Geotechnical Engineering Report
Gruening Middle School Earthquake Repairs
Eagle River, Alaska

August 2019

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EAGLE RIVER, ALASKA

1.0 INTRODUCTION

This report presents the results of data review, subsurface explorations, laboratory testing, and geotechnical engineering studies conducted by Shannon & Wilson, Inc. for proposed repairs to Gruening Middle School in Eagle River, Alaska. We understand that the school was damaged during the November 30, 2018 Earthquake. The purpose of this geotechnical study was to explore subsurface conditions and provide a discussion of the geotechnical conditions at the site as they pertain to the existing school foundation and observed damage. To accomplish this, ten soil borings, two test pits, and eight Dynamic Cone Penetrometer (DCP) tests were advanced around and inside of the school building. Soil samples recovered from the borings and test pits were tested in our geotechnical laboratory and engineering studies were performed to support foundation repair design. Presented in this report are descriptions of the site and project, a historical data review, subsurface explorations and laboratory test procedures, an interpretation of subsurface conditions, and conclusions and generalized recommendations from our engineering studies.

Authorization to proceed with this work was received in the form of a signed Notice to Proceed (NTP) by Mr. Garrett Burtner, AIA of McCool Carlson Green (MCG) on June 20, 2019. The work was performed in general accordance with our June 11, 2019 proposal with the following exceptions: the test pits were advanced with less total length and the interior borings were advanced until auger refusal. Additionally, one of the exterior test pits was removed due to conflicts with utilities around the building perimeter.

2.0 SITE AND PROJECT DESCRIPTION

The Gruening Middle School is located at 9601 Lee St, south of Eagle River Road and west of Eagle River Loop Road, in Eagle River, Alaska. The site is developed with the middle school building, paved parking and walking areas, and several large grass and/or treed areas. In general, the site was sloping slightly downward toward the southwest with about ten feet of relief from one side of the school to the other. A vicinity map showing the general project area is included as Figure 1. Figure 2 includes a site plan showing the boring locations and other prominent site features.

We understand that the preliminary site investigation identified potential settlement or displacement on the east end of the building and gymnasium, including possible settlement under the gymnasium floor and displacement under the stairwell on the east side of the gymnasium. We understand that the Anchorage School District (ASD) wishes to evaluate the damage and design repairs to the building.

3.0 DATA REVIEW

Subsurface and geotechnical information from the post-earthquake site evaluation was provided by MCG. The report is primarily a review of the historical data available and a summary of the post-earthquake condition of the school. This report is included in Appendix A.

Sources of Information

- *Draft – Geotechnical Evaluation of Gruening Middle School Foundation Earthquake Damage, Eagle River, Alaska.* Golder Associates (Golder). February 11, 2019.

We reviewed the Golder report and the supporting information contained therein as part of our effort. Golder's report presents an opinion that there were no obvious geotechnical conditions evident in the existing information that would suggest that the site would be vulnerable to significant settlement or ground displacement due to seismic shaking. As a result, Golder recommends additional explorations be conducted on site to determine if soil conditions exist at the site that could have contributed to the experienced earthquake damage. We generally agree with these conclusions provided in by Golder in their report.

4.0 SUBSURFACE EXPLORATIONS

Subsurface explorations at the site consisted of advancing and sampling ten soil borings across the site, six of which were outside of the school building, the other four of which were advanced inside of the gymnasium. Additionally, two test pits were excavated and eight DCP tests were advanced. Exterior boring locations were selected to provide coverage of conditions near areas of distress as well as areas where distress was not observed for comparison purposes. Test pit locations were selected to observe conditions adjacent to and directly beneath the portions of the building that experienced distress. The interior borings were selected to provide even coverage over the perimeter of the gym floor and the DCP test locations were selected in part by observations in our interior borings and to target areas close to building distress. The approximate boring, test pit, and DCP locations, shown on Figure 2, were selected by our onsite representative, with input from MCG, to provide reasonable coverage of both the damaged areas and the entire site and to avoid conflicts with onsite utilities. An experienced representative from

Shannon & Wilson was present during drilling and excavation to locate the borings and test pits, observe drill action and soil removal, collect samples, log subsurface conditions, and observe groundwater conditions.

4.1 Drilling and Test Pits

The borings, designated Borings B-1 through B-10 were drilled by Discovery Drilling of Anchorage, Alaska between June 27 and July 3, 2019 using a truck-mounted CME-75 drill rig for the exterior borings and a track mounted Geoprobe 6712DT for the interior borings. The test pits were advanced by Northern Excavation of Chugiak, Alaska on June 26, 2019 using a Hitachi Zaxis 160 LC excavator. Exterior boring locations were positioned using a handheld GPS device capable of 10-foot accuracy. Locations of interior borings were estimated based on swing tie measurements from interior structural features. The surface elevations shown on the boring and test pit logs for building exterior work were estimated from topographic contours provided by the Municipality of Anchorage GIS department. Elevations for interior borings were estimated based on the planned finish floor elevation of the gym provided in the reviewed building design plans. The boring locations shown on the site plan and the elevations reported on the boring and test pit logs should be considered approximate.

The borings were advanced with 3 1/4-inch inner diameter (ID), continuous flight, hollow-stem augers to depths of approximately 6 to 20 feet below ground surface (bgs). As the borings were advanced, samples were generally recovered using Standard Penetration Test (SPT) methods at 2.5-foot intervals to 10 feet bgs and 5-foot intervals thereafter to the bottom of the boring. With the SPT method, samples are recovered by driving a 2-inch outer diameter (OD) split-spoon sampler into the bottom of the advancing hole with blows of a 140-pound hammer free falling 30 inches onto the drill rods. For each sample, the number of blows required to drive the sampler the final 12 inches of an 18-inch penetration into undisturbed soil is recorded. Where the sampler did not penetrate the full 18 inches, our log reports the blow count and corresponding penetration in inches. Blow counts are shown graphically on the boring log figures as "penetration resistance" and are displayed adjacent to sample depth. The penetration resistance values give a measure of the relative density (compactness) or consistency (stiffness) of cohesionless or cohesive soils, respectively.

During test pit excavations, grab samples were collected from representative soil horizons encountered in the test pit. Approximate relative density classifications of the encountered soils were based on observing excavation action and comparison of soil types to those encountered in the geotechnical borings.

The soils encountered in borings and test pits were observed and described in the field in general accordance with the classification system described by ASTM International (ASTM) D2488. Selected samples recovered during drilling were tested in our laboratory to refine our soil descriptions in general accordance with the Unified Soil Classification System (USCS) described in Appendix B, Figure B-1. Frost classifications were also estimated for samples based on laboratory testing (sieve analyses [P200] and hydrometer [0.02 mil]) and are shown on the boring logs. The frost classification system is presented in Appendix B, Figure B-2. Summary logs of the borings and test pits are presented in Appendix B, Figures B-3 through B-14.

Upon completion, the test pits were backfilled with the materials removed during excavation and periodically tamped with the excavator bucket. The materials were roughly segregated during digging and returned to the test pits such that no significant change in location or elevation occurred as result of the excavation activities. It should be noted that existing utilities adjacent to the exterior footings were impacted during test pit excavations. Impacts were communicated to the project team during fieldwork and repairs were made to impacted lines per the direction of the ASD. The exterior borings were completed by backfilling the hole with auger cuttings produced during drilling. The interior borings were completed by backfilling the hole with cement and the cuttings were transported offsite for disposal.

4.2 Dynamic Cone Penetrometer (DCP) Testing

Shannon & Wilson performed DCP tests July 1 through 11, 2019. DCP tests were performed at the locations of Borings B-07 through B-10 prior to advancing the borings, as well as at four additional locations in the gymnasium, Test Holes TH-1 through TH-4. The DCP testing was performed in general accordance with the procedure as described by ASTM D6951 and the Office of Minnesota Road Research's *User Guide to the Dynamic Cone Penetrometer*. The DCP measures penetration per blow, which is an indication of the subgrade stiffness. The DCP data were correlated to the California Bearing Ratio (CBR). Results of the DCP tests are presented in Appendix B, Figures B-15 through B-22.

4.3 Concrete Coring

Prior to advancing the interior borings described in Section 4.1 and the DCP testing in Section 4.2, we cored through the existing concrete slab floor in the gymnasium. At each coring location, the thickness of the concrete floor slab was noted and inspection of the conditions directly beneath the slab were observed. Our representative also examined the outer edge of the cored area to detect support soil subsidence beneath the slab and voids beneath the slab.

5.0 LABORATORY TESTING

Laboratory tests were performed on soil samples recovered from the borings to confirm our field classifications and to estimate the index properties of the typical materials encountered at the site. The laboratory testing was formulated with emphasis on determining gradation properties, natural water content, and frost characteristics.

Water content tests were performed on each sample recovered from the borings. The tests were generally conducted according to procedures described in ASTM D2216. The results of the water content measurements are presented graphically on the boring logs presented in Appendix B, Figures B-3 through B-14.

Grain size classification (gradation) testing was performed to estimate the particle size distribution of selected samples from the borings. The gradation testing generally followed the procedures described in ASTM C117/C136 and D422. The grain size testing results are presented as Appendix B, Figure B-23, and summarized on the boring logs as percent gravel, percent sand, and percent fines. Percent fines on the boring logs are equal to the sum of the silt and clay fractions indicated by the percent passing the No. 200 sieve. Note that hydrometer testing indicates particle size only and visual classification under USCS designates the entire fraction of soil finer than the No. 200 sieve as silt. Plasticity characteristics (Atterberg Limits results) are required to differentiate between silt and clay soils under USCS.

Atterberg Limits were evaluated for two samples of fine grained soil to estimate plasticity characteristics. The tests generally followed procedures described in ASTM D4318. The results of these tests are presented in Appendix B, Figure B-24.

6.0 SUBSURFACE CONDITIONS

The subsurface conditions encountered in our explorations at the site are depicted graphically on the boring logs in Appendix B Figures B-2 through B-12, on the test pit logs in Appendix B, Figures B-13 and B-14, and on the DCP logs in Appendix B, Figures B-15 through B-22. In general, our explorations encountered 3.5 to 9 feet of fill over native soils. The fill soils were typically sands and gravels and the native soils typically consisted of sands and gravels with an increased fines content relative to the fill soils. The exterior borings, Boring B-01 through B-06 were advanced through an approximately 1 to 3 inch thick grass mat. The test pits, Test Pits TP-1 and TP-2 were advanced through a combination of asphalt sidewalk and grass mat. Borings B-07 through B-10 were advanced indoors through 5 to 6 inches of concrete. Occasional organics and construction debris were observed in the upper 2 feet of several exterior borings and in the test pits.

Based on typical penetration resistance values ranging between 12 and greater than 50 blows per foot (bpf), with frequent sampler refusal, the granular soils encountered by our borings would be considered medium dense to very dense. According to our laboratory tests, fines contents in the fill soils ranged between approximately 4 and 15 percent and fines content in the native soils ranged between approximately 19 and 37 percent. Moisture contents generally ranged from about 1 to 10 percent. Atterberg Limits identified the fines as plastic in two samples of native soil.

Groundwater was not encountered in any of the borings, however small seeps were encountered in one of the test pits and several of the borings at depths ranging from approximately 5.2 to 21.5 feet bgs.

6.1 Test Pits

Based on utility drawings provided by ASD and on visual observations in our test pits there appear to be numerous utilities adjacent to the school's foundation. In Test Pit TP-1 both footing drain and storm drain piping were encountered in close proximity to one another, with these systems overlapping each other in one location. In Test Pit TP-2 only footing drain piping was encountered. Based on our observations, the footing drain in Test Pit TP-2 was constructed within a clean gravel envelope surrounded by a drainage geofabric. The drain in Test Pit TP-1 did not have the same gravel/fabric surrounding and it appeared that the end of the drain was left open with drainage fabric stuffed into the end of the pipe. Based on our observations in the test pit, we believe that the location of these test pits are intended to be the up-gradient ends of the two footing drains that run on the north and south sides of the building, draining to the west. The footer in Test Pit TP-1 had what appeared to be excess concrete at the top forming a ledge that extended approximately 8 to 12 inches from the face of the stem wall. This feature was not observed in the footer in Test Pit TP-2.

The soil conditions encountered in the test pits included loose to medium dense granular fill materials with scattered organics and debris to between 6 and 6.5 feet bgs. Native soils under the fill consisted of dense to very dense silty sand with gravel. In each test pit, the base of the footing was approximately 5.5 feet bgs and the soils beneath the footings appeared relatively compact and did not contain organic debris.

6.2 Exterior Borings

Based on our borings, it appears the fill may be thicker on the southern part of the site than the more northern portion, which agrees with our understanding of the site development. In general, fill soils consisted of sand and gravel with varying fines content (but typically less than approximately 15 percent) down to between 4.5 and 9 feet bgs. In each boring, SPT sampling suggests that fills are medium dense to very dense and typically dense or greater below the anticipated footing depth of 4.5 to 5.5 feet bgs. Native soils beneath the fills consisted of dense to very dense silty sand with gravel and silty gravel with sand.

6.3 Concrete Coring

The concrete slab in the gym ranged in thickness from approximately 4 to 6 inches, with the greatest thickness variations occurring around the outer edges of the gym. We encountered utilities directly beneath the slab, with two PVC conduits encountered near Boring B-10 and potentially additional conduit located near Test Hole TH-4. Plumbing drawings for the school indicate that water lines may be located under the slab near the outer perimeter of the gym in several locations. In all of the cores through the gym floor vapor barrier was observed to be present below the slab.

At all locations cored through the gym floor slab the foundation appeared to be resting on the subgrade soil with no obvious voids or gaps visible. Two concrete cores were advanced through areas of the slab containing relief cuts. It was observed that in both relief cut locations the slab had a crack running for the full vertical thickness extending down from the relief cut.

6.4 Interior Borings and DCP

Borings advanced through the slab encountered dense to very dense fill and native soils directly beneath the floor slab to the depths of the borings. Fill and native soil conditions generally agreed with conditions encountered in the exterior borings though we did not encounter intermixed organics. Fill soils extended to depths of 3.6 to 6.5 feet bgs and consisted of well graded sand with silt and gravel. Native soils were largely silty sand with gravel.

The DCP tests generally indicated increased soil densities below 0.3 to 0.8 feet below the base of concrete. The SPT sampler generally indicated increased soil densities below 0.5 feet below the base of concrete, which generally agrees with the DCP findings. Test Hole TH-2 was the only DCP test where refusal was not reached prior to reaching the end of the rod.

7.0 SEISMIC CONDITIONS

Based on our explorations and local experience, the site class according to the 2012 International Building Code (IBC) will be D for a stiff soil profile based on the blow count (N) method with typical blow counts ranging between 15 and 50 blows per foot. We believe that the naturally occurring soils at this site have a low susceptibility to slope failure, liquefaction, and surface rupture. Therefore, we believe that a Site Class D will be the most representative of the site. Based on Section 1613.5 of IBC 2012, S_s and S_1 for the Maximum Considered Earthquake were estimated at 1.5 and 0.687 times the force of gravity (g), respectively. The site specific modifying coefficients for the spectral response accelerations are $F_A = 1.0$ and $F_v = 1.5$ for the short and long periods, respectively. The S_{MS} and S_{M1} were calculated to be 1.5 and 1.03 g respectively. The computed S_{DS} and S_{D1} are 1.0 and 0.687 g.

8.0 OBSERVED DAMAGES

A representative from Shannon & Wilson was present at the site on numerous occasions between June 19 and July 11, 2019. Our observations were generally constrained to the area of the building surrounding the gymnasium and the adjacent East stairwell. Cracking was noted in both the East and North stairwells attached to the gymnasium. The cracking was generally located where the stairwell exterior wall and gymnasium exterior wall meet. The most severe cracking was noted in the northern corner of the East stairwell. It was also noted that the southwest gymnasium wall appeared to have suffered from earthquake related damage as it appeared to have been temporarily structurally reinforced with anchors at numerous points connecting the wall to the floor and the building staff reported that they were instructed not to walk along the back (gymnasium) side of the wall on the mezzanine level. Similar wall anchoring appears to be in place at other locations in the school.

9.0 EARTHQUAKE SUMMARY

On November 30, 2018 at 8:29 am, southcentral Alaska experienced a 7.1 magnitude earthquake that occurred approximately 5 miles north of Anchorage. With a depth of approximately 27 miles, the shaking was felt by a large portion of southcentral Alaska. The strong shaking lasted for approximately 20 seconds and the peak ground acceleration (PGA) in the Anchorage and Eagle River areas was generally recorded ranging from 0.14 to 0.56 times the gravitational constant (g), with a large number of sites reporting PGAs in the range of 0.23 to 0.30g. Seven minutes after the main shock an M5.7 aftershock occurred, the largest of the aftershocks to date. The closest ground motion sites to the project were located at the Chugiak Volunteer Fire Station 32 and at Saint Christopher Episcopal Church in Anchorage, which reported PGAs of 0.298g and 0.295g, respectively. Based on this information, we believe that the ground motions experienced by this site were likely between 0.25 and 0.35g.

There was a wide variety of damage to structures in southcentral Alaska as a result of the November 30 earthquake, however there are several common themes relating much of the damage. Many structures that experienced damage were constructed over thick layers of poor quality (loose and/or silty) fills, are located in areas with regionally shallow groundwater, or are in areas with loose or liquefiable soils. Both liquefaction and consolidation related failures have been identified, as well as failures related to soil displacement, especially in steep embankment fills.

10.0 ENGINEERING CONCLUSIONS

Based on our observations of the building distress and the conditions encountered in our explorations, it is difficult to determine if the damages are a direct result of foundation distress or failure. The native soils at the site appear to be dense to very dense and not susceptible to failure or strength loss during a seismic event. Furthermore, fill materials under the gym floor slab and footings appears to be in a dense and compact condition. The loosest conditions under the slab were encountered in Test Hole TH-2 where refusal was not encountered within the length of the rods and a low CBR value of 2 directly below the slab. There does not appear to be a significant potential for significant amounts of loose fill and shallow groundwater under the foundation elements. Our test pit, boring, or DCP testing explorations did not reveal any obvious causes of soil conditions that would lend themselves to poor foundation performance during an earthquake.

The condition that we encountered with the greatest potential for contributing to poor foundation performance was apparently loose soil conditions that may be present adjacent to the exterior foundation stem walls. The fill soils in our test pits adjacent to the foundation stem walls appeared to be relatively loose (in comparison to the fill soils under the slab and footings) and contained scattered organics and debris. Furthermore, utilities buried outside the perimeter of the building may have made compaction during construction more difficult in some locations. These utilities also carry stormwater from roof drains and other stormwater works and, if full and leaking at the time of the earthquake, could have been contributing excess moisture to the loose soils adjacent to the stem walls. It is possible that loose soils may have not provided sufficient lateral support during the earthquake, which may have contributed to the damages to the structure in the north and east stairwells. It should be noted that the limited area of footings and stem walls that we exposed during test pit excavation did not reveal foundation damage or out-of-plumb stem walls. Additionally, our borings which were advanced within 5 to 10 feet of the foundations did not encounter loose soil conditions.

In conclusion, we did not encounter obvious conditions in our explorations that would account for the poor performance of the structure. The conditions described in the shallow portions of our test pits outside of the east stairwell may have provided insufficient lateral support and contributed to the observed damage, though we are unable to draw a definitive conclusion to that possibility. Further investigation of the perimeter footing and stem wall may be able to clarify if movement in the foundation occurred. However, exposing the foundation for long distances will be difficult given the location of buried utilities outside of the building. Other conditions may exist under the building that caused distress in interior walls, but based on our explorations, those conditions would be highly localized and therefore less likely to cause larger scale effects observed in the building. As such, we believe that it is possible that the damages could be more likely caused by structural deficiencies.

11.0 CLOSURE/LIMITATIONS

This report was prepared for the exclusive use of our client and their representatives for evaluating the site as it relates to the geotechnical aspects discussed herein. The analyses and conclusions contained in this report are based on site conditions as they presently exist. It is assumed that the exploratory borings are representative of the subsurface conditions throughout the site, i.e., the subsurface conditions everywhere are not significantly different from those disclosed by the explorations.

The conclusions in this report are not intended to be used for final repair design. The intent of the explorations was to evaluate the local conditions around the building and aid in determining whether subsurface conditions contributed to damages caused by the November 30, 2019 earthquake. We assume that the information and conclusions included herein will be used by the ASD in the decision-making process for planning whether repairs to the building will be conducted or if the structure will be replaced. Additional engineering analysis, and potentially subsurface investigations depending on the repair approach, will be needed to develop final design recommendations for the repair. Shannon & Wilson has prepared the attachments in Appendix C *Important Information About Your Geotechnical/Environmental Report* to assist you and others in understanding the use and limitations of the reports.

Copies of documents that may be relied upon by our client are limited to the printed copies (also known as hard copies) that are signed or sealed by Shannon & Wilson with a wet, blue ink signature. Files provided in electronic media format are furnished solely for the convenience of the client. Any conclusion or information obtained or derived from such electronic files shall be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, or you question the authenticity of the report please contact the undersigned.

We appreciate this opportunity to be of service. Please contact the undersigned at (907) 561-2120 with questions or comments concerning the contents of this report.

SHANNON & WILSON, INC.

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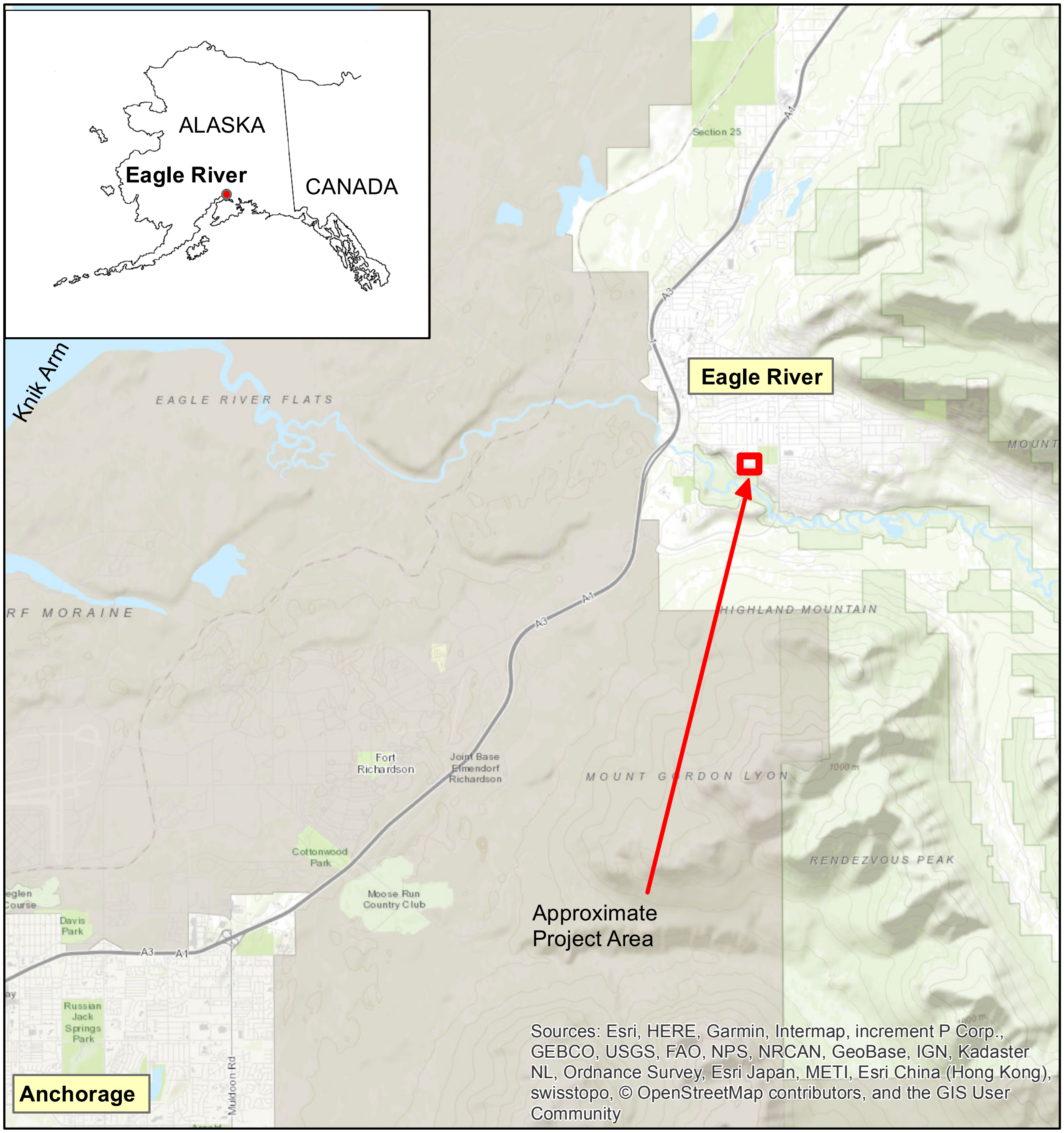

Gruening Middle School Earthquake Repairs
Eagle River, Alaska

VICINITY MAP

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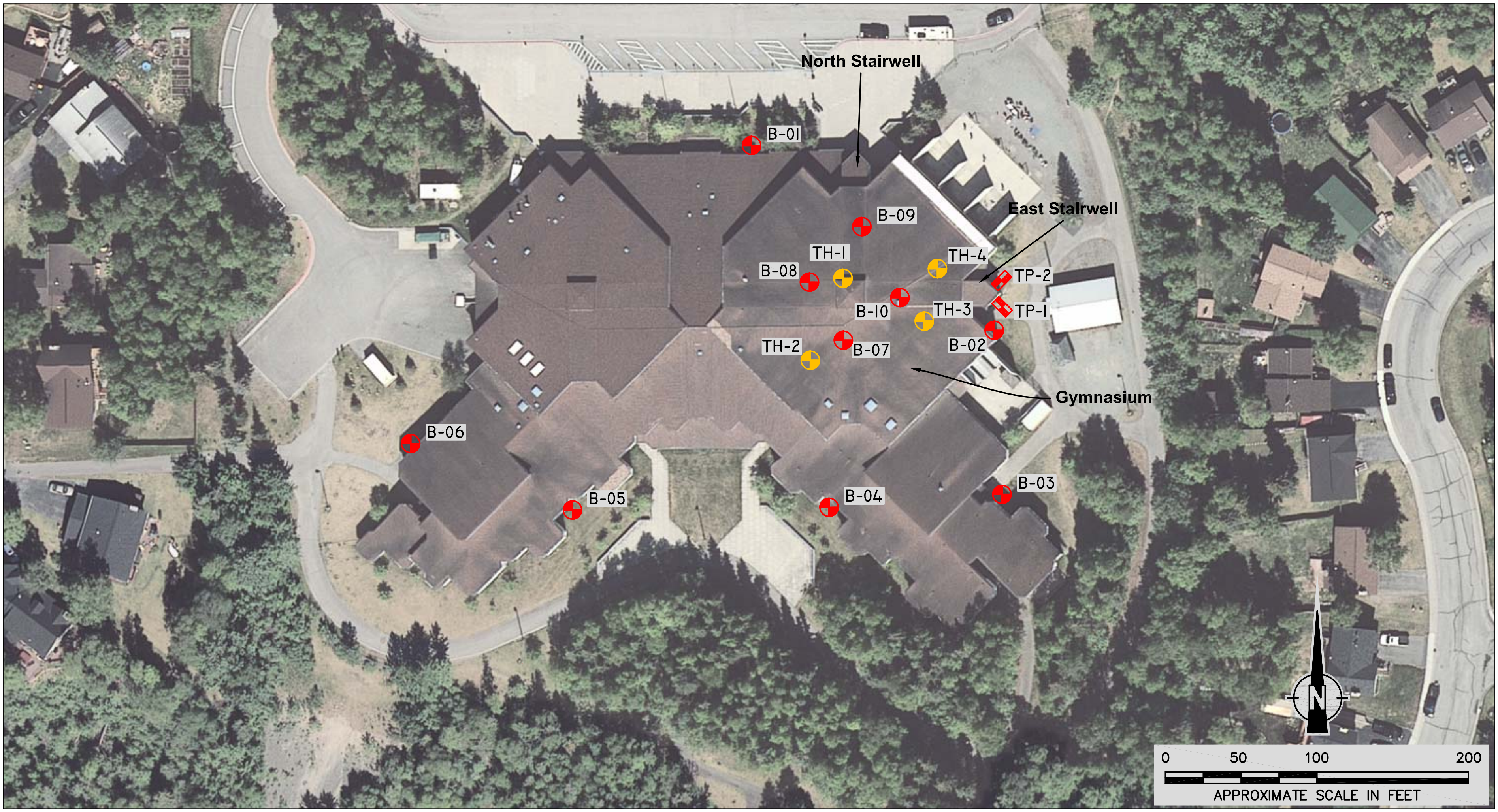
FIG. 1



LEGEND

- B-01: Approximate Location of Boring B-01, Advanced by Shannon & Wilson, June and July 2019.
- TP-1: Approximate Location of Test Pit TP-1, Advanced by Shannon & Wilson, June 2019.
- TH-1: Approximate Location of Test Hole TH-1, Advanced by Shannon & Wilson, July 2019.

NOTES

1. Map adapted from aerial imagery and data sources provided by the Municipality of Anchorage. Image date: May 2015
2. Locations of existing features should be considered approximate.

Gruening Middle School Earthquake Repairs
Eagle River, Alaska

SITE PLAN

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SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 2

APPENDIX A

DATA REVIEW

February 11, 2019

GEOTECHNICAL EVALUATION OF GRUENING MIDDLE SCHOOL FOUNDATION EARTHQUAKE DAMAGE, EAGLE RIVER, ALASKA

Golder Associates Inc. (Golder) is pleased to present this report summarizing our review of historic information relating to design and construction of Gruening Middle School, located in Eagle River, Alaska (Figure 1). We understand that school was damaged in the November 30, 2018 earthquake, and is currently closed to the public due to the damage. BDS Architects (BDS) is under subcontract to Anchorage School District (ASD) to lead planning and design efforts to repair the damage. Planning efforts for renovation of the school include a geotechnical evaluation of the site.

The first phase of geotechnical site evaluation is review of available data related to school design and construction. Golder completed the review of site data presented in this report following a site visit on January 24, 2019 by Golder engineers Mark Musial, PE, and John Thornley, PE, who met with representatives of ASD, Reid Middleton, Inc., and BDS. The purpose of the site visit was to observe 1) separation of an exterior stairwell from the main gymnasium building, 2) apparent settlement of the mezzanine surrounding the gymnasium, and 3) possible settlement of the gymnasium floor; however, other types of damage were also noted in walls and corridors surrounding the gymnasium area.

The conclusions presented in this report were prepared in accordance with our proposal to BDS dated January 28, 2019 to compete the general scope of work outlined below.

- Reviewing historical air photos of the site prior to development of the school.
- Reviewing Municipality of Anchorage (MOA) LiDAR data to establish site topography prior to the earthquake.
- Reviewing geotechnical reports, plans, and as-built records for the school to establish initial design conditions and configuration of foundation elements.
- Comparing pre-earthquake and post-earthquake data, if available, in order to identify changes that may have occurred in the site grading, foundations, or gymnasium mezzanine area.

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- Developing a scope of work and cost estimate for conducting a geotechnical site investigation that may be needed to evaluate the soil and foundation conditions, identify possible causes of related settlement distress, and present recommendations for rehabilitation and stabilization of foundation soils.

1.0 SITE CONDITIONS/TOPOGRAPHY

Gruening Middle school is located on top of bluff above a slope which extends approximately 210 feet down to Eagle River at an approximate slope of 2H:1V (horizontal to vertical). The main school building is approximately 100 feet north of the slope, with elevations ranging from 483 feet at the top of the bluff to 493 feet on the north side of the school.

Grading plans for the site were included in the design drawings. A review of the drawings indicates that the original ground under the structure ranged from approximate elevation 480 feet to 485 feet, with the ground sloping to the south towards the bluff. According to the design documents, the finished floor elevation in the gymnasium area of the school is 487 feet.

The project grading plans indicate higher ground elevation east of the school, near the residential developments, which is consistent with observations made during our January 2019 site visit. The slope on the east side of the property appears to range from approximately five to 12 feet high and slopes west down towards the school property.

A cleared area along the slope leading to Eagle River exists southwest of the school, as seen in Figures 2 through 6. Based on the utility plans, this area has a storm outfall easement that contains a buried 18-inch corrugated steel pipe. The area is also visible on the more recent aerial imagery (Figure 7).

2.0 GEOLOGIC SETTING

The Eagle River Valley is a large valley in the western Chugach Mountains with local topography and geology defined by glaciation during the Pleistocene and late Tertiary. Bedrock in the area is generally a mix of weakly metamorphosed sedimentary and igneous rocks overlain by soils composed of alluvial outwash and moraine deposits. Soil overburden is relatively thin or absent on steeper slopes and mountainous areas but can be up to 700 feet thick in the Eagle River Valley. Glacial erratics are present. The topography is generally flat to rolling in the mid valley. The vegetation consists of a mixed forest of spruce, birch, and some poplar.

HLA mapped the site as seismic zone 2 in their 1979 geohazards study for the MOA (HLA, 1979). The report defines seismic zone 2 as “moderately low ground failure susceptibility”.

The soils at the Gruening Middle School site are identified by the United States Geological Survey (USGS) in 1989 as fill material, while the soils immediately surrounding the site were identified as ground moraine, glacial till composed of poorly sorted gravel with small amounts of clay and silt (Yehle and Schmoll, 1989). Bedrock in the vicinity of the school is thought to be greater than 250 feet below ground surface.

3.0 BACKGROUND DATA REVIEW

The following sections provide a summary of data provided by BDS related to historic site conditions and geotechnical engineering, as well as change detection analysis of LIDAR data performed by Golder.

3.1 Specifications and Design Drawings

The specifications and design drawings for the school, titled "Eagle River / Chugiak / Eklutna Junior High School, Specifications, Drawings, and Contract Documents", were developed by Lane+Knorr+Plunkett Architects and Planners and submitted to ASD and the MOA in December 1981. The design documents include 54 pages of specifications that are include in Volume 1 of the documents and contain the geotechnical report for the site by Harding-Lawson Associates (HLA, 1981), which is discussed in Section 3.2.

- Sheet C-5. Grading Plan, South. The finish floor elevation in the gymnasium area is shown as elevation 487 feet, which appears to be within zero to three feet of the existing ground elevation in the vicinity of the gymnasium, which slopes to the southwest. Other positions of the building also appear to have finish floor elevations with a few feet of existing grades and appears to indicate that foundations would be in compacted native soil or structural fill.
- Sheet S-1. General Notes and Typical Details. Typical foundation details and a footing schedule are provided on this sheet. The footing schedule provides footing sizes and installation depths. A note on the sheet indicates that "All footings shall bear on undisturbed soil overlaid with 4" (min.) of compacted granular NFS fill" (Lane+Knorr+Plunkett, 1981).
- Sheet S-3. Foundation Plan/East Wing. Foundations in the stairwell appear to be spread footings with widened areas at columns. Similarly, the east and west walls of the gymnasium, which are reported to be tilting, appear to be supported on spread footings. In the gymnasium, the plan shows six-inch diameter pipe columns supported on spread footings.
- Sheet S-12. Foundation Sections & Details. This sheet shows a number of cross sections for the eastern side of the school, including the gymnasium. Foundation details, including footing size and fill requirements are not presented on this sheet, but are outlined elsewhere in the document, including in the specifications as well as in the geotechnical report discussed in Section 3.2.

Copies of the plan sheets and specification sheets containing the geotechnical report are included in Appendix A.

3.2 Geotechnical Exploration

The geotechnical study (HLA, 1981) consisted of drilling and sampling test borings at the locations shown in Figure 2.1. Comparison of dimensions shown in Figure 3.1 indicate that the school building appears to be in approximately the same location and general shape as the existing building. One test boring (HLA Test Boring 12) is at the corner of the gymnasium at the location of the separated stairwell. Other site features of note are ponded surface water observed by HLA around the building footprint, indicated as 'wet areas' by HLA in Figure 3.1.

The data obtained by HLA indicates relatively consistent subsurface conditions, generally characterized as a dense silty gravel with sand below a near surface layer of sandy silt (Figure 3.2). Boulders and cobbles were encountered in the boreholes. Groundwater was encountered in five of the 31 boreholes at the time of drilling. Groundwater was generally observed ranging from 10 to 20 feet below ground surface (bgs) at the time of drilling. One borehole, HLA Test Boring 22, encountered water at three feet bgs at the time of drilling, but groundwater was measured to be 16 feet bgs three weeks after completion of drilling.

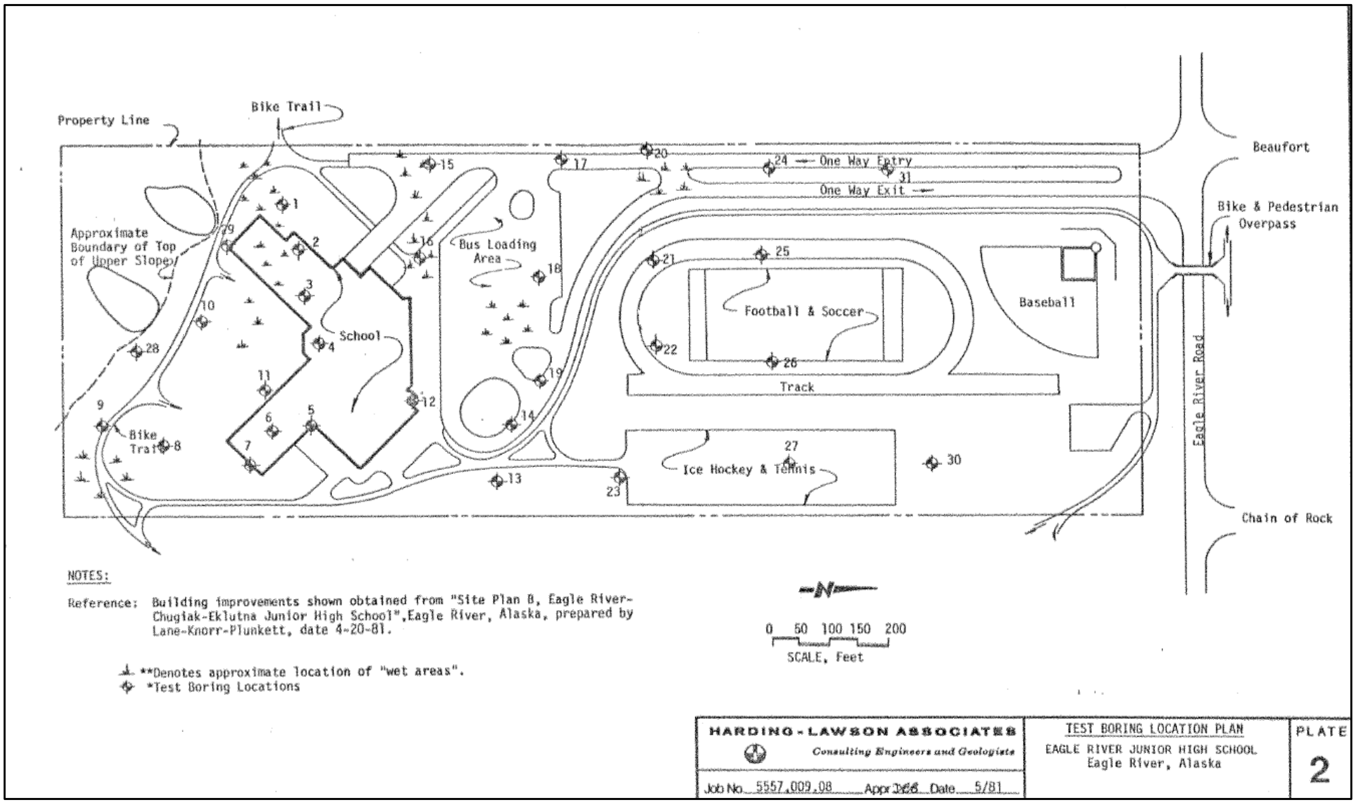


Figure 3.1: Borehole Location Map (HLA, 1981)

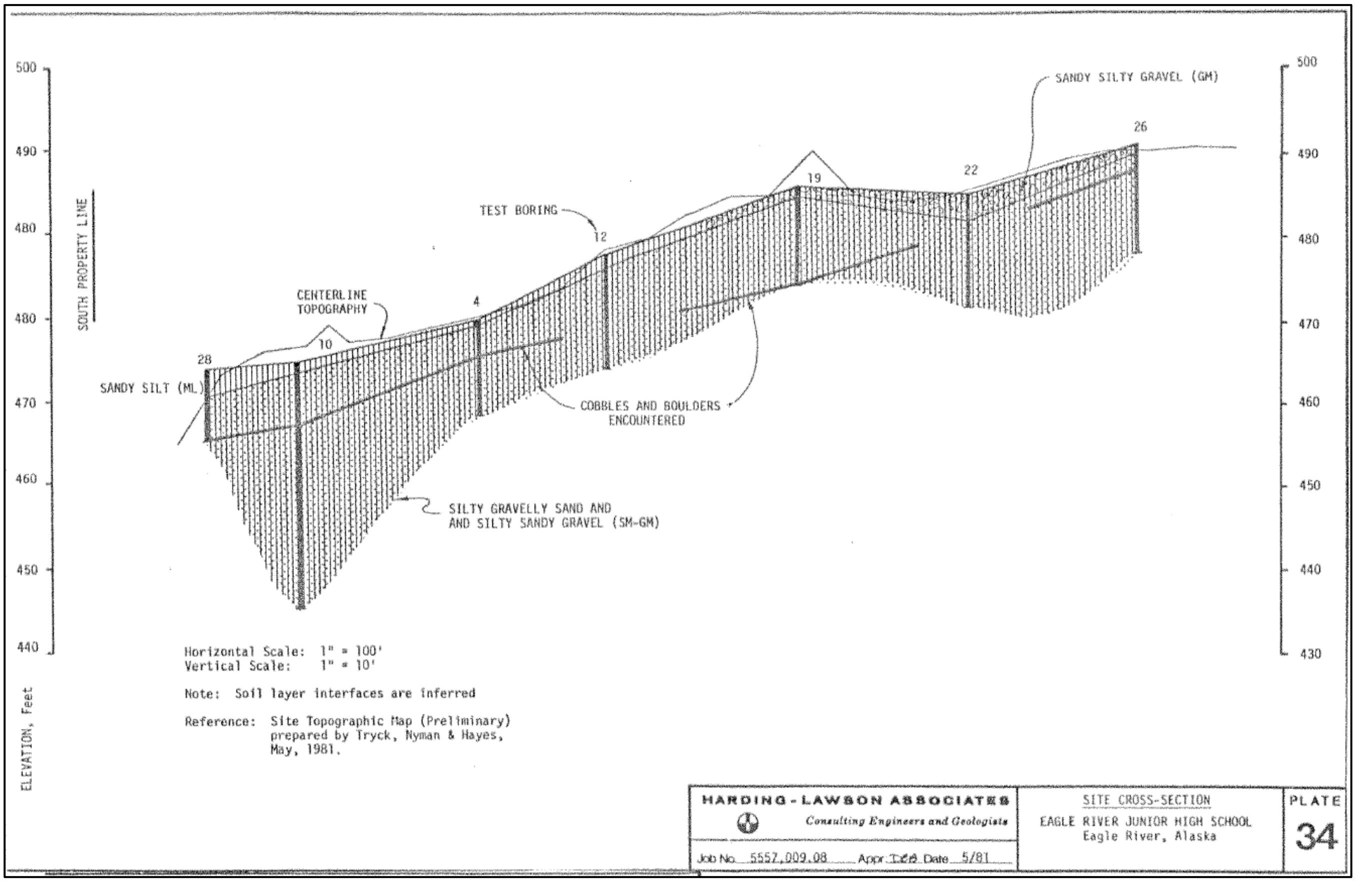


Figure 3.2: Cross Section Showing Generalized Subsurface Conditions (HLA, 1981)

Recommendations for site development and foundations are provided in the HLA (1981) report, including design of footings for 3,000 psf bearing pressure for dead loads and 4,000 psf for total loads including wind and seismic. The design criteria provided by HLA include use of insulation adjacent to exterior footings to limit the potential for frost penetration beneath exterior footings.

3.3 Other Documents

Construction of the school began in 1982. We understand that litigation occurred related to school construction. Golder was provided various documents combined in a nearly 700-page PDF of information discussing the basis of a claim for equitable adjustment made by the prime contractor, Rogers and Babler. The documents also contained correspondence between the prime contractor, Architect, Municipality of Anchorage, and others. According to the documents, there were many issues during construction that caused delays and cost overruns. The outcome of the claims is unknown, and no legal documents or records of court decision were reviewed.

The documents were reviewed to better understand the geotechnical aspects of the project. The documents indicate the following:

- Construction quality control was completed by the owner.
- Compaction testing of fill was completed by the owner and a third party hired by the prime contractor.

- Fill material was rejected on numerous occasions due to oversized material, but the issue was resolved after material was screened and run through a crusher.
- There were issues in the design drawings with the foundation footing elevations that had to be resolved with revised design drawings.

3.4 Aerial Imagery / LiDAR

3.4.1 Aerial Imagery

Golder acquired a series of historical aerial images to review the development of the school site and surrounding areas. Specifically, we reviewed aerial images acquired in 1950, 1953, 1957, 1962, 1972, 1977, 1978, 1982, 1984, 1990, 1996, 2002, and 2015. In addition, Golder acquired and reviewed stereo aerial images from 1982, including photos taken on April 30, June 1, June 24, and September 27 of that year, documenting various stages of construction at the school site. Figures 2 through 6 present aerial images of the project site for select years.

Review of the historic aerial imagery indicate the following:

- Prior to 1950, vegetation around the school site extending down to Eagle River was absent, while surrounding areas were forested.
- Between 1950 and 1978, the site photographs shown vegetation recovering. No other development was observed.
- In April 1982 clearing and initial earthwork had begun (Figure 3). By June of 1982 the site was being leveled (Figures 4 and 5), and by September 1982 most of the exterior of the school had been completed.
- Subsequent aerial photographs (1984 to 2015) show development in surrounding areas, but no significant change at the school site.

3.4.2 LiDAR / Change Detection Analyses

Golder acquired three different years of Airborne LiDAR data (2014, 2015, and 2018 – post earthquake), and performed a change detection analysis to look for ground movement related to the earthquake. The change detection analyses were performed using two types of filtering on the LiDAR datasets. The first LiDAR dataset analyzed filtered out everything but the ground or bare earth points, and the second LiDAR dataset analyzed used all points, including structures such as the top of the school. Figure 7 presents the Hillshade image of 2018 data obtained after the earthquake, showing the site and surrounding area.

The change analysis did not indicate any ground movements more than two feet around the school grounds or the structure between 2015 and 2018. These results are within the accuracy of the analysis, and they cannot be used to identify changes less than two feet. However, they do show that large scale ground displacement did not occur at the school, unlike the landslide that appears to have occurred on the bluff slope above Eagle River located approximately 650 feet southeast of the school.

4.0 CONCLUSIONS

Golder reviewed multiple documents related to the design of the Gruening Middle School in order to determine if there were unique site conditions warranting further investigation and better refine the scope of additional field investigations. Results of the review do not point to an apparent geotechnical reason for the reported settlement of mezzanine areas and tilting of walls in the gymnasium, as well as separation of the stairwell area north of the gymnasium from the main building. Rather, the results of our review suggest that the reported structure deformations, if related to site conditions and foundation performance, will require further site-specific site investigation.

A geotechnical investigation will allow location-specific data to be collected and used to assist with identifying possible causes of related settlement distress and assist in developing recommendations for rehabilitation and stabilization of foundation soils, if needed. We have attached (Appendix B) a proposed scope of work and cost estimate to provide a site-specific geotechnical investigation inside and outside the gymnasium and stairwell.

5.0 USE OF REPORT

This report was prepared for BDS for the use in evaluating the damage to Gruening Middle School that occurred during the November 30, 2018 earthquake. This report is based on data and information collected by others and provided to Golder. We accept no responsibility for any deficiency, misstatements or inaccuracy contained in this report as a result of omissions, misstatements or fraudulent acts of published data. Golder did not independently verify the accuracy and completeness of the data and information provided for this report.

Our work followed the standard of care expected of professionals undertaking similar work in Alaska under similar contractual conditions and site constraints. No warranty expressed or implied is made.

6.0 CLOSING

Thank you for the opportunity to assist BDS with this project and for considering the attached proposal for site-specific investigation. If you have comments or questions, please contact John Thornley at (907) 865-2536.

Golder Associates Inc.

DRAFT, No Signatures

John D. Thornley, PE
Associate, Senior Geotechnical Engineer

Mark R. Musial, PE
Principal, Senior Geotechnical-Permafrost Engineer

BBS/JDT/MRM/mlp

Attachments: Figure 1: Vicinity Map
Figures 2 – 6: Historic Aerial Imagery
Figure 7: Hillshade Image – 2018 LiDAR
Appendix A: Select Historical Documents
Appendix B: Proposal for Geotechnical Investigation

https://golderassociates.sharepoint.com/sites/103615/deliverables/1911656 gruening data review - draft.docx

7.0 REFERENCES

Harding-Lawson Associates (HLA). 1979. Seismically-Induced Ground Failure Susceptibility. Accessed digitally from the Municipality of Anchorage, Information Technology Department.

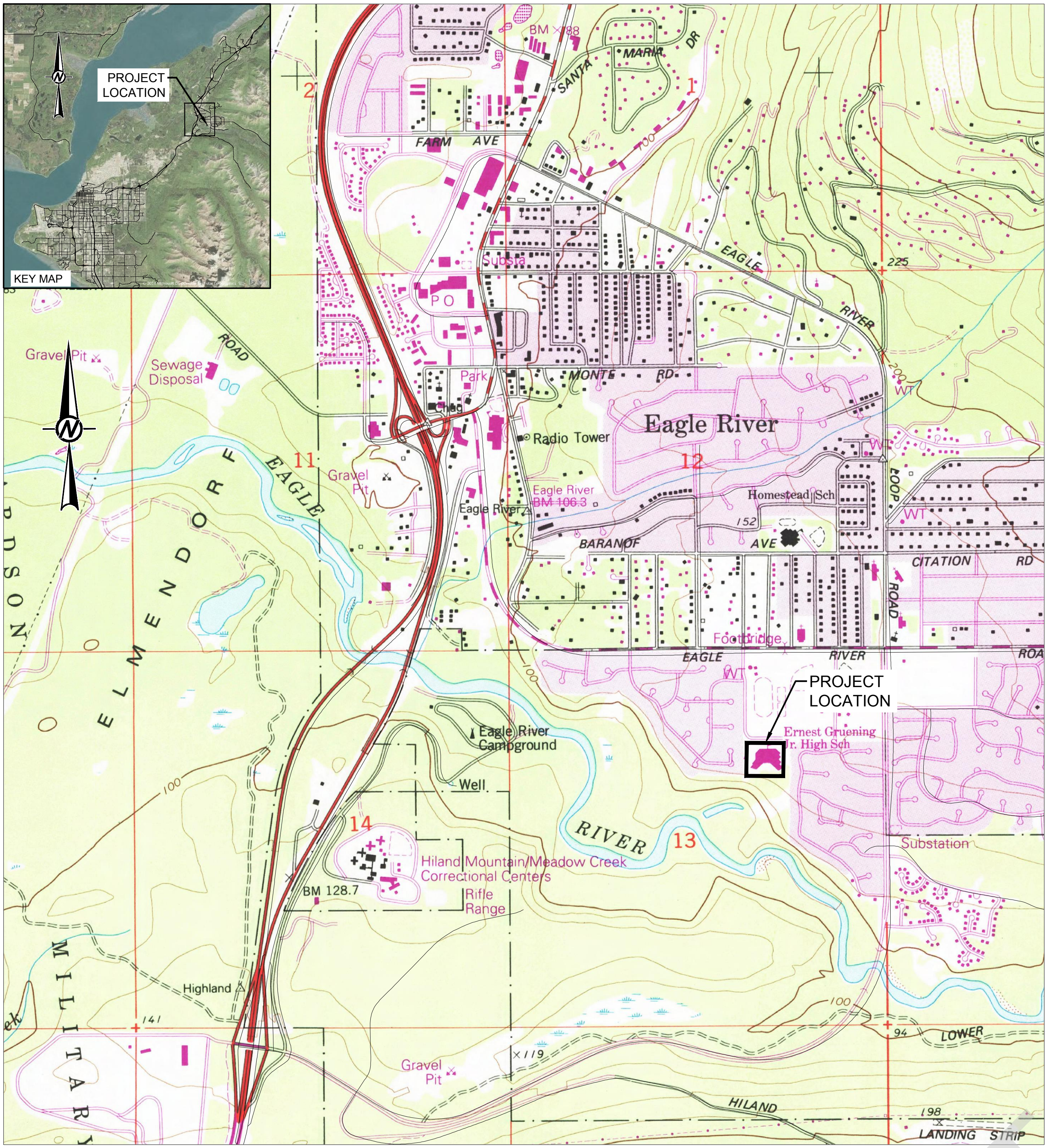
Harding-Lawson Associates (HLA). May 1981. Report titled “Soil Investigation Eagle River Junior High School, Eagle River, Alaska”, pp 14-17 of 55 in “Specifications, Drawings, and Contract Documents” by Lane+Knorr+Plunkett.

Lane+Knorr+Plunkett, Architects and Planners. December 1981. Eagle River/Chugiak/Eklutna Junior High School, Specifications, Drawings, and Contract Documents. Prepared for the Anchorage School District and the Municipality of Anchorage.

Rogers & Babler. August 1983. Ernest Gruening Jr. High School, Eagle River, Alaska, Proposal for Equitable Adjustment. PDF copy and associated documents provided by BDS Architects on January 29, 2019.

Yehle, L.A., and Schmoll, H.R., 1989, Surficial geologic map of the Anchorage B-7 NE quadrangle, Alaska: U.S. Geological Survey Open-File Report 89-318.

FIGURES



REFERENCE(S)

1:25,000 SCALE TOPOGRAPHIC MAP PRODUCED AND DISTRIBUTED BY USGS. QUADRANGLE USED WAS ANCHORAGE (B-7) SW, ALASKA (1993).

DRAFT

0 1000 2000
1" = 2000' FEET

CLIENT
BDS ARCHITECTS

PROJECT
GRUENING MIDDLE SCHOOL
EAGLE RIVER, ALASKA

CONSULTANT
GOLDER

YYYY-MM-DD	2019-02-06
PREPARED	APG
DESIGN	-
REVIEW	BBS
APPROVED	-

TITLE
VICINITY MAP

PROJECT No.	CONTROL	Rev.	FIGURE
19116560		A	1

Path: \\Anchorage\Public\Geomatics\BDS Architects\Eagle River\99_PROJECTS\19116560 BDS Gruening Middle School\0001\02_PRODUCTION\DWG\ | File Name: 19116560.000.0001.dwg

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

REFERENCE(S)

AIRPHOTO DATED MAY 31, 1962 WAS OBTAINED FROM THE U.S. GEOLOGICAL SURVEY (USGS) AERIAL PHOTOGRAPHY SINGLE FRAME RECORDS COLLECTION AND DISTRIBUTED BY U.S. GEOLOGICAL SURVEY (USGS) AND EARTH RESOURCES OBSERVATION AND SCIENCE (EROS) CENTER.

CLIENT
BDS ARCHITECTS

CONSULTANT
GOLDER

YYYY-MM-DD	2019-02-07
DESIGNED	-
PREPARED	APG
REVIEWED	BBS
APPROVED	-

PROJECT
GRUENING MIDDLE SCHOOL

EAGLE RIVER, ALASKA

TITLE
HISTORICAL AIRPHOTO - MAY 31, 1962

PROJECT NO.	CONTROL	REV.	FIGURE
19116560		A	2

REFERENCE(S)
AIRPHOTO DATED APRIL 30, 1982 WAS ACQUIRED AND PROVIDED BY QUANTUM SPATIAL, ANCHORAGE ALASKA. COPYRIGHTED

CLIENT
BDS ARCHITECTS

CONSULTANT
GOLDER

YYYY-MM-DD	2019-02-06
DESIGNED	-
PREPARED	APG
REVIEWED	BBS
APPROVED	-

PROJECT
GRUENING MIDDLE SCHOOL

EAGLE RIVER, ALASKA

TITLE
HISTORICAL AIRPHOTO - APRIL 30, 1982

PROJECT NO.	CONTROL	REV.	FIGURE
19116560		A	3

REFERENCE(S)
AIRPHOTO DATED JUNE 1, 1982 WAS ACQUIRED AND PROVIDED BY QUANTUM SPATIAL, ANCHORAGE ALASKA. COPYRIGHTED

CLIENT
BDS ARCHITECTS

CONSULTANT
GOLDER

YYYY-MM-DD	2019-02-06
DESIGNED	-
PREPARED	APG
REVIEWED	BBS
APPROVED	-

PROJECT
GRUENING MIDDLE SCHOOL

EAGLE RIVER, ALASKA

TITLE
HISTORICAL AIRPHOTO - JUNE 1 1982

PROJECT NO.	CONTROL	REV.	FIGURE
19116560		A	4

REFERENCE(S)

AIRPHOTO DATED JUNE 24, 1982 WAS ACQUIRED AND PROVIDED BY QUANTUM SPATIAL, ANCHORAGE ALASKA. COPYRIGHTED

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BDS ARCHITECTS

CONSULTANT
GOLDER

YYYY-MM-DD	2019-02-06
DESIGNED	-
PREPARED	APG
REVIEWED	BBS
APPROVED	-

PROJECT
GRUENING MIDDLE SCHOOL

EAGLE RIVER, ALASKA

TITLE
HISTORICAL AIRPHOTO - JUNE 24 1982

PROJECT NO.	CONTROL	REV.	FIGURE
19116560		A	5

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
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Path: \\Anchorage\Public\Geomatics\BDS Architects\Eagle River\02_DATA\DWG\ | File Name: 19116560.000.0002.dwg

REFERENCE(S)

1. ORTHOIMAGERY ACQUIRED IN MAY 2015 BY THE ANCHORAGE LIDAR AND IMAGERY PROJECT AND WAS DISTRIBUTED BY ALASKA DIVISION OF GEOLOGICAL AND GEOPHYSICAL SURVEYS (DGGS) ONLINE MAP.

CLIENT
BDS ARCHITECTS

CONSULTANT
GOLDER

YYYY-MM-DD	2019-02-06
DESIGNED	-
PREPARED	APG
REVIEWED	BBS
APPROVED	-

PROJECT
GRUENING MIDDLE SCHOOL

EAGLE RIVER, ALASKA

TITLE
HISTORICAL AIRPHOTO - MAY 2015

PROJECT NO.	CONTROL	REV.	FIGURE
19116560		A	6

DRAFT

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
1 in
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REFERENCE(S)

HILLSHADE IMAGE DEVELOPED FROM GROUND POINT DATA DERIVED FROM LIDAR POINT CLOUD DATA ACQUIRED BY KODIAK MAPPING INC. ON 2018-12-18. LIDAR DATA WAS DISTRIBUTED AS PART OF 2018 EARTHQUAKE-QL2 PHASE 01 DELIVERY AND IS INTENDED TO PROVIDE GENERALIZED SURFACE INFORMATION SUITABLE FOR INITIAL RESPONSE AND ASSESSMENT EFFORTS.

CLIENT
BDS ARCHITECTS

CONSULTANT

GOLDER

YYYY-MM-DD	2019-02-06
DESIGNED	-
PREPARED	APG
REVIEWED	BBS
APPROVED	-

PROJECT
GRUENING MIDDLE SCHOOL

EAGLE RIVER, ALASKA

TITLE
HILLSHADE IMAGE - 2018 LIDAR

PROJECT NO.	CONTROL	REV.	FIGURE
19116560		A	7

DRAFT

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

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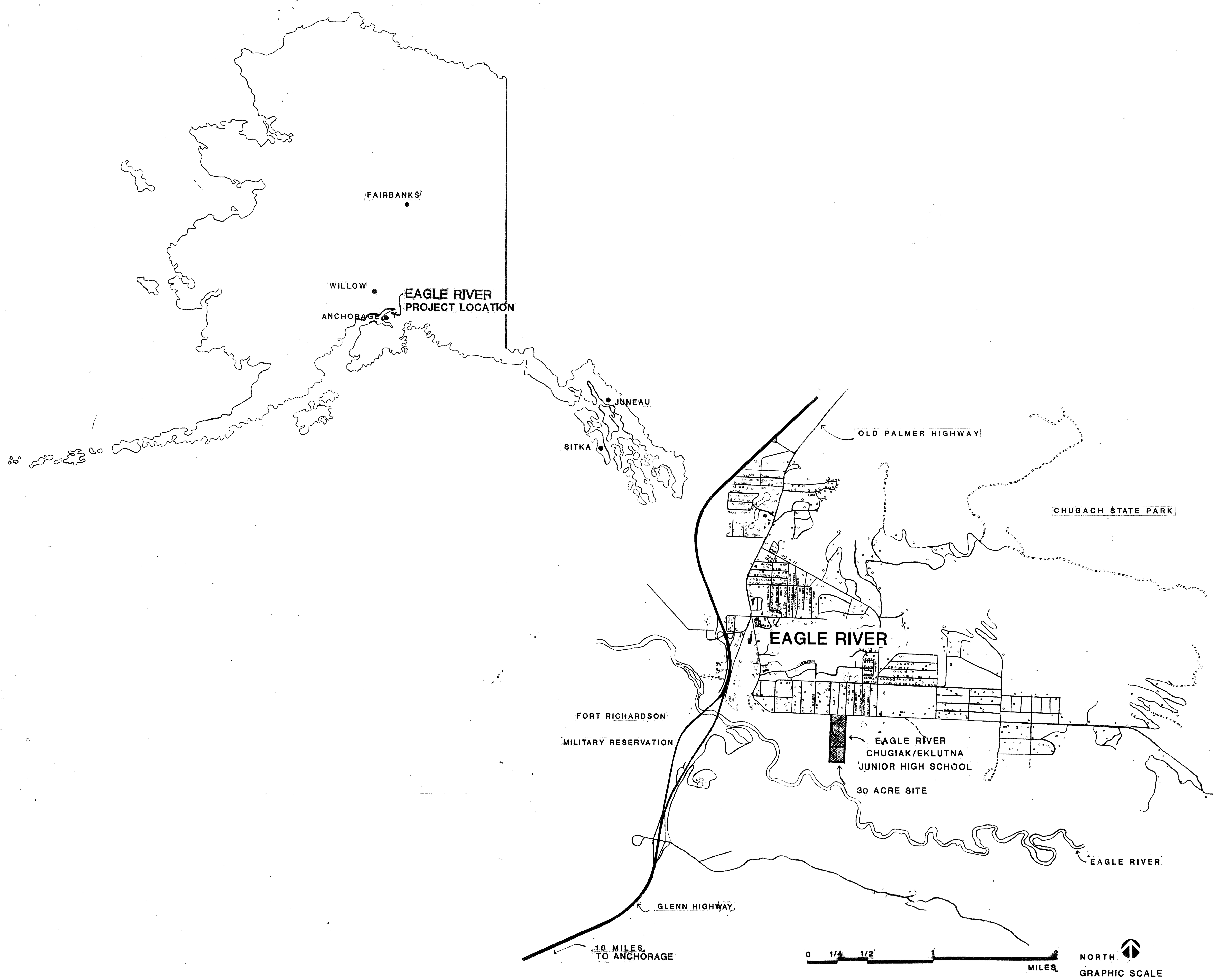
APPENDIX A

Select Historical Documents

Gruening Jr High 12-81 COVER



LANE+KNORR+PLUNKETT

ARCHITECTS AND PLANNERS
800 CORDOVA
ANCHORAGE, ALASKA 99501

EDUCATIONAL CONSULTANTS
NORTHWEST REGIONAL LABORATORIES

CIVIL ENGINEERS AND SURVEYORS
TRYCK, NYMAN & HAYES

ELECTRICAL AND MECHANICAL ENGINEERS
HARGIS ENGINEERS

STRUCTURAL ENGINEERS
SKILLING, HELLE, CHRISTIANSEN, ROBERTSON

LANDSCAPE ARCHITECTS
LAND DESIGN NORTH

COST CONSULTANTS
HANSCOMB ASSOCIATES

FOOD SERVICE CONSULTANTS
LINO AGOSTI ASSOCIATES

GEOTECHNICAL ENGINEERS
HARDING-LAWSON & ASSOCIATES

ACOUSTICAL CONSULTANTS
TOWNE, RICHARDS & CHAUDIERE, INC.

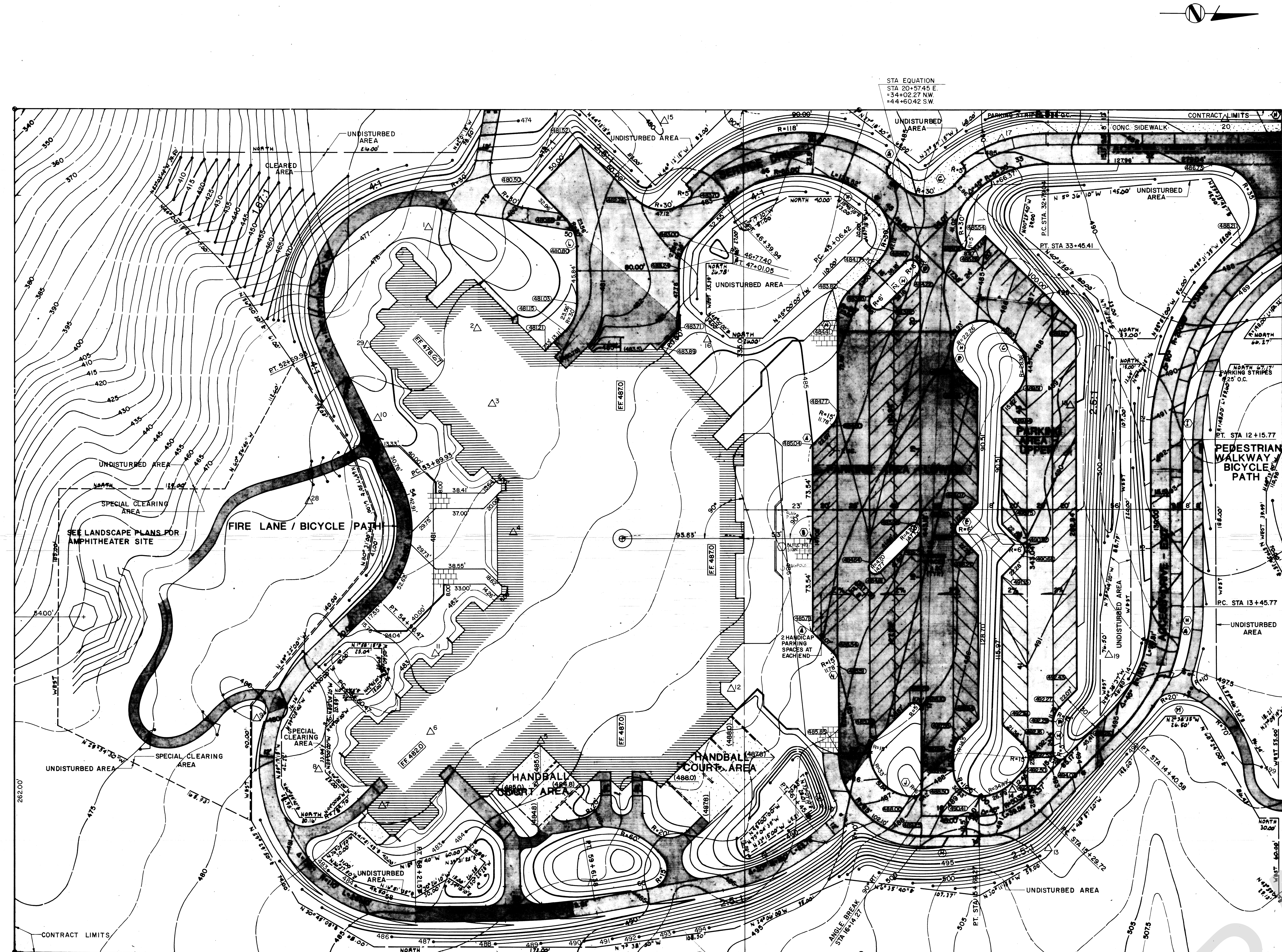
THEATRE AND LIGHTING CONSULTANT
PEDER H. KNUDSON

EAGLE RIVER–CHUGIAK–EKLUTNA JUNIOR HIGH SCHOOL

PREPARED FOR
THE ANCHORAGE SCHOOL DISTRICT AND THE MUNICIPALITY OF ANCHORAGE
ANCHORAGE, ALASKA

41706

Gruening Jr High 12-81 C-5



NOTES

1. ALL PROPOSED ELEVATIONS TO FINISHED GRADE.
2. ALL DIMENSIONS TO CURB ARE TO BACK OF CURB
3. ALL CONCRETE SIDEWALK SHALL BE 4 INCHES THICK
4. TREE FENCE SHALL BE PLACED ALONG THE ENTIRE LENGTH OF THE CLEARING LIMITS BOUNDARY
5. REFER TO STRUCTURAL PLANS FOR HANDBALL COURT SLAB DETAIL
6. FOR CONCRETE SIDEWALK AT NORTH AND SOUTH ACCESS TO BUILDING SEE DETAIL ON SHEET C-12
7. FOR SOILS DETAILS REFER TO SECTION 02010 OF SPECIFICATIONS
8. FOR HANDICAPPED CURB CUT DETAIL SEE SHEET C-11
9. FOR TRAFFIC SIGNING SCHEDULE SEE SECTION 10400, IDENTIFYING DEVICES SECTION IN SPECIFICATION
10. FOR STAIRWAY BETWEEN UPPER AND LOWER PARKING AREAS SEE SHEET C-12 FOR DETAIL
11. REFER TO LANDSCAPE PLANS FOR AMPITHEATER SITE DETAILS
12. ALL TRAFFIC STRIPING SHALL BE DONE IN ACCORDANCE WITH SECTION 02510, 1.J. OF SPECIFICATION

LEGEND

◒	2-1/2" ALUM. CAP (EXIST.)
▣	MONUMENT-(SEE DETAIL SHT. C-12)
(pattern)	RESLITE RUNNING TRACK SURFACE
(shading)	A.C. SURFACING
— —500— —	EXISTING CONTOURS
——501——	PROPOSED INTERMEDIATE CONTOURS
——500——	PROPOSED INDEX CONTOURS
(494.73)	PROPOSED SPOT ELEVATIONS
500.00	PROPOSED TOP BACK CURB ELEVATIONS
F.F. 500.00	FINISHED FLOOR ELEVATION
—— —— ——	CLEARING LIMIT
— — — — —	SPECIAL CLEARING LIMIT
→ → →	DRAINAGE SWALE
4:1	SLOPE RATIO
—— - - ——	PROJECT BOUNDARY/CONTRACT LIMITS
Ⓐ	TRAFFIC SIGN
✱	HANDICAP CURB CUTS
△	TEST HOLE LOCATIONS

PROJECT

EAGLE RIVER/ CHUGIAK/ EKLUTNA

JUNIOR HIGH SCHOOL

Eagle River, Alaska

LANE KNORR PLUNKETT

ARCHITECTS & PLANNERS
800 CORDOVA SUITE 201
ANCHORAGE ALASKA

CONSULTANTS

NORTHWEST REGIONAL LAB. — EDUCATIONAL CONSULTANTS
TRYCK, NYMAN & HAYES — SURVEYORS, CIVIL ENGINEERS
HARGIS ENGINEERS — ELECTRICAL/MECHANICAL ENGINEERS
SKILLING, HELLE, CHRISTIANSEN, ROBERTSON — STRUCTURAL ENGINEERS
LAND DESIGN NORTH — LANDSCAPE ARCHITECTS
HANSCOMB ASSOCIATES — COST CONSULTANTS
LINO AGOSTI & ASSOCIATES — FOOD SERVICE CONSULTANTS
HARDING-LAWSON & ASSOC. — GEOTECHNICAL ENGINEERS
TOWNE, RICHARDS & CHAUDIERE, INC. — ACOUSTICAL CONSULTANTS
PEDER H. KNUDSON — THEATRE AND LIGHTING CONSULTANT

SHEET TITLE

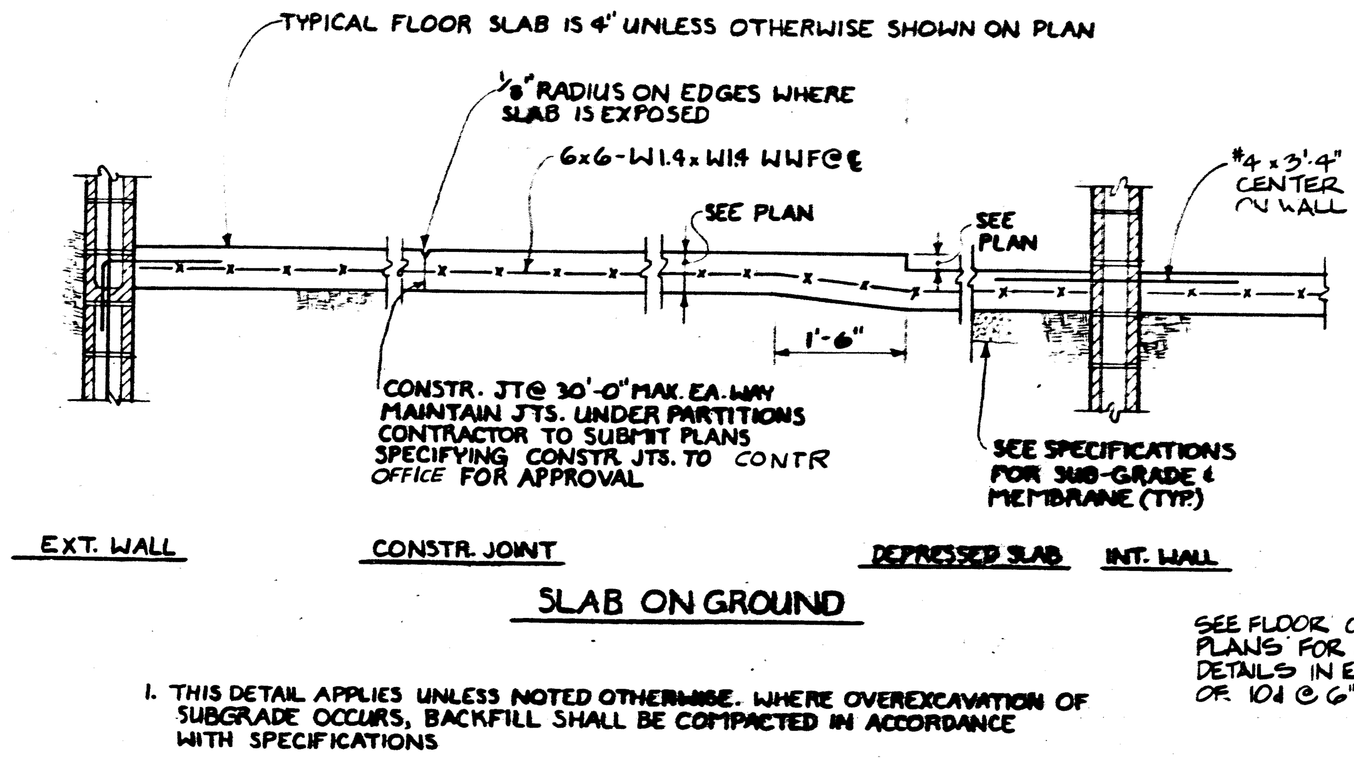
GRADING PLAN
SOUTH

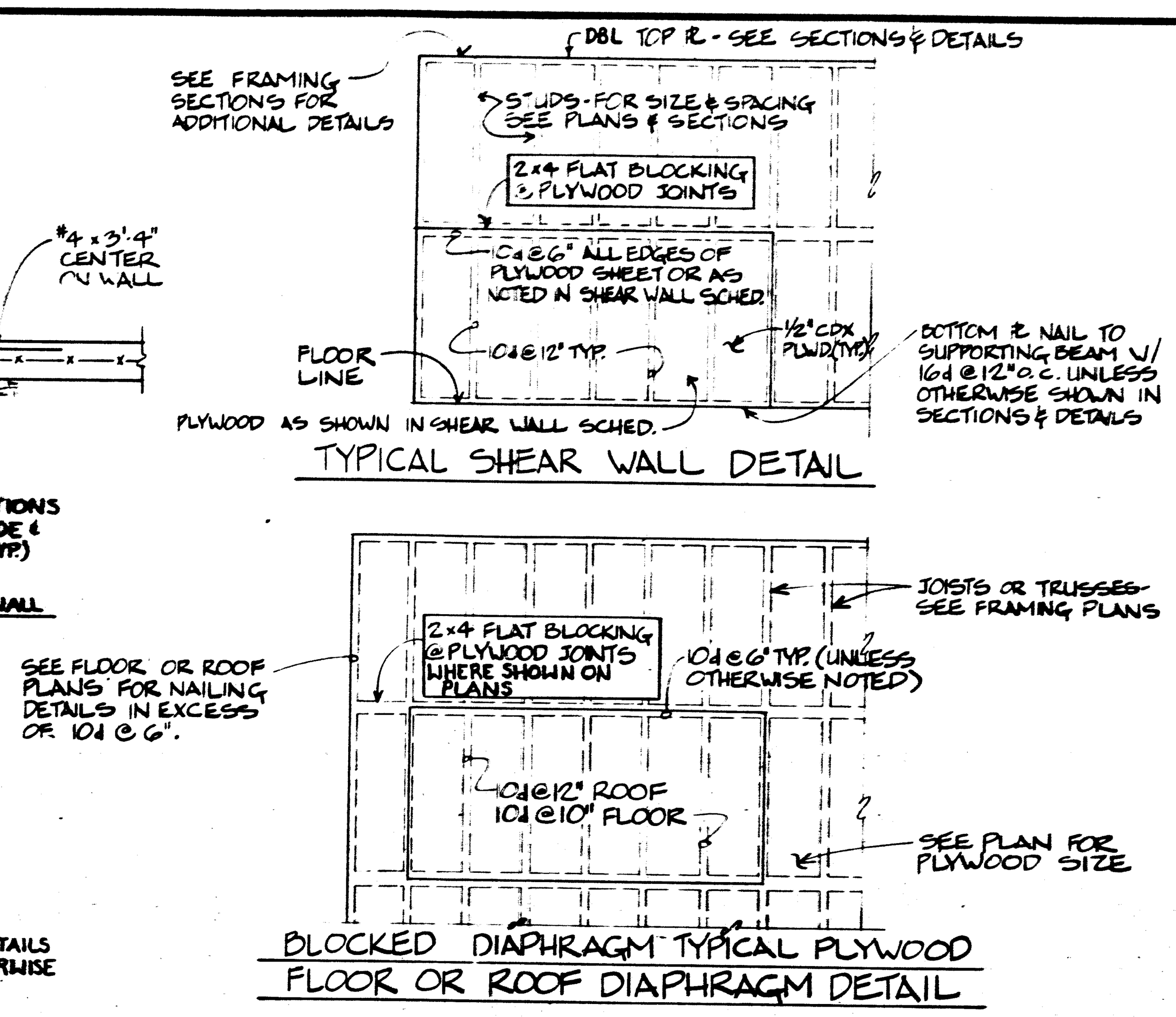
REVISIONS

41713

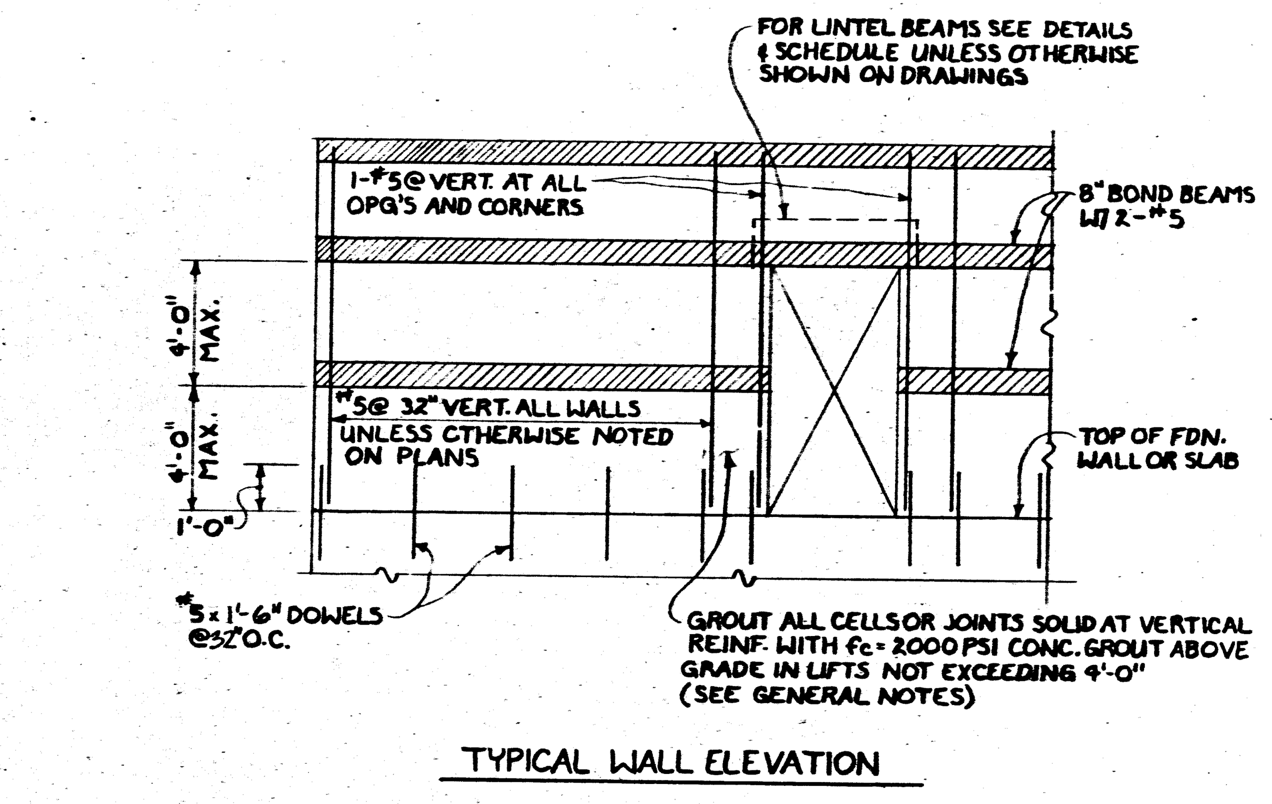
SCALE 1"=30'	DATE DEC 1981
DRAWN RC	CHECKED
SEAL	SHEET C-5
	OF 12 SHEETS

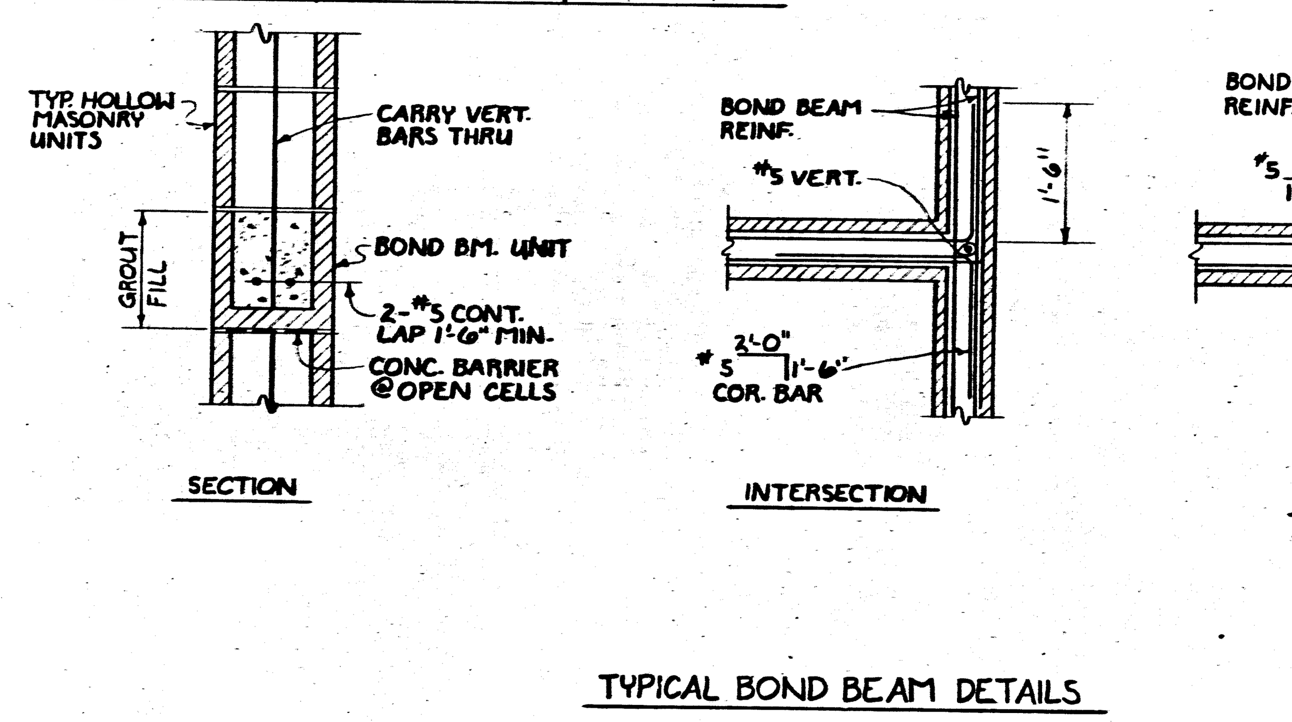
General Notes
Typical Details   GRUENING   81/12/00   S1 (of 17)

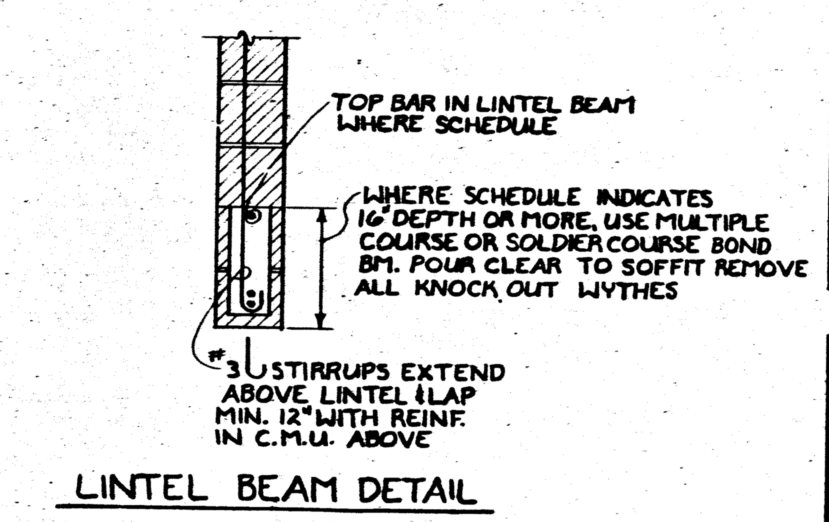




JOIST SCHEDULE				
MARK	SIZE	SPC'G	SPECIES	GRADE
J-1	2x12	16"O.C.	D.F.-LARCH	NO. 1
J-2	2x12	24"O.C.	D.F.-LARCH	NO. 1
J-3	2x8	16"O.C.	D.F.-LARCH	NO. 1
J-4	2x8	24"O.C.	D.F.-LARCH	NO. 1
J-5	2x8	12"O.C.	D.F.-LARCH	NO. 1
J-6	2x12	12"O.C.	D.F.-LARCH	NO. 1
J-7	2x6	16"O.C	HEM-FIR	NO 1
RJ-1	2x12	16"O.C.	HEM-FIR	NO. 1
RJ-2	2x12	24"O.C.	HEM-FIR	NO. 1
RJ-3	2x12	12"O.C.	HEM-FIR	NO. 1
RJ-4	3x12	12"O.C.	HEM-FIR	NO. 1
RJ-5	3x12	16"O.C.	HEM-FIR	NO. 1
RJ-6	3x12	24"O.C.	HEM-FIR	NO. 1



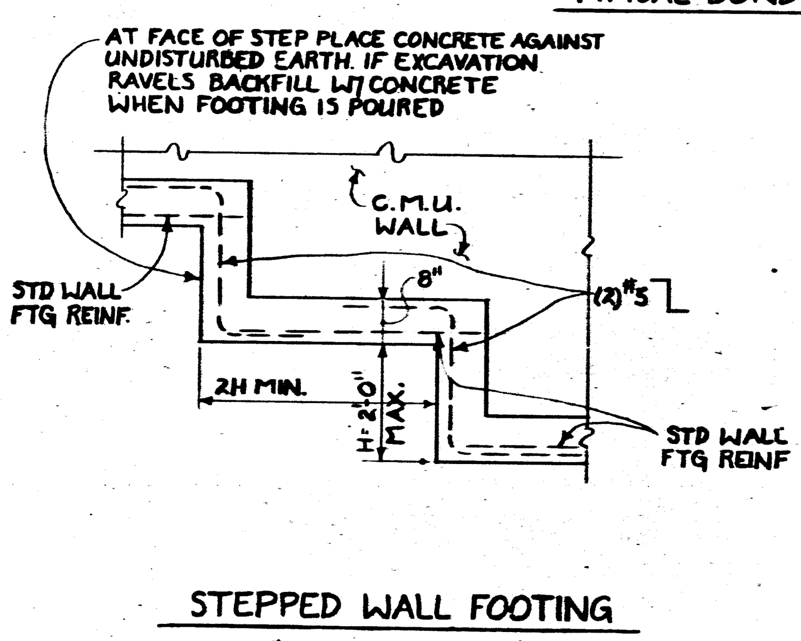


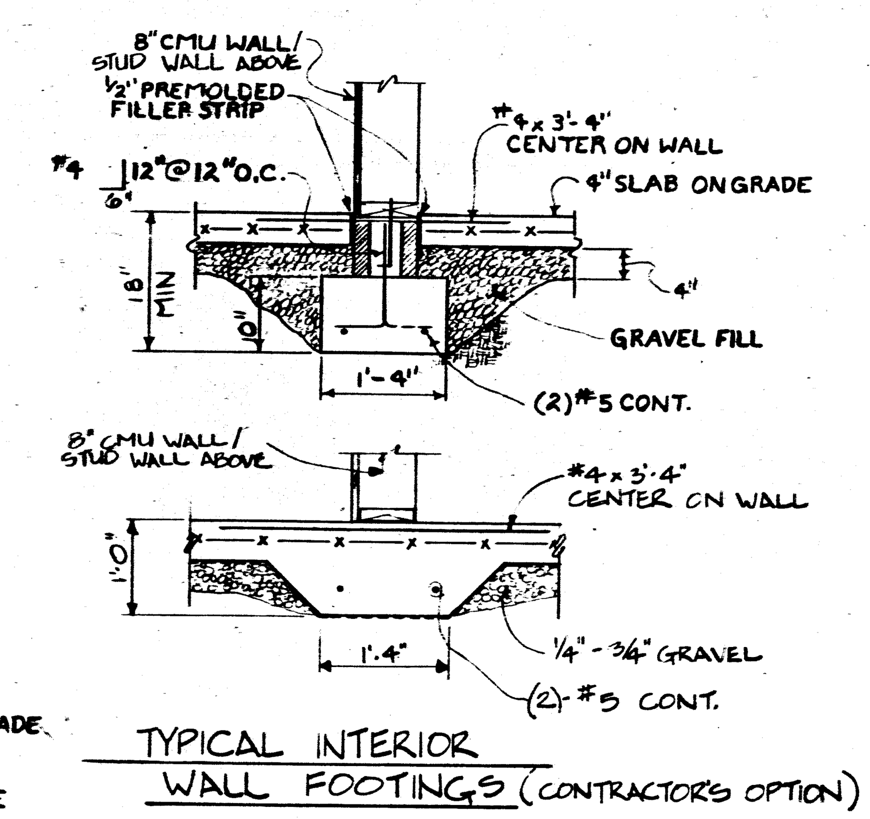


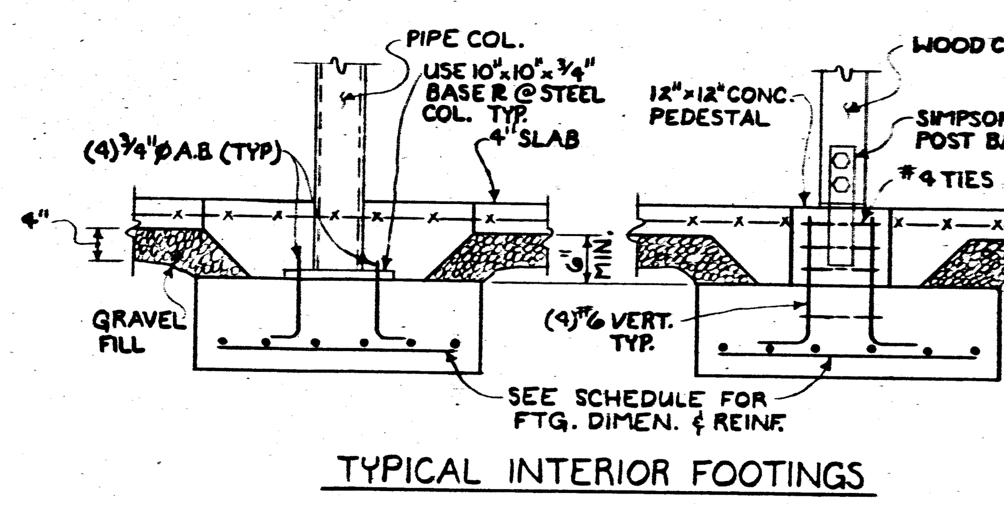
C.M.U LINTEL SCHEDULE				
WALL THICKNESS	CLEAR SPAN	DEPTH	HORIZ. REINF.	STIRRUPS
8"	4'-0" OR LESS	8"	2-#4 BOT.	#3 U @ 16"
8"	4'-0" TO 6'-6"	16"	2-#5 BOT.	#3 U @ 8"
8"	6'-6" TO 9'-0"	16"	2-#6 TOP 1-#5 BOT.	#3 U @ 8"
8"	9'-0" TO 12'-0"	24"	2-#5 TOP 2-#5 BOT.	#3 U @ 8"

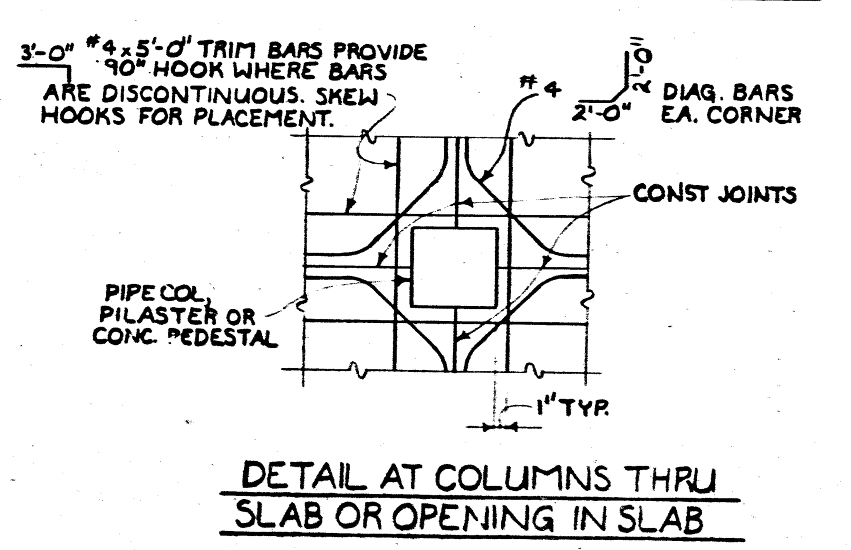
MIN. BEARING EA. END OF LINTEL BEAM = 8"

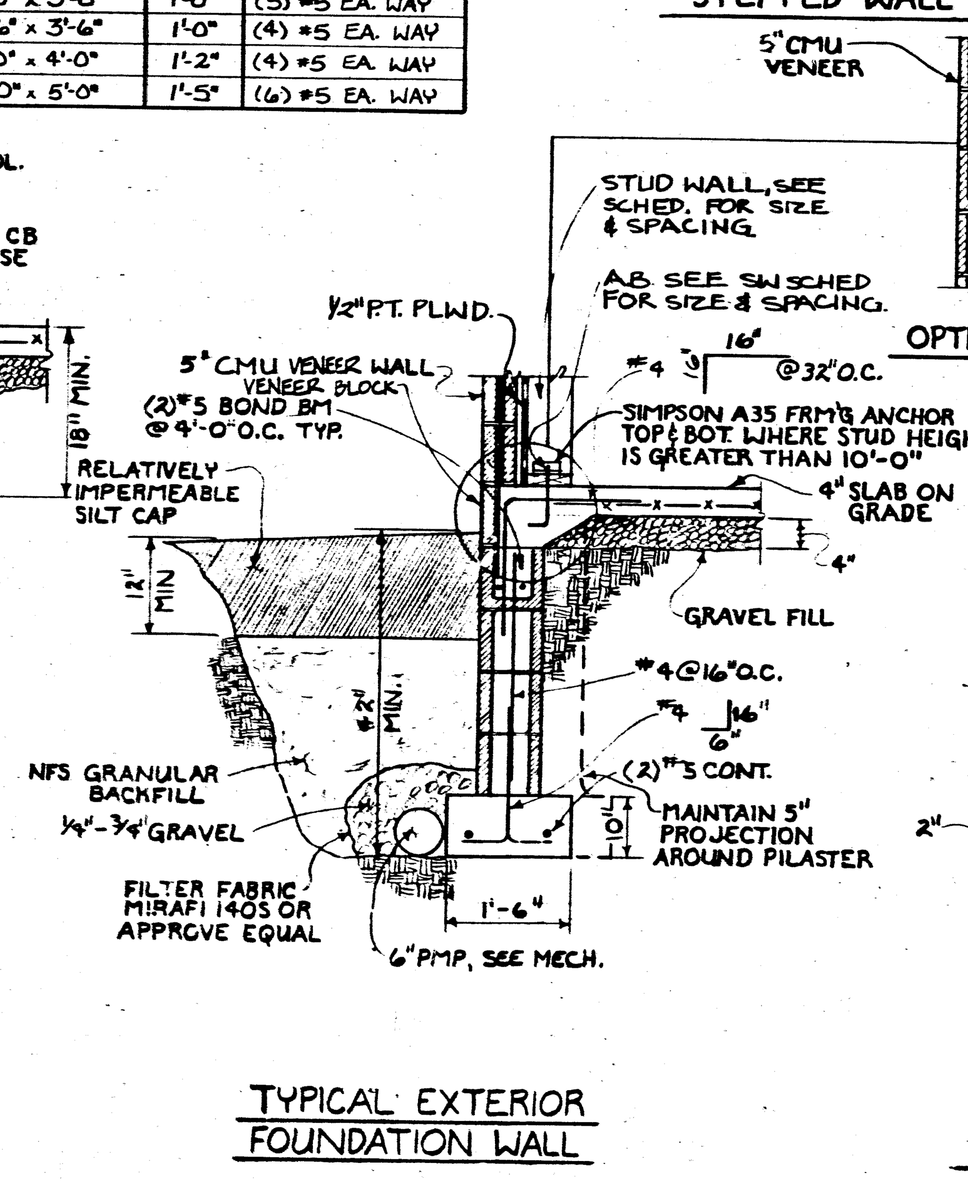
FOOTING SCHEDULE			
MARK	SIZE LENGTH x WIDTH	DEPTH	REINFORCING
A	2'-0" x 2'-0"	0'-9"	(2) #5 EA. WAY
B	2'-6" x 2'-6"	0'-9"	(2) #5 EA. WAY
C	3'-0" x 3'-0"	1'-0"	(3) #5 EA. WAY
D	3'-6" x 3'-6"	1'-0"	(4) #5 EA. WAY
E	4'-0" x 4'-0"	1'-2"	(4) #5 EA. WAY
F	5'-0" x 5'-0"	1'-5"	(6) #5 EA. WAY

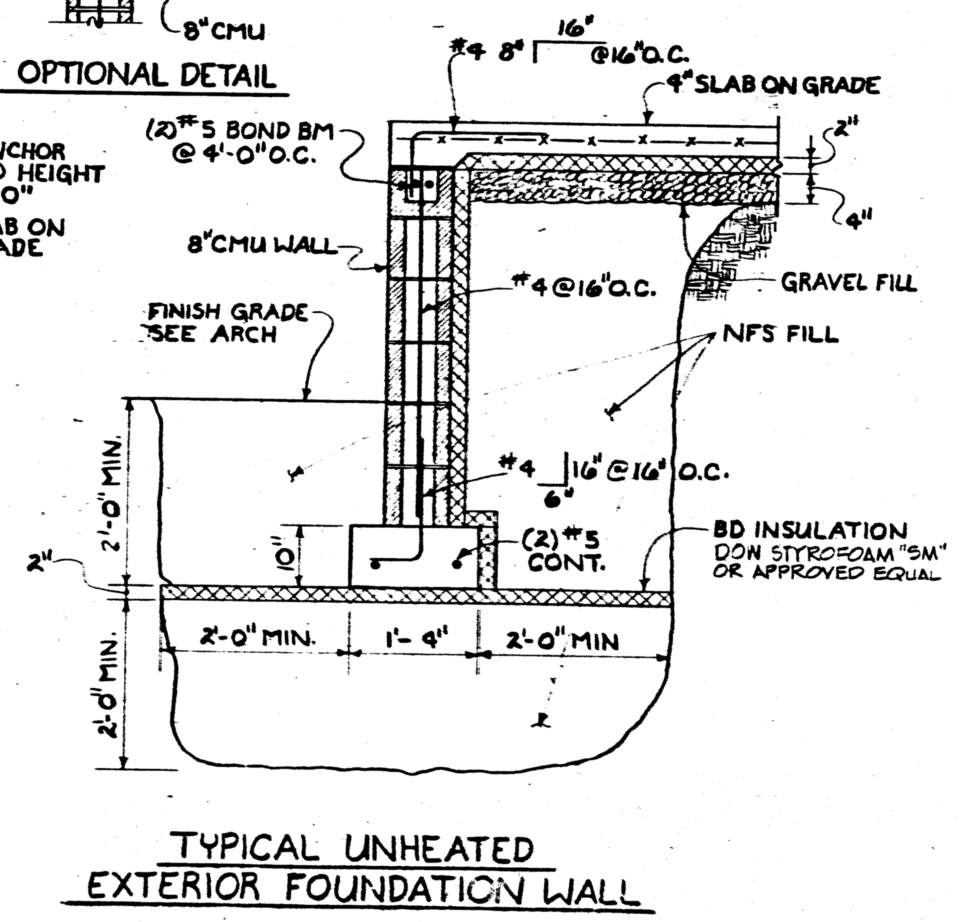


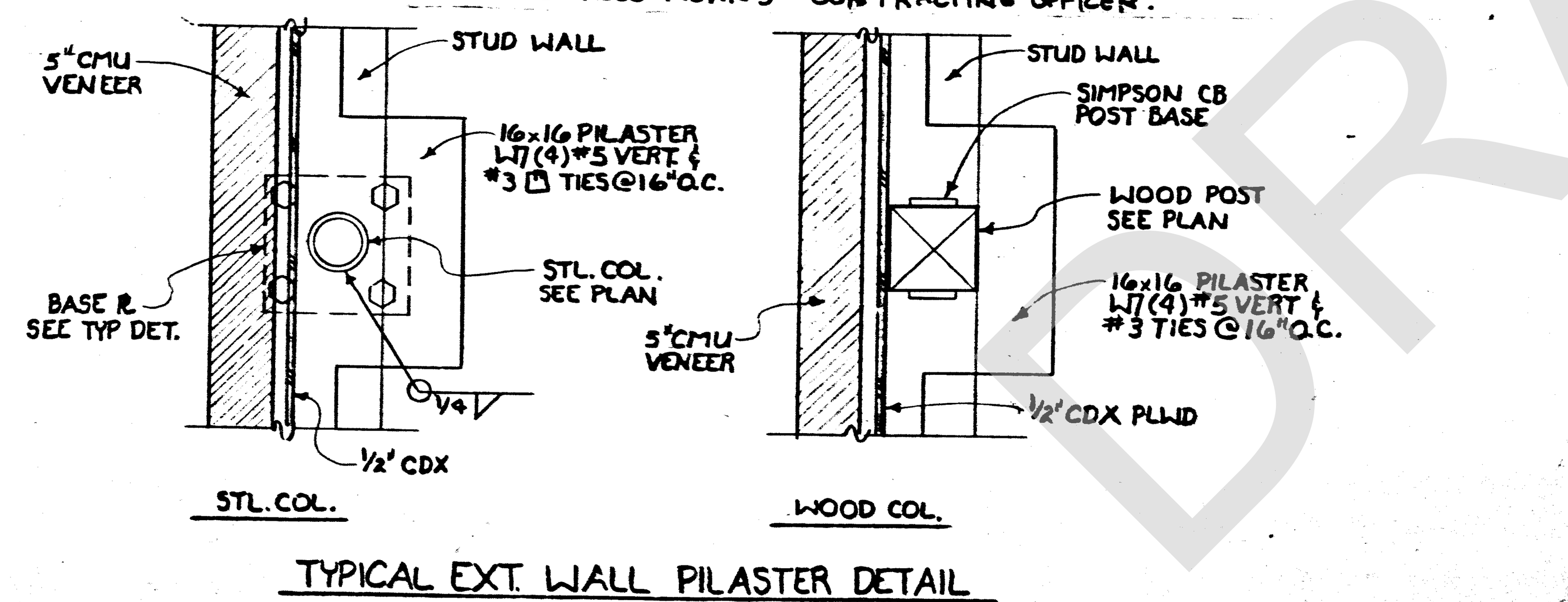












GENERAL NOTES

DESIGN:
DESIGN IS AND CONSTRUCTION SHALL BE, IN CONFORMANCE WITH THE UNIFORM BUILDING CODE (UBC), 1979 EDITION, AND THESE PLANS AND SPECIFICATIONS.

DESIGN LIVE LOADS:

ROOF (SNOW)	40 psf
MECHANICAL ROOM	125 psf OR ACTUAL LOADS
STORAGE	125 psf
GYMNASIUM/MULTIPURPOSE ROOMS	100 psf
CLASSROOMS	40 psf
LIBRARY	60 psf

DESIGN LATERAL LOADS:

WIND (BASIC)	25 psf
SEISMIC	ZONE 4, UBC 1979

FOUNDATION:
FOUNDATION DESIGN IS BASED ON ASSUMED SOIL PRESSURE OF 4,000 psf AS RECOMMENDED IN A GEOTECHNICAL REPORT PREPARED BY HARDING-LAWSON ASSOCIATES. ALL FOOTINGS SHALL BEAR ON UNDISTURBED SOIL OVERLAID WITH 4" (MIN.) OF COMPACTED GRANULAR NFS FILL. SEE NOTES ON SHEET S-1 FOR CONSTRUCTION REQUIREMENTS.

CONCRETE:
MIXING AND PLACING OF ALL CONCRETE AND SELECTION OF MATERIALS SHALL BE IN ACCORDANCE WITH THE UNIFORM BUILDING CODE, 1979 EDITION. ALL CONCRETE, INCLUDING SLABS ON GROUND, SHALL HAVE SIKA "PLASTIMENT" OR MASTER BUILDERS "POZZOLITH 300N" ADDED IN ACCORDANCE WITH MANUFACTURER'S DIRECTIONS. ALL CONCRETE EXPOSED TO THE WEATHER SHALL CONTAIN DAREX AEA TO PRODUCE 4 TO 6 PERCENT ENTRAINED AIR. MAXIMUM SIZE OF AGGREGATE 1-1/2" (EXCEPT 3/4" MAXIMUM FOR SLABS-ON-GROUND), BUT MAXIMUM SIZE OF AGGREGATE SHALL NOT BE MORE THAN 3/4 OF THE CLEAR DISTANCE BETWEEN REINFORCING BARS OR BETWEEN BARS AND SIDE FORMS. WATER/CEMENT RATIO AND CEMENT CONTENT SHALL BE AS FOLLOWS FOR VARIOUS CONCRETE STRENGTHS (f'c) BASED ON STANDARD 7 OR 28 DAY CYLINDER TESTS.

f'c	MIN. SACKS OF CEMENT/CU. YD. OF CONCRETE	MAX. GALS OF WATER/SACK CEMENT	MAX. SLUMP	LOCATION
2,500 psi	5	7-1/2	3"	SLABS ON GROUND
3,000 psi	5-1/2	6	4"	ALL CONCRETE NOT OTHERWISE NOTED.

MASONRY:
MATERIALS AND CONSTRUCTION SHALL MEET REQUIREMENTS OF CHAPTER 24, UNIFORM BUILDING CODE, 1979 EDITION, FOR REINFORCED HOLLOW UNIT MASONRY. HOLLOW CONCRETE UNITS SHALL BE GRADE N(f'm = 1,350 psi). MORTAR SHALL BE TYPE M(f'm = 2,500 psi) OR TYPE S(f'm = 1,800 psi). GROUT SHALL BE PROPORTIONED IN ACCORDANCE WITH UBC SECTION 2403s (f'c = 2,000 psi). ALL CELLS CONTAINING REINFORCEMENT SHALL BE FILLED SOLID WITH GROUT. GROUT ALL CELLS SOLID FOR MASONRY BELOW FINISH GRADE. COORDINATE BLOCK LAYOUT AND FINISH W/ ARCH.

WELDED WIRE FABRIC:
ALL WELDED WIRE FABRIC (WWF) SHALL CONFORM TO ASTM A185, GRADE 60. WWF SHALL BE SUPPORTED ON APPROVED CHAIRS. AN 8" MINIMUM LAP SHALL BE PROVIDED AT ALL SIDE AND END LAPS.

REINFORCING STEEL:
ALL REINFORCING SHALL BE NEW BILLET STOCK ASTM A615, GRADE 40. BARS SHALL BE SECURELY TIED IN PLACE WITH #16 DOUBLE-ANNEALED IRON WIRE. BARS SHALL BE SUPPORTED ON APPROVED CHAIRS OR WELL CURED CONCRETE BLOCKS. REINFORCING STEEL SHALL BE DETAILED IN ACCORDANCE WITH ACI "MANUAL OF STANDARD PRACTICE FOR DETAILING OF REINFORCED CONCRETE STRUCTURES". SHOP DRAWINGS (INCLUDING PLACING PLANS AND ELEVATIONS) SHALL BE SUBMITTED TO AND REVIEWED BY THE CONTRACTING OFFICER/ENGINEER BEFORE STARTING FABRICATION. REINFORCEMENT SHALL BE LAP SPLICED FOR TENSION UNLESS OTHERWISE NOTED ON DRAWING. WELDING OR TACK WELDING OR REINFORCING BARS TO OTHER BARS OR TO PLATES, ANGLES, ETC., IS PROHIBITED, UNLESS OTHERWISE SHOWN ON THE DRAWINGS OR APPROVED BY THE CONTRACTING OFFICER.

STRUCTURAL STEEL:
STEEL SHALL CONFORM TO ASTM A36 UNLESS OTHERWISE NOTED. WHERE HIGHER STRENGTH STEELS ARE REQUIRED, THEY SHALL CONFORM TO ASTM A441 OR ASTM A572. ROUND OR SHAPED STRUCTURAL STEEL TUBES SHALL CONFORM TO ASTM A500, Fy = 36 ksi, OR ASTM A501. STEEL PIPE SHALL CONFORM TO ASTM A53, TYPES E OR S, GRADE B, Fy = 35 ksi. ALL WORK SHALL BE IN ACCORDANCE WITH THE AISC "SPECIFICATION FOR THE DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL FOR BUILDINGS" AS REVISED THROUGH NOVEMBER 1978. SHOP DRAWINGS SHALL BE SUBMITTED FOR THE CONTRACTING OFFICER/ENGINEER'S REVIEW BEFORE COMMENCING FABRICATION. SHOP DRAWINGS SHALL SHOW ALL WELDING WITH AWS A2.4 SYMBOLS. ALL WELDING SHALL BE DONE BY AWS CERTIFIED WELDERS AND IN ACCORDANCE WITH AWS "STRUCTURAL WELDING CODE", AWS D1.1-80. MINIMUM WELDING SHALL BE 3/16". WELDING PROCEDURES SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW BEFORE STARTING FABRICATION OR ERECTION. ALL STEEL ANCHORS, TIES AND OTHER MEMBERS EMBEDDED IN CONCRETE OR MASONRY SHALL BE LEFT UNPAINTED. ALL HIGH-STRENGTH BOLTS, EITHER ASTM A325 OR A490, SHALL BE FRICTION TYPE AND SHALL BE TIGHTENED WITH PROPERLY CALIBRATED WRENCHES OR BY THE TURN-OF-THE-NUT METHOD. CONTRACTOR MAY USE EITHER TIGHTENING METHOD PROVIDED SELECTED METHOD IS USED ON ALL BOLTS IN SIMILAR CONNECTIONS. ALL MACHINE BOLTS SHALL BE ASTM A306 AND SHALL BE PROVIDED WITH LOCK WASHERS UNDER NUTS OR SELF-LOCKING NUTS.

LUMBER:
ALL LUMBER SHALL BE VISUALLY GRADED IN ACCORDANCE WITH CURRENT W.W.P.A. GRADING RULES. ALL DIMENSION LUMBER SHOWN ON PLANS SHALL BE S4S SEASONED NO. 2 GRADE HEM-FIR OR BETTER, POSTS SHALL BE S4S SEASONED NO. 1 HEM-FIR OR BETTER; OR AS INDICATED ON THE DRAWINGS. (IE, JST SCHED)

GLUED LAMINATED LUMBER (G.L.):
ALL GLUE LAMINATED LUMBER SHALL BE MANUFACTURED IN ACCORDANCE TO AITC 117-79 AND PS-56 WITH F_b = 2,400 psi, F_v = 165 psi. SUBMIT PLACING PLANS AND SHOP DRAWINGS OF ALL GLUED LAMINATED MEMBERS TO THE CONTRACTING OFFICER FOR REVIEW BEFORE FABRICATION.

MINILAM LUMBER (M.L.):
ALL MINILAM STUDS SHALL BE MANUFACTURED IN ACCORDANCE TO PS 56-73 AND ICBO RESEARCH REPORT NO. 3327. F_b = 2,000 psi, E = 1.7 x 10^6, F_v = 165 psi. EXTERIOR ADHESIVE SHALL BE USED.

PLYWOOD:
ALL PLYWOOD EXCEPT WHERE OTHERWISE NOTED ON DRAWINGS SHALL BE STANDARD C-D INTERIOR WITH EXTERIOR GLUE AS GRADED BY THE AMERICAN PLYWOOD ASSOCIATION. ALL PLYWOOD SHALL BE MADE WITH EXTERIOR TYPE GLUE. SEE TYPICAL DIAPHRAGM AND SHEAR WALL DETAILS AND SCHEDULES FOR OTHER REQUIREMENTS.

TREATED WOOD:
ALL WOOD LEDGERS, PLATES, SILLS, AND NAILERS IN CONTACT WITH CONCRETE OR MASONRY SHALL BE TREATED IN ACCORDANCE WITH AWPB-FDN, AND BEAR THAT QUALITY MARK.

CONNECTIONS AND FRAMING:
ALL FRAMING DETAILS SHALL BE IN ACCORDANCE WITH SEC. 2518 OF U.B.C. (1979) UNLESS OTHERWISE SHOWN ON DRAWINGS. ALL FRAMING NAILING SHALL CONFORM TO TABLES 25-P OF U.B.C., UNLESS OTHERWISE SHOWN. EXCEPT WHERE M.I. WASHERS ARE CALLED FOR ON PLANS, STANDARD WASHERS SHALL BE UNDER ALL BOLT HEADS AND NUTS CONTACTING WOOD. PROVIDE STEEL STRAPS AT PIPES IN STUD WALLS AS REQUIRED BY U.B.C., SECTION 2518 (g) .8. BOLTS SHALL BE STANDARD MACHINE BOLTS. REFER TO "STRUCTURAL STEEL" FOR FABRICATION OF G.L. HANGARS. ALL 16d SHALL BE BOX WIRE NAILS. ALL 10d SHALL BE COMMON WIRE OR GALVANIZED BOX. IF PNEUMATIC NAILERS ARE TO BE USED, CONTRACTOR MUST SUBMIT SCHEDULE OF NAILS DESIRED AS SUBSTITUTION TO THE ENGINEER FOR REVIEW. ALL METAL CONNECTORS SHALL BE FULLY NAILED OR BOLTED UNLESS OTHERWISE NOTED ON THE PLANS.

MISCELLANEOUS:
REFER TO ARCHITECTURAL PLANS FOR WALL OPENINGS, ARCHITECTURAL TREATMENT AND DIMENSIONS NOT SHOWN. CONSULT MECHANICAL PLANS FOR SIZE AND LOCATIONS OF ALL OPENINGS FOR DUCTS, PIPING, ETC., NOT SHOWN. WHERE SECTIONS ARE INDICATED ON A PLAN BY LETTER AND A SUBSCRIPT NUMBER THUS (B2), THE INDICATED SECTION B IS SHOWN ON DRAWING S-2. "ENGINEER" IN THESE NOTES ALSO MEANS "CONTRACTING OFFICER".

PROJECT

EAGLE RIVER/ CHUGIAK/ EKLUTNA
JUNIOR HIGH SCHOOL
Eagle River, Alaska

LANE KNORR PLUNKETT
ARCHITECTS & PLANNERS
800 CORDOVA SUITE 201
ANCHORAGE ALASKA

CONSULTANTS
NORTHWEST REGIONAL LAB. EDUCATIONAL CONSULTANTS
TRYCK, NYMAN & HAYES SURVEYORS, CIVIL ENGINEERS
HARGIS ENGINEERS ELECTRICAL/MECHANICAL ENGINEERS
SKILLING, HELLE, CHRISTIANSEN, ROBERTSON STRUCTURAL ENGINEERS
LAND DESIGN NORTH LANDSCAPE ARCHITECTS
HANSCOMB ASSOCIATES COST CONSULTANTS
LINO AGOSTI & ASSOCIATES FOOD SERVICE CONSULTANTS
HARDING-LAWSON & ASSOC. GEOTECHNICAL ENGINEERS
TOWNE, RICHARDS & CHAUDIERE, INC. ACOUSTICAL CONSULTANTS
PEDER H. KNUDSON THEATRE AND LIGHTING CONSULTANT

SHEET TITLE
GENERAL NOTES & TYPICAL DETAILS

REVISIONS

SCALE NOTED	DATE DEC. 1981
DRAWN HJP	CHECKED PWM
SEAL	SHEET S-1
	OF 17 SHEETS

STATE OF ALASKA
Arthur J. Berkshire
No. 3870-E
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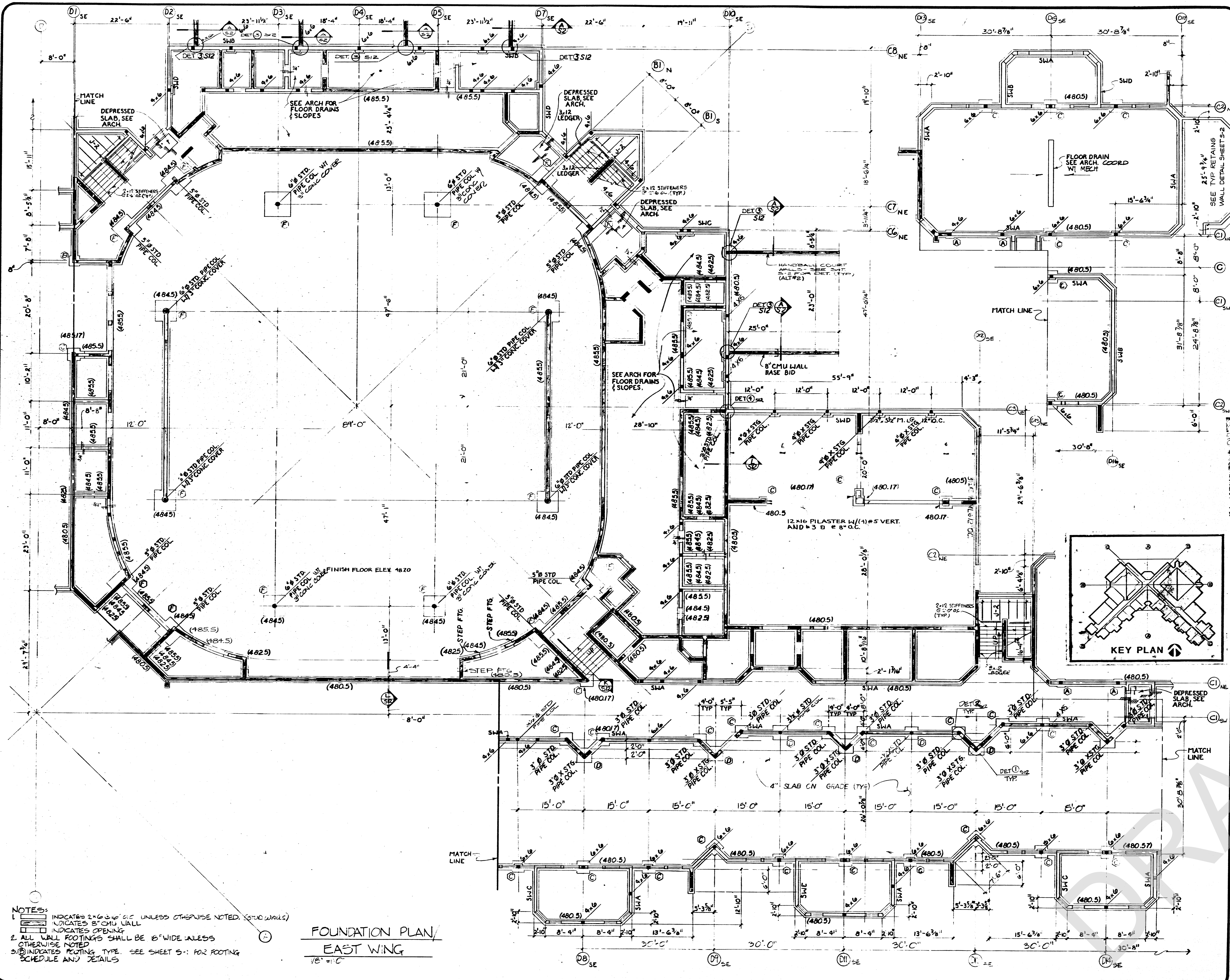
DRAFT

Foundation Plan East Wing GRUENING 81/12/00 53 of 17



PROJECT

EAGLE RIVER/ CHUGIAK/ EKLUTNA

JUNIOR HIGH SCHOOL

Eagle River, Alaska

LANE KNORR PLUNKETT

ARCHITECTS & PLANNERS
800 CORDOVA SUITE 201
ANCHORAGE ALASKA

CONSULTANTS

NORTHWEST REGIONAL LAB.
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TRYCK, NYMAN & HAYES
SURVEYORS, CIVIL ENGINEERS

HARGIS ENGINEERS
ELECTRICAL/MECHANICAL ENGINEERS

SKILLING, HELLE, CHRISTIANSEN, ROBERTSON
STRUCTURAL ENGINEERS

LAND DESIGN NORTH
LANDSCAPE ARCHITECTS

HANSCOMB ASSOCIATES
COST CONSULTANTS

LINO AGOSTI & ASSOCIATES
FOOD SERVICE CONSULTANTS

HARDING-LAWSON & ASSOC.
GEOTECHNICAL ENGINEERS

TOWNE, RICHARDS & CHAUDIERE, INC.
ACOUSTICAL CONSULTANTS

PEDER H. KNUDSON
THEATRE AND LIGHTING CONSULTANT

SHEET TITLE

FOUNDATION PLAN/ EAST WING

REVISIONS

SCALE NOTED	DATE Dec 1981
DRAWN	CHECKED PKM
SEAL	SHEET S-3
	OF 17 SHEETS

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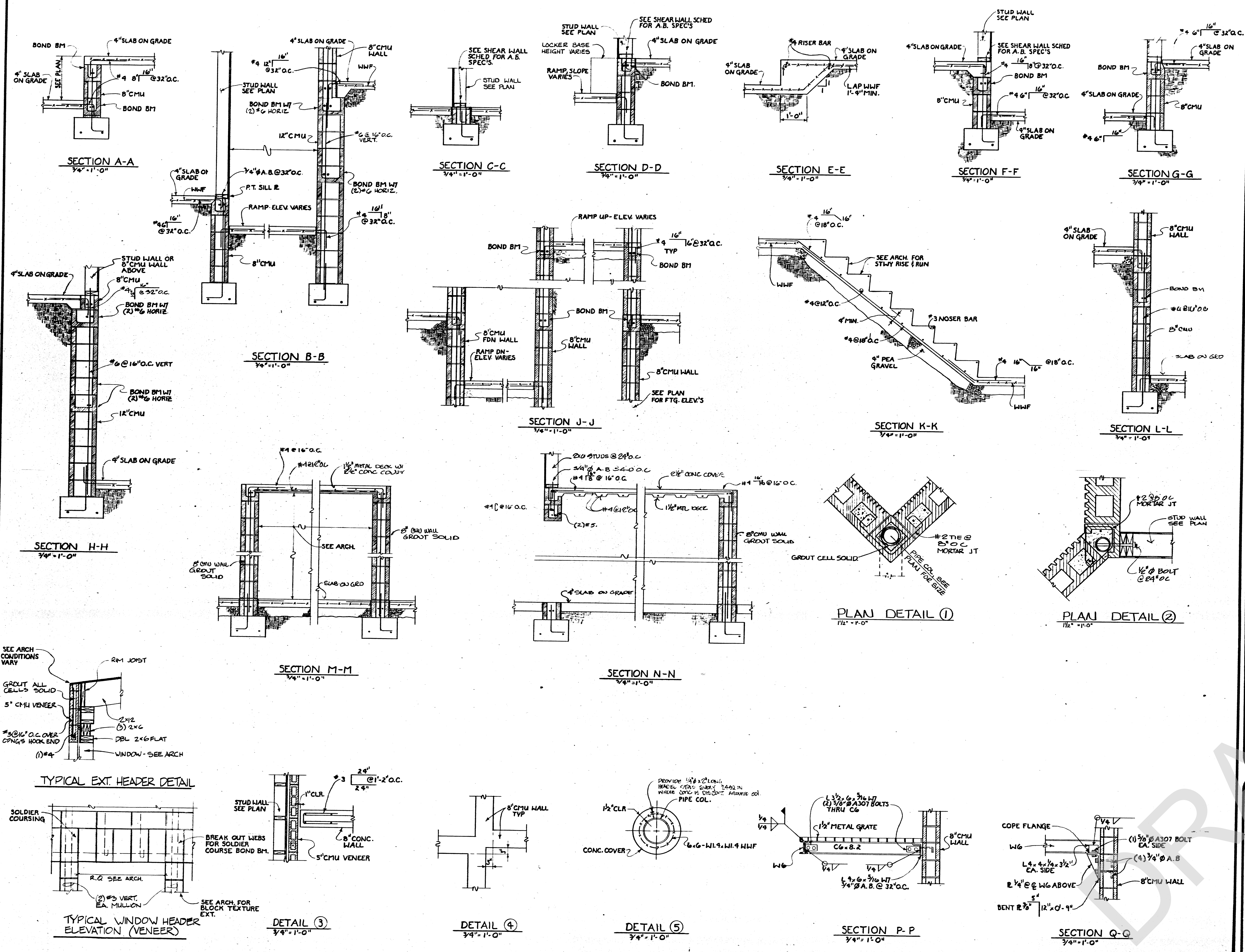
Foundation Sections & Details GRUENING 81/12/00 S12 of 17



PROJECT

EAGLE RIVER/ CHUGIAK/ EKLUTNA

JUNIOR HIGH SCHOOL

Eagle River, Alaska

LANE KNORR PLUNKETT

ARCHITECTS & PLANNERS
800 CORDOVA SUITE 201
ANCHORAGE ALASKA

CONSULTANTS

NORTHWEST REGIONAL LAB. — EDUCATIONAL CONSULTANTS
TRYCK, NYMAN & HAYES — SURVEYORS, CIVIL ENGINEERS
HARGIS ENGINEERS — ELECTRICAL/MECHANICAL ENGINEERS
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LAND DESIGN NORTH — LANDSCAPE ARCHITECTS
HANSCOMB ASSOCIATES — COST CONSULTANTS
LINO AGOSTI & ASSOCIATES — FOOD SERVICE CONSULTANTS
HARDING-LAWSON & ASSOC. — GEOTECHNICAL ENGINEERS
TOWNE, RICHARDS & CHAUDIERE, INC. — ACOUSTICAL CONSULTANTS
PEDER H. KNUDSON — THEATRE AND LIGHTING CONSULTANT

SHEET TITLE

FOUNDATION SECTIONS & DETAILS

REVISIONS

SCALE AS NOTED	DATE DEC 1981
DRAWN	CHECKED PWM
SEAL	SHEET S-12
	OF 17 SHEETS

APPENDIX B

Proposal for Geotechnical Investigation

February 8, 2019 Proposal No. P19116560

Ray Amsden
BDS Architects
3330 C Street, Suite 200
Anchorage, AK 99503

PROPOSAL FOR GEOTECHNICAL EVALUATION OF GRUENING MIDDLE SCHOOL FOUNDATIONS EARTHQUAKE DAMAGE, EAGLE RIVER, ALASKA

Dear Ray:

Golder Associates Inc. (Golder) is pleased to provide this proposal for geotechnical investigation of foundation and floor slab damage at Gruening Middle School in Eagle River, Alaska that resulted from the November 30, 2018 earthquake. The proposal has been developed based on a site visit with you on January 24, 2019 and subsequent review of data provided by BDS. During the site visit we observed movement and cracking in walls around the school, but our primary focus was to observe interior and exterior damage in the gymnasium area and an adjoining stairwell.

1.0 SCOPE OF WORK

We have arranged the scope of work into three tasks covering the site investigation, laboratory testing, and geotechnical engineering analysis and recommendations. We will arrange for utility locates through the Alaska Digline and will work with Anchorage School District Staff to identify utility conflicts using as-built records. We will prepare a health and safety plan for this project, and information regarding specific hazards is welcome.

2.0 SITE INVESTIGATION

In order to assess geotechnical conditions in the gymnasium and stairwell area we recommend conducting a multi-phase geotechnical site investigation consisting of the following elements:

- **Ground penetrating radar (GPR) survey**. The gymnasium floor and surrounding track was identified as having potential settlement. Therefore, a GPR survey is recommended in order to identify and map potential voids beneath the gymnasium floor and changes in thickness of the slab.
- **Boreholes and DCP in gymnasium area**. Based on the results of the GPR survey, we will identify proposed borehole locations inside the gymnasium. The boreholes will be conducted in combination with dynamic cone penetration (DCP) testing in order to determine the density of the fill beneath the floor slab. In addition, DCP may be conducted at other locations to compare differences in soil density between areas with and without potential voids.

- **Exterior Test Pits and Boreholes**. Additional boreholes and test pits will be advanced along the east and north sides of the school to further understand the site conditions and how those conditions may vary from interior areas where there is concern about settlement of mezzanine columns. Test pits are proposed adjacent to the stairwell in order to provide a detailed view of the soil condition immediately beneath the footings.

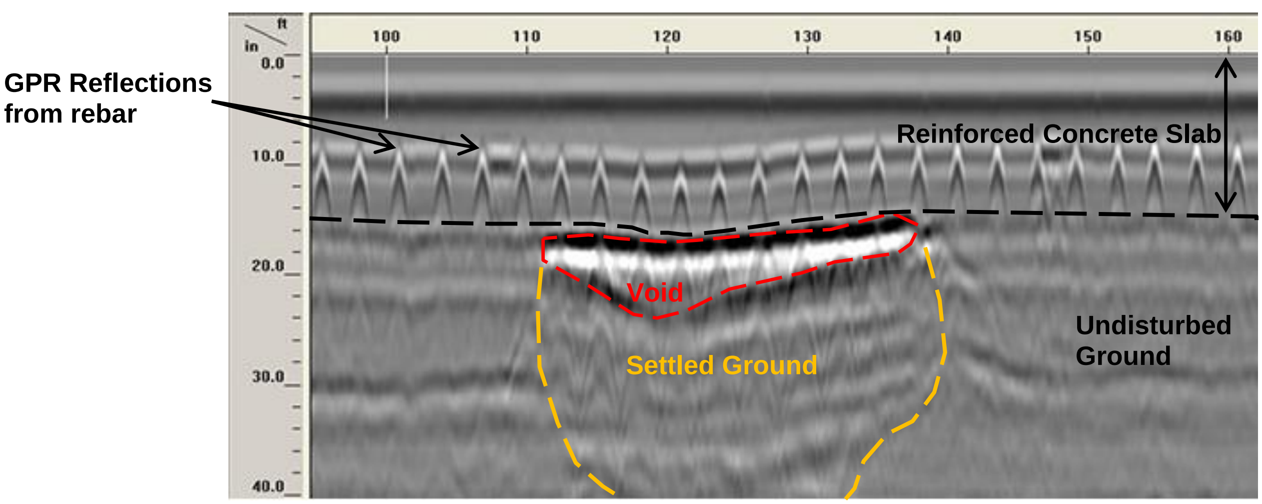
2.1 Ground Penetrating Radar

The GPR method uses electromagnetic (radar) pulses that are directed into the ground from an antenna. Reflections of these pulses from subsurface features are produced where there is a contrast between the electrical properties of subsurface objects, such as utilities, and the surrounding soil.

The proposed GPR investigation for the project consists of the following:

- Mobilizing one field geophysicist and helper, one complete cart-based GPR system, and one EMUL (electromagnetic utility locator) to site.
- Collecting GPR data in the gymnasium with a grid pattern
- Processing and interpreting collected data.

Based on our geotechnical experience in the area, we understand the shallow subsurface soils largely consist of glacial till, which both allow for acceptable GPR signal penetration and should provide a sharp contrast between the concrete slab and subgrade, as seen in the figure below. We will optimize GPR system settings to be able to image the subsurface below the slab and identify any air-filled gaps or other anomalies between the concrete slab and subgrade. The EMUL may be used to supplement the GPR to identify any buried utilities (particularly power) prior to any drilling activities.



Example Radargram of a Void and Associated Ground Settlement below a Concrete Slab.

The areas of interest will be broken into local grids and identified on a floor plan for gymnasium. The location of anomalies that suggest the presence of soil voids will be noted in real-time by our geophysicist and anomalous locations will be marked on the floor and mapped by swing ties with a fiberglass measuring tape relative to local features such as room corners or doorways. Field sketches will be generated to document these locations as targets for potential drilling and follow-up survey effort. A senior geophysicist will also review the radargrams obtained to identify any additional anomalies or features not identified in the field and to confirm the real-time interpretations of voids.

Identified voids will be checked by drilling a small hole through the slab and inserting a downhole camera to inspect the suspected void. These locations will be marked and covered.

2.2 Limitations of Geophysical Methods

Golder's services will be conducted in a manner consistent with that level of care and skill ordinarily exercised by other members of the geophysical community currently practicing under similar conditions subject to the time limits, and financial and physical constraints applicable to the services. GPR and video inspection are remote sensing geophysical methods that may not detect all subsurface voids or utilities. Furthermore, discrete objects such as miscellaneous debris or cobbles and boulders may produce anomalies that are misinterpreted as utilities or subsurface features of concern.

2.3 Geotechnical Drilling

We propose advancing 4 boreholes inside the gymnasium and 6 boreholes around the exterior perimeter of the school. The boreholes will be advanced to 20 feet below ground surface using a low-profile rubber tracked drill rig. The drill rig is approximately 4.5 feet wide by 10 feet long and can fit through double man doors to operate inside the school. Borehole locations as drilled will be determined by measuring relative to site features such as the building corners or doorways as well as with a handheld GPS. If soft or organic material is encountered, additional drilling may be advised. If contaminated soils are observed, drilling will stop and BDS will be notified immediately.

Samples will be obtained using a 3-inch outside diameter split-barrel sampler advanced using a drop hammer. Disturbed, but representative soil samples will be attempted at continuous intervals to 10 feet and then at nominal five-foot intervals to total depth or as directed by our field personnel. Recovered soil samples will be visually classified in the field according to the Unified Soil Classification System (USCS) field method.

For the drilling inside the school, rubber matting will be placed to protect the floor during drilling. An approximate inch diameter hole will be cored through the gymnasium floor before advancing a hand-operated dynamic cone penetrometer (DCP) up to 24-inches below the slab subgrade. After completion of the DCP, the borehole will then be advanced, and samples will be collected continuously using hollow-stem auger methods with spilt-barrel samplers.

Standpipe piezometers consisting of machine slotted PVC casings will be installed in the exterior boreholes to allow for measurement of water levels.

Equipment exhaust will be vented outside during drilling operations. At the completion of drilling inside the school, the boreholes will be backfilled with a cement grout. We have assumed that Anchorage School District maintenance staff will patch the concrete slab and repair the gym floor.

Boreholes advanced outside the school with be backfilled with soil cuttings that are tamped as backfill is added.

2.4 Test Pit Excavation

We propose advancing two test pits along the east side of the school at Stairwell SW2 using equipment owned and operated by BC Excavating. The test pits will extend perpendicular from the exterior wall footing up to as much as 15 feet from the footing, depending on conditions observed in the field. The trench will extend to the bottom of the fill layer or up to 10 feet below ground surface.

We have assumed that snow clearing, and ground thawing will be required to advance the test pits. Ground thawing requires access to two electrical circuits rated to 20 amps and will take 5 to 7 days. After excavation and soil logging, the test pits will be backfilled and compacted. We have assumed that any additional compaction, revegetation, or surface improvements will be performed by others.

3.0 LABORATORY TESTING

Select soil samples will be submitted to our Anchorage laboratory for testing. Most of the samples will be tested to determine moisture content. We have assumed that ten sieve analyses and two Atterberg analyses may also be completed to verify field classification.

4.0 GEOTECHNICAL RECOMMENDATIONS REPORT

Golder will summarize the result of the investigation and observed subsurface conditions in a written report that includes the following.

- Summary of subsurface soil conditions
- Borehole and test pit logs
- Summary of laboratory test results
- Discussion of the GPR survey and results
- Summary map of subsurface anomalies in interior and exterior areas
- Identification of geotechnical issues and discussion of mitigation concepts

APPENDIX B

SUBSURFACE EXPLORATIONS

Shannon & Wilson, Inc. (S&W), uses a soil identification system modified from the Unified Soil Classification System (USCS). Elements of the USCS and other definitions are provided on this and the following pages. Soil descriptions are based on visual-manual procedures (ASTM D2488) and laboratory testing procedures (ASTM D2487), if performed.

S&W INORGANIC SOIL CONSTITUENT DEFINITIONS

CONSTITUENT[2]	FINE-GRAINED SOILS (50% or more fines)[1]	COARSE-GRAINED SOILS (less than 50% fines)[1]
Major	***Silt, Lean Clay, Elastic Silt,*** or ***Fat Clay***[3]	***Sand*** or ***Gravel***[4]
Modifying (Secondary) Precedes major constituent	30% or more coarse-grained: ***Sandy*** or ***Gravelly***[4]	More than 12% fine-grained: ***Silty*** or ***Clayey***[3]
Minor Follows major constituent	15% to 30% coarse-grained: ***with Sand*** or ***with Gravel***[4]	5% to 12% fine-grained: ***with Silt*** or ***with Clay***[3]
	30% or more total coarse-grained *and* lesser coarse-grained constituent is 15% or more: ***with Sand*** or ***with Gravel***[5]	15% or more of a second coarse-grained constituent: ***with Sand*** or ***with Gravel***[5]

[1]All percentages are by weight of total specimen passing a 3-inch sieve.
[2]The order of terms is: *Modifying Major with Minor*.
[3]Determined based on behavior.
[4]Determined based on which constituent comprises a larger percentage.
[5]Whichever is the lesser constituent.

MOISTURE CONTENT TERMS

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, from below water table

STANDARD PENETRATION TEST (SPT) SPECIFICATIONS

Hammer:	140 pounds with a 30-inch free fall. Rope on 6- to 10-inch-diam. cathead 2-1/4 rope turns, > 100 rpm NOTE: If automatic hammers are used, blow counts shown on boring logs should be adjusted to account for efficiency of hammer.
Sampler:	10 to 30 inches long Shoe I.D. = 1.375 inches Barrel I.D. = 1.5 inches Barrel O.D. = 2 inches
N-Value:	Sum blow counts for second and third 6-inch increments. Refusal: 50 blows for 6 inches or less; 10 blows for 0 inches.

NOTE: Penetration resistances (N-values) shown on boring logs are as recorded in the field and have not been corrected for hammer efficiency, overburden, or other factors.

PARTICLE SIZE DEFINITIONS

DESCRIPTION	SIEVE NUMBER AND/OR APPROXIMATE SIZE
FINES	< #200 (0.075 mm = 0.003 in.)
SAND	
Fine	#200 to #40 (0.075 to 0.4 mm; 0.003 to 0.02 in.)
Medium	#40 to #10 (0.4 to 2 mm; 0.02 to 0.08 in.)
Coarse	#10 to #4 (2 to 4.75 mm; 0.08 to 0.187 in.)
GRAVEL	
Fine	#4 to 3/4 in. (4.75 to 19 mm; 0.187 to 0.75 in.)
Coarse	3/4 to 3 in. (19 to 76 mm)
COBBLES	3 to 12 in. (76 to 305 mm)
BOULDERS	> 12 in. (305 mm)

RELATIVE DENSITY / CONSISTENCY

COHESIONLESS SOILS		COHESIVE SOILS	
N, SPT, BLOWS/FT.	RELATIVE DENSITY	N, SPT, BLOWS/FT.	RELATIVE CONSISTENCY
< 4	Very loose	< 2	Very soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium dense	4 - 8	Medium stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very dense	15 - 30	Very stiff
		> 30	Hard

WELL AND BACKFILL SYMBOLS

Bentonite Cement Grout	Surface Cement Seal
Bentonite Grout	Asphalt or Cap
Bentonite Chips	Slough
Silica Sand	Inclinometer or Non-perforated Casing
Perforated or Screened Casing	Vibrating Wire Piezometer

PERCENTAGES TERMS[1, 2]

Trace	< 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

[1]Gravel, sand, and fines estimated by mass. Other constituents, such as organics, cobbles, and boulders, estimated by volume.

[2]Reprinted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.

Gruening Middle School Earthquake Repairs
Eagle River, Alaska

SOIL DESCRIPTION AND LOG KEY

August 2019 103327-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B-1
Sheet 1 of 3

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)
(Modified From USACE Tech Memo 3-357, ASTM D2487, and ASTM D2488)

MAJOR DIVISIONS			GROUP/GRAPHIC SYMBOL	TYPICAL IDENTIFICATIONS
COARSE-GRAINED SOILS *(more than 50% retained on No. 200 sieve)*	Gravels *(more than 50% of coarse fraction retained on No. 4 sieve)*	Gravel *(less than 5% fines)*	GW	Well-Graded Gravel; Well-Graded Gravel with Sand
			GP	Poorly Graded Gravel; Poorly Graded Gravel with Sand
		Silty or Clayey Gravel *(more than 12% fines)*	GM	Silty Gravel; Silty Gravel with Sand
			GC	Clayey Gravel; Clayey Gravel with Sand
	Sands *(50% or more of coarse fraction passes the No. 4 sieve)*	Sand *(less than 5% fines)*	SW	Well-Graded Sand; Well-Graded Sand with Gravel
			SP	Poorly Graded Sand; Poorly Graded Sand with Gravel
		Silty or Clayey Sand *(more than 12% fines)*	SM	Silty Sand; Silty Sand with Gravel
			SC	Clayey Sand; Clayey Sand with Gravel
FINE-GRAINED SOILS *(50% or more passes the No. 200 sieve)*	Silts and Clays *(liquid limit less than 50)*	Inorganic	ML	Silt; Silt with Sand or Gravel; Sandy or Gravelly Silt
			CL	Lean Clay; Lean Clay with Sand or Gravel; Sandy or Gravelly Lean Clay
		Organic	OL	Organic Silt or Clay; Organic Silt or Clay with Sand or Gravel; Sandy or Gravelly Organic Silt or Clay
	Silts and Clays *(liquid limit 50 or more)*	Inorganic	MH	Elastic Silt; Elastic Silt with Sand or Gravel; Sandy or Gravelly Elastic Silt
			CH	Fat Clay; Fat Clay with Sand or Gravel; Sandy or Gravelly Fat Clay
		Organic	OH	Organic Silt or Clay; Organic Silt or Clay with Sand or Gravel; Sandy or Gravelly Organic Silt or Clay
HIGHLY-ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor		PT	Peat or other highly organic soils (see ASTM D4427)

NOTE: No. 4 size = 4.75 mm = 0.187 in.; No. 200 size = 0.075 mm = 0.003 in.

NOTES

1. Dual symbols *(symbols separated by a hyphen, i.e., SP-SM, Sand with Silt)* are used for soils with between 5% and 12% fines or when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart. Graphics shown on the logs for these soil types are a combination of the two graphic symbols (e.g., SP and SM).

2. Borderline symbols *(symbols separated by a slash, i.e., CL/ML, Lean Clay to Silt; SP-SM/SM, Sand with Silt to Silty Sand)* indicate that the soil properties are close to the defining boundary between two groups.

Gruening Middle School Earthquake Repairs
Eagle River, Alaska

SOIL DESCRIPTION AND LOG KEY

August 2019 103327-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B-1
Sheet 2 of 3

2013 BORING CLASS2 GINT.GPJ SWNEW.GDT 7/30/19

GRADATION TERMS

Poorly Graded	Narrow range of grain sizes present or, within the range of grain sizes present, one or more sizes are missing (Gap Graded). Meets criteria in ASTM D2487, if tested.
Well-Graded	Full range and even distribution of grain sizes present. Meets criteria in ASTM D2487, if tested.

CEMENTATION TERMS[1]

Weak	Crumbles or breaks with handling or slight finger pressure
Moderate	Crumbles or breaks with considerable finger pressure
Strong	Will not crumble or break with finger pressure

PLASTICITY[2]

DESCRIPTION	VISUAL-MANUAL CRITERIA	APPROX. PLASITICTY INDEX RANGE
Nonplastic	A 1/8-in. thread cannot be rolled at any water content.	< 4
Low	A thread can barely be rolled and a lump cannot be formed when drier than the plastic limit.	4 to 10
Medium	A thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. A lump crumbles when drier than the plastic limit.	10 to 20
High	It take considerable time rolling and kneading to reach the plastic limit. A thread can be rerolled several times after reaching the plastic limit. A lump can be formed without crumbling when drier than the plastic limit.	> 20

ADDITIONAL TERMS

Mottled	Irregular patches of different colors.
Bioturbated	Soil disturbance or mixing by plants or animals.
Diamict	Nonsorted sediment; sand and gravel in silt and/or clay matrix.
Cuttings	Material brought to surface by drilling.
Slough	Material that caved from sides of borehole.
Sheared	Disturbed texture, mix of strengths.

PARTICLE ANGULARITY AND SHAPE TERMS[1]

Angular	Sharp edges and unpolished planar surfaces.
Subangular	Similar to angular, but with rounded edges.
Subrounded	Nearly planar sides with well-rounded edges.
Rounded	Smoothly curved sides with no edges.
Flat	Width/thickness ratio > 3.
Elongated	Length/width ratio > 3.

ACRONYMS AND ABBREVIATIONS

ATD	At Time of Drilling
Diam.	Diameter
Elev.	Elevation
ft.	Feet
FeO	Iron Oxide
gal.	Gallons
Horiz.	Horizontal
HSA	Hollow Stem Auger
I.D.	Inside Diameter
in.	Inches
lbs.	Pounds
MgO	Magnesium Oxide
mm	Millimeter
MnO	Manganese Oxide
NA	Not Applicable or Not Available
NP	Nonplastic
O.D.	Outside Diameter
OW	Observation Well
pcf	Pounds per Cubic Foot
PID	Photo-Ionization Detector
PMT	Pressuremeter Test
ppm	Parts per Million
psi	Pounds per Square Inch
PVC	Polyvinyl Chloride
rpm	Rotations per Minute
SPT	Standard Penetration Test
USCS	Unified Soil Classification System
q_u	Unconfined Compressive Strength
VWP	Vibrating Wire Piezometer
Vert.	Vertical
WOH	Weight of Hammer
WOR	Weight of Rods
Wt.	Weight

STRUCTURE TERMS[1]

Interbedded	Alternating layers of varying material or color with layers at least 1/4-inch thick; singular: bed.
Laminated	Alternating layers of varying material or color with layers less than 1/4-inch thick; singular: lamination.
Fissured	Breaks along definite planes or fractures with little resistance.
Slickensided	Fracture planes appear polished or glossy; sometimes striated.
Blocky	Cohesive soil that can be broken down into small angular lumps that resist further breakdown.
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay.
Homogeneous	Same color and appearance throughout.

[1]Reprinted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.
[2]Adapted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.

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August 2019 | 103327-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B-1
Sheet 3 of 3

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FROST CLASSIFICATION

(after Municipality of Anchorage, 2007)

GROUP		0.02 Mil.	P-200*	USC SYSTEM (based on P-200 results)
NFS	Sandy Soils	0 to 3	0 to 6	SW, SP, SW-SM, SP-SM
	Gravelly Soils	0 to 3	0 to 6	GW, GP, GW-GM, GP-GM
F1	Gravelly Soils	3 to 10	6 to 13	GM, GW-GM, GP-GM
F2	Sandy Soils	3 to 15	6 to 19	SP-SM, SW-SM, SM
	Gravelly Soils	10 to 20	13 to 25	GM
F3	Sands, except very fine silty sands**	Over 15	Over 19	SM, SC
	Gravelly Soils	Over 20	Over 25	GM, GC
	Clays, PI>12			CL, CH
F4	All Silts			ML, MH
	Very fine silty sands**	Over 15	Over 19	SM, SC
	Clays, PI<12			CL, CL-ML
	Varved clays and other fined grained, banded sediments			CL and ML CL, ML, and SM; SL, SH, and ML; CL, CH, ML, and SM

PI = Plasticity index
P-200 = Percent passing the number 200 sieve
0.02 Mil. = Percent material below 0.02 millimeter grain size

*Approximate P-200 value equivalent for frost classification.
Value range based on typical, well-graded soil curves.

** Very fine sand : greater than 50% of sand fraction passing the number 100 sieve

Gruening Middle School Earthquake Repairs
Eagle River, Alaska

FROST CLASSIFICATION LEGEND

August 2019 103327-001

SHANNON & WILSON, INC.
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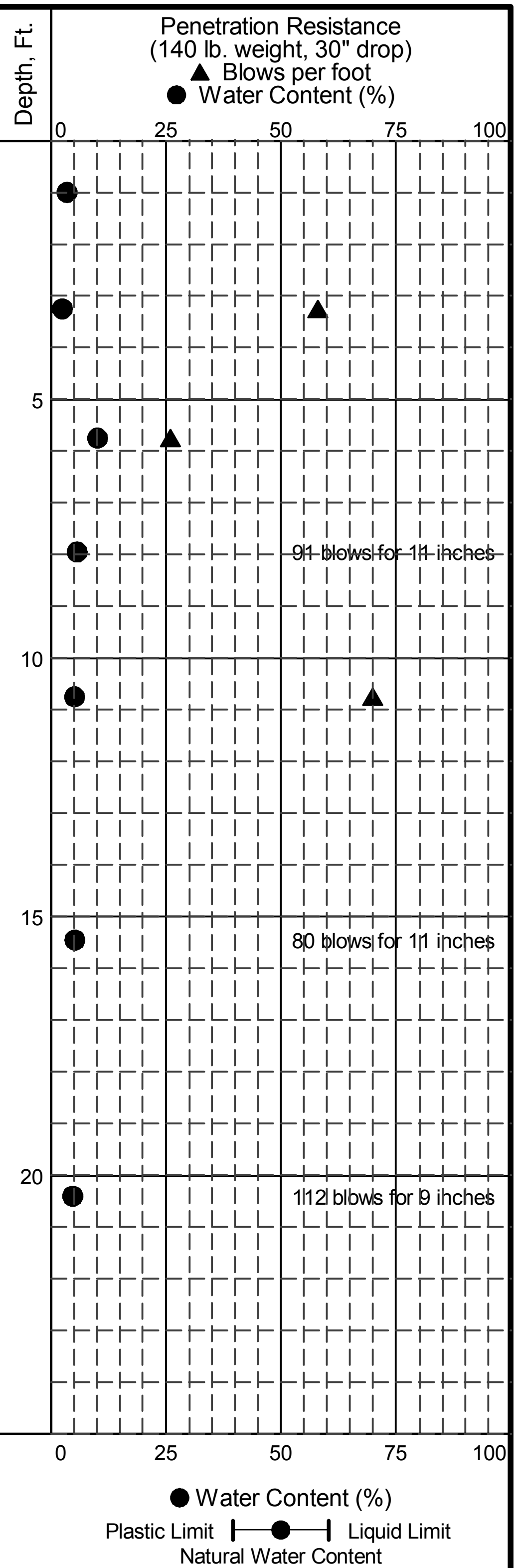
FIG. B-2

MATERIAL DESCRIPTION	Depth, Ft.	Symbol	Samples
Approx. Elevation: 486 Ft.			
1 to 2 inch grass mat	0.2		
Stiff, tan, *Silt with Gravel (ML)*; moist; trace roots and organics [FILL]			S1
Very dense, brown, *Poorly Graded Gravel with Silt and Sand (GP-GM)*; moist [FILL] S2: 52% Gravel, 37% Sand, 11% Fines (F1 [P200])	2.2		S2
Medium dense to very dense, gray-brown to light brown to brown, *Silty Sand with Gravel (SM)*; moist; occasional wet lenses from approximately 5.2 to 7 feet bgs	5.2		S3, S4, S5
S6: 34% Gravel, 44% Sand, 21% Fines (F3 [P200])			S6
			S7
Bottom of Boring Boring Completed 6/27/2019	20.8		

Ground Water: Groundwater not encountered during drilling on 6/27/2019



LEGEND

- * Sample Not Recovered
- 2" O.D. Split Spoon Sample
- Grab Sample

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.

Gruening Middle School Earthquake Repairs
Eagle River, Alaska

LOG OF BORING B-01

August 2019 103327-001

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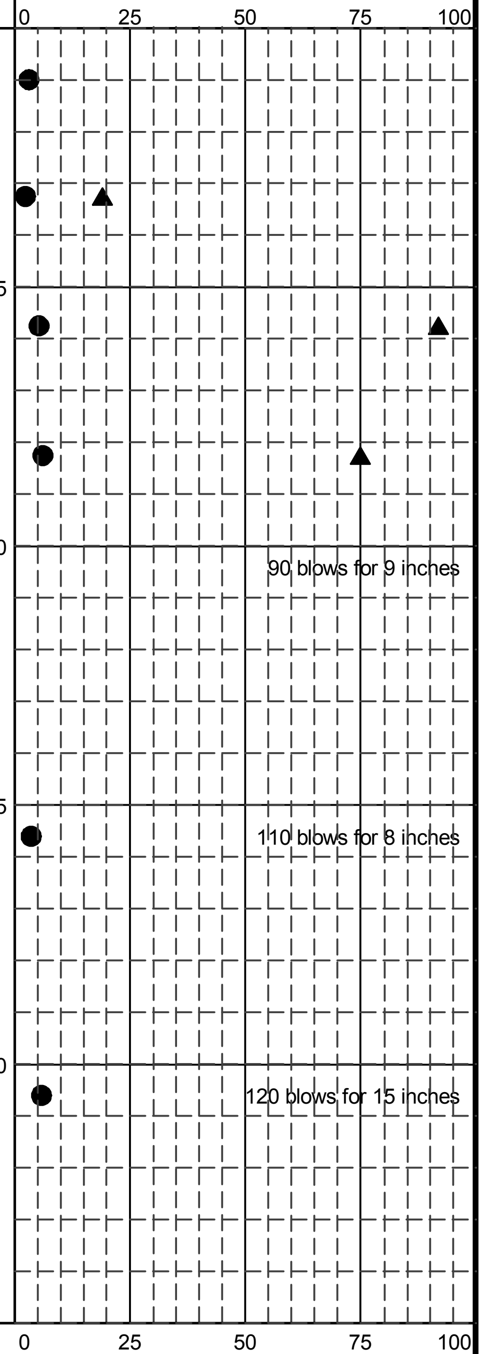
FIG. B-3

REV 3 - Approved for Submittal

MATERIAL DESCRIPTION Approx. Elevation: 486 Ft.	Depth, Ft.	Symbol	Samples	Ground Water	Depth, Ft.
2 inch grass mat	0.2				
Medium dense, light to dark brown, *Silty Sand with Gravel (SM)*; moist; construction debris present [FILL]			S1, S2		
Very dense, tan to brown to gray-brown, *Silty Sand with Gravel (SM)*; moist; occasional wet lenses from approximately 15 to 21.2 feet bgs S4: 28% Gravel, 36% Sand, 36% Fines (F3 [0.02 mil])	4.5		S3, S4, S5, S6, S7	Groundwater not encountered during drilling on 6/27/2019	5, 10, 15, 20
Bottom of Boring Boring Completed 6/27/2019	21.2				

Penetration Resistance
(140 lb. weight, 30" drop)
▲ Blows per foot
● Water Content (%)



LEGEND

- * Sample Not Recovered
- 2" O.D. Split Spoon Sample
- Grab Sample

● Water Content (%)

Plastic Limit ├──●──┤ Liquid Limit

Natural Water Content

NOTES

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Gruening Middle School Earthquake Repairs
Eagle River, Alaska

LOG OF BORING B-02

August 2019 | 103327-001

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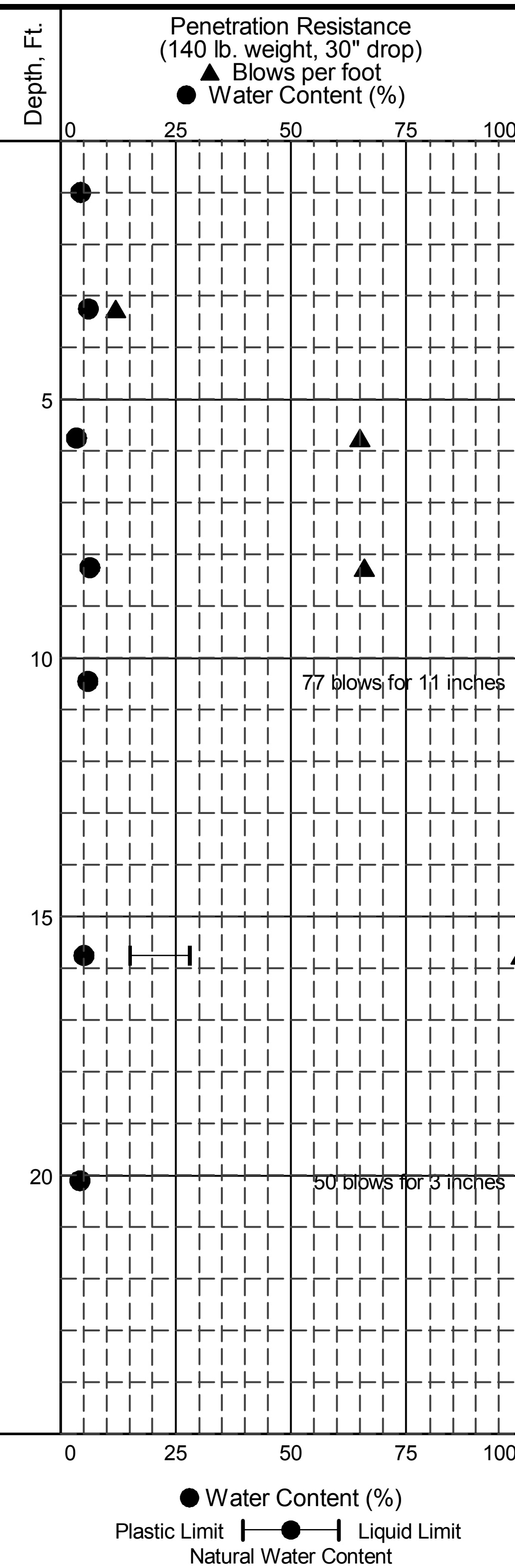
FIG. B-4

MATERIAL DESCRIPTION Approx. Elevation: 482 Ft.	Depth, Ft.	Samples	Ground Water
2 inch grass mat	0.2		
Medium dense, brown, *Poorly Graded Gravel with Silt and Sand (GP-GM)*; moist; roots and trace organics [FILL] S1: 55% Gravel, 35% Sand, 10% Fines (F1 [P200])		S1, S2	
Very dense, dark brown, *Silty Gravel with Sand (GM)*; moist [FILL?] S3: 49% Gravel, 36% Sand, 15% Fines (F2 [P200])	4.5	S3	
Very dense, gray-brown to light brown to brown to tan, *Silty Sand with Gravel (SM)*; moist; wet seams from approximately 7 to 9.5 feet bgs	7.0	S4, S5, S6, S7	Groundwater not encountered during drilling on 6/27/2019
Bottom of Boring Boring Completed 6/27/2019	20.2		



LEGEND

- * Sample Not Recovered
- 2" O.D. Split Spoon Sample
- Grab Sample

NOTES

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2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
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Gruening Middle School Earthquake Repairs
Eagle River, Alaska

LOG OF BORING B-03

August 2019 103327-001

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FIG. B-5

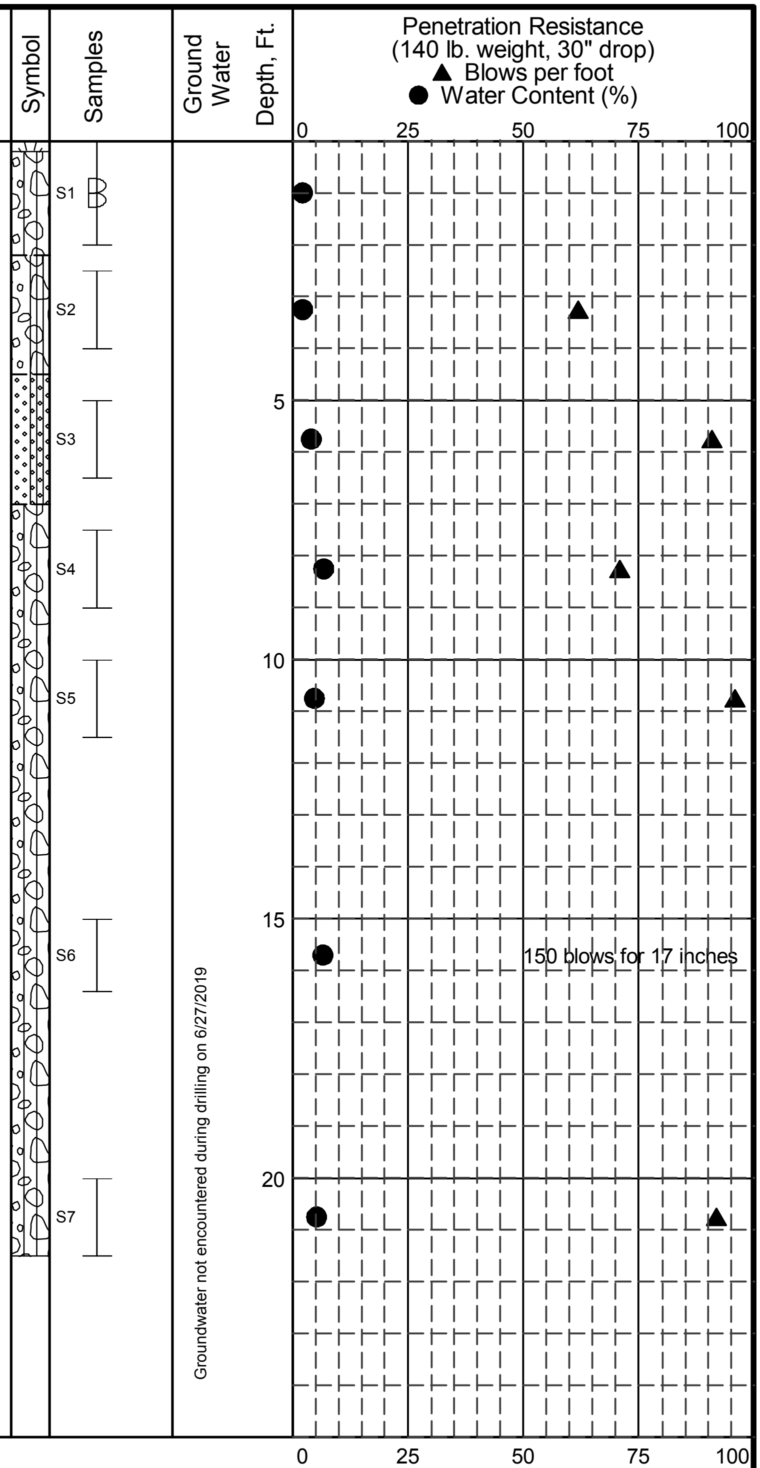
REV 3 - Approved for Submittal

GEOTECHNICAL LOG GINT.GPJ S&W_GEO1.GDT 8/29/19

LOG OF BORING B-04

MATERIAL DESCRIPTION (Approx. Elevation: 483 Ft.)	Depth, Ft.
2 inch grass mat	0.2
Medium dense, light brown, *Silty Gravel with Sand (GM)*; moist; few roots [FILL]	2.2
Very dense, brown, *Poorly Graded Gravel with Silt and Sand (GP-GM)*; moist [FILL]	4.5
Very dense, gray, *Well-Graded Sand with Silt and Gravel (SW-SM)*; moist to wet; occasional wet seeps [FILL?] S3: 42% Gravel, 48% Sand, 10% Fines (F2 [P200])	7.0
Very dense, tan to light brown to brown, *Silty Gravel with Sand (GM)*; moist; trace coal from approximately 7 to 9.5 feet bgs; occasional sand lenses from approximately 10 to 18 feet bgs; occasional wet seeps from approximately 20 to 21.5 feet bgs S5: 39% Gravel, 36% Sand, 25% Fines (F3 [P200])	21.5

Bottom of Boring
Boring Completed 6/27/2019



LEGEND

- * Sample Not Recovered
- 2" O.D. Split Spoon Sample
- Grab Sample

● Water Content (%)
Plastic Limit — ● — Liquid Limit
Natural Water Content

NOTES

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Gruening Middle School Earthquake Repairs
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LOG OF BORING B-04

August 2019 | 103327-001

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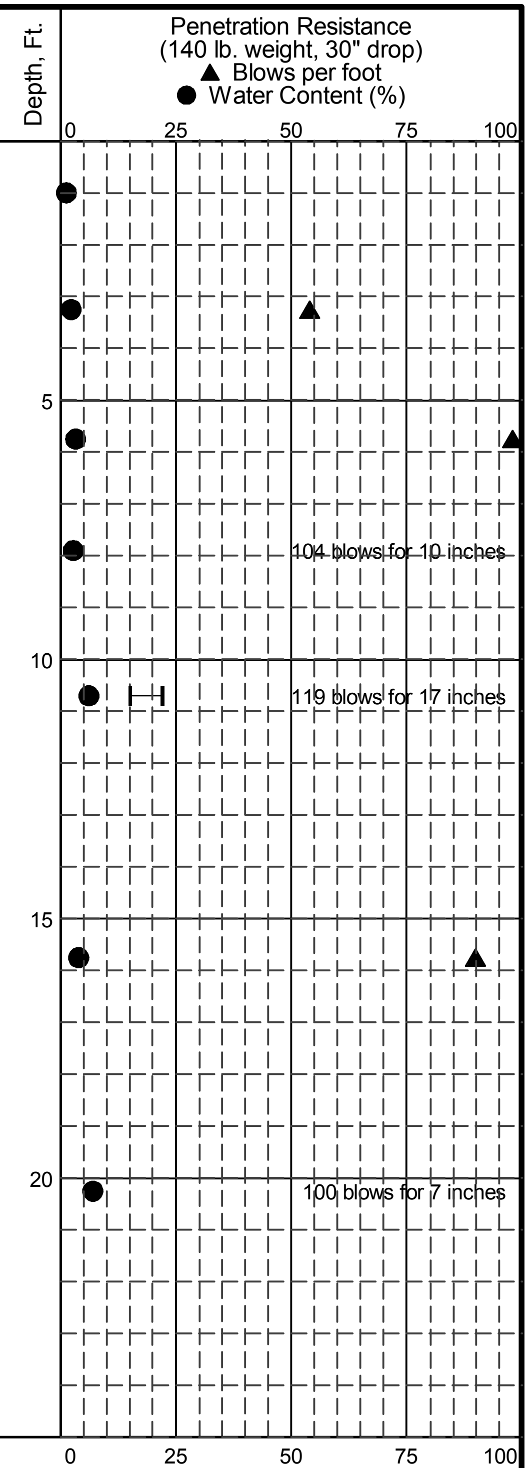
FIG. B-6

REV 3 - Approved for Submittal

MATERIAL DESCRIPTION	Depth, Ft.	Symbol	Samples
Approx. Elevation: 482 Ft.			
2 inch grass mat	0.2		
Medium dense, light brown, *Silty Gravel with Sand (GM)*; moist; trace grass roots; trace rocks up to 5 inches in diameter [FILL]	2.2		S1
Very dense, brown to dark gray, *Well-Graded Gravel with Silt and Sand (GW-GM) to Silty Gravel with Sand (GM)*; moist; occasional wet seams at approximately 6 feet bgs [FILL]			S2
S3: 51% Gravel, 40% Sand, 10% Fines (F1 [0.02 mil])			S3
	9.0		S4
Very dense, light brown to brown to tan, *Silty Sand with Gravel (SM)*; moist; interbedded with *Poorly Graded Sand with Silt and Gravel (SP-SM)* from approximately 15 to 16.5 feet bgs; occasional wet seams at approximately 20 feet bgs			S5
S6: 40% Gravel, 41% Sand, 19% Fines (F2 [P200])			S6
	20.5		S7
Bottom of Boring Boring Completed 6/28/2019			

Ground Water: Groundwater not encountered during drilling on 6/28/2019



LEGEND

- * Sample Not Recovered
- 2" O.D. Split Spoon Sample
- Grab Sample

● Water Content (%)

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

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Gruening Middle School Earthquake Repairs
Eagle River, Alaska

LOG OF BORING B-05

August 2019 103327-001

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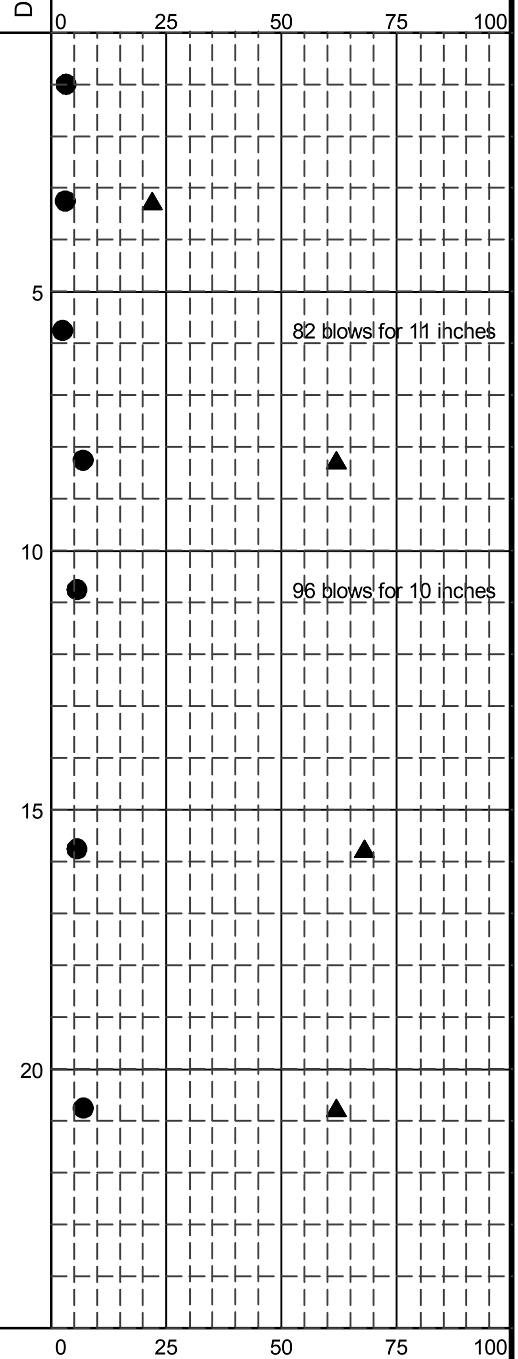
FIG. B-7

MATERIAL DESCRIPTION (Approx. Elevation: 480 Ft.)	Depth, Ft.	Symbol	Samples	Ground Water
2 inch grass mat	0.2			
Medium dense, light brown, *Poorly Graded Gravel with Silt and Sand (GP-GM)*; moist; few roots [FILL] S1: 64% Gravel, 24% Sand, 12% Fines (F1 [P200])			S1	
Medium dense to very dense, dark gray, *Poorly Graded Sand with Silt and Gravel (SP-SM)*; moist [FILL]	2.8		S2, S3	
Very dense, tan to light brown to brown to gray-brown, *Silty Sand with Gravel (SM)*; moist; interbedded with *Poorly Graded Sand with Silt and Gravel (SP-SM)* from approximately 10 to 18 feet bgs; occasional wet seams from approximately 12 to 18 feet bgs S4: 25% Gravel, 38% Sand, 37% Fines (F3 [P200])	6.5		S4, S5, S6, S7	Groundwater not encountered during drilling on 6/28/2019
Bottom of Boring Boring Completed 6/28/2019	21.5			

Penetration Resistance
(140 lb. weight, 30" drop)
▲ Blows per foot
● Water Content (%)



● Water Content (%)
Plastic Limit ├──●──┤ Liquid Limit
Natural Water Content

LEGEND

- * Sample Not Recovered
- 2" O.D. Split Spoon Sample
- Grab Sample

NOTES

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Gruening Middle School Earthquake Repairs
Eagle River, Alaska

LOG OF BORING B-06

August 2019 103327-001

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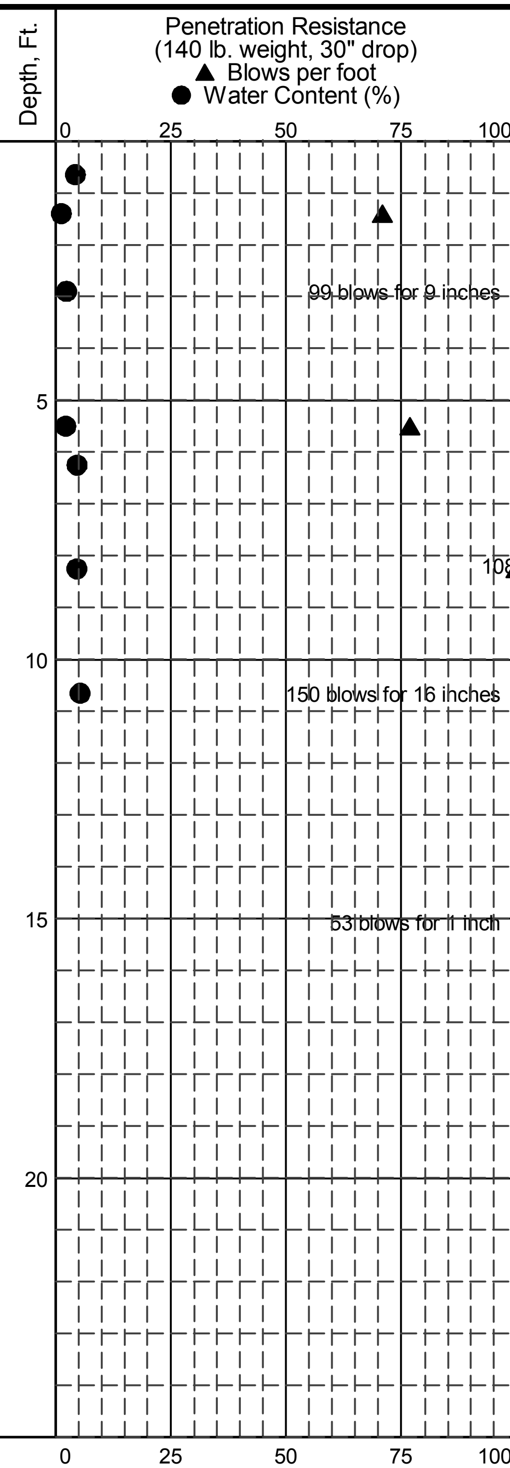
FIG. B-8

REV 3 - Approved for Submittal

GEOTECHNICAL LOG GINT.GPJ S&W_GEO1.GDT 8/29/19

MATERIAL DESCRIPTION Approx. Elevation: 487 Ft.	Depth, Ft.	Symbol	Samples	Ground Water
5 inches of concrete; black vapor barrier between soil and concrete	0.4			
S1A: 46% Gravel, 46% Sand, 8% Fines (F2 [P200]) Medium dense, gray-brown, *Well-Graded Sand with Silt and Gravel (SW-SM)*; wet (from coring) [FILL]	0.9		S1A, S1B	
Very dense, gray-brown, *Silty Sand with Gravel (SM)*; moist [FILL?]			S2, S3A	
Very dense, light brown to gray-brown, *Silty Sand with Gravel (SM)*; moist S4: 32% Gravel, 38% Sand, 30% Fines (F3 [P200])	6.0		S3B, S4, S5, S6*	
Bottom of Boring Boring Completed 7/1/2019	15.1			Groundwater not encountered during drilling on 7/1/2019



LEGEND

- * Sample Not Recovered
- 2" O.D. Split Spoon Sample
- Grab Sample

● Water Content (%)

Plastic Limit —●— Liquid Limit

Natural Water Content

NOTES

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Gruening Middle School Earthquake Repairs
Eagle River, Alaska

LOG OF BORING B-07

August 2019 103327-001

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FIG. B-9

REV 3 - Approved for Submittal

GEOTECHNICAL LOG GINT.GPJ S&W_GEO1.GDT 8/29/19

MATERIAL DESCRIPTION Approx. Elevation: 487 Ft.	Depth, Ft.	Symbol	Samples	Ground Water	Depth, Ft.	Penetration Resistance (140 lb. weight, 30" drop) ▲ Blows per foot ● Water Content (%)
5.5 inches concrete; black vapor barrier between soil and concrete	0.5					
Very dense, gray-brown, *Well-Graded Sand with Silt and Gravel (SW-SM) to Silty Sand with Gravel (SM)*; moist [FILL] S2: 42% Gravel, 47% Sand, 11% Fines (F2 [0.02 mil])			S1 S2 S3		5	150 blows for 10 inches 100 blows for 9 inches
Very dense, yellow-brown to orange-brown, *Silty Sand with Gravel to Silty Sand (SM)*; moist; occasional high fines lenses up to 2 inches thick S5: 25% Gravel, 39% Sand, 36% Fines (F3 [P200]) Auger refusal, sample only contained rock fragments	6.5		S4 S5 S6		10	26 blows for 1 inch
Bottom of Boring Boring Completed 7/3/2019	14.6			Groundwater not encountered during drilling on 7/3/2019	15 20	

0 25 50 75 100

LEGEND

- * Sample Not Recovered
- 2" O.D. Split Spoon Sample
- Grab Sample

● Water Content (%)

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

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Gruening Middle School Earthquake Repairs
Eagle River, Alaska

LOG OF BORING B-08

August 2019 103327-001

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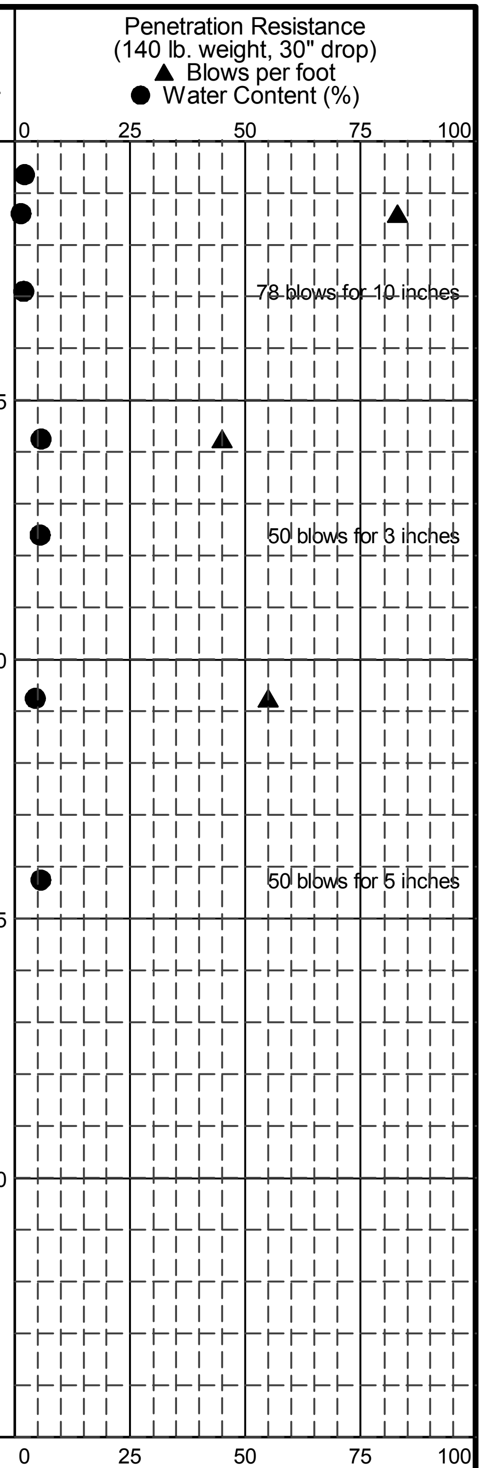
FIG. B-10

REV 3 - Approved for Submittal

MATERIAL DESCRIPTION Approx. Elevation: 487 Ft.	Depth, Ft.	Symbol	Samples	Ground Water	Depth, Ft.
5 inches concrete; black vapor barrier between soil and concrete	0.4				
S1A: 42% Gravel, 51% Sand, 8% Fines (F2 [P200])			S1A		
Medium dense to very dense, gray-brown, *Well-Graded Sand with Silt (SW-SM)*; moist [FILL]			S1B, S2		
Dense to very dense, gray-brown to yellow-brown, *Silty Sand with Gravel (SM)*; moist; gravel lenses from approximately 4 to 8 feet bgs	4.0		S3, S4		5
Very dense, gray-brown, *Silty Gravel with Sand (GM))*; moist Fines content increasing with depth S5: 40% Gravel, 35% Sand, 25% Fines (F2 [P200])	9.0		S5, S6		10
Bottom of Boring Boring Completed 7/3/2019	14.5			Groundwater not encountered during drilling on 7/3/2019	15, 20



LEGEND

- * Sample Not Recovered
- 2" O.D. Split Spoon Sample
- Grab Sample

● Water Content (%)

Plastic Limit ●— Liquid Limit
Natural Water Content

NOTES

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Gruening Middle School Earthquake Repairs
Eagle River, Alaska

LOG OF BORING B-09

August 2019 103327-001

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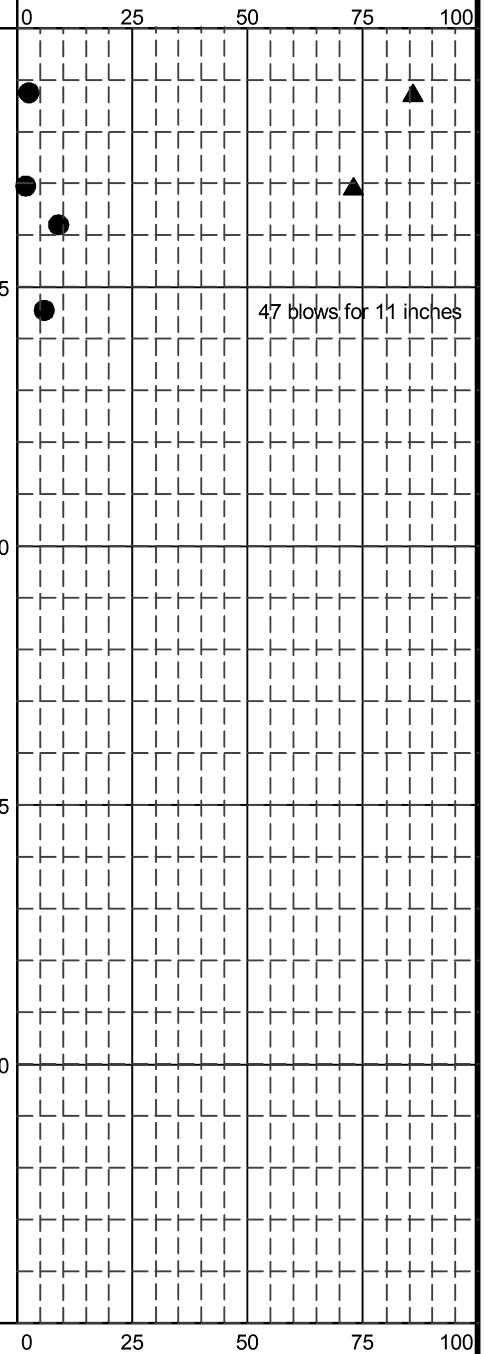
FIG. B-11

REV 3 - Approved for Submittal

MATERIAL DESCRIPTION Approx. Elevation: 487 Ft.	Depth, Ft.	Symbol	Samples	Ground Water	Depth, Ft.
6 inches concrete; black vapor barrier between soil and concrete	0.5				
Dense to very dense, gray-brown, *Well-Graded Sand with Silt and Gravel (SW-SM)*; moist [FILL] S2A: 41% Gravel, 48% Sand, 11% Fines (F2 [P200])	3.6		S1 S2A		
Dense to very dense, yellow-brown, *Silty Sand to Silty Sand with Gravel (SM)*; moist Refusal on large rock based on drill action and sound of sampler	6.0		S2B S3	Groundwater not encountered during drilling on 7/3/2019	5
Bottom of Boring Boring Completed 7/3/2019					10 15 20

Penetration Resistance
(140 lb. weight, 30" drop)
▲ Blows per foot
● Water Content (%)



● Water Content (%)
Plastic Limit |—●—| Liquid Limit
Natural Water Content

LEGEND

- * Sample Not Recovered
- 2" O.D. Split Spoon Sample
- Grab Sample

NOTES

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2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
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Gruening Middle School Earthquake Repairs
Eagle River, Alaska

LOG OF BORING B-10

August 2019 103327-001

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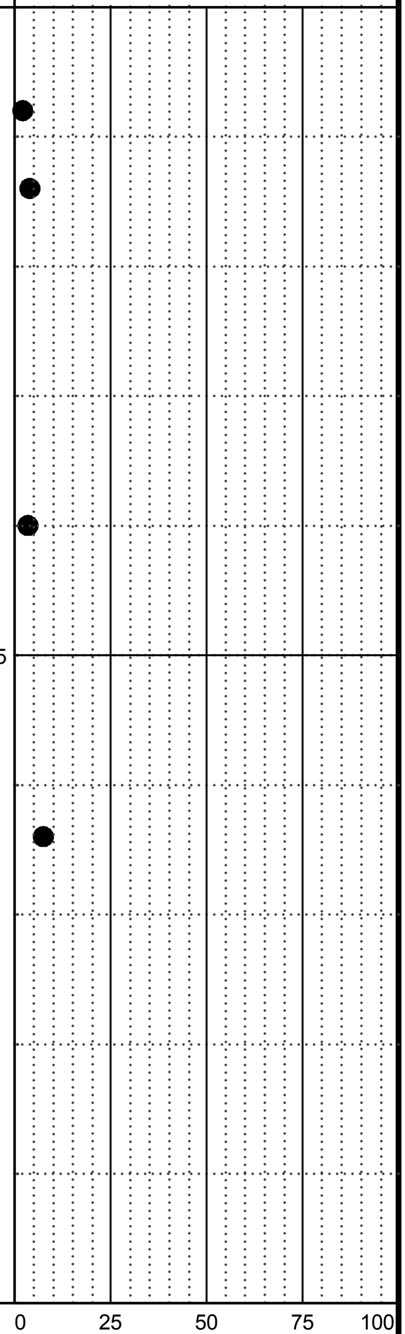
FIG. B-12

REV 3 - Approved for Submittal

MATERIAL DESCRIPTION Approx. Elevation: 486 Ft.	Depth, Ft.	Symbol	Samples	Ground Water Depth, Ft.
3 inch grass mat	0.2			
Medium dense, brown, *Poorly Graded Gravel with Silt and Sand (GP-GM)*; moist; trace roots/organics [FILL]	1.0		S1	
Loose to medium dense, gray, *Well-Graded Gravel with Silt and Sand (GW-GM)*; moist; occasional construction debris [FILL]			S2	
S3: 66% Gravel, 29% Sand, 6% Fines (F1 [0.02 mil])			S3	
Top of footer at approximately 4.5 feet bgs; approximately 8 to 12 inch wide "mushroom" of concrete at base of stem wall				5
Estimated base of footer at approximately 5.5 feet bgs	6.0			
Dense to very dense, brown, *Silty Sand with Gravel (SM)*; moist	6.8		S4	
Bottom of Test Pit Observed on 6/26/2019				

Groundwater Not Encountered During Excavation on 6/26/2019



● % Water Content

Plastic Limit ├──●──┤ Liquid Limit

Natural Water Content

LEGEND

2" O.D. Split Spoon Sample

Grab Sample

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
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Gruening Middle School Earthquake Repairs
Eagle River, Alaska

LOG OF TEST PIT TP-1

August 2019 103327-001

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FIG. B-13

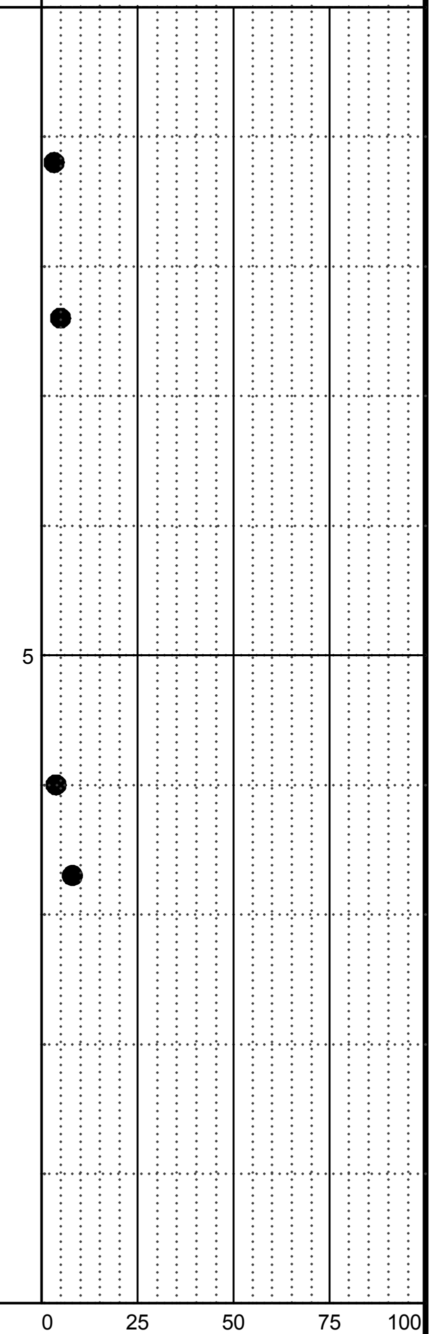
REV 3 - Approved for Submittal

TEST_PIT GINT.GPJ S&W_GEO.GDT 8/29/19

MATERIAL DESCRIPTION Approx. Elevation: 486 Ft.	Depth, Ft.	Samples
3 inches of asphalt	0.2	
Loose to medium dense, dark gray, *Poorly Graded Sand with Silt and Gravel (SP-SM)*; moist; trace organics; occasional cobbles up to approximately 6 inches; occasional construction debris [FILL]	2.0	S1
Medium dense, tan, *Silty Sand with Gravel (SM)*; moist [FILL]	3.5	S2
Medium dense, gray-brown, *Well-Graded Gravel with Sand (GW)*; moist to wet; small seep at approximately 6 feet bgs [FILL] Top of footer at approximately 4.5 feet bgs Base of footer at approximately 5.5 feet bgs S3: 55% Gravel, 34% Sand, 4% Fines (NFS)	6.5	S3
Dense to very dense, tan, *Silty Sand with Gravel (SM)*; moist; occasional cobbles up to approximately 9 inches	7.2	S4

Bottom of Test Pit
Observed on 6/26/2019

Ground Water Depth, Ft.: Groundwater Not Encountered During Excavation on 6/26/2019



● % Water Content

Plastic Limit ├──●──┤ Liquid Limit
Natural Water Content

LEGEND

2" O.D. Split Spoon Sample
Grab Sample

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.

Gruening Middle School Earthquake Repairs
Eagle River, Alaska

LOG OF TEST PIT TP-2

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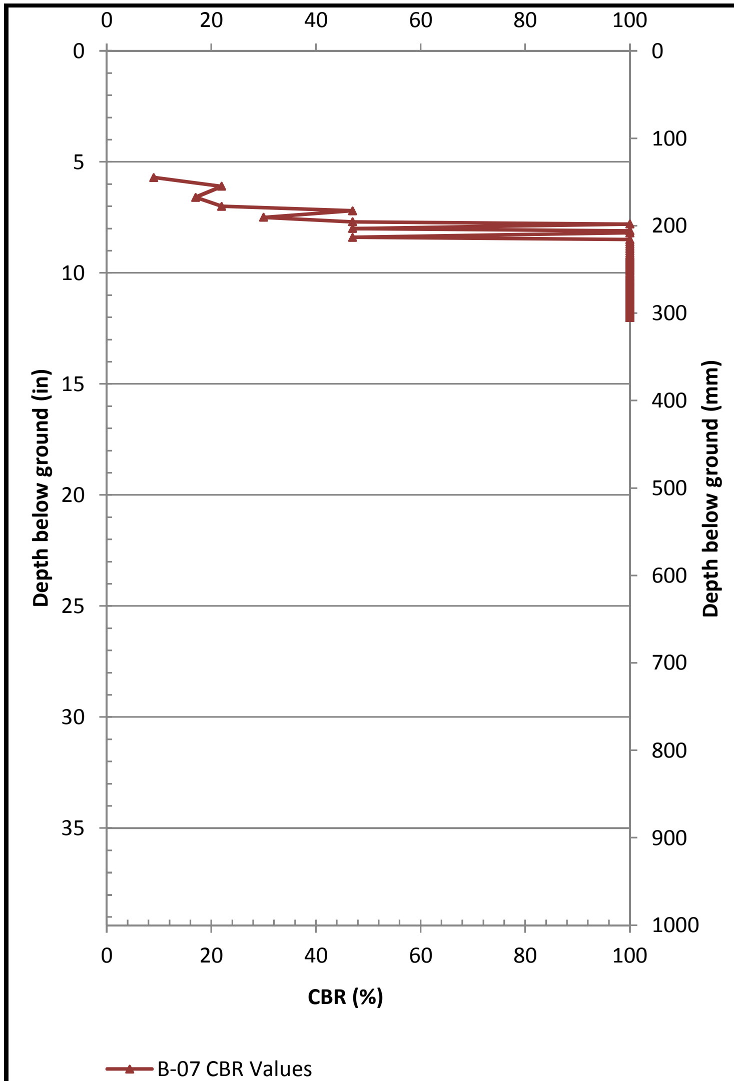
FIG. B-14

REV 3 - Approved for Submittal

TEST_PIT GINT.GPJ S&W_GEO.GDT 8/29/19



Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Num ber of	Depth (in)	DPI (mm/ blow)	CBR
1	5.7	23	9	**31**	9.6	1	100	**61**	10.7	1	100	**91**	11.2	1	100
2	6.1	10	22	**32**	9.7	1	100	**62**	10.7	1	100	**92**	11.3	1	100
3	6.6	13	17	**33**	9.7	1	100	**63**	10.8	1	100	**93**	11.3	1	100
4	7.0	10	22	**34**	9.8	1	100	**64**	10.8	1	100	**94**	11.4	1	100
5	7.2	5	47	**35**	9.8	1	100	**65**	10.8	1	100	**95**	11.4	1	100
6	7.5	8	30	**36**	9.9	2	100	**66**	10.8	1	100	**96**	11.4	1	100
7	7.7	5	47	**37**	9.9	2	100	**67**	10.8	1	100	**97**	11.4	1	100
8	7.8	3	100	**38**	10.0	2	100	**68**	10.9	1	100	**98**	11.5	1	100
9	8.0	5	47	**39**	10.0	2	100	**69**	10.9	1	100	**99**	11.5	1	100
10	8.1	3	100	**40**	10.1	2	100	**70**	10.9	1	100	**100**	11.5	1	100
11	8.2	3	100	**41**	10.1	1	100	**71**	10.9	1	100	**101**	11.5	1	100
12	8.4	5	47	**42**	10.2	1	100	**72**	10.9	1	100	**102**	11.5	1	100
13	8.5	3	100	**43**	10.2	1	100	**73**	11.0	1	100	**103**	11.6	1	100
14	8.6	3	100	**44**	10.3	1	100	**74**	11.0	1	100	**104**	11.6	1	100
15	8.7	3	100	**45**	10.3	1	100	**75**	11.0	1	100	**105**	11.6	1	100
16	8.8	3	100	**46**	10.3	1	100	**76**	11.0	1	100	**106**	11.6	1	100
17	8.9	3	100	**47**	10.3	1	100	**77**	11.0	1	100	**107**	11.6	1	100
18	9.0	3	100	**48**	10.4	1	100	**78**	11.1	1	100	**108**	11.7	1	100
19	9.1	3	100	**49**	10.4	1	100	**79**	11.1	1	100	**109**	11.7	1	100
20	9.2	3	100	**50**	10.4	1	100	**80**	11.1	1	100	**110**	11.7	1	100
21	9.2	1	100	**51**	10.4	1	100	**81**	11.1	1	100	**111**	11.7	1	100
22	9.3	1	100	**52**	10.5	1	100	**82**	11.1	1	100	**112**	11.7	1	100
23	9.3	1	100	**53**	10.5	1	100	**83**	11.2	1	100	**113**	11.8	1	100
24	9.4	1	100	**54**	10.6	1	100	**84**	11.2	1	100	**114**	11.8	1	100
25	9.4	1	100	**55**	10.6	1	100	**85**	11.2	1	100	**115**	11.8	1	100
26	9.4	1	100	**56**	10.6	1	100	**86**	11.2	0	100	**116**	11.8	1	100
27	9.5	1	100	**57**	10.6	1	100	**87**	11.2	0	100	**117**	11.8	1	100
28	9.5	1	100	**58**	10.7	1	100	**88**	11.2	0	100	**118**	11.9	1	100
29	9.6	1	100	**59**	10.7	1	100	**89**	11.2	0	100	**119**	11.9	1	100
30	9.6	1	100	**60**	10.7	1	100	**90**	11.2	0	100	**120**	11.9	1	100

Note:
Table continued on next page.

Note:
California Bearing Ratio (CBR) calculated using:
CBR = 292/DPI^1.12
where DPI = Dynamic Cone Penetration Index (mm/blow)
as suggested in ASTM D6951/D6951M-09

Gruening Middle School Earthquake Repairs
Eagle River, Alaska

CBR VALUES
IN B-07

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SHANNON & WILSON, INC.

FIG. B-15
Sheet 1 of 2

Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR
121	11.9	0	100	**151**				**181**				**211**				**241**				**271**			
122	11.9	0	100	**152**				**182**				**212**				**242**				**272**			
123	11.9	0	100	**153**				**183**				**213**				**243**				**273**			
124	11.9	0	100	**154**				**184**				**214**				**244**				**274**			
125	11.9	0	100	**155**				**185**				**215**				**245**				**275**			
126	11.9	1	100	**156**				**186**				**216**				**246**				**276**			
127	11.9	1	100	**157**				**187**				**217**				**247**				**277**			
128	12.0	1	100	**158**				**188**				**218**				**248**				**278**			
129	12.0	1	100	**159**				**189**				**219**				**249**				**279**			
130	12.0	1	100	**160**				**190**				**220**				**250**				**280**			
131	12.0	0	100	**161**				**191**				**221**				**251**				**281**			
132	12.0	0	100	**162**				**192**				**222**				**252**				**282**			
133	12.0	0	100	**163**				**193**				**223**				**253**				**283**			
134	12.0	0	100	**164**				**194**				**224**				**254**				**284**			
135	12.0	0	100	**165**				**195**				**225**				**255**				**285**			
136	12.0	0	100	**166**				**196**				**226**				**256**				**286**			
137	12.0	0	100	**167**				**197**				**227**				**257**				**287**			
138	12.0	0	100	**168**				**198**				**228**				**258**				**288**			
139	12.0	0	100	**169**				**199**				**229**				**259**				**289**			
140	12.0	0	100	**170**				**200**				**230**				**260**				**290**			
141	*REFUSAL			**171**				**201**				**231**				**261**				**291**			
142				**172**				**202**				**232**				**262**				**292**			
143				**173**				**203**				**233**				**263**				**293**			
144				**174**				**204**				**234**				**264**				**294**			
145				**175**				**205**				**235**				**265**				**295**			
146				**176**				**206**				**236**				**266**				**296**			
147				**177**				**207**				**237**				**267**				**297**			
148				**178**				**208**				**238**				**268**				**298**			
149				**179**				**209**				**239**				**269**				**299**			
150				**180**				**210**				**240**				**270**				**300**			

Note:
Refusal after 140 blows due to < 0.1 inches penetration within 10 blows.

Gruening Middle School Earthquake Repairs
Eagle River, Alaska

CBR VALUES
IN B-07 CONT'D

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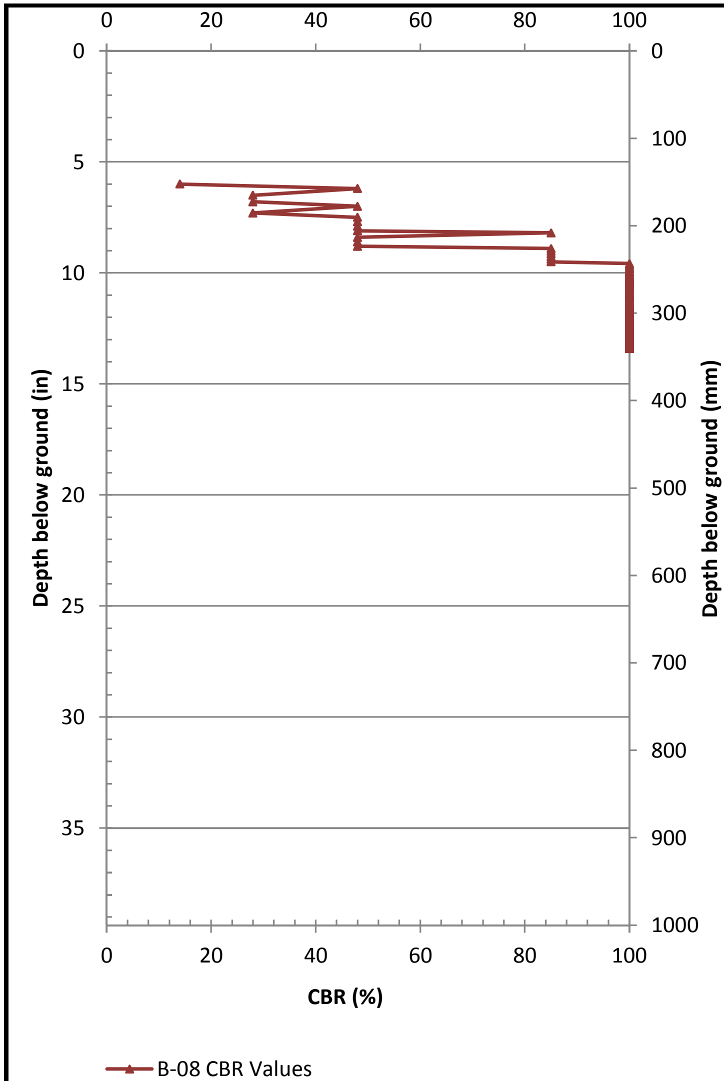
SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. B-15
Sheet 2 of 2



Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Num ber of	Depth (in)	DPI (mm/ blow)	CBR
1	6.0	15	14	**31**	10.2	1	100	**61**	11.6	1	100	**91**	12.5	0	100
2	6.2	5	48	**32**	10.3	1	100	**62**	11.6	1.0	100	**92**	12.5	0	100
3	6.5	8	28	**33**	10.3	1.0	100	**63**	11.7	1.0	100	**93**	12.6	0	100
4	6.8	8	28	**34**	10.4	1.0	100	**64**	11.7	1.0	100	**94**	12.6	0	100
5	7.0	5	48	**35**	10.4	1.0	100	**65**	11.7	1.0	100	**95**	12.6	0	100
6	7.3	8	28	**36**	10.4	1.0	100	**66**	11.7	1.0	100	**96**	12.6	0	100
7	7.5	5	48	**37**	10.5	1	100	**67**	11.8	1	100	**97**	12.6	1	100
8	7.7	5	48	**38**	10.5	1	100	**68**	11.8	1	100	**98**	12.7	1	100
9	7.9	5	48	**39**	10.6	1	100	**69**	11.9	1	100	**99**	12.7	1	100
10	8.1	5	48	**40**	10.6	1	100	**70**	11.9	1	100	**100**	12.7	1	100
11	8.2	3	85	**41**	10.7	2	100	**71**	11.9	1	100	**101**	12.7	1	100
12	8.4	5	48	**42**	10.7	2	100	**72**	12.0	1	100	**102**	12.7	1	100
13	8.6	5	48	**43**	10.8	2	100	**73**	12.0	1	100	**103**	12.8	1	100
14	8.8	5	48	**44**	10.8	2	100	**74**	12.1	1	100	**104**	12.8	1	100
15	8.9	3	85	**45**	10.9	2	100	**75**	12.1	1	100	**105**	12.8	1	100
16	9.0	3	85	**46**	10.9	1	100	**76**	12.1	1	100	**106**	12.8	1	100
17	9.1	3	85	**47**	11	1	100	**77**	12.1	1	100	**107**	12.8	1	100
18	9.3	3	85	**48**	11	1	100	**78**	12.2	1	100	**108**	12.9	1	100
19	9.4	3	85	**49**	11.1	1	100	**79**	12.2	1	100	**109**	12.9	1	100
20	9.5	3	85	**50**	11.1	1	100	**80**	12.2	1	100	**110**	12.9	1	100
21	9.6	2	100	**51**	11.2	2	100	**81**	12.2	1	100	**111**	12.9	1	100
22	9.7	2	100	**52**	11.2	2	100	**82**	12.3	1	100	**112**	12.9	1	100
23	9.7	2	100	**53**	11.3	2	100	**83**	12.3	1	100	**113**	13.0	1	100
24	9.8	2	100	**54**	11.3	2	100	**84**	12.4	1	100	**114**	13.0	1	100
25	9.9	2	100	**55**	11.4	2	100	**85**	12.4	1	100	**115**	13.0	1	100
26	10.0	2	100	**56**	11.4	1	100	**86**	12.4	1	100	**116**	13.0	0	100
27	10.0	2	100	**57**	11.5	1	100	**87**	12.4	1	100	**117**	13.0	0	100
28	10.1	2	100	**58**	11.5	1	100	**88**	12.5	1	100	**118**	13.0	0	100
29	10.1	2	100	**59**	11.6	1	100	**89**	12.5	1	100	**119**	13.0	0	100
30	10.2	2	100	**60**	11.6	1	100	**90**	12.5	1	100	**120**	13.0	0	100

Note:
Table continued on next page.

Note:
California Bearing Ratio (CBR) calculated using:
CBR = 292/DPI^1.12
where DPI = Dynamic Cone Penetration Index (mm/blow)
as suggested in ASTM D6951/D6951M-09

Gruening Middle School Earthquake Repairs
Eagle River, Alaska

CBR VALUES IN B-08

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SHANNON & WILSON, INC.

FIG. B-16
Sheet 1 of 2

Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR
121	13.0	1	100	**151**	13.4	0	100	**181**				**211**				**241**				**271**			
122	13.0	1	100	**152**	13.4	0	100	**182**				**212**				**242**				**272**			
123	13.1	1	100	**153**	13.4	0	100	**183**				**213**				**243**				**273**			
124	13.1	1	100	**154**	13.4	0	100	**184**				**214**				**244**				**274**			
125	13.1	1	100	**155**	13.4	0	100	**185**				**215**				**245**				**275**			
126	13.1	0	100	**156**	13.4	0	100	**186**				**216**				**246**				**276**			
127	13.1	0	100	**157**	13.4	0	100	**187**				**217**				**247**				**277**			
128	13.1	0	100	**158**	13.4	0	100	**188**				**218**				**248**				**278**			
129	13.1	0	100	**159**	13.4	0	100	**189**				**219**				**249**				**279**			
130	13.1	0	100	**160**	13.4	0	100	**190**				**220**				**250**				**280**			
131	13.1	1	100	**161**	*REFUSAL			**191**				**221**				**251**				**281**			
132	13.1	1	100	**162**				**192**				**222**				**252**				**282**			
133	13.2	1	100	**163**				**193**				**223**				**253**				**283**			
134	13.2	1	100	**164**				**194**				**224**				**254**				**284**			
135	13.2	1	100	**165**				**195**				**225**				**255**				**285**			
136	13.2	1	100	**166**				**196**				**226**				**256**				**286**			
137	13.2	1	100	**167**				**197**				**227**				**257**				**287**			
138	13.3	1	100	**168**				**198**				**228**				**258**				**288**			
139	13.3	1	100	**169**				**199**				**229**				**259**				**289**			
140	13.3	1	100	**170**				**200**				**230**				**260**				**290**			
141	13.3	1	100	**171**				**201**				**231**				**261**				**291**			
142	13.3	1	100	**172**				**202**				**232**				**262**				**292**			
143	13.4	1	100	**173**				**203**				**233**				**263**				**293**			
144	13.4	1	100	**174**				**204**				**234**				**264**				**294**			
145	13.4	1	100	**175**				**205**				**235**				**265**				**295**			
146	13.4	0	100	**176**				**206**				**236**				**266**				**296**			
147	13.4	0	100	**177**				**207**				**237**				**267**				**297**			
148	13.4	0	100	**178**				**208**				**238**				**268**				**298**			
149	13.4	0	100	**179**				**209**				**239**				**269**				**299**			
150	13.4	0	100	**180**				**210**				**240**				**270**				**300**			

Note:
Refusal after 160 blows due to < 0.1 inches penetration within 10 blows.

Gruening Middle School Earthquake Repairs
Eagle River, Alaska

CBR VALUES
IN B-08 CONT'D

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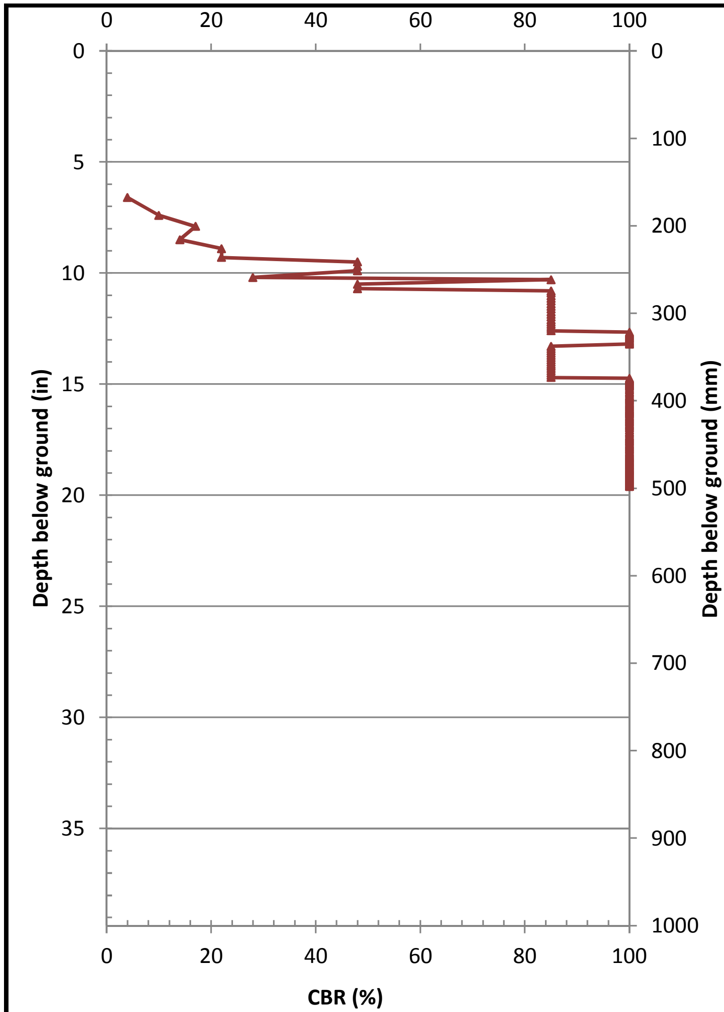
SHANNON & WILSON, INC. GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. B-16
Sheet 2 of 2



Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Number of	Depth (in)	DPI (mm/ blow)	CBR
1	6.6	46	4	**31**	12.7	2	100	**61**	14.9	1	100	**91**	16.7	2	100
2	7.4	20	10	**32**	12.7	2	100	**62**	15.0	1	100	**92**	16.7	2	100
3	7.9	13	17	**33**	12.8	2	100	**63**	15.0	1	100	**93**	16.8	2	100
4	8.5	15	14	**34**	12.8	2	100	**64**	15.1	1	100	**94**	16.8	2	100
5	8.9	10	22	**35**	12.9	2	100	**65**	15.1	1	100	**95**	16.9	2	100
6	9.3	10	22	**36**	13.0	2	100	**66**	15.2	2	100	**96**	17.0	2	100
7	9.5	5	48	**37**	13.0	2	100	**67**	15.3	2	100	**97**	17.1	2	100
8	9.7	5	48	**38**	13.1	2	100	**68**	15.3	2	100	**98**	17.1	2	100
9	9.9	5	48	**39**	13.1	2	100	**69**	15.4	2	100	**99**	17.2	2	100
10	10.2	8	28	**40**	13.2	2	100	**70**	15.5	2	100	**100**	17.3	2	100
11	10.3	3	85	**41**	13.3	3	85	**71**	15.6	2	100	**101**	17.4	2	100
12	10.5	5	48	**42**	13.4	3	85	**72**	15.6	2	100	**102**	17.4	2	100
13	10.7	5	48	**43**	13.5	3	85	**73**	15.7	2	100	**103**	17.5	2	100
14	10.8	3	85	**44**	13.6	3	85	**74**	15.7	2	100	**104**	17.5	2	100
15	10.9	3	85	**45**	13.7	3	85	**75**	15.8	2	100	**105**	17.6	2	100
16	11.0	3	85	**46**	13.8	3	85	**76**	15.9	2	100	**106**	17.7	2	100
17	11.1	3	85	**47**	13.9	3	85	**77**	15.9	2	100	**107**	17.7	2	100
18	11.3	3	85	**48**	14.0	3	85	**78**	16.0	2	100	**108**	17.8	2	100
19	11.4	3	85	**49**	14.1	3	85	**79**	16.0	2	100	**109**	17.8	2	100
20	11.5	3	85	**50**	14.2	3	85	**80**	16.1	2	100	**110**	17.9	2	100
21	11.6	3	85	**51**	14.3	3	85	**81**	16.1	1	100	**111**	18.0	2	100
22	11.7	3	85	**52**	14.4	3	85	**82**	16.2	1	100	**112**	18.0	2	100
23	11.9	3	85	**53**	14.5	3	85	**83**	16.2	1	100	**113**	18.1	2	100
24	12.0	3	85	**54**	14.6	3	85	**84**	16.3	1	100	**114**	18.1	2	100
25	12.1	3	85	**55**	14.7	3	85	**85**	16.3	1	100	**115**	18.2	2	100
26	12.2	3	85	**56**	14.7	1	100	**86**	16.4	2	100	**116**	18.2	1	100
27	12.3	3	85	**57**	14.8	1	100	**87**	16.4	2	100	**117**	18.3	1	100
28	12.4	3	85	**58**	14.8	1	100	**88**	16.5	2	100	**118**	18.3	1	100
29	12.5	3	85	**59**	14.9	1	100	**89**	16.5	2	100	**119**	18.4	1	100
30	12.6	3	85	**60**	14.9	1	100	**90**	16.6	2	100	**120**	18.4	1	100

Note:
Table continued on next page.

Note:
California Bearing Ratio (CBR) calculated using:
CBR = 292/DPI^1.12
where DPI = Dynamic Cone Penetration Index (mm/blow)
as suggested in ASTM D6951/D6951M-09

Gruening Middle School Earthquake Repairs
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CBR VALUES IN B-09

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SHANNON & WILSON, INC.

FIG. B-17
Sheet 1 of 2

Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR
121	18.4	1	100	**151**	19.5	1	100	**181**				**211**				**241**				**271**			
122	18.5	1	100	**152**	19.5	1	100	**182**				**212**				**242**				**272**			
123	18.5	1	100	**153**	19.6	1	100	**183**				**213**				**243**				**273**			
124	18.6	1	100	**154**	19.6	1	100	**184**				**214**				**244**				**274**			
125	18.6	1	100	**155**	19.6	1	100	**185**				**215**				**245**				**275**			
126	18.6	1	100	**156**	19.6	0	100	**186**				**216**				**246**				**276**			
127	18.7	1	100	**157**	19.6	0	100	**187**				**217**				**247**				**277**			
128	18.7	1	100	**158**	19.6	0	100	**188**				**218**				**248**				**278**			
129	18.8	1	100	**159**	19.6	0	100	**189**				**219**				**249**				**279**			
130	18.8	1	100	**160**	19.6	0	100	**190**				**220**				**250**				**280**			
131	18.8	1	100	**161**	19.6	0	100	**191**				**221**				**251**				**281**			
132	18.8	1	100	**162**	19.6	0	100	**192**				**222**				**252**				**282**			
133	18.9	1	100	**163**	19.6	0	100	**193**				**223**				**253**				**283**			
134	18.9	1	100	**164**	19.6	0	100	**194**				**224**				**254**				**284**			
135	18.9	1	100	**165**	19.6	0	100	**195**				**225**				**255**				**285**			
136	18.9	1	100	**166**	*REFUSAL			**196**				**226**				**256**				**286**			
137	19.0	1	100	**167**				**197**				**227**				**257**				**287**			
138	19.0	1	100	**168**				**198**				**228**				**258**				**288**			
139	19.1	1	100	**169**				**199**				**229**				**259**				**289**			
140	19.1	1	100	**170**				**200**				**230**				**260**				**290**			
141	19.1	1	100	**171**				**201**				**231**				**261**				**291**			
142	19.2	1	100	**172**				**202**				**232**				**262**				**292**			
143	19.2	1	100	**173**				**203**				**233**				**263**				**293**			
144	19.3	1	100	**174**				**204**				**234**				**264**				**294**			
145	19.3	1	100	**175**				**205**				**235**				**265**				**295**			
146	19.3	1	100	**176**				**206**				**236**				**266**				**296**			
147	19.4	1	100	**177**				**207**				**237**				**267**				**297**			
148	19.4	1	100	**178**				**208**				**238**				**268**				**298**			
149	19.5	1	100	**179**				**209**				**239**				**269**				**299**			
150	19.5	1	100	**180**				**210**				**240**				**270**				**300**			

Note:

*Refusal after 165 blows due to < 0.1 inches penetration within 10 blows.

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CBR VALUES
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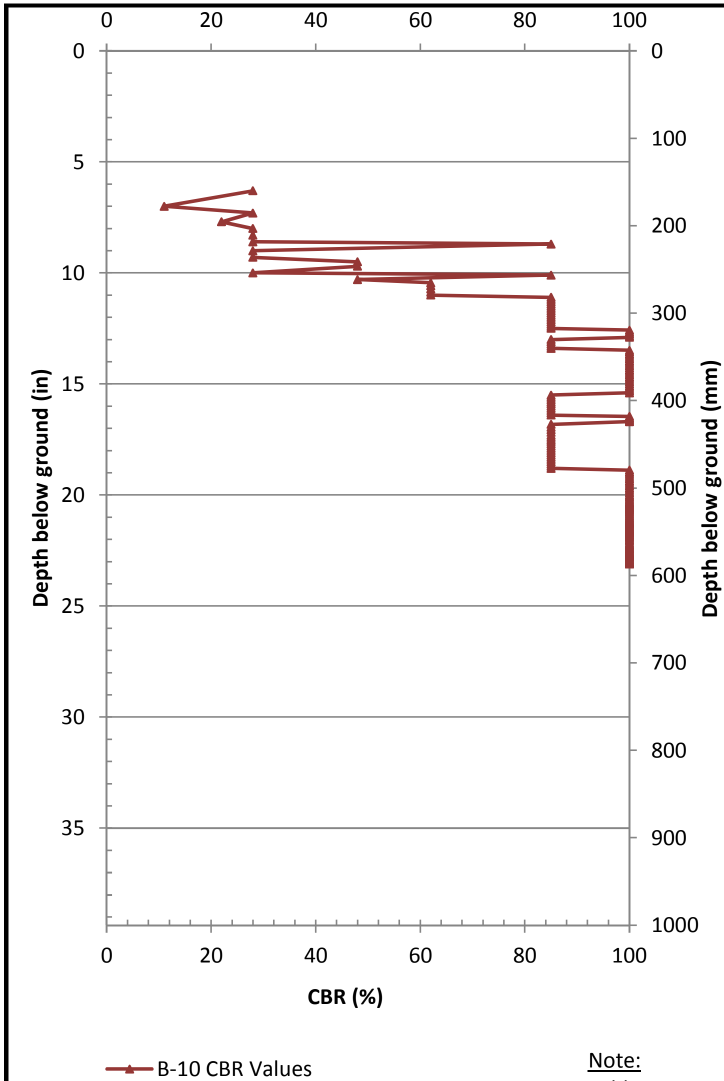
FIG. B-17
Sheet 2 of 2



Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Number of	Depth (in)	DPI (mm/ blow)	CBR
1	6.3	8	28	**31**	12.1	3	85	**61**	14.7	2	100	**91**	17.4	3	85
2	7.0	18	11	**32**	12.2	3	85	**62**	14.8	2	100	**92**	17.5	3	85
3	7.3	8	28	**33**	12.3	3	85	**63**	14.8	2	100	**93**	17.6	3	85
4	7.7	10	22	**34**	12.4	3	85	**64**	14.9	2	100	**94**	17.7	3	85
5	8.0	8	28	**35**	12.5	3	85	**65**	15.0	2	100	**95**	17.8	3	85
6	8.3	8	28	**36**	12.6	2	100	**66**	15.1	2	100	**96**	17.9	3	85
7	8.6	8	28	**37**	12.7	2	100	**67**	15.2	2	100	**97**	18.0	3	85
8	8.7	3	85	**38**	12.7	2	100	**68**	15.2	2	100	**98**	18.1	3	85
9	9.0	8	28	**39**	12.8	2	100	**69**	15.3	2	100	**99**	18.2	3	85
10	9.3	8	28	**40**	12.9	2	100	**70**	15.4	2	100	**100**	18.3	3	85
11	9.5	5	48	**41**	13.0	3	85	**71**	15.5	3	85	**101**	18.4	3	85
12	9.7	5	48	**42**	13.1	3	85	**72**	15.6	3	85	**102**	18.5	3	85
13	10.0	8	28	**43**	13.2	3	85	**73**	15.7	3	85	**103**	18.6	3	85
14	10.1	3	85	**44**	13.3	3	85	**74**	15.8	3	85	**104**	18.7	3	85
15	10.3	5	48	**45**	13.4	3	85	**75**	15.9	3	85	**105**	18.8	3	85
16	10.4	4	62	**46**	13.5	2	100	**76**	16.0	3	85	**106**	18.9	2	100
17	10.6	4	62	**47**	13.6	2	100	**77**	16.1	3	85	**107**	19.0	2	100
18	10.7	4	62	**48**	13.6	2	100	**78**	16.2	3	85	**108**	19.0	2	100
19	10.9	4	62	**49**	13.7	2	100	**79**	16.3	3	85	**109**	19.1	2	100
20	11.0	4	62.0	**50**	13.8	2	100	**80**	16.4	3	85	**110**	19.2	2	100
21	11.1	3	85	**51**	13.9	2	100	**81**	16.5	2	100	**111**	19.3	2	100
22	11.2	3	85	**52**	14.0	2	100	**82**	16.5	2	100	**112**	19.4	2	100
23	11.3	3	85	**53**	14.0	2	100	**83**	16.6	2	100	**113**	19.4	2	100
24	11.4	3	85	**54**	14.1	2	100	**84**	16.6	2	100	**114**	19.5	2	100
25	11.5	3	85	**55**	14.2	2	100	**85**	16.7	2	100	**115**	19.6	2	100
26	11.6	3	85	**56**	14.3	2	100	**86**	16.8	3	85	**116**	19.7	2	100
27	11.7	3	85	**57**	14.4	2	100	**87**	16.9	3	85	**117**	19.8	2	100
28	11.8	3	85	**58**	14.4	2	100	**88**	17.1	3	85	**118**	19.8	2	100
29	11.9	3	85	**59**	14.5	2	100	**89**	17.2	3	85	**119**	19.9	2	100
30	12.0	3	85	**60**	14.6	2	100	**90**	17.3	3	85	**120**	20.0	2	100

Note:
Table continued on next page.

Note:
California Bearing Ratio (CBR) calculated using:
CBR = 292/DPI^1.12
where DPI = Dynamic Cone Penetration Index (mm/blow)
as suggested in ASTM D6951/D6951M-09

Gruening Middle School Earthquake Repairs
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CBR VALUES IN B-10

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SHANNON & WILSON, INC.

FIG. B-18
Sheet 1 of 2

Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR
121	20.1	2	100	**151**	21.3	1	100	**181**	22.4	1	100	**211**	23.1	0	100	**241**				**271**			
122	20.1	2	100	**152**	21.4	1	100	**182**	22.5	1	100	**212**	23.1	0	100	**242**				**272**			
123	20.2	2	100	**153**	21.4	1	100	**183**	22.5	1	100	**213**	23.1	0	100	**243**				**273**			
124	20.2	2	100	**154**	21.5	1	100	**184**	22.6	1	100	**214**	23.1	0	100	**244**				**274**			
125	20.3	2	100	**155**	21.5	1	100	**185**	22.6	1	100	**215**	23.1	0	100	**245**				**275**			
126	20.3	1	100	**156**	21.5	1	100	**186**	22.6	1	100	**216**	*REFUSAL			**246**				**276**			
127	20.4	1	100	**157**	21.5	1	100	**187**	22.6	1	100	**217**				**247**				**277**			
128	20.4	1	100	**158**	21.6	1	100	**188**	22.7	1	100	**218**				**248**				**278**			
129	20.5	1	100	**159**	21.6	1	100	**189**	22.7	1	100	**219**				**249**				**279**			
130	20.5	1	100	**160**	21.6	1	100	**190**	22.7	1	100	**220**				**250**				**280**			
131	20.5	1	100	**161**	21.6	1	100	**191**	22.7	1	100	**221**				**251**				**281**			
132	20.6	1	100	**162**	21.6	1	100	**192**	22.7	1	100	**222**				**252**				**282**			
133	20.6	1	100	**163**	21.7	1	100	**193**	22.8	1	100	**223**				**253**				**283**			
134	20.7	1	100	**164**	21.7	1	100	**194**	22.8	1	100	**224**				**254**				**284**			
135	20.7	1	100	**165**	21.7	1	100	**195**	22.8	1	100	**225**				**255**				**285**			
136	20.8	2	100	**166**	21.7	1	100	**196**	22.8	1	100	**226**				**256**				**286**			
137	20.8	2	100	**167**	21.8	1	100	**197**	22.9	1	100	**227**				**257**				**287**			
138	20.9	2	100	**168**	21.8	1	100	**198**	22.9	1	100	**228**				**258**				**288**			
139	20.9	2	100	**169**	21.9	1	100	**199**	23.0	1	100	**229**				**259**				**289**			
140	21.0	2	100	**170**	21.9	1	100	**200**	23.0	1	100	**230**				**260**				**290**			
141	21.0	1	100	**171**	22.0	2	100	**201**	23.0	1	100	**231**				**261**				**291**			
142	21.1	1	100	**172**	22.0	2	100	**202**	23.0	1	100	**232**				**262**				**292**			
143	21.1	1	100	**173**	22.1	2	100	**203**	23.1	1	100	**233**				**263**				**293**			
144	21.2	1	100	**174**	22.1	2	100	**204**	23.1	1	100	**234**				**264**				**294**			
145	21.2	1	100	**175**	22.2	2	100	**205**	23.1	1	100	**235**				**265**				**295**			
146	21.2	1	100	**176**	22.2	1	100	**206**	23.1	0	100	**236**				**266**				**296**			
147	21.2	1	100	**177**	22.3	1	100	**207**	23.1	0	100	**237**				**267**				**297**			
148	21.3	1	100	**178**	22.3	1	100	**208**	23.1	0	100	**238**				**268**				**298**			
149	21.3	1	100	**179**	22.4	1	100	**209**	23.1	0	100	**239**				**269**				**299**			
150	21.3	1	100	**180**	22.4	1	100	**210**	23.1	0	100	**240**				**270**				**300**			

Note:

*Refusal after 215 blows due to <0.1 inches penetration within 10 blows.

Gruening Middle School Earthquake Repairs
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**CBR VALUES
IN B-10 CONT'D**

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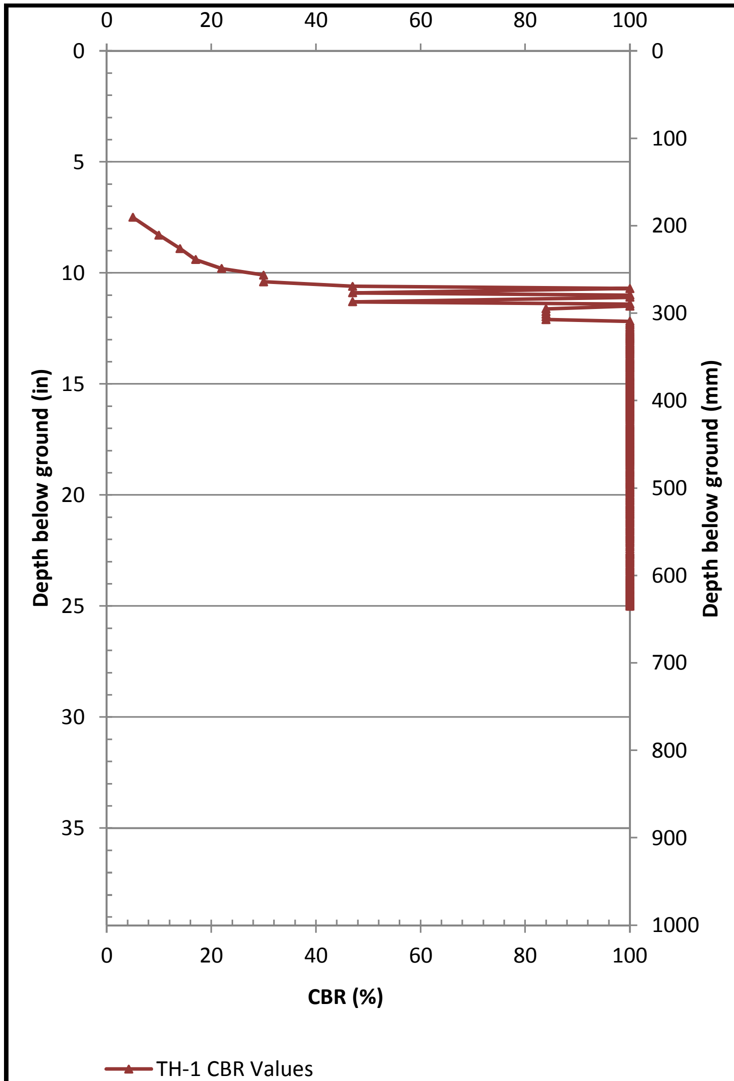
FIG. B-18
Sheet 2 of 2



Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Number of	Depth (in)	DPI (mm/ blow)	CBR
1	7.5	38	5	**31**	12.8	1	100	**61**	14.1	1	100	**91**	15.1	1	100
2	8.3	20	10	**32**	12.9	1	100	**62**	14.2	1	100	**92**	15.2	1	100
3	8.9	15	14	**33**	12.9	1	100	**63**	14.2	1	100	**93**	15.2	1	100
4	9.4	13	17	**34**	13.0	1	100	**64**	14.3	1	100	**94**	15.3	1	100
5	9.8	10	22	**35**	13.0	1	100	**65**	14.3	1	100	**95**	15.3	1	100
6	10.1	8	30	**36**	13.1	2	100	**66**	14.3	0	100	**96**	15.3	1	100
7	10.4	8	30	**37**	13.1	2	100	**67**	14.3	0	100	**97**	15.4	1	100
8	10.6	5	47	**38**	13.2	2	100	**68**	14.3	0	100	**98**	15.4	1	100
9	10.7	3	100	**39**	13.2	2	100	**69**	14.3	0	100	**99**	15.5	1	100
10	10.9	5	47	**40**	13.3	2	100	**70**	14.3	0	100	**100**	15.5	1	100
11	11.0	3	100	**41**	13.3	1	100	**71**	14.4	2	100	**101**	15.5	1	100
12	11.1	3	100	**42**	13.4	1	100	**72**	14.4	2	100	**102**	15.5	1	100
13	11.3	5	47	**43**	13.4	1	100	**73**	14.5	2	100	**103**	15.6	1	100
14	11.4	3	100	**44**	13.5	1	100	**74**	14.5	2	100	**104**	15.6	1	100
15	11.5	3	100	**45**	13.5	1	100	**75**	14.6	2	100	**105**	15.6	1	100
16	11.6	3	84	**46**	13.6	2	100	**76**	14.6	1	100	**106**	15.6	1	100
17	11.7	3	84	**47**	13.6	2	100	**77**	14.6	1	100	**107**	15.7	1	100
18	11.9	3	84	**48**	13.7	2	100	**78**	14.7	1	100	**108**	15.7	1	100
19	12.0	3	84	**49**	13.7	2	100	**79**	14.7	1	100	**109**	15.8	1	100
20	12.1	3	84	**50**	13.8	2	100	**80**	14.7	1	100	**110**	15.8	1	100
21	12.2	2	100	**51**	13.8	1	100	**81**	14.7	1	100	**111**	15.8	1	100
22	12.3	2	100	**52**	13.8	1	100	**82**	14.8	1	100	**112**	15.8	1	100
23	12.3	2	100	**53**	13.9	1	100	**83**	14.8	1	100	**113**	15.9	1	100
24	12.4	2	100	**54**	13.9	1	100	**84**	14.9	1	100	**114**	15.9	1	100
25	12.5	2	100	**55**	13.9	1	100	**85**	14.9	1	100	**115**	15.9	1	100
26	12.6	2	100	**56**	13.9	1	100	**86**	14.9	1	100	**116**	15.9	1	100
27	12.6	2	100	**57**	14.0	1	100	**87**	15.0	1	100	**117**	16.0	1	100
28	12.7	2	100	**58**	14.0	1	100	**88**	15.0	1	100	**118**	16.0	1	100
29	12.7	2	100	**59**	14.1	1	100	**89**	15.1	1	100	**119**	16.1	1	100
30	12.8	2	100	**60**	14.1	1	100	**90**	15.1	1	100	**120**	16.1	1	100

Note:
Table continued on next page.

Note:
California Bearing Ratio (CBR) calculated using:
CBR = 292/DPI^1.12
where DPI = Dynamic Cone Penetration Index (mm/blow)
as suggested in ASTM D6951/D6951M-09

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CBR VALUES IN TH-1

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SHANNON & WILSON, INC. GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. B-19
Sheet 1 of 3

Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR
121	16.1	1	100	**151**	17.3	1	100	**181**	18.6	2	100	**211**	20.2	2	100	**241**	21.9	2	100	**271**	23.6	1	100
122	16.2	1	100	**152**	17.4	1	100	**182**	18.6	2	100.0	**212**	20.2	2	100.0	**242**	21.9	2	100	**272**	23.7	1	100
123	16.2	1	100	**153**	17.4	1	100	**183**	18.7	2	100	**213**	20.3	2	100	**243**	22.0	2	100	**273**	23.7	1	100
124	16.3	1	100	**154**	17.5	1	100	**184**	18.7	2	100	**214**	20.3	2	100	**244**	22.0	2	100	**274**	23.8	1	100
125	16.3	1	100	**155**	17.5	1	100	**185**	18.8	2	100	**215**	20.4	2	100	**245**	22.1	2	100	**275**	23.8	1	100
126	16.3	1	100	**156**	17.5	1	100	**186**	18.8	1	100	**216**	20.5	1	100	**246**	22.2	2	100	**276**	23.8	1	100
127	16.4	1	100	**157**	17.6	1	100	**187**	18.9	1	100	**217**	20.5	1	100	**247**	22.3	2	100	**277**	23.9	1	100
128	16.4	1	100	**158**	17.6	1	100	**188**	18.9	1	100	**218**	20.6	1	100	**248**	22.3	2	100	**278**	23.9	1	100
129	16.5	1	100	**159**	17.7	1	100	**189**	19.0	1	100	**219**	20.6	1	100	**249**	22.4	2	100	**279**	24.0	1	100
130	16.5	1	100	**160**	17.7	1	100	**190**	19.0	1	100	**220**	20.7	1	100	**250**	22.5	2	100	**280**	24.0	1	100
131	16.6	2	100	**161**	17.7	1	100	**191**	19.1	2	100	**221**	20.7	1	100	**251**	22.5	1	100	**281**	24.0	1	100
132	16.6	2	100	**162**	17.8	1	100	**192**	19.1	2	100	**222**	20.8	1	100	**252**	22.6	1	100	**282**	24.1	1	100
133	16.7	2	100	**163**	17.8	1	100	**193**	19.2	2	100	**223**	20.8	1	100	**253**	22.6	1	100	**283**	24.1	1	100
134	16.7	2	100	**164**	17.9	1	100	**194**	19.2	2	100	**224**	20.9	1	100	**254**	22.7	1	100	**284**	24.2	1	100
135	16.8	2	100	**165**	17.9	1	100	**195**	19.3	2	100	**225**	20.9	1	100	**255**	22.7	1	100	**285**	24.2	1	100
136	16.8	1	100	**166**	17.9	1	100	**196**	19.3	1	100	**226**	21.0	2	100	**256**	22.8	2	100	**286**	24.2	1	100
137	16.8	1	100	**167**	18.0	1	100	**197**	19.4	1	100	**227**	21.0	2	100	**257**	22.8	2	100	**287**	24.2	1	100
138	16.9	1	100	**168**	18.0	1	100	**198**	19.4	1	100	**228**	21.1	2	100	**258**	22.9	2	100	**288**	24.3	1	100
139	16.9	1	100	**169**	18.1	1	100	**199**	19.5	1	100	**229**	21.1	2	100	**259**	22.9	2	100	**289**	24.3	1	100
140	16.9	1	100	**170**	18.1	1	100	**200**	19.5	1	100	**230**	21.2	2	100	**260**	23.0	2	100	**290**	24.3	1	100
141	16.9	1	100	**171**	18.1	1	100	**201**	19.6	2	100	**231**	21.3	2	100	**261**	23.1	2	100	**291**	24.3	1	100
142	17.0	1	100	**172**	18.2	1	100	**202**	19.6	2	100	**232**	21.3	2	100	**262**	23.1	2	100	**292**	24.4	1	100
143	17.0	1	100	**173**	18.2	1	100	**203**	19.7	2	100	**233**	21.4	2	100	**263**	23.2	2	100	**293**	24.4	1	100
144	17.1	1	100	**174**	18.3	1	100	**204**	19.7	2	100	**234**	21.4	2	100	**264**	23.2	2	100	**294**	24.5	1	100
145	17.1	1	100	**175**	18.3	1	100	**205**	19.8	2	100	**235**	21.5	2	100	**265**	23.3	2	100	**295**	24.5	1	100
146	17.1	1	100	**176**	18.3	1	100	**206**	19.9	2	100	**236**	21.6	2	100	**266**	23.4	2	100	**296**	24.5	1	100
147	17.2	1	100	**177**	18.4	1	100	**207**	19.9	2	100	**237**	21.6	2	100	**267**	23.4	2	100	**297**	24.5	1	100
148	17.2	1	100	**178**	18.4	1	100	**208**	20.0	2	100	**238**	21.7	2	100	**268**	23.5	2	100	**298**	24.6	1	100
149	17.3	1	100	**179**	18.5	1	100	**209**	20.0	2	100	**239**	21.7	2	100	**269**	23.5	2	100	**299**	24.6	1	100
150	17.3	1	100	**180**	18.5	1	100	**210**	20.1	2	100	**240**	21.8	2	100	**270**	23.6	2	100	**300**	24.6	1	100

Note:
Table continued on next page.

Gruening Middle School Earthquake Repairs
Eagle River, Alaska

CBR VALUES
IN TH-1 CONT'D

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SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. B-19
Sheet 2 of 3

Blow	Depth (in)	DPI (mm/ blow)	CBR
301	24.6	1	100
302	24.6	1	100
303	24.7	1	100
304	24.7	1	100
305	24.7	1	100
306	24.7	0	100
307	24.7	0	100
308	24.7	0	100
309	24.7	0	100
310	24.7	0	100
311	24.7	1	100
312	24.7	1	100
313	24.8	1	100
314	24.8	1	100
315	24.8	1	100
316	24.8	1	100
317	24.8	1	100
318	24.9	1	100
319	24.9	1	100
320	24.9	1	100
321	24.9	0	100
322	24.9	0	100
323	24.9	0	100
324	24.9	0	100
325	24.9	0	100
326	24.9	1	100
327	24.9	1	100
328	25.0	1	100
329	25.0	1	100
330	25.0	1	100

Blow	Depth (in)	DPI (mm/ blow)	CBR
331	25.0	0	100
332	25.0	0	100
333	25.0	0	100
334	25.0	0	100
335	25.0	0	100
336	25.0	0	100
337	25.0	0	100
338	25.0	0	100
339	25.0	0	100
340	25.0	0	100
341	*REFUSAL		
342			
343			
344			
345			
346			
347			
348			
349			
350			
351			
352			
353			
354			
355			
356			
357			
358			
359			
360			

Blow	Depth (in)	DPI (mm/ blow)	CBR
361			
362			
363			
364			
365			
366			
367			
368			
369			
370			
371			
372			
373			
374			
375			
376			
377			
378			
379			
380			
381			
382			
383			
384			
385			
386			
387			
388			
389			
390			

Blow	Depth (in)	DPI (mm/ blow)	CBR
391			
392			
393			
394			
395			
396			
397			
398			
399			
400			
401			
402			
403			
404			
405			
406			
407			
408			
409			
410			
411			
412			
413			
414			
415			
416			
417			
418			
419			
420			

Blow	Depth (in)	DPI (mm/ blow)	CBR
421			
422			
423			
424			
425			
426			
427			
428			
429			
430			
431			
432			
433			
434			
435			
436			
437			
438			
439			
440			
441			
442			
443			
444			
445			
446			
447			
448			
449			
450			

Blow	Depth (in)	DPI (mm/ blow)	CBR
451			
452			
453			
454			
455			
456			
457			
458			
459			
460			
461			
462			
463			
464			
465			
466			
467			
468			
469			
470			
471			
472			
473			
474			
475			
476			
477			
478			
479			
480			

Note:
*Refusal after 340 blows due to < 0.1 inches penetration within 10 blows.

Gruening Middle School Earthquake Repairs
Eagle River, Alaska

CBR VALUES
IN TH-1 CONT'D

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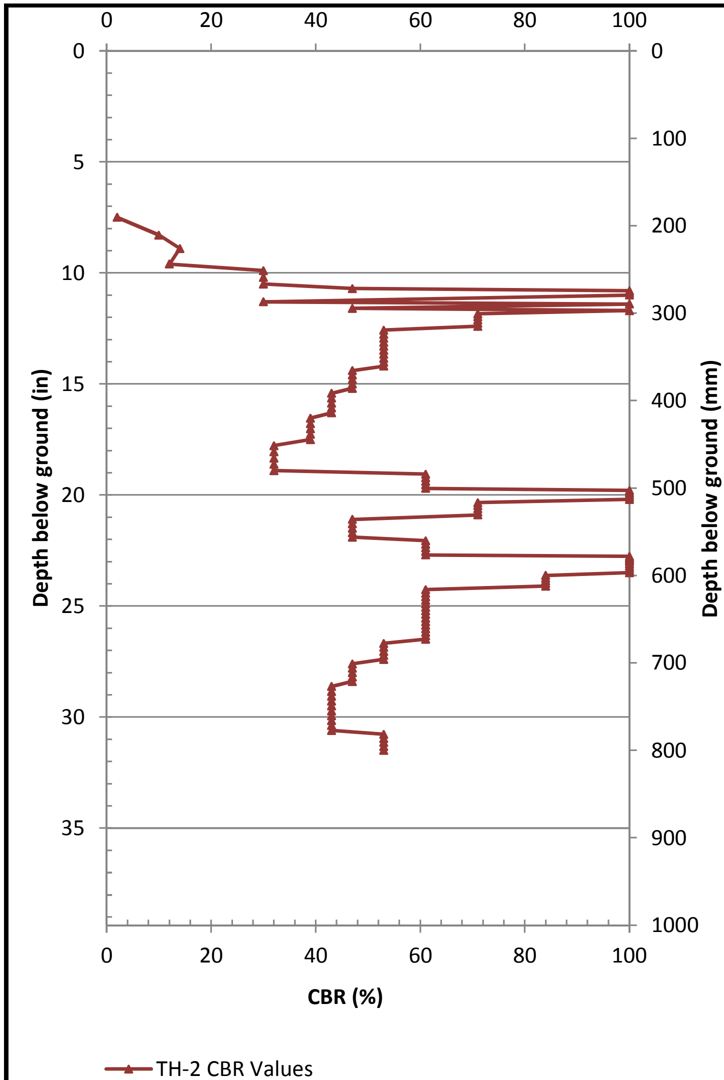
SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. B-19
Sheet 3 of 3



Blow	Depth (in)	DPI (mm/blow)	CBR	Blow	Depth (in)	DPI (mm/blow)	CBR	Blow	Depth (in)	DPI (mm/blow)	CBR	Number of	Depth (in)	DPI (mm/blow)	CBR
1	7.5	99	2	**31**	14.4	5	47	**61**	20.3	4	71	**91**	24.3	4	61
2	8.3	20	10	**32**	14.6	5	47.0	**62**	20.5	4	71	**92**	24.4	4	61
3	8.9	15	14	**33**	14.8	5	47	**63**	20.6	4	71	**93**	24.6	4	61
4	9.6	18	12	**34**	15.0	5	47	**64**	20.8	4	71	**94**	24.7	4	61
5	9.9	8	30	**35**	15.2	5	47	**65**	20.9	4	71	**95**	24.9	4	61
6	10.2	8	30	**36**	15.4	6	43	**66**	21.1	5	47	**96**	25.1	4	61
7	10.5	8	30	**37**	15.6	6	43	**67**	21.3	5	47	**97**	25.2	4	61
8	10.7	5	47	**38**	15.9	6	43	**68**	21.5	5	47	**98**	25.4	4	61
9	10.8	3	100	**39**	16.1	6	43	**69**	21.7	5	47	**99**	25.5	4	61
10	10.9	3	100	**40**	16.3	6	43	**70**	21.9	5	47	**100**	25.7	4	61
11	11.0	3	100	**41**	16.5	6	39	**71**	22.1	4	61	**101**	25.9	4	61
12	11.3	8	30	**42**	16.8	6	39	**72**	22.2	4	61	**102**	26.0	4	61
13	11.4	3	100	**43**	17.0	6	39	**73**	22.4	4	61	**103**	26.2	4	61
14	11.6	5	47	**44**	17.3	6	39	**74**	22.5	4	61	**104**	26.3	4	61
15	11.7	3	100	**45**	17.5	6	39	**75**	22.7	4	61	**105**	26.5	4	61
16	11.8	4	71	**46**	17.8	7	32	**76**	22.8	2	100	**106**	26.7	5	53
17	12.0	4	71	**47**	18.1	7	32	**77**	22.8	2	100	**107**	26.9	5	53
18	12.1	4	71	**48**	18.3	7	32	**78**	22.9	2	100	**108**	27.0	5	53
19	12.3	4	71	**49**	18.6	7	32	**79**	22.9	2	100	**109**	27.2	5	53
20	12.4	4	71	**50**	18.9	7	32	**80**	23	2	100	**110**	27.4	5	53
21	12.6	5	53	**51**	19.1	4	61	**81**	23.1	3	100	**111**	27.6	5	47
22	12.8	5	53	**52**	19.2	4	61	**82**	23.2	3	100	**112**	27.8	5	47
23	12.9	5	53	**53**	19.4	4	61	**83**	23.3	3	100	**113**	28.0	5	47
24	13.1	5	53	**54**	19.5	4	61	**84**	23.4	3	100	**114**	28.2	5	47
25	13.3	5	53	**55**	19.7	4	61	**85**	23.5	3	100	**115**	28.4	5	47
26	13.5	5	53	**56**	19.8	3	100	**86**	23.6	3	84	**116**	28.6	6	43
27	13.7	5	53	**57**	19.9	3	100	**87**	23.7	3	84	**117**	28.8	6	43
28	13.8	5	53	**58**	20.0	3	100	**88**	23.9	3	84	**118**	29.1	6	43
29	14.0	5	53	**59**	20.1	3	100	**89**	24	3	84	**119**	29.3	6	43
30	14.2	5	53	**60**	20.2	3	100	**90**	24.1	3	84	**120**	29.5	6	43

<u>Note:</u>
Table continued on next page.

<u>Note:</u>
California Bearing Ratio (CBR) calculated using:
CBR = 292/DPI^1.12
where DPI = Dynamic Cone Penetration Index (mm/blow)
as suggested in ASTM D6951/D6951M-09

Gruening Middle School Earthquake Repairs
Eagle River, Alaska

CBR VALUES IN TH-2

August 2019 | 103327-001

SHANNON & WILSON, INC. GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. B-20
Sheet 1 of 2

Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR
121	29.7	6	43	151				181			
122	29.9	6	43	152				182			
123	30.2	6	43	153				183			
124	30.4	6	43	154				184			
125	30.6	6	43	155				185			
126	30.8	5	53	156				186			
127	31.0	5	53	157				187			
128	31.1	5	53	158				188			
129	31.3	5	53	159				189			
130	31.5	5	53	160				190			
131	*END OF ROD			161				191			
132				162				192			
133				163				193			
134				164				194			
135				165				195			
136				166				196			
137				167				197			
138				168				198			
139				169				199			
140				170				200			
141				171				201			
142				172				202			
143				173				203			
144				174				204			
145				175				205			
146				176				206			
147				177				207			
148				178				208			
149				179				209			
150				180				210			

Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR
211				241				271			
212				242				272			
213				243				273			
214				244				274			
215				245				275			
216				246				276			
217				247				277			
218				248				278			
219				249				279			
220				250				280			
221				251				281			
222				252				282			
223				253				283			
224				254				284			
225				255				285			
226				256				286			
227				257				287			
228				258				288			
229				259				289			
230				260				290			
231				261				291			
232				262				292			
233				263				293			
234				264				294			
235				265				295			
236				266				296			
237				267				297			
238				268				298			
239				269				299			
240				270				300			

<u>Note:</u>
*Reached the end of the road after 130 blows.

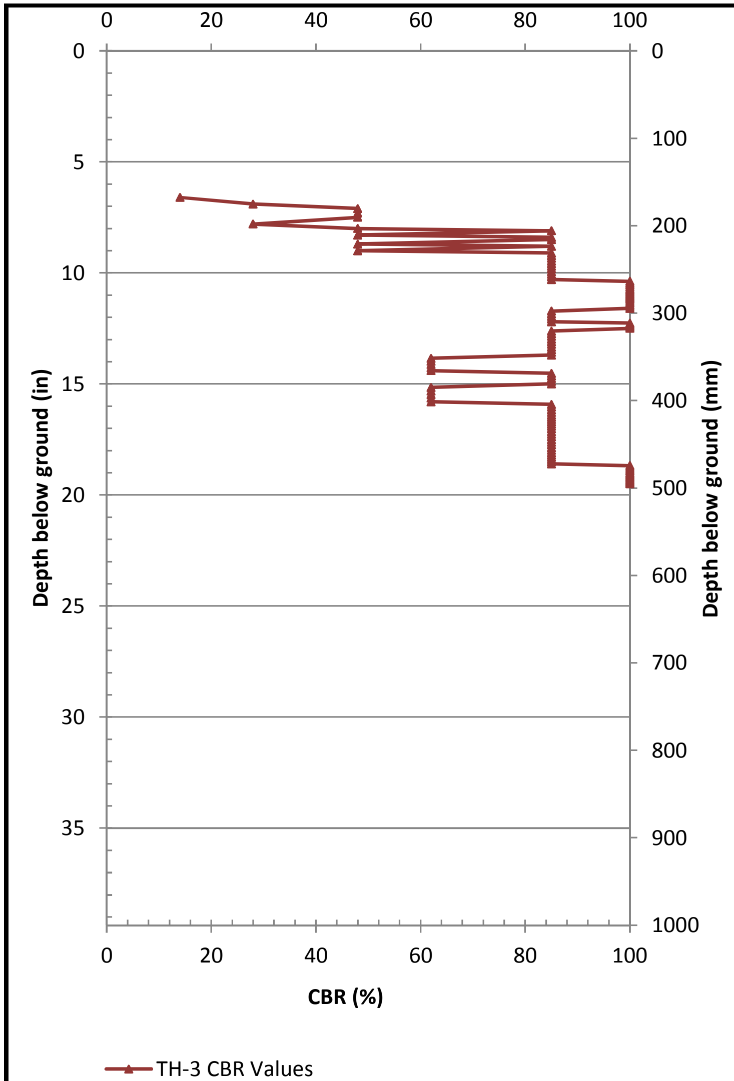
Gruening Middle School Earthquake Repairs
Eagle River, Alaska

CBR VALUES
IN TH-2 CONT'D

August 2019 | 103327-001

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. B-20
Sheet 2 of 2



Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Number of	Depth (in)	DPI (mm/ blow)	CBR
1	6.6	15	14	**31**	10.8	2	100	**61**	13.2	3	85	**91**	17.0	3	85
2	6.9	8	28	**32**	10.8	2	100	**62**	13.3	3.0	85	**92**	17.1	3	85
3	7.1	5	48	**33**	10.9	2	100	**63**	13.5	3.0	85	**93**	17.3	3	85
4	7.3	5	48	**34**	10.9	2	100	**64**	13.6	3.0	85	**94**	17.4	3	85
5	7.5	5	48	**35**	11.0	2	100	**65**	13.7	3.0	85	**95**	17.5	3	85
6	7.8	8	28	**36**	11.0	1	100	**66**	13.8	4.0	62	**96**	17.6	3	85
7	8.0	5	48	**37**	11.1	1	100.0	**67**	14.0	4	62	**97**	17.7	3	85
8	8.1	3	85	**38**	11.1	1	100	**68**	14.1	4	62	**98**	17.9	3	85
9	8.3	5	48	**39**	11.2	1	100	**69**	14.3	4	62	**99**	18.0	3	85
10	8.4	3	85	**40**	11.2	1	100	**70**	14.4	4	62	**100**	18.1	3	85
11	8.5	3	85	**41**	11.3	2	100	**71**	14.5	3	85	**101**	18.2	3	85
12	8.7	5	48	**42**	11.4	2	100	**72**	14.6	3	85	**102**	18.3	3	85
13	8.8	3	85	**43**	11.4	2	100	**73**	14.8	3	85	**103**	18.4	3	85
14	9.0	5	48	**44**	11.5	2	100	**74**	14.9	3	85	**104**	18.5	3	85
15	9.1	3	85	**45**	11.6	2	100	**75**	15.0	3	85	**105**	18.6	3	85
16	9.2	3	85	**46**	11.7	3	85	**76**	15.2	4	62	**106**	18.7	2	100
17	9.3	3	85	**47**	11.8	3	85	**77**	15.3	4	62	**107**	18.8	2	100
18	9.5	3	85	**48**	12	3	85	**78**	15.5	4	62	**108**	18.8	2	100
19	9.6	3	85	**49**	12.1	3	85	**79**	15.6	4	62	**109**	18.9	2	100
20	9.7	3	85.0	**50**	12.2	3	85	**80**	15.8	4	62	**110**	19.0	2	100
21	9.8	3	85	**51**	12.3	2	100	**81**	15.9	3	85	**111**	19.1	2	100
22	9.9	3	85	**52**	12.3	2	100	**82**	16.0	3	85	**112**	19.1	2	100
23	10.1	3	85	**53**	12.4	2	100	**83**	16.2	3	85	**113**	19.2	2	100
24	10.2	3	85	**54**	12.4	2	100	**84**	16.3	3	85	**114**	19.2	2	100
25	10.3	3	85	**55**	12.5	2	100	**85**	16.4	3	85	**115**	19.3	2	100
26	10.4	2	100	**56**	12.6	3	85	**86**	16.5	3	85	**116**	19.3	1	100
27	10.5	2	100	**57**	12.7	3	85	**87**	16.6	3	85	**117**	19.4	1	100
28	10.5	2	100	**58**	12.9	3	85	**88**	16.7	3	85	**118**	19.4	1	100
29	10.6	2	100	**59**	13	3	85	**89**	16.8	3	85	**119**	19.5	1	100
30	10.7	2	100	**60**	13.1	3	85	**90**	16.9	3	85	**120**	19.5	1	100

Note:
*Refusal after 120 blows due to rod leaning > 3 inches.

Note:
California Bearing Ratio (CBR) calculated using:
CBR = 292/DPI^1.12
where DPI = Dynamic Cone Penetration Index (mm/blow)
as suggested in ASTM D6951/D6951M-09

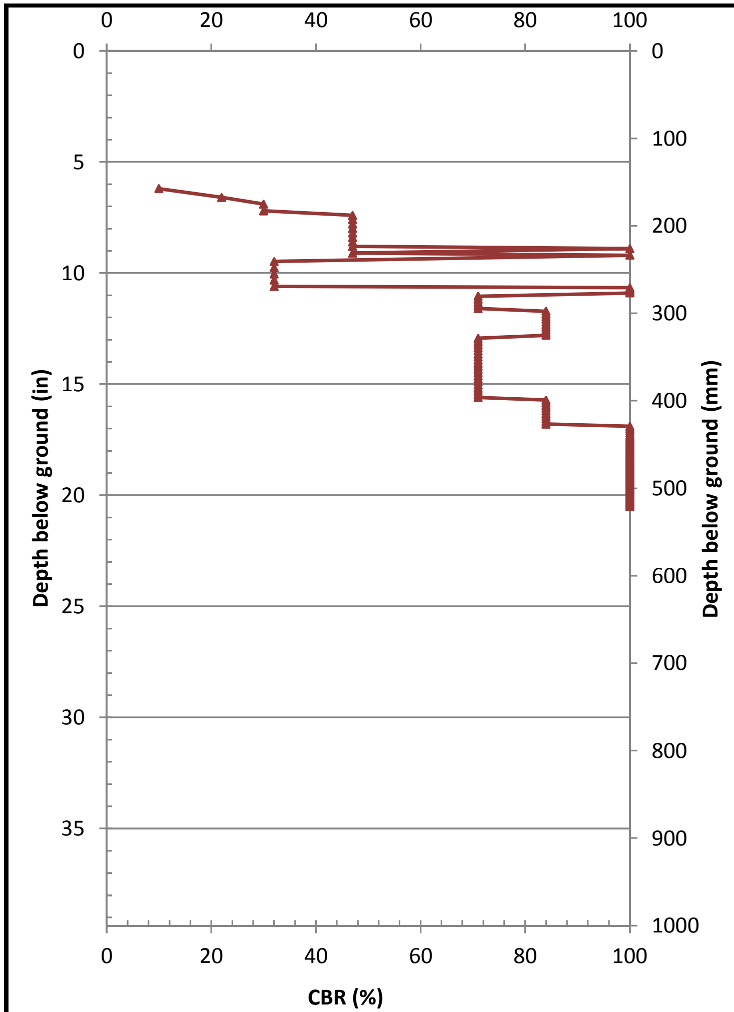
Gruening Middle School Earthquake Repairs
Eagle River, Alaska

CBR VALUES IN TH-3

August 2019 103327-001

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. B-21



Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Number of	Depth (in)	DPI (mm/ blow)	CBR
1	6.2	20	10	**31**	11.7	3	84	**61**	15.7	3	84	**91**	18.1	1	100
2	6.6	10	22	**32**	11.8	3	84	**62**	15.8	3	84	**92**	18.2	1	100
3	6.9	8	30	**33**	12.0	3	84	**63**	16.0	3	84	**93**	18.2	1	100
4	7.2	8	30	**34**	12.1	3	84	**64**	16.1	3	84	**94**	18.3	1	100
5	7.4	5	47	**35**	12.2	3	84	**65**	16.2	3	84	**95**	18.3	1	100
6	7.6	5	47	**36**	12.3	3	84	**66**	16.3	3	84	**96**	18.3	1	100
7	7.8	5	47	**37**	12.4	3	84	**67**	16.4	3	84	**97**	18.3	1	100
8	8.0	5	47	**38**	12.6	3	84	**68**	16.6	3	84	**98**	18.4	1	100
9	8.2	5	47	**39**	12.7	3	84	**69**	16.7	3	84	**99**	18.4	1	100
10	8.4	5	47	**40**	12.8	3	84	**70**	16.8	3	84	**100**	18.4	1	100
11	8.6	5	47	**41**	12.9	4	71	**71**	16.9	3	100	**101**	18.4	1	100
12	8.8	5	47	**42**	13.1	4	71	**72**	17.0	3	100	**102**	18.5	1	100
13	8.9	3	100	**43**	13.2	4	71	**73**	17.1	3	100	**103**	18.5	1	100
14	9.1	5	47	**44**	13.4	4	71	**74**	17.2	3	100	**104**	18.6	1	100
15	9.2	3	100	**45**	13.5	4	71	**75**	17.3	3	100	**105**	18.6	1	100
16	9.5	7	32	**46**	13.6	4	71	**76**	17.4	2	100	**106**	18.6	1	100
17	9.8	7	32	**47**	13.8	4	71	**77**	17.4	2	100	**107**	18.6	1	100
18	10.0	7	32	**48**	13.9	4	71	**78**	17.5	2	100	**108**	18.7	1	100
19	10.3	7	32	**49**	14.1	4	71	**79**	17.5	2	100	**109**	18.7	1	100
20	10.6	7	32	**50**	14.2	4	71	**80**	17.6	2	100	**110**	18.7	1	100
21	10.7	2	100	**51**	14.3	4	71	**81**	17.7	2	100	**111**	18.7	1	100
22	10.7	2	100	**52**	14.5	4	71	**82**	17.7	2	100	**112**	18.8	1	100
23	10.8	2	100	**53**	14.6	4	71	**83**	17.8	2	100	**113**	18.8	1	100
24	10.8	2	100	**54**	14.8	4	71	**84**	17.8	2	100	**114**	18.9	1	100
25	10.9	2	100	**55**	14.9	4	71	**85**	17.9	2	100	**115**	18.9	1	100
26	11.0	4	71	**56**	15.0	4	71	**86**	17.9	1	100	**116**	18.9	1	100
27	11.2	4	71	**57**	15.2	4	71	**87**	18.0	1	100	**117**	18.9	1	100
28	11.3	4	71	**58**	15.3	4	71	**88**	18.0	1	100	**118**	19.0	1	100
29	11.5	4	71	**59**	15.5	4	71	**89**	18.1	1	100	**119**	19.0	1	100
30	11.6	4	71	**60**	15.6	4	71	**90**	18.1	1	100	**120**	19.0	1	100

Note:
Table continued on next page.

Note:
California Bearing Ratio (CBR) calculated using:
CBR = 292/DPI^1.12
where DPI = Dynamic Cone Penetration Index (mm/blow)
as suggested in ASTM D6951/D6951M-09

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CBR VALUES IN TH-4

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FIG. B-22
Sheet 1 of 2

Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR	Blow	Depth (in)	DPI (mm/ blow)	CBR
121	19.0	1	100	**151**	19.6	1	100	**181**	20.2	1	100	**211**	*REFUSAL			**241**				**271**			
122	19.0	1	100	**152**	19.6	1	100	**182**	20.2	1	100	**212**				**242**				**272**			
123	19.1	1	100	**153**	19.7	1	100	**183**	20.3	1	100	**213**				**243**				**273**			
124	19.1	1	100	**154**	19.7	1	100	**184**	20.3	1	100	**214**				**244**				**274**			
125	19.1	1	100	**155**	19.7	1	100	**185**	20.3	1	100	**215**				**245**				**275**			
126	19.1	1	100	**156**	19.7	1	100	**186**	20.3	0	100	**216**				**246**				**276**			
127	19.1	1	100	**157**	19.7	1	100	**187**	20.3	0	100	**217**				**247**				**277**			
128	19.2	1	100	**158**	19.8	1	100	**188**	20.3	0	100	**218**				**248**				**278**			
129	19.2	1	100	**159**	19.8	1	100	**189**	20.3	0	100	**219**				**249**				**279**			
130	19.2	1	100	**160**	19.8	1	100	**190**	20.3	0	100	**220**				**250**				**280**			
131	19.2	1	100	**161**	19.8	1	100	**191**	20.3	1	100	**221**				**251**				**281**			
132	19.2	1	100	**162**	19.8	1	100	**192**	20.3	1	100	**222**				**252**				**282**			
133	19.3	1	100	**163**	19.9	1	100	**193**	20.4	1	100	**223**				**253**				**283**			
134	19.3	1	100	**164**	19.9	1	100	**194**	20.4	1	100	**224**				**254**				**284**			
135	19.3	1	100	**165**	19.9	1	100	**195**	20.4	1	100	**225**				**255**				**285**			
136	19.3	1	100	**166**	19.9	1	100	**196**	20.4	1	100	**226**				**256**				**286**			
137	19.3	1	100	**167**	19.9	1	100	**197**	20.4	1	100	**227**				**257**				**287**			
138	19.4	1	100	**168**	20.0	1	100	**198**	20.5	1	100	**228**				**258**				**288**			
139	19.4	1	100	**169**	20.0	1	100	**199**	20.5	1	100	**229**				**259**				**289**			
140	19.4	1	100	**170**	20.0	1	100	**200**	20.5	1	100	**230**				**260**				**290**			
141	19.4	0	100	**171**	20.0	1	100	**201**	20.5	0	100	**231**				**261**				**291**			
142	19.4	0	100	**172**	20.0	1	100	**202**	20.5	0	100	**232**				**262**				**292**			
143	19.4	0	100	**173**	20.1	1	100	**203**	20.5	0	100	**233**				**263**				**293**			
144	19.4	0	100	**174**	20.1	1	100	**204**	20.5	0	100	**234**				**264**				**294**			
145	19.4	0	100	**175**	20.1	1	100	**205**	20.5	0	100	**235**				**265**				**295**			
146	19.4	1	100	**176**	20.1	1	100	**206**	20.5	0	100	**236**				**266**				**296**			
147	19.5	1	100	**177**	20.1	1	100	**207**	20.5	0	100	**237**				**267**				**297**			
148	19.5	1	100	**178**	20.2	1	100	**208**	20.5	0	100	**238**				**268**				**298**			
149	19.6	1	100	**179**	20.2	1	100	**209**	20.5	0	100	**239**				**269**				**299**			
150	19.6	1	100	**180**	20.2	0.508	100	**210**	20.5	0	100	**240**				**270**				**300**			

Note:

*Refusal after 210 blows due to <0.1 inches pentration within 10 blows.

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CBR VALUES IN TH-4 CONT'D

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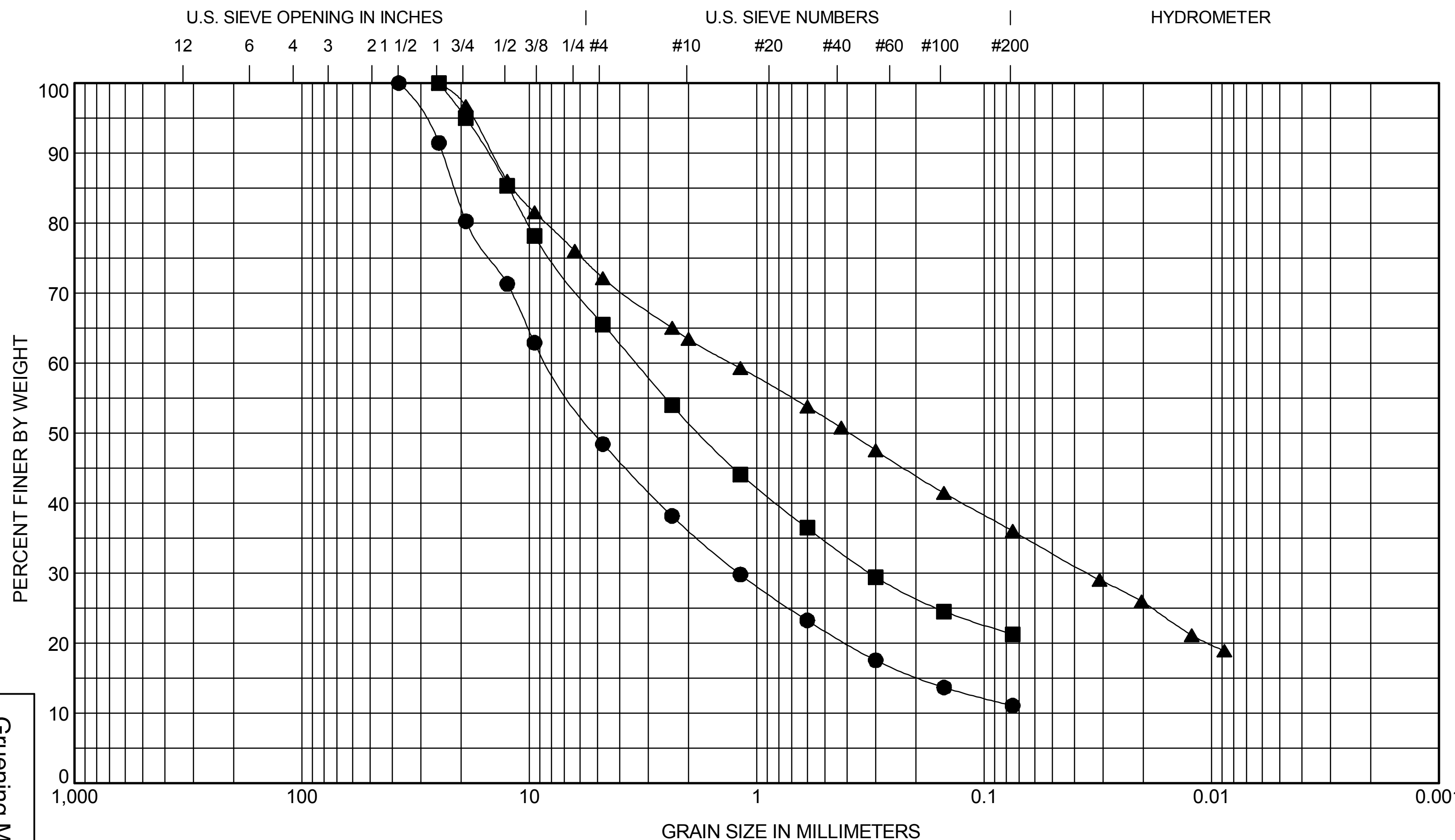
FIG. B-22
Sheet 2 of 2



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample	Depth, Ft	Classification	LL	PL	PI	Cc	Cu
●	B-01 S2	2.5 - 4.0	**Poorly Graded Gravel with Silt and Sand (GP-GM)**				3.1	146.8
■	B-01 S6	15.0 - 16.5	**Silty Sand with Gravel (SM)**					
▲	B-02 S4	7.5 - 9.0	**Silty Sand with Gravel (SM)**					

	Sample	Depth, Ft	D100	D60	D30	D10	%Gravel	%Sand	%Silt / %Clay
●	B-01 S2	2.5 - 4.0	37.5	8.27	1.2		52	37	11
■	B-01 S6	15.0 - 16.5	25	3.4	0.32		34	44	21
▲	B-02 S4	7.5 - 9.0	25	1.29	0.04		28	36	36

Gruening Middle School Earthquake Repairs
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FIG. B-23
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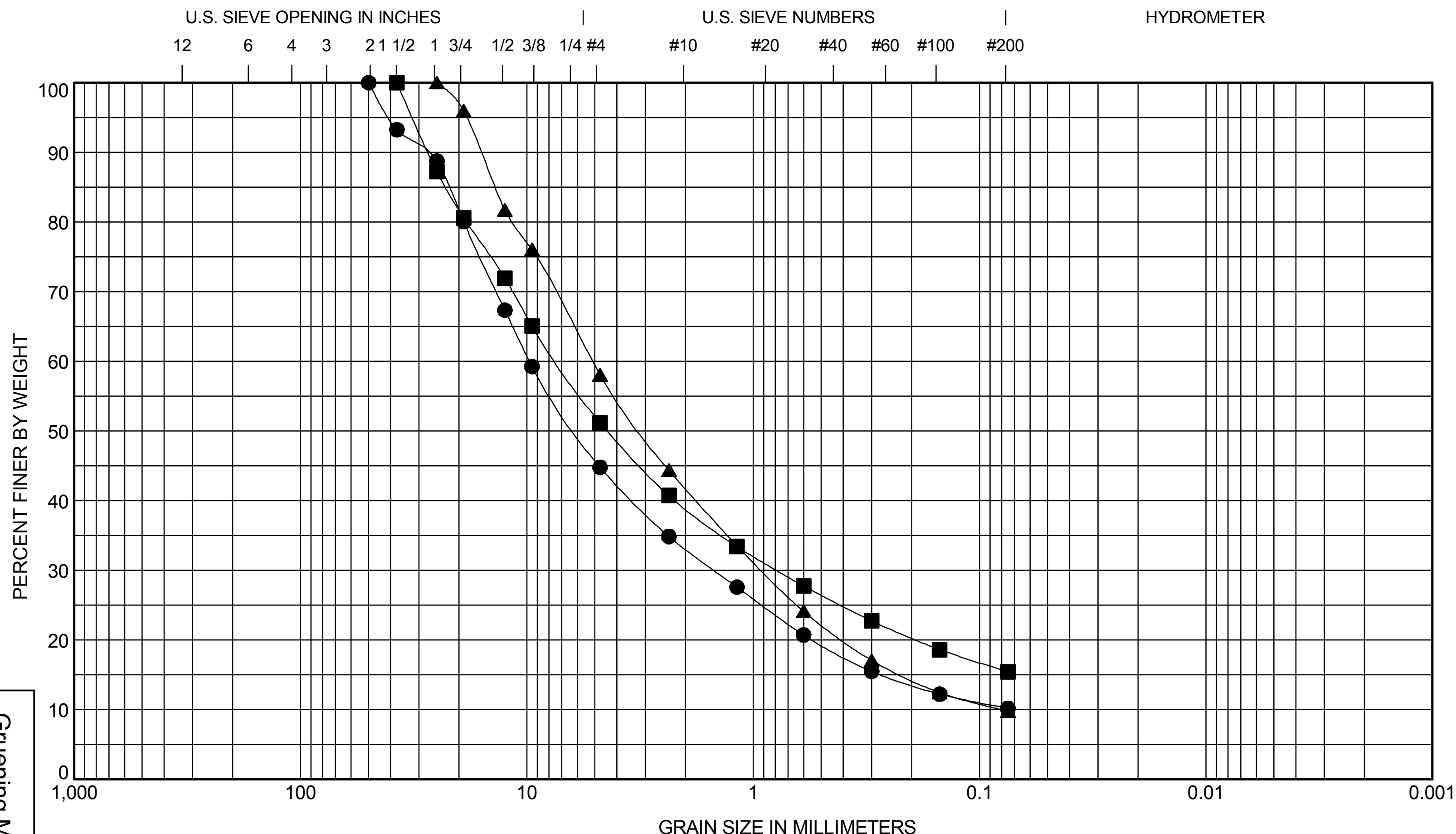

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample	Depth, Ft	Classification	LL	PL	PI	Cc	Cu
●	B-03 S1	0.0 - 1.5	**Poorly Graded Gravel with Silt and Sand (GP-GM)**				3.2	138.3
■	B-03 S3	5.0 - 6.5	**Silty Gravel with Sand (GM)**					
▲	B-04 S3	5.0 - 6.5	**Well-Graded Sand with Silt and Gravel (SW-SM)**				2.1	64.5

	Sample	Depth, Ft	D100	D60	D30	D10	%Gravel	%Sand	%Silt / %Clay
●	B-03 S1	0.0 - 1.5	50	9.74	1.49		55	35	10
■	B-03 S3	5.0 - 6.5	37.5	7.38	0.78		49	36	15
▲	B-04 S3	5.0 - 6.5	25	5.12	0.92	0.08	42	48	10

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FIG. B-23
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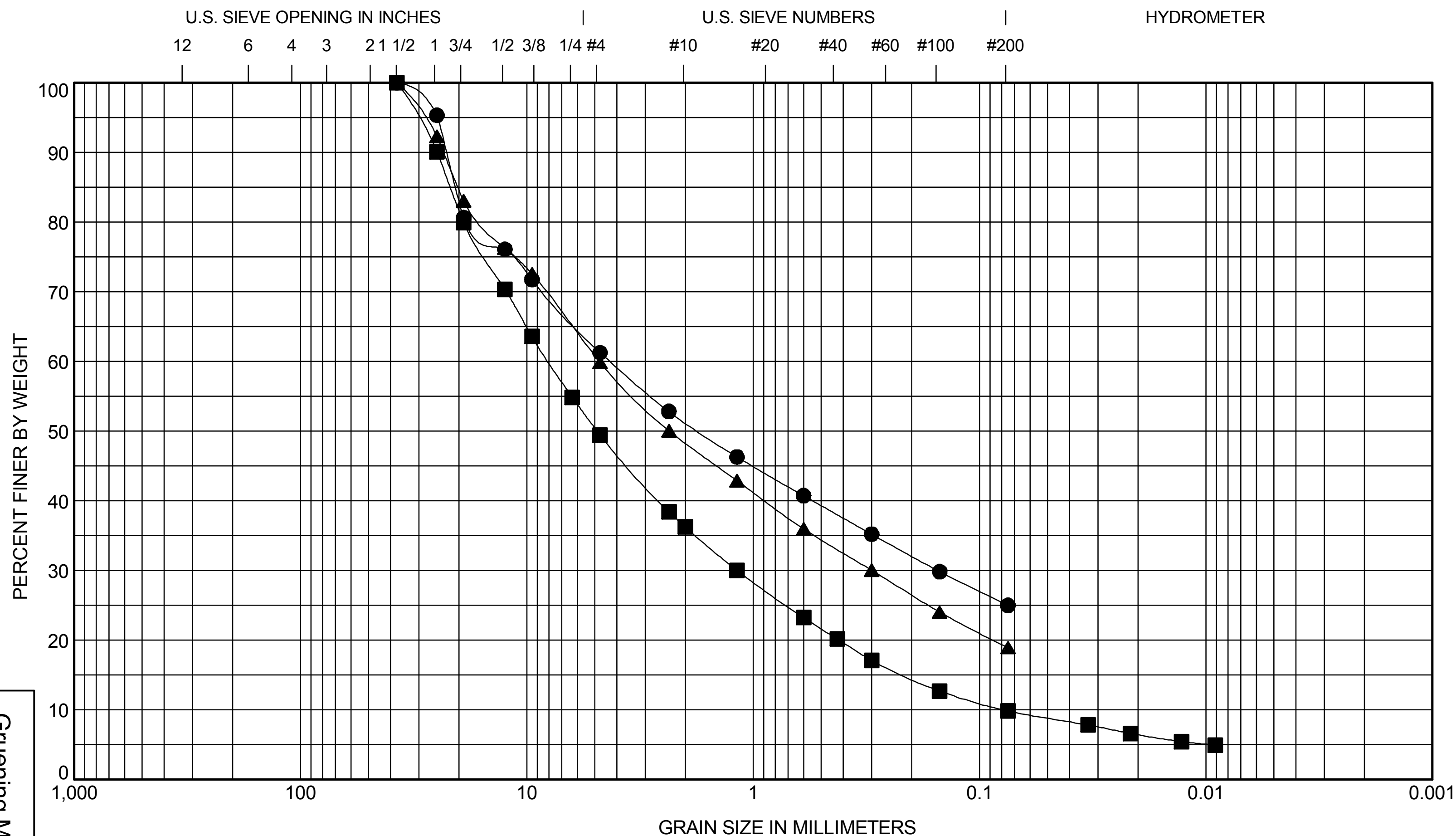

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample	Depth, Ft	Classification	LL	PL	PI	Cc	Cu
●	**B-04 S5**	**10.0 - 11.5**	**Silty Gravel with Sand (GM)**					
■	**B-05 S3**	**5.0 - 6.5**	**Well-Graded Gravel with Silt and Sand (GW-GM)**				**2.2**	**102.5**
▲	**B-05 S6**	**15.0 - 16.5**	**Silty Sand with Gravel (SM)**					

	Sample	Depth, Ft	D100	D60	D30	D10	%Gravel	%Sand	%Silt / %Clay
●	**B-04 S5**	**10.0 - 11.5**	**37.5**	**4.28**	**0.15**		**39**	**36**	**25**
■	**B-05 S3**	**5.0 - 6.5**	**37.5**	**8.03**	**1.18**	**0.08**	**51**	**40**	**10**
▲	**B-05 S6**	**15.0 - 16.5**	**37.5**	**4.79**	**0.3**		**40**	**41**	**19**

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FIG. B-23
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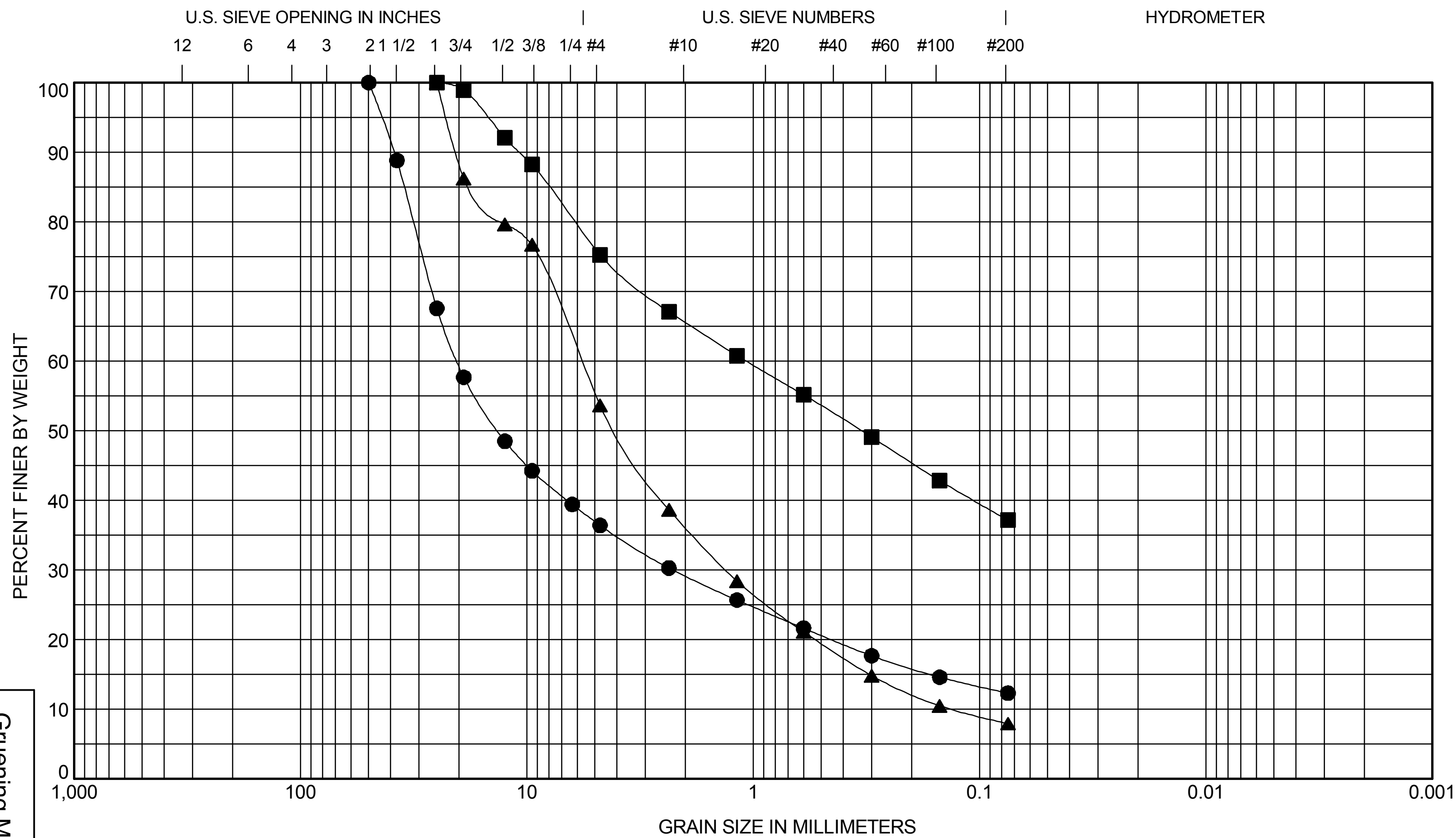

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample		Depth, Ft	Classification	LL	PL	PI	Cc	Cu
●	**B-06 S1**	**0.0 - 1.5**	**Poorly Graded Gravel with Silt and Sand (GP-GM)**				**6.8**	**542.6**
■	**B-06 S4**	**7.5 - 9.0**	**Silty Sand with Gravel (SM)**					
▲	**B-07 S1A**	**0.4 - 1.9**	**Well-Graded Sand with Silt and Gravel (SW-SM)**				**2.3**	**43.6**

Sample		Depth, Ft	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-06 S1**	**0.0 - 1.5**	**50**	**20.27**	**2.27**		**64**	**24**	**12**	
■	**B-06 S4**	**7.5 - 9.0**	**25**	**1.07**			**25**	**38**	**37**	
▲	**B-07 S1A**	**0.4 - 1.9**	**25**	**5.75**	**1.32**	**0.13**	**46**	**46**	**8**	

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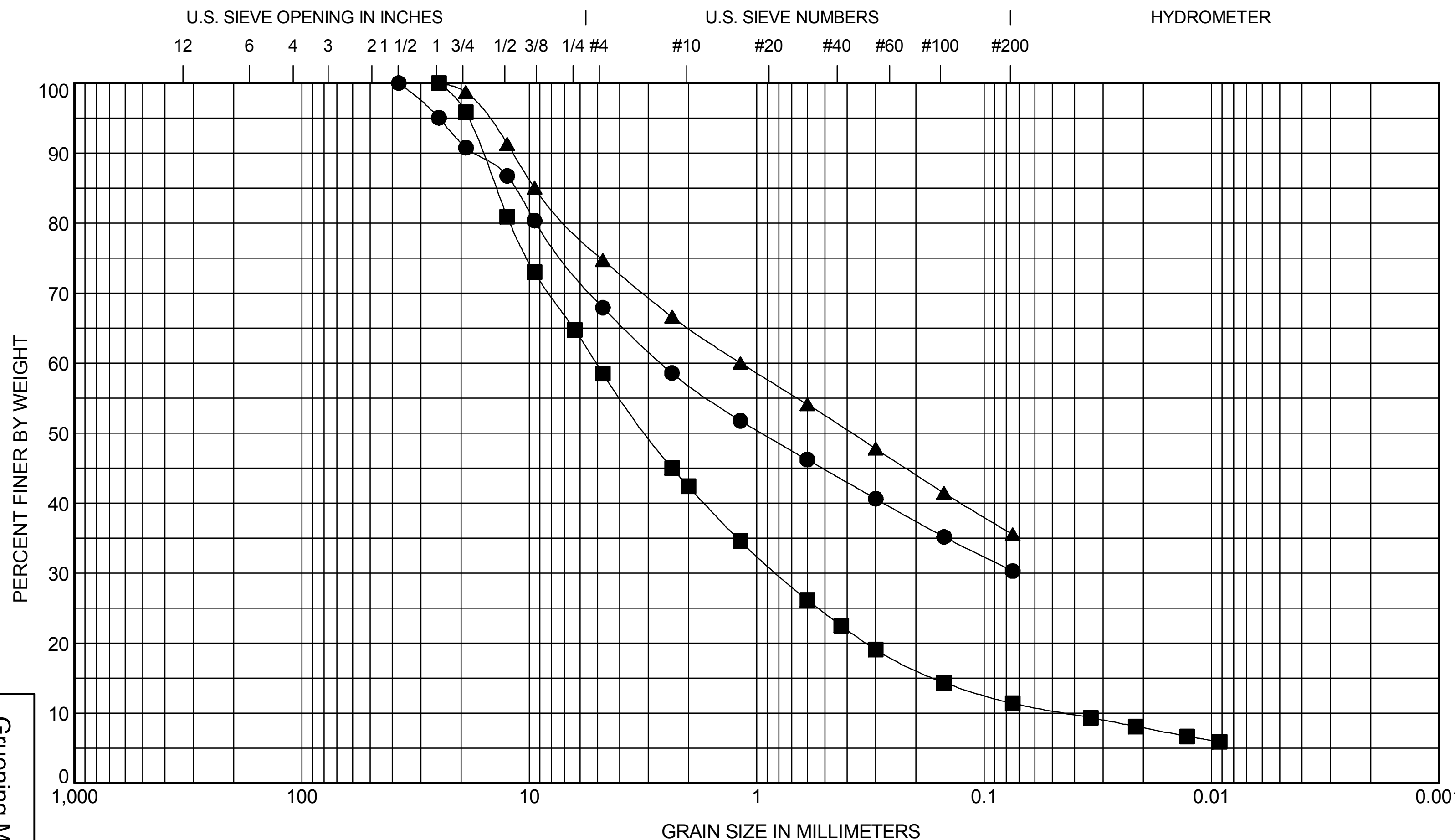
FIG. B-23
Sheet 4 of 7



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample		Depth, Ft	Classification	LL	PL	PI	Cc	Cu
●	**B-07 S4**	**7.5 - 9.0**	**Silty Sand with Gravel (SM)**					
■	**B-08 S2**	**2.5 - 4.0**	**Well-Graded Sand with Silt and Gravel (SW-SM)**				**3.0**	**116.1**
▲	**B-08 S5**	**10.0 - 11.5**	**Silty Sand with Gravel (SM)**					

Sample		Depth, Ft	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-07 S4**	**7.5 - 9.0**	**37.5**	**2.62**			**32**	**38**	**30**	
■	**B-08 S2**	**2.5 - 4.0**	**25**	**5.09**	**0.82**	**0.04**	**42**	**47**	**11**	
▲	**B-08 S5**	**10.0 - 11.5**	**25**	**1.18**			**25**	**39**	**36**	

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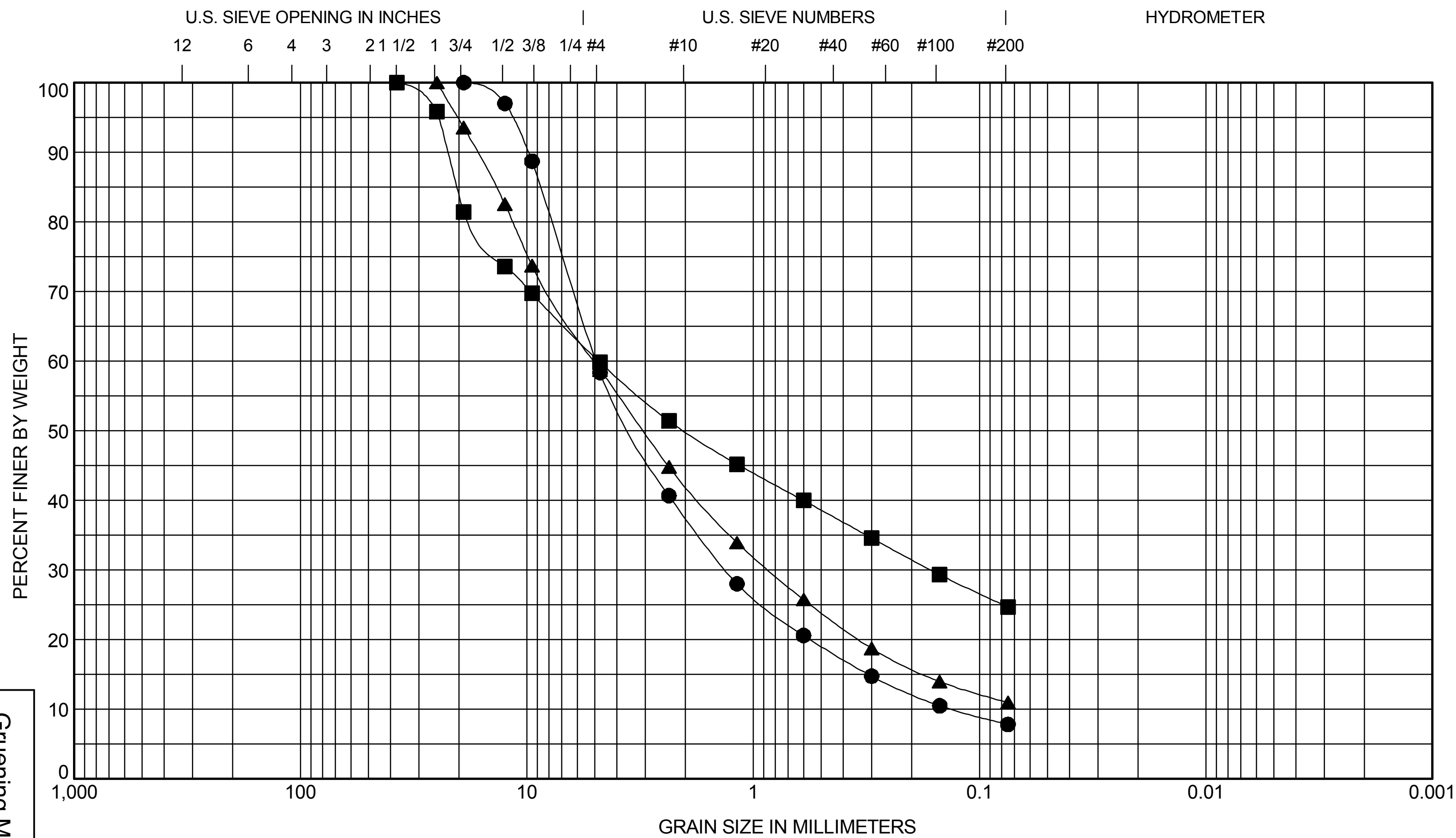
FIG. B-23
Sheet 5 of 7



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample		Depth, Ft	Classification	LL	PL	PI	Cc	Cu
●	**B-09 S1A**	**0.4 - 1.9**	**Well-Graded Sand with Silt and Gravel (SW-SM)**				**2.7**	**37.2**
■	**B-09 S5**	**10.0 - 11.5**	**Silty Gravel with Sand (GM)**					
▲	**B-10 S2A**	**2.5 - 4.0**	**Well-Graded Sand with Silt and Gravel (SW-SM)**				**2.4**	**83.7**

Sample		Depth, Ft	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-09 S1A**	**0.4 - 1.9**	**19**	**4.93**	**1.32**	**0.13**	**42**	**51**	**8**	
■	**B-09 S5**	**10.0 - 11.5**	**37.5**	**4.82**	**0.16**		**40**	**35**	**25**	
▲	**B-10 S2A**	**2.5 - 4.0**	**25**	**5.04**	**0.85**		**41**	**48**	**11**	

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FIG. B-23
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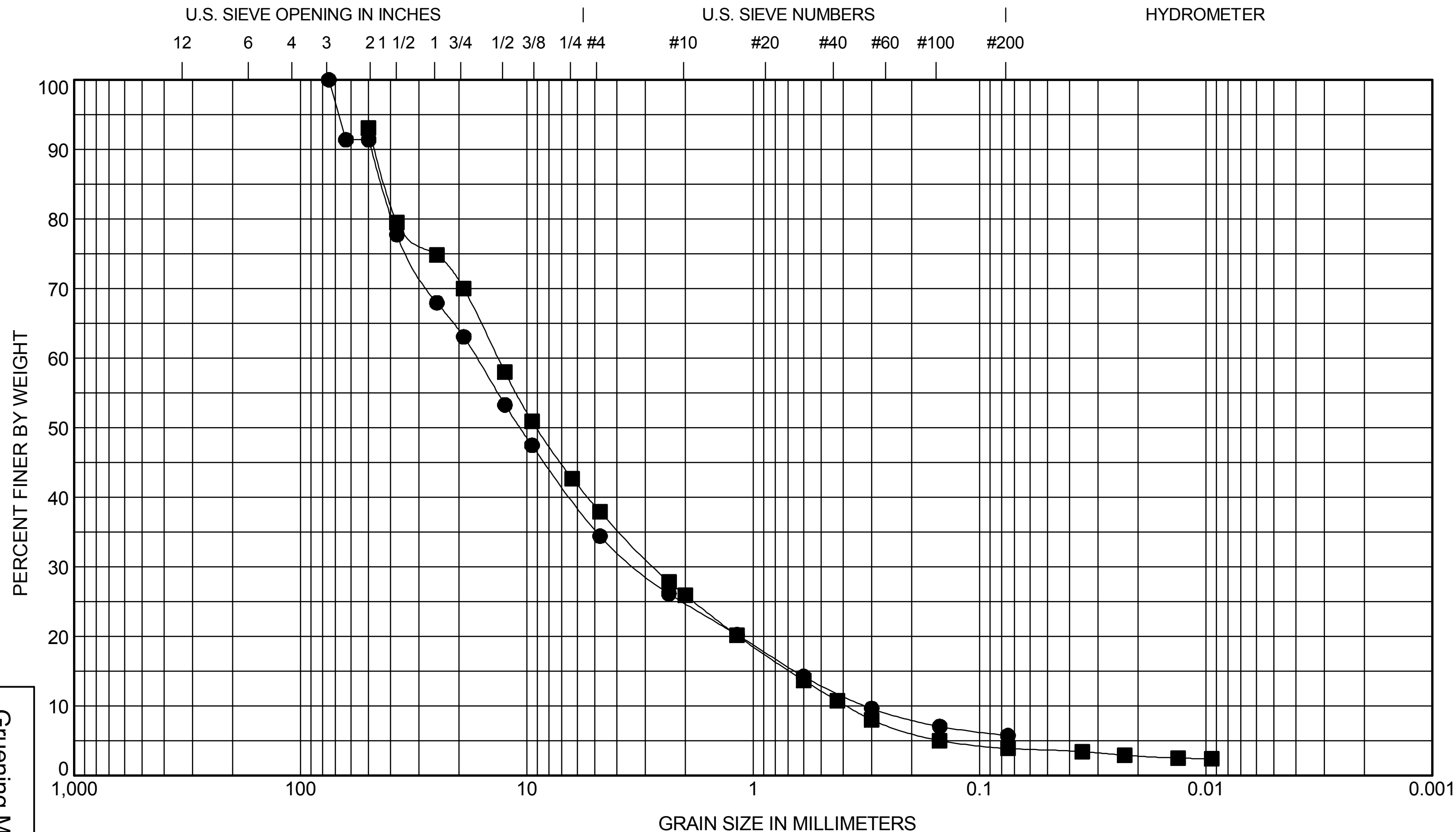

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample	Depth, Ft	Classification	LL	PL	PI	Cc	Cu
●	**TP-1 S3**	**3.8 - 5.3**	**Well-Graded Gravel with Silt and Sand (GW-GM)**				**2.0**	**52.6**
■	**TP-2 S3**	**5.8 - 6.2**	**Well-Graded Gravel with Sand (GW)**				**1.4**	**34.7**

	Sample	Depth, Ft	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**TP-1 S3**	**3.8 - 5.3**	**75**	**16.67**	**3.27**	**0.32**	**66**	**29**	**6**	
■	**TP-2 S3**	**5.8 - 6.2**	**50**	**13.42**	**2.74**	**0.39**	**55**	**34**	**4**	

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FIG. B-23
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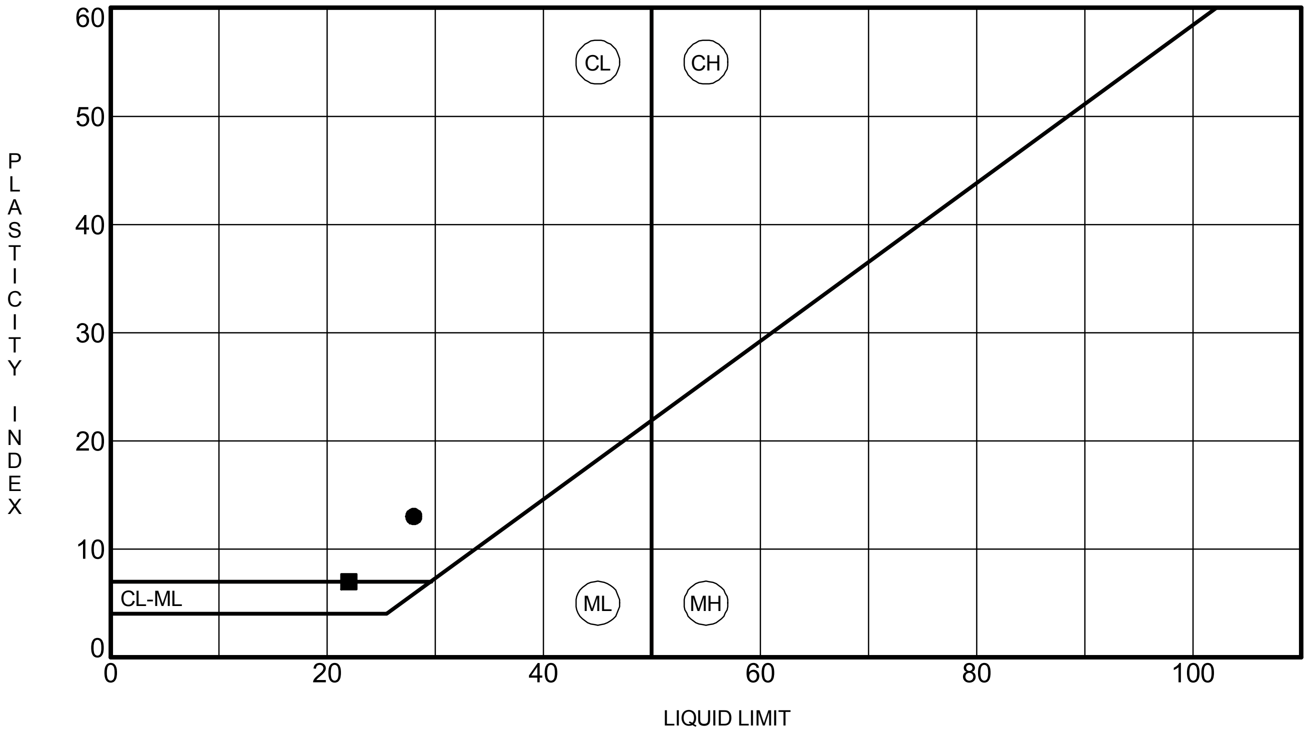

	Boring	Depth, Ft	LL	PL	PI	Fines	Classification
●	**B-03, S6**	**15.0 - 16.5**	**28**	**15**	**13**		**Clay (CL)**
■	**B-05, S5**	**10.0 - 11.5**	**22**	**15**	**7**		**Clayey Silt (CL-ML)**

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ATTERBERG LIMITS RESULTS

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FIG. B-24

APPENDIX C

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL/ENVIRONMENTAL REPORT

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL/ENVIRONMENTAL REPORT

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include: the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used: (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors which were considered in the development of the report have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports, and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the
ASFE/Association of Engineering Firms Practicing in the Geosciences, Silver Spring, Maryland