VOLUME II

Proposed Terms of Reference

Environmental Assessment of the Proposed
Quarry Landfill Expansion, Stelco Lake Erie Works, Nanticoke

20136711

September 2023

Table of Contents

SUPPORTING DOCUMENT #1

Feasibility of Quarry Landfill Expansion

REVISED FINAL REPORT

FEASIBILITY OF QUARRY LANDFILL EXPANSION

LAKE ERIE WORKS SITE

Submitted to:

Stelco, Lake Erie Works

Mr. Mark DeMelo
2330 Regional Road #3, Nanticoke
Haldimand, Ontario
N0A 1L0

Submitted by:

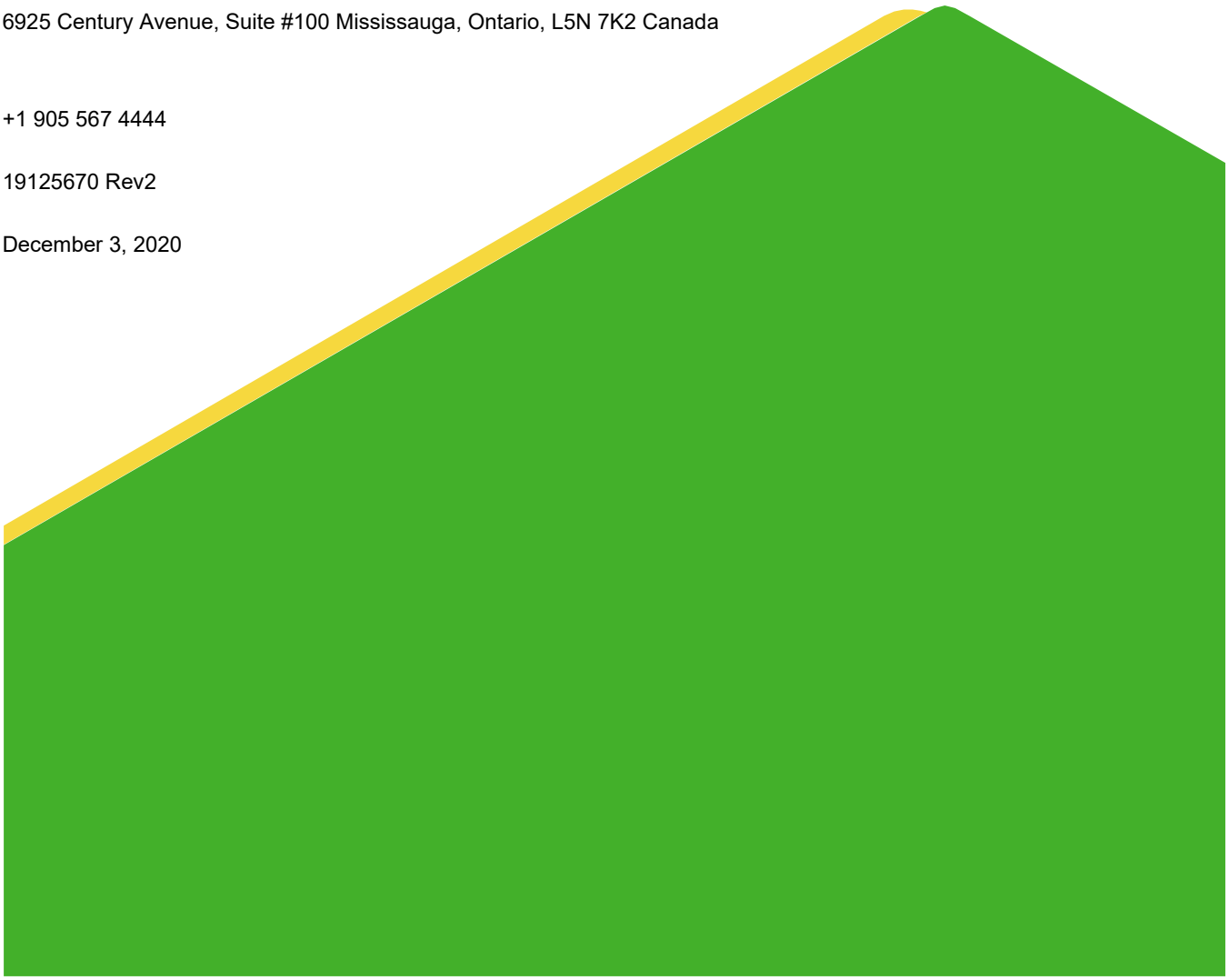
Golder Associates Ltd.

6925 Century Avenue, Suite #100 Mississauga, Ontario, L5N 7K2 Canada

+1 905 567 4444

19125670 Rev2

December 3, 2020



Distribution List

1 e-copy Stelco

1 e-copy Golder

Table of Contents

FIGURES

1.0 INTRODUCTION

Golder Associates Limited (Golder) was retained by Stelco to assess the feasibility of expanding the Quarry Landfill at the Lake Erie Works Facility in Nanticoke, Ontario. The expansion of the landfill is being considered by Stelco to accommodate steel making wastes which will include waste currently stored at the Hamilton Works Facility and new waste generated at the Lake Erie Works Facility after the existing Quarry Landfill reaches capacity. Currently, no timeline for the rate of transfer of wastes from Hamilton Works is defined. For the purpose of this assessment, the required volumetric capacity of the landfill expansion was set 870,000 m^3 as suggested by Stelco, although it is possible that the required capacity will be larger once quantities at the Hamilton Works Facility are defined.

Conceptual designs for two alternative lateral expansion alternatives were developed and their feasibility assessed with respect to: i) constructability, ii) environmental protection, and iii) regulatory approvals requirements. A recommendation is then provided on what is considered to be a preferred expansion concept from the above perspectives. It is noted that as part of the regulatory process to obtain approval for this additional landfill airspace, i.e., an Individual Environmental Assessment (EA), it will be necessary to compare these and/or other possible expansion alternatives using criteria that cover the broad spectrum of environment to identify the overall preferred expansion alternative, which would then be carried forward as the basis for an application to amend the current Certificate of Approval (CoA) (now referred to as an Environmental Compliance Approval, ECA), detailed design and construction.

2.0 BACKGROUND

The existing Quarry Landfill is situated in a 5.5 hectare (Ha), 34 m deep former limestone quarry at the west end of the Lake Erie Works Facility (Figure 1). The landfill boundary corresponds to the vertical rock wall of the former quarry. (CoA) No. A110119 for the Quarry Landfill was issued in 1984 for the disposal of 1,300,000 m^3 of *"Blast Furnace (BF) Slag, steel making slag and other non-hazardous solid wastes having a leachate quality better than or equal to leachate from Blast Furnace Slag and steel making slag".*

Landfilling commenced in 1984, with the waste type limited to BF slag only (i.e., no other steel making wastes were landfilled). The BF Slag is granular in nature and was initially dumped in ponded water throughout the former quarry, except at the south end that remained as an open pond area referred to as the Quarry Pond (Figure 1). Landfilling of BF Slag continued to the end of 2003. Over the following years to the end of 2011, the upper/unsaturated portion of the BF Slag (above the Quarry Pond water level) was excavated and processed for sale as aggregate. The submerged portion of the BF Slag was left in place. No additional wastes were placed in the landfill during this period.

In 2012, amended ECA No. A110119 was issued for a new engineered landfill cell of 545,000 m^3 capacity, founded on the remaining BF Slag fill within the northern portion of the Quarry Landfill. The design of the new cell was presented in a Design and Operations Plan (Golder, 2010). A key condition of the amended ECA was that the original approved waste fill capacity of 1,300,000 m^3 for the overall Quarry Landfill is not exceeded (i.e., the amended ECA was not for an expansion of the landfill). Construction of the new cell commenced in 2013 and was completed in 2014. Construction involved temporary dewatering of the Quarry Pond (to lower water levels in the existing BF Slag), excavation/ processing of additional BF Slag within the northern portion of the landfill (for sale as aggregate), regrading of the remaining BF Slag including placement of clayey soil fill to form the cell base grades, and installation of a base liner and leachate collection system.

Landfilling resumed following construction of the new cell, with the fill area limited to the new cell. However, unlike the historical operations that involved landfilling of only BF Slag, the wastes placed in the new cell consist of various steel making wastes from both the Lake Erie and Hamilton Works Facilities that have limited reuse potential. These wastes include Basic Oxygen Furnace (BOF) Slag, Off-gas Sludge and refractory materials.

Figure 2 shows the January 2019 topographic surface of the Quarry Landfill and adjacent area to the east. Figure 3 shows a north-south cross-section through the Quarry Pond and the new cell, with the current (January 2019) and approved final waste fill profiles. The current top of waste elevation in the new cell is approximately 189 metres above sea level (masl). The estimated remaining capacity in the new cell is approximately 166,000 m^3, which corresponds to a remaining life of approximately 4.5 years at the recent filling rate of 36,400 m^3 per year. Note that daily cover materials are not used as the waste is generally granular in nature and does not have a significant organic content.

Leachate collected from the sump of the new cell is monitored for chemical quality on a quarterly basis. The leachate has a very high pH in the range of 11 to 13, but fairly low levels of total dissolved solids (1,500 mg/L to 2,300 mg/L) and Dissolved Organic Carbon (50 mg/L to 100 mg/L). The primary dissolved constituents are chloride (150 mg/L to 300 mg/L), sodium (200 mg/L to 300 mg/L) and total ammonia-N (30 mg/L to 50 mg/L).

Stelco is considering expanding the Quarry Landfill to accommodate approximately 870,000 m^3 (1.8 million tonnes) of additional steel making wastes currently stored at the Hamilton Works Facility. The waste types are similar to those being placed in the new cell.

3.0 PHYSICAL SETTING

The Stelco Lake Erie Works site lies within the physiographic region known as the Haldimand Clay Plain. This physiographic region is characterized as having massive to laminated lacustrine clay and silty clay deposits overlying limestone bedrock, with some localized areas having a stoney silt till between the clay deposits and bedrock. The topographic relief is very low and generally slopes downwards to the south (towards Lake Erie) at approximately 2 to 4 m per kilometre. Additional topographic relief is provided by local stream valleys cut into the clay deposits.

The clay deposit in the area surrounding the Quarry Landfill is medium brown to grey-brown and stiff to hard in consistency. The thickness typically ranges from 5 m to 10 m, except in the area flanking the east side of the Quarry Pond where the overburden was stripped during the quarrying operation, and in the Centre Creek valley south of the landfill. A well-developed system of near vertical fractures exists in the clay deposits, extending 3 to 4 m below ground surface. Where present, the stoney silt till layer between the clay deposits and underlying bedrock is generally less than 1.5 m thick.

The upper limestone bedrock sequence at the Quarry Landfill consists of the middle Devonian Dundee Formation underlain by the Devonian Bois Blanc Formation. The Dundee Formation is a medium grey to light brown, thickly-bedded, fine to medium crystalline, cherty limestone of approximately 7.5 m thickness. It dips gently to the south-southwest towards Lake Erie. The Blanc Formation is similar to the Dundee Formation, but with more abundant chert nodules and shale partings. The Dundee Formation and Bois Blanc Formations are separated by a thin grey to black shale layer, as observed on the exposed vertical walls of the Quarry Pond.

Natural groundwater flow in the area of the Quarry Landfill occurs primarily along fractures within the clay overburden and underlying bedrock. The principal direction of natural groundwater flow is downward through the clay overburden into the upper bedrock, and then horizontal (southward) along bedrock fractures discharging to Centre Creek and Lake Erie.

4.0 ALTERNATIVE LANDFILL EXPANSION CONCEPTS

4.1 Potential Expansion Areas

This feasibility study examines two areas for a potential lateral expansion of the Quarry Landfill, as shown in Figures 1 and 2.

The first area (Expansion Area 1) has an approximately 5 Ha waste fill area and flanks the east boundary of the existing Quarry Landfill adjacent to the Quarry Pond. This area is bordered by the Centre Creek valley to the south, Townline Road to the east and the new landfill cell to the north. The northern portion of this area was stripped of overburden material as part of the former quarry operation and is exposed bedrock. The southern portion is a natural forested area.

The second area (Expansion Area 2) has an approximately 8 Ha waste fill area and is located east of Townline Road, across from the existing Quarry Landfill and north of “G” Road West. As such, this would be a new landfill area that is physically separate from the existing landfill. This is an unused open area with grass vegetation. The area dips gently to the south from an elevation of 193 masl at the north end to 185 masl at the south end. A shallow drainage ditch traverses this area from north to south and connects to Centre Creek south of the Quarry Landfill. Based on records of previous hydrogeological investigations, this potential expansion area is inferred to have approximately 3 m to 6 m of silty clay overburden directly overlying limestone bedrock.

The areas north and south of the existing Quarry Landfill have Centre Creek running through them and therefore were not considered for the purpose of expansion. The area to the west of the Quarry Landfill is outside the Stelco property boundary.

4.2 Conceptual Cell Design for Potential Expansion Areas

4.2.1 Cell Base Grades and Final Top of Waste Contours

Expansion Area 1

Figures 4 to 6 show the proposed based base grades and final top of waste fill contours for Expansion Area 1. Note that the base grades represent the founding surface on which the base lining system would be constructed and, for conceptual design purposes, do not reflect fine grading of the cell floor for leachate drainage/collection.

The proposed base grades for this area involve construction of a perimeter berm to a uniform crest elevation of approximately 189.5 masl similar to the perimeter containment berm of the existing new cell, with 3(H):1(V) interior slopes and 2.5(H):1(V) exterior slopes. The berm height relative to existing ground surface ranges from 1 m to 7 m. To minimize rock excavation, the proposed floor of the cell base grade is at Elevation 182 masl, which corresponds to the exposed bedrock surface elevation where the overburden soil was removed during former quarrying operations. The estimated cut volume for the base grade preparation is 65,800 m^3 and the fill volume 107,000 m^3. Therefore, approximately 41,200 m^3 of additional soil fill material would need to be obtained, potentially from the soil stockpile located east of the Quarry Landfill (see Figure 2 for stockpile location). The stockpile has an estimated 712,500 m^3 of soil.

The proposed final top of waste contours have 4(H):1(V) perimeter and 20(H):1(V) top surface grades. The final contours overlap the approved top of waste final contours on the south side of the existing new cell, to form a contiguous mound with a uniform peak elevation at 197.5 masl. The maximum waste fill thickness below the peak elevation is approximately 16 m.

The increase in waste fill volume capacity within Expansion Area 1 is estimated at 520,000 m^3, which is less than the targeted volume of 870,000 m^3 for this assessment. The maximum airspace available is limited by physical and geometrical constraints.

Expansion Area 2

Figures 7 to 9 show the proposed base grades and final top of waste contours for Expansion Area 2 east of Townline Road. Note that the base grades represent the founding surface on which the base lining system would be constructed and, for concept design purposes, do not reflect fine grading of the cell floor for leachate drainage/collection.

The proposed base grades involve construction of a perimeter berm to a uniform crest elevation of approximately 195.7 masl, with 3(H):1(V) interior sideslopes and 2.5(H):1(V) exterior sideslopes. The berm height relative to existing ground surface ranges from 3 m to 9 m. The floor of the cell base grade dips at 1% grade from an Elevation of 190 masl at the north end to 186 masl at the south end, leaving an estimated 2 m to 3 m thickness of native overburden between the floor of the base grade and top of limestone bedrock. The estimated cut volume to achieve the proposed base grades is approximately 140,000 m^3, which matches the required fill volume for the perimeter berm (i.e., the proposed base grades have an approximate cut/fill balance).

The final top of waste fill contours has 4(H):1(V) perimeter grades and 20(H):1(V) top surface grades to a peak Elevation of 204.5 masl. This peak elevation is approximately 7 m higher than the approved peak waste fill elevation of the existing new cell. The maximum final waste fill thickness is approximately 18 m.

The increase in waste fill volume capacity with Expansion Area 2 is estimated at 1,010,000 m^3, which exceeds the targeted volume of 870,000 m^3 for this assessment. Note however that the required volume capacity may be higher than 870,000 m^3 once the actual waste quantities at Hamilton Works are defined.

4.2.2 Base Liner and Leachate Collection System

The proposed base liner and leachate collection system design for Expansion Areas 1 and 2 is the same as that of the existing Quarry Landfill new cell as shown on Figure 10 Detail A.

The base liner system consists of a single composite liner system comprised of a 1.5 mm (60 mil) thick textured high-density polyethylene (HDPE) geomembrane underlain by a geosynthetic clay liner (GCL). A 0.3 m thick protection layer comprised of screened BF Slag (6 mm maximum particle size) overlies the geomembrane.

The leachate collection system is on the cell floor and consists of the following layers starting with the lower-most layer:

- 0.5 m thick drainage layer consisting of 50 mm washed clear natural stone;
- non-woven geotextile filter fabric; and
- 0.3 m thick filter layer comprised of screened BF Slag (6 mm maximum particle size)

Leachate would be pumped from a sump at the low point (south end) of the cell floor via a riser pipe that extends up the 3(H):1(V) interior slope of the perimeter berm. The leachate would be conveyed via forcemain to the Lake Erie Works wastewater treatment plant.

The total surface area of the base liner/leachate collection system is 50,700 m^2 for Expansion Area 1 and 81,100 m^2 for Expansion Area 2.

4.2.3 Final Cover

The proposed final cover design for Expansion Areas 1 and 2 is the same as that approved for the existing Quarry Landfill new cell as shown in Figure 10 Detail B.

The final cover design is consistent with *Ontario Regulation O.Reg. 232/98 (MECP Landfill Standards)* and consists of a 0.6 m (minimum) thick layer of clayey soil overlain by a 0.15 m thick topsoil layer vegetated with grass. The total surface area of the final cover is approximately 59,000 m^2 for Expansion Area 1 and 80,000 m^2 for Expansion Area 2. Runoff from the final cover would be directed via drainage ditches to Centre Creek.

The clayey soil material for final cover construction can be obtained from the existing soil stockpile located immediately east of Expansion Area 2 (see Figures 1 and 2) provided that the soil is free of debris and meets the MECP “Table 3” Standards for Industrial/Commercial use in a non-potable groundwater setting (MOE, 2004). The estimated quantities of clayey soil required are 35,400 m^3 for Expansion Area 1 and 48,000 m^3 for Expansion Area 2. In comparison, the estimated volume of the existing stockpile is approximately 712,500 m^3.

The percolation rate of atmospheric water through the final cover was predicted at 200 mm/year (Golder Associates, 2010) using the HELP Model (Schroeder et. al. 1994). Using this infiltration rate and the above-noted final cover surface areas, the corresponding annual average leachate generation rates post-closure are 11,800 m^3 for Expansion Area 1 and 16,000 m^3 for Expansion Area 2. The leachate generation rate during the landfilling period could be significantly higher depending on the moisture content of the incoming waste and the sequence of waste placement and progressive capping.

5.0 FEASIBILITY ASSESSMENT

5.1 Constructability

For each expansion concept, it is expected that cell construction would be straight forward and could be carried out using standard construction equipment, materials and methods. Furthermore, there are local (Southern Ontario) Contractors with extensive experience in landfill cell construction, as evidenced when tendering the new cell construction in 2013.

Each expansion area is accessible via existing access roads and construction traffic would not adversely affect the steel plant operations.

Each concept should be constructed in stages (up to 2 Ha per stage) as the filling period progresses, starting at the low end of the cell. This approach minimizes leachate generation during the landfilling period by limiting the active fill area at any given time and allowing the wastes to be placed to final contours for progressive capping. It is estimated that each stage of construction would take about three to four months to complete.

Expansion Area 1 has several disadvantages including the need to: i) remove a pond and clear/grub a large area at the south end of the cell footprint, ii) excavate bedrock in localized areas for shaping the cell base grade, and iii) acquire approximately 41,200 m^3 of additional soil fill to construct the perimeter berms (possibly from the soil stockpile to the east of the Quarry Landfill). Expansion Area 2 requires minor clearing/grubbing, no bedrock excavation and no additional soil fill for perimeter berm construction (i.e., all soil fill for the perimeter berm can be obtained from the cell base grade excavation).

Neither expansion area would require groundwater depressurization nor stabilization of the foundation soils.

5.2 Environmental Protection

The proposed leachate containment system for both expansion areas involves a composite geosynthetic clay liner / HDPE geomembrane base liner and granular leachate collection system. All leachate collected from the cell would be treated at the Lake Erie Works water treatment plant for pH adjustment and removal of ammonia-N and trace heavy metals.

The proposed leachate containment system is compatible with the waste types and is expected to have a service life of hundreds of years. As such, the containment system is expected to provide a high level of protection against groundwater and surface water quality impacts. Expansion Area 1 has the added natural protection of 2 m to 3 m of natural clayey soil separating the base of the cell from the underlying bedrock.

In the event of underperformance or failure of the leachate containment system, the leachate migration pathways for both expansion areas are predictable based on the current understanding of the site hydrogeological conditions. Contaminant migration from the cells would be downward to the underlying fractured bedrock and then southwesterly discharging to the Quarry Pond and/or Centre Creek south of the existing Quarry Landfill. Shallow bedrock groundwater monitoring wells along this pathway would provide early warning of leachate migration to these on-site receptors and contingency measures such as groundwater purge wells and/or a low permeability geomembrane final cover can be implemented to minimize impacts.

5.3 Regulatory Approvals Requirements

As set out in *Ontario Regulation (O.Reg.) 101/07 for Waste Management Projects* under the *Environmental Assessment Act* (EAA), approval of a change in landfill capacity of 870,000 m^3 requires completion of an Individual Environmental Assessment (EA) under the EAA. An EA under the EAA is a planning study that assesses environmental effects and advantages and disadvantages of a proposed project. The environment is considered in broad terms that include the environmental (technical) and social (including cultural and economic) aspects of the environment. Commonly in waste projects the environment includes considerations and studies of biology, hydrogeology, surface water, air, noise, archaeology, cultural heritage, land use, visual, social and economic considerations. Occasionally traffic and agriculture are also included. In an Individual EA, the first step is to develop a Terms of Reference (ToR); once approved by the MECP, the ToR becomes the framework under which the EA is conducted.

The development of the ToR includes defining the rationale / need for and description of the project and the EA study; identifying the range of alternatives that will be evaluated in the EA (generally a minimum of three expansion design alternatives are required); defining study areas and study time frames; describing the existing environmental conditions in the areas to be studied; developing and undertaking a consultation program for the ToR that includes stakeholders from the regulatory agencies, Indigenous Communities and the public; developing a proposed consultation program for the EA; and describing the technical studies that will be undertaken during the EA.

The ToR is circulated in draft form to the stakeholders for comment and the comments received are incorporated into a final ToR for a second circulation, followed by consideration by the Minister for approval.

Following approval of the ToR the EA studies are undertaken, including any field work to support them, along with the consultation program, resulting in preparation of a draft EA Study Report that is subjected to two rounds of stakeholder circulation and then considered by the Minister for approval. The EA Study Report will identify the overall preferred alternative for the project.

The overall preferred alternative for the project forms the basis for the preparation of an application for an ECA amendment to implement the project, in this case the expansion of the Quarry Landfill. Application for any other regulatory approvals required to proceed to construction and operation would also be completed.

In the end, EAs are a provincial decision. The local municipality is a stakeholder, as is the business community, Indigenous Communities and the public. It is obviously preferred if the municipality and business community are in support, but this is not always the case. The MECP typically requires the proponent to address the municipality's concerns as well as possible. The MECP also requires the proponent to address any opposition issues but recognizes that in some cases they will never be satisfied. The MECP will view concerns or issues brought forward by Indigenous Communities with slightly more importance. Having and maintaining a good relationship with all of these stakeholders is beneficial to the EA process and often its schedule and budget.

Although there are regulated timelines for ToR and EA approval, they are not generally adhered to by the MECP. In addition, there are unspoken rules related to the timing of Public Open Houses during the consultation process that can affect the timelines. For example, open houses should not be held during the summer months or December.

Based on recent landfill expansion approvals in Ontario, it typically takes about two years from Notice of Commencement to ToR approval, followed by another two years or more to get EA approval. After EA approval, typically 18 months are required to prepare the ECA application package and get an ECA amendment approved. If construction is required prior to placing waste in the expansion area. then this adds additional time until the expansion area is ready to receive waste. Therefore, typically, one can expect to it to take five to six years total from the Notice of Commencement to the time waste can be placed in the expansion. Given the specific conditions expected for the Quarry Landfill expansion, it may be possible to reduce the timing of the ToR based on more broadly understood existing conditions and limited variability in alternatives to consider. Further schedule efficiencies can be gained by conducting environmental field studies during the ToR phase and conducting ECA application package preparation during the EA review period. In each of these cases there is some risk in proceeding in that the approval for the next step has not been received; however, it is noted this accelerated approach is common practice, especially for private sector proponents. There are also avenues that can be explored with MECP, on a project-specific basis, to reduce the overall timeframe for *EAA* and *EPA* approvals.

Another potential delay in the EA approval process can include provincial elections. Typically, one can expect no ToR or EA approval during the four to six months prior to an election and for a couple months after.

The existing Quarry Landfill and proposed expansion are located on private lands within an industrial site bordering on undeveloped agricultural lands. The purpose of the proposed expansion is to be able to continue the management of waste materials generated from steel-making processes. As such, it is considered reasonable to expect that the province would be supportive of a project that will continue to internally provide cost-effective waste management services for this sector of the economy, noting that approval will require the project design and operations to demonstrate that the environmental effects from the proposed expansion will meet provincial standards and regulations. Based on this feasibility assessment, it appears that expansion of the landfill is

technically feasible in terms of there being an area within the property available to provide the target volume as per the technical requirements of *O.Reg. 232/98 Landfill Standards*.

Although there is a variety of studies to be done as part of the EA and other matters to be addressed in the EA process, in our experience it is considered that this expansion is likely to receive EA and subsequently EPA approval in the form of an amended ECA to implement the expansion. To our knowledge, it is noted that expansion of both private and public sector landfills in Ontario over the past 5 to 20 years have received EAA and then EPA approval.

6.0 RECOMMENDATION ON PREFERRED EXPANSION APPROACH

Based on this feasibility assessment, it is recommended that consideration be given to an expansion approach that involves alternatives that are physically separate from the existing landfill, such as that assessed in Expansion Area 2 located on the opposite side of Townline Road. This expansion concept could provide an increase in waste fill volume capacity of approximately 1,010,000 m^3, which exceeds the targeted volume increase of 870,000 m^3. This evaluation has shown that expansion alternatives overlapping onto the south side of the existing landfill are not expected to be able to achieve the targeted volume increase, and as such would not fulfill the objective. Cell construction would be straight forward and there are a number of local (Southern Ontario) Contractors with extensive landfill cell construction experience. The proposed containment system is protective of the environment and, in the hypothetical event of underperformance or failure, the contaminant migration pathway and potential receptors are well understood and are within the Lake Erie Works property boundary. Contingency measures can be implemented as required to minimize any impacts.

Approval for landfill expansion first requires an Individual Environmental Assessment under the Ontario Environmental Assessment Act. As part of this process, a number of expansion alternatives that provide the targeted volume increase would be developed and compared against a set of environmental criteria to identify the overall preferred expansion alternative.

Signature Page

Golder Associates Ltd.

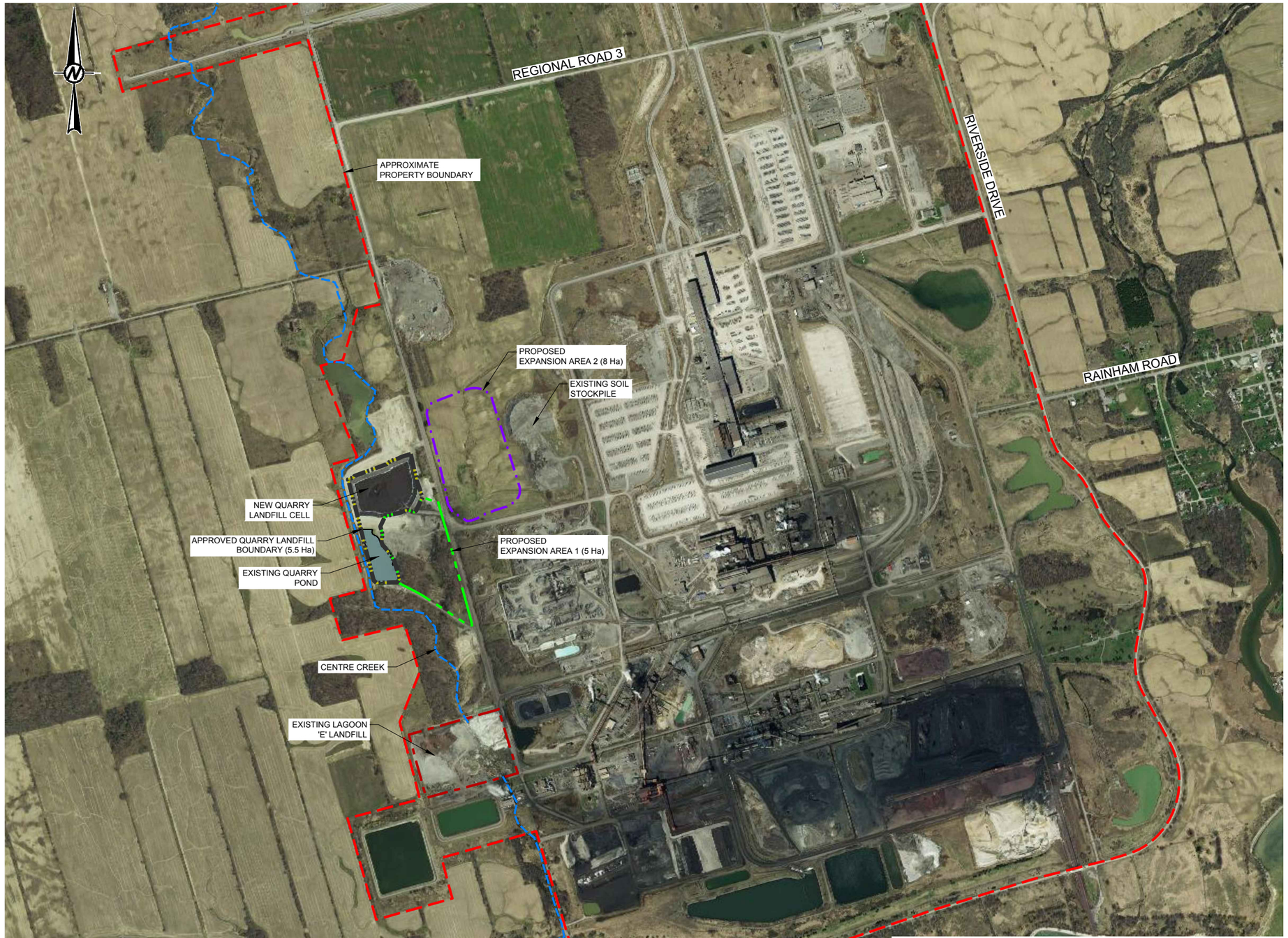
Frank Barone, Ph.D., P.Eng.
Principal

FSB/ml

Golder and the G logo are trademarks of Golder Associates Corporation

https://golderassociates.sharepoint.com/sites/111318/project files/6 deliverables/final/rev2/19125670 final report rev2 2020dec03.docx

FIGURES



KEY MAP

LEGEND

- APPROXIMATE PROPERTY BOUNDARY
- PROPOSED LANDFILL EXPANSION - AREA 1
- PROPOSED LANDFILL EXPANSION - AREA 2
- APPROXIMATE LAGOON E LANDFILL BOUNDARY
- APPROVED QUARRY LANDFILL BOUNDARY (5.5 Ha)
- CREEK

NOTE(S)

1. PROJECTION: UTM NAD83 ZONE 17. ELEVATIONS ARE GEODETIC (masl).

REFERENCE(S)

1. BASE IMAGERY FROM ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, AEROGRID, IGN, AND THE GIS USER COMMUNITY.

0 250 500
METRES

CLIENT
STELCO INC.

CONSULTANT
GOLDER

YYYY-MM-DD	2019-08-30
DESIGNED	FSB
PREPARED	SEC
REVIEWED	FSB
APPROVED	FSB

PROJECT
QUARRY LANDFILL EXPANSION FEASIBILITY STUDY
LAKE ERIE WORKS
NANTICOKE, ONTARIO

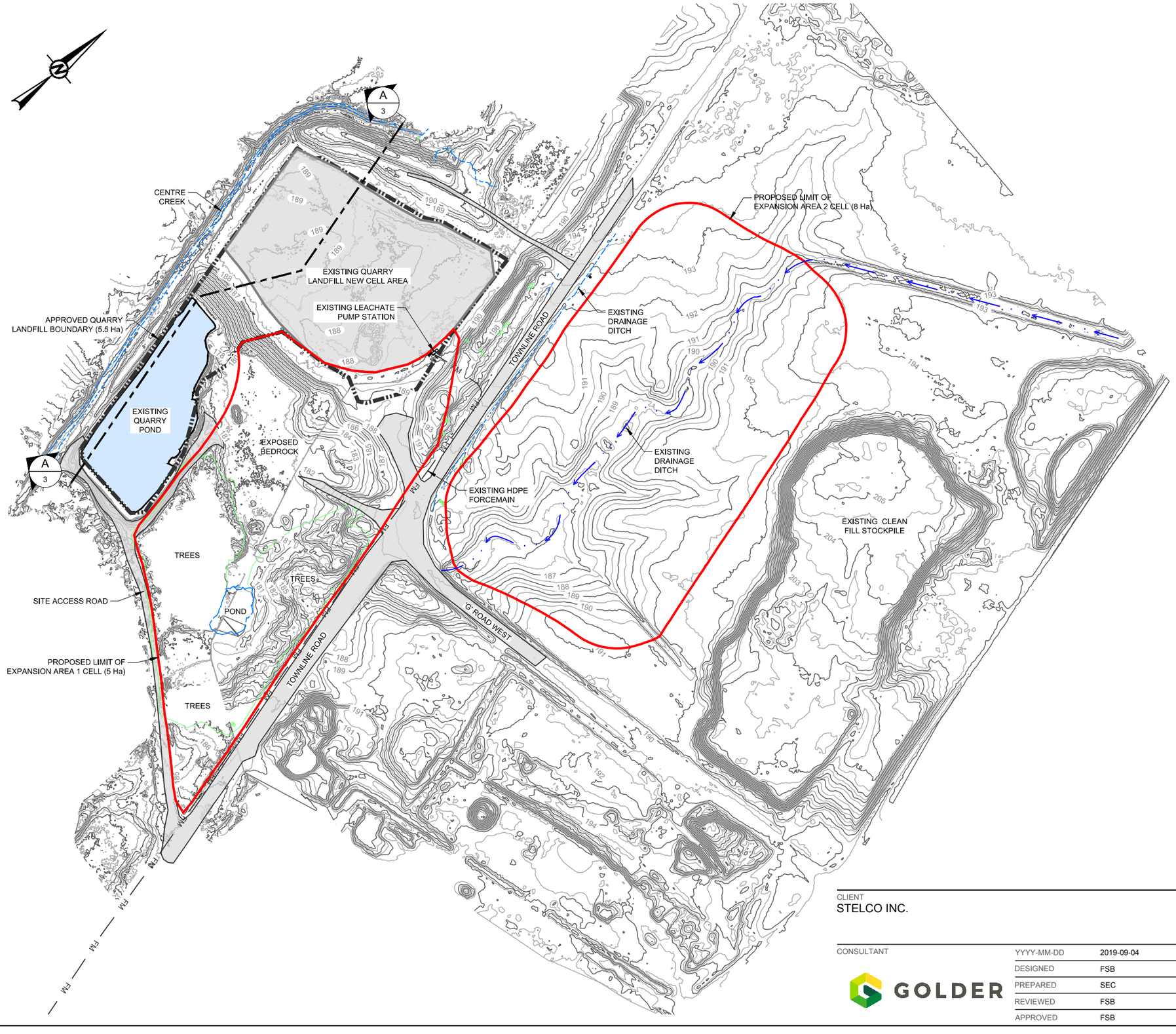
TITLE
SITE AERIAL PHOTO

PROJECT NO.	CONTROL	REV.	FIGURE
19125670	0002	1	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 — 25 mm

Path: \\golder.gds\gal\mississauga\aim\Clients\Stelco\Quarry_Landfill\99_PRO\19125670_Landfill_Expansion\40_PROD\0002_Feasibility_Study\ | File Name: 19125670-0002-CW-0001.dwg | Last Edited By: scarlson Date: 2019-09-04 Time:4:15:34 PM | Printed By: SCarlson Date: 2019-09-04 Time:4:17:14 PM



LEGEND

- TOPOGRAPHIC GROUND SURFACE CONTOUR (1.0 masl INTERVAL)
- ACCESS ROAD
- DITCH
- CREEK
- EXISTING QUARRY LANDFILL BOUNDARY (5.5 Ha)

NOTE(S)

1. PROJECTION: UTM NAD83 ZONE 17. ELEVATIONS ARE GEODETIC (masl).

REFERENCE(S)

1. BASE PLAN INFORMATION IS BASED ON TOPOGRAPHIC SURVEY PLAN BY A. J. CLARKE & ASSOCIATES LTD. DATED MAY 31, 2010.
2. TOPOGRAPHIC GROUND CONTOURS ARE BASED ON A COMPILATION OF SOURCES: EXISTING QUARRY FILL LEVEL EXTRACTED FROM TOPOGRAPHIC DRONE SURVEY DATED JANUARY 23, 2019 BY TEC-SURVEY; EXISTING QUARRY BERM AND RAMP AND QUARRY POND BATHYMETRY FROM AS-BUILT CONSTRUCTION SURVEYS DATED DECEMBER 8, 2014 AND JUNE 9, 2014 RESPECTIVELY BY TERVITA.

0 100 200
METRES

CLIENT
STELCO INC.

CONSULTANT
GOLDER

YYYY-MM-DD	2019-09-04
DESIGNED	FSB
PREPARED	SEC
REVIEWED	FSB
APPROVED	FSB

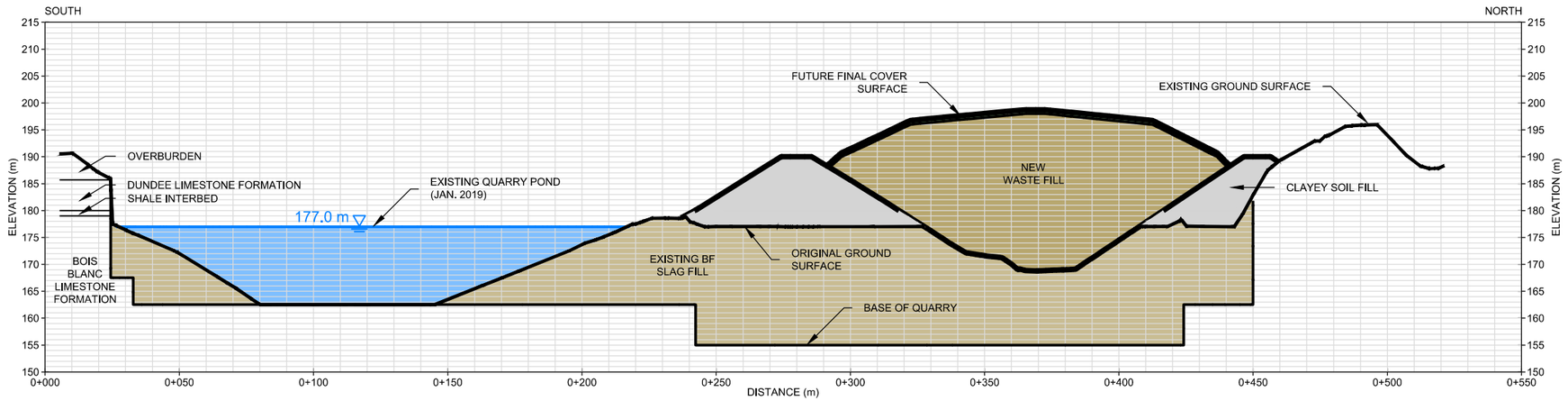
PROJECT
QUARRY LANDFILL EXPANSION FEASIBILITY STUDY
LAKE ERIE WORKS
NANTICOKE, ONTARIO

TITLE
EXISTING CONDITIONS

PROJECT NO.	CONTROL	REV.	FIGURE
19125670	0002	1	2

0 25 mm
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

Path: \\golder.gds\gal\mississauga\skm\Clients\Stelco\Quarry_Landfill\tlb_PRO\19125670_Landfill_Expansion\40_PROD\0002_Feasibility_Study\ | File Name: 19125670-0002-CW-0002.dwg | Last Edited By: scarlson Date: 2019-09-04 Time:4:58:59 PM | Printed By: SCarlson Date: 2019-09-04 Time:5:39:09 PM



V.E. = 2X A/2 PROFILE A

CLIENT
STELCO INC.

CONSULTANT
GOLDER

YYYY-MM-DD	2019-09-04
DESIGNED	FSB
PREPARED	SEC
REVIEWED	FSB
APPROVED	FSB

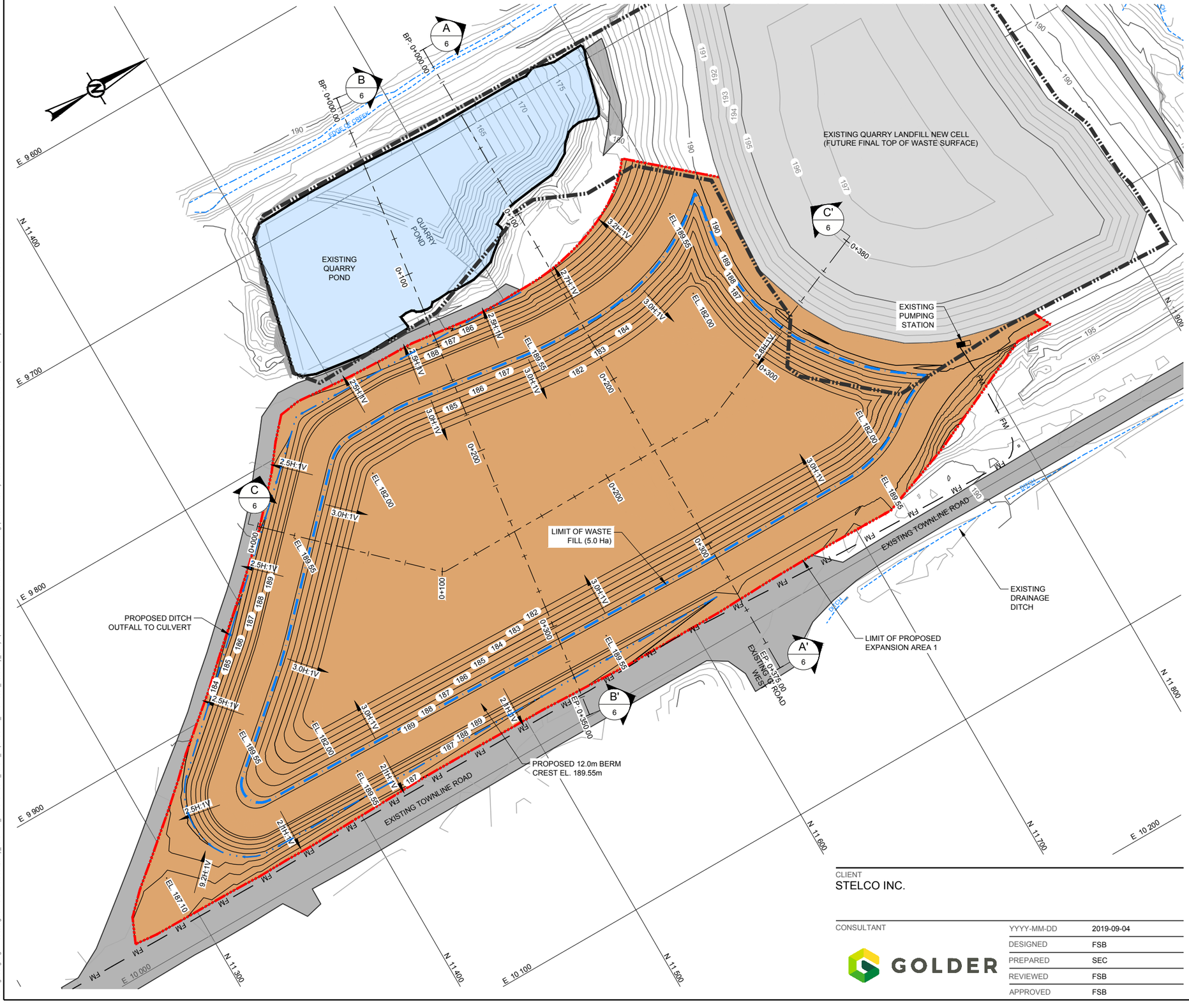
PROJECT
QUARRY LANDFILL EXPANSION FEASIBILITY STUDY
LAKE ERIE WORKS
NANTICOKE, ONTARIO

TITLE
EXISTING APPROVED QUARRY LANDFILL NEW CELL - PROFILE

PROJECT NO.	CONTROL	REV.	FIGURE
19125670	0002	1	3

0 25 mm
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

Path: \\golder.gds\gal\mississauga\sim\Clients\Stelco\Quarry_Landfill99_PRO\A19125670_Landfill_Expansion\40_PROD\0002_Feasibility_Study\ | File Name: 19125670-0002-CW-0003.dwg | Last Edited By: scarlson Date: 2019-09-04 Time:4:57:38 PM | Printed By: SCarlson Date: 2019-09-04 Time:5:37:25 PM



LEGEND

- TOPOGRAPHIC GROUND SURFACE CONTOUR (0.5m INTERVAL)
- PROPOSED BASE GRADE CONTOUR (1.0m INTERVAL)
- ACCESS ROAD
- PROPOSED DITCH CENTRELINE
- EXISTING DITCH CENTRELINE
- FM — HDPE FORCEMAIN PIPE FROM PUMP DISCHARGE HOSE TO MISA POND/WATER TREATMENT PLANT
- EXISTING 5.5 Ha QUARRY LANDFILL BOUNDARY

NOTE(S)

1. EASTING, NORTHING AND ELEVATIONS WERE BASED ON STELCO, LAKE ERIE SITE LOCAL GRID SYSTEM. SITE BENCH MARK AT NORTHEAST CORNER OF QUARRY HAVING THE FOLLOWING COORDINATES:

   EASTING: 10,016.050 m
   NORTHING: 11,950.770 m
   ELEVATION: 193.310 m

REFERENCE(S)

1. TOPOGRAPHIC GROUND CONTOURS ARE BASED ON A COMPILATION OF SOURCES: EXISTING QUARRY FILL LEVEL EXTRACTED FROM TOPOGRAPHIC DRONE SURVEY DATED JANUARY 23, 2019 BY TEC-SURVEY; QUARRY POND BATHYMETRY FROM AS-BUILT CONSTRUCTION SURVEYS DATED DECEMBER 8, 2014 AND JUNE 9, 2014 RESPECTIVELY BY TERVITA.

0 50 100
METRES

CLIENT
STELCO INC.

CONSULTANT
GOLDER

YYYY-MM-DD	2019-09-04
DESIGNED	FSB
PREPARED	SEC
REVIEWED	FSB
APPROVED	FSB

PROJECT
QUARRY LANDFILL EXPANSION FEASIBILITY STUDY
LAKE ERIE WORKS
NANTICOKE, ONTARIO

TITLE
LANDFILL EXPANSION AREA 1 - PROPOSED BASE GRADE

PROJECT NO.	CONTROL	REV.	FIGURE
19125670	0002	1	4

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 25 mm

Path: \\golder.gds\gal\mississauga\active\Clients\Stelco\Quarry_Landfill\99_PROJ\19125670_Landfill_Expansion\40_PROD\0002_Feasibility_Study\ | Last Edited By: scarlson Date: 2019-09-04 Time:5:02:59 PM | Printed By: SCarlson Date: 2019-09-04 Time:5:42:03 PM | File Name: 19125670-0002-CW-0004.dwg

LEGEND

- 190 — TOPOGRAPHIC GROUND SURFACE CONTOUR (1.0m INTERVAL)
- PROPOSED FINAL WASTE FILL CONTOUR (1.0m INTERVAL)
- 0+000 — EXISTING ACCESS ROAD
- EXISTING DITCH
- PROPOSED DRAINAGE DITCH
- PRE-FABRICATED CONCRETE HAZMAT STORAGE SHED FOR LEACHATE COLLECTION SYSTEM PUMPING STATION
- FM — HDPE FORCEMAIN PIPE FROM PUMP DISCHARGE HOSE TO TREATMENT PLANT
- APPROXIMATE LIMIT OF 5.5 Ha QUARRY LANDFILL CORRESPONDING TO ROCK WALL OF FORMER LIMESTONE QUARRY (BASED ON MAY 2010 TOPOGRAPHIC SURVEY AND LAKE ERIE STEEL SITE DEVELOPMENT PLAN DATED MARCH 30, 1983.

NOTE(S)

1. EASTING, NORTHING AND ELEVATIONS WERE BASED ON STELCO, LAKE ERIE SITE LOCAL GRID SYSTEM. SITE BENCH MARK AT NORTHEAST CORNER OF QUARRY HAVING THE FOLLOWING COORDINATES:

   EASTING: 10,016.050 m
   NORTHING: 11,950.770 m
   ELEVATION: 193.310 m

REFERENCE(S)

1. TOPOGRAPHIC GROUND CONTOURS ARE BASED ON A COMPILATION OF SOURCES: EXISTING QUARRY FILL LEVEL EXTRACTED FROM TOPOGRAPHIC DRONE SURVEY DATED JANUARY 23, 2019 BY TEC-SURVEY; QUARRY POND BATHYMETRY FROM AS-BUILT CONSTRUCTION SURVEYS DATED DECEMBER 8, 2014 AND JUNE 9, 2014 RESPECTIVELY BY TERVITA.

0 50 100
METRES

CLIENT
STELCO INC.

CONSULTANT
GOLDER

YYYY-MM-DD	2019-09-04
DESIGNED	FSB
PREPARED	SEC
REVIEWED	FSB
APPROVED	FSB

PROJECT
QUARRY LANDFILL EXPANSION FEASIBILITY STUDY
LAKE ERIE WORKS
NANTICOKE, ONTARIO

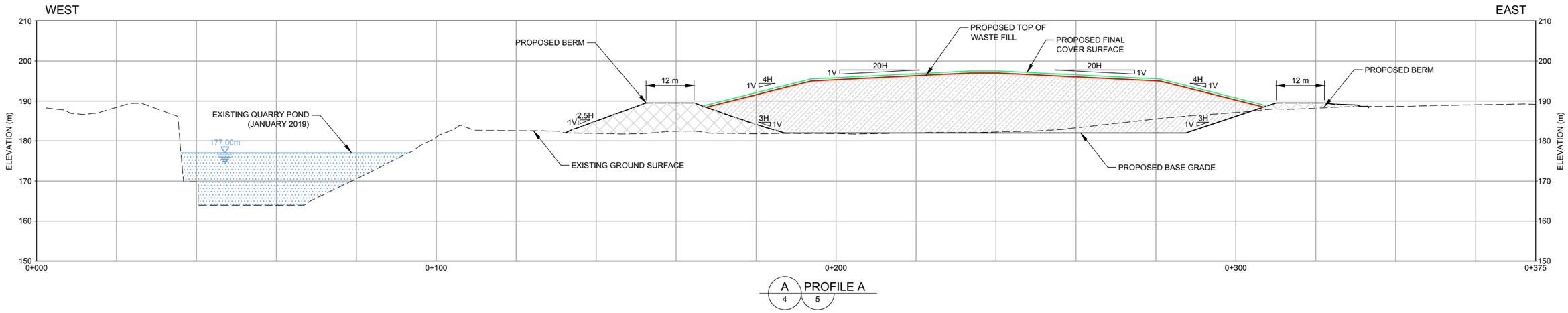
TITLE
LANDFILL EXPANSION AREA 1 - PROPOSED FINAL COVER

PROJECT NO.	CONTROL	REV.	FIGURE
19125670	0002	1	5

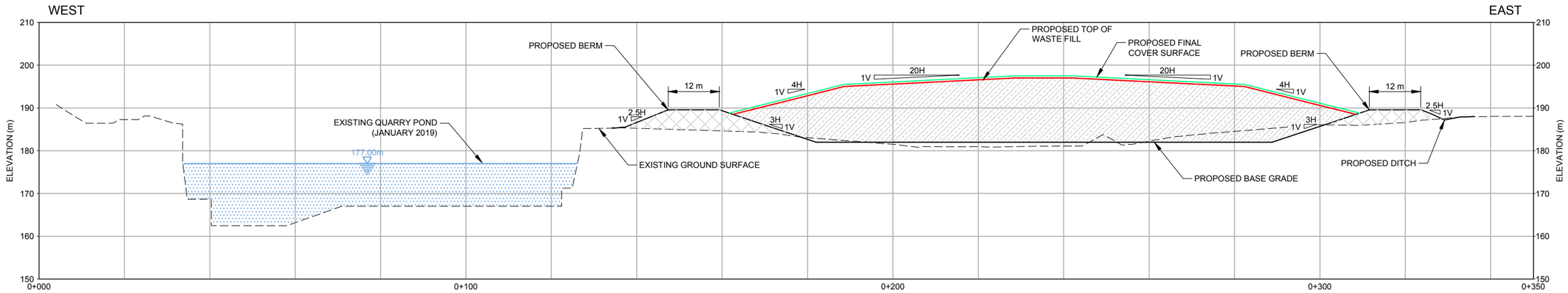
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 25 mm

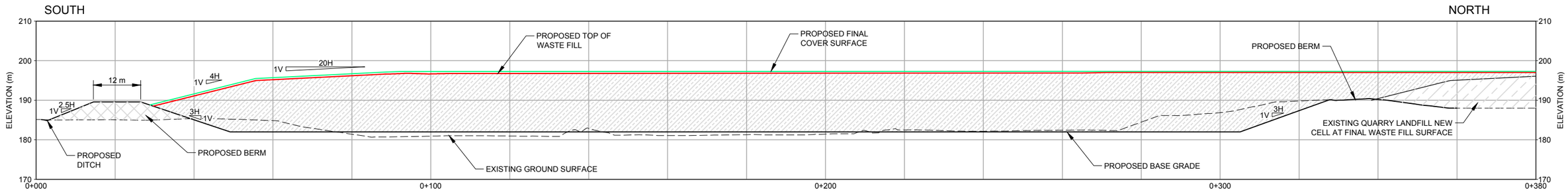
Path: \\golder.gds\gal\mississauga\akm\Clients\StelcoQuarry_Landfill\69_PRO\19125670_Landfill_Expansion\40_PROD\0002_FeasibilityStudy\ | File Name: 19125670-0002-CW-0005.dwg | Last Edited By: scarlson Date: 2019-09-04 Time:10:25:18 AM | Printed By: SCarlson Date: 2019-09-04 Time:5:05:30 PM



A 4 PROFILE A 5



B 4 PROFILE B 5



C 4 PROFILE C 5

0 20 40
METRES

NOTE(S)

1. EASTING, NORTHING AND ELEVATIONS WERE BASED ON STELCO, LAKE ERIE SITE LOCAL GRID SYSTEM. SITE BENCH MARK AT NORTHEAST CORNER OF QUARRY HAVING THE FOLLOWING COORDINATES:

   EASTING: 10,016.050 m
   NORTHING: 11,950.770 m
   ELEVATION: 193.310 m

LEGEND

- PROPOSED FINAL COVER SURFACE
- PROPOSED TOP OF WASTE FILL
- PROPOSED WASTE FILL MATERIAL
- PROPOSED BERM MATERIAL
- EXISTING NORTH QUARRY LANDFILL MATERIAL
- EXISTING QUARRY POND

CLIENT
STELCO INC.

CONSULTANT
GOLDER

YYYY-MM-DD	2019-09-04
DESIGNED	FSB
PREPARED	SEC
REVIEWED	FSB
APPROVED	FSB

PROJECT
QUARRY LANDFILL EXPANSION FEASIBILITY STUDY
LAKE ERIE WORKS
NANTICOKE, ONTARIO

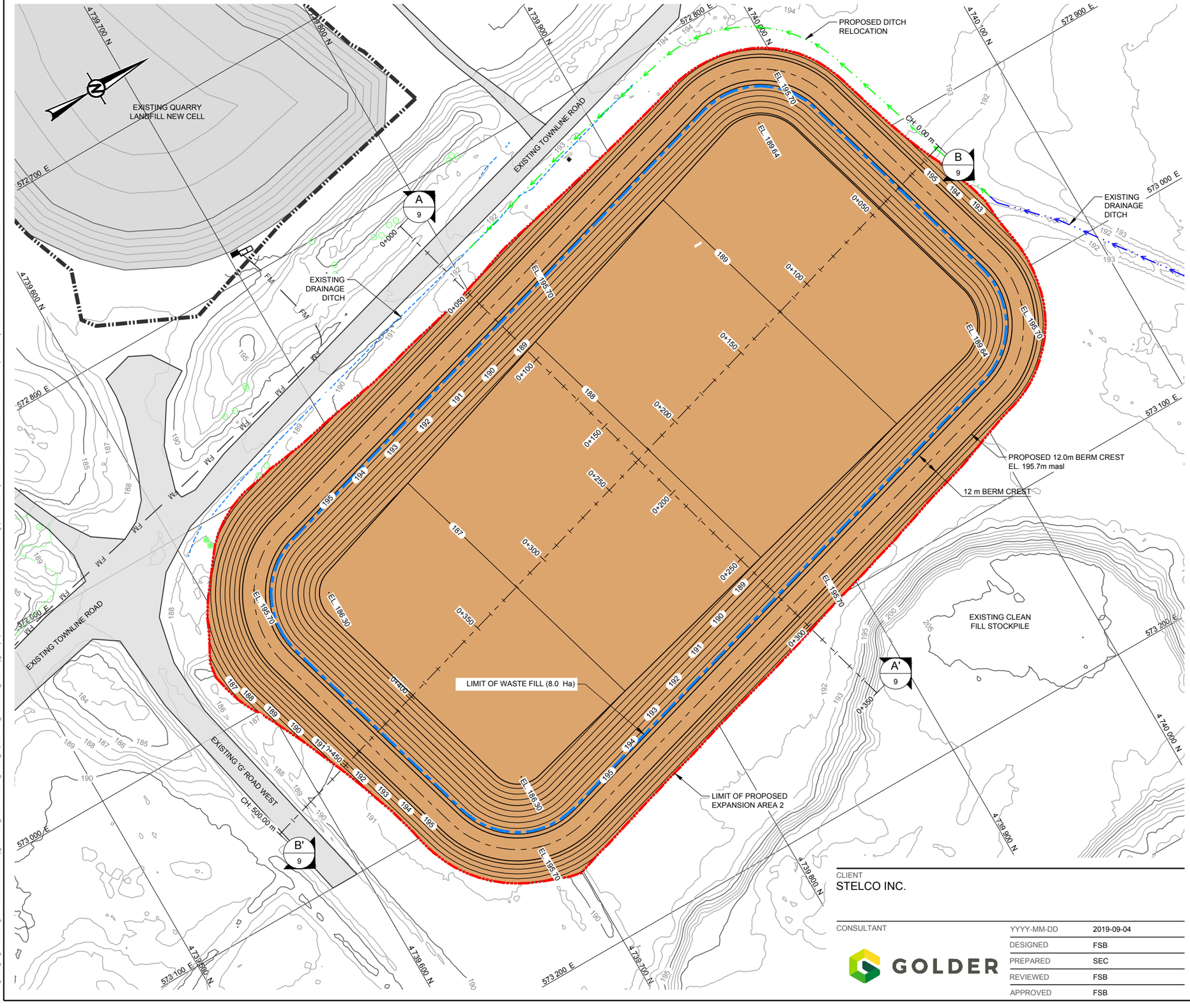
TITLE
LANDFILL EXPANSION AREA 1 - PROFILES

PROJECT NO.	CONTROL	REV.	FIGURE
19125670	0002	1	6

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 25 mm

Path: \\golder.gds\gal\mississauga\sim\Clients\Stelco\Quarry_Landfill\99_PROJ\19125670_Landfill_Expansion\40_PROD\0002_Feasibility_Study\ | File Name: 19125670-0002-GW-0006.dwg | Last Edited By: scarlson Date: 2019-09-04 Time:2:41:11 PM | Printed By: SCarlson Date: 2019-09-04 Time:5:06:26 PM



LEGEND

- EXISTING GROUND SURFACE CONTOUR (1.0m INTERVAL)
- PROPOSED BASE GRADE CONTOURS AND ELEVATION (1.0m INTERVAL)
- ACCESS ROADS
- EXISTING DRAINAGE DITCH
- PROPOSED DRAINAGE DITCH REALIGNMENT
- PROPOSED BERM CENTRELINE

NOTE(S)

1. PROJECTION: UTM NAD83 ZONE 17. ELEVATIONS ARE GEODETIC (masl).

REFERENCE(S)

1. TOPOGRAPHIC GROUND CONTOURS ARE BASED ON INTERNAL GIS DATA EXTRACTION.

0 50 100

METRES

CLIENT
STELCO INC.

CONSULTANT
GOLDER

YYYY-MM-DD	2019-09-04
DESIGNED	FSB
PREPARED	SEC
REVIEWED	FSB
APPROVED	FSB

PROJECT
QUARRY LANDFILL EXPANSION FEASIBILITY STUDY
LAKE ERIE WORKS
NANTICOKE, ONTARIO

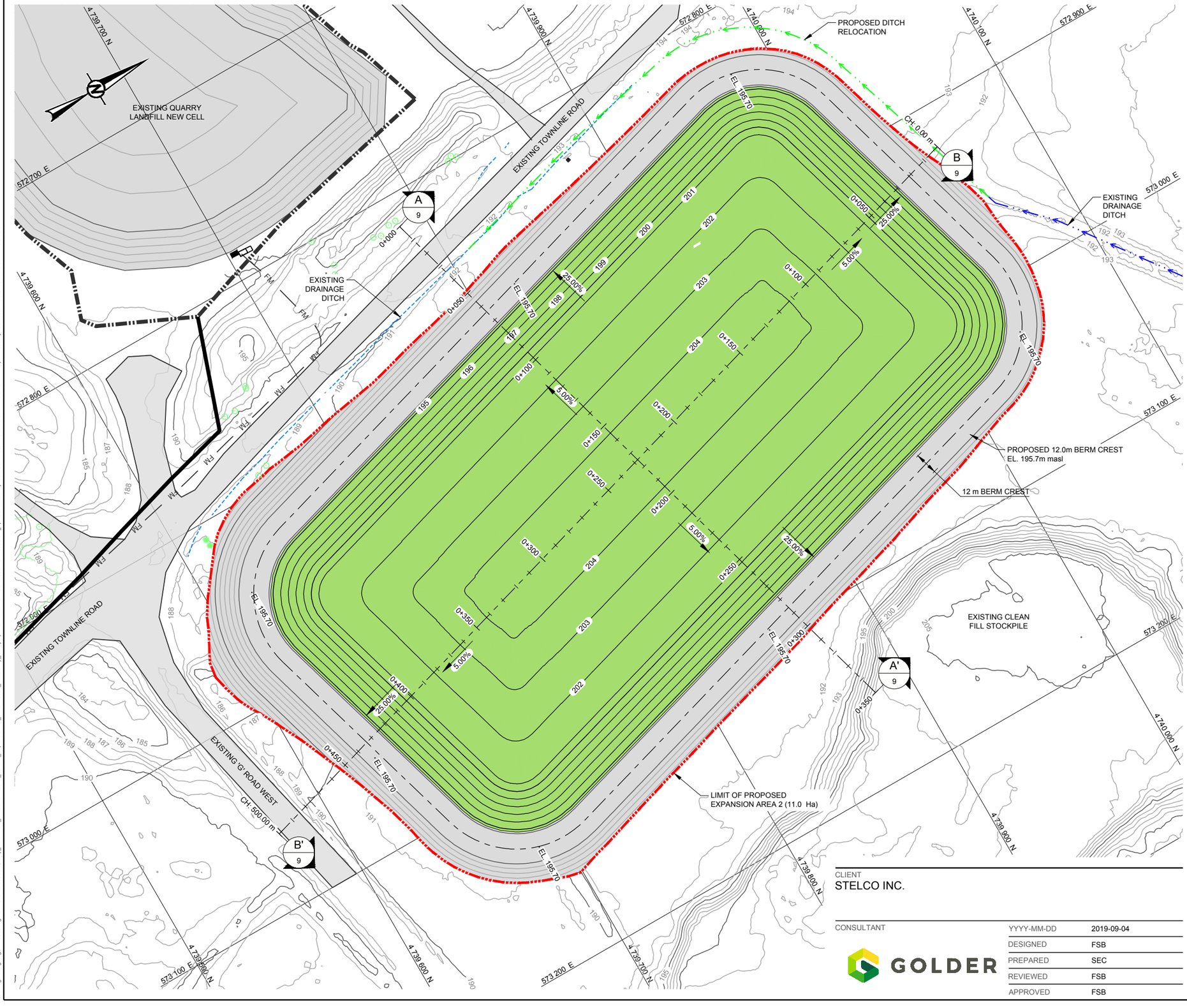
TITLE
LANDFILL EXPANSION AREA 2 - PROPOSED BASE GRADE

PROJECT NO.	CONTROL	REV.	FIGURE
19125670	0002	1	7

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 25 mm

Path: \\golder.gds\gal\mississauga\jobs\Clients\Stelco\Quarry_Landfill\99_PROJ\19125670_Landfill_Expansion\40_PROD\0002_Feasibility_Study\ | File Name: 19125670-0002-CW-0007.dwg | Last Edited By: scarlson Date: 2019-09-04 Time:5:16:07 PM | Printed By: SCarlson Date: 2019-09-04 Time:5:45:06 PM



LEGEND

- EXISTING GROUND SURFACE CONTOUR (1.0m INTERVAL)
- PROPOSED TOP OF WASTE FILL CONTOURS AND ELEVATION (1.0m INTERVAL)
- ACCESS ROADS
- EXISTING DRAINAGE DITCH
- PROPOSED DRAINAGE DITCH REALIGNMENT

NOTE(S)

1. PROJECTION: UTM NAD83 ZONE 17. ELEVATIONS ARE GEODETIC (masl).

REFERENCE(S)

1. TOPOGRAPHIC GROUND CONTOURS ARE BASED ON INTERNAL GIS DATA EXTRACTION.

0 50 100
METRES

CLIENT
STELCO INC.

CONSULTANT
GOLDER

YYYY-MM-DD	2019-09-04
DESIGNED	FSB
PREPARED	SEC
REVIEWED	FSB
APPROVED	FSB

PROJECT
QUARRY LANDFILL EXPANSION FEASIBILITY STUDY
LAKE ERIE WORKS
NANTICOKE, ONTARIO

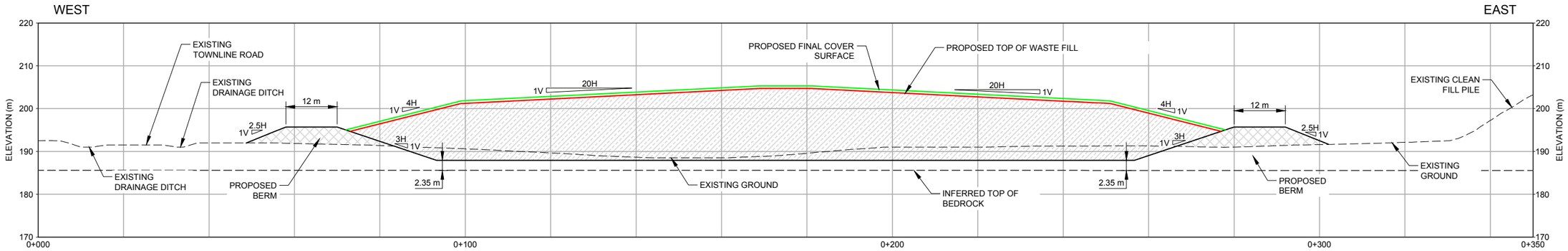
TITLE
LANDFILL EXPANSION AREA 2 - PROPOSED FINAL COVER

PROJECT NO.	CONTROL	REV.	FIGURE
19125670	0002	1	8

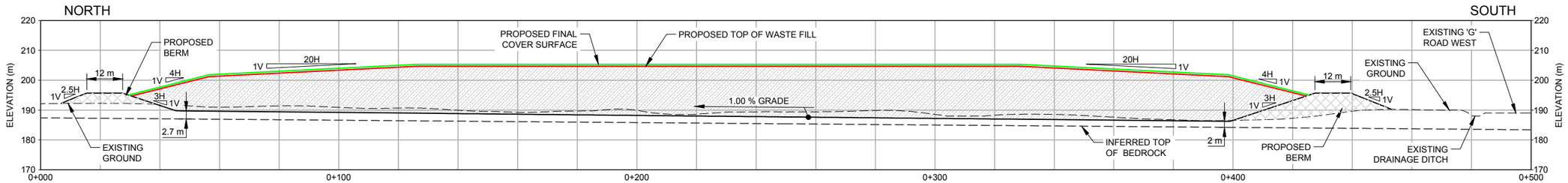
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 25 mm

Path: \\golder.gds\gal\mississauga\sm\Clients\Stelco\Quarry_Landfill\99_PRO\A19125670_Landfill_Expansion\40_PROD\0002_Feasibility_Study\ | File Name: 19125670-0002-CW-0008.dwg | Last Edited By: scarlson Date: 2019-09-04 Time:5:19:21 PM | Printed By: SCarlson Date: 2019-09-04 Time:5:19:52 PM



A PROFILE A
7 8



B PROFILE B
7 8

LEGEND

- PROPOSED TOP OF FINAL COVER
- PROPOSED TOP OF WASTE FILL
- PROPOSED WASTE FILL MATERIAL
- PROPOSED BERM MATERIAL

NOTE(S)

1. EASTING, NORTHING AND ELEVATIONS WERE BASED ON STELCO, LAKE ERIE SITE LOCAL GRID SYSTEM. SITE BENCH MARK AT NORTHEAST CORNER OF QUARRY HAVING THE FOLLOWING COORDINATES:

   EASTING: 10,016.050 m
   NORTHING: 11,950.770 m
   ELEVATION: 193.310 m

CLIENT
STELCO INC.

CONSULTANT
GOLDER

YYYY-MM-DD	2019-09-04
DESIGNED	FSB
PREPARED	SEC
REVIEWED	FSB
APPROVED	FSB

PROJECT
QUARRY LANDFILL EXPANSION FEASIBILITY STUDY
LAKE ERIE WORKS
NANTICOKE, ONTARIO

TITLE
LANDFILL EXPANSION AREA 2 - PROFILES

PROJECT NO.	CONTROL	REV.	FIGURE
19125670	0002	1	9

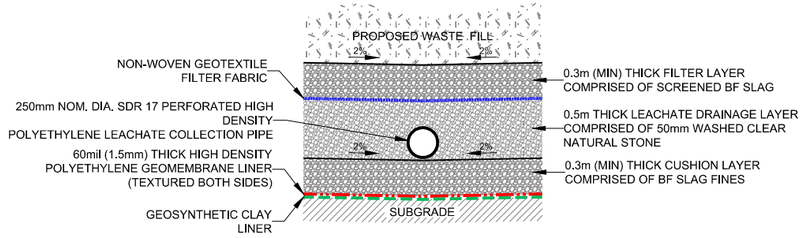
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 25 mm

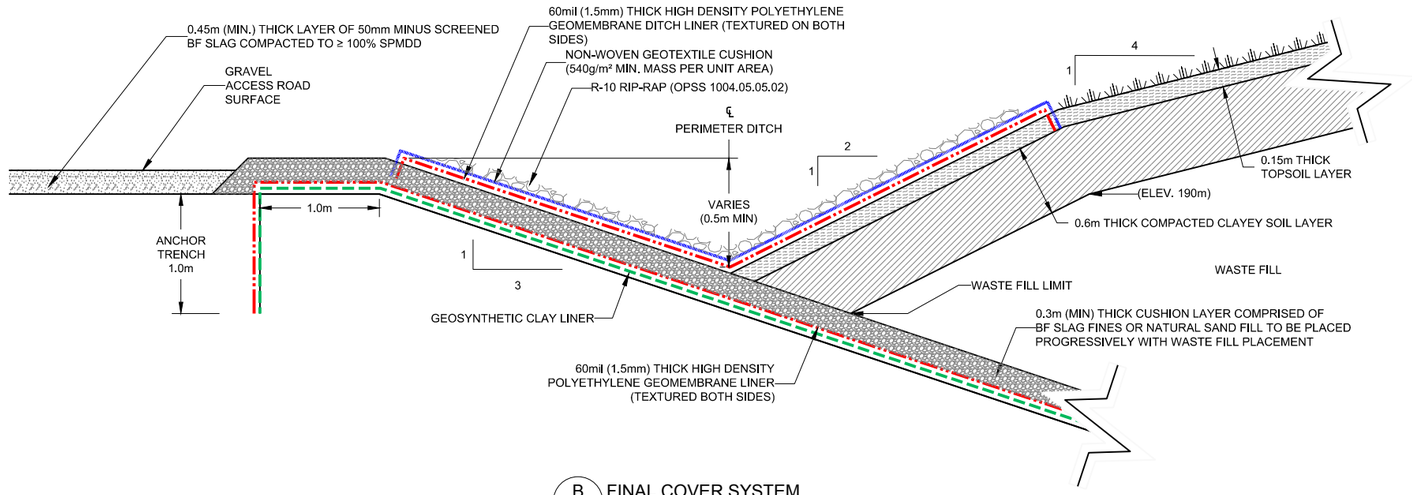
Path: \\golder.gds\gal\mississauga\sim\Clients\Stelco\Quarry_Landfill\99_PRO\A19125670_Landfill_Expansion\40_PRO\0002_Feasibility_Study\v. | File Name: 19125670-0002-CW-0009.dwg | Last Edited By: scarlson Date: 2019-09-04 Time:10:14:05 AM | Printed By: SCarlson Date: 2019-09-04 Time:5:23:51 PM

NOTE(S)

1. BF SLAG FINES USED FOR BEDDING LAYER AND CUSHION LAYERS SHALL BE SCREENED TO 6mm MAXIMUM PARTICLE SIZE.
2. BF SLAG USED FOR FILTER LAYER ABOVE CLEAR STONE DRAINAGE LAYER SHALL BE SCREENED TO 6mm MAXIMUM PARTICLE SIZE.



A 10 BASE LINER AND LEACHATE COLLECTION SYSTEM



B 10 FINAL COVER SYSTEM

0 100 200
METRES

CLIENT
STELCO INC.

CONSULTANT
GOLDER

YYYY-MM-DD	2019-09-04
DESIGNED	FSB
PREPARED	SEC
REVIEWED	FSB
APPROVED	FSB

PROJECT
QUARRY LANDFILL EXPANSION FEASIBILITY STUDY
LAKE ERIE WORKS
NANTICOKE, ONTARIO

TITLE
TYPICAL DETAILS FOR BASE LINER, LEACHATE COLLECTION SYSTEM AND FINAL COVER

PROJECT NO.	CONTROL	REV.	FIGURE
19125670	0002	1	10

0 25 mm
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

Path: \\golder.gds\gal\mississauga\sim\Clients\Stelco\Quarry_Landfill\99_PRO\A19125670_Landfill_Expansion\40_PRO\0002_Feasibility_Study\ | File Name: 19125670-0002-CW-0010.dwg | Last Edited By: scarlson Date: 2019-09-04 Time:10:48:25 AM | Printed By: SCarlson Date: 2019-09-04 Time:5:27:48 PM

golder.com

SUPPORTING DOCUMENT #2

Comparative Screening Evaluation of ‘Alternatives To’

TECHNICAL MEMORANDUM

DATE April 26, 2023 **Project No.** 20136711

TO File

FROM Trish Edmond; Paul Smolkin **EMAIL** trish.edmond@wsp.com; paul.smolkin@wsp.com

SUPPORTING DOCUMENT #2
COMPARATIVE SCREENING EVALUATION OF 'ALTERNATIVES TO'

This technical memorandum presents the comparative screening evaluation of 'Alternatives To' for the Environmental Assessment of the Proposed Quarry Landfill Expansion, Stelco Lake Erie Works, Nanticoke.

1.0 'ALTERNATIVES TO'

Following a feasibility assessment, the remaining available 'Alternatives To' the Proposed Quarry Landfill Expansion were Alternative 1 - closure of the existing landfill site and export waste for off-site disposal, Alternative 2 - landfill site expansion and Alternative 6 - the do nothing alternative. A brief description of the available 'Alternatives To' is provided below.

1.1 Alternative 1 – Closure of Existing Landfill Site and Export Waste for Off-site Disposal

Under Alternative 1, the existing Quarry Landfill would be closed. Stelco would likely continue to operate waste diversion activities at the landfill site or elsewhere on their property, and the remaining waste would be exported to an appropriately licensed landfill for disposal. Stelco presently accepts non-hazardous steel making secondary materials from its LEWF at the existing Quarry Landfill. Under Alternative 1, it was assumed that Stelco would continue to operate the Quarry Landfill until it reaches its currently approved capacity of 1,300,000 m^3.

Public and private waste facilities (landfills) within approximately 100 km of the existing Quarry Landfill allowed to accept steel making secondary material / waste and with the appropriate service area in their respective ECAs are outlined in Table 1.

Table 1: Landfills or Transfer Stations Capable of Accepting Stelco LEWF Steel Making Secondary Materials

Waste Disposal Facility	Location	Total Approved Capacity (m^3)	Approved Fill Rate (Tonnes Per Year)
GFL Stoney Creek Regional Facility	Hamilton	6,700,000 + 3,680,000 (EA approved)	750,000
WCC Ridge Landfill	Blenheim	28,900,000	1,300,000

It is noted that this listing is limited as many local or nearby municipally owned or operated waste management facilities are unable to accept the Stelco secondary material because it is not a waste type listed within their respective ECAs. The two landfills noted in Table 1 were contacted directly and confirmed their ability to receive

this waste, although they did note it is a difficult waste type for them to work with. The WCC Ridge Landfill has about 20 years of remaining capacity while the Stoney Creek facility has approximately 15 years remaining capacity. It is therefore concluded that Alternative 1 is a feasible alternative for Stelco to consider.

1.2 Alternative 2 – Landfill Site Expansion

Under Alternative 2, the process to obtain approval for an increase in the disposal capacity of the Quarry Landfill would be undertaken so that waste disposal would continue at this location under the ownership of Stelco. Approximately 1,250,000 m^3 of additional landfill airspace required for the 25 year planning period will be developed and considered, noting that the volume will be refined during the EA.

To determine the technical and economic feasibility of this alternative, an initial technical evaluation of the expected design and operational requirements to successfully obtain approval of an expansion under the *EAA* (Ontario, 1990) and following the requirements of *O.Reg. 232/98* Landfill Standards was undertaken in 2020 (Volume II Supporting Document #1 – Feasibility of Quarry Landfill Expansion). The feasibility study examined two areas for a potential expansion of the Quarry Landfill, assuming a target additional airspace of 870,000 m^3, which was the volume identified at that time.

The first area (described as Expansion Area 1) had an approximately 5 ha waste fill area and flanked the east boundary of the existing Quarry Landfill adjacent to the Quarry Pond. This area is bordered by the Centre Creek valley to the south, Townline Road to the east and the new landfill cell to the north. The northern portion of this area was stripped of overburden material as part of the former quarry operation and is exposed bedrock. The southern portion is a natural forested area.

The increase in waste fill volume capacity within Expansion Area 1 was estimated at 520,000 m^3, less than the targeted volume of 870,000 m^3 for this initial assessment. The maximum airspace available in the area adjoining the east side of the existing Quarry Landfill was limited by natural, physical and geometrical constraints.

The second area (described as Expansion Area 2) had an approximately 8 ha waste fill area and is located east of Townline Road, across from the existing Quarry Landfill and north of “G” Road West. As such, this would be a new landfill area that is physically separate from the existing Quarry Landfill (but would still constitute a landfill expansion). This is a currently unused open area with grass vegetation. The area dips gently to the south from an elevation of 193 masl at the north end to 185 masl at the south end. A shallow drainage ditch traverses this area from north to south and connects to Centre Creek south of the Quarry Landfill. Based on records of previous hydrogeological investigations, this potential expansion area was inferred to have approximately 3 m to 6 m of silty clay overburden directly overlying limestone bedrock.

The increase in waste fill volume capacity with Expansion Area 2 was estimated at 1,010,000 m^3, which exceeds the volume of 870,000 m^3 targeted for the initial assessment.

For both initial expansion Alternatives 1 and 2, a bottom liner and leachate collection system as was used in the new cell were considered necessary to provide the required engineered leachate containment and control.

The areas north and south of the existing Quarry Landfill have Centre Creek running through them and therefore were not considered to have potential for the purpose of expansion. The area to the west of the Quarry Landfill is outside the Stelco property boundary and, as such, was also not considered for possible expansion.

Based on the results of the initial technical evaluation, Alternative 2 was considered to be a reasonable solution, with the understanding that Stelco would utilize currently owned property in the vicinity of the Quarry Landfill.

Since completion of Supporting Document #1 in 2020, the potential volume requiring disposal has been revised as mentioned above to be 1,250,000 m^3. Despite this increase in volume requiring disposal, it is envisioned that the lands to the east of the existing Quarry Landfill would still have the required space to allow for this slightly larger capacity. Additionally, another option that could be considered in the EA is a combination of what was previously described as Alternatives 1 and 2. It was concluded that landfill expansion was a technically feasible alternative for Stelco to pursue.

1.3 Alternative 6 – Do Nothing

In EAs, the Do Nothing alternative is considered in the evaluation of 'Alternatives To' as a benchmark against which the potential environmental impacts and the advantages and disadvantages of the alternatives being considered can be measured and compared. For Stelco, the Do Nothing alternative would be to close the Quarry Landfill when it reaches its approved capacity and not pursue any other solution for waste management. It is noted that one of Stelco's basic operational requirements as a corporation is to be able to provide disposal for or delegate responsibility to properly manage its waste materials. As such, the Do Nothing alternative is not an 'Alternative To' that could be considered to resolve the long-term waste management problem; rather, as stated above, it provides a basis of comparison as part of the EA process.

2.0 ENVIRONMENTAL COMPONENTS, CRITERIA AND INDICATORS FOR 'ALTERNATIVES TO'

A broad set of criteria were developed for comparative evaluation of the 'Alternatives To'. These evaluation criteria cover the components that comprise the natural, social, economic, cultural and built environment as shown in Table 2.

Table 2: Environmental Components, Criteria, Indicators and Data Sources for 'Alternatives To' Screening Assessment

Environmental Component	Evaluation Criteria/ Criterion	Rationale for Including the Criteria/Criterion	Indicators	Data Sources
Atmosphere	■ Potential effects on air quality (including dust, and GHG). ■ Potential effects on noise.	■ Associated activities may produce dust and GHG during construction, operation and closure. ■ Waste management construction and operations may also produce noise at levels that are undesirable to off-site sensitive receptors .	■ Qualitative amount and/or type of emissions generated/ offset due to alternative. ■ Qualitative amount of non-renewable resources conserved. ■ Qualitative relative expected amount of noise from alternative.	■ Quarry Landfill studies/reports. ■ Applicable provincial regulations, standards and guidelines. ■ Aerial mapping.

Environmental Component	Evaluation Criteria/ Criterion	Rationale for Including the Criteria/Criterion	Indicators	Data Sources
Geology and Hydrogeology	■ Potential effects on groundwater resources.	■ Contaminants from site operations may enter the groundwater and impact off-site groundwater.	■ Qualitative possible effect on groundwater quality at the property boundary.	■ Quarry Landfill studies/reports. ■ Aerial mapping. ■ Borehole logs. ■ Published geology and hydrogeology maps and reports.
Surface Water	■ Potential effects on surface water resources.	■ Contaminants from site operations may enter the groundwater and discharge to surface water or runoff directly and impact surface water. ■ Surface water quantity may change at a site because of site development.	■ Qualitative possible effect on surface water quality and/or quantity within the area.	■ Quarry Landfill studies/reports. ■ Aerial mapping. ■ Topographic Maps. ■ Published hydrology maps and reports.
Biology	■ Potential effects on natural environment features (aquatic and terrestrial ecosystems).	■ Contaminants from site operations may adversely affect aquatic or terrestrial life (including rare or endangered species).	■ Qualitative evaluation of possible disturbance of terrestrial and/or aquatic environment.	■ Haldimand County Official Plan. ■ Long Point Region Conservation reports, mapping and data. ■ Quarry Landfill studies/reports ■ Published natural environment reports for the area.
Agriculture and Land Use	■ Potential effects on existing land use and agriculture.	■ The agricultural land base or agricultural operations may be impacted by the site operations. ■ Other land uses, such as residential, may be impacted by the site operations.	■ Approximate number or types of land use conflicts.	■ Haldimand County Official Plan. ■ Aerial and topographic mapping.

Environmental Component	Evaluation Criteria/ Criterion	Rationale for Including the Criteria/Criterion	Indicators	Data Sources
Cultural Heritage	■ Potential effects on archaeological resources. ■ Potential effects on cultural heritage landscapes and built heritage resources.	■ Archaeological resources or areas of archaeological potential may be impacted by site construction operations. ■ Potential cultural heritage landscapes and built heritage resources may be impacted by site construction and operations.	■ Archaeological sites or archaeological potential. ■ Identified known or potential cultural heritage landscape/ built heritage resources.	■ Haldimand County Official Plan. ■ Published technical cultural heritage studies (e.g., archaeological assessments, cultural heritage evaluation reports) where publicly available.
Socio-economic	■ Potential site operational effects on sensitive off-site receptors (i.e., noise, visual, dust).	■ Facilities may potentially affect the use and enjoyment of sensitive uses in the vicinity of the site.	■ Approximate proximity of alternative to potential off-site sensitive receptors.	■ Haldimand County Official Plan. ■ Aerial mapping. ■ Applicable provincial regulations, standards and guidelines.
Technical Considerations	■ Relative ability of Stelco to operate. ■ Relative technical risks associated with the operation of the alternative. ■ Relative costs and timing of approvals. ■ Relative cost of implementation (capital and operational costs).	■ Different methods of waste management can have different risks or effects based on the status of development of the technology, relative maintenance requirements and/or expertise required to operate. ■ Site operations can influence employment and business in the wider regional area. ■ Different methods of waste management can have different costs based on the method, type and amount of engineering required.	• Availability of examples where technology used with similar tonnage. ■ Types of barriers to implementation. ■ Approximate cost per tonne. ■ Anticipated types of approvals required for alternative and level of effort to obtain the approvals.	■ Quarry Landfill studies/ reports. ■ Applicable provincial regulations, standards, and guidelines. ■ Practitioner expertise.

3.0 COMPARATIVE SCREENING EVALUATION OF ‘ALTERNATIVES TO’

The potential effects and/or implications of each of the remaining Alternatives 1 and 2 has been generally identified and described for each of the evaluation criteria. A qualitative assessment methodology was applied to complete a comparative assessment of remaining Alternatives 1 and 2. Information on Alternative 6 is also provided as a basis of comparison. The methodology consists of assigning an overall relative rating from most preferred to least preferred for each alternative, first for each of the criteria and then for the environmental component. Qualitative comparative rating of potential impact uses the descriptors “more preferred”, “less preferred” and “equally preferred”. Based on the description of potential impact for each criterion, the assignment of the qualitative descriptors should be readily apparent and understandable.

The comparative assessment of feasible ‘Alternatives To’ for each criterion is presented in Table 3.

Table 3: Comparative Screening of Feasible 'Alternatives To'

Consideration	Alternative 1: Landfill Site Closure and Export of Waste for Disposal[1]	Alternative 2: Landfill Site Expansion	Alternative 6: Do Nothing
Criteria	Potential effects on air quality (including dust and GHG)		
Comments	Closure of the existing landfill will eliminate the landfill site operations as a possible source of any off-site dust impacts. Increased emissions of GHG from hauling efforts.	Landfill expansion will produce dust during construction and continue to produce dust at levels comparable to the current waste management practices (off-site dust is noted as an issue of concern in consultation from Virtual Consultation Event #1, although it is unclear if this is dust from the landfill or dust from other sources, particularly considering the distance of receptors from the landfill). Available landfill expansion areas are not forested for the most part, so there would be limited to no loss of GHG sequestration associated with an expansion.	Landfill would be capped and closed and the landfill site operations would be eliminated as a possible source of any off-site dust impacts. Non-hazardous steel making secondary materials would accumulate on-site and require management.
Qualitative Rating	Equally preferred	Equally preferred	-
Criteria	Potential effects on noise		
Comments	Closure of the existing landfill would eliminate the landfill site operations as a possible source of any off-site noise impacts. Potential for new haul route noise.	Landfill expansion will continue to produce noise at levels comparable to the current waste management practices (noise is noted as an issue of concern in consultation from Virtual Consultation Event #1 from one individual, although it is unclear if this noise is from the landfill or noise from other sources, particularly considering the distance of the receptor from the landfill). Construction of the new landfill could produce noise.	Landfill would be capped and closed; no noise as all but post-closure maintenance activities would stop. Non-hazardous steel making secondary materials would continue to accumulate on-site and require management.
Qualitative Rating	Equally preferred	Equally preferred	-
Overall Atmosphere Environmental Component Rating	Equally preferred	Equally preferred.	

Consideration	Alternative 1: Landfill Site Closure and Export of Waste for Disposal[1]	Alternative 2: Landfill Site Expansion	Alternative 6: Do Nothing
Criteria	Potential effects on groundwater resources		
Comments	Groundwater quality at current landfill site is in compliance with current monitoring requirements and should gradually improve following site closure. The site to which waste is exported will need to adhere to relevant environmental standards and guidelines and comply regarding potential impact to off-site groundwater. The receiving site may need to alter leachate treatment to accommodate the newly imported material types.	Leachate can affect groundwater in the vicinity of the waste site. The expanded landfill capacity would be developed to comply with provincial standards and guidelines to protect off-site groundwater quality.	Landfill would be capped and closed; leachate generation and migration in groundwater would be ongoing as described for Alternative 1. Risk of leachate generation and groundwater impacts from unregulated waste management practices. Non-hazardous steel making secondary materials would continue to accumulate on-site and require management.
Qualitative Rating	Equally preferred	Equally preferred	-
Overall Groundwater Environmental Component Rating	Equally preferred	Equally preferred	
Criteria	Potential effects on surface water resources		
Comments	Surface water quality at current landfill site is in compliance with current monitoring requirements and should gradually improve following site closure. The site to which waste is exported will need to adhere to relevant environmental standards and guidelines regarding potential impact to surface water. The receiving site may need to alter leachate treatment to accommodate the newly imported material types.	Impacted groundwater can affect surface water in the vicinity of the waste site. The expanded landfill capacity will be developed to comply with provincial standards to protect surface water quality. An expanded landfill will be designed to consider climate change and match post development flows to pre-development flows.	Landfill would be capped and closed; effects on surface water would be as described for Alternative 1. If Stelco does not pursue another waste management alternative, risk of leachate generation and surface water impacts from unregulated waste management practices. Non-hazardous steel making secondary materials would continue to accumulate on-site and require management.
Qualitative Rating	Equally preferred	Equally preferred	-
Overall Surface Water Environmental Component Rating	Equally preferred	Equally preferred	

Consideration	Alternative 1: Landfill Site Closure and Export of Waste for Disposal[1]	Alternative 2: Landfill Site Expansion	Alternative 6: Do Nothing
Criteria	Potential effects on natural environment features (aquatic and terrestrial ecosystems)		
Comments	Existing landfill and landfill to which waste is exported could potentially impact aquatic resources if leachate enters the environment.	Expansion of landfill site could result in disruption and/or destruction of habitat and disrupt the terrestrial environment. Any clearing would be carried out in accordance with provincial and local requirements. Expanded landfill could potentially impact aquatic resources if leachate impacts surface water at sufficiently high concentrations. The expanded landfill capacity will be developed to comply with provincial standards to protect surface water quality.	Landfill would be capped and closed. Increased risk of waste/leachate effects on natural environment from unorganized waste management practices can be expected. Non-hazardous steel making secondary materials would continue to accumulate on-site and require management.
Qualitative Rating	More preferred	Less preferred	-
Overall Biology Environmental Component Rating	More preferred	Less preferred	
Criteria	Potential effects on existing land use and agriculture		
Comments	The closed landfill site would not be suitable for agricultural or other land uses and would likely remain as its current land use designation. The landfill site to which waste is exported is also unlikely to be suited for agriculture or other uses post-closure. Official planning assesses and designates surrounding land uses to be compatible with both waste disposal sites.	Current landfill site property is designated in an area for major industrial use and is suitable for landfilling. There is sufficient area on the Stelco property to accommodate landfill expansion.	Landfill would be capped and closed; effects on land uses in vicinity of the existing landfill site would be as described for Alternative 1. Non-hazardous steel making secondary materials would continue to accumulate on-site and require management.
Qualitative Rating	Equally preferred	Equally preferred	-
Overall land use and agriculture environmental component rating	Equally preferred	Equally preferred	

Consideration	Alternative 1: Landfill Site Closure and Export of Waste for Disposal[1]	Alternative 2: Landfill Site Expansion	Alternative 6: Do Nothing
Criteria	Potential effects on archaeological Resources		
Comments	Minimal, if any, site alteration needed to close the landfill site. Approval of the site to which waste would be exported would have received the required provincial approvals regarding archaeology.	Expansion of landfill site could result in new areas of landfill footprint but within areas of the Stelco property previously disturbed and developed. The area is expected to have archaeological potential. Approval of the site expansion requires provincial approvals regarding archaeology.	Landfill would be capped and closed; effects on archaeology would be as described for Alternative 1. Non-hazardous steel making secondary materials would continue to accumulate on-site and require management.
Qualitative Rating	Equally preferred	Equally preferred	-
Criteria	Potential effects on cultural heritage landscapes and built heritage resources		
Comments	Minimal, if any, site alteration expected to close landfill site. Landfill is well within Stelco property boundary and is estimated to have minimal to no impact on built heritage resources and cultural heritage landscapes. Approval of the site to which waste would be exported would have received the required provincial approvals regarding cultural heritage.	Expansion of landfill site could result in new areas of landfill footprint but within areas of the Stelco property previously disturbed and developed. Given the landfill location within Stelco property, it is estimated the landfill expansion will have minimal to no impact on built heritage resources or cultural heritage landscapes if they exist noting preliminary assessment suggests there are none which is to be confirmed during the EA as required. Approval of the site expansion may require provincial approvals regarding cultural heritage.	Landfill would be capped and closed; effects on cultural heritage would be as described for Alternative 1. Non-hazardous steel making secondary materials would continue to accumulate on-site and require management.
Qualitative Rating	Equally preferred	Equally preferred	-
Overall cultural heritage environmental component rating	Equally preferred	Equally preferred	

Consideration	Alternative 1: Landfill Site Closure and Export of Waste for Disposal[1]	Alternative 2: Landfill Site Expansion	Alternative 6: Do Nothing
Criteria	Potential site operational effects on sensitive receptors (i.e., noise, visual, dust)		
Comments	Closure of landfill site will eliminate the landfill site operations as a possible source for off-site dust or noise effects. Few to no existing sensitive receptors in proximity of current landfill due to lack of neighbours on adjacent properties. Additional hauling for exporting waste could lead to additional noise along haul routes. Two responses to Virtual Consultation Event #1 would prefer export of waste.	Construction and operation of the landfill expansion expected to have similar minimal effects on sensitive existing off-site receptors as current landfill site. Few to no existing sensitive receptors in proximity of current landfill due to lack of neighbours on adjacent properties. Complaints of dust and noise received during Virtual Consultation Event #1, but it is unclear if they are from the landfill or other potential sources. Historically Stelco LEWF has received complaints about dust, but the Quarry Landfill has never been identified as the source of the dust. Expansion will include a haul of material from the HWF.	Landfill would be capped and closed; effects in vicinity of the landfill site would be as described for Alternative 1. Non-hazardous steel making secondary materials would continue to accumulate on-site and require management.
Qualitative Rating	Less preferred	More preferred	-
Overall Socio-economic environmental component rating	Less preferred	More preferred	
Criteria	Relative technical risks associated with the operation of the alternative		
Comments	Risks would be associated with exporting waste to an off-site location (such as increased traffic to handle export methods, available capacity and possibly leachate treatment requirements at the receiving site). Also, longevity or service life of the receiving site.	Common risks and responsibilities associated with landfilling are expected (leachate management, management of nuisances such as dust and noise).	Unorganized waste management within Stelco would lead to increased future difficulty in managing environmental impacts from waste.
Qualitative Rating	Less preferred	More preferred	-

Consideration	Alternative 1: Landfill Site Closure and Export of Waste for Disposal[1]	Alternative 2: Landfill Site Expansion	Alternative 6: Do Nothing
Criteria	Relative Cost and timing of approvals		
Comments	Closure plan for existing landfill will need to be submitted before approved capacity is reached. Preparation of closure plan is expected to take 3 to 4 months and approval of closure plan will take another 9 to 12 months. Approximate total approvals cost is estimated to be 20 to 30 times less than the cost associated with Alternative 2.	Expansion of the current landfill site will require completion and approval of an EA (4 to 5 years total, likely in 2024 to 2025) followed by an amendment to the site's existing ECA (1 year).	Landfill would be capped and closed; costs associated with approvals for closure would be as described for Alternative 1. Unorganized waste management could result in future approvals costs.
Qualitative Rating	More preferred	Less preferred	-
Criteria	Relative Cost of Implementation (capital and operational costs)		
Comments	The 25-year cost of Alternative #1 is 14-15-times more expensive than the 25-year cost associated with Alternative #2. Costs associated with Alternative 1 include the capital closure expenditure as well as the estimated costs and fees associated with the disposal of waste at an off-site landfill. The costs do not include the transportation of material to the—ff-site landfill which would be an additional cost borne by the company.	Costs include the initial capital associated with construction and closure to reach the desired capacity. Some of these capital costs associated with additional construction and progressive closure will occur throughout the 25-year period. Estimated costs also include the annual operating costs of the on-site landfill which are anticipated to be comparable to the current operating costs.	Landfill would be capped and closed; capital costs associated with closure would be as described for Alternative 1. There are no other capital costs; however, unorganized waste management could lead to costs for cleanup or management in the future.
Qualitative Rating	Less preferred	More preferred	–

Consideration	Alternative 1: Landfill Site Closure and Export of Waste for Disposal[1]	Alternative 2: Landfill Site Expansion	Alternative 6: Do Nothing
Criteria	Relative ability of Stelco to operate		
Comments	To export waste, Stelco would need to set up a deal for waste transport and disposal, which is readily in their control.	Stelco has been operating their existing landfilling operations since 1984 and since 2012 with engineering controls and is well positioned to continue with landfilling operations.	No additional activities are required.
Qualitative Rating	Equally preferred	Equally preferred	-
Overall Technical Considerations environmental component rating	Less preferred	More preferred	-

Note: [1] None of the waste management sites identified for waste export have an existing approved operating life long enough to meet Stelco's requirements for long term waste management if 25 years is considered.

A graphical summary of the results of Table 3, as well as the public feedback on the relative importance of the various environmental components and sub-components gathered during Virtual Consultation Event #1, are provided in Table 4. The outcome of this comparative evaluation is the identification of the preferred 'Alternative To' for long term waste management for Stelco.

Table 4: Summary of 'Alternatives To' and Feedback

Component	Sub-component	Alternative 1: Landfill Site Closure and Export of Waste for Disposal	Alternative 2: Landfill Site Expansion	Public Ranking Group[1]
Atmosphere	Air quality/ Greenhouse Gas	🟡	🟡	Very important
	Noise	🟡	🟡	Very important
Geology and Hydrogeology		🟡	🟡	Very important
Surface Water		🟡	🟡	Very important
Biology		🟢	🔴	Very important
Agriculture and Land Use		🟡	🟡	Very important
Cultural Heritage	Archaeological Resources	🟡	🟡	Very important
	Cultural heritage landscapes, built heritage resources	🟡	🟡	Very important
Socio-Economic	Nuisance factors (i.e., dust, noise, visual)	🔴	🟢	Very important
Technical Considerations	Ability to operate	🟡	🟡	Important
	Technical risks	🔴	🟢	Important
	Cost and timing of approvals	🟢	🔴	Less Important
	Capital and operating costs	🔴	🟢	Less Important

Notes:

🟡 represents equally preferred

🟢 represents more preferred

🔴 represents less preferred

1. Three individuals or groups responded to the request for rankings.

golder.com

stelco.com