GOLDER
MEMBER OF WSP

TECHNICAL MEMORANDUM

DATE 10 June 2021 **Reference No.** 19115216-034-TM--Rev0-2090

TO Eric Constantinescu, PEng
A/Lead Geotechnical Engineer, Foundations
BC Ministry of Transportation and Infrastructure

CC Ben Singleton-Polster, PEng (Golder)

FROM Tim Russell, PEng **EMAIL Tim_Russell@Golder.com**
M. Yogendrakumar, PhD, PEng **MYogendrakumar@Golder.com**

PRELIMINARY GEOTECHNICAL ASSESSMENT - ROCK WALL
HIGHWAY NO.16 – MCBRIDE STREET AND 2nd AVENUE INTERSECTION IMPROVEMENTS (#37608)
PRINCE RUPERT, BC

As requested by BC Ministry of Transportation and Infrastructure (MoTI), Golder Associates Ltd. (Golder) carried out a preliminary geotechnical assessment of the rock wall near the 2nd Ave West and 1st Street intersection in Prince Rupert, BC. We understand the purpose of the assessment is to assist MoTI in the planning and design of the Highway 16 - McBride Street and 2nd Avenue Intersection Improvements (Project No. 37608).

This assessment was performed in conjunction with a Golder geophysics investigation, the results of which are discussed in Golder's report titled Geophysical Investigation 2nd Ave West and McBride Street, Prince Rupert, BC (Reference No.19115216-028-R-RevA-2000 dated 22 April 2021). This memorandum should be read in conjunction with the geophysics report for a full understanding of the site conditions. This work was conducted under the existing Consulting Services Contract 863CS1087 between Golder and MoTI.

1.0 SITE LOCATION

This preliminary geotechnical assessment site encompasses the rock wall which borders the approximately 17,000 m^2 parking lot at the northeast corner of 2nd Avenue West and 1st Street as shown in the 70% design drawings[1] provided by MoTI with select drawings shown in Attachment 1. The parking area at the base of the wall is about 3 to 5 m below the surrounding 2nd Ave W and 1st Street. The wall starts at 1st Street and runs approximately 56 m along 2nd Ave W and is presumed to end at the abandoned parking garage. The wall runs for about 30 m along 1st Street and ends at the existing laneway as seen in Figure 1.

[1] MoTI Highway No. 16 – McBride Street and 2nd Avenue Intersection Improvements, McElhanney Consulting Services Ltd. Dwg. NR-NNN-101, 20 May 2020.

Based on the 70% design drawings, Golder understands that the 2nd Ave W and McBride Street intersection improvements will consist of installing a roundabout and realignment of the adjacent travel lanes. The limits of construction (LoC) will extend approximately 45 m along 2nd Ave W, 15 m of which will take place above a portion of the rock wall, the remainder will take place in the area currently occupied by an abandoned garage structure. The existing garage structure will be demolished, and the existing bus stop will be relocated. In addition to the roundabout construction, a cul-de-sac is planned in the alley off 1st Street as shown in Attachment 1. Golder understands that some property acquisition would be required for portions of this project.

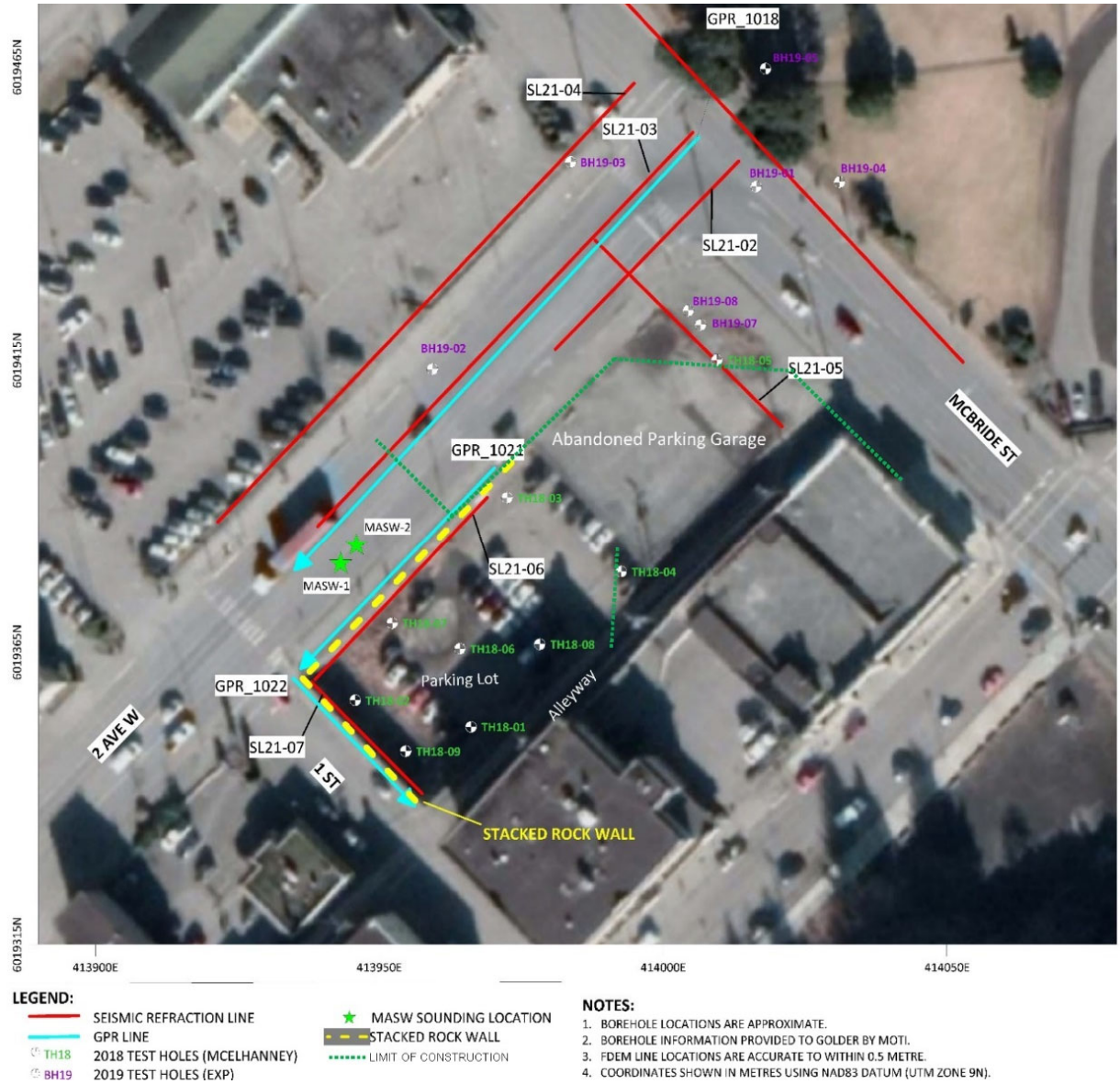


Figure 1: Site Plan

2.0 PREVIOUS INVESTIGATIONS

Golder has reviewed geotechnical reports by McElhanney[2] and EXP[3] provided by MoTI. Golder understands the subsurface conditions in front of the rock wall are inferred to comprise about 1 m of granular fills overlying peat, silt and silty clay of varying thickness, overlying a metasedimentary schist bedrock. A geophysical survey conducted by Golder 10 to 12 March 2021 included Ground Penetrating Radar (GPR) and Seismic Refraction Tomography (SRT) in and around the rock wall and backfill. The results of the Golder geophysical investigation are generally consistent with these soil conditions, but GPR results also identified several anomalies that could represent potential voids in the fills behind the wall. Based on the air photos included in McElhanney's Phase 1 investigation report[4], it appears that the rock wall is at least 50 years old.

As part of the geophysical investigation, Golder completed seismic surveys and measured shear and compressional wave velocities of 1200-1400 and 3500-4500 m/s, respectively, in the bedrock. These seismic velocities are representative of slightly weathered to fresh bedrock and indicate that bedrock is non-rippable based on seismic properties alone. Seismic tests along the base of the rock wall indicate bedrock depths generally increase westward along 2nd Avenue W toward the intersection of 2nd Avenue W and 1st St, where depths are reported to be 3.5 to 4 m in Figure 3 of Golder's geophysical report.

3.0 SITE CONDITIONS

Site visits by geotechnical engineers Kurt Gasser, EIT, and Tim Russell, PEng, based out of Golder's Terrace office, were completed on 08 March 2021 and 01 April 2021. The following observations were made while on site:

3.1 Road and Sidewalk

Vertical cracking was visible in the side-profile of the sidewalk above the rock wall along 2nd Ave W. The sidewalk near the intersection of 1st Street and 2nd Ave W was visibly deformed and sloping away from the wall crest (Figure 2). A gap in the concrete was visible between the sidewalk and the railing. Vertical cracks were visible in the sidewalk sidewall.

The sidewalk along 1st Street is also sloped away from the wall crest. The concrete pedestals supporting road signs along 1st Street were visibly deformed at the base. However, this deformation may be due to traffic, snow clearing, etc. and not related to wall backfill settlement. Deformation and previous patching of the asphalt road edge near the concrete sidewalk was also visible. The concrete sidewalks are approximately 0.25 m raised above the asphalt roadway.

[2] 3rd Avenue &McBride Street Institutional Building Geotechnical Assessment, Prince Rupert, BC, McElhanney Consulting Services Ltd. 4 December, 2020. 2311-30068-00

[3] Geotechnical Report – Highway 16 at 2nd Avenue West, Prince Rupert, BC MOTI Project No. 37608. EXP Services Inc. 16 Jan 2020. VAN-00251109-A0

[4] Phase 1 Environmental Site Assessment located at 2nd Ave West and McBride Street, Prince Rupert, BC. McElhanney Consulting Services Ltd. 6 February 2019. 2121-00418-02/2000

Figure 2: View of sidewalk above rock wall along 2 Ave W. Cracking and sidewalk deformation visible. Looking south from bus stop.

3.2 Wall Geometry

The rock wall varies in height from approximately 3 to 5 m along 2nd Ave W with the highest portion at the intersection of 1st Street and 2nd Ave W. Generally, the rock wall along 2nd Ave W is sloped at about 85 degrees while the portion along 1st Street is at near vertical.

A vertical change in the wall angle, slope-break, was noted in the southern 30 m of the rock wall along 2nd Ave W, near 1st Street. The lower half of the rock wall was near vertical, whereas the upper half of the wall was sloping at about 80 degrees. It is possible that this slope-break is the result of outward horizontal movement or bulging of a portion of the rock wall. The cracking and sidewalk deformation in Figure

Along the alleyway between 2nd Ave W and 3rd Ave W, another rock wall segment was observed, see the left side of Figure 3. The corner section of the rock wall intersecting the alleyway and 1st Street was estimated at about a 1.3 H : 1 V (Horizontal : Vertical) soil slope and vegetated with grass and deciduous shrubs. A rock wall may be present behind the soil slope.

Figure 3: View of rock wall looking southwest from the NE corner of the parking lot.

3.3 Rock Wall Face Conditions

The rock wall consists of locally derived schist boulders with cement mortar between boulders in most areas, as seen in Figure 4. The lower portion of the wall along 1st Street does not appear to have any mortar between the boulders. The mortar/cement is generally in poor condition and gaps were visible between boulders where mortar has fallen out. It is unclear whether the mortar extends the entire depth of the rock wall or is merely holding together the facing.

The boulders making up the face of the rock wall are generally square or rectangular in shape and vary from approximately 0.2 m to 1.2 m in size. The boulders in the 2nd Ave W portion of the wall appeared to be generally larger and less square than those making up the rock wall along 1st Street. Some cracks that are inferred to have formed post-construction were noted within individual boulders and varied from having a slight aperture to having full contact between adjacent boulder sections.

The toe of the rock wall is vegetated with grass and hemlock, spruce and deciduous shrubs.

Figure 4: View of rock wall along 2nd Ave W looking south approximately mid way along the wall.

3.4 Seepage and Surface Water

Seepage was visible on the rock wall face along 2nd Ave W. Drainage pipes were visible emptying out of the rock wall and onto the parking lot surface (Figure 4).

The parking area appeared to have poor drainage and ponded water was visible in the parking lot near the corner of 1st Street and 2nd Ave W. The surface water from the pond appeared to flow towards a gap in the base of the rock wall (Figure 5).

Figure 5: View of rock wall at the corner of 1st Street and 2nd Ave with vegetation and gap visible in the base of the wall. Taken from the south end of the parking lot looking west.

3.5 Bedrock

A bedrock outcrop was noted at the base of the wall approximately 30 metres northeast from the corner of 1st and 2nd Avenue. The outcrop was topped with a layer of concrete approximately 0.2 m thick that may have been used to create a leveling pad for the overlying boulder placement. At the northeast end bedrock became shallower and outcropped along the rock wall (Figure 4).

3.6 Concrete Layers

A 0.3 m thick row of concrete was visible extending horizontally along the 2nd Ave W rock wall from the base to about 0.6 m up the wall at the corner of 1st Street and 2ndAve W (Figure 4). A 0.3 m thick row of concrete was also visible extending horizontally mid-way up the wall along the 1st Street portion in Figure 5. The original intent and details of the current condition of the concrete layers, including potential reinforcement and horizontal extent behind the rock wall, are unknown.

4.0 GEOTECHNICAL CONSIDERATIONS

Conditions at the rock wall encountered during Golder's site visit indicate that differential settlement and deformation appears to have occurred along the wall as evidenced by the presence of settlement cracks in the concrete sidewalks, concrete along wall face and bulging visible in the wall face. Drainage at the site appears to be poor based on the seepage visible in the wall and ponding of water in the parking area.

Information is very limited regarding the details of the existing rock wall. The construction methods, wall backfill material characteristics, potential reinforcements or repairs completed during the lifetime of the wall, are all unknown. It is unclear whether the wall stability relies on gravity and the frictional property of the boulders or

whether the mortar provides additional stability. Regardless, the mortar appears to be in generally poor condition and is not fully continuous. The condition of any reinforcements or water drains, rock drains, and filters behind the wall, if any, is unknown. Drainage represents an important consideration to the stability of the wall given Prince Rupert's airport received an average annual precipitation of 2,619 mm between 1981 and 2010 according to Environment Canada.

Based in our understanding of MoTI wall classifications and the poor condition of the mortar, MoTI may consider classifying this rock wall a rock stacked wall during design as opposed to a conventional retaining wall. It should be noted that the existing wall does not meet the requirements outlined in MoTI technical circular T01-10 for Rock Stacked Retaining Walls. Furthermore, Golder has seen no evidence of stability analyses carried out for this rock wall.

The previous subsurface investigation reports and Golder's geophysical report indicate that the soils retained by the rock wall include peats and clays. Global stability assessments are outside the current scope of this memo. We understand that the current MoTI guidelines do not allow rock stacked walls retaining an embankment supporting a numbered highway or where failure would take adjacent or dependant structures out of service. The voids inferred during the geophysical investigation indicate movement of soil backfill (i.e., piping or internal erosion) may be occurring behind the wall and under the road.

Given the above and the requirement to excavate behind a portion of the wall, Golder recommends wall rehabilitation/replacement be included as part of the project design.

5.0 REMEDIATION OPTIONS

5.1 Remediation Extent

MoTI has requested that Golder present options for remediation of the rock wall that would meet current MoTI design standards. Golder understands that the current limits of construction (LoC) extend partway along the rock wall on 2nd Ave W. At present it is unknown if the entire length of the wall will be considered for remediation by MoTI or simply the section within the current LoC.

Since details of any possible rock wall reinforcement or drainage features are unknown, Golder recommends the project team consider potential impacts to the stability of the rock wall outside the remediation area. Construction activities such and drilling, blasting and/or ripping of the bedrock would create vibrations which may negatively impact the integrity and stability of the adjacent rock wall sections and any adjacent structures. Consideration could be given to expanding the LoC along 2nd Ave W to allow for remediation along a larger portion of the rock wall.

Based on the preliminary rock wall assessment and Golder's geotechnical experience, the following options could be considered.

5.2 Option 1: Fill Parking Lot Area to Match Highway Grade

From a geotechnical perspective, a simple way to mitigate the potential instability of the rock wall would be to place fill in front of the wall to eliminate the vertical drop from the sidewalks to the parking lot and replace this with a fill embankment. This could be achieved by placing fill in the parking lot area to raise the grade to match the top of the existing rock wall. In order to maximize the flat, usable land within the parking lot, the entire lot grade could be raised and leveled. Consideration would need to be given to the tie-in to the existing alleyway grade with slopes or a relatively short retaining wall.

Potential advantages of this solution would be the simplicity of the solution and changing the classification of the wall to an embankment with little impact to the existing highway. Consideration could be given to the re-use of the parking lot property for parking or other community amenities.

Dismantling the boulder facing of the entire height of the rock wall is not likely to be a requirement for this remediation option. Depending on the depth of excavation behind the rock wall for the new pavement structure construction and/or any future buried services, the upper portion of the rock wall could be removed and replaced with approved granular fill. A layer of suitable geotextile fabric could be placed across the near-vertical rock wall surface, between it and the new fill material in the parking lot area. The purpose of the geotextile layer would be to reduce the potential for migration of soil particles through the rock wall face. Pressure grouting or polyurethane injection could be considered to seal the void space between the individual rocks in the rock wall to reduce soil migration, piping and seepage.

This option would require property acquisition of the entire property or an agreement with the current property owner. In addition, large quantities of imported suitable fill material and quality control during construction would be required. This option would also not address any potential settlements within the roads or sidewalks caused by the potential voids and deleterious soils possibly retained by the rock wall. However, although the settlement issue may not be completely eliminated, it is possible that the future settlement could be reduced as piping and other mechanisms are partially eliminated. Golder understands that soils at this site may potentially be contaminated so removal and replacement would need to be discussed with the project team.

5.3 Option 2: Rockfill Buttress

Similar to the option presented above, a rockfill buttress could be constructed along the rock wall in order to mitigate the stability concerns of the wall using a rockfill buttress. Areas of the rock wall with a suitable rockfill buttress would be considered as an embankment as opposed to a retaining wall when comparing to current design standards.

Further analysis would be required to determine a design geometry that meets the current MoTI standards. This option would require some property acquisition along both 1st Street and 2nd Ave W. Potential advantages of this option includes simplicity of design and construction and limited amounts of offsite fills required. As described in the previous section, geotextile layer placement, pressure grouting or polyurethane injection could be considered to reduce the potential for the rock wall backfill material to migrate outward through voids in the rock wall. The rockfill buttress could tie into the proposed fill slope within the abandoned parking garage property, provided a consistent aesthetic.

Potential challenges would be the similar to those in Section 5.2, including the need for property acquisition of a portion of the site or an agreement with the current property owner, reducing the useable space and costs of imported material. This option would not address any potential settlements within the roads or sidewalks caused by the potential voids and deleterious soils possibly retained by the rock wall.

5.4 Option 3: Anchored Wall

Consideration could be given to the construction of an anchored concrete wall to improve stability and meet current MoTI design standards. The wall portion would consist of either poured concrete or shotcrete for the full length and height of the wall. For options assessment and planning purposes, drilled steel anchors installed into the bedrock behind the wall and grouted in place could be used. Additional design would be required to determine the anchor location and installation angle and depth into bedrock. Input from a structural engineer would be required to determine anchor length, location and concrete/shotcrete design. Existing and future utility locations under the current highway would need to be considered and better defined in the design, especially regarding proposed anchor installation locations.

Drainage of the wall backfill would need to be considered, and installation of drains may be required. Pressure grouting or polyurethane injection could be considered to seal the void space between the individual rocks in the rock wall to provide additional frictional strength to the boulders within the wall.

A potential benefit of the anchored concrete wall option is potential improvement of the global stability of the wall during seismic loading conditions. Additionally, there would be limited impact to the usable space in the parking lot area post construction.

An agreement with the current property owner may still be required for this option depending on the geometry of the wall in relation to the property line. Ongoing settlement of the retained soils under the existing highway will likely still occur. A geotechnical drilling investigation may be required to reduce uncertainties regarding the bedrock surface profile and design input parameters.

This option would require temporary access to the property for construction.

5.5 Option 4: Dismantle Existing Rock Wall and Construct New Wall

Consideration could also be given to the dismantling of the existing rock wall and constructing a new retaining wall structure, built to current MoTI standards.

A newly constructed wall would allow for the controlled placement of suitable backfill material which would be expected to reduce the potential for future settlement of the adjacent sidewalk and road. The need for property acquisition would likely be reduced or potentially eliminated compared to the options presented in Sections 5.2 and 5.3. However, temporary construction access would likely be required. A properly designed and constructed wall would be expected to meet current design criteria. The usable, flat space in the parking lot property would likely be similar to the current conditions. Consideration should be given to the stability of adjacent rock wall segments and the LoC may need to be adjusted for a new wall construction.

This option will require a disruption to traffic caused by excavation and construction activities and management of existing utilities. The design and construction effort and schedule implications would be the greatest for this option and may be cost prohibitive.

5.6 Remedial Options Summary

Golder recommends remediation of the rock wall be completed as part of project design and construction. Preliminary remedial options for wall stabilization are presented in the preceding sections. Depending on the remediation selected by MoTI, design and possibly additional test holes behind the wall may be required to advance the overall project design.

The following table presents remediation options for the rock wall and lists them in order of increasing expected relative cost, based on our current understanding. All remediation options presented below, if properly designed and constructed, are expected to increase the slope stability of the rock wall; however, not all of the options directly address settlement potential.

Table 1: Rock Wall Remediation Options Summary

Option	Relative Cost[1]	Potential Advantages	Potential Disadvantages
Rockfill Buttress (Option 2)	1	- Relatively low cost - Low level of design effort - Less fill material and property acquisition required relative to filling whole parking lot - Contractors and material available - Conventional construction methods	- Property acquisition required - Potentially significant reduction in flat usable space in the parking lot area - Settlement potential of road and sidewalk not directly addressed
Fill Parking Lot (Option 1)	2	- Lowest complexity solution - Lowest design effort - No maintenance costs related to wall or slope stability - Maximized useable parking lot space - Potentially preferred option for existing owner - Contractors and material available - Conventional construction methods	- Largest property acquisition area required - Higher cost and longer construction duration than rockfill buttress - Large volume of fill required - Tie-in to the alleyway and adjacent building should be considered and may require retaining structures - Settlement potential of road and sidewalk not directly addressed
Anchored Wall (Option 3)	3	- Minimal property acquisition, if any, required - Existing parking lot configuration and usable space maintained - Settlement potential could be addressed - Potential for improved aesthetic - May be preferred option by property owner and City	- Higher level of design effort and cost than options above. - Uncertainties present, drilling investigation likely required - Underground utilities present a hazard - Specialized contractor and equipment required - Agreement with property owner likely required during construction
Dismantle Existing Wall and New Wall Construction (Option 4)	4	- Minimal property acquisition, if any, required - Most rigorous design option - Potential to excavate and replace deleterious soils and void spaces behind the wall with competent fills - Greatest reduction in settlement potential	- Highest level of design effort. - Highest cost. - Uncertainties present, drilling investigation likely required - Underground utilities present complications to design - Specialized contractor and equipment may be required depending on design - Potentially longest construction period - Agreement with property owner likely required during construction

Note 1: Options ordered based on increasing expected relative cost, based on current understandings. "1" is the lowest cost and "4" is the highest cost.

6.0 CLOSURE

We trust that the information contained within this memo is sufficient for your current requirements. Should you have any questions or require clarification of our assessment, or any of our geotechnical comments and recommendations, please do not hesitate to contact the undersigned.

Golder Associates Ltd.

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
T. D. RUSSELL
48756

Tim Russell, PEng
Geotechnical Engineer

M. Yogendrakumar, PhD, PEng
Principal, Senior Geotechnical Engineer

KG/TDR/MY/asd

Attachment 1: McElhanney 70% Design Drawing No. NR-NNN101

https://golderassociates.sharepoint.com/sites/102414/deliverables/issued to client_for wp/19115216-034-tm-rev0/19115216-034-tm-rev0-mcbride memo 10jun_21.docx

Important Information and Limitations of this Report

Standard of Care: Golder Associates Ltd. (Golder) has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied is made.

Basis and Use of the Report: This report has been prepared for the specific site, design objective, development and purpose described to Golder by the Client. The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. Any change of site conditions, purpose, development plans or if the project is not initiated within eighteen months of the date of the report may alter the validity of the report. Golder can not be responsible for use of this report, or portions thereof, unless Golder is requested to review and, if necessary, revise the report.

The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without Golder's express written consent. If the report was prepared to be included for a specific permit application process, then upon the reasonable request of the client, Golder may authorize in writing the use of this report by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process. Any other use of this report by others is prohibited and is without responsibility to Golder. The report, all plans, data, drawings and other documents as well as all electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder, who authorizes only the Client and Approved Users to make copies of the report, but only in such quantities as are reasonably necessary for the use of the report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make available the report or any portion thereof to any other party without the express written permission of Golder. The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client cannot rely upon the electronic media versions of Golder's report or other work products.

The report is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by the Client, communications between Golder and the Client, and to any other reports prepared by Golder for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. Golder can not be responsible for use of portions of the report without reference to the entire report.

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project. The extent and detail of investigations, including the number of test holes, necessary to determine all of the relevant conditions which may affect construction costs would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety and equipment capabilities.

Soil, Rock and Groundwater Conditions: Classification and identification of soils, rocks, and geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgment, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, Golder does not warrant or guarantee the exactness of the descriptions.

Special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions. The environmental, geologic, geotechnical, geochemical and hydrogeologic conditions

that Golder interprets to exist between and beyond sampling points may differ from those that actually exist. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. **The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report.** The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities (traffic, excavation, groundwater level lowering, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting, drying or frost. Unless otherwise indicated the soil must be protected from these changes during construction.

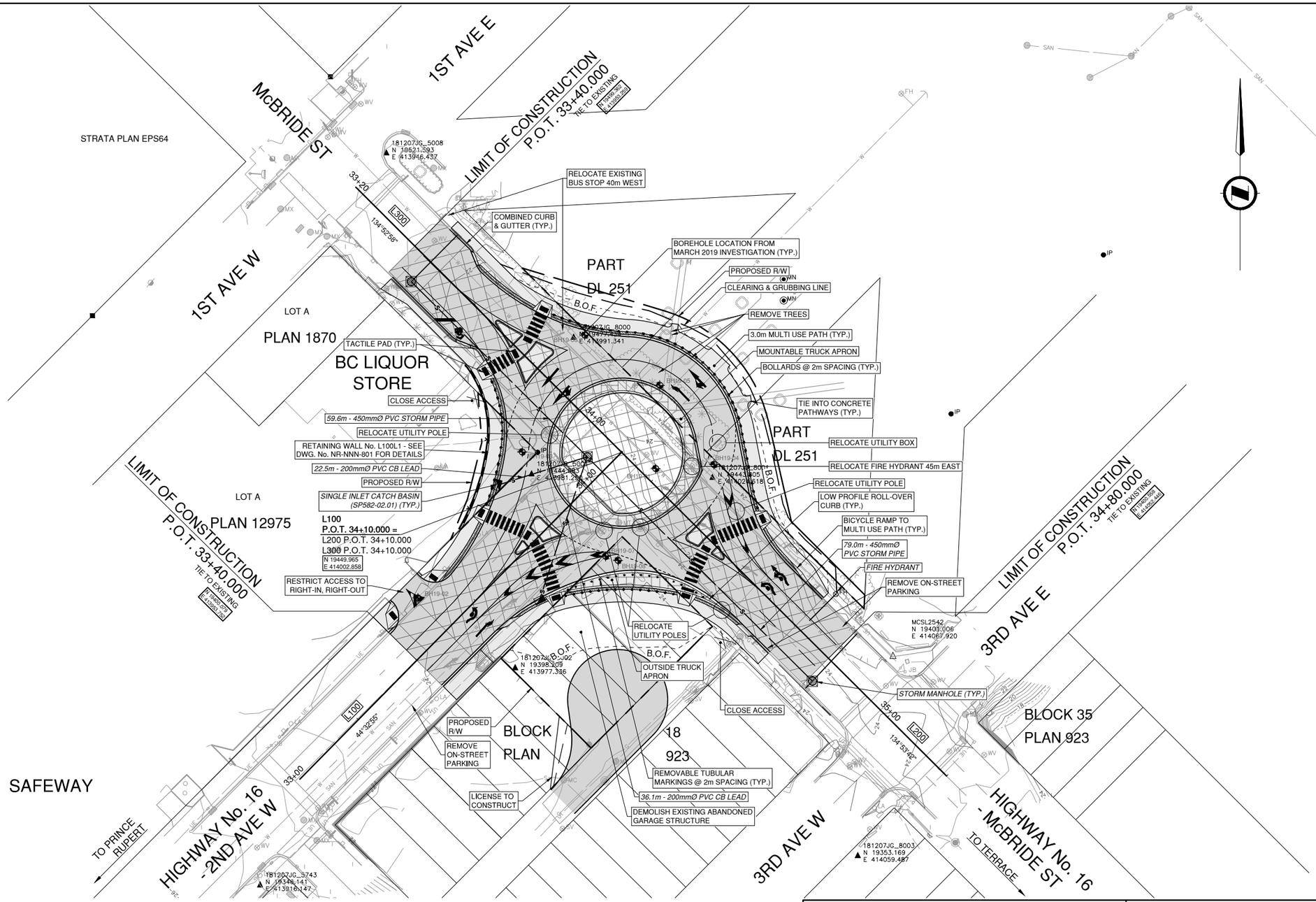
Sample Disposal: Golder will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fills or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

Follow-Up and Construction Services: All details of the design were not known at the time of submission of Golder's report. Golder should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of Golder's report.

During construction, Golder should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of Golder's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in Golder's report. Adequate field review, observation and testing during construction are necessary for Golder to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, Golder's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

Changed Conditions and Drainage: Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that Golder be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that Golder be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. Golder takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.



ALIGNMENT	CLASSIFICATION	DESIGN SPEED
L100 - HWY 16 (2ND AVE W)	UAU	50 km/h
L200 - HWY 16 (McBRIDE ST)	UAU	50 km/h
L300 - McBRIDE ST	UCU	50 km/h

REFERENCE DRAWINGS

FOR PROFILES SEE DWG. NR-NNN-201
FOR TYPICAL SECTIONS SEE DWG. NR-NNN-301 TO 303
FOR GEOMETRICS & LANING SEE DWG. NR-NNN-401
FOR SIGNING & PAVEMENT MARKINGS SEE DWG. NR-NNN-601
FOR WALL GENERAL ARRANGEMENT SEE DWG. NR-NNN-801

HALFSIZE

FOR DISCUSSION ONLY

McElhanney
Suite 200
858 Beatty Street
Vancouver BC
Canada V6B 1C1
Tel 604 683 8521

SCALE 0 5 1:500 25m

CAD FILENAME NR-NNN-100
PLOT DATE 5/29/2020

REV	DATE	REVISIONS	NAME
A	2020-03-20	PRELIMINARY DESIGN	J. PINTO
B	2020-05-29	70% DETAILED DESIGN	J. PINTO

BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
NORTHERN REGION
HIGHWAY ENGINEERING AND GEOMATICS

PLAN

HIGHWAY No. 16 - McBRIDE STREET AND 2ND AVENUE
INTERSECTION IMPROVEMENTS

E. NEWCOMBE
SENIOR DESIGNER
DATE 2020-05-29

DESIGNED T. MCKENZIE DATE 2020-05-29
QUALITY CONTROL E. NEWCOMBE DATE 2020-05-29
QUALITY ASSURANCE J. PINTO DATE 2020-05-29
DRAWN R. LIN DATE 2020-05-29

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
2121-00606-01	37608	3	NR-NNN-101	B

PLOT DATE: 2020/05/29 X:\2121\2121-00606-01 MoTI-Hwy16 Detailed Design Services\10.0 DRAWINGS\10.3 Engineering\Hwy16McBride\DrawingProduction\100_Plans\NR-NNN-100.dwg