Elfrida Urban Boundary Expansion

Functional Servicing Report

Prepared for:
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Sign-off Sheet

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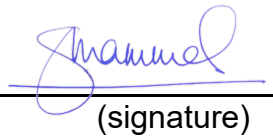
Prepared by  (signature)

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1.0 INTRODUCTION & SITE DESCRIPTION

Stantec Consulting Ltd. (“Stantec”) has been retained by the Elfida Community Builders Group Inc. (the “Client”) to prepare this Functional Servicing Report (FSR) to support the application to expand the City of Hamilton’s urban boundary to include the Elfrida Lands (herein referred to as the Subject Lands).

The Subject Lands are comprised of approximately 1,209.84 hectares located atop of the Hamilton Escarpment, adjacent to the southeast limits of the City of Hamilton’s current urban boundary. The lands are configured in the shape of a reverse “L” and are bisected by an existing hydro corridor running east to west. The lands north of the hydro corridor are roughly bordered by Mud Street at the north, Upper Centennial Parkway to the west and Second Road East/Hendershot Road to the east. Lands south of the hydro corridor are roughly bordered by Trinity Church Road to the west, Second Road East/Hendershot Road at the east, and Golf Club Road to the south. Existing surrounding land uses include urban areas to the west of Upper Centennial and Trinity Road, and north of the hydro corridor. Rural areas are located north of Mud Street, east of Second Road East/Hendershot Road, and south of Golf Club Road. The location of the Subject Lands is illustrated on **Figure 1.1**.

Historically, the Subject Lands have been located just outside of the City’s urban boundary (within the City’s Rural Official Plan). The area has been a planned growth node, documented in City of Hamilton’s 2006 *Growth Related Integrated Development Strategy* (GRIDS) and the City’s 2006 *Water and Wastewater Master Plan Class Environmental Assessment Report*. The GRIDS study identified urban expansion areas around the airport to accommodate employment growth and in the Elfrida Area to accommodate residential growth. In reviewing opportunities for potential future growth areas, Elfrida was selected, amongst other factors, because of its potential to use existing infrastructure more efficiently and with current infrastructure having capacity to accommodate growth. As such, the Subject Lands have been included in the City’s municipal servicing strategies for urban growth since 2006.

In 2018, the City began the process of updating the GRIDS in coordination with the Municipal Comprehensive Review process to update the City’s long term growth strategy to the Year 2041 (since revised to 2051). GRIDS 2 was undertaken by the City and is still being formalized along with the updated Water and Wastewater Master Plans for the City.

Figure 1.2 illustrates the proposed development concept for the Subject Lands (as prepared by Bousfields Ltd., which consists of 957.29 net developable hectares of lands and an anticipated residential population of 114,903 persons and 14,363 employees.

The 2006 GRIDS study anticipated growth within the Elfrida Lands to consist of 1,256 gross hectares and a residential population of 109,151 persons and 8,953 employees by the year 2031.

This FSR has been prepared to address the municipal servicing strategies for the Subject Lands including grading and road works, sanitary wastewater collection and treatment, water supply and distribution, storm water servicing, phasing of development, geotechnical and hydrogeologic conditions, provision of utilities (electricity, telecommunications, and natural gas) as well as address natural hazards components (floodline delineation / hydraulic analysis, erosion hazards assessment, meander belt assessment slope stability, channel design and geofluvial assessment, cut / fill analysis and Karst assessment). This report is to be read in conjunction with the other technical documents submitted with the planning application, as outlined further in Section 1.2.

The servicing strategies presented in this report are consistent with the City of Hamilton's development guidelines, design and construction drawings, standards and specifications as required.

Throughout the years (2006 to present), the City has undertaken a number of studies related to the future development of the Elfrida Lands in which some studies refer to the Elfrida Urban Boundary Expansion (UBE) Lands as the Southeast Mountain UBE Lands. For the purposes of this report the Elfrida UBE Lands, Southwest Mountain UBE Lands and the Subject Lands are considered to be the same land landholdings.

1.1 SITE DESCRIPTION

1.1.1 Existing Conditions

The Subject Lands are predominantly agricultural fields and residential land uses with some fragmented commercial and industrial uses. Agricultural uses vary from crop production to livestock and horse farms. There are pockets of residential development fronting Trinity Church Road, Fletcher Road, Golf Club Road and Upper Centennial Parkway / Regional Road 56, Regional Road 20 and Highland Road East. There are also scattered single family homes typically associated with existing farms scattered throughout the Study Area. A small employment park is located at Swayze Road and Portside Street with a strip of commercial lands fronting onto Rymal Road East to the north which are not included in the Subject Lands. Institutional uses include Our Lady of the Assumption Catholic Elementary School and Our Lady of the Assumption Roman Catholic Church.

The Subject Lands traverses the following five subwatersheds.

- Stoney Creek,
- Upper Davis Creek,
- Hannon Creek,

- Twenty Mile Creek, and
- Sinkhole Creek.

Figure 1.3 illustrates the Subject Lands within the five subwatersheds.

Upper Davis Greek, Hannon Creek and Twenty Mile Creek originate within the subject Lands. Stoney Creek and Sinkhole Creek headwaters originate within the existing urbanizing lands to the west which drain into the Subject Lands across Centennial Parkway. The watercourses are generally ephemeral, headwater features.

The subwatersheds of Stoney Creek, Upper Davis Creek and Hannon Creek drain northward towards Lake Ontario and are under the jurisdiction of the Hamilton Conservation Authority (HCA). The subwatersheds of Twenty Mile Creek and Sinkhole Creek drain southwesterly and are under the jurisdiction of the Niagara Peninsula Conservation Authority (NPCA).

1.1.2 Proposed Conditions

Future land uses within the Subject Lands will be defined through the City's Secondary Plan Process. Based on the documentation prepared by and for the City to date including the City's 2006 GRIDS and Water and Wastewater Master Plan, the lands are expected to develop primarily for community use as residential, and supporting uses such as retail, schools, parks and community facilities.

The Subject Lands will be developed with full municipal services including water, sanitary sewers, storm sewers, stormwater management, utilities (electricity, telecommunications and natural gas) and road works.

1.2 CONCURRENT AND PREVIOUS STUDIES

A number of previous and concurrent studies have been undertaken in support of the Elfrida Urban Boundary Expansion and the Subject Lands. These studies are relied on to provide the appropriate criteria that apply to this FSR. The studies include:

Related Studies

- "*Growth Related Integrated Development Strategy: Growth Report*", prepared by Dillon Consulting Ltd., May 2006.

- *"City of Hamilton Water and Wastewater Master Plan, Class Environmental Assessment Report",* KMK Consultants Limited, November 22, 2006.

- "*City of Hamilton Development Charges Background Study*", Watson & Associates Economists Ltd., 2006, 2011, 2019 and 2023/2024 versions.

- "*City of Hamilton Stormwater Master Plan – Class Environmental Assessment Report (City-Wide)*", Aquafer Beech Limited, May 2007.
- *"Hamilton Southeast Mountain Water Servicing Strategy – FINAL"*, Stantec Consulting Ltd., October 2013
- *"Elfrida Growth Area Study, Existing Conditions Report*", WSP., September 20, 2017.
- *"Elfrida Subwatershed Study, Final Phase 1 Report*", Aquafor Beech Limited, May 24, 2018.
- "*City of Hamilton Comprehensive Development Guidelines and Financial Policies Manual*", 2019.
- *"Urban Hamilton Official Plan*", May 22, 2022 (including amendments to November 2022).
- "*Rural Hamilton Official Plan*", February 2021 (including amendments to November 2022).

Concurrent Studies

- "*Subwatershed Study*", Stantec Consulting Ltd., October 2024.
- "Transportation Impact Study", C.F. Crozier Associates Inc., October 2024.

2.0 PHASING AND CONSTRUCTION STAGING

Due to the size of the Subject Lands and the multiple land parcel ownership, it is intended to develop the Subject Lands in multiple phases. As outlined in the following sections of this FSR, supporting infrastructure (storm sewers, sanitary sewers, watermains and utilities), stormwater management and the roadworks will need to be advanced moving from the north to the south and extending east and west from Upper Centennial, as supporting infrastructure is advanced from the existing facilities to the north and west to distribute full municipal services through the Subject Lands. This will be articulated in further studies prepared in support of the Secondary Plan stage of the City's planning process.

Development of the individual development blocks will follow the requirements of the future Secondary Plan for the Subject Lands and be established through the Draft Plan of Subdivision and Site Plan process, which may occur concurrently or independently of each other.

Typically, following preparation and approval of the Secondary Plan and Draft Plan of Subdivision approval for the each developments within in the Subject Lands, the construction staging would be as follows.

1. Detailed Engineering Design and Permit Applications

    - Preparation of detailed engineering design of site grading and municipal servicing (storm sewers, sanitary sewers, stormwater management, watermains, roadways and utility design coordination) including all permit applications, design plans and reports. Submission to the reviewing agencies for approval and permit issuance (City, Ministry of the Environment, Conservation and Parks (MECP), NPCA and HCA, and Ministry of Natural Resources and Forestry (MNRF) (if required) amongst other regulatory agencies as identified in the Conditions of Draft Plan Approval issued by the City. Includes rough site grading plans and erosion / sedimentation control (ESC) plans.

2. Agency Review and approval/permit issue.

3. Utility relocations (if required).

4. Site Earthworks (Rough Grading)

    - Site removals/demolition.

    - Installation of ESC works as required by the approved plans.

- Clear and grub the site as required.
- Strip topsoil and stockpile on site and/or removal from the site to an approved disposal site.
- Earthworks – cut and fill operations, import and fill placement (if required), excavation, removal and disposal of site of surplus and/or unsuitable materials (if required).

5. Municipal servicing (storm sewers, sanitary sewers, stormwater management, watermains, roadways) and utility design coordination Including any works external to the development site required to service the site.
6. Utility installation
7. Development Block Site Plan Approval (if required)
8. Building Permit Issue
9. Building Construction and final development block grading

3.0 CONCEPTUAL GRADING AND ROAD ACCESS

3.1 EXISTING SITE TOPOGRAPHY AND LAND USE

The Subject Lands are predominantly agricultural fields and residential land uses with some fragmented commercial and industrial uses. Agricultural uses vary from crop production to livestock and horse farms.

The Subject Lands traverses the following five subwatersheds.

- Stoney Creek,
- Upper Davis Creek,
- Hannon Creek,
- Twenty Mile Creek, and
- Sinkhole Creek.

Upper Davis Greek, Hannon Creek and Twenty Mile Creek originate within the subject Lands. Stoney Creek and Sinkhole Creek headwaters originate within the existing urbanizing lands to the west which drain into the Subject Lands across Centennial Parkway. The watercourses are generally ephemeral, headwater features.

The subwatersheds of Stoney Creek, Upper Davis Creek and Hannon Creek drain northward towards Lake Ontario and are under the jurisdiction of the HCA. The subwatersheds of Twenty Mile Creek and Sinkhole Creek drain southwesterly and are under the jurisdiction of the NPCA.

Topography of the Subject Lands is generally flat as described below.

- Lands within the Stoney Creek watershed generally fall from south to north at approximately a 0.9% grade for the lands between Centennial Parkway and First Road West. For the lands between First Road West and Second Road West the lands generally fall from south to the northeast at approximately a 1.1% grade.

- Lands within the Upper Davis Creek watershed generally fall from south to north at approximately a 1.2% grade.

- Lands within the Hannon Creek watershed generally fall from southeast to northwest at approximately a 1.3% grade.

- Lands within the Twenty Mile Creek watershed generally fall from northwest to southeast at approximately a 0.8% grade for the lands west of Centennial Parkway and 1.1% from northwest to southeast for lands east of Centennial Parkway.

- Lands within the Sinkhole Creek watershed generally fall from west to east at approximately a 0.45% grade for the lands west of Centennial Parkway and 0.2% from west to east for lands east of Centennial Parkway.

3.2 EXISTING SOIL CONDITIONS - GEOTECHNICAL INFORMATION

Geotechnical investigations for the Subject Lands will be undertaken as part of the Secondary Plan stage of the City's planning process.

A summary of the area geology as outlined in the *"Elfrida Subwatershed Study, Final Phase 1 Report*", Aquafor Beech Limited, May 24, 2018. is provided as follows.

- The geology of the Elfrida area is comprised of a low permeability laciolacustrine clay and silt overlying a dolostone bedrock aquifer. The clay deposits consist predominantly of interstratified clay and silt which partially cover the Niagara Falls Moraine.

- The Niagara Falls Moraine is expressed as a gently sloping ridge which traverses the study area from approximately Highland Road East in the east to just south of Rymal Road East in the western end of the study area. The Niagara Falls Moraine consists of the low permeability Halton clay till. The thickness of the low permeability clay ranges across the Subject Lands from 2 to 3 m at Highland Road East near Centennial Parkway, to greater than 10 m along Highway 20 near Second Road East.

- The underlying dolostone forms the regional aquifer for the study area. The dolostone is from the Guelph Formation and the Eramosa Member of the Lockport Formation from the Silurian Era. The Eramosa Member is described as light brown to black in color and is thin to moderately layered.

- The Eramosa Member of the Lockport Formation is known to be karstic north of the western section of the Subject Lands within the Davis Creek and Hannon Creek subwatershed areas, especially where the Eramosa Escarpment is exposed at, or near, surface. This area, which is outside of the Subject Lands to the northwest, has been extensively mapped for the presence of sinkholes and emergent springs.

- A sinkhole is present in the northwest corner of the Subject Lands within the Hannon Creek subwatershed. It is located in the eastern ditch of Trinity Church Road near the electrical transmission lines.

3.3 GRADING DESIGN

Development of preliminary grading and drainage design has not been undertaken and is deferred to the Secondary Plan process for the Subject Lands. The Subwatershed Study will inform the Secondary Plan process, identifying development limits based on natural heritage features and locations and rough sizing for SWM facilities. Once this information is available SWM facility outfall elevations and development limits can be established providing storm sewer/drainage elevations which in turn will establish minimum cover and preliminary road and lot elevations. Once preliminary road and lot grading elevations are generated an overall preliminary cut/fill calculation may be performed to determine if the Subject Lands are in a net deficit (import) or excess (export) of topsoil and earth materials. These calculations may be used to inform the Secondary Plan for the Subject Lands. Final earthworks quantities and earth movement volumes will not be established until development applications are processed by the City through the Draft Plan of Subdivision / Site Plan process for the individual development within the Subject Lands.

3.3.1 Design Constraints and Procedures

Constraints in designing the road profile and site grading are as follows:

- Match existing grades along the Perimeter of the Subject Lands.
- Match existing road and boulevard elevations of Mud Street East, Highland Road East, Regional Road 20, Golf Club Road, Trinity Church Road, Fletcher Road, Regional Road 56 / Centennial Parkway, First Road East and Second Road East / Hendershot Road.
- Set proposed property line elevations along all existing roads proposed for urbanization to coordinate with future road and right-of-way widenings.
- Capture and convey the Subject Lands minor and major storm water flows to the site specific Stormwater Management (SWM) facilities identified through the Subwatershed Study and Area Secondary Plan.
- Satisfy the City’s requirements for minimum and maximum road grades.
- Provide major overland flow routes for flows in excess of the storm sewer capacity with conveyance to the site specific SWM facilities identified through the Subwatershed Study and Area Secondary Plan.
- Maintain storm sewer outlet elevation to the SWM facilities above the SWM pond permanent pool elevation.
- Maintain adequate cover over storm, sanitary sewers, and watermains.

3.3.2 Grading Design Criteria

The pavement grades for the development are to be designed to the requirements of the City of Hamilton. Within development parcels, earthworks grading slopes are again to be designed to the requirements of the City, typically between a minimum of 2.0% and 8.0% and 3:1 slopes to accommodate various grade changes necessitated within the Subject Lands. The use of retaining walls may be required in various locations throughout the Subject Lands where 3:1 sloping cannot be accommodated. This will be confirmed at the time of detailed design of the development parcels site grading through the Plan of Subdivision and Site Plan process.

Grading plans for each development parcel will be detailed during the Plan of Subdivision and Site Plan stage. Each individual development block will be required to match existing grades at the perimeter of the property, with consideration for potential future grading where new development abuts lands planned for future development.

The existing roads within the Subject Lands are currently constructed to a rural standard. It is anticipated that with an UBE of the Subject Lands, upgrading of the existing roadways to the City's urban standard will be undertaken during development of the Lands, road standards and right of way widths for all existing and new roadways will be identified through the Secondary Plan process for the Subject Lands.

3.3.3 Earthworks

As mentioned previously development of preliminary grading and drainage design has not been undertaken and is deferred to the Secondary Plan process for the Subject Lands. At the Secondary Plan Stage, overall preliminary cut/fill calculations may be performed to determine if the Subject Lands are in a net deficit (import) or excess (export) of topsoil and earth materials. These calculations may be used to inform the Secondary Plan for the Subject Lands.

Final earthworks quantities and earth movement volumes will not be established until development applications are processed by the City through the Draft Plan of Subdivision / Site Plan process for the individual development within the Subject Lands.

3.4 ROADWORKS

For a description of the existing and proposed road network to provide access and vehicle distribution through the Subject Lands please be directed to the Traffic Impact Study prepared by C.F. Crozier Associates Inc. accompanying the UBE application for the Subject Lands.

4.0 WATER SUPPLY AND DISTRIBUTION

4.1 EXISTING CONDITIONS

There is no current water infrastructure servicing the Subject Lands. Existing water infrastructure in the vicinity of the Subject Lands includes:

- The City of Hamilton's Pressure District (PD) 7 is located northwest of the Subject Lands.
- The area north of Rymal Road, within PD 7, is serviced by a watermain network ranging in diameter from less than 150mm to 400mm.
- A 400mm diameter watermain on Trinity Church Road south from Rymal Road to approximately 1.0 kilometer south of Rymal Road where it reduces to 300mm to Golf Club Road.
- A 400mm watermain running north-south along Regional Road 56 currently services the community of Binbrook (PD 23). The community of Binbrook is located south of the Subject Lands and includes the HDT23 Elevated Storage Tank, HD023 Pumping Station and watermains ranging from less than 150mm to 400mm in diameter.
- PD 7 is currently serviced through the HD007 Highland Pumping Station (PS), which pumps water from PD 5. The HD007 PS is located at 293 Highland Road in Stoney Creek and feeds from the HDR07 Highland Reservoir. The facility includes a pump house, a reservoir access house and a two cell reservoir (HDR07). There are four pumps at the station, each with a rated capacity of 250 L/s, discharging to a common 600 mm diameter discharge header which splits into two 600 mm diameter discharge headers to supply the distribution system. The existing area water distribution system is shown in Figure 38 of the *Elfrida Growth Area Study, Existing Conditions Report*", WSP., September 20, 2017, reproduced herein as **Figure 4.1**.

4.1.1 Existing Water Supply

The urban area of the City of Hamilton is supplied with treated potable water from the Woodward Ave. Water Treatment Plant which draws raw water from Lake Ontario. The Woodward Avenue Water Treatment Plant provides potable water to all of the Pressure Districts through PD 1.

As mentioned above, PD7 is currently serviced through PD 5. PD 5 is fed from PD 1 through two pumping stations, HD005 and HD05A.

4.2 PROPOSED CONDITIONS

As mentioned in Section 1.0 above, the Subject Lands have been included in the City's municipal servicing strategies for urban growth since 2006. The Subject Lands are to be included within City of Hamilton PD 7 with ground elevations ranging between approximately of 195m to 219m.

As outlined in the 2013 *Hamilton Southeast Mountain Water Servicing Strategy*, the following works were identified for servicing PD 7 including the Subject Lands and PD23.

- Project W-10 - HD007 Highland Pumping Station Upgrades
- Project W-11 – HDR07 Highland Reservoir Expansion
- Project W-13 – Centennial Parkway Feedermain
- Project W-20 – HD019 Binbrook Hwy 56 Pumping Station Upgrades and PD23 Additional Storage
- Project W-21 – New PD7 Pumping Station HD07A
- Project W-22 – HD07A Feedermain
- Project W-23 – PD 7 Elevated Tank
- Project W-24 – Stone Church Trunk Feedermain
- Project W-28 – HD05A Greenhill PS Upgrades
- Project W-30 – Binbrook Trunk Feedermain

The above projects have been included in the City's Development Charge (DC) Background Studies since 2013. **Table 4.1** below lists the projects above with their corresponding DC Background Study Project Identification (ID) No., brief project description and current status as outlined in the 2023 *City of Hamilton Development Charges Background Study*.

Table 4.1 – PD7 and PD23 Water Supply Projects

Project No.	DC Background Report ID No.	Project Description	Project Status
W-10	SCU8-W	HD007 Highland Pumping Station Upgrades	Completed
W-11	SCU7-W	HDR07 Highland Reservoir Expansion	>6 Years
W-13	SCU11-W	Centennial Parkway Feedermain between Barton St. and HD05A	Completed

W-20	B2-W	HD019 Binbrook Hwy 56 Pumping Station Upgrades and PD23 Additional Storage	0 to 5 years
W-21	SCU21-W	New PD7 PS HD07A – Upper Centennial Parkway and Regional Road 20	>6 Years
W-22	SCU22-W	HD07A Feedermain – Mud Street to New PS HD07A	>6 Years
W-23	HM28-W	PD 7 Elevated Tank – 420 Trinity Church Road	0 to 5 years Design Tender Awarded
W-24	HM20-W	Stone Church Trunk Feedermain – First Road West to HD06B	0 to 5 years Tender Closed Sept. 24, 2024
W-28	SCU18-W	HD05A Greenhill PS Upgrades	0 to 5 years
W-30	B7-W	Binbrook Trunk Feedermain – Fletcher's Rd. & Cemetery Road from Hydro Corridor to HD019	0 to 5 years

A schematic of the existing water distribution system for the Hamilton Mountain and Upper Stoney Creek area including the above-mentioned projects is provided on Figure 1-5 from the City's 2023 Background Study reproduced herein as **Figure 4.2**.

4.3 WATER SYSTEM ASSESSMENT

4.3.1 Methodology

The Average Day Demand (ADD), Maximum Day Demand (MDD) Peak Hour Demand (PHD) and Fire Flow Demand is calculated based on the *City of Hamilton Comprehensive Development Guidelines and Financial Policies Manual*", 2019. The City's 2019 manual indicates that Domestic and Fire Flow Demand design flows shall conform to the latest edition of the "*Ontario Ministry of the Environment, Conservation and Parks (MECP), Guidelines for the Design of Water Distribution Systems*". Fire flows are to be determined in accordance with the Fire Underwriters Survey (FUS) 1999.

The maximum operating pressure of the distribution system piping shall not exceed 700 KPa. The distribution system shall be sized to meet the greater of the PHD or MDD plus

Fire Flow whichever is greater, and the pressure in the system shall not drop below 140 Kpa at any time.

Water distribution system design parameters for the subject land are summarized in Table 4.3.

4.3 Subject Lands Water System Design Parameters

Parameter	Value	Reference
Subject Lands Population Residential Employment	 114,903 14,363	Planning Justification Report, Bousfields Inc.
ADD Residential Employment	 360 L/cap/day 260 L/emp/day	City – Southeast Mountain Water Servicing Strategy
MDD Residential Employment	 1.9 x ADD 1.9 x ADD	City – Southeast Mountain Water Servicing Strategy
PHD Residential Employment	 3.0 x ADD 3.0 x ADD	City – Southeast Mountain Water Servicing Strategy
Fire Flow	250 L/s	City – Southeast Mountain Water Servicing Strategy

4.3.2 System Pressure Requirements

The maximum operating pressure of the distribution system piping shall not exceed 700 KPa. The distribution system shall be sized to meet the greater of the PHD or MDD plus Fire Flow whichever is greater, and the pressure in the system shall not drop below 140 KPa.

The Ontario Building code requires individual pressure regulating valves within buildings if pressures are above 80 psi (550 kPa).

4.3.3 Analysis

Servicing of the Subject Lands will require extension of the existing local water distribution system to and throughout the property as anticipated in the 2006 *City of Hamilton Water and Wastewater Master Plan, Class Environmental Assessment Report* and will require a water distribution system analysis report prepared to City standards to support water servicing to the Lands.

Within the 2013 *Hamilton Southeast Mountain Water Servicing Strategy*, the anticipated design demand water requirements for the Elfrida area (PD 7) was estimated to be ADD = 41.6 ML/day, MDD = 79.1 ML/day and PHD = 124.9 ML/day, based on a total population of 109,151 and a total number of employment jobs of 8,953 to 2031 (consistent with the populations reported in the 2006 *City of Hamilton Water and Wastewater Master Plan, Class Environmental Assessment Report*. Of the estimated 2031 population, an approximate population of 41,558 and 3,525 employment jobs are attributable to the proposed Southeast Mountain Urban Boundary Expansion Area (being the area of the Subject Lands).

Based on the Subject Lands Concept Plan prepared by Bousfields Inc., the updated projected population for the Southeast Mountain Urban Boundary Expansion Area (Subject Lands), is estimated to be 114,903 and 14,363 employment jobs, based on a net developable area of 957.29 of the 1209.84 ha. This increase in population results in an anticipated design demand water requirements for PD 7 of ADD = 70.8 ML/day, MDD = 134.6 ML/day and PHD = 212.5 ML/day (see Table 4.4 for calculations).

As can be seen from the data above, there is a considerable increase in the water demands for PD7 based on the projected population of the Subject Lands over the 2031 projected water demands for PD 7 reported in the 2013 *Hamilton Southeast Mountain Water Servicing Strategy*. Further discussions with City Staff is required to better understand how the increase in the anticipated water demands of the Subject Lands impacts the proposed water infrastructure projects and the timing of such projects. With resolution of the impacts the proposed increase in population may have, a existing and proposed conditions hydraulic model of the City's water system including the Subject Lands can be developed and analyzed to provide domestic water supply and distribution including adequate supply and pressure for firefighting purposes from extension and connection to City's existing local distribution system.

Hydraulic modelling of the proposed Subject Lands' water distribution network including watermain sizing and system upgrades required is to be undertaken in conjunction with the Secondary Plan process which will establish the preferred land use and road pattern for the Subject Lands.

Table 4.4 – ADD, MDD, PHD, Fire Flow and Total Peak Design Flow Calculations

Total PD 7 Including the Subject Lands ADD	360 L/c/day x pop'n of (109,151 – 41,558+114,903) + 260 L/emp/day x (8,953-3,525+14,363)	70.8 ML/day or 820.0 L/s
Total PD 7 Including the Subject Lands MDD	360 L/c/day x pop'n of (109,151 – 41,558+114,903) x 1.9 max day factor + 260 L/emp/day x (8,953-3,525+14,363) x 1.9 max day factor	134.6 ML/day or 1,558 L/s
Peak Hourly Demand (PHD)	360 L/c/day x pop'n of (109,151 – 41,558+114,903) x 3.0 peak hour factor + 260 L/emp/day x (8,953-3,525+14,363) x 3.0 peak hour factor	212.5 ML/day or 2,460 L/s
Required Fire Flow (RFF)	250 L/s per the W/WW master plan	21.6 ML/day or 250 L/s
Total Peak Design Flow	MDD + RFF = 1558+250	1,808 L/s or 156.5 ML/day

Updated calculations are to be completed as the development plan for the Subject Lands is advanced through the Secondary Plan for the area.

5.0 SANITARY SEWER DESIGN

5.1 EXISTING CONDITIONS

There are no local sanitary sewers within the Subject Lands to service the area. The Upper Centennial Parkway (UCP) sanitary trunk sewer is constructed within the road allowances of Regional Road 56 and Upper Centennial Parkway from south of Golf Club Road to Green Mountain Road northward. The trunk sewer is an 1800mm diameter pipe constructed at depth with various access shafts along its length where connections for future sewers to service the Subject Lands may connect. As constructed, the depth of the trunk sewer is anticipated to be sufficient to accommodate the wastewater servicing of the Subject Lands via a system of local gravity sewers.

The Dickenson Road trunk sanitary sewer extending from Upper James Street to Regional Road 56 is currently under construction. The Dickenson Road trunk sanitary sewer section through the Subject Lands is located within the Golf Club Road right of way between Trinity Church Road and outlets into the UCP trunk at Regional Road 56. This section of the trunk sewer is a 1500mm diameter pipe constructed at depth with various access shafts along its length which may accommodate for future sanitary sewer connections servicing the Subject Lands. When designed and constructed the depth of the trunk sewer is anticipated to service the Subject Lands via a system of local gravity sewers.

Depending on the final development plans for the Subject Lands, the connection points to the UCP and Dickenson Road trunk sewers will be confirmed as well as if all the lands can drain by gravity to the trunks. If not, specific areas within the Subject Lands may require a sewage pumping station. This may be confirmed at the Secondary Plan stage of the Subject Lands.

Sanitary sewer design sheets or capacity calculations for the Dickenson Road and UCP sanitary trunk sewer were not available at the time this report was prepared. As indicated in Section 4 of this FSR population projections for the Subject lands vary considerably from the population projections presented in the 2006 *City of Hamilton Water and Wastewater Master Plan, Class Environmental Assessment Report* and the 2013 *Hamilton Southeast Mountain Water Servicing Strategy – FINAL*. Section 5.2.2 below, addresses the population difference and the anticipated wastewater flows and compares the difference to the anticipated designed reserve capacities available in the Dickenson Road and UCP sanitary trunk sewers.

5.1.1 Existing Wastewater Treatment

The Subject Lands are located within the sewershed tributary to the Woodward Avenue Wastewater Treatment Plant (WWTP) on Woodard Avenue in the City of Hamilton. The Woodward Avenue WWTP treats wastewater flows from most of the City of Hamilton.

The Subject Lands have historically been included in the City's municipal servicing strategies for urban growth. The 2006 *City of Hamilton Water and Wastewater Master Plan, Class Environmental Assessment Report* discusses that the Elfrida UBE area was included in its assessment of needed upgrades at the Woodward WWTP. However, this is on the basis of the original 2006 population growth numbers to 2031. We will work with the municipality moving forward to ensure that increases in population targets since 2006 are reviewed, to ensure that they system can accommodate a greater population.

5.2 PROPOSED SANITARY SERVICING

Sanitary servicing of the Subject Lands will require construction of a system of local sanitary sewers to convey flows to the Dickenson Road and UCP trunk sewers. The design of the internal sanitary sewer system for the proposed development is to conform to the current City of Hamilton, and the MECP Design Guidelines. Design parameters are summarized in **Table 5.1** below.

Table 5.1 – Sanitary Sewer System Design Parameters

Design Parameter	Value	Unit
Average Domestic Flow	360	L/cap/day
Peaking Factor	2 to 5	Babbit Formula $M=5/P^{0.2}$ (P = population in thousands)
Infiltration Rate	0.4 0.6	L/s/hectare where weeping tiles of dwellings are designed to drain by gravity L/s/hectare where weeping tiles of dwellings are designed to drain by sump pump
Minimum Sewer Size (Industrial)	250 375	mm diameter for residential mm diameter for Industrial or Commercial
Minimum Flow Velocity	0.75	m/s
Maximum Flow Velocity	2.75	m/s
Minimum Sewer Cover Depth	2.75	m
Maximum Manhole Spacing	120	m
Maximum Pipe Flow Design Capacity	75% 60%	For pipe diameter less than or equal to 450 mm diameter For pipe diameter greater than 450 mm diameter

5.2.1 Proposed Sanitary Sewer System

Figure 5.1 illustrates a preliminary conceptual sanitary sewer system design for the Subject Lands based on the Development Concept Plan prepared by Bousfields Inc. Development Block areas and population numbers are illustrated on the figure as well as the location of the existing and proposed conceptual sanitary sewer system for the Subject Lands. Sanitary sewer pipe sizes and grades have been calculated for the internal local sewer system based on the City's design criteria and are illustrated in the Sanitary Sewer Design Sheet provided as **Figure 5.2**. Sewer sizing is based on the following assumptions.

- All local sewer are design at 0.5% grade.
- All sewer can drain by gravity to the Dickenson Road or the UCP sanitary trunk sewer.
- Local sewer depth of cover is not confirmed

The anticipated total wastewater flow for the subject lands is 1,468 L/s as reported in **Figure 5.2.**

5.2.2 Existing Trunk Sanitary Sewer Reserve Capacity Analysis

As outlined in **Table 5.1**, the design of new sanitary sewer system are to provide for the following reserve capacity in the sizing of the sewer pipes.

- 25% for pipes less than or equal to 450 mm diameter (i.e maximum flow volume of 75% in the pipes).
- 40% for pipes greater than 450 mm diameter (i.e maximum flow volume of 60% in the pipes).

Assuming that the above design requirements were applied to the design of the Dickenson Road trunk sanitary sewer and the UCP trunk sanitary sewer, the calculated reserve capacity in each of the trunks would be as follows.

- The UCP trunk sanitary sewer – 1800mm diameter sewer at 0.10% grade has a full flow capacity of 3,635 L/s. Reserve capacity in the pipe would be 40% of 3,635 L/s = 1,454 L/s
- Dickenson Road trunk sanitary sewer – 1500mm diameter sewer at 0.15% grade has a full flow capacity of 2,738 L/s. Reserve capacity in the pipe would be 40% of 2,737 L/s = 1,095 L/s

As sanitary sewer design sheets or capacity calculations for the Dickenson Road and UCP sanitary trunk sewer were not available at the time this report was prepared, it is assumed that the design of the trunk sewers accommodated wastewater flows from the Elfrida UBE lands at the populations and development areas reported in the 2006 *City of Hamilton Water and Wastewater Master Plan, Class Environmental Assessment Report* and the 2013 *Hamilton Southeast Mountain Water Servicing Strategy – FINAL*. As such, a comparison of the increase in the peak wastewater flow rates calculated for the Subject Lands (at the higher population figures) over that of the wastewater flow rates calculated based on populations in the 2006 and 2013 reports above, and the reserve capacities in the Dickenson Road and UCP trunk sewers, would confirm if the higher flow rates may be accommodated in the existing trunk sewers.

Peak dry weather wastewater flow rate is calculated by the expression:

$Q = (P \times ADF \times M)/86{,}400 + AI$

where:

Q = Peak wastewater flow rate (L/s)
P = Population
ADF = Average Daily Wastewater Flow Rate (L/cap/day)
M = Wastewater Peaking Factor (Babbit Formula) = $5/(P/1000)^{0.2}$
A = Drainage Area (hectare)
I = Infiltration Allowance = 0.4 (L/hectare)

For the 2013 Elfrida UBE, the peak wastewater flow rate is calculated as follows:

$M = 5/(45.113)^{0.2} = 2.33$

$Q = (45{,}113 \times 360 \times 2.33)/86{,}400 + 1{,}256 \times 0.4 = 941$ L/s

For the 2024 Subject Lands UBE, the peak wastewater flow rate is calculated as:

$M = 5/(129.266)^{0.2} = 2.0$ (minimum value)

$Q = (129{,}266 \times 360 \times 2.0)/86{,}400 + 957.29 \times 0.4 = 1{,}460$ L/s

Difference: 1,460 – 941 = 529 L/s

Based on the above calculations, the total increase in peak wastewater flow rate of 529 L/s is less than the reserve capacities for both the Dickenson Road and UCP trunk sanitary sewers reported above and the existing trunk sewers should be able to accommodate the Subject Lands.

6.0 STORM SEWER DESIGN

6.1 EXISTING CONDITIONS

The Subject Lands are predominantly agricultural fields and residential land uses with some fragmented commercial and industrial uses. Agricultural uses vary from crop production to livestock and horse farms.

The Subject Lands traverses the following five subwatersheds.

- Stoney Creek,
- Upper Davis Creek,
- Hannon Creek,
- Twenty Mile Creek, and
- Sinkhole Creek.

Upper Davis Greek, Hannon Creek and Twenty Mile Creek originate within the subject Lands. Stoney Creek and Sinkhole Creek headwaters originate within the existing urbanizing lands to the west which drain into the Subject Lands across Centennial Parkway. The watercourses are generally ephemeral, headwater features.

The subwatersheds of Stoney Creek, Upper Davis Creek and Hannon Creek drain northward towards Lake Ontario and are under the jurisdiction of the HCA. The subwatersheds of Twenty Mile Creek and Sinkhole Creek drain southwesterly and are under the jurisdiction of the NPCA.

In 2018 Aquifer Beech Limited completed the *Elfrida Subwatershed Study, Final Phase 1 Report*, on behalf of the City of Hamilton, in conjunction with the Elfrida Growth Area Study also being undertaken by the City. The Elfida Growth Area Study was initiated by the City in 2016 to inform and fulfill the requirements for an UBE for the Elfrida Lands including development of the area Secondary Plan. The Elfrida Growth Area Study and the Subwatershed Study were suspended by the City in 2018 pending the outcome of the City's Land Needs Assessment as well as pending outcomes of prior appeals of the City's Urban and Rural Official Plans related to the Elfrida UBE to the Local Planning Appeal Tribunal, as well asother planning work required to bring policy into conformance with numerous provincial policy changes. As such the Elfrida Subwatershed Study remains incomplete.

The 2006 *City of Hamilton Development Charges Background Study* included an allowance for a variety of stormwater management facilities (approximately 18 witin the Subject Lands), in addition to culvert improvements, erosion and sediment control measures, etc. These were carried through to the 2011 and 2019 background studies.

However, as of the 2024 DC By-law, stormwater management facilities outside of the urban boundary as of Council's June 8, 2022, boundary decision, will now be 100% developer cost until such time as Council approves an Urban Boundary Expansion and amends the by-law.

6.2 PROPOSED CONDITIONS

Development of preliminary stormwater management and drainage design has not been undertaken and is deferred to the Secondary Plan process and completion of the Subwatershed Study for the Subject Lands. Given the time lapse between 2018 and now, additional study and field work are required to reaffirm and or modify the findings and recommendations of the original Aquifer Beech study and complete the Subwatershed Study process. The completed Subwatershed Study shall address such items including determining the natural and environmental features that impact storm drainage, determine which watercourses should be regulated and others which should not, and the ability for outlets to accept modified drainage patterns as a result of future development. Additional assessment such as hydrogeology, fish habitat, etc. will be valuable input in terms of locating stormwater control features (quantity and quality).

The Subwatershed Study should also inform the area Secondary Plan addressing such items as natural hazards components (floodline delineation / hydraulic analysis, erosion hazards assessment, meander belt assessment, slope stability, channel design and geofluvial assessment, Karst assessment) as well as identify the limits of development associated with the natural hazard components as well as the locations and rough land requirements for the SWM facilities.

6.2.1 SWM Criteria

The proposed development of the Subject Lands is subject to NPCA, HCA and City of Hamilton SWM policies. These SWM criteria include:

- Quantity Control:
    - Control post-development flows to pre-development levels for 2, 5, 25, and 100-year events.
    - Different design storm distributions and durations to be assessed to determine the lowest pre-development and highest post-development peak flows. At minimum 3-hour Chicago, 12-hour AES, 24-hour SCS distributions should be considered.
    - The SWM plan should assess the capacity of the receiving system.
    - Major flow route should be designed for the Regulatory flow (100-year or Regional storm event).

- Quality Control:
    - Normal (70% TSS removal) level of treatment is required.
    - Enhanced level of treatment is required for Type 1 or Critical Fish habitat.
- Erosion Control:
    - Retain 25 mm, 4-hour Chicago design storm for over a 24-hour period.
- Water Balance:
    - All efforts should be made to match pre and post-development infiltration volumes in order to maintain groundwater recharge.
    - Untreated stormwater shall be prevented from being directly infiltrated.
- Erosion and Sediment Control (ESC) Plan:
    - ESC plan should be prepared to demonstrate that the water quality and fish habitat are not impacted by sediment from the property during or following site construction.

6.2.2 Stormwater Management Plan

In preparation of the SWM Plan for the Subject Lands, it shall conform with the updated Area Subwatershed Study as mentioned above and meet the applicable SWM criteria for the site including the following.

Quantity Control of the proposed site will be provided by end-of-pipe SWM facilities, e.g. wet ponds. The proposed wet ponds will be sized to provide peak flow control, quality control, and erosion control. The proposed wet ponds will discharge to existing tributaries to Upper Davis Creek, Hannon Creek, Twenty Mile Creek, Sinkhole Creek and Stoney Creek.

Quality Control of the proposed site will be provided by the proposed wet ponds, which will be sized to provide either normal or enhanced level of controls, depending on the watercourse classifications.

Erosion Control of the proposed site will be provided by the proposed wet ponds, which will be sized to provide extended detention to meet erosion control targets. The City of Hamilton Stormwater Master Plan (Aquafor Beech, 2007) includes ‘Location of Erosion Stream Reaches (Figure 8.17)’, which shows that the headwater features at the site are not active erosion sites.

Future reviews will include regulated wetlands, watercourses, and floodplains based on NPCA's Watershed Explorer. This will assist in determining the viability of low impact development features to meet water balance requirements. LID features can be determined with specific details being provided at the subdivision and site plan stages.

Development of the future subdivisions and site plans may require the realignment or removal of certain watercourse reaches. Further discussion with HCA and NPCA is required in the due course of the development of these plans.

Hydraulic Assessment of existing culvert crossings should be undertaken for both the existing and proposed conditions to ensure that the hydraulic performance of the culverts remains the same as before or does not worsen in the proposed condition.

As per the Land Use Planning Document (NPCA 2018), if placement of fill on the Subject Lands exceeds 250 m^3, the following studies, as a minimum, are required.

- Environmental Impact Study.
- Hydrogeological Study.
- Geotechnical Investigation Report.
- SWM Plan.
- Other Studies as may be required.

7.0 UTILITIES

The Subject Site can be serviced by the following utility providers.

- Alectra Utility Corporation and Hydro One Networks Inc. – electrical power
- Enbridge Gas Inc. – natural gas
- Rogers, Bell, Cogeco – cable television and telecommunications

Service is proposed through the connection to and extension of existing services currently in place along the surrounding existing roads. Actual utility requirements will be determined during the detailed design stage of the project.

8.0 CONCLUSIONS AND RECOMMENDATIONS

General

Grading, storm water drainage and stormwater management for the Subject Lands needs to be informed from the completion of the Subwatershed Study for the Elfrida Area.

It is recommended that:

- Upon completion of the Area Subwatershed Plan, an updated Functional Servicing Study be prepared in support of the Subject Lands.

Phasing of Development

Due to the size of the Subject Lands and the multiple land parcel ownership, it is intended to develop the Subject Lands in multiple phases. It is anticipated that phasing of development will generally progress from the Upper Centennial trunk sewer: moving from the north to the south and extending east and west from Upper Centennial, as supporting infrastructure is advanced from the existing facilities to the north and west to distribute full municipal services through the Subject Lands. This will be articulated and refined in further studies prepared in support of the Secondary Plan stage of the City's planning process.

Conceptual Grading and Road Access

Development of preliminary grading and drainage design has not been undertaken and is deferred to the Secondary Plan process for the Subject Lands. The Subwatershed Study will inform the Secondary Plan process, identifying development limits based on natural heritage features and locations and rough sizing for Stormwater Management facilities which in turn will establish storm sewer design and drainage, road patterns and site elevations.

Final earthworks quantities and earth movement volumes will not be established until development applications are processed by the City through the Draft Plan of Subdivision / Site Plan process for the individual development within the Subject Lands.

Geotechnical investigations for the Subject Lands will be undertaken as part of the Secondary Plan stage of the City's planning process.

The roadway grades and lot grading elevations are to be designed to the requirements of the City of Hamilton, Hamilton Conservation Authority and the Niagara Peninsula Conservation Authority.

For a description of the existing and proposed road network to provide access and vehicle distribution through the Subject Lands please be directed to the Traffic Impact Study prepared by C.F. Crozier Associates Inc. accompanying the Urban Boundary Expansion application for the Subject Lands.

It is recommended that:

- The Area Subwatershed Study be completed to inform the grading design concept for the Subject Lands.

Water Supply and Distribution

The Subject Lands have been included in the City's municipal servicing strategies for urban growth since 2006. As such a number of upgrades to the existing water network system and new water works projects have been identified and included within the City's Development Charge Background Reports since 2006. To date, the design of the existing water system upgrades have been based on growth population numbers for the Subject Lands of an approximate residential population of 41,558 and 3,525 employment jobs. Based on the proposed conceptual land use plan outlined herein, the updated population projection for the Subject Lands are anticipated to be a residential population of 114,903 and 14,363 employment jobs. The resulting increase to the Average Day Demand, Maximum Day Demand and Peak Hour Demand is in the order of 70%. Further discussions with City Staff is required to better understand how the increase in the anticipated water demands of the Subject Lands impacts the proposed water infrastructure projects and the timing of such projects. These will logically be addressed as part of the City's latest Water/Wastewater Master Servicing Plan.

With resolution of the impacts the proposed increase in population described above, an existing and proposed conditions hydraulic model of the City's water system including the Subject Lands can be developed and analyzed to provide domestic water supply and distribution including adequate supply and pressure for firefighting purposes from extension and connection to City's existing local distribution system.

It is recommended that:

- Further discussions with City Staff is required to better understand how the increase in the anticipated water demands of the Subject Lands impacts the proposed water infrastructure projects and the timing of such projects.

- Hydraulic modelling of the proposed Subject Lands' water distribution network including watermain sizing and system upgrades required is to be undertaken in conjunction with the Secondary Plan process.

Sanitary Sewage

The Subject Lands can be adequately serviced for sanitary drainage using conventional municipal engineering practices and in compliance with City of Hamilton and Ministry of the Environment, Conservation and Parks standards.

The Upper Centennial Parkway sanitary trunk sewer has been constructed at depth with various access shafts along its length where connections for future sewers to service the Subject Lands may connect.

The Dickenson Road sanitary trunk sewer is currently being constructed at depth with various access shafts along its length which may accommodate for future sanitary sewer connections servicing the Subject Lands.

An analysis of the theoretical reserve capacity in the Upper Centennial Parkway and Dickenson Road sanitary trunk sewers indicates that there is sufficient reserve capacity in the sewer system to accommodate the anticipated increase in peak wastewater flow attributable to the increase in population between the original growth population numbers for the Subject Lands and the updated population projection for the Subject Lands.

Storm Servicing

Development of preliminary stormwater management and drainage design has not been undertaken and is deferred to the Secondary Plan process and completion of the Subwatershed Study for the Subject Lands.

In 2018 Aquafor Beech Limited completed the *Elfrida Subwatershed Study, Final Phase 1 Report*, on behalf of the City of Hamilton, in conjunction with the Elfrida Growth Area Study being undertaken by the City. The Elfrida Growth Area Study and the Subwatershed Study were suspended by the City in 2018. As such the Elfrida Subwatershed Study remains incomplete.

Additional study and field work are required to reaffirm and or modify the findings and recommendations of the original Aquafor Beech study and complete the Subwatershed Study process.

Upon completion of the Area Subwatershed Study a stormwater management plan for the Subject Lands is to be prepared.

It is recommended that:

- The Area Subwatershed Study be completed to inform the preparation of a separate Stormwater Management Report in support of development of the Subject Lands.

Utilities

The Site can be serviced through the extension of existing utilities including hydro, gas, cable TV and telephone. Applications to each service provider are required to confirm capacity of existing services.

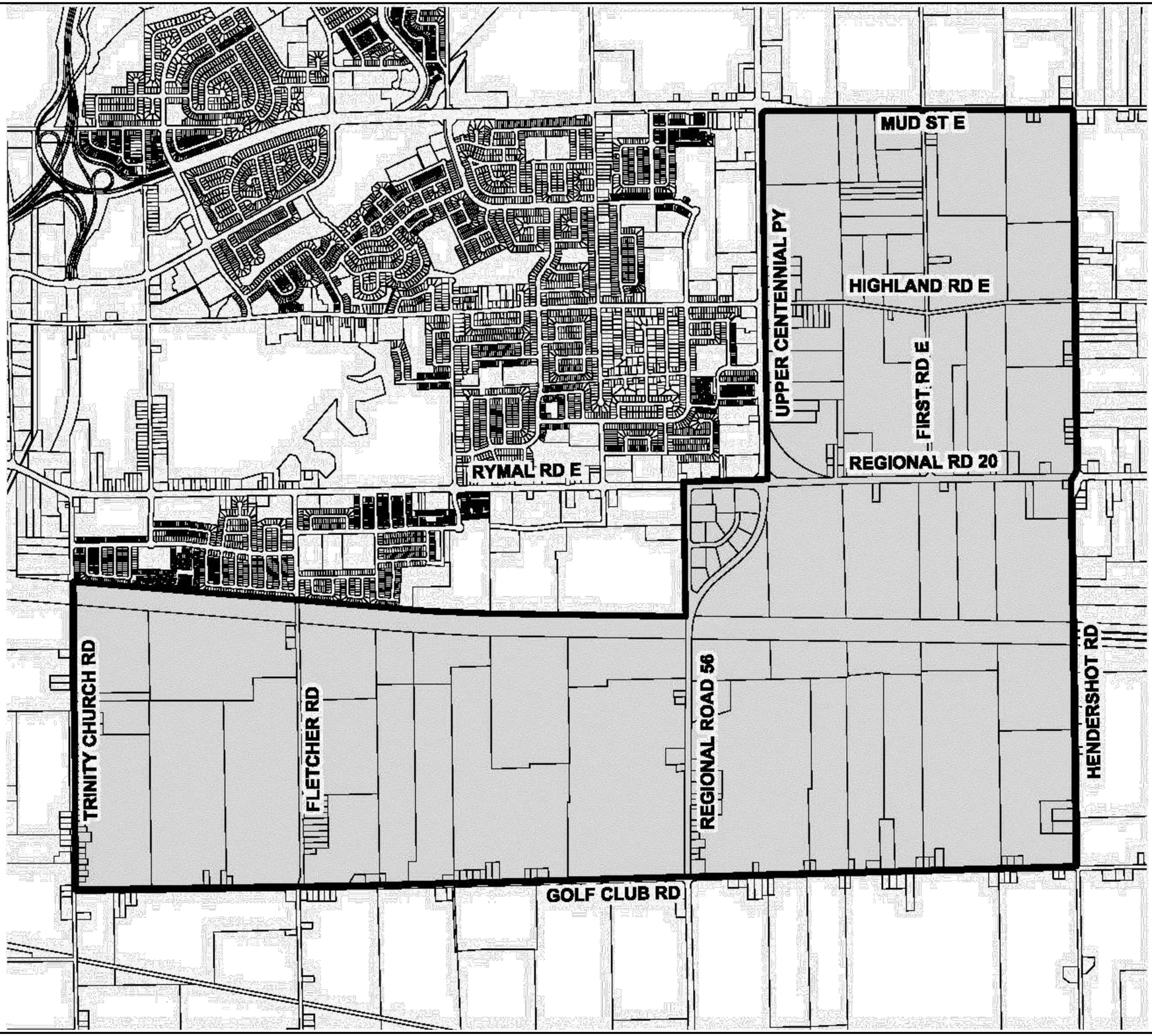
We are pleased to submit this Functional Servicing Report in support Elfrida Urban Boundary Expansion. If you have any questions, please do not hesitate to contact the undersigned.

Regards,

STANTEC CONSULTING LTD.

Suzanne Mammel MBA
Senior Associate, Community Development
Direct: 278 208 7210
Suzanne.mammel@ stantec.com

Stantec



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SUBJECT LANDS

Notes

Hamilton

November 2024
161414400

Client/Project
Elfrida Community Builders' Group
ELFRIDA
URBAN EXPANSION AREA

Figure No.
1.1

Title
SITE LOCATION PLAN

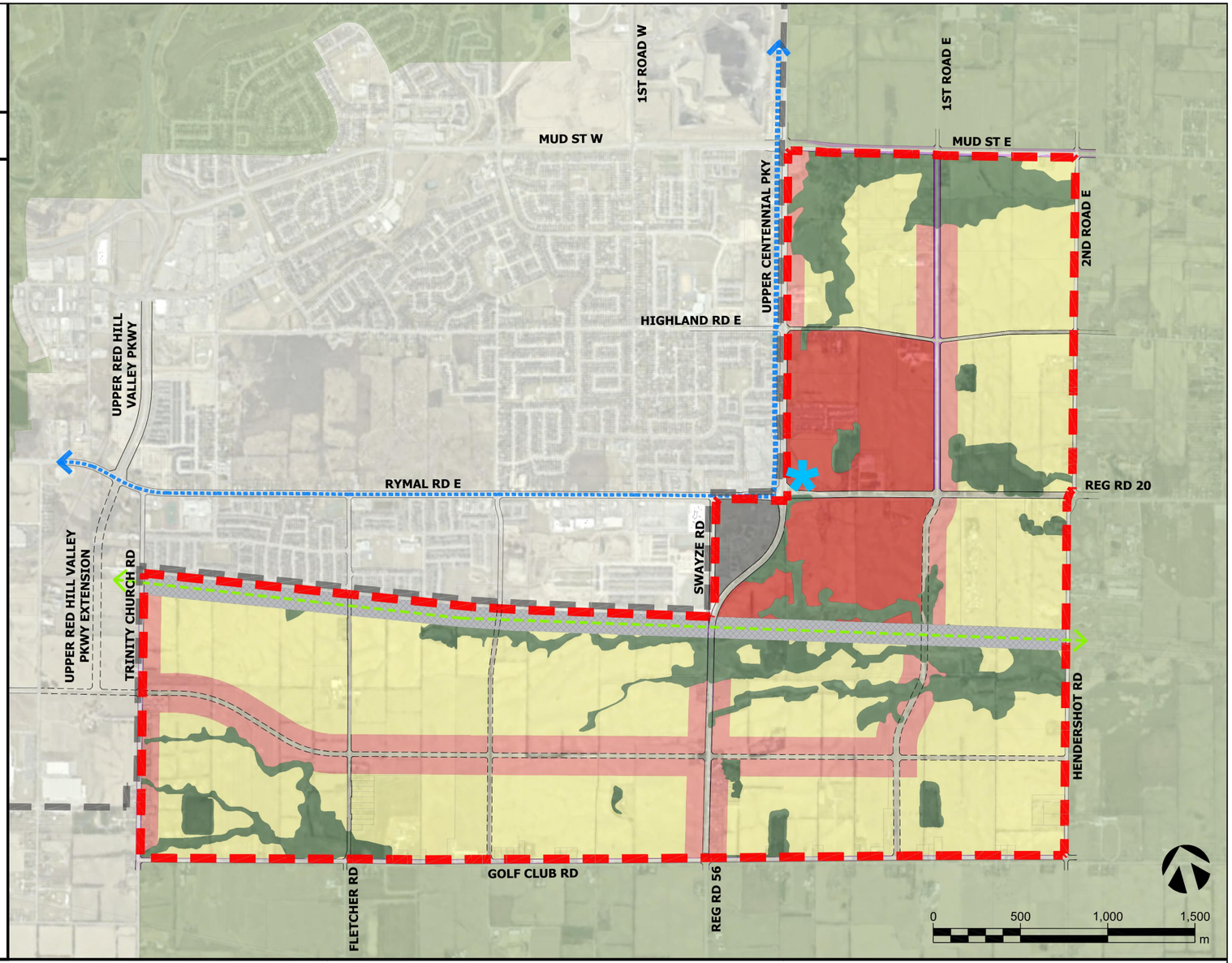
ELFRIDA
URBAN EXPANSION AREA

CITY OF HAMILTON

LEGEND:

- Elfrida Study Area (Urban Boundary Expansion Lands)
- Urban Boundary *(UHOP - Schedule E)*
- Existing Roads
- Proposed Roads
- Planned ROW *(RHOP / UHOP)*
- Potential Linear Greenway
- Preliminary Natural Heritage System Area *(Stantec)*
- Greenbelt Plan Area
- Hydro Corridor (Utility) *(RHOP - Schedule B)*
- Existing Developed Industrial / Commercial Uses
- Potential Residential
- Potential Intensification Hub
- Potential Intensification Corridor
- Potential Higher Order Transit *(UHOP - Appendix B)*
- Planned Elfrida Gateway Station *(As per "(Re)envision the HSR" Concept Network Plan)*

Image source: First Base Solutions



BOUSFIELDS inc.
Nov 13 - 24

Concept Plan

ORIGINAL SHEET - ISO A3

November 2024
161414400

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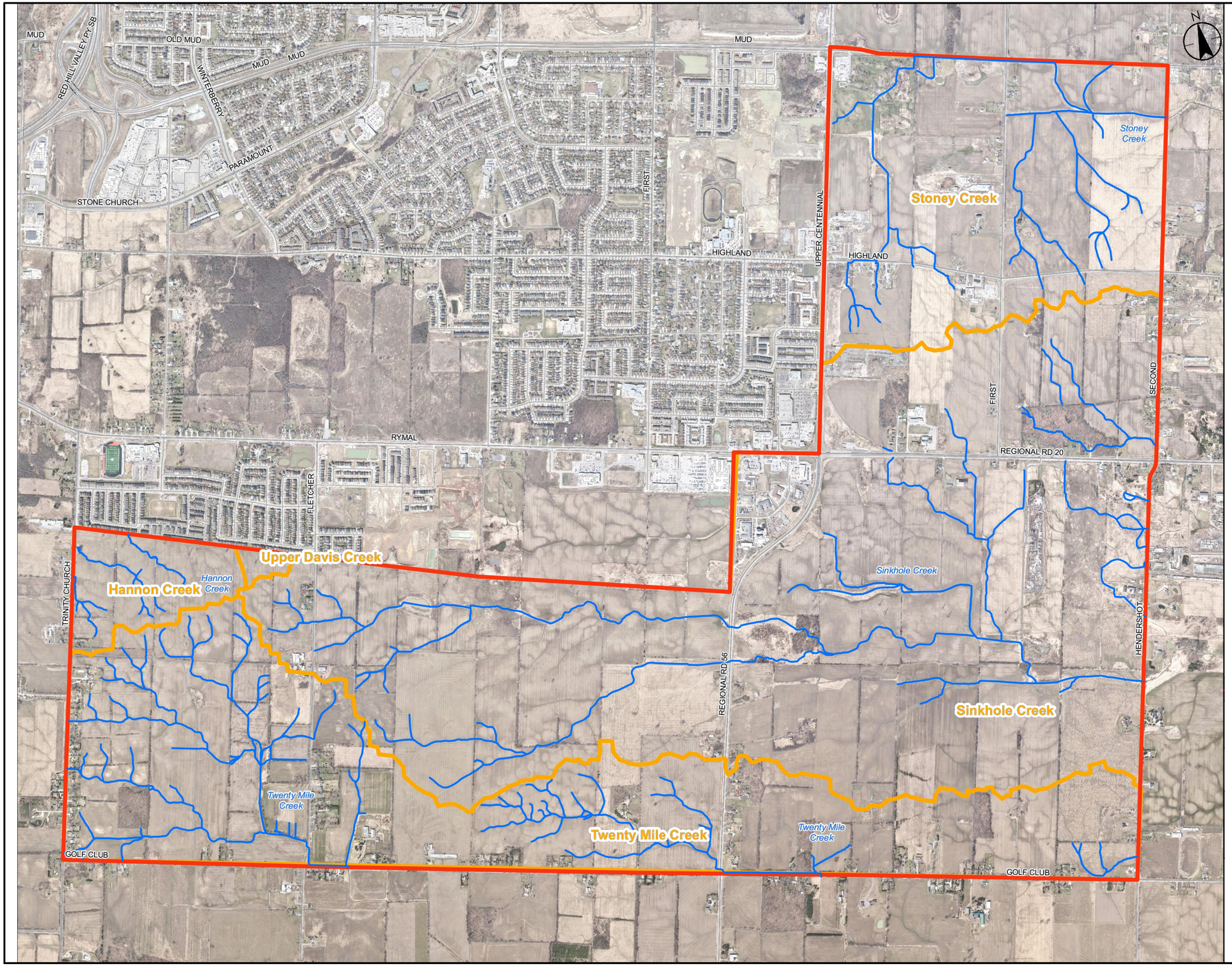
ELFRIDA
URBAN EXPANSION AREA

Figure No.
1.2

Title
CONCEPT PLAN

Hamilton



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- SUBJECT LANDS
- SUBWATERSHED BOUNDARY
- WATERCOURSE

Notes

Hamilton

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161414400

Client/Project
Elfrida Community Builder's Group
ELFRIDA
URBAN EXPANSION AREA

Figure No.
1.3

Title
ELFRIDAY SUBWATERSHED STUDY

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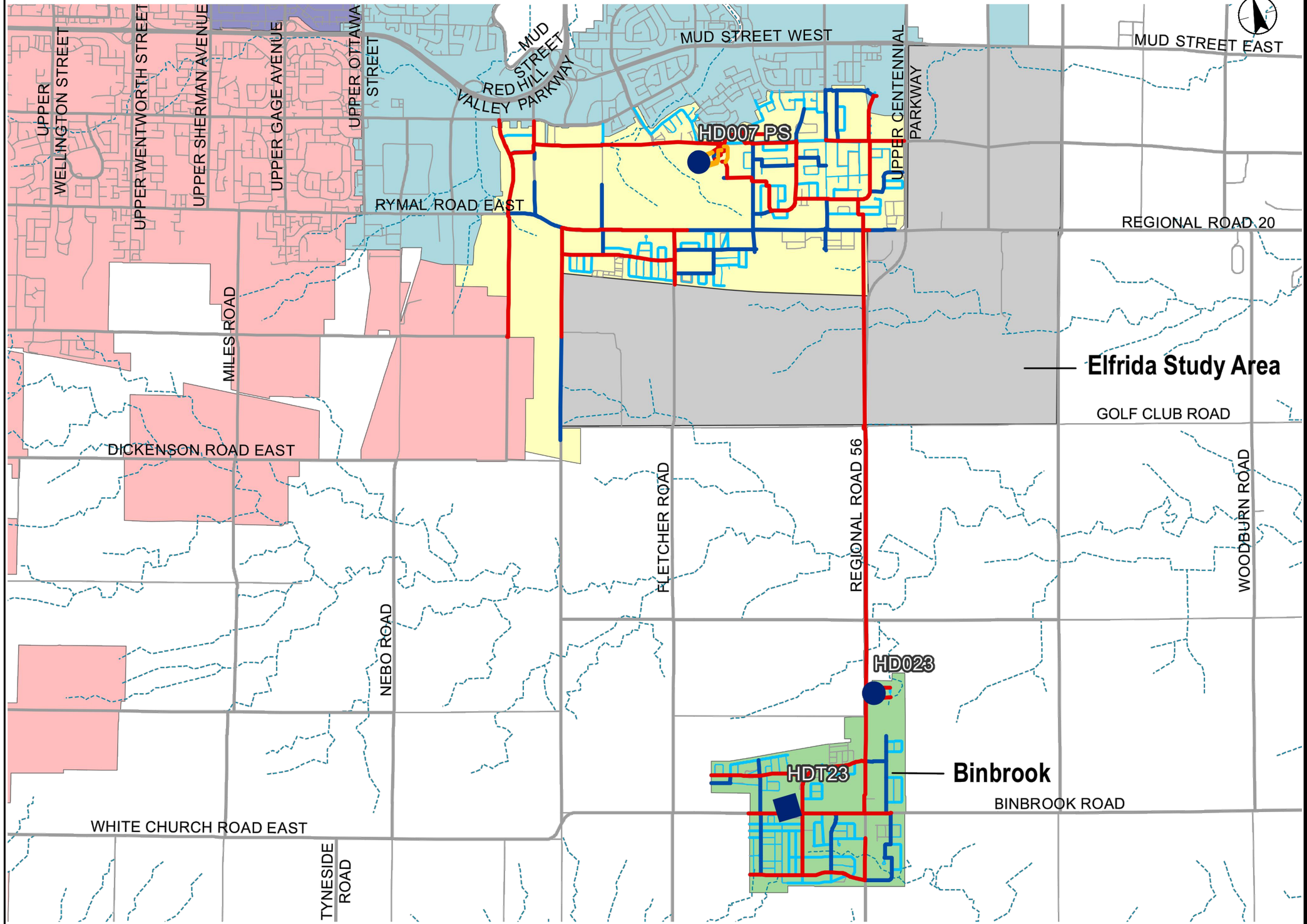

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- Elevated Reservoir
- Pumping Station
- Watercourse
- Study Area

Watermains

- <=150 mm
- <= 250 mm
- <=350 mm
- 400 mm
- >400 mm

Pressure Districts

- 23
- 25
- 5
- 6
- 7

Hamilton

November 2024
161414400

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Elfrida Community Builders' Group
ELFRIDA
URBAN EXPANSION AREA

Figure No.
4.1

Title
EXISTING WATER DISTRIBUTION SYSTEM

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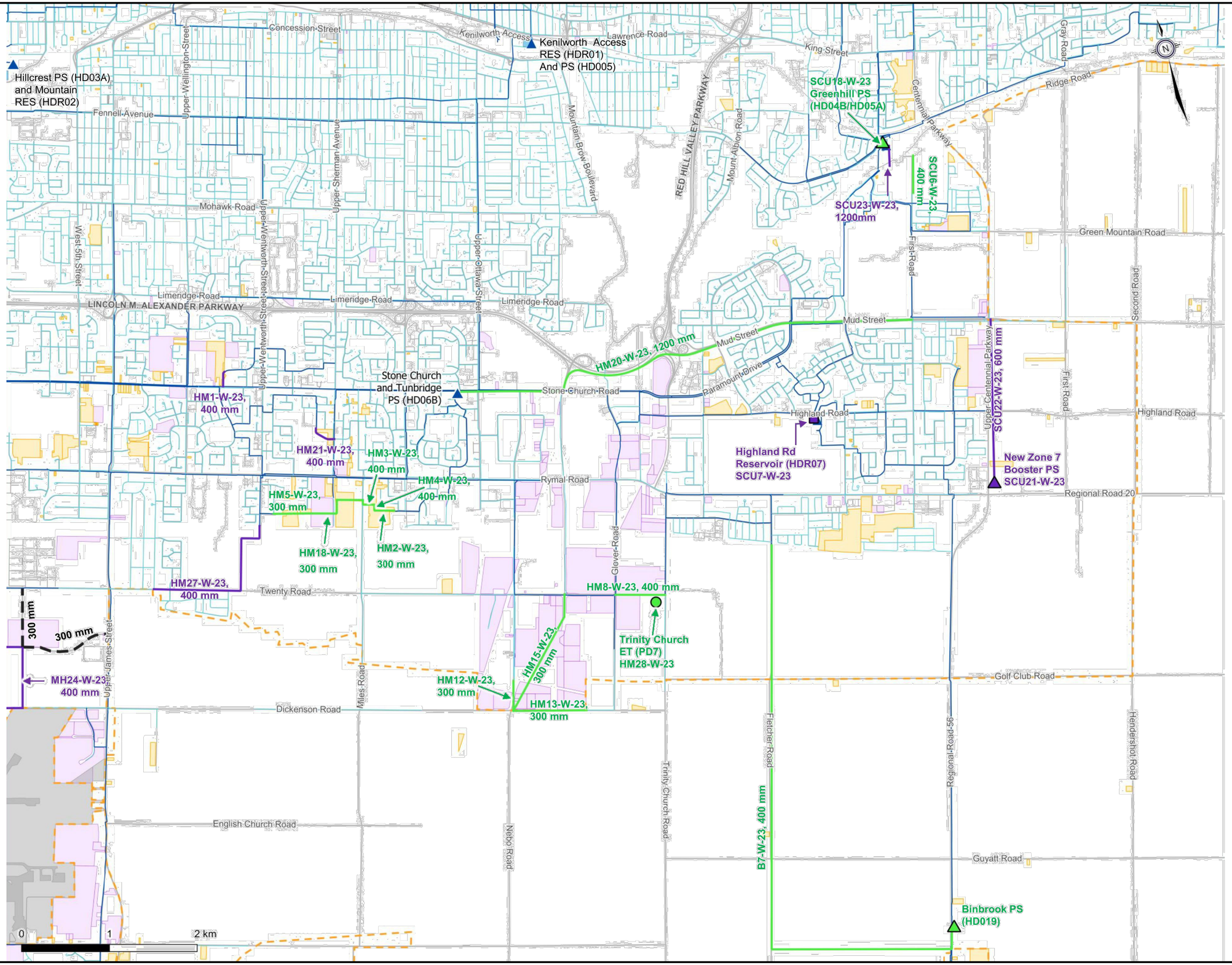

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General Features
- Railways
- Expanded Urban Boundary
- Other Municipalities
- Parking Lot
- Vacant Non-Residential
- Vacant Residential

Existing Infrastructure
- Water Treatment Plant (WTP)
- Elevated Tank (ET)
- Pumping Station (PS)
- Reservoir (RES)
- Water Main Less than 400mm
- Water Main 400mm and Greater

Future Water Infrastructure
- WTP 0 - 5 Years
- PS 0 - 5 Years
- ET 0 - 5 Years
- Watermain 0 - 5 Years
- PS 6 Plus Years
- RES 6 Plus Years
- Watermain 6 Plus Years
- Watermain 100% Direct Devel Contribut

BluePlan

August, 2023
717010-W-021
Projection EPSG:26917

Hamilton

November 2024
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ELFRIDA
URBAN EXPANSION AREA

Figure No.
4.2

Title
PROPOSED WATER
DC BACKGROUND STUDY

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ELFRIDA
URBAN EXPANSION AREA

CITY OF HAMILTON

LEGEND:

- Elfrida Study Area (Urban Boundary Expansion Lands)
- Urban Boundary *(UHOP - Schedule E)*
- Existing Roads
- Proposed Roads
- Planned ROW *(RHOP / UHOP)*
- Potential Linear Greenway
- Preliminary Natural Heritage System Area *(Stantec)*
- Greenbelt Plan Area
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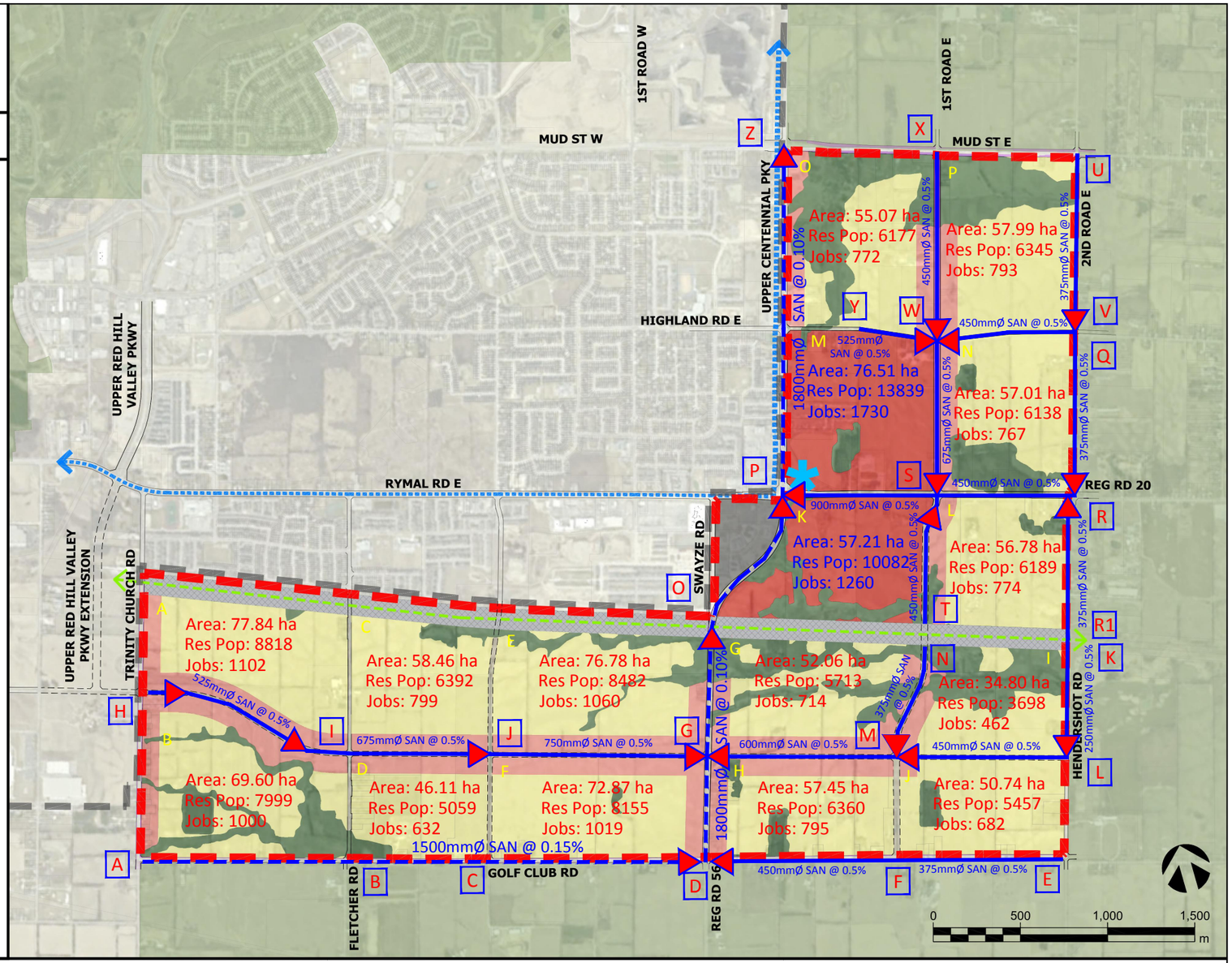
- Potential Intensification Corridor
- Potential Higher Order Transit *(UHOP - Appendix B)*
- Planned Elfrida Gateway Station *(As per "(Re)envision the HSR" Concept Network Plan)*

Image source: First Base Solutions



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Nov 13 - 24

Concept Plan

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November 2024
161414400

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- PROPOSED LOCAL SANITARY SEWER
- EXISTING TRUNK SANITARY SEWER
- A — MANHOLE ID
- A — STUDY AREA

Notes

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URBAN EXPANSION AREA

Figure No.
5.1

Title
SANITARY DRAINAGE AREA PLAN

Hamilton

Elfrida UBE

FIGURE 5.2 Preliminary Sanitary Sewer Design Sheet

Project Number:	161414400	**Mannings 'n':**	0.013	**Max. Capacity (%):**	75%	**Babbit Peaking Factor:**	**Q =** Design Flow (L/s)
Date:	Nov. 18, 2024	**Min. Velocity (m/s):**	0.75	**Infiltration Flow (L/s):**	0.40	$M = 5/(P/1000)^{0.2}$	**q =** Average Domestic Flow (L/c/d)
Consultant:	Stantec Consulting Ltd.	**Max. Velocity m/s):**	2.75	**Max. Peaking Factor:**	5.00		**P =** Population/1000
City File Number:	N/A	**Min. Pipe Slope (%):**	0.50%	**Min. Peaking Factor:**	2.00	**Design Flow:**	**I =** Infiltration Flow
Designed By	Chris Overholt	**Avg. Domestic Flow, q (L/c/d):**	360			Q = (MqP/86.4) + IA	**A =** Gross Drainage Area (ha)

Location			Contributing Area					Population		Design Calculations				Capacity Calculations				
Street	**Manhole**		**Area**	**Accum. Area**	**Units**	**Density**		**Section**	**Accum.**	**Peaking Factor**	**Infil. Flow**	**Design Flow**	**Total Flow**	**Size**	**Slope**	**Full Capacity**	**Full Velocity**	**Q_A/Q_C**
	U/S	D/S	(ha)	0.00		(p/ha)	(p/unit)				(L/s)	(L/s)	(L/s)	(mm)	(%)	(L/s)	(m/s)	(%)
Golf Club	A	B	34.80	34.80	0			4500	4500	3.70	13.92	69.39	83.31	1500	0.15	2737.76	1.55	3%
Golf Club	B	C	23.06	57.86	0			2846	7345	3.36	23.14	102.70	125.84	1500	0.15	2737.76	1.55	5%
Golf Club	C	D	36.44	94.29	0			4587	11932	3.05	37.72	151.40	189.12	1500	0.15	2737.76	1.55	7%
SE Internal	E	F	25.37	25.37	0			3070	3070	4.00	10.15	51.10	61.25	375	0.50	123.98	1.12	49%
SE Internal	F	D	28.73	54.10	0			3578	6647	3.42	21.64	94.81	116.45	450	0.50	201.60	1.27	58%
Regional Rd 56	D	G	0.00	148.39	0			0	18579	2.79	59.35	215.76	275.12	1800	0.10	3634.96	1.43	8%
SW Internal	H	I	112.64	112.64	0			14445	14445	2.93	45.06	176.41	221.47	525	0.50	304.10	1.40	73%
SW Internal	I	J	81.52	194.16	0			10049	24494	2.64	77.66	269.15	346.82	675	0.50	594.39	1.66	58%
SW Internal	J	G	113.22	307.37	0			14166	38660	2.41	122.95	387.76	510.71	750	0.50	787.21	1.78	65%
SE Internal	K	L	8.70	8.70	0			1040	1040	4.96	3.48	21.50	24.98	250	0.50	42.05	0.86	59%
SE Internal	L	M	42.77	51.47	0			5150	6190	3.47	20.59	89.55	110.14	450	0.50	201.60	1.27	55%
SE Internal	N	M	34.73	34.73	0			4254	4254	3.74	13.89	66.34	80.23	375	0.50	123.98	1.12	65%
SE Internal	M	G	54.76	140.96	0			6791	17234	2.83	56.38	203.17	259.56	600	0.50	434.17	1.54	60%
Regional Rd 56	G	O	0.00	596.71	0			0	74473	2.11	238.68	655.17	893.86	1800	0.10	3634.96	1.43	25%
Regional Rd 56	O	P	0.00	596.71	0			0	74473	2.11	238.68	655.17	893.86	1800	0.10	3634.96	1.43	25%
NE Internal	Q	R	28.51	28.51	0			3453	3453	3.90	11.40	56.14	67.54	375	0.50	123.98	1.12	54%
NE Internal	R1	R	28.39	28.39	0			3482	3482	3.90	11.36	56.52	67.87	375	0.50	123.98	1.12	55%
NE Internal	R	S	0.00	56.90	0			0	6934	3.39	22.76	98.07	120.83	450	0.50	201.60	1.27	60%
NE Internal	U	V	29.00	29.00	0			3569	3569	3.88	11.60	57.65	69.25	375	0.50	123.98	1.12	56%
NE Internal	V	W	28.51	57.50	0			3482	7051	3.38	23.00	99.39	122.39	450	0.50	201.60	1.27	61%
NE Internal	X	W	56.53	56.53	0			7044	7044	3.38	22.61	99.31	121.92	450	0.50	201.60	1.27	60%
NE Internal	Y	W	65.79	65.79	0			11259	11259	3.08	26.32	144.53	170.85	525	0.50	304.10	1.40	56%
NE Internal	W	S	0.00	179.82	0			0	25353	2.62	71.93	276.68	348.61	675	0.50	594.39	1.66	59%
NE Internal	T	S	57.00	57.00	0			9153	9153	3.21	22.80	122.46	145.26	450	0.50	201.60	1.27	72%
NE Internal	S	P	66.86	360.57	0			13456	54895	2.24	144.23	513.32	657.54	900	0.50	1280.08	2.01	51%
Regional Rd 56	P	Z	0.00	957.28	0			0	129368	2.00	382.91	1078.06	1460.97	1800	0.10	3634.96	1.43	40%

Notes:
[1]
[2]
[3]

Stantec
300W-675 Cochrane Drive
Markham ON Canada
www.stantec.com

Legend

Notes

Hamilton

November 2024
161414400

Client/Project
Elfrida Community Builders' Group
ELFRIDA
URBAN EXPANSION AREA

Figure No.
5.2

Title
SANITARY DESIGN SHEET