VOLUME 2 OF 3

GEOTECHNICAL ENGINEERING REPORT
INFRASTRUCTURE IMPROVEMENTS
FOR THE PIER 202 DEVELOPMENT
RIO SALADO PARKWAY, EAST OF RURAL ROAD
TEMPE , ARIZONA

TERRACON PROJECT NO. 65065044
AUGUST 23, 2007

Prepared for:

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Attn: Michael Barker

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August 23, 2007

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Attn: Michael Barker

RE: **Geotechnical Engineering Report**
Infrastructure Improvements for the Pier 202 Development
Rio Salado Parkway, East of Rural Road
Tempe, Arizona
Terracon Project No. 65065044

Terracon has completed supplemental geotechnical engineering services for the proposed infrastructure improvements at the Pier 202 development, which will be located at the southeast corner of Loop 202 and Rural Road in Tempe, Arizona. Our previous services were presented in our "Geotechnical Engineering Report, Pier 202 Development, Rio Salado Parkway East of Rural Road, Tempe, Arizona, Terracon Project No. 65065044" dated May 30, 2006.

The purpose of these services is to provide supplemental geotechnical engineering recommendations for planned infrastructure improvements and basement excavations. This study was performed in general accordance with our Supplement to Agreement for Services number D6506059-1, dated May 9, 2007. The results of our supplemental services, including a site plan, laboratory test results, logs of explorations, and our conclusions and the geotechnical recommendations needed to aid in the design and construction of slopes, excavations and roadways, and other earth connected phases of this project are attached.

As presented on the exploration logs, the soil profile over most of the site includes uncontrolled fill over native sand, gravel, cobble (SGC). The fill is considered "uncontrolled" because there is no construction documentation to verify the materials were placed at controlled moisture contents and compacted to particular densities.

In general, the predominant fill materials included alternating layers of silty sand and poorly graded sand with gravel. Some silty gravels and poorly graded gravels were also encountered, as well as variable amounts of cobbles and occasional boulders. Some concrete rubble was observed, as well as trace amounts of plastic refuse and metal debris. At Test Pit TP-4, the fill was seven feet thick; at other explorations in the fill pad, the fill was 12 to 19 feet thick.

Native sand, gravel, cobble (SGC) soils were encountered at the surface in the low area and beneath the fill pad to the maximum depth of exploration. The SGC includes poorly graded gravel with sand and poorly graded sand with gravel with variable amounts of cobbles and some boulders. Some silty gravel with sand was also encountered in the SGC. No bedrock was encountered to the maximum depths of exploration.

Field penetration test results indicate the near surface native soils are generally dense to very dense in relative density, and the SGC is very dense in relative density. Penetration test results in the fill were consistent with moderate compaction in Boring B-3 near the bottom of the fill layer. The dry density and moisture contents, and the percent compaction of the fill, varied with depth and location. Based on our test results, the surficial six to eight feet of existing fill at the site was poorly compacted. Compaction of fill materials below a depth of eight feet were variable, with poorly compacted areas as well as moderately compacted areas.

While it is desirable to remove all of the existing fill at the site and replace it as engineered fill, it is our opinion the existing fill below a depth of eight feet may remain in place for support of planned roadways. If soil nails will be used for excavation support, longer or larger nails may be appropriate in the poorly compacted layers of the fill. As an alternative to excavating the fill materials and placing in lifts – including the surficial eight feet or the entire thickness – deep dynamic compaction should be considered.

Based on our test results and analyses, the existing fill soils and native materials at the site may be excavated with slopes as steep as 1½ H:1V (horizontal to vertical). This should be acceptable for slopes excavated into the existing fills and native soils, and for newly constructed fills consisting of the on-site fill materials.

It is vital that runoff be controlled to ensure no channelized flow is directed onto the slopes. A brow berm at the top of the slope should be constructed to prevent the flow of surface water drainage over the face of the slope. Consultation with a landscape architect or other erosion control specialist is recommended for development of plans and specifications for erosion control on the planned slopes.

To reduce the potential for the use of pumps and sumps during this infrastructure phase of construction, we recommend excavation not be extended below an elevation of 1131 feet MSL at the east edge of the site, and 1125 feet MSL at the west edge of the site. Should excavations need to be advanced to elevations lower than recommended and depending on seasonal conditions, groundwater may be encountered in excavations. Pumping from sumps may be used to control water within excavations. Well points may be required for significant groundwater flow, or where excavations penetrate groundwater to a significant depth.

Other design and construction recommendations, based upon geotechnical conditions, are presented in the report.

We have appreciated being of service to you in the geotechnical engineering phase of this project, and are prepared to assist you during the construction phases as well. If you have any questions concerning this report or any of our testing, inspection, design, and consulting services, please do not hesitate to contact us.

Sincerely,
Terracon

Registered Professional Engineer (Civil)
CERTIFICATE NO. 41868
MICHAEL RAYMOND SCHAFFER
DATE SIGNED 8-23-07
ARIZONA U.S.A.

Michael R. Schaffer, P.E.
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Copies to: Addressee (1 via e-mail, 5 mailed)

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GEOTECHNICAL ENGINEERING REPORT
INFRASTRUCTURE IMPROVEMENTS FOR THE PIER 202 DEVELOPMENT
RIO SALADO PARKWAY, EAST OF RURAL ROAD
TEMPE , ARIZONA

TERRACON PROJECT NO. 65065044
AUGUST 23, 2007

INTRODUCTION

This report presents the results of our supplemental geotechnical engineering explorations for the proposed infrastructure improvements at the Pier 202 development, which will be located at the southeast corner of Loop 202 and Rural road in Tempe, Arizona. The 27 acre site is located in the northwest quarter of Section 14, Township 1 North, Range 4 East of the Gila and Salt River Base Line and Meridian. We understand the site consists of portions of Parcels 132-32-004C, 132-31-003C and 132-31-003D.

The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- subsurface soil conditions
- groundwater conditions
- fill soil conditions relative to planned roads and utilities
- excavation slope geometry for basement excavations and support of roadways
- pavement design and construction
- earthwork
- drainage

The recommendations in this report are based on the results of field and laboratory testing, engineering analyses, experience with similar soil conditions and structures, and our understanding of the proposed project.

PLANNED CONSTRUCTION

The Pier 202 development will consist of mixed use buildings including condominiums, hotels, office buildings, retail space, and parking. Some of the structures near the Tempe Town Lake waterfront may range up 20 stories in height with two to three stories below grade for parking. The planned structures will be cast-in-place concrete with mat foundations. Isolated column loads are estimated to range up to 2,000 kips.

Based on information provided by Punya Khanal, P.E., and JianJun Wu both of LP/GAS Engineering (LP/GAS), the development will be constructed in three phases. Each phase includes one to five buildings. We understand construction of the public infrastructure (i.e.

roadways and utilities) throughout the site is a priority for Phase 1 of the project. The Developer plans to sell building sites in Phase 2 and Phase 3 to others within a few years.

Infrastructure: Planned utilities will include water, gas, electric, cable, sewer, and storm water. Most of the stormwater drains will be 8 to 18 feet in depth. The drains will discharge into 12 foot diameter stormwater retention facilities that will be up to 20 feet below finished grade.

Based on drawings provided by Punya Khanal with LP/GAS, we understand approximately 3,200 linear feet of public roadway is planned at the site. The public roadways will serve as residential streets in utility corridors between the planned buildings. The anticipated traffic loading for planned roadways is anticipated to be consistent with residential roadways (ESAL's of 73,000 or less).

The proposed roadway grades will be on the order of five feet above existing site grades across most of the site. Up to twenty feet of fill will be needed along roadway segments where they extend into the low area between the flood control structure and the existing fill pad. Preliminary earthwork estimates rely on fill material borrowed from basement excavation areas. For estimating, LP/GAS assumed all seven basement areas would be excavated to provide fill material. Based on an assumed excavation sideslope of 1½H:1V (horizontal to vertical) and a maximum excavation depth of approximately 25 feet, LP/GAS estimated approximately 35,000 cubic yards of imported fill would be required to complete fills for the planned infrastructure.

Basement Excavations: We understand that parking garages will be two or three stories below finished grade. We have assumed that approximately 10 feet of depth is required for each level of parking below grade. Therefore, the maximum depth of excavation for any parking structure will not be greater than approximately 30 feet below an assumed finished floor elevation of 1165.0 feet mean sea level (MSL). Thus, planned excavations will not extend below an elevation of 1135.0 feet MSL. Depending on foundation type, excavations may extend to depths greater than 1135.0 feet MSL, but are not anticipated to extend to a depth greater than 1130.0 feet MSL.

A key cost issue for project construction is the volume of material that must be left in the sideslopes of the basement excavations for support of surface infrastructure. If all of the basement excavations were completed with vertical sidewalls, a net export of 92,000 cubic yards would be required. The delayed availability of fill material from basement excavations introduces the need for 35,000 cubic yards of import during Phase 1 – and increases the net export for the project by 35,000 cubic yards.

Basement excavations will extend below the ground surface in close proximity to the existing flood control structure owned by the Maricopa County Flood Control District. Basement excavations will also be completed in close proximity to Rio Salado Parkway on the south margin of the site. We understand the roadway and the flood control structure must remain in service throughout construction.

Locations of planned buildings are shown on the Site Plan and Exploration Locations diagram, Figure 1. Each building is in its own Parcel. Basements are planned for all of the buildings except the one in Parcel 7, which is on the eastern side of the site.

SITE EXPLORATION

The scope of the services performed for this project included site reconnaissance by a field engineer, a subsurface exploration program, laboratory testing, and engineering analyses.

Field Exploration: A total of three test pits were excavated on March 27, 2006: Test Pits TP-1, TP-2, and TP-3. The test pits were excavated to approximate depths from 20 to 21 feet below ground surface. The test pits were excavated using a Hitachi PC 200 track mounted excavator equipped with a 36-inch wide bucket.

A total of three test borings were drilled on May 16 and May 17, 2006. Borings B-1 and B-2 were drilled to an approximate depth of 70 feet and boring B-3 was drilled to an approximate depth of 100 feet. A groundwater monitoring well was installed in boring B-3 after completion of drilling. The borings were advanced with an AP-1000 dual-wall percussion hammer drill using 9 inch outside diameter, continuous driven pipe casing.

A total of five test pits were excavated on June 5, 2007: Test Pits TP-4 through TP-8. The test pits were excavated to approximate depths from 20½ to 25 feet below ground surface. These test pits were excavated with sideslopes that permitted personnel access to benched surfaces in the excavation. A nuclear density gage and sand-cone were used to measure in-situ densities at various depths in the soil profile. The test pits were excavated using a Hitachi PC 300 LC track mounted excavator equipped with a 36-inch wide bucket.

Approximate locations of the explorations are shown on the Site Plan and Exploration Locations diagram, Figure 1.

The borings and test pits were located in the field by pacing from property lines and/or existing site features. Ground surface elevations at each boring location were obtained by measurements with an engineer's level from a temporary bench mark (TBM). The TBM was the top of the City of Tempe's piezometer number PZ-49 located near the northeast portion of the site. The elevation of PZ-49 as provided by the City of Tempe is 1151.6 feet MSL, and was assumed to represent the top of the protective standpipe for the piezometer. The accuracy of boring locations and elevations should only be assumed to the level implied by the methods used to determine each.

Continuous lithologic logs of each boring were recorded by an engineering geologist during the drilling operations. At selected intervals, samples of the subsurface materials were taken by driving split-spoon samplers.

Penetration resistance measurements were obtained by driving the split-spoon sampler into the subsurface materials with a 140-pound hammer falling 30 inches. The penetration resistance value is a useful index for estimating the consistency or relative density of the materials encountered.

Groundwater conditions were evaluated in each boring at the time of site exploration, and upon completion of drilling. The borings were backfilled with cement grout at the completion of drilling. The test pits were backfilled with the materials excavated during exploration.

Laboratory Testing: Samples retrieved during the field exploration were taken to the laboratory for observation by the project geotechnical engineer and were classified in accordance with the Unified Soil Classification System described in Appendix A. At that time, the field descriptions were confirmed or modified as necessary and an applicable laboratory testing program was formulated to determine engineering properties of the subsurface materials. Boring logs were prepared and are presented in Appendix A.

Laboratory tests were conducted on selected soil samples and results are presented in Appendix B and on the exploration logs. The test results were used for the geotechnical engineering analyses and the development of foundation and earthwork recommendations. Laboratory tests were performed in general accordance with the applicable ASTM, local, or other accepted standards.

Selected soil samples were tested for the following engineering properties:

- Water Content
- Dry Density
- pH and Resistivity
- Direct Shear
- Gradation Analyses
- Plasticity Index
- Water Soluble Sulfate Content
- Moisture-Density Relationship

Both large box and small box direct shear testing was performed. The small box direct shear test measures the friction angle and cohesion of material passing the #4 sieve (smaller than about ¼-inch). The friction angle and cohesion were measured on the same sample tested at TP-8 at 16 feet to determine if there was any significant change due to density. The large box direct shear can measure the friction angle and cohesion of material up to 2-inches in size. The large box direct shear tests were performed on the native materials which were typically more coarse in their grain size.

SITE CONDITIONS

General: The site is an irregular shaped property on the north side of Rio Salado Parkway, east of Rural Road in Tempe, Arizona. The site includes approximately 27 acres and has approximately 1,500 feet of frontage along Rio Salado Parkway. The neighboring property to the south (across Rio Salado Parkway) and to the east is Karsten-Arizona State University (ASU) Golf Course. The neighboring property to the north is Tempe Town Lake, which is immediately north of the Maricopa County Flood Control District flood control structure that runs along the north edge of the site. The property to the west is an ASU parking lot.

At the time of our site visits, there were no buildings on the site. Total topographic relief across the site was on the order of 15 feet. Large portions of the site bordering Rio Salado Parkway have been filled with soil to depths of up to 19 feet.

Four separate areas of the site were identified as follows:

- **South Drainage Channel:** An unlined drainage channel parallels Rio Salado Parkway along approximately 900 feet, the entire length of the south edge of the site. The channel collects surface water runoff from the site as well as Rio Salado Parkway's westbound lanes. The channel drains to the east, and into a culvert.

  In general, the channel was 10 to 15 feet wide across its bottom, with side slopes at angles between 1H:1V (horizontal to vertical) and 2H:1V. The sideslopes were unlined, but brush, trees, and small shrubs covered most of the bottom and sideslopes of the channel. The soil on the south slope of the channel appeared to be fill that included some concrete rubble.

- **Uncontrolled Fill Pad Area:** The southern portion of the site has been filled and graded. The surface is relatively flat and slopes downward to the north at approximately one to two percent. The north slope of the fill pad appears to be 12 to 16 feet in height. Several road cuts provide vehicle access down to the low area between the flood control structure and the north edge of the fill pad. The fill pad area accounts for approximately 8½ acres and is vegetated with scattered weeds, grass, and some low shrubs.

- **Low Area:** •There is a low area between the flood control structure on the north edge of the site and the north edge of the fill pad. In our previous report, this area was identified as the Sand-Gravel-Cobble (SGC) Base Pad Area because the surface is native SGC materials. The surface is relatively flat and may have been graded in the past. The low area accounts for approximately five acres of the site and is sparsely vegetated.

End dumped fill piles were observed on the eastern portion of this area. The fill piles were composed of large cobbles and boulders, concrete debris, metal debris, and various soil types.

- **Flood Control Structure:** A Maricopa County Flood Control Structure extends along the entire north edge of the site. In our previous report, the structure was identified as the Tempe Town Lake Levee. Tempe Town Lake is on the north side of the structure.

SUBSURFACE CONDITIONS

Geology: The project area is located in the Basin and Range physiographic province ([1]Cooley, 1967) of the North American Cordillera ([2]Stern, et al, 1979) of the southwestern United States. The southern portion of the Basin and Range province is situated along the southwestern flank of the Colorado Plateau and is bounded by the Sierra Nevada Mountains to the west. Formed during middle and late Tertiary time (100 to 15 m.y. ago), the Basin and Range province is dominated by fault controlled topography. The topography consists of mountain ranges and relatively flat alluviated valleys. These mountain ranges and valleys have evolved from generally complex movements and associated erosional and depositional processes. Structurally, the site lies within the Phoenix Basin. Drainage flows to the Salt River during late Tertiary time, coupled with structural activity discussed above, are generally responsible for the present day topography within the basin.

Typically, the ranges in this area are of small aerial extent, but protrude significantly above adjacent wide alluviated plains and valleys. The basin rims are formed by mountain ranges which consist of sedimentary, igneous and metamorphic materials that have been subjected to recurrent faulting and tilting, and in some places volcanic and intrusive events. As a result of erosion, the valleys have experienced partial infilling with sedimentary material deposited as alluvial fans. Occasionally, the valleys may become interlocking as a result of coalescing alluvial fans, which are referred to as bajadas.

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[1]Cooley, M.E., 1967, ***Arizona Highway Geologic Map***, Arizona Geological Society.

[2]Stern, C.W., et al, 1979, ***Geological Evolution of North America***, John Wiley & Sons, Santa Barbara, California.

Surficial geologic conditions mapped at the site ([3]Wilson, et al, 1957) consist of alluvium of Holocene to middle Pleistocene age (10,000 to 1 m.y. ago). The alluvial materials have been described as weakly to moderately consolidated deposits consisting of sand, gravel and conglomerate. Additionally, the site is located in the historic flood plain of the Salt River. Typically, subsurface alluvial materials in close proximity to the flood plain consist of dense mixtures of sand, gravel, and cobbles (SGC). Based on explorations for this project the sand-gravel-cobble (SGC) layer will generally be encountered at depths varying between zero and 16 feet below the ground surface. This layer is expected to extend for significant depths below the ground surface at the site, although, locally, the materials may overlie shallow bedrock. In some areas, the SGC layer is also known to contain interbedded layers of sandy clays at depth.

Soil Conditions: As presented on the exploration logs, the soil profile over most of the site includes uncontrolled fill over native sand, gravel, cobble (SGC). The fill is considered "uncontrolled" because there is no construction documentation to verify the materials were placed at controlled moisture contents and compacted to particular densities.

In general, the predominant fill materials included alternating layers of silty sand and poorly graded sand with gravel. Some silty gravels and poorly graded gravels were also encountered, as well as variable amounts of cobbles and occasional boulders. Some concrete rubble was observed, as well as trace amounts of plastic refuse and metal debris. At Test Pit TP-4, the fill was seven feet thick; at other explorations in the fill pad, the fill was 12 to 19 feet thick.

Native SGC soils were encountered at the surface in the low area and beneath the fill pad to the maximum depth of exploration. The SGC includes poorly graded gravel with sand and poorly graded sand with gravel with variable amounts of cobbles and some boulders. Some silty gravel with sand was also encountered in the SGC. No bedrock was encountered to the maximum depths of exploration.

It should be noted that local use identifies the native soils at the site as SGC. Per the Unified Soil Classification System and ASTM D2487, an SGC material would likely classify as poorly graded gravel with sand and cobbles.

Field and Laboratory Test Results: Field penetration test results indicate the near surface native soils are generally dense to very dense in relative density, and the SGC is very dense in relative density. Penetration test results in the fill were consistent with moderate compaction in Boring B-3 near the bottom of the fill layer.

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[3]Wilson, E.D., Moore, R.T., and Pierce, H.W., 1957, ***Geologic Map of Maricopa County, Arizona***, Arizona Bureau of Mines, University of Arizona.

The results of direct shear testing indicate the poorly graded sand materials have a friction angle of 32 degrees and a cohesion that varies from 285 psf to 400 psf. The coarse grained gravels tested from the SGC formation have laboratory tested friction angles of 43 and 57 degrees with a cohesion value of zero. The sample from TP-8 at 16 feet was remolded to densities of 110 pcf and 120 pcf. This was done to see if an appreciable gain in friction angle or cohesion would be realized. The results indicate the friction angle was essentially unchanged, and the cohesion value went up by 100 psf. The friction angle and cohesion values obtained from the direct shear testing generally agree with typical values as provided in the Design of Small Dams ([4] 1987). The average friction angle for SP materials is 37 degrees with a standard deviation of 2. The average cohesion for SP materials is 790 psf with a standard deviation of 450 psf.

In-situ moisture and density readings were collected using a nuclear density gage during excavation of the test pits in the fill pad area. Samples of the materials were tested to determine moisture-density relationships, which provided a basis for evaluating relative compaction using field density data. The available data indicate dry density and moisture contents, and the percent compaction of the fill, varied with depth and location. Based on our test results, the surficial six to eight feet of existing fill at the site was poorly compacted. Compaction of fill materials below a depth of eight feet were variable, with poorly compacted areas as well as moderately compacted areas.

The results of field exploration and laboratory testing completed for this study indicate the existing fill soils and the native soils at the site are non plastic. Based on the low plasticity of site soils, the expansive potential is anticipated to be negligible under loading conditions such as lightly loaded near surface flatwork.

Standard Proctor tests per ASTM D-698 were used as the basis for evaluating compaction of existing fills. The maximum dry density from a Proctor Test and nuclear density test readings from test pits were used to determine the relative compaction of existing fill materials. It should be noted that some of the on-site soils do not yield a useful moisture-density relationship curve when tested using the Proctor method. This can be seen in the moisture-density relationship data for the sample from TP-6 at 6 feet. For construction control, these materials should be compacted to densities determined using a relative density test rather than a Proctor test. For our analyses, we assumed the dry density of the wettest point was close to the maximum relative density had a relative density test been performed.

It should be noted that Proctor test results are subject to an adjustment – the maximum dry density is increased and the optimum moisture content is decreased - to account for the portion

[4] 1957, ***Design of Small Dams***, Bureau of Reclamation, United States Department of the Interior.

of the sample material retained on the ¾ inch sieve. This is called a "rock correction." (It should also be noted that recommendations for compaction control are based on the Modified Proctor test per ASTM D-1557.)

Groundwater Conditions: Groundwater was encountered in all three borings during the exploration. No groundwater was encountered in the test pits. Depths to groundwater, elevation and approximate time when it was measured are presented in the following table:

GROUNDWATER CONDITIONS			
Boring No.	Depth to Groundwater		Elevation of Most Recent Measurement (Ft.)
	While Drilling (WD)	After Boring Completion (AB)	
B-1	27 ft	25 ft 1hr AB	1123.5
B-2	35 ft	Wet Cave In	1113.5
B-3	59 ft	46 ft. 1 hr. AB	1118.0

- **Monitoring Well:** A monitoring well was installed at the location of boring B-3 for groundwater monitoring purposes. The well is designated as well No. 55-904833 under the Arizona Department of Water Resources records. Based on USGS topographic maps, the approximate geodetic coordinates for the well location are N 33° 25' 47" and W 111° 55' 03"; and the approximate elevation of the well is 1164 feet above mean sea level.

  The well was constructed with a four-inch diameter, schedule 40, PVC pipe. The slotted length extended between depths of 100 to 40 feet. Solid pipe extended from 40 feet to the surface. Each pipe segment was connected with flush mounted threaded joints and there was a threaded end cap attached at the bottom. The top was capped with a J-plug locked in place with a master lock (key serial #2359).

  A sand pack was installed between depths of 100 to 35 feet. A bentonite plug was installed around the well pipe between depths of 35 to 29 feet. Water was added to hydrate the bentonite. Cement grout was installed from a depth of 29 feet to the surface. At the surface, a standard 12 inch Morrison Monitoring Well Monument was set with the bolted lid flush on a four by four foot concrete slab that is approximately 4-inches thick.

The depth to groundwater was measured during installation of the well on May 17, 2006. The depth to water in the well was also measured on May 22, 2006. The available depth to groundwater data for the monitor well is as follows:

Depth to Groundwater Measured in Monitor Well 1 (B-3)		
Date	**Depth to Groundwater (feet)**	**Elevation (feet MSL)**
May 17, 2006	46.0	1118.0
May 22, 2006	41.9	1122.0
July 23, 2007	46.6	1117.5

- **Piezometers:** The City of Tempe provided records of groundwater elevations for measurements of six piezometers on and near the site. The data includes monthly readings from September of 1997. A graph of the groundwater elevation data is provided to show the seasonal variations that have been observed. The data includes approximately ten years of monthly readings. It appears the groundwater level at the east end of the site is generally six to ten feet higher than at the west end. One reading for PZ-49 indicates a groundwater elevation higher than 1,150 feet (1151.6 feet) on September 27, 2002. This data point is an outlier and may be an error. Based on data from piezometers west of Parcel 8, groundwater elevations above 1,130 feet MSL were observed once in the ten years. It appears a minimum basement floor elevation of 1,130 may be acceptable. However, we recommend an experienced hydrogeologist be retained to collect additional available data and provide recommendations using a risk-based approach. The graph is presented in Appendix C, with a site plan showing piezometer locations, which was also provided by the City.

CONCLUSIONS AND RECOMMENDATIONS

Slope Stability Recommendations: Three slope stability cases were considered in our analyses. Each case corresponds to a particular cross section as shown on Figure 1. Section A-A' is at Rio Salado Parkway on the south edge of the site; Section B-B' is at the flood control structure on the north edge of the site; and Section C-C' is at an interior basement excavation slope.

Geotechnical profiles for stability analyses were based on exploration data and results of laboratory tests. The excavation slopes were modeled with soil profiles consistent with the information from our explorations and our understanding of planned earthwork. Mohr-Coulomb strength parameters used for modeling subsurface stratigraphy for the stability analyses were based on direct shear data from laboratory testing, and correlated and typical values for the on-site soils based on parameters included in the Design of Small Dams, (1987). The Mohr-Coulomb strength parameters for the excavations are summarized as follows:

Depth Interval (ft.)	USCS Classification	Moist Unit Weight (pcf)	Internal Friction (ϕ')	Cohesion C' (psf)
0-8	FILL – Densified Silty to to Poorly Graded Sand	120	32	300
8-18	FILL – Existing SM to SP	120	32	275
18-45	NATIVE - SGC	130	43	0

Analytical Approach: Stability analyses for proposed slopes were performed using the computer program Slope/W developed by Geo Slope. Slope/W utilizes algorithms for the Modified Bishop method of slices for circular slip surfaces and modified Janbu techniques for irregular surfaces and for translation of active-passive block failure surfaces. Both Modified Bishop and Janbu analyses were performed on each cross section. The Modified Bishop method uses moment limit-equilibrium to determine the factor of safety, while the modified Janbu technique uses force limit-equilibrium to determine the factor of safety. Both of these analyses are based on limit-equilibrium where the forces resisting failure are compared against the forces tending to cause failure. This ratio, termed the factor of safety (FS), is an indication of stability of the postulated failure surface.

A search is undertaken in both types of analyses to determine the lowest factor of safety on the critical failure surface for each model. The factor of safety varies between the Modified Bishop and Janbu for each section analyzed based on a side force parameter termed lambda. The change in factor of safety for each type of analyses was plotted against lamda; the intersection of the plots was chosen as the factor of safety for the particular analysis. The Modified Bishop (moment equilibrium) factor of safety was chosen to represent the factor of safety for slope cross sections where the plots did not intersect or the results were unreasonable.

The stability of each cross section was analyzed for static conditions. Pseudo static analyses were not performed considering the short term life expectancy of the slopes. The lowest factor of safety obtained from a search routine of potential failure surfaces within each cross section is considered as an indicator of the long term safety of the slope against instability. A factor of safety of 1.5 is usually the minimum value considered for long term stability of slopes under static conditions.

For each analysis, 1000 potential random failure surfaces for each cross section were analyzed. The critical surface was then further refined using 2000 additional iterations until the minimum factor of safety was determined. Detailed results of the stability calculations for each cross section are shown in Appendix D.

Analyses of Slope Stability Results: Results of the stability analyses have been graphed and are shown in Appendix D, Figure Nos. D1 through D6. These stability analyses results are the basis of the conclusions and recommendations for this project. The recommendations for proposed slope angles are predicated on the upper eight feet of the on-site existing fill materials being improved by removal and recompaction or by deep dynamic compaction.

Based on our test results and analyses, the existing fill soils and native soils at the site may be excavated with slopes as steep as 1½ H:1V (horizontal to vertical). The stability analyses also indicate that excavations could be deepened to approximately 40 feet and remain stable.

The affect of varying the cohesion and friction angle of the upper two fill material types is shown in the Sensitivity Data plot on Figure D7. The Sensitivity Data plot is a graph of the factor of safety for the slope as specific soil parameters are changed. A value of 0.5 on the Sensitivity Range axis, shown on the bottom of the plot, represents the mean value of the soil parameter. Each corresponding change of 0.1 on the Sensitivity Range axis is equivalent to a change of 0.5 degrees for friction angle parameters and 25 psf for cohesion parameters.

The results of the Sensitivity Data plot (Figure D7) indicate changes in cohesion of either material has a larger impact on the factor of safety than does varying the friction angle. This result is expected since the slope is relatively shallow and the cohesion has more of an influence on the shear strength, than does the friction angle of the material. It should be noted that even when the cohesion is reduced to 150 psf, the factor of safety remains above 1.6.

The face of all slopes should be compacted to the minimum specification for fill embankments. Alternately, fill slopes can be over-built and trimmed to compacted material.

At the recommended maximum slope angles, the soils will be vulnerable to erosion and shallow sloughing. The silty sand and fine to medium sand typical in the existing on-site fill soils will be especially vulnerable to erosion. Use of a rolled erosion control product or other protection from direct precipitation should be considered where the existing fill soils will be exposed.

We anticipate that slopes in dense, undisturbed native soils may be less vulnerable to erosion. However, maintenance of the temporary slopes will be difficult so we suggest the slopes be protected with rip-rap materials for erosion protection. Cobbles and boulders from excavations into the native SGC soils at the site can be processed to create a coarse, angular crushed rock product that would be suitable (Without processing, the coarse materials in the native soils are fully rounded and could not be placed on the temporary slopes.)

It is vital that runoff be controlled to ensure no channelized flow is directed onto the slopes. A brow berm at the top of the slope should be constructed to prevent the flow of surface water drainage over the face of the slope. Consultation with a landscape architect or other erosion control specialist is recommended for development of plans and specifications for erosion control on the planned slopes.

Retaining Wall for Support of Flood Control Structure:: We understand that below grade construction will occur immediately adjacent to the south side of the flood control structure requiring a retaining wall to support the flood control structure during construction. We anticipate a soil nail wall will be the most economical retaining system for support of the flood control structure during the below grade construction. The specific design of the retaining wall system was outside the scope of services for this report. Design of such retaining wall systems are typically provided by the wall contractor with a third party review of the design prior to acceptance. Terracon has designed many soil nail walls and is available to provide a third party review as requested.

Risk Analysis: The notion of risk is an important aspect of any geotechnical exploration. The primary reason for this is that investigative and analytical methods used to develop geotechnical conclusions and recommendations do not comprise an exact science. The analytical tools are generally empirical and must be tempered by engineering judgment and experience. The solutions or recommendations presented in any geotechnical study should not be considered risk-free and more importantly, are not a guarantee that the proposed structure will perform satisfactorily. What the engineering recommendations do constitute is the geotechnical engineers' best estimate of those measures that are necessary to make the structure perform satisfactorily based on usually limited subsurface information. The purpose of the following paragraphs is to discuss the concept of risk so the owner, who must ultimately decide what an acceptable risk is, can better apply the findings of this study.

As previously outlined, the most critical geotechnical consequence of this study is considered to be slope stability of the proposed slope configurations. The stability of a portion of this slope is expressed as a factor of safety. It is important to note the concept of factor of safety is a derived value and not an intrinsic property of the slope. The accuracy with which the factor of safety for a given slope can be determined, is based on a number of factors the most significant of which are listed below:

- Variability of surface conditions
- Variability and type of subsurface conditions
- Validity of the analytical method
- Validity of simplifying assumptions
- Intensity of study
- Certainty of the design loading conditions occurring.

Depending on how well the above factors can be assessed determines what minimum factor of safety would be required to have a reasonable degree of confidence that a failure will not occur. It is the geotechnical engineers' responsibility to assess these conditions and advise the owner as to a minimum acceptable factor of safety.

Theoretically, a factor of safety of 1.0 indicates that a slope is on the verge of instability. Therefore, any lower factor of safety should result in failure and any higher factor of safety should theoretically represent a safe slope. However, due to the uncertainties associated with any geotechnical investigation and the factors discussed in the preceding paragraph, all slopes, even those with factors of safety greater than 1.0, have some potential for failure. The higher the computed factor of safety is for a given slope, the lower its probability of failure will be.

Earthwork:

- **General Considerations:** The following presents recommendations for site preparation, excavation, subgrade preparation, and placement of engineered fills on the project. The recommendations presented for design and construction of earth supported elements including foundations, slabs and pavements are contingent upon following the recommendations outlined in this section.

Earthwork on the project should be observed and evaluated by Terracon. Mass excavations and grading should be monitored on a full-time basis. The evaluation of earthwork should include observation and testing of engineered fill, subgrade preparation, and other geotechnical conditions exposed during the construction of the project.

Based on our test results, the surficial six to eight feet of existing fill at the site was poorly compacted. Compaction of fill materials below a depth of eight feet were variable, with poorly compacted areas as well as moderately compacted areas. These materials should be removed and replaced as engineered fill.

While it is desirable to remove all of the existing fill at the site and replace it as engineered fill, it is our opinion the existing fill below a depth of eight feet may remain in place for support of planned roadways. However, if soil nails will be used for excavation support, longer or larger nails may be appropriate in poorly compacted layers. As an alternative to excavating the fill materials and placing in lifts – including the surficial eight feet or the entire thickness – deep dynamic compaction should be considered.

- **Site Preparation:** Strip and remove existing vegetation, debris, refuse, and other deleterious materials from proposed building and pavement areas. Stripped materials consisting of vegetation and organic materials should be wasted from the site. Exposed surfaces should be free of mounds and depressions that could prevent uniform compaction.

  If fill is placed in areas of the site where existing slopes are steeper than 5H:1 V (horizontal to vertical), the area should be benched to reduce the potential for slippage between existing slopes and fills. Benches should be wide enough to accommodate compaction and earth moving equipment, and to allow placement of horizontal lifts of fill.

  Although evidence of fills or underground facilities such as septic tanks, cesspools, basements, and utilities was not observed during the site reconnaissance, such features could be encountered during construction. If unexpected fills or underground facilities are encountered, such features should be removed and the excavation thoroughly cleaned prior to backfill placement and/or construction.

  It appears the on-site soils will be suitable for use as engineered fill. The on-site fill soils encountered in the explorations contained some concrete rubble and trace amounts of refuse, and will be suitable for use as engineered fill. However, zones of refuse or debris in the fill could be encountered during construction. Contract documents should make provision for disposal of refuse, debris, or other unsuitable materials.

It is anticipated that excavations for the proposed construction can be accomplished with conventional earthmoving equipment. Some additional effort may be necessary to extract boulder sized materials, particularly in deep narrow excavations such as utility trenches. Consideration should be given to obtaining a unit price for difficult excavation in the contract documents for the project.

To reduce the potential for the use of pumps and sumps during this infrastructure phase of construction, we recommend excavation not be extended below an elevation of 1131 feet MSL at the east edge of the site, and 1125 feet MSL at the west edge of the site. Should excavations need to be advanced to elevations lower than recommended and depending on seasonal conditions, groundwater may be encountered in excavations. Pumping from sumps may be used to control water within excavations. Well points may be required for significant groundwater flow, or where excavations penetrate groundwater to a significant depth.

- **Subgrade Preparation:** Exposed surfaces that will receive fill, once properly cleared and benched where necessary, should be scarified to a minimum depth of ten inches, conditioned to near optimum moisture content, and compacted. This is not necessary where the exposed surface is dense or very dense undisturbed native materials.

  Subgrade soils beneath pavements should be scarified, moisture conditioned, and compacted to a minimum depth of ten inches. The moisture content and compaction of subgrade soils should be maintained until slab or pavement construction.

  The high fines-content silt with sand encountered in the existing fill soils should be excluded from the zone of fill within two feet of subgrade elevation. This material is undesirable as a pavement subgrade soil.

- **Imported Soils:** Imported materials may be used as fill material for general site grading and pavement areas. Imported Soils (if required) should conform to the following:

Gradation	PERCENT FINER BY WEIGHT (ASTM C136)
6"	100
3"	70-100
No. 4 Sieve	50-100
No. 200 Sieve	35 (max)

- Liquid Limit .... 25 (max)
- Plasticity Index .... 10 (max)
- Maximum expansive potential (%)* 1.0

*Measured on a sample compacted to approximately 95 percent of the ASTM D698 maximum dry density at about 3 percent below optimum water content. The sample is confined under a 100 psf surcharge and submerged.

- **Processed Soils:** During mass grading, full-time construction observation and testing can be used to ensure proper compaction of fills containing oversize materials, but only in designated zones of the fill. Oversize particles, as defined below, must be removed from materials used as fill in areas that will be excavated for utilities; in reinforced fill in retaining walls; in fill where routine density testing using a nuclear densometer is desired; and in other areas that may be identified.

It appears on-site soils will require processing after excavation to control the gradation of the materials placed as engineered fill. For discussion, "processing" can include screening to remove oversize materials, crushing to create a new material, or stone-by-stone removal of boulders. Other methods may be used, depending on the Contractor's equipment and practices. The mass grading Contractor will control the construction sequence and methods and this will control the handling and processing effort required for the earthwork.

We anticipate some effort will be needed to remove cobbles and boulders from on-site fill soils, which are predominantly sand. Based on our explorations, we anticipate the Contractor may be able to remove oversize particles (e.g. boulders or boulder-sized rubble) from the on-site fill on a stone-by-stone basis during handling, either by hand, or using equipment. Consideration should be given to stockpiling existing fill soils for use in fill zones where oversize particles must be excluded, such as pipe bedding, or in fill zones along utility trenches.

We also anticipate crushing will be needed to process on-site native SGC, as well as some oversize material from existing on-site fill soils. If the separated oversize materials are not processed for use, significant shrink of the materials should be expected.

Engineered fill placed at the site should be crushed or otherwise processed to the following maximum dimensions:

Fill Placement Area	Maximum Particle Dimension (inches)
At least 4 feet below grade:	
Outside Utility trench zone*	24
Inside Utility trench zone*	6
Within 4 feet of grade:	
Outside Utility trench zone*	3
Inside Utility trench zone*	3
Used as Bedding	1½

*For these requirements, the "Utility Trench Zone" is a zone in the subsurface 20 feet wide along the centerline of a buried utility extending from the subgrade surface to a foot below bottom-of-pipe.

All processed material should be well graded and should meet the fines content and plasticity requirements of imported soils.

We have assumed dry utilities will be located in shallow trenches within four feet of subgrade. It may be desirable to restrict fill with a maximum particle size greater than three inches (or six inches) to depths greater than four feet if utilities will be buried at depths greater than 4 feet.

Screening through a Grizzly, can yield a coarse, granular material, but it will have a substantial content of rounded particles. Crushing on-site SGC materials, or material separated from existing fill soils, can yield coarse angular crushed rock material. The materials with rounded particles will be much more difficult to place, groom, or repair on exposed fill slopes. We recommend exposed slopes be constructed with coarse angular materials.

- **Fill Placement:** Earthwork on the project should be observed and evaluated by Terracon. Mass excavations and grading should be monitored on a full-time basis.

It should be noted that placement of engineered fill that contains particles larger than three inches cannot be monitored using conventional nuclear densometer field tests. Prescriptive placement methods should be established by field demonstrations verified with field testing. Monitoring verifies the Contractor's methods during placement are consistent with the verified placement protocols.

Field density testing for verifying compaction protocols should include large-scale density testing. The testing should be completed in accordance with the procedures outlined in ASTM D4914. Laboratory evaluation of moisture-density relationships should be conducted in accordance with ASTM D1557 (i.e. the Modified Proctor Test) Method C. Rock correction should be applied to determine the maximum density and at each test location in accordance with ASTM D4718. Gradation testing will need to be performed on materials from each large-scale density test to determine the appropriate amount of oversized material.

Engineered fill with a maximum particle size of three inches, may have a gradation suitable for conventional nuclear densometer testing. The Modified Proctor test (ASTM D-1557) should be used to determine the density standard for compaction evaluations. However, depending on the material gradation, it may be necessary to establish compaction criteria based on relative density tests. Where this is the case, compaction should yield densities corresponding to at least 70 percent relative density in accordance with ASTM D4253 and D4254.

Recommended compaction criteria for engineered fill materials are as follows:

Material	MINIMUM PERCENT (ASTM D1557)
Scarified subgrade soils	95
Retaining wall backfill	95
Aggregate base (beneath pavements)	97
Existing Fill – Upper 8 feet inside or outside of ROW	95
Newly Constructed Engineered Fill:	
at depths less than 10 feet inside of ROW	95
at depths less than 10 feet outside of ROW	90
at depths greater than 10 feet inside or outside of ROW	95

Existing fill materials located within the perimeter of planned basement excavations need not be removed and recompacted.

Engineered fill soils should be placed and compacted in horizontal lifts, using equipment and procedures that will produce recommended moisture contents and densities throughout the lift. Fill soils should be compacted within a moisture content range of three percent below (-3%) to three percent above (+3%) optimum. Free draining materials may require substantial volumes of water during compaction.

Engineered fill should be compacted with a minimum of four overlapping passes of a vibratory compactor operating at a vibration of 30 to 50 hertz. Maximum speed of the compactor while placing fill should be 300 feet per minute. Loose lift fill thickness should not exceed 24 inches provided a minimum 20 ton vibratory compactor is used for construction. For 10-ton vibratory compactors, the maximum lift thickness should be limited to 15 inches. In no case should a compactor less than 10 tons be used for construction. Variations in the compaction protocols may be acceptable, depending on the Contractor's equipment.

Where coarse granular materials are used as engineered fill, the materials should be wetted prior to compaction to decrease compressibility and to increase the deformability of the soil mass during construction. The Contractor should be responsible for the capacity to apply water at a volumetric rate of at least 100 gallons per cubic yard of rock fill material. Based on field observations, more water may be appropriate. Nesting or segregation of coarse materials should be prevented and where it occurs, the materials should be removed, mixed, and recompacted.

- **Shrinkage:** For balancing grading plans, estimated shrink or swell of soils for use as engineered fill per the recommendations in this report assume oversize materials will be processed and used on the project. The estimated shrink and swell due to density changes are as follows:

Material	Estimated Shrink(-) Swell (+) Based on ASTM D1557
Existing Fill Soils within 8 feet of the surface	-15% to -5%
Existing Fill Soils more than 8 feet below grade	-10% to 0%
Native Soils	-5% to +5%

Screening excavated materials to remove oversize particles prior to use as engineered fill will contribute to shrink. In general, we anticipate shrinkage due to screening will be minor where existing fill soils are excavated. However, removal of oversize particles from excavated native SGC soils could yield substantial shrinkage. The net effect will vary depending on the material gradation as well as the size of particles that are separated. We suggest oversize material be crushed otherwise processed for use on site.

Suggested Construction Alternatives: A key issue for site development is the availability of fill materials for use in construction of the roadway fill sections. The more material that can be removed from basement excavations during Phase 1, the less material will need to be imported. Since the net volumes at the site call for export, any volume imported will increase the total export volume, though the export will happen in later Phases.

We suggest several alternative approaches for construction of slopes and basement excavations. In general, however, it appears much of the excavation support for the project will include top-down construction of soil-nail walls. Soil-nail walls are anticipated for excavation shoring and soil support along Rio Salado Parkway and along the flood control structure.

Considerable design and construction effort will be appropriate to properly install soil nails, which will extend outside the building perimeters – possibly beyond property lines – into soils where there are buried utilities. To the extent practicable, utilities should be excluded from the reinforced zones of soil nail walls or MSE retaining walls. Buried stormwater storage facilities, utilidors, duct banks, manholes, and other relatively large utility structures must be excluded from reinforced zones altogether. It should be noted that if utilities are damaged during installation of soil-nail walls, excavations for repairs will be hindered by the presence of any previously installed soil nails.

We suggest several alternatives be considered for maximizing the volume of material that can be excavated from basement areas during Phase 1.

- **Load Relief Walls:** Load relief walls are constructed around the basement of a building, providing support for the surrounding soils. The wall face can be constructed near-vertical, which allows excavation of the full height of the planned basement.

  We suggest considering wire-basket faced, geogrid reinforced, mechanically stabilized earth (MSE) walls for this application. The face of the load relief walls would create the interior surfaces of the basement excavation. For planning purposes, we suggest assuming the excavations for the reinforced zone (the stabilized earth fill) will need to extend away from the wall face a distance equal to approximately 75 percent of the wall height. The excavation would need to be full depth.

  Some offsetting cost savings could be realized during building construction because the MSE retaining wall would replace excavation shoring. Additionally, the soil loads on the basement walls would be reduced to near zero, which would reduce wall thickness and structure costs.

It should be noted that utilities should not be installed in the reinforced zone of the MSE retaining wall. Some shallow conduit or pressurized water line utilities may be placed in the reinforced zone during wall construction. Gravity flow utilities would conflict with reinforcements and should always be excluded from reinforcement zones. Additionally, excavations through reinforcing geogrid should be avoided after wall construction.

- **Partial Height MSE Walls:** MSE retaining walls could be constructed around the perimeter of the basement excavations. The wall face can be constructed near-vertical, which moves the top-of-slope of the material being excavated downward. As the wall height increases, the volume of material that can be removed from the basement excavation increases.

  We suggest considering wire basket faced, geogrid reinforced, mechanically stabilized earth (MSE) walls for this application. The face of the partial-height load relief walls would create the interior surfaces of the basement excavation for the height of the wall. For planning purposes, we suggest assuming the excavations for the reinforced zone (the stabilized earth fill) will need to extend away from the wall face a distance equal to approximately 75 percent of the wall height. This approach could be especially economical where the wall heights correspond to the depth of on-site fill soils recommended for recompaction.

  For planning purposes, the slope of the soils below the toe-of-wall should begin two feet above the bottom-of-wall; it should extend horizontally away from the wall for at least two feet; and then downward at slopes no steeper than recommended.

  As with full-height MSE walls, it should be noted that utilities should not be installed in the reinforced zone of the retaining wall. However, the shorter wall heights yield shorter reinforcement lengths, which will leave more room outside the reinforced zone for utility trenches.

- **Soil Nail Walls:** Soil nail walls could be constructed to serve as excavation shoring and load relief walls in the same manner as MSE walls, but excavation of the retained material is not necessary. Soil nail walls are often used where excavations for MSE walls would extend off site. For planning purposes, we suggest assuming the reinforcements (the soil nails) will extend away from the wall face, into the retained material, a distance equal to the wall height. We anticipate soil nail walls will be used for excavation shoring and soil support along Rio Salado Parkway and along the flood control structure.

We suggest considering a soil nail retaining system that doesn't rely on a shotcrete wall face, such as the Teco Wall system. The Teco Wall uses a geotextile beneath a wire mesh to retain the wall face between nails. While the wall may be less attractive than a shotcrete covered surface, it won't be visible once the building is constructed.

Considerable care should be taken to ensure the soil nails are installed where they will not be at risk of damage due to future excavations. Much like MSE walls, the reinforced zone of the walls becomes an exclusion zone for utilities and other below grade construction.

- **Combination Walls:** A combination of retaining systems may be a cost effective alternative. MSE walls will be most economical where the materials in the reinforced zone will be fill or will be excavated due to being in a poorly compacted condition. This is the case for the uppermost zone of fill soils at the site. The MSE walls would have a shorter reinforcement length compared with soil nail walls, which would leave additional area in the retained soil outside the reinforced zone for utility trenches.

  A soil nail wall under an MSE wall would provide a permanent vertical wall face without requiring the excavation and recompaction of dense and very dense native soils. This approach may be especially cost effective for the Developer where roadways extend into the low area between the flood control structure and the fill pad.

- **Deep Dynamic Compaction:** Conflicts with the reinforced zones of MSE walls may yield unacceptable restrictions for utility locations. If this is the case, we suggest using deep dynamic compaction to densify the entire thickness of existing fill along the roadway prisms. Deep dynamic compaction relies on a crane-dropped heavy mass to compact surficial soils.

  Based on the soil conditions encountered at the site, we anticipate deep dynamic compaction would be an effective approach for compacting the full depth of the on-site fill soils. We suggest that this method be used along roadway segments where the existing fill will not be excavated.

  Once post-testing confirms the densified materials were adequately compacted, utility installation could begin. Once the utilities were installed, excavations for the adjacent basement(s) could begin. Top-down construction of a soil-nail wall could be completed although considerable care would be needed to avoid the newly installed utilities.

Pavement Design and Construction: Design of pavements for the project have been based generally on the procedures outlined in the 1993 Guideline for Design of Pavement Structures by the American Association of State Highway and Transportation Officials (AASHTO), as modified by the Arizona Department of Transportation (ADOT) and the Maricopa Association of Governments ([5]MAG, 1998 revised through 2005).

We recommend the local street pavement section consist of 3 inches asphalt cement concrete (AC) over 4 inches of aggregate base course. Subgrade soils are anticipated to be imported materials.

Based on the recommended requirements for imported materials, the minimum design subgrade modulus should be approximately 25,609 psi, which is near the maximum allowable of 26,000 psi. Using the design methodology, the recommended pavement section yields a back calculated design ESAL count of approximately 481,800 for a 20 year design life. This corresponds to a traffic demand substantially greater than anticipated for local residential or small volume collector streets.

Actual design traffic loading should be verified to confirm the pavement section will be adequate. Reevaluation of the recommended pavement section may be necessary if the actual traffic is greater than the back calculated ESAL count outlined above.

Rigid concrete pavement, a minimum of 6 inches in thickness, is recommended at the location of dumpsters where trash trucks will park and load or any other areas of anticipated heavy vehicle loads.

It should be noted that the pavement design is based on the soil properties of imported soils, and on-site soils exclusive of the silt with sand soils. As previously stated, the silt with sand encountered in the existing fill soils should be excluded from the zone of fill within two feet of subgrade elevation.

Additional Design and Construction Considerations:

- **Corrosion Protection:** Results of soluble sulfate testing indicate that ASTM Type I/II Portland cement is suitable for all concrete on and below grade. Foundation concrete should be designed in accordance with the provisions of the ACI Design Manual, Section 318, Chapter 4.

  Laboratory test results indicate that on-site soils have pH values ranging from 8 to 9.3 and resistivities ranging from 650 to 7,000 ohm-centimeters. These values should be

[5]Maricopa Association of Governments, 1998, revised through 2005, ***Uniform Standard Specifications for Public Works Construction***, Arizona.

used to determine potential corrosive characteristics of the on-site soils with respect to contact with the various underground materials which will be used for project construction.

- **Surface Drainage:** Positive drainage should be provided during construction and maintained throughout the life of the proposed project. Grades along the top-of-slope should be designed to ensure runoff is directed away from the interiors of the basement excavations. Once buildings are constructed, grades will direct runoff away from the structures.

- **Utility Conflicts:** Based on preliminary plans provided by LP/GAS, it appears several 12 foot diameter stormwater retention facilities may be located in areas that will conflict with the reinforced zone around the perimeter of basement excavations. The stormwater retention facilities should be located outside potential reinforcement zones. If this cannot be completed due to geometry constraints, then a secant pile wall could be considered as an alternative.

  In general, utility locations should be adjusted to minimize the number of buried utilities inside reinforcement zones around basement excavations. We understand it is possible to install a soil nailed wall without damaging a utility line buried in the reinforced zone. Conduits for shallow, dry utilities are sometimes installed in the reinforced zone of MSE walls. However, to the extent practicable, utilities should be located outside the reinforcement zones.

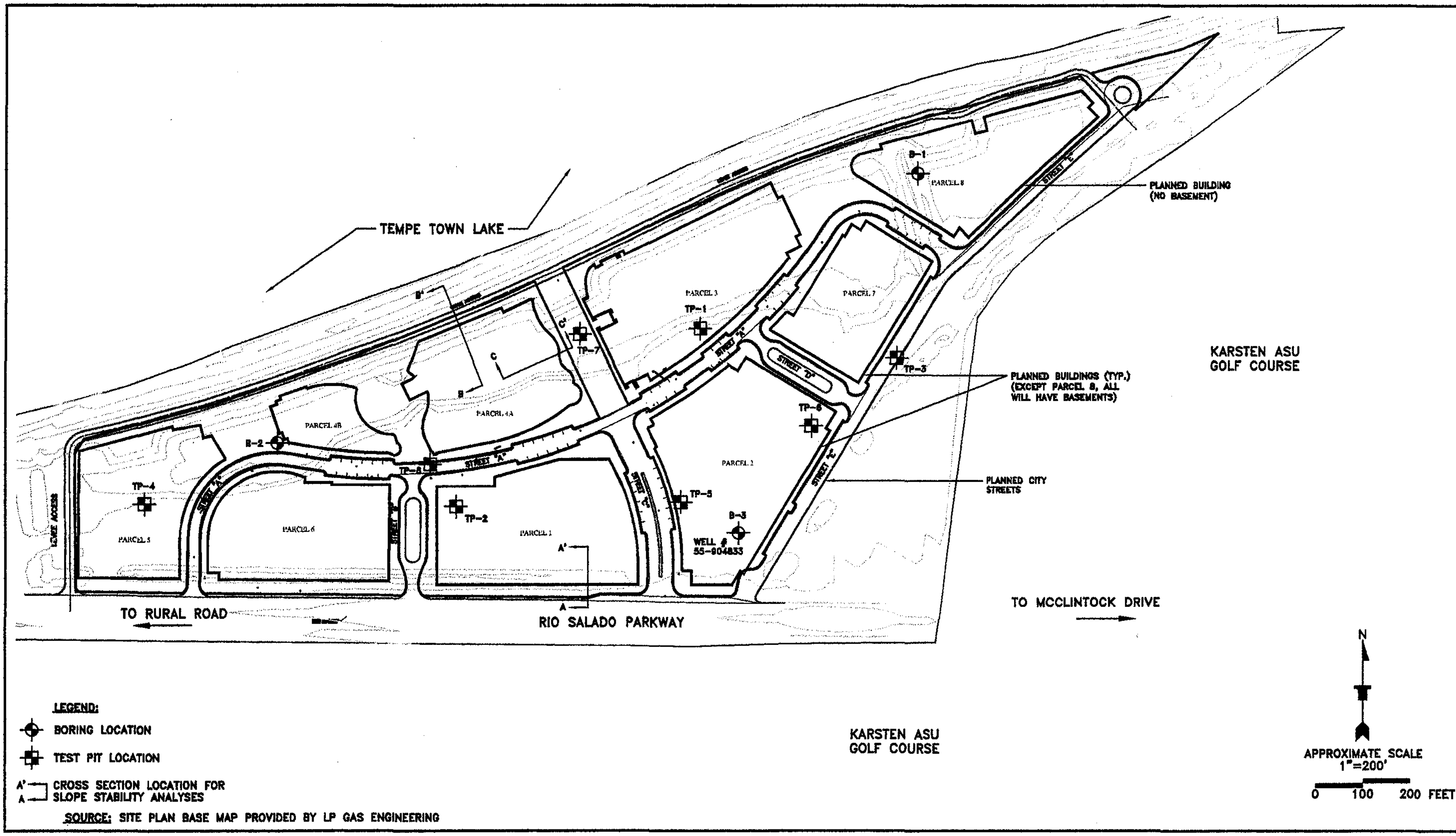
GENERAL COMMENTS

The analysis and recommendations in this report are based on data from borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of weather. The nature and extent of such variations may not become evident until supplemental geotechnical exploration is performed.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

We have appreciated being of service to you in the geotechnical engineering phase of this project, and are prepared to assist you during the construction phases as well. If you have any questions concerning this report or any of our testing, inspection, design, and consulting services, please do not hesitate to contact us.



Terracon
4685 SOUTH ASH AVENUE, STE H-4
TEMPE, ARIZONA 85282
(480) 897-8200 FAX (480) 897-1133

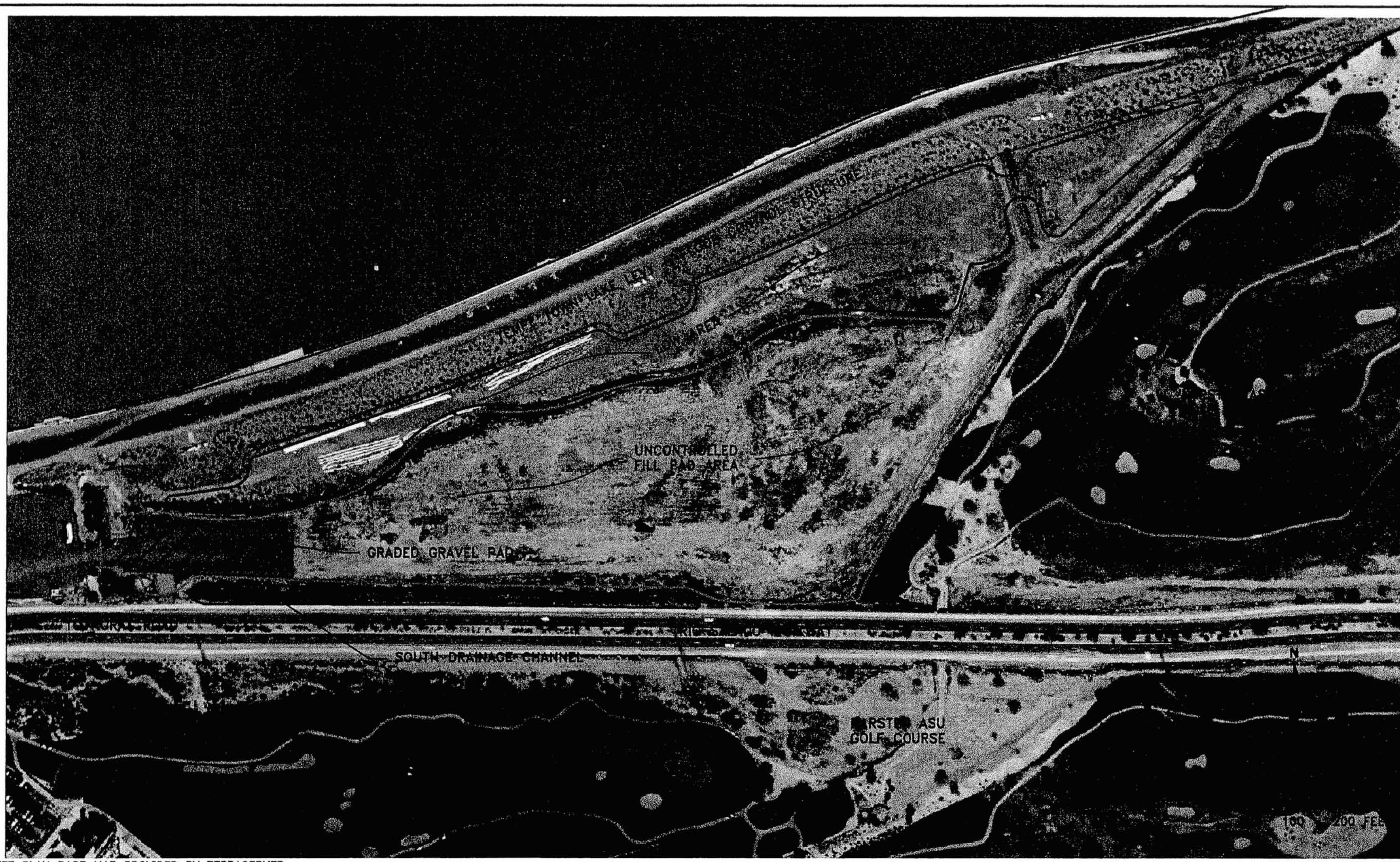
DRAWN BY:	ADB
CHECKED BY:	SDN
SCALE:	AS SHOWN
DATE:	07/23/2007

SITE PLAN AND EXPLORATION LOCATIONS

TERRACON PROJECT NO. 65065044

PIER 202 DEVELOPMENT
EAST OF RURAL ROAD AND
NORTH SIDE OF RIO SALADO PARKWAY
TEMPE, ARIZONA

FIGURE No.
1



SOURCE: SITE PLAN BASE MAP PROVIDED BY TERRASERVER

Terracon

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DRAWN BY:	ADB
CHECKED BY:	SDN
SCALE:	AS SHOWN
DATE:	08/24/2006

SITE FEATURES

TERRACON PROJECT NO. 65065044

PIER 202 DEVELOPMENT
EAST OF RURAL ROAD AND
NORTH SIDE OF RIO SALADO PARKWAY
TEMPE, ARIZONA

FIGURE No.
2

APPENDIX A

LOG OF BORING NO. B-1

CLIENT	ENGINEER
Pier 202, LLC	LP/GAS
SITE E. of Rural Rd. on N. side of Rio Salado Pkwy. Tempe, Arizona	PROJECT Pier 202 Development - Infrastructure Improvements

GRAPHIC LOG	DESCRIPTION Approx. Surface Elev.: 1148.5 ft	DEPTH, ft.	USCS SYMBOL	SAMPLE: INTERVAL	SAMPLE: TYPE	SAMPLE: RECOVERY (in)	SAMPLE: BLOWS/FT.	TESTS: WATER CONTENT, %	TESTS: DRY DENSITY pcf	TESTS: LIQUID LIMIT	TESTS: PLASTICITY INDEX	TESTS: -#200
	SANDS, GRAVELS AND COBBLES; light brown to grey, dense, dry.	1–4										
		5–6		X	SS		50/3"					
	very dense, dry to moist.	7–9										
		10–11		X	SS		50/5"					
		15–16		X	SS		50/4"					
		20–21		X	SS		50/5"					
	▼	25–26		X	SS		50/4"					
	27 ▽ 1121.5	27										
	POORLY GRADED SAND WITH GRAVEL; trace cobbles, light brown, wet.	28–29										
		30–31	SP	X	SS		41					
		32–36										

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 27 ft.	WD ▼ 25 ft. 1hr AB
WL	▽	▼
WL	Backfilled Upon Completion	

Terracon

BORING STARTED			5-16-06
BORING COMPLETED			5-16-06
RIG	BECKER	FOREMAN	VD
APPROVED	SDN	JOB #	65065044

LOG OF BORING NO. B-1

CLIENT	ENGINEER
Pier 202, LLC	LP/GAS
SITE E. of Rural Rd. on N. side of Rio Salado Pkwy. Tempe, Arizona	PROJECT Pier 202 Development - Infrastructure Improvements

DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLE: INTERVAL	SAMPLE: TYPE	SAMPLE: RECOVERY (in)	SAMPLE: BLOWS/FT.	TESTS: WATER CONTENT, %	TESTS: DRY DENSITY pcf	TESTS: LIQUID LIMIT	TESTS: PLASTICITY INDEX	TESTS: -#200
POORLY GRADED SAND WITH GRAVEL; trace cobbles, light brown, wet.	37–39										
39 — 1109.5	39										
SANDS, GRAVELS AND COBBLES; light brown to grey, very dense, wet.	40–41		X	SS		50/2"					
	50–51		X	SS		50/3"					
- more sand between 55 and 57 feet.	55										
	60–61		X	SS		50/3"					
- trace clay.	68										
	70–71		X	SS		50/5"					
71.5 — 1077	71.5										
Bottom of BORING.											

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft				
WL	∇ 27 ft.	WD	▼ 25 ft.	1hr AB
WL	∇		▼	
WL	Backfilled Upon Completion			

Terracon

BORING STARTED			5-16-06
BORING COMPLETED			5-16-06
RIG	BECKER	FOREMAN	VD
APPROVED	SDN	JOB #	65065044

BOREHOLE 2000 65065044.GPJ TERR2000.GDT 8/24/07

LOG OF BORING NO. B-2

CLIENT Pier 202, LLC	ENGINEER LP/GAS
SITE E. of Rural Rd. on N. side of Rio Salado Pkwy. Tempe, Arizona	PROJECT Pier 202 Development - Infrastructure Improvements

GRAPHIC LOG	DESCRIPTION Approx. Surface Elev.: 1148.5 ft	DEPTH, ft.	USCS SYMBOL	SAMPLE: INTERVAL	SAMPLE: TYPE	SAMPLE: RECOVERY (in)	SAMPLE: BLOWS/FT.	TESTS: WATER CONTENT, %	TESTS: DRY DENSITY pcf	TESTS: LIQUID LIMIT	TESTS: PLASTICITY INDEX	TESTS: #200
	SANDS, GRAVELS AND COBBLES; light brown to grey, very dense, dry to moist.	5		X	SS		50/2"					
		10		X	SS		50/4"					
		15		X	SS		50/5"					
		25		X	SS		50/4"					
	moist.	32										
	36 wet. ▽ 1112.5	35		X	SS		50/5"					

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 35 ft.	WD	▼
WL	▼		▼
WL	Backfilled Upon Completion		

Terracon

BORING STARTED			5-16-06
BORING COMPLETED			5-16-06
RIG	BECKER	FOREMAN	VD
APPROVED	SDN	JOB #	65065044

BOREHOLE 2000 65065044.GPJ TERR2000.GDT 8/24/07

LOG OF BORING NO. B-2

CLIENT	ENGINEER
Pier 202, LLC	LP/GAS
SITE E. of Rural Rd. on N. side of Rio Salado Pkwy. Tempe, Arizona	PROJECT Pier 202 Development - Infrastructure Improvements

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLE: INTERVAL	SAMPLE: TYPE	SAMPLE: RECOVERY (in)	SAMPLE: BLOWS/FT.	TESTS: WATER CONTENT, %	TESTS: DRY DENSITY pcf	TESTS: LIQUID LIMIT	TESTS: PLASTICITY INDEX	TESTS: -#200
	SANDS, GRAVELS AND COBBLES; light brown to grey, very dense, wet.	37–44										
		45–46		X	SS		50/3"					
		47–54										
		55–56		X	SS		50/4"					
		57–64										
		65–66		X	SS		50/4"					
		67–71										
	71.5 — 1077											
	Bottom of BORING.											

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 35 ft.	WD	▼
WL	▼		▼
WL	Backfilled Upon Completion		

Terracon

BORING STARTED			5-16-06
BORING COMPLETED			5-16-06
RIG	BECKER	FOREMAN	VD
APPROVED	SDN	JOB #	65065044

BOREHOLE 2000 65065044.GPJ TERR2000.GDT 8/24/07

LOG OF BORING NO. B-3

CLIENT	ENGINEER
Pier 202, LLC	LP/GAS
SITE E. of Rural Rd. on N. side of Rio Salado Pkwy. Tempe, Arizona	PROJECT Pier 202 Development - Infrastructure Improvements

GRAPHIC LOG	DESCRIPTION Approx. Surface Elev.: 1164 ft	DEPTH, ft.	USCS SYMBOL	SAMPLE: INTERVAL	SAMPLE: TYPE	SAMPLE: RECOVERY (in)	SAMPLE: BLOWS/FT.	TESTS: WATER CONTENT, %	TESTS: DRY DENSITY pcf	TESTS: LIQUID LIMIT	TESTS: PLASTICITY INDEX	TESTS: -#200
	FILL - SILTY SAND WITH GRAVEL; light brown, dry to moist.	1–9										
	trace cobbles, dense.	10–11	SM	X	SS		45					
	13 — 1151	12										
	SANDS, GRAVELS AND COBBLES; light brown to grey, very dense, dry to moist.	13–19										
		20–21		X	SS		50/5"					
		22–29										
		30–31		X	SS		50/3"					
		32–36										

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 59 ft. WD	▼ 46 ft. 1hr AB
WL	▼ 42 ft. 5-22-06	▽
WL	Backfilled Upon Completion	

Terracon

BORING STARTED			5-17-06
BORING COMPLETED			5-17-06
RIG	BECKER	FOREMAN	VD
APPROVED	SDN	JOB #	65065044

BOREHOLE 2000 65065044.GPJ TERR2000.GDT 8/24/07

LOG OF BORING NO. B-3

CLIENT: Pier 202, LLC	ENGINEER: LP/GAS
SITE: E. of Rural Rd. on N. side of Rio Salado Pkwy. Tempe, Arizona	PROJECT: Pier 202 Development - Infrastructure Improvements

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLE: INTERVAL	SAMPLE: TYPE	SAMPLE: RECOVERY (in)	SAMPLE: BLOWS/FT.	TESTS: WATER CONTENT, %	TESTS: DRY DENSITY pcf	TESTS: LIQUID LIMIT	TESTS: PLASTICITY INDEX	TESTS: #200
	SANDS, GRAVELS AND COBBLES; light brown to grey, very dense, dry to moist. moist.	37–39										
		40–41		X	SS		40					
	▽ (≈41.8) ▼ (≈45.8)	42–47										
	48 — 1116	48										
	SILTY GRAVEL WITH SAND; some cobbles, light brown, very dense, moist.	48–49										
		50–51	GM	X	SS		50/3"					
	moist to wet.	52–58										
	▽ (≈59) trace clay, wet.	59										
		60–61	GM	X	SS		50/4"					
		62–69										
	71 — 1093	70–71	GM	X	SS		50/5"					
		72										

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 59 ft.	WD ▼ 46 ft.	1hr AB
WL	▼ 42ft. 5-22-06	▽	
WL	Backfilled Upon Completion		

Terracon

BORING STARTED	5-17-06		
BORING COMPLETED	5-17-06		
RIG	BECKER	FOREMAN	VD
APPROVED	SDN	JOB #	65065044

BOREHOLE 2000 65065044.GPJ TERR2000.GDT 8/24/07

LOG OF BORING NO. B-3

CLIENT	ENGINEER
Pier 202, LLC	LP/GAS
SITE E. of Rural Rd. on N. side of Rio Salado Pkwy. Tempe, Arizona	PROJECT Pier 202 Development - Infrastructure Improvements

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE RECOVERY (in)	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	TESTS DRY DENSITY pcf	TESTS LIQUID LIMIT	TESTS PLASTICITY INDEX	TESTS -#200
	SANDS, GRAVELS AND COBBLES; light brown to grey, very dense, wet.	73–79										
		80–81		X	SS		50/3"					
		82–89										
		90–91		X	SS		50/6"					
		92–99										
	101.5 1062.5	100–101		X	SS		50/5"					
	Monitoring well #55-904833 installed to 100'. **Bottom of BORING.**											

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft			BORING STARTED	5-17-06
WL	▽ 59 ft. WD ▼ 46 ft. 1hr AB	Terracon	BORING COMPLETED	5-17-06
WL	▽ 42 ft. 5-22-06 ▽		RIG BECKER	FOREMAN VD
WL	Backfilled Upon Completion		APPROVED SDN	JOB # 65065044

BOREHOLE 2000 65065044.GPJ TERR2000.GDT 8/24/07

LOG OF TEST PIT NO. TP-1

CLIENT	ENGINEER
Pier 202, LLC	LP/GAS
SITE E. of Rural Rd. on N. side of Rio Salado Pkwy. Tempe, Arizona	PROJECT Pier 202 Development - Infrastructure Improvements

Approx. Surface Elev.: 1147 ft

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLE: INTERVAL	SAMPLE: TYPE	SAMPLE: RECOVERY (in)	SAMPLE: BLOWS/FT.	TESTS: WATER CONTENT, %	TESTS: DRY DENSITY pcf	TESTS: LIQUID LIMIT	TESTS: PLASTICITY INDEX	TESTS: -#200
	POORLY GRADED SAND WITH GRAVEL; with cobbles, brown to grey, loose to medium dense, moist.	1										
	easy excavation, moderate caving.	3										
		4	SP	↕	GS					0	0	2
6.5	moderate to severe caving. 1140.5	6										
	POORLY GRADED GRAVEL WITH SAND; cobbles and boulders.	7										
	moderate caving.	8										
		10	GP	↕	GS					0	0	2
	maximum size increases with depth.	11										
	easy excavation. slow advance due to increase in volume from moderate caving. slower advance near to reach limit.	16–18										
21	1126	21										
	Bottom of TEST PIT.											

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft		
WL	∇ None WD	▼
WL	▼	▼
WL	Backfilled Upon Completion	

Terracon

TEST PIT STARTED	3-27-06
TEST PIT COMPLETED	3-27-06
BACKHOE PC-200	FOREMAN MRS
APPROVED SDN	JOB # 65065044

BOREHOLE 2000 65065044.GPJ TERR2000.GDT 8/24/07

LOG OF TEST PIT NO. TP-2

CLIENT	ENGINEER
Pier 202, LLC	LP/GAS
SITE E. of Rural Rd. on N. side of Rio Salado Pkwy. Tempe, Arizona	PROJECT Pier 202 Development - Infrastructure Improvements

Approx. Surface Elev.: 1161.5 ft

Depth (ft)	Description	Elev. (ft)
0.75	**FILL - CLAYEY SAND WITH GRAVEL**; brown, moist, poorly to moderately compacted.	1161
2.5	**FILL - POORLY GRADED SAND**; trace gravel, brown, moist, poorly compacted.	1159
4	**FILL - POORLY GRADED SAND**; grey, moist, poorly compacted.	1157.5
15	**FILL - POORLY GRADED SAND**; some gravel, brown, moist. moderate caving.	1146.5
20	**POORLY GRADED GRAVEL**; with cobbles, brown to grey. operator reports "Easy to Dig". slow progress due to caving.	1141.5
	Bottom of TEST PIT.	

Depth, ft. (approx.)	USCS Symbol	Interval	Type	Recovery (in)	Blows/ft.	Water Content, %	Dry Density pcf	Liquid Limit	Plasticity Index	#200
0–1			FDT			3	115			
1–2	SP		GS					0	0	30
2–3			FDT			5	95			
3–4	SP		GS					0	0	2
4–5			FDT			7	91			

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft		
WL	None WD	
WL		
WL	Backfilled Upon Completion	

Terracon

TEST PIT STARTED	3-27-06
TEST PIT COMPLETED	3-27-06
BACKHOE PC-200	FOREMAN MRS
APPROVED SDN	JOB # 65065044

LOG OF TEST PIT NO. TP-3

CLIENT	ENGINEER
Pier 202, LLC	LP/GAS
SITE E. of Rural Rd. on N. side of Rio Salado Pkwy. Tempe, Arizona	PROJECT Pier 202 Development - Infrastructure Improvements

Approx. Surface Elev.: 1163 ft

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLE: INTERVAL	SAMPLE: TYPE	SAMPLE: RECOVERY (in)	SAMPLE: BLOWS/FT.	TESTS: WATER CONTENT, %	TESTS: DRY DENSITY pcf	TESTS: LIQUID LIMIT	TESTS: PLASTICITY INDEX	TESTS: -#200
	0.5 **FILL - POORLY GRADED SAND**; trace gravel, brown, moist, moderately compacted. 1162.5				FDT			3	111			
	FILL - POORLY GRADED SAND WITH GRAVEL; with cobbles, brown, moist, poorly compacted. moderate caving.				FDT			3	93			
			SP		GS FDT			2	116	0	0	2
	12 — 1151	12										
	POORLY GRADED SAND; brown, moist. 13 — 1150											
	POORLY GRADED SAND WITH GRAVEL; with cobbles, grey to brown, moist. moderate caving. cobbles and boulders.		SP		GS					0	0	3
			SP		GS					0	0	1
	21 — 1142 **Bottom of TEST PIT.**	21										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft		
WL	None WD	
WL		
WL	Backfilled Upon Completion	

Terracon

TEST PIT STARTED	3-27-06
TEST PIT COMPLETED	3-27-06
BACKHOE PC-200	FOREMAN MRS
APPROVED SDN	JOB # 65065044

BOREHOLE 2000 65065044.GPJ TERR2000.GDT 8/24/07

LOG OF TEST PIT NO. TP-4

CLIENT: **Pier 202, LLC**	ENGINEER: **LP/GAS**
SITE: **E. of Rural Rd. on N. side of Rio Salado Pkwy. Tempe, Arizona**	PROJECT: **Pier 202 Development - Infrastructure Improvements**

Approx. Surface Elev.: 1159 ft

Depth (ft)	Description	Elev. (ft)
0 – 2	**FILL - POORLY GRADED SAND WITH GRAVEL**; some cobbles, gray, well compacted, dry, zones of silty sand in sidewall of pit.	1157
2 – 4.5	**FILL - POORLY GRADED SAND**; trace silt, light brown, poorly compacted, moist, fine sand.	1154.5
4.5 – 6	18 inch diameter concrete pipe debris at 2 feet.	1153
6 – 7	**FILL - POORLY GRADED SAND**; some cobbles, brown, poorly compacted, moist, fine to medium sand.	1152
	FILL - POORLY GRADED SAND WITH GRAVEL; light brown, moderately compacted, dry.	
7 – 25	**POORLY GRADED SAND WITH GRAVEL**; AND COBBLES, gray, medium dense, dry. dense, (operator reports firm at 10 feet). more cobbles. moderate caving below 15 feet.	1134
25	**Bottom of TEST PIT.**	

Depth, ft. (approx.)	USCS Symbol	Sample Interval	Sample Type	Recovery (in)	Blows/ft.	Water Content, %	Dry Density pcf	Liquid Limit	Plasticity Index	-#200
0.5	SP		B2							
2.5	SP	↕	GS							
4.5			FDT			5	94			
6.5	SP	↕	GS FDT			3	107			
8.5	SP		B2 FDT			2	115			
10.5			FDT			2	119			
12.5			FDT			2	115			
14.5	SP		P							1
16.5	SP		P							
20.5	SP		P							
24.5	SP		B2							

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft		
WL	∇ None WD	▼
WL	▼	▼
WL	Backfilled Upon Completion	

Terracon

TEST PIT STARTED	6-5-07
TEST PIT COMPLETED	6-5-07
BACKHOE PC300LC	FOREMAN MRS
APPROVED SDN	JOB # 65065044

BOREHOLE 2000 65065044.GPJ TERR2000.GDT 8/24/07

LOG OF TEST PIT NO. TP-5

CLIENT: Pier 202, LLC	ENGINEER: LP/GAS
SITE: E. of Rural Rd. on N. side of Rio Salado Pkwy. Tempe, Arizona	PROJECT: Pier 202 Development - Infrastructure Improvements

Approx. Surface Elev.: 1162.5 ft

Depth (ft)	Elev.	DESCRIPTION
0 – 2	1160.5	**FILL - SILTY SAND**; some gravel, occasional cobbles, brown, well compacted, dry, trace refuse, trace concrete rubble.
2 – 6.5	1156	**FILL - POORLY GRADED SAND**; light brown, poorly compacted, moist, fine sand.
6.5 – 10	1152.5	**FILL - SILTY SAND**; some gravel, brown, poor to moderately compacted, moist, fine sand, trace wood debris, trace refuse.
10 – 16	1146.5	**FILL - POORLY GRADED SAND WITH GRAVEL**; AND COBBLES, light brown, moderately compacted, moist. broken glass bottle at 11 feet. moderately to well compacted.
16 – 18	1144.5	**FILL - POORLY GRADED SAND**; trace gravel, gray, poorly to moderately compacted, dry.
18 – 20.5	1142	**POORLY GRADED SAND WITH SILT AND GRAVEL**; AND COBBLES, brown, medium dense to dense, moist.
20.5		**Bottom of TEST PIT.**

DEPTH, ft.	USCS SYMBOL	SAMPLE: INTERVAL	SAMPLE: TYPE	SAMPLE: RECOVERY (in)	SAMPLE: BLOWS/FT.	TESTS: WATER CONTENT, %	TESTS: DRY DENSITY pcf	TESTS: LIQUID LIMIT	TESTS: PLASTICITY INDEX	TESTS: -#200
1.5	SM		B3					0	0	24
4.5			FDT				90	2		
5.5	SP		P3							
6.5			FDT				88	4		
8.5			FDT				96	3		
10.5	SP		B3				117	2		
11.5			FDT				120	1		
12.5			FDT				106	2		
14.5	SP		GS				118	1		
15.5			FDT				112	2		
16.5	SP		P				91	2		
17.5			FDT				106	2		
18.5			FDT				115	2		
19.5	SP-SM		B3					0	0	8

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft		
WL	None WD	
WL		
WL	Backfilled Upon Completion	

Terracon

TEST PIT STARTED	6-5-07
TEST PIT COMPLETED	6-5-07
BACKHOE PC300LC	FOREMAN MRS
APPROVED SDN	JOB # 65065044

BOREHOLE 2000 65065044.GPJ TERR2000.GDT 8/24/07

LOG OF TEST PIT NO. TP-6

CLIENT Pier 202, LLC	ENGINEER LP/GAS
SITE E. of Rural Rd. on N. side of Rio Salado Pkwy. Tempe, Arizona	PROJECT Pier 202 Development - Infrastructure Improvements

Approx. Surface Elev.: 1162.5 ft

Depth, ft	DESCRIPTION	Elev., ft
2	**FILL - SILTY GRAVEL**; light brown, well compacted, dry.	1160.5
3	**FILL - POORLY GRADED SAND**; trace gravel, light brown, well compacted, moist, fine sand.	1159.5
5	**FILL - SILT WITH SAND**; brown, moderately compacted, moist.	1157.5
8	**FILL - WELL GRADED SAND**; some gravel, gray, moderately compacted, moist.	1154.5
11.5	**FILL - POORLY GRADED SAND WITH GRAVEL**; trace cobbles, light brown, poorly to moderately compacted, moist.	1151
19	**FILL - POORLY GRADED SAND WITH GRAVEL**; some cobbles, gray, poorly compacted, moist.	1143.5
23	**POORLY GRADED SAND WITH GRAVEL**; AND COBBLES, brown, loose to medium dense, moist, many cobbles.	1139.5
	Bottom of TEST PIT.	

DEPTH, ft.	USCS SYMBOL	SAMPLE: TYPE	RECOVERY (in)	BLOWS/FT.	TESTS: WATER CONTENT, %	DRY DENSITY pcf	LIQUID LIMIT	PLASTICITY INDEX	-#200
0-2	GM	GS							
4-5	SP-SM	BS FDT			16	77	35	10	82
6-7	SW	B3 FDT			3	102	0	0	5
8-9		FDT			2	119			
10-11		FDT			2	107			
12-13	SP	B3 FDT			2	93			
14-15	SP	B1							
16-17	SP	B1							
22-23	SP	B3							

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft		
WL	None WD	
WL		
WL	Backfilled Upon Completion	

Terracon

TEST PIT STARTED	6-5-07
TEST PIT COMPLETED	6-5-07
BACKHOE PC300LC	FOREMAN MRS
APPROVED SDN	JOB # 65065044

BOREHOLE 2000 65065044.GPJ TERR2000.GDT 8/24/07

LOG OF TEST PIT NO. TP-7

CLIENT Pier 202, LLC	ENGINEER LP/GAS
SITE E. of Rural Rd. on N. side of Rio Salado Pkwy. Tempe, Arizona	PROJECT Pier 202 Development - Infrastructure Improvements

GRAPHIC LOG	DESCRIPTION Approx. Surface Elev.: 1149 ft	DEPTH, ft.	USCS SYMBOL	SAMPLE INTERVAL	SAMPLE TYPE	SAMPLE RECOVERY (in)	SAMPLE BLOWS/FT.	TESTS WATER CONTENT, %	TESTS DRY DENSITY pcf	TESTS LIQUID LIMIT	TESTS PLASTICITY INDEX	TESTS -#200
	POORLY GRADED SAND WITH GRAVEL; AND COBBLES, gray, dry, fine to coarse sand. moist.		SP		B3					0	0	1
		6			FDT			3	104			
		8	SP		B1							
	9 — 1140											
	POORLY GRADED SAND WITH GRAVEL; AND COBBLES, brown to red brown, moist, coarse sand, many cobbles. moderate caving below 12 feet.											
		14	SP		B1							
		18	SP		B1							
		22	SP		B1							
	23 — 1126											
	Bottom of TEST PIT.											

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft		
WL	∇ None WD	▼
WL	▼	▼
WL	Backfilled Upon Completion	

Terracon

TEST PIT STARTED	6-5-07
TEST PIT COMPLETED	6-5-07
BACKHOEPC300LC	FOREMAN MRS
APPROVED SDN	JOB # 65065044

BOREHOLE 2000 65065044.GPJ TERR2000.GDT 8/24/07

LOG OF TEST PIT NO. TP-8

CLIENT Pier 202, LLC	ENGINEER LP/GAS
SITE E. of Rural Rd. on N. side of Rio Salado Pkwy. Tempe, Arizona	PROJECT Pier 202 Development - Infrastructure Improvements

Approx. Surface Elev.: 1162 ft

Depth (ft)	DESCRIPTION	Elev. (ft)
2	**FILL - SILTY GRAVEL**; light brown, well compacted, dry.	1160
5	**FILL - POORLY GRADED SAND**; trace gravel, gray, moderately compacted, dry, fine sand.	1157
7	**FILL - SILTY SAND**; some gravel, brown, poorly compacted, moist.	1155
12	**FILL - POORLY GRADED SAND**; some gravel, light brown, poorly to moderately compacted, moist, coarse gravel lense 7½ to 8 feet.	1150
18	**FILL - POORLY GRADED SAND**; trace gravel, gray, poorly compacted, moist, fine sand.	1144
23	**POORLY GRADED SAND WITH GRAVEL**; AND COBBLES, brown, loose to medium dense, moist, many cobbles.	1139
	Bottom of TEST PIT.	

DEPTH, ft.	USCS SYMBOL	SAMPLE: INTERVAL	SAMPLE: TYPE	SAMPLE: RECOVERY (in)	SAMPLE: BLOWS/FT.	TESTS: WATER CONTENT, %	TESTS: DRY DENSITY pcf	TESTS: LIQUID LIMIT	TESTS: PLASTICITY INDEX	TESTS: -#200
3–4	SP	✓	B1 FDT			2	87			3
5		✓	FDT			7	88			
7		✓	FDT			6	88			
9–10	SP	✓	FDT B1			3	98			
11		✓	FDT			3	91			
13–14	SP	✓	FDT B1			4	86			
16–17	SP		B1							13
22–23	SP		B3							

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft		
WL	▽ None WD	▼
WL	▼	▼
WL	Backfilled Upon Completion	

Terracon

TEST PIT STARTED	6-5-07
TEST PIT COMPLETED	6-5-07
BACKHOE PC300LC	FOREMAN MRS
APPROVED SDN	JOB # 65065044

BOREHOLE 2000 65065044.GPJ TERR2000.GDT 8/24/07

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon - 1-^{3}/8" I.D., 2" O.D., unless otherwise noted	HS:	Hollow Stem Auger
MC:	Modified California Sampler – 2.5" O.D., unless otherwise noted	DC:	Dynamic Cone
RS:	Ring Sampler - 2.42" I.D., 3" O.D., unless otherwise noted	HA:	Hand Auger
BS:	Bulk Sample or Auger Sample	GS:	Grab Sample
Hammer Blows:	Number of Blows to advance the 9" O.D. steel casing one foot with the diesel hammer at "full" throttle.	WB:	Wash Boring or Mud Rotary

The number of blows required to advance a standard 2-inch O.D. split-spoon sampler (SS) the last 12 inches of the total 18-inch penetration with a 140-pound hammer falling 30 inches is considered the "Standard Penetration" or "N-value". For 3" O.D. ring samplers (RS) the penetration value is reported as the number of blows required to advance the sampler 12 inches using a 140-pound hammer falling 30 inches, reported as "blows per foot," and is not considered equivalent to the "Standard Penetration"or "N-value".

WATER LEVEL MEASUREMENT SYMBOLS:

WL:	Water Level	WS:	While Sampling
WCI:	Wet Cave in	WD:	While Drilling
DCI:	Dry Cave in	BCR:	Before Casing Removal
AB:	After Boring	ACR:	After Casing Removal

Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. Groundwater levels at other times and other locations across the site could vary. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels may not be possible with only short-term observations.

DESCRIPTIVE SOIL CLASSIFICATION: Soil classification is based on the Unified Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

CONSISTENCY OF FINE-GRAINED SOILS

Unconfined Compressive Strength, Qu, psf	Standard Penetration or N-value (SS) Blows/Ft.	Consistency
< 500	<2	Very Soft
500 – 1,000	2-3	Soft
1,001 – 2,000	4-6	Medium Stiff
2,001 – 4,000	7-12	Stiff
4,001 – 8,000	13-26	Very Stiff
8,000+	26+	Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Standard Penetration or N-value (SS) Blows/Ft.	Ring Sampler (RS) Blows/Ft.	Relative Density
0 – 3	0-6	Very Loose
4 – 9	7-17	Loose
10 – 29	18-55	Medium Dense
30 – 49	56-95	Dense
50+	96+	Very Dense

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 – 29
Modifier	> 30

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 – 12
Modifiers	> 12

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75 mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm)
Silt or Clay	Passing #200 Sieve (0.075mm)

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1-10
Medium	11-30
High	30+

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UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]				Soil Classification: Group Symbol	Soil Classification: Group Name[B]
Coarse Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$[E]	GW	Well-graded gravel[F]
			$Cu < 4$ and/or $1 > Cc > 3$[E]	GP	Poorly graded gravel[F]
		Gravels with Fines More than 12% fines[C]	Fines classify as ML or MH	GM	Silty gravel[F,G,H]
			Fines classify as CL or CH	GC	Clayey gravel[F,G,H]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$[E]	SW	Well-graded sand[I]
			$Cu < 6$ and/or $1 > Cc > 3$[E]	SP	Poorly graded sand[I]
		Sands with Fines More than 12% fines[D]	Fines classify as ML or MH	SM	Silty sand[G,H,I]
			Fines Classify as CL or CH	SC	Clayey sand[G,H,I]
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays Liquid limit less than 50	inorganic	PI > 7 and plots on or above "A" line[J]	CL	Lean clay[K,L,M]
			PI < 4 or plots below "A" line[J]	ML	Silt[K,L,M]
		organic	(Liquid limit - oven dried) / (Liquid limit - not dried) < 0.75	OL	Organic clay[K,L,M,N] Organic silt[K,L,M,O]
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line	CH	Fat clay[K,L,M]
			PI lots below "A" line	MH	Elastic Silt[K,L,M]
		organic	(Liquid limit - oven dried) / (Liquid limit - not dried) < 0.75	OH	Organic clay[K,L,M,P] Organic silt[K,L,M,Q]
Highly organic soils	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A] Based on the material passing the 3-in. (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

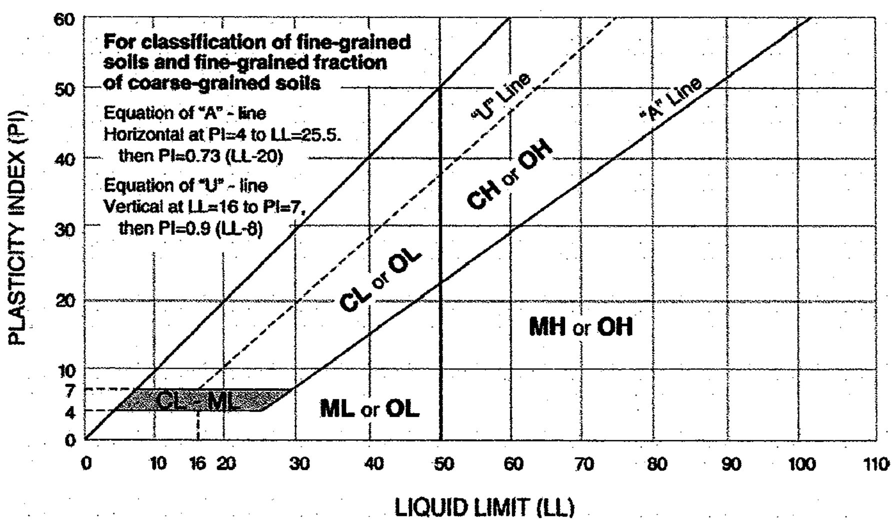
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



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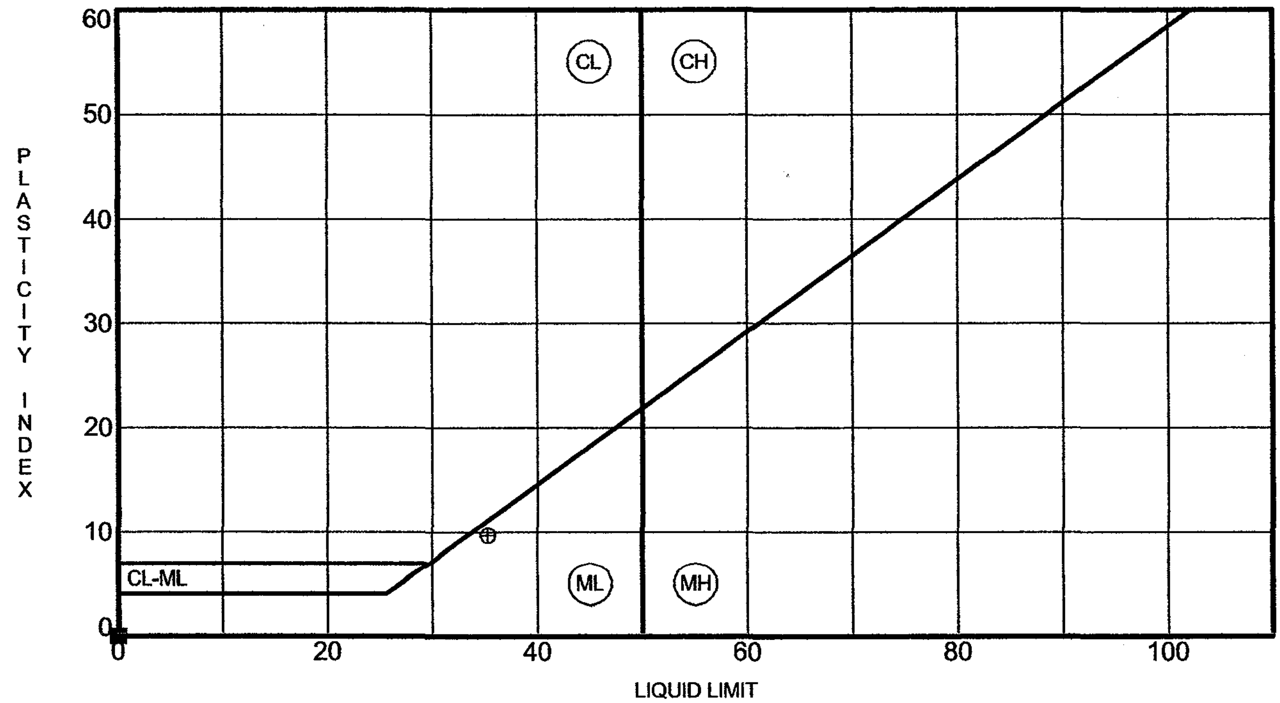
APPENDIX B



	Specimen Identification		LL	PL	PI	%-#200	Soil Description
●	TP-1	4.0ft	NP	NP	NP	2	POORLY GRADED GRAVEL with SAND(GP)
⊠	TP-1	10.0ft	NP	NP	NP	2	POORLY GRADED GRAVEL with SAND(GP)
▲	TP-2	1.0ft	NP	NP	NP	30	SILTY SAND(SM)
★	TP-2	3.0ft	NP	NP	NP	2	POORLY GRADED SAND(SP)
⊙	TP-3	4.0ft	NP	NP	NP	2	POORLY GRADED SAND(SP)
✪	TP-3	13.0ft	NP	NP	NP	3	POORLY GRADED SAND with GRAVEL(SP)
○	TP-3	20.0ft	NP	NP	NP	1	WELL-GRADED GRAVEL with SAND(GW)
△	TP-5	1.0ft	NP	NP	NP	24	SILTY GRAVEL with SAND(GM)
⊗	TP-5	19.0ft	NP	NP	NP	8	POORLY GRADED SAND with SILT and GRAVEL(SP-SM)
⊕	TP-6	4.0ft	35	26	9	82	SILT with SAND(ML)
□	TP-6	6.0ft	NP	NP	NP	5	WELL-GRADED SAND(SW)
●	TP-7	0.0ft	NP	NP	NP	1	POORLY GRADED GRAVEL with SAND(GP)

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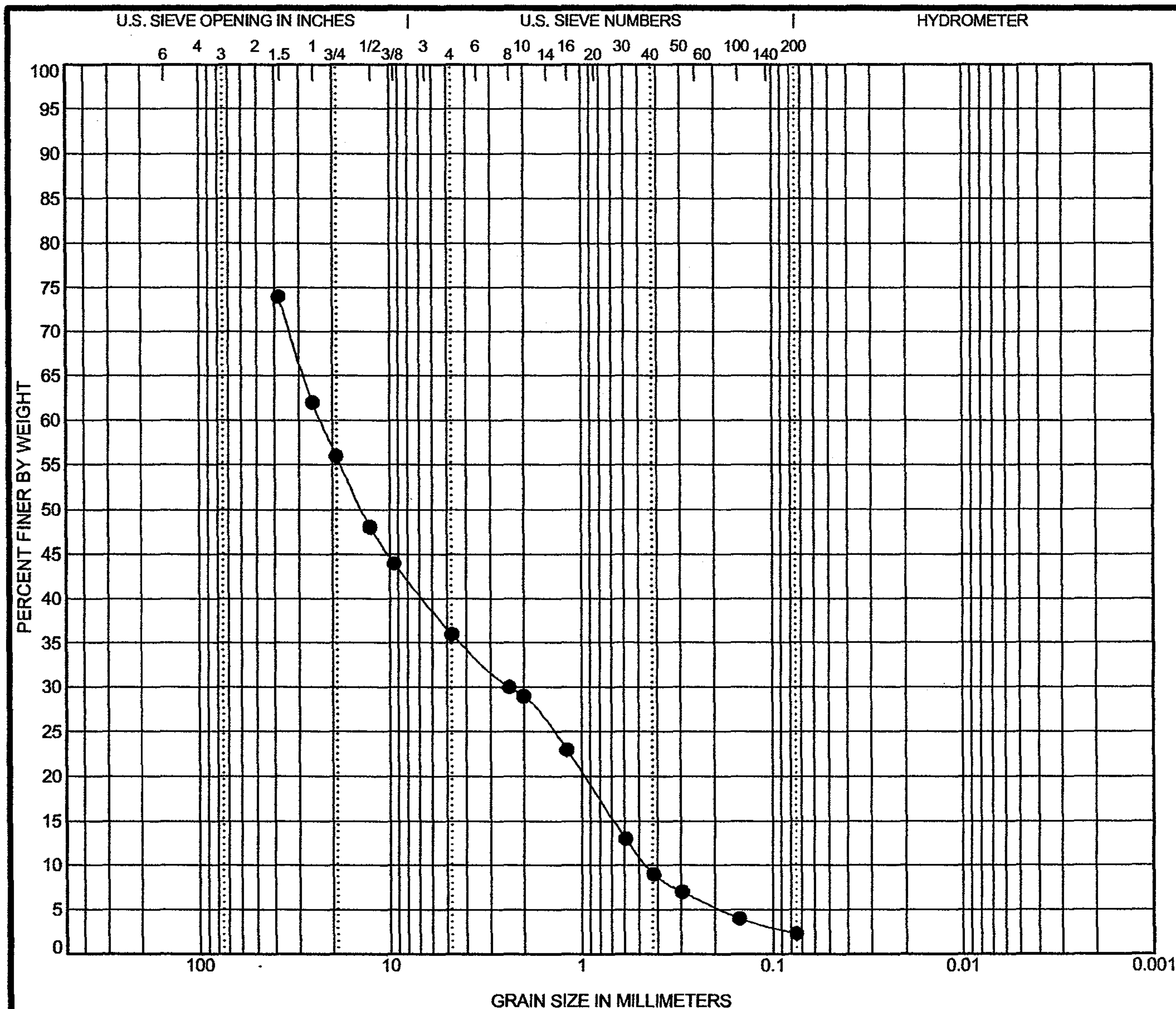
ATTERBERG LIMITS RESULTS

Project: Pier 202 Development - Infrastructure Improvements
Site: E. of Rural Rd. on N. side of Rio Salado Pkwy. Tempe, Arizona
Job #: 65065044
Date: 8-24-07

TC ATTERBERG LIMITS 65065044.GPJ TERRACON.GDT 8/24/07



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			USCS Soil Classification	LL	PL	PI	Cc	Cu
●	TP-1	4.0 ft	**POORLY GRADED GRAVEL with SAND(GP)**	NP	NP	NP	0.54	50.51

Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	TP-1	4.0 ft	38.1	23.098	2.38	0.457	38.0	33.7	2.3	

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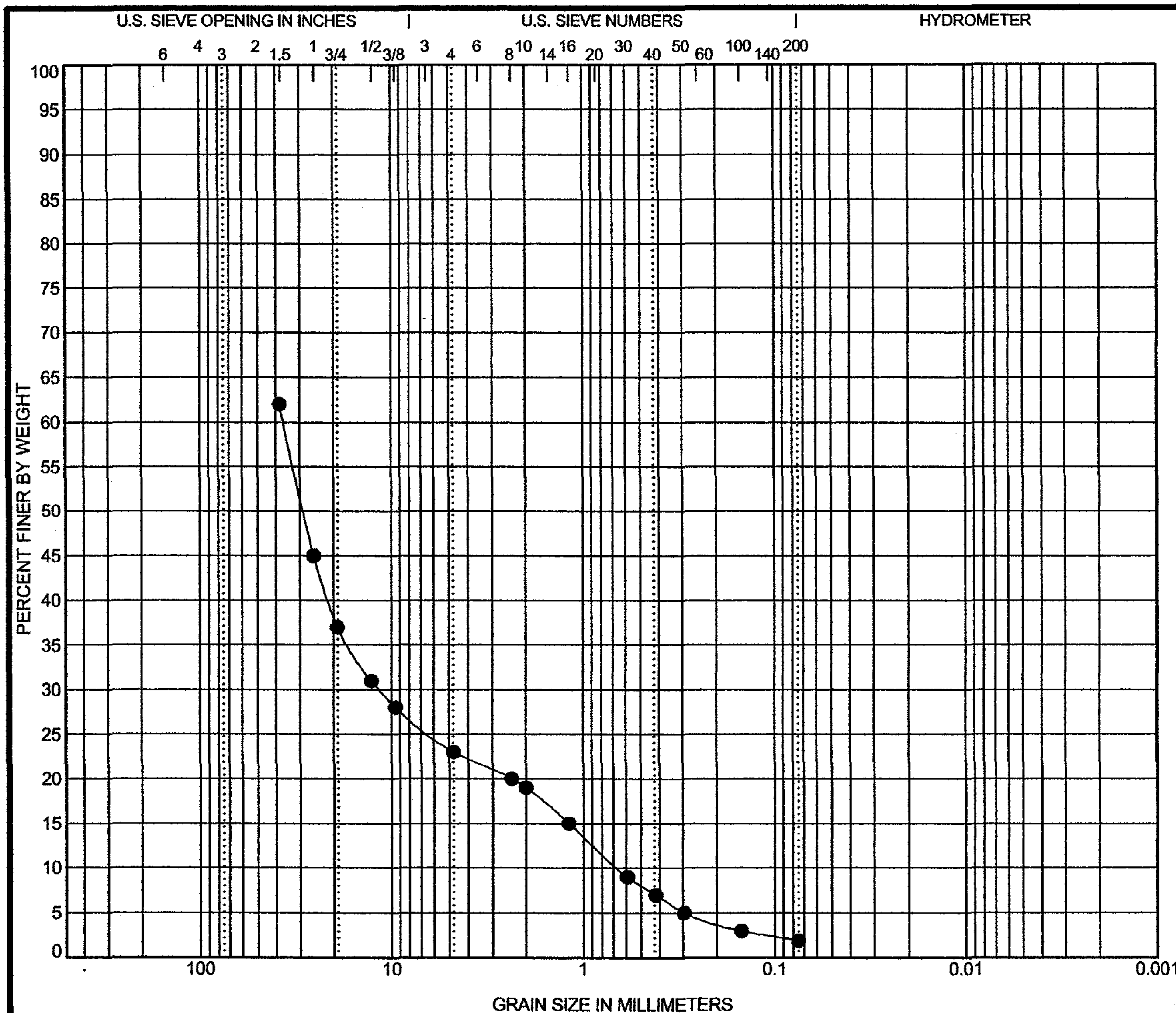
GRAIN SIZE DISTRIBUTION

Project: Pier 202 Development - Infrastructure Improvements
Site: E. of Rural Rd. on N. side of Rio Salado Pkwy. Tempe, Arizona
Job #: 65065044
Date: 8-24-07



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		USCS Soil Classification	LL	PL	PI	Cc	Cu
● TP-1	10.0 ft	POORLY GRADED GRAVEL with SAND(GP)	NP	NP	NP	5.52	54.77

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● TP-1	10.0 ft	38.1	36.325	11.529	0.663	39.0	21.1	1.9	

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GRAIN SIZE DISTRIBUTION

Project: Pier 202 Development - Infrastructure Improvements
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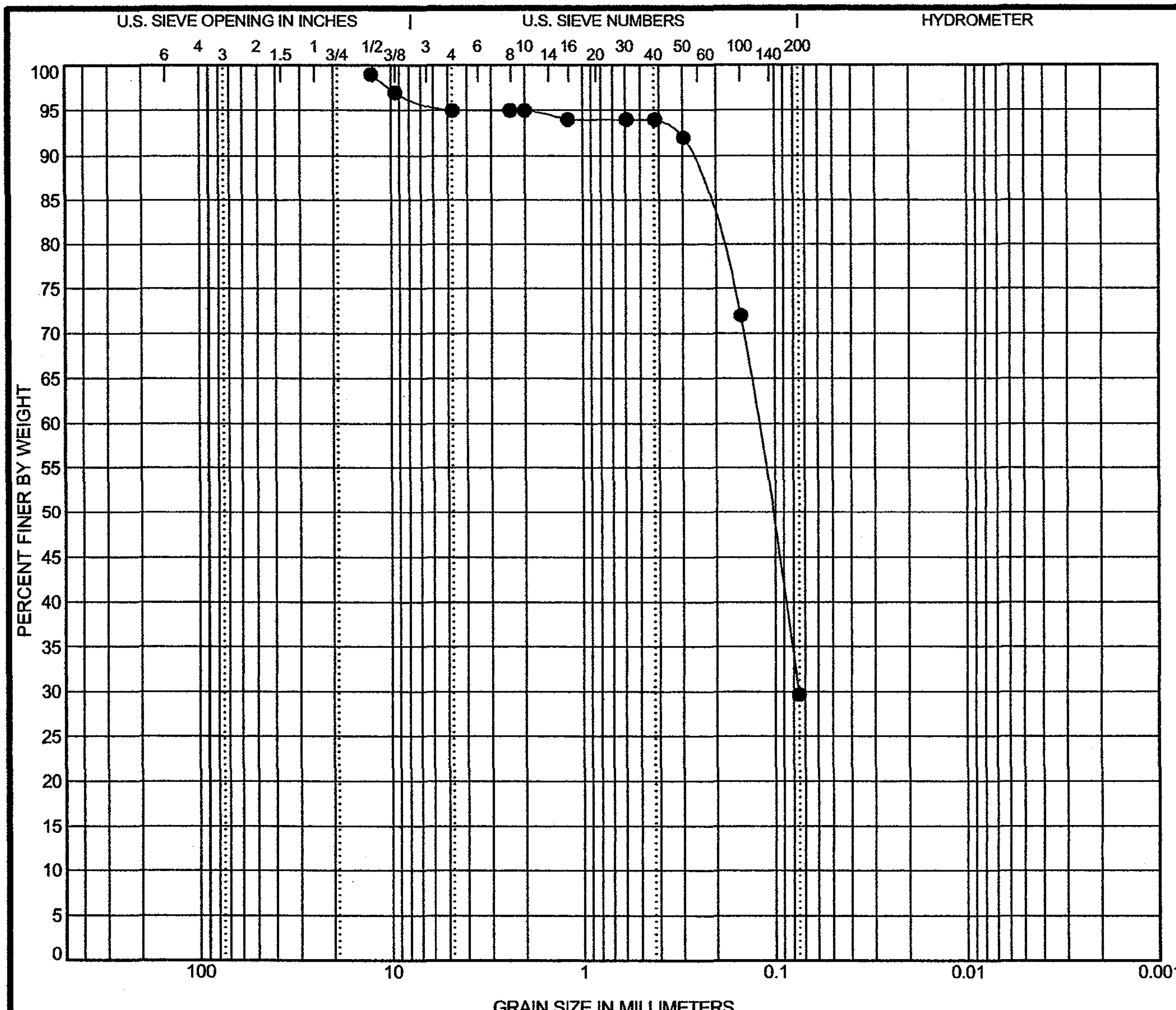
Job #: 65065044
Date: 8-24-07

TC GRAIN SIZE 65065044.GPJ TERRACON.GDT 8/24/07



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Soil Classification	LL	PL	PI	Cc	Cu
●	**TP-2**	**1.0 ft**	**SILTY SAND(SM)**	**NP**	**NP**	**NP**		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**TP-2**	**1.0 ft**	**12.7**	**0.123**	**0.075**		**4.0**	**65.3**	**29.7**	

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GRAIN SIZE DISTRIBUTION

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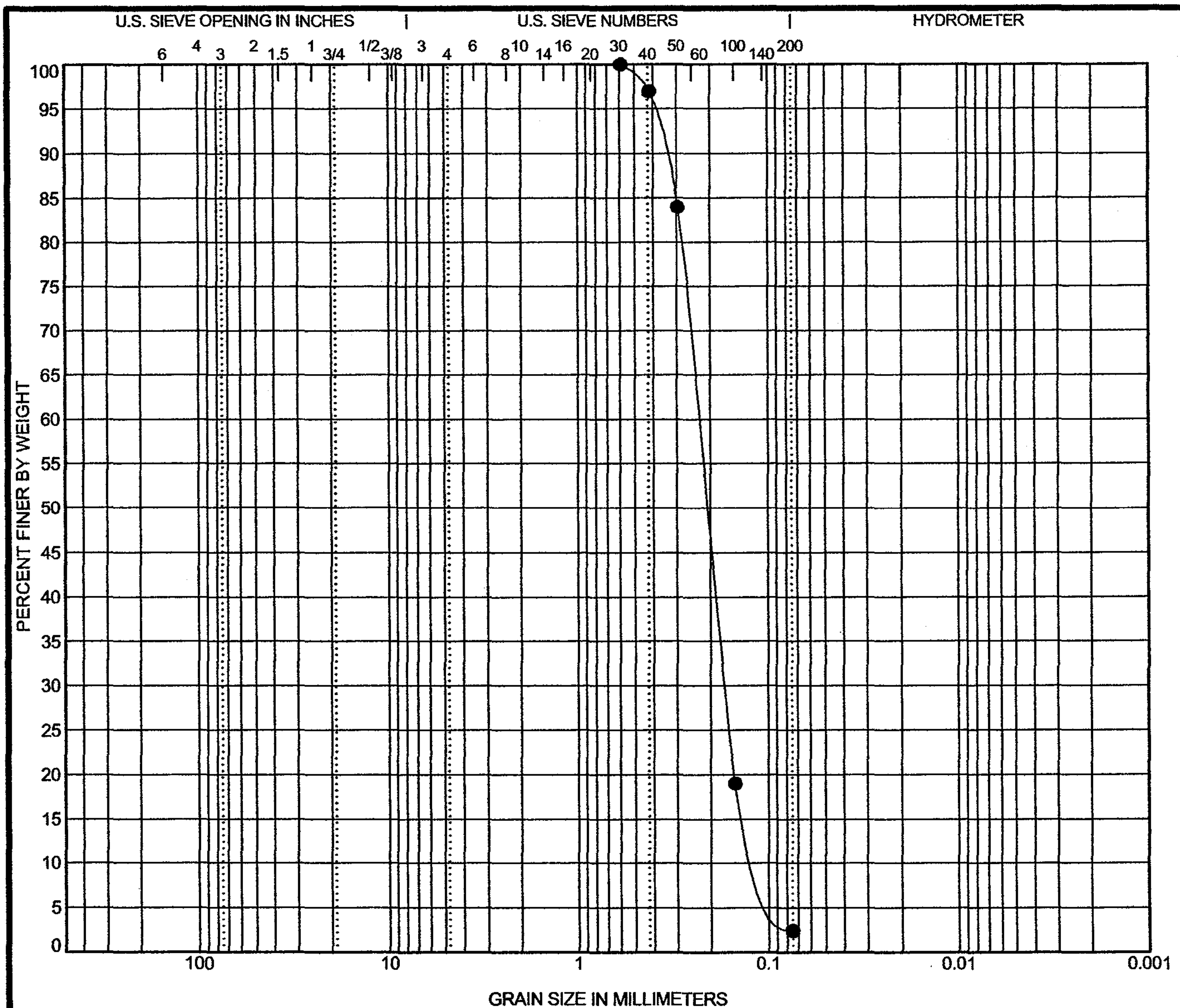
Date: 8-24-07

TC GRAIN SIZE 65065044.GPJ TERRACON.GDT 8/24/07



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Soil Classification	LL	PL	PI	Cc	Cu
●	**TP-2**	**3.0 ft**	**POORLY GRADED SAND(SP)**	**NP**	**NP**	**NP**	**1.19**	**2.24**

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**TP-2**	**3.0 ft**	**0.59**	**0.23**	**0.167**	**0.103**	**0.0**	**97.6**	**2.4**	

TC GRAIN SIZE 65065044.GPJ TERRACON.GDT 8/24/07

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GRAIN SIZE DISTRIBUTION

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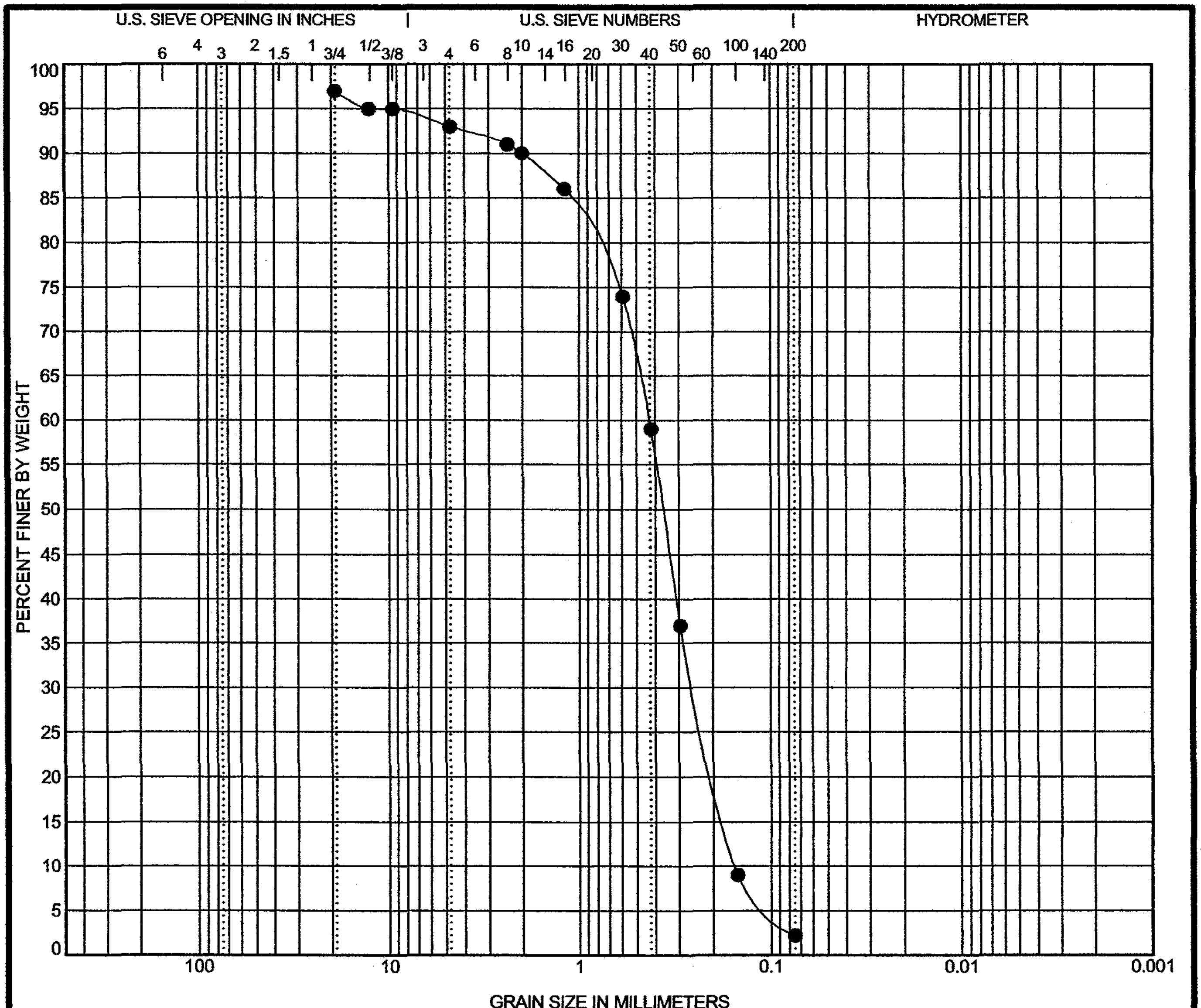

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Soil Classification	LL	PL	PI	Cc	Cu
●	**TP-3**	**4.0 ft**	**POORLY GRADED SAND(SP)**	**NP**	**NP**	**NP**	**0.95**	**2.81**

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**TP-3**	**4.0 ft**	**19.1**	**0.43**	**0.25**	**0.153**	**4.0**	**90.8**	**2.2**	

TC GRAIN SIZE 65065044.GPJ TERRACON.GDT 8/24/07

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GRAIN SIZE DISTRIBUTION

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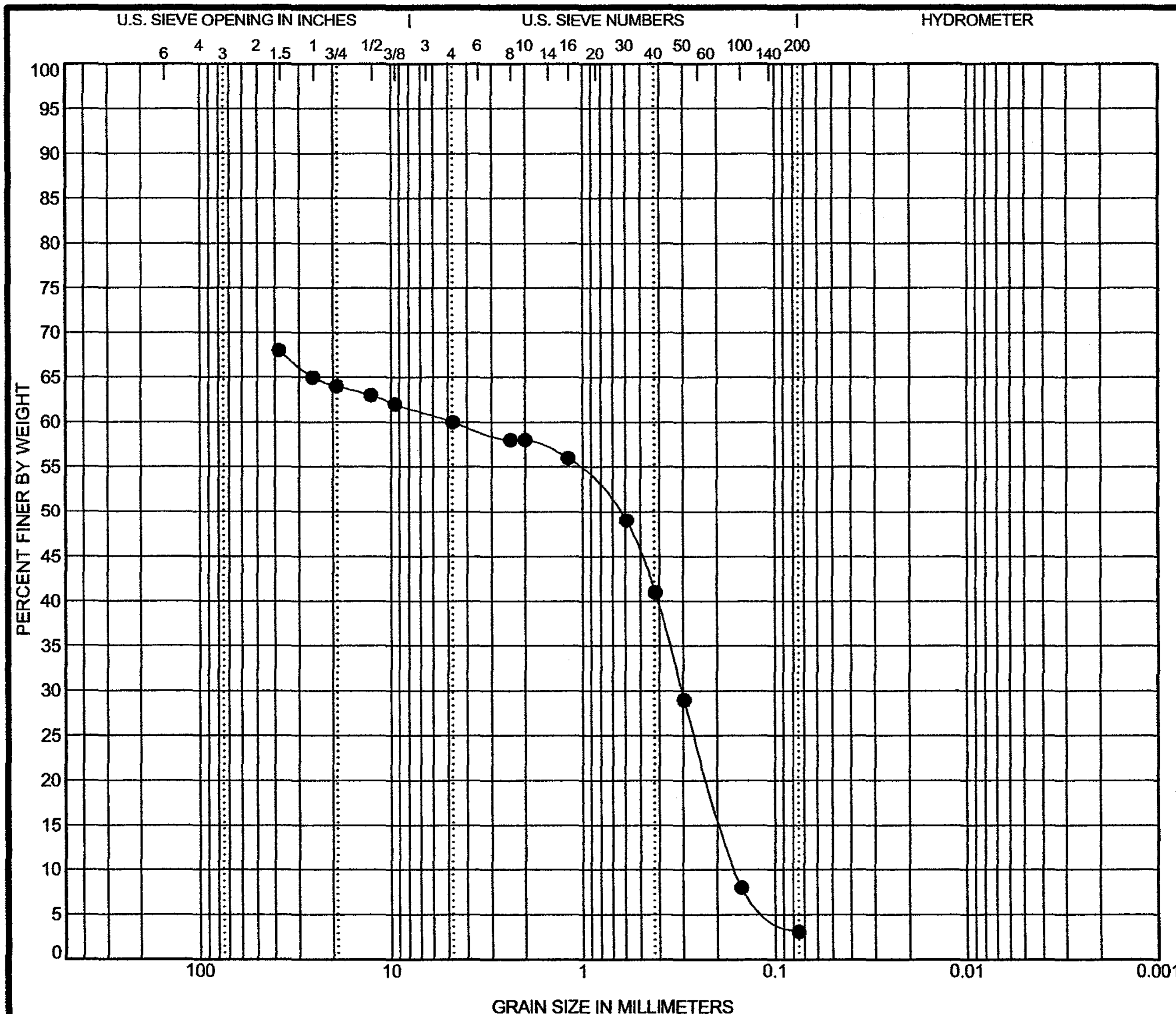
Job #: 65065044
Date: 8-24-07



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Soil Classification	LL	PL	PI	Cc	Cu
●	**TP-3**	**13.0 ft**	**POORLY GRADED SAND with GRAVEL(SP)**	**NP**	**NP**	**NP**	**0.12**	**29.85**

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**TP-3**	**13.0 ft**	**38.1**	**4.75**	**0.306**	**0.159**	**8.0**	**56.9**	**3.1**	

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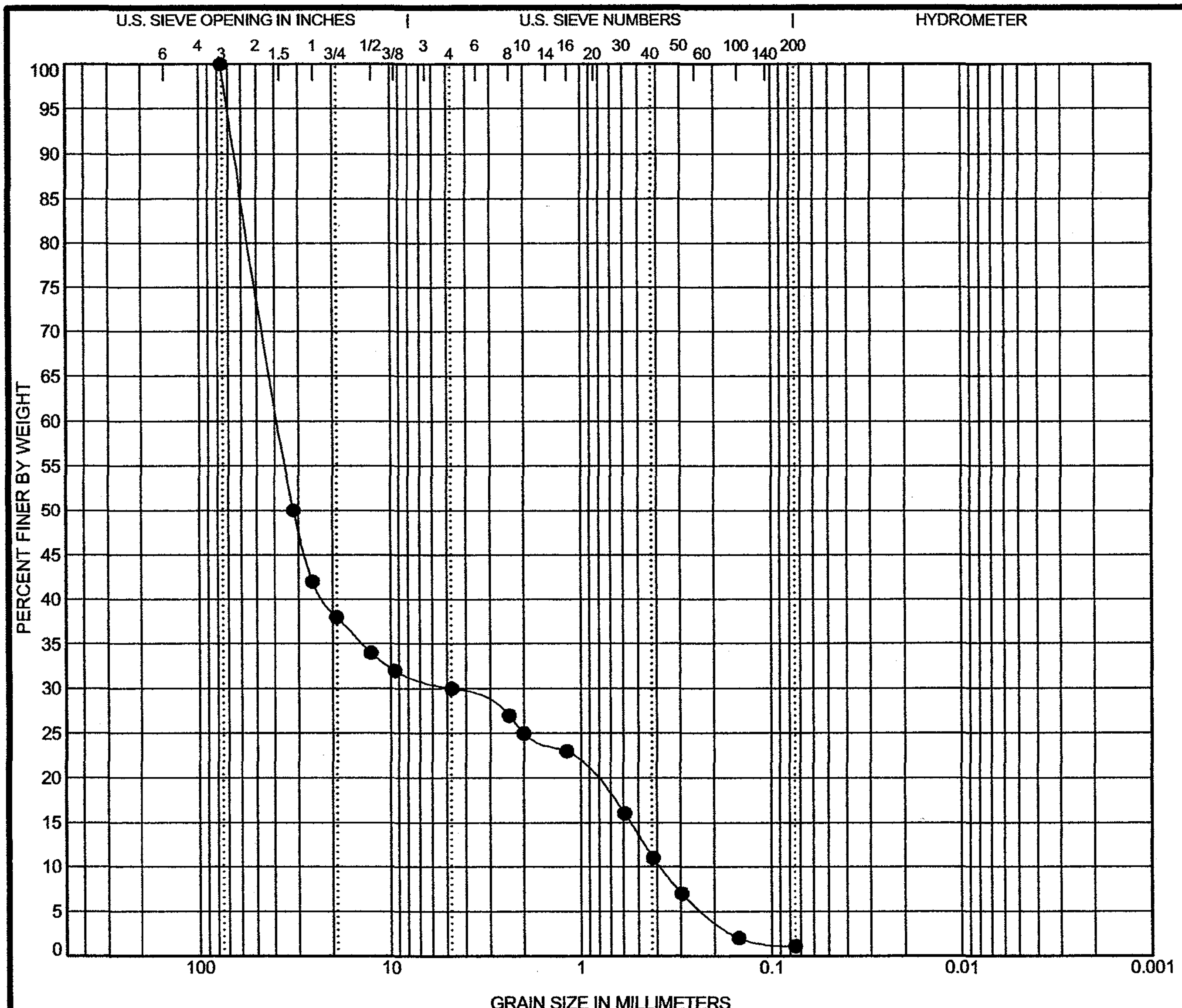
GRAIN SIZE DISTRIBUTION

Project: Pier 202 Development - Infrastructure Improvements
Site: E. of Rural Rd. on N. side of Rio Salado Pkwy. Tempe, Arizona
Job #: 65065044
Date: 8-24-07

TC GRAIN SIZE 65065044.GPJ TERRACON.GDT 8/24/07



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Soil Classification	LL	PL	PI	Cc	Cu
●	**TP-3**	**20.0 ft**	**WELL-GRADED GRAVEL with SAND(GW)**	**NP**	**NP**	**NP**	**1.55**	**98.21**

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**TP-3**	**20.0 ft**	**76.2**	**37.826**	**4.75**	**0.385**	**69.1**	**28.9**	**1.1**	

TC GRAIN SIZE 65065044.GPJ TERRACON.GDT 8/24/07

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GRAIN SIZE DISTRIBUTION

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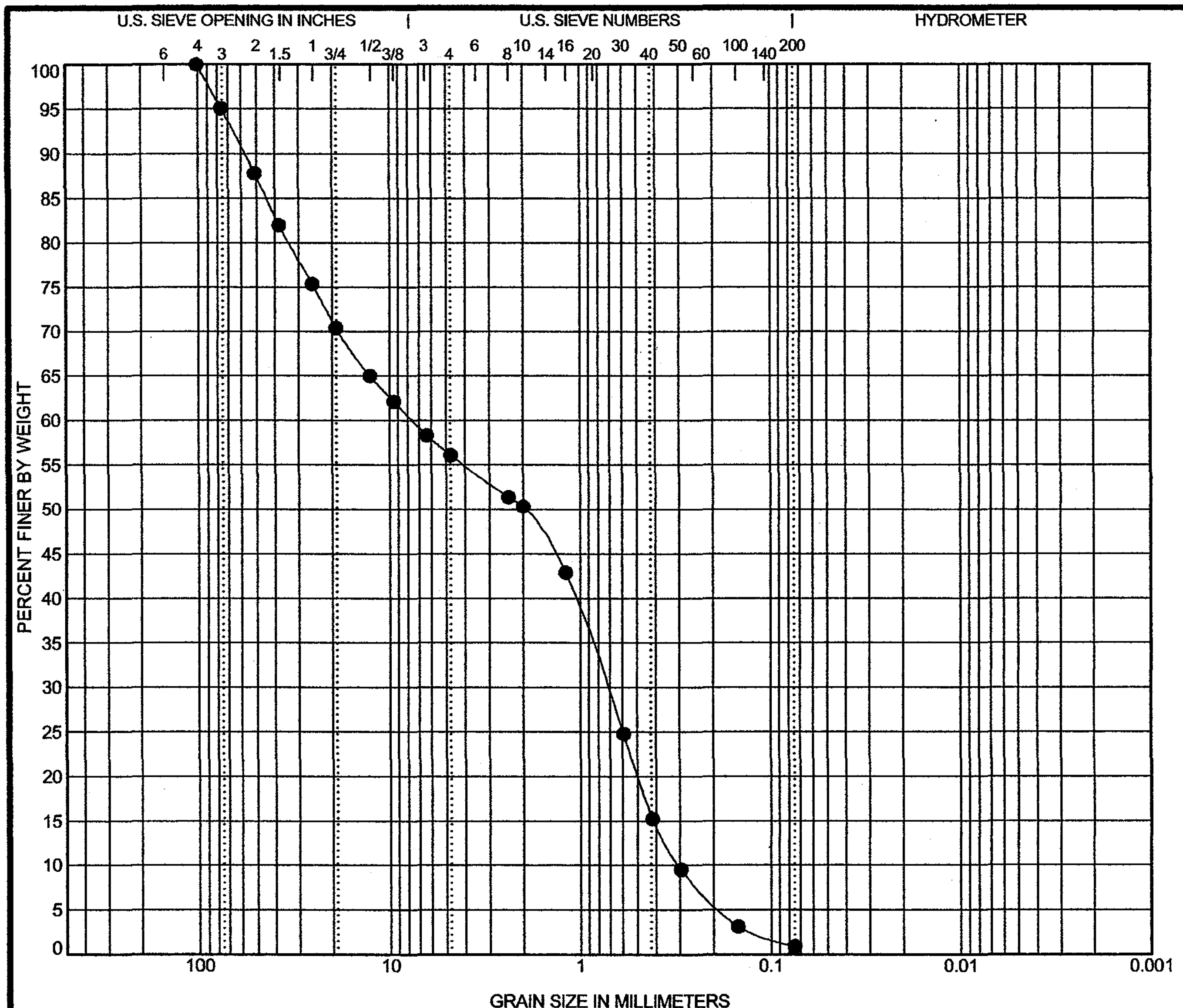
Job #: 65065044
Date: 8-24-07



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Soil Classification	LL	PL	PI	Cc	Cu
●	**TP-4**	**14.0 ft**	**POORLY GRADED SAND with GRAVEL(SP)**				**0.22**	**24.84**

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**TP-4**	**14.0 ft**	**101.6**	**7.604**	**0.722**	**0.306**	**38.7**	**55.2**	**0.9**	

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GRAIN SIZE DISTRIBUTION

Project: Pier 202 Development - Infrastructure Improvements
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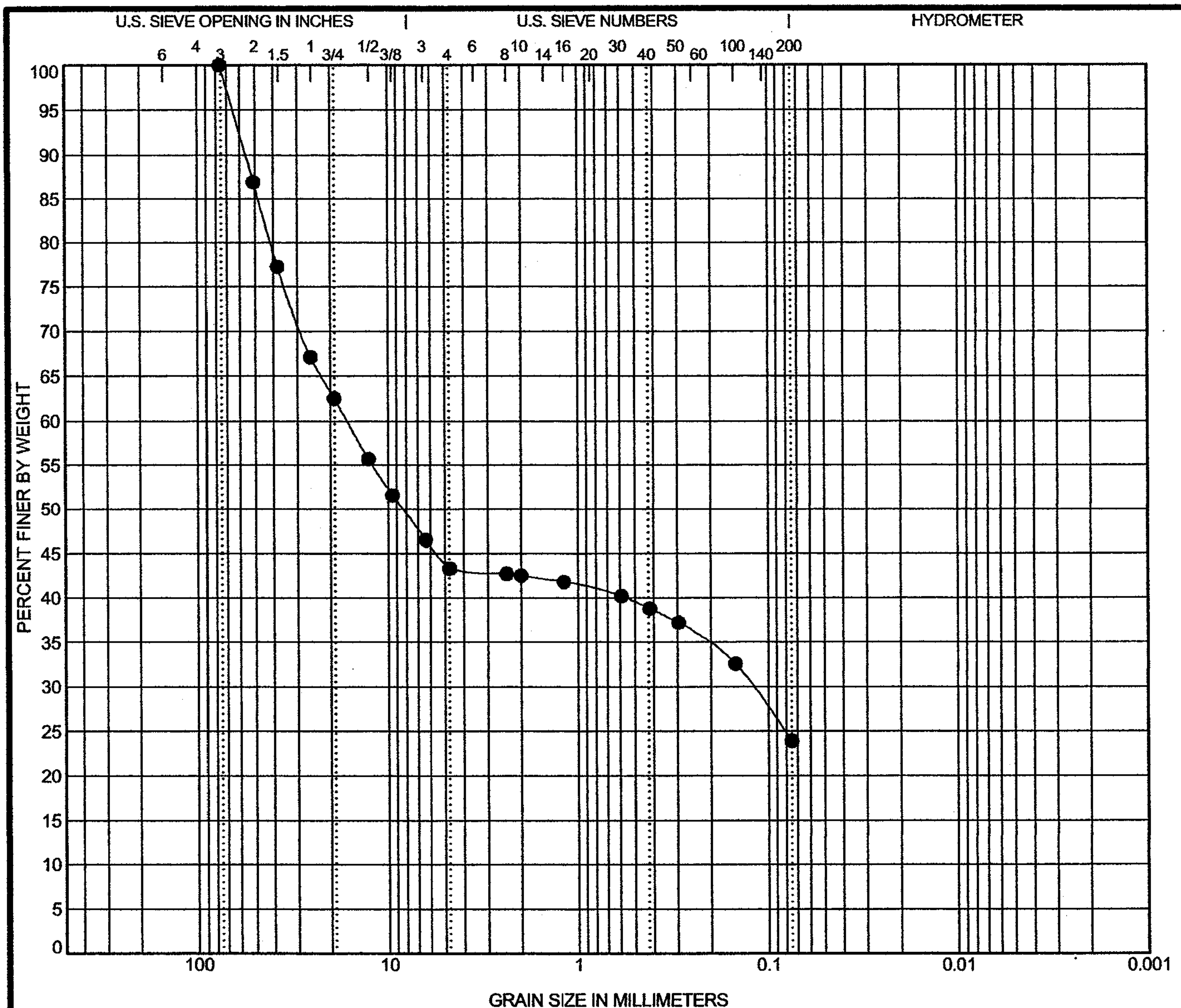
Job #: 65065044
Date: 8-24-07

TC GRAIN SIZE 65065044.GPJ TERRACON.GDT 8/24/07



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		USCS Soil Classification	LL	PL	PI	Cc	Cu
● TP-5	1.0 ft	**SILTY GRAVEL with SAND(GM)**	**NP**	**NP**	**NP**		

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● TP-5	1.0 ft	**76.2**	**16.439**	**0.121**		**56.2**	**19.4**	**23.9**	

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GRAIN SIZE DISTRIBUTION

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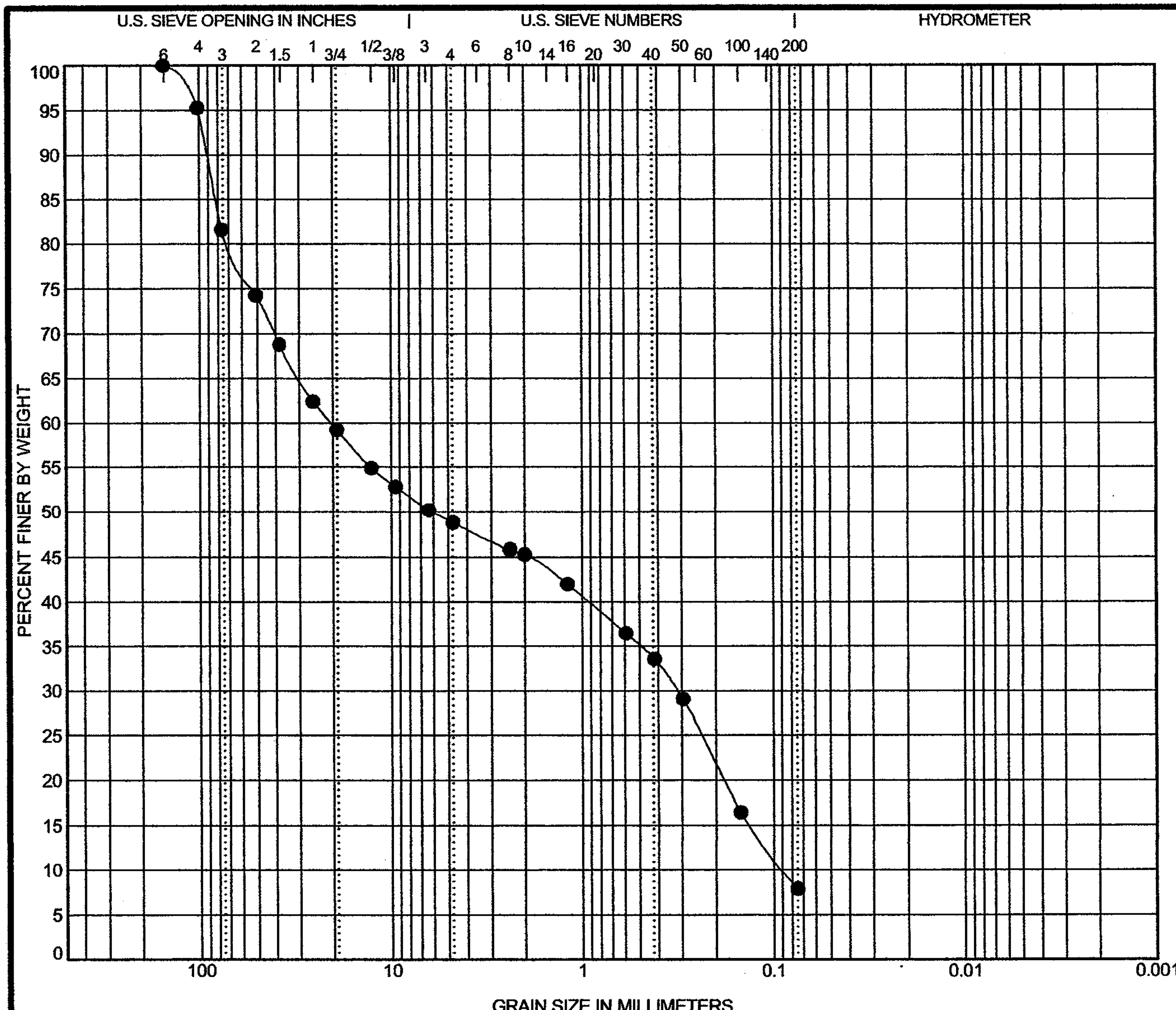
TC GRAIN SIZE 65065044.GPJ TERRACON.GDT 8/24/07



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Soil Classification	LL	PL	PI	Cc	Cu
●	**TP-5**	**19.0 ft**	**POORLY GRADED SAND with SILT and GRAVEL(SP-SM)**	**NP**	**NP**	**NP**	**0.06**	**230.82**

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**TP-5**	**19.0 ft**	**152.4**	**20.511**	**0.318**	**0.089**	**32.5**	**40.9**	**7.9**	

TC GRAIN SIZE 65065044.GPJ TERRACON.GDT 8/24/07

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GRAIN SIZE DISTRIBUTION

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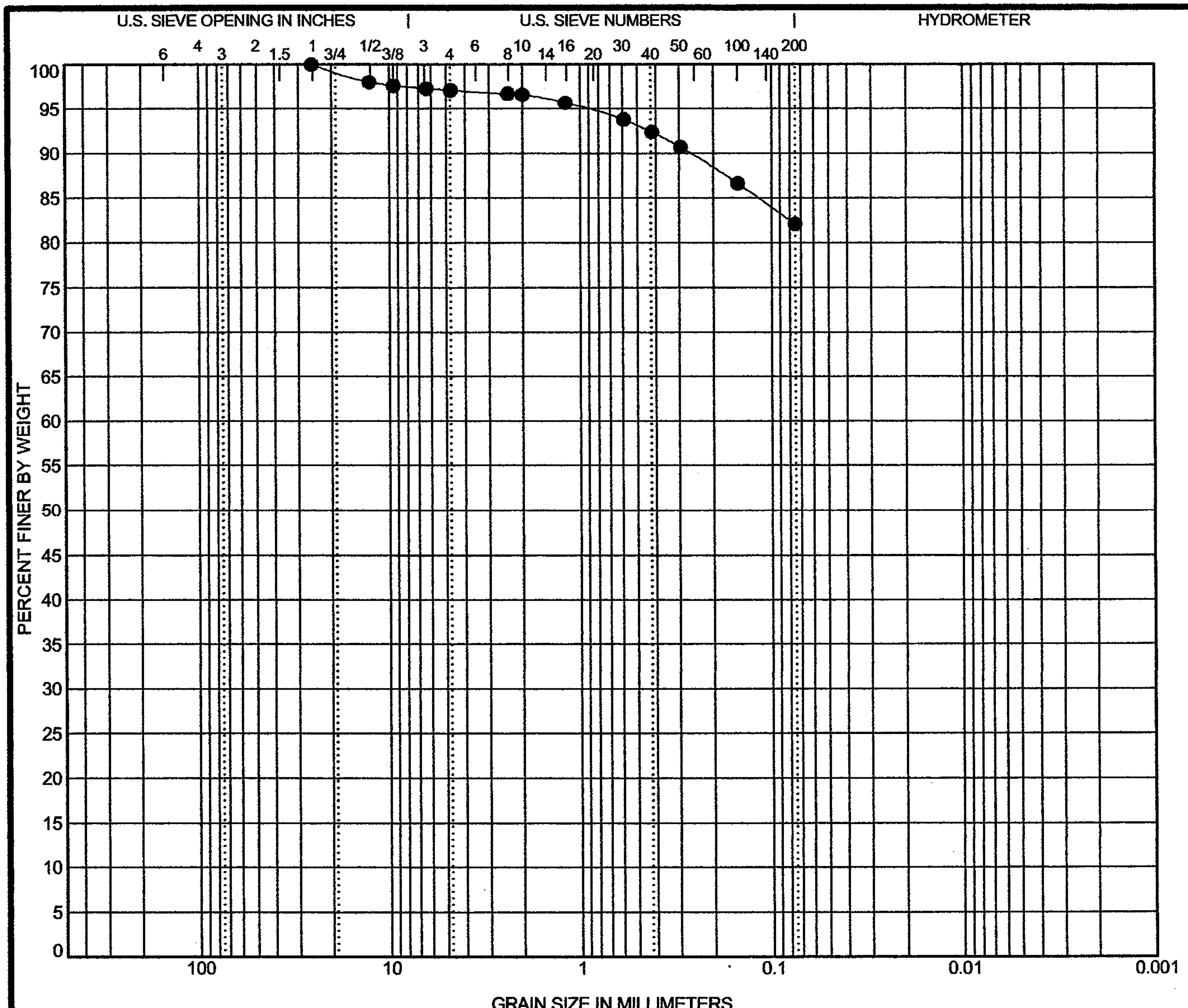


COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Soil Classification	LL	PL	PI	Cc	Cu
●	**TP-6**	**4.0 ft**	**SILT with SAND(ML)**	**35**	**26**	**9**		

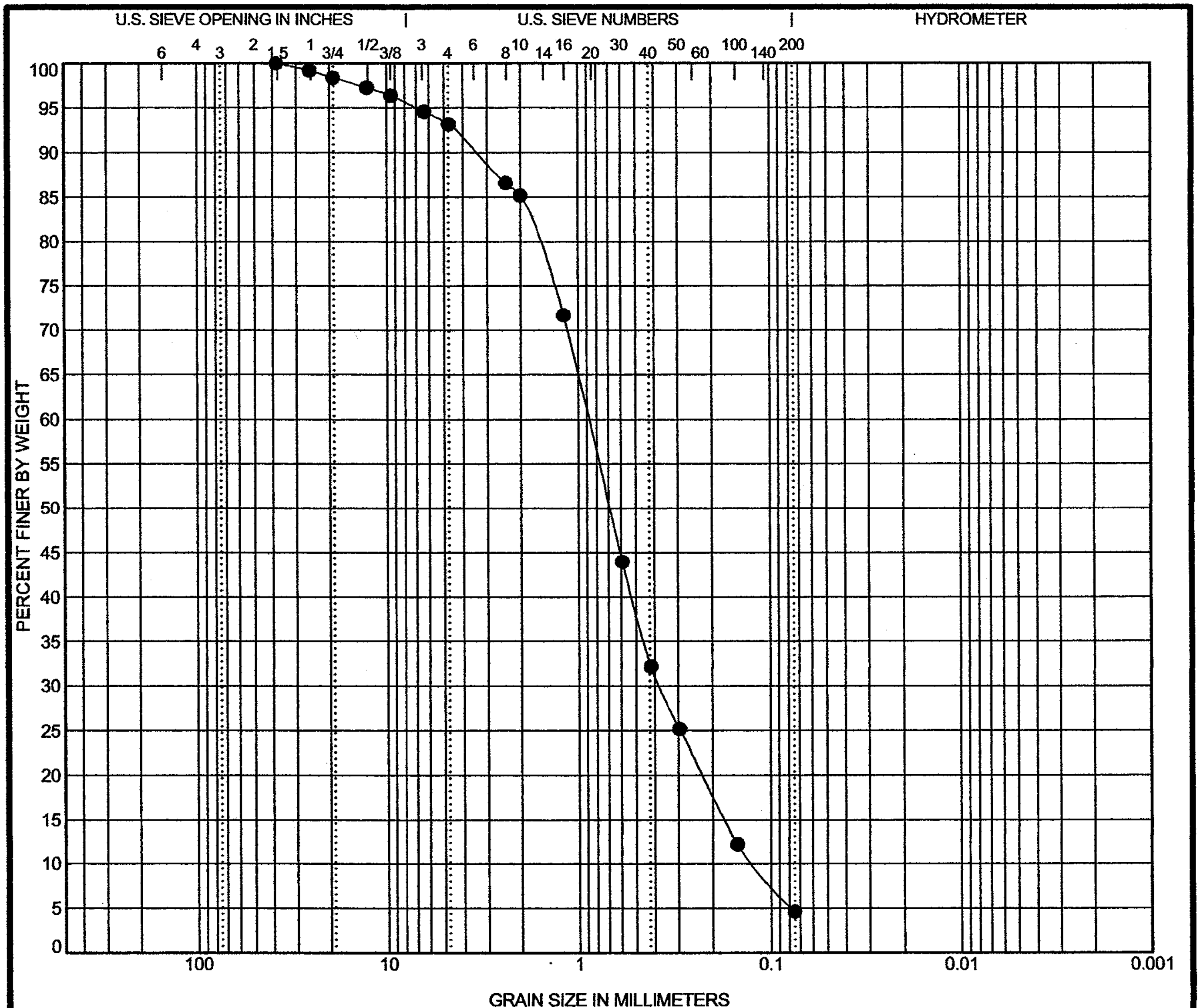
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**TP-6**	**4.0 ft**	**25.4**				**2.9**	**15.0**	**82.1**	

TC GRAIN SIZE 65065044.GPJ TERRACON.GDT 8/24/07

Terracon

GRAIN SIZE DISTRIBUTION

Project: Pier 202 Development - Infrastructure Improvements
Site: E. of Rural Rd. on N. side of Rio Salado Pkwy. Tempe, Arizona
Job #: 65065044
Date: 8-24-07



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		USCS Soil Classification	LL	PL	PI	Cc	Cu
● TP-6	6.0 ft	**WELL-GRADED SAND(SW)**	**NP**	**NP**	**NP**	**1.31**	**7.24**

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● TP-6	6.0 ft	**38.1**	**0.885**	**0.377**	**0.122**	**6.8**	**88.6**	**4.6**	

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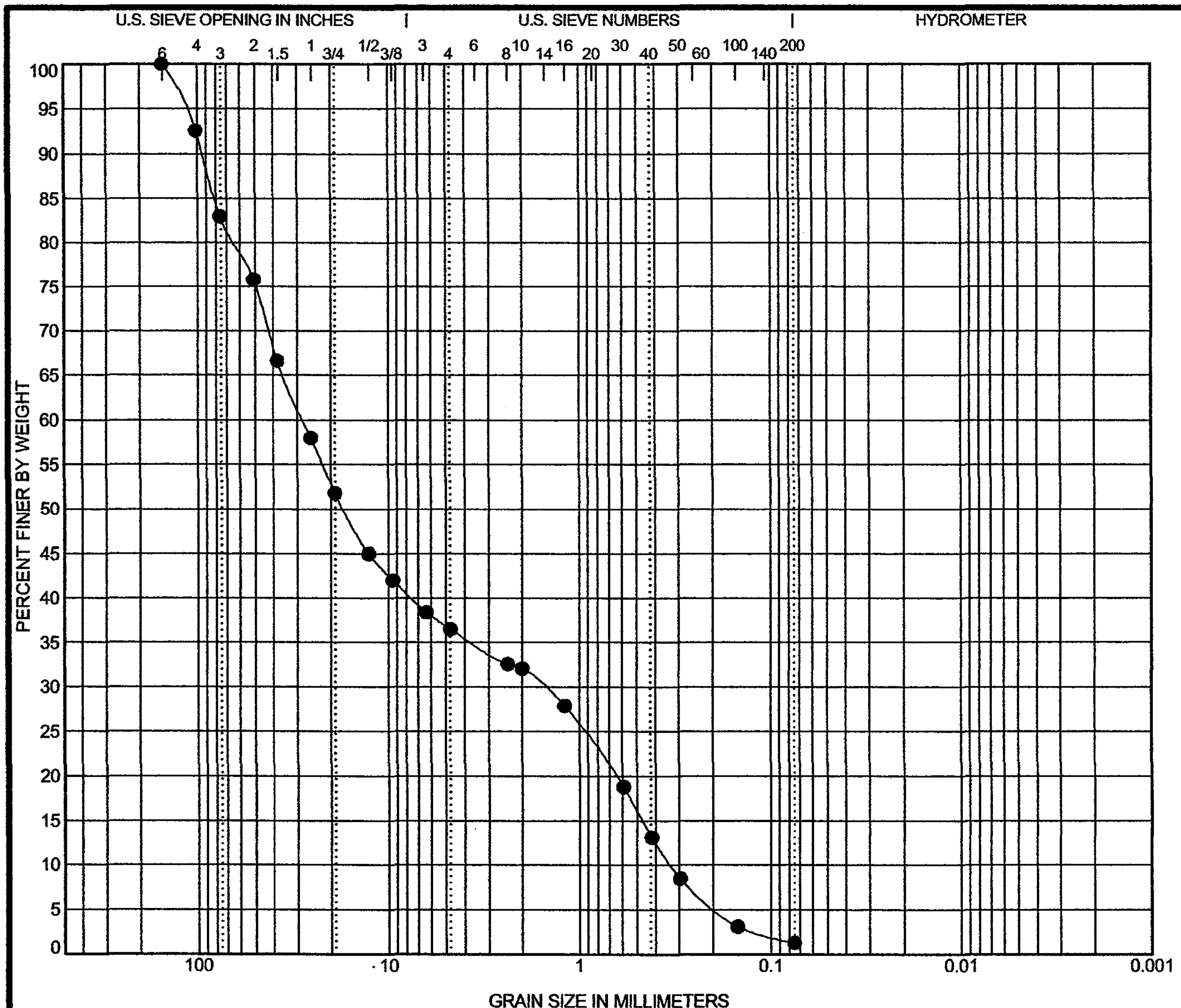
GRAIN SIZE DISTRIBUTION

Project: Pier 202 Development - Infrastructure Improvements
Site: E. of Rural Rd. on N. side of Rio Salado Pkwy. Tempe, Arizona
Job #: 65065044
Date: 8-24-07

TC_GRAIN_SIZE 65065044.GPJ TERRACON.GDT 8/24/07



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Soil Classification	LL	PL	PI	Cc	Cu
●	TP-7	0.0 ft	**POORLY GRADED GRAVEL with SAND(GP)**	NP	NP	NP	0.26	83.94

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	TP-7	0.0 ft	152.4	27.912	1.543	0.333	46.2	35.2	1.3	

TC GRAIN SIZE 65065044.GPJ TERRACON.GDT 8/24/07

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GRAIN SIZE DISTRIBUTION

Project: Pier 202 Development - Infrastructure Improvements
Site: E. of Rural Rd. on N. side of Rio Salado Pkwy. Tempe, Arizona
Job #: 65065044
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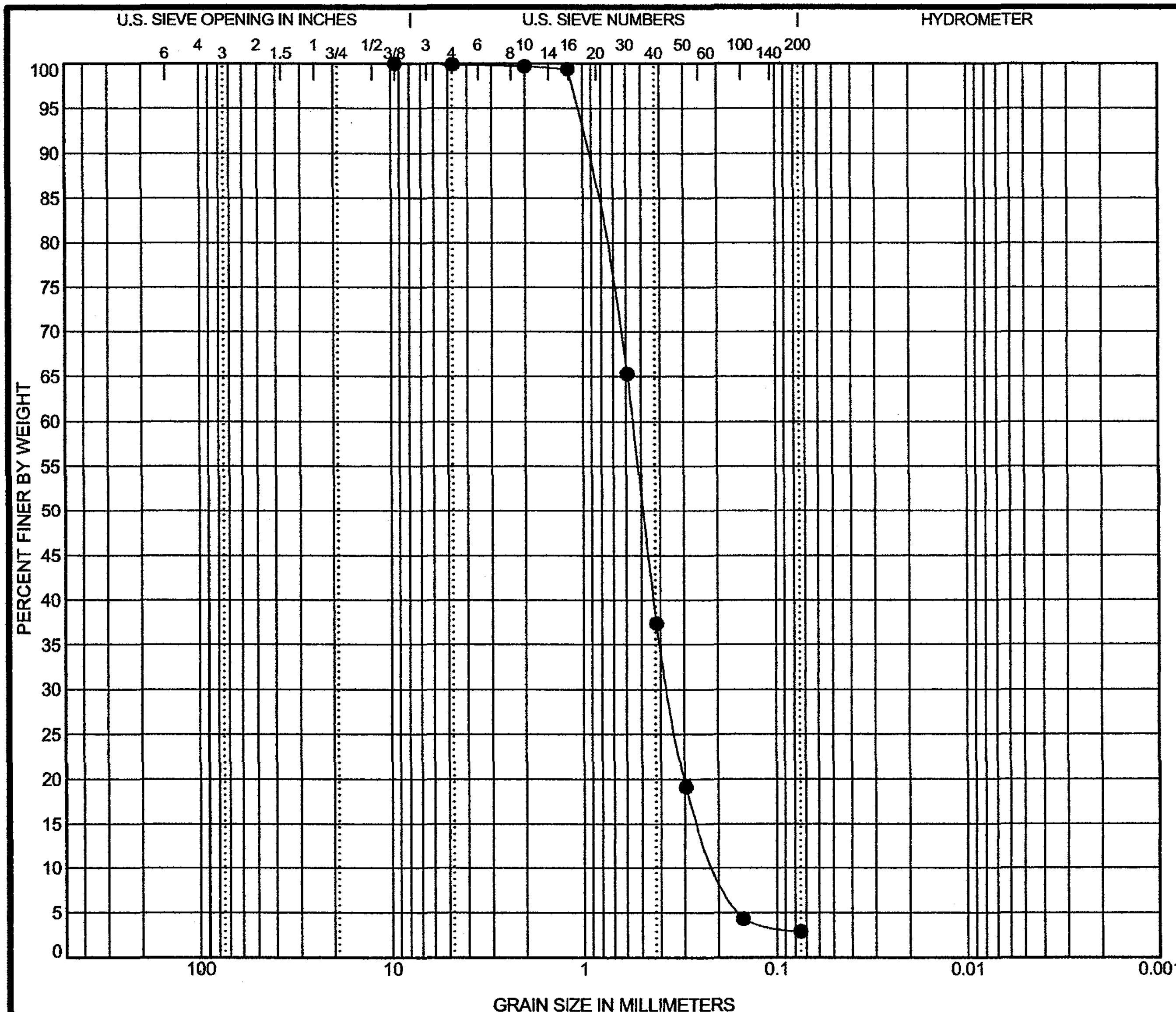

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Soil Classification	LL	PL	PI	Cc	Cu
●	**TP-8**	**3.0 ft**	**POORLY GRADED SAND(SP)**				**1.24**	**2.85**

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**TP-8**	**3.0 ft**	**9.5**	**0.553**	**0.365**	**0.194**	**0.1**	**97.0**	**2.9**	

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GRAIN SIZE DISTRIBUTION

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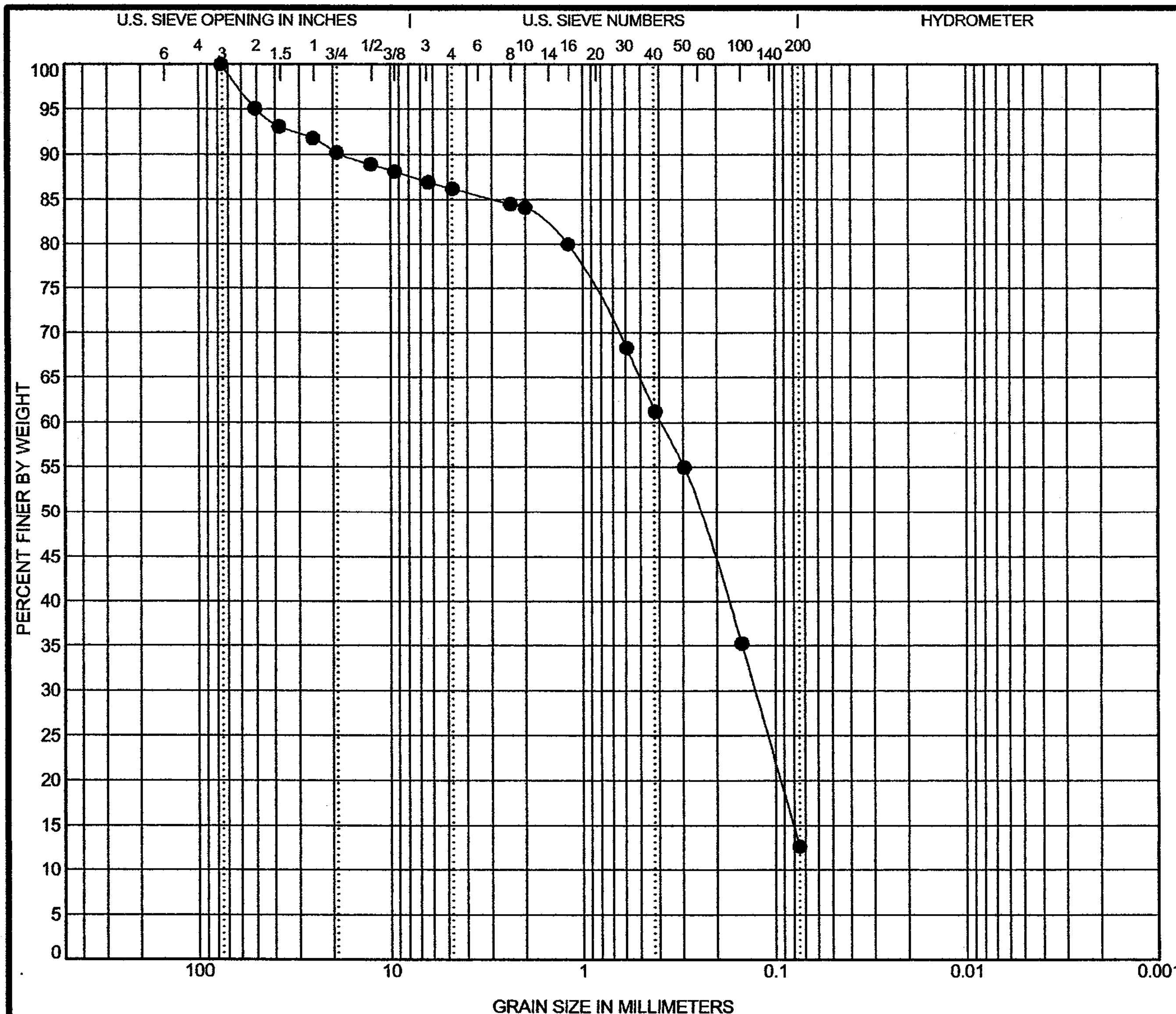
Job #: 65065044
Date: 8-24-07

TC GRAIN SIZE 65065044.GPJ TERRACON.GDT 8/24/07



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Soil Classification	LL	PL	PI	Cc	Cu
●	**TP-8**	**16.0 ft**						

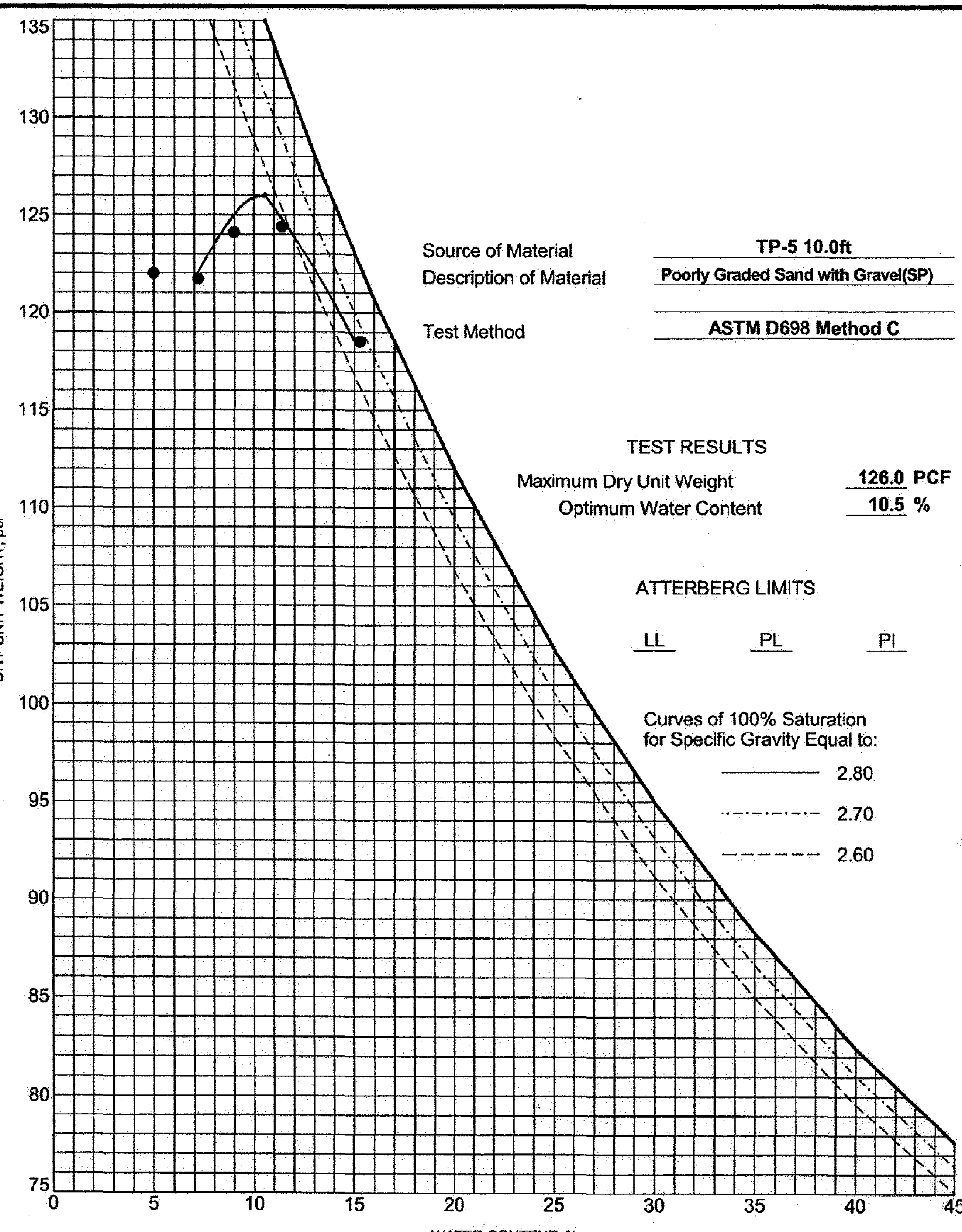
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**TP-8**	**16.0 ft**	**76.2**	**0.393**	**0.127**		**13.6**	**73.6**	**12.6**	

TC GRAIN SIZE 65065044.GPJ TERRACON.GDT 8/24/07

Terracon

GRAIN SIZE DISTRIBUTION

Project: Pier 202 Development - Infrastructure Improvements
Site: E. of Rural Rd. on N. side of Rio Salado Pkwy. Tempe, Arizona
Job #: 65065044
Date: 8-24-07



Source of Material	TP-5 10.0ft
Description of Material	Poorly Graded Sand with Gravel(SP)
Test Method	ASTM D698 Method C

TEST RESULTS

Maximum Dry Unit Weight 126.0 PCF

Optimum Water Content 10.5 %

ATTERBERG LIMITS

LL	PL	PI

Curves of 100% Saturation for Specific Gravity Equal to:

- 2.80
- 2.70
- 2.60

TC COMPACTION 65065044.GPJ TERRACON.GDT 8/24/07

Terracon

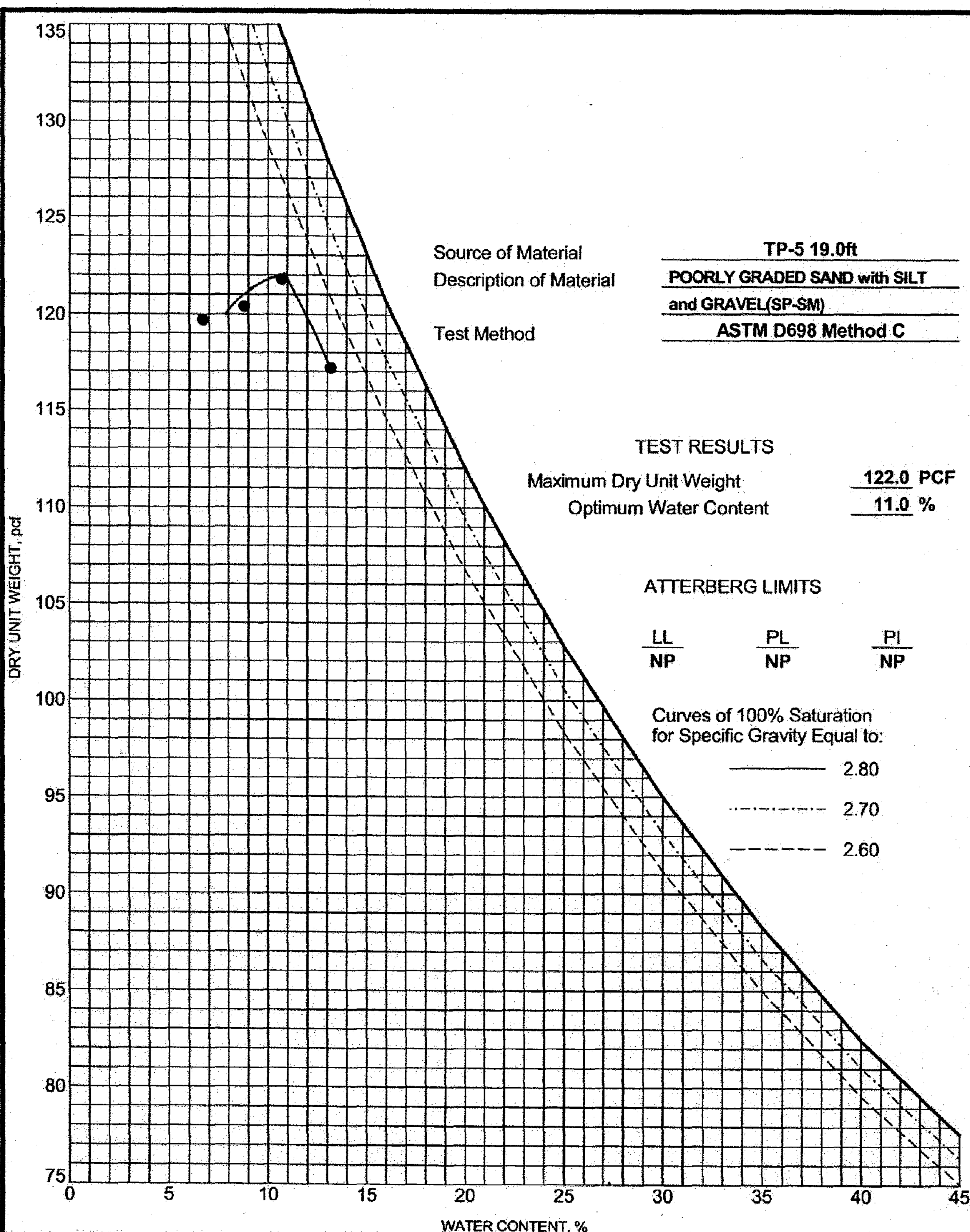
MOISTURE-DENSITY RELATIONSHIP

Project: Pier 202 Development - Infrastructure Improvements

Site: E. of Rural Rd. on N. side of Rio Salado Pkwy. Tempe, Arizona

Job #: 65065044

Date: 8-24-07



MOISTURE-DENSITY RELATIONSHIP

Terracon

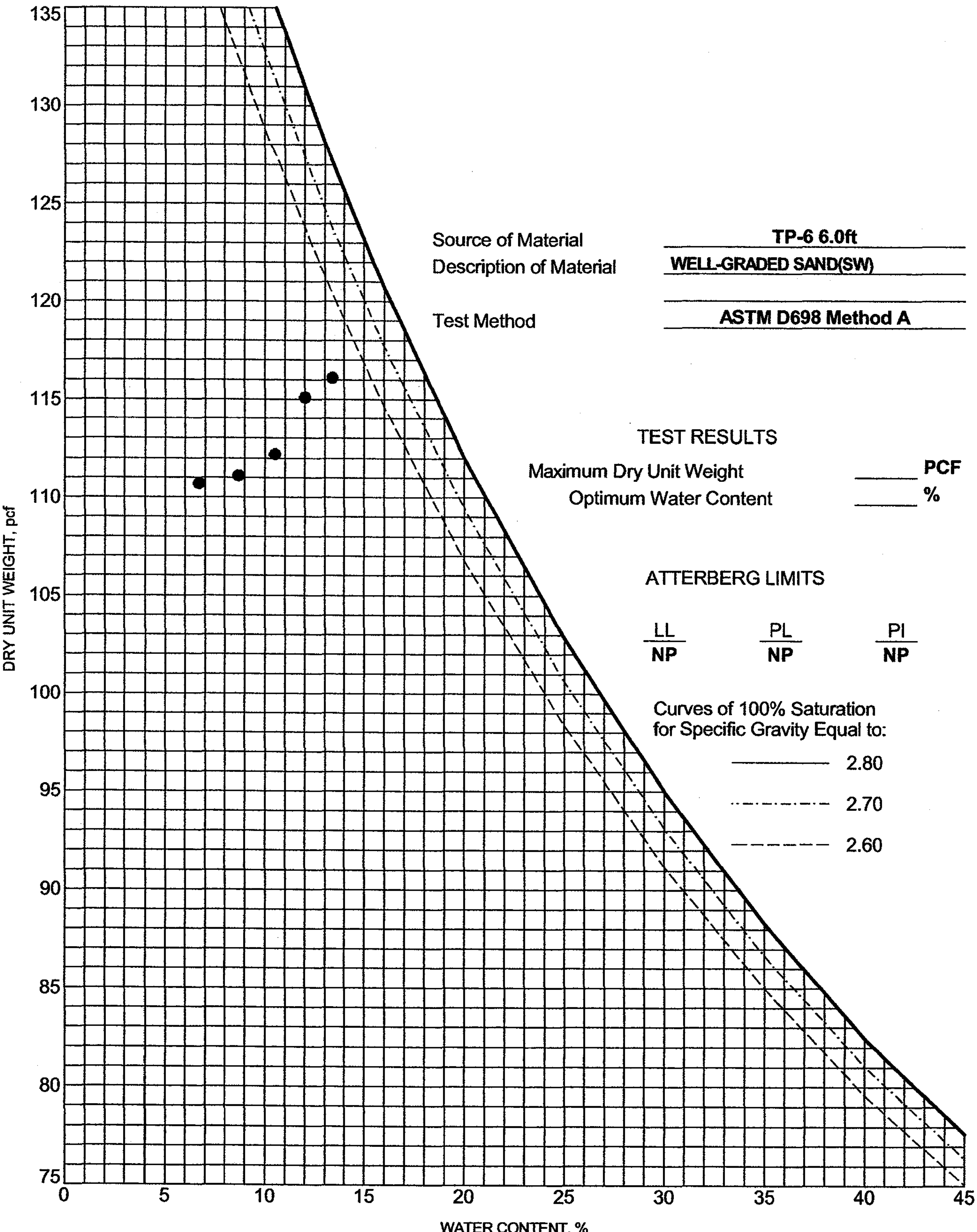
Project: Pier 202 Development - Infrastructure Improvements

Site: E. of Rural Rd. on N. side of Rio Salado Pkwy. Tempe, Arizona

Job #: 65065044

Date: 8-24-07

TC_COMPACTION 65065044.GPJ TERRACON.GDT 8/24/07



Source of Material	**TP-6 6.0ft**
Description of Material	**WELL-GRADED SAND(SW)**
Test Method	**ASTM D698 Method A**

TEST RESULTS

Maximum Dry Unit Weight ______ **PCF**

Optimum Water Content ______ **%**

ATTERBERG LIMITS

LL	PL	PI
NP	**NP**	**NP**

Terracon

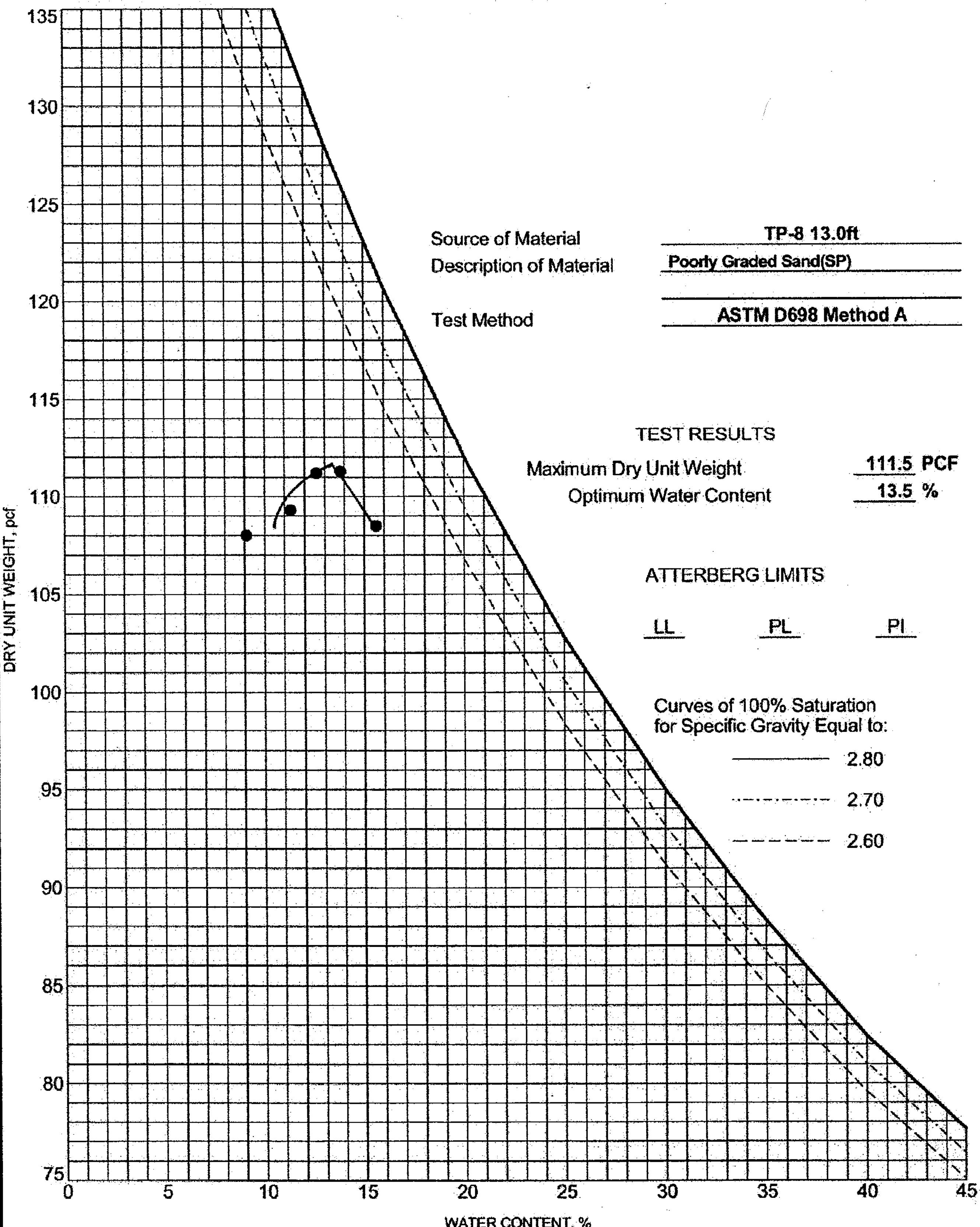
MOISTURE-DENSITY RELATIONSHIP

Project: Pier 202 Development - Infrastructure Improvements

Site: E. of Rural Rd. on N. side of Rio Salado Pkwy. Tempe, Arizona

Job #: 65065044

Date: 8-24-07



TC COMPACTION 65065044.GPJ TERRACON.GDT 8/24/07

Terracon

MOISTURE-DENSITY RELATIONSHIP

Project: Pier 202 Development - Infrastructure Improvements
Site: E. of Rural Rd. on N. side of Rio Salado Pkwy. Tempe, Arizona
Job #: 65065044
Date: 8-24-07

Terracon

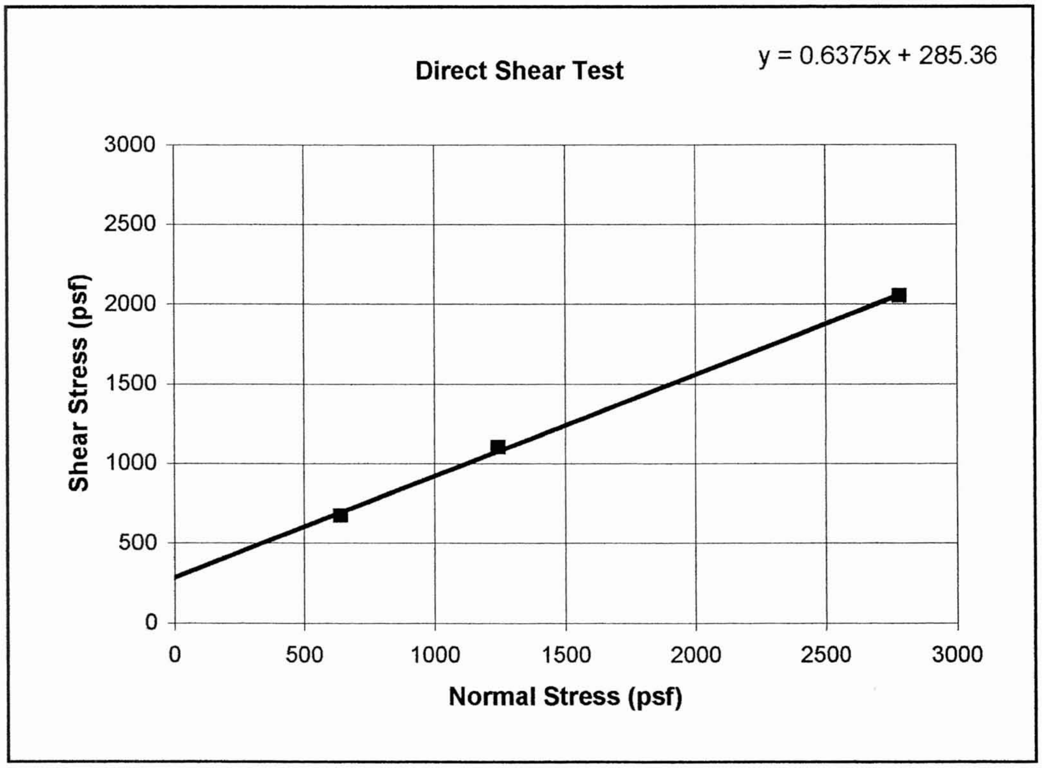
4685 South Ash Avenue; Suite H-4
Tempe, Arizona 85282
Ph (480) 897-8200 Fax (480) 897-1133

DIRECT SHEAR
ASTM D 3080

CLIENT:	Pier 202, LLC	DATE OF TEST:	6/27/07
PROJECT:	Pier 202 Development - Infrastructure Improvements		
LOCATION:	TP-5 at 5 feet		
TERRACON NO.	65065044	CLASSIFICATION:	Poorly Graded Sand(SP)

SAMPLE DATA TEST RESULTS

TEST SPECIMEN NO.	1	2	3
NORMAL PRESSURE (psf)	638	1241	2783
SHEAR STRESS (psf)	673	1103	2052
ULTIMATE FRICTION ANGLE	32		
EFFECTIVE COHESION (psf)	285		



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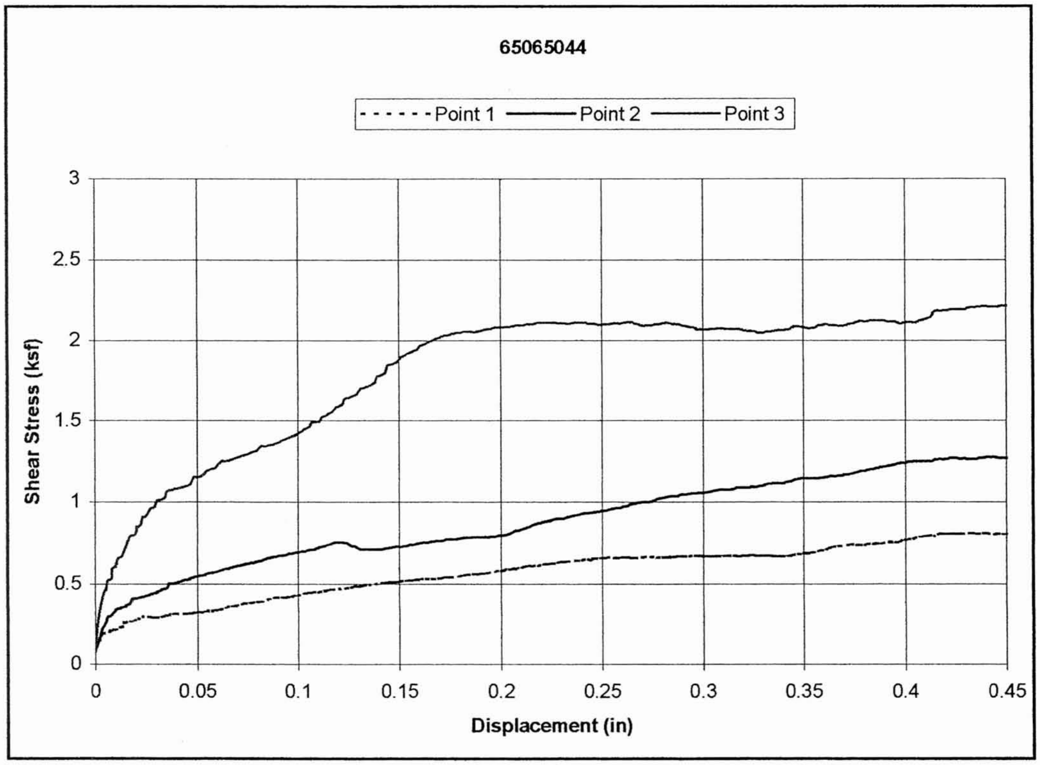
DIRECT SHEAR
ASTM D 3080

CLIENT:	Pier 202, LLC	DATE OF TEST:	6/27/07
PROJECT:	Pier 202 Development - Infrastructure Improvements		
LOCATION:	TP-5 at 5 feet		
TERRACON NO.	65065044	CLASSIFICATION:	Poorly Graded Sand(SP)

SAMPLE DATA TEST RESULTS

TEST SPECIMEN NO.	1	2	3
DRY DENSITY BEFORE TEST (pcf)	100.0	100.0	100.0
INITIAL WATER CONTENT (%)	3.0	3.0	3.0
FINAL WATER CONTENT, SAT. (%)	3.0	3.0	3.0
SHEAR RATE (mm/min)	0.423	0.423	0.423



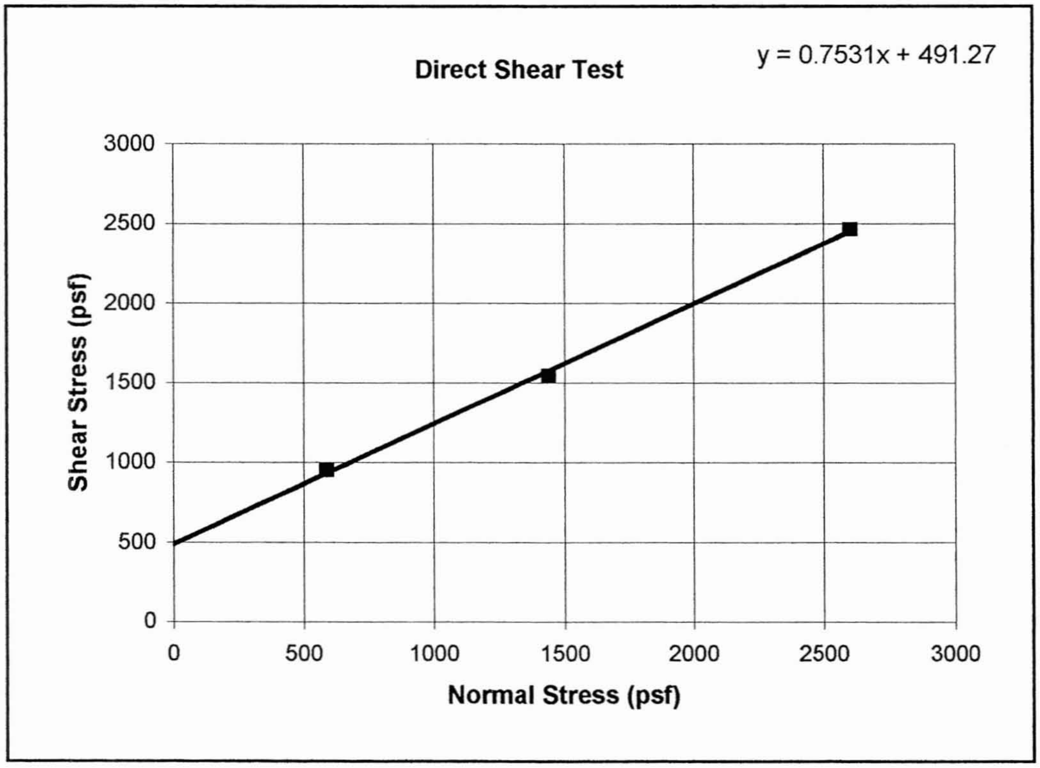
Terracon
4685 South Ash Avenue; Suite H-4
Tempe, Arizona 85282
Ph (480) 897-8200 Fax (480) 897-1133

DIRECT SHEAR
ASTM D 3080

CLIENT:	Pier 202, LLC	DATE OF TEST:	6/29/07
PROJECT:	Pier 202 Development - Infrastructure Improvements		
LOCATION:	TP-6 at 4 feet		
TERRACON NO.	65065044	CLASSIFICATION:	Silt with Sand(ML)

SAMPLE DATA TEST RESULTS

TEST SPECIMEN NO.	1	2	3
NORMAL PRESSURE (psf)	588	1440	2601
SHEAR STRESS (psf)	953	1543	2464
ULTIMATE FRICTION ANGLE	37		
EFFECTIVE COHESION (psf)	490		



Terracon

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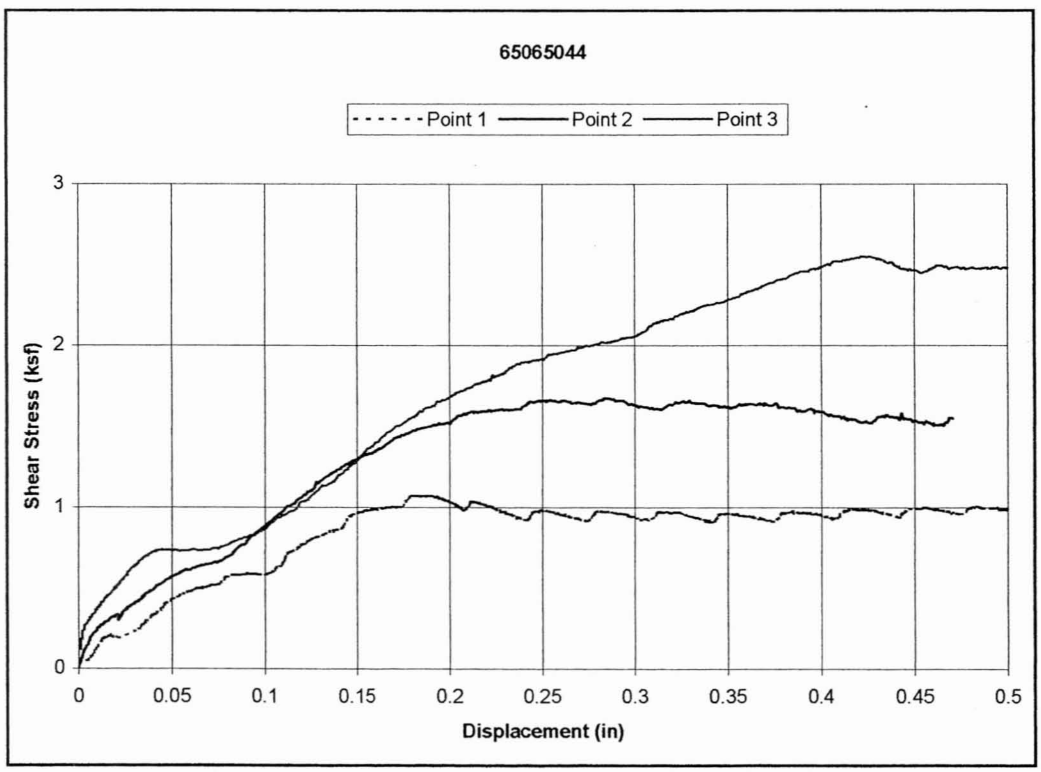
Tempe, Arizona 85282
Ph (480) 897-8200 Fax (480) 897-1133

DIRECT SHEAR
ASTM D 3080

CLIENT:	Pier 202, LLC	DATE OF TEST:	6/29/07
PROJECT:	Pier 202 Development - Infrastructure Improvements		
LOCATION:	TP-6 at 4 feet		
TERRACON NO.	65065044	CLASSIFICATION:	Silt with Sand(ML)

SAMPLE DATA TEST RESULTS

TEST SPECIMEN NO.	1	2	3
DRY DENSITY BEFORE TEST (pcf)	90.0	90.0	90.0
INITIAL WATER CONTENT (%)	15.0	15.0	15.0
FINAL WATER CONTENT, SAT. (%]	15.0	15.0	15.0
SHEAR RATE (mm/min)	0.053	0.053	0.053



Terracon

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Tempe, Arizona 85282
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DIRECT SHEAR
ASTM D 3080

CLIENT:	Pier 202, LLC	**DATE OF TEST:**	6/29/07
PROJECT:	Pier 202 Development - Infrastructure Improvements		
LOCATION:	TP-8 at 16 feet compacted to 110 pcf		
TERRACON NO.	65065044	**CLASSIFICATION:**	Poorly Graded Sand(SP)

SAMPLE DATA TEST RESULTS

TEST SPECIMEN NO.	1	2	3
NORMAL PRESSURE (psf)	852	2468	4943
SHEAR STRESS (psf)	838	1795	3345
ULTIMATE FRICTION ANGLE	32		
EFFECTIVE COHESION (psf)	300		

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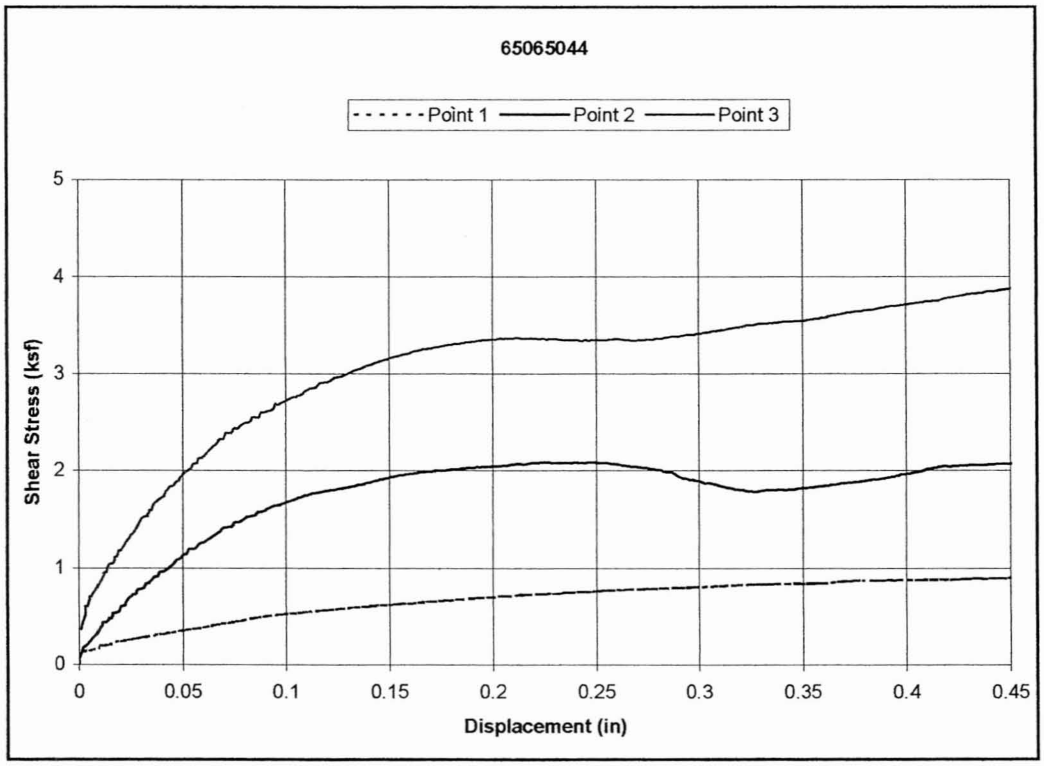
DIRECT SHEAR
ASTM D 3080

CLIENT: Pier 202, LLC **DATE OF TEST:** 6/29/07
PROJECT: Pier 202 Development - Infrastructure Improvements
LOCATION: TP-8 at 16 feet compacted to 110 pcf
TERRACON NO. 65065044 **CLASSIFICATION: Poorly Graded Sand(SP)**

SAMPLE DATA TEST RESULTS

TEST SPECIMEN NO.	1	2	3
DRY DENSITY BEFORE TEST (pcf)	110.0	110.0	110.0
INITIAL WATER CONTENT (%)	3.0	3.0	3.0
FINAL WATER CONTENT, SAT. (%)	3.0	3.0	3.0
SHEAR RATE (mm/min)	0.423	0.423	0.423



Terracon

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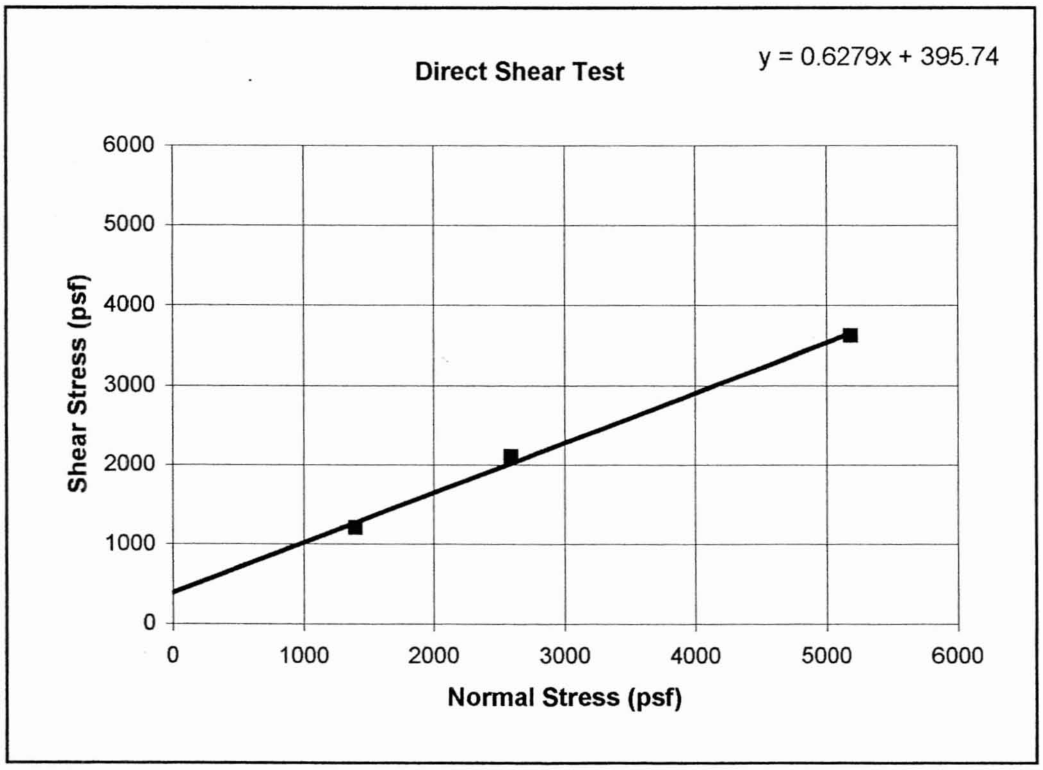
DIRECT SHEAR
ASTM D 3080

CLIENT:	Pier 202, LLC	**DATE OF TEST:**	7/6/07
PROJECT:	Pier 202 Development - Infrastructure Improvements		
LOCATION:	TP-8 at 16 feet compacted to 120 pcf		
TERRACON NO.	65065044	**CLASSIFICATION:**	Poorly Graded Sand(SP)

SAMPLE DATA TEST RESULTS

TEST SPECIMEN NO.	1	2	3
NORMAL PRESSURE (psf)	1398	2587	5189
SHEAR STRESS (psf)	1212	2110	3626
ULTIMATE FRICTION ANGLE	32		
EFFECTIVE COHESION (psf)	400		



Terracon

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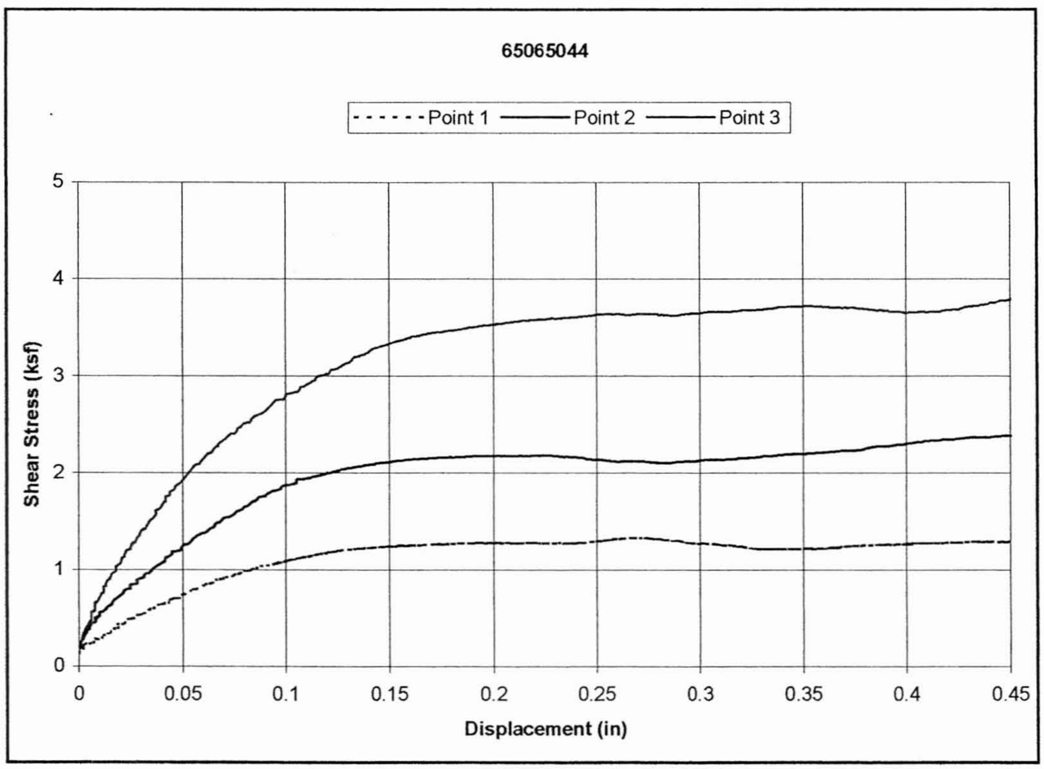
Tempe, Arizona 85282
Ph (480) 897-8200 Fax (480) 897-1133

DIRECT SHEAR
ASTM D 3080

CLIENT:	Pier 202, LLC	**DATE OF TEST:**	7/6/07
PROJECT:	Pier 202 Development - Infrastructure Improvements		
LOCATION:	TP-8 at 16 feet compacted to 120 pcf		
TERRACON NO.	65065044	**CLASSIFICATION:**	Poorly Graded Sand(SP)

SAMPLE DATA TEST RESULTS

TEST SPECIMEN NO.	1	2	3
DRY DENSITY BEFORE TEST (pcf)	120.0	120.0	120.0
INITIAL WATER CONTENT (%)	3.0	3.0	3.0
FINAL WATER CONTENT, SAT. (%)	3.0	3.0	3.0
SHEAR RATE (mm/min)	0.423	0.423	0.423



LARGE SCALE INTERNAL DIRECT SHEAR TEST DATA

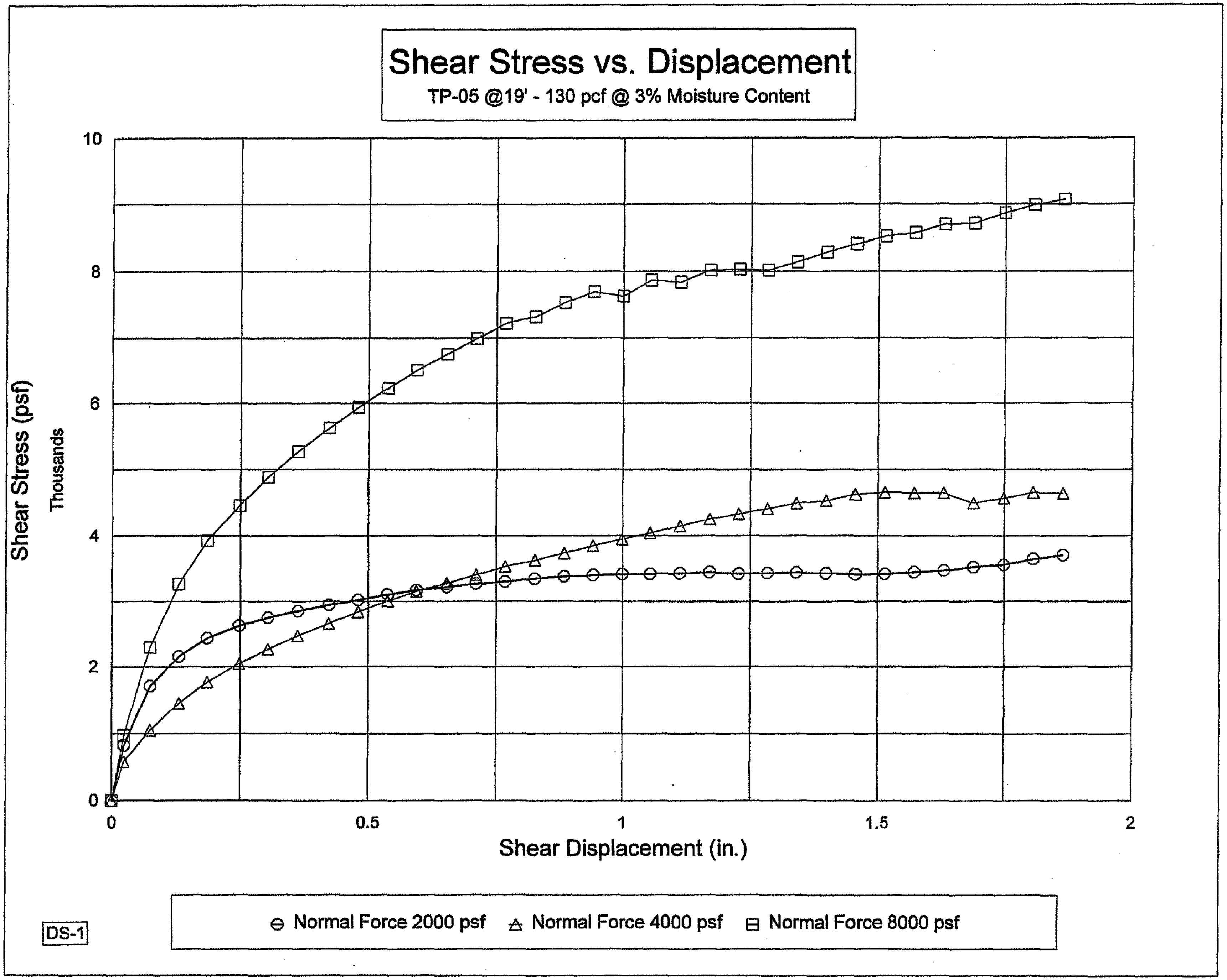
ASTM D 3080/MOD. - 12" x 12" Box

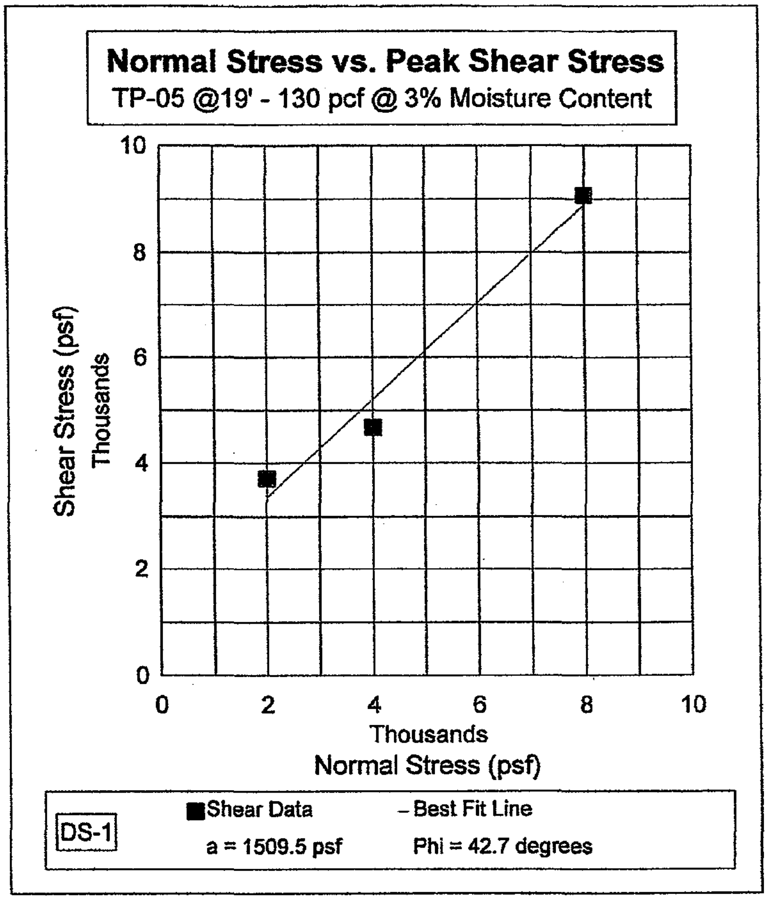
Client:	Terracon	Date:	07/02/2007
Project No:	2261-85	Test Date:	06-28,29-07
Project:	Infrastructure Improvements, #65065044	Technician:	WAR
Interface:	TP-05 @19' - 130 pcf @ 3% Moisture Content	Shear Rate:	0.04"/in
Special conditions:	Unsaturated	Test Series:	DS-1

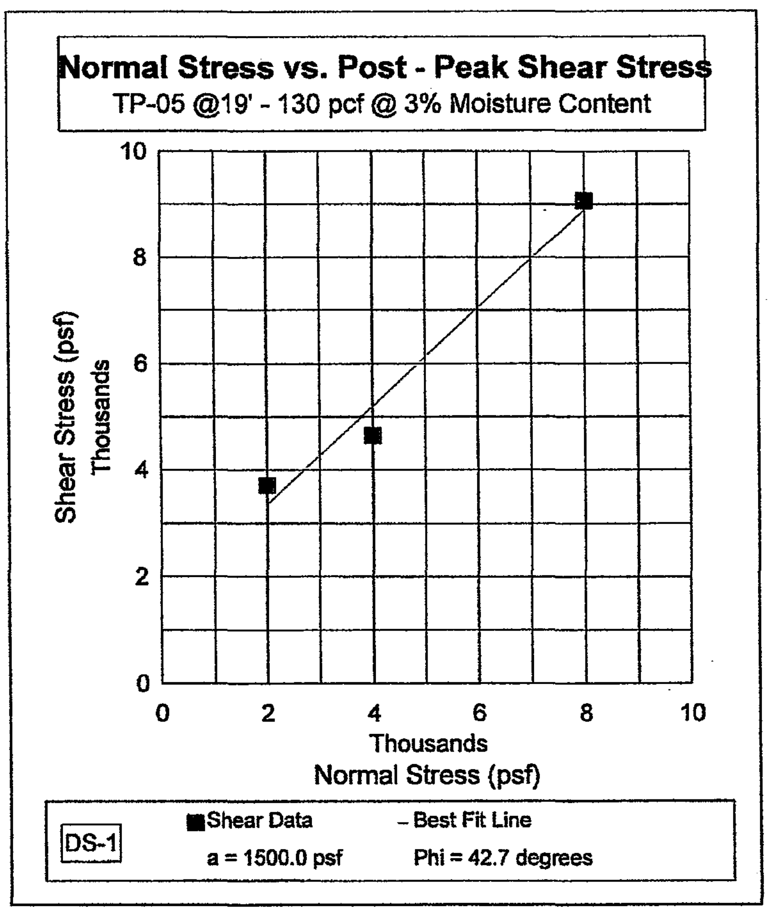
Displacement (inches)	Normal Force 2000 psf Shear Stress (psf)	Normal Force 4000 psf Shear Stress (psf)	Normal Force 8000 psf Shear Stress (psf)
0	0	0	0
0.023	829	582	973
0.075	1712	1049	2296
0.132	2160	1451	3264
0.187	2443	1771	3933
0.248	2627	2047	4458
0.304	2751	2269	4894
0.362	2853	2475	5273
0.423	2946	2659	5618
0.48	3027	2840	5934
0.538	3107	3006	6233
0.595	3176	3154	6508
0.654	3221	3280	6754
0.711	3273	3406	6990
0.768	3306	3533	7220
0.826	3351	3630	7320
0.884	3384	3740	7528
0.941	3404	3851	7694
0.999	3420	3949	7629
1.054	3424	4042	7866
1.112	3434	4148	7833
1.17	3445	4255	8017
1.227	3427	4333	8027
1.284	3437	4411	8017
1.341	3440	4497	8138
1.4	3435	4535	8280
1.457	3420	4635	8406
1.514	3425	4666	8519
1.573	3449	4656	8572
1.631	3475	4656	8696
1.689	3523	4499	8708
1.749	3562	4577	8864
1.807	3648	4658	8979
1.865	3709	4647	9065

Data Entered By: SR Date: 07/02/2007
Data Checked By: CJ Date: 07/02/07
File Name: TADSINIM

Advanced Terra Testing, Inc.


Shear Stress vs. Displacement
TP-05 @19' - 130 pcf @ 3% Moisture Content
Shear Stress (psf)
Thousands
10
8
6
4
2
0
0
0.5
1
1.5
2
Shear Displacement (in.)
Normal Force 2000 psf
Normal Force 4000 psf
Normal Force 8000 psf
DS-1





ADVANCED TERRA TESTING, Inc.

LARGE SCALE INTERNAL DIRECT SHEAR TEST DATA

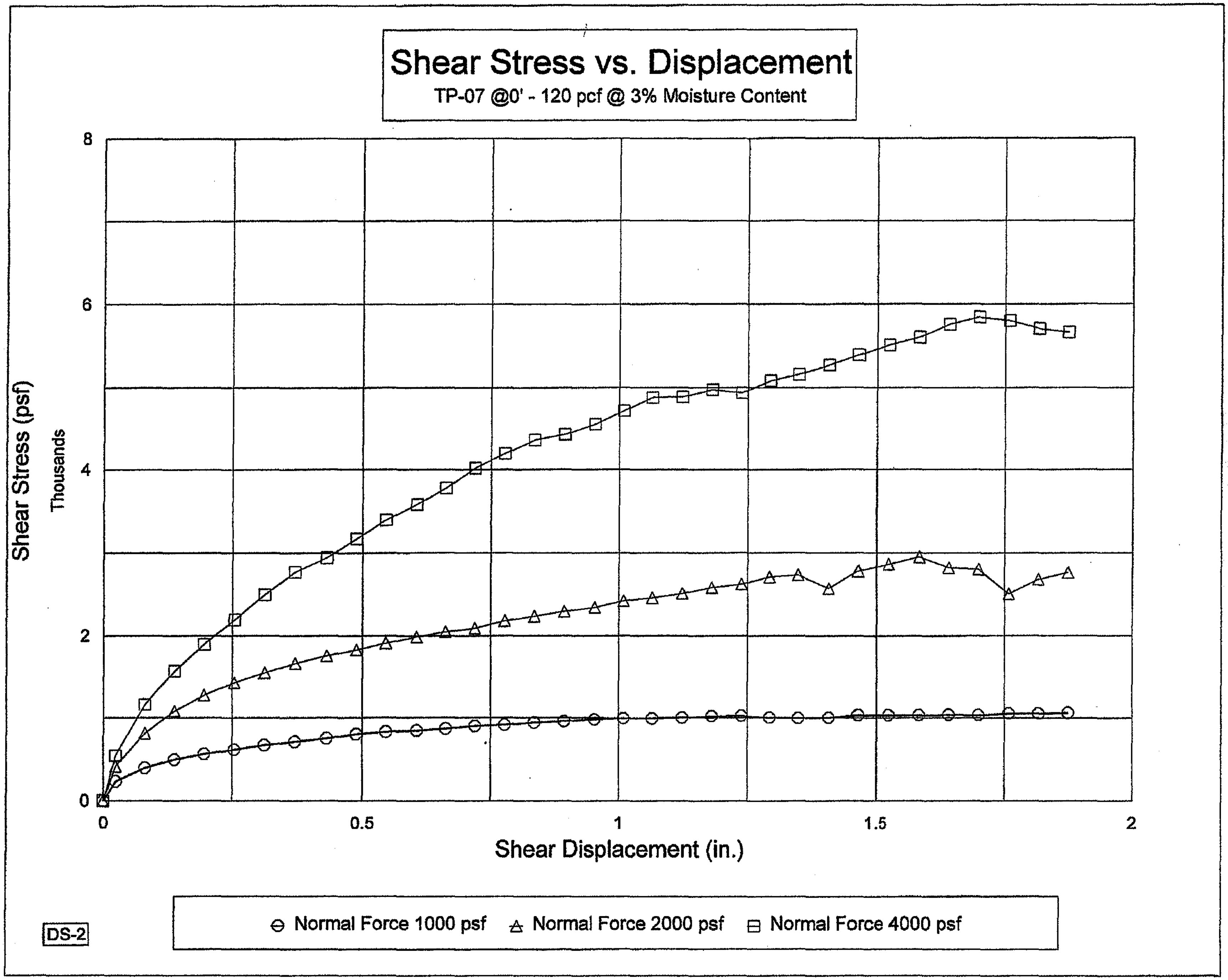
ASTM D 3080/MOD. - 12" x 12" Box

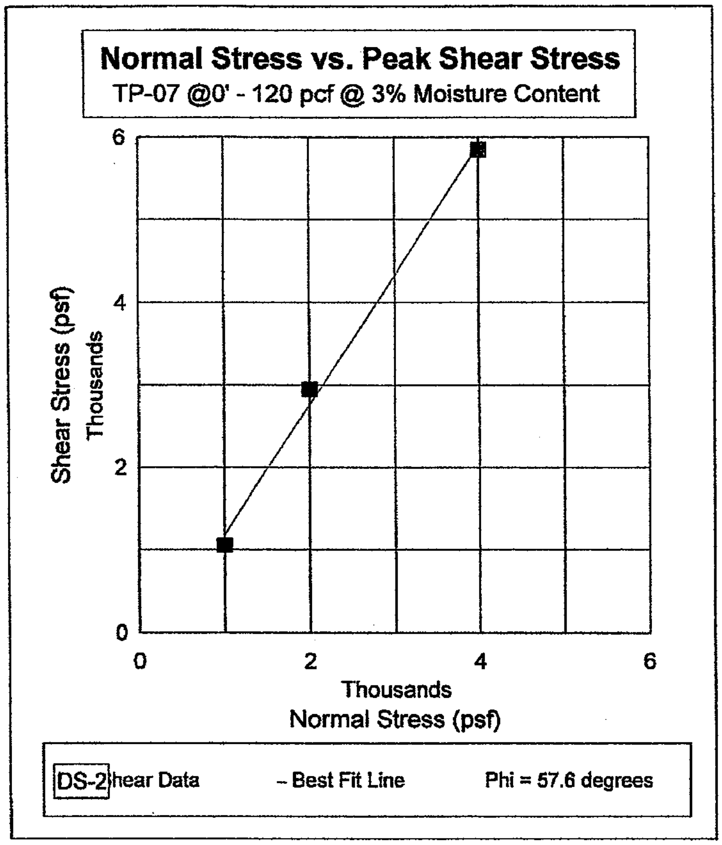
Client:	Terracon	Date:	07/02/2007
Project No:	2261-85	Test Date:	06-29-07
Project:	Infrastructure Improvements, #65065044	Technician:	WAR
Interface:	TP-07 @0' - 120 pcf @ 3% Moisture Content	Shear Rate:	0.04"/in
Special conditions:	Unsaturated	Test Series:	DS-2

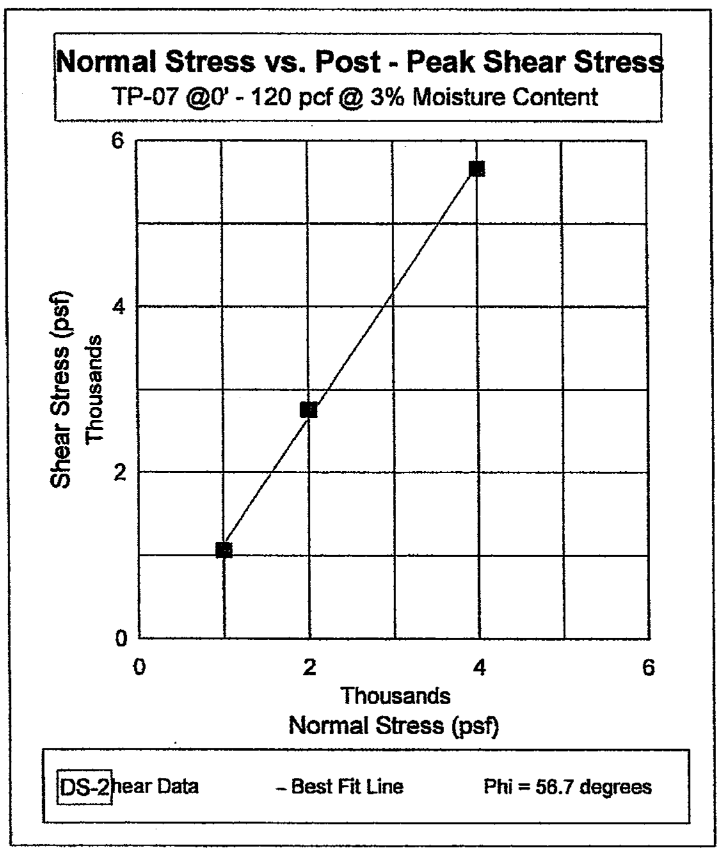
Displacement (inches)	Normal Force 1000 psf Shear Stress (psf)	Normal Force 2000 psf Shear Stress (psf)	Normal Force 4000 psf Shear Stress (psf)
0	0	0	0
0.024	234	410	541
0.08	390	810	1162
0.137	493	1078	1569
0.195	562	1275	1899
0.254	615	1428	2190
0.312	669	1548	2499
0.371	708	1665	2768
0.431	752	1755	2942
0.489	801	1828	3169
0.546	826	1911	3392
0.605	845	1989	3581
0.662	866	2047	3779
0.719	898	2092	4019
0.777	914	2182	4194
0.835	941	2237	4360
0.893	957	2293	4430
0.952	979	2344	4552
1.009	994	2422	4720
1.065	989	2457	4881
1.123	1002	2509	4889
1.18	1019	2582	4977
1.238	1022	2625	4936
1.293	1001	2706	5082
1.349	997	2733	5160
1.408	1002	2570	5273
1.465	1029	2778	5392
1.525	1029	2861	5514
1.583	1029	2949	5607
1.641	1036	2818	5759
1.699	1034	2803	5846
1.758	1052	2504	5804
1.817	1054	2681	5705
1.875	1062	2761	5666

Data Entered By: SR Date: 07/02/2007
Data Checked By: ___ Date: 07/02/07
File Name: TADSINIA

Advanced Terra Testing, Inc.


Shear Stress vs. Displacement
TP-07 @0' - 120 pcf @ 3% Moisture Content
Shear Stress (psf)
Thousands
0
2
4
6
8
0
0.5
1
1.5
2
Shear Displacement (in.)
Normal Force 1000 psf
Normal Force 2000 psf
Normal Force 4000 psf
DS-2





ADVANCED TERRA TESTING, Inc.

Data suggested negative cohesion intercept on Peak and Ultimate Shear Stress Graph. No cohesion values are reported.

Borehole No.	Depth (ft.)	USCS Soil Class.	In-Situ Properties: Dry Density (pcf)	In-Situ Properties: Water Content (%)	Classification: Passing #200 Sieve (%)	Atterberg Limits: LL	Atterberg Limits: PL	Atterberg Limits: PI	Expansion Testing: Dry Density (pcf)	Expansion Testing: Water Content (%)	Expansion Testing: Surcharge (psf)	Expansion Testing: Expansion (%)	Expansion Testing: Expansion Index EI_{50}	Corrosivity: pH	Corrosivity: Resistivity (ohm-cm)	Corrosivity: Sulfates (ppm)	Remarks
TP-1	4	GP			2	NP	NP	NP									
TP-1	10	GP			2	NP	NP	NP									
TP-2	0		115	3													
TP-2	1	SM			30	NP	NP	NP						8.0	2200	0.05	
TP-2	2		95	5													
TP-2	3	SP			2	NP	NP	NP									
TP-2	4		91	7													
TP-3	0		111	3													
TP-3	2		93	3													
TP-3	4	SP			2	NP	NP	NP									
TP-3	4		116	2													
TP-3	13	SP			3	NP	NP	NP									
TP-3	20	GW			1	NP	NP	NP									
TP-4	4		94	5													
TP-4	6	SP												9.3	5000		2
TP-4	6		107	3													
TP-4	8		115	2													
TP-4	10		119	2													
TP-4	12		115	2													
TP-4	14	SP			1												
TP-5	1	GM			24	NP	NP	NP									
TP-5	4		90														
TP-5	6		88														
TP-5	8		96														
TP-5	10		117														

REMARKS
1. Dry Density and/or moisture determined from one or more rings of a multi-ring sample.
2. Visual Classification.
3. Submerged to approximate saturation.
4. Expansion Index in accordance with ASTM D4829-95.
5. Air-Dried Sample

Terracon

SUMMARY OF LABORATORY RESULTS

Project: Pier 202 Development - Infrastructure Improvements
Site: E. of Rural Rd. on N. side of Rio Salado Pkwy. Tempe, Arizona
Job #: 65065044
Date: 8-24-07

Borehole No.	Depth (ft.)	USCS Soil Class.	In-Situ Properties: Dry Density (pcf)	In-Situ Properties: Water Content (%)	Classification: Passing #200 Sieve (%)	Atterberg Limits: LL	Atterberg Limits: PL	Atterberg Limits: PI	Expansion Testing: Dry Density (pcf)	Expansion Testing: Water Content (%)	Surcharge (psf)	Expansion (%)	Expansion Index EI_{50}	Corrosivity: pH	Resistivity (ohm-cm)	Sulfates (ppm)	Remarks
TP-5	11		120														
TP-5	12		106														
TP-5	14		118														
TP-5	15		112														
TP-5	16		91														
TP-5	17		106														
TP-5	18		115														
TP-5	19	SP-SM			8	NP	NP	NP									
TP-6	4	ML			82	35	26	9									
TP-6	4		77	16													
TP-6	6	SW			5	NP	NP	NP									
TP-6	6		102	3													
TP-6	8		119	2													
TP-6	10		107	2													
TP-6	12		93	2													
TP-6	14	SP												9.2	7000		2
TP-7	0	GP			1	NP	NP	NP									
TP-7	6		104	3													
TP-8	3	SP			3												
TP-8	3		87	2													
TP-8	5		88	7													
TP-8	7		88	6													
TP-8	9		98	3													
TP-8	9	SP												8.1	650		2
TP-8	11		91	3													

REMARKS

1. Dry Density and/or moisture determined from one or more rings of a multi-ring sample.
2. Visual Classification.
3. Submerged to approximate saturation.
4. Expansion Index in accordance with ASTM D4829-95. 5. Air-Dried Sample

Terracon

SUMMARY OF LABORATORY RESULTS

Project: Pier 202 Development - Infrastructure Improvements
Site: E. of Rural Rd. on N. side of Rio Salado Pkwy. Tempe, Arizona
Job #: 65065044
Date: 8-24-07

SOIL PROPERTIES 65065044.GPJ TERR2000.GDT 8/24/07

Borehole No.	Depth (ft.)	USCS Soil Class.	In-Situ Properties		Classification				Expansion Testing					Corrosivity			Remarks
			Dry Density (pcf)	Water Content (%)	Passing #200 Sieve (%)	Atterberg Limits			Dry Density (pcf)	Water Content (%)	Surcharge (psf)	Expansion (%)	Expansion Index EI_{50}	pH	Resistivity (ohm-cm)	Sulfates (ppm)	
						LL	PL	PI									
TP-8	13		86	4													
TP-8	16	SP			13												

REMARKS

1. Dry Density and/or moisture determined from one or more rings of a multi-ring sample.
2. Visual Classification.
3. Submerged to approximate saturation.
4. Expansion Index in accordance with ASTM D4829-95.
5. Air-Dried Sample

Terracon

SUMMARY OF LABORATORY RESULTS

Project: Pier 202 Development - Infrastructure Improvements

Site: E. of Rural Rd. on N. side of Rio Salado Pkwy. Tempe, Arizona

Job #: 65065044

Date: 8-24-07

SOIL PROPERTIES 65065044.GPJ TERR2000.GDT 8/24/07

Borehole No.	Depth (ft.)	USCS Soil Class.	In-Situ Properties		Classification				Moisture-Density Relationship			Organic Content	Specific Gravity	Porosity	R-Value	Remarks
			Dry Density (pcf)	Water Content (%)	Passing #200 Sieve (%)	Atterberg Limits			Max Dry Density (pcf)	Optimum Water Content (%)	Method					
						LL	PL	PI								
TP-4	14	SP			1						698C					
TP-5	5	SP									698A					
TP-5	10	SP							126.0	10.5	698C					
TP-5	19	SP-SM			8	NP	NP	NP	122.0	11.0	698C					
TP-6	6	SW			5	NP	NP	NP			698A					
TP-7	0	GP			1	NP	NP	NP			698C					
TP-8	13	SP							111.5	13.5	698A					

REMARKS
1. Dry Density determined from one or more rings of a multi-ring sample.
2. Visual Classification.
3. Submerged to approximate saturation.

Terracon

SUMMARY OF LABORATORY RESULTS

Project: Pier 202 Development - Infrastructure Improvements
Site: E. of Rural Rd. on N. side of Rio Salado Pkwy. Tempe, Arizona
Job #: 65065044
Date: 8-24-07

APPENDIX C

Piezometers Near The Pier 202 Development Area

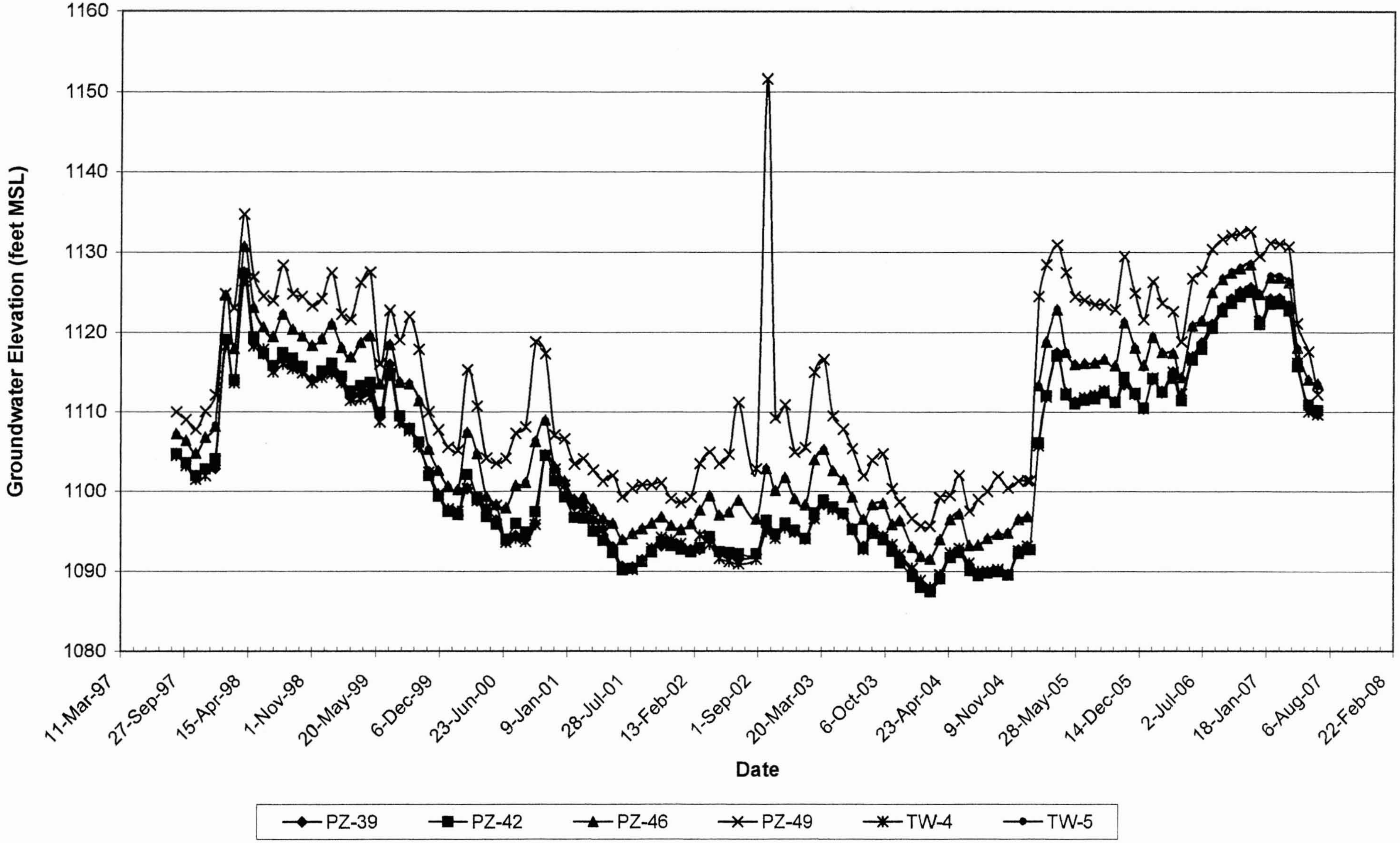
Explanation

Piezometer Location

0 200 400 Feet

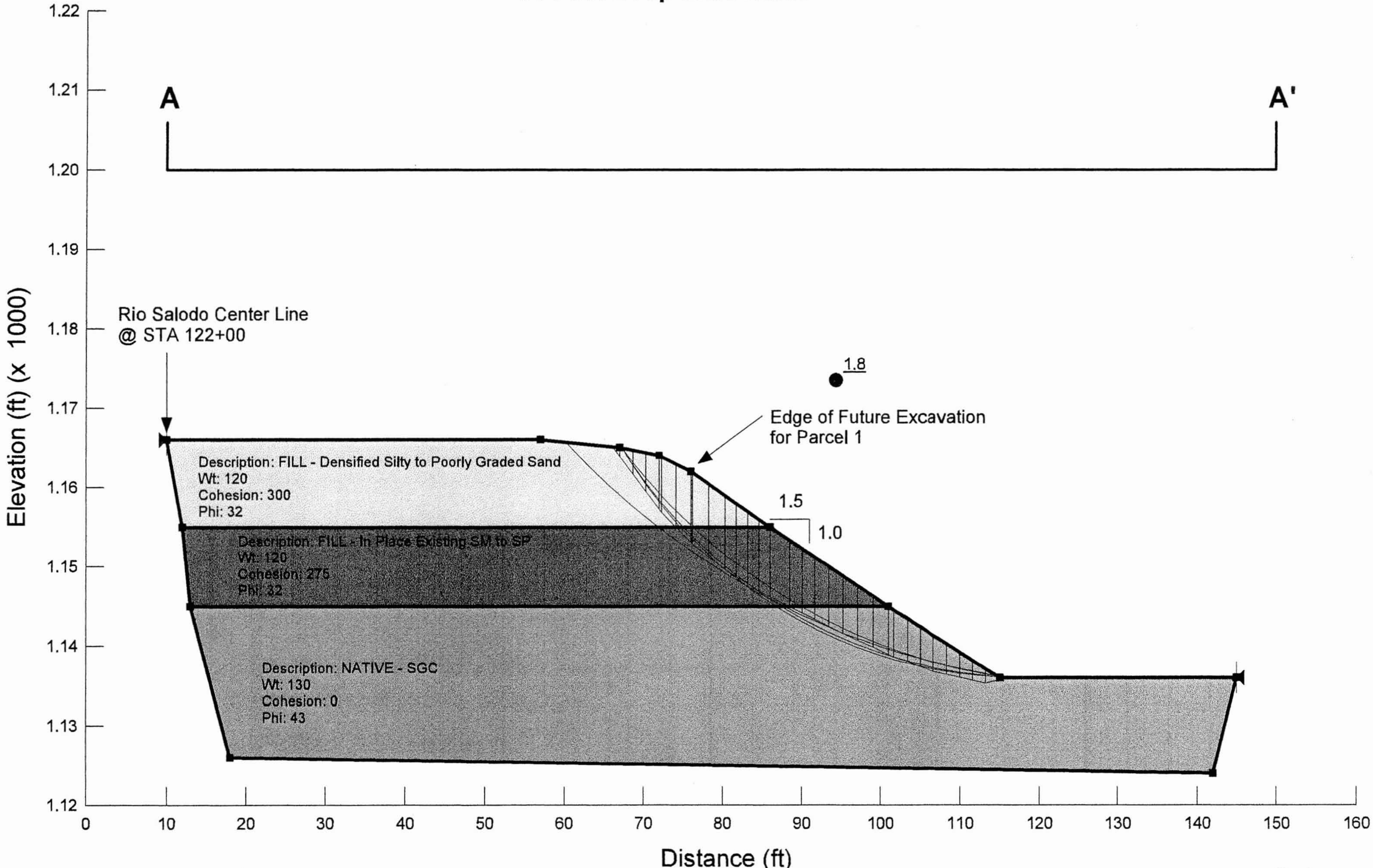
N

Groundwater Elevations
City of Tempe Piezometers

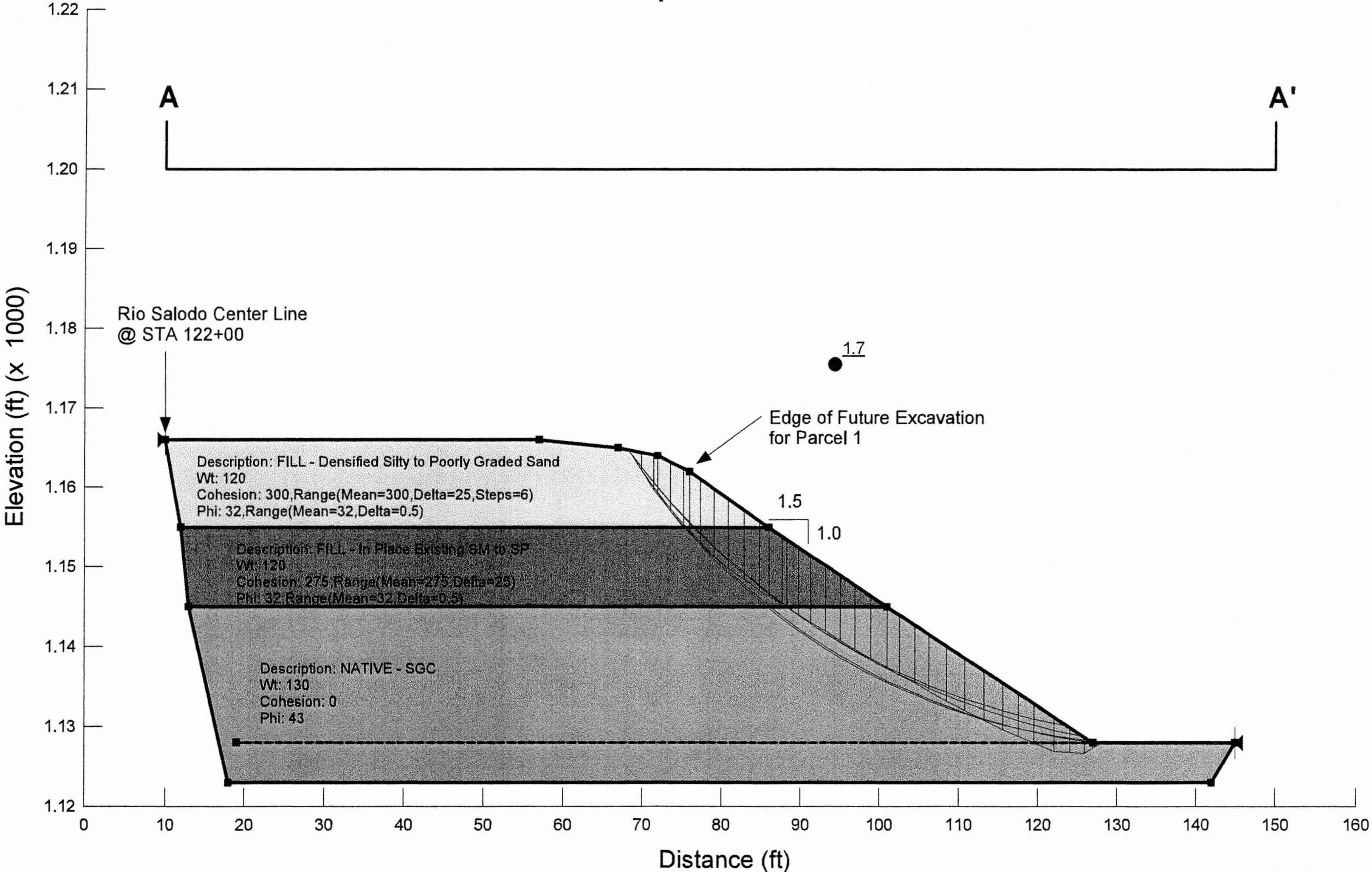


APPENDIX D

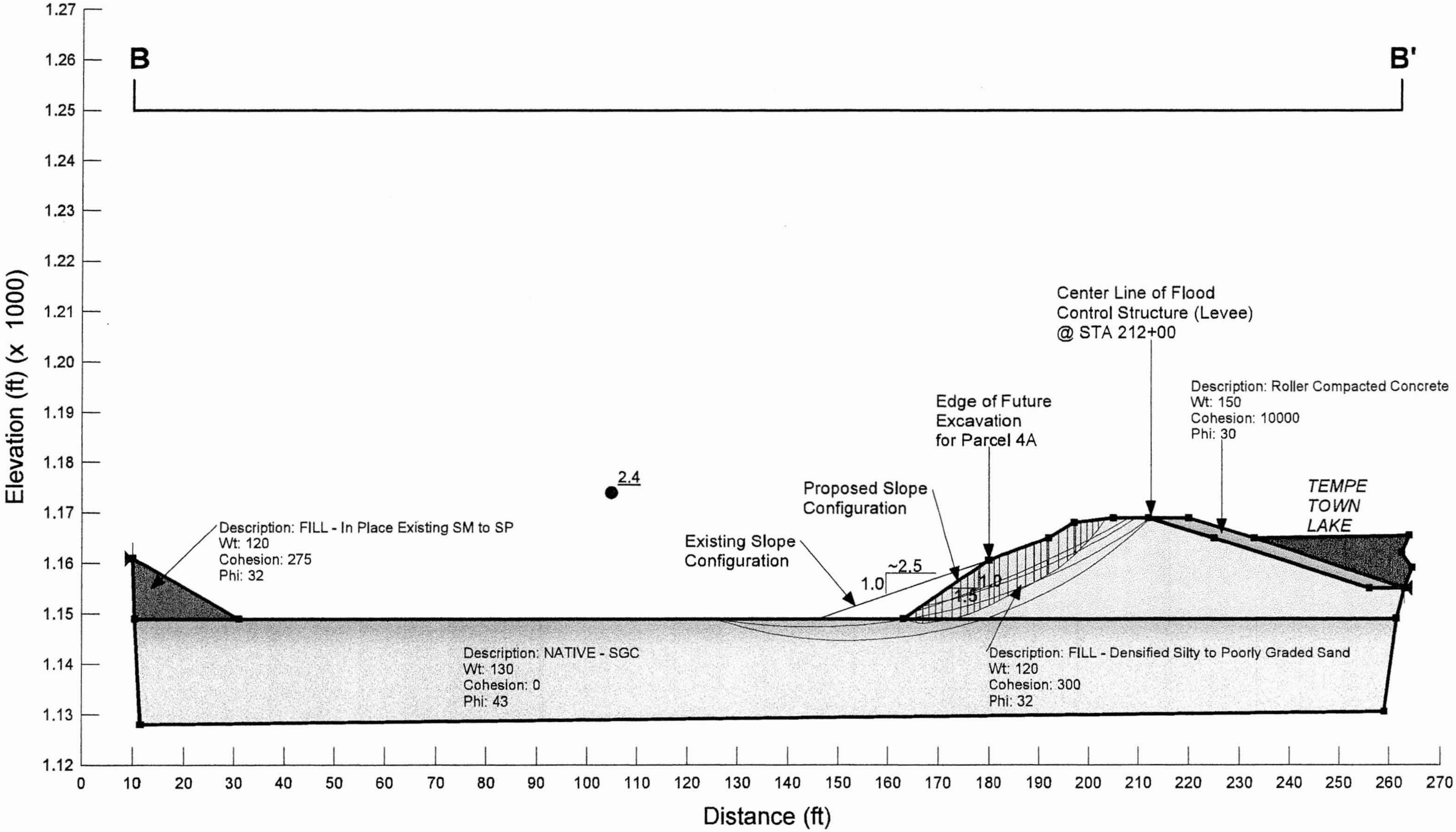
Pier 202 Development
Infrastructure Improvements
Name: Cross Section A-A' @30'.gsz
30 Feet Deep Excavation



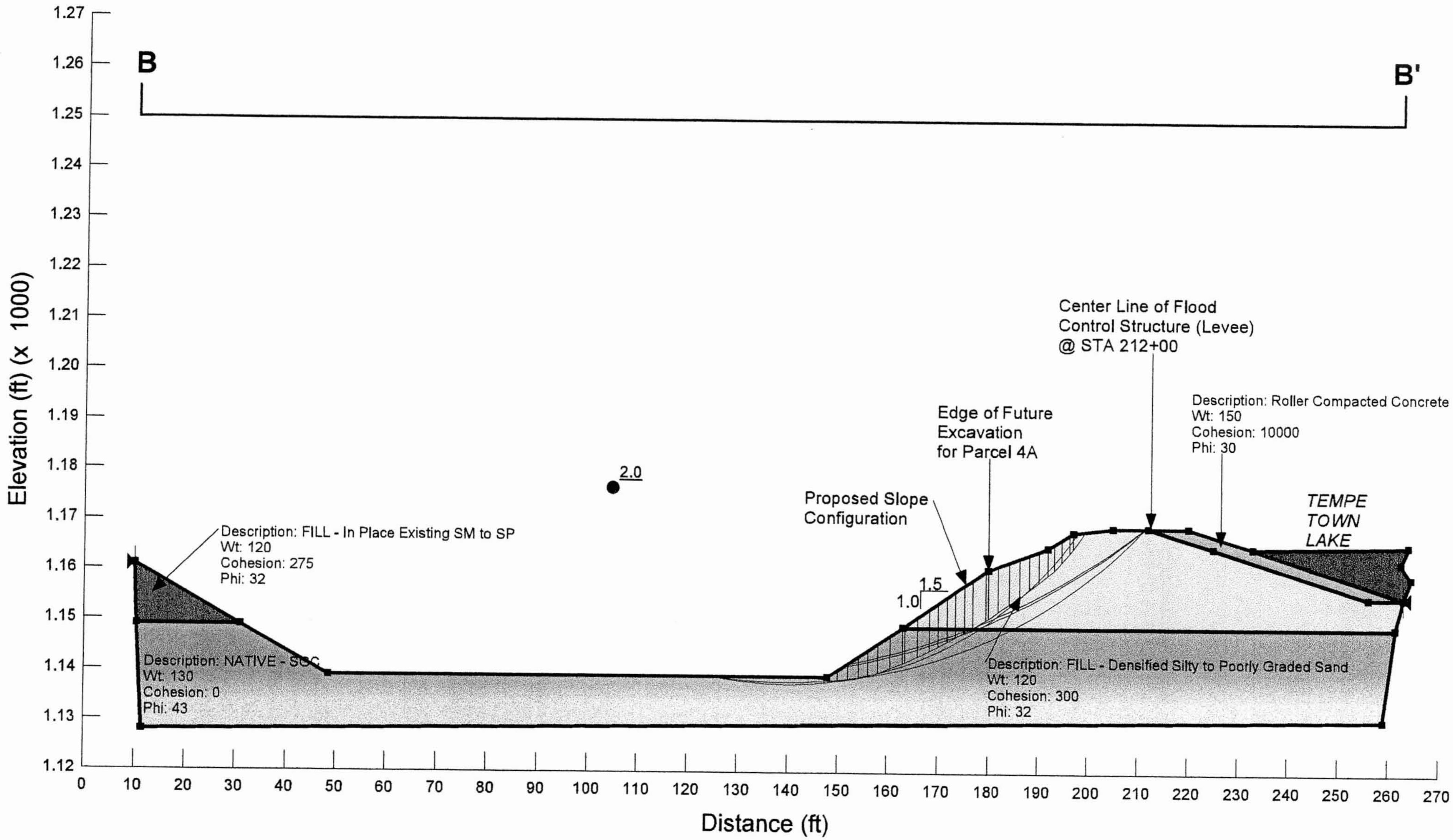
Pier 202 Development
Infrastructure Improvements
Name: Cross Section A-A' @38'.gsz
38 Feet Deep Excavation



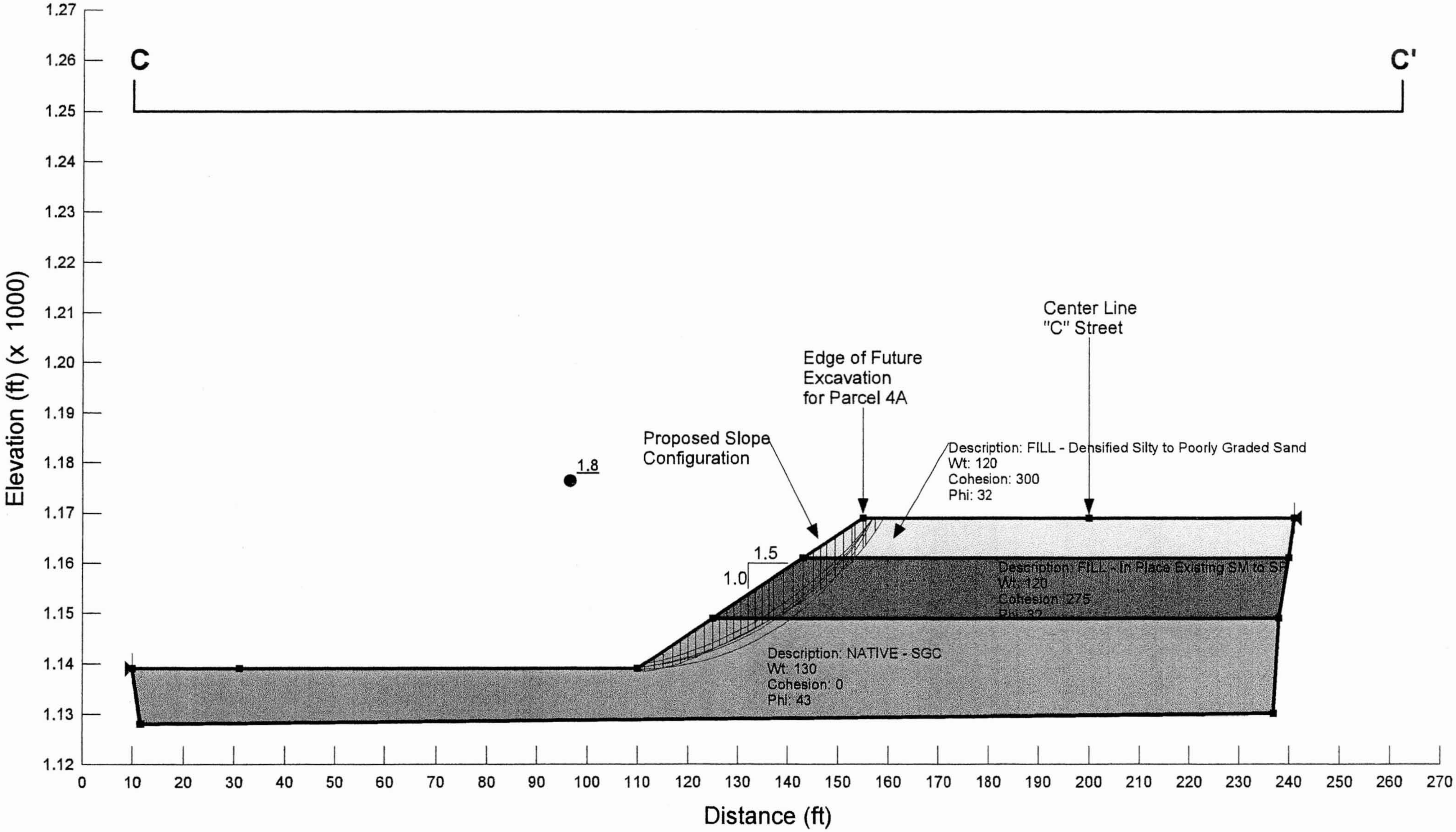
Pier 202 Development
Infrastructure Improvements
Name: Cross Section B-B'@30'.gsz
30 Feet Deep Excavation



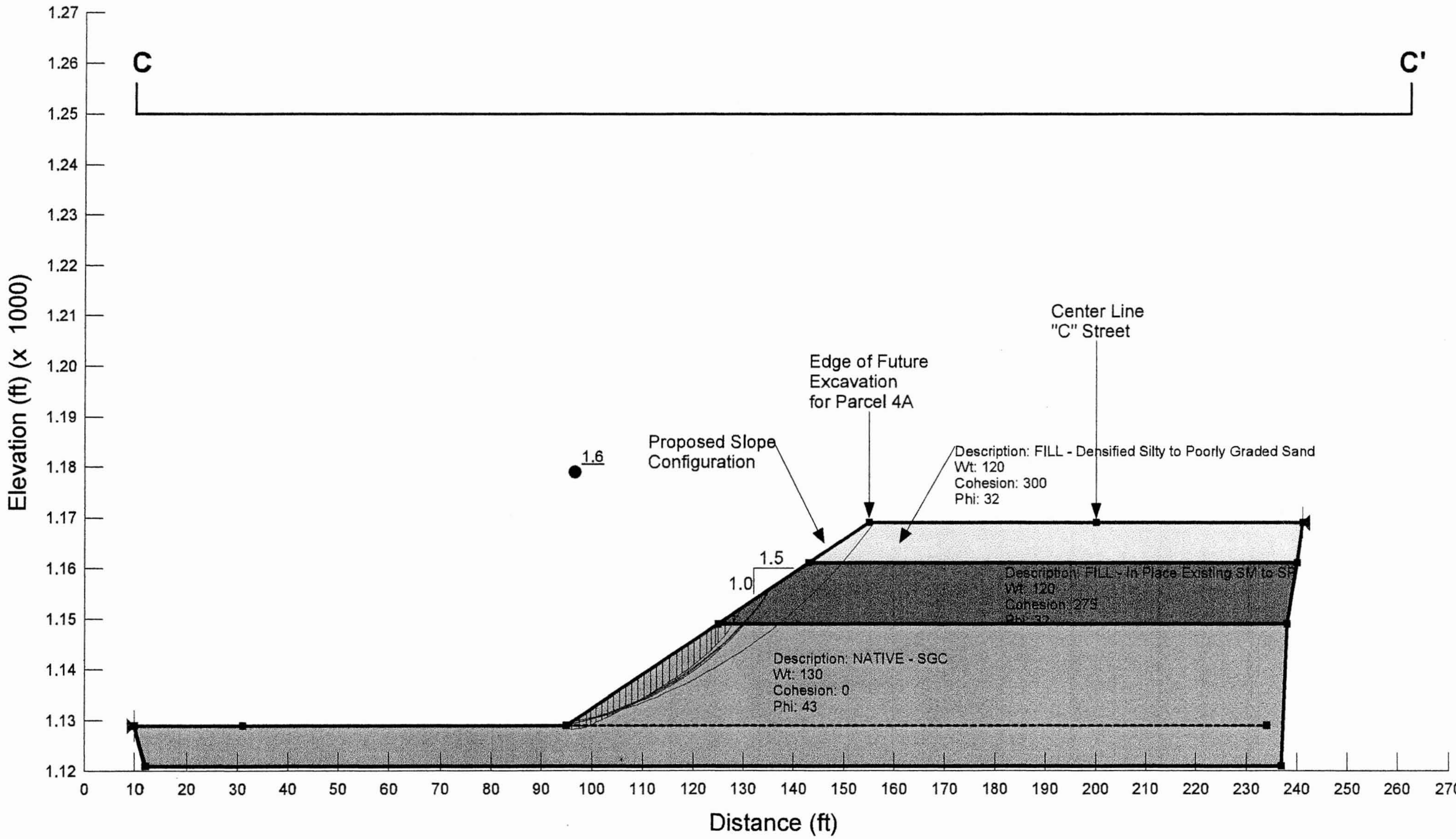
Pier 202 Development
Infrastructure Improvements
Name: Cross Section B-B' @40'.gsz
40 Feet Deep Excavation

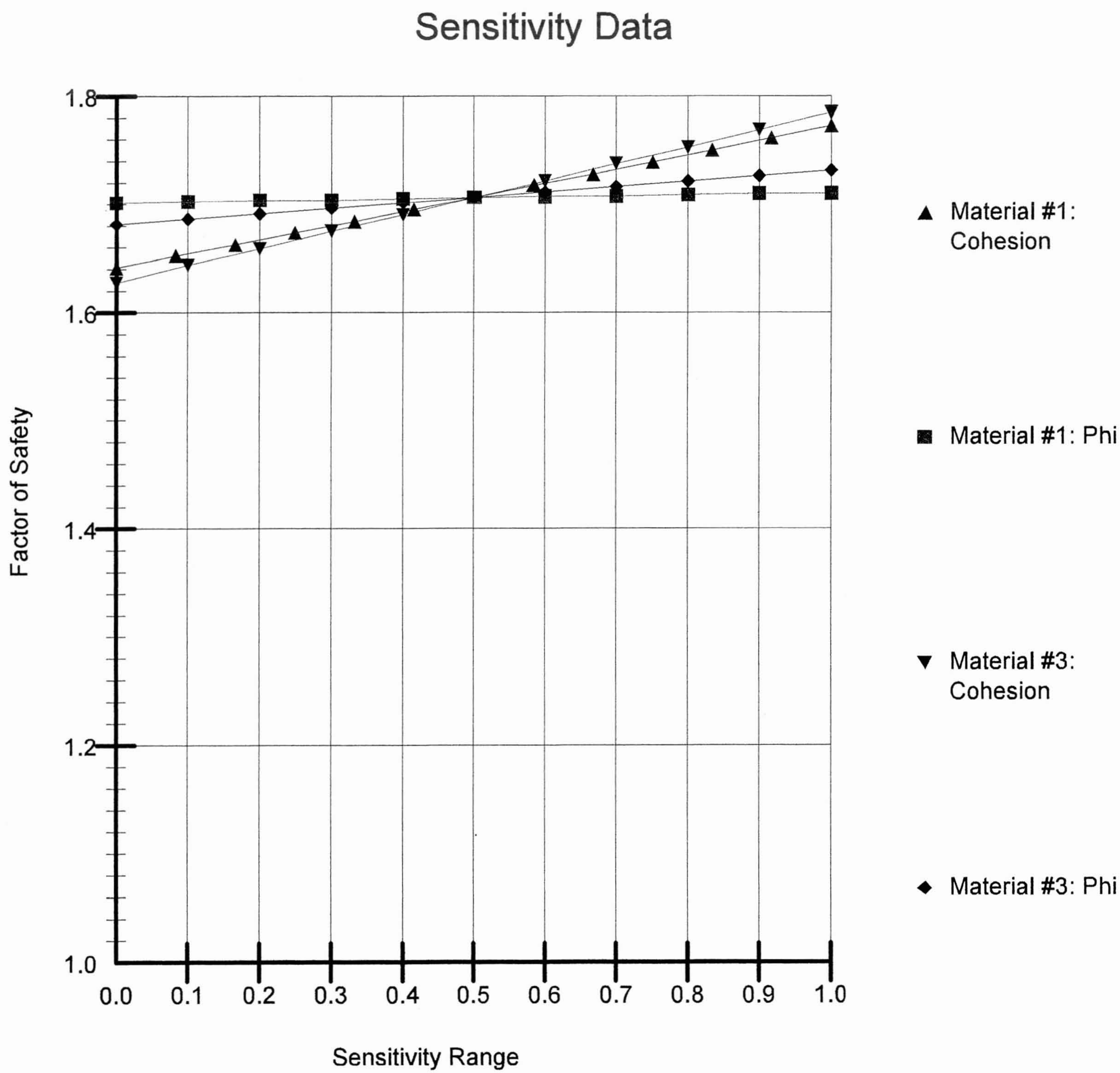


Pier 202 Development
Infrastructure Improvements
Name: Cross Section C-C' @30'.gsz
30 Feet Deep Excavation



Pier 202 Development
Infrastructure Improvements
Name: Cross Section C-C' @40'.gsz
40 Feet Deep Excavation




Sensitivity Data
Factor of Safety
1.8
1.6
1.4
1.2
1.0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Sensitivity Range
Material #1: Cohesion
Material #1: Phi
Material #3: Cohesion
Material #3: Phi