GEOTECHNICAL HAZARD ASSESSMENT

7099 Lantzville Road, 6852 Wiles Road
Lantzville, BC

Legal Addresses:
Lot A, District Lot 27G, Wellington District, Plan VIP54592, PID 017-838-941

Lot 1, District Lot 45, Wellington District, Plan VIP8752 Except Plan VIP46247 and VIP63648, PID: 001-258-435

Prepared For:
District of Lantzville
PO Box 100 - 7192 Lantzville Road,
Lantzville, BC, V0R 2H0

Attention:
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September 7, 2025

File No.: E3761.03
Revision No.: 00
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DISCLAIMER, ACKNOWLEDGMENTS, AND LIMITATIONS

1. Lewkowich Engineering Associates Ltd. (LEA) acknowledges that this report, from this point forward referred to as "the Report," may be used by the District of Lantzville (DoL) as a precondition to the issuance of a subdivision and/or development permit. It is acknowledged that Approving Officers and/or Building Officials of the DoL may rely on this Report when making a decision on application for development of the land. It is acknowledged that this Report and any conditions contained in the Report may be included in a restrictive covenant under Section 56 of the Community Charter and registered against the title of the Properties at the discretion of the DoL.
2. This Report has been prepared in accordance with standard geotechnical engineering practice solely for and at the expense of the DoL.
3. The conclusions and recommendations submitted in this Report are based upon information from relevant publications, a visual site assessment of the property, encountered and inferred subsurface conditions, current construction techniques, and generally accepted engineering practices. No other warrantee, expressed or implied, is made. If unanticipated conditions become known during construction or other information pertinent to the development becomes available, the recommendations may be altered or modified in writing by the undersigned.
4. The conclusions and recommendations submitted in this Report are based upon the data obtained from a limited number of subsurface explorations. Subgrade conditions are known only at the locations of the explorations and have been used to infer subgrade conditions throughout the site in preparation of this Report. The nature and extent of subgrade variation throughout the site may not become evident until construction or further investigation.
5. Future construction shall be carried out within the requirements and recommendations of the Environmental Consultant (if applicable), any defined jurisdictional bylaws, or any existing restrictive covenants, whichever is more stringent. Any environmental and/or jurisdictional limitations may supersede the recommendations in this Report.
6. This Report was authored, to the best of our knowledge at the time of issuance, with considerations for local requirements specific to the Authority Having Jurisdiction (AHJ) and their standards for the preparation of such reports, the 2024 British Columbia Building Code (BCBC), and current engineering standards. Updates to bylaws, policies, or requirements of the AHJ, or updates to the BCBC or professional practice guidelines, may impact the validity of this Report.
7. This Report has been prepared by Tennes Hamre, P.Geo., and reviewed by Chris Hudec, M.A.Sc., P.Eng. and Stuart Crossfield, P.Geo., P.L.Eng. all adequately experienced and are also members in good standing with the Engineers and Geoscientists of British Columbia (EGBC).

EXECUTIVE SUMMARY

1. The following is a brief synopsis of the property, assessment methods, and findings presented in the Report. The reader must read the Report in its entirety; the reader shall not rely solely on the information provided in this summary.
2. The subject properties, 7099 Lantzville Road and 6852 Wiles Road, Lantzville, BC, from this point forward referred to as "the Properties," are located on southeastern Vancouver Island within the jurisdictional boundaries of the DoL. At the time of this Report there is no development proposed for the Properties.
3. A site-specific hazard assessment was conducted to identify any potential geotechnical hazards for any future development within the Properties. Two hazards were identified and addressed in this Report: flooding from a nearby watercourse and slope stability associated with the watercourse bank.
4. The Report recommends a Flood Construction Level (FCL) of 1.5m above the present natural boundary (PNB) and a setback of 15.0m from the PNB of the Bloods Creek watercourse.
5. The Report recommends three different safe building setbacks from the crest of the watercourse bank which are detailed in Section 5.3 and illustrated on the attached drawing E3761-01.
6. The findings confirm the land is considered safe for the use intended, provided the recommendations in this Report are followed.

List of Abbreviations Used in the Report

Abbreviation	Title
AHJ	Authority Having Jurisdiction
BCBC	British Columbia Building Code
BH	Borehole
CGVD	Canadian Geodetic Vertical Datum
DoL	District of Lantzville
DPA	Development Permit Area
EGBC	Engineers and Geoscientists of British Columbia
FCL	Flood Construction Level
LEA	Lewkowich Engineering Associates Ltd.
PGA	Peak Ground Acceleration
PNB	Present Natural Boundary

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1.0 INTRODUCTION

1.1 General

a. As requested, LEA has carried out a Geotechnical Hazard Assessment of the subject Properties with respect to future development within the Properties. This Report provides a summary of our findings and recommendations.

1.2 Background

a. At the time of our assessment, 6852 Wiles Road was undeveloped and primarily forested. 7099 Lantzville Road Property was developed with an existing single-family residence and detached garage. We understand the DoL is currently utilizing the 7099 Lantzville Road Property for daily operations.

b. The Properties are located within the jurisdictional limits of the DoL and are zoned Residential 1 Zone (R-1). As per the DoL Zoning Bylaw[1], the Properties are within the Watercourse Protection (DPA 1) development permit area. Therefore, an assessment of the potential natural hazards prepared by a professional engineer with experience in geotechnical engineering is required and shall include recommendations or mitigation strategies with respect to the potential natural hazards.

c. At the time of this Report, no development is proposed for the Properties.

1.3 Assessment Methodology

a. This assessment included a desktop review of relevant background information, including applicable DoL bylaws, available development plans, registered covenants on title, aerial photographs, and published geology, and topography mapping. Please refer to the list of references at the end of this Report.

b. A subsurface investigation was carried out on July 29 and 30, 2025, using a Boart LS250 Sonic Drill provided by Drillwell Enterprises Ltd. Three BHs (BH25-01 to BH25-03) were advanced at locations across the Properties to provide good lot coverage and characterize the subsurface conditions. The BHs included in-situ testing at specified intervals. The BHs were backfilled upon completion of the investigation.

c. Our assessment included an evaluation of the global stability of the steep watercourse slope under both static and seismic conditions. Two-dimensional slope models were developed and assessed using slope stability analysis software to determine a safe setback from the crest of the slope for future development of the Properties.

d. This assessment was prepared with consideration of the referenced EGBC professional practice guidelines, Legislated Flood Assessments in a Changing Climate in BC and Landslide Assessments in British Columbia.[2,3]

1.4 Covenant Review

a. As part of our assessment, we have reviewed the legal titles of the Properties, specifically relative to any restrictive covenants that may impact the conclusions or recommendations made in this Report. At the time of this Report, there were no covenants registered against the titles of the Properties that would impact the findings, recommendations, or conclusions in this Report.

2.0 SITE CONDITIONS

2.1 Physical Setting

a. The Properties are located to the south of Lantzville, to east of Wiles Road. Please refer to Figure 2.1 below.

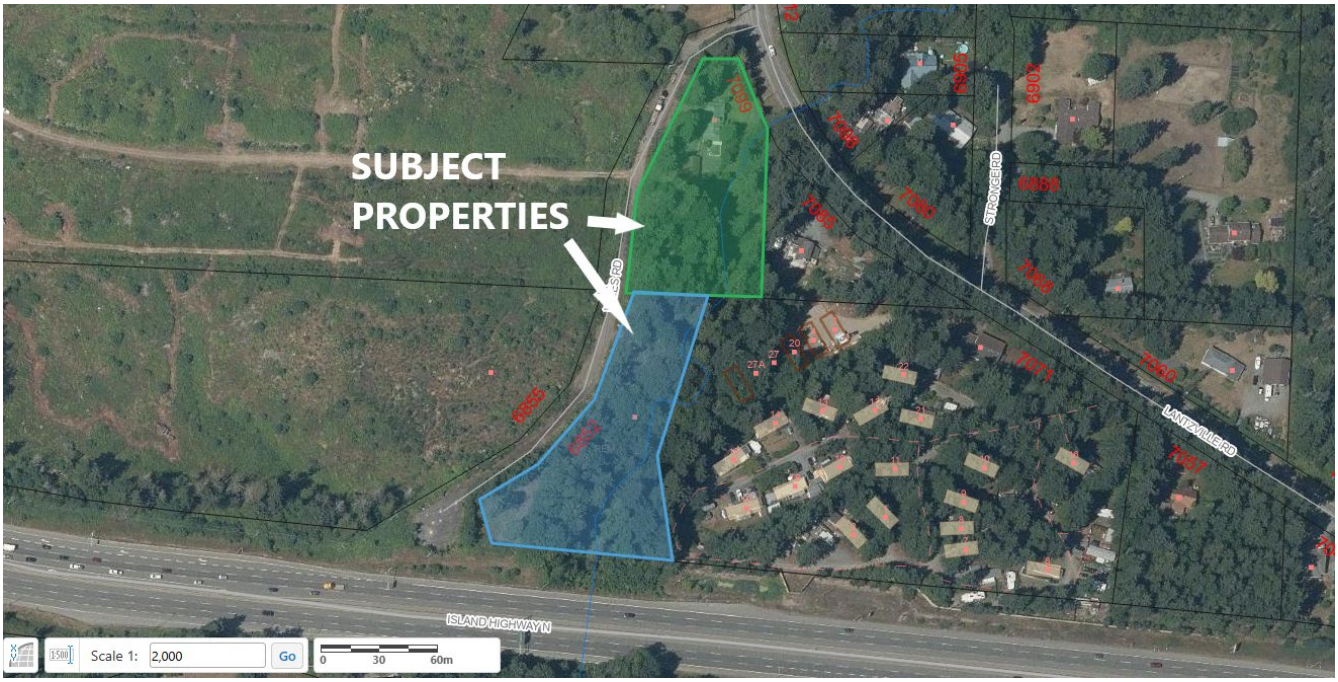

Figure 2.1 – Location of Subject Property[4]

2.2 Terrain and Features

a. The terrain of Properties is primarily defined by the Bloods Creek watercourse which meanders along the eastern portion of each Property. The watercourse enters 6852 Wiles Road from a culvert discharging to the north of Highway 19. A steep watercourse bank up to approximately 14m in height encompasses the majority of the Property area of 6852 Wiles Road. The watercourse slope bank becomes progressively lower in height northward into the 7099 Lantzville Road Property eventually becoming a <1.0m bank height with gentle to moderate surrounding inclinations within the northern half of 7099 Lantzville Road. Inclinations along the Bloods Creek bank vary from approximately 27° to 45° overall with localized areas exceeding 65°.

b. West of the watercourse bank the Properties generally slope to the north at gentle to moderate inclinations between 10° to 15° becoming less than 5° within the northern half of 7099 Lantzville Road.

c. Developed areas of 7099 Lantzville Road include typical residential lawn cover, landscaped areas, and gravel surfacing. The remainder of 7099 Lanztville Road and the majority of 6852 Wiles Road is forested with a light to moderate understory cover. Vegetation cover on the steep watercourse bank is generally poor due to the steep inclinations of the bank. Pistol butted trees are common along the slope face indicating small scale slope movements in surficial soils over time.

d. We have reviewed air photos as early as 2004 and have not observed any indications of significant slope instability or failures.

e. Refer to the following photos for general conditions across the Property.

Photo 2.2.1 – Aerial view of 7099 Lantzville Road, looking southwest.

Photo 2.2.1 – Watercourse bank conditions on 6852 Wiles Road, looking south.

Photo 2.2.1 – Watercourse bank conditions on 6852 Wiles Road, looking west.

2.3 Regional Geology

a. Surficial geology for the area is classified as marine and glaciomarine deposits consisting of gravel and sand overlying ground moraine deposits of sand and silt with lenses of gravel.[5]

b. Bedrock geology for the area is classified as the Nanaimo Group, comprised of undivided sedimentary rocks from the upper Cretaceous period, generally consisting of boulder, cobble, and pebble conglomerate, coarse to fine sandstone, siltstone, shale, and/or coal.[6]

2.4 Soil Conditions

a. Relatively consistent soil strata were encountered during the subsurface investigation. The main soil strata are summarized in Table 2.4.1 and 2.4.2 below. Detailed descriptions of the subsurface conditions are provided on the attached BH logs (BH25-01 to BH25-03).

Table 2.4.1 – Summary of Encountered Soil Strata

Soil Stratum No.	Soil Description	Depths	
		From	To
1	Gravelly sand, some silt, trace organics, compact, brown to dark brown, moist	0.00	1.00
2	Varying gravel and sand stratums, trace silt to silty with occasional silt lenses, dense to very dense, brown	0.61	10.97
3	Silt, some sand, trace clay, very stiff, grey with dark brown lenses, moist to wet	8.84	11.89
4	Clayey sand and silt, trace gravel, very dense, grey, moist (glacial till)	9.75	16.70

Table 2.4.2 – Summary of Encountered Soil Strata

Soil Stratum No.	Depth (m) to Bottom of Stratum per TP No.		
	BH25-01	BH25-02	BH25-03
1	1.00	0.61	0.61
2	8.84	10.97	9.75
3	9.75	11.89	NE
4	16.70	12.20	NE
*NE Denotes Not Encountered			

2.5 Groundwater Conditions

a. Groundwater was recorded in BH25-01 on August 18, 2025, at a depth of 9.31m within the piezometer installed to 11.0m. A second piezometer was installed in BH25-01 at a depth of 6.1m and was dry. Groundwater was inferred in BH25-02 at a depth of 9.75m based on observations during drilling.

b. Groundwater levels can be expected to fluctuate seasonally with cycles of precipitation. Groundwater conditions at other times and locations can differ from those observed at the time of our assessment.

3.0 WATERCOURSE FLOODING

3.1 Recommendations

a. Based on our field observations of the Bloods Creek watercourse within the eastern portions of the Properties, we expect this watercourse would meet the classification of a smaller stream.

b. Typical FCL values from the Flood Hazard Area Land Use Management Guidelines[7] suggest a minimum FCL of 1.5m above the PNB with a safe building setback of 15.0m from the PNB for smaller streams.

c. Therefore, LEA recommends an FCL of 1.5m above the PNB of the watercourse and a 15.0m setback from the PNB of the watercourse.

3.2 Floodwater and Inundation

a. The recommended FCL applies to any Habitable Area; defined as any room or space within a building or structure that is or can be used for human occupancy, commercial sales, or storage of goods, possessions, or equipment (including furnaces) which would be subject to damage if flooded.

a. The FCL establishes the minimum elevation of the underside of a wooden floor system or top of concrete slab for any Habitable Area. During construction, floor elevations should be confirmed by qualified survey personnel to ensure compliance with FCL requirements.

b. Provided any construction within the Properties satisfies the minimum recommended FCL and setback, we do not anticipate any damage to structures as a result of floodwater. However, anything constructed or stored below the recommended FCL, such as crawlspaces, basements, or storage rooms, could be subject damage from flooding.

c. Following best construction practices, areas below the FCL should not be used for the installation of furnaces, major electrical switchgear, or other fixed equipment susceptible to damage by floodwater.

4.0 SLOPE STABILITY ANALYSIS

4.1 General

a. A pseudo-static limit equilibrium slope stability analysis was carried out using GeoStudio 2024 Slope/W software, employing the Morgenstern-Price method. The software was used to evaluate the slope's resistance to slope failure by calculating a range of potential slip surfaces, determining the critical FoS, and the estimated extent of failure. The analysis was performed for both static and 2% in 50 year seismic

conditions, with a target FoS of 1.5 for the static condition and 1.0 for the seismic condition.

b. The analysis considered global rotational failures from crest to toe through the full slope height.

c. A single slope profile was modelled, corresponding to a section perpendicular to the slope face, through the steepest portion of the slope. The slope profile was created using available provincial lidar data[8]. We consider this information sufficient for slope modelling purposes and the slope dimensions were checked for accuracy on-site using hand-held inclinometers. A site plan showing the slope sections is attached to this Report.

4.2 Soil Parameters

a. The stability analysis was performed using effective stress conditions and frictional soil parameters as estimated based on the encountered soils during the BH investigation, published soil parameters, and based on LEA experience with similar soil conditions.

b. The soil strength parameters are summarized in Table 4.2 below.

Table 4.2: Mohr-Coulomb Soil Parameters

Soil Layer	Unit Weight (kN/m^3)	Effective Friction Angle (degrees)	Effective Cohesion (kPa)
01 – Gravelly sand, compact, brown, moist	20	34	0
01b – Sand, trace silt, trace gravel, dense, moist	21	36	0
02 – Sand and gravel, trace silt, very dense, brown, moist to wet	21	38	0
03 – Silt, some sand, very stiff, grey, moist	21	30	0
03b – Silt, trace clay and sand, stiff, grey-brown, moist	21	28	0
04 – Clayey sand and silt, very dense, grey, moist (glacial till)	22	40	0

4.3 Piezometric Conditions

a. A piezometric line was added to Section A-A' based on the recorded groundwater levels in the installed BH25-01 piezometer. Another piezometric line was added to Section B-B' based on drilling observations and an inferred piezometric surface in BH25-03. We conservatively increased the piezometric surface heights in the models to account for seasonal fluctuations in groundwater levels and climate change. The piezometric lines are identified on the attached Slope/W Section Plots as a dashed blue line.

4.4 Seismic Slope Analysis Methodology

b. The EGBC Landslide Assessment Guidelines specify that if soil liquefaction or strain softening is not a governing failure mode, the seismic slope stability FoS and magnitude of slope displacement can be

estimated by the methods provided by the guidelines.

c. The seismic hazard was first assessed using the k15 slope-displacement based seismic coefficient as initially defined in the 2010 EGBC Landslide Assessment Guidelines, then checked using updated methods by Bray and Macedo (2018, 2019) as per the 2022 EGBC Landslide Assessment Guidelines, to ensure slope displacements do not exceed 15cm for the combined interface and non-interface seismic sources. At the time of this Report, only combined source seismic hazard values were available. As per the guidelines, 15cm is considered an appropriate threshold for the maximum tolerable displacement for conventional residential construction.

d. The k15 coefficient was computed to be 0.276g, based on an earthquake moment magnitude (M) of 7.0 and a spectral response acceleration (Sa(0.5)) of 1.11g, for 2% in 50-year ground motions.

e. Seismic slope displacements were subsequently checked for the governing slip surface using a seismic yield coefficient (ky) corresponding to a FoS of 1.0, as determined with the Slope/W software.

d. The 2020 National Building Code (NBC) of Canada seismic hazard calculation for the Properties are attached to this Report.

4.5 Results

a. The results of the slope stability analysis and seismic slope displacement calculations are summarized in Tables 4.5.1 and 4.5.2 below. Detailed Slope/W plots can also be found attached to this Report. The Slope/W plots display computed slip surfaces that have a FoS less than the minimum target value.

b. Table 4.5.1 below summarizes the minimum setbacks from crest of slope that are required to satisfy the design FoS for each condition.

Table 4.5.1: Summary of Slope/W Results

Section	Failure Scenario	Condition	Setback from Crest of Slope (m)
Section A-A’	Rotational Failure	Static	7.0m
Section A-A’	Rotational Failure	Seismic	13.0m
Section B-B’	Rotational Failure	Static	5.5m
Section B-B’	Rotational Failure	Seismic	8.5m

c. Table 4.5.2 below summarizes the results of the seismic slope displacement calculations along the critical slip surface (i.e., the slip surface resulting in the greatest setback) for combined seismic sources.

Table 4.5.2: Seismic Displacement Check for the Critical Slip Surface

Section	Site Classification	Initial Fundamental Period of Sliding Mass (sec)	Seismic Yield Coefficient (g)	Median Seismic Slope Displacement (M7) Earthquakes (cm)
A-A'	C	0.055	0.274	4.55
B-B'	C	0.039	0.265	4.17

5.0 STEEP SLOPE DISCUSSIONS AND RECOMMENDATIONS

5.1 General

a. Our assessment indicates the slope is primarily comprised of hard/ dense glacially consolidated materials. These hard soils can maintain steep slopes for lengthy periods of time, however are susceptible to erosion and lose strength when saturated or exposed to heavy rain or concentrated overbank runoff. Over time, continued erosion can cause earth movement and slope instability, which could be accelerated during extreme natural occurrences such as earthquakes or low frequency storms events.

b. The steep slope is considered to be in a relatively stable condition, considering there were no visual signs of imminent global / full slope height instability observed on the Properties and slope at the time of our investigation.

5.2 Bank Erosion

a. There were varying degrees of watercourse channel erosion noted at the toe of the bank particularly where glacially consolidated sand and gravel materials were exposed along the natural boundary. These soils are susceptible to further erosion over the design life of future construction.

b. The natural boundary of Bloods Creek includes frequent areas of exposed soil, and examples of undercutting of the toe of the bank. The rate of erosion, without historical monitoring of the PNB through survey data, is difficult to quantify. Based on our assessment and local experience, we recommend that an additional 5.0m be added to the slope setbacks as an allowance for bank erosion from the Bloods Creek watercourse over a 50-year design life for new construction.

c. The PNB should be surveyed by a licensed surveyor to allow for monitoring of changes to the PNB location over time in the future.

5.3 Recommended Setback

a. Based on slope geometry, subsurface conditions, interpreted mechanisms of slope movement described above, and the results of the slope stability analyses, we recommend the following setbacks be established

from the crest of the slope based on the varying slope geometry and conditions identified during our field review, analysis results, and the 5.0m allowance for bank erosion:

i. Area 1: 18.0m
ii. Area 2: 13.5m
iii. Area 3: 5.0m

b. The setback areas are identified on the attached drawing (E3761-01) where each setback shall apply to future development.
c. The recommended setbacks shall be surveyed and marked on-site by qualified personnel prior to construction.
d. The recommended setbacks are in general agreement with other slope stability assessments completed by LEA in the area and is associated with seismic displacements of 15cm or less. This setback is intended to mitigate catastrophic damage to structures (collapse) and does not propose to provide any mitigation against damage to land.
e. Ponds, swimming pools, and in-ground lawn irrigation systems shall be prohibited within the setback zone.
f. Ancillary structures such as near-grade sundecks, gazebos, and sheds may be located within the setback area, with the understanding that they are not considered occupiable space and are not structurally attached to habitable buildings. Please note that the potential for loss or damage of these less critical ancillary structures due to slope failure increases as the distance to the crest diminishes. Ultimately it is at the discretion of the AHJ whether a specific ancillary structure is considered occupiable space and be constructed in accordance with the BCBC. LEA can provide further recommendations for construction of ancillary structures within the setback area upon request.

5.4 Slope Maintenance

a. It should be noted that landslides can occur due to human activity (i.e., excavation, placement of fill, removal of vegetation, etc.) or by failure of civil infrastructure (i.e., leakage/rupture of underground water and sewer mains, stormwater disposal from existing developments, etc.).
b. Minimizing infiltration of water into the slope and setback zone is essential to reducing the risk of slope movement. It is important that water does not pond near the crest of slope. Surface water flow across the slope from precipitation events, collected stormwater, or from any other drainage system must be prevented from flowing in a concentrated manner down the slope. The concentrated discharge of collected stormwater can lead to erosion, earth movement, or slope failure.
c. The existing native vegetation cover on the slope should be maintained. The slope should not be cleared of vegetation, although select pruning, spiraling, or limbing of trees as directed by a qualified tree professional or arborist is permissible, subject to bylaw and geotechnical review. Generally, trees should

only be cut if their roots are undermined by slope regression or if they are leaning severely. An arborist shall be contacted to direct any topping, pruning, or cutting of trees. Exposed soils should be seeded to encourage new growth.

d. Preserve a healthy natural vegetated buffer zone adjacent to cleared / landscaped areas for runoff attenuation which will assist in maintaining stability of surficial cover.

e. Disposal of fills, yard waste, organic debris or excavation spoils shall not be discharged or dumped onto the slope or placed along the slope crest.

6.0 DESIGN PHASE

6.1 Foundation Design

a. Prior to construction, the foundation areas should be stripped to remove all unsuitable materials to provide an undisturbed natural subgrade for footing support.

b. Foundation loads should be supported on natural undisturbed material or structural fill, approved for use as a bearing stratum by our office, and may be designed using the following values.

   i. For foundations constructed on a dense to very dense naturally deposited subgrade an SLS bearing pressure of 150 kPa and a ULS bearing pressure of 225 kPa may be used for design purposes. These values assume a minimum 0.45m footing embedment depth.

   ii. For foundations constructed on a minimum of 0.6m of structural fill, placed and compacted as outlined in Section 6.2 of this Report, an SLS bearing pressure of 150 kPa and a ULS bearing pressure of 225 kPa may be used for design purposes. These values assume a minimum 0.45m footing embedment depth.

c. Exterior footings should be provided with a minimum 0.45m depth of ground cover for frost protection.

d. The Geotechnical Engineer should evaluate the subsurface conditions at the time of construction to confirm that soil and/or groundwater conditions do not materially differ to those encountered during the subsurface investigation and that footings are based on appropriate and properly prepared founding material.

6.2 Seismic Criteria

a. As per the 2024 BCBC (Division B, Part 4, Table 4.1.8.4-B), the encountered and inferred subsurface conditions would be classified as “Site Class C” (very dense soil and soft rock).

7.0 CONSTRUCTION PHASE

7.1 General Excavation – Future Building Sites

a. Prior to construction, all unsuitable materials should be removed to provide a suitable base of support. Unsuitable materials include any non-mineral material such as vegetation, topsoil, peat, fill, or other materials containing organic matter, as well as any soft, loose, or disturbed soils.

b. The average depth to competent subgrade as encountered within the BHs was approximately 1.1m.

c. Ground water ingressing into any excavations should be controlled with a perimeter ditch located just outside of the building areas, connected to positive drainage.

d. Prior to placement of concrete footings, any bearing soils that have been softened, loosened, or otherwise disturbed during the course of construction, should be removed or else compacted following our recommendations for structural fill. Compaction will only be feasible if the soil has suitable moisture content and if there is access to heavy compaction equipment. If no structural fill is placed, a smooth-bladed clean up bucket should be used to finish the excavation.

e. The Geotechnical Engineer is to confirm the removal of unsuitable materials and approve the exposed competent inorganic subgrade, prior to the placement of any structural fill material.

7.2 Structural Fill

a. Where fill is required to raise areas that will support buildings, slabs, or pavements, structural fill should be used. The Geotechnical Engineer should first approve the exposed subgrade in fill areas, to confirm the removal of all unsuitable materials.

b. Structural fill should not be placed on sloping ground; sloping ground should first be benched and leveled prior to the placement of structural fill.

c. Structural fill should be inorganic sand and gravel. If structural fill placement is to be carried out during the wet season, material with a fines content limited to 5% passing the 75µm sieve should be used, as such a material will not be overly sensitive to moisture, allowing compaction during rainy periods of weather.

d. Structural fill should be compacted to a minimum of 95% of Modified Proctor maximum dry density (ASTM D1557) in foundation and floor slab areas, as well as in paved roadway and parking areas.

e. Structural fills under foundations (including any isolated pad footings), roadways, and pavements should include the zone defined by a plane extending down and outward a minimum 0.5m from the outer edge of the foundation at an angle of 45 degrees from horizontal to ensure adequate subjacent support. This support zone is shown in Figure 7.2 below.

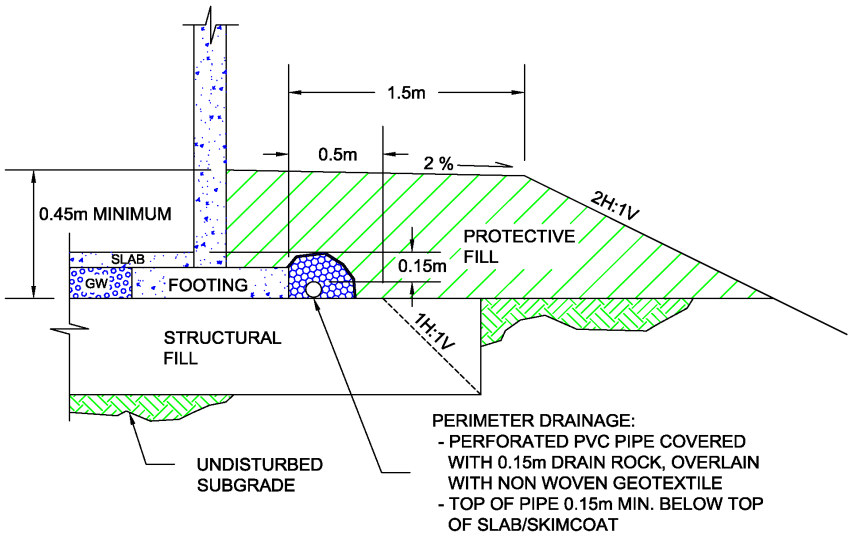

Figure 7.2 – Typical Section, Structural Fill

f. Compaction of fill should include moisture conditioning as needed to bring the soils to the optimum moisture content and compacted using vibratory compaction equipment in lift thicknesses appropriate for the size and type of compaction equipment used.

g. A general guideline for maximum lift thickness is no more than 100mm for light hand equipment such as a "jumping-jack," 200mm for a small roller, and 300mm for a large roller or heavy (>500 kg) vibratory plate compactor or a backhoe mounted hoe-pac or a large excavator mounted hoe-pac, as measured loose.

h. It should be emphasized that the long-term performance of buildings and slabs is highly dependent on the correct placement and compaction of underlying structural fills. Consequently, we recommend that structural fills be observed and approved by the Geotechnical Engineer. This would include approval of the proposed fill materials and performing a suitable program of compaction testing during construction.

7.3 Foundation Drainage

a. Our assessment did not identify any abnormal groundwater conditions that would necessitate special foundation drainage measures outside of Part 9 of the 2024 BCBC. Conventional requirements of the 2024 BCBC pertaining to building drainage are considered suitable at this site.

b. We assume the installed foundation and site drainage measures will be inspected and approved by Others (i.e., the Plumbing Inspector for the AHJ) during construction.

7.4 Stormwater Management

a. Runoff from paved areas, roof drains and perimeter foundation drains should be collected and piped to the municipal storm sewer system.

b. In the absence of a municipal storm sewer, collected stormwater could be discharged through solid UV

resistant conduit to the base of slope if permissible. The conduit should be anchored to the slope to prevent rupture and should include flexible couplings and a tear-away connection at or near the building. The conduit should be discharged at the toe of slope into a dispersion chamber, armoured splash pad or an approved outlet area where erosion can be managed. The conduit must be regularly inspected for leakage by current and future property owners, and immediately repaired if required.

c. Any stormwater infiltration measures (rock pits or similar) should be located outside of the recommended slope setback area and at a minimum distance of 5.0m from any structure.

d. LEA can provide a detailed Stormwater Management Plan upon request.

8.0 CONCLUSIONS

8.1 Local Government Conformance Statement

a. From a geotechnical point of view, and provided the recommendations in this Report are followed, the land is considered safe for the use intended (defined for the purposes of this Report as future development of conventional construction methods), with the probability of a geotechnical failure resulting in property damage of less than:

   i. 2% in 50 years for geotechnical hazards due to seismic events, including slope stability;

   ii. 1 in 200 year flood event; and

   iii. 10% in 50 years for all other geotechnical hazards.

8.2 Geotechnical and Quality Assurance Statement

a. The 2024 BCBC requires that a Geotechnical Engineer be retained to provide Geotechnical Assurance services for the construction of buildings that are outside of Part 9 of the BCBC. Geotechnical Assurance services include review of the geotechnical components of the plans and supporting documents, and responsibility for field reviews of these components during construction.

9.0 CLOSURE

a. Lewkowich Engineering Associates Ltd. appreciates the opportunity to be of service on this project. If you have any comments, or additional requirements at this time, please contact us at your convenience.

Respectfully Submitted,
Lewkowich Engineering Associates Ltd.

Tennes Hamre, P.Geo.
Project Geoscientist

September 7, 2025

Chris Hudec, M.A.Sc., P.Eng.
Senior Project Engineer

Reviewed By:
Stuart Crossfield, P.Geo., P.L.Eng.
Engineering Geologist

10.0 ATTACHMENTS

1. E3761-01, Geotechnical Site Plan, dated August 25, 2025.
2. LEA, Borehole Logs, BH25-01 to BH25-03.
3. LEA, Slope/W plots (4 plots).
4. LEA, Grain Size Analysis, Lab Nos. L1481-01 to L1481-07. (7 pages).
5. 2020 National Building Code Seismic Hazard Calculation sheet.
6. EGBC Appendix D – Landslide Assurance Statement
7. EGBC Appendix I – Flood Hazard Assurance Statement

11.0 REFERENCES

1. DoL – Zoning Bylaw, Bylaw No. 180, 2020.
2. Engineers and Geoscientists British Columbia, Legislated Flood Assessments in a Changing Climate in BC, Version 2.1, dated August 28, 2018.
3. Engineers and Geoscientists of British Columbia, Landslide Assessments in British Columbia, Version 4.1, published March 1, 2023.
4. Lantzville Interactive Web Map, accessed August 2025.
5. Geological Survey of Canada, Surficial Geology - Nanaimo, Map 27-1963 Sheet 2, 1986.
6. Province of BC, interactive web-map, iMapBC, accessed September 2024.
7. BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development, Flood Hazard Area Land Use Management Guidelines, amended January 1, 2018.
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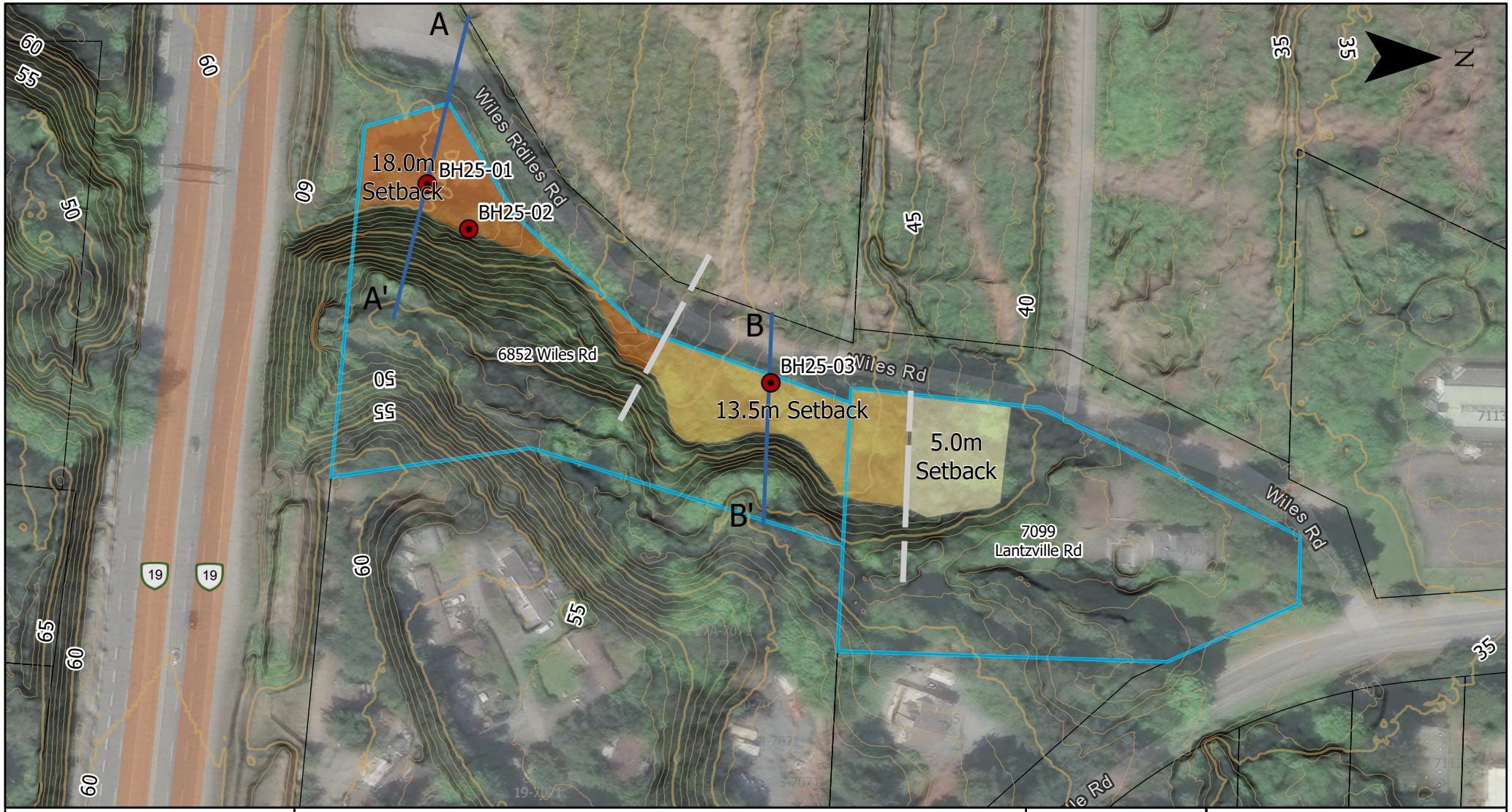


Legend

- Borehole
- Subject Property
- Property Lines
- Contour
  - 1.0m
  - 5.0m
- Cross Section
- Slope Setback Divisor
- Slope Setback Areas
  - 1
  - 2
  - 3

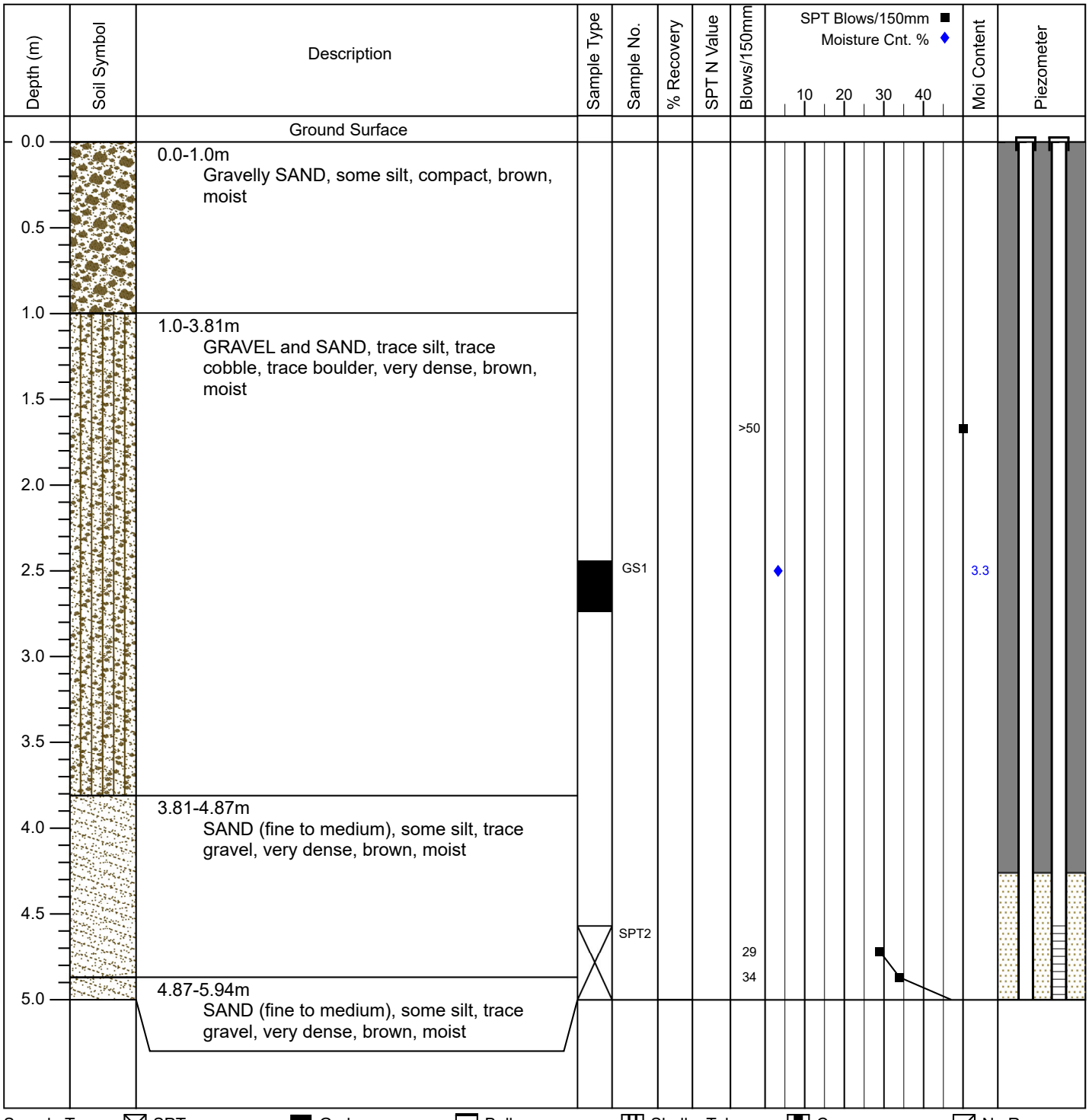
PROJECT NAME 7099 Lantzville Road & 6852 Wiles Road, Lantzville, BC	Drawing No. E3761-01	Lewkowich Engineering Associates Ltd.
DRAWING TITLE Geotechnical Site Plan	Date: 2025-08-25 / Drawn By: TH	
LEGAL DESCRIPTION Lot A, District Lot 27G, Wellington District, Plan VIP54592, PID 017-838-941, and Lot 1, District Lot 45, Wellington District, Plan VIP8752 Except Plan VIP46247 and VIP63648, PID: 001-258-435	Lidar Aquisition Date: 2024 Coordinate System: NAD 1983 CSRS UTM Zone 10N Vertical Datum: CGVD 2013	0 10 20 30 40 Meters

Lewkowich Engineering Associates Ltd.

BOREHOLE LOG

File Number: E3761 BH25-01
Client: District of Lantzville
Project: 7099 Lantzville Road & 6852 Wiles Road
Location: Lantzville, BC

Coordinates: 49.244288, -123.074184



Sample Type: SPT Grab Bulk Shelby Tube Core No Recovery

Logged By: Tennes Hamre, P.Geo.
Reviewed By: Jeff Scott, P.Eng.
Digging Method: Boart LS250 Sonic Drill

Date: July 29, 2025

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Nanaimo, BC, V9S 5Y2
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Email: geotech@lewkowich.com

Lewkowich Engineering Associates Ltd.

BOREHOLE LOG

File Number: E3761 BH25-01
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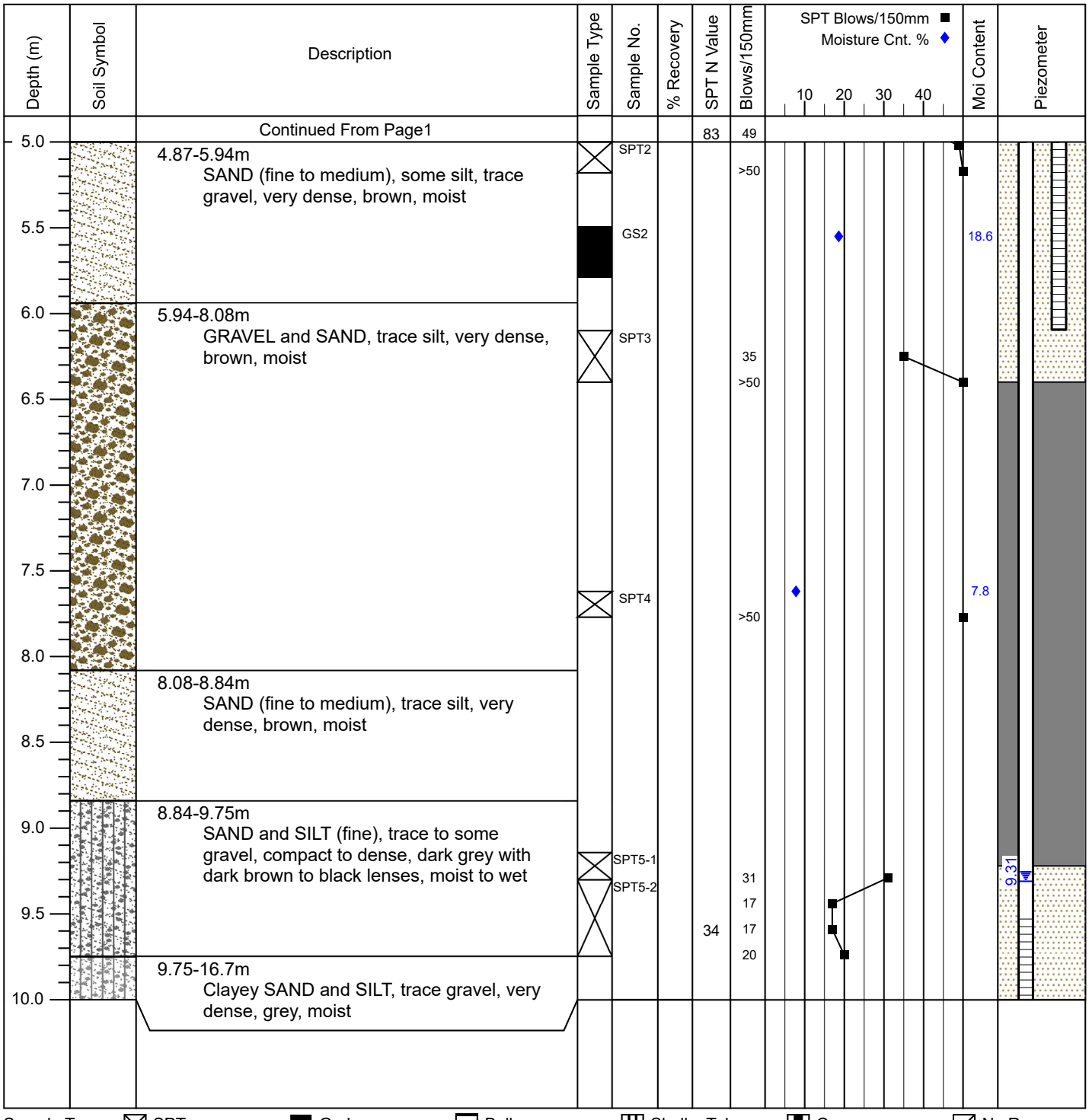
Project: 7099 Lantzville Road & 6852 Wiles Road
Location: Lantzville, BC

Coordinates: 49.244288, -123.074184



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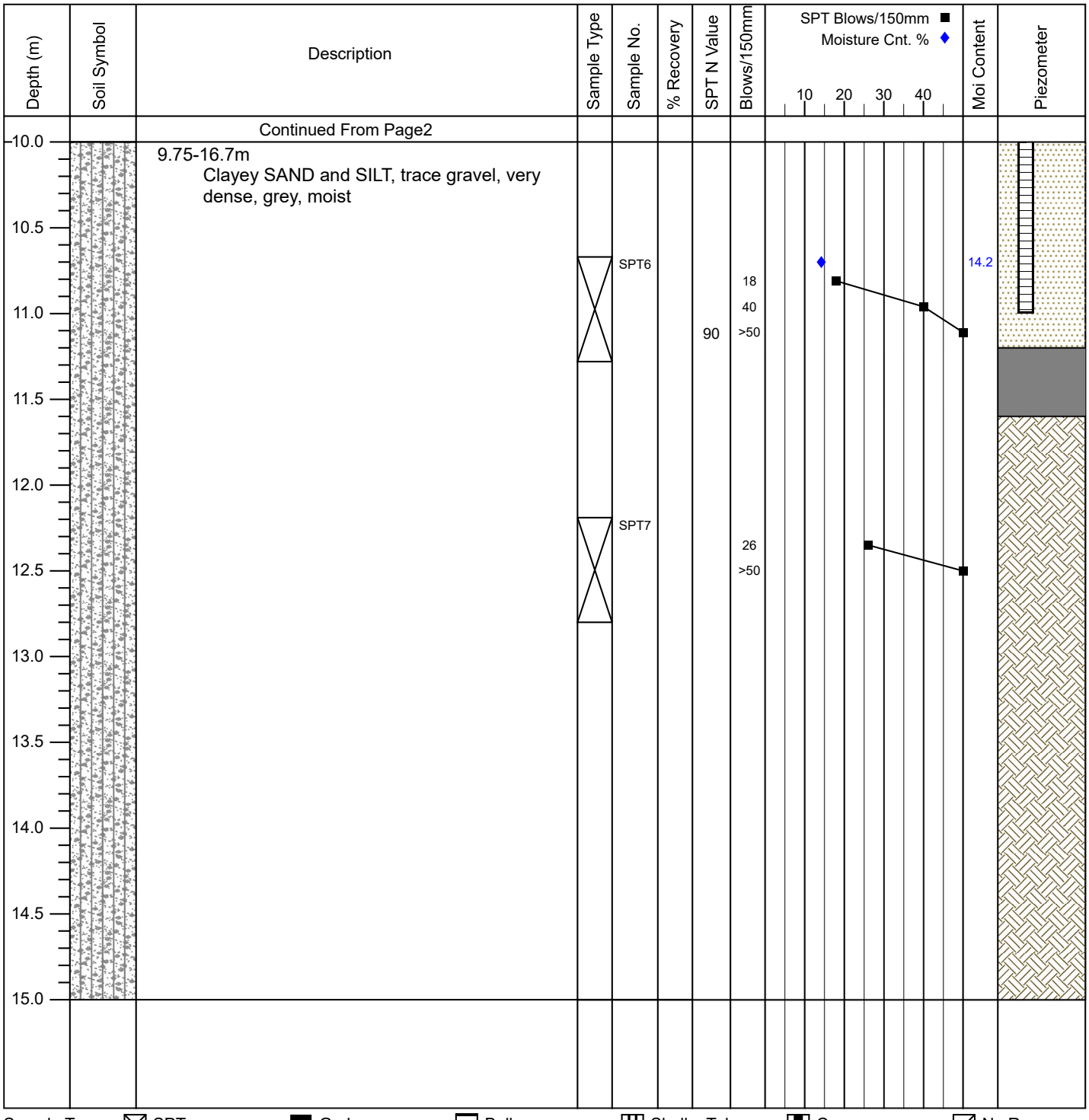
BOREHOLE LOG

File Number: E3761 BH25-01
Client: District of Lantzville
Project: 7099 Lantzville Road & 6852 Wiles Road
Location: Lantzville, BC

Coordinates: 49.244288, -123.074184



Sample Type: SPT Grab Bulk Shelby Tube Core No Recovery

Logged By: Tennes Hamre, P.Geo.
Reviewed By: Jeff Scott, P.Eng.
Digging Method: Boart LS250 Sonic Drill

Date: July 29, 2025

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BOREHOLE LOG

File Number: E3761 BH25-01
Client: District of Lantzville
Project: 7099 Lantzville Road & 6852 Wiles Road
Location: Lantzville, BC

Coordinates: 49.244288, -123.074184

Depth (m)	Soil Symbol	Description	Sample Type	Sample No.	% Recovery	SPT N Value	Blows/150mm	SPT Blows/150mm ■ Moisture Cnt. % ♦ (10 20 30 40)	Moi Content	Piezometer
		Continued From Page3								
15.0		9.75-16.7m Clayey SAND and SILT, trace gravel, very dense, grey, moist		SPT8		84	15 34 >50			
15.5										
16.0										
16.5										
		Groundwater levels recorded on August 18, 2025. Piezometer at 6.1m was dry. Moisture contents may be inaccurate due to drilling fluid/ water End of Borehole at 16.7m (target depth reached)								
17.0										
17.5										
18.0										
18.5										
19.0										
19.5										
20.0										

Sample Type: ☒ SPT ■ Grab ▤ Bulk ▥ Shelby Tube ◧ Core ◪ No Recovery

Logged By: Tennes Hamre, P.Geo. Date: July 29, 2025
Reviewed By: Jeff Scott, P.Eng. Page 4 of 4
Digging Method: Boart LS250 Sonic Drill

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Lewkowich Engineering Associates Ltd.

BOREHOLE LOG

File Number: E3761 BH25-02
Client: District of Lantzville
Project: 7099 Lantzville Road & 6852 Wiles Road
Location: Lantzville, BC

Coordinates: 49.244392, -124.074018

Depth (m)	Description	Sample Type	Sample No.	% Recovery	SPT N Value	Blows/150mm
0.0	Ground Surface					
	0.0-0.61m SAND, some gravel, some silt, compact, brown, moist					
	0.61-1.52m Silty SAND, some gravel, dense, brown, moist					
	1.52-3.05m SAND (fine to medium), some gravel, trace silt, very dense, brown, moist		SPT1		86	42 46 40 36
	3.05-5.79m SAND (fine to medium), trace gravel, trace silt, very dense, brown, moist		SPT2		60	13 25 35 44
			SPT3			18 33
5.0						

SPT Blows/150mm ■ Moisture Cnt. % ♦ (10, 20, 30, 40)

Moi Content

Sample Type: SPT Grab Bulk Shelby Tube Core No Recovery

Logged By: Tennes Hamre, P.Geo. Date: July 29, 2025
Reviewed By: Jeff Scott, P.Eng. Page 1 of 3
Digging Method: Boart LS250 Sonic Drill

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Lewkowich Engineering Associates Ltd.

BOREHOLE LOG

File Number: E3761 BH25-02
Client: District of Lantzville
Project: 7099 Lantzville Road & 6852 Wiles Road
Location: Lantzville, BC

Coordinates: 49.244392, -124.074018

Depth (m)	Description	Sample Type	Sample No.	% Recovery	SPT N Value	Blows/150mm
	Continued From Page1				67	34
5.0	3.05-5.79m SAND (fine to medium), trace gravel, trace silt, very dense, brown, moist		SPT3			>50
5.79	5.79-9.75m Gravelly SAND, trace to some silt, very dense, brown, moist				89	36 44 45 >50
9.75	9.75-10.97m SAND (fine to medium), trace silt, very dense, brown with grey lenses, wet					
10.0						

SPT Blows/150mm ■ Moisture Cnt. % ♦ (10, 20, 30, 40)

Moi Content

Sample Type: SPT Grab Bulk Shelby Tube Core No Recovery

Logged By: Tennes Hamre, P.Geo.
Reviewed By: Jeff Scott, P.Eng.
Digging Method: Boart LS250 Sonic Drill

Date: July 29, 2025

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BOREHOLE LOG

File Number: E3761 BH25-02
Client: District of Lantzville
Project: 7099 Lantzville Road & 6852 Wiles Road
Location: Lantzville, BC

Coordinates: 49.244392, -124.074018

Depth (m)	Soil Symbol	Description	Sample Type	Sample No.	% Recovery	SPT N Value	Blows/150mm	SPT Blows/150mm ■ Moisture Cnt. % ♦ (10 20 30 40)	Moi Content
		Continued From Page2							
10.0		9.75-10.97m SAND (fine to medium), trace silt, very dense, brown with grey lenses, wet							
11.0		10.97-11.89m SILT, some sand, trace clay, very stiff, grey with dark brown lenses, wet	■	GS1				♦	26.5
12.0		11.89-12.2m Clayey SAND and SILT, trace gravel, very dense, grey, moist							
		Piezometric surface inferred at 9.75m Moisture contents may be inaccurate due to drilling fluid/ water End of Borehole at 12.2m (target depth reached)							
15.0									

Sample Type: ☒ SPT ■ Grab ▤ Bulk ▥ Shelby Tube ◧ Core ⊘ No Recovery

Logged By: Tennes Hamre, P.Geo. Date: July 29, 2025
Reviewed By: Jeff Scott, P.Eng. Page 3 of 3
Digging Method: Boart LS250 Sonic Drill

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Lewkowich Engineering Associates Ltd.

BOREHOLE LOG

File Number: E3761 BH25-03
Client: District of Lantzville
Project: 7099 Lantzville Road & 6852 Wiles Road
Location: Lantzville, BC

Coordinates: 49.245135, -124.073462

Depth (m)	Description	Sample Type	Sample No.	% Recovery	SPT N Value	Blows/150mm	Moi Content
	Ground Surface						
0.0	0.0-0.61m SAND (fine to medium), some gravel, trace organics (roots, rootlets), loose, dark brown, moist						
0.61	0.61-3.35m SAND (fine), trace silt, trace gravel, dense, light brown, moist		SPT1		33	5 14 19 27	11.8
			SPT2			9 23 32 45	
3.35	3.35-4.57m SAND (fine), trace silt, trace gravel, very dense, grey-brown, moist				55		
4.57	4.57-5.18m SILT, trace clay, trace sand, very stiff, grey-brown, moist		SPT3			4 6	34.2
5.0							

SPT Blows/150mm ■ Moisture Cnt. % ♦ (10, 20, 30, 40)

Sample Type: SPT Grab Bulk Shelby Tube Core No Recovery

Logged By: Tennes Hamre, P.Geo.
Reviewed By: Jeff Scott, P.Eng.
Digging Method: Boart LS250 Sonic Drill

Date: July 29, 2025
Page 1 of 2

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BOREHOLE LOG

Lewkowich Engineering Associates Ltd.

File Number: E3761 BH25-03
Client: District of Lantzville
Project: 7099 Lantzville Road & 6852 Wiles Road
Location: Lantzville, BC

Coordinates: 49.245135, -124.073462

Depth (m)	Description	Sample Type	Sample No.	% Recovery	SPT N Value	Blows/150mm	Moi Content
	Continued From Page1				14	8	
5.0	4.57-5.18m SILT, trace clay, trace sand, very stiff, grey-brown, moist		SPT3			10	
5.5	5.18-5.48m Gravelly SAND, some silt, dense, grey, moist						
6.0	5.48-6.1m SAND and SILT, trace gravel, trace clay, dense, brown, moist					19	
	6.1-7.62m Gravelly SAND, some silt, very dense, grey, moist				66	24	
6.5						42	
7.0						36	
7.5							
	7.62-9.14m SAND (fine to medium), some gravel, some silt, very dense, grey, moist		SPT5			24	
8.0					81	31	
8.5						>50	
9.0							
	9.14-9.75m SAND (fine), trace gravel, very dense, grey, wet		SPT6			33	
9.5					93	47	
						46	
						44	
10.0	Moisture contents may be inaccurate due to drilling fluid/ water End of borehole at 9.75m (target depth reached)						

SPT Blows/150mm ■ Moisture Cnt. % ♦
10 20 30 40

Sample Type: SPT Grab Bulk Shelby Tube Core No Recovery

Logged By: Tennes Hamre, P.Geo.
Reviewed By: Jeff Scott, P.Eng.
Digging Method: Boart LS250 Sonic Drill

Date: July 29, 2025

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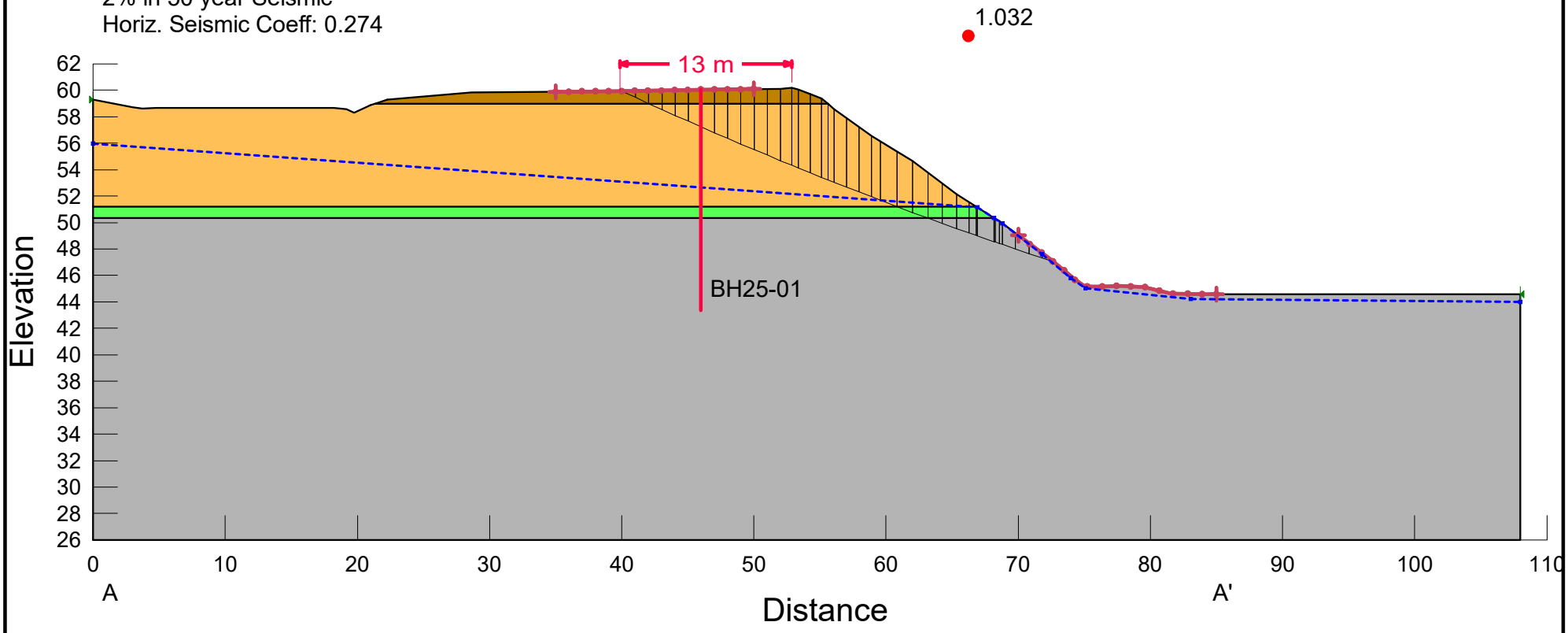
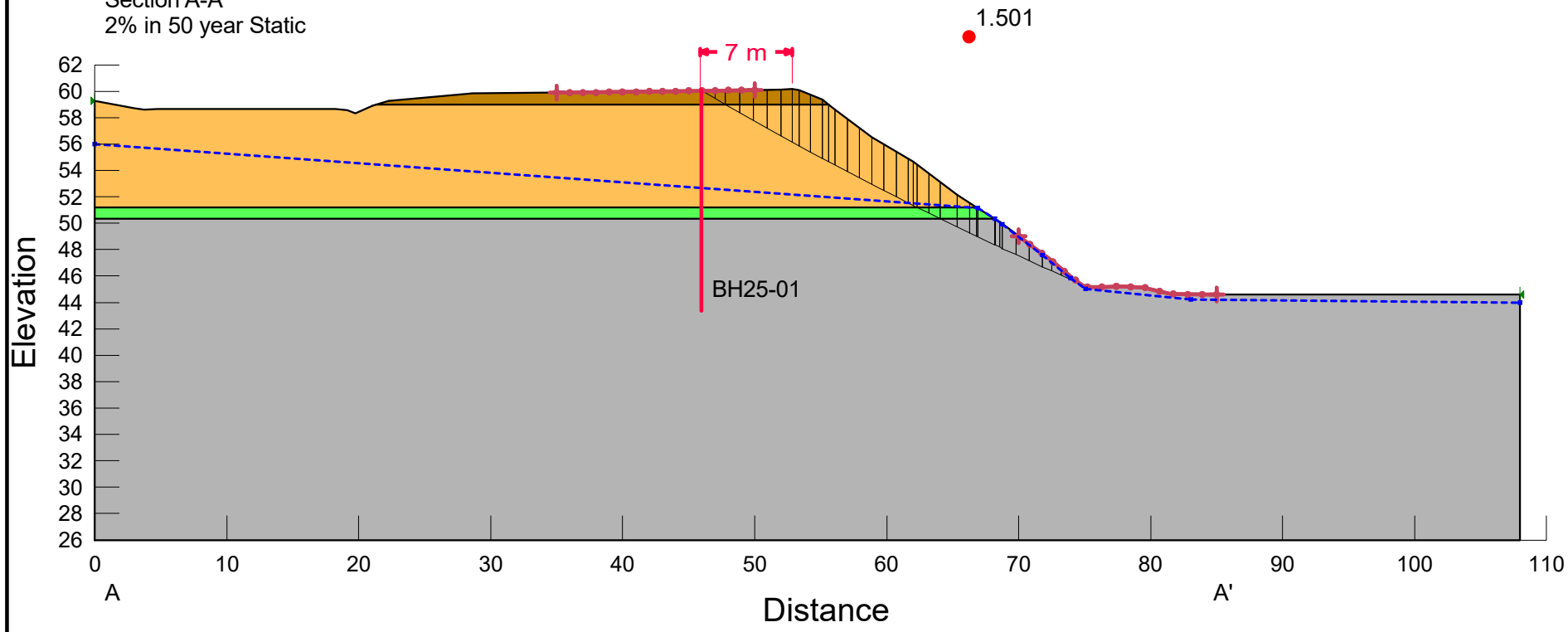
Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Surface
	01 - Gravelly sand, compact, brown, moist	Mohr-Coulomb	20	0	34	
	02 - Sand and Gravel, trace silt, very dense, brown, moist to wet	Mohr-Coulomb	21	0	38	1
	03 - Silt, some sand, very stiff, grey, moist	Mohr-Coulomb	21	0	30	1
	04 Clayey sand and silt, very dense, grey, moist	Mohr-Coulomb	22	0	40	

E3761
Section A-A'
2% in 50 year Seismic
Horiz. Seismic Coeff: 0.274

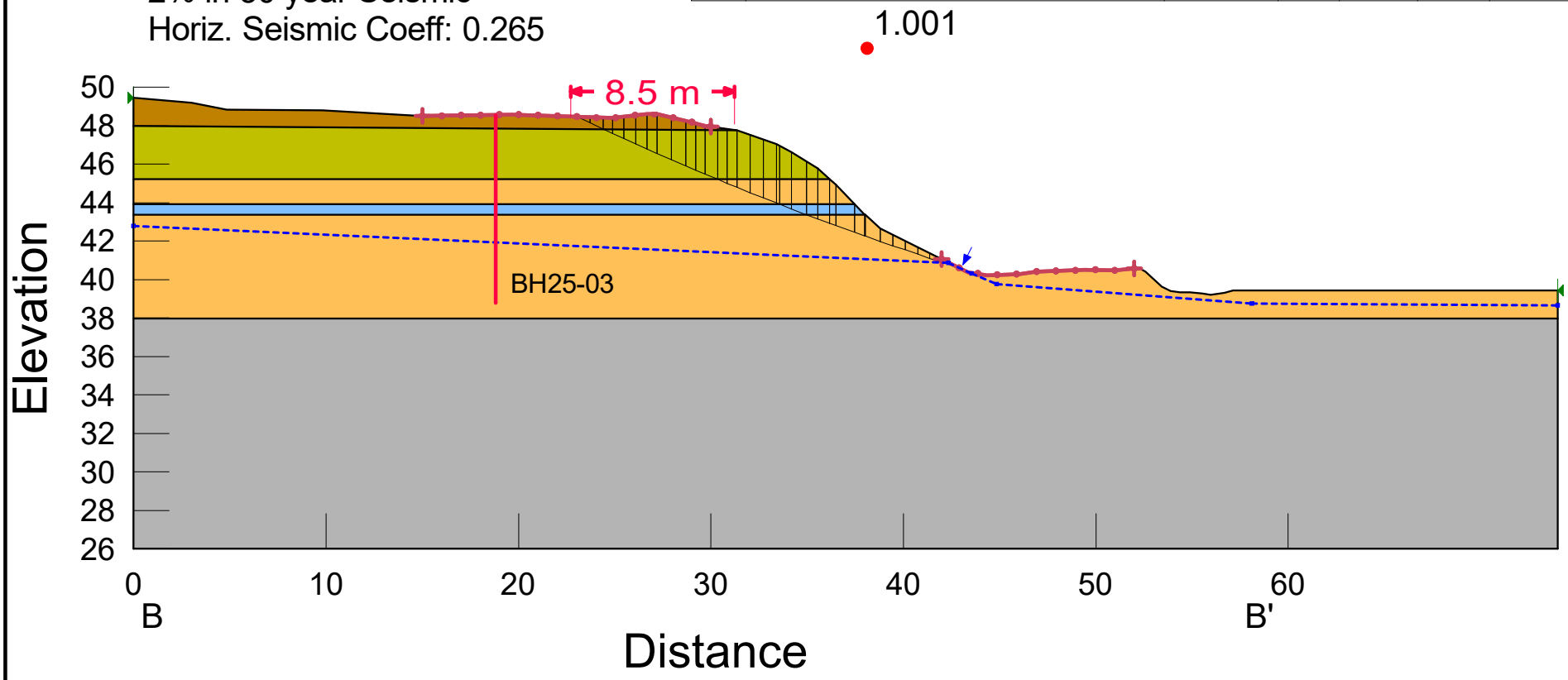


Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Surface
	01 - Gravelly sand, compact, brown, moist	Mohr-Coulomb	20	0	34	
	02 - Sand and Gravel, trace silt, very dense, brown, moist to wet	Mohr-Coulomb	21	0	38	1
	03 - Silt, some sand, very stiff, grey, moist	Mohr-Coulomb	21	0	30	1
	04 Clayey sand and silt, very dense, grey, moist	Mohr-Coulomb	22	0	40	

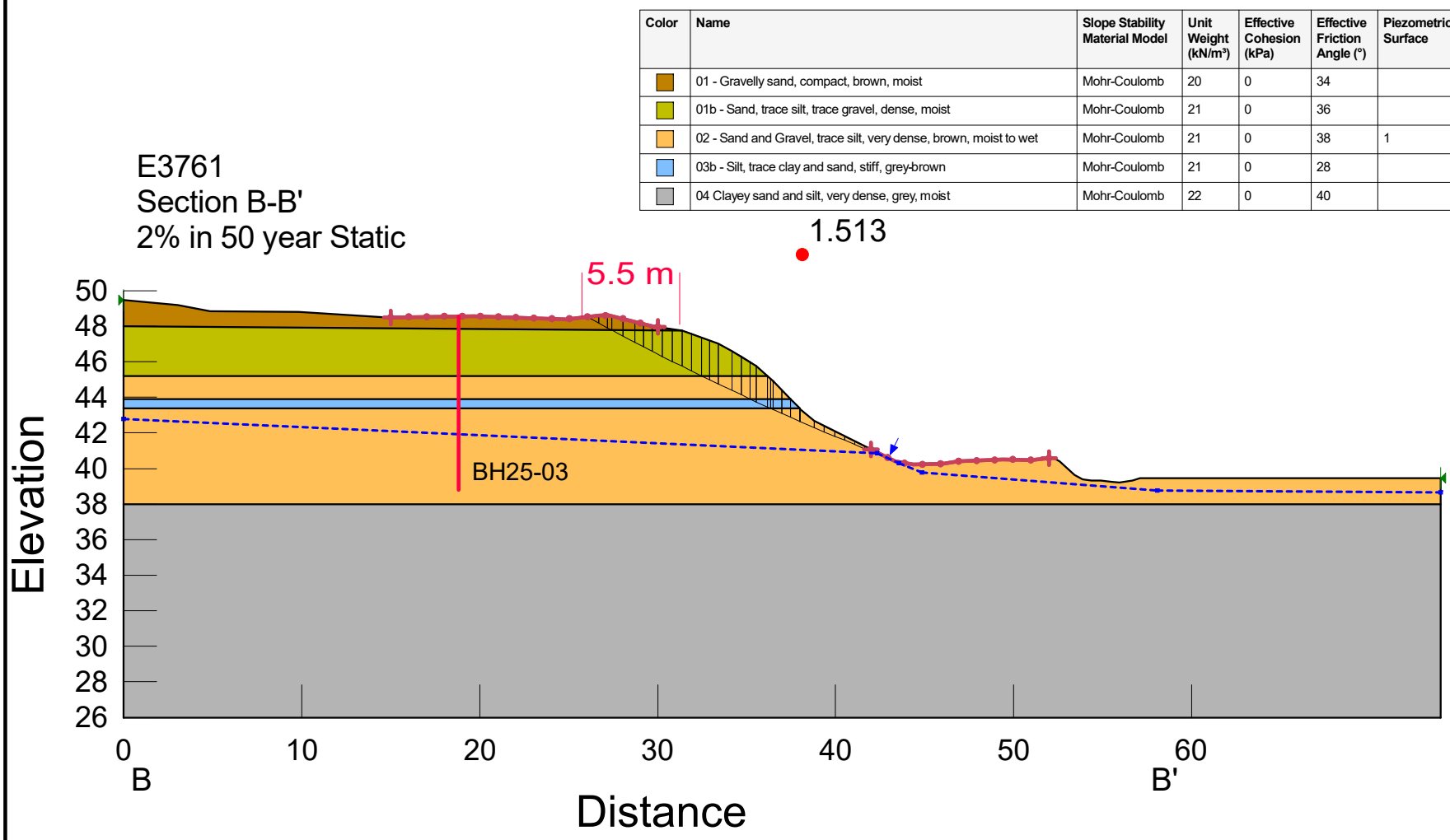


Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Surface
	01 - Gravelly sand, compact, brown, moist	Mohr-Coulomb	20	0	34	
	01b - Sand, trace silt, trace gravel, dense, moist	Mohr-Coulomb	21	0	36	
	02 - Sand and Gravel, trace silt, very dense, brown, moist to wet	Mohr-Coulomb	21	0	38	1
	03b - Silt, trace clay and sand, stiff, grey-brown	Mohr-Coulomb	21	0	28	
	04 Clayey sand and silt, very dense, grey, moist	Mohr-Coulomb	22	0	40	

E3761
Section B-B'
2% in 50 year Seismic
Horiz. Seismic Coeff: 0.265



Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Surface
	01 - Gravelly sand, compact, brown, moist	Mohr-Coulomb	20	0	34	
	01b - Sand, trace silt, trace gravel, dense, moist	Mohr-Coulomb	21	0	36	
	02 - Sand and Gravel, trace silt, very dense, brown, moist to wet	Mohr-Coulomb	21	0	38	1
	03b - Silt, trace clay and sand, stiff, grey-brown	Mohr-Coulomb	21	0	28	
	04 Clayey sand and silt, very dense, grey, moist	Mohr-Coulomb	22	0	40	

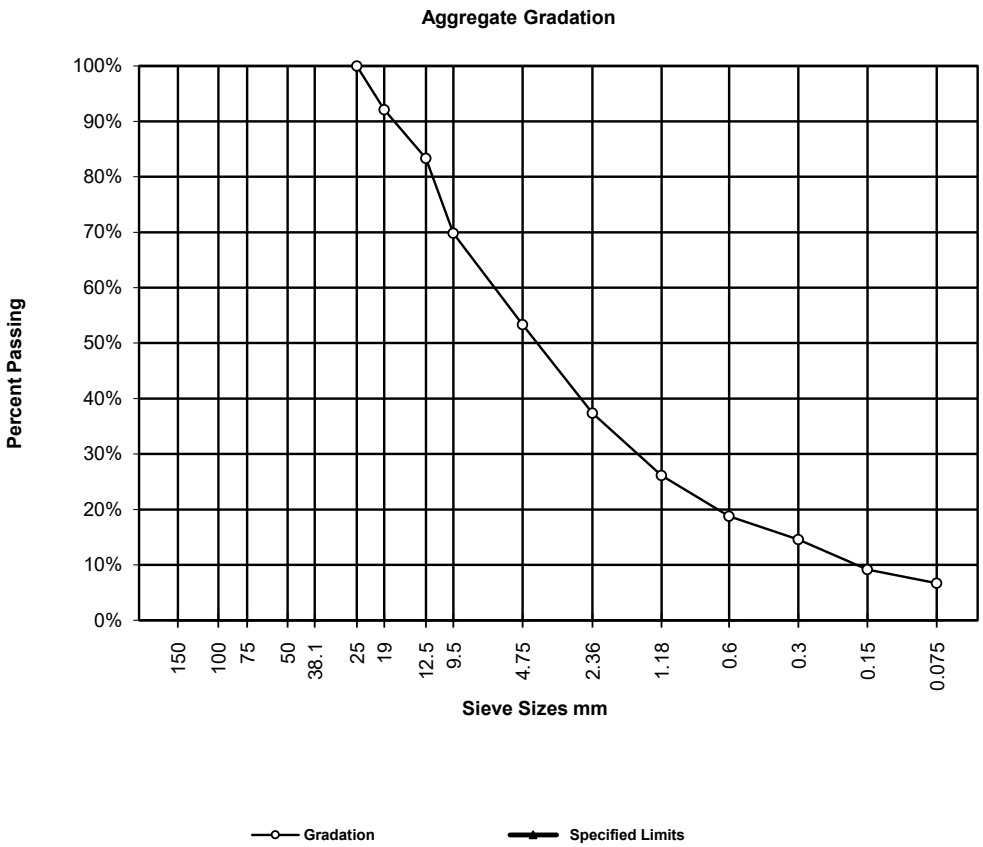


Lewkowich Engineering Associates Ltd.

Grain Size Analysis

Client: District of Lantzville
Project Name: 7099 Lantzville Road & 6852 Wiles Road
Site Location: Lantzville, BC
Sample Source: BH25-01, SPT 3, 6.1-6.4m
Specified Limits: No Specified Limits
Material Type:
Classification Description: Well Graded Gravel with silt and sand
Comments:

Job No. E3761
Lab No. L1481-01
Date Sampled: July 29, 2025
Date Tested: August 13, 2025
Sampled By: TH
Unified Classification: GW-GM



Aggregate Gradation		Specified Limits	
Sieve Sizes mm	Percent Passing	Minimum	Maximum
150			
100			
75			
50			
38.1			
25	100%		
19	92%		
12.5	83%		
9.5	70%		
4.75	53%		
2.36	37%		
1.18	26%		
0.6	19%		
0.3	15%		
0.15	9%		
0.075	6.7%		

As Received Moisture Content = 7.8%

Reviewed By:

Method: Wash Sieve ASTM C136 and C117
Classification: Based on ASTM D2487

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Permit to Practice Number: 1001802.

Lewkowich Engineering Associates Ltd.

Grain Size Analysis (Hydrometer)

Method: ASTM D422

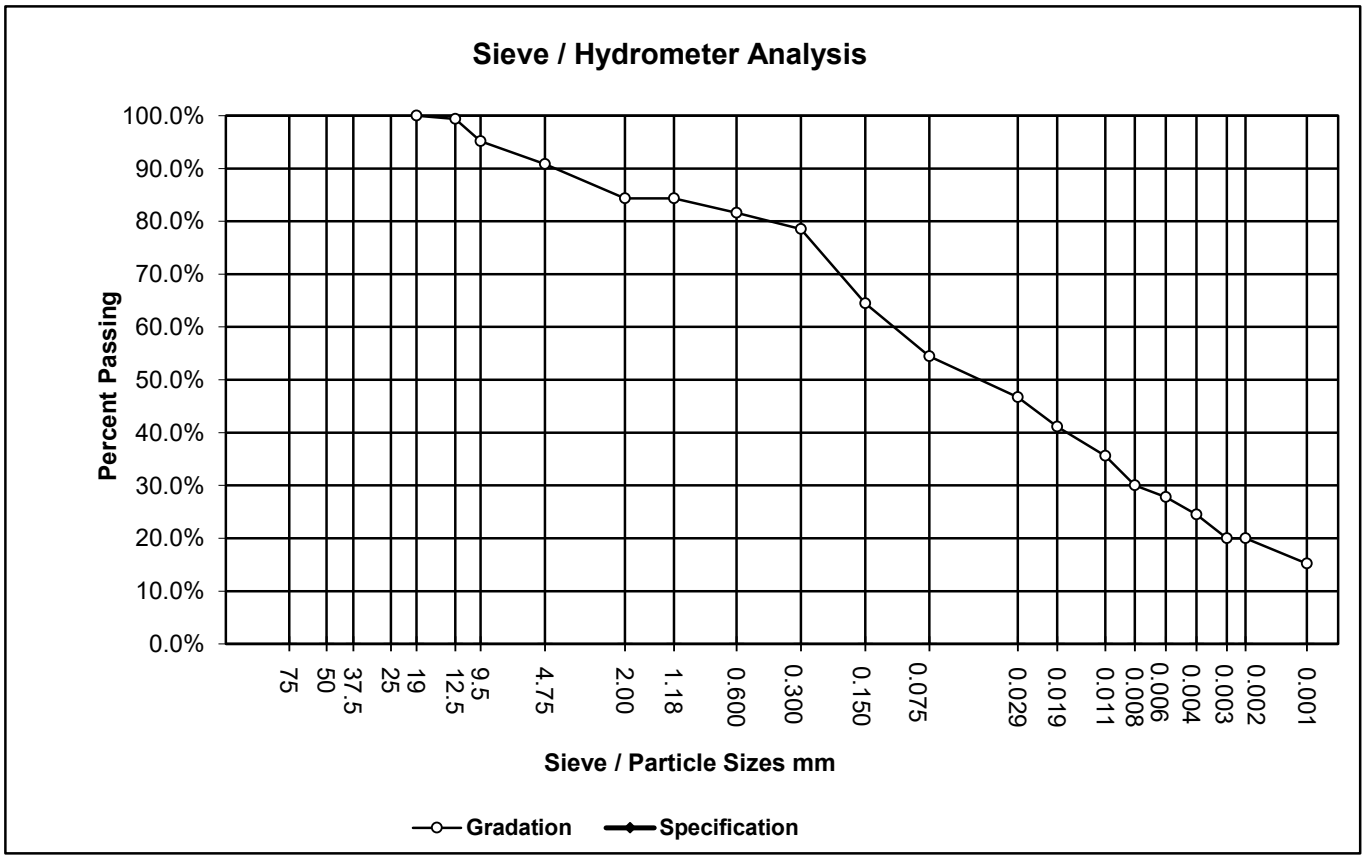
Client: District of Lantzville
Project Name: 7099 Lantzville Road & 6852 Wiles Road
Site Location: Lantzville, BC
Sample Source: BH25-01, SPT 6, 10.67-11.28m
Comments:

Job No. E3761
Lab No. L1481-02
Date Sampled: July 29, 2025
Date Tested: August 13, 2025
Sampled By: TH
Tested By: CM

Sieve Analysis		Hydrometer Analysis	
Sieve Sizes mm	Percent Passing	Particle Sizes mm	Percent Passing
		0.029	46.7%
75		0.019	41.1%
50		0.011	35.6%
37.5		0.008	30.0%
25		0.006	27.8%
19	100.0%	0.004	24.5%
12.5	99.4%	0.003	20.0%
9.5	95.2%	0.002	20.0%
4.75	90.9%	0.001	15.2%
2.00	84.3%		
1.18	84.3%		
0.600	81.6%		
0.300	78.5%		
0.150	64.5%		
0.075	54.4%		

Grading per ASTM D2487
Cobble Sizes: < 300mm > 75mm
Gravel Sizes: < 75mm > 4.75mm
Sand Sizes: < 4.75mm > 0.075mm
Silt Sizes: < 0.075mm > 0.002mm
Clay Sizes: < 0.002mm

As Received Moisture Content = **14.2%**



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Permit to Practice Number: 1001802.

Lewkowich Engineering Associates Ltd.

Grain Size Analysis (Hydrometer)

Method: ASTM D422

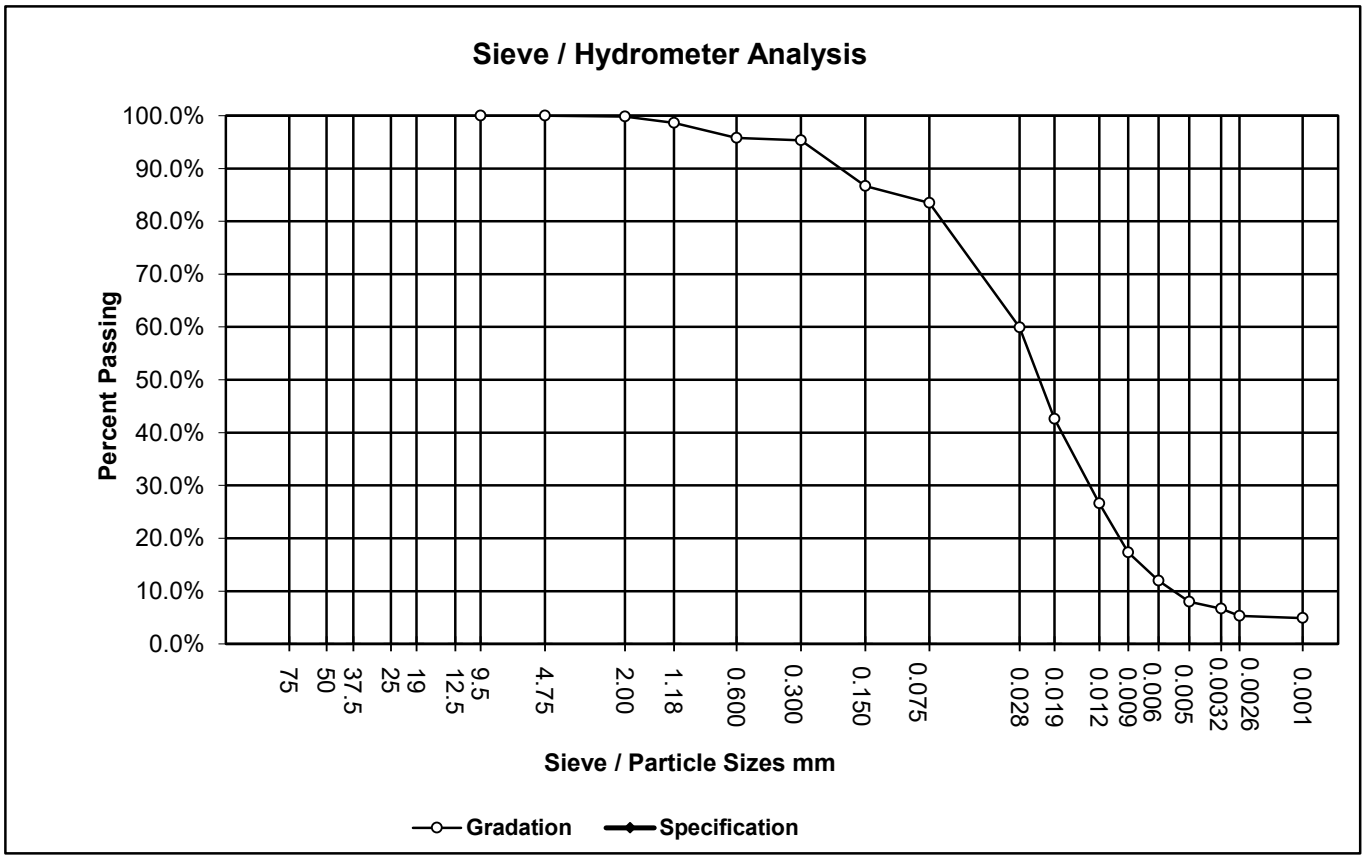
Client: District of Lantzville
Project Name: 7099 Lantzville Road & 6852 Wiles Road
Site Location: Lantzville, BC
Sample Source: BH25-02, GS1, 11.28m
Comments:

Job No. E3761
Lab No. L1481-05
Date Sampled: July 29, 2025
Date Tested: August 13, 2025
Sampled By: TH
Tested By: CM

Sieve Analysis		Hydrometer Analysis	
Sieve Sizes mm	Percent Passing	Particle Sizes mm	Percent Passing
		0.028	59.9%
75		0.019	42.6%
50		0.012	26.6%
37.5		0.009	17.3%
25		0.006	12.0%
19		0.005	8.0%
12.5		0.0032	6.7%
9.5	100.0%	0.0026	5.3%
4.75	100.0%	0.001	4.9%
2.00	99.8%		
1.18	98.6%		
0.600	95.8%		
0.300	95.3%		
0.150	86.7%		
0.075	83.5%		

Grading per ASTM D2487
Cobble Sizes: < 300mm > 75mm
Gravel Sizes: < 75mm > 4.75mm
Sand Sizes: < 4.75mm > 0.075mm
Silt Sizes: < 0.075mm > 0.002mm
Clay Sizes: < 0.002mm

As Received Moisture Content = **26.5%**



Reviewed By:

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Permit to Practice Number: 1001802.

Lewkowich Engineering Associates Ltd.

Grain Size Analysis (Hydrometer)

Method: ASTM D422

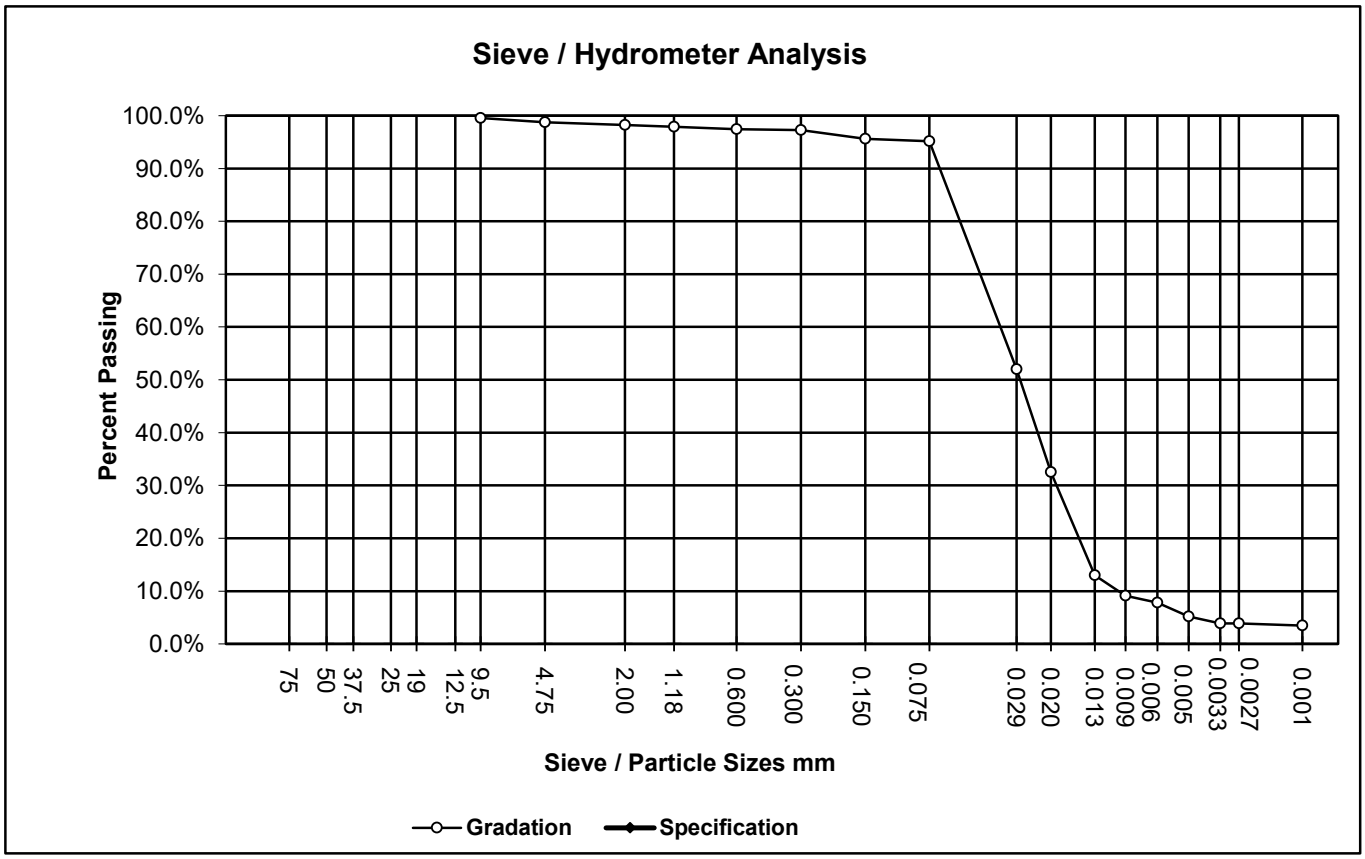
Client: District of Lantzville
Project Name: 7099 Lantzville Road & 6852 Wiles Road
Site Location: Lantzville, BC
Sample Source: BH25-03, SPT 3, 4.57-5.18m
Comments:

Job No. E3761
Lab No. L1481-07
Date Sampled: July 29, 2025
Date Tested: August 13, 2025
Sampled By: TH
Tested By: CM

Sieve Analysis		Hydrometer Analysis	
Sieve Sizes mm	Percent Passing	Particle Sizes mm	Percent Passing
		0.029	52.0%
75		0.020	32.5%
50		0.013	13.0%
37.5		0.009	9.1%
25		0.006	7.8%
19		0.005	5.2%
12.5		0.0033	3.9%
9.5	99.6%	0.0027	3.9%
4.75	98.7%	0.001	3.5%
2.00	98.3%		
1.18	97.9%		
0.600	97.4%		
0.300	97.3%		
0.150	95.6%		
0.075	95.1%		

Grading per ASTM D2487
Cobble Sizes: < 300mm > 75mm
Gravel Sizes: < 75mm > 4.75mm
Sand Sizes: < 4.75mm > 0.075mm
Silt Sizes: < 0.075mm > 0.002mm
Clay Sizes: < 0.002mm

As Received Moisture Content = **34.2%**



Reviewed By:

1900 Boxwood Road, Nanaimo, British Columbia, V9S 5Y2
Telephone: (250) 756-0355 Facsimile: (250) 756-3831
Permit to Practice Number: 1001802.

Lewkowich Engineering Associates Ltd.

Grain Size Analysis

Client: District of Lantzville
Job No. E3761

Project Name: 7099 Lantzville Road & 6852 Wiles Road
Lab No. L1481-03

Site Location: Lantzville, BC
Date Sampled: July 29, 2025

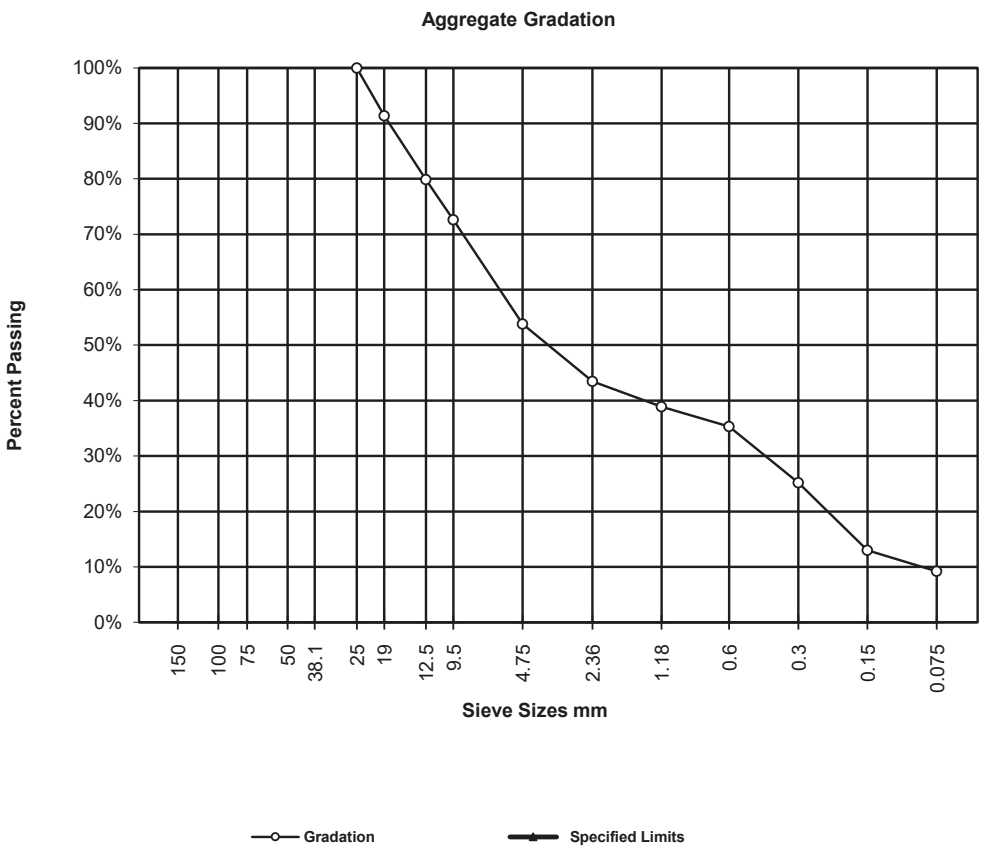
Sample Source: BH25-01, GS1, 2.44-2.74m
Date Tested: August 13, 2025

Specified Limits: No Specified Limits
Sampled By: TH

Material Type:
Unified Classification: GP-GM

Classification Description: Poorly Graded Gravel with silt and sand

Comments:



Aggregate Gradation		Specified Limits	
Sieve Sizes mm	Percent Passing	Minimum	Maximum
150			
100			
75			
50			
38.1			
25	100%		
19	91%		
12.5	80%		
9.5	73%		
4.75	54%		
2.36	43%		
1.18	39%		
0.6	35%		
0.3	25%		
0.15	13%		
0.075	9.2%		

As Received Moisture Content = 3.3%

Reviewed By:

Method: Wash Sieve ASTM C136 and C117

Classification: Based on ASTM D2487

1900 Boxwood Road, Nanaimo, British Columbia, V9S 5Y2
Telephone: (250) 756-0355 Facsimile: (250) 756-3831
Permit to Practice Number: 1001802.

Lewkowich Engineering Associates Ltd.

Grain Size Analysis

Client: District of Lantzville
Job No. E3761

Project Name: 7099 Lantzville Road & 6852 Wiles Road
Lab No. L1481-04

Site Location: Lantzville, BC
Date Sampled: July 29, 2025

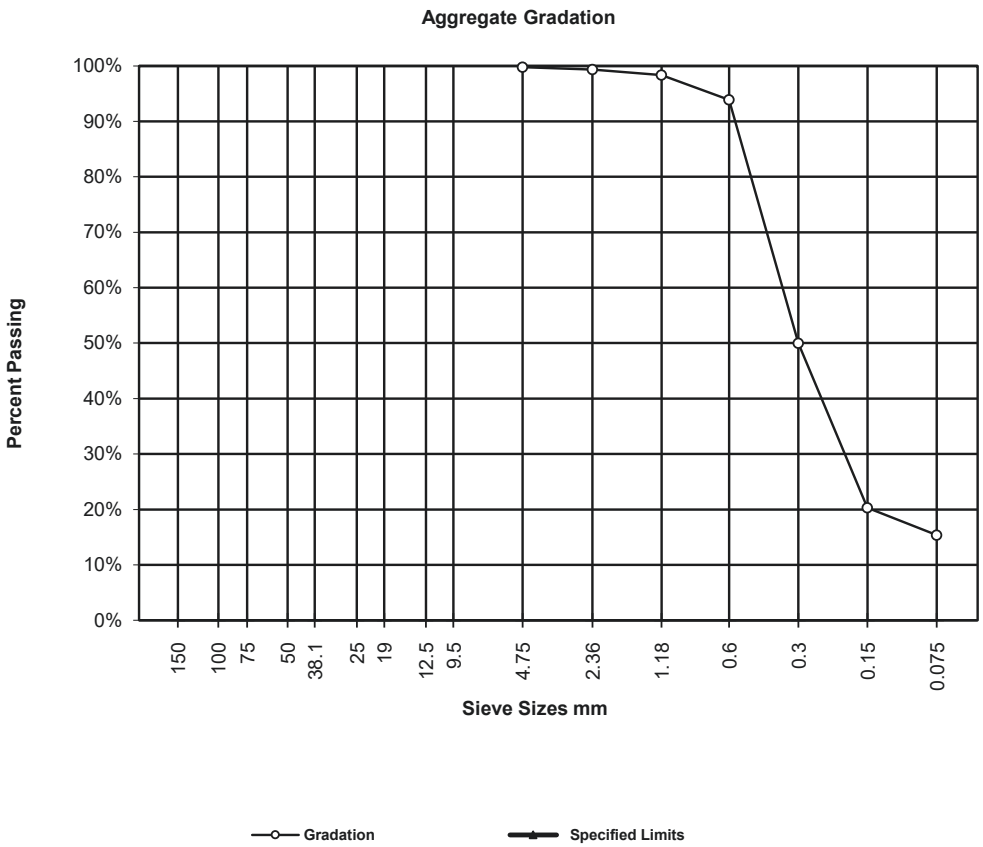
Sample Source: BH25-01, GS2, 5.49-5.79m
Date Tested: August 13, 2025

Specified Limits: No Specified Limits
Sampled By: TH

Material Type:
Unified Classification: SM

Classification Description: Silty Sand

Comments:



Aggregate Gradation		Specified Limits	
Sieve Sizes mm	Percent Passing	Minimum	Maximum
150			
100			
75			
50			
38.1			
25			
19			
12.5			
9.5			
4.75	100%		
2.36	99%		
1.18	98%		
0.6	94%		
0.3	50%		
0.15	20%		
0.075	15%		

As Received Moisture Content = 18.6%

Reviewed By:

Method: Wash Sieve ASTM C136 and C117

Classification: Based on ASTM D2487

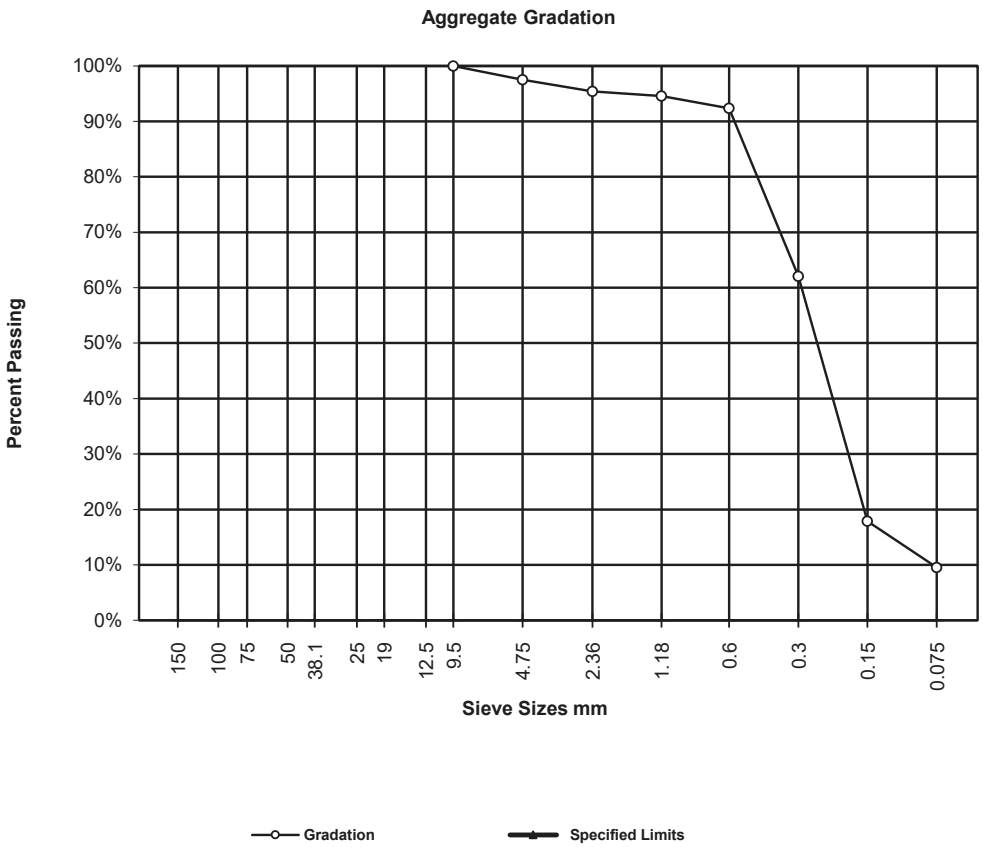
1900 Boxwood Road, Nanaimo, British Columbia, V9S 5Y2
Telephone: (250) 756-0355 Facsimile: (250) 756-3831
Permit to Practice Number: 1001802.

Lewkowich Engineering Associates Ltd.

Grain Size Analysis

Client: District of Lantzville
Project Name: 7099 Lantzville Road & 6852 Wiles Road
Site Location: Lantzville, BC
Sample Source: BH25-03, SPT1, 1.52-2.13m
Specified Limits: No Specified Limits
Material Type:
Classification Description: Poorly Graded Sand with silt
Comments:

Job No. E3761
Lab No. L1481-06
Date Sampled: July 29, 2025
Date Tested: August 13, 2025
Sampled By: TH
Unified Classification: SP-SM



Aggregate Gradation		Specified Limits	
Sieve Sizes mm	Percent Passing	Minimum	Maximum
150			
100			
75			
50			
38.1			
25			
19			
12.5			
9.5	100%		
4.75	98%		
2.36	95%		
1.18	95%		
0.6	92%		
0.3	62%		
0.15	18%		
0.075	9.5%		

As Received Moisture Content = 11.8%

Reviewed By:

Method: Wash Sieve ASTM C136 and C117
Classification: Based on ASTM D2487

1900 Boxwood Road, Nanaimo, British Columbia, V9S 5Y2
Telephone: (250) 756-0355 Facsimile: (250) 756-3831
Permit to Practice Number: 1001802.

Government of Canada / Gouvernement du Canada

2020 National Building Code of Canada Seismic Hazard Tool

This application provides seismic values for the design of buildings in Canada under Part 4 of the National Building Code of Canada (NBC) 2020 as prescribed in Article 1.1.3.1. of Division B of the NBC 2020.

Seismic Hazard Values

User requested values

Code edition	NBC 2020
Site designation X_S	X_C
Latitude (°)	49.245
Longitude (°)	-124.073

Please select one of the tabs below.

NBC 2020 | Additional Values | Plots | API | Background Information

The NBC 5% damped spectral acceleration values can be viewed in the NBC tab. Additional hazard values for your site can be found below.

The 5%-damped spectral acceleration ($S_a(T)$, where T is the period, in s) and peak ground acceleration (PGA) values are given in units of acceleration due to gravity (g, 9.81 m/s^2). Peak ground velocity (PGV) is given in m/s. Probability is expressed in terms of percent (%) exceedance in 50 years.

By default, all probabilities for the user-specified site designation are shown. Other site designations can be selected from the respective drop-down menu in the table. In low hazard regions, a minimum value of 0.001g for T ≤ 2.0s and of 0.0001g for T > 2.0s is assigned. Further information on the calculation of seismic hazard is provided in the *Background Information* tab.

Site Designation XC	**Probability** All	**S_a(0.05)**	**S_a(0.1)**	**S_a(0.2)**	**S_a(0.3)**	**S_a(0.5)**	**S_a(1.0)**	**S_a(2.0)**	**S_a(5.0)**	**S_a(10.0)**	**PGA**	**PGV**
X_C	2	0.732	1.06	1.26	1.33	1.11	0.662	0.417	0.113	0.0455	0.542	0.663
X_C	2.5	0.672	0.977	1.16	1.21	1.01	0.601	0.371	0.0976	0.038	0.499	0.598
X_C	3.5	0.587	0.856	1.02	1.06	0.874	0.512	0.307	0.0776	0.0291	0.438	0.509
X_C	5	0.504	0.737	0.877	0.901	0.739	0.425	0.245	0.06	0.0221	0.378	0.421
X_C	7	0.433	0.632	0.753	0.767	0.621	0.351	0.193	0.0464	0.017	0.325	0.348
X_C	10	0.363	0.53	0.631	0.636	0.507	0.279	0.145	0.0347	0.0127	0.273	0.279
X_C	14	0.302	0.442	0.525	0.523	0.41	0.22	0.108	0.0258	0.00943	0.228	0.222
X_C	20	0.242	0.356	0.423	0.415	0.318	0.166	0.0783	0.0185	0.00663	0.183	0.17
X_C	30	0.181	0.266	0.316	0.307	0.23	0.117	0.0531	0.0123	0.00427	0.136	0.121
X_C	40	0.14	0.207	0.248	0.238	0.176	0.0885	0.0396	0.00906	0.00303	0.106	0.092

Download CSV

← Go back to the seismic hazard calculator form

Date modified: 2021-04-06

LANDSLIDE ASSESSMENT ASSURANCE STATEMENT

Notes: This statement is to be read and completed in conjunction with the Engineers and Geoscientists BC *Professional Practice Guidelines – Landslide Assessments in British Columbia* ("the guidelines") and the current *BC Building Code* (*BCBC*), and is to be provided for Landslide Assessments (not floods or flood controls), particularly those produced for the purposes of the *Land Title Act*, *Community Charter*, or *Local Government Act*. Some jurisdictions (e.g., the Fraser Valley Regional District or the Cowichan Valley Regional District) have developed more comprehensive assurance statements in collaboration with Engineers and Geoscientists BC. Where those exist, the Qualified Professional is to fill out the local version only. Defined terms are capitalized; see the Defined Terms section of the guidelines for definitions.

To: The Approving Authority (or Client)

District of Lantzville

7192 Lantzville Road, Lantzville, BC, V0R 2H0

Jurisdiction/name and address

File No.: E3761.03

Date: September 7, 2025

With reference to (CHECK ONE):

- ☐ A. *Land Title Act* (Section 86) – Subdivision Approval
- ☑ B. *Local Government Act* (Sections 919.1 and 920) – Development Permit
- ☑ C. Community Charter (Section 56) – Building Permit
- ☐ D. Non-legislated assessment

For the following property (the "Property"):

7099 Lantzville Road and 6852 Wiles Road, Lantzville, BC

Civic address of the Property

The undersigned hereby gives assurance that they are a Qualified Professional and a professional engineer or professional geoscientist who fulfils the education, training, and experience requirements as outlined in the guidelines.

I have signed, authenticated, and dated, and thereby certified, the attached Landslide Assessment Report on the Property in accordance with the guidelines. That report must be read in conjunction this statement.

In preparing that report I have:

[CHECK TO THE LEFT OF APPLICABLE ITEMS]

- ☑ 1. Collected and reviewed appropriate background information
- ☑ 2. Reviewed the proposed Residential Development or other development on the Property
- ☑ 3. Conducted field work on and, if required, beyond the Property
- ☑ 4. Reported on the results of the field work on and, if required, beyond the Property
- ☑ 5. Considered any changed conditions on and, if required, beyond the Property
- 6. For a Landslide Hazard analysis or Landslide Risk analysis, I have:
  - ☑ 6.1 reviewed and characterized, if appropriate, any Landslide that may affect the Property
  - ☑ 6.2 estimated the Landslide Hazard
  - ☑ 6.3 identified existing and anticipated future Elements at Risk on and, if required, beyond the Property
  - ☑ 6.4 estimated the potential Consequences to those Elements at Risk
- 7. Where the Approving Authority has adopted a Level of Landslide Safety, I have:
  - ☐ 7.1 compared the Level of Landslide Safety adopted by the Approving Authority with the findings of my investigation
  - ☐ 7.2 made a finding on the Level of Landslide Safety on the Property based on the comparison
  - ☐ 7.3 made recommendations to reduce Landslide Hazards and/or Landslide Risks

8. Where the Approving Authority has **not** adopted a Level of Landslide Safety, or where the Landslide Assessment is not produced in response to a legislated requirement, I have:
   - ☑ 8.1 described the method of Landslide Hazard analysis or Landslide Risk analysis used
   - ☑ 8.2 referred to an appropriate and identified provincial, national, or international guideline for Level of Landslide Safety
   - ☑ 8.3 compared those guidelines (per item 8.2) with the findings of my investigation
   - ☑ 8.4 made a finding on the Level of Landslide Safety on the Property based on the comparison
   - ☑ 8.5 made recommendations to reduce Landslide Hazards and/or Landslide Risks
- ☑ 9. Reported on the requirements for future inspections of the Property and recommended who should conduct those inspections

Based on my comparison between:

[CHECK ONE]

- ☐ the findings from the investigation and the adopted Level of Landslide Safety (item 7.2 above)
- ☑ the appropriate and identified provincial, national, or international guideline for Level of Landslide Safety (item 8.4 above)

Where the Landslide Assessment is not produced in response to a legislated requirement, I hereby give my assurance that, based on the conditions[1] contained in the attached Landslide Assessment Report:

A. SUBDIVISION APPROVAL

☐ For subdivision approval, as required by the *Land Title Act* (Section 86), "the land may be used safely for the use intended"

[CHECK ONE]

- ☐ with one or more recommended additional registered Covenants
- ☐ without an additional registered Covenant(s)

B. DEVELOPMENT PERMIT

☑ For a development permit, as required by the *Local Government Act* (Sections 488 and 491), my report will "assist the local government in determining what conditions or requirements it will impose under subsection (2) of [Section 491]"

[CHECK ONE]

- ☐ with one or more recommended additional registered Covenants
- ☑ without an additional registered Covenant(s)

C. BUILDING PERMIT

☑ For a building permit, as required by the *Community Charter* (Section 56), "the land may be used safely for the use intended"

[CHECK ONE]

- ☐ with one or more recommended additional registered Covenants
- ☑ without any additional registered Covenant(s)

[1] When seismic slope stability assessments are involved, Level of Landslide Safety is considered to be a "life safety" criteria, as described in Commentary JJJ of the *National Building Code of Canada* (*NBC) 2015*, Structural Commentaries (User's Guide – NBC 2015: part 4 of division B). This states:

> "The primary objective of seismic design is to provide an acceptable level of safety for building occupants and the general public as the building responds to strong ground motion; in other words, to minimize loss of life. This implies that, although there will likely be extensive structural and non-structural damage, during the DGM (design ground motion), there is a reasonable degree of confidence that the building will not collapse, nor will its attachments break off and fall on people near the building. This performance level is termed 'extensive damage' because, although the structure may be heavily damaged and may have lost a substantial amount of its initial strength and stiffness, it retains some margin of resistance against collapse."

Tennes Hamre, P.Geo.
Name (print)

September 7, 2025
Date

1900 Boxwood Road
Address

Nanaimo, BC V9S 5Y2

250-756-0355
Telephone

thamre@lewkowich.com
Email

(Affix PROFESSIONAL SEAL and signature here)

The Qualified Professional, as a registrant on the roster of a registrant firm, must complete the following:

I am a member of the firm Lewkowich Engineering Associates Ltd.
(Print name of firm)

with Permit to Practice Number 1001802
(Print permit to practice number)

and I sign this letter on behalf of the firm.

FLOOD ASSURANCE STATEMENT

Note: This statement is to be read and completed in conjunction with the current Engineers and Geoscientists BC *Professional Practice Guidelines – Legislated Flood Assessments in a Changing Climate in BC* ("the guidelines") and is to be provided for flood assessments for the purposes of the *Land Title Act*, Community Charter, or the *Local Government Act*. Defined terms are capitalized; see the Defined Terms section of the guidelines for definitions.

To: The Approving Authority

LEA File No.: E3761.03

District of Lantzville

Date: September 7, 2025

7192 Lantzville Road, Lantzville, BC, V0R 2H0

Jurisdiction and address

With reference to (CHECK ONE):

- ☐ *Land Title Act* (Section 86) – Subdivision Approval
- ☑ *Local Government Act* (Part 14, Division 7) – Development Permit
- ☑ Community Charter (Section 56) – Building Permit
- ☐ *Local Government Act* (Section 524) – Flood Plain Bylaw Variance
- ☐ *Local Government Act* (Section 524) – Flood Plain Bylaw Exemption

For the following property ("the Property"):

Lot A, District Lot 27G, Wellington District, Plan VIP54592, PID 017-838-941, 7099 Lanztville Road; Lot 1, District Lot 45, Wellington District, Plan VIP8752 Except Plan VIP46247 and VIP63648, PID: 001-258-435, 6852 Wiles Road

Legal description and civic address of the Property

The undersigned hereby gives assurance that he/she is a Qualified Professional and is a Professional Engineer or Professional Geoscientist who fulfils the education, training, and experience requirements as outlined in the guidelines.

I have signed, sealed, and dated, and thereby certified, the attached Flood Assessment Report on the Property in accordance with the guidelines. That report and this statement must be read in conjunction with each other. In preparing that Flood Assessment Report I have:

[CHECK TO THE LEFT OF APPLICABLE ITEMS]

☐ 1. Consulted with representatives of the following government organizations:

☑ 2. Collected and reviewed appropriate background information

☑ 3. Reviewed the Proposed Development on the Property

☑ 4. Investigated the presence of Covenants on the Property, and reported any relevant information

☑ 5. Conducted field work on and, if required, beyond the Property

☑ 6. Reported on the results of the field work on and, if required, beyond the Property

☑ 7. Considered any changed conditions on and, if required, beyond the Property

8. For a Flood Hazard analysis I have:
   - ☑ 8.1 Reviewed and characterized, if appropriate, Flood Hazard that may affect the Property
   - ☑ 8.2 Estimated the Flood Hazard on the Property
   - ☑ 8.3 Considered (if appropriate) the effects of climate change and land use change
   - ☐ 8.4 Relied on a previous Flood Hazard Assessment (FHA) by others
   - ☐ 8.5 Identified any potential hazards that are not addressed by the Flood Assessment Report

9. For a Flood Risk analysis I have:
   - ☐ 9.1 Estimated the Flood Risk on the Property
   - ☐ 9.2 Identified existing and anticipated future Elements at Risk on and, if required, beyond the Property
   - ☐ 9.3 Estimated the Consequences to those Elements at Risk

10. In order to mitigate the estimated Flood Hazard for the Property, the following approach is taken:
- ☐ 10.1 A standard-based approach
- ☐ 10.2 A Risk-based approach
- ☑ 10.3 The approach outlined in the guidelines, Appendix F: Flood Assessment Considerations for Development Approvals
- ☐ 10.4 No mitigation is required because the completed flood assessment determined that the site is not subject to a Flood Hazard

11. Where the Approving Authority has adopted a specific level of Flood Hazard or Flood Risk tolerance, I have:
- ☐ 11.1 Made a finding on the level of Flood Hazard or Flood Risk on the Property
- ☐ 11.2 Compared the level of Flood Hazard or Flood Risk tolerance adopted by the Approving Authority with my findings
- ☐ 11.3 Made recommendations to reduce the Flood Hazard or Flood Risk on the Property

12. Where the Approving Authority has not adopted a level of Flood Hazard or Flood Risk tolerance, I have:
- ☑ 12.1 Described the method of Flood Hazard analysis or Flood Risk analysis used
- ☑ 12.2 Referred to an appropriate and identified provincial or national guideline for level of Flood Hazard or Flood Risk
- ☑ 12.3 Made a finding on the level of Flood Hazard of Flood Risk tolerance on the Property
- ☑ 12.4 Compared the guidelines with the findings of my flood assessment
- ☑ 12.5 Made recommendations to reduce the Flood Hazard or Flood Risk

☑ 13. Considered the potential for transfer of Flood Risk and the potential impacts to adjacent properties

☑ 14. Reported on the requirements for implementation of the mitigation recommendations, including the need for subsequent professional certifications and future inspections.

Based on my comparison between:

[CHECK ONE]

- ☐ The findings from the flood assessment and the adopted level of Flood Hazard or Flood Risk tolerance (item 11.2 above)
- ☑ The findings from the flood assessment and the appropriate and identified provincial or national guideline for level of Flood Hazard or Flood Risk tolerance (item 12.4 above)

I hereby give my assurance that, based on the conditions contained in the attached Flood Assessment Report:

☐ For subdivision approval, as required by the *Land Title Act* (Section 86), "that the land may be used safely for the use intended":

[CHECK ONE]

- ☐ With one or more recommended registered Covenants.
- ☐ Without any registered Covenant.

☑ For a development permit, as required by the *Local Government Act* (Part 14, Division 7), my Flood Assessment Report will "assist the local government in determining what conditions or requirements it will impose under subsection (2) of this section [Section 491 (4)]".

☑ For a building permit, as required by the Community Charter (Section 56), "the land may be used safely for the use intended":

[CHECK ONE]

- ☐ With one or more recommended registered Covenants.
- ☑ Without any registered Covenant.

☐ For flood plain bylaw variance, as required by the *Flood Hazard Area Land Use Management Guidelines* and the *Amendment Section 3.5 and 3.6* associated with the *Local Government Act* (Section 524), "the development may occur safely".

☐ For flood plain bylaw exemption, as required by the *Local Government Act* (Section 524), "the land may be used safely for the use intended".

I certify that I am a Qualified Professional as defined below.

September 7, 2025
Date

Tennes Hamre, P.Geo.
Prepared by

Tennes Hamre
Name (print)

Signature

1900 Boxwood Road
Address

Nanaimo, BC V9S 5Y2

250-756-0355
Telephone

thamre@lewkowich.com
Email

Chris Hudec, M.A.Sc., P.Eng.
Reviewed by

Chris Hudec
Name (print)

Signature

(Affix PROFESSIONAL SEAL here)

If the Qualified Professional is a member of a firm, complete the following:

I am a member of the firm Lewkowich Engineering Associates Ltd. - Permit to Practice No. 1001802
and I sign this letter on behalf of the firm. (Name of firm)