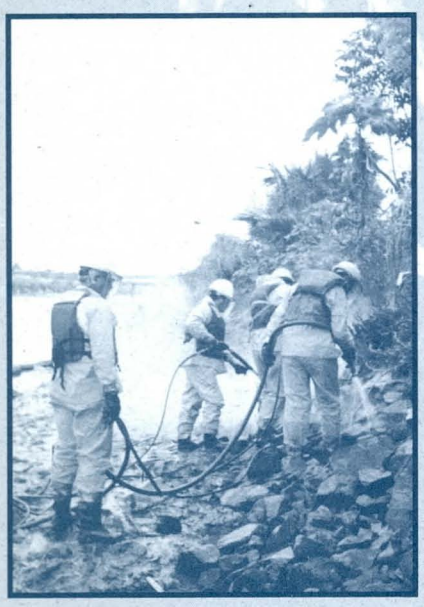
DRAFT GEOTECHNICAL EVALUATION
NORTH INLET CHANNEL
WHITE TANKS
FLOOD RETARTING STRUCTURE NO. 3
MARICOPA COUNTY, ARIZONA



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Ninyo & Moore

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Geotechnical and Environmental Sciences Consultants

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NORTH INLET CHANNEL
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MARICOPA COUNTY, ARIZONA

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December 7, 2004
Project No. 600760001

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December 7, 2004
Project No. 600760001

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Subject: Draft Geotechnical Evaluation
North Inlet Channel
White Tanks Flood Retarting Structure No. 3
Maricopa County, Arizona

Dear Mr. Ling:

In accordance with your authorization dated August 30, 2004, we have performed a geotechnical evaluation for proposed channel improvements in Maricopa County, Arizona. This report presents our geotechnical findings, conclusions and recommendations for the design and construction of the subject project.

We appreciate the opportunity to be of service on this project. If you have any questions or comments regarding our report, please do not hesitate to contact our office.

Sincerely,
NINYO & MOORE

Steven D. Nowaczyk, P.E.
Senior Project Engineer

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JSR/SDN/RM/hmm

Distribution: (3) Addressee

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1. INTRODUCTION

In accordance with your authorization dated August 30, 2004, we have performed a geotechnical evaluation for proposed channel improvements in Maricopa County, Arizona. The purpose of our evaluation was to assess the general subsurface conditions along the proposed channel alignment in order to formulate geotechnical recommendations for design and construction. This report presents the results of our evaluation of the project, and our geotechnical conclusions and recommendations regarding the proposed construction.

2. SCOPE OF SERVICES

Ninyo & Moore's scope of services for this project included review of pertinent background data, performance of a geologic reconnaissance, subsurface evaluation, laboratory testing, and engineering analysis. Specifically, we performed the following tasks:

- Review of the background data listed in the Selected References section of this report. The data reviewed included topographic maps, geologic data and aerial photographs.
- Marking out the boring locations based on the drawings provided by your company and notifying Arizona Blue Stake of the boring locations prior to drilling.
- Excavating eight small diameter exploratory borings along the proposed channel alignment. Driven split-spoon and bulk samples were obtained during the drilling operations and transported to our laboratory in Phoenix for testing and evaluation. The boring logs are presented in Appendix A.
- Collecting four surface soil samples by hand near the Cholla Wash influent and the existing Flood Retarting Structure (FRS) No. 3 embankment.
- Testing selected samples obtained from the borings and hand samples to evaluate in-situ moisture content and dry density, sieve analysis, Atterberg limits, shear strength, and maximum density characteristics. The results of the laboratory testing are presented on the boring logs or in Appendix B.
- Conducting engineering analysis of the data obtained.
- Preparing this report that presents our findings, conclusions, and recommendations regarding the design and construction of the proposed channel improvements.

3. PROPOSED CONSTRUCTION

The project includes the design and construction of a diversion channel that will be located parallel to the Beardsley Canal, roughly between Olive Avenue and Northern Avenue, a distance of approximately 1 mile. The channel will divert surface water flows from the Beardsley Wash at Olive Avenue (to the east side of the Beardsley Canal), convey this water to the south in an open, unlined channel and then divert the flow back to the west side of the Beardsley Canal at Northern Avenue. The new channel will be constructed by excavating the existing soils and using the spoils to construct the side slopes. The depth of excavation needed will be on the order of 10 to 15 feet.

The diversion channel crossings at Olive and Northern Avenues will be situated below the existing Beardsley Canal. These excavations could be on the order to 20 feet deep. The construction technique used for these crossings are not know at this time; however, it is likely that this construction will be accomplished during a Beardsley Canal shut-down period and conventional "cut and cover" excavation methods will be used with sloped excavations.

In addition to the new diversion channel, bank protection measures will be provided along the east side of the Beardsley Wash, specifically where the Cholla Wash influent is located and along the previously improved segment of the wash that is located to the south of Northern Avenue.

4. SITE DESCRIPTION

The project site to generally bordered by residential development to the west and undeveloped land to the east. The Beardsley Canal is situated near the middle of the project site and is situated in a north-south alignment. This canal is concrete lined is continuously flowing with water. The Beardsley Canal Wash is located adjacent to the Beardsley Canal to the west and is ephemeral. The vegetation on the east side of the Beardsley Canal consisted of low lying brush and scattered trees, while the vegetation on the west side of the canal (specifically within the Beardsley Canal Wash) included larger trees at a higher density.

The proposed diversion channel alignment is located within Section 33, Township 2 and 3 North and Range 33 West. Based on the surveying information that was provided by Consultant Engineering, Inc., the ground surface elevations at our boring locations varied from approximately 1,278 feet relative to mean sea level (MSL) near the north end of the project site to approximately 1,234 feet MSL near the south end of the project site. The surrounding area typically sloped from the northwest to the southeast.

Two aerial photographs were reviewed for this project. A 1973 United States Department of Agriculture and 2004 Maricopa County aerial photographs depict the site to be mostly undeveloped land, very similar to its current condition. However, the 1973 photograph did not depict the current residential development that is located on the west side of the Beardsley Canal Wash. Our evaluation of the aerial photographs and visual reconnaissance did not indicate large disturbed areas that might be indicative of past development or filling.

5. FIELD EXPLORATION AND LABORATORY TESTING

On October 26, 2004 Ninyo & Moore conducted a subsurface exploration at the proposed diversion channel in order to evaluate the existing subsurface conditions and to collect soil samples for laboratory testing. This exploration was conducted by drilling eight boreholes, designated as B-1 through B-8, using a CME-75 truck-mounted drill rig equipped with hollow-stem augers. The borings were each drilled to a depth of about 20 feet below ground surface (bgs). Bulk and relatively undisturbed soil samples were collected at selected intervals. Detailed descriptions of the soils encountered are presented in the boring logs in Appendix A.

The ground surface elevations at each boring were measured by Consultant Engineering, Inc of Phoenix, Arizona, after the drilling was finished. The elevations of each boring location are presented on the logs. The general locations of each of the borings are denoted on the Soil Boring and Hand Sample Location Map (Figure 2).

On November 16, 2004, a Ninyo & Moore representative collected four surface soil samples using hand sampling equipment at four locations within the project site. Two of these sampling

locations (denoted as HS-1 and HS 2) were located near the Cholla Wash influent to the Beardsley Canal Wash. The other two hand sampling locations (denoted as HS-3 and HS-4) were located on the FRS No. 3 embankment, south of Northern Avenue. The approximate locations of these hand sampling points are depicted on the Soil Boring and Hand Sample Location Map (Figure 2).

Laboratory testing was performed on select representative samples collected during our subsurface evaluation to evaluate in-situ moisture content and dry density, sieve analysis, Atterberg limits, shear strength, and maximum density characteristics. The results of the in-situ moisture and dry density tests are shown on the boring logs that are presented in Appendix A. Other laboratory test results are presented in Appendix B.

6. GEOLOGY AND SUBSURFACE CONDITIONS

Our findings regarding regional geology, including landsliding, faulting and seismicity, liquefaction, and groundwater conditions along the proposed alignments are provided in the following sections.

6.1. Geologic Setting

The project site is located in the Basin and Range physiographic province. The Basin and Range physiographic province 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 13 million years ago during the mid- to late-Tertiary. Extensional tectonics resulted in the formation of horsts (mountains) and grabens (basins) with vertical displacement along high-angle normal faults. Intermittent volcanic activity also occurred during this time. The 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 surface geology of the locations of the borings is described as Holocene (<10,000 years) to Middle Pleistocene (<790,000 years) age alluvium. The deposits have varying amounts of calcium carbonate (Spencer, et al, 1996, and Pearthree, 1994). Generally, Quaternary age alluvium composed of silts, clays, sands, and gravels with varying degrees of consolidation and cementation by caliche overlie bedrock units in the area. Traditionally, the Holocene age alluvium has higher shrink/swell potentials than the Pleistocene age alluvium.

6.2. Subsurface Conditions

Our knowledge of the subsurface conditions at the project site is based on our review of background documents, field exploration, and laboratory testing and general experience in the area. The following paragraph provides generalized descriptions of the materials encountered. More detailed descriptions are presented on the boring logs in Appendix A.

Alluvium was encountered at the ground surface of the borings and extended to the total depths explored. This material was generally classified as brown, pale brown and light brown to reddish brown, damp, silty sand, sandy silt, clayey silt, silty gravels and sandy clay. The in-place densities of these deposits ranged from loose to very dense and some caliche nodules, filaments, and cementation was observed in served on our borings.

6.3. Groundwater

Groundwater was not encountered in our boring excavations. Based on well data provided by the Arizona Department of Water Resources, groundwater could be as shallow as approximately 350 feet bgs at locations near the borings. Groundwater levels can fluctuate due to seasonal variations, irrigation, groundwater withdrawal or injection, and other factors. In addition, seepage from the Beardsley Canal though cracks in the lining could be experienced during construction of the new diversion channel. Groundwater is not expected to be a constraint to the construction of this project.

7. GEOLOGIC HAZARDS

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

7.1. Faulting and Seismicity

The site lies within the Sonoran zone, which is a relatively stable tectonic region located in southwestern Arizona, southeastern California, southern Nevada, and northern Mexico (Euge et al., 1992). This zone is characterized by sparse seismicity and few Quaternary faults. Based on our field observations, review of pertinent geologic data, and analysis of aerial photographs, faults are not located on or adjacent to the property. The closest fault to the site with documented Quaternary age movement is the 7.5 mile-long northwest striking Carefree fault zone, located approximately 30 to 35 miles to the northeast of the site (Pearthree, 1998). Approximately 2 meters of displacement has occurred along this fault within middle Pleistocene deposits (<750,000 years), but the upper Pleistocene and Holocene deposits (<250,000 years) are generally not displaced. Estimates for a possible credible earthquake magnitude that could be generated along the Carefree fault zone (Skotnicki et al., 1997) yield a range of magnitudes from about 6.3 to 6.5.

Based on a Probabilistic Seismic Hazard Assessment for the Western United States, issued by the United States Geological Survey (1999), peak ground accelerations are expressed in units of percentage of standard gravitational acceleration (g). The probabilistic accelerations for the project site which 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. These ground motion values are calculated for "firm rock" sites, which correspond to a shear-wave velocity of approximately 2,500 ft./sec. in approximately the top 100 feet bgs. Different soil sites may amplify or deamplify these values. Seismic design parameters according to the 2003 International Building Code (IBC) are presented in Table 1. The IBC soil profile type for the site is D. The requirements of the governing jurisdictions and applicable building codes should be considered in the design of the subsurface structures. The remaining seismic design parameters according to the UBC are presented in Table 1.

Table 1 – Seismic Design Parameters

Parameter	Value	2003 IBC Reference
Site Class Definition	D	Table 1615.1.1
Site Coefficient F_a	1.6	Table 1615.1.2 (1)
Site Coefficient F_v	2.4	Table 1615.1.2 (2)

7.2. Land Subsidence and Earth Fissures

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

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

A detailed study associated with the presence of land subsidence and earth fissures at the project site was conducted by others and is included in a separate report.

7.3. Liquefaction Potential

Based on the standard penetration test values at the sites evaluated, the lack of near surface water, and the low ground motion hazard (relatively low ground accelerations), the likelihood or potential for liquefaction is not considered to be a design factor.

7.4. Landsliding

No landslides or indications of deep-seated landsliding in the project areas were noted during our field exploration or during our review of the available geologic literature, topographic maps, and aerial photographs and is not considered to be a design factor.

8. CONCLUSIONS

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

- The on-site soils should generally be excavatable to reasonable foundation depths, with conventional earth moving construction equipment in good working condition. However, our fieldwork indicated the presence of caliche-cemented zones, nodules and filaments, which could be encountered when excavating in some areas.

- Temporary slopes above the water table and excavations in and alluvium should be inclined no steeper than 1.5:1 (horizontal : vertical).

- Because the proposed diversion channel is to be in close proximity to the existing Beardsley Canal and roadways, an earth retention system may be needed to maintain the stability and integrity of the sides of the channel excavation as well as the portion of the Beardsley Canal that will remain in-place during the construction.

- Imported soils and soils generated from on-site excavation activities that exhibit relatively low plasticity indices and a very low to low swell potential can generally be used for engineered fill.

- A shallow groundwater table is not anticipated along the alignments during construction. However, groundwater could possibly be encountered where the alignments cross existing drainage courses. The possibility for dewatering surface run-off should be considered in any larger drainage courses along the alignments. However, stream flow and surface run-off will vary seasonally depending on rainfall.

- Corrosivity test results indicate that the subgrade materials encountered could 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 diversion channel. Maricopa Association of Governments (MAG) specifications with any Flood Control District of Maricopa County supplements should be applicable except as noted. If the proposed construction is changed from that discussed in this report, Ninyo & Moore should be contacted for additional recommendations.

9.1. Excavation Characteristics

Our evaluation of the excavation characteristics of the on-site materials is based on the results of eight exploratory borings, our site observations, and our experience with similar materials. The results of our field exploration program indicate that alluvium underlies the proposed channel alignment. The alluvium soils should generally be excavatable by conventional heavy-duty excavation equipment. However, our fieldwork indicated the presence of caliche-cemented zones, nodules and filaments, which could be encountered when excavating in some areas. The excavation rates could be slowed as a result of this caliche. The contractor should use the soil boring data presented in Appendix A as a tool for estimating the excavation parameters associated with this project, but may elect to perform additional test excavations.

9.2. Temporary Excavations

Excavations for the proposed channel are anticipated to range from about 15 to 20 feet deep. As such, we recommend that the excavations be constructed in accordance with Occupational Safety and Health Administration (OSHA) guidelines.

9.2.1. Temporary Slope Stability

OSHA regulations provide trench sloping and shoring design parameters for trenches up to 20 feet deep based on a description of the soil types encountered. Trenches over 20 feet deep should be designed by the Contractor's engineer based on site-specific geo-

technical analyses. For planning purposes, we recommend that the following OSHA soil classification be used:

Alluvium	*Type C*

Upon making the excavations, the soil classifications and excavation performance should be evaluated in the field by the geotechnical consultant in accordance with the OSHA regulations.

In general, temporary slopes above the water table and excavations in and alluvium should be inclined no steeper than 1.5:1 (horizontal : vertical). Temporary excavations that encounter surface seepage may need shoring or may be stabilized by placing sand-bags or gravel along the base of the seepage zone. Excavations encountering seepage, if any, should be evaluated on a case-by-case basis.

9.2.2. Temporary Retention System

Based on our understanding of the proposed construction, temporary excavations up to an average depth of approximately 15 to 20 feet below the existing grade may be needed to accommodate the diversion channel crossing at Olive Avenue and Northern Avenue. Due to the proximity of the proposed construction to existing structures (e.g., the Beardsley Canal), it may not be feasible to perform the excavation at a safe and stable slope ratio without causing loss of lateral support to the canal. For this reason, temporary shoring may be needed for some portions of the proposed construction of the diversion channel. Recommendations for shoring and design and construction of this retaining structure are provided in the following section.

9.2.2.1. Shoring

Shoring systems such as soldier piles and lagging, sheet piles, or braced sheeting may be used to support the sidewalls of the temporary excavations. In areas where sensitive structures are located close to the proposed excavations, sheet piles may not be a viable alternative due to the possible damage that could occur to nearby

structures while the sheet piles are being driven or vibrated into place. In comparison, soldier piles and lagging (wood or precast concrete) are considered to offer a more practical and safe method of shoring within the site.

For a soldier piles and lagging alternative, it is recommended that the soldier piles consist of steel H-beams installed within pre-drilled holes that are subsequently backfilled with concrete. Once the soldier piles are installed and the concrete is cured, excavation of the site may begin. Care should be taken to ensure that the lagging drops down as the excavation advances to lower elevations. Any gaps in the lagging could cause undermining of the adjacent structures.

The shoring system should be designed for a minimum safety factor of 1.5, and the lateral deformation of the ground surface should be controlled by structural design in order to protect the adjacent structures. The shoring should be designed to support the surcharge loads from the adjacent structures in addition to the earth pressures exerted by the native backfill soils. Recommended design values with respect to distribution of earth pressures on shoring elements are presented below.

9.2.2.2. Shoring Design Parameters

For cantilever soldier piles, an active earth pressure of 35 pounds per square foot (psf) per foot of depth may be considered for the native backfill materials. It should be noted that under this condition, movement of the soldier piles are not restrained so that the soil internal strength can be fully developed. If movement of the soldier piles is restrained at the top, then an at-rest earth pressure of 55 psf per foot of depth should be used in design.

A passive earth pressure increasing at a rate of 750 psf per foot of depth, to a value of 7,500 or more psf per foot of depth, may be used to estimate lateral resistance for soldier piles. The passive resistance should be ignored for the upper one diameter of the soldier pile embedded below the excavation bottom.

The soldier piles should be 24 or more inches in diameter. The final depth and spacing of the piles should be estimated by the project structural engineer based on the estimated total service (dead and live) and lateral loads. However, the piles should extend 15 or more feet below the bottom of the excavation. A clear spacing between the soldier piles (sidewall to sidewall) of three or more pile diameters should be maintained.

The excavations for the soldier piles should be observed by a representative of the project geotechnical consultant to verify total embedment depths determined by the project structural engineer. The drilled holes should be cleared of loose soil and/or construction debris prior to pouring concrete. The excavation should be conducted with continuous monitoring of the retained soil and all the adjacent structures for any signs of potential lateral and vertical movements. If any movement is observed, it should be brought to the immediate attention of the project geotechnical engineer and the excavation suspended until appropriate corrective measures are taken. Depending on the movements observed, bracing of the retaining structure by measures such as counterforts or whalers and struts may be needed.

9.2.3. Bottom Stability

The proposed excavations are not anticipated to encounter groundwater (with the exception of possible surface run-off or seepage from the nearby canal) or soft materials at their base. Therefore, trench bottom stability problems during construction are generally not anticipated. However, if excavations are located within or near a known wash, arroyo, or drainage area and are open during a heavy rain event, the trench material(s) might become saturated and unstable.

9.2.4. Construction Dewatering

A shallow groundwater table is not anticipated along the alignments during construction. Groundwater could, however, be anticipated where the alignment crosses existing

drainage courses. Stream flow and surface run-off will vary seasonally depending on rainfall.

Given the low probability of encountering significant seepage along the alignments, we anticipate that the excavations that do encounter seepage or surface run-off could be dewatered by sumping the water from the bottom of the excavation. However, heavily saturated units or perched groundwater zones, if encountered, may call for more aggressive means of dewatering and consultation with a qualified expert. Discharge of water from the excavations to natural drainage channels may entail securing a special permit.

9.2.5. Grading, Fill Placement, and Compaction

Vegetation and debris from the clearing operation should be removed from the site and disposed of at a legal dumpsite. Demolition debris should be removed from the site and disposed of at a legal dumpsite. Obstructions that extend below finish grade, if present, should be removed and the resulting holes filled with compacted soil.

The geotechnical consultant should carefully evaluate any areas of soft or wet soils prior to placement of fill or other construction. Drying or overexcavation and replacement of such materials should be anticipated. Based on our field and laboratory testing, an earthwork (shrinkage) factor of 5 to 15 percent for the on-site soils is estimated.

Imported soils and soils generated from on-site excavation activities that exhibit relatively low plasticity indices and very low to low expansive potential are generally suitable for reuse as engineered fill. Relatively low plasticity indices are defined as a Plasticity Index (by the American Society for Testing and Materials [ASTM] 4318-00) value of 20 or less. Very low to low expansive potential soils are defined as having an Expansion Index (by ASTM D 4829) of 50 or less. The Atterberg Limits tests performed during this study resulted in plasticity indices of 0 (non-plastic). These Atterberg Limits tests were conducted on samples from borings B-2, B-3 and B-6. As such, many on-site soils will be suitable for re-use as engineered fill during construction. It is recommended that additional observations, and possibly, laboratory testing be performed

during the earthwork activities if soils other than those encountered in our borings are encountered.

Suitable fill should not include organic material, clay lumps, construction debris, rock particles, and other non-soil fill materials larger than 6 inches in dimension. This material should be disposed of offsite or in non-structural areas.

We recommend that new fill associated with this project be placed in horizontal lifts approximately 9 inches in loose thickness and compacted by appropriate mechanical methods, to 95 percent or more relative compaction, in accordance with ASTM D 698-00 at a moisture content within 2 percent of its optimum moisture content.

9.2.6. Imported Fill Material

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

In addition to the above requirements, we recommend that imported fill materials meet the following gradations:

Table 2 – Imported Fill Gradation

Sieve Size	Percent Passing (By Weight)
3 inch	100
No. 4	40 – 100
No. 200	5 – 50

9.3. Box Culverts

New box culverts will be used at several locations for this project to convey water below existing roadways. Based on our experience with similar projects, we assume that the scour depth associated with these culverts will be on the order of 5 feet below the bottom of the culvert. Consequently, the base of the box culverts will presumably be about 5 feet below the bottom of the culverts. Based on the soil boring information and the proposed depth of the culverts, we recommend that an allowable bearing capacity of up to 3,000 pounds per square foot (psf) be used for static conditions.

Total and differential settlement of up to about 1-inch and 1/2-inch, respectively, may occur. Distortions of no more than about 1 inch (vertical) over 20 feet (horizontal) are possible.

Following the excavation for the culverts, and prior to the placement of concrete, the geotechnical consultant should carefully evaluate the exposed surface. Based on the results of this evaluation, remediation of the exposed surface may be needed. This could include scarification of the exposed surface or removal and replacement of unsuitable soils. This additional remediation, if needed, should be addressed by the geotechnical consultant during the earthwork operations.

Culverts that are subject to lateral loadings may be designed using an ultimate coefficient of friction of 0.4 (total frictional resistance equals the coefficient of friction multiplied by the dead load). An ultimate passive resistance value of 250 psf per foot of depth can be used. The lateral resistance can be taken as the sum of the frictional resistance and passive resistance, provided that the passive resistance does not exceed two-thirds of the total allowable resistance. The passive resistance may be increased by one-third when considering loads of short duration such as wind or seismic forces.

9.4. Soil-Cement Bank Protection

We understand that a soil-cement treated surface may be utilized for this project, specifically at the Cholla Wash influent to the Beardsley Canal Wash, a distance of about 1,000 feet. This surface will be located on the east side of the existing Beardsley Canal Wash. Soil-cement

bank protection is normally constructed in horizontal stair-step lifts, with relatively steep (1 horizontal :1 vertical) side slopes. Lift thicknesses generally range from 6 to 9 inches and each stair-step is typically on the order of 8 feet wide. The soil-cement treatment should have a toed-down to an elevation that is deeper that the estimate total scout depth.

The percentage of cement needed for this type of application is typically based on a desired compressive strength and the composition of the soils used. We recommend utilizing a compressive strength of 750 or more pounds per square inch (psi). However, the percentage of cement content needed may differ along the alignment because of the variety of soil types encountered. The following table represents a typical range of cement content percentages needed to achieve a maximum dry density of about 120 pounds per cubic foot for various soil gradations.

Table 3 – Typical Variation in Cement Content

Material Retained on No 4 Sieve (%)	Typical Cement Content (%)
0 to 14	7 to 8
15 to 29	6 to 8
30 to 45	6 to 9
45 and greater	soil-cement not recommended

Based on the above-mentioned table and our laboratory testing, we estimate that the cement content needed for this project ranges between about X and X percent. This estimate is based on limited soil sampling and testing and should be used for planning purposes only. The contract should perform independent testing during the earthwork operations to better define the actual percentage of cement needed for this project. It should also be noted that soil-cement treated surfaces may be difficult to manufacture from soil types with excessive amounts of clay and silt.

9.5. Gabion Mattress Bank Protection

Gabion mattress bank protection is tentatively planned along the east side of the existing FRS No. 3 side slope, roughly from Northern Avenue, and extends approximately 3,200 feet south. Empty gabion mattresses form containers, that when filled with stone or rip-rap, provide an aesthetic method for reducing soil erosion. This type of bank protection is typically sloped no steeper than 2 horizontal :1 vertical. Filters are generally needed underneath the gabion mattress to reduce material from being leached out through the stone fill material. Two types of filter materials are commonly used: gravel filters and fabric filters. Gravel filters consist of a layer of well-graded sands and gravels, with a thickness on the order of 9 inches. Fabric filter cloths have been used beneath gabions and other revetments with good success. Although some care should be exercised in placing large rocks on the fabrics, it is generally much easier and more economical to install a fabric filter than a gravel filter. Fabrics should be keyed in and overlapped, and should preferably be of a non-woven type.

The design associated with this type of system (including the gabion thickness, top-of-bank key-in length, toe apron length and bank stabilization cut-off width, etc.) should be performed by an erosion except that is a registered professional engineer in the State of Arizona in accordance with the requirements outlined in Arizona Department of Water Resources Flood Mitigation Section, Water Bank Stabilization, May 1998 or any Flood Control District of Maricopa County supplements

9.6. Pre-Construction Conference

We recommend that a pre-construction conference be held. Representatives of the owner, 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.

9.7. Construction Observation and Testing

During construction operations, we recommend that a qualified geotechnical consultant perform observation and testing services for the project. These services should be performed to

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

10. LIMITATIONS

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

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

This report is intended for design purposes only. It does not provide sufficient data to prepare an accurate bid by contractors. It is suggested that the bidders and their geotechnical consultant perform an independent evaluation of the subsurface conditions in the project areas. The

independent evaluations may include, but not be limited to, review of other geotechnical reports prepared for the adjacent areas, site reconnaissance, and additional exploration and laboratory testing.

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

This report is intended exclusively for use by the client. Any use or 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 Public Works Association and Associated General Contractors of California (APWA), 1991, Standard Specifications for Public Works Construction: BNI Building News, Los Angeles, California.

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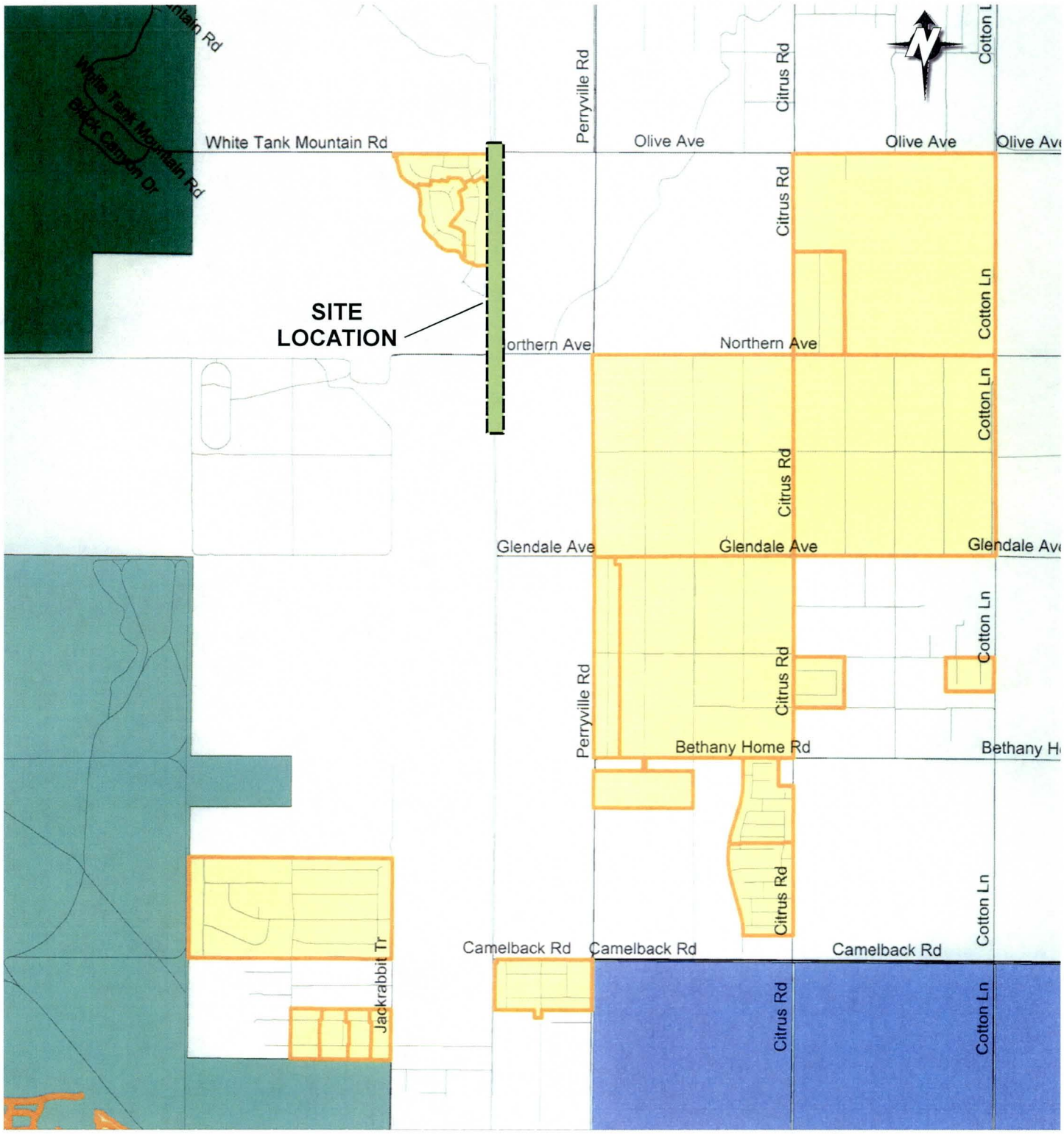
United States Geological Survey, 1997, 1998, 1999, National Seismic Hazard Mapping Project, World Wide Web, http://geohazards.cr.usgs.gov/eq.

Reference Aerial Photographs

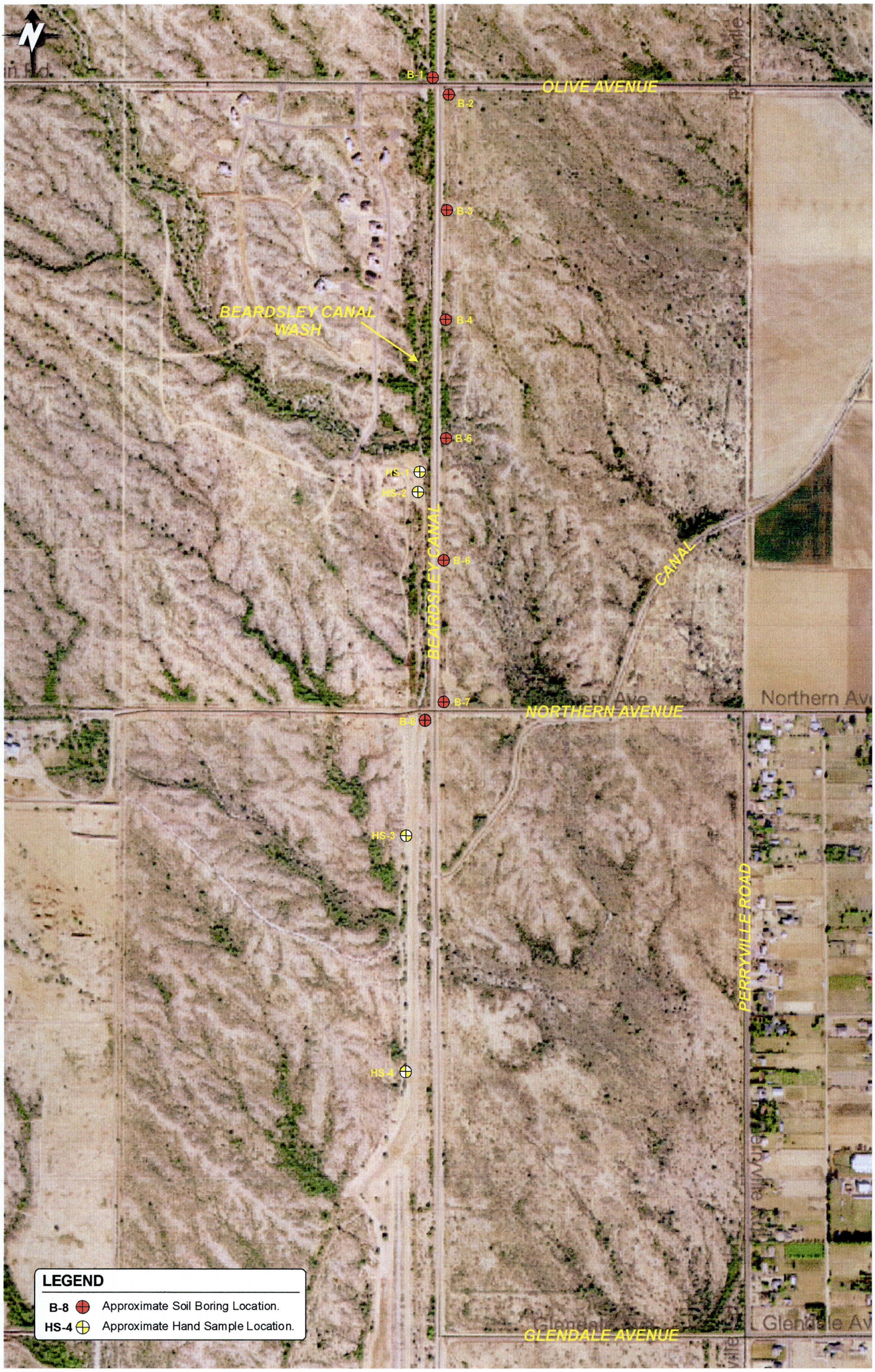
Source	Photo Date	Flight Line
Maricopa County GIS Online	2004	N/A
United States Department of Agriculture	1973	N/A



NOT TO SCALE

SOURCE: Maricopa County GIS Department, 2004.

Ninyo & Moore	SITE LOCATION MAP	
NORTH INLET CHANNEL WHITE TANKS FRS No. 3		FIGURE 1
PROJECT No: 600760001	FILE No: 760vmap1104	DATE: 12/04



0 400 800

Approximate Scale:
1 inch = 800 feet

SOURCE: Maricopa County GIS Department, 2004.

Ninyo & Moore	SOIL BORING AND HAND SAMPLE LOCATION MAP			FIGURE
NORTH INLET CHANNEL WHITE TANKS FRS No. 3				2
PROJECT No: 600760001	FILE No: 760sp1104	DATE: 12/04		

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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 excavations. 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 methods.

The Modified Split-Barrel Drive Sampler

The sampler, with an external diameter of 3.0 inches, was lined with 1-inch long, thin brass rings with inside diameters of approximately 2.4 inches. The sample barrel was driven into the ground with the weight of a 140-pound hammer, in general accordance with ASTM D 3550-84. The driving weight was permitted to fall freely. The approximate length of the fall, the weight of the hammer, and the number of blows per foot of driving are presented on the boring logs as an index to the relative resistance of the materials sampled. The samples were removed from the sample barrel in the brass rings, sealed, and transported to the laboratory for testing.

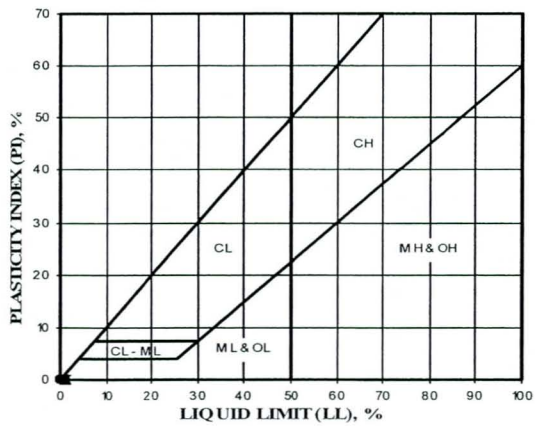
U.S.C.S. METHOD OF SOIL CLASSIFICATION

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

GRAIN SIZE CHART

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

PLASTICITY CHART



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

BORING LOG EXPLANATION SHEET

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

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BORING LOG

EXPLANATION OF BORING LOG SYMBOLS

PROJECT NO.	DATE	FIGURE
	Rev. 01/03	

DATE DRILLED 10/26/04 BORING NO. B-1

GROUND ELEVATION 1278' MSL SHEET 1 OF 1

METHOD OF DRILLING CME-75, 6.5" HOLLOW-STEM AUGER

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY JSR/TLC LOGGED BY JSR/TLC REVIEWED BY

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						SM	ALLUVIUM: Light brown (7.5YR 6/9), damp, loose, silty fine to coarse SAND; few gravel; scattered rootlets.
		8					
		11					Medium dense; trace clay; less gravel; no rootlets.
5							
		13	1.4	118.4			Loose.
		19					Medium dense; few clay; few to little gravel; scattered specs of caliche.
10						SC	Strong brown (2.5YR 5/8), damp, medium dense, clayey fine to medium SAND.
		23	4.8	115.1			
						SM	Brown (7.5YR 4/4), damp, medium dense, silty fine to medium SAND.
		10					Lighter brown (7.5YR 5/8), fine to coarse grained.
15							
						ML	Yellowish brown (10YR 5/6), damp, hard, clayey SILT; trace fine sand; scattered caliche nodules, filament; scattered pinhole-sized pore spaces.
		75	10.0	91.2			
20							Total Depth = 19.5 feet. Groundwater not encountered. Backfilled on 10/26/04.

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BORING LOG

NORTH INLET CHANNEL
WHTIE TANKS FRS NO. 3

PROJECT NO.	DATE	FIGURE
600760001	12/04	A-1

DATE DRILLED 10/26/04 BORING NO. B-2

GROUND ELEVATION 1373' MSL SHEET 1 OF 2

METHOD OF DRILLING CME-75, 6.5" HOLLOW-STEM AUGER

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY JSR/TLC LOGGED BY JSR/TLC REVIEWED BY

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							SM	ALLUVIUM: Strong brown (7.5YR 4/6), damp, medium dense, silty SAND; scattered caliche nodules; trace clay.
			17	2.9				
			23					Brown (7.5YR 5/4).
5								
								Light brown (7.5YR 6/4).
			51	8.6	99.1		CL	Brown (7.5YR 5/4), damp, hard, silty CLAY; scattered caliche nodules; weak to moderate cementation; scattered pinhole-sized pore spaces.
							GM	Pinkish white (7.5YR 8/2), damp, very dense, silty GRAVEL; scattered caliche nodules; weak to moderate cementation.
			36					
10								
							SM	Strong brown (7.5YR 4/6), damp, medium dense, silty SAND; weak cementation.
			30	2.5	110.1			
15								
							SC	Light brown (7.5YR 6/3), damp, very dense, clayey SAND; weak cementation.
			50/6"					
20							CL	Pinkish white (7.5YR 8/2), damp, hard, CLAY; scattered to numerous caliche nodules and

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BORING LOG

NORTH INLET CHANNEL
WHTIE TANKS FRS NO. 3

PROJECT NO.	DATE	FIGURE
600760001	12/04	A-2

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20								layers; moderately cemented.
								Total Depth = 19.5 feet.
								Groundwater not encountered.
								Backfilled on 10/26/04.
25								
30								
35								
40								

DATE DRILLED 10/26/04 BORING NO. B-2

GROUND ELEVATION 1373' MSL SHEET 2 OF 2

METHOD OF DRILLING CME-75, 6.5" HOLLOW-STEM AUGER

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY JSR/TLC LOGGED BY JSR/TLC REVIEWED BY

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BORING LOG

NORTH INLET CHANNEL
WHTIE TANKS FRS NO. 3

PROJECT NO.	DATE	FIGURE
600760001	12/04	A-3

DATE DRILLED 10/26/04 BORING NO. B-3

GROUND ELEVATION 1265' MSL SHEET 1 OF 2

METHOD OF DRILLING CME-75, 6.5" HOLLOW-STEM AUGER

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY JSR/TLC LOGGED BY JSR/TLC REVIEWED BY

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						CL	ALLUVIUM: Strong brown (7.5YR 4/6), damp, very stiff, silty CLAY; little sand.
		17					
		26	3.5	96.7		ML	Light brown (7.5YR 6/4), damp, medium dense, sandy SILT; scattered caliche filament; trace gravel.
5							
		26					Dense; gravel.
						SC	Light brown (7.5YR 6/4), damp, dense, clayey fine to coarse SAND; scattered to numerous caliche nodules; weak to moderate cementation.
		50/3"					Very dense.
10							
		44					Very dense.
15						SM	Pink (7.5YR 7/3), damp, very dense, silty fine to coarse SAND.
		50/5"				ML	Light brown (7.5YR 6/3), damp, hard, clayey SILT; weak cementation.
20							

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BORING LOG

NORTH INLET CHANNEL
WHTIE TANKS FRS NO. 3

PROJECT NO.	DATE	FIGURE
600760001	12/04	A-4

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20								Total Depth = 19.9 feet. Groundwater not encountered. Backfilled on 10/26/04.
25								
30								
35								
40								

DATE DRILLED 10/26/04 BORING NO. B-3

GROUND ELEVATION 1265' MSL SHEET 2 OF 2

METHOD OF DRILLING CME-75, 6.5" HOLLOW-STEM AUGER

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY JSR/TLC LOGGED BY JSR/TLC REVIEWED BY

DRAFT

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BORING LOG

NORTH INLET CHANNEL
WHTIE TANKS FRS NO. 3

PROJECT NO.	DATE	FIGURE
600760001	12/04	A-5

DATE DRILLED 10/26/04 BORING NO. B-4

GROUND ELEVATION 1256' MSL SHEET 1 OF 2

METHOD OF DRILLING CME-75, 6.5" HOLLOW-STEM AUGER

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY JSR/TLC LOGGED BY JSR/TLC REVIEWED BY

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						SM	ALLUVIUM: Light brown (7.5YR 6/4), damp, loose, silty SAND; little gravel; scattered gravel and cobbles at the surface.
		10					
		24					Strong brown (7.5YR 5/6), dense, fine-grained, few clay; scattered caliche filament.
5							
		40	1.0	107.4			Light brown (7.5YR 6/4); medium dense.
		42					Pink (7.5YR 8/3); medium dense to dense; little clay.
10							
		50/3"					Pink (7.5YR 7/4); very dense; weak to moderate cementation.
15							
		50/5"					Reddish yellow (7.5YR 6/6).
20							

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BORING LOG

NORTH INLET CHANNEL
WHTIE TANKS FRS NO. 3

PROJECT NO.	DATE	FIGURE
600760001	12/04	A-6

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20								Total Depth = 19.9 feet. Groundwater not encountered. Backfilled on 10/26/04.
25								
30								
35								
40								

DATE DRILLED 10/26/04 BORING NO. B-4

GROUND ELEVATION 1256' MSL SHEET 2 OF 2

METHOD OF DRILLING CME-75, 6.5" HOLLOW-STEM AUGER

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY JSR/TLC LOGGED BY JSR/TLC REVIEWED BY

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BORING LOG

NORTH INLET CHANNEL
WHTIE TANKS FRS NO. 3

PROJECT NO.	DATE	FIGURE
600760001	12/04	A-7

DATE DRILLED 10/26/04 BORING NO. B-5

GROUND ELEVATION 1242'MSL SHEET 1 OF 1

METHOD OF DRILLING CME-75, 6.5" HOLLOW-STEM AUGER

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY JSR/TLC LOGGED BY JSR/TLC REVIEWED BY

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							SM	ALLUVIUM: Brown (7.5YR 5/4), damp, loose to medium dense, silty fine to coarse SAND.
			7					
			20					No recovery.
5								Gravel.
							SM	Pink (7.5YR 7/3), damp, dense, silty fine to coarse SAND; some gravel.
			9					No recovery.
			60	0.9	102.7			
10								
			80				SC	Pink (7.5YR 7/4), damp, very dense, clayey SAND; little silt; few gravel; scattered caliche filament.
							CL	Pink (7.5YR 7/4), damp, hard, silty CLAY; some sand; scattered caliche filament; weak to moderate cementation.
15							GM	Pink (7.5YR 7/4), damp, very dense, silty GRAVEL; little fine to coarse sand; trace to few clay.
			50/2"					
								Total Depth = 18.9 feet. Groundwater not encountered. Backfilled on 10/26/04.
20								

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BORING LOG

NORTH INLET CHANNEL
WHTIE TANKS FRS NO. 3

PROJECT NO.	DATE	FIGURE
600760001	12/04	A-8

DATE DRILLED 10/26/04 BORING NO. B-6

GROUND ELEVATION 1242' MSL SHEET 1 OF 2

METHOD OF DRILLING CME-75, 6.5" HOLLOW-STEM AUGER

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY JSR/TLC LOGGED BY JSR/TLC REVIEWED BY

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						ML	ALLUVIUM: Light brown (7.5YR 6/4), damp, medium dense, sandy SILT; trace clay; scattered caliche filament.
		16	3.5	102.3			
		23				CL	Light brown (7.5YR 6/4), damp, hard, silty CLAY; scattered caliche filament.
5						SM	Pink (7.5YR 7/4), damp, medium dense, silty fine to coarse SAND.
		23	1.3	116.5			
							Very dense; gravel.
		68				CL	Pink (7.5YR 7/4), damp, hard, sandy CLAY; scattered caliche nodules.
10							
		80/11"	5.6	97.1			Reddish yellow (7.5YR 6/6); scattered pinhole-sized pore spaces; scattered caliche filament.
15							
						SM	Brown (7.5YR 5/4), damp, very dense, silty fine to coarse SAND; trace clay.
		40					Pinkish gray (7.5YR 7/2).
20							

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BORING LOG

NORTH INLET CHANNEL
WHTIE TANKS FRS NO. 3

PROJECT NO.	DATE	FIGURE
600760001	12/04	A-9

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20								Total Depth = 20.0 feet. Groundwater not encountered. Backfilled on 10/26/04.
25								
30								
35								
40								

DATE DRILLED 10/26/04 BORING NO. B-6

GROUND ELEVATION 1242' MSL SHEET 2 OF 2

METHOD OF DRILLING CME-75, 6.5" HOLLOW-STEM AUGER

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY JSR/TLC LOGGED BY JSR/TLC REVIEWED BY

Ninyo & Moore

BORING LOG

NORTH INLET CHANNEL
WHTIE TANKS FRS NO. 3

PROJECT NO.	DATE	FIGURE
600760001	12/04	A-10

DATE DRILLED 10/26/04 BORING NO. B-7

GROUND ELEVATION 1234' MSL SHEET 1 OF 2

METHOD OF DRILLING CME-75, 6.5" HOLLOW-STEM AUGER

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY JSR/TLC LOGGED BY JSR/TLC REVIEWED BY

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						ML	ALLUVIUM: Reddish yellow (7.5YR 7/6), damp, hard, clayey SILT; little fine to coarse sand; scattered caliche filament.
		24					
		34	4.6	106.7		SC	Strong brown (7.5YR 5/6), damp, medium dense, clayey SAND; little silt; scattered caliche filament.
5							
		32				CL	Reddish yellow (7.5YR 6/6), damp, hard, silty CLAY; little sand; scattered to numerous caliche nodules.
		36	5.5	115.3		SC	Pink (7.5YR 7/4), damp, medium dense, clayey SAND; few silt; scattered caliche nodules.
10							
		41					Very dense; weak to moderate cementation; scattered caliche nodules.
							Scattered to numerous caliche nodules. Gravel at 13.0 feet.
		40	11.0	111.3		CL	Reddish yellow (7.5YR 6/6), damp, hard, silty CLAY; few sand; scattered to numerous caliche nodules.
15							
						SM	Light yellowish brown (7.5YR 6/4), damp, dense, silty fine to coarse SAND; scattered caliche filament; few coarse gravel.
		30				ML	Strong brown (7.5YR 5/6), damp, hard, clayey SILT; few fine sand.
20							

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BORING LOG

NORTH INLET CHANNEL
WHTIE TANKS FRS NO. 3

PROJECT NO.	DATE	FIGURE
600760001	12/04	A-11

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20								Total Depth = 20.0 feet. Groundwater not encountered. Backfilled on 10/26/04.
25								
30								
35								
40								

DATE DRILLED 10/26/04 BORING NO. B-7

GROUND ELEVATION 1234' MSL SHEET 2 OF 2

METHOD OF DRILLING CME-75, 6.5" HOLLOW-STEM AUGER

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY JSR/TLC LOGGED BY JSR/TLC REVIEWED BY

DRAFT

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BORING LOG

NORTH INLET CHANNEL
WHTIE TANKS FRS NO. 3

PROJECT NO.	DATE	FIGURE
600760001	12/04	A-12

DATE DRILLED 10/26/04 BORING NO. B-8

GROUND ELEVATION 1237' MSL SHEET 1 OF 2

METHOD OF DRILLING CME-75, 6.5" HOLLOW-STEM AUGER

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY JSR/TLC LOGGED BY JSR/TLC REVIEWED BY

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							SC	FILL: Strong brown (7.5YR 5/6), damp, loose, clayey fine SAND; few silt; scattered caliche filament.
		■	9	5.5	103.6			
		◥	7				CL	ALLUVIUM: Strong brown (7.5YR 5/6), damp, stiff, silty CLAY; little fine sand; scattered caliche filament.
5								
		■	9	2.9	105.1		SM	Strong brown (7.5YR 5/6), damp, loose, silty SAND; little clay; scattered caliche filament.
		◥	13					Medium dense.
10							CL	Dark yellowish brown (10YR 4/6), damp, very stiff, silty CLAY; few sand; scattered caliche filament. Increased drilling effort.
		■	32	12.4	107.2			Brownish yellow (10YR 6/6); hard; scattered to numerous caliche nodules; scattered pinhole-sized pore spaces; Stage II cementation.
15								Gravel.
		■	22				SM	Dark yellowish brown (10YR 4/6), damp, dense, silty fine to coarse SAND; few gravel; possible cobbles.
20								

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BORING LOG

NORTH INLET CHANNEL
WHTIE TANKS FRS NO. 3

PROJECT NO.	DATE	FIGURE
600760001	12/04	A-13

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20								Light yellowish brown (10YR 6/4).
								Total Depth = 20.0 feet.
								Groundwater not encountered.
								Backfilled on 10/26/04.
25								
30								
35								
40								

DATE DRILLED 10/26/04 BORING NO. B-8

GROUND ELEVATION 1237' MSL SHEET 2 OF 2

METHOD OF DRILLING CME-75, 6.5" HOLLOW-STEM AUGER

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY JSR/TLC LOGGED BY JSR/TLC REVIEWED BY

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BORING LOG

NORTH INLET CHANNEL
WHTIE TANKS FRS NO. 3

PROJECT NO.	DATE	FIGURE
600760001	12/04	A-14

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APPENDIX B

LABORATORY TESTING

Classification
Soils were visually and texturally classified in accordance with the Unified Soil Classification System (USCS) in general accordance with ASTM D 2488-93. Soil classifications are indicated on the logs of the exploratory excavations in Appendix A.

In-Place Moisture and Density Tests
The moisture content and dry density of relatively undisturbed samples obtained from the exploratory excavations were evaluated in general accordance with ASTM D 2937-94. The test results are presented on the logs of the exploratory excavations in Appendix A.

Gradation Analysis
Gradation analysis tests were performed on selected representative soil samples in general accordance with ASTM C 136. The grain-size distribution curves are shown on Figures B-1 through B-5. These test results were utilized in evaluating the soil classifications in accordance with the Unified Soil Classification System.

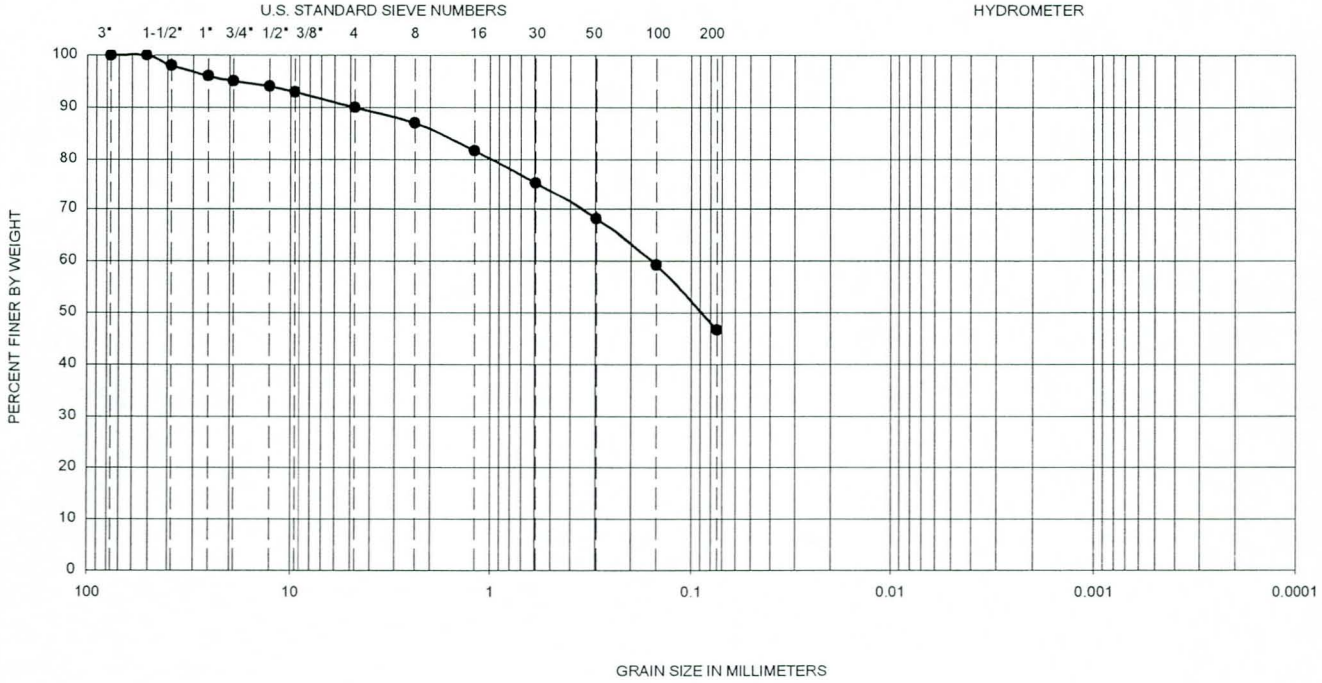
Atterberg Limits
Tests were performed on selected representative fine-grained soil samples to evaluate the liquid limit, plastic limit, and plasticity index in general accordance with ASTM D 4318-00. These test results were utilized to evaluate the soil classification in accordance with the Unified Soil Classification System. The test results and classifications are shown on Figure B-6.

Shear Strength Tests
Shear strength tests were performed on undisturbed samples in general accordance with ASTM D 3080-03 to evaluate the shear strength characteristics of selected materials. The samples were inundated during shearing to represent adverse field conditions. The results are shown on Figures B-7 through B-10.

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. The results of these tests are summarized on Figure B-11 though B-13.

Soil Corrosivity Tests
Soil pH and minimum resistivity tests were performed on representative samples in general accordance with Arizona Test ARIZ 236b. The sulfate content and chloride content of selected sample was evaluated in general accordance with ARIZ 733 and 736, respectively. The test results are presented on Figure B-14.

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-2	0-5	NP	NP	NP	--	--	--	--	--	47	SM

NP- INDICATES OUT OF SPECIFICATION

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PERFORMED IN GENERAL ACCORDANCE WITH ASTM C 136

Ninyo & Moore

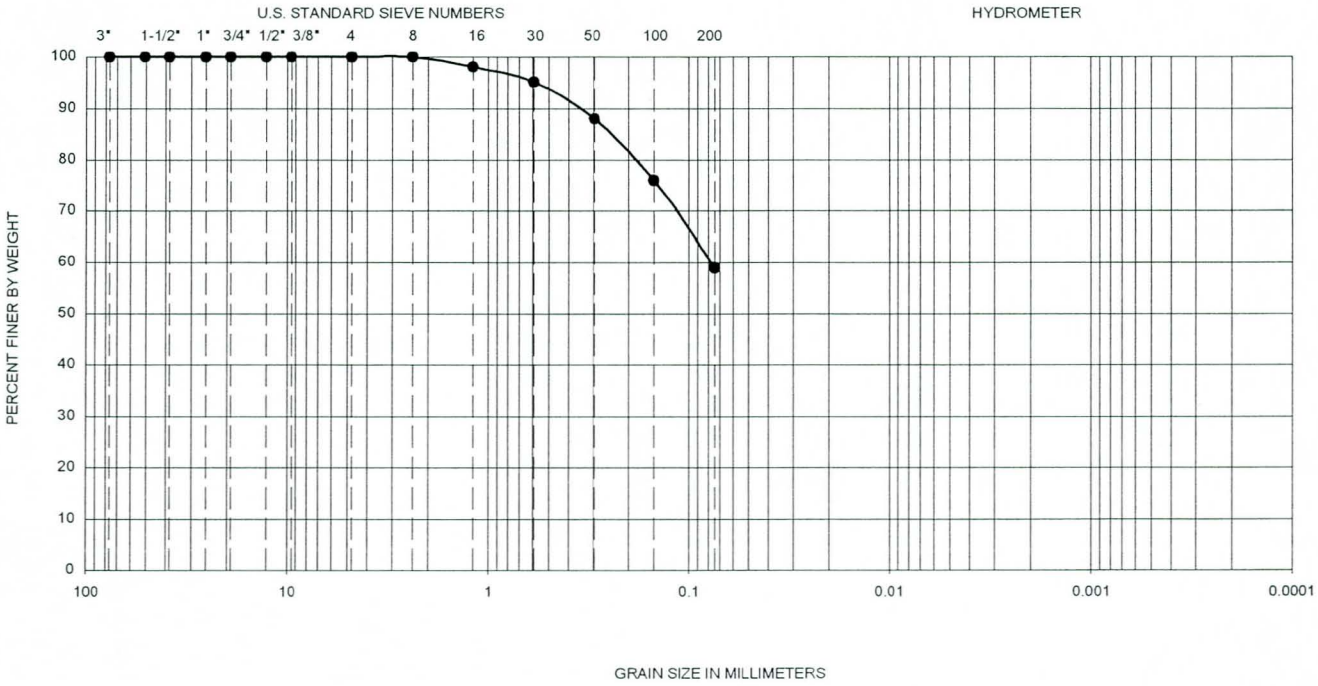
GRADATION TEST RESULTS

NORTH INLET CHANNEL
WHITE TANKS FRS NO.3
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600760001	12/04	B-1

SPLITSIEVE B-2 0-5

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-3	3.5-5	NP	NP	NP	--	--	--	--	--	59	ML

NP- INDICATES NON-PLASTIC

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PERFORMED IN GENERAL ACCORDANCE WITH ASTM C 136

Ninyo & Moore

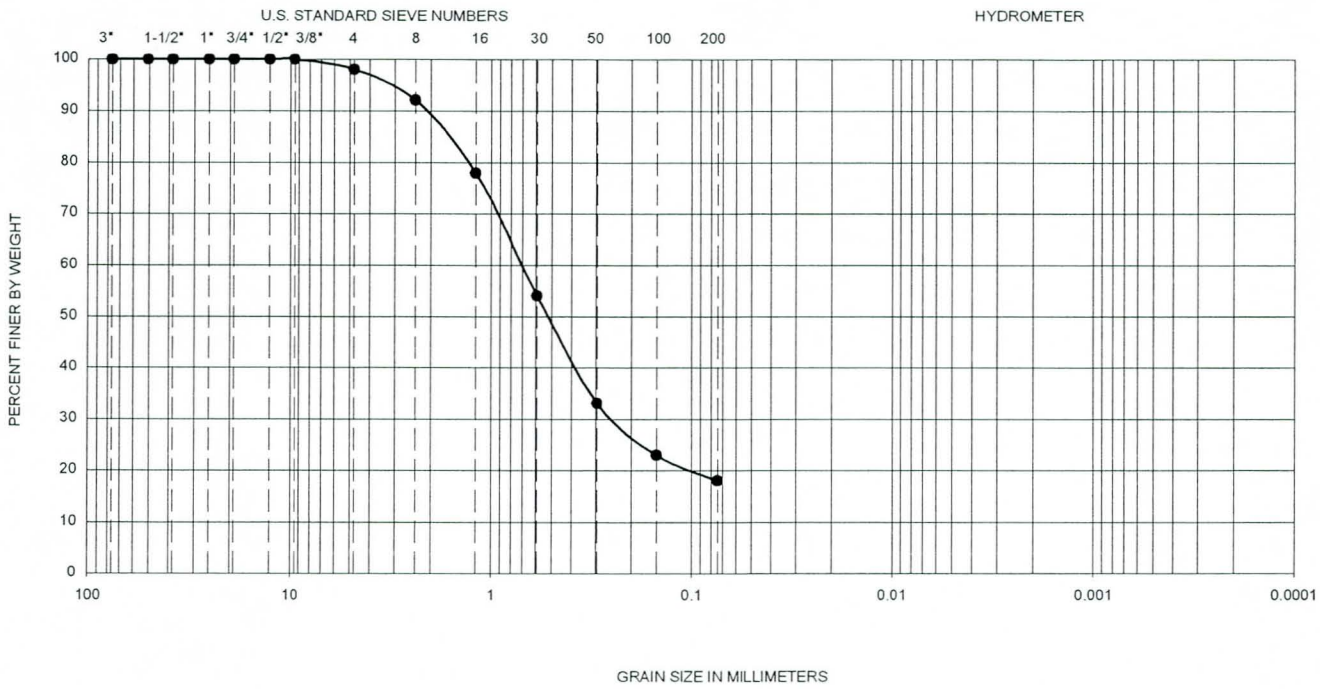
GRADATION TEST RESULTS

NORTH INTEL CHANNEL
WHITE TANKS FRS NO. 3
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
60076001	12/04	B-2

SIEVE B-3 3.5-5

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	6-7.5	NP	NP	NP	--	--	--	--	--	18	SM

NP- INDICATES NON-PLASTIC

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PERFORMED IN GENERAL ACCORDANCE WITH ASTM C 136

Ninyo & Moore

GRADATION TEST RESULTS

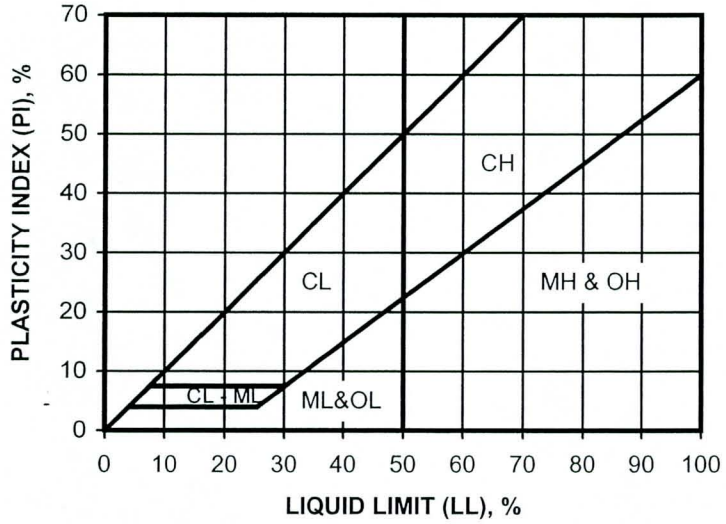
NORTH INTEL CHANNEL
WHITE TANKS FRS NO. 3
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
60076001	12/04	B-3

SIEVE B-6 6-7.5

SYMBOL	LOCATION	DEPTH (FT)	LL (%)	PL (%)	PI (%)	U.S.C.S. CLASSIFICATION (Minus No. 40 Sieve Fraction)	U.S.C.S. (Entire Sample)
●	B-2	0-5	NP	NP	NP	SM	SM
■	B-3	3.5-5	NP	NP	NP	ML	ML
◆	B-6	6-7.5	NP	NP	NP	SM	SM

NP - Indicates non-plastic



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PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4318-00

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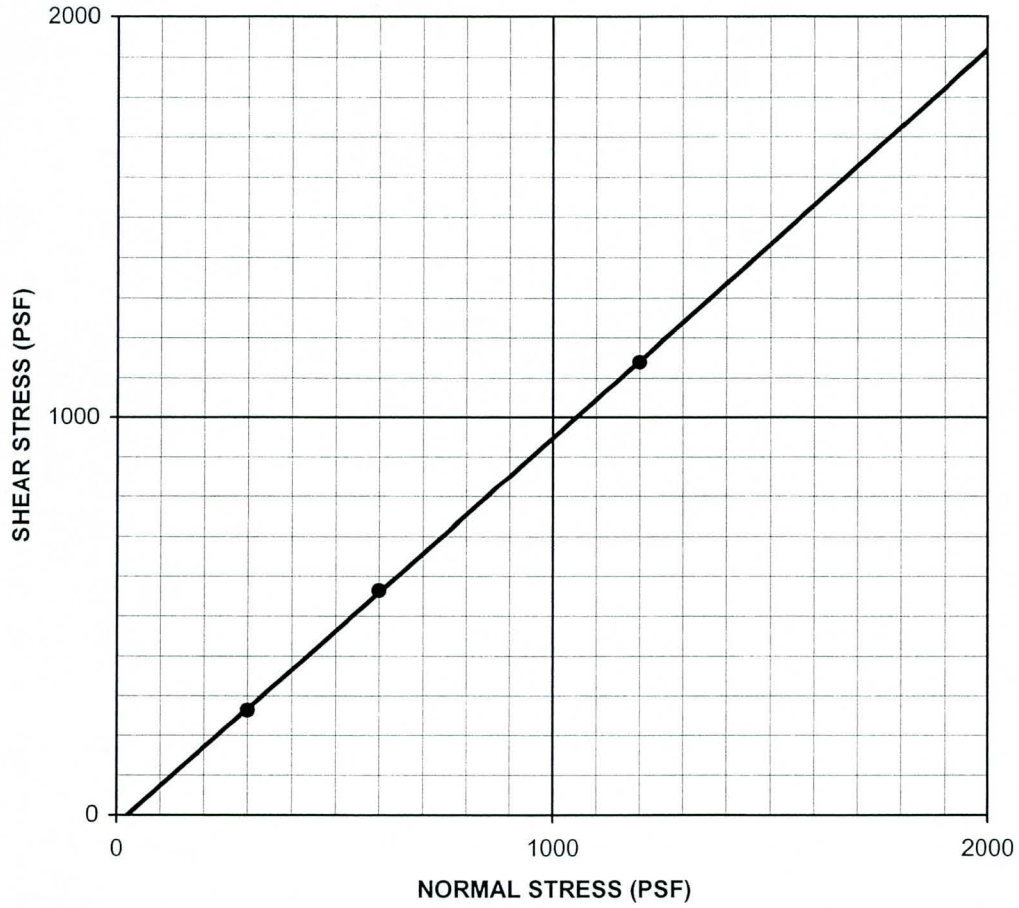
ATTERBERG LIMITS TEST RESULTS

NORTH INLET CHANNEL
WHITE TANKS FRS NO. 3
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600760001	12/04	B-6



Description	Symbol	Boring Number	Depth (ft)	Shear Strength	Cohesion (psf)	Friction Angle (deg)	Soil Type
UNDISTURBED	—●—	B-1	6-7.5	Peak	24	44	SM

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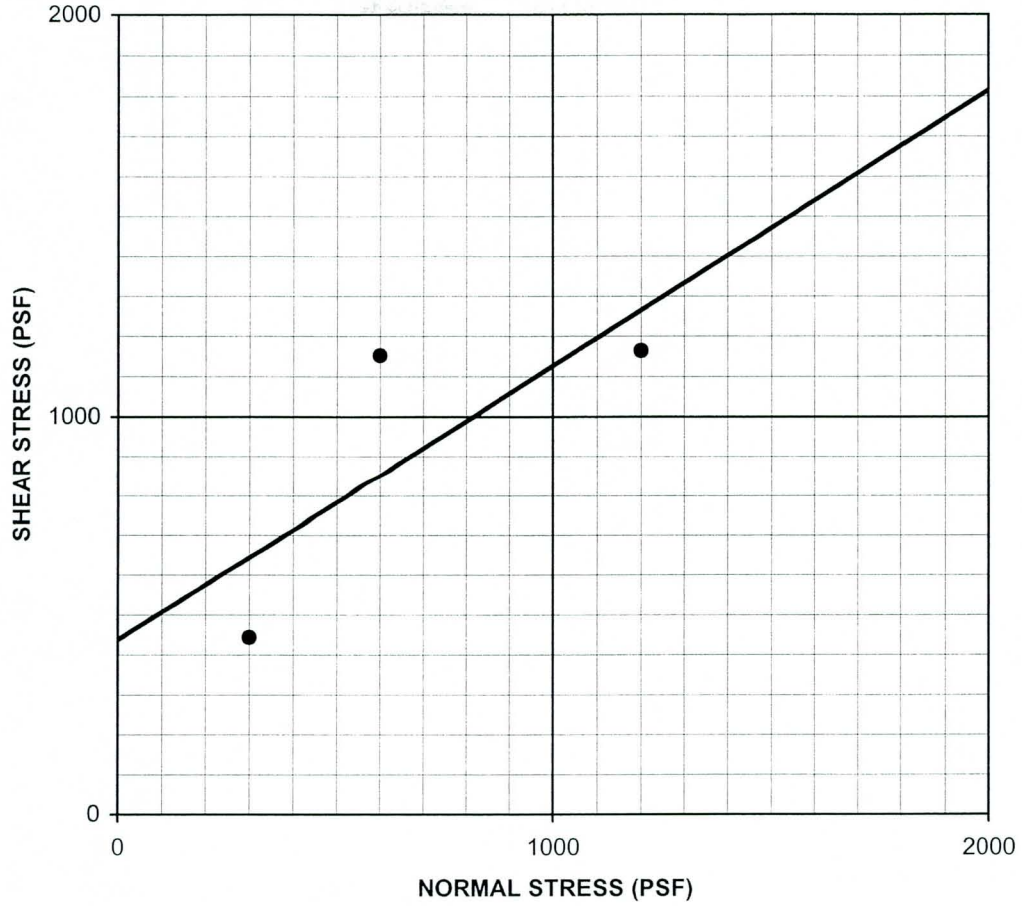
SHEAR STRENGTH TEST RESULTS

NORTH INTEL CHANNEL
WHITE TANKS FRS NO.3
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
60076001	12/04	B-7



Description	Symbol	Boring Number	Depth (ft)	Shear Strength	Cohesion (psf)	Friction Angle (deg)	Soil Type
UNDISTURBED	—●—	B-2	6-7.5	Peak	438	35	SM / CL

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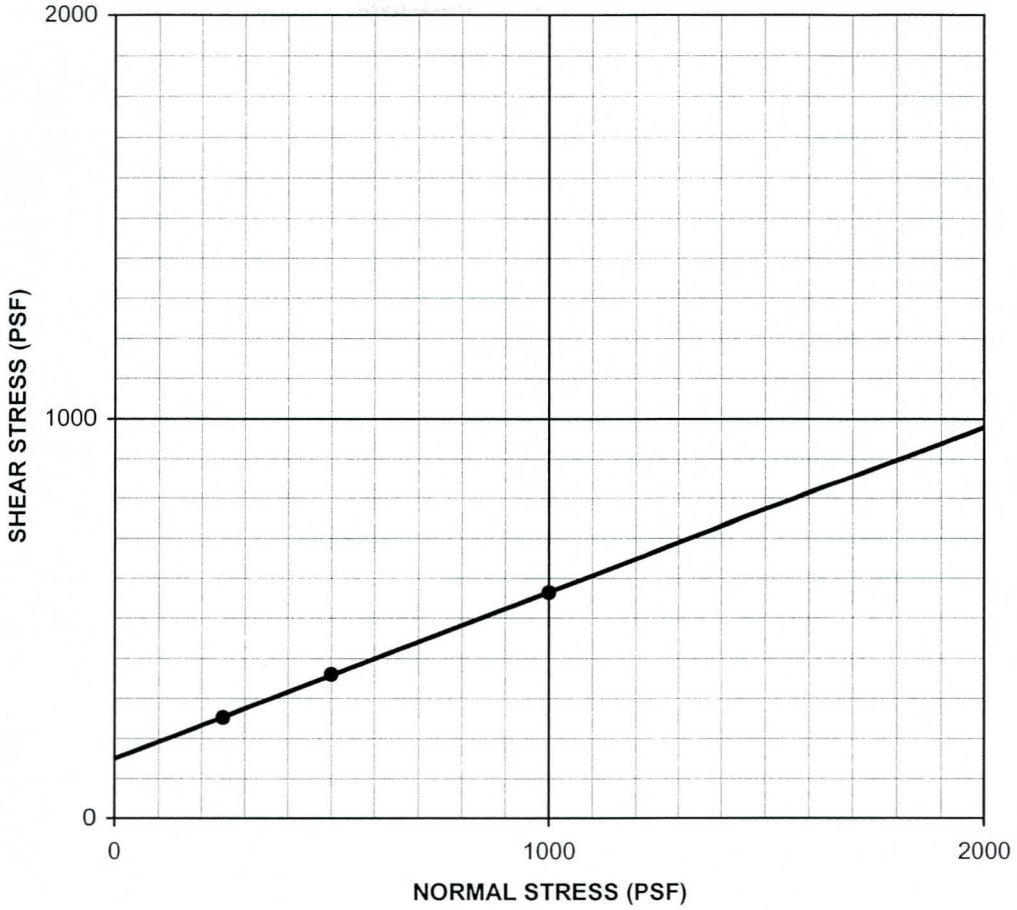
SHEAR STRENGTH TEST RESULTS

NORTH INTEL CHANNEL
WHITE TANKS FRS NO.3
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
60076001	12/04	B-8



Description	Symbol	Boring Number	Depth (ft)	Shear Strength	Cohesion (psf)	Friction Angle (deg)	Soil Type
UNDISTURBED	—●—	B-7	3.5-5	Peak	150	23	ML / SC

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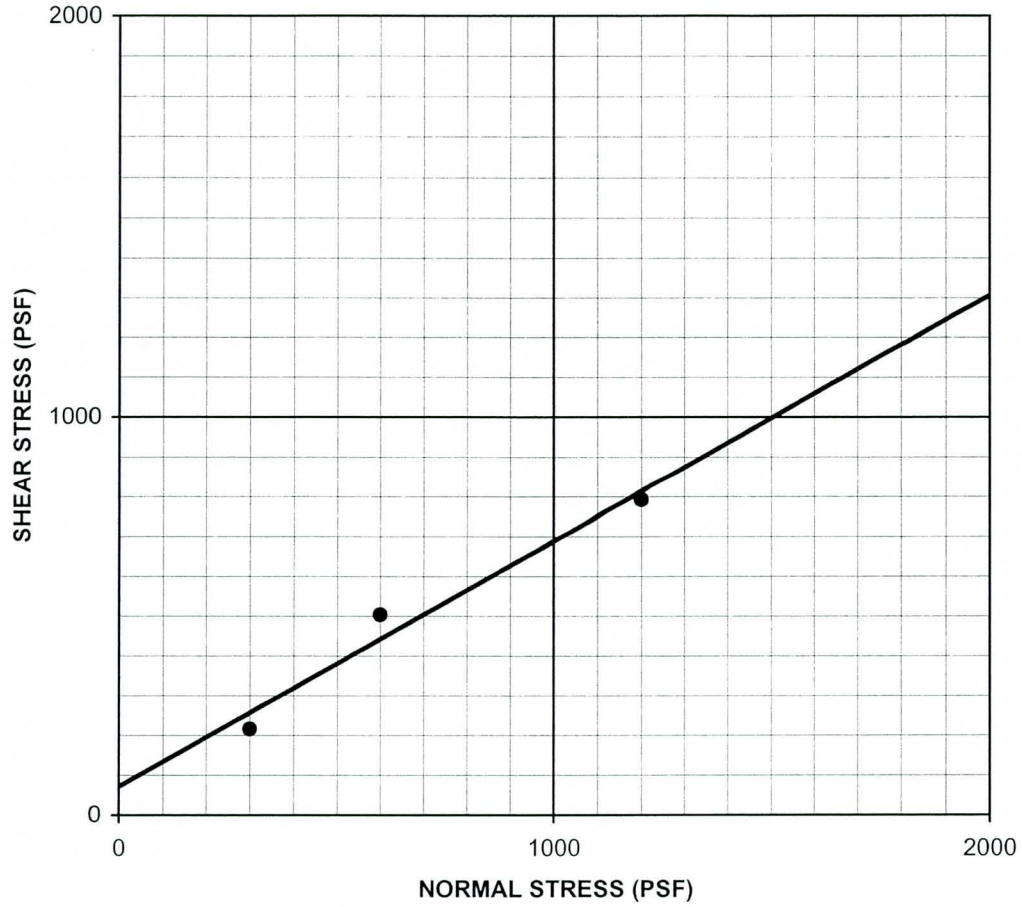
SHEAR STRENGTH TEST RESULTS

NORTH INTEL CHANNEL
WHITE TANKS FRS NO.3
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
60076001	12/04	B-9



Description	Symbol	Boring Number	Depth (ft)	Shear Strength	Cohesion (psf)	Friction Angle (deg)	Soil Type
UNDISTURBED	—●—	B-8	6-7.5	Peak	72	32	CL / SM

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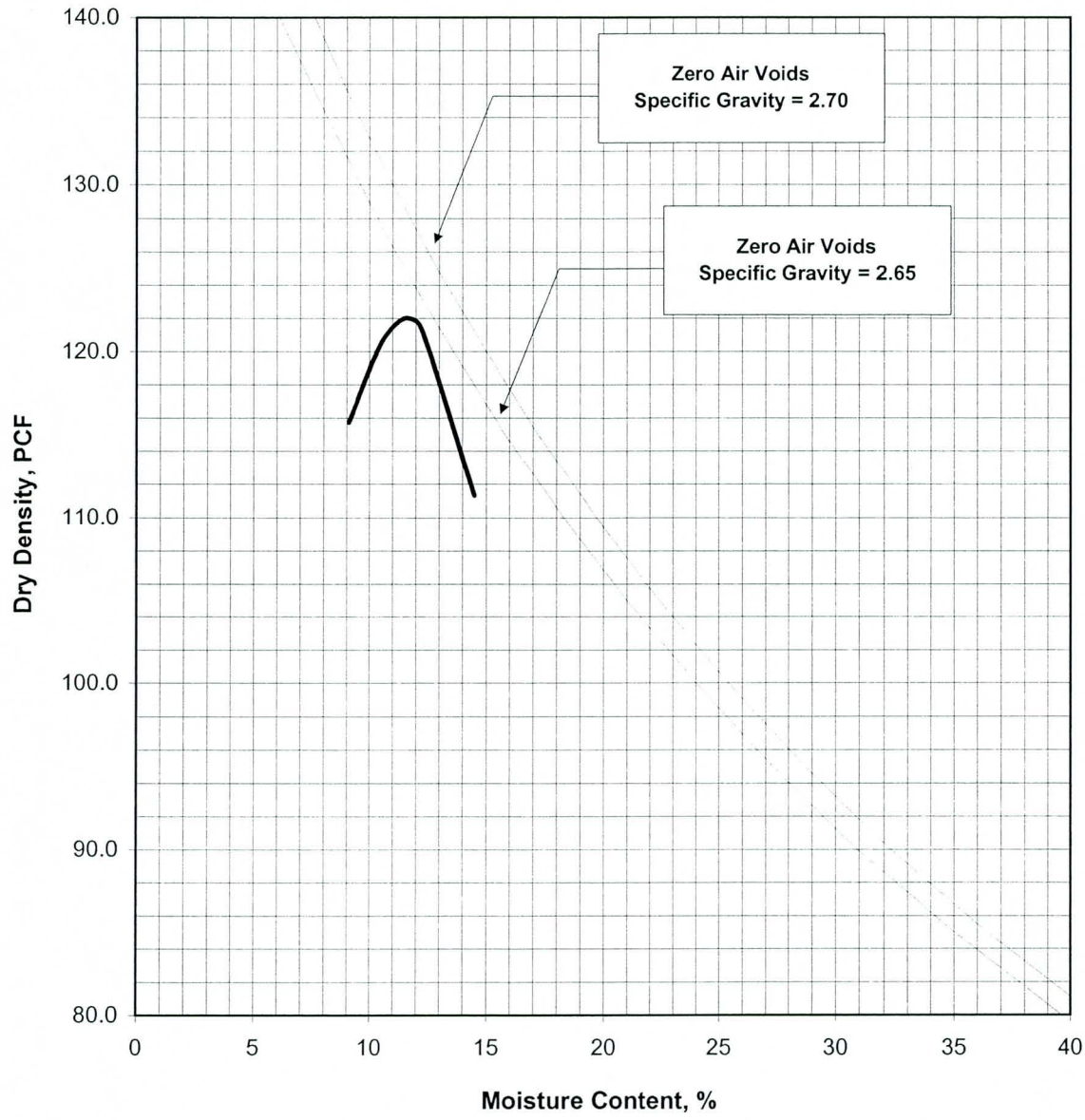
SHEAR STRENGTH TEST RESULTS

NORTH INTEL CHANNEL
WHITE TANKS FRS NO.3
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
60076001	12/04	B-10



SAMPLE LOCATION	DEPTH (FT)	SOIL DESCRIPTION	MAXIMUM DENSITY (PCF)	OPTIMUM MOISTURE CONTENT (%)
B-2	0-5	CLAYEY SILT	122.0*	11.5*

* 10 % PLUS NO. 4 ROCK WAS FOUND IN LABORATORY SAMPLE
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 698 METHOD "A"

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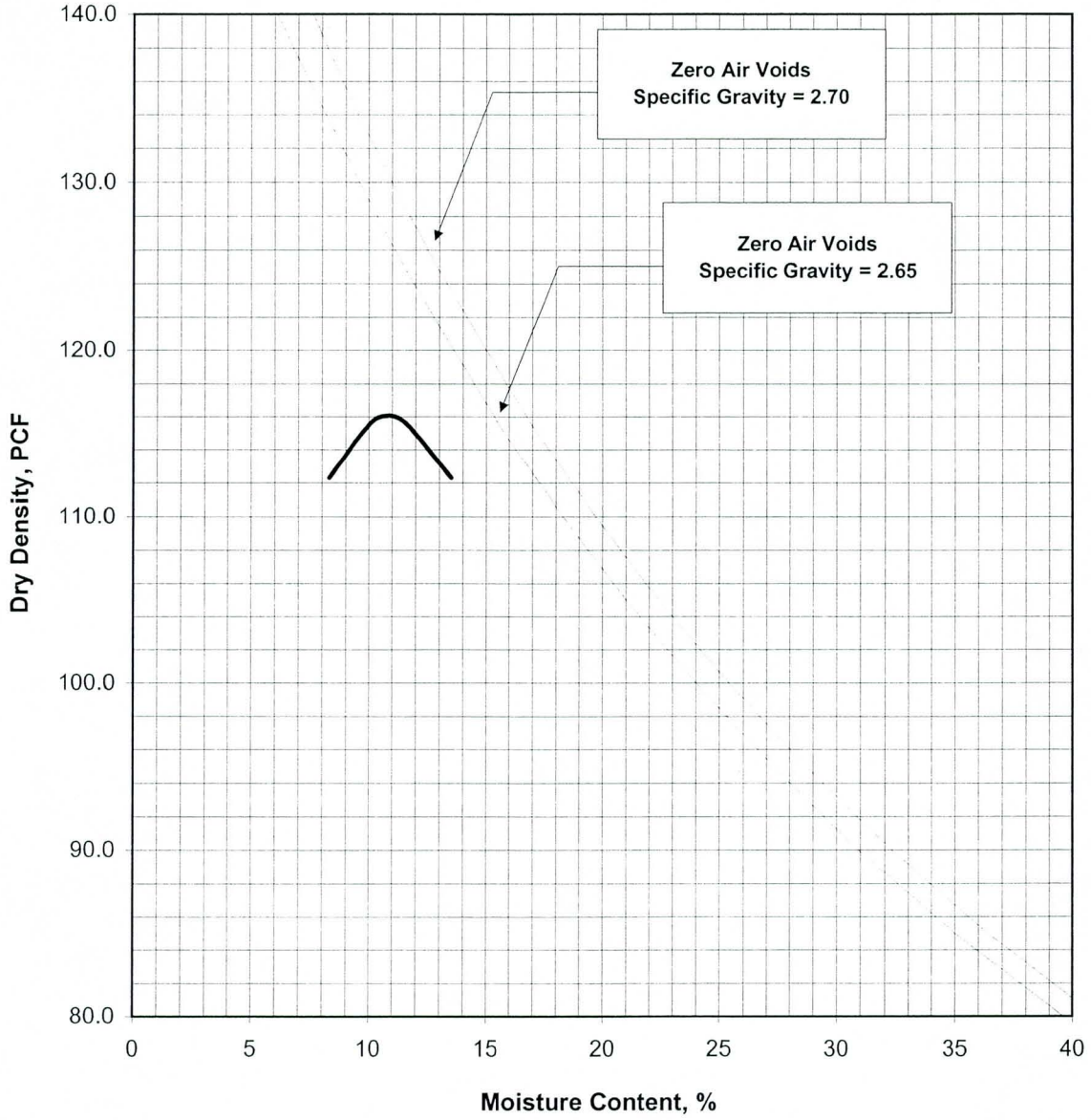
Ninyo & Moore

MAXIMUM DENSITY TEST RESULTS

NORTH INLET CHANNEL
WHITE TANKS FRS NO.3
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600760001	12/04	B-11

MAXDENSITY P9241B-2 0-5 -ML



SAMPLE LOCATION	DEPTH (FT)	SOIL DESCRIPTION	MAXIMUM DENSITY (PCF)	OPTIMUM MOISTURE CONTENT (%)
B-5	0-5	SILTY SAND	116.0	10.5

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 698 METHOD "A"

DRAFT

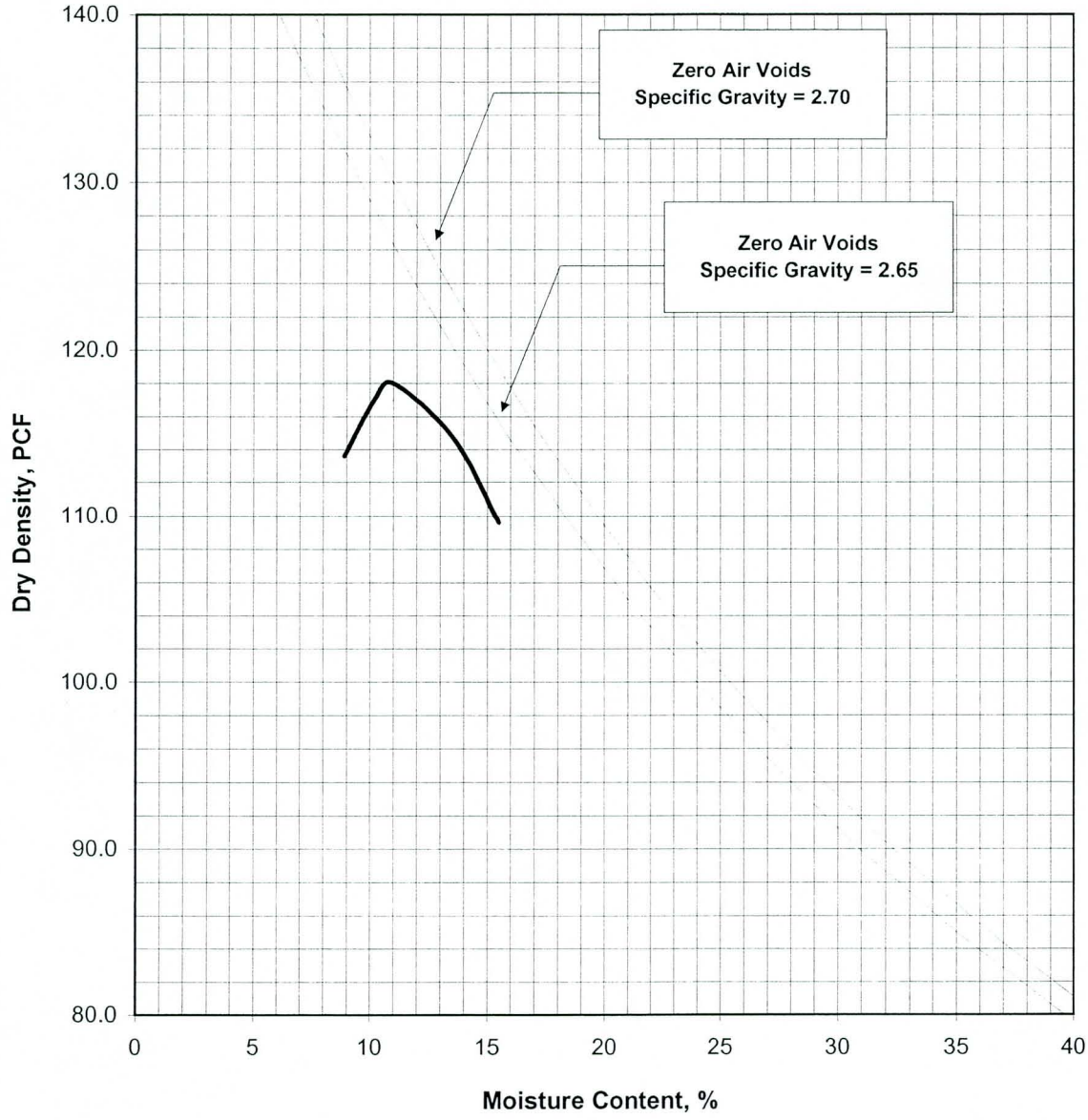
Ninyo & Moore

MAXIMUM DENSITY TEST RESULTS

NORTH INLET CHANNEL
WHITE TANKS FRS NO.3
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600760001	12/04	B-12

MAXDENSITY P9241 B-5 0-5 -SM



SAMPLE LOCATION	DEPTH (FT)	SOIL DESCRIPTION	MAXIMUM DENSITY (PCF)	OPTIMUM MOISTURE CONTENT (%)
B-7	0-5	CLAYEY SILT/ CLAYEY SAND	118.0	11.0

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 698 METHOD "A"

DRAFT

Ninyo & Moore

MAXIMUM DENSITY TEST RESULTS

NORTH INLET CHANNEL
WHITE TANKS FRS NO.3
MARICOPA COUNTY, ARIZONA

PROJECT NO.	DATE	FIGURE
600760001	12/04	B-13

MAXDENSITY P9241 B-7 0-5-S

Ninyo & Moore

APPENDIX C

AGRONOMY TEST RESULTS

FRUIT GROWERS LABORATORY, INC.

ANALYTICAL CHEMISTS

November 8, 2004

Dear Valued Customer:

Subject: Changes in Your Soil Analysis Report

Fruit Growers Laboratory has now completed its new soils report. The changes included in the new report can be summarized as follows:

Report units

All analysis data and optimum ranges will be reported in pounds per acre foot (lbs/AF).

Phosphorus and Potassium

Phosphorus and Potassium laboratory results will be reported as P_2O_5 and K_2O respectively. These are the chemical compositions in which these fertilizers are sold. This will eliminate the need to make conversions when calculating how much of either to apply.

Optimum Ranges

In the past, we have utilized the optimum ranges that are published by the University of California. These tended to be very broad in order to accommodate all types of soils. With the new report we will take into account the relative nutrient holding capacity and nutrient availability of each soil sample. This will result in more concise optimum ranges to reflect these characteristics in the specific soil being analyzed.

Impact of the changes

The new soil reports:

1. Will enable you to fine-tune your fertilization program in a much shorter period of time.
2. It will promote the efficient use of fertilizers and will help improve yields.

If you have questions or comments, please let me know.

FRUIT GROWERS LABORATORY, INC.

William L. Pidduck
Vice President

Corporate Offices & Laboratory
PO Box 272 / 853 Corporation Street
Santa Paula, CA 93061-0272
TEL: 805/392-2000
FAX: 805/525-4172

Office & Laboratory
2500 Stagecoach Road
Stockton, CA 95215
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FAX: 209/942-0423

Field Office
Visalia, CA
TEL: 559/734-9473
FAX: 559/734-8435
Mobile: 559/737-2399

FRUIT GROWERS LABORATORY, INC.

ANALYTICAL CHEMISTS

November 17, 2004

Lab ID : SP 0411630-001
Customer ID : 2-18569

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

Recommendation for Project #600760001/White Tanks FRS No.3, MCFC

The following report presents the results of analyses conducted on your soil. See page 4 for sample information and analyses results. The following recommendations are based upon the current conditions of the soil. All application recommendations are for each 1,000 square feet of growing area. Please be sure to read the standard application notes presented on page 3.

I. Plant Selection

The Analyses of this soil indicates the following plant selection requirements:

A. Select only non-acidic loving plants for this soil.
B. Select only those plants that have a slight or greater tolerance to free limestone for planting at this site.
C. Select only those plants that have a slight or greater tolerance to Salinity for planting at this site. A review of the plants growing in the immediate area of the site to be landscaped will provide some additional guidelines as to the proper plant selection.

II. Preplant Soil Amendments and Fertilizers

A. Turf and Groundcover

	Apply per 1000 sq. ft.
1. Soil Amendments	
a. Organic (Well-composted)	2.00 cu. yds.
b. Limestone	0.00 lbs.
c. Soil Sulfur	0.00 lbs.
	Apply per 1000 sq. ft.
2. Fertilizers	
a. Nitrogen (N)	1.20 lbs.
b. Phosphorus (P2O5)	3.30 lbs.
c. Potassium (K2O)	0.00 lbs.
d. Magnesium (Mg)	0.00 lbs.
e. Zinc (Zn)	1.00 lbs.
f. Manganese (Mn)	0.00 lbs.
g. Iron (Fe)	0.70 lbs.
h. Copper (Cu)	0.03 lbs.
i. Boron (B)	0.00 lbs.

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TEL: 559/734-9473
FAX: 559/734-8435
Mobile: 559/737-2399

B. Tree and Shrub Backfill Mix

1.	Native (site) soil	66%
2.	Nitrogen Fertilized Organic Material	33%
3.	Commerical Fertilizer (8-8-4)	1 lb./cu. yd.
4.	Iron	2 oz./cu. yd.
5.	Zinc	1 oz./cu. yd.
6.	Manganese	1 oz./cu. yd.

When planting specifications do not call for a separate backfill mix then backfill the holes that are excavated to install containerized plants using the native (site) soil amended according to the preplant recommendations given on page 1.

III. Leaching Requirement

It is recommended that this soil be thoroughly leached to lower the Sulfate, Chloride prior to planting. This leaching operation should be made after the application of any recommended soil amendments, but prior to applying any of the recommended preplant fertilizers. The leaching operation should consist of three applications of irrigation water with enough water being applied at each irrigation to thoroughly wet this soil to a depth of twenty-four inches with the water being applied at a rate slow enough to prevent any runoff. A two to three day waiting period between applications of water should occur to allow for internal soil drainage.

Sulfate, ChlorideSulfate, Chloride levels should be rechecked after the above leaching operation is completed to determine the degree of improvement. These new levels will allow for the selection of plants having the appropriate salt tolerances.

IV. Post-Plant Fertilization - lbs./1000 sq. ft.

Nitrogen	3/4 lb.
Phosphorus	1/3 lb.
Potassium	1/3 lb.

The actual post-plant requirements for fertilizers and soil amendments will vary depending upon the specific site conditions. Periodic post-plant analyses can be used to assure proper soil conditions and balanced levels of plant nutrition.

V. Irrigation

Make certain that the irrigation water being applied is penetrating to a depth slightly greater than the root zone of the plants being grown. Water with a frequency needed to maintain moist soil at all times - never wet for long periods and never let the soil dry out.

Application Notes

The application instructions listed below apply only if the material(s) is recommended in this report on page 1. Materials not included in the recommendations are excluded either because the analyses data did not indicate a need or the analysis to determine if a need existed was not requested.

Organic Materials

Nitrolized redwood compost is preferred but other organic mixes may be substituted depending upon the site requirements. Organic materials should be spread uniformly over the surface soils and when possible should be incorporated to a depth of two to three inches.

Limestone, Dolomite & Sulfur

These materials should be broadcast uniformly over the surface soils and then incorporated to a depth of two to three inches.

Gypsum

This material should be broadcast uniformly over surface soils for water penetration. For best results do not incorporate.

Preplant Phosphorous, Zinc, Manganese, Iron & Copper

These materials should be broadcast uniformly over the surface soils and then incorporated to a depth of two to three inches. Post-plant applications can be surface applied for water penetration.

Nitrogen, Potassium & Magnesium

These materials are highly water soluble and can be applied uniformly over the surface soils for water penetration or they can be incorporated with the other materials. Magnesium sources for plant nutrition include Epsom salts (Magnesium Sulfate), and the double salt of Potasium-Magnesium Sulfate (Sulfate of Potash-magnesia).

FRUIT GROWERS LABORATORY, INC.

ANALYTICAL CHEMISTS

November 17, 2004

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

Lab ID : SP 0411630-001
Customer ID : 2-18569

Sampled On : October 26, 2004
Sampled By : Ninyo and Moore
Received On : November 8, 2004
Depth : 0-60"
Meth Irrg. : S.S. Sprinklers

Description : Sample 1 B-2
Project : Project #600760001/White Tanks FRS No.3, MCFC

LANDSCAPE SOIL ANALYSIS

Test Description	Result	Units	Optimum Range	Graphical Results Presentation				
				Very Low	Moderately Low	Optimum	Moderately High	Very High
Primary Nutrients								
Nitrate-Nitrogen	16	Lbs/AF	65 - 105					
Phosphorus	24	Lbs/AF	100 - 140					
Potassium (Exch)	720	Lbs/AF	710 - 1780					
Potassium (Sol)	125	Lbs/AF	117 - 430			2%		
Secondary Nutrients								
Calcium (Exch)	16300	Lbs/AF	10900 - 14600					
Calcium (Sol)	1430	Lbs/AF	160 - 641				53%	
Magnesium (Exch)	780	Lbs/AF	1100 - 2210					
Magnesium (Sol)	209	Lbs/AF	12 - 158				13%	
Sodium (Exch)	300	Lbs/AF	0 - 1040					
Sodium (Sol)	966	Lbs/AF	0 - 1810				31%	
Sulfate	4090	Lbs/AF	610 - 4460					
Micro Nutrients								
Zinc	2.0	Lbs/AF	4 - 160					
Manganese	15.6	Lbs/AF	8 - 240					
Iron	24.4	Lbs/AF	32 - 272					
Copper	3.2	Lbs/AF	1.2 - 41.2					
Boron	1.56	Lbs/AF	2 - 8.00					
Chloride	1320	Lbs/AF	43 - 752					
CEC	22.7	meq/100g	5 - 65.0					
% Base Saturation								
CEC - Calcium	89.4	%	60 - 80.0					
CEC - Magnesium	7.0	%	10 - 20.0					
CEC - Potassium	2.03	%	2 - 5.00					
CEC - Sodium	1.45	%	0 - 5.00					
CEC - Hydrogen	0.00	%	0 - 3.00					
				Strongly Acidic	Moderately Acidic	Near Neutral	Moderately Alkaline	Strongly Alkaline
pH	7.96	---	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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TEL: 209/942-0181
FAX: 209/942-0423

Field Office
Visalia, CA
TEL: 559/734-9473
FAX: 559/734-8435
Mobile: 559/737-2399

November 17, 2004

Ninyo & Moore

Lab ID : SP 0411630-001
Customer ID : 2-18569
Description : Sample 1 B-2

LANDSCAPE SOIL ANALYSIS

Test Description	Result	Units	Optimum Range	Graphical Results Presentation
Others				Satisfactory / Possible Problem / Moderate Problem / Increasing Problem
Soil Salinity	3.10	mmhos/cm	0.5 - 2.00	
SAR	3.2		0 - 6.0	
Limestone	1.4	%	0 - 0.5	
				0 / 1 / 2 / 3 / 4 / 5 / 6
Lime Requirement	0	Tons/AF	2.5 - 3.50	
				Very Low / Moderately Low / Optimum / Moderately High / Very High
Moisture	3.8	%	6.5 - 19.5	
				Loamy Sand / Sandy Loam / Loam / Silt Loam / Clay Loam / Clay / Organic
Saturation	26.0	%	40 - 50.0	

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.

William L. Pidduck, Vice President

WLP:MEH

Recommendation for Project #600760001/White Tanks FRS No.3, MCFC

The following report presents the results of analyses conducted on your soil. See page 4 for sample information and analyses results. The following recommendations are based upon the current conditions of the soil. All application recommendations are for each 1,000 square feet of growing area. Please be sure to read the standard application notes presented on page 3.

I. Plant Selection

The Analyses of this soil indicates the following plant selection requirements:

A. Select only non-acidic loving plants for this soil.

II. Preplant Soil Amendments and Fertilizers

A. Turf and Groundcover

		Apply per 1000 sq. ft.
1.	Soil Amendments	
a.	Organic (Well-composted)	2.00 cu. yds.
b.	Limestone	0.00 lbs.
c.	Soil Sulfur	25.00 lbs.

		Apply per 1000 sq. ft.
2.	Fertilizers	
a.	Nitrogen (N)	1.30 lbs.
b.	Phosphorus (P2O5)	3.70 lbs.
c.	Potassium (K2O)	2.30 lbs.
d.	Magnesium (Mg)	0.00 lbs.
e.	Zinc (Zn)	0.60 lbs.
f.	Manganese (Mn)	0.00 lbs.
g.	Iron (Fe)	0.85 lbs.
h.	Copper (Cu)	0.03 lbs.
i.	Boron (B)	0.01 lbs.

		0.03 lbs.
i.	Boron (B)	0.00 lbs.

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B. Tree and Shrub Backfill Mix

1.	Native (site) soil	66%
2.	Nitrogen Fertilized Organic Material	33%
3.	Commerical Fertilizer (8-8-4)	1 lb./cu. yd.
4.	Iron	2 oz./cu. yd.
5.	Zinc	1 oz./cu. yd.
6.	Manganese	1 oz./cu. yd.

When planting specifications do not call for a separate backfill mix then backfill the holes that are excavated to install containerized plants using the native (site) soil amended according to the preplant recommendations given on page 1.

III. Leaching Requirement

No Leaching Requirement for this soil.

IV. Post-Plant Fertilization - lbs./1000 sq. ft.

Nitrogen	1 lb.
Phosphorus	1/4 lb.
Potassium	1/4 lb.

The actual post-plant requirements for fertilizers and soil amendments will vary depending upon the specific site conditions. Periodic post-plant analyses can be used to assure proper soil conditions and balanced levels of plant nutrition.

V. Irrigation

Make certain that the irrigation water being applied is penetrating to a depth slightly greater than the root zone of the plants being grown. Water with a frequency needed to maintain moist soil at all times - never wet for long periods and never let the soil dry out.

Make certain that the irrigation water being applied is penetrating to a depth slightly greater than the root zone of the plants being grown. Water with a frequency needed to maintain moist soil at all times - never wet for long periods and never let the soil dry out.

Application Notes

The application instructions listed below apply only if the material(s) is recommended in this report on page 1. Materials not included in the recommendations are excluded either because the analyses data did not indicate a need or the analysis to determine if a need existed was not requested.

Organic Materials

Nitrolized redwood compost is preferred but other organic mixes may be substituted depending upon the site requirements. Organic materials should be spread uniformly over the surface soils and when possible should be incorporated to a depth of two to three inches.

Limestone, Dolomite & Sulfur

These materials should be broadcast uniformly over the surface soils and then incorporated to a depth of two to three inches.

Gypsum

This material should be broadcast uniformly over surface soils for water penetration. For best results do not incorporate.

Preplant Phosphorous, Zinc, Manganese, Iron & Copper

These materials should be broadcast uniformly over the surface soils and then incorporated to a depth of two to three inches. Post-plant applications can be surface applied for water penetration.

Nitrogen, Potassium & Magnesium

These materials are highly water soluble and can be applied uniformly over the surface soils for water penetration or they can be incorporated with the other materials. Magnesium sources for plant nutrition include Epsom salts (Magnesium Sulfate), and the double salt of Potasium-Magnesium Sulfate (Sulfate of Potash-magnesia).

FRUIT GROWERS LABORATORY, INC.

ANALYTICAL CHEMISTS

November 17, 2004

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

Lab ID : SP 0411630-002
Customer ID : 2-18569

Sampled On : October 26, 2004
Sampled By : Ninyo and Moore
Received On : November 8, 2004
Depth : 0-60"
Meth Irrg. : S.S. Sprinklers

Description : Sample 2 B-5
Project : Project #600760001/White Tanks FRS No.3, MCFC

LANDSCAPE SOIL ANALYSIS

Test Description	Result	Units	Optimum Range	Graphical Results Presentation (Very Low / Moderately Low / Optimum / Moderately High / Very High)
Primary Nutrients				
Nitrate-Nitrogen	9	Lbs/AF	56 - 96	
Phosphorus	16	Lbs/AF	100 - 140	
Potassium (Exch)	550	Lbs/AF	440 - 1090	
Potassium (Sol)	69	Lbs/AF	117 - 430	9%
Secondary Nutrients				
Calcium (Exch)	10500	Lbs/AF	6730 - 8980	
Calcium (Sol)	281	Lbs/AF	160 - 641	72%
Magnesium (Exch)	290	Lbs/AF	680 - 1360	
Magnesium (Sol)	24	Lbs/AF	12 - 158	10%
Sodium (Exch)	< 80	Lbs/AF	0 - 640	
Sodium (Sol)	41	Lbs/AF	0 - 820	9%
Sulfate	120	Lbs/AF	190 - 4030	
Micro Nutrients				
Zinc	3.6	Lbs/AF	4 - 160	
Manganese	12.0	Lbs/AF	8 - 240	
Iron	15.6	Lbs/AF	32 - 272	
Copper	2.4	Lbs/AF	1.2 - 41.2	
Boron	0.56	Lbs/AF	2 - 8.00	
Chloride	26	Lbs/AF	43 - 752	
CEC	14.0	meq/100g	5 - 65.0	
% Base Saturation				
CEC - Calcium	93.6	%	60 - 80.0	
CEC - Magnesium	4.3	%	10 - 20.0	
CEC - Potassium	2.50	%	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	8.06	---	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.

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FAX: 559/734-8435
Mobile: 559/737-2399

November 17, 2004

Ninyo & Moore

Lab ID : SP 0411630-002
Customer ID : 2-18569
Description : Sample 2 B-5

LANDSCAPE SOIL ANALYSIS

Test Description	Result	Units	Optimum Range	Graphical Results Presentation
Others				Satisfactory / Possible Problem / Moderate Problem / Increasing Problem
Soil Salinity	0.47	mmhos/cm	0.5 - 2.00	
SAR	0.3		0 - 6.0	
Limestone	< 0.10	%	0 - 0.5	
				0 / 1 / 2 / 3 / 4 / 5 / 6
Lime Requirement	0	Tons/AF	2.5 - 3.50	
				Very Low / Moderately Low / Optimum / Moderately High / Very High
Moisture	1.8	%	6.2 - 18.6	
				Loamy Sand / Sandy Loam / Loam / Silt Loam / Clay Loam / Clay / Organic
Saturation	24.8	%	40 - 50.0	

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.

William L. Pidduck, Vice President

WLP:MEH

Recommendation for Project #600760001/White Tanks FRS No.3, MCFC

The following report presents the results of analyses conducted on your soil. See page 4 for sample information and analyses results. The following recommendations are based upon the current conditions of the soil. All application recommendations are for each 1,000 square feet of growing area. Please be sure to read the standard application notes presented on page 3.

I. Plant Selection

The Analyses of this soil indicates the following plant selection requirements:

A. Select only non-acidic loving plants for this soil.

B. Select only those plants that have a slight or greater tolerance to free limestone for planting at this site.

C. Select only those plants that have a slight or greater tolerance to Salinity for planting at this site. A review of the plants growing in the immediate area of the site to be landscaped will provide some additional guidelines as to the proper plant selection.

II. Preplant Soil Amendments and Fertilizers

A. Turf and Groundcover

	Apply per 1000 sq. ft.
1. Soil Amendments	
a. Organic (Well-composted)	2.00 cu. yds.
b. Limestone	0.00 lbs.
c. Soil Sulfur	25.00 lbs.

	Apply per 1000 sq. ft.
2. Fertilizers	
a. Nitrogen (N)	0.00 lbs.
b. Phosphorus (P2O5)	3.90 lbs.
c. Potassium (K2O)	3.40 lbs.
d. Magnesium (Mg)	0.00 lbs.
e. Zinc (Zn)	0.70 lbs.
f. Manganese (Mn)	0.00 lbs.
g. Iron (Fe)	0.70 lbs.
h. Copper (Cu)	0.03 lbs.
i. Boron (B)	0.01 lbs.

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Application Notes

The application instructions listed below apply only if the material(s) is recommended in this report on page 1. Materials not included in the recommendations are excluded either because the analyses data did not indicate a need or the analysis to determine if a need existed was not requested.

Organic Materials

Nitrolized redwood compost is preferred but other organic mixes may be substituted depending upon the site requirements. Organic materials should be spread uniformly over the surface soils and when possible should be incorporated to a depth of two to three inches.

Limestone, Dolomite & Sulfur

These materials should be broadcast uniformly over the surface soils and then incorporated to a depth of two to three inches.

Gypsum

This material should be broadcast uniformly over surface soils for water penetration. For best results do not incorporate.

Preplant Phosphorous, Zinc, Manganese, Iron & Copper

These materials should be broadcast uniformly over the surface soils and then incorporated to a depth of two to three inches. Post-plant applications can be surface applied for water penetration.

Nitrogen, Potassium & Magnesium

These materials are highly water soluble and can be applied uniformly over the surface soils for water penetration or they can be incorporated with the other materials. Magnesium sources for plant nutrition include Epsom salts (Magnesium Sulfate), and the double salt of Potasium-Magnesium Sulfate (Sulfate of Potash-magnesia).

B. Tree and Shrub Backfill Mix

1.	Native (site) soil	66%
2.	Nitrogen Fertilized Organic Material	33%
3.	Commerical Fertilizer (8-8-4)	1 lb./cu. yd.
4.	Iron	2 oz./cu. yd.
5.	Zinc	1 oz./cu. yd.
6.	Manganese	1 oz./cu. yd.

When planting specifications do not call for a separate backfill mix then backfill the holes that are excavated to install containerized plants using the native (site) soil amended according to the preplant recommendations given on page 1.

III. Leaching Requirement

It is recommended that you periodically add N-pHURIC to the irrigation water to obtain a water pH of 5.0 to facilitate the leaching of Sodium.

IV. Post-Plant Fertilization - lbs./1000 sq. ft.

Nitrogen	3/4 lb.
Phosphorus	1/3 lb.
Potassium	1/3 lb.

The actual post-plant requirements for fertilizers and soil amendments will vary depending upon the specific site conditions. Periodic post-plant analyses can be used to assure proper soil conditions and balanced levels of plant nutrition.

V. Irrigation

Make certain that the irrigation water being applied is penetrating to a depth slightly greater than the root zone of the plants being grown. Water with a frequency needed to maintain moist soil at all times - never wet for long periods and never let the soil dry out.

Make certain that the irrigation water being applied is penetrating to a depth slightly greater than the root zone of the plants being grown. Water with a frequency needed to maintain moist soil at all times - never wet for long periods and never let the soil dry out.

FRUIT GROWERS LABORATORY, INC.

ANALYTICAL CHEMISTS

November 17, 2004

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

Lab ID : SP 0411630-003
Customer ID : 2-18569

Sampled On : October 26, 2004
Sampled By : Ninyo and Moore
Received On : November 8, 2004
Depth : 0-60"
Meth Irrg. : S.S. Sprinklers

Description : Sample 3 B-7
Project : Project #600760001/White Tanks FRS No.3, MCFC

LANDSCAPE SOIL ANALYSIS

Test Description	Result	Units	Optimum Range	Graphical Results Presentation				
				Very Low	Moderately Low	Optimum	Moderately High	Very High
Primary Nutrients								
Nitrate-Nitrogen	57	Lbs/AF	60 - 100					
Phosphorus	12	Lbs/AF	100 - 140					
Potassium (Exch)	390	Lbs/AF	650 - 1620					
Potassium (Sol)	25	Lbs/AF	117 - 430	1%				
Secondary Nutrients								
Calcium (Exch)	14700	Lbs/AF	9960 - 13300					
Calcium (Sol)	529	Lbs/AF	160 - 641			30%		
Magnesium (Exch)	730	Lbs/AF	1010 - 2010					
Magnesium (Sol)	78	Lbs/AF	12 - 158			7%		
Sodium (Exch)	480	Lbs/AF	0 - 950					
Sodium (Sol)	1290	Lbs/AF	0 - 1120				63%	
Sulfate	2070	Lbs/AF	400 - 4240					
Micro Nutrients								
Zinc	3.2	Lbs/AF	4 - 160					
Manganese	15.2	Lbs/AF	8 - 240					
Iron	25.6	Lbs/AF	32 - 272					
Copper	2.8	Lbs/AF	1.2 - 41.2					
Boron	1.16	Lbs/AF	2 - 8.00					
Chloride	553	Lbs/AF	43 - 752					
CEC	20.7	meq/100g	5 - 65.0					
% Base Saturation								
CEC - Calcium	88.9	%	60 - 80.0					
CEC - Magnesium	7.2	%	10 - 20.0					
CEC - Potassium	1.21	%	2 - 5.00					
CEC - Sodium	2.51	%	0 - 5.00					
CEC - Hydrogen	0.00	%	0 - 3.00					
				Strongly Acidic	Moderately Acidic	Near Neutral	Moderately Alkaline	Strongly Alkaline
pH	7.87	---	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.

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Mobile: 559/737-2399

November 17, 2004

Ninyo & Moore

Lab ID : SP 0411630-003
Customer ID : 2-18569
Description : Sample 3 B-7

LANDSCAPE SOIL ANALYSIS

Test Description	Result	Units	Optimum Range	Graphical Results Presentation
Others				Satisfactory / Possible Problem / Moderate Problem / Increasing Problem
Soil Salinity	2.54	mmhos/cm	0.5 - 2.00	
SAR	6.9		0 - 6.0	
Limestone	2.5	%	0 - 0.5	
				0 / 1 / 2 / 3 / 4 / 5 / 6
Lime Requirement	0	Tons/AF	2.5 - 3.50	
				Very Low / Moderately Low / Optimum / Moderately High / Very High
Moisture	2.9	%	6.8 - 20.3	
				Loamy Sand / Sandy Loam / Loam / Silt Loam / Clay Loam / Clay / Organic
Saturation	27.1	%	40 - 50.0	

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.

William L. Pidduck, Vice President

WLP:MEH

FGL FRUIT GROWERS LABORATORY

CHAIN OF CUSTODY
AND ANALYSIS REQUEST DOCUMENT

ORIGINAL

CLIENT DETAILS — SECTION I

Client: NINYO & MOORE
☐ New Customer — Customer Number: 2-18569
Address: 3001 S. 35th St, Suite 6
PHOENIX, AZ - 85034
Phone: 602-243-1600
FAX: 602-243-2699
Project name: WHITE TANKS FRS NO.3, MCFC
Contact person: SAM SHERMAN

Information (if different from above)
Name:
Address:
Phone:
FAX:
Contact person:
Purchase order/contract/FGL quote number: PROJ # 600760001
email: SSherman@ninyoandmoore.com

SAMPLING — SECTION II

Sampler (s): NINYO & MOORE
HOLLOW STEM AUGER
Date of Sampling: 10/26/04
Time: Mileage:

REPORT INFORMATION — SECTION III

Rush Analysis: 5 Days ____ 7 Days ____
Subject to surcharge
QA/QC report required: yes
Tissue Monitoring Required: yes
Lab number: 411 630
Lab Loc: SP ☒ STK ☐ VI ☐

(2-18569)
Ninyo and Moore
SP 0411630
LDA-11/08/2004-11:57:18

SAMPLE INFORMATION — SECTION IV

Sample Number	Location/Description	Date of Planting	Crop	Growth Stage	Sample Depth	Recommendations: Yes (Y) No (N) Preplant (PP)	Soil Texture: Light (L) Medium (M) Heavy (H)	Irrigation: Solid Set Sprinklers (SSS) Dmgline Sprinklers (DLS) Furrow (F) Fanjet (FJ) Flood (FL) Drip (DP) Fogger (FO)	Plant Condition: Very Good (VG) Good (G) Fairly Good (FG) Fair (F) Poor (P)	SOIL ANALYSES: Comprehensive Soil Suitability	Basic Soil	Gypsum Requirement	Organic Materials Analysis	Other: Specify	PLANT TISSUE ANALYSES: Comprehensive Leaf	Comprehensive Petiole	Basic Leaf	Basic Petiole	Other: Specify	OTHER ANALYSES: Whole Fruit	Soil Amendments	Fertilizers	PATHOLOGY: Citrus Phytophthora	Citrus Nematode	Avocado Phytophthora P.Clnt	Disease Assay	IRRIGATION SUITABIL
1) B-2	Sample ①	—	—	PP	0-5'	PP	L	SSS	/		X																	
2) B-5	Sample ②	—	—	PP	0-5'	PP	L	SSS	/		X																	
3) B-7	Sample ③	—	—	PP	0-5'	PP	L	SSS	/		X																	

Land use

REMARKS — SECTION V

SAMPLE FROM PHOENIX, AZ
GO-BY REPORT ATTACHED.
Left message regarding crop 11/10/04 SD

CUSTODY — SECTION VI

Relinquished by and subject to the terms and conditions on the reverse of this document:

Relinquished by:		Print Name:		Date	Time
Received by:		Print Name:		Date	Time
Relinquished by:	CA overnight	Print Name:	CA overnight	Date 11/8/04	Time 10:00
Received by:	Laura De Anda	Print Name:	Laura De Anda	Date 11/8/04	Time 10:00

CORPORATE OFFICE & LABORATORY
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Tel: (209) 942-0181

FIELD OFFICE
Visalia, California
Tel: (559) 734-9473

OUT OF STATE

November 17, 2004

Lab ID : SP 0411630-001
Customer ID : 2-18569

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

Recommendation for Project #600760001/White Tanks FRS No.3, MCFC

The following report presents the results of analyses conducted on your soil. See page 4 for sample information and analyses results. The following recommendations are based upon the current conditions of the soil. All application recommendations are for each 1,000 square feet of growing area. Please be sure to read the standard application notes presented on page 3.

I. Plant Selection

The Analyses of this soil indicates the following plant selection requirements:

A. Select only non-acidic loving plants for this soil.
B. Select only those plants that have a slight or greater tolerance to free limestone for planting at this site.
C. Select only those plants that have a slight or greater tolerance to Salinity for planting at this site. A review of the plants growing in the immediate area of the site to be landscaped will provide some additional guidelines as to the proper plant selection.

II. Preplant Soil Amendments and Fertilizers

A. Turf and Groundcover

	Apply per 1000 sq. ft.
1. Soil Amendments	
a. Organic (Well-composted)	2.00 cu. yds.
b. Limestone	0.00 lbs.
c. Soil Sulfur	0.00 lbs.

	Apply per 1000 sq. ft.
2. Fertilizers	
a. Nitrogen (N)	1.20 lbs.
b. Phosphorus (P2O5)	3.30 lbs.
c. Potassium (K2O)	0.00 lbs.
d. Magnesium (Mg)	0.00 lbs.
e. Zinc (Zn)	1.00 lbs.
f. Manganese (Mn)	0.00 lbs.
g. Iron (Fe)	0.70 lbs.
h. Copper (Cu)	0.03 lbs.
i. Boron (B)	0.00 lbs.

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B. Tree and Shrub Backfill Mix

1.	Native (site) soil	66%
2.	Nitrogen Fertilized Organic Material	33%
3.	Commerical Fertilizer (8-8-4)	1 lb./cu. yd.
4.	Iron	2 oz./cu. yd.
5.	Zinc	1 oz./cu. yd.
6.	Manganese	1 oz./cu. yd.

When planting specifications do not call for a separate backfill mix then backfill the holes that are excavated to install containerized plants using the native (site) soil amended according to the preplant recommendations given on page 1.

III. Leaching Requirement

It is recommended that this soil be thoroughly leached to lower the Sulfate, Chloride prior to planting. This leaching operation should be made after the application of any recommended soil amendments, but prior to applying any of the recommended preplant fertilizers. The leaching operation should consist of three applications of irrigation water with enough water being applied at each irrigation to thoroughly wet this soil to a depth of twenty-four inches with the water being applied at a rate slow enough to prevent any runoff. A two to three day waiting period between applications of water should occur to allow for internal soil drainage.

Sulfate, ChlorideSulfate, Chloride levels should be rechecked after the above leaching operation is completed to determine the degree of improvement. These new levels will allow for the selection of plants having the appropriate salt tolerances.

IV. Post-Plant Fertilization - lbs./1000 sq. ft.

Nitrogen	3/4 lb.
Phosphorus	1/3 lb.
Potassium	1/3 lb.

The actual post-plant requirements for fertilizers and soil amendments will vary depending upon the specific site conditions. Periodic post-plant analyses can be used to assure proper soil conditions and balanced levels of plant nutrition.

V. Irrigation

Make certain that the irrigation water being applied is penetrating to a depth slightly greater than the root zone of the plants being grown. Water with a frequency needed to maintain moist soil at all times - never wet for long periods and never let the soil dry out.

Application Notes

The application instructions listed below apply only if the material(s) is recommended in this report on page 1. Materials not included in the recommendations are excluded either because the analyses data did not indicate a need or the analysis to determine if a need existed was not requested.

Organic Materials

Nitrolized redwood compost is preferred but other organic mixes may be substituted depending upon the site requirements. Organic materials should be spread uniformly over the surface soils and when possible should be incorporated to a depth of two to three inches.

Limestone, Dolomite & Sulfur

These materials should be broadcast uniformly over the surface soils and then incorporated to a depth of two to three inches.

Gypsum

This material should be broadcast uniformly over surface soils for water penetration. For best results do not incorporate.

Preplant Phosphorous, Zinc, Manganese, Iron & Copper

These materials should be broadcast uniformly over the surface soils and then incorporated to a depth of two to three inches. Post-plant applications can be surface applied for water penetration.

Nitrogen, Potassium & Magnesium

These materials are highly water soluble and can be applied uniformly over the surface soils for water penetration or they can be incorporated with the other materials. Magnesium sources for plant nutrition include Epsom salts (Magnesium Sulfate), and the double salt of Potasium-Magnesium Sulfate (Sulfate of Potash-magnesia).

FRUIT GROWERS LABORATORY, INC.

ANALYTICAL CHEMISTS

November 17, 2004

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

Lab ID : SP 0411630-001
Customer ID : 2-18569

Sampled On : October 26, 2004
Sampled By : Ninyo and Moore
Received On : November 8, 2004
Depth : 0-60"
Meth Irrg. : S.S. Sprinklers

Description : Sample 1 B-2
Project : Project #600760001/White Tanks FRS No.3, MCFC

LANDSCAPE SOIL ANALYSIS

Test Description	Result	Units	Optimum Range	Graphical Results Presentation				
				Very Low	Moderately Low	Optimum	Moderately High	Very High
Primary Nutrients								
Nitrate-Nitrogen	16	Lbs/AF	65 - 105					
Phosphorus	24	Lbs/AF	100 - 140					
Potassium (Exch)	720	Lbs/AF	710 - 1780					
Potassium (Sol)	125	Lbs/AF	117 - 430			2%		
Secondary Nutrients								
Calcium (Exch)	16300	Lbs/AF	10900 - 14600					
Calcium (Sol)	1430	Lbs/AF	160 - 641				53%	
Magnesium (Exch)	780	Lbs/AF	1100 - 2210					
Magnesium (Sol)	209	Lbs/AF	12 - 158				13%	
Sodium (Exch)	300	Lbs/AF	0 - 1040					
Sodium (Sol)	966	Lbs/AF	0 - 1810				31%	
Sulfate	4090	Lbs/AF	610 - 4460					
Micro Nutrients								
Zinc	2.0	Lbs/AF	4 - 160					
Manganese	15.6	Lbs/AF	8 - 240					
Iron	24.4	Lbs/AF	32 - 272					
Copper	3.2	Lbs/AF	1.2 - 41.2					
Boron	1.56	Lbs/AF	2 - 8.00					
Chloride	1320	Lbs/AF	43 - 752					
CEC	22.7	meq/100g	5 - 65.0					
% Base Saturation								
CEC - Calcium	89.4	%	60 - 80.0					
CEC - Magnesium	7.0	%	10 - 20.0					
CEC - Potassium	2.03	%	2 - 5.00					
CEC - Sodium	1.45	%	0 - 5.00					
CEC - Hydrogen	0.00	%	0 - 3.00					
				Strongly Acidic	Moderately Acidic	Near Neutral	Moderately Alkaline	Strongly Alkaline
pH	7.96	---	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.

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November 17, 2004

Ninyo & Moore

Lab ID : SP 0411630-001
Customer ID : 2-18569
Description : Sample 1 B-2

LANDSCAPE SOIL ANALYSIS

Test Description	Result	Units	Optimum Range	Graphical Results Presentation						
Others				Satisfactory	Possible Problem	Moderate Problem	Increasing Problem			
Soil Salinity	3.10	mmhos/cm	0.5 - 2.00							
SAR	3.2		0 - 6.0							
Limestone	1.4	%	0 - 0.5							
				0	1	2	3	4	5	6
Lime Requirement	0	Tons/AF	2.5 - 3.50							
				Very Low	Moderately Low	Optimum	Moderately High	Very High		
Moisture	3.8	%	6.5 - 19.5							
				Loamy Sand	Sandy Loam	Loam	Silt Loam	Clay Loam	Clay	Organic
Saturation	26.0	%	40 - 50.0							

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.

William L. Pidduck, Vice President

WLP:MEH

Recommendation for Project #600760001/White Tanks FRS No.3, MCFC

The following report presents the results of analyses conducted on your soil. See page 4 for sample information and analyses results. The following recommendations are based upon the current conditions of the soil. All application recommendations are for each 1,000 square feet of growing area. Please be sure to read the standard application notes presented on page 3.

I. Plant Selection

The Analyses of this soil indicates the following plant selection requirements:

A. Select only non-acidic loving plants for this soil.

II. Preplant Soil Amendments and Fertilizers

A. Turf and Groundcover

	Apply per 1000 sq. ft.
1. Soil Amendments	
a. Organic (Well-composted)	2.00 cu. yds.
b. Limestone	0.00 lbs.
c. Soil Sulfur	25.00 lbs.
	Apply per 1000 sq. ft.
2. Fertilizers	
a. Nitrogen (N)	1.30 lbs.
b. Phosphorus (P2O5)	3.70 lbs.
c. Potassium (K2O)	2.30 lbs.
d. Magnesium (Mg)	0.00 lbs.
e. Zinc (Zn)	0.60 lbs.
f. Manganese (Mn)	0.00 lbs.
g. Iron (Fe)	0.85 lbs.
h. Copper (Cu)	0.03 lbs.
i. Boron (B)	0.01 lbs.

0.03 lbs.
i. Boron (B) 0.00 lbs.

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B. Tree and Shrub Backfill Mix

1.	Native (site) soil	66%
2.	Nitrogen Fertilized Organic Material	33%
3.	Commerical Fertilizer (8-8-4)	1 lb./cu. yd.
4.	Iron	2 oz./cu. yd.
5.	Zinc	1 oz./cu. yd.
6.	Manganese	1 oz./cu. yd.

When planting specifications do not call for a separate backfill mix then backfill the holes that are excavated to install containerized plants using the native (site) soil amended according to the preplant recommendations given on page 1.

III. Leaching Requirement

No Leaching Requirement for this soil.

IV. Post-Plant Fertilization - lbs./1000 sq. ft.

Nitrogen	1 lb.
Phosphorus	1/4 lb.
Potassium	1/4 lb.

The actual post-plant requirements for fertilizers and soil amendments will vary depending upon the specific site conditions. Periodic post-plant analyses can be used to assure proper soil conditions and balanced levels of plant nutrition.

V. Irrigation

Make certain that the irrigation water being applied is penetrating to a depth slightly greater than the root zone of the plants being grown. Water with a frequency needed to maintain moist soil at all times - never wet for long periods and never let the soil dry out.

Make certain that the irrigation water being applied is penetrating to a depth slightly greater than the root zone of the plants being grown. Water with a frequency needed to maintain moist soil at all times - never wet for long periods and never let the soil dry out.

Application Notes

The application instructions listed below apply only if the material(s) is recommended in this report on page 1. Materials not included in the recommendations are excluded either because the analyses data did not indicate a need or the analysis to determine if a need existed was not requested.

Organic Materials

Nitrolized redwood compost is preferred but other organic mixes may be substituted depending upon the site requirements. Organic materials should be spread uniformly over the surface soils and when possible should be incorporated to a depth of two to three inches.

Limestone, Dolomite & Sulfur

These materials should be broadcast uniformly over the surface soils and then incorporated to a depth of two to three inches.

Gypsum

This material should be broadcast uniformly over surface soils for water penetration. For best results do not incorporate.

Preplant Phosphorous, Zinc, Manganese, Iron & Copper

These materials should be broadcast uniformly over the surface soils and then incorporated to a depth of two to three inches. Post-plant applications can be surface applied for water penetration.

Nitrogen, Potassium & Magnesium

These materials are highly water soluble and can be applied uniformly over the surface soils for water penetration or they can be incorporated with the other materials. Magnesium sources for plant nutrition include Epsom salts (Magnesium Sulfate), and the double salt of Potasium-Magnesium Sulfate (Sulfate of Potash-magnesia).

FRUIT GROWERS LABORATORY, INC.

ANALYTICAL CHEMISTS

November 17, 2004

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

Lab ID : SP 0411630-002
Customer ID : 2-18569

Sampled On : October 26, 2004
Sampled By : Ninyo and Moore
Received On : November 8, 2004
Depth : 0-60"
Meth Irrg. : S.S. Sprinklers

Description : Sample 2 B-5
Project : Project #600760001/White Tanks FRS No.3, MCFC

LANDSCAPE SOIL ANALYSIS

Test Description	Result	Units	Optimum Range	Graphical Results Presentation (Very Low / Moderately Low / Optimum / Moderately High / Very High)
Primary Nutrients				
Nitrate-Nitrogen	9	Lbs/AF	56 - 96	
Phosphorus	16	Lbs/AF	100 - 140	
Potassium (Exch)	550	Lbs/AF	440 - 1090	
Potassium (Sol)	69	Lbs/AF	117 - 430	9%
Secondary Nutrients				
Calcium (Exch)	10500	Lbs/AF	6730 - 8980	
Calcium (Sol)	281	Lbs/AF	160 - 641	72%
Magnesium (Exch)	290	Lbs/AF	680 - 1360	
Magnesium (Sol)	24	Lbs/AF	12 - 158	10%
Sodium (Exch)	< 80	Lbs/AF	0 - 640	
Sodium (Sol)	41	Lbs/AF	0 - 820	9%
Sulfate	120	Lbs/AF	190 - 4030	
Micro Nutrients				
Zinc	3.6	Lbs/AF	4 - 160	
Manganese	12.0	Lbs/AF	8 - 240	
Iron	15.6	Lbs/AF	32 - 272	
Copper	2.4	Lbs/AF	1.2 - 41.2	
Boron	0.56	Lbs/AF	2 - 8.00	
Chloride	26	Lbs/AF	43 - 752	
CEC	14.0	meq/100g	5 - 65.0	
% Base Saturation				
CEC - Calcium	93.6	%	60 - 80.0	
CEC - Magnesium	4.3	%	10 - 20.0	
CEC - Potassium	2.50	%	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	8.06	---	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.

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November 17, 2004

Ninyo & Moore

Lab ID : SP 0411630-002
Customer ID : 2-18569
Description : Sample 2 B-5

LANDSCAPE SOIL ANALYSIS

Test Description	Result	Units	Optimum Range	Graphical Results Presentation
Others				Satisfactory / Possible Problem / Moderate Problem / Increasing Problem
Soil Salinity	0.47	mmhos/cm	0.5 - 2.00	
SAR	0.3		0 - 6.0	
Limestone	< 0.10	%	0 - 0.5	
				0 / 1 / 2 / 3 / 4 / 5 / 6
Lime Requirement	0	Tons/AF	2.5 - 3.50	
				Very Low / Moderately Low / Optimum / Moderately High / Very High
Moisture	1.8	%	6.2 - 18.6	
				Loamy Sand / Sandy Loam / Loam / Silt Loam / Clay Loam / Clay / Organic
Saturation	24.8	%	40 - 50.0	

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.

William L. Pidduck, Vice President

WLP:MEH

Recommendation for Project #600760001/White Tanks FRS No.3, MCFC

The following report presents the results of analyses conducted on your soil. See page 4 for sample information and analyses results. The following recommendations are based upon the current conditions of the soil. All application recommendations are for each 1,000 square feet of growing area. Please be sure to read the standard application notes presented on page 3.

I. Plant Selection

The Analyses of this soil indicates the following plant selection requirements:

A. Select only non-acidic loving plants for this soil.

B. Select only those plants that have a slight or greater tolerance to free limestone for planting at this site.

C. Select only those plants that have a slight or greater tolerance to Salinity for planting at this site. A review of the plants growing in the immediate area of the site to be landscaped will provide some additional guidelines as to the proper plant selection.

II. Preplant Soil Amendments and Fertilizers

A. Turf and Groundcover

		Apply per 1000 sq. ft.
1.	Soil Amendments	
a.	Organic (Well-composted)	2.00 cu. yds.
b.	Limestone	0.00 lbs.
c.	Soil Sulfur	25.00 lbs.

		Apply per 1000 sq. ft.
2.	Fertilizers	
a.	Nitrogen (N)	0.00 lbs.
b.	Phosphorus (P2O5)	3.90 lbs.
c.	Potassium (K2O)	3.40 lbs.
d.	Magnesium (Mg)	0.00 lbs.
e.	Zinc (Zn)	0.70 lbs.
f.	Manganese (Mn)	0.00 lbs.
g.	Iron (Fe)	0.70 lbs.
h.	Copper (Cu)	0.03 lbs.
i.	Boron (B)	0.01 lbs.

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B. Tree and Shrub Backfill Mix

1.	Native (site) soil	66%
2.	Nitrogen Fertilized Organic Material	33%
3.	Commerical Fertilizer (8-8-4)	1 lb./cu. yd.
4.	Iron	2 oz./cu. yd.
5.	Zinc	1 oz./cu. yd.
6.	Manganese	1 oz./cu. yd.

When planting specifications do not call for a separate backfill mix then backfill the holes that are excavated to install containerized plants using the native (site) soil amended according to the preplant recommendations given on page 1.

III. Leaching Requirement

It is recommended that you periodically add N-pHURIC to the irrigation water to obtain a water pH of 5.0 to facilitate the leaching of Sodium.

IV. Post-Plant Fertilization - lbs./1000 sq. ft.

Nitrogen	3/4 lb.
Phosphorus	1/3 lb.
Potassium	1/3 lb.

The actual post-plant requirements for fertilizers and soil amendments will vary depending upon the specific site conditions. Periodic post-plant analyses can be used to assure proper soil conditions and balanced levels of plant nutrition.

V. Irrigation

Make certain that the irrigation water being applied is penetrating to a depth slightly greater than the root zone of the plants being grown. Water with a frequency needed to maintain moist soil at all times - never wet for long periods and never let the soil dry out.

Make certain that the irrigation water being applied is penetrating to a depth slightly greater than the root zone of the plants being grown. Water with a frequency needed to maintain moist soil at all times - never wet for long periods and never let the soil dry out.

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Gypsum

This material should be broadcast uniformly over surface soils for water penetration. For best results do not incorporate.

Preplant Phosphorous, Zinc, Manganese, Iron & Copper

These materials should be broadcast uniformly over the surface soils and then incorporated to a depth of two to three inches. Post-plant applications can be surface applied for water penetration.

Nitrogen, Potassium & Magnesium

These materials are highly water soluble and can be applied uniformly over the surface soils for water penetration or they can be incorporated with the other materials. Magnesium sources for plant nutrition include Epsom salts (Magnesium Sulfate), and the double salt of Potasium-Magnesium Sulfate (Sulfate of Potash-magnesia).

FRUIT GROWERS LABORATORY, INC.

ANALYTICAL CHEMISTS

November 17, 2004

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

Lab ID : SP 0411630-003
Customer ID : 2-18569

Sampled On : October 26, 2004
Sampled By : Ninyo and Moore
Received On : November 8, 2004
Depth : 0-60"
Meth Irrg. : S.S. Sprinklers

Description : Sample 3 B-7
Project : Project #600760001/White Tanks FRS No.3, MCFC

LANDSCAPE SOIL ANALYSIS

Test Description	Result	Units	Optimum Range	Graphical Results Presentation				
				Very Low	Moderately Low	Optimum	Moderately High	Very High
Primary Nutrients								
Nitrate-Nitrogen	57	Lbs/AF	60 - 100					
Phosphorus	12	Lbs/AF	100 - 140					
Potassium (Exch)	390	Lbs/AF	650 - 1620					
Potassium (Sol)	25	Lbs/AF	117 - 430	1%				
Secondary Nutrients								
Calcium (Exch)	14700	Lbs/AF	9960 - 13300					
Calcium (Sol)	529	Lbs/AF	160 - 641			30%		
Magnesium (Exch)	730	Lbs/AF	1010 - 2010					
Magnesium (Sol)	78	Lbs/AF	12 - 158			7%		
Sodium (Exch)	480	Lbs/AF	0 - 950					
Sodium (Sol)	1290	Lbs/AF	0 - 1120				63%	
Sulfate	2070	Lbs/AF	400 - 4240					
Micro Nutrients								
Zinc	3.2	Lbs/AF	4 - 160					
Manganese	15.2	Lbs/AF	8 - 240					
Iron	25.6	Lbs/AF	32 - 272					
Copper	2.8	Lbs/AF	1.2 - 41.2					
Boron	1.16	Lbs/AF	2 - 8.00					
Chloride	553	Lbs/AF	43 - 752					
CEC	20.7	meq/100g	5 - 65.0					
% Base Saturation								
CEC - Calcium	88.9	%	60 - 80.0					
CEC - Magnesium	7.2	%	10 - 20.0					
CEC - Potassium	1.21	%	2 - 5.00					
CEC - Sodium	2.51	%	0 - 5.00					
CEC - Hydrogen	0.00	%	0 - 3.00					
				Strongly Acidic	Moderately Acidic	Near Neutral	Moderately Alkaline	Strongly Alkaline
pH	7.87	---	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.

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November 17, 2004

Ninyo & Moore

Lab ID : SP 0411630-003
Customer ID : 2-18569
Description : Sample 3 B-7

LANDSCAPE SOIL ANALYSIS

Test Description	Result	Units	Optimum Range	Graphical Results Presentation
Others				Satisfactory / Possible Problem / Moderate Problem / Increasing Problem
Soil Salinity	2.54	mmhos/cm	0.5 - 2.00	
SAR	6.9		0 - 6.0	
Limestone	2.5	%	0 - 0.5	
				0 / 1 / 2 / 3 / 4 / 5 / 6
Lime Requirement	0	Tons/AF	2.5 - 3.50	
				Very Low / Moderately Low / Optimum / Moderately High / Very High
Moisture	2.9	%	6.8 - 20.3	
				Loamy Sand / Sandy Loam / Loam / Silt Loam / Clay Loam / Clay / Organic
Saturation	27.1	%	40 - 50.0	

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.

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William L. Pidduck, Vice President

WLP:MEH