FUNCTIONAL SERVICING &
PRELIMINARY STORMWATER MANAGEMENT REPORT
FOR
1854 & 1858 LIVERPOOL ROAD

CITY OF PICKERING

October 2019

Ref No.: 19550

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Topographic Survey prepared by Omari Mwinyi Surveying Ltd. dated October 29, 2018

Drawing No. 101 – Preliminary Site Servicing Plan
Drawing No. 102 – Preliminary Site Grading Plan

Reference:

"Mixed-Use Development at 1294 Kingston Road & 1848-1852 Liverpool Road - Functional Servicing and Stormwater Management Report" prepared by Stantec, dated May 22, 2019.

1.0 INTRODUCTION

Politis Engineering Ltd. has been retained by Liverpool Estates to prepare a functional servicing and preliminary stormwater management report in support of the proposed residential development located at 1854 and 1858 Liverpool Road in the City of Pickering.

2.0 SITE DESCRIPTION

The subject site is 2993 square meters or 0.30 hectares in area and is located on the west side of Liverpool Road just north of Kingston Road as shown in **Figure 1**. It is made up of Lots 24 and 25, Registered Plan 492. The property is occupied by a two 1 storey houses, both with pitched roofs and one having a paved front parking area and driveway and the other a gravel driveway, as well as a number of sheds in their rear yards.

Figure 1 – Key Plan (Not to Scale)

The intention is to demolish the existing houses to re-develop the property and construct a 13-story apartment condominium building with ground floor commercial and amenity space.

3.0 EXISTING TOPOGRAPHY

The topographic survey shows that the property is relatively flat along the Liverpool road frontage with the existing city sidewalk ranging in elevation between 89.57 at the south and 89.38 at the north. However the property does slope overall to the west except for the area close to Liverpool Road where surface drainage is intercepted by three 300 mm CSP culverts that convey storm runoff to the existing storm sewer system on Liverpool Road . The topographical relief ranges from

89.57 to 88.30 near the north west corner, a difference of 1.27 m. Currently the north and south boundaries are directing a small portion of surface drainage to Liverpool Road with the balance directed to the west.

4.0 EXISTING MUNICIPAL INFRASTRUCTURE

Figure 2 shows the existing municipal infrastructure in front of the subject property on Liverpool Road:

- 375 and 450 mm storm sewers with a depth of about 2.5 m
- 250 mm sanitary sewer with a depth of 4.3 m
- 200 mm watermain

There are 2 sanitary and 2 water service connections that serve the 2 existing dwellings that will need to be abandoned to the satisfaction of the Region of Durham.

5.0 PROPOSED GRADING

The proposed grading will provide for a positive emergency overland flow route to Liverpool Road. A small portion of the property will continue to drain to the west as existing grades along the north and south boundary are taken into account and respected. There will be a need for some retaining walls and embankments in order to achieve positive drainage patterns that will provide safe conveyance of storm runoff.

6.0 STORMWATER MANAGEMENT

There are 3 criteria that need to be meet:

1. Water Quantity Control Criteria - requires that post-development peak flows are controlled to pre-development levels for the 2 year through 100 year events.

2. In-Stream Erosion Control:

   For small infill sites and site plans less than 5 hectares the minimum erosion control requirements are:
   - extended detention of the 4 hour, 25 mm Chicago distribution rainfall event for a minimum of 24 hours, or
   - runoff reduction from the site through infiltration, evapotranspiration and reuse of a minimum 5mm of rainfall depth across all impervious surfaces.

3. Water Qualtity Control Criteria - development must provide water quality control measures designed to provide Enhanced (Level 1) water quality control as defined by the MOE Design Manual.

6.1 Water Quantity Control

6.1.1 Pre-Development Peak Flows

The pre-development storm drainage plan for is shown in **Figure 3**.

The pre-development topographical conditions result in split drainage with surface runoff being directed to the front and rear of the property. Liverpool Road is urbanized with sidewalks, curb and gutter and a storm sewer system.

The pre-development composite runoff coefficient for drainage directed to Liverpool Road is:

Table 1 - Pre-Development Composite Runoff Coefficient - Liverpool Road			
Description	Area (A) (sq.m.)	Runoff Coeff. (C)	C x A
Roof	47.1	0.95	44.745
Landscaped Area	765.6	0.25	191.4
Gravel Driveway	61.2	0.70	42.84
Paved/Concrete	196.6	0.95	186.77
Totals	1070.5		465.755
Composite Runoff Coefficient = 0.44			

Based on the City of Pickering IDF curves, the following are the pre-development peak flows to Liverpool Road:

Table 2 - Pre-Development Peak Flows to Liverpool Road									
Return Period	Pickering IDF Parameters			Intensity (mm/hour)	Composite C	Ca	C x Ca	Area (Ha)	Peak Flow (L/s)
	A	B	C						
2 Year	715.076	5.262	0.815	77.57	0.44	1.00	0.44	0.107	10.1
5 Year	1082.901	6.007	0.837	106.31	0.44	1.00	0.44	0.107	13.9
100 Year	2096.425	6.485	0.863	186.69	0.44	1.25	0.55	0.107	30.5

The pre-development composite runoff coefficient for drainage directed to the west is:

Table 3 - Pre-Development Composite Runoff Coefficient - To West			
Description	Area (A) (sq.m.)	Runoff Coeff. (C)	C x A
Roofs	157.4	0.95	149.53
Landscaped Area	1660.2	0.25	415.05
Conc. Pad/Stone Patio	21.7	0.70	15.19
Paved Driveway	62.1	0.95	58.995
Stone Patio/Walkway	21.1	0.95	20.045
Totals	1922.5		658.81
Composite Runoff Coefficient = 0.34			

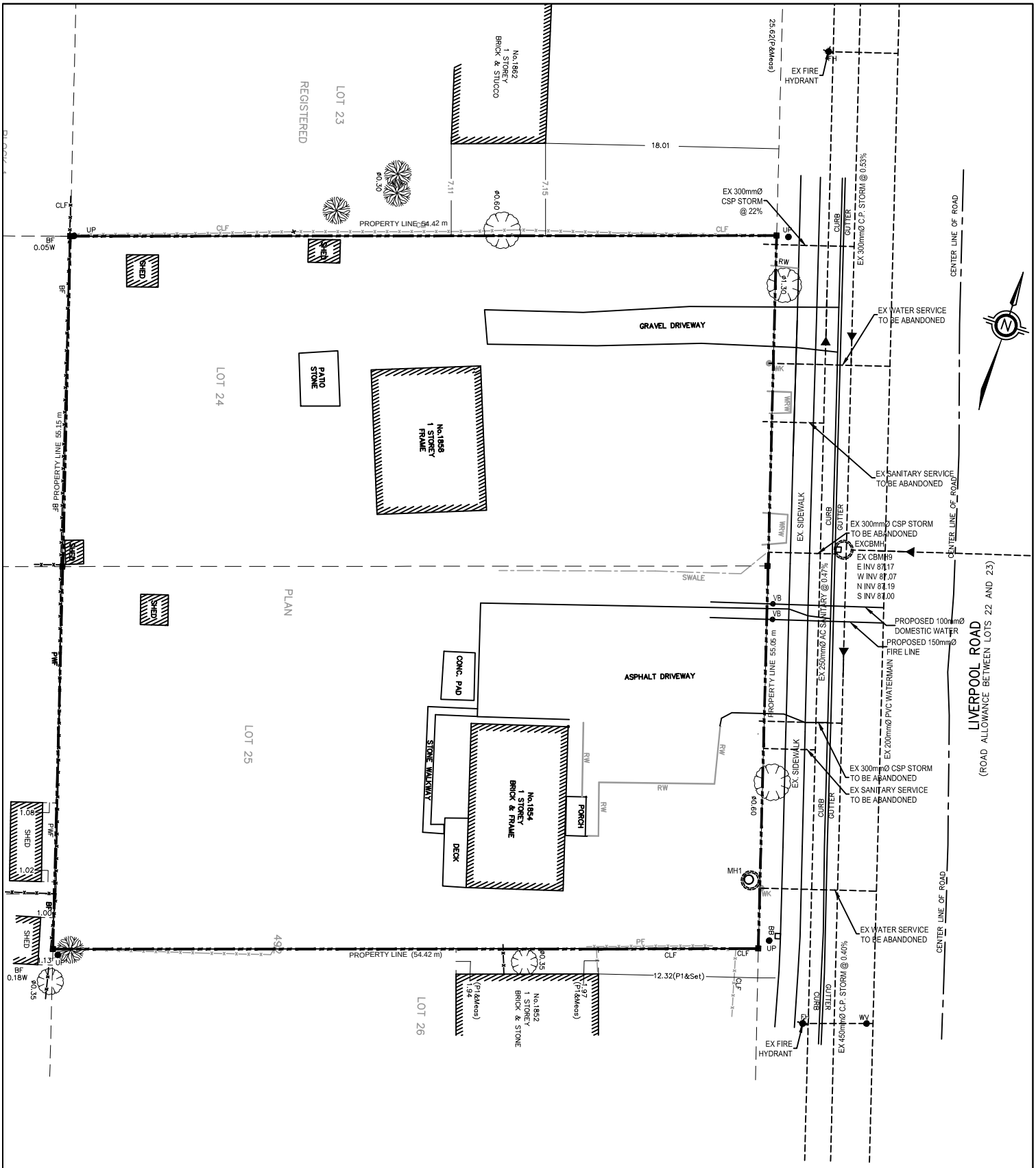


FIGURE 2 - EXISTING MUNICIPAL INFRASTRUCTURE (SCALE = 1:400)

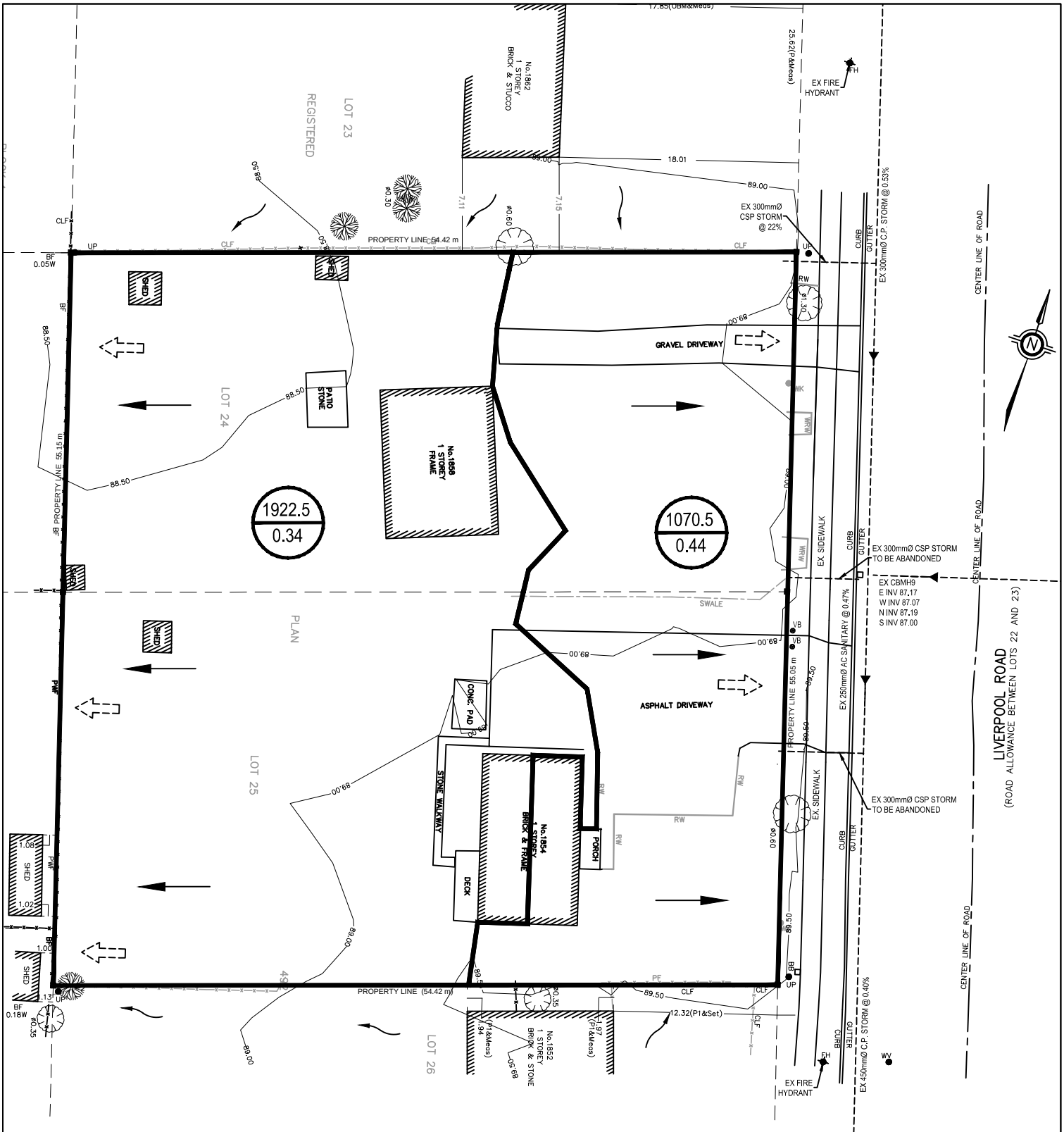


FIGURE 3 - PRE-DEVELOPMENT STORM DRAINAGE PLAN (SCALE = 1:400)

The pre-development peak flows are:

Table 4 - Pre-Development Peak Flows to West									
Return Period	Pickering IDF Parameters			Intensity (mm/hour)	Composite C	Ca	C x Ca	Area (Ha)	Peak Flow (L/s)
	A	B	C						
2 Year	715.076	5.262	0.815	77.57	0.34	1.00	0.34	0.192	14.1
5 Year	1082.901	6.007	0.837	106.31	0.34	1.00	0.34	0.192	19.3
100 Year	2096.425	6.485	0.863	186.69	0.34	1.25	0.43	0.192	42.3

6.2 Post Development Storm Drainage

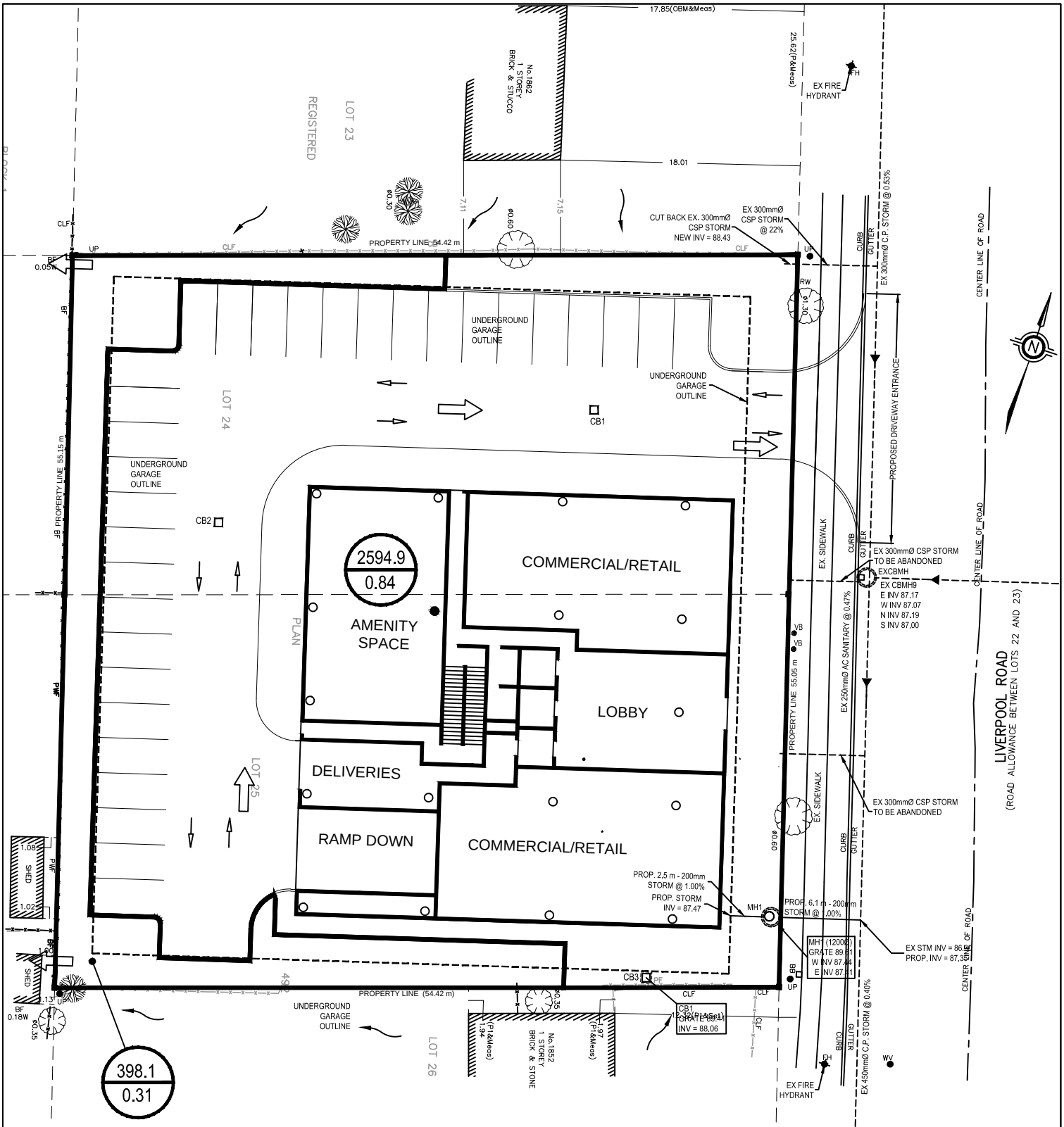
6.2.1 Peak Storm Flows

The proposed development includes the construction of a 13 storey condominium apartment building with a driveway and outdoor parking (**Appendix 1**). **Figure 4** is the post development drainage plan. Based on the proposed configuration, the post development runoff coefficients for the 2 drainage areas are calculated in **Tables 5** and **6**:

Table 5 - Post Development Composite Runoff Coefficient to West			
Description	Area (A) (sq.m.)	Runoff Coeff. (C)	C x A
Landscaped Area	362.7	0.25	90.675
Paved Area/Walkways	35.4	0.95	33.63
Totals	398.1		124.305
Composite Runoff Coefficient = 0.31			

Table 6 - Post Development Composite Runoff Coefficient to Liverpool Road Storm			
Description	Area (A) (sq.m.)	Runoff Coeff. (C)	C x A
Building	1034.0	0.95	982.3
Landscaped Area	396.1	0.25	99.025
Paved Area/Walkways	1164.8	0.95	1106.56
Totals	2594.9		2187.885
Composite Runoff Coefficient = 0.84			

Table 7 compares the post versus pre-development runoff directed to the west:



1070.5 / 0.44 — TRIBUTARY AREA (sq.m) / COMPOSITE RUNOFF COEFFICIENT

DIRECTION OF SURFACE DRAINAGE

STORM DRAINAGE BOUNDARY

OVERLAND FLOW DIRECTION

DIRECTION OF EXISTING SURFACE DRAINAGE

FIGURE 4 - POST DEVELOPMENT STORM DRAINAGE PLAN (SCALE = 1:400)

Table 7 - Post versus Pre-Development Peak Flows to West									
		Post Development					Pre		
Return Period	Intensity (mm/hour)	Composite C	Ca	C x Ca	Area (Ha)	Peak Flow (L/s)	Peak Flow (L/s)	Difference (L/s)	(%)
2 Year	77.57	0.31	1.00	0.31	0.040	2.7	14.1	-11.4	-81.1%
5 Year	106.31	0.31	1.00	0.31	0.040	3.7	19.3	-15.6	-81.0%
100 Year	186.69	0.31	1.25	0.39	0.040	8.0	42.3	-34.3	-81.0%

The post development peak flows to the west are reduced by 81.0% for all storm events.

The post development peak flows directed to the Liverpool Road and the required detention volumes are compared in **Table 8**. The required detention volumes are calculated in **Appendix 2.**

Table 8 - Comparison of Post to Pre Peak Flows and Temp. Det. Volume Required			
	Peak Flows		Detention
Storm Event	Pre (L/s)	Post (L/s)	Volume (cu.m.)
2	10.1	47.1	25.3
5	13.9	64.5	34.9
100	30.5	141.6	76.0

6.2.2 Storm Connection

A 150 mm storm connection is proposed to the existing 450 mm diameter storm sewer main. The capacity of the proposed connection laid at 1.0% is 15.9 L/s, which exceeds the 5 year allowable release rate (pre-development peak flow).

An inspection manhole will be provided near the property line.

6.2.3 Peak Flow Control

An orifice tube or vortex valve will be used to control the peak flow to the allowable discharge rate, subject to the detailed engineering design.

6.2.4 Temporary Detention Storage

Detention storage will be required to mitigate the peak flows controlled to the allowable release rate. The detention storage will be provided within an underground detention chamber and temporary surface storage within the driveway and parking area, subject to the detailed engineering design.

6.3 In-stream Erosion Control & Water Balance

For small infill sites and site plans less than 5 hectares the minimum erosion control requirements are:

- extended detention of the 4 hour, 25 mm Chicago distribution rainfall event for a minimum of 24 hours, or
- runoff reduction from the site through infiltration, evapotranspiration and reuse of a minimum 5mm of rainfall depth across all impervious surfaces.

The total impervious area of the site is 2,234.2 sq.m. and therefore a total volume of 11.2 cu.m. will need to be retained to meet the 5mm requirement.

Since the proposed development includes an underground parking structure that covers most of the site, use of infiltration techniques is not feasible, therefore other techniques will need to be considered and implemented. The following is a list of possible uses of retained storm runoff will be determined during the detailed engineering design:

- Irrigation for landscaped areas and terrace/ rooftop landscape features
- Provide green roofs
- Building mechanical systems which will be specified by the Mechanical Engineer at the detailed design stage (i.e. evaporative cooling)

6.4 Water Quality Control

6.4.1 Permanent Water Quality

The water quality control criteria requires that the development must provide water quality control measures designed to provide Enhanced (Level 1) water quality control as defined by the MOE Design Manual.

Runoff from the rooftop and landscaped areas, are considered to be clean and will not require treatment prior to being discharged from the site. Flows from paved areas will require treatment to meet the TSS removal criteria.

For the subject development, a "treatment train" approach will be taken which will ultimately include an oil/grit separator in order to meet the TSS removal criteria prior to discharge to the municipal storm sewer system, subject to the detailed design process.

6.4.2 Water Quality During Construction

Temporary erosion and sediment control will be required during the construction period. It would be prudent to make provisions to provide “good housekeeping” measures to mitigate the transportation of silt from the site during the construction phases. These measures include, but are not limited to the following:

- Provide silt fences around the perimeter of the site to reduce silt from leaving the site.

- Provide silt filters at catchbasins upon their installation to reduce the amount of silt entering the sewer system during construction.

- Use of a “mud mat” or temporary tracking control at the entrance of the site to minimize mud tracking from the site.

- Stabilize the site as soon as possible, that is, re-establish vegetative ground cover and avoid bare soil areas.

All the above erosion and siltation control measures should be monitored and maintained on a regular basis to ensure maximum benefit and minimum silt migration off-site and shall be in accordance with the GTA CA's Erosion & Sediment Control Guidelines for Urban Construction (2006).

7.0 SANITARY SEWER

There is an existing 250 mm diameter sanitary sewer on Liverpool Road in front of the subject property.

7.1 Pre-Development Sanitary Drainage

The subject property is occupied by 2 detached dwellings. The equivalent population based on 3.5 persons per detached dwelling is 7 P.

The daily average flow is 364 L per person per day and the peaking factor is 3.8 (maximum) based on the Harmon equation and the dry weather flow is:

Q = 7 x 364 x 3.8 = 9,682.4 litres per day or 0.112 litres per second

The infiltration allowance is 0.26 L/s per hectare of gross area:

Q = 0.26 L/s/Ha x 0.299 Ha = 0.078 L/s

The total pre-development sanitary flow = 0.112 + 0.078 = 0.190 L/s.

7.2 Post Development Sanitary Drainage

The proposed development is a 13 storey apartment condominium with a mix of units and ground floor commercial and amenity space.

Table 9 calculates the residential post development population based on the Region's design criteria.

TABLE 9 - POST DEVELOPMENT POPULATION CALCULATION

NO. UNITS	TYPE	POPULATION DENSITY	RESIDENTIAL POPULATION
RESIDENTIAL SUITES			
52	1 BR	1.5	78
42	2 BR	2.5	105
4	3 BR	3.5	14
98	TOTAL POPULATION =		197

The peaking factor is:

$$PF = 1 + (14/(4+(P/1000)^{1/2}) \text{ - Maximum } 3.8$$

where P = population in thousands

PF = 4.150 (therefore use 3.8)

Using a daily average flow of 364 L per person per day the dry weather flow is:

Q = 197 x 364 x 3.80 = 272,490.4 litres per day or 3.154 litres per second

The infiltration allowance is 0.26 L/s per hectare of gross area:

Q = 0.26 L/s/Ha x 0.299 Ha = 0.078 L/s

The total residential post development sanitary flow = 3.154 + 0.078 = 3.232 L/s.

There is a further 646.6 sq.m. of commercial and amenity space proposed on the ground floor. Considering the entire area is commercial space, the Region's design criteria of 18 L/sq.m./day including infiltration can be used and results in a 0.135 L/s contribution, or 3.367 L/s in total.

Therefore, the proposed development will increase the sanitary peak flow from the pre-development level by 3.177 L/s.

7.3 Available Sanitary Capacity

A sanitary sewer study was prepared for a new development at 1294 Kingston Road & 1848 to 1852 Liverpool Road by Stantec in May 2019. The report considered post development sanitary contribution from 1854 & 1858 Liverpool Road based on 30 - 1 bedroom and 35 - 2 bedroom units.

The population considered by Stantec for the subject development is 132.5 and therefore has underestimated the residential sanitary peak flow by 1.033 L/s. Adding the ground floor commercial contribution, the post development peak flow has been underestimated by 1.168 L/s.

Considering Stantec's "Scenario 3: Proposed (Including Potential Future Developments)" sanitary sewer analysis, the critical leg is between Glenanna Road between H6-0136 to H6-0137 where they are showing 74% of full flow capacity. Adding in the 1.168 L/s will raise this to 78% which is still acceptable.

Therefore, the existing downstream sanitary sewer system has the capacity to convey the proposed sanitary flows from the subject development as well as the development proposed at 1294 Kingston Road & 1848 to 1852 Liverpool Road.

7.4 Sanitary Sewer Connection

A 150 mm diameter sanitary connection from the existing main will provide a suitable outlet for the proposed development. Laid at 2%, the proposed service connection will have a capacity of 22.5 L/s.

An inspection manhole will be provided near the property line.

8.0 WATER SYSTEM

The Region of Durham does not have specific design criteria for residential domestic water systems, therefore the latest Ministry of the Environment, Climate Change and Parks criteria as well as the Fire Underwriter's Survey will be used.

8.1 Domestic Water Demand

For the residential portion of the building, the population was calculated to be 197. For the ground floor area space (646.6 sq.m.), using an equivalent population of 86 Persons/Ha yields 6 persons. Therefore for the purposes of domestic water demand, the total population is 203.

Assuming the average water demand is equal to the sanitary daily flow rate of 364 L/Person/day, the domestic average demand is 73,892 l/day or 51.3 L/minute.

8.2 Fire Flow Demand

The proposed building will be serviced by sprinklers and the construction will consist of fire resistive construction, that is, fully protected structural members and floors. Fire flow calculations based on the Fire Underwriter's Survey "Water Supply for Public Fire Protection" dated 1999 have determined the required fire flow is 5400 L/minute (see **Appendix 3**).

8.3 Total Water Demand

The required flow required is the greater of the maximum daily demand plus the fire flow or the peak hourly demand. In this case, the maximum daily demand plus fire flow is critical and based on a maximum day peaking factor of 1.65, the design flow is 5,485 L/minute.

The Stantec FSR included hydrant flow tests that were conducted by the Region of Durham which determined that the municipal water distribution system is capable of supplying 16,966 L/minute, which exceeds the required flow.

8.4 Water Connection

Separate domestic and fire line connections will be provided (subject to detailed engineering design) with a shutoffs located within the city boulevard to the Region's approval. Appropriate check valves and meters are to be provided and located within a meter room acceptable to the Region.

A Siamese or Fire connection will be provided and will need to be within 45 m of a hydrant.

9.0 SUMMARY

The area of the site is 2993 square meters or 0.30 hectares.

The intention is to demolish the 2 existing houses and construct a 13 storey condominium apartment building.

The existing topographic condition has most of the surface drainage being directed to the rear (west) with a portion of the drainage directed to Liverpool Road.

There is existing storm, sanitary and water mains on Liverpool Road.

The proposed grading will provide for a positive emergency overland flow route to Liverpool Road. A small portion of the property will continue to drain to the west as existing grades along the north and south boundary are taken into account and respected.

The proposed development and grading will result in a reduction in drainage directed to the rear by 81.0%.

The remainder of the site will be drained by a storm system that will control the peak flows to the pre-development levels. Detention storage will be provided in an underground detention storage and on the surface of the driveway and surface parking area.

An orifice tube or vortex valve will be used to control the peak flow to the allowable discharge rate, subject to the detailed engineering design.

In order to provide in-stream erosion control and water balance, 5 mm of rainfall is to be retained on site which is 11.2 cubic meters. Green roofs can be provided to retain storm runoff. The retained water can be reused for irrigation for landscaped areas and rooftop landscape features and/or for building mechanical systems which will be specified by the Mechanical Engineer at the detailed design stage.

In order to meet the water quality criteria, an oil/grit separator will be required as part of a treatment train approach which will be part of the detailed design stage.

Due to the very nature of construction and development, the potential for erosion and migration of sediment from the site is increased dramatically. By implementing “good housekeeping” measures such as providing silt fences around the perimeter of the site, silt filters at catchbasins, temporary tracking control at the construction vehicle entrance to the site, rock check dams with filter cloth in any temporary drainage swale, and stabilizing the site as soon as possible, the potential for erosion and sediment migration can be minimized. and shall be in accordance with the GTA CA's Erosion & Sediment Control Guidelines for Urban Construction (2006).

The existing 250 mm sanitary sewer main on Liverpool Road will provide an outlet for the new development. The proposed sanitary peak flow of 3.367 L/s.

A 150 mm diameter sanitary connection laid at 2% will be capable of conveying the proposed flows and an inspection manhole will be provided near the property line.

The proposed building will be equipped with sprinklers and the existing 200 mm watermain and distribution system on Liverpool Road can provide the required water demand including fire flow.

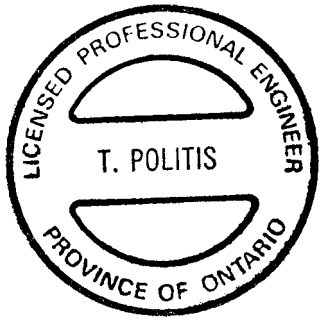
Separate domestic and fire lines will be provided. A Siamese or Fire Connection will be required and can be located to be within 45 m of the 2 existing adjacent fire hydrants.

Water meters and backflow prevention will be provided within a meter room to the satisfaction of the Region of Durham.

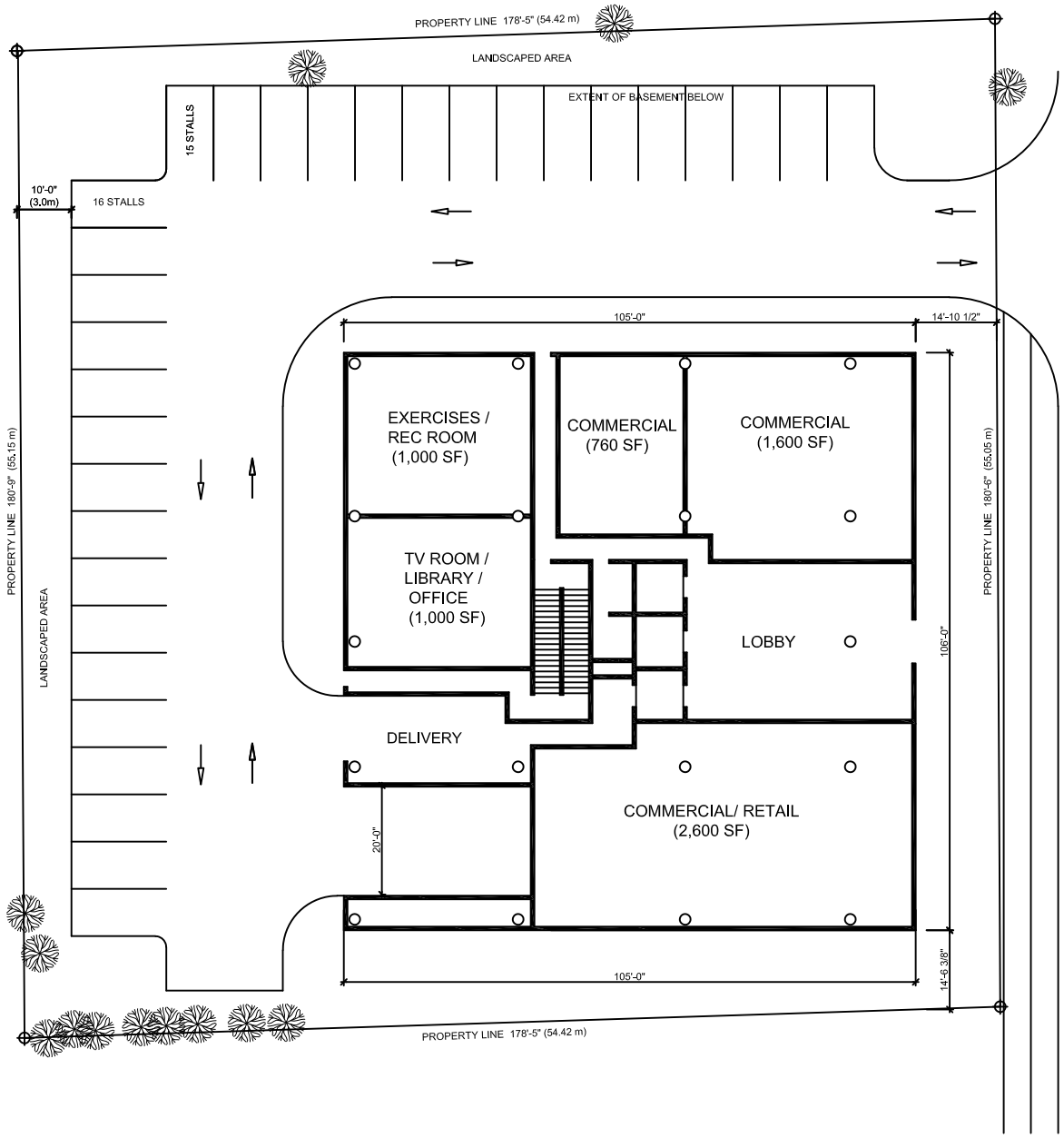
Respectfully submitted

Politis Engineering Ltd.

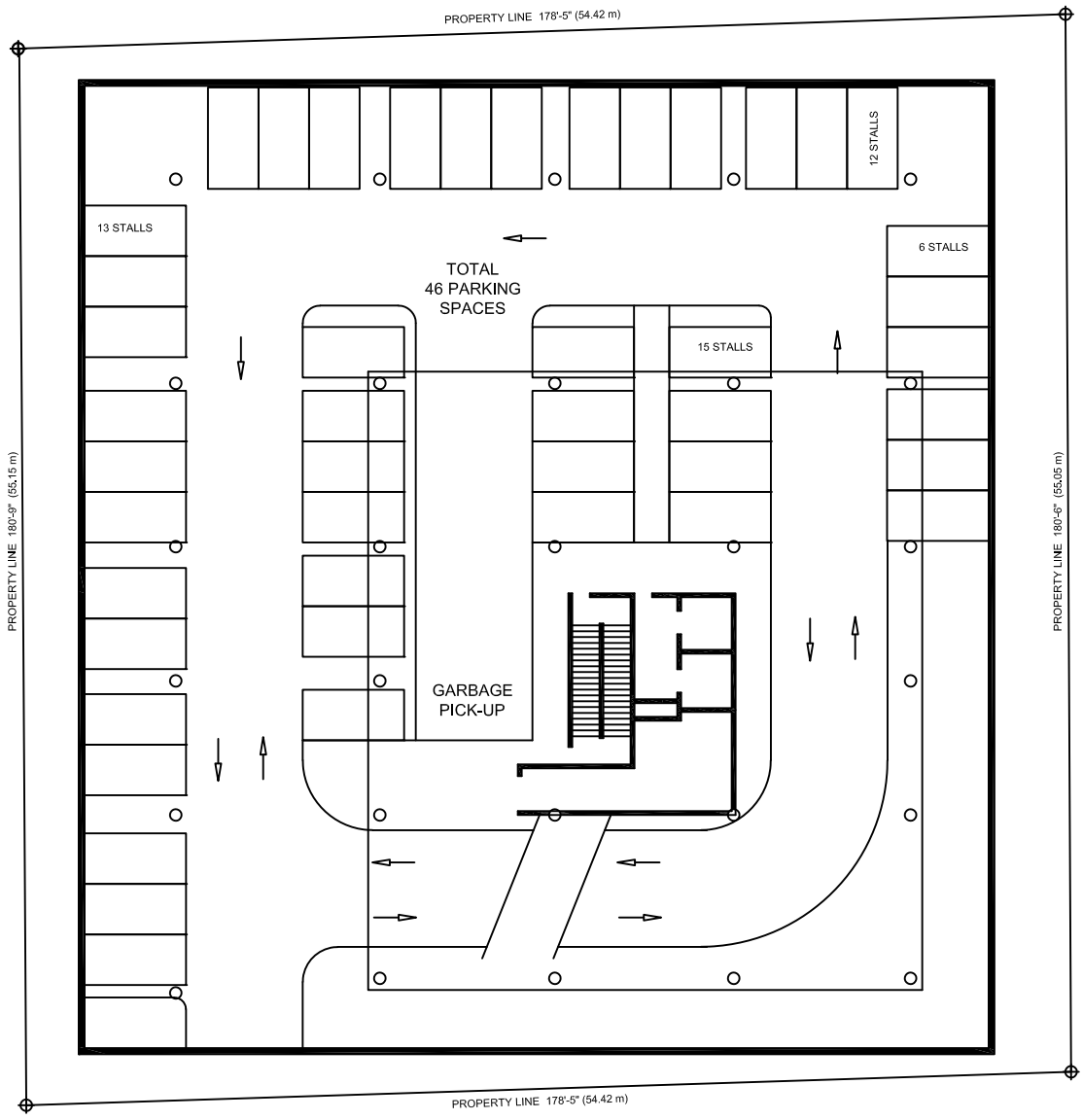
Per: Tim Politis, P.Eng.



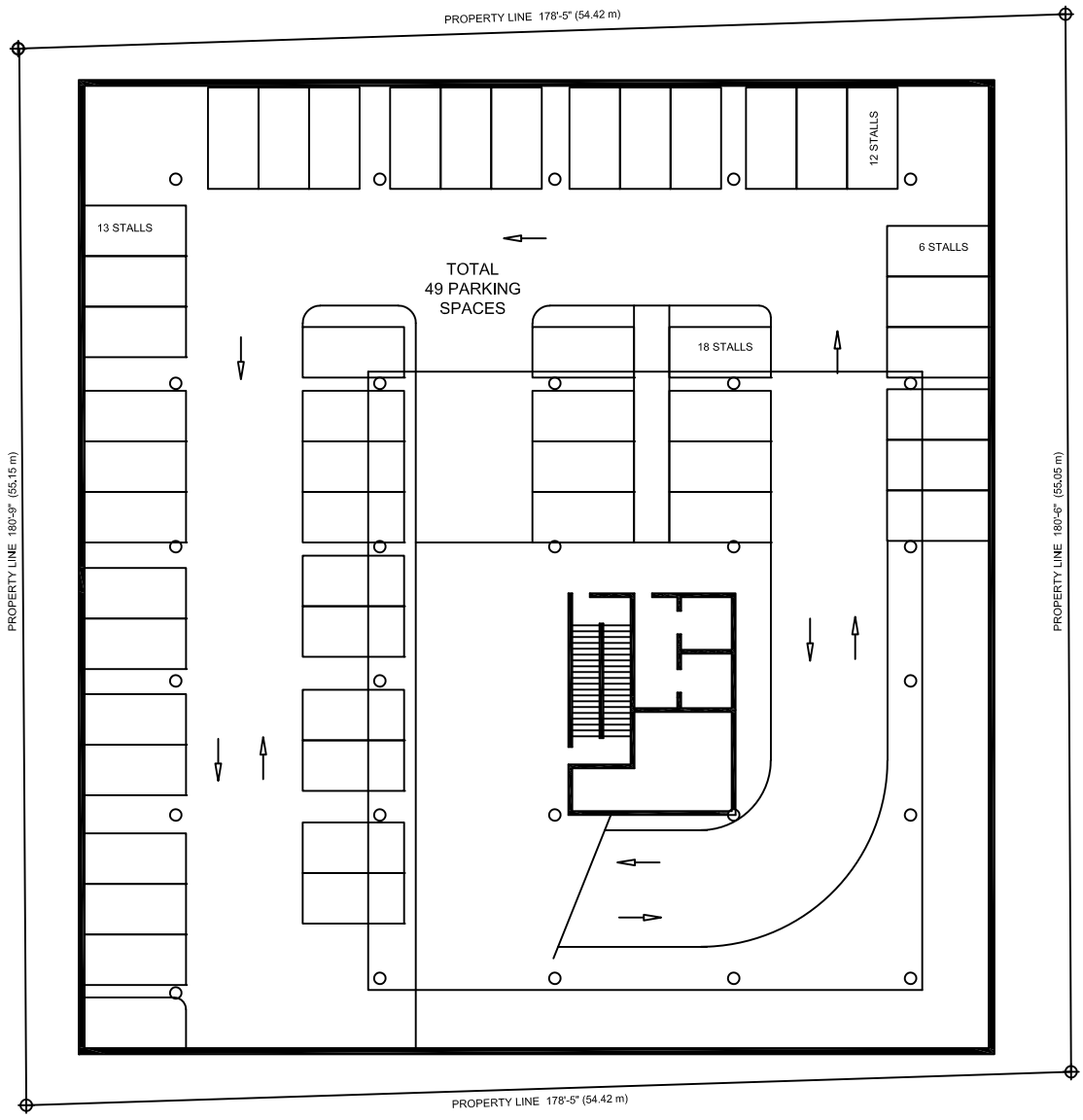
APPENDIX 1



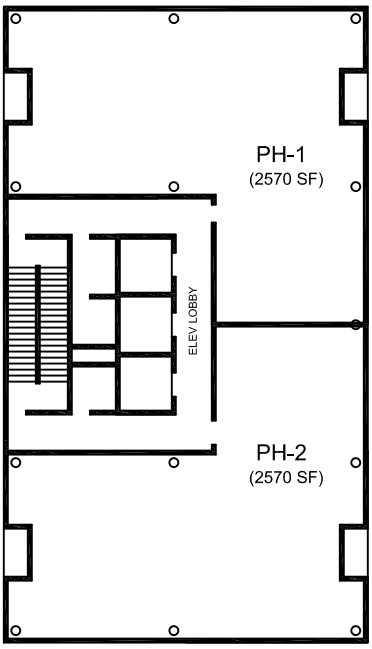
EMILIO DE LEON, ARCHITECT 25 BAYSIDE GATE, WHITBY 416 371 7588 edeleon@bimeb.ca www.bimeb.ca	PROPOSED 13-STOREY APARTMENT - LIVERPOOL ROAD, PICKERING	SHEET NO.
	GROUND FLOOR PLAN SCALE: 1/32" = 1'-0	A-1



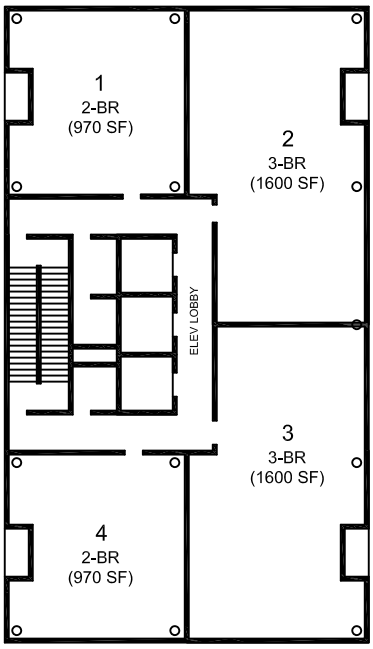
EMILIO DE LEON, ARCHITECT 25 BAYSIDE GATE, WHITBY 416 371 7588 edeleon@bimeb.ca www.bimeb.ca	PROPOSED 13-STOREY APARTMENT - LIVERPOOL ROAD, PICKERING	SHEET NO.
	FLOOR PLAN - BASEMENT LEVEL 1 SCALE: 1/32" = 1'-0	A-2



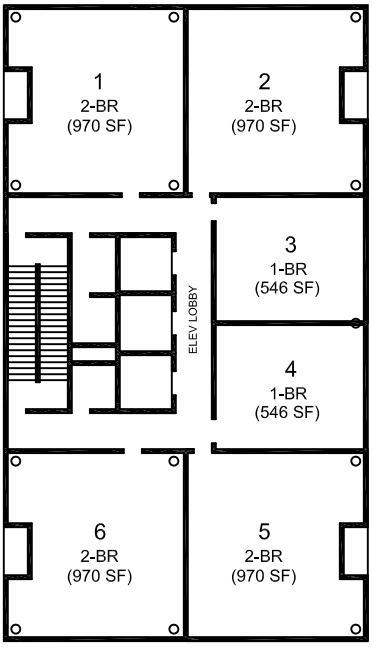
EMILIO DE LEON, ARCHITECT 25 BAYSIDE GATE, WHITBY 416 371 7588 edeleon@bimeb.ca www.bimeb.ca	PROPOSED 13-STOREY APARTMENT - LIVERPOOL ROAD, PICKERING	SHEET NO.
	FLOOR PLAN - BASEMENT LEVEL 2 SCALE: 1/32" = 1'-0	A-3



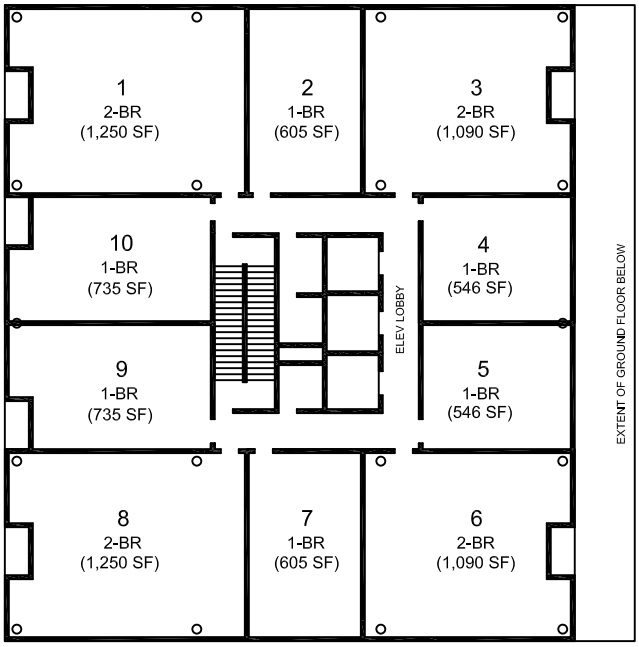
LEVEL 13 PENTHOUSE (2 UNITS)
GROSS AREA = 6,430 SF



LEVEL 12 (4 UNITS)
GROSS AREA = 6,430 SF

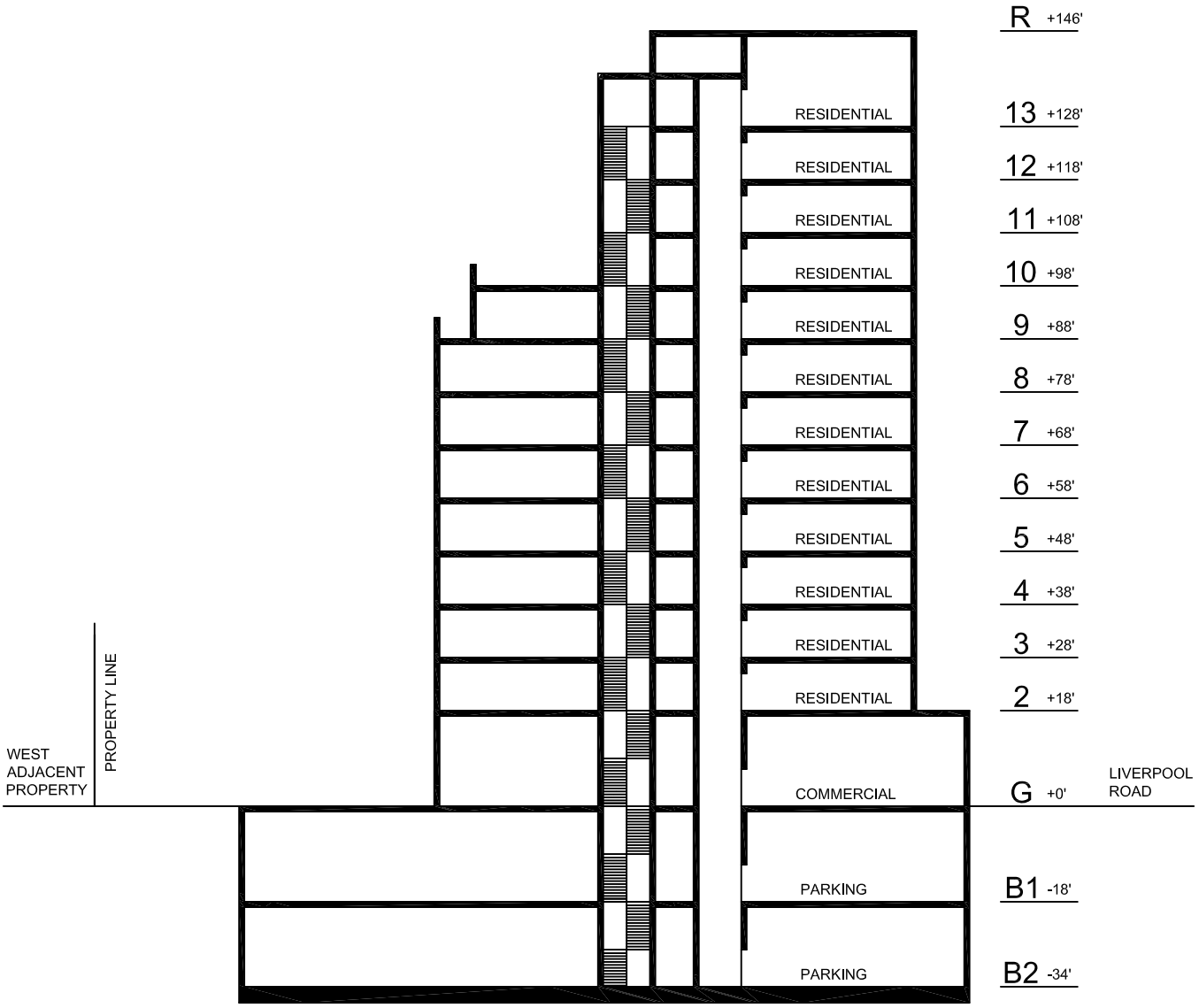


LEVELS 10 & 11 (6 X 2 = 12 UNITS)
GROSS AREA = 6,430 SF

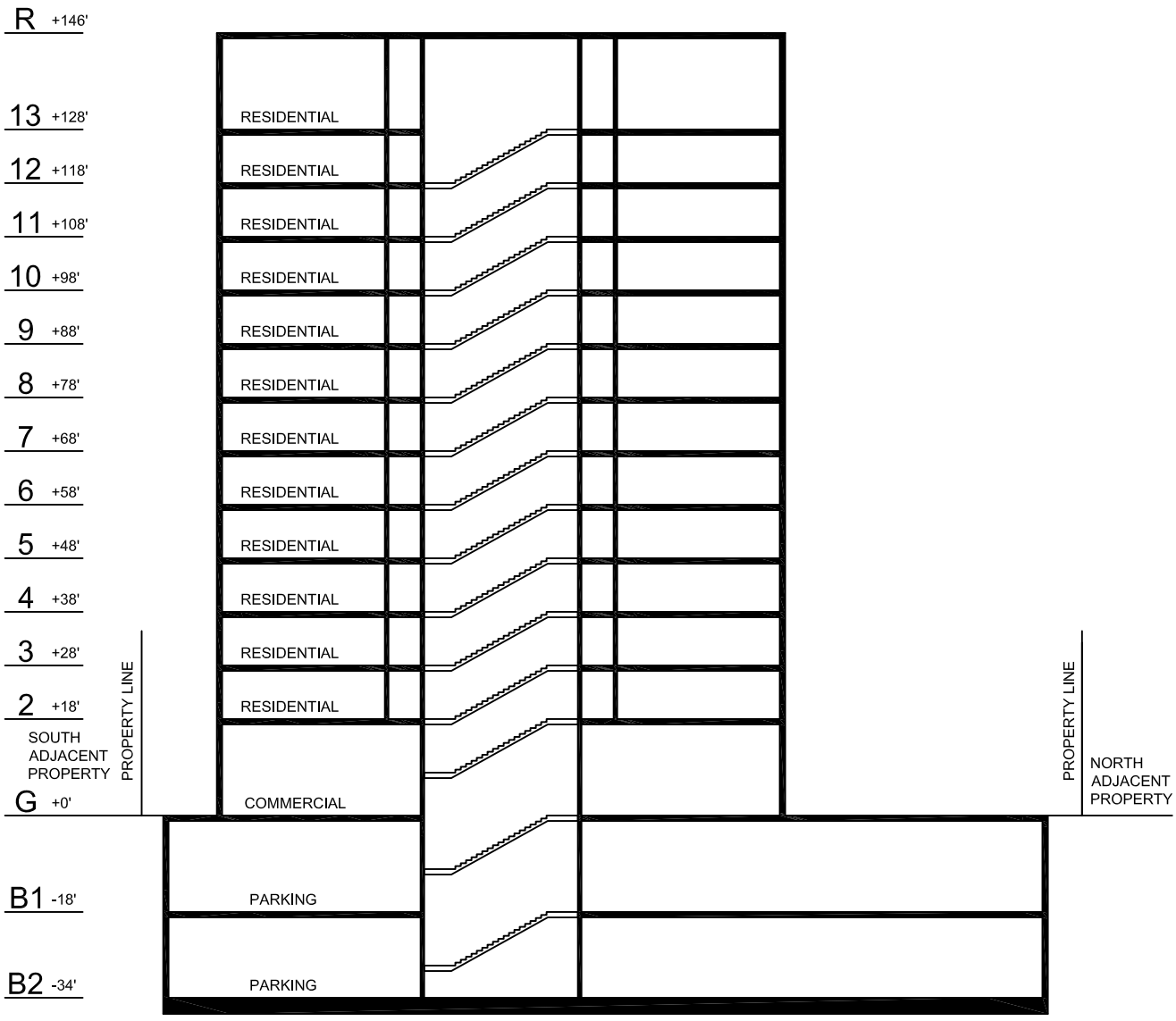


LEVELS 2 TO 9 (10 X 8 = 80 UNITS)
GROSS AREA = 10,070 SF (935 SM)

EMILIO DE LEON, ARCHITECT 25 BAYSIDE GATE, WHITBY 416 371 7588 edeleon@bimeb.ca www.bimeb.ca	PROPOSED 13-STOREY APARTMENT - LIVERPOOL ROAD, PICKERING	SHEET NO.
	FLOOR PLANS SCALE: 1/32" = 1'-0	A-4



EMILIO DE LEON, ARCHITECT 25 BAYSIDE GATE, WHITBY 416 371 7588 edeleon@bimeb.ca www.bimeb.ca	PROPOSED 13-STOREY APARTMENT - LIVERPOOL ROAD, PICKERING	SHEET NO.
	BUILDING SECTION (EAST-WEST) SCALE: 1/32" = 1'-0	A-5



EMILIO DE LEON, ARCHITECT

25 BAYSIDE GATE, WHITBY
416 371 7588
edeleon@bimeb.ca
www.bimeb.ca

PROPOSED 13-STOREY APARTMENT - LIVERPOOL ROAD, PICKERING

SHEET NO.

BUILDING SECTION (NORTH-SOUTH)

SCALE: 1/32" = 1'-0

A-6

APPENDIX 2

2 YEAR STORAGE REQUIREMENTS UPSTREAM OF ORIFICE

TRIBUTARY AREA DATA
AREA (ha) = 0.260
C = 0.840
Ca = 1.00

ALLOWABLE DISCHARGE RATE (m3/s) = 0.0101

RAINFALL INTENSITY

I = A/(T+B) ^ C

Where 715.076
5.262
0.815

REQUIRED STORAGE VOLUME (m3) = 25.3

TIME (min)	INTENSITY (mm/hr)	PEAK FLOW (m3/s)	RUNOFF VOLUME (m3/s)	DISCHARGE VOLUME (m3/s)	STORAGE VOLUME (m3)
10.0	77.57	0.047	28.2	6.1	22.1
11.0	73.66	0.045	29.4	6.7	22.8
12.0	70.17	0.042	30.6	7.3	23.3
13.0	67.02	0.041	31.7	7.9	23.8
14.0	64.17	0.039	32.6	8.5	24.2
15.0	61.58	0.037	33.6	9.1	24.5
16.0	59.20	0.036	34.4	9.7	24.7
17.0	57.03	0.035	35.2	10.3	24.9
18.0	55.02	0.033	36.0	10.9	25.1
19.0	53.17	0.032	36.7	11.5	25.2
20.0	51.44	0.031	37.4	12.1	25.3
21.0	49.84	0.030	38.0	12.7	25.3
22.0	48.35	0.029	38.6	13.3	25.3
23.0	46.95	0.028	39.2	13.9	25.3
24.0	45.64	0.028	39.8	14.5	25.2
25.0	44.40	0.027	40.3	15.2	25.2
26.0	43.24	0.026	40.8	15.8	25.1
27.0	42.15	0.026	41.3	16.4	25.0
28.0	41.11	0.025	41.8	17.0	24.9

5 YEAR STORAGE REQUIREMENTS UPSTREAM OF ORIFICE

TRIBUTARY AREA DATA
AREA (ha) = 0.260
C = 0.840
Ca = 1.00

ALLOWABLE DISCHARGE RATE (m3/s) = 0.0139

RAINFALL INTENSITY

$I = A/(T+B)^{C}$

Where 1082.901
6.007
0.837

REQUIRED STORAGE VOLUME (m3) = 34.9

TIME (min)	INTENSITY (mm/hr)	PEAK FLOW (m3/s)	RUNOFF VOLUME (m3/s)	DISCHARGE VOLUME (m3/s)	STORAGE VOLUME (m3)
10.0	106.31	0.064	38.6	8.3	30.3
11.0	101.05	0.061	40.4	9.2	31.2
12.0	96.34	0.058	42.0	10.0	32.0
13.0	92.07	0.056	43.5	10.8	32.6
14.0	88.21	0.053	44.9	11.7	33.2
15.0	84.68	0.051	46.1	12.5	33.6
16.0	81.45	0.049	47.3	13.3	34.0
17.0	78.47	0.048	48.5	14.2	34.3
18.0	75.73	0.046	49.5	15.0	34.5
19.0	73.18	0.044	50.5	15.8	34.7
20.0	70.82	0.043	51.5	16.7	34.8
21.0	68.62	0.042	52.4	17.5	34.8
22.0	66.56	0.040	53.2	18.3	34.9
23.0	64.64	0.039	54.0	19.2	34.8
24.0	62.83	0.038	54.8	20.0	34.8
25.0	61.13	0.037	55.5	20.9	34.7
26.0	59.52	0.036	56.2	21.7	34.5
27.0	58.01	0.035	56.9	22.5	34.4
28.0	56.58	0.034	57.6	23.4	34.2

100 YEAR STORAGE REQUIREMENTS UPSTREAM OF ORIFICE

TRIBUTARY AREA DATA
AREA (ha) = 0.260
C = 0.840
Ca = 1.25

ALLOWABLE DISCHARGE RATE (m3/s) = 0.0305

RAINFALL INTENSITY

I = A/(T+B) ^ C

Where 2096.425
6.485
0.863

REQUIRED STORAGE VOLUME (m3) = 76.0

TIME (min)	INTENSITY (mm/hr)	PEAK FLOW (m3/s)	RUNOFF VOLUME (m3/s)	DISCHARGE VOLUME (m3/s)	STORAGE VOLUME (m3)
10.0	186.69	0.141	84.8	18.3	66.5
20.0	124.00	0.094	112.6	36.6	76.0
30.0	94.05	0.071	128.1	54.9	73.2
35.0	84.19	0.064	133.8	64.1	69.8
36.0	82.47	0.062	134.8	65.9	69.0
37.0	80.83	0.061	135.8	67.7	68.1
38.0	79.26	0.060	136.8	69.5	67.2
39.0	77.76	0.059	137.7	71.4	66.3
40.0	76.31	0.058	138.6	73.2	65.4
41.0	74.92	0.057	139.5	75.0	64.5
42.0	73.59	0.056	140.4	76.9	63.5
43.0	72.30	0.055	141.2	78.7	62.5
44.0	71.06	0.054	142.0	80.5	61.5
45.0	69.87	0.053	142.8	82.4	60.4
46.0	68.72	0.052	143.6	84.2	59.4
47.0	67.61	0.051	144.3	86.0	58.3
48.0	66.54	0.050	145.0	87.8	57.2
49.0	65.50	0.050	145.8	89.7	56.1
50.0	64.50	0.049	146.5	91.5	55.0

APPENDIX 3

FIRE FLOW REQUIREMENTS

Based on "Water Supply for Public Fire Protection - 1999", Fire Underwriters survey

Address 1854 & 1858 Liverpool Road

NBC Occupancy Group C

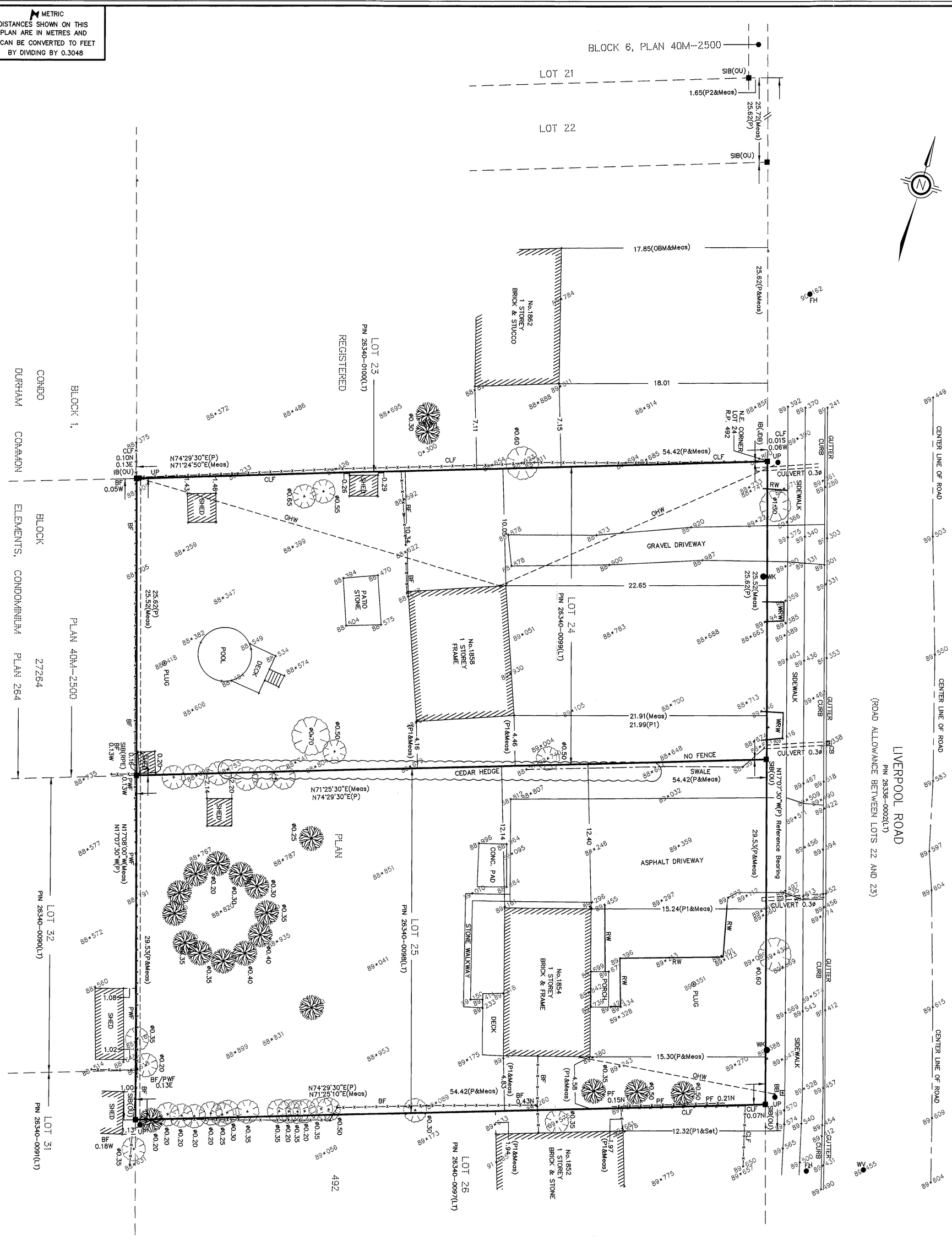
Construction Class Fire Resistive Construction

-fully protected structural members and floors - concrete & steel

STEP 1 - DETERMINE FIRE FLOW:

REQUIRED FIRE FLOW (F)	F = 220 x C x A^0.5	
Largest Floor Area =	1034	m2 (Ground Floor)
Maximum Floor Area A =	1502	m2 (largest floor plus 25% of the two immediately adjoining floors where fire-resistive building and vertical openingsand exterior vertical communications are properly protected (one hour rating))
C =	0.6	Fire-resistive construction (fully protected frame, floors, roof)
F =	6000	L/min (Round up to nearest 1,000 L/min)
STEP 2 - OCCUPANCY FACTOR:	25%	Reduction for Low Hazard Occupancy (Dwellings)
Decrease =	1500	L/min
STEP 3 - AUTO SPRINKLER FACTOR:	30%	NFPA 13 sprinkler standard
	10%	Standard Water Supply
	0%	Fully Supervised System
	40%	Total Credit
Decrease =	2400	L/min
STEP 4 - EXPOSURE FACTORS:	Maximum exposure increase is 75%	
Exposure 1	20%	3.1 to 10 m South Exposure
Exposure 2	10%	20.1 to 30 m East Exposure
Exposure 3	10%	20.1 to 30 m North Exposure
Exposure 4	15%	10.1 to 20 m West Exposure
	55%	
Increase =	3300	L/min
STEP 5 - TOTAL REQUIRED FIRE FLOW	**5400**	L/min

METRIC
DISTANCES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048



SURVEYOR'S REAL PROPERTY REPORT
(PART 1) PLAN OF SURVEY AND TOPOGRAPHIC DETAIL OF

LOTS 24 AND 25
REGISTERED PLAN 492
CITY OF PICKERING

REGIONAL MUNICIPALITY OF DURHAM

SCALE 1 : 200

0 1 2 3 4 5 10 15 Metres

© OMARI MWINYI SURVEYING LTD., 2018

PART 2

HOUSE Nos. 1852 AND 1862 TIES ARE TAKEN TO BRICK AND STUCCOWALLS.
HOUSE No. 1854 TIES ARE TAKEN TO BRICK AND FRAME WALLS.
HOUSE No. 1858 TIES ARE TAKEN TO FRAME WALLS.

THIS REPORT WAS PREPARED FOR ALIREZA ADJEDANI AND SHAHNAZ ALIYANNAJAD THE UNDERSIGNED ACCEPTS NO RESPONSIBILITY FOR USE BY OTHER PARTIES.

ASSOCIATION OF ONTARIO LAND SURVEYORS
PLAN SUBMISSION FORM
2061484

THIS PLAN IS NOT VALID UNLESS IT IS AN EMBOSSED ORIGINAL COPY ISSUED BY THE SURVEYOR In accordance with Regulation 1026, Section 29(3).

LEGEND:

■	DENOTES SURVEY MONUMENT FOUND
□	DENOTES SURVEY MONUMENT PLANTED
IB	DENOTES IRON BAR
SIB	DENOTES STANDARD IRON FENCE
BF	DENOTES BOARD FENCE
CLF	DENOTES CHAIN LINK FENCE
WV	DENOTES WATER VALVE
OU	DENOTES ORIGIN UNKNOWN
	DENOTES DECIDUOUS TREE
MH	DENOTES MANHOLE
CB	DENOTES CATCH BASIN
ø	DENOTES DIAMETER
BB	DENOTES BELL BOX
	DENOTES CONIFEROUS TREE
FH	DENOTES FIRE HYDRANT
P	DENOTES REGISTERED PLAN 492
P1	DENOTES PLAN BY DAVID HORWOOD LIMITED, O.L.S. DATED JUNE 11, 1992.
P2	DENOTES PLAN 40M-2500
PWF	DENOTES POST AND WIRE FENCE
OBM	DENOTES OMARI MWINYI SURVEYING LTD., O.L.S. OLD SURVEY NOTES
RPE	DENOTES DENOTES RADY-PENTEK & EDWARD SURVEYING LTD., O.L.S.
JDB	DENOTES J. D. BARNES LIMITED, O.L.S.
RW	DENOTES RETAINING WALL
WK	DENOTES WATER KEY
OHW	DENOTES OVERHEAD WIRE

ELEVATIONS:
ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE DERIVED FROM BENCH MARK No. 1-058. BRASS TABLET SET HORIZONTALLY IN SOUTH FACE OF CONCRETE RETAINING WALL ON NORTH SIDE OF ASPHALT WALKWAY. LOCATED 21.00M EAST OF THE CENTRELINE OF LIVERPOOL ROAD. TABLET IS LOCATED 1.50M EAST OF THE WEST END OF RETAINING WALL AND IS 0.30M ABOVE GRADE. HAVING AN ELEVATION OF 101.626M.

BEARINGS
BEARINGS HEREON ARE ASTRONOMIC AND ARE REFERRED TO THE WESTERLY LIMIT OF LIVERPOOL ROAD, HAVING A BEARING OF N17°07'30"W AS SHOWN ON REGISTERED PLAN 492.

SURVEYOR'S CERTIFICATE:
I CERTIFY THAT;

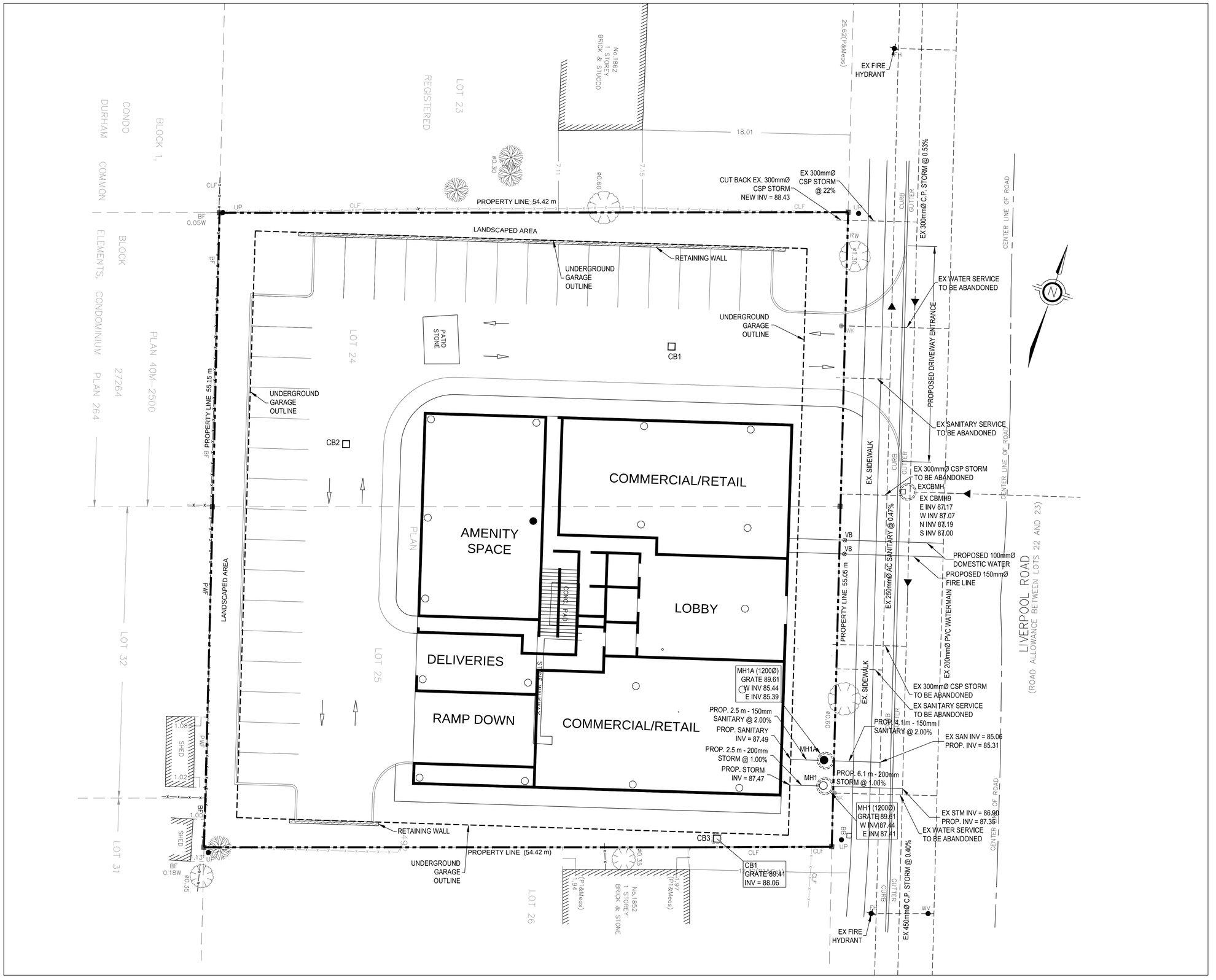
1. THIS SURVEY AND PLAN ARE CORRECT AND IN ACCORDANCE WITH THE SURVEYS ACT, THE SURVEYORS ACT AND THE LAND TITLES ACT, AND THE REGULATIONS MADE UNDER THEM.
2. THE SURVEY WAS COMPLETED ON THE 28TH DAY OF SEPTEMBER 2018.

Oct. 29, 2018
DATE

OMARI B. MWINYI
ONTARIO LAND SURVEYOR

OMARI MWINYI SURVEYING LTD
1905 PINEGROVE AVENUE
PICKERING ON, L1V 6T1
Ph. (905) 831 5485
Fax: (905) 492 5485

PROJECT		PROJECT No.
1854 AND 1858 LIVERPOOL ROAD		18-090-T
DRAFTSPERSON	CALCULATIONS	CHECKED BY
SUGI	E:\OMSL\18-090\18-090	O.M.



KEY PLAN N.T.S.

LEGEND

× 174.18	DENOTES EXISTING ELEVATION
× (171.21)	DENOTES INTERPOLATED EXISTING ELEVATION
× (171.21G)	DENOTES INTERPOLATED EXISTING GUTTER ELEVATION
× 171.21	DENOTES PROPOSED ELEVATION
× 171.21TW	DENOTES TOP OF WALL ELEVATION
× 171.21BW	DENOTES BOTTOM OF WALL ELEVATION
× 171.21SW	DENOTES SWALE ELEVATION
× 171.21TC	DENOTES TOP OF CURB GRADE
	DENOTES SANITARY MANHOLE
	DENOTES STORM MANHOLE
	DENOTES CATCHBASIN
	DENOTES VALVE & BOX
	DENOTES FIRE HYDRANT
	DENOTES EXISTING DIRECTION OF SURFACE DRAINAGE
	DENOTES EXISTING OVERLAND FLOW ROUTE
	DENOTES PROPOSED OVERLAND FLOW ROUTE
	DENOTES PROPERTY LINE

NO.	DESCRIPTION	DATE

REVISION

PROJECT TITLE

PROPOSED RESIDENTIAL DEVELOPMENT
1854 & 1858 LIVERPOOL ROAD
PICKERING, ONTARIO

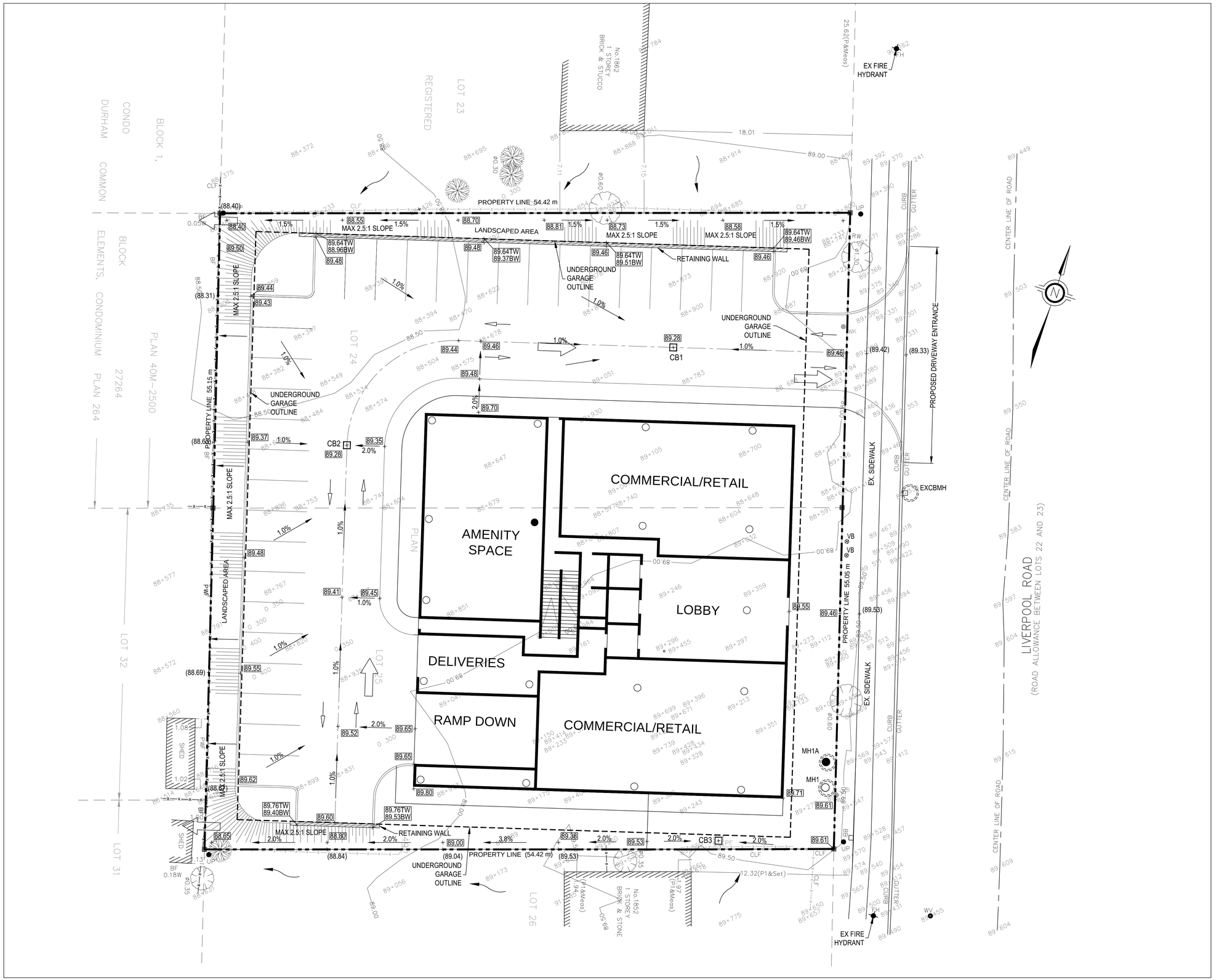
LICENSED PROFESSIONAL ENGINEER — T. POLITIS — NOV. 3/19 — PROVINCE OF ONTARIO

SHEET TITLE

PRELIMINARY SITE SERVICING PLAN

POLITIS ENGINEERING LTD.
PH302 - 133 WYNFORD DRIVE
TORONTO ONTARIO M3C 0J5
T 416-429-8645
F 416-429-8951

DESIGNED BY: T.P.	CHECKED BY: T.P.
DATE : OCTOBER 2019	PROJECT No.: 19550
SCALES: 1 : 150	DWG. No. 101



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	DENOTES PROPOSED OVERLAND FLOW ROUTE
	DENOTES PROPERTY LINE

NO.	DESCRIPTION	DATE

REVISION

PROJECT TITLE

PROPOSED RESIDENTIAL DEVELOPMENT
1854 & 1858 LIVERPOOL ROAD
PICKERING, ONTARIO

LICENSED PROFESSIONAL ENGINEER
T. POLITIS
NOV. 3/19
PROVINCE OF ONTARIO

SHEET TITLE

PRELIMINARY SITE GRADING PLAN

POLITIS ENGINEERING LTD.
PH302 - 133 WYNFORD DRIVE
TORONTO ONTARIO M3C 0J5
T 416-429-8645
F 416-429-8951

DESIGNED BY: T.P.	CHECKED BY: T.P.
DATE : OCTOBER 2019	PROJECT No.: 19550
SCALES: 1 : 150	DWG. No. 102