KONTUR
GEOTECHNICAL CONSULTANTS inc

MEMORANDUM

February 24, 2025 (Version 2)
Project No.: **K-241223-00**

To:	Mike King Resort Municipality of Whistler	**By Email:**	mking@whistler.ca
	Marc Freno Resort Municipality of Whistler		mfreno@whistler.ca
cc:	Sebastian Gurrero Chalten Engineering		chaltenengineering@shaw.ca
From:	Peter Knott EIT Kontur Geotechnical Consultants Inc.		pknott@kontur.ca
Subject:	**Memorandum – Mini-Pile Design v2** **Blueberry Lift Station 1 – Remediation of Settlement** **Blueberry Drive, Whistler BC**		

As requested, Kontur Geotechnical Consultants Inc. (Kontur) is providing updated geotechnical recommendations for mini-piles to provide resistance for vertical (compression) forces at ten (10) locations at the above noted site. The purpose of the mini-piles is to re-establish support for foundations for the existing lift station which appears to be experiencing ongoing settlement.

Based on information obtained from geotechnical exploration (refer Kontur's previously issued report titled "*Geotechnical Exploration and Report*" dated July 15, 2024), subsurface conditions are anticipated to consist of loose or loose to compact sands and gravels in the order of 3m thick, underlain by soft peat to between about 5 to 5.5m depth, underlain by compact sand and gravel, some silt to the limit of investigation at about 9m depth. It is anticipated that thickness of the soft peat would likely decrease from southeast to northwest. It should be noted that bedrock was observed within slopes near the northern side of the building. In order, to create a suitable foundation the installation of mini-piles is recommended.

A review of structural drawings prepared by Chalten Engineering (dated February 20, 2025) indicates that a vertical resistance (compression) at Ultimate Limit State (ULS) conditions of 145kN is required for each mini-pile. It is expected that the drill holes for anchor installation into will be at least 75mm in diameter. Using a factor of 0.6 for tested anchors, a factored bond strength of 43kN/m was used for calculation of the anchor length required for 75mm diameter drill holes.

R38N Galvanized Dywidag anchor bars with should be installed with a casing consisting of a 100mm diameter Schedule 40 steel pipe extending 6m below existing grades. A bonded length of at least 4.5m should be installed below the base of the steel casing. **Should bedrock be encountered**, the casing should be socketed at least 0.5m into the bedrock, and a bonded length of at least 3m should be installed below the base of the steel casing in this circumstance. A minimum centre-to-center spacing of 1m between piles should be maintained. Where closer spacings are proposed, staggering of the bond length or varying inclinations of the anchors may be required. Design for the proposed mini piles is detailed in the attached

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drawing *"Mini Pile Design"*. Approximate layout/offsets and connection details to existing foundations should be detailed on drawings provided by the Structural Engineer.

The anchors should be grouted with non-shrink grout by Tremie method. Centralizers should be used with spacings no greater than 3m. To facilitate effective testing of the mini-piles, testing apparatus such as reaction pads/beams should be considered (ie. steel plates/beams), with reaction pads placed at least 0.3m from the edge of the mini-pile to mitigate potential load transfer from the reaction pads to the steel casing. Following testing, the anchors should be post-grouted to top of anchor. Post grout tubes to the bottom of the anchor hole is recommended in case of anchor failure during testing.

Testing of the anchors should follow the most recent edition of "R*ecommendations for Prestressed Rock and Soil Anchors"* prepared by the Post-Tensioning institute (PTI). At least one mini-pile should be Performance tested with the remaining anchors being Proof Tested. Anchors should be tested to 133% of design load as shown on the drawing notes. All testing should be witnessed and analyzed by Kontur personnel. Anchor testing should occur no sooner than the time required for the grout to achieve at least 25MPa compressive strength.

This memorandum has been prepared for the exclusive use of Resort Municipality of Whistler and/or their designated agents or consultants. Any use of the information contained in this memorandum for other than its intended purpose or by any other party must first be verified in writing by Kontur. Kontur does not accept any responsibility or damages because of any other party relying on or using the information, comments, opinions, and recommendations contained in this memorandum.

Kontur trusts that the information described above meets your current requirements. If you should have any concerns or questions, please do not hesitate to contact the undersigned.

Sincerely,

Kontur Geotechnical Consultants Inc.
EGBC Permit to Practice #1000925

Per:

Peter Knott EIT
Geotechnical Engineer

Reviewed by:

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
E. G. SYKES
23025

Feb 24, 2025

Evan Sykes P.Eng.
Principal | Geotechnical Engineer

Attachments: Interpretation and Use of Study and Report
Mini Pile Design v2

INTERPRETATION AND USE OF STUDY AND REPORT DOCUMENT

1.0 STANDARD OF CARE

This study and Report have been prepared in accordance with generally accepted engineering consulting practices in this area. No other warranty, expressed or implied, is made. Engineering studies and reports do not include environmental engineering or consulting.

2.0 COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report which is of a summary nature and is not intended to stand alone without reference to the instructions given to us by the Client, communications between us and the Client, and to any other reports, writings, proposals or documents prepared by us for the Client relative to the specific site described herein, all of which constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. WE CANNOT BE RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3.0 BASIS OF THE REPORT

The Report has been prepared for the specific site, development, building, design or building assessment objectives and purpose that were described to us by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the document are only valid to the extent that there has been no material alteration to or variation from any of the said descriptions provided to us unless we are specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4.0 USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT OUR WRITTEN CONSENT. WE WILL CONSENT TO ANY REASONABLE REQUEST BY THE CLIENT TO APPROVE THE USE OF THIS REPORT BY OTHER PARTIES AS "APPROVED USERS". The contents of the Report remain our copyright property and we authorise only the Client and Approved Users to make copies of the Report 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 the Report, or any portion thereof, available to any party without our written permission. Any use which a third party makes of the Report, or any portion of the Report, are the sole responsibility of such third parties. We accept no responsibility for damages suffered by any third party resulting from unauthorised use of the Report.

5.0 INTERPRETATION OF THE REPORT

Nature and Exactness of Descriptions: Classification and identification of soils, rocks, geological units, contaminant materials, building envelopment assessments, and engineering estimates have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature and even comprehensive sampling and testing programs, implemented with the appropriate equipment by experienced personnel, may fail to locate some conditions. All investigations, or building envelope descriptions, utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarising such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and all persons making use of such documents or records should be aware of, and accept, this risk. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

Reliance on Provided information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to us. We have relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, we cannot accept responsibility for any deficiency, misstatement or inaccuracy contained in the report as a result of misstatements, omissions, misrepresentations or fraudulent acts of persons providing information.

To avoid misunderstandings, KONTUR should be retained to work with the other design professionals to explain relevant engineering findings and to review their plans, drawings, and specifications relative to engineering issues pertaining to consulting services provided by KONTUR. Further, KONTUR should be retained to provide field reviews during the construction, consistent with building codes guidelines and generally accepted practices. Where applicable, the field services recommended for the project are the minimum necessary to ascertain that the Contractor's work is being carried out in general conformity with KONTUR's recommendations. Any reduction from the level of services normally recommended will result in KONTUR providing qualified opinions regarding adequacy of the work.

6.0 ALTERNATE REPORT FORMAT

When KONTUR submits both electronic file and hard copies of reports, drawings and other documents and deliverables (KONTUR's instruments of professional service), the Client agrees that only the signed and sealed hard copy versions shall be considered final and legally binding. The hard copy versions submitted by KONTUR shall be the original documents for record and working purposes, and, in the event of a dispute or discrepancy, the hard copy versions shall govern over the electronic versions. Furthermore, the Client agrees and waives all future right of dispute that the original hard copy signed version archived by KONTUR shall be deemed to be the overall original for the Project.

The Client agrees that both electronic file and hard copy versions of KONTUR's instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except KONTUR. The Client warrants that KONTUR's instruments of professional service will be used only and exactly as submitted by KONTUR.

The Client recognizes and agrees that electronic files submitted by KONTUR have been prepared and submitted using specific software and hardware systems. KONTUR makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

NOTE:

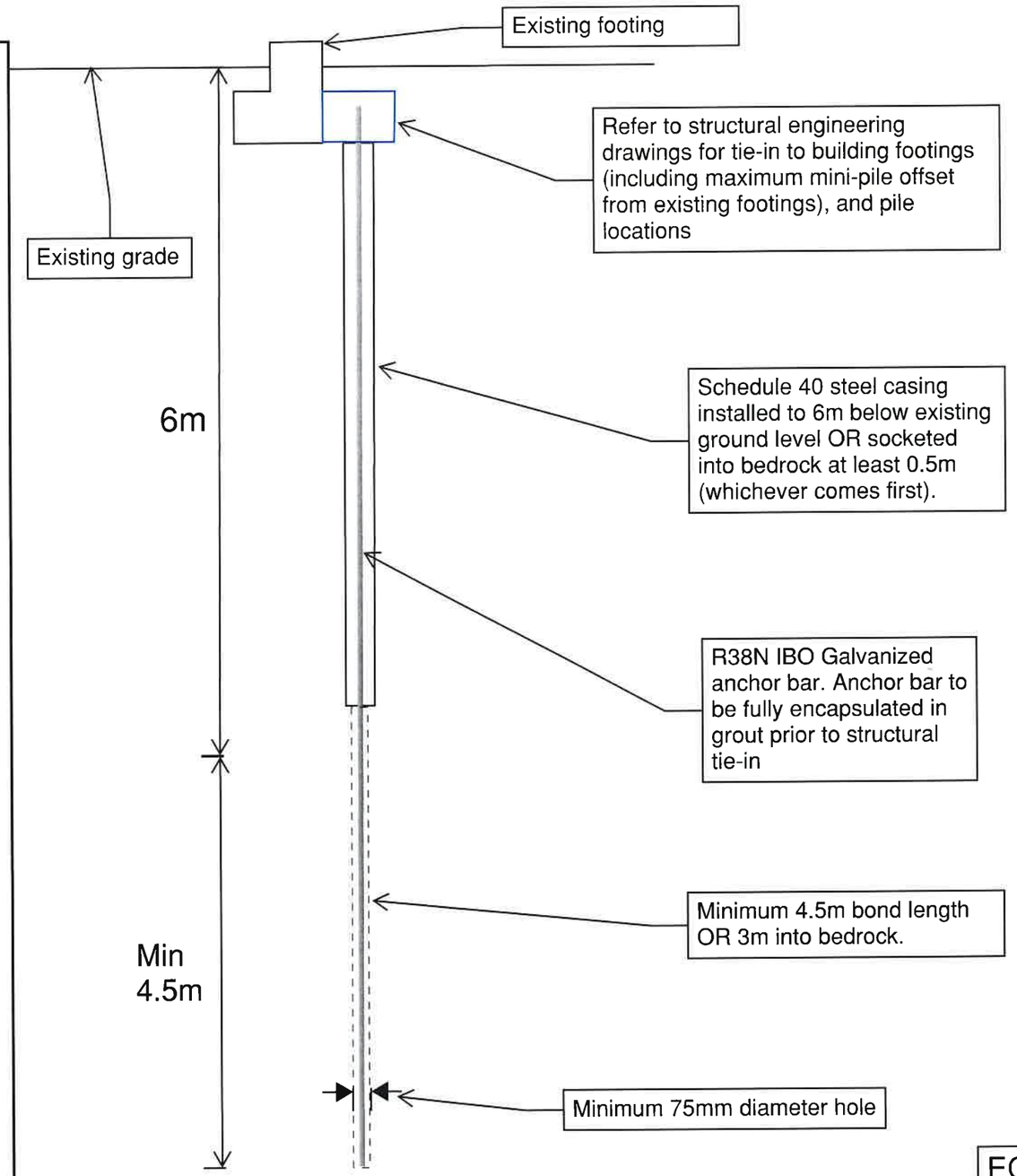
- Center-to-center spacing between piles to be at least 1m. Staggering bond lengths or varying inclinations of the anchors may be required where this spacing is not practical

- If bedrock is encountered, casing should be socketed 0.5m into bedrock and minimum bond length of 3m should be adopted

- Anchors to be proof/performance tested as per Post Tensioning Institute (PTI) guidelines.

- Design load = 145 kN

- Maximum Test Load = 193 kN



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SEAL

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA E. G. SYKES # 23025 — Feb 27, 2025

VERSIONS		
NO	DESCRIPTION	DATE
0	Issued for Review	Oct 29, 2024
1	Issued for Construction	Jan 21, 2025
2	Issued for Construction - Revised Design Load	Feb 24, 2025

TITLE	Mini Pile Design	PROJECT NO.: K-241223-00		
CLIENT	Resort Municipality of Whistler	DATE: Feb 24, 2025	SCALE: NTS	DWG NO.: 1
PROJECT LOCATION	Blueberry Lift Station - Blueberry Drive, Whistler BC	DRAFT: PAK	DESIGN: PAK	CHECK: EGS

1. General Specifications

1.1. Location of all services and nearby structures to be confirmed by Contractor prior to construction. Report all discrepancies between actual conditions and drawings to Kontur Geotechnical Services Inc. (Kontur) immediately. Drilling for installation of anchors is not to commence until all service/nearby structure locations have been established and a memo stating such has been forwarded by the contractor to Kontur.

1.2. Where unexpected soil conditions are encountered, revisions to the drawings may be required. Kontur should be immediately notified where unexpected soil conditions are encountered

1.3. All attempts have been made to ensure that these drawings are the latest revisions. However, the contractor should ensure that discrepancies do not exist between the drawings and those provided by the other consultants. All discrepancies or dimension inaccuracies to be reported to Kontur prior to commencement of the work. Contractors using the drawings for quantity take-offs do so at their own risk.

2. Anchor Specifications

2.1. Grout for anchors to consist of non-shrinkage cementitious grout (or equivalent) with compressive strength requirements as follows:

- 20 MPa in 24 hours
- 35 MPa in 28 days

2.2. Anchors to be placed in minimum 75mm diameter holes

2.3. Hole to be thoroughly cleaned by appropriate means prior to placement of grout

2.4. Hole drilling technique required will depend on soil conditions. The contractor should prove that test anchors can be installed using a method that will sustain the required test and lock-off loads prior to installing production anchors.

2.5. Anchors to be provided with suitable centralizers at 3m o/c to ensure the anchor is completely encircled by grout.

2.6. Grout to be installed by Tremie grouting from bottom of hole, by pressure grouting or through use of IBO anchors (if deemed acceptable by Kontur).

2.7. The required design and test loads are shown on the drawings.

2.8. Minimum center-to-center spacing of anchors to be 1m. Staggering bond lengths or varying inclinations of the anchors may be required where this spacing is not practical.

3. Anchor testing

3.1. Anchors shall be tested as soon as practicable but no sooner than the time required for the grout to achieve at least 25MPa compressive strength.

3.2. Testing of the anchors should follow the most recent edition of "Recommendations for Prestressed Rock and Soil Anchors" prepared by the Post-Tensioning institute (PTI). At least one anchor should be Performance tested with the remaining anchors being Proof Tested.

3.3. Kontur is to be notified in advance of the schedule for testing. Kontur should be present for testing for all permanent anchors.

3.4. The contractor will provide required testing apparatus including recently calibrated jack and ram compatible with the anchor test load, nuts, plates, couplers, wrenches, and tensioning chair, together with personnel to set up and operate the equipment. For testing of micropiles, testing apparatus such as reaction pads/beams should be used (ie. steel plates/beams), with reaction pads placed at least 0.3m from the edge of the micropile to mitigate potential load transfer from the reaction pads to the steel casing. Post grout tubes to the bottom of the anchor hole is recommended in case of anchor failure during initial testing.

3.5. Anchors which fail any of the above tests shall be re-grouted via the post-grout tubes and re-tested (if post grout tubes are installed)

3.6. Anchors which fail the above tests should be replaced at the Contractor's expense. A failure rate of 3% of the total anchors installed will be assumed as typical and will be at the contractor's expense. Failure rates in excess of 3% will be investigated to determine the cause of the failures and will form an extra only where soil conditions/groundwater conditions can be proved to be significantly different than those reported in the project soils report.

4. Payment

4.1. The contract should establish the terms of payment to the contractor for items shown on these drawings and for additions or deletions which may be required by Kontur during execution of the work. It should be noted that the installed quantities may vary from the quantities indicated on these drawings by more than the limits often considered as representing a change in scope of work.

4.2. Kontur will not be responsible for additional costs or savings, directly or indirectly arising from adjustments in the amount of anchors. Kontur will not be responsible for delays resulting in changes in the anchor design or changes in the order of work or scheduling as required by Kontur.

4.3. Kontur will not be responsible for recording quantities unless specific arrangements are made by the owner.

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SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — E. G. SYKES # 23[illegible] — Revised Feb 24, 2025

VERSIONS		
NO	DESCRIPTION	DATE
0	Issued for Review	Oct 29, 2024
1	Issued for Construction	Jan 21, 2025
2	Issued for Construction - Revised Design Load	Feb 24, 2025

TITLE	Mini Pile Design - General Notes	PROJECT NO.: K-241223-00		
CLIENT	Resort Municipality of Whistler	DATE: Feb 24, 2025	SCALE: NA	DWG NO.: 2
PROJECT LOCATION	Blueberry Lift Station - Blueberry Drive, Whistler BC	DRAFT: PAK	DESIGN: PAK	CHECK: EGS