

**MUNICIPAL PLANNING COMMISSION AGENDA  
SUMMER VILLAGE OF BIRCHCLIFF  
SUMMER VILLAGES ADMINISTRATION OFFICE  
MARCH 3, 2021 @ 9:00 A.M.**

- A. CALL TO ORDER**
- B. ADOPTION OF AGENDA**
- C. DEVELOPMENT ITEMS**
  - 1) 101 Birchcliff Road
- D. ADJOURNMENT**

**Summer Village of Birchcliff – Municipal Planning Commission****Agenda Item****March 3, 2022****101 Birchcliff Road (Lot 3A, Block 2, Plan 8020413)****Development Permit Application****Background:**

An application was submitted by the homeowner of 101 Birchcliff Road (Lot 3A, Block 2, Plan 8020413) in the Summer Village of Birchcliff for escarpment stabilization including retaining walls and a new set of stairs. This property is in the R1 District (Lakeshore Residential).

The development proposed will take place on the escarpment of the property. Currently there is a set of stairs and wood platforms leading down to the lake that encroach onto the neighbouring property, this will be removed and replaced with the proposed retaining walls and a new set of steel stairs. 3 trees will be removed from the escarpment and will be replaced along with other natural, native vegetation that includes a natural no mow zone.

**Discussion:**

This application is before MPC for the following reasons:

- Mechanized Excavation, Stripping and Grading is listed as a discretionary use; therefore, the decision must come from the Municipal Planning Commission.
- Land located below the top of bank/top of escarpment should be in a natural state, a variance is required.

**Recommendation:**

After reviewing the application and all relevant planning documents, it is the recommendation of administration to approve the application for the escarpment development. The Municipal Development Plan 6.3.4 states “Birchcliff recognizes that remedial actions may be necessary from time to time, the village strongly desires that banks abutting the shoreline remain as natural as possible to retain natural ecosystems.” The shoreline and bank measures appear necessary according to the geotechnical report, and the proposed development show the escarpment to have natural/native landscaping with a no mow zone. Adjacent landowners have been notified and no response has been received.

## Conditions:

If approved, Administration would recommend the following conditions:

- Completions Deposit of \$4,000.00.
- Vegetation to be planted according to the landscaping plan, including the replacement of the trees with a no mow zone adjacent to the lake. The no mow zone shall be a buffer strip of vegetation that includes native plantings that let aquatic vegetation grow to maintain a stable natural state, a no mow zone allows native plans to seed and reestablish.
- Escarpment work to be completed in accordance to the geotechnical report recommendations.
- No work to be done on the shoreline or in the water without approval from Alberta Environment and Parks and is to be submitted to the Development Officer prior to work commencing.

## Authorities:

For a discretionary use in any district:

- The Municipal Planning Commission may approve an application for a Development Permit:
  - With or without conditions;
  - Based on the merits of the proposed development, including it's relationship to any approved statutory plan, non-statutory plan, or approved policy, affecting the site;
  - Where the proposed development conforms in every respect to this Land Use Bylaw; or
- May refuse an application for a development permit based on the merits of the proposed development, even though it meets the requirements of the Land Use Bylaw; or
- Subject to provisions of section 2.4 (2), the Municipal Planning Commission shall refuse an application for a development permit if the proposed development does not conform in every respect to the Land Use Bylaw.

The MPC may:

- Grant a variance to reduce the requirements of any use of the LUB and that use will be deemed to comply with LUB.
- Approve application even though the proposed development does not comply or is a non-conforming building if:
  - It would not unduly interfere with the amenities of the neighborhood, or
  - Materially interfere with or affect the use, enjoyment, or value of neighboring parcels of land, And
  - It conforms with the use prescribed for that land or building in the bylaw.

- Consider a Variance only where warranted by the merits or the proposed development and in response to irregular lot lines, parcel shapes or site characteristics which create difficulties in siting structures within the required setback or in meeting the usual bylaw requirements, except there shall be no variance for Parcel Coverage or Building Height.

**Decision:**

In order to retain transparency of the Commission, Administration recommends one of the following:

1. Approve the application with or without conditions (*Section 642 of the MGA*), or
2. Deny the application stating reasons why (*Section 642(4) of the MGA*).



Proposed Development for demoliton. January 19,2022

Demolition of existing stair structure will be required. The operation will be carried out in the winter months when many people are not occupying there summer cabins. Existing wood will be hauled away and disposed of as required. Land will be reclaimed as per engineered drawings with new piles and stair case installed.

Thank you



Statement of existing and proposed uses. January 19,2022

We are currently using the existing structures and land as our access to lakefront and docking.

Development to take place will also be for access to lakefront and docking, as well as to shore up the cliff at the lakeshore to prevent further erosion of land.

Thank you



## Statement Tree Removal. January 19,2022

3 Trees must be removed from the bank area as indicated on drawings. They must be removed to complete the stabilization of the bank. New sweedish aspen trees to be planted on the bottom tier of the development along the new retaining wall to minimize the look of the new retaining wall . No other trees to be effected during construction of retaining wall and stairs.

Thank you



Letter Of Intent. January 19,2022

Our intention is to remove the existing stair case down to the lakeshore, and replace with new retaining walls and staircase to stabilize the lakeshore.

Thank you

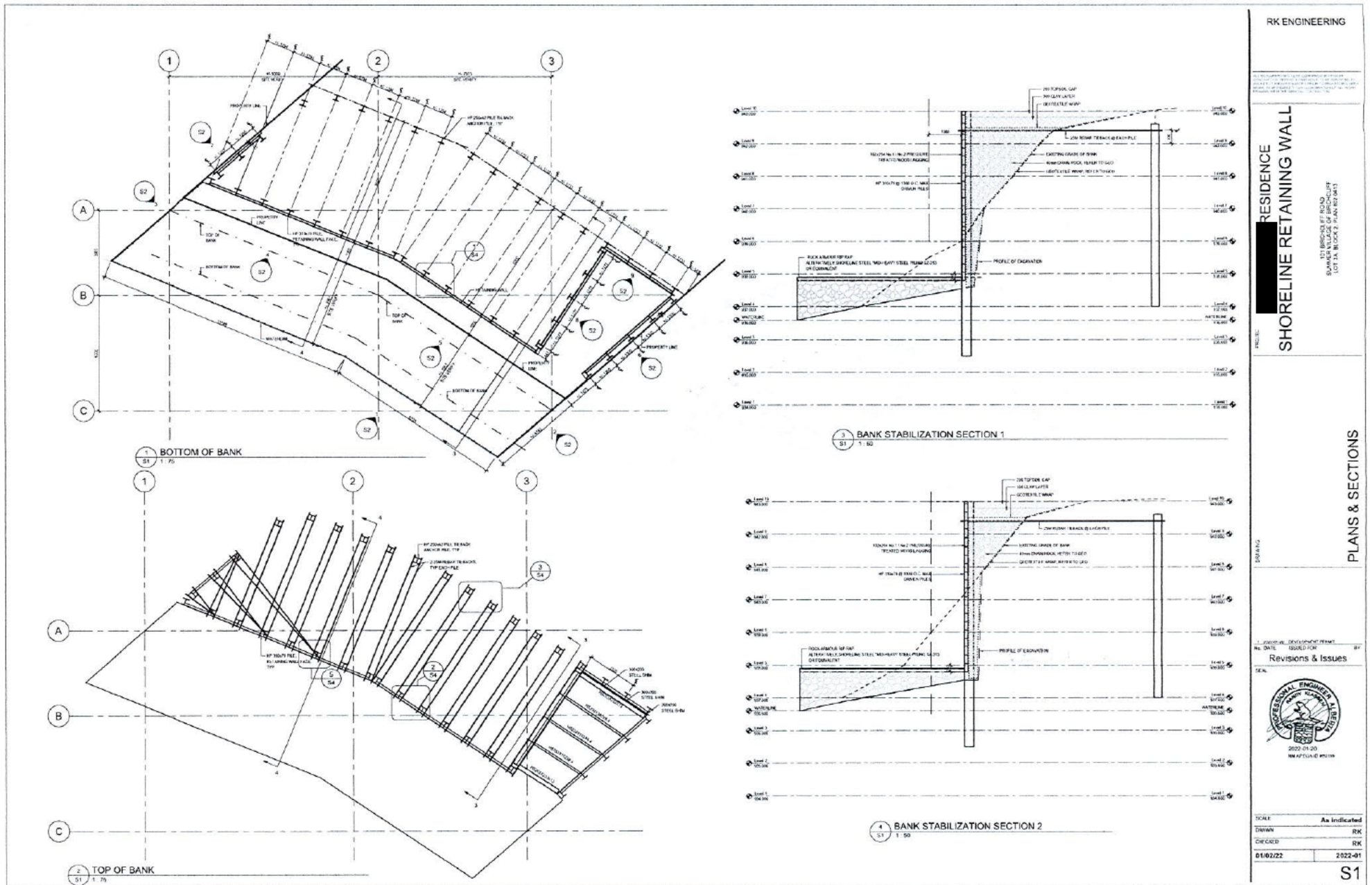


## Neighbouring Slopes . February 8,2022

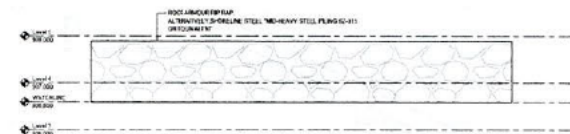
The work being performed on the bank at 101 Birchcliff Road will not affect the neighbouring slopes. Side retaining walls will be installed to ensure the work done to the bank will not affect either neighbour. Side retaining walls are designed to hold the land back from going to the side as well as the main retaining wall holding the land back from the lake.

Thank you









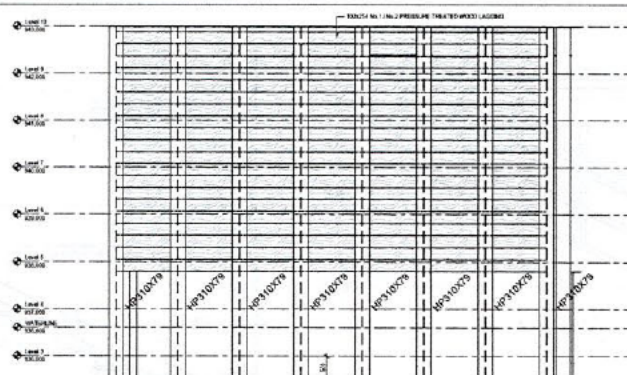
1 BOAT DOCK RETAINING WALL 1  
S1 1:50



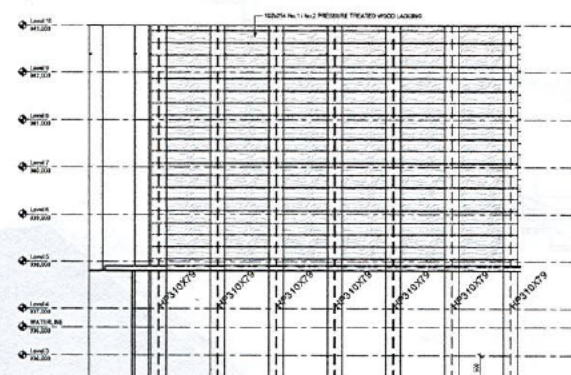
2 BOAT DOCK RETAINING WALL 2  
S1 1:50



3 BOAT DOCK RETAINING WALL 3  
S1 1:50



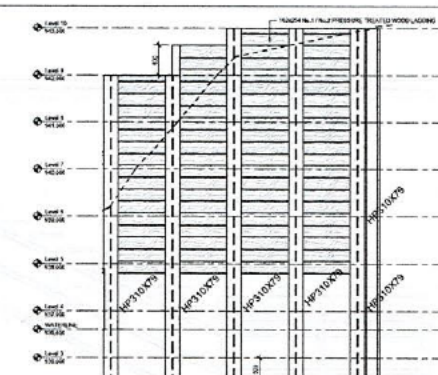
4 BANK STABILIZATION RETAINING WALL 1  
S1 1:50



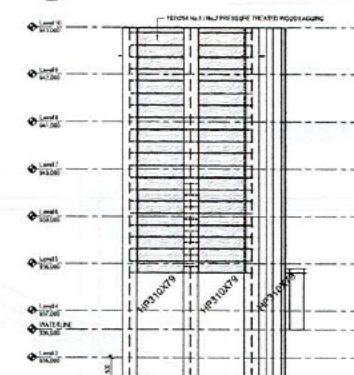
5 BANK STABILIZATION RETAINING WALL 2  
S1 1:50



6 BANK STABILIZATION RETAINING WALL 3  
S1 1:50



7 BANK STABILIZATION RETAINING WALL 4  
S1 1:50



8 BANK STABILIZATION RETAINING WALL 5  
S1 1:50



9 BANK STABILIZATION RETAINING WALL 6  
S1 1:50

RK ENGINEERING

PROJECT  
RESIDENCE  
SHORELINE RETAINING WALL

1000 BUCKINGHAM ROAD  
LOT 3A BLOCK 3 PLAN 02/04/13

RETAINING WALL  
ELEVATIONS

1. PROJECT DEVELOPMENT PERMIT

RE. DATE: 1/20/2018 FOR

Revisions & Issues

SCALE

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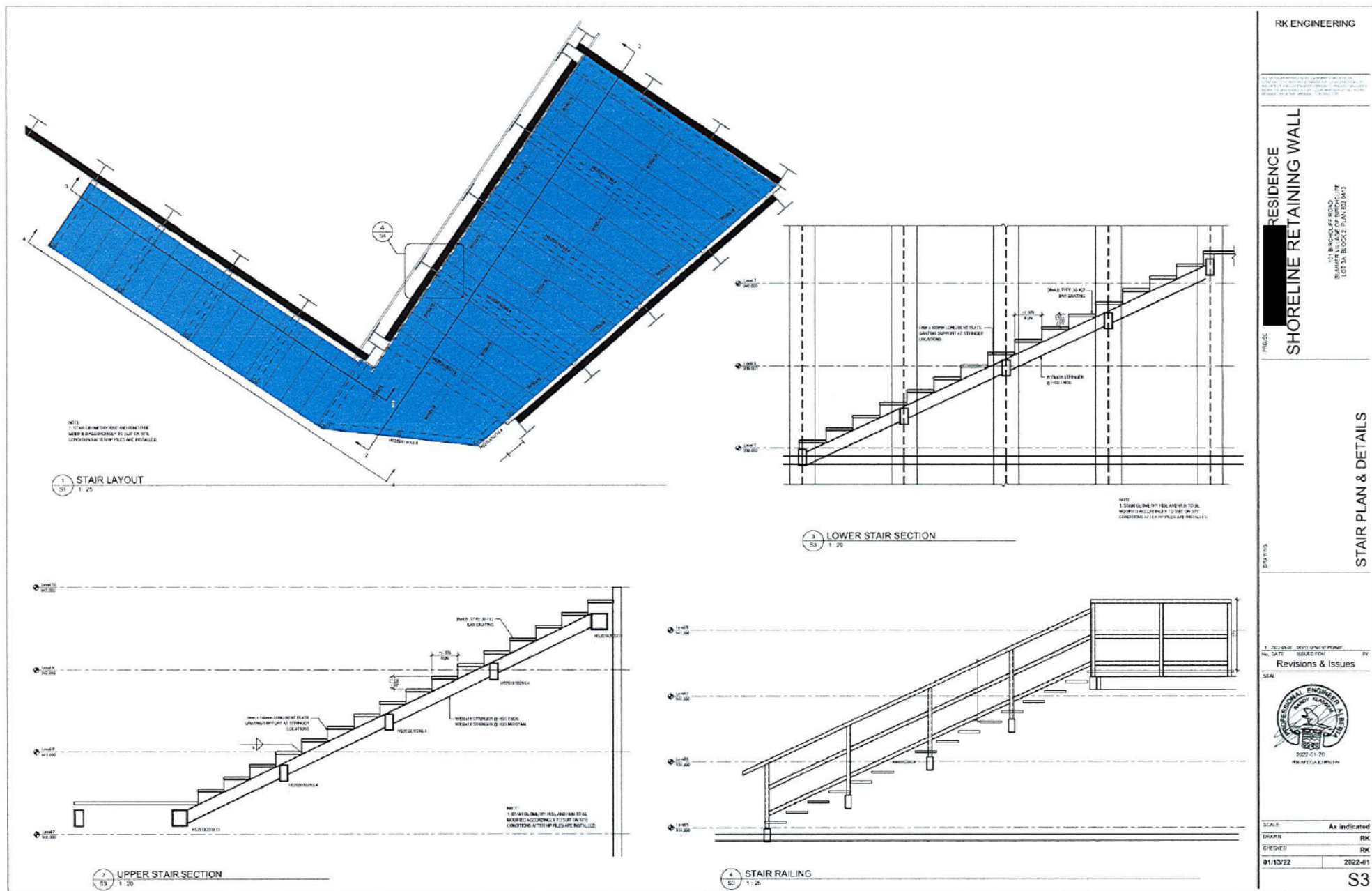
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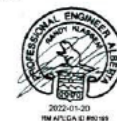


RESIDENCE  
[REDACTED]  
SHORELINE RETAINING WALL

101 BIRCHCLIFF ROAD  
HUNTER VILLAGE OF BIRCHCLIFF

## DETAILS

No.	DATE	ISSUED FOR	
<b>Revisions &amp; Issues</b>			



SCALE	1:1
DRAWN	R
CHECKED	R
01/02/22	2022-0

S4

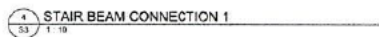


FIGURE 1  
RESIDENCE  
SHORELINE RETAINING WALL

101 BIRCHCLIFF ROAD  
SUMNER VILLAGE OF BIRCHCLIFF

## DESIGN NOTES AND SCHEDULES

## Revisions &amp; Issues

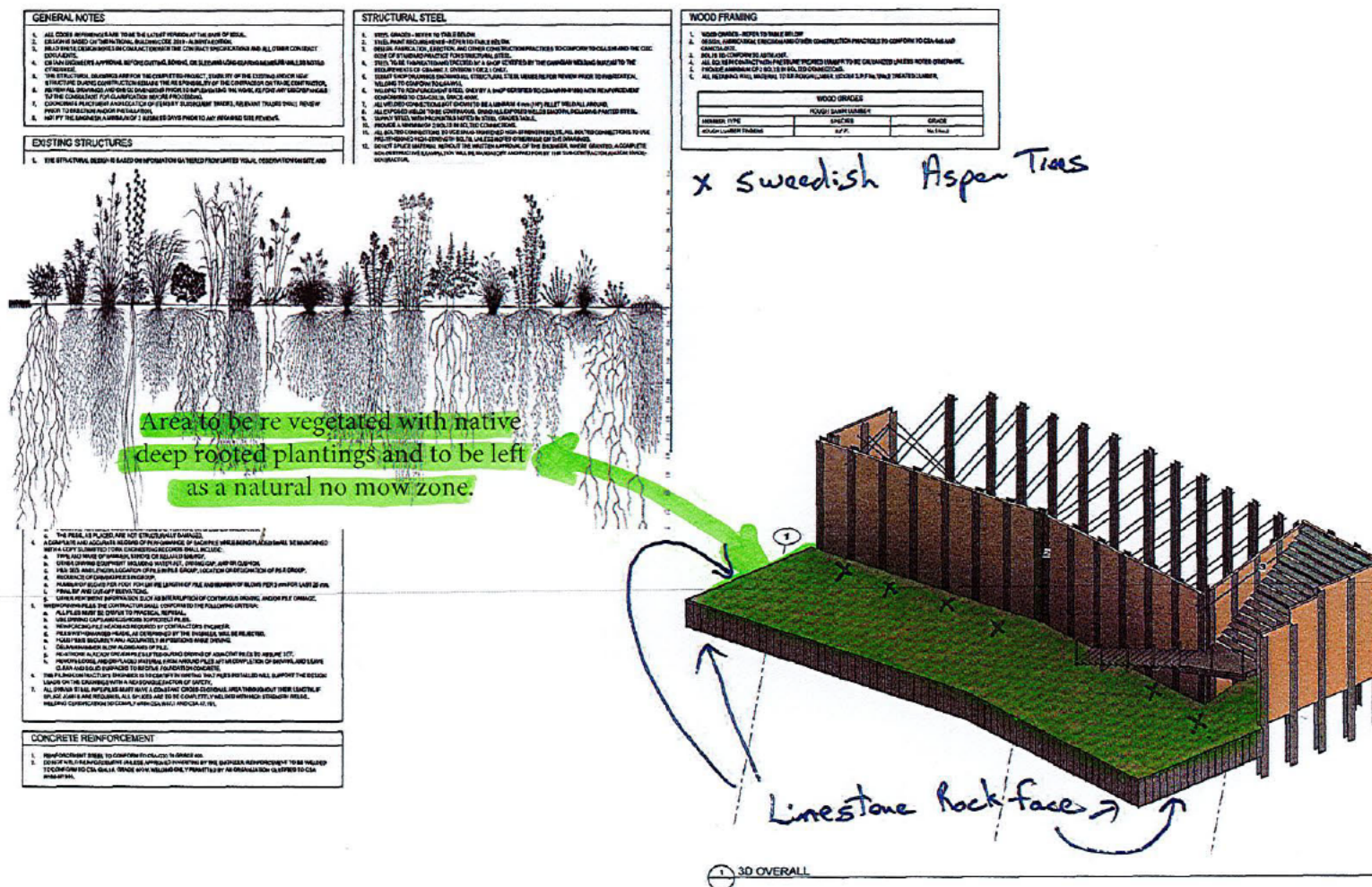
## Revisions & Issues



2152-01-00

ACAGE	1:1
ISSUANCE	RM
ON/CARD	RM
09/16/22	2022-09

SO





[illegible]

1. THE STRUCTURAL DESIGN IS BASED ON INFORMATION GATHERED FROM LIMITED VISUAL OBSERVATION ON SITE AND SITE SURVEY.
2. VERIFY ALL EXISTING DIMENSIONS AND CONDITIONS ON SITE PRIOR TO IMPLEMENTING ANY OTHER WORK.
3. THE OWNER IS REQUESTING THAT ANY SITE CONDITIONS THAT DIFFER FROM THE CONTRACT DOCUMENTS BE THE RESULT OF CHANGES.
4. SHORE AND UNDERPINNINGS ARE REQUIRED TO PREVENT SETTLEMENT TO ADJACENT STRUCTURES, STREETS, ROADSWAYS AND UTILITIES.
5. FLOODPLAIN AND EROSION STUDIES ARE THE RESPONSIBILITY OF THE CONTRACTOR TO MAINTAIN EXISTING STRUCTURE AND ROADWAY, AND ALIAS UNDESIRABLE DAMAGE, INSTANT AND/OR DELAYED CONSEQUENCES.

[illegible][illegible]

1. REINFORCEMENT STEEL TO CONFORM TO CSA-G30.18 GRADE 400.
2. DO NOT WELD REINFORCEMENT UNLESS APPROVED IN WRITING BY THE ENGINEER. REINFORCEMENT TO BE WELDED TO CONFORM TO CSA-G30.18 GRADE 400S WELDING ONLY PERMITTED BY AN ORGANIZATION CERTIFIED TO CSA W59.1-1970.

[illegible]

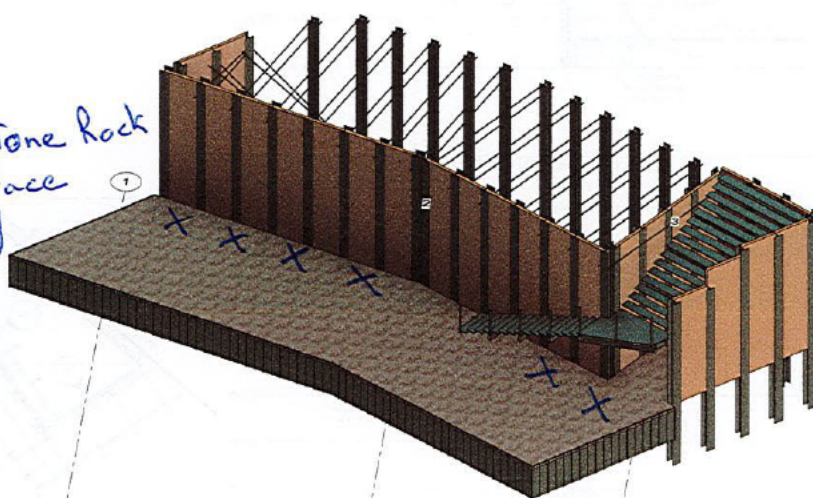
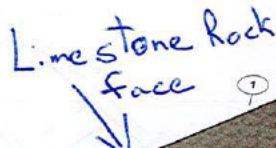
MEDIA TYPE		GRADE
QUILTED MEDIUM TILES	CSA GLEIT BURN	
WELDED WEEF FLANGE SECTIONS	CSA GLEIT BURN	
WELDED STRUCTURAL SECTIONS	CSA GLEIT BURN CLASSIC	
W/OUT STRUCTURAL BRACKETS AND PLATES	CSA GLEIT BURN	
W/OUT		
IN-OR-OUT ROOF	ASTM F1582 GRADE 36	
THREADS 6000	ASTM A563	

STEEL PAINT REQUIREMENTS	
<b>ZONE 1 - ENVIRONMENT SYSTEM</b> 1. PAINTS MUST BE TESTED FOR BRACKETS COMBUSTION, GRAIN- SPREAD, OR REDUCE IN BRASSION	<b>PART 3 - PREPARATION REQUIREMENTS</b> 1. ALL SURFACES MUST BE PREPARED COMMERICAL, 100% CLEANING, TO BE INSURE THE TESTED TO CONFORM TO THE SPECIFICATIONS

STEEL CLEANING REQUIREMENTS	
SPECIFICATION - SUBJECT	CLEANING REQUIREMENTS
SP-11 / NON-REINFORCED STEEL CLEANING	BLAST CLEANING TO AT LEAST TWO THIRDS OF EACH

[illegible]

X-Swedish Aspen

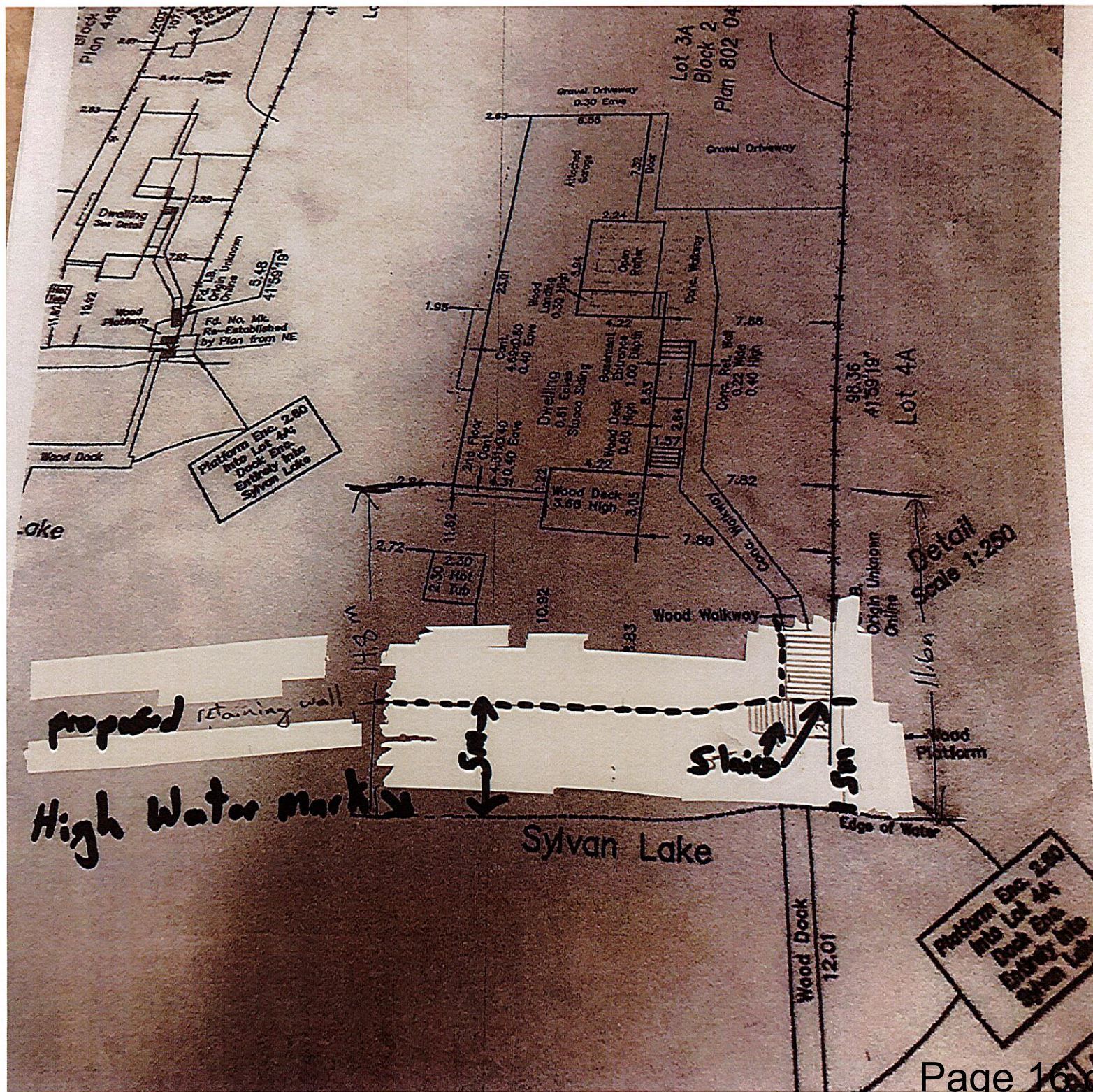


3D OVERALL









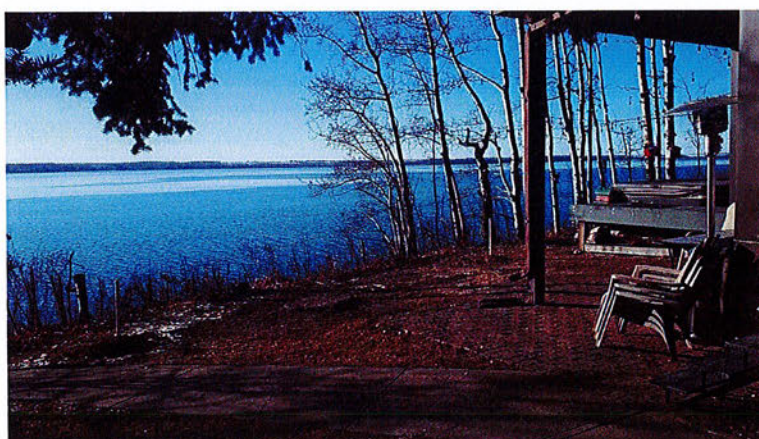




**Smith Dow**  
& Associates Ltd.

- Foundation and Geotechnical Engineering
- Soil Investigation and Site Assessment
- Slope Stability Reports
- Environmental Audits
- Material Testing: Soil, Asphalt, and Concrete

**Proposed Slope Stabilization and Retaining Structure  
101 Birchcliff Road  
Summer Village of Birchcliff, Alberta**



File No: 101 Birchcliff Road

December 15, 2021



- Foundation and Geotechnical Engineering
- Soil Investigation and Site Assessment
- Slope Stability Reports
- Environmental Audits
- Material Testing: Soil, Asphalt, and Concrete

December 15, 2021

File No: 101 Birchcliff Road

Attn: [REDACTED]

**Re: Proposed Slope Stabilization and Retaining Structures**  
**101 Birchcliff Road**  
**Summer Village of Birchcliff, Alberta**

At your request, we conducted a geotechnical investigation at the above referenced location on October 13, 2021. At the time of site drilling, the subject property contained an existing residential structure with a basement and a detached garage on the site. It is our understanding that the existing septic tank, residence and garage will remain on site in their current place.

The subject slope to be analyzed was a southwest facing slope primarily covered with minor vegetation and decking structures. The slope began to decline at a fairly steep gradient from the slope crest towards Sylvan Lake. The southwest facing downward slant contained various gradients as per the two provided cross-sectional drawing from Compass Geomatics. Our scope of work for this report is strictly for recommendations regarding slope stabilization and erosion control of the southwest slope facing the lake. All existing structures and their conditions (residence, garage, septic tank, ect.) are not included within the scope of this report.

The observed localized erosional features associated with the slope were considered and posed minor threat to the existing slopes. However, the erosion along the slope should be addressed to protect the existing slope surface.

The purpose of this investigation was to determine the general extent and nature of the subsurface materials encountered along with some basic engineering properties of the subsurface soil. Environmental studies are beyond the scope of this report.

**Field Investigation**

Two (2) bore holes were required at this site. Both test holes were opened near the crest of the slope in accessible areas. A specialized track mounted drilling rig with continuous flight auger was utilized to drill the test holes. The approximate locations of the test holes are shown on drawing #1.

The holes were advanced incrementally by auguring approximately 1.6 meters into the ground and withdrawing soil on the auger vanes. All samples retained were carefully sealed to prevent moisture loss and subsequently taken to our Soil Mechanics Laboratory for further analysis.

The in-situ strength of the soil was determined in the field by conducting a series of standard penetration tests and obtaining the corresponding blow count - N values. Where cohesive materials were encountered, pocket penetrometer tests were performed.



## **Subsurface Features**

### **A) Subsoil Conditions**

The soil profiles, as logged at the borehole locations, are shown on drawing No.'s 2 through 4 inclusive, Appendix A. Results of field and laboratory tests are shown on the borehole logs.

The soil profile at the test hole areas consisted of surficial topsoil, native clayey silt till, native clay till and siltstone / sandstone bedrock. The geotechnical report should be read in conjunction with information provided in the attached soil logs.

### **Topsoil / Organic Silt**

Topsoil / organic silt material was encountered across all test holes locations. The topsoil / organic material was primarily a mixture of topsoil and silt. Its thickness ranged from approximately 100 – 125 millimeters thick at the test hole locations. It should be noted that the thickness and characteristics of the fill material may vary across the site during site construction.

The fill material is unsuitable as foundation material to support any structural load. Exterior flatworks, brick / stoneworks, etc. resting on the on-site fill soil could experience some differential movement. Any fill material placed near the slope crest or along the slope will reduce the stability of the slope with the existing slope parameters. All excavated soil during construction should be moved from the sloped portion of the property.

### **Clayey Silt Till**

Clayey silt till was encountered beneath the topsoil / fill material. The native clayey silt till was detected in various regions within both test holes. In borehole #1, the clayey silt regions were encountered at 0.6 – 0.9 meters and 7.9 – 11.9 meters. In borehole #2, the clayey silt till was noted at depths of approximately 0.6 – 1.2 meters. The olive brown colored native clayey silt soil was primarily stiff in consistency. The native clayey silt till was characterized with white mineral deposits, stones to pebbles, rusting, grey streaks, coal specks and bedrock fragments. Damp interlayers were noted at occasional elevations within the native clay deposit.

### **Clay Till**

In the upper regions of both boreholes, clay till deposits were documented directly below the clayey silt till. The clay till was encountered at depths of approximately 1.2 – 4.0 meters across borehole #1 and #2. The light brown colored native clayey soil was primarily stiff to very stiff in consistency with some firm interlayers. The native silty clay till was characterized with white mineral traces, rust stains, coal, stones, bedrock fragments, grey siltstone traces and some tan color zones within the clay till region.

The on-site clayey soil with a plastic index of about 19.6% can be classified as inorganic clay with medium plasticity. The clayey soil has a medium potential to swell when in contact with water. It is imperative penetration of surface and subsurface water (such as pipe leakage) into the native clay subgrade soil should be prohibited. All subsurface plumbing work must be completed to the highest standard to prevent leaking. Any leakage could cause undesirable movement of the slab or exterior flatworks and reduce the stability of the slope.

**Sandstone / Siltstone**

Sandstone / siltstone extended to the bottom of both test holes. In borehole #1 locale, the first section of bedrock material was encountered at a depth of approximately 4.3 meters and extended to 6.2 meters. The second section of bedrock material discovered in borehole #1 was found to immediately after the clayey silt till at depths of roughly 12.2 meters below grade. The tan / golden brown bedrock material was slightly weathered and dense to very dense in consistency in the upper regions of both boreholes. As drilled depth increased, it became very dense to hard in consistency. Difficult augering was experienced in the bedrock regions of the two test holes.

In view of the presence of relatively shallow bedrock measured from the slope surface and varied bedrock hardness, installation of pile foundation could be difficult. Predrilling to allow driven piles socketed into the shallow bedrock and encased in concrete might be required. Alternatively, tiebacks near the bottom section of the driven piles might be required to secure the piles at the bottom. Test piles should be installed to ensure the piles can be driven to the required embedded depth with no vibration impacting the structural integrity of surrounding structures.

**B) Groundwater**

Underground water was detected at various elevations in each of the boreholes on October 13, 2021. Two slotted PVC standpipes were installed in borehole #1 and #2 locations for monitoring the groundwater levels. On October 20 and 28 of 2021, the watertable measurements were recorded and summarized as follows in the table below. Both water table measurements were very similar during the two site visits. Topographic survey and borehole elevations were provided by Compass Geomatics as shown on their cross-sectional slope profile.

Hole	Approximate Borehole Elevation (meters)	Groundwater Level recorded in standpipes (meters)	Groundwater Level Measured from Existing Grade (mbg)
1	943.05	936.65	6.40m
2	943.02	936.72	6.30m

**mbg = meters below grade**

It should be noted that the water conditions were observed in a relatively short term and may not represent stabilized ground water readings. The groundwater table has the potential for short term upward fluctuations during periods of snow melt or precipitation. These seasonal fluctuations will impact subgrade support conditions and excavations.



### C) Stability of Slope

Field observation revealed the southwest facing slope appeared to have apparent signs of erosion within the subject property at the time of site drilling. Though groundwater or seepage was not directly noticed on the slope surface neighboring the building site, the potential of seepage or springs cannot be wholly discounted of under all circumstances.

Slope stability analyses was carried out using the slope computer program (Geostudio) to evaluate the stability of the existing southwest facing slope profile in its current state and with the proposed construction of new retaining system to stabilize the stability of the slope. The slope stability analyses were to determine the factors of safety (FS) for various slip planes through compelling development features.

The slope factors of safety (FS) based on the proposed slope retaining wall configurations constructed throughout from the slope crest were analyzed.

The following conservatively assumed soil parameters were used:

Soil Type	Unit Weight (kN/m <sup>3</sup> )	Cohesive Strength (kPa)	Angle of Internal Friction (degree)
Topsoil / Organic	15	0	10
Native Clayey Soil	20	10	32
Bedrock	22	0	50

Essentially, a factor of safety (FS) of less than 1 indicates that failure is expected. Given the possibility of soil variation, groundwater fluctuation, erosion and other factors, slopes with FS ranging between 1.0 and 1.3 are considered to be marginally stable. A “long term” stable slope to have a calculated FS of at least 1.5 is required for structures constructed at or near the slope.

On account of the present slope configuration, existing vegetation and decking structures on the slope, the stability of the slope based on the cross-sectional profiles from Compass Geomatics were analyzed under the following conditions.

- a) The first stage of the slope stability analysis was under “normal” groundwater conditions and existing slope parameters found in cross-sectional profiles #1 and #2.

The first stage of the slope stability analyses of the existing slope profiles confirms a long-term factor of safety (F.S.) of 1.417 for cross section #1 and 1.758 for cross section #2. This means the existing parameters of the slope along cross section of hole #2 crest is deemed stable. The F.S.'s of 1.758 exceed the minimum required FS of 1.5. Whereas, the slope cross section along hole #1 is on a borderline of F.S. = 1.417 which is less than the minimum requirement of F.S. of 1.5. Proper retaining wall structure should be provided to protect the slope surface.

- b) The second stage of slope stability analysis was under the assumption of simulated high groundwater level utilizing the cross-sectional profiles #1 and #2.

The second stage of the slope stability assessment also confirmed a long-term factor of safety (F.S.) of 1.196 for cross section #1 and 1.552 for cross section #2. The F.S. of 1.196 reveal that the cross-sectional profile #1 is only marginally stable. Under these conditions, only the cross-sectional profile #2 exceeds the minimum required FS = 1.5.

- c) The third stage of slope stability analysis is using the cross-sectional profile #1 and proposed slope modifications to help stabilize the slope.

The third stage of the slope stability analysis with the proposed slope modifications and a properly designed retaining wall reveals a factor of safety (F.S.) of 1.870 can be obtained. This means the construction of an engineered retaining wall with setback and measurements as per the slope stability drawings increases the factor of safety to over 1.5. The F.S. of 1.870 exceed the minimum required FS of 1.5. The new engineered retaining wall should be maintained at least one meter inside of the property line.

- d) The final stage of slope stability analysis is using the cross-sectional profile #1 and proposed slope modifications with an engineered retaining wall to help stabilize the slope with the addition of a simulated high groundwater table.

The final stage of the slope stability analysis with the proposed slope modifications and an engineered retaining wall reveals a factor of safety (F.S.) of 1.617. This means the construction of an engineered retaining wall maintaining about one meter inside of the sloped property line with the addition of a simulated high groundwater still maintains a factor of safety of over 1.5. The F.S. of 1.617 exceed the minimum required FS of 1.5.

On November 22, 2021, our office conducted a meeting to discuss retaining wall construction parameters. Present at this meeting was Mike Touchette, Martin Touchette and Philip Kwong. The proposed slope configuration from the last two stages of slope stability reflects the construction and design parameters that were discussed.



In order to maintain the stability of the slope, it is imperative the following should be adhered to:

- a) In view of the presence of steep slope, customer prefers to use driven H steel piles with wood lagging to be installed along the slope. Installation of the driven H steel piles will likely minimize excavation along the slope and could be more cost effective. However, vibration of the driven steel piles could impact the existing and surrounding structures. As well, all driven H piles and tieback must be properly designed by a qualified structural engineer and the shallow depth and varied hardness of the bedrock could create some difficulty in piling. Review of the pile designs could be required during test pile installation.
- b) Full time pile inspection by our personnel during construction of retaining wall and backfilling operation. As quality and elevation of the bedrock will vary at each pile location, our personnel has to confirm its required depth and penetration resistance.
- c) Proper drainage and site grading must be maintained in order to maintain the stability of the slope.
- d) All other recommendations in this geotechnical report.

The following sections regarding recommendations for retaining wall construction parameters, soil compaction, the slope developments, site grading, subsurface drainage, and different stages of site inspections as required must also be adhered to for maintaining the stability of the slope during and after construction.

## Recommendations

### A) Driven Steel Piles

By virtue of our findings at the two test hole locations and the customer intent of creating a retaining structure with driven H steel piles and wood lagging, driven steel can be considered for the support of structural loading of the proposed retaining structure. The driven H steel piles may be designed as end bearing piles embedded in the bedrock and with a combination of tie-backs to support the required lateral loading. All end bearing piles should be driven to practical refusal in the dense to hard shale bedrock deposits.

- 1) The bedrock is relatively close to the slope surface, especially near the property line area. It is advisable that the driven steel H piles should be maintained about 1.5 meters or more inside the property line and more towards the slope crest in order to provide additional frost covering for the piles. The required horizontal distance of the driven piles away from the property line has to be reviewed by our personnel during test pile installation.
- 2) For piles driven to practical refusal, the factored ULS end bearing resistance may be determined by multiplying the cross-sectional area of the pile at the tip by  $0.35 F_y$ .  $F_y$  is the yield strength of the steel. The maximum permissible value of  $F_y$  should be supplied by the manufacturer.
- 3) The factored ULS resistance values are determined by multiplying the ultimate resistance values by a geotechnical factor of 0.4.
- 4) All driven H steel piles must be driven to practical refusal under an imparted energy of 32, 600 Joules. For preliminary design, refusal criteria can be taken as 5 blows per 25 millimeters over the last 150 millimeters. Our representative will determine the actual refusal criteria required during pile driving operations, when the pile weight, driving energy, pile details and load carrying capacities are determined / known.
- 5) Practical pile refusal depths are roughly estimated in the upper regions of the sandstone/siltstone stratum. Test piles can be installed to ensure the steel pipe piles can be driven to the required depths due to change in siltstone elevations and varying soil deposits encountered in the test hole locations. As hard driving is anticipated, thicker pile wall should be contemplated. Any piles not reaching the refusal criteria must be extended using proper welding techniques.
- 6) All driven steel piles should be embedded about one meter or deeper into the bedrock to minimize the frost jacking of the piles. Where less pile embedment into the bedrock can be achieved, some potential frost jacking on the driven piles could occur. This could be obvious for shallow steel sheet piles of about one meter above the lake water are installed along the slope toe for boat ramp storage.
- 7) Any structures built on the slope including deck must be supported by properly designed driven piles.
- 8) Frost heave forces will also act on the underside of tieback anchors embedded within the freezing zone. An upward heaving pressure in the order of 1000 kPa or greater could be encountered. The potential of frost heaving forces can be greatly reduced by the placement of compressible material or by providing a void of at least 100mm between the underside of the tieback anchors and soil.



The finished grade adjacent to the tieback anchors should be properly sloped away to prevent the surface runoff from infiltrating and collecting in the void space or in the compressible medium. If water is allowed to accumulate in the void space or the compressible medium becomes saturated, frost heaving pressure will become evident.

- 9) In the pile design, a structural engineer should be consulted to ensure that the foundation is adequate to support the vertical, horizontal and dynamic loading of the proposed retaining structure.
- 10) Site classification for seismic site response for the subject property is E.
- 11) If driven piles are installed in frozen ground, the zone of frost should be predrilled. Predrilled pilot holes should be no greater than 90 percent of the pile diameter.
- 12) Pile driving may result in significant vibrations which may be unacceptable for adjacent structures. In areas where this is a concern, continuous monitoring of vibrations induced in adjacent structures is recommended in order to assess the potential damage and the need for modification of procedures. A detailed damage survey of nearby structures is recommended prior to pile driving.
- 13) In accordance with the Alberta Building Code, full time inspection by our geo-technical personnel is necessitated to confirm that the piles are installed in accordance with design assumptions and that the driving criteria to reach load carrying capacities are satisfied. A complete driving record of blows per 300 millimeters of penetration for each pile should be obtained and reviewed by the pile designer.



**B) Soil Lateral Pressure**

Due to current slope configurations, soil parameters and erosion noted near the crest of the slope, construction of a retaining structure is needed to sure the long-term stability of the slope.

- 1) All retaining walls must be properly designed by a qualified structural engineer to ensure they can withstand the following anticipated soil lateral pressures and over-burden load.
- 2) The lateral pressures are dependent on the soil type behind the wall, the wall orientation, exposure to frost action, the slope of the backfill away from the wall, and compactive effort used.
- 3) For the general case of a permanent vertical wall with horizontal backfill, lateral earth pressures may be computed using the following equation:

$$P = KQ + KrH$$

Where:

- P = Lateral earth pressure at depth H below ground level (kPa)  
 Q = Surcharge loading at the ground surface (kPa)  
 K = Coefficient of lateral earth pressure  
 r = Total unit weight of soil backfill compacted to at least 95% Standard Proctor Maximum Dry Density (kN/m<sup>3</sup>)  
 H = depth below ground level (meters)

- 3) Recommended designed values for these parameters will depend on the type of backfill used. Recommended designed values are given in the table below:

<b>Lateral Earth Pressure Parameter</b>		
<b>Type of Backfill</b>	<b>Total Unit Weight (kN/m<sup>3</sup>)</b>	<b>Coefficient of Lateral Earth Pressure K</b>
Free draining material (40mm Rock)	21	0.4
Clay	20	0.7

The values given above are for backfill compacted to 95 % Standard Proctor Maximum Dry Density. If the density of the backfill is increased, the lateral pressures acting on the wall should be reviewed.

The following should also be considered in the wall design:

- 1) Prior to the placement of drain rock between the retaining wall and slope, a layer of geotextile filter cloth should be placed to completely wrap around the drain rock, including the top to prevent fine material from contaminating the draining medium.
- 2) Applicable surcharge loading should be applied if applicable.
- 3) It is imperative that proper steps be taken to prevent any water that infiltrates the backfill soil from accumulating behind the wall. If water is allowed to permeate the soil behind the wall, large additional pressures will be applied to the wall. The drain rock surface should be covered with approximately 300 millimeters of compacted clay to prevent water from seeping into the draining medium.

**C) General Slope Recommendations**

The following general recommendations apply to maintain the stability of the slope during and after construction at this site.

- 1) In order to reduce the possibility of surficial sloughing, the slopes outside of the new retaining wall structure must be kept well vegetated at all times. The factor of safety of a slope will increase slightly as vegetation is maintained on the slope surface to protect the subgrade soil from weathering.
- 2) The native soil could be susceptible to erosion. Surface drainage and roof water must be discharged on the ground surface and kept away from the developed slope and the new retaining structure. No water is permitted to discharge below grade as that could cause erosion and potential slope failure.
- 3) All underground services should be installed to the highest standards to minimize the risk of seepage infiltration into the slope area due to leaking water.
- 4) No fill or excavated material may be placed at the top of the slope with the exception of any designed retaining wall.
- 5) Automatic sprinkler system, ornamental fountains, other water retaining structure are prohibited.
- 6) The finished site grade should be properly sloped to direct all surface water from the house and sloped areas. A minimum grade slope of 3% is advised at this site.



**D) Foundation Concrete**

A water soluble sulphate concentration test were completed on one soil samples randomly collected from a selected borehole locations indicated a water soluble concentration of 0.046%. In accordance with current CSA standards, the degree of sulphate exposure may be considered negligible and the use of sulphate resistant hydraulic cement is not required for concrete in contact with local soil. It is advisable water soluble sulphate concentration tests should be completed on any imported fill to verify the sulphate resistant requirements for concrete elements in contact with fill material.

Concrete element exposed to de-icing salts or other substances containing chlorides should be designed in accordance with an exposed concrete classification pertaining to concrete exposed to chloride attack. As well, subsurface concrete could be subject in seasonal saturated conditions. Air-entrainment should be incorporated into any concrete elements that are exposed to freeze-thaw to enhance its durability. In accordance with Clause 4.1.1.1 of CSA A23.1-19, where more than one exposure condition applies to concrete elements, the concrete shall be designed to meet the highest specified 28 day compressive strength, the lowest water-to-cementing materials ratio, the highest range in air content, and the most stringent cement type requirement.

**E) Construction Monitoring**

The engineering design recommendations presented in this report are based on the assumption that an adequate level of inspection will be provided during construction and that all construction will be carried out by a qualified contractor experienced in construction.

- for pile construction
- verification of the penetration resistance along the pile shaft and documentation of the install and configuration of each pile by our representative.

**Closure**

This report is based on the findings at the borehole locations. Should conditions encountered during construction appear to be different from those shown by the test holes, this office should be notified immediately so that we may reassess our recommendations on the basis of the new findings. Recommendations presented herein may not be valid if an adequate level of inspection is not provided during construction or if relevant building code requirements are not met.

Soil conditions, by their nature, can be highly variable across a construction site. The placement of fill during and prior to construction activities on a site can contribute to variable near surface soil conditions. A contingency should be included in the construction budget to allow for the possibility of variations in soil conditions, which may result in modification of the design, and / or changes in construction procedures.

This report has been prepared for the exclusive use of [REDACTED] and their agents, for specific application to the development at 101 Birchcliff Road, Summer Village of Birchcliff, Alberta. Any use that a third party makes of this report, or any reliance or decisions based on this report, are the sole responsibility of those parties. It has been prepared in accordance with generally accepted soil and foundation engineering practices. No other warranty is made, either expressed or implied.

Sincerely,  
**Smith Dow and Associates Ltd. (Red Deer)**

*Philip Kwong*

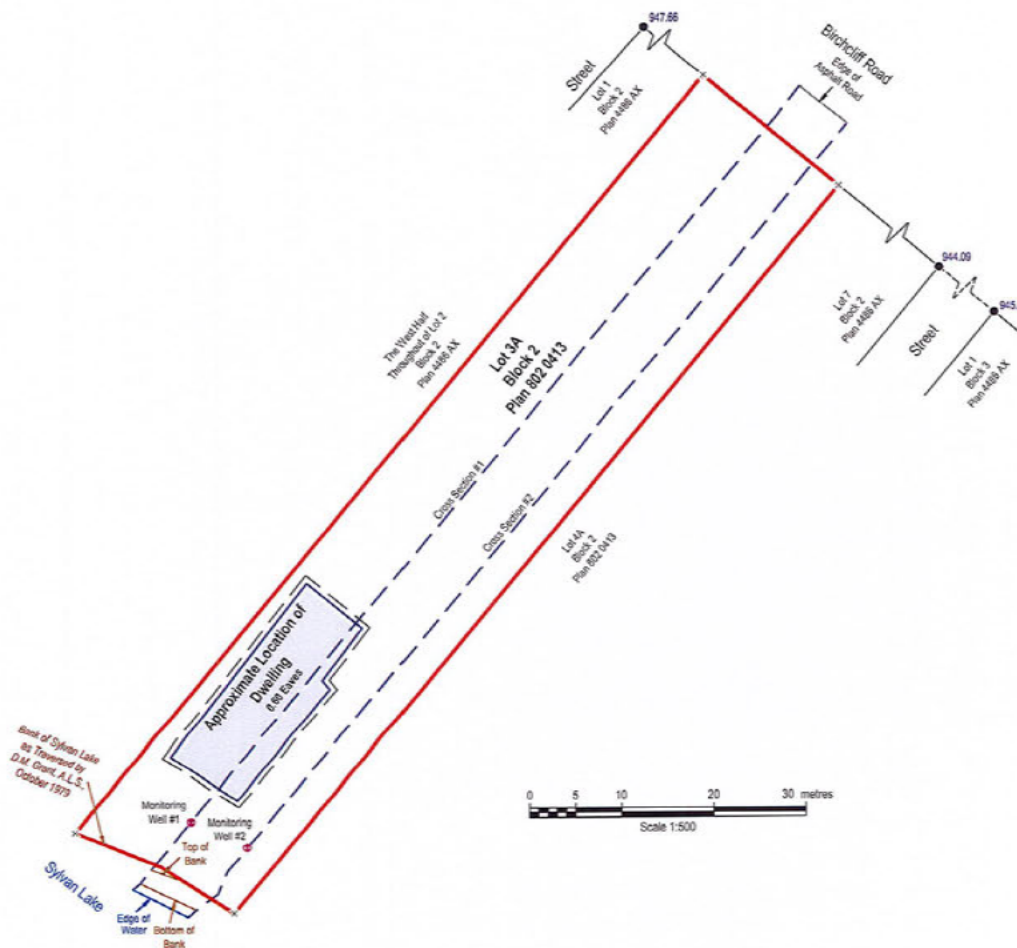
Philip Kwong (P.Eng)



**APPENDIX - A**

# PLAN SHOWING CROSS SECTIONS

Civic Address: 101 Birchcliff Road,  
Summer Village of Birchcliff, Alberta  
Legal Description: Lot 3A, Block 2, Plan 802 0413



0 5 10 20 30 metres  
Scale 1:500

**COMPASS**  
Geomatics Ltd.

11-4008 82nd Street  
Red Deer, Alberta T4N 6T3  
Office (403) 256-0111 Fax (403) 256-0114  
www.compassgeomatics.ca



COMPASS DWG: 01467-21-MSC-RD SURVEYED BY: CN

## REVISION SUMMARY

Original Issue (11/10/21) DRPC

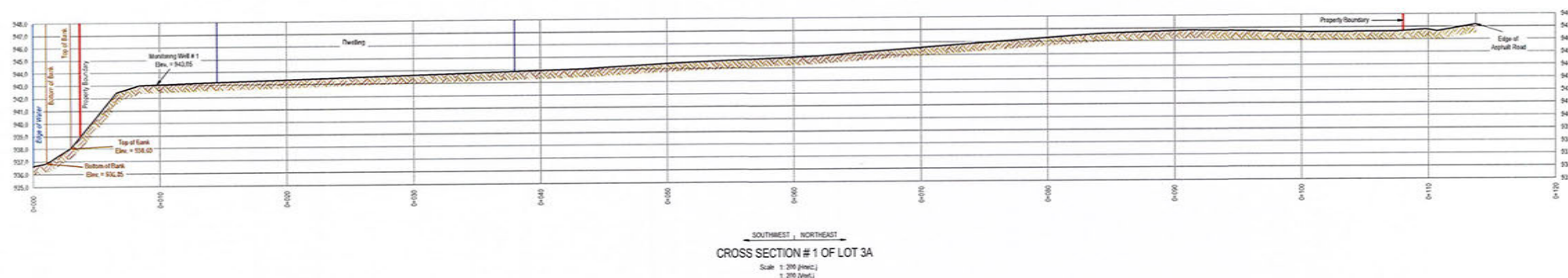
CLIENT: [REDACTED]

REV. PAGE  
1 of 3



**PLAN SHOWING CROSS SECTION # 1**

Civic Address: 101 Birchcliff Road,  
Summer Village of Birchcliff, Alberta  
Legal Description: Lot 3A, Block 2, Plan 802 0413



**COMPASS**  
Geomatics Ltd.

11-400 2nd Street  
Sudbury, Ontario L6N 5T3  
Office (416) 256-0111 Fax (416) 256-0114  
www.compassgeomatics.ca

COMPASS Geomatics Ltd. 11-400 2nd Street Sudbury, Ontario L6N 5T3

**REVISION SUMMARY**

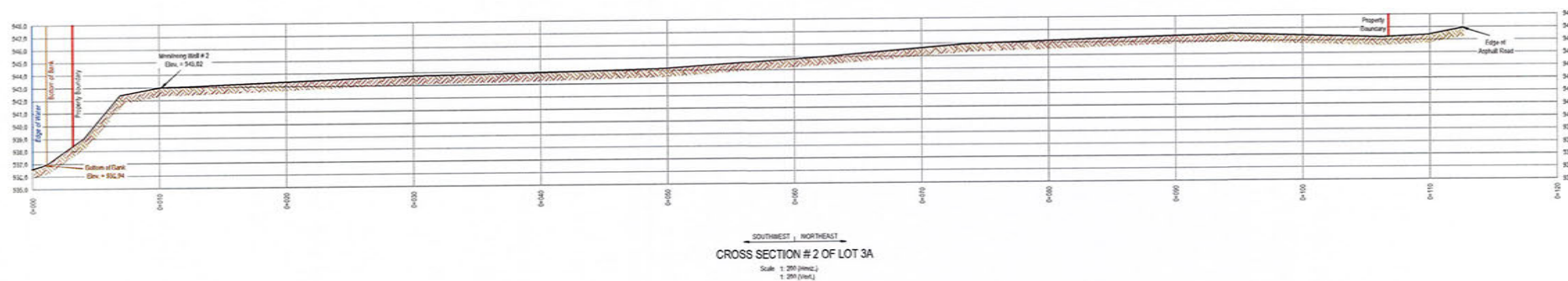
1 ORIGINAL ISSUE (11/05/05) DAPC

REV. PAGE  
2 of 3



**PLAN SHOWING CROSS SECTION # 2**

Civic Address: 101 Birchdell Road,  
Summer Village of Birchdell, Alberta  
Legal Description: Lot 3A, Block 2, Plan 802 0413



**COMPASS**  
Geomatics Ltd.

11-4000 42nd Street  
Red Deer, Alberta T4N 6T3  
Office (403) 254-8111 Fax (403) 254-8114  
www.compassgeomatics.ca

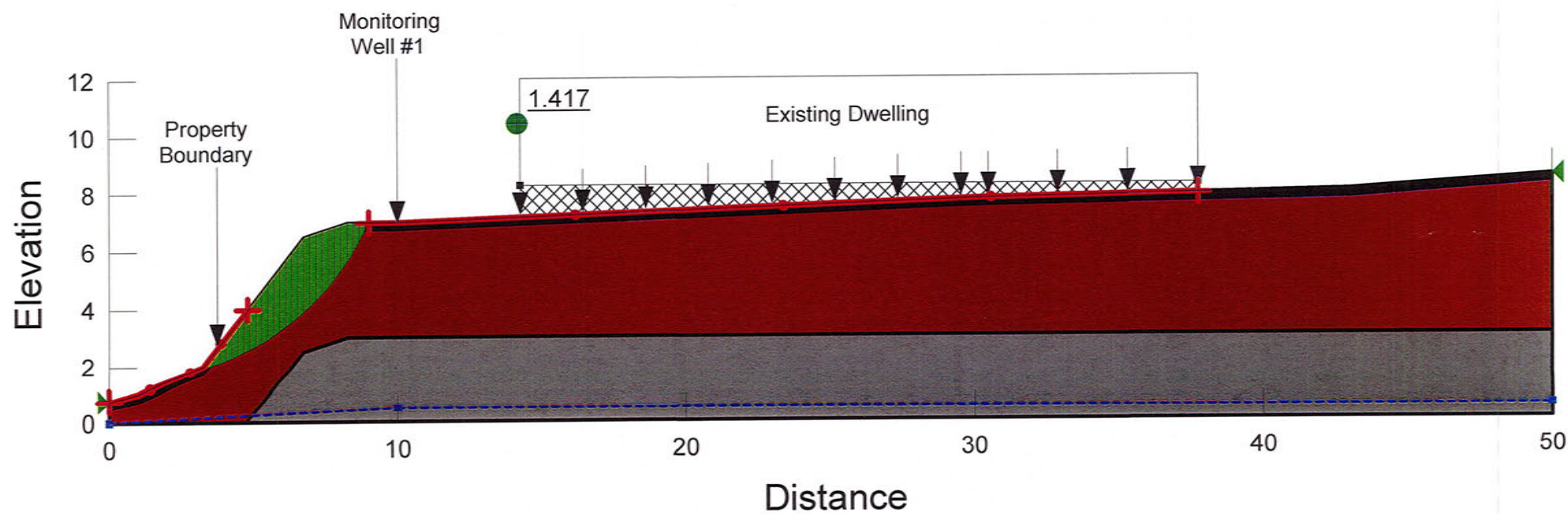
CHARTERED SURVEYORS' REGISTRATION NO. 11112-21-0000-0000

**REVISION SUMMARY**

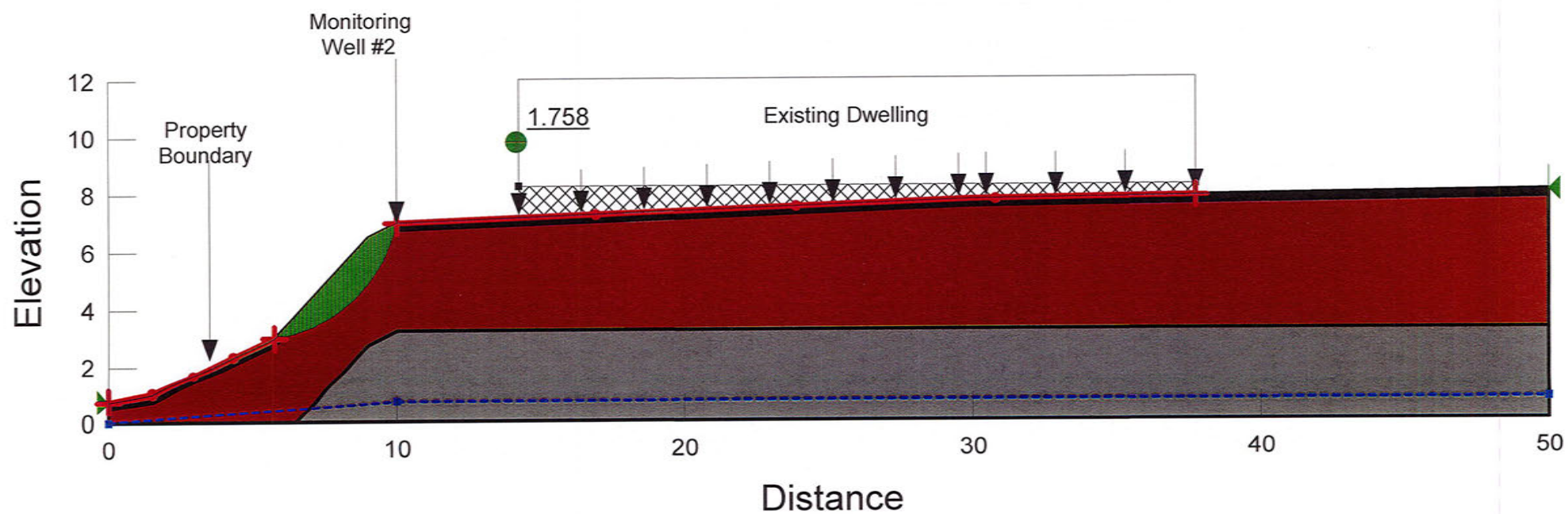
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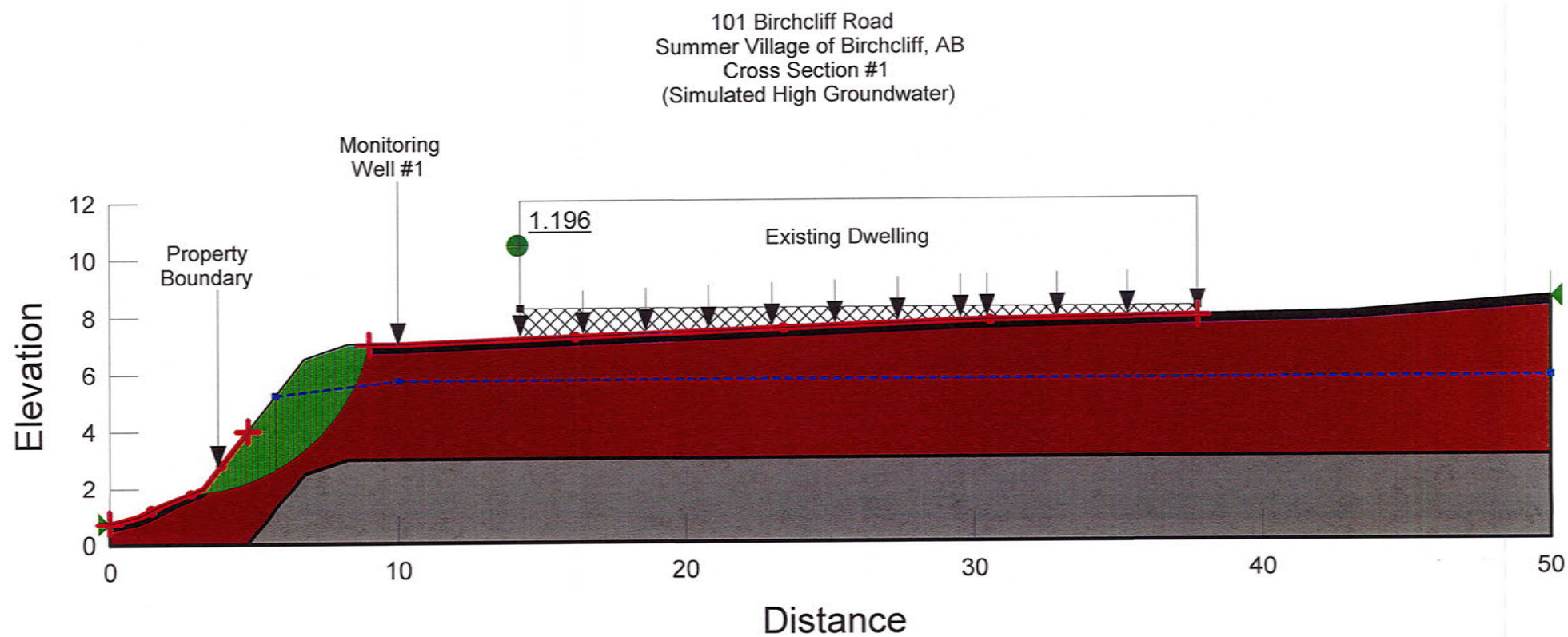
3 of 3

101 Birchcliff Road  
Summer Village of Birchcliff, AB  
Cross Section #1



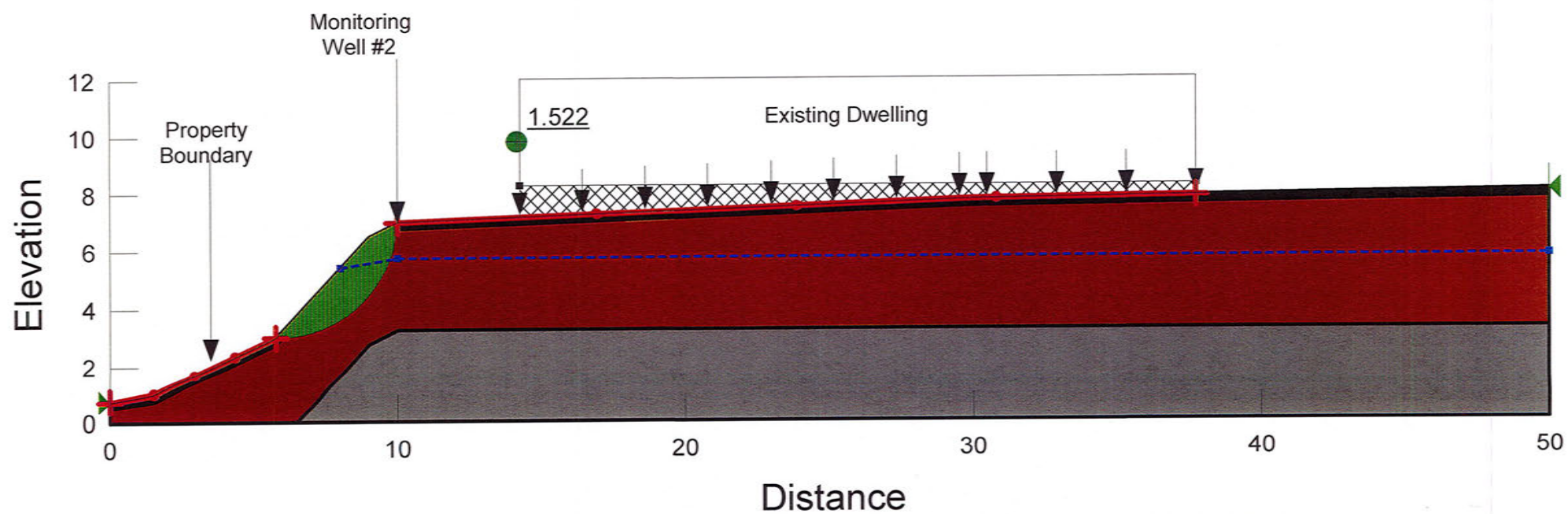
101 Birchcliff Road  
Summer Village of Birchcliff, AB  
Cross Section #2



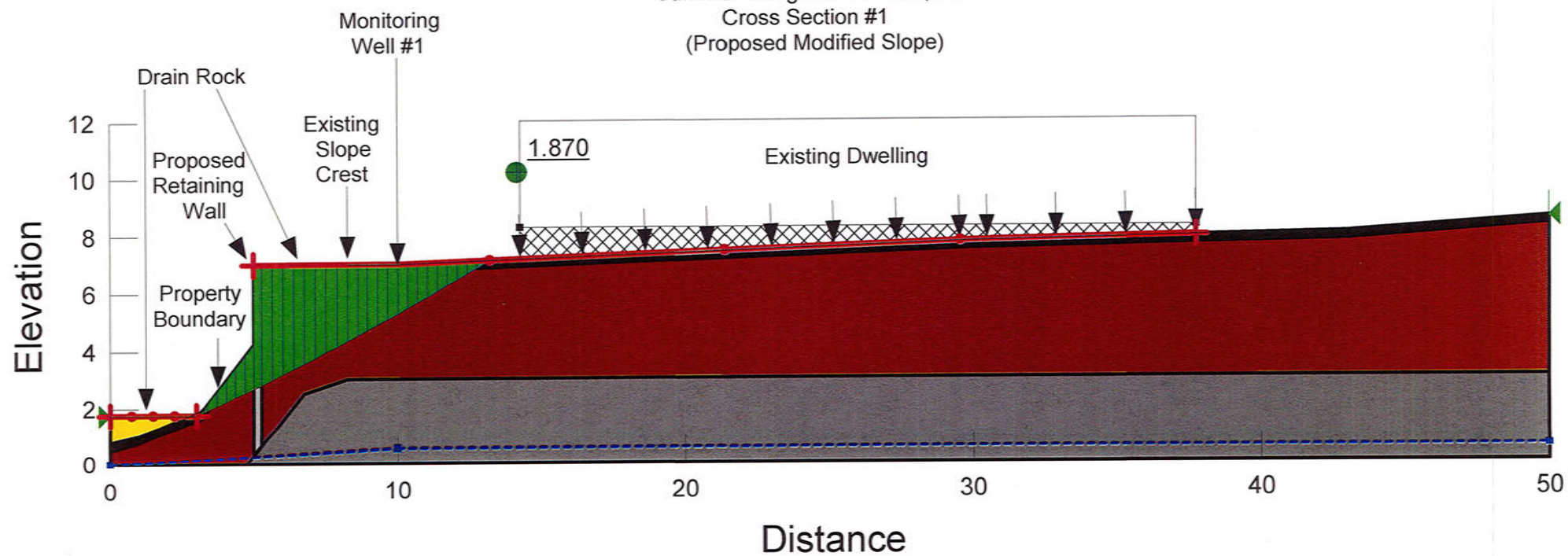




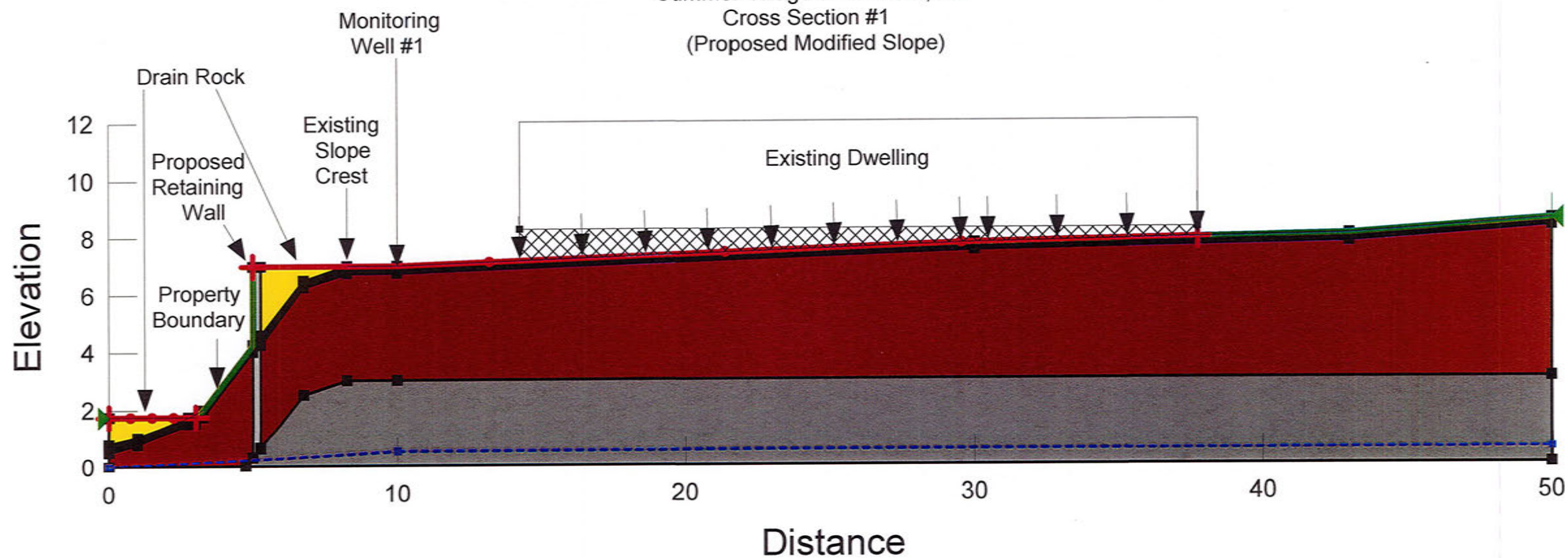
101 Birchcliff Road  
Summer Village of Birchcliff, AB  
Cross Section #2  
(Simulated High Groundwater)

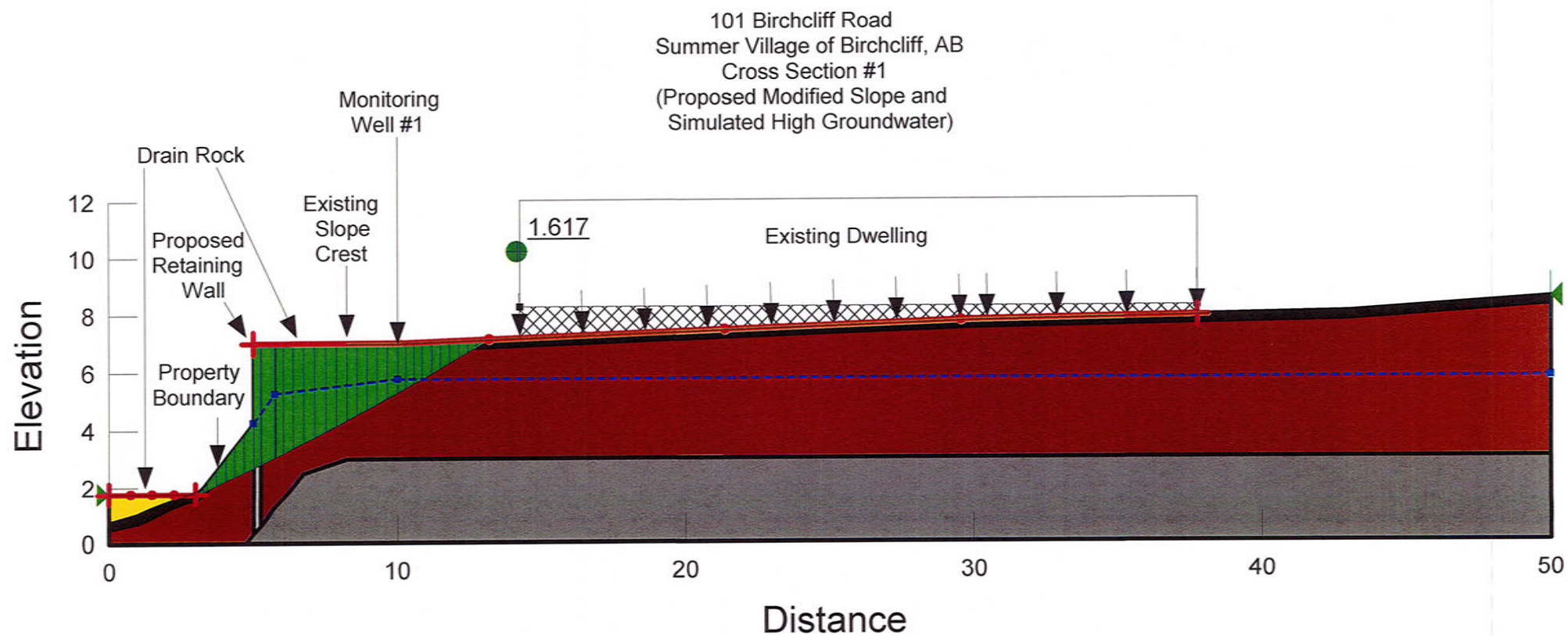


101 Birchcliff Road  
Summer Village of Birchcliff, AB  
Cross Section #1  
(Proposed Modified Slope)

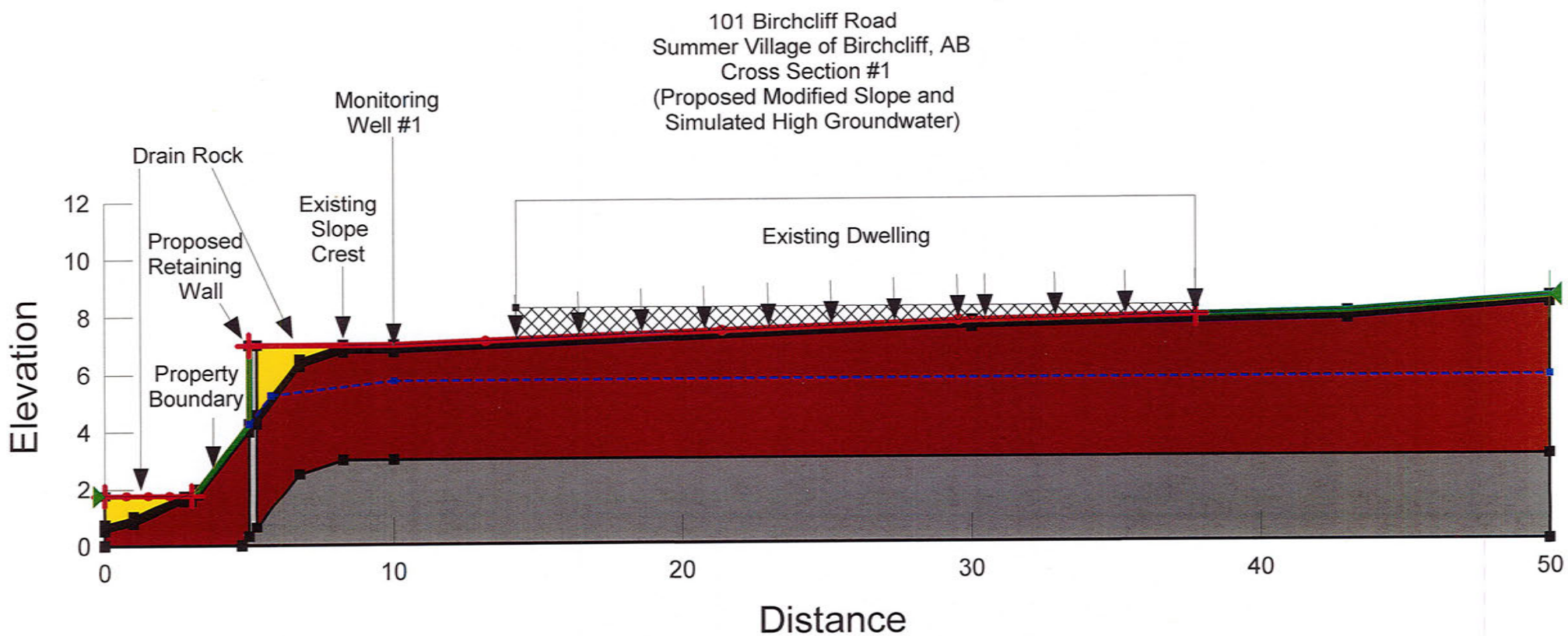


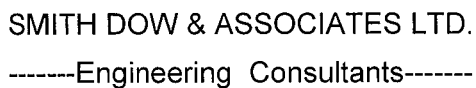
101 Birchcliff Road  
Summer Village of Birchcliff, AB  
Cross Section #1  
(Proposed Modified Slope)











**Project:** 101 Birchcliff Road  
SV of Birchcliff, Alberta

~~C-1~~

[illegible]

Tube	/
Penetrometer	X
No Recovery	

## TEST HOLE LOG AND LAB DATA

**DWG # 2**

DWN		HB		CKD		MK		DATE		October 13, 2021		FILE #		HOLE		1b																							
STRENGTH----- MOISTURE----- PENETRATION-----								▲ DATUM ● GROUND ELEV.- X		CLASSIFICATION		SYMBOL		TEST DATA		SAMPLE																							
<table border="1"> <tr> <td>▲</td> <td>100</td> <td>200</td> <td>300</td> <td>400</td> <td>500</td> </tr> <tr> <td>●</td> <td>10</td> <td>20</td> <td>30</td> <td>40</td> <td>50</td> </tr> <tr> <td>X</td> <td>0</td> <td>10</td> <td>20</td> <td>30</td> <td>40</td> <td>50</td> <td>60</td> <td>70</td> <td>80</td> <td>90</td> <td>100</td> </tr> </table>								▲	100	200	300	400	500	●	10	20	30	40	50	X	0	10	20	30	40	50	60	70	80	90	100								
▲	100	200	300	400	500																																		
●	10	20	30	40	50																																		
X	0	10	20	30	40	50	60	70	80	90	100																												
								Clayey Silt Till		coal specks sandy with siltstone fragments <u>water</u> , olive brown <u>wet</u> , sandy sandstone traces medium dense sandstone layers, grey olive <u>water</u> clayey silt, rusting		N=16		X																									
Sandstone / Siltstone								some laminations, coal traces light olive, very dense slightly weathered		N=25		X																											
End of Hole (Standpipe In)																																							
FILL TOPSOIL SAND SILT								CLAY PEAT GRAVEL SILTSTONE		TILL COAL WATER LIMITS		Q - Unconfirmed Strength, kN/m2 d - Dry Unit Weight, kN/m3 S - Sulphate Concentration, % N - Penetration Resistance, blows		Tube / Penetrometer X No Recovery																									
TEST HOLE LOG AND LAB DATA																																							
DWG # 3																																							





SMITH DOW & ASSOCIATES LTD.  
-----Engineering Consultants-----

Project: 101 Birchcliff Road  
SV of Birchcliff, Alberta

DWN		HB		CKD		MK		DATE		October 13, 2021		FILE #		HOLE		2																									
<b>STRENGTH</b> ----- <b>MOISTURE</b> ----- <b>PENETRATION</b> -----								<b>▲</b> DATUM <b>•</b> GROUND ELEV.- <b>X</b>		<b>CLASSIFICATION</b>		<b>SYMBOL</b>	<b>TEST DATA</b>	<b>SAMPLE</b>	Depth																										
															feet	meters																									
<table border="1"><thead><tr><th>▲</th><th>100</th><th>200</th><th>300</th><th>400</th><th>500</th></tr></thead><tbody><tr><td>•</td><td>10</td><td>20</td><td>30</td><td>40</td><td>50</td></tr><tr><td>X</td><td>0</td><td>10</td><td>20</td><td>30</td><td>40</td><td>50</td><td>60</td><td>70</td><td>80</td><td>90</td><td>100</td></tr></tbody></table>								▲	100	200	300	400	500	•	10	20	30	40	50	X	0	10	20	30	40	50	60	70	80	90	100										
▲	100	200	300	400	500																																				
•	10	20	30	40	50																																				
X	0	10	20	30	40	50	60	70	80	90	100																														
								<b>Topsoil</b> 125mm black, humus, roots				<b>N=18</b>		<b>X</b>		1		1																							
								<b>Clayey Silt</b> low to non-plastic, rootlets, silty								2																									
								<b>Till</b> rust and coal specks clayey, low plastic, stiff								3																									
																<b>Clay Till</b> tan to brown stiff, low plastic, stiff white mineral deposits clayey, rusting, medium to low plastic olive/brown, stones coal & bedrock fragments, stones firm to stiff, rust stains low plastic				<b>N=11</b>		<b>X</b>		4																	
																5																									
																6																									
																7																									
																8																									
																9																									
																10																									
11																																									
12																																									
																<b>Sandstone / Siltstone</b> weathered, golden brown dense laminated dense golden brown very dense, rusting laminated rusting very dense to hard laminations golden brown rusting										<b>N=46</b>		<b>X</b>		5											
								6																																	
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								12																																	
								13																																	
																<b>water, very dense/hard</b> <b>wet</b>				<b>N=81</b>		<b>X</b>								6											
7																																									
8																																									
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11																																									
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13																																									
14																																									
																<b>End of Hole</b> (Standpipe In)										<b>N=85</b>		<b>X</b>		7											
								8																																	
								9																																	
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	FILL		CLAY		TILL	Q - Unconfirmed Strength, kN/m2	Tube /
	TOPSOIL		PEAT		COAL	d - Dry Unit Weight, kN/m3	Penetrometer X
	SAND		GRAVEL		WATER	S - Sulphate Concentration, %	No Recovery
	SILT		SILTSTONE		LIMITS	N - Penetration Resistance, blows	

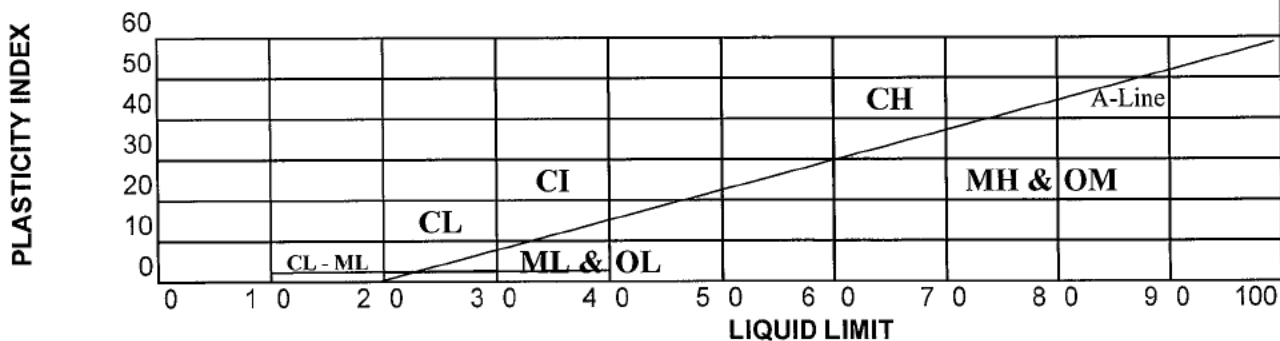
**TEST HOLE LOG AND LAB DATA**

**DWG # 4**

<b>Smith Dow &amp; Associates Ltd.</b> 4632-62 Street Red Deer, Alberta Phone 403-343-6888 Fax 403-341-4710	Client	
	Project #	101 Birchcliff Road
	Date	26-Oct-21
	Location	Summer Village of Birchcliff, AB

Location	Depth (meters)	Liquid Limit	Plastic Limit	Plasticity Index	Flow Index
Hole 2	2.1	36.3	16.7	19.6	8.5

Location	Depth (meters)	Inherent Swelling Capacity	Soil Classification
Hole 2	2.1	Medium Swell	CI
			Inorganic clay, sandy clay, silty of medium plasticity



ATTERBERG LIMIT TEST - ASTM D4318















C-1











FEB 03 2022







FEB 03 2022





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FEB 03 2022







FEB 03 2022







FEB 03 2022

