THE GALLI GROUP
Geotechnical Consulting

PRELIMINARY SEISMIC RETROFIT STUDY
OAK GROVE ELEMENTARY SCHOOL
MEDFORD, OREGON

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1.0 INTRODUCTION

This report presents results of our geotechnical and geological evaluation of the Washington Elementary School for a potential Seismic Retrofit of portions of the school campus. The subject school is located at 2838 W. Main Street on the north side of West Main Street at its intersection with Oak Grove Road in Medford Oregon. Please see Figure 1, Vicinity Map, for a more precise location.

The purpose of our investigation and this report was to accomplish a limited site surface and subsurface evaluation (one boring) and conduct a planning level seismic risk assessment (office studies) in order to provide preliminary geotechnical and geologic information and evaluate the likelihood and consequences of geotechnical/geologic related seismic failures, including liquefaction and landslide potential during the design seismic event, for consideration of the potential seismic retrofit.

2.0 SITE AND PROJECT DESCRIPTION

The site is currently occupied by a functioning school, which consists of approximately 7 structures, connected via covered walkways or with direct connections. The structures are surrounded by play fields, access roads, parking lots, walkways and open space. The site is relatively flat to mildly sloping with undeveloped portions of the site consisting of well-maintained lawn and a few trees.

We understand the district is conducting a preliminary review to determine the level of seismic retrofit needed for the structures on this campus. Their review will largely be based on the evaluation of the potential geologic hazards (such as liquefaction) provided in this report, and an evaluation of the potential structural damage to these facilities associated with the design seismic event. The findings will also likely be used to determine if grant funding will be pursued to complete the seismic retrofit work.

3.0 FIELD EXPLORATION

On June 18, 2021, Associate Engineer, Dennis Duru, M.Sc., E.I.T, and our drilling crew, visited the site to accomplish the subsurface investigation. One (1) exploratory boring was drilled in the planter area near the southeast corner of the school buildings. A utility locate was completed prior to our investigation and our representative coordinated with school personnel to identify the field exploration location away from the marked and known utility locations. See Figure 2, Site Plan, for a layout of the site and the location of the boring. The boring was drilled with our ATV-mounted solid stem auger drill rig and penetrated to depth of 11.0 feet before encountering the hard, gravelly Clay (hardpan). Upon completion, the boring was backfilled with drill spoils.

Standard Penetration Testing (SPT) was accomplished during drilling, as part of the exploratory boring. This entails driving a 1½-inch diameter steel split spoon sampler by dropping a 140-pound weight for a 30-inch drop. The total number of blows it takes to drive the sampler the last 12 inches of an 18-inch drive is called the SPT N-value. These can be correlated with density and soil strength parameters from testing on thousands of other projects.

Our representative identified the final exploration location, logged subsurface soils and water conditions and obtained soil samples for transport to our laboratory. Visual classifications of the soils were made in the field and are presented in the Boring Log in Appendix A, at the end of this report.

4.0 LABORATORY TESTING

Moisture content tests were accomplished on soil samples obtained by Standard Penetration Testing. No other tests were accomplished.

5.0 SUBSURFACE CONDITIONS

5.1 SOIL

The subsurface consisted of medium stiff, brown, clayey Silt to approximately 4.0 feet. This was underlain by medium dense to dense, clayey, sandy Gravels, to a depth of 11.0 feet. This was then underlain by hard, brown, cemented gravelly Clay.

Please see more specific soils information in the Boring Logs in Appendix A. Please note that the soils are shown as distinct layers in the Boring Logs while in nature they may change more gradually. Soils conditions may also change somewhat between the locations investigated.

5.2 GROUNDWATER

Generally, the soils encountered were moist to saturated. Groundwater was encountered in the boring at 4.0 feet below ground surface.

6.0 GEOLOGIC OR SEISMIC INDUCED HAZARDS

Summary of Site Geology and Seismicity. The project area is located in the Medford East 30x60 minute USGS topographic quadrangle (see Vicinity Map, Figure 1). Mapped geologic units at the project area consist primarily of Alluvial Fan deposits and bedrock members of the Hornbrook Formation (Wiley et al, 2011). The Marine Sandstone, Siltstone and Conglomerate members are the mapped bedrock unit at the project (Wiley et al, 2011; OGDC-6, 2015). Weathered conglomerate Sandstone was encountered in the auger boring at this site at relatively shallow depths of 11.0 feet below ground surface.

The project site is in proximity to several zones of active seismicity. The region is affected by the Cascadia Subduction Zone (CSZ), an active subduction zone off the Oregon coast considered capable of Magnitude 8.5 or greater earthquakes. Average recurrence intervals for such great earthquakes, as determined by recent investigations, range between 300-600 years. The last "great" earthquake was interpreted to be approximately 300 years ago. The CSZ is the main seismic event for consideration for this seismic retrofit.

The project area has an additional tectonic source from earthquakes occurring along active Basin and Range faults as close as 50 kilometers to the southeast. This region has produced numerous earthquakes, including significant events near Klamath Falls and Warner Valley. Such events occur generally once every one to two decades.

Flood Hazard. The site is not within a 100-year floodplain of any river or streams according to the FEMA flood mapping.

Landslides/Slope Instability. The project site is located within a mapped Quaternary landside (Qls). This mapped feature is present on the state landslide database (Statewide Landslide Information Database for Oregon; SLIDO, 2017). Based upon the published mapping, general geomorphology, review of 2-foot contours generated from Lidar datasets (Dogami, 2021) and aerial photos (Google Earth, 2021), as well as subsurface data obtained in this investigation, the mapped landslide in the project area is interpreted to be an alluvial fan deposit of material originating upslope.

No recent movement or damage to structures has been associated with this feature in readily available published accounts or our general geotechnical and geologic knowledge of the area. It is therefore assumed this is an inactive “older” deposit. Therefore, in our professional opinion, based on the information from our limited exploration data, the risk of damage due to natural slope instability at this site is considered low. However, any proposed manmade cut or fill slopes should only be made following the recommendations from a detailed geotechnical investigation and report.

Liquefaction and Lateral Spread. The project is underlain by clayey silt, clay sandy gravels and gravelly Clay. Sandy soils with clay and gravel content in a medium dense to dense condition (similar to the ones observed during our limited exploration) have not been known to liquefy in a seismic event. Therefore, liquefaction and lateral spread is considered to be a low to very low potential hazard for this site. See more in Section 7.0 of this report.

Expansive Soils. The upper soils within the subsurface consist of clayey silt and clayey sandy Gravel. The clays will likely have moderate to high expansion potential based on our experience with soils with similar visual properties.

These expansive soils can have adverse impacts on foundations and all manner of concrete flatwork if the building design does not account for such soils. We recommend that each proposed building site (with clayey soils present) have the soil subgrade examined and tested (Expansion Index) prior to final design and construction. In that way, locations that have expansive soils will have the retrofit structure(s) and drainage designed accordingly.

Construction over expansive soils generally requires embedment of footings to 3 to 4 feet (final depth to be verified after EI testing) below the exterior grade and placement of floor slabs over at least 24 inches or more of compacted rock fill in order to mitigate expansion potential of the underlying soil subgrades. Maintaining the moisture content in the soil to keep it in a moist and fully swelled condition prior to being covered is also critical to proper performance of the structures.

Note: The geotechnical engineer must provide site specific laboratory testing and remedial design recommendations on projects that have potentially expansive, gravelly Clay, clayey Silt or Clay soils present.

Ground Rupture. No Quaternary faults were identified at the project site on review of USGS fault (US Quaternary Faults) maps, and from the one limited exploratory boring. Therefore, the risk of damage at the site due to ground rupture is considered very low.

Ground Shaking. Project structures including foundations and retaining walls must be designed for the potential for very strong ground shaking during the anticipated seismic event. The peak site modified horizontal acceleration (PGA_M), is 0.363g. This is based on the Site Class C designation, determined for the project from subsurface drilling and evaluation of SPT data. The PGA_M value can be used with an appropriate seismic coefficient in pseudo static analysis for design of the seismic upgrades.

Seismic Ground Amplification or Resonance. No unusually hazardous amplification or resonance effects on seismic waves have been associated with soil/bedrock subsurface conditions in the project area.

Tsunami and Seiche. The site is approximately 80 miles inland from the coast, and not subject to tsunami hazard. The site is not located adjacent to a large lake or body of water, and therefore, not subject to seiche hazard.

7.0 LIQUEFACTION EVALUATION

The liquefaction phenomenon occurs in saturated, loose (low density, uncompacted or poorly compacted), cohesionless soils. When loose, cohesionless soils are saturated, which is the case when the soil is below the water table, then water fills the soil pores. In response to compression when a load is applied to the soil, the water increases in pressure and attempts to migrate towards zones of low pressure. However, if the applied load is rapid and large enough, or if it is repeated many times (cyclic loading), like in an earthquake, such that there is not enough time for the water to dissipate before the next cycle of loading is applied, then the water pressure may build up to a degree where it becomes greater than the grain-to-grain contact stresses of the soil. The grain-to-grain contact stresses are the source of the shear strength that supports structure foundations and overburden soils in these soil structures. This buildup of excess pore water pressure results in total or partial loss of the soil strength, and the soil may be observed to flow like a liquid, hence “liquefaction”. At this point, the soil will lose all its shear strength, be deformed, and will not be able to support structures.

The site is underlain medium stiff clayey Silt and medium dense to dense, clayey, sandy Gravel. Groundwater was observed in the boring at 4.0 feet deep. <u>The conditions for liquefaction to occur were not observed at this site during our limited subsurface investigation</u>. The medium dense to dense, clayey, sandy Gravel below the groundwater will not undergo further densification enough to cause liquefaction during a seismic event due to the high gravel and clay content, and also due to the dense condition. Therefore, the possibility of liquefaction that could adversely affect the site is very low.

<u>Therefore, in our professional opinion, the site conditions found in the boring will not result in wide spread liquefaction that will have significant adverse impacts on the structures during a seismic event.</u>

8.0 CONCLUSIONS

In our professional opinion, based on our field investigation, office review and previous work in the area, the soils conditions at the site are suitable for a conventional seismic retrofit. Crushed rock structural fill over the clayey, sandy Gravel will provide adequate support of new foundations, grade beams and/or buttresses. In our opinion, this school site is not subject to large scale liquefaction that will cause a significant adverse impact to the structures.

Additional borings around the structures on this site could possibly find zones of soils that may liquefy. However, these are likely to be moderate to small in size and should not adversely impact the structure.

If a full seismic retrofit geotechnical design report is needed, additional tasks to be accomplished would be as follows:

1. 2 or 3 additional borings.
2. Laboratory testing for expansive index, strength and settlement evaluation.
3. Evaluation of data for developing design parameters.

These could be used to provide a full scale Seismic Retrofit Design Report.

8.1 LIMITATIONS

The analyses, conclusions and recommendations contained in this report are based on site conditions as they existed at the time of the study, and assume soils, rock and groundwater conditions exposed and observed in the boring during our investigation are representative of soils and groundwater conditions throughout the site. If during construction, subsurface conditions or assumed design information is found to be different, we should be advised at once so that we can review this report and reconsider our recommendations in light of the changed conditions. If there is a significant lapse of time (5 years) between submission of this report and the start of work at the site, if the project is changed, or if conditions have changed due to acts of God or construction at or adjacent to the site, it is recommended that this report be reviewed in light of the changed conditions and/or time lapse.

This report was prepared for the use of the School District and their design team for evaluating the need for a full scale Seismic Retrofit evaluation and design report. It should be made available to contractors for information and factual data only. This report should not be used for contractual purposes as a warranty of site subsurface conditions. It should also not be used at other sites or for projects other than the one intended.

We have performed these services in accordance with generally accepted geotechnical engineering and professional geology practices in southern Oregon, at the time the study was accomplished. No other warranties, either expressed or implied, are provided.

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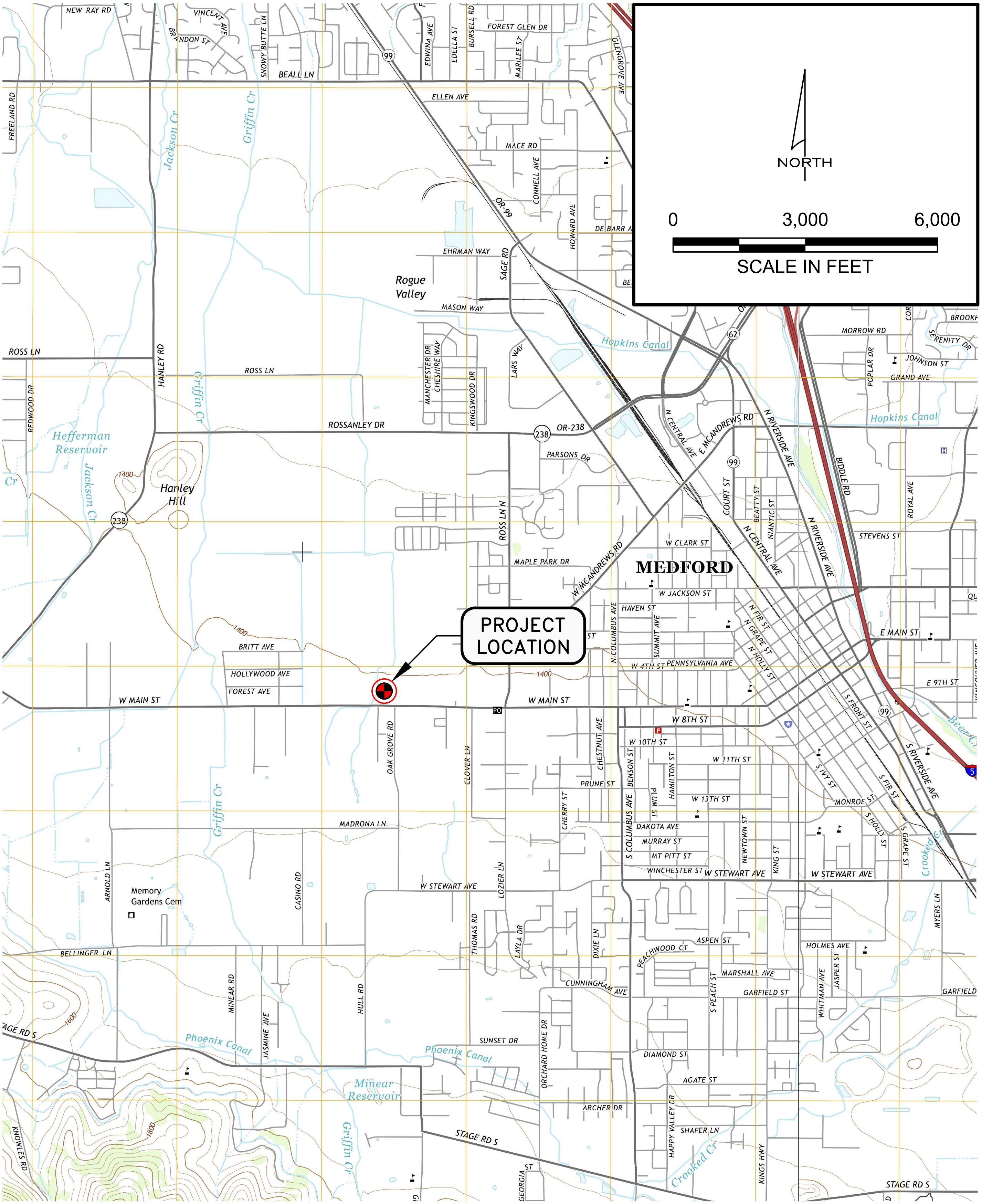

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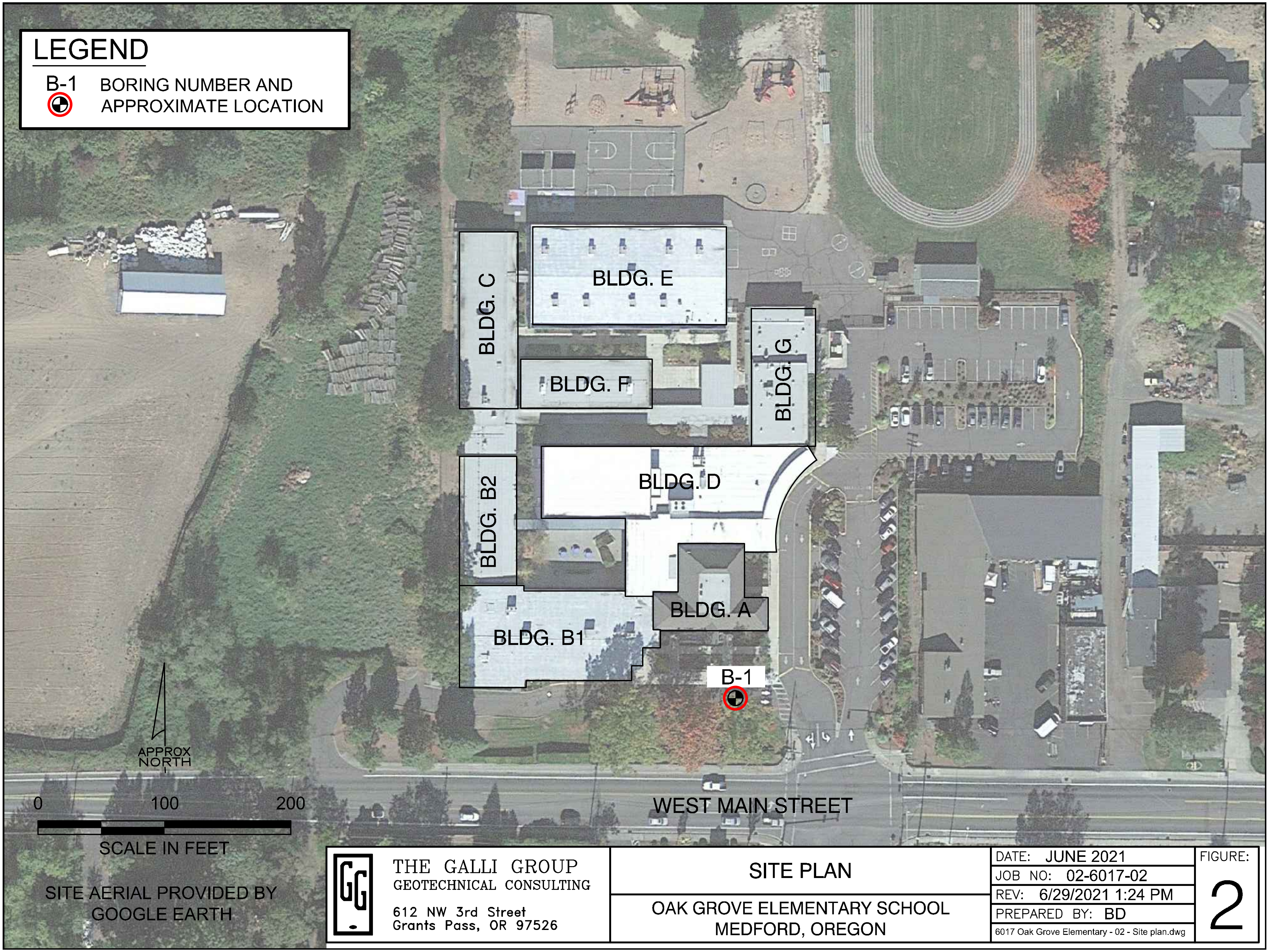
612 NW 3rd Street
Grants Pass, OR 97526

VICINITY MAP

OAK GROVE ELEMENTARY SCHOOL
MEDFORD, OREGON

DATE: JUNE 2021
JOB NO: 02-6017-02
REV: 6/29/2021 1:15 PM
PREPARED BY: BD
6017 Oak Grove Elementary - 01 - Vicinity.dwg

FIGURE: 1



THE GALLI GROUP GEOTECHNICAL CONSULTING 612 NW 3rd Street Grants Pass, OR 97526	SITE PLAN OAK GROVE ELEMENTARY SCHOOL MEDFORD, OREGON	DATE: JUNE 2021 JOB NO: 02-6017-02 REV: 6/29/2021 1:24 PM PREPARED BY: BD 6017 Oak Grove Elementary - 02 - Site plan.dwg	FIGURE: 2

APPENDIX A

BORING LOGS

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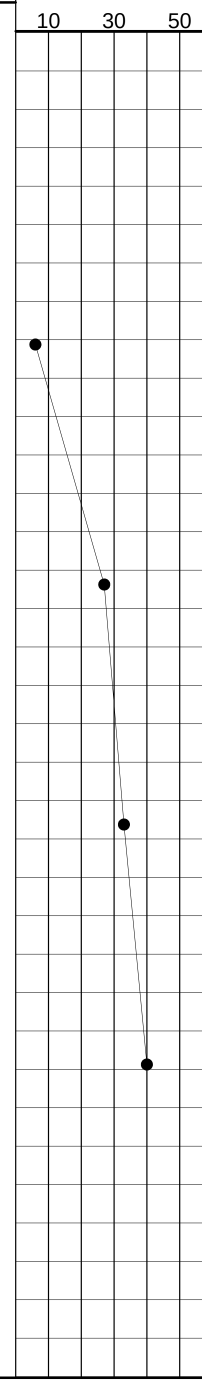
BORING LOG
B-1

Project: Oak Grove Elementary School
Client: Medford School District
Location: Planter area south of Building A (see Site Plan)
Driller: TGG (Ken, Nick)
Drill Rig: ATV Mounted SSA, 4" Diameter
Depth To Water> Initial : 4.0

Project No.: 02-6017-02
Date: 6/18/2021
Elevation:
Logged By: Dennis Duru
At Completion : 4.0

Graphic Log	USCS	Description	Depth	Sample No. and Type	NMC	N
		Grass rootzone.	0.25			
	CH-MH	Medium stiff, brown, clayey Silt; some gravel moist.		S-1	9%	6
	GC/SC	Medium dense to dense, clayey, sandy Gravel; saturated.	5.0	S-2	17%	27
				S-3	17%	33
				S-4	17%	40
	CL	Hard, brown, cemented, gravelly Clay; damp.	11.0		13%	
		Bottom of boring at 11.5 Free groundwater at 4.0	11.5			

Standard Penetration Test CURVE



Legend of Samplers: Grab sample SPT sample Shelby tube sample

This information pertains only to this boring and should not be interpreted as being indicative of the site.