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SHOREPLAN

July 13, 2022

William R. Hicks
HDS | Hicks Design Studio Inc.
295 Robinson Street, Suite 200
Oakville, Ontario, Canada L6J 1G7

Dear Mr. Hicks

**RE: Natural Hazards Assessment**
**105 Avondale Court, Burlington ON**
**Our File: 22-3717**

This letter presents our assessment of the natural hazards at the above noted property and provides comments on how the hazard limits will affect development setbacks. We have considered the erosion, flooding and dynamic beach hazards at the site, as defined by the Natural Hazards Policy 3.1 of the 2020 Provincial Policy Statement. We have also considered Conservation Halton's policies, procedures and guidelines for the application of Ontario Regulation 162/06. For the purpose of descriptions provided in this letter it is approximated that the main central part of the shoreline faces south.

## Existing Conditions

A site review was conducted on May 27th, 2022. The daily mean water level for that day was approximately 75.2m IGLD 1985 as reported by the gauge in Toronto. The photos presented in this report are from that day.

The subject property is situated at 105 Avondale Court on Lake Ontario. The existing shoreline is approximately 120m long. The site consists of three reaches: one on the east, one central reach and one on the west. The tablelands behind each reach of the shoreline sit at an approximate elevation of 84.2m.

The east reach consists of a stacked armour stone seawall fronted by a concrete deck that has an elevation of approximately 76.4m. A narrow cobble and gravel beach sits to the east of the concrete deck and extends between the deck and the neighbour to the east. The backshore behind the stacked armour stone seawall has large trees on a steep bank. There is a lawn area behind the beach sloping up gently inland. The shoreline of this reach is approximately 25 meter long, measured along the existing seawalls. The neighbouring property to the east is informally protected with concrete rubble and armour stone along the property line with some areas of exposed bank.

The central reach of the subject site is protected with a concrete seawall. The top of the wall is at an elevation of approximately 76.4m. Armour stone has

been stacked in front of portions of this seawall. This seawall extends approximately 90m from the concrete deck on the east to the west reach where it turns to the north. The backshore behind the wall is vegetated with grass and small shrubs on the steep bank.



The west reach of this property is protected with a section of concrete seawall and a low stacked armour stone seawall. This wall extends north to meet the neighbouring property to the west. The bank behind the armour stone wall is heavily vegetated with large trees.

The existing shoreline protection was reviewed and found to not provide a sufficient level of protection to allow a reduction of the erosion hazard. Provision of new shoreline protection with a minimum 35 year design life and maintenance access will be required to reduce the development setback at the site as described below.

## Shoreline Hazard Assessment

The Provincial Policy Statement identifies three natural hazards that must be considered along the shores of the Great Lakes: the dynamic beach hazard, the flooding hazard and the erosion hazard. Each of those hazards is discussed separately below.

i) Dynamic Beach Hazard

The definition of a dynamic beach is described in the Technical Guidelines to the Provincial Policy Statement. The dynamic beach hazard does not apply to this site. The existing beach does not meet the minimum length, width and depth requirements outlined in the provincial guide.

ii) Flood Hazard

The flood hazard limit is defined as the 100-year flood level (which is the instantaneous water level with a 1% probability of occurrence) plus an allowance for wave uprush and other water related hazards. MNR (1989) calculated 100-year flood levels along the Great Lakes shorelines using a combined probability analysis of the 100-year monthly mean lake level and the 100-year wind setup (storm surge). The subject property is located in a sector which has a 100-year flood level of 75.9m GSC.

Our recent review of the MNR (1989) 100-year flood levels has indicated that they should be higher when the recent high water levels of 2017 and 2019 are considered. Our review for the Oakville area has indicated that the 100-year water level should be increased to 76.3m GSC. This level was used in our review.

With the existing shoreline protection in place the waves would overtop the existing concrete seawall and stacked armour stone wall, and wave run up will extend up the bank. The wave uprush and overtopping will not extend past the top of the bank on the west and central reach. Wave up rush will extend up the

beach and above the seawall backing the beach in the east reach of the property. For the purposes of shoreline hazard assessment, we applied a minimum default 15m flood hazard setback from the high-water level elevation until the details of the store protection are determined. The flood hazard will not be the governing hazard at this site. We have not shown the flood hazard on Figure 1.



Detailed wave uprush will be calculated for each protection structure and reach in the detailed design phase.

iii) Erosion Hazard

The erosion hazard limit consists of two components: an erosion allowance plus a stable slope allowance. The erosion allowance is calculated as 100 times the average annual erosion rate for unprotected shoreline.

The technical guide to the Provincial Policy Statement (PPS) describes the parameters to be used to determine site specific erosion rates and provides a province wide default of 0.3 metres per year, which is to be used in the absence of site-specific data. Conservation Halton's Regulations also require the use of a 0.3 metre per year erosion allowance. Applied over a 100-year time frame, that gives an erosion allowance of 30 metres, measured horizontally from the toe of the natural bank.

The stable slope allowance is a product of the stable slope and the slope height. The technical guidelines specify a 3H:1V stable slope to be used in absence of a site-specific geotechnical report. Such a report was completed by Terraprobe Inc. and issued December 10, 2015. A copy of the report is attached to this submission. They determined the stable slope at the site to be 1.8h:1v. The stable slope allowance is a function of the toe of bank and the backshore elevations for the noted stable slope. As the tableland elevation varies across the site, we have projected the 1.8:1 slope from the erosion limit to the tableland along the site. The line represents the erosion hazard limit and is shown on Figure 1.

**Development Setbacks**

Conservation Halton can allow development within the erosion hazard as long as the hazards are addressed. The shoreline erosion hazards can be addressed with the implementation of protection works designed to prevent shoreline erosion.

The construction of new protection along the shoreline with a design life of at least 35 years would allow for a 10m reduction of the erosion hazard to 20m, resulting in a total engineered development setback limit as shown in Figure 1. Provision of access to maintain the structure is a requirement to allow this reduced setback. Maintenance access must be a minimum of 5m wide from a public roadway to and along the protection structure to ensure it maintains its functionality over its design life.

Conservation Halton's Regulations also controls the location of swimming pools under section 3.46.6 of their Shoreline Policy (2015). The pool development setback is determined using a 30 year planning horizon or 9 meters plus a stable slope allowance. The pool setback, assuming the existing protection works will be replaced with a structure that meets CH protection works standard, is shown on Figure 1. The line is shown for a portion of the site from the west side of the property to the top of bank that turns north along the valley in the east portion of the site only. The pool setback within the valley is not controlled by the by the same parameters.



The assumed provision of the new shoreline protection with a 35 year design life addresses the erosion hazard component of the pool setback. The pool development setback, as shown, is determined using only the long-term stable slope allowance from the toe of bank. Maintenance access of 5 meters along the top of a new structure would also need to be provided. The greater of the 5m allowance from the back of the protection works or the stable slope allowance would govern the pool setback. The influence of the protection works on the setback of the pool can only be determined once a new protection structure has been designed and as such is not shown in Figure 1.

## Concepts Designs

It is our opinion that simple repair or moderate upgrading of the existing shore protection works to meet the Protection Works Standard required by Conservation Halton is not a practical solution. We propose that the protection works are replaced with a new structure, while maintaining most of the existing works in place. We are proposing two alternative cross-sections of an armour stone revetment. These are applicable in the south and west facing shorelines. A seawall section is proposed for the beach area in the east part of the site.

The alternative revetment sections are presented on Figure 2. First alternative is a single layer special placement armour stone revetment. This type of structure is shown in Photo 6. Second alternative is a random placement armour stone revetment which consists of two layers of armour stone. This structure type is shown in Photo 7. Both structures can be designed to meet the CH required design standard. Double layer armour stone typically provides a more robust structure with lower wave run up. The single layer provides a more uniform and elegant appearance and provides easier access into the water. The cost of the double layer is expected to be marginally, 10% to 20%, higher than the single layer. However, we caution that supply of high quality armour stone required for the single layer armour stone has become limited and the cost difference may be less than anticipated. We suggest $12,000 per metre of shoreline is carried as a budget for shore protection works.

Other variations of these basic revetment structures can be developed to complement landscape design and site features.

The shoreline in the east reach, where a cobble beach with a timber wall exists, can be improved with a stacked armour stone seawall to replace the existing timber wall. A typical section of the seawall is shown on Figure 2. An image of

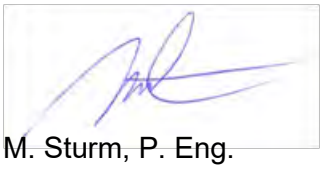
a similar seawall is shown on Photo 8. We suggest $5,000 per metre of shoreline is carried as a budget for shore protection works within the east reach.

It is unclear if the beach portion of the east sector will require a protection upgrade or if CH Halton will accept protection improvements in the high bank portions of the site only. It can be argued that the provision of the shore protection along the south side will limit the erosion potential in the beach area. It is also unclear that how far the protection works need to extend on the west side of the site. We are proposing that protection works stop at the property line, but this view may be challenged by CH.

**Closing Comments**

We trust these comments will assist you as you develop your plans for this property. Please do not hesitate to call us if you have any questions about this letter.

Yours truly
Shoreplan Engineering Limited



M. Sturm, P. Eng.



### Photo 1 East Reach of Shoreline - Concrete Pad



### Photo 2 East Reach of Shoreline - Cobble and Gravel Beach



### Photo 3 Central Reach of Shoreline



### Photo 4 West Reach of Shoreline



**Photo 5 Backshore**



**Photo 6 - Example of Single Layer Revetment**

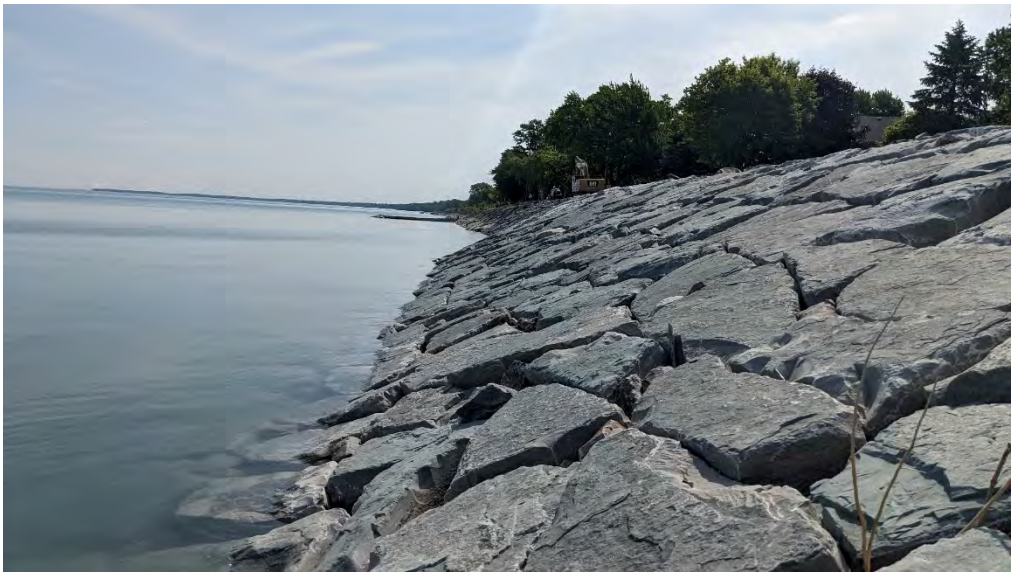


**Photo 7 - Example of Double Layer Revetment**



**Photo 8 - Example of Stacked Seawall**



LOT 13

REGISTERED PLAN No 1233

BLOCK "A"

RIGHT OF WAY AS IN JUDGE'S PLAN 1233

3.048m RIGHT OF WAY AS IN JUDGE'S PLAN 1233

PART 1, PLAN 20R6382
SUBJECT TO UNION GAS EASEMENT AS IN INST 597917

OUTLINE OF EXISTING DWELLING

PROPOSED DWELLING

EROSION HAZARD LIMIT

LOT 25

ENGINEERED DEVELOPMENT SETBACK WITH NEW PROTECTION WORKS AND MAINTENANCE ACCESS

STABLE SLOPE ALLOWANCE (1.8H : 1V)

EROSION ALLOWANCE (30m)

EROSION ALLOWANCE WITH PROTECTION & ACCESS (20m)

POOL SETBACK

TOP OF BANK

TOE OF BANK

WEST REACH

CENTRAL REACH

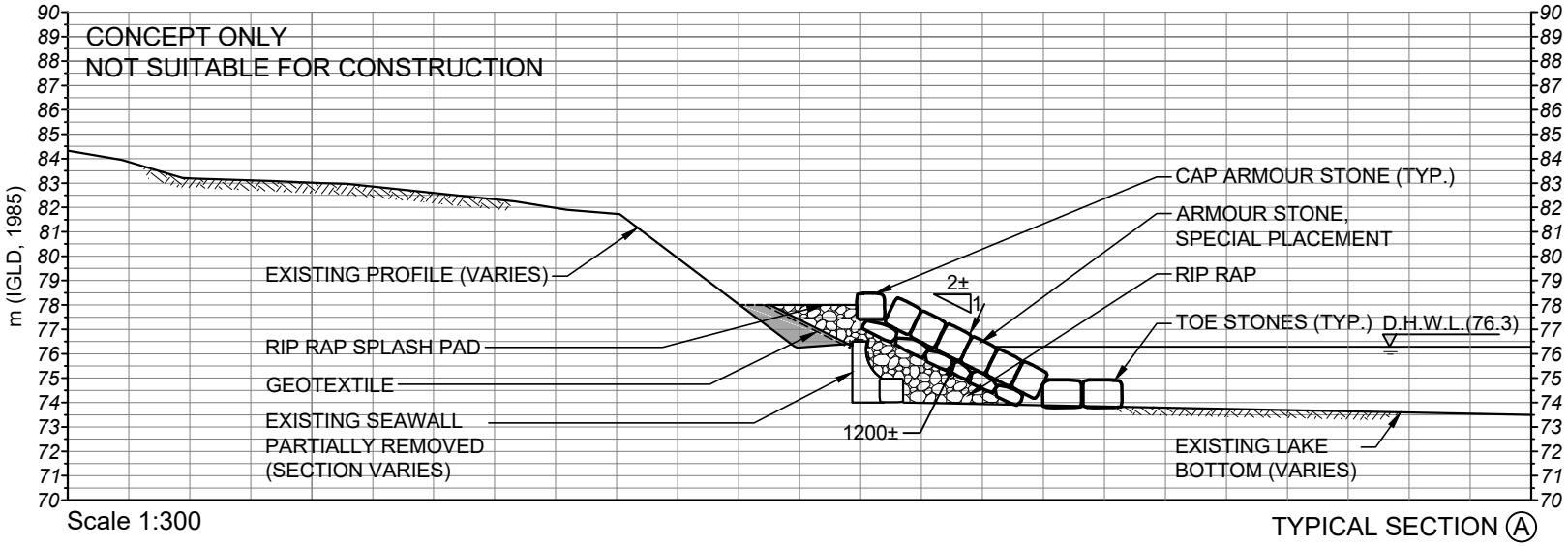
EAST REACH

LAKE ONTARIO

Project #22-3717
Scale 1:400
SHOREPLAN

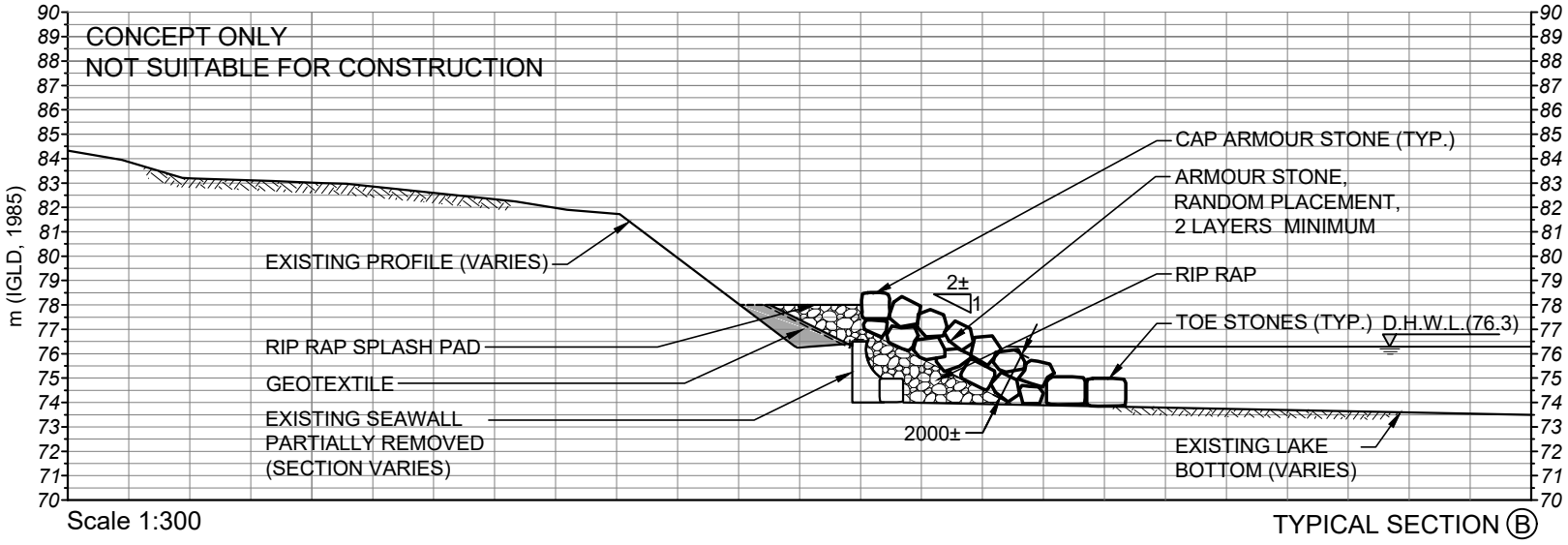
Figure 1
105 Avondale Crt. Burlington
Hazard Limits & Development Setback

Drawing Location: S:\Shoreplan Project Files\Files 3700-3799\22-3717 105 Avondale Crt Burlington (Hicks)\Drawings\22-3717 r0c.dwg




Scale 1:300

TYPICAL SECTION Ⓐ




Scale 1:300

TYPICAL SECTION Ⓑ

Project #22-3717
Scale 1:300
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Figure 2
105 Avondale Crt. Burlington
Typical Sections

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