October 11, 2022

Cascade Medical Center
402 Lake Cascade Parkway
Cascade, Idaho 83611

Attention: Tom Reinhardt (treinhardt@cmchd.org)

RE: Geotechnical Evaluation
Cascade Medical Center Expansion
Lake Cascade Parkway and School Street
Cascade, Idaho
ALLWEST Project No. 522-404G

Mr. Reinhardt,

ALLWEST has completed the authorized geotechnical evaluation for the proposed Cascade Medical Center Expansion to be located on the northwest corner of the Lake Cascade Parkway and School Street intersection in Cascade, Idaho. The purpose of this evaluation was to characterize the subsurface conditions at the site and prepare the attached report with the results of our field evaluation and laboratory testing, and our geotechnical recommendations to assist planning, design, and construction of the proposed development.

We appreciate the opportunity to provide services for this project. If you have any questions or need additional information, please contact us at (208) 895-7898.

Sincerely,

ALLWEST

PROFESSIONAL ENGINEER
LICENSED
10/11/22
14253
STATE OF IDAHO
ADRIAN MASCORRO

Kevin Dyekman, P.G.
Engineering Services Manager

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Area Manager

GEOTECHNICAL EVALUATION
CASCADE MEDICAL CENTER EXPANSION
LAKE CASCADE PARKWAY AND SCHOOL STREET
CASCADE, IDAHO
ALLWEST PROJECT NO. 522-404G

October 11, 2022

Prepared for:
CASCADE MEDICAL CENTER
402 LAKE CASCADE PARKWAY
CASCADE, IDAHO 83611

Prepared by:
ALLWEST
255 NORTH LINDER ROAD, SUITE 100
MERIDIAN, IDAHO 83642

ALLWEST

EXECUTIVE SUMMARY

ALLWEST has completed the geotechnical evaluation for the proposed Cascade Medical Center Expansion located in Cascade, Idaho. The following geotechnical considerations were identified:

- We anticipate approximately 6 to 12 inches of site stripping will be required for most of the site to remove surficial vegetation and roots (topsoil).
- Undocumented fill (poorly-graded gravel with silt and sand) was observed within TP-3 to a depth of 1.5 feet. Undocumented fill (silty sand) was observed within TP-4 to a depth of 6 feet and contained concrete/metal debris between 5 and 6 feet. In proposed development areas, undocumented fill soils should be over-excavated and replaced with suitable soils.
- In general, native subsurface soils within the observed test pits consisted of silty sands, silty-clayey sands, clayey sands, and sandy lean clays.
- At the time of exploration, we observed groundwater within test pit TP-5 at 7.5 feet below existing ground in silty sand soils, but we did not visibly note groundwater at similar depths within the other test pits, most likely due to low-permeability clayey soils.
- We recommend stormwater disposal occur within native subsurface silty sand or silty-clayey sand soils utilizing a recommended seepage rate of 1 inch per hour (in/hr).
- For light vehicle areas: Pavement sections should consist of 2.5-inches of asphalt concrete, over 4-inches of crushed base course, over 13-inches of aggregate subbase.
- For heavy-truck areas: Pavement sections should consist of 3-inches of asphalt concrete, over 6-inches of crushed base course, over 11-inches of aggregate subbase.
- Based on existing site grades, we anticipate grading will consist of constructing a flat building pad, resulting in a cut/fill transition below the proposed building foundation footprint. As such, we recommend the mat-slab foundation be supported on a minimum of 1-foot of suitably moisture-conditioned and compacted base course gravel. Foundations constructed as stated in this report may be designed for an allowable bearing pressure of 2,500 psf.
- Crushed base course should extend a minimum of 6 inches beyond foundation edges and be compacted as recommended in section *6.4 Fill Placement and Compaction*.

Our services were provided in accordance with ALLWEST proposal no. 522-404P dated August 5, 2022. Close monitoring of the construction operations discussed herein will be critical in achieving the design subgrade support. If we are not retained to provide required construction observation and materials testing services, we cannot be responsible for soil engineering-related construction errors or omissions. This summary should be used in conjunction with the entire report for design and construction purposes. It should be recognized that details were not included or fully developed in this section, and the report should be read in its entirety for a comprehensive understanding of the items contained herein.

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1.0 PROJECT DOCUMENTS

A *Floor Plan* (received July 26, 2022) and *Site Plan* (received September 30, 2022) were provided to ALLWEST to help develop our understanding of the planned development.

2.0 PROJECT DESCRIPTION

Based on communication with you and review of the project documents, we understand that development of the approximate 0.6-acre site will include a 1-story 5,000-square-foot building with associated infrastructure, a snow/stormwater retention area, and asphalt pavement areas. The building will be constructed with pre-manufactured components supported on a concrete mat-slab foundation.

Based on existing ground elevations obtained from Google Earth, site grades generally slope down approximately 3 to 5 feet from south to north within the area of the proposed building. As a result, we anticipate site grading will include cuts in the southern portion of the site and fills in the northern portion of the site, on the order of 3 feet, to create a flat pad for building construction.

3.0 EVALUATION PROCEDURES

To complete this evaluation, we reviewed published geologic/soil information and advanced exploratory test pits on-site to evaluate the subsurface conditions. The general location of the site is shown on *Figure A-1: Vicinity Map* in Appendix A.

We observed the excavation of 5 test pits (TP-1 through TP-5) on August 19, 2022, utilizing a Yanmar Mini Excavator with a 24-inch-wide toothed excavation bucket. Test pits were advanced to maximum depths of 10 to 12 feet below existing ground. The approximate locations of the test pits are shown on *Figure A-2: Exploration Location Map* in Appendix A.

The soils observed in the test pits were visually described and classified in general accordance with ASTM D 2488. We logged the subsurface profiles and obtained soil samples at select depths for further identification and laboratory testing. We also performed a field seepage test within test pit TP-3 near the planned snow/stormwater retention area. Information obtained from the field evaluation, laboratory testing, and geotechnical analysis was utilized to develop the recommendations presented in this report.

4.0 SITE CONDITIONS

At the time of exploration, the site consisted of undeveloped land with minor vegetation and a few trees. The site is generally bordered by the existing Cascade Medical Center facility to the west, a residential lot to the north, School Street to the east, and Lake Cascade Parkway to the south.

4.1 Published Geologic and Soil Information

The geologic conditions at the site are mapped as Alluvium and Colluvium (Holocene and Pleistocene) on the *Surficial Geologic Map of Long Valley, Valley County, Idaho,* by R.M. Breckenridge, and K.L. Othberg (2006). This unit is described as poorly stratified to massive, silty sand to pebbly coarse sand, and is approximately 2 to 20 feet thick.

The USDA Natural Resources Conservation Service (NRCS), which classifies soils to a depth of 5 feet, has mapped the site as Archabal loam. These soils consist of loam, coarse sandy loam, and coarse sand. Parent materials of these soils include mixed alluvium.

The soils encountered in test pits are generally consistent with published information.

4.2 Subsurface Soil Conditions

At the time of exploration, the site contained approximately 6 to 12 inches of surficial roots and vegetation at the ground surface. Surficial undocumented fill consisting of poorly-graded gravel with silt and sand was observed within TP-3 to a depth of 1.5 feet. Additionally, undocumented fill consisting of silty sand was observed within TP-4 to a depth of 6 feet and contained concrete and metal debris between 5 and 6 feet. Undocumented fill soils are likely associated with adjacent helipad and sewer line construction. Undocumented fills are not suitable to support site grading fill, pavement sections, or structural improvements. In general, native subsurface soils within the observed test pits consisted of silty sands, silty-clayey sands, clayey sands, and sandy lean clays.

Detailed soil descriptions are presented on individual test pit logs in Appendix B. The descriptive soil terms used on the test pit logs, and in this report, can be referenced with the *Unified Soil Classification System (USCS)*, which is included in Appendix B. Subsurface conditions may vary between exploration locations, and such changes may not be apparent until construction.

4.3 Groundwater Conditions

At the time of exploration, we observed groundwater within test pit TP-5 at a depth of 7.5 feet below existing ground in silty sand soils, but we did not visibly note groundwater at similar depths within the other test pits, most likely due to low-permeability clayey soils. Groundwater in the area is influenced by water levels in Lake Cascade and seasonal snow melt, but may also be affected by precipitation, on-site construction, and development to adjacent sites. Groundwater elevations will fluctuate throughout the different seasons of the year and will likely peak during snow melt season (March to May); as such, groundwater monitoring should be accomplished.

We installed slotted PVC pipes within 2 test pits near the snow/stormwater retention area for future groundwater monitoring. If requested, ALLWEST can perform monthly groundwater monitoring to help establish seasonal high groundwater elevations at the site, which may be necessary to assist civil stormwater disposal design.

5.0 LABORATORY TESTING

We performed or outsourced laboratory testing to supplement field classifications and to assess some of the soil engineering properties and parameters. Laboratory testing included fines content (ASTM D1140), moisture content (ASTM D2216), liquid and plastic limits (ASTM D4318), California bearing ratio (CBR) (ASTM D1883), pH (AASTHO T289), resistivity (EPA 120.1), and chloride/sulfate content (EPA 300.0). The laboratory test results are included in Appendix C and are also summarized on the test pit logs in Appendix B.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Based on our field observations, testing, and evaluation, in our opinion the site is suitable for the planned development provided our recommendations are properly implemented during design and construction. The following recommendations are presented to assist development relative to earthwork, utilities, stormwater disposal, asphalt pavement section design, and foundation construction.

These recommendations are based on our understanding of the proposed development, the conditions observed within exploration locations, laboratory test results, and engineering analysis. If the proposed development changes or if unforeseen conditions are encountered, we should be given the opportunity to review the new information, and if necessary, update our recommendations.

6.1 Site Preparation

- Prior to conducting site grading, surficial soil containing vegetation, roots, and organics should be removed below proposed development areas. In general, we anticipate approximately 6 to 12 inches of stripping will be required to remove surficial vegetation and roots (topsoil).
- Where trees are encountered and will be removed as part of the development, large root systems should be completely over-excavated and replaced with suitable fill soils. Tree root depths will not fully be known until construction, but we anticipate approximately 3 to 4 feet of over-excavation will be required to remove large tree root systems.

- Undocumented fill soils are not suitable to support site grading fill, pavement sections, or structural improvements. Within proposed development areas, existing undocumented fill soils should be over-excavated their entire depth to suitable native soils, and replaced with site grading fill soils that have been moisture-conditioned and compacted in accordance with the requirements provided in section *6.4 Fill Placement and Compaction*. Existing undocumented fill soils may be reused as site grading fill soils, provided they are free of debris, organics, or other deleterious materials, and they meet criteria in section *6.3 Materials*.

- Over-excavation depths and lateral limits, associated with unsuitable fill soil removal, may not fully be known until earthwork begins. The earthwork contractor should have continencies in place to ensure that these areas are fully over-excavated down to suitable native soils within proposed development areas.

- Loose test pit backfill will settle with time, so where any test pits are located below proposed pavement, structural, or any development areas, loose test pit backfill soil should be re-excavated its entire depth and replaced with suitably moisture-conditioned and compacted fill soils. Over-excavated soils can be reused to backfill the test pits, provided the soils are not overly saturated, and they can achieve the required compaction criteria as provided in section *6.4 Fill Placement and Compaction*. Test pit locations observed by ALLWEST were identified in the field with white-flagged stakes and/or white PVC pipes (where installed). Approximate test pit locations are shown on *Figure A-2: Exploration Location Map*. We recommend test pit areas be accurately surveyed so that they may be located and remediated prior to earthwork construction and development.

- Excavations for foundations, flatwork, and pavements should be accomplished using a smooth-blade bucket to limit subgrade disturbance.

- After site stripping, over-excavations, loose test pit remediation, and prior to site grading, utility/roadway construction, or any other type of development, the exposed subgrades should be proof-rolled with a minimum 5-ton vibratory roller, with loaded dump trucks, with loaded front-end loaders, or with a vibratory hoe-pack, to confirm subgrade suitability. This will also assist in identifying any soft subgrade areas that may need to be remediated. If native subgrades are observed to significantly deflect or pump, the subgrades should be over-excavated and replaced with properly compacted fills or stabilized as recommended in section *6.1.1 Subgrade Stabilization*.

6.1.1 Subgrade Stabilization

Subgrades may be stabilized using geosynthetic (geogrid) or woven geotextile reinforcement in conjunction with imported granular structural fill. The required thicknesses of granular structural fill (used in conjunction with geogrid or woven geotextile reinforcement) will be dependent on the construction traffic loading (which is unknown at this time), the type of reinforcement (geogrid or woven geotextile), and subgrade conditions. Therefore, a certain degree of trial and error may be required during construction to verify recommended stabilization section thicknesses and reinforcement types.

Geogrid reinforcement should consist of Tensar TX-160 or equivalent. Woven geotextile reinforcement should consist of Contech C200 or equivalent. Alternatives to these reinforcement types should be approved by the geotechnical engineer prior to use on site. The following recommendations are provided for subgrade stabilization using reinforcement materials.

- Subgrade soils that are disturbed by construction equipment (caused rutting or pumping) should be over-excavated down to undisturbed native soils, utilizing a smooth-blade bucket to limit further disturbance of native soils. Reinforcement materials should be placed on a properly prepared non-disturbed subgrade with smooth surface.
- If geogrid reinforcement is used, a minimum weight 4-ounce, non-woven filter fabric should first be placed on the properly prepared subgrade. The geogrid reinforcement should then be placed directly on top of the filter fabric. The filter fabric and reinforcement materials should be unrolled in the primary direction of fill placement and should be over-lapped at least 3 feet or follow manufacturer’s recommendations. Filter fabric is not required if a woven geotextile is used for reinforcement.
- The reinforcements materials should be pulled taut to remove slack.
- Construction equipment should not be operated directly on the reinforcement materials. Granular structural fill should be placed from outside the excavation to create a pad to operate equipment on. We recommend a minimum of 12 to 18 inches of granular structural fill be placed over the reinforcement material before operating construction equipment on the fill. Low pressure, track-mounted equipment should be used to place fill over the reinforcement materials.
- Granular structural fill placed directly over reinforcement materials should be properly moisture-conditioned prior to placement, and once placed, be statically rolled. This combination of reinforcement materials and granular structural fill is considered the “bridge” section over soft subgrades.
- After the first “bridge” section has been placed, the remaining structural fill material above the “bridge” section should be compacted to structural fill criteria in section *6.4 Fill Placement and Compaction*, utilizing vibratory compaction methods.
- Vibratory compaction should be discontinued if it reduces the subgrade stability. If compaction criterion is not met within the fill lift above the “bridge” section, the “bridge” section is not thick enough, and subgrade stabilization should be attempted again with a thicker “bridge” section.

The geotechnical engineer or a representative of the geotechnical engineer should be on-site during subgrade stabilization to verify our recommendations are followed, and to provide additional recommendations, as needed.

6.1.2 Utility Trenches

Support soils for underground utilities will likely consist of native silty sands, silty-clayey sands, clayey sands, and/or sandy lean clays observed during field exploration. These soils should provide adequate support for utilities, provided utility subgrades are compacted utilizing vibratory methods, such as with a large vibratory hoe-pack.

If utility pipe subgrades are soft, yielding, and/or saturated at the time of construction, subgrade over-excavation and replacement with granular structural fill may be required below utilities. If support soils yield and/or are saturated at the time of construction, we should be notified to observe these soils and provide additional recommendations, as necessary.

6.2 Excavation

We anticipate on-site soils can be excavated with typical excavation equipment. Slope stability of temporary excavations is a function of many factors, including the presence and abundance of groundwater, the type and density of various soil strata, the depth of cut, surcharge loadings adjacent to the excavation, and the length of time the excavation remains open.

It is exceedingly difficult under the variable circumstances to pre-establish a safe and "maintenance-free" temporary cut slope angle. Therefore, it is the responsibility of the contractor to maintain safe temporary slope configurations since the contractor is continuously at the job site, able to observe the nature and condition of the cut slopes, and able to monitor the subsurface materials and groundwater conditions encountered. Unsupported vertical slopes or cuts deeper than 4 feet are not recommended if worker access is necessary. The cuts should be adequately sloped, shored, or supported to prevent injury to personnel from local sloughing and spalling. The excavation should conform to applicable federal, state, and local regulations. Regarding trench wall support, the site soil is considered Type C soil according to *Occupational Safety and Health Administration* (*OSHA)* guidelines and therefore should not exceed a 1.5H:1V (horizontal to vertical) temporary slope.

6.3 Materials

Stripped soils containing vegetation or debris are only suitable for use in non-structural landscape areas. Existing on-site soils may be reused as site grading fill, provided they are stockpiled separately, they meet the criteria below, and they are moisture-conditioned and compacted as required in this report. Imported soils should be free of organics, debris, and other deleterious material and meet the following criteria. Import materials should be approved by ALLWEST prior to delivery to the site.

Fill Type	Criteria
Site Grading Fill	Maximum size ≤ 6 inches; Retained on ¾-inch sieve < 30%; Liquid limit < 50%
Granular Structural Fill, Granular Subbase	Maximum size ≤ 6 inches; Retained on ¾-inch sieve < 30%; Passing No. 200 sieve ≤ 15%; Non-plastic Alternatively, meet ISPWC section 801 (6-inch max) or ISPWC section 802 (Type II)
Crushed Base Course	Maximum size ≤ 1 inch; Retained on ¾-inch sieve < 10%; Passing No. 200 sieve < 10%; Non-plastic Alternatively, meet ISPWC section 802 (Type I)
Utility Trenches	Maximum size ≤ 2 inches; Retained on ¾-inch sieve < 30%; Passing No. 200 sieve ≤ 10%; Non-plastic Alternatively, meet ISPWC section 305 (Type I Bedding) and section 306 (Trench Backfill)

6.4 Fill Placement and Compaction

Fill should be placed in lift thicknesses which are appropriate for the compaction equipment used. Typically, 8- to 12-inch-thick loose-lifts are appropriate for rubber-tire and steel-drum compaction equipment. Lift thicknesses should be reduced to 4 inches for hand-operated compaction equipment. Fill should be moisture-conditioned to within 2 percentage points of the optimum moisture content prior to placement to facilitate compaction. Fill should be compacted to the percentages of the maximum dry density, based on ASTM D 1557 (modified Proctor).

Fill Area	Compaction (%)
Subgrade[1]	Proof-roll
Site Grading Fill / Granular Structural Fill	95
Granular Subbase / Crushed Base Course	95
Utility Trench Backfill	92

[1]Subgrade stability should be verified and approved by a representative of the geotechnical engineer prior to any fill placement or construction.

We strongly recommend backfilling utility trench excavations with fill soils which meet the criteria in section *6.3 Materials*, as fine-grained soils (silts and clays) may be difficult to moisture-condition and compact in utility trenches.

6.5 Wet Weather Construction

We recommend earthwork for the site be scheduled for the drier seasons of the year. If construction is undertaken in wet periods of the year, it will be important to slope the ground surface to provide drainage away from construction. If construction occurs during or immediately after excessive precipitation, it may be necessary to over-excavate and replace saturated subgrade soil, which might otherwise be suitable.

The on-site soils are sensitive to disturbance when wet. If these soils become wet and unstable, we recommend construction traffic is minimized where these soils are exposed. Low ground-pressure (tracked) equipment should be used to minimize disturbance. Soft and disturbed subgrade areas should be excavated to undisturbed soil and backfilled with structural fill, compacted to requirements stated in this report.

In addition, it should be noted the on-site soils tend to have notable adhesion when wet and may be easily transported off-site by construction traffic.

6.6 Cold Weather Construction

The on-site soils are frost susceptible. If site grading and construction are anticipated during cold weather, we recommend good winter construction practices be implemented. Snow and ice should be removed from excavated areas and fill areas, prior to additional earthwork or construction. Pavement and flatwork portions of the construction should not be placed on frozen ground, nor should the supporting soils be permitted to freeze during or after construction. Frozen soils should not be used as fill.

If native subgrades, or suitably moisture-conditioned and compacted fill lifts, will be left exposed to freezing temperatures overnight, those areas should be protected with a minimum of 12 inches of loose soil, or covered with heated construction blankets, so construction subgrades do not freeze. Frozen soils should be removed prior to any fill placement or construction of any kind.
Earthwork construction during cold inclement weather will require a higher level of attention and detail to achieve required construction and compaction criteria and may lead to additional earthwork requirements and extended construction schedules.

6.7 Stormwater

During our field exploration we performed field seepage testing in test pit TP-3 within a silty-clayey sand, where we obtained a field-measured seepage rate of 3 inches per hour (in/hr).

We recommend stormwater disposal occur within the native silty sand or silty-clayey sand soils, as observed during our field exploration. Based on field seepage testing, the variability of underlying low-permeability clayey soils, and our experience with similar soils, we recommend the following seepage rate be utilized for on-site civil stormwater disposal design:

- Silty Sand / Silty-Clayey Sand ……………………………………………….. 1 in/hr

Stormwater disposal facilities should be constructed a minimum of 1 foot into the receiving soil. Stormwater disposal facility drain rock and filter sand materials should maintain a separation/filter fabric between native soils and drain rock/filter sand to help prevent fine-soil migration into drainable/filtering media, as required by civil design. ALLWEST should observe stormwater disposal facility subgrades to establish if the suitable receiving soil is encountered (based on civil design depths), to confirm the recommended seepage rate, and to ensure the separation/filter fabric has been properly installed (as required by civil design).

The proper separation from bottom of stormwater disposal facilities and seasonal high groundwater should be maintained. As such, seasonal high groundwater should be confirmed via groundwater monitoring throughout snow melt and irrigation seasons (March to October), to assist civil stormwater design.

We installed slotted PVC pipes within 2 test pits in the snow/stormwater retention area, for future groundwater monitoring. If requested, ALLWEST can perform monthly groundwater monitoring to help establish seasonal high groundwater elevations at the site.

6.8 Asphalt Pavement

Prior to pavement section construction, the pavement subgrade should be proof-rolled as recommended in section *6.1 Site Preparation*. Drive-lanes and parking areas for light vehicle traffic should be designed for a 20-year *Equivalent Single Axle Load* (ESAL) of 33,000, which is equivalent to *Traffic Index* (TI) value of 6 (similar to local roadway). Where heavy-duty traffic is expected, drive-lanes and parking areas should be designed with a 20-year ESAL of 370,000, which is equivalent to a TI of 8 (similar to a collector roadway). If actual traffic conditions are different than what is stated, we should be notified so that we may modify our pavement section design.

Based on existing site grades, it is anticipated that majority of pavement subgrade areas will consist of silty sands and silty-clayey sands. We performed CBR testing on a silty-clayey sand to evaluate pavement section design and obtained a CBR of 13.0, which is approximately equivalent to an R-value of 33.

The following flexible asphalt pavement sections were designed utilizing the AASHTO pavement methodology, our experience with local jurisdictions, and the anticipated frost depth of the area. Based on subgrade preparation requirements and design assumptions, we recommend the following pavement sections be utilized for construction of parking and access drives for light vehicle and heavy-duty traffic.

Pavement Application (parking & access drives)	Asphalt Concrete (inches)	Crushed Base Course (inches)	Granular Subbase (inches)
Light Vehicle Traffic	2.5	4	13
Heavy-Duty Traffic	3	6	11

Base course and subbase should conform to the material recommendations as noted in this report and should be placed over a properly prepared subgrade. Finished asphalt surfaces should slope no less than 2% to help reduce the potential for surface water to infiltrate into the underlying pavement sections and subgrade soils. If the overall finished site is relatively flat, then finished asphalt surfaces should be constructed with crowns that slope away at a minimum gradient of 2% toward stormwater collection areas.

Crack maintenance on pavements should be performed at least every 3 years, or when cracking is evident. Crack sealing will help reduce surface water from infiltrating into the supporting soils.

6.9 Foundation Recommendations

The proposed building may be supported on a concrete mat-slab foundation, provided the recommendations provided herein are properly implemented during design and construction.

- Within the proposed building area, over-excavation of undocumented fills and preparation of subgrades should be accomplished as indicated in section *6.1 Site Preparation*.
- Based on existing site grades, we anticipate site grading will include cuts and fills to create a flat pad for construction and will result in a cut/fill transition below the proposed building foundation. As a result, we recommend the concrete mat-slab foundation be supported on a minimum of 1-foot of crushed base course over suitable native soils and/or properly compacted site grading fill subgrades.
- Crushed base course should extend a minimum of 6-inches beyond the edges of the concrete mat-slab foundation and be compacted as recommended in section *6.4 Fill Placement and Compaction*.
- ALLWEST should observe any foundation excavations, including column footings for porches and/or canopies, to confirm subgrade suitability and confirm that our recommendations are being adhered to. Foundation subgrade soils should be probed, and any over-excavations should be approved, prior to placement of crushed based course or concrete.
- If subgrades are constructed and approved as stated above, concrete mat-slabs may be designed for the following bearing pressures:

Bearing Condition	Allowable Bearing Pressure (psf)	Minimum Crushed Base Course Thickness Below Slab (feet)
Crushed Base Course over Suitable Native Soil and/or Site Grading Fill Subgrades	2,500	1

- The net allowable bearing pressure value may be increased by 1/3 to account for transient loads such as wind and seismic.
- If the previous recommendations are implemented, it is our opinion total settlement will be approximately less than 1 inch and differential settlement will be approximately less than ½ of an inch in a 30-foot span.
- A coefficient of friction of 0.40 may be used for sliding resistance between concrete slab foundations and suitable native soils/properly compacted site grading fill subgrades, or 0.45 between concrete footings and crushed base course.

6.10 Concrete Slabs-on-Grade

We recommend placing a minimum of 12 inches of crushed base course below exterior slabs and flatwork. Subgrades within these areas should be prepared as indicated in section *6.1 Site Preparation* and be suitably proof-rolled utilizing vibratory compaction equipment. Base course should be compacted as recommended in section *6.4 Fill Placement and Compaction*.

If moisture-sensitive floor coverings are planned, we recommend consideration be given to including a moisture vapor retarder beneath concrete slab-on-grade floors to retard moisture migration through the slabs. We recommend the moisture retarder be installed per American Concrete Institute (ACI) recommendations and specifications. To protect slabs from moisture migration which may impact flooring performance, it is important to include the moisture vapor retarder as well as directing surface and subsurface water away from the slabs. In addition, concrete should have adequate time to cure prior to placing impermeable flooring.

6.11 Seismic Design Parameters

We anticipate the most current edition of the International Building Code (IBC) will be used as the basis for design of the proposed structures. Based on our experience and review of well driller logs in the area, the subsurface soils up to 100 feet below ground can be characterized as Site Class D "stiff soil" for seismic design.

The following seismic parameters were calculated using OSHPD Seismic Design Maps using site-specific latitude and longitude coordinates. The following maximum earthquake spectral response accelerations may be used for design.

Latitude	Longitude	Spectral Accelerations		Site Coefficients	
		Ss	S_1	Fa	Fv
44.518562º	-116.048369º	0.463	0.141	1.429	2.235

6.12 Grading and Drainage

Final grades should slope down and away from the completed building foundation at a minimum gradient of 5% within the first 5 feet. Final grades adjacent to foundations should be based on the grade of properly moisture-conditioned and compacted ground surfaces, not the grade of loose/dry soil, or the grades of landscape rock/gravel adjacent to the foundation. If the adjoining ground surfaces consist of impermeable hardscapes (i.e., asphalt or concrete), they may be sloped at a minimum gradient of 2% within the first 5 feet.

6.13 Corrosion Potential

Resistivity, pH, and chloride testing was performed on a near surface native silty sand to evaluate corrosion potential to buried metal (cables, pipes, piles, etc.). Laboratory testing of the on-site soil resulted in pH value of 6.58, resistivity value of 7,692 Ohm-cm, and chloride concentration of 30 parts per million (ppm).

A pH of 7 is considered neutral, values below 7 are considered acidic, and values above 7 are considered basic; pH ranges of 5 to 8.5 are unlikely to have a direct influence on corrosion of buried metals.

In general, soil resistivity values below 1,000 are considered extremely corrosive to metal, values between 1,000 and 3,000 are considered highly corrosive to metal, values between 3,000 and 10,000 are considered mildly corrosive, and values above 10,000 are considered non-corrosive to metal (Roberge, 2006). Based on resistivity test results, the on-site soils are considered mildly corrosive to buried metal.

Chloride can affect metals differently and the severity of the affect is based on the type of metal and the chloride concentration. Relevant protection/coating against high chloride concentrations may be selected by the design engineer based on the type of metal to be buried.

Sulfate testing was also performed on the near surface native silty sand to evaluate requirements for concrete exposed to water soluble sulfates in soil. Laboratory testing resulted in dissolved sulfate in water concentration of <10 ppm. Based on the International Building Code (IBC), exposure classifications of concrete to dissolved sulfates in water are as follows: less than 150 ppm is negligible; 150 to 1,500 ppm is moderate; 1,500 to 10,000 ppm is severe; and over 10,000 ppm is very severe. Based on laboratory testing, the dissolved sulfates in water concentrations are negligible to exposed concrete.

7.0 ADDITIONAL RECOMMENDED SERVICES

To maintain continuity and efficiency, we recommend ALLWEST be retained to provide observations and testing throughout earthwork construction. As an independent testing company, ALLWEST can document the recommendations included in this report are properly implemented, provide quality control testing, and observe earthwork for conformance to project specifications. As a minimum, we recommend the following testing and observations be provided by ALLWEST:

- Observe site stripping, over-excavations, test pit remediation, and any other soil over-excavations and backfills.
- Observe subgrade proof-rolling and approve subgrades prior to fill/materials placement or pavement section/utility construction.
- Observe removal of disturbed soil and subgrade stabilization, if required.
- Observe stormwater disposal facility subgrades, confirm subsurface seepage rates by performing large-scale seepage testing within stormwater disposal facility locations, and observe overall stormwater disposal facility construction.
- Conduct compaction testing of fill soils for general site grading, utility backfills, and pavement subsections.
- Observe placement of asphalt and test for compaction, oil content, and gradation.

If we are not retained to provide the recommended construction observation and testing services, we shall not be responsible for soil engineering-related construction errors or omissions.

8.0 EVALUATION LIMITATIONS

This report has been prepared to assist design and construction for the proposed Cascade Medical Center Expansion located at Lake Cascade Parkway and School Street in Cascade, Idaho. Reliance by any other party is prohibited without the written authorization of ALLWEST. Our services consist of professional opinions and conclusions made in accordance with generally accepted geotechnical engineering principles and practices in the local area at the time this report was prepared. This acknowledgement is in lieu of all warranties, express or implied.

The following appendices complete this report:

Appendix A – Vicinity Map, Exploration Location Map
Appendix B – Test Pit Logs, Unified Soil Classification System
Appendix C – Laboratory Test Results

Appendix A

A-1: Vicinity Map
A-2: Exploration Location Map

ALLWEST

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FIGURE A-1: VICINITY MAP

GEOTECHNICAL EVALUATION

CASCADE MEDICAL CENTER EXPANSION

CASCADE, IDAHO

CLIENT: CASCADE MEDICAL CENTER

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