GEOTECHNICAL EVALUATION
CITY OF PRESCOTT AIRPORT
WATER RECLAMATION FACILITY EXPANSION
PRESCOTT, ARIZONA

PREPARED FOR:
Water Works Engineers
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PREPARED BY
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September 30, 2011
(Revised January 30, 2012)
Project No. 603427001

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Mr. John Matta, P.E.
Water Works Engineers
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Scottsdale, Arizona 85260

Subject: Geotechnical Evaluation
City of Prescott Airport Water Reclamation Facility Expansion
Prescott, Arizona

Dear Mr. Matta:

In accordance with our revised proposal dated March 21, 2011, and your authorization, Ninyo & Moore has performed a geotechnical evaluation for the above-referenced site. The attached report presents our methodology, findings, conclusions, and recommendations regarding the geotechnical conditions at the project site.

We appreciate the opportunity to be of service to you during this phase of the project.

Respectfully submitted,
NINYO & MOORE

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1. INTRODUCTION

In accordance with our revised proposal dated March 21, 2011, and your authorization, we have performed a geotechnical evaluation for the Prescott Airport Water Reclamation Facility Expansion project in Prescott, Arizona. The purpose of our evaluation was to assess the subsurface conditions at the project site in order to formulate geotechnical recommendations for design and construction. This report presents the results of our evaluation and our geotechnical conclusions and recommendations regarding the proposed construction.

2. SCOPE OF SERVICES

The scope of services for this project included:

- Reviewing available background data including topographic maps, geologic data and aerial photographs pertaining to the project site.
- Conducting a visual geologic reconnaissance of the project area.
- Establishing boring locations in the field and arranging for the mark out of underground utilities through Arizona Blue Stake.
- Drilling, logging, and sampling seven exploratory soil borings to depths ranging from approximately 38 to 40 feet below ground surface (bgs). The boring logs are presented in Appendix A.
- Conducting laboratory testing of selected samples obtained from the borings to evaluate in-situ moisture content and dry density, particle-size gradation, Atterberg limits, consolidation (response-to-wetting), and corrosion characteristics (pH, minimum electrical resistivity, and chloride and soluble sulfate contents). The results of our laboratory testing are presented on the boring logs in Appendix A and/or in Appendix B of this report.
- Preparing this report presenting our findings, conclusions, and recommendations regarding the design and construction of the proposed improvements.

Our scope of services did not include environmental consulting services such as hazardous waste sampling or analytical testing at the site. A detailed scope of services and estimated fee for such services can be provided upon request.

3. SITE DESCRIPTION

The project site is situated at the existing Prescott Municipal Airport in Township 15 North, Range 2 West in Section 19 in Prescott, Arizona (Figure 1). At the time of our evaluation, the project site consisted of an existing water reclamation facility (WRF). The facility generally consisted of slab-on-grade, single-story structures and several basins. The Prescott Municipal Airport was situated to the northwest of the site, and Granite Creek was situated adjacent to the eastern limits of the site. Scattered vegetation was observed in the undeveloped areas of the site.

Based on the *Chino Valley South, Arizona-Yavapai Co., 7.5-Minute United States Geological Survey (USGS) Topographic Quadrangle Map (1985)*, the site elevation is approximately 4,940 feet relative to mean sea level. Based on the topographic map, the site generally slopes from the west down to the east, towards Granite Creek.

Four aerial photographs were reviewed for this project. Aerial photographs from 1992 (United States Department of Agriculture Web Soil Survey), and USGS photographs from 2002, 2005, and 2010 depicted the site as being an existing water reclamation facility with single-story, slab-on-grade structures and existing basins. These photographs depicted the site as being similar to its current condition.

4. PROPOSED CONSTRUCTION

This project consists of the design and construction of an expansion to the WRF. The planned improvements generally consist of new headworks, aeration basins, clarifiers, filters, a chlorine contact tank, an administration building, and a blower building. These features are planned to extend to depths up to 20 feet below ground surface (bgs). The buildings are planned to be slab-on-grade, single-story structures.

At the time of our evaluation, site layout, grading, and drainage plans were not yet available; however, we assume that very little grade-raise fill will be needed for this project, and that positive drainage will be maintained around structures.

5. FIELD EXPLORATION AND LABORATORY TESTING

On September 1, 2011, Ninyo & Moore conducted a subsurface exploration at the site to evaluate the subsurface conditions and to collect soil samples for laboratory testing. The exploration consisted of drilling, logging, and sampling seven exploratory soil borings using a Diedrich D-50 truck-mounted drill rig equipped with hollow-stem augers. The borings extended to approximately 40 feet bgs. Borings B-1, B-2, B-6, and B-7 were situated in the approximate locations of the planned slab-on grade structures and filters. Borings B-3 through B-5 were situated in the approximate locations of the planned clarifiers, aeration basins, and headworks. The approximate locations of the borings are depicted on Figure 2.

Bulk and relatively undisturbed samples were collected at various depths within the soil borings. Detailed descriptions of the soils encountered in our borings are presented on the boring logs in Appendix A. The samples obtained during the excavation operations were visually classified, placed into appropriate containers, and transported to the Ninyo & Moore laboratory for testing and evaluation.

Laboratory testing was performed on select representative samples collected during our subsurface evaluation in order to evaluate the in-situ moisture content and dry density, particle-size gradation, Atterberg limits, consolidation (response-to-wetting), and corrosivity (pH, minimum electrical resistivity, and chloride and soluble sulfate contents). Detailed descriptions of our laboratory test methods are presented on the boring logs and/or in Appendix B.

6. GEOLOGY AND SUBSURFACE CONDITIONS

The geology and subsurface conditions at the site are described in the following sections.

6.1. Geologic Setting

The project area is located in what is known as the Transition Zone province. The Transition Zone tectonic (or Central Highlands physiographic) province is typified by the absence of younger units that have been removed by erosion, including many Mesozoic and Paleozoic sedimentary rock units that typically overlie older sedimentary, granitic, and metamorphic units. The older Proterozoic-age basement granites, phyllites, gneisses, and other metamorphic rocks are sometimes exposed in restricted erosional windows, but are more often widely exposed within the main trend of the northwest trending Transition Zone.

The surficial geology of the site is described as being Pliocene-age (5 million years to 1.8 million years) fluvial and lacustrine deposits. Part of the project site near the northern limits is situated within Holocene-age (less than 10,000 years) gravel and alluvium deposits, generally deposited from adjacent creeks (Krieger, 1965).

6.2. Subsurface Conditions

Our knowledge of the subsurface conditions at the project site are based on our field exploration, laboratory testing, and our understanding of the general geology of the area. The following sections provide generalized descriptions of the materials encountered. More detailed descriptions are presented on the boring logs in Appendix A.

6.2.1. Fill

Man-placed fill was encountered in borings B-3 through B-5, and was approximately 3 feet thick in our borings and generally consisted of very dense, clayey sand.

6.2.2. Alluvium

Alluvium was encountered underlying the fill in borings B-3 through B-5, and at the surface of borings B-1, B-2, B-6, and B7. The alluvium extended to decomposed bedrock in boring B-2, and to the total explored depths in other borings. The alluvium generally consisted of sandy clay, clayey sand, silty sand, well-graded sand with clay and gravel, silty gravel, and clayey gravel with sand. Cobbles and possible boulders were encountered in the alluvium at various depths.

6.2.3. Bedrock

Granodiorite was encountered in Boring B-2 underlying the alluvium at approximately 26 feet bgs. The granodiorite encountered in our boring was observed to be soft, damp, and decomposed. The granodiorite extended to the total explored depth of our boring.

6.3. Groundwater

Groundwater was not encountered in our borings during our field exploration. Based on well data presented by the Arizona Department of Water Resources Web Groundwater Data Map, the depth to groundwater has been estimated at approximately 180 feet bgs near the site. Groundwater levels can fluctuate due to seasonal variations, irrigation, groundwater withdrawal or injection, and other factors. Due to the close proximity of Granite Creek, groundwater levels or perched zones may be encountered at shallower depths within the project area, and may be a constraint during construction. Based on information presented on Federal Emergency Management Agency (FEMA) Floodplain Maps, the project site has been mapped within a documented floodplain.

However, an updated detailed study has been completed for Granite Creek Wash. Revisions to the current FEMA mapping of the 100yr and 500yr floodplains are in process and being reviewed by FEMA. Acceptance is anticipated for late 2014 when the facility is schedule to be completed.

7. GEOLOGIC HAZARDS

The following sections describe potential geologic hazards at the site, including land subsidence and earth fissures, faulting, and liquefaction.

7.1. Land Subsidence and Earth Fissures

Based on our field reconnaissance and review of the referenced material, there are no known land subsidence or earth-fissures documented in the Transition Zone province. Land subsidence and earth fissures are not expected to be a design constraint to this project.

7.2. Faulting and Seismicity

The site lies within the Transition Zone, an approximately 50-mile wide mountain belt that extends through Arizona, between the Colorado Plateau and the Basin and Range (Euge et al., 1992). This zone is characterized by sparse seismicity and few Quaternary faults. Based on our field observations, review of pertinent geologic data and analysis of aerial photographs, faults are not located on or adjacent to the property. The closest documented Quaternary faults to the site are the Prescott Valley Grabens, located approximately 5 miles to the west of the site (Pearthree, 1998). This is a northwest-southeast trending fault zone situated along the western margin of the structural and physiographic basin known as Prescott Valley and Chino Valley. Less than 11 meters of middle Pleistocene-age (800,000 years) deposits are displaced, and approximately 4 meters of displacement has been observed in the upper Pleistocene-age (10,0000 years to 800,000 years) age deposits. The uppermost Pleistocene and Holocene Deposits (<10,000 years) have not been displaced. Seismic parameters recommended for the design of the proposed improvements are presented in Section 9.3.

7.3. Liquefaction Potential

Based on the Standard Penetration Test values at the site, the lack of near surface water, and the low ground motion hazard (relatively low ground accelerations), the likelihood or potential for liquefaction at the project site is not a design consideration.

8. CONCLUSIONS

Based on the results of our subsurface evaluation, laboratory testing, and data analysis, it is our opinion that the proposed construction is feasible from a geotechnical standpoint, provided that the recommendations of this report are incorporated into the design and construction of the proposed project, as appropriate. Geotechnical considerations include the following:

- In general, the surficial fill and alluvium materials in the project area are considered to be rippable with conventional heavy-duty excavation equipment in good working condition. However, bedrock was encountered in Boring B-2. Although the encountered bedrock was decomposed at our boring location, denser bedrock may be encountered during construction that may call for the use of heavy earthmoving construction equipment and special excavation methods (e.g., pneumatic hammering, rock saws, blasting, etc.).

- Imported soils and soils generated from on-site excavation activities that exhibit a relatively low plasticity and very low to low swell potential can generally be used as engineered fill. Particles larger than 3 inches in dimension should not be used as backfill material unless appropriately processed.

- Based on the results of the field and laboratory evaluations, it is our opinion that the proposed structures for this project can be founded on shallow foundations proportioned for moderate bearing pressures supported on a zone of moisture-conditioned and compacted engineered fill.

- Groundwater was not encountered during the time of our field exploration. Based on well data from nearby wells, the regional groundwater table is on the order of 180 feet bgs. However, shallow or perched groundwater conditions could be encountered during construction based on the proximity of Granite Creek and recharge basins, and should be considered in the design of the project.

- No known or documented geologic hazards are present underlying or adjacent to the site.

- Corrosivity test results indicate that subgrade soils at the site may be corrosive to ferrous metals and the sulfate content of the soils present a negligible sulfate exposure to concrete. However, given the type of facility at the site (a water reclamation plant), a more sulfate-resistant concrete may be appropriate (e.g. Type V cement).

9. RECOMMENDATIONS

The following sections present our geotechnical recommendations for the proposed construction. These recommendations are based on our understanding of the design. Ninyo & Moore should be contacted for additional recommendations and/or evaluation as the design and construction progress.

9.1. Earthwork

The following sections provide our earthwork recommendations for this project. In general, the earthwork specifications contained in the Northern Arizona Council of Governments (NACOG) guidelines, which adopts the Maricopa Association of Governments (MAG), *Uni-*

form Standard Specifications and Details for Public Works Construction (including any amendments from the City of Prescott), should apply, except as noted in this report.

9.1.1. Excavations

Our evaluation of the excavation characteristics of the on-site materials is based on the results of seven exploratory borings, our site observations, and our experience with similar materials. In our opinion, excavation of the surface on-site materials can generally be accomplished with excavation or earthmoving equipment in good operating condition. However, the underlying dense gravel, cobbles, and possible boulders, or bedrock, if encountered, may call for the use of heavy excavation equipment. These materials could be more difficult to excavate and could result in slow excavation rates.

The proposed excavations could generate oversize material (particles larger than 3 inches) that will not be suitable for use as backfill. Screening, disposal, and/or crushing of this material should be anticipated if re-use of this material is considered.

It may be desirable to note utilities, underground structures or other features that are near the planned construction and to survey or document (e.g., photographs, video, official documentation, etc.) their pre-construction condition. The findings of the survey could be used to document any damage to the existing utilities that might result from this work.

9.1.2. Temporary Slope Stability

Excavations that are 20 feet deep or less could be constructed using a sloped excavation in accordance with Occupational Safety and Health Administration (OSHA) Standards. OSHA standards provide trench sloping and shoring design parameters for trenches up to 20 feet deep based on the soil types encountered. For planning purposes, we recommend that the OSHA soil “Type C” be used for the fill and alluvial soils and a temporary side slope of 1.5:1 (horizontal to vertical), or flatter, be considered for sloped excavations that are 20 feet deep or less.

Temporary excavations that encounter surface seepage may need shoring or may be stabilized by placing sandbags or gravel along the base of the seepage zone. Excavations encountering seepage should be evaluated on a case-by-case basis. Trenches over 20 feet deep should be designed by the contractor's engineer based on alignment-specific soil properties and settlement-sensitive features. Excavations encountering seepage, if any, should be evaluated on a case-by-case basis. Additional considerations regarding dewatering are provided in Section 9.1.4.

9.1.3. Shoring

Temporary shoring may be desired in areas where wider trench excavations cannot be conducted, such as near roadways and adjacent to structures or utilities. Temporary earth retention systems may include braced systems, such as trench boxes or shields with internal supports or cantilever systems like soldier piles and lagging; however, the risk of excessive lateral deflection may render the cantilever shoring system inappropriate for the project.

Braced temporary earth retention systems should be designed using the lateral earth pressure parameters presented on Figure 3, depending on the soil conditions. The recommended design earth pressures are based on the assumptions that the shoring system will be constructed without raising the ground surface elevation behind the shoring system, that there are no surcharge loads, such as soil stockpiles and construction materials, and that no loads act above a 1:1 (horizontal to vertical) plane extending up and back from the dredge line. For earth retention systems subjected to the above-mentioned surcharge loads, the contractor should include the effect of these loads on the design lateral earth pressures.

We anticipate that settlement of the ground surface will occur behind shoring systems during excavation. The amount of settlement depends heavily on the type of shoring system used, the contractor's workmanship, and soil conditions. We recommend that roadways, utilities, and structures in the vicinity of the planned shoring installation be reviewed with regard to foundation support and tolerance to settlement. To reduce the potential for distress to adjacent structures, we recommend that the retaining system be designed to limit the ground settlement behind the shoring system to ½-inch or less. Possible causes of settlement that should be addressed include settlement during excavation for structure construction, construction vibrations, de-watering, and removal of the support system. We recommend that shoring installation be evaluated carefully by the contractor prior to construction and that ground vibration and settlement monitoring be performed during construction.

If the utility is to be installed near or beneath the foundation of an existing structure or utility, the existing structure or utility should be supported or underpinned to reduce construction-related damage, and, if needed, the proposed drainage line encased in concrete to accommodate imposed structural loads.

The contractor should retain a qualified and experienced engineer to design the shoring system. The contractor should evaluate the adequacy of the shoring parameters presented in this report, and make the appropriate modifications for their design. We recommend that the contractor take appropriate measures to protect the workers. OSHA requirements pertaining to workers' safety should be observed.

Some of the proposed below-grade excavations may encounter groundwater. Groundwater (or surface water accumulation where groundwater is not encountered) may cause the bearing surface to weaken. The base of the excavation should, therefore, be sloped to drain towards a sump or other dewatering equipment.

9.1.4. Bottom Stability and Dewatering

Groundwater seepage could also occur where the structure or utility excavations crosses or abut existing drainage courses. Stream flow and surface run-off will vary seasonally depending on rainfall in the site vicinity.

For excavations that do encounter seepage or surface run-off, dewatering by pumping the water out from the bottom and away from the excavation may be needed. Heavily saturated units or perched groundwater zones, if encountered, may call for more aggressive means of dewatering and consultation with a qualified expert. Discharge of water from the excavations to natural drainage channels may entail securing a special permit (e.g. 404 Permit from the Army Corps of Engineers).

9.1.5. Grading, Fill Placement, and Compaction

Vegetation, debris and other unsuitable materials from the clearing operation should be removed from the site and disposed of at a legal dumpsite. Demolition debris, if any, should also be removed from the site and disposed of at a legal dumpsite. Due to the existing structures, removal or relocation of existing utilities or other buried obstructions may be needed. The contractor should be prepared to remove and replace buried obstructions with engineered fill.

On-site and imported soils that exhibit relatively low plasticity indices and very low to low expansive potential are generally suitable for re-use as engineered fill. Relatively low plasticity indices are defined as a Plasticity Index ([PI] by the American Society for Testing and Materials [ASTM] D 4318) value of 20 or less. Very low to low expansive potential soils are defined as having an Expansion Index ([EI] by ASTM D 4829) of 50 or less. The Atterberg limits tests performed on selected samples resulted in PI values ranging from 7 to 28. As such, it is our opinion that some of the on-site soils may not be suitable for re-use as engineered fill during construction. Additional field sampling and laboratory testing should be conducted during construction if unsuitable soils are encountered.

In addition, suitable fill should not include organic material, clay lumps, construction debris, rock particles, and other non-soil fill materials larger than 3 inches in dimension. This material should be disposed of off site or in non-structural areas.

For above-grade structures founded on shallow foundations, footings should be founded on a zone of moisture-conditioned and compacted engineered fill, extending 2 foot, or more below the bearing elevation. The overexcavation should extend lateral for a distance of two feet or more. Below-grade structures founded on shallow foundations should be founded on a 1-foot zone of engineered fill that is moisture-conditioned and compacted. This new fill should be placed in horizontal lifts no more than approximately 8 inches in loose thickness and compacted by appropriate mechanical methods, to 95 percent relative compaction, in accordance with ASTM D 698 at a moisture content within 2 percent of its optimum moisture. These overexcavations should extend laterally 2 feet horizontally beyond the foundation footprint.

Mat foundations and slabs below grade should be placed on a 6-inch zone, or more, of moisture-conditioned and compacted engineered fill that extends below the granular base material. This new fill should be compacted by appropriate mechanical methods, to 95 percent relative compaction, in accordance with ASTM D 698 at a moisture content within 2 percent its optimum moisture. The overexcavation should extend laterally 1 foot horizontally beyond the foundation footprint.

We recommend that new concrete slabs-on-grade and pavements be supported on 12 inches, or more, of moisture-conditioned and compacted engineered fill. This improved zone can either be improved by overexcavation or scarification. The fill thickness should be measured from the bottom of the base material and should be compacted by appropriate mechanical methods to 95 percent relative compaction, in accordance with ASTM D 698 at a moisture content generally near optimum. The overexcavation below these areas should extend laterally 1 or more feet horizontally beyond the slab/pavement footprint.

Following the overexcavations detailed above, the resulting surface should be carefully evaluated by the geotechnical consultant by visual observations, proof rolling, and/or probing. The geotechnical consultant should also evaluate any areas of soft or wet soils prior to placement of grade-raise fill or other construction. Based on this evaluation, additional excavation and/or remediation may be needed. This additional remediation, if needed, should be addressed by the geotechnical consultant during the earthwork operations and could consist of additional overexcavation or reworking of the exposed surface. For estimating purposes, an earthwork (shrinkage) factor of about 10 to 20 percent for the on-site soils is anticipated.

9.1.6. Backfill Materials

We recommend that fill should not include organic material, clay lumps, construction debris, rock particles, or other non-soil fill materials larger than 3 inches in dimension. The geotechnical consultant should evaluate such materials and details of their placement prior to importation.

The backfill soils should be compacted to 95 percent of the maximum dry density at a moisture content generally above optimum, as evaluated by ASTM D 698. The lift thickness for engineered fill soils will vary depending on the type of compaction equipment used. To reduce potential settlements resulting from consolidation of the backfill we recommend that backfill should generally be placed in lifts not exceeding 8 inches in loose thickness. We recommend using hand-operated compaction equipment and 4-inch thick loose lifts adjacent to concrete walls and in confined areas.

If the annular spacing between the excavation sidewalls and the below grade structures is such that compaction equipment can not fit in this space, we recommend that a Controlled Low Strength Material (CLSM) be used to backfill this area. The CLSM should be designed according to ASTM C 495 and ASTM C150.

The pipes and connections associated with the below grade structures should be designed with sufficiently flexible connections to avoid damage to these connections due to settlement of the backfill, particularly where structures or pipes span the transition from deep fill to little or no fill.

Special care should be exercised to avoid damaging the pipe or other structures during the compaction of the backfill. In addition, the underside (or haunches) of the buried pipe should be supported on bedding material that is compacted as described above. This may need to be performed with placement by hand or small-scale compaction equipment.

9.1.7. Imported Fill Material

Imported fill, if utilized, should consist of granular material with a very low or low expansion potential. Import material in contact with ferrous metals or concrete should preferably have low corrosion potential (minimum resistivity more than 2,000 ohm-cm, chloride content less than 25 parts per million [ppm]). Soluble sulfate content should preferably be less than 0.1 percent. The geotechnical consultant should evaluate such materials and details of their placement prior to importation.

9.2. Pipeline Considerations

We recommend that the new underground utilities be supported on 4 inches or more of graded granular bedding material such as sand and gravel, or crushed rock with a particle size of 3/4-inch or less with 5 to 10 percent of the materials passing the No. 200 sieve. Graded, crushed rock with a particle size of 3/4-inch or less, derived from the excavations would also be suitable for use as pipe bedding. Care should be taken not to allow voids beneath the pipe (i.e., the pipe haunches should be continuously supported). Bedding material and compaction requirements should be in accordance with the recommendations in this section and in Section 9.1.5, as well as the MAG or Standard Specifications for Public Works Construction (Public Works Standards, Inc., 2009). Pipe bedding guidelines are presented on Figure 4.

The modulus of soil reaction (E´) is used to characterize the stiffness of soil backfill placed at the sides of buried pipelines for the purpose of evaluating deflection caused by the weight of the backfill over the pipe. For pipelines at a depth of up to 10 feet bgs, we recommend using an E´ value of 1,200 pounds per square inch (psi). For piping that extends to depths of more than 10 feet bgs, an E´ value of 1,600 psi may be used. These values assume that the bedding and trench backfill materials are selected and compacted according to the recommendations provided in Section 9.1.5.

9.3. Seismic Design Considerations

Based on a Probabilistic Seismic Hazard Assessment for the conterminous United States, issued by the USGS (2002 data), the site is located in a zone where the peak ground accelerations having 10, 5, and 2 percent probability of being exceeded in 50 years are 0.06g, 0.09g, and 0.15g, respectively. These ground motion values are calculated for "firm rock" sites, which correspond to a shear-wave velocity of approximately 2,500 feet per second in approximately the top 100 feet bgs. Different soil or rock types may amplify or de-amplify these values. The proposed improvements should be designed in accordance with the requirements of governing jurisdictions and applicable building codes. Table 1 presents the seismic design parameters for the site in accordance with International Building Code (IBC, 2009) guidelines and mapped spectral acceleration parameters (USGS, 2009).

Table 1 – 2009 International Building Code Seismic Design Criteria

Seismic Design Factors	Value
Site Class	D
Site Coefficient, F_a	1.516
Site Coefficient, F_v	2.383
Mapped Spectral Acceleration at 0.2-second Period, S_s	0.355g
Mapped Spectral Acceleration at 1.0-second Period, S_1	0.104 g
Spectral Acceleration at 0.2-second Period Adjusted for Site Class, S_{MS}	0.538 g
Spectral Acceleration at 1.0-second Period Adjusted for Site Class, S_{M1}	0.248 g
Design Spectral Response Acceleration at 0.2-second Period, S_{DS}	0.358 g
Design Spectral Response Acceleration at 1.0-second Period, S_{D1}	0.165 g

9.4. Foundations

The following sections present our recommendations for shallow foundations and mat foundations.

9.4.1. Shallow Foundations

Spread or continuous footings should be supported at a depth of 24 inches below the adjacent grade on a 2-foot zone of engineered fill, as described in Section 9.1.5. Continuous footings should have a width of 16 or more inches, and isolated spread footings should have a width of 24 or more inches. Spread or continuous footings should be reinforced in accordance with the recommendations of the structural engineer. Footings less than 5 feet below existing grade may be designed using a gross allowable bearing pressure of up to 2,000 psf for static conditions for shallow foundations. For spread footings deeper than 5 feet below existing grade, an allowable bearing pressure of up to of 3,000 psf can be used. Foundations that bear on bedrock may be designed using an allowable bearing pressure of up to 5,000 psf for static conditions. Foundations should bear either on soil, or bedrock, but not both (i.e. there should be no soil/bedrock transition within the foundation footprint).

Total and differential settlement of up to about 1 inch and 1/2-inch, respectively, may occur. Distortions of about 1/2- inch (vertical) over 20 feet (horizontal) are possible.

Foundations bearing on moisture-conditioned, re-compacted material and subject to lateral loadings may be designed using an ultimate coefficient of friction of 0.35 (total frictional resistance equals the coefficient of friction multiplied by the dead load). A passive resistance value of 200 psf per foot of depth up to 2,000 psf may be used. The lateral resistance can be taken as the sum of the frictional resistance and passive resistance, provided that the passive resistance does not exceed two-thirds of the total allowable resistance. The passive resistance may be increased by one-third when considering loads of short duration such as wind or seismic forces. The foundations should preferably be proportioned such that the resultant force from lateral loadings falls within the kern (i.e., middle one-third).

9.4.2. Mat Foundations

We recommend that mat foundations be used to support the heavy equipment and should be founded on 6 inches, or more, of moisture-conditioned and compacted engineered fill, as described in Section 9.1.5. An allowable gross equivalent bearing pressure of up to 2,000 psf may be used for the design of mat foundations bearing at a depth of 1.5 feet or more below finished grade, and up to 1,000 psf for mat foundations designed on grade. For depths 10 feet or more, an allowable bearing pressure of up to 3,000 psf can be used.These values correspond to a mat width of 3 feet or more. Peak edge stresses may exceed the allowable soil bearing pressures as long as the average pressure does not exceed this value and the resultant passes through the middle third of the foundation base. The allowable soil bearing pressure may be increased by one-third when considering total loads including loads of short duration such as wind or seismic forces. For the anticipated loading, estimated total settlements will be less than about 1 inch.

Mat foundations may be designed using a coefficient of subgrade reaction, K, in kips per cubic foot (kcf) as defined using the following equation:

$$K = 300 / \sqrt{A}$$

Where A is size of the loaded area, in square feet.

9.5. Floor Slabs

The design of the floor slabs is the responsibility of the structural engineer. However, from a geotechnical standpoint, we recommend that floor slabs have a thickness of 4 inches and be reinforced with steel rebar. Placement of the reinforcement in the slabs is vital for satisfactory performance. The slabs should be underlain by 4 inches of granular material 12 inches of engineered fill as described in Section 9.1.5.

Floor slabs should either be constructed so that they “float” independent of the foundations or be designed to be structurally connected to the foundations. Soils underlying the slabs should be moisture-conditioned and compacted in accordance with the recommendations contained in Section 9.1.5. Joints should be constructed at intervals designed by the structural engineer to help reduce random cracking of the slab.

9.6. Lateral Earth Pressures against Below-Grade Wall/Structures

Walls that are not restrained from movement at the top and have a level backfill behind the wall may be designed using an "active" equivalent fluid unit weight of 35 pounds per cubic foot (pcf) for drained conditions. For undrained conditions, an equivalent fluid unit weight of 83 pcf should be used. For seismic lateral loading, an equivalent fluid unit weight of 39 pcf may be used. This value assumes compaction within about 5 feet of the wall will be accomplished with relatively light compaction equipment, and that very low to low expansive backfill will be placed behind the wall. This value also assumes that the retaining walls will have a height less than 12 feet. Retaining walls should also be designed to resist a surcharge pressure of 0.35q. The value for "q" represents the pressure induced by adjacent light loads, slab, or traffic loads plus any adjacent footing loads.

The "at-rest" earth pressure against walls that are restrained at the top or braced so that they cannot yield, and with level backfill, may be taken as equivalent to the pressure exerted by a fluid weighing 55 pcf for drained conditions. For undrained conditions, an equivalent fluid pressure of 90 pcf should be used. Restrained retaining walls should also be designed to resist a horizontal earth pressure of 0.5q. The value for "q" represents the vertical surcharge pressure induced by adjacent light loads, slab, or traffic loads plus any adjacent footing loads.

For "passive" resistance to lateral loads, we recommend that an equivalent fluid weight of 350 pcf be used up to a value of 2,000 psf for drained conditions, and an equivalent fluid weight of 280 pcf for undrained conditions. This value assumes that the ground is horizontal for a distance of 10 feet or more behind the wall or three times the height generating the passive pressure, whichever is more. We recommend that the upper 12 inches of soil not protected by pavement or a concrete slab be neglected when calculating passive resistance.

For frictional resistance to lateral loads, we recommend that a coefficient of friction of 0.35 be used between soil and concrete. If passive and frictional resistances are to be used in combination, we recommend that the passive resistance be limited to one-half of the ultimate lateral resistance. The passive resistance values may be increased by one-third when considering loads of short duration, such as wind or seismic forces.

Measures should be taken so that moisture does not build up behind retaining walls. Back drainage measures should include free-draining backfill material and perforated drainpipes or weep holes. Drainpipes should outlet away from structures, and retaining walls should be waterproofed in accordance with the recommendations of the project civil engineer or architect. To reduce the potential for water- and sulfate/salt-related damage to the retaining walls, particular care should be taken in the selection of the appropriate type of waterproofing material to be utilized and in the application of this material.

9.7. Pavements

No traffic information was provided during the writing of this report. However, we assume that traffic will consist of maintenance vehicles and occasional heavy trucks. For the paved areas, we assume that asphalt concrete (AC) will be utilized. The pavement section given below is assumed to bear on imported or on-site soils with an average soil R-value of 20 or more.

An asphalt pavement section consisting of 4 inches of plant-mix asphalt (per MAG Section 710) over 6 inches of graded AB can be considered in the standard duty parking areas. However, for areas that will experience heavy truck traffic, an asphalt pavement section consisting of 4 inches of plant-mix asphalt (per MAG Section 710) over 9 inches of graded AB can be utilized. As an alternative, 8 inches of Portland cement concrete (PCC) can be utilized in these heavy truck traffic areas.

Concrete pavements, if utilized, should have longitudinal and transverse joints that meet the applicable requirements of the MAG Uniform Standard Specification and/or any City of Prescott requirements. Concrete pavements should be underlain by 4 inches or more of AB that meets Section 702 of the MAG specifications and/or any City of Prescott requirements, as shown in Table 2.

Table 2 – Recommended Aggregate Base Gradation

Sieve Size (per ASTM D422-63)	Percent Passing by Weight
1 1/8 inch	100
No. 4	38-65
No. 8	25-60
No. 30	10-40
No. 200	3-12
P.I. Max.	5

The minimal reinforcement for the concrete pavement areas should be No. 4 reinforcing bars placed 18 inches on-center (each way) in the middle one-third of slab height. The structural engineer may decide that additional reinforcement is needed.

For both the PCC and asphalt pavements given above, we recommend the underlying subgrade soils be prepared as described in Section 9.1.5. AB material should be compacted to a relative compaction of 95 percent of the maximum dry density, as evaluated by ASTM D 698, at a moisture content generally within two percent of its optimum moisture content.

9.8. Concrete Flatwork

To reduce the potential manifestation of distress to exterior concrete flatwork due to movement of the underlying soil, we recommend that such flatwork be installed with crack-control joints and/or reinforcement steel at appropriate spacing as designed by the structural engineer. We recommend that exterior concrete flatwork be supported on 12 or more inches of moisture-conditioned and compacted engineered fill as described in Section 9.1.5 of this report. Positive drainage should be established and maintained adjacent to flatwork.

9.9. Corrosion

The corrosion potential of the on-site materials was analyzed to evaluate its potential effect on the foundations and structures. Corrosion potential was evaluated using the results of laboratory testing of a sample obtained during our subsurface evaluation that was considered representative of soils at the subject site.

Laboratory testing consisted of pH, minimum electrical resistivity, and chloride and soluble sulfate contents. The pH and minimum electrical resistivity tests were performed in general accordance with Arizona Test 236b, while sulfate and chloride tests were performed in accordance with Arizona Test 733 and 736, respectively. The results of the corrosivity tests are presented in Appendix B.

The soil pH values of the selected representative samples generally ranged from 6.9 to 8.0, which is considered to be slightly acidic to alkaline, respectively. The minimum electrical resistivities measured in the laboratory ranged from 1,233 to 2,192 ohm-cm, which could be considered corrosive to ferrous materials. The chloride contents of the samples tested ranged from 13 to 73 ppm, which also may be considered corrosive to ferrous materials. The soluble sulfate contents of the soil samples ranged from 0.003 to 0.004 percent by weight, which is considered to represent negligible sulfate exposure for concrete.

The results of the laboratory testing indicate that the on-site materials could be corrosive to ferrous metals. Therefore, special consideration should be given to the use of heavy gauge, corrosion protected, underground steel pipe or culverts, if any are planned. As an alternative, plastic pipe or reinforced concrete pipe could be considered. A corrosion specialist should be consulted for further recommendations.

9.10. Concrete

Laboratory chemical tests performed on selected samples of on-site soils indicated a sulfate content up to 0.004 percent by weight. Based on the following American Concrete Institute (ACI) table, the on-site soils are considered to have a negligible sulfate exposure to concrete.

Table 3 – ACI Requirements for Concrete Exposed to Sulfate-Containing Soil

Sulfate Exposure	Water-Soluble Sulfate (SO_4) in Soil, Percentage by Weight	Cement Type	Water-Cementitious Materials Ratio, by Weight, Normal-Weight Aggregate Concrete[1]	f'_c, Normal-Weight and Lightweight Aggregate Concrete, psi
				x 0.00689 for MPa
Negligible	0.00 - 0.10	--	--	--
Moderate[2]	0.10 - 0.20	II, IP(MS), IS (MS)	0.50, or less.	4,000, or more.
Severe	0.20 - 2.00	V	0.45, or less.	4,500, or more.
Very severe	Over 2.00	V plus pozzolan[3]	0.45, or less.	4,500, or more.

[1] A lower water-cementitious materials ratio or higher strength may be needed for low permeability or for protection against corrosion of embedded items or freezing and thawing (ACI Table 4.2.2).
[2] Seawater.
[3] Pozzolan that has been evaluated by test or service record to improve sulfate resistance when used in concrete containing Type V cement.

Notwithstanding the sulfate test results, and given the exposure of the structures to sulfate-containing reclaimed water, we recommend the use of Type V cement for construction of concrete structures at this site. Additionally, pozzolan or admixtures designed to increase sulfate resistance may be considered.

The concrete should have a water-cementitious materials ratio no more than 0.45 by weight for normal weight aggregate concrete. The structural engineer should ultimately select the concrete design strength based on the project specific loading conditions. Higher strength concrete may be selected for increased durability and resistance to slab curling and shrinkage cracking.

In order to reduce the potential for shrinkage cracks in the concrete during curing, we recommend that for slabs-on-grade, the concrete be placed with a slump in accordance with ACI Table 5.2.1 of Section 302.1R of “Guidelines for Floor and Slab Construction,” or ACI Table 2.2 of Section 332R in “Guidelines for Residential Cast-in-Place Concrete Construction.” If a higher slump is needed for screeding and leveling, a super plasticizer is recommended to achieve the higher slump without changing the recommended water to cement ratio. The slump should be checked periodically at the site prior to concrete placement.

We also recommend that crack control joints be provided in slabs in accordance with the recommendations of the structural engineer to reduce the potential for distress due to minor soil movement and concrete shrinkage. We further recommend that concrete cover over reinforcing steel for slabs-on-grade and foundations be in accordance with IBC 1907.7.1. The structural engineer should be consulted for additional concrete specifications.

9.11. Site Drainage

Surface drainage should be provided to divert water away from the structures (below- and above-ground) and off of paved surfaces. Surface water should not be permitted to drain toward the structures or to pond adjacent to footings or on pavement areas. Positive drainage is defined as a slope of 2 or more percent for a distance of 5 or more feet away from the structures. Roof gutters should be installed on buildings. Downspouts should discharge to drainage systems away from structures, pavements, and flatwork. Soil improvements below the new grade slabs and pavement sections should be sloped to drain beyond the edges of these areas.

9.12. Pre-Construction Conference

We recommend that a pre-construction conference be held. Representatives of the owner, the civil engineer, the geotechnical consultant, and the contractor should be in attendance to discuss the project plans and schedule. Our office should be notified if the project description included herein is incorrect, or if the project characteristics are significantly changed.

9.13. Construction Observation and Testing

During construction operations, we recommend that a qualified geotechnical consultant perform observation and testing services for the project. These services should be performed to evaluate exposed subgrade conditions, including the extent and depth of overexcavation, to evaluate the suitability of proposed borrow materials for use as fill, and to observe placement and test compaction of fill soils. If another geotechnical consultant is selected to perform observation and testing services for the project, we request that the selected consultant provide a letter to the owner, with a copy to Ninyo & Moore, indicating that they fully understand our recommendations and that they are in full agreement with the recommendations contained in this report. Qualified subcontractors utilizing appropriate techniques and construction materials should perform construction of the proposed improvements.

10. LIMITATIONS

The field evaluation, laboratory testing, and geotechnical analyses presented in this geotechnical report have been conducted in general accordance with current practice and the standard of care exercised by geotechnical consultants performing similar tasks in the project area. No warranty, expressed or implied, is made regarding the conclusions, recommendations, and opinions presented in this report. There is no evaluation detailed enough to reveal every subsurface condition. Variations may exist and conditions not observed or described in this report may be encountered during construction. Uncertainties relative to subsurface conditions can be reduced through additional subsurface exploration. Additional subsurface evaluation will be performed upon request. Please also note that our evaluation was limited to assessment of the geotechnical aspects of the project, and did not include evaluation of structural issues, environmental concerns, or the presence of hazardous materials.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Ninyo & Moore should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document.

This report is intended for design purposes only. It does not provide sufficient data to prepare an accurate bid by contractors. It is suggested that the bidders and their geotechnical consultant perform an independent evaluation of the subsurface conditions in the project areas. The independent evaluations may include, but not be limited to, review of other geotechnical reports prepared for the adjacent areas, site reconnaissance, and additional exploration and laboratory testing.

Our conclusions, recommendations, and opinions are based on an analysis of the observed site conditions. If geotechnical conditions different from those described in this report are encountered, our office should be notified and additional recommendations, if warranted, will be provided upon request. It should be understood that the conditions of a site could change with time as a result of natural processes or the activities of man at the subject site or nearby sites. In addition, changes to the applicable laws, regulations, codes, and standards of practice may occur due to government action or the broadening of knowledge. The findings of this report may, therefore, be invalidated over time, in part or in whole, by changes over which Ninyo & Moore has no control.

This report is intended exclusively for use by the client. Any use or re-use of the findings, conclusions, and/or recommendations of this report by parties other than the client is undertaken at said parties' sole risk.

11. REFERENCES

American Concrete Institute, 2005, Building Code Requirements for Structural Concrete (ACI 318-05) and Commentary (ACI 318R-05).

American Concrete Institute, 1991a, Guidelines for Concrete Floor and Slab Construction (ACI 302.1R).

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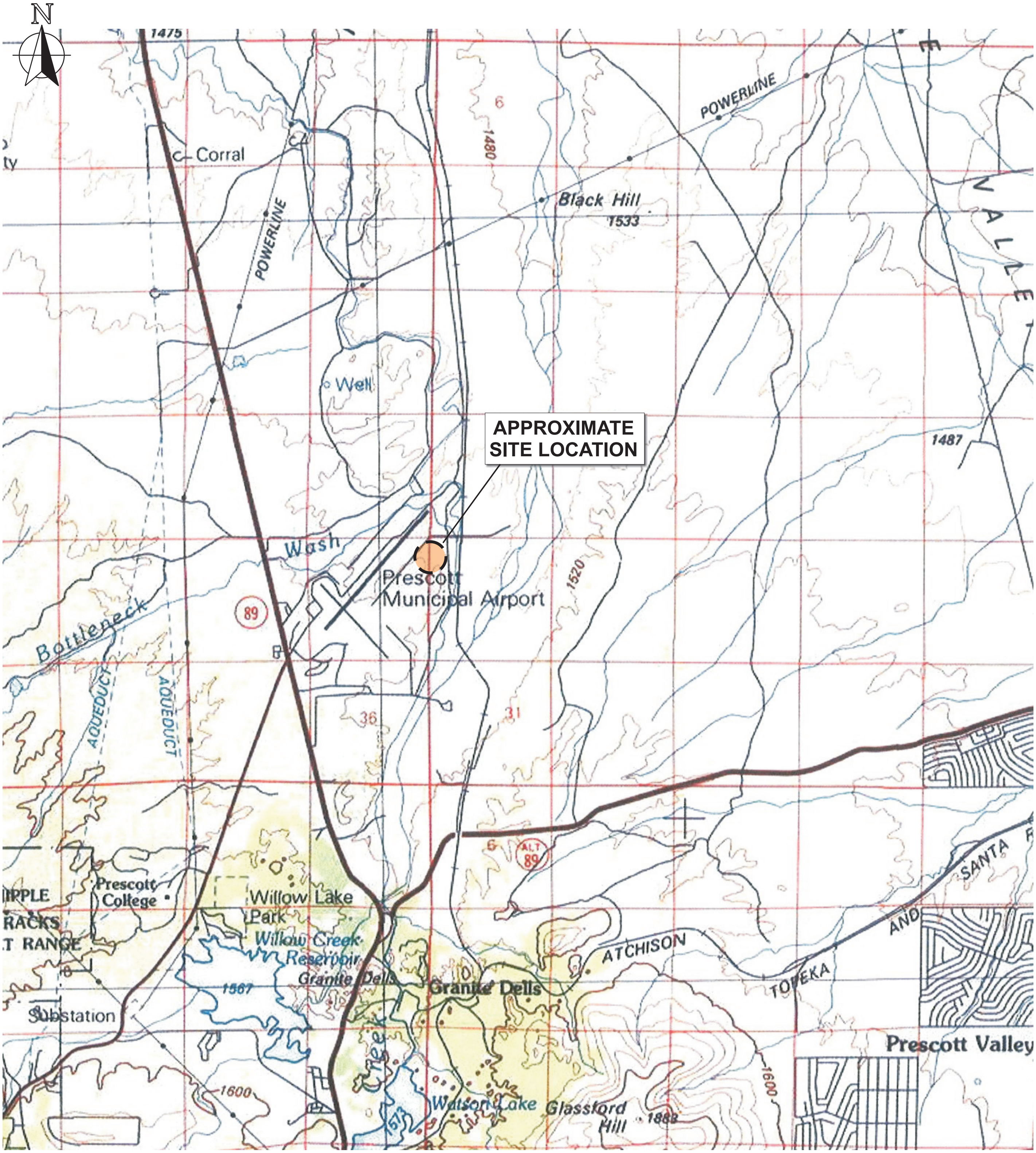
United States Geological Survey, 1985, Chino Valley South Topographic Map.

Aerial Photographs

Source	Photo Date
United States Department of Agriculture	1992
United States Geologic Survey	2002, 2005, 2010



Source: US Geological Survey 100K map series topographic map; Chino Valley South, Prescott Valley, and Prescott, Arizona; 1973.

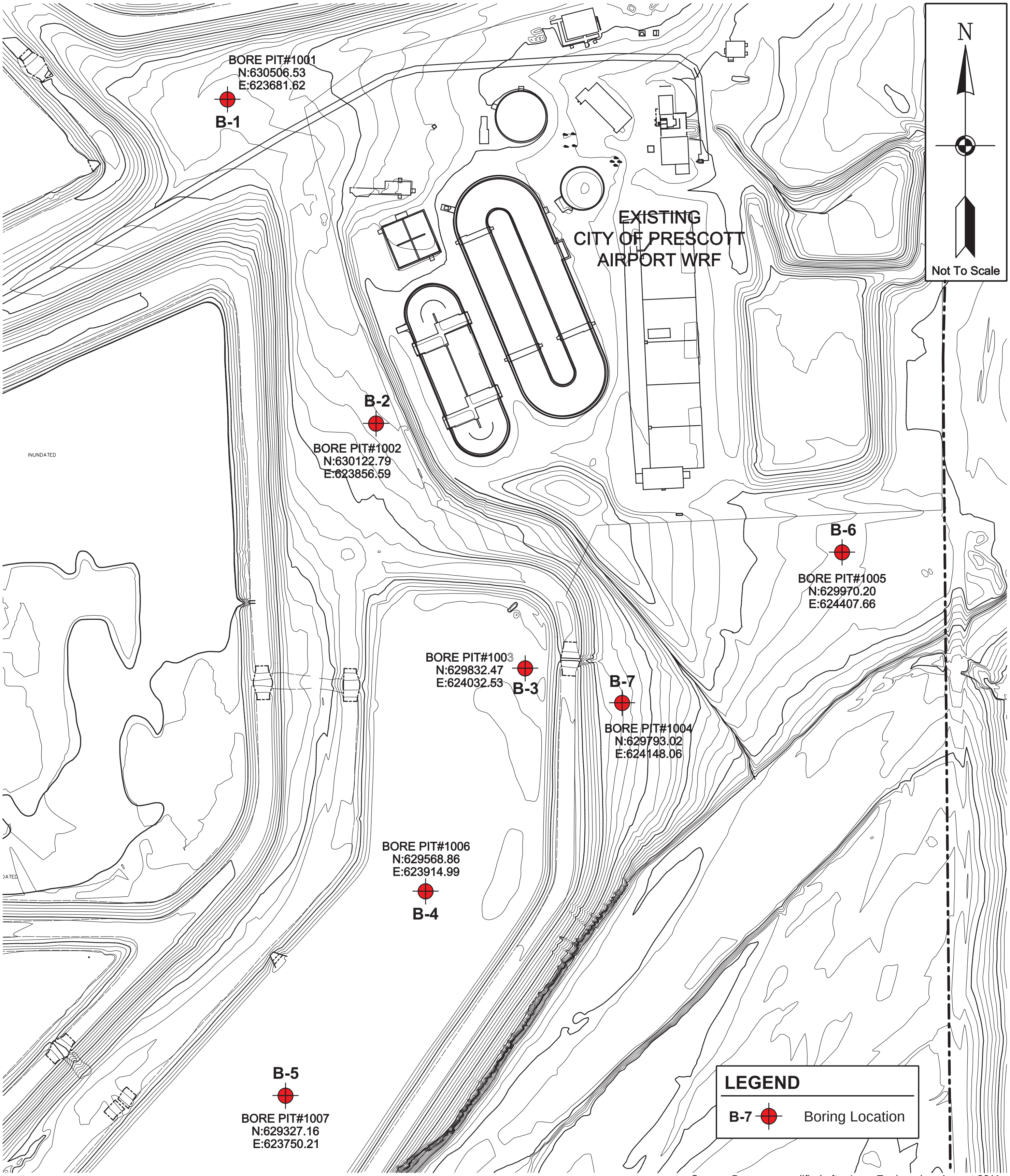
0 6000

Approximate Scale:
1 inch = 6000 feet

Note: Dimensions, directions, and locations are approximate.

Ninyo & Moore	SITE LOCATION	FIGURE
PROJECT NO: 603427001	DATE: 1/12	CITY OF PRESCOTT AIRPORT WATER RECLAMATION FACILITY EXPANSION PRESCOTT, ARIZONA	1

file no: 3427vmap0911

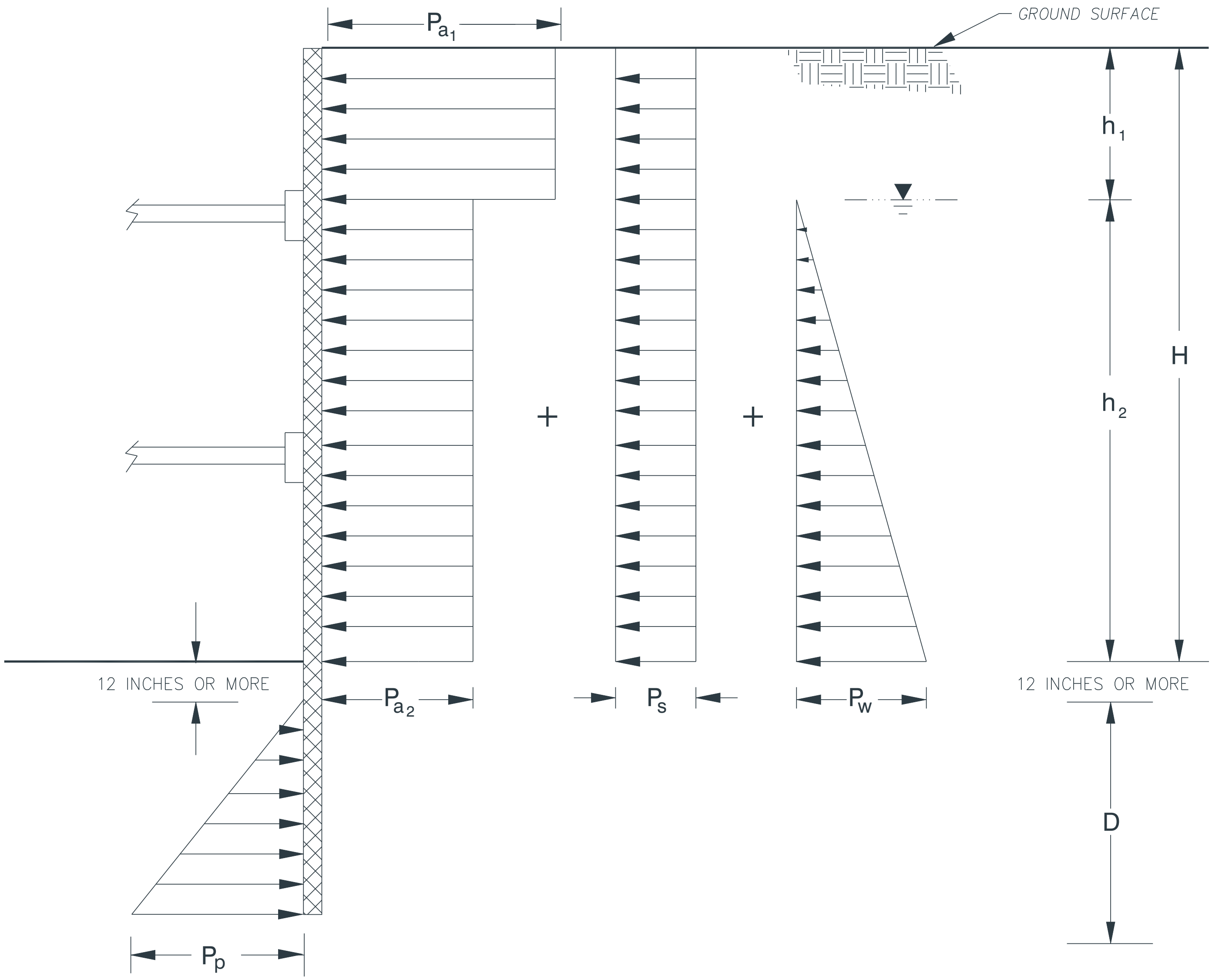


Source: Basemap modified after Lyon Engineering, August 2011.

Note: Dimensions, directions, and locations are approximate.

Ninyo & Moore	BORING LOCATION MAP		FIGURE
PROJECT NO: 603427001	DATE: 1/12	CITY OF PRESCOTT AIRPORT WATER RECLAMATION FACILITY EXPANSION PRESCOTT, ARIZONA	2

file no: 3427blm0911



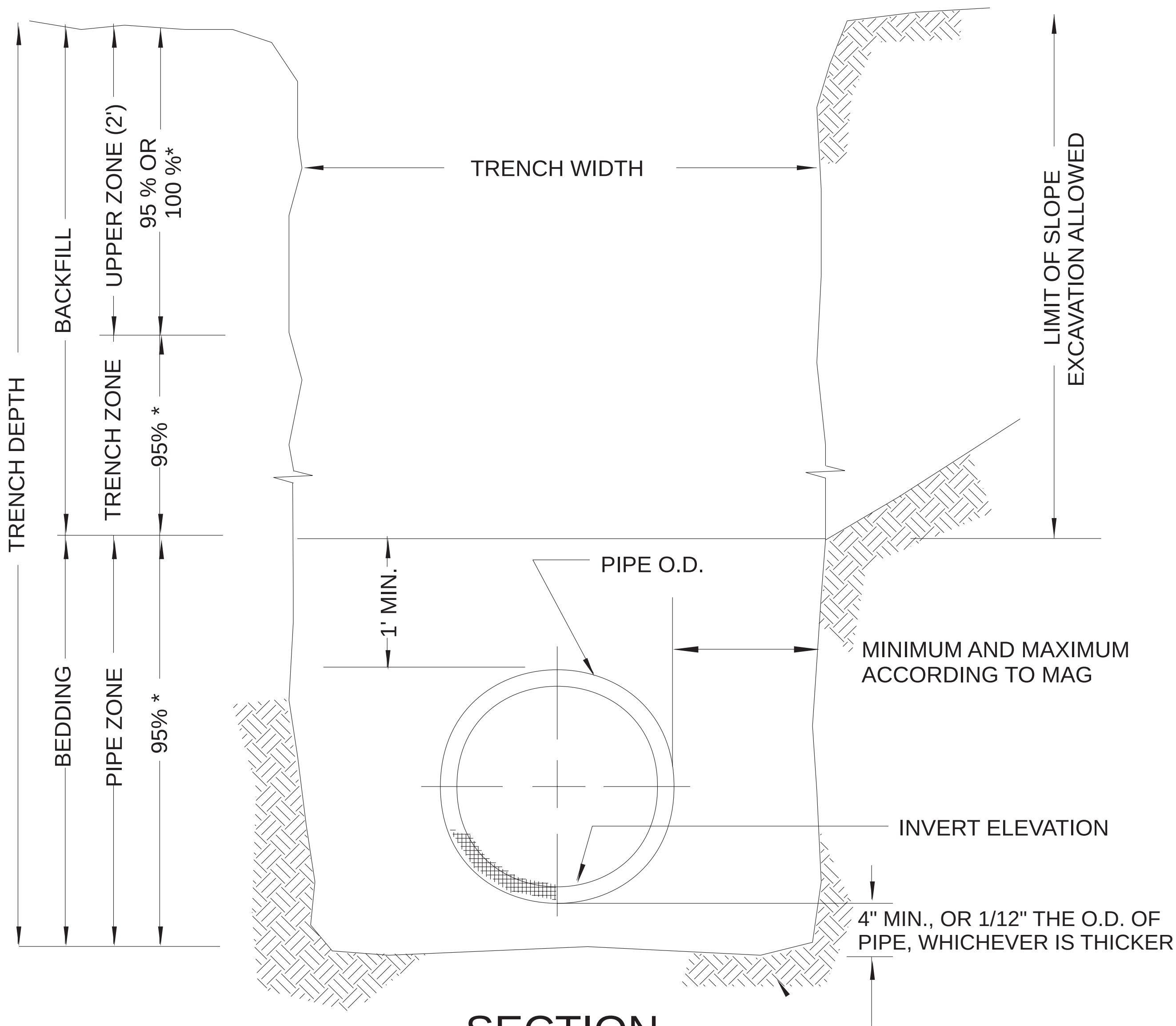
NOTES:

1. APPARENT LATERAL EARTH PRESSURE, $P_{a\,1}$ AND $P_{a\,2}$
   $P_{a\,1} = 24\ h_1$ psf
   $P_{a\,2} = 14\ h_2$ psf
2. CONSTRUCTION TRAFFIC INDUCED SURCHARGE PRESSURE, P_s
   $P_s = 120$ psf
3. WATER PRESSURE, P_w
   $P_w = 62.4\ h_2$ psf
4. PASSIVE PRESSURE, P_p
   $P_p = 200$ D psf
5. SURCHARGES FROM EXCAVATED SOIL OR CONSTRUCTION MATERIALS ARE NOT INCLUDED
6. H, h_1 , h_2 AND D ARE IN FEET
7. GROUNDWATER TABLE

NOT TO SCALE

Ninyo & Moore	LATERAL EARTH PRESSURES FOR BRACED EXCAVATION	FIGURE 3
PROJECT NO: 603427001 / DATE: 1/12	CITY OF PRESCOTT AIRPORT WATER RECLAMATION FACILITY EXPANSION PRESCOTT, ARIZONA	

file no: 3427lep0911a



SECTION

NOTE

* Indicates minimum relative compaction (see report for details).

Upper zone required for pavement areas only.

Diagram not drawn to scale.

NOT FOR CONSTRUCTION

Ninyo & Moore		PIPE BEDDING GUIDELINES	FIGURE
PROJECT NO: 603427001	DATE: 1/12	CITY OF PRESCOTT AIRPORT WATER RECLAMATION FACILITY EXPANSION PRESCOTT, ARIZONA	4

file no: 3427pbg0911

APPENDIX A

BORING LOGS

Field Procedure for the Collection of Disturbed Samples

Disturbed soil samples were obtained in the field using the following methods.

Bulk Samples

Bulk samples of representative earth materials were obtained from the exploratory borings. The samples were bagged and transported to the laboratory for testing.

The Standard Penetration Test Spoon

Disturbed drive samples of earth materials were obtained by means of a Standard Penetration Test spoon sampler. The sampler is composed of a split barrel with an external diameter of 2 inches and an unlined internal diameter of 1-3/8 inches. The spoon was driven up to 18 inches into the ground with a 140-pound hammer free-falling from a height of 30 inches in general accordance with ASTM D 1586. The blow counts were recorded for every 6 inches of penetration; the blow counts reported on the logs are those for the last 12 inches of penetration. Soil samples were observed and removed from the spoon, bagged, sealed, and transported to the laboratory for testing.

Field Procedure for the Collection of Relatively Undisturbed Samples

Relatively undisturbed soil samples were obtained in the field using the following method.

The Modified Split-Barrel Drive Sampler

The sampler, with an external diameter of 3.0 inches, was lined with 1-inch long, thin brass rings with inside diameters of approximately 2.4 inches. The sample barrel was driven into the ground with the weight of a hammer or the Kelly bar of the drill rig in general accordance with ASTM D 3550. The driving weight was permitted to fall freely. The approximate length of the fall, the weight of the hammer or bar, and the number of blows per foot of driving are presented on the boring logs as an index to the relative resistance of the materials sampled. The samples were removed from the sample barrel in the brass rings, sealed, and transported to the laboratory for testing.

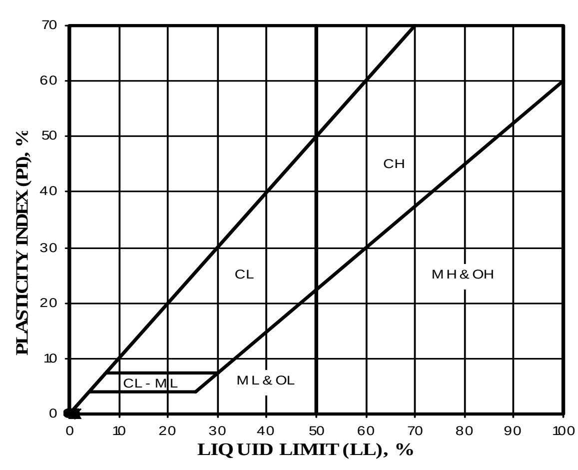
U.S.C.S. METHOD OF SOIL CLASSIFICATION

MAJOR DIVISIONS		SYMBOL	TYPICAL NAMES
COARSE-GRAINED SOILS (More than 1/2 of soil >No. 200 sieve size)	**GRAVELS (More than 1/2 of coarse fraction > No. 4 sieve size)**	GW	Well graded gravels or gravel-sand mixtures, little or no fines
		GP	Poorly graded gravels or gravel-sand mixtures, little or no fines
		GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
	SANDS (More than 1/2 of coarse fraction <No. 4 sieve size)	SW	Well graded sands or gravelly sands, little or no fines
		SP	Poorly graded sands or gravelly sands, little or no fines
		SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (More than 1/2 of soil <No. 200 sieve size)	**SILTS & CLAYS Liquid Limit <50**	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean
		OL	Organic silts and organic silty clays of low plasticity
	SILTS & CLAYS Liquid Limit >50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silty clays, organic silts
HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils

GRAIN SIZE CHART

CLASSIFICATION	RANGE OF GRAIN SIZE	
	U.S. Standard Sieve Size	Grain Size in Millimeters
BOULDERS	Above 12"	Above 305
COBBLES	12" to 3"	305 to 76.2
GRAVEL **Coarse** **Fine**	3" to No. 4 3" to 3/4" 3/4" to No. 4	76.2 to 4.76 76.2 to 19.1 19.1 to 4.76
SAND **Coarse** **Medium** **Fine**	No. 4 to No. 200 No. 4 to No. 10 No. 10 to No. 40 No. 40 to No. 200	4.76 to 0.075 4.76 to 2.00 2.00 to 0.420 0.420 to 0.075
SILT & CLAY	Below No. 200	Below 0.075

PLASTICITY CHART



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U.S.C.S. METHOD OF SOIL CLASSIFICATION

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	BORING LOG EXPLANATION SHEET
0								Bulk sample.
								Modified split-barrel drive sampler.
								No recovery with modified split-barrel drive sampler.
								Sample retained by others.
								Standard Penetration Test (SPT).
5								No recovery with a SPT.
			XX/XX					Shelby tube sample. Distance pushed in inches/length of sample recovered in inches.
								No recovery with Shelby tube sampler.
								Continuous Push Sample.
								Seepage.
10								Groundwater encountered during drilling.
								Groundwater measured after drilling.
							SM	ALLUVIUM: Solid line denotes unit change.
								Dashed line denotes material change.
15								Attitudes: Strike/Dip b: Bedding c: Contact j: Joint f: Fracture F: Fault cs: Clay Seam s: Shear bss: Basal Slide Surface sf: Shear Fracture sz: Shear Zone sbs: Sheared Bedding Surface
20								The total depth line is a solid line that is drawn at the bottom of the boring.

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BORING LOG

EXPLANATION OF BORING LOG SYMBOLS

PROJECT NO.	DATE	FIGURE
	Rev. 01/03	

DATE DRILLED	9/1/11	BORING NO.	B-1
GROUND ELEVATION	4,938' ± MSL	SHEET 1 OF 3	
METHOD OF DRILLING	Diedrich D-50, 8" Diameter Hollow-Stem Auger (D&S Drilling)		
DRIVE WEIGHT	140lbs. (Automatic)	DROP	30"
SAMPLED BY	DM	LOGGED BY DM	REVIEWED BY JSR

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						SC	ALLUVIUM: Brown, damp, very dense, clayey SAND with gravel.
		50/5"	3.7	120.6			
						SM	Brown, damp, medium dense, silty SAND; few gravel.
		11					
5							
		30					
						SC	Brown, moist, medium dense, clayey SAND.
		14					
10							
						GC	Brown, moist, very dense, clayey GRAVEL with sand; cobbles and possible boulders.
		50/5"					
15							
		50/2"					
						CL	Brown, damp, hard, sandy CLAY; trace gravel.
		21					
20							

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BORING LOG

City of Prescott Airport Water Reclamation Facility Expansion
Prescott, Arizona

PROJECT NO.	DATE	FIGURE
603427001	1/12	A-1

DEPTH (feet)	SAMPLES: Bulk	SAMPLES: Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DATE DRILLED 9/1/11 BORING NO. B-1 GROUND ELEVATION 4,938' ± MSL SHEET 2 OF 3 METHOD OF DRILLING Diedrich D-50, 8" Diameter Hollow-Stem Auger (D&S Drilling) DRIVE WEIGHT 140lbs. (Automatic) DROP 30" SAMPLED BY DM LOGGED BY DM REVIEWED BY JSR DESCRIPTION/INTERPRETATION
20							CL	ALLUVIUM: (Continued) Brown, damp, hard, sandy CLAY; trace gravel.
							SM	Brown, damp, medium dense, silty SAND; few gravel.
25			39					
30			22					Dense.
							SC	Brown, moist, medium dense, clayey SAND; trace gravel.
35			27					
			50/5"					Very dense.
40								Total Depth = 39.4 feet.

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BORING LOG

City of Prescott Airport Water Reclamation Facility Expansion
Prescott, Arizona

PROJECT NO.	DATE	FIGURE
603427001	1/12	A-2

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DATE DRILLED 9/1/11 BORING NO. B-1 GROUND ELEVATION 4,938' ± MSL SHEET 3 OF 3 METHOD OF DRILLING Diedrich D-50, 8" Diameter Hollow-Stem Auger (D&S Drilling) DRIVE WEIGHT 140lbs. (Automatic) DROP 30" SAMPLED BY DM LOGGED BY DM REVIEWED BY JSR **DESCRIPTION/INTERPRETATION**
40								Groundwater no encountered during drilling. Backfilled on 9/1/11 promptly after completion of drilling. Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
45								
50								
55								
60								

Ninyo & Moore

BORING LOG

City of Prescott Airport Water Reclamation Facility Expansion
Prescott, Arizona

PROJECT NO.	DATE	FIGURE
603427001	1/12	A-3

DATE DRILLED	9/1/11
BORING NO.	B-2
GROUND ELEVATION	4,928' ± MSL
SHEET	1 OF 3
METHOD OF DRILLING	Diedrich D-50, 8" Diameter Hollow-Stem Auger (D&S Drilling)
DRIVE WEIGHT	140lbs. (Automatic)
DROP	30"
SAMPLED BY	DM
LOGGED BY	DM
REVIEWED BY	JSR

DEPTH (feet)	SAMPLES Bulk / Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						SC	ALLUVIUM: Brown, damp, medium dense, clayey SAND.
	Driven	13					
	Driven	17	7.5	98.1			
5							
	Driven	40					Very dense; scattered caliche filaments.
						GC	Brown, damp, very dense, clayey GRAVEL with sand; cobbles and possible boulders.
	Driven	50/2"	4.8	101.5			
10							
	Driven	50/5"					
15							
						CL	Brown, moist, hard, sandy CLAY; trace gravel.
	Driven	27					
20							

Ninyo & Moore

BORING LOG

City of Prescott Airport Water Reclamation Facility Expansion
Prescott, Arizona

PROJECT NO.	DATE	FIGURE
603427001	1/12	A-4

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DATE DRILLED 9/1/11 BORING NO. B-2 GROUND ELEVATION 4,928' ± MSL SHEET 2 OF 3 METHOD OF DRILLING Diedrich D-50, 8" Diameter Hollow-Stem Auger (D&S Drilling) DRIVE WEIGHT 140lbs. (Automatic) DROP 30" SAMPLED BY DM LOGGED BY DM REVIEWED BY JSR DESCRIPTION/INTERPRETATION
20							CL	ALLUVIUM: (Continued) Brown, moist, hard, sandy CLAY; trace gravel.
			51				GM	Gray, damp, very dense, silty GRAVEL with sand; cobbles and possible boulders.
25								
			30					PRESCOTT GRANODIORITE: Light brown, moist, soft, GRANODIORITE; decomposed.
30								
			30					
35								
			50/5"	4.8	129.6			
40								Total Depth = 38.9 feet. Groundwater no encountered during drilling. Backfilled on 9/1/11 promptly after completion of drilling.

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BORING LOG

City of Prescott Airport Water Reclamation Facility Expansion
Prescott, Arizona

PROJECT NO.	DATE	FIGURE
603427001	1/12	A-5

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
40								Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
45								
50								
55								
60								

DATE DRILLED 9/1/11 BORING NO. B-2

GROUND ELEVATION 4,928' ± MSL SHEET 3 OF 3

METHOD OF DRILLING Diedrich D-50, 8" Diameter Hollow-Stem Auger (D&S Drilling)

DRIVE WEIGHT 140lbs. (Automatic) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY JSR

Ninyo & Moore

BORING LOG

City of Prescott Airport Water Reclamation Facility Expansion
Prescott, Arizona

PROJECT NO.	DATE	FIGURE
603427001	1/12	A-6

DATE DRILLED 9/1/11 BORING NO. B-3

GROUND ELEVATION 4,933' ± MSL SHEET 1 OF 3

METHOD OF DRILLING Diedrich D-50, 8" Diameter Hollow-Stem Auger (D&S Drilling)

DRIVE WEIGHT 140lbs. (Automatic) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY JSR

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							SC	FILL: Brown, damp, very dense, clayey SAND.
			50/4"					
			8				SW-SC	ALLUVIUM: Brown, damp, loose, well-graded SAND with clay and gravel.
5								
			18	3.7	104.8			Medium dense; decrease in gravel content.
							SC	Brown, damp, very dense, clayey SAND; with gravel.
			77/10"					
10								
							GP	Brown, damp, dense, poorly-graded GRAVEL with sand; cobbles and possible boulders.
			51				SC	Brown, moist, dense, clayey SAND with gravel.
15								
			25					
20								

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BORING LOG

City of Prescott Airport Water Reclamation Facility Expansion
Prescott, Arizona

PROJECT NO.	DATE	FIGURE
603427001	1/12	A-7

DATE DRILLED 9/1/11	BORING NO. B-3	
GROUND ELEVATION 4,933' ± MSL	SHEET 2 OF 3	
METHOD OF DRILLING Diedrich D-50, 8" Diameter Hollow-Stem Auger (D&S Drilling)		
DRIVE WEIGHT 140lbs. (Automatic)	DROP 30"	
SAMPLED BY DM	LOGGED BY DM	REVIEWED BY JSR

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20							SC	ALLUVIUM: (Continued) Brown, damp, dense, clayey SAND with gravel.
								(Approximate Proposed Grade)
		■	60	8.2	120.5			
25								
							CL	Brown, moist, stiff, sandy CLAY.
		◣	8					
30								
							SM	Brown, damp, dense, silty SAND; few gravel.
		■	63					
35								
		◣	50/5"					Very dense; cobbles and possible boulders.
								Total Depth = 39.4 feet.
40								

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BORING LOG

City of Prescott Airport Water Reclamation Facility Expansion
Prescott, Arizona

PROJECT NO.	DATE	FIGURE
603427001	1/12	A-8

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DATE DRILLED 9/1/11 BORING NO. B-3
								GROUND ELEVATION 4,933' ± MSL SHEET 3 OF 3
								METHOD OF DRILLING Diedrich D-50, 8" Diameter Hollow-Stem Auger (D&S Drilling)
								DRIVE WEIGHT 140lbs. (Automatic) DROP 30"
								SAMPLED BY DM LOGGED BY DM REVIEWED BY JSR
								DESCRIPTION/INTERPRETATION
40								Groundwater no encountered during drilling. Backfilled on 9/1/11 promptly after completion of drilling. Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
45								
50								
55								
60								

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BORING LOG

City of Prescott Airport Water Reclamation Facility Expansion
Prescott, Arizona

PROJECT NO.	DATE	FIGURE
603427001	1/12	A-9

DATE DRILLED	9/1/11	BORING NO.	B-4
GROUND ELEVATION	4,933' ± MSL	SHEET	1 OF 3
METHOD OF DRILLING	Diedrich D-50, 8" Diameter Hollow-Stem Auger (D&S Drilling)		
DRIVE WEIGHT	140lbs. (Automatic)	DROP	30"
SAMPLED BY	DM	LOGGED BY	DM
REVIEWED BY	JSR		

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							SC	FILL: Brown, damp, dense, clayey SAND; scattered caliche nodules.
			30					
							GC	ALLUVIUM: Gray, damp, very dense, clayey GRAVEL with sand; cobbles and possible boulders.
			50/3"	1.9	110.4			
5								
			50/5"				GM	Brown, damp, very dense, silty GRAVEL with sand; cobbles and possible boulders.
			50/4"					
10								
			59					
15								
							SC	Brown, moist, medium dense, clayey SAND; few gravel.
			36					
20								

Ninyo & Moore

BORING LOG

City of Prescott Airport Water Reclamation Facility Expansion
Prescott, Arizona

PROJECT NO.	DATE	FIGURE
603427001	1/12	A-10

DATE DRILLED	9/1/11	BORING NO.	B-4
GROUND ELEVATION	4,933' ± MSL	SHEET	2 OF 3
METHOD OF DRILLING	Diedrich D-50, 8" Diameter Hollow-Stem Auger (D&S Drilling)		
DRIVE WEIGHT	140lbs. (Automatic)	DROP	30"
SAMPLED BY	DM	LOGGED BY	DM
REVIEWED BY	JSR		

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20						SC	ALLUVIUM: (Continued) Brown, moist, medium dense, clayey SAND; few gravel.
							(Approximate Proposed Grade)
25	Driven	21					Dense.
						GM	Brown, moist, very dense, silty GRAVEL with sand.
30	Driven	50/4"					
						CL	Brown, moist, very stiff, sandy CLAY.
35	Driven	16					
						SC	Brown, moist, clayey SAND; few gravel.
40	Driven	23	31.3	89.7			

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BORING LOG

City of Prescott Airport Water Reclamation Facility Expansion
Prescott, Arizona

PROJECT NO.	DATE	FIGURE
603427001	1/12	A-11

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
40								Total Depth = 40 feet. Groundwater no encountered during drilling. Backfilled on 9/1/11 promptly after completion of drilling. Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
45								
50								
55								
60								

DATE DRILLED 9/1/11 BORING NO. B-4

GROUND ELEVATION 4,933' ± MSL SHEET 3 OF 3

METHOD OF DRILLING Diedrich D-50, 8" Diameter Hollow-Stem Auger (D&S Drilling)

DRIVE WEIGHT 140lbs. (Automatic) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY JSR

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BORING LOG

City of Prescott Airport Water Reclamation Facility Expansion
Prescott, Arizona

PROJECT NO.	DATE	FIGURE
603427001	1/12	A-12

DATE DRILLED 9/2/11 BORING NO. B-5

GROUND ELEVATION 4,933' ± MSL SHEET 1 OF 3

METHOD OF DRILLING Diedrich D-50, 8" Diameter Hollow-Stem Auger (D&S Drilling)

DRIVE WEIGHT 140lbs. (Automatic) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY JSR

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							SC	FILL: Brown, damp, very dense, clayey SAND; few gravel.
			77/10"	11.3	113.3			
							GC	ALLUVIUM: Brown, damp, very dense, clayey GRAVEL with sand; cobbles and possible boulders.
			67					
5								
			50/3"					
			75					
10								
							SC	Brown, moist, medium dense, clayey SAND; few gravel.
			39	15.3	115.3			
15								
			31					Dense.
20								

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BORING LOG

City of Prescott Airport Water Reclamation Facility Expansion
Prescott, Arizona

PROJECT NO.	DATE	FIGURE
603427001	1/12	A-13

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20							SC	ALLUVIUM: (Continued) Brown, moist, dense, clayey SAND; few gravel.
							GM	Brown, damp, very dense, silty GRAVEL with sand; cobbles and possible boulders.
			50/4"					
25								
			24					Dense.
30								
							SM	Brown, damp, dense, silty SAND; few gravel.
			70					
35								
							SC	Brown, damp, very dense, clayey SAND; few gravel.
			72					
40								

DATE DRILLED 9/2/11 BORING NO. B-5

GROUND ELEVATION 4,933' ± MSL SHEET 2 OF 3

METHOD OF DRILLING Diedrich D-50, 8" Diameter Hollow-Stem Auger (D&S Drilling)

DRIVE WEIGHT 140lbs. (Automatic) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY JSR

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BORING LOG

City of Prescott Airport Water Reclamation Facility Expansion
Prescott, Arizona

PROJECT NO.	DATE	FIGURE
603427001	1/12	A-14

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DATE DRILLED 9/2/11 BORING NO. B-5 GROUND ELEVATION 4,933' ± MSL SHEET 3 OF 3 METHOD OF DRILLING Diedrich D-50, 8" Diameter Hollow-Stem Auger (D&S Drilling) DRIVE WEIGHT 140lbs. (Automatic) DROP 30" SAMPLED BY DM LOGGED BY DM REVIEWED BY JSR **DESCRIPTION/INTERPRETATION**
40								Total Depth = 40 feet. Groundwater no encountered during drilling. Backfilled on 9/2/11 promptly after completion of drilling. Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
45								
50								
55								
60								

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BORING LOG

City of Prescott Airport Water Reclamation Facility Expansion
Prescott, Arizona

PROJECT NO.	DATE	FIGURE
603427001	1/12	A-15

DATE DRILLED	9/2/11
BORING NO.	B-6
GROUND ELEVATION	4,918' ± MSL
SHEET	1 OF 3
METHOD OF DRILLING	Diedrich D-50, 8" Diameter Hollow-Stem Auger (D&S Drilling)
DRIVE WEIGHT	140lbs. (Automatic)
DROP	30"
SAMPLED BY	DM
LOGGED BY	DM
REVIEWED BY	JSR

DEPTH (feet)	SAMPLES Bulk / Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						SM	ALLUVIUM: Brown, damp, dense, silty SAND.
		28					
						SC	Brown, damp, dense, clayey SAND.
		54	5.8	115.3			
5							
						SM	Brown, damp, dense, silty SAND; few gravel.
		65/9"					
						GC	Brown, damp, very dense, clayey GRAVEL with sand; cobbles and possible boulders.
		50/5"					
10							
		37					
15							
		67					Dense.
20							

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20							GC	ALLUVIUM: (Continued) Brown, damp, dense, clayey GRAVEL with sand; cobbles and possible boulders.
								(Approximate Proposed Grade)
							SC	Brown, damp, very dense, clayey SAND; few gravel.
25		■	41					
							SM	Brown, damp, dense, silty SAND; few gravel.
30		■	61	6.0	112.3			
35		■	35					Very dense.
		■	50/5"					
40								Total Depth = 39.4 feet.

DATE DRILLED 9/2/11 BORING NO. B-6

GROUND ELEVATION 4,918' ± MSL SHEET 2 OF 3

METHOD OF DRILLING Diedrich D-50, 8" Diameter Hollow-Stem Auger (D&S Drilling)

DRIVE WEIGHT 140lbs. (Automatic) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY JSR

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BORING LOG

City of Prescott Airport Water Reclamation Facility Expansion
Prescott, Arizona

PROJECT NO.	DATE	FIGURE
603427001	1/12	A-17

DEPTH (feet)	SAMPLES: Bulk	SAMPLES: Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
40								Groundwater no encountered during drilling. Backfilled on 9/2/11 promptly after completion of drilling. <u>Note</u>: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
45								
50								
55								
60								

DATE DRILLED 9/2/11 BORING NO. B-6

GROUND ELEVATION 4,918' ± MSL SHEET 3 OF 3

METHOD OF DRILLING Diedrich D-50, 8" Diameter Hollow-Stem Auger (D&S Drilling)

DRIVE WEIGHT 140lbs. (Automatic) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY JSR

Ninyo & Moore

BORING LOG

City of Prescott Airport Water Reclamation Facility Expansion
Prescott, Arizona

PROJECT NO.	DATE	FIGURE
603427001	1/12	A-18

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							SC	ALLUVIUM: Brown, damp, very dense, clayey SAND; few gravel.
			50/5"					
							GM	Gray, damp, very dense, silty GRAVEL with sand; cobbles and possible boulders.
			50/4"					
5								
			50/4"	5.2	115.9		SC	Brown, damp, very dense, clayey SAND; few gravel.
			69/10"					Increase in gravel content.
10								
							GM	Brown, damp, very dense, silty GRAVEL with sand; cobbles and possible boulders.
			50/4"					
15								
							SM	Brown, damp, very dense, SAND; few gravel.
			45					
20								(Approximate Proposed Grade)

DATE DRILLED 9/2/11 BORING NO. B-7

GROUND ELEVATION 4,932' ± MSL SHEET 1 OF 3

METHOD OF DRILLING Diedrich D-50, 8" Diameter Hollow-Stem Auger (D&S Drilling)

DRIVE WEIGHT 140lbs. (Automatic) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY JSR

Ninyo & Moore

BORING LOG

City of Prescott Airport Water Reclamation Facility Expansion
Prescott, Arizona

PROJECT NO.	DATE	FIGURE
603427001	1/12	A-19

DATE DRILLED 9/2/11 BORING NO. B-7

GROUND ELEVATION 4,932' ± MSL SHEET 2 OF 3

METHOD OF DRILLING Diedrich D-50, 8" Diameter Hollow-Stem Auger (D&S Drilling)

DRIVE WEIGHT 140lbs. (Automatic) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY JSR

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20							SM	ALLUVIUM: (Continued) Brown, damp, very dense, silty SAND; few gravel.
			52					Dense.
25								
							SC	Brown, damp, dense, clayey SAND.
			31					
30								
			63	9.2	122.8			
							SM	Brown, damp, dense, silty SAND; gravel.
35								
							GM	Brown, damp, very dense, silty GRAVEL with sand; cobbles and possible boulders.
			53					
40								

Ninyo & Moore

BORING LOG

City of Prescott Airport Water Reclamation Facility Expansion
Prescott, Arizona

PROJECT NO.	DATE	FIGURE
603427001	1/12	A-20

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DATE DRILLED 9/2/11 BORING NO. B-7 GROUND ELEVATION 4,932' ± MSL SHEET 3 OF 3 METHOD OF DRILLING Diedrich D-50, 8" Diameter Hollow-Stem Auger (D&S Drilling) DRIVE WEIGHT 140lbs. (Automatic) DROP 30" SAMPLED BY DM LOGGED BY DM REVIEWED BY JSR **DESCRIPTION/INTERPRETATION**
40								Total Depth = 40 feet. Groundwater no encountered during drilling. Backfilled on 9/2/11 promptly after completion of drilling. Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
45								
50								
55								
60								

APPENDIX B

LABORATORY TESTING

Classification

Soils were visually and texturally classified in accordance with the Unified Soil Classification System (USCS) in general accordance with ASTM D 2488. Soil classifications are indicated on the logs of the exploratory excavations in Appendix A.

In-Place Moisture and Density Tests

The moisture content and dry density of relatively undisturbed samples obtained from the exploratory excavations were evaluated in general accordance with ASTM D 2937. The test results are presented on the logs of the exploratory excavations in Appendix A.

Gradation Analysis

Gradation analysis tests were performed on selected representative soil samples in general accordance with ASTM D 422. The grain-size distribution curves are shown on Figures B-1 through B-6. These test results were utilized in evaluating the soil classifications in accordance with the Unified Soil Classification System.

Atterberg Limits

Tests were performed on selected representative fine-grained soil samples to evaluate the liquid limit, plastic limit, and plasticity index in general accordance with ASTM D 4318. These test results were utilized to evaluate the soil classification in accordance with the Unified Soil Classification System. The test results and classifications are shown on Figure B-7.

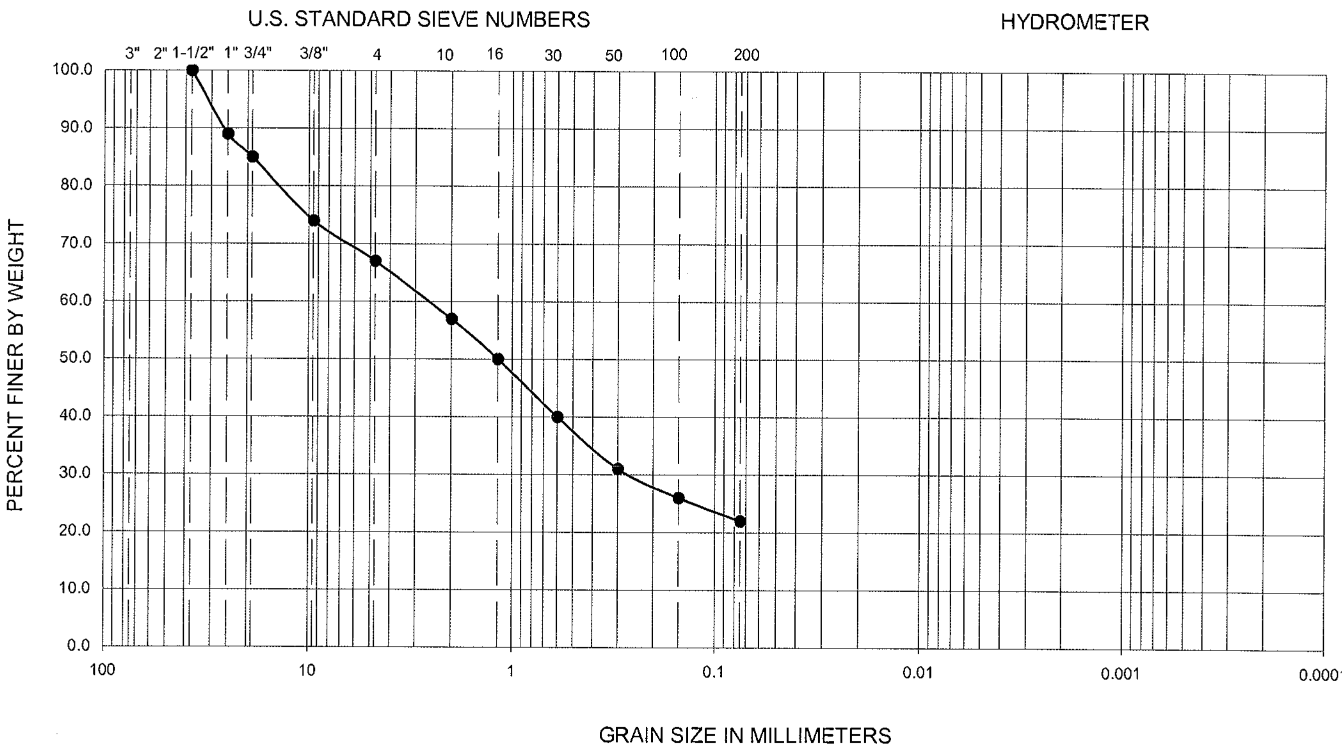
Consolidation (Response-to-Wetting) Tests

Consolidation tests were performed on selected relatively undisturbed soil samples in general accordance with ASTM D 2435. The samples were inundated during testing to represent adverse field conditions. The percent of consolidation for each load cycle was recorded as a ratio of the amount of vertical compression to the original height of the sample. The results of the tests are summarized on Figures B-8 through B-9.

Soil Corrosivity Tests

Soil pH and minimum resistivity tests were performed on representative samples in general accordance with Arizona Test 236b. The chloride content of selected samples was evaluated in general accordance with Arizona Test 736. The sulfate content of selected samples was evaluated in general accordance with Arizona Test 733. The test results are presented on Figure B-10.

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY



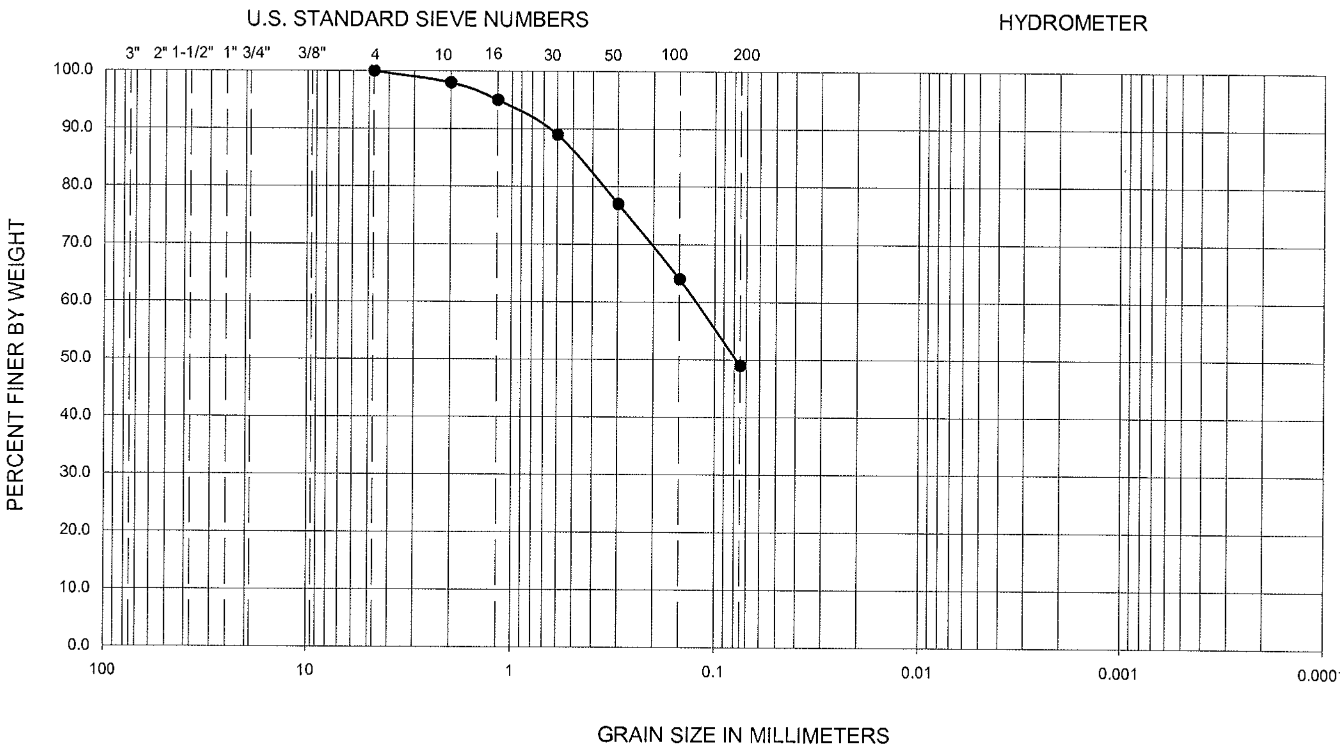
Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
●	B-1	1-1.9	30	15	15	--	--	--	--	--	22	SC

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422

Ninyo & Moore		GRADATION TEST RESULTS	FIGURE
PROJECT NO.	DATE	CITY OF PRESCOTT AIRPORT WATER RECLAMATION FACILITY EXPANSION PRESCOTT, ARIZONA	B-1
603427001	1/12		

SIEVE B-1@1-2

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY



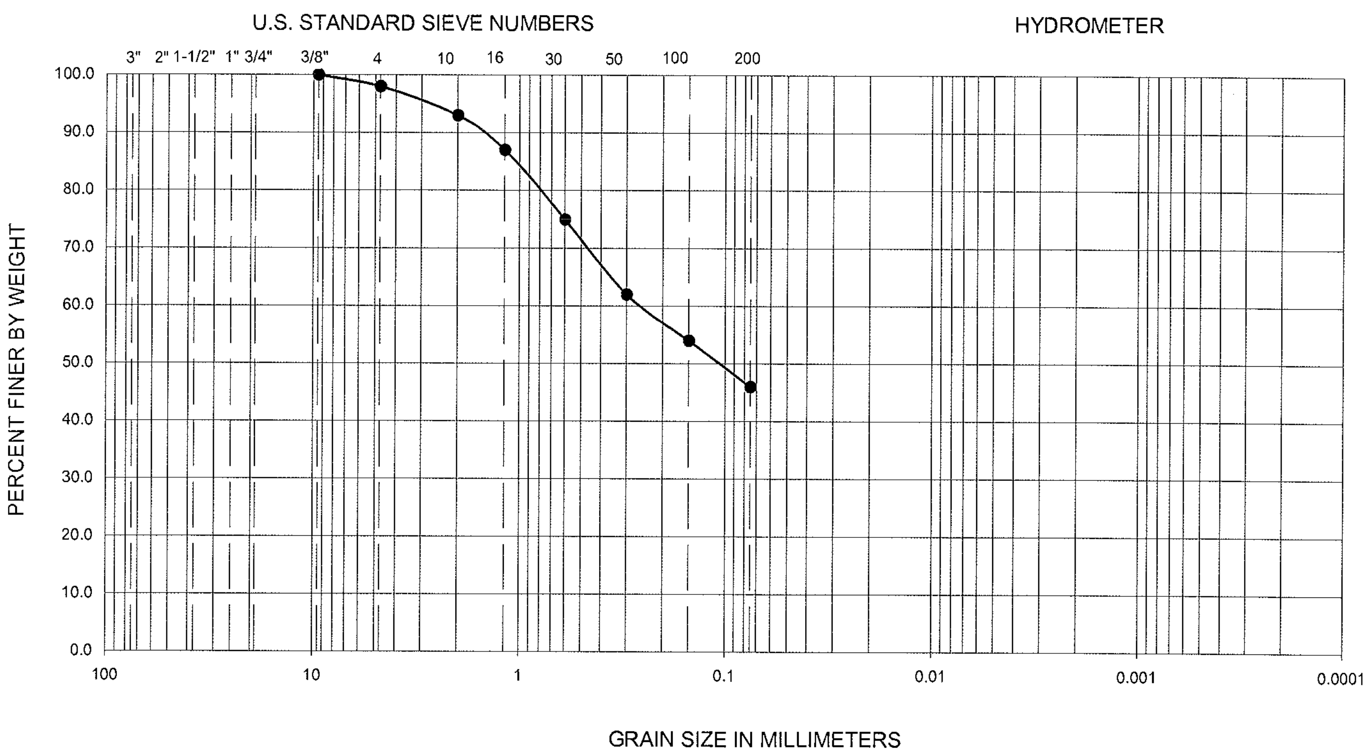
Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
●	B-2	3.5-5	31	16	15	--	--	--	--	--	49	SC

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422

Ninyo & Moore		GRADATION TEST RESULTS	FIGURE
PROJECT NO.	DATE	CITY OF PRESCOTT AIRPORT WATER RECLAMATION FACILITY EXPANSION PRESCOTT, ARIZONA	B-2
603427001	1/12		

SIEVE B-2@3.5-5

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY



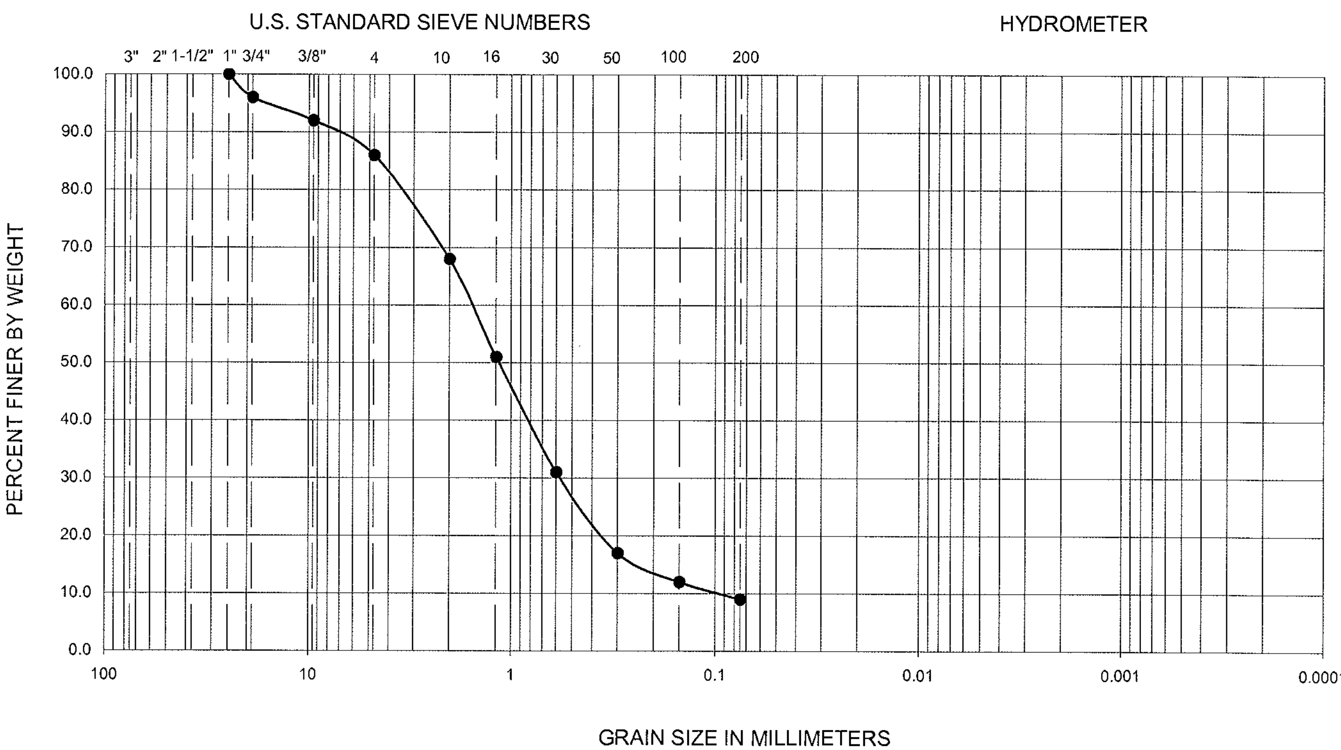
Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
●	B-2	28.5-30	46	18	28	--	--	--	--	--	46	Decomposed Granite

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422

Ninyo & Moore		GRADATION TEST RESULTS	FIGURE
PROJECT NO.	DATE	CITY OF PRESCOTT AIRPORT WATER RECLAMATION FACILITY EXPANSION PRESCOTT, ARIZONA	B-3
603427001	1/12		

SIEVE B-2@28.5-30

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY

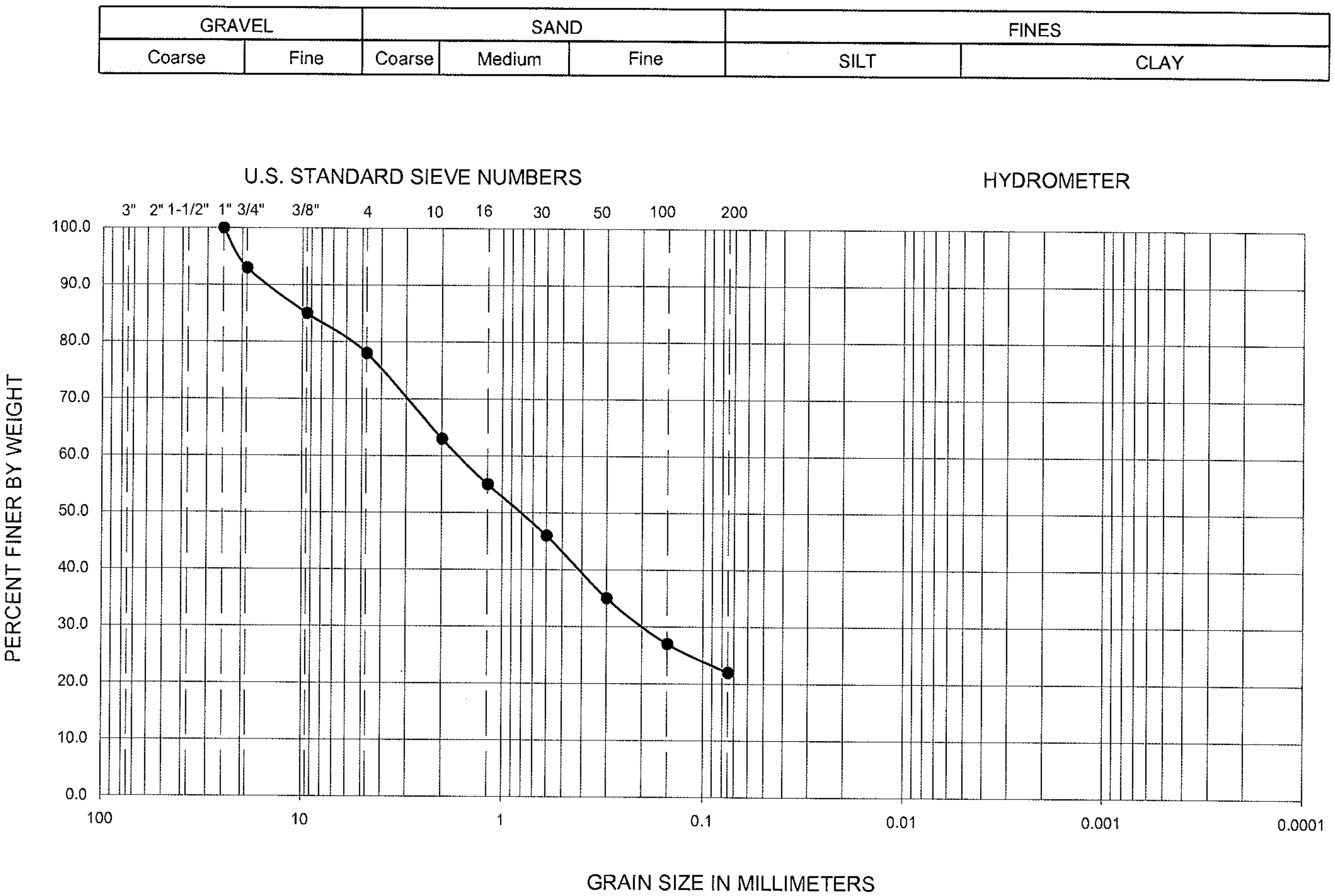


Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
●	B-3	6-7.5	27	20	7	0.09	0.58	1.70	18.9	2.2	9	SW-SC

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422

Ninyo & Moore		GRADATION TEST RESULTS	FIGURE
PROJECT NO.	DATE	CITY OF PRESCOTT AIRPORT WATER RECLAMATION FACILITY EXPANSION PRESCOTT, ARIZONA	B-4
603427001	1/12		

SIEVE B-3@6-7.5



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
●	B-3	23.5-25	37	15	22	--	--	--	--	--	22	SC

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422

Ninyo & Moore		GRADATION TEST RESULTS	FIGURE
PROJECT NO.	DATE	CITY OF PRESCOTT AIRPORT WATER RECLAMATION FACILITY EXPANSION PRESCOTT, ARIZONA	B-5
603427001	1/12		

SIEVE B-3@23.5-25

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY

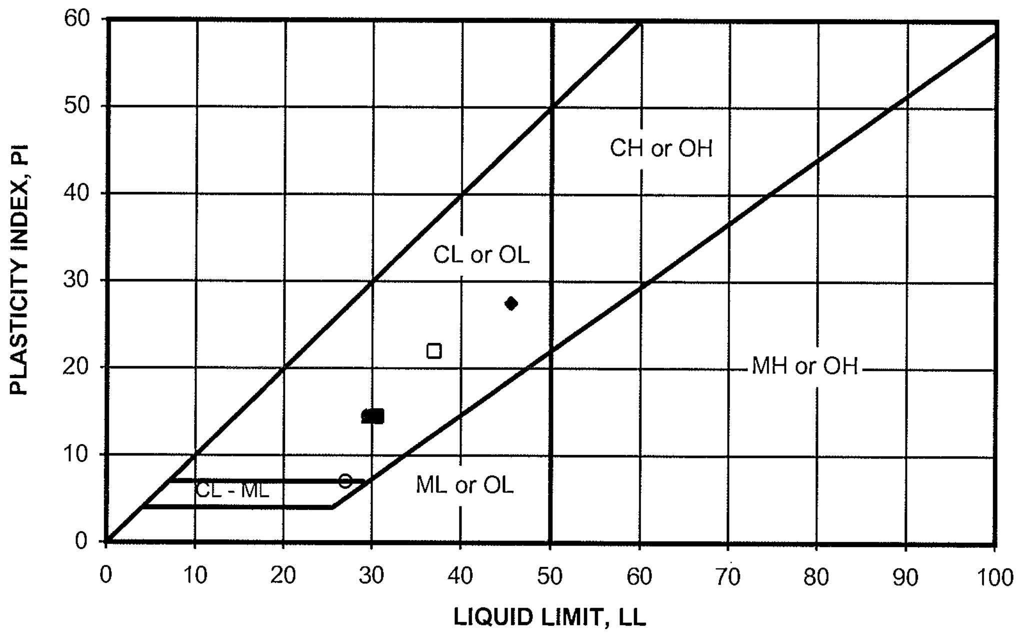
Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
●	B-6	3.5-5	30	15	15	--	--	--	--	--	42	SC

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. / DATE	CITY OF PRESCOTT AIRPORT WATER RECLAMATION FACILITY EXPANSION PRESCOTT, ARIZONA	B-6
603427001 / 1/12		

SIEVE B-6@3.5-5

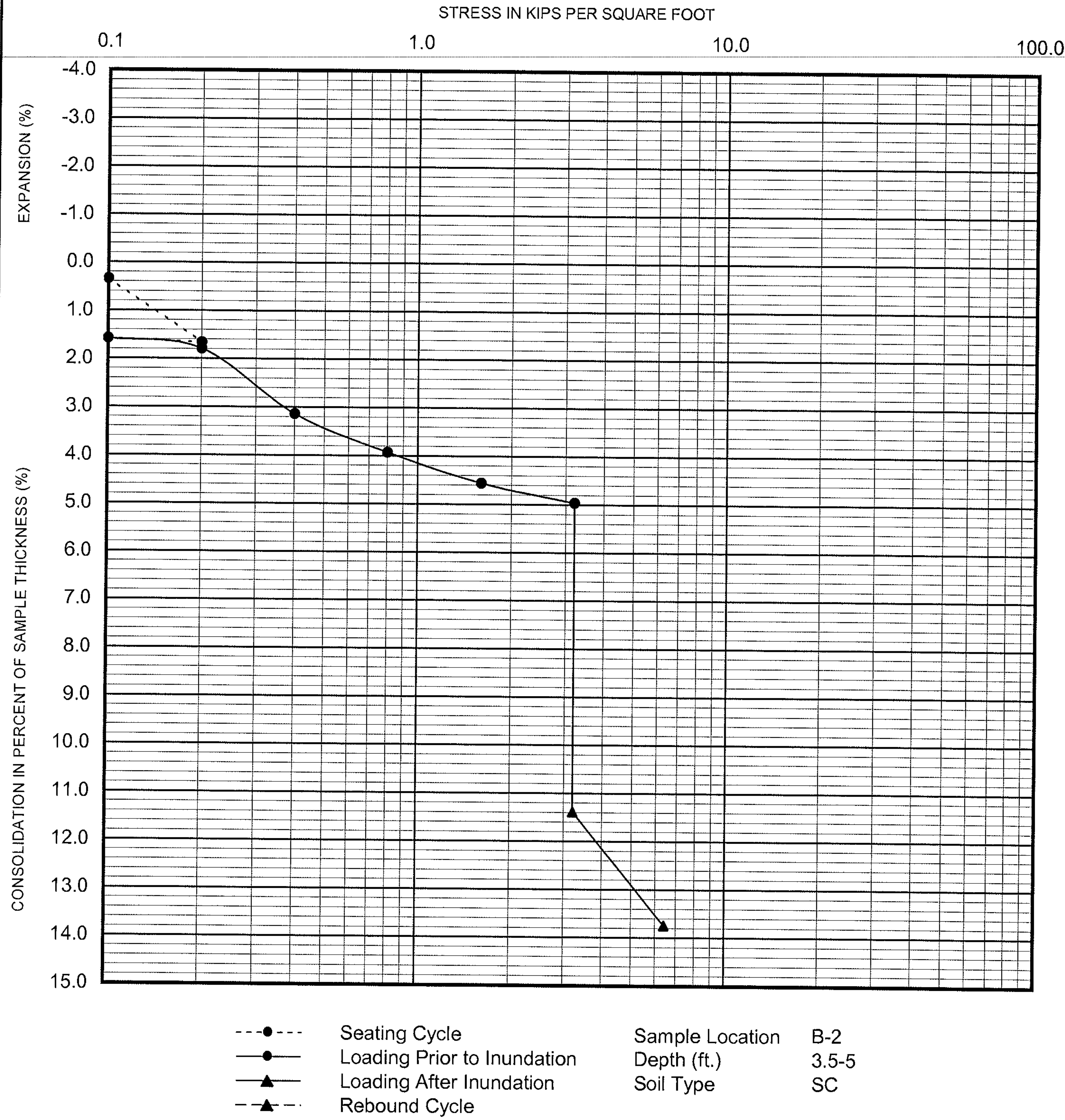
SYMBOL	LOCATION	DEPTH (FT)	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	USCS CLASSIFICATION (Fraction Finer Than No. 40 Sieve)	USCS (Entire Sample)
●	B-1	1-1.9	30	15	15	CL	SC
■	B-2	3.5-5	31	16	15	CL	SC
◆	B-2	28.5-30	46	18	28	CL	Decomposed Granite
○	B-3	6-7.5	27	20	7	CL	SW-SC
□	B-3	23.5-25	37	15	22	CL	SC
Δ	B-6	3.5-5	30	15	15	CL	SC



PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4318

Ninyo & Moore		ATTERBERG LIMITS TEST RESULTS	FIGURE
PROJECT NO.	DATE	CITY OF PRESCOTT AIRPORT WATER RECLAMATION FACILITY EXPANSION PRESCOTT, ARIZONA	B-7
603427001	1/12		

ATTERBERG1

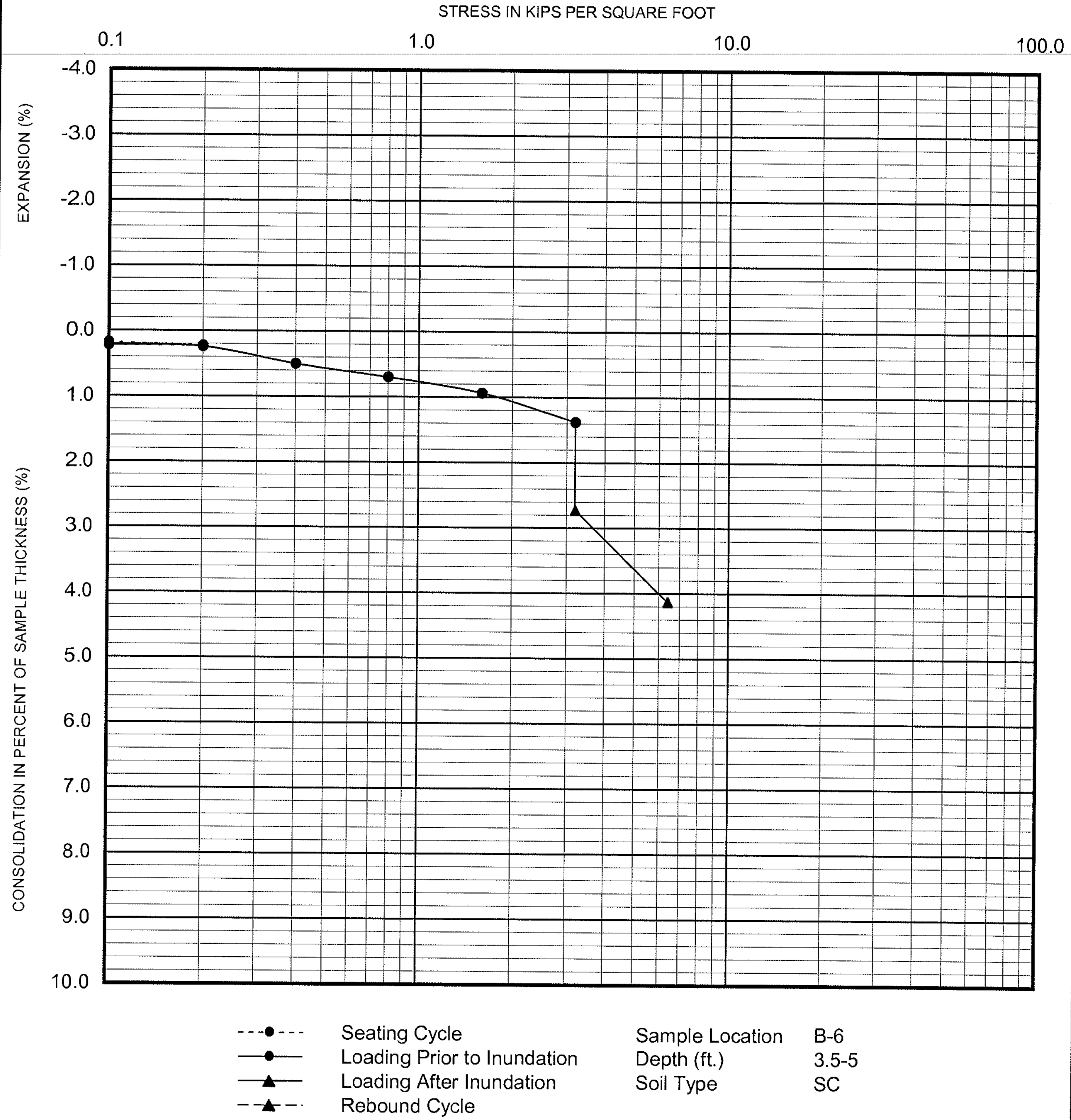


Sample Location	B-2
Depth (ft.)	3.5-5
Soil Type	SC

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435

Ninyo & Moore		CONSOLIDATION TEST RESULTS	FIGURE
PROJECT NO.	DATE	CITY OF PRESCOTT AIRPORT WATER RECLAMATION FACILITY EXPANSION PRESCOTT, ARIZONA	B-8
603427001	1/12		

CONSOLIDATION B-2@3.5-5



Sample Location	B-6
Depth (ft.)	3.5-5
Soil Type	SC

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435

Ninyo & Moore		CONSOLIDATION TEST RESULTS	FIGURE
PROJECT NO.	DATE	CITY OF PRESCOTT AIRPORT WATER RECLAMATION FACILITY EXPANSION PRESCOTT, ARIZONA	B-9
603427001	1/12		

CONSOLIDATION B-6@3.5-5

SAMPLE LOCATION	SAMPLE DEPTH (FT)	pH [1]	RESISTIVITY [1] (Ohm-cm)	SULFATE CONTENT [2]		CHLORIDE CONTENT [3] (ppm)
				(ppm)	(%)	
B-1	0-5	7.9	2,192	37	0.004	44
B-4	0-5	8.0	1,507	39	0.004	13
B-6	0-5	6.9	1,233	27	0.003	73

[1] PERFORMED IN GENERAL ACCORDANCE WITH ARIZONA TEST METHOD 236b
[2] PERFORMED IN GENERAL ACCORDANCE WITH ARIZONA TEST METHOD 733
[3] PERFORMED IN GENERAL ACCORDANCE WITH ARIZONA TEST METHOD 736

Ninyo & Moore		CORROSIVITY TEST RESULTS	FIGURE
PROJECT NO.	DATE	CITY OF PRESCOTT AIRPORT WATER RECLAMATION FACILITY EXPANSION PRESCOTT, ARIZONA	B-10
603427001	1/12		

CORROSIVITY

May 25, 2012
Project No. 603427001

Mr. Robert Bryant, P.E.
Water Works Engineers
10165 East Larkspur
Scottsdale, Arizona 85260

Subject: Addendum No. 1 to Geotechnical Evaluation City of Prescott Airport Water Reclamation Facility Expansion, dated January 30, 2012
Prescott, Arizona

Dear Mr. Bryant:

Pursuant to your request, we have addressed the comments received by Carollo Engineers on our Geotechnical Evaluation report dated January 30, 2012. The comments along with our responses are presented below.

Comment 1: Clarify whether there is an acceptable horizontal distance from below grade walls that the processed native soils (with a plasticity of less than 20) may be used, say 5'-0", after which non-processed native material may be used within the limits of the excavation. See paragraph three on page 11 of the report.

We recommend that a 2-foot horizontal distance, or more, be maintained from the below-grade walls for engineered fill.

Comment 2: Confirm that the 12-inches of improved soil recommended below slabs-on-grade can be achieved without overexcavation and replacement, but simply by scarification and recompaction of the existing soil. If scarification can be used, clarify whether this approach is acceptable for all foundation types. See paragraph three on page 12.

This depends on the soil type and if it fits the acceptable fill recommendations we stated in our report. If the soils at the location fall within the acceptable guidelines that we state in our report, then they may be scarified, moisture-conditioned, and re-compacted. Otherwise, it will need to be overexcavated and replaced with acceptable fill material. This is the contractor's decision during construction which method they choose.

Comment 3: Clarify the recommendation to use hand-operated equipment and 4-inch lifts adjacent to concrete walls. These limitations appear to be rather restrictive and not typical for backfill techniques against the large structures proposed. Furthermore, please provide a practical dimension away from walls that lift heights may be increased and larger equipment may be used. See paragraph two on page 13.

We recommend this in order to reduce the stress that is placed on the walls when backfilling behind them. This will depend on the stiffness of the wall, and if it can handle the loads imposed by heavy compaction equipment adjacent to it. The intent of this recommendation is to show that care should be taken during the backfilling of the wall. The structural engineer should evaluate which method is appropriate based on the properties of the wall.

Comment 4: Correct values indicated for Fa to 1.516 and Fv to 2.383. See Table 1 on page 15.

This was changed in our revised report.

Comment 5: Clarify whether the slab-on-grade static allowable bearing pressures may be increased for wind and seismic loads. See paragraph one on page 16.

Allowable bearing pressures may be increased by one-third for wind and seismic loads.

Comment 6: Clarify whether the allowable bearing pressure of 2,000 psf provided may be increased for deeper structures. There are several structures that will be at depths of 10-15 feet where a 2,000 psf allowable would seem conservative. See Section 9.4.2.

The bearing capacity for deeper structures may be increased to 3,000 psf for structures founded at 10 to 15 feet below ground surface (bgs). In addition, for structures at this bearing elevation, we recommend that the foundations bear on a 6-inch scarified, moisture conditioned, and compacted zone.

Comment 7: Provide seismic lateral soil pressures and corresponding load distribution for below grade walls. See pages 17 and 18.

For seismic loading, an equivalent fluid weight of 2 pounds per cubic foot (pcf) is recommended to be added to the active equivalent fluid weight, resulting in a value of 39 pcf. The load distribution is triangular for both at-rest and seismic loading. The resultant for static conditions is at one-third of the wall height from the base, and for seismic conditions it is three-fifths of the wall height from the base of the wall.

For at-rest conditions, the seismic equivalent fluid weight of 34 pcf is recommended to be added to the active equivalent fluid weight, resulting in a value of 90 pcf. The load distribution is an inverted triangle with the resultant situated 1/3 of the wall height from the top of the wall.

Comment 8: Provide the allowable bearing pressure for foundations bearing directly on the granodiorite strata found in boring number two. The proposed bottom elevation of the grit system could potentially place the structure within this layer.

For foundations (both spread footings and mat foundations) bearing on competent bedrock, we recommend a gross allowable bearing pressure of 5,000 psf. Foundations should bear either on soil or bedrock, however there should be no transition between bedrock and soil within the footprint of the structure.

The geotechnical engineer should visually evaluate the exposed surface in the field prior to placement of foundations. If shallow bedrock is encountered within the excavation, the bedrock should be removed to a depth of 1 foot below grade and replaced with a zone of moisture-conditioned and compacted engineered fill. The fill should be placed in horizontal lifts with no more than approximately 8 inches in loose thickness and compacted to 95 percent, or more, relative compaction per ASTM D 698 at a moisture content near its optimum. .

Comment 9: Review grit structure elevations to provide recommendations for possible deep foundation system. Latest design places deep excavation adjacent to at-grade building creating concern that significant settlement of fill material may occur.

We recommend that drilled shafts be constructed to a depth of 5 feet, or more below grade. In addition, the shafts should extend to competent material. The on-site geotechnical representative should evaluate the bearing material during construction for conformance with our recommendations. Our borings in this area did not extend to the depths needed for drilled shafts deeper than 5 feet below grade. As such, depths to very dense materials and/or bedrock are not known and these materials may be encountered during construction.

The allowable capacity for a single 3-foot diameter shaft is 21 kips based on an estimated allowable end bearing of 3,000 psf for shafts placed in soil, and 35 kips based on an estimated allowable end bearing of 5,000 psf for shafts placed on bedrock. Drilled shafts should not be spaced closer than three diameters (3B). For a drilled shaft center-to-center spacing of 3B (where B is the diameter of the pile in question), the capacities should be reduced by 0.65 times the allowable capacity of the shaft. This reduction factor should linearly increase until a spacing of 8B is achieved, at which point the reduction factor is not applied (1.0). For intermediate spacing, the reduction factor may be evaluated by linear interpolation.

Based on the plans provided to us, an approximate 10-foot cut is planned over an approximate horizontal distance of 50 feet from the dewatering building (an approximate slope of 5:1 (H:V). This slope is acceptable for this project.

Respectfully submitted,
NINYO & MOORE

REGISTERED GEOLOGIST CERTIFICATE NO. 49080 JEFFREY RODGERS Date Signed 5-25-12 ARIZONA, U.S.A.

Jeffrey S. Rodgers, RG
Project Geologist

EXPIRES: 03/31/15

Steven D. Nowaczyk, PE
Principal Engineer

Registered Professional Engineer (Civil) CERTIFICATE NO. 34866 STEVEN D. NOWACZYK Date Signed 5-25-12 ARIZONA U.S.A.

EXPIRES: 06/30/12

JSR/SDN/clj

Distribution: (1) Addressee – Electronic Copy

June 28, 2012
Project No. 603427001

Mr. Robert Bryant, P.E.
Water Works Engineers
10165 East Larkspur
Scottsdale, Arizona 85260

Subject: Addendum No. 2 to Geotechnical Evaluation dated January 30, 2012
City of Prescott Airport Water Reclamation Facility Expansion
Prescott, Arizona

Dear Mr. Bryant:

Pursuant to your request, we have performed additional geotechnical engineering services for the City of Prescott Airport Water Reclamation Facility Expansion Project. This letter presents our methodology, findings, and recommendations for drilled shaft foundations for the headworks structure.

PROJECT DESCRIPTION

The project consists of the design and construction of a headworks structure. The structure will have a below-grade element that is on the order of approximately 30 feet below existing grade and will be founded on drilled shafts.

FIELD EXPLORATION

On June 20, 2012, we performed a field exploration to evaluate the subsurface conditions at the project site. Our field exploration consisted of drilling, logging, and sampling two small-diameter exploratory borings, designated as B-1 and B-2, to approximately 70 feet below ground surface (bgs). The borings were drilled using a Diedrich D-120 truck-mounted drill rig equipped with hollow-stem augers. The borings were drilled within the footprint of the proposed headworks structure. The approximate locations of the soil borings are depicted on Figure 1.

Soil samples were obtained by driving a split-spoon sampler approximately 18 inches into the soil at the bottom of the borehole using an automatic 140-pound hammer falling approximately 30 inches. Ninyo & Moore logged the borings in general accordance with the Unified Soil Classification System (USCS) by observing auger cuttings and samples. The boring logs are presented on Figures 2 through 9.

DRILLED SHAFT RECOMMENDATIONS

Figure 10 presents allowable downward capacities for three separate diameters of drilled shafts at various depths. These capacities are for dry conditions. If saturated conditions are anticipated, Ninyo & Moore should be notified for additional recommendations. The capacities shown are for loads applied at the top of the shaft. The weight of below-grade concrete in the shaft may be neglected for downward loading. Axial drilled shaft capacities were conservatively estimated based on the Beta method, as presented in AASHTO (2007).

The allowable axial drilled shaft capacities presented on Figure 10 are for single shafts, with no group reduction factor applied. We used a factor of safety (FS) of 2.5 to calculate the allowable capacities. For a drilled shaft center-to-center spacing of 2.5B (where B is the diameter of the shaft), the above capacities should be reduced to 65 percent of the value shown on the chart. This reduction factor should linearly increase until a spacing of 4B is achieved, at which point the reduction factor is not applied. For intermediate spacing, the reduction factor may be evaluated by linear interpolation.

The recommended soil parameters to be used for lateral load analysis of drilled shafts using computer program LPILE are included in Table 1 below:

Table 1 – Parameters for Lateral Load Analysis using LPILE

Average Depth Below Final Grade (ft)	Soil Type to be used in Lateral Load Analysis	Effective Unit Weight (pcf)	Cohesion (psf)	Angle of Internal Friction (φ) (degrees)	Lateral Parameter k (lb/in3)
10-30 (Unsaturated)	Sand (Reese)	120	0	32	90

For lateral loading in the direction in-line with a group of drilled shafts, the lateral resistance (p-y curves) should be modified within the COM624P or LPILE program to account for group effects. This may be accomplished by using a p-multiplier to reduce the apparent resistance to lateral movement.

Based on the relatively high blow counts encountered at many of our boring locations, heavy duty equipment may be needed to excavate the drilled shafts. At the boring locations, zones of potentially low cohesion silty sands were encountered. Therefore, some caving soils, and sloughing should be anticipated in the sandy cohesionless layers. Concrete quantities may be somewhat higher than those based on neat excavation volumes. The contractor should be prepared to use a temporary full-length casing, if needed.

The drilled shafts should be observed and evaluated to check that adequate bearing material has been reached and that the bearing surface has been suitably cleaned. Where possible, the drilled shafts should be constructed in the “dry” (i.e. no more than 3 inches of water covering the base of the drilled shaft excavation). Also, the bottom of the hole should be cleaned such that no more than 2 inches of loose material remains. Depending on the type of auger used and the depth of the shaft excavation, alternative cleaning techniques, including vacuuming, may be needed. For drilled shafts constructed in the “dry,” the concrete may be placed by the free-fall method. This method consists of using a vertical section of concrete chute to aim the concrete flow out of the truck in a vertical stream of concrete with a relatively small diameter. The stream should be aimed to avoid hitting the sides of the drilled shaft or the reinforcing cage, which could cause concrete segregation. Adequate consolidation will be achieved by free-fall of the concrete up to the top 10 feet. The top 10 feet of concrete should be vibrated in order to achieve consolidation. The concrete mix should be designed so that the slump during placement is in the range of 4 to 6 inches for dry, uncased conditions.

Where the drilled shafts are constructed in the "wet," a tremie pipe connected either to a hopper or concrete pump should be used to displace the fluid in the drilled shaft excavation upwards as the concrete is placed. If this method is used, detailed procedures should be submitted by the contractor for review and approval by the geotechnical engineer. The top 10 feet of concrete should be vibrated in order to achieve compaction. The concrete should be designed so that the slump during placement is in the range of 7 to 9 inches for conditions other than a dry, uncased hole. Integrity testing should be performed on shafts constructed in "wet" conditions.

Respectfully submitted,
NINYO & MOORE

REGISTERED GEOLOGIST
CERTIFICATE NO.
49080
JEFFREY
RODGERS
Date Signed 6-28-12
ARIZONA, U.S.A.

Jeffrey S. Rodgers, RG
Project Geologist

EXPIRES: 03/31/15

Registered Professional Engineer (Civil)
CERTIFICATE NO.
41716
KEVIN L.
PORTER
Date Signed 6-28-12
ARIZONA U.S.A.

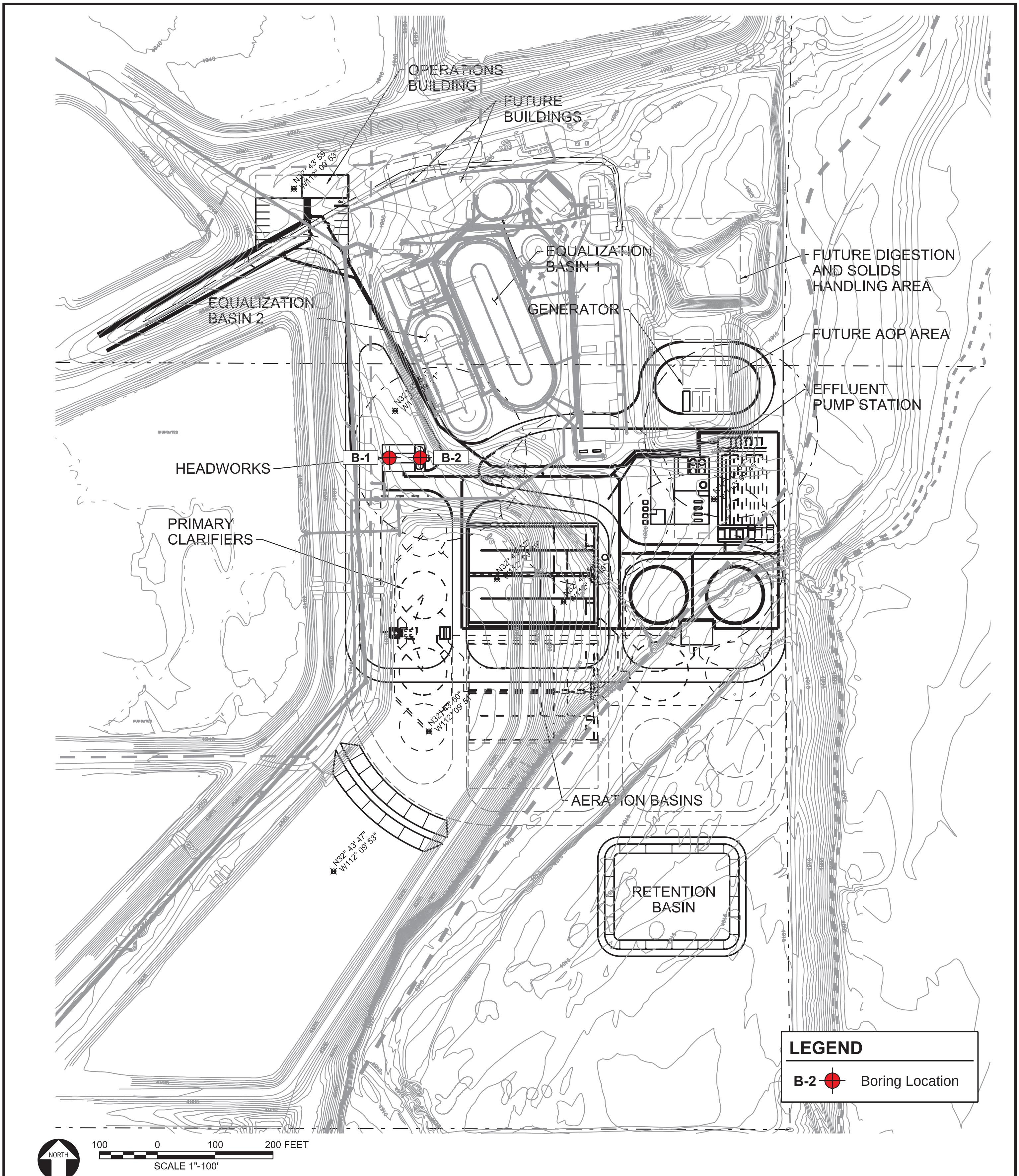
Kevin L. Porter, PE
Senior Engineer

EXPIRES 12/31/13

JSR/KLP/clj

Attachments: Figure 1 – Boring Location Map
Figures 2 - 9 – Boring Logs
Figure 10 – Allowable Downward Axial Capacity Chart

Distribution: (1) Addressee – Electronic Copy



Source: Waterworks Engineers, 01/12.
Note: Dimensions, directions, and locations are approximate.

Ninyo & Moore

BORING LOCATION MAP

FIGURE 1

PROJECT NO:	DATE:	
603427001	6/12	CITY OF PRESCOTT AIRPORT WATER RECLAMATION FACILITY EXPANSION PRESCOTT, ARIZONA

file no: 3427blm0612

DATE DRILLED	6/20/12	BORING NO.	B-1
GROUND ELEVATION	--	SHEET	1 OF 4
METHOD OF DRILLING	Diedrich D-120, 8" Diameter Hollow-Stem Auger (D&S Drilling)		
DRIVE WEIGHT	140 lbs. (Automatic)	DROP	30"
SAMPLED BY	DM	LOGGED BY	DM
REVIEWED BY	JSR		

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						SC	ALLUVIUM: Brown, damp, dense, clayey SAND; scattered caliche nodules.
	Driven	28					
5	Driven	36					Very dense; caliche nodules not observed.
	Driven	31					Dense.
						SM	Brown, damp, medium dense, silty SAND.
10	Driven	18					
							Increase in gravel content.
						SC	Brown, damp, very dense, clayey SAND; few gravel.
15	Driven	46					
						SM	Brown, damp, very dense, silty SAND with gravel; cobbles and possible boulders.
	Driven	50/5"					
20							

Ninyo & Moore

BORING LOG

City of Prescott Airport Water Reclamation Facility Expansion
Prescott, Arizona

PROJECT NO.	DATE	FIGURE
603427001	6/12	2

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20							SM	ALLUVIUM: (Continued) Brown, damp, very dense, silty SAND; few gravel.
							SC	Brown, damp, very dense, clayey SAND.
			35					
25								
							CL	Brown, moist, very stiff, sandy CLAY.
			15					
30								
			69					Hard.
35								
								PRESCOTT GRANODIORITE: Light reddish brown, damp, soft, GRANODIORITE; decomposed.
			67					
40								

DATE DRILLED 6/20/12 BORING NO. B-1
GROUND ELEVATION -- SHEET 2 OF 4
METHOD OF DRILLING Diedrich D-120, 8" Diameter Hollow-Stem Auger (D&S Drilling)
DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"
SAMPLED BY DM LOGGED BY DM REVIEWED BY JSR

Ninyo & Moore

BORING LOG

City of Prescott Airport Water Reclamation Facility Expansion
Prescott, Arizona

PROJECT NO.	DATE	FIGURE
603427001	6/12	3

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
40								PRESCOTT GRANODIORITE: (Continued) Light reddish brown, damp, soft, GRANODIORITE; decomposed.
			38					Brown.
45								
			50/4"					
50								
			32					
55								
			41					
60								

DATE DRILLED 6/20/12 BORING NO. B-1

GROUND ELEVATION -- SHEET 3 OF 4

METHOD OF DRILLING Diedrich D-120, 8" Diameter Hollow-Stem Auger (D&S Drilling)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY JSR

Ninyo & Moore

BORING LOG

City of Prescott Airport Water Reclamation Facility Expansion
Prescott, Arizona

PROJECT NO.	DATE	FIGURE
603427001	6/12	4

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
60							SC	PRESCOTT GRANODIORITE: (Continued) Brown, damp moderately hard, GRANODIORITE; decomposed.
		◣	42					
65								
		◣	48					
70								Total Depth = 70 feet. Groundwater not encountered during drilling. Backfilled on 6/20/12 promptly after completion of drilling. Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
75								
80								

DATE DRILLED 6/20/12 BORING NO. B-1

GROUND ELEVATION -- SHEET 4 OF 4

METHOD OF DRILLING Diedrich D-120, 8" Diameter Hollow-Stem Auger (D&S Drilling)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY JSR

Ninyo & Moore

BORING LOG

City of Prescott Airport Water Reclamation Facility Expansion
Prescott, Arizona

PROJECT NO.	DATE	FIGURE
603427001	6/12	5

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							SC	ALLUVIUM: Brown, damp, dense, clayey SAND.
		■	23					
		■	35					Very dense.
5								
		■	50/4"					Scattered caliche nodules; trace gravel.
		■	50/5"					
10								
							SM	Brown, damp, very dense, silty SAND with gravel; cobbles and possible boulders.
		■	50/5"					
15								
		■	43					
20								

DATE DRILLED 6/20/12 BORING NO. B-2

GROUND ELEVATION -- SHEET 1 OF 4

METHOD OF DRILLING Diedrich D-120, 8" Diameter Hollow-Stem Auger (D&S Drilling)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY

Ninyo & Moore

BORING LOG

City of Prescott Airport Water Reclamation Facility Expansion
Prescott, Arizona

PROJECT NO.	DATE	FIGURE
603427001	6/12	6

DATE DRILLED 6/20/12 BORING NO. B-2

GROUND ELEVATION -- SHEET 2 OF 4

METHOD OF DRILLING Diedrich D-120, 8" Diameter Hollow-Stem Auger (D&S Drilling)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20							SM	ALLUVIUM: (Continued) Brown, damp, very dense, silty SAND with gravel; cobbles and possible boulders.
							GC	Grayish brown, damp, very dense, clayey GRAVEL with sand. Brown, moist, very dense, clayey fine to medium SAND.
			39					
25								
							SC	Brown, damp, medium dense, clayey SAND.
			17					
30								
							SM	Brown, damp, very dense, silty SAND; few gravel.
			46					
35								
			38					
40								

Ninyo & Moore

BORING LOG

City of Prescott Airport Water Reclamation Facility Expansion
Prescott, Arizona

PROJECT NO.	DATE	FIGURE
603427001	6/12	7

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION

DATE DRILLED 6/20/12 BORING NO. B-2

GROUND ELEVATION -- SHEET 3 OF 4

METHOD OF DRILLING Diedrich D-120, 8" Diameter Hollow-Stem Auger (D&S Drilling)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY

DEPTH (feet)	Bulk	Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
40						SM	ALLUVIUM: (Continued) Brown, damp, very dense, silty SAND.
							PRESCOTT GRANODIORITE: Light brown, damp, moderately soft, GRANODIORITE; decomposed.
		X	50/2"				
45							
		■	50/2"				
50							
		■	24				
55							
		■	50/3"				
60							

Ninyo & Moore

BORING LOG

City of Prescott Airport Water Reclamation Facility Expansion
Prescott, Arizona

PROJECT NO.	DATE	FIGURE
603427001	6/12	8

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
60							SM	PRESCOTT GRANODIORITE: (Continued) Light brown, damp, moderately soft, GRANODIORITE; decomposed.
			25					
65								
			50/5"					
70								Total Depth = 69.4 feet. Groundwater not encountered during drilling. Backfilled on 6/20/12 promptly after completion of drilling. Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
75								
80								

DATE DRILLED 6/20/12 BORING NO. B-2

GROUND ELEVATION -- SHEET 4 OF 4

METHOD OF DRILLING Diedrich D-120, 8" Diameter Hollow-Stem Auger (D&S Drilling)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY

Ninyo & Moore

BORING LOG

City of Prescott Airport Water Reclamation Facility Expansion
Prescott, Arizona

PROJECT NO.	DATE	FIGURE
603427001	6/12	9