GEOTECHNICAL EVALUATION
BEARDSLEY ROAD CONNECTOR - PHASE I
PEORIA, ARIZONA

DRAFT

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December 28, 2007
Project No. 600635001

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Mr. Gary Fromm, P.E.
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Phoenix, Arizona 85003

Subject: Geotechnical Evaluation
Beardsley Road Connector - Phase I
Peoria, Arizona

Dear Mr. Fromm:

In accordance with our revised proposal dated July 14, 2006, Ninyo & Moore has performed a geotechnical evaluation for the above-referenced project. The attached foundation 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. If you have any questions or comments regarding this report, please call.

Sincerely,
NINYO & MOORE

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Senior Project Engineer

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Principal Engineer

KLP/SAH/SDN/zvs

Distribution: (6) Addressee

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1. INTRODUCTION

In accordance with our revised proposal dated July 14, 2006, we have performed a geotechnical evaluation for the planned improvements of the Beardsley Road Connector - Phase I project located in Peoria, Arizona. The project includes the design of improvements to Beardsley Road, approximately between 83rd Avenue and State Route (SR) 101L and includes a new bridge over New River, associated retaining structures, and new roadways and pavement. 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.

2. SCOPE OF SERVICES

Our scope of services for this portion of the project generally included:

- Reviewing available as-built documents from the City of Peoria, City of Glendale, Maricopa County, and the Arizona Department of Transportation (ADOT), published geologic and engineering data, aerial photographs, and published maps pertaining to the project site.
- Conducting engineering and geologic reconnaissance to better define the characteristics of the project corridor.
- Obtaining applicable permits, establishing boring locations in the field, and notifying the underground utilities through Arizona Blue Stake.
- Drilling four small diameter exploratory soil borings to depths of approximately 85 feet below ground surface (bgs) for the bridge structure. The borings were logged in general accordance with industry standard methods and samples were obtained for laboratory testing.
- Laboratory testing of representative samples obtained from the borings.
- Preparation of this report presenting our findings, conclusions, and geotechnical recommendations.

3. SITE DESCRIPTION

The project site is located within Section 26, Township 4 North, Range 1 East. The site is located near the intersection of the Beardsley Road alignment and SR 101L in Peoria, Arizona. The approximate location of the site is depicted on the Site Location Map (Figure 1).

According to the United States Geological Survey (USGS), 7.5-Minute Topographic Quadrangle Map Series, Hedgpeth Hills, Arizona-Maricopa Co. (photo revised 1981) the site ranges in elevation from roughly 1,240 to 1,255 feet above mean sea level (MSL). Based on the information obtained from this quadrangle map, the overall project site slopes from the northeast down to the southwest. However, the New River has the lowest elevation on the site and there are slopes that rise on both sides of it.

Four aerial photographs from the Flood Control District of Maricopa County were reviewed for this project. A 1949 aerial photograph depicted the site as being agricultural land with the New River dissecting the site. Beardsley Road was depicted as a graded roadway. A 1993 aerial photograph showed the development of residential structures, and the SR 101L. A 1999 aerial photograph depicted the development of residential structures to the north of the site. A 2004 aerial photograph depicted the site as being similar to its current condition, with residential structures to the north, east, and west of the site.

4. PROPOSED CONSTRUCTION

It is our understanding that the City of Peoria desires to have a connection between SR 101L and 83rd Avenue at Beardsley Road. The overall project has been divided into separate phases and includes frontage roads, auxiliary lanes, new bridge structures, retaining walls, and other interchange modifications. Phase I of the project includes improvements to Beardsley Road, from approximately 83rd Avenue to SR101L. These improvements include roadway widening and construction including a new round-about at 81st Avenue, retaining structures, and a new bridge over the New River to carry east and west bound traffic from Beardsley Road to the frontage road along SR101L.

It is our understanding new pavements associated with this project will consist of asphaltic concrete in accordance with Maricopa Association of Governments (MAG) and the City of Peoria standards. We understand retaining structures less than 10 feet in height are planned near the vicinity of 81st and 83rd Avenues. Further, we understand the bridge over New River will be a three-span reinforced concrete structure, which will probably be supported on drilled shaft foundations at both the abutments and piers. The overall structure length will be approximately 292 feet with a total width of about 72 feet.

5. FIELD EXPLORATION AND LABORATORY TESTING

On September 18 and 19, 2007, Ninyo & Moore conducted an additional subsurface exploration at the proposed bridge site in order to evaluate the existing subsurface conditions and to collect soil samples for laboratory testing. Our evaluation consisted of the drilling, logging, and sampling of four small-diameter borings denoted as BR-1 through BR-4. The borings were advanced using an AP-1000 truck-mounted drill rig to depths of approximately 85 feet bgs using Becker Hammer percussion drilling techniques. Bulk and relatively undisturbed soil samples were collected at selected intervals. Descriptions of the soils encountered are presented on the boring logs in Appendix A. The general locations of these bridge borings are depicted on the Boring Location Map (Figure 2).

Soil samples were obtained by driving a split-spoon sampler, approximately 18 inches into the soil at the bottom of the borehole at selected depths using a 140-pound hammer falling approximately 30 inches, operated by a cat-head, spooling cable, or automatic trip hammer. California Modified and Standard Penetration Test (SPT) split-spoon samplers were used in generally alternating intervals. Samples were typically taken at approximate 5-foot intervals throughout the depth of each boring. Few relatively undisturbed ring samples were obtained with the California Modified sampler and small bag samples were obtained using the unlined SPT sampler. The equipment and sampling methodology are described in detail in Appendix A. It should be noted that due to the coarse granular nature of the subsurface materials, limited soil samples were obtained for laboratory testing.

Ninyo & Moore personnel logged the borings in general accordance with the Unified Soil Classification System (USCS) and American Society for Testing and Materials (ASTM) D2488 by observing cuttings and split-spoon samples. The ring samples were trimmed in the field, wrapped in plastic bags, and placed in moisture-tight cylindrical plastic containers, while the SPT samples were placed in zip-lock baggies to help preserve their natural moisture. Field classifications and other pertinent data are presented on the boring logs in Appendix A. The ground surface elevations noted on the logs were estimated from topographic information we received from the project team.

Samples collected from our borings were transported to the Ninyo & Moore laboratory in Phoenix, Arizona for geotechnical laboratory analyses. The laboratory analyses included in-situ moisture content and dry density, and grain size analysis. The results of the in-situ moisture and density testing are presented on the logs in Appendix A. A description of each test method and the remainder of the laboratory results are presented in Appendix B.

6. PREVIOUS FIELD EXPLORATION AND LABORATORY TESTING

A Preliminary Geotechnical Evaluation, dated February 2, 2004, was prepared by Ninyo & Moore for the subject project. This evaluation was conducted to evaluate the existing subsurface conditions and to collect soil samples for laboratory testing. Our subsurface evaluation during this phase of the project consisted of the excavation, logging, and sampling of 10 test pits denoted as NM-1 through NM-10. The purpose of the test pits was to observe and collect samples as well as to obtain the excavation characteristics of the underlying earth materials. The test pits were performed along the centerlines of the proposed frontage roads. The target test pit depth was approximately 10 feet bgs. The general test pit locations are depicted on the Test Pit Location Map (Figure 3). Detailed descriptions of the soils encountered are presented on the test pit logs in Appendix C. Laboratory test results, including grain size analysis, Atterberg limits, expansion index, maximum dry density and optimum moisture content, and R-value tests, are also presented in Appendix C.

7. GEOLOGY AND SUBSURFACE CONDITIONS

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

7.1. Geologic Setting

The project site is located in the Sonoran Desert Section of the Basin and Range physiographic province, which is typified by broad alluvial valleys separated by steep, discontinuous, subparallel mountain ranges. The mountain ranges generally trend north-south and northwest-southeast. The basin floors consist of alluvium with thickness extending to several thousands of feet.

The basins and surrounding mountains were formed approximately 10 to 18 million years ago during the mid- to late-Tertiary. Extensional tectonics resulted in the formation of horsts (mountains) and grabens (basins) with vertical displacement along high-angle normal faults. Intermittent volcanic activity also occurred during this time. The basins filled with alluvium from the erosion of the surrounding mountains as well as from deposition from rivers. Coarser-grained alluvial material was deposited at the margins of the basins near the mountains.

The surface geology of the site is described as being three units (Demsey, 1988). The first unit consists of Holocene (<10,000 years) age alluvial deposits of sand and silt. The second unit is described as being late to middle Pleistocene (10,000-250,000 years old) deposits composed of sand and silt to medium gravels with stage II to III caliche cementation. The third unit is a middle to early middle Pleistocene age (250,000-790,000 years old) deposit composed of sand and fine gravels to large cobbles with stage III to IV caliche cementation.

7.2. Subsurface Conditions

Our knowledge of the subsurface conditions at the project site is based on our field explorations and laboratory testing and our understanding of the general geology of the area. The

following sections provide a generalized description of the materials encountered. More detailed descriptions are presented on the test pit logs in Appendix A.

7.2.1. Fill

Undocumented fill consisting of silty sand and clayey sand was encountered from the surface of test pits NM-4, NM-6 and NM-9. The fill extended to a depth of 9.5 feet in test pit NM-4, and to the explored depths (10 feet) of test pits NM-6 and NM-9. The fill contained pieces of concrete, roots, wire, wood, PVC pipe, plastic, foam and tubing in our test pits.

Some of the test pits noted above are located outside the limits of the Phase I project. However, the results noted may be indicative of the subsurface materials present at other locations within the Phase I project limits and should be anticipated during construction.

7.2.2. Alluvium

Alluvium was encountered at the ground surface of some of our test pits and the four bridge borings and extended to the total depths explored. The alluvium observed at our exploration locations generally consisted of inter-layered silty sand, clayey sand, poorly-graded sand, and gravel with silt and sand. Cobbles and possible boulders were observed within the alluvium at various depths in our borings and test pits.

7.2.3. Groundwater

Groundwater was not encountered in our borings. Based on well data from the Arizona Department of Water Resources, the approximate depth to groundwater is 400 feet bgs or deeper. Groundwater levels can fluctuate due to seasonal variations, irrigation, groundwater withdrawal or injection, and other factors. In general, groundwater is not expected to be a constraint to the construction of the project. However, shallow perched groundwater may be present during or after periods of floodwater flow in the New River channel.

8. GEOLOGIC HAZARDS

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

8.1. Land Subsidence and Earth Fissures

Groundwater depletion, due to groundwater pumping, has caused land subsidence and earth fissures in numerous alluvial basins in southern Arizona. It has been estimated that subsidence has affected more than 3,000 square miles and has caused damage to a variety of engineered structures and agricultural land (Schumann and Genualdi, 1986). From 1948 to 1983, excessive groundwater withdrawal has been documented in several alluvial valleys where groundwater levels have been reportedly lowered by up to 500 feet. With such large depletions of groundwater, the alluvium has undergone consolidation resulting in large areas of land subsidence.

In Arizona, earth fissures are generally associated with land subsidence and pose an ongoing geologic hazard. Earth fissures generally form near the margins of geomorphic basins where significant amounts of groundwater depletion have occurred. Reportedly, earth fissures have also formed due to tensional stress caused by differential subsidence of the unconsolidated alluvial materials over buried bedrock ridges and irregular bedrock surfaces (Schumann and Genualdi, 1986).

Based on our field reconnaissance and review of the referenced material, there are no known earth-fissures underlying the subject site. Based on our research, the closest earth fissure to this site is located approximately 11 miles to the southwest of the project site, near the Luke Air Force Base. Continued groundwater withdrawal in the area may result in subsidence and the formation of new fissures or the extension of existing fissures. While the future occurrence of land subsidence and earth fissures cannot accurately be predicted, these phenomena are not expected to be a constraint to the construction of this project.

8.2. Faulting and Seismicity

The site lies within the Sonoran zone, which is a relatively stable tectonic region located in southwestern Arizona, southeastern California, southern Nevada, and northern Mexico (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 fault to the site is the Carefree fault zone, located approximately 25 miles to the northeast of the site (Pearthree, 1998). Approximately 2 meters of displacement has occurred along this fault within middle Pleistocene deposits (<750,000 years), but the upper Pleistocene and Holocene deposits (<250,000 years) are not displaced.

Based on a Probabilistic Seismic Hazard Assessment for the Western United States, issued by the USGS (2002), the site is located in a zone where the peak ground accelerations that have a 10 percent and 2 percent probability of being exceeded in 50 years are 0.04g, and 0.08g respectively. Seismic design parameters according to the 2006 International Building Code (IBC) are presented in Table 1.

Table 1 – Seismic Design Parameters

Parameter	Value	2006 IBC Reference
Site Class Definition	D	Table 1613.5.2
Site Coefficient F_a	1.6	Table 1613.5.3 (1)
Site Coefficient F_v	1.4	Table 1613.5.3 (2)

8.3. Liquefaction Potential

Based on the general lack of near surface water and the low ground motion hazard (relatively low ground accelerations), the likelihood or potential for liquefaction is considered to be negligible.

9. RECOMMENDATIONS

The following sections present our geotechnical recommendations for earthwork, bridges, lateral earth pressures, and pavement design for the proposed project. Ninyo & Moore should be contacted for additional recommendations if the actual design details change from those detailed or assumed in our report.

9.1. General Earthwork

The following sections provide our earthwork recommendations for this project. In general, we understand that the City of Peoria generally follows the earthwork specifications contained in Maricopa Association of Governments (MAG), *Uniform Standard Specifications and Details for Public Works Construction* as amended by the City of Peoria. These specifications are expected to apply, unless specifically noted.

9.1.1. Excavations

Our evaluation of the excavation characteristics of the on-site surface materials is based on the results of our exploratory test pits and borings performed for this project, our site observations, and our experience on similar projects. In our opinion, excavation of the on-site materials can be accomplished with heavy-duty earthmoving or excavation equipment in good operating condition. We observed gravels, cobbles and possible boulders in our deeper borings, but due to the limitations of subsurface exploration methods, we were unable to evaluate the quantity of cobbles and/or boulders that could be encountered. The contractor should be prepared to encounter cobbles or boulders during construction, which could call for more aggressive excavation measures and could slow excavation rates.

9.1.2. Grading, Fill Placement, and Compaction

After rough grade has been achieved and prior to placement of fill, the exposed subgrade should be visually checked for the presence of debris, organic matter and other unsuitable materials. If unsuitable subgrade soils are encountered at subgrade level dur-

ing earthwork operations, these soils should be removed to their full depth and be replaced with engineered fill.

The on-site geotechnical representative should carefully evaluate any areas of soft or wet soils, revealed during the site preparation activities, prior to placement of grade-raise fill or other construction. Drying or overexcavation of some materials may be appropriate.

We recommend the subgrade soils beneath planned roadway improvements be improved in-place by disking or ripping, moisture-conditioning and compacting the existing soils to a depth of 6 inches below the bottom of the pavement section. The subgrade improvement zone should extend laterally 2 feet or more horizontally beyond the roadway footprint.

Beneath planned retaining structures, we recommend the existing soils be overexcavated to a depth of about 2 feet below the footing bottom elevation and replaced with compacted fill. New fill should be placed in horizontal lifts no more than approximately 9 inches in loose thickness and should be compacted by appropriate mechanical methods to a relative compaction of 95 percent or more, in accordance with ASTM D698 at a moisture content within 2 percent of its optimum moisture. The overexcavated zone should extend an equivalent distance horizontally (beyond the foundation footprint) as it extends below the bottom of the foundation.

We understand that grade-raise fill may be needed to obtain the vertical profile of the proposed improvements, particularly in the vicinity of the bridge where up to approximately 15 vertical feet of fill is proposed to be placed. We recommend that the areas to receive fill be prepared by scarifying and compacting the upper 12 inches prior to the placement of grade-raise fill. Fill placement should be benched into the sides of any existing embankments and the exposed surface prepared as specified herein.

Following the recommendations described above, and prior to the placement of new fill, the resulting exposed surface should be carefully evaluated by the geotechnical consultant for the presence of loose and/or unsuitable soil. Based on this evaluation, additional remediation may be needed. This could include scarification of the exposed surface. This additional remediation, if needed, should be addressed by the geotechnical consultant during the earthwork operations.

New fill should be placed in horizontal lifts approximately 9 inches in loose thickness and compacted by appropriate mechanical methods to 95 percent relative compaction as evaluated by ASTM D698 and at a moisture content slightly above the laboratory optimum.

9.1.3. Suitable Fill and Borrow Material

Suitable engineered fill should not include deleterious or organic material, clay lumps, construction debris, rock particles, and other non-soil fill materials larger than 6 inches in dimension.

In addition, suitable fill material should exhibit low plasticity and very low to low expansive potential. Low plasticity soils should have a Plasticity Index (by ASTM D4318) of 20 or less. Very low to low expansive potential soils are defined as having an Expansion Index (by ASTM D4829) of 50 or less. Our laboratory tests indicated plasticity indices of 0 (non-plastic) to 27, and Expansion Indices of 1 and 28. As such, some of the on-site soils may not be suitable for re-use as engineered fill. We also recommend suitable fill material placed within 3 feet of the finished roadway have an R-value of 30 or more.

Imported fill, if utilized, should consist of granular material with a very low or low expansion potential. Import material in contact with ferrous metals should preferably have low corrosion potential (minimum resistivity greater than 2,000 ohm-cm, chloride content less than 25 parts per million [ppm]). Import material in contact with concrete

should have a soluble sulfate content of less than 0.1 percent. The geotechnical consultant should evaluate borrow materials prior to importation.

9.1.4. Shrinkage and Ground Compaction Factor

Potential bidders should consider the earthwork factor in preparing estimates and should review the available data to make their own conclusions regarding excavation conditions.

We recommend that a ground compaction factor of 0.2 feet be used for soil on this project. The ground compaction factor given should be compensated when constructing embankment fill sections outside the existing roadway prism. We recommend a shrinkage factor of approximately 10 percent for soil excavation associated with this project.

9.2. Constructed Slopes

We recommend that permanent cut and fill slopes associated with this project be constructed no steeper than 2:1 (H:V). This fill slope recommendation assumes that the fill material used to construct the slope meets the criteria in this report. Fill slopes should be benched and constructed in a manner (e.g., overfilling and cutting to grade) such that the recommended degree of compaction is achieved to the finished slope face. Fill slopes should be protected from erosion and scour.

9.3. Bridge Foundations

Work and materials for construction of the proposed foundation elements should be in accordance with the recommendations presented in this report. Due to the anticipated loading conditions and scour depths, we recommend that drilled shaft foundations be utilized for support of the proposed bridge.

Based on information received from TY Lin, Inc., we understand the design axial individual shaft design loads for the bridge abutments and piers are approximately 455 kips at each

abutment and 900 kips at each pier. Depending on the final drilled shaft spacing, group reduction factors may be needed, as explained below.

The Allowable Capacity Design Chart (Figure 4) summarizes our recommended axial loads for individual drilled shafts at the abutments and piers. The recommendations were generally formulated using skin friction resistance, end bearing, and an assumed factor of safety of 2.5.

These recommendations are based on the results of our exploratory borings and laboratory testing performed for the new bridge, and the method for estimating the axial capacity of drilled shaft foundations outlined in AASHTO Standard Specifications for Highway Bridges (17th Edition - 2002).

Our drilled shaft capacity charts incorporate the scour depth information we obtained from J2 Engineering and Environmental Design, LLC for the project. Based on this information, we used a scour depth of approximately 20 feet (Elevation 1,221 MSL) below existing ground in our axial capacity analysis. This depth represents the 500-yr scour depth.

In addition, the design chart reflects the shallowest suggested allowable drilled shaft depths and diameters based on the loads given and the soil profile encountered. Larger diameter or deeper shafts could be used if this proves to be more convenient or if they are needed due to lateral load.

The axial capacities presented in the design chart are for a single drilled shaft, with no group reduction factor applied. For a drilled shaft center-to-center spacing of 3B (where B is the diameter of the shaft in question), the above axial capacities should be reduced by 0.67. 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 spacings, the reduction factor may be evaluated by linear interpolation.

The design chart does not include downdrag loads at the abutments caused by the potential compression of embankment fill. However, the effect of downdrag caused by the construction of drilled shafts within the embankment fill is considered to be minimal. Therefore, it is recommended the effects of downdrag be neglected.

We estimate that total settlement for the drilled shaft foundations recommended above should be approximately 1/2 inch or less when subjected to the loads presented above, provided that the drilled shaft bearing materials are not significantly disturbed during construction and that other provisions of this report are followed. This estimate is based on the geologic conditions disclosed by the borings, the given loading conditions, and our experience with similar projects.

The suggested soil parameters for lateral load analyses are summarized on Figure 5. We understand that the lateral load analysis of drilled shafts will be performed by others using these parameters.

9.4. Drilled Shaft Construction Considerations

Our evaluation of the excavation characteristics of the on-site materials is based on the results of our exploratory borings, site observations, and experience with similar materials. In our opinion, excavation of the on-site fill and alluvium materials for the drilled shaft foundations can generally be accomplished with heavy-duty excavation equipment in good operating condition. However, very dense sand and gravel with cobbles and/or boulders is present within the alluvium, which could slow excavation rates or call for more aggressive techniques. Due to the small size (8 inches) of our boreholes, dimensions of potentially large particles (e.g., cobbles and boulders) could not be observed during our study; however, these larger materials will be encountered and the drilled shaft contractor should be prepared to address constructability issues related to the presence of cobbles and/or boulders.

The drilled shafts should be evaluated to check that adequate bearing material has been reached and that the bearing surface has been cleaned. Where possible, the drilled shafts

should be constructed in the "dry" (i.e., no more than 2 inches of water covering the base of the drilled shaft excavation). The concrete for the drilled shafts should be designed so that it satisfies the requirements of the specifications. In such cases, the concrete may be placed by the free-fall method. This method consists of using a vertical section of concrete chute to direct the concrete flow out of the truck in a vertical stream of concrete with a relatively small diameter. The stream should be directed to avoid hitting the sides of the drilled shaft or the reinforcing cage, which could cause concrete segregation.

Due to the presence of cohesionless soils, it may be appropriate to use a temporary casing and/or the slurry method while installing the shafts. The contractor should be prepared to use casing, if needed. If slurry is used during construction, detailed procedures should be submitted by the contractor for review and approval by the geotechnical engineer, and the shaft will need to be equipped with special casing to house equipment that can be used to evaluate the integrity of the shaft concrete after it has been cured. The excavation technique chosen by the contractor should not adversely affect the quality or strength of the shaft sidewalls or the bearing surface.

9.5. Shallow Foundations

The spread foundations for the planned retaining structures should be constructed according to the recommendations outlined in this report. As stated previously, our exploratory borings revealed near-surface fill and alluvium soils, consisting primarily of clayey sand, silty sand, and sand with gravel and possible cobbles and/or boulders.

Based on the results of our test pits, we recommend an allowable equivalent uniform soil bearing pressure of 3,000 psf for spread or continuous foundations bearing on 2 or more feet of compacted fill as described above. The average footing bearing pressure should not exceed the allowable equivalent uniform bearing pressure presented above. However, peak edge stresses may exceed this value as long as the resultant passes through the middle third of the footing base. The weight of any soil above the footings should be added to the weight

of the structure when calculating the actual bearing pressures. An estimated unit weight of 125 pcf may be assumed for compacted soil above spread footings.

Total and differential settlement of up to about 1 inch and 1/2 inch over a horizontal distance of 40 feet, respectively, may occur for spread footings. These settlement estimates are based on the estimated loading conditions and the available soil information. The actual settlement will depend on the size, elevation and location of the specific foundation.

A coefficient of friction of 0.40 may be used against sliding between the foundation base and compacted fill. A passive resistance value of 350 psf per foot of depth up to 3,500 psf may be used. The allowable lateral pressure may be taken as the sum of the frictional resistance and passive resistance provided the passive resistance does not exceed one-half of the total resistance.

Trench footings (earth-formed footings) may not be suitable when extending through the relatively sandy soils due to the potential for caving and sloughing of these materials. Rather, the footing excavations may have to be sloped back and the footings constructed using man-made forms in these soil conditions.

9.6. Lateral Earth Pressure Recommendations for Abutments and Wing Walls

The abutments and wing walls associated with this project should be designed in accordance with AASHTO Standard Specifications for Highway Bridges, Section 5.5.

Active earth pressure occurs when the wall moves away from the soil and the soil mass stretches horizontally, sufficient to mobilize its shear strength, and a condition of plastic equilibrium is reached. For a drained granular backfill, an equivalent fluid active earth pressure of 35 psf per foot (psf/ft) of wall height can be used for the design of cantilevered, yielding walls. Drainage should consist of free-draining granular material and could be accompanied by weepholes through the walls or corrugated, perforated pipe placed parallel to the wall or abutment bottom, wrapped in a filter fabric, and surrounded by 6 or more inches

of a granular filter material (e.g., pea gravel). If drainage is not provided, an equivalent fluid earth pressure of 85 psf/ft of wall height should be used for design of the walls. These earth pressures are based on the walls being flexible enough to allow mobilization of the active earth pressure condition. An outward lateral movement of approximately 0.001H (where H is the height of the wall) at the top of the wall is generally needed to mobilize the active earth pressure condition.

A soil mass that is neither stretched nor compressed is said to be in an at-rest state. If the wall is rigidly restrained, so that it does not rotate sufficiently to reach the active earth pressure condition, at-rest earth pressure conditions will exist. An equivalent fluid at-rest earth pressure of 55 psf/ft should be used for the drained condition, and 90 psf/ft should be used for the undrained condition.

If the walls are partially restrained, the actual lateral earth pressure may be somewhere between the active and at-rest pressure conditions. The actual pressure distribution will depend on the stiffness of the wall. Also, any additional lateral wall loads resulting from surcharge loading, such as traffic loads, should be added to the above earth pressures. Precautions should be taken to avoid overstressing of the below-grade walls during backfilling. Temporary bracing of the walls during backfilling may be needed to help avoid this problem.

9.7. Pavement Design

The following sections present our design assumptions and recommendations for new flexible pavement sections for the Beardsley Road Connector - Phase I project extending from approximately 83rd Avenue to SR101L. Our recommendations are based on the design procedures listed in the ADOT Preliminary Engineering and Design Manual (Manual). In providing these recommendations we assumed that asphalt concrete would be used. We also assumed that the subgrade preparation recommendations outlined in this report would be employed.

Based on the "North Central Peoria/Northwest Glendale Circulation Study" prepared by Parsons Brinckerhoff, dated October 2002, the Beardsley Road Connector traffic for the year 2020 would be 23,000 vehicles per day. Assuming these vehicles would be split the same on the frontage roads, and assuming 1.8 percent heavy trucks, 0.3 percent buses and 10.4 percent medium trucks (from available Arizona Department of Transportation [ADOT] traffic mixes on Loop 101), we have calculated one-way flexible pavement Equivalent Single Axle Loads (ESALs) of about 7.5 million.

Using a design R-value of 30 for new pavements, based on Figure 202.02-2 of the ADOT Manual, and correlating the R-value and a seasonal variation factor of 1.0 taken from Table 202.02-4, a resilient modulus of 18,000 pounds per square inch was estimated. A standard deviation of 0.35 was used for design of flexible pavements, in accordance with current ADOT policy.

Based on Table 202.02-01 for 10,000+ ADT, a level of reliability of 95 percent was selected for design of the Beardsley Road Connector. A serviceability loss index of 1.4, in accordance with Table 202.02-2, was selected for design.

Based on the above input values and pavement design using published ADOT procedures, we recommend that the pavement sections provided in Table 2 be used for the proposed pavement sections associated with this project:

Table 2 – Recommended Asphalt Pavement Sections

Street	Layer	Material	Thickness (Inches)
Beardsley Road Connector – Phase I	Bituminous Surface Course	MAG Section 710	2.0 of D 1/2
	Bituminous Base Course	MAG Section 710	4.0 of A 1-1/2
	Aggregate Base Course	MAG Section 702 (See Table 3 below)	8.0

The recommended pavement thicknesses assume that the above pavement sections are founded on improved soil as needed, as outlined in Section 9.1.2. For our analysis of structural number values associated with the project, we estimated a structural coefficient of 0.44 for plant-mix AC pavements, and 0.12 for aggregate base material.

The aggregate base mentioned above should meet Section 702 of the MAG specifications and/or any City of Peoria requirements, as shown in Table 3. Construction associated with the base course should conform to MAG Standard Specifications, Sec. 321 and 710.

Table 3 – Recommended Aggregate Base Gradation

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

Aggregate base material should be compacted to a relative compaction of 100 percent or more of the maximum dry density, as evaluated by ASTM D698, at a moisture content slightly above optimum moisture.

9.8. Site Drainage

Drainage should be provided to divert water away from the paved surfaces and foundation elements. Surface water should not be permitted to pond on pavement areas. Positive drainage is defined as a slope of 2 percent or more for a distance of 5 feet or more away from the pavements. Grading associated with the proposed soil improvements below the new pavement sections should be sloped toward the outside edge of the roadway.

Erosion protection may be needed for the new soil embankments. These protection measures may include grading, riprap, geotextiles, gabion mats, concrete lining, bio-reinforcement or methods considered appropriate by the design engineer.

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 reuse of the findings, conclusions, and/or recommendations of this report by parties other than the client is undertaken at said parties' sole risk.

11. SELECTED REFERENCES

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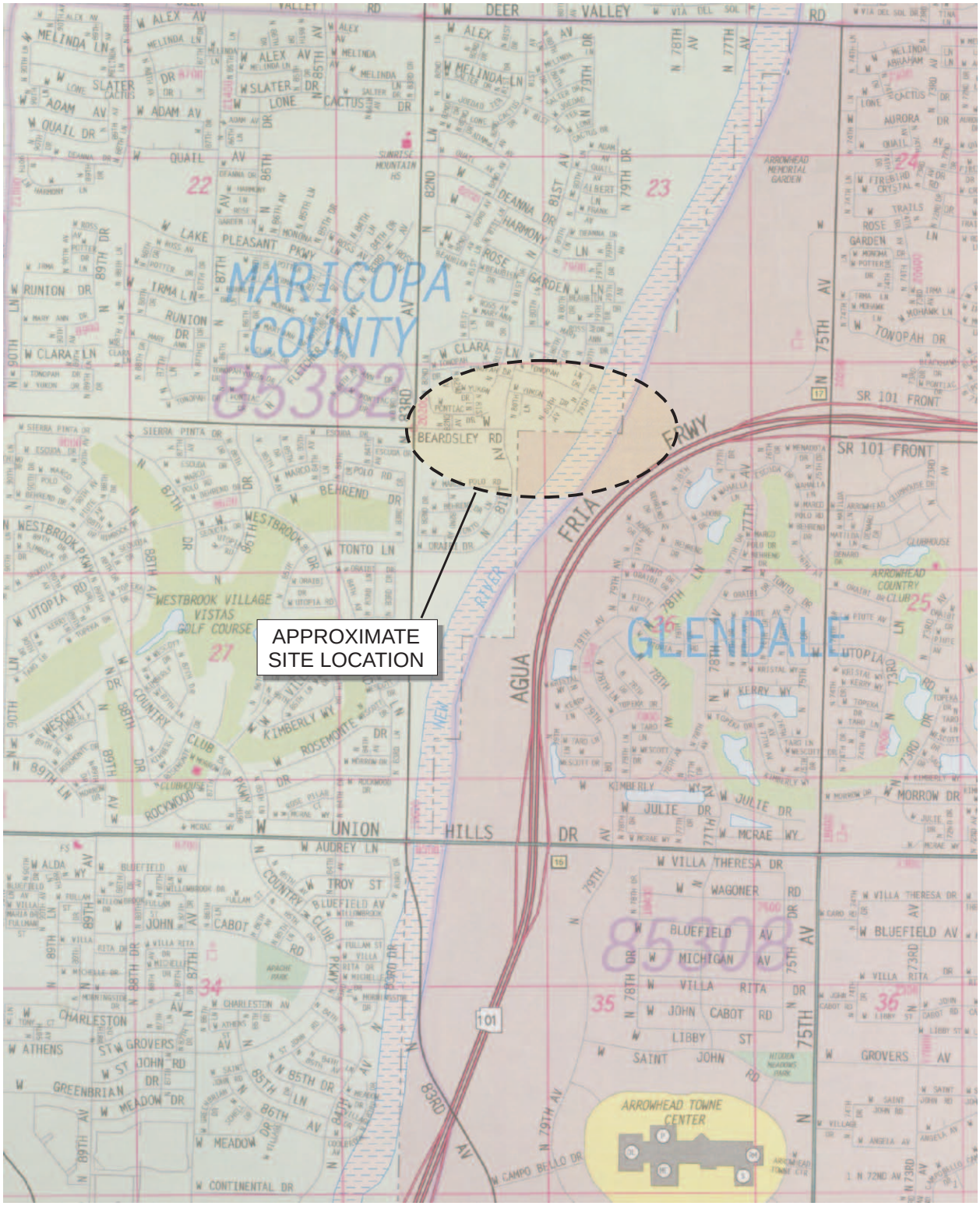
Aerial Photograph Review

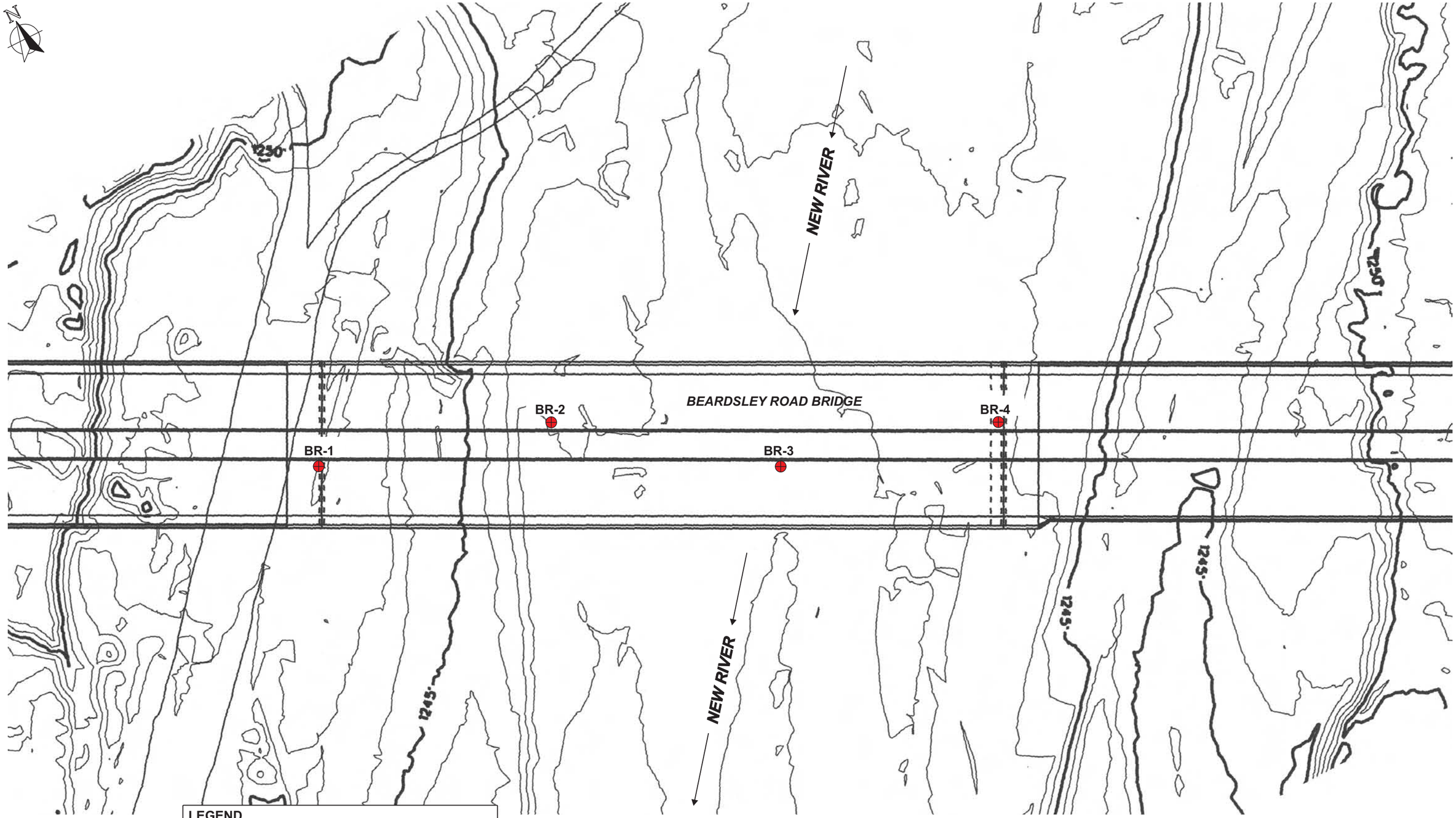
Source	Date
Flood Control District of Maricopa County	1949, 1993, 1999, 2004



Source: Thomas Guide, Phoenix Metro Edition, 2006.

Ninyo & Moore		SITE LOCATION MAP	FIGURE 1
PROJECT NO: 600635001	DATE: 12/07	BEARDSLEY ROAD CONNECTOR - PHASE 1 PEORIA, ARIZONA	

file no: 0635vmap1207



LEGEND

BR-4 ⊕ Approximate Boring Location (Ninyo & Moore 2007)

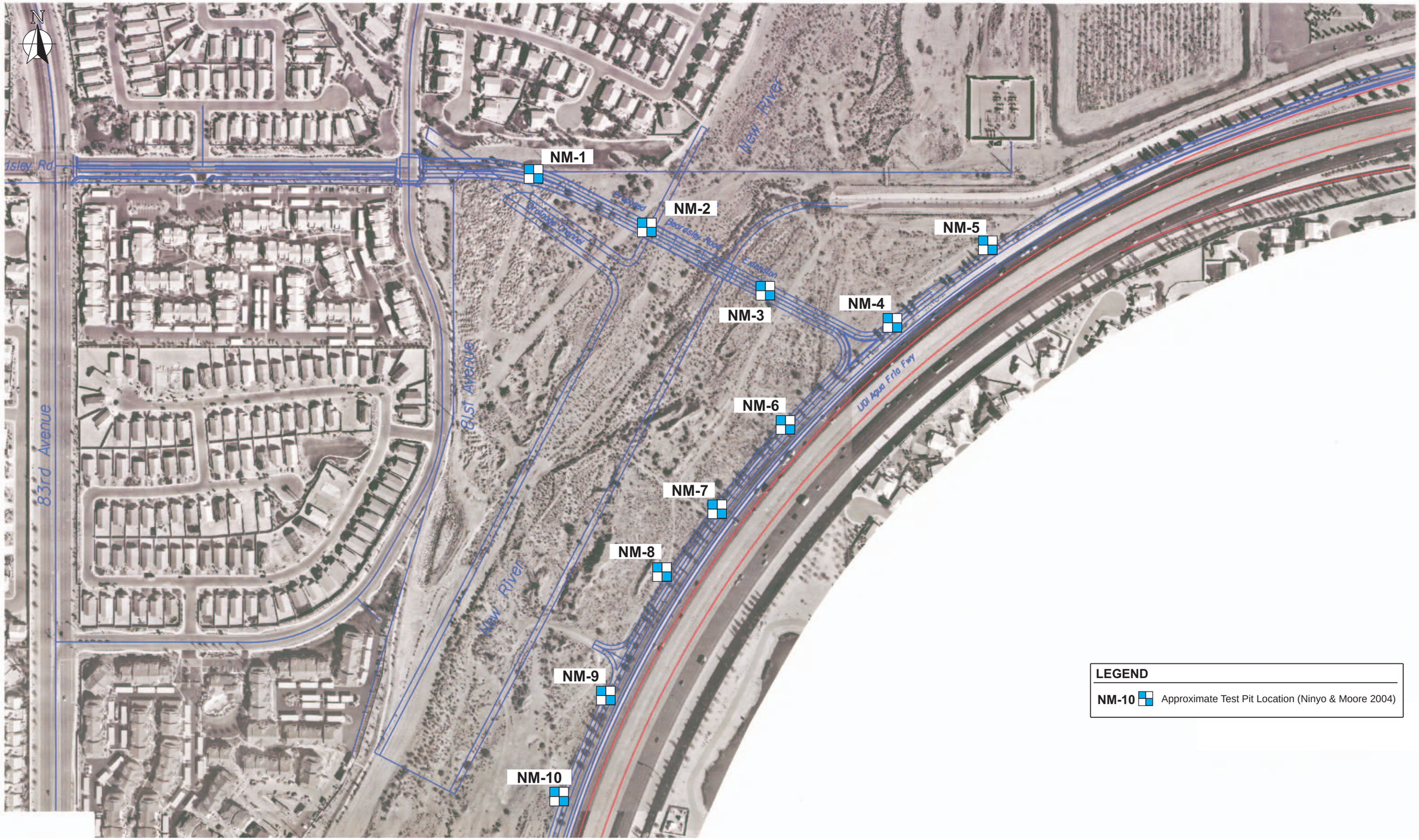
0 40

Approximate Scale:
1 inch = 40 feet

Note: Basemap supplied from Carter-Burgess, 10/07.

0635blm1207

Ninyo & Moore	BORING LOCATION MAP	FIGURE
PROJECT NO: 600635001 / DATE: 12/07	BEARDSLEY ROAD CONNECTOR - PHASE 1 PEORIA, ARIZONA	2



LEGEND

NM-10 Approximate Test Pit Location (Ninyo & Moore 2004)

0 300

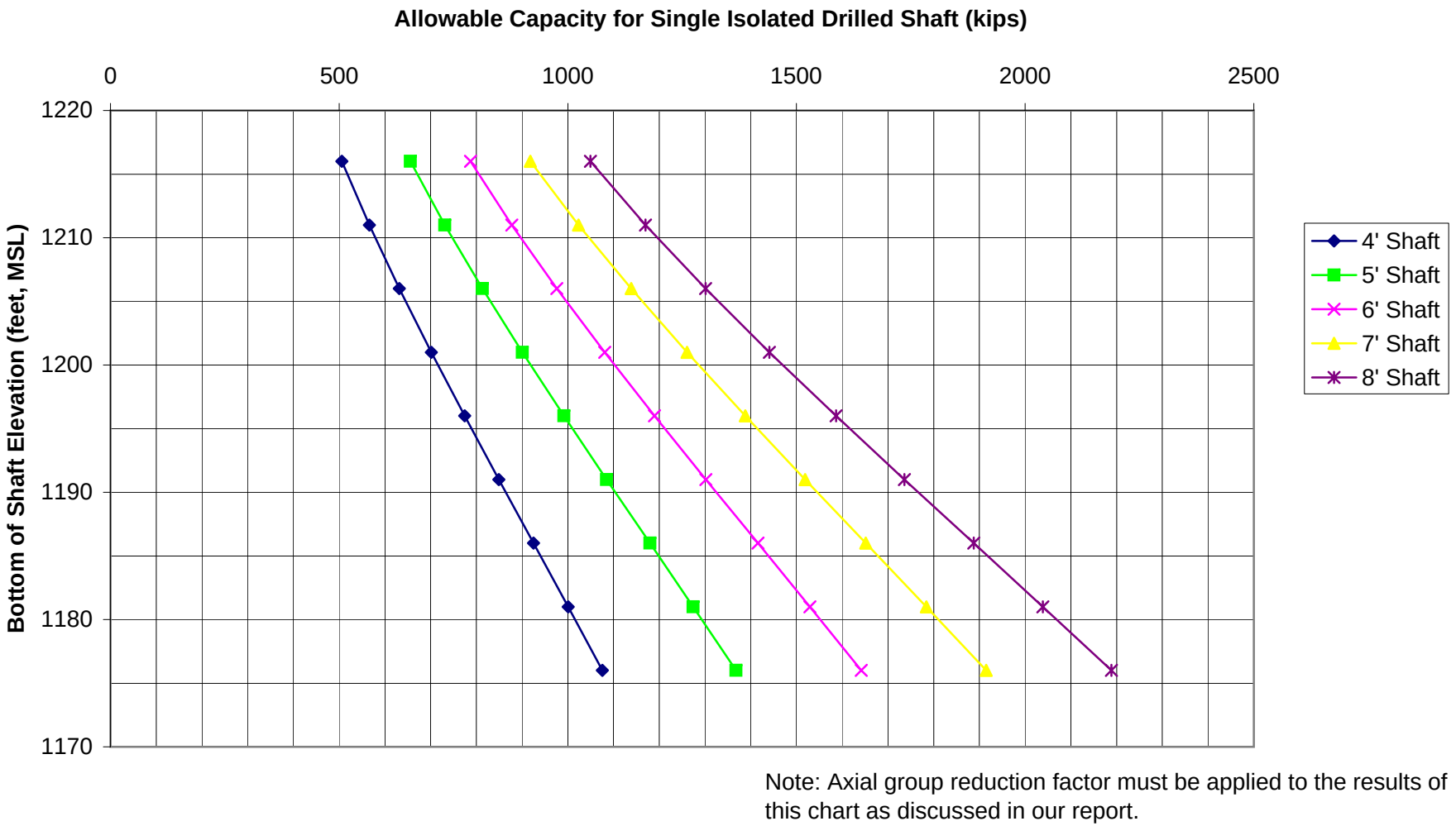
Approximate Scale:
1 inch = 300 feet

Note: All locations and boundaries are approximate.

0635tp1207

Ninyo & Moore	TEST PIT LOCATION MAP	FIGURE
PROJECT NO: 600635001 / DATE: 12/07	BEARDSLEY ROAD CONNECTOR - PHASE 1 PEORIA, ARIZONA	3

FIGURE 4 - ALLOWABLE CAPACITY FOR SINGLE DRILLED SHAFT
BEARDSLEY ROAD BRIDGE AT NEW RIVER
BEARDSLEY ROAD CONNECTOR - PHASE I
PEORIA, ARIZONA



Note: Axial group reduction factor must be applied to the results of this chart as discussed in our report.

Figure 5
Suggested Soil Parameters for Lateral Load Analysis
Beardsley Road Bridge at New River
Beardsley Road Connector - Phase I
Peoria, Arizona

Location	Approximate Elevation (ft, MSL)	Soil type to be used in Lateral Load Analysis	Effective Unit Weight (pcf)	Cohesion (psf)	Angle of Internal Friction (ϕ) (degrees)	k_ϕ (lb/in^3)	Remarks
Abutment 1	1,245 - 1,221	Sand (Reese)	0	0	0	0	0-24' (scour)
	1,221 - 1,180	Sand (Reese)	125	0	35	125	24'-65'
Pier 1	1,240 - 1,221	Sand (Reese)	0	0	0	0	0-19' (scour)
	1,221 - 1,175	Sand (Reese)	125	0	35	125	19'-65'
Pier 2	1,239 - 1,221	Sand (Reese)	0	0	0	0	0-18' (scour)
	1,221 - 1,174	Sand (Reese)	125	0	35	125	18'-65'
Abutment 2	1,240 - 1,221	Sand (Reese)	0	0	0	0	0-19' (scour)
	1,221 - 1,175	Sand (Reese)	125	0	35	125	19'-65'

Notes:

Soil layering was aggregated based on boring logs.

For those parameters for which laboratory or field data was not available, presumptive values were obtained from relevant published literature.

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 (SPT) 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 into the ground 12 to 18 inches with a 140-pound hammer free-falling from a height of 30 inches in general accordance with ASTM D 1586-99. 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 methods.

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 a 140-pound hammer free-falling from a height of 30 inches in general accordance with ASTM D 1586-99. The samples were removed from the sample barrel in the brass rings, sealed, and transported to the laboratory for testing.

DATE DRILLED 09/18/07 BORING NO. BR-1

GROUND ELEVATION 1,245' ± MSL SHEET 1 OF 5

METHOD OF DRILLING AP 1000, Percussion Hammer (Layne Christensen)

DRIVE WEIGHT 140 lbs. (Cathead) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY KJT

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						GM	ALLUVIUM: Brown, damp, very dense, silty GRAVEL with sand; cobbles and possible boulders.
5	⊠	50/2"					
10		50/0"					
						SC	Brown, damp, very dense, clayey fine to coarse SAND; few gravel; possible cobbles and boulders.
15	■	50/6"					
20							

Ninyo & Moore

BORING LOG

BEARDSLEY ROAD CONNECTOR - PHASE I
PEORIA, ARIZONA

PROJECT NO.	DATE	FIGURE
600635001	12/07	A-1

DATE DRILLED 09/18/07 BORING NO. BR-1

GROUND ELEVATION 1,245' ± MSL SHEET 2 OF 5

METHOD OF DRILLING AP 1000, Percussion Hammer (Layne Christensen)

DRIVE WEIGHT 140 lbs. (Cathead) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY KJT

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20		50/4"				SC	ALLUVIUM: (continued) Brown, damp, very dense, clayey fine to coarse SAND with gravel; cobbles and possible boulders.
25		50/6"					
30		50/3"					
35		50/6"					
40							

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BORING LOG

BEARDSLEY ROAD CONNECTOR - PHASE I
PEORIA, ARIZONA

PROJECT NO.	DATE	FIGURE
600635001	12/07	A-2

DATE DRILLED 09/18/07 BORING NO. BR-1

GROUND ELEVATION 1,245' ± MSL SHEET 3 OF 5

METHOD OF DRILLING AP 1000, Percussion Hammer (Layne Christensen)

DRIVE WEIGHT 140 lbs. (Cathead) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY KJT

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
40			50/3"				SC	ALLUVIUM: (continued) Brown, damp, very dense, clayey fine to coarse SAND with gravel; cobbles and possible boulders.
							GC	Brown, damp, very dense, clayey fine to coarse GRAVEL with sand; cobbles and possible boulders.
45			50/5"					
50			50/3"					
55			50/4"					
60								

Ninyo & Moore

BORING LOG

BEARDSLEY ROAD CONNECTOR - PHASE I
PEORIA, ARIZONA

PROJECT NO.	DATE	FIGURE
600635001	12/07	A-3

DATE DRILLED 09/18/07 BORING NO. BR-1

GROUND ELEVATION 1,245' ± MSL SHEET 4 OF 5

METHOD OF DRILLING AP 1000, Percussion Hammer (Layne Christensen)

DRIVE WEIGHT 140 lbs. (Cathead) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY KJT

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
60			50/5"				GC	ALLUVIUM: (continued) Brown, damp, very dense, fine to coarse clayey GRAVEL with sand; possible cobbles and boulders.
65			50/4"					
70			50/5"					
75			50/3"					
							SM	Grayish brown, damp, very dense, silty fine to coarse SAND with gravel.
80								

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BORING LOG

BEARDSLEY ROAD CONNECTOR - PHASE I
PEORIA, ARIZONA

PROJECT NO.	DATE	FIGURE
600635001	12/07	A-4

DATE DRILLED 09/18/07 BORING NO. BR-1

GROUND ELEVATION 1,245' ± MSL SHEET 5 OF 5

METHOD OF DRILLING AP 1000, Percussion Hammer (Layne Christensen)

DRIVE WEIGHT 140 lbs. (Cathead) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY KJT

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
80		50/5"				SM	ALLUVIUM: (continued) Grayish brown, damp, very dense, silty fine to coarse SAND with gravel; possible cobbles and boulders.
85		50/4"					Total Depth = 85.3 feet. Groundwater not encountered during drilling. Backfilled on 09/18/07 promptly after completion of drilling. 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.
90							
95							
100							

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BORING LOG

BEARDSLEY ROAD CONNECTOR - PHASE I
PEORIA, ARIZONA

PROJECT NO.	DATE	FIGURE
600635001	12/07	A-5

DATE DRILLED 09/18/07 BORING NO. BR-2

GROUND ELEVATION 1,240' ± MSL SHEET 1 OF 5

METHOD OF DRILLING AP 1000, Percussion Hammer (Layne Christensen)

DRIVE WEIGHT 140 lbs. (Cathead) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY KJT

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						GM	ALLUVIUM: Brown, damp, very dense, silty GRAVEL with sand; cobbles and possible boulders.
5		50/3"					
10		50/3"				SC	Brown, damp, very dense, clayey fine to coarse SAND with gravel; cobbles and possible boulders.
15		50/4"				GM	Brown, damp, very dense, silty GRAVEL with fine to coarse sand; cobbles and possible boulders.
20							

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BORING LOG

BEARDSLEY ROAD CONNECTOR - PHASE I
PEORIA, ARIZONA

PROJECT NO.	DATE	FIGURE
600635001	12/07	A-6

DATE DRILLED 09/18/07 BORING NO. BR-2

GROUND ELEVATION 1,240' ± MSL SHEET 2 OF 5

METHOD OF DRILLING AP 1000, Percussion Hammer (Layne Christensen)

DRIVE WEIGHT 140 lbs. (Cathead) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY KJT

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20		50/6"				GW-GC	ALLUVIUM: (continued) Brown, damp, very dense, clayey GRAVEL with fine to coarse sand; cobbles and possible boulders.
25		50/6"					
30		50/6"					
						SM	Brown, damp, medium dense to dense; silty fine SAND; possible gravel, cobbles, and boulders.
35		30					
							Very dense; few gravel.
40							

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BORING LOG

BEARDSLEY ROAD CONNECTOR - PHASE I
PEORIA, ARIZONA

PROJECT NO.	DATE	FIGURE
600635001	12/07	A-7

DATE DRILLED 09/18/07 BORING NO. BR-2

GROUND ELEVATION 1,240' ± MSL SHEET 3 OF 5

METHOD OF DRILLING AP 1000, Percussion Hammer (Layne Christensen)

DRIVE WEIGHT 140 lbs. (Cathead) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY KJT

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
40		50/5"				SM	ALLUVIUM: (continued) Brown, damp, very dense; silty fine to coarse SAND with gravel; cobbles and possible boulders.
						GW-GM	Brown, damp, very dense, well-graded GRAVEL with silt and sand; cobbles and possible boulders.
45		50/5"					
50		50/6"					
						SM	ALLUVIUM: Brown, damp, very dense, silty fine to coarse SAND with gravel; possible cobbles and boulders.
55		50/5"					
60							

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BORING LOG

BEARDSLEY ROAD CONNECTOR - PHASE I
PEORIA, ARIZONA

PROJECT NO.	DATE	FIGURE
600635001	12/07	A-8

DATE DRILLED 09/18/07 BORING NO. BR-2

GROUND ELEVATION 1,240' ± MSL SHEET 4 OF 5

METHOD OF DRILLING AP 1000, Percussion Hammer (Layne Christensen)

DRIVE WEIGHT 140 lbs. (Cathead) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY KJT

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
60		50/6"				SM	ALLUVIUM: (continued) Brown, damp, very dense, silty fine to coarse SAND with gravel; possible cobbles and boulders.
65		50/4"					
70		50/4"					
75		50/6"					
80							

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BORING LOG

BEARDSLEY ROAD CONNECTOR - PHASE I
PEORIA, ARIZONA

PROJECT NO.	DATE	FIGURE
600635001	12/07	A-9

DATE DRILLED 09/18/07 BORING NO. BR-2

GROUND ELEVATION 1,240' ± MSL SHEET 5 OF 5

METHOD OF DRILLING AP 1000, Percussion Hammer (Layne Christensen)

DRIVE WEIGHT 140 lbs. (Cathead) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY KJT

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
80		50/2"				SM	ALLUVIUM: (continued) Brown, damp, dense, silty fine to coarse SAND with gravel; possible cobbles and boulders.
85		50/5"					Total Depth = 85.4 feet. Groundwater not encountered during drilling. Backfilled on 09/18/07 promptly after completion of drilling. 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.
90							
95							
100							

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BORING LOG

BEARDSLEY ROAD CONNECTOR - PHASE I
PEORIA, ARIZONA

PROJECT NO.	DATE	FIGURE
600635001	12/07	A-10

DATE DRILLED 09/19/07 BORING NO. BR-3

GROUND ELEVATION 1,239' ± MSL SHEET 1 OF 5

METHOD OF DRILLING AP 1000, Percussion Hammer (Layne Christensen)

DRIVE WEIGHT 140 lbs. (Cathead) DROP 30"

SAMPLED BY JSR LOGGED BY JSR REVIEWED BY KJT

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						GM	ALLUVIUM: Grayish brown, damp, very dense, silty GRAVEL with sand; cobbles and possible boulders.
5		50/2"					
						GC	Light brown, damp, very dense, clayey GRAVEL with sand; cobbles and possible boulders.
10		50/5"					
15		50/6"					
20		50/4"					

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BORING LOG

BEARDSLEY ROAD CONNECTOR - PHASE I
PEORIA, ARIZONA

PROJECT NO.	DATE	FIGURE
600635001	12/07	A-11

DATE DRILLED 09/19/07 BORING NO. BR-3

GROUND ELEVATION 1,239' ± MSL SHEET 2 OF 5

METHOD OF DRILLING AP 1000, Percussion Hammer (Layne Christensen)

DRIVE WEIGHT 140 lbs. (Cathead) DROP 30"

SAMPLED BY JSR LOGGED BY JSR REVIEWED BY KJT

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20						GC	ALLUVIUM: (continued) Light brown, damp, very dense, clayey GRAVEL with sand; cobbles and possible boulders.
25		50/5"					
		50/6"					
30							
35		50/4"					
		50/6"					
40							

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BORING LOG

BEARDSLEY ROAD CONNECTOR - PHASE I
PEORIA, ARIZONA

PROJECT NO.	DATE	FIGURE
600635001	12/07	A-12

DATE DRILLED 09/19/07 BORING NO. BR-3

GROUND ELEVATION 1,239' ± MSL SHEET 3 OF 5

METHOD OF DRILLING AP 1000, Percussion Hammer (Layne Christensen)

DRIVE WEIGHT 140 lbs. (Cathead) DROP 30"

SAMPLED BY JSR LOGGED BY JSR REVIEWED BY KJT

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
40						GC	ALLUVIUM: (continued) Light brown, damp, very dense, clayey GRAVEL with sand; cobbles and possible boulders.
						SC	Brown, damp, very dense, clayey fine to coarse SAND with gravel; cobbles and possible boulders.
45		50/6"					
		50/5"					
50							
55		50/3"				GC	Brown, damp, very dense, clayey GRAVEL with sand; cobbles and possible boulders.
		50/6"				SC	Brown, damp, very dense, clayey fine to coarse SAND with gravel; cobbles and possible boulders.
60							

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BORING LOG

BEARDSLEY ROAD CONNECTOR - PHASE I
PEORIA, ARIZONA

PROJECT NO.	DATE	FIGURE
600635001	12/07	A-13

DATE DRILLED 09/19/07 BORING NO. BR-3

GROUND ELEVATION 1,239' ± MSL SHEET 4 OF 5

METHOD OF DRILLING AP 1000, Percussion Hammer (Layne Christensen)

DRIVE WEIGHT 140 lbs. (Cathead) DROP 30"

SAMPLED BY JSR LOGGED BY JSR REVIEWED BY KJT

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
60						SC	ALLUVIUM: (continued) Brown, damp, very dense, clayey fine to coarse SAND with gravel; cobbles and possible boulders.
						SM	Brown, damp, very dense, silty fine to coarse SAND; few gravel; possible cobbles and boulders.
65		50/6"					
70		50/4"					
75		50/1"					Cobbles and possible boulders.
						SC	Brown, damp, very dense, clayey SAND with gravel; possible cobbles and boulders.
80		50/6"					

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BORING LOG

BEARDSLEY ROAD CONNECTOR - PHASE I
PEORIA, ARIZONA

PROJECT NO.	DATE	FIGURE
600635001	12/07	A-14

DATE DRILLED 09/19/07 BORING NO. BR-3

GROUND ELEVATION 1,239' ± MSL SHEET 5 OF 5

METHOD OF DRILLING AP 1000, Percussion Hammer (Layne Christensen)

DRIVE WEIGHT 140 lbs. (Cathead) DROP 30"

SAMPLED BY JSR LOGGED BY JSR REVIEWED BY KJT

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
80							SC	ALLUVIUM: (continued) Brown, damp, very dense, clayey SAND with gravel;possible cobbles and boulders.
							SM	Brown, damp, very dense, silty fine to coarse SAND with gravel; possible cobbles and boulders.
85		◢	50/6"					Total Depth = 85.5 feet. Groundwater not encountered during drilling. Backfilled on 09/18/07 promptly after completion of drilling. 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.
90								
95								
100								

Ninyo & Moore

BORING LOG

BEARDSLEY ROAD CONNECTOR - PHASE I
PEORIA, ARIZONA

PROJECT NO.	DATE	FIGURE
600635001	12/07	A-15

DATE DRILLED 09/19/07 BORING NO. BR-4

GROUND ELEVATION 1,240' ± MSL SHEET 1 OF 5

METHOD OF DRILLING AP 1000, Percussion Hammer (Layne Christensen)

DRIVE WEIGHT 140 lbs. (Cathead) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY KJT

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						GM	ALLUVIUM: Brown, damp, very dense, silty GRAVEL with sand; cobbles and possible boulders.
5		50/3"					
10		50/3"					
						SC	Brown, dry to damp, very dense, clayey fine to coarse SAND with gravel; cobbles and possible boulders.
15		50/4"					
20							

Ninyo & Moore

BORING LOG

BEARDSLEY ROAD CONNECTOR - PHASE I
PEORIA, ARIZONA

PROJECT NO.	DATE	FIGURE
600635001	12/07	A-16

DATE DRILLED 09/19/07 BORING NO. BR-4

GROUND ELEVATION 1,240' ± MSL SHEET 2 OF 5

METHOD OF DRILLING AP 1000, Percussion Hammer (Layne Christensen)

DRIVE WEIGHT 140 lbs. (Cathead) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY KJT

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20		50/3"				SC	ALLUVIUM: (continued) Brown, damp, clayey fine to coarse SAND with gravel; cobbles and possible boulders.
25		50/4"					
30		50/1"					
35		50/5"					
40							

Ninyo & Moore

BORING LOG

BEARDSLEY ROAD CONNECTOR - PHASE I
PEORIA, ARIZONA

PROJECT NO.	DATE	FIGURE
600635001	12/07	A-17

DATE DRILLED 09/19/07 BORING NO. BR-4

GROUND ELEVATION 1,240' ± MSL SHEET 3 OF 5

METHOD OF DRILLING AP 1000, Percussion Hammer (Layne Christensen)

DRIVE WEIGHT 140 lbs. (Cathead) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY KJT

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
40			50/4"				SC	ALLUVIUM: (continued) Brown, damp, clayey fine to coarse SAND; few to little fine gravel; possible cobbles and boulders.
45			50/3"				SM	Brown, damp, very dense, silty SAND with gravel; possible cobbles and boulders.
50			50/3"					
55			50/3"					Cobbles.
60								

Ninyo & Moore

BORING LOG

BEARDSLEY ROAD CONNECTOR - PHASE I
PEORIA, ARIZONA

PROJECT NO.	DATE	FIGURE
600635001	12/07	A-18

DATE DRILLED 09/19/07 BORING NO. BR-4

GROUND ELEVATION 1,240' ± MSL SHEET 4 OF 5

METHOD OF DRILLING AP 1000, Percussion Hammer (Layne Christensen)

DRIVE WEIGHT 140 lbs. (Cathead) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY KJT

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
60		50/2"				SM	ALLUVUIM: (continued) Brown, damp, very dense, silty SAND with gravel; possible cobbles and boulders.
65		50/6"					
70		50/4"					
75		50/2"					
80							

Ninyo & Moore

BORING LOG

BEARDSLEY ROAD CONNECTOR - PHASE I
PEORIA, ARIZONA

PROJECT NO.	DATE	FIGURE
600635001	12/07	A-19

DATE DRILLED 09/19/07 BORING NO. BR-4

GROUND ELEVATION 1,240' ± MSL SHEET 5 OF 5

METHOD OF DRILLING AP 1000, Percussion Hammer (Layne Christensen)

DRIVE WEIGHT 140 lbs. (Cathead) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY KJT

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
80		29				SM	ALLUVIUM: (continued) Brown, damp, medium dense, silty fine to coarse SAND; few gravel; possible cobbles and boulders.
85		50/4"					Very dense; increase gravel content.
							Total Depth = 85.3 feet. Groundwater not encountered during drilling. Backfilled on 09/19/07 promptly after completion of drilling. 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.
90							
95							
100							

Ninyo & Moore

BORING LOG

BEARDSLEY ROAD CONNECTOR - PHASE I
PEORIA, ARIZONA

PROJECT NO.	DATE	FIGURE
600635001	12/07	A-20

APPENDIX B

GEOTECHNICAL LABORATORY TESTING

Classification

Soils were visually and texturally classified in accordance with the Unified Soil Classification System (USCS) in general accordance with ASTM D 2488-00. Soil classifications are indicated on the logs of the exploratory borings in Appendix A.

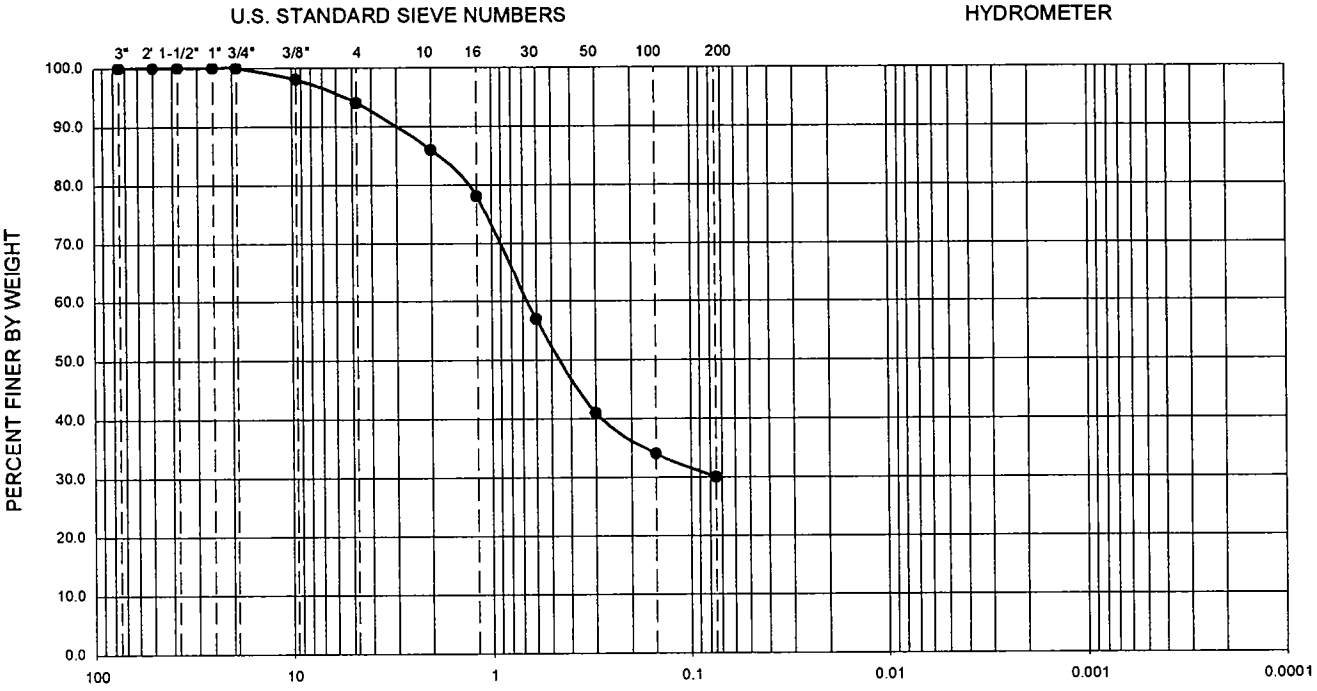
In-Place Moisture and Density Tests

The moisture content and dry density of relatively undisturbed samples obtained from the exploratory borings were evaluated in general accordance with ASTM D2937-04. These test results are presented on the logs of the exploratory borings in Appendix A.

Gradation Analysis

Gradation analysis tests were performed on selected representative soil samples in general accordance with ASTM D 422-63 (02). The grain-size distribution curves are shown on Figures B-1 through B-8. These test results were utilized in evaluating the soil classifications in accordance with the Unified Soil Classification System.

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY

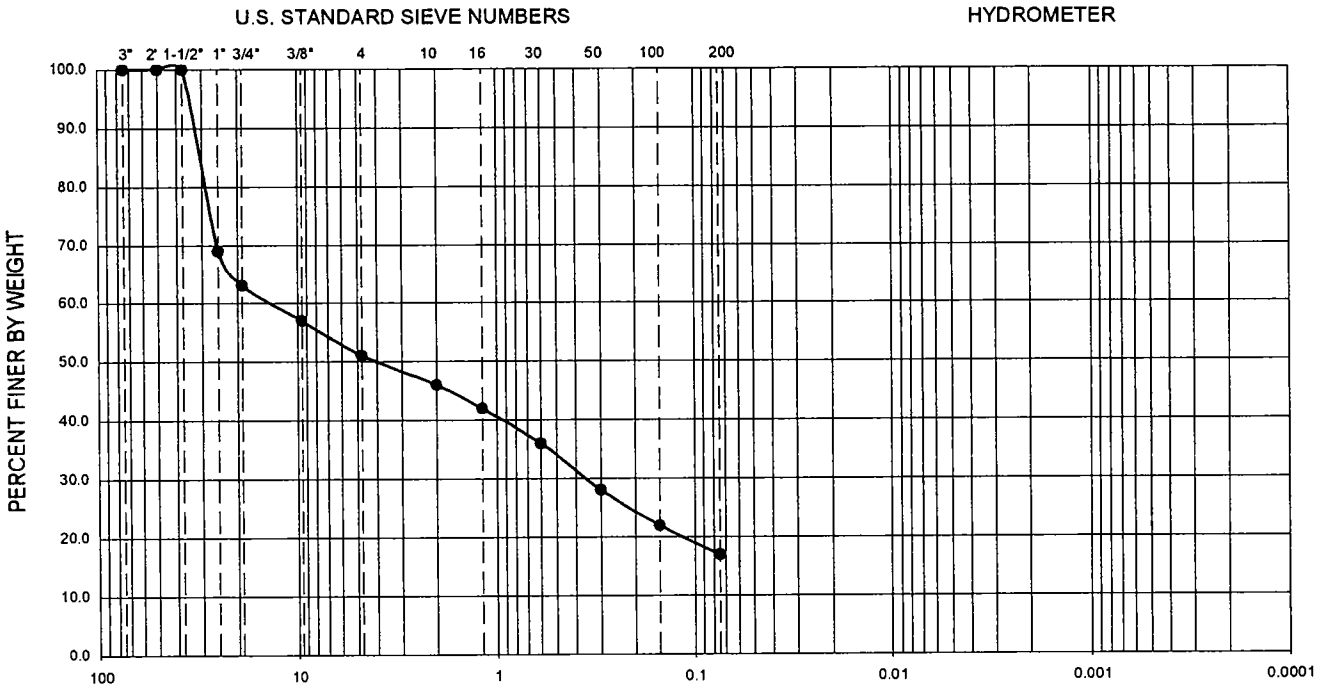


Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
●	BR-1	25-25.5	--	--	--	--	--	--	--	--	30	SC

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63 (02)

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. / DATE	BEARDSLEY ROAD CONNECTOR - PHASE I PEORIA, ARIZONA	B-1
600635001 / 12/07		

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY

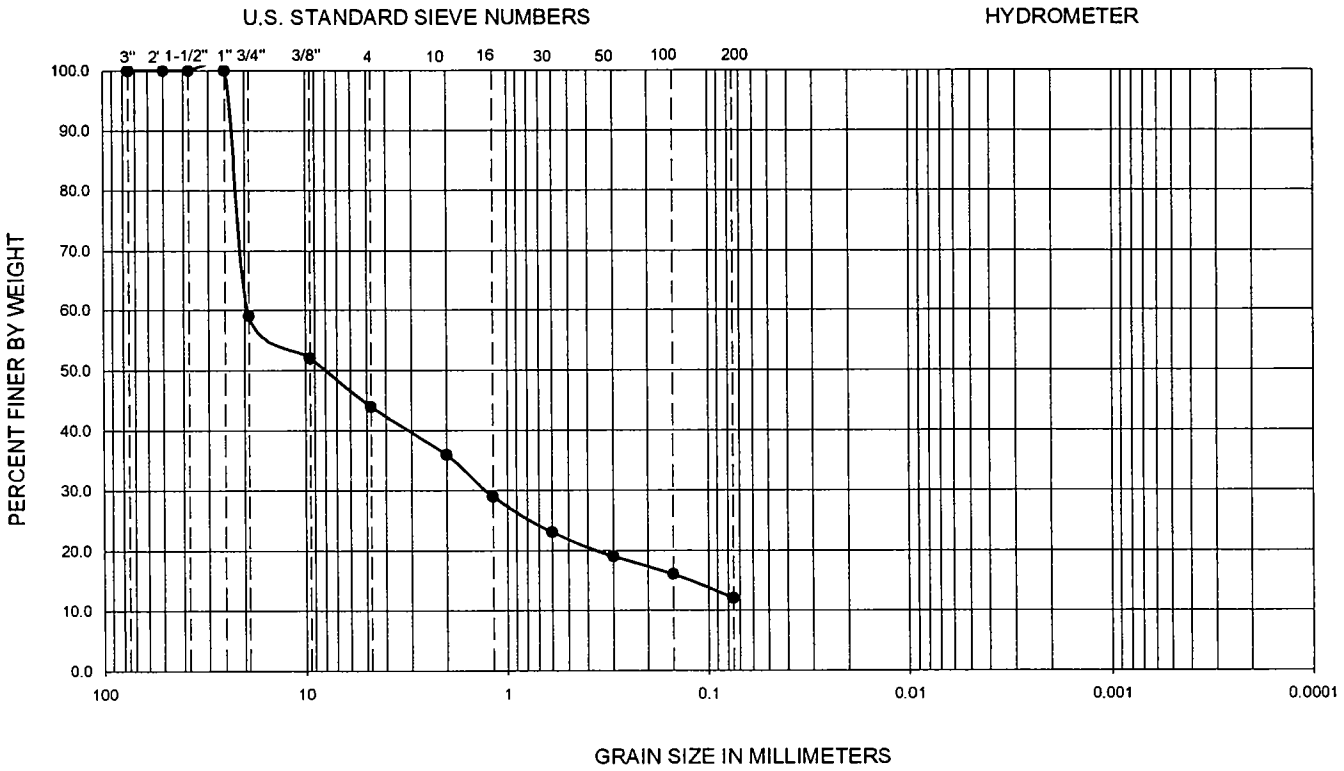


Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
●	BR-1	45-45.4	--	--	--	--	--	--	--	--	17	GC

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63 (02)

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. / DATE	BEARDSLEY ROAD CONNECTOR - PHASE I PEORIA, ARIZONA	B-2
600635001 / 12/07		

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY



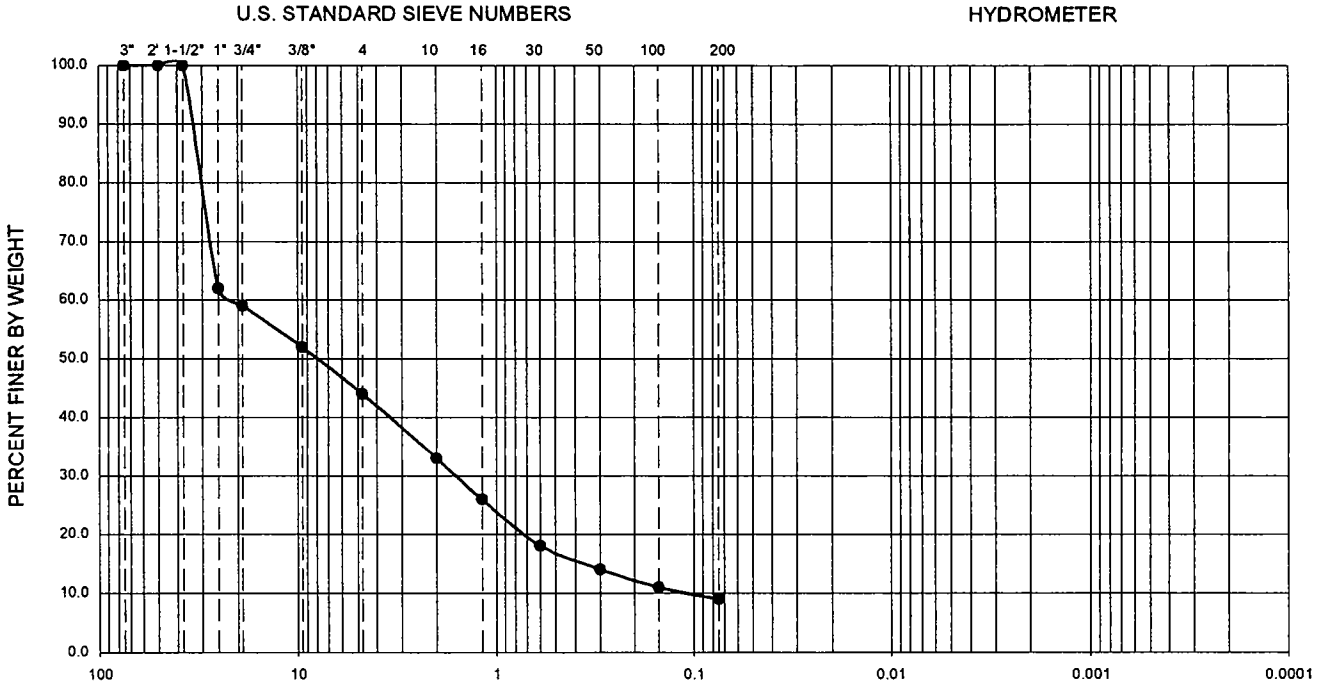
Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	BR-2	20-20.5	--	--	--	0.05	1.30	19.00	380.0	1.8	12	GW-GC

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63 (02)

* Extrapolated

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. / DATE	BEARDSLEY ROAD CONNECTOR - PHASE I PEORIA, ARIZONA	B-3
600635001 / 12/07		

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY

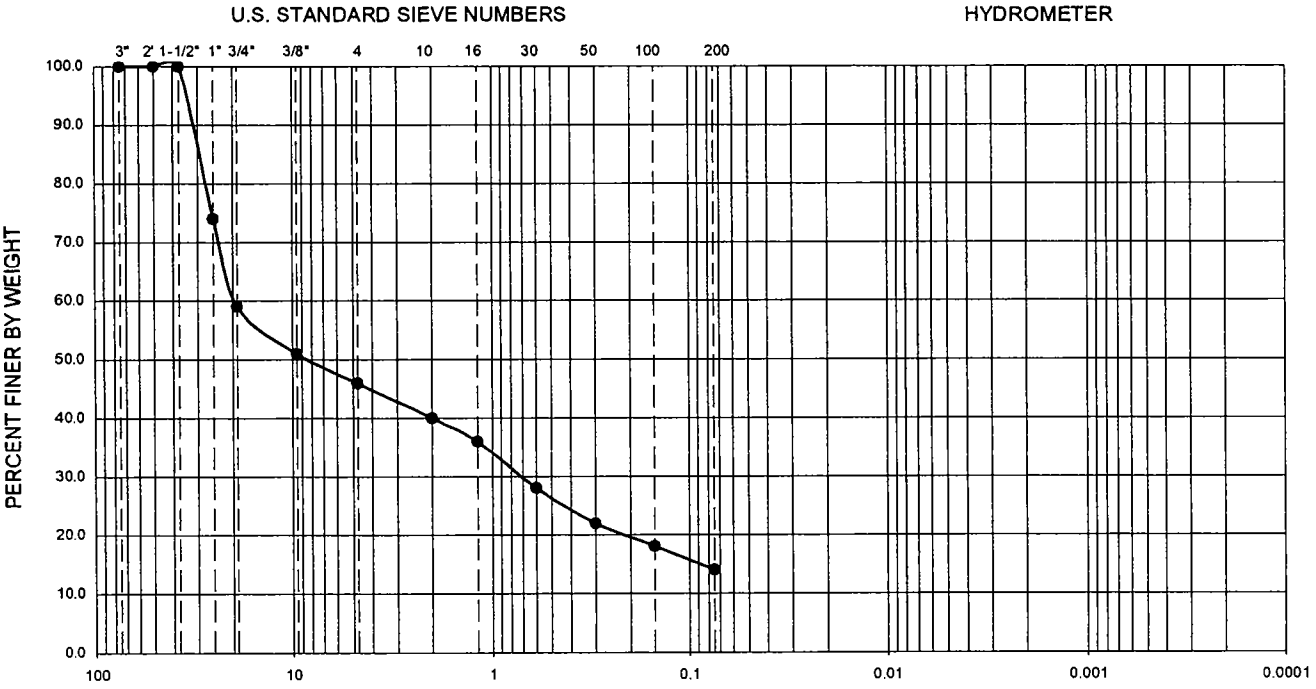


Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
●	BR-2	50-50.5	--	--	--	0.10	1.60	22.00	220.0	1.2	9	GW-GM

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63 (02)

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. / DATE	BEARDSLEY ROAD CONNECTOR - PHASE I PEORIA, ARIZONA	B-4
600635001 / 12/07		

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY

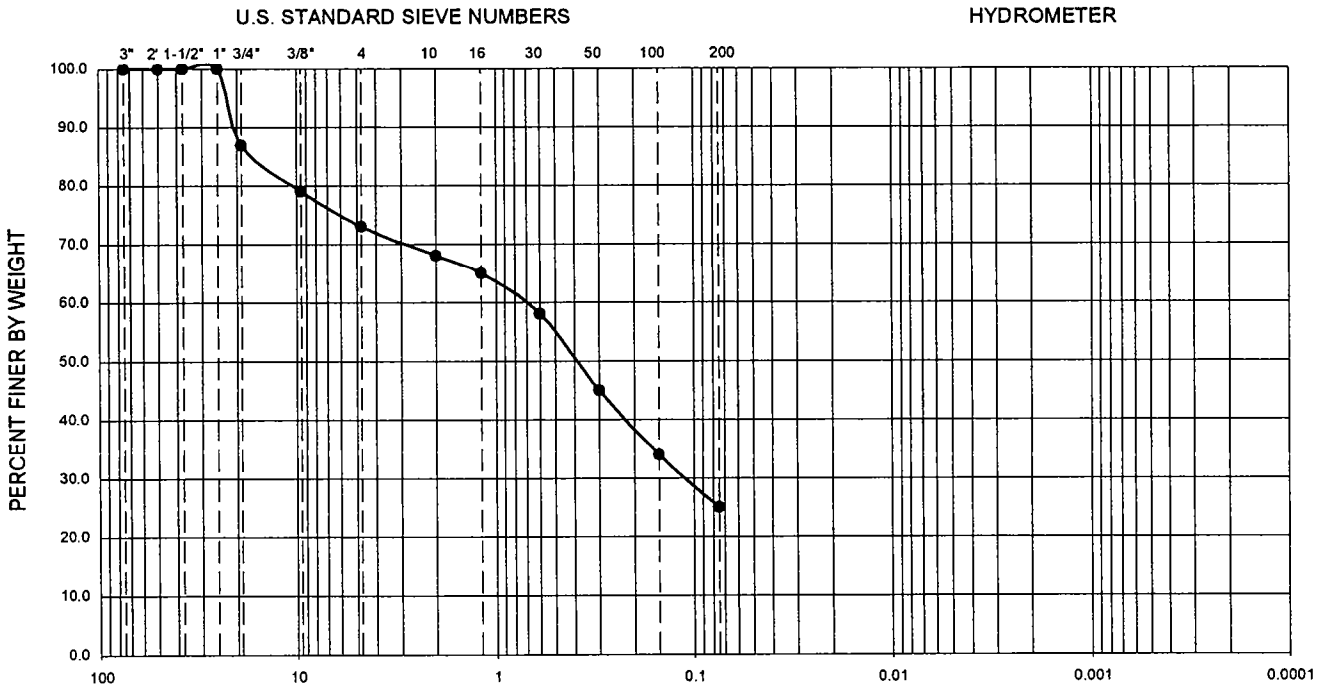


Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
●	BR-3	39-39.5	--	--	--	--	--	--	--	--	14	GC

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63 (02)

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. / DATE	BEARDSLEY ROAD CONNECTOR - PHASE I PEORIA, ARIZONA	B-5
600635001 / 12/07		

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY

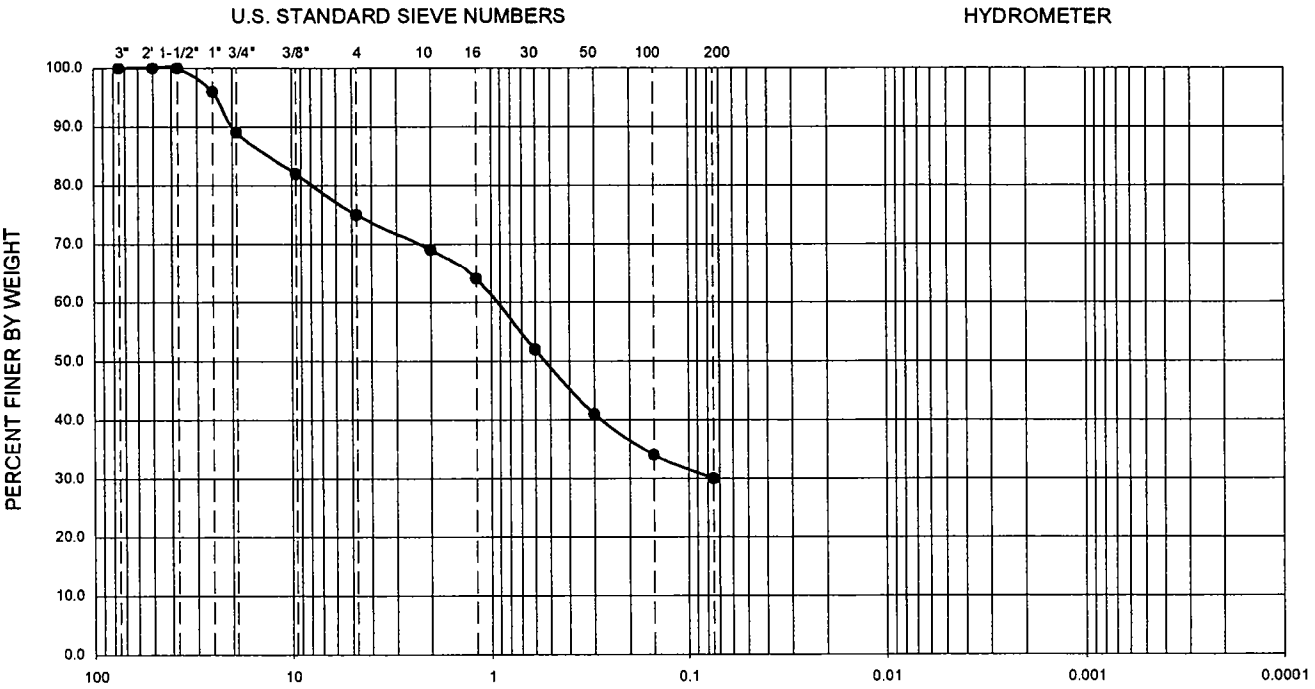


Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
●	BR-3	59-59.5	--	--	--	--	--	--	--	--	25	SC

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63 (02)

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. 600635001 / DATE 12/07	BEARDSLEY ROAD CONNECTOR - PHASE I PEORIA, ARIZONA	B-6

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY

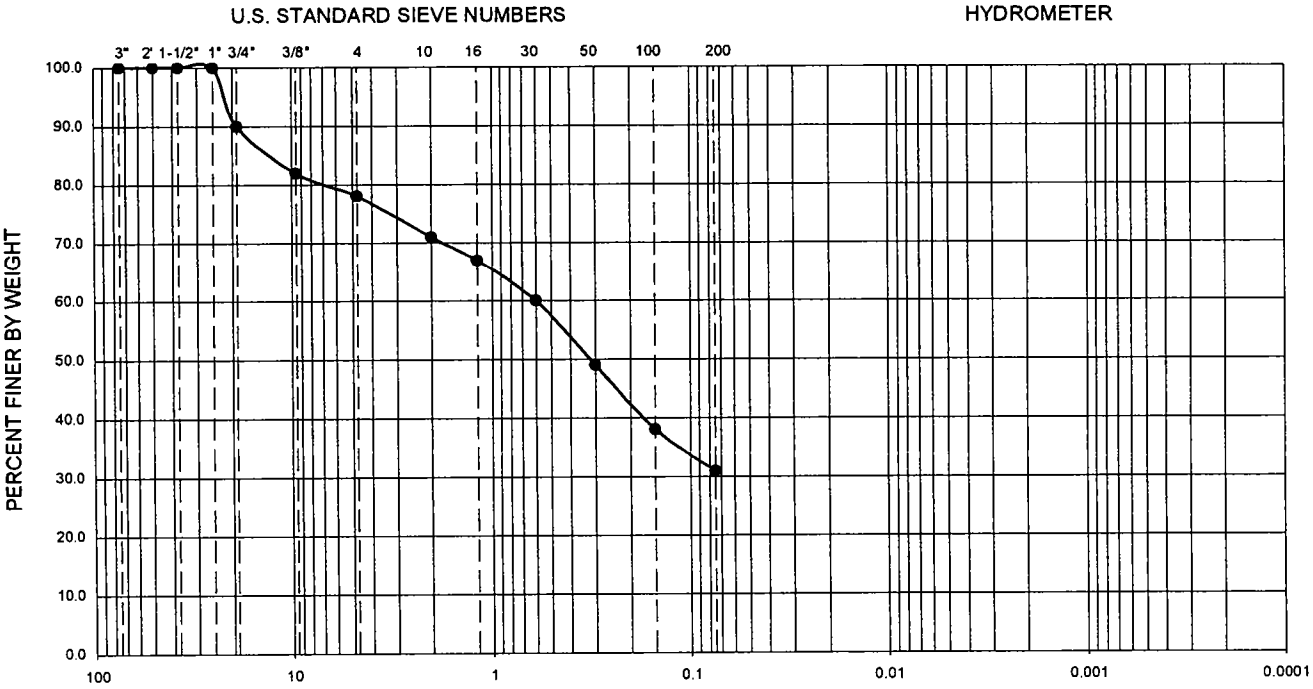


Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
●	BR-4	15-15.3	--	--	--	--	--	--	--	--	30	SC

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63 (02)

Ninyo & Moore		GRADATION TEST RESULTS	FIGURE
PROJECT NO.	DATE	BEARDSLEY ROAD CONNECTOR - PHASE I PEORIA, ARIZONA	B-7
600635001	12/07		

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
●	BR-4	35-35.4	--	--	--	--	--	--	--	--	31	SC

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-63 (02)

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. / DATE	BEARDSLEY ROAD CONNECTOR - PHASE I PEORIA, ARIZONA	B-8
600635001 / 12/07		

APPENDIX C

PREVIOUS EXPLORATION DATA

Ninyo & Moore

TEST PIT LOG

Beardsley Road Connection
Peoria and Glendale Arizona

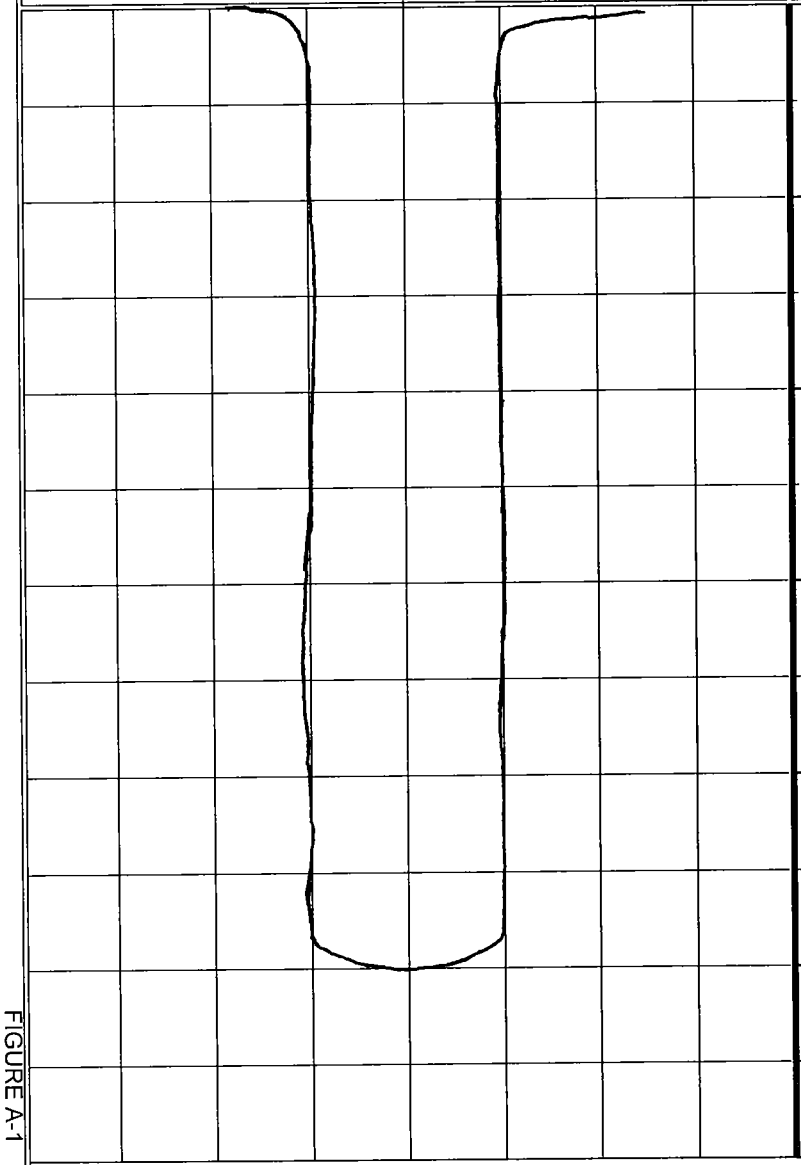
PROJECT NO.	DATE
600635001	2/04

DATE EXCAVATED 1/15/04 TEST PIT NO. NM-1

GROUND ELEVATION -- LOGGED BY MLE

METHOD OF EXCAVATION Manual (Backhoe)

LOCATION See Figure 2 - Test Pit Location Map



SCALE = 1 in./2 ft.

DEPTH (FEET)	SAMPLES: Bulk	SAMPLES: Driven	SAMPLES: Sand Cone	MOISTURE (%)	DRY DENSITY (PCF)	CLASSIFICATION U.S.C.S.	DESCRIPTION
0						SC	ALLUVIUM: Brown, moist, clayey fine to coarse SAND; little gravel; few cobbles up to 6" in length; trace cobble up to 12" in length.
2	■						
4							
6	■						Increase in cobbles.
8						SM	Brown, moist, silty fine to coarse SAND; some gravel; scattered cobbles.
10	■						Total depth = 10.0 feet. Groundwater not encountered. Backfilled on 1/15/04.
12							

FIGURE A-1

Ninyo & Moore

TEST PIT LOG

Beardsley Road Connection
Peoria and Glendale Arizona

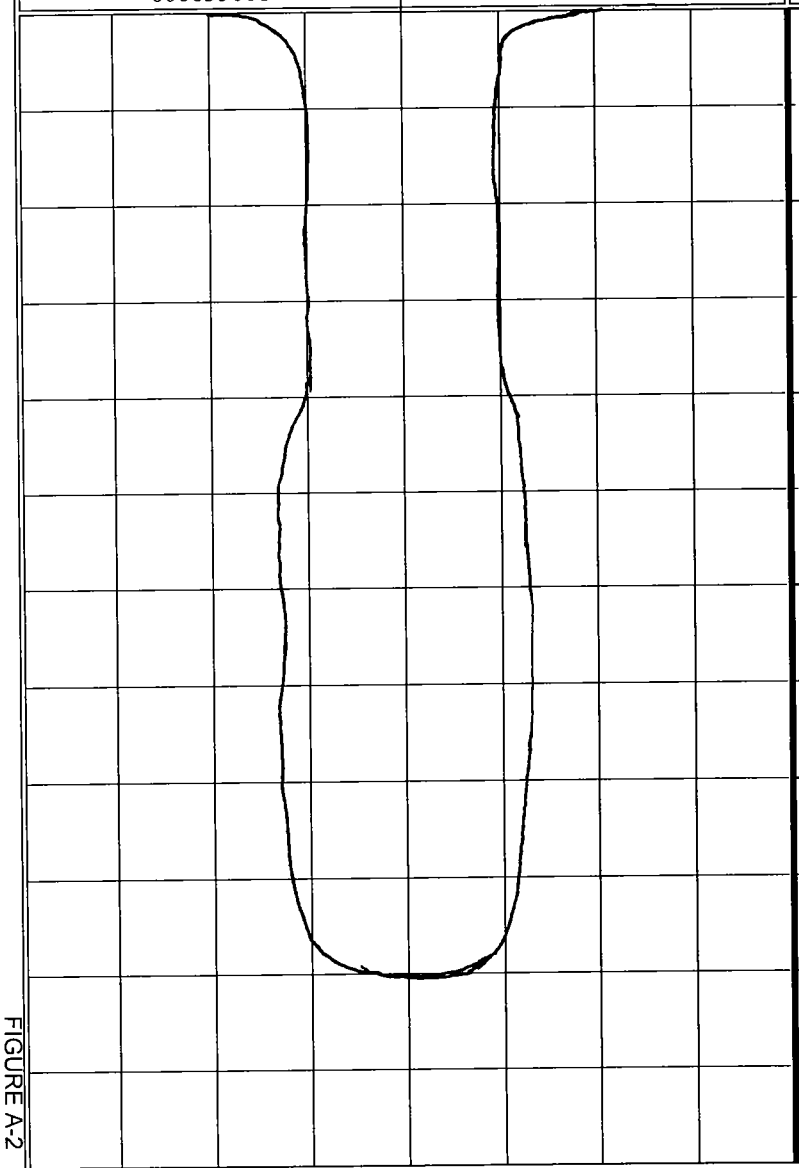
PROJECT NO.	DATE
600635001	2/04

DATE EXCAVATED 1/15/04 TEST PIT NO. NM-2

GROUND ELEVATION -- LOGGED BY MLE

METHOD OF EXCAVATION Manual (Backhoe)

LOCATION See Figure 2 - Test Pit Location Map



CLASSIFICATION U.S.C.S.	DESCRIPTION
SM	ALLUVIUM: Brown, damp, silty fine to medium SAND; some gravel; trace clay; few cobbles up to 12" in length; scattered roots.
	Increase in sand content and gravel content; no roots.
	Total depth = 10.0 feet. Groundwater not encountered. Backfilled on 1/15/04.

SCALE = 1 in./2 ft.

FIGURE A-2

Ninyo & Moore

TEST PIT LOG

Beardsley Road Connection
Peoria and Glendale Arizona

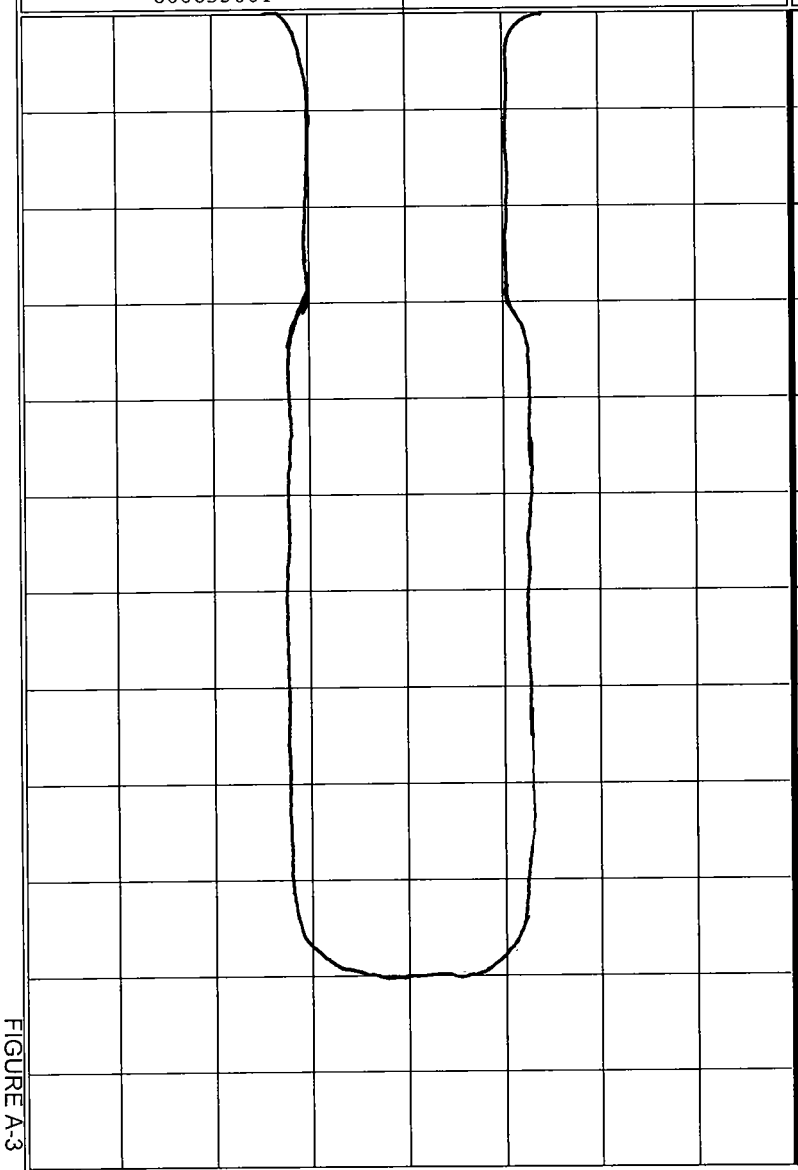
PROJECT NO.	DATE
600635001	2/04

DATE EXCAVATED 1/15/04 TEST PIT NO. NM-3

GROUND ELEVATION -- LOGGED BY MLE

METHOD OF EXCAVATION Manual (Backhoe)

LOCATION See Figure 2 - Test Pit Location Map



CLASSIFICATION U.S.C.S.	DESCRIPTION
SM	ALLUVIUM: Brown, damp, silty fine to coarse SAND; some gravel.
SP	Fine to coarse SAND; some gravel; trace cobbles up to 5" in length.
	Some cobbles.
	Total depth = 10.0 feet. Groundwater not encountered. Backfilled on 1/15/04.

SCALE = 1 in./2 ft.

FIGURE A-3

Ninyo & Moore

TEST PIT LOG

Beardsley Road Connection
Peoria and Glendale Arizona

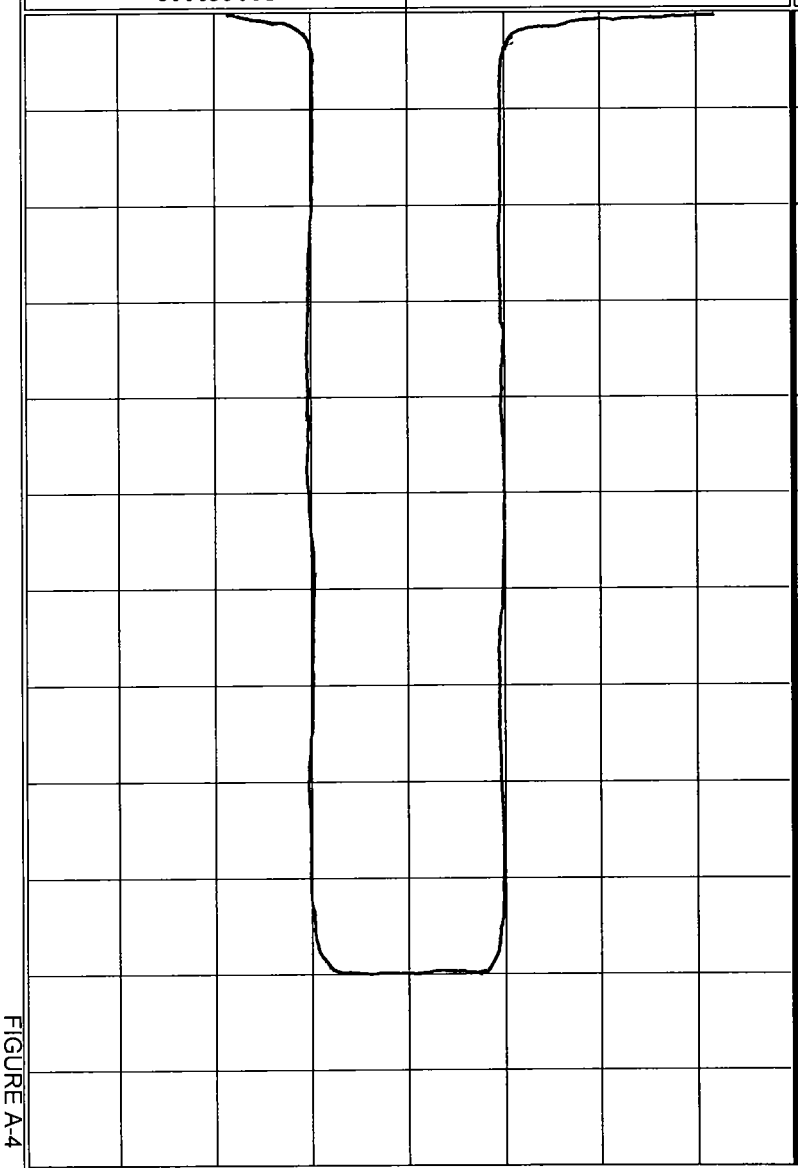
PROJECT NO.	DATE
600635001	2/04

DATE EXCAVATED 1/15/04 TEST PIT NO. NM-4

GROUND ELEVATION -- LOGGED BY MLE

METHOD OF EXCAVATION Manual (Backhoe)

LOCATION See Figure 2 - Test Pit Location Map



CLASSIFICATION U.S.C.S.	DESCRIPTION
SM	FILL: Brown, damp, silty fine to coarse SAND; trace clay; few gravel; some cobbles up to 12" in length; scattered roots.
	No roots.
	Pieces of concrete.
SC	Brown, damp, clayey fine to coarse sand; some gravel and cobbles.
	Total depth = 10.0 feet. Groundwater not encountered. Backfilled on 1/15/04.

SCALE = 1 in./2 ft.

FIGURE A-4

Ninyo & Moore

TEST PIT LOG

Beardsley Road Connection
Peoria and Glendale Arizona

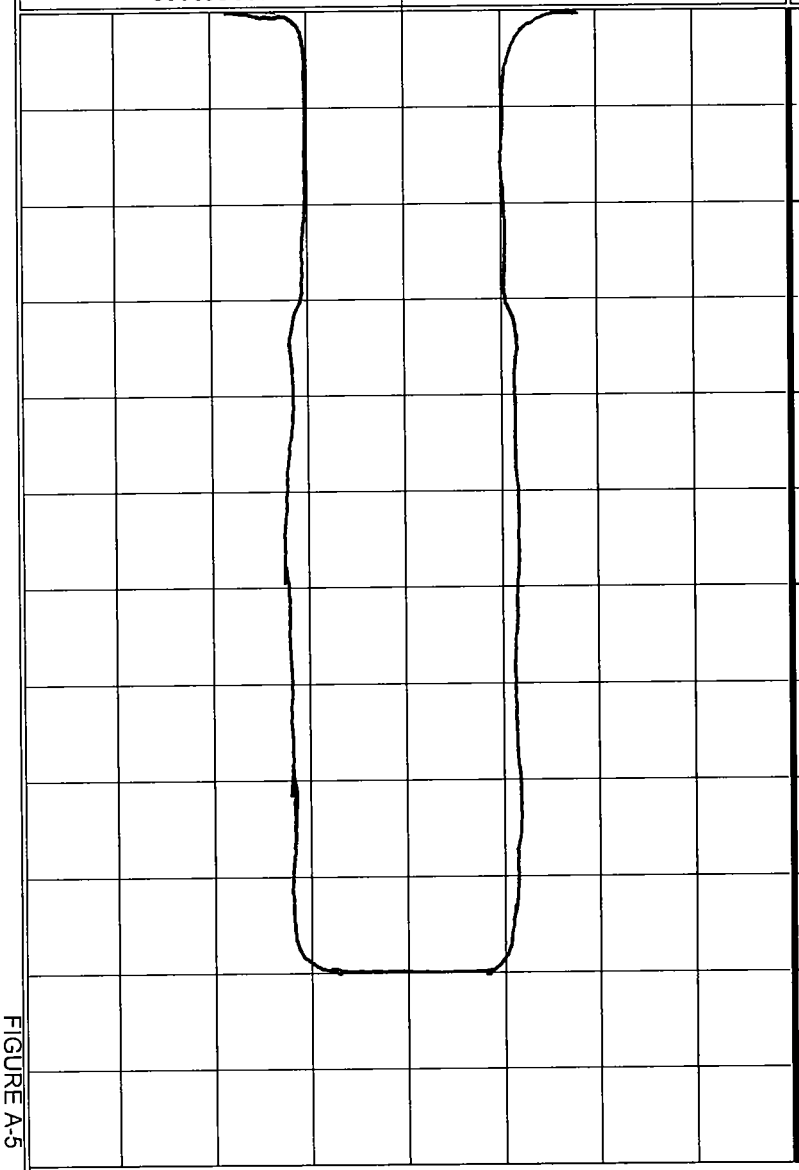
PROJECT NO.	DATE
600635001	2/04

DATE EXCAVATED 1/15/04 TEST PIT NO. NM-5

GROUND ELEVATION -- LOGGED BY MLE

METHOD OF EXCAVATION Manual (Backhoe)

LOCATION See Figure 2 - Test Pit Location Map



DESCRIPTION

ALLUVIUM:
Brown, damp, silty fine SAND; little clay; few gravel; few cobbles up to 6" in length; scattered roots.

No roots.

Trace clay; some cobbles; silty fine to coarse SAND.

No clay.

Total depth = 10.0 feet.
Groundwater not encountered.
Backfilled on 1/15/04.

SCALE = 1 in./2 ft.

FIGURE A-5

Ninyo & Moore

TEST PIT LOG

Beardsley Road Connection
Peoria and Glendale Arizona

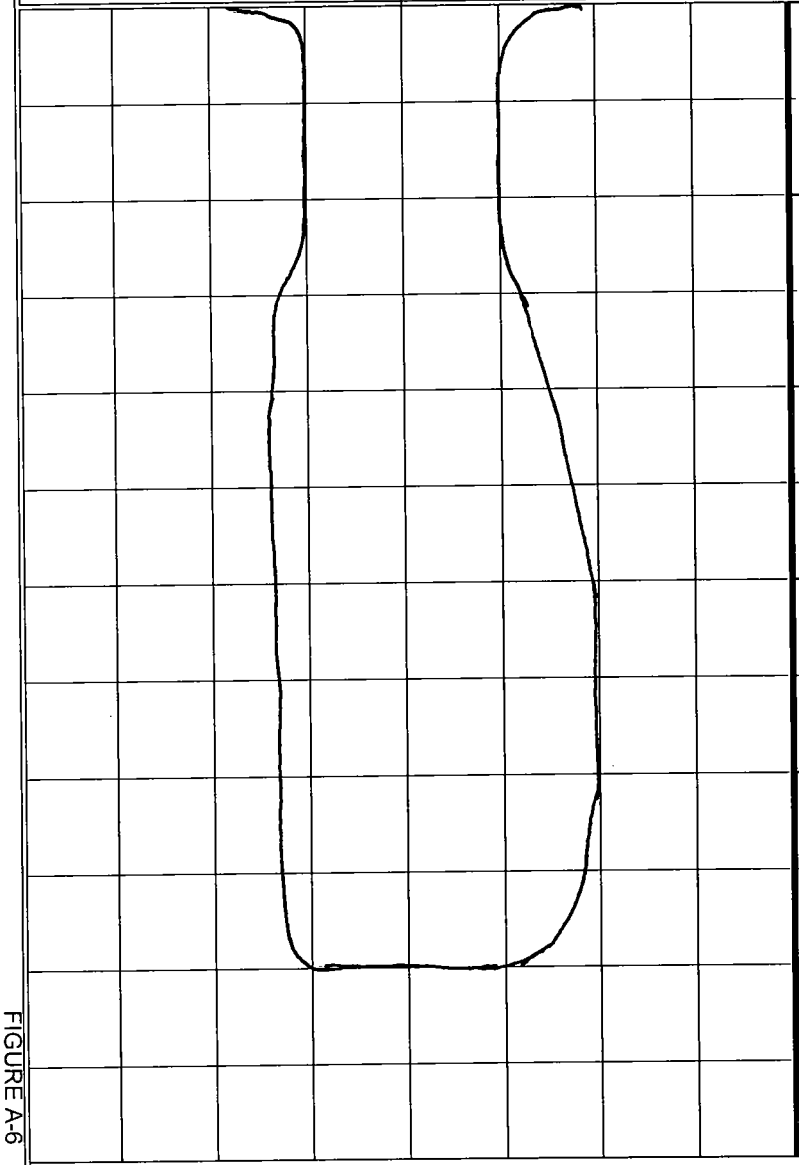
PROJECT NO.	DATE
600635001	2/04

DATE EXCAVATED 1/15/04 TEST PIT NO. NM-6

GROUND ELEVATION -- LOGGED BY MLE

METHOD OF EXCAVATION Manual (Backhoe)

LOCATION See Figure 2 - Test Pit Location Map



DEPTH (FEET)	SAMPLES: Bulk	SAMPLES: Driven	SAMPLES: Sand Cone	MOISTURE (%)	DRY DENSITY (PCF)	CLASSIFICATION U.S.C.S.	DESCRIPTION
0						SM	FILL: Brown, damp, silty fine to coarse SAND; trace clay; few gravel.
2	■						
4							
6	■						Pieces of wood, black PVC pipe and wire. Brown to reddish brown. 5-1/2' long by 8" wide wood.
8							Wire.
10	■						Total depth = 10.0 feet. Groundwater not encountered. Backfilled on 1/15/04.
12							

SCALE = 1 in./2 ft.

FIGURE A-6

Ninyo & Moore

TEST PIT LOG

Beardsley Road Connection
Peoria and Glendale Arizona

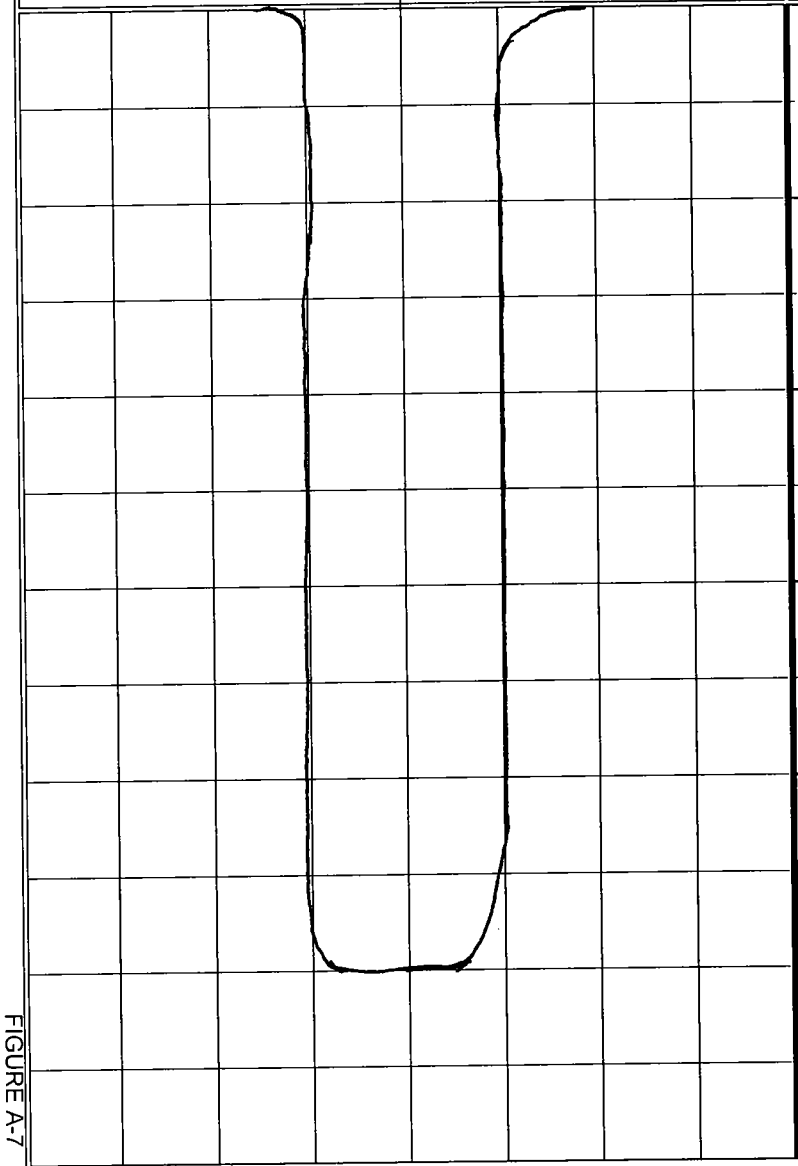
PROJECT NO.	DATE
600635001	2/04

DATE EXCAVATED 1/15/04 TEST PIT NO. NM-7

GROUND ELEVATION -- LOGGED BY MLE

METHOD OF EXCAVATION Manual (Backhoe)

LOCATION See Figure 2 - Test Pit Location Map



CLASSIFICATION U.S.C.S.	DESCRIPTION
GP-GC	ALLUVIUM: Reddish brown, sandy, clayey fine to coarse GRAVEL; trace silt; some cobbl up to 8" in length; scattered roots.
	No roots.
	Total depth = 10.0 feet. Groundwater not encountered. Backfilled on 1/15/04.

SCALE = 1 in./2 ft.

FIGURE A-7

Ninyo & Moore

TEST PIT LOG

Beardsley Road Connection
Peoria and Glendale Arizona

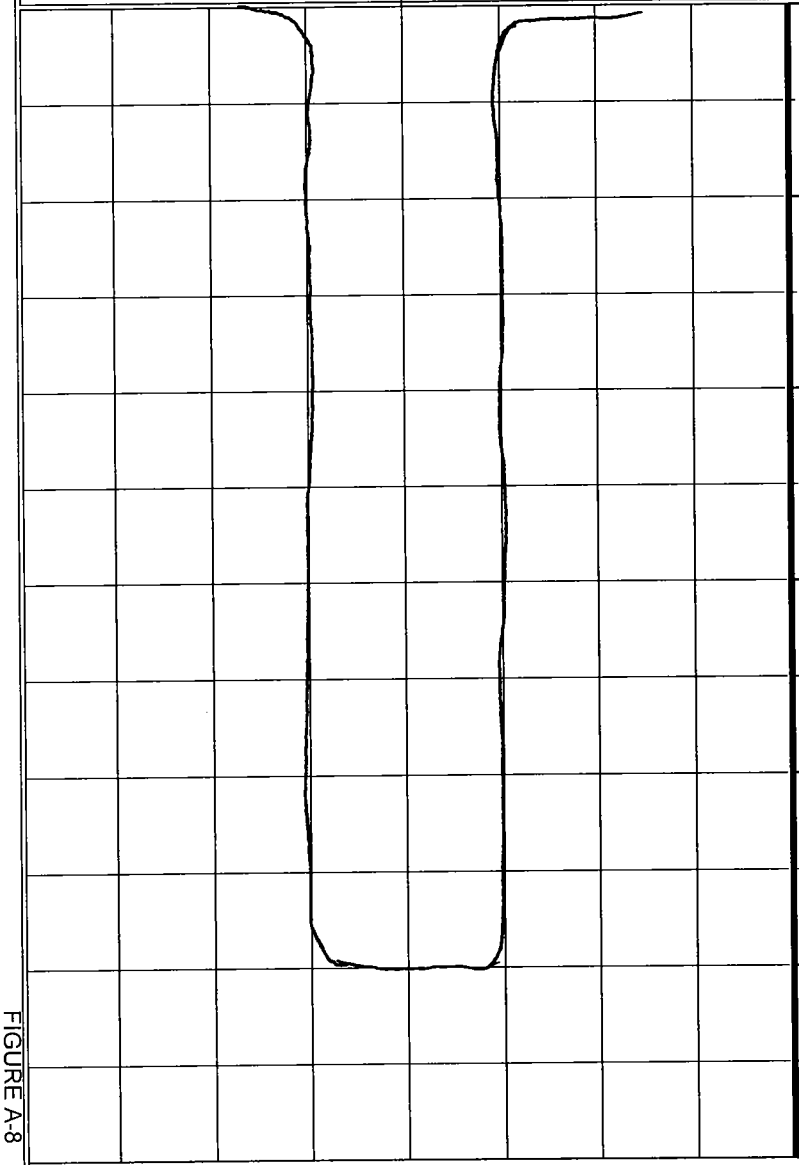
PROJECT NO.	DATE
600635001	2/04

DATE EXCAVATED 1/15/04 TEST PIT NO. NM-8

GROUND ELEVATION -- LOGGED BY MLE

METHOD OF EXCAVATION Manual (Backhoe)

LOCATION See Figure 2 - Test Pit Location Map



CLASSIFICATION U.S.C.S.	DESCRIPTION
SM	ALLUVIUM: Brown, damp, silty fine to coarse SAND; trace clay; little gravel; some cobble up to 5" in length.
	No roots.
	Reddish brown.
	Total depth = 10.0 feet. Groundwater not encountered. Backfilled on 1/15/04.

SCALE = 1 in./2 ft.

FIGURE A-8

Ninyo & Moore

TEST PIT LOG

Beardsley Road Connection
Peoria and Glendale Arizona

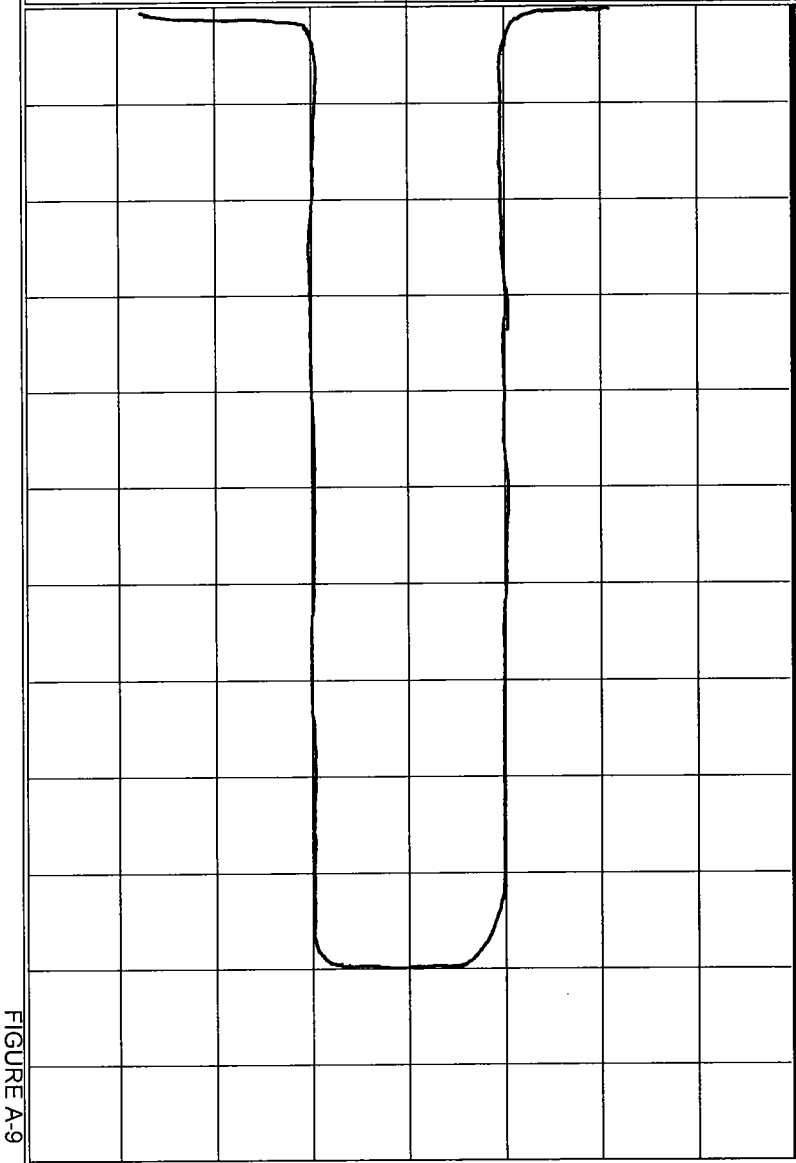
PROJECT NO.	DATE
600635001	2/04

DATE EXCAVATED 1/15/04 TEST PIT NO. NM-9

GROUND ELEVATION -- LOGGED BY MLE

METHOD OF EXCAVATION Manual (Backhoe)

LOCATION See Figure 2 - Test Pit Location Map



DEPTH (FEET)	SAMPLES: Bulk	SAMPLES: Driven	SAMPLES: Sand Cone	MOISTURE (%)	DRY DENSITY (PCF)	CLASSIFICATION U.S.C.S.	DESCRIPTION
0						SC	FILL: Brown, damp, clayey fine to coarse SAND; some gravel; some cobbles up to 6" in length.
2	■						
4	■						Buried plastic, black tubing, foam, wood, cinder block, concrete, fine sand.
10	■						Total depth = 10.0 feet. Groundwater not encountered. Backfilled on 1/15/04.

SCALE = 1 in./2 ft.

FIGURE A-9

Ninyo & Moore

TEST PIT LOG

Beardsley Road Connection
Peoria and Glendale Arizona

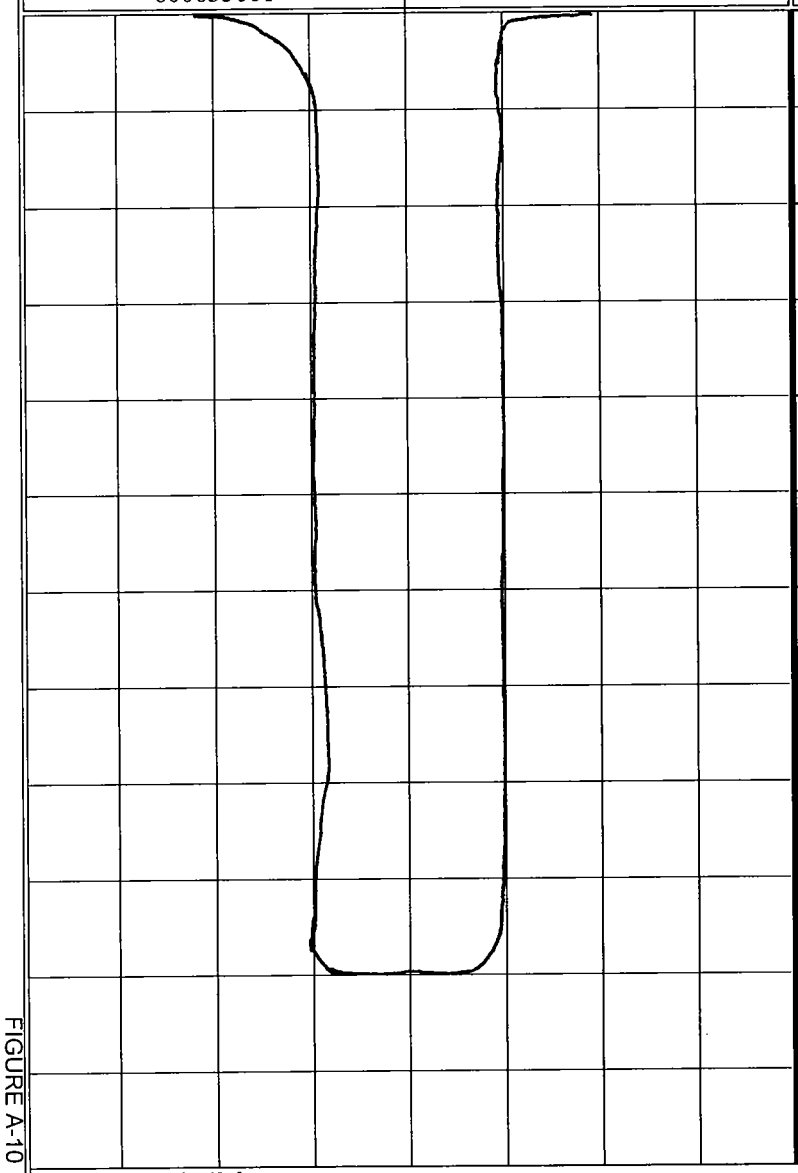
PROJECT NO.	DATE
600635001	2/04

DATE EXCAVATED 1/15/04 TEST PIT NO. NM-10

GROUND ELEVATION -- LOGGED BY MLE

METHOD OF EXCAVATION Manual (Backhoe)

LOCATION See Figure 2 - Test Pit Location Map

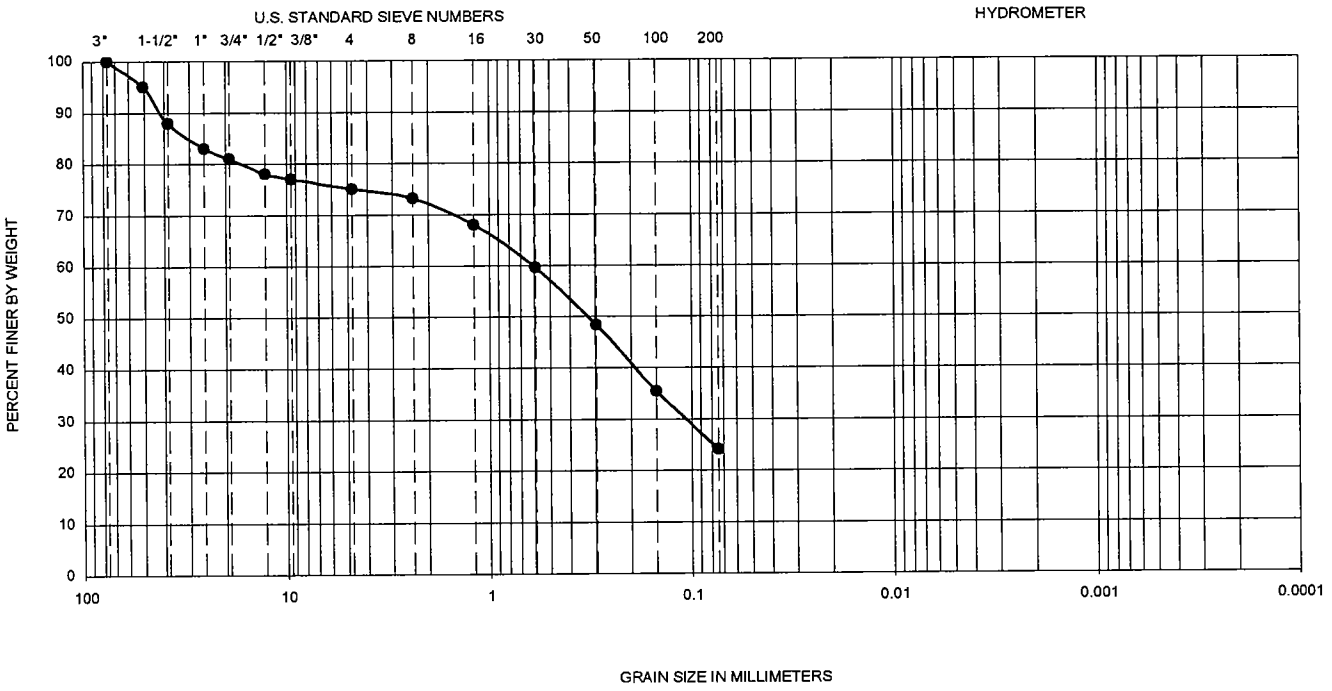


SCALE = 1 in./2 ft.

DEPTH (FEET)	SAMPLES: Bulk	SAMPLES: Driven	SAMPLES: Sand Cone	MOISTURE (%)	DRY DENSITY (PCF)	CLASSIFICATION U.S.C.S.	DESCRIPTION
0						SM	ALLUVIUM: Brown, damp, silty fine SAND; trace clay; few gravel; some cobbles up to 6" in length; scattered roots.
2	■						
4		■					
6							
8						SC	Brown, damp, clayey fine to coarse SAND; few gravel; some cobbles up to 6 in length.
10		■					
12							Total depth = 10.0 feet. Groundwater not encountered. Backfilled on 1/15/03.

FIGURE A-10

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	NM-2	1-2	--	NP	NP	--	--	--	--	--	24	SM

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-98

Ninyo & Moore

GRADATION TEST RESULTS

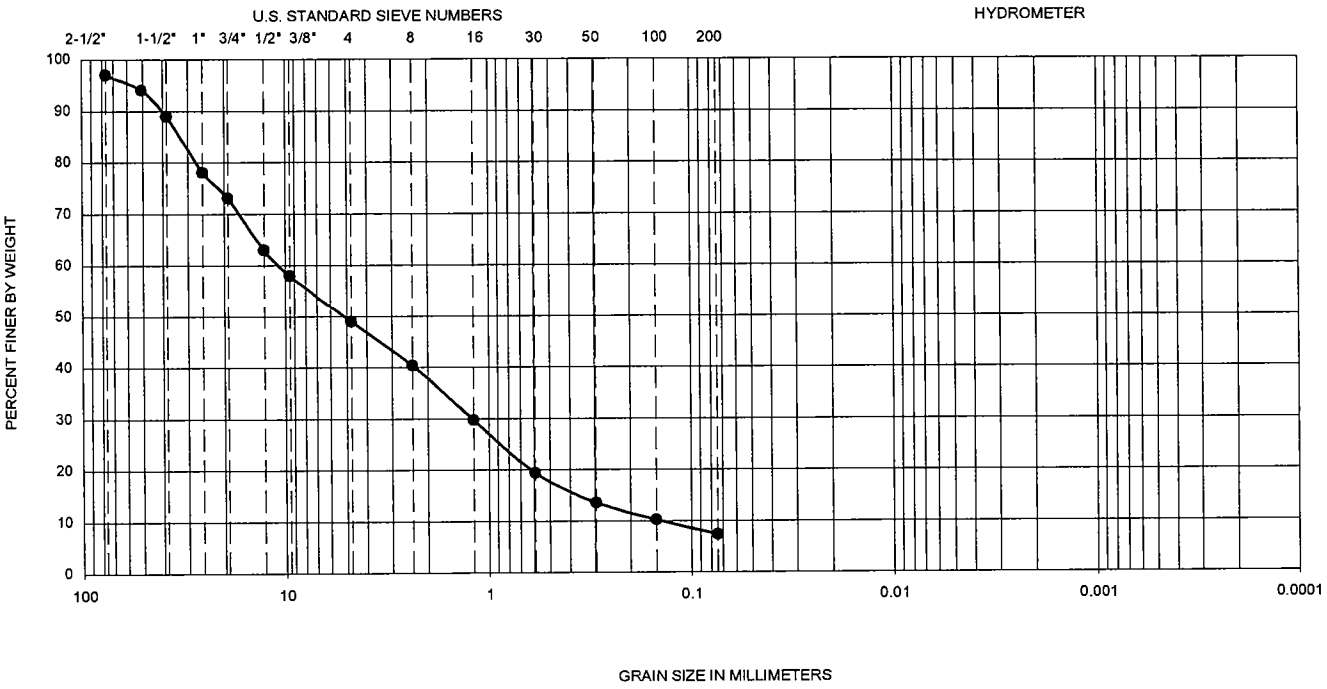
BEARDSLEY ROAD CONNECTION
PEORIA AND GLENDALE, ARIZONA

PROJECT NO.	DATE
600635001	2/04

FIGURE
B-1

SIEVE NM-2 (1-2)

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	NM-7	1-2	53	26	27	0.17	1.20	12.00	70.6	0.7	7	GP-GC

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422-98

Ninyo & Moore

GRADATION TEST RESULTS

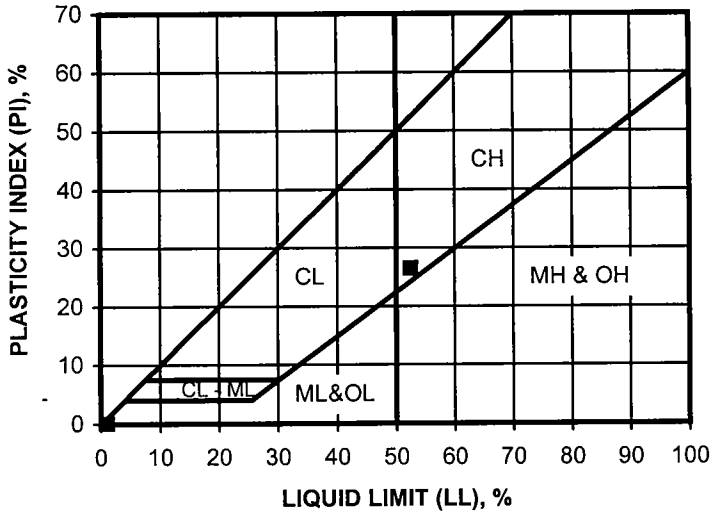
BEARDSLEY ROAD CONNECTION
PEORIA AND GLENDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
600635001	2/04	B-2

SIEVE NM-7 (1-2)

SYMBOL	LOCATION	DEPTH (FT)	LL (%)	PL (%)	PI (%)	U.S.C.S. CLASSIFICATION (Minus No. 40 Sieve Fraction)	U.S.C.S. (Entire Sample)
●	NM-2	1-2	--	NP	NP	NP	SM
■	NM-7	1-2	53	26	27	CH	GP-GC

NP - Indicates non-plastic



PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4318-00

Ninyo & Moore

ATTERBERG LIMITS TEST RESULTS

BEARDSLEY ROAD CONNECTION
PEORIA AND GLENDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
600635001	2/04	B-3

EXPANSION INDEX TEST RESULTS

SAMPLE LOCATION	SAMPLE DEPTH (FT)	INITIAL MOISTURE (%)	COMPACTED DRY DENSITY (PCF)	FINAL MOISTURE (%)	VOLUMETRIC SWELL (IN)	EXPANSION INDEX	EXPANSION POTENTIAL
NM-2	1-2	7.3	111.8	17.2	0.001	1	Very Low
NM-7	1-2	11.7	103.5	21.6	0.0276	28	Low

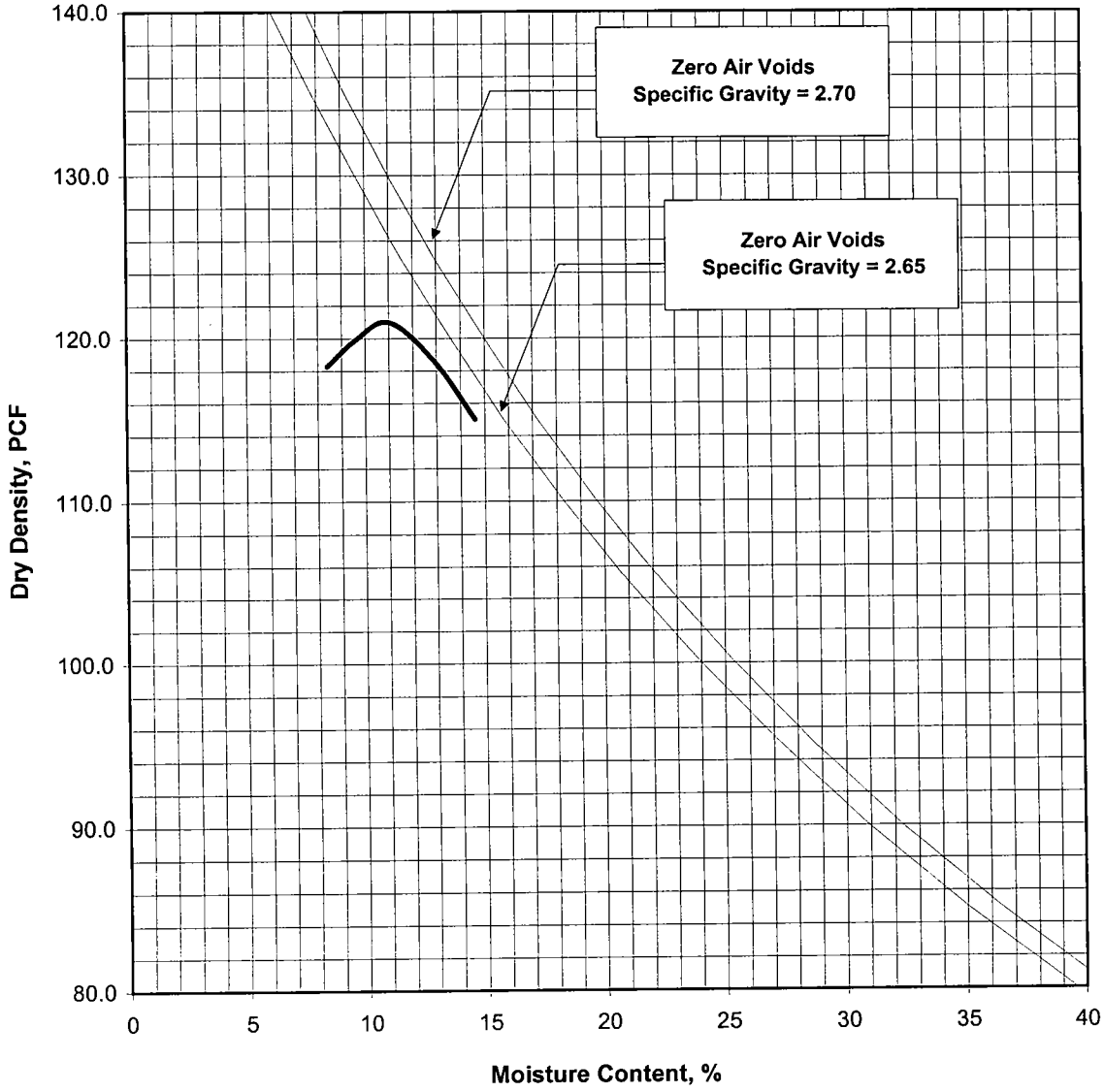
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4829-95

Ninyo & Moore

EXPANSION INDEX TEST RESULTS

BEARDSLEY ROAD CONNECTION
PEORIA AND GLENDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
600635001	2/04	B-4



SAMPLE LOCATION	DEPTH (FT)	SOIL DESCRIPTION	MAXIMUM DENSITY (PCF)	OPTIMUM MOISTURE CONTENT (%)
NM-2	1-2	SM	121.0 / 128.0*	11.0 / 8.5*

*25% ROCK CORRECTION

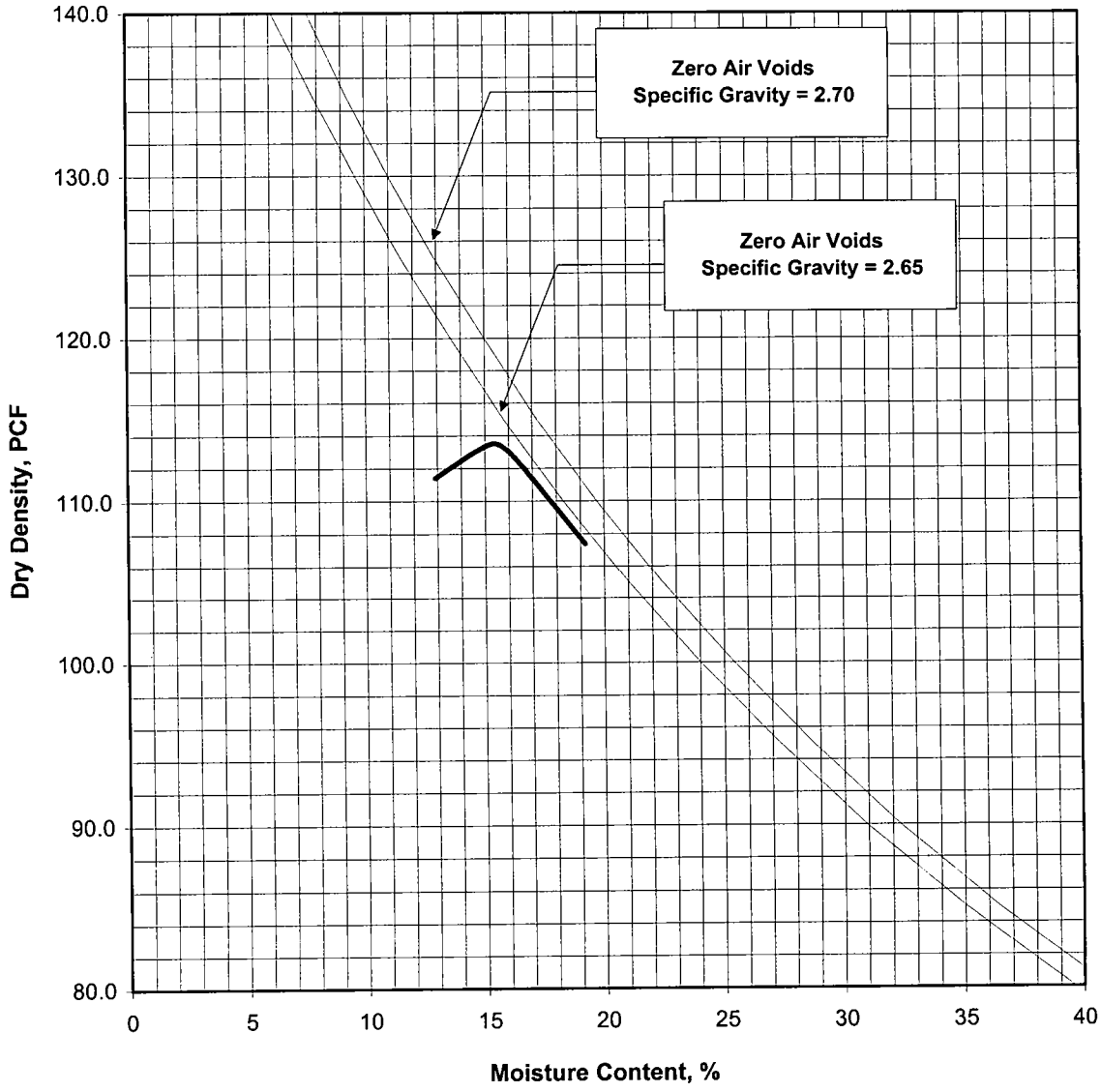
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 698-00a METHOD "A"

Ninyo & Moore

MAXIMUM DENSITY TEST RESULTS

BEARDSLEY ROAD CONNECTION
PEORIA AND GLENDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
600635001	2/04	B-5



SAMPLE LOCATION	DEPTH (FT)	SOIL DESCRIPTION	MAXIMUM DENSITY (PCF)	OPTIMUM MOISTURE CONTENT (%)
NM-7	1-2	GP-GC	113.5 / 131.3*	15.5 / 8.2*

*50% ROCK CORRECTION

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 698-00a METHOD "A"

Ninyo & Moore

MAXIMUM DENSITY TEST RESULTS

BEARDSLEY ROAD CONNECTION
PEORIA AND GLENDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
600635001	2/04	B-6

R-VALUE TEST RESULTS

SAMPLE LOCATION	SAMPLE DEPTH (FT)	SOIL TYPE	R-VALUE
NM-3	1-2	Silty Fine to Coarse Sand	70
NM-10	1-2	Silty Fine Sand	59

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2844-94

Ninyo & Moore

R-VALUE TEST RESULTS

BEARDSLEY ROAD CONNECTION
PEORIA AND GLENDALE, ARIZONA

PROJECT NO.	DATE	FIGURE
600635001	2/04	B-7

RVTABLE1