	0				
			Building - no. of units per floor	1				
3	Enter area of a unit	Enter floor space area of one unit (excluding basement)		1	1100.0		sq.m.	
4	Obtain fire flow before reductions	Required fire flow	**Fire Flow = 220 x C x Area^0.5**				L/min	**7,000**
							L/s	116.7
			Reductions or surcharge due to factors affecting burning					
5	Choose combustibility of contents	Occupancy hazard reduction or surcharge	Non-combustible	-0.25	Combustible	0		
			Limited combustible	-0.15				
			Combustible	0				
			Free burning	0.15			L/min	**7,000**
			Rapid burning	0.25			L/s	116.7
6	Choose reduction for sprinklers	Sprinkler reduction	Sprinklers (NFPA13)	-0.30	True	-0.3		
			Water supply is standard for both the system and fire department hose lines	-0.10	True	-0.1	L/min	**4,200**
			Fully supervised system	-0.10	False	0	L/s	70.0
7	Choose separation	Exposure distance between units	North side	Over 45m	0			
			East side	20.1 to 30m	0.1			
			South side	Over 45m	0		L/min	**6,000**
			West side	20.1 to 30m	0.1	0.2	L/s	100.0
			Net required fire flow					
8	Obtain fire flow, duration, and volume	Minimum required fire flow rate (rounded to nearest 1000)					L/min	**6,000**
		Minimum required fire flow rate					L/s	**100.0**
		Required duration of fire flow					hr	**2**

APPENDIX B

Stormwater Management Design Sheets

LRL Associates Ltd.
Storm Design Sheet

LRL File No.	170757
Project:	Commercial Site Development
Location:	1850 Walkley Road, Ottawa, Ontario
Date:	November 19, 2019
Designed:	M. Longtin
Checked:	V. Johnson
Drawing Reference:	C401 Rev.01

Storm Design Parameters

Rational Method Q = 2.78CIA

Q = Peak flow in litres per second (L/s)
A = Drainage area in hectares (ha)
C = Runoff coefficient
I = Rainfall intensity (mm/hr)

Runoff Coefficient (C)	
Grass	0.2
Gravel	0.80
Asphalt / rooftop	0.90

Ottawa Macdonald-Cartier International Airport IDF curve equation (5 year event, intensity in mm/hr)
$I = 998.071 / (T_c + 6.053)^{0.814}$
Min. velocity = 0.80 m/s
Manning's "n" = 0.013

LOCATION			AREA (ha)			FLOW					STORM SEWER								MANHOLE							WATERSHED		AVAILABLE STORAGE				
WATERSHED / STREET	From MH	To MH	C = 0.20	C = 0.80	C = 0.90	Indiv. 2.78AC	Accum. 2.78AC	Time of Conc. (min.)	Rainfall Intensity (mm/hr)	Peak Flow Q (l/s)	Pipe Diameter (mm)	Type	Slope (%)	Length (m)	Capacity Full (L/s)	Velocity Full (m/s)	Time of Flow (min.)	Ratio (Q/Q_{FULL})	Up Invert (m)	Down Invert (m)	T/G Up Stream (m)	T/G Down Stream	Up Depth obv (m)	Down Depth obv (m)	Up Depth inv (m)	Total Area (ha)	Combined C	Pipe Storage (m^3)	Upstream CB/MH Size (m)	Water Depth (m)	CB/MH Storage (m^3)	Insulation
WS-01	CB13	CBMH12	0.000	0.000	0.040	0.10	0.10	10.00	104.19	10.30	200	PVC	0.50%	42.9	23.2	0.74	0.97	**0.44**	84.13	83.99	86.00	85.90	1.67	1.71	1.67	0.04	0.90	1.35	0.60	1.67	0.60	
WS-02	CBMH12	CBMH11	0.000	0.000	0.028	0.07	0.17	10.97	99.34	16.85	200	PVC	0.50%	26.5	23.2	0.74	0.60	**0.73**	83.92	83.87	85.90	85.82	1.78	1.75	1.78	0.03	0.90	0.83	1.20	1.78	2.01	
WS-04	CBMH11	CBMH10	0.000	0.000	0.025	0.06	0.23	11.57	96.59	22.50	250	PVC	0.43%	25.5	39.0	0.79	0.53	**0.58**	83.80	83.76	85.82	85.82	1.77	1.81	1.77	0.03	0.90	1.25	1.20	1.77	2.00	
WS-03	CBMH10	CBMH09	0.007	0.000	0.083	0.21	0.44	12.10	94.26	41.78	300	PVC	0.34%	19.4	56.4	0.80	0.41	**0.74**	83.73	83.78	85.82	86.00	1.79	1.92	1.79	0.09	0.85	1.37	1.20	1.79	2.02	
WS-05	CBMH09	CBMH08	0.014	0.000	0.089	0.23	0.67	12.51	92.58	62.27	375	PVC	0.25%	22.2	87.7	0.79	0.47	**0.71**	83.73	83.78	85.82	86.00	1.71	1.85	1.71	0.10	0.81	2.45	1.20	1.71	1.94	
WS-06	CBMH08	CBMH06	0.012	0.000	0.090	0.23	0.91	12.97	90.73	82.12	450	PVC	0.20%	26.4	127.5	0.80	0.55	**0.64**	83.73	83.78	85.82	86.00	1.64	1.77	1.64	0.10	0.82	4.20	1.20	1.64	1.85	
WS-07	CB07	CBMH06	0.014	0.000	0.022	0.06	0.06	13.52	88.66	5.50	200	PVC	0.50%	23.2	23.2	0.74	0.52	**0.24**	83.73	83.78	85.82	86.00	1.89	2.02	1.89	0.04	0.63	0.73	1.20	1.89	2.14	
WS-08	CBMH06	CBMH05	0.000	0.000	0.052	0.13	1.10	14.05	86.77	95.30	450	PVC	0.20%	21.9	127.5	0.80	0.46	**0.75**	83.73	83.78	85.82	86.00	1.64	1.77	1.64	0.05	0.90	3.48	1.20	1.64	1.85	
WS-11	CBMH05	CBMH02	0.010	0.000	0.066	0.17	1.27	14.50	85.20	108.20	450	PVC	0.20%	21.9	127.5	0.80	0.46	**0.85**	83.73	83.78	85.82	86.00	1.64	1.77	1.64	0.08	0.81	3.48	1.20	1.64	1.85	
WS-09	CB04	CBMH03	0.010	0.000	0.066	0.17	0.17	10.00	104.19	17.88	250	PVC	0.43%	19.7	39.0	0.79	0.41	**0.46**	83.90	83.83	85.90	86.00	1.75	1.92	1.75	0.08	0.81	0.97	0.60	1.75	0.63	
WS-10	CBMH03	CBMH02	0.000	0.000	0.033	0.08	0.25	10.41	102.06	25.86	250	PVC	0.43%	20.6	39.0	0.79	0.43	**0.66**	83.92	83.87	85.90	85.82	1.73	1.70	1.73	0.03	0.90	1.01	1.20	1.73	1.96	
	CBMH02	CDS	0.000	0.000	0.000	0.00	1.52	10.85	99.93	152.22	300	PVC	0.31%	10.3	53.6	0.76	0.23	**2.84**	83.46	83.43	86.25	86.74	2.49	3.01	2.49	0.00	-	0.00	0.00	0.00	0.00	
	CDS	EXIST	0.000	0.000	0.000	0.00	1.52	11.07	98.85	150.58	375	PVC	0.25%	13.4	53.6	0.49	0.46	**2.81**	83.43	83.40	86.74	-	2.93		-	0.00	-	0.00	0.00	0.00	0.00	
																												21.14			**18.87**	

Note: The Peak flow controlled by the undersized pipe is shown in this design sheet.

HWL (100 Year)	86.12
TOTAL STORAGE	40.00

APPENDIX C

Sanitary Design Sheet

LRL File No. 170757
Project: Commercial Site Development
Location: 1850 Walkley Road, Ottawa, Ontario
Date: November 19, 2019

Sanitary Design Parameters

Average Daily Flow = 350 L/p/day
Commercial & Institutional Flow = 50000 L/ha/day
Light Industrial Flow = 35000 L/ha/day
Heavy Industrial Flow = 55000 L/ha/day
Maximum Residential Peak Factor = 4.0
Commercial & Institutional Peak Factor = 1.5

Industrial Peak Factor = as per Appendix 4-B = 7
Extraneous Flow = 0.28 L/s/gross ha

Pipe Design Parameters

Minimum Velocity = 0.60 m/s
Manning's n = 0.013

LOCATION			RESIDENTIAL AREA AND POPULATION						COMMERCIAL		INDUSTRIAL			INSTITUTIONAL		C+I+I	INFILTRATION			TOTAL FLOW	PIPE						MANHOLE	
					CUMMULATIVE																							
STREET	FROM MH	TO MH	AREA (Ha)	POP.	AREA (Ha)	POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (Ha)	ACCU. AREA (Ha)	AREA (Ha)	ACCU. AREA (Ha)	PEAK FACT.	AREA (Ha)	ACCU. AREA (Ha)	PEAK FLOW (l/s)	TOTAL AREA (Ha)	ACCU. AREA (Ha)	INFILT. FLOW (l/s)	(l/s)	LENGTH (m)	DIA. (mm)	SLOPE (%)	MATERAIL	CAP. (FULL) (l/s)	VEL. (FULL) (m/s)	UP INVERT (m)	DOWN INVERT (m)
SITE	PROP. BLDG 02	MH01	0.000	0.0	0.00	0.0	4.0	0.00	0.068	0.068	0.00	0.00	7.0	0.0	0.0	0.06	0.07	0.07	0.02	0.08	90.0	200	1.00%	PVC	32.80	1.04	83.86	82.96
SITE	PROP. BLDG 01	MH01	0.000	0.0	0.00	0.0	4.0	0.00	0.484	0.484	0.00	0.00	7.0	0.0	0.0	0.42	0.48	0.48	0.14	0.56	2.5	150	1.00%	PVC	15.23	0.86	83.02	82.99
SITE	MH01	TRUNK	0.000	0.0	0.00	0.0	4.0	0.00	0.000	0.552	0.00	0.00	7.0	0.0	0.0	0.48	0.00	0.00	0.00	0.48	62.0	200	1.00%	PVC	32.80	1.04	82.93	82.31

NOTES

Existing inverts and slopes are estimated. They are to be confirmed on-site.

Designed: G.B.	PROJECT: Commercial Site Development		
Checked: J.C.L.	LOCATION: 1850 Walkley Road, Ottawa, Ontario		
Dwg. Reference: C.401	File Ref.: 170575	Date: 12/03/2018	Sheet No. 1 of 1

APPENDIX D

Supporting Documents and CDS Treatment System

LRL Associates Ltd.

Storm Watershed Summary

LRL File No.	170757
Project:	Commercial Site Development
Location:	1850 Walkley Road, Ottawa, Ontario
Date:	November 19, 2019
Designed:	M. Longtin
Checked:	V. Johnson
Drawing Reference:	C701, C702 Rev.03

Pre-Development Catchments

WATERSHED	C = 0.20	C = 0.85	C = 0.90	Total Area (ha)	Combined C
EWS-01	0.742	0.000	0.000	0.742	0.20
TOTAL	0.742	0.000	0.000	0.742	0.20

Post-Development Catchments (Controlled)

WATERSHED	C = 0.20	C = 0.80	C = 0.90	Total Area (ha)	Combined C
WS-01	0.000	0.000	0.040	0.040	0.90
WS-02	0.000	0.000	0.028	0.028	0.90
WS-03	0.007	0.000	0.083	0.089	0.85
WS-04	0.000	0.000	0.025	0.025	0.90
WS-05	0.014	0.000	0.089	0.102	0.81
WS-06	0.012	0.000	0.090	0.103	0.82
WS-07	0.014	0.000	0.022	0.036	0.63
WS-08	0.000	0.000	0.052	0.052	0.90
WS-09	0.010	0.000	0.066	0.077	0.81
WS-10	0.000	0.000	0.033	0.033	0.90
WS-11	0.000	0.000	0.115	0.115	0.90
TOTAL	0.057	0.000	0.495	0.700	0.84

Post-Development Catchments (Un-Controlled)

WATERSHED	C = 0.20	C = 0.80	C = 0.90	Total Area (ha)	Combined C
WS-12	0.004	0.000	0.000	0.004	0.20
WS-13	0.008	0.000	0.000	0.008	0.20
WS-14	0.030	0.000	0.000	0.030	0.20
TOTAL	0.042	0.000	0.000	0.042	0.20

LRL File No.	170757
Project:	Commercial Site Development
Location:	1850 Walkley Road, Ottawa, Ontario
Date:	November 19, 2019
Designed:	M. Longtin
Checked:	V. Johnson
Drawing Ref.:	C401 Rev.01

Stormwater Management Design Sheet

STORM - 5 YEAR

Runoff Equation

Q = 2.78CIA (L/s)
C = Runoff coefficient
I = Rainfall intensity (mm/hr) = A / (Td + C)^{B}
A = Area (ha)
T_c = Time of concentration (min)

Pre-Devlopment Catchments within Development Area

	Total Area =	**0.742**	ha	**∑R=**	**0.20**
Un-Controlled	EWS-01	0.742	ha	R=	0.20
	Total Uncontrolled =	**0.742**	**ha**	**∑R=**	**0.20**

Allowable Release Rate

5 Year Pre-Development Flow Rate

I_5 = 998.071 / (Td + 6.053)$^{0.814}$ **a = 998.071** **b = 0.814** **C = 6.053**

C =	0.25	max of 0.5 as per City of Ottawa
I =	104.2	mm/hr
Tc =	10	min
Total =	0.742	ha
Allowable Release Rate=	**53.72**	L/s

Post-development Stormwater Management

					$\sum R_5$	$\sum R_{100}$
	Total Site Area =	**0.742**	ha	**∑R=**	**0.79**	**0.99**
Controlled	WS-01	0.040	ha	R=	0.90	1.00
	WS-02	0.028	ha	R=	0.90	1.00
	WS-03	0.089	ha	R=	0.85	1.00
	WS-04	0.025	ha	R=	0.90	1.00
	WS-05	0.102	ha	R=	0.81	1.00
	WS-06	0.103	ha	R=	0.82	1.00
	WS-07	0.036	ha	R=	0.63	0.78
	WS-08	0.052	ha	R=	0.90	1.00
	WS-09	0.077	ha	R=	0.81	1.00
	WS-10	0.033	ha	R=	0.90	1.00
	WS-11	0.115	ha	R=	0.90	1.00
	Total Contolled =	**0.700**	**ha**	**∑R=**	**0.84**	**0.99**
Un-Controlled	WS-12	0.004	ha	R=	0.20	0.25
	WS-13	0.008	ha	R=	0.20	0.25
	WS-14	0.030	ha	R=	0.20	0.25
	Total Un-Contolled =	**0.042**	**ha**	**∑R=**	**0.20**	**0.25**

Post-development Stormwater Management

I_5 = 998.071 / (Td + 6.053)$^{0.814}$ **a = 998.071** **b = 0.814** **C = 6.053**

		Storage Required				
Time (min)	**Intensity (mm/hr)**	**Controlled Runoff** (L/s)**	**Storage Volume (m^3)**	**Controlled Release Rate (L/s)**	**Uncontrolled Runoff (L/s)**	**Total Release Rate (L/s)**
10	104.2	200.36	89.79	50.71	3.01	53.72
15	83.6	160.68	98.97	50.71	2.41	53.12
20	70.3	135.09	101.25	50.71	2.03	52.74
25	60.9	117.10	99.58	50.71	1.76	52.47
30	53.9	103.70	95.38	50.71	1.56	52.27
35	48.5	93.30	89.43	50.71	1.40	52.11
40	44.2	84.96	82.21	50.71	1.27	51.99
45	40.6	78.13	74.02	50.71	1.17	51.88
50	37.7	72.41	65.08	50.71	1.09	51.80
60	32.9	63.35	45.49	50.71	0.95	51.66
70	29.4	56.48	24.23	50.71	0.85	51.56
80	26.6	51.08	1.76	50.71	0.77	51.48
90	24.3	46.71	0.00	50.71	0.70	51.41
100	22.4	43.09	0.00	50.71	0.65	51.36
110	20.8	40.04	0.00	50.71	0.60	51.31
120	19.5	37.44	0.00	50.71	0.56	51.27

Onsite Stormwater Retention

Total Storage Required =	**101.25**	**m^3**	
Pipe Storage =	21.14	m^3	refer to Storm Sewer Design Sheet
CB/MH Storage =	18.87	m^3	refer to Storm Sewer Design Sheet
Stormtech Chambers =	34.00	m^3	refer to LRL Plan C.301
Surface Ponding =	156.68	m^3	refer to LRL Plan C.301
Total Available Storage =	**230.68**	**m^3**	

LRL File No.	170757
Project:	Commercial Site Development
Location:	1850 Walkley Road, Ottawa, Ontario
Date:	November 19, 2019
Designed:	M. Longtin
Checked:	V. Johnson
Drawing Ref.:	C401 Rev.01

Stormwater Management Design Sheet

STORM - 100 YEAR

Runoff Equation

Q = 2.78CIA (L/s)
C = Runoff coefficient
I = Rainfall intensity (mm/hr) = A / (Td + C)^{B}
A = Area (ha)
T_c = Time of concentration (min)

Pre-Devlopment Catchments within Development Area

	Total Area =	**0.742**	ha	**∑R=**	**0.20**
Un-Controlled	EWS-01	0.742	ha	R=	0.20
	Total Uncontrolled =	**0.742**	**ha**	**∑R=**	**0.20**

Allowable Release Rate

5 Year Pre-Development Flow Rate

I_5 = 998.071 / (Td + 6.053)$^{0.814}$ **a = 998.071** **b = 0.814** **C = 6.053**

C =	0.25	max of 0.5 as per City of Ottawa
I =	104.2	mm/hr
Tc =	10	min
Total =	0.742	ha
Allowable Release Rate=	**53.72**	L/s

Post-development Stormwater Management

					$\sum R_5$	$\sum R_{100}$
	Total Site Area =	**0.000**	ha	**∑R=**	**#DIV/0!**	**#DIV/0!**
Controlled	WS-01	0.040	ha	R=	0.90	1.00
	WS-02	0.028	ha	R=	0.90	1.00
	WS-03	0.089	ha	R=	0.85	1.00
	WS-04	0.025	ha	R=	0.90	1.00
	WS-05	0.102	ha	R=	0.81	1.00
	WS-06	0.103	ha	R=	0.82	1.00
	WS-07	0.036	ha	R=	0.63	0.78
	WS-08	0.052	ha	R=	0.90	1.00
	WS-09	0.077	ha	R=	0.81	1.00
	WS-10	0.033	ha	R=	0.90	1.00
	WS-11	0.115	ha	R=	0.90	1.00
	Total Contolled =	**0.700**	**ha**	**∑R=**	**0.84**	**0.99**
Un-Controlled	WS-12	0.004	ha	R=	0.20	0.25
	WS-13	0.008	ha	R=	0.20	0.25
	WS-14	0.030	ha	R=	0.20	0.25
	Total Un-Contolled =	**0.042**	**ha**	**∑R=**	**0.20**	**0.25**

Post-development Stormwater Management

I_{100} = 1735.688 / (Td + 6.014)$^{0.820}$ **a = 1735.688** **b = 0.82** **C = 6.014**

		Storage Required				
Time (min)	**Intensity (mm/hr)**	**Controlled Runoff** (L/s)**	**Storage Volume (m^3)**	**Controlled Release Rate (L/s)**	**Uncontrolled Runoff (L/s)**	**Total Release Rate (L/s)**
10	178.6	343.36	176.88	48.57	5.15	53.72
15	142.9	274.78	203.59	48.57	4.12	52.69
20	120.0	230.66	218.51	48.57	3.46	52.03
25	103.8	199.69	226.69	48.57	3.00	51.56
30	91.9	176.66	230.57	48.57	2.65	51.22
35	82.6	158.80	231.48	48.57	2.38	50.95
40	75.1	144.50	230.24	48.57	2.17	50.73
45	69.1	132.78	227.38	48.57	1.99	50.56
50	64.0	122.98	223.24	48.57	1.84	50.41
60	55.9	107.48	212.10	48.57	1.61	50.18
70	49.8	95.74	198.14	48.57	1.44	50.00
80	45.0	86.52	182.16	48.57	1.30	49.86
90	41.1	79.05	164.64	48.57	1.19	49.75
100	37.9	72.89	145.92	48.57	1.09	49.66
110	35.2	67.69	126.23	48.57	1.02	49.58
120	32.9	63.26	105.76	48.57	0.95	49.52

ECHELON ENVIRONMENTAL
505 Hood Road Unit 26 Markham ON L3R 5V6
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March 07, 2018

LRL Associates Ltd.
5430 Canotek Road
Ottawa, ON
K1J 9G2

Attention: Mr. Guillaume Brunet P.Eng.

RE: CDS Unit for 1850 Walkley Road, Ottawa

Site Specific Data

The proposed CDS design is based on site-specific data provided by LRL Associates Ltd. The following table provides a summary of the hydrologic parameters specific to the application:

Total Drainage Area (ha):	0.7415
Site Imperviousness:	79%
Time of Concentration, t_c (min):	10
Particle Size Distribution:	FINE
Level of Protection Required:	Enhanced (MOE Level 1)
Estimated Peak Flowrate, Q_{100}:	53.68 L/s (100yr)

Selected CDS Model

The selected CDS model and its standard capacities are summarized in the table below:

CDS Model:	PMSU2020_5
Sump Capacity (L):	1.668
Total Holding Capacity (L):	3.149
Oil Capacity (L):	376

Att: A) CDS TSS Calculations
B) CDS General Cut Sheet Drawings
C) MOE NETE Approval Certificate

Appendix A

CDS TSS Calculations

CDS Average Annual Efficiency For TSS Removal & Total Annual Volume Treated

Area =	0.74	ha	**Upstream Storage:**			**Engineer:**	**LRL Associates Ltd.**
Impervious:	79	%	Storage	226	m^3	**Contact:**	Guillaume Brunet, P.Eng
CDS Model:	PMSU2020_5					**Date:**	7-Mar-18
Flowrate:	31	l/s					
IDF Data:	Ottawa					**Project:**	1850 Walkley Road
PSD:	FINE					**Location:**	Ottawa, ON
						OGS ID:	CDS

Return	Period	Peak Flow	TSS Percentage Captured	Treated Flow Volume	Total Flow Volume	Annual Exceedance Probability	System Flow	CDS Flow	By-Pass Flow	Volume Percentage Treated
month / yr	Yr	l/s	%	litres	litres	%	l/s	l/s	l/s	%
1-M	0.08	4.94	95.71	4910	4910	**100.00**	4.94	4.94	0.00	100.00
2-M	0.17	11.02	91.99	11087	11087	**99.75**	11.02	11.02	0.00	100.00
3-M	0.25	15.93	88.97	16246	16246	**98.17**	15.93	15.93	0.00	100.00
4-M	0.33	20.37	86.25	20978	20978	**95.04**	20.37	20.37	0.00	100.00
5-M	0.42	23.81	84.13	24686	24686	**90.91**	23.81	23.81	0.00	100.00
6-M	0.50	27.24	82.02	28394	28394	**86.47**	27.24	27.24	0.00	100.00
7-M	0.58	29.80	80.18	30991	31225	**82.01**	29.80	29.80	0.00	99.37
8-M	0.67	32.36	78.34	33588	34056	**77.67**	32.36	31.15	1.21	98.73
9-M	0.75	34.93	76.49	36184	36886	**73.64**	34.93	31.15	3.78	98.10
10-M	0.83	36.94	74.60	37614	39154	**69.90**	36.94	31.15	5.79	96.28
11-M	0.92	38.94	72.71	39044	41422	**66.40**	38.94	31.15	7.79	94.46
1-Yr	1	40.95	70.82	40473	43689	**63.21**	40.95	31.15	9.80	92.64
2-Yr	2	57.53	57.12	48117	62692	**39.35**	57.53	31.15	26.38	76.75
5-Yr	5	88.36	40.87	56157	100892	**18.13**	88.36	31.15	57.21	55.66
10-Yr	10	110.35	33.85	60477	130669	**9.52**	110.35	31.15	79.20	46.28
25-Yr	25	134.34	28.42	64779	166272	**3.92**	134.34	31.15	103.19	38.96
50-Yr	50	158.47	24.37	68918	205751	**1.98**	158.47	31.15	127.32	33.50
100-Yr	100	176.66	21.91	72065	238965	**1.00**	176.66	31.15	145.51	30.16

Average Annual TSS Removal Efficiency [%]: **80.1** Ave. Ann. T. Volume [%]: **96.3**

Notes:

1) CDS Efficiency based on testing conducted at the University of Central Florida

2) CDS design flowrate and scaling based on standard manufacturer model & product specificiations

ECHELON ENVIRONMENTAL

CDS TECHNOLOGIES

CDS Stormwater Treatment Unit Performance

Table 1. Fine Particle Size Distribution (PSD)

Particle Size (µm)	% of Particle Mass
< 20	20
20 – 40	10
40 – 60	10
60 – 130	20
130 – 400	20
400 – 2000	20

Removal Efficiencies – CDS Unit Testing Under Various Flow Rates

The following performance curves are based on controlled tests using a full scale CDS Model PMSU20_20 (2400 micron screen), 1.1-cfs (494-gpm) capacity treatment unit.

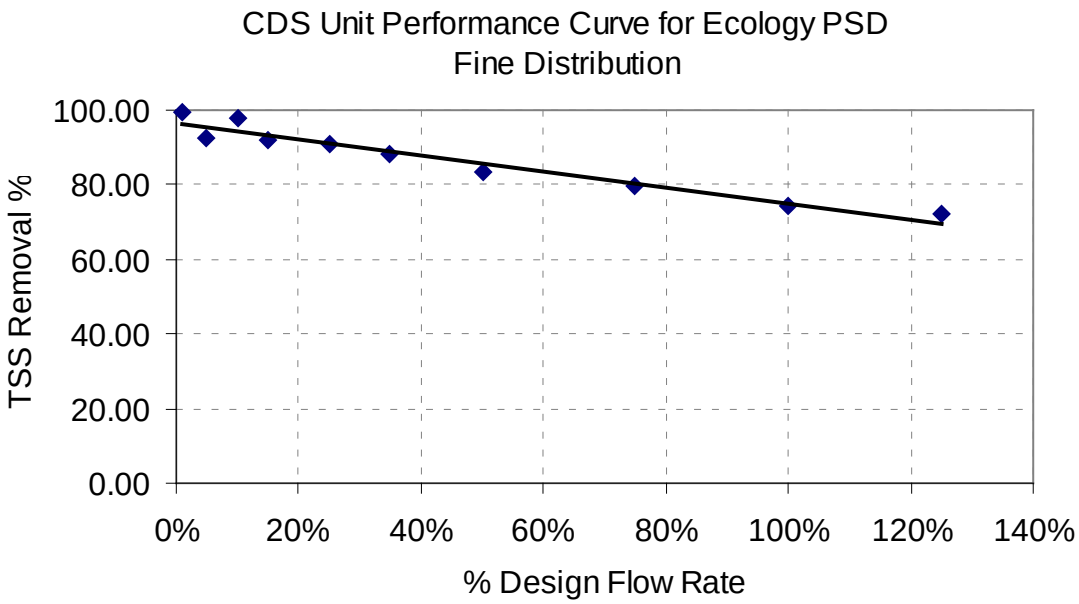

Figure 1. CDS Unit Performance for Fine PSD

CDS Unit Performance Testing Protocol

Tests were conducted using two types of sand – U.S. Silica OK-110 and UF sediment (a mixture of U.S. Silica sands). Particle size gradations for the two types of sand are illustrated in Figure 2.

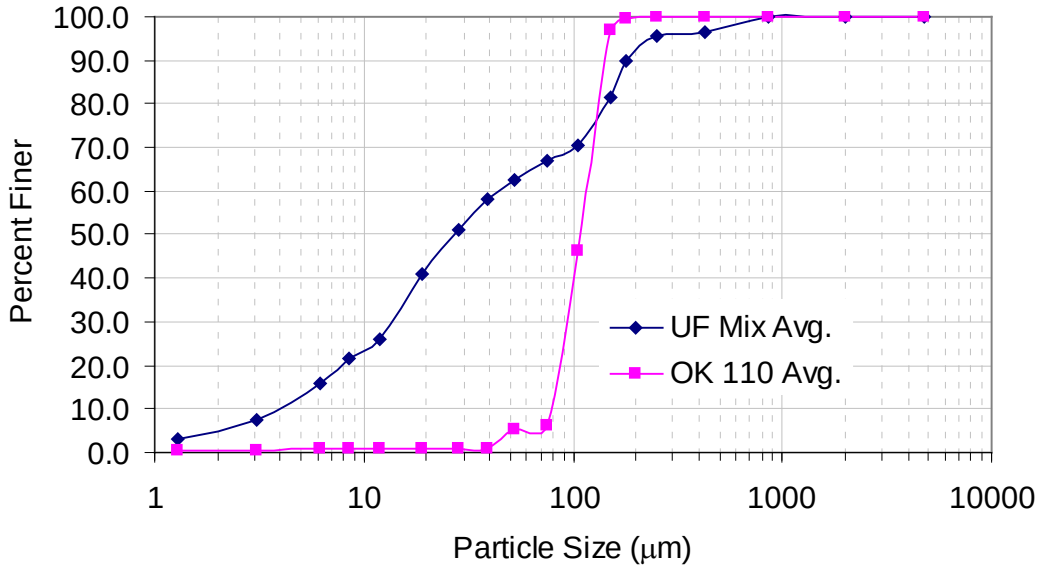

Figure 2. Test material particle size gradations - CDS Model PMSU20_20 test
(Analytical results provided by MACTEC Engineering and Consulting Inc. FL
ASTM D-422 with Hydrometer method)

The influent concentration (mg/L) for the test was set at 200-mg/L and verified from slurry feeding. Effluent samples were taken at fixed time intervals during each test run at various flow rates. The composite effluent samples were sent to Test American Analytical Testing Lab, OR for TSS analysis (ASTM D3977-97).

TSS removal rates for the specified PSD (d_{50} of 90 μm) under various flow rates were calculated from Figure 2 shows the removal efficiency as a function of operating flow rate. This removal efficiency curve as a function of percent flow rate can be applied to all CDS unit models.

Appendix B

CDS General Cut Sheet Drawings

Echelon Environmental 505 Hood Road, Unit 26, Markham, Ontario L3R 5V6 Tel: (905) 948-0000 Fax: (905) 948-0577

APPPENDIX E

Engineering Drawings