# FUNCTIONAL SERVICING & STORMWATER MANAGEMENT REPORT

## 6611 Harmony Hill

City of Mississauga

Regional Municipality of Peel

Prepared for

**2512461 Ontario Limited**

Project #: 16-502

AUGUST 2017

**Urbantech Consulting, A Division of Leighton-Zec Ltd.**
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# 1. Introduction

This report provides functional servicing design and stormwater management information in support of the Draft Plan of Subdivision and Condominium Site Plan for the proposed development at 6611 Harmony Hill in the City of Mississauga, Regional Municipality of Peel. The servicing and development concept presented in this report are an extension of the information contained in the following reports:

- Environmental Site Assessment (January 2017) by Soil Engineers Ltd.
- Soil Investigation and Slope Stability study (January 2016), updated (February, 2017) by Soil Engineers Ltd.

This report is also applicable for any future revisions to the Draft Plan, assuming the revisions are in general conformance with the servicing and stormwater management concepts outlined herein. The design information presented in this report considers the following guidelines:

- City of Mississauga Engineering Standard Drawings and Specifications Manuals
- Regional Municipality of Peel Design Criteria and Development Procedures Manual, latest edition.

## 1.1. Subject Site

The subject property is approximately 0.83 hectares in size and is located in the City of Mississauga at the municipal address of 6611 Harmony Hill. The site is located approximately 220m north of Highway 401 and east of Second Line West in the City of Mississauga, Regional Municipality of Peel. The site is bounded by existing residential developments to the east and south, a woodlot/minor wetland to the north and Second Line West to the west. The legal description of the subject lands is Part of Lot 9, Concession 2 West of Hurontario Street. The proposed development will have a Draft Plan of Subdivision component as well as a condominium block, which will require additional approvals through the Site Plan Application process.

The land use plan includes 13 condominium townhouses units (within the site plan area), 6 semi-detached lots, and surface parking spaces. One public road (subdivision) and one privately owned condominium road (site plan) are proposed within the development area.

Please refer to **Figure 1- Site Location Plan** for further details.


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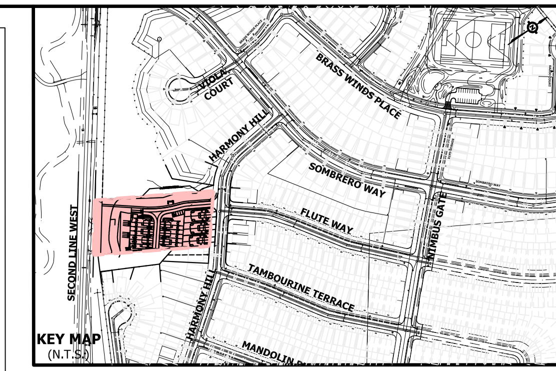


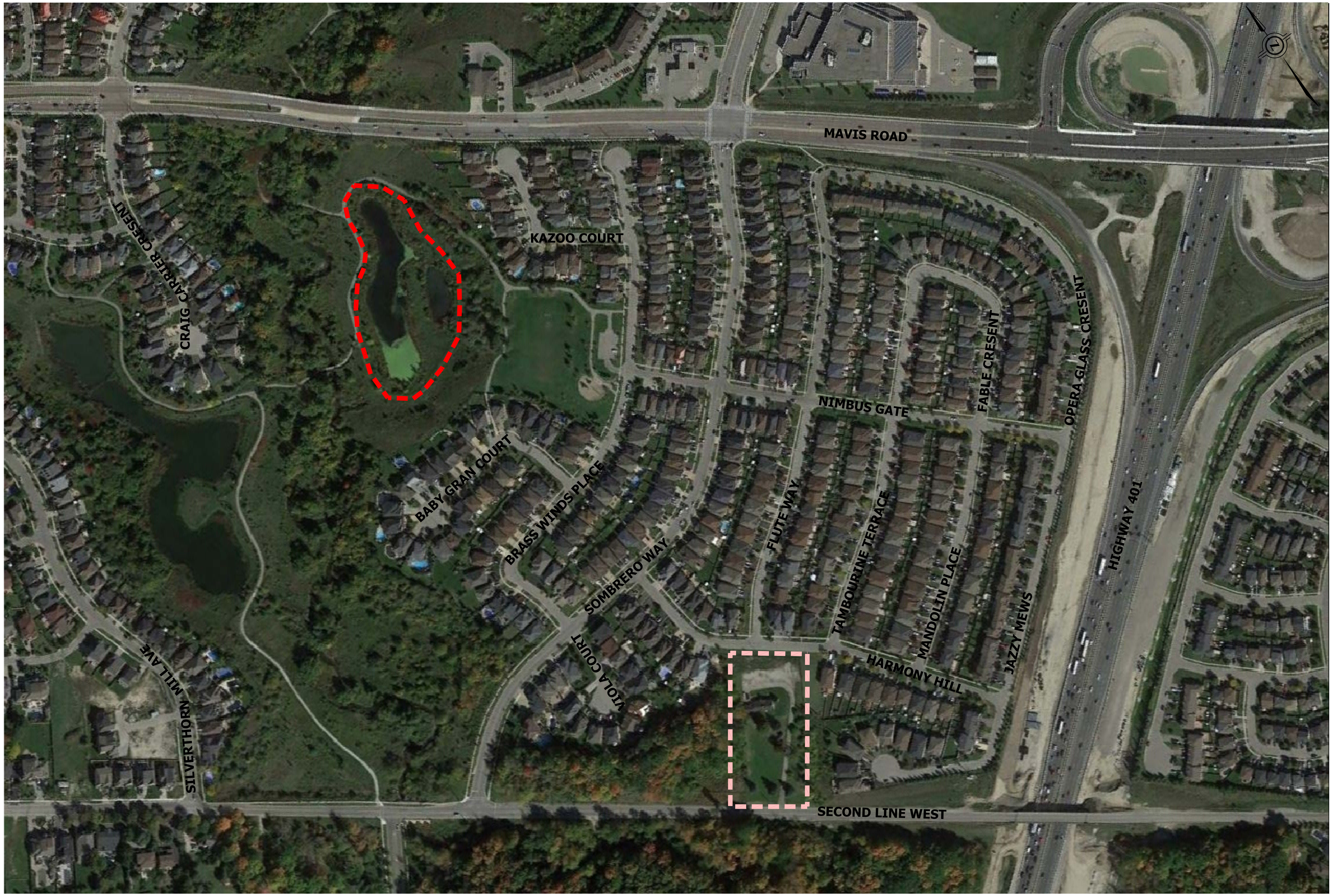


## LEGEND

SITE BOUNDARY

EXISTING STORMWATER MANAGEMENT POUND BOUNDARY

BENCHMARK NOTE

| No. | REVISIONS | DATE | BY |
|---|---|---|---|
| 3 | | | |
| 2 | | | |
| 1 | | | |

**HARMONY HILL RESIDENTIAL DEVELOPMENT**
**2512461 ONTARIO LIMITED**

MISSISSAUGA

TOWN FILE No. -

REGION FILE No.

MUNICIPAL

APPROVED IN PRINCIPAL SUBJECT TO DETAIL CONSTRUCTION CONFORMING TO CITY STANDARDS AND SPECIFICATIONS.

SIGNED______________ DATE__________

ENGINEERING DEPARTMENT

REGIONAL

DESIGN OF SANITARY AND WATER SERVICES APPROVED SUBJECT TO DETAIL CONSTRUCTION CONFORMING TO PEEL REGION STANDARDS AND SPECIFICATIONS AND LOCATION APPROVAL FROM AREA MUNICIPALITY.

SIGNED______________ DATE__________

LEGISLATIVE AND PLANNING SERVICES

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**SITE LOCATION**

| | | | | | |
|---|---|---|---|---|---|
| DRAWN BY: | A.I. | CHECKED BY: | S.M. | PROJECT NO: | 16-502 |
| DESIGNED BY: | S.M. | DATE: | AUGUST, 2017 | DRAWING NAME: | |
| SCALE: | N.T.S | | | | **FIGURE - 1** |

## 2. Background Information

### 2.1. Site Topography/Existing Conditions

The majority of the site is cleared grassland with an existing one storey residential building and an asphalt driveway located in the eastern portion of the site. The driveway extends to the south-western portion of the site and connects to Second Line West. A woodlot bounds the site to the north and contains a small wetland area. The existing topography of the subject site generally slopes from north-east to south-west. The terrain of the site is uneven, with existing grade differences of up to 8m within the site between Harmony Hill and Second Line West.

### 2.2. Soil Conditions

The findings of a soil investigation carried out in 2002 by Soil Engineers Ltd. (0210-S44) and confirmed by a recent site inspection on January 8, 2016 by Soil Engineers Ltd. indicated the following:

- The site is covered by topsoil fill 10cm to 15cm thick, and/or a layer of silty clay fill of granular fill underlined by a layer of firm to hard, generally very stiff silty clay till. The surficial weather zone generally extends to 1m.
- Cobbles and boulders are embedded in the till; this was noted as a result of the hard resistance to auguring which was encountered in various places.
- The silty clay fill, occasionally containing topsoil was found extending to depths ranging from 0.6m – 4.0m beneath the prevailing ground surface.
- All boreholes remained dry upon completion of work and the brown oxidized soil changes to grey at depths ranging from 3.4m – 6.2m due to low permeability of the clay till.

### 2.3. Water Bodies and Areas of Natural Significance

An Area of Natural Scientific Interest (ANSI) is located within 30m of the subject property. Fletchers Creek runs along to opposite side of 2$^{nd}$ Line West adjacent to the frontage of the subject site, and then proceeds underneath 2$^{nd}$ Line West and into an existing woodlot which is also adjacent to the site. A smaller wetland exists adjacent to the subject property, near the north-west corner of the site. This feature was staked in January 2016 and is illustrated in Drawing **STM-1**.


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# 3. Storm Drainage

## 3.1. Pre-Development Storm Drainage

The subject property currently contains no storm water infrastructure. Presently, there is an existing 1200mm storm sewer located within Harmony Hill adjacent to the subject property which was sized for a future flow of 0.51 ha (0.55 runoff coefficient) from the subject lands. Surface runoff from the site is currently spilt, with 0.26 ha draining to the existing woodland / valley north of the property, and 0.57 ha draining towards Second Line West into an existing ditch along the roadway and ultimately to the existing tributary of Fletchers creek.

Please refer to Drawing **STM-1** for additional details regarding pre-development storm drainage conditions.

## 3.2. Post-Development Storm Drainage

### 3.2.1. Minor System Drainage

Storm sewers on the subject lands are designed to convey flows from the 10-year return period storm event per City of Mississauga standards. The minor system flows will discharge to a 1200mm diameter storm sewer within Harmony Hill.

**Figure 2** is an excerpt from the Arrowsmith Village – Phase 4 subdivision plan designed by RAND Engineering Corporation showing that part of 6611 Harmony Hill (0.51ha at 0.55 runoff coefficient) was taken into account while designing the subdivision sewers.

**Table 1** (Existing storm sewer design sheet for Arrowsmith Village – Phase 4 prepared by RAND Engineering), shows the existing design values for 6611 Harmony Hill (Future Residential), which were as follows;

<u>Existing Site Runoff Data</u>
Area (A) = 0.51 ha
Runoff coefficient (C) =0.55
A x C = 0.28 ha

Q = CIA
Where, A x C (cumulative from Table 1) = 6.44 ha which includes the 0.51 ha site at 0.55 runoff coefficient,

$I_{10}$ (10-year rainfall intensity) = 77.02 mm/hour
$Q_{10}$ at MH 20 (existing design) = 1.377 $m^3/s$

<u>Pipe Data</u>
Maximum capacity of existing 1200mm pipe at 0.22% slope = 1.819 $m^3/s$


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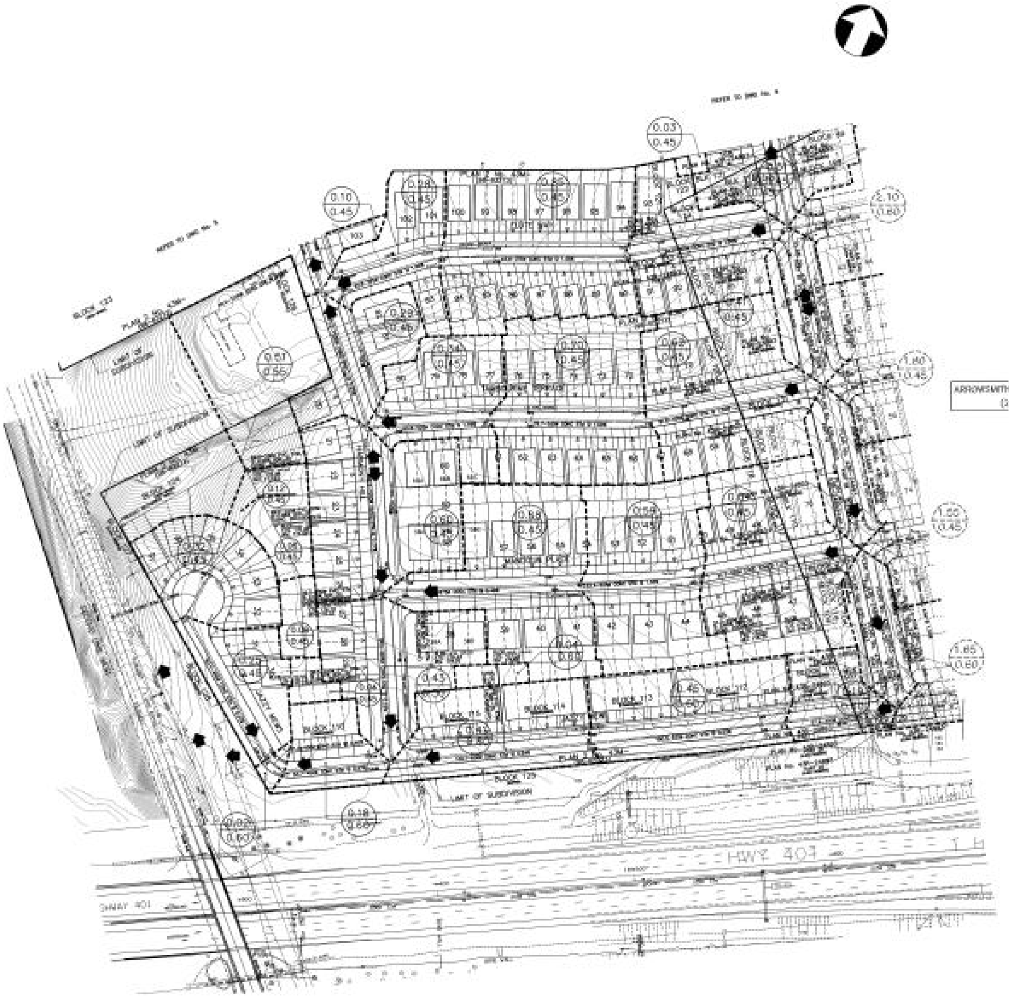

Figure 2: Extract from Rand Engineering plan showing that 6611 Harmony Hill as part of the subdivision

Table 1: Storm Drainage calculations prepared by Rand Engineering

..sultant: RAND Engineering Corporation
5285 Solar Drive
Mississauga, Ont. L4W 5B8

**CITY OF MISSISSAUGA**
**STORM SEWER DESIGN SHEET**
**Arrowsmith Village - Phase 4**
**Gasmuz Construction Inc. - 968907 Ontario Inc.**

**City File : 21T-95007**
**Project No.: 97457**
**Designer:**
**Date: June 30/00**

| | | | | RUNOFF DATA | | | | | | | PIPE DATA | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LOCATION | FROM M.H. | TO M.H. | Time of concen-tration (min.) | Area (Ha) | Cumul. A (Ha) | C | A x C | Cumul. A x C | Intensity (mm/hr) | Q (m3/s) | Length (m) | Diamete (mm) | Slope (%) | Q (m3/s) | V (m/s) | Time of Flow In Pipe (min.) |
| | | | 15+(180-50)/120 | | | | | | | | | | | | | |
| Tambourine Drive | PLUG | 13 | 16.08 | 1.80 | 1.80 | 0.60 | 1.08 | 1.08 | 95.10 | **0.285** | 16.5 | 450 | 1.20 | **0.326** | 1.98 | 0.14 |
| Tambourine Drive | 13 | 14 | 16.22 | 0.62 | 2.42 | 0.45 | 0.28 | 1.36 | 94.61 | **0.357** | 91.5 | 450 | 1.50 | **0.364** | 2.22 | 0.69 |
| Tambourine Drive | 14 | 15 | 16.91 | 0.70 | 3.12 | 0.45 | 0.32 | 1.67 | 92.24 | **0.429** | 80.0 | 525 | 1.00 | **0.449** | 2.01 | 0.66 |
| Tambourine Drive | 15 | 16 | 17.57 | 0.34 | 3.46 | 0.45 | 0.15 | 1.83 | 90.08 | **0.457** | 61.0 | 525 | 1.50 | **0.549** | 2.46 | 0.41 |
| | | | 17.98 | | 3.46 | | | 1.83 | | | | | | | | |
| **Future Residential** | PRIVATE LANDS | | | 0.51 | 0.51 | 0.55 | 0.28 | 0.28 | | | | | | | | |
| Harmony Hill | 16 | 20 | 22.50 | 0.29 | 12.56 | 0.45 | 0.13 | 6.44 | 77.02 | **1.377** | 71.5 | 1200 | 0.20 | **1.819** | 1.56 | 0.76 |
| | | | 23.26 | | 12.56 | | | 6.44 | | | | | | | | |
| Flute Way | 17 | 18 | 15.00 | 0.41 | 0.41 | 0.45 | 0.18 | 0.18 | 99.17 | **0.051** | 61.0 | 300 | 2.00 | **0.143** | 1.96 | 0.52 |
| Flute Way | 18 | 19 | 15.52 | 0.85 | 1.26 | 0.45 | 0.38 | 0.57 | 97.16 | **0.153** | 93.5 | 375 | 1.50 | **0.224** | 1.96 | 0.79 |
| Flute Way | 19 | 20 | 16.31 | 0.28 | 1.54 | 0.45 | 0.13 | 0.69 | 94.27 | **0.181** | 62.5 | 375 | 1.50 | **0.224** | 1.96 | 0.53 |
| | | | 16.84 | | 1.54 | | | 0.69 | | | | | | | | |
| Harmony Hill | 20 | 21 | 23.26 | 0.10 | 14.20 | 0.45 | 0.05 | 7.17 | 75.37 | **1.502** | 40.0 | 1200 | 0.20 | **1.819** | 1.56 | 0.43 |
| Harmony Hill | 21 | 22 | 23.69 | 0.30 | 14.50 | 0.45 | 0.14 | 7.31 | 74.48 | **1.512** | 27.5 | 1200 | 0.20 | **1.819** | 1.56 | 0.29 |
| Harmony Hill | 22 | 26 | 23.99 | 0.43 | 14.93 | 0.45 | 0.19 | 7.50 | 73.88 | **1.540** | 73.0 | 1200 | 0.20 | **1.819** | 1.56 | 0.78 |
| | | | 24.77 | | 14.93 | | | 7.50 | | | | | | | | |
| Sombrero Way | **RLCB** | 23 | 15.00 | 0.03 | 0.03 | 0.45 | 0.01 | 0.01 | 99.17 | **0.004** | 41.0 | 250 | 4.56 | **0.132** | 2.61 | 0.26 |
| Sombrero Way | 23 | 24 | 15.26 | 0.42 | 0.45 | 0.45 | 0.19 | 0.20 | 98.15 | **0.055** | 40.5 | 300 | 2.00 | **0.143** | 1.96 | 0.35 |
| Sombrero Way | 24 | 25 | 15.61 | 0.73 | 1.18 | 0.45 | 0.33 | 0.53 | 96.84 | **0.143** | 79.5 | 450 | 1.50 | **0.364** | 2.22 | 0.60 |
| Sombrero Way | 25 | 26 | 16.20 | 0.23 | 1.41 | 0.45 | 0.10 | 0.63 | 94.66 | **0.167** | 40.5 | 450 | 1.50 | **0.364** | 2.22 | 0.30 |
| | | | 16.20 | | 1.41 | | | 0.63 | | | | | | | | |
| **From** Harmony Hill | 22 | 26 | 24.77 | | 14.93 | | | 7.50 | | | | | | | | |
| Sombrero Way | 26 | 33 | 24.77 | 0.46 | 16.80 | 0.45 | 0.21 | 8.34 | 72.34 | **1.677** | 80.5 | 1200 | 0.20 | **1.819** | 1.56 | 0.86 |
| | | | 25.63 | | 16.80 | | | 8.34 | | | | | | | | |
| Sombrero Way | 30 | 33 | 15.00 | 0.50 | 0.50 | 0.45 | 0.23 | 0.23 | 99.17 | **0.062** | 68.0 | 300 | 0.50 | **0.071** | 0.98 | 1.16 |
| | | | 15.26 | | 0.50 | | | 0.23 | | | | | | | | |
| Viola Court | 31 | 32 | 15.00 | 0.31 | 0.31 | 0.45 | 0.14 | 0.14 | 99.17 | **0.038** | 18.0 | 300 | 1.00 | **0.101** | 1.38 | 0.22 |
| Viola Court | 32 | 33 | 15.22 | 0.40 | 0.71 | 0.45 | 0.18 | 0.32 | 98.32 | **0.087** | 60.0 | 375 | 0.50 | **0.129** | 1.13 | 0.88 |
| | | | 16.10 | | 0.71 | | | 0.32 | | | | | | | | |

Drawing **SS1** and **Appendix A** illustrate the proposed post-development drainage and the storm sewer design for the site. All minor flows will be conveyed via 450mm diameter pipes and will connect to the existing 1200mm diameter storm sewer on Harmony Hill.

While the post-development drainage area of 0.48 ha is lower than the existing design drainage area of 0.51 ha, the post-development runoff coefficient (0.67) is higher than the existing design runoff coefficient (0.55). Therefore, there will be a minor increase in flow to the 1200mm storm sewer.

<u>Runoff Data</u>
Area (A) = 0.42 ha
Runoff coefficient (C) =0.69
A x C = 0.29 ha

Difference in proposed A x C versus “design” A x C = 0.29 – 0.28 = 0.01 ha
Increase in Cumulative A x C = 6.44 ha + 0.01 ha = 6.45 ha

Q=CIA = 6.45 ha x 77.02 mm/hour

**$Q_{10}$ at MH 1 (proposed design) = 1.380 $m^3/s$**

The proposed development design values (A x C) increased the total A x C downstream from 6.44 ha to 6.45 ha, which is only a 0.16% increase. This minor increase results in a 0.22% increase in the flow sent to the 1200mm sewer pipe within Harmony Hill; i.e. from 1.377$m^3/s$ to 1.380$m^3/s$ (a negligible increase). The maximum flow capacity of the 1200mm storm sewer in this location is 1.819$m^3/s$.

Therefore, the minor system storm flows for the proposed development can be accommodated by the existing 1200mm diameter pipe on Harmony Hill with negligible downstream impact

Please refer to Drawing **STM-2** for additional details regarding the post-development storm drainage conditions.

### 3.2.2. Major System Drainage

Major system flows (for storms in excess of the 10-year storm) are directed onto the proposed right-of-way within the development. Flows drain towards the existing Second Line West ditch located on the western limit of the development, and eventually to Fletchers Creek tributary maintaining the overland pre-development drainage pattern.

**Table 2 – Appendix A** presents the calculations for the ultimate major system flow for the subject property.


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For existing conditions, the ultimate flows that have been discharged to Second Line West was 0.454 $m^3/s$; the proposed development would reduce the major system flows to 0.365 $m^3/s$ since the 10-year flow is captured in the storm sewer system and diverted away from the existing overland flow outlet.

### 3.3. Wetland Water Balance

Drawing **STM-1** illustrates the pre-development contributing areas to the existing woodlot/wetland west of the proposed development. Currently, approximately 0.26ha at a run-off coefficient of 0.35 contributes to the woodlot/wetland. The total area x runoff coefficient contributing to the wetland is therefore 0.26 ha x 0.35 = 0.09 ha

The proposed development grading and drainage have been designed to maintain the runoff contributing area (and hence the volume) to the woodland/wetland. Drawing **STM-2** shows the proposed contributing areas. A swale is proposed at the rear of the westernmost condominium town house lots to convey drainage to the south west corner of the site. This will ensure that the runoff volumes to the woodland/wetland are maintained.

<u>Areas and runoff coefficient to be maintained to woodlots/wetlands</u>

Proposed contributing area = 0.16 ha
Runoff coefficient = 0.28

<u>Additional Area diverted to contributing woodlot/wetland areas</u>

Proposed diverted area = 0.06ha (roof tops and rear yards)
Runoff coefficient = 0.51

Using weighted averages,

Total area contributing to woodlot/wetland area = 0.16 + 0.06 = 0.22 ha
Total runoff coefficient = 0.52

The total proposed contributing runoff (A x C) = 0.22 ha x 0.52 = 0.08 ha

From the above calculations it is evident that the proposed development will have negligible effect on the contributing runoff to the woodlot/wetland.


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### 3.4. Stormwater Management and Quality Control

An existing stormwater management pond is located to the north of the subject lands in the Arrowsmith Village – Phase 4 subdivision. The future drainage area from the subject lands (0.51 ha at 0.55 runoff coefficient) was taken into account during the design and construction of this stormwater management pond. As noted in the preceding sections, the proposed A x C is slightly higher than the previous design; this minor increase relative to the total area approaching the pond is negligible and will not affect the performance of the SWM facility.

**Drawings 8** to **10** in **Appendix C** illustrates the total contributing area to the SWM facility. Currently, approximately 26 ha with an average weighted runoff coefficient of 0.47 is being serviced by the SWM pond. It should be noted that 0.51ha at 0.55 runoff coefficient was taken into account while designing the SWM pond by RAND Engineering Corporation. The proposed A x C is 0.42 ha x 0.69 = 0.42 ha.

Hence, the design A x C = 26 ha x 0.47 = 12.35 ha

The proposed A x C contributing to SWM = (Design A x C – 0.51 x 0.55) + 0.42 x 0.69 = 12.36 ha

Increase in A x C values = Proposed A x C - Design A x C = 12.36 – 12.35 = 0.01 ha.

From the above calculations it is shown that the proposed development would increase the A x C values to the pond by only 0.01 which amounts to a negligible/insignificant increase of 0.1%.

The existing stormwater management facility will provide quality and quantity control for the subject lands.

Please refer to **Figure 1- Site Location** for details.

### 3.5. Low Impact Development SWM Recommendations

Infiltration/low-impact development measures (LID) have the potential to assist in the achievement of stormwater attenuation targets as well as to mitigate water balance impact. The following LID measures will be explored for the proposed development

- Permeable Pavement Driveway
- Porous asphalt or Permeable pavers for parking area
- Infiltration/Vegetated Swale
- Green roofs
- Increased topsoil depth
- Cistern Storage
- Pervious pipes


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## 4. Sanitary Drainage

Sanitary sewers will be designed to convey flows from the proposed development (condominium blocks) to the existing 250mm sanitary sewer on Harmony Hill. The proposed semi-detached units fronting Harmony Hill will have direct service connections to the existing 250mm sanitary sewer within Harmony Hill.

**Drawings 12** to **14** in **Appendix C** shows the drainage area taken into account at MH 21A during the design of the sanitary sewers for Arrowsmith village – Phase 4 community by RAND Engineering Corporation. The Region of Peel design guidelines recommend a minimum peak flow of $0.0130 m^3/sec$ per 1000 people. The total population contributing flows at MH 21A is 742 people based on the approved design by RAND Engineering. The proposed development will have a design population of 43 people, taking the total population contributing flows at MH21A to 785 people which is substantially lower than the minimum Region of Peel standard for flow calculation (i.e. 1000 people). Hence, the flows from the proposed development would have no negative effect on the sanitary system since the sewers were designed for a minimum of 13 L/s regardless of the contributing population.

Please refer to Drawing **SAN-1** and the sanitary sewer design sheet in **Appendix A** for additional details

## 5. Water Distribution

The design criteria and construction of the water system will adhere to the Region of Peel's design criteria and latest edition of the development procedures manual for water systems and appurtenances. The subject site will be serviced internally by a 200mm diameter PVC watermain which will be connected to the existing 200mm watermain on Harmony Hill. The semi-detached lots fronting Harmony Hill will be connected directly to the watermain located within Harmony Hill. The watermain cannot be looped, however it is assumed that the proposed population will provide sufficient usage/turnover to maintain proper water quality. All condominium townhouse units will be provided with individual water service connections per the Region of Peel standards.

Please refer to Drawing **SS-1** for additional details

## 6. Grading

The proposed grading design will take into consideration the following requirements and constraints:

- Conform to City of Mississauga grading criteria
- Minimize cut and fill earthworks operations and work towards a balanced site
- Match existing boundary grading conditions



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- Maintain required drainage boundaries
- Provide minimum cover on proposed servicing
- Provide overland flow conveyance for major storm conditions

The existing site has a significant grade difference between the east and west property limits. The largest grade change occurs at the western limit of the condominium townhouse block. Proposed road grades will have flatter slopes (0.5% - 2%) while lot grading have steeper slopes (up to 5% for driveways) in an effort to balance the site earthworks. With the exception of the units located on the westernmost side of the site, the proposed semi-detached and townhouses will be graded to be split-draining lots to mitigate the significant grade differences across the units and also conform to the grading criteria of the City of Mississauga. Existing vegetation is to be removed as required to facilitate proposed grading.

The City of Mississauga requested the construction of a nature trail from the proposed development to Second Line West. To facilitate this nature trail, some fill will be placed on the floodplain/regulated areas.

Retaining walls are proposed in two locations: along the southern property line adjacent to the condominium block, where the private condo road terminates and along the northern boundary of the site adjacent to the proposed walkway. In the first location, the proximity of the condo road to the property boundary is not sufficient for adequate sloping, hence the need for a retaining wall to cover the difference in elevation between the proposed site grades and existing property line grades. In the second location, the elevation between the walkway and the northern property line drops rapidly and the transition grade would need to exceed the allowable slope to match into the existing conditions without a retaining wall.

Refer to Drawing **SG-1** for further details.

## 7. Erosion and Sediment Control

The erosion and sediment control plan will be designed in accordance with the City of Mississauga and the Credit Valley Conservation Authority (CVC) guidelines. Erosion and sediment control will be implemented for all construction activities including topsoil stripping, foundation excavation and stockpiling of materials to ensure movement of sediment is minimized.

The following erosion and sediment control measures will be implemented during construction:

- A temporary sediment control fence will be placed prior to grading and construction fence / tree protection fence along the woodlot as required by an arborists recommendations;
- Temporary sediment traps will be provided;


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- Gravel mud mats will be provided at construction vehicle access points to minimize off-site tracking of sediments
- All temporary erosion and sediment control measures will be routinely inspected and repaired during construction. Temporary controls will not be removed until the areas they serve are restored and stable.


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## 8. Conclusions

- Grading can be completed in accordance with the Credit Valley Conservation Authority (CVC) and City of Mississauga design criteria.

- The proposed development can be serviced adequately via existing storm, water and sanitary infrastructure on Harmony Hill and will not adversely impact any of the surrounding infrastructure, residence or natural features.

- The planning, preliminary grading, servicing and stormwater management strategies presented in this Functional Servicing Report supports the Draft Plan approval for the proposed development.


Report Prepared by:

Sean McKoy, P. Eng.
*Project Manager*

Austin C. Ibeson, EIT
*Assistant Municipal Designer*



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# Appendix A

## Design Calculations



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TEL: 905.946.9461 FAX: 905.946.9595
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# STORM SEWER DESIGN SHEET

## 10 Year Storm

## Harmony Hill Residential Development

City of Mississauga

**PROJECT DETAILS**

Project No: 16-502
Date: 18-Aug-17
Designed by: A.I.
Checked by: S.M.

**DESIGN CRITERIA**

Min. Diameter = 300 mm
Mannings 'n'= 0.013
Starting Tc = 15 min

Rainfall Intensity = $\frac{A}{(Tc+B)^c}$

A = 1010
B = 4.6
C= 0.78

NOMINAL PIPE SIZE USED

| AREA ID | STREET | FROM MH | TO MH | AREA (ha) | RUNOFF COEFFICIENT "R" | 'AR' | ACCUM. 'AR' | RAINFALL INTENSITY (mm/hr) | FLOW (m3/s) | CONSTANT FLOW (m3/s) | ACCUM. CONSTANT FLOW (m3/s) | TOTAL FLOW (m3/s) | LENGTH (m) | SLOPE (%) | PIPE DIAMETER (mm) | FULL FLOW CAPACITY (m3/s) | FULL FLOW VELOCITY (m/s) | INITIAL Tc (min) | TIME OF CONCENTRATION (min) | ACC. TIME OF CONCENTRATION (min) | PERCENT FULL (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Street B | | 5 | 0.03 | 0.90 | 0.03 | 0.03 | | | | | | | | | | | | | | |
| | Street B | | 5 | 0.06 | 0.74 | 0.04 | 0.04 | | | | | | | | | | | | | | |
| | Street B | 5 | 4 | 0.22 | 0.59 | 0.13 | 0.20 | 99.2 | 0.055 | | | 0.055 | 42.2 | 0.50 | 450 | 0.202 | 1.27 | 15.00 | 0.55 | 15.55 | 27% |
| | Street B | | | 0.16 | 0.90 | 0.14 | 0.14 | | | | | | | | | | | | | | |
| | Street A | | 4 | 0.01 | 0.90 | 0.01 | 0.01 | | | | | | | | | | | | | | |
| | Street A | 4 | 3 | 0.03 | 0.90 | 0.03 | 0.24 | 97.0 | 0.064 | | | 0.064 | 37.8 | 0.50 | 450 | 0.202 | 1.27 | 15.55 | 0.50 | 16.05 | 32% |
| | Street A | 3 | 2 | 0.03 | 0.90 | 0.03 | 0.26 | 95.2 | 0.070 | | | 0.070 | 27.6 | 0.50 | 450 | 0.202 | 1.27 | 16.05 | 0.36 | 16.41 | 35% |
| | Street A | 2 | 1 | | | | 0.26 | 93.9 | 0.069 | | | 0.069 | 9.1 | 0.50 | 450 | 0.202 | 1.27 | 16.41 | 0.12 | 16.53 | 34% |

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*P:\Projects\16-502\Reports\FSR\Design Sheets\16-502 STM (10 yr):5yr*

**PROJECT DETAILS**

| | |
|---|---|
| **Title1:** | **Table 2** |
| **Title2:** | **Ultimate Constant Flow Calculations** |
| **Project Name:** | |
| **Municipality:** | **The City of Mississauga** |
| **Project No:** | **16-502** |
| **Date:** | **18-Aug-17** |
| **Designed by:** | **A.I** |
| **Checked by:** | **A.F.** |

| IDF Parameters for Brampton | | | |
|---|---|---|---|
| | | 10-yr | 100-yr |
| $I=A/(T+b)^c$ | A | 1010 | 1450 |
| | B | 4.6 | 4.9 |
| | C | 0.78 | 0.78 |

| CAPTURE LOCATION | AREA ID | Minor System Drainage Area ha | 10YR R | 10YR A x R | Major System Drainage Area ha | 100 YR - R | 100 YR - A x R | Tc* min | I10 mm/hr | I100 mm/hr | Q10 m3/s | Q100 m3/s | Q100-Q10 m3/s | Const. flow m3/s |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Area 1 | 1 | 0.38 | 0.70 | 0.27 | 0.8 | 0.52 | 0.52 | 15.00 | 294.7 | 403.8 | 0.218 | 0.583 | 0.365 | 0.365 |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | 0.83 | 0.39 | 0.40 | 15.00 | | 403.8 | | 0.454 | | 0.454 |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | |

*Where available, Tc is calculated from design sheet or overland flow calculation

Tc calcs *where Tc = starting Tc + flow length/velocity*
*(starting Tc = 10min)*

Assumed Velocities for Calculation of time of Concentration urbantech

# SANITARY SEWER DESIGN SHEET

**(Preliminary)**

## Harmony Hill Residential Development

**CITY OF MISSISSAUGA, REGION OF PEEL**

**PROJECT DETAILS**

**Project No:** 16-502
**Date:** 18-Aug-17
**Designed by:** A.I.
**Checked by:** S.M.

**DESIGN CRITERIA**

| | | | | | |
|---|---|---|---|---|---|
| Min Diameter = | 250 | mm | Avg. Domestic Flow = | 302.8 | l/c/d |
| Mannings 'n'= | 0.013 | | Infiltration = | 0.200 | l/s/ha |
| Min. Velocity = | 0.75 | m/s | Max. Peaking Factor = | 4.00 | |
| Max. Velocity = | 3.50 | m/s | Min. Peaking Factor= | 1.50 | |
| Factor of Safety = | 15 | % | | | |

**NOMINAL PIPE SIZE USED**

| STREET | FROM MH | TO MH | RESIDENTIAL AREA (ha) | RESIDENTIAL ACC. AREA (ha) | RESIDENTIAL UNITS (#) | RESIDENTIAL DENISTY (P/ha) | RESIDENTIAL DENSITY (P/unit) | RESIDENTIAL POP | RESIDENTIAL ACCUM. RES. POP. | COMMERCIAL/INDUSTRIAL/INSTITUTIONAL AREA (ha) | COMMERCIAL/INDUSTRIAL/INSTITUTIONAL ACC. AREA (ha) | COMMERCIAL/INDUSTRIAL/INSTITUTIONAL EQUIV. POP. (p/ha) | COMMERCIAL/INDUSTRIAL/INSTITUTIONAL FLOW RATE (l/s/ha) | COMMERCIAL/INDUSTRIAL/INSTITUTIONAL EQUIV. POP. | COMMERCIAL/INDUSTRIAL/INSTITUTIONAL ACCUM. EQUIV. POP. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STREET B | 5A | 4A | 0.41 | 0.41 | | 70 | | 29 | 29 | | | | | | |
| | | | | | | | | | | | | | | | |
| STREET A | | 4A | | | | | | | | | | | | | |
| | 4A | 3A | | 0.41 | | | | | 29 | | | | | | |
| | 3A | 2A | 0.20 | 0.61 | | 70 | | 14 | 43 | | | | | | |
| | 2A | 1A | | 0.61 | | | | | 43 | | | | | | |

| STREET | FROM MH | TO MH | FLOW CALCULATIONS INFILTRATION (l/s) | FLOW CALCULATIONS TOTAL ACCUM. POP. | FLOW CALCULATIONS PEAKING FACTOR | FLOW CALCULATIONS RES. FLOW (l/s) | FLOW CALCULATIONS COMM. FLOW (l/s) | FLOW CALCULATIONS ACCUM. COMM. FLOW (l/s) | FLOW CALCULATIONS TOTAL FLOW (l/s) | PIPE DATA SLOPE (%) | PIPE DATA PIPE DIAMETER (mm) | PIPE DATA FULL FLOW CAPACITY (l/s) | PIPE DATA FULL FLOW VELOCITY (m/s) | PIPE DATA ACTUAL VELOCITY (m/s) | PIPE DATA PERCENT FULL (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STREET B | 5A | 4A | 0.1 | 29 | 4.00 | 0.4 | | | 0.5 | 1.00 | 250 | 59.5 | 1.2 | 0.3 | 1% |
| | | | | | | | | | | | | | | | |
| STREET A | | 4A | | | | | | | | | | | | | |
| | 4A | 3A | 0.1 | 29 | 4.00 | 0.4 | | | 0.5 | 0.50 | 250 | 42.0 | 0.9 | 0.3 | 1% |
| | 3A | 2A | 0.1 | 43 | 4.00 | 0.6 | | | 0.7 | 0.50 | 250 | 42.0 | 0.9 | 0.3 | 2% |
| | 2A | 1A | 0.1 | 43 | 4.00 | 0.6 | | | 0.7 | 0.50 | 250 | 42.0 | 0.9 | 0.3 | 2% |




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# Appendix B

## Drawings



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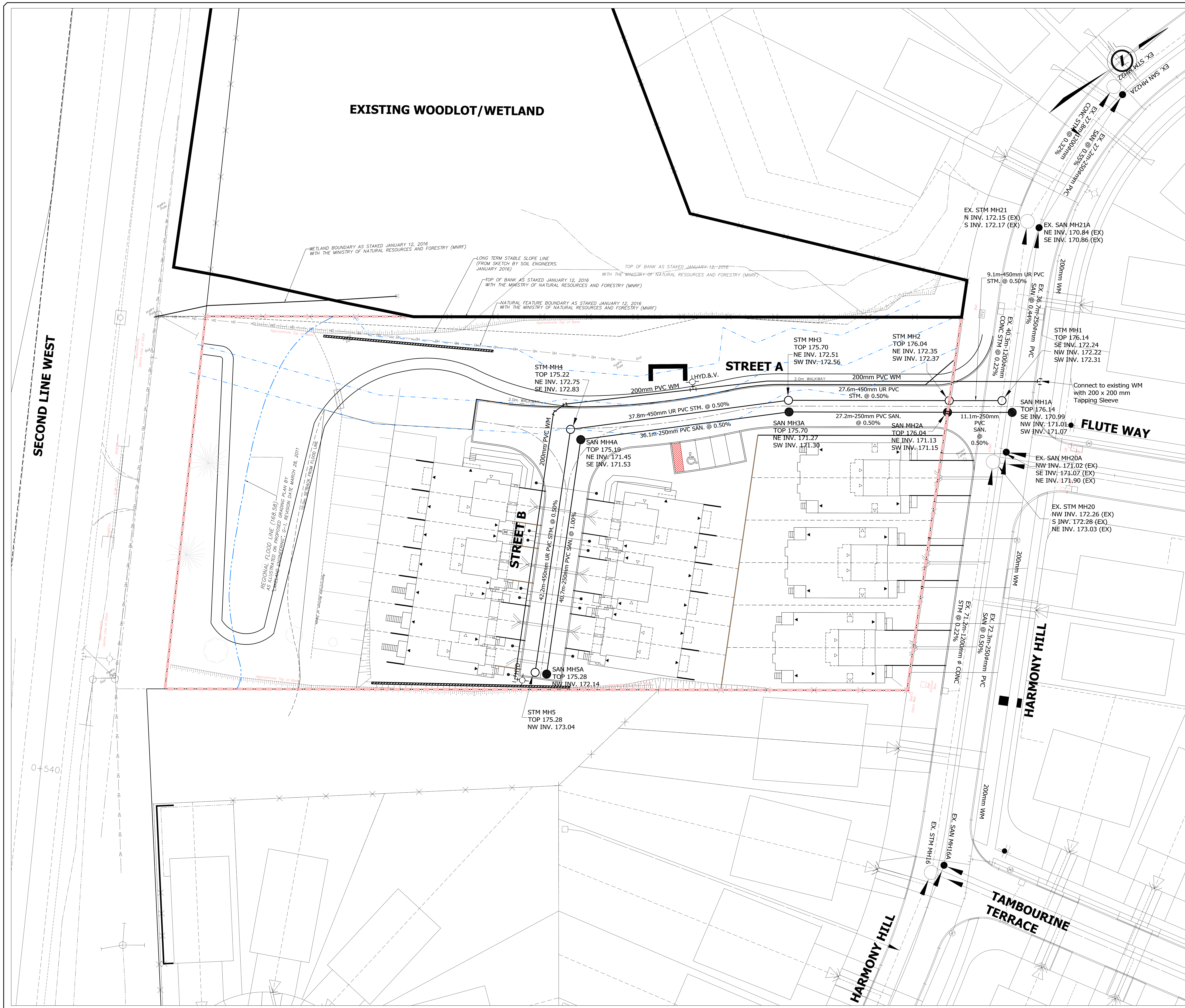


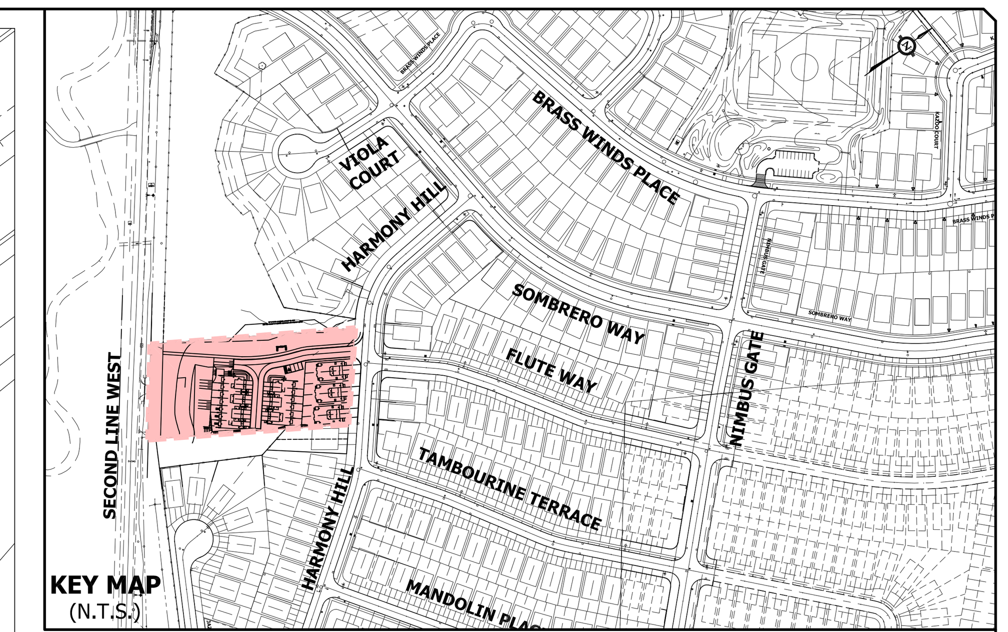


**LEGEND**

- SUBJECT PROPERTY
- STORM SEWER AND MANHOLE
- SANITARY SEWER AND MANHOLE
- WATERMAIN
- SINGLE, DOUBLE STORM SERVICE CONNECTION
- SINGLE, DOUBLE SANITARY SERVICE CONNECTION
- PROPOSED WATER SERVICE CONNECTION
- EXISTING CATCHBASIN SINGLE / REAR LOT
- EXISTING CATCHBASIN DOUBLE
- HYD PROPOSED, EX. HYDRANT & SECONDARY VALVE
- PROPOSED, WATER BOX
- WOODLOT/WETLAND BOUNDARY

**BENCHMARK NOTE**

ELEVATIONS HEREON ARE GEODETIC IN ORIGIN AND WERE DERIVED FROM GPS OBSERVATIONS USING THE "TopNET" GPS NETWORK AND ARE REFERRED TO THE CGVD-1928:1978 DATUM.

| No. | REVISIONS | DATE | BY |
|---|---|---|---|
| 3 | | | |
| 2 | | | |
| 1 | | | |

# HARMONY HILL RESIDENTIAL DEVELOPMENT
# 2512461 ONTARIO LIMITED

MISSISSAUGA

TOWN FILE No.____________ REGION FILE No.____________

MUNICIPAL

APPROVED IN PRINCIPAL SUBJECT TO DETAIL CONSTRUCTION CONFORMING TO CITY STANDARDS AND SPECIFICATIONS.

SIGNED______________ DATE__________

ENGINEERING DEPARTMENT

REGIONAL

DESIGN OF SANITARY AND WATER SERVICES APPROVED SUBJECT TO DETAIL CONSTRUCTION CONFORMING TO PEEL REGION STANDARDS AND SPECIFICATIONS AND LOCATION APPROVAL FROM AREA MUNICIPALITY.

SIGNED______________ DATE__________

LEGISLATIVE AND PLANNING SERVICES

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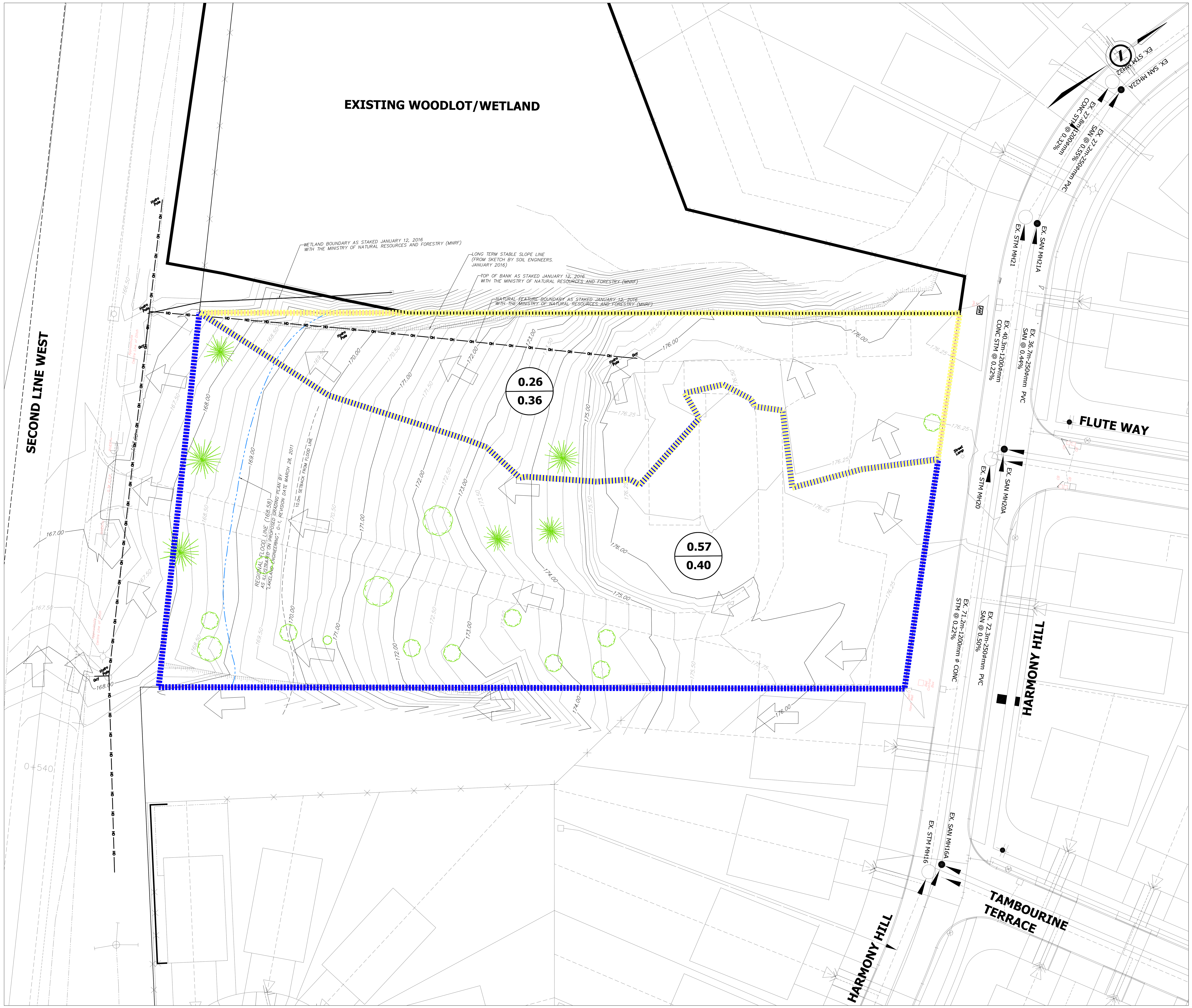
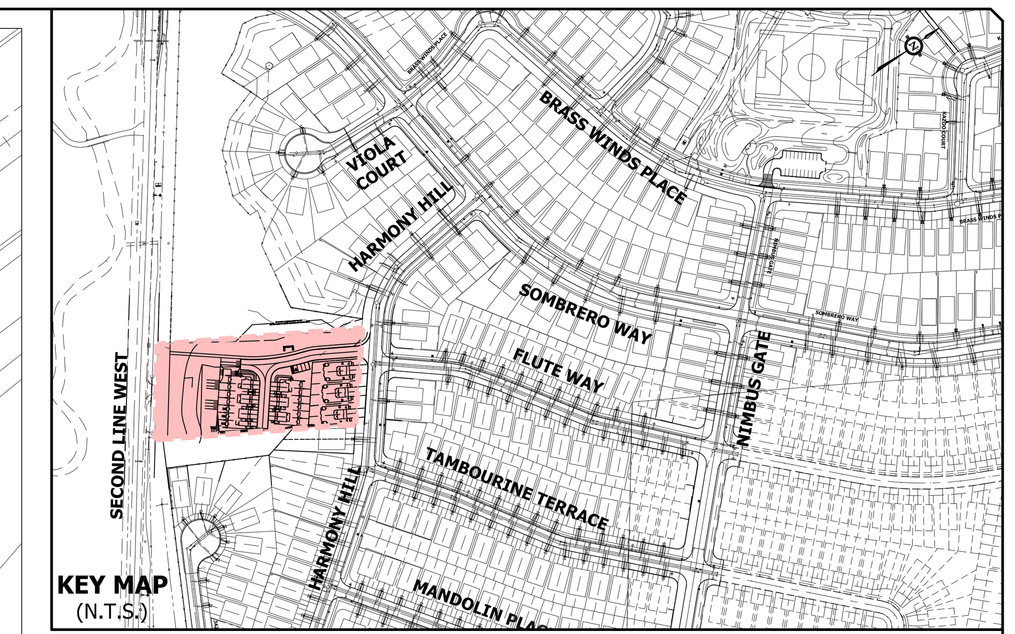
www.urbantech.com

## SITE SERVICING PLAN

| | | | |
|---|---|---|---|
| DRAWN BY: A.I. | CHECKED BY: S.M. | PROJECT NO: 16-502 | |
| DESIGNED BY: S.M. | DATE: AUGUST, 2017 | DRAWING NO. SS-1 | SHEET NO. |
| SCALE: 1:300 | | | |



KEY MAP
(N.T.S.)

**LEGEND**

- SUBJECT PROPERTY
- EXISTING GROUND CONTOUR AND ELEVATION
- EXISTING OVERLAND FLOW DIRECTION
- EXISTING TREE (TO BE REMOVED AS REQUIRED WITHIN SUBJECT PROPERTY)
- EXISTING TREE (TO BE REMOVED AS REQUIRED WITHIN SUBJECT PROPERTY)
- 0.25 DRAINAGE AREA (ha)
- 0.50 RUNOFF COEFFICIENT
- PRE DEVELOPMENT DRAINAGE AREA BOUNDARY CONTRIBUTING TO WOODLOT
- PRE DEVELOPMENT DRAINAGE AREA BOUNDARY
- WOODLOT/WETLAND BOUNDARY

**BENCHMARK NOTE**

ELEVATIONS HEREON ARE GEODETIC IN ORIGIN AND WERE DERIVED FROM GPS OBSERVATIONS USING THE "TopNET" GPS NETWORK AND ARE REFERRED TO THE CGVD-1928:1978 DATUM.

| No. | REVISIONS | DATE | BY |
|---|---|---|---|
| 3 | | | |
| 2 | | | |
| 1 | | | |

# HARMONY HILL RESIDENTIAL DEVELOPMENT
# 2512461 ONTARIO LIMITED

MISSISSAUGA

TOWN FILE No.__________ REGION FILE No.__________

MUNICIPAL

APPROVED IN PRINCIPAL SUBJECT TO DETAIL CONSTRUCTION CONFORMING TO CITY STANDARDS AND SPECIFICATIONS.

SIGNED__________ DATE__________
ENGINEERING DEPARTMENT

REGIONAL

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SIGNED__________ DATE__________
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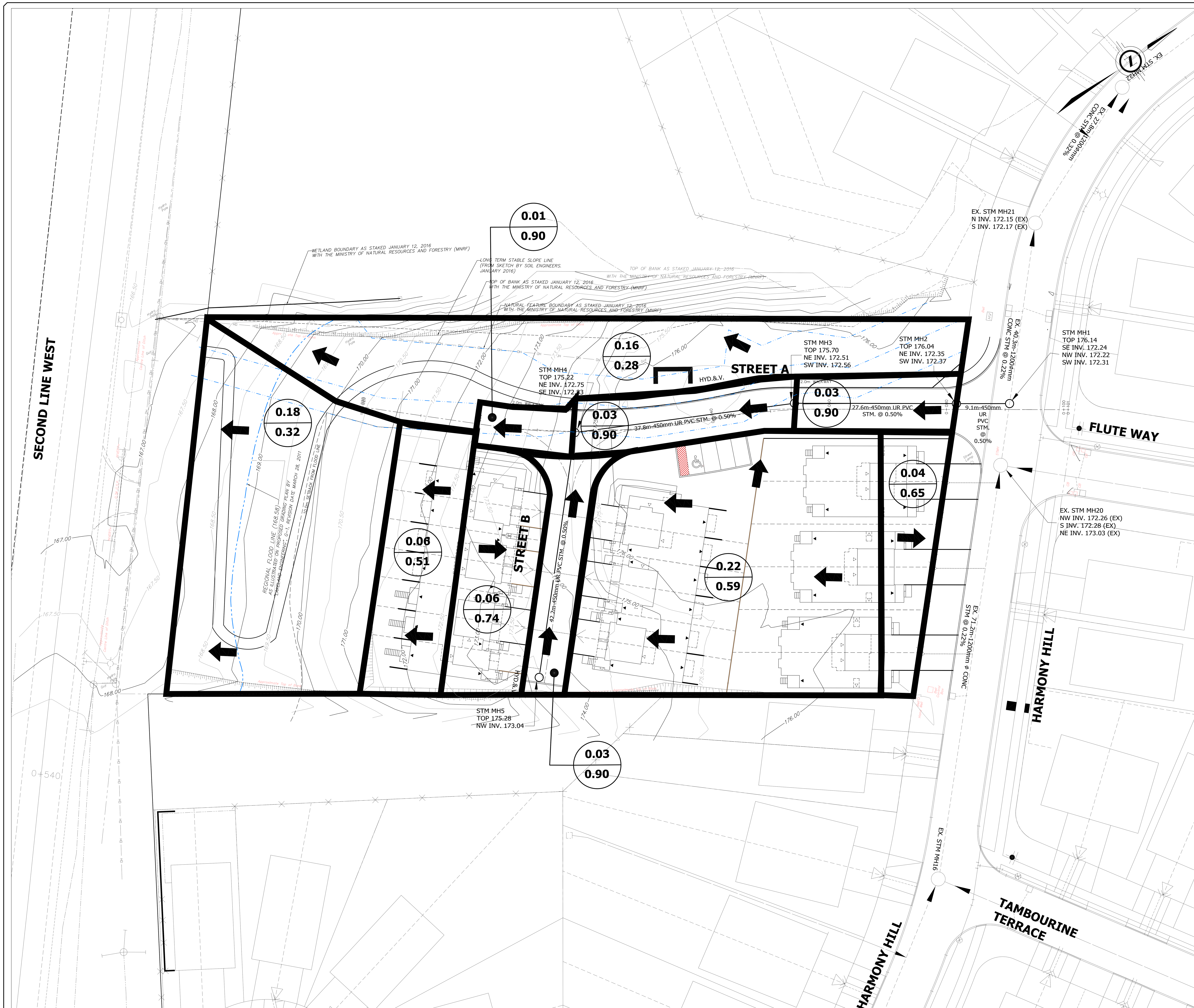
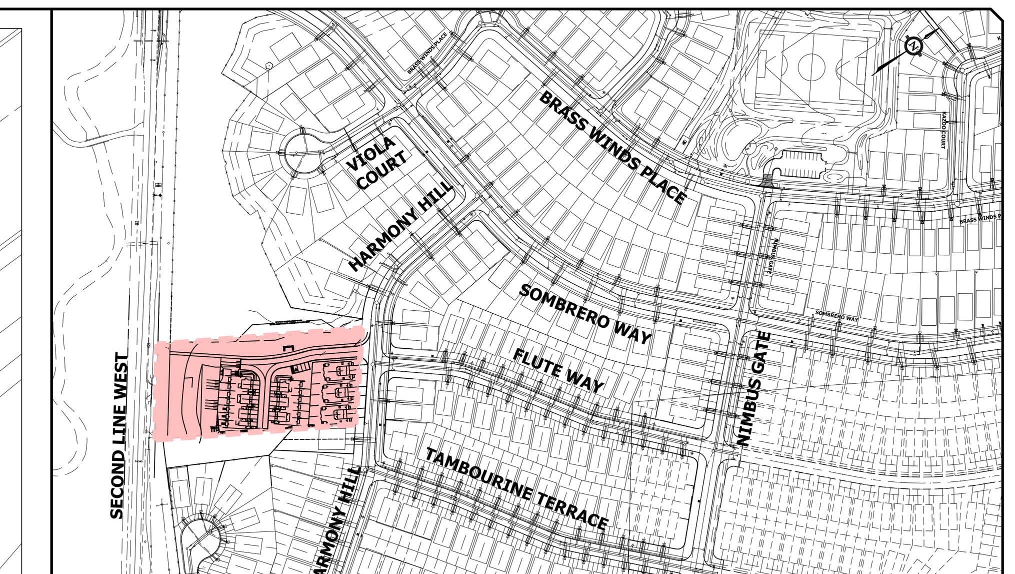
tel: 905.946.9461 fax: 905.946.9595
www.urbantech.com

## PRE-DEVELOPMENT STORM DRAINAGE PLAN

| | | | |
|---|---|---|---|
| DRAWN BY: A.I. | CHECKED BY: S.M. | PROJECT NO: 16-502 | |
| DESIGNED BY: S.M. | DATE: AUGUST, 2017 | DRAWING NAME: | STM-1 |
| SCALE: 1:300 | | | |



KEY MAP
(N.T.S.)

**LEGEND**

SUBJECT PROPERTY
EXISTING GROUND CONTOUR AND ELEVATION (247.00)
STORM MANHOLE
STORM SEWER & FLOW DIRECTION ARROW
SINGLE/REARLOT CATCHBASIN
DOUBLE CATCHBASIN
DOUBLE HOUSE CONNECTION
SINGLE HOUSE CONNECTION
REGIONAL FLOODLINE
0.75 — DRAINAGE AREA (ha) FOR MINOR SYSTEM (10 YEAR) FLOW
0.50 — RUNOFF COEFFICIENT
MINOR SYSTEM DRAINAGE AREA BOUNDARY
OVERLAND FLOW ROUTE
WOODLOT/WETLAND AREA BOUNDARY

**BENCHMARK NOTE**

ELEVATIONS HEREON ARE GEODETIC IN ORIGIN AND WERE DERIVED FROM GPS OBSERVATIONS USING THE "TopNET" GPS NETWORK AND ARE REFERRED TO THE CGVD-1928:1978 DATUM.

| No. | REVISIONS | DATE | BY |
|---|---|---|---|
| 3 | | | |
| 2 | | | |
| 1 | | | |

**HARMONY HILL RESIDENTIAL DEVELOPMENT**
**2512461 ONTARIO LIMITED**

MISSISSAUGA

TOWN FILE No.________ REGION FILE No.________

MUNICIPAL

APPROVED IN PRINCIPAL SUBJECT TO DETAIL CONSTRUCTION CONFORMING TO CITY STANDARDS AND SPECIFICATIONS.

SIGNED________ DATE________
ENGINEERING DEPARTMENT

REGIONAL

DESIGN OF SANITARY AND WATER SERVICES APPROVED SUBJECT TO DETAIL CONSTRUCTION CONFORMING TO PEEL REGION STANDARDS AND SPECIFICATIONS AND LOCATION APPROVAL FROM AREA MUNICIPALITY.

SIGNED________ DATE________
LEGISLATIVE AND PLANNING SERVICES

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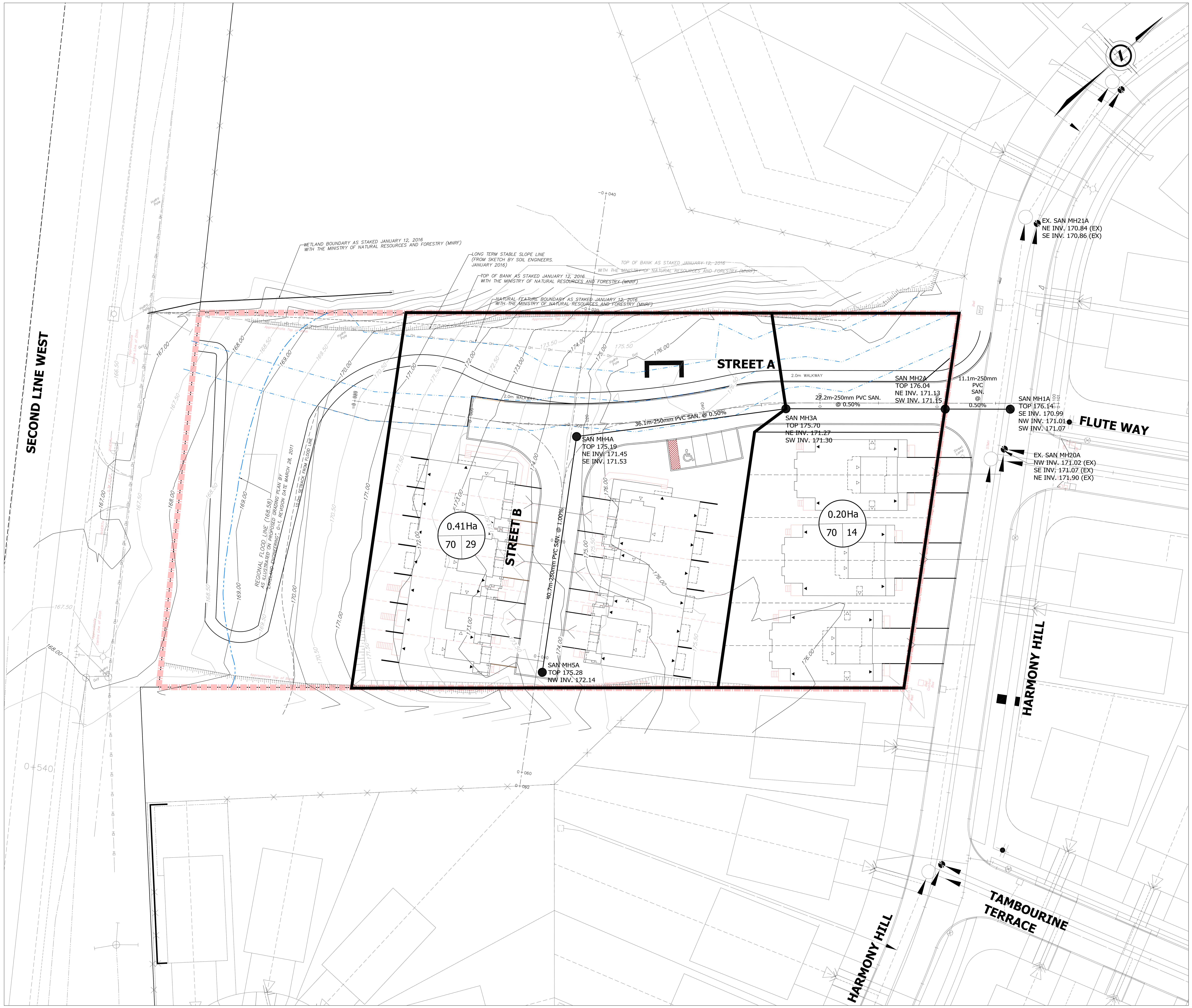
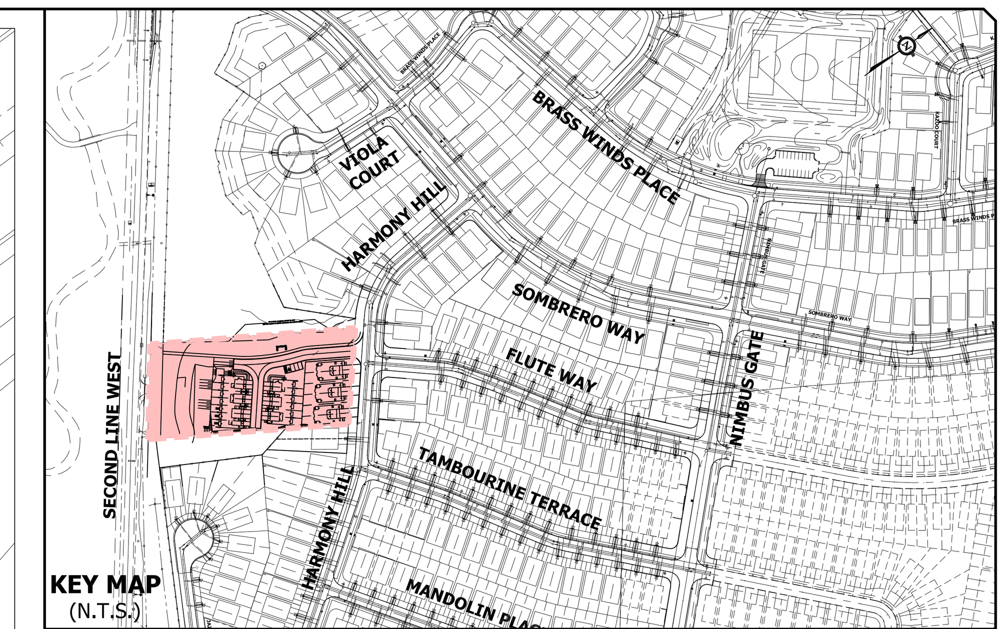
**STORM DRAINAGE PLAN**

| DRAWN BY: A.I. | CHECKED BY: S.M. | PROJECT NO: 16-502 |
|---|---|---|
| DESIGNED BY: S.M. | DATE: AUGUST, 2017 | DRAWING NAME: STM-2 |
| SCALE: 1:300 | | |




KEY MAP
(N.T.S.)

**LEGEND**

- SUBJECT PROPERTY
- SANITARY MANHOLE AND FLOW DIRECTION ARROW
- DRAINAGE AREA (ha) (0.10ha)
- POPULATION (35)
- POPULATION PER HECTARE (P/HA) (70)
- DRAINAGE AREA BOUNDARY
- SUB-DRAINAGE AREA BOUNDARY
- DOUBLE HOUSE CONNECTION
- SINGLE HOUSE CONNECTION
- EXISTING SANITARY MANHOLE

**BENCHMARK NOTE**

ELEVATIONS HEREON ARE GEODETIC IN ORIGIN AND WERE DERIVED FROM GPS OBSERVATIONS USING THE "TopNET" GPS NETWORK AND ARE REFERRED TO THE CGVD-1928:1978 DATUM.

| No. | REVISIONS | DATE | BY |
|---|---|---|---|
| 3 | | | |
| 2 | | | |
| 1 | | | |

**HARMONY HILL RESIDENTIAL DEVELOPMENT**
**2512461 ONTARIO LIMITED**

MISSISSAUGA

TOWN FILE No.________ REGION FILE No.________

MUNICIPAL

APPROVED IN PRINCIPAL SUBJECT TO DETAIL CONSTRUCTION CONFORMING TO CITY STANDARDS AND SPECIFICATIONS.

SIGNED________ DATE________
ENGINEERING DEPARTMENT

REGIONAL

DESIGN OF SANITARY AND WATER SERVICES APPROVED SUBJECT TO DETAIL CONSTRUCTION CONFORMING TO PEEL REGION STANDARDS AND SPECIFICATIONS AND LOCATION APPROVAL FROM AREA MUNICIPALITY.

SIGNED________ DATE________
LEGISLATIVE AND PLANNING SERVICES

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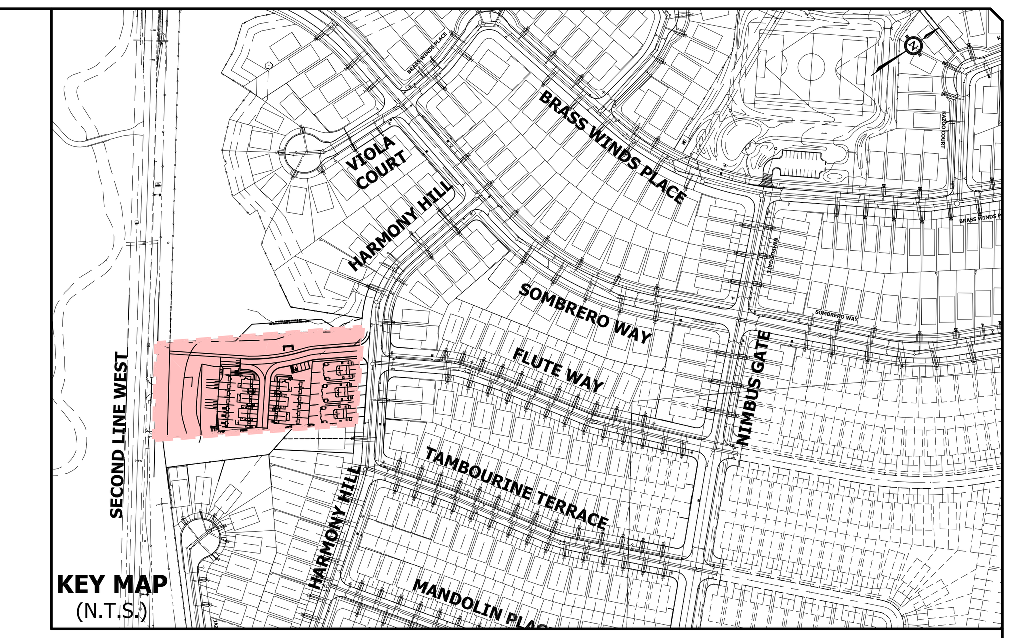
tel: 905.946.9461 fax: 905.946.9595
www.urbantech.com

**SANITARY DRAINAGE PLAN**

| | | | | | |
|---|---|---|---|---|---|
| DRAWN BY: | A.I. | CHECKED BY: | S.M. | PROJECT NO: | 16-502 |
| DESIGNED BY: | S.M. | DATE: | AUGUST, 2017 | DRAWING NAME: | SAN-1 |
| SCALE: | 1:300 | | | | |


**KEY MAP**
(N.T.S.)

**LEGEND**

| | |
|---|---|
| 200.25 | PROPOSED GRADE |
| 200.25 | EXISTING ELEVATION |
| 201.0 | EXISTING CONTOUR |
| | EXISTING SANITARY SEWER AND MANHOLE |
| | EXISTING STORM SEWER AND MANHOLE |
| | EXISTING SINGLE/REARLOT CATCHBASIN |
| | EXISTING DOUBLE CATCHBASIN |
| | VALVE & BOX |
| | EXISTING HYDRANT & VALVE |
| | EXISTING LIGHT STANDARD |
| | EXISTING CHAIN LINK FENCE |
| | EXISTING WOODLOT/WETLAND BOUNDARY |
| | PROPOSED 3:1 SLOPE |

**BENCHMARK NOTE**

ELEVATIONS HEREON ARE GEODETIC IN ORIGIN AND WERE DERIVED FROM GPS OBSERVATIONS USING THE "TopNET" GPS NETWORK AND ARE REFERRED TO THE CGVD-1928:1978 DATUM.

| No. | REVISIONS | DATE | BY |
|---|---|---|---|
| 3 | | | |
| 2 | | | |
| 1 | | | |

# HARMONY HILL RESIDENTIAL DEVELOPMENT 2512461 ONTARIO LIMITED

MISSISSAUGA

TOWN FILE No.________________ REGION FILE No.________________

MUNICIPAL

APPROVED IN PRINCIPAL SUBJECT TO DETAIL CONSTRUCTION CONFORMING TO CITY STANDARDS AND SPECIFICATIONS.

SIGNED____________________ DATE____________
ENGINEERING DEPARTMENT

REGIONAL

DESIGN OF SANITARY AND WATER SERVICES APPROVED SUBJECT TO DETAIL CONSTRUCTION CONFORMING TO PEEL REGION STANDARDS AND SPECIFICATIONS AND LOCATION APPROVAL FROM AREA MUNICIPALITY.

SIGNED____________________ DATE____________
LEGISLATIVE AND PLANNING SERVICES

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tel: 905.946.9461 fax: 905.946.9595
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## GRADING PLAN

| | | | |
|---|---|---|---|
| DRAWN BY: A.I. | CHECKED BY: S.M. | PROJECT NO: 16-502 | |
| DESIGNED BY: S.M. | DATE: AUGUST, 2017 | DRAWING NO. SG-1 | SHEET NO. |
| SCALE: 1:300 | | | |

# Appendix C

## Rand Engineering As-Constructed Drawings



**Urbantech Consulting, A Division of Leighton-Zec Ltd.**
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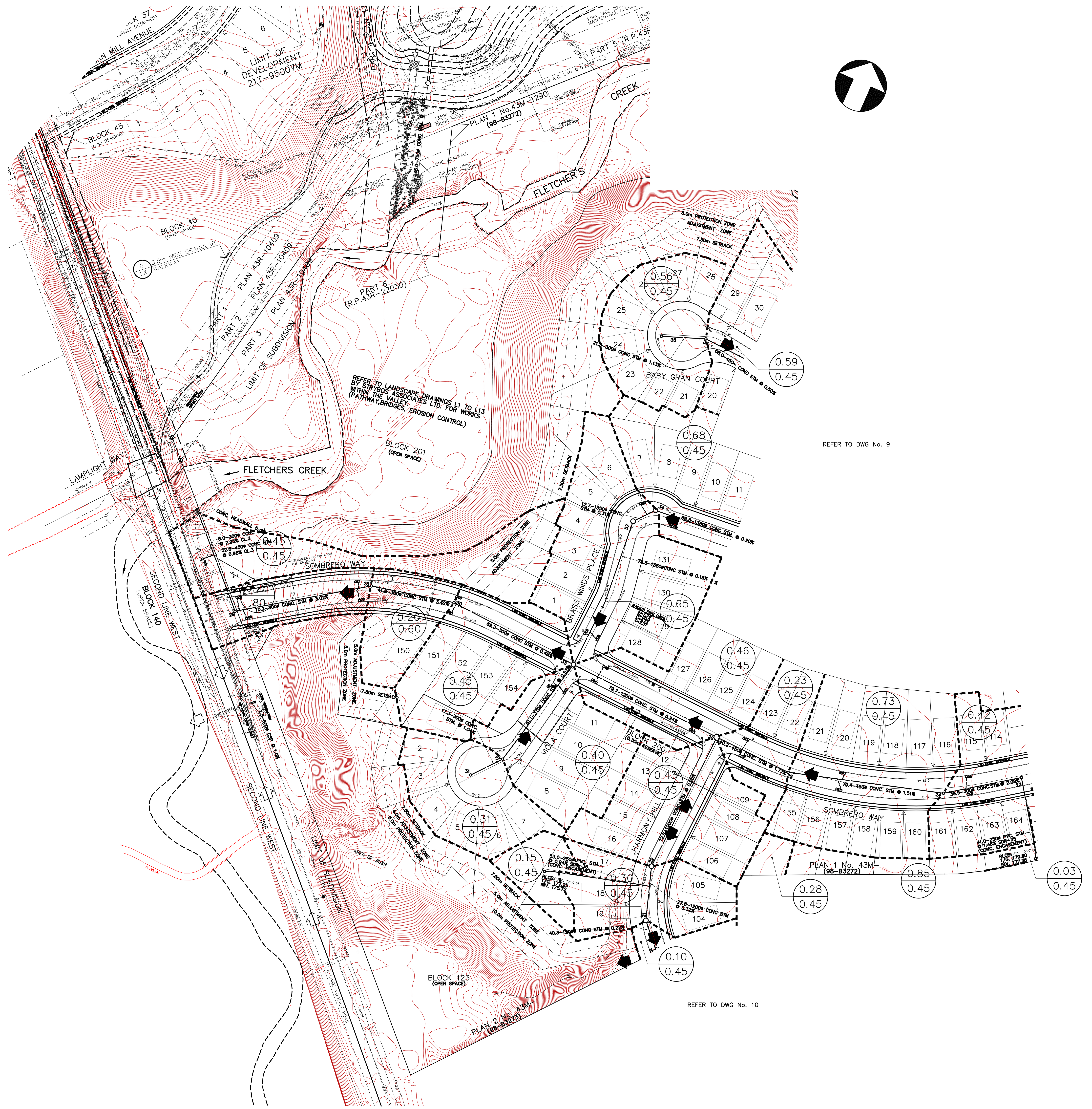


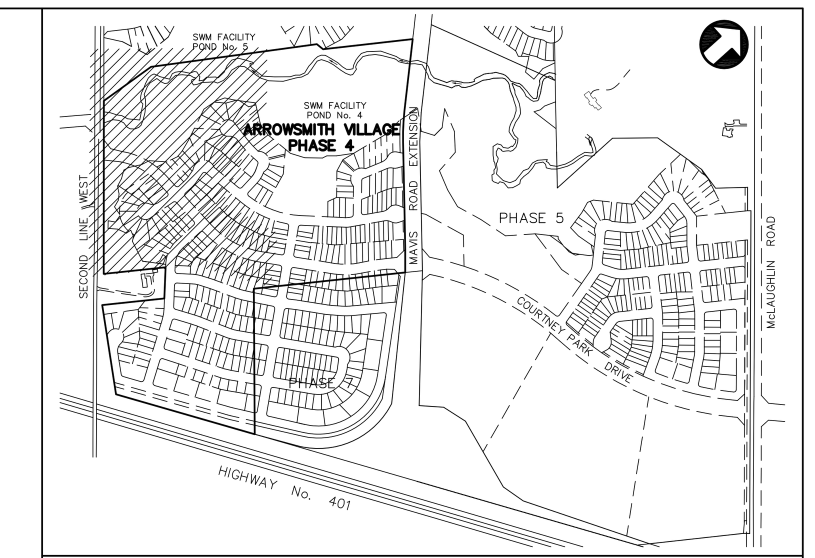


KEYPLAN N.T.S.

LEGEND

DENOTES OVERLAND FLOW DIRECTION

DENOTES Ex. OVERLAND FLOW DIRECTION

DENOTES STORM DRAINAGE BOUNDARY

0.80 DENOTES AREA IN HECTARES
0.50 DENOTES RUN-OFF COEFFICIENT

0.3 DENOTES Ex. AREA IN HECTARES
0.4 DENOTES Ex. RUN-OFF COEFFICIENT

9.07 DENOTES 100 YR. OVERLAND FLOW DRAINAGE AREA IN HECTARES
0.50 AVERAGE RUN-OFF COEFFICIENT

DENOTES DOUBLE SERVICE CONNECTION

DENOTES SINGLE SERVICE CONNECTION

EXISTING CONTOUR

1 TO 100 YEAR STORM PONDING AREA

AS CONSTRUCTED
AUGUST 2004

BENCH MARK:

CITY OF MISSISSAUGA
REFERENCE No. 409 ELEVATION 189.899m

ON THE W. FACE AT CENTRE OF THE MOST W. CENTRE COLUMN OF THE MacDONALD CARTIER FREEWAY (HWY. #401) AND McLAUGHLIN RD. OVERPASS AT HIGHWAY LEVEL.

| FIRST | INTERIM | SECOND | PRE-SER | FINAL |
|---|---|---|---|---|
| DATE OCT. 8, 1999 | DATE MAY 19, 2000 | DATE JUNE 30, 2000 | DATE SEPT. 8, 2000 | DATE MAY 15, 2001 |

REGISTERED PROFESSIONAL ENGINEER
E.W.C.GODDARD
PROVINCE OF ONTARIO

DESIGNED BY
CHKD.
APPROVED BY

RAND
ENGINEERING CORPORATION
5285 SOLAR DRIVE
MISSISSAUGA, ONTARIO
L4W 5B8
TEL. (905) 625-9500

ARROWSMITH VILLAGE – PHASE 4
968907 ONTARIO INC. &
GASMUZ CONSTRUCTION INC.

MISSISSAUGA
Transportation And Works Department

# STORM DRAINAGE PLAN

21T-95007E

| | | |
|---|---|---|
| SCALE: 1:1000 | AREA: | PROJECT No. 97457 |
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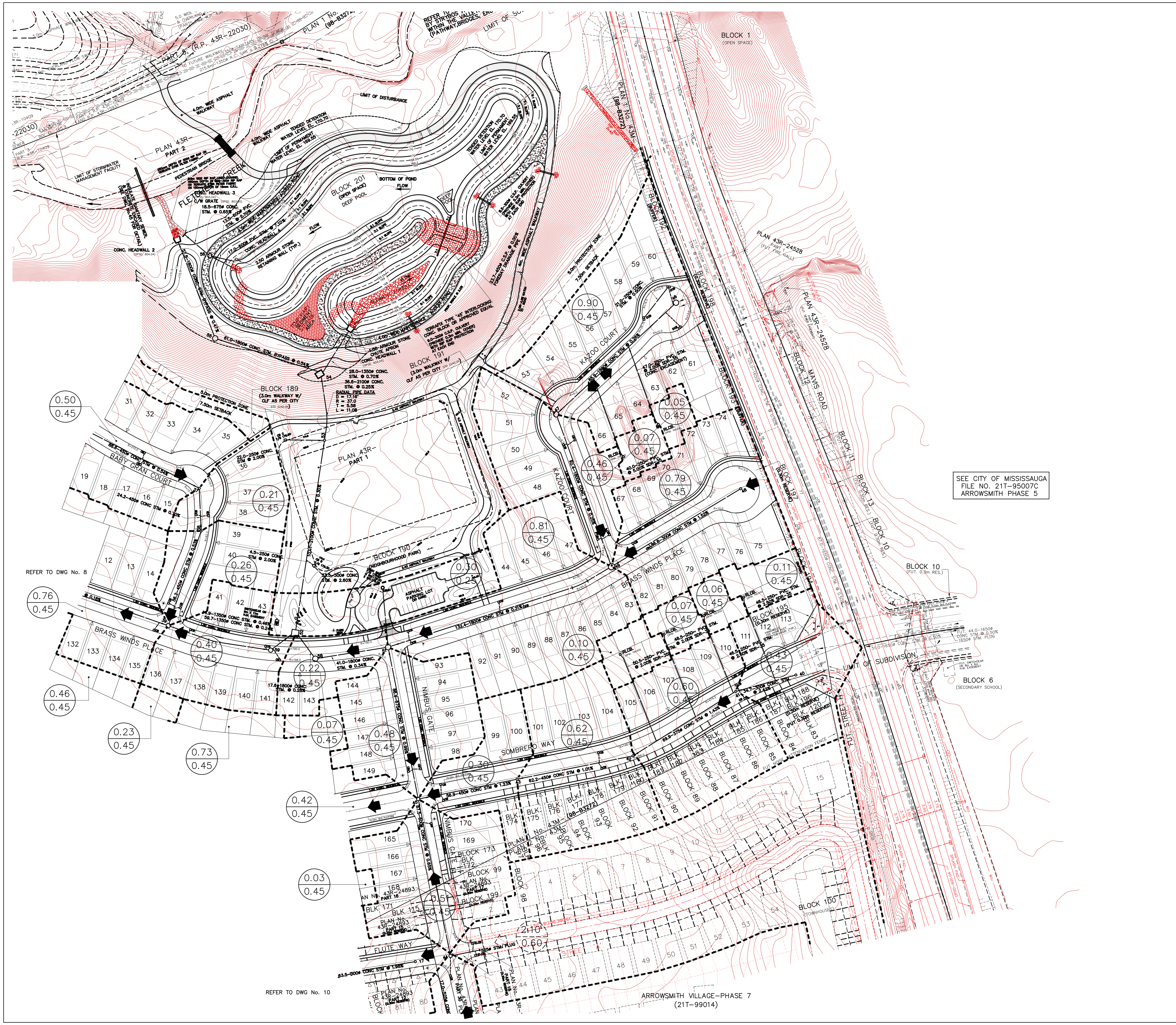
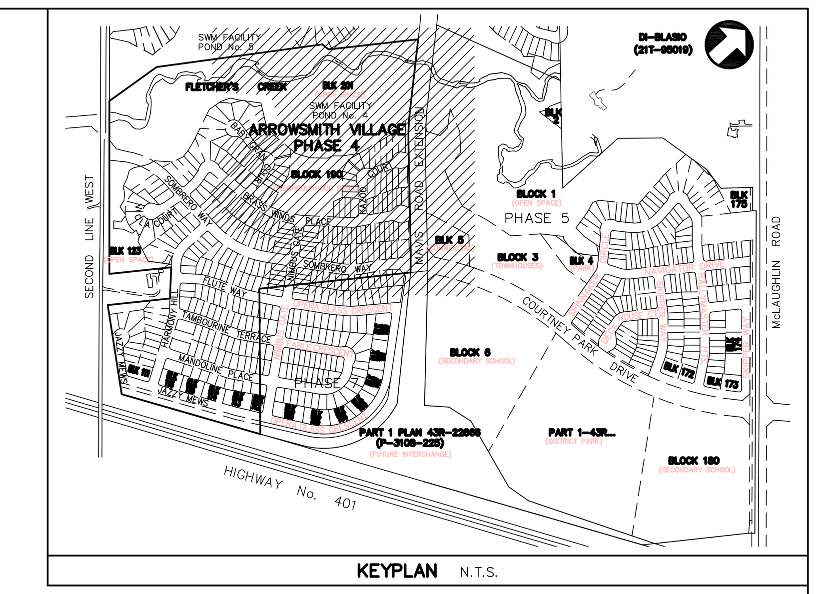
| DATE: OCTOBER 2000 | SHEET OF | C- |






LEGEND

DENOTES OVERLAND FLOW DIRECTION

DENOTES Ex. OVERLAND FLOW DIRECTION

DENOTES STORM DRAINAGE BOUNDARY

0.80 — DENOTES AREA IN HECTARES
0.50 — DENOTES RUN-OFF COEFFICIENT

0.3 — DENOTES Ex. AREA IN HECTARES
0.4 — DENOTES Ex. RUN-OFF COEFFICIENT

9.07 — DENOTES 100 YR. OVERLAND FLOW DRAINAGE AREA IN HECTARES
0.50 — AVERAGE RUN-OFF COEFFICIENT

DENOTES DOUBLE SERVICE CONNECTION

DENOTES SINGLE SERVICE CONNECTION

EXISTING CONTOUR

1 TO 100 YEAR STORM PONDING AREA

AS CONSTRUCTED
AUGUST 2004

BENCH MARK:

CITY OF MISSISSAUGA REFERENCE No. 409 — ELEVATION 189.899m

ON THE W. FACE AT CENTRE OF THE MOST W. CENTRE COLUMN OF THE MacDONALD CARTIER FREEWAY (HWY. #401) AND McLAUGHLIN RD. OVERPASS AT HIGHWAY LEVEL.

| FIRST | INTERIM | SECOND | PRE-SER | FINAL |
|---|---|---|---|---|
| OCT. 8, 1999 | MAY 19, 2000 | JUNE 30, 2000 | SEPT. 8, 2000 | MAY 15, 2001 |

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PROVINCE OF ONTARIO

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Transportation And Works Department

STORM DRAINAGE PLAN

21T-95007E

| SCALE: 1:1000 | AREA: | PROJECT No. 97457 |
|---|---|---|
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| DATE: OCTOBER 2000 | SHEET OF | C– |

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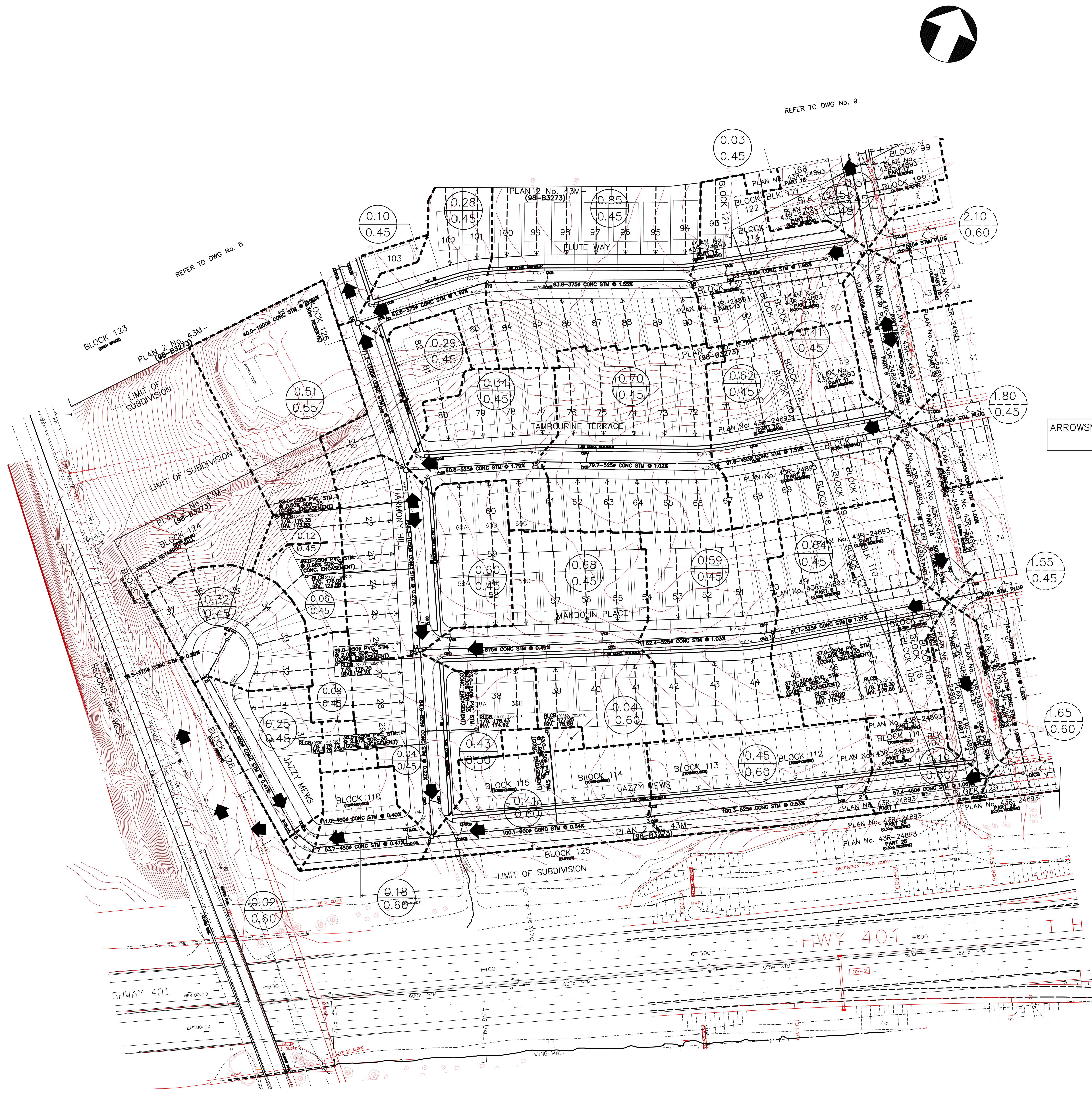


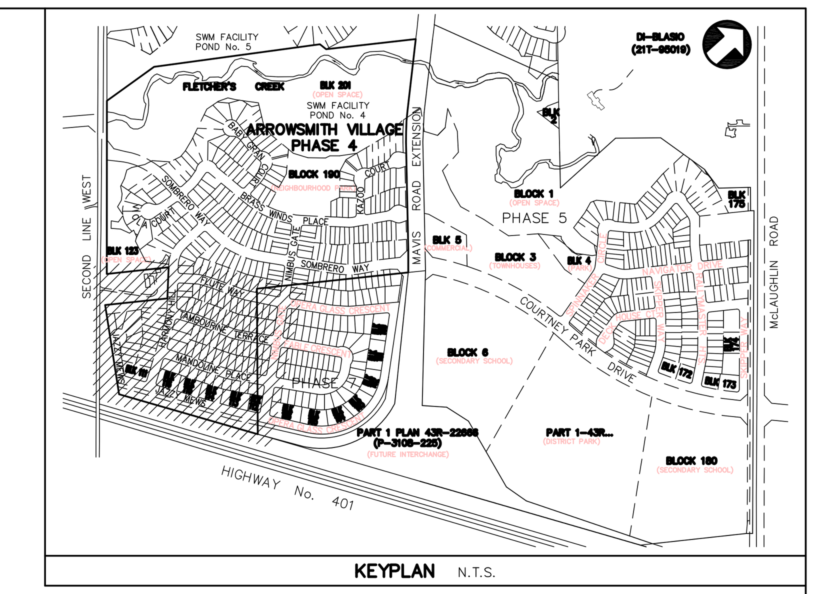


LEGEND

DENOTES OVERLAND FLOW DIRECTION

DENOTES Ex. OVERLAND FLOW DIRECTION

DENOTES STORM DRAINAGE BOUNDARY

0.80 DENOTES AREA IN HECTARES

0.50 DENOTES RUN–OFF COEFFICIENT

0.3 DENOTES FUTURE AREA IN HECTARES

0.4 DENOTES FUTURE RUN–OFF COEFFICIENT

9.07 DENOTES 100 YR. OVERLAND FLOW DRAINAGE AREA IN HECTARES

0.50 AVERAGE RUN–OFF COEFFICIENT

DENOTES DOUBLE SERVICE CONNECTION

DENOTES SINGLE SERVICE CONNECTION

EXISTING CONTOUR

1 TO 100 YEAR STORM PONDING AREA

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| FIRST | INTERIM | SECOND | PRE–SER | FINAL |
|---|---|---|---|---|
| DATE OCT. 8, 1999 | DATE MAY 19, 2000 | DATE JUNE 30, 2000 | DATE SEPT. 8, 2000 | DATE MAY 15, 2001 |

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# STORM DRAINAGE PLAN

21T–95007E

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|---|---|---|
| SCALE: 1:1000 | AREA: | PROJECT No. 97457 |
| DRAWN BY: ACAD | CHECKED BY: R.T. | PLAN No. 10 |
| DATE: OCTOBER 2000 | SHEET OF | C– |

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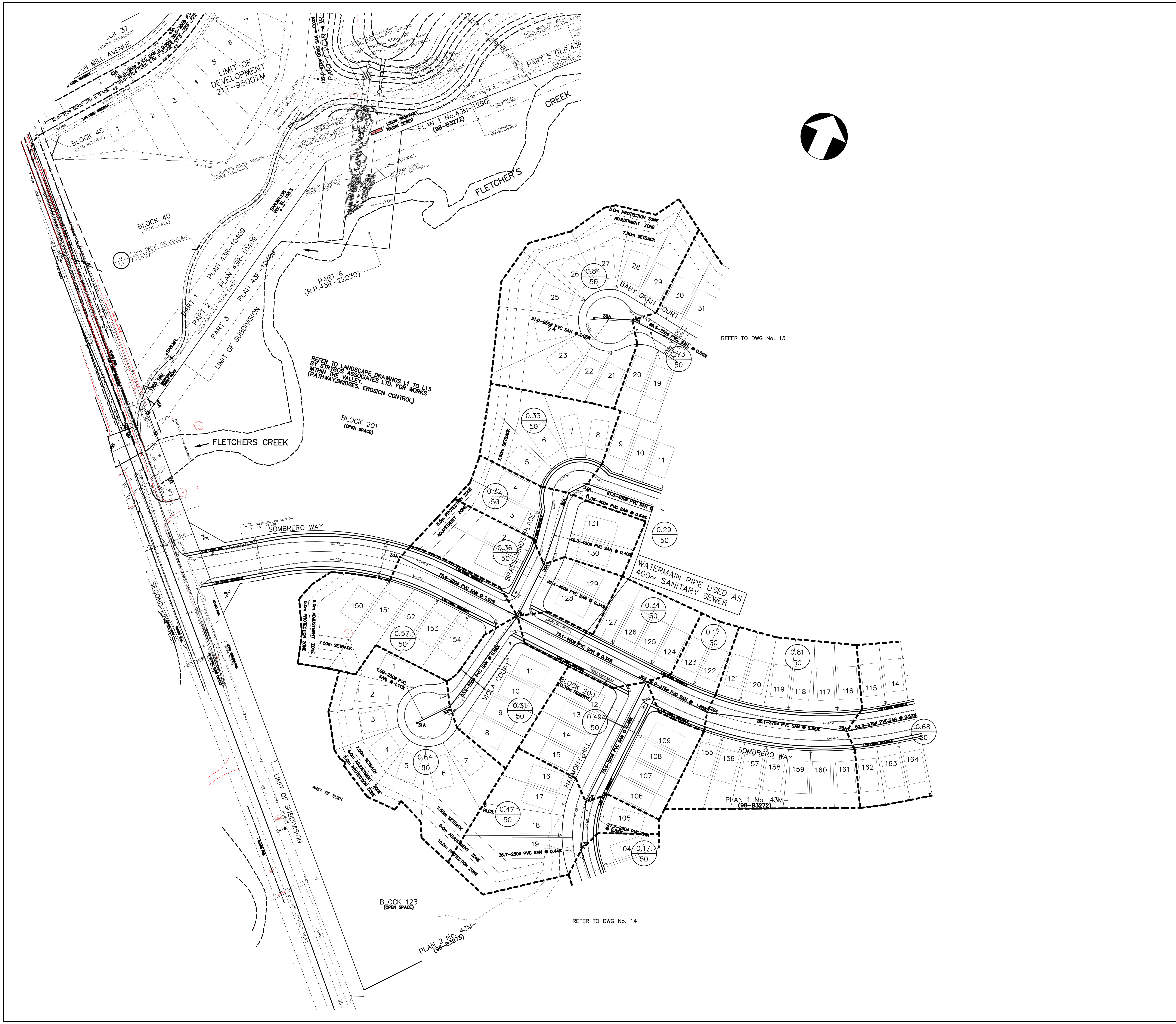
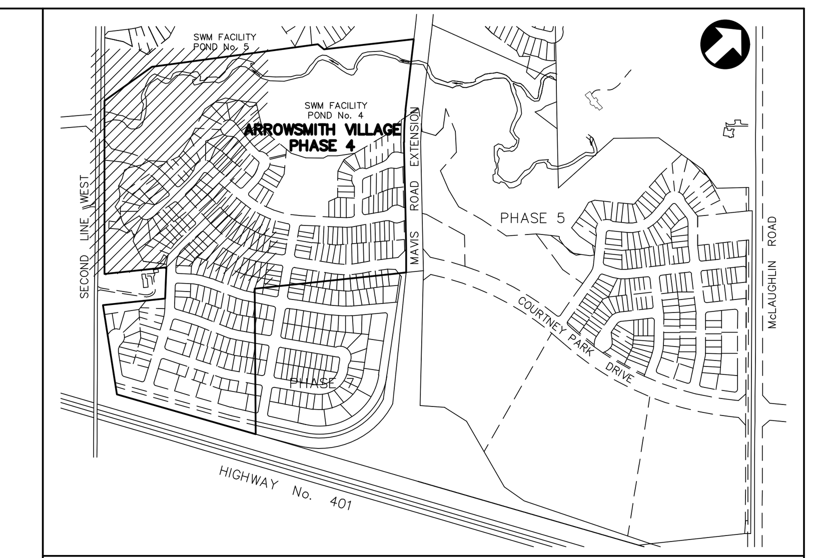



## LEGEND

| | |
|---|---|
| 0.70 | DENOTES DRAINAGE AREA IN HECTARES |
| 50 | DENOTES POPULATION DENSITY PER HECTARE |
| — — — | SANITARY DRAINAGE AREA BOUNDARY |
| 4.23 | DENOTES EXTERNAL DRAINAGE AREA IN HECTARES |
| 289 | DENOTES EXTERNAL POPULATION |
| △ | DENOTES DOUBLE SERVICE CONNECTION |
| ◿ | DENOTES SINGLE SERVICE CONNECTION |




KEYPLAN N.T.S.

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| FIRST | INTERIM | SECOND | PRE-SER | FINAL |
|---|---|---|---|---|
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# SANITARY DRAINAGE PLAN

21T-95007E

| | | | |
|---|---|---|---|
| SCALE: 1:1000 | AREA: | PROJECT No. 97457 | |
| DRAWN BY: ACAD | CHECKED BY: R.T. | PLAN No. 12 | |
| DATE: OCTOBER 2000 | SHEET OF | C– | |

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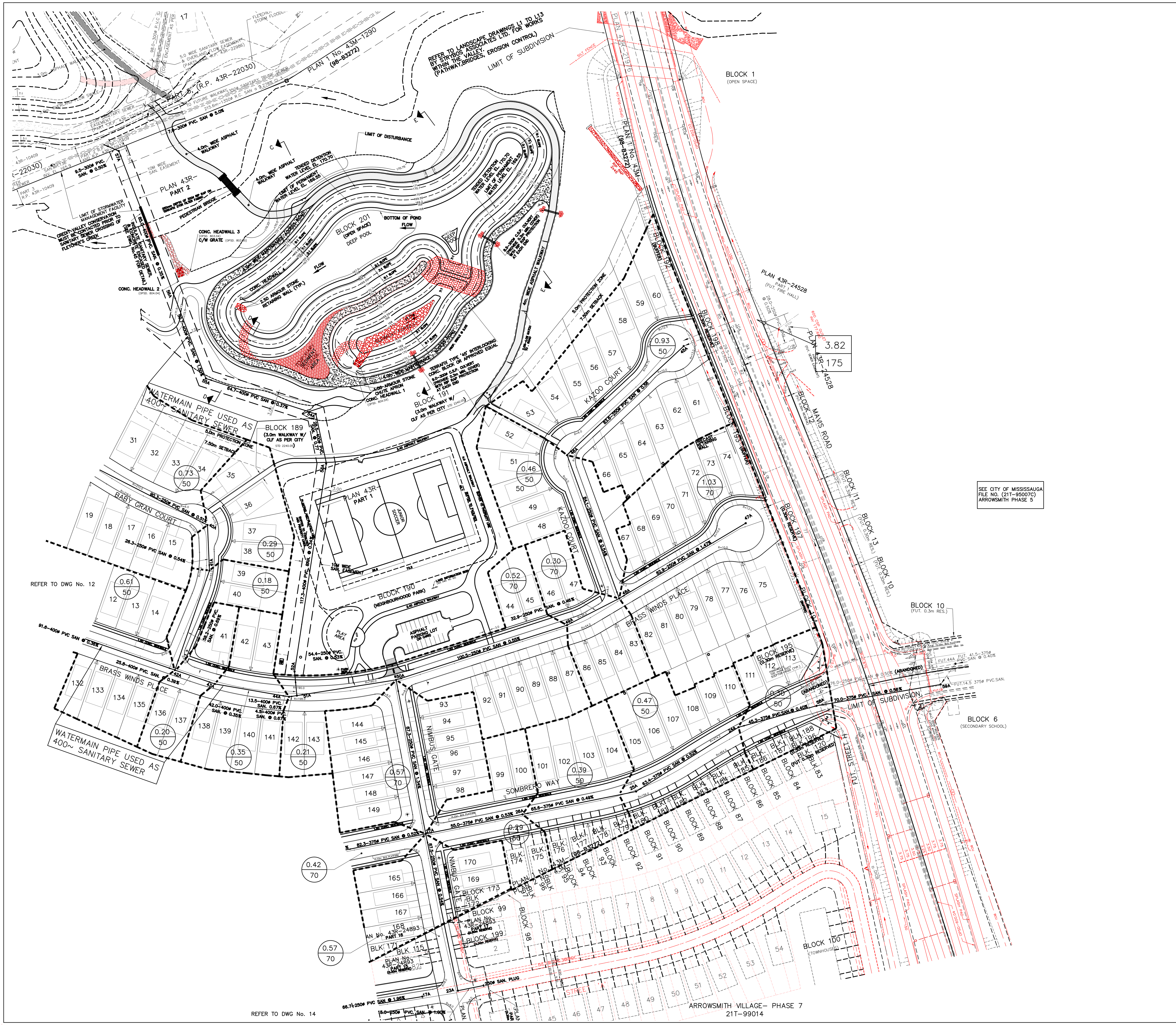


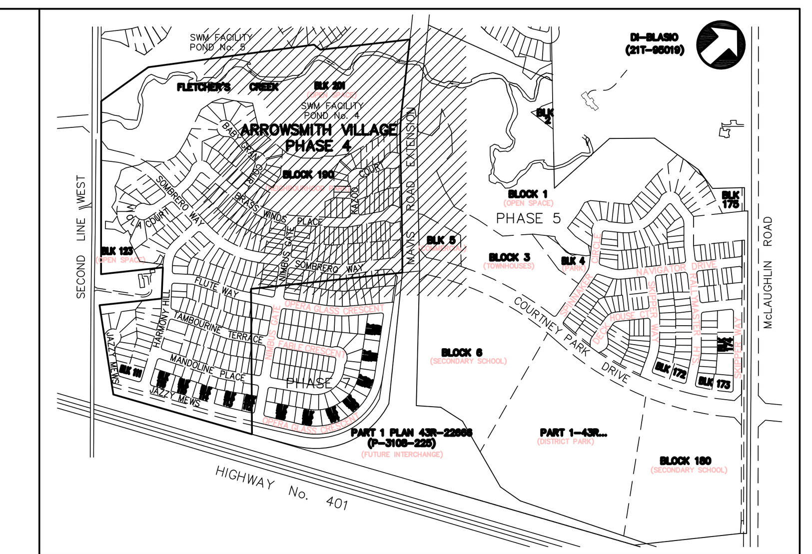


KEYPLAN N.T.S.

LEGEND

| | |
|---|---|
| 0.70 | DENOTES DRAINAGE AREA IN HECTARES |
| 50 | DENOTES POPULATION DENSITY PER HECTARE |
| — — — | SANITARY DRAINAGE AREA BOUNDARY |
| 4.23 | DENOTES EXTERNAL DRAINAGE AREA IN HECTARES |
| 289 | DENOTES EXTERNAL POPULATION |
| △ | DENOTES DOUBLE SERVICE CONNECTION |
| ◿ | DENOTES SINGLE SERVICE CONNECTION |

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| FIRST | INTERIM | SECOND | PRE-SER | FINAL |
|---|---|---|---|---|
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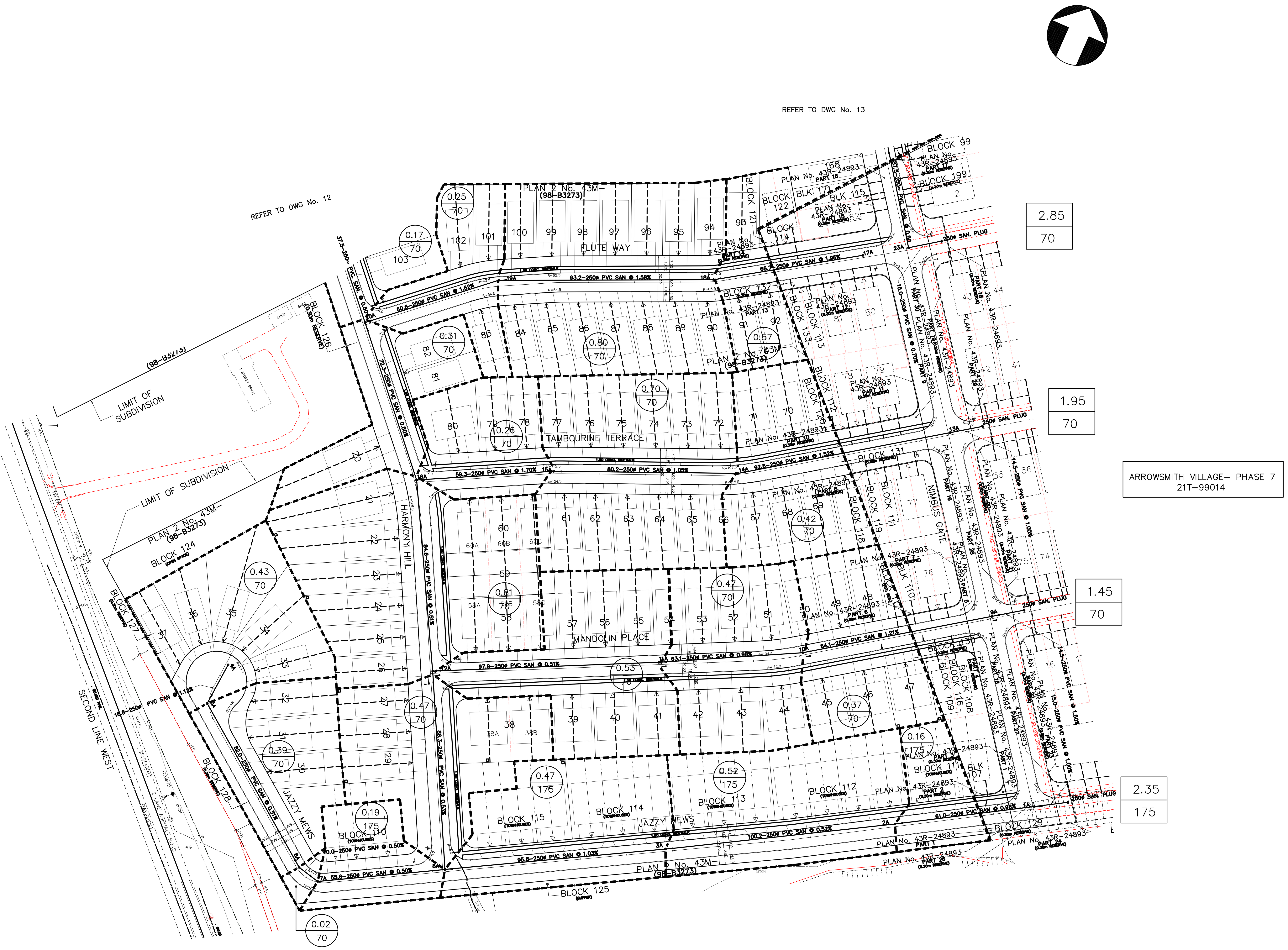
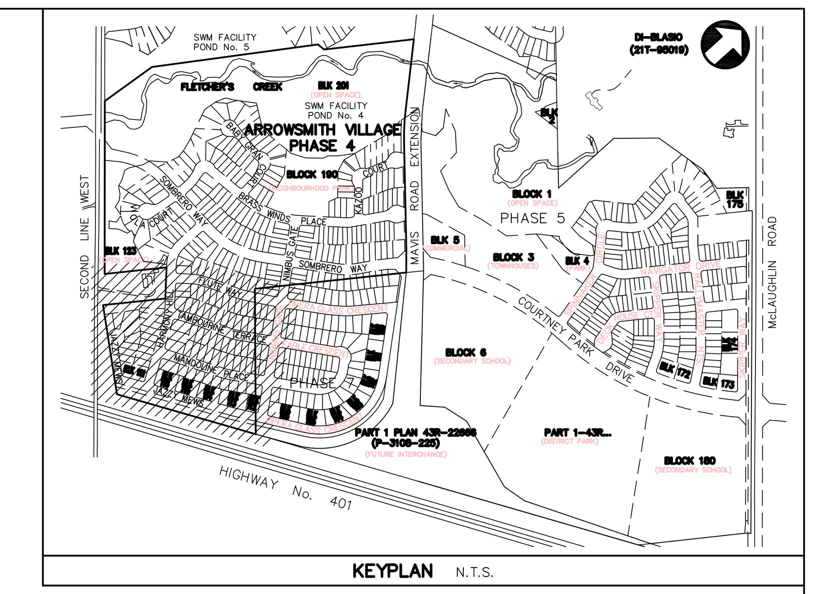
SANITARY DRAINAGE PLAN

21T-95007E

| | | |
|---|---|---|
| SCALE: 1:1000 | AREA: | PROJECT No. 97457 |
| DRAWN BY: ACAD | CHECKED BY: RAM | PLAN No. 13 |
| DATE: OCTOBER 2000 | SHEET OF | C– |




LEGEND

| | |
|---|---|
| 0.70 / 50 | DENOTES DRAINAGE AREA IN HECTARES<br>DENOTES POPULATION DENSITY PER HECTARE |
| — — — | SANITARY DRAINAGE AREA BOUNDARY |
| 4.23 / 289 | DENOTES EXTERNAL DRAINAGE AREA IN HECTARES<br>DENOTES EXTERNAL POPULATION |
| △ | DENOTES DOUBLE SERVICE CONNECTION |
| ◁ | DENOTES SINGLE SERVICE CONNECTION |

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| FIRST | INTERIM | SECOND | PRE-SER | FINAL |
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SANITARY DRAINAGE PLAN

21T–95007E

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|---|---|---|---|---|---|
| SCALE: | 1:1000 | AREA: | | PROJECT No. | 97457 |
| DRAWN BY: | ACAD | CHECKED BY: | R.T. | PLAN No. | 14 |
| DATE: | OCTOBER 2000 | SHEET | OF | C– | |

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