Geotechnical Investigation
Madras Campus Site
E. Ashwood Road
Madras, Oregon
Project No: 2109066-900

Prepared by:
FEI Testing & Inspection, Inc.
62979 NE Plateau Drive, #3
Bend, Oregon 97701

October 21, 2010

Geotechnical & Construction Services

October 21, 2010

Central Oregon Community College
Attention: Richard Brecke
2600 NW College Way
Bend, Oregon 97701

Re: Project 1349-10, Madras Building Site
Project No: 2109066-900

Transmitted herewith is our report of a geotechnical investigation performed for the referenced project. According to the information provided to us for the investigation, the property is to be developed with the Campus Building. Our investigation and analysis was directed toward A wood framed building construction, with partial basement and concrete slab-on-grade, supported primarily upon continuous wall-type and isolated spread foundations. Foundation wall loads of up to 4 kips per lineal foot and column loads of up to 50 kips have been considered during our analyses.

Our investigation indicates that the project is feasible from a geotechnical engineering standpoint. The subsurface conditions consist of small to moderate amounts of medium dense native silty sand soils, overlying weathered tuffaceous sandstone bedrock. The existing soil conditions, and variable weathering of the underlying sandstone have been identified as possible constraints to development. We have provided recommendations for mitigating these features in our report. Generally, the recommendations provide for the creation of uniformly dense footing conditions for the proposed building by additional compaction of the existing native soil or fill where the footings will not bear on bedrock. Design parameters are also provided for pavement, foundations, stormwater infiltration, and appurtenant features.

We appreciate having the opportunity of being of service to you on this project. If you have any questions concerning this report or the investigation, do not hesitate to contact our office.

Sincerely,
FEI Testing & Inspection, Inc.

REGISTERED PROFESSIONAL CIVIL ENGINEER 15178 OREGON OCT. 2, 1990 WILLIAM SMITH

William A. Smith, P.E.
Geotechnical Engineer

Exp. 6/30/2012

Contents

October 21, 2010

1 INTRODUCTION

This report presents results of a geotechnical exploration performed by FEI Testing & Inspection, Inc. (FEI) at the site of a proposed educational building in Madras, Oregon. The purpose of our services is to provide information and design guidelines for:

- Seismic Design Criteria
- Foundation and Lateral Design Criteria
- Slab-on-grade Design
- Pavement Section Design
- Excavations and Site Grading
- Construction Observation and Testing
- Preliminary Stormwater Disposal

The recommendations, conclusions, and opinions presented in this report are based on our field observations and laboratory testing, published geologic data for the area, and our experience with similar projects. A topographic map prepared by WHPacific was provided for our reference during the investigation, and forms the basis of the site map in this report. Logs were retrieved from the Oregon State Water Resources database for previous work in the vicinity. Of the logs retrieved, none fall within the subject property, and have not been included or attached to this report.

1.1 Site Location

The project site is located on the north side of East Ashwood Road, between City View Street and Bean Drive. The site is generally described as lying within the south half of Section 6, Township 11 South, Range 14 East, Willamette Meridian, Jefferson County, Oregon. The site is the southwesterly portion of parcel 1, part of a two parcel partition. A Soil Vicinity Map showing the general location is shown on Figure 1. The relevant portion of parcel 1 is shown on the Site Map, Figure 2.

1.2 Site Conditions

The project site is located in moderate to gently sloping terrain, which overall drains towards the west at gradients of less than 10 percent. The proposed building area is situated on the flatter west side of the site, with the parking area located above, north and east of the building area on slightly steeper slopes. A few rock outcrops are visible on the slopes towards the north and east. At the time of our investigation the property was sparsely covered with dry forbs and grass, with scattered Juniper trees on the northerly portion of the parcel. A shallow irrigation ditch traverses the west side of the parcel, and buried utilities are noted through the site. Small amounts of fill soil, trash, and debris were encountered about the site. During our site reconnaissance the southwest corner monument, and topographic map details were used to locate our explorations.

1.3 Proposed Construction

Planning for the proposed building was in a preliminary phase during the course of our investigation. The site development plan indicates that the building area will be situated near the center of the southwest quadrant of the parcel. The building construction type is expected to consist of wood and steel frame with brick veneer, supported by individual columns and continuous wall footings. Maximum column loads are anticipated to be on the order of 50 kips, with wall loads to continuous footings of up to 4 kips/ft. We have also assumed that soil supported ground floor loads will not exceed 300 pounds per square foot (psf). Grade changes for the building pad are expected to be relatively minor, with maximum cuts and fills of about 4 feet. A paved access road and parking areas, buried utilities, stormwater retention and infiltration areas, and landscaping will be included in the development.

2 GEOLOGIC SETTING

The site is located in the central portion of the Deschutes Basin, a broad valley extending from the Ochoco Mountains on the east to the Cascade Range on the west, and from the Mutton Mountains on the north to the High Lava Plains, near the town of Redmond, on the south. Volcaniclastic deposits and scattered lava flows gradually filled the Deschutes Basin during the Miocene Age (about 8 million to 4 million years ago). These deposits comprise the Deschutes Formation which underlies the site. Characteristic materials of the Deschutes Formation are light colored tuffaceous sandstones, conglomerates, and welded tuff. A broad thin lava flow, originating from a vent approximately 10 miles south of the site, covered a broad area of the basin about 5 million years ago. Throughout the lower elevations in and around the city of Madras, this lava has generally been eroded and removed. A considerable thickness of the light colored tuffaceous sandstones and conglomerates, which make up most of the formation, generally underlie the city. A water well log from approximately 1/4 mile east of the project site indicates the sandstone underlying the site extends to a depth of 276 feet below the ground surface.

2.1 Seismicity

The project site lies within an area of generally low historic seismic activity. Two general types of earthquakes can affect regions in Oregon: (1) Local relatively shallow crustal earthquakes with potential magnitude up to M 7+, and (2) More distant deep seated earthquakes occurring within the Cascadia subduction zone, estimated magnitude M 9. The Cascadia subduction zone is the region encompassing the boundary between the descending or subducting Juan de Fuca oceanic plate (or the Gorda plate at the southern end) and the overlying North American continental plate. The zone stretches from Vancouver Island in British Columbia southward to Cape Mendocino in northern California. Subduction zone earthquakes are rare. Probably the most recent large subduction zone earthquake, magnitude M 9, occurred in 1700. Available data indicate, however, that large earthquakes appear to have struck the Pacific Northwest coast at intervals ranging from a few centuries to about 1,000 years. Although subduction zone earthquakes are the largest earthquakes expected to occur in the Northwest region, seismic hazards at the site are due almost entirely from crustal earthquakes. This is due primarily to the large distance from the Cascadia margin.

2.2 Seismic Hazard Evaluation

Because of the apparent long recurrence interval for subduction zone earthquakes and the substantial distance from the Madras project site, the seismic risk associated with large subduction zone earthquakes is considered very low. There are no known active faults in the immediate area, and the regional seismicity associated with crustal earthquakes is very limited. On this basis, the seismic risk associated with a crustal earthquake, on a known or unknown fault in the region, is considered low.

Damage to structures related to fault movement may be divided into two categories: (a) primary deformation such as surface fault rupture and ground shaking; and (b) secondary failure such as landsliding, liquefaction, lurch cracking, and differential compaction and subsidence.

Surface faulting or ground rupture tends to occur along lines of previous faulting. Since there are no known fault lines within the site, the possibility of surface fault rupture is negligible within the subject property. Damage from ground shaking is caused by the transmission of earthquake vibrations from the ground to the structure. The most destructive effects of an earthquake are usually seen where the ground is unstable and structures are poorly designed and constructed. At the project site, soil and rock conditions are considered seismically stable. Under these conditions, structures designed in conformance with the provisions and principles set forth in modern building codes should, in general, be able to resist moderate earthquakes without structural damage. Because of the site location, the topography, limited soil depth, great depth to groundwater, and the near surface occurrence of bedrock, the hazard associated with secondary earthquake effects is essentially nil. The lack of rimrock formation, and moderate slopes indicate the risk of rock falls and slope failures are also very low.

3 FIELD EXPLORATIONS & TESTING

3.1 Subsurface Exploration

Subsurface conditions were explored by excavation of five exploratory test pits at the locations indicated on Figure 2. Test pits were excavated using a small excavator. Test excavation locations were based on a proposed site plan to provide general profiles of subsurface conditions within the proposed building footprint, and a nearby parking and stormwater retention areas. All test pits were excavated to the machine limit, or refusal, or to the planned test depth of 6 feet below the existing ground surface, terminating in the underlying soft bedrock. Logs of the test pits were made at the time of excavation by a geotechnical engineer, and are included in Appendix A. Test pits were backfilled using either native materials, or prepared for infiltration testing using crushed drain rock.

3.2 Infiltration Testing

Three of the exploratory excavations were prepared for the purpose of infiltration testing at the locations shown on Figure 2. Test pits approximately 2 feet wide, 4 feet long, and ranging from 2 to 6 feet in depth were excavated, lined with a filter fabric, and filled with coarse drain rock around a perforated observation pipe. Infiltration testing was performed in accordance with Central Oregon Stormwater Manual Method 4C. A tabulated summary of results and field test data is presented in Appendix C.

3.3 Subsurface Conditions

The explorations indicate that the overall site generally consists of less than 1.0 to 2.0 feet of silty sand covering variably soft to hard tuffaceous sedimentary bedrock. The silty sand is generally shallower on the steeper slopes. The silty sand is in a medium dense condition below the surficial root zone, typically 6 inches in depth.

Below the silty sand layer, soft to moderately hard tuffaceous sandstone was encountered. The sandstone can be excavated by hand tools or the excavator with initially slight, then increasing difficulty. Shallow refusal at 26-inches was encountered at TP-5, and about 5.1 feet at TP-1.

Groundwater was not encountered in any test pits. A search of well records in the vicinity of the site indicates that depth to usable groundwater exceeds three hundred feet. Some potential for perched water conditions on the harder or cemented sedimentary rock present does exist. Normalized infiltration test rates calculated in accordance with the test method ranged from 6.7E-5 to 9.7E-5 cubic feet per square feet absorption area per foot of head.

4 LABORATORY TESTING

Laboratory tests were performed on representative bulk samples to determine some of the physical and engineering properties of the subsurface soils. The results of the laboratory testing are presented in Appendix B, and include the following:

Particle Size Analysis (ASTM C117/C136 or AASHTO T-11/27) – Sieve analyses were performed on one selected soil sample to aid in classification and characterization of the engineering properties of the soil. The soil is type SM in the Unified Soil Classification System, and type A-2-4(0) in the AASHTO classification system. These classifications correspond with generic descriptions of sands with silt to silty sands.

Moisture-Density Compaction Curve (ASTM D1557 or AASHTO T-180) – This test uses a standardized method to compact soil into a mold at varying moisture contents. The resulting data curve identifies the optimum moisture and maximum density. The maximum density can then be compared to the field density of natural or fill soils to determine relative compaction.

5 CONCLUSIONS & RECOMMENDATIONS

Based on the results of our investigation, it is our opinion that the site soil and bedrock conditions are adequate for construction of the proposed structures and appurtenant features, providing the design and construction incorporates the recommendations found in this report.

Lava tubes, rock voids, and similar significant discontinuities were not present in any of our test pits. Our field explorations represent a random sample of site conditions in the proposed building area. While significant discontinuities are rare in this rock formation, they may be encountered during construction. If such voids are encountered, recommendations specific to the size, type, and location of the void will be necessary.

Field explorations indicate that hard bedrock is not generally present within 6 feet of the existing surface across most of the proposed construction area. Where shallow sandstone rock is encountered, it is expected that most or all of it can be ripped and trenched by large excavation equipment. For deeper cuts, and especially in confined trenching areas, some limited hydraulic hammering should be expected for rock excavation and removal.

Conventional spread footing foundation systems are suitable for the support of structures at this site. Settlement of moderately loaded foundations bearing on properly compacted native soils or engineered fill should be less than 3/4-inch, with 1/2-inch potential differential settlement within a 30 foot span. Foundation design parameters, including allowable bearing capacity for recompacted soil and engineered fill are provided in section 5.2.

We recommend that fill placed within the future building area consist of well-graded 3-inch minus material suitable for compaction testing. Moderate amounts of rock rubble is anticipated from grading and trench excavation. Over-size rock fragments used in engineered fill in landscape and pavement areas should be sized and placed in accordance with ODOT requirements as noted in their Standard Specifications, Section 00330.42(c-2-d). On-site soils may be stockpiled and used for structural fills and backfills subject to the compaction requirements in section 5.4. Fills and pad surfaces exposed to the elements can be degraded due to freeze-thaw and dessication cycles; recompaction of surfaces should be expected when foundation construction or paving significantly lag initial grading.

On-site soils are shallow and predominantly granular, and generally will have natural moisture contents well below their plastic limits. Accordingly, wet weather construction techniques are not comprehensively specified. If muddy or shallow areas of unstable soil are developed, replacement with clean crushed rock or aggregate base having a gradation appropriate for future support requirements is recommended. If preventative or protective measures are required, complete working surface gravel blankets of 8-inch thickness placed on compacted subgrade are normally sufficient to prevent unstable mud or excessive rutting for local conditions and the anticipated construction loads.

Groundwater or shallow saturated soil conditions were not encountered on this site. Foundation drains are not necessary provided that adequate surface drainage occurs. Because high soil moisture may occur under slabs-on-grade, even in the absence of generally high water tables, we recommend that vapor retarders be installed below moisture sensitive floor coverings, as noted in section 5.2.

Stormwater infiltration using permeable pavement, ponds, or swales is feasible on this site. Further design information for stormwater infiltration is provided in section 5.7.

5.1 Seismic Design Parameters

Deterministic seismic parameters were developed from results of the on-site investigation and in accordance with Section 1613 of the 2010 Oregon Specialty Structural Code (OSSC) and Chapter 20 of ASCE 7-05. These parameters are as follows:

- Site Classification: C
- Maximum Considered Earthquake Spectral Response Acceleration Ss: 0.390
- Maximum Considered Earthquake Spectral Response Acceleration S1: 0.153

5.2 Foundation & Lateral Design Criteria

- Allowable bearing capacity for spread footings bearing on compacted native soils or engineered fill as described in section 5.4 shall be 2000 psf for dead load plus live load. This value may be increased 1/3 for analysis of seismic and wind conditions.
- Continuous footings shall not be less than 12 inches wide. Isolated footing pads shall not be less than 18 inches square. It is recommended that all perimeter foundation elements be placed a minimum of 18 inches below lowest adjacent grade in order to be below expected frost penetration.
- Unrestrained retaining walls may be designed for on-site or similar imported soils using an equivalent fluid pressure of 30 pcf for level backfill, and 40 pcf for backfill sloping up to 2H:1V. Restrained retaining walls may be designed for on-site or similar imported soils using an equivalent fluid pressure of 45 pcf for level backfill. A dynamic load increment equal to an equivalent fluid pressure of 13 pcf should be applied to the active or at-rest pressures above for seismic analysis. A passive earth pressure of 400 psf/ft may be used for that portion of members which are embedded more than 12 inches below lowest adjacent grade or confined below a slab. A static coefficient for lateral sliding of 0.5 may be used for design. The above values are unfactored; construction and service surcharges should be applied to these parameters. Alternatively, lateral design parameters from OSSC Table 1806.2 may be used for Class 4 materials, which will generally result in more conservative designs. Positive piped drainage should be provided behind retaining walls. Final site topography should prevent water from ponding above or adjacent to the foundation. Degree of compaction of wall backfill shall be as for general fill.
- Interior slabs-on-grade should have a minimum of one No. 3 bar at 24 inches o.c.e.w. Slab reinforcement shall be placed at mid-depth of slabs. Slab subgrade shall be compacted to a minimum of 92 percent of ASTM D1557 to a depth of 12 inches. A minimum 4-inch clean granular cushion shall be placed under all slabs to prevent capillary rise. The granular cushion shall be clean sand and gravel consisting of 1 inch minus with less than 5 percent passing the #200 sieve. In areas where moisture sensitive floor coverings are anticipated, it is recommended that the slab concrete mix contain moisture retarding admixture to reduce the moisture in the slab and minimize moisture condensation under floor coverings. Minimum slab thickness shall be four inches, actual. Significantly greater slab thickness and reinforcing may be required by the structural engineer or architect to meet loading requirements. A modulus of subgrade reaction k=200 pci may be used for design.

5.3 Pavement Design

- Based on the above data regarding site soils, and the anticipated vehicle loads, we recommend a minimum pavement section of 2.0 inches of Asphalt Concrete (AC) over 6 inches of crushed Aggregate Base (AB) in areas restricted to light trucks and automobiles. In areas such as through streets subject to regular truck or bus traffic we recommend a minimum pavement section of 3.0 inches of AC over 8.0 inches of AB. If Portland cement concrete (PCC) or composite heated pavement sections are used, a section should consist of a minimum effective depth of 5.5-inches of PCC having a modulus of rupture of 600 psi.

- Aggregate Base should consist of 1-inch or 3/4-inch minus crushed aggregate conforming to applicable ODOT Standards. Subgrade should be compacted at least 12 inches deep to a minimum relative compaction of 90 percent of maximum density as determined by ASTM D1557. Aggregate Base should be compacted to a minimum of 95 percent of maximum density as determined by ASTM D1557.

5.4 Grading of Building and Pavement Areas

- Preparation of future building areas should consist of removal of all existing uncontrolled fill, soil disturbed or loosened by clearing or grading, and deleterious materials within 5 feet of the building footprint, including exterior columns. Where moderately loaded (2000 psf) footings will be located at native soil elevations, excavations should be thoroughly moisture conditioned to near optimum and then compacted to a minimum depth of 12-inches below the footing base. Compaction shall not be less than 92 percent relative compaction as determined by ASTM D1557. If necessary, placement of granular fill within footing areas should be in loose lifts of 9 inches or less, then thoroughly compacted.

- In private street, sidewalk, or other paved areas, placement of fill should be preceded by removal of loose materials, and compaction of the surface to a minimum of 90 percent relative compaction, or proof-rolled at near optimum moisture to verify a dense and non-yielding condition. Compaction depth of finished subgrade should equal the thickness of new fill or 12 inches, whichever is greater. Minimum relative compaction of the upper 12 inches of subgrade is 90 percent of maximum density as determined by ASTM D1557.

5.5 General Site Grading

- If old utility lines or water pipes are found within the construction area, they shall be properly abandoned or removed. All excavation caused from such removals, including such things as cistern or vault excavations, shall be backfilled and compacted. The degree compaction shall be as specified below for general fill.

- Remove all vegetation, organic material, and any deleterious debris, such as roots, wood, or demolition debris, from the construction area. Except where bedrock is encountered, existing ground, including the bottom of over-excavation areas shall be scarified and compacted prior to placement of fill. Where moisture addition is required, scarification to a depth of 12 inches shall be accomplished by ripping at intervals no further apart than 18 inches in all areas requiring moisture conditioning. All scarified surfaces shall be compacted to a minimum relative compaction of 90 percent of maximum density as determined by ASTM D1557.

- Fill material other than designated topsoil shall be substantially free of organic matter or debris. Engineered fill shall consist of three inches minus, with less than 30 percent retained above the 3/4-inch sieve, unless otherwise specified and approved by the Geotechnical Engineer. Import soils shall not be composed of cinders or pumice, shall be granular in nature, and shall be approved by the Geotechnical Engineer prior to transporting to the site.

- All general fill shall be compacted to a minimum relative compaction of 90 percent of maximum density as determined by ASTM D1557. Fill material shall be placed at a moisture content which will allow adequate compaction. This is normally within two percent of optimum. Field density tests shall be made in conformance to ASTM D1556 or D2922.

- Compaction of fills shall be done with an adequate machine. On-site soils should be most readily compacted by heavy tracked, sheepsfoot, or rubber-tired equipment. Confined areas such as footing excavations should be compacted with tractor-mounted hoe-packs, unless it is demonstrated that smaller equipment will adequately compact the full depth of material required.

- Backfill of utility trenches or similar narrow areas shall be done with approved on-site material or import fill in lifts, and thoroughly compacted to 90 percent of maximum density. Where backfill is placed within a previously filled area, *e.g.* a building pad, the backfill shall be compacted to at least the degree of compaction as the surrounding fill.

- Footing excavations and form areas shall be cleaned of all loose soils, clods and mud to expose dense compacted soils, or recompacted. This shall be done as needed prior to placement of forms, reinforcement, or concrete.

- Excavation stability requires that temporary cuts for all soil and loose rock be sloped at not steeper than 1.5H:1V, tightly jointed rock greater than 5.0 feet in height should be sloped not steeper than 1/4H:1V. Permanent slopes constructed of engineered fill shall not be steeper than 2H:1V. Permanent cut and fill slopes greater than 15.0 feet in height should be evaluated for stability and specific drainage requirements by a geotechnical engineer or geologist.

5.6 Inspection and Testing

- All grading operations including demolition, excavation and fill placement, and foundation preparation shall be observed by the Geotechnical Engineer on a near continuous basis. In particular, we intend to discourage excavating compaction test locations into previous lifts of compacted material to achieve the recommended test frequency or material observations. The Contractor shall perform no grading operations until the Geotechnical Engineer or testing agency has been notified. A pre-job meeting with the grading Contractor and Geotechnical Engineer should be conducted at the job site prior to the start of grading.

- All backfill and general fill shall be approved by the Geotechnical Engineer. Placement of all fill and backfill should be observed and tested for relative compaction by a qualified technician working under the direction of the Geotechnical Engineer. A suitable testing frequency would be to test every one foot of fill depth as the material is placed, with each passing test representative of no more than 200 cubic yards of fill. The owner should notify the Geotechnical Engineer prior to the commencement of filling operations.

- All general excavations and footing excavations shall be inspected and approved by the Geotechnical Engineer or his representative prior to placement of any soil backfill or concrete.

5.7 Preliminary Stormwater Disposal

- Infiltration testing of the soil indicates that permeability ranges from good to fair, with actual normalized application rates of 6.7E-5 to 9.7E-5 cubic feet per square feet absorption area per foot of head ($cfs/ft^2/ft$). The site is generally suitable for shallow infiltration, although the observed test infiltration rates, and climatic considerations indicate that the design stormwater runoff volume will need to be stored for gradual absorption.

- To reduce the risk of saturation induced settlement and slope seepage, a minimum setback of 20 feet should be maintained between ponded infiltration areas and building areas or downslope faces. Stormwater conveyance facilities should be piped or lined to prevent infiltration within building and setback areas.

6 LIMITATIONS

Explorations performed for this study are intended to provide a reasonable picture of underground conditions for preliminary design purposes. Variations from the interpreted conditions, not indicated by our observations are possible. These variations are sometimes sufficient to necessitate modifications in the design. If unexpected conditions are observed during construction, or if the size, type, or location of the structures should change, we should be notified to review our recommendations. The professional judgments expressed in this report meet the current standard of care of our profession.

Our services did not include evaluation of regulated materials, hazardous wastes, hydrological phenomena, or environmental conditions which may be pertinent to development or use of the site. FEI Testing & Inspection, Inc. has performed its services in accordance with generally accepted engineering and consulting standards in effect at the time services were performed. No other warranty is offered, expressed or implied.

7 REFERENCES

Central Oregon Stormwater Manual, Chapter 4 – Geotechnical Site Characterization, May 2007.

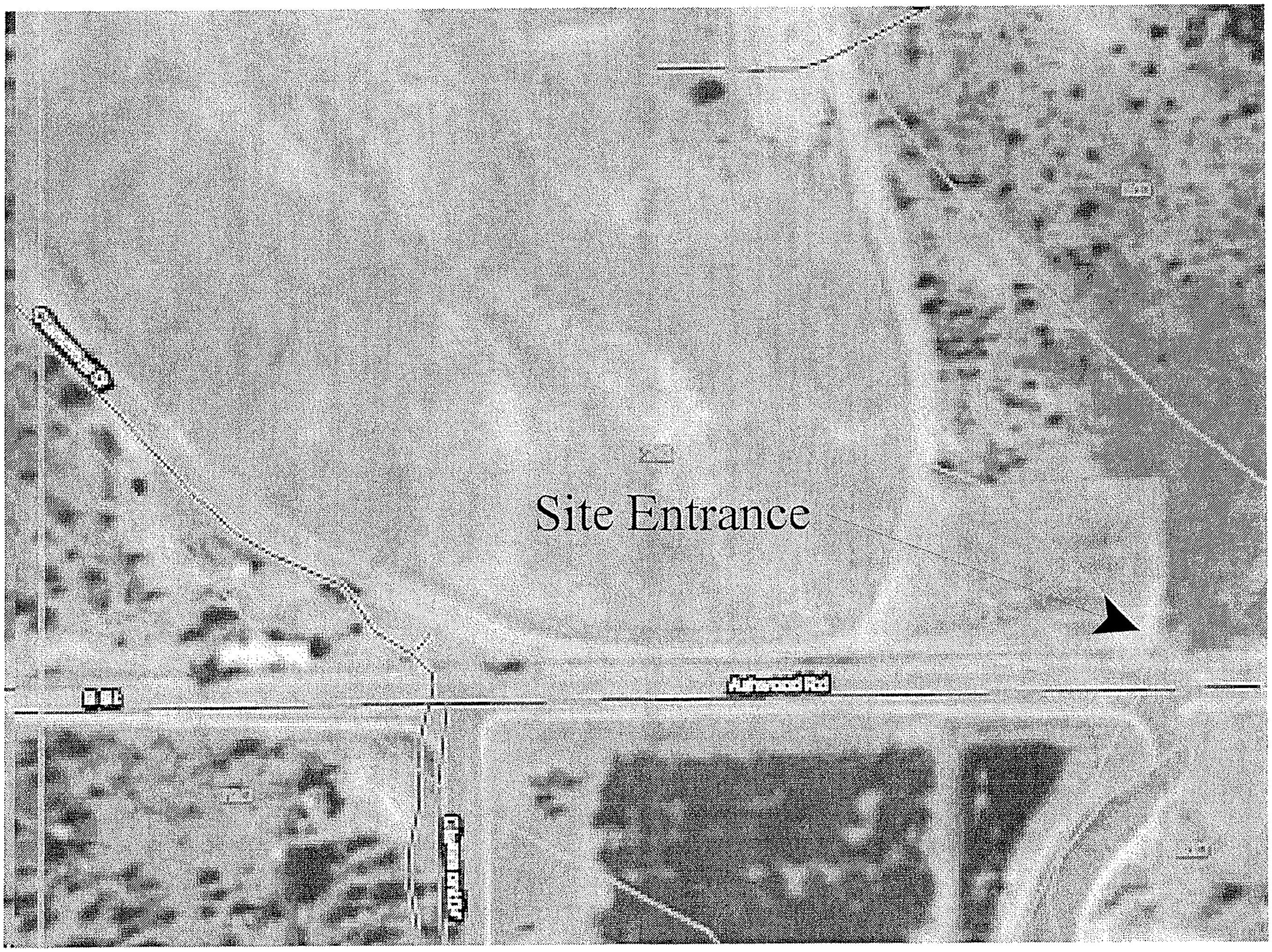
Geologic Map of Oregon, by G.W. Walker and N.S. Macleod, 1991.

Oregon State Water Resources Department,

`http://apps2.wrd.state.or.us/apps/gw/well_log/Default.aspx`

Oregon Structural Specialty Code, International Conference of Building Officials, 2010.

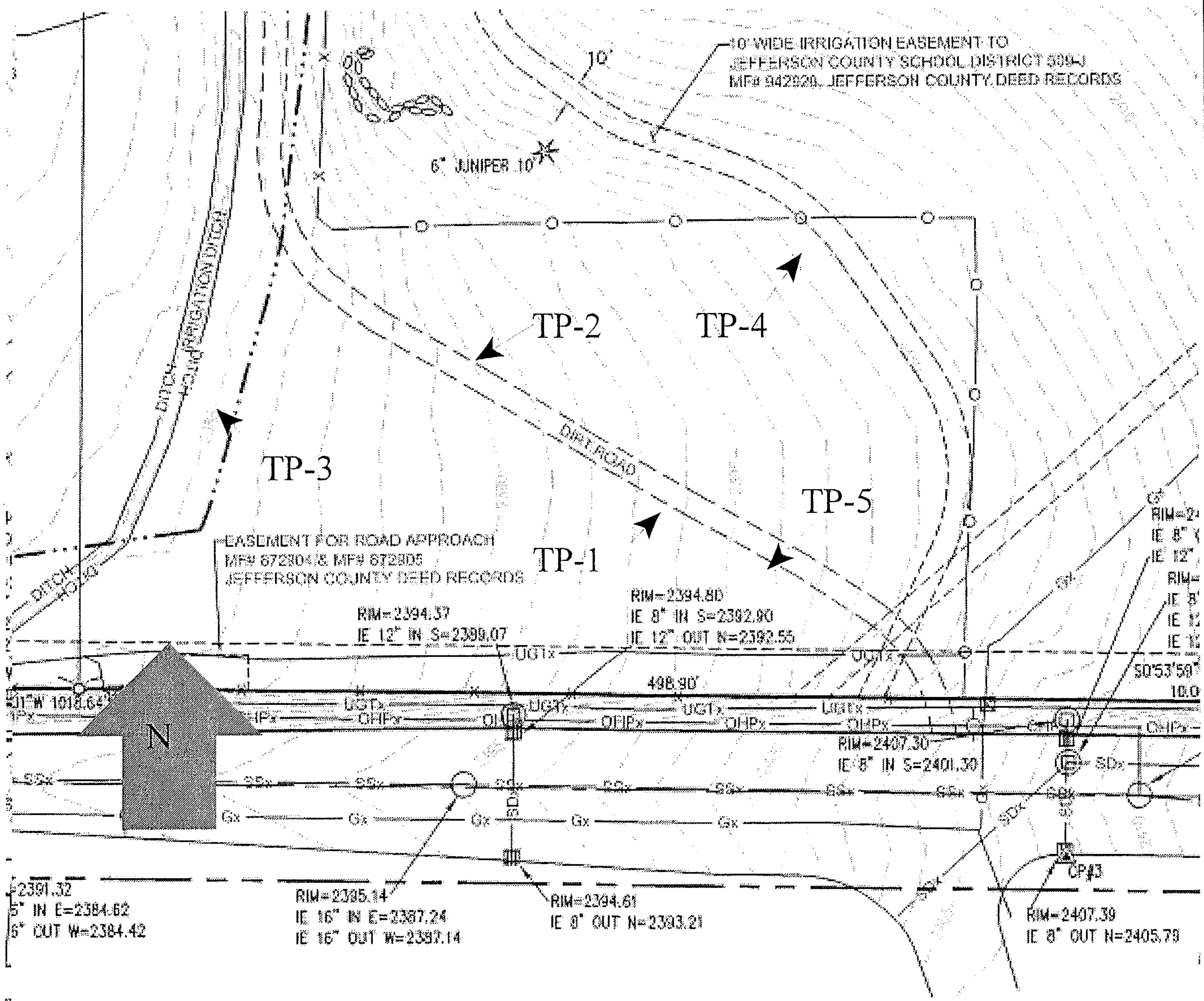
Standard Specifications for Highway Construction, Oregon Department of Transportation, 1996.



FEI TESTING & INSPECTION, INC.

GEOLOGIC VICINITY MAP
COCC Madras Campus
E. Ashwood Road
Madras, Oregon

Date: Oct 2010	**Figure: 1**
Scale: NA	
Project No. : 2109066-900	



TESTING & INSPECTION, INC.

SITE MAP
COCC Madras Campus
E. Ashwood Road
Madras, Oregon

Date: Oct 2010	**Figure: 2**
Scale: 1" is approx. 67'	
Project No. : 2109066-900	

APPENDIX A

Test Pit Logs

TESTING & INSPECTION, INC.

Log of Trench TP-1

(Page 1 of 1)

Central Oregon Community College
Madras Campus
E. Ashwood Road, Madras Oregon

Geotechnical Investigation

Project No: 2109066-900

Excavation Date : Oct. 12, 2010
Contractor : Latham
Equipment : BCT w/ 2' bucket
Logged By : W.A. Smith

Feet	2394		USCS		Moisture %	Dry Unit Weight pcf
0			SM	SILTY SAND, fine-coarse, with gravel and few cobbles, brownish-gray, dry, medium dense.		
1	2393					
2	2392		SS	SANDSTONE, very little cementation or induration, friable, with few limited cemented zones, brown to light gray, digs easily to 5.0 feet.	7.2	87.3
3	2391					
4	2390				9.9	81.4
5	2389			Refusal, no groundwater or mottling.		
6	2388					
7	2387					
8	2386					
9	2385					
10	2384					
11	2383					
12	2382					

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TESTING & INSPECTION, INC.

Log of Trench TP-2

Central Oregon Community College
Madras Campus
E. Ashwood Road, Madras Oregon

Geotechnical Investigation

Project No: 2109066-900

Excavation Date	: Oct. 12, 2010	Logged By	: W.A. Smith
Contractor	: Latham		
Equipment	: BCT w/ 2' bucket		

Feet	2390	USCS	Description	Moisture %	Dry Unit Weight pcf
0		SM	SILTY SAND, fine-coarse, with gravel and few cobbles, brownish-gray, dry, medium dense.		
1	2389	SS	SANDSTONE, very little cementation or induration, friable, with few limited cemented zones, brown to light gray, digs easily to 10.0 feet.	8.0	81.4
2	2388				
3	2387			10.0	88.0
4	2386				
5	2385				
6	2384				
7	2383				
8	2382				
9	2381				
10	2380				
11	2379		End of trench, no groundwater or mottling.		
12	2378				

TESTING & INSPECTION, INC.

Log of Trench TP-3

Central Oregon Community College
Madras Campus
E. Ashwood Road, Madras Oregon

Geotechnical Investigation

Project No: 2109066-900

Excavation Date : Oct. 12, 2010
Contractor : Latham
Equipment : BCT w/ 2' bucket

Logged By : W.A. Smith

Feet	2385	USCS	Description	Moisture %	Dry Unit Weight pcf
0					
1	2384	SM	SILTY SAND, fine-coarse, with gravel and few cobbles, brownish-gray, dry, medium dense.		
2	2383		SANDSTONE, very little cementation or induration, friable, with few limited cemented zones, brown to light gray, digs easily to 6.0 feet.		
3	2382				
4	2381	SS			
5	2380				
6	2379		End of trench, no groundwater or mottling.		
7	2378				
8	2377				
9	2376				
10	2375				
11	2374				
12	2373				

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FEI TESTING & INSPECTION, INC.

Log of Trench TP-4

Central Oregon Community College
Madras Campus
E. Ashwood Road, Madras Oregon

Geotechnical Investigation

Project No: 2109066-900

Excavation Date	: Oct. 12, 2010	Logged By	: W.A. Smith
Contractor	: Latham		
Equipment	: BCT w/ 2' bucket		

Feet	2399	USCS	Description	Moisture %	Dry Unit Weight pcf
0		SM	SILTY SAND, fine-coarse, with gravel and few cobbles, brownish-gray, dry, medium dense.		
1	2398	SS	SANDSTONE, very little cementation or induration, friable, with few limited cemented zones, brown to light gray, digs easily to 6.0 feet.		
2	2397				
3	2396				
4	2395				
5	2394				
6	2393		End of trench, no groundwater or mottling.		
7	2392				
8	2391				
9	2390				
10	2389				
11	2388				
12	2387				

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TESTING & INSPECTION, INC.

Log of Trench TP-5

Central Oregon Community College
Madras Campus
E. Ashwood Road, Madras Oregon

Geotechnical Investigation

Project No: 2109066-900

Excavation Date : Oct. 12, 2010
Contractor : Latham
Equipment : BCT w/ 2' bucket
Logged By : W.A. Smith

Feet	2397		USCS		Moisture %	Dry Unit Weight pcf
0			SM	SILTY SAND, fine-coarse, with gravel and few cobbles, brownish-gray, dry, medium dense.		
1	2396		SS	SANDSTONE, medium hard to hard, dense, brown-gray, shallow refusal.		
2	2395					
				Refusal, no groundwater or mottling.		
3	2394					
4	2393					
5	2392					
6	2391					
7	2390					
8	2389					
9	2388					
10	2387					
11	2386					
12	2385					

10-14-2010 c:\mtech46\cocc\tp5.bor

APPENDIX B

Laboratory Test Results

Sieve Analysis ASTM C-136

% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	3.8	12.7	1.0	24.8	43.0	14.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5 in.	100.0		
3/4 in.	96.2		
3/8 in.	90.8		
#4	83.5		
#10	82.5		
#20	73.3		
#40	57.7		
#100	28.9		
#200	14.7		

* (no specification provided)

Material Description

SM, brn-gry, w/ gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 5.73 D_{60}= 0.463 D_{50}= 0.323
D_{30}= 0.157 D_{15}= 0.0762 D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

Sample No.: 409 **Source of Sample:** 409 **Date:**
Location: **Elev./Depth:**

FEI Testing & Inspection, Inc.
Corvallis, OR

Client:
Project: COCC - Madras
Project No: 2109066 **Figure** B-1

COMPACTION TEST REPORT

Project No.: 2109066-900

Date: 10-13-2010

Project: COCC Madras Campus

Location: TP-1

Remarks:

MATERIAL DESCRIPTION

Description: Silty Sand, fine-coarse w/ gravel, brown-gray

Classifications - **USCS:** SM **AASHTO:** A-2-4

Nat. Moist. = **Sp.G. =**

Liquid Limit = **Plasticity Index =**

% > 3/8 in. = % **% < No.200 =**

TEST RESULTS
Maximum dry density = 110.4 pcf
Optimum moisture = 15.7 %

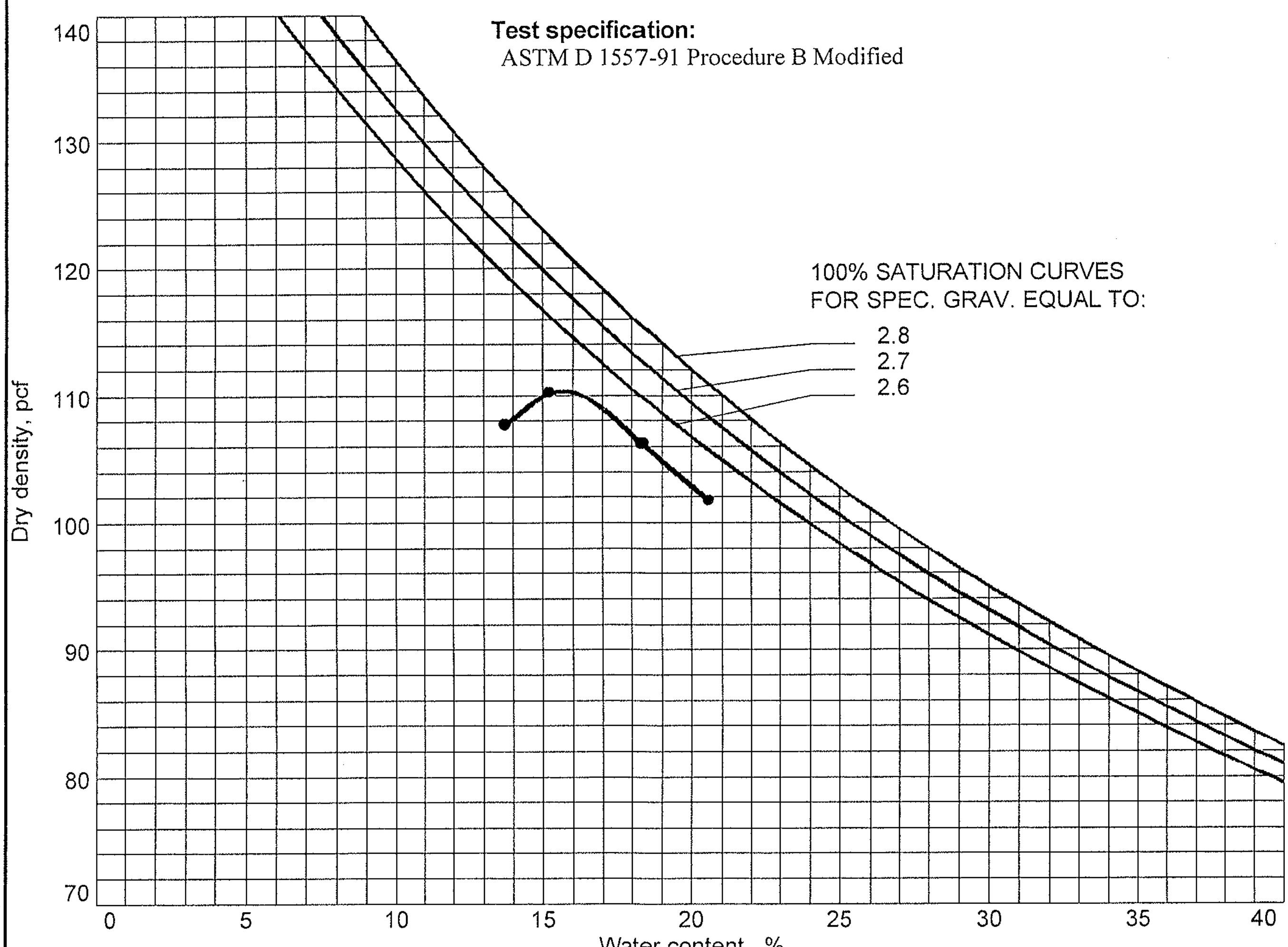

Figure B-2

APPENDIX C

Infiltration Test Results

Test Summary

Test Pit Number	Rate (gpm)	q_N (*E-5)
3	1.35	6.7
4	1.40	9.7
5	1.08	7.5

Units of q_N are cubic feet per square feet absorption area per foot of head ($cfs/ft^2/ft$).

Infiltration Tests method COSM-4C
Meter readings in gallons, level readings in inches

Location	TP-3	Meter/Level	TP-4	Meter/Level	TP-5	Meter/Level
Total Depth (inches)	76		94.5		44	
Stick-up (inches)	18		21.5		18	
Fill Depth	66		70.5		20	
Start Time	10:10:00 AM	498.2	12:20:00 PM	646.4	12:30:00 PM	35.2
Full Time	10:28:00 AM	550.1	01:35:00 PM	816.3	02:11:00 PM	172.2
Adjust Time	11:50:00 AM	627.1	01:51:00 PM	829.4	02:11:00 PM	172.2
Stop Time	12:10:00 PM	646.4	02:20:00 PM	870	02:30:00 PM	192.8
Readings	12:15:00 PM	67	02:25:00 PM	71.5	02:35:00 PM	26
	12:20:00 PM	68	02:30:00 PM	73.25	02:40:00 PM	27.5
	12:25:00 PM	69	02:35:00 PM	74.75	02:45:00 PM	29
	12:30:00 PM	69.5	02:40:00 PM	76.25	02:50:00 PM	30.25
	12:35:00 PM	70	02:45:00 PM	77.75	02:55:00 PM	31.5
	12:40:00 PM	70.5	02:50:00 PM	79	03:00:00 PM	32.75
dq=		19.3		40.6		20.6
dt=		20		29		19

Eqn 4C-1, q_N=(Q/A)/(H/2) where:
Q is determined from Adjust Time to Stop Time, converted from gpm to cfs.
A is the wetted bottom and sidewall area, taken as 2x4 + 12x2 = 32 sq.ft.
H is depth of water in test pit, taken as 2 ft.

q_N=	6.719E-05	9.748E-05	7.549E-05