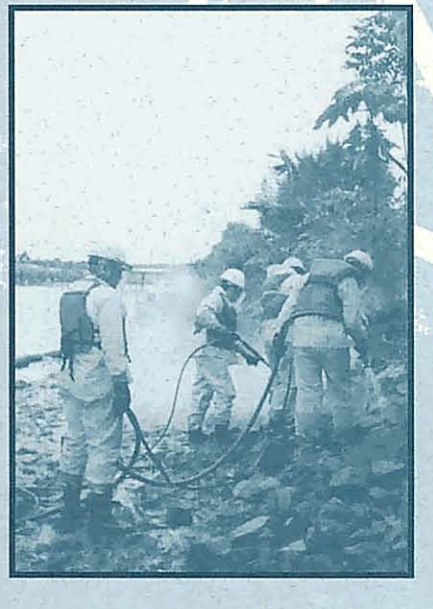
GEOTECHNICAL EVALUATION
HERMOSA VISTA DRIVE/HAWES ROAD
STORM DRAIN AND BASIN
MESA, ARIZONA



Geotechnical

and

Environmental

Sciences

Consultants

Ninyo & Moore

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HERMOSA VISTA DRIVE/HAWES ROAD
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MESA, ARIZONA

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July 31, 2007
Project No. 601527001

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Mr. Jeff Minch, P.E.
Wood Patel & Associates
2051 West Northern Avenue, Suite 100
Phoenix, Arizona 85021

Subject: Geotechnical Evaluation
Hermosa Vista Drive/Hawes Road, Storm Drain and Basin
Mesa, Arizona
Contract No. FCD 2005C009
PCN 420.02.31

Dear Mr. Minch:

In accordance with our Agreement for Services dated July 20, 2006 and June 27, 2007, Ninyo & Moore has performed a geotechnical evaluation for the above-referenced project. The attached report describes our methodology, and presents our findings, conclusions, and recommendations regarding the geologic and geotechnical conditions along the project alignment and in the basin area.

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

Sincerely,
NINYO & MOORE

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Registered Professional Engineer (Geological) CERTIFICATE NO. 10812 GEORGE BRUCE KAY Date Signed 7-31-07 ARIZONA, U.S.A.

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1. INTRODUCTION

In accordance with the Agreement for Services dated July 20, 2006 and June 27, 2007, we have performed a geotechnical evaluation for proposed storm drain improvements along Hermosa Vista Drive, Hawes Road, and McDowell Road in Mesa, Arizona. The project also includes the construction of a detention basin at the northeast corner of the intersection of Hawes Road and Culver Street. The purpose of our evaluation was to observe existing subsurface conditions along the project alignment and to formulate recommendations relative to the design and construction of the planned improvements.

2. SCOPE OF SERVICES

The scope of our services for the project generally included:

- Reviewing readily available geotechnical reports, geologic maps, as-built data, and aerial photographs.
- Performing a site reconnaissance, obtaining relevant permits, notifying Arizona Blue Stake of proposed subsurface work, and coordinating layout of the proposed boring locations with utility companies prior to drilling.
- Drilling, logging, and sampling 20 exploratory test borings along the storm drain alignment and within the basin, each extending to depths of about 20 feet below the existing ground surface (bgs). The boring logs are presented in Appendix A.
- Performing pavement cores at six locations along Hermosa Vista Drive, Hawes Road, and McDowell Road in areas near the proposed storm drain alignment.
- Testing selected soil samples in our laboratory to evaluate in-situ moisture content and dry density, grain-size distribution, Atterberg limits, Expansion Index, standard Proctor moisture-density relationships, corrosion characteristics (including pH, minimum electrical resistivity, soluble sulfates, and chlorides), and R-value. The results of the laboratory testing are presented on the logs in Appendix A and/or in Appendix B.
- Performing agronomic soil testing to assist in the landscaping of the detention basin. The results of the agronomic soil testing are presented in Appendix C.
- Excavating and logging eight test pits along the storm drain alignment. The test pit logs and photographs are included in Appendix D.

- Performing seismic refraction surveys at 10 locations along the planned alignment. The results of the seismic refraction surveys are presented in Appendix E.
- Preparing this report to present our findings, conclusions, and recommendations regarding the design and construction of the planned 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 alignment is located within the southwest quarter of Sections 4, 5, and 6 in Township 1 North, Range 7 East, and Section 33 in Township 2 North, Range 7 East in Mesa, Arizona. The alignment extends along Hermosa Vista Drive, from its western boundary, to Hawes Road; then along Hawes Road from Hermosa Vista Drive to McDowell Road; then along McDowell Road to the east for a distance of approximately 0.5 miles. The general location of the project area is depicted on the Site Location Map (Figure 1). At the time of our evaluation, the site consisted of an asphalt paved roadway bordered by residences and undeveloped desert.

According to the Buckhorn, Arizona-Maricopa Co., 7.5-Minute United States Geological Survey (USGS) Topographic Quadrangle Map, (1982), the ground surface elevations along McDowell Road range from roughly 1,820 feet above mean sea level (MSL) at the eastern end to roughly 1,660 feet MSL at the western end. Based on the information obtained from this map, the topography in the project vicinity slopes from the northeast down to the southwest.

Three aerial photographs were reviewed for this project. A 1937 Flood Control District of Maricopa County (FCDMC) aerial photograph depicted the project site as undeveloped desert land cross cut by many northeast-southwest trending drainages. A 1996 FCDMC aerial photograph depicted Hermosa Vista Drive as a graded roadway with undeveloped desert land and scattered residential buildings adjacent to it. Hawes Road was depicted as an asphalt concrete paved roadway south of Hermosa Vista Drive and a graded roadway north. McDowell Road was depicted as

an asphalt concrete paved roadway. A 2006 FCDMC aerial photograph depicted each of the roadways as asphalt concrete paved, with an increase in residential development surrounding the roadways.

4. PROJECT DESCRIPTION

The proposed improvements associated with this project include the design of a new stormwater collection system. Stormwater from an existing private drainage basin at 90th Street and McDowell will outlet into a new storm drain system. The new system will convey flows west along McDowell Road, south along Hawes Road, and west along Hermosa Vista Drive to the outfall at the Flood Retarding Structure (FRS). High flows will be diverted into a new detention basin at Hawes Road and Culver Street. The offline basin will be designed to accept and discharge flows from and into the new system.

The new detention basin will occupy approximately 410,000 square feet. The base elevation will be approximately 20 to 25 feet lower than the surrounding ground surface elevations. The basin will collect sheet flows from the northeast portion of the site and high flows from the new storm drain system via a splitter box, prior to discharging into the new system via a bleed off pipe. We understand that approximate 10:1 slopes are planned and that fill will be needed along the southwest portion of the site.

We have assumed that the conveyance pipe will be placed below other existing utilities and invert elevations will be up to approximately 20 feet bgs. It is our understanding that reinforced concrete pipe (RCP) will be used for the stormwater lines and will be installed using cut-and-cover techniques. According to the proposed design concept, various pipe diameters are planned along various sections of this storm drain segment ranging from 36 inches at the inlet to 96 inches at the outfall. We understand that Controlled Low Strength Material (CLSM) will be used as backfill from the invert elevation to the spring line of the pipe.

5. FIELD EXPLORATION AND LABORATORY TESTING

Ninyo & Moore conducted an initial subsurface exploration between January 31 and February 23, 2007, which consisted of the drilling, logging, and sampling of 20 small-diameter borings at the approximate locations shown on the Exploration Location Map (Figure 2). The borings were drilled using a CME-75 truck-mounted drill rig equipped with hollow-stem augers. The borings, denoted as B-1 through B-20, were drilled to depths of approximately 20 feet bgs. Bulk and relatively undisturbed soil samples were collected at selected intervals. Detailed descriptions of the soils encountered at each boring location are presented on the boring logs in Appendix A. The pavement section was cored at six locations to measure the thickness of the asphaltic concrete (AC) and the underlying aggregate base (AB). It should be noted that at the time of our observations, paving work was being performed along portions of Hermosa Vista Drive, and an underground utility was being installed along Hawes Road. The approximate locations of the borings are shown on Figure 2.

Ninyo & Moore personnel logged the borings in general accordance with the Unified Soil Classification System (USCS) and American Society for Testing and Materials (ASTM) D 2488) by observing cuttings and drive samples. Collected ring samples were trimmed in the field, wrapped in plastic bags, and placed in cylindrical plastic containers to retain in-place moisture conditions. Similarly, the Standard Penetration Test and bulk samples were sealed in plastic bags to retain their approximate in-place moisture.

The soil samples collected from our field activities were transported to the Ninyo & Moore laboratory in Phoenix, Arizona for geotechnical laboratory analysis. The laboratory testing included evaluation of the in-situ moisture content and dry density, grain-size distribution, Atterberg limits, expansion index, standard proctor moisture-density relationships, corrosion characteristics (including pH, minimum electrical resistivity, soluble sulfates, and chlorides), and R-value. The results of the laboratory tests are presented on the logs in Appendix A and/or in Appendix B. Agronomic soil testing was performed on selected samples of the basin soils by Fruit Growers Laboratory of Santa Paula, CA, and the test results are presented in Appendix C.

Ninyo & Moore conducted additional subsurface exploration on June 27, 2007, which consisted of the excavating and logging of eight test pits at the approximate locations shown on the Exploration Location Map (Figure 2). The test pits were excavated using a rubber-tired Case 580 Super L backhoe with an approximate 2-foot wide bucket. The test pits, denoted as TP-1 through TP-8, were excavated to depths of approximately 1.5 to 10 feet bgs. Detailed descriptions of the soils encountered at each test pit location, along with photographs of the test pits and spoil piles, are presented on the boring logs in Appendix D.

Ninyo & Moore also performed seismic refraction surveys for this project. The surveys were performed on June 26 and 27, 2007, to provide an indirect evaluation of the approximate rippability characteristics of the site soils at 10 locations along the proposed alignment. A SmartSeis S12 seismograph and 12 geophones were utilized to collect generalized and approximate velocities of seismic waves transmitted through subsurface soils. Correlations between the seismic wave velocities and excavatability, and additional discussion on the seismic refraction surveys are provided in Appendix E. The approximate locations of the surveys are also shown on Figure 2.

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 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 age. 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 surrounding 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 surficial geology of the site is comprised of 3 units. These units consist of late Pleistocene (10,000 to 250,000 years) alluvial fan and terrace deposits, a combination of late Pleistocene and Holocene deposits (< 250,000 years), and middle Pleistocene (250,000 to 750,000 years) alluvial fan and terrace deposits. Particle sizes in the late Pleistocene deposits range from sand to cobbles and boulders. These soils have moderate soil development with argillic horizons and calcic horizons (stage I to III). The second unit is a combination of both late Pleistocene and Holocene alluvial deposits. This unit has a variety of young and older soils with grain sizes ranging from silt to boulders. The middle Pleistocene deposits consist of particle sizes ranging from sand to boulders, fining downstream. These deposits have strong soil development characterized by argillic horizons and calcic horizons (stage II to IV) (Pearthree and Huckleberry, 1994). Descriptions of the soils encountered during our evaluation are presented in the following section.

6.2. Subsurface Conditions

Our knowledge of the subsurface conditions at the project site is based on our field exploration, 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 boring logs in Appendix A.

6.2.1. Asphalt Concrete over Aggregate Base

AC over AB material was observed in six of our borings. The AC thickness varied from approximately 3 to 6 inches and the thickness of the AB material varied from approximately 3 to 12 inches at our boring locations.

6.2.2. Fill

Fill soils were encountered beneath the pavement section in some of our borings and extended to depths ranging from approximately 1 to 4 feet bgs. Fill soils were also encountered in some of our test pits and extended to depths ranging from approximately 2 to 4 feet bgs in our explorations. The fill soils generally consisted of silty sand and gravel or clayey sand in our explorations.

6.2.3. Alluvium

Alluvium was encountered at the surface of borings B-5, B-10, B-11, and B-18 through B-20, and below the pavement and/or fill soils in the other borings. Alluvium was encountered at the surface of test pits TP-4, TP-7, and TP-8, and below the fill soils in the other test pits. The alluvium extended to the total depth explored. This material generally consisted of silty or clayey sand with varying amounts of gravel in our borings and test pits. Scattered caliche filaments and weakly to strongly cemented soils were observed within the alluvium in our borings and test pits. Soil density generally increased with depth in the alluvium we observed. Although not observed in our borings or test pits, cobbles and/or possible boulders could exist within this alluvium deposit.

It should be noted that although our borings were able to be advanced to depths of approximately 20 feet bgs, excavation of the test pits encountered backhoe refusal on very dense and/or cemented soils at depths ranging from approximately 1.5 to 5 feet bgs.

6.3. Groundwater

Groundwater was not encountered in our borings. Based on well data from the Arizona Department of Water Resources (2006), the approximate depth to groundwater has been estimated to be as shallow as 200 feet bgs. In general, groundwater does not need to be considered for the design and the construction of the project. However, groundwater levels can fluctuate due to seasonal variations, irrigation, groundwater withdrawal or injection, and other factors.

7. GEOLOGIC HAZARDS

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

7.1. Land Subsidence and Earth Fissures

Groundwater depletion due to groundwater pumping has resulted in land subsidence and earth fissures in numerous alluvial basins in 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, irregular bedrock surfaces, and facies changes within the unconsolidated alluvial material (Schumann and Genualdi, 1986).

Based on our field reconnaissance and review of the referenced material, there is active land subsidence within the project limits, and there are documented earth fissures less than one mile south of Hermosa Vista Drive. While the future occurrence of land subsidence and earth fissures cannot accurately be predicted, continued groundwater withdrawal in the area may result in subsidence and the formation of new fissures or the extension of existing fissures. Continued subsidence may change the storm drain grade and may cause some areas of pipe failure. Due to the depth and extent of the mechanics involved in subsidence and fissure activity, it is generally understood that even quality design and construction may not entirely eliminate future damage if subsidence and fissuring continue.

7.2. 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 project. The closest fault to the site is the Sugarloaf fault, located approximately 18 miles to the northeast of the site (Pearthree, 1998). Up to 5 meters of displacement has occurred along this fault within upper and uppermost Pleistocene deposits, but middle Holocene deposits are not displaced.

Based on a Probabilistic Seismic Hazard Assessment for the Western United States, issued by the USGS (1999), the site is located in a zone where the peak ground accelerations that have a 10 percent, 5 percent, and 2 percent probability of being exceeded in 50 years are 0.05g, 0.07g, and 0.11g, respectively. Due to the relatively low ground motions, seismic hazards (e.g., liquefaction, ground shaking, etc.) are considered to be negligible. Seismic design parameters according to the 2003 International Building Code (IBC) are presented in the following table.

Table 1 – Seismic Design Parameters

Parameter	Value	2003 IBC Reference
Site Class Definition	C	Table 1615.1.1
Site Coefficient F_a	1.2	Table 1615.1.2 (1)
Site Coefficient F_v	1.7	Table 1615.1.2 (2)

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 design and construction of the proposed project, as appropriate. Geotechnical considerations include the following:

- Some of our borings and test pits exposed strata with strong caliche cementation. It should be anticipated that these on-site soils will be difficult to excavate and may call for specialized excavation equipment and techniques (e.g., hoe-ram, rock saw, etc.).

- Although cemented soils were encountered along the proposed alignment, due to interbedded layers of uncemented sandy material, the vibrations that will exist near open trenches (due to the adjacent roadway and construction activity), and the potential consequence of slope instability (road closure, structural damage), an Occupational Safety and Health Administration (OSHA) soil-type "B" should be used for planning excavation side slopes. Due to the diameter of the pipe, and according to OSHA requirements, shoring will probably be needed during construction.

- We estimate an earthwork (shrinkage) factor of 5 to 15 percent for this project.

- Soils generated from on-site excavation activities that exhibit a very low to low expansion potential can generally be used as engineered fill. Many of the on-site soils that we observed will meet this criterion. Cobbles and soil particles larger than 3 inches should not be used as backfill material unless appropriately processed.

- Groundwater was not observed in our borings. The approximate depth to regional groundwater in the area, on average, has been estimated to be as shallow as 200 feet bgs. In general, groundwater is not anticipated to be a design or construction consideration. However, groundwater levels can fluctuate due to seasonal factors.

- No known or documented geologic hazards are present underlying or immediately adjacent to the site. However, there are documented subsidence-related earth fissures less than one mile south of 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.

9. RECOMMENDATIONS

Based on our understanding of the project, the following recommendations are provided for the design and construction of the proposed storm drain and basin. If the proposed construction is changed from that discussed in this report, Ninyo & Moore should be contacted for additional recommendations.

9.1. Storm Drain Considerations

The following sections provide our recommendations relating to the storm drain construction and design. In general, the specifications contained in Maricopa Association of Governments (MAG), *Uniform Standard Specifications and Details for Public Works Construction (2002)* are expected to apply unless noted.

9.1.1. Site Preparation

Construction areas should be cleared of unsuitable materials, including grass, weeds, asphalt pavement, concrete, old construction debris, and any other material that might interfere with the performance or progress of the work.

Within the limits of clearing and below the ground surface, roots, deleterious, or other objectionable material should be removed and disposed of at a legal dumpsite. Obstructions that extend below finish grade, if present, should be removed and resulting voids filled with compacted soil.

If the storm drain is to be installed near or beneath the foundation of an existing structure or utility, the existing structure or utility should be supported to reduce the potential for damage, and, if needed, the drain pipe encased in concrete to accommodate imposed structural loads.

It may be desirable to evaluate structures or features that are very 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 of existing improvements that might result from this work. For other facilities (e.g., structures, homes, etc.), where excavation-induced settlement may be a concern, baseline elevations and horizontal control data should be recorded.

9.1.2. Excavations

It is our opinion that the excavation of the surface on-site materials can generally be accomplished to the assumed earthwork depths (up to about 20 feet deep) with heavy earthmoving equipment and specialized excavation equipment in good operating condition. However, during the excavation operations, there is a potential for encountering very strongly cemented soils, including gravel, cobbles, and boulders that could call for rock breaking equipment or other aggressive excavation techniques. Contractors should make their own evaluations of excavatability and plan means and methods in accordance with their evaluation, as well as project specifications. Approximate velocities from seismic refraction testing are provided in Appendix E.

Depending on the excavation method used, the proposed excavations may generate oversize material (particles larger than 3 inches) that will not be suitable for re-use as trench backfill. Screening, disposal, and/or crushing of this material should be anticipated if re-use is considered.

Excavations in soils with cemented material may tend to have rugged or irregular bottoms or sidewalls. In order to provide more consistent support and grade control to the pipe, we recommend that the proposed storm drains be supported on 4 inches or more of moisture-conditioned and compacted material such as sand, gravel, or AB, with a particle size of 3/4-inch or less. If gravel or AB is used for bedding material, a 4-inch layer of compacted sand should be used as a cushion between the pipe and foundation material. On-site materials with a particle size of 3/4-inch or less may be considered for pipe bedding if appropriately processed, moisture-conditioned, and compacted. Pea gravel or crushed chips are not acceptable for use as bedding material. Pipe bedding guidelines are presented on Figure 3.

It may be difficult to place backfill against these irregular surfaces. When backfilling, care should be taken to fill voids with compacted material so that excessive settlement of the backfill will not occur.

We anticipate that the soil conditions and stability of the excavation sidewalls will vary along the storm drain alignment. Soils with higher fines content and/or significant cementation may stand vertically for a short time with little sloughing. However, as the soil dries after excavation, or as the excavations are exposed to rainfall or other wetting events, sloughing may occur. Soils with low cohesion (e.g., predominately sandy or gravelly material), will probably slough or cave during excavation, especially if wet or saturated. Additionally, vibrations caused by nearby traffic or construction equipment may accelerate sloughing.

The contractor should provide safely sloped excavations or an adequately constructed and braced shoring system, in compliance with OSHA regulations for employees working in excavations that may expose them to the danger of moving ground. Reducing the inclination of the sidewalls of the excavations, where feasible, may increase the stability of the excavations. If construction or earth material is stored or equipment is operated near an excavation, flatter slope geometry or stronger shoring should be used during construction.

The OSHA regulations provide trench sloping and shoring design parameters for trenches up to 20 feet deep based on the soil types encountered. Trenches over 20 feet deep should be designed by the contractor's engineer based on alignment-specific geotechnical analyses. Although cemented layers were observed, for planning purposes and according to OSHA soil classifications, a "Type B" soil should be considered due to the presence of interbedded layers of uncemented soils and the anticipated roadway vibrations. Trench side walls can be sloped at a ratio of 1.0 horizon (H) to 1.0 vertical (V) for "Type B" soil. Upon making the excavations, soil classification and excavation performance should be evaluated in the field by the geotechnical consultant in accordance with the OSHA regulations.

In general, temporary slopes should be inclined no steeper than 1.0 (H):1.0 (V) to a depth of 20 feet below the surface. Due to the diameter of the pipe and MAG specifica-

tions, temporary excavations will probably need shoring. Lateral earth pressures recommended for braced excavations are presented on Figure 4. The earth pressure values in Figure 4 were derived by assuming an internal angle of friction of 34 degrees and an average total unit weight of 110 pounds per cubic foot (pcf) for the depth of the excavation. If construction or earth material is stored or equipment is operated near an excavation, flatter slope geometry or stronger shoring should be used during construction. Temporary excavations that encounter seepage, if any, should be evaluated on a case-by-case basis. Additional considerations regarding dewatering are provided in Section 9.1.3.

9.1.3. Construction Dewatering

Generally, we anticipate that significant groundwater will not be encountered along the proposed storm drain alignment. However, because the project excavations will be associated with existing drainage channels, the trench soils might capture surface water and become saturated and unstable. The contractor should divert surface water away from the trench or be made responsible for the design, timing, construction, operation, maintenance, and removal of a dewatering system(s), if needed. The system should reduce migration and pumping of soil fines with the discharge water. It is anticipated that some dewatering can occur by pumping from the trenches or sumps located outside of, and below the limits of the main excavation.

9.1.4. Trench Widths

The trench width should be the pipe diameter plus 6 inches on each side, but not more than 36 inches. In general, trench widths should be in accordance with MAG Section 601. The trench width should be taken as the clear distance between trench walls or the inside face-to-face distance between the ground support systems.

9.1.5. Controlled Low Strength Material

We understand that CLSM will be used for backfill and extend from the pipe invert to approximately the pipe's spring line. CLSM consists of a fluid, workable mixture of aggregate, Portland cement, and water. The use of CLSM has some advantages:

1. A narrower trench can be used, thereby minimizing the quantity of soil to be excavated and possibly reducing disturbance to the near-by traffic;
2. The support given to the pipe is generally better, and higher values of modulus of soil reaction (E') can be used to design the pipe;
3. Because little compaction is needed to place CLSM, there is less risk of damaging the pipe;
4. If native soils are used to formulate the CLSM, less imported material will be needed; and
5. CLSM can be batched to flow into irregularities in the trench bottom and walls.

The CLSM design mix should be in accordance with the MAG (2004) or Standard Specifications for Public Works Construction (American Public Works Association, 1991) and applicable City of Mesa specifications. The 28-day strength of the material should be no less than 50 pounds per square inch (psi) and no more than 120 psi. If on-site materials are used for the aggregate mixture, test batches may be needed to observe conformity with strength requirements.

Buoyant or uplift forces on the piping should be considered when using CLSM and prudent construction techniques may call for multiple pours to avoid inducing excessive uplift forces. The construction methods should not allow for the storm drain pipe to displace laterally or vertically during placement of CLSM. Sufficient time should be provided to allow the CLSM to cure before placing additional lifts of CLSM or trench backfill.

9.1.6. Trench Backfill

Trench backfill material above the spring line of the storm drain (above the CLSM) should be moisture-conditioned to within 2 percent of its laboratory optimum and mechanically compacted to a relative compaction of 95 percent or more as evaluated by ASTM D 698. The trench backfill in the upper 2-foot zone (2 feet below pavement/flatwork sections) should also be moisture-conditioned to within 2 percent of its laboratory optimum; however, in this zone the material should be mechanically compacted to a relative compaction of 100 percent or more as evaluated by ASTM D 698.

Lift thickness for backfill will be dependent upon the type of compaction equipment utilized, but should generally be placed in lifts not exceeding 8 inches in loose thickness. Special care should be exercised to avoid damaging the pipe or other structures during the compaction of the backfill. Backfilling should generally be accomplished in a manner consistent with the standards provided by MAG (2002) and applicable City of Mesa specifications and/or amendments.

Soils generated from on-site excavation activities (excluding cobbles and large diameter particles) or imported soils that exhibit very low to low expansion potential are generally suitable for use as engineered fill. Very low to low expansion potential soils are defined as having an Expansion Index (by UBC Standard No. 18-2) of 50 or less and a Plasticity Index (PI) less than 20. Laboratory tests performed on soil samples obtained from our exploratory borings indicated PIs ranging from 0 to 20. Therefore, many of the soils encountered along the trench alignments should be suitable for re-use as trench backfill, provided oversize material is removed or processed. Additionally, suitable fill should not include deleterious or organic material, clay lumps, construction debris, rock particles, and other non-soil fill materials larger than 3 inches in diameter. Screening, processing, and/or blending of the onsite soils may be needed prior to re-use. The content of rock in the backfill more than 1-1/2 inches in diameter should not exceed 40 percent by weight.

We recommend that additional observation, soil sampling, and possible laboratory testing be conducted during construction to evaluate the presence of any unsuitable soils not encountered in our borings and test pits. Based on our observations and laboratory testing, we estimate an earthwork (shrinkage) factor of 5 to 15 percent for the on-site soils.

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 more 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 such materials and details of their placement prior to importation.

9.1.7. Soil Parameters for Pipeline Design

Based on our field observations, our experience with similar materials, and our laboratory testing, a unit weight of 125 pcf can be estimated for engineered fill derived from on-site excavations. If import fill is used for trench backfill, a unit weight of 130 pcf may be estimated for use in design.

The modulus of soil reaction (E') is used to characterize the stiffness of the backfill placed on the sides of a buried pipe for the purpose of evaluating deflection caused by the weight of the backfill over the pipe. As mentioned previously, CLSM will be used and it is our understanding that the depth of cover will range from about 5 feet to 12 feet. We therefore recommend a general E' value of 1,800 psi.

The coefficient of friction between the soil and the pipe depends upon the type of each material in the interaction. We understand that RCP will be utilized as the storm drain pipe. For planning purposes, we suggest a coefficient of friction, μ, of 0.30. The manufacturer of the pipe should be consulted for this parameter once the pipe material has been chosen.

9.1.8. Below Grade Structures

Footings for below grade structures may be designed using an allowable gross bearing pressure of up to 3,000 pounds per square foot (psf) when bearing on dense native soils or compacted engineered fill. Total and differential settlement of up to about 1/2- inch and 1/4- inch, respectively, may occur. A vertical modulus of subgrade reaction, k, of 150 pounds per cubic inch (pci) may be used for the design of concrete slabs founded on dense native soils or compacted engineered fill, as specified herein.

Below grade structures and/or 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 pcf. This value assumes a drained granular backfill is placed behind the wall and that compaction within about 5 feet of the wall will be accomplished with relatively light compaction equipment.

Drainage should consist of free-draining granular material and should be accompanied by weep holes through the walls or corrugated, perforated pipe placed parallel to the wall or abutment bottom, wrapped in a filter fabric, and surrounded by 6 inches of a granular filter material. If drainage is not provided, an equivalent fluid earth pressure of 100 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 permit the active earth pressure condition to be reached. 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. Walls should also be designed to resist a surcharge pressure of 0.30q, where "q" represents the surcharge pressure.

Structural walls that are restrained from movement at the top and have a level backfill behind the wall may be designed using an "at-rest" equivalent fluid unit weight of 55 pcf and 120 pcf for drained or undrained conditions, respectively.

For below-grade portions of walls with granular backfill, an equivalent fluid passive earth pressure of 300 psf/ft of wall height can be utilized (triangular pressure distribu-

tion) to for lateral resistance. However, since significant movement of the structural wall will be needed to mobilize full passive earth pressure, passive pressures should be neglected unless analysis indicates that the structure can tolerate this movement, and there is certainty that the soil providing the passive restraint will be present. Passive resistance should be neglected in soils located within the upper 3 feet of the finished subgrade.

Foundations bearing on dense native soils or compacted engineered fill that are subject to lateral loadings may be designed using an ultimate coefficient of friction of 0.40 (total frictional resistance equals the coefficient of friction multiplied by the dead load). The ultimate lateral resistance can be taken as the sum of the frictional resistance and passive resistance, provided that the passive resistance does not exceed one-half 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.

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. Precautions should be considered to avoid overstressing walls during backfilling. Temporary bracing of the walls during backfilling may be needed to help avoid this problem.

9.2. Pavement Structural Section

The following sections present our assumptions and recommendations for the flexible pavement sections along the affected reaches of Hermosa Vista Drive, Hawes Road, and McDowell Road to be restored following the storm drain installation. It should be noted that portions of the storm drain alignment will be within Maricopa County or the City of Mesa right of way. For our analysis, we used the Maricopa County Department of Transportation (MCDOT) design guidelines for pavement design and compared them to the City of Mesa standards and recommended the more conservative design. We assumed that the subgrade would be prepared according to the trench zone backfill described in Section 9.1.6.

9.2.1. Existing Pavement Section

During our field exploration activities, Ninyo & Moore advanced six pavement cores to evaluate the thickness of the roadway section. Pavement sections observed in our borings are summarized in Table 2 below. It should be noted that at the time of our observations, paving work was being performed along portions of Hermosa Vista Drive.

Table 2 – Observed Pavement Structural Sections

Roadway	Boring	Asphalt Concrete Thickness (inch)	Aggregate Base Thickness (inch)
Hermosa Vista Drive	B-1	3	3
Hermosa Vista Drive	B-7	4	12
Hermosa Vista Drive	B-8	4.5	6
Hawes Road	B-9	3	4
Hawes Road	B-17*	5	6
McDowell Road	B-14	4	8
McDowell Road	B-16	6	6

*Pavement thickness measured from exposed pavement section adjacent to boring.

9.2.2. Pavement Design

In accordance with the MCDOT Roadway Design Manual, the following design parameters were used in evaluating the recommended pavement thicknesses for this project.

9.2.2.1. Traffic Analysis

The traffic loading information used to conduct the pavement design for the various roadways was estimated based on traffic volumes obtained from published MAG sources in the vicinity of the proposed project. For our analysis, we assumed a growth factor of 5 percent, 5 percent heavy trucks, and Average Daily Traffic (ADTs) of 500, 4,000, and 8,000 for Hermosa Vista Drive, Hawes Road, and McDowell Road, respectively. Using this information, we calculated an Equivalent

Single Axle Load (ESAL) for each roadway for a design life of 20 years. The results are summarized in the table below.

Roadway	ADT	ESAL	Classification*
Hermosa Vista Drive	500	185,000	Local
Hawes Road	4,000	1,500,000	Major Collector
McDowell Road	8,000	2,700,000	Minor Arterial
*Classifications in accordance with MCDOT Roadway Design Manual and City of Mesa standards.			

9.2.2.2. Resilient Modulus

The soils encountered in the borings and test pits typically consisted of sand, silty sand, and clayey sand. A design R-value of 30 or more is recommended for this project based on the methods for calculating the mean R-value outlined in the MCDOT design manual. Using the mean R-value noted above, a resilient modulus of 17,875 psi was calculated.

9.2.2.3. Standard Deviation, Level of Reliability, and Serviceability Index

Considering the roadway classifications noted above, a standard deviation of 0.45 was used for design of flexible pavements. Levels of reliability, standard normal deviations (Z_R), and serviceability loss indexes for the various classifications shown below were utilized for design of roadway pavements.

Classification	Reliability	ZR Value	Serviceability Loss Index
Local	80	-0.841	2.0
Major Collector	90	-1.282	2.1
Minor Arterial	95	-1.645	2.2

9.2.2.4. Pavement Design Requirements

In accordance with the MCDOT procedure for pavement design, and using the above parameters, we calculated a structural numbers (SN) for design of the proposed pavement sections to be 1.72, 2.61, and 3.05 for Hermosa Vista Drive, Hawes Road, and McDowell Road, respectively.

9.2.2.5. Recommended Flexible Pavement Section

Based on the results of our laboratory testing and in general accordance with MCDOT procedures, our recommended pavement section for the various roads are noted in the table below. The section obtained using the MCDOT procedure was compared to the pavement section tabulated in the City of Mesa Standards and the more conservative section is recommended in the table below. For the three roadways evaluated, the section tabulated in the City of Mesa Standards was the more conservative section.

Table 3 – Recommended Asphalt Pavement Sections

Location	Layer	Thickness (Inches)
Hermosa Vista Drive	AC Surface Course (R-12.5)	1.5
	AC Base Course (R-25)	2
	Aggregate Base Course	4
Hawes Road	AC Surface Course (A-19)	2.5
	AC Base Course (A-19)	3
	Aggregate Base Course	10
McDowell Road	AC Surface Course (A-19)	2.5
	AC Base Course (A-19)	3
	Aggregate Base Course	10

A layered design analysis was performed for each alternative pavement section to demonstrate the adequacy of the thickness of the AB and AC layers. The recommended pavement thickness assumes that the above pavement section is founded on compacted soil as outlined in Section 9.1.6. AB material should be compacted to a relative compaction of 100 percent of the maximum dry density, as evaluated by ASTM D 698, at a moisture content within approximately 2 percent of optimum.

We recommend that AC used for this project be in accordance with Section 710 of the MAG specifications and designated as "arterial." For our analysis of structure number values associated with the project, we estimated a structural coefficient of 0.42 for plant-mix AC pavements and 0.12 for AB material. The AB mentioned above should meet Section 702 of the MAG specifications and/or any Maricopa County requirements. Furthermore, we suggest a fog coat also be applied to the new roadway surface.

9.3. Concrete Flatwork

To reduce the potential manifestation of distress to exterior concrete flatwork (such as curbs and sidewalks) due to movement of the underlying soil, we recommend that such flatwork (if utilized for this project) be installed with crack-control joints at appropriate spacing as designed by the structural engineer. Additionally, we recommend that concrete flatwork be supported on 9 or more inches of adequately moisture-conditioned and compacted fill (in accordance with Section 9.1.6 of this report). Positive drainage should be established and maintained adjacent to flatwork.

9.4. Corrosion

The corrosion potential of the on-site materials was analyzed to evaluate its potential effect on the storm drain pipe and structures. Corrosion potential was evaluated using the results of laboratory testing of a near-surface soil 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 summarized in the table below and presented in Appendix B.

Table 4 – Corrosivity Test Results

Boring	Sample Depth (ft.)	pH	Resistivity (ohm-cm)	Water-Soluble Sulfates, %	Chloride Content (ppm)
B-3	0-5	8.0	1,368	0.005	95
B-7	0-5	7.8	684	0.0065	668
B-10	0-5	7.9	3,146	0.001	21
B-12	0-5	7.7	4,514	0.01	41
B-15	0-5	7.9	2,120	0.0024	37

The pH results ranged from 7.7 to 8.0, which is considered to be alkaline. The minimum electrical resistivity measured for the near-surface samples ranged from 684 ohm-cm to 4,514 ohm-cm, which represents a corrosive to moderately corrosive environment to ferrous metals. The chloride content of the samples tested ranged from 21 to 668, which also may be corrosive to ferrous metals. The soluble sulfate content of the soil samples tested ranged from 0.001 percent to 0.01 percent, which is considered to represent negligible sulfate exposure for concrete.

The results of the laboratory testing indicate that the on-site materials are probably corrosive to ferrous metals. Therefore, special consideration should be given to the use of heavy gauge, corrosion protected steel for use if there is potential for contact (or close proximity) to soil.

9.5. Concrete

Laboratory chemical tests performed on selected samples of on-site soils indicated sulfate contents between 0.010 and 0.001 percent by weight. Based on the following IBC table, the on-site soils should be considered to have a negligible sulfate exposure to concrete.

Table 5 – IBC 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	4,000
Severe	0.20 - 2.00	V	0.45	4,500
Very severe	Over 2.00	V plus pozzolan[3]	0.45	4,500

[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 (Table 19-A-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 due to the limited number of chemical tests performed, as well as our experience with similar soil conditions and local practice, we recommend the use of "Type II" cement for construction of concrete structures at this site. Due to potential uncertainties as to the use of reclaimed irrigation water, or topsoil that may contain higher sulfate contents, 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. The structural engineer should select the concrete design strength based on the project specific loading conditions.

9.6. Site Drainage

Surface drainage should be provided to divert water off of paved surfaces. Surface water should also not be permitted to pond on or below 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.

9.7. 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.

9.8. 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 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 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

American Society for Testing and Materials (ASTM), 1997 Annual Book of ASTM Standards.

Euge, K.M., et al. I.P., 1992, Development of Seismic Acceleration Contour Maps for Arizona: Arizona Department of Transportation Report No. AZ 92-344, dated September.

International Conference of Building Officials, 2003, International Building Code: Whittier California.

Maricopa Association of Governments, 1998 9 (revised 2007), Uniform Standard Specifications and Details for Public Works Construction.

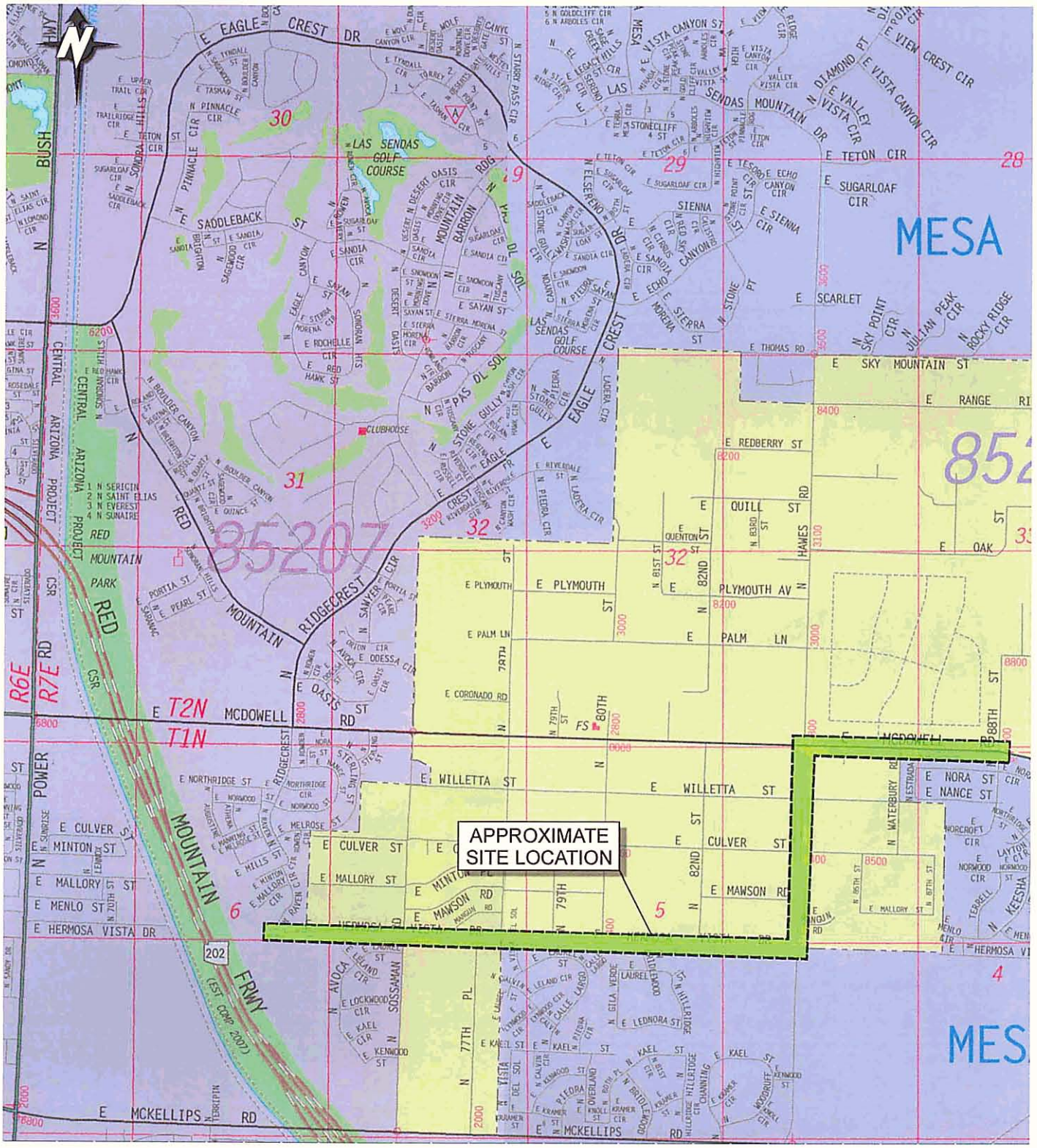
Ninyo & Moore, In-house proprietary information.

Pearthree, P.A., 1998, Quaternary Fault Data and Map for Arizona: Arizona Geological Survey, Open-File Report 98-24, 122 p.

Schumann, H.H. and Genualdi, R., 1986, Land Subsidence, Earth Fissures, and Water level Changes in Southern Arizona: Arizona Geological Survey OFR 86-14, Scale 1:500,000.

United States Department of Agriculture, 1974, Eastern-Maricopa County and Northern Pinal Counties Area, Arizona.

United States Geological Survey, 1999, National Seismic Hazard Mapping Project, World Wide Web, http://geohazards.cr.usgs.gov/eq.

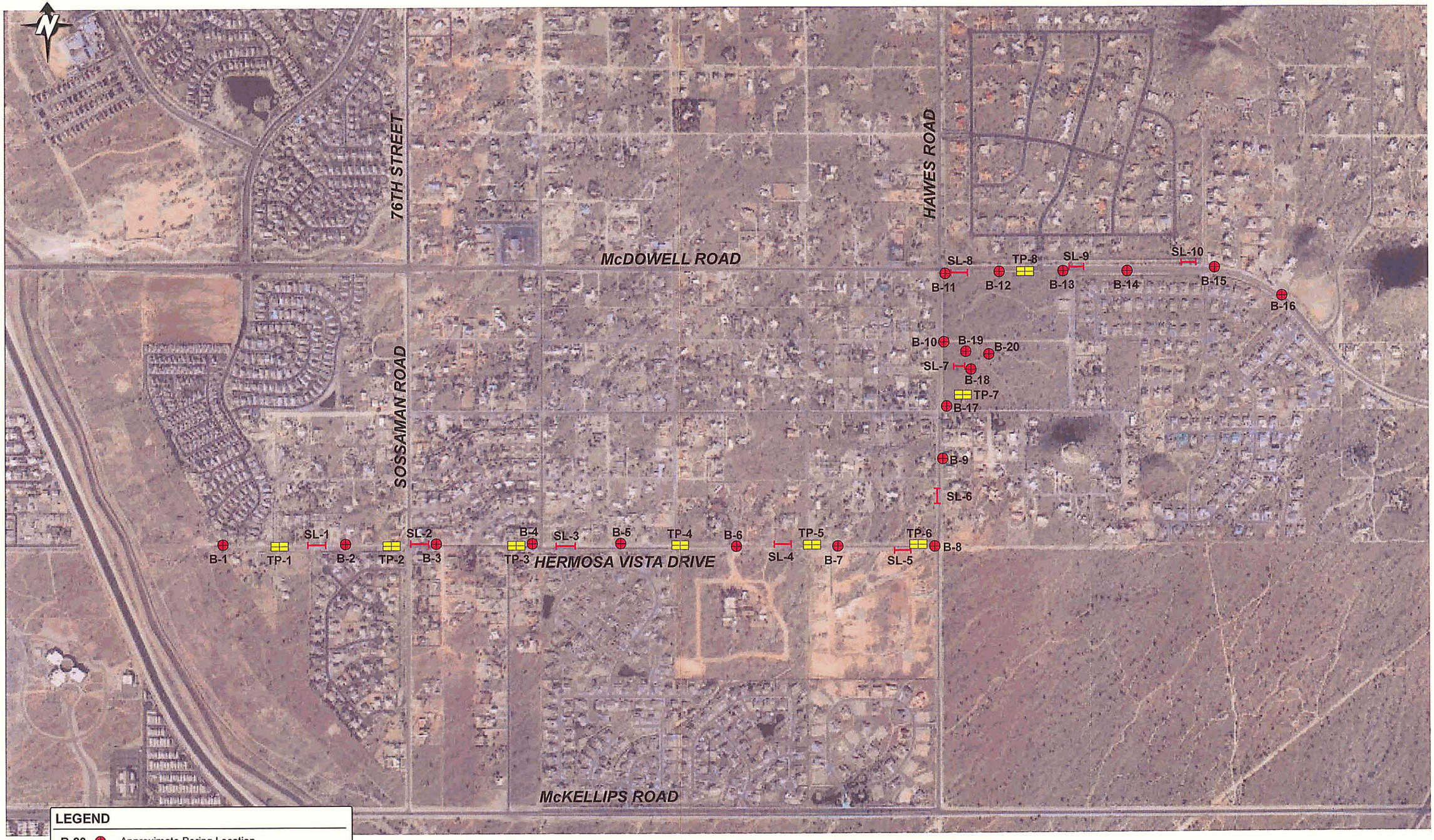


0 1900

Approximate Scale:
1 inch = 1900 feet
Source: The Thomas Guide, Phoenix Metro Edition, 2006.

Ninyo & Moore	SITE LOCATION MAP	FIGURE 1
PROJECT NO: 601527001	DATE: 07/07	HERMOSA VISTA DRIVE/HAWES ROAD STORM DRAIN AND BASIN MESA, ARIZONA

file no: 1527vmap0307



LEGEND

B-20 ⊕	Approximate Boring Location
TP-8 ▭	Approximate Test Pit Location
SL-10 ⊢⊣	Approximate Seismic Refraction Survey Location

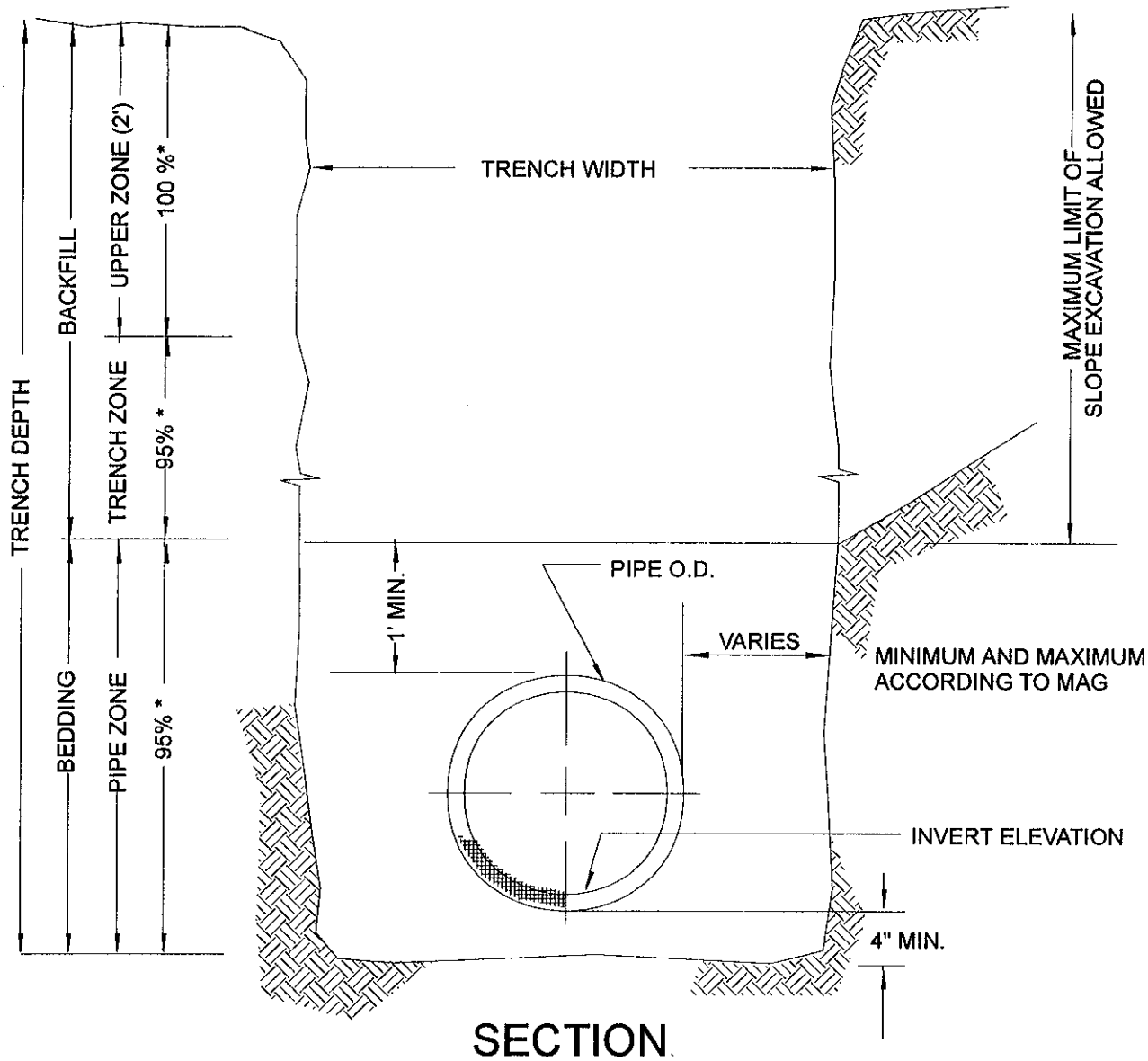
0 1050

Approximate Scale:
1 inch = 1050 feet

Source: MARICOPA COUNTY ASSESSORS GIS SITE.

1527blm0307

Ninyo & Moore	EXPLORATION LOCATION MAP	FIGURE
PROJECT NO: 601527001 / DATE: 07/07	HERMOSA VISTA DRIVE/HAWES ROAD STORM DRAIN AND BASIN MESA, ARIZONA	2



SECTION

NOTE

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

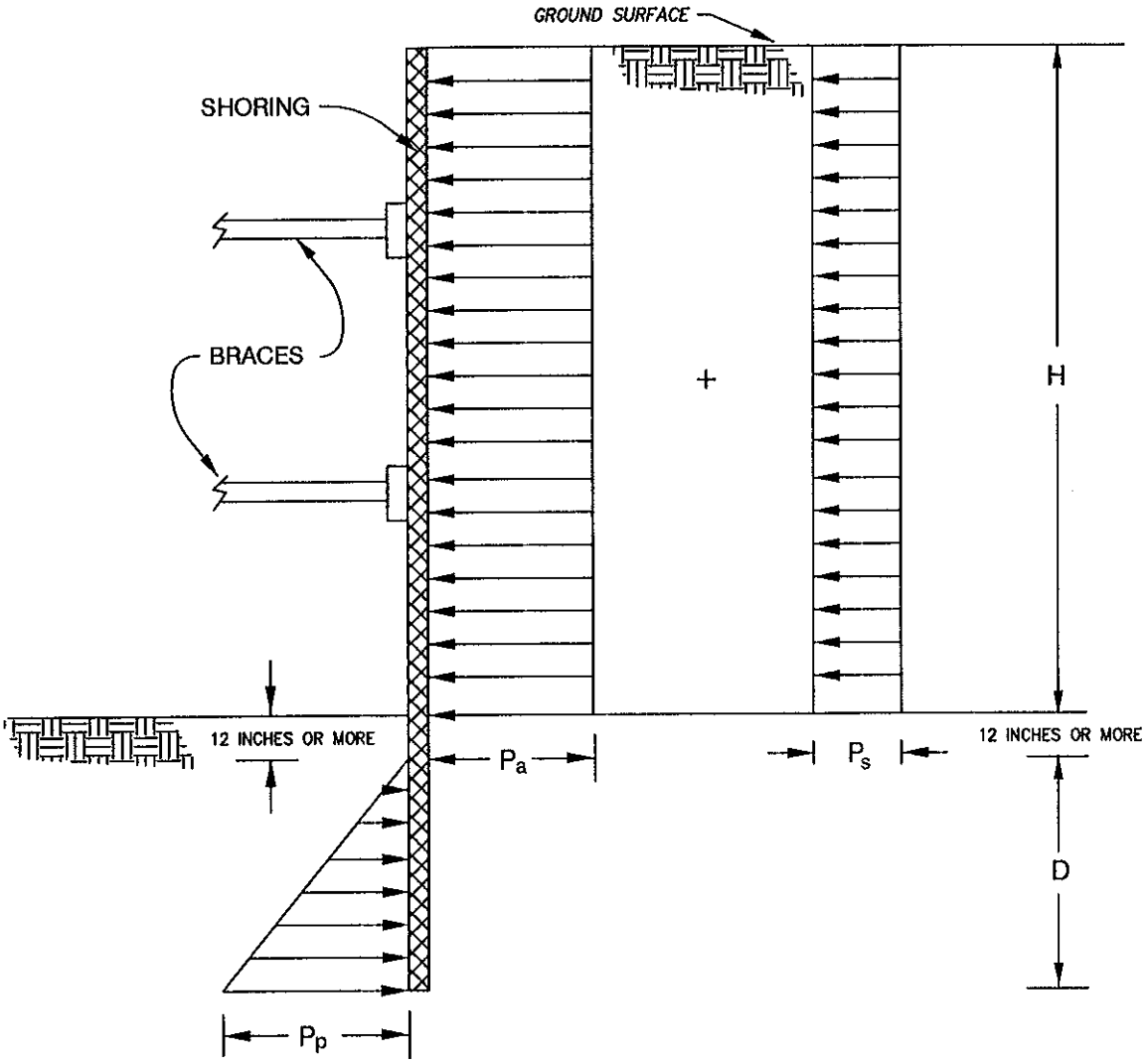
Upper zone required for pavement areas only.

CLSM may be used as beddings or trench backfill.

Diagram not drawn to scale.

Ninyo & Moore		PIPE BEDDING GUIDELINES	FIGURE 3
PROJECT NO: 601527001	DATE: 07/07	HERMOSA VISTA DRIVE/HAWES ROAD STORM DRAIN AND BASIN MESA, ARIZONA	

file no: 1527pbd0307



NOTES:

1. APPARENT LATERAL EARTH PRESSURE, P_a
   P_a = 20H psf
2. CONSTRUCTION TRAFFIC INDUCED SURCHARGE PRESSURE, P_s
   P_s = 120 psf
3. PASSIVE LATERAL EARTH PRESSURE, P_p
   P_p = 250D psf
4. ASSUMES GROUNDWATER IS NOT PRESENT
5. SURCHARGES FROM EXCAVATED SOIL OR CONSTRUCTION MATERIALS ARE NOT INCLUDED
6. H AND D ARE IN FEET

NOT TO SCALE

1527DTLA0307

Ninyo & Moore	LATERAL EARTH PRESSURES FOR BRACED EXCAVATIONS	FIGURE
PROJECT NO. 601527001 / DATE 07/07	HERMOSA VISTA DRIVE/HAWES ROAD STORM DRAIN AND BASIN MESA, ARIZONA	4

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 1586-84. 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 a 140-pound hammer free-falling from a height of 30 inches in general accordance with ASTM D 1586-84. The samples were removed from the sample barrel in the brass rings, sealed, and transported to the laboratory for testing.

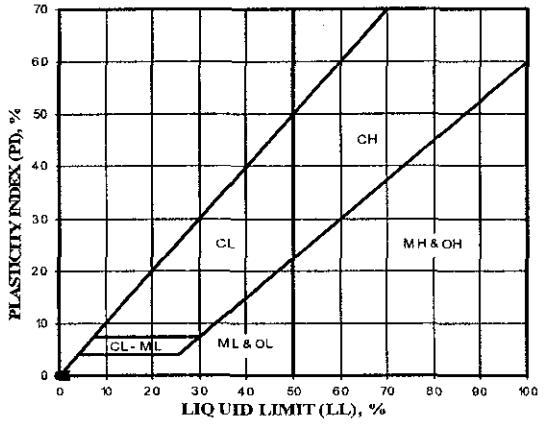
U.S.C.S. METHOD OF SOIL CLASSIFICATION

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	3" to No. 4	76.2 to 4.76
Coarse	3" to 3/4"	76.2 to 19.1
Fine	3/4" to No. 4	19.1 to 4.76
SAND	No. 4 to No. 200	4.76 to 0.075
Coarse	No. 4 to No. 10	4.76 to 2.00
Medium	No. 10 to No. 40	2.00 to 0.420
Fine	No. 40 to No. 200	0.420 to 0.075
SILT & CLAY	Below No. 200	Below 0.075

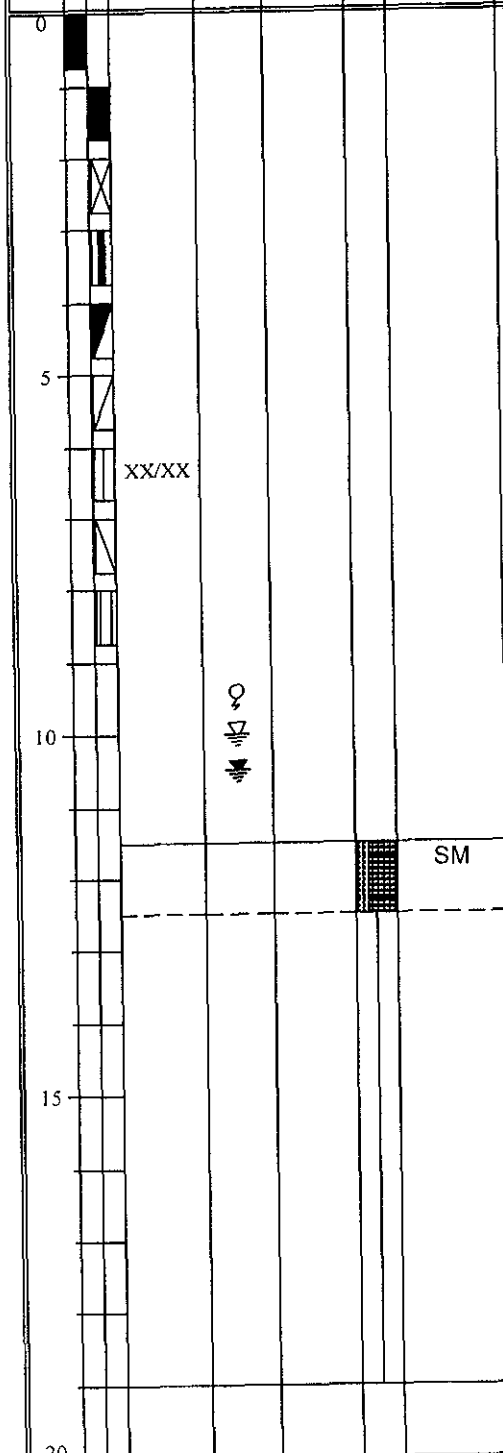
PLASTICITY CHART



Ninyo & Moore

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

BORING LOG EXPLANATION SHEET



Bulk sample.

Modified split-barrel drive sampler.

No recovery with modified split-barrel drive sampler.

Sample retained by others.

Standard Penetration Test (SPT).

No recovery with a SPT.

Shelby tube sample. Distance pushed in inches/length of sample recovered in inches.

No recovery with Shelby tube sampler.

Continuous Push Sample.

Seepage.

Groundwater encountered during drilling.

Groundwater measured after drilling.

ALLUVIUM:
Solid line denotes unit change.

Dashed line denotes material change.

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

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 02/23/07 BORING NO. B-1

GROUND ELEVATION 1,590' ± (MSL) SHEET 1 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) 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							ASPHALT CONCRETE: Approximately 3 inches thick.
						GP-GM	AGGREGATE BASE: Approximately 3 inches thick.
						SM	Brown, damp, medium dense, poorly graded GRAVEL with silt and sand.
							ALLUVIUM:
		26	3.2	110.0			Brown, damp, medium dense, silty fine to coarse SAND with fine gravel.
		9					
5							
		13	1.6	106.8			Loose.
		50/5"					Very dense.
10							
		50/4"					Fine sand; few fine gravel; numerous caliche nodules.
15							
		50/5"					Fine to medium sand.
							Total Depth = 18.9 feet.
							Groundwater not encountered during drilling.
20							Grouted and capped with concrete on 02/23/07 promptly after completion of drilling.

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BORING LOG

HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-1

DATE DRILLED 02/23/07 BORING NO. B-1

GROUND ELEVATION 1,590' ± (MSL) SHEET 2 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) 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
20								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.
25								
30								
35								
40								

Ninyo & Moore

BORING LOG

HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-2

DATE DRILLED 02/01/07 BORING NO. B-2

GROUND ELEVATION 1,608' ± (MSL) SHEET 1 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY WTD LOGGED BY WTD REVIEWED BY KJT

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						GP-GM	AGGREGATE BASE: Approximately 3 inches thick.
						GC	Brown, damp, medium dense, poorly graded GRAVEL with silt and sand.
							ALLUVIUM:
		80/1"					Brown, damp, very dense, clayey fine to coarse GRAVEL.
		76					Light brown; scattered caliche filaments and nodules; weakly to moderately cemented.
5							
		50/4"					
		50/3"					Moderately to strongly cemented.
10							
		50/1"					
15							
						SM	Brown, damp, very dense, silty SAND; few fine gravel.
		69/10"					
20							

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BORING LOG

HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-3

DATE DRILLED 02/01/07 BORING NO. B-2

GROUND ELEVATION 1,608' ± (MSL) SHEET 2 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY WTD LOGGED BY WTD REVIEWED BY KJT

DEPTH (feet)	SAMPLES: Bulk	SAMPLES: Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20								Total Depth = 19.8 feet.
								Groundwater not encountered during drilling.
								Backfilled on 02/01/07 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.
25								
30								
35								
40								

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BORING LOG

HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-4

DATE DRILLED 02/01/07 BORING NO. B-3

GROUND ELEVATION 1,622' ± (MSL) SHEET 1 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY WTD LOGGED BY WTD REVIEWED BY KJT

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						GP-GM	AGGREGATE BASE: Approximately 3 inches thick.
						SC	Brown, damp, medium dense, poorly graded GRAVEL with silt and sand.
							ALLUVIUM:
							Brown, damp, dense, clayey SAND; few gravel; scattered caliche filaments.
		22					
		59					Moderately cemented.
5							
		32					
		50/6"	5.6	102.7			Very dense; strongly cemented.
10							
		50/4"					
15							
		50/4"					Little to some fine gravel.
							Total Depth = 18.8 feet.
							Groundwater not encountered during drilling.
							Backfilled on 02/01/07 promptly after completion of drilling.
20							

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BORING LOG

HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-5

DATE DRILLED 02/01/07 BORING NO. B-3

GROUND ELEVATION 1,622' ± (MSL) SHEET 2 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY WTD LOGGED BY WTD REVIEWED BY KJT

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20								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.
25								
30								
35								
40								

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BORING LOG

HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-6

DATE DRILLED 02/02/07 BORING NO. B-4

GROUND ELEVATION 1,638' ± (MSL) SHEET 1 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY WTD LOGGED BY WTD REVIEWED BY KJT

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						GP-GM	AGGREGATE BASE: Approximately 6 inches thick. Brown, damp, medium dense, poorly graded GRAVEL with silt and sand.
						SC	ALLUVIUM: Light brown, damp, very dense, clayey SAND with gravel; scattered caliche filaments and nodules; moderately cemented.
		50/6"					
		50/4"					
5							
		50/4"					Increase in gravel content.
		50/5"					
10							
		50/3"					
15							
		50/4"					Total Depth = 18.8 feet. Groundwater not encountered during drilling. Grouted on 02/02/07 promptly after completion of drilling.
20							

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BORING LOG

HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-7

DATE DRILLED 02/02/07 BORING NO. B-4

GROUND ELEVATION 1,638' ± (MSL) SHEET 2 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY WTD LOGGED BY WTD REVIEWED BY KJT

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20								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.
25								
30								
35								
40								

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BORING LOG

HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-8

DATE DRILLED 02/02/07 BORING NO. B-5

GROUND ELEVATION 1,652' ± (MSL) SHEET 1 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY WTD LOGGED BY WTD REVIEWED BY KJT

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						SC	ALLUVIUM: Light brown, damp, dense, clayey SAND with gravel; scattered caliche filaments and nodules; weakly to moderately cemented.
		69	3.8	115.6			
		90/9"					Very dense; strongly cemented.
5						GC	Light brown, damp, very dense, clayey fine GRAVEL with sand; scattered caliche filaments and nodules; moderately cemented.
		50/3"					
		50/5"					
10						SM	Light brown, damp, very dense, silty SAND with fine gravel; scattered caliche filaments and nodules; weakly to moderately cemented.
		50/3"					
15							
		50/6"					Strongly cemented.
							Total Depth = 19 feet. Groundwater not encountered during drilling.
20							

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BORING LOG

HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-9

DATE DRILLED 02/02/07 BORING NO. B-5

GROUND ELEVATION 1,652' ± (MSL) SHEET 2 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY WTD LOGGED BY WTD REVIEWED BY KJT

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20							Backfilled on 02/02/07 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.
25							
30							
35							
40							

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BORING LOG

HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-10

DATE DRILLED 02/23/07 BORING NO. B-6

GROUND ELEVATION 1,672' ± (MSL) SHEET 1 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) 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						SM	ASPHALT CONCRETE: Approximately 1 inch thick.
		50/1"					ALLUVIUM: Light brown, damp, very dense, silty SAND with fine gravel; numerous caliche nodules; moderately cemented.
		50/5"					
5		50/4"					
		50/2"					Strongly cemented.
10							
		61					*Trace to few fine to coarse gravel.*
15							
		50/5"					
20							Total Depth = 18.9 feet. Groundwater not encountered during drilling. Grouted and capped with concrete on 02/23/07 promptly after completion of drilling.

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HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-11

DATE DRILLED 02/23/07 BORING NO. B-6

GROUND ELEVATION 1,672' ± (MSL) SHEET 2 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) 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
20								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.
25								
30								
35								
40								

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HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-12

DATE DRILLED 02/02/07 BORING NO. B-7

GROUND ELEVATION 1,690' ± (MSL) SHEET 1 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY WTD LOGGED BY WTD REVIEWED BY KJT

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							ASPHALT CONCRETE: Approximately 4 inches thick.
						GP-GM	AGGREGATE BASE: Approximately 12 inches thick. Brown, damp, medium dense, poorly graded GRAVEL with silt and sand.
		50/3"				SC-SM	ALLUVIUM: Light brown, damp, very dense, silty, clayey SAND with fine gravel; scattered caliche filaments and nodules; moderately cemented.
		50/3"					Strongly cemented.
5		50/5"					
		50/3"	4.5	107.3		GM	Brown, damp, very dense, silty fine to coarse GRAVEL with sand; numerous caliche filaments and nodules; strongly cemented.
10							
		50/6"				SC	Light brown, damp, very dense, clayey SAND; few fine gravel; scattered caliche filaments and nodules; moderately cemented.
15							
		50/4"					
20							*Total Depth = 18.8 feet.* Groundwater not encountered during drilling. Backfilled and asphalt patched on 02/02/07 promptly after completion of drilling.

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BORING LOG

HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-13

DATE DRILLED 02/02/07 BORING NO. B-7

GROUND ELEVATION 1,690' ± (MSL) SHEET 2 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY WTD LOGGED BY WTD REVIEWED BY KJT

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20								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.
25								
30								
35								
40								

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BORING LOG

HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-14

DATE DRILLED 02/02/07 BORING NO. B-8

GROUND ELEVATION 1,708' ± (MSL) SHEET 1 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY WTD LOGGED BY WTD REVIEWED BY KJT

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							ASPHALT CONCRETE: Approximately 4.5 inches thick.
						GP-GM	AGGREGATE BASE: Approximately 6 inches thick.
						SC	Brown, damp, medium dense, poorly graded GRAVEL with silt and sand.
		30					FILL: Dark brown, damp, medium dense, clayey SAND; scattered asphalt concrete fragments.
		26				SC	ALLUVIUM: Light brown, damp, dense, clayey SAND with fine gravel; scattered caliche filaments; weakly cemented.
5		50/4"					Very dense; strongly cemented.
		50/4"				GC	Light brown, damp, very dense, clayey fine GRAVEL with sand; numerous caliche filaments and nodules; strongly cemented.
10							
		50/4"					
15							
		86				SM	Light brown, damp, very dense, silty SAND with fine gravel; scattered caliche filaments and nodules; moderately cemented.
20							

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BORING LOG

HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-15

DATE DRILLED 02/02/07 BORING NO. B-8

GROUND ELEVATION 1,708' ± (MSL) SHEET 2 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY WTD LOGGED BY WTD REVIEWED BY KJT

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20							Total Depth = 20 feet. Groundwater not encountered during drilling. Grouted and asphalt patched on 02/02/07 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.
25							
30							
35							
40							

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BORING LOG

HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-16

DATE DRILLED 01/31/07 BORING NO. B-9

GROUND ELEVATION 1,728' ± (MSL) SHEET 1 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY WTD LOGGED BY WTD REVIEWED BY KJT

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							ASPHALT CONCRETE: Approximately 3 inches thick.
						GP-GM	AGGREGATE BASE: Approximately 4 inches thick.
						SM	Brown, damp, medium dense, poorly graded GRAVEL with silt and sand.
		25					ALLUVIUM: Brown, damp, medium dense, silty SAND; trace fine gravel.
						SW-SM	Light brown, damp, very dense, well graded SAND with silt and gravel.
		71					
5							
		50/4"					
		45					
10							
						SM	Brown, damp, very dense, silty coarse SAND; few fine gravel.
		81	3.1	123.4			
15							
						GC	Light brown, damp, very dense, clayey GRAVEL; numerous caliche filaments and nodules; strongly cemented.
		50/6"					
							Total Depth = 19 feet. Groundwater not encountered during drilling.
20							

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HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-17

DATE DRILLED 01/31/07 BORING NO. B-9

GROUND ELEVATION 1,728' ± (MSL) SHEET 2 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY WTD LOGGED BY WTD REVIEWED BY KJT

DEPTH (feet)	SAMPLES: Bulk	SAMPLES: Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20								Grouted and asphalt patched on 01/31/07 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.
25								
30								
35								
40								

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BORING LOG

HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-18

DATE DRILLED 01/31/07 BORING NO. B-10

GROUND ELEVATION 1,742' ± (MSL) SHEET 1 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY WTD LOGGED BY WTD 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: Light brown, damp, dense to very dense, silty fine GRAVEL; few sand; trace clay.
		33					
		88					Very dense; moderately cemented.
5							
		50/4"					
		50/3"					
10							
		61					Dense.
15							
		87/11"	3.4	130.1			Very dense.
20							

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BORING LOG

HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-19

DATE DRILLED 01/31/07 BORING NO. B-10

GROUND ELEVATION 1,742' ± (MSL) SHEET 2 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY WTD LOGGED BY WTD REVIEWED BY KJT

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20							Total Depth = 19.9 feet.
							Groundwater not encountered during drilling.
							Backfilled on 01/31/07 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.
25							
30							
35							
40							

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HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-20

DATE DRILLED 02/23/07 BORING NO. B-11

GROUND ELEVATION 1,755' ± (MSL) SHEET 1 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) 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						SM	ALLUVIUM: Brown, damp, very dense, silty SAND with fine gravel; scattered caliche nodules and filaments.
		90/10"	5.8	116.0			
		50/4"					Numerous caliche nodules; moderately to strongly cemented..
5		50/3"					
		50/4"					
10							
		50/2"					Coarse gravel present.
15							
		50/2"					
20							Total Depth = 18.7 feet. Groundwater not encountered during drilling. Grouted and capped with concrete on 02/23/07 promptly after completion of drilling.

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HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-21

DATE DRILLED 02/23/07 BORING NO. B-11

GROUND ELEVATION 1,755' ± (MSL) SHEET 2 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) 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
20								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.
25								
30								
35								
40								

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HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-22

DATE DRILLED 08/03/05 BORING NO. B-12

GROUND ELEVATION 1,765' ± (MSL) SHEET 1 OF 2

METHOD OF DRILLING CME-75, 6.5" Diameter Hollow-Stem Auger

DRIVE WEIGHT 140 lbs. (Automatic) 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						SM	ALLUVIUM: Brown, damp, medium dense, silty SAND; few fine gravel.
		11					
		75	5.6	111.9			Very dense; scattered caliche filaments.
5							
						SP	Brown, damp, dense, poorly graded SAND.
		30					
10							
		50/3"				SC-SM	Brown, damp, very dense, silty, clayey SAND; few to little fine gravel.
15							
						SP	Brown, damp, very dense, poorly graded SAND; trace gravel.
		48					
		50/6"	3.8	113.0			
							Total Depth = 19 feet. Groundwater not encountered during drilling.
20							

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BORING LOG

HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-23

DATE DRILLED 08/03/05 BORING NO. B-12

GROUND ELEVATION 1,765' ± (MSL) SHEET 2 OF 2

METHOD OF DRILLING CME-75, 6.5" Diameter Hollow-Stem Auger

DRIVE WEIGHT 140 lbs. (Automatic) 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
20								Backfilled on 08/03/05 promptly after completion of drilling. Groundwater, though not encountered at the time of drilling, may rise to a high level due to seasonal variations in precipitation and several other factors as discussed in the report.
25								
30								
35								
40								

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BORING LOG

HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-24

DATE DRILLED 02/01/07 BORING NO. B-13

GROUND ELEVATION 1,780' ± (MSL) SHEET 1 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY WTD LOGGED BY WTD REVIEWED BY KJT

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						GP-GM	AGGREGATE BASE: Approximately 6 inches thick. Brown, damp, medium dense, poorly graded GRAVEL with silt and sand.
						SC	ALLUVIUM: Light brown, damp, very dense, clayey SAND; few fine gravel.
		46					
		50/6"					Scattered caliche filaments and nodules; moderately cemented.
5						GM	Light brown, damp, very dense, silty fine GRAVEL with sand.
		75					
		50/2"					
10							
		50/6"					
15							
		74/11"					
20							

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BORING LOG

HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-25

DATE DRILLED 02/01/07 BORING NO. B-13

GROUND ELEVATION 1,780' ± (MSL) SHEET 2 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY WTD LOGGED BY WTD REVIEWED BY KJT

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20							Total Depth = 19.9 feet. Groundwater not encountered during drilling. Backfilled on 02/01/07 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.
25							
30							
35							
40							

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BORING LOG

HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-26

DATE DRILLED 02/01/07 BORING NO. B-14

GROUND ELEVATION 1,795' ± (MSL) SHEET 1 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY WTD LOGGED BY WTD REVIEWED BY KJT

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							ASPHALT CONCRETE: Approximately 4 inches thick.
						GP-GM	AGGREGATE BASE: Approximately 8 inches thick.
							Brown, damp, medium dense, poorly graded GRAVEL with silt and sand.
						GC	ALLUVIUM:
		13					Brown, damp, loose, clayey fine GRAVEL with sand.
		10					Medium dense.
5							
						SM	Brown, damp, dense, silty SAND with fine gravel.
		54	4.1	120.0			
		62					Very dense.
10							
		50/4"					
15							
		55					
20							

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BORING LOG

HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-27

DATE DRILLED 02/01/07 BORING NO. B-14

GROUND ELEVATION 1,795' ± (MSL) SHEET 2 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY WTD LOGGED BY WTD REVIEWED BY KJT

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20								Total Depth = 20 feet. Groundwater not encountered during drilling. Grouted and asphalt patched on 02/01/07 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.
25								
30								
35								
40								

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BORING LOG

HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-28

DATE DRILLED 02/01/07 BORING NO. B-15

GROUND ELEVATION 1,820' ± (MSL) SHEET 1 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY WTD LOGGED BY WTD REVIEWED BY KJT

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						GP-GM	AGGREGATE BASE: Approximately 6 inches thick. Brown, damp, medium dense, poorly graded GRAVEL with silt and sand.
						GM	ALLUVIUM: Light brown, damp, medium dense, silty fine GRAVEL with sand.
		15					
		31					
5							
		31					Dense.
		50/6"					Very dense.
10							
		50/6"					
15							
		50/2"					
							Total Depth = 18.6 feet. Groundwater not encountered during drilling. Grouted on 02/01/07 promptly after completion of drilling.
20							

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BORING LOG

HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-29

DATE DRILLED 02/01/07 BORING NO. B-15

GROUND ELEVATION 1,820' ± (MSL) SHEET 2 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY WTD LOGGED BY WTD REVIEWED BY KJT

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20							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.
25							
30							
35							
40							

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BORING LOG

HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-30

DATE DRILLED 01/31/07 BORING NO. B-16

GROUND ELEVATION 1,830' ± (MSL) SHEET 1 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY WTD LOGGED BY WTD REVIEWED BY KJT

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							ASPHALT CONCRETE: Approximately 6 inches thick.
						GP-GM	AGGREGATE BASE: Approximately 6 inches thick.
						GM	Brown, damp, medium dense, poorly graded GRAVEL with silt and sand.
		18					ALLUVIUM: Brown, damp, medium dense, silty GRAVEL with coarse sand.
		12					
5						SC	Brown, damp, dense, clayey SAND with fine gravel.
		64					
		88					Very dense.
10							
		50/3"	3.0	92.5			Coarse gravel present.
15							
						GM	Light brown, damp, very dense, silty GRAVEL with sand.
		50/3"					
20							Total Depth = 18.8 feet. Groundwater not encountered during drilling. Grouted and asphalt patched on 01/31/07 promptly after completion of drilling.

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BORING LOG

HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-31

DATE DRILLED 01/31/07 BORING NO. B-16

GROUND ELEVATION 1,830' ± (MSL) SHEET 2 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY WTD LOGGED BY WTD REVIEWED BY KJT

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20							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.
25							
30							
35							
40							

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BORING LOG

HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-32

DATE DRILLED 02/02/07 BORING NO. B-17

GROUND ELEVATION 1,732' ± (MSL) SHEET 1 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY WTD LOGGED BY WTD REVIEWED BY KJT

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						GP-GM	AGGREGATE BASE: Approximately 12 inches thick. Brown, damp, medium dense, poorly graded GRAVEL with silt and sand.
		42				GC	ALLUVIUM: Light brown, damp, very dense, clayey GRAVEL with sand; scattered caliche filaments and nodules; moderately cemented.
		50/5"					Strongly cemented.
5		50/6"					
		77	3.0	124.9		GM	Light brown, damp, very dense, silty fine GRAVEL with sand.
10							
		37					
15							
		50/5"					
20							Total Depth = 18.9 feet. Groundwater not encountered during drilling. Backfilled and asphalt patched on 02/02/07 promptly after completion of drilling.

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BORING LOG

HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-33

DATE DRILLED 02/02/07 BORING NO. B-17

GROUND ELEVATION 1,732' ± (MSL) SHEET 2 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY WTD LOGGED BY WTD REVIEWED BY KJT

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20							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.
25							
30							
35							
40							

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BORING LOG

HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-34

DATE DRILLED 02/23/07 BORING NO. B-18

GROUND ELEVATION 1,745' ± (MSL) SHEET 1 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) 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						SC	ALLUVIUM: Reddish brown, damp, very dense, clayey fine to medium SAND; trace to few fine gravel.
		35					
		50/4"				SM	Light brown, damp, very dense, silty fine to coarse SAND; trace to few fine gravel; numerous caliche nodules.
5		50/5"					
		50/2"					Coarse gravel present; strongly cemented.
10							
		95/9"					
15							
		81/11"					
20							

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BORING LOG

HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-35

DATE DRILLED 02/23/07 BORING NO. B-18

GROUND ELEVATION 1,745' ± (MSL) SHEET 2 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) 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							Total Depth = 19.9 feet.
							Groundwater not encountered during drilling.
							Backfilled on 02/23/2007 promptly after completion of drilling.
							Groundwater, though not encountered at the time of drilling, may rise to a high level due to seasonal variations in precipitation and several other factors as discussed in the report.
25							
30							
35							
40							

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BORING LOG

HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-36

DATE DRILLED 02/23/07 BORING NO. B-19

GROUND ELEVATION 1,748' ± (MSL) SHEET 1 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) 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						SM	ALLUVIUM: Brown, damp, medium dense, silty SAND; few fine gravel.
		10					
		77/11"					Very dense; scattered caliche nodules.
5							
		50/5"					Numerous caliche nodules; moderately to strongly cemented.
		50/3"					
10							
		50/4"					
15							
		82					Trace coarse gravel present.
20							

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BORING LOG

HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-37

DATE DRILLED 02/23/07 BORING NO. B-19

GROUND ELEVATION 1,748' ± (MSL) SHEET 2 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) 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							Total Depth = 20 feet. Groundwater not encountered during drilling. Backfilled on 02/23/2007 promptly after completion of drilling. Groundwater, though not encountered at the time of drilling, may rise to a high level due to seasonal variations in precipitation and several other factors as discussed in the report.
25							
30							
35							
40							

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BORING LOG

HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-38

DATE DRILLED 02/23/07 BORING NO. B-20

GROUND ELEVATION 1,754' ± (MSL) SHEET 1 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) 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		42				SC	ALLUVIUM: Reddish brown, damp, medium dense to dense, clayey SAND; trace to few fine gravel; trace silt; scattered caliche filaments.
		50/4"				SM	Reddish brown, damp, very dense, silty SAND; few to little fine gravel; scattered caliche nodules.
5		50/4"					Numerous caliche nodules; moderately to strongly cemented.
		27					Dense.
10		50/4"					Very dense.
15		67					
20							

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BORING LOG

HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-39

DATE DRILLED 02/23/07 BORING NO. B-20

GROUND ELEVATION 1,754' ± (MSL) SHEET 2 OF 2

METHOD OF DRILLING CME-75, 7" Diameter Hollow-Stem Auger (Enviro-Drill, Inc.)

DRIVE WEIGHT 140 lbs. (Automatic) 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							Total Depth = 20 feet. Groundwater not encountered during drilling. Backfilled on 02/23/2007 promptly after completion of drilling. Groundwater, though not encountered at the time of drilling, may rise to a high level due to seasonal variations in precipitation and several other factors as discussed in the report.
25							
30							
35							
40							

Ninyo & Moore

BORING LOG

HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN
MESA, ARIZONA

PROJECT NO.	DATE	FIGURE
601527001	07/07	A-40

APPENDIX B

LABORATORY TEST RESULTS

Classification
Soils were visually and texturally classified in accordance with the USCS in general accordance with ASTM D 2488-06. 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 D 2937-04. The 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-13. 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 4318-05. 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-14.

Expansion Index Tests
The expansion index of selected materials was evaluated in general accordance with U.B.C. Standard No. 18-2 (ASTM D 4829-03). Specimens were molded under a specified compactive energy at approximately 50 percent saturation (plus or minus 1 percent). The prepared 1-inch thick by 4-inch diameter specimens were loaded with a surcharge of 144 psf and were inundated with tap water. Readings of volumetric swell were made for a period of 24 hours. The results of these tests are presented on Figure B-15.

Maximum Dry Density and Optimum Moisture Content Tests
The maximum dry density and optimum moisture content of selected representative soil samples were evaluated in general accordance with ASTM D 698-00a. The results of these tests are summarized on Figures B-16 through B-18.

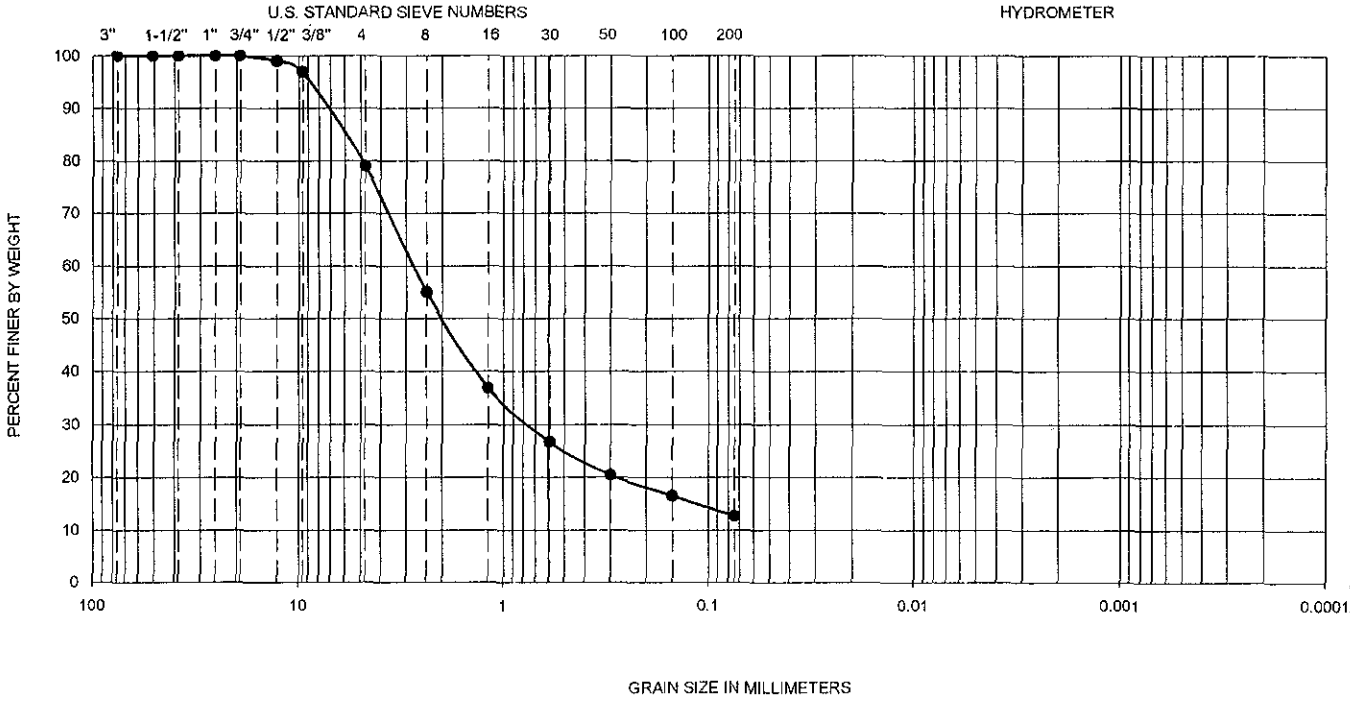
Soil Corrosivity Tests

Soil pH and minimum resistivity tests were performed on a representative soil sample in general accordance with Arizona Test 236b. The sulfate content was evaluated in general accordance with Arizona Test 733. The chloride content was evaluated in general accordance with Arizona Test 736. The test results are presented on Figure B-19.

R-value

The resistance value, or R-value, of alluvial soils was evaluated in general accordance with ASTM D 2844-01. Samples were prepared and each was tested for exudation pressure and R-value. The graphically evaluated R-value at an exudation pressure of 300 psi is reported. The test results are shown on Figure B-20.

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay

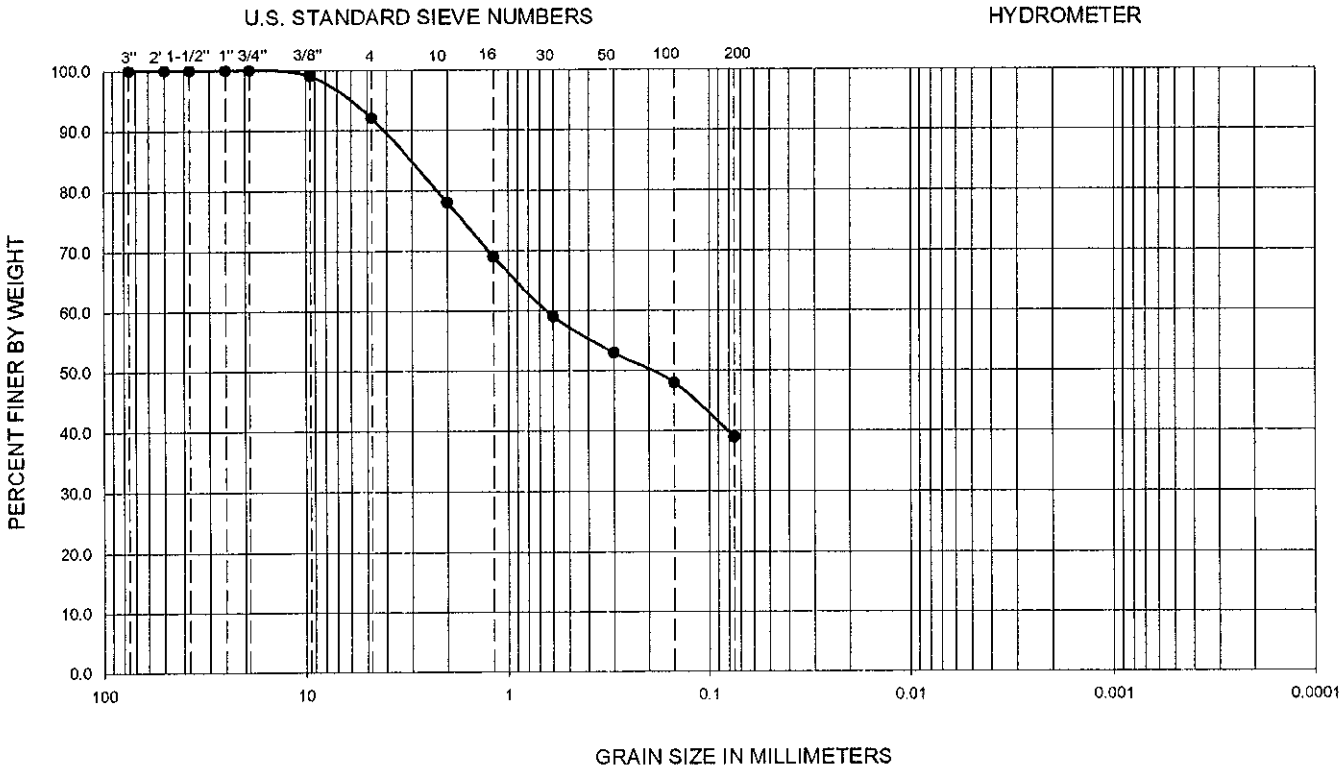


Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-1	0.5-5	--	--	--	--	--	--	--	--	13	SM

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

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. 601527001 / DATE 07/07	HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN MESA, ARIZONA	B-1

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY

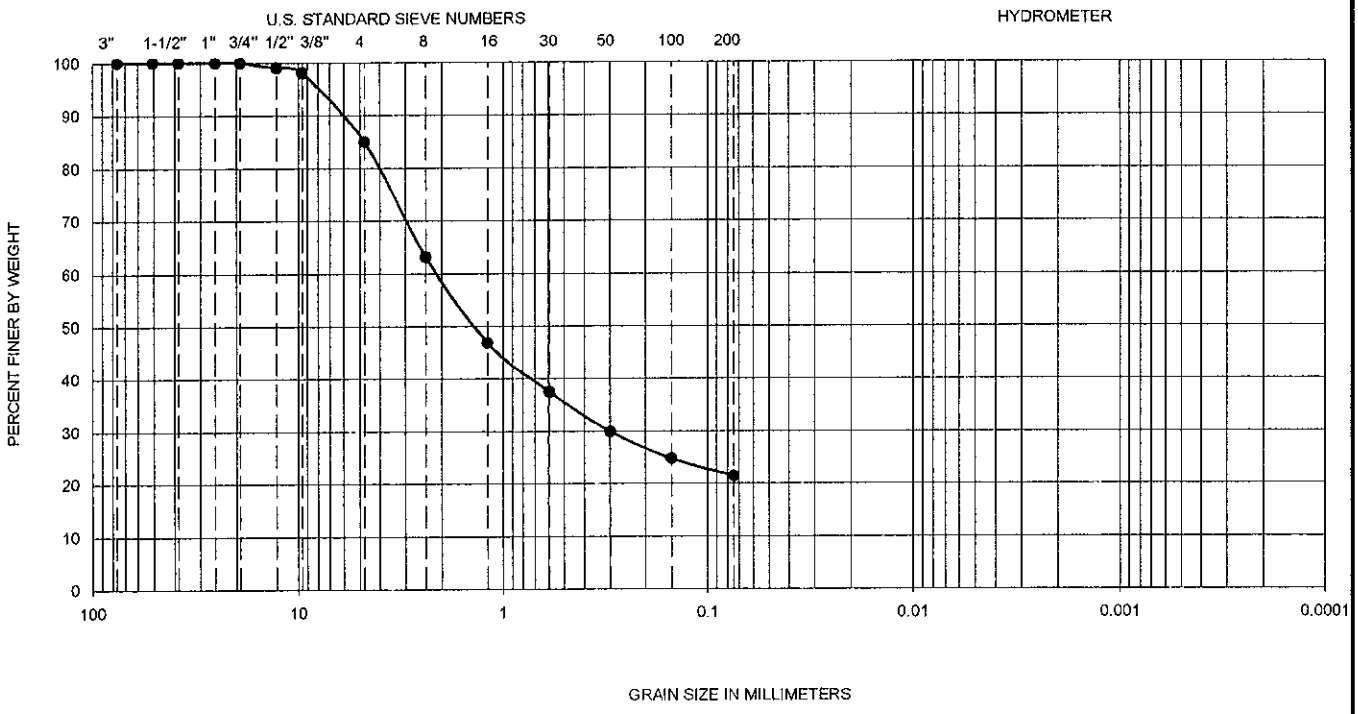


Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-3	6-7.5	46	26	20	--	--	--	--	--	39	SC

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

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. 601527001 / DATE 07/07	HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN MESA, ARIZONA	B-2

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay

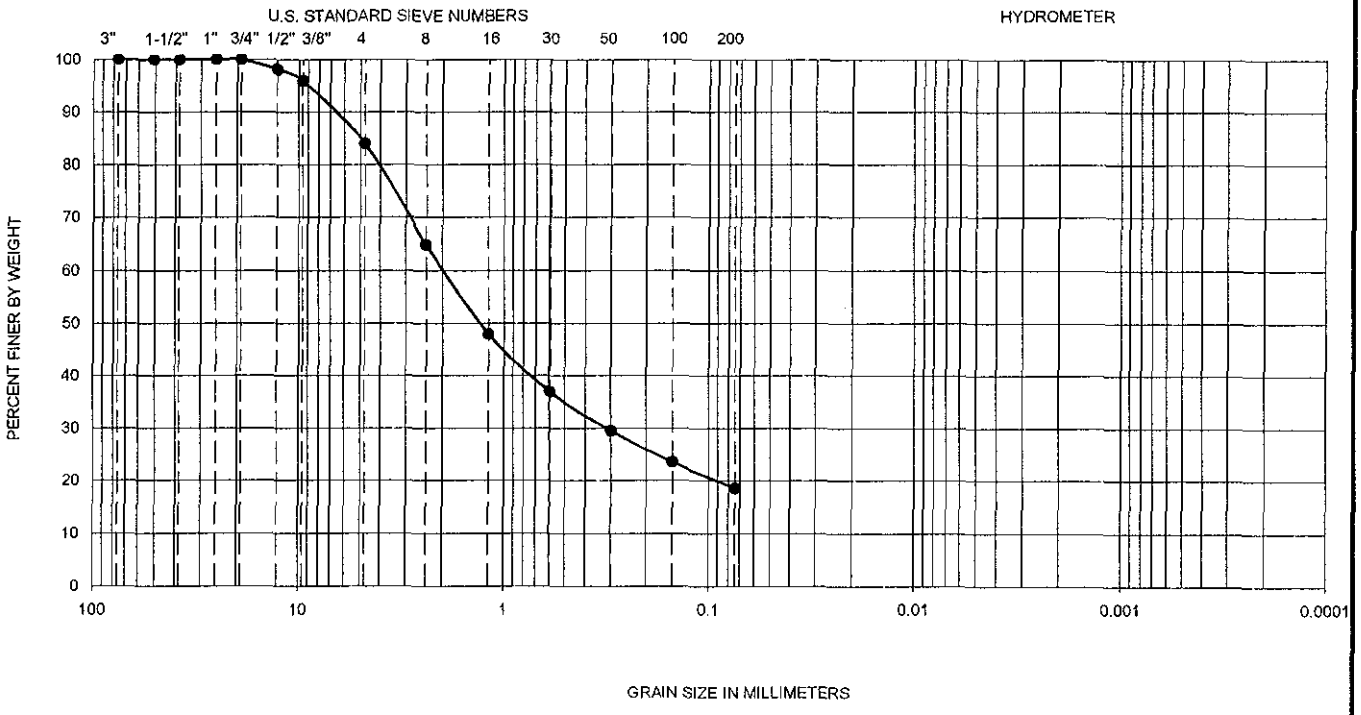


Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-6	0.1-5	--	--	--	--	--	--	--	--	21	SM

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

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. 601527001 / DATE 07/07	HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN MESA, ARIZONA	B-3

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay

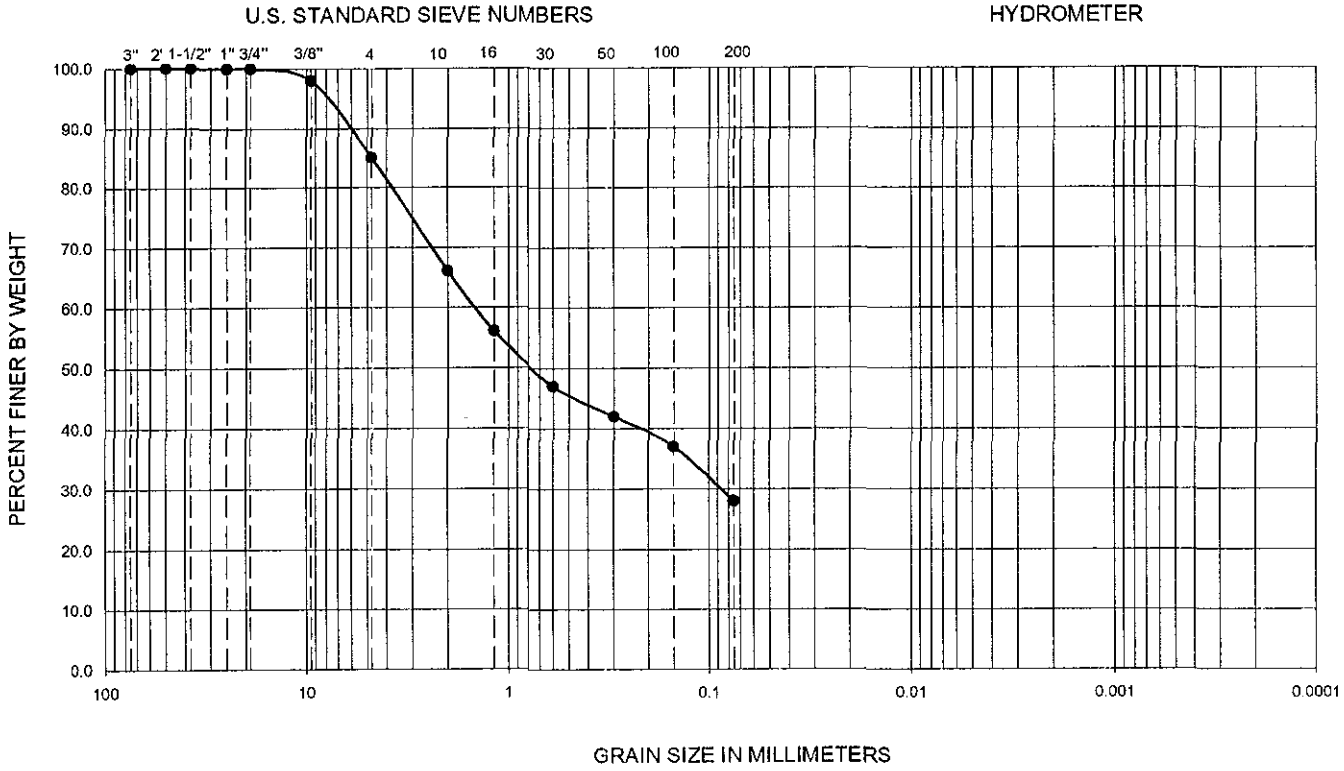


Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-7	1.3-5	24	20	4	--	--	--	--	--	19	SC-SM

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

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. 601527001 / DATE 07/07	HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN MESA, ARIZONA	B-4

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY

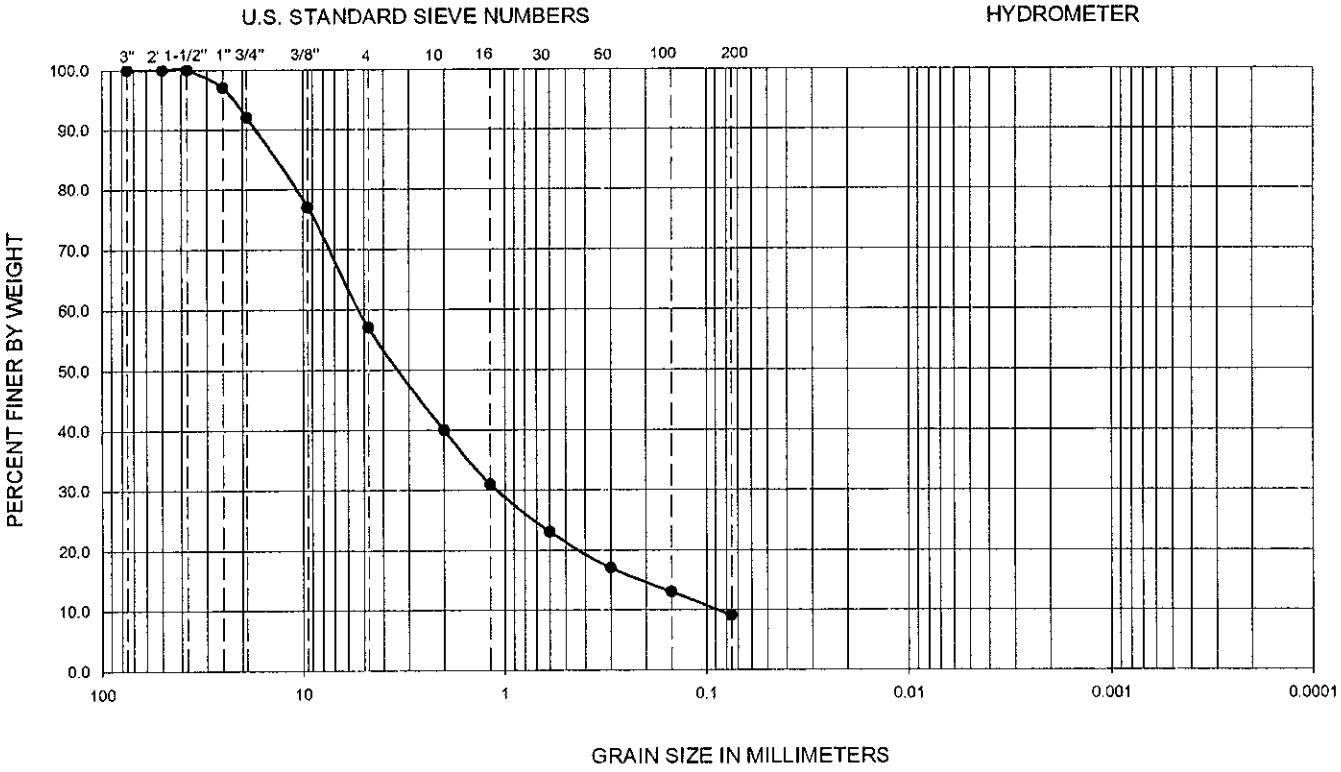


Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-8	18.5-20	--	--	--	--	--	--	--	--	28	SM

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

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. 601527001 / DATE 07/07	HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN MESA, ARIZONA	B-5

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY



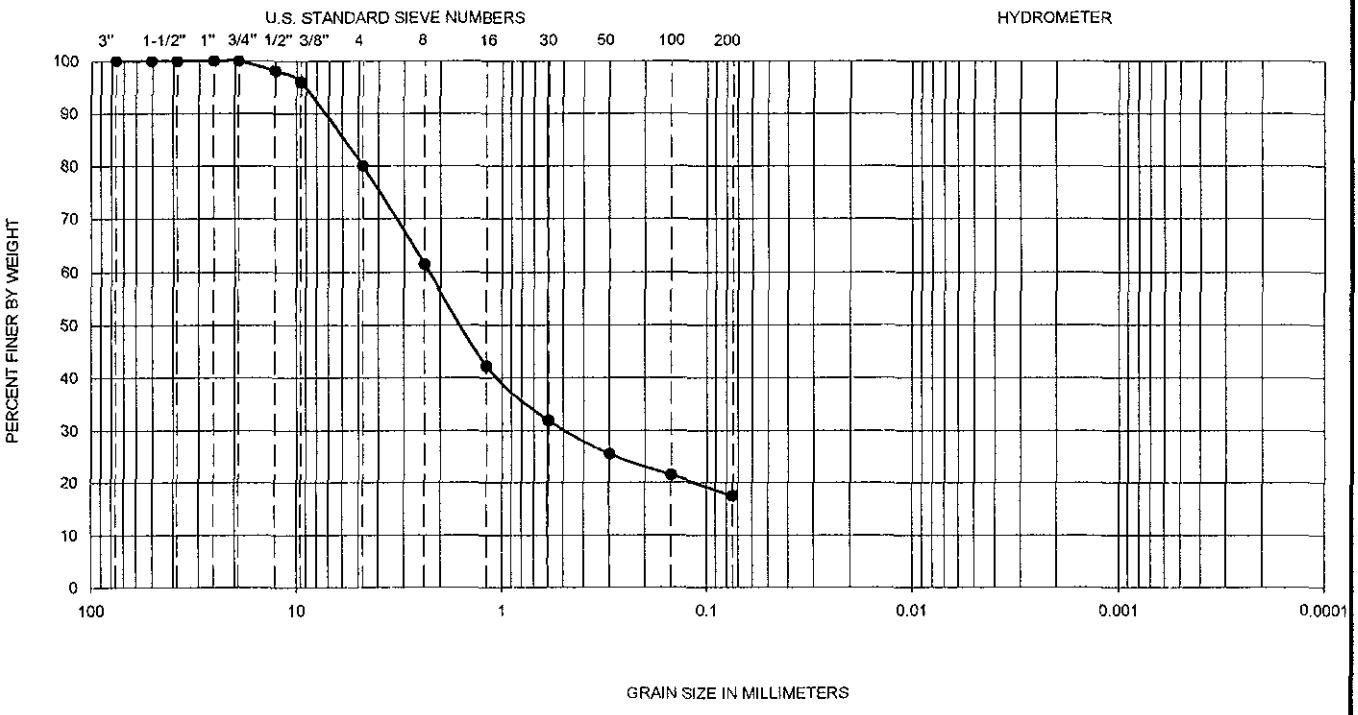
Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-9	6-6.8	NP	NP	NP	0.09	1.20	5.30	58.9	3.0	9	SW-SM

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

NP - Indicates Non-Plastic

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. 601527001 / DATE 07/07	HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN MESA, ARIZONA	B-6

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay

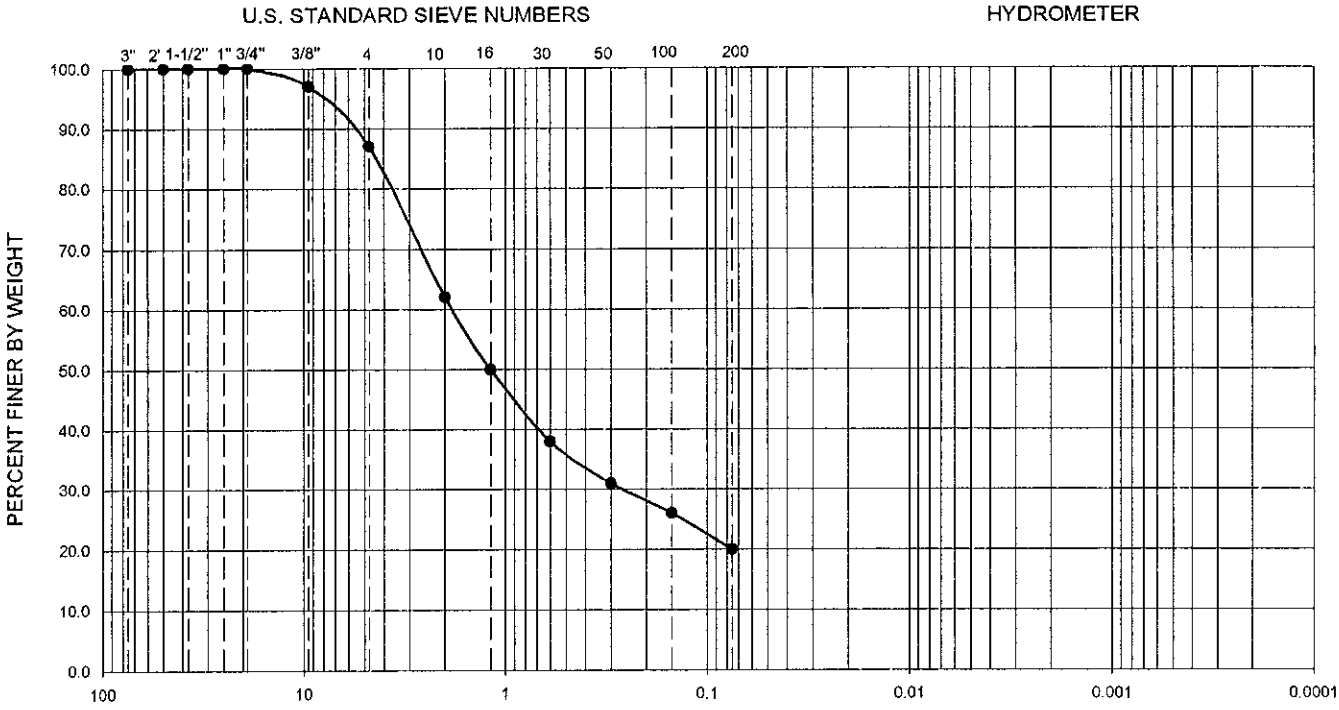


Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-11	0-5	--	--	--	--	--	--	--	--	18	SM

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

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. 601527001 / DATE 07/07	HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN MESA, ARIZONA	B-7

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY

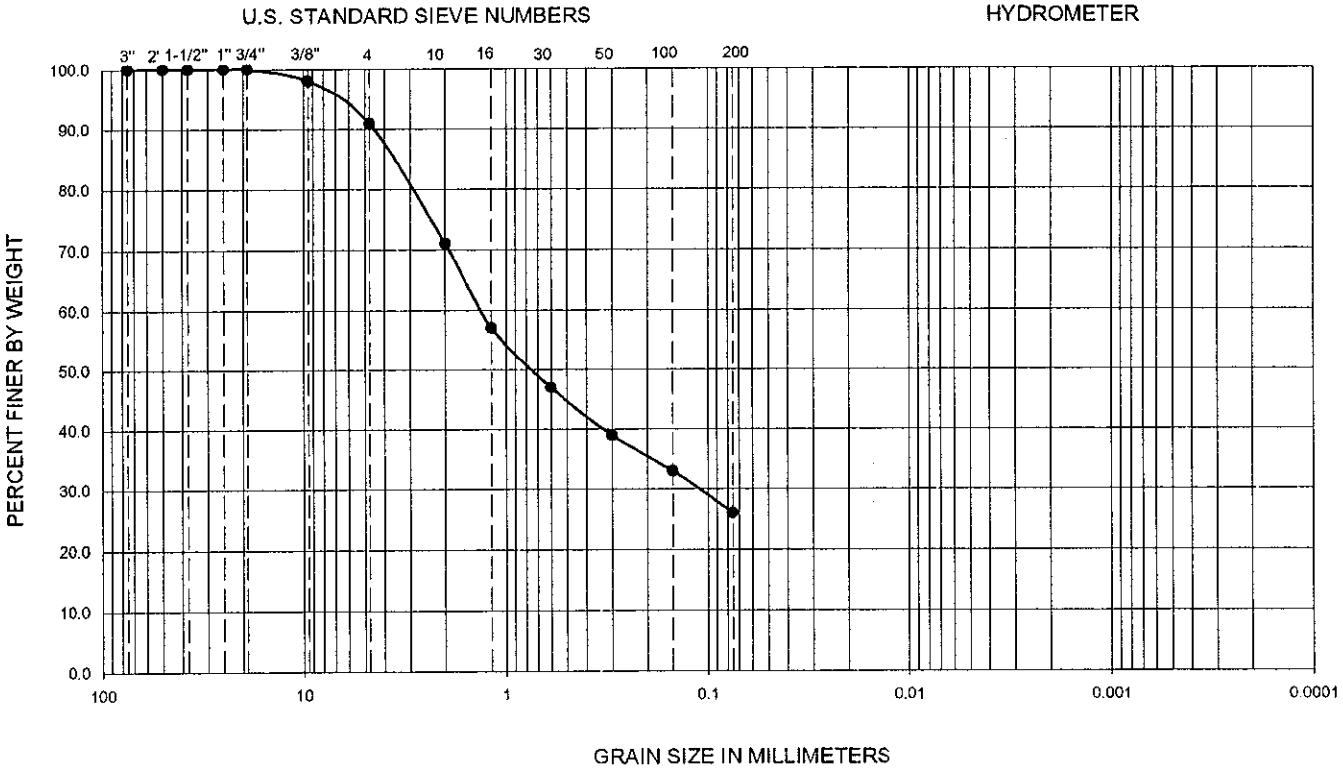


Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-12	13.5-13.7	25	18	7	--	--	--	--	--	20	SC-SM

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

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. 601527001 / DATE 07/07	HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN MESA, ARIZONA	B-8

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY

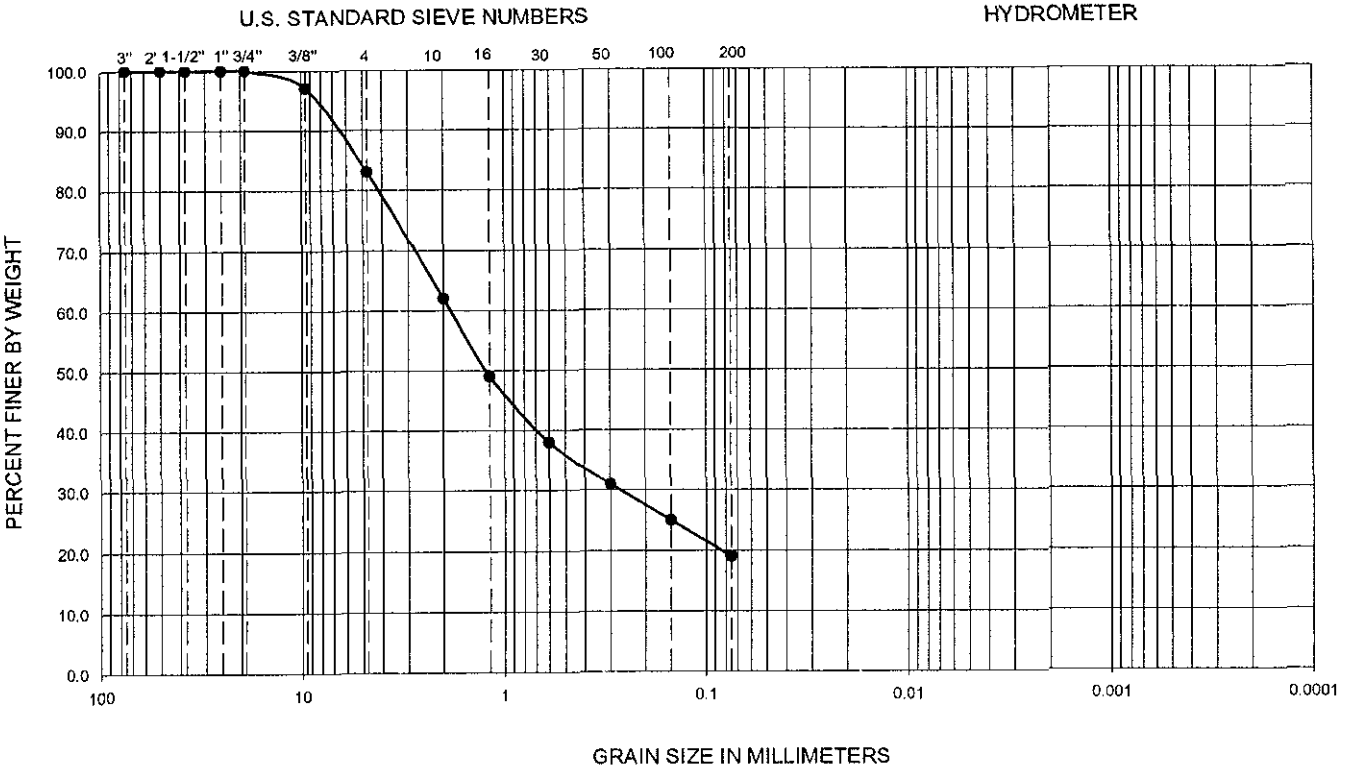


Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-13	3.5-4.5	37	23	14	--	--	--	--	--	26	SC

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

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. 601527001 / DATE 07/07	HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN MESA, ARIZONA	B-9

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY



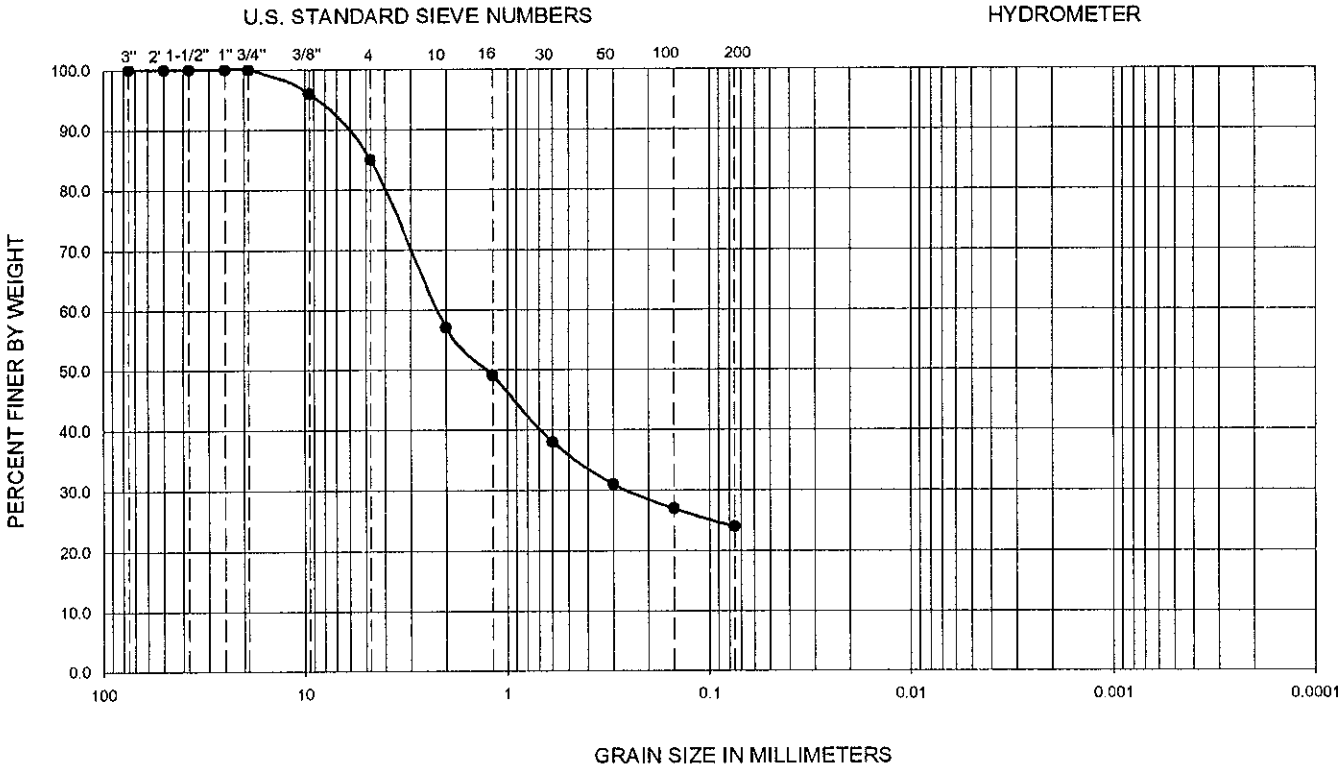
Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-14	8.5-10	NP	NP	NP	--	--	--	--	--	19	SM

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

NP - Indicates Non-Plastic

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. 601527001 / DATE 07/07	HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN MESA, ARIZONA	B-10

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY

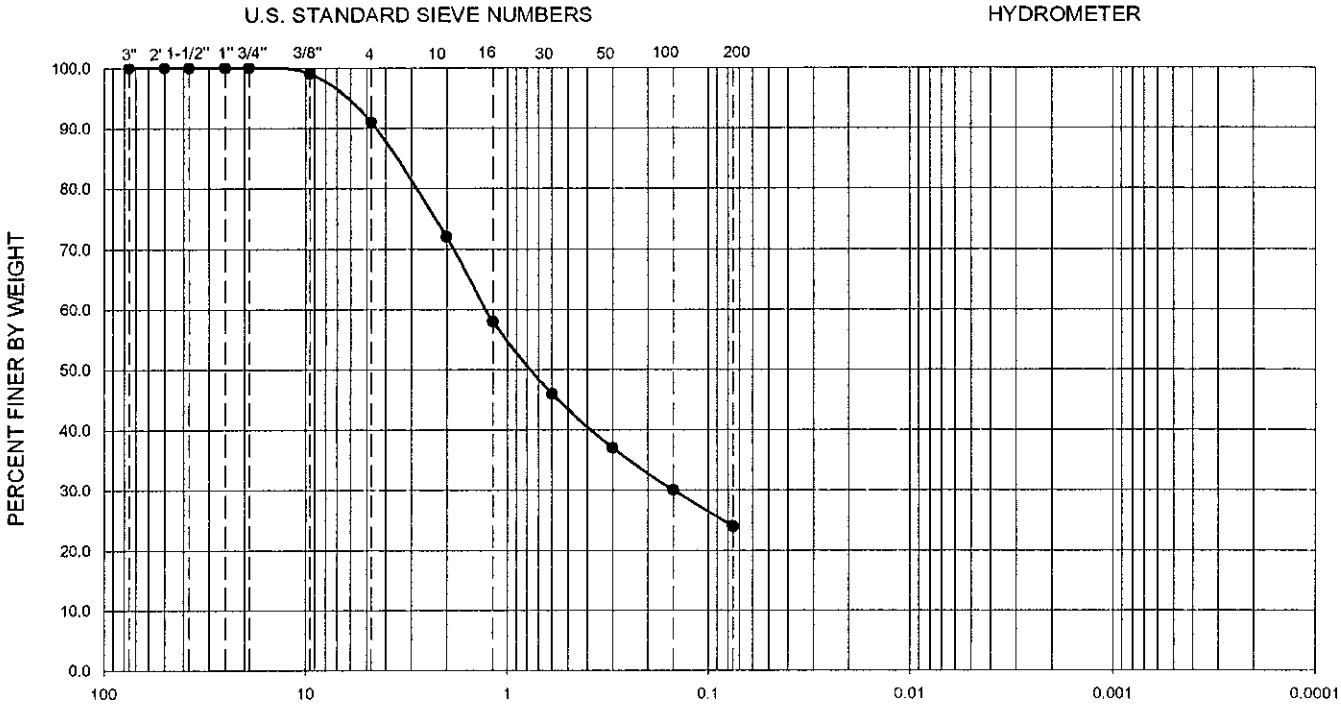


Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-16	6-7.5	36	18	18	--	--	--	--	--	24	SC

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

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. 601527001 / DATE 07/07	HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN MESA, ARIZONA	B-11

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY

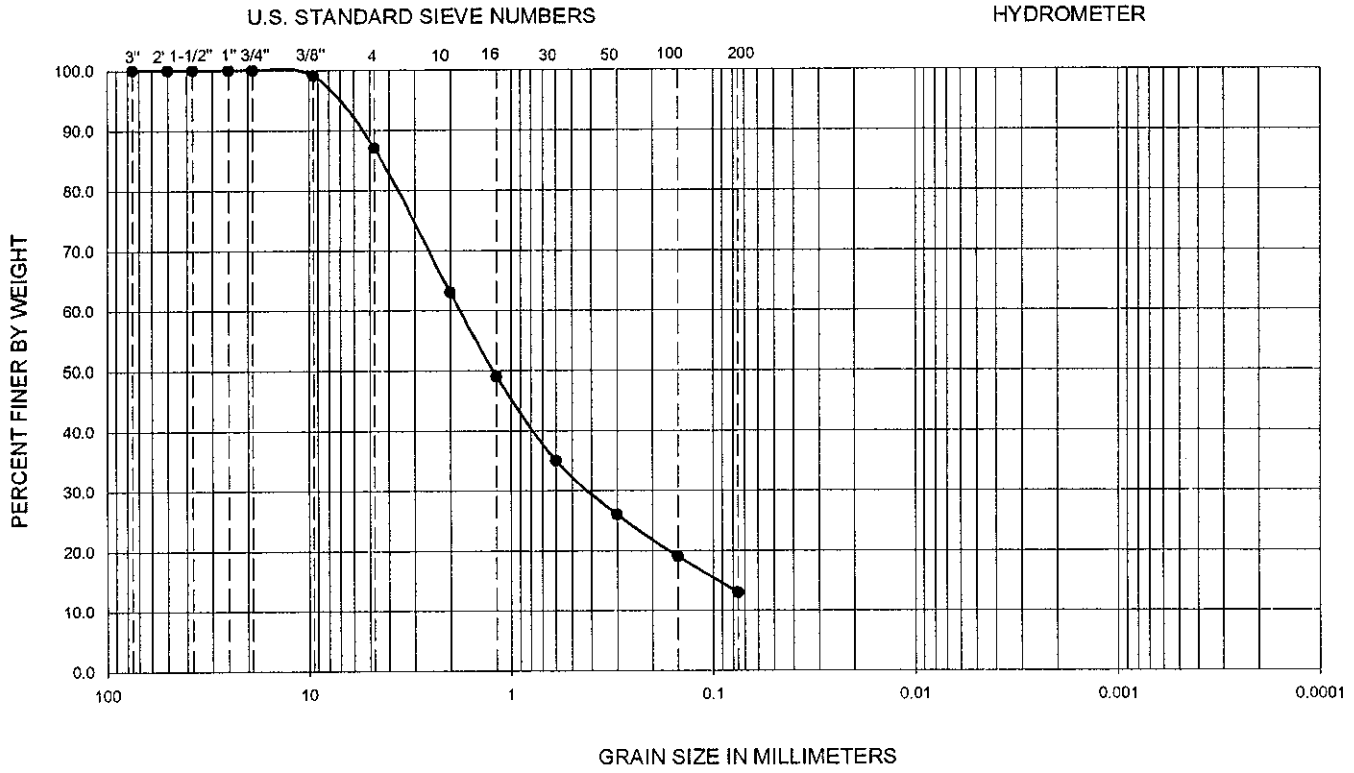


Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-19	6-6.9	--	--	--	--	--	--	--	--	24	SM

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

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. 601527001 / DATE 07/07	HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN MESA, ARIZONA	B-12

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY



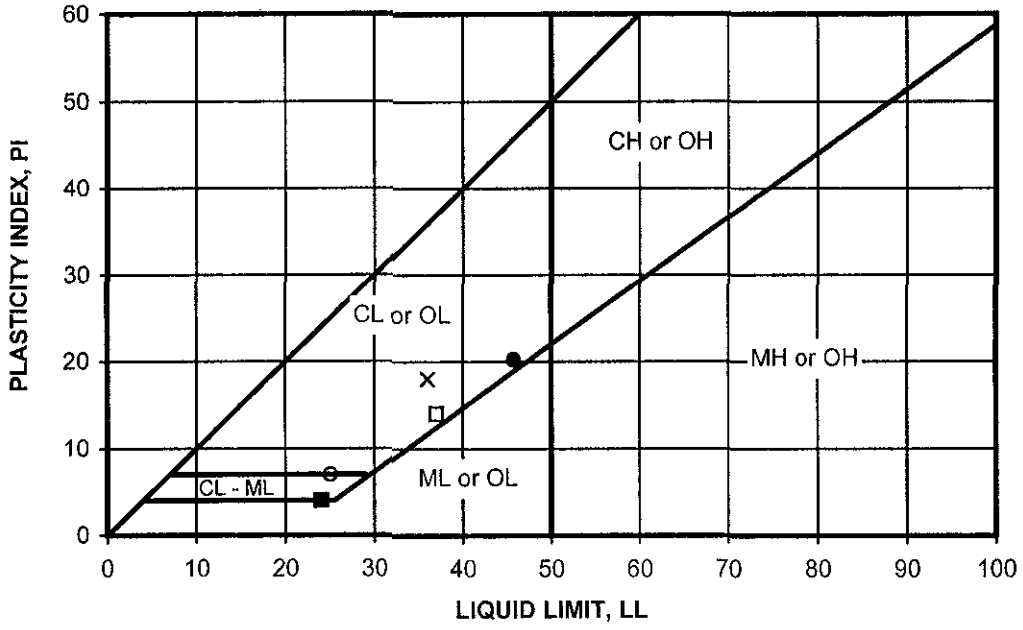
Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-20	8.5-10	--	--	--	--	--	--	--	--	13	SM

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

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. 601527001 / DATE 07/07	HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN MESA, ARIZONA	B-13

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-3	6-7.5	46	26	20	CL	SC
■	B-7	1.3-5	24	20	4	CL-ML	SC-SM
◆	B-9	6-6.8	NP	NP	NP	ML	SW-SM
○	B-12	13.5-13.7	25	18	7	CL-ML	SC-SM
□	B-13	3.5-4.5	37	23	14	CL	SC
△	B-14	8.5-10	NP	NP	NP	ML	SM
X	B-16	6-7.5	36	18	18	CL	SC

NP - Indicates Non-Plastic



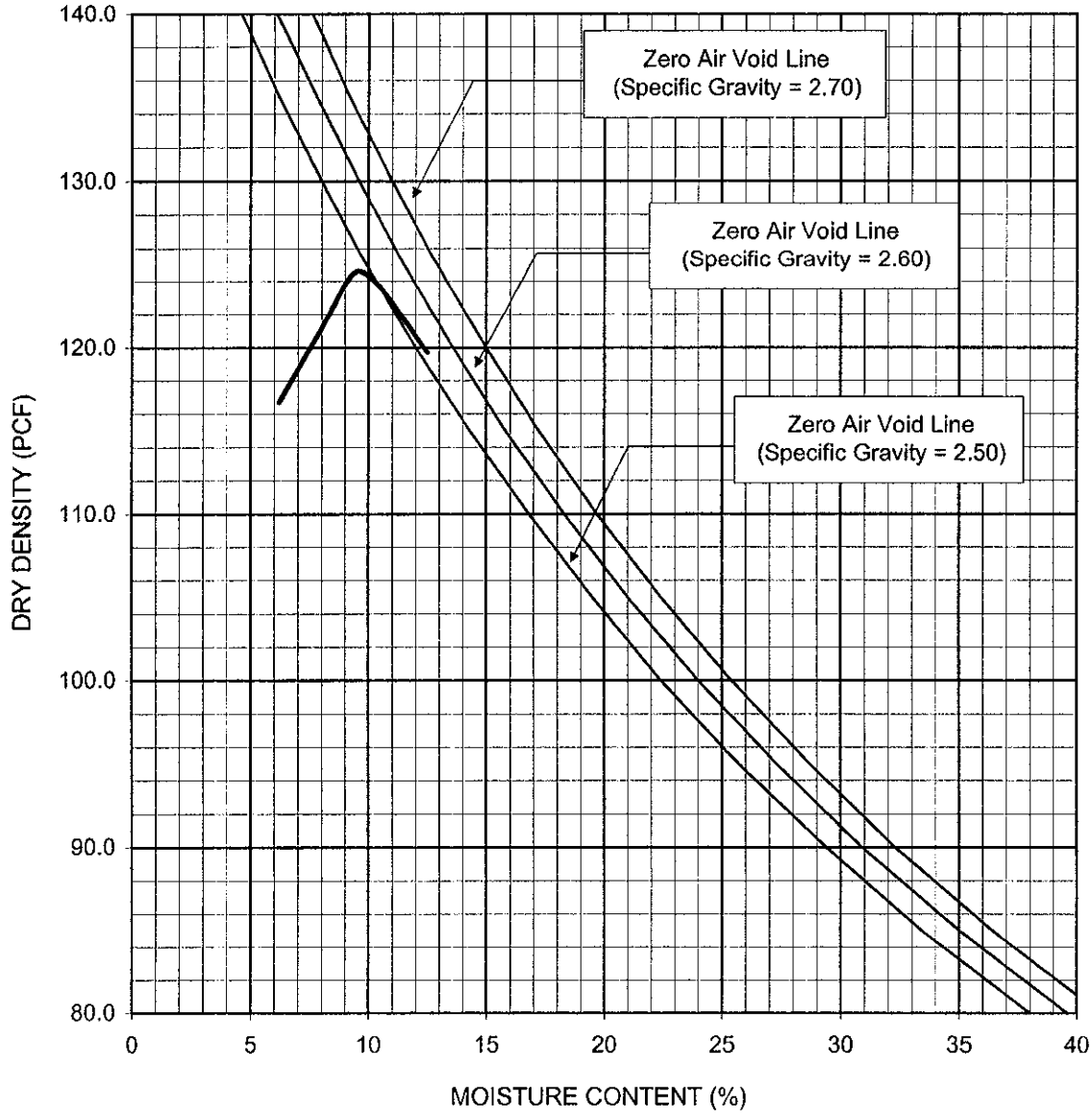
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4318-05

Ninyo & Moore	ATTERBERG LIMITS TEST RESULTS	FIGURE
PROJECT NO. 601527001 / DATE 07/07	HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN MESA, ARIZONA	B-14

SAMPLE LOCATION	SAMPLE DEPTH (FT)	INITIAL MOISTURE (%)	COMPACTED DRY DENSITY (PCF)	FINAL MOISTURE (%)	VOLUMETRIC SWELL (IN)	EXPANSION INDEX	POTENTIAL EXPANSION
B-12	0-5	7.0	124.5	9.3	-	2	Very Low

PERFORMED IN GENERAL ACCORDANCE WITH ☐ UBC STANDARD 18-2 ☑ ASTM D 4829-03

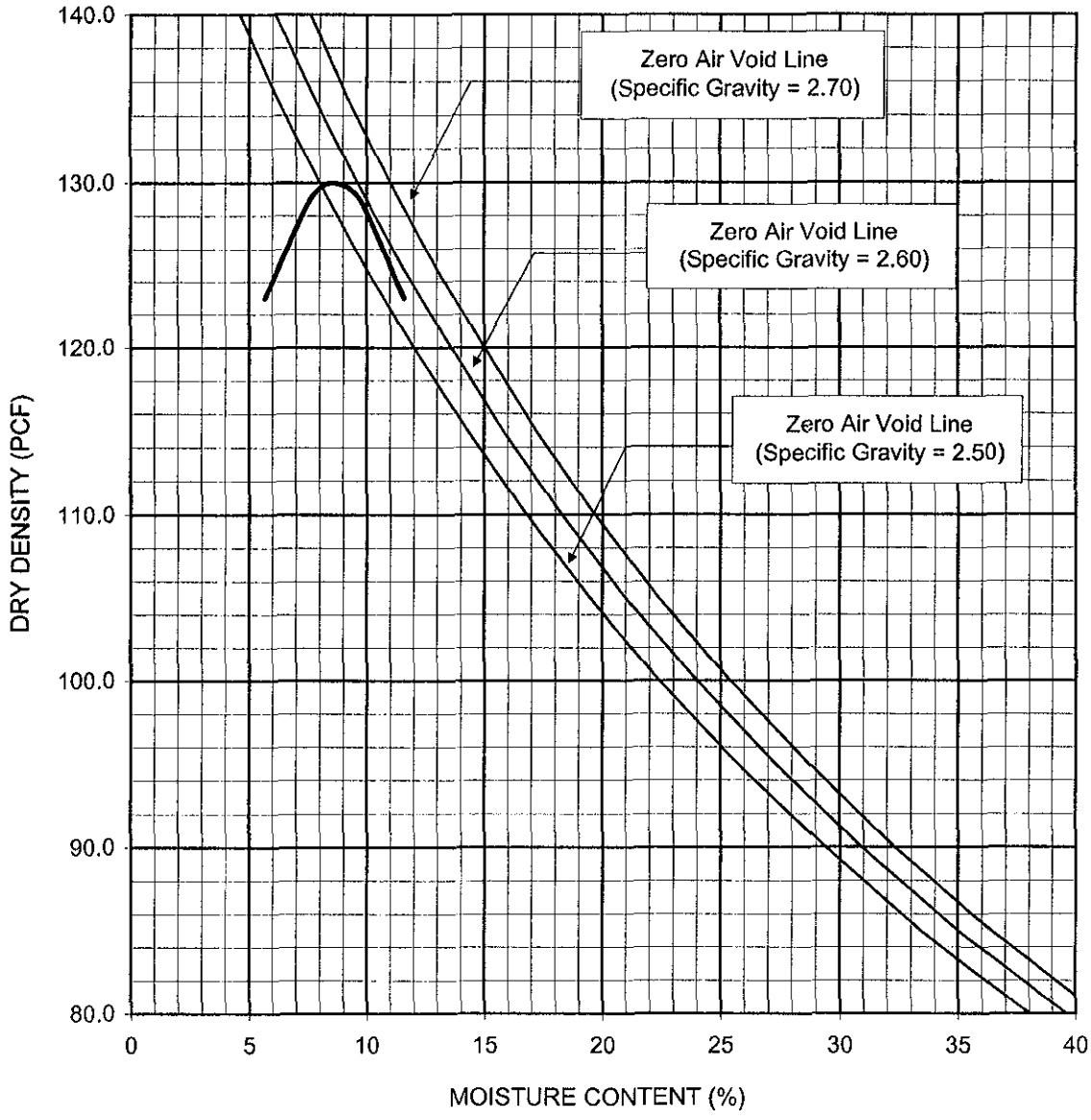
Ninyo & Moore	EXPANSION INDEX TEST RESULTS	FIGURE
PROJECT NO. / DATE	HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN MESA, ARIZONA	B-15
601527001 / 07/07		



Sample Location	Depth (ft)	Soil Description	Maximum Dry Density (pcf)	Optimum Moisture Content (%)
B-3	0.3-5	CLAYEY SAND	124.5	9.4

PERFORMED IN GENERAL ACCORDANCE WITH ☐ ASTM D 1557-02 ☑ ASTM D 698-00a METHOD ☑ A ☐ B ☐ C

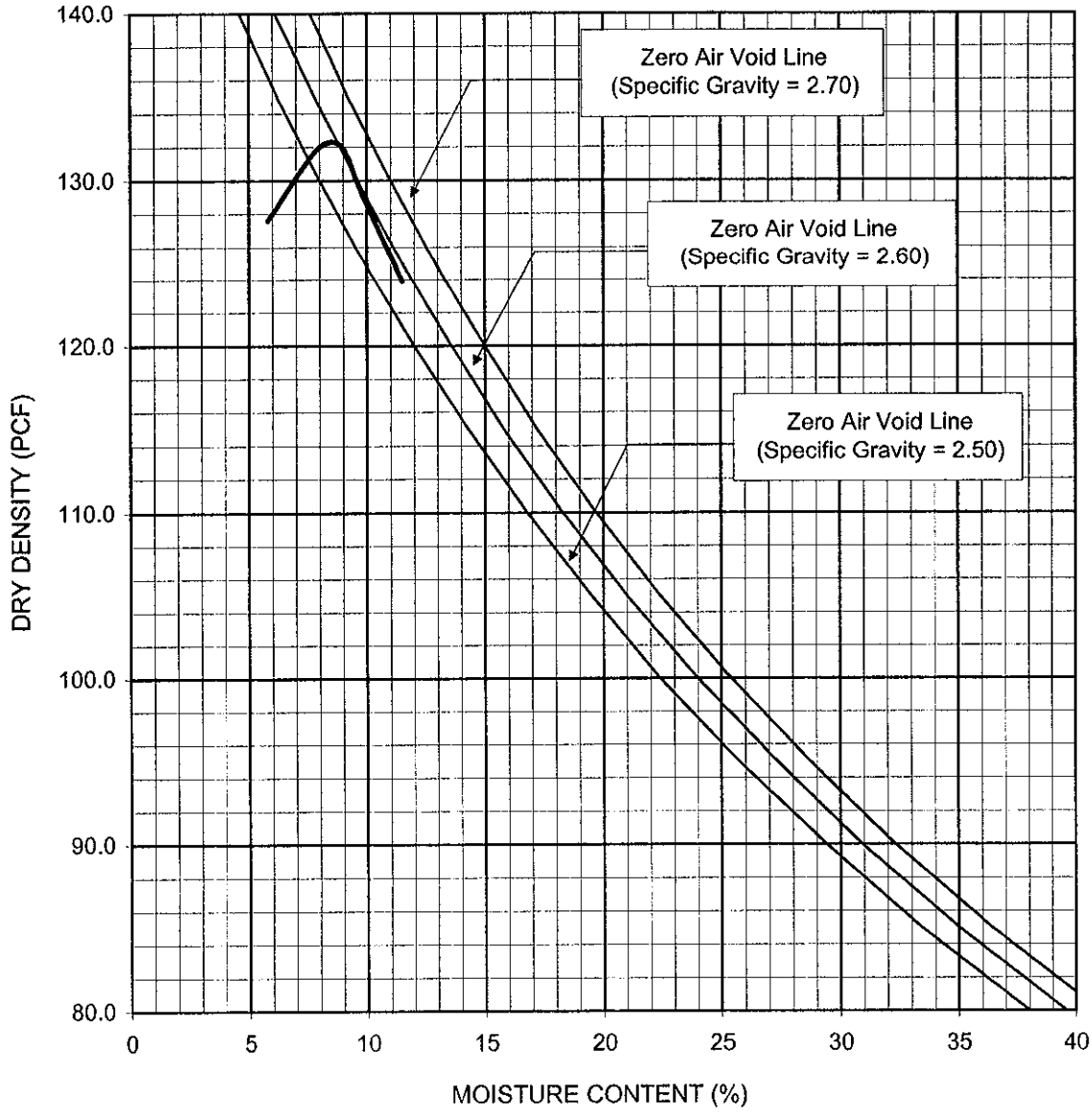
Ninyo & Moore	PROCTOR DENSITY TEST RESULTS	FIGURE
PROJECT NO. 601527001 / DATE 07/07	HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN MESA, ARIZONA	B-16



Sample Location	Depth (ft)	Soil Description	Maximum Dry Density (pcf)	Optimum Moisture Content (%)
B-12	0-5	SILTY SAND	130.0	8.5

PERFORMED IN GENERAL ACCORDANCE WITH ☐ ASTM D 1557-02 ☑ ASTM D 698-00a METHOD ☑ A ☐ B ☐ C

Ninyo & Moore	PROCTOR DENSITY TEST RESULTS	FIGURE
PROJECT NO. 601527001 / DATE 07/07	HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN MESA, ARIZONA	B-17



Sample Location	Depth (ft)	Soil Description	Maximum Dry Density (pcf)	Optimum Moisture Content (%)
B-15	0.5-5	SILTY GRAVEL WITH SAND	132.1	8.9

PERFORMED IN GENERAL ACCORDANCE WITH ☐ ASTM D 1557-02 ☑ ASTM D 698-00a METHOD ☑ A ☐ B ☐ C

Ninyo & Moore	PROCTOR DENSITY TEST RESULTS	FIGURE
PROJECT NO. 601527001 / DATE 07/07	HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN MESA, ARIZONA	B-18

SAMPLE LOCATION	SAMPLE DEPTH (FT)	pH [1]	RESISTIVITY [1] (Ohm-cm)	SULFATE CONTENT [2]		CHLORIDE CONTENT [3] (ppm)
				(ppm)	(%)	
B-3	0.2-5	8.0	1,368	50	0.0050	95
B-7	1.3-5	7.8	684	65	0.0065	668
B-10	0-5	7.9	3,146	10	0.0010	21
B-12	0-5	7.7	4,514	100	0.0100	41
B-15	0.5-5	7.9	2,120	24	0.0024	37

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

Ninyo & Moore	CORROSIVITY TEST RESULTS	FIGURE
PROJECT NO. 601527001 / DATE 07/07	HERMOSA VISTA DRIVE/HAWES ROAD, STORM DRAIN AND BASIN MESA, ARIZONA	B-19

SAMPLE LOCATION	SAMPLE DEPTH (FT)	SOIL TYPE	R-VALUE
B-12	0-5	SM	72

PERFORMED IN GENERAL ACCORDANCE WITH ASTM *D 2844-00*

Ninyo & Moore		R-VALUE TEST RESULTS	FIGURE
PROJECT NO.	DATE	HERMOSA VISTA ROAD/HAWES ROAD, STORM DRAIN AND BASIN MESA, ARIZONA	B-20
601527001	07/07		

APPENDIX C

AGRONOMIC TEST RESULTS

FRUIT GROWERS LABORATORY, INC.

Analytical Chemists

March 13, 2007

Ninyo & Moore
5710 Ruffin Road
San Diego, CA 92123-1013

Lab ID : SP 0702147-001
Customer ID : 2-18569

Sampled On : February 23, 2007
Sampled By : Dale Mooney
Received On : February 27, 2007
Depth : 0-60"
Meth Irrg. : None

Description : Site B18
Project : Hermosa Vista/Project #601527001

NATIVE PLANT SOIL ANALYSIS

Test Description	Result	Units	Optimum Range	Graphical Results Presentation
				Very Low / Moderately Low / Optimum / Moderately High / Very High
Primary Nutrients				
Nitrate-Nitrogen	7	Lbs/AF	18 - 58	
Phosphorus-P_2O_5	40	Lbs/AF	130 - 270	
Potassium-K_2O (Exch)	340	Lbs/AF	1010 - 2530	
Potassium-K_2O (Sol)	28	Lbs/AF	65 - 442	5%
Secondary Nutrients				
Calcium (Exch)	20800	Lbs/AF	12900 - 17200	
Calcium (Sol)	176	Lbs/AF	102 - 582	72%
Magnesium (Exch)	390	Lbs/AF	1310 - 2620	
Magnesium (Sol)	15	Lbs/AF	46 - 192	10%
Sodium (Exch)	< 80	Lbs/AF	0 - 1240	
Sodium (Sol)	36	Lbs/AF	0 - 720	13%
Sulfate	60	Lbs/AF	120 - 3960	
Micro Nutrients				
Zinc	2.4	Lbs/AF	2.9 - 172	
Manganese	14.4	Lbs/AF	3.6 - 258	
Iron	33.6	Lbs/AF	28.8 - 203	
Copper	2.0	Lbs/AF	0.9 - 44.3	
Boron	0.16	Lbs/AF	0.38 - 6.38	
Chloride	18	Lbs/AF	6 - 652	
CEC	26.9	meq/100g	5 - 65.0	
% Base Saturation				
CEC - Calcium	96.3	%	60 - 80.0	
CEC - Magnesium	3.0	%	10 - 20.0	
CEC - Potassium	0.67	%	2 - 5.00	
CEC - Sodium	0.00	%	0 - 5.00	
CEC - Hydrogen	0.00	%	0 - 3.00	
				Strongly Acidic / Moderately Acidic / Near Neutral / Moderately Alkaline / Strongly Alkaline
pH	7.86	---	6.5 - 7.50	

Good — Problem — Indicates physical conditions and/or phenological and amendment requirements.

Note: Color coded bar graphs have been used to provide you with 'AT-A-GLANCE' interpretations.

Corporate Offices & Laboratory
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Santa Paula, CA 93061-0272
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FAX: 805/392-2063
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CA ELAP Certification No. 1573

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Chico, CA 95926
TEL: 530/343-5818
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Field Office
Visalia, California
TEL: 559/734-9473
Mobile: 559/737-2399
FAX: 559/734-8435

March 13, 2007

Ninyo & Moore

Lab ID : SP 0702147-001
Customer ID : 2-18569
Description : Site B18

NATIVE PLANT SOIL ANALYSIS

Test Description	Result	Units	Optimum Range	Graphical Results Presentation
Others				Satisfactory | Possible Problem | Moderate Problem | Increasing Problem
Soil Salinity	0.33	mmhos/cm	0 - 2.00	
SAR	0.3		0 - 6.0	
Limestone	3.2	%	0 - 0.5	
Lime Requirement	0	Tons/AF		0 | 1 | 2 | 3 | 4 | 5 | 6
Moisture	2.5	%	4.8 - 14.2	Very Low | Moderately Low | Optimum | Moderately High | Very High
Saturation	19.0	%	40 - 50.0	Loamy Sand | Sandy Loam | Loam | Silt Loam | Clay Loam | Clay | Organic

Good Problem Indicates physical conditions and/or phenological and amendment requirements.

Note: Color coded bar graphs have been used to provide you with 'AT-A-GLANCE' interpretations.

Soil pH & Limestone levels are important to consider when making plant selections. Soil pH levels above 7.0 are not suitable for acid loving plants. Soils containing limestone are not suitable for plants sensitive to Limestone.

FRUIT GROWERS LABORATORY, INC.

Darrell H. Nelson

Darrell H. Nelson, Agronomist

DHN:JRJ

APPENDIX D

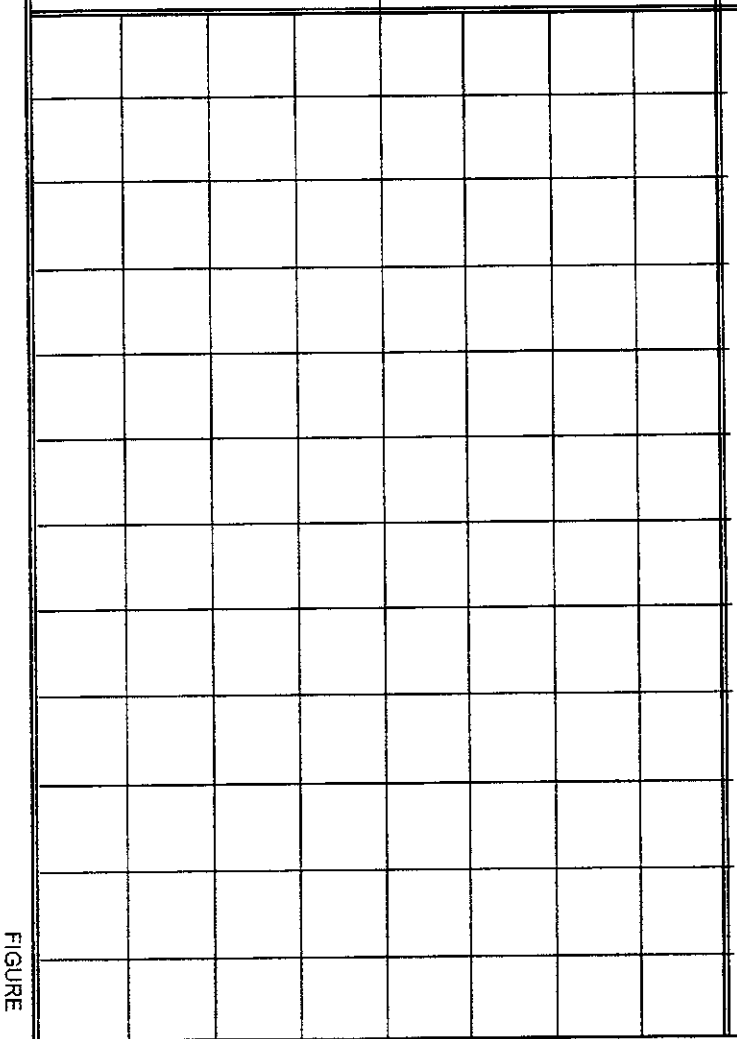
TEST PIT LOGS AND PHOTOGRAPHS

Ninyo & Moore

Explanation of Test Pit, Core, Trench and Hand Auger Log Symbols

PROJECT NO.	DATE

EXCAVATION LOG EXPLANATION SHEET



SM — FILL:

Bulk sample.

Dashed line denotes material change.

ML

Drive sample.

Sand cone performed.

Seepage

Groundwater encountered during excavation.

No recovery with drive sampler.

Groundwater encountered after excavation.

Sample retained by others.

Shelby tube sample. Distance pushed in inches/length of sample recovered in inches

No recovery with Shelby tube sampler.

SM — ALLUVIUM

Solid line denotes unit change.

Attitude: 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

The total depth line is a solid line that is drawn at the bottom of the excavation log.

SCALE: 1 inch = 1 foot

FIGURE

Testpit explanation.xls

Ninyo & Moore

Test Pit LOG

HERMOSA VISTA DRIVE/HAWES ROAD
STORM DRAIN AND BASIN
MESA, ARIZONA

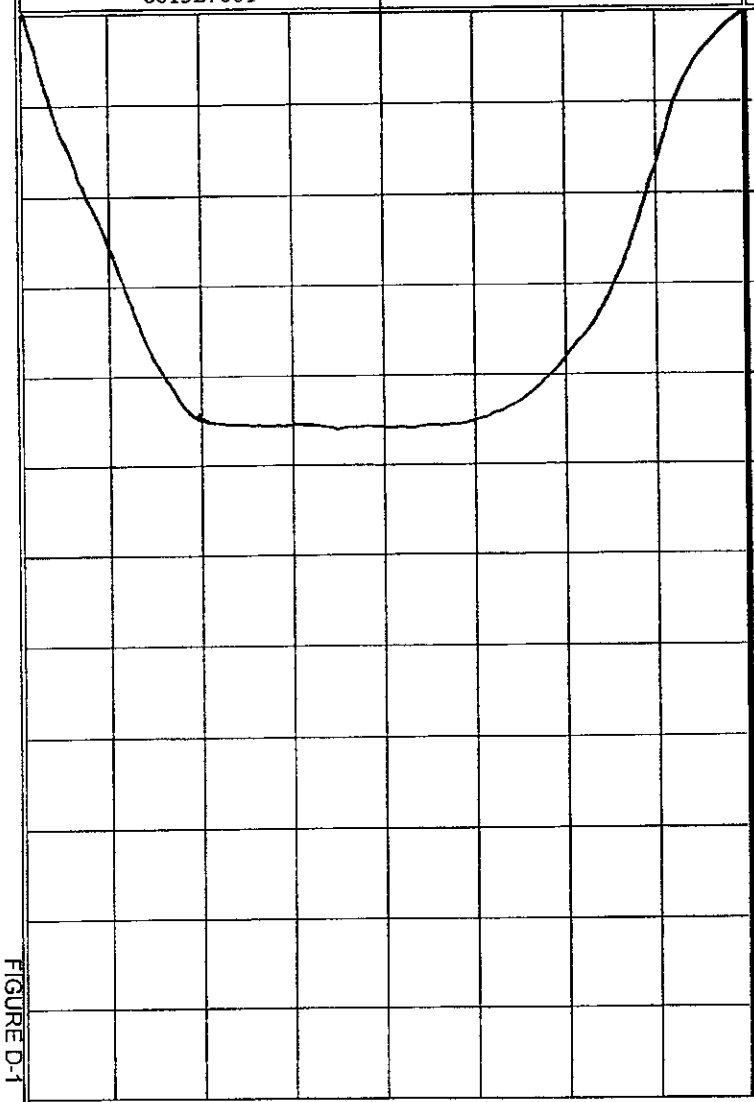
PROJECT NO.	DATE
601527001	07/07

DATE EXCAVATED 06/27/07 TEST PIT NO. TP-1

GROUND ELEVATION -- LOGGED BY DM

METHOD OF EXCAVATION Case 580-Super L Backhoe

LOCATION Hermosa Vista (See Figure 2)



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	FILL: Brown, damp, medium dense, silty fine to medium SAND; few fine gravel.
4						SM	ALLUVIUM: Brown, dry, dense to very dense, silty fine to coarse SAND; few fine gravel; strongly cemented. Refusal on caliche.
							Total Depth = 4.5 feet (Backhoe Refusal). Groundwater not encountered during excavation. Backfilled on 06/27/07 promptly after completion of excavation. Groundwater, though not encountered at the time of excavation, may rise to higher levels due to seasonal variations in precipitation and several other factors as discussed in the report.

FIGURE D-1

Ninyo & Moore

Test Pit LOG

HERMOSA VISTA DRIVE/HAWES ROAD
STORM DRAIN AND BASIN
MESA, ARIZONA

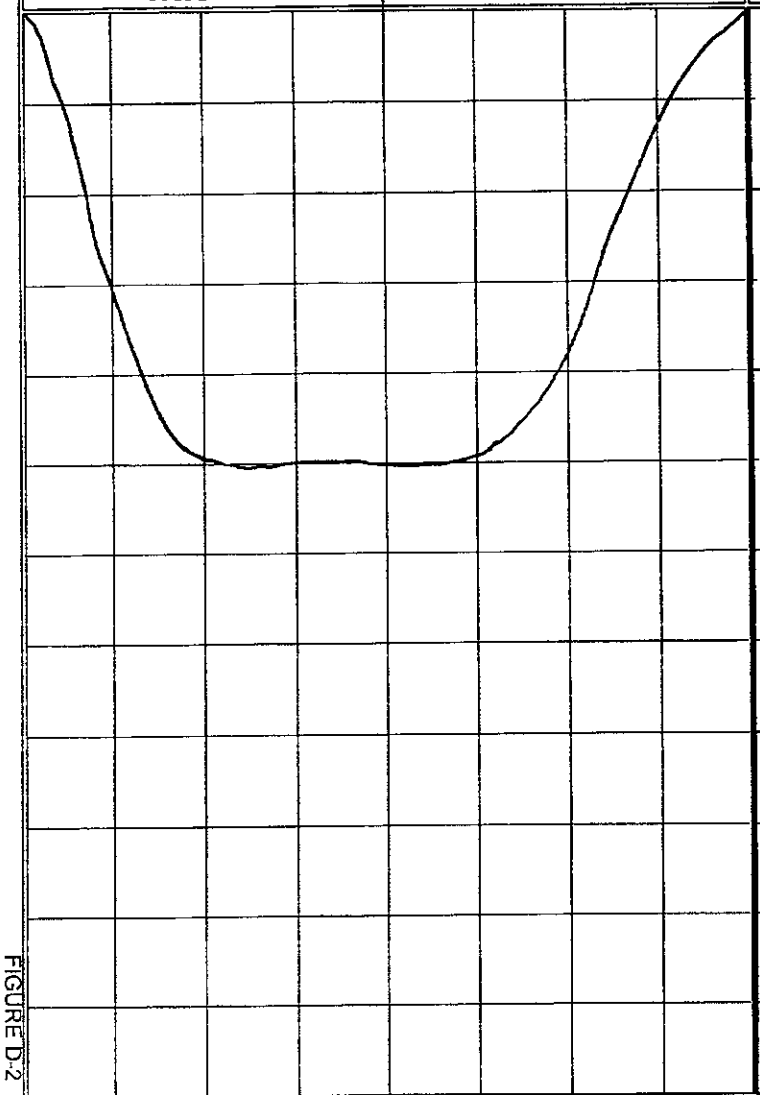
PROJECT NO.	DATE
601527001	07/07

DATE EXCAVATED 06/27/07 TEST PIT NO. TP-2

GROUND ELEVATION -- LOGGED BY DM

METHOD OF EXCAVATION Case 580-Super L Backhoe

LOCATION Hermosa Vista (See Figure 2)



DEPTH (FEET)	SAMPLES: Bulk	SAMPLES: Driven	SAMPLES: Sand Cone	MOISTURE (%)	DRY DENSITY (PCF)	CLASSIFICATION U.S.C.S.	DESCRIPTION
0						SM	FILL: Brown, damp, medium dense, silty fine to medium SAND; few fine gravel.
4						SM	ALLUVIUM: Light brown, damp, very dense, silty fine to medium SAND; numerous caliche nodules; strongly cemented. Refusal on caliche.
							Total Depth = 5 feet (Backhoe Refusal). Groundwater not encountered during excavation. Backfilled on 06/27/07 promptly after completion of excavation. Groundwater, though not encountered at the time of excavation, may rise to higher levels due to seasonal variations in precipitation and several other factors as discussed in the report.

SCALE = 1 in./2 ft.

FIGURE D-2

Ninyo & Moore

Test Pit LOG

HERMOSA VISTA DRIVE/HAWES ROAD
STORM DRAIN AND BASIN
MESA, ARIZONA

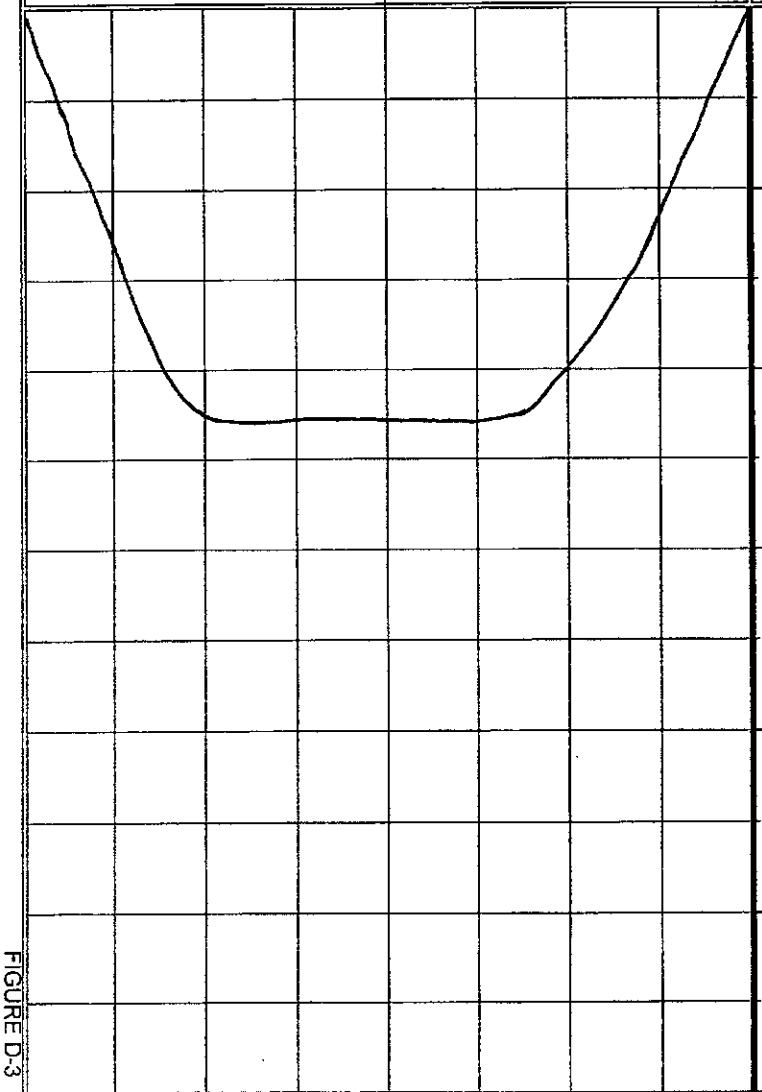
PROJECT NO.	DATE
601527001	07/07

DATE EXCAVATED 06/27/07 TEST PIT NO. TP-3

GROUND ELEVATION -- LOGGED BY DM

METHOD OF EXCAVATION Case 580-Super L Backhoe

LOCATION Hermosa Vista (See Figure 2)



DEPTH (FEET)	SAMPLES: Bulk	SAMPLES: Driven	SAMPLES: Sand Cone	MOISTURE (%)	DRY DENSITY (PCF)	CLASSIFICATION U.S.C.S.	DESCRIPTION
0						SM	FILL: Brown, damp, medium dense, silty fine to coarse SAND; few fine gravel.
4						SM	ALLUVIUM: Light brown, damp, very dense, silty fine to medium SAND; numerous caliche nodules; strongly cemented. Refusal on caliche.
							Total Depth = 4.5 feet (Backhoe Refusal). Groundwater not encountered during excavation. Backfilled on 06/27/07 promptly after completion of excavation. Groundwater, though not encountered at the time of excavation, may rise to higher levels due to seasonal variations in precipitation and several other factors as discussed in the report.

SCALE = 1 in./2 ft.

FIGURE D-3

Ninyo & Moore

Test Pit LOG

HERMOSA VISTA DRIVE/HAWES ROAD
STORM DRAIN AND BASIN
MESA, ARIZONA

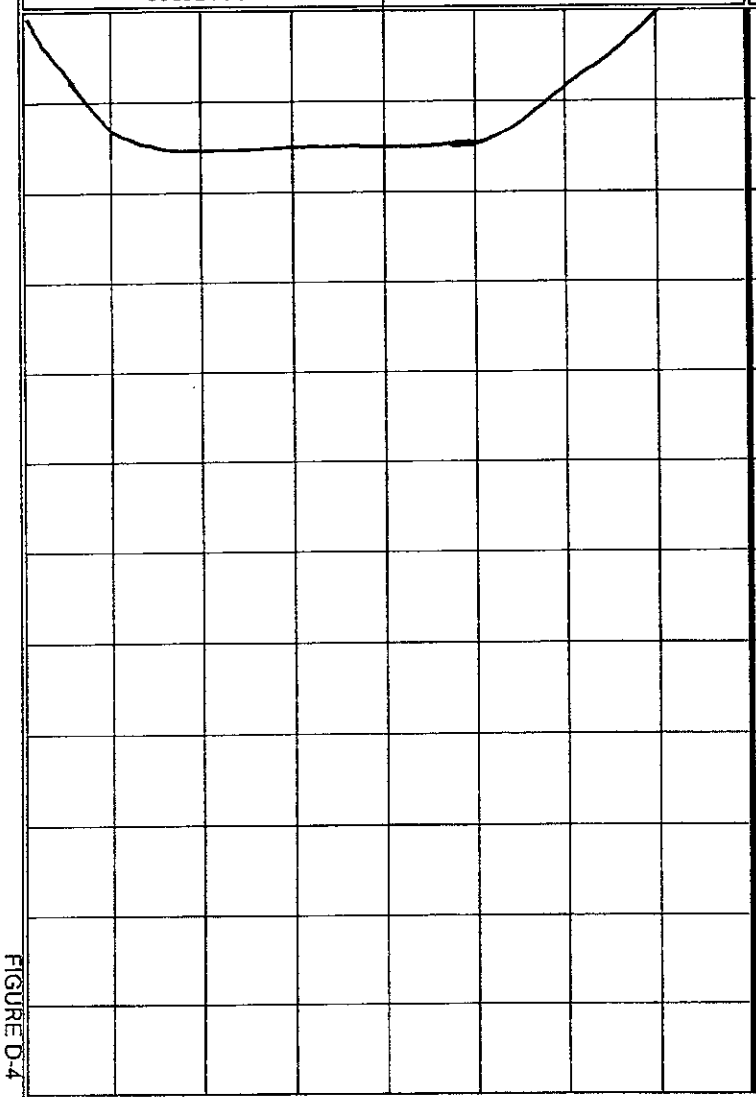
PROJECT NO.	DATE
601527001	07/07

DATE EXCAVATED 06/27/07 TEST PIT NO. TP-4

GROUND ELEVATION -- LOGGED BY DM

METHOD OF EXCAVATION Case 580-Super L Backhoe

LOCATION Hermosa Vista (See Figure 2)



DEPTH (FEET)	SAMPLES: Bulk	SAMPLES: Driven	SAMPLES: Sand Cone	MOISTURE (%)	DRY DENSITY (PCF)	CLASSIFICATION U.S.C.S.	DESCRIPTION
0						SM	ALLUVIUM: Brown, damp, very dense, silty fine to coarse SAND; numerous caliche filaments and nodules; strongly cemented. Refusal on caliche.
							Total Depth = 1.4 feet (Backhoe Refusal). Groundwater not encountered during excavation. Backfilled on 06/27/07 promptly after completion of excavation. Groundwater, though not encountered at the time of excavation, may rise to higher levels due to seasonal variations in precipitation and several other factors as discussed in the report.

SCALE = 1 in./2 ft.

FIGURE D-4

Ninyo & Moore

Test Pit LOG

HERMOSA VISTA DRIVE/HAWES ROAD
STORM DRAIN AND BASIN
MESA, ARIZONA

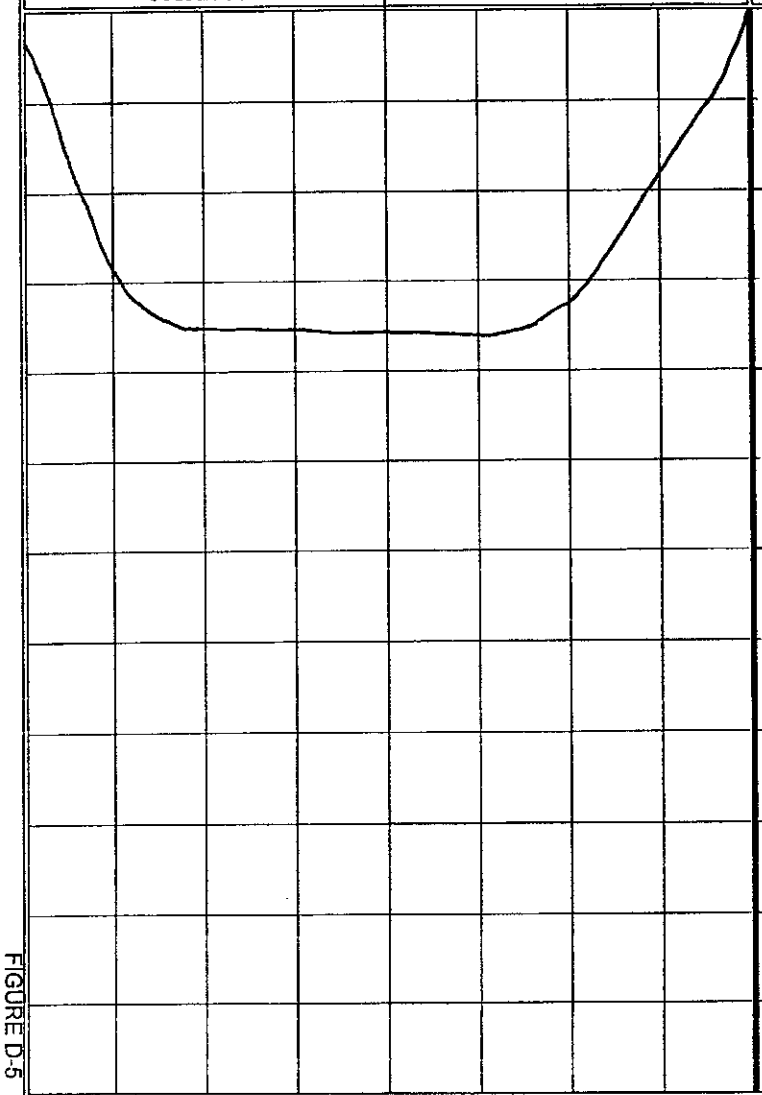
PROJECT NO.	DATE
601527001	07/07

DATE EXCAVATED 06/27/07 TEST PIT NO. TP-5

GROUND ELEVATION – LOGGED BY DM

METHOD OF EXCAVATION Case 580-Super L Backhoe

LOCATION Hermosa Vista (See Figure 2)



DEPTH (FEET)	SAMPLES: Bulk	SAMPLES: Driven	SAMPLES: Sand Cone	MOISTURE (%)	DRY DENSITY (PCF)	CLASSIFICATION U.S.C.S.	DESCRIPTION
0						SM	FILL: Brown, damp, dense to very dense, silty fine to coarse SAND with gravel.
2						SM	ALLUVIUM: Brown, damp, very dense, silty fine to coarse SAND; numerous caliche nodules; strongly cemented. Refusal on caliche.
4							Total Depth = 3.5 feet (Backhoe Refusal). Groundwater not encountered during excavation. Backfilled on 06/27/07 promptly after completion of excavation. Groundwater, though not encountered at the time of excavation, may rise to higher levels due to seasonal variations in precipitation and several other factors as discussed in the report.
6							
8							
10							
12							

SCALE = 1 in./2 ft.

FIGURE D-5

Ninyo & Moore

Test Pit LOG

HERMOSA VISTA DRIVE/HAWES ROAD
STORM DRAIN AND BASIN
MESA, ARIZONA

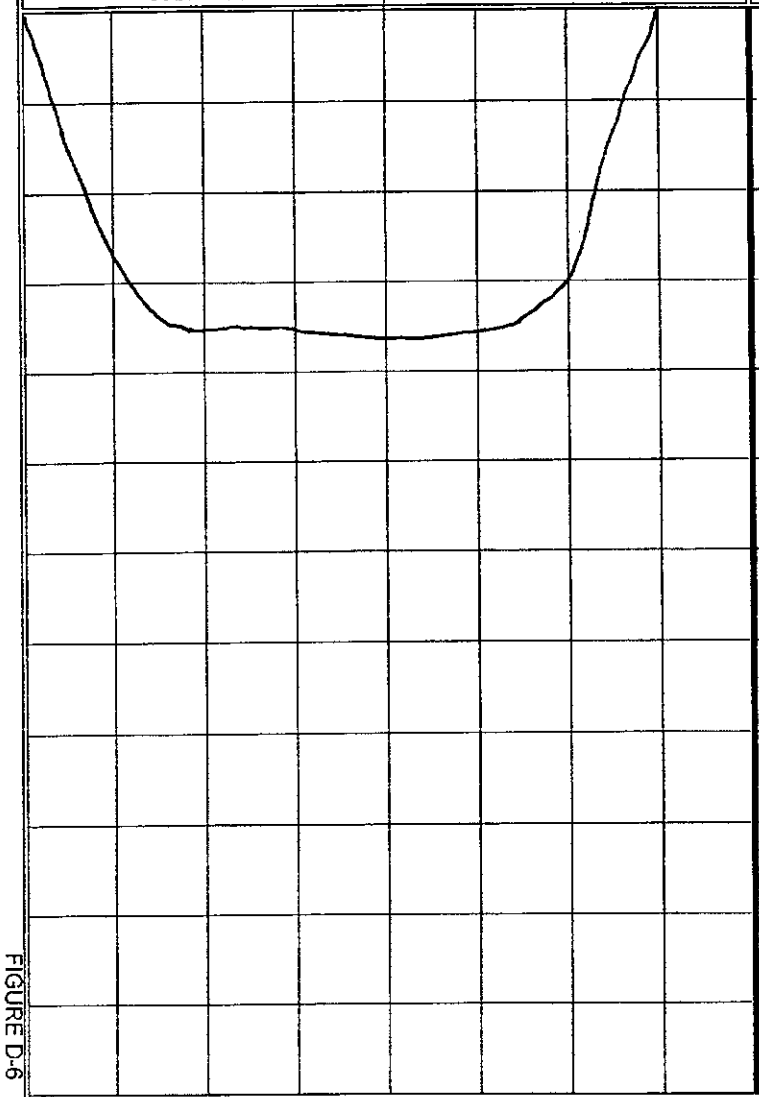
PROJECT NO.	DATE
601527001	07/07

DATE EXCAVATED 06/27/07 TEST PIT NO. TP-6

GROUND ELEVATION -- LOGGED BY DM

METHOD OF EXCAVATION Case 580-Super L Backhoe

LOCATION Hermosa Vista (See Figure 2)



DEPTH (FEET)	SAMPLES: Bulk	SAMPLES: Driven	SAMPLES: Sand Cone	MOISTURE (%)	DRY DENSITY (PCF)	CLASSIFICATION U.S.C.S.	DESCRIPTION
0						SM	FILL: Brown, damp, medium dense to dense, silty fine to coarse SAND with gravel.
2						SM	ALLUVIUM: Light brown, damp, dense to very dense, silty fine to coarse SAND with gravel; numerous caliche nodules; strongly cemented. Refusal on caliche.
4							Total Depth = 3.5 feet (Backhoe Refusal). Groundwater not encountered during excavation. Backfilled on 06/27/07 promptly after completion of excavation. Groundwater, though not encountered at the time of excavation, may rise to higher levels due to seasonal variations in precipitation and several other factors as discussed in the report.
6							
8							
10							
12							

SCALE = 1 in./2 ft.

FIGURE D-6

Ninyo & Moore

Test Pit LOG

HERMOSA VISTA DRIVE/HAWES ROAD
STORM DRAIN AND BASIN
MESA, ARIZONA

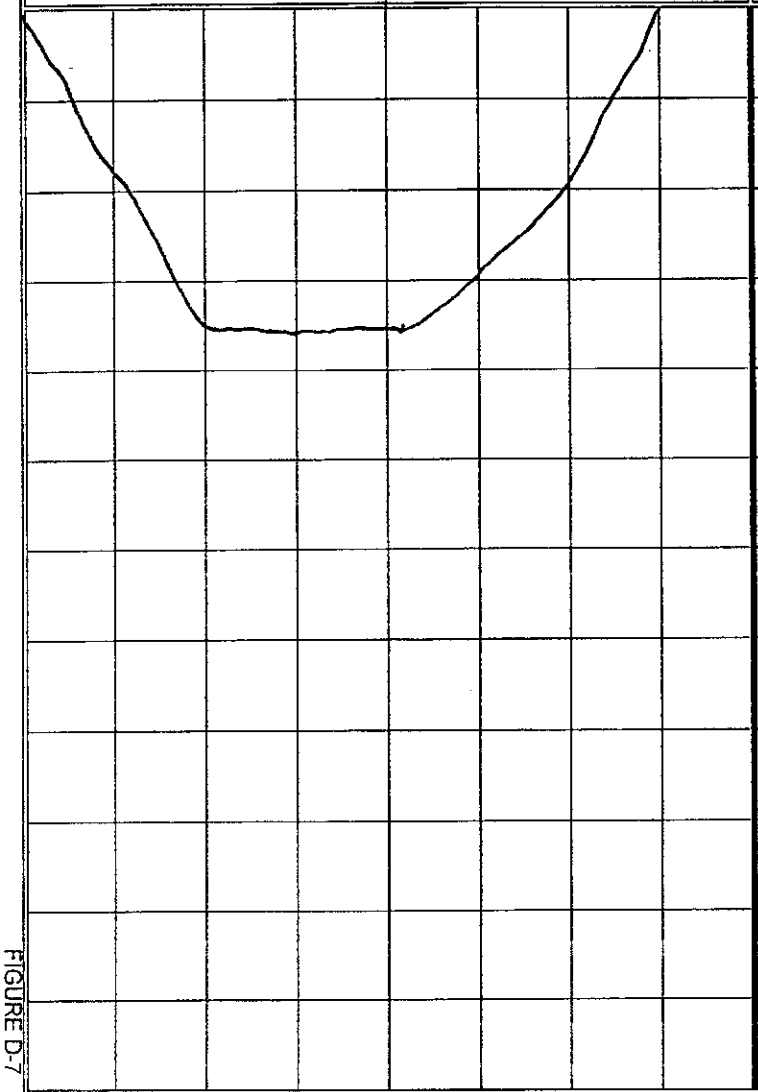
PROJECT NO.	DATE
601527001	07/07

DATE EXCAVATED 06/27/07 TEST PIT NO. TP-7

GROUND ELEVATION – LOGGED BY DM

METHOD OF EXCAVATION Case 580-Super L Backhoe

LOCATION Hawes Road (See Figure 2)



DEPTH (FEET)	SAMPLES: Bulk	SAMPLES: Driven	SAMPLES: Sand Cone	MOISTURE (%)	DRY DENSITY (PCF)	CLASSIFICATION U.S.C.S.	DESCRIPTION
0						SM	ALLUVIUM: Brown, damp, medium dense to dense, silty fine to coarse SAND; few fine gravel. Numerous caliche nodules; strongly cemented. Refusal on caliche.
							Total Depth = 3.5 feet (Backhoe Refusal). Groundwater not encountered during excavation. Backfilled on 06/27/07 promptly after completion of excavation. Groundwater, though not encountered at the time of excavation, may rise to higher levels due to seasonal variations in precipitation and several other factors as discussed in the report.

SCALE = 1 in./2 ft.

FIGURE D-7

Ninyo & Moore

Test Pit LOG

HERMOSA VISTA DRIVE/HAWES ROAD
STORM DRAIN AND BASIN
MESA, ARIZONA

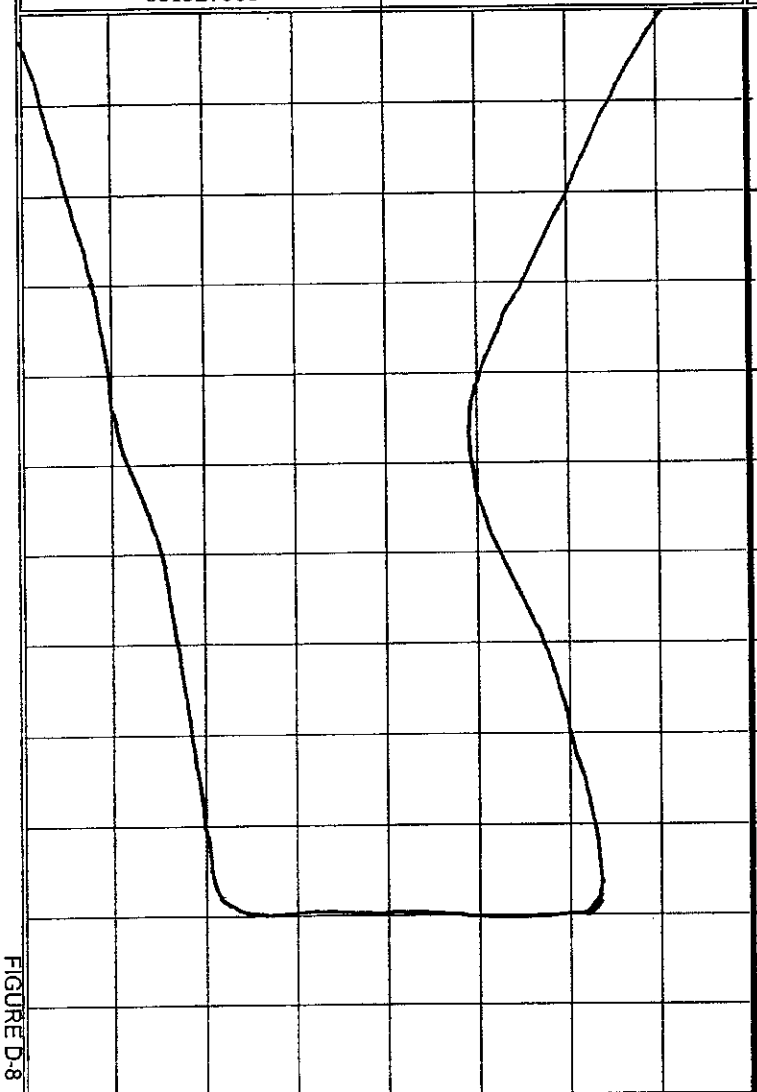
PROJECT NO.	DATE
601527001	07/07

DATE EXCAVATED 06/27/07 TEST PIT NO. TP-8

GROUND ELEVATION -- LOGGED BY DM

METHOD OF EXCAVATION Case 580-Super L Backhoe

LOCATION McDowell Road (See Figure 2)



DEPTH (FEET)	SAMPLES: Bulk	SAMPLES: Driven	SAMPLES: Sand Cone	MOISTURE (%)	DRY DENSITY (PCF)	CLASSIFICATION U.S.C.S.	DESCRIPTION
0						SM	ALLUVIUM: Brown, damp, medium dense, silty fine to coarse SAND; few fine gravel.
							Numerous caliche nodules.
10							Total Depth = 10 feet. Groundwater not encountered during excavation. Backfilled on 06/27/07 promptly after completion of excavation. Groundwater, though not encountered at the time of excavation, may rise to higher levels due to seasonal variations in precipitation and several other factors as discussed in the report.

SCALE = 1 in./2 ft.

FIGURE D-8

Photo 1. View of TP-1

Photo 2. View of TP-1

Photo 3. View of TP-1 Spoil Pile

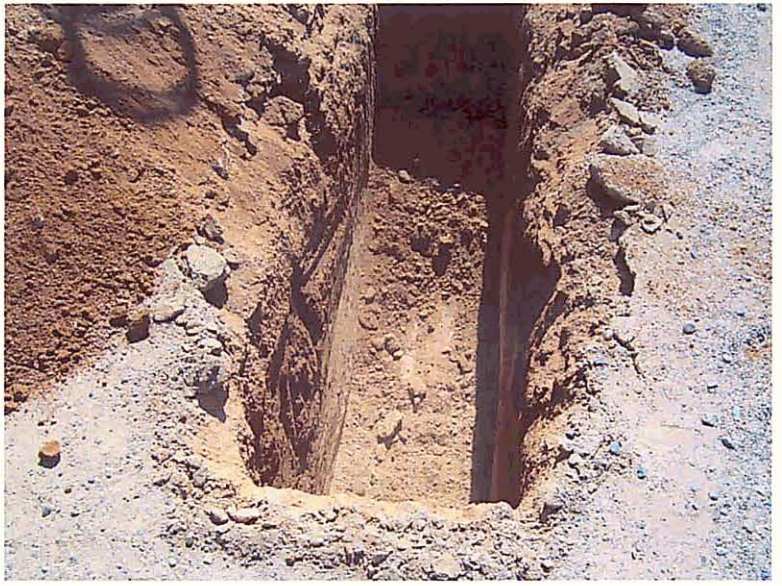


Photo 4. View of TP-2

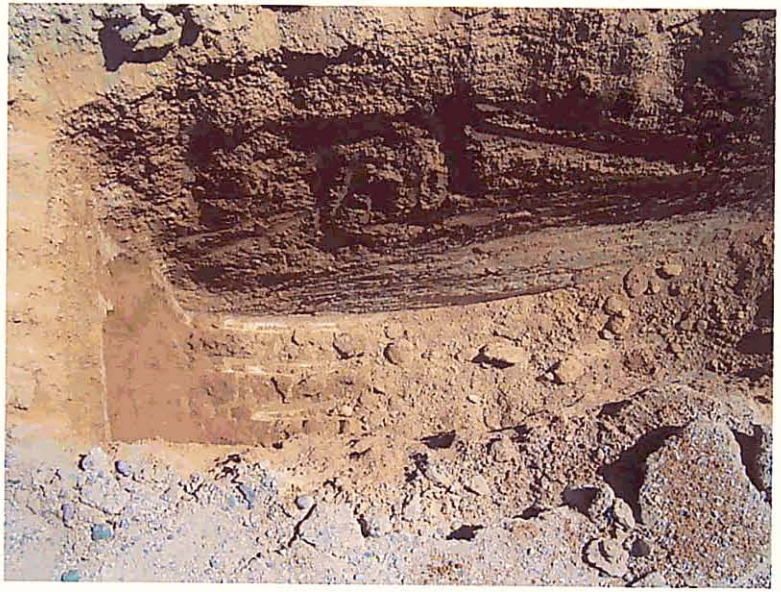


Photo 5. View of TP-2

Photo 6. View of TP-2 Spoil Pile

Photo 7. View of TP-3

Photo 8. View of TP-3

Photo 9. View of TP-3 Spoil Pile

Photo 10. View of TP-5

Photo 11. View of TP-6

Photo 12. View of TP-6 Spoil Pile

APPENDIX E

SEISMIC REFRACTION SURVEY RESULTS

APPENDIX E

GEOPHYSICAL SEISMIC REFRACTION SURVEY

Ninyo and Moore personnel conducted seismic refraction surveys at the site on June 26 and 27, 2007, to evaluate the rippability characteristics of the near surface materials. The seismic refraction data were collected with a SmartSeis S12, high performance exploration seismograph and 12 vertical component geophones. A 10-pound hammer and metal plate were used as the seismic wave source. A total of 10 seismic refraction traverses were performed, and the approximate locations of the traverses are depicted on Figure 2.

The seismic refraction method uses first-arrival times of refracted seismic waves in units of milliseconds to evaluate the thicknesses and seismic velocities of subsurface layers. Seismic waves generated by hammer at the ground surface at a given "shot" point are refracted at boundaries separating materials of contrasting material velocities. These refracted seismic waves are then detected by a series of surface geophones and recorded with a seismograph. The measured time that the seismic wave signals take to travel to each geophone are used in conjunction with the known shot-to-geophone horizontal distances to obtain thickness and velocity information about the subsurface materials.

The refraction method requires that subsurface velocities (and therefore material density) increase with depth. A layer having a velocity lower than that of the layer which overlies it will not be detectable by the seismic refraction method and, therefore, could lead to errors in the depth calculations of subsequent layers. This is known as a "velocity inversion" problem. In addition, relatively significant lateral variations in velocity, such as those which occur at shallow buried discontinuous caliche deposits that are surrounded by lower velocity soils, can also result in the misinterpretation of the subsurface conditions when using this method. Near surface accumulations of significant caliche deposits can create velocity inversion problems as the caliche generally has a higher velocity than surrounding non-caliche soils, and will often mimic bedrock velocities. This means that the relatively near surface caliche we encountered in our explorations may preclude acquiring velocity and depth data for materials underlying the caliche at our survey

locations. Several of our test pits for this project encountered backhoe refusal on caliche at relatively shallow depths, generally 3.5 feet bgs or less. However, using auger drilling equipment, several of our small-diameter soil borings were able to penetrate the caliche layers.

In general, seismic wave velocities can be correlated to material density and/or rock hardness. The relationship between rippability and seismic velocity is empirical and assumes a homogenous mass for each detected layer. Localized areas of differing composition, texture, or structure may affect both the measured data and the actual rippability of the mass. The rippability of a mass is also dependent on the excavation equipment used and the skill and experience of the equipment operator.

The following rippability chart (Table E-1) is based on our experience with similar materials. It assumes that a Caterpillar D-9 dozer ripping with a single shank is used. We emphasize that the cutoffs in this classification scheme are approximate and that soil characteristics can play a significant role in determining excavation rates and rippability. In addition, where excavations encounter or penetrate weathered or fresh bedrock, rock characteristics, such as depth of and degree of weathering, degree of cementation (if any), the presence or absence of fractures and/or joints, and fracture/joint spacing and orientation, also play a significant role in determining rock rippability. These soil and rock characteristics may also vary with location and depth.

Table E-1 - Qualitative Rippability Classification

0 to 2000 ft/s	Easy Ripping
2000 to 4000 ft/s	Moderate Ripping
4000 to 5500 ft/s	Difficult Ripping, Possible Blasting
5500 to 7000 ft/s	Very Difficult Ripping, Probable Blasting
Greater than 7000 ft/s	Blasting Generally Required

For trenching and other relatively narrow excavation operations, the rippability figures should be scaled downward. For example, velocities as low as 3,200 feet per second might indicate difficult ripping or possible blasting during trenching operations. In addition, the presence of cobbles and

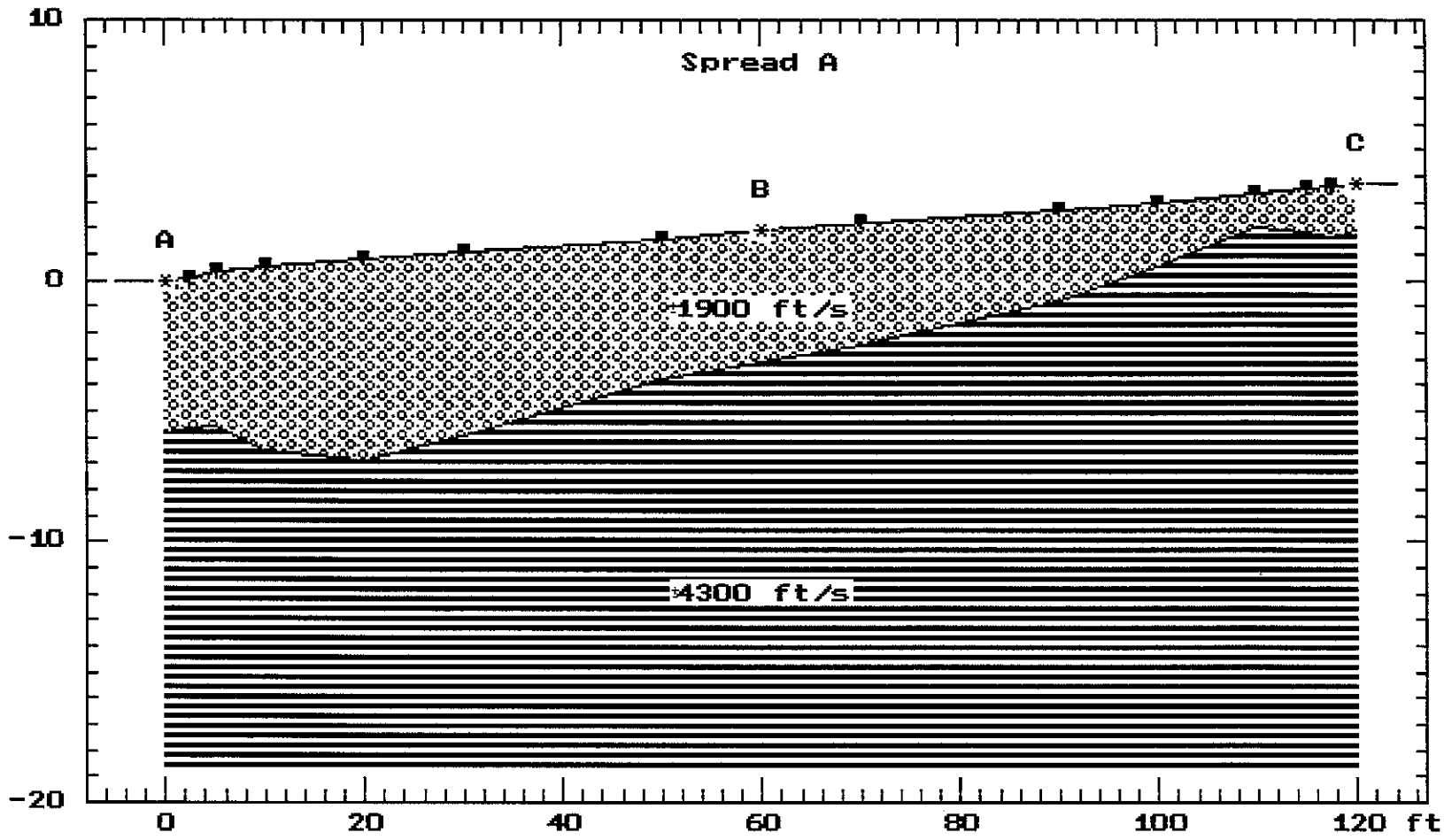
boulders, and eroded remnants of weathered bedrock and fresh bedrock, which can be trouble-some in trench excavations, should be anticipated. Based on our visual field observations, results from our test pits, and our seismic refraction survey results, the presence of near-surface bedrock and/or cemented soils is anticipated in this area. It is also possible that variations in erosion rates and fracture density and spacing may have caused variable depths to bedrock and/or cemented soils. It is also possible that a spatially varying presence of cemented soils and/or buried bedrock, including weathered and non-weathered bedrock remnants, in addition to boulders and cobbles, might be encountered in areas of the site. The above classification scheme should be used with discretion, and contractors should not be relieved of making their own independent evaluation of the rippability of the on-site materials prior to submitting their bids. Table E-2 lists the average velocities and depths calculated from the seismic refraction traverses conducted during this evaluation. Our seismic refraction layer profiles are presented as Figures E-1 through E-10.

It should also be noted that, as a general rule of thumb, the effective depth of evaluation for a seismic refraction traverse is approximately one-third to one-fifth the length of the refraction line. The lengths of the seismic refraction lines are listed, with our interpretations, in Table E-2.

Table E-2 – Seismic Refraction Results

Traverse No. And Length	Approximate Velocity Feet/Second	Approximate Depth to Bottom of Layer (range in feet below ground surface)	Rippability
SL-1 120 feet	V1 = 1,900 V2 = 4,300	1-8 --	Easy Ripping Difficult Ripping, Possible Blasting
SL-2 120 feet	V1 = 2,500 V2 = 4,600	1-6 --	Moderate Ripping Difficult Ripping, Possible Blasting
SL-3 80 feet	V1 = 1,700 V2 = 5,200	2-3 --	Easy Ripping Difficult Ripping, Possible Blasting
SL-4 120 feet	V1 = 2,100 V2 = 6,000	1-6 --	Moderate Ripping Very Difficult Ripping, Probable Blasting
SL-5 120 feet	V1 = 2,200 V2 = 6,000	1-5 --	Moderate Ripping Very Difficult Ripping, Probable Blasting
SL-6 80 feet	V1 = 1,900 V2 = 4,200	<1-3 --	Easy Ripping Difficult Ripping, Possible Blasting
SL-7 80 feet	V1 = 1,300 V2 = 4,300	1-4 --	Easy Ripping Difficult Ripping, Possible Blasting
SL-8 120 feet	V1 = 1,700 V2 = 3,800	1-4 --	Easy Ripping Moderate Ripping
SL-9 120 feet	V1 = 2,100 V2 = 3,600	2-6 --	Moderate Ripping Moderate Ripping
SL-10 120 feet	V1 = 1,800 V2 = 4,800	2-4 --	Easy Ripping Difficult Ripping, Possible Blasting

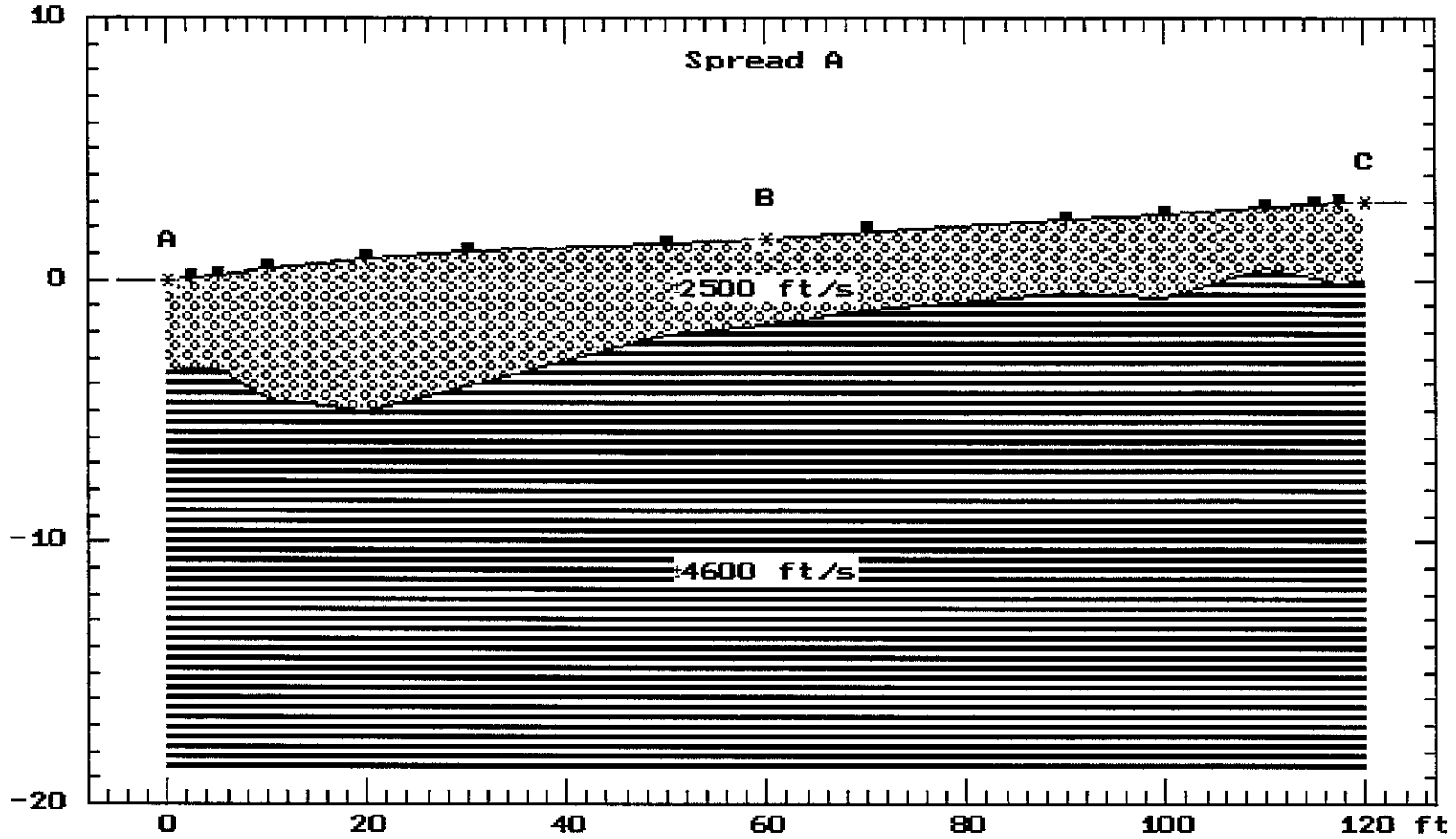
HERMOSA VISTA STORM DRAIN AND BASIN, SEISMIC REFRACTION SURVEY, SL-1



Ninyo & Moore		SEISMIC REFRACTION SURVEY SL-1	FIGURE
PROJECT NO: 601527001	DATE: 07/07	HERMOSA VISTA DRIVE/HAWES ROAD STORM DRAIN AND BASIN MESA, ARIZONA	E-1

file no: 1527sei0707a

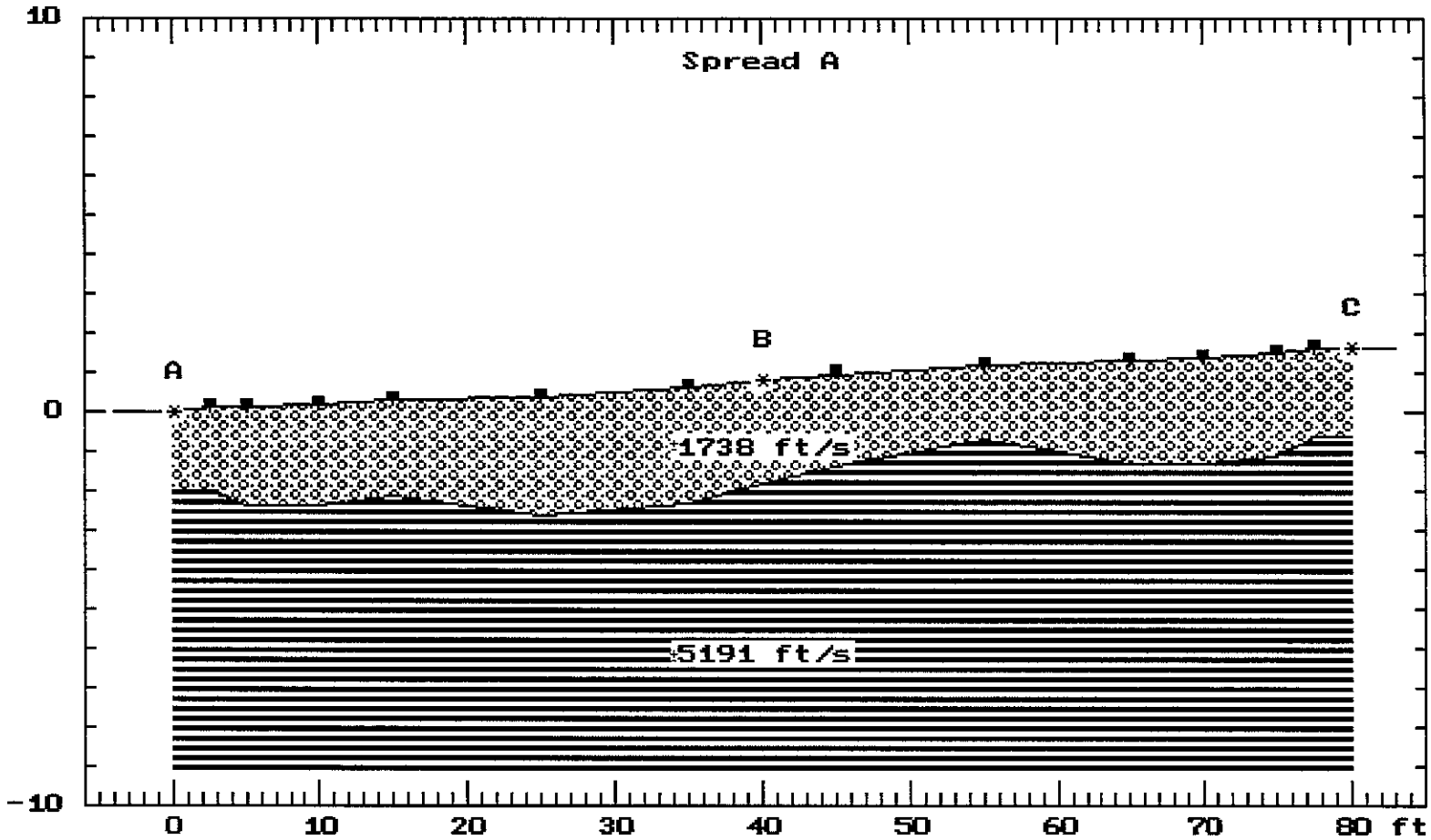
HERMOSA VISTA STORM DRAIN AND BASIN, SEISMIC REFRACTION SURVEY, SL-2



Ninyo & Moore	SEISMIC REFRACTION SURVEY SL-2	FIGURE
PROJECT NO: 601527001 / DATE: 07/07	HERMOSA VISTA DRIVE/HAWES ROAD STORM DRAIN AND BASIN MESA, ARIZONA	E-2

file no: 1527sei0707a

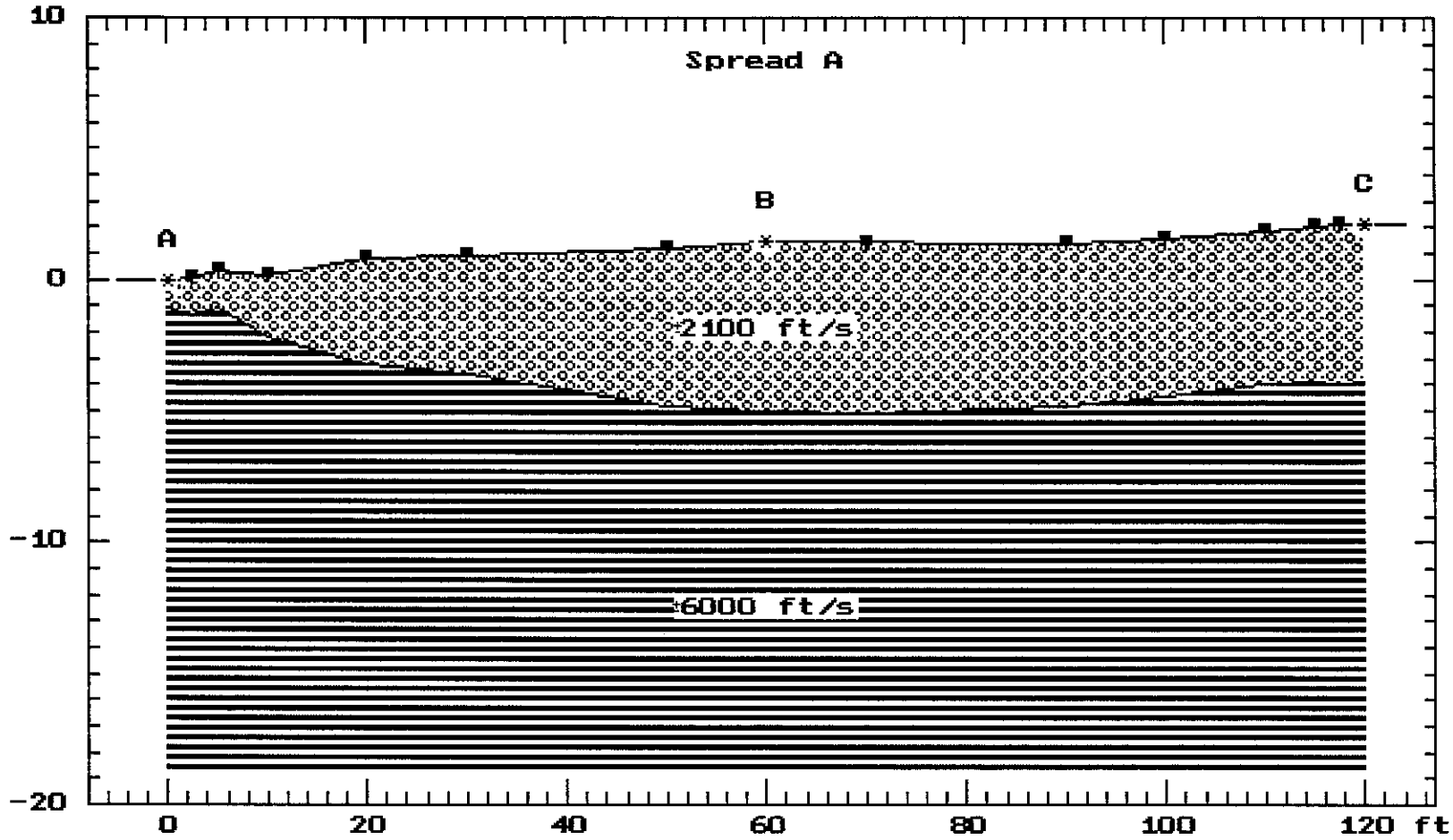
HERMOSA VISTA STORM DRAIN AND BASIN, SEISMIC REFRACTION SURVEY, SL-3



Ninyo & Moore		SEISMIC REFRACTION SURVEY SL-3	FIGURE
PROJECT NO: 601527001	DATE: 07/07	HERMOSA VISTA DRIVE/HAWES ROAD STORM DRAIN AND BASIN MESA, ARIZONA	E-3

file no: 1527sei0707c

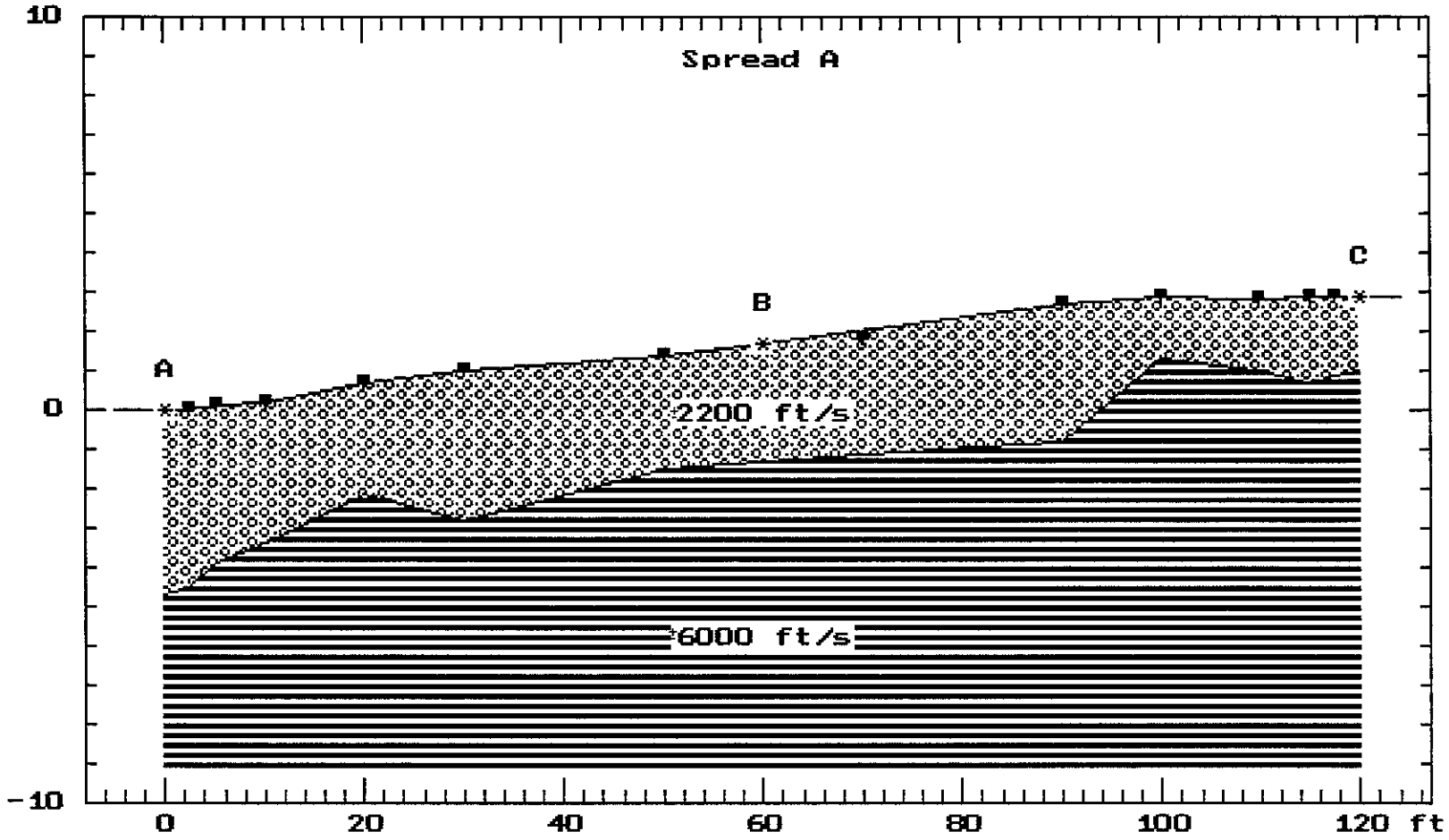
HERMOSA VISTA STORM DRAIN AND BASIN, SEISMIC REFRACTION SURVEY, SL-4



Ninyo & Moore	SEISMIC REFRACTION SURVEY SL-4	FIGURE
PROJECT NO: 601527001 / DATE: 07/07	HERMOSA VISTA DRIVE/HAWES ROAD STORM DRAIN AND BASIN MESA, ARIZONA	E-4

file no: 1527sei0707d

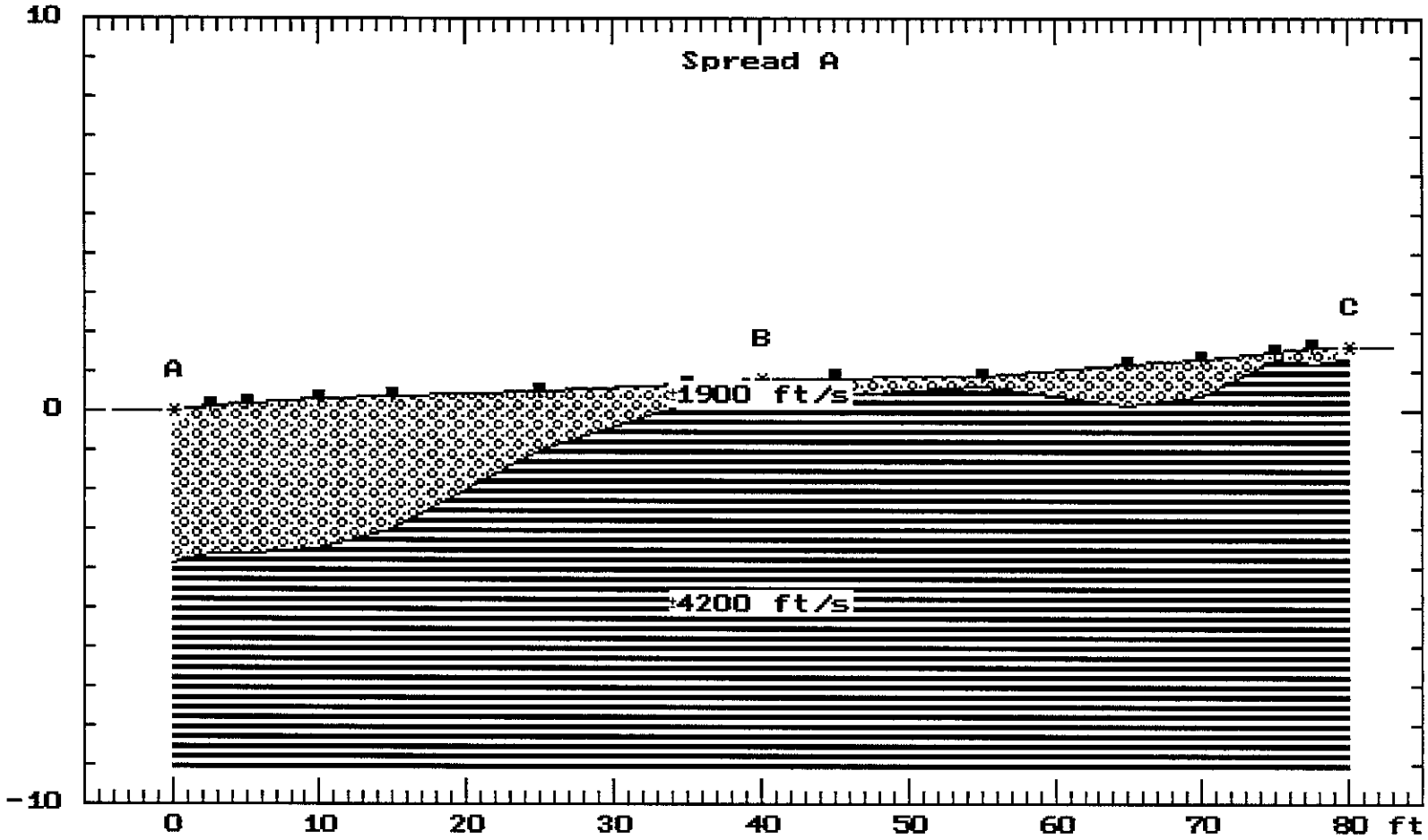
HERMOSA VISTA STORM DRAIN AND BASIN, SEISMIC REFRACTION SURVEY, SL-5



Ninyo & Moore	SEISMIC REFRACTION SURVEY SL-5	FIGURE
PROJECT NO: 601527001 / DATE: 07/07	HERMOSA VISTA DRIVE/HAWES ROAD STORM DRAIN AND BASIN MESA, ARIZONA	E-5

file no: 1527sei0707e

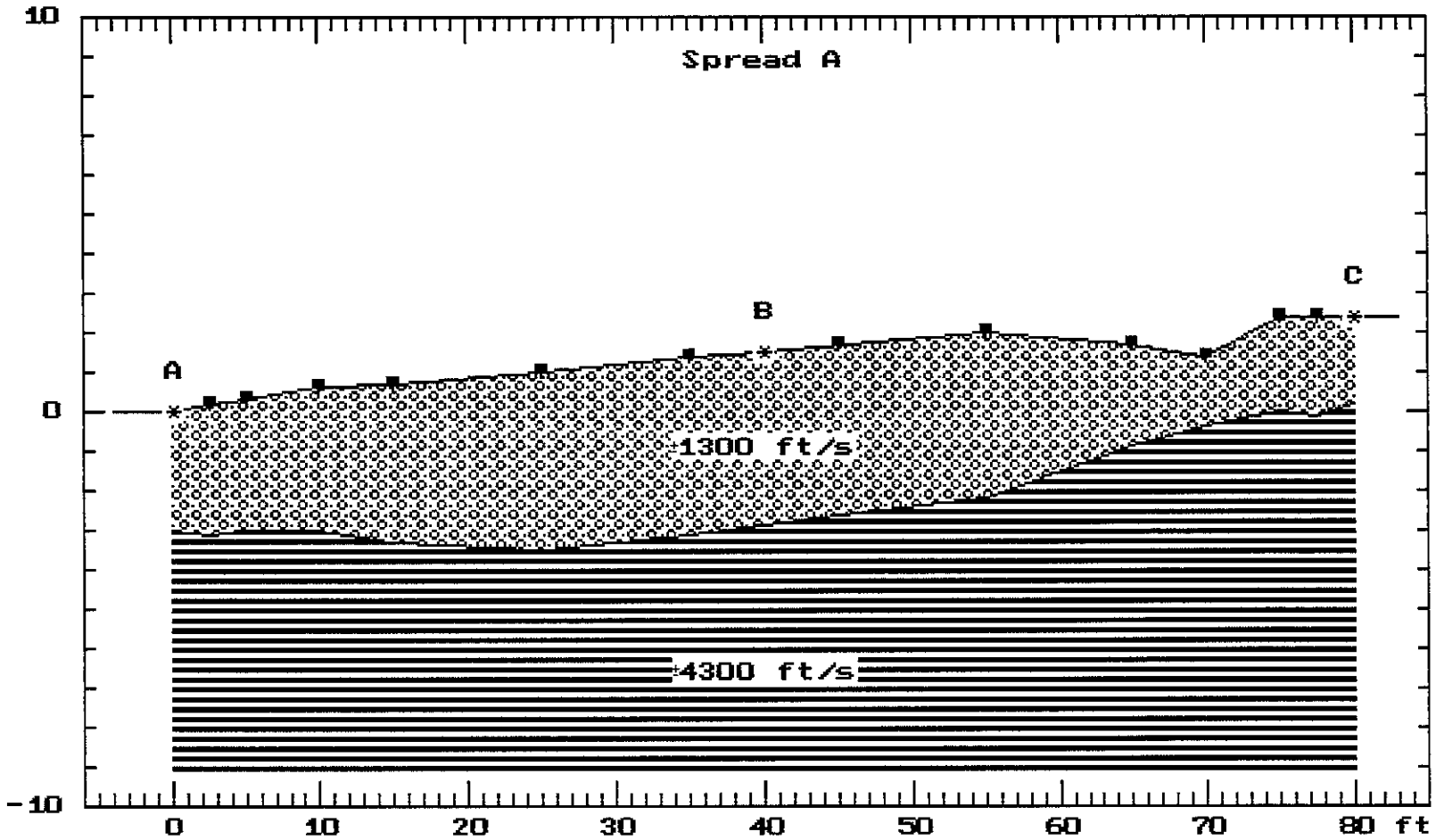
HERMOSA VISTA STORM DRAIN AND BASIN, SEISMIC REFRACTION SURVEY, SL-6



Ninyo & Moore	SEISMIC REFRACTION SURVEY SL-6	FIGURE
PROJECT NO: 601527001 / DATE: 07/07	HERMOSA VISTA DRIVE/HAWES ROAD STORM DRAIN AND BASIN MESA, ARIZONA	E-6

file no: 1527sei0707f

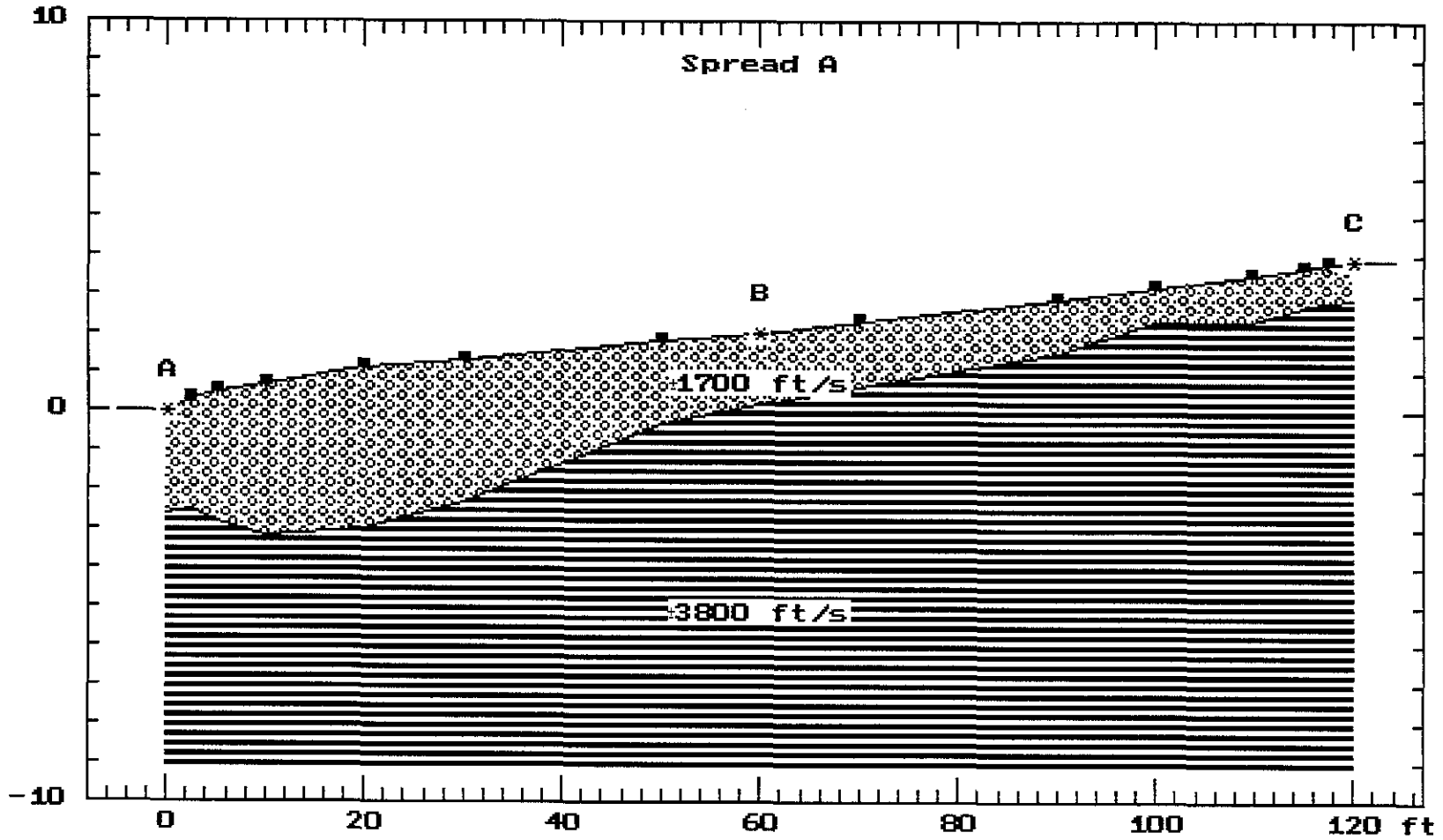
HERMOSA VISTA STORM DRAIN AND BASIN, SEISMIC REFRACTION SURVEY, SL-7



Ninyo & Moore	SEISMIC REFRACTION SURVEY SL-7	FIGURE
PROJECT NO: 601527001 / DATE: 07/07	HERMOSA VISTA DRIVE/HAWES ROAD STORM DRAIN AND BASIN MESA, ARIZONA	E-7

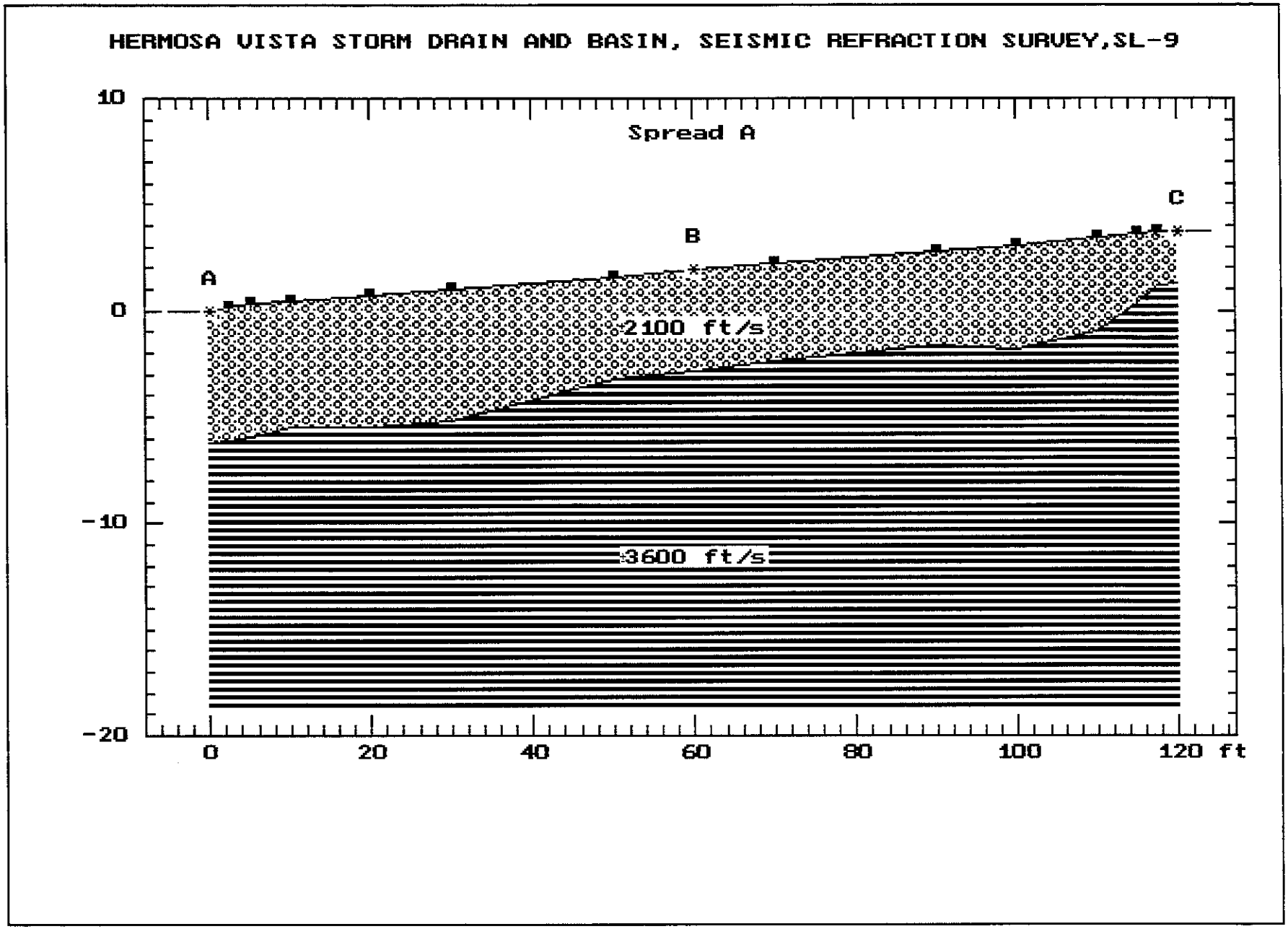
file no: 1527sei0707g

HERMOSA VISTA STORM DRAIN AND BASIN, SEISMIC REFRACTION SURVEY, SL-8



Ninyo & Moore		SEISMIC REFRACTION SURVEY SL-8	FIGURE
PROJECT NO: 601527001	DATE: 07/07	HERMOSA VISTA DRIVE/HAWES ROAD STORM DRAIN AND BASIN MESA, ARIZONA	E-8

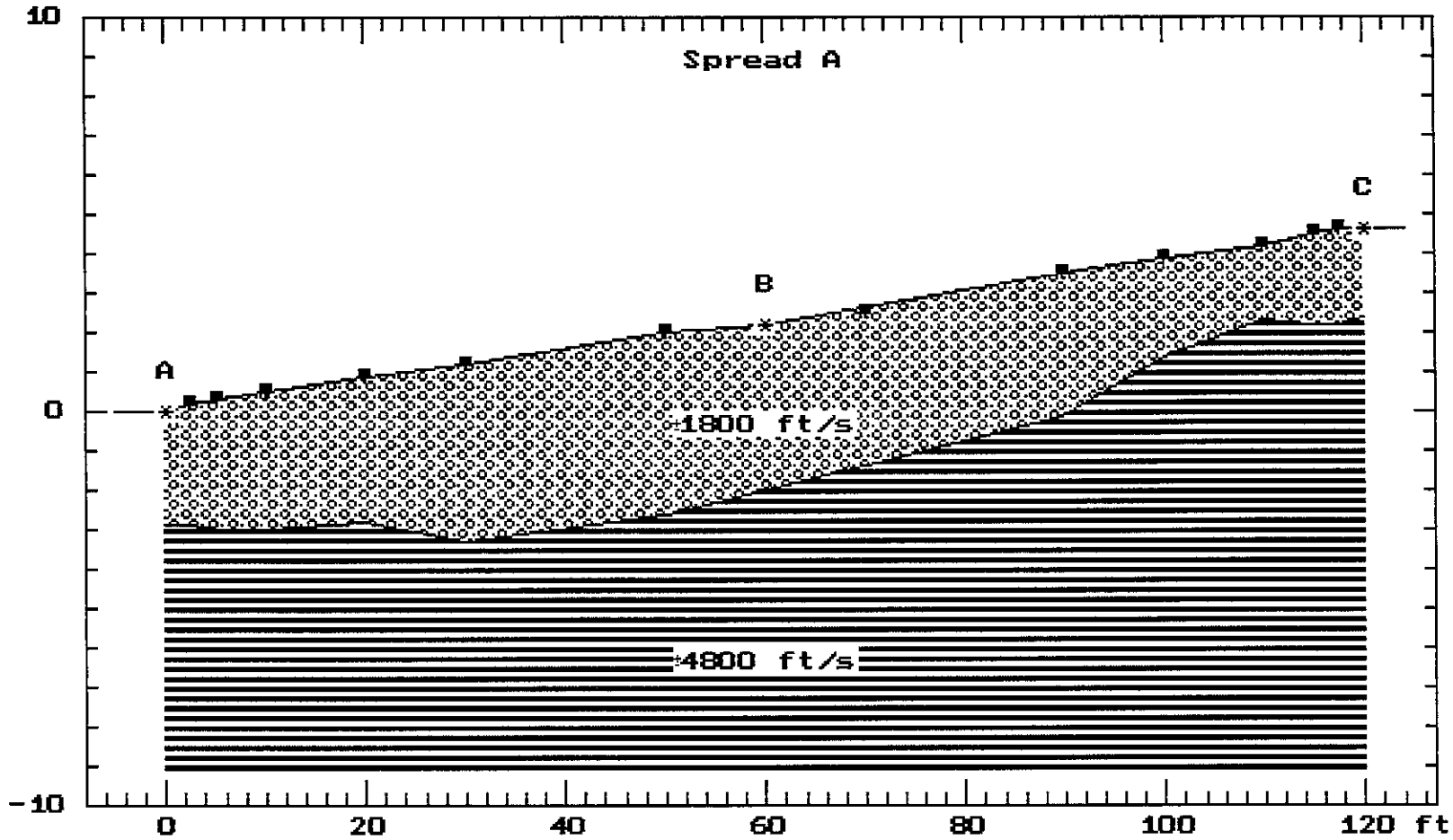
file no: 1527sel0707h



Ninyo & Moore	SEISMIC REFRACTION SURVEY SL-9	FIGURE
PROJECT NO: 601527001 / DATE: 07/07	HERMOSA VISTA DRIVE/HAWES ROAD STORM DRAIN AND BASIN MESA, ARIZONA	E-9

file no: 1527sei0707i

HERMOSA VISTA STORM DRAIN AND BASIN, SEISMIC REFRACTION SURVEY, SL-10



Ninyo & Moore	SEISMIC REFRACTION SURVEY SL-10	FIGURE
PROJECT NO: 601527001 / DATE: 07/07	HERMOSA VISTA DRIVE/HAWES ROAD STORM DRAIN AND BASIN MESA, ARIZONA	E-10

file no: 1527sei0707j