TECHNICAL MEMORANDUM

Date:	September 15, 2014	**Project No.:**	1405906
To:	Paul Weisner, PE	**Company:**	CE2 Engineers, Inc.
From:	Peter Calvin, PE; Richard Mitchells, PE		
cc:		**Email:**	p.weisner@ce2engineers.com

RE: PRELIMINARY GEOTECHNICAL FINDINGS - CHEFORNAK PUMPHOUSE

This technical memorandum provides Golder Associates (Golder) preliminary geotechnical findings for the proposed Chefornak Pumphouse project, including an initial review of the preferred grouted micro-pile foundation for the two pump houses planned for Chefornak, Alaska. This document should serve as a working document based on currently available data and may be revised as the project progresses. This memorandum will be followed by a report providing more detailed engineering recommendations.

The two new pumphouses are planned as part of a water system improvement project in Chefornak Alaska. The structures will be of a similar design, with dimensions of approximately 42 by 30 feet. We understand that the preferred foundation type would be a 6-inch diameter grouted micropile system. The micropile would be drilled and driven to the point it is adequately seated in competent bed rock. A smaller diameter hole would then be drilled into the bedrock and a rock anchor would be grouted in place to resist the anticipated frost uplift forces. This type of foundation system has distinct advantages over other deep foundations in that it can be installed in areas with variable thermal and groundwater conditions and in areas where float rock and boulders could be encountered.

While the pile axial loads have not been finalized, CE2 has indicated they are to be in the range of 7-kips to 14-kips (per pile) for geotechnical design purposes. For frost uplift, we have used design stress of 40-pounds per square inch (psi) along the pile perimeter though the expected active layer. At these design loads, the frost uplift will exceed the axial compressive design loads.

Golder conducted a limited geotechnical investigation at the proposed projects sites in August 2014. Due to limited funding, a site-specific geotechnical drilling program was not authorized. The investigation involved advancing a series of shallow depth hand probes and drill holes to characterize the near surface soil and thermal conditions. The maximum depth of exploration for this investigation was 8 feet below ground surface. For geotechnical data pertaining to the conditions below 8 feet we have relied on the information presented in our February 20, 2013 report to CE2 “Conceptual Geotechnical Considerations for Triodedic Frame Foundation Systems, Chefornak, AK”.

Based on a review of relevant reports and our geotechnical experience in Chefornak, the generalized subsurface conditions in the community consist of an organic mat overlying fine-grained organic and

Golder, Golder Associates and the GA globe design are trademarks of Golder Associates Corporation

inorganic silt. Discontinuous volcanic flow consisting of vesicular basalt has been encountered below the silt at variable depths, but generally between 20 and 30 feet below ground surface. However, basalt boulders have been located closer to ground surface in certain areas in and around the community. Degrading permafrost is present in the community, particularly near larger surface water bodies, in damaged tundra areas, and under snow drifts.

During our August 2014 limited geotechnical investigation we found that the thermal conditions at pump house 1 were highly variable ranging from 2 feet to over 8 feet below ground surface near the existing pump house. Additionally pockets of relic seasonal frost were found between 5 and 6 feet below ground surface. The highly variable thermal conditions are likely due to the dumping of backwash from the pump house, standing water and thermal influence of the nearby board walk. The subsurface thermal conditions at pump house 2 were found to be more consistent, likely due to the lack of development in the area. The depth of thaw was found to be between 2 and 3 feet below ground surface.

Based on the information gathered during our limited geotechnical investigation and review of relevant geotechnical reports, the proposed drilled and grouted micro pile foundation is suitable for this application. If seated into competent bedrock the proposed 6-inch diameter pile is expected to provide adequate bearing capacity. Rock anchors will need to be installed inside the pile interior and grouted into competent bedrock to account for the frost uplift forces. Due variable subsurface thermal states the pile diameter may need to be adjusted to account for lateral deflections.

This technical memorandum will be followed by more detailed engineering recommendations when we complete the laboratory analysis and the project loading design is finalized. If you have any comments or questions please contact us.