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FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT

FOR

5520 EIGHTH LINE & 5552 EIGHTH LINE

TOWN OF ERIN
WELLINGTON COUNTY

PROJECT NO. 21-1242

July 2024

FUNCTIONAL SERVICING
AND
STORMWATER MANAGEMENT REPORT
FOR
5520 EIGHTH LINE & 5552 EIGHTH LINE

TOWN OF ERIN

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TOWN OF ERIN

1.0 INTRODUCTION

DSEL has been retained by Mattamy (Erin) Limited and 2779181 Ontario Inc. to prepare a functional servicing and stormwater management report (FSR) for 5520 Eighth Line and 5552 Eighth Line in support of their draft plan submissions. Both properties are covered in this report.

5520 Eighth Line and 5552 Eighth Line consist of approximately 36.10 hectares and 27.05 hectares respectively and are bounded by Eighth Line and existing residential properties to the east, agricultural lands to the west, forest to the south, and Sideroad 17 and existing residential properties to the north, as illustrated in ***Figure 1***.

The subject lands are located within Wellington County in the Town of Erin and are further located in the Village of Erin.

The subject lands are proposed to be developed for residential and related purposes. The plan includes single family homes, townhouses, medium density residential, a neighbourhood park, Natural Heritage System (NHS), stormwater management facilities, and municipal rights-of-way. The draft plans are included in ***Appendix A.*** To avoid confusion with referencing duplicated street names on the draft plans, the composite plan is used as the basis for the FSR and is illustrated in ***Figure 2***.

The following report will outline the servicing and stormwater management requirements for the project and will confirm that adequate services are available to support the proposed developments in accordance with the standards of the Town of Erin, Wellington County, Credit Valley Conservation (CVC), and general industry practice.

2.0 PREVIOUS STUDIES AND REPORTS

The following material has been reviewed in order to identify the constraints, which govern development within the subject site:

- **Urban Centre Wastewater Class EA**
  Ainley & Associates Ltd., October 2019
  (Wastewater Servicing EA)

- **Urban Centre Water Servicing Class EA**
  Triton Engineering Services Ltd., February 2020
  (Water Servicing EA)

- **Water and Wastewater Development Charges Update Study**
  Watson & Associates Economists Ltd., December 2022
  (DC Update Study)

- **Development Charges Background Study**
  Watson & Associates Economists Ltd., May 2024
  (DC Study)

- **Erin and Hillsburgh DC Charge Study Briefing - Water Components**
  Triton Engineering Services Limited, May 2020
  (DC Study Water Memo)

- **Issued for CVC Submission, Construction of Trunk Sanitary Sewer, Watermain & Related Infrastructure Segment 4 (Phase 1)**
  WSP, February 2024
  (Issued for Tender Drawings)

- **Town of Erin Engineering Design Standards Manual**
  Tatham Engineering Limited, May 2022
  (Municipal Design Criteria)

- **Stormwater Management Planning and Design Manual**
  Ministry of Environment, March 2003
  (SWMP Design Manual)

- **Stormwater Management Criteria**
  Credit Valley Conservation, August 2012
  (SWM Criteria)

- **Low Impact Development and Stormwater Management Planning and Design Guide**
  Credit Valley Conservation and Toronto and Region Conservation Authority, 2010
  (LID Guide)

- **Erosion and Sediment Control Guidelines for Urban Construction**
  TRCA et al, December 2006
  (ESC Guidelines)

- **Bridge 11 Replacement Hydraulic Report**
  RJ Burnside, April 2020
  (Bridge 11 Hydraulic Report)

- **Hydrogeological Assessment – Langen Property**
  R.J. Burnside & Associates Limited, June 2022
  (Hydrogeological Assessment)

- **Drinking Water Threats Disclosure Report and Salt Management Plan**
  R.J. Burnside & Associated Limited, June 2022
  (Threats Disclosure Report)

- **Environmental Impact Study 5520 Eighth Line & 5552 Eighth Line**
  R.J. Burnside & Associates Limited, July 2024
  (EIS)

- **Town of Erin Water Servicing Analysis**
  WSP, August 2023
  (*Erin Water Servicing Report*)

- **Mattamy, Coscorp, & Empire Watermain Hydraulic Analysis**
  WSP, October 2023
  (Site Watermain Report)

- **Erosion Mitigation Assessment West Credit River (Erin Branch)**
  Geo Morphix Ltd., June 2022
  (Erosion Assessment)

- **Addendum #1 to the May 17, 2024 Development Charges Background Study**
  Watson & Associates Economists Ltd., July 2024
  (Addendum #1 to the DC Study)

The above documents form the basis for this report.

3.0 WATER SUPPLY SERVICING

3.1 Water Supply Servicing Design Criteria

The water supply servicing the subject lands will be designed according to the ***Municipal Design Criteria***, by taking into consideration watermain sizing, depth, crossings, valves, hydrants, and service connections such that adequate pressures and fire flows can be achieved. Water design flows will be designed with the following criteria shown in ***Table 3-1*** and ***Table 3-2*** below.

Table 3-1: Water Design Criteria

DEMAND TYPE	CRITERIA
Average Daily Demand – Residential (L/c/d)	290
Maximum Daily Demand – Residential (L/c/d)	2.75 x avg. day or per MECP Guidelines
Peak Hour Demand – Residential (L/c/d)	4.13 x avg. day or per MECP Guidelines

Table 3-2: Town of Erin Population Densities

DEVELOPMENT TYPE	EQUIVALENT POPULATION DENSITY (PERSON / UNIT)	EQUIVALENT POPULATION DENSITY (UNIT / HA)
Single Family	2.8	24
Townhouse	2.8	40

3.2 Existing Water Services

Existing watermains are currently available in the vicinity of the subject lands as follows:

Table 3-3: Summary of Existing Watermains

Street	Size	Location
Eighth Line	unconfirmed[1]	Erin Heights Drive to Sideroad 17
Sideroad 17	250 mm	Eighth Line to Wellington County Road 23

[1] Record drawings unavailable from the Town

The existing watermains are illustrated in ***Figure 3.***

3.3 External Water Supply Requirements

As identified in the ***Water Servicing EA***, the Town of Erin is planning future water infrastructure to service existing and future lands throughout Erin and Hillsburgh. This will be achieved through the design and construction of new municipal wells and treatment facilities, pumping facilities, transmission mains, and storage facilities.

Based on correspondence with Ainley Group in October 2021 included in ***Appendix B*** and information provided in the ***DC Study Water Memo***, the following projects are required to support future development within Erin:

Table 3-4: DC Water Projects

Project	Description
W2020-03A	Design and construction of a new municipal well at 5657 Wellington CR23
W2020-03B	Design and construction of 1,500 m of trunk watermain on CR23 from the new municipal well to Sideroad 17
W2020-04	Design and construction of a 2,140 m^3 water tower within Erin
W2020-10A	Design and construction of 950 m of trunk watermain from the intersection of Sideroad 17 & Wellington CR23 to the future municipal water tower
W2020-12	Watermain connection to Development Area 4 (DA4)

The anticipated timing for the above projects is noted in the ***DC Update Study*** as between 2021 and 2031. An excerpt of the DC projects map from the ***DC Update Study*** has been provided in **Appendix M**. Furthermore, it is understood a Water Booster Station may be required based on the findings of the municipal hydraulic water model prepared by WSP. The Water Booster Station has been added as per ***Addendum #1 to the DC Study*** published July 2024.

3.4 Town of Erin Water Model

The Town of Erin released a municipal watermain model in August 2023, however it is understood a new version of the municipal watermain model will be available in advance of detailed design. The preliminary model concludes that water booster station will be required to service a portion of the subject lands. The proposed Draft Plan identifies Block 29 of the southern parcel as the location for the water booster station. As the ***Municipal Design Criteria*** does not specify design parameters for the water booster station, the design requirements will be refined during detailed design. The subject lands will be added to the model to confirm the systems pressure and demands as part of the detailed design application. Discussion on the proposed water servicing is provided below.

3.5 Proposed Water Supply

The site will be serviced by connecting to external watermains within Eighth Line at the south end of the proposed development at Street ‘E’ and by extending the watermain on Sideroad 17 from Eighth Line to Street ‘C’.

The water distribution system within the development will be sized to meet the pressures and flows in accordance with the ***Municipal Design Criteria***. The system will be looped internally in order to provide system security.

The Town of Erin retained WSP to complete a system wide water model to evaluate current and future demand system performance. The ***Erin Water Servicing Report*** concludes the system has insufficient pressure to service the subject lands without introducing a local water booster station within the subject lands. The water booster station is identified as development charge infrastructure within ***Addendum #1 to the DC Study***. A watermain analysis will be completed at detailed design to confirm sizing and system requirements to meet flow and pressure demands.

The proposed watermain network is illustrated in ***Figure 3.***

4.0 WASTEWATER SERVICING

4.1 Wastewater Design Criteria

The wastewater mains will be designed with the following ***Municipal Design Criteria***:

Table 4-1: Wastewater Design Criteria

DEMAND TYPE	CRITERIA
Average Residential Daily Sewage Rate	290 L/capita/day
Inflow and Infiltration	0.29 L/s/hectare
Peaking Factor	Peak Flow Factor – Harmon Formula

Table 4-2: Town of Erin Population Densities

DEVELOPMENT TYPE	EQUIVALENT POPULATION DENSITY (UNITS / HA)	EQUIVALENT POPULATION DENSITY (PERSON / UNIT)
Single Family	24	2.8
Townhouses	40	2.8

4.2 Existing Wastewater Services

No municipal wastewater system exists within the Town of Erin as of the current date of this report. Private on-site septic systems service the existing properties in the vicinity of the subject lands.

4.3 External Wastewater Requirements

As identified in the ***Wastewater Servicing EA***, a municipal wastewater system for the Town has been recommended, which includes the following: gravity sewers, forcemains, pumping stations, and a wastewater treatment plant (WWTP).

Based on correspondence with Ainley Group in May 2022 included in ***Appendix C*** the following projects will be required to support the proposed development:

- Design and construction of the proposed Wastewater Treatment Plant
- Segment 1 - Erin Sewage Pumping Station (E-SPS-1) in Lions Park and forcemains to the WWTP
- Segment 2 - Micro-Tunnelled Trunk Sanitary Sewer on Main Street from E-SPS-1 to the intersection with the Elora Cataract Trail
- Segment 3 - Trunk Sanitary Gravity Sewer from Hillsburgh to Erin via the Elora Cataract Trail

The WWTP construction contract was awarded to North American Construction (NAC) in March of 2022 and construction is underway. Linear infrastructure related to Segments 1 through 4 is ongoing with in-service dates varied but all segments anticipated for completion by Fall 2025 as per the Town of Erin Construction Bulletin update dated July 2024.

The external wastewater servicing scheme has evolved since the ***Wastewater Servicing EA*** was completed. In particular, the Segment 2 trunk sewer has been deepened and increased in size. Segment 3 has been revised to a gravity trunk sewer from Main Street to Sideroad 17 to service the outfall from Hillsburgh. The revised trunk configuration allows the subject lands to discharge to the sewer at the Elora Cataract Trail at the intersection with Sideroad 17. A gravity system is proposed for the subject lands to convey all flows to the Elora Cataract Trail sanitary trunk as described in ***Section 4.4*** below. The sanitary sewer along Eighth Line will span from the south intersection of the Street 'C' and Eighth Line to the Elora Cataract Trail trunk. The sanitary sewer on Eighth Line will cross the West Credit River. Due to the existing profile of Eighth Line and the hydraulic requirements of the culvert, minimal cover for the sanitary sewer around the creek crossing will be provided. Mitigation measures and discussion on design recommendations are provided in ***Section 4.3.1*** below. External sanitary system design is presented in ***Drawing 1.***

4.3.1 *West Credit River Sanitary Crossing*

This external sanitary gravity solution includes a gravity sanitary sewer routed north on Eighth Line and east on Sideroad 17. The proposed gravity sanitary sewer on Sideroad 17 will connect with the gravity sanitary sewer proposed by the Town of Erin at the intersection of Sideroad 17 and the Elora Cataract Trail where flows will ultimately be conveyed to the proposed municipal WWTP. This sewer services the subject lands as well as the adjacent Empire development.

A review of the ***Issued for Tender Drawings*** confirmed that a gravity external sanitary solution is feasible to service the proposed development and the neighbouring Empire development. Town staff and WSP have confirmed the design of the Elora Cataract Trail sewer will be lowered to accommodate this gravity solution and eliminate the requirement for a sanitary pump station to service the subject lands. To connect to the Elora Cataract Trail trunk sewer, the proposed sewer along Eighth Line and 17th Sideroad has a proposed grade of 0.25% due to cover limitations within

Eighth Line. This is less than the Town Standards requirement of 0.30% but greater than the 0.20% grade proposed for the Elora Cataract Trail trunk sewer segment. Opportunities to raise the elevation of Eighth Line of provide additional cover can be explored at detailed design, subject to the results of the hydrology update of the West Credit tributary currently underway by the CVC as further discussed below.

The available lowering of the downstream trunk sewer does not provide a depth sufficient for a typical crossing of the West Credit River beneath the bridge footings and watercourse invert. As such, the gravity solution requires the sanitary sewer to be integrated into the bridge structure itself by strapping the pipe to the side of the bridge. For a length upstream and downstream of the bridge crossing, the gravity sewer will have less than the minimum cover specified by the ***Municipal Design Criteria***. To mitigate against frost, a combination of insulation and mechanical measures will be used to prevent the sanitary sewer from freezing. Cover mitigation is conceptually outlined in this report, and design will be further detailed during the detailed design application(s). The conceptual design for the external sanitary sewer servicing the subject lands and Empire is described from south to north as follows.

1. **Street 'C' and Eighth Line to ~80 m south of the Bridge** – sanitary sewer design will comply with ***Municipal Design Criteria*** as the road profile, topography and other infrastructure are sufficient to allow the sewer to be located at a standard depth and location within the roadway.

2. **~80 m south of the Bridge to the Channel Crossing** – to maintain required clearances from proposed storm and existing watermain infrastructure, the sanitary sewer alignment is shifted to the east boulevard of Eighth Line. Insulation will be provided, and the existing boulevard grades are proposed to be revised locally to maximize cover over sewer where feasible.

3. **Channel Crossing** – Channel hydraulics restrict the bridge deck depth to maintain existing flood levels. As such, the sewer is required to be strapped to the east side of the bridge deck such that hydraulic conveyance is not impacted. The section of sanitary sewer will be mechanically insulated and structurally enclosed generally as depicted in the preliminary cross section prepared by RJ Burnside provided in ***Appendix N***.

   Additionally, the existing watermain is proposed to be realigned to the east to meet horizontal clearances to the sanitary sewer. The watermain will continue to cross underneath the channel.

4. **North of Channel Crossing to ~20 m north of the Bridge** – sanitary sewer will remain in the eastern boulevard. Similar to the segment immediately south of the bridge, insulation will be provided, and the existing boulevard grades are proposed to be revised locally to maximize cover over sewer where feasible.

5. **~20 m North of Bridge to connection to Elora Cataract Trail trunk** – alignment of sanitary sewer to be within the pavement width as per Town standards. A ~90 m section of sewer is proposed to be insulated due to lack of available cover. The majority of the sewer north of the bridge to Sideroad 17 will comply with ***Municipal Design Criteria.*** The external sewer will discharge to the 450 mm Elora Cataract Trail trunk at its intersection of Sideroad 17 on the south road shoulder.

The conceptual external sanitary design outlined above will be advanced at detailed design in conjunction with the Bridge 9 replacement, restoration of Eighth Line, final design of the Elora Cataract trunk sewer segment, and results of the CVC West Credit Hydrology Update. The sanitary sewer product material and fittings will be specified by the supplier and specifications confirmed by the hydrogeologist, environmental consultant, and structural engineer at detailed design. The details of the external servicing design do not impact the proposed Draft Plan.

To provide future flexibility, the drainage area for the existing Erin Heights subdivision has been accounted for in the sizing of this external sewer. However, provisions for their connection to the trunk infrastructure is beyond the requirements of the draft plan application and will need to be determined by the Town at a later date.

The proposed gravity external sanitary design is depicted in ***Drawing 1*** and relevant details provided in ***Appendix N.***

4.4 Proposed Wastewater Servicing

4.4.1 *General Overview*

The subject site will be serviced by a network of local gravity sewers designed in accordance with the ***Municipal Design Criteria***.

The conceptual wastewater servicing concept is illustrated in ***Figure 4***. Sanitary drainage from the subject site will be conveyed via local gravity sewers to either “Trunk 1” or “Trunk 2”. The sanitary drainage from the site is split by a high point located on Street ‘E’ near the intersection with Street ‘A’. Trunk 1 generally collects sewage from the area north and west of the high point and conveys it north, and Trunk 2 generally collects sewage from the area south and east of the high point and conveys it southeast.

Trunk 1, located on Street ‘A’, conveys sewage north towards Street ‘C’ and then east on Street ‘C’. Trunk 1 is then routed through an easement within the northern Medium Density Block before traversing south across the NHS. Further details regarding the NHS sanitary crossing can be found in ***Section 4.4.2*** below. Following the NHS crossing, Trunk 1 is routed along the outer edge of the Stormwater Management (SWM) Pond 2 block and conveys sanitary drainage towards Eighth Line. As described in ***Section 4.3***, Trunk 1 will discharge to a gravity trunk sewer on Eighth Line.

Trunk 2, located on Street ‘E’, conveys sewage southeast towards Eighth Line where it connects into the proposed trunk sewer on Eighth Line.

Sanitary drainage areas are illustrated in ***Drawing 2*** with design sheets included in ***Appendix D***. The external sanitary gravity sewer conveys flows north on Eighth Line and east on Sideroad 17. The proposed gravity sanitary sewer on Sideroad 17 will connect with the gravity sanitary sewer proposed by the Town of Erin at the intersection of Sideroad 17 and the Elora Cataract Trail where flows will ultimately be conveyed to the proposed municipal WWTP.

4.4.2 *Natural Heritage System Crossing*

To connect Trunk 1 to the proposed Eighth Line trunk gravity sewer, a crossing of the NHS is required. The sanitary sewer installation is proposed to be completed via open cut construction. The sanitary crossing will generally follow the existing laneway through the NHS to minimize the impact to the area. As noted in the ***EIS,*** the existing laneway bisects two wetlands and provides a crossing alignment that is already heavily disturbed and avoids further fragmenting the adjacent wetlands. The ***EIS*** recommends the following mitigation measures:

- Fuel handling and construction staging to be located, at minimum, outside of the 30 m PSW buffer
- Robust ESC and spills plan to be implemented for the crossing works to prevent sedimentation and contamination of the PSW
- Area to be restored with a planting plan that will include self-sustaining native vegetation

A site inspection was completed on August 24, 2022, to review the NHS crossing alignment and assess potential impacts to the NHS. The Town, through their peer review consultant, confirmed there are no concerns with the proposed sanitary sewer alignment and installation methodology through the NHS. Refer to Town of Erin ecology/forestry peer review comment 10 issued by Greg Scheifele as part of comments on the first submission of this FSR.

4.4.3 *Sanitary Easements*

As noted above, sanitary easements are required to convey Trunk 1 through the northern medium density block as well as across the NHS through the lands to be retained north of the pond block. A 10 m easement is proposed through the northern medium density block and a 15 m easement is proposed through the retained lands. The proposed easement widths are in excess of the minimum required easement widths for sanitary sewers per the ***Municipal Design Criteria*** and accommodate the construction and maintenance of the sanitary sewer. Infiltration and inflow contribution to the sanitary sewers have been accounted for the sanitary easement.

5.0 STORM DRAINAGE

5.1 Existing Features and Drainage Patterns

The subject lands are located within the Credit River Watershed and generally drain northeast toward the West Credit River (Erin Branch). The existing site is comprised of plowed fields, forested areas, hedgerows, and wetlands. There is a series of cascading wetlands in the northern half of the site that are part of a provincially significant wetland (PSW) complex. There is no existing storm infrastructure within the subject lands.

The existing drainage areas are illustrated in ***Figure 5***.

5.2 Conveyance of Minor System Flows

The subject lands will be serviced by a conventional storm sewer system designed in accordance with the ***Municipal Design Criteria***. The storm sewers will be sized using a 5-year return frequency and Town of Erin IDF curve. Units with basements will be serviced with gravity storm connections.

Storm flows will generally be directed to one of two stormwater management facilities located within the site where the runoff will be treated for water quality, erosion, and quantity control. As backyard and roof drainage is considered clean, some backyard and roof areas will be directed overland to the NHS or via clean water sewers, to maintain the water balance to wetland features within the NHS. ***Section 10.2*** provides further detail regarding the feature-based water balance for the wetlands.

The minor system drainage from the northern medium density block will be conveyed to the NHS to maintain flow to the wetland features and will treated for quality control before discharging. In order to match pre-development flows at Eighth Line, the flow directed to the NHS from the medium density block will be limited to approximately 135 L/s through a flow splitter, and the remainder of the flow will be conveyed to Pond 1 for treatment. The conceptual storm servicing plan is provided in ***Figure 6***.

Additionally, the minor system drainage from the southern medium density block will be conveyed to an infiltration gallery in the park as part of the 5 mm retention strategy before discharging to Pond 2. To prevent excess sediment build up in the infiltration gallery, pre-treatment is proposed by way of an oil grit separator (OGS) located within the block.

The conceptual storm servicing plan and drainage areas are illustrated in ***Drawing 3*** with design sheets included in ***Appendix E***.

5.3 Conveyance of Major Storm Flows

Major system runoff in excess of the minor system and up to the 100-year event will be conveyed within the road allowances via a continuous overland flow route or captured at 100-year intakes and conveyed via storm sewers, ultimately directed to Ponds 1 and 2. The major system flow will not exceed the width of the road allowance, and in no case will the depth of flow exceed 0.15 meters above the crown of the road during a 100-year event, in accordance with the ***Municipal Design Criteria***. Should the major system flow exceed the conveyance capacity of any given road, the minor system will be sized to accommodate the flows in excess of the road capacity at detailed design. Right-of-way conveyance capacities will be confirmed at the detailed design stage based on detailed road grades.

Due to constraints with the site grading which are further discussed in ***Section 11***, several 100-year intakes are proposed to capture and convey major system flows to Pond 2 via gravity storm sewers sized to accommodate the 100-year event:

- Due to the large grade differential between Street ‘A’ and Pond 2 and to avoid routing a continuous overland flow route through the park, a 100-year intake is proposed on Street ‘A’ at the north end of the park to capture major system flows within the storm sewer.

- A 100-year intake is proposed on Street ‘D’ at the intersection with Street ‘A’ as the Street ‘D’ flows are to be directed to Pond 2 but the grading on Street ‘A’ does not allow for the high point to be shifted north of this intersection.

- A 100-year intake is proposed on Street ‘H’ in order to grade the street to the north following the existing topography of the site which helps to reduce the grade difference to Eighth Line.

- A 100-year intake is proposed on Street ‘G’ in order to reduce the significant grade difference between Streets ‘G’ and ‘E’ and tie into the boundary grades along Eighth Line and minimize the use of retaining walls.

- Finally, a 100-year intake is proposed on Street ‘E’ at the intersection with Eighth Line to minimize major drainage from the subdivision major discharging to Eighth Line.

Emergency spill points have been provided at respective 100-year intake areas to safely convey storm events above the 100-year storm as well as provide a safe outlet in the event of blockage.

As noted in ***Section 5.2***, minor system drainage from the northern medium density block will be conveyed to the NHS. Major system flow from the northern medium density block, however, will be conveyed overland to Pond 1.

5.4 Clean Water Collection

Clean water collection sewers are proposed in various locations across the site to convey clean flow to the wetland features within the NHS as part of water balance requirements. The clean water collectors will convey roof and backyard drainage captured in rear yard catch basins as well as NHS drainage captured in ditch inlet catch basins (DICB). The clean water collection system is illustrated in ***Figure 6***.

The clean water collection sewers are included in the design sheets in ***Appendix E***.

5.5 External Drainage

The site conveys pre-development flows from approximately 1.75 ha of external lands to the west of the proposed development. Pond 2 also treats external drainage of from 1.74 ha from Eighth Line, 0.06 ha from rear lots, 0.29 ha open space and 1.87 ha of existing residential properties to the east of the subject lands as illustrated in ***Figure 6***. Pond 2 has not been sized for future development 1.87 ha of existing lots.

External flows from the west of the subject lands will be conveyed to the local storm sewers via cut off swales to DICBs or rear yard swales and rear yard catch basins along the west limit of the development. External drainage from the existing residential properties east of the subject lands will flow overland towards Pond 2 where flows will be captured in DICB(s). Flows are then conveyed to around Pond 2 where flows discharge to respective wetlands located within the NHS or to the road side ditch.

For the Pond 2 outfall pipe within Eighth Line, there may be opportunity to accommodate flows from the pond outfall from adjacent development lands being advanced by Empire Communities. This could reduce impacts to the natural heritage system by reducing the number of outfalls. A preliminary assessment indicates that to accommodate this combined outfall, the outfall within Eighth Line would be increased to a box sewer with an approximate size of 1800 mm x 1200 mm. This external storm outfall alternative can be explored further at detailed design if requested by Empire and subject to appropriate cost share arrangements. This potential alternative does impact the Draft Plan of the subject lands.

5.5.1 *Eighth Line Drainage*

As discussed in ***Section 10.1***, Eighth Line will be urbanized from Dundas Street to the watercourse crossing on Eighth Line. The minor system drainage for Eighth Line between Dundas Street and Pond 2 will be conveyed to Pond 2 via a gravity storm sewer located within the Eighth Line ROW. The minor system for Eighth Line between Pond 2 and the watercourse crossing will be conveyed through a local storm sewer within the Eighth Line ROW and treated for quality control prior to discharging to the West Credit River. Major system drainage from Eighth Line will be conveyed uncontrolled to the West Credit River via the Eighth Line ROW as the low point on Eighth Line is located near the bridge, north of Pond 2.

5.6 Southern Slope Drainage

As depicted in ***Drawing 6,*** cut off swales are proposed along the base of the slope within the deep lots in the southwest portion of the site. Cut off swales are sized to capture the drainage from the slope. The cut off swales will convey the flows to DICBs which will connect to the clean water collection pipe as depicted in ***Figure 6***.

5.7 Easements

Several storm sewer and clean water sewer easements are proposed through residential lots to convey drainage to the local storm system and to convey clean water to wetland features. Easements have been sized in accordance with Table 15 of the ***Municipal Design Criteria***.

6.0 STORMWATER MANAGEMENT

6.1 Stormwater Management Requirements

In the absence of a high-level stormwater management planning study, the CVC confirmed in an email dated August 2021, included in ***Appendix F***, that stormwater management must be practiced as follows:

Water Quality Control	Enhanced stormwater quality control in accordance with the ***SWMP Design Manual***
Erosion Control	Minimum 5mm on site retention or as determined by detailed geomorphic studies. Detention of the 25mm event for 48 hr if required based on the erosion assessment.
Quantity Control	Control post development peak flows to pre-development for 2 – 100-year events. No regional controls required.

Stormwater treatment will be provided by two end of pipe stormwater management wetland facilities. The requirement for wetland facilities is largely driven by topographical constraints within the pond blocks which restricts the ability to provide a wet pond facility. Pond 1 is located at the north end of the site adjacent to Sideroad 17 and Pond 2 is located centrally in the site adjacent to Eighth Line. The ponds are discussed in **Sections 7** and **8** below.

The pond block locations are proposed in the lowest areas of the site in close proximity to the receiving water body, the West Credit River. In addition to property limits, the pond block limits were established by defining existing constraints in the proposed locations. Pond 1 is defined by a dripline buffer to the east. Pond 2 is defined by wetland buffers to the north and south, and a 100 m well head protection area (WHPA) to the east. Further information regarding the WHPA is provided in ***Section 12***. As discussed with the Town, there are significant topographical and environmental constraints on the subject lands which impact the design of the ponds as discussed further below.

As noted in ***Section 5.2***, the minor system flows from the northern and southern medium density blocks with be treated for quality control prior to discharging to the wetlands to meet the feature-based water balance and to provide pre-treatment prior to discharging to an infiltration gallery in the park as part of the 5 mm on site retention strategy respectively.

As noted in ***Section 5.5***, the minor system drainage for Eighth Line between Pond 2 and the watercourse crossing is proposed to be conveyed to the West Credit River via a local storm sewer. Quality control will be provided prior to discharging.

Details of the quality control will be confirmed at detailed design.

7.0 POND OPERATING CHARACTERISTICS

The stormwater management ponds have been sized in accordance with the requirements of the ***Municipal Design Criteria*** and ***SWMP Design Manual***, and include the following features:

Sediment Forebay	➢ to improve sediment removal prior to entering the pond and contain turbidity
Permanent Pool	➢ to buffer storm flows and trap pollutants
Extended Detention Storage	➢ to provide water quality and erosion control
Quantity Control Storage	➢ to attenuate post development flows to pre-development

The ponds have been sized to ensure post-development flows do not exceed pre-development conditions. To set the pond release rates a pre-development SWMHYMO model was created based on underlying soil mapping, land use, and topographic data. This model was run for the 2–100-year events to determine the release rates of the site to the West Credit River at three different nodes under pre-development conditions. Node 1 is located just south of Sideroad 17, Node 2 is located west of the bridge crossing on Eighth Line, and Node 3 is located immediately east of the bridge crossing on Eighth Line. The model was then updated to reflect the proposed development plan, and the two proposed SWM ponds were iteratively sized to ensure post-development peak flows do not exceed pre-development conditions. Pond 1 release rates are based on pre-development flows at Node 1 and Pond 2 release rates are based on pre-development peak flows at Node 3. The pond sizing and pond controls are included in ***Appendix G***.

The Pond 1 and Pond 2 outfalls to the West Credit River are located at HEC-RAS cross-sections 12075.12 and 11808.34, respectively, per the September 2023 WestCredit.* existing conditions model by R.J. Burnside and Associates Ltd. At the Pond 1 outfall, the 25-year flood level is 396.34 m, and the Regional flood level is 397.03 m. Pond 1 has been designed to consider the restrictive downstream Regional flood level. At the Pond 2 outfall, the 25-year flood level is 395.78 m, and the Regional flood level is 396.55 m. As the permanent pool of the pond is above the Regional flood level, it does not impact the performance of the pond. Ponds have been designed and hydraulically modelled to verify performance can be met given water levels at the respective receiver location. Additionally, the CVC is currently undertaking a hydrology model update for the receiving watercourse to calibrate simulated modelled flows with historical flow gauge data in the area. While results are not available at the time of this report, it is understood that modelled flows are expected to decrease within the West Credit and as such respective storm event water levels at the pond outlets are expected to decrease to further reduce restrictive outfall conditions. The CVC is targeting release of the updated hydrology and hydraulic models August 2024. Pond operating levels will be updated and re-evaluated at detailed design once this information is finalizing and available.

The conceptual design of the stormwater management ponds and typical cross-sections are presented in ***Figure 7*** and ***Figure 8.*** A summary of the pond operating characteristics is presented in ***Table 7-1.***

Table 7-1: Summary of Required Stormwater Management Facility Storage Characteristics

Pond I.D.	Facility Type	Drainage Area (ha)	Imp. Coverage (%)	Permanent Pool Volume [1] (m^3)	Erosion Control Volume [2] (m^3)	25 Year Flood Control Volume [3] (m^3)	100 Year Flood Control Volume [3] (m^3)
1	Wetland	12.45	69	984	1,485	7,158	8,786
2	Wetland	23.96	59	1,653	3,005	13,030	15,220

[1] 80 m3/ha and 65 m3/ha for wetlands (SWMP Design Manual, Table 3.2)
[2] Based on volume required to detain the 25 mm event for a minimum of 48 hrs
[3] Based on volume required to attenuate peak flows to pre-development flows

The impervious coverage has been estimated based on the various land uses and their respective sizes in the current plan and are summarized in ***Table 7-2*** below. The runoff coefficients used for the development meet or exceed the minimum runoff coefficients per Table 12 of the ***Municipal Design Criteria***. Please note that the final impervious coverage will be updated at the detailed design stage based on the plan characteristics. Respective pond sizing will be refined accordingly.

Table 7-2: Summary of Runoff Coefficients

Land Use	Runoff Coefficient
Single Family Residential	0.69
Townhouses	0.75
Medium Density Block	0.90
Open Space & NHS	0.25
Park	0.40

Details of the conceptual pond designs are discussed in ***Section 8***.

8.0 POND COMPONENTS

8.1 Sediment Forebay

The stormwater management constructed wetlands include a sediment forebay in order to improve the pollutant removal by trapping larger particles near the inlet of the pond. The forebay will be designed with a length to width ratio of approximately 2:1 and will not exceed 20% of the permanent pool surface area for wetlands, as required in the ***SWMP Design Manual***. Furthermore, the forebay will have a minimum depth of 1.0 metre to minimize the potential for re-suspension.

8.2 Permanent Pool

The permanent pool of the constructed wetlands are approximately 0.3 metres deep outside of the forebay, which is within the range recommended in the ***SWMP Design Manual***.

The permanent pools have been sized to provide an enhanced level of protection in accordance with the ***SWMP Design Manual***. The required and provided permanent pool volumes are summarized in ***Table 8-1*** below:

Table 8-1: Permanent Pool Storage

Pond I.D.	Pond Type	Drainage Area (ha)	Imp. Coverage (%)	Volume Required (m^3)	Volume Provided (m^3) [2]
1	Wetland	12.45	69	984	1,464
2	Wetland	23.96	59	1,653	2,092

[1] Interpolated from SWMP Design Manual, Table 3.2

The side slopes in the permanent pools will be graded with side slopes of 7:1 along the perimeter of the permanent pool water level, with minor localized variations in accordance with ***Municipal Design Criteria***.

8.3 Extended Detention Storage

The ***Erosion Assessment*** notes the critical discharge rate for the receiving watercourse is 1.41 m^3/s, which equates to a unitary release rate of 0.00043 $m^3/s/ha$ over the watercourse's 3,571 ha drainage area. Based on the uncontrolled flow required for the wetland water balances, controlling the extended detention for each pond to the release rate based on the unitary release rate noted above would result in negative release rates in the ponds. Additionally, based on the pre-development SWMHYMO results, the existing flows exceeds the unitary release rate. As noted in the ***Erosion Assessment***, this threshold is considered conservative and should only be used as an overall target for the watershed as drainage contributions on a per hectare basis will vary significantly based on individual site characteristics. The assessment notes that extended detention of the 25 mm event, in addition to the onsite retention target of, is expected to sufficiently mitigate excess erosion.

The extended detention storage has been sized based on releasing the 25mm storm event over a minimum of 48 hours for erosion control. As per the extended detention tables Table 7B and 11B included in ***Appendix G,*** the 25mm event is expected to drawdown in approximately 3.2 days in Pond 1 and 2.98 days in Pond 2.

The extended detention storage for Ponds 1 and 2 does not exceed 1.0 metre depth for storms less than the 10-year event in accordance with the ***Municipal Design Criteria*** and ***SWMP Design Manual***.

The extended detention component has been provided with side slopes of 7:1 with minor localized variations in accordance with the ***SWMP Design Manual***.

8.4 Extended Detention Outlet

The extended detention volumes within the ponds will outlet through a reverse graded pipe. A 110 mm orifice will be provided at an elevation of 395.50 m to discharge the extended detention volume at a maximum release rate of 17 L/s for Pond 1.

A 170 mm orifice will be provided at an elevation of 403.00 m to discharge the extended detention volume at a maximum release rate of 40 L/s for Pond 2.

Calculations in support of the extended detention outlet are provided in ***Appendix G.***

8.5 Quantity Control Outlet

Quantity control will be provided by a combination of orifices and weirs located in pre-cast box outlet structures. The allowable release rates for the site are based on the pre-development peak flow rates at Nodes 1 and 3 located upstream of the pond outlets. The target flow rates for the nodes based on pre-development conditions are summarized in ***Table 8-2*** for the 24-hour SCS storm, with additional details provided in Table 13 of ***Appendix G***.

Table 8-2: Summary of Node Target Discharge Rates

Node I.D.	Peak Outflow Rates (m^3/s)	
	25 Year	100 Year
1	0.588	0.816
2	2.618	3.635
3	2.814	3.890

Pond 1

A 100 mm diameter vertical circular orifice at an elevation of 396.00 and a 320 mm wide x 200 mm high vertical rectangular orifice at an elevation of 396.60 m will be provided for quantity control. These orifices in combination with the 110 mm diameter circular orifice at an elevation of 395.50 m for quality control will control the post development 100-year flow from the pond to 0.208 m^3/s. This results in a 100-year flow at Node 1 of 0.699 m^3/s which is less than the pre-development flow of 0.816 m^3/s.

The controlled flows at the outlet structure will be conveyed by a 525 mm diameter concrete pipe (or equivalent) with a 0.30% slope and a capacity of 0.236 m^3/s. The flows from that pipe will be directed to the West Credit River immediately south of Sideroad 17.

The simulated operating levels for Pond 1 under free outfall conditions are presented in ***Table 8-3***:

Table 8-3: Pond 1 Summary of Pond Operating Characteristics

Design Storm	Lower Elevation (m)	Upper Elevation (m)	Outflow (m^3/s)	Total Volume Used (m^3)
Permanent Pool	394.50[1]	395.50	-	1,464
Extended Detention	395.50	395.93	0.017	1,485
25 Year	395.50	397.13	0.170	7,158
100 Year	395.50	397.41	0.208	8,786

[1] Permanent pool is 1.0 m deep in the forebay only

Under restrictive downstream conditions, the 100-year pond level is 397.50 m (8,786 m^3). As noted above, the Regional water level at the outlet of Pond 1 to the watercourse is 397.03 m under restrictive downstream conditions. Calculations in support of the quantity control orifices and weirs are provided in ***Appendix G***.

Pond 2

A 100 mm diameter vertical circular orifice at an elevation of 403.50 m and a 900 mm wide x 800 mm high vertical rectangular orifice at an elevation of 403.85 m will be provided for quantity control. These orifices in combination with the 170 mm diameter circular orifice at an elevation of 403.00 m for quality control will control the post development 100-year flow from the pond to 1.647 m^3/s. This results in a 100-year flow at Node 3 of 3.550 m^3/s which is less than the pre-development flow of 3.890 m^3/s.

The controlled flows at the outlet structure will be conveyed by a 750 mm diameter concrete pipe (or equivalent) with a 3.0% slope and a capacity of 1.927 m^3/s. The flows from that pipe will be directed to the West Credit River, immediately east of Eighth Line.

The simulated operating levels for Pond 2 are presented in ***Table 8-4***:

Table 8-4: Pond 2 Summary of Pond Operating Characteristics

Design Storm	Lower Elevation (m)	Upper Elevation (m)	Outflow (m^3/s)	Total Volume Used (m^3) [2]
Permanent Pool	402.00[1]	403.00	-	2,092
Extended Detention	403.00	403.45	0.040	3,005
25 Year	403.00	404.59	1.020	13,030
100 Year	403.00	404.81	1.647	15,220

[1] Permanent pool is 1.0 m deep in the forebay only

Pond 2 operates under free outfall conditions only, as the Regional flood level at the outlet of Pond 2 to the watercourse is 396.55 m as noted above; below the permanent pool elevation. Calculations in support of the quantity control orifices and weirs are provided in ***Appendix G***.

8.6 Emergency Overflows

In the event of a blockage or a storm event greater than the 100-year design horizon, an emergency overflow weir will be provided in each pond.

Pond 1 is located adjacent to Sideroad 17 and will be provided with an overflow weir to the Sideroad 17 ROW ditch to the north of the pond and will be conveyed to the West Credit River. The overflow weir has been conceptually sized at a length of 20.0 m at an elevation of 398.20 m. Pond 2 is located adjacent to Eighth Line and will be provided with an overflow weir to the Eighth Line ROW and ultimately to the West Credit River. The overflow weir has been conceptually sized at a length of 20.0 m at an elevation of 405.20 m. Note that the elevations of these weirs are set by the road elevations rather than by the 100-year pond levels; to provide emergency overflow between the 100-year pond level and these emergency overflow weirs, the top of the drop inlet structures will also provide overflow conveyance. For Pond 1, the top of the 0.9 m x 1.2 m drop inlet structure is set at an elevation of 396.60 m. For Pond 2, the top of the 1.8 m x 2.4 m drop inlet structure is set at an elevation of 404.95 m. These emergency overflow will maintain the

Regional pond level below the top of berm elevations in Ponds 1 and 2, even under 50% blockage of the outlet controls.

8.7 Pond Liner

As recommended in the ***Threats Disclosure Report,*** Pond 2 will be lined to prevent infiltration and mitigate potential drinking water threats posed by the SWM pond. The report also notes that a thick clay, silt and stone layer is present in the area of the pond. Efforts will be made to preserve as much of the layer as possible to protect the underlying sediments from potential contamination. Lining the emergency spillway may also be implemented to prevent infiltration in the WHPA-A in the unlikely event the emergency spillway is activated. Further discussion is provided in **Section 12**.

Additionally, A detailed geotechnical report and analysis will be completed in support of detailed design. The findings of the geotechnical report will further clarify Ponds 1 and 2 liner requirements.

8.8 Access Road

A 4.0 m wide access road, with 0.5 m wide shoulder will be provided in the pond blocks in order to facilitate routine inspection and maintenance activities within the pond (5.0 m wide total). The pond access road will double as a trail to provide pedestrian connection between adjacent streets and naturalized areas. The access roads will be paved and graded with a maximum slope of 5% where the access road doubles as a trail and 10% elsewhere, in accordance with the ***Municipal Design Criteria***.

8.9 Thermal Mitigation

Thermal mitigation measures will be provided at pond locations where feasible. The application of the following measures will be further investigated at detailed design:

- Ponds will discharge will through a buried outlet pipe, thereby using the thermal mass of the surrounding soil to attenuate temperatures.
- The facilities have been designed with a high length to width ratio where possible to allow for effective shading with landscape material.
- Increased riparian vegetation will be provided throughout the constructed wetlands.
- Ponds will outlet via a reverse graded pipe provided in a deep pool below the pond bottom. The depth will vary by Pond depending on grading feasibility and will be confirmed at detailed design.

9.0 WATER BALANCE

9.1 Site Wide Water Balance

A ***Hydrogeology Assessment*** has been completed by RJ Burnside for the proposed development to assess the existing hydrogeologic conditions of the site and determine potential impacts of development on the water balance.

The site-specific water balance assessment concluded that without mitigation, the development lands would experience 32% less infiltration under post-development conditions. This equates to an annual infiltration deficit of approximately 47,400 m^3/year without mitigation.

In order to promote additional infiltration and to reduce runoff volumes under post-development conditions, several low impact development strategies (LIDs) are recommended. The LIDs recommended to achieve pre to post development water balance for the subject lands are outlined below:

- Disconnect roof leaders and discharge to pervious grade
- Increased 450mm topsoil depth in the lots, boulevards, and park

Introducing the above noted LIDs will increase the infiltration volume by 43,400 m^3/year when compared to the unmitigated post-development scenario. This results in only a 3% annual infiltration deficit when compared to pre-development conditions. Please refer to the ***Hydrogeological Report*** for post-development water balance calculations.

9.2 LID Measures

In addition to maintaining site wide pre- to post development annual infiltration for the subject lands, the ***Erosion Assessment*** suggested working toward a 5 mm on-site retention target. The 5 mm target is the best-efforts target for erosion mitigation referenced from the CVC stormwater guidelines. Retaining frequent low flow events on site will mitigate erosion within the receiving watercourse. The following LID measures are used to calculate the on-site retention:

- Divert clean water to wetland features
- Implement rear yard infiltration trenches
- Implement an infiltration gallery in the park

As described in ***Section 9.3***, clean water is proposed to be conveyed from several areas across the development to the NHS to maintain the pre-development runoff to wetland features within the NHS. Diverting clean flow to the NHS rather than conveying it to a stormwater management facility is expected to mitigate erosion in the receiving watercourse by providing an opportunity for infiltration and evapotranspiration prior to reaching the watercourse.

Rear yard infiltration trenches are proposed where feasible. Rear yard trenches are proposed to collect and infiltrate runoff from impervious roof and backyard areas. Runoff will be conveyed through rear yard swales to rear lot catch basins. As depicted in the infiltration trench detail provided on ***Figure 9***, the subdrain invert is lower than the rear yard catch basin lead invert, allowing the infiltration trench to fill and infiltrate runoff before overflowing to the catch basin lead and entering the mainline storm sewer. The rear yard infiltration trenches have been conceptually sized to store up to the 25 mm event.

An infiltration gallery is proposed in the park to store and infiltrate flows from the southern medium density block. An OGS is proposed to pre-treat stormwater from the medium density block prior to conveying the flows to the infiltration gallery. Pre-treatment is recommended to prevent sediment buildup and blockage within the infiltration facility. The proposed infiltration gallery will operate similar to the rear yard infiltration trenches. The gallery will be composed of clearstone and will be equipped with an overflow pipe that will convey flows in excess of the infiltration gallery capacity to the local storm system and ultimately Pond 2. The infiltration gallery has been conceptually sized to store runoff from the medium density block during a 25 mm rainfall event.

Site constraints result in limited infiltration opportunities across the development. In an effort to match the existing topography, walk up and walkout units are proposed throughout the site resulting in limited rear yard catch basins and limited opportunities for rear yard infiltration trenches. Rear yard infiltration trenches have also not been proposed in lots with retaining walls due to the proximity of the infiltration facility relative to the structure. In addition to the grading constraints, the high groundwater table in the northeast of the site limits the possible infiltration locations.

Crediting 5 mm retention to the impervious areas draining to the existing wetlands, the proposed LIDs have a storage capacity of approximately 680 m^3, which equates to approximately 3 mm of runoff from the impervious development area. Although the storage capacity is less than the 5 mm retention target, retaining 3mm across the development can be achieved with the challenging site constraints and is expected to have positive impacts on the downstream watercourse. For the following reasons the provided 3 mm of on-site retention is sufficient to mitigate against the potential of excess erosion within reach WC-1:

- Reach WC-1 is a stable reach not particularly sensitive to erosion. As detailed in the ***Erosion Assessment***, Reach WC-1 is a low gradient, relatively wide stream channel that is very well connected to the extensive wetland system bordering the channel. No significant active erosion was observed within or downstream of the subject lands, and a survey of historical images of the reach indicated no significant changes in channel planform. These site characteristics suggest that reach WC-1 is stable and not particularly sensitive to erosion.

- The relatively small development footprint relative to the reach WC-1 drainage area. The drainage area of WC-1 is approximately 3,570 ha (as defined using the OWIT assessment tool). The drainage area to WC-1 via the site is approximately 55 ha of which 46 ha is on the subject lands. The drainage area of the subject lands accounts for approximately 1.3% of the total drainage area to reach WC-1. Developments with such relatively small development footprints are not likely to have any meaningful impact on the rates of erosion within the receiving watercourses.

- The site's existing wetland and forested areas will be retained which includes approximately 12.3 ha of forests, wetlands, and wetland buffer areas which account for approximately 27% of the drainage area from the subject lands. A Feature-based Water Balance for the wetlands conveying runoff from the site to the wetland complex adjacent to reach WC-1 indicates that annual runoff volumes to the wetland complex will increase by 8% but that peak monthly runoff volumes which occur during the month of April will be reduced by approximately 12%. All individual wetlands on site are within +/- 5% of pre-development targets. We therefore expect there to be a slight reduction in erosion potential related to reduced spring runoff volumes from the site.

Within this context, the provided 3mm in on-site retention is expected to be sufficient to reduce the risk of excess erosion at reach WC-1 as the assimilative capacity of the receiving channel is adequate given the expected hydrological changes associated with the development. Given the size of the receiving watercourse, it is understood the planned LIDs and wetland water balance requirements mitigates potential erosion risk at this location. The storage volume calculations for the proposed LIDs are included in ***Appendix E***.

Site specific infiltration testing and groundwater monitoring should be completed at detailed design to ensure there is sufficient clearance between the base of the LID and the groundwater table as well as confirm the drawdown time of each LID.

Figure 9 illustrates the proposed LIDs.

9.3 Feature Based Water Balance

A review of the ecological features located within, and in close proximity to, the proposed development was conducted by RJ Burnside in the ***EIS***. It was determined through review of the ecological features that there are eight wetlands and one aquatic feature located within the site that rely on surface flow from the subject lands to maintain the vegetation community. The ***EIS*** recommends that under post-development conditions drainage be maintained to the features and feature based water balance analyses have been completed for these features.

A feature-based water balance has also been completed for a pond feature located on the neighboring lands to the northeast of the proposed development. The feature is not part of the PSW complex, and as such, the feature was not assessed through the ***EIS***. The pond's post development drainage area, however, is reduced in the post development condition. Therefore, to ensure the feature receives a similar volume of runoff post-development, a feature-based water balance has been completed.

A feature-based water balance analysis was completed by GeoMorphix Ltd. to assess the water balance to the eight wetlands and two pond features. The results of the feature-based water balance have been included in ***Appendix H*** and are summarized below.

Figure 10 and ***Figure 11*** depict the pre-development and post-development drainage areas to the features respectively.

9.3.1 *SWDM4-5 & SAS 1-1 – Wetland A*

As depicted in ***Figure 10*** the pre-development drainage area to wetland features SWDM4-5 and SAS_1-1 is approximately 3.81 Ha. A portion of the wetlands' pre-development drainage area is proposed to be developed, causing flows to be diverted away from the wetland. To maintain the water balance to the SWDM4-5 and SAS_1-1 features post development, clean water from the southern NHS, roofs, and back yards is proposed to be routed to the wetland via overland flow and clean water collection sewers. Based on modelling results from the feature based water balance analysis, diverting clean water from these areas to SWDM4-5 and SAS_1-1 achieves 98% of the pre-development runoff to the features in the post development condition.

9.3.2 *SWTM2-1 & SWDM2-2 – Wetland B*

As depicted in ***Figure 10*** the pre-development drainage area to wetland features SWTM2-1 and SWDM2-2 is approximately 6.99 Ha. A portion of the wetlands' predevelopment drainage area is proposed to be developed, causing flows to be diverted away from the wetland. To maintain the water balance to the SWTM2-1 and SWDM2-2 features post development, clean water from the southern NHS, roofs, and back yards is proposed to be routed to the wetland via overland flow and clean water collection sewers. Based on modelling results from the feature based water balance analysis, diverting clean water from these areas to SWTM2-1 and SWDM2-2 achieves 101% of the pre-development runoff to the features in the post development condition.

9.3.3 *SWDM4-1 – Wetland C*

As depicted in ***Figure 10*** the pre-development drainage area to wetland feature SWDM4-1 is approximately 7.08 Ha. A portion of the wetland's pre-development drainage area is proposed to be developed, causing flows to be diverted away from the wetland. To maintain the water balance to the SWDM4-1 feature post development, clean flows from the SWTM2-1 and SWDM2-2 features will be intercepted in a cut-off swale south of Pond 2 and conveyed to SWDM4-1 via clean water collection pipes. Clean water from the park, roofs, and back yards is also proposed to be routed to the wetland via overland flow and clean water collection sewers. Based on modelling results from the feature based water balance analysis, diverting clean water from these areas to SWDM4-1 achieves 97% of the pre-development runoff to the feature in the post development condition.

9.3.4 *MAMM1-3 – Wetland D*

As depicted in ***Figure 10*** the pre-development drainage area to wetland feature MAMM1-3 is approximately 14.38 Ha. As illustrated in the figure, drainage from wetland feature SWDM4-1 cascades into wetland feature MAMM1-3. A portion of the wetland's predevelopment drainage area is proposed to be developed, causing flows to be diverted away from the wetland. To maintain the water balance to the MAMM1-3 feature post development, a portion of the minor system drainage from the northern medium density block is proposed to be routed to the wetland. As discussed in ***Section 5.2***, quality control will be provided prior to discharging flows to the wetland. Based on modelling results from the feature based water balance analysis, diverting water from the medium density block to wetland MAMM1-3 achieves 102% of the pre-development runoff to the feature in the post development condition.

9.3.5 *MAMM2-2 – Wetland E*

As depicted in ***Figure 10*** the predevelopment drainage area to wetland feature MAMM2-2 is approximately 19.96 Ha. As illustrated in the figure, drainage from wetland features SWDM4-1 and MAMM1-3 cascades into wetland feature MAMM2-2. A portion of the wetland's pre-development drainage area is proposed to be developed, causing flows to be diverted away from the wetland. To maintain the water balance to the MAMM2-2 feature post development, clean flows from the SWTM2-1 and SWDM2-2 features will be intercepted in a cut-off swale south of Pond 2 and conveyed to MAMM2-2 via a clean water collection sewer. Based on modelling results from the feature based water balance analysis, diverting clean water from these wetlands to

MAMM2-2 achieves 108% of the pre-development runoff to the feature in the post development condition.

9.3.6 *SWDM4 – Wetland F*

As depicted in ***Figure 10*** the pre-development drainage area to wetland feature SWDM4 is approximately 20.77 Ha. As illustrated in the figure, drainage from wetland features SWDM4-1, MAMM1-3 and MAMM2-2 cascades into wetland feature SWDM4. A portion of the upstream wetland's pre-development drainage areas, and therefore the SWMD4 drainage area is proposed to be developed, causing flows to be diverted away from the wetland. Based on modelling results from the feature based water balance analysis, providing clean flow to the upstream wetlands that cascade into SWDM4 achieves 108% of the pre-development runoff to the SWDM4 in the post development condition, without routing any additional flow directly to the feature.

9.3.7 *AQ1*

As depicted in ***Figure 10*** the pre-development drainage area to the AQ1 feature is approximately 1.00 Ha. In the post development condition, the drainage area is reduced due to stormwater management Pond 2. To maintain the water balance to the AQ1 feature post development, clean water from the NHS south of Pond 2 will be collected in a ditch inlet catch basin and conveyed via a clean water pipe in Eighth Line to the AQ1 feature. Based on modelling results from the feature based water balance analysis, diverting clean water from this area to the AQ1 feature achieves 111% of the pre-development runoff to the feature in the post development condition.

9.3.8 *AQ2*

As depicted in ***Figure 10*** and ***Figure 11***, a portion of the 2.32 Ha AQ2 pre-development drainage area is proposed to be developed. To ensure the pond receives similar water volumes in the post development condition a pre to post development water balance analysis was conducted for the AQ2 feature. Based on the results of the analysis, diverting clean water from backyard and roof areas north of Street 'C' to the AQ2 feature will maintain 92% of the pre-development runoff to the AQ2 feature post development.

9.3.9 *Environmental Review*

The ***EIS*** notes that the post-development hydroperiods for the features are sufficiently close to the pre-development condition which will protect the wetlands.

10.0 ROADS

Access to the property is available from the north by Sideroad 17 via Street 'C' and from the east by Eighth Line via Street 'E'. Municipal right of way widths proposed in the site are 18 m, 20 m, and 23 m. 18 m ROW section is not in the published **Municipal Design Criteria**, however was shared during the circulation of the draft **Municipal Design Criteria**. It has been agreed on by Town staff that the 18 m ROW section can be used for the subject Draft Plan. The typical Town of Erin road sections are included in ***Appendix I***. Modified standard road sections depicting the servicing layout in areas where there is a three pipe system are included in ***Figure 12.***

Local streets will be designed in accordance with the ***Municipal Design Criteria***. Due to the steep topography of the site, road grades up to 5.0% are proposed in areas with lot frontage and up to 7.0% elsewhere, which has been agreed upon by Town staff.

Sidewalks will be constructed in accordance with the enclosed municipal cross sections. Where single sidewalks are proposed, locations have been provided in an effort to increase pedestrian connectivity. The proposed locations are illustrated on ***Figure 13***.

10.1 Eighth Line Urbanization

Eighth Line is proposed to be widened and urbanized along the frontage of the subject lands. As it will tie into 20 m 2-lane rural cross-sections at both the north and south ends, and as no widening is expected to be provided along the existing Erin Heights Subdivision, a 23 m cross-section is proposed to provide a 2-lane urban section with the widening occurring on the west side of the road.

The 23.0 m ROW is proposed approximately from Dundas Street W to the northern limit of the retained Langen property on Eighth Line. North of the 23.0 m ROW, a 20.0 m urban ROW is proposed to the watercourse crossing. The remaining section of Eighth Line from the watercourse crossing to Sideroad 17 is proposed to remain as a 20.0 m rural road per existing conditions. A sidewalk is proposed on both sides of the 23.0 m ROW from the proposed Street ‘E’ and Erin Heights Drive intersection to the pond access road on the west side of Eighth Line and to the park in the Empire development lands on the east side of Eighth Line. Typical cross-sections for Eighth Line have been included in ***Figure 14***.

To match boundary elevations at existing driveways, Erin Heights Drive, and the ROW limit, Eighth Line centreline grades have generally been maintained. The proposed profile of Eighth Line is illustrated in ***Drawing 1***. The proposed slopes vary from 0.5% to 8.0%, with the majority of the road at or below 6% and only localized sections which exceed the Town’s maximum slope of 6% for collector roads. The steeper sections are proposed to generally match the existing profile and allow for existing grades to be matched along the existing Erin Heights subdivision.

In additional to generally matching the existing profile, a modified cross-section is proposed adjacent to the existing Erin Heights Subdivision in order to tie into existing grades. An asymmetric cross-section is proposed to increase the boulevard width on the east side in order to tie into the existing ditch in an effort to preserve the existing trees along the ROW. Tree inventory along Eighth Line has been completed, however a tree preservation plan evaluating removals and protection fencing locations will be provided in support to the final Eighth Line design.

Similarly, a modified cross-section is proposed north of the proposed park within the Empire development to the crossing. Boulevard widths have been narrowed in order to tie into existing grades.

All elements associated required for the ultimate Eighth Line improvements are to be processed separate to the Draft Plan application. Furthermore, the proposed works are to be funded as part of an update to the Town’s current ***DC Study***. Dundas Street is not proposed to be urbanized. Sideroad 17 is also not proposed to be urbanized, however local restoration of the existing conditions will be required to facilitate external servicing requirements to support the proposed Draft Plan. Clarity on the Town’s preference and DC funding should be provided prior to detailed design.

The conceptual grading is illustrated in ***Drawing 4*** with cross-sections in ***Drawing 5***. Eighth Line design and transportation engineering requirements will be prepared in support of detailed design.

10.1.1 *Eighth Line Crossing*

The existing single lane bridge on Eighth Line that traverses the West Credit River will be replaced with a two-lane structure as part of the Eighth Line works. The Eighth Line bridge was identified by the Town of Erin as requiring replacement and the project is included in the ***DC Study***.

As noted in the ***Erosion Assessment*** a crossing span consistent with the Eighth Line crossing north of Sideroad 17 is recommended to maintain the existing channel form. The structure design will be further reviewed through a separate detailed design than the subdivision works, including a hydraulic analysis and ecological review to confirm the structure span.

11.0 PRELIMINARY GRADING PLAN

A preliminary grading plan has been prepared for the subject site based on the engineering constraints identified in previous sections further discussed below. The site is generally constrained by the steep existing grades within the subject lands and the boundary elevations at the interface with the NHS, existing residential lots, agricultural lands to the west, Eighth Line and Sideroad 17. There is over 60 vertical metres between the highest elevation at the ridge at the south end the site and the lowest elevation at Sideroad 17. As a result of the challenging existing topography, the proposed streets, ponds, and park have been strategically configured to optimize the grading design.

The spine road for the site is comprised of Street ‘E’ from Eighth Line to Street ‘A’, Street ‘A’ from Street ‘E’ to Street ‘C’, and ‘Street C’ from Street ‘A’ to Sideroad 17. The high point of the spine road is located on Street ‘E’ just east of Street ‘A’ and has been positioned near the existing high point of the site to mimic the existing topography. North of the high point, the spine road falls north generally following the existing topography toward a low point at Sideroad 17. Southeast of the high point, the spine road falls southeast toward a low point at Eighth Line. The spine road is slightly curved to maximize its length and therefore maximize the grade differential that can be accommodated along the road.

The southwest area of the site is near the top of the existing ridge and is especially steep. The local streets off the spine road in this area have been designed to generally run parallel to the existing contours, while the lots are aligned perpendicular to the existing contours. This configuration minimizes the centreline grade of the local streets and takes advantage of the large grade differential that can be accommodated through the walk out and walk up units proposed in this area.

The proposed grading design limits the use and height of retaining walls by maximizing transitional sloping where possible and by implementing walk-up and walk-out unit types to maximize the grades over the units. The proposed centreline grades of local streets have been limited to 5.0% in areas along lot frontage to minimize the crossfall between lots and reduce the need for driveway retaining walls. All boundary conditions are achieved with the proposed plan as demonstrated on the conceptual grading plan in ***Drawing 6*** and cross-sections in ***Drawing 7.***

11.1 Grading in Natural Heritage System

Grading in the NHS and the associated buffers is minimized but may be required at the following locations:

- Storm outfalls
- Grade transitions within the outer 15 m of the 30 m wetland buffer
- Grade transitions within localized areas of the 10 m dripline buffer

As discussed in ***Section 9.3***, eight wetlands within or adjacent to the subject lands require a surface water balance. As such, storm outfalls are required in proximity to the wetlands to convey clean water to the features. The storm outfalls and associated grading works, therefore, are required in the NHS buffers.

As depicted in ***Drawing 6*** and ***Drawing 7***, there are significant grade differentials between the lots at the south end of the site and the southern NHS as well as between the lots north of the park and the adjacent wetland. To accommodate these grade differentials while minimizing the use of retaining walls, grade transitions have been implemented in the wetland and dripline buffers to match the existing boundary grades.

As noted in the ***EIS***, the impacts to accommodate the required grading are temporary and once restored will be an improvement from existing conditions as the land has been historically disturbed due to intensive farming practices and is significantly degraded. No long term net effects are anticipated as a result of grading within the buffers. The restoration of the buffers in these locations represents a net benefit and will be enhanced with a native seed mix and conveyed into public use.

The anticipated grading within the NHS buffers is illustrated on ***Drawing 1*** and a summary of the disturbed areas within the NHS buffer has been provided in **Appendix O**. A preliminary buffer enhancement plan has been prepared as part of the ***EIS*** which outlines how disturbed buffers will be restored. The ***EIS*** further proposed areas for enhancement within the NHS where the existing ecological condition is degraded. The buffer enhancement plan has been included in **Appendix O** and provided as Drawing LC-1 within the ***EIS***.

11.2 Retaining Walls

As depicted in ***Drawing 6*** and ***Drawing 7*** retaining walls are required in some areas to accommodate grade transitions between lots and to match existing boundary grades. The use of retaining walls has been minimized by implementing walk-out and walk-up units to maximize the grades over the units as well as using extensive sloping where possible.

The retaining wall between Street ‘F’ and Street ‘E’ has been limited to a maximum height of 1.5 m. The retaining wall between Street ‘E’ and Street ‘G’ ranges in height up to approximately 2.0 m to accommodate the grade difference between Street ‘E’ and Street ‘G’. As discussed in ***Section 5.3***, 100-year intakes are proposed on Street ‘G’ to minimize the grade differential between Street ‘E’ and Street ‘G’ and limit of the height of the retaining wall.

Retaining walls on either side of Street ‘C’ at the north end of the site are required to accommodate the grade transition between the existing residential lot to the west and Pond 1 to the east. Pond

1 elevations have been set based on the existing property line grades to the east and the Sideroad 17 boundary grades to the north. As depicted on ***Drawing 6*** there is up to approximately 6 m of elevation difference between the existing property to the west of Pond 1 and the existing property to the east of Pond 1 as well as approximately 10 m of elevation difference between Sideroad 17 and the rear lot line of the property west of Pond 1. Due to the steepness of the lot west of Street 'C', Street 'C' is required to be lower than the adjacent existing property to accommodate the tie-in to existing Sideroad 17, provide a low point adjacent to the pond, and adhere to the maximum centreline grade per the ***Municipal Design Criteria.*** Additionally, due to the limited width of the site in this location, the width available for transitional grading within the pond block and west of the Street 'C' boulevard is limited and retaining walls are required to make up some of the grade differential.

As noted in ***Section 11.3***, extensive transitional sloping is used to match existing boundary grades where possible, however, retaining walls are required in some constrained areas to tie into existing boundary grades. Boundary retaining walls have generally been limited to 3.0 m in height, with localized exceedances.

The retaining walls within the medium density blocks are shown for illustrative purposes only to note that conditions will be met and will be further reviewed through the site plans for those blocks.

All retaining walls over 1.0 m in height will be designed by a Professional Engineer and will be equipped with a 1.5 m high safety fencing as per ***Municipal Design Criteria***. Any retaining walls between two backyards will be fully contained within one lot so that the wall itself and any backfill, tiebacks, etc. will be within one property. Retaining walls are generally proposed to be armour stone material to minimize future maintenance requirements while providing an aesthetically pleasing landscape. A preliminary feasibility assessment for the retaining walls has been completed by the structural consultant, Jewell Engineering, and is provided within **Appendix P**.

11.3 Boundary Grading

Boundary grades have generally been met through the use of 3:1 transition sloping, however in localized sections along the southern limit of development where grading is constrained, maximum 2:1 sloping is proposed to accommodate the grade differential between the forested area south of the development and the lots on Street 'E' and Street 'G'. Flat 1.0 m wide shelves are proposed approximately midway up the slope where slopes exceed 3:1 and 6 vertical metres to mitigate erosion. The use of 2:1 sloping eliminates or minimizes the need for retaining walls in these areas.

A slope stability analysis has been completed by Shad and Associates Ltd. for the transition slopes with the larger cuts and fills in the site including the proposed 2:1 slopes. The analysis confirms that the proposed slopes are stable. The slope stability analysis has been included in ***Appendix J***.

11.4 Park Grading

The park grading is constrained by the need to match existing grades at the PSW to the north and woodlot to the south, and the grade differential between Street A and Pond 2 which varies from approximately 19 to 23 m. As a result, transition sloping up to 3:1 has been proposed to tie into all boundary conditions. While this exceeds the Town's criteria of 5:1, this maximizes useable park area graded at 2-5% and works with the challenging site topography. Should the Town require park grading to a maximum of 4% per ***Municipal Design Criteria*** the useable are of the park will be less as more transition sloping would be required.

11.5 Floodplain

A review of the existing West Credit River (Erin Branch) flood levels adjacent to the subject lands was completed. Based on the ***Bridge 11 Hydraulic Report*** the existing flood elevation downstream of the Sideroad 17 culvert, east of the proposed SWM Pond 1, is 398.08 m due to overtopping of Sideroad 17. To maintain SWM Pond 1 above the floodplain, the northeast Pond 1 berm has been set at an elevation of 398.40 m. Maintaining the pond berm above the flood level results in localized filling in the floodplain in the northeast corner of the Pond 1 block. The loss of floodplain volume is anticipated to be minor and have little impact on the overall floodplain storage in the system.

The floodplain assessment as part of the bridge detailed design will also consider the works currently underway by the Town for the Sideroad 17 culvert replacement. As noted in ***Section 7.0***, the CVC is currently undertaking a hydrology model update to calibrate simulated modelled flows with historical flow gauge data in the area. While results are not available at the time of this report, it is understood that modelled flows are expected to decrease within the West Credit and as such respective storm event water levels at the pond outlets are expected to decrease. The updated hydrology and hydraulic models are anticipated to be made available in August 2024 and will be considered during detailed design if timing permits.

11.6 Wildlife Passage

A review of the wildlife within, and in close proximity to, the proposed development was conducted by RJ Burnside in the ***EIS***. The review determined that connectivity is required between the southern NHS and the wetland features SAS_1-1 and SWDM4-1 to provide passage for amphibians and reptiles. A slotted, at-grade wildlife tunnel equipped with headwalls to direct migrating animals through the tunnel is proposed on Street 'E' to provide the required connectivity. The slotted at grade tunnel is proposed rather than a box culvert as the tunnel minimizes the length of the crossing. As noted in the ***EIS***, the animal passage should ideally be less than 25 m in length. With the use of the at grade, slotted tunnel, the length of the crossing can be minimized to approximately 20 m. ***Drawing 6*** illustrates the wildlife passage with a cross-section through the tunnel provided in ***Drawing 7***. Details of the tunnel are provided in ***Appendix K*** and will be further refined at detailed design.

12.0 WELL HEAD PROTECTION AREA

A municipal well known as Erin Well 8 is located east of the subject lands on Eighth Line. Well head protection areas (WHPA) associated with Erin Well 8 extend into the site, including a highly vulnerable 100 m radius surrounding the well defined as WHPA-A (vulnerability score of 10). RJ Burnside developed a Drinking Water Threats Disclosure Report and Salt Management Plan for the site. Figure 2 included in the ***Threats Disclosure Report*** illustrates the extent of the WHPA within the site.

As noted in the ***Threats Disclosure Report*** the following proposed site activities are among the list of drinking water threats;

1. Establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage.
2. The application of road salt.
3. An activity that reduces the recharge of an aquifer.

The ***Threat Disclosure Report*** also notes that the Official Plan requires disclosure of several activities including the following activities which are proposed within the development;

- Sanitary sewage and stormwater management
- Winter maintenance activities including road salt application, road salt storage, and snow storage

12.1 Stormwater Conveyance and Stormwater Management Facilities

The two on site stormwater management facilities are located outside of the highly vulnerable WHPA-A and are located within the WHPA-B with a vulnerability score of 8. The emergency spillway for Pond 2 is located within WHPA-A. The locations of the stormwater management facilities were chosen as they are the lowest areas of the site which facilitates gravity conveyance of stormwater, they are close to the West Credit River where the facilities discharge, and they are located outside of the WHPA-A. As recommended in the ***Threats Disclosure Report,*** Pond 2 will be lined to prevent infiltration and mitigate potential drinking water threats posed by the SWM pond. The report also notes that a thick clay, silt and stone layer is present in the area of the pond. Efforts will be made to preserve as much of the layer as possible to protect the underlying sediments from potential contamination. Lining the emergency spillway may also be implemented to prevent infiltration in the WHPA-A in the unlikely event the emergency spillway is activated.

The stormwater outfall pipe from Pond 2 traverses WHPA-A and the Pond 2 headwall located on the east side of Eighth Line at the West Credit River is located within the WHPA-B which has a vulnerability score of 10. As recommended in the ***Threats Disclosure Report*** enhanced construction techniques will be used for the installing the stormwater outfall sewer through the highly vulnerable WHPA to mitigate the risk of leakage.

A local storm sewer is also proposed on Eighth Line to service Eighth Line drainage, the respective sewer will run from the north side of Pond 2 to the watercourse, therefore traversing the WHPA-A. An OGS is also proposed upstream of the stormwater outlet at the West Credit River within the WHPA-B with the vulnerability score of 10.

A clean water collection pipe is proposed to discharge within the WHPA-A. The clean water pipe will convey clean flows from the NHS south of Pond 2 to the ecological feature AQ1 located within the PSW complex west of Eighth Line to meet feature-based water balance requirements as per the ***EIS***.

12.2 Sanitary Sewage Conveyance

The proposed sanitary servicing strategy, as presented in ***Section 4*** of this report proposes a gravity sanitary sewer through the NHS, along the northeastern Pond 2 boundary, and on Eighth

Line from the south property limit to Sideroad 17 within the highly vulnerable WHPA-A. The proposed sewers must traverse the WHPA-A to connect to the proposed municipal trunk sewer on the Elora Cataract Trail.

12.3 Winter Maintenance

It is assumed road salt will be applied to roads, sidewalks and driveways within subject site, including within the WHPA. The ***Threats Disclosure Report*** discusses the salt management plan for the subject site.

12.4 Water Quantity

As noted in the ***Threats Disclosure Report*** the subject lands are not located within an area where water quality threats under the Clean Water Act may be identified.

The imperviousness of the subject lands post development will be higher than the pre-development condition which may reduce the groundwater recharge should mitigation measures not be provided. ***Section 9.1*** of this report describes the proposed mitigation measures at the subject site to maintain the pre-development water balance.

The subject site will be serviced with municipal water, therefore water will not be taken from the aquifer within the development lands for residential use.

13.0 POND MAINTENANCE

13.1 Inspections

As recommended in the ***SWMP Design Manual***, inspections should be made after every significant storm (say, >10 mm) during the first two years of operation to ensure that the facility is functioning properly. It is anticipated that four inspections will be required per year. After the initial period, and proper operation has been confirmed, an inspection schedule can be established based on the observed operation of the pond. As a minimum requirement, however, the pond should be inspected annually, although four inspections per year are recommended.

13.2 Regular Operation and Maintenance Activities

Grass Cutting

Grass cutting is not recommended for the pond. Allowing grass to grow enhances the water quality and provides other benefits. It is understood though, that grass cutting enhances the aesthetics of the facility for nearby residents and therefore, should be done as infrequently as possible.

Grass should not be cut to the edge of the permanent pool and should be done parallel to the shoreline. Grass clippings should be ejected away from the pond.

Weed Control

If weed control is required in order to remove a specific species, the weeds should be removed by hand.

Plantings

A vegetative community is required in three different locations – upland / flood, shoreline, and aquatic fringes. Planting methods and any replanting should be carried out in accordance with the approved Landscape Design and the recommendations of the ***SWMP Design Manual***, or as modified by the operating authority.

Trash Removal

Trash and debris should be removed by hand, performed as required based on inspections.

Sediment Removal

In accordance with the ***SWMP Design Manual,*** it is recommended that the frequency of sediment removal be determined based on a 5% reduction in the total suspended solids (TSS) removal efficiency. The frequency of pond maintenance will be determined at the detailed design stage. It should be noted that routine cleaning of the sediment forebay should allow for less frequent cleaning of the main cell than indicated in the ***SWMP Design Manual,*** however the extension of service life prior to cleaning cannot be quantified.

Safety

The pond should be provided with appropriate signage which warns the public of the presence of deep water and slopes.

Landscape drawings will be prepared with strategic plantings around the perimeter of the pond in order to discourage direct access to the facility.

All inlets, outlets, structures, and headwalls will be provided with the appropriate grates, covers, and safety features in order to prevent public entry or tampering.

14.0 EROSION AND SEDIMENT CONTROL

An erosion and sediment control strategy should be implemented prior to construction of site services. The following measures are recommended:

- environmental fencing where required;
- stone mud mat at the construction entrance;
- use of the permanent pond as a temporary silt basin during site construction activities
- regular inspection and monitoring of the erosion and sediment control devices;
- removal and disposal of the erosion and sediment control devices after the site has been stabilized.

15.0 CONCLUSIONS

The Functional Servicing and Stormwater Management Report provides an overview of the servicing plan for 5520 Eighth Line and 5552 Eighth Line located within the Town of Erin. This report demonstrates the availability of water, wastewater, and storm services for the proposed subdivision in accordance with Town and CVC criteria, and general industry practice. This report is to demonstrate functional design concepts only and not to be used for construction.

Report Prepared by,
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LICENSED PROFESSIONAL ENGINEER
H. M. MCLEAN
100531716
07/23/2024
PROVINCE OF ONTARIO

Per: Mack McLean P.Eng.

SWM Modeling Prepared by,
JFSA Canada Inc.

LICENSED PROFESSIONAL ENGINEER
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2023/10/19
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Per: Laura Pipkins, P.Eng.

SWM Modeling Updated by,
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LICENSED PROFESSIONAL ENGINEER
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Per: Jonathon Burnett, P.Eng.

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Per: Paulo Pickart, P.Eng.

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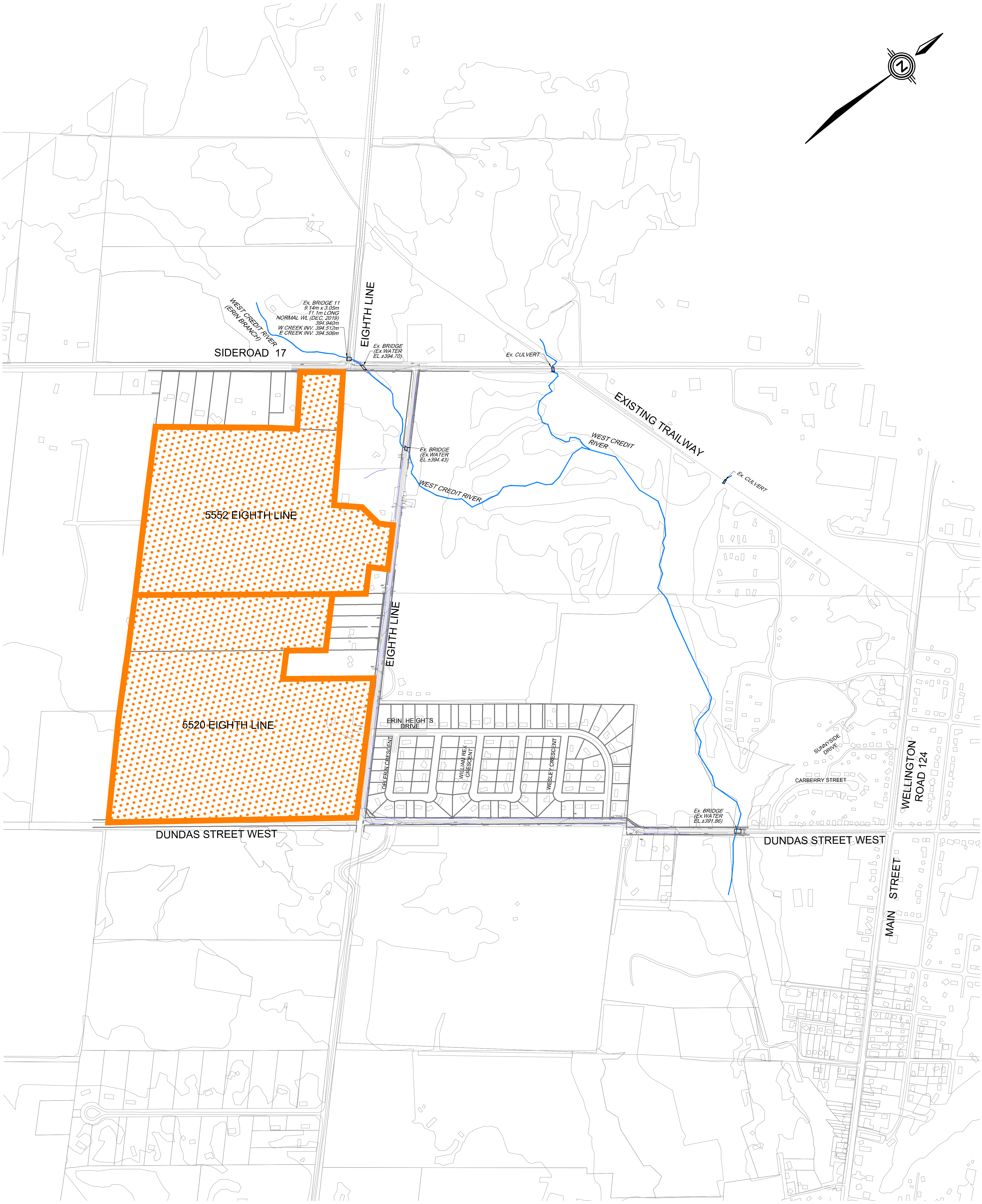
FIGURES & DRAWINGS



LEGEND

▨	SITE BOUNDARY

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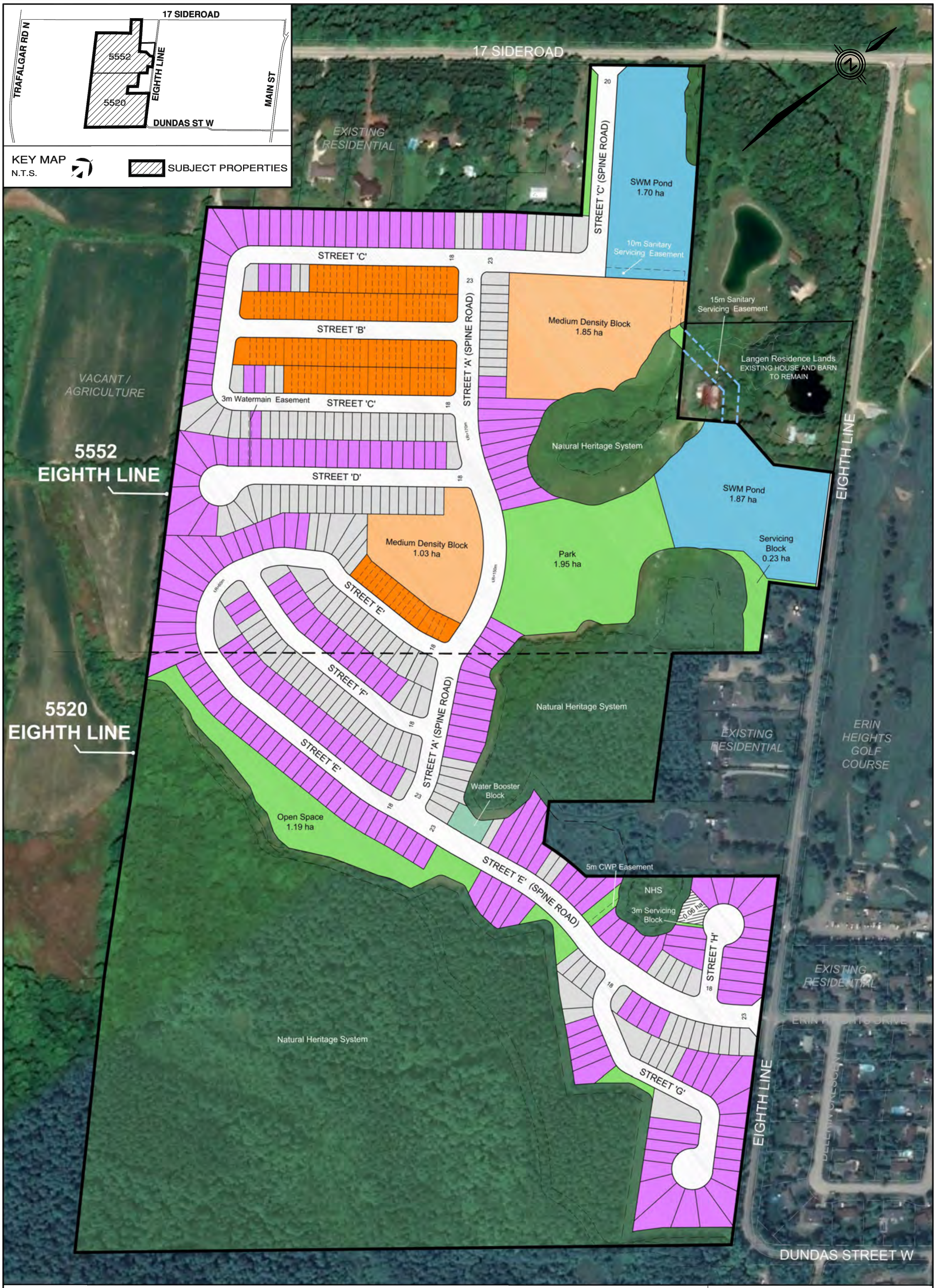
5520 EIGHTH LINE & 5552 EIGHTH LINE

TOWN OF ERIN

SITE LOCATION PLAN

SCALE:	1:10000	PROJECT No.:	21-1242
DATE:	JULY 2024	FIGURE:	1



ERIN

5552 EIGHTH LINE &
5552 EIGHTH LINE

Composite Lotted Plan

	Unit Count (±)			%	
Unit Type	5552	5520	Total	Overall	Singles
⬜ 30' Singles	103	62	165	31	40
🟪 36' Singles	112	132	244	46	60
🟧 21' Townhouses	121	0	121	23	-
Total	336	194	530	100	100

▨ External land sale

mattamyHOMES
COSCORP INC
SCALE 1:3500
July 11, 2024
KORSIAK Urban Planning

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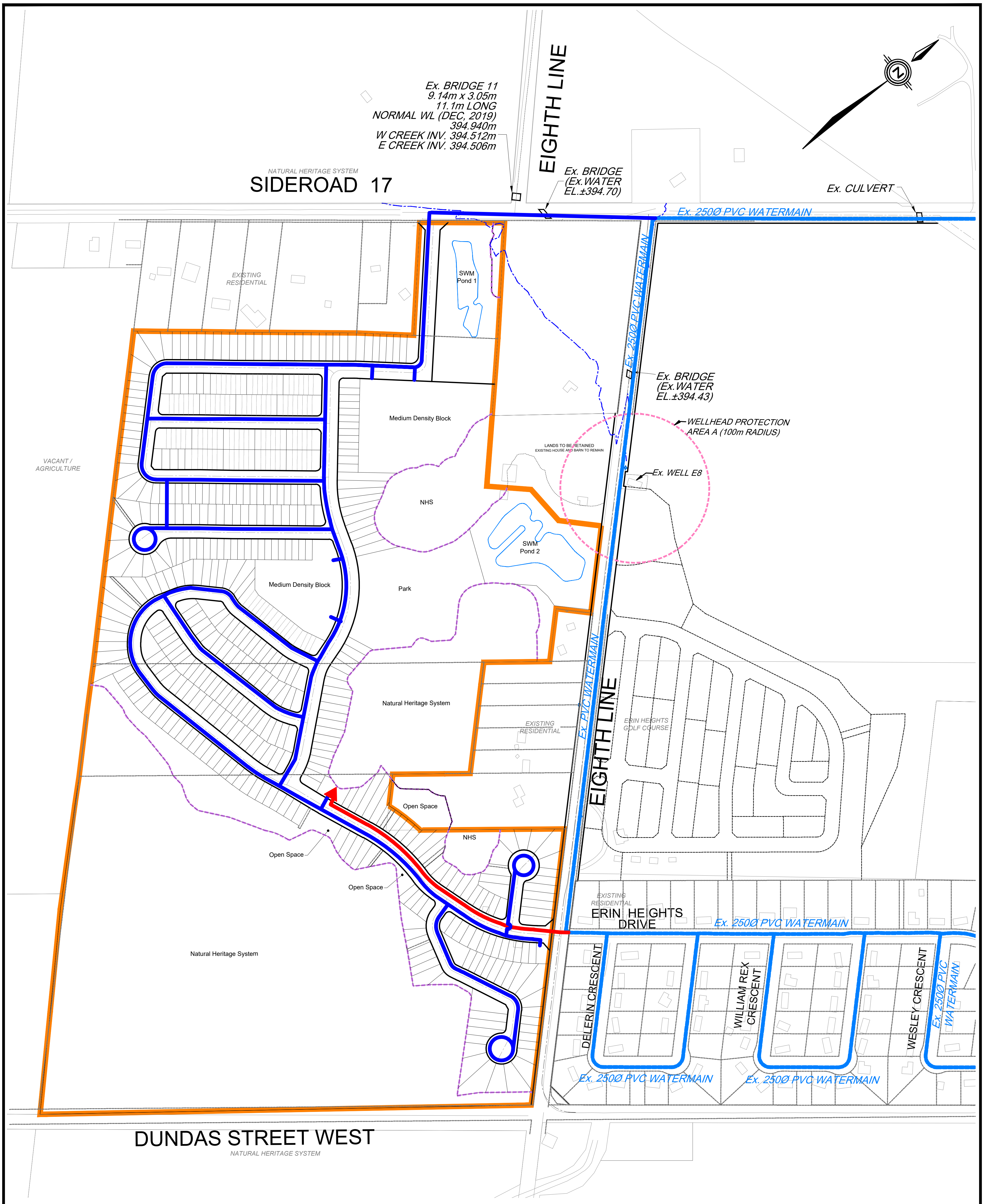
5520 EIGHTH LINE & 5552 EIGHTH LINE

TOWN OF ERIN

COMPOSITE PLAN

SCALE:	AS SHOWN	PROJECT No.:	21-1242
DATE:	JULY 2024	FIGURE:	2



LEGEND

SITE BOUNDARY

DEVELOPMENT LIMIT

PROPOSED WATERMAIN

EXISTING WATERMAIN

BOOSTER PUMP FEED

▲ BOOSTER PUMP STATION

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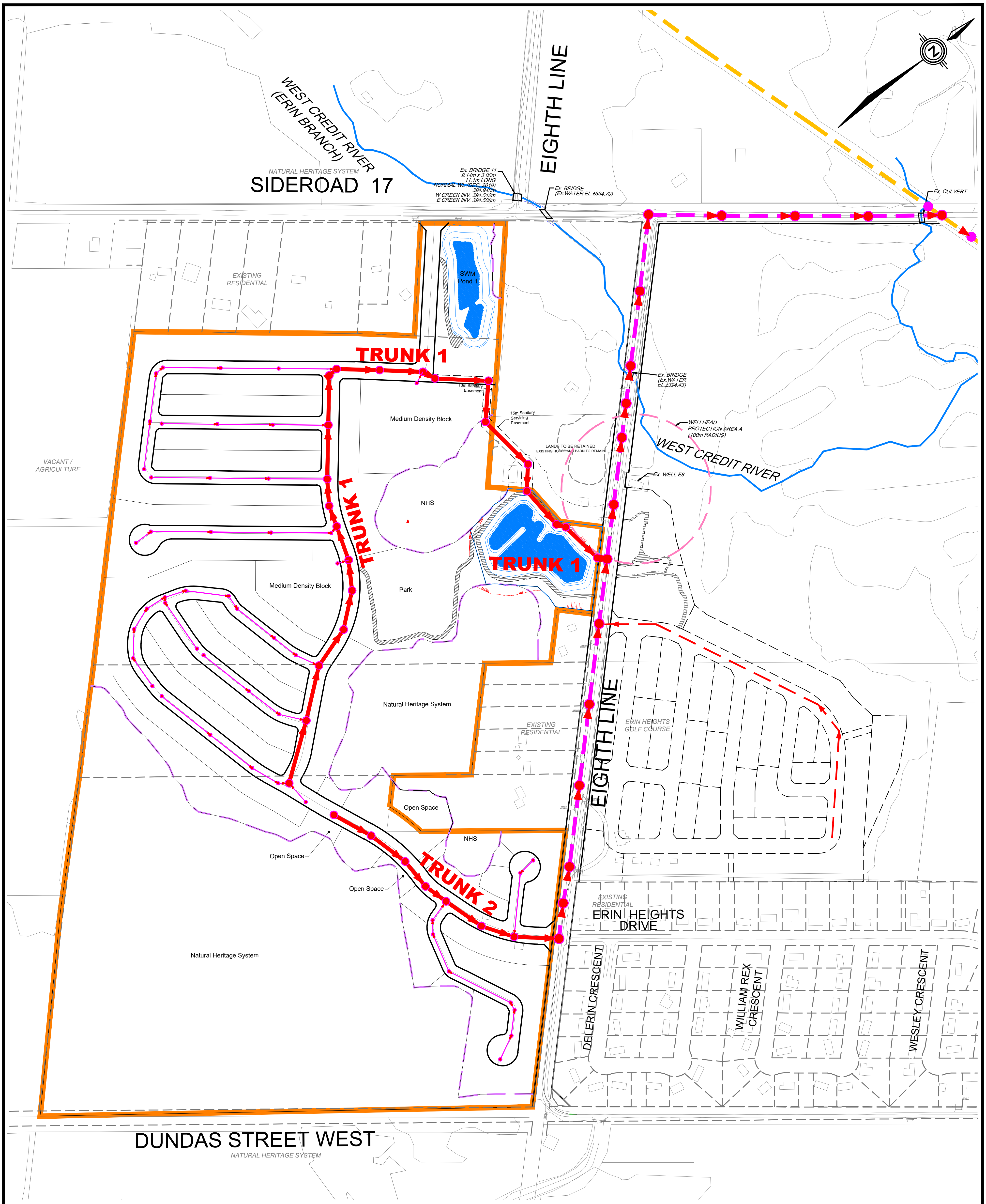
TOWN OF ERIN

CONCEPTUAL WATERMAIN SERVICING PLAN

SCALE:	1:5000	PROJECT No.:	21-1242
DATE:	JULY 2024	FIGURE:	3



LEGEND

▬	SITE BOUNDARY
– –	DEVELOPMENT LIMIT
▬ ▬ ►	PROPOSED EXTERNAL SANITARY TRUNK SEWER (SEE DWG. 1)
──►	PROPOSED SANITARY SEWER
━━►	PROPOSED SANITARY TRUNK SEWER
– – ►	PROPOSED SANITARY SEWER (B.O.)
▬ ▬ ►	ELORA CATARACT TRAIL TRUNK SEWER (B.O.)
•	PROPOSED SANITARY MANHOLE
●	PROPOSED SANITARY TRUNK MANHOLE
●	PROPOSED SANITARY TRUNK MANHOLE (B.O.)

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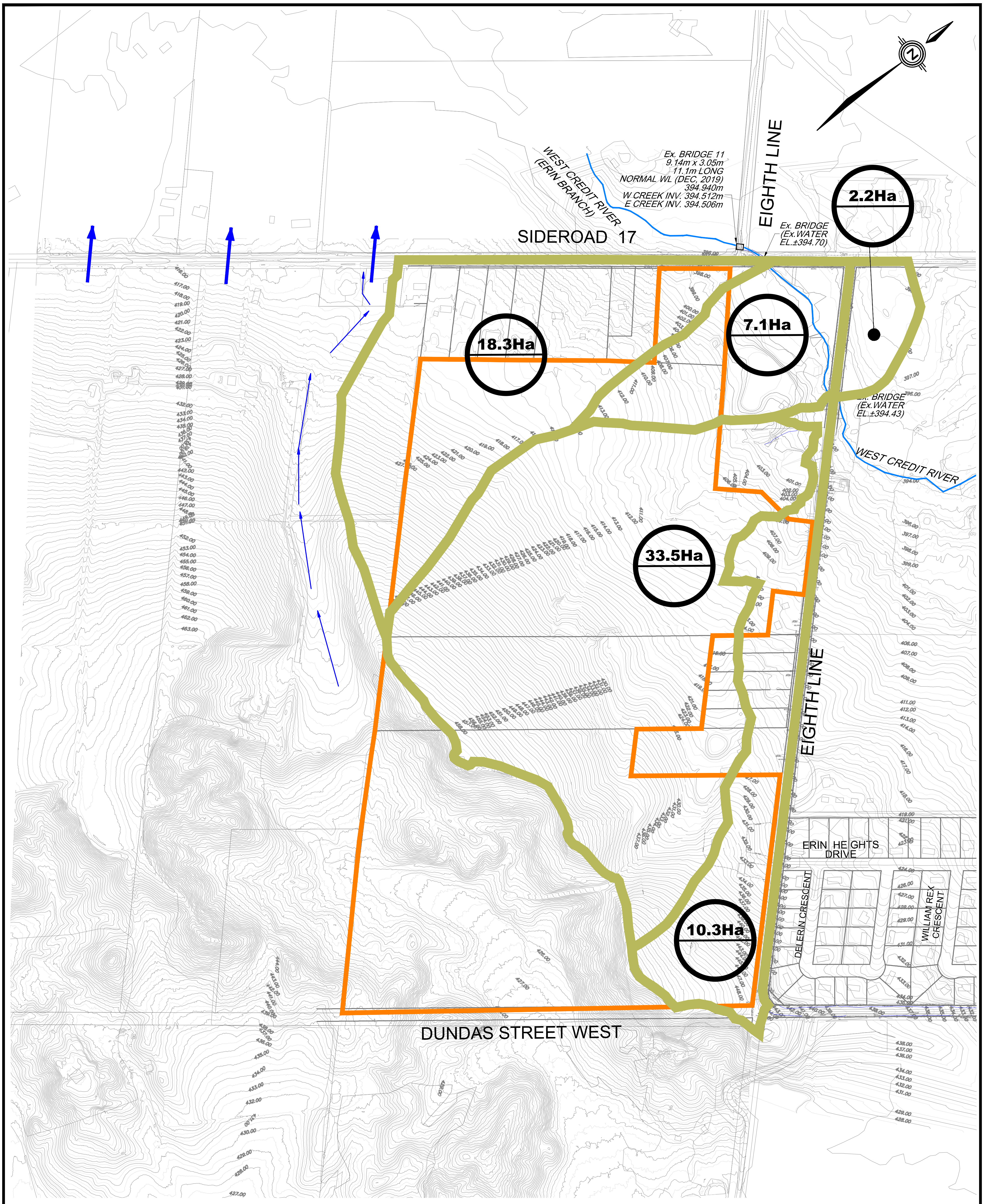
5520 EIGHTH LINE & 5552 EIGHTH LINE

TOWN OF ERIN

CONCEPTUAL SANITARY SERVICING PLAN

SCALE:	1:5000	PROJECT No.:	21-1242
DATE:	JULY 2024	FIGURE:	4



LEGEND

SITE BOUNDARY

PRE-DEVELOPMENT STORM DRAINAGE AREA

33.5Ha PRE-DEVELOPMENT DRAINAGE AREA

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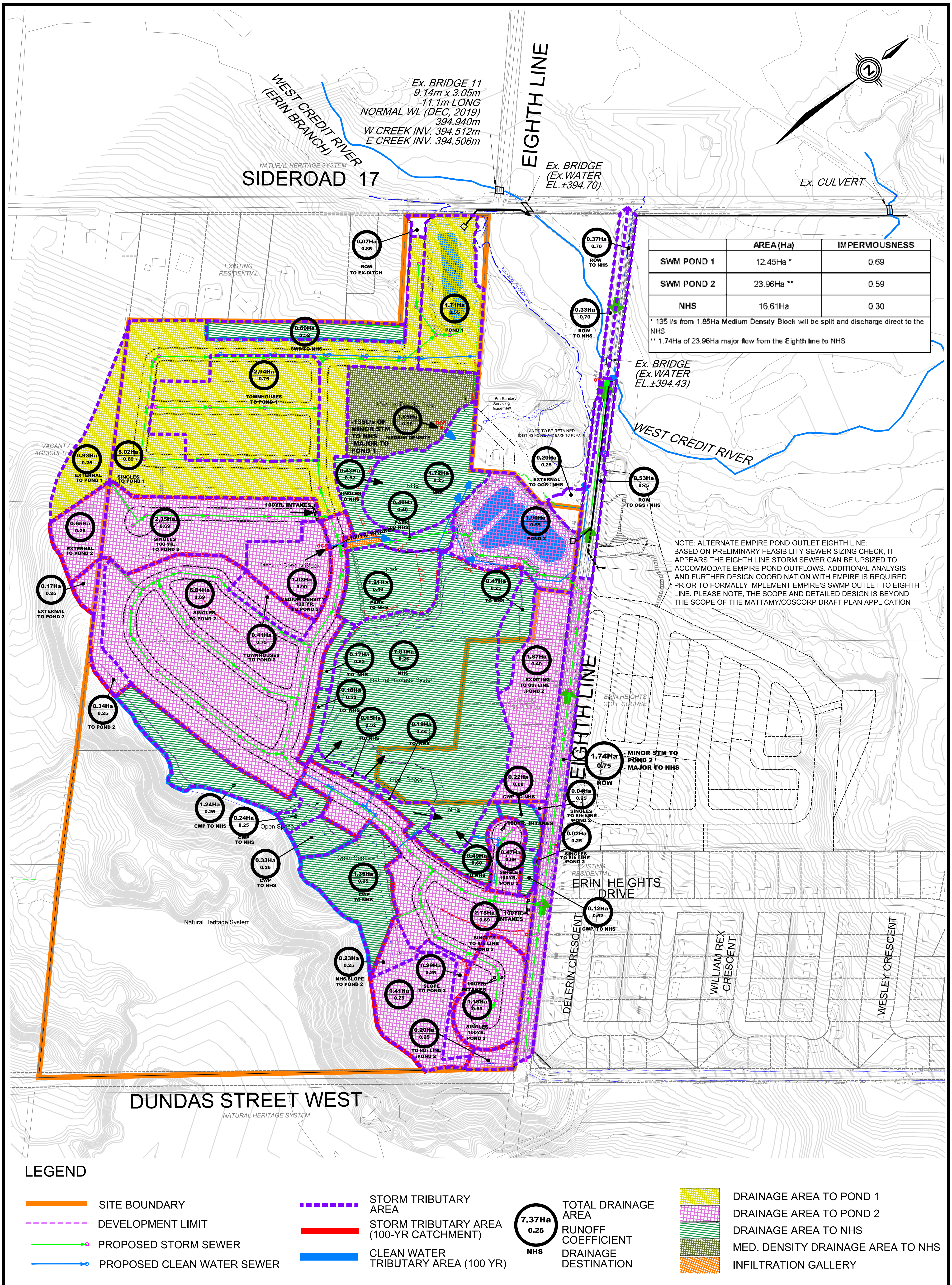
5520 EIGHTH LINE & 5552 EIGHTH LINE

TOWN OF ERIN

PRE-DEVELOPMENT STORM DRAINAGE AREAS

SCALE:	1:6000	PROJECT No.:	21-1242
DATE:	JULY 2024	FIGURE:	5



	AREA (Ha)	IMPERVIOUSNESS
SWM POND 1	12.45Ha *	0.69
SWM POND 2	23.96Ha **	0.59
NHS	16.61Ha	0.30

* 135 l/s from 1.85Ha Medium Density Block will be split and discharge direct to the NHS

** 1.74Ha of 23.96Ha major flow from the Eighth line to NHS

NOTE: ALTERNATE EMPIRE POND OUTLET EIGHTH LINE:
BASED ON PRELIMINARY FEASIBILITY SEWER SIZING CHECK, IT APPEARS THE EIGHTH LINE STORM SEWER CAN BE UPSIZED TO ACCOMMODATE EMPIRE POND OUTFLOWS. ADDITIONAL ANALYSIS AND FURTHER DESIGN COORDINATION WITH EMPIRE IS REQUIRED PRIOR TO FORMALLY IMPLEMENT EMPIRE'S SWMP OUTLET TO EIGHTH LINE. PLEASE NOTE, THE SCOPE AND DETAILED DESIGN IS BEYOND THE SCOPE OF THE MATTAMY/COSCORP DRAFT PLAN APPLICATION

LEGEND

- SITE BOUNDARY
- DEVELOPMENT LIMIT
- PROPOSED STORM SEWER
- PROPOSED CLEAN WATER SEWER
- STORM TRIBUTARY AREA
- STORM TRIBUTARY AREA (100-YR CATCHMENT)
- CLEAN WATER TRIBUTARY AREA (100 YR)
- 7.37Ha — TOTAL DRAINAGE AREA
- 0.25 — RUNOFF COEFFICIENT
- NHS — DRAINAGE DESTINATION
- DRAINAGE AREA TO POND 1
- DRAINAGE AREA TO POND 2
- DRAINAGE AREA TO NHS
- MED. DENSITY DRAINAGE AREA TO NHS
- INFILTRATION GALLERY

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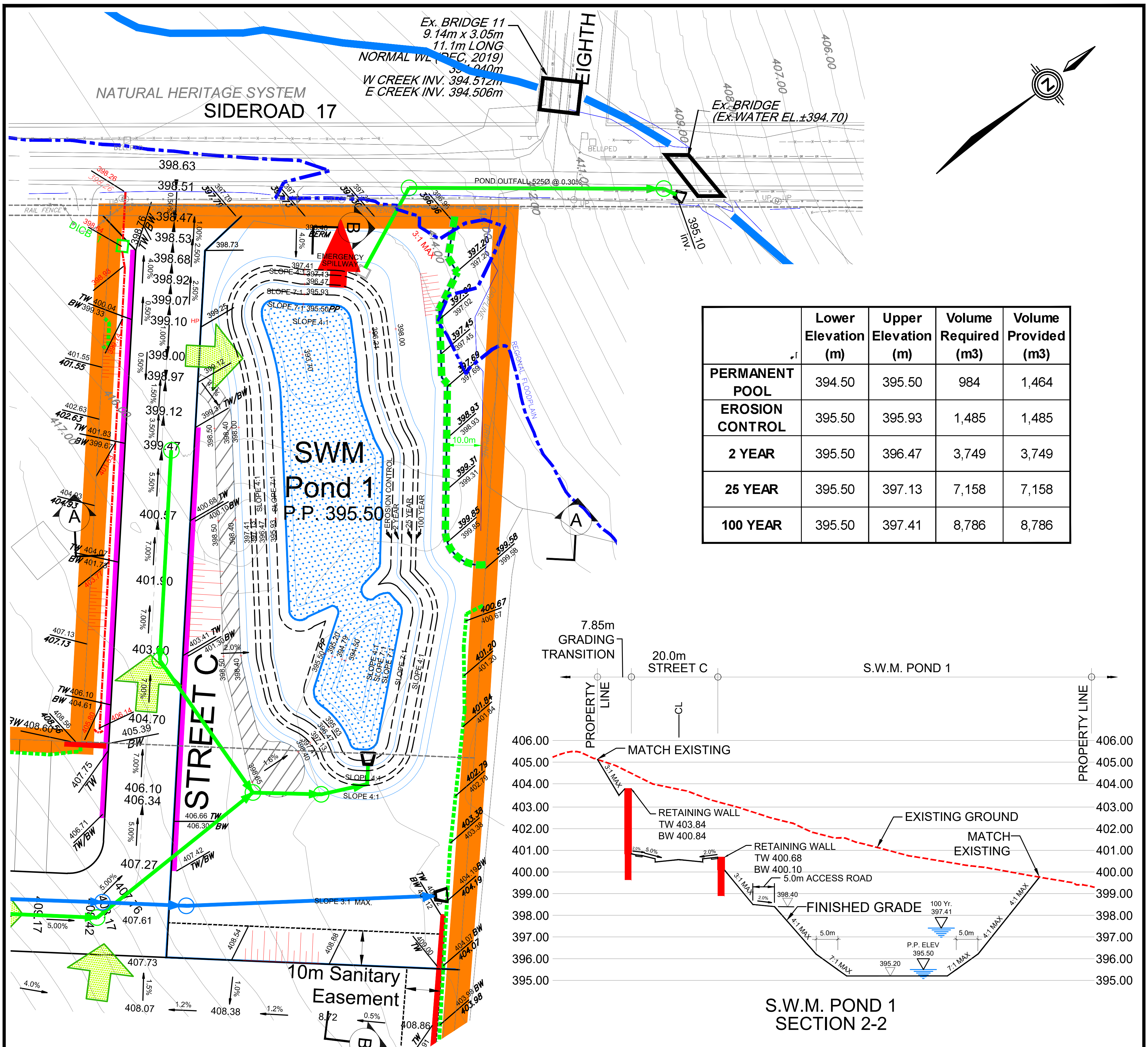
5520 EIGHTH LINE & 5552 EIGHTH LINE

TOWN OF ERIN

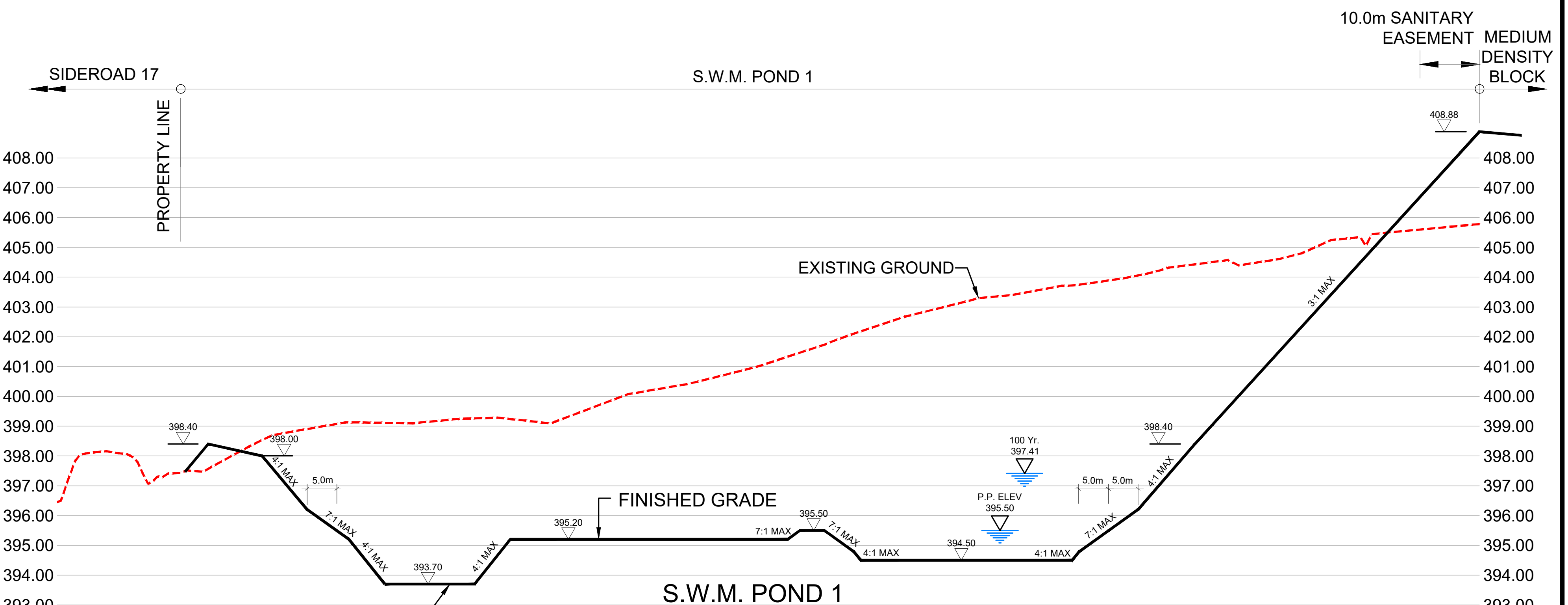
CONCEPTUAL STORM SERVICING PLAN

SCALE:	1:5000	PROJECT No.:	21-1242
DATE:	JULY 2024	FIGURE:	6



S.W.M. POND 1
SECTION 2-2

	Lower Elevation (m)	Upper Elevation (m)	Volume Required (m3)	Volume Provided (m3)
PERMANENT POOL	394.50	395.50	984	1,464
EROSION CONTROL	395.50	395.93	1,485	1,485
2 YEAR	395.50	396.47	3,749	3,749
25 YEAR	395.50	397.13	7,158	7,158
100 YEAR	395.50	397.41	8,786	8,786



S.W.M. POND 1
SECTION B-B

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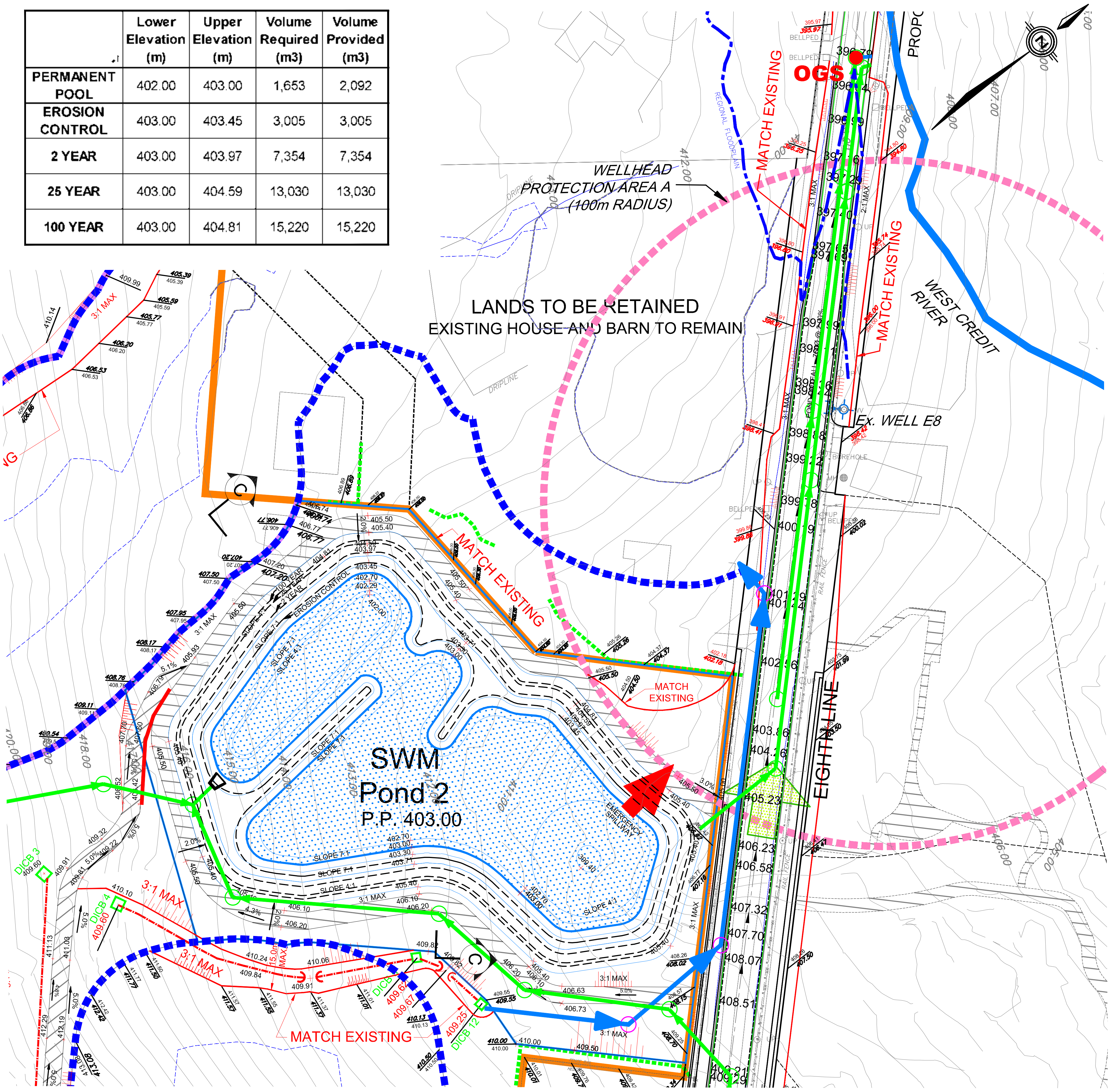
5520 EIGHTH LINE & 5552 EIGHTH LINE

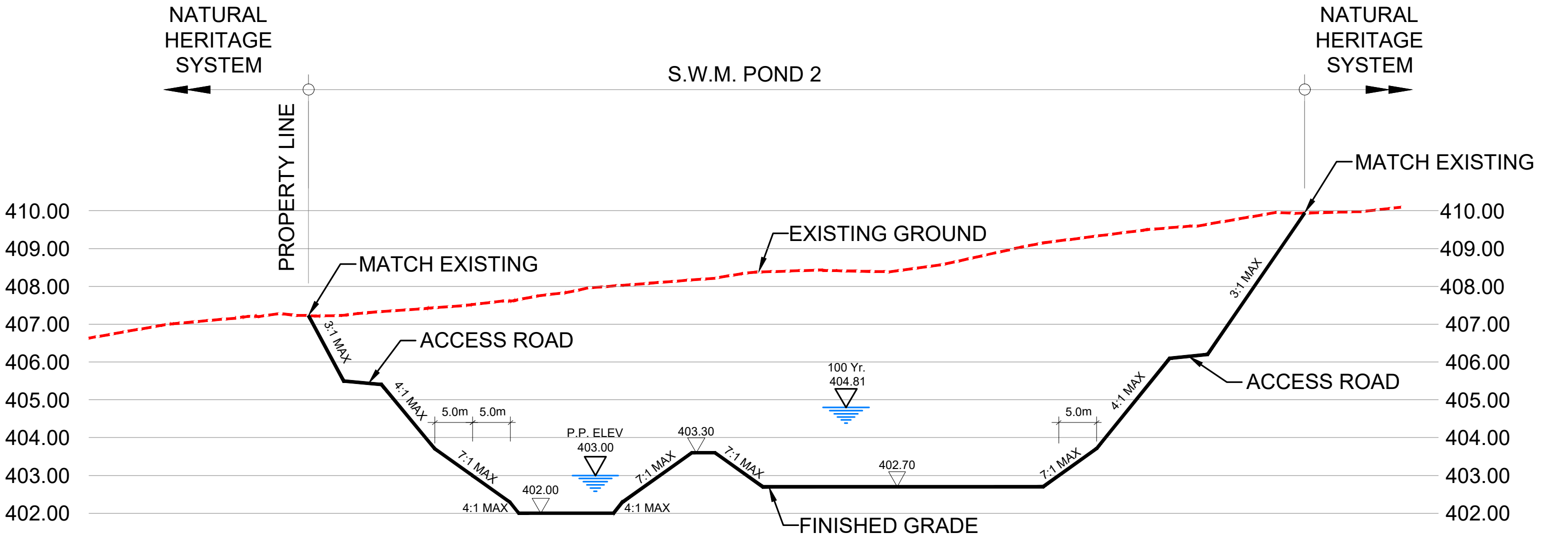
TOWN OF ERIN

SWM POND 1

SCALE:	1:1250	PROJECT No.:	21-1242
DATE:	JULY 2024	FIGURE:	7

	Lower Elevation (m)	Upper Elevation (m)	Volume Required (m3)	Volume Provided (m3)
PERMANENT POOL	402.00	403.00	1,653	2,092
EROSION CONTROL	403.00	403.45	3,005	3,005
2 YEAR	403.00	403.97	7,354	7,354
25 YEAR	403.00	404.59	13,030	13,030
100 YEAR	403.00	404.81	15,220	15,220





S.W.M. POND 2
SECTION C-C
SCALE HOR. 1:1000
VER. 1:200

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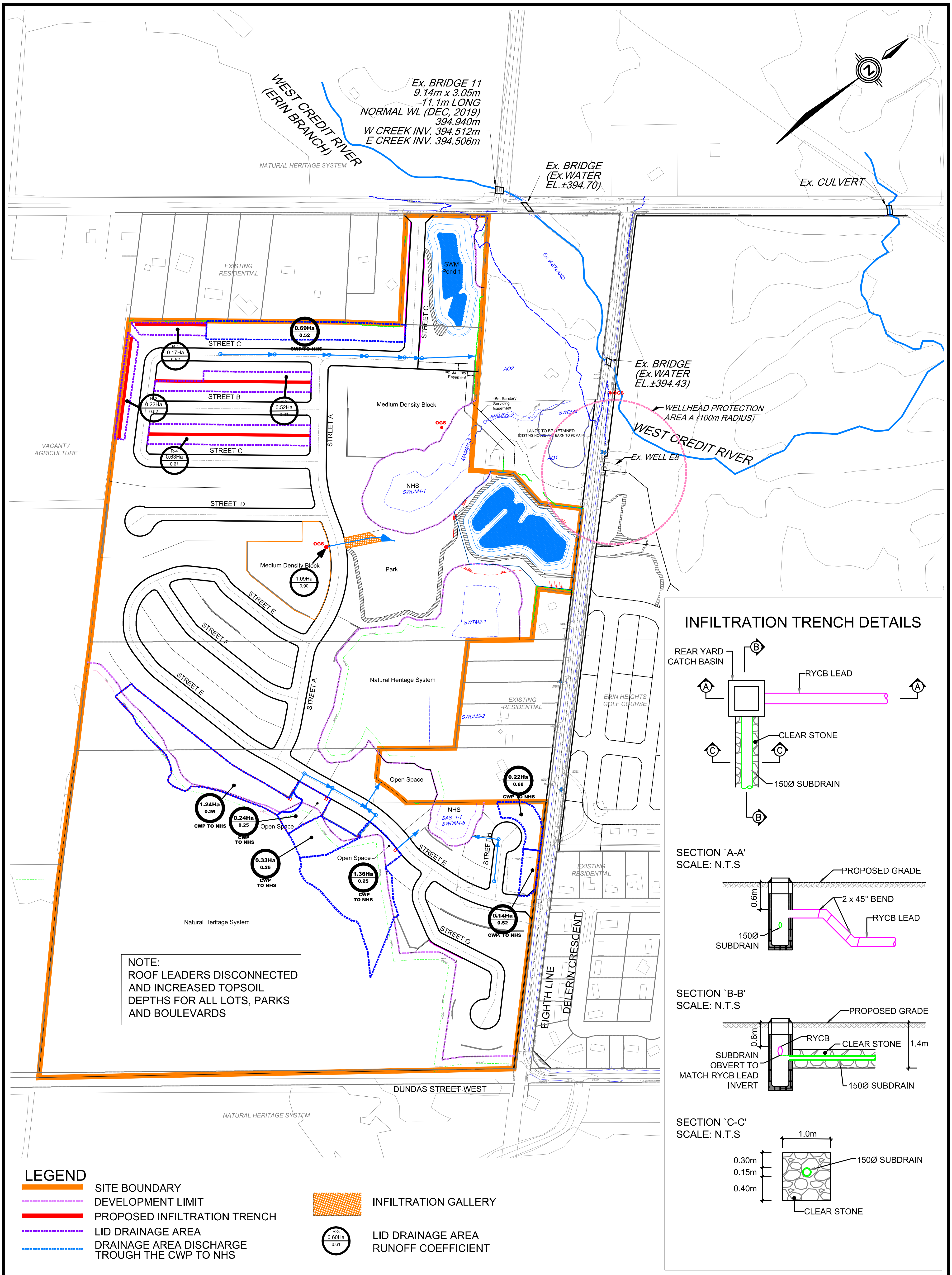
5520 EIGHTH LINE & 5552 EIGHTH LINE

TOWN OF ERIN

SWM POND 2

SCALE:	1:1250	PROJECT No.:	21-1242
DATE:	JULY 2024	FIGURE:	8



NOTE:
ROOF LEADERS DISCONNECTED
AND INCREASED TOPSOIL
DEPTHS FOR ALL LOTS, PARKS
AND BOULEVARDS

LEGEND

🟧	SITE BOUNDARY
┄	DEVELOPMENT LIMIT
🟥	PROPOSED INFILTRATION TRENCH
┄	LID DRAINAGE AREA
┄	DRAINAGE AREA DISCHARGE TROUGH THE CWP TO NHS
▨	INFILTRATION GALLERY
R-3 0.60Ha 0.61	LID DRAINAGE AREA RUNOFF COEFFICIENT

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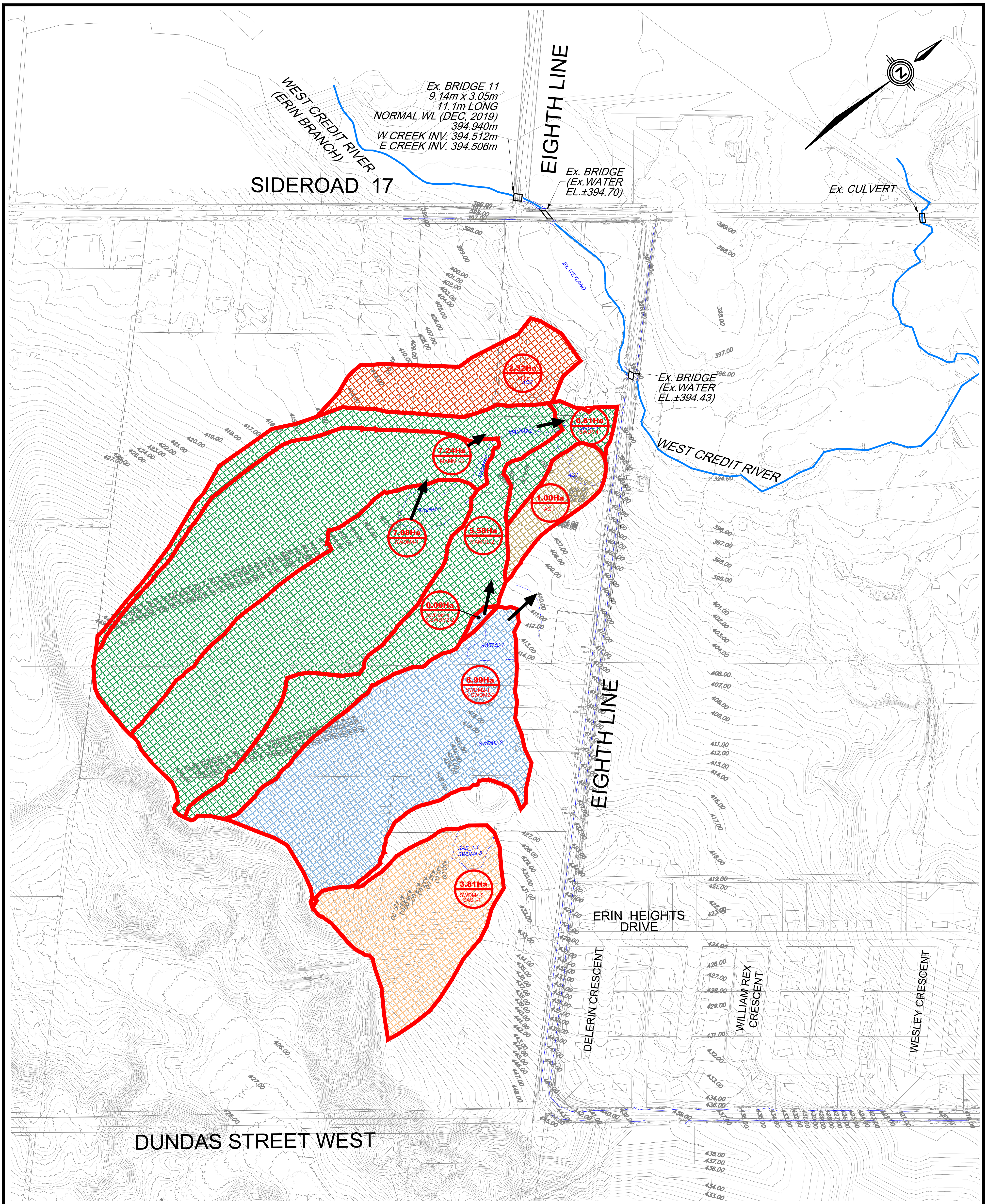
5520 EIGHTH LINE & 5552 EIGHTH LINE

TOWN OF ERIN

POTENTIAL LID OPPORTUNITIES

SCALE:	1:5000	PROJECT No.:	21-1242
DATE:	JULY 2024	FIGURE:	9



LEGEND

▬ SITE BOUNDARY

▬ PRE-DEVELOPMENT DRAINAGE AREAS TO WETLANDS

5.16Ha PSW TOTAL DRAINAGE AREA DRAINAGE DESTINATION

🟩 DRAINAGE AREA TO MAMM1-3
MAMM2-2
SWDM4-1
SWDM4

🟦 DRAINAGE AREA TO SWTM2-1 & SWDM2-2

🟨 DRAINAGE AREA TO SWDM4-5 & SAS1-1

🟫 DRAINAGE AREA TO AQ1

🟥 DRAINAGE AREA TO AQ2

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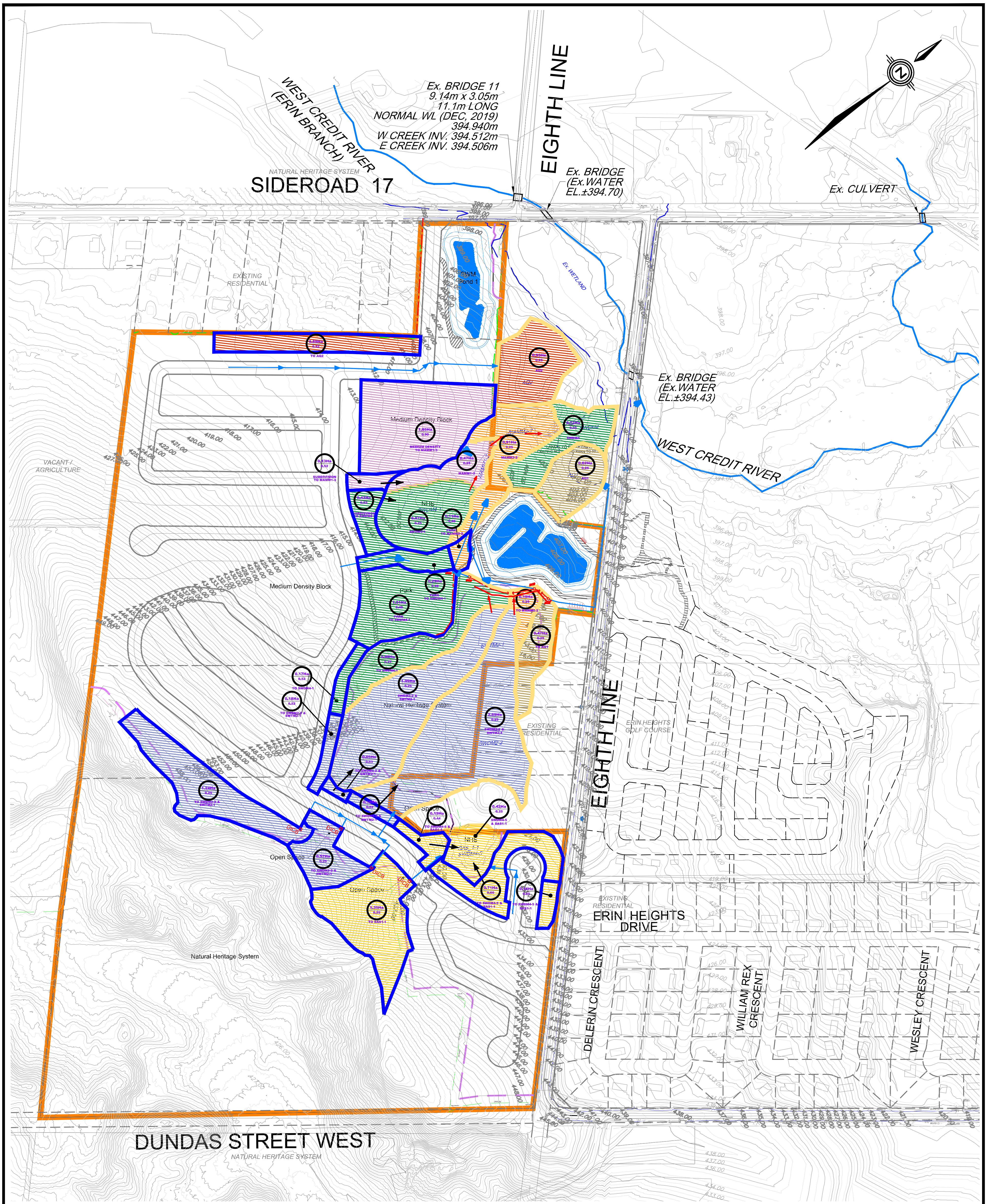
TOWN OF ERIN

PRE-DEVELOPMENT DRAINAGE AREAS TO WETLANDS

SCALE:	1:5000	PROJECT No.:	21-1242
DATE:	JULY 2024	FIGURE:	10



LEGEND

🟧 SITE BOUNDARY

🟦 POST DEVELOPMENT DRAINAGE AREAS TO WETLANDS

🟨 PRE-DEVELOPMENT DRAINAGE AREAS TO WETLANDS

→ PROPOSED CLEANWATER SEWER

▨ DRAINAGE AREA TO AQ2

▨ DRAINAGE AREA TO MAMM1-3

▨ DRAINAGE AREA TO SWDM4-1

▨ DRAINAGE AREA TO SWDM2-2 & SWTM2-1

▨ DRAINAGE AREA TO SWDM4-5 & SAS1-1

▨ DRAINAGE AREA TO MAMM2-2

○ 0.04Ha 0.52 TO SWTM2-1 — TOTAL DRAINAGE AREA RUNOFF COEFFICIENT DRAINAGE DESTINATION

▨ DRAINAGE AREA TO AQ1

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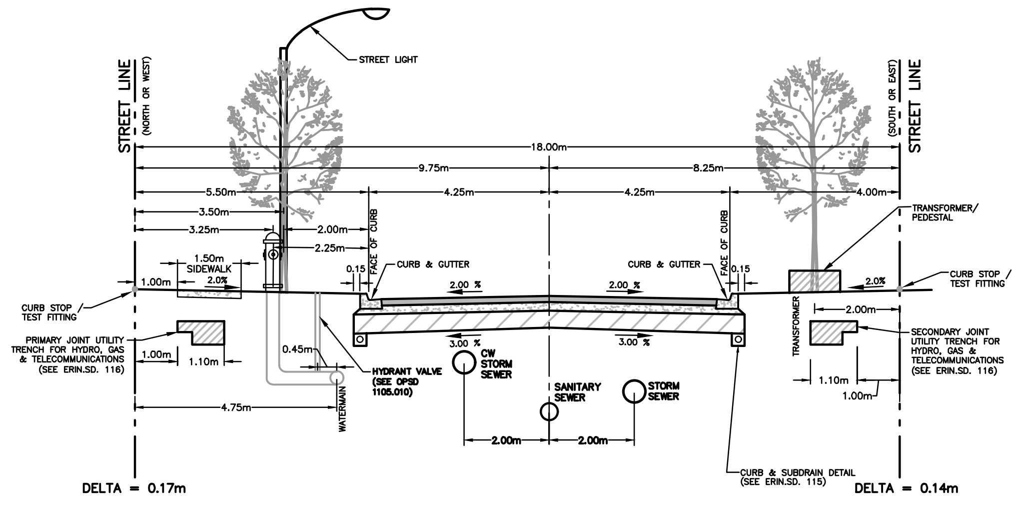
TOWN OF ERIN

POST DEVELOPMENT DRAINAGE AREAS TO WETLANDS

SCALE:	1:5000	PROJECT No.:	21-1242
DATE:	JULY 2024	FIGURE:	11



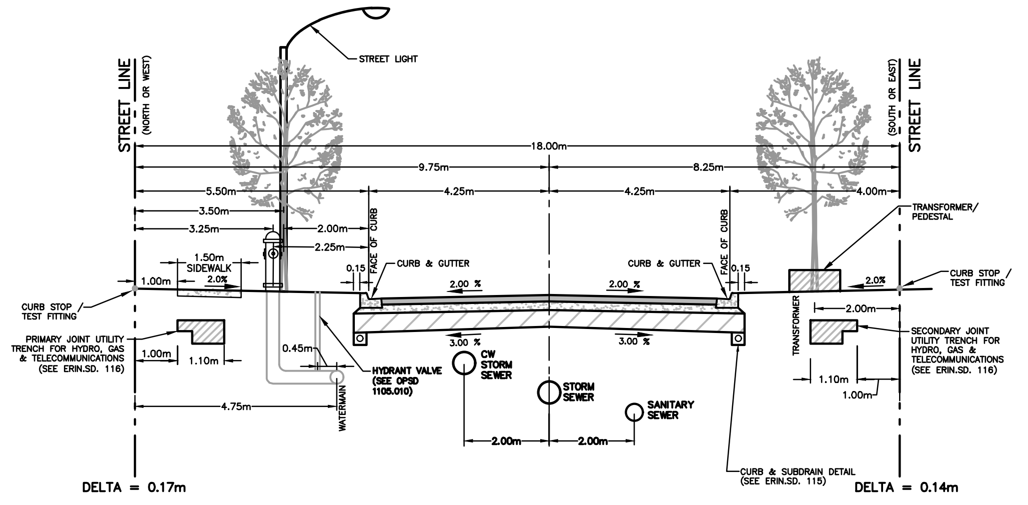
NOTE:
1. 18.0m CORRIDOR ONLY TO BE USED ON SUBDIVISIONS WITH DRAFT PLAN APPROVAL AS OF APRIL 2021.

URBAN MINOR LOCAL
(8.5m ROAD ON 18.0m RIGHT-OF-WAY)

NO.	REVISIONS	DATE	APR'D

SCALE: N.T.S.
DATE: NOV. 2021
ERIN SD. 101 (MOD.)

STREET C - ROAD CROSS SECTION WITH CLEAN WATER PIPE



NOTE:
1. 18.0m CORRIDOR ONLY TO BE USED ON SUBDIVISIONS WITH DRAFT PLAN APPROVAL AS OF APRIL 2021.

URBAN MINOR LOCAL
(8.5m ROAD ON 18.0m RIGHT-OF-WAY)

NO.	REVISIONS	DATE	APR'D

SCALE: N.T.S.
DATE: NOV. 2021
ERIN SD. 101 (MOD.)

STREET H - ROAD CROSS SECTION WITH CLEAN WATER PIPE

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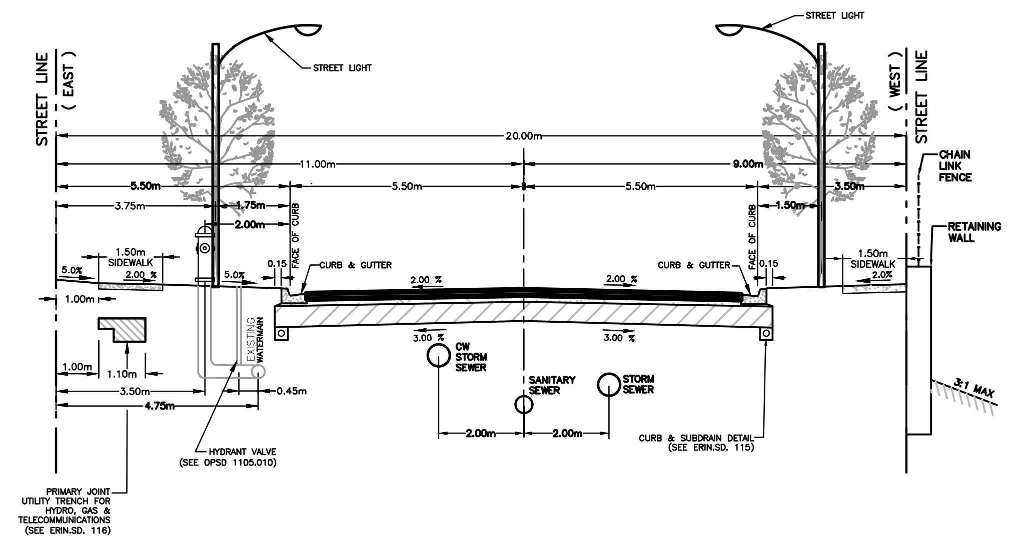
5520 EIGHTH LINE & 5552
EIGHTH LINE

TOWN OF ERIN

MODIFIED TYPICAL ROAD
SECTIONS - INTERNAL

SCALE:	AS SHOWN	PROJECT No.:	21-1242
DATE:	JULY 2024	FIGURE:	12

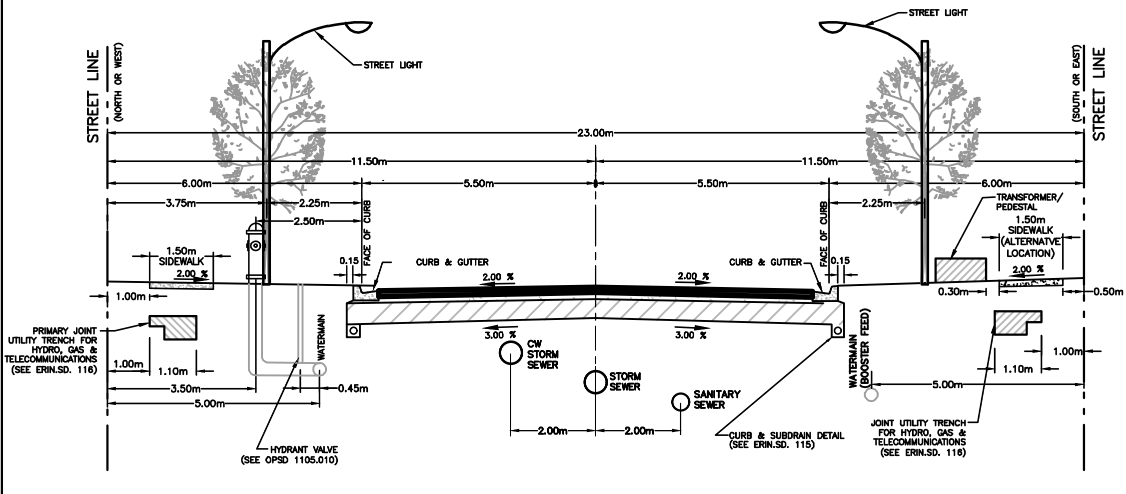


URBAN/SUBURGAN ROAD SECTION
(11.0m ROAD ON 20.0m RIGHT-OF-WAY)

NO.	REVISIONS	DATE	APR'D

SCALE: N.T.S.
DATE: NOV. 2021
ERIN SD.
102(MOD.)

STREET C (SPINE ROAD) ROAD CROSS SECTION 20.0m ROW MODIFIED



NOTE:
1. WHERE MULTI-USE TRAIL OR BICYCLE LANES ARE REQUIRED THE ROW WIDTH SHALL BE INCREASED TO 26.0m

MINOR COLLECTOR
(10.0m ROAD ON 23.0m RIGHT-OF-WAY)

NO.	REVISIONS	DATE	APR'D

SCALE: N.T.S.
DATE: NOV. 2021
ERIN SD.
103

STREET C (SPINE ROAD) CROSS SECTION WITH CLEAN WATER PIPE
STREET E (SPINE ROAD) CROSS SECTION WITH CLEAN WATER PIPE & BOOSTER FEED

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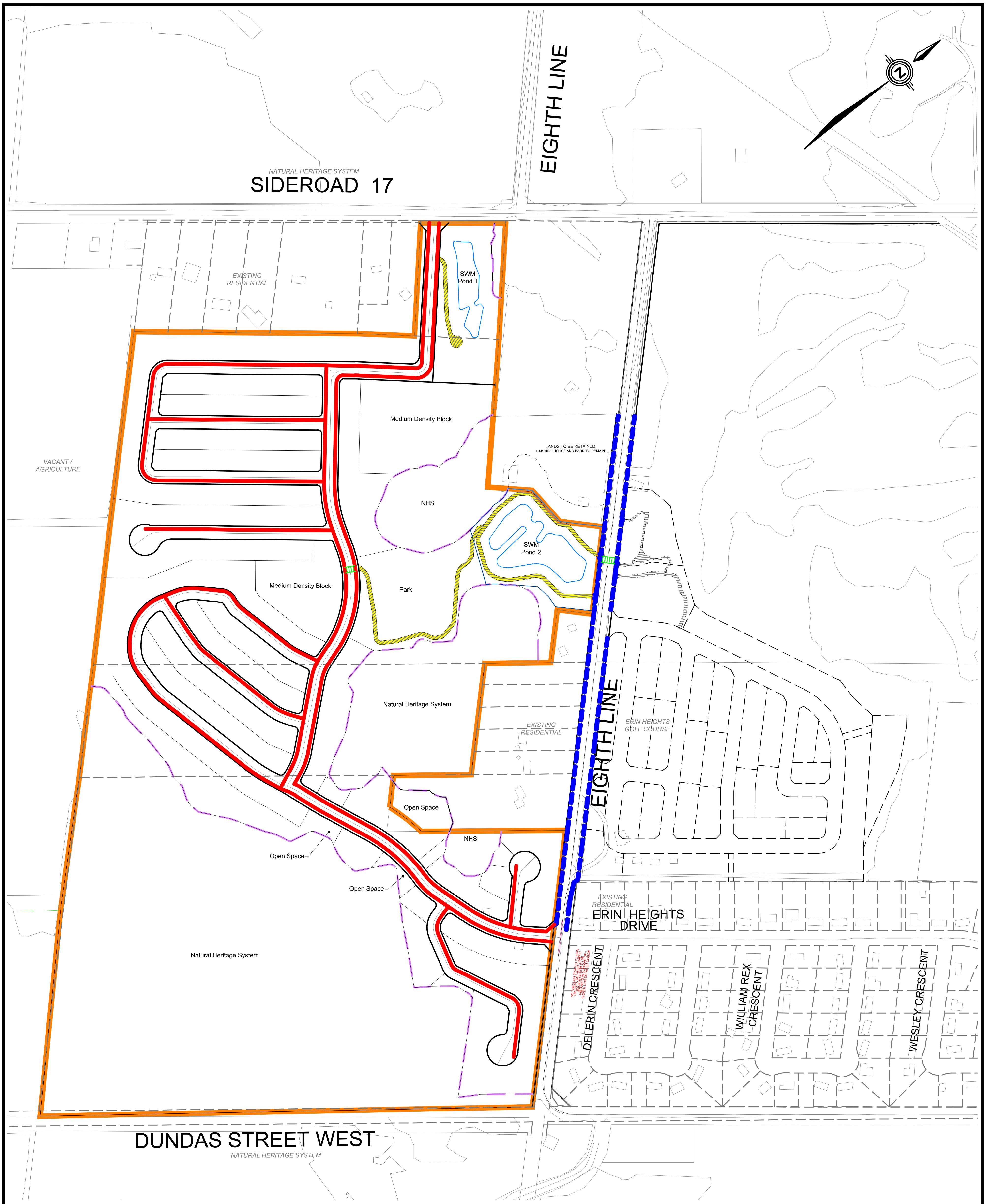
5520 EIGHTH LINE & 5552
EIGHTH LINE

TOWN OF ERIN

MODIFIED TYPICAL ROAD
SECTIONS - INTERNAL

SCALE:	AS SHOWN	PROJECT No.:	21-1242
DATE:	JULY 2024	FIGURE:	12A



LEGEND

🟧 SITE BOUNDARY

— — — DEVELOPMENT LIMIT

🟥 PROPOSED SIDEWALK LOCATION

▬ ▬ ▬ EXTERNAL PROPOSED SIDEWALK LOCATION

▨ POND ACCESS ROAD/ PARK PATHWAY

▥ FUTURE PEDESTRIAN CROSSING

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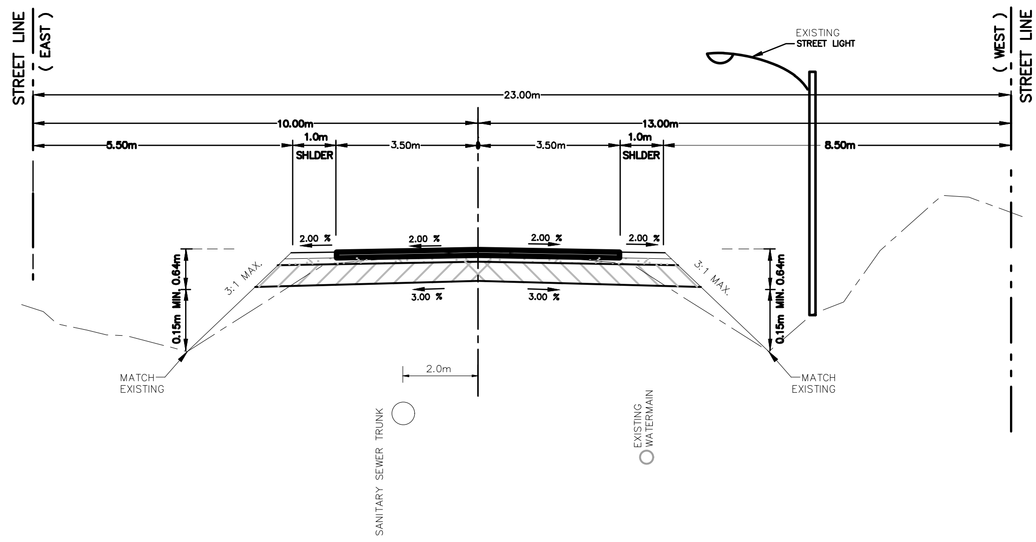
5520 EIGHTH LINE & 5552 EIGHTH LINE

TOWN OF ERIN

SIDEWALK LOCATION PLAN

SCALE:	1:5000	PROJECT No.:	21-1242
DATE:	JULY 2024	FIGURE:	13



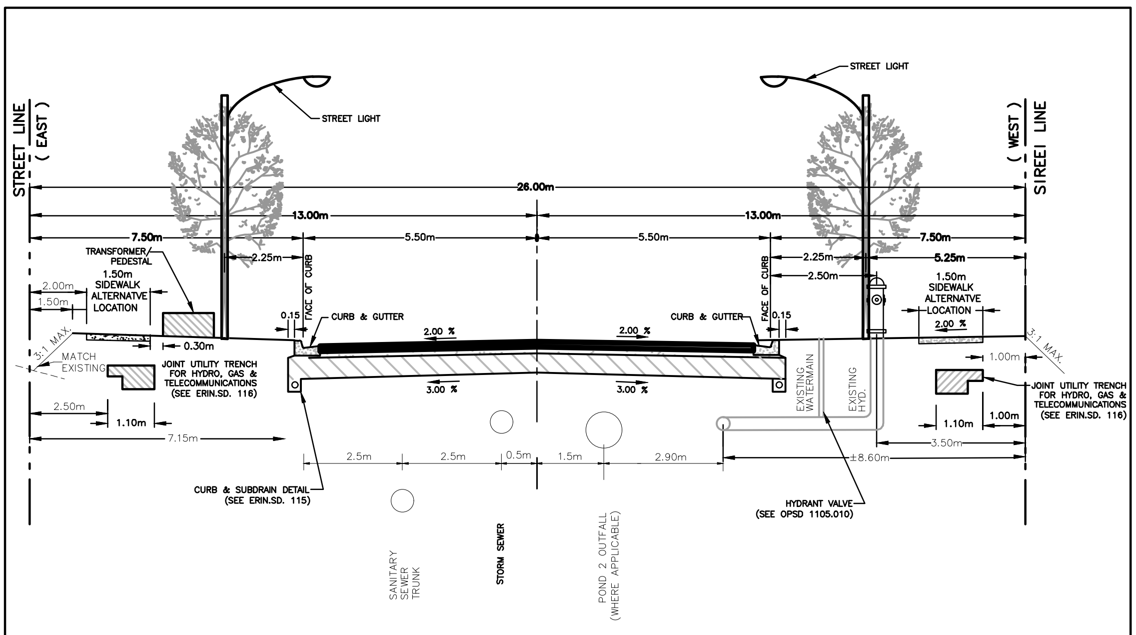
NOTE:
1. WHERE MULTI-USE TRAIL OR BICYCLE LANES ARE REQUIRED THE ROW WIDTH SHALL BE INCREASED TO 26.0m

RURAL
(7.0 m ROAD ON 23.0m RIGHT-OF-WAY)

NO.	REVISIONS	DATE	APR'D

SCALE: N.T.S.
DATE: NOV. 2021
ERIN SD.
108 (MOD.)

EIGHTH LINE (from ±0+000.0 to 0+210.000)

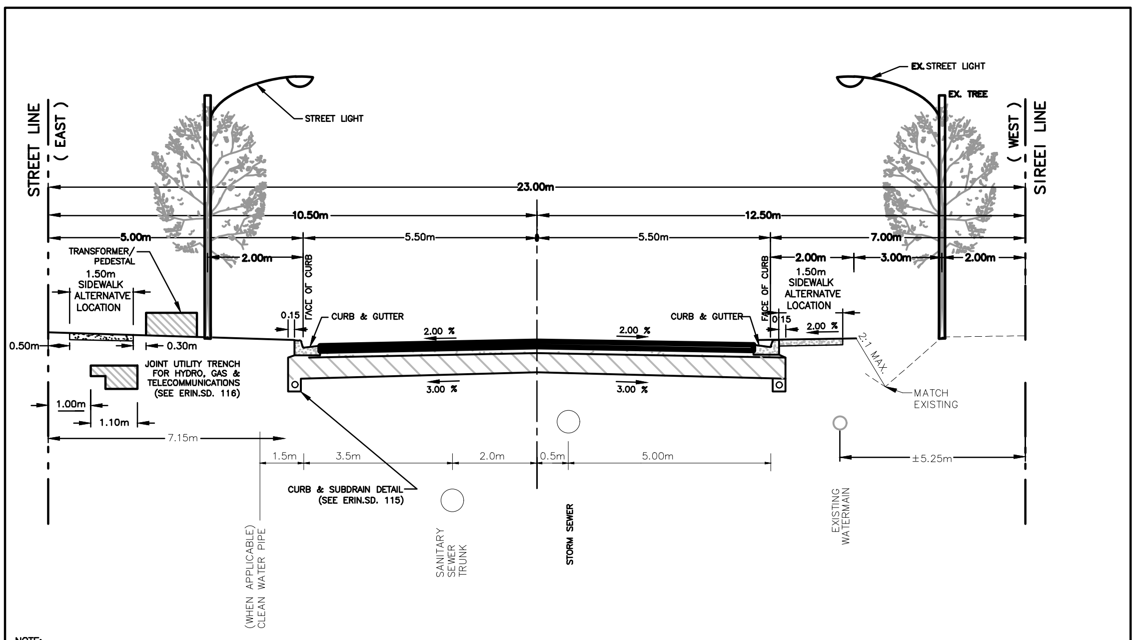


MINOR COLLECTOR
(11.0m **ROAD ON** 26.0m **RIGHT-OF-WAY)**

NO.	REVISIONS	DATE	APR'D

SCALE: N.T.S.
DATE: NOV. 2021
ERIN SD.
107 (MOD.)

EIGHTH LINE (from ±0+210.0 to 0+910.0)



NOTE:
1. WHERE MULTI-USE TRAIL OR BICYCLE LANES ARE REQUIRED THE ROW WIDTH SHALL BE INCREASED TO 26.0m

MINOR COLLECTOR
(11.0m **ROAD ON** 23.0m **RIGHT-OF-WAY)**

NO.	REVISIONS	DATE	APR'D

SCALE: N.T.S.
DATE: NOV. 2021
ERIN SD.
107 (MOD.)

EIGHTH LINE (from ±0+910.0 to 1+173.0)

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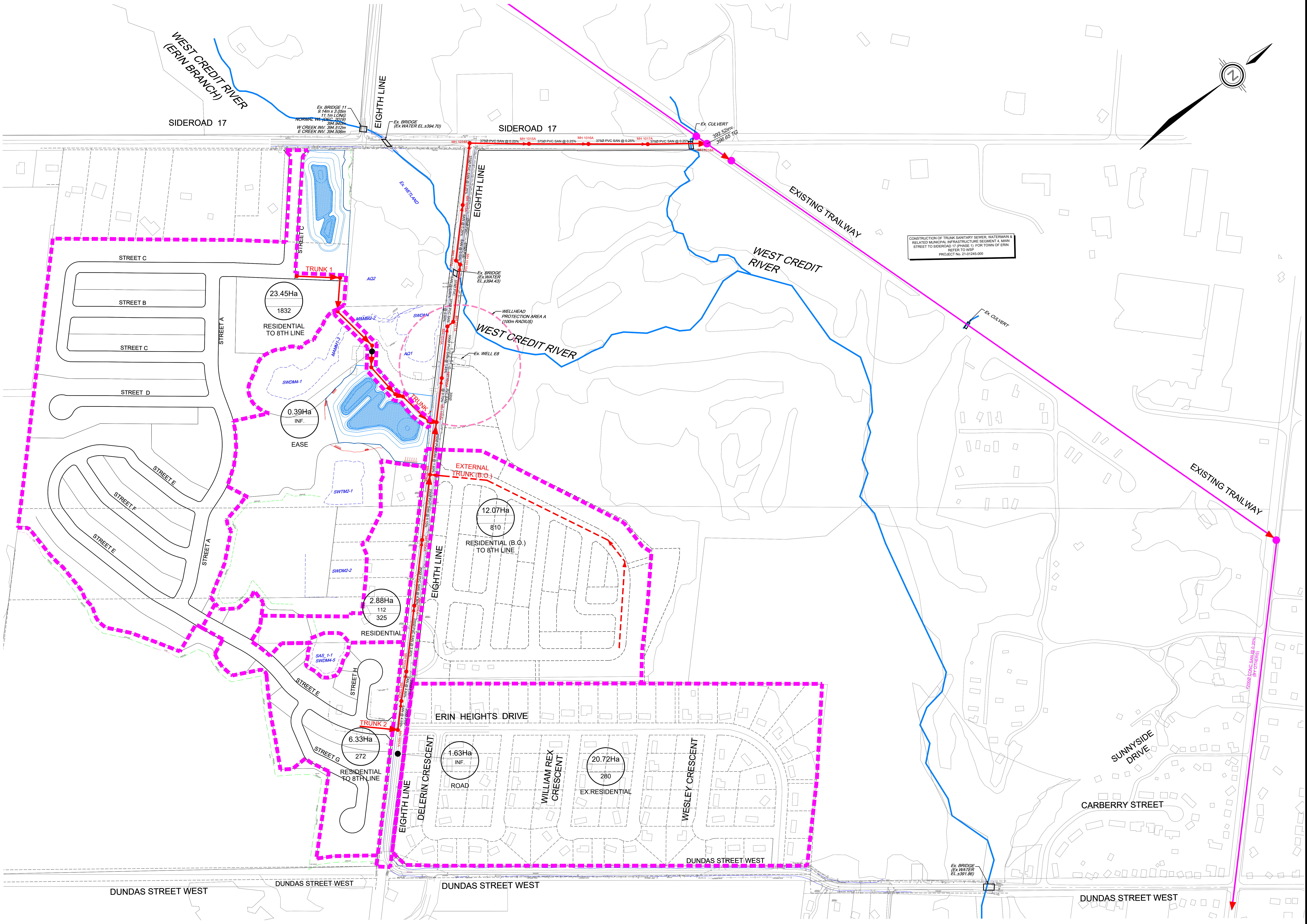
5520 EIGHTH LINE & 5552
EIGHTH LINE

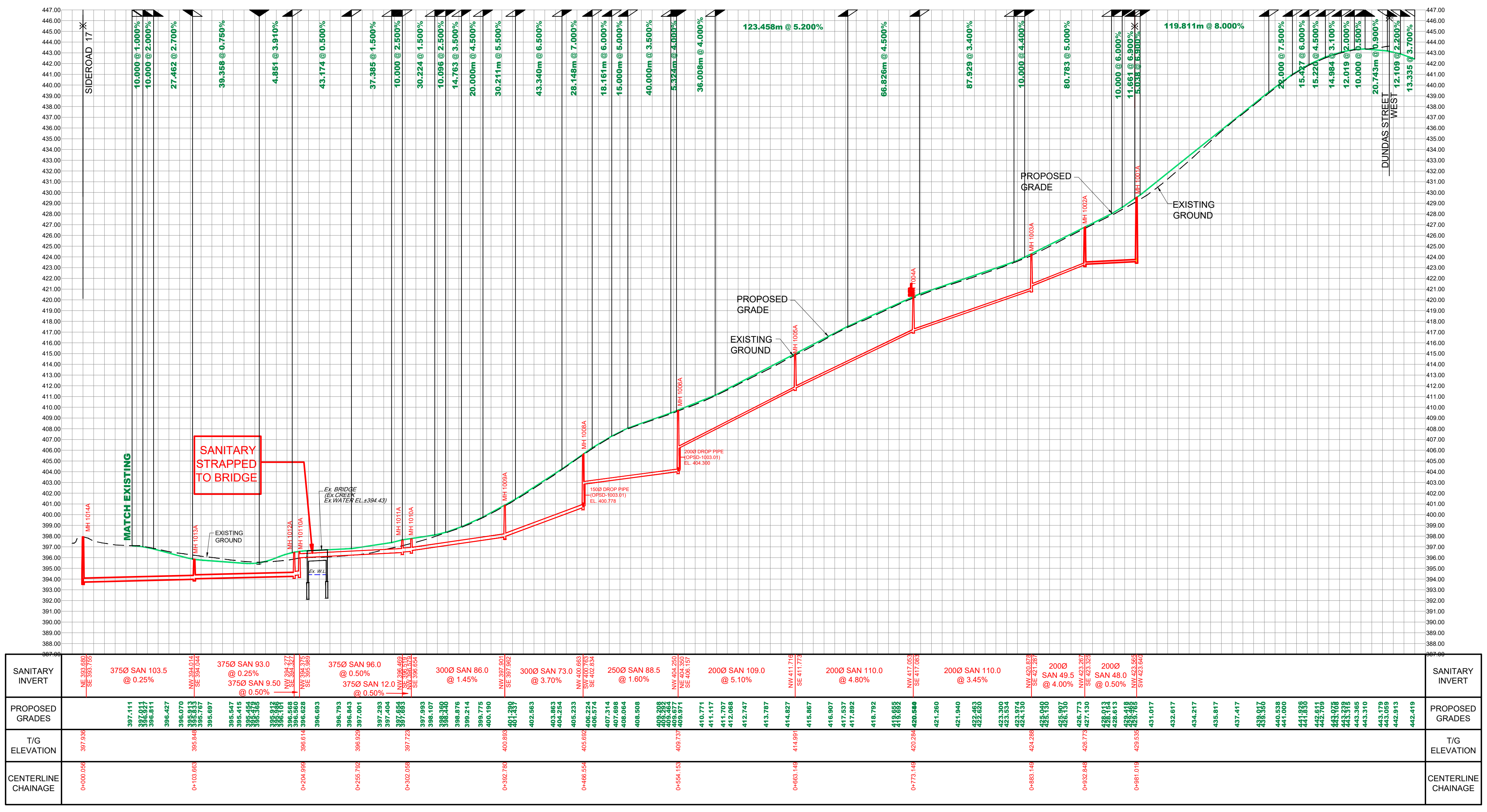
TOWN OF ERIN

MODIFIED TYPICAL ROAD
SECTIONS - EIGHTH LINE

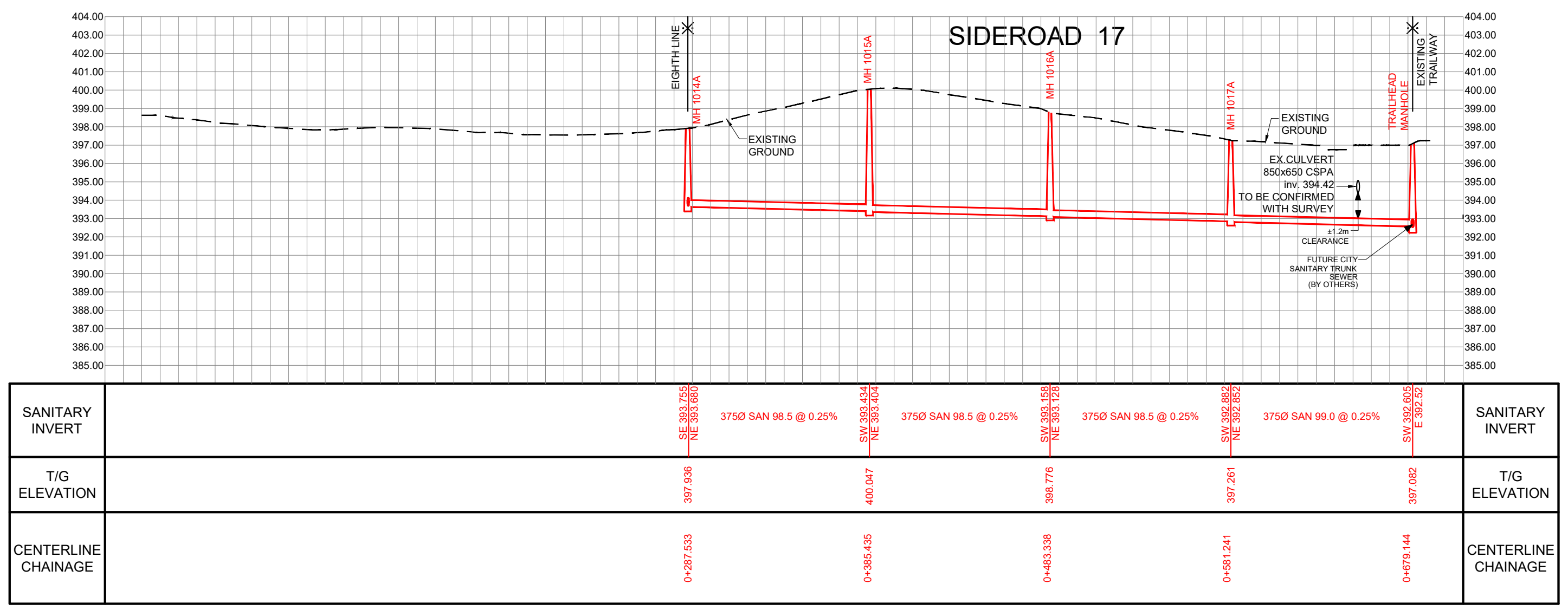
SCALE:	AS SHOWN	PROJECT No.:	21-1242
DATE:	JULY 2024	FIGURE:	14



GRAVITY SYSTEM



EIGHTH LINE



SIDEROAD 17

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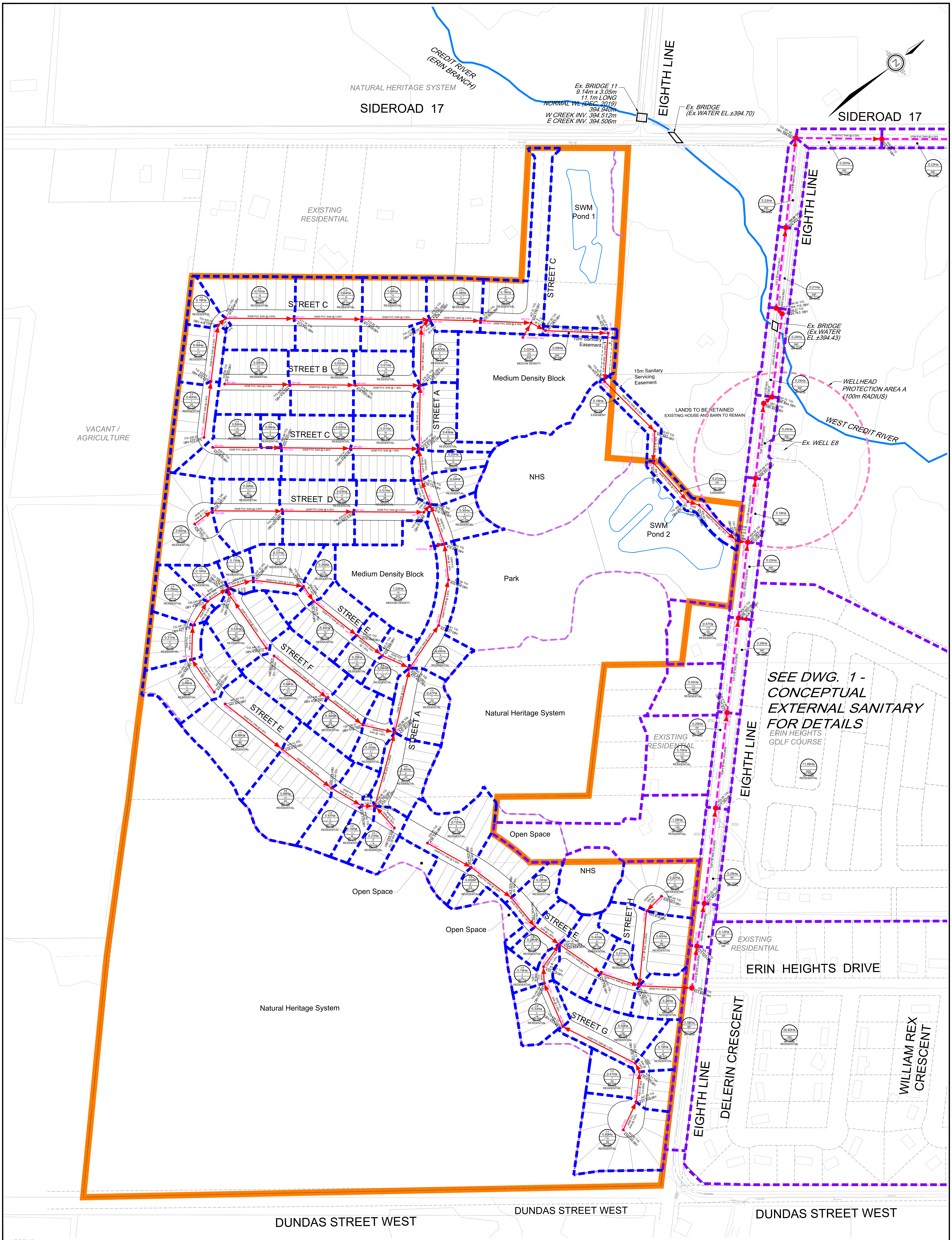
5520 EIGHTH LINE & 5552 EIGHTH LINE

TOWN OF ERIN

CONCEPTUAL EXTERNAL SANITARY

SCALE:	1:2500	PROJECT No.:	21-1242
DATE:	JULY 2024	DRAWING:	1



LEGEND

▬	SITE BOUNDARY
- - -	DEVELOPMENT LIMIT
- - -	SANITARY DRAINAGE AREA
- - -	EXTERNAL SANITARY DRAINAGE AREA
→	PROPOSED SANITARY SEWER
- - ▶	PROPOSED EXTERNAL SANITARY TRUNK (B.O.)
- - ▶	PROPOSED EXTERNAL SANITARY TRUNK (SEE DWG. 1)
● MH 64A	PROPOSED SANITARY MANHOLE
●	PROPOSED EXTERNAL TRUNK SANITARY MANHOLE (B.O.)
●	PROPOSED EXTERNAL SANITARY TRUNK MANHOLE (SEE DWG. 1)

UPSTREAM MANHOLE
DOWNSTREAM MANHOLE
POPULATION PER # UNITS
TRIBUTARY AREA
OF UNITS
TOTAL POPULATION
TRIBUTARY TYPE

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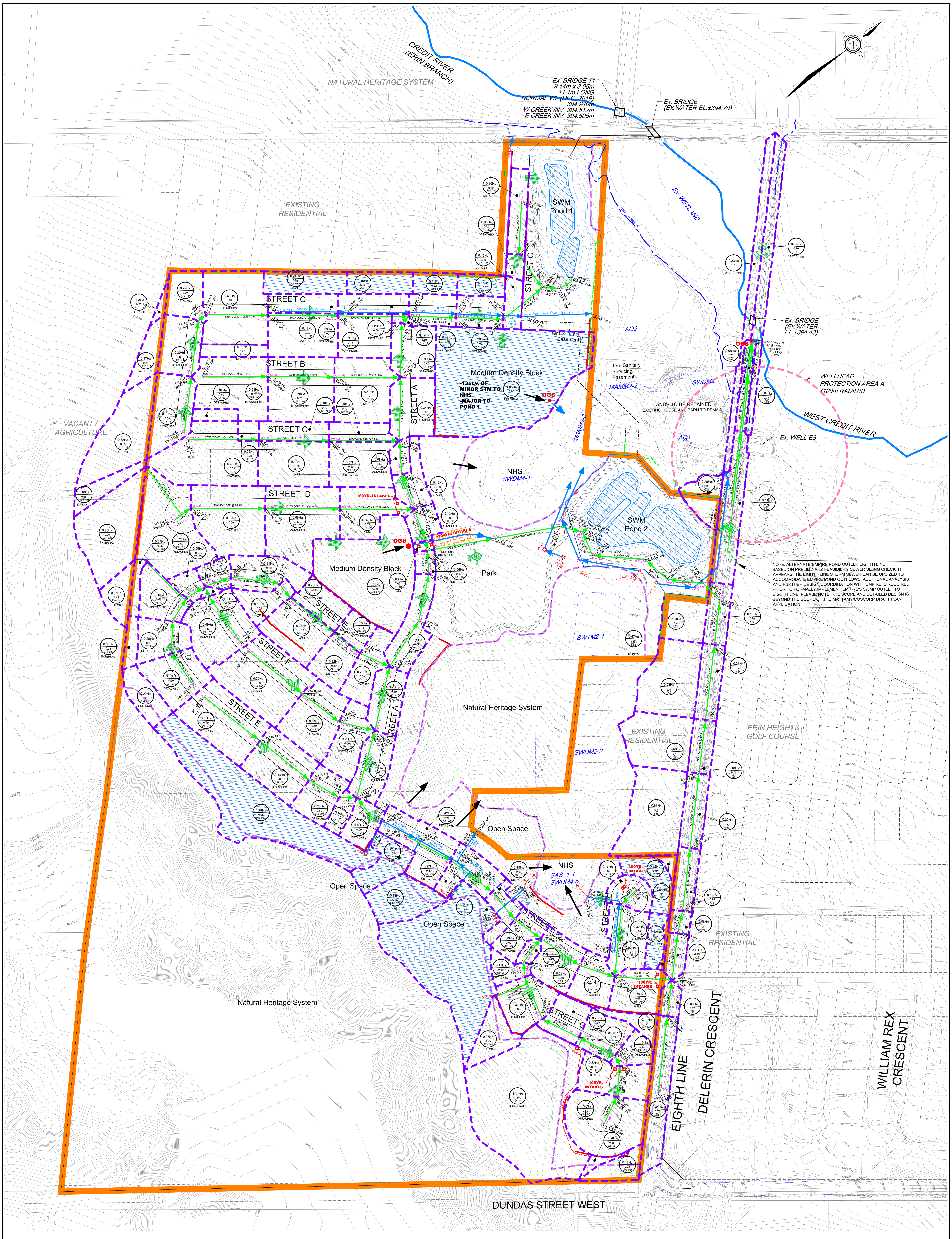
5520 EIGHTH LINE & 5552 EIGHTH LINE

TOWN OF ERIN

CONCEPTUAL SANITARY SERVICING PLAN

SCALE:	1:1250	PROJECT No.:	21-1242
DATE:	JULY 2024	DRAWING:	2



NOTE: ALTERNATE EMPIRE POND OUTLET EIGHTH LINE: BASED ON PRELIMINARY FEASIBILITY SEWER SIZING CHECK, IT APPEARS THE EIGHTH LINE STORM SEWER CAN BE UPSIZED TO ACCOMMODATE EMPIRE POND OUTFLOWS. ADDITIONAL ANALYSIS AND FURTHER DESIGN COORDINATION WITH EMPIRE IS REQUIRED PRIOR TO FORMALLY IMPLEMENT EMPIRE'S SWMP OUTLET TO EIGHTH LINE. PLEASE NOTE, THE SCOPE AND DETAILED DESIGN IS BEYOND THE SCOPE OF THE MATTAMY/COSCORP DRAFT PLAN APPLICATION

LEGEND

🟧	SITE BOUNDARY
- - -	DEVELOPMENT LIMIT
○ MH 115	PROPOSED STORM MANHOLE
○ MH 1000	PROPOSED CLEANWATER STORM MANHOLE
→	PROPOSED STORM SEWER
→	PROPOSED CLEANWATER STORM SEWER
⇨	STORM OVERLAND FLOW ARROW
⇨ E	EMERGENCY STORM OVERLAND FLOW ARROW
	STORM TRIBUTARY AREA
〰	EXISTING WATERCOURSE
▤	CLEANWATER TRIBUTARY AREA (100 YEAR)
▨	INFILTRATION GALLERY
0.57Ha	TOTAL DRAINAGE AREA
0.69	RUNOFF COEFFICIENT
200	UPSTREAM MANHOLE
201	DOWNSTREAM MANHOLE
DETACHED	

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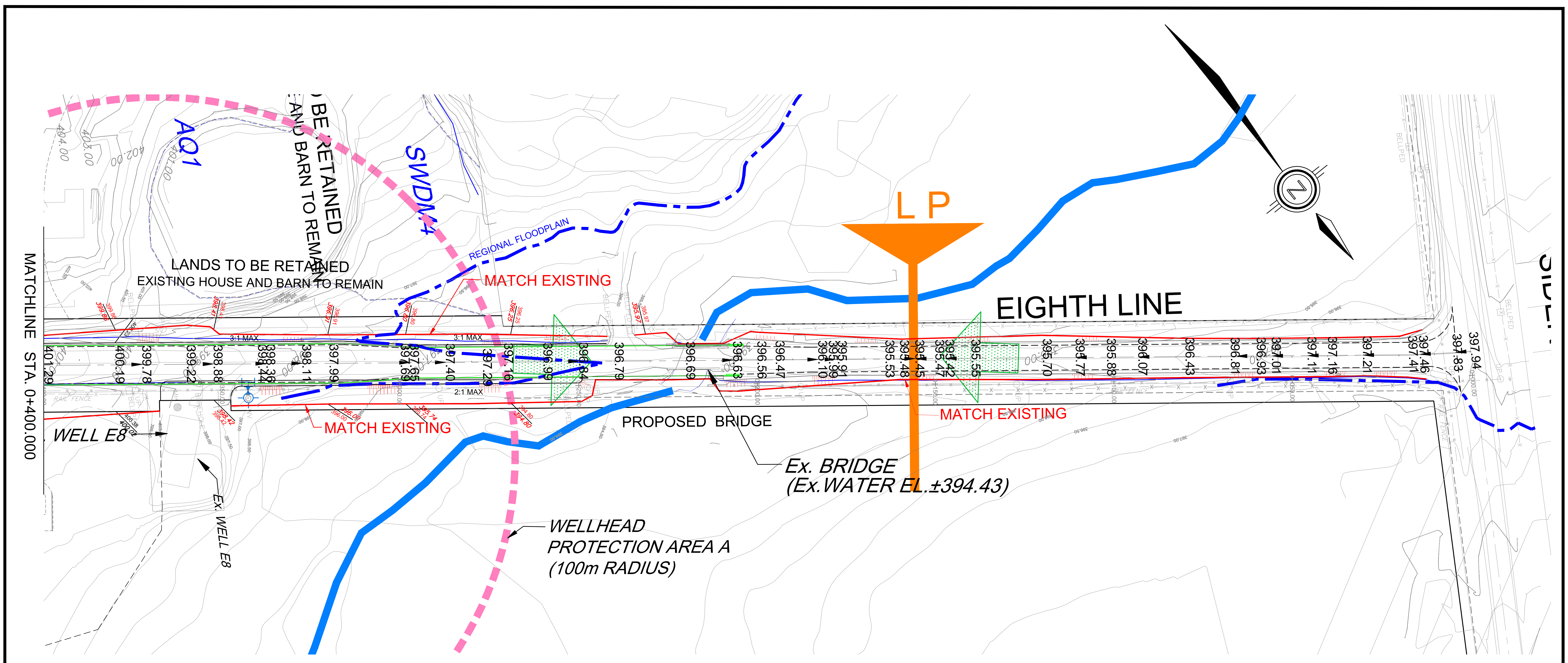
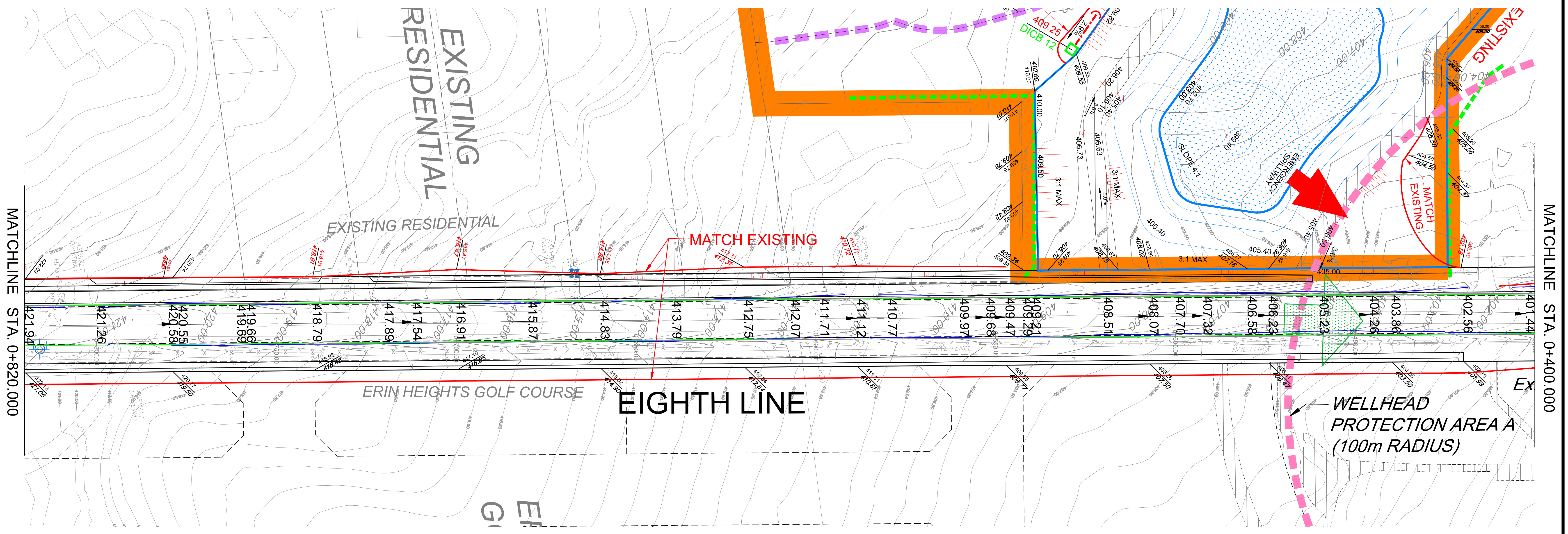
5520 EIGHTH LINE & 5552 EIGHTH LINE

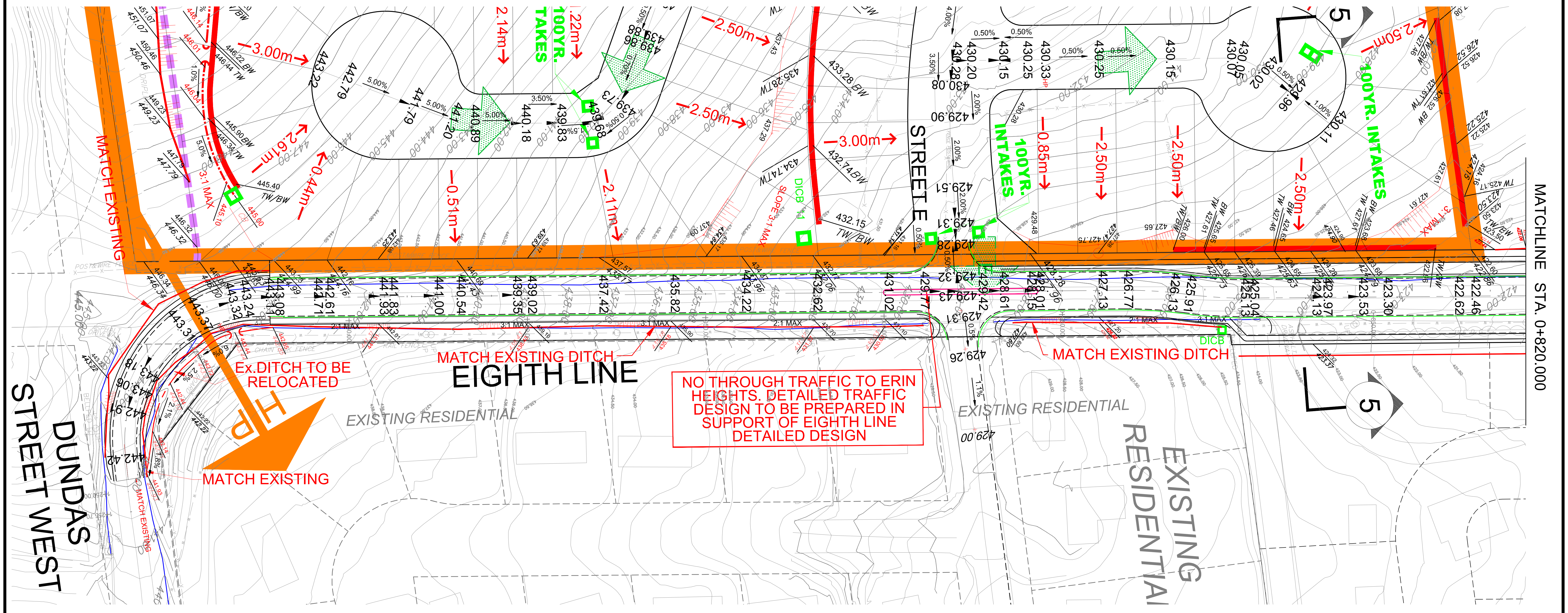
TOWN OF ERIN

CONCEPTUAL STORM SERVICING PLAN

SCALE:	1:1250	PROJECT No.:	21-1242
DATE:	JULY 2024	DRAWING:	3







LEGEND

🟧	SITE BOUNDARY
┅	DEVELOPMENT LIMIT
┅	WELLHEAD PROTECTION AREA A
➡	STORM OVERLAND FLOW ARROW
―	RETAINING WALL
‐·‐	EXISTING DITCH
427.13	PROPOSED CENTERLINE ELEVATION
427.47 / 427.47	PROPOSED ELEVATION EXISTING ELEVATION
244.50	EXISTING CONTOUR ELEVATION
―	PROPOSED SIDEWALK
―	PROPOSED CURB

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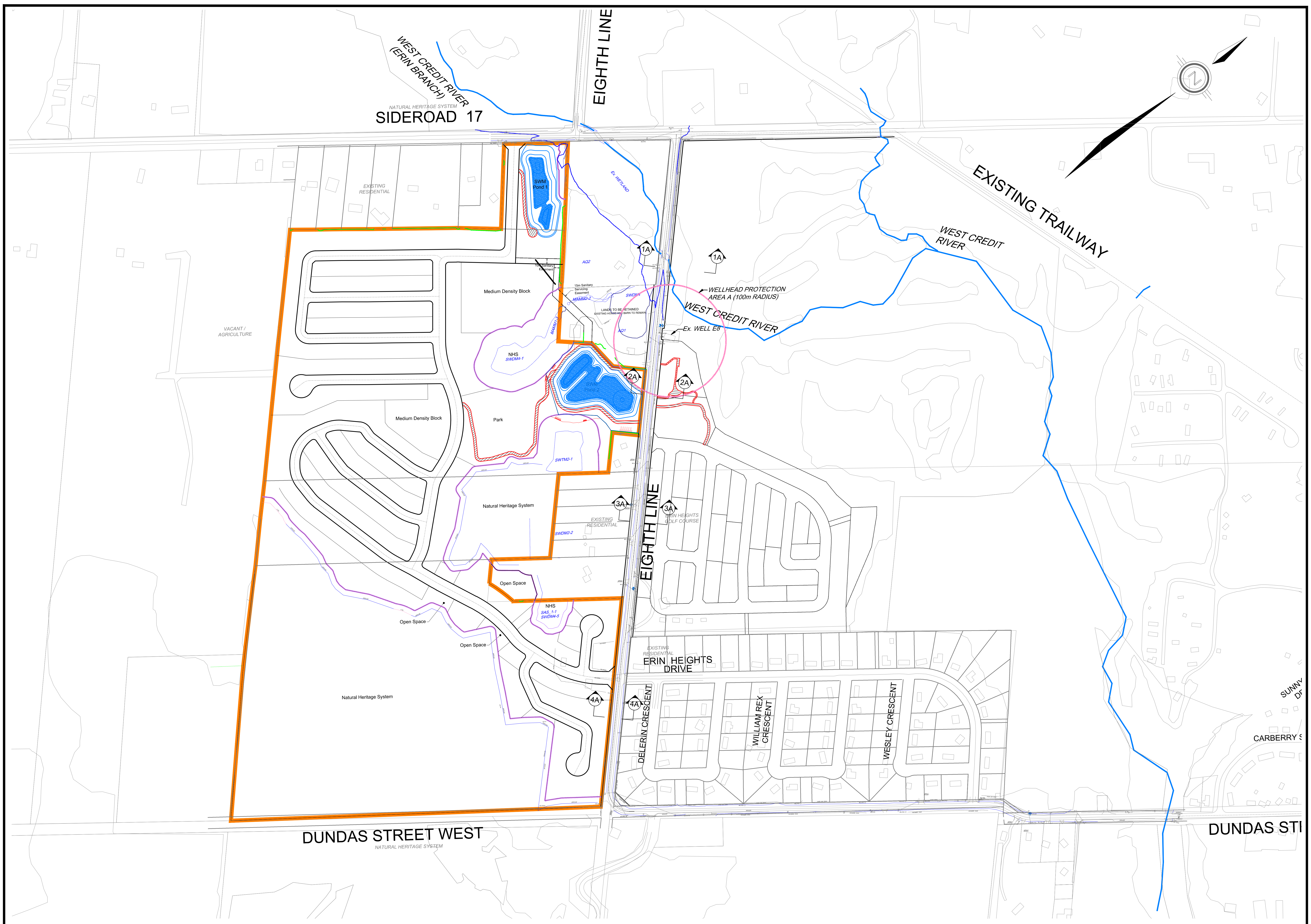
5552 EIGHTH
LINE & 5520
EIGHTH LINE

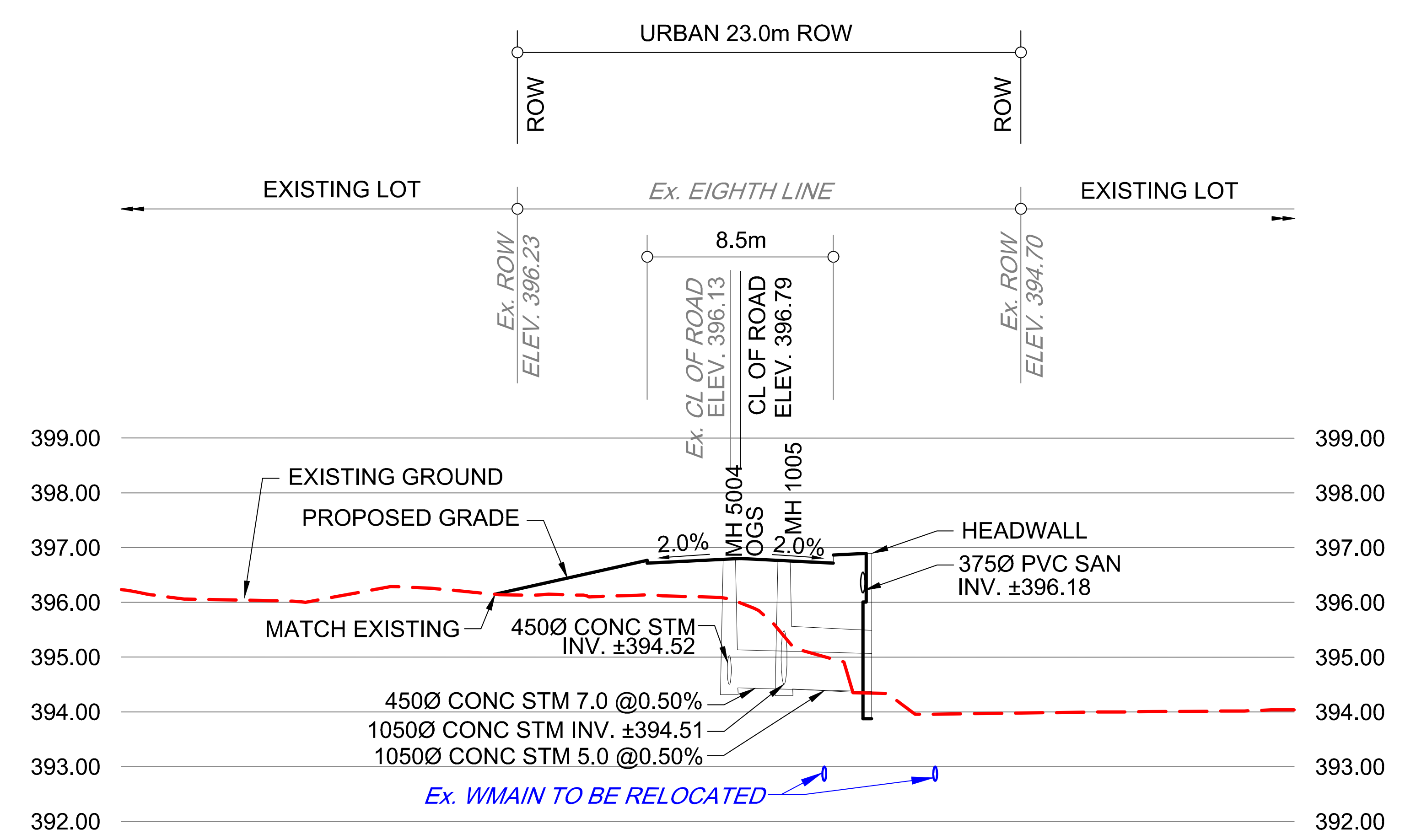
TOWN OF ERIN

EIGHTH LINE - CONCEPTUAL
GRADING PLAN

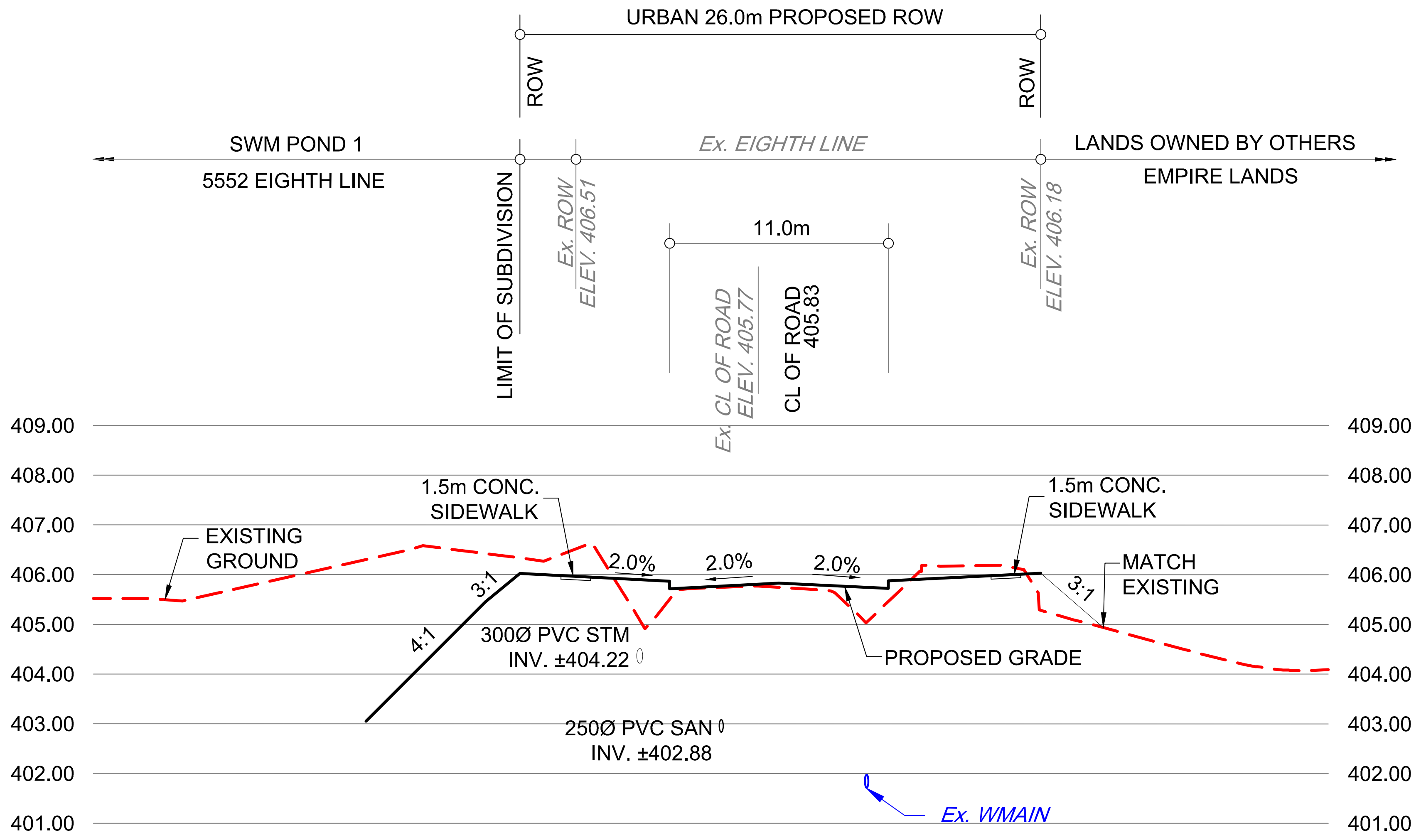
SCALE: 1:750
PROJECT No.: 21-1242
DATE: JULY 2024
DRAWING: 4



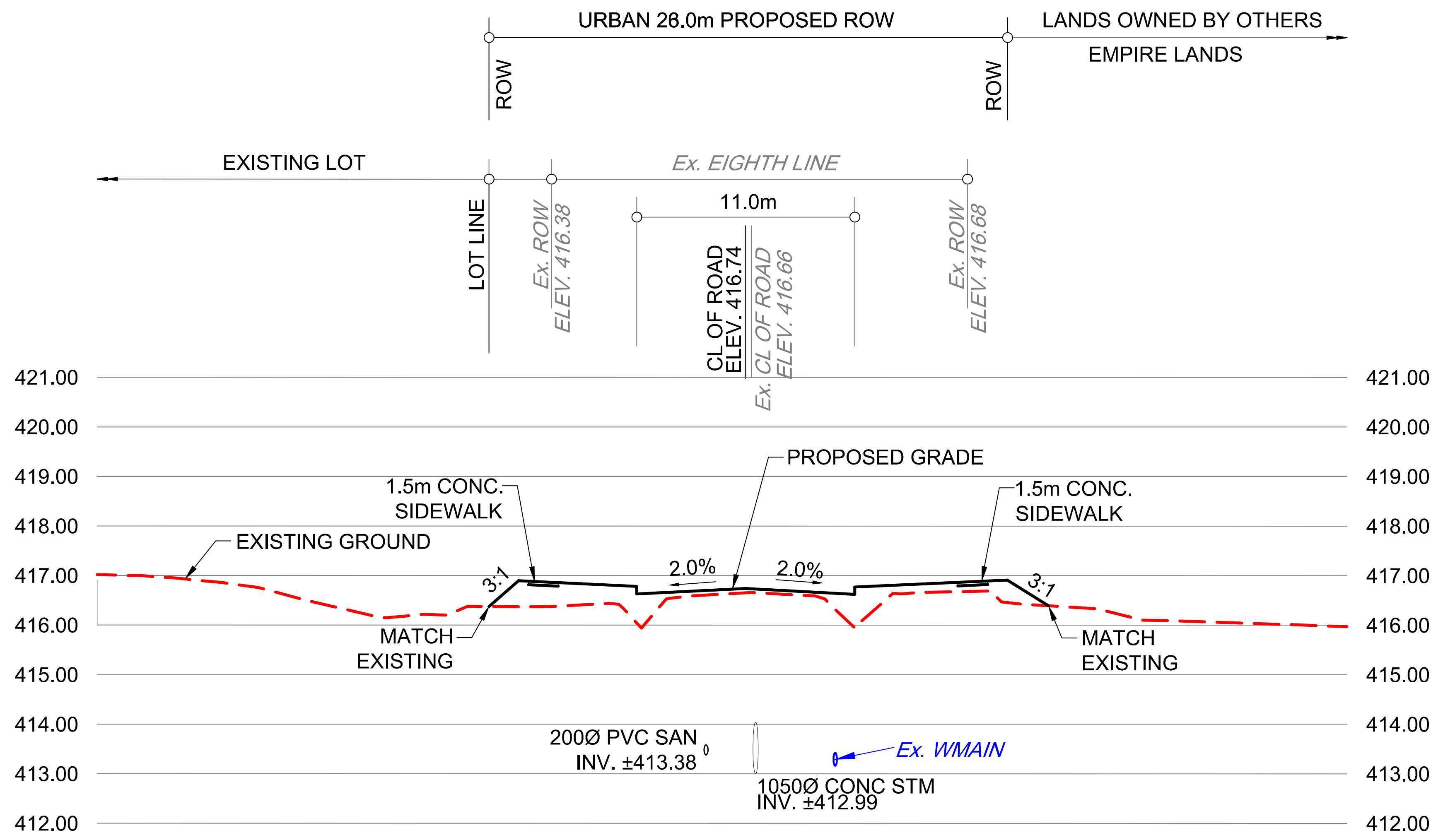
PLAN VIEW
SCALE: 1:4000



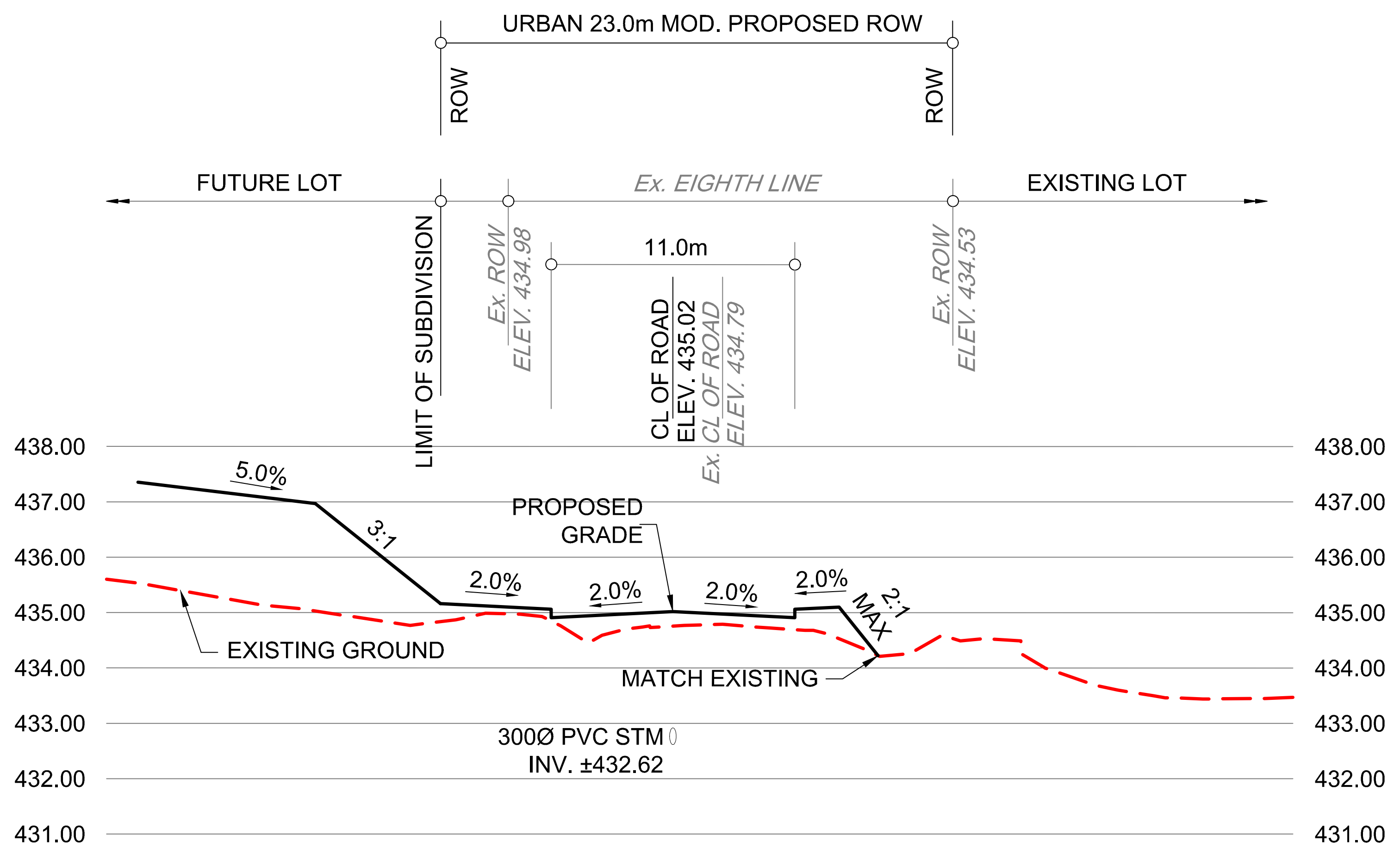
SECTION 1A-1A
SCALE HOR. 1: 250
VER. 1:100



SECTION 2A-2A
SCALE HOR. 1: 250
VER. 1:100



SECTION 3A-3A
SCALE HOR. 1: 250
VER. 1: 100



SECTION 4A-4A
SCALE HOR. 1: 250
VER. 1: 100

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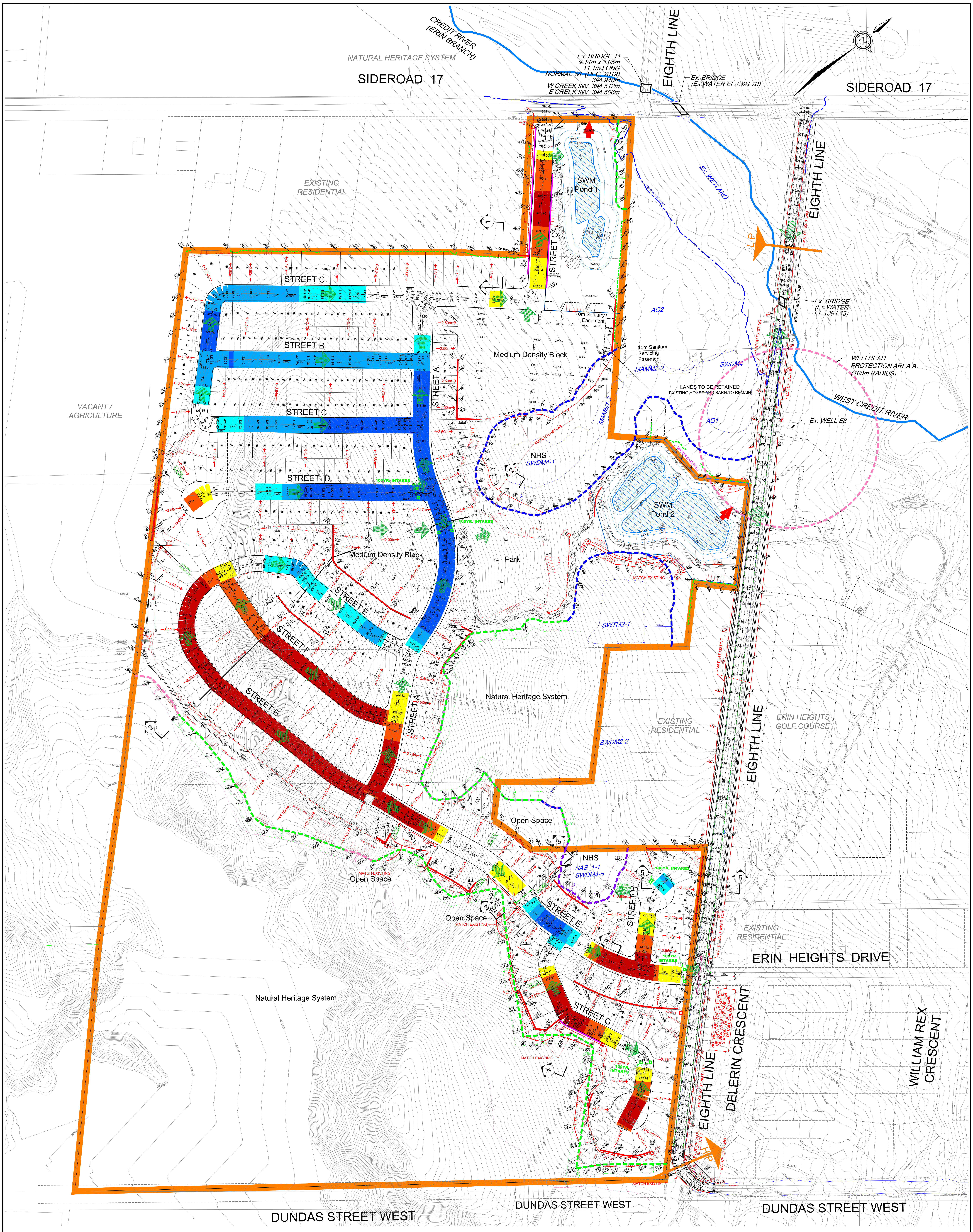
5552 EIGHTH LINE & 5520 EIGHTH LINE

TOWN OF ERIN

EIGHTH LINE - CROSS SECTIONS

SCALE:	AS SHOWN	PROJECT No.:	21-1242
DATE:	JULY 2024	DRAWING:	5



LEGEND:

▬	SITE BOUNDARY
▬ ▬ ▬	DEVELOPMENT LIMIT
▬ ▬ ▬	WELLHEAD PROTECTION AREA A
➡	STORM OVERLAND FLOW ARROW
➡	EMERGENCY STORM OVERLAND FLOW ARROW
*	POSSIBLE ENGINEERING FILL LOT (TO BE VERIFIED DURING DETAIL DESIGN)
188.89	PROPOSED CENTERLINE ELEVATION
187.74 / 187.74	PROPOSED ELEVATION EXISTING ELEVATION
244.50	EXISTING CONTOUR ELEVATION
▬	PRIVATE RETAINING WALL
▬	PUBLIC RETAINING WALL
- - - - -	TREE PROTECTION FENCE

CUT-FILL DEPTH ALONG CENTERLINE

CUT DEPTH (m)		FILL DEPTH (m)	
0.00~1.00:	▬	0.00~1.00:	▬
1.00~2.00:	🟨	1.00~2.00:	▬
2.00~3.00:	🟧	2.00~3.00:	▬
>3.00	🟥	>3.00	🟦

HAZARD LINE AND BUFFERS

▬ ▬ ▬ (10.0m)	10m NHS HAZARD LINE AND BUFFERS
- - - - -	DRIPLINE
▬ ▬ ▬ (10.0m)	10m WETLAND HAZARD LINE AND BUFFERS
- - - - -	WETLAND HAZARD
▬ ▬ ▬ (30.0m)	30m SWM HAZARD LINE AND BUFFERS
- - - - -	SWM HAZARD
▬ ▬ ▬ (10.0m)	10m LONG TERM STABLE SLOPE HAZARD LINE AND BUFFER
- - - - -	LONG TERM STABLE SLOPE HAZARD

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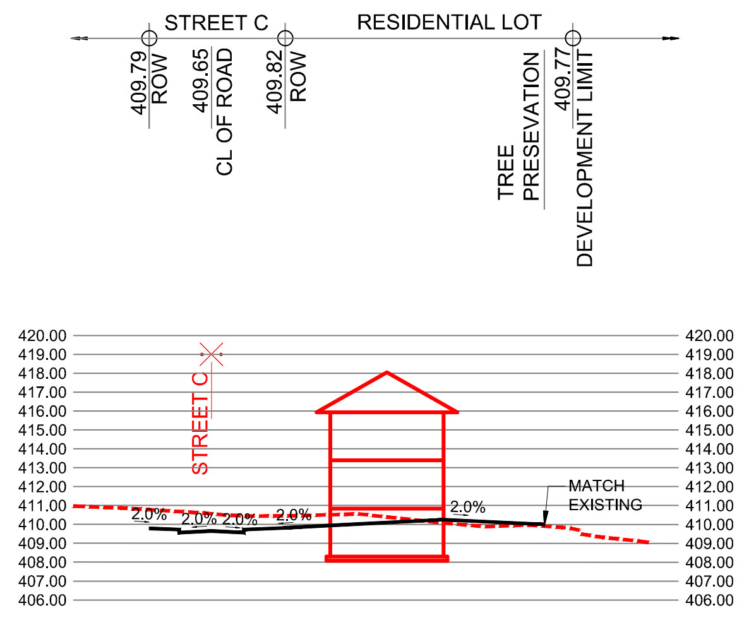
5520 EIGHTH LINE & 5552 EIGHTH LINE

TOWN OF ERIN

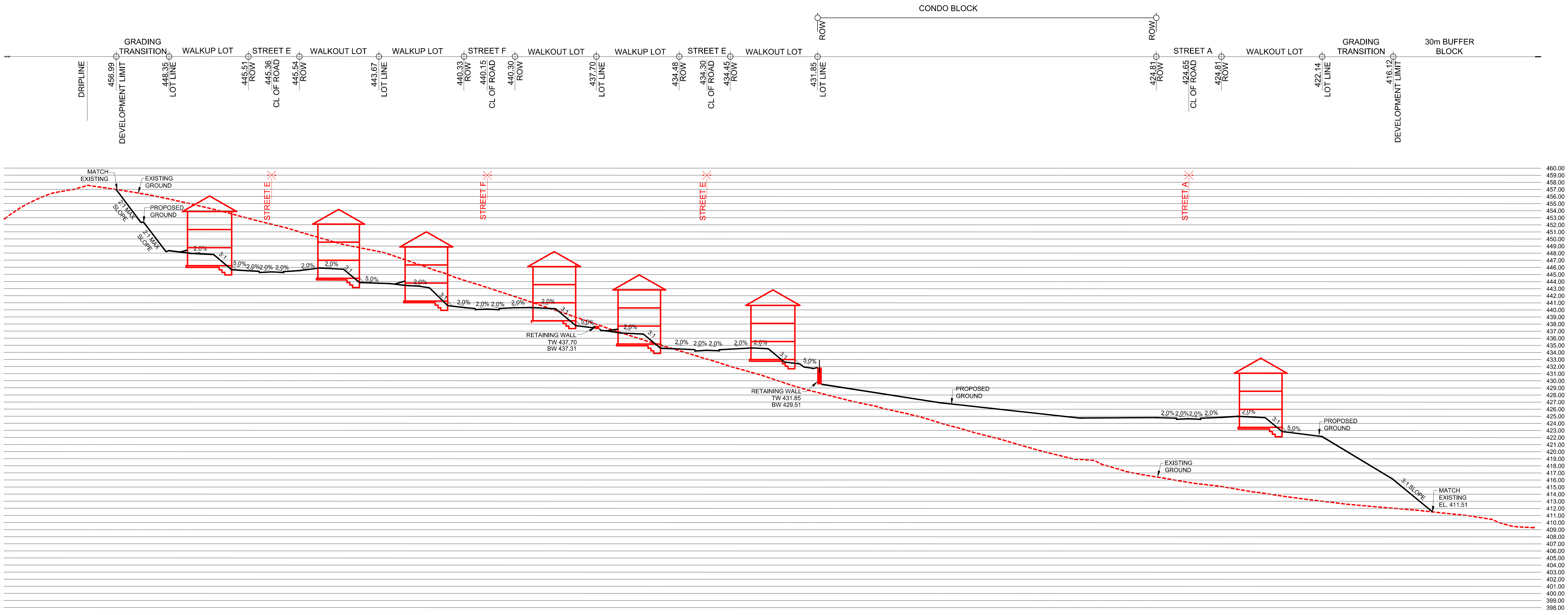
CONCEPTUAL GRADING PLAN

SCALE:	1:1250	PROJECT No.:	21-1242
DATE:	JULY 2024	DRAWING:	6



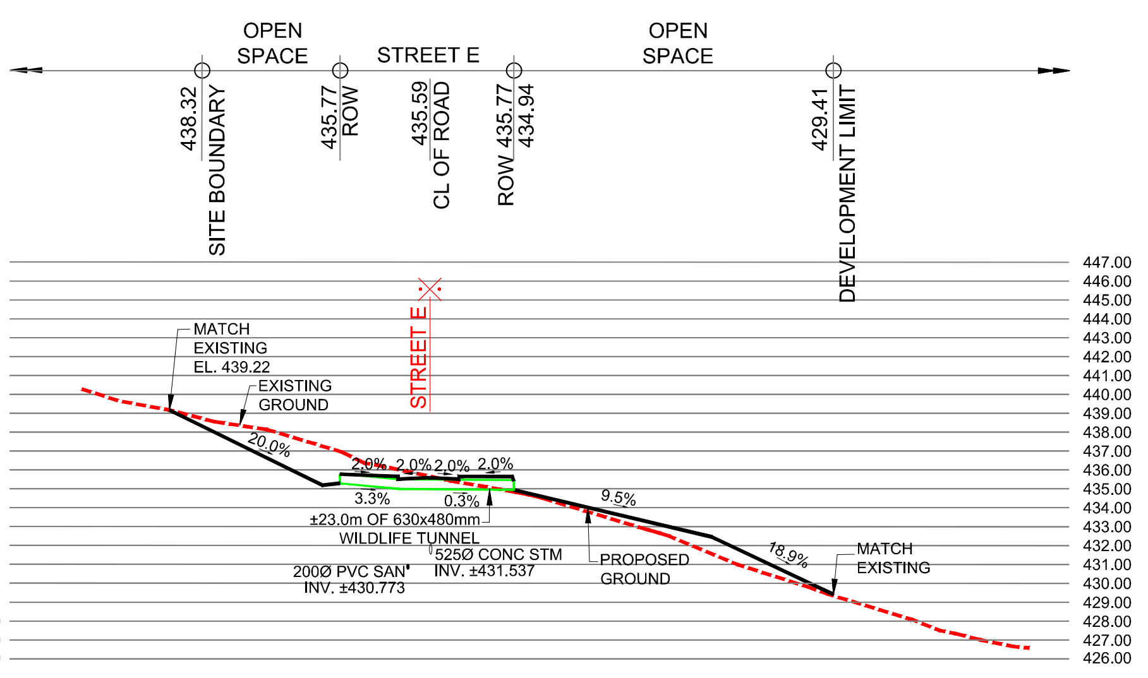
SECTION 1-1

SCALE HOR 1:1000
VER 1:400



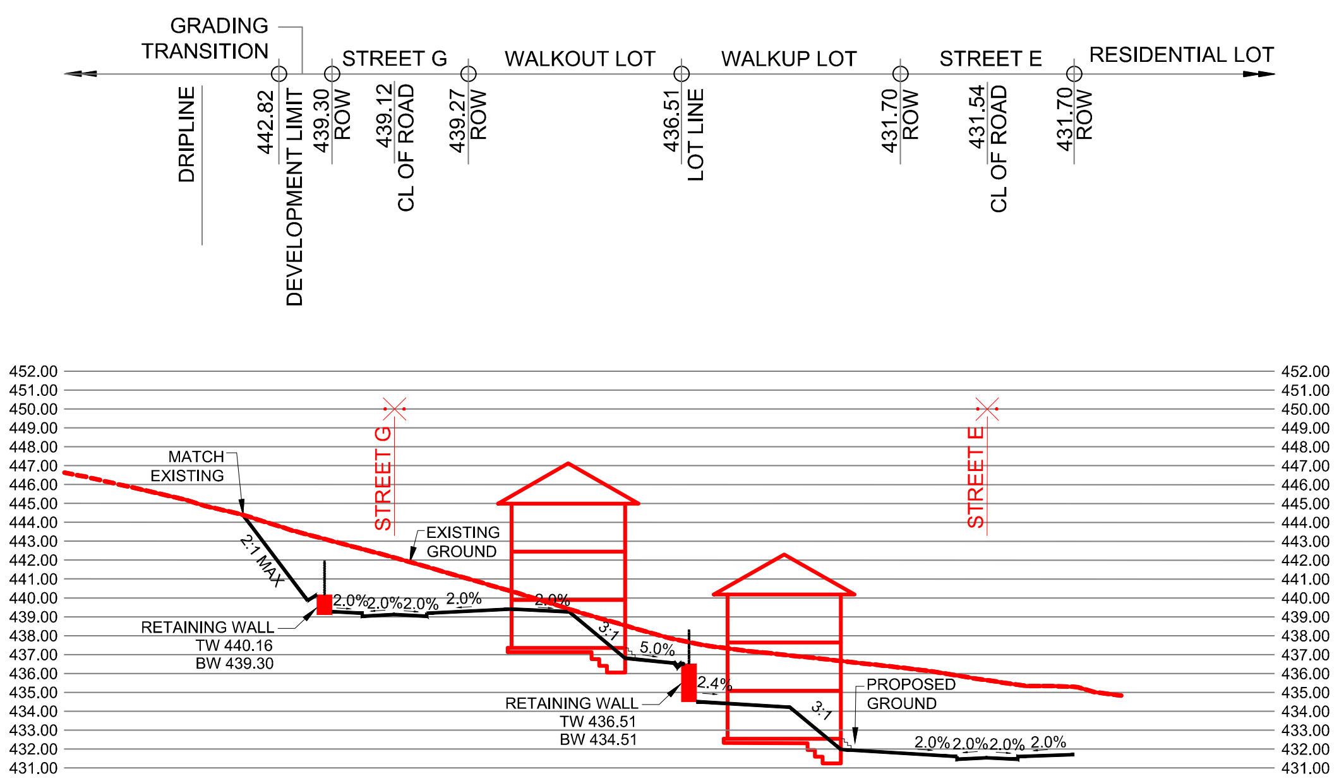
SECTION 2-2

SCALE HOR 1:1000
VER 1:400



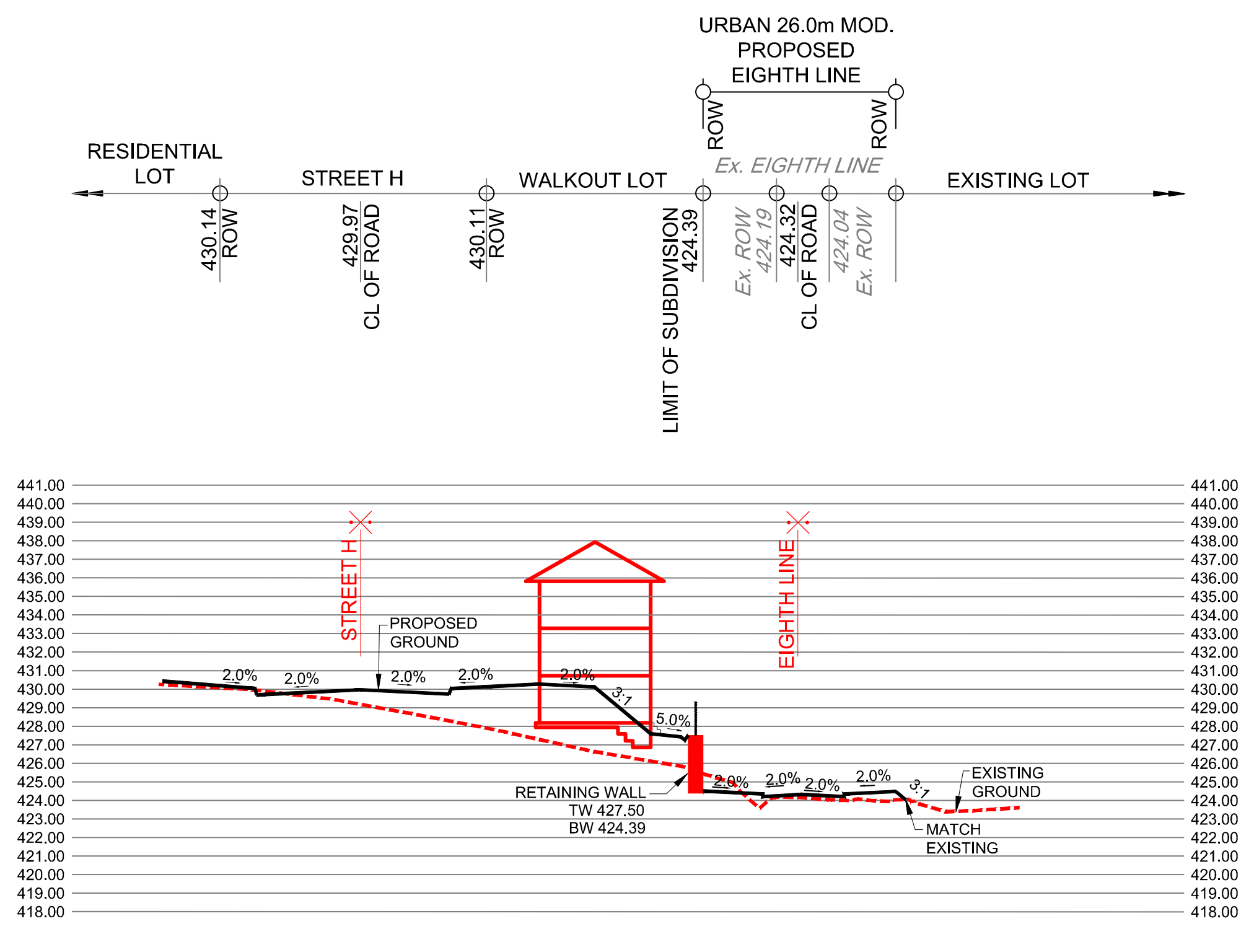
SECTION 3-3

SCALE HOR 1:100
VER 1:40



SECTION 4-4

SCALE HOR 1:1000
VER 1:400



SECTION 5-5

SCALE HOR 1:1000
VER 1:400

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5552 EIGHTH LINE & 5520 EIGHTH LINE

TOWN OF ERIN

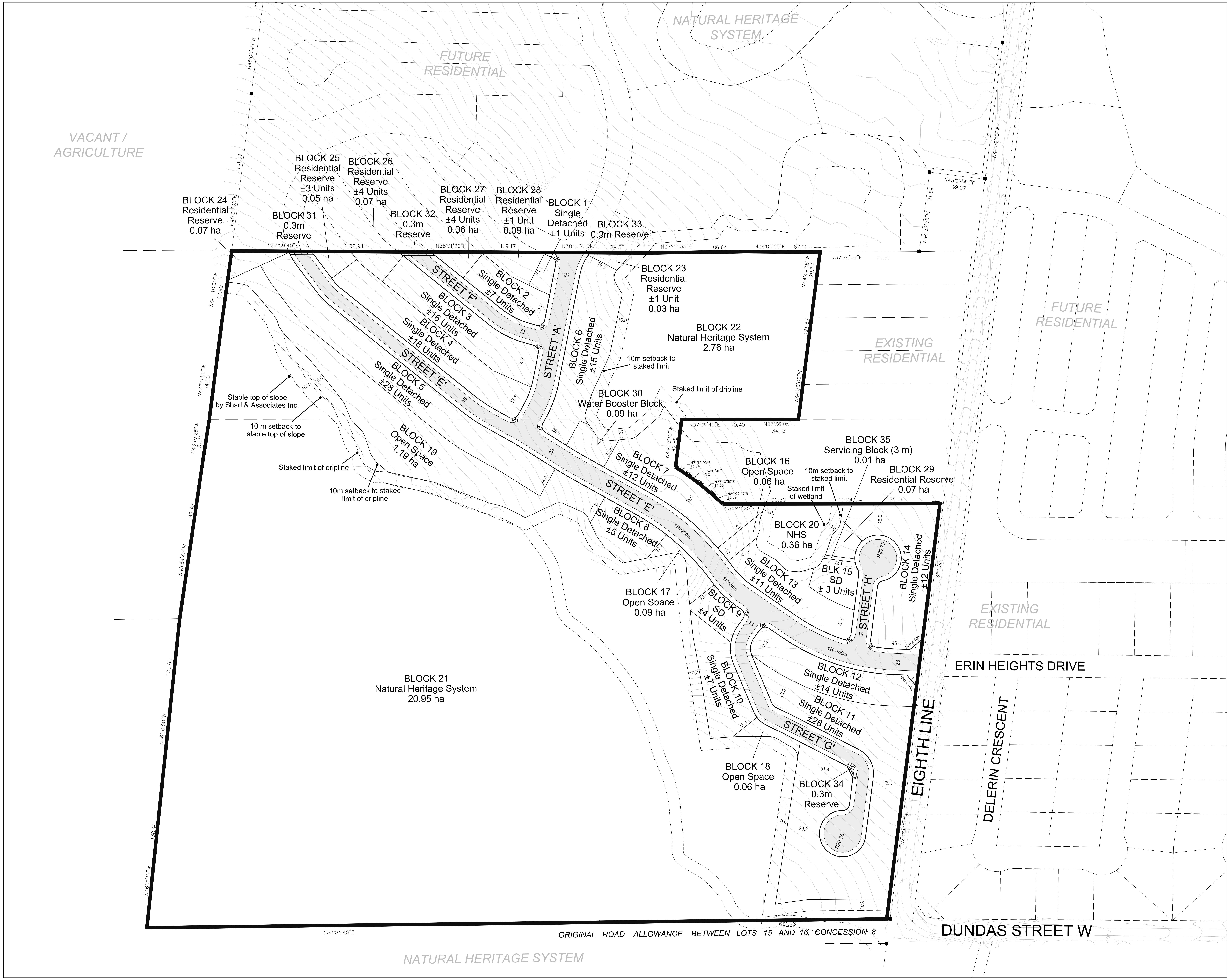
CROSS SECTIONS

SCALE:	AS SHOWN	PROJECT No.:	21-1242
DATE:	JULY 2024	DRAWING:	7

APPENDIX A

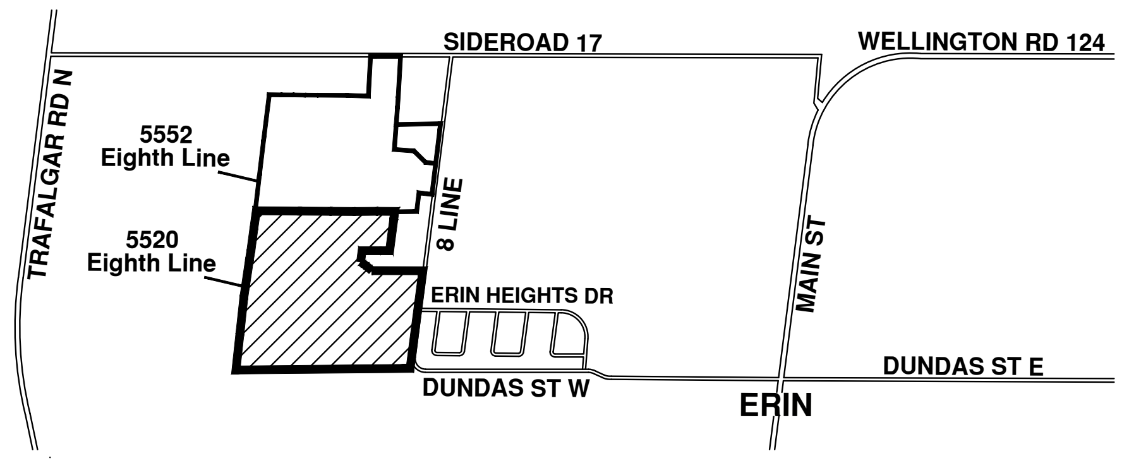
DRAFT PLANS

KORSIAK URBAN PLANNING, OCTOBER 2023



DRAFT PLAN OF SUBDIVISION
23T-22003

5520 Eighth Line
PART OF LOT 16
CONCESSION 8
(GEOGRAPHIC TOWNSHIP OF ERIN)
TOWN OF ERIN
COUNTY OF WELLINGTON



KEY MAP
N.T.S.

▨ SUBJECT PROPERTY

OWNER'S AUTHORIZATION

I HEREBY AUTHORIZE KORSIAK URBAN PLANNING TO PREPARE AND SUBMIT THIS DRAFT PLAN OF SUBDIVISION TO WELLINGTON COUNTY FOR APPROVAL.

SIGNED ________ DATE June 9, 2022
Gary Langen
2779176 Ontario Inc.

SURVEYOR'S CERTIFICATE

I HEREBY CERTIFY THAT THE BOUNDARIES OF THE LANDS TO BE SUBDIVIDED AS SHOWN ON THIS PLAN AND THEIR RELATIONSHIP TO ADJACENT LANDS ARE CORRECTLY AND ACCURATELY SHOWN.

SIGNED R. DenBroeder DATE May 10, 2022
R. DenBroeder, Ontario Land Surveyor

R-PE SURVEYING LTD.
ONTARIO LAND SURVEYORS
643 CHRISLEA ROAD, SUITE 7, WOODBRIDGE, ONTARIO L4L 8A3
Tel.(416)635-5000 Fax (416)635-5001

ADDITIONAL INFORMATION (UNDER SECTION 51 (17) OF THE PLANNING ACT)

A) SHOWN ON PLAN
B) SHOWN ON PLAN
C) SHOWN ON PLAN
D) SHOWN ON PLAN
E) SHOWN ON PLAN
F) SHOWN ON PLAN
G) SHOWN ON PLAN
H) MUNICIPAL AND PIPED WATER TO BE PROVIDED
I) CLAY LOAM
J) SHOWN ON PLAN
K) SANITARY AND STORM SEWERS TO BE PROVIDED
L) SHOWN ON PLAN

LAND USE SCHEDULE

Land Use	Lots/Blocks	Block Total	Area (ha)	Units	SDE*
Residential (Single Detached)	1-15	15	7.21	181	181
Open Space	16-19	4	1.40		
Natural Heritage System (NHS)	20-22	3	24.07		
Residential Reserve	23-29	7	0.44	13	13
Water Booster Block	30	1	0.09		
0.3m Reserve	31-34	4	0.00		
3m Servicing Block	35	1	0.01		
18m ROW (790m)			1.51		
23m ROW (589m)			1.37		
Total	35	35	36.10	194	194

*SDE Factor:
Single Detached - 1.0
Current subscription: 210 SDEs

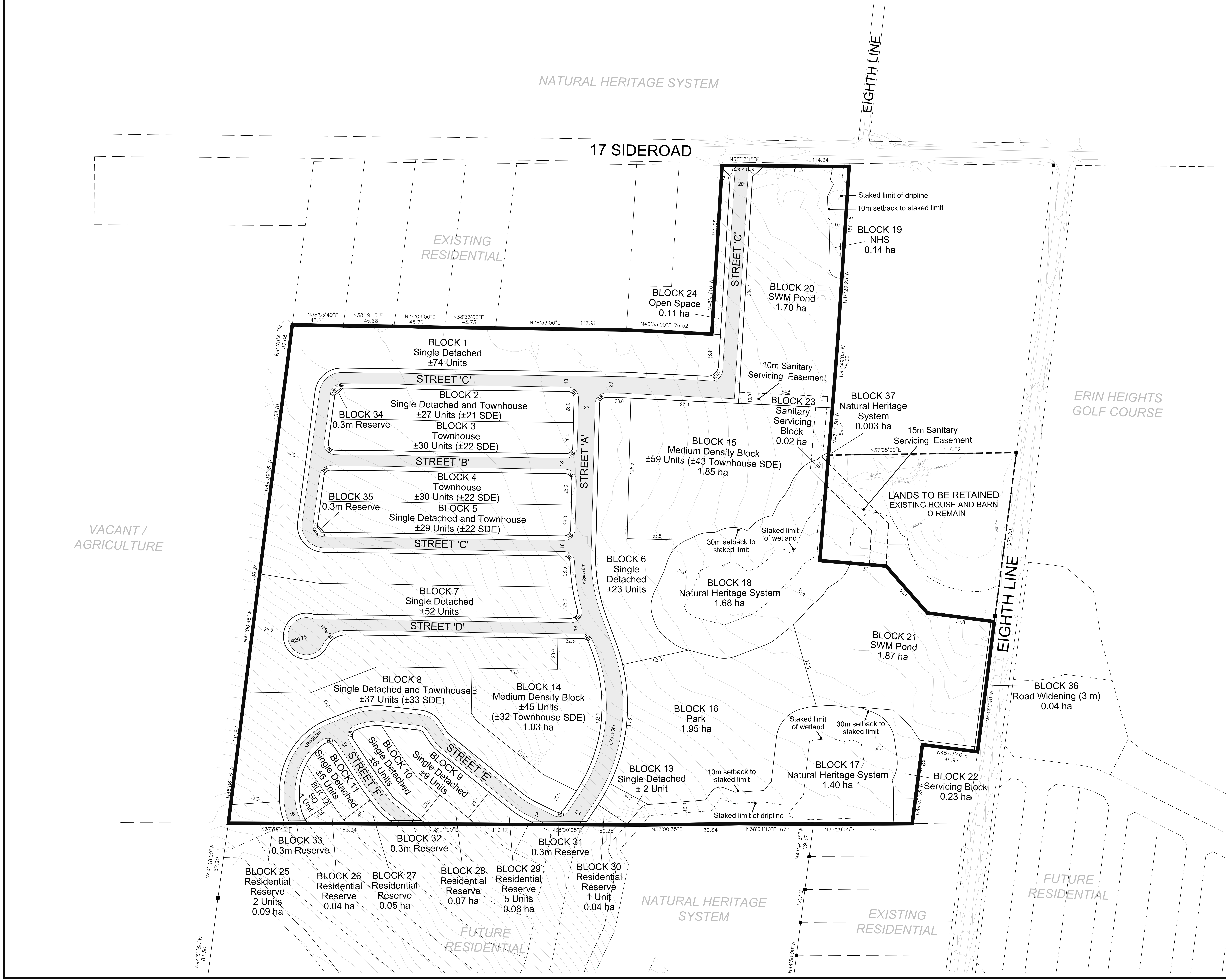
DATE	REVISION	DWG	BY
July 11, 2024	Third Submission	D	KC
Oct. 10, 2023	Second Submission	C	WS
Nov. 2, 2022	Add severance lands	B	KC
June 6, 2022	First Submission	A	KC

NOTES:
- * Local road/Local road corner radii = 6m
- * Pavement illustration is diagrammatic

mattamyHOMES

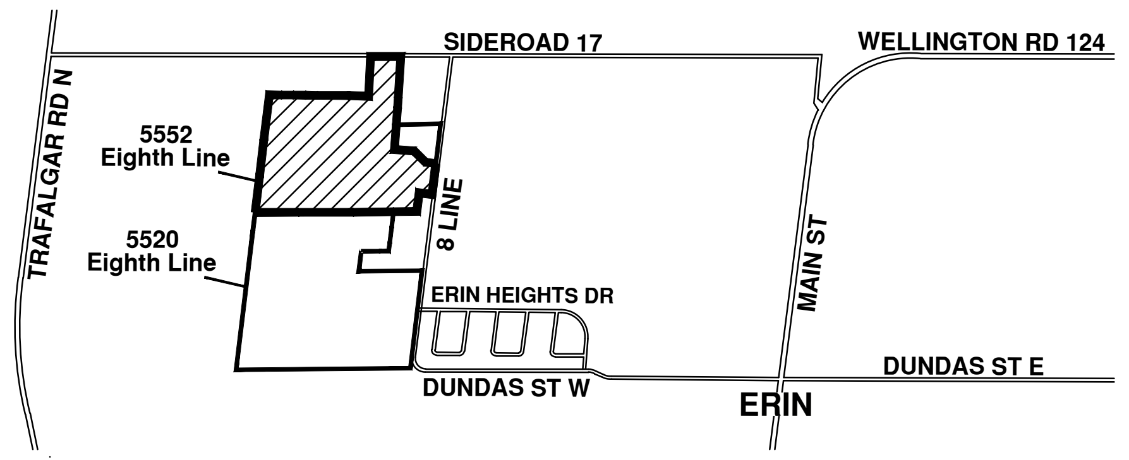
SCALE 1:1500 July 11, 2024
DRAWN BY: WS CHECKED BY: KC
D

KORSIAK Urban Planning
206-277 Lakeshore Road East
Oakville, Ontario L6J 1H9
T: 905-257-0227
info@korsiak.com



DRAFT PLAN OF SUBDIVISION
23T-22004

5552 Eighth Line
PART OF LOT 17
CONCESSION 8
(GEOGRAPHIC TOWNSHIP OF ERIN)
TOWN OF ERIN
COUNTY OF WELLINGTON



KEY MAP
N.T.S.

▨ SUBJECT PROPERTY

OWNER'S AUTHORIZATION

I HEREBY AUTHORIZE KORSIAK URBAN PLANNING TO PREPARE AND SUBMIT THIS DRAFT PLAN OF SUBDIVISION TO WELLINGTON COUNTY FOR APPROVAL.

SIGNED ______ DATE June 7, 2022
Tom Baskerville
2779181 Ontario Inc.

SURVEYOR'S CERTIFICATE

I HEREBY CERTIFY THAT THE BOUNDARIES OF THE LANDS TO BE SUBDIVIDED AS SHOWN ON THIS PLAN AND THEIR RELATIONSHIP TO ADJACENT LANDS ARE CORRECTLY AND ACCURATELY SHOWN.

SIGNED R. DenBroeder DATE May 10, 2022
R. DenBroeder, Ontario Land Surveyor

rpe
R-PE SURVEYING LTD.
ONTARIO LAND SURVEYORS
643 CHRISLEA ROAD, SUITE 7, WOODBRIDGE, ONTARIO L4L 8A3
Tel.(416)635-5000 Fax (416)635-5001

ADDITIONAL INFORMATION (UNDER SECTION 51 (17) OF THE PLANNING ACT)

A) SHOWN ON PLAN
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C) SHOWN ON PLAN
D) SHOWN ON PLAN
E) SHOWN ON PLAN
F) SHOWN ON PLAN
G) SHOWN ON PLAN
H) MUNICIPAL AND PIPED WATER TO BE PROVIDED
I) CLAY LOAM
J) SHOWN ON PLAN
K) SANITARY AND STORM SEWERS TO BE PROVIDED
L) SHOWN ON PLAN

LAND USE SCHEDULE

Land Use	Lots/Blocks	Block Total	Area (ha)	Units	SDE*
Residential (Single Detached and Townhouse)	1-13	13	10.18	328	295
Medium Density Block	14, 15	2	2.88	104	75
Park	16	1	1.95		
Natural Heritage System (NHS)	17-19, 37	4	3.22		
SWM Pond	20, 21	2	3.57		
Servicing Block	22	1	0.23		
Sanitary Servicing Block	23	1	0.02		
Open Space	24	1	0.11		
Residential Reserve	25-30	6	0.37	8	8
0.3m Reserve	31-35	5	0.00		
Road Widening	36	1	0.04		
18m ROW (1531 m)			2.83		
20m ROW (214 m)			0.44		
23m ROW (523 m)			1.21		
Total	37	37	27.05	440	378

*SDE Factors:
Single Detached - 1.0
Townhouse - 0.72
Current subscription: 365 SDEs

DATE	REVISION	DWG	BY
July 11, 2024	Third Submission	C	KC
Oct. 10, 2023	Second Submission	B	WS
June 6, 2022	First Submission	A	KC

NOTES:

* Local road/Local road corner radii = 6m
* Pavement illustration is diagrammatic

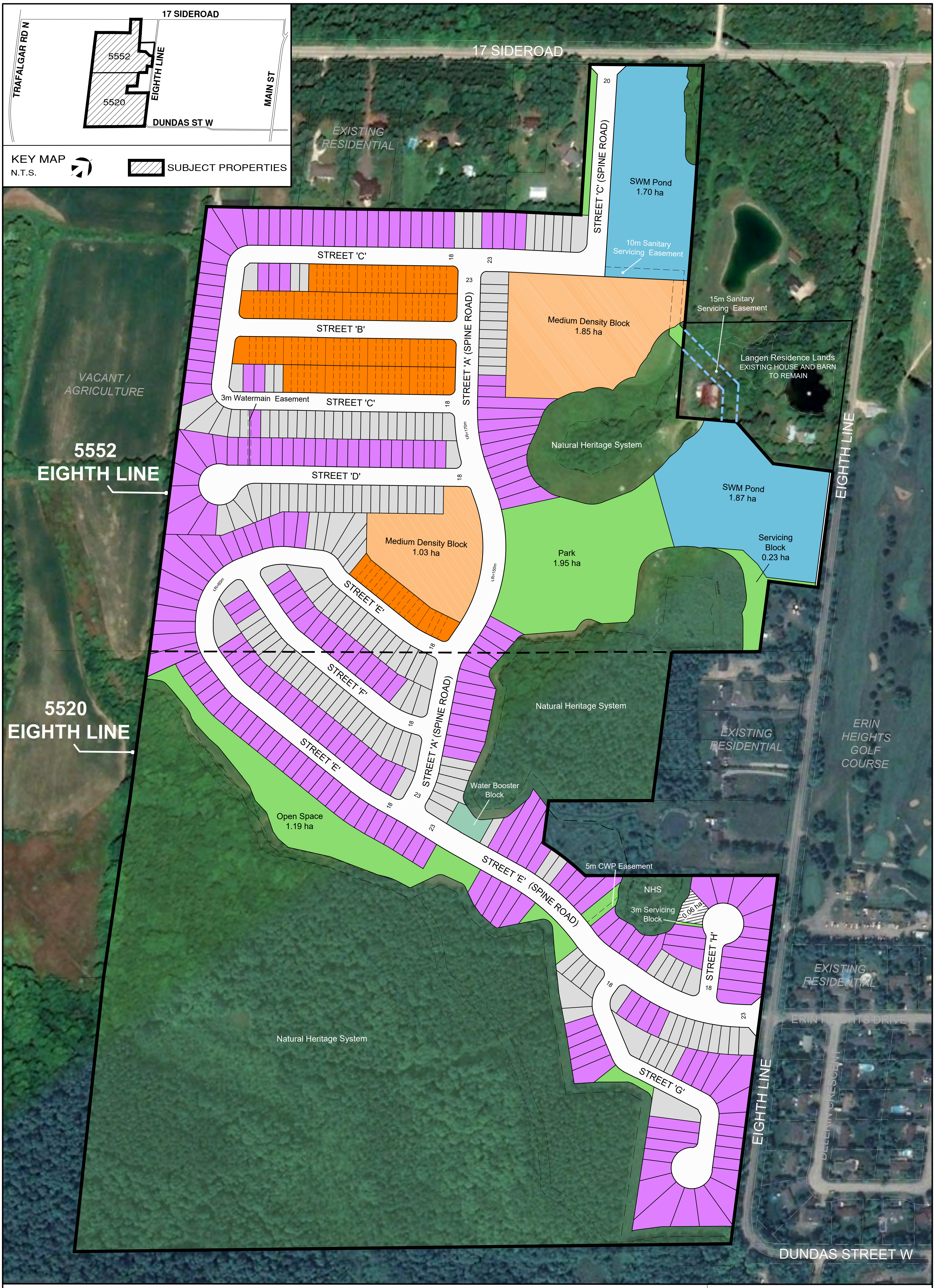
COSCORP INC.

SCALE 1:1500	July 11, 2024
DRAWN BY: WS	CHECKED BY: KC

C

KORSIAK Urban Planning
206-277 Lakeshore Road East
Oakville, Ontario L6J 1H9
T: 905-257-0227
info@korsiak.com

S:\Korsiak & Company\MATTAMY\Erin\Draft Plan\North\2024-07\Erin - 5552 Eighth Line Draft Plan - Jul 11 24_kc.dwg



ERIN
5552 EIGHTH LINE &
5520 EIGHTH LINE

Composite Lotted Plan

	Unit Count (±)			%	
Unit Type	5552	5520	Total	Overall	Singles
⬜ 30' Singles	103	62	165	31	40
🟪 36' Singles	112	132	244	46	60
🟧 21' Townhouses	121	0	121	23	-
Total	336	194	530	100	100

▨ External land sale

mattamyHOMES

COSCORP INC.

SCALE 1:3500

July 11, 2024

KORSIAK Urban Planning

S:\Korsiak & Company\MATTAMY\Erin\Lotted Plan\2024-07\Erin - Lotted Plan - Jul 11 24_kc.dwg

APPENDIX B

CORRESPONDENCE REGARDING WATER SERVICING

Elizabeth Reid

From:	Joe Mullan <mullan@ainleygroup.com>
Sent:	October 7, 2021 1:05 PM
To:	Kenny Sun
Cc:	John Tjeerdsma; Nick Colucci
Subject:	RE: Mattamy Erin: As-builts & WM Modelling
Attachments:	FCV's.dbf; FCV's.shp; FCV's.shx; Fire Flows.dbf; Fire Flows.shp; Fire Flows.shx; Junctions.dbf; Junctions.shp; Junctions.shx; Pipes.dbf; Pipes.shp; Pipes.shx; Pump Status.dbf; Pump Status.shp; Pump Status.shx; Pumps.dbf; Pumps.shp; Pumps.shx; Resiviors.dbf; Resiviors.shp; Resiviors.shx; Tanks.dbf; Tanks.shp; Tanks.shx
Follow Up Flag:	Follow up
Flag Status:	Flagged

Hi Kenny:

Further to your request please find attached the existing WaterCAD model files/components associated with the Town of Erin Water system that was prepared by Triton Engineering. In utilizing this model please be aware of the following:

- The model was prepared a number of years ago.
- We are unsure if the model was ever field calibrated
- The model is based on historic information and discussions with former in-house water operation staff, however; not necessarily all based on “As-Built” information.
- The exact material, alignment, limits and elevations of the watermain are in some cases approximate and should not be relied upon.
- Well/pump details and operating conditions are based on historic information and pump curve information and discussions with former staff. If pumps have been since been replaced this information will need to be updated.

After you have a chance to review this material, please let us know if you have specific questions and we try to follow up with Triton and or Operations Staff to get answers.

With regard to available Water Capacity in Erin, we do know from recent annual Water Reports that there is “very limited” residual capacity available in the system and that in conjunction with the new developments proposed in Erin the following water related works will have to be completed:

a) The design and construction of a new Municipal Well at #5657 Wellington CR23.
b) The design and construction of a 2,140m^3 Water Tower within Erin.
c) The design and construction of 1,500m of trunk main on CR23 from the new Municipal Well to Sideroad 17.
d) The design and construction of 950m of trunk watermain from the intersection of Sideroad 17 & Wellington CR 23 to the future Water Tower.
e) Possible watermain upgrades on Eight Line, Dundas St West & Sideroad 17.

Note the Town are currently in the process of retaining a consultant to Develop Calibrated a Water Model for the Town water systems that will look at the existing systems and the future infrastructure needs to accommodate the proposed growth. It is anticipated that this new model will be completed in the spring of 2022.

Regards,

J. A. Mullan, P.Eng.
President & CEO

Tel: (705) 445-3451 Ext. 126
Cell: (705) 718-7230

WWW.AINLEYGROUP.COM

Ainley Group is committed to providing accessible customer service. Please inform us if you require this information in an alternative format or require communication supports.

From: Kenny Sun <KSun@dsel.ca>
Sent: Thursday, October 7, 2021 9:16 AM
To: Joe Mullan <mullan@ainleygroup.com>; Nick Colucci <nick.colucci@erin.ca>
Cc: John Tjeerdsma <JTjeerdsma@dsel.ca>
Subject: RE: Mattamy Erin: As-builts & WM Modelling
Importance: High

Hi Nick & Joe,

Just following up with you on the file request below.

Could you advise if we can hear back sometime this week with the as-builts / watermain modelling?

Cheers,

Kenny Sun

DSEL
david schaeffer engineering ltd.

600 Alden Road, Suite 700
Markham, ON L3R 0E7

phone: (905) 475-3080 ext.284
fax: (905) 475-3081
email: ksun@DSEL.ca

From: Joe Mullan <joe.mullan@ainleygroup.com>
Sent: October 11, 2023 12:43 PM
To: Mack McLean
Cc: Khalid Rahman; Tom Baskerville; John Tjeerdsma; Alexander Drung; jswartz@empirecommunities.com
Subject: Mattamy-Coscorp-Empire Developments - Water Model Review
Attachments: Mattamy-Coscorp-Empire Developments - Final Watermain Analysis Report (Oct 2023).pdf

Hi Mack:

Please find attached the finalized Watermain Analysis Report associated with the Mattamy-Coscorp-Empire Developments.

As noted within the Report, we will require your team to calculate the required fire flow for any multi-unit or multi-storey buildings, based on Fire Underwriters Survey standards and submit the calculations to the Town for review and comparison with the available fire flows identified within the attached report.

After you and your team have had a chance to review the report, let us know if you have any questions.

Regards

J. A. Mullan, P.Eng.
President & CEO

Ainley GROUP

Tel: (705) 445-3451 Ext. 426
Cell: (705) 718-7230

WWW.AINLEYGROUP.COM

From: Mack McLean <MMcLean@dsel.ca>
Sent: Tuesday, September 5, 2023 10:57 AM
To: Joe Mullan <joe.mullan@ainleygroup.com>
Cc: Khalid Rahman <Khalid.Rahman@erin.ca>; Nick Colucci <nick.colucci@erin.ca>; Daviau, Jean-Luc <Jean.Luc.Daviau@wsp.com>; Lahaie, Antoine <Antoine.Lahaie@wsp.com>; Yao, Steven <Steven.Yao@wsp.com>; Tom Baskerville <tbaskerville@coscorp.ca>; John Tjeerdsma <JTjeerdsma@dsel.ca>; Alexander Drung

<Alexander.Drung@mattamycorp.com>; Yao, Steven <Steven.Yao@wsp.com>
Subject: RE: Nick Colucci's Zoom Meeting - Water Model Review

Hi Joe,

I hope you had a good long weekend.

May you please advise if you have received the scope Mattamy/Coscorp WSP report and advise when you expect to circulate?

Regards,

Mack McLean, P. Eng.

david schaeffer engineering ltd.

600 Alden Road, Suite 606
Markham, ON L3R 0E7

phone: (437) 880-3419
cell: (647) 225-1874
fax: (905) 475-3081
email: mmclean@DSEL.ca

APPENDIX C

CORRESPONDENCE REGARDING SANITARY SERVICING

Elizabeth Reid

To: Alexandra Schaeffer
Subject: RE: Erin Trunk Sewers & SPSs - Mattamy Homes and Derrydale Golf Sanitary Servicing

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From: Joe Mullan <joe.mullan@ainleygroup.com>
Sent: May 16, 2022 2:54 PM
To: Ryan Oosterhoff <Ryan.Oosterhoff@mattamycorp.com>; Jason Suddergaard <Jason.Suddergaard@mattamycorp.com>; jswartz@empirecommunities.com; Tom Baskerville <tbaskerville@coscorp.ca>
Cc: Nathan Hyde <Nathan.Hyde@erin.ca>; Nick Colucci <nick.colucci@erin.ca>; Quinto Annibale <qannibale@loonix.com>; Claudio Micelli <Claudio.Micelli@wsp.com>; John Tjeerdsma <JTjeerdsma@dsel.ca>; Dragan Zec - Urbantech (dzec@urbantech.com) <dzec@urbantech.com>
Subject: Erin Trunk Sewers & SPSs - Mattamy Homes and Derrydale Golf Sanitary Servicing

EXTERNAL E-MAIL - Do not click links or open attachments unless you recognize the sender.

Hi Ryan:

I apologize for delay in this response, but there has been a lot of things happening on this project over the past four weeks, which has caused our delay in getting a response back to you and your team.

Following Solmar advising the Town in mid-Apr that they did not wish to pay the extra monies to have the Trunk Sewer downstream of Dundas St lowered, WSP re-evaluated the overall collection system including the need for a Sewage Pumping Station in Hillsburgh and have recently presented a new Design solution to the Town which includes the following components

Segment 1	Erin Sewage Pumping Station (E-SPS-1) in Lions Park and forcemains to the WWTP (No Change from Class EA)
Segment 2	Micro-Tunnelled Trunk Sanitary Sewer on Main Street from (E-SPS-1) to the intersection with the Eora Cataract Trail. (This has been changed to a larger diameter pipe that will be lower than proposed in the Class EA)
Segment 3	Trunk Sanitary Gravity Sewer from Hillsburgh to Erin via the Eora Cataract Trail. (This has changed from a Sewage Pumping Station (H-SPS-1) in Hillsburgh and forcemain(s) to Erin, via the Eora Cataract Trail, to a trunk gravity sewer from Hillsburgh to Erin).
Segment 4	Trunk Sanitary Sewer on Trafalgar Road in Hillsburgh from Eora Cataract Trail to Queen Street (No Change from Class EA)

In conjunction with latest design solution, it was determined that the Town needs to proceed with the Tendering and award of these Infrastructure Segments ASAP, to comply with the timelines in the executed Front Ending Agreements and to ensure that the Contracts can be awarded by Town Council, before the date when the pending Municipal Election would render Council not able to make a significant financial decision.

As such the following tendering and awards have now been set and WSP is proceeding to comply:

Linear Works contract – Segments 2, 3 & 4

Request for Tender (RFT) issue date	May 19
Bid Closing date	June 16
Council Award date	June 30

Sewage Pumping Station (SPS) contract – Segment 1

RFT issue date	May 26
Bid Closing date	June 23
Council Award date	July 7

While the proposed design solution will not permit Mattamy Homes and Empire Communities to drain the sewage flows from your developments to the trunk sewer via gravity, it still provides significant benefit as it will allow Mattamy Homes and Empire Communities to discharge your sewage flows to the gravity sewer on the Elora Cataract Trailway at the intersection with Sideroad 17, which is significantly closer and less disruptive than having to construct a forcemain along Dundas St West to Main St.

In conjunction with all this, Quinto's office is working with Watson and Associates to develop updated Cost Sharing Tables and we anticipate that follow-up meetings with all Developers will be arranged in early summer to review and discuss the updated financial tables.

Thank you for your patience and please let me know if you have any additional questions.

Regards,

J. A. Mullan, P.Eng.
President & CEO

Ainley GROUP

Tel: (705) 445-3451 Ext. 126
Cell: (705) 718-7230

WWW.AINLEYGROUP.COM

From: Ryan Oosterhoff <Ryan.Oosterhoff@mattamycorp.com>
Sent: Wednesday, May 11, 2022 9:40 AM
To: Joe Mullan <joe.mullan@ainleygroup.com>; Jason Suddergaard <Jason.Suddergaard@mattamycorp.com>; jswartz@empirecommunities.com; Tom Baskerville <tbaskerville@coscorp.ca>
Cc: Nathan Hyde <Nathan.Hyde@erin.ca>; Nick Colucci <nick.colucci@erin.ca>; Quinto Annibale <qannibale@loonix.com>; Claudio Micelli <Claudio.Micelli@wsp.com>; John Tjeerdsma <jtjeerdsma@dsel.ca>; Dragan Zec - Urbantech (dzec@urbantech.com) <dzec@urbantech.com>
Subject: RE: [EXTERNAL] Erin Trunk Sewers & SPSs - Mattamy Homes and Derrydale Golf Sanitary Servicing

Good morning Joe, hope all is well.
Wondering if there is any update you can provide with respect to the alternative Sanitary sewer design that WSP is working on? We are eager, as is the Town, to ensure the most efficient and cost effective design is implemented and would like to suggest a meeting with our engineers and WSP even if a design alternative has not been completed. Both Urbantech and DSEL, the engineering consultants for Empire and Mattamy respectively, have been analysing this over the past few months and a meeting to share design ideas and collaborate on this matter may prove to be of value.
We can make ourselves available to accommodate the Town and WSP's availability.

Much appreciated,

Ryan Oosterhoff
289.981.9056

From: Ryan Oosterhoff
Sent: May 2, 2022 1:44 PM
To: Joe Mullan <joe.mullan@ainleygroup.com>; Jason Suddergaard <Jason.Suddergaard@mattamycorp.com>; jswartz@empirecommunities.com; Tom Baskerville <tbaskerville@coscorp.ca>
Cc: Nathan Hyde <Nathan.Hyde@erin.ca>; Nick Colucci <nick.colucci@erin.ca>; Quinto Annibale <qannibale@loonix.com>; Claudio Micelli <Claudio.Micelli@wsp.com>; John Tjeerdsma <jtjeerdsma@dsel.ca>; Dragan Zec - Urbantech (dzec@urbantech.com) <dzec@urbantech.com>
Subject: RE: [EXTERNAL] Erin Trunk Sewers & SPSs - Mattamy Homes and Derrydale Golf Sanitary Servicing

Good afternoon Joe
Following up to see how your meeting with WSP went last week and if there is anything you can update us on.

Thanks,

Ryan Oosterhoff
289.981.9056

From: Joe Mullan <joe.mullan@ainleygroup.com>
Sent: April 25, 2022 10:04 AM
To: Ryan Oosterhoff <Ryan.Oosterhoff@mattamycorp.com>; Jason Suddergaard <Jason.Suddergaard@mattamycorp.com>; jswartz@empirecommunities.com; Tom Baskerville <tbaskerville@coscorp.ca>
Cc: Nathan Hyde <Nathan.Hyde@erin.ca>; Nick Colucci <nick.colucci@erin.ca>; Quinto Annibale <qannibale@loonix.com>; Claudio Micelli <Claudio.Micelli@wsp.com>; John Tjeerdsma <jtjeerdsma@dsel.ca>; Dragan Zec - Urbantech (dzec@urbantech.com) <dzec@urbantech.com>
Subject: [EXTERNAL] Erin Trunk Sewers & SPSs - Mattamy Homes and Derrydale Golf Sanitary Servicing

Hi Ryan:

I was out of the office on vacation for a week, so I apologize for the delayed response.

We have a mtg with WSP on Wed, to review and discuss the overall Design and we will be discussing the options for the collections system, given Solmar's recent decision not to pay the additional costs for the lowering of the trunk sewer downstream of the Main St & Dundas St intersection. As such, I will follow up with you after Wed's mtg to discus next steps.

Regards,

J. A. Mullan, P.Eng.
President & CEO

Tel: (705) 445-3451 Ext. 126
Cell: (705) 718-7230

WWW.AINLEYGROUP.COM

**** Please note that we have transitioned our email addresses to a new format. While my previous address will continue to work, we ask that you please update your address book with my new email address: Joe.Mullan@ainleygroup.com ****

From: Ryan Oosterhoff <Ryan.Oosterhoff@mattamycorp.com>
Sent: Monday, April 25, 2022 9:00 AM
To: Joe Mullan <joe.mullan@ainleygroup.com>; Jason Suddergaard <Jason.Suddergaard@mattamycorp.com>; jswartz@empirecommunities.com; Tom Baskerville <tbaskerville@coscorp.ca>
Cc: Nathan Hyde <Nathan.Hyde@erin.ca>; Nick Colucci <nick.colucci@erin.ca>; Quinto Annibale <qannibale@loonix.com>; Claudio Micelli <Claudio.Micelli@wsp.com>; John Tjeerdsma <jtjeerdsma@dsel.ca>; Dragan Zec - Urbantech (dzec@urbantech.com) <dzec@urbantech.com>
Subject: RE: [EXTERNAL] Erin Trunk Sewers & SPSs - Mattamy Homes and Derrydale Golf Sanitary Servicing

Good morning Joe, I hope all is well.
Following up on our request, per the email below, and hoping we can meet with WSP to discuss.
I understand from Nick that Solmar declined the most recent proposal and that WSP is looking at an alternative design – perhaps we can arrange a meeting for when they expect to have this completed.

Thanks,

Ryan Oosterhoff
289.981.9056

From: Ryan Oosterhoff
Sent: April 13, 2022 9:42 AM
To: Joe Mullan <joe.mullan@ainleygroup.com>; Jason Suddergaard <Jason.Suddergaard@mattamycorp.com>; jswartz@empirecommunities.com; Tom Baskerville <tbaskerville@coscorp.ca>
Cc: Nathan Hyde <Nathan.Hyde@erin.ca>; Nick Colucci <nick.colucci@erin.ca>; Quinto Annibale <qannibale@loonix.com>; Claudio Micelli <Claudio.Micelli@wsp.com>; John Tjeerdsma <jtjeerdsma@dsel.ca>; Dragan Zec - Urbantech (dzec@urbantech.com) <dzec@urbantech.com>
Subject: RE: [EXTERNAL] Erin Trunk Sewers & SPSs - Mattamy Homes and Derrydale Golf Sanitary Servicing

Good Morning Joe

Thank you for investigating the lowering of the Trunk Sanitary Sewers in Erin & Hillsburgh to determine if the Mattamy/Corcorp/Empire lands could be accommodated by gravity. We have reviewed the memo provided which was helpful however there remains a number of questions related to the design and the assumptions being made that we and our engineers are unable to reconcile and are hoping we could arrange a meeting with yourself and WSP to review some of these technical matters. We understand time is of the essence for us to confirm our decision on the alternatives presented below and as such would request your availability for next week. As a suggestion, the participants of the allocation program are meeting at the Town's office next week Wednesday, April 20th, at 10:30 a.m., perhaps we could arrange a meeting to discuss the sanitary trunk lowering at 9/9:30 that same day.

Thanks,

Ryan Oosterhoff
289.981.9056

From: Joe Mullan <joe.mullan@ainleygroup.com>
Sent: April 4, 2022 11:10 AM
To: Frank Miceli <fmiceli@westonlaw.ca>; Jason Suddergaard <Jason.Suddergaard@mattamycorp.com>; Ryan Oosterhoff <ryan.oosterhoff@mattamycorp.com>
Cc: Nathan Hyde <Nathan.Hyde@erin.ca>; Nick Colucci <nick.colucci@erin.ca>; Quinto Annibale <qannibale@loonix.com>; Claudio Micelli <Claudio.Micelli@wsp.com>
Subject: [EXTERNAL] Erin Trunk Sewers & SPSs - Mattamy Homes and Derrydale Golf Sanitary Servicing

Hi Everyone:

As you know WSP are proceeding with the design of the Trunk Sanitary Sewers in Erin & Hillsburgh (Segments 1, 2, 3 & 4) to accommodate the servicing of the new developments in Erin & Hillsburgh. During the design, WSP were required to investigate the lowering of the trunk sanitary sewers in Erin, such that the new developments could drain to the trunk sewer, via gravity and avoid the developers having to design and construct sewage pumping stations in conjunction with their developments. Note in accordance with the approved Wastewater Class EA, dated Oct. 2019, Mattamy Homes and Derrydale Golf would be required to design and construct sewage pumping station(s) within your developments along with a forcemain to discharge the flows to the trunk sewer at the intersection of Dundas Street and Main Street in Erin.

WSP have developed a scenario, outlined in the attached Tech Memo, whereby the trunk sewer on Main Street in Erin, could be lowered and extended along Main Street from Dundas St to the Elora Cataract Trail and along the Elora Cataract Trail to Sideroad 17, such that Mattamy Homes & Derrydale Golf could eliminate the proposed sewage pumping station(s) within their developments; however, Mattamy Homes & Derrydale Golf would be solely responsible for the increased cost of $14.0 Million to lower the trunk sewer. Note the feasibility of this alternative is conditional upon Solmar agreeing to pay additional costs for the lowering of the trunk sewer on Main Street between Lions Park Pumping Station and Dundas Street and a similar Tech Memo relating to their additional costs has been sent to Solmar.

Given that time is of the essence, we would like to get a decision on which alternative to proceed with asap, and the alternatives are:

i. The Town proceed with the design and construction of a deep trunk sewer on Main Street that is lowered and extended along Main Street, from Dundas Street to the Elora Cataract Trail, and along the Elora Cataract Trail to Sideroad 17, with all Developers sharing in the cost of the "shallow" trunk sewer cost, as per the executed Agreements with the Town, and Mattamy Homes & Derrydale Golf paying the additional $14.0 Million to lower and extend the trunk sewer, as per the attached Tech Memo.

   or

ii. The Town proceed with the design and construction of "shallow" trunk sewer on Main Street, as per the approved Wastewater Class EA, with all Developers sharing in the cost in accordance with the executed Agreements with the Town.

After you and your teams have a chance to review this information, we would be happy to arrange a meeting to discuss, if necessary.

Regards,

J. A. Mullan, P.Eng.
President & CEO

Tel: (705) 445-3451 Ext. 126
Cell: (705) 718-7230

WWW.AINLEYGROUP.COM

**** Please note that we have transitioned our email addresses to a new format. While my previous address will continue to work, we ask that you please update your address book with my new email address: Joe.Mullan@ainleygroup.com ****

From: Aghniaey, Nima <Nima.Aghniaey1@wsp.com>
Sent: September 26, 2023 10:58 AM
To: Mack McLean; Micelli, Claudio
Cc: Hardy, Melissa; Khalid Rahman
Subject: RE: Nick Colucci's Zoom Meeting re: Mattamy/Coscorp: Engineering Commentss on FSR

Good morning Mack,

Apologies for the late reply. Please see below an update on the status of design for the ECT linear works:

60% design drawings were submitted to CVC In August for review. A copy was submitted to you as well. We have been waiting for their comments before we can update and finalize the drawings. We received CVC comments earlier today and have started addressing them. Our plan is to issue the 100% drawings in the next three to 4 weeks. We will send you a copy of the updated design drawings (in pdf and CAD as requested) once they are ready.

Please let me know if you have any questions or concerns.

Thanks,
Nima Aghniaey

From: Mack McLean <MMcLean@dsel.ca>
Sent: Wednesday, September 20, 2023 5:24 PM
To: Aghniaey, Nima <Nima.Aghniaey1@wsp.com>; Micelli, Claudio <Claudio.Micelli@wsp.com>
Cc: Hardy, Melissa <Melissa.Hardy@wsp.com>; Khalid Rahman <Khalid.Rahman@erin.ca>
Subject: RE: Nick Colucci's Zoom Meeting re: Mattamy/Coscorp: Engineering Commentss on FSR
Importance: High

Hi Nima and Claudio,

May you please advise on the status of the design? As you know this is critical to our design to ensure the sewer has been lowered a sufficient amount and our comments addressed.

Please confirm and provide detailed pdf and CAD inclusive of MH at your convenience. Thank you in advance.

Regards,

Mack McLean, P. Eng.

david schaeffer engineering ltd.

600 Alden Road, Suite 606
Markham, ON L3R 0E7

phone: (437) 880-3419
cell: (647) 225-1874
fax: (905) 475-3081
email: mmclean@DSEL.ca

From: Mack McLean
Sent: Wednesday, September 13, 2023 4:54 PM
To: 'Aghniaey, Nima' <Nima.Aghniaey1@wsp.com>; 'Micelli, Claudio' <Claudio.Micelli@wsp.com>
Cc: 'Hardy, Melissa' <Melissa.Hardy@wsp.com>
Subject: RE: Nick Colucci's Zoom Meeting re: Mattamy/Coscorp: Engineering Commentss on FSR

Hi Nima and Claudio,

May you please provide CAD with the latest design including the MH on Sdrd 17?

Regards,

Mack McLean, P. Eng.

DSEL
david schaeffer engineering ltd.

600 Alden Road, Suite 606
Markham, ON L3R 0E7

phone: (437) 880-3419
cell: (647) 225-1874
fax: (905) 475-3081
email: mmclean@DSEL.ca

From: Mack McLean
Sent: Tuesday, September 5, 2023 8:56 PM
To: 'Aghniaey, Nima' <Nima.Aghniaey1@wsp.com>; Micelli, Claudio <Claudio.Micelli@wsp.com>
Cc: Hardy, Melissa <Melissa.Hardy@wsp.com>
Subject: RE: Nick Colucci's Zoom Meeting re: Mattamy/Coscorp: Engineering Commentss on FSR

Thanks Nima.

Do you CAD you are able to circulate?

Regards,

Mack McLean, P. Eng.

david schaeffer engineering ltd.

600 Alden Road, Suite 606
Markham, ON L3R 0E7

phone: (437) 880-3419
cell: (647) 225-1874
fax: (905) 475-3081
email: mmclean@DSEL.ca

From: Aghniaey, Nima <Nima.Aghniaey1@wsp.com>
Sent: Tuesday, September 5, 2023 9:18 AM
To: Mack McLean <MMcLean@dsel.ca>; Micelli, Claudio <Claudio.Micelli@wsp.com>
Cc: Hardy, Melissa <Melissa.Hardy@wsp.com>
Subject: RE: Nick Colucci's Zoom Meeting re: Mattamy/Coscorp: Engineering Commentss on FSR

Good morning Mack,

Attached is draft drawing set that we submitted to the CVCA in mid-August for their review as part an access permit application. This set does not include the additional manhole you had requested at Sideroad 17 but it has been added since, as per your instructions. We are waiting for CVC's comment before we finalize the P&P design. I will submit a final version for your review.

Please let me know if you have any questions or comments.

Thanks,
Nima

From: Mack McLean <MMcLean@dsel.ca>
Sent: Friday, September 1, 2023 3:29 PM
To: Aghniaey, Nima <Nima.Aghniaey1@wsp.com>; Micelli, Claudio <Claudio.Micelli@wsp.com>
Cc: Hardy, Melissa <Melissa.Hardy@wsp.com>
Subject: RE: Nick Colucci's Zoom Meeting re: Mattamy/Coscorp: Engineering Commentss on FSR
Importance: High

HI Nima and Claudio,

May you please advise if there has been an update from the town regarding Elora Cataract trunk lowering? Additionally, do you have an estimated timeline to provide drawings for coordination slash review?

Feel free to give me a call on my cell below if you wish to discuss further. Have a great long weekend.

Regards,

Mack McLean, P. Eng.

david schaeffer engineering ltd.

600 Alden Road, Suite 606
Markham, ON L3R 0E7

phone: (437) 880-3419
cell: (647) 225-1874
fax: (905) 475-3081
email: mmclean@DSEL.ca

From: Aghniaey, Nima <Nima.Aghniaey1@wsp.com>
Sent: Tuesday, June 27, 2023 9:59 AM
To: Mack McLean <MMcLean@dsel.ca>
Cc: Hardy, Melissa <Melissa.Hardy@wsp.com>; Micelli, Claudio <Claudio.Micelli@wsp.com>
Subject: FW: Nick Colucci's Zoom Meeting re: Mattamy/Coscorp: Engineering Commentss on FSR

EXTERNAL E-MAIL - Do not click links or open attachments unless you recognize the sender.

Good morning Mack,

I am working with Claudio on the Town of Erin linear works project. I would like to have a quick meeting with you to discuss the addition of a new MH as per your previous discussions with Claudio. I am free Wednesday and Thursday afternoon, and most of next week. Please let me know when you are available to have a quick call. Thanks.

Nima Aghniaey, Ph.D., P.Eng.
(He/Him)
Senior Manager, Linear Infrastructure
Water/Wastewater

T+ 1 289-982-7447
C+ 1 416-558-9443

WSP Canada Inc.
100 Commerce Valley Drive West
Thornhill, Ontario
L3T 0A1 Canada

wsp.com

From: Mack McLean <MMcLean@dsel.ca>
Sent: Wednesday, May 24, 2023 6:24 PM
To: Nick Colucci <Nick.Colucci@erin.ca>; Micelli, Claudio <Claudio.Micelli@wsp.com>
Cc: Joe Mullan <joe.mullan@ainleygroup.com>; Khalid Rahman <Khalid.Rahman@erin.ca>
Subject: RE: Nick Colucci's Zoom Meeting re: Mattamy/Coscorp: Engineering Commentss on FSR

Hi Claudio,

For some reason attachments did not copy over. They have been reattached for your reference.

All, please reach out directly should you have any questions or concerns.

Regards,

Mack McLean, P. Eng.

DSEL
david schaeffer engineering ltd.

600 Alden Road, Suite 606
Markham, ON L3R 0E7

phone: (437) 880-3419
cell: (647) 225-1874
fax: (905) 475-3081
email: mmclean@DSEL.ca

From: Nick Colucci <Nick.Colucci@erin.ca>
Sent: Wednesday, May 24, 2023 3:40 PM
To: Micelli, Claudio <Claudio.Micelli@wsp.com>
Cc: Joe Mullan <joe.mullan@ainleygroup.com>; Mack McLean <MMcLean@dsel.ca>; Nick Colucci <Nick.Colucci@erin.ca>; Khalid Rahman <Khalid.Rahman@erin.ca>
Subject: FW: Nick Colucci's Zoom Meeting re: Mattamy/Coscorp: Engineering Commentss on FSR

Dear Claudio,

Could you please review the request in the attached email to lower the trail portion of the sewer between 17 and Main Street to accommodate a gravity sewer?

I believe we may have looked at this option in the past?

Thank you,

Nick


TOWN OF ERIN

Nick Colucci P.Eng., BASc, MBA, FEC

Director of Infrastructure &
Engineering Services

519-855-4407 Ext.227
Nick.Colucci@erin.ca
5684 Trafalgar Rd, Hillsburgh
ON, N0B 1Z0
www.erin.ca

From: Mack McLean [mailto:MMcLean@dsel.ca]
Sent: Wednesday, May 24, 2023 3:36 PM
To: Nick Colucci <Nick.Colucci@erin.ca>
Subject: Fwd: Nick Colucci's Zoom Meeting re: Mattamy/Coscorp: Engineering Commentss on FSR

Yours truly,

Mack McLean

DSEL
david schaeffer engineering ltd.

600 Alden Road, Suite 700
Markham, ON L3R 0E7

phone: (905) 475-3080 ext.211
cell: (647) 225-1874
fax: (905) 475-3081
email: MMcLean@dsel.ca

Begin forwarded message:

From: Mack McLean <MMcLean@dsel.ca>
Date: May 17, 2023 at 3:47:00 PM EDT
To: Nick Colucci <Nick.Colucci@erin.ca>, Leonard Borgdorff <leonard.borgdorff@ainleygroup.com>
Cc: Tom Baskerville <tbaskerville@coscorp.ca>, Joe Mullan <joe.mullan@ainleygroup.com>, John Tjeerdsma <JTjeerdsma@dsel.ca>, Alexander Drung <Alexander.Drung@mattamycorp.com>
Subject: RE: Nick Colucci's Zoom Meeting re: Mattamy/Coscorp: Engineering Commentss on FSR

Hi Nick,

As discussed in our meeting on April 27, 2023, we understand the Town is willing to review opportunities with WSP to revise the Elora Cataract trunk design to eliminate the need for the sanitary pump station and force main infrastructure. We strongly believe providing a gravity sewer for the community will serve as a benefit to residents, developers, and the Town. We have provided discussion on the gravity option, and a table listing cons associated with a pump station/forcemain option below.

Gravity Sanitary Sewer Solution:

As presented in the FSR, vertical constraints of proposed trunk infrastructure, and existing creek parameters eliminate the possibility for the sanitary sewer on Eighth Line to cross below the West Credit River. As a result, DSEL has investigated an alternative gravity design option, which proposes the sanitary sewer on Eighth Line to be strapped to the east side of the proposed culvert to ensure existing culvert hydraulic conveyance is not negatively impacted. Strapping the sanitary sewer to the side of the culvert will eliminate the need for sanitary sewers to cross below the creek, however these sewers will require additional measures to mitigate against frost due to lack of cover. CVC will also need to be consulted to ensure they can support this method of sanitary crossing of the creek. Please refer to *Typical Cross Section* attached illustrating how the culvert will be strapped to the side of the bridge.

Additionally, DSEL has reviewed the May 2022 Elora Cataract Trunk detailed design prepared by WSP. Based on WSPs detailed design, the Elora Cataract Trunk sewer would require to be lowered in sewer legs from 17th Sideroad to the downstream connection at the Main Street Trunk to allow for the proposed developments to drain via gravity. Please note, the proposed trunk sewer lowering is not expected to result in an unmanageable increase in tendered costs in comparison to the current design.

DSEL has the following comments on WSP's design to allow for discharge of sanitary flows. Recall, the contributing area and population from the community developments is 66 ha and 3530 persons. Markups of WSPs design is attached for your reference:

1. **Elora Cataract Sanitary Trunk Lowering**: Based on the external sanitary sewer designed by DSEL, we are formally requesting the Elora Cataract Trunk to be lowered by ~1.0m (proposed invert at STA 5+870 ~= 392.60). Doing so would allow for sanitary flows from future development via gravity. Please note, DSEL's detailed design of the external sanitary sewer provides a 375mm sanitary sewer at a 0.20%, strapping to the culvert at the bridge, and a minimum cover within the Eighth Line asphalt of 0.9m. Further refinements to minimum cover, and sewer grade can be explored with Town staff, however will impact respective sewer lowering.

   Based on DSEL's review of the trunk design, we believe the following opportunities may be explored; 1) sewer grades could be flattened in sections from 0.4% to 0.2%, and/or 2) the drop pipe at Main St. could be reduced.

2. **Addition of MH to be added on 17th Sideroad**: The current trunk design does not allow for future development to enter the trunk within 17th Sideroad allowance. Therefore, a new MH is required between H-MH-56 and H-MH-57. The preferred location would be ~ STA 5+870 to avoid conflicts with the telecoms in the south boulevard. Alternatively, H-MH-56 could be shifted to avoid introduction of another MH and mitigate further adjustments to the system. Please note a MH will be required within the 17th Sideroad for either a gravity or forcemain option.

As presented in the Table below and to support the gravity solution, we wish to highlight the following cons associated with a pump station/forcemain sanitary servicing option for Town staff review and consideration:

Pump Station + Forcemain Cons	
Maintenance	Daily Operation
1. Routine inspection of pump station and forcemains.	8. Pump stations have more components subject to failure in comparison to gravity systems.
2. Anticipated service life of pumps is less than sewers.	9. Noise generated by facility may require mitigation.
3. Longer stretches of forcemain versus gravity, making forcemain issues more difficult to isolate and repair.	10. Odour control may be required.
4. Town will be conveyed block containing pump station infrastructure. Block will require various maintenance seasonally.	11. Power must be maintained in all cases. In the event of an outage a back up power solution is required.
5. Increased operational budget costs encountered by the Town.	12. Emergency overflow is required. Typically overflow discharges to the nearest area permitting backup to disperse via gravity.
6. Operational staff completing maintenance may require training, or additional staff hired/outsourced.	13. Regular impacts to the community residents and likely increased resident complaints.
7. Others concerns?	14. Other concerns?

We greatly appreciate your time and consideration of the proposed sanitary solution. Should you have any questions or concerns please feel free to reach out our team via email or phone. Thank you in advance.

Regards,

Mack McLean, P. Eng.

<image001.png>

david schaeffer engineering ltd.

600 Alden Road, Suite 606

APPENDIX D

SANITARY DESIGN SHEETS

DAVID SCHAEFFER ENGINEERING LTD.
600 ALDEN ROAD, SUITE 606
MARKHAM, ONTARIO
L3R 0E7
TEL: (905) 475-3080
FAX: (905) 475-3081

SANITARY SEWER DESIGN

n (PVC): 0.013
n (Conc): 0.013

Single Family: 2.8 pph
Semi-detached: 2.8 pph
Townhouse: 2.8 pph
Commercial: 100 pph
Community Services 70 pph
School 60 pph
Infil.Flow (INF): 0.29 L/s/ha

SHEET No.: 1 OF 3
LOCATION: TOWN OF ERIN
PROJECT No.: 21-1242
DATE: 18 Jul 2024
DESIGNED BY: C.B.
CHECKED BY: P.P.

STREET	MANHOLE		LENGTH (m)	TRIBUTARY AREA HECTARE							POPULATION TRIBUTARY						AVG. L/s INC.	AVG. L/s TOTAL	PEAKING FACTOR	MAX L/s	INF. L/s	MAX FLOW EXP.	SEWER					PIPE		Q/Qf	REMARKS
				INCREMENT						TOTAL	INCREMENT					TOTAL							SIZE	SLOPE	Q L/s	VEL (m/s)					
	FROM	TO		SINGLE F.	SEMI.	TOWNHOUSE	COMMERCIAL	SCHOOL	INFILT		SINGLE F.	SEMI.	TOWNHOUSE	COMMERCIAL	SCHOOL											FULL	ACT.	TYPE	CLASS		
STREET B																															
	38A	39A	74.5	0.59						0.59	59					59	0.20	0.20	4.00	0.79	0.17	0.96	200	2.90	55.85	1.78	0.67	PVC	SDR-35	0.02	
	39A	40A	74.5	0.55						1.14	59					118	0.20	0.40	4.00	1.58	0.33	1.91	200	2.90	55.85	1.78	0.82	PVC	SDR-35	0.03	
	40A	41A	74.5	0.51						1.65	51					169	0.17	0.57	4.00	2.27	0.48	2.75	200	1.30	37.40	1.19	0.69	PVC	SDR-35	0.07	
To STREET D, Pipe 41A - 42A										1.65						169															
STREET C																															
				0.08						0.08	9					9															
	34A	35A	79.0	0.59						0.67	42					51	0.14	0.17	4.00	0.68	0.19	0.88	200	2.40	50.81	1.62	0.61	PVC	SDR-35	0.02	
	35A	36A	79.0	0.62						1.29	59					110	0.20	0.37	4.00	1.48	0.37	1.85	200	2.85	55.37	1.76	0.81	PVC	SDR-35	0.03	
	36A	37A	79.0	0.51						1.80	45					155	0.15	0.52	4.00	2.08	0.52	2.60	200	1.50	40.17	1.28	0.71	PVC	SDR-35	0.06	
To STREET D, Pipe 37A - 41A										1.80						155															
	43A	44A	65.0	0.40						0.40	20					20	0.07	0.07	4.00	0.27	0.12	0.38	200	4.95	72.97	2.32	0.60	PVC	SDR-35	0.01	
	44A	45A	65.0	0.30						0.70	17					37	0.06	0.12	4.00	0.50	0.20	0.70	200	5.00	73.34	2.33	0.71	PVC	SDR-35	0.01	
	45A	46A	12.0	0.16						0.86	6					43	0.02	0.14	4.00	0.58	0.25	0.83	200	1.45	39.49	1.26	0.50	PVC	SDR-35	0.02	
	46A	47A	78.0	0.75						1.61	45					88	0.15	0.30	4.00	1.18	0.47	1.65	200	2.60	52.89	1.68	0.76	PVC	SDR-35	0.03	
	47A	48A	78.0	0.64						2.25	51					139	0.17	0.47	4.00	1.87	0.65	2.52	200	2.65	53.39	1.70	0.86	PVC	SDR-35	0.05	
	48A	49A	78.0	0.58						2.83	42					181	0.14	0.61	4.00	2.43	0.82	3.25	200	2.95	56.33	1.79	0.96	PVC	SDR-35	0.06	
To STREET A, Pipe 49A - 50A										2.83						181															
STREET D																															
	27A	28A	25.0	0.65						0.65	26					26	0.09	0.09	4.00	0.35	0.19	0.54	200	1.70	42.76	1.36	0.45	PVC	SDR-35	0.01	
	28A	29A	81.0	0.59						1.24	40					66	0.13	0.22	4.00	0.89	0.36	1.25	200	2.85	55.37	1.76	0.71	PVC	SDR-35	0.02	
	29A	30A	81.0	0.63						1.87	48					114	0.16	0.38	4.00	1.53	0.54	2.07	200	4.00	65.60	2.09	0.94	PVC	SDR-35	0.03	
	30A	31A	81.0	0.51						2.38	34					148	0.11	0.50	4.00	1.99	0.69	2.68	200	2.05	46.96	1.49	0.80	PVC	SDR-35	0.06	
To STREET D, Pipe 31A - 32A										2.38						148															
STREET F																															
	5A	6A	75.0	0.53						0.53	34					34	0.11	0.11	4.00	0.46	0.15	0.61	200	3.05	57.28	1.82	0.58	PVC	SDR-35	0.01	
	6A	7A	7.5							0.53						34		0.11	4.00	0.46	0.15	0.61	200	1.00	32.80	1.04	0.39	PVC	SDR-35	0.02	
To STREET E, Pipe 7A - 8A										0.53						34															
	13A	14A	77.5	0.69						0.69	51					51	0.17	0.17	4.00	0.68	0.20	0.88	200	2.50	51.86	1.65	0.62	PVC	SDR-35	0.02	
	14A	15A	51.5	0.39						1.08	28					79	0.09	0.27	4.00	1.06	0.31	1.37	200	3.00	56.81	1.81	0.75	PVC	SDR-35	0.02	
	15A	22A	37.5	0.25						1.33	14					93	0.05	0.31	4.00	1.25	0.39	1.63	200	1.90	45.21	1.44	0.68	PVC	SDR-35	0.04	
To STREET D, Pipe 22A - 23A										1.33						93															
STREET E																															
	20A	21A	33.5	0.27						0.27	9					9	0.03	0.03	4.00	0.12	0.08	0.20	200	1.90	45.21	1.44	0.35	PVC	SDR-35	0.00	
To STREET D, Pipe 21A - 22A										0.27						9															
	16A	17A	83.5	0.98						0.98	48					48	0.16	0.16	4.00	0.64	0.28	0.93	200	2.35	50.28	1.60	0.60	PVC	SDR-35	0.02	
	17A	18A	72.0	0.96						1.94	40					88	0.13	0.30	4.00	1.18	0.56	1.74	200	2.30	49.74	1.58	0.73	PVC	SDR-35	0.04	
	18A	19A	40.5	0.41						2.35	17					105	0.06	0.35	4.00	1.41	0.68	2.09	200	4.25	67.62	2.15	0.97	PVC	SDR-35	0.03	
	19A	21A	14.5	0.16						2.51	6					111	0.02	0.37	4.00	1.49	0.73	2.22	200	2.95	56.33	1.79	0.87	PVC	SDR-35	0.04	
To STREET D, Pipe 21A - 22A										2.51						111															
	1A	2A	45.5	0.59						0.59	14					14	0.05	0.05	4.00	0.19	0.17	0.36	200	4.55	69.96	2.23	0.57	PVC	SDR-35	0.01	
	2A	3A	39.0	0.31						0.90	12					26	0.04	0.09	4.00	0.35	0.26	0.61	200	4.70	71.11	2.26	0.69	PVC	SDR-35	0.01	

DAVID SCHAEFFER ENGINEERING LTD.
600 ALDEN ROAD, SUITE 606
MARKHAM, ONTARIO
L3R 0E7
TEL: (905) 475-3080
FAX: (905) 475-3081

SANITARY SEWER DESIGN

SHEET No.: 2 OF 3
LOCATION: TOWN OF ERIN
PROJECT No.: 21-1242
DATE: 18 Jul 2024
DESIGNED BY: C.B.
CHECKED BY: P.P.

Single Family: 2.8 pph
Semi-detached: 2.8 pph
Townhouse: 2.8 pph
Commercial: 100 pph
Community Services 70 pph
School 60 pph
Infil.Flow (INF): 0.29 L/s/ha

n (PVC): 0.013
n (Conc): 0.013

Note: To be conservative, industrial Kav is considered to be 1

STREET	MANHOLE		LENGTH (m)	TRIBUTARY AREA HECTARE							POPULATION TRIBUTARY						AVG. L/s INC.	AVG. L/s TOTAL	PEAKING FACTOR	MAX L/s	INF. L/s	MAX FLOW EXP.	SEWER					PIPE		Q/Qf	REMARKS
				INCREMENT						TOTAL	INCREMENT					TOTAL							SIZE	SLOPE	Q L/s	VEL (m/s)					
	FROM	TO		SINGLE F.	SEMI.	TOWNHOUSE	COMMERCIAL	SCHOOL	INFILT		SINGLE F.	SEMI.	TOWNHOUSE	COMMERCIAL	SCHOOL											FULL	ACT.	TYPE	CLASS		
	3A	4A	32.5	0.29						1.19	9					35	0.03	0.12	4.00	0.47	0.35	0.82	200	4.90	72.60	2.31	0.74	PVC	SDR-35	0.01	
	4A	7A	28.5	0.19						1.38	9					44	0.03	0.15	4.00	0.59	0.40	0.99	200	6.00	80.34	2.56	0.85	PVC	SDR-35	0.01	
Contribution From STREET F, Pipe 6A - 7A										0.53						34															
	7A	8A	29.5	0.15						2.06	9					87	0.03	0.29	4.00	1.17	0.60	1.77	200	2.80	54.88	1.75	0.79	PVC	SDR-35	0.03	
	8A	9A	58.0	0.37						2.43	17					104	0.06	0.35	4.00	1.40	0.70	2.10	200	4.20	67.22	2.14	0.96	PVC	SDR-35	0.03	
	9A	10A	20.5	0.26						2.69	14					118	0.05	0.40	4.00	1.58	0.78	2.36	200	1.50	40.17	1.28	0.69	PVC	SDR-35	0.06	
	10A	11A	63.0	0.45						3.14	42					160	0.14	0.54	4.00	2.15	0.91	3.06	200	2.00	46.38	1.48	0.82	PVC	SDR-35	0.07	
	11A	12A	37.5	0.25						3.39	23					183	0.08	0.61	4.00	2.46	0.98	3.44	200	1.95	45.80	1.46	0.86	PVC	SDR-35	0.08	
	12A	23A	34.0	0.26						3.65	20					203	0.07	0.68	4.00	2.73	1.06	3.78	200	1.00	32.80	1.04	0.69	PVC	SDR-35	0.12	
To STREET D, Pipe 23A - 24A										3.65						203															
STREET D																															
Contribution From STREET D, Pipe 30A - 31A										2.38						148															
	31A	32A	11.5							2.38						148		0.50	4.00	1.99	0.69	2.68	200	1.00	32.80	1.04	0.62	PVC	SDR-35	0.08	
Contribution From STREET E, Pipe 19A - 21A										2.51						111															
Contribution From STREET E, Pipe 20A - 21A										0.27						9															
	21A	22A	87.5	0.46						3.24	23					143	0.08	0.48	4.00	1.92	0.94	2.86	200	5.05	73.71	2.35	1.11	PVC	SDR-35	0.04	
Contribution From STREET F, Pipe 15A - 22A										1.33						93															
	22A	23A	76.0	0.47						5.04	20					256	0.07	0.86	4.00	3.44	1.46	4.90	200	5.00	73.34	2.33	1.33	PVC	SDR-35	0.07	
Contribution From STREET E, Pipe 12A - 23A										3.65						203															
	23A	24A	59.0	0.49						9.18	12					471	0.04	1.58	3.99	6.31	2.66	8.97	200	5.05	73.71	2.35	1.59	PVC	SDR-35	0.12	
	24A	25A	53.5							9.18						471		1.58	3.99	6.31	2.66	8.97	200	5.95	80.00	2.55	1.68	PVC	SDR-35	0.11	
	25A	26A	41.5							9.18						471		1.58	3.99	6.31	2.66	8.97	200	1.85	44.61	1.42	1.10	PVC	SDR-35	0.20	
				0.30						9.48	12					483															
	26A	32A	48.0	1.03						10.51	207					690	0.69	2.32	3.90	9.03	3.05	12.08	200	2.15	48.09	1.53	1.27	PVC	SDR-35	0.25	
	32A	33A	29.5	0.23						13.12	9					847	0.03	2.84	3.85	10.95	3.80	14.75	200	2.00	46.38	1.48	1.31	PVC	SDR-35	0.32	
	33A	37A	36.0	0.20						13.32	6					853	0.02	2.86	3.84	10.99	3.86	14.86	200	2.45	51.34	1.63	1.41	PVC	SDR-35	0.29	
Contribution From STREET C, Pipe 36A - 37A										1.80						155															
	37A	41A	72.5	0.43						15.55	23					1031	0.08	3.46	3.79	13.12	4.51	17.62	200	3.75	63.51	2.02	1.73	PVC	SDR-35	0.28	
Contribution From STREET B, Pipe 40A - 41A										1.65						169															
	41A	42A	66.5	0.32						17.52	17					1217	0.06	4.08	3.74	15.28	5.08	20.36	200	1.85	44.61	1.42	1.38	PVC	SDR-35	0.46	
To STREET A, Pipe 42A - 49A										17.52						1217															
STREET A																															
Contribution From STREET D, Pipe 41A - 42A										17.52						1217															
	42A	49A	13.0							17.52						1217		4.08	3.74	15.28	5.08	20.36	200	6.00	80.34	2.56	2.12	PVC	SDR-35	0.25	
Contribution From STREET C, Pipe 48A - 49A										2.83						181															
	49A	50A	58.0	0.38						20.73	17					1415	0.06	4.75	3.70	17.57	6.01	23.58	200	3.40	60.48	1.93	1.80	PVC	SDR-35	0.39	
	50A	51A	58.0	0.75						21.48	14					1429	0.05	4.80	3.69	17.70	6.23	23.93	200	2.75	54.39	1.73	1.67	PVC	SDR-35	0.44	
To TRUNK 1 - SAN EASEMENT, Pipe 51A - 52A										21.48						1429															
TRUNK 1 - SAN EASEMENT																															
Contribution From STREET A, Pipe 50A - 51A										21.48						1429															
	51A	52A	18.5	2.02						23.50	403					1832	1.35	6.15	3.62	22.26	6.82	29.07	250	0.50	42.05	0.86	0.92	PVC	SDR-35	0.69	
	52A	53A	72.0						0.09	23.59						1832		6.15	3.62	22.26	6.84	29.10	250	0.50	42.05	0.86	0.92	PVC	SDR-35	0.69	
	53A	54A	55.5							23.59						1832		6.15	3.62	22.26	6.84	29.10	250	0.50	42.05	0.86	0.92	PVC	SDR-21	0.69	
	54A	55A	80.5						0.18	23.77						1832		6.15	3.62	22.26	6.89	29.15	300	0.30	52.97	0.75	0.76	PVC	SDR-35	0.55	
	55A	56A	36.0							23.77						1832		6.15	3.62	22.26	6.89	29.15	300	0.30	52.97	0.75	0.76	PVC	SDR-35	0.55	
	56A	57A	59.5						0.21	23.98						1832		6.15	3.62	22.26	6.95	29.21	300	0.30	52.97	0.75	0.77	PVC	SDR-35	0.55	
	57A	58A	13.5							23.98						1832		6.15	3.62	22.26	6.95	29.21	300	0.30	52.97	0.75	0.77	PVC	SDR-35	0.55	
	58A	59A	59.0							23.98						1832		6.15	3.62	22.26	6.95	29.21	300	0.30	52.97	0.75	0.77	PVC	SDR-35	0.55	
	59A	1008A	13.5							23.98						1832		6.15	3.62	22.26	6.95	29.21	300	0.30	52.97	0.75	0.77	PVC	SDR-35	0.55	
To EIGHTH LINE, Pipe 1008A - 1009A										23.98						1832															

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SANITARY SEWER DESIGN

SHEET No.: 3 OF 3
LOCATION: TOWN OF ERIN
PROJECT No.: 21-1242
DATE: 18 Jul 2024
DESIGNED BY: C.B.
CHECKED BY: P.P.

Single Family: 2.8 pph
Semi-detached: 2.8 pph
Townhouse: 2.8 pph
Commercial: 100 pph
Community Services 70 pph
School 60 pph
Infil.Flow (INF): 0.29 L/s/ha

n (PVC): 0.013
n (Conc): 0.013

Note: To be conservative, industrial Kav is considered to be 1

STREET	MANHOLE		LENGTH (m)	TRIBUTARY AREA HECTARE							POPULATION TRIBUTARY						AVG. L/s INC.	AVG. L/s TOTAL	PEAKING FACTOR	MAX L/s	INF. L/s	MAX FLOW EXP.	SEWER					PIPE		Q/Qf	REMARKS
				INCREMENT						TOTAL	INCREMENT					TOTAL							SIZE	SLOPE	Q L/s	VEL (m/s)					
	FROM	TO		SINGLE F.	SEMI.	TOWNHOUSE	COMMERCIAL	SCHOOL	INFILT		SINGLE F.	SEMI.	TOWNHOUSE	COMMERCIAL	SCHOOL											FULL	ACT.	TYPE	CLASS		
STREET H																															
	63A	64A	24.0	0.52						0.52	20					20	0.07	0.07	4.00	0.27	0.15	0.42	200	1.85	44.61	1.42	0.43	PVC	SDR-35	0.01	
	64A	78A	86.5	0.60						1.12	26					46	0.09	0.15	4.00	0.62	0.32	0.94	200	1.00	32.80	1.04	0.46	PVC	SDR-35	0.03	
To STREET E, Pipe 78A - 1001A										1.12						46															
STREET G																															
	65A	66A	35.5	0.80						0.80	28					28	0.09	0.09	4.00	0.38	0.23	0.61	200	5.00	73.34	2.33	0.68	PVC	SDR-35	0.01	
	66A	67A	34.5	0.41						1.21	20					48	0.07	0.16	4.00	0.64	0.35	1.00	200	3.55	61.80	1.97	0.71	PVC	SDR-35	0.02	
	67A	68A	11.0	0.19						1.40	6					54	0.02	0.18	4.00	0.73	0.41	1.13	200	3.95	65.19	2.07	0.78	PVC	SDR-35	0.02	
	68A	69A	93.0	0.55						1.95	26					80	0.09	0.27	4.00	1.07	0.57	1.64	200	1.15	35.17	1.12	0.57	PVC	SDR-35	0.05	
	69A	70A	54.0	0.33						2.28	14					94	0.05	0.32	4.00	1.26	0.66	1.92	200	3.55	61.80	1.97	0.89	PVC	SDR-35	0.03	
	70A	71A	19.0	0.19						2.47	6					100	0.02	0.33	4.00	1.34	0.72	2.05	200	2.20	48.65	1.55	0.77	PVC	SDR-35	0.04	
	71A	76A	31.5							2.47						100		0.33	4.00	1.34	0.72	2.05	200	1.45	39.49	1.26	0.65	PVC	SDR-35	0.05	
To STREET E, Pipe 76A - 77A										2.47						100															
STREET E																															
	72A	73A	57.5	0.72						0.72	23					23	0.08	0.08	4.00	0.31	0.21	0.52	200	3.30	59.58	1.90	0.58	PVC	SDR-35	0.01	
	73A	74A	57.5	0.45						1.17	23					46	0.08	0.15	4.00	0.62	0.34	0.96	200	3.30	59.58	1.90	0.69	PVC	SDR-35	0.02	
	74A	75A	43.0	0.29						1.46	9					55	0.03	0.18	4.00	0.74	0.42	1.16	200	1.00	32.80	1.04	0.48	PVC	SDR-35	0.04	
	75A	76A	34.50	0.28						1.74	17					72	0.06	0.24	4.00	0.97	0.50	1.47	200	1.85	44.61	1.42	0.64	PVC	SDR-35	0.03	
Contribution From STREET G, Pipe 71A - 76A										2.47						100															
	76A	77A	58.0	0.42						4.63	26					198	0.09	0.66	4.00	2.65	1.34	4.00	200	2.75	54.39	1.73	1.00	PVC	SDR-35	0.07	
	77A	78A	46.5	0.31						4.94	20					218	0.07	0.73	4.00	2.92	1.43	4.35	200	6.00	80.34	2.56	1.35	PVC	SDR-35	0.05	
Contribution From STREET H, Pipe 64A - 78A										1.12						46															
	78A	1001A	60.5	0.28						6.34	14					278	0.05	0.93	4.00	3.73	1.84	5.57	200	0.95	31.97	1.02	0.76	PVC	SDR-35	0.17	
To EIGHTH LINE, Pipe 1001A - 1002A										6.34						278															
EIGHTH LINE																															
Contribution From STREET E, Pipe 78A - 1001A										6.34						278															
	1001A	1002A	48.0						0.54	6.88						278		0.93	4.00	3.73	2.00	5.72	200	4.55	69.96	2.23	1.33	PVC	SDR-35	0.08	
	1002A	1003A	49.5						0.12	7.00						278		0.93	4.00	3.73	2.03	5.76	200	4.90	72.60	2.31	1.38	PVC	SDR-35	0.08	
	1003A	1004A	110.0	1.29					0.29	8.58	145					423		1.42	4.00	5.67	2.49	8.16	200	3.45	60.92	1.94	1.34	PVC	SDR-35	0.13	
	1004A	1005A	110.0	0.70					0.29	9.57	79					502	0.27	1.68	3.97	6.68	2.78	9.46	200	4.80	71.86	2.29	1.58	PVC	SDR-35	0.13	
	1005A	1006A	109.0	0.88					0.29	10.74	99					601	0.33	2.02	3.93	7.92	3.11	11.04	200	5.10	74.07	2.36	1.69	PVC	SDR-35	0.15	
Contribution From FUTURE DEVELOPMENT, Pipe5002A - 1005A										32.49						1139															
	1006A	1008A	88.5						0.23	43.46						1740		5.84	3.63	21.20	12.60	33.80	250	1.60	75.22	1.53	1.48	PVC	SDR-35	0.45	
Contribution From TRUNK 1 - SAN EASEMENT, Pipe 59A - 1008A										23.98						1832															
	1008A	1009A	73.0						0.19	67.63						3572		11.99	3.38	40.52	19.61	60.13	300	3.70	186.01	2.63	2.34	PVC	SDR-35	0.32	
	1009A	1010A	86.0						0.24	67.87						3572		11.99	3.38	40.52	19.68	60.20	300	1.45	116.44	1.65	1.66	PVC	SDR-35	0.52	
	1010A	1011A	12.0							67.87						3572		11.99	3.38	40.52	19.68	60.20	375	0.50	123.98	1.12	1.11	PVC	SDR-35	0.49	
	1011A	10110A	96.0						0.24	68.11						3572		11.99	3.38	40.52	19.75	60.27	375	0.50	123.98	1.12	1.11	PVC	SDR-35	0.49	
	10110A	1012A	9.5							67.87						3572		11.99	3.38	40.52	19.68	60.20	375	0.50	123.98	1.12	1.11	PVC	SDR-35	0.49	
	1012A	1013A	93.0						0.21	68.08						3572		11.99	3.38	40.52	19.74	60.26	375	0.25	87.67	0.79	0.85	PVC	SDR-35	0.69	
	1013A	1014A	103.5						0.23	68.31						3572		11.99	3.38	40.52	19.81	60.33	375	0.25	87.67	0.79	0.85	PVC	SDR-35	0.69	
To SIDEROAD 17, Pipe 1014A - 1015AA										68.31						3572															
SIDEROAD 17																															
Contribution From EIGHTH LINE, Pipe 1013A - 1014A										68.31						3572															
	1014A	1015AA	98.50						0.22	68.53						3572		11.99	3.38	40.52	19.87	60.39	375	0.25	87.67	0.79	0.86	PVC	SDR-35	0.69	
	1015AA	1016AA	98.50						0.23	68.76						3572		11.99	3.38	40.52	19.94	60.46	375	0.25	87.67	0.79	0.86	PVC	SDR-35	0.69	
	1016AA	1017AA	98.50						0.23	68.99						3572		11.99	3.38	40.52	20.01	60.53	375	0.25	87.67	0.79	0.86	PVC	SDR-35	0.69	
	1017AA	1018AA	99.00						0.22	69.21						3572		11.99	3.38	40.52	20.07	60.59	375	0.25	87.67	0.79	0.86	PVC	SDR-35	0.69	

APPENDIX E

STORM DESIGN SHEETS AND LID CALCULATIONS

Project Name: 5520 EIGHTH LINE & 5552 EIGHTH LINE
Project No.: 21-1242
Date: June 2022

LID ID	**Location**	**Type**	**LID Storage Volume**						**Rainfall Volume**			
			LID Storage Length (m)	**LID Storage Width (m)**	**LID Storage Depth (m)**	**Porosity [1]**	**Drawdown Time [2] (hr)**	**Provided Storage Volume (m^3)**	**Contributing Drainage Area (Ha)**	**Imperviousness (%)**	**Rainfall Event Storage (mm)**	**Provided Rainfall Volume (to LID) (m^3)**
Total Required Rainfall Volume to Infiltrate:									36.57	62%	5.0	**1133.6**
1	Table Land - Rear Yard	Trench	88	1.2	0.60	0.4		25.3	0.17	46%	25.0	19.4
2	Table Land - Rear Yard	Trench	134	1.2	0.60	0.4		38.6	0.21	46%	25.0	24.0
3	Table Land - Rear Yard	Trench	217	1.5	0.60	0.4		78.1	0.53	59%	25.0	77.5
4	Table Land - Rear Yard	Trench	225	1.5	0.70	0.4		94.5	0.63	59%	25.0	92.3
5	Park	Infiltration Gallery	41	15.0	1.10	0.4		270.6	1.09	100%	24.5	267.1
	Wetland	Wetlands ***							6.79	59%	5.0	198.9
Total Provided Rainfall Volume to Infiltrate:												**679.0**

Notes:

1. Porosity assumed to be 0.40 for 50mm clear stone, as per CVC LID Design Manual (v2010), pg 4-57
2. Recommended drawdown time of 48hrs, as per CVC LID Design Manual (v2010), pg 4-57
3. Groundwater elevation to be confirmed by Hydrogeological Assessment.

*Percolation rate to be determined through on site infiltration testing
**Drawdown time to be confirmed with percolation rates
***Cleanwater conveyed to wetlands to maintain predevelopment flow to wetlands

LOCATION			CONTRIBUTING AREA				FLOW		SEWER DESIGN											
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
STREET	FROM MANHOLE	TO MANHOLE	AREA "A" (ha)	STORM COEFFICIENT "C"	SECTION AxC	ACCUMULATED AxC	5 YR RATIONAL INTENSITY "I" (mm/hr)	FLOW Q (L/s)	LENGTH (m)	SLOPE (%)	DIAMETER (mm)	FULL FLOW CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)	TIME OF FLOW IN PIPE (min)	TIME OF CONCENTRATION (min)	ACTUAL VELOCITY (m/s)	MANHOLE INLET INVERT (m)	MANHOLE LOSSES (m)	MANHOLE OUTLET INVERT (m)	PIPE % CAPACITY
STREET B															10.00					
			0.07	0.69	0.05	0.05														
	106	107	0.54	0.75	0.41	0.45	123.38	155	76.0	2.90	375	299	2.70	0.47	10.47	2.73				52%
	107	108	0.56	0.75	0.42	0.87	119.92	291	76.0	2.90	450	486	3.05	0.41	10.88	3.18				60%
	108	109	0.49	0.75	0.37	1.24	117.03	403	76.0	1.30	600	700	2.48	0.51	11.40	2.56				58%
To STREET A, Pipe 109 - 110						1.24									11.40					
STREET D															10.00					
			0.65	0.25	0.16	0.16														
	227	228	0.72	0.69	0.50	0.66	123.38	226	24.0	1.55	450	355	2.23	0.18	10.18	2.36				64%
	228	229	0.62	0.69	0.43	1.09	122.03	368	85.5	2.95	450	490	3.08	0.46	10.64	3.38				75%
	229	230	0.66	0.69	0.46	1.54	118.69	509	85.5	4.00	525	860	3.97	0.36	11.00	4.13				59%
			0.36	0.69	0.25	1.79	100Yr Intake=	996												
	230	231			0.00	1.79	116.25	1575	85.5	1.35	900	2103	3.31	0.43	11.43	3.63				75%
To STREET A, Pipe 231 - 270						1.79		996							11.43					
STREET C																				
Contribution From STREET A, Pipe 109 - 110						3.21									12.03					
	110	118	0.02	0.69	0.01	3.22	109.87	984	11.5	1.20	750	1220	2.76	0.07	12.10	3.07				81%
Contribution From STREET C, Pipe 116 - 118						2.11									11.80					
	118	119	0.19	0.69	0.13	5.47	109.47	1663	54.0	2.30	825	2177	4.07	0.22	12.32	4.48				76%
	119	120	0.20	0.69	0.14	5.61	108.22	1686	54.0	2.30	825	2177	4.07	0.22	12.54	4.50				77%
	120	123	0.12	0.69	0.08	5.69	106.99	1691	57.5	2.15	825	2105	3.94	0.24	12.78	4.37				80%
To STREET C, Pipe 123 - 124						5.69									12.78					
															10.00					
	121	122	0.20	0.69	0.14	0.14	123.38	47	60.5	0.40	300	61	0.87	1.17	11.17	0.96				77%
	122	123	0.06	0.69	0.04	0.18	115.17	57	46.5	0.30	375	96	0.87	0.89	12.06	0.91				60%
Contribution From STREET C, Pipe 120 - 123						5.69									12.78					

NOTES:

Q = 2.78ACI L/s

Initial time of concentration = 10 min.

C = Runoff Co-efficient

I = Intensity (mm/hr)

A = Area (hectares)

n = 0.013 (conc.) for sewers =>525mm

$$I5 = \frac{744}{(td + 1.76)^{0.729}}$$

PROJECT: 5520 EIGHT LINE & 5552 EIGHT LINE

PROJECT NO: 21-1242

DESIGNED BY: C.B.

CHECKED BY: P.P.

CONSULTANT DAVID SCHAEFFER ENGINEERING LTD.

DATE: 10 Jul 2024

TOWN OF ERIN

STORM SEWER DESIGN

SHEET 1 OF 10

LOCATION			CONTRIBUTING AREA				FLOW		SEWER DESIGN											
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
STREET	FROM MANHOLE	TO MANHOLE	AREA "A" (ha)	STORM COEFFICIENT "C"	SECTION AxC	ACCUMULATED AxC	5 YR RATIONAL INTENSITY "I" (mm/hr)	FLOW Q (L/s)	LENGTH (m)	SLOPE (%)	DIAMETER (mm)	FULL FLOW CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)	TIME OF FLOW IN PIPE (min)	TIME OF CONCENTRATION (min)	ACTUAL VELOCITY (m/s)	MANHOLE INLET INVERT (m)	MANHOLE LOSSES (m)	MANHOLE OUTLET INVERT (m)	PIPE % CAPACITY
	123	124			0.00	5.87	105.69	1723	19.5	0.95	975	2184	2.93	0.11	12.89	3.24				79%
	124	HW1			0.00	5.87	105.10	1714	20.5	0.90	975	2126	2.85	0.12	13.01	3.17				81%
															10.00					
			0.05	0.70	0.04	0.04														
			0.16	0.25	0.04	0.08														
	100	101	0.70	0.69	0.48	0.56	123.38	191	80.5	2.30	375	266	2.41	0.56	10.56	2.62				72%
			0.18	0.70	0.13	0.68														
	101	102	0.42	0.69	0.29	0.97	119.29	323	80.5	2.90	450	486	3.05	0.44	11.00	3.26				66%
			0.16	0.70	0.11	1.09														
	102	105	0.37	0.69	0.26	1.34	116.28	433	80.5	1.50	600	752	2.66	0.50	11.50	2.74				58%
To STREET A, Pipe 105 - 109						1.34									11.50					
															10.00					
			0.38	0.69	0.26	0.26														
	111	112	0.58	0.25	0.15	0.41	123.38	140	64.5	4.90	300	214	3.03	0.35	10.35	3.22				65%
			0.17	0.25	0.04	0.45														
	112	113	0.30	0.69	0.21	0.66	120.73	220	64.5	5.00	375	392	3.55	0.30	10.66	3.65				56%
			0.03	0.25	0.01	0.66														
	113	114	0.22	0.69	0.15	0.82	118.58	269	11.5	2.40	450	442	2.78	0.07	10.73	2.91				61%
			0.11	0.75	0.08	0.90														
	114	115	0.61	0.69	0.42	1.32	118.10	433	71.5	2.50	525	680	3.14	0.38	11.11	3.32				64%
			0.18	0.69	0.12	1.44														
	115	116	0.41	0.75	0.31	1.75	115.55	562	80.5	2.50	600	971	3.43	0.39	11.50	3.56				58%
			0.19	0.69	0.13	1.88														
	116	118	0.31	0.75	0.23	2.11	113.06	664	81.0	4.15	600	1251	4.42	0.31	11.80	4.48				53%
To STREET C, Pipe 118 - 119						2.11									11.80					

NOTES:

Q = 2.78ACI L/s

Initial time of concentration = 10 min.

C = Runoff Co-efficient

I = Intensity (mm/hr)

A = Area (hectares)

$$I5 = \frac{744}{(td + 1.76)^{0.729}}$$

n = 0.0561 (conc.) for sewers =>525mm

PROJECT: 5520 EIGHT LINE & 5552 EIGHT LINE

PROJECT NO: 21-1242

DESIGNED BY: C.B.

CHECKED BY: P.P.

CONSULTANT DAVID SCHAEFFER ENGINEERING LTD.

DATE: 10 Jul 2024

TOWN OF ERIN

STORM SEWER DESIGN

SHEET 2 OF 10

LOCATION			CONTRIBUTING AREA				FLOW		SEWER DESIGN											
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
STREET	FROM MANHOLE	TO MANHOLE	AREA "A" (ha)	STORM COEFFICIENT "C"	SECTION AxC	ACCUMULATED AxC	5 YR RATIONAL INTENSITY "I" (mm/hr)	FLOW Q (L/s)	LENGTH (m)	SLOPE (%)	DIAMETER (mm)	FULL FLOW CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)	TIME OF FLOW IN PIPE (min)	TIME OF CONCENTRATION (min)	ACTUAL VELOCITY (m/s)	MANHOLE INLET INVERT (m)	MANHOLE LOSSES (m)	MANHOLE OUTLET INVERT (m)	PIPE % CAPACITY
STREET A															10.00					
	103	104	0.19	0.69	0.13	0.13	123.38	45	35.0	4.95	300	215	3.04	0.19	10.19	2.41				21%
	104	105	0.08	0.69	0.06	0.19	121.93	63	38.5	4.90	300	214	3.03	0.21	10.40	2.63				29%
Contribution From STREET C, Pipe 102 - 105						1.34									11.50					
	105	109	0.34	0.69	0.23	1.76	113.03	553	72.5	4.00	600	1228	4.34	0.28	11.78	4.23				45%
Contribution From STREET B, Pipe 108 - 109						1.24									11.40					
	109	110	0.30	0.69	0.21	3.21	111.34	993	62.5	3.20	675	1504	4.20	0.25	12.03	4.48				66%
To STREET C, Pipe 110 - 118						3.21									12.03					
Contribution From STREET D, Pipe 230 - 231						1.79		996							11.43					
	231	270	0.13	0.69	0.09	1.88	113.47	1589	38.5	0.55	1050	2025	2.34	0.27	11.71	2.59				78%
			0.03	0.69	0.02	1.90	100Yr Intake=	1875												
	270	258			0.00	1.90	111.78	3462	11.0	1.25	1200	4359	3.85	0.05	11.75	4.27				79%
To POND 2 WEST, Pipe 258 - 259						1.90		2872							11.75					
Contribution From STREET E, Pipe 271 - 272						0.92									11.33					
Contribution From STREET E, Pipe 273 - 272						0.12									10.75					
	272	276	0.28	0.69	0.19	1.24	114.13	392	80.0	4.45	450	601	3.78	0.35	11.68	4.02				65%
Contribution From STREET F, Pipe 246 - 276						0.98									11.08					
	276	277	0.26	0.69	0.18	2.39	111.94	744	75.0	3.85	600	1205	4.26	0.29	11.97	4.47				62%
Contribution From STREET E, Pipe 243 - 277						2.38									12.07					
	277	278	0.32	0.69	0.22	4.99	109.61	1520	62.0	2.40	825	2224	4.16	0.25	12.32	4.47				68%
	278	279	1.03	0.90	0.93	5.92	108.20	1779	54.5	2.15	900	2654	4.17	0.22	12.54	4.46				67%
	279	258	0.06	0.69	0.04	5.96	106.99	1771	27.0	2.15	900	2654	4.17	0.11	12.65	4.46				67%
To POND 2 WEST, Pipe 258 - 259						5.96									12.65					

NOTES:

Q = 2.78ACI L/s

Initial time of concentration = 10 min.

C = Runoff Co-efficient

I = Intensity (mm/hr)

A = Area (hectares)

n = (conc.) for sewers =>525mm

$$I5 = \frac{744}{(td + 1.76)^{0.729}}$$

PROJECT: 5520 EIGHT LINE & 5552 EIGHT LINE

PROJECT NO: 21-1242

DESIGNED BY: C.B.

CHECKED BY: P.P.

CONSULTANT DAVID SCHAEFFER ENGINEERING LTD.

DATE: 10 Jul 2024

TOWN OF ERIN

STORM SEWER DESIGN

SHEET 3 OF 10

LOCATION			CONTRIBUTING AREA				FLOW		SEWER DESIGN											
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
STREET	FROM MANHOLE	TO MANHOLE	AREA "A" (ha)	STORM COEFFICIENT "C"	SECTION AxC	ACCUMULATED AxC	5 YR RATIONAL INTENSITY "I" (mm/hr)	FLOW Q (L/s)	LENGTH (m)	SLOPE (%)	DIAMETER (mm)	FULL FLOW CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)	TIME OF FLOW IN PIPE (min)	TIME OF CONCENTRATION (min)	ACTUAL VELOCITY (m/s)	MANHOLE INLET INVERT (m)	MANHOLE LOSSES (m)	MANHOLE OUTLET INVERT (m)	PIPE % CAPACITY
STREET F															10.00					
	232	233	0.49	0.69	0.34	0.34	123.38	116	66.0	2.95	300	166	2.35	0.47	10.47	2.54				70%
	233	238	0.02	0.69	0.01	0.35	119.92	117	12.0	0.70	375	147	1.33	0.15	10.62	1.47				80%
To STREET E, Pipe 238 - 239						0.35									10.62					
															10.00					
	244	245	0.69	0.69	0.48	0.48	123.38	163	79.5	2.40	375	272	2.46	0.54	10.54	2.56				60%
	245	246	0.44	0.69	0.30	0.78	119.42	259	53.5	3.05	450	498	3.13	0.28	10.82	3.16				52%
	246	276	0.29	0.69	0.20	0.98	117.44	320	41.5	1.90	525	593	2.74	0.25	11.08	2.78				54%
To STREET A, Pipe 276 - 277						0.98									11.08					
STREET G															10.00					
			0.04	0.25	0.01	0.01														
			0.16	0.25	0.04	0.05														
	200	201	0.57	0.69	0.39	0.44	123.38	152	36.0	4.90	300	214	3.03	0.20	10.20	3.28				71%
			0.32	0.69	0.22	0.66	100Yr Intake=	299												
	201	202			0.00	0.66	121.89	524	36.0	3.45	525	799	3.69	0.16	10.36	3.93				66%
	202	203	0.13	0.69	0.09	0.75	120.69	552	13.0	1.25	600	686	2.43	0.09	10.45	2.70				80%
			0.24	0.69	0.17	0.92														
	203	204	1.71	0.25	0.43	1.35	120.05	748	46.5	0.45	825	963	1.80	0.43	10.88	1.99				78%
	204	205	0.20	0.69	0.14	1.48	117.06	782	46.5	1.95	825	2004	3.75	0.21	11.09	3.50				39%
			0.23	0.25	0.06	1.54														
	205	206	0.31	0.69	0.21	1.76	115.68	864	52.5	2.80	825	2402	4.49	0.19	11.28	4.10				36%
	206	207	0.11	0.69	0.08	1.83	114.42	882	17.5	2.80	825	2402	4.49	0.06	11.35	4.13				37%
	207	212	0.05	0.69	0.03	1.87	114.01	890	33.5	1.50	825	1758	3.29	0.17	11.52	3.29				51%
To STREET E, Pipe 212 - 213						1.87		299							11.52					

NOTES:

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Initial time of concentration = 10 min.

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I = Intensity (mm/hr)

A = Area (hectares)

n = (conc.) for sewers =>525mm

$$I5 = \frac{744}{(td + 1.76)^{0.729}}$$

PROJECT: 5520 EIGHT LINE & 5552 EIGHT LINE

PROJECT NO: 21-1242

DESIGNED BY: C.B.

CHECKED BY: P.P.

CONSULTANT DAVID SCHAEFFER ENGINEERING LTD.

DATE: 10 Jul 2024

TOWN OF ERIN

STORM SEWER DESIGN

SHEET 4 OF 10

LOCATION			CONTRIBUTING AREA				FLOW		SEWER DESIGN											
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
STREET	FROM MANHOLE	TO MANHOLE	AREA "A" (ha)	STORM COEFFICIEN T "C"	SECTION AxC	ACCUMULAT ED AxC	5 YR RATIONAL INTENSITY "I" (mm/hr)	FLOW Q (L/s)	LENGTH (m)	SLOPE (%)	DIAMETER (mm)	FULL FLOW CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)	TIME OF FLOW IN PIPE (min)	TIME OF CONCENTRA TION (min)	ACTUAL VELOCITY (m/s)	MANHOLE INLET INVERT (m)	MANHOLE LOSSES (m)	MANHOLE OUTLET INVERT (m)	PIPE % CAPACITY
STREET H															10.00					
			0.17	0.69	0.12	0.12	100Yr Intake=	119												
	214	215			0.00	0.12	123.38	159	25.0	0.50	450	202	1.27	0.33	10.33	1.40				79%
	215	216	0.32	0.69	0.22	0.34	120.93	233	84.0	0.30	600	336	1.19	1.18	11.51	1.28				69%
To STREET E, Pipe 216 - 249						0.34		119							11.51					
EIGHTH LINE															10.00					
			0.11	0.25	0.03	0.03														
	247	248	0.41	0.75	0.31	0.34	123.38	115	90.0	7.65	300	267	3.78	0.40	10.40	3.63				43%
	248	249	0.08	0.75	0.06	0.40	120.43	132	42.0	7.85	300	271	3.83	0.18	10.58	3.80				49%
Contribution From STREET E, Pipe 216 - 249						3.48		1299							12.20					
			0.02	0.25	0.01	3.88														
	249	251	0.12	0.75	0.09	3.97	108.86	2500	53.5	1.75	1050	3612	4.17	0.21	12.42	4.50				69%
	251	252	0.06	0.75	0.05	4.02	107.66	2501	26.0	1.75	1050	3612	4.17	0.10	12.52	4.50				69%
			0.04	0.25	0.01	4.03														
	252	253	0.18	0.75	0.14	4.16	107.09	2537	73.0	1.70	1050	3560	4.11	0.30	12.82	4.46				71%
			0.22	0.75	0.17	4.33														
	253	254	0.63	0.40	0.25	4.58	105.50	2641	86.0	1.65	1050	3508	4.05	0.35	13.17	4.44				75%
			0.16	0.75	0.12	4.70														
	254	255	0.46	0.40	0.18	4.88	103.67	2706	62.0	1.65	1050	3508	4.05	0.26	13.43	4.46				77%
			0.23	0.75	0.17	5.05														
	255	256	0.53	0.40	0.21	5.27	102.40	2798	86.5	1.60	1050	3454	3.99	0.36	13.79	4.44				81%
			0.18	0.75	0.14	5.40														
	256	257	0.24	0.40	0.10	5.50	100.66	2837	50.0	1.60	1200	4932	4.36	0.19	13.98	4.50				58%
To POND 2 EAST, Pipe 257 - 223						5.50		1299							13.98					

NOTES:

Q = 2.78ACI L/s

Initial time of concentration = 10 min.

C = Runoff Co-efficient

I = Intensity (mm/hr)

A = Area (hectares)

n = 0.0561 (conc.) for sewers =>525mm

$$I5 = \frac{744}{(td + 1.76)^{0.729}}$$

PROJECT: 5520 EIGHT LINE & 5552 EIGHT LINE

PROJECT NO: 21-1242

DESIGNED BY: C.B.

CHECKED BY: P.P.

CONSULTANT DAVID SCHAEFFER ENGINEERING LTD.

DATE: 10 Jul 2024

TOWN OF ERIN

STORM SEWER DESIGN

SHEET 5 OF 10

LOCATION			CONTRIBUTING AREA				FLOW		SEWER DESIGN											
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
STREET	FROM MANHOLE	TO MANHOLE	AREA "A" (ha)	STORM COEFFICIENT "C"	SECTION AxC	ACCUMULATED AxC	5 YR RATIONAL INTENSITY "I" (mm/hr)	FLOW Q (L/s)	LENGTH (m)	SLOPE (%)	DIAMETER (mm)	FULL FLOW CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)	TIME OF FLOW IN PIPE (min)	TIME OF CONCENTRATION (min)	ACTUAL VELOCITY (m/s)	MANHOLE INLET INVERT (m)	MANHOLE LOSSES (m)	MANHOLE OUTLET INVERT (m)	PIPE % CAPACITY
POND 2 EAST																				
Contribution From EIGHTH LINE, Pipe 256 - 257						5.50		1299							13.98					
	257	223	0.15	0.75	0.11	5.61	99.77	2854	26.5	1.45	1200	4695	4.15	0.11	14.08	4.34				61%
	223	224			0.00	5.61	99.28	2847	42.5	0.30	1500	3872	2.19	0.32	14.41	2.39				74%
	224	225			0.00	5.61	97.83	2824	33.5	0.30	1500	3872	2.19	0.25	14.66	2.39				73%
	225	226			0.00	5.61	96.72	2807	60.5	0.30	1500	3872	2.19	0.46	15.12	2.39				72%
	226	261			0.00	5.61	94.79	2777	29.5	0.30	1500	3872	2.19	0.22	15.35	2.38				72%
To POND 2 WEST, Pipe 261 - HW2						5.61		1299							15.35					
POND 2 WEST																				
Contribution From STREET A, Pipe 270 - 258						1.90		2872							11.75					
Contribution From STREET A, Pipe 279 - 258						5.96									12.65					
	258	259			0.00	7.86	106.41	5195	77.0	1.05	1500	7243	4.10	0.31	12.96	4.45				72%
	259	260			0.00	7.86	104.75	5159	77.0	1.05	1500	7243	4.10	0.31	13.27	4.44				71%
	260	261			0.00	7.86	103.16	5124	27.0	0.50	1650	6445	3.01	0.15	13.42	3.34				80%
Contribution From POND 2 EAST, Pipe 226 - 261						5.61		1299							15.35					
	261	HW2			0.00	13.47	93.88	7684	12.0	0.75	1800	9955	3.91	0.05	15.40	4.31				77%

NOTES:

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I = Intensity (mm/hr)

A = Area (hectares)

$$I5 = \frac{744}{(td + 1.76)^{0.729}}$$

n = 1.0893 (conc.) for sewers =>525mm

PROJECT: 5520 EIGHT LINE & 5552 EIGHT LINE

PROJECT NO: 21-1242

DESIGNED BY: C.B.

CHECKED BY: P.P.

CONSULTANT DAVID SCHAEFFER ENGINEERING LTD.

DATE: 10 Jul 2024

TOWN OF ERIN

STORM SEWER DESIGN

SHEET 6 OF 10

LOCATION			CONTRIBUTING AREA				FLOW		SEWER DESIGN											
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
STREET	FROM MANHOLE	TO MANHOLE	AREA "A" (ha)	STORM COEFFICIENT "C"	SECTION AxC	ACCUMULATED AxC	5 YR RATIONAL INTENSITY "I" (mm/hr)	FLOW Q (L/s)	LENGTH (m)	SLOPE (%)	DIAMETER (mm)	FULL FLOW CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)	TIME OF FLOW IN PIPE (min)	TIME OF CONCENTRATION (min)	ACTUAL VELOCITY (m/s)	MANHOLE INLET INVERT (m)	MANHOLE LOSSES (m)	MANHOLE OUTLET INVERT (m)	PIPE % CAPACITY
STREET E															10.00					
	273	272	0.18	0.69	0.12	0.12	123.38	43	33.5	0.30	300	53	0.75	0.75	10.75	0.83				80%
To STREET A, Pipe 272 - 276						0.12									10.75					
															10.00					
	275	274	0.55	0.69	0.38	0.38	123.38	130	81.5	2.25	375	263	2.38	0.57	10.57	2.37				49%
	274	250	0.43	0.69	0.30	0.68	119.19	224	72.5	2.25	450	428	2.69	0.45	11.02	2.71				52%
	250	271	0.25	0.69	0.17	0.85	116.12	274	40.0	3.20	450	510	3.21	0.21	11.23	3.26				54%
	271	272	0.10	0.69	0.07	0.92	114.76	293	20.0	3.50	450	533	3.35	0.10	11.33	3.42				55%
To STREET A, Pipe 272 - 276						0.92									11.33					
															10.00					
			0.20	0.25	0.05	0.05														
	234	235	0.35	0.69	0.24	0.29	123.38	100	45.0	4.60	300	207	2.93	0.26	10.26	2.90				48%
			0.08	0.25	0.02	0.31														
	235	236	0.25	0.69	0.17	0.48	121.46	163	37.5	4.90	300	214	3.03	0.21	10.46	3.33				76%
			0.16	0.25	0.04	0.52														
	236	237	0.26	0.69	0.18	0.70	119.96	234	31.5	5.05	375	394	3.57	0.15	10.61	3.72				59%
			0.07	0.25	0.02	0.72														
	237	238	0.09	0.69	0.06	0.78	118.92	259	24.0	4.85	375	386	3.50	0.11	10.72	3.74				67%
Contribution From STREET F, Pipe 233 - 238						0.35									10.62					
	238	239	0.11	0.69	0.08	1.21	118.12	397	32.0	3.25	450	514	3.23	0.17	10.89	3.57				77%
	239	240	0.31	0.69	0.21	1.42	117.00	463	55.0	4.05	450	574	3.61	0.25	11.14	4.01				81%
	240	241	0.17	0.69	0.12	1.54	115.32	494	22.0	2.05	525	616	2.84	0.13	11.27	3.16				80%
			0.20	0.75	0.15	1.69														
	241	242	0.37	0.69	0.26	1.95	114.48	619	63.5	2.00	600	868	3.07	0.34	11.62	3.33				71%
			0.13	0.75	0.10	2.04														
	242	243	0.22	0.69	0.15	2.20	112.32	685	38.0	1.95	600	857	3.03	0.21	11.83	3.37				80%
	243	277	0.26	0.69	0.18	2.38	111.06	733	37.5	1.00	750	1113	2.52	0.25	12.07	2.69				66%
To STREET A, Pipe 277 - 278						2.38									12.07					

NOTES:

Q = 2.78ACI L/s

Initial time of concentration = 10 min.

C = Runoff Co-efficient

I = Intensity (mm/hr)

A = Area (hectares)

$$I5 = \frac{744}{(td + 1.76)^{0.729}}$$

n = 0.9957 (conc.) for sewers =>525mm

PROJECT: 5520 EIGHT LINE & 5552 EIGHT LINE

PROJECT NO: 21-1242

DESIGNED BY: C.B.

CHECKED BY: P.P.

CONSULTANT DAVID SCHAEFFER ENGINEERING LTD.

DATE: 10 Jul 2024

TOWN OF ERIN

STORM SEWER DESIGN

SHEET 7 OF 10

LOCATION			CONTRIBUTING AREA				FLOW		SEWER DESIGN											
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
STREET	FROM MANHOLE	TO MANHOLE	AREA "A" (ha)	STORM COEFFICIENT "C"	SECTION AxC	ACCUMULATED AxC	5 YR RATIONAL INTENSITY "I" (mm/hr)	FLOW Q (L/s)	LENGTH (m)	SLOPE (%)	DIAMETER (mm)	FULL FLOW CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)	TIME OF FLOW IN PIPE (min)	TIME OF CONCENTRATION (min)	ACTUAL VELOCITY (m/s)	MANHOLE INLET INVERT (m)	MANHOLE LOSSES (m)	MANHOLE OUTLET INVERT (m)	PIPE % CAPACITY
															10.00					
	208	209	0.42	0.69	0.29	0.29	123.38	99	59.0	3.30	300	176	2.49	0.40	10.40	2.56				57%
	209	210	0.27	0.69	0.19	0.48	120.44	159	59.0	3.25	375	316	2.86	0.34	10.74	2.86				50%
	210	211	0.15	0.69	0.10	0.58	118.02	190	40.5	0.65	525	347	1.60	0.42	11.16	1.63				55%
	211	212	0.19	0.69	0.13	0.71	115.20	227	37.0	1.40	525	509	2.35	0.26	11.42	2.28				45%
Contribution From STREET G, Pipe 207 - 212						1.87		299							11.52					
	212	213	0.29	0.69	0.20	2.78	112.94	1171	54.5	2.75	825	2380	4.45	0.20	11.72	4.43				49%
	213	216	0.24	0.69	0.17	2.94	111.69	1212	42.5	2.80	825	2402	4.49	0.16	11.88	4.49				50%
Contribution From STREET H, Pipe 215 - 216						0.34		119							11.51					
			0.29	0.69	0.20	3.48	100Yr Intake=	881												
	216	249			0.00	3.48	110.75	2370	66.0	1.15	1050	2928	3.38	0.33	12.20	3.76				81%
To EIGHTH LINE, Pipe 249 - 251						3.48		1299							12.20					

NOTES:

Q = 2.78ACI L/s

Initial time of concentration = 10 min.

C = Runoff Co-efficient

I = Intensity (mm/hr)

A = Area (hectares)

$$I5 = \frac{744}{(td + 1.76)^{0.729}}$$

n = 0.9687 (conc.) for sewers =>525mm

PROJECT: 5520 EIGHT LINE & 5552 EIGHT LINE

PROJECT NO: 21-1242

DESIGNED BY: C.B.

CHECKED BY: P.P.

CONSULTANT DAVID SCHAEFFER ENGINEERING LTD.

DATE: 10 Jul 2024

TOWN OF ERIN

STORM SEWER DESIGN

LOCATION			CONTRIBUTING AREA				FLOW		SEWER DESIGN											
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
STREET	FROM MANHOLE	TO MANHOLE	AREA "A" (ha)	STORM COEFFICIENT "1.25*C"	SECTION AxCx 1.25	ACCUMULATED AxC	100 YR RATIONAL INTENSITY "I" (mm/hr)	FLOW Q (L/s)	LENGTH (m)	SLOPE (%)	DIAMETER (mm)	FULL FLOW CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)	TIME OF FLOW IN PIPE (min)	TIME OF CONCENTRATION (min)	ACTUAL VELOCITY (m/s)	MANHOLE INLET INVERT (m)	MANHOLE LOSSES (m)	MANHOLE OUTLET INVERT (m)	PIPE % CAPACITY
CLEANWATER 01															10.00					
	1000	1001	0.24	0.65	0.20	0.20	204.55	111	75.5	2.55	300	154	2.18	0.58	10.58	2.37				72%
	1001	1002	0.19	0.65	0.15	0.35	197.55	192	75.5	2.45	375	274	2.48	0.51	11.08	2.69				70%
	1002	1003	0.13	0.65	0.11	0.46	191.85	242	52.5	3.75	375	340	3.07	0.28	11.37	3.33				71%
	1003	1004	0.14	0.65	0.11	0.57	188.81	298	52.5	5.10	375	396	3.59	0.24	11.61	3.93				75%
	1004	1005			0.00	0.57	186.29	294	24.0	0.30	600	336	1.19	0.34	11.95	1.34				88%
	1005	1006			0.00	0.57	182.95	289	75.0	0.30	600	336	1.19	1.05	13.00	1.34				86%
						0.57									13.00					
CLEANWATER 02															10.00					
	2005	2006	0.33	0.31	0.13	0.13	204.55	73	19.0	0.40	375	111	1.00	0.32	10.32	1.07				66%
						0.13									10.32					
			0.24	0.31	0.09	0.09									10.00					
	2003	2004	1.24	0.31	0.48	0.58	204.55	328	45.0	2.75	450	473	2.97	0.25	10.25	3.21				69%
	2004	2006			0.00	0.58	201.41	323	52.5	3.15	450	506	3.18	FALSE	10.25	3.37				64%
						0.58									10.25					
Contribution From STREET E, Pipe 2004 - 2006						0.58									10.25					
Contribution From STREET E, Pipe 2005 - 2006						0.13									10.32					
	2006	HW 2007			0.00	0.71	200.64	394	40.5	1.10	525	451	2.08	0.32	10.64	2.35				87%
						0.71									10.64					
CLEANWATER 03															10.00					
	2103	HW 2104	1.36	0.31	0.53	0.53	204.55	302	42.5	1.50	450	349	2.20	0.32	10.32	2.47				86%
						0.53									10.32					
CLEANWATER 04															10.00					
	2100	2101	0.12	0.65	0.10	0.10	204.55	55	59.0	0.50	300	68	0.97	1.02	11.02	1.08				81%
	2101	HW 2102	0.22	0.65	0.18	0.28	192.57	148	36.0	0.90	375	166	1.51	0.40	11.41	1.70				89%
						0.28									11.41					

NOTES:

Q = 2.78ACI L/s

Initial time of concentration = 10 min.

C = Runoff Co-efficient

I = Intensity (mm/hr)

A = Area (hectares)

$$I5 = \frac{744}{(td + 1.76)^{0.729}}$$

n = 1.1261 (conc.) for sewers =>525mm

PROJECT: 5520 EIGHT LINE & 5552 EIGHT LINE

PROJECT NO: 21-1242

DESIGNED BY: C.B.

CHECKED BY: P.P.

CONSULTANT DAVID SCHAEFFER ENGINEERING LTD.

DATE: 10 Jul 2024

TOWN OF ERIN

STORM SEWER DESIGN

SHEET 9 OF 10

LOCATION			CONTRIBUTING AREA				FLOW		SEWER DESIGN											
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
STREET	FROM MANHOLE	TO MANHOLE	AREA "A" (ha)	STORM COEFFICIENT "C"	SECTION AxC	ACCUMULATED AxC	5 YR RATIONAL INTENSITY "I" (mm/hr)	FLOW Q (L/s)	LENGTH (m)	SLOPE (%)	DIAMETER (mm)	FULL FLOW CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)	TIME OF FLOW IN PIPE (min)	TIME OF CONCENTRATION (min)	FALL IN PIPE SECTION (m)	MANHOLE INLET INVERT (m)	MANHOLE LOSSES (m)	MANHOLE OUTLET INVERT (m)	PIPE % CAPACITY
SWM Pond 2 - outfall							100Yr Intake=	1647	(External 100 Yr Inflow to Pipe, per JFSA, Oct 2023)						10.00					
	6001	6002			0.00	0.00	0.00	1647	28.0	3.00	750	1928	4.36	0.11	10.11					85%
	6002	6003			0.00	0.00	0.00	1647	85.0	3.00	750	1928	4.36	0.32	10.32					85%
	6003	6004			0.00	0.00	0.00	1647	85.0	1.80	825	1926	3.60	0.39	10.72					86%
	6004	6005			0.00	0.00	0.00	1647	36.5	0.50	1050	1931	2.23	0.27	10.99					85%
	6005	HW			0.00	0.00	0.00	1647	5.0	0.50	1050	1931	2.23	0.04	11.03					85%
SWM Pond 1 - outfall							100Yr Intake=	208	(External 100 Yr Inflow to Pipe, per JFSA, Oct 2023)						10.00					
	9001	9002			0.00	0.00	0.00	208	104.0	0.30	525	236	1.09	1.59	11.59					88%
								208												
EIGHTH LINE			0.20	0.25	0.05	0.05									10.00					
	5001	5002	0.41	0.75	0.31	0.36	123.38	123	90.0	5.10	300	218	3.09	0.49	10.49					56%
	5002	5003	0.08	0.75	0.06	0.42	119.79	139	69.0	1.70	375	229	2.07	0.56	11.04					61%
	5003	5004 (OGS)	0.04	0.75	0.03	0.45	115.98	144	35.0	0.50	450	202	1.27	0.46	11.50					72%
	5004	HW			0.00	0.45	113.03	141	7.5	0.50	450	202	1.27	0.10	11.60					70%
To NHS						0.45		141							11.60					

NOTES:

Q = 2.78ACI L/s Initial time of concentration = 10 min.

C = Runoff Co-efficient

I = Intensity (mm/hr)

A = Area (hectares)

n = 0.013 (conc.) for sewers =>525mm

$$I5 = \frac{744}{(td + 1.76)^{0.729}}$$

PROJECT: 5520 EIGHT LINE & 5552 EIGHT LINE

PROJECT NO: 21-1242

DESIGNED BY: P.P.

CHECKED BY: D.A.

CONSULTANT DAVID SCHAEFFER ENGINEERING LTD.

DATE: Jul 2024

TOWN OF ERIN

STORM SEWER DESIGN

SHEET 10 OF 10

APPENDIX F

STORMWATER MANAGEMENT DESIGN CRITERIA

CVC, 2021

Elizabeth Reid

To: Alexandra Schaeffer
Subject: RE: DR 21/041 - CVC review of EIS TOR for Mattamy, 8th Line Erin (PD 20/199)

From: Hosale, Lisa <Lisa.Hosale@cvc.ca>
Sent: August 24, 2021 2:53 PM
To: Paudel, Elizabeth <Elizabeth.Paudel@cvc.ca>; John Tjeerdsma <JTjeerdsma@dsel.ca>; Kenny Sun <KSun@dsel.ca>
Subject: RE: DR 21/041 - CVC review of EIS TOR for Mattamy, 8th Line Erin (PD 20/199)

Hi John,
Good afternoon- my apologies for the delay in getting back to you. In terms of water quantity, quality, and erosion controls, we would like to see the following criteria met which differs a bit from the approach that you outlined. Please do let me know if you have any questions I can set up a quick discussion with Rizwan if needed.

Stormwater management criteria is defined in detail in CVC's stormwater management Criteria document:
https://cvc.ca/wp-content/uploads//2021/06/cvc-swm-criteria-appendices-Aug12-D-july14.pdf

Generally, following SWM criteria is recommended in the absence of local studies high level studies (i.e. subwatershed studies, EIS, etc.):
Quality Control: Enhance stormwater quality control i.e. 80% sediment removal in CVC watershed.
Erosion Control: minimum 5mm infiltration or as determined by detail geomorphic studies.
For sites with SWM ponds, 25mm-48hr detention may also be required, depending on the results of the erosion assessment.
Quantity Control: post to pre for 2-100 year event, no Regional control. Safe conveyance of Regional flows through the SWM Pond.

And in terms of your other question regarding whether CVC has additional reporting in support of the model and associated hydrology so that you can reference the original source for the flow information, we are still looking into that for you. But hope to have an answer soon.

We do hope that this helps-
Best wishes,
Lisa

I'm working remotely. The best way to reach me is by email, mobile phone or Microsoft Teams.

Lisa Hosale | M.A., M.Sc., AICP | she/her/hers
Planner, Planning and Development Services | Credit Valley Conservation
905-670-1615 ext 268 | M: 437-881-1737
lisa.hosale@cvc.ca | cvc.ca

Credit Valley Conservation
inspired by nature

2021 CANADA'S GREENEST EMPLOYERS

GREATER TORONTO'S TOP 2021 EMPLOYERS

View our privacy statement

From: John Tjeerdsma
Sent: August 18, 2021 2:50 PM
To: 'Paudel, Elizabeth' <Elizabeth.Paudel@cvc.ca>
Cc: Kenny Sun <KSun@dsel.ca>
Subject: RE: DR 21/041 - CVC review of EIS TOR for Mattamy, 8th Line Erin (PD 20/199)

Hi Elizabeth

I hope all is well. Thank you for the hydraulic model that was included in Data Sharing Agreement below. Included in the model are flows for various storm events, and we are wondering if there is additional reporting in support of the model and associated hydrology so that we can reference the original source for the flow information. We will be using this as the basis for our post to pre modeling for the SWM pond quantity control. We are moving forward on the following basis:

Quality Control: MOE criteria
Erosion Control: proceeding with 25mm even detained for 48 hrs, subject to additional input from the ongoing assessment of the downstream watercourse by the fluvial consultant.
Quantity Control: post to pre for 2-100 year event, no Regional control.

Trusting the above is acceptable but let me know if you have any comments, and if the CVC can provide additional information on the hydrology.

Thanks!

John Tjeerdsma, P.Eng.

DSEL
David Schaeffer Engineering Ltd.

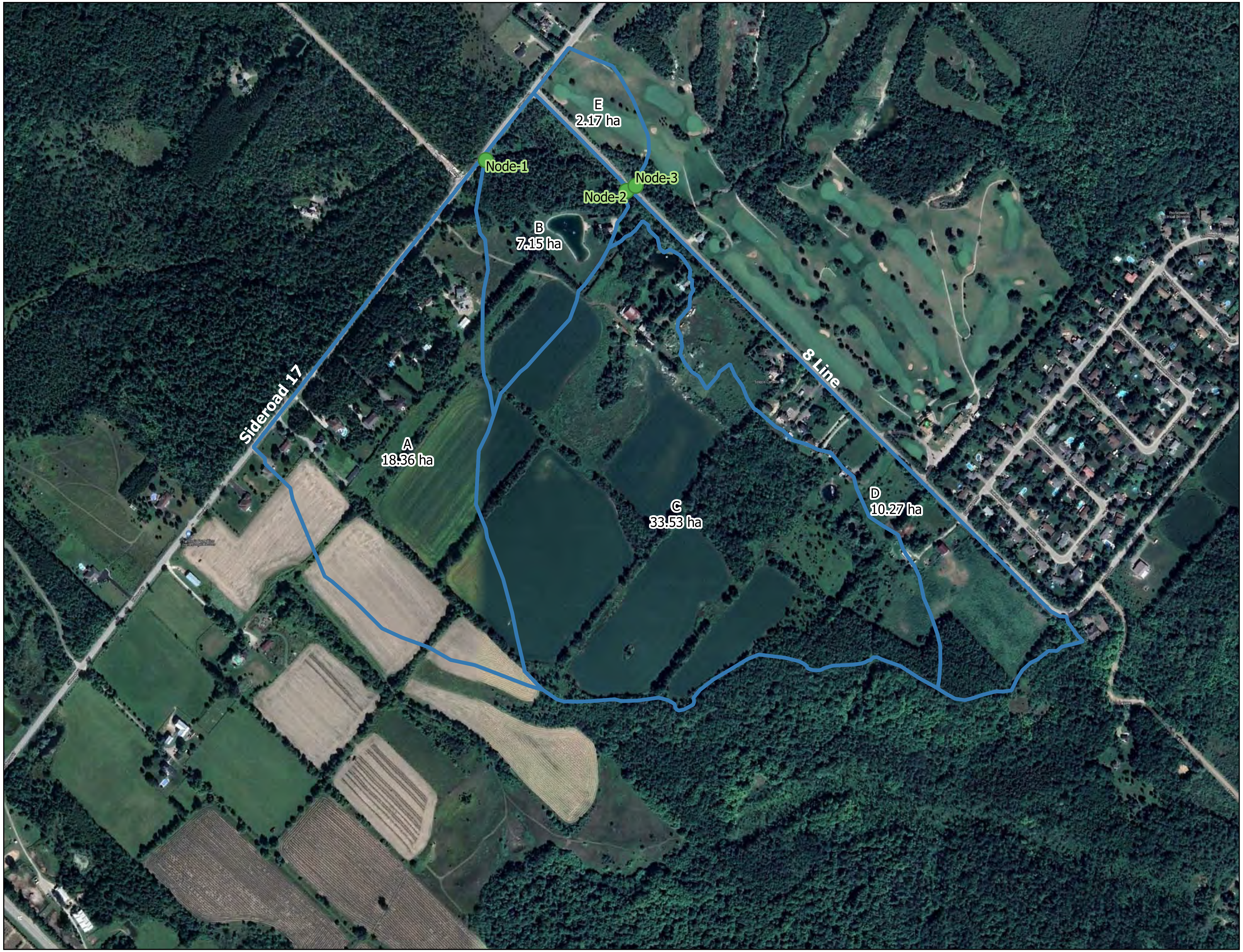
600 Alden Road, Suite 700
Markham, ON L3R 0E7

phone: (905) 475-3080 ext. 255
cell: (705) 229-8525
fax: (905) 475-3081
email: jtjeerdsma@DSEL.ca

APPENDIX G

PRELIMINARY POND SIZING AND POND CONTROLS

J.F. SABOURIN & ASSOCIATES, INC., JULY 2024



Legend

▭ Drainage Area:
[Name]
[Area]

● Model Nodes

— Watercourses

SCALE: 1:6000

0 100 200 m

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Ottawa, ON, K2S 1B9
(613) 836-3884
www.jfsa.com

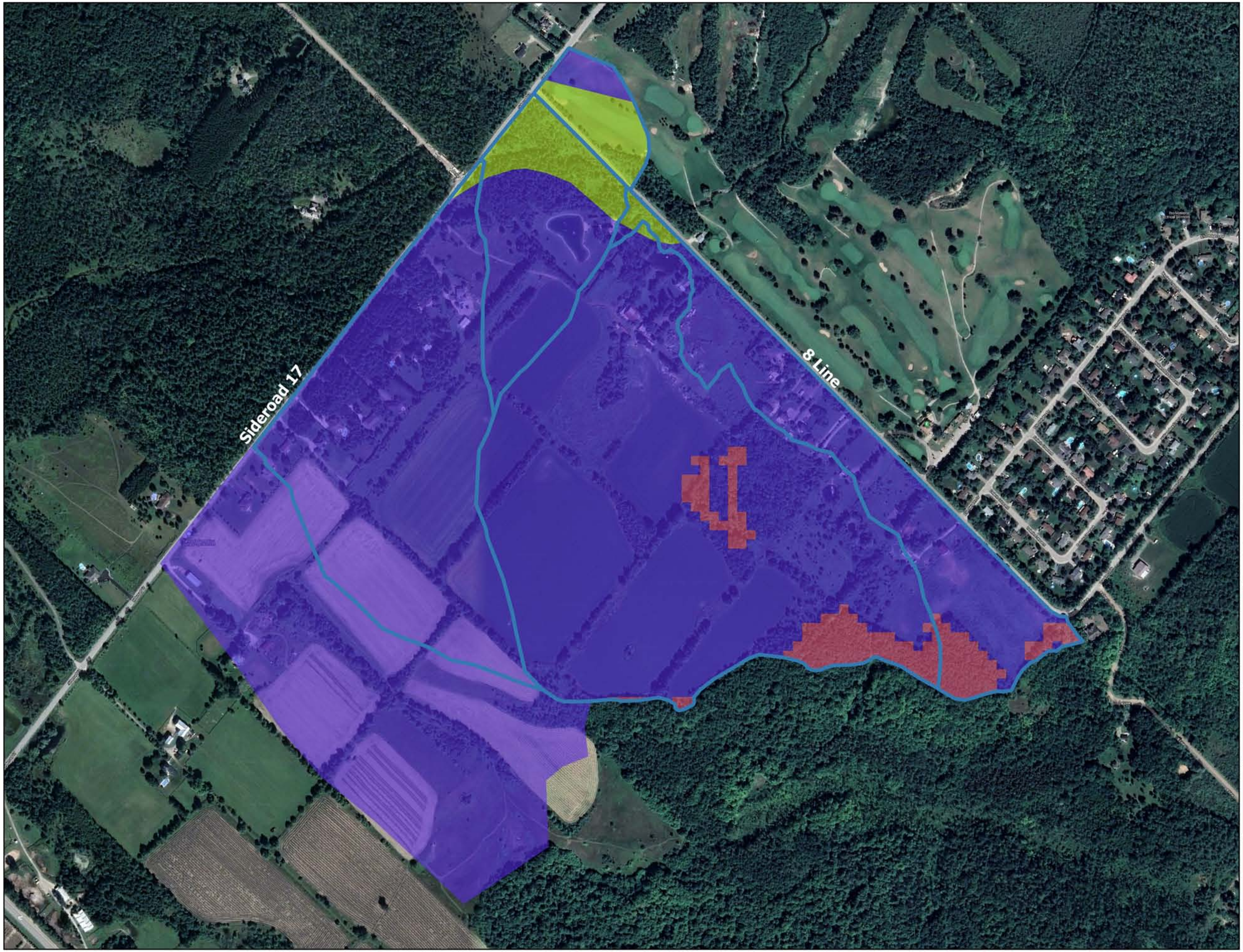
DSEL
david schaeffer engineering ltd

Mattamy Erin

Figure 1: Pre Development Area

PROJECT	2147-21
DRAWN	JB
DATE	Oct 2023

C:\Users\LauraPipkins\J.F. Sabourin and Associates Inc\JFSA-OTTAWA-SERVER - Documents\PROJ\2147-21\202302 FSR\Design\GIS\20231019-Figures



N

Legend

Soils:

- 🟥 DONNYBROOK SANDY LOAM (A)
- 🟪 HILLSBURGH FINE SANDY LOAM (A)
- 🟩 MUCK (D)
- ▭ Drainage Area

SCALE: 1:6000

0 100 200 m

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Figure 2: Soils Mapping

PROJECT	2147-21
DRAWN	JB
DATE	Oct 2023

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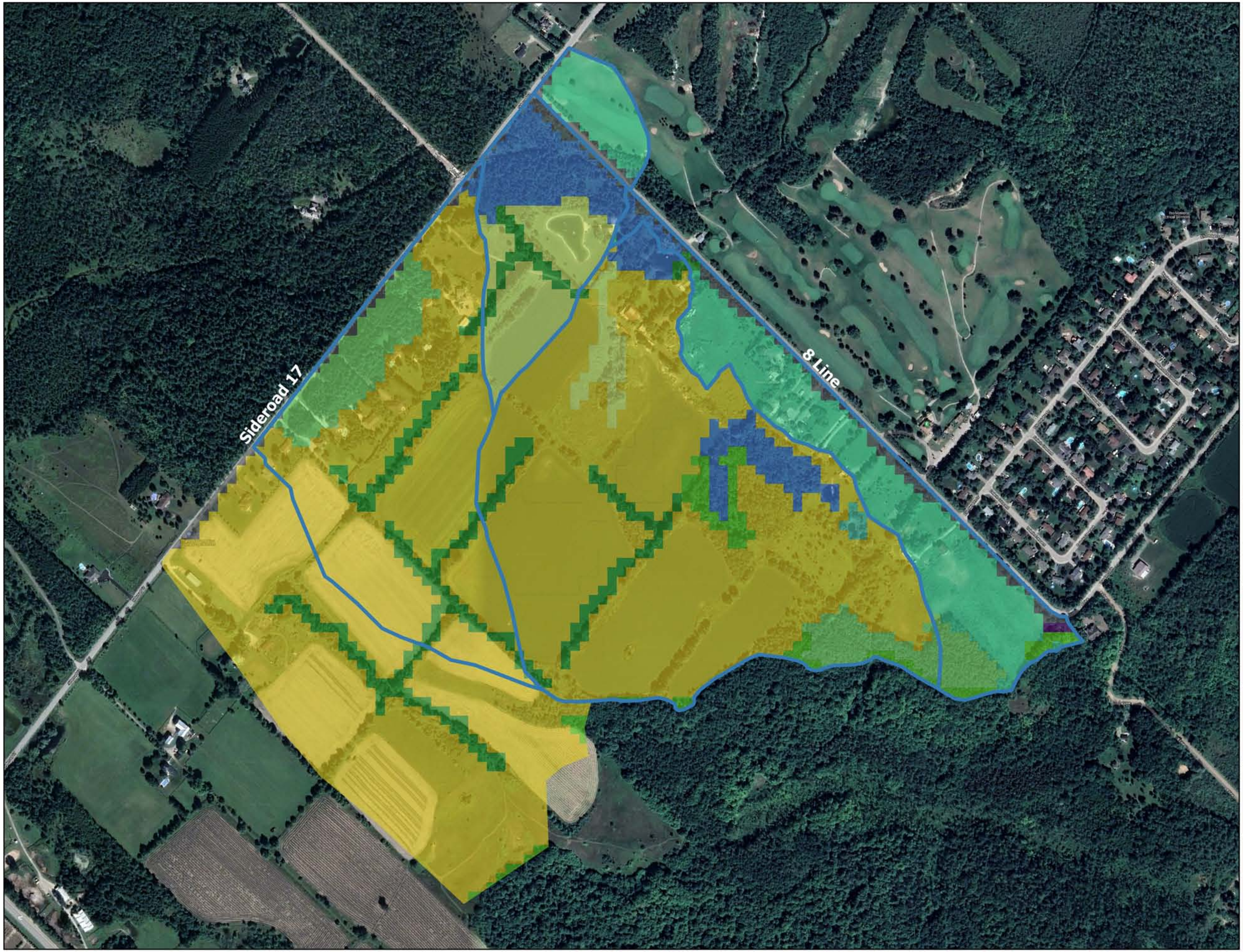

Legend

Land Use:

- 🟪 Built Up Area - Impervious
- 🟩 Built Up Area - Pervious
- 🟨 Coniferous Forest
- 🟩 Deciduous Forest
- 🟩 Hedge Rows
- 🟨 Marsh
- 🟩 Plantation
- 🟩 Thicket Swamp
- 🟨 Tilled
- ⬛ Transportation
- 🟦 Treed Swamp
- ▭ Drainage Area

SCALE: 1:6000

0 100 200 m

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Mattamy Erin

Figure 3: Land Use

PROJECT	2147-21
DRAWN	JB
DATE	Oct 2023

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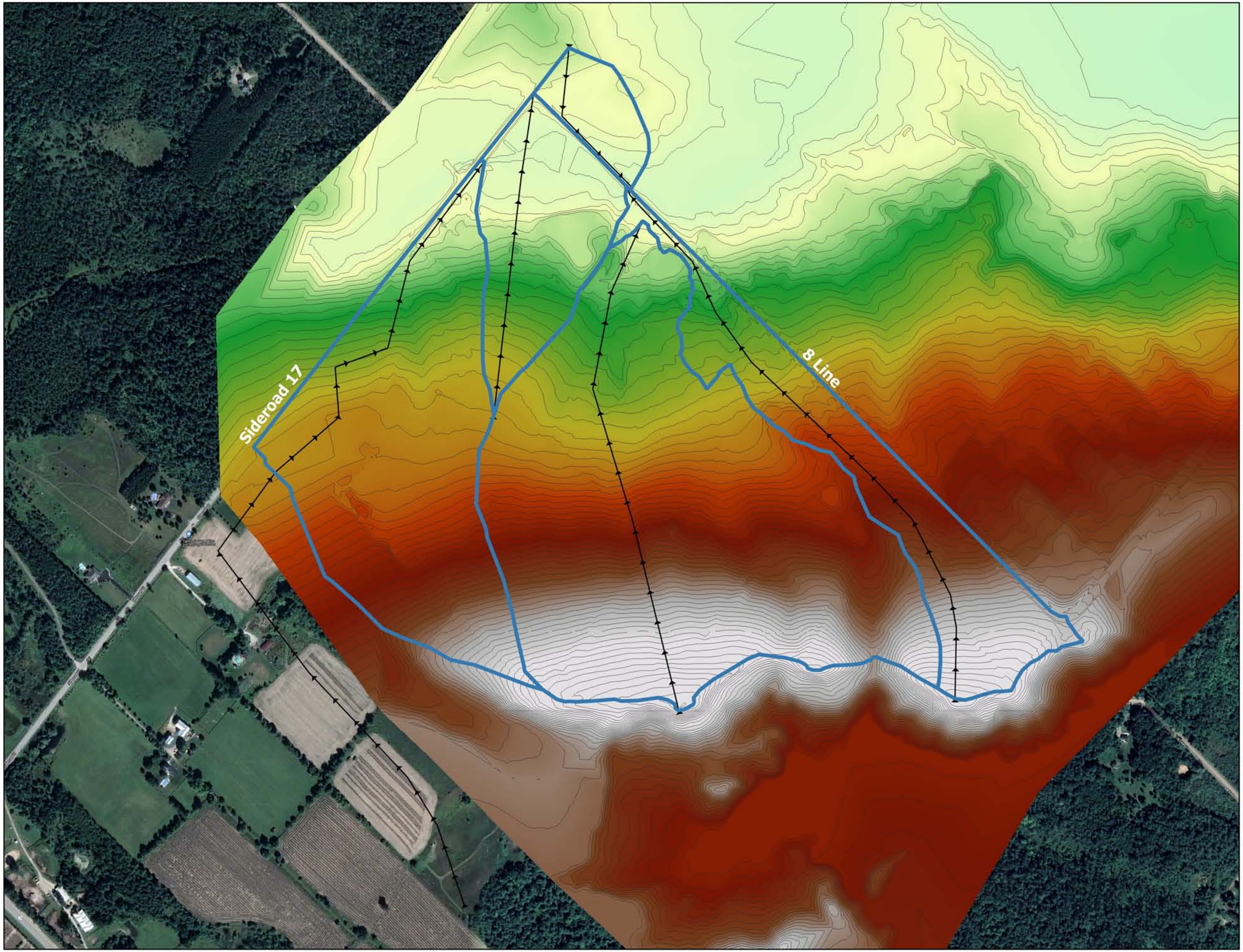

SCALE: 1:6000

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Figure 4: Topography

PROJECT	2147-21
DRAWN	JB
DATE	Oct 2023

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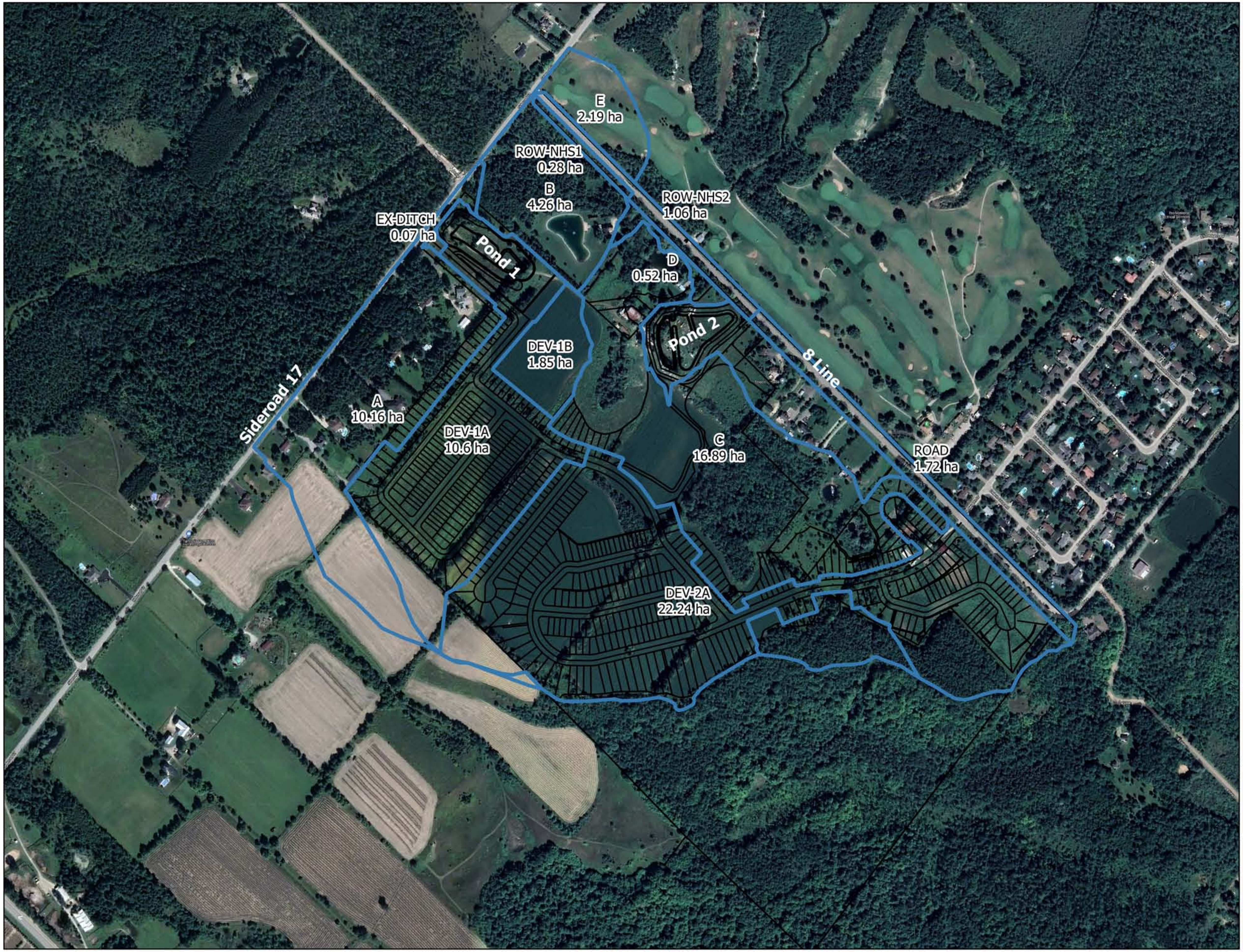

N

Legend

Drainage Areas:
[Name]
[Area]
—— Development Plan

SCALE: 1:6000

0 100 200 m

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Figure 5: Post Development Areas

PROJECT	2147-21
DRAWN	JB
DATE	Oct 2023

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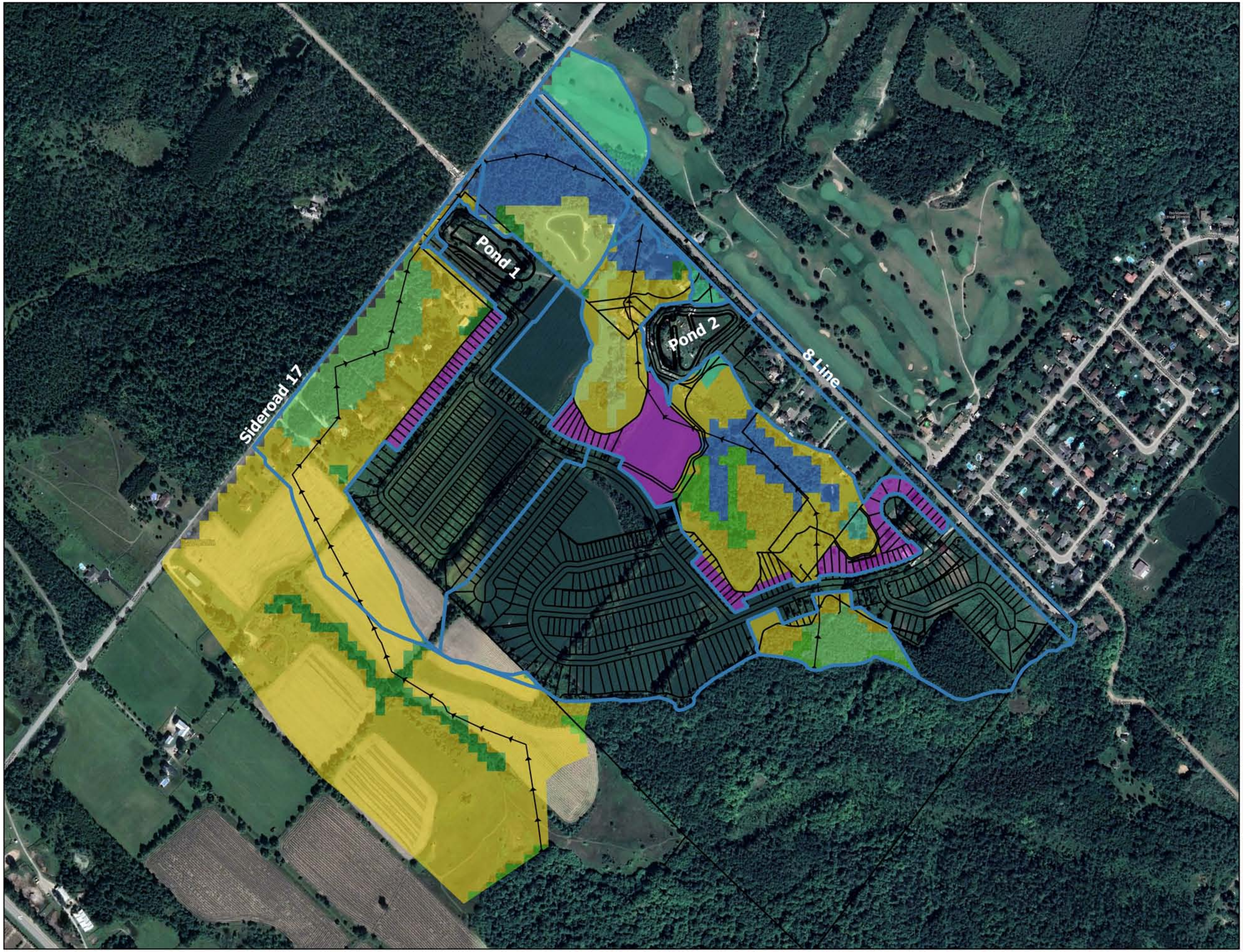

Legend

- Drainage Areas
- Flow Lengths
- Development Plan

CN PostDev-Clipped

- 🟪 Built Up Area - Impervious
- 🟩 Built Up Area - Pervious
- 🟨 Coniferous Forest
- 🟩 Deciduous Forest
- 🟩 Hedge Rows
- 🟨 Marsh
- 🟩 Plantation
- 🟩 Thicket Swamp
- 🟨 Tilled
- ⬜ Transportation
- 🟦 Treed Swamp
- 🟪 Rear Yards

SCALE: 1:6000

0 100 200 m

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Figure 6: Post Development Land Use

PROJECT	2147-21
DRAWN	JB
DATE	Oct 2023

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Table C-1 : Drainage Area to SWM Facility 1

Subcatchment ID (1)	Area (ha)	Imperviousness (%)	Imp Area (ha)
DEV-1A	10.6	64	6.814
DEV-1B	1.85	99	1.832
Total	**12.450**	**69**	**8.646**

DEV-1B : 135 L/s flow split to NHS (5-year flow), excess to Pond 1

Table C-2 : Drainage Area to SWM Facility 2

Subcatchment ID (1)	Area (ha)	Imperviousness (%)	Imp Area (ha)
DEV-2A	22.24	57	12.675
ROAD	1.72	79	1.359
Total	**23.960**	**59**	**14.034**

ROAD: 429 L/s flow split to Pond 2 (5-year flow + 12%), excess to watercourse

Table 6A: Pond 1- Criteria for Required Storage Volumes

Pond	Area [1] (ha)	Imperviousness (%)	Storage Volume for Impervious Level [2] (m³/ha)
N/A	N/A	55	105
SWM Pond 1	12.45	69	119
N/A	N/A	70	120

[1] Refer to Appendix C for drainage areas to the SWM facility.

[2] Protection Level for Weland: Enhanced 80% long-term S.S. removal.
SWM Planning & Design Manual, Table 3.2, p.3-10 (March 2003).

Table 6B: Pond 1 -Required Storage Volumes for SWM Facility

Pond Component	Required Volume (m³)	Provided Volume [4] (m³)	Volume Ratio	Pond Elevation (m)
Permanent Pool (PP) [1]	984	1558	1.58	395.50
Quality Control [2]	498	498	1.00	395.65
Extended Detention [3]	1485	1761	1.19	396.00
Forebay (20% PP)	197	N/A	N/A	-
PP - Forebay	787	N/A	N/A	-

[1] Required PP volume based on Table B-1.

[2] Required quality control volume based on 40 m^3/ha.

[3] Extended detention of the 25 mm storm runoff volume for a minimum of 48 hours.

[4] Provided volume based on stage-storage curve and extended detention (refer to Tables 7-A and 7-B).

[5] Based on grading plan provided by DSEL (refer to Figure 2).

[6] As per MOE, Maximum Forebay Area: 33% of Total Permanent Pool.

Table 7A: Pond 1 Extended Detention Parameters for SWM Facility

Permanent Pool Parameters			Quality Orifice Parameters		
Area (C3)	3091.78	m^2	Width	0.110	m
Volume	1464	m^3			
PP Elev	395.500	m	Area	0.010	m^2
QC Elev	395.653	m	Invert	395.500	m
			C_o	0.62	

Notes:
- C3 is the intercept from the area-depth linear regression.
- PP Elev indicates the elevation of the permanent pool.
- QC Elev indicates the elevation of the storage volume required by MOE for quality control.
- h is the maximum water elevation above the orifice (m).

Table 7B: Pond 1 Extended Detention Drawdown Time for SWM Facility

Elev. (m)	Active Storage			C2	Drawdown Time	Drawdown Time	Flow	Demarkation
	V (m^3)	A (m^2)	depth (m)	(m^2/m)	(h)	(days)	(m^3/s)	Point
395.50	**0**	**3092**	**0.00**		**0.00**		**0.000**	**PP Elev**
395.55	158	3233	0.05	2829.59	31.58	1.32	0.003	
395.60	322	3305	0.10	2133.71	42.46	1.77	0.006	
395.65	489	3377	0.15	1903.81	49.28	2.05	0.008	
395.653	**498**	**3381**	**0.15**	**1895.77**	**49.60**	**2.07**	**0.008**	**QC Elev**
395.70	659	3450	0.20	1791.73	54.55	2.27	0.010	
395.75	834	3523	0.25	1726.55	59.06	2.46	0.012	
395.80	1012	3597	0.30	1682.88	63.11	2.63	0.013	
395.85	1193	3670	0.35	1652.76	66.83	2.78	0.014	
395.90	1379	3744	0.40	1631.30	70.32	2.93	0.015	
395.95	1568	3819	0.45	1616.36	73.63	3.07	0.016	
396.00	**1761**	**3894**	**0.50**	**1604.11**	**76.80**	**3.20**	**0.017**	**Ext Det**
396.05	1957	3969	0.55	1594.99	79.66	3.32	0.021	
396.10	2158	4045	0.60	1588.73	82.14	3.42	0.024	
396.15	2362	4121	0.65	1583.45	84.37	3.52	0.027	
396.20	2570	4197	0.70	1579.35	86.42	3.60	0.029	
396.25	2781	4274	0.75	1576.79	88.36	3.68	0.031	
396.30	2997	4351	0.80	1574.55	90.21	3.76	0.033	
396.35	3217	4429	0.85	1572.91	91.99	3.83	0.035	
396.40	3440	4507	0.90	1571.98	93.72	3.90	0.037	
396.45	3667	4585	0.95	1571.58	95.40	3.98	0.038	
396.50	3898	4664	1.00	1571.76	97.04	4.04	0.040	
396.55	4134	4742	1.05	1572.02	98.65	4.11	0.041	
396.60	4373	4822	1.10	1572.66	100.24	4.18	0.043	
396.65	4616	4901	1.15	1573.53	101.69	4.24	0.050	
396.70	4863	4982	1.20	1574.94	102.91	4.29	0.062	
396.75	5114	5062	1.25	1576.33	103.91	4.33	0.077	
396.80	5369	5143	1.30	1578.12	104.74	4.36	0.093	
396.85	5628	5225	1.35	1579.88	105.43	4.39	0.117	
396.90	5892	5306	1.40	1581.83	106.02	4.42	0.129	
396.95	6159	5388	1.45	1583.78	106.58	4.44	0.139	
397.00	6430	5471	1.50	1585.82	107.10	4.46	0.149	
397.05	6706	5553	1.55	1587.97	107.60	4.48	0.157	
397.10	6986	5636	1.60	1590.30	108.08	4.50	0.166	
397.15	7270	5720	1.65	1592.67	108.55	4.52	0.173	
397.20	7558	5804	1.70	1595.31	109.00	4.54	0.181	
397.25	7850	5888	1.75	1597.98	109.44	4.56	0.188	
397.30	8147	5973	1.80	1600.63	109.87	4.58	0.195	

Notes:
- C2 is the slope coefficient from the area-depth linear regression.
- PP Elev indicates the elevation of the permanent pool.
- QC Elev indicates the elevation of the storage volume required by MOE for quality control.
- Ext Det indicates the elevation of extended detention.

Table 8A: Pond 1 - Stage-Storage-Outflow Curve for SWM Facility (Free Outfall Conditions)

			Quality Control 1		Quantity Control 1		Quantity Control 2		Overflow Control 1		Emergency Overflow			
			Vertical Orifice		Vertical Orifice		Vertical Rect. Orifice		Sharp Crested Weir		Broad Crested Weir			
			Dia (m)	0.110	Dia (m)	0.100	Width (m)	0.320	L (m)	4.200	L (m)	20.000		
							Height (m)	0.200						
			Area (m^2)	0.010	Area (m^2)	0.008	Area (m^2)	0.064	0.9mx1.2m drop inlet					
			Invert (m)	395.50	Invert (m)	396.00	Invert (m)	396.60	C_w	1.800	C_w	1.580		
			C_o	0.62	C_o	0.62	C_o	0.62	Invert (m)	397.60	Invert (m)	398.20		
			Q @ D	0.006	Q @ D	0.005	C_w	1.800	n contr.	0	n contr.	0		
Elevation	Active Sto.	Demarkation Points	Depth	Outflow	Depth	Outflow	Depth	Outflow	Head	Outflow	Depth	Outflow	Outflow	Storage
(m)	(m^3)		(m)	(m^3/s)	(m)	(m^3/s)	(m)	(m^3/s)	(m)	(m^3/s)	(m)	(m^3/s)	(m^3/s)	(ha·m)
395.50	**0**	**PP Elev**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
395.55	158		0.050	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.016
395.60	322		0.100	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.032
395.65	489		0.150	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.049
395.653	**498**	**QC Elev**	**0.153**	**0.008**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.008**	**0.050**
395.70	659		0.200	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.010	0.066
395.75	834		0.250	0.012	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.083
395.80	1012		0.300	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.013	0.101
395.85	1193		0.350	0.014	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.014	0.119
395.90	1379		0.400	0.015	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.015	0.138
395.95	1568		0.450	0.016	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.016	0.157
396.00	**1761**	**Ext Det**	**0.500**	**0.017**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.017**	**0.176**
396.05	1957		0.550	0.018	0.050	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.021	0.196
396.10	2158		0.600	0.019	0.100	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.024	0.216
396.15	2362		0.650	0.020	0.150	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.027	0.236
396.20	2570		0.700	0.021	0.200	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.029	0.257
396.25	2781		0.750	0.022	0.250	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.031	0.278
396.30	2997		0.800	0.023	0.300	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.033	0.300
396.35	3217		0.850	0.023	0.350	0.012	0.000	0.000	0.000	0.000	0.000	0.000	0.035	0.322
396.40	3440		0.900	0.024	0.400	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.037	0.344
396.45	3667		0.950	0.025	0.450	0.014	0.000	0.000	0.000	0.000	0.000	0.000	0.038	0.367
396.50	3898		1.000	0.025	0.500	0.014	0.000	0.000	0.000	0.000	0.000	0.000	0.040	0.390
396.55	4134		1.050	0.026	0.550	0.015	0.000	0.000	0.000	0.000	0.000	0.000	0.041	0.413
396.60	**4373**		**1.100**	**0.027**	**0.600**	**0.016**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.043**	**0.437**
396.65	4616		1.150	0.027	0.650	0.017	0.050	0.006	0.000	0.000	0.000	0.000	0.050	0.462
396.70	4863		1.200	0.028	0.700	0.017	0.100	0.017	0.000	0.000	0.000	0.000	0.062	0.486
396.75	5114		1.250	0.029	0.750	0.018	0.150	0.030	0.000	0.000	0.000	0.000	0.077	0.511
396.80	5369		1.300	0.029	0.800	0.019	0.200	0.045	0.000	0.000	0.000	0.000	0.093	0.537
396.85	5628		1.350	0.030	0.850	0.019	0.250	0.068	0.000	0.000	0.000	0.000	0.117	0.563
396.90	5892		1.400	0.030	0.900	0.020	0.300	0.079	0.000	0.000	0.000	0.000	0.129	0.589
396.95	6159		1.450	0.031	0.950	0.020	0.350	0.088	0.000	0.000	0.000	0.000	0.139	0.616
397.00	6430		1.500	0.031	1.000	0.021	0.400	0.096	0.000	0.000	0.000	0.000	0.149	0.643
397.05	6706		1.550	0.032	1.050	0.022	0.450	0.104	0.000	0.000	0.000	0.000	0.157	0.671
397.10	6986		1.600	0.032	1.100	0.022	0.500	0.111	0.000	0.000	0.000	0.000	0.166	0.699
397.15	7270		1.650	0.033	1.150	0.023	0.550	0.118	0.000	0.000	0.000	0.000	0.173	0.727
397.20	7558		1.700	0.033	1.200	0.023	0.600	0.124	0.000	0.000	0.000	0.000	0.181	0.756
397.25	7850		1.750	0.034	1.250	0.024	0.650	0.130	0.000	0.000	0.000	0.000	0.188	0.785
397.30	8147		1.800	0.034	1.300	0.024	0.700	0.136	0.000	0.000	0.000	0.000	0.195	0.815
397.35	8447		1.850	0.035	1.350	0.025	0.750	0.142	0.000	0.000	0.000	0.000	0.201	0.845
397.40	8752		1.900	0.035	1.400	0.025	0.800	0.147	0.000	0.000	0.000	0.000	0.208	0.875
397.45	9062		1.950	0.036	1.450	0.026	0.850	0.152	0.000	0.000	0.000	0.000	0.214	0.906
397.50	**9375**	**100 Year**	**2.000**	**0.036**	**1.500**	**0.026**	**0.900**	**0.157**	**0.000**	**0.000**	**0.000**	**0.000**	**0.220**	**0.938**
397.55	9693		2.050	0.037	1.550	0.026	0.950	0.162	0.000	0.000	0.000	0.000	0.225	0.969
397.60	**10015**		**2.100**	**0.037**	**1.600**	**0.027**	**1.000**	**0.167**	**0.000**	**0.000**	**0.000**	**0.000**	**0.231**	**1.002**
397.65	10342		2.150	0.038	1.650	0.027	1.050	0.171	0.050	0.085	0.000	0.000	0.321	1.034
397.70	10673		2.200	0.038	1.700	0.028	1.100	0.176	0.100	0.239	0.000	0.000	0.481	1.067
397.75	11008		2.250	0.039	1.750	0.028	1.150	0.180	0.150	0.439	0.000	0.000	0.686	1.101
397.80	11348		2.300	0.039	1.800	0.029	1.200	0.184	0.200	0.676	0.000	0.000	0.928	1.135
397.85	11692		2.350	0.040	1.850	0.029	1.250	0.188	0.250	0.945	0.000	0.000	1.202	1.169
397.90	12041		2.400	0.040	1.900	0.029	1.300	0.193	0.300	1.242	0.000	0.000	1.504	1.204
397.95	12394		2.450	0.040	1.950	0.030	1.350	0.197	0.350	1.565	0.000	0.000	1.832	1.239
398.00	12752		2.500	0.041	2.000	0.030	1.400	0.200	0.400	1.913	0.000	0.000	2.184	1.275
398.05	13115		2.550	0.041	2.050	0.031	1.450	0.204	0.450	2.282	0.000	0.000	2.558	1.311
398.10	13482		2.600	0.042	2.100	0.031	1.500	0.208	0.500	2.673	0.000	0.000	2.953	1.348
398.15	13854		2.650	0.042	2.150	0.031	1.550	0.212	0.550	3.084	0.000	0.000	3.369	1.385
398.20	**14230**	**Ovf Elev**	**2.700**	**0.042**	**2.200**	**0.032**	**1.600**	**0.215**	**0.600**	**3.514**	**0.000**	**0.000**	**3.803**	**1.423**
398.25	14611		2.750	0.043	2.250	0.032	1.650	0.219	0.650	3.962	0.050	0.353	4.609	1.461
398.30	14996		2.800	0.043	2.300	0.032	1.700	0.222	0.700	4.428	0.100	0.999	5.725	1.500
398.35	15386		2.850	0.044	2.350	0.033	1.750	0.226	0.750	4.910	0.150	1.836	7.048	1.539
398.40	**15781**	**Top of Berm**	**2.900**	**0.044**	**2.400**	**0.033**	**1.800**	**0.229**	**0.800**	**5.409**	**0.200**	**2.826**	**8.542**	**1.578**

Notes :
- PP Elev indicates the elevation of the permanent pool.
- QC Elev indicates the elevation of the storage volume required by MOE for quality control.
- Ext Det indicates the elevation of extended detention provided.
- Ovf Elev indicates the elevation of the overflow provided above the 100-year water level.
- Top of Berm indicates the elevation at the top of the berm.

Table 8B: Pond 1 - Stage-Storage-Outflow Curve for SWM Facility (Restrictive Downstream Conditions)

			Quality Control 1		Quantity Control 1		Quantity Control 2		Overflow Control 1		Emergency Overflow			
			Vertical Orifice		Vertical Orifice		Vertical Rect. Orifice		Sharp Crested Weir		Broad Crested Weir			
			Dia (m)	0.110	Dia (m)	0.100	Width (m)	0.320	L (m)	4.200	L (m)	20.000		
							Height (m)	0.200						
			Area (m^2)	0.010	Area (m^2)	0.008	Area (m^2)	0.064	0.9mx1.2m drop inlet					
			Invert (m)	397.03	Invert (m)	397.03	Invert (m)	397.03	C_w	1.800	C_w	1.580		
			C_o	0.62	C_o	0.62	C_o	0.62	Invert (m)	397.60	Invert (m)	398.20		
			Q @ D	0.006	Q @ D	0.005	C_w	1.800	n contr.	0	n contr.	0		
Elevation	**Active Sto.**	**Demarkation Points**	**Depth**	**Outflow**	**Depth**	**Outflow**	**Depth**	**Outflow**	**Head**	**Outflow**	**Depth**	**Outflow**	**Outflow**	**Storage**
(m)	**(m^3)**		**(m)**	**(m^3/s)**	**(m)**	**(m^3/s)**	**(m)**	**(m^3/s)**	**(m)**	**(m^3/s)**	**(m)**	**(m^3/s)**	**(m^3/s)**	**(ha·m)**
395.50	**0**	**PP Elev**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
395.55	158		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.016
395.60	322		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.032
395.65	489		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.049
395.653	**498**	**QC Elev**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.050**
395.75	834		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.083
395.80	1012		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.101
395.85	1193		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.119
395.90	1379		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.138
395.95	1568		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.157
396.00	**1761**	**Ext Det**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.176**
396.05	1957		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.196
396.10	2158		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.216
396.15	2362		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.236
396.20	2570		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.257
396.25	2781		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.278
396.30	2997		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.300
396.35	3217		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.322
396.40	3440		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.344
396.45	3667		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.367
396.50	3898		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.390
396.55	4134		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.413
396.60	**4373**		**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.437**
396.65	4616		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.462
396.70	4863		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.486
396.75	5114		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.511
396.80	5369		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.537
396.85	5628		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.563
396.90	5892		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.589
396.95	6159		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.616
397.00	6430		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.643
397.05	6706		0.020	0.004	0.020	0.003	0.020	0.025	0.000	0.000	0.000	0.000	0.032	0.671
397.10	6986		0.070	0.007	0.070	0.006	0.070	0.047	0.000	0.000	0.000	0.000	0.059	0.699
397.15	7270		0.120	0.009	0.120	0.007	0.120	0.061	0.000	0.000	0.000	0.000	0.077	0.727
397.20	7558		0.170	0.011	0.170	0.009	0.170	0.072	0.000	0.000	0.000	0.000	0.092	0.756
397.25	7850		0.220	0.012	0.220	0.010	0.220	0.082	0.000	0.000	0.000	0.000	0.105	0.785
397.30	8147		0.270	0.014	0.270	0.011	0.270	0.091	0.000	0.000	0.000	0.000	0.116	0.815
397.35	8447		0.320	0.015	0.320	0.012	0.320	0.099	0.000	0.000	0.000	0.000	0.126	0.845
397.40	8752		0.370	0.016	0.370	0.013	0.370	0.107	0.000	0.000	0.000	0.000	0.136	0.875
397.45	9062		0.420	0.017	0.420	0.014	0.420	0.114	0.000	0.000	0.000	0.000	0.145	0.906
397.50	**9375**	**100 Year**	**0.470**	**0.018**	**0.470**	**0.015**	**0.470**	**0.120**	**0.000**	**0.000**	**0.000**	**0.000**	**0.153**	**0.938**
397.55	9693		0.520	0.019	0.520	0.016	0.520	0.127	0.000	0.000	0.000	0.000	0.161	0.969
397.60	**10015**		**0.570**	**0.020**	**0.570**	**0.016**	**0.570**	**0.133**	**0.000**	**0.000**	**0.000**	**0.000**	**0.169**	**1.002**
397.65	10342		0.620	0.021	0.620	0.017	0.620	0.138	0.050	0.085	0.000	0.000	0.260	1.034
397.70	10673		0.670	0.021	0.670	0.018	0.670	0.144	0.100	0.239	0.000	0.000	0.422	1.067
397.75	11008		0.720	0.022	0.720	0.018	0.720	0.149	0.150	0.439	0.000	0.000	0.629	1.101
397.80	11348		0.770	0.023	0.770	0.019	0.770	0.154	0.200	0.676	0.000	0.000	0.872	1.135
397.85	11692		0.820	0.024	0.820	0.020	0.820	0.159	0.250	0.945	0.000	0.000	1.147	1.169
397.90	12041		0.870	0.024	0.870	0.020	0.870	0.164	0.300	1.242	0.000	0.000	1.451	1.204
397.95	12394		0.920	0.025	0.920	0.021	0.920	0.169	0.350	1.565	0.000	0.000	1.780	1.239
398.00	12752		0.970	0.026	0.970	0.021	0.970	0.173	0.400	1.913	0.000	0.000	2.133	1.275
398.05	13115		1.020	0.026	1.020	0.022	1.020	0.178	0.450	2.282	0.000	0.000	2.508	1.311
398.10	13482		1.070	0.027	1.070	0.022	1.070	0.182	0.500	2.673	0.000	0.000	2.904	1.348
398.15	13854		1.120	0.028	1.120	0.023	1.120	0.186	0.550	3.084	0.000	0.000	3.320	1.385
398.20	**14230**	**Ovf Elev**	**1.170**	**0.028**	**1.170**	**0.023**	**1.170**	**0.190**	**0.600**	**3.514**	**0.000**	**0.000**	**3.755**	**1.423**
398.25	14611		1.220	0.029	1.220	0.024	1.220	0.194	0.650	3.962	0.050	0.353	4.562	1.461
398.30	14996		1.270	0.029	1.270	0.024	1.270	0.198	0.700	4.428	0.100	0.999	5.679	1.500
398.35	15386		1.320	0.030	1.320	0.025	1.320	0.202	0.750	4.910	0.150	1.836	7.003	1.539
398.40	**15781**	**Top of Berm**	**1.370**	**0.031**	**1.370**	**0.025**	**1.370**	**0.206**	**0.800**	**5.409**	**0.200**	**2.826**	**8.497**	**1.578**

Notes :

- PP Elev indicates the elevation of the permanent pool.
- QC Elev indicates the elevation of the storage volume required by MOE for quality control.
- Ext Det indicates the elevation of extended detention provided.
- Ovf Elev indicates the elevation of the overflow provided above the 100-year water level.
- Top of Berm indicates the elevation at the top of the berm.

Table 10A: Pond 2 - Criteria for Required Storage Volumes

Pond	Area [(1)] (ha)	Imperviousness (%)	Storage Volume for Impervious Level [(2)] (m³/ha)
N/A	N/A	55	105
SWM Pond 2	23.96	59	109.00
N/A	N/A	70	120

(1) Refer to Appendix C for drainage areas to the SWM facility.

(2) Protection Level for Wetland: Enhanced 80% long-term S.S. removal.
SWM Planning & Design Manual, Table 3.2, p.3-10 (March 2003).

Table 10B: Pond 2 -Required Storage Volumes for SWM Facility

Pond Component	Required Volume (m³)	Provided Volume [(4)] (m³)	Volume Ratio	Pond Elevation (m)
Permanent Pool (PP) (1)	1653	2092	1.27	403.00
Quality Control (2)	958	958	1.00	403.16
Extended Detention (3)	3005	3393	1.13	403.50
Forebay (20% PP)	331	N/A	N/A	-
PP - Forebay	1323	N/A	N/A	-

(1) Required PP volume based on Table B-1.

(2) Required quality control volume based on 40 m^3/ha.

(3) Extended detention of the 25 mm storm runoff volume for a minimum of 48 hours.

(4) Provided volume based on stage-storage curve and extended detention (refer to Tables 11-A and 11-B).

(5) Based on grading plan provided by DSEL (refer to Figure 2).

(6) As per MOE, Maximum Forebay Area: 33% of Total Permanent Pool.

Table 11A: Pond 2 - Extended Detention Parameters for SWM Facility

Permanent Pool Parameters			Quality Orifice Parameters		
Area (C3)	5775.18	m^2	Dia.	0.170	m
Volume	2092	m^3			
PP Elev	403.000	m	Area	0.023	m^2
QC Elev	403.158	m	Invert	403.000	m
			C_o	0.62	

Notes:
- C3 is the intercept from the area-depth linear regression.
- PP Elev indicates the elevation of the permanent pool.
- QC Elev indicates the elevation of the storage volume required by MOE for quality control.
- h is the maximum water elevation above the orifice (m).

Table 11B: Pond 2- Extended Detention Drawdown Time for SWM Facility

Elev.	Active Storage			C2	Drawdown Time	Drawdown Time	Flow	Demarkation
(m)	V (m^3)	A (m^2)	depth (m)	(m^2/m)	(h)	(days)	(m^3/s)	Point
403.00	**0**	**5775**	**0.00**		**0.00**		**0.000**	**PP Elev**
403.05	293	5951	0.05	3519.54	30.47	1.27	0.005	
403.10	595	6130	0.10	3548.97	40.93	1.71	0.011	
403.15	906	6312	0.15	3575.82	47.40	1.97	0.016	
403.158	**958**	**6342**	0.16	3581.24	48.28	2.01	0.017	**QC Elev**
403.20	1226	6496	0.20	3602.12	52.19	2.17	0.021	
403.25	1556	6682	0.25	3626.60	56.13	2.34	0.025	
403.30	1895	6875	0.30	3665.49	59.60	2.48	0.029	
403.35	2252	7406	0.35	4659.92	62.86	2.62	0.032	
403.40	2625	7539	0.40	4410.65	65.95	2.75	0.035	
403.45	3006	7673	0.45	4217.16	68.86	2.87	0.038	
403.50	**3393**	**7806**	**0.50**	**4062.62**	**71.62**	**2.98**	**0.040**	**Ext Det**
403.55	3786	7940	0.55	3936.75	74.19	3.09	0.045	
403.60	4187	8074	0.60	3832.11	76.55	3.19	0.050	
403.65	4594	8209	0.65	3743.90	78.74	3.28	0.054	
403.70	5008	8343	0.70	3668.76	80.81	3.37	0.057	
403.71	5091	8372	0.71	3657.75	81.21	3.38	0.058	
403.75	5427	8435	0.75	3546.22	82.79	3.45	0.060	
403.80	5851	8508	0.80	3416.52	84.69	3.53	0.063	
403.85	6278	8582	0.85	3302.41	86.52	3.60	0.066	
403.90	6709	8656	0.90	3201.27	88.08	3.67	0.087	
403.95	7144	8731	0.95	3111.03	89.24	3.72	0.122	
404.00	7582	8805	1.00	3030.07	90.09	3.75	0.165	
404.05	8024	8880	1.05	2957.03	90.73	3.78	0.215	
404.10	8470	8955	1.10	2890.91	91.24	3.80	0.270	
404.15	8920	9031	1.15	2830.76	91.66	3.82	0.329	
404.20	9373	9106	1.20	2775.86	92.01	3.83	0.393	
404.25	9831	9182	1.25	2725.54	92.31	3.85	0.459	
404.30	10292	9258	1.30	2679.31	92.57	3.86	0.528	
404.35	10756	9335	1.35	2636.69	92.80	3.87	0.599	
404.40	11225	9411	1.40	2597.29	93.00	3.88	0.671	
404.45	11698	9488	1.45	2560.79	93.19	3.88	0.746	
404.50	12174	9566	1.50	2526.93	93.36	3.89	0.822	
404.55	12654	9643	1.55	2495.39	93.51	3.90	0.898	
404.60	13138	9721	1.60	2465.97	93.66	3.90	0.976	
404.65	13626	9799	1.65	2438.53	93.79	3.91	1.054	
404.70	14118	9877	1.70	2412.82	93.90	3.91	1.429	
404.75	14614	9956	1.75	2388.77	93.99	3.92	1.502	

Notes:
- C2 is the slope coefficient from the area-depth linear regression.
- PP Elev indicates the elevation of the permanent pool.
- QC Elev indicates the elevation of the storage volume required by MOE for quality control.
- Ext Det indicates the elevation of extended detention.

Table 12: Pond 2 Stage-Storage-Outflow Curve for SWM Facility (Free Outfall Conditions)

			Quality Control 1		Quantity Control 1		Quantity Control 2		Overflow Control 1		Emergency Overflow			
			Vertical Orifice		Vertical Orifice		Vertical Rect. Orifice		Sharp Crested Weir		Broad Crested Weir			
			Dia (m)	0.170	Dia (m)	0.100	Width (m)	0.900	L (m)	8.400	L (m)	20.000		
							Height (m)	0.800						
			Area (m^2)	0.023	Area (m^2)	0.008	Area (m^2)	0.720	1.8mx2.4m drop inlet					
			Invert (m)	403.00	Invert (m)	403.50	Invert (m)	403.85	C_w	1.800	C_w	1.580		
			C_o	0.62	C_o	0.62	C_o	0.62	Invert (m)	404.95	Invert (m)	405.20		
			Q @ D	0.018	Q @ D	0.005	C_w	1.800	n contr.	0	n contr.	2		
Elevation (m)	Active Sto. (m^3)	Demarkation Points	Depth (m)	Outflow (m^3/s)	Depth (m)	Outflow (m^3/s)	Depth (m)	Outflow (m^3/s)	Head (m)	Outflow (m^3/s)	Depth (m)	Outflow (m^3/s)	Outflow (m^3/s)	Storage (ha·m)
403.00	**0**	**PP Elev**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
403.05	293		0.050	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.029
403.10	595		0.100	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.011	0.060
403.15	906		0.150	0.016	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.016	0.091
403.158	**958**	**QC Elev**	**0.158**	**0.017**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.017**	**0.096**
403.20	1226		0.200	0.021	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.021	0.123
403.25	1556		0.250	0.025	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.025	0.156
403.30	1895		0.300	0.029	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.029	0.189
403.35	2252		0.350	0.032	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.032	0.225
403.40	2625		0.400	0.035	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.035	0.263
403.45	3006		0.450	0.038	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.038	0.301
403.50	**3393**	**Ext Det**	**0.500**	**0.040**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.040**	**0.339**
403.55	3786		0.550	0.043	0.050	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.045	0.379
403.60	4187		0.600	0.045	0.100	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.050	0.419
403.65	4594		0.650	0.047	0.150	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.054	0.459
403.70	5008		0.700	0.049	0.200	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.057	0.501
403.71	5091		0.710	0.049	0.210	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.058	0.509
403.75	5427		0.750	0.051	0.250	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.060	0.543
403.80	5851		0.800	0.053	0.300	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.063	0.585
403.85	**6278**		**0.850**	**0.055**	**0.350**	**0.012**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.066**	**0.628**
403.90	6709		0.900	0.056	0.400	0.013	0.050	0.018	0.000	0.000	0.000	0.000	0.087	0.671
403.95	7144		0.950	0.058	0.450	0.014	0.100	0.050	0.000	0.000	0.000	0.000	0.122	0.714
404.00	7582		1.000	0.060	0.500	0.014	0.150	0.091	0.000	0.000	0.000	0.000	0.165	0.758
404.05	8024		1.050	0.061	0.550	0.015	0.200	0.138	0.000	0.000	0.000	0.000	0.215	0.802
404.10	8470		1.100	0.063	0.600	0.016	0.250	0.191	0.000	0.000	0.000	0.000	0.270	0.847
404.15	8920		1.150	0.064	0.650	0.017	0.300	0.248	0.000	0.000	0.000	0.000	0.329	0.892
404.20	9373		1.200	0.066	0.700	0.017	0.350	0.309	0.000	0.000	0.000	0.000	0.393	0.937
404.25	9831		1.250	0.067	0.750	0.018	0.400	0.373	0.000	0.000	0.000	0.000	0.459	0.983
404.30	10292		1.300	0.069	0.800	0.019	0.450	0.440	0.000	0.000	0.000	0.000	0.528	1.029
404.35	10756		1.350	0.070	0.850	0.019	0.500	0.509	0.000	0.000	0.000	0.000	0.599	1.076
404.40	11225		1.400	0.071	0.900	0.020	0.550	0.580	0.000	0.000	0.000	0.000	0.671	1.123
404.45	11698		1.450	0.073	0.950	0.020	0.600	0.653	0.000	0.000	0.000	0.000	0.746	1.170
404.50	12174		1.500	0.074	1.000	0.021	0.650	0.726	0.000	0.000	0.000	0.000	0.822	1.217
404.55	12654		1.550	0.075	1.050	0.022	0.700	0.801	0.000	0.000	0.000	0.000	0.898	1.265
404.60	13138		1.600	0.077	1.100	0.022	0.750	0.877	0.000	0.000	0.000	0.000	0.976	1.314
404.65	13626		1.650	0.078	1.150	0.023	0.800	0.953	0.000	0.000	0.000	0.000	1.054	1.363
404.70	14118		1.700	0.079	1.200	0.023	0.850	1.326	0.000	0.000	0.000	0.000	1.429	1.412
404.75	14614		1.750	0.080	1.250	0.024	0.900	1.398	0.000	0.000	0.000	0.000	1.502	1.461
404.80	15114		1.800	0.082	1.300	0.024	0.950	1.466	0.000	0.000	0.000	0.000	1.572	1.511
404.85	**15617**	**100 Year**	**1.850**	**0.083**	**1.350**	**0.025**	**1.000**	**1.532**	**0.000**	**0.000**	**0.000**	**0.000**	**1.639**	**1.562**
404.90	16125		1.900	0.084	1.400	0.025	1.050	1.594	0.000	0.000	0.000	0.000	1.703	1.612
404.95	**16637**		**1.950**	**0.085**	**1.450**	**0.026**	**1.100**	**1.654**	**0.000**	**0.000**	**0.000**	**0.000**	**1.765**	**1.664**
405.00	17152		2.000	0.086	1.500	0.026	1.150	1.712	0.050	0.169	0.000	0.000	1.994	1.715
405.05	17672		2.050	0.087	1.550	0.026	1.200	1.769	0.100	0.478	0.000	0.000	2.360	1.767
405.10	18195		2.100	0.088	1.600	0.027	1.250	1.823	0.150	0.878	0.000	0.000	2.817	1.820
405.15	18723		2.150	0.090	1.650	0.027	1.300	1.876	0.200	1.352	0.000	0.000	3.345	1.872
405.20	**19255**	**Ovf Elev**	**2.200**	**0.091**	**1.700**	**0.028**	**1.350**	**1.927**	**0.250**	**1.890**	**0.000**	**0.000**	**3.936**	**1.925**
405.25	19790		2.250	0.092	1.750	0.028	1.400	1.977	0.300	2.484	0.050	0.353	4.935	1.979
405.30	20330		2.300	0.093	1.800	0.029	1.450	2.026	0.350	3.131	0.100	0.998	6.277	2.033
405.35	20874		2.350	0.094	1.850	0.029	1.500	2.074	0.400	3.825	0.150	1.833	7.855	2.087
405.40	**21422**	**Top of Berm**	**2.400**	**0.095**	**1.900**	**0.029**	**1.550**	**2.120**	**0.450**	**4.564**	**0.200**	**2.821**	**9.630**	**2.142**

Notes :

- PP Elev indicates the elevation of the permanent pool.
- QC Elev indicates the elevation of the storage volume required by MOE for quality control.
- Ext Det indicates the elevation of extended detention provided.
- Ovf Elev indicates the elevation of the overflow provided above the 100-year water level.
- Top of Berm indicates the elevation at the top of the berm.

Table 13: Summary of SWM Pond Operating Characteristics

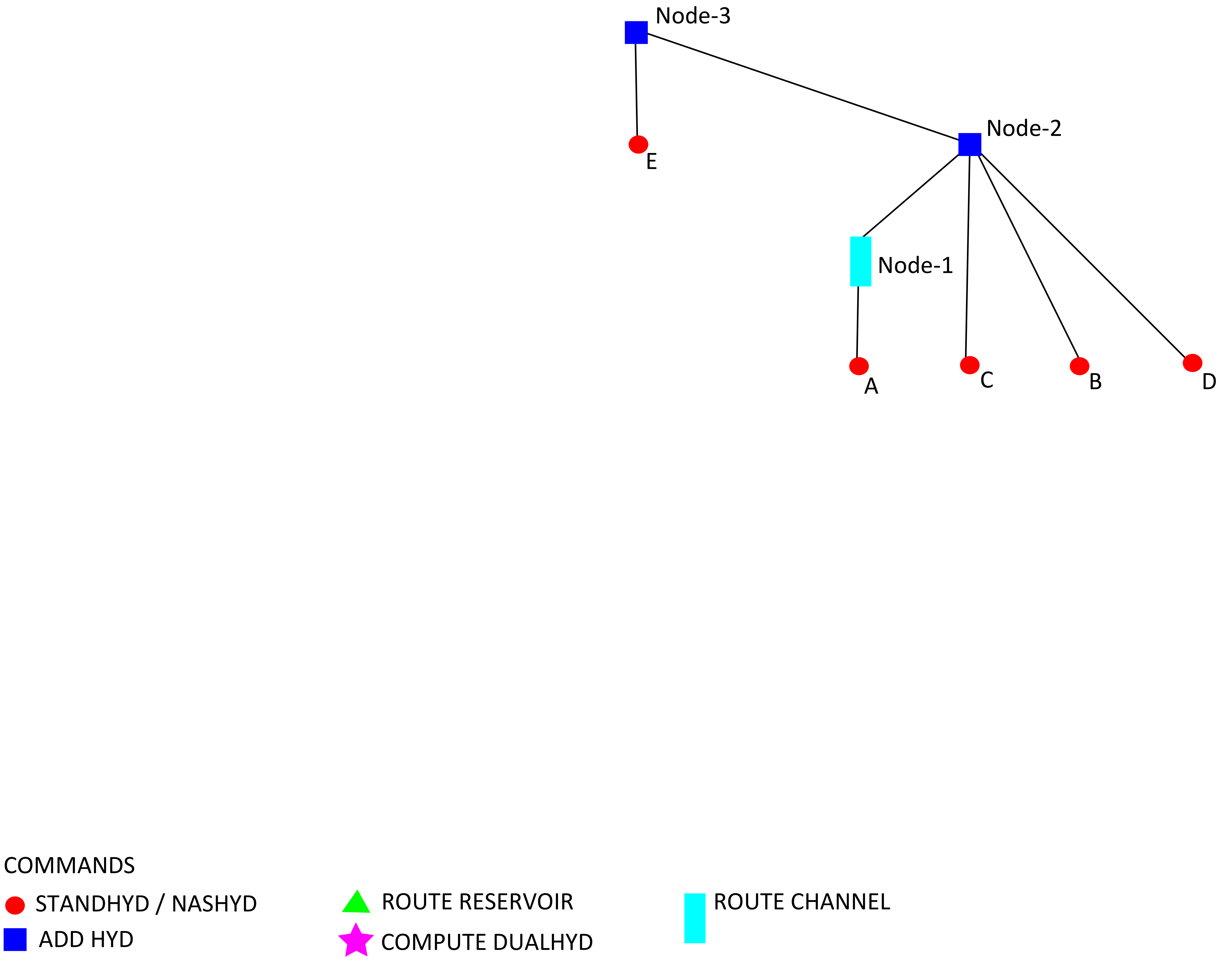
Pond Components	Pond 1 Release Rate (m^3/s)	Pond 1 Volume (m^3)	Node 1 - Target Flow[1] (m^3/s)	Node 1 - Post Dev[1] (m^3/s)	Difference (m^3/s)	Node 2 - Target Flow[2] (m^3/s)	Node 2 - Post Dev[2] (m^3/s)	Difference (m^3/s)	Pond 2 Release Rate (m^3/s)	Pond 2 Volume (m^3)	Node 3 - Target Flow[2] (m^3/s)	Node 3 - Post Dev[2] (m^3/s)
2-Year CHI 4Hr	0.030	2,660	0.086	0.080	-0.006	0.368	0.200	-0.168	0.059	5,261	0.404	0.403
5-Year CHI 4Hr	0.039	3,833	0.156	0.132	-0.024	0.675	0.330	-0.345	0.133	7,255	0.737	0.526
10-Year CHI 4Hr	0.052	4,642	0.212	0.171	-0.041	0.923	0.435	-0.488	0.247	8,284	1.005	0.766
25-Year CHI 4Hr	0.098	5,429	0.293	0.265	-0.028	1.285	0.615	-0.670	0.443	9,725	1.394	1.181
50-Year CHI 4Hr	0.134	6,015	0.359	0.347	-0.012	1.578	0.776	-0.802	0.597	10,750	1.709	1.519
100-Year CHI 4Hr	0.156	6,669	0.426	0.411	-0.015	1.879	0.924	-0.955	0.754	11,750	2.030	1.849
2-Year SCS 12 Hr	0.036	3,380	0.152	0.128	-0.024	0.670	0.306	-0.364	0.087	6,715	0.734	0.526
5-Year SCS 12 Hr	0.059	4,785	0.268	0.216	-0.052	1.190	0.522	-0.668	0.330	8,922	1.295	0.970
10-Year SCS 12 Hr	0.112	5,576	0.358	0.328	-0.030	1.596	0.732	-0.864	0.546	10,410	1.731	1.427
25-Year SCS 12 Hr	0.156	6,669	0.490	0.453	-0.037	2.192	1.017	-1.175	0.838	12,280	2.366	2.051
50-Year SCS 12 Hr	0.179	7,475	0.592	0.537	-0.055	2.651	1.221	-1.430	1.041	13,550	2.855	2.488
100-Year SCS 12 Hr	0.196	8,225	0.691	0.614	-0.077	3.092	1.415	-1.677	1.481	14,470	3.324	3.140
2-Year SCS 24 Hr	0.039	3,749	0.188	0.152	-0.036	0.827	0.382	-0.445	0.142	7,354	0.902	0.603
5-Year SCS 24 Hr	0.079	5,148	0.326	0.273	-0.053	1.448	0.649	-0.799	0.437	9,683	1.567	1.234
10-Year SCS 24 Hr	0.132	5,962	0.432	0.392	-0.040	1.922	0.889	-1.033	0.660	11,150	2.074	1.741
25-Year SCS 24 Hr	0.170	7,158	0.588	0.525	-0.063	2.618	1.211	-1.407	0.958	13,030	2.814	2.416
50-Year SCS 24 Hr	0.192	8,018	0.705	0.617	-0.088	3.143	1.446	-1.697	1.433	14,150	3.370	3.136
100-Year SCS 24 Hr	0.208	8,786	0.816	0.699	-0.117	3.635	1.660	-1.975	1.587	15,220	3.890	3.550

(1) Node1 - Target flows based on peak pre development flows at Downstream side of Side Road 17

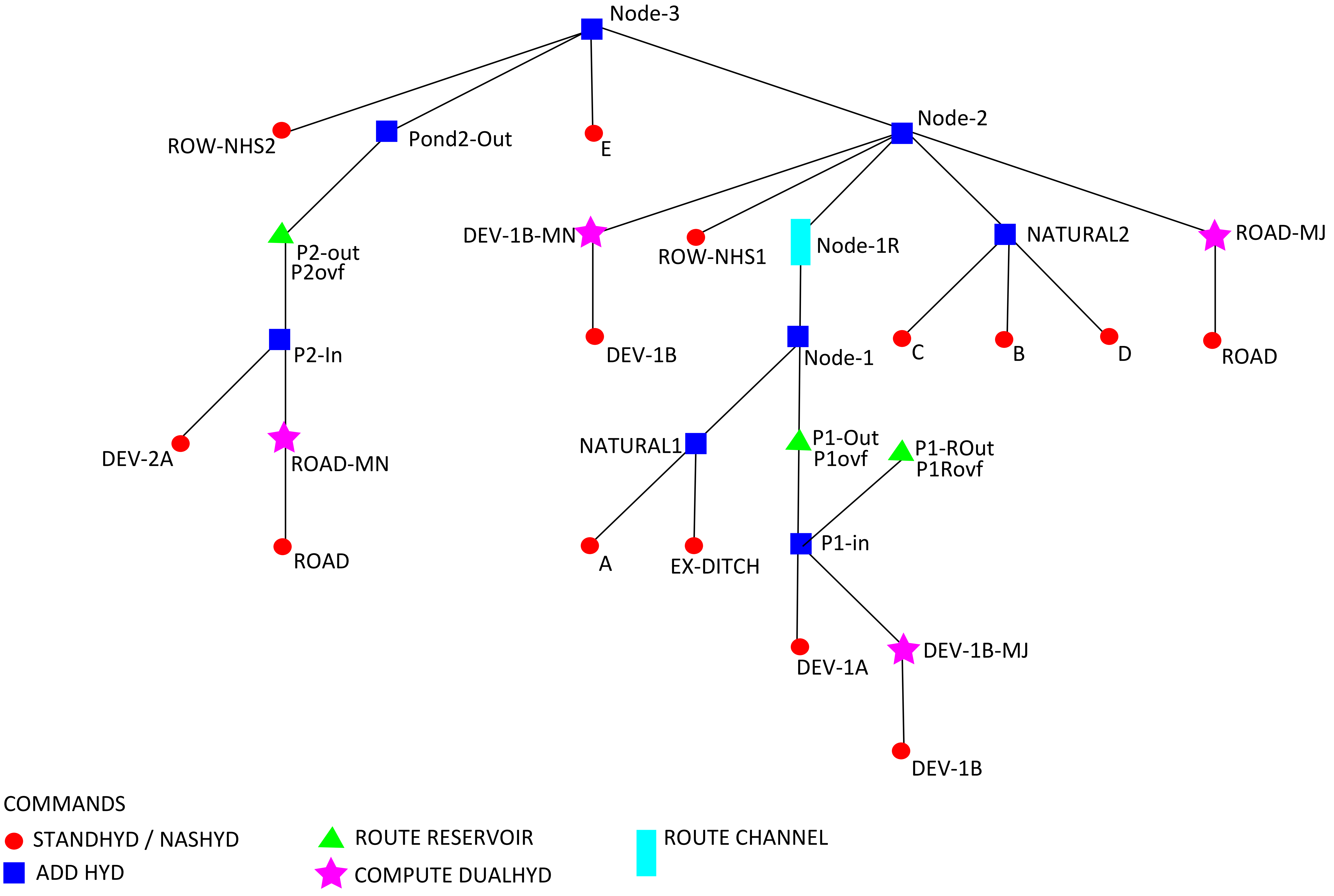
(2) Node 2 -Target flows based on peak pre development flows upstream of 8th Line Crossing

(3) Node 3 -Target flows based on peak pre development flows downstream of 8th Line Crossing

Existing Conditions SWMHYMO Schematic



Proposed Conditions SWMHYMO Schematic



APPENDIX H

FEATURE BASED WATER BALANCE ASSESSMENT

GEOMORPHIX LTD., JULY 2024

GEO | MORPHIX™

May 22, 2024

Mattamy (Erin) Limited and 2779181 Ontario Inc.
c/o David Schaeffer Engineering Limited
600 Alden Road, Suite 700
Markham, Ontario
L3R 0E7

Attention: **Mack McLean**

Re: **Feature Based Water Balance Assessment**
Proposed Residential Development
5520 & 5552 8th Line, Erin, Ontario
GEO Morphix Project No. 22026

GEO Morphix Ltd. was retained by Mattamy (Erin) Limited and 2779181 Ontario Inc. to conduct a feature-based water balance assessment of the wetland and aquatic features situated on the properties located at 5520 & 5552 Eighth Line in the Town of Erin, Ontario. Feature-based water balance assessments are undertaken to predict how changes in hydrological processes resulting from planned development will impact the water balance of surface water features such as wetlands and ponds. In most physiographic regions of Southern Ontario, development activities typically tend to increase the percentage of a property's impervious cover which depending on the details of the planned development may alter runoff rates to subject features. Therefore, a water balance assessment provides a means of understanding how land use changes may alter the hydrologic regime of these features.

For this assessment the following tasks were completed:

- Characterization of the study area by review of available background reports pertaining to the site's physiography, hydrology, and geology.
- Determine the hydrological characteristics for the distinct land uses for both the existing and proposed conditions using the methodology detailed in the Ontario Ministry of Environment's Stormwater Management Planning and Design Manual (MOE 2003).
- Complete pre- and post-development water balance assessment of eight (8) wetlands and two (2) aquatic features using a monthly water-balance approach (Thornthwaite and Mather 1957)
- Iteration of the model to account for changes to the proposed development plan for the site.
- Analysis of the results obtained from the final water balance model for each of the wetlands and aquatic features located on the subject property.

Study Area Location and Description

The subject property is located on a 65-ha site situated southwest of the intersection of Sideroad 17 and 8th Line in the town of Erin, Ontario. Existing land use at the site is a mix of crops, pasture, forested areas, meadows and swampland. The defining feature of the site is its relatively steep topography; the site is situated on a north facing slope with an average surface gradient of ~ 8%. Surface runoff drains to one of ten (10) distinct surface water features, six (6) of which are located on the property and four (4) of which are located immediately adjacent to the property, and which likely receive runoff from the subject property. Note that for modeling purposes features SAS1-1 and SWDM4-5 were considered a single feature (i.e., Wetland A), and features SWTM2-1 and SWDM2-2 were also considered a single feature (i.e., Wetland B).

For reference, a site location map showing the wetlands and ponds is provided in **Appendix A**.

Climatic Conditions

Climate data used for the water-balance assessment was obtained from the Fergus Shand Dam Climate Normals (Station ID: 6142400; Environment Canada, 2022). This weather station is located approximately 27 km west of the study area at an elevation of ~418 m above sea level and is the closest meteorological station with a climate record relevant for a water-balance assessment. Climate Normals (1981-2010) from the aforementioned weather station, indicate that the study area receives an average of 946 mm of annual precipitation (i.e., rain and snowfall). Total precipitation is highest in August (97 mm) and lowest in February (56 mm). Average monthly temperatures range from a minimum of -7.4°C in January to a maximum of 20.0°C in July. The months of December, January, February, and March have monthly average temperatures below 0°C.

Surface Water Hydrology and Drainage

The subject site is situated immediately south of the Erin Branch of the Credit River which flows through the West Credit River Wetland Complex located along the northern border of the property. Runoff from the site ultimately discharges to the Credit River via the Credit River Wetland Complex. There are eight (8) wetland features and two (2) aquatic feature (i.e., ponds) which are the subject of this assessment.

The wetlands are classified as either swamps or marshes with swamps defined as wooded wetlands with 25% or more tree or tall shrub cover; marshes are defined as wetlands with periodically or permanently inundated standing or slowly moving open water and which have limited woody vegetation cover (i.e., less than 25%; MNRF 2014). The relatively steep topography at the site indicates that runoff generation via the wetlands is likely dominated by rapid fill-and-spill processes with limited surface water retention or surface water storage within these features; with the exception of Wetland A which contains an open water feature (i.e., water storage). Based on our desktop analysis Wetland A does not appear to be directly connected to downstream wetlands via a surface water connection. Details about each of surface water features including the two off-site ponds are summarized in the table below which provides: (i) identification codes shown on the site's Ecological Land Classification Map dated June 9, 2022 (Burnside 2022); and (ii) the existing catchment areas as defined on the pre-development drainage area drawings provided by DSEL. For reference, a map showing the pre-development drainage areas for each of the features is provided in **Appendix A**.

With the exception of the wetlands and ponds there are no other surface water features shown on the Environmental Constraints map (Burnside 2022) and therefore on-site drainage to these features was assumed to be as overland flow along the topographic gradients and within the boundaries of the pre-development catchment areas that were provided.

Drainage to Wetland A, Pond 2, and Pond 3 were assumed to be contained within the feature (i.e., no surface water outlets), whereas Wetlands C, D, E, and F were assumed to be connected, with the outlet from the upstream wetland contributing inflows to the immediately downstream wetland. In the existing (pre-development) condition a corner of Wetland B is situated on a drainage divide with the catchment of Wetland E. Therefore, a small portion of the runoff from Wetland B was assumed to drain to Wetland E with the remaining outflow from Wetland B draining offsite via overland flow to a drainage ditch along 8th line.

Land cover classes were defined using the provided Environmental Constraints Map (Burnside) and were simplified to conform to the water balance methodology detailed in the Ontario Ministry of Environment's Stormwater Management Planning and Design Manual (MOE 2003). As such, existing land cover classes were defined as: forest; agriculture (moderately rooted crops; pasture and shrubs); and lawn. Land cover classes were used to define water balance component values for the feature-based water balance models. Post-development land cover classes were provided by DSEL along with their drainage areas and percent imperviousness. Hydrological routing between post-development features was also provided. For reference, maps showing the pre- and post-development land cover classes and drainage areas are provided in **Appendix A**.

Feature	ELC Code	Description	Surface Area (m^2)	Existing Catchment Area (m^2)
Wetland A	SAS1-1 & SWDM4-5	Pondweed submerged shallow aquatic, Poplar Mineral Deciduous Swamp	2440	35744
Wetland B	SWTM2-1 & SWDM2-2	Red-osier Dogwood Mineral Deciuous Thicket Swamp, Green Ash Minderal Deciduous Swamp	13506	56439
Wetland C	SMDM4-1	Willow Mineral Deciduous Swamp	4072	66800
Wetland D	MAMM1-3	Reed-canary Grass Gramiroid Mineral Meadow Marsh	865	75501
Wetland E (off-site)	MAMM2-2	Panicled Aster Mineral Meadow Marsh	466	55358
Wetland F (off-site)	SWDM4	Mineral Deciduous Swamp	3157	5411
Pond 2 (off-site)	AQ1	Aquatic System	1859	8143
Pond 3 (off-site)	AQ2	Aquatic System	3109	20043

Surficial Geology and Hydrogeological Conditions

The subject property is located in the eastern portion of the Guelph Drumlin Field, a physiographic region characterized by an expansive drumlin field furrowed by cross cutting glacial spillways that formed as a result of the advance and retreat of the continental ice sheets that covered the area until approximately 10,000 years ago (Chapman and Putman, 1987). The higher elevation portions of the site are located on a drumlinized till plain. The lower elevation portions of the site where the surface water features are situated is located on a post-glacial spillway (Chapman and Putman, 2007). Soils at the site are sandy loams with the upper portions of the site mapped as Donnybrook Sandy Loam and the lower portions of the site as Hillsburgh Fine Sandy Loam (OMAFRA, 2022).

Geotechnical Investigations were completed by Shad & Associates Inc. on behalf of the Mattamy Development Corporation in November of 2020, and January and March of 2021 (Shad 2020; Shad 2021a; Shad 2021b). One of the objectives of these investigations was to characterize subsurface conditions at the site; the relevant findings are summarized in the following paragraphs.

The November 2020 investigation involved the excavation and sampling of 11 test pits ranging in depth from 4.7 to 5.3 m below ground surface (bgs) distributed over the upper (higher elevation) half of the subject property. A detailed description of the stratigraphy of the project site is provided in the investigation report (Shad 2020). In general terms the site stratigraphy over this portion of the site can be summarized as follows: (i) a layer of topsoil (0-0.8m bgs); (ii) overlaying a layer of silty sand till with cobbles and boulders that was encountered to the maximum depth in each of the excavations. These results are consistent with the regional scale mapping of the area showing that this portion of the study site is a drumlinized till plain. The investigation report also notes that the glacial till is particularly compact at depths below 2.5m bgs, and that there was no observable groundwater seepage into any of the 11 test pits. Additionally, in March 2021 two boreholes were drilled to depths of 19.8 and 18.3 m below ground surface (bgs) with three borehole attempts aborted due to auger refusal on possible cobbles and/or boulders at depths of approximately 5-7 m bgs (Shad 2021b). The stratigraphy of the two boreholes is consistent with the results of the test pitting program over this portion of the site; topsoil over compact and very dense silty sand (till) and sandy silt (till) but with silty sand fill or fine sand fill extending to depths of approximately 1-2 m bgs. Both boreholes were dry upon completion as was the monitoring well installed in one of the wells at subsequent monitoring events on March 5 and 12, 2021. The report noted the potential for perched groundwater tables due to the presence of the dense and less-permeable deposits underlaying the more permeable topsoils and fill and possible fill at these locations.

The January 2021 investigation involved the excavation and sampling of 12 test pits ranging in depth from 4.1 to 5.0 m bgs distributed over the bottom (lower elevation) half of the subject property. A detailed description of the stratigraphy of the project site is provided in the investigation report (Shad 2021a). In general terms the site stratigraphy over this portion of the site can be summarized as follows: (i) a layer of topsoil (0-0.4 m bgs); (ii) overlaying organic stained silty sand (0.4-0.8 m bgs); (ii) overlaying a layer of silty sand till. However, in three test pits a silty sand layer extended to depths of 1.5 – 2.0 m bgs before till was encountered. Nine of the 12 test pits remained dry several hours after completion. The remaining three test pits accumulated water; at these three test pit locations a seam of water-yielding sand and gravel was observed at depths ranging from 2.0 to 3.5 m bgs. In all three locations these sand and gravel layers were between layers of glacial till. These results are consistent with the regional scale mapping of the site showing that the surficial geology over the northern portion of the site as either Port Stanley Till deposits (i.e., glacial diamicton) or glaciofluvial outwash deposits (i.e., gravel/sand under sand/silt).

Water Balance Methodology

Water balance calculations were completed using a monthly soil-moisture water balance approach (Thornthwaite and Mather, 1957). This is a relatively straightforward approach to estimate a monthly water balance from commonly available meteorological data (i.e., temperature and precipitation), and information about the site's topography, soils, and landcover. The approach uses the following relation where the variable quantities are expressed either as volumes or depths (volumes per unit area):

$$P = ET + R + I \qquad \text{[Eq. 1]}$$

Where:

P = Precipitation (mm)
ET = Evapotranspiration (mm)
R = Surface Water Runoff (mm)
I = Infiltration (mm)

Precipitation (P) data were retrieved from the Fergus Shand Dam Climate Normals 1981 to 2010 Canadian Climate Normals (Environment Canada, 2010), which report an average of 946 mm of annual total precipitation (i.e., rain and snow). Evapotranspiration (ET) rates are governed by meteorological conditions and influenced by water availability which is accounted for in the model. Potential evapotranspiration (PET) rates were calculated using a temperature-based method (Hamon, 1963).

Surface Water Runoff (R) and Infiltration (I) are largely dependent on soil type, topography and the proportion of impervious surface at the site. The values for these parameters for each of the various land cover classes within the wetland and pond catchment areas was determined using the methodology detailed in Table 3.1 of the MOE's Stormwater Planning and Design Manual (MOE, 2003). Using the land cover details shown on the provided Environmental Constraints Map land cover classes were delineated based on the vegetation cover types specified in the aforementioned MOE manual. Land cover classes are used to inform the infiltration factors and soil moisture storage capacities used in the water balance analysis. The infiltration factors are calculated as follows:

$$I.F = T + S + C \qquad \text{[Eq. 2]}$$

Where:

I.F = Infiltration factor
T = Topography Factor
S = Soil Type
C = Cover Type

This infiltration factor is then multiplied by the calculated monthly water surplus to estimate the monthly infiltration rate, with the remainder of the water surplus attributed to monthly surface runoff. Notably, infiltration is assumed not to occur during months in which the average temperature is below zero (December – March) as the available water is considered to be frozen. Note that the model does not directly account for the storage and flow of groundwater although some of the infiltrating water can assumed to discharge back to the stream as baseflow. The infiltration factors, soil types, soil moisture storage capacity and total area for each land use type are provided in the table below.

Land cover class	Water Holding Capacity (mm)	Topography (*T*)	Soils (*S*)	Cover (*C*)	Infiltration Factor
Forest	300	Very Hilly 0.05	Fine Sandy Loam 0.25	Woodland 0.2	0.50
Forest	300	Hilly 0.1	Fine Sandy Loam 0.25	Woodland 0.2	0.55
Pasture & Crops	150	Hilly 0.1	Fine Sandy Loam 0.25	Cultivated 0.1	0.45
Greenspace / NHS	150	Hilly 0.1	Fine Sandy Loam 0.25	Cultivated 0.1	0.45
Parkland / Lawn	75	Hilly 0.1	Fine Sandy Loam 0.25	Non-Cultivated 0.0	0.35

Results

For all on-site wetlands the water-balance model results indicate that post-development annual runoff volumes will be maintained within +/- 5% (i.e., 95-105% of pre-development annual runoff). The two off-site wetlands and off-site pond AQ2 are predicted to have post-development annual runoff volumes within +/- 10% of pre-development annual runoff volumes. The off-site pond AQ1 is within 11% of pre-development annual runoff volumes.

The post-development water balances to the features are achieved by: maintaining natural heritage features (i.e., forests), the conversion of portions of the sites existing agricultural and pastoral lands to parks and green space and the routing of runoff from these areas to wetlands and ponds via overland flow and clean water collection systems; the routing of rooftop drainage via backyard lawns to wetlands and ponds via overland flow and clean water collection systems; and the interception of a portion of the runoff from Wetland B (i.e., SWDM2-2;SWTM2-1) which currently drains to a roadside ditch along 8th line approximately 150m downslope from the wetland. In the proposed development a portion of the intercepted runoff from Wetland B will be directed into Wetland C (SWDM4-1) with the remainder directed to Wetland E (MAMM2-2) via a cut off swale located immediately downslope of Wetland B. To maintain the water balance for Wetland D (MAMM1-3) 135 L/s of minor system drainage from a medium density development block (see Dh on the "Post Development Drainage Areas and Land Cover Classes" Map) is proposed to be routed to the wetland via an oil and grit separator (OGS).

Seasonally, the water balance model shows that there is no surface runoff during the months of December-March owning to the model assumption that precipitation inputs during months with sub-zero temperatures (i.e., December-March) are as snow which is stored and released as melt water in April when average monthly temperatures rise above freezing (i.e., 5.7ºC). Under pre-development conditions approximately 83% of the annual runoff occurs in the spring (i.e., months of April-May), whereas in the post-development condition spring runoff volumes for the surface water features ranged from 64-83% of annual runoff.

Under existing conditions, the model also shows that during the months of June and July there is no surface runoff to any of the surface water features as evaporation rates exceed monthly precipitation rates during this period. Under post-development conditions the model shows that surface water features (with the exception of Pond 2) receive some runoff during the months of June and July; monthly runoffs in the range of 1-4% of annual runoff. The source of this runoff is the backyard lawns where rooftop drainage maintains a water surplus (i.e., precipitation inputs exceed rates of evapotranspiration) and therefore the generation of some runoff from these areas during June and July. The increased post-development runoff to the features during the summer months (May-September) offset the decreased runoff to the features during the months of April and November such that annual runoff volumes remain balanced to within +/- 5% of pre-development volumes for on-site wetlands, and to within +/- 11% for off-site wetlands and ponds.

In summary, the monthly water-balance indicates that under existing-conditions the hydrological regime of the wetlands is characterized as snow-melt dominant with dry summer conditions (June-August) followed by wetter autumn conditions (September-November) and an absence of runoff during the winter period (December-March). Under proposed conditions, the hydrological regime remains consistent with existing conditions with a slight reduction in spring and autumn runoff values and an increase in runoff through the wetlands during the summer period.

Feature	Existing Catchment Area (m^2)	Pre-development Total Runoff (m^3/year)	Post-development Total Runoff (m^3/year)	Deficit/ Surplus (m^3)	% of Pre-development Runoff
Wetland A	35744	7902	7782	-121	98%
Wetland B	56439	12056	12194	138	101%
Wetland C	66800	15245	14793	-452	97%
Wetland D	75501	33398	34196	798	102%
Wetland E (off-site)	55358	46521	50170	3649	108%
Wetland F (off-site)	5411	47658	51255	3597	108%
Pond 2 (off-site)	8143	1865	2078	213	111%
Pond 3 (off-site)	20043	4859	4446	-413	92%

Summary

This memo summarizes the results of a feature-based water-balance assessment to determine the influence of the proposed development on average monthly and average annual surface runoff volumes to the six (6) wetlands located on the subject property and the two (2) wetlands and two (2) ponds located immediately adjacent to the subject property. A monthly soil-moisture water balance approach (Thornthwaite and Mather, 1957) was used to predict the seasonal changes in evapotranspiration, runoff, and infiltration within the study area for pre- and post-development conditions. Water-balance model estimates indicate that the post-development annual runoff volumes are maintained within +/- 5% (i.e., 95-105% of pre-development annual runoff) for the four (4) on-site wetland features.

For the two (2) connected off-site wetlands (i.e., Wetlands E and F) the water-balance model estimates indicate an 8% increase in post-development annual runoff volumes. This increase in annual runoff volume is not expected to significantly alter the hydrology or hydroecology of the wetlands as both features are relatively narrow riverine wetlands that border a narrow, shallow, and steeply sloping watercourse (i.e., ~ 4% gradient) which flows from the site to the adjacent West Credit River. Given the morphology of the watercourse and wetlands the additional runoff is not expected to be retained within the features and therefore is not expected to alter the hydrological or ecological functioning of the wetlands. Water-balance model estimates indicate that post-development runoff to the two (2) off-site ponds are within +/- 11% of pre-development volumes. The increase in runoff to Pond 2 (AQ1; 11%) and the decrease in runoff to Pond 3 (AQ@; -8%) are not expected to significantly alter the hydrology of these features.

The water-balance models provide estimates of runoff to the site's surface water features. These models do not directly account for groundwater discharge to/from these features. There is a potential that groundwater fluxes may contribute to the seasonal and annual water balances for these surface water features; particularly for those features situated on the north end (lower elevation) portion of the subject property. However, 20 of the 23 (i.e., 87%) exploratory test pits dug at the site showed no evidence of groundwater seepage. At the three (3) test pits where groundwater seepage was observed, the water-yielding sand and gravel seams were situated under a 1.2 m to 2.0 m thick layer of silty sand glacial till (Shad 2021b). More detailed measurements within the wetlands would be required to determine whether net groundwater contributions are significant (i.e., > 5% of total annual inflows) to the annual water balances of the site's wetlands and pond.

The results of the feature-based water-balance models provide a relative assessment of the ability of the proposed post-development land use to match the annual pre-development water balances at this site and thereby to mitigate changes to hydrological conditions associated with the proposed development.

We trust the memo meets your current requirements. Should you have any questions, please contact the undersigned.

Respectfully submitted,

Paul Villard, Ph.D., P.Geo., CAN-CISEC, EP, CERP
Director, Principal Geomorphologist

Jan Franssen, Ph.D
Senior Watershed Scientist

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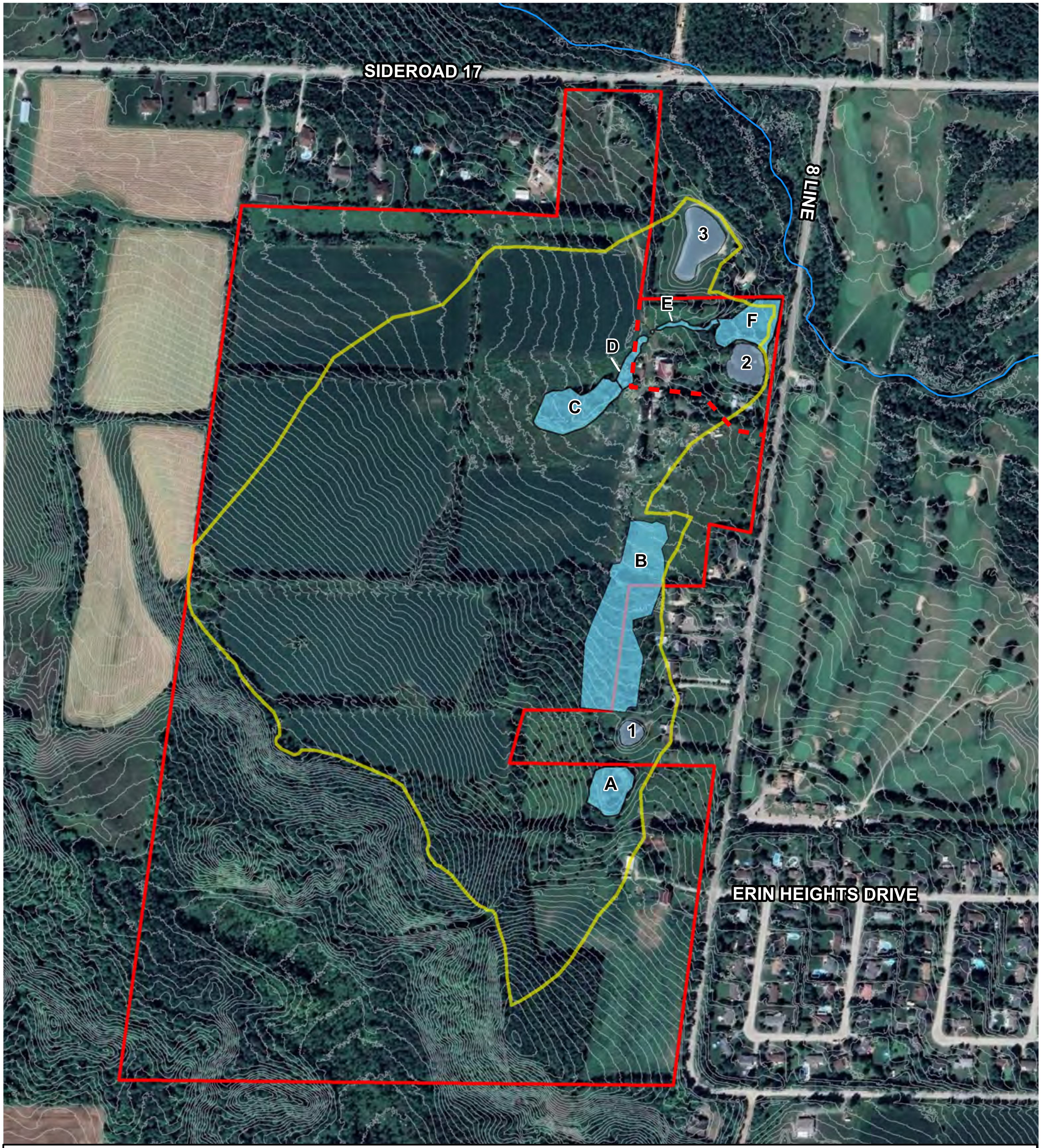
Appendix A
Figures



Legend

- Watercourse
- 1 m Contour
- Pond
- Wetland
- Catchment Area
- Study Boundary
- Retained Lands

Feature Based Water Balance Assessment

Study Site

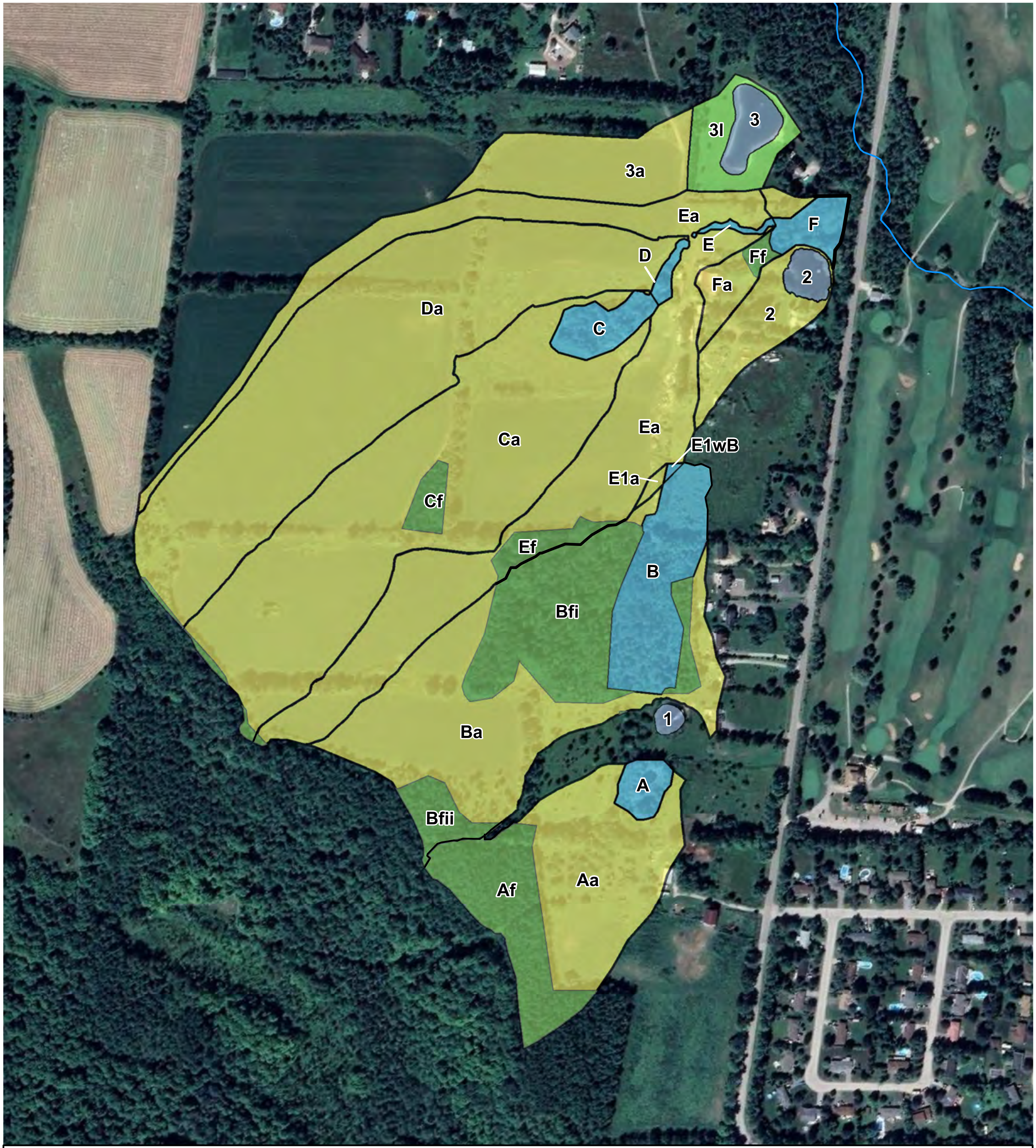
5520 and 5552 Eighth Line, Town of Erin, Ontario

GEO MORPHIX™

N

0 75 150
Metres

Imagery: Google Earth, 2018.
Watercourse: MNRF, 2021. 1 m Contour: MNRF, 2018.
Pond and Wetland: DSEL, 2022.
Catchement: GEO Morphix Ltd., 2022.
Print Date: June 2022. PN22026. Drawn By: J.F., M.O.



Legend

- Watercourse
- Pond
- Wetland
- Forest
- Agriculture
- Lawn
- Drainage Area

GEO MORPHIX™

Feature Based Water Balance Assessment

Existing Drainage Areas and Land Cover Classes

5520 and 5552 Eighth Line, Town of Erin, Ontario

N

0 75 150

Metres

Imagery: Google Earth, 2018.
Watercourse: MNRF, 2021.
Landuse Classification: GEO Morphix Ltd., 2022.
Pond and Wetland: DSEL, 2022.
Print Date: June 2022. PN22026. Drawn By: J.F., M.O.

Legend

〰 Watercourse

▨ Pond

▨ Wetland

▨ Forest

▨ Lawn

▨ Parks and Greenspace

▨ Development

GEO MORPHIX™

Feature Based Water Balance Assessment

Post Development Drainage Areas and Land Cover Classes

5520 and 5552 Eighth Line, Town of Erin, Ontario

N

0 75 150

Metres

Imagery: Google Earth, 2018.
Watercourse: MNRF, 2021.
Landuse Classification: GEO Morphix Ltd., 2022.
Pond and Wetland: DSEL, 2022.
Print Date: September 2023. PN22026. Drawn By: J.F., M.O.

Appendix B
Tables

WATER BALANCE SUMMARY TABLES

5520 & 5552 8th Line, Erin, Ontario [PN22026]

WETLANDS

(A) SMDM4-5; SAS1-1

Total Runoff to Wetland (m^3)	January	February	March	April	May	June	July	August	September	October	November	December	TOTAL
Pre-development	0	0	0	5921	657	0	0	0	2	717	604	0	7902
Post-development	0	0	0	4604	728	257	240	335	411	675	531	0	7782
Deficit/Surplus	0	0	0	-1317	70	257	240	335	409	-43	-72	0	-121

% Change 0.98

(B) SWTM2-1 & SWDM2-2

Total Runoff to Wetland (m^3)	January	February	March	April	May	June	July	August	September	October	November	December	TOTAL
Pre-development	0	0	0	9035	1003	0	0	0	3	1093	921	0	12056
Post-development	0	0	0	8772	1039	76	70	100	128	1096	913	0	12194
Deficit/Surplus	0	0	0	-263	35	76	70	100	125	3	-8	0	138

% Change 1.01

(C) SMDM4-1

post recieves runoff from portion of Wetland B (C1wB)

Total Runoff to Wetland (m^3)	January	February	March	April	May	June	July	August	September	October	November	December	TOTAL
Pre-development	0	0	0	11411	1267	0	0	0	6	1397	1164	0	15245
Post-development	0	0	0	10273	1281	143	108	219	357	1323	1088	0	14793
Deficit/Surplus	0	0	0	-1137	14	143	108	219	351	-75	-76	0	-452

% Change 0.97

(D) MAMM1-3

recieves runoff from Wetland C

Total Runoff to Wetland (m^3)	January	February	March	April	May	June	July	August	September	October	November	December	TOTAL
Pre-development	0	0	0	24912	2766	0	0	2	126	3052	2540	0	33398
Post-development	0	0	0	18768	3285	1515	1522	1854	2057	2938	2258	0	34196
Deficit/Surplus	0	0	0	-6144	519	1515	1522	1852	1931	-115	-283	0	798

% Change 1.02

(E) MAMM2-2

recieves runoff from Wetland D; recieves portion of runoff from Wetland B (E1wB pre; C1wB post)

Total Runoff to Wetland (m^3)	January	February	March	April	May	June	July	August	September	October	November	December	TOTAL
Pre-development	0	0	0	34713	3854	0	0	2	159	4252	3540	0	46521
Post-development	0	0	0	30401	4595	1506	1504	1890	2457	4368	3449	0	50170
Deficit/Surplus	0	0	0	-4312	741	1506	1504	1887	2298	116	-91	0	3649

% Change 1.08

(F) SWDM4

recieves runoff from Wetland E

Total Runoff to Wetland (m^3)	January	February	March	April	May	June	July	August	September	October	November	December	TOTAL
Pre-development	0	0	0	35558	3948	0	0	3	168	4355	3626	0	47658
Post-development	0	0	0	31215	4685	1501	1494	1890	2470	4467	3532	0	51255
Deficit/Surplus	0	0	0	-4343	738	1501	1494	1887	2302	112	-94	0	3597

% Change 1.08

PONDS

(2) AQ1

Total Runoff to Wetland (m^3)	January	February	March	April	May	June	July	August	September	October	November	December	TOTAL
Pre-development	0	0	0	1396	155	0	0	0	1	171	142	0	1865
Post-development	0	0	0	1555	173	0	0	0	1	191	159	0	2078
Deficit/Surplus	0	0	0	159	18	0	0	0	0	20	16	0	213

% Change 1.11

(3) AQ2

Total Runoff to Wetland (m^3)	January	February	March	April	May	June	July	August	September	October	November	December	TOTAL
Pre-development	0	0	0	3629	403	0	0	0	13	445	370	0	4859
Post-development	0	0	0	2662	412	131	115	181	252	390	305	0	4446
Deficit/Surplus	0	0	0	-967	9	131	115	181	239	-55	-65	0	-413

% Change 0.92

May 17, 2024

Mattamy (Erin) Limited and 2779181 Ontario Inc.
c/o David Schaeffer Engineering Limited
600 Alden Road, Suite 700
Markham, Ontario
L3R 0E7

Attn: Mack McLean, P.Eng.

Re: Response to the Town of Erin's Review of the Functional Servicing and Stormwater Management Report for 5520 Eighth Line and 5552 Eighth Line (2nd Submission)
Town of Erin, Ontario
GEO Morphix Project No. PN22026a

GEO Morphix Ltd. was retained by Mattamy (Erin) Limited and 2779181 Ontario Inc. to provide hydrologic and geomorphic expertise in support of the stormwater management (SWM) strategy for the proposed development located at 5520 & 5552 Eighth Line in the Town of Erin, Ontario. GEO Morphix has reviewed the comments provided by the Town of Erin on March 14, 2024, regarding the second FSR submission for the subject property, and pertaining to erosion mitigation along the receiving reach WC-1 flowing adjacent to the subject property. The purpose of this letter is to address the following comment regarding onsite retention and it relation to downstream erosion potential within the receiving reach of the West Credit River:

> *"Please provide a document from the geomorphologist (signed and sealed) to confirm that the 3 mm retention will not cause downstream erosion at the receiving channel."*

We note that the June 8, 2022 Erosion Mitigation report prepared by GEO Morphix suggested working toward a 5 mm on-site retention target. The 5 mm target is the best-efforts target for erosion mitigation referenced from the CVC stormwater guidelines.

For the following reasons the provided 3 mm of on-site retention is assessed to be sufficient in mitigating against the potential of excess erosion within reach WC-1:

i) Reach WC-1 is a stable reach not particularly sensitive to erosion. As detailed in the Erosion Mitigation report, Reach WC-1 is a low gradient, relatively wide stream channel that is very well connected to the extensive wetland system bordering the channel. No significant active erosion was observed within or downstream of the subject lands, and a survey of historical images of the reach indicated no significant changes in channel planform. These site characteristics suggest that reach WC-1 is stable and not particularly sensitive to erosion.

ii) The development footprint is small relative to the reach WC-1 drainage area. The drainage area of WC-1 is approximately 3,570 ha (as defined using the OWIT assessment tool). The drainage area to WC-1 via the site is approximately 55 ha of which 46 ha is on the subject lands. The drainage area of the subject lands accounts for approximately 1.3% of the total drainage area to reach WC-1. Developments with such relatively small footprints are not likely to have any meaningful or detectable impact on the rates of erosion within the receiving watercourses.

iii) All the site's existing wetland and forested areas will be retained which includes approximately 12.3 ha of forests, wetlands, and wetland buffer areas, accounting for approximately 27% of the drainage area from the subject lands. A Feature-based Water Balance for the wetlands conveying runoff from the site to the wetland complex adjacent to reach WC-1 indicates that annual runoff volumes to the wetland complex will increase by 8% but that peak monthly runoff volumes which occur during the month of April will be reduced by approximately 12%. All individual wetlands on site are within +/- 5% of pre-development targets. We therefore expect there to be a slight reduction in erosion potential related to reduced spring runoff volumes from the site.

Within this context, the provided 3 mm onsite retention is expected to be sufficient to reduce the risk of excess erosion at reach WC-1 as the assimilative capacity of the receiving channel is adequate based on the expected hydrological changes associated with the development. Given the size of the receiving watercourse, it is understood the planned LIDs and wetland water balance requirements will appropriately mitigate potential erosion risk at this location.

We trust this memo meets your current requirements. Should you have any questions, please contact the undersigned.

Respectfully submitted,

PROFESSIONAL GEOSCIENTIST
PAUL V. VILLARD
PRACTISING MEMBER
0957
ONTARIO

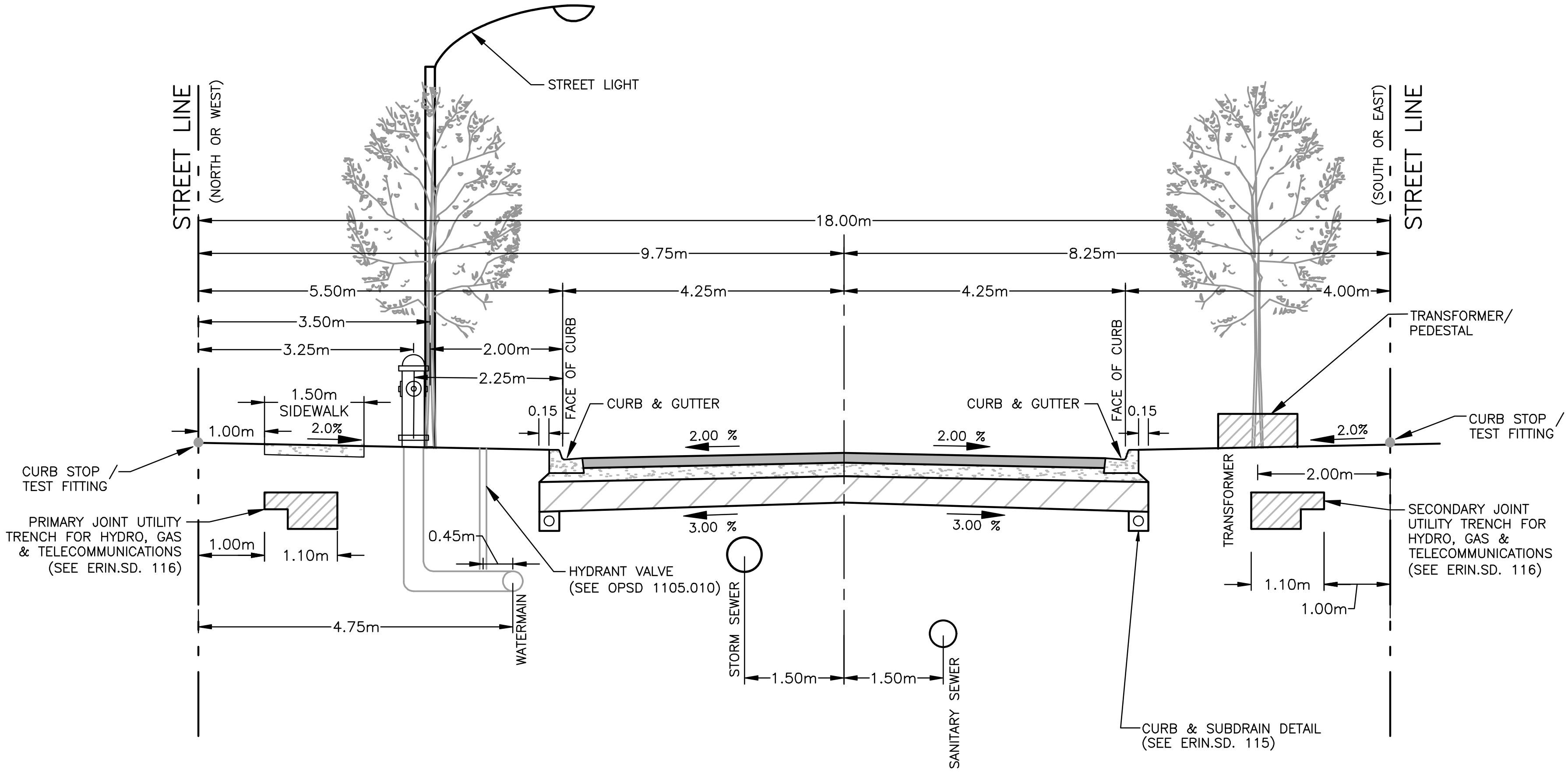
Paul Villard, Ph.D., P.Geo., CAN-CISEC, EP, CERP
Director, Principal Geomorphologist

Jan Franssen, Ph.D
Senior Watershed Scientist

APPENDIX I

STANDARD RIGHT OF WAY CROSS SECTIONS

TOWN OF ERIN, NOVEMBER 2021



NOTE:

1. 18.0m CORRIDOR ONLY TO BE USED ON SUBDIVISIONS WITH DRAFT PLAN APPROVAL AS OF APRIL 2021.

TOWN OF ERIN

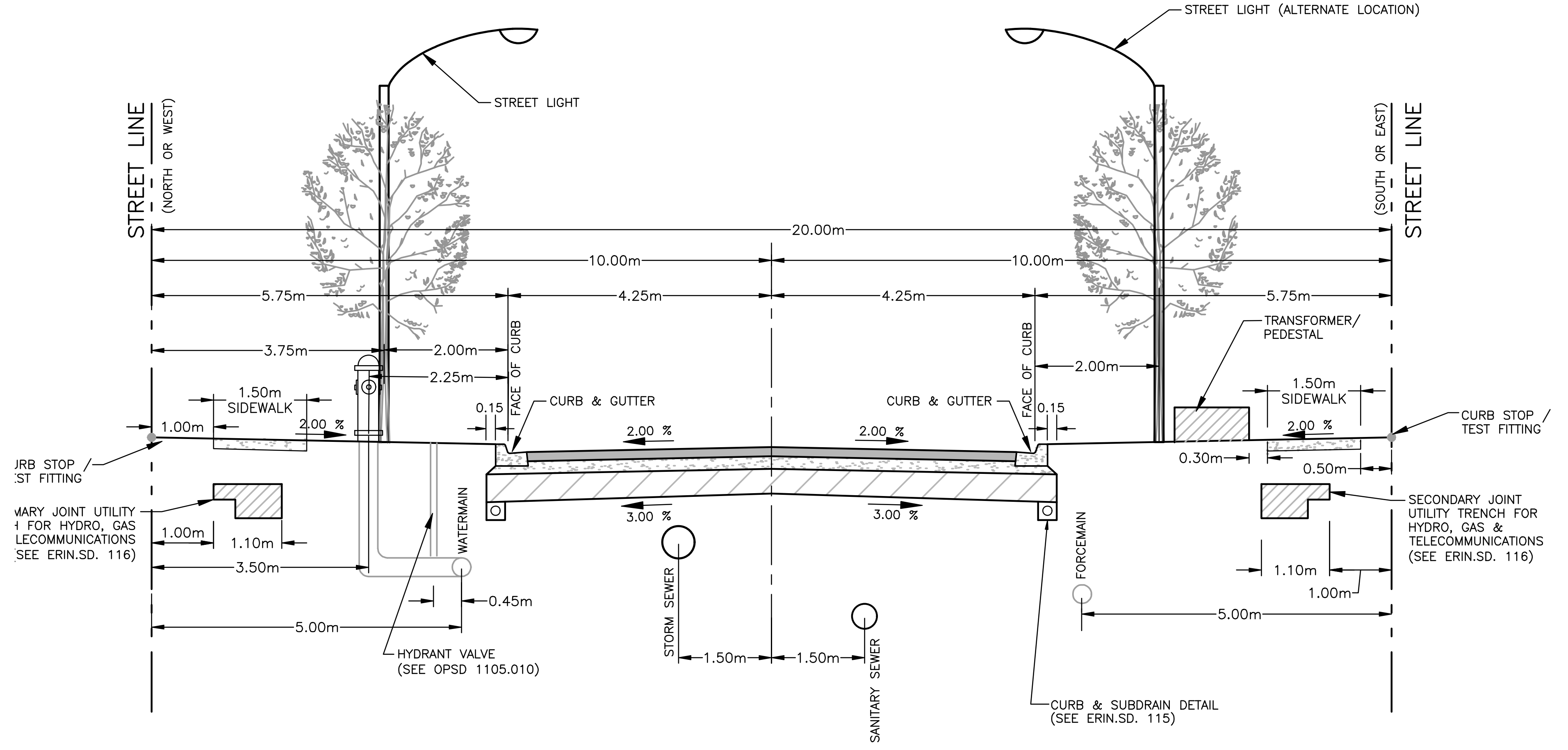
URBAN MINOR LOCAL
(8.5m ROAD ON 18.0m RIGHT-OF-WAY)

NO.	REVISIONS	DATE	APR'D

SCALE: N.T.S.

DATE: NOV. 2021

**ERIN SD.
101**



NOTE:

1. WHERE MULTI-USE TRAIL OR BICYCLE LANES ARE REQUIRED THE ROW WIDTH SHALL BE INCREASED TO 26.0m

TOWN OF ERIN

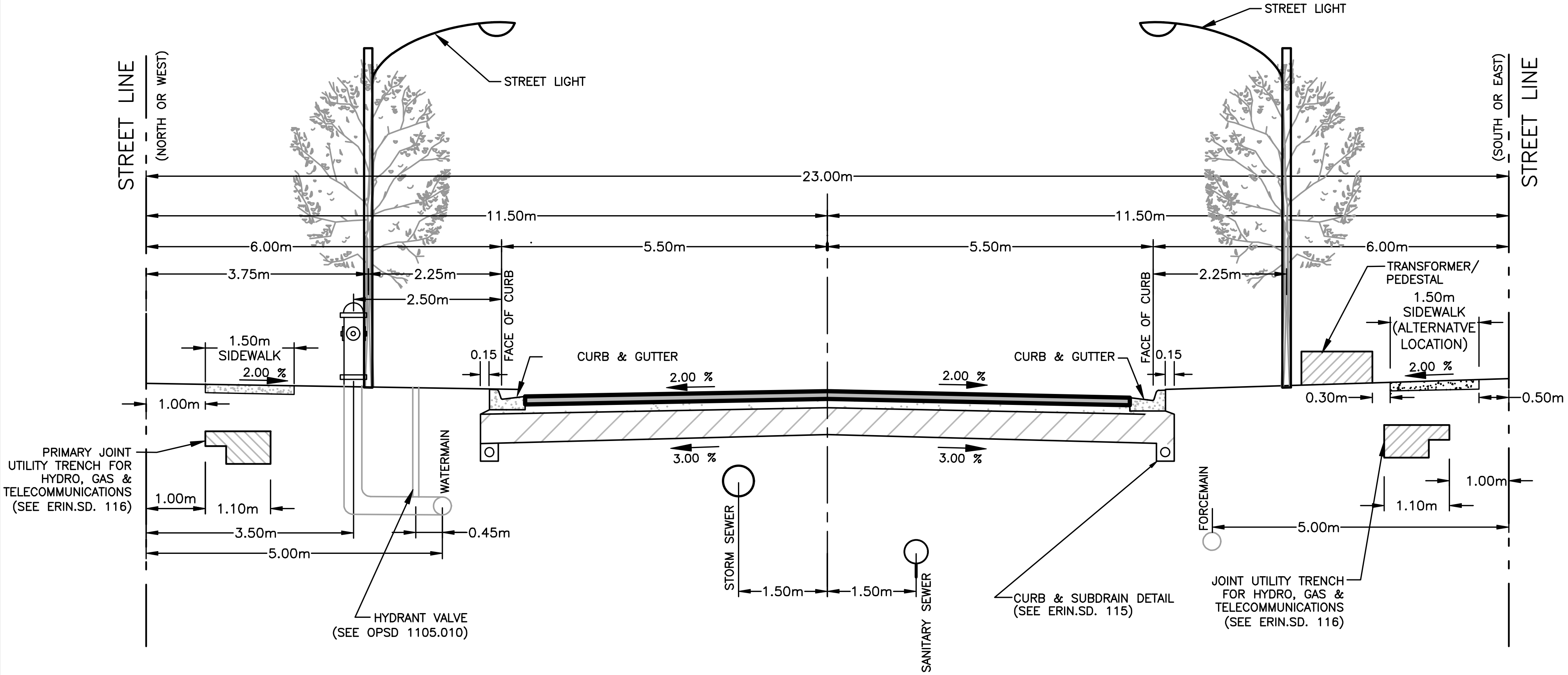
URBAN/ SUBURBAN ROAD SECTION (8.5m ROAD ON 20.0m RIGHT-OF-WAY)

NO.	REVISIONS	DATE	APR'D

SCALE: N.T.S.

DATE: NOV. 2021

ERIN SD. 102



NOTE:

1. WHERE MULTI-USE TRAIL OR BICYCLE LANES ARE REQUIRED THE ROW WIDTH SHALL BE INCREASED TO 26.0m

TOWN OF ERIN

MINOR COLLECTOR
(10.0m ROAD ON 23.0m RIGHT-OF-WAY)

NO.	REVISIONS	DATE	APR'D

SCALE: N.T.S.

DATE: NOV. 2021

ERIN SD.
103

APPENDIX J

PRELIMINARY GEOTECHNICAL SLOPE STABILITY ANALYSIS

SHAD AND ASSOCIATES INC., JUNE 2022 & MAY 2024

SHAD & ASSOCIATES INC.

June 1, 2022
Ref. No.: T20828

Mattamy (Erin) Limited
c/o David Schaeffer Engineering Limited
600 Alden Road, Suite 700
Markham, Ontario
L3R 0E7

Attention: **Mr. Alexandra Schaeffer, P.Eng.**

RE: **PRELIMINARY GEOTECHNICAL SLOPE STABILITY ANALYSIS**
SITE GRADING
ERIN PROPERTY
8TH LINE 7 & DUNDAS STREET WEST
ERIN, ONTARIO

As requested, we have carried out some preliminary slope stability analysis for the proposed site slopes at the above captioned site and this report is prepared to summarize our findings and recommendations. For this review and assessment, the following information were referenced:

1) Conceptual Grading Plan prepared by David Schaeffer Engineering Limited (‘DSEL’ plan dated May 2022);
2) Geotechnical Test Pit Investigation Report (South Parcel); Report prepared by Shad & Associates Inc. (‘Shad’ Report No. T20828 dated November 9, 2020);
3) Geotechnical Test Pit Investigation Report (North Parcel); Shad Report No. T20828-1 dated January 18, 2021; and
4) Geotechnical Borehole Information; Shad Report T21837 dated March 13, 2021.

It should be noted that this report is prepared as an addendum to the above-mentioned geotechnical reports and they should be referenced for additional details and recommendations.

1.0 Subsurface Conditions

Based on the subsurface conditions encountered at the preliminary test pits and a couple of boreholes drilled at the property, generally below some surficial topsoil and/or fill and some compact silty sand to sandy silt till extending down to a depth of about 1 to 2 m below existing ground surface, the site was predominantly underlain by dense to very dense silty sand to sandy silt till extending down to the investigated depths. Furthermore, the boreholes drilled on the site were both dry on completion as well as during the groundwater monitoring through the installation of a standpipe piezometer in one of the boreholes.

2.0 Slope Stability Analysis

Considering the above subsurface information, some preliminary slope stability analysis were carried out for the proposed relatively larger cuts and fills by assuming six representative cross sections passing through the most critical parts of the site. The assumed sections are shown in Figure 1.

The assumed sections were analysed by assuming conservative soil parameters based on the preliminary subsurface information, the field and laboratory tests performed, our experience with similar site conditions as well as published geotechnical data. These are summarized in Table 1.

Table 1: Assumed Conservative Geotechnical Parameters

Soil Type	Bulk Unit Weight (kN/m^3)	Shear Strength Parameters			
		C' (kPa)	Φ' (degree)	C_u (kPa)	Φ_u (degree)
Existing Topsoil, Silty Sand/Sandy Silt Fill	17.0	0	17	0	16
Compact Silty Sand/Sandy Silt Till, Engineered Silty Sand/Sandy Silt Fill	19.0	0	30	0	29
Dense to Very Dense Silty Sand to Sandy Silt Till	22.0	0	34	0	33

For slope stability analysis, computer program Slope/W 2012 and the Bishop's Simplified method for the calculation of the factor of safety for slip surface were used. For a slope to be assessed as being stable under static loading, a minimum Factor of Safety ('FOS') of 1.5 is normally required. Furthermore, the pond walls were also analysed under seismic loading conditions. The site-specific seismic hazards as per National Building Code of Canada (2015) were obtained from Earthquakes Canada website (www.EarthquakesCanada.ca) and are provided in Appendix A. The peak ground acceleration (PGA) for 2 percent probability in 50 years (0.000404 per annum or return period of 2,475 years) for the site is 0.081g corresponding to Site Class C. For this study, although a geophysical assessment was not completed in assessing the applicable seismic site classification, considering the subsurface conditions encountered at the boreholes drilled at the site, for a conservative analysis, a site Class D is assigned for seismic design purposes. Therefore, the peak ground acceleration corresponding to Site Class D at the site will be PGA=1.3×0.081g=0.1053g. According to industry standards, the acceleration used in pseudostatic analysis is equal to 0.5 × PGA. Based on these values and in accordance with the Canadian Foundation Manual (4th Edition), the following parameters were used for seismic stability evaluations:

Horizontal Seismic Coefficient = 0.5 X 0.1053g=0.0527g
Vertical Seismic Coefficient = 0

For a stable slope under seismic loading using pseudostatic analysis, a minimum FOS of 1.1 is normally recommended.

Considering the subsurface soil and groundwater information as well as the assumed geotechnical parameters, the assumed cross-sections were analyzed under the following conditions:

-During and Immediately after the End of Construction (Undrained Analysis);
-Long-term (Drained Analysis); and
-Seismic Loading (Undrained Analysis).

Where applicable, surface loads of 30 kPa and 12 kPa were assumed across the proposed roads in order to include the effects of construction and traffic loads in the slope stability analysis. Furthermore, any existing topsoil and/or fill located within the study area were assumed to be removed and replaced with properly placed and compacted engineered fill.

Considering the above details, the stability of the assumed six cross-sections was analysed and some of the results are shown in Enclosures 1 to 18. The results indicate stable conditions with calculated FOS being more than the minimum recommended value of 1.5 for static conditions and 1.1 under seismic loading.

3.0 Discussions and Recommendations

Based on the subsurface conditions encountered at the test pits excavated at the site as well as the two relatively boreholes drilled within the property, the proposed side slopes were assessed to be stable under static and seismic loading conditions. However, we would recommend that before final design, the assumed subsurface conditions to be confirmed by drilling representative number of the boreholes as well as carrying out supplementary detailed slope stability modelling and analysis.

Furthermore, in an attempt to minimize the potential for surface erosion and formation of gulleys and localized slope instability, we would recommend the proposed side slopes to be covered with topsoil and vegetated.

4.0 Closure

We wish to mention that this report is prepared as addendum to Shad Geotechnical Investigation Reports T20828, T20828-1 and T21837. These reports should be referenced for more details.

Sincerely,
Shad & Associates Inc.

S. Chong

LICENSED PROFESSIONAL ENGINEER
H. SHAD
PROVINCE OF ONTARIO

H. Shad

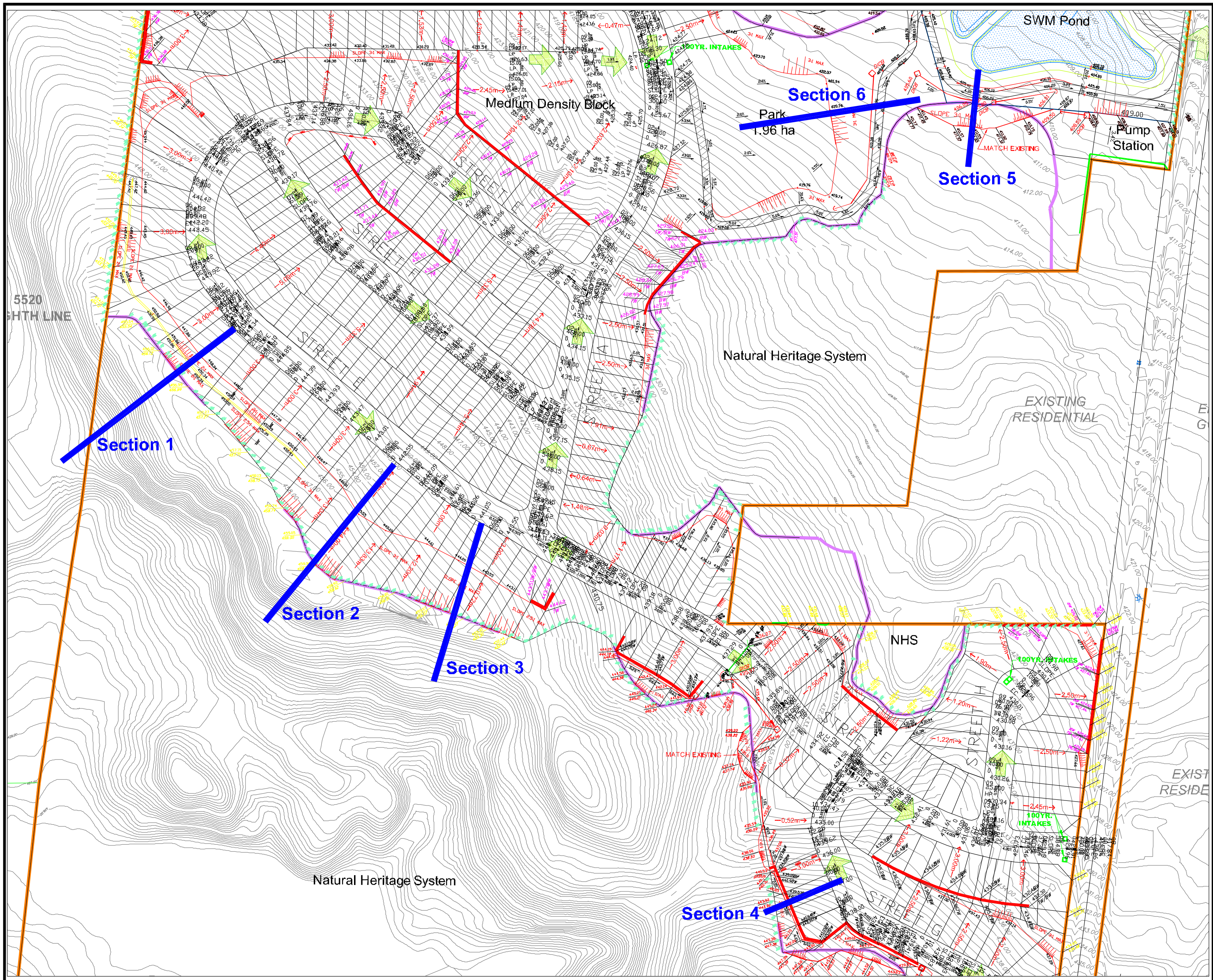
Stephen Chong, P.Eng.
Senior Engineer

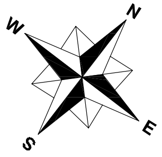
Houshang Shad, Ph.D., P. Eng.
Principal

cc. Mr. Ryan Oosterhoff, Mattamy (Erin) Limited

FIGURES

FIGURE 1: ASSUMED CROSS-SECTIONS FOR SLOPE STABILITY ANALYSIS





LEGEND:

▬ Sections

NOTES:

1. Cross-Section locations are approximate.
2. Drawing was provided by DSEL.
3. The drawing should be read in conjunction with the associated report by Shad & Associates Inc. T20828.

CLIENT:

Mattamy (Erin) Limited

SHAD & ASSOCIATES INC.
GEOTECHNICAL, ENVIRONMENTAL AND MATERIALS ENGINEERS
83 Citation Drive, Unit 9
Vaughan, Ontaruio, L4K 2Z6
Tel: (905) 760-5566
Fax: (905) 760-5567

Drawn By:	R.H.
Checked By:	H.S.
Datum:	-
Projection:	-
Scale:	-

TITLE:

ASSUMED CROSS-SECTIONS FOR SLOPE STABILITY ANALYSIS

PROJECT:

Proposed Residential Subdivision
Erin Property
5520 8th Line, Erin, Ontario

Date:	June, 2022
Project No.:	**T20828**
Figure No.:	**1**

APPENDICES

APPENDIX A: SITE SPECIFIC SEISMIC HAZARDS AS PER NBC 2015

2015 National Building Code Seismic Hazard Calculation

INFORMATION: Eastern Canada English (613) 995-5548 français (613) 995-0600 Facsimile (613) 992-8836
Western Canada English (250) 363-6500 Facsimile (250) 363-6565

Site: 43.736N 80.044W **User File Reference:** Erin Subdivision 2022-05-30 18:58 UT

Requested by: Razi Husnain, Shad & Associates Inc.

Probability of exceedance per annum	0.000404	0.001	0.0021	0.01
Probability of exceedance in 50 years	2 %	5 %	10 %	40 %
Sa (0.05)	0.112	0.065	0.038	0.010
Sa (0.1)	0.146	0.088	0.054	0.016
Sa (0.2)	0.132	0.081	0.052	0.018
Sa (0.3)	0.107	0.067	0.044	0.016
Sa (0.5)	0.082	0.053	0.035	0.012
Sa (1.0)	0.047	0.031	0.020	0.006
Sa (2.0)	0.024	0.015	0.010	0.003
Sa (5.0)	0.006	0.004	0.002	0.001
Sa (10.0)	0.003	0.002	0.001	0.000
PGA (g)	0.081	0.048	0.030	0.009
PGV (m/s)	0.066	0.040	0.026	0.007

Notes: Spectral (Sa(T), where T is the period in seconds) and peak ground acceleration (PGA) values are given in units of g (9.81 m/s^2). Peak ground velocity is given in m/s. Values are for "firm ground" (NBCC2015 Site Class C, average shear wave velocity 450 m/s). NBCC2015 and CSAS6-14 values are highlighted in yellow. Three additional periods are provided - their use is discussed in the NBCC2015 Commentary. Only 2 significant figures are to be used. **These values have been interpolated from a 10-km-spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the directly calculated values.**

References

National Building Code of Canada 2015 NRCC no. 56190; Appendix C: Table C-3, Seismic Design Data for Selected Locations in Canada

Structural Commentaries (User's Guide - NBC 2015: Part 4 of Division B)
Commentary J: Design for Seismic Effects

Geological Survey of Canada Open File 7893 Fifth Generation Seismic Hazard Model for Canada: Grid values of mean hazard to be used with the 2015 National Building Code of Canada

See the websites www.EarthquakesCanada.ca and www.nationalcodes.ca for more information

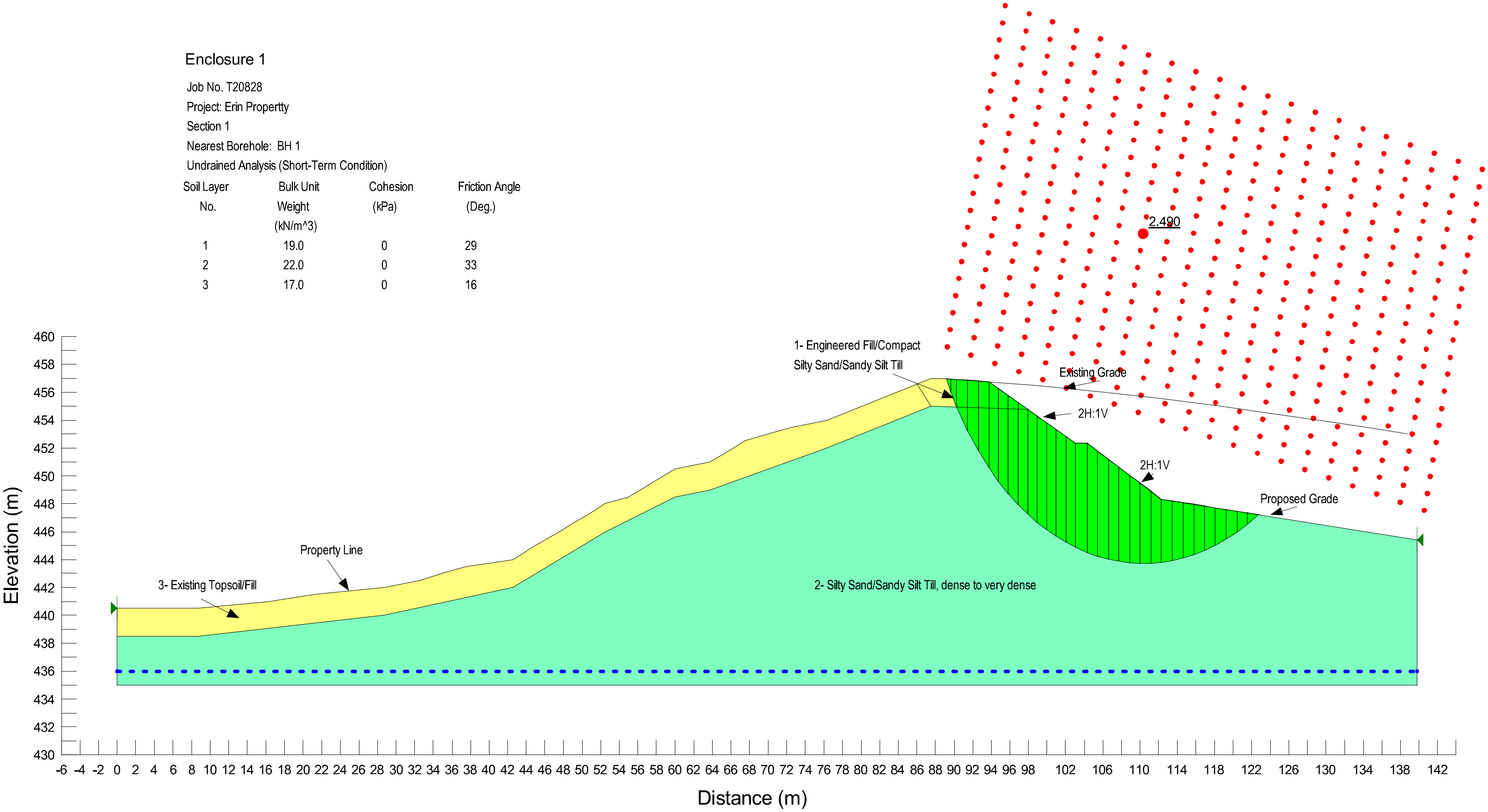
ENCLOSURES

SLOPE STABILITY ANALYSIS RESULTS

Enclosure 1

Job No. T20828
Project: Erin Propertty
Section 1
Nearest Borehole: BH 1
Undrained Analysis (Short-Term Condition)

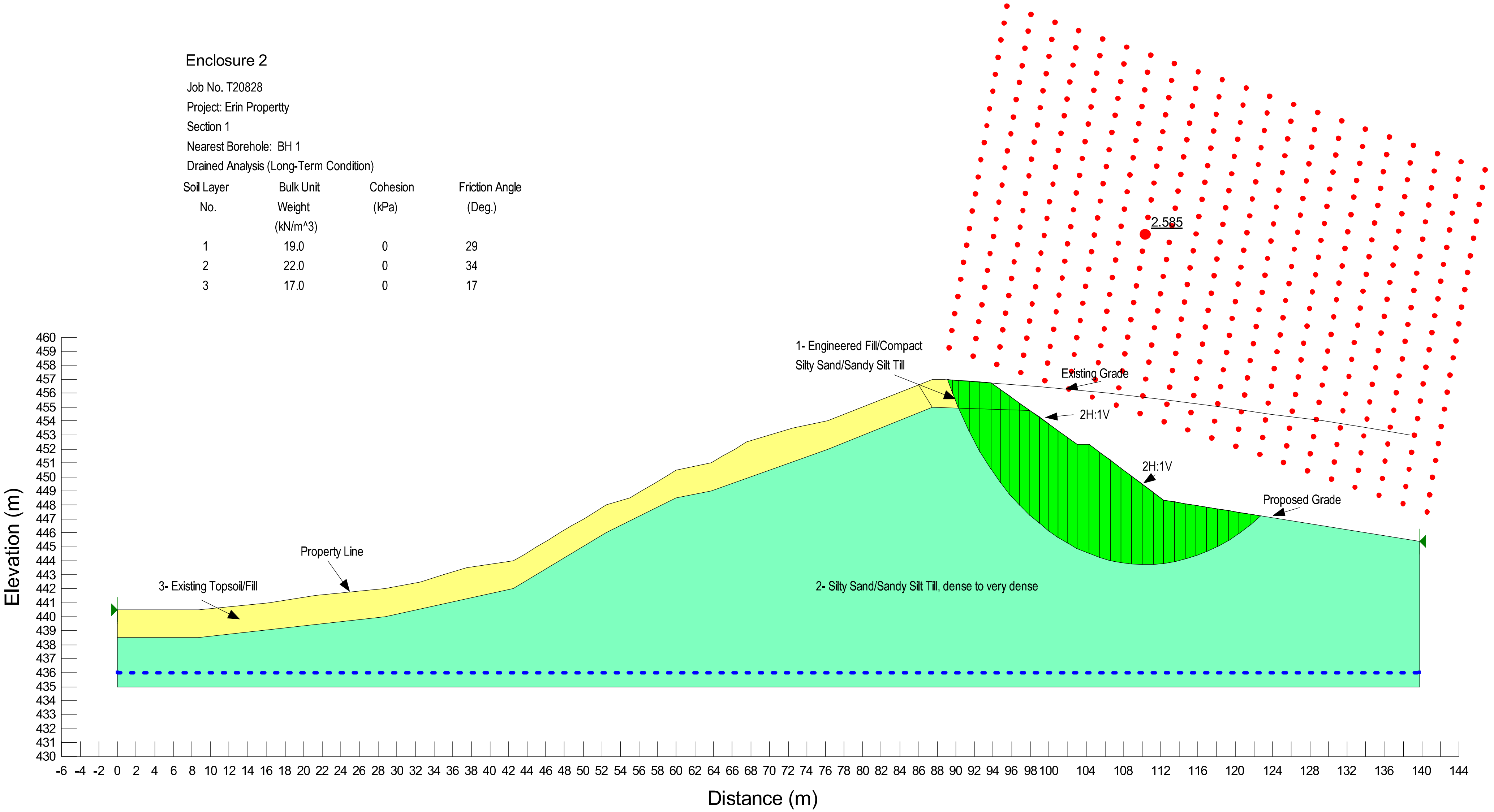
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	29
2	22.0	0	33
3	17.0	0	16



Enclosure 2

Job No. T20828
Project: Erin Propertty
Section 1
Nearest Borehole: BH 1
Drained Analysis (Long-Term Condition)

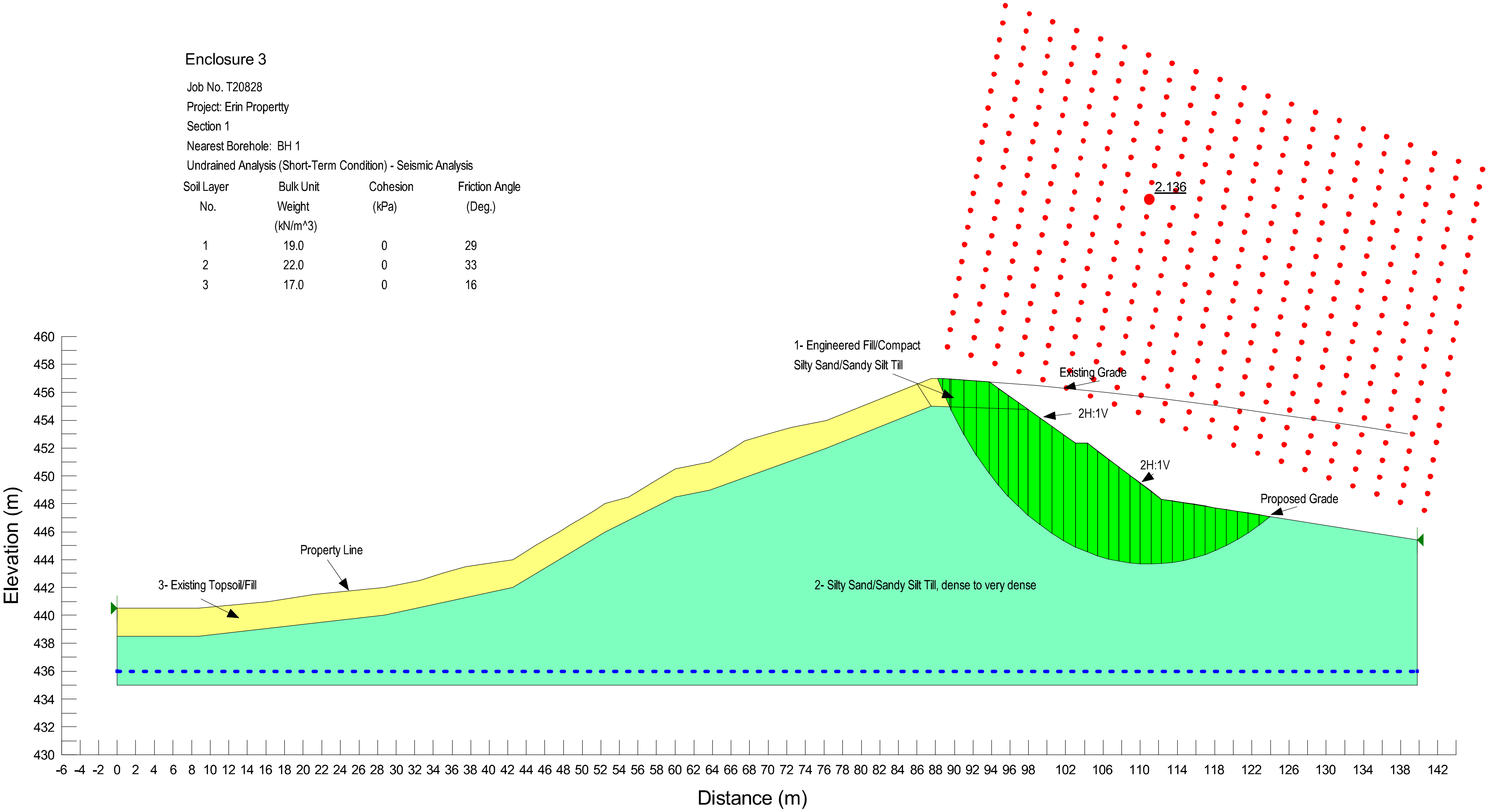
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	29
2	22.0	0	34
3	17.0	0	17

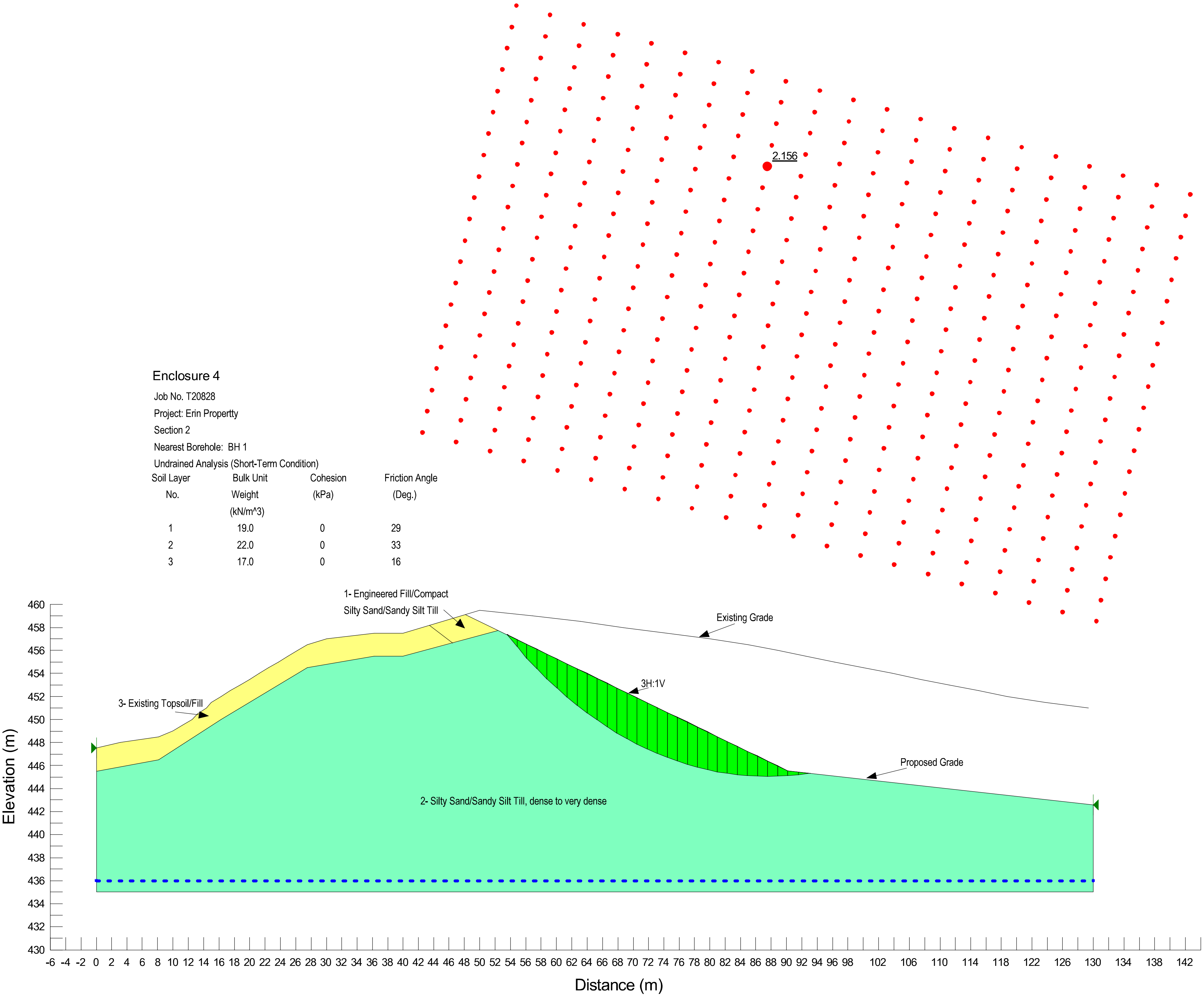


Enclosure 3

Job No. T20828
Project: Erin Propertty
Section 1
Nearest Borehole: BH 1
Undrained Analysis (Short-Term Condition) - Seismic Analysis

Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	29
2	22.0	0	33
3	17.0	0	16





Enclosure 4

Job No. T20828

Project: Erin Propertty

Section 2

Nearest Borehole: BH 1

Undrained Analysis (Short-Term Condition)

Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	29
2	22.0	0	33
3	17.0	0	16

Enclosure 5

Job No. T20828

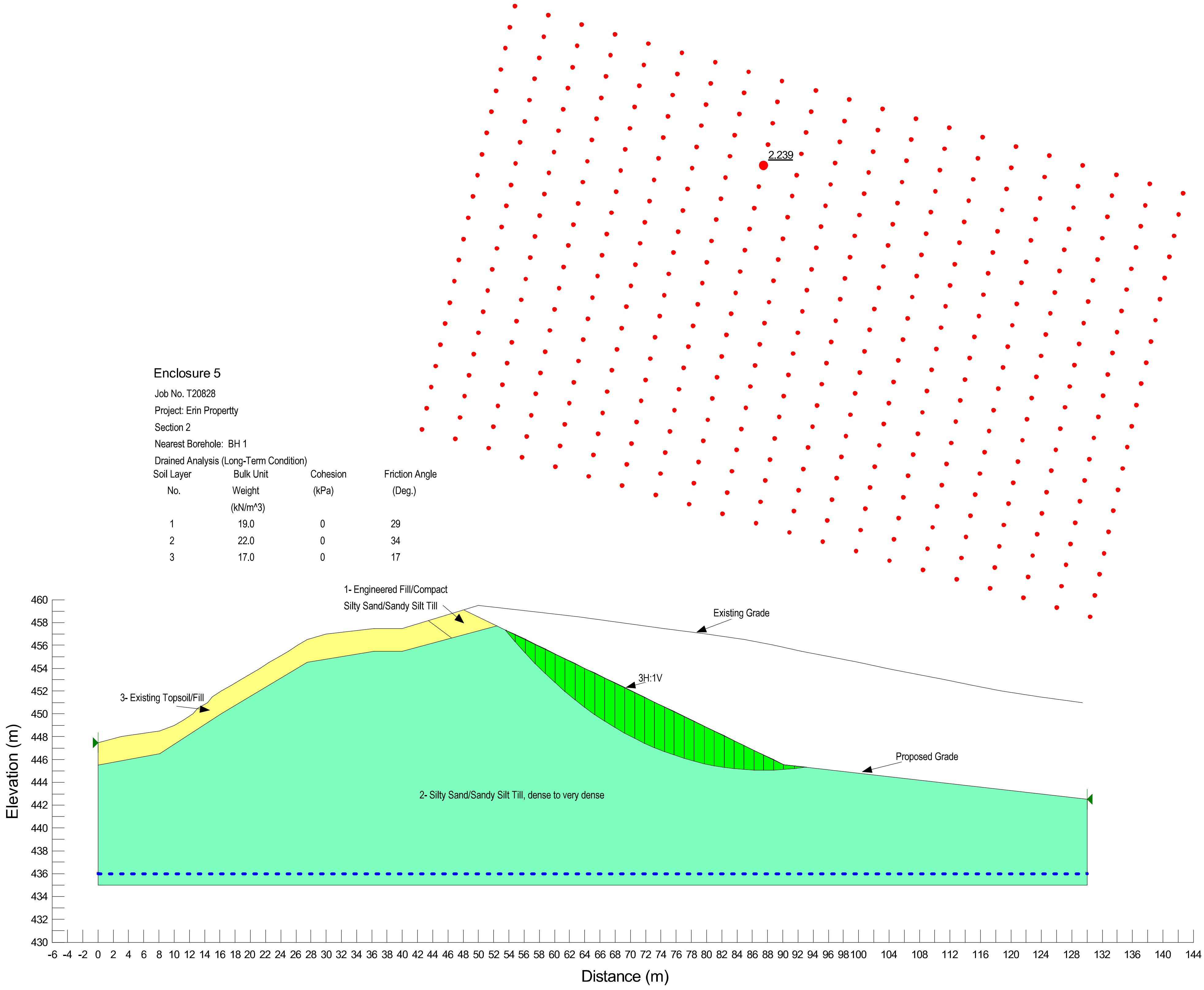
Project: Erin Propertty

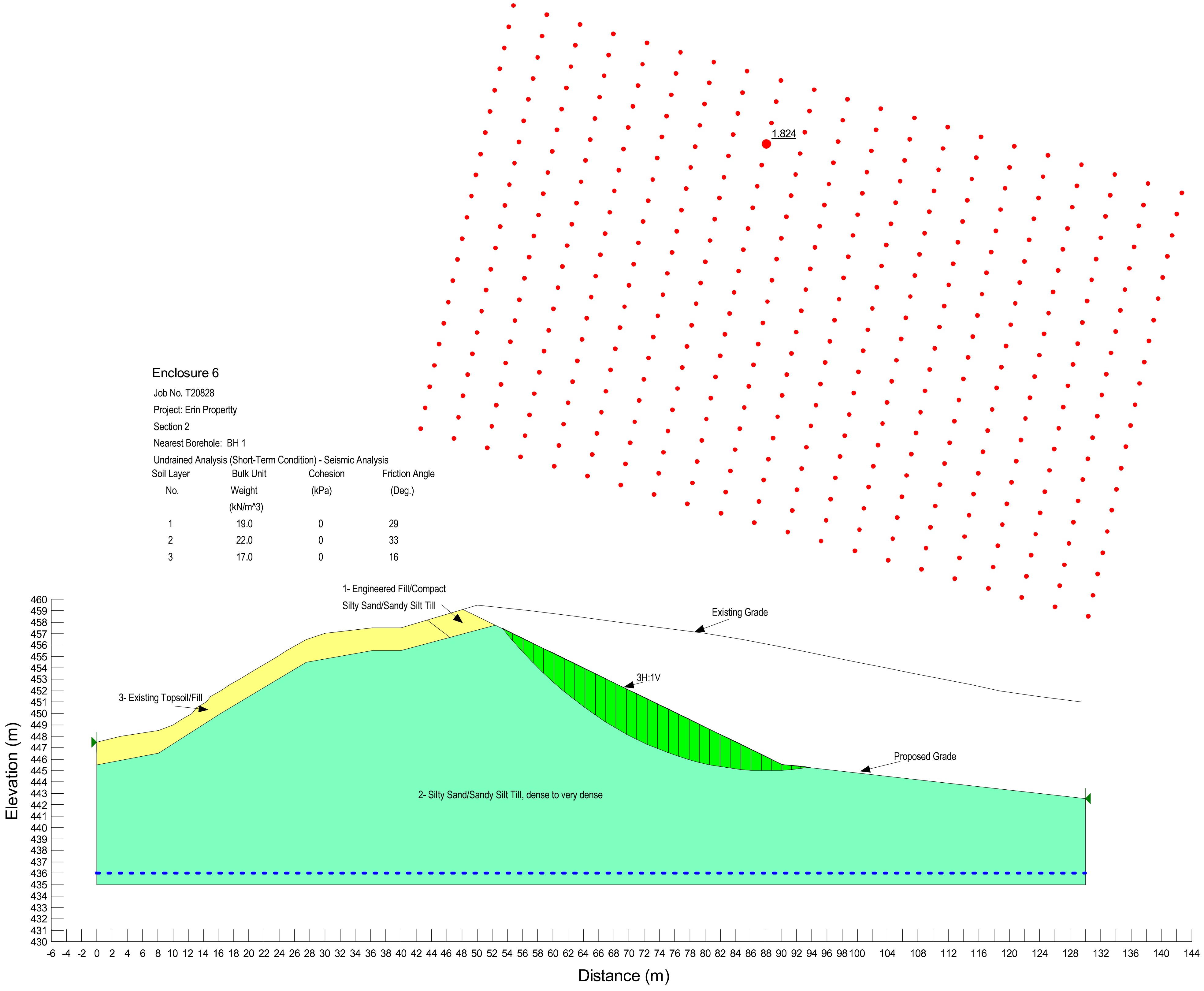
Section 2

Nearest Borehole: BH 1

Drained Analysis (Long-Term Condition)

Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	29
2	22.0	0	34
3	17.0	0	17





Enclosure 6

Job No. T20828

Project: Erin Propertty

Section 2

Nearest Borehole: BH 1

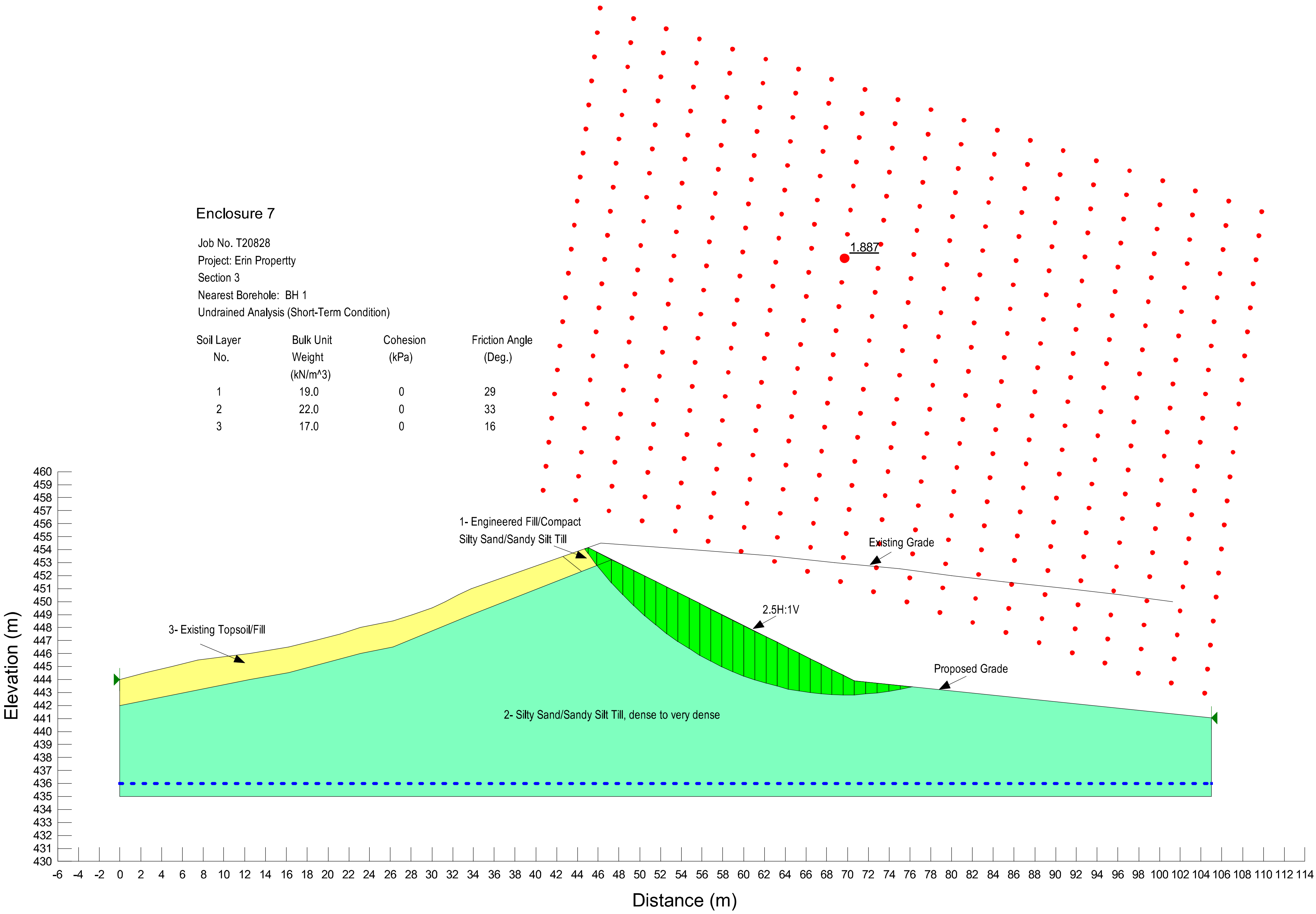
Undrained Analysis (Short-Term Condition) - Seismic Analysis

Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	29
2	22.0	0	33
3	17.0	0	16

Enclosure 7

Job No. T20828
Project: Erin Propertty
Section 3
Nearest Borehole: BH 1
Undrained Analysis (Short-Term Condition)

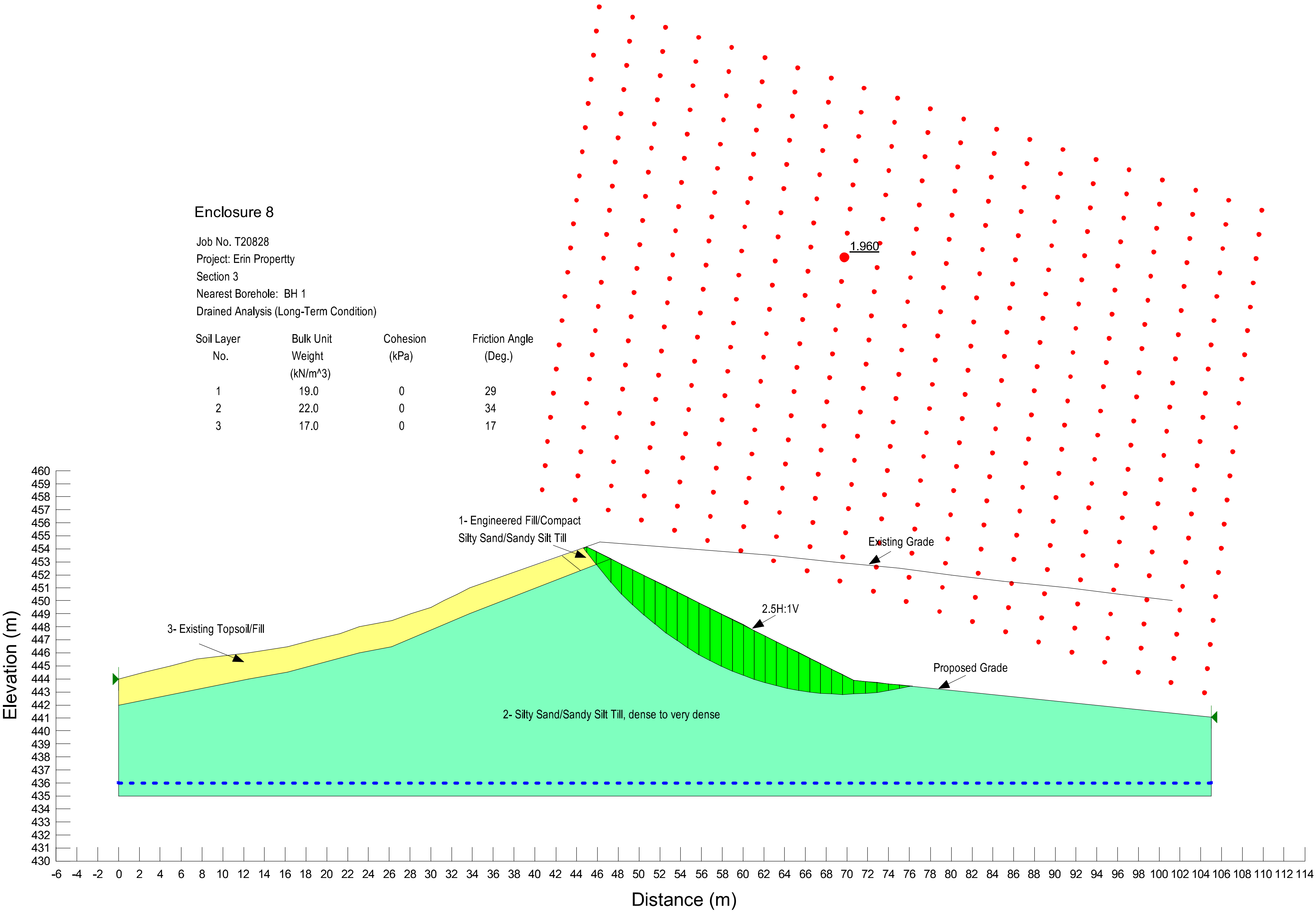
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	29
2	22.0	0	33
3	17.0	0	16



Enclosure 8

Job No. T20828
Project: Erin Propertty
Section 3
Nearest Borehole: BH 1
Drained Analysis (Long-Term Condition)

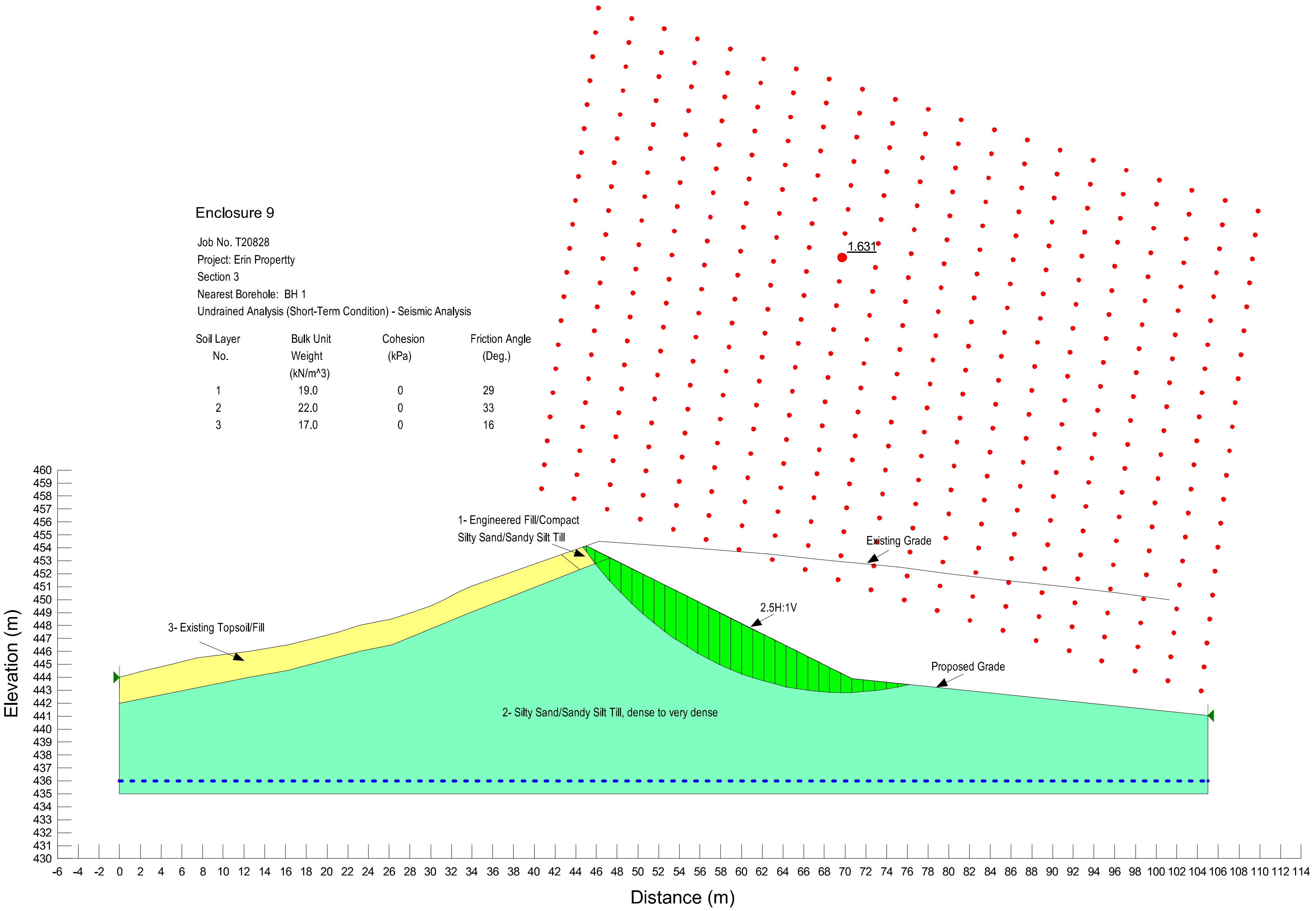
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	29
2	22.0	0	34
3	17.0	0	17



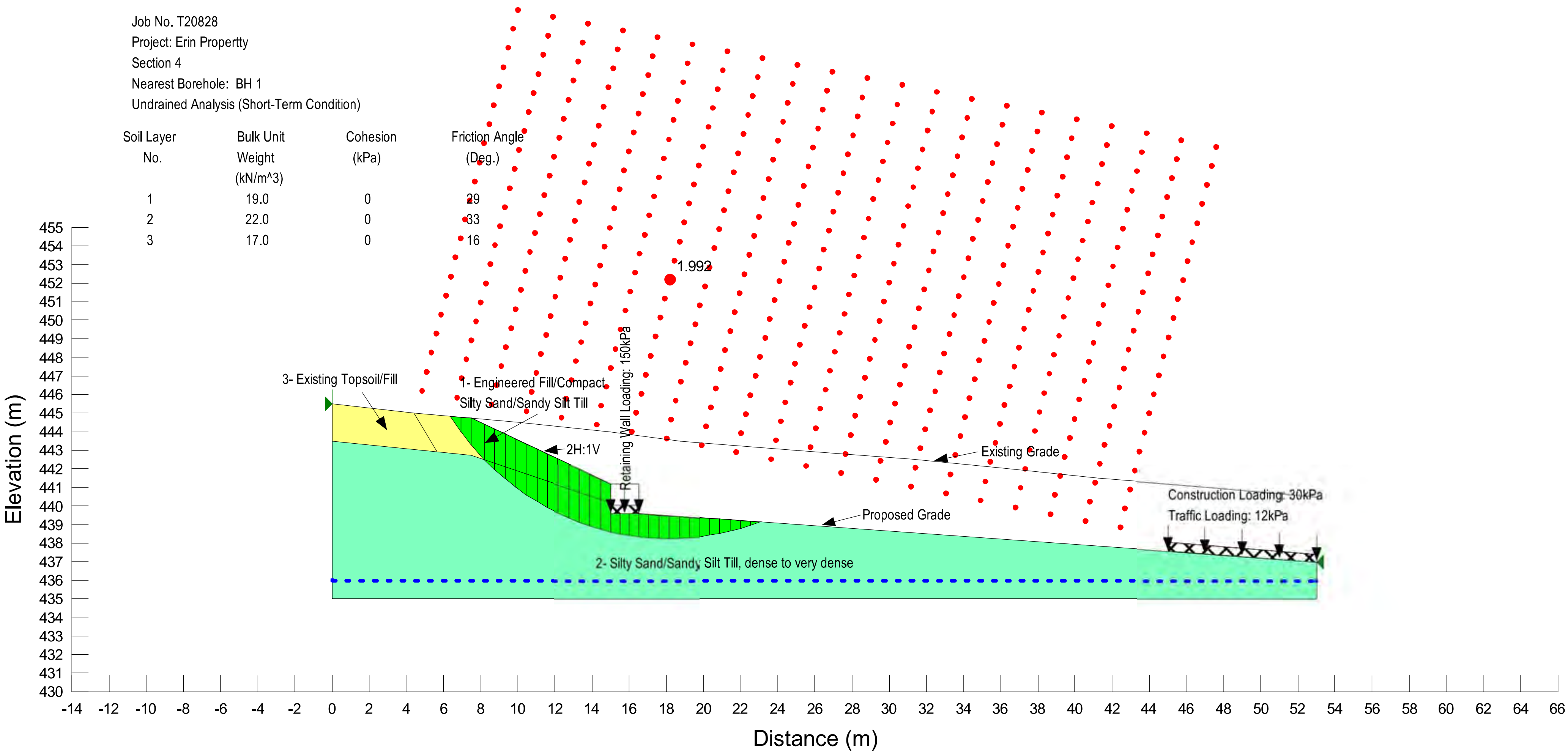
Enclosure 9

Job No. T20828
Project: Erin Propertty
Section 3
Nearest Borehole: BH 1
Undrained Analysis (Short-Term Condition) - Seismic Analysis

Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	29
2	22.0	0	33
3	17.0	0	16



Enclosure 10



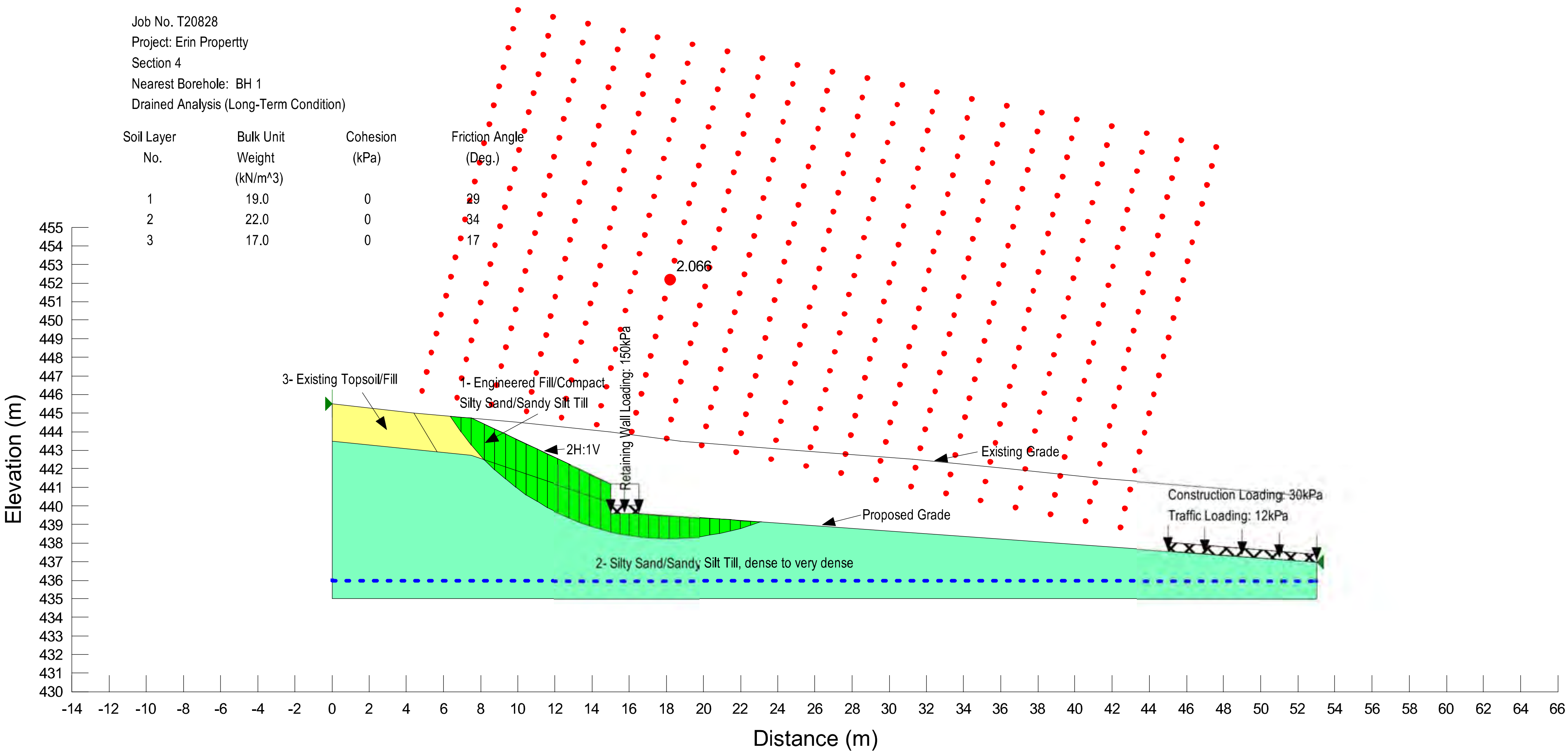
Job No. T20828
Project: Erin Propertty
Section 4
Nearest Borehole: BH 1
Undrained Analysis (Short-Term Condition)

Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	29
2	22.0	0	33
3	17.0	0	16

Enclosure 11

Job No. T20828
Project: Erin Propertty
Section 4
Nearest Borehole: BH 1
Drained Analysis (Long-Term Condition)

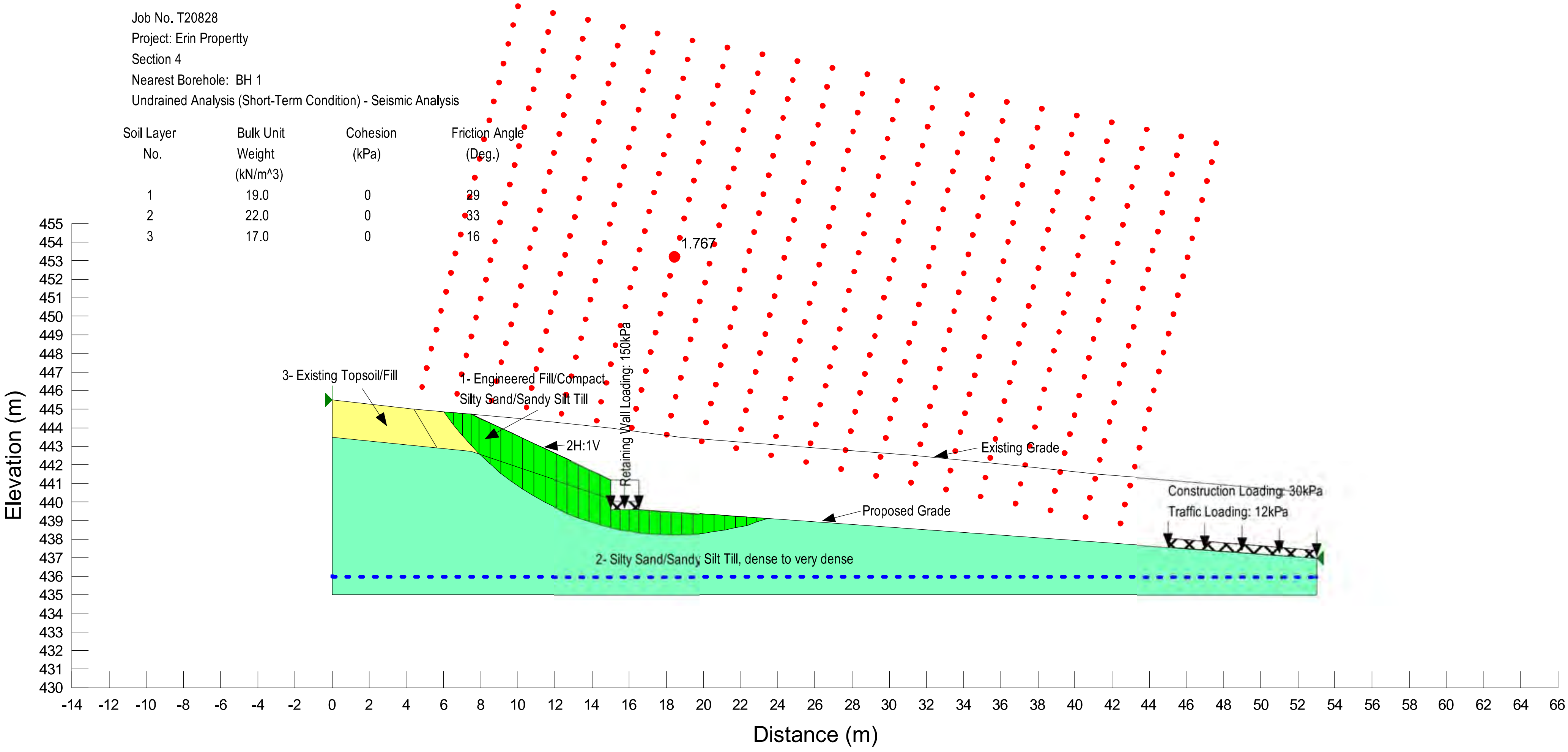
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	29
2	22.0	0	34
3	17.0	0	17



Enclosure 12

Job No. T20828
Project: Erin Propertty
Section 4
Nearest Borehole: BH 1
Undrained Analysis (Short-Term Condition) - Seismic Analysis

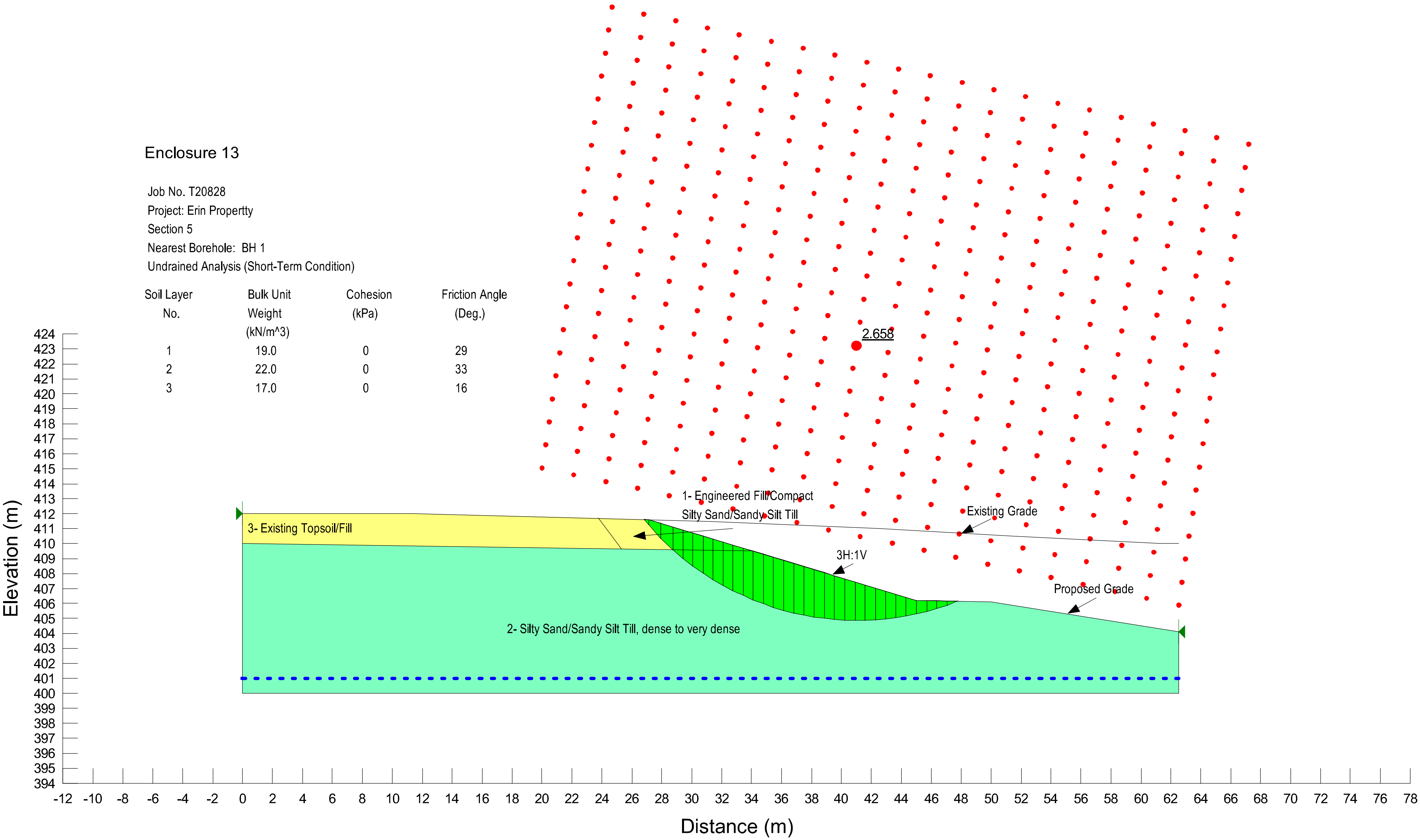
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	29
2	22.0	0	33
3	17.0	0	16



Enclosure 13

Job No. T20828
Project: Erin Propertty
Section 5
Nearest Borehole: BH 1
Undrained Analysis (Short-Term Condition)

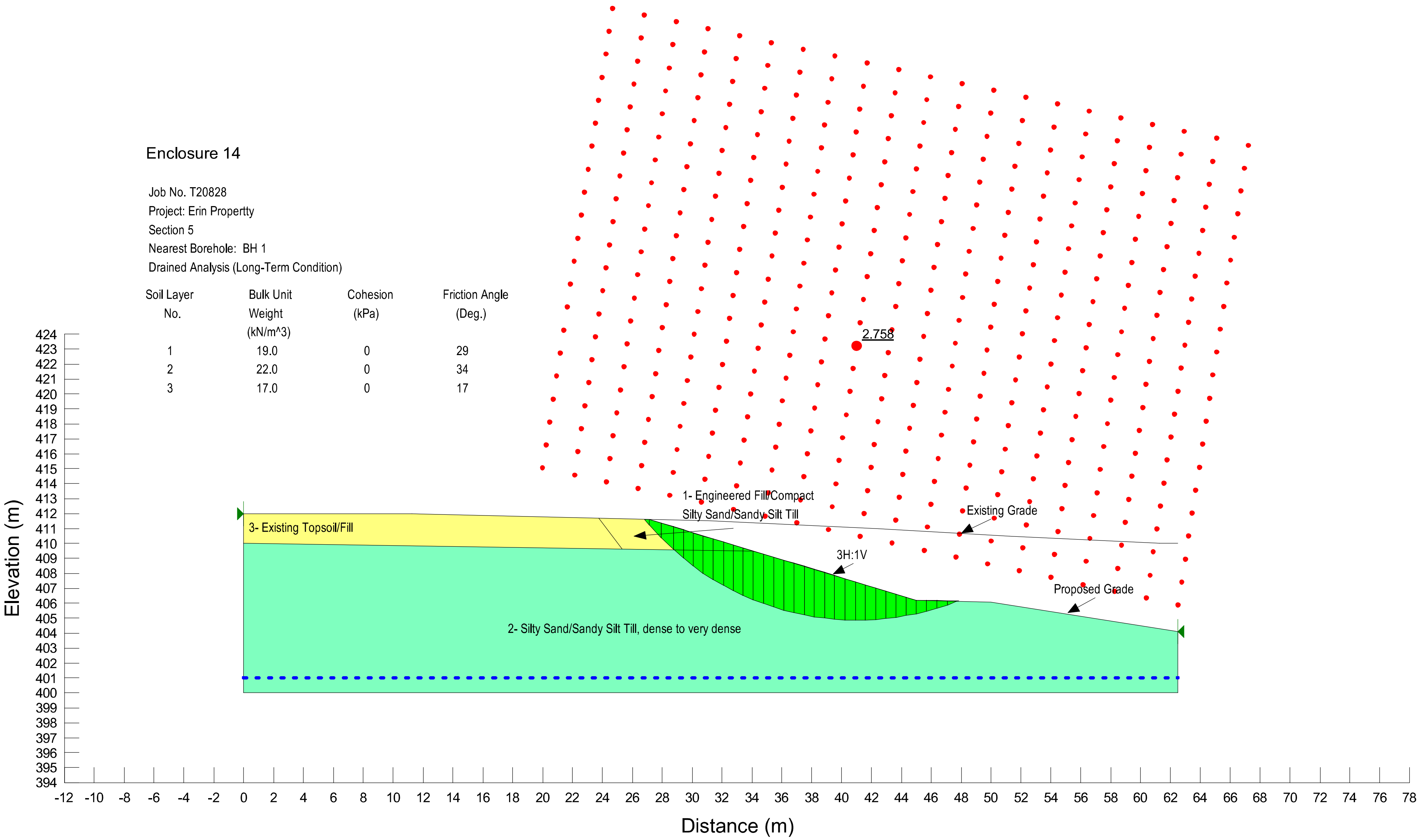
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	29
2	22.0	0	33
3	17.0	0	16



Enclosure 14

Job No. T20828
Project: Erin Propertty
Section 5
Nearest Borehole: BH 1
Drained Analysis (Long-Term Condition)

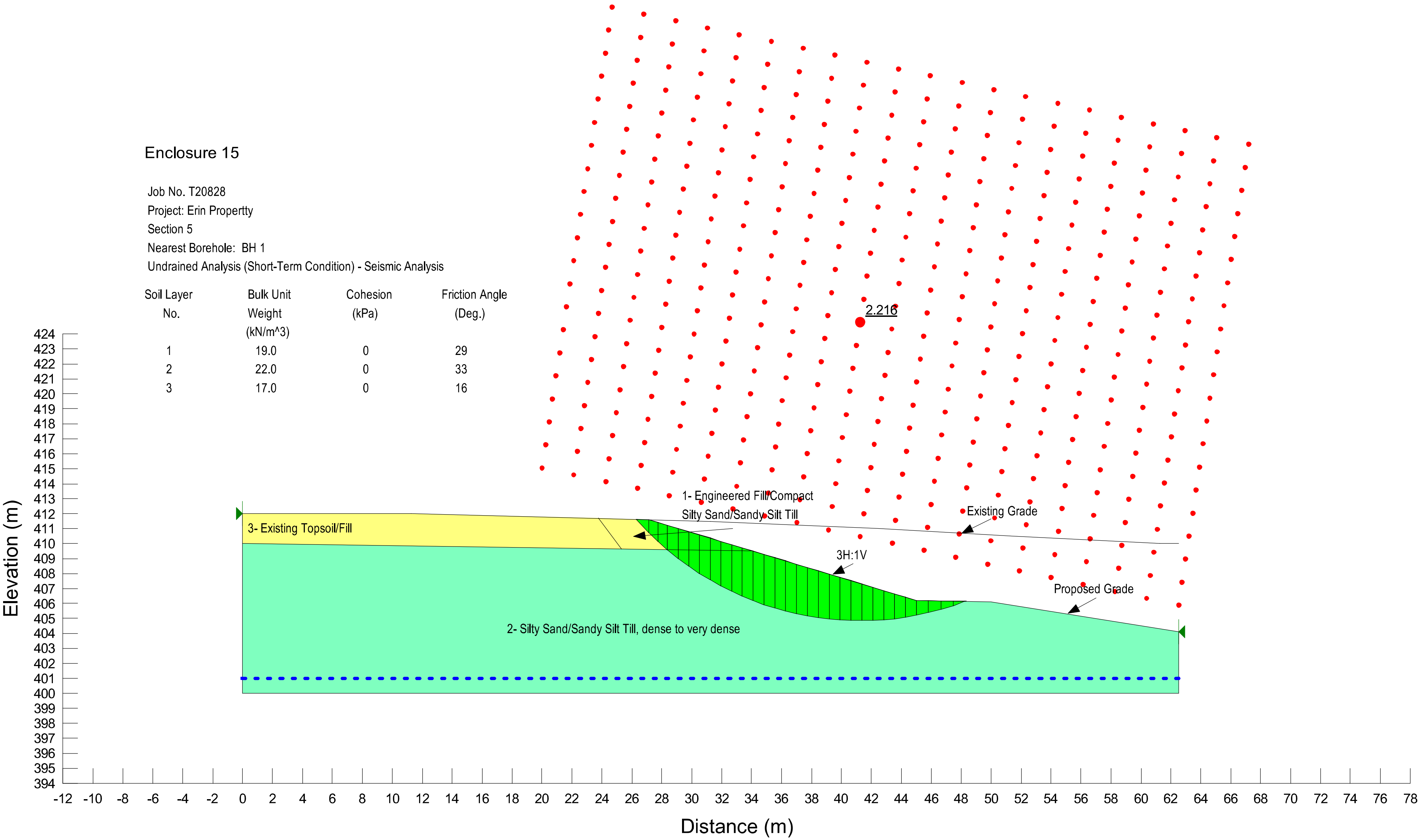
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	29
2	22.0	0	34
3	17.0	0	17

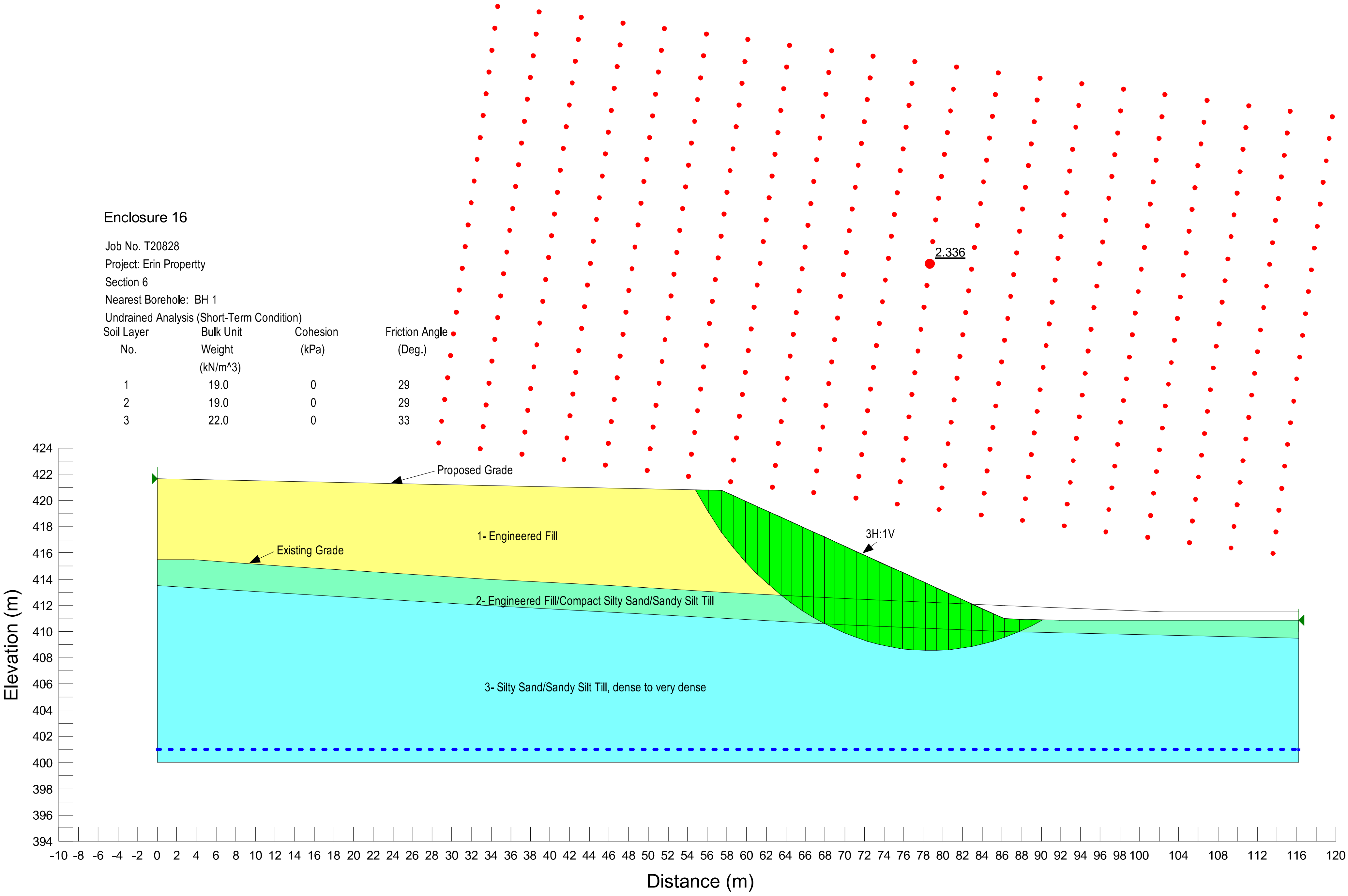


Enclosure 15

Job No. T20828
Project: Erin Propertty
Section 5
Nearest Borehole: BH 1
Undrained Analysis (Short-Term Condition) - Seismic Analysis

Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	29
2	22.0	0	33
3	17.0	0	16





Enclosure 16

Job No. T20828

Project: Erin Propertty

Section 6

Nearest Borehole: BH 1

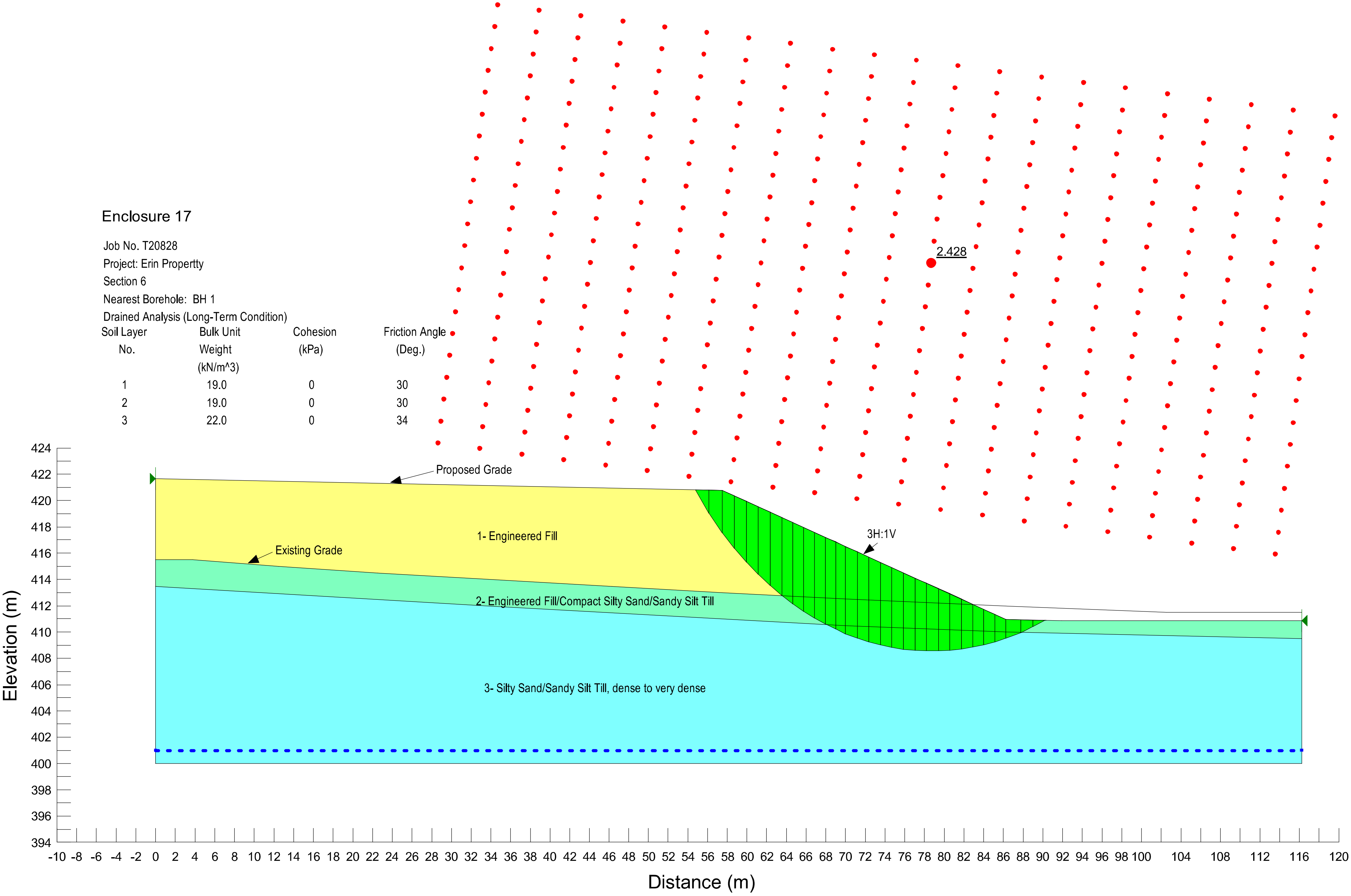
Undrained Analysis (Short-Term Condition)

Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	29
2	19.0	0	29
3	22.0	0	33

Enclosure 17

Job No. T20828
Project: Erin Propertty
Section 6
Nearest Borehole: BH 1
Drained Analysis (Long-Term Condition)

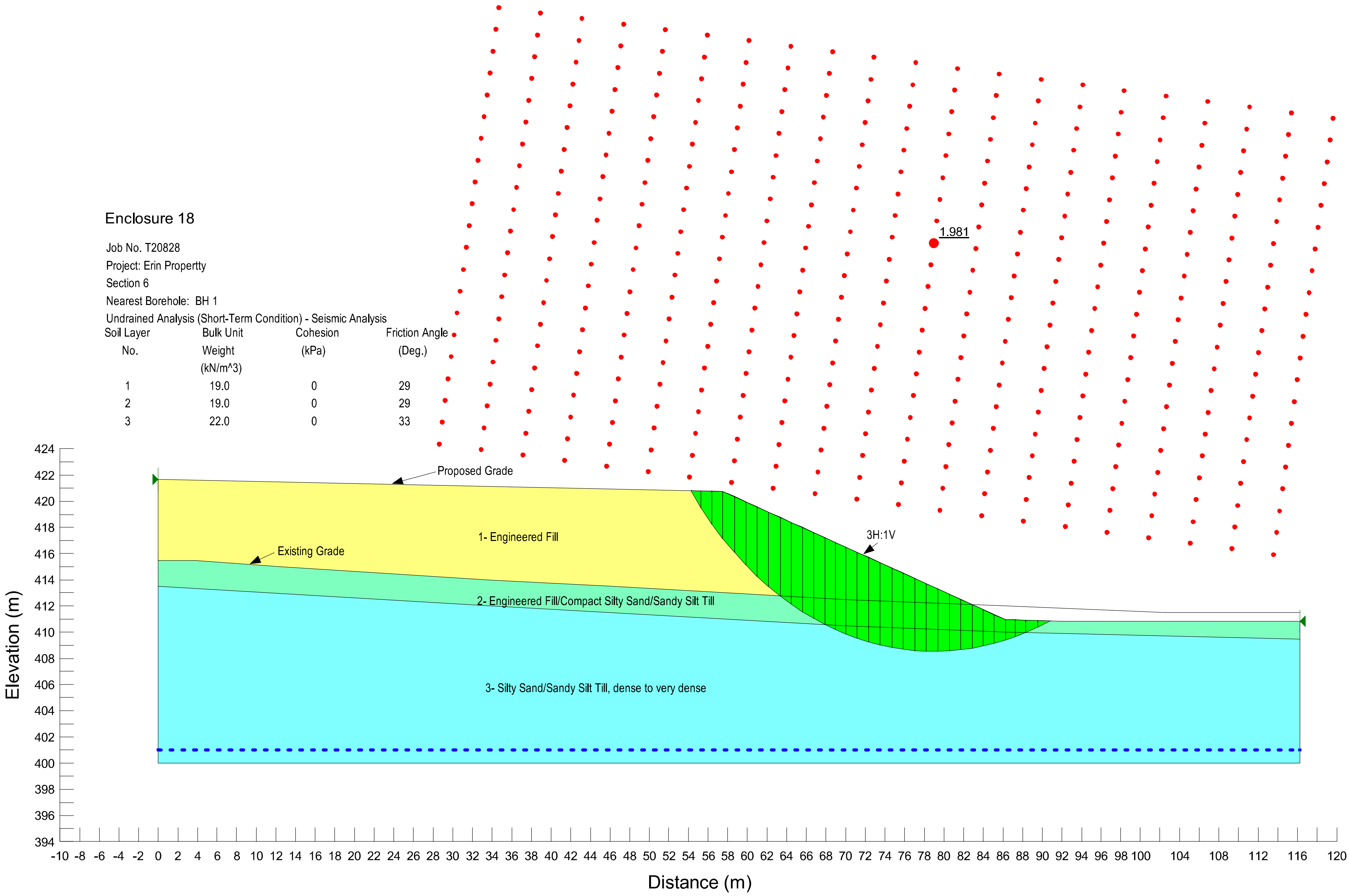
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	30
2	19.0	0	30
3	22.0	0	34



Enclosure 18

Job No. T20828
Project: Erin Propertty
Section 6
Nearest Borehole: BH 1
Undrained Analysis (Short-Term Condition) - Seismic Analysis

Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	19.0	0	29
2	19.0	0	29
3	22.0	0	33



May 16, 2024
Ref. No.: T22907

Mattamy (Erin) Limited
c/o David Schaeffer Engineering Limited
600 Alden Road, Suite 606, Markham, Ontario
L3R 0E7

Attention: Mr. Mack McLean, P. Eng.

Dear Sir:

RE: **LONG TERM STABLE TOP OF SLOPE ASSESSMENT**
EXISTING SLOPE
ERIN PROPERTY
8TH LINE & DUNDAS STREET WEST
ERIN, ONTARIO

1.0 INTRODUCTION

As requested, Shad & Associates Inc. has carried out a detailed slope stability modelling and analysis for the existing slope located on the south end of the above captioned subdivision, as shown in Figure 1. For this assessment reference was made to the following information:

1) Conceptual Grading Plan prepared by David Schaeffer Engineering Limited (DSEL, Drawing No.6 dated October 2023);
2) Topographic Site Survey and LiDAR information by RP-E Surveying Limited-Ontario Land Surveyors provided to our office by DSEL;
3) Geotechnical Test Pit Investigation Report (South Parcel) prepared by Shad & Associates (Shad Report Reference No. T20828 dated November 9, 2020);
4) Geotechnical Test Pit Investigation Report (North Parcel) prepared by Shad & Associates (Shad Report Reference No. T20828-1 dated January 18, 2021);
5) Geotechnical Borehole Information; Shad Report T21837 dated March 13, 2021;
6) Preliminary Geotechnical Slope Stability Analysis-Proposed Site Grading; Shad Report Reference No. T20828 dated June 1, 2022; and
7) Preliminary Geotechnical Investigation Report-Proposed Residential Subdivision-Internal Works; Shad Report Reference No. T22907 dated January 13, 2023 ('2023 Report').

We wish to note that this report is prepared as an addendum to the above captioned 2023 Report and should be referenced for any additional information.

2.0 SUB-SURFACE CONDITIONS

Based on the subsurface conditions encountered at the location of the excavated test pits and drilled boreholes placed close to the existing south slope, below the surficial topsoil and fill, the site is predominantly underlain by a compact to very dense but generally dense to very dense silty sand to sandy silt glacial till deposits with occasional sand and gravel seams/interbeddings, cobbles and/or boulders. However, occasional layers of non-glacial very dense silt and silty sand to sandy silt deposits were also contacted at some boreholes. The study area together with the location of the nearest boreholes are shown in Figure 2 and their Record of Boreholes are presented in Enclosure A.

3.0 SLOPE STABILITY ANALYSIS

Based on the topographic site survey as well as LiDAR information provided to us, the south slope with its height ranging from approximately 21 to 31 m, generally slopes from about 3H:1V to flatter with occasional steeper sections. Considering these and the subsurface information encountered at the boreholes and test pits, seven representative approximate cross-sections (i.e., Sections A-A' to G-G') were selected through existing slope and their locations are shown in Figure 3. The sections were then modelled and analyzed by assuming conservative soil parameters, as summarized in Table 1 below, based on the borehole information, the field and laboratory tests performed, our experience with similar site conditions as well as published geotechnical data.

Table 1: Assumed Geotechnical Parameters

Soil Type	Bulk Unit Weight (kN/m^3)	Shear Strength Parameters			
		C_u (kPa)	Φ_u (degree)	C' (kPa)	Φ' (degree)
Topsoil and Fill (sandy)	17.0	0	16	0	17
Compact Silty Sand Till / Sandy Silt Till	19.5	0	30	0	31
Dense to Very Dense Silty Sand Till / Sandy Silt Till	22.0	0	34	0	35
Very Dense Silt	18.5	0	28	0	29
Very Dense Silty Sand to Sandy Silt	21.0	0	32	0	33

For slope stability analysis, computer program Slope/W 2012 and the Bishop's Simplified method for the calculation of the factor of safety for slip surface were used. It should be noted that for a stable slope under a static loading condition, a minimum Factor of Safety (FOS) of 1.5 is normally recommended.

The assumed sections were also analysed under seismic loading conditions. The site-specific seismic hazards as per National Building Code of Canada (2015) were obtained from Earthquakes Canada website (www.EarthquakesCanada.ca) and are provided in Enclosure B. The peak ground acceleration (PGA) for 2 percent probability in 50 years (0.000404 per annum or return period of 2,475 years) for the site is 0.079g corresponding to Site Class C. For this study, although a geophysical assessment was not completed in assessing the applicable seismic site classification, considering the subsurface conditions encountered at the boreholes drilled at the site, for a conservative analysis, a site Class D is assigned for seismic design purposes. Therefore, the peak ground acceleration corresponding to Site Class D at the site will be PGA=1.3×0.079g= 0.1027g. According to industry standards, the acceleration used in pseudostatic analysis is equal to 0.5 × PGA. Based on these values and in accordance to the Canadian Foundation Manual (4th Edition), the following parameters were used for seismic stability evaluations:

Horizontal Seismic Coefficient = 0.5 X 0.1027g=0.05135g
Vertical Seismic Coefficient = 0

For a stable slope under seismic loading using pseudostatic analysis, a minimum FOS of 1.1 is normally recommended.

Some of the slope stability analysis results are presented in Enclosures C-1 to C-21. Based on our analyses, the assumed existing physical top for the south slope is assessed to be stable with calculated factors of safety in excess of the recommended minimum values of 1.5 for static loading and 1.1 for seismic analysis. The location of the recommended Long Term Stable Slope line (LTSS) for the south slope is shown in Figure 4.

We recommend that the existing vegetation on the valley wall to be maintained or enhanced, if needed. Furthermore, the potential for any concentrated runoff from the tableland should be minimized.

4.0 CLOSURE

We wish to note that this report is prepared as an addendum to the 2023 Report and should be referenced for additional information.

The attached Report Limitations are an integral part of this report.

Sincerely,
Shad & Associates Inc.

S. Chong
S. CHONG
H. SHAD
H. Shad

Stephen Chong, P. Eng.
Senior Engineer

Houshang Shad, Ph.D., P. Eng
Principal

cc. Mr. Ryan Oosterhoff, Mattamy (Erin) Limited

FIGURES

CLIENT:

Milton (Erin) Limited

SHAD & ASSOCIATES INC.
GEOTECHNICAL, ENVIRONMENTAL AND MATERIALS CONSULTING ENGINEERS
250 Shields Court, Unit 27
Markham, Ontario, L3R 9W7
Tel: (905) 760-5566
Fax: (905) 760-5567
www.shadinc.com

SHAD & ASSOCIATES INC.

Drawn By: M.P.
Checked By: H.S.
Datum: -
Projection: -
Scale: N.T.S.

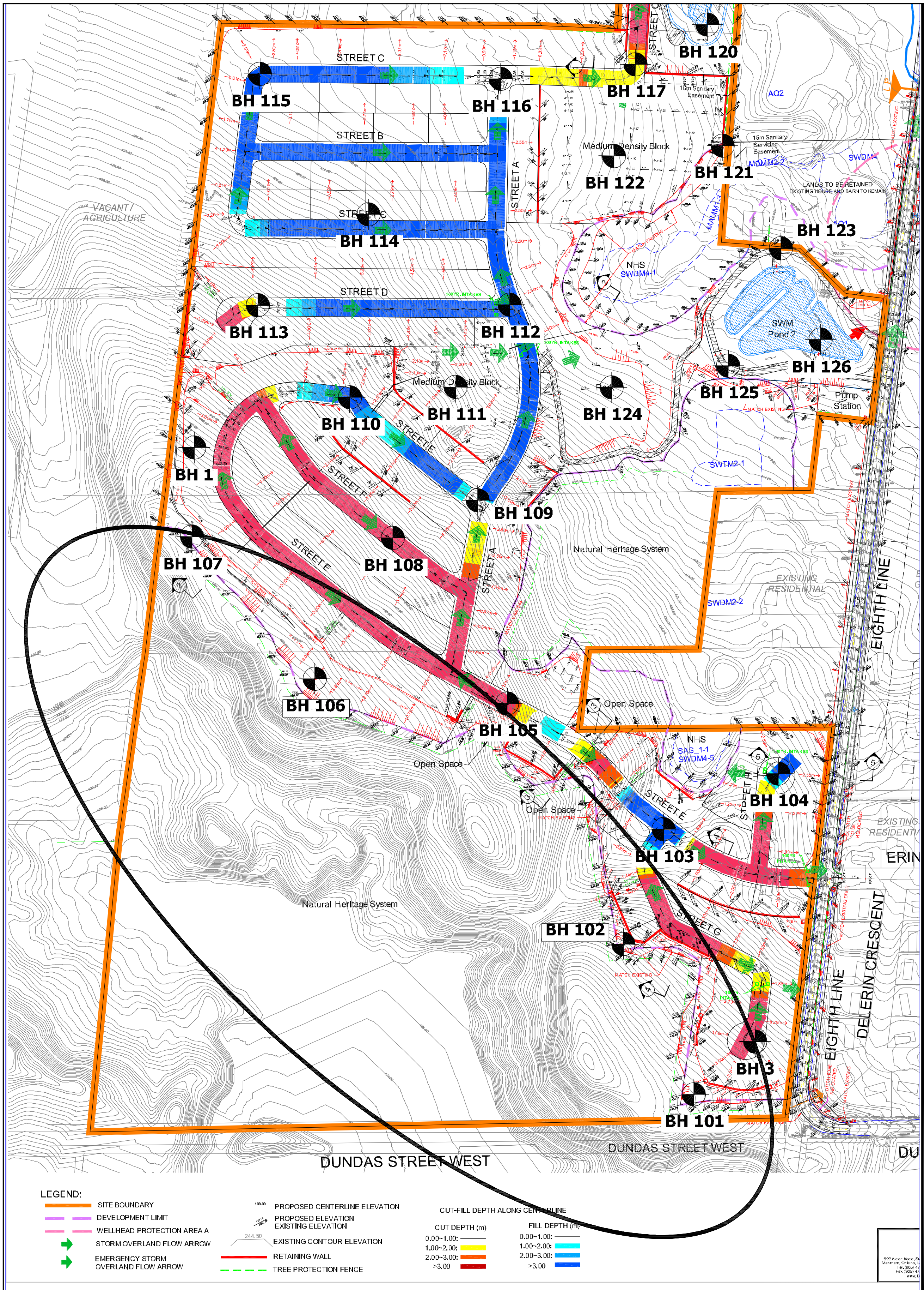
TITLE:

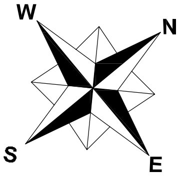
SITE LOCATION PLAN

PROJECT:

Stable Top of Slope Assessment
Erin Property
Eighth Line, north of Dundas Street West
Erin, Ontario

Date: May, 2024
Project No.: **T22907**
Figure No.: **1**





LEGEND:

◯ Stable Top of Slope Assessment Area

BH 1 / BH 101

⊕ Existing Borehole Locations

NOTES:

1. Borehole locations are approximate.
2. Drawing not to scale.
3. Drawing was provided by DSEL.
3. The drawing should be read in conjunction with the associated report by Shad & Associates Inc., T22907.

CLIENT:

Mattamy (Erin) Limited

SHAD & ASSOCIATES INC.
GEOTECHNICAL, ENVIRONMENTAL AND MATERIALS ENGINEERS
250 Shields Court, Unit 27
Markham, Ontario, L3R 9W7
Tel: (905) 760-5566
Fax: (905) 760-5567

Drawn By: M.P.

Checked By: H.S.

Datum: -

Projection: -

Scale: N.T.S.

TITLE:

Borehole Locations & Stable Top of Slope Assessment Area

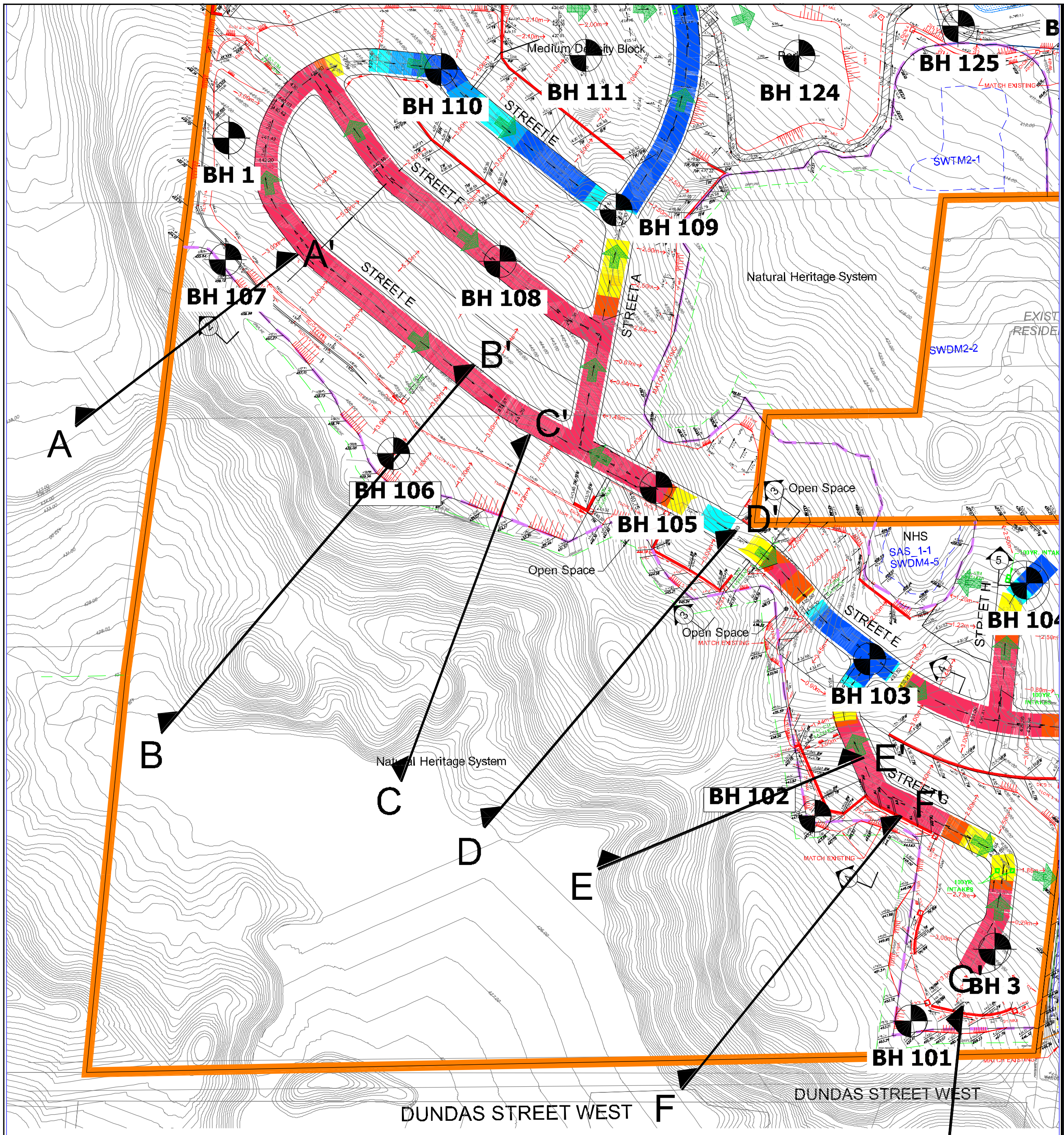
PROJECT:

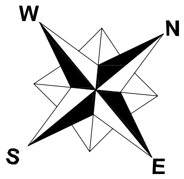
Stable Top of Slope Assessment
Erin Property
Eighth Line, north of Dundas Street West
Erin, Ontario

Date: May, 2024

Project No.: T22907

Figure No.: 2





LEGEND:

BH 1 / BH 101

⊕ Existing Borehole Locations

▲▬▲ Assumed Cross-Section for Slope Stability Analysis

LEGEND:

🟧 SITE BOUNDARY

▬ ▬ DEVELOPMENT LIMIT

▬ ▬ WELLHEAD PROTECTION AREA A

➡ STORM OVERLAND FLOW ARROW

➡ EMERGENCY STORM OVERLAND FLOW ARROW

188.89 PROPOSED CENTERLINE ELEVATION

PROPOSED ELEVATION
EXISTING ELEVATION

244.50 EXISTING CONTOUR ELEVATION

🟥 RETAINING WALL

▬ ▬ TREE PROTECTION FENCE

CUT-FILL DEPTH ALONG CENTERLINE

CUT DEPTH (m)		FILL DEPTH (m)	
0.00~1.00:	—	0.00~1.00:	—
1.00~2.00:	🟨	1.00~2.00:	🟦
2.00~3.00:	🟧	2.00~3.00:	🟦
>3.00	🟥	>3.00	🟦

Approximate Scale Bar
0m 30m 60m 120m 240m

NOTES:

1. Borehole locations are approximate.
2. Drawing scale as shown.
3. Drawing was provided by DSEL.
3. The drawing should be read in conjunction with the associated report by Shad & Associates Inc., T22907.

CLIENT:

Mattamy (Erin) Limited

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SHAD & ASSOCIATES INC.

Drawn By: M.P.

Checked By: H.S.

Datum: -

Projection: -

Scale: As Shown

TITLE:

Assumed Cross-Section for Slope Stability Analysis

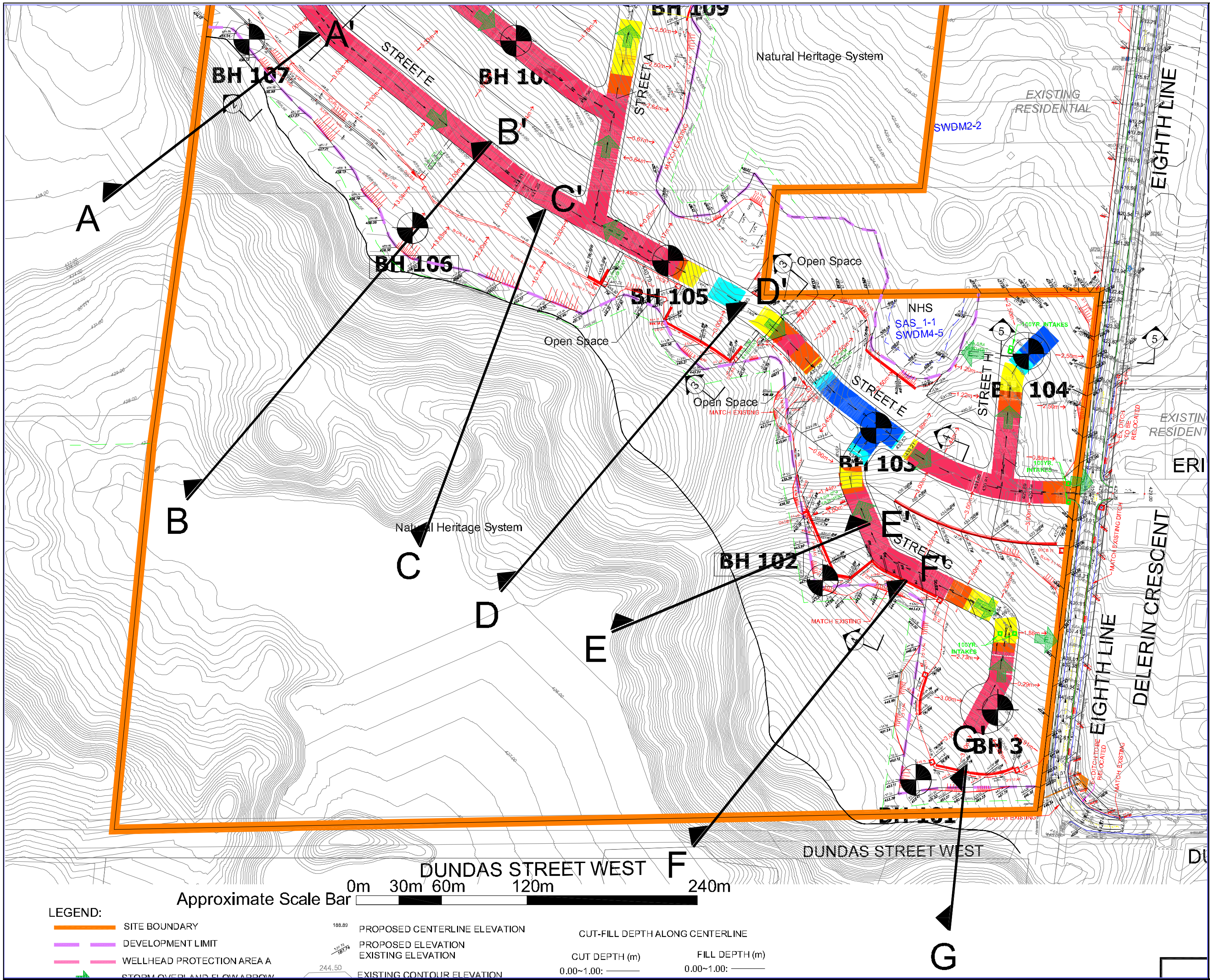
PROJECT:

Stable Top of Slope Assessment
Erin Property
Eighth Line, north of Dundas Street West
Erin, Ontario

Date: May, 2024

Project No.: T22907

Figure No.: 3



LEGEND:

BH 1 / BH 101

Existing Borehole Locations

Assumed Cross-Section for Slope Stability Analysis

Recommended LTSS

NOTES:

1. Borehole locations are approximate.
2. Drawing as shown.
3. Base drawing was provided by DSEL.
3. The drawing should be read in conjunction with the associated report by Shad & Associates Inc., T22907.

CLIENT:

Mattamy (Erin) Limited

SHAD & ASSOCIATES INC.
GEOTECHNICAL, ENVIRONMENTAL AND MATERIALS CONSULTING ENGINEERS
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www.shadinc.com

Drawn By:	M.P.
Checked By:	H.S.
Datum:	-
Projection:	-
Scale:	As Shown.

TITLE:

Recommended LTSS

PROJECT:

Stable Top of Slope Assessment
Erin Property
Eighth Line, north of Dundas Street West
Erin, Ontario

Date:	May, 2024
Project No.:	**T22907**
Figure No.:	**4**

ENCLOSURES

Enclosure A: Record of Previous Boreholes (101, 102, 105, 106, 107, 1)

RECORD OF BOREHOLE 101

Project No.: T22907
CLIENT: Mattamy (Erin) Limited
ORIGINATED BY: R.H.
DATE: Nov 28 - Dec 06, 2022
LOCATION: 8th Line, Erin, Ontario
COMPILED BY: R.H.
DATUM: Geodetic
BOREHOLE TYPE: Hollow Stem
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7

ELEVATION (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	WATER CONTENT (%)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
452.5	Ground Surface						
	Topsoil Mixed Fill	1	SS	5	5	24	
451.9	occ. organic stains						
	brown **Silty Sand Till** occ. gravel damp, compact	2	SS	46	21	4	
	very dense	3	SS	5	60	5	possible coobles/boulder
450.4	light brown **Silty Sand/Sandy Silt Till** occ. sand seams, some gravel damp, dense	4	SS	46	34	7	Gradation Analysis, S(4): 18 44 32 6
	very dense	5	SS	20	50/13cm	6	
448.9	greyish brown **Silty Sand Till** some gravel damp, very dense	6	SS	20	50/8cm	5	possible cobbles/boulder
		7	SS	10	50/10cm	5	
							possible cobbles/boulder
447.0	grey **Silty Sand/Sandy Silt** damp, very dense					8	Gradation Analysis, S(8B): 0 54 46 0
446.3	grey **Silty Fine Sand/Sandy Silt** damp, very dense	8	SS	46	71	4	

DEPTH SCALE (metres): 0 1 2 3 4 5 6 7

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: 20 40 60 80 100

WATER CONTENT (%): 5 15 25 35

GROUND WATER CONDITIONS

MONITORING WELL

RECORD OF BOREHOLE 101

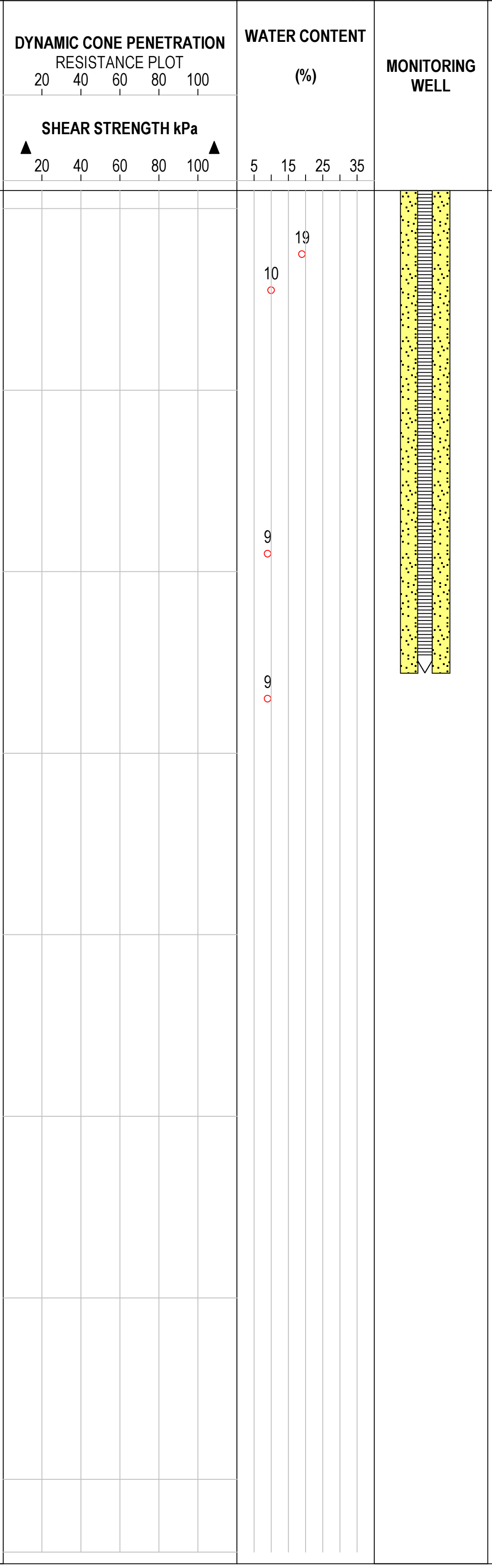
Project No.: T22907
CLIENT: Mattamy (Erin) Limited
ORIGINATED BY: R.H.
DATE: Nov 28 - Dec 06, 2022
LOCATION: 8th Line, Erin, Ontario
COMPILED BY: R.H.
DATUM: Geodetic
BOREHOLE TYPE: Hollow Stem
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7

ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	WATER CONTENT (%)
		grey silty sand/sandy silt interbedding wet	9	SS	36	86/23cm	19 10
	8						
	9	moist	10	SS	41	85/28cm	9
	10		11	SS	41	88/28cm	9
442.2		**End of Borehole**					

Cave-in Depth on Completion: None
Groundwater Depth on Completion: Dry

Measuring Groundwater Level in Installed Monitoring Well on:
December 13, 2022: Dry
December 20, 2022: Dry



REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

RECORD OF BOREHOLE 102

Project No.: T22907
CLIENT: Mattamy (Erin) Limited
ORIGINATED BY: R.H.
DATE: Nov 28 - Dec 06, 2022
LOCATION: 8th Line, Erin, Ontario
COMPILED BY: R.H.
DATUM: Geodetic
BOREHOLE TYPE: Hollow Stem
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7

SOIL PROFILE				SAMPLES								
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	STRATA PLOT	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa 20 40 60 80 100	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
447.3	0	Ground Surface										
447.1		**Topsoil**								20		
446.6		brown **Clayey Silty Sand/Clayey Sandy Silt Fill** some topsoil, some rootlets damp to moist		1	SS	41	2			16		
445.9	1	brown **Silty Sand Till** damp, compact		2	SS	46	10			7		
		brown **Silty Sand/Sandy Silt Till** damp, dense		3	SS	36	30			7		
	2			4	SS	46	31			7		
	3	some sand seams		5	SS	46	40			7		
	4	occ. cobbles/boulder, very dense		6	SS	10	78/20cm			2		possible cobbles/boulder
	5	greyish brown moist, compact		7	SS	46	24			9		
	6	very dense		8	SS	30	63/18cm			9		possible cobbles/boulder
	7											

RECORD OF BOREHOLE 102

Project No.: T22907
CLIENT: Mattamy (Erin) Limited
ORIGINATED BY: R.H.
DATE: Nov 28 - Dec 06, 2022
LOCATION: 8th Line, Erin, Ontario
COMPILED BY: R.H.
DATUM: Geodetic
BOREHOLE TYPE: Hollow Stem
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7

SOIL PROFILE				SAMPLES								
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	STRATA PLOT	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ▲ 20 40 60 80 100 ▲	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	8	occ. oxidized fissures dense		9	SS	46	43			8		
		very dense										
	9			10	SS	15	50/3cm			8		possible cobbles/boulder
		damp to moist										
437.2	10			11	SS	15	50/8cm			8		
		End of Borehole Cave-in Depth on Completion: None Groundwater Depth on Completion: Dry										
	11											
	12											
	13											
	14											
	15											

RECORD OF BOREHOLE 105

Project No.: T22907
CLIENT: Mattamy (Erin) Limited
ORIGINATED BY: R.H.
DATE: Nov 28 - Dec 06, 2022
LOCATION: 8th Line, Erin, Ontario
COMPILED BY: R.H.
DATUM: Geodetic
BOREHOLE TYPE: Hollow Stem
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
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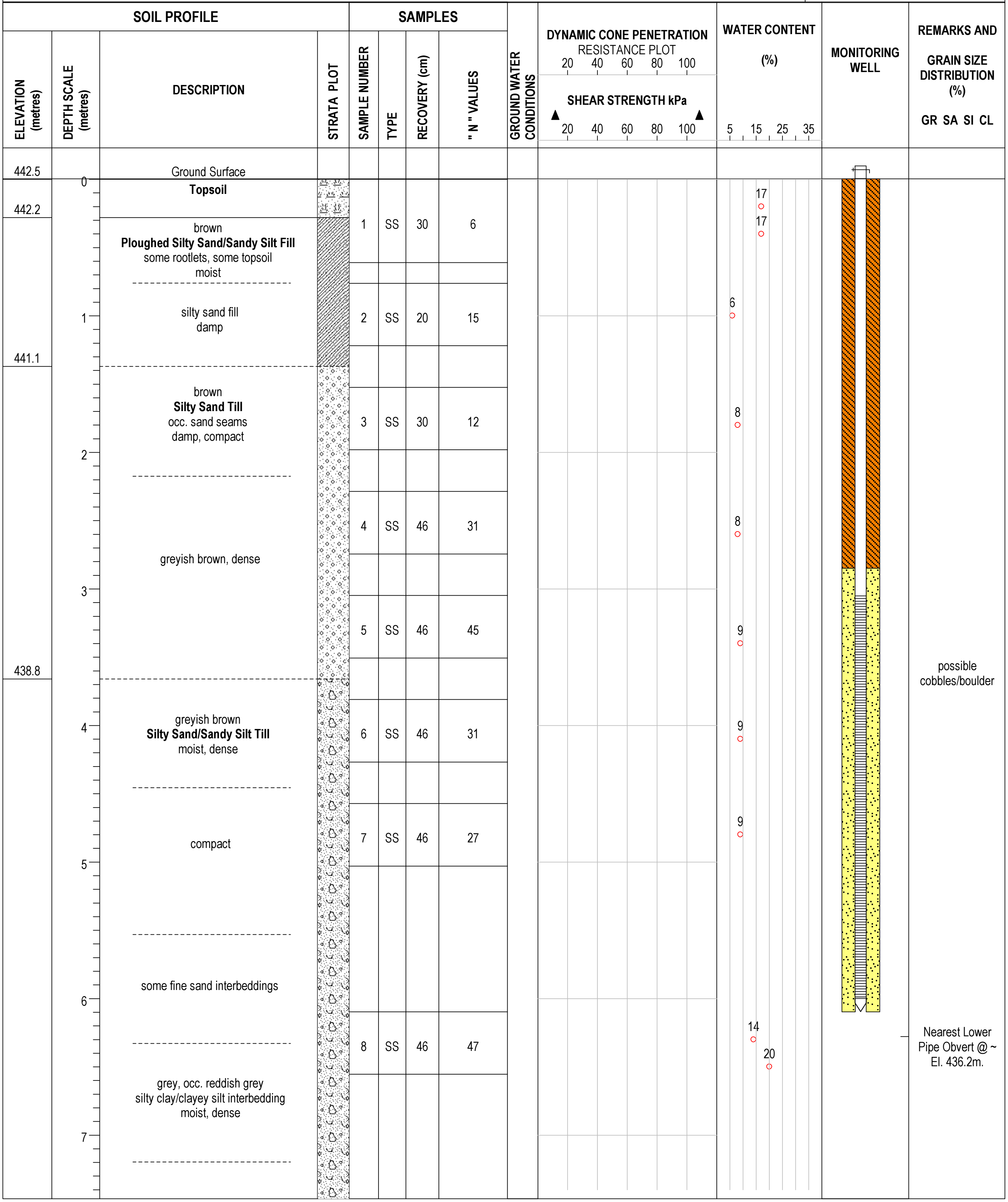
Markham, Ontario, L3R 9W7



ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	WATER CONTENT (%)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)
442.5		Ground Surface						
	0	**Topsoil**						
442.2		brown **Ploughed Silty Sand/Sandy Silt Fill** some rootlets, some topsoil moist	1	SS	30	6	17 17	
	1	silty sand fill damp	2	SS	20	15	6	
441.1		brown **Silty Sand Till** occ. sand seams damp, compact	3	SS	30	12	8	
	2	greyish brown, dense	4	SS	46	31	8	
	3		5	SS	46	45	9	
438.8	4	greyish brown **Silty Sand/Sandy Silt Till** moist, dense	6	SS	46	31	9	possible cobbles/boulder
		compact	7	SS	46	27	9	
	5							
	6	some fine sand interbeddings	8	SS	46	47	14 20	Nearest Lower Pipe Obvert @ ~ El. 436.2m.
	7	grey, occ. reddish grey silty clay/clayey silt interbedding moist, dense						

RECORD OF BOREHOLE 105

Project No.: T22907
CLIENT: Mattamy (Erin) Limited
ORIGINATED BY: R.H.
DATE: Nov 28 - Dec 06, 2022
LOCATION: 8th Line, Erin, Ontario
COMPILED BY: R.H.
DATUM: Geodetic
BOREHOLE TYPE: Hollow Stem
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7

SOIL PROFILE				SAMPLES								
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	STRATA PLOT	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa 20 40 60 80 100	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
434.4	8	grey some gravel damp, very dense		9	SS	46	54			7		
	9 10 11 12 13 14	**End of Borehole** Cave-in Depth on Completion: None Groundwater Depth on Completion: Dry Measuring Groundwater Level in Installed Monitoring Well on: December 13, 2022: Dry December 20, 2022: Dry										

RECORD OF BOREHOLE 106

Project No.: T22907
CLIENT: Mattamy (Erin) Limited
ORIGINATED BY: R.H.
DATE: Nov 28 - Dec 06, 2022
LOCATION: 8th Line, Erin, Ontario
COMPILED BY: R.H.
DATUM: Geodetic
BOREHOLE TYPE: Hollow Stem
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7

ELEVATION (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	WATER CONTENT (%)
458.3	Ground Surface					
458.1	**Topsoil**					
	brown **Clayey Sandy Silt/Clayey Silty Sand Fill** some gravel, damp to moist	1	SS	15	10	20 8
	dark brown	2	SS	20	54/28cm	12 6
457.0	brown occ. organic stains, damp					
	brown **Silty Sand Till** occ. gravel damp, compact	3	SS	30	13	8
455.4	light brown some gravel, dense	4	SS	36	33	5
	light brown **Silty Sand/Sandy Silt Till** occ. oxidized fissures damp, very dense	5	SS	41	78/25cm	9
	brown fine sand interbedding, damp	6	SS	46	50	6 5
	occ. sand seams	7	SS	46	67	6
	greyish brown occ. oxidized fissures occ. sand seams/pockets	8	SS	41	68	7

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100
SHEAR STRENGTH kPa: 20 40 60 80 100
WATER CONTENT (%): 5 15 25 35
MONITORING WELL
REMARKS AND GRAIN SIZE DISTRIBUTION (%): GR SA SI CL
GROUND WATER CONDITIONS
DEPTH SCALE (metres): 0 1 2 3 4 5 6 7

RECORD OF BOREHOLE 106

Project No.: T22907
CLIENT: Mattamy (Erin) Limited
ORIGINATED BY: R.H.
DATE: Nov 28 - Dec 06, 2022
LOCATION: 8th Line, Erin, Ontario
COMPILED BY: R.H.
DATUM: Geodetic
BOREHOLE TYPE: Hollow Stem
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7

SOIL PROFILE

ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION
		occ. cobbles/boulder
449.8		grey **Silt** some sand moist to wet, very dense occ. sand seams
446.8		grey **Silty Fine Sand** damp, very dense

Depth scale: 8, 9, 10, 11, 12, 13, 14

SAMPLES

SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	WATER CONTENT (%)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
9	SS	5	50/10cm	4	possible cobbles/boulder
10	SS	20	50/8cm	12	Gradation Analysis, S(10): 0 14 94 6
11	SS	25	50/13cm	13	
12	SS	46	64	6	
13	SS	46	88	6	

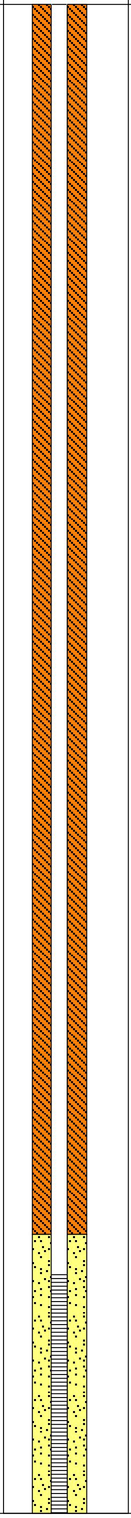
GROUND WATER CONDITIONS

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH kPa
20 40 60 80 100

WATER CONTENT (%)
5 15 25 35

MONITORING WELL



RECORD OF BOREHOLE 106

Project No.: T22907 **CLIENT:** Mattamy (Erin) Limited **ORIGINATED BY:** R.H.

DATE: Nov 28 - Dec 06, 2022 **LOCATION:** 8th Line, Erin, Ontario **COMPILED BY:** R.H.

DATUM: Geodetic **BOREHOLE TYPE:** Hollow Stem **CHECKED BY:** H.S.

SHAD & ASSOCIATES INC.

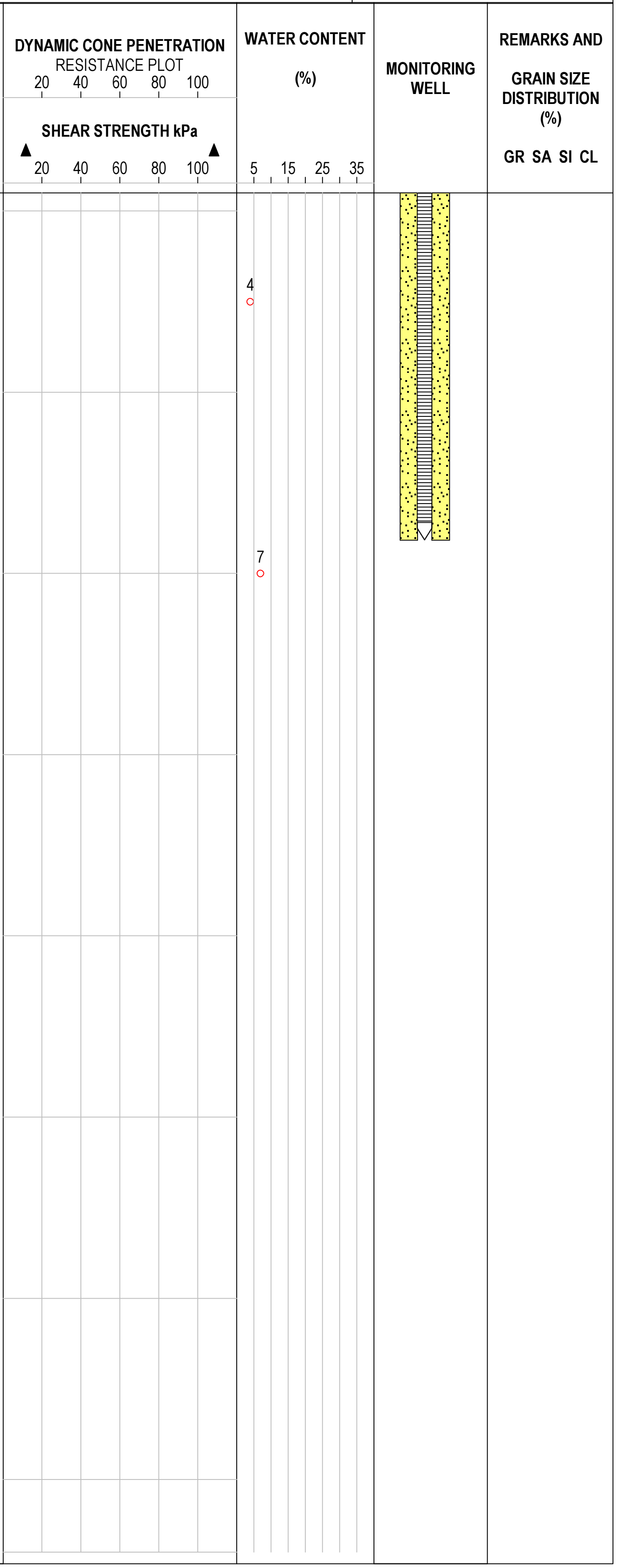
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7

ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	GROUND WATER CONDITIONS
	15						
			14	SS	41	90/28cm	
	16	occ. silt interbeddings					
	17		15	SS	41	90/28cm	
441.1		**End of Borehole**					
	18						
	19						
	20						
	21						
	22						

End of Borehole

Cave-in Depth on Completion: None
Groundwater Depth on Completion: Dry

Measured Groundwater Level in Installed Monitoring Well on:
December 13, 2022: Dry
December 20, 2022: Dry



RECORD OF BOREHOLE 107

Project No.: T22907
CLIENT: Mattamy (Erin) Limited
ORIGINATED BY: R.H.
DATE: Nov 28 - Dec 06, 2022
LOCATION: 8th Line, Erin, Ontario
COMPILED BY: R.H.
DATUM: Geodetic
BOREHOLE TYPE: Hollow Stem
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7

SOIL PROFILE				SAMPLES								
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	STRATA PLOT	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa 20 40 60 80 100	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
455.7		Ground Surface										
	0	**Topsoil**								18		
455.4		brown **Silty Sand/Sandy Silt Fill** some rootlets, damp		1	SS	36	4			12		
	1	some gravel		2	SS	10	11			2		
454.3		brown **Silty Sand/Sandy Silt Till** damp to moist, compact		3	SS	41	20			7		
	2	occ. gravel, dense		4	SS	46	43			8		
	3	brown, occ. greyish brown damp		5	SS	46	42			7		
	4	greyish brown		6	SS	46	46			6		
	5	some gravel, very dense		7	SS	15	50/13cm			6		possible cobbles/boulder
450.2	6	greyish brown **Silty Sand Till** damp, very dense		8	SS	5	50/10cm			6		possible cobbles/boulder
	7											

RECORD OF BOREHOLE 107

Project No.: T22907
CLIENT: Mattamy (Erin) Limited
ORIGINATED BY: R.H.
DATE: Nov 28 - Dec 06, 2022
LOCATION: 8th Line, Erin, Ontario
COMPILED BY: R.H.
DATUM: Geodetic
BOREHOLE TYPE: Hollow Stem
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7

ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa 20 40 60 80 100	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
			9	SS	10	50/13cm			5		
	8										possible cobbles/boulder
		occ. fine sand interbeddings damp									
	9										Auger refusal @ 9.1m. Borehole was moved 1.5m west of stake and re-drilled.
			10	SS	25	50/13cm			8		
445.6	10	grey **Silty Fine Sand** damp, very dense									
	11		11	SS	46	90			7		possible cobbles/boulder
	12		12	SS	15	50/8cm			4		
	13										possible cobbles/boulder
	14		13	SS	0	50/3cm					possible cobbles/boulder

RECORD OF BOREHOLE 107

Project No.: T22907
CLIENT: Mattamy (Erin) Limited
ORIGINATED BY: R.H.
DATE: Nov 28 - Dec 06, 2022
LOCATION: 8th Line, Erin, Ontario
COMPILED BY: R.H.
DATUM: Geodetic
BOREHOLE TYPE: Hollow Stem
CHECKED BY: H.S.

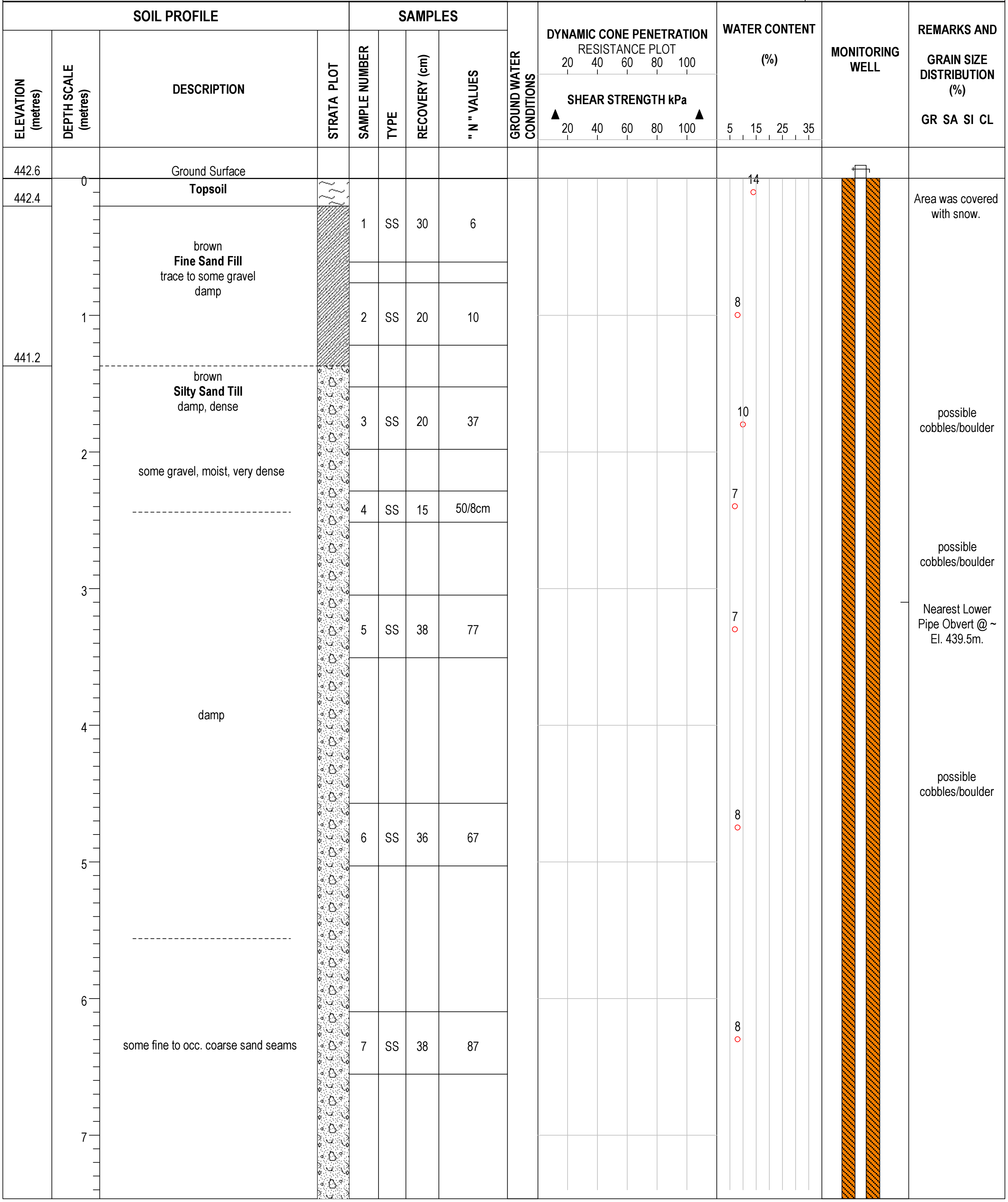
SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7

SOIL PROFILE				SAMPLES								
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	STRATA PLOT	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ▲ 20 40 60 80 100 ▲	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	15		░	14	SS	41	59			4 ○		
440.4		**End of Borehole** Cave-in Depth on Completion: None Groundwater Depth on Completion: Dry Measured Groundwater Level in Installed Monitoring Well on: December 13, 2022: Dry December 20, 2022: Dry										
	16											
	17											
	18											
	19											
	20											
	21											
	22											

RECORD OF BOREHOLE 1

Project No.: T21837
CLIENT: Mattamy Development Corporation
ORIGINATED BY: S.C.
DATE: February 23-26, 2021
LOCATION: 5520 Eighth Line, Erin
COMPILED BY: R.H.
DATUM: Geodetic
BOREHOLE TYPE: Hollow Stem
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6



ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	WATER CONTENT (%)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
442.6		Ground Surface						
442.4	0	**Topsoil**					14	
		brown **Fine Sand Fill** trace to some gravel damp	1	SS	30	6		Area was covered with snow.
	1		2	SS	20	10	8	
441.2		brown **Silty Sand Till** damp, dense	3	SS	20	37	10	possible cobbles/boulder
	2	some gravel, moist, very dense	4	SS	15	50/8cm	7	possible cobbles/boulder
	3		5	SS	38	77	7	Nearest Lower Pipe Obvert @ ~ El. 439.5m.
	4	damp						possible cobbles/boulder
	5		6	SS	36	67	8	
	6	some fine to occ. coarse sand seams	7	SS	38	87	8	
	7							

RECORD OF BOREHOLE 1

Project No.: T21837
CLIENT: Mattamy Development Corporation
ORIGINATED BY: S.C.
DATE: February 23-26, 2021
LOCATION: 5520 Eighth Line, Erin
COMPILED BY: R.H.
DATUM: Geodetic
BOREHOLE TYPE: Hollow Stem
CHECKED BY: H.S.

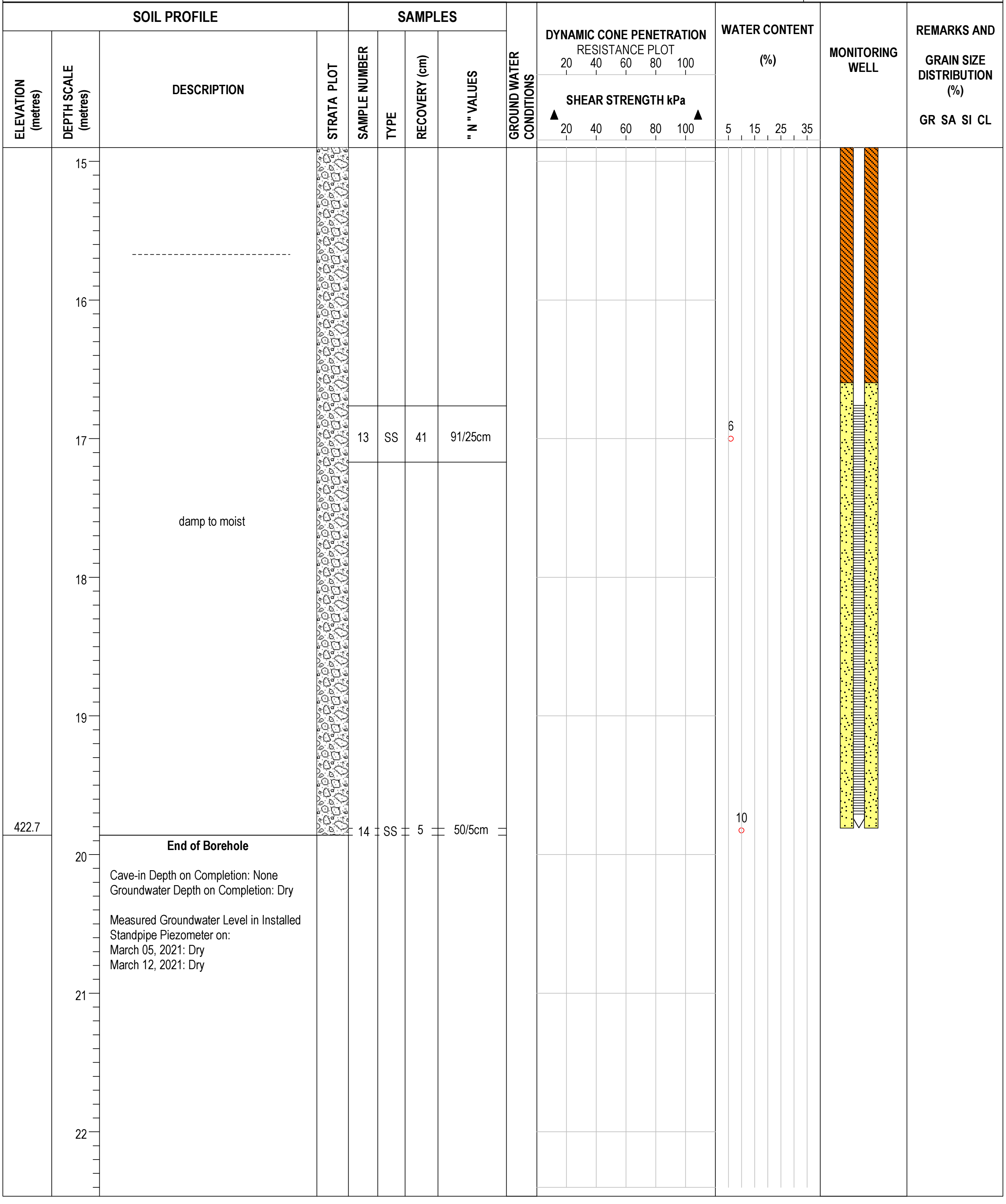
SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6

SOIL PROFILE			SAMPLES				GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa 20 40 60 80 100	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES					
		some coarse sand seams	8	SS	46	93			7		
	8										
	9	grey	9	SS	46	64			6		
432.6	10	grey **Silty Sand/Sandy Silt Till** damp to moist, very dense									
			10	SS	13	50/13cm			8		
	11										
	12		11	SS	46	67			6		
	13	damp									
	14		12	SS	30	86			6		

RECORD OF BOREHOLE 1

Project No.: T21837
CLIENT: Mattamy Development Corporation
ORIGINATED BY: S.C.
DATE: February 23-26, 2021
LOCATION: 5520 Eighth Line, Erin
COMPILED BY: R.H.
DATUM: Geodetic
BOREHOLE TYPE: Hollow Stem
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6



damp to moist

SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES
13	SS	41	91/25cm
14	SS	5	50/5cm

422.7

End of Borehole

Cave-in Depth on Completion: None
Groundwater Depth on Completion: Dry

Measured Groundwater Level in Installed Standpipe Piezometer on:
March 05, 2021: Dry
March 12, 2021: Dry

ENCLOSURES

Enclosure B: 2015 National Building Code Seismic Hazard Calculation

2015 National Building Code Seismic Hazard Calculation

INFORMATION: **Eastern Canada English (613) 995-5548 français (613) 995-0600 Facsimile (613) 992-8836**
Western Canada English (250) 363-6500 Facsimile (250) 363-6565

Site: 43.765N 80.087W **User File Reference:** Erin Subdivision 2024-05-06 17:01 UT

Probability of exceedance per annum	0.000404	0.001	0.0021	0.01
Probability of exceedance in 50 years	2 %	5 %	10 %	40 %
Sa (0.05)	0.108	0.063	0.038	0.010
Sa (0.1)	0.142	0.085	0.053	0.016
Sa (0.2)	0.129	0.080	0.052	0.018
Sa (0.3)	0.104	0.066	0.044	0.016
Sa (0.5)	0.081	0.052	0.035	0.012
Sa (1.0)	0.047	0.031	0.020	0.006
Sa (2.0)	0.024	0.015	0.010	0.003
Sa (5.0)	0.006	0.004	0.002	0.001
Sa (10.0)	0.003	0.002	0.001	0.000
PGA (g)	0.079	0.047	0.030	0.009
PGV (m/s)	0.065	0.040	0.025	0.007

Notes: Spectral (Sa(T), where T is the period in seconds) and peak ground acceleration (PGA) values are given in units of g (9.81 m/s^2). Peak ground velocity is given in m/s. Values are for "firm ground" (NBCC2015 Site Class C, average shear wave velocity 450 m/s). NBCC2015 and CSAS6-14 values are highlighted in yellow. Three additional periods are provided - their use is discussed in the NBCC2015 Commentary. Only 2 significant figures are to be used. **These values have been interpolated from a 10-km-spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the directly calculated values.**

References

National Building Code of Canada 2015 NRCC no. 56190; Appendix C: Table C-3, Seismic Design Data for Selected Locations in Canada

Structural Commentaries (User's Guide - NBC 2015: Part 4 of Division B)
Commentary J: Design for Seismic Effects

Geological Survey of Canada Open File 7893 Fifth Generation Seismic Hazard Model for Canada: Grid values of mean hazard to be used with the 2015 National Building Code of Canada

See the websites www.EarthquakesCanada.ca and www.nationalcodes.ca for more information

Natural Resources Canada Ressources naturelles Canada

Canada

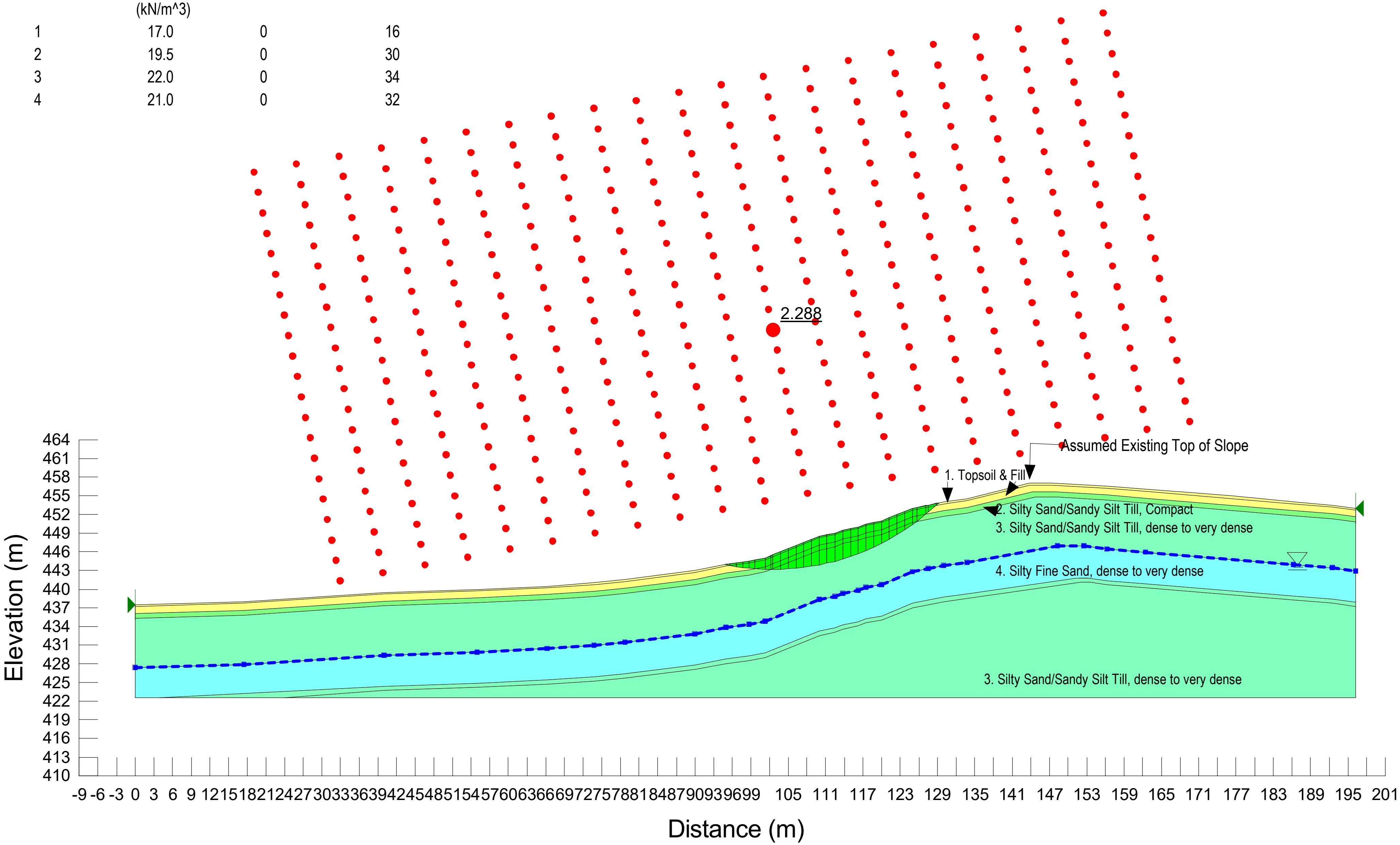
ENCLOSURES

Enclosure C: Slope Stability Analysis Results (C-1 to C-21)

Enclosure C-1 Section AA'

Job No. T22907
Project: Erin Subdivision
Section AA'
Nearest Borehole: BH 1 & BH 107
Short Term (Unrained Analysis)

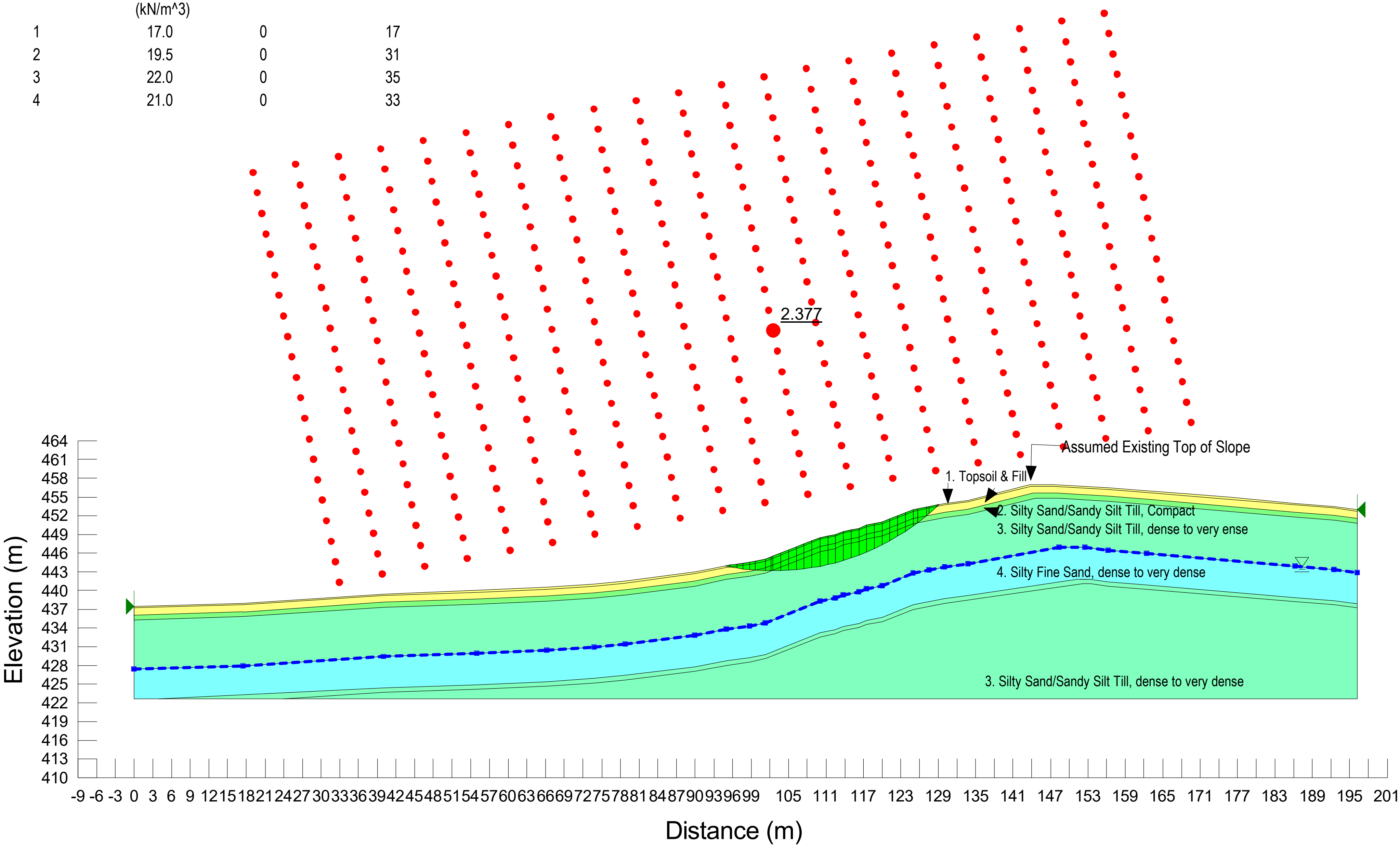
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	17.0	0	16
2	19.5	0	30
3	22.0	0	34
4	21.0	0	32



Enclosure C-2 Section AA'

Job No. T22907
Project: Erin Subdivision
Section AA'
Nearest Borehole: BH 1 & BH 107
Long Term (Drained Analysis)

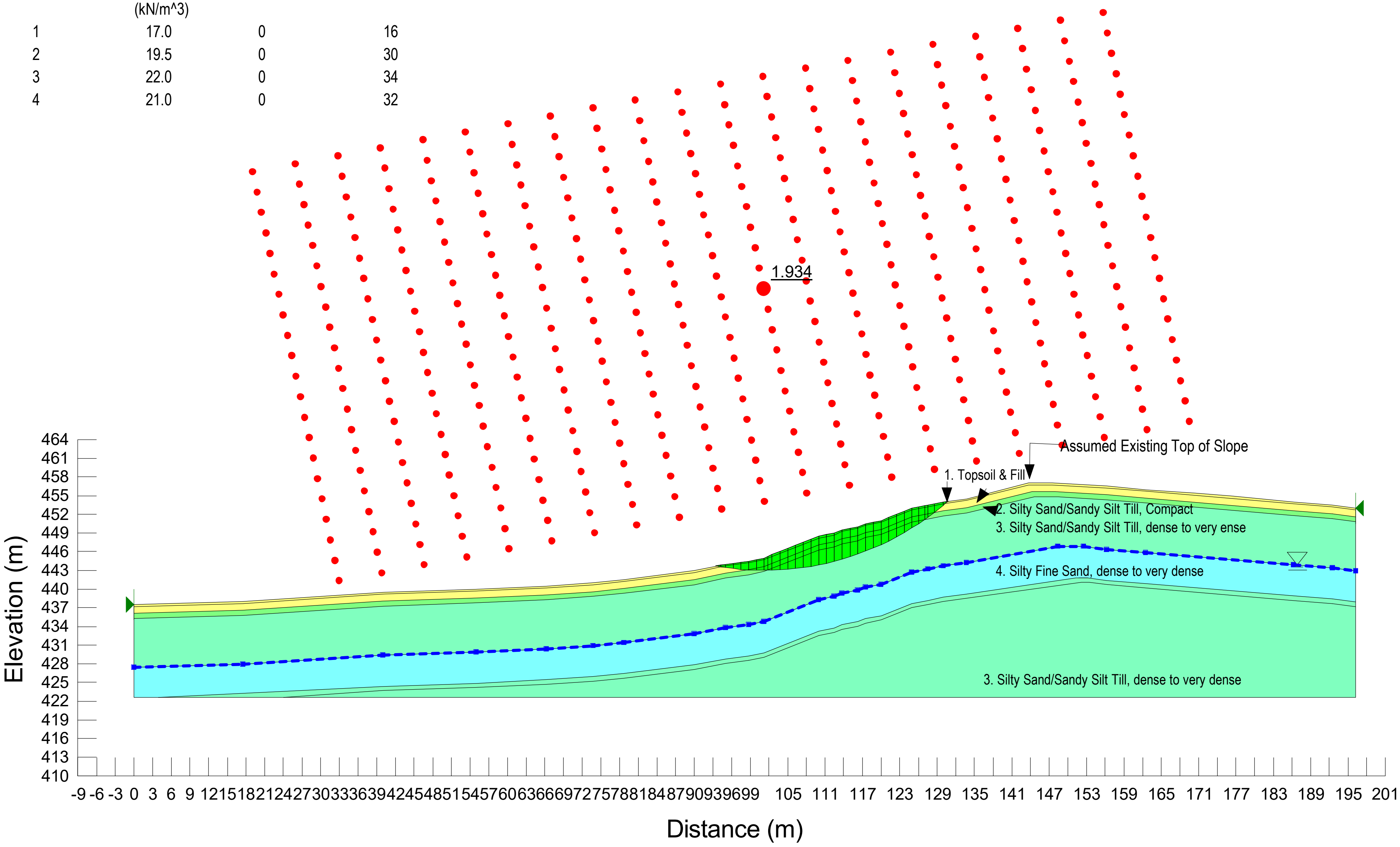
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	17.0	0	17
2	19.5	0	31
3	22.0	0	35
4	21.0	0	33



Enclosure C-3 Section AA'

Job No. T22907
Project: Erin Subdivision
Section AA'
Nearest Borehole: BH 1 & BH 107
Short Term (Unrained Analysis - Seismic Loading Analysis)

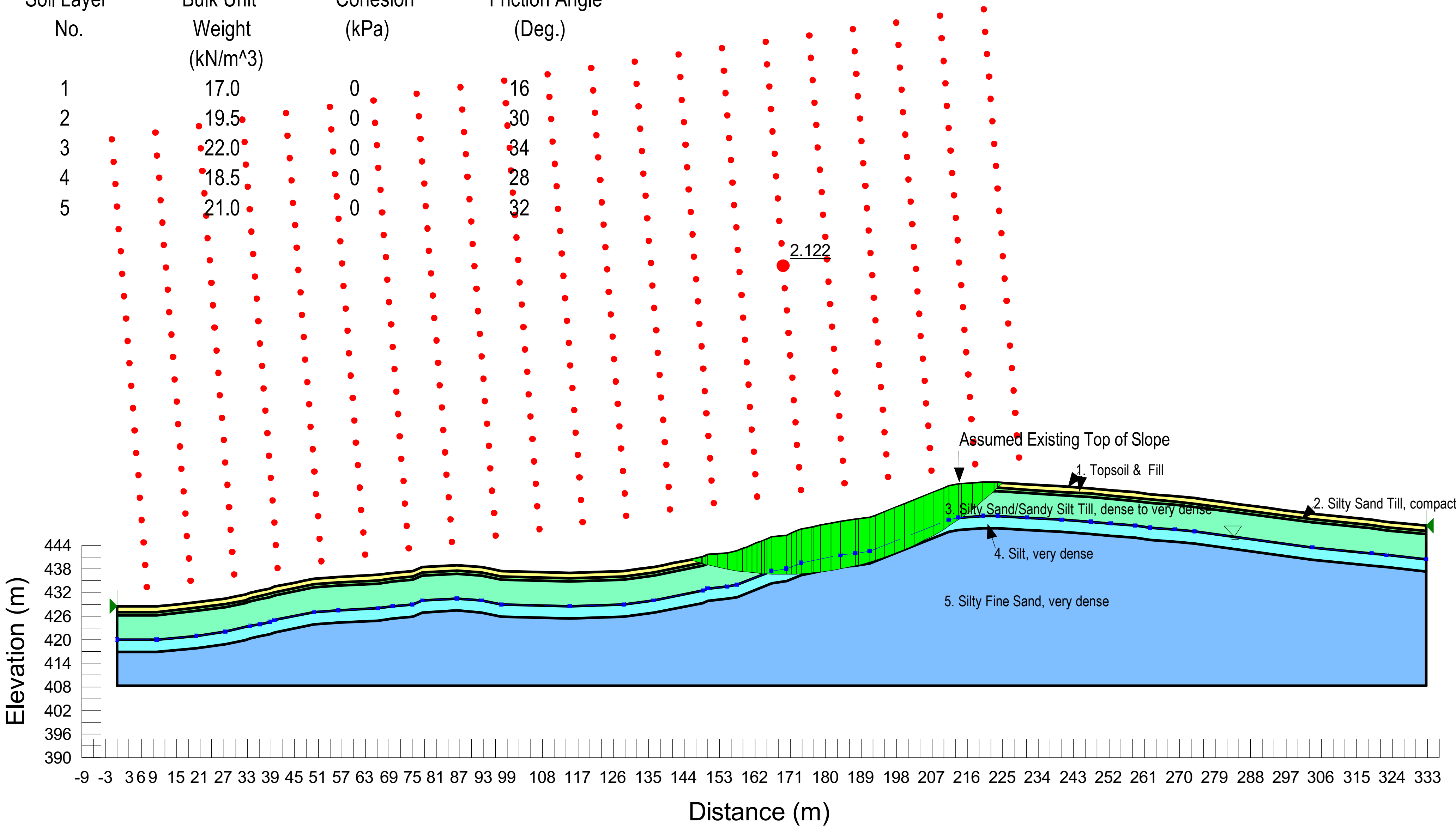
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	17.0	0	16
2	19.5	0	30
3	22.0	0	34
4	21.0	0	32



Enclosure C-4 Section BB'

Job No. T22907
Project: Erin Subdivision
Section BB'
Nearest Borehole: BH 106
Short Term (Undrained Analysis)

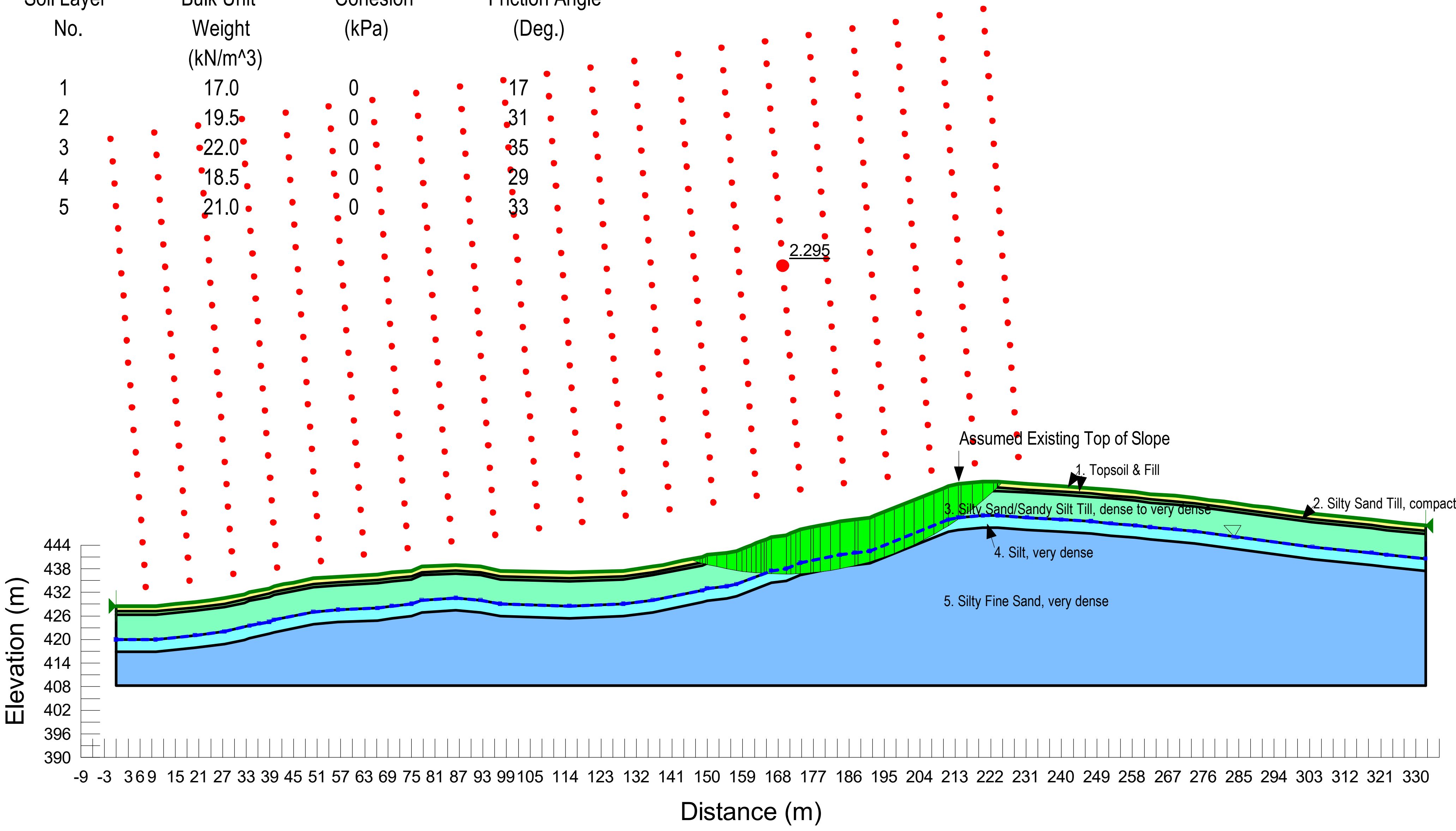
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	17.0	0	16
2	19.5	0	30
3	22.0	0	34
4	18.5	0	28
5	21.0	0	32



Enclosure C-5 Section BB'

Job No. T22907
Project: Erin Subdivision
Section BB'
Nearest Borehole: BH 106
Long Term (Drained Analysis)

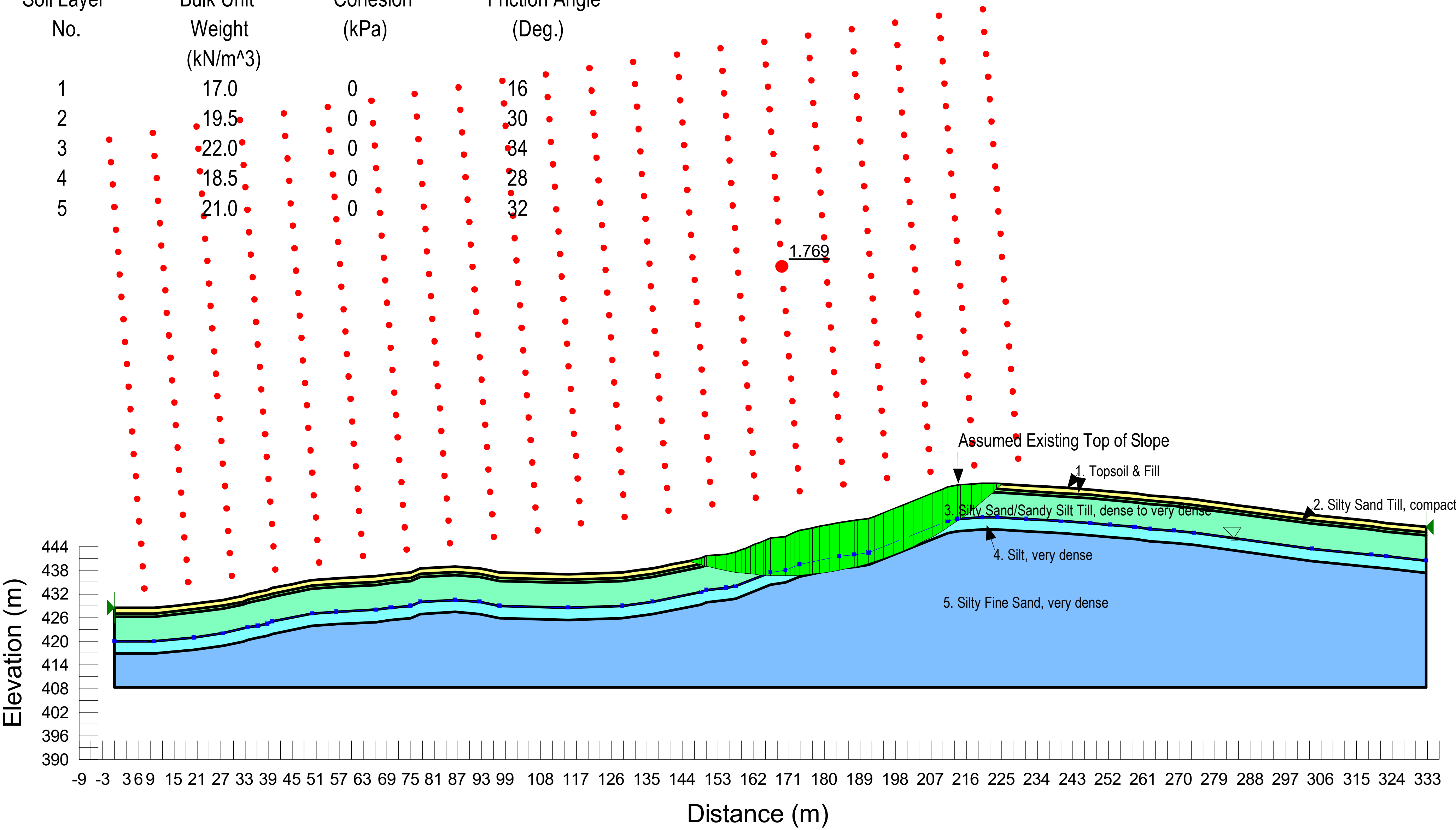
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	17.0	0	17
2	19.5	0	31
3	22.0	0	35
4	18.5	0	29
5	21.0	0	33



Enclosure C-6 Section BB'

Job No. T22907
Project: Erin Subdivision
Section BB'
Nearest Borehole: BH 106
Short Term (Undrained Analysis - Seismic Loading Analysis)

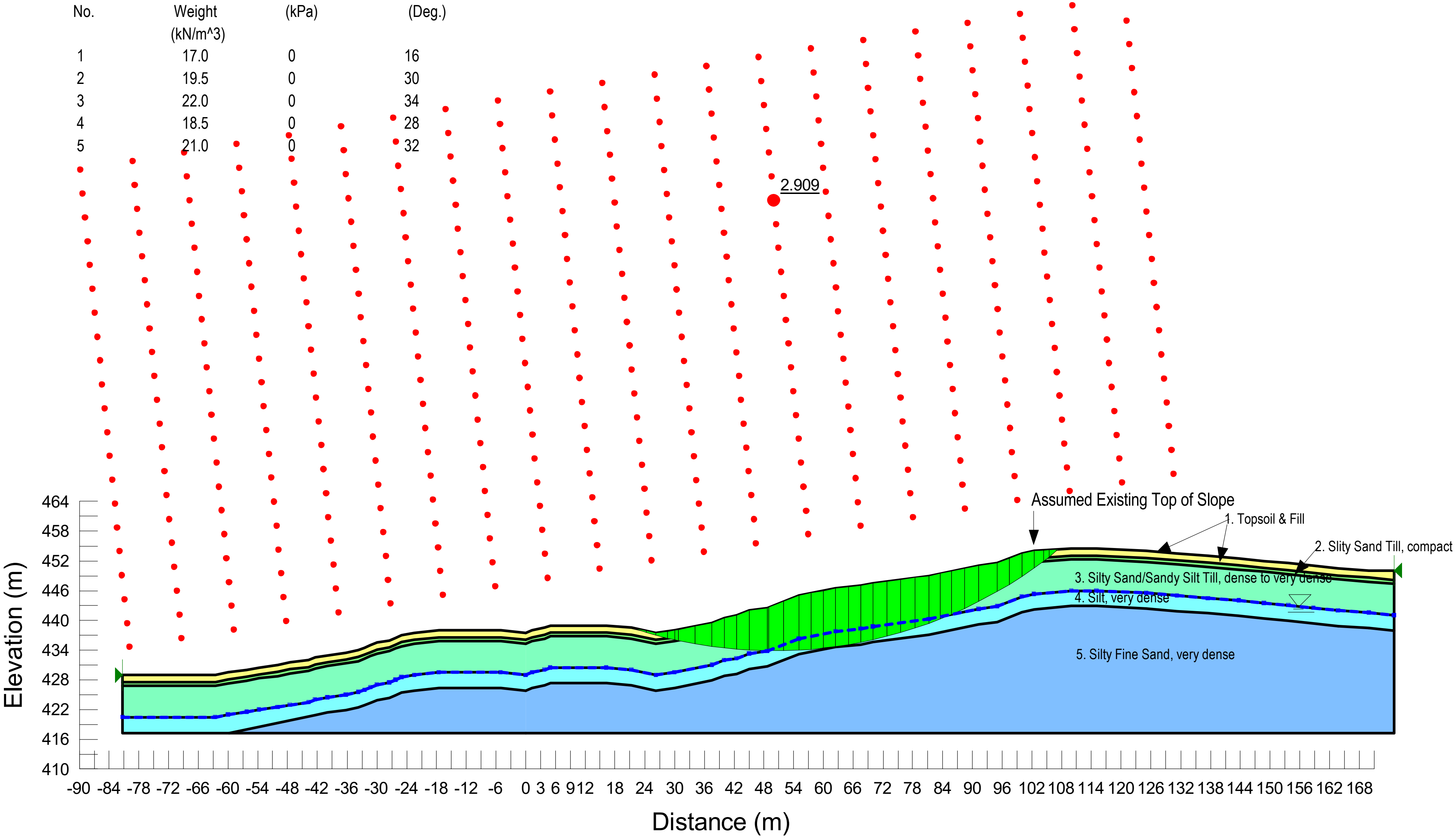
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	17.0	0	16
2	19.5	0	30
3	22.0	0	34
4	18.5	0	28
5	21.0	0	32



Enclosure C-7 Section CC'

Job No. T22907
Project: Erin Subdivision
Section CC'
Nearest Borehole: BH 106
Short Term (Undrained Analysis)

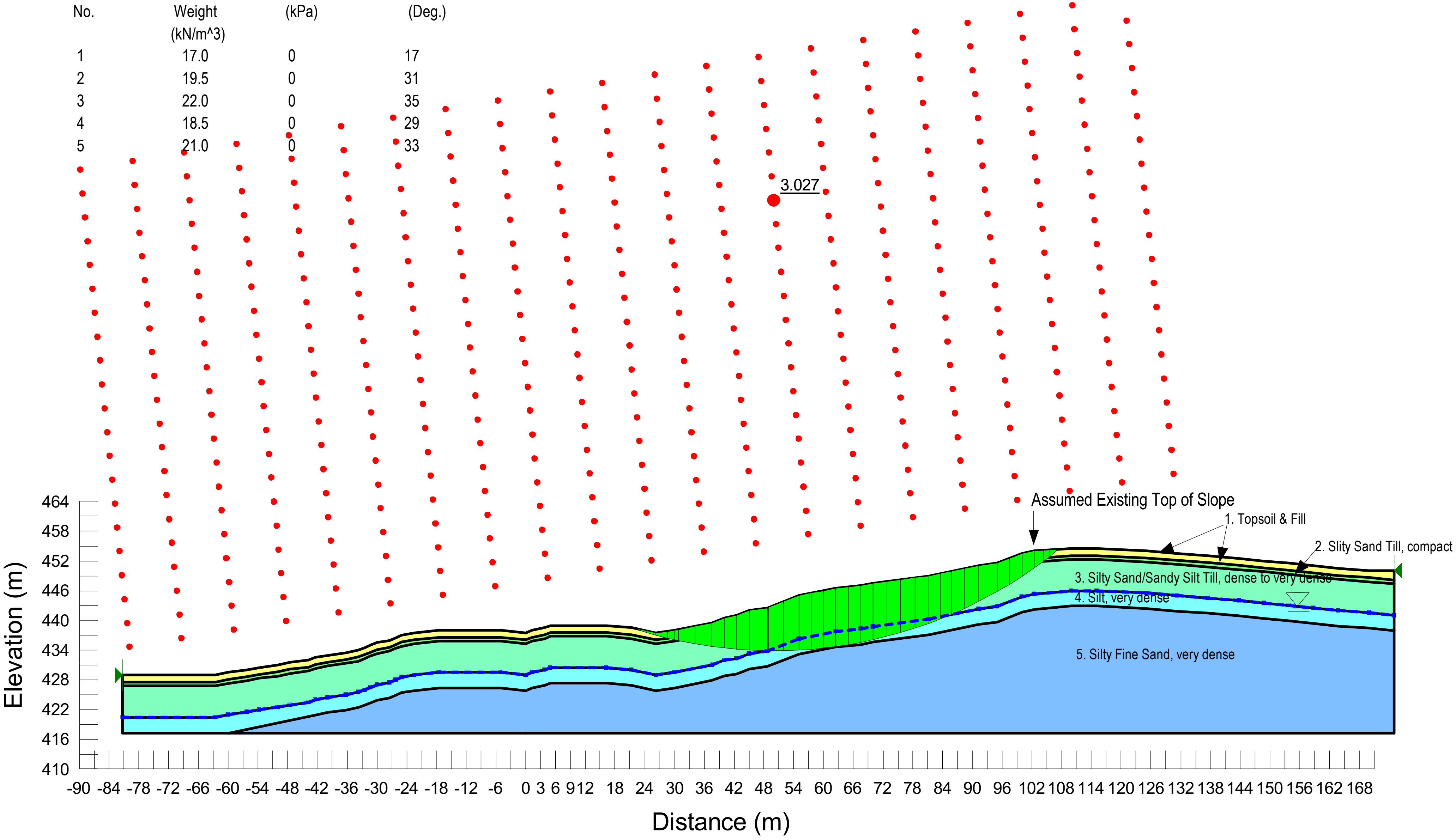
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	17.0	0	16
2	19.5	0	30
3	22.0	0	34
4	18.5	0	28
5	21.0	0	32



Enclosure C-8 Section CC'

Job No. T22907
Project: Erin Subdivision
Section CC'
Nearest Borehole: BH 106
Long Term (Drained Analysis)

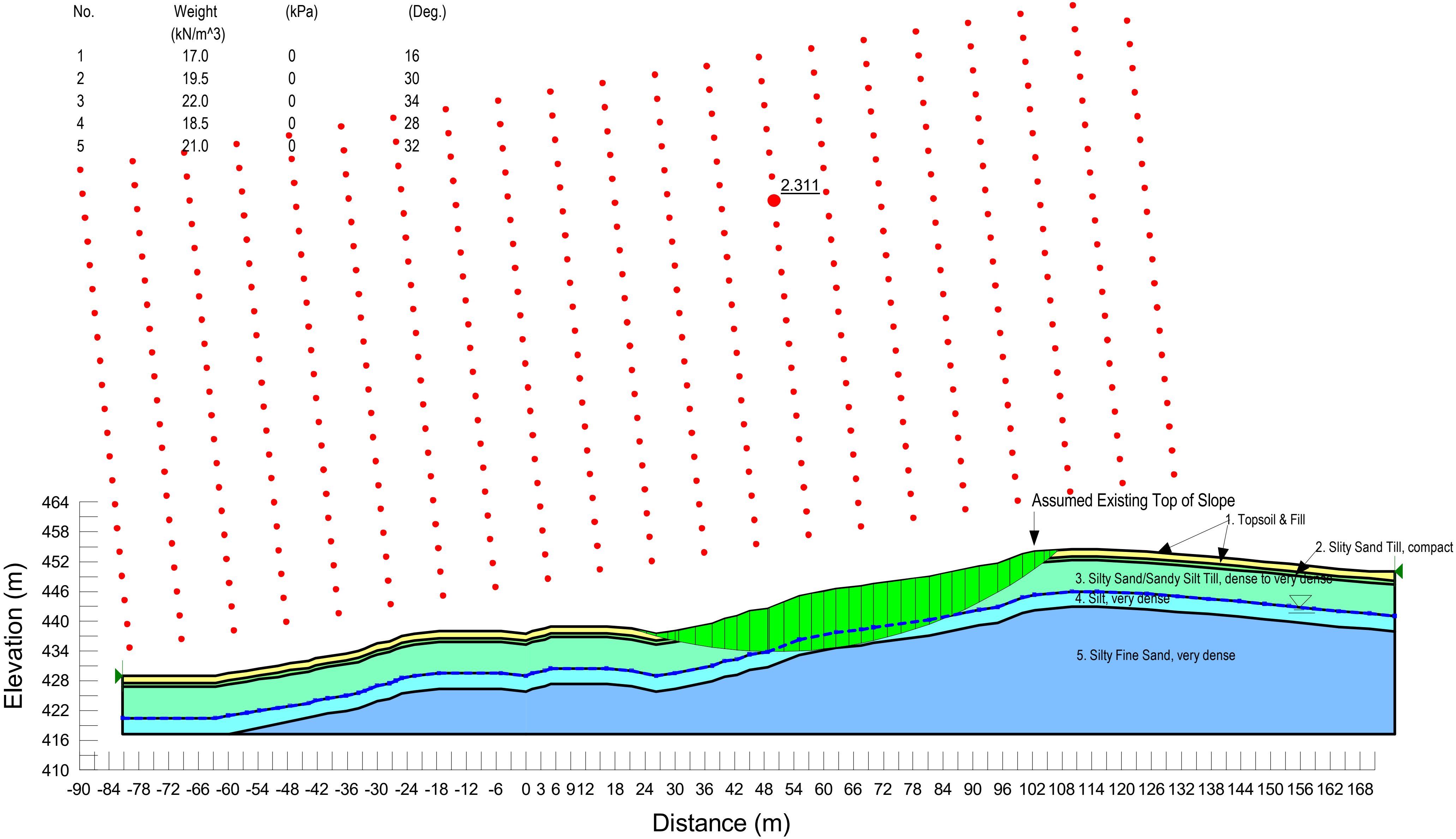
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	17.0	0	17
2	19.5	0	31
3	22.0	0	35
4	18.5	0	29
5	21.0	0	33



Enclosure C-9 Section CC'

Job No. T22907
Project: Erin Subdivision
Section CC'
Nearest Borehole: BH 106
Short Term (Undrained Analysis - Seismic Loading Analysis)

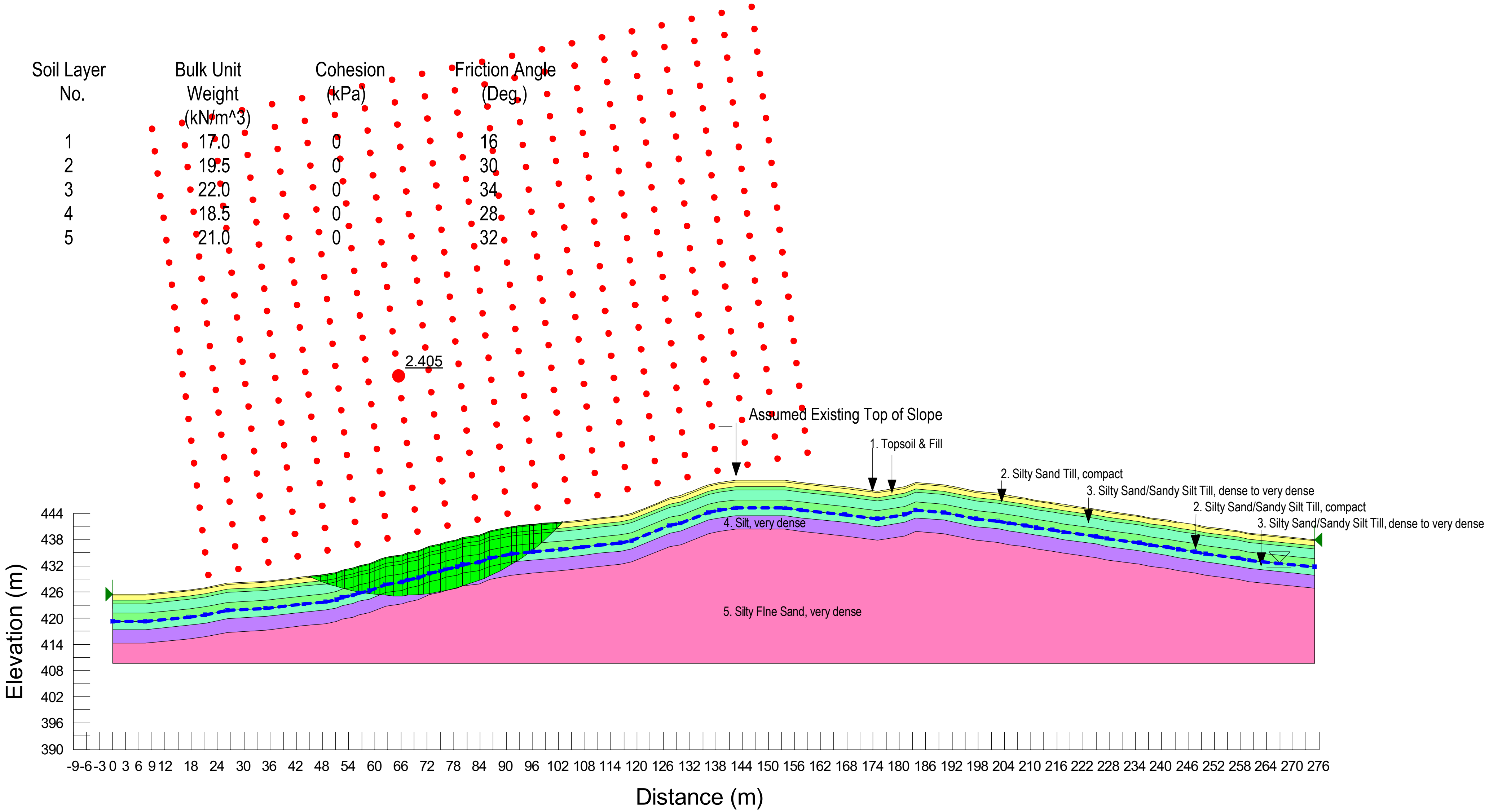
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	17.0	0	16
2	19.5	0	30
3	22.0	0	34
4	18.5	0	28
5	21.0	0	32



Enclosure C-10 Section DD'

Job No. T22907
Project: Erin Subdivision
Section DD'
Nearest Borehole: BH 105 & BH 106
Short Term (Undrained Analysis)

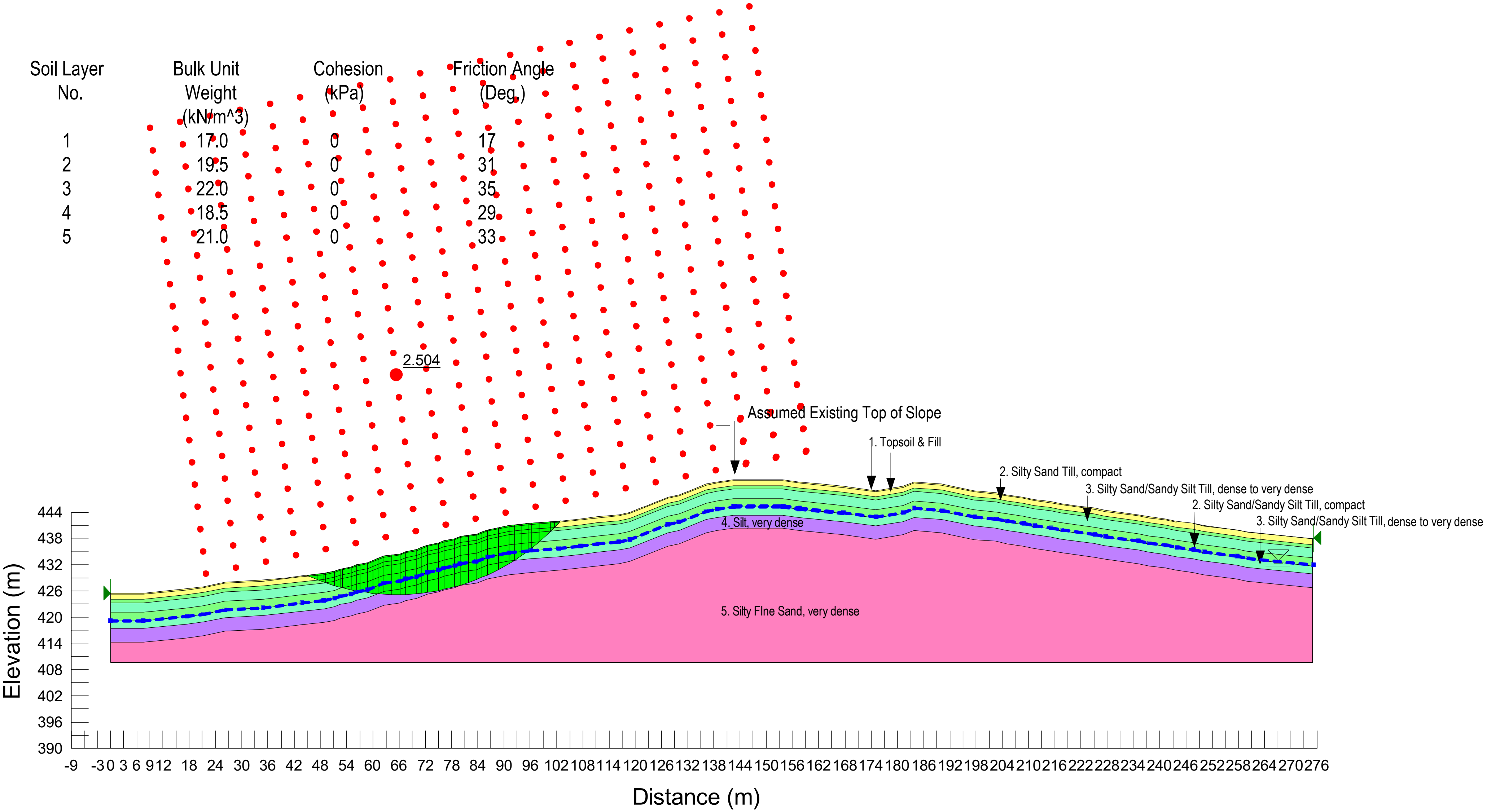
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	17.0	0	16
2	19.5	0	30
3	22.0	0	34
4	18.5	0	28
5	21.0	0	32



Enclosure C-11 Section DD'

Job No. T22907
Project: Erin Subdivision
Section DD'
Nearest Borehole: BH 105 & BH 106
Long Term (Drained Analysis)

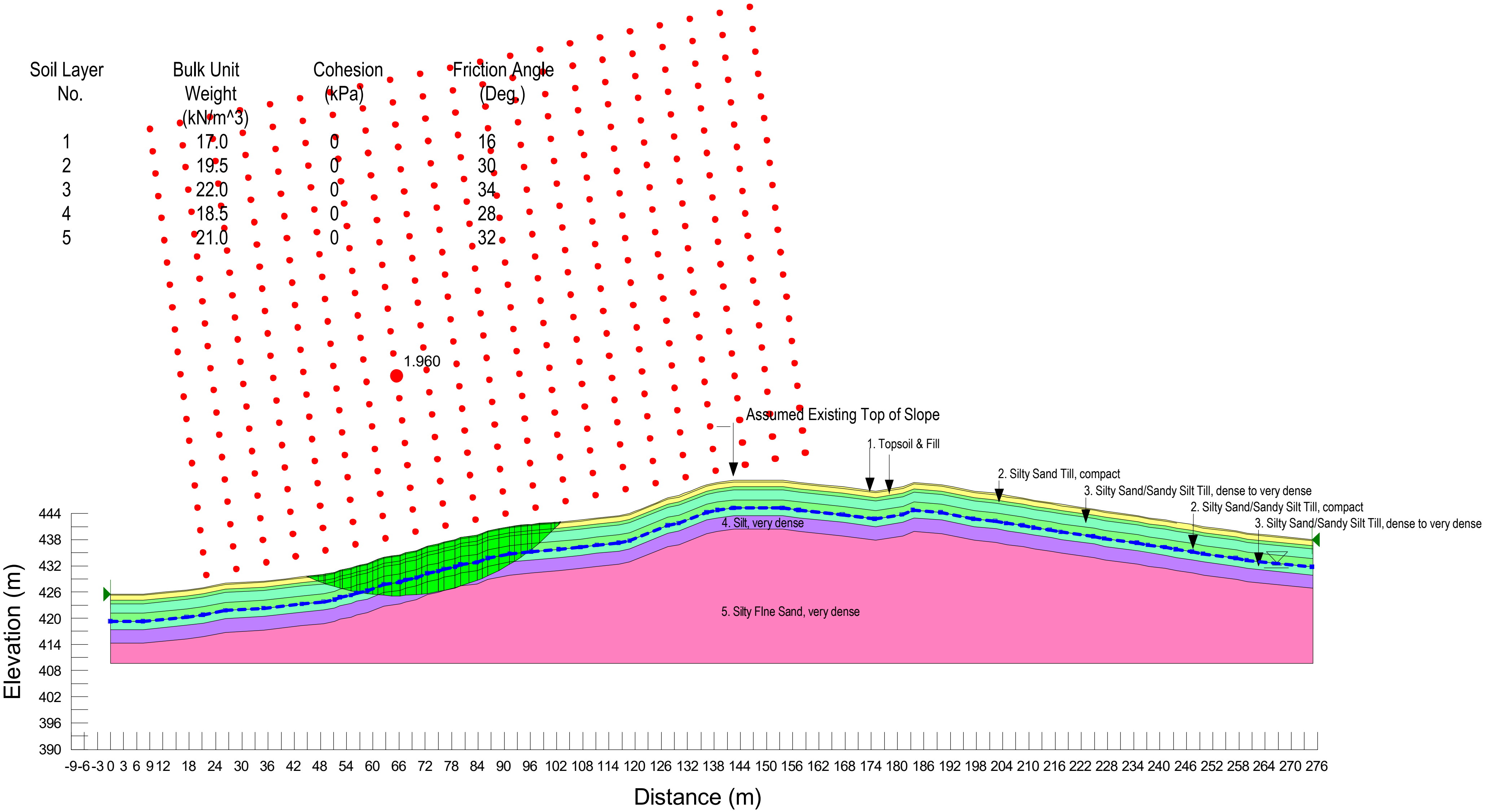
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	17.0	0	17
2	19.5	0	31
3	22.0	0	35
4	18.5	0	29
5	21.0	0	33



Enclosure C-12 Section DD'

Job No. T22907
Project: Erin Subdivision
Section DD'
Nearest Borehole: BH 105 & BH 106
Short Term (Undrained Analysis - Seismic Loading Analysis)

Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	17.0	0	16
2	19.5	0	30
3	22.0	0	34
4	18.5	0	28
5	21.0	0	32



Enclosure C-13 Section EE'

Job No. T22907

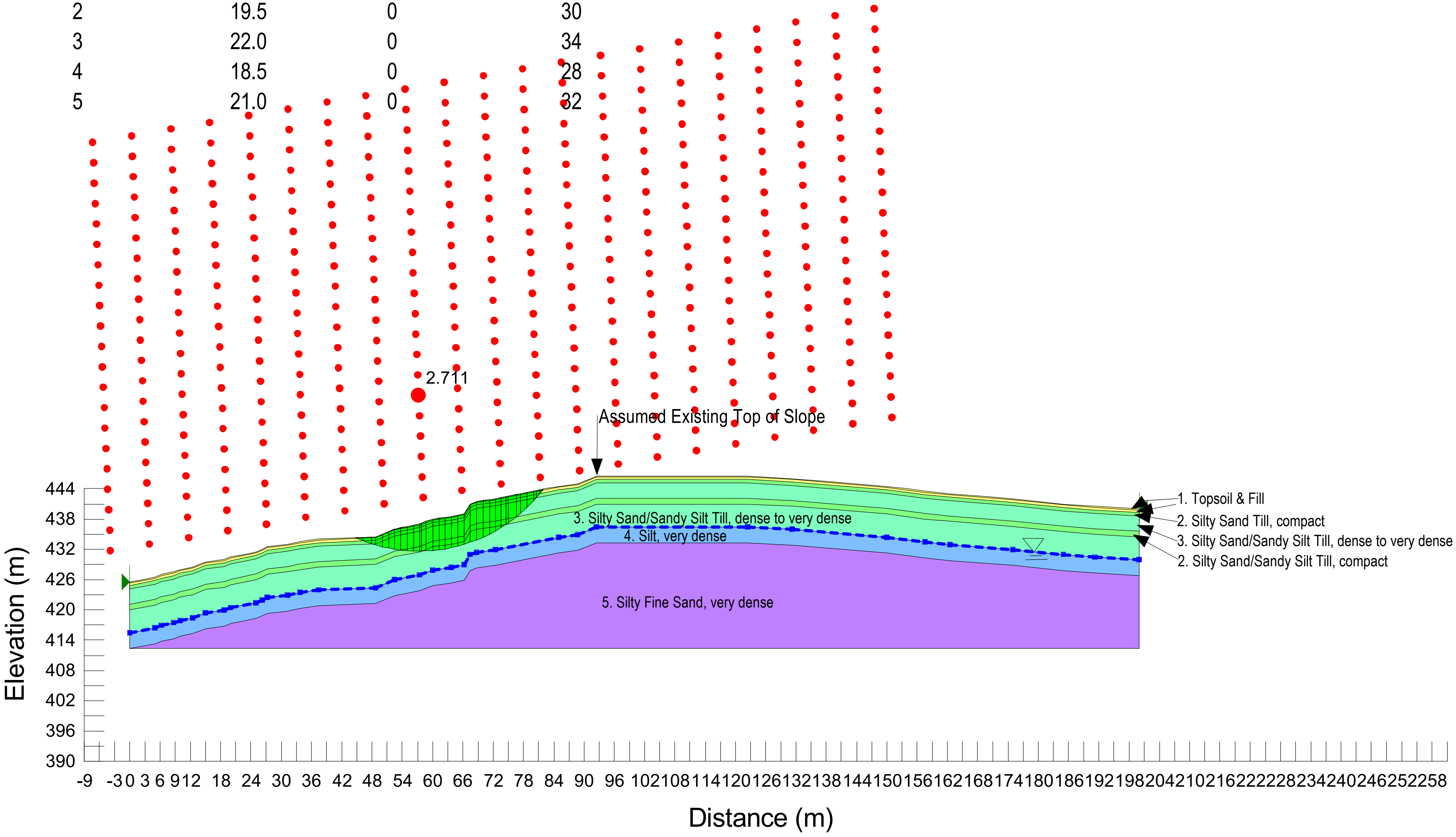
Project: Erin Subdivision

Section EE'

Nearest Borehole: BH 102 & BH 106

Short Term (Undrained Analysis)

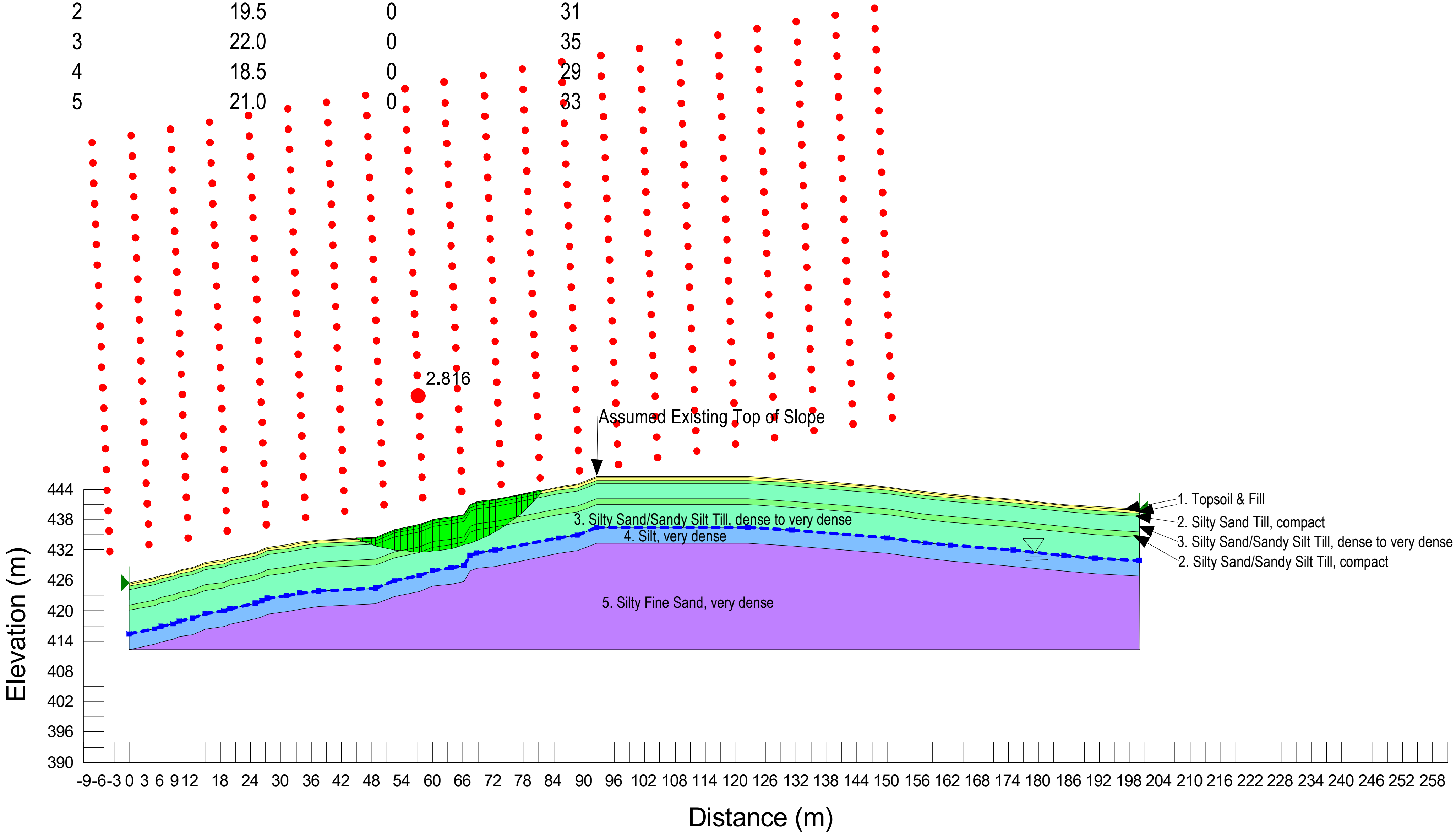
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	17.0	0	16
2	19.5	0	30
3	22.0	0	34
4	18.5	0	28
5	21.0	0	32



Enclosure C-14 Section EE'

Job No. T22907
Project: Erin Subdivision
Section EE'
Nearest Borehole: BH 102 & BH 106
Long Term (Drained Analysis)

Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	17.0	0	17
2	19.5	0	31
3	22.0	0	35
4	18.5	0	29
5	21.0	0	33



Enclosure C-15 Section EE'

Job No. T22907

Project: Erin Subdivision

Section EE'

Nearest Borehole: BH 102 & BH 106

Short Term (Undrained Analysis - Seismic Loading Analysis)

Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
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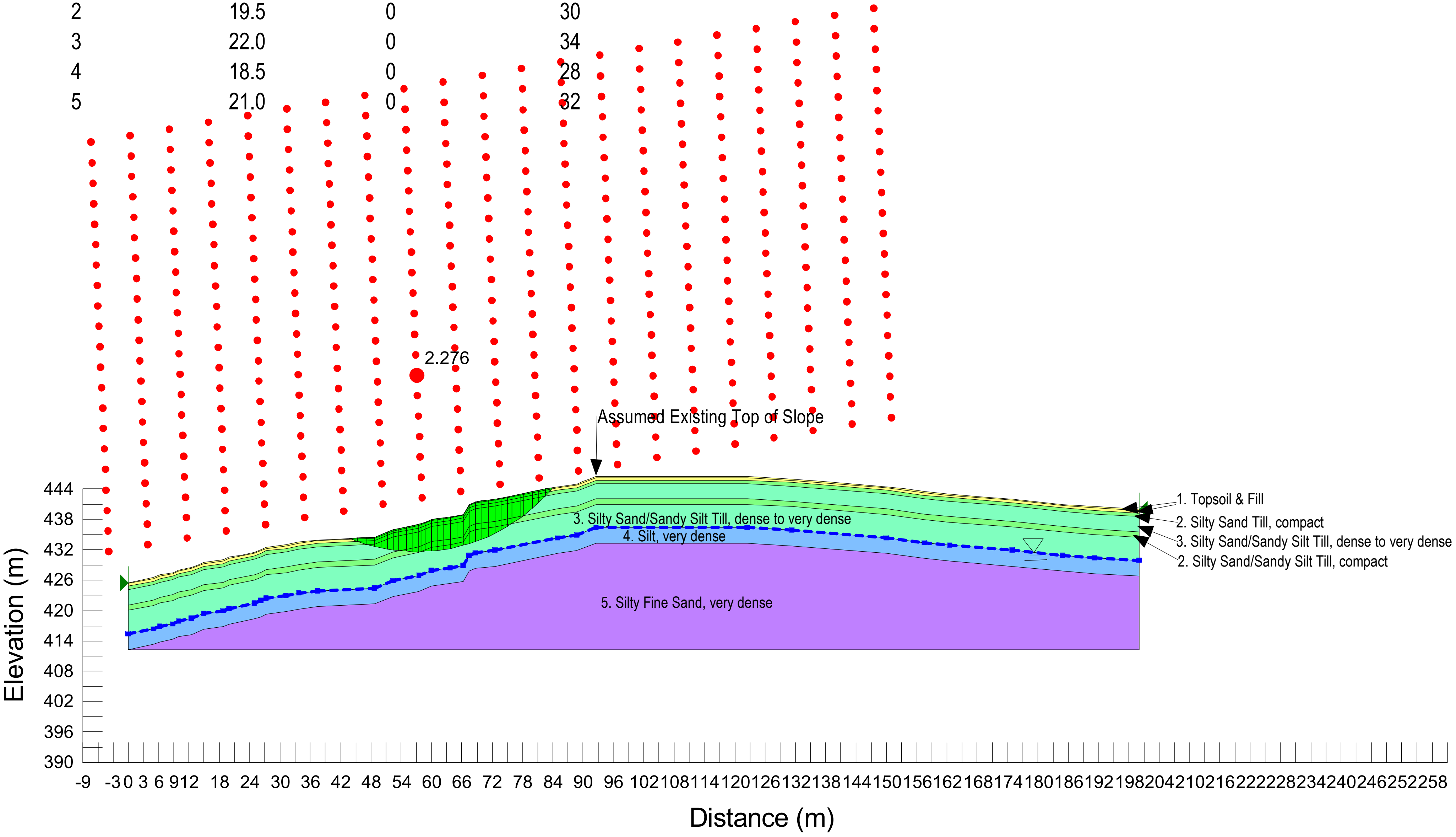
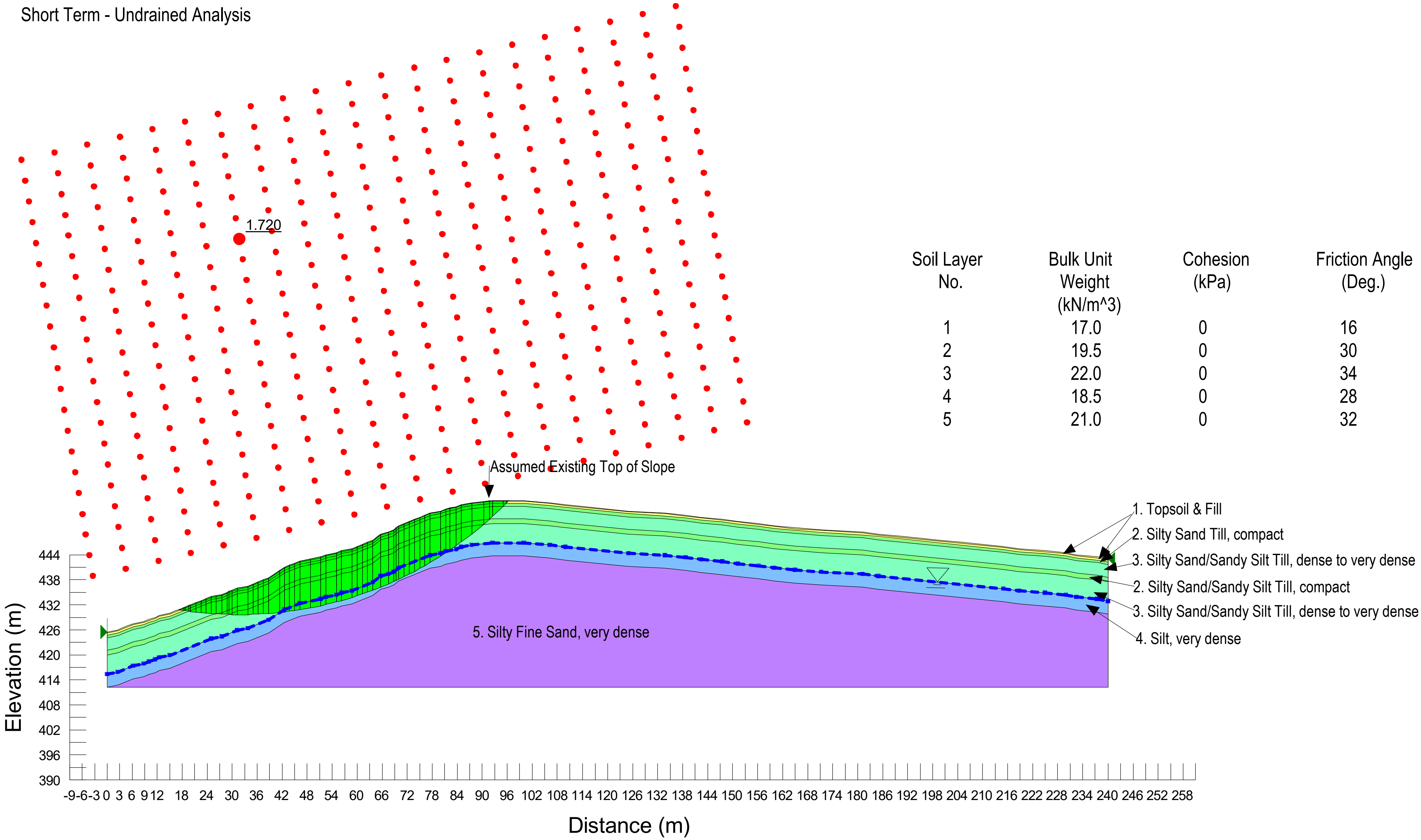
2	19.5	0	30
3	22.0	0	34
4	18.5	0	28
5	21.0	0	32



Enclosure C-16 Section FF'

Job No. T22907
Project: Erin Subdivision
Section FF'
Nearest Borehole: BH 102 & BH 106
Short Term - Undrained Analysis



Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
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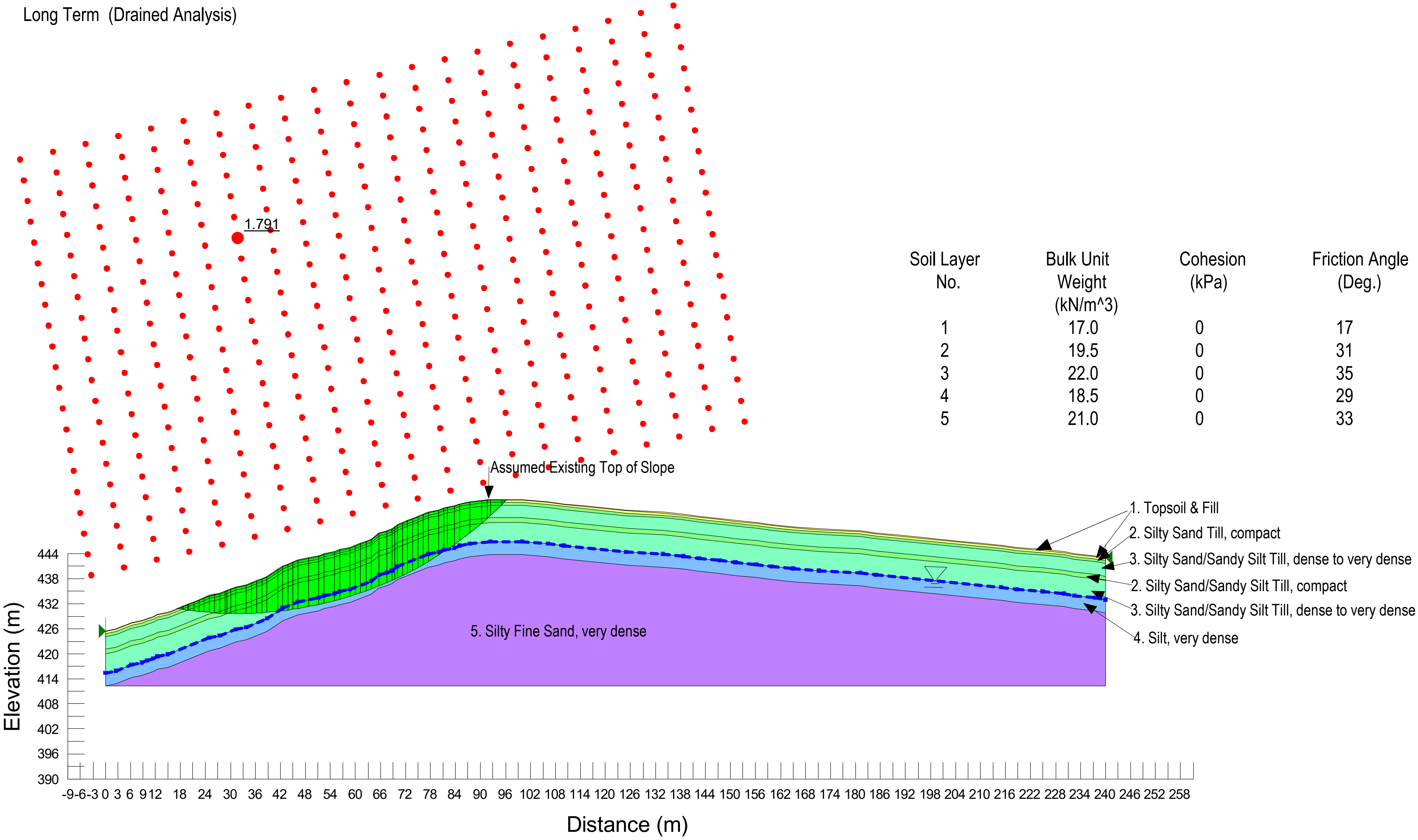
2	19.5	0	30
3	22.0	0	34
4	18.5	0	28
5	21.0	0	32

Enclosure C-17 Section FF'

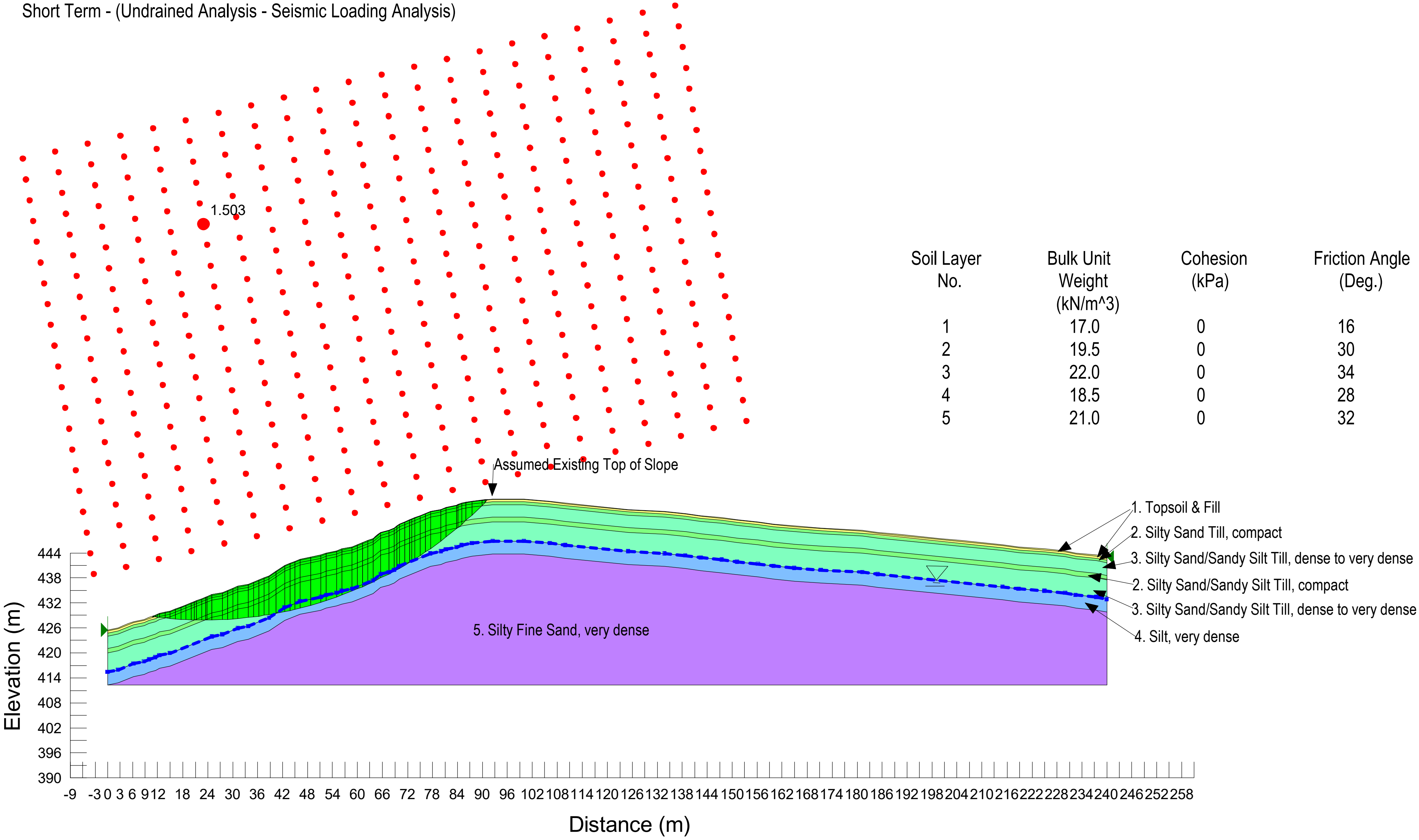
Job No. T22907
Project: Erin Subdivision
Section FF'
Nearest Borehole: BH 102 & BH 106
Long Term (Drained Analysis)



Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	17.0	0	17
2	19.5	0	31
3	22.0	0	35
4	18.5	0	29
5	21.0	0	33

Enclosure C-18 Section FF'

Job No. T22907
Project: Erin Subdivision
Section FF'
Nearest Borehole: BH 102 & BH 106
Short Term - (Undrained Analysis - Seismic Loading Analysis)



Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
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2	19.5	0	30
3	22.0	0	34
4	18.5	0	28
5	21.0	0	32

Enclosure C-19 Section GG'

Job No. T22907
Project: Erin Subdivision
Section GG'
Nearest Borehole: BH 101
Short Trem - Undrained Analysis

Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
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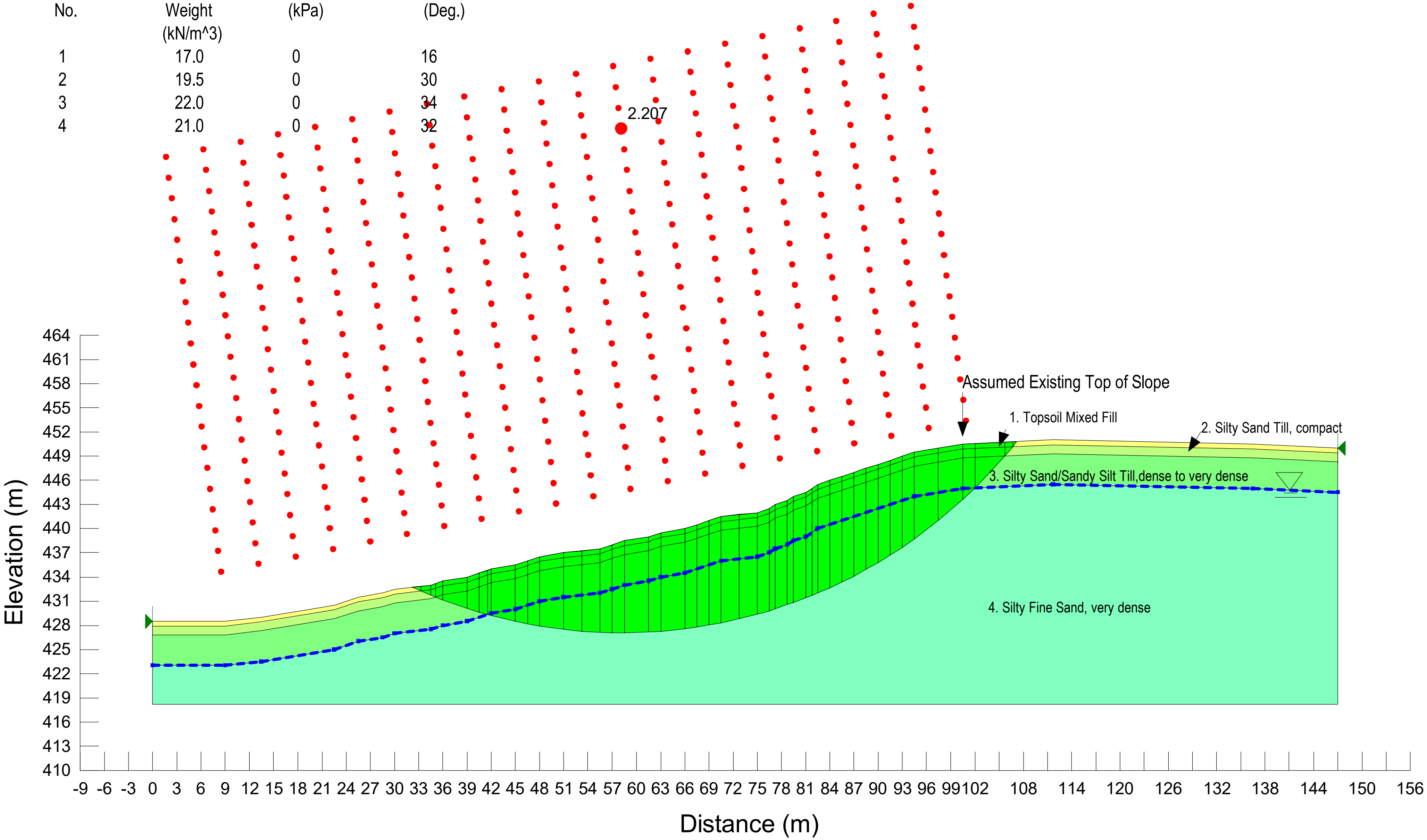
2	19.5	0	30
3	22.0	0	34
4	21.0	0	32



Enclosure C-20 Section GG'

Job No. T22907
Project: Erin Subdivision
Section GG'
Nearest Borehole: BH 101
Long Trem - Drained Analysis

Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
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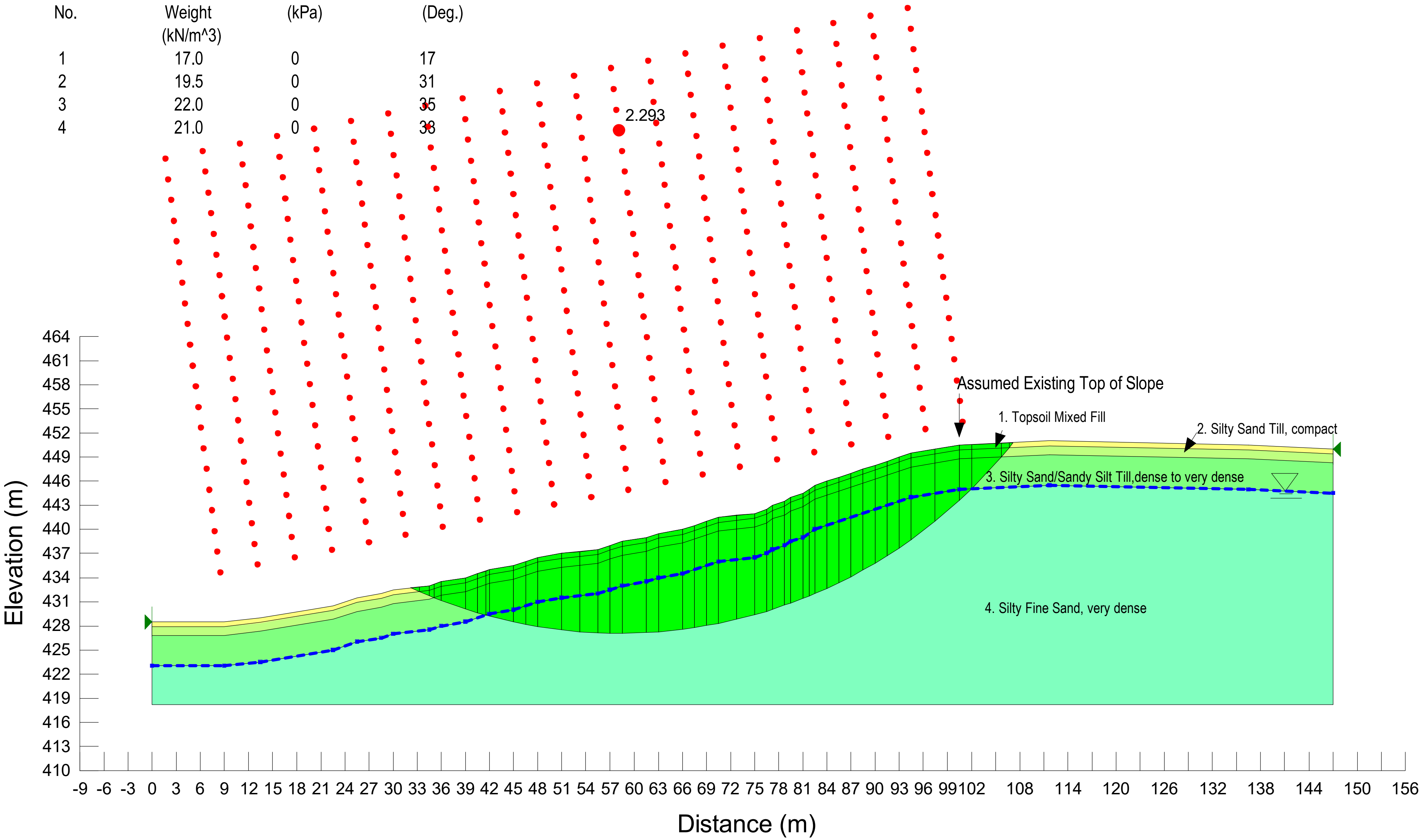
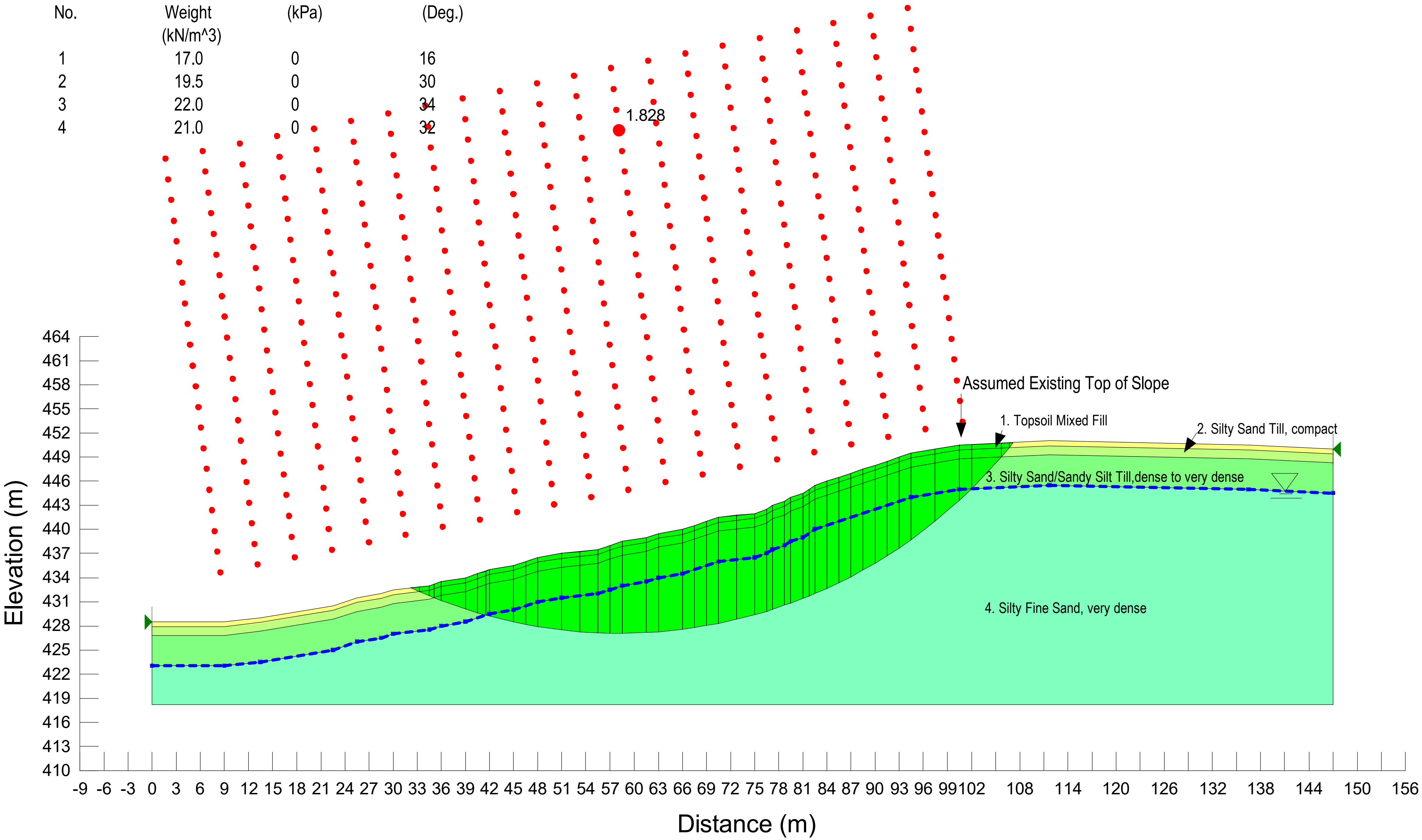
3	22.0	0	35
4	21.0	0	38



Enclosure C-21 Section GG'

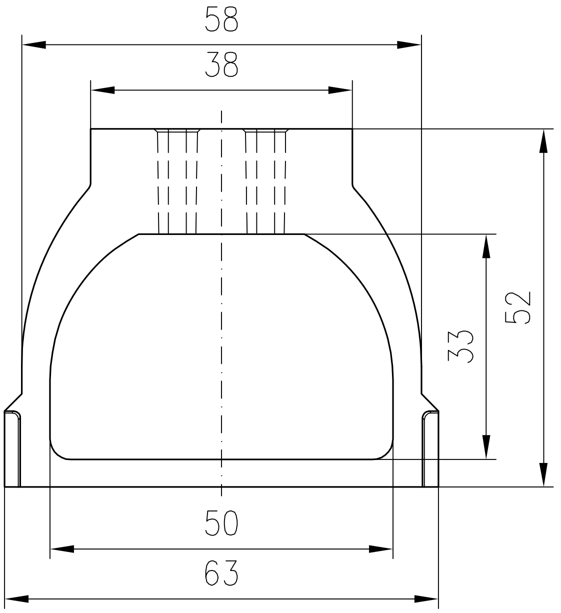
Job No. T22907
Project: Erin Subdivision
Section GG'
Nearest Borehole: BH 101
Short Trem (Undrained Analysis - Seismic Loading Analysis)

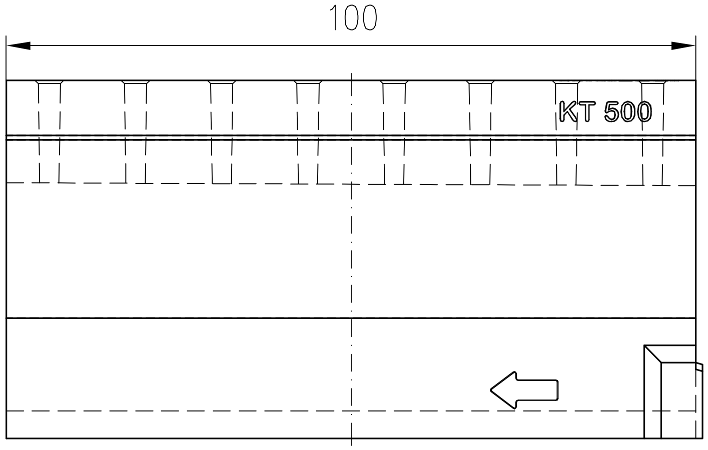
Soil Layer No.	Bulk Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (Deg.)
1	17.0	0	16
2	19.5	0	30
3	22.0	0	34
4	21.0	0	32

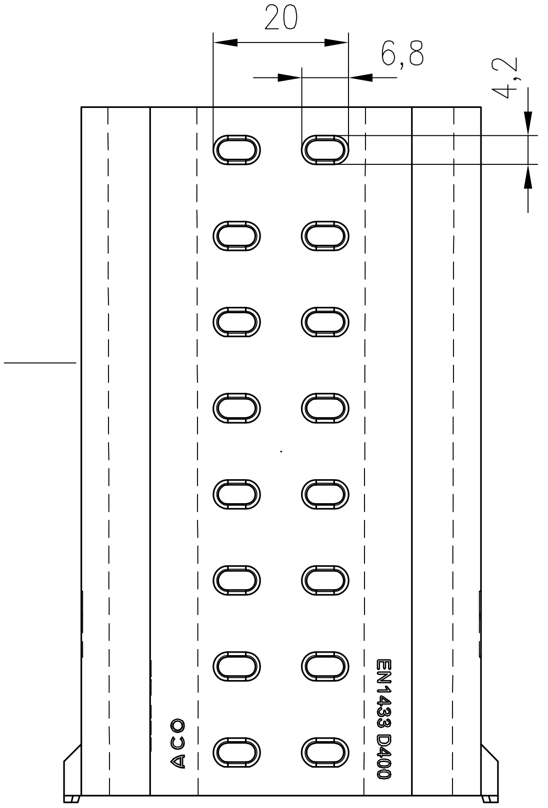


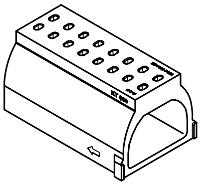
APPENDIX K

WILDLIFE TUNNEL DETAILS, ACO









Index	Datum	Benennung	Name

Werkstoff: Polymerbeton

Gewicht:

zul. Abweich.:

Oberfläche

ACO Severin Ahlmann
GmbH & Co. KG
24755 Rendsburg • Postfach 320
Tel. 04331 354-0
Fax 04331 354-130
www.aco-pro.de

	Datum	Name
Gezeichnet:	26.01.2011	wreimers
Geprüft		
Update:	11.02.2011	

Massstab: 1:10

Masseinheit: cm

Projektion: ISO-E

Diese Zeichnung darf weder kopiert noch dritten Personen, insbesondere zum Zweck anderweitiger Benutzung mitgeteilt werden und bleibt unser Eigentum.
Schutzvermerk nach DIN 34 beachten

ACO PRO Klimatunnel KT 500
1m lang Bauhöhe 52cm mit Öffnung

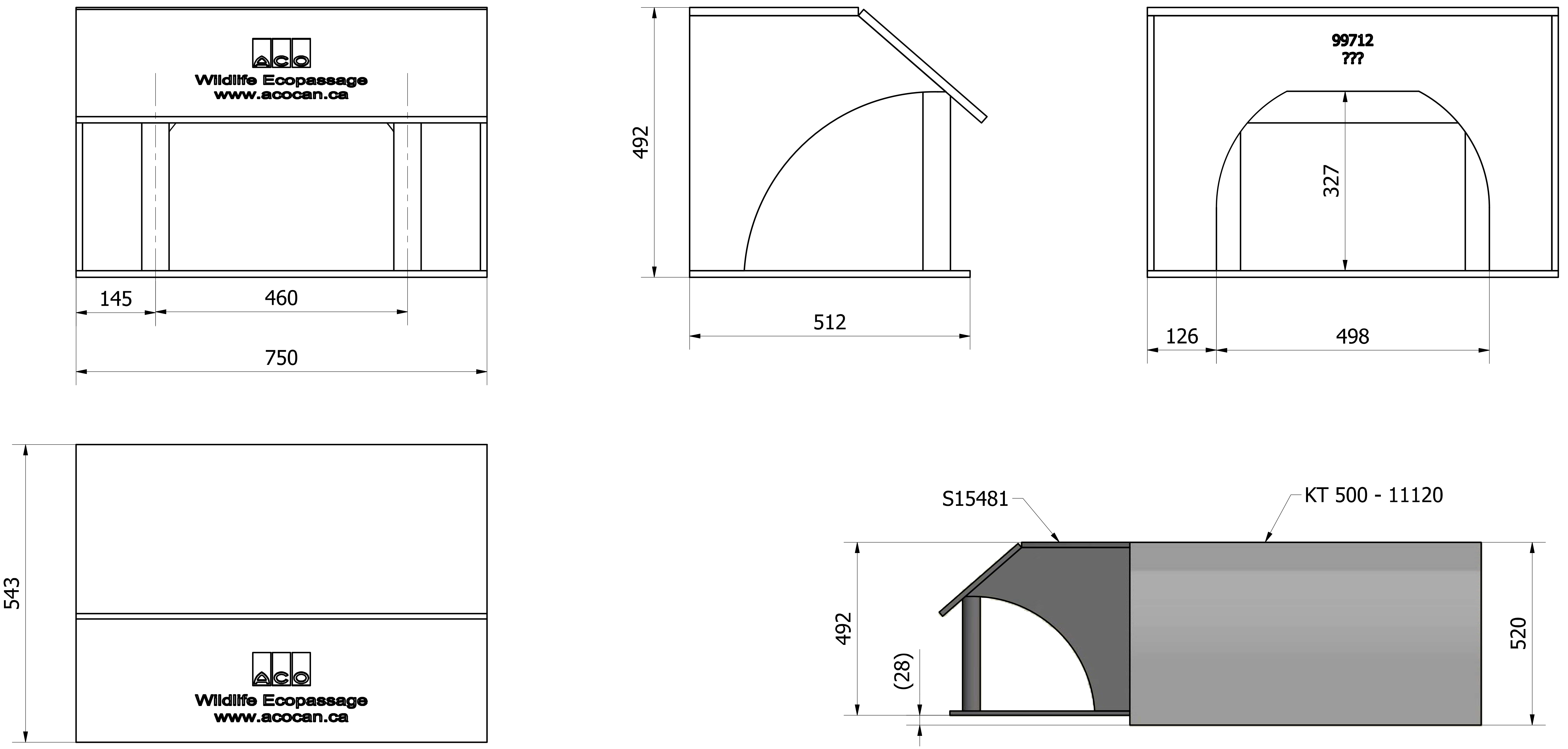
Art.-Nr. 11120

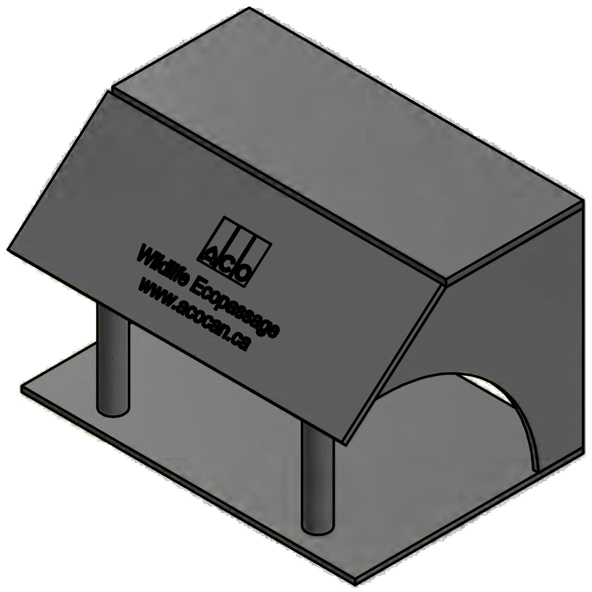
Zeichnung Nr.: G1-K32-0135-00-00

Index 000

Ersatz für:

Ersetzt durch:





Material

Mass
N/A

Tolerance
TKV_06

Tolerance for welding

ACO Industries Tábor s.r.o.
Průmyslová 1158
391 02 Sezimovo Ústí
Tel.: 381474600
Fax: 381632550
www.aco-industries.cz

	Date	Name
Created by	9.5.2019	jdivis
Reviewed by		
Update		

Scale

Projection: ISO-E

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KT 500 Wildlife

Entrance tunnel

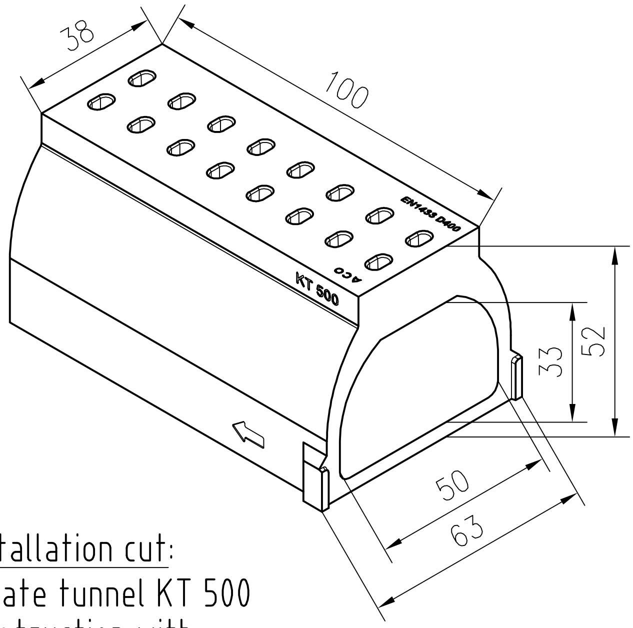
S15481

Drawing NO.
N321-2180-00-00

Index

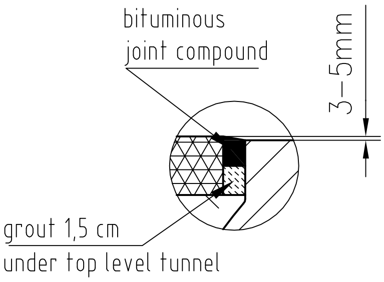
List:1 /1

A3



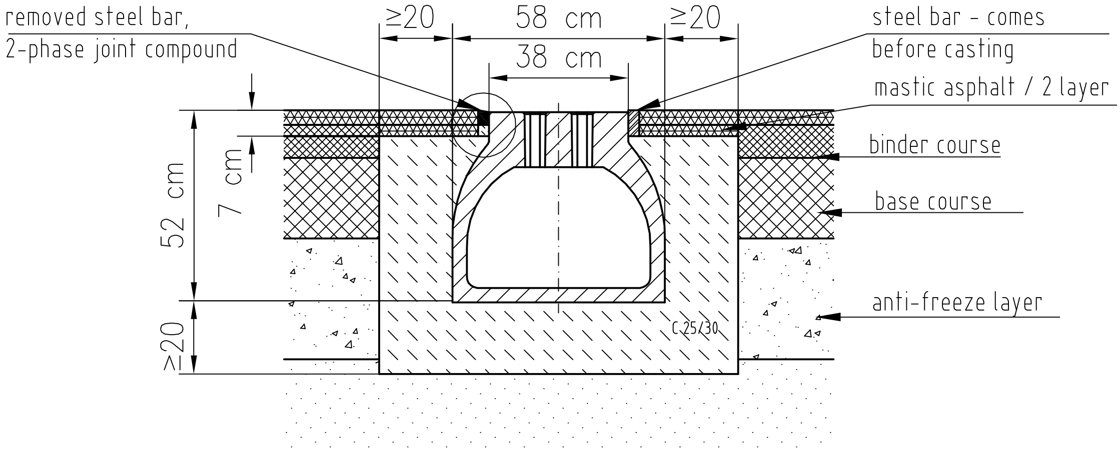
perspective:

climate tunnel KT 500
Art.-Nr. 11120



installation cut:

climate tunnel KT 500
construction with
climate openings
road area D 400



Index	Datum	Benennung	Name

Werkstoff:

Gewicht:

zul. Abweich.:

Oberfläche

ACO Wildlife

ACO Funki GmbH
Postfach 320, 24755 Rendsburg
Telefon: 04331 354-900
Telefax: 04331 354-910
www.aco-funki.com

	Datum	Name
Gezeichnet:	07.03.2011	wreimers
Geprüft		
Update:	11.02.2011	

Massstab: 1:20

Masseinheit: cm

Projektion: ISO-E

Diese Zeichnung darf weder kopiert noch dritten Personen, insbesondere zum Zweck anderweitiger Benutzung mitgeteilt werden und bleibt unser Eigentum.
Schutzvermerk nach DIN 34 beachten

climate stilt tunnel KT 500
1m long with openings

Art.-Nr. 11120 / flush mounted D400

Zeichnung Nr.: G1-E32-0135-00-02-W

Index: 000

Ersatz für:

Ersetzt durch:

Product description

ACO Climate Tunnel (Slotted) KT 500 (11120 & 11121)

For use in crossings installed flush with the surface

The ACO KT 500 Climate Tunnel with slotted upper surface is installed within the road structure, flush with the road surface. The advantages of this system are particularly apparent in difficult terrain conditions, such as where there are ditches on one or both sides of the road or if there are high groundwater levels. The benefits for amphibians and small animals are easily explained: installation flush with the road surface permits minimum crossing distances, uncomplicated entrance areas at road verge level, optimum climatic conditions due to the ingress of water and air and, at the same time, optimum adaptation of tunnel temperature to ambient conditions.

Technical data

System components and dimensions

Installed length = 1000 (11120) and 500mm (11121)

Installed width = 580 mm

Standard installed depth = 520mm

Weights

The standard 1000mm component weighs approx. 260 kg and can be transported and positioned using light construction equipment.

Material

Polymer concrete, characterised by

- high compressive strength and flexural strength
- high chemical resistance
- water penetration depth = 0 mm
- no reinforcement

Stability of shape

The components are inherently stable in shape. Minimal coefficients of expansion permit precise installation without expansion joints.

Load-bearing capacity

The units are certified to
BS EN 1433 Load Class D 400.

The properties of polymer concrete guarantee a long service life.

The practical advantages

Ground water

Minimal installation depth ensures that the efficiency of ACO KT 500 Climate Tunnels is not affected by high levels of ground water. Extreme conditions, such as a temporarily flooded tunnel or water flowing through the tunnel from time to time, will not damage the superior polymer concrete material of the tunnel components.

Ditch locations

The ACO Climate Tunnel has a minimal installed depth of just 520mm so it can be installed even where there are ditches, without extensive construction works at the entrances.

Minimum crossing distances

In comparison with all other forms of tunnel crossing system, the ACO Climate Tunnel achieves the shortest possible crossing distance. The tunnel surface is aligned with the surface of the roadway or verges as appropriate to the gradients of the road. The floor of the tunnel exit is 480mm below the upper edge of the verge/roadway. Installation of the KT 500 system can be shown to reduce crossing distances in comparison to other forms of tunnel.

Example 1: Tunnel diameter Ø 1.00m, 1.00m cover, gradient 1:1.5 = 4.50m reduction in distance using the KT 500 system.

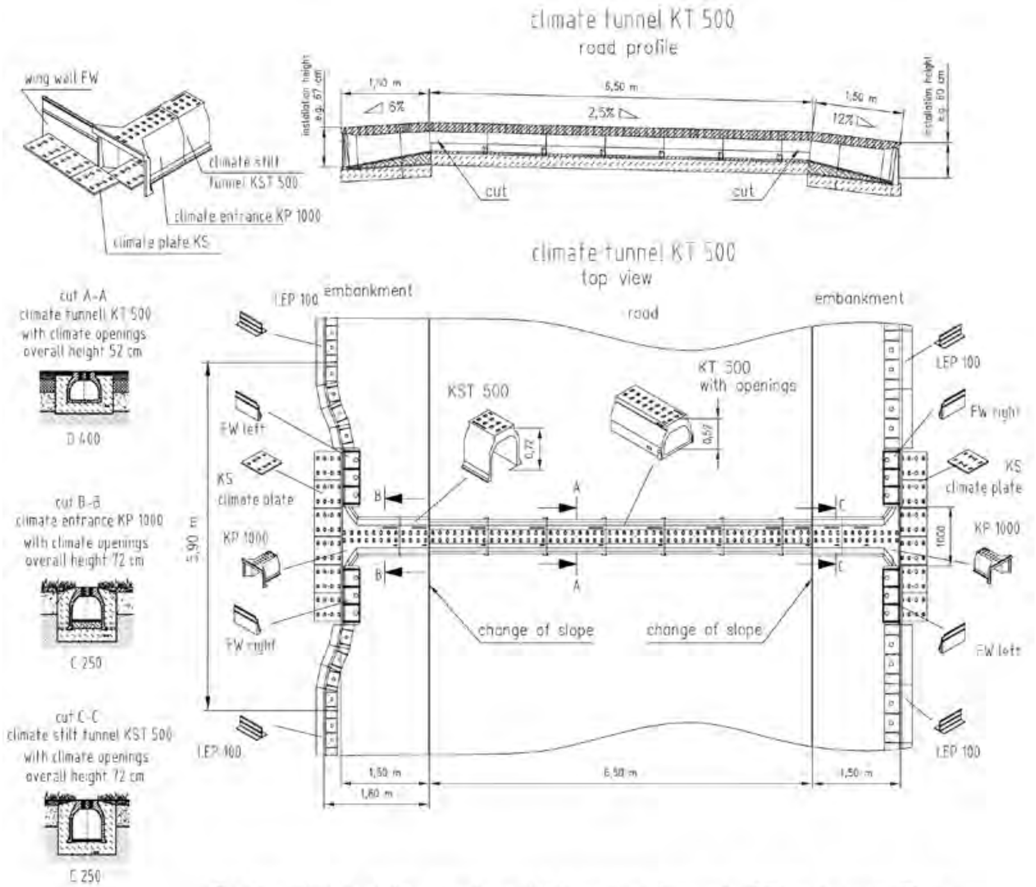
Example 2: Tunnel diameter Ø 1.50m at foot of gradient, 5m embankment height, gradient 1:1.5 = 13.50m reduction in crossing distance using the KT 500 system.

Protection of amphibians

Smooth, non-absorbent surfaces with minimal thermal conductivity form an ideal contact area for amphibians. ACO KT 500 Climate Tunnels are manufactured without using metal reinforcement, eliminating the possibility of disorientation to animals arising from distortion of magnetic fields. Optimally designed slotted openings at surface level permit the ingress of rainwater, thus not only serving the moisture needs particularly of younger amphibians, but also creating a thermal effect, helping the crossing temperature to approximate closely to ambient temperatures. The airflow in crossings often presents problems in closed systems due to “central dryness” inside the tunnel. The slots in the ACO Climate Tunnel form numerous air-inlet openings so that airflow is minimised and vital moisture is retained. Surveys have shown that this system is effective in use.

Installation

ACO Climate Tunnel (Slotted) KT 500 (11120 & 11121)



The inner height of the climate portal is variabel from min. 50 cm to max. 70 cm.

The slotted ACO Climate Tunnel is installed flush with the carriageway, cycle path or verges and adjusted to suit any relevant gradients The system can be installed in existing roadways by closing one lane at a time. The installation trench has a maximum width of 1000mm and depth of 700mm. The KT 500 system is bedded in concrete in accordance with good practice and the adjacent road surfaces are then repaired.

For detailed information please refer to the installation recommendations for the slotted ACO Climate Tunnel below.

Maintenance

The ACO Climate Tunnel is made from polymer concrete, a homogenous material resistant to various chemicals and salts. The product is manufactured without reinforcement. Even cut surfaces retain all their original material properties. Cover gratings are not necessary. When properly installed, maintenance is limited to flushing the contact surfaces at intervals of several years. In heavily forested areas such flushing is found to be necessary at 3 to 5 year intervals; under favourable conditions the amphibian contact surfaces are flushed naturally by the effects of rainwater. Regular checks should be made to ensure that the system continues to function efficiently. At minimum this should include a visual inspection prior to spring migration periods. A maintenance plan should be developed to keep the system free of accumulations of vegetation and leaves.

Recommendations/notes on installation

ACO Climate Tunnel (Slotted) KT 500 (11120 & 11121)

Installation: flush with surface

General notes

These are general guidelines on the installation of ACO KT 500 Climate Tunnels in carriageway surfaces.

Specific details of an installation should always be determined by the designers, taking into account all local conditions.

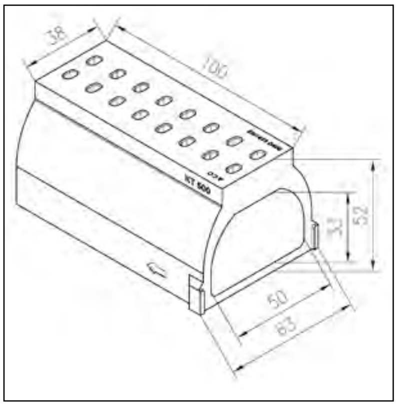
The ACO KT 500 Climate Tunnel should fulfil two purposes:

a) amphibians and small animals should be able to cross the road without danger,

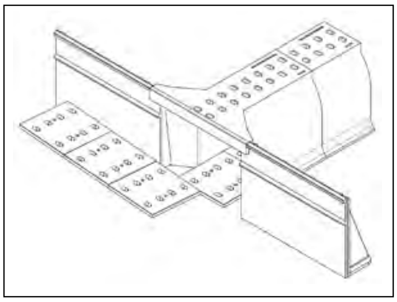
b) static and dynamic loads from traffic must be accommodated.

When installing ACO Climate Tunnels the latest versions of the following technical standards should be observed insofar as they apply to the specific installation:

- compliance with the applicable load-bearing class in accordance with BS EN 1433 "Drainage channels for vehicular and pedestrian areas",
- compliance with the requirements of the Highways Agency "Specification for Highway Works" Section 517 – Linear Drainage Channel Systems.



KT 500 climate tunnel



KP 1000-700 climate tunnel entrance with entrance wings and climate plates

Recommendations for laying out/installation

ACO Climate Tunnel (Slotted) KT 500 (11120 & 11121)

Installation: flush with surface

Tips on laying tunnels

ACO Climate Tunnels are available with or without ventilation slots. This description of installation flush with the surface is for tunnels with ventilation slots. The upper surface of the tunnel sits flush with the upper surface of the carriageway. Bevelled cutting of tunnel elements (by the customer or on site) is required to suit changes in gradient within the length of the tunnel.

Climate tunnels are laid so that they extend outside the road surface into the verge areas. ACO KP 1000 Tunnel Elements are installed flush with the tunnel and at the same level at both ends. These are installed in the course of concreting work.

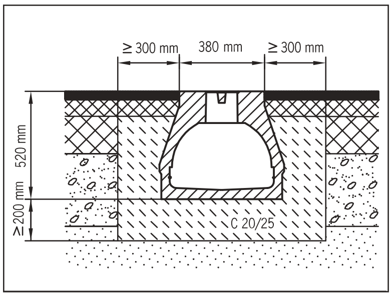
The KT 500 and KP 1000 combined length should extend through the width of the road safety verges (normally 1.50m from the edge of the roadway).

The following should also be taken into account:

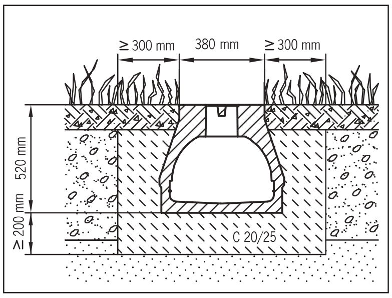
- siting of the guide wall.
- the use of closed elements where specially required. Please refer to the details of our Blind Climate Tunnel or to our Design Services Department for further details.

Installation:

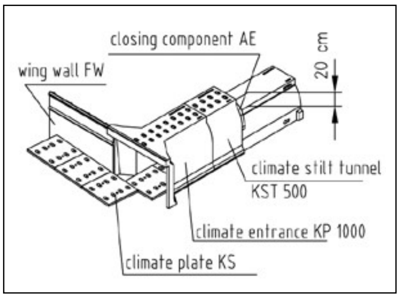
1) When carriageway asphalting is completed, cut the road surface out to a width of 1000mm or to suit the width of the digger bucket or other special requirements.
2) For installation flush with the road surface, excavate the trench for the foundation to a depth of approx. 700mm.
3) Lay a C 20/25 concrete footing of approx. 200mm thickness and compact onto a load-bearing foundation.
4) Position the tunnel and entrance elements on this concrete footing to the correct line and level.
5) Lay the individual elements so that they butt tight up against each other.
6) Fill the voids on each side of the tunnel with C 20/25 concrete and compact evenly in layers on both sides. The final top level of the concrete will depend on such factors as the thickness of the asphalt binding and top courses. The top of the concrete should be approx. 100mm below the upper surface of the tunnel.
7) Next, repair the roadway surface either side of the tunnel, preferably by pouring asphalt. If rolled asphalt is used, do not roll over the line of the channel. Take care to ensure that the space is not overfilled or underfilled. The KT 500 system can also be installed before the top course is laid. Care should be taken to ensure an even height at the join between the surface of the tunnel and the top course and that there are also expansion joints at the edge of the concrete surround.
8) Lay a gravel bed in the verge areas before and after the tunnel.
9) Clean any residual concrete and/or asphalt from the floor of the climate tunnel.



Installation detail – roadway



Installation detail – verge

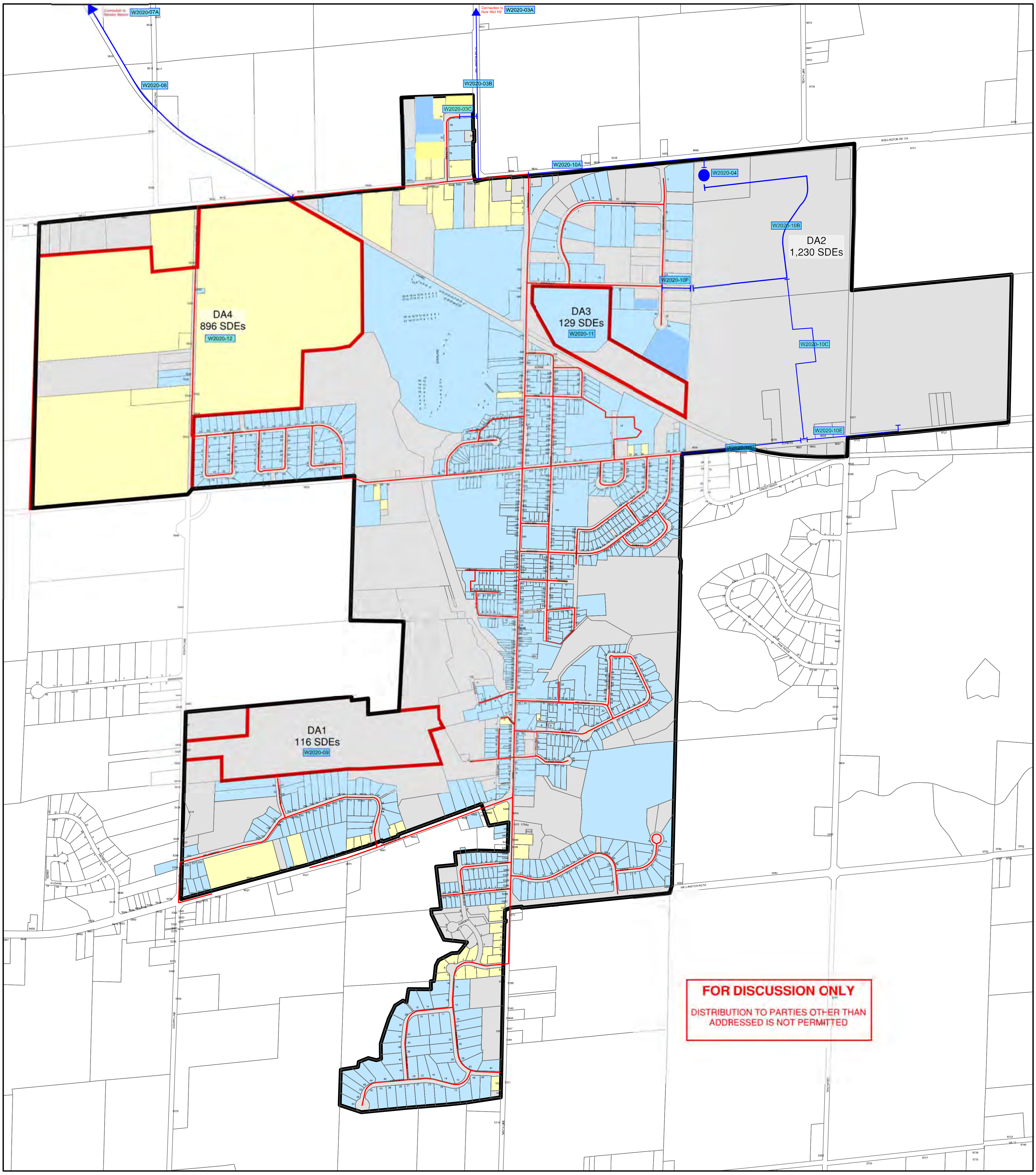


ACO KT 500/KP1000-700 P (typical)

APPENDIX M

TOWN OF ERIN WATER DEVELOPMENT CHARGE PROJECT MAP

Village of Erin



FOR DISCUSSION ONLY

DISTRIBUTION TO PARTIES OTHER THAN ADDRESSED IS NOT PERMITTED

0 250 500 1,000 1,500 2,000 Meters

Legend

- ― Erin_Water_Main
- ▨ 56 Buildings within Urban Boundary not serviced by municipal water
- ▨ On Municipal Water
- ▨ Urban Boundary

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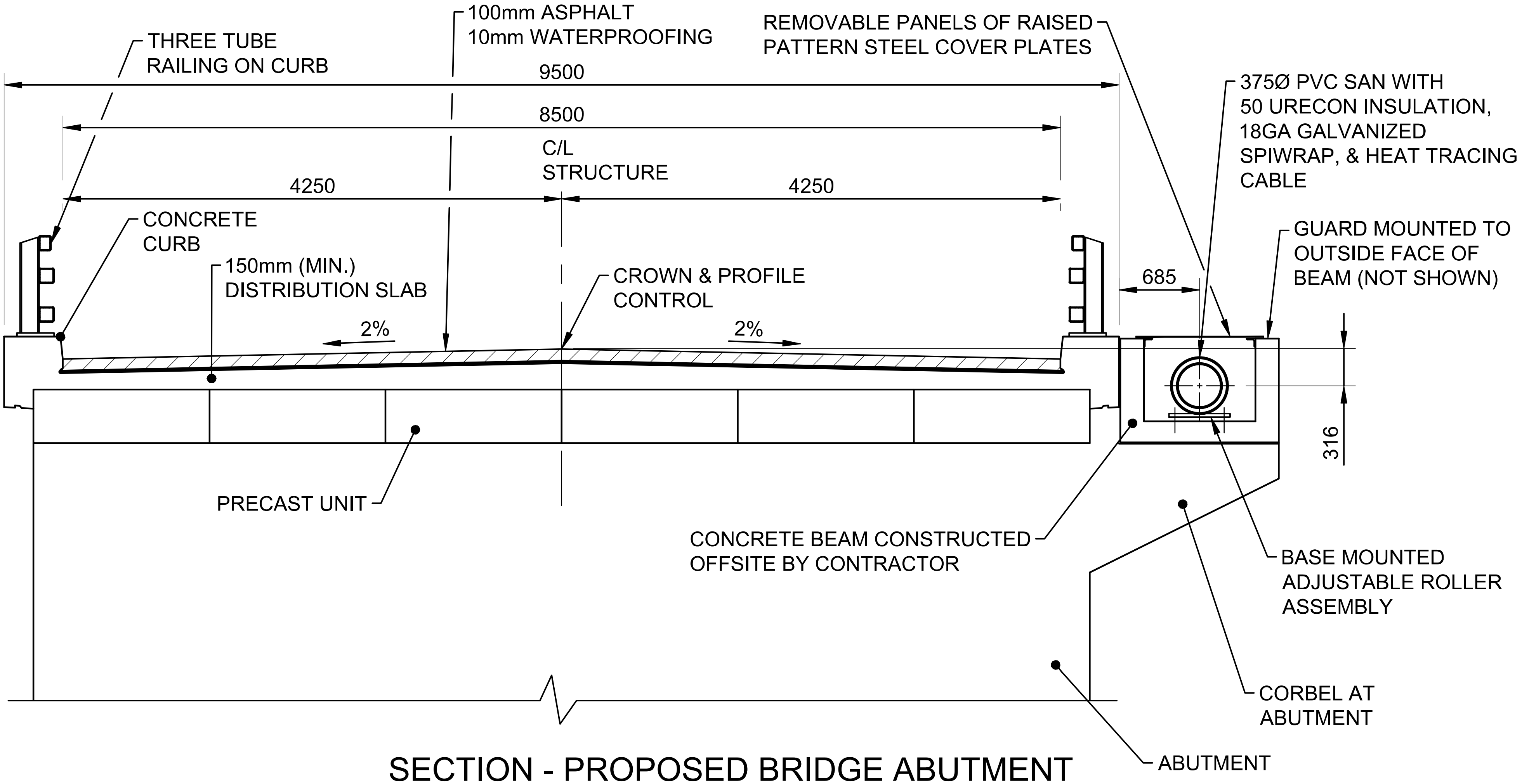
May not be reproduced without permission.
Sources:
County of Wellington Planning and Development Department 2011.

APPENDIX N

PROPOSED BRIDGE 9 SECTION, R.J. BURNSIDE



SECTION - PROPOSED BRIDGE ABUTMENT

1:50

BURNSIDE

Figure Title

REPLACEMENT OF BRIDGE 9 (8TH LINE)

PROPOSED BRIDGE SECTION

Client

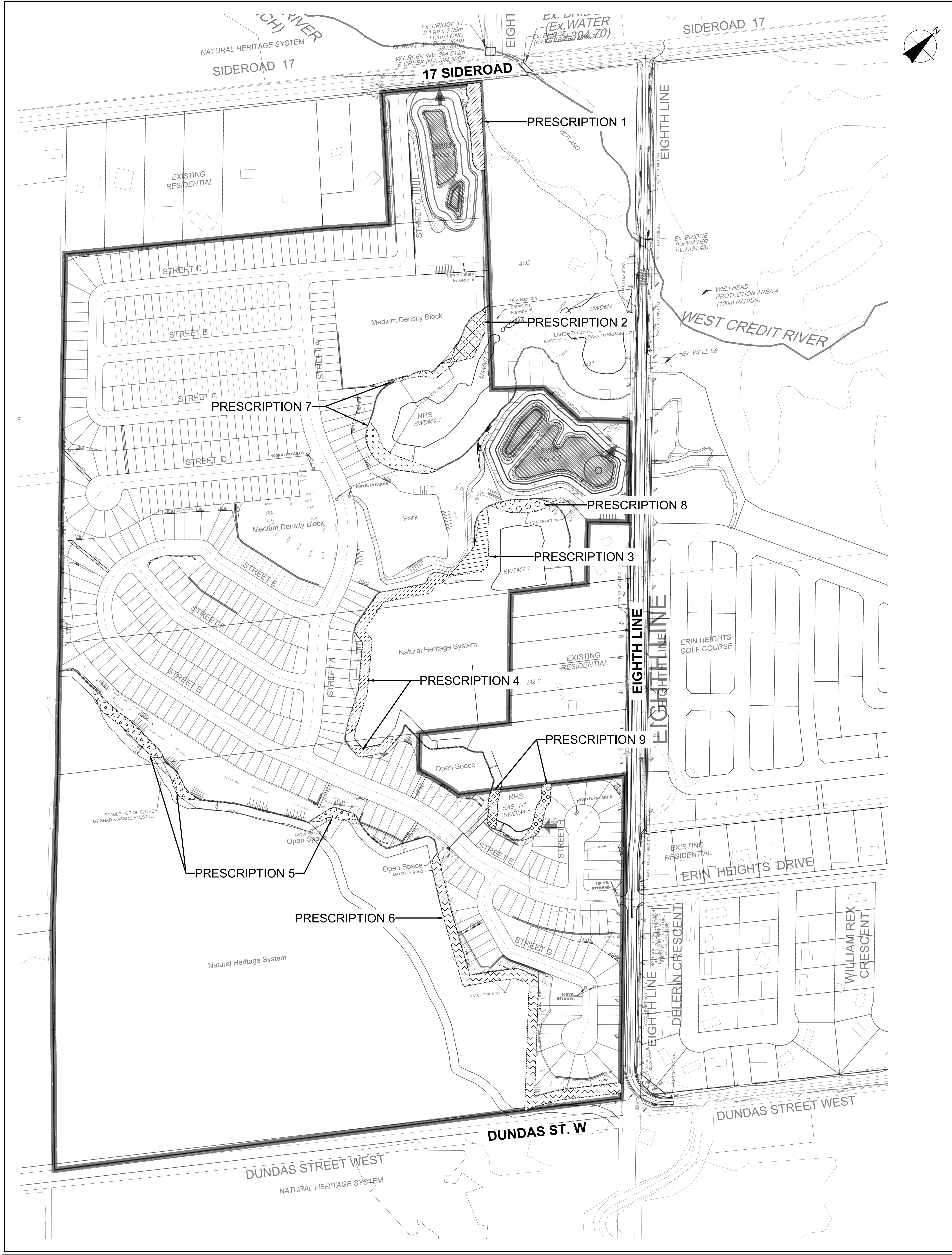
TOWN OF ERIN

Drawn	Checked	Date	Figure No.
NP	MB	22/11/08	**FIG.1**
Scale		Project No.	
AS NOTED		300053936	

File: \\collingwood\Shared Work Areas\053936 - Erin 8th Line - Bridge 9 Replacement\02_ReferenceDwg\053936 - PRBASE.dwg Date Plotted: June 29, 2023 - 11:12 AM

APPENDIX O

ENHANCED BUFFER PLAN & PROPOSED BUFFER GRADING, R.J. BURNSIDE & DSEL, JULY 2024



PRESCRIPTION 1: MIXED FOREST EDGE PLANTING LIST

Botanical Name	Common Name	HT (cm)	Root	Spacing	Total Stem Per Hectare
Deciduous Trees					1237
Acer saccharum	Sugar Maple	40-60cm	2 GAL.	3m O.C.	
Betula papyrifera	Paper Birch	40-60cm	2 GAL.	3m O.C.	
Coniferous Trees					
Thuja occidentalis	Eastern White Cedar	40-60cm	2 GAL.	3m O.C.	
Shrubs					1705
Cornus alternifolia	Pagoda Dogwood		2 GAL.	1m O.C.	
Crataegus punctata	Dotted Hawthorn		2 GAL.	1m O.C.	
Sambucus pubens	Scarlet Elderberry		2 GAL.	1m O.C.	

PRESCRIPTION 2: MEADOW THICKET PLANTING LIST

Botanical Name	Common Name	HT (cm)	Root	Spacing	Total Stem Per Hectare
Deciduous Trees					1273
Populus balsamifera	Balsam Poplar	40-60cm	2 GAL.	3m O.C.	
Populus tremuloides	Trembling Aspen	40-60cm	2 GAL.	3m O.C.	
Salix amygdaloides	Peachleaf Willow	40-60cm	2 GAL.	3m O.C.	
Coniferous Trees					
Thuja occidentalis	Eastern White Cedar	40-60cm	2 GAL.	3m O.C.	
Shrubs					1382
Aronia melanocarpa	Black Chokeberry		2 GAL.	1m O.C.	
Cornus amomum	Silky Dogwood		2 GAL.	1m O.C.	
Sambucus canadensis	Common Elderberry		2 GAL.	1m O.C.	
Viburnum lentago	Nannyberry		2 GAL.	1m O.C.	
Groundcover					
St Williams - Water's Edge Seed Mix					

PRESCRIPTION 3: WET MEADOW PLANTING LIST

Botanical Name	Common Name	HT (cm)	Root	Spacing	Total Stem Per Hectare
Deciduous Trees					1276
Acer rubrum	Red Maple	40-60cm	2 GAL.	5m O.C.	
Betula alleghaniensis	Swamp Birch	40-60cm	2 GAL.	5m O.C.	
Populus tremuloides	Trembling Aspen	40-60cm	2 GAL.	5m O.C.	
Shrubs					1356
Cornus stolonifera	Red-Osier Dogwood		2 GAL.	1m O.C.	
Salix bebbiana	Bebb's Willow		2 GAL.	1m O.C.	
Sambucus canadensis	Common Elderberry		2 GAL.	1m O.C.	
Spiraea alba	White Meadowsweet		2 GAL.	1m O.C.	
Groundcover					
St Williams - Water's Edge Seed Mix					

PRESCRIPTION 4: DECIDUOUS FOREST EDGE PLANTING LIST

Botanical Name	Common Name	HT (cm)	Root	Spacing	Total Stem Per Hectare
Deciduous Trees					1236
Acer saccharum	Sugar Maple	40-60cm	2 GAL.	3m O.C.	
Populus tremuloides	Trembling Aspen	40-60cm	2 GAL.	3m O.C.	
Prunus serotina	Black Cherry	40-60cm	2 GAL.	3m O.C.	
Tilia americana	Basswood	40-60cm	2 GAL.	3m O.C.	
Shrubs					1713
Amelanchier arborea	Downy Serviceberry		2 GAL.	1m O.C.	
Cornus alternifolia	Pagoda Dogwood		2 GAL.	1m O.C.	
Prunus virginiana	Chokecherry		2 GAL.	1m O.C.	
Sambucus racemosa	Red Elderberry		2 GAL.	1m O.C.	
Groundcover					
St. Williams - Roadside & Forest Edge Seed Mix					

PRESCRIPTION 5: MIXED FOREST 2 PLANTING LIST

Botanical Name	Common Name	HT (cm)	Root	Spacing	Total Stem Per Hectare
Deciduous Trees					1231
Acer saccharum	Sugar Maple	40-60cm	2 GAL.	3m O.C.	
Prunus serotina	Black Cherry	40-60cm	2 GAL.	3m O.C.	
Ostrya virginiana	Ironwood	40-60cm	2 GAL.	3m O.C.	
Coniferous Trees					
Pinus strobus	Eastern White Pine	40-60cm	2 GAL.	3m O.C.	
Thuja occidentalis	Eastern White Cedar	40-60cm	2 GAL.	3m O.C.	
Shrubs					1052
Amelanchier laevis	Allegheny Serviceberry		2 GAL.	1m O.C.	
Diervilla lonicera	Bush Honeysuckle		2 GAL.	1m O.C.	
Prunus virginiana	Chokecherry		2 GAL.	1m O.C.	
Rubus odoratus	Purple Flowering Raspberry		2 GAL.	1m O.C.	
Groundcover					
St. Williams - Roadside & Forest Edge Seed Mix					

PRESCRIPTION 6: PLANTATION WOODLAND PLANTING LIST

Botanical Name	Common Name	HT (cm)	Root	Spacing	Total Stem Per Hectare
Deciduous Trees					1248
Acer saccharum	Sugar Maple	40-60cm	2 GAL.	3m O.C.	
Prunus serotina	Black Cherry	40-60cm	2 GAL.	3m O.C.	
Quercus rubra	Red Oak	40-60cm	2 GAL.	3m O.C.	
Coniferous Trees					
Pinus strobus	Eastern White Pine	40-60cm	2 GAL.	3m O.C.	
Shrubs					1603
Cornus alternifolia	Pagoda Dogwood		2 GAL.	1m O.C.	
Diervilla lonicera	Bush Honeysuckle		2 GAL.	1m O.C.	
Rosa blanda	Smooth Rose		2 GAL.	1m O.C.	
Sambucus racemosa	Red Elderberry		2 GAL.	1m O.C.	
Groundcover					
St. Williams - Roadside & Forest Edge Seed Mix					

PRESCRIPTION 7: MOIST SHRUBS ON GRADING PLANTING LIST

Botanical Name	Common Name	HT (cm)	Root	Spacing	Total Stem Per Hectare
Deciduous Trees					1256
Populus balsamifera	Balsam Poplar	40-60cm	2 GAL.	3m O.C.	
Populus tremuloides	Trembling Aspen	40-60cm	2 GAL.	3m O.C.	
Salix amygdaloides	Peachleaf Willow	40-60cm	2 GAL.	3m O.C.	
Coniferous Trees					
Thuja occidentalis	Eastern White Cedar	40-60cm	2 GAL.	3m O.C.	
Shrubs					1532
Cornus stolonifera	Red-Osier Dogwood		2 GAL.	1m O.C.	
Ribes americanum	Wild Black Currant		2 GAL.	1m O.C.	
Salix petiolaris	Meadow Willow		2 GAL.	1m O.C.	
Viburnum lentago	Nannyberry		2 GAL.	1m O.C.	
Groundcover					
St. Williams - Base Restoration Seed Mix					

PRESCRIPTION 8: MOIST MEADOW WITH SPARSE SHRUB PLANTING LIST

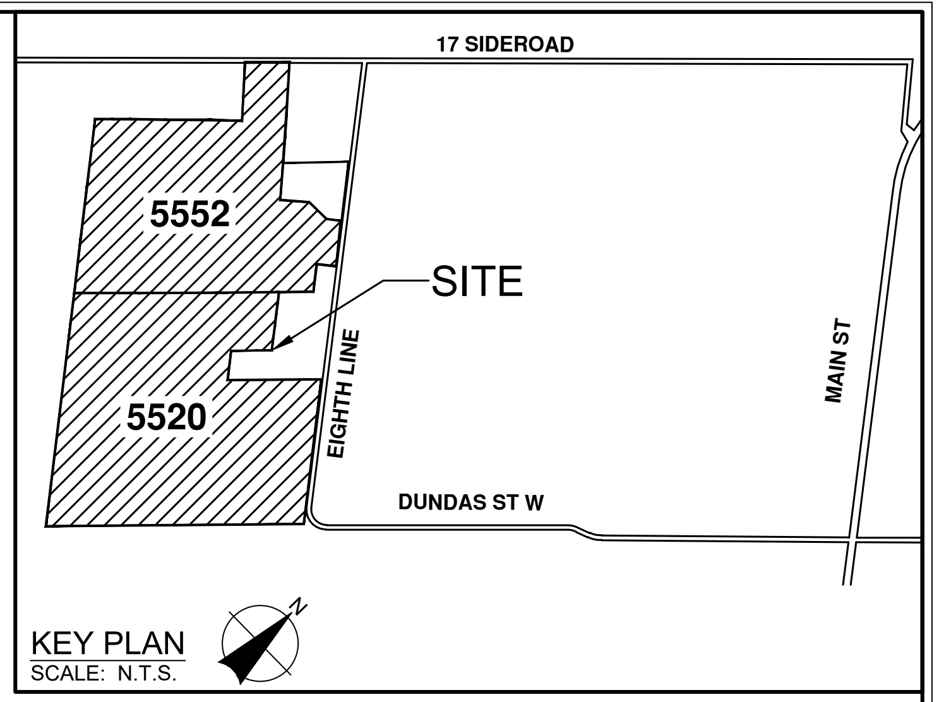
Botanical Name	Common Name	HT (cm)	Root	Spacing	Total Stem Per Hectare
Shrubs					509
Cornus stolonifera	Red-Osier Dogwood		2 GAL.	5m O.C.	
Salix bebbiana	Bebb's Willow		2 GAL.	5m O.C.	
Sambucus canadensis	Common Elderberry		2 GAL.	5m O.C.	
Viburnum lentago	Nannyberry		2 GAL.	5m O.C.	
Groundcover					
St. Williams - Water's Edge Seed Mix					

PRESCRIPTION 9: TREED SWAMP EDGE PLANTING LIST

Botanical Name	Common Name	HT (cm)	Root	Spacing	Total Stem Per Hectare
Deciduous Trees					1217
Acer saccharinum	Silver Maple	40-60cm	2 GAL.	3m O.C.	
Populus balsamifera	Balsam Poplar	40-60cm	2 GAL.	3m O.C.	
Populus tremuloides	Trembling Aspen	40-60cm	2 GAL.	3m O.C.	
Coniferous Trees					
Larix laricina	Tamarack	40-60cm	2 GAL.	3m O.C.	
Shrubs					1878
Aronia melanocarpa	Black Chokeberry		2 GAL.	1m O.C.	
Cornus stolonifera	Red-Osier Dogwood		2 GAL.	1m O.C.	
Rhus typhina	Staghorn Sumac		2 GAL.	1m O.C.	
Sambucus canadensis	Common Elderberry		2 GAL.	1m O.C.	
Groundcover					
St. Williams - Base Restoration Seed Mix					

BUCKTHORN REMOVAL:

MATURE, FRUIT-BEARING BUCKTHORN (3+ CM DBH) WITHIN 5 METERS OF THE PLANTING AREAS WILL BE REMOVED. THIS INCLUDES 5 METERS INTO THE DRIPLINE OF ADJACENT WOODLANDS. BUCKTHORN IS TO BE TREATED BY BEING CUT BACK AND APPROPRIATE CONTACT KILL HERBICIDE APPLIED TO THE STUMPS.



KEY PLAN
SCALE: N.T.S.

LANDSCAPE LEGEND

BUFFER PLANTING AREAS

- ▨ PRESCRIPTION 1: MIXED FOREST EDGE
- ▨ PRESCRIPTION 2: MEADOW THICKET
- ▨ PRESCRIPTION 3: WET MEADOW
- ▨ PRESCRIPTION 4: DECIDUOUS FOREST EDGE
- ▨ PRESCRIPTION 5: MIXED FOREST 2
- ▨ PRESCRIPTION 6: PLANTATION WOODLAND
- ▨ PRESCRIPTION 7: MOIST SHRUBS ON GRADING
- ▨ PRESCRIPTION 8: MOIST MEADOW WITH SPARSE SHRUB
- ▨ PRESCRIPTION 9: TREED SWAMP EDGE

Notes

1. This drawing is the exclusive property of R. J. Burnside & Associates Limited. The reproduction of any part without prior written consent of this office is strictly prohibited.
2. The contractor shall verify all dimensions, levels, and datums on site and report any discrepancies or omissions to this office prior to construction.
3. This drawing is to be read and understood in conjunction with all other plans and documents applicable to this project.

NOT FOR CONSTRUCTION

No.	Issue / Revision	Date	Auth.

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Mattamy (Erin) Limited and 2779181 Ontario Inc
6696 Financial Drive
Mississauga, ON
L5N 7J6

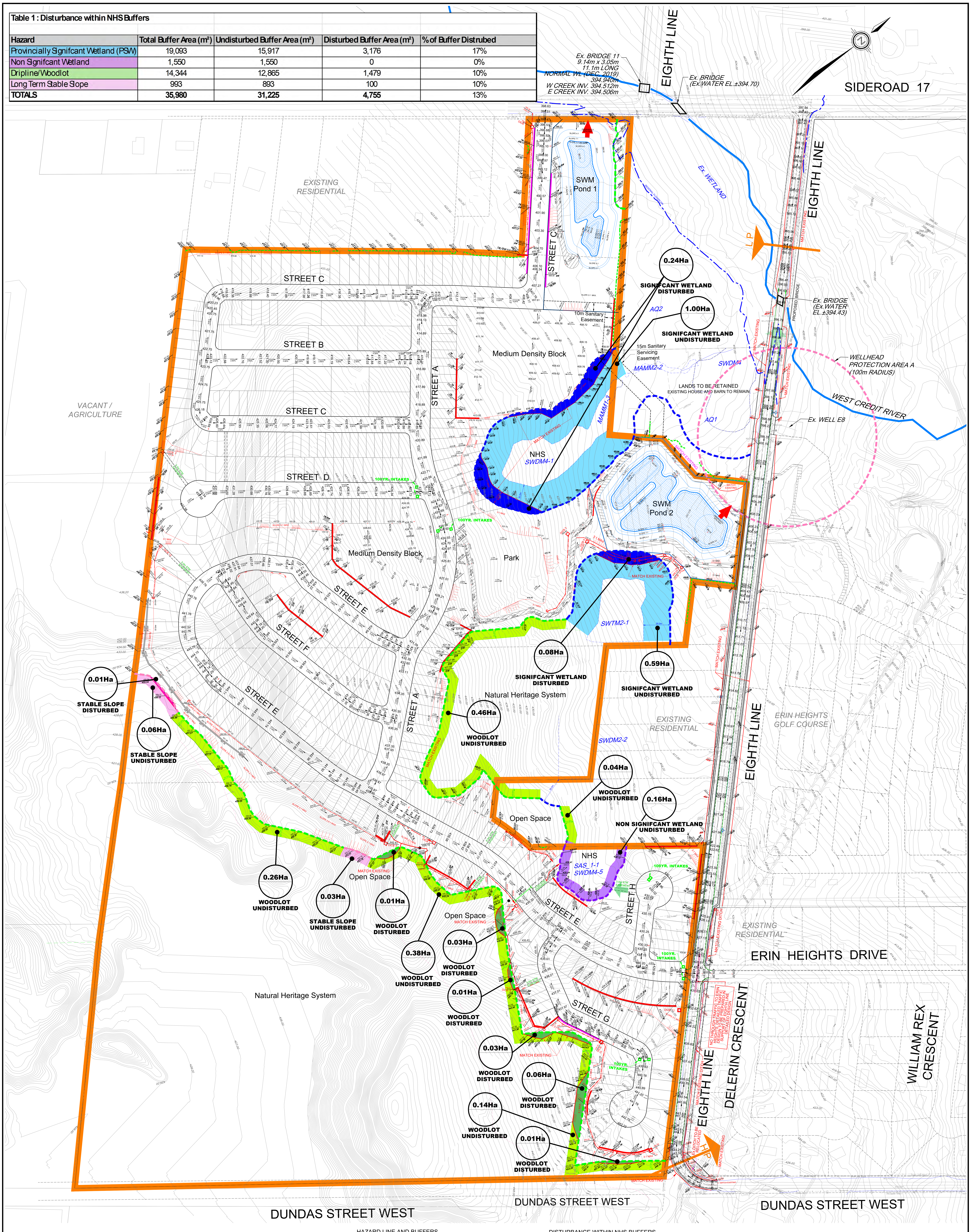
Drawing Title
ERIN
5520 EIGHTH LINE & 5552 EIGHTH LINE
Langen Buffer Enhancement Conceptual Plan

Drawn	Checked	Designed	Checked	Date	Drawing No.
HC	LA	LA	HC	24/06/19	LC-1
Project No. 300052075		Contract No. CONTRACT NO.		Revision No. 0	
Scale 1:2,500	0 50 100 150m				

File: \\elmo\shared work areas\052075 Langen EIS\02_Production\052075_LAN_Buffer Plan_Conceptual.dwg Date Plotted: July 17, 2024 - 9:43 AM

Table 1 : Disturbance within NHS Buffers

Hazard	Total Buffer Area (m²)	Undisturbed Buffer Area (m²)	Disturbed Buffer Area (m²)	% of Buffer Distrubed
Provincially Signifcant Wetland (PSW)	19,093	15,917	3,176	17%
Non Signifcant Wetland	1,550	1,550	0	0%
Dripline/Woodlot	14,344	12,865	1,479	10%
Long Term Stable Slope	993	893	100	10%
TOTALS	**35,980**	**31,225**	**4,755**	**13%**



LEGEND:

- SITE BOUNDARY
- DEVELOPMENT LIMIT
- WELLHEAD PROTECTION AREA A
- STORM OVERLAND FLOW ARROW
- EMERGENCY STORM OVERLAND FLOW ARROW

188.89 PROPOSED CENTERLINE ELEVATION
187.74 / 187.74 PROPOSED ELEVATION EXISTING ELEVATION
244.50 EXISTING CONTOUR ELEVATION
PRIVATE RETAINING WALL
PUBLIC RETAINING WALL
TREE PROTECTION FENCE

HAZARD LINE AND BUFFERS

- 10m NHS HAZARD LINE AND BUFFERS
- DRIPLINE
- 10m WETLAND HAZARD LINE AND BUFFERS
- WETLAND HAZARD
- 30m SWM HAZARD LINE AND BUFFERS
- SWM HAZARD
- 10m LONG TERM STABLE SLOPE LINE AND BUFFERS
- LONG TERM STABLE SLOPE LINE

DISTURBANCE WITHIN NHS BUFFERS

UNDISTURBED BUFFER AREA DISTURBED BUFFER AREA	WOODLOT
UNDISTURBED BUFFER AREA DISTURBED BUFFER AREA	NON SIGNIFICANT WETLAND
UNDISTURBED BUFFER AREA DISTURBED BUFFER AREA	SIGNIFICANT WETLAND (PSW)
UNDISTURBED LTSS AREA DISTURBED LTSS AREA	LONG STABLE STABLE SLOPE (LTSS)

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5520 EIGHTH LINE & 5552 EIGHTH LINE
TOWN OF ERIN

BUFFER AND GRADING LIMITS DISTURBANCE WITHIN NHS BUFFERS

SCALE:	1:1250	PROJECT No.:	21-1242
DATE:	JULY 2024	DRAWING:	10

APPENDIX P

RETAINING WALL FEASIBILITY MEMO, JEWELL ENGINEERING, JULY 2024

JEWELL
ENGINEERING

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July 12, 2024

David Schaeffer Engineering Ltd.
600 Alden Road, Suite 606
Markham, ON L3R 0E7

Attention: Mack McLean, P.Eng.

Re: Town of Erin – 5520 Eighth Line & 5552 Eighth Line Development
Retaining Walls
Metrolinx Complications

Dear Mack:

As per DSEL's request, this memo addresses the proposed retaining walls within the Eighth Line Development in the Town of Erin.

Overview of Retaining Walls

Upon reviewing DSEL's conceptual grading plan dated October 2023, we identified 19 retaining walls to be constructed within the development limits. To facilitate construction and minimize costs, Jewell Engineering (JE) recommends using armour stone where feasible. For retaining walls constrained by property limits, a precast block system like Siena Stone by RisiStone is suggested. The retaining walls are categorized by height as follows:

1. Exposed wall face of 0.5m to 2m
2. Exposed wall face of 2m to 3m
3. Exposed wall face of 3m to 4m
4. Exposed wall face of 4m to 5m

Detailed Design and Grouping

During the detailed design phase, these categories will be further divided into sub-groups, considering the grading behind and in front of each wall (e.g., flat, 3:1 slope, proximity to a road). Appendix ‘A’ provides preliminary design concepts for walls in categories 2 and 4, representing the variety of sub-groups anticipated. For walls in categories 3 and 4, a Geotechnical Engineer should perform a global stability analysis to review the design and offer recommendations if needed.

Construction Process

The construction of an armour stone wall includes the following steps:

1. **Excavation**: The contractor excavates a trench under the supervision of a Geotechnical Engineer, who verifies the bearing capacity.
2. **Base Preparation**: The granular base is placed and compacted to specified requirements, with verification by the Geotechnical Engineer.
3. **Stone Placement**: Armour stones are placed, starting with larger stones at the bottom, reducing in size as the wall is built up. Each course is backfilled and compacted.
4. **Inspection**: The Structural Engineer or representative, along with the Geotechnical Engineer, inspects the construction to ensure compliance with approved design drawings.

Maintenance and Future Considerations

Post-construction, the retaining walls require maintenance, with inspections recommended every two years to assess their condition. JE advises that homeowners planning to add features like swimming pools, raised patios, or privacy fences within their property limits consult a structural engineer to ensure these additions do not compromise the retaining walls.

Yours truly,

Jewell Engineering Inc.

Alex Bartusevicius, CET
Manager

APPENDIX ‘A’

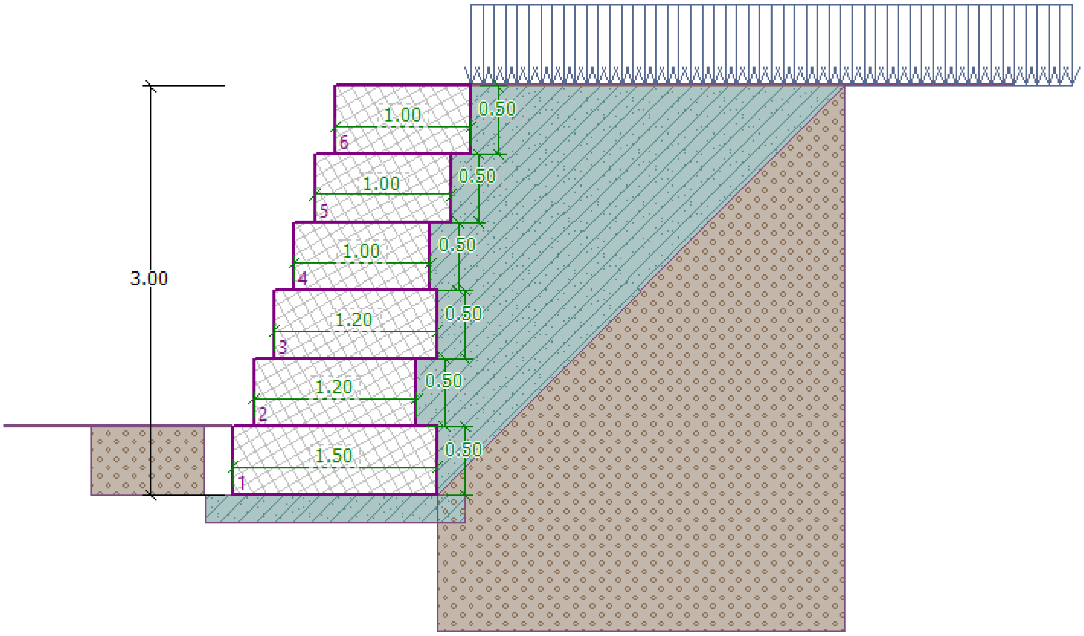

Figure 1: Sample of Category 2 Retaining Wall with a Road Behind

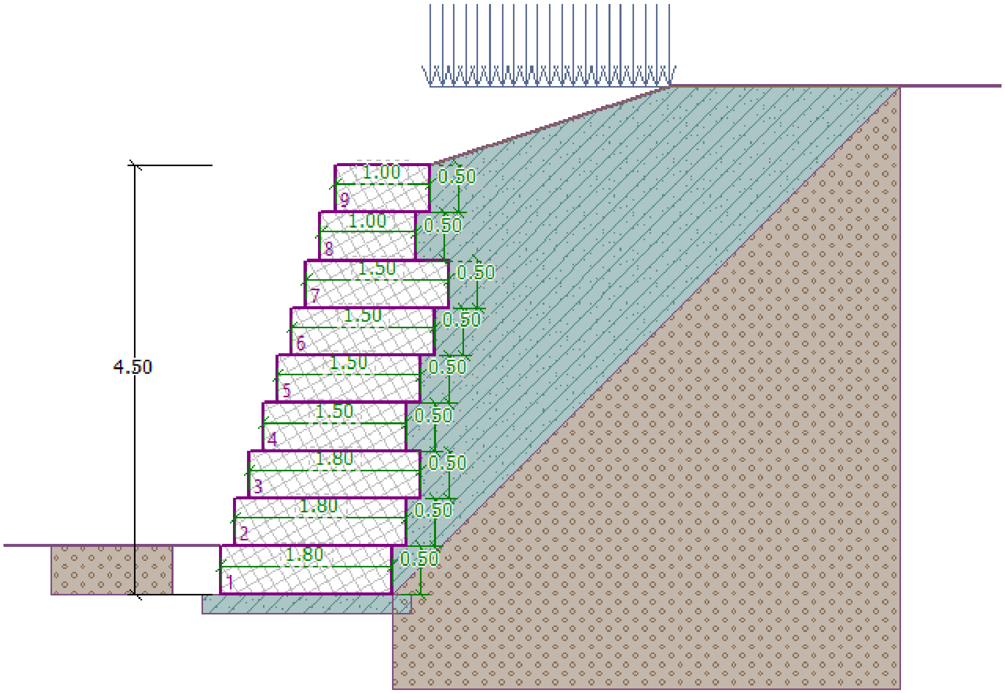

Figure 2: Sample of Catgeory 4 Retaining Wall with a 3:1 Slope Behind

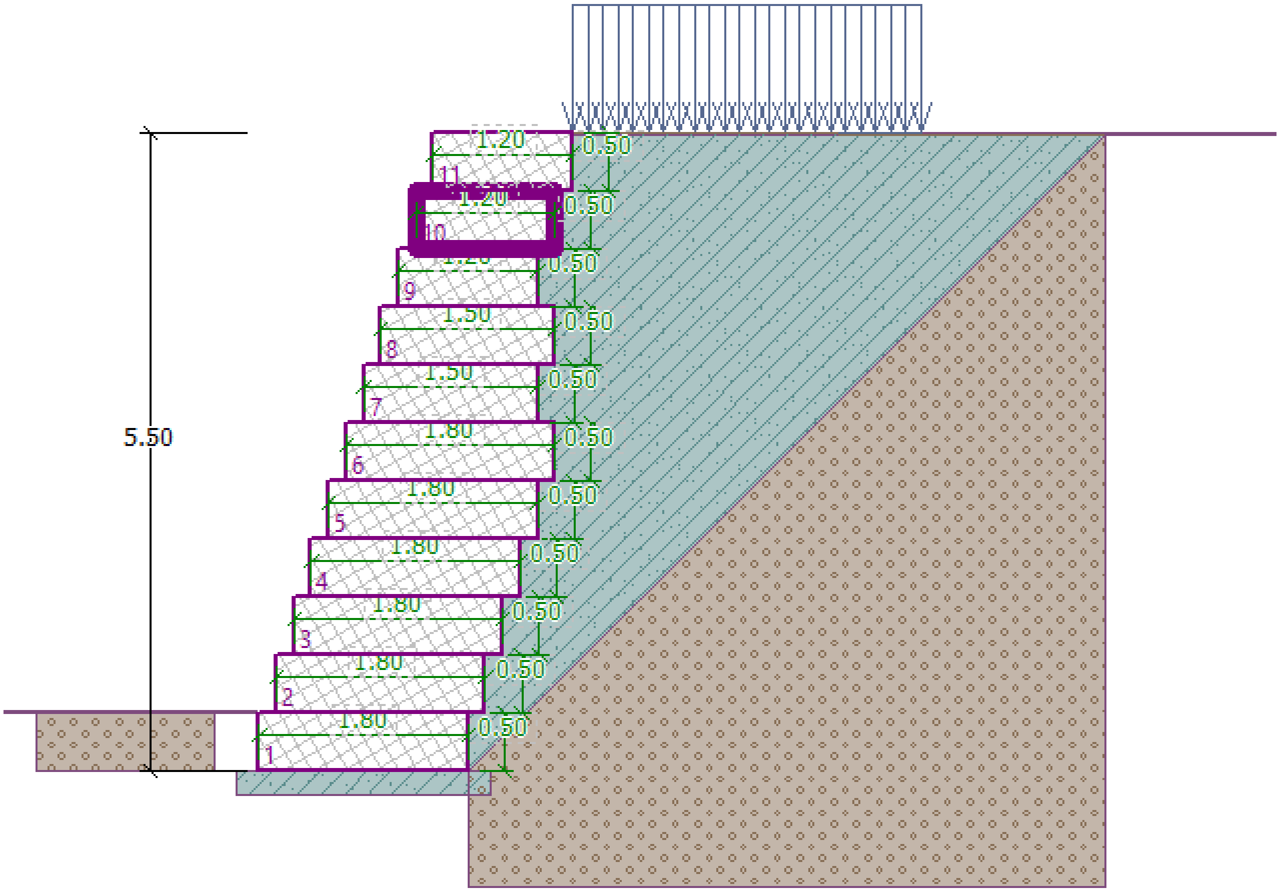

Figure 3: Sample of Category 4 Retaing Wall with 0.5% Reverse Slope Behind