# AS-BUILT REPORT COVER, EROSION, AND REVEGETATION TEST PLOT STUDY TAILING TEST PLOTS

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# **1.0 INTRODUCTION**

Phelps Dodge Tyrone Inc. (Tyrone) and Chino Mines Company (Chino) operate copper mining facilities near Silver City, New Mexico (Figure 1). Tyrone and Chino are evaluating reclamation options with respect to meeting pertinent applicable requirements of the New Mexico Water Quality Control Act (WQA), the Water Quality Control Commission (WQCC) Regulations, and the New Mexico Mining Act (NMMA). The New Mexico Mining and Minerals Division (MMD) regulate Tyrone (Permit No. GR010RE) and Chino (Permit No. GR009RE) as existing mines. The New Mexico Environment Department (NMED) issued Discharge Permit 1341 (DP-1341) to Tyrone and DP-1340 to Chino to regulate closure related activities. Conditions for the tailing test plot program were also negotiated in association with the DP-27 Settlement Agreement for Tyrone.

Condition 76 (DP-1341) and Condition 82 (DP-1340) require the development and interpretation of cover, erosion, and revegetation test plots. The purpose of the test plots is to "evaluate: net infiltration [drainage] through the store and release cover with differing cover thicknesses; feasibility of construction and construction techniques required during cover placement; erosion rates of covered and uncovered slopes; vegetation success; and the potential for upward migration of acidic solutions from the Tailing Impoundments, Waste Rock Piles and Leach Ore Stockpiles".

Environmental conditions (soils, climate, waste characteristics) at the Mangas Valley tailing ponds are approximately similar to the Chino tailing ponds. Because of broad similarities in operational considerations, climate, vegetation, and materials, the NMED and MMD agreed to combine the Chino and Tyrone tailing pond test plot studies at the Tyrone Mine.

## 1.1 Background

Cover design is an important component of the reclamation plans for the Tyrone and Chino tailing facilities. Tyrone and Chino identified the need for cover design studies in the development of their respective closure/closeout plans (DBS&A, 1997a and 1997b). Through meetings and discussions with the NMED and the MMD during the spring of 1998, Tyrone and Chino prepared and submitted cover design work plans for regulatory review. Based upon agency comments, a revised work plan was submitted on October 23, 1998 and work was initiated on the cover design studies in early November 1998.

Implementation of the initial work plan and subsequent work led to the development of the Cover Design Study Status Reports (CDSSR) for both Chino (DBS&A 1999a) and Tyrone (DBS&A,

1999b). The CDSSR presented the results of the materials characterization, soil water balance simulations, and technical reviews of various types of cover systems. Based on this work and subsequent interactions with the NMED and MMD, a store and release cover was selected as the most appropriate for use in this region.

In May 2003, Chino submitted a test plot study work plan to address the requirements of DP-1340 Condition 82 (Tetra Tech, 2003a). Subsequently, the Chino work plan was amended in October 2003 and submitted for Agency review (Tetra Tech, 2003b). In December 2003, separate but nearly identical work plans were submitted by Tyrone to address the tailing impoundment test pots for Condition 76 (DP-1341) and Condition 29 (DP-27) (Tetra Tech, 2003c and 2003d). These work plans were ultimately approved by the NMED in May 2004. The MMD granted final approval for the Tyrone test plot work plans related to Condition 9.L.1 (Permit GR010RE) in February 2006.

# **1.2** Goals and Objectives

The primary goal of the vadose zone monitoring program is to calibrate the existing soil water balance models (UNSAT-H) for the Chino and Tyrone mines to predict long-term performance of the covers based on the data collected during the cover performance period. Ultimately, modeling is necessary to accommodate the natural variations in climate that characterize this region. The objectives proposed as part of the cover, erosion, and revegetation test plot study include the following:

- Determine if the covers described in Supplemental Discharge Plans DP-1340 and DP-1341 and/or alternative cover systems will ensure that the requirements of the WQA and WQCC Regulations are met;
- Evaluate infiltration beneath the various cover systems;
- Evaluate the feasibility of limiting infiltration beneath the covers to less than one percent of the mean annual precipitation;
- Evaluate the constructability of cover systems of variable thicknesses on slopes with a range of gradients;
- Calibrate the existing water balance model with data obtained as part of this study and in coordination with studies in other pertinent conditions required by DP-1341, DP-1340, DP-27 and Permits GR010RE and GR009RE; and
- Verify field performance of the proposed and alternate covers.

# **1.3** As-built report

The various MMD and NMED permit conditions require that Tyrone and Chino provide as-built information within 90 days of the completion of the test plots. The test plots are substantively complete from an earthmoving and revegetation perspective, although additional work is required to finalize the test plots. Outstanding issues related to completion of the test plots are discussed at the end of this report.

The intent of this report is to document:

- final configuration of the test plots
- baseline cover and waste rock characterization
- the vadose zone monitoring instrument installation, testing, and calibration,
- lysimeter materials, construction, and testing results,
- seed mixture and seeding rates, and
- meteorological station instrumentation testing and calibration.

This report also includes as-built diagrams of the test plots including location, number designation, and size. The general layout of the 3X and 3 Dam test plots is presented in Figure 2. The actual cover thickness data generated from the sampling of five excavations per test plot is included in this report as well as information on borrow sources. Major deviations from the work plans are discussed in appropriate sections of the report. Costs associated with construction of the test plots will be presented once the test plots are finalized and the costs are tabulated by Tyrone and Chino.

## 2.0 MATERIALS CHARACTERIZATION

The cover and underlying materials in the test plots were sampled and analyzed to establish a physiochemical baseline for each site. The field and laboratory characterization methods are discussed in Section 2.1. The results of the physical and chemical characterizations are discussed in Sections 2.2, while the hydraulic data are presented in Section 2.3.

## 2.1 Characterization Methods

#### 2.1.1 Field Methods

Individual tailing and cover samples were collected for physical and chemical analysis of the fineearth fraction (particles < 2 mm in diameter). The fine-earth samples were 5 to 10 kg in size and the larger rock fragments (> 75 mm) were removed. The samples collected for particle size analyses were placed directly in gallon-size plastic bags, while the samples for soil-hydraulic analyses were placed in 5-gallon airtight plastic buckets. The samples were shipped to the associated analytical laboratories at ambient temperature.

Tailing samples were collected during the instrument installation phase and prior to cover placement. Bulk samples from the upper two feet of tailing and undisturbed cores from various depths were collected for laboratory analysis.

Following cover placement but before seeding, 5 test pits were excavated in the cover in each plot. The entire interval of the exposed profile was described (Soil Survey Division Staff, 1993). The pits were examined with emphasis on determining the spatial and volumetric relationships of the fineearth and rock fragments. Cover thickness was determined by examining the exposed faces of the pits. Cover material samples were collected from the test pits (5 pits per test plot), and used to determine the final cover thickness; one sample was collected from the surface to a depth of one foot; and the second sample was collected from the one-foot interval above the basal contact with the tailing.

#### 2.1.2 Chemical and Physical Analysis Methods

The chemical and physical analyses were conducted at Energy Laboratories in Billings, Montana. A total of 40 tailing and 70 cover samples were collected for chemical and physical analyses. The individual sample locations are presented in Figure 3. The bulk samples were air-dried and passed through a 2 mm sieve at the laboratory. The less than 2 mm soil fraction of the cover materials was analyzed for the parameters listed in Table 1. Similar tests were made on the tailing, except that

nitrogen, phosphorous, and organic carbon were not determined. These analyses were conducted using standard methods that are consistent with the 1996 MMD Draft Closeout Plan Guidelines (MMD, 1996).

#### 2.1.3 Soil Hydraulic Characterization Methods

The goal of the soil hydraulic analyses was to develop an understanding of the range of hydraulic properties of the materials. A total of 15 tailing and 6 cover samples were collected for soil hydraulic analyses. The samples were analyzed at the Daniel B. Stephens & Associated (DBS&A) Laboratory in Albuquerque, New Mexico. Because the cover materials contain rock fragments, the soil-hydraulic analyses were conducted on the < 2-mm fraction. The fine-earth fraction of the samples was packed to specified bulk densities based on well established soil textural relationships (Soil Survey Division Staff, 1993). The soil hydraulic characterization testing methods are summarized in Table 2.

#### 2.2 Chemical and Physical Characteristics

## 2.2.1 Cover

Cover materials were derived from borrow areas established as part of the Dam 3 and Dam 3X reclamation activities (Figure 2). Five test pits were excavated in each plot for verification of cover thickness and to allow sampling (Figure 3) Field descriptions of the cover materials are summarized in Table 3. The chemical and physical properties of the cover materials are summarized in Table 4; the laboratory data are included in Appendix A. The soils are predominantly moderately-coarse textured, represented primarily by sandy loams and sandy clay loams. All the cover samples contained rock fragments (Tables 3 and 4). In accordance with the cover design for the 3X Dam, the test plots on the outslopes tended to have higher rock fragment contents, particularly in the surface layer, compared to the top surface test plots (Table 3). The soils are slightly- to moderately- alkaline (pH 7.4 to 8.1) and non- to slightly saline (0.4 to 3.3 deciSiemens per meter [dS/m]). The pH and electrical conductivity (EC) are reflective of soils containing free CaCO<sub>3</sub>. The organic matter, phosphorous, and nitrate contents are relatively low.

#### 2.2.2 Tailing

Tailing samples were collected in several locations in the test plot prior to cover placement (Figure 3). The chemical and physical properties of the tailing are summarized in Table 5; the laboratory reports are provided in Appendix B. The tailing samples from the outslope test plots were generally coarser textured than the samples collected from the top surface test plots (Table 5). The tailing on the slope were all classified as sandy loams with 6 to 12 percent clay. The tailing on the top surface were

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predominantly classified as loams with 14 to 22 percent clay. All the samples were extremely acid (pH 1.7 to 3.5) and ranged from saline to moderately saline (6.9 to 13.4 dS/m).

# 2.3 Soil Hydraulic Characteristics

The soil hydraulic characterization was meant to provide site-specific information, as well as to complement the existing database for the Gila Conglomerate at Tyrone (DBS&A, 1999a; Golder, 2005). The hydraulic characterization data for the cover materials are summarized in Table 6; the laboratory reports are included in Appendix C. Pertinent data in Table 6 were corrected to account for rock fragments contained in the samples submitted to the laboratory; however, it should be noted that the samples were not fully reflective of the field conditions with respect to rock fragments. The hydraulic characterization data for the tailing are summarized in Table 7; the laboratory reports are included in Appendix D. Because the tailing are devoid of rock fragments, no corrections are required for these data.

# 3.0 TEST PLOT DESIGN AND CONSTRUCTION

The tailing test plots were constructed concurrently with the reclamation of the 3X tailing impoundment. This approach allowed a field-scale evaluation of the techniques that are applied in the normal course of reclamation. The final details of the construction process will ultimately be provided as part of the Construction Quality Assurance Design Report (CQDAR) for the 3X tailing impoundment. Section 3.1 provides an overview of the construction practices that were applied at the tailing test plots. The final configuration of the test plots is represented in Section 3.2. Section 3.3 details the calibration and installation of the vadose zone monitoring instruments, including the volumetric lysimeters. The erosion monitoring equipment is detailed in Section 3.4. Finally, Section 3.5 discusses cost information pertinent to the tailing test plots.

#### **3.1** Construction Methods

#### 3.1.1 Subgrade Preparation

Minor grading of the tailing on the top surface was performed with a 14H motor grader. Major regrading of the slopes was performed with D8R dozers to remove the original benches on the tailing embankments and to fill erosion features. This operation was followed by final grading with a 14H motor grader. The computer aided earthmoving system (CAES) was used to assist in grade control and equipment operations. This process was complemented by conventional Global Positioning System (GPS) surveys.

## 3.1.2 Drainage channels

Surface drainage channels were designed and constructed to accommodate the 100-year frequency, 24-hr storm event. Ditches were pre-excavated in the tailing using excavators, scrapers, dozers, and graders. Pre-excavation allowed for the placement of 2 feet of local borrow materials under the specified thickness of filter bedding and rip rap.

#### 3.1.3 Cover Placement

Cover materials from the borrow areas was placed on the top surface and slopes with 631 and 637 scrapers. On some occasions, subgrade cover materials were staged along benches and pushed over the slopes using dozers. The cover soils were placed in lifts to conform to the design specifications for the tailing impoundments (Tetra Tech, 2004). Specifically, borrow materials that met the texture and rock content requirements for the upper 6 inches of cover were selectively handled to comply with the cover specifications.

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Borrow sources of Gila conglomerate cover material were developed in several locations adjacent to the impoundment as shown on Figure 2. The cover material was excavated and hauled using scrapers and placed in 8- to 10-inch thick lifts. The final grade on the cover was confirmed using a 14H motor grader equipped with CAES and post-cover GPS surveys.

Cover thickness was initially assessed by excavating pits and measuring cover thickness during the quality control process. Areas with overbuilt or underbuilt covers were graded to achieve the design thickness. The locations of the 5 cover thickness confirmation test pits required by the MMD are shown on Figure 3. The cover thickness for each test pit is listed in Table 3. Figures 4 and 5 illustrate the mean cover thickness for the test plots. The thickness data indicate that the mean cover thickness treatments are statistically different with 95 percent confidence.

#### 3.1.4 Revegetation

The test plots were revegetated in a manner consistent with requirements of Permit GR010RE, DP-1341, and the Settlement Agreement. The seeding operations were performed by Rocky Mountain Reclamation beginning in early June and were completed in late July. Operationally, the revegetation procedures included: 1) scarification and seedbed preparation, 2) seeding, and 3) mulching and crimping.

# 3.1.4.1 Seedbed Preparation

The seedbed was initially ripped in early June using a motor grader or dozer to about 12 inches. During the seeding operation, Rocky Mountain Reclamation scarified to a depth of 8 to 12 inches using tractor mounted steel shanks. These scarification procedures were performed on the contour.

# 3.1.4.2 Seeding

The seed was drilled and broadcast simultaneously using a modified rangeland drill with depth control bands, packer wheels, agitators and augers, and picker wheels. Light and fluffy seed were allowed to fall freely behind the drill, and the broadcast seeds were lightly covered using chain drags pulled behind the drill. The seeding operation on the 3X test plots began in late June 2005 and was completed in about 3 weeks. For Test Plot 4 on Dam 3, seeding was completed prior to June 30, 2006.

# 3.1.4.3 Seed Mix

The seed mix applied on the tailing test plots is listed in Table 8. Seed was procured by Rocky Mountain Reclamation from Granite Seed Company. The seed mix deviated slightly from the primary seed mix (Appendix C of Permit GR010RE) to primarily accommodate requests from the New Mexico Game and Fish Department and the MMD, and because of seed availability issues.

# 3.1.4.4 Mulching and Crimping

Certified weed-free, long-stem, native hay was supplied by Rocky Mountain Reclamation and used to mulch the test plots. The mulch was delivered in cylindrical bales originating from Kansas and Oklahoma. Specially-adapted, mulch-spreading equipment pulled behind a 4-wheel drive tractor was used to uniformly spread the mulch at the rate of about 2.0 tons per acre. The mulch was then crimped 3 to 4 inches into the cover using a disc harrow with straight coulter discs. The coulters were spaced approximately 6 to 8 inches apart. The crimping operation was performed on the contour.

## 3.1.4.5 Chemical Amendments

No chemical amendments were applied to the test plots. Fertilization of a portion of the test plots was proposed in the work plan and this oversight by Golder represents a data gap in the completion of the test plots. A schedule for rectifying this oversight is presented in Section 4.0.

## 3.2 Test Plot Configurations

Test plots representing different cover thickness treatments (1.5, 2, 3, and 4 feet) were constructed on the No. 3 and 3X Dams at the Tyrone Mine in accordance with permit conditions and approved work plan. The NMED and MMD agreed to combine the Chino and Tyrone tailing test plot studies at the Tyrone Mine. Plate 1 illustrates the general layout for the tailing pond test plots. The test plots were integrated into the closure of the tailing impoundments and imitate the expected construction operations of a full-scale reclamation effort.

Three test plots with cover thickness of 2, 3, and 4 feet (60, 90, and 120 cm) were constructed on the top surface of the 3X Dam. Unacceptable subgrade conditions (i.e., mixed-soil and tailing from a excavation of a catchment) were discovered during the cover verification activities at the original location of 1.5 foot plot. This condition resulted in the need to construct of the 1.5 foot test plot on the 3 Dam. Three test plots with cover depths of 2, 3, and 4 feet (60, 90, and 120 cm) were

constructed on the west face of the 3X Dam. The tailing test plots ranged from 2 to 5.4 acres, totaling about 28 acres reclaimed. Top surface slope gradients ranged from 6.4 percent (15.7:1) near the crest of the impoundment to less than 1 percent towards the center of pond.

On the outslopes, surface water controls were constructed on gradient benches spaced at a nominal 100 feet. To evaluate longer slope lengths, one interbench section was constructed to have a slope length of about 200 feet. Slope gradients on the outslope test plots ranged from about 21 to 29 percent (4.8- to 3.5:1). Slope lengths ranged from 80 to 95 feet on the shorter slopes and about 185 to 200 feet in the longer section.

#### **3.3 Vadose Zone Monitoring Instrumentation**

Numerous types of instrumentation are commercially available to measure in-situ soil water content, matric potential, and drainage. The relative advantages and limitations of soil water potential and water content measuring devices were discussed in the original work plan (Tetra Tech, 2003a) and subsequent correspondence. The vadose zone monitoring system installed at the No. 3X test plots was designed to evaluate the performance and applicability of instrumentation in measuring soil matric potentials, soil water contents, soil temperatures, and fluid levels in the lysimeter reservoirs with the ultimate objective of evaluating drainage from the reclaimed tailing. Three replicate vadose zone monitoring nests were installed on the primary test plots, which included the top surface two and three foot cover thickness treatments. As requested by the NMED, single monitoring nests were installed in the remaining test plots. The vadose zone instruments are all connected to data loggers, which allow for continuous monitoring and storage of data from the various instruments.

Data stored on the loggers are currently being downloaded on a weekly basis and then incorporated into a master database. The vadose-zone monitoring network will be monitored with the automated systems for a period of at least seven years. Volumetric lysimeters were also installed in the two and three foot cover treatment top surface and side slope test plots to accommodate a request from the NMED. The specific number, type, and placement of instruments in the instrument nests are listed in Table 9. The vadose zone monitoring systems for the individual test plots include instrumentation nests consisting of a combination of heat dissipation sensors (HDS) and electrical resistance sensors (ERS) for estimating soil matric potentials, frequency domain reflectometers (FDR) for estimating water content within the cover materials and underlying waste materials. Pressure transducers were installed to measure fluid levels in the lysimeter reservoirs. The HDS also provide measurements of soil temperatures.

# 3.3.1 <u>Calibration</u>

Soil matric potential is required to determine both the gradient and direction of soil-water movement within the vadose zone. There are a variety of commercially available instruments for measuring soil matric potential, including tensiometers, psychrometers, ERSs, and HDSs. With the exception of tensiometers, all of these instruments measure some geophysical property that is related to the soil water or matric potential through a calibration curve. As such, it is imperative that the instruments selected for monitoring the test plots be carefully calibrated. The development of water retention characteristics for the heat dissipation sensors and test plot materials, along with calibration of the FDR sensors to the site materials, will allow for more accurate measurement of the soil water content and matric potential within the test plots.

The HDS were calibrated in the laboratory according to the standards methods developed by Scanlon et al. (2002) including compensation for ambient temperature variations (Flint et al., 2002). The HDS calibrations included five point measurements made at varying suctions for each sensor. Individual water characteristic curves were subsequently developed for each sensor (van Genuchten, 1980). The van Genuchten coefficients for the individual sensors installed at the tailing test plots are summarized in Table 10 and the laboratory calibration reports provided by DBS&A are included in Appendix E.

Delmhorst model 227 ERSs have also been installed in select instrumentation nests for measurement of soil matric potentials. The manufacturer's standard polynomial equation for converting sensor resistance to soil matric potential has been applied to the individual ERSs as part of the test plot study.

FDR calibrations were performed in the Golder laboratory using bulk samples of representative tailing and cover material obtained from the 3X Dam. Work published by Whalley (1993) and White, et al. (1994) show an almost linear correlation between the square root of the soil dielectric constant (related to the DC voltage measured with the FDR sensors) and soil volumetric moisture content. The material-specific calibrations were conducted in accordance with the manufacturer's specifications (Dynamax, 1999). Specifically, the calibrations were conducted by measuring the soil dielectric constant (from the FDR sensors) at varying water contents (determined gravimetrically at the DBS&A laboratory). Calibration equations for each material type were then developed that relate the DC voltage from the FDR sensors with in-situ soil volumetric moisture content. The individual calibration equations and calibration plots associated with the cover and tailing are presented in Appendix F.

Manufacturer's calibration curves relating neutron counts to soil water content are supplied with neutron probes. However, it is important to develop site-specific calibrations to account for the type of access tube (PVC, aluminum, or steel pipe) and the material being monitored. Neutron probes are considered among the most accurate methods for measuring soil water content when properly calibrated. Special licensing, operator training, handling, shipping, and storage procedures are required because of the potential radiation safety hazards associated with neutron probes. The permits for this equipment have not been finalized and the calibrations for this equipment are still outstanding (see Section 4.0).

Factory calibrations were provided for each of the four Druck model CS-420 pressure transducers installed within the lysimeter reservoirs at the No. 3X test plots. These calibration certificates are provided in Appendix H.

#### <u>3.3.2</u> Installation

The HDS, ERS, and FDR sensors were installed using a downhole emplacement and profile reconstruction method developed for this project. This method resulted in the installation of instruments with minimal disturbance of the cover. Specifically, this method involved installing a 4-inch diameter, schedule 40, PVC pipe vertically in the tailing following grading, but prior to cover placement. The pipe was installed so that the terminal depth was about 220 cm in a covered condition. Following cover placement and seeding operations, the vadose zone instruments were lowered into the PVC pipe annulus to the target depths in a step wise manner; a section of the pipe was lifted out of the hole and the void space was backfilled with either tailing or cover as appropriate depending on the depth of the instrument and the material was then compacted. At completion the entire length of pipe was removed. The tailing and cover soil used as backfill was tamped using a closed end 1-inch PVC pipe to ensure good contact with the instruments.

The ERSs were installed at about 10 inches (25 cm) bgs directly in the pit or auger hole walls. The soils in the immediate vicinity of the block were saturated to improve the soil-instrument block contact. The holes were then backfilled with cover materials and lightly compacted.

The instrument cables were then routed through 1.5-inch diameter, schedule 40, PVC pipes to the tripods used to secure and house the data loggers and solar panels. These pipes were then buried to protect the PVC from solar degradation.

#### 3.3.3 Volumetric Lysimeters

At the request of the NMED, volumetric lysimeters were installed in 4 test plots at the 3X Tailing Impoundment (Plate 1). The lysimeters will allow measurement of cumulative drainage and provide confirmation of the drainage estimates obtained from the vadose zone monitoring nests. Lysimeters were installed in the 2 and 3 foot cover treatments on the top surface and slopes.

The lysimeters consist of polyethylene cone bottom tanks (84-inch diameter and 48-inch height) with a 2-inch diameter Schedule 80 HDPE discharge pipe connected to the bottom of the tank. The asbuilt designs for the top surface and side slope lysimeters are presented in Plate 2.

Prior to construction, each lysimeter location was surveyed using GPS survey equipment. A track hoe was used to excavate the tailing to create an opening for placement of the lysimeter tank and discharge reservoir. The overall slopes of the excavation were maintained at gradients flatter than about 2.5:1 to provide a safe working environment. During construction the excavation was benched in 2-foot cuts. Selected locations on these benches were cleared and leveled by hand using a shovel. Soil density was measured at a minimum of 3 locations using a nuclear density gauge. All density measurements were completed by a licensed technician provided by Summit Technical of Hurley, New Mexico. The soil density data are summarized in Table 11 and the laboratory reports are summarized in Appendix G.

The excavated tailing was segregated by discrete depth increments and stored in piles adjacent to the excavation. In general, the piles represented materials from distinct 2-foot increments. As the excavation was advanced, each pile of material was covered with a plastic sheet to reduce the loss of moisture from the materials. The intent of the segregation and covering was to allow backfilling of the excavation with materials similar to those excavated.

Upon reaching the terminal depth of the excavation for the lysimeter tank, the base depth was measured. The depth of the excavation was determined by the cover thickness for the given test plot, such that the top of the lysimeter would be approximately 7 to 8 feet below the final cover grade. The area for the base of the lysimeter tank was compacted and molded to the conical geometry of the lysimeter base. The lysimeter tank was then set into place and leveled. Native materials were pushed in the open space between the lysimeter and the ground surface and compacted. A small trench was excavated for the discharge pipe and the lysimeter was set into place. Final leveling of the lysimeter was then performed.

A 55-gallon closed-top polyethylene drum was installed at the end of the trench in an excavation completed by the track hoe. The material beneath the drum was compacted and the drum was placed such that the grade on the discharge pipe between the lysimeter tank and the drum (storage reservoir) was at least 4 percent. The 55-gal drum, piping, and the lysimeter were backfilled until level with the 1-foot mark above the base of the lysimeter. Filter fabric and 10/20 silica sand (700 lbs) were placed into the lysimeter and spread out such that a level top surface was formed. Backfilling of the excavation was then completed in 2-foot lifts using materials from the depth appropriate stockpiles. As each sequential lift was completed, three in-situ density measurements were collected on the backfilled material. If the measurements indicated that further compaction, additional compaction was completed using a hand tamper and/or a mechanized vibrating compactor. If the measurements indicated that the material was within 10 percent of the original measurements or greater than the original average density, no additional compacting of the materials was conducted. Material samples were collected at the midpoint and the top of lysimeter for laboratory analysis.

Upon completion of the backfilling, the site was regraded using a grader, to the extent practical without damaging the underlying or exposed pipes. Final grade at the center of the lysimeter was surveyed using GPS equipment.

#### 3.3.4 Meteorological Station

Fully automated meteorological (met) stations were assembled and installed at the 3X Dam (Plate 1) and near Pond 7 at Chino (Figure 6). The met stations consist of a tipping bucket rain gage (Texas Electronic model TE525); relative humidity/air temperature probe (Vaisala model HMP45AC); wind speed and direction sensor (R.M. Young model 05103); and silicon pyranometer for measuring solar radiation (Kipp & Zonen SP-LITE). The sensors are mounted on a 10-foot tripod anchored in place. The sensors and gauges are connected to Campbell Scientific, Inc. data loggers (CR-23X at the 3X Dam and CR-1000 at Chino) that are powered by 86 amp-hour batteries and charged by 20W solar panels. Calibration certificates for the met station instruments are included in Appendix H.

# 3.4 Soil Erosion Monitoring

Soil erosion will be measured in the field using a portable erosionometer. Fabrication of the erosionometer was recently completed; however, the field measuring stations have not been constructed. Ground conditions associated with above normal precipitation in late August and early

September prevented construction of the monitoring points. The erosion monitoring stations will be finalized in the fall as ground conditions permit (see Section 4).

# 3.5 Construction Feasibility and Costs

Costs associated with the construction and instrumentation of the test plots will be presented when the test plots are finalized and all costs are tabulated by Tyrone and Chino.

# 4.0 SCHEDULE FOR FUTURE WORK

The tailing test plots were constructed and seeded by the summer of 2005 according to the approved schedule, except for the 1.5 foot plot on Dam 3. Subsequent work involved the installation of the vadose zone monitoring instruments. Outstanding items that need to be finalized prior to completion of the test plots include:

- 1) Installation of the erosion monitoring points,
- 2) Fertilization of a section of the top surface plots,
- 3) Acquisition of the neutron probe certifications and licenses,
- 4) Neutron probe calibration, and
- 5) Cost summary.

The erosion transect location were approved in mid-August for the tailing test plots. Records rains in August and continued wet conditions in early September prevented the completion of the erosion monitoring points. These points will be constructed in the fall of 2006 when ground conditions are acceptable to avoid undo disturbance of the test plots. Fertilization of the plots will be completed in the early spring prior to the on-set of plant growth. Acquisition of a neutron probe license should be completed within the next 60 days. The probe will be calibrated within 120 days. Cost information will be finalized by Tyrone and Chino pending the completion of the erosion monitoring, but no later than December 15, 2006.

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**TABLES** 

Analysis	Source-Method
Saturated Paste pH	SLS 1954 - Method 2 and 21a
Electrical Conductivity	SLS 1954 - Method 3a and 4b
Saturation Percentage	SLS 1954 - Method 2, 3a, 27a, & 27b
Particle Size Distribution	Gee and Bauder (1986)
Rock Fragment	Dry sieve/gravimetric
Organic Carbon	Walkley-Black Method (Dichromate oxidation)
Nitrate	1:2 - Cd reduction (Agron 9, 1982; Method 10-2.3.2)
Phosphorous	Sodium Bicarbonate (Agron 9, 1982; Method 24-5.4)

# TABLE 1 CHEMICAL AND PHYSICAL CHARACTERIZATION METHODS

Analysis	Method							
Saturated hydraulic conductivity (K <sub>sat</sub> )	ASTM 2434-68							
Moisture retention curves	ASTM D2325-68 (94)							
Antecedent water content	Gardner (1986)							
van Genuchten parameters (RETC4)	van Genuchten et al. (1997)							
Rock fragment content	ASTM D2487-90							
Particle density	Blake and Hartge (1986)							

 TABLE 2
 SOIL-HYDRAULIC CHARACTERIZATION METHODS

		Sumfor	Surface Fact Desal Fact Efformaciones					
Test Pit Thickness			Cohhlo	Creared	Cabble	Ellerve	scence	Notos
ID	(inches)	Gravei			Cobble	Surface Foot	<b>Basal Foot</b>	INOLES
1 4 ;	27	500/	1004	250/	- 5:1 Slope	2 Cover	strong	
1AI 1B	27	<u> </u>	10%	33% 45%	-	violont	strong	
1D 1C	27	4J70 3004	20%	4,5 % 3,0%	-	slight	slight	
10 1D	20	50%	270 5%	25%	-	violent	slight	subgrade SC over CI
1D 1E	32	35%	5%	20%	-	strong	none	Subgrade SC Over CL
112	52	3370	ן <u>1</u> ד	Love Plot 2 .		3' Cover	none	
24	36	45%	10%	20%		strong	slight	
2A 2B	34	40%	15%	20%		violent	violent	
2D 2C	39	50%	15%	35%		violent	slight	
2C 2D	42	45%	5%	45%		violent	slight	
2D 2E	36	45%	20%	45%	5%	strong	strong	
20	50	4370	2070 T	est Plot 3 .	3.1 Slone	4' Cover	strong	
3Ai	50	60%	-	25%	-	violent	violent	
3B	49	35%	_	55%	12%	violent	violent	
3D 3C	54	40%	10%	35%	-	slight	none	
3D	52	35%	-	45%	-	strong	slight	
3E	47	40%	5%	30%	5%	strong	strong	
512	17	T	est Plot 4 -	18" Top S	urface Cov	ver (#3 Tailing	Dam)	
4A	19	30%	2%	20%	-	ND	ND	
4B	24	25%	2%	15%	-	ND	ND	
4C	21	25%	2%	7%	_	ND	ND	
4D	24	20%	>2%	10%	_	ND	ND	
4E	18	25%	5%	15%	_	ND	ND	
			Те	st Plot 5 - 2	2' Top Sur	face Cover		
5Ai	28	30%	-	15%		violent	violent	
5Bi	26	35%	-	20%	_	violent	violent	
5Ci	26	30%	-	20%	-	strong	strong	
5D	28	35%	-	20%	-	violent	strong	Mixing at Contact
5E	26	35%	-	15%	-	strong	violent	
_			Те	st Plot 6 - 3	8' Top Sur	face Cover		
6A	40	35%	-	30%	-	violent	violent	Mixing at Contact
6Bi	35	45%	-	25%	-	violent	slight	8
6Ci	42	45%	-	20%	-	violent	slight	
6D	36	37%	-	30%	-	violent	violent	Mixing at Contact
6E	34	45%	5%	40%	5%	violent	slight	U
			Те	st Plot 7 - 4	l' Top Sur	face Cover	U U	
7Ai	50	60%	-	25%	-	violent	violent	Mixing at Contact
7B	50	55%	-	30%	-	violent	strong	
7C	52	47%	-	40%	-	violent	strong	
7D	51	30%	-	12%	-	strong	slight	
7E	54	60%	-	20%	10%	violent	violent	

# TABLE 3 DESCRIPTIVE SUMMARY OF COVER MATERIALS

Notes:

% vol = percent by volume

ND = not determined

CHEMICAL AND PHYSICAL PROPERTIES OF COVER MATERIALS											
Sample ID	Partic	le Size Dist (%)	ribution	Rock Fragments	Saturation Percentage	USDA	Saturated Paste		Organic Carbon	mg/k	g
-	Sand	Silt	Clay	(Wt%)	(% water)	Texture"	pН	EC (dS/m)	(wt%)	Phosphorus	Nitrate
				3:1 Slope	2' Cover (Test	<b>Plot #1</b> )					
3XTP-1Ai, 0-12"	65	17	18	38	28.3	SL	7.6	0.81	0.03	3	<1
3XTP-1Ai, 13-25"	57	17	26	31	39.1	SCL	7.7	1.60	0.03	2	<1
3XTP-1B, 0-12"	63	15	22	33	32.7	SCL	7.8	1.47	0.06	3	<1
3XTP-1B, 13-25"	61	13	26	37	36.6	SCL	7.8	1.58	0.04	2	1
3XTP-1C, 0-12"	53	20	27	24	31.8	SCL	7.7	2.37	0.04	2	1
3XTP-1C, 11-23"	61	13	26	45	30.3	SCL	7.8	1.08	0.02	3	<1
3XTP-1D, 0-12"	76	9	15	35	23.5	SL	8.1	0.44	0.02	2	<1
3XTP-1D, 15-27"	65	10	25	24	30.9	SCL	7.4	2.94	0.05	5	<1
3XTP-1E, 0-12"	69	13	18	32	27.5	SL	7.8	0.81	< 0.02	2	<1
3XTP-1E, 25-37"	85	3	12	14	22.9	LS	7.8	1.26	< 0.02	2	<1
				3:1 Slope	3' Cover (Test	<b>Plot #2</b> )					
3XTP-2A, 0-12"	71	9	20	37	28.2	SCL	7.8	1.07	0.03	1	<1
3XTP-2A, 22-34"	51	21	28	34	43.0	SCL	7.7	1.39	0.12	3	<1
3XTP-2B, 0-12"	67	17	16	40	27.5	SL	7.8	1.01	< 0.02	3	<1
3XTP-2B, 18-30"	55	25	20	27	32.1	SCL	7.9	0.91	0.05	2	<1
3XTP-2C, 0-12"	63	18	19	35	29.0	SL	7.8	1.10	0.02	3	<1
3XTP-2C, 25-37"	67	13	20	31	32.1	SCL	7.8	2.75	0.06	3	1
3XTP-2D, 0-12"	69	15	16	29	28.7	SL	8.0	0.92	0.03	2	<1
3XTP-2D, 28-40"	79	6	15	42	25.6	SL	7.9	1.28	< 0.02	2	<1
3XTP-2E, 0-12"	67	13	20	36	33.4	SCL	7.8	1.42	0.11	3	1
3XTP-2E, 22-34"	63	15	22	40	35.2	SCL	7.8	1.70	0.13	2	2
				3:1 Slope	4' Cover (Test	<b>Plot #3</b> )					
3XTP-3Ai, 0-1'	77	10	13	30	24.8	SL	7.8	0.38	0.02	1	<1
3XTP-3Ai, 3-4'	54	23	23	24	33.2	SCL	7.8	0.90	< 0.02	2	<1
3XTP-3B, 0-1'	73	12	15	37	24.5	SL	7.8	0.47	< 0.02	2	<1
3XTP-3B, 36-48"	59	21	20	28	29.1	SCL	7.7	1.34	< 0.02	2	<1
3XTP-3C, 0-12"	67	14	19	36	29.8	SL	7.7	1.64	0.05	3	1
3XTP-3C, 40-52"	70	8	22	31	28.6	SCL	7.4	2.49	< 0.02	9	1
3XTP-3D, 0-12"	72	11	17	30	31.4	SL	7.7	1.32	0.06	2	1
3XTP-3D, 38-50"	59	15	26	34	37.4	SCL	7.9	0.96	0.18	2	5
3XTP-3E, 0-12"	73	10	17	35	24.9	SL	7.7	1.25	0.04	3	1
3XTP-3E, 33-45"	67	12	21	28	33.8	SCL	7.7	3.01	0.04	5	1

# TABLE 4 CHEMICAL AND PHYSICAL PROPERTIES OF COVER MATERIAI

September 2006

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CHEMICAL AND PHYSICAL PROPERTIES OF COVER MATERIALS											
Sample ID	Particle Size Distribution (%)			Rock Fragments	Saturation Percentage	USDA	Saturated Paste		Organic Carbon	mg/k	g
	Sand	Silt	Clay	(wt%)	(% water)	Texture"	pН	EC (dS/m)	(wt%)	Phosphorus	Nitrate
				Top Surface	e 18" Cover (To	est Plot #4)					
3TP4A-1, 0-9"	66	12	22	36	31.9	SCL	7.7	2.98	0.21	5	2
3TP4A-2, 15-24"	70	9	21	25	31.4	SCL	7.6	2.67	0.02	3	<1
3TP4B-1, 0-9"	69	10	21	26	29.8	SCL	7.6	2.73	0.06	2	1
3TP4B-2, 10-19"	71	9	20	30	29.1	SCL	7.7	3.37	< 0.02	2	<1
3TP4C-1, 0-9"	62	16	22	38	32.2	SCL	7.6	2.89	0.07	3	1
3TP4C-2, 12-21"	66	13	21	26	31.9	SCL	7.6	2.77	< 0.02	2	<1
3TP4D-1, 0-9"	60	16	24	35	33.9	SCL	7.7	2.79	0.06	2	1
3TP4D-2, 14-23"	62	15	23	21	34.1	SCL	7.7	1.54	< 0.02	3	<1
3TP4E-1, 0-9"	62	16	22	37	30.4	SCL	7.6	3.13	0.11	3	1
3TP4E-2, 9-18"	62	16	22	25	30.6	SCL	7.7	2.38	0.11	2	<1
				Top Surfac	e 2' Cover (Te	st Plot #5)					
3XTP-5Ai, 0-1'	73	10	17	30	24.9	SL	7.7	1.22	0.04	2	3
3XTP-5Ai, 14-26"	41	32	27	24	45.8	CL	7.7	1.26	0.27	2	3
3XTP-5Bi, 0-1'	59	20	21	35	33.3	SCL	7.8	1.23	< 0.02	2	<1
3XTP-5Bi, 1-2'	57	22	21	35	35.5	SCL	7.8	1.01	0.03	2	<1
3XTP-5Ci, 0-1'	75	10	15	37	26.9	SL	7.7	0.88	< 0.02	2	<1
3XTP-5Ci, 1-2'	37	38	25	27	41.5	L	7.8	1.16	0.03	2	<1
3XTP-5D, 0-1'	71	13	16	35	28.7	SL	7.7	1.03	0.13	3	1
3XTP-5D, 14-26"	57	20	23	32	34.2	SCL	7.8	1.38	0.02	2	1
3XTP-5E, 0-1'	79	8	13	34	25.1	SL	7.9	0.43	< 0.02	2	<1
3XTP-5E, 1-2'	59	20	21	24	36.7	SCL	7.7	1.64	0.02	2	<1
				Top Surfac	e 3' Cover (Te	st Plot #6)					
3XTP-6A, 0-1'	77	12	11	37	23.9	SL	7.8	0.58	< 0.02	2	<1
3XTP-6A, 26-38"	65	12	23	33	40.0	SCL	7.8	1.77	< 0.02	2	2
3XTP-6Bi, 0-1'	63	16	21	29	34.8	SCL	7.4	3.34	0.04	4	<1
3XTP-6Bi, 22-34"	65	16	19	33	31.8	SL	7.7	2.56	0.04	3	2
3XTP-6Ci, 0-1'	75	12	13	33	27.6	SL	7.6	1.10	0.17	3	1
3XTP-6Ci, 28-40"	67	14	19	33	34.5	SL	7.7	1.46	0.21	5	6
3XTP-6D, 0-1'	72	12	16	35	26.9	SL	7.9	0.37	0.02	3	<1
3XTP-6D, 2-3'	42	34	24	18	39.9	L	7.7	1.54	0.03	3	<1
3XTP-6E, 0-1'	66	11	23	42	36.0	SCL	7.7	1.87	0.03	2	<1
3XTP-6E, 20-32"	77	8	15	38	24.6	SL	7.8	1.03	0.02	2	<1

# TABLE 4 CHEMICAL AND PHYSICAL PROPERTIES OF COVER MATERIAI

September 2006

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CHEMICAL AND PHYSICAL PROPERTIES OF COVER MATERIALS											
Sample ID	Particle Size Distribution (%)			Rock Fragments	Saturation Percentage	USDA	Saturated Paste		Organic Carbon	mg/kg	
	Sand	Sand Silt Clay		(Wt%)	(% water)	Texture"	pН	EC (dS/m)	(wt%)	Phosphorus	Nitrate
				Top Surfac	e 4' Cover (Tes	st Plot #7)					
3XTP-7A, 0-1'	72	13	15	36	28.1	SL	7.9	0.71	< 0.02	2	<1
3XTP-7A, 3-4'	56	22	22	27	36.0	SCL	7.8	0.70	< 0.02	2	1
3XTP-7Ai, 0-1'	67	14	19	36	26.8	SL	7.8	0.61	0.04	2	<1
3XTP-7Ai, 3-4'	44	27	29	36	47.1	CL	7.7	1.69	0.12	2	5
3XTP-7C, 0-1'	76	10	14	35	24.2	SL	7.9	0.37	< 0.02	2	<1
3XTP-7C, 38-50"	82	5	13	33	23.3	SL	7.8	0.67	< 0.02	2	<1
3XTP-7D, 0-1'	72	11	17	34	27.1	SL	7.8	0.67	< 0.02	2	<1
3XTP-7D, 37-49"	54	25	21	27	31.0	SCL	7.7	0.92	0.03	2	<1
3XTP-7E, 0-1'	76	7	17	31	25.3	SL	7.9	0.49	< 0.02	2	<1
3XTP-7E, 40-52"	50	19	31	53	49.6	SCL	7.6	1.62	0.31	3	5

# TABLE 4 HEMICAL AND PHYSICAL PROPERTIES OF COVER MATERIAL

Notes:

September 2006

a) USDA Texture = texture class according to Soil Survey Division Staff (1993)

wt % = percent by weight

dS/m = deciSiemens per meter

mg/kg = milligrams per kilogram

053-2365

Sample ID	Depth	Particle S	Size Distrib	oution (%)	USDA Tortuno <sup>a</sup>	Satur	ated Paste	Saturation Percentage	
		Sand	Silt	Clay	Texture	pH EC (dS/m)		(% water)	
3X-1A	32-38"	74	20	6	SL	2.0	11.10	25.3	
3X-1A	0-2'	74	19	7	SL	1.9	12.80	24.6	
3X-1B	0-2'	76	16	8	SL	2.5	11.50	25.8	
3X-1A-L	23" BGS	73	17	10	SL	2.0	11.00	26.2	
3X-1A-L	40" BGS	74	17	9	SL	2.0	10.40	26.4	
3X-1A-L	0" TL	78	14	8	SL	2.4	8.89	27.6	
$3X-1A-L^1$	38" BL	76	15	9	SL	2.3	9.92	25.5	
3X-2A	0-2'	74	17	9	SL	2.2	10.70	25.0	
3X-2B	0-2'	72	16	12	SL	2.0	10.60	23.7	
3X-2C	0-2'	75	15	10	SL	1.7	11.90	26.4	
3X-2A-L	24" BGS	75	16	9	SL	2.2	11.00	24.3	
3X-2A-L	35" BGS	74	18	8	SL	2.1	10.90	24.9	
3X-2A-L	0" TL	74	17	9	SL	2.2	10.60	23.6	
$3X-2A-L^1$	6" BL	75	17	8	SL	2.5	9.49	25.3	
3X-2A-L	24" BTL	75	16	9	SL	2.1	10.90	24.9	
3X-3A	0-2'	70	20	10	SL	1.9	13.40	24.3	
3X-3B	0-2'	76	18	6	SL	3.5	7.89	28.0	
3X-5A	0-2'	48	33	19	L	2.1	13.20	29.7	
3X-5A	34-38"	53	30	17	SL	2.3	11.70	28.3	
3X-5A	53-57"	48	36	16	L	2.1	12.70	31.3	
3X-5B	0-2'	42	38	20	L	2.1	11.90	34.5	
3X-5B	34-37"	44	36	20	L	2.1	12.20	34.1	
3X-5B	54-57"	50	33	17	L	2.0	12.40	30.6	
3X-5B-L	24"	45	38	17	L	2.2	10.80	32.4	
3X-5B-L	40"	44	38	18	L	2.1	12.60	32.4	
3X-5B-L	60"	38	45	17	L	2.4	10.50	37.9	
3X-5B-L	90"	46	40	14	L	3.1	6.86	32.8	
3X-5C	0-2'	39	41	20	L	2.2	10.20	36.6	
3X-5C	0-2'	45	35	20	L	2.2	10.20	34.2	
3X-5C	34-38"	47	35	18	L	2.0	13.40	28.3	
3X-5C	52-58"	40	42	18	L	2.8	10.30	36.1	
3X-6A	0-2'	45	35	20	L	2.4	10.20	34.3	
3X-6B	0-2'	47	33	20	L	2.2	11.40	33.3	
3X-6B	39-45"	45	35	20	L	2.1	12.80	31.9	
3X-6C	0-24"	35	43	22	L	2.3	10.40	40.6	
3X-7A	0-20"	40	39	21	L	2.3	12.90	35.7	
3X-7B	0-2'	33	45	22	L	2.3	9.23	41.3	
4B-3DAM	0-24	38	42	20	L	2.4	11.00	35.0	
4C-3DAM	0-24	32	49	19	L	2.4	7.61	38.8	
4D-3DAM	0-24	38	42	20	L	2.1	9.88	35.5	

 TABLE 5

 CHEMICAL AND PHYSICAL PROPERTIES OF TAILING SAMPLES

a) USDA Texture = texture class according to Soil Survey Division Staff (1993)

BGS = below ground surface; BTL & BL = below top of lysimeter; TL = top of lysimeter

wt % = percent by weight

dS/m = deciSiemens per meter

TABLE 6 SOIL HYDRAULIC PROPERTIES OF COVER MATERIALS

Sample ID	Depth	Rock Fragments <sup>a</sup>	Rock Particle Fragments <sup>a</sup> Density		Saturated Hydraulic		Volumetric W (cm <sup>3</sup> /	van Genuchten Coefficients			
	Interval	(vol %)	$(g/cm^3)$	Conductivity (CIII/S)		$\theta_{r}$		$\theta_{s}$		α	N
				<2mm	whole soil	<2mm	whole soil	<2mm	whole soil	1/cm	dimensionless
3XTP-5Ai	0-1'	26.76	2.70	6.0E-02	3.5E-02	0.00	0.00	44.66	32.71	0.1628	1.2172
3XTP-5Ci	1-2'	25.74	2.69	8.4E-04	5.0E-04	0.00	0.00	47.88	35.56	0.0239	1.2122
3XTP-6Bi	0-1'	34.19	2.69	7.9E-02	3.9E-02	0.00	0.00	42.05	27.67	0.2031	1.1892
3XTP-6D	2-3'	26.64	2.67	6.8E-04	4.0E-04	0.00	0.00	45.67	33.50	0.0247	1.1984
3XTP-7Ai	0-1'	30.58	2.68	2.3E-02	1.3E-02	0.00	0.00	44.03	30.56	0.1296	1.2195
3XTP-7D	37-49"	26.98	2.65	2.9E-02	1.7E-02	0.79	0.58	46.00	33.58	0.0869	1.2603

a) Rock fragment contents based on laboratory samples.

 $\Theta_{\rm r}$  = residual water content

 $\Theta_s$  = saturated water content

whole soil = value corrected for lab gravel content

 $cm^3/cm^3 = cubic$  centimeter per cubic centimeter

 $g/cm^3 = grams$  per cubic centimeter cm/s = centimeters per second

mm = millimeters

vol % = percent by volume

		Saturated Hydraulic	Volumetric V	Water Content	van Genuchten Coefficients		
Sample ID	Particle Density	Conductivity	(cm	<sup>3</sup> /cm <sup>3</sup> )	α	N	
	(g/cm)	(cm/s)	$\theta_{r}$	$\theta_{\rm s}$	1/cm	dimensionless	
3X-5B (3-9)	2.78	1.3E-05	0.0000	0.4412	0.0168	1.2207	
3X-5B (52-58)	2.81	7.1E-06	0.0000	0.4151	0.0013	1.3101	
3X-4A (3-9)	2.77	1.5E-04	0.0331	0.4550	0.0201	1.4820	
3X-4A (58-64)	2.80	1.6E-07	0.0000	0.3439	0.0001	2.1662	
3X-5C (2-8)	2.73	1.3E-04	0.0000	0.4417	0.0203	1.2090	
3X-5C (56-62)	2.78	2.9E-08	0.0000	0.3440	0.0002	1.6881	
3X-6A (2-8)	2.74	7.0E-07	0.0000	0.4824	0.0016	1.3784	
3X-6A (39-45)	2.76	4.4E-07	0.0000	0.3961	0.0036	1.3059	
3X-7A (26-32)	2.75	5.8E-07	0.0095	0.3659	0.0025	1.4615	
TP-1-1A (3-9)	2.73	3.9E-03	0.0369	0.4496	0.0317	1.5552	
TP-1-1A (52-58)	2.72	3.0E-03	0.0118	0.4663	0.0805	1.3216	
2A (1-7)	2.76	4.5E-03	0.0226	0.4538	0.0253	1.4785	
2A (40-46)	2.73	9.8E-04	0.0395	0.4393	0.0227	1.6113	
3A (9-15)	2.75	1.5E-06	0.0000	0.3232	0.0251	1.2117	
3A (28-34)	2.75	4.5E-05	0.0000	0.4574	0.0302	1.2290	

 TABLE 7

 SOIL HYDRAULIC PROPERTIES OF TAILING SAMPLES

 $\Theta_r$  = residual water content

 $\Theta_{\rm s}$  = saturated water content

 $g/cm^3 = grams per cubic centimeter$ 

cm/s = centimeters per second

 $cm^3/cm^3 = cubic$  centimeter per cubic centimeter

		PLS
Common Name	Scientific Name	lbs. per acre
Blue grama	Bouteloua gracilis	0.25
Sideoats grama	Bouteloua curtipendula	1.25
Galleta	Hilaria jamesii	0.40
Green sprangletop	Leptochloa dubia	0.15
Sand dropseed	Sporobolus cryptandrus	0.05
Bottlebrush squirreltail	Elymus elymoides	1.25
Indian ricegrass	Oryzopsis hymenoides	1.75
Streambank wheatgrass	Agropyron dastachyum v. riparium	1.50
Rubber rabbitbrush	Chrysothamnus nauseosus	0.15
Mountain mahogany	Cercocarpus montanus	1.00
Winterfat	Certoides lanata	0.60
White prairie clover	Dalea candidum	0.20
Blue flax	Linum lewisii	0.15
Prairie coneflower	Ratibida columnifera	0.20
Total		8.90

# TABLE 8RECLAMATION SEED MIX AND RATES

Notes:

PLS = pure live seed

18" Cover

(#3 Dam)

9978

9979

9976

38.0

20.0

10.0

			Instrumentation/Monitoring Devices										
Test Plot Slope/Cover Depth (feet)	ТР	Instrumentation	Heat Dissipation Sensors (HDS)		Frequenc Reflectome	y Domain eters (FDR)	Electrical Sensor	Resistance s (ERS)	Pressure Transducer		Installation	Data	
	Depth (feet)	No.	Nest	Serial Number	Installation Depth (inches)	Serial Number	Installation Depth (inches)	Serial Number	Installation Depth (inches)	Serial Number	Installation Depth (inches)	Date	Logger Number
Top Surface	5	5A	10000	19			148562	9.50			7/8/2005	CR-23X	
2' Cover			9984	29.3									
			9995	59.5									
			9986	78.7									
		5B	9974	19.5	163/049	17	148589	9.75	2104244	221	7/8/2005		
			9973	29.5	163/020	27							
			9971	59	163/040	59							
			9972	79	163/051	70							
		5C	9964	19.5			148590	9.80			7/8/2005		
			9965	29.5									
			9963	59.23									
			9966	75									
Top Surface,	6	6A	9970	26.5			148561	9.80			8/8/2005	CR-23X	
3' Cover			9967	40									
			9969	59									
			9968	78.8									
		6B	9987	29.5			148545	9.80			8/9/2005		
			9993	39.5									
			9985	59									
			9992	78									
		6C	9960	29.5	163/034	28	148563	9.80	2104242	212	8/8/2005		
			9959	40	163/046	40							
			9961	59.1	163/037	59.1							
			9962	77.5	163/018	78							
Top Surface	7	7A	9999	39.4							8/9/2005		
4' Cover			9997	59.1									
			9998	70.9									
			9996	79.5									
3:1 Slope	1	1A	9980	19.7	163/024	19			2104243	216	8/9/2005	CR-23X	
2' Cover			9983	29.5	163/022	29.5							
			9981	59	163/043	57.5							
			9982	79	163/027	77							
3:1 Slope	2	2A	10003	29.5	163/039	29.5			2104241	237	8/9/2005		
3' Cover			10001	39	163/031	39.5							
			9994	59.1	163/042	59							
			10002	79.5	163/033	79							
3:1 Slope	3	3A	9988	39							8/10/2005	CR-23X	
4' Cover			9990	59									
			9991	70									
			9989	78									
Top Surface	4	4A	9977	78.5							8/22/2006	CR-1000	
18" Cover			9975	58.0									

#### TABLE 9 VADOSE ZONE INSTRUMENTATION SUMMARY

Sensor	van	Genucht	en Parame	eters	T* at Each Calibration Point						
Serial			delt	a T	764850	1.0198	1019.8	3059.4	13257.4	15297	
Number	α	N	dry	wet			С	cm			
9959	0.00360	1.5746	2.704	0.730	0	1	0.4549	0.2442	0.1165	_	
9960	0.00431	1.5358	2.882	0.763	0	1	0.4389	0.2430	0.1241	-	
9961	0.00327	1.6600	2.818	0.771	0	1	0.4304	0.2120	0.0889	-	
9962	0.00362	1.5841	2.895	0.779	0	1	0.4494	0.2344	0.1153	-	
9963	0.00340	1.6561	2.800	0.738	0	1	0.4229	0.2095	0.0873	-	
9964	0.00784	1.4681	2.700	0.771	0	1	0.3660	0.2395	0.1089	-	
9965	0.00420	1.5762	2.812	0.770	0	1	0.4177	0.2262	0.1028	-	
9966	0.00370	1.5948	2.998	0.763	0	1	0.4385	0.2237	0.1110	-	
9967	0.00361	1.6146	2.923	0.755	0	1	0.4322	0.2186	0.1024	-	
9968	0.00340	1.5790	2.858	0.779	0	1	0.4675	0.2443	0.1231	-	
9969	0.00390	1.5578	2.818	0.754	0	1	0.4472	0.2422	0.1202	-	
9970	0.00394	1.5609	2.862	0.754	0	1	0.4431	0.2381	0.1186	-	
9971	0.00357	1.5674	2.872	0.779	0	1	0.4630	0.2451	0.1247	-	
9972	0.00397	1.5388	2.895	0.770	0	1	0.4555	0.2489	0.1304	-	
9973	0.00369	1.5245	2.909	0.738	0	1	0.4781	0.2759	0.1368	-	
9974	0.00324	1.6234	2.788	0.730	0	1	0.4534	0.2284	0.1059	-	
9975	0.00453	1.5142	2.869	0.738	0	1	0.4425	0.2506	0.1323	-	
9976	0.00340	1.6147	2.630	0.787	0	1	0.4438	0.2349	0.0982	-	
9977	0.00527	1.4894	2.663	0.779	0	1	0.4246	0.2606	0.1269	-	
9978	0.00730	1.4536	2.739	0.763	0	1	0.3902	0.2535	0.1260	-	
9979	0.00441	1.4956	2.637	0.713	0	1	0.4584	0.2718	0.1409	-	
9980	0.00361	1.6275	3.315	0.787	0	1	0.4272	0.2045	0.1048	-	
9981	0.00381	1.5587	2.803	0.754	0	1	0.4519	0.2445	0.1215	-	
9982	0.00514	1.5438	3.074	0.754	0	1	0.3970	0.2172	0.1086	-	
9983	0.00431	1.5170	2.851	0.713	0	1	0.4518	0.2535	0.1356	-	
9984	0.00634	1.4600	2.826	0.705	0	1	0.4130	0.2560	0.1372	-	
9985	0.00432	1.5055	2.915	0.745	0	1	0.4594	0.2594	0.1433	-	
9986	0.00644	1.4692	2.828	0.754	0	1	0.4026	0.2498	0.1283	-	
9987	0.00374	1.6000	3.036	0.754	0	1	0.4334	0.2191	0.1087	-	
9988	0.01080	1.4329	2.654	0.729	0	1	0.3470	0.2265	-	0.1138	
9989	0.00460	1.5831	2.685	0.696	0	1	0.4012	0.1986	-	0.1016	
9990	0.00450	1.6276	2.917	0.705	0	1	0.3843	0.1722	-	0.1035	
9991	0.00420	1.5984	2.725	0.688	0	1	0.4109	0.2052	-	0.0972	
9992	0.00430	1.5069	2.732	0.770	0	1	0.4567	0.2655	0.1371	-	
9993	0.00374	1.5544	2.828	0.721	0	1	0.4594	0.2468	0.1272	-	
9994	0.00382	1.5642	2.985	0.738	0	1	0.4495	0.2354	0.1233	-	
9995	0.00530	1.3739	2.711	0.681	0	1	0.3862	0.2010	0.0820	-	
9996	0.00580	1.4615	2.499	0.647	0	1	0.4357	0.2451	-	0.1496	
9997/	0.00460	1.5968	2.794	0.713	0	1	0.3840	0.2023	-	0.0822	
9998	0.00340	1.6938	2.544	0.688	0	1	0.4014	0.2020	-	0.0582	
9999	0.00390	1.6301	2.776	0.696	0	1	0.4111	0.1899	-	0.1025	
10000	0.00430	1.3701	2.715	0.689	0	1	0.4023	0.2078	0.0886	-	
10001	0.00520	1.4003	2.643	0.714	0	1	0.4215	0.2312	0.1006	-	
10002	0.00420	1.4571	2.677	0.705	0	1	0.4092	0.2231	0.0953	-	
10003	0.00420	1.4012	2.637	0.705	0	1	0.4099	0.2324	0.1020	-	

 TABLE 10

 HDS CHARACTERIZATION AND CALIBRATION DATA

delta T = temperture differnce before and immediately after heating period

 $T^* =$  normalized delta T (Flint et al., 2002)

<b>Depth (feet Density (lbs/ft<sup>3</sup>)</b>			Percent of	Water cont	Percent of						
below ground surface)	In-situ	Backfilled	initial value	In-situ	Backfilled	initial value					
		LYSIMI	ETER 1A - 3:1	Slope 2' Cover	•						
0	80.5	86.3	107.3	6.2	ND	ND					
2	78.0	67.3	86.3	7.8	7.2	92					
4	74.4	65.1	87.5	6.3	5.4	87					
6	66.0	63.7	96.5	7.0	3.8	54					
8.5	56.6	85.1	150.4	7.1	4.4	63					
		LYSIMI	ETER 2A - 3:1	Slope 3' Cover	•						
0	95.7	94.4	98.6	8.4	7.2	86					
2	69.5	83.7	120.5	8.0	5.9	74					
4	4 80.2 87		108.9	7.7	6.7	87					
6	6 76.3 62.5		82.0	6.7	5.5	82					
8	58.9	64.2	109.1	7.1	7.5	106					
		LYSIMET	TER 5B - 2' To	p Surface Cov	er						
0	92.9	96.0	103.4	18.0	18.1	100					
2	80.0	90.4	113.0	19.1	17.0	89					
4	82.5	91.4	110.8	19.8	15.0	76					
7	83.8	93.7	111.8	23.7	16.7	70					
9.5	81.8	84.4	103.1	23.2	15.6	67					
	LYSIMETER 6C - 3' Top Surface Cover										
0	87.0	91.3	104.9	19.3	22.3	115					
2	83.5	87.6	104.8	20.3	19.0	93					
4	88.1	91.0	103.3	18.0	15.3	85					
6	87.4	93.9	107.5	8.2	10.7	131					
8	94.4	92.5	98.0	14.9	14.8	99					

 TABLE 11

 IN-SITU AND BACKFILL DENSITIES FOR THE LYSIMETER INSTALLATIONS

 $lbs/ft^3 = pounds per cubic foot$ 

wt % = percent by weight
FIGURES













Drawing file: FIGURE06.dwg Sep 29, 2006 - 11:37am

PLATES







# APPENDIX A

# CHEMICAL AND PHYSICAL LABORATORY DATA COVER MATERIALS



# ANALYTICAL SUMMARY REPORT

November 02, 2005

Lewis Munk Golder Associates Inc 4910 Alameda Blvd NE, Ste A Albuquerque, NM 87113

Workorder No.: B05100810 Project Name: Tailing Test Plots Quote ID: B856 - 40 Soil/Rock Samples

Energy Laboratories Inc received the following 60 samples from Golder Associates Inc on 10/13/2005 for analysis.

Sample ID	Client Sample ID	Collect Date	<b>Receive Date</b>	Matrix	Test
B05100810-001	3XTP-1Ai, 0-12"	06/13/05 0:00	10/13/05	Soil	Coarse Fragments Conductivity Nitrate as N, KCL Extract Organic Carbon-Walkley/Black pH, Saturated Paste Phosphorus-Olsen Particle Size Analysis Saturation Percentage Texture
B05100810-002	3XTP-1Ai, 13-25"	06/13/05 0:00	10/13/05	Soil	Same As Above
B05100810-003	3XTP-1B, 0-12"	06/14/05 0:00	10/13/05	Soil	Same As Above
B05100810-004	3XTP-1B, 13-25"	06/14/05 0:00	10/13/05	Soil	Same As Above
B05100810-005	3XTP-1C, 0-12"	06/17/05 0:00	10/13/05	Soil	Same As Above
B05100810-006	3XTP-1C, 11-23"	06/17/05 0:00	10/13/05	Soil	Same As Above
B05100810-007	3XTP-1D, 0-12"	06/14/05 0:00	10/13/05	Soil	Same As Above
B05100810-008	3XTP-1D, 15-27"	06/14/05 0:00	10/13/05	Soil	Same As Above
B05100810-009	3XTP-1E, 0-12"	06/17/05 0:00	10/13/05	Soil	Same As Above
B05100810-010	3XTP-1-E, 25-37"	06/17/05 0:00	10/13/05	Soil	Same As Above
B05100810-011	3XTP-2A, 0-12"	06/17/05 0:00	10/13/05	Soil	Same As Above
B05100810-012	3XTP-2A, 22-34"	06/17/05 0:00	10/13/05	Soil	Same As Above
B05100810-013	3XTP-2B, 0-12"	06/13/05 0:00	10/13/05	Soil	Same As Above
B05100810-014	3XTP-2B, 18-30"	06/13/05 0:00	10/13/05	Soil	Same As Above
B05100810-015	3XTP-2C, 0-12"	06/13/05 0:00	10/13/05	Soil	Same As Above
B05100810-016	3XTP-2C, 25-37"	06/13/05 0:00	10/13/05	Soil	Same As Above
B05100810-017	3XTP-2D, 0-12"	06/17/05 0:00	10/13/05	Soil	Same As Above
B05100810-018	3XTP-2D, 28-40"	06/17/05 0:00	10/13/05	Soil	Same As Above
B05100810-019	3XTP-2E, 0-12"	06/17/05 0:00	10/13/05	Soil	Same As Above



B05100810-020	3XTP-2E, 22-34"	06/17/05 0:00	10/13/05	Soil	Same As Above
B05100810-021	3XTP-3Ai, 0-1'	06/13/05 0:00	10/13/05	Soil	Same As Above
B05100810-022	3XTP-3Ai, 3-4'	06/13/05 0:00	10/13/05	Soil	Same As Above
B05100810-023	3XTP-3B, 0-1'	06/14/05 0:00	10/13/05	Soil	Same As Above
B05100810-024	3XTP-3B, 36-48"	06/14/05 0:00	10/13/05	Soil	Same As Above
B05100810-025	3XTP-3C, 0-12"	06/17/05 0:00	10/13/05	Soil	Same As Above
B05100810-026	3XTP-3C, 40-52"	06/17/05 0:00	10/13/05	Soil	Same As Above
B05100810-027	3XTP-3D, 0-12"	06/17/05 0:00	10/13/05	Soil	Same As Above
B05100810-028	3XTP-3D, 38-50"	06/17/05 0:00	10/13/05	Soil	Same As Above
B05100810-029	3XTP-3E, 0-12"	06/17/05 0:00	10/13/05	Soil	Same As Above
B05100810-030	3XTP-3E, 33-45"	06/17/05 0:00	10/13/05	Soil	Same As Above
B05100810-031	3XTP-5Ai, 0-1'	06/08/05 0:00	10/13/05	Soil	Same As Above
B05100810-032	3XTP-5Ai, 14-26"	06/08/05 0:00	10/13/05	Soil	Same As Above
B05100810-033	3XTP-5Bi, 0-1'	06/08/05 0:00	10/13/05	Soil	Same As Above
B05100810-034	3XTP-5Bi, 1-2'	06/08/05 0:00	10/13/05	Soil	Same As Above
B05100810-035	3XTP-5Ci, 0-1'	06/08/05 0:00	10/13/05	Soil	Same As Above
B05100810-036	3XTP-5Ci, 1-2'	06/08/05 0:00	10/13/05	Soil	Same As Above
B05100810-037	3XTP-5D, 0-1'	06/08/05 0:00	10/13/05	Soil	Same As Above
B05100810-038	3XTP-5D, 14-26"	06/08/05 0:00	10/13/05	Soil	Same As Above
B05100810-039	3XTP-5E, 0-1'	06/08/05 0:00	10/13/05	Soil	Same As Above
B05100810-040	3XTP-5E, 1-2'	06/08/05 0:00	10/13/05	Soil	Same As Above
B05100810-041	3XTP-6A, 0-1'	06/07/05 0:00	10/13/05	Soil	Same As Above
B05100810-042	3XTP-6A, 26-38"	06/07/05 0:00	10/13/05	Soil	Same As Above
B05100810-043	3XTP-6Bi, 0-1'	06/07/05 0:00	10/13/05	Soil	Same As Above
B05100810-044	3XTP-6Bi, 22-34"	06/07/05 0:00	10/13/05	Soil	Same As Above
B05100810-045	3XTP-6Ci, 0-1'	06/07/05 0:00	10/13/05	Soil	Same As Above
B05100810-046	3XTP-6Ci, 28-40"	06/07/05 0:00	10/13/05	Soil	Same As Above
B05100810-047	3XTP-6D, 0-1'	06/07/05 0:00	10/13/05	Soil	Same As Above
B05100810-048	3XTP-6D, 2-3'	06/07/05 0:00	10/13/05	Soil	Same As Above
B05100810-049	3XTP-6E, 0-1'	06/07/05 0:00	10/13/05	Soil	Same As Above
B05100810-050	3XTP-6E, 20-32"	06/07/05 0:00	10/13/05	Soil	Same As Above
B05100810-051	3XTP-7A, 0-1'	06/07/05 0:00	10/13/05	Soil	Same As Above
B05100810-052	3XTP-7A, 3-4'	06/07/05 0:00	10/13/05	Soil	Same As Above
B05100810-053	3XTP-7Ai, 0-1'	06/07/05 0:00	10/13/05	Soil	Same As Above
B05100810-054	3XTP-7Ai, 3-4'	06/07/05 0:00	10/13/05	Soil	Same As Above



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B05100810-055	3XTP-7C, 0-1'	06/07/05 0:00	10/13/05	Soil	Same As Above
B05100810-056	3XTP-7C, 38-50"	06/07/05 0:00	10/13/05	Soil	Same As Above
B05100810-057	3XTP-7D, 0-1'	06/07/05 0:00	10/13/05	Soil	Same As Above
B05100810-058	3XTP-7D, 37-49"	06/07/05 0:00	10/13/05	Soil	Same As Above
B05100810-059	3XTP-7E, 0-1'	06/07/05 0:00	10/13/05	Soil	Same As Above
B05100810-060	3XTP-7E, 40-52"	06/07/05 0:00	10/13/05	Soil	Same As Above

There were no problems with the analyses and all data for associated QC met EPA or laboratory specifications except if noted in report comments or the Case Narrative.

If you have any questions regarding these tests results, please call.



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-001 Client Sample ID: 3XTP-1Ai, 0-12" 
 Report Date:
 11/02/05

 Collection Date:
 06/13/05

 Date Received:
 10/13/05

 Matrix:
 Soil

	MCL/								
Analyses	Result	Units	Qual	RL Q	CL Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS									
Coarse Fragments	38	wt%		2	ASA15-5	10/25/05 15:56 / srm			
Sand	65	%		1	ASA15-5	10/31/05 08:36 / srm			
Silt	17	%		1	ASA15-5	10/31/05 08:36 / srm			
Clay	18	%		1	ASA15-5	10/31/05 08:36 / srm			
Texture	SL				ASA15-5	10/31/05 08:36 / srm			
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y	)								
SATURATED PASTE									
pH, sat. paste	7.60	s.u.		0.10	ASAM10-3.2	10/31/05 08:36 / srm			
Conductivity, sat. paste	0.81	mmhos/cm		0.01	ASA10-3	10/31/05 08:36 / srm			
Saturation	28.3	%		0.1	USDA27a	10/31/05 08:36 / srm			
CHEMICAL CHARACTERISTICS									
Organic Carbon	0.03	wt%		0.02	ASA29-3	11/01/05 12:43 / srm			
Phosphorus, Olsen	3	mg/kg		1	ASA24-5	10/28/05 13:47 / srm			
Nitrate as N, KCL Extract	ND	mg/kg		1	ASA33-8.1	10/27/05 10:53 / srm			



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-002 Client Sample ID: 3XTP-1Ai, 13-25" **Report Date:** 11/02/05 **Collection Date:** 06/13/05 **Date Received:** 10/13/05 **Matrix:** Soil

	MCL/								
Analyses	Result	Units	Qual	RL	QCL	Method	Analysis Date / By		
PHYSICAL CHARACTERISTICS									
Coarse Fragments	31	wt%		2		ASA15-5	10/25/05 15:56 / srm		
Sand	57	%		1		ASA15-5	10/31/05 08:36 / srm		
Silt	17	%		1		ASA15-5	10/31/05 08:36 / srm		
Clay	26	%		1		ASA15-5	10/31/05 08:36 / srm		
Texture	SCL					ASA15-5	10/31/05 08:36 / srm		
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)									
SATURATED PASTE									
pH, sat. paste	7.70	s u		0.10		ASAM10-3.2	10/31/05 08:36 / srm		
Conductivity, sat. paste	1.60	mmhos/cm		0.01		ASA10-3	10/31/05 08:36 / srm		
Saturation	39.1	%		0.1		USDA27a	10/31/05 08:36 / srm		
CHEMICAL CHARACTERISTICS									
Organic Carbon	0.03	wt%		0.02		ASA29-3	11/01/05 12:43 / srm		
Phosphorus, Olsen	2	mg/kg		1		ASA24-5	10/28/05 13:48 / srm		
Nitrate as N, KCL Extract	ND	mg/kg		1		ASA33-8.1	10/27/05 10:54 / srm		



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-003 Client Sample ID: 3XTP-1B, 0-12" 
 Report Date:
 11/02/05

 Collection Date:
 06/14/05

 Date Received:
 10/13/05

 Matrix:
 Soil

	MCL/									
Analyses	Result	Units	Qual	RL	QCL	Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS										
Coarse Fragments	33	wt%		2		ASA15-5	10/25/05 15:56 / srm			
Sand	63	%		1		ASA15-5	10/31/05 08:36 / srm			
Silt	15	%		1		ASA15-5	10/31/05 08:36 / srm			
Clay	22	%		1		ASA15-5	10/31/05 08:36 / srm			
Texture	SCL					ASA15-5	10/31/05 08:36 / srm			
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)										
SATURATED PASTE										
pH, sat. paste	7.80	s.u		0.10		ASAM10-3.2	10/31/05 08:36 / srm			
Conductivity, sat. paste	1.47	mmhos/cm		0.01		ASA10-3	10/31/05 08:36 / srm			
Saturation	32.7	%		0.1		USDA27a	10/31/05 08:36 / srm			
CHEMICAL CHARACTERISTICS										
Organic Carbon	0.06	wt%		0.02		ASA29-3	11/01/05 12:43 / srm			
Phosphorus, Olsen	3	mg/kg		1		ASA24-5	10/28/05 13:50 / srm			
Nitrate as N, KCL Extract	ND	mg/kg		1		ASA33-8.1	10/27/05 10:54 / srm			

ReportRL - ArDefinitions:OCL - C

RL - Analyte reporting limit. QCL - Quality control limit.



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-004 Client Sample ID: 3XTP-1B, 13-25"

 Report Date:
 11/02/05

 Collection Date:
 06/14/05

 Date Received:
 10/13/05

 Matrix:
 Soil

	MCL/									
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By				
PHYSICAL CHARACTERISTICS										
Coarse Fragments	37	wt%		2	ASA15-5	10/25/05 15:56 / srm				
Sand	61	%		1	ASA15-5	10/31/05 08:36 / srm				
Silt	13	%		1	ASA15-5	10/31/05 08:36 / srm				
Clay	26	%		1	ASA15-5	10/31/05 08:36 / srm				
Texture	SCL				ASA15-5	10/31/05 08:36 / srm				
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)										
SATURATED PASTE										
pH, sat. paste	7.80	s.u.		0.10	ASAM10-3.2	10/31/05 08:36 / srm				
Conductivity, sat. paste	1.58	mmhos/cm		0.01	ASA10-3	10/31/05 08:36 / srm				
Saturation	36.6	%		0.1	USDA27a	10/31/05 08:36 / srm				
CHEMICAL CHARACTERISTICS										
Organic Carbon	0.04	wt%		0.02	ASA29-3	11/01/05 12:43 / srm				
Phosphorus, Olsen	2	mg/kg		1	ASA24-5	10/28/05 13:51 / srm				
Nitrate as N, KCL Extract	1	mg/kg		1	ASA33-8.1	10/27/05 10:55 / srm				

ReportRL - Analyte reporting limit.Definitions:QCL - Quality control limit.

MCL - Maximum contaminant level. ND - Not detected at the reporting limit.



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-005 Client Sample ID: 3XTP-1C, 0-12" **Report Date:** 11/02/05 **Collection Date:** 06/17/05 **Date Received:** 10/13/05 **Matrix:** Soil

	MCL/								
Analyses	Result	Units	Qual	RL Q	CL Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS									
Coarse Fragments	24	wt%		2	ASA15-5	10/25/05 15:56 / srm			
Sand	53	%		1	ASA15-5	10/31/05 08:36 / srm			
Silt	20	%		1	ASA15-5	10/31/05 08:36 / srm			
Clay	27	%		1	ASA15-5	10/31/05 08:36 / srm			
Texture	SCL				ASA15-5	10/31/05 08:36 / srm			
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)									
SATURATED PASTE									
pH, sat. paste	7.70	s.u.		0.10	ASAM10-3.2	10/31/05 08:36 / srm			
Conductivity, sat. paste	2.37	mmhos/cm		0.01	ASA10-3	10/31/05 08:36 / srm			
Saturation	31.8	%		0.1	USDA27a	10/31/05 08:36 / srm			
CHEMICAL CHARACTERISTICS									
Organic Carbon	0.04	wt%		0.02	ASA29-3	11/01/05 12:43 / srm			
Phosphorus, Olsen	2	mg/kg		1	ASA24-5	10/28/05 13:52 / srm			
Nitrate as N, KCL Extract	1	mg/kg		1	ASA33-8.1	10/27/05 10:56 / srm			



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-006 Client Sample ID: 3XTP-1C, 11-23" **Report Date:** 11/02/05 **Collection Date:** 06/17/05 **Date Received:** 10/13/05 **Matrix:** Soil

	MCL/								
Analyses	Result	Units	Qual	RL QCI	_ Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS									
Coarse Fragments	45	wt%		2	ASA15-5	10/25/05 15:56 / srm			
Sand	61	%		1	ASA15-5	10/31/05 08:36 / srm			
Silt	13	%		1	ASA15-5	10/31/05 08:36 / srm			
Clay	26	%		1	ASA15-5	10/31/05 08:36 / srm			
Texture	SCL				ASA15-5	10/31/05 08:36 / srm			
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)									
SATURATED PASTE									
pH, sat. paste	7.80	s.u.		0.10	ASAM10-3.2	10/31/05 08:36 / srm			
Conductivity, sat. paste	1.08	mmhos/cm		0.01	ASA10-3	10/31/05 08:36 / srm			
Saturation	30.3	%		0.1	USDA27a	10/31/05 08:36 / srm			
CHEMICAL CHARACTERISTICS									
Organic Carbon	0.02	wt%		0.02	ASA29-3	11/01/05 12:43 / srm			
Phosphorus, Olsen	3	mg/kg		1	ASA24-5	10/28/05 13:54 / srm			
Nitrate as N, KCL Extract	ND	mg/kg		1	ASA33-8.1	10/27/05 10:56 / srm			



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-007 Client Sample ID: 3XTP-1D, 0-12" **Report Date:** 11/02/05 **Collection Date:** 06/14/05 **Date Received:** 10/13/05 **Matrix:** Soil

	MCL/								
Analyses	Result	Units	Qual	RL	QCL	Method	Analysis Date / By		
PHYSICAL CHARACTERISTICS									
Coarse Fragments	35	wt%		2		ASA15-5	10/25/05 15:56 / srm		
Sand	76	%		1		ASA15-5	10/31/05 08:36 / srm		
Silt	9	%		1		ASA15-5	10/31/05 08:36 / srm		
Clay	15	%		1		ASA15-5	10/31/05 08:36 / srm		
Texture	SL					ASA15-5	10/31/05 08:36 / srm		
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)									
SATURATED PASTE									
pH, sat. paste	8.10	su		0.10		ASAM10-3.2	10/31/05 08:36 / srm		
Conductivity, sat. paste	0.44	mmhos/ <b>cm</b>		0.01		ASA10-3	10/31/05 08:36 / srm		
Saturation	23.5	%		0.1		USDA27a	10/31/05 08:36 / srm		
CHEMICAL CHARACTERISTICS									
Organic Carbon	0.02	wt%		0.02		ASA29-3	11/01/05 12:43 / srm		
Phosphorus, Olsen	2	mg/kg		1		ASA24-5	10/28/05 13:55 / srm		
Nitrate as N, KCL Extract	ND	mg/kg		1		ASA33-8.1	10/27/05 10 <sup>.</sup> 57 / srm		



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-008 Client Sample ID: 3XTP-1D, 15-27" 
 Report Date:
 11/02/05

 Collection Date:
 06/14/05

 Date Received:
 10/13/05

 Matrix:
 Soil

	MCL/								
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS									
Coarse Fragments	24	wt%		2	ASA15-5	10/25/05 15:56 / srm			
Sand	65	%		1	ASA15-5	10/31/05 08:36 / srm			
Silt	10	%		1	ASA15-5	10/31/05 08:36 / srm			
Clay	25	%		1	ASA15-5	10/31/05 08:36 / srm			
Texture	SCL				ASA15-5	10/31/05 08:36 / srm			
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)									
SATURATED PASTE									
pH, sat. paste	7.40	s.u.		0.10	ASAM10-3.2	10/31/05 08:36 / srm			
Conductivity, sat. paste	2.94	mmhos/cm		0.01	ASA10-3	10/31/05 08:36 / srm			
Saturation	30.9	%		0.1	USDA27a	10/31/05 08:36 / srm			
CHEMICAL CHARACTERISTICS									
Organic Carbon	0.05	wt%		0.02	ASA29-3	11/01/05 12:43 / srm			
Phosphorus, Olsen	5	mg/kg		1	ASA24-5	10/28/05 13:57 / srm			
Nitrate as N, KCL Extract	ND	mg/kg		1	ASA33-8.1	10/27/05 10:58 / srm			

Report Definitions: RL - Analyte reporting limit. QCL - Quality control limit.



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-009 Client Sample ID: 3XTP-1E, 0-12" **Report Date:** 11/02/05 **Collection Date:** 06/17/05 **Date Received:** 10/13/05 **Matrix:** Soil

	MCL/								
Analyses	Result	Units	Qual	RL	QCL	Method	Analysis Date / By		
PHYSICAL CHARACTERISTICS									
Coarse Fragments	32	wt%		2		ASA15-5	10/25/05 15:56 / srm		
Sand	69	%		1		ASA15-5	10/31/05 08:36 / srm		
Silt	13	%		1		ASA15-5	10/31/05 08:36 / srm		
Clay	18	%		1		ASA15-5	10/31/05 08:36 / srm		
Texture	SL					ASA15-5	10/31/05 08:36 / srm		
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)	1								
SATURATED PASTE									
pH, sat. paste	7.80	s.u.		0.10		ASAM10-3.2	10/31/05 08:36 / srm		
Conductivity, sat. paste	0.81	mmhos/cm		0.01		ASA10-3	10/31/05 08:36 / srm		
Saturation	27.5	%		0.1		USDA27a	10/31/05 08:36 / srm		
CHEMICAL CHARACTERISTICS									
Organic Carbon	ND	wt%		0.02		ASA29-3	11/01/05 12:43 / srm		
Phosphorus, Olsen	2	mg/kg		1		ASA24-5	10/28/05 13:58 / srm		
Nitrate as N, KCL Extract	ND	mg/kg		1		ASA33-8.1	10/27/05 10:59 / srm		



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-010 Client Sample ID: 3XTP-1-E, 25-37" 
 Report Date:
 11/02/05

 Collection Date:
 06/17/05

 Date Received:
 10/13/05

 Matrix:
 Soil

		MCL/									
Analyses	Result	Units	Qual	RL Q	QCL_	Method	Analysis Date / By				
PHYSICAL CHARACTERISTICS											
Coarse Fragments	14	wt%		2		ASA15-5	10/25/05 15:56 / srm				
Sand	85	%		1		ASA15-5	10/31/05 08:36 / srm				
Silt	3	%		1		ASA15-5	10/31/05 08:36 / srm				
Clay	12	%		1		ASA15-5	10/31/05 08:36 / srm				
Texture	LS					ASA15-5	10/31/05 08:36 / srm				
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)	I										
SATURATED PASTE											
pH, sat. paste	7.80	s.u.		0.10		ASAM10-3.2	10/31/05 08:36 / srm				
Conductivity, sat. paste	1.26	mmhos/cm		0.01		ASA10-3	10/31/05 08:36 / srm				
Saturation	22.9	%		0.1		USDA27a	10/31/05 08:36 / srm				
CHEMICAL CHARACTERISTICS											
Organic Carbon	ND	wt%		0.02		ASA29-3	11/01/05 12:43 / srm				
Phosphorus, Olsen	2	mg/kg		1		ASA24-5	10/28/05 14:00 / srm				
Nitrate as N, KCL Extract	ND	mg/kg		1		ASA33-8.1	10/27/05 10:59 / srm				



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-011 Client Sample ID: 3XTP-2A, 0-12" **Report Date:** 11/02/05 **Collection Date:** 06/17/05 **Date Received:** 10/13/05 **Matrix:** Soil

	MCL/								
Analyses	Result	Units	Qual	RL QC	L Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS									
Coarse Fragments	37	wt%		2	ASA15-5	10/25/05 15:56 / srm			
Sand	71	%		1	ASA15-5	10/31/05 08:36 / srm			
Silt	9.	%		1	ASA15-5	10/31/05 08:36 / srm			
Clay	20	%		1	ASA15-5	10/31/05 08:36 / srm			
Texture	SCL				ASA15-5	10/31/05 08:36 / srm			
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)									
SATURATED PASTE									
pH, sat. paste	7.80	s.u.		0.10	ASAM10-3.2	10/31/05 08:36 / srm			
Conductivity, sat. paste	1.07	mmhos/cm		0.01	ASA10-3	10/31/05 08:36 / srm			
Saturation	28.2	%		0.1	USDA27a	10/31/05 08:36 / srm			
CHEMICAL CHARACTERISTICS									
Organic Carbon	0.03	wt%		0.02	ASA29-3	11/01/05 12:43 / srm			
Phosphorus, Olsen	1	mg/kg		1	ASA24-5	10/28/05 14:07 / srm			
Nitrate as N, KCL Extract	ND	mg/kg		1	ASA33-8.1	10/27/05 11:03 / srm			



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-012 Client Sample ID: 3XTP-2A, 22-34" 
 Report Date:
 11/02/05

 Collection Date:
 06/17/05

 Date Received:
 10/13/05

 Matrix:
 Soil

	MCL/								
Analyses	Result	Units	Qual	RL	QCL	Method	Analysis Date / By		
PHYSICAL CHARACTERISTICS									
Coarse Fragments	34	wt%		2		ASA15-5	10/25/05 15:56 / srm		
Sand	51	%		1		ASA15-5	10/31/05 08:36 / srm		
Silt	21	%		1		ASA15-5	10/31/05 08:36 / srm		
Clay	28	%		1		ASA15-5	10/31/05 08:36 / srm		
Texture	SCL					ASA15-5	10/31/05 08:36 / srm		
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)									
SATURATED PASTE									
pH, sat. paste	7.70	su		0.10	)	ASAM10-3.2	10/31/05 08:36 / srm		
Conductivity, sat. paste	1.39	mmhos/cm		0.01		ASA10-3	10/31/05 08:36 / srm		
Saturation	43.0	%		0.1		USDA27a	10/31/05 08:36 / srm		
CHEMICAL CHARACTERISTICS									
Organic Carbon	0.12	wt%		0.02		ASA29-3	11/01/05 12:43 / srm		
Phosphorus, Olsen	3	mg/kg		1		ASA24-5	10/28/05 14:08 / srm		
Nitrate as N, KCL Extract	ND	mg/kg		1		ASA33-8.1	10/27/05 11:04 / srm		



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-013 Client Sample ID: 3XTP-2B, 0-12" 
 Report Date:
 11/02/05

 Collection Date:
 06/13/05

 Date Received:
 10/13/05

 Matrix:
 Soil

		MCL/									
Analyses	Result	Units	Qual	RL	QCL	Method	Analysis Date / By				
PHYSICAL CHARACTERISTICS											
Coarse Fragments	40	wt%		2		ASA15-5	10/25/05 15:56 / srm				
Sand	67	%		1		ASA15-5	10/31/05 08:36 / srm				
Silt	17	%		1		ASA15-5	10/31/05 08:36 / srm				
Clay	16	%		1		ASA15-5	10/31/05 08:36 / srm				
Texture	SL					ASA15-5	10/31/05 08:36 / srm				
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)											
SATURATED PASTE											
pH, sat. paste	7.80	s.u.		0.10		ASAM10-3.2	10/31/05 08:36 / srm				
Conductivity, sat. paste	1.01	mmhos/cm		0.01		ASA10-3	10/31/05 08:36 / srm				
Saturation	27.5	%		0.1		USDA27a	10/31/05 08:36 / srm				
CHEMICAL CHARACTERISTICS											
Organic Carbon	ND	wt%		0.02		ASA29-3	11/01/05 12:43 / srm				
Phosphorus, Olsen	3	mg/kg		1		ASA24-5	10/28/05 14:09 / srm				
Nitrate as N, KCL Extract	ND	mg/kg		1		ASA33-8.1	10/27/05 11:04 / srm				



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-014 Client Sample ID: 3XTP-2B, 18-30" 
 Report Date:
 11/02/05

 Collection Date:
 06/13/05

 Date Received:
 10/13/05

 Matrix:
 Soil

		MCL/									
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By					
PHYSICAL CHARACTERISTICS											
Coarse Fragments	27	wt%		2	ASA15-5	10/25/05 15:56 / srm					
Sand	55	%		1	ASA15-5	10/31/05 08:36 / srm					
Silt	25	%		1	ASA15-5	10/31/05 08:36 / srm					
Clay	20	%		1	ASA15-5	10/31/05 08:36 / srm					
Texture	SCL				ASA15-5	10/31/05 08:36 / srm					
- C = Clay, S = Sand(y), SI = Siit(y), L = Loam(y)											
SATURATED PASTE											
pH, sat. paste	7.90	s.u.		0.10	ASAM10-3.2	10/31/05 08:36 / srm					
Conductivity, sat. paste	0.91	mmhos/cm		0.01	ASA10-3	10/31/05 08:36 / srm					
Saturation	32.1	%		0.1	USDA27a	10/31/05 08:36 / srm					
CHEMICAL CHARACTERISTICS											
Organic Carbon	0.05	wt%		0.02	ASA29-3	11/01/05 12:43 / srm					
Phosphorus, Olsen	2	mg/kg		1	ASA24-5	10/28/05 14:11 / srm					
Nitrate as N, KCL Extract	ND	mg/kg		1	ASA33-8.1	10/27/05 11:05 / srm					



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-015 Client Sample ID: 3XTP-2C, 0-12" **Report Date:** 11/02/05 **Collection Date:** 06/13/05 **Date Received:** 10/13/05 **Matrix:** Soil

	MCL/									
Analyses	Result	Units	Qual	RL (	QCL	Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS										
Coarse Fragments	35	wt%		2		ASA15-5	10/25/05 15:56 / srm			
Sand	63	%		1		ASA15-5	10/31/05 08:36 / srm			
Silt	18	%		1		ASA15-5	10/31/05 08:36 / srm			
Clay	19	%		1		ASA15-5	10/31/05 08:36 / srm			
Texture	SL					ASA15-5	10/31/05 08:36 / srm			
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)										
SATURATED PASTE										
pH, sat. paste	7.80	s.u.		0.10		ASAM10-3.2	10/31/05 08:36 / srm			
Conductivity, sat. paste	1.10	mmhos/cm		0.01		ASA10-3	10/31/05 08:36 / srm			
Saturation	29.0	%		0.1		USDA27a	10/31/05 08:36 / srm			
CHEMICAL CHARACTERISTICS										
Organic Carbon	0.02	wt%		0.02		ASA29-3	11/01/05 12:43 / srm			
Phosphorus, Olsen	3	mg/kg		1		ASA24-5	10/28/05 14:12 / srm			
Nitrate as N, KCL Extract	ND	mg/kg		1		ASA33-8.1	10/27/05 11:06 / srm			



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-016 Client Sample ID: 3XTP-2C, 25-37" 
 Report Date:
 11/02/05

 Collection Date:
 06/13/05

 Date Received:
 10/13/05

 Matrix:
 Soil

		MCL/								
Analyses	Result	Units	Qual	RL O	QCL	Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS										
Coarse Fragments	31	wt%		2		ASA15-5	10/25/05 15:56 / srm			
Sand	67	%		1		ASA15-5	10/31/05 08:36 / srm			
Silt	13	%		1		ASA15-5	10/31/05 08:36 / srm			
Clay	20	%		1		ASA15-5	10/31/05 08:36 / srm			
Texture	SCL					ASA15-5	10/31/05 08:36 / srm			
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)										
SATURATED PASTE										
pH, sat. paste	7.80	s.u.		0.10		ASAM10-3.2	10/31/05 08:36 / srm			
Conductivity, sat. paste	2.75	mmhos/cm		0.01		ASA10-3	10/31/05 08:36 / srm			
Saturation	32.1	%		0.1		USDA27a	10/31/05 08:36 / srm			
CHEMICAL CHARACTERISTICS										
Organic Carbon	0.06	wt%		0.02		ASA29-3	11/01/05 12:43 / srm			
Phosphorus, Olsen	3	mg/kg		1		ASA24-5	10/28/05 14:14 / srm			
Nitrate as N, KCL Extract	1	mg/kg		1		ASA33-8.1	10/27/05 11:06 / srm			



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-017 Client Sample ID: 3XTP-2D, 0-12" **Report Date:** 11/02/05 **Collection Date:** 06/17/05 **Date Received:** 10/13/05 **Matrix:** Soil

	MCL/									
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By				
PHYSICAL CHARACTERISTICS										
Coarse Fragments	29	wt%		2	ASA15-5	10/25/05 15:56 / srm				
Sand	69	%		1	ASA15-5	10/31/05 08:36 / srm				
Silt	15	%		1	ASA15-5	10/31/05 08:36 / srm				
Clay	16	%		1	ASA15-5	10/31/05 08:36 / srm				
Texture	SL				ASA15-5	10/31/05 08:36 / srm				
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)										
SATURATED PASTE										
pH, sat. paste	8.00	s.u.		0.10	ASAM10-3.2	10/31/05 08:36 / srm				
Conductivity, sat. paste	0.92	mmhos/cm		0.01	ASA10-3	10/31/05 08:36 / srm				
Saturation	28.7	%		0.1	USDA27a	10/31/05 08:36 / srm				
CHEMICAL CHARACTERISTICS										
Organic Carbon	0.03	wt%		0.02	ASA29-3	11/01/05 12:43 / srm				
Phosphorus, Olsen	2	mg/kg		1	ASA24-5	10/28/05 14:15 / srm				
Nitrate as N, KCL Extract	ND	mg/kg		1	ASA33-8.1	10/27/05 11:07 / srm				

Report Definitions: RL - Analyte reporting limit. QCL - Quality control limit.



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-018 Client Sample ID: 3XTP-2D, 28-40" 
 Report Date:
 11/02/05

 Collection Date:
 06/17/05

 Date Received:
 10/13/05

 Matrix:
 Soil

		MCL/								
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By				
PHYSICAL CHARACTERISTICS										
Coarse Fragments	42	wt%		2	ASA15-5	10/25/05 15:56 / srm				
Sand	79	%		1	ASA15-5	10/31/05 08:36 / srm				
Silt	6	%		1	ASA15-5	10/31/05 08:36 / srm				
Clay	15	%		1	ASA15-5	10/31/05 08:36 / srm				
Texture	SL				ASA15-5	10/31/05 08:36 / srm				
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y	/)									
SATURATED PASTE										
pH, sat. paste	7.90	s.u.		0.10	ASAM10-3.2	10/31/05 08:36 / srm				
Conductivity, sat. paste	1.28	mmhos/cm		0.01	ASA10-3	10/31/05 08:36 / srm				
Saturation	25.6	%		0.1	USDA27a	10/31/05 08:36 / srm				
CHEMICAL CHARACTERISTICS										
Organic Carbon	ND	wt%		0.02	ASA29-3	11/01/05 12:43 / srm				
Phosphorus, Olsen	2	mg/kg		1	ASA24-5	10/28/05 14:16 / srm				
Nitrate as N, KCL Extract	ND	mg/kg		1	ASA33-8.1	10/27/05 11:08 / srm				



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-019 Client Sample ID: 3XTP-2E, 0-12" **Report Date:** 11/02/05 **Collection Date:** 06/17/05 **Date Received:** 10/13/05 **Matrix:** Soil

	MCL/									
Analyses	Result	Units	Qual	RL	QCL	Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS										
Coarse Fragments	36	wt%		2		ASA15-5	10/25/05 15:56 / srm			
Sand	67	%		1		ASA15-5	10/31/05 08:36 / srm			
Silt	13	%		1		ASA15-5	10/31/05 08:36 / srm			
Clay	20	%		1		ASA15-5	10/31/05 08:36 / srm			
Texture	SCL					ASA15-5	10/31/05 08:36 / srm			
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)										
SATURATED PASTE										
pH, sat. paste	7.80	s.u.		0.10		ASAM10-3.2	10/31/05 08:36 / srm			
Conductivity, sat. paste	1.42	mmhos/cm		0.01		ASA10-3	10/31/05 08:36 / srm			
Saturation	33.4	%		0.1		USDA27a	10/31/05 08:36 / srm			
CHEMICAL CHARACTERISTICS										
Organic Carbon	0.11	wt%		0.02		ASA29-3	11/01/05 12:43 / srm			
Phosphorus, Olsen	3	mg/kg		1		ASA24-5	10/28/05 14:18 / srm			
Nitrate as N, KCL Extract	1	mg/kg		1		ASA33-8.1	10/27/05 11:08 / srm			



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-020 Client Sample ID: 3XTP-2E, 22-34" **Report Date:** 11/02/05 **Collection Date:** 06/17/05 **Date Received:** 10/13/05 **Matrix:** Soil

	MCL/								
Analyses	Result	Units	Qual	RL	QCL	Method	Analysis Date / By		
PHYSICAL CHARACTERISTICS									
Coarse Fragments	40	wt%		2		ASA15-5	10/25/05 15:56 / srm		
Sand	63	%		1		ASA15-5	10/31/05 08:36 / srm		
Silt	15	%		1		ASA15-5	10/31/05 08:36 / srm		
Clay	22	%		1		ASA15-5	10/31/05 08:36 / srm		
Texture	SCL					ASA15-5	10/31/05 08:36 / srm		
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)									
SATURATED PASTE									
pH, sat. paste	7.80	s.u.		0.10		ASAM10-3.2	10/31/05 08:36 / srm		
Conductivity, sat. paste	1.70	mmhos/cm		0.01		ASA10-3	10/31/05 08:36 / srm		
Saturation	35.2	%		0.1		USDA27a	10/31/05 08:36 / srm		
CHEMICAL CHARACTERISTICS									
Organic Carbon	0.13	wt%		0.02		ASA29-3	11/01/05 12:43 / srm		
Phosphorus, Olsen	2	mg/kg		1		ASA24-5	10/28/05 14:19 / srm		
Nitrate as N, KCL Extract	2	mg/kg		1		ASA33-8.1	10/27/05 11:09 / srm		



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-021 Client Sample ID: 3XTP-3Ai, 0-1'

**Report Date:** 11/02/05 **Collection Date:** 06/13/05 **Date Received:** 10/13/05 **Matrix:** Soil

		MCL/									
Analyses	Result	Units	Qual	RL	QCL	Method	Analysis Date / By				
PHYSICAL CHARACTERISTICS											
Coarse Fragments	30	wt%		2		ASA15-5	10/25/05 15:56 / srm				
Sand	77	%		1		ASA15-5	10/31/05 08:36 / srm				
Silt	10	%		1		ASA15-5	10/31/05 08:36 / srm				
Clay	13	%		1		ASA15-5	10/31/05 08:36 / srm				
Texture	SL					ASA15-5	10/31/05 08:36 / srm				
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y	)										
SATURATED PASTE											
pH, sat. paste	7.80	s.u.		0.10		ASAM10-3.2	10/31/05 08:36 / srm				
Conductivity, sat. paste	0.38	mmhos/cm		0.01		ASA10-3	10/31/05 08:36 / srm				
Saturation	24.8	%		0.1		USDA27a	10/31/05 08:36 / srm				
CHEMICAL CHARACTERISTICS											
Organic Carbon	0.02	wt%		0.02		ASA29-3	11/01/05 12:43 / srm				
Phosphorus, Olsen	1	mg/kg		1		ASA24-5	10/28/05 14:26 / srm				
Nitrate as N, KCL Extract	ND	mg/kg		1		ASA33-8.1	10/27/05 11:11 / srm				

ReportRL - Analyte reporting limitDefinitions:QCL - Quality control limit

MCL - Maximum contaminant level. ND - Not detected at the reporting limit.



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-022 Client Sample ID: 3XTP-3Ai, 3-4' **Report Date:** 11/02/05 **Collection Date:** 06/13/05 **Date Received:** 10/13/05 **Matrix:** Soil

Analyses		MCL/						
	Result	Units	Qual	RL	QCL	Method	Analysis Date / By	
PHYSICAL CHARACTERISTICS								
Coarse Fragments	24	wt%		2		ASA15-5	10/25/05 15:56 / srm	
Sand	54	%		1		ASA15-5	10/31/05 08:36 / srm	
Silt	23	%		1		ASA15-5	10/31/05 08:36 / srm	
Clay	23	%		1		ASA15-5	10/31/05 08:36 / srm	
Texture	SCL					ASA15-5	10/31/05 08:36 / srm	
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)								
SATURATED PASTE								
pH, sat. paste	7.80	s.u.		0.10		ASAM10-3.2	10/31/05 08:36 / srm	
Conductivity, sat. paste	0.90	mmhos/cm		0.01		ASA10-3	10/31/05 08:36 / srm	
Saturation	33.2	%		0.1		USDA27a	10/31/05 08:36 / srm	
CHEMICAL CHARACTERISTICS								
Organic Carbon	ND	wt%		0.02		ASA29-3	11/01/05 12:43 / srm	
Phosphorus, Olsen	2	mg/kg		1		ASA24-5	10/28/05 14:28 / srm	
Nitrate as N, KCL Extract	ND	mg/kg		1		ASA33-8.1	10/27/05 11:13 / srm	


Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-023 Client Sample ID: 3XTP-3B, 0-1'

 Report Date:
 11/02/05

 Collection Date:
 06/14/05

 Date Received:
 10/13/05

 Matrix:
 Soil

		MCL/									
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By					
PHYSICAL CHARACTERISTICS											
Coarse Fragments	37	wt%		2	ASA15-5	10/25/05 15:56 / srm					
Sand	73	%		1	ASA15-5	10/31/05 08:36 / srm					
Silt	12	%		1	ASA15-5	10/31/05 08:36 / srm					
Clay	15	%		1	ASA15-5	10/31/05 08:36 / srm					
Texture	SL				ASA15-5	10/31/05 08:36 / srm					
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y	)										
SATURATED PASTE											
pH, sat. paste	7.80	s.u.		0.10	ASAM10-3.2	10/31/05 08:36 / srm					
Conductivity, sat. paste	0.47	mmhos/cm		0.01	ASA10-3	10/31/05 08:36 / srm					
Saturation	24.5	%		0.1	USDA27a	10/31/05 08:36 / srm					
CHEMICAL CHARACTERISTICS											
Organic Carbon	ND	wt%		0.02	ASA29-3	11/01/05 12:43 / srm					
Phosphorus, Olsen	2	mg/kg		1	ASA24-5	10/28/05 14:29 / srm					
Nitrate as N, KCL Extract	ND	mg/kg		1	ASA33-8.1	10/27/05 11:13 / srm					



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-024 Client Sample ID: 3XTP-3B, 36-48" **Report Date:** 11/02/05 **Collection Date:** 06/14/05 **Date Received:** 10/13/05 **Matrix:** Soil

	MCL/									
Analyses	Result	Units	Qual	RL	QCL	Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS										
Coarse Fragments	28	wt%		2		ASA15-5	10/25/05 15:56 / srm			
Sand	59	%		1		ASA15-5	10/31/05 08:36 / srm			
Silt	21	%		1		ASA15-5	10/31/05 08:36 / srm			
Clay	20	%		1		ASA15-5	10/31/05 08:36 / srm			
Texture	SCL					ASA15-5	10/31/05 08:36 / srm			
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)										
SATURATED PASTE										
pH, sat. paste	7.70	s.u.		0.10		ASAM10-3.2	10/31/05 08:36 / srm			
Conductivity, sat. paste	1.34	mmhos/cm		0.01		ASA10-3	10/31/05 08:36 / srm			
Saturation	29.1	%		0.1		USDA27a	10/31/05 08:36 / srm			
CHEMICAL CHARACTERISTICS										
Organic Carbon	ND	wt%		0.02		ASA29-3	11/01/05 12:43 / srm			
Phosphorus, Olsen	2	mg/kg		1		ASA24-5	10/28/05 14:31 / srm			
Nitrate as N, KCL Extract	ND	mg/kg		1		ASA33-8.1	10/27/05 11:14 / srm			



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-025 Client Sample ID: 3XTP-3C, 0-12" **Report Date:** 11/02/05 **Collection Date:** 06/17/05 **Date Received:** 10/13/05 **Matrix:** Soil

		MCL/									
Analyses	Result	Units	Qual	RL	QCL	Method	Analysis Date / By				
PHYSICAL CHARACTERISTICS											
Coarse Fragments	36	wt%		2		ASA15-5	10/25/05 15:56 / srm				
Sand	67	%		1		ASA15-5	10/31/05 08:36 / srm				
Silt	14	%		1		ASA15-5	10/31/05 08:36 / srm				
Clay	19	%		1		ASA15-5	10/31/05 08:36 / srm				
Texture	SL					ASA15-5	10/31/05 08:36 / srm				
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)											
SATURATED PASTE											
pH, sat. paste	7.70	s.u.		0.10	ł	ASAM10-3.2	10/31/05 08:36 / srm				
Conductivity, sat. paste	1.64	mmhos/cm		0.01		ASA10-3	10/31/05 08:36 / srm				
Saturation	29.8	%		0.1		USDA27a	10/31/05 08:36 / srm				
CHEMICAL CHARACTERISTICS											
Organic Carbon	0.05	wt%		0.02		ASA29-3	11/01/05 12:43 / srm				
Phosphorus, Olsen	3	mg/kg		1		ASA24-5	10/28/05 14:32 / srm				
Nitrate as N, KCL Extract	1	mg/kg		1		ASA33-8.1	10/27/05 11:15 / srm				



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-026 Client Sample ID: 3XTP-3C, 40-52" 
 Report Date:
 11/02/05

 Collection Date:
 06/17/05

 Date Received:
 10/13/05

 Matrix:
 Soil

	MCL/									
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By				
PHYSICAL CHARACTERISTICS										
Coarse Fragments	31	wt%		2	ASA15-5	10/25/05 15:56 / srm				
Sand	70	%		1	ASA15-5	10/31/05 08:36 / srm				
Silt	8	%		1	ASA15-5	10/31/05 08:36 / srm				
Clay	22	%		1	ASA15-5	10/31/05 08:36 / srm				
Texture	SCL				ASA15-5	10/31/05 08:36 / srm				
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)										
SATURATED PASTE										
pH, sat. paste	7.40	s.u.		0.10	ASAM10-3.2	10/31/05 08:36 / srm				
Conductivity, sat. paste	2.49	mmhos/cm		0.01	ASA10-3	10/31/05 08:36 / srm				
Saturation	28.6	%		0.1	USDA27a	10/31/05 08:36 / srm				
CHEMICAL CHARACTERISTICS										
Organic Carbon	ND	wt%		0.02	ASA29-3	11/01/05 12:43 / srm				
Phosphorus, Olsen	9	mg/kg		1	ASA24-5	10/28/05 14:33 / srm				
Nitrate as N, KCL Extract	1	mg/kg		1	ASA33-8.1	10/27/05 11:16 / srm				



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-027 Client Sample ID: 3XTP-3D, 0-12" **Report Date:** 11/02/05 **Collection Date:** 06/17/05 **Date Received:** 10/13/05 **Matrix:** Soil

		MCL/								
Analyses	Result	Units	Qual	RL	QCL	Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS										
Coarse Fragments	30	wt%		2		ASA15-5	10/25/05 15:56 / srm			
Sand	72	%		1		ASA15-5	10/31/05 08:36 / srm			
Silt	11	%		1		ASA15-5	10/31/05 08:36 / srm			
Clay	17	%		1		ASA15-5	10/31/05 08:36 / srm			
Texture	SL					ASA15-5	10/31/05 08:36 / srm			
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)										
SATURATED PASTE										
pH, sat. paste	7.70	s.u.		0.10		ASAM10-3.2	10/31/05 08:36 / srm			
Conductivity, sat. paste	1.32	mmhos/cm		0.01		ASA10-3	10/31/05 08:36 / srm			
Saturation	31.4	%		0.1		USDA27a	10/31/05 08:36 / srm			
CHEMICAL CHARACTERISTICS										
Organic Carbon	0.06	wt%		0.02		ASA29-3	11/01/05 12:43 / srm			
Phosphorus, Olsen	2	mg/kg		1		ASA24-5	10/28/05 14:35 / srm			
Nitrate as N, KCL Extract	1	mg/kg		1		ASA33-8.1	10/27/05 11:16 / srm			



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-028 Client Sample ID: 3XTP-3D, 38-50" 
 Report Date:
 11/02/05

 Collection Date:
 06/17/05

 Date Received:
 10/13/05

 Matrix:
 Soil

	MCL/									
Analyses	Result	Units	Qual	RL	QCL	Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS										
Coarse Fragments	34	wt%		2		ASA15-5	10/25/05 15:56 / srm			
Sand	59	%		1		ASA15-5	10/31/05 08:36 / srm			
Silt	15	%		1		ASA15-5	10/31/05 08:36 / srm			
Clay	26	%		1		ASA15-5	10/31/05 08:36 / srm			
Texture	SCL					ASA15-5	10/31/05 08:36 / srm			
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)										
SATURATED PASTE										
pH, sat. paste	7.90	s.u.		0.10		ASAM10-3.2	10/31/05 08:36 / srm			
Conductivity, sat. paste	0.96	mmhos/cm		0.01		ASA10-3	10/31/05 08:36 / srm			
Saturation	37.4	%		0.1		USDA27a	10/31/05 08:36 / srm			
CHEMICAL CHARACTERISTICS										
Organic Carbon	0.18	wt%		0.02		ASA29-3	11/01/05 12:43 / srm			
Phosphorus, Olsen	2	mg/kg		1		ASA24-5	10/28/05 14:36 / srm			
Nitrate as N, KCL Extract	5	mg/kg		1		ASA33-8.1	10/27/05 11:17 / srm			



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-029 Client Sample ID: 3XTP-3E, 0-12" 
 Report Date:
 11/02/05

 Collection Date:
 06/17/05

 Date Received:
 10/13/05

 Matrix:
 Soil

		MCL/								
Analyses	Result	Units	Qual	RL QC	L Method	Analysis Date / By				
PHYSICAL CHARACTERISTICS										
Coarse Fragments	35	wt%		2	ASA15-5	10/25/05 15.56 / srm				
Sand	73	%		1	ASA15-5	10/31/05 08:36 / srm				
Silt	10	%		1	ASA15-5	10/31/05 08:36 / srm				
Clay	17	%		1	ASA15-5	10/31/05 08:36 / srm				
Texture	SL				ASA15-5	10/31/05 08:36 / srm				
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)										
SATURATED PASTE										
pH, sat. paste	7.70	s.u.		0.10	ASAM10-3.2	10/31/05 08:36 / srm				
Conductivity, sat. paste	1.25	mmhos/cm		0.01	ASA10-3	10/31/05 08:36 / srm				
Saturation	24.9	%		0.1	USDA27a	10/31/05 08:36 / srm				
CHEMICAL CHARACTERISTICS										
Organic Carbon	0.04	wt%		0.02	ASA29-3	11/01/05 12:43 / srm				
Phosphorus, Olsen	3	mg/kg		1	ASA24-5	10/28/05 14:38 / srm				
Nitrate as N, KCL Extract	1	mg/kg		1	ASA33-8.1	10/27/05 11:18 / srm				



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-030 Client Sample ID: 3XTP-3E, 33-45" 
 Report Date:
 11/02/05

 Collection Date:
 06/17/05

 Date Received:
 10/13/05

 Matrix:
 Soil

		MCL/									
Analyses	Result	Units	Qual	RL	QCL	Method	Analysis Date / By				
PHYSICAL CHARACTERISTICS											
Coarse Fragments	28	wt%		2		ASA15-5	10/25/05 15:56 / srm				
Sand	67	%		1		ASA15-5	10/31/05 08:36 / srm				
Silt	12	%		1		ASA15-5	10/31/05 08:36 / srm				
Clay	21	%		1		ASA15-5	10/31/05 08:36 / srm				
Texture	SCL					ASA15-5	10/31/05 08:36 / srm				
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)											
SATURATED PASTE											
pH, sat. paste	7.70	s.u.		0.10		ASAM10-3.2	10/31/05 08:36 / srm				
Conductivity, sat. paste	3.01	mmhos/cm		0.01		ASA10-3	10/31/05 08:36 / srm				
Saturation	33.8	%		0.1		USDA27a	10/31/05 08:36 / srm				
CHEMICAL CHARACTERISTICS											
Organic Carbon	0.04	wt%		0.02		ASA29-3	11/01/05 12:43 / srm				
Phosphorus, Olsen	5	mg/kg		1		ASA24-5	10/28/05 14:39 / srm				
Nitrate as N, KCL Extract	1	mg/kg		1		ASA33-8.1	10/27/05 11:18 / srm				



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-031 Client Sample ID: 3XTP-5Ai, 0-1' **Report Date:** 11/02/05 **Collection Date:** 06/08/05 **Date Received:** 10/13/05 **Matrix:** Soil

		MCL/									
Analyses	Result	Units	Qual	RL	QCL	Method	Analysis Date / By				
PHYSICAL CHARACTERISTICS											
Coarse Fragments	30	wt%		2		ASA15-5	10/25/05 15:56 / srm				
Sand	73	%		1		ASA15-5	10/31/05 08:36 / srm				
Silt	10	%		1		ASA15-5	10/31/05 08:36 / srm				
Clay	17	%		1		ASA15-5	10/31/05 08:36 / srm				
Texture	SL					ASA15-5	10/31/05 08:36 / srm				
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)											
SATURATED PASTE											
pH, sat. paste	7.70	s.u.		0.10		ASAM10-3.2	10/31/05 08:36 / srm				
Conductivity, sat. paste	1.22	mmhos/cm		0.01		ASA10-3	10/31/05 08:36 / srm				
Saturation	24.9	%		0.1		USDA27a	10/31/05 08:36 / srm				
CHEMICAL CHARACTERISTICS											
Organic Carbon	0.04	wt%		0.02		ASA29-3	11/01/05 12:43 / srm				
Phosphorus, Olsen	2	mg/kg		1		ASA24-5	10/28/05 14:46 / srm				
Nitrate as N, KCL Extract	3	mg/kg		1		ASA33-8.1	10/27/05 11:20 / srm				



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-032 Client Sample ID: 3XTP-5Ai, 14-26" 
 Report Date:
 11/02/05

 Collection Date:
 06/08/05

 Date Received:
 10/13/05

 Matrix:
 Soil

		MCL/									
Analyses	Result	Units	Qual	RL	QCL	Method	Analysis Date / By				
PHYSICAL CHARACTERISTICS											
Coarse Fragments	24	wt%		2		ASA15-5	10/25/05 15:56 / srm				
Sand	41	%		1		ASA15-5	10/31/05 08:36 / srm				
Silt	32	%		1		ASA15-5	10/31/05 08:36 / srm				
Clay	27	%		1		ASA15-5	10/31/05 08:36 / srm				
Texture	CL					ASA15-5	10/31/05 08:36 / srm				
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)											
SATURATED PASTE											
pH, sat. paste	7.70	su		0.10		ASAM10-3.2	10/31/05 08:36 / srm				
Conductivity, sat. paste	1.26	mmhos/cm		0.01		ASA10-3	10/31/05 08:36 / srm				
Saturation	45.8	%		0.1		USDA27a	10/31/05 08:36 / srm				
CHEMICAL CHARACTERISTICS											
Organic Carbon	0.27	wt%		0.02		ASA29-3	11/01/05 12:43 / srm				
Phosphorus, Olsen	2	mg/kg		1		ASA24-5	10/28/05 14:48 / srm				
Nitrate as N, KCL Extract	3	mg/kg		1		ASA33-8.1	10/27/05 11:23 / srm				



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-033 Client Sample ID: 3XTP-5Bi, 0-1' **Report Date:** 11/02/05 **Collection Date:** 06/08/05 **Date Received:** 10/13/05 **Matrix:** Soil

		MCL/									
Analyses	Result	Units	Qual	RL	QCL	Method	Analysis Date / By				
PHYSICAL CHARACTERISTICS											
Coarse Fragments	35	wt%		2		ASA15-5	10/25/05 15:56 / srm				
Sand	59	%		1		ASA15-5	10/31/05 08:36 / srm				
Silt	20	%		1		ASA15-5	10/31/05 08:36 / srm				
Clay	21	%		1		ASA15-5	10/31/05 08:36 / srm				
Texture	SCL					ASA15-5	10/31/05 08:36 / srm				
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)											
SATURATED PASTE											
pH, sat. paste	7.80	s.u.		0.10		ASAM10-3.2	10/31/05 08:36 / srm				
Conductivity, sat. paste	1.23	mmhos/cm		0.01		ASA10-3	10/31/05 08:36 / srm				
Saturation	33.3	%		0.1		USDA27a	10/31/05 08:36 / srm				
CHEMICAL CHARACTERISTICS											
Organic Carbon	ND	wt%		0.02		ASA29-3	11/01/05 12:43 / srm				
Phosphorus, Olsen	2	mg/kg		1		ASA24-5	10/28/05 14:49 / srm				
Nitrate as N, KCL Extract	ND	mg/kg		1		ASA33-8.1	10/27/05 11:23 / srm				

ReportRL - Analyte reporting limit.Definitions:QCL - Quality control limit.

MCL - Maximum contaminant level. ND - Not detected at the reporting limit.



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-034 Client Sample ID: 3XTP-5Bi, 1-2' 
 Report Date:
 11/02/05

 Collection Date:
 06/08/05

 Date Received:
 10/13/05

 Matrix:
 Soil

		MCL/								
Analyses	Result	Units	Qual	RL QCI	_ Method	Analysis Date / By				
PHYSICAL CHARACTERISTICS										
Coarse Fragments	35	wt%		2	ASA15-5	10/25/05 15:56 / srm				
Sand	57	%		1	ASA15-5	10/31/05 08:36 / srm				
Silt	22	%		1	ASA15-5	10/31/05 08:36 / srm				
Clay	21	%		1	ASA15-5	10/31/05 08:36 / srm				
Texture	SCL				ASA15-5	10/31/05 08:36 / srm				
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y	)									
SATURATED PASTE										
pH, sat. paste	7.80	s.u.		0.10	ASAM10-3.2	10/31/05 08:36 / srm				
Conductivity, sat. paste	1.01	mmhos/cm		0.01	ASA10-3	10/31/05 08:36 / srm				
Saturation	35.5	%		0.1	USDA27a	10/31/05 08:36 / srm				
CHEMICAL CHARACTERISTICS										
Organic Carbon	0.03	wt%		0.02	ASA29-3	11/01/05 12:43 / srm				
Phosphorus, Olsen	2	mg/kg		1	ASA24-5	10/28/05 14:50 / srm				
Nitrate as N, KCL Extract	ND	mg/kg		1	ASA33-8.1	10/27/05 11:24 / srm				



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-035 Client Sample ID: 3XTP-5Ci, 0-1'

**Report Date:** 11/02/05 **Collection Date:** 06/08/05 **Date Received:** 10/13/05 **Matrix:** Soil

		MCL/								
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By				
PHYSICAL CHARACTERISTICS										
Coarse Fragments	37	wt%		2	ASA15-5	10/25/05 15:56 / srm				
Sand	75	%		1	ASA15-5	10/31/05 08:36 / srm				
Silt	10	%		1	ASA15-5	10/31/05 08:36 / srm				
Clay	15	%		1	ASA15-5	10/31/05 08:36 / srm				
Texture	SL				ASA15-5	10/31/05 08:36 / srm				
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)	)									
SATURATED PASTE										
pH, sat. paste	7 70	s.u.		0.10	ASAM10-3.2	10/31/05 08:36 / srm				
Conductivity, sat. paste	0 88	mmhos/cm		0.01	ASA10-3	10/31/05 08:36 / srm				
Saturation	26 9	%		0.1	USDA27a	10/31/05 08:36 / srm				
CHEMICAL CHARACTERISTICS										
Organic Carbon	ND	wt%		0.02	ASA29-3	11/01/05 12:43 / srm				
Phosphorus, Olsen	2	mg/kg		1	ASA24-5	10/28/05 14:52 / srm				
Nitrate as N, KCL Extract	ND	mg/kg		1	ASA33-8.1	10/27/05 11:25 / srm				



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-036 Client Sample ID: 3XTP-5Ci, 1-2' **Report Date:** 11/02/05 **Collection Date:** 06/08/05 **Date Received:** 10/13/05 **Matrix:** Soil

		MCL/							
Analyses	Result	Units	Qual	RL	QCL	Method	Analysis Date / By		
PHYSICAL CHARACTERISTICS									
Coarse Fragments	27	wt%		2		ASA15-5	10/25/05 15:56 / srm		
Sand	37	%		1		ASA15-5	10/31/05 08:36 / srm		
Silt	38	%		1		ASA15-5	10/31/05 08:36 / srm		
Clay	25	%		1		ASA15-5	10/31/05 08:36 / srm		
Texture	L					ASA15-5	10/31/05 08:36 / srm		
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)									
SATURATED PASTE									
pH, sat. paste	7.80	s.u.		0.10		ASAM10-3.2	10/31/05 08:36 / srm		
Conductivity, sat. paste	1.16	mmhos/cm		0.01		ASA10-3	10/31/05 08:36 / srm		
Saturation	41.5	%		0.1		USDA27a	10/31/05 08:36 / srm		
CHEMICAL CHARACTERISTICS									
Organic Carbon	0.03	wt%		0.02		ASA29-3	11/01/05 12:43 / srm		
Phosphorus, Olsen	2	mg/kg		1		ASA24-5	10/28/05 14:53 / srm		
Nitrate as N, KCL Extract	ND	mg/kg		1		ASA33-8.1	10/27/05 11:25 / srm		

ReportRL - Analyte reporting limit.Definitions:QCL - Quality control limit.

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Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-037 Client Sample ID: 3XTP-5D, 0-1' **Report Date:** 11/02/05 **Collection Date:** 06/08/05 **Date Received:** 10/13/05 **Matrix:** Soil

MCL/								
Result	Units	Qual	RL	QCL	Method	Analysis Date / By		
35	wt%		2		ASA15-5	10/25/05 15:56 / srm		
71	%		1		ASA15-5	10/31/05 08:36 / srm		
13	%		1		ASA15-5	10/31/05 08:36 / srm		
16	%		1		ASA15-5	10/31/05 08:36 / srm		
SL					ASA15-5	10/31/05 08:36 / srm		
7.70	s.u.		0.10		ASAM10-3.2	10/31/05 08:36 / srm		
1.03	mmhos/cm		0.01		ASA10-3	10/31/05 08:36 / srm		
28.7	%		0.1		USDA27a	10/31/05 08·36 / srm		
0.13	wt%		0.02		ASA29-3	11/01/05 12:43 / srm		
3	mg/kg		1		ASA24-5	10/28/05 14:55 / srm		
1	mg/kg		1		ASA33-8.1	10/27/05 11:26 / srm		
	Result 35 71 13 16 SL 7.70 1.03 28.7 0.13 3 1	Result         Units           35         wt%           71         %           13         %           16         %           SL            7.70         s.u.           1.03         mmhos/cm           28.7         %           0.13         wt%           3         mg/kg           1         mg/kg	Result         Units         Qual           35         wt%           71         %           13         %           16         %           SL	Result         Units         Qual         RL           35         wt%         2           71         %         1           13         %         1           16         %         1           SL         0.10           1.03         mmhos/cm         0.01           28.7         %         0.1           0.13         wt%         0.02           3         mg/kg         1           1         mg/kg         1	Result         Units         Qual         RL         QCL           35         wt%         2           71         %         1           13         %         1           16         %         1           SL         0.10           1.03         mmhos/cm         0.01           28.7         %         0.1           0.13         wt%         0.02           3         mg/kg         1           1         mg/kg         1	Result         Units         Qual         RL QCL         Method           35         wt%         2         ASA15-5           71         %         1         ASA15-5           13         %         1         ASA15-5           16         %         1         ASA15-5           SL          ASA15-5           SL          ASA15-5           SL          ASA15-5           SL          ASA15-5           SL          ASA15-5           SL          ASA10-3           28.7         %         0.1         USDA27a           0.13         wt%         0.02         ASA29-3           3         mg/kg         1         ASA33-8.1		



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-038 Client Sample ID: 3XTP-5D, 14-26" 
 Report Date:
 11/02/05

 Collection Date:
 06/08/05

 Date Received:
 10/13/05

 Matrix:
 Soil

		MCL/							
Analyses	Result	Units	Qual	RL	QCL	Method	Analysis Date / By		
PHYSICAL CHARACTERISTICS									
Coarse Fragments	32	wt%		2		ASA15-5	10/25/05 15:56 / srm		
Sand	57	%		1		ASA15-5	10/31/05 08:36 / srm		
Silt	20	%		1		ASA15-5	10/31/05 08:36 / srm		
Clay	23	%		1		ASA15-5	10/31/05 08:36 / srm		
Texture	SCL					ASA15-5	10/31/05 08:36 / srm		
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)									
SATURATED PASTE									
pH, sat. paste	7.80	s.u.		0.10		ASAM10-3.2	10/31/05 08:36 / srm		
Conductivity, sat. paste	1.38	mmhos/cm		0.01		ASA10-3	10/31/05 08:36 / srm		
Saturation	34.2	%		0.1		USDA27a	10/31/05 08:36 / srm		
CHEMICAL CHARACTERISTICS									
Organic Carbon	0.02	wt%		0.02		ASA29-3	11/01/05 12:43 / srm		
Phosphorus, Olsen	2	mg/kg		1		ASA24-5	10/28/05 14:56 / srm		
Nitrate as N, KCL Extract	1	mg/kg		1		ASA33-8.1	10/27/05 11:27 / srm		



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-039 Client Sample ID: 3XTP-5E, 0-1' 
 Report Date:
 11/02/05

 Collection Date:
 06/08/05

 Date Received:
 10/13/05

 Matrix:
 Soil

		MCL/								
Analyses	Result	Units	Qual	RL Q	CL Method	Analysis Date / By				
PHYSICAL CHARACTERISTICS										
Coarse Fragments	34	wt%		2	ASA15-5	10/25/05 15:56 / srm				
Sand	79	%		1	ASA15-5	10/31/05 08:36 / srm				
Silt	8	%		1	ASA15-5	10/31/05 08:36 / srm				
Clay	13	%		1	ASA15-5	10/31/05 08:36 / srm				
Texture	SL				ASA15-5	10/31/05 08:36 / srm				
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)										
SATURATED PASTE										
pH, sat. paste	7.90	s.u.		0.10	ASAM10-3.2	10/31/05 08:36 / srm				
Conductivity, sat. paste	0.43	mmhos/cm		0.01	ASA10-3	10/31/05 08:36 / srm				
Saturation	25.1	%		0.1	USDA27a	10/31/05 08:36 / srm				
CHEMICAL CHARACTERISTICS										
Organic Carbon	ND	wt%		0.02	ASA29-3	11/01/05 12:43 / srm				
Phosphorus, Olsen	2	mg/kg		1	ASA24-5	10/28/05 14:57 / srm				
Nitrate as N, KCL Extract	ND	mg/kg		1	ASA33-8.1	10/27/05 11:28 / srm				



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-040 Client Sample ID: 3XTP-5E, 1-2' **Report Date:** 11/02/05 **Collection Date:** 06/08/05 **Date Received:** 10/13/05 **Matrix:** Soil

		MCL/							
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS									
Coarse Fragments	24	wt%		2	ASA15-5	10/25/05 15:56 / srm			
Sand	59	%		1	ASA15-5	10/31/05 08:36 / srm			
Silt	20	%		1	ASA15-5	10/31/05 08:36 / srm			
Clay	21	%		1	ASA15-5	10/31/05 08:36 / srm			
Texture	SCL				ASA15-5	10/31/05 08:36 / srm			
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(	у)								
SATURATED PASTE									
pH, sat. paste	7.70	s.u.		0.10	ASAM10-3.2	10/31/05 08:36 / srm			
Conductivity, sat. paste	1.64	mmhos/cm		0.01	ASA10-3	10/31/05 08:36 / srm			
Saturation	36.7	%		0.1	USDA27a	10/31/05 08:36 / srm			
CHEMICAL CHARACTERISTICS									
Organic Carbon	0.02	wt%		0.02	ASA29-3	11/01/05 12:43 / srm			
Phosphorus, Olsen	2	mg/kg		1	ASA24-5	10/28/05 14:59 / srm			
Nitrate as N, KCL Extract	ND	mg/kg		1	ASA33-8.1	10/27/05 11:28 / srm			

ReportRL - Analyte reporting limit.Definitions:QCL - Quality control limit.

MCL - Maximum contaminant level. ND - Not detected at the reporting limit.



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-041 Client Sample ID: 3XTP-6A, 0-1' 
 Report Date:
 11/02/05

 Collection Date:
 06/07/05

 Date Received:
 10/13/05

 Matrix:
 Soil

	MCL/								
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS									
Coarse Fragments	37	wt%		2	ASA15-5	10/25/05 15:56 / srm			
Sand	77	%		1	ASA15-5	10/31/05 08:36 / srm			
Silt	12	%		1	ASA15-5	10/31/05 08:36 / srm			
Clay	11	%		1	ASA15-5	10/31/05 08:36 / srm			
Taxture	SL				ASA15-5	10/31/05 08:36 / srm			
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)									
SATURATED PASTE									
pH, sat, paste	7.80	s.u.		0.10	ASAM10-3.2	10/31/05 08:36 / srm			
Conductivity, sat. paste	0.58	mmhos/cm		0.01	ASA10-3	10/31/05 08:36 / srm			
Saturation	23.9	%		0.1	USDA27a	10/31/05 08:36 / srm			
CHEMICAL CHARACTERISTICS									
Organic Carbon	ND	wt%		0.02	ASA29-3	11/01/05 12:43 / srm			
Phosphorus, Olsen	2	mg/kg		1	ASA24-5	10/28/05 15:06 / srm			
Nitrate as N, KCL Extract	ND	mg/kg		1	ASA33-8.1	10/27/05 11:30 / srm			



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-042 Client Sample ID: 3XTP-6A, 26-38" 
 Report Date:
 11/02/05

 Collection Date:
 06/07/05

 Date Received:
 10/13/05

 Matrix:
 Soil

	MCL/							
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By		
PHYSICAL CHARACTERISTICS								
Coarse Fragments	33	wt%		2	ASA15-5	10/25/05 15:56 / srm		
Sand	65	%		1	ASA15-5	10/31/05 08:36 / srm		
Silt	12	%		1	ASA15-5	10/31/05 08:36 / srm		
Clay	23	%		1	ASA15-5	10/31/05 08:36 / srm		
Texture	SCL				ASA15-5	10/31/05 08:36 / srm		
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)								
SATURATED PASTE								
pH, sat. paste	7.80	s.u.		0.10	ASAM10-3.2	10/31/05 08:36 / srm		
Conductivity, sat. paste	1.77	mmhos/cm		0.01	ASA10-3	10/31/05 08:36 / srm		
Saturation	40.0	%		0.1	USDA27a	10/31/05 08:36 / srm		
CHEMICAL CHARACTERISTICS								
Organic Carbon	ND	wt%		0.02	ASA29-3	11/01/05 12:43 / srm		
Phosphorus, Olsen	2	mg/kg		1	ASA24-5	10/28/05 15:07 / srm		
Nitrate as N, KCL Extract	2	mg/kg		1	ASA33-8.1	10/27/05 11:30 / srm		



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-043 Client Sample ID: 3XTP-6Bi, 0-1' 
 Report Date:
 11/02/05

 Collection Date:
 06/07/05

 Date Received:
 10/13/05

 Matrix:
 Soil

	MCL/								
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS									
Coarse Fragments	29	wt%		2	ASA15-5	10/25/05 15:56 / srm			
Sand	63	%		1	ASA15-5	10/31/05 08:36 / srm			
Silt	16	%		1	ASA15-5	10/31/05 08:36 / srm			
Clay	21	%		1	ASA15-5	10/31/05 08:36 / srm			
Texture	SCL				ASA15-5	10/31/05 08:36 / srm			
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)									
SATURATED PASTE									
pH, sat, paste	7.40	s.u.		0.10	ASAM10-3.2	10/31/05 08:36 / srm			
Conductivity, sat. paste	3.34	mmhos/cm		0.01	ASA10-3	10/31/05 08:36 / srm			
Saturation	34.8	%		0.1	USDA27a	10/31/05 08:36 / srm			
CHEMICAL CHARACTERISTICS									
Organic Carbon	0.04	wt%		0.02	ASA29-3	11/01/05 12:43 / srm			
Phosphorus, Olsen	4	mg/kg		1	ASA24-5	10/28/05 15:09 / srm			
Nitrate as N. KCL Extract	ND	mg/kg		1	ASA33-8.1	10/27/05 11:32 / srm			



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-044 Client Sample ID: 3XTP-6Bi, 22-34" 
 Report Date:
 11/02/05

 Collection Date:
 06/07/05

 Date Received:
 10/13/05

 Matrix:
 Soil

		MCL/							
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS									
Coarse Fragments	33	wt%		2	ASA15-5	10/25/05 15:56 / srm			
Sand	65	%		1	ASA15-5	10/31/05 08:36 / srm			
Silt	16	%		1	ASA15-5	10/31/05 08:36 / srm			
Clay	19	%		1	ASA15-5	10/31/05 08:36 / srm			
Texture	SL				ASA15-5	10/31/05 08:36 / srm			
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)	)								
SATURATED PASTE									
pH, sat, paste	7.70	s.u.		0.10	ASAM10-3.2	10/31/05 08:36 / srm			
Conductivity, sat. paste	2.56	mmhos/cm		0.01	ASA10-3	10/31/05 08:36 / srm			
Saturation	31.8	%		0.1	USDA27a	10/31/05 08:36 / srm			
CHEMICAL CHARACTERISTICS									
Organic Carbon	0.04	wt%		0.02	ASA29-3	11/01/05 12:43 / srm			
Phosphorus, Olsen	3	mg/kg		1	ASA24-5	10/28/05 15:10 / srm			
Nitrate as N, KCL Extract	2	mg/kg		1	ASA33-8.1	10/27/05 11:33 / srm			



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-045 Client Sample ID: 3XTP-6Ci, 0-1' 
 Report Date:
 11/02/05

 Collection Date:
 06/07/05

 Date Received:
 10/13/05

 Matrix:
 Soil

		MCL/							
Analyses	Result	Units	Qual	RL	QCL	Method	Analysis Date / By		
PHYSICAL CHARACTERISTICS									
Coarse Fragments	33	wt%		2		ASA15-5	10/25/05 15:56 / srm		
Sand	75	%		1		ASA15-5	10/31/05 08:36 / srm		
Silt	12	%		1		ASA15-5	10/31/05 08:36 / srm		
Clav	13	%		1		ASA15-5	10/31/05 08:36 / srm		
Texture	SL					ASA15-5	10/31/05 08:36 / srm		
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)									
SATURATED PASTE									
pH, sat. paste	7.60	s.u.		0.10		ASAM10-3.2	10/31/05 08:36 / srm		
Conductivity, sat. paste	1.10	mmhos/cm		0.01		ASA10-3	10/31/05 08:36 / srm		
Saturation	27.6	%		0.1		USDA27a	10/31/05 08:36 / srm		
CHEMICAL CHARACTERISTICS									
Organic Carbon	0.17	wt%		0.02		ASA29-3	11/01/05 12:43 / srm		
Phosphorus, Olsen	3	mg/kg		1		ASA24-5	10/28/05 15:12 / srm		
Nitrate as N. KCL Extract	1	mg/kg		1		ASA33-8.1	10/27/05 11:34 / srm		



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-046 Client Sample ID: 3XTP-6Ci, 28-40" **Report Date:** 11/02/05 **Collection Date:** 06/07/05 **Date Received:** 10/13/05 **Matrix:** Soil

		MCL/							
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS									
Coarse Fragments	33	wt%		2	ASA15-5	10/25/05 15:56 / srm			
Sand	67	%		1	ASA15-5	10/31/05 08:36 / srm			
Silt	14	%		1	ASA15-5	10/31/05 08:36 / srm			
Clav	19	%		1	ASA15-5	10/31/05 08:36 / srm			
Texture	SL				ASA15-5	10/31/05 08:36 / srm			
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)	)								
SATURATED PASTE									
pH, sat. paste	7.70	s.u.		0.10	ASAM10-3.2	10/31/05 08:36 / srm			
Conductivity, sat. paste	1.46	mmhos/cm		0.01	ASA10-3	10/31/05 08:36 / srm			
Saturation	34.5	%		0.1	USDA27a	10/31/05 08:36 / srm			
CHEMICAL CHARACTERISTICS									
Organic Carbon	0.21	wt%		0.02	ASA29-3	11/01/05 12.43 / srm			
Phosphorus, Olsen	5	mg/kg		1	ASA24-5	10/28/05 15:13 / srm			
Nitrate as N. KCL Extract	6	mg/kg		1	ASA33-8.1	10/27/05 11:35 / srm			

ReportRL - Analyte reporting limit.Definitions:QCL - Quality control limit.

MCL - Maximum contaminant level. ND - Not detected at the reporting limit.



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-047 Client Sample ID: 3XTP-6D, 0-1' **Report Date:** 11/02/05 **Collection Date:** 06/07/05 **Date Received:** 10/13/05 **Matrix:** Soil

		MCL/							
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS									
Coarse Fragments	35	wt%		2	ASA15-5	10/25/05 15:56 / srm			
Sand	72	%		1	ASA15-5	10/31/05 08:36 / srm			
Silt	12	%		1	ASA15-5	10/31/05 08:36 / srm			
Clav	16	%		1	ASA15-5	10/31/05 08:36 / srm			
Texture	SL				ASA15-5	10/31/05 08:36 / srm			
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)									
SATURATED PASTE									
pH, sat. paste	7.90	s.u.		0.10	ASAM10-3.2	10/31/05 08:36 / srm			
Conductivity, sat. paste	0.37	mmhos/cm		0.01	ASA10-3	10/31/05 08:36 / srm			
Saturation	26.9	%		0.1	USDA27a	10/31/05 08:36 / srm			
CHEMICAL CHARACTERISTICS									
Organic Carbon	0.02	wt%		0.02	ASA29-3	11/01/05 12:43 / srm			
Phosphorus, Olsen	3	mg/kg		1	ASA24-5	10/28/05 15:14 / srm			
Nitrate as N, KCL Extract	ND	mg/kg		1	ASA33-8.1	10/27/05 11:35 / srm			



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-048 Client Sample ID: 3XTP-6D, 2-3' 
 Report Date:
 11/02/05

 Collection Date:
 06/07/05

 Date Received:
 10/13/05

 Matrix:
 Soil

	MCL/								
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS									
Coarse Fragments	18	wt%		2	ASA15-5	10/25/05 15:56 / srm			
Sand	42	%		1	ASA15-5	10/31/05 08:36 / srm			
Silt	34	%		1	ASA15-5	10/31/05 08:36 / srm			
Clav	24	%		1	ASA15-5	10/31/05 08:36 / srm			
Texture - C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)	L				ASA15-5	10/31/05 08:36 / srm			
SATURATED PASTE									
pH, sat, paste	7.70	s.u.		0.10	ASAM10-3.2	10/31/05 08:36 / srm			
Conductivity sat paste	1.54	mmhos/cm		0.01	ASA10-3	10/31/05 08:36 / srm			
Saturation	39.9	%		0.1	USDA27a	10/31/05 08:36 / srm			
CHEMICAL CHARACTERISTICS									
Organic Carbon	0.03	wt%		0.02	ASA29-3	11/01/05 12:43 / srm			
Phosphorus, Olsen	3	mg/kg		1	ASA24-5	10/28/05 15:16 / srm			
Nitrate as N. KCL Extract	ND	mg/kg		1	ASA33-8.1	10/27/05 11:36 / srm			



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-049 Client Sample ID: 3XTP-6E, 0-1' 
 Report Date:
 11/02/05

 Collection Date:
 06/07/05

 Date Received:
 10/13/05

 Matrix:
 Soil

	MCL/								
Analyses	Result	Units	Qual R	L QCL	Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS									
Coarse Fragments	42	wt%		2	ASA15-5	10/25/05 15:56 / srm			
Sand	66	%		1	ASA15-5	10/31/05 08:36 / srm			
Silt	11	%		1	ASA15-5	10/31/05 08:36 / srm			
Clay	23	%		1	ASA15-5	10/31/05 08:36 / srm			
Texture	SCL				ASA15-5	10/31/05 08:36 / srm			
- C = Clay, S = Sand(y), SI = Silt(y), L = Loam(y)									
SATURATED PASTE									
pH, sat. paste	7.70	s.u.	0	.10	ASAM10-3.2	10/31/05 08:36 / srm			
Conductivity, sat. paste	1.87	mmhos/cm	0	.01	ASA10-3	10/31/05 08:36 / srm			
Saturation	36.0	%	C	0.1	USDA27a	10/31/05 08:36 / srm			
CHEMICAL CHARACTERISTICS									
Organic Carbon	0.03	wt%	0	.02	ASA29-3	11/01/05 12:43 / srm			
Phosphorus, Olsen	2	mg/kg		1	ASA24-5	10/28/05 15:17 / srm			
Nitrate as N, KCL Extract	ND	mg/kg		1	ASA33-8.1	10/27/05 11:37 / srm			

ReportRL - Analyte reporting limit.Definitions:QCL - Quality control limit.

MCL - Maximum contaminant level. ND - Not detected at the reporting limit.



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-050 Client Sample ID: 3XTP-6E, 20-32" 
 Report Date:
 11/02/05

 Collection Date:
 06/07/05

 Date Received:
 10/13/05

 Matrix:
 Soil

	MCL/								
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS									
Coarse Fragments	38	wt%		2	ASA15-5	10/25/05 15:56 / srm			
Sand	77	%		1	ASA15-5	10/31/05 08:36 / srm			
Silt	8	%		1	ASA15-5	10/31/05 08:36 / srm			
Clay	15	%		1	ASA15-5	10/31/05 08:36 / srm			
Texture	SL				ASA15-5	10/31/05 08:36 / srm			
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)									
SATURATED PASTE									
pH, sat, paste	7.80	s.u.		0.10	ASAM10-3.2	10/31/05 08:36 / srm			
Conductivity, sat. paste	1.03	mmhos/cm		0.01	ASA10-3	10/31/05 08:36 / srm			
Saturation	24.6	%		0.1	USDA27a	10/31/05 08:36 / srm			
CHEMICAL CHARACTERISTICS									
Organic Carbon	0.02	wt%		0.02	ASA29-3	11/01/05 12:43 / srm			
Phosphorus, Olsen	2	mg/kg		1	ASA24-5	10/28/05 15:19 / srm			
Nitrate as N. KCL Extract	ND	mg/kg		1	ASA33-8.1	10/27/05 11:37 / srm			



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-051 Client Sample ID: 3XTP-7A, 0-1' **Report Date:** 11/02/05 **Collection Date:** 06/07/05 **Date Received:** 10/13/05 **Matrix:** Soil

		MCL/								
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By				
PHYSICAL CHARACTERISTICS										
Coarse Fragments	36	wt%		2	ASA15-5	10/25/05 15:56 / srm				
Sand	72	%		1	ASA15-5	10/31/05 08:36 / srm				
Silt	13	%		1	ASA15-5	10/31/05 08:36 / srm				
Clay	15	%		1	ASA15-5	10/31/05 08:36 / srm				
Texture	SL				ASA15-5	10/31/05 08:36 / srm				
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)	)									
SATURATED PASTE										
pH, sat. paste	7.90	s.u.		0.10	ASAM10-3.2	10/31/05 08:36 / srm				
Conductivity, sat. paste	0.71	mmhos/cm		0.01	ASA10-3	10/31/05 08:36 / srm				
Saturation	28.1	%		0.1	USDA27a	10/31/05 08:36 / srm				
CHEMICAL CHARACTERISTICS										
Organic Carbon	ND	wt%		0.02	ASA29-3	11/01/05 12:43 / srm				
Phosphorus, Olsen	2	mg/kg		1	ASA24-5	10/28/05 15:26 / srm				
Nitrate as N, KCL Extract	ND	mg/kg		1	ASA33-8.1	10/27/05 11:40 / srm				



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-052 Client Sample ID: 3XTP-7A, 3-4' 
 Report Date:
 11/02/05

 Collection Date:
 06/07/05

 Date Received:
 10/13/05

 Matrix:
 Soil

	MCL/								
Analyses	Result	Units	Qual	RL QC	L Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS									
Coarse Fragments	27	wt%		2	ASA15-5	10/25/05 15:56 / srm			
Sand	56	%		1	ASA15-5	10/31/05 08:36 / srm			
Silt	22	%		1	ASA15-5	10/31/05 08:36 / srm			
Clay	22	%		1	ASA15-5	10/31/05 08:36 / srm			
Texture	SCL				ASA15-5	10/31/05 08:36 / srm			
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)									
SATURATED PASTE									
pH, sat. paste	7.80	s.u.		0.10	ASAM10-3.2	10/31/05 08:36 / srm			
Conductivity, sat. paste	0.70	mmhos/cm		0.01	ASA10-3	10/31/05 08:36 / srm			
Saturation	36.0	%		0.1	USDA27a	10/31/05 08:36 / srm			
CHEMICAL CHARACTERISTICS									
Organic Carbon	ND	wt%		0.02	ASA29-3	11/01/05 12:43 / srm			
Phosphorus, Olsen	2	mg/kg		1	ASA24-5	10/28/05 15:27 / srm			
Nitrate as N, KCL Extract	1	mg/kg		1	ASA33-8.1	10/27/05 11:40 / srm			



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-053 Client Sample ID: 3XTP-7Ai, 0-1' 
 Report Date:
 11/02/05

 Collection Date:
 06/07/05

 Date Received:
 10/13/05

 Matrix:
 Soil

		MCL/								
Analyses	Result	Units	Qual	RL	QCL	Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS										
Coarse Fragments	36	wt%		2		ASA15-5	10/25/05 15:56 / srm			
Sand	67	%		1		ASA15-5	10/31/05 08:36 / srm			
Silt	14	%		1		ASA15-5	10/31/05 08:36 / srm			
Clay	19	%		1		ASA15-5	10/31/05 08:36 / srm			
Texture	SL					ASA15-5	10/31/05 08:36 / srm			
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)										
SATURATED PASTE										
pH, sat. paste	7.80	s.u.		0.10		ASAM10-3.2	10/31/05 08:36 / srm			
Conductivity, sat. paste	0.61	mmhos/cm		0.01		ASA10-3	10/31/05 08:36 / srm			
Saturation	26.8	%		0.1		USDA27a	10/31/05 08:36 / srm			
CHEMICAL CHARACTERISTICS										
Organic Carbon	0.04	wt%		0.02		ASA29-3	11/01/05 12:43 / srm			
Phosphorus, Olsen	2	mg/kg		1		ASA24-5	10/28/05 15:28 / srm			
Nitrate as N, KCL Extract	ND	mg/kg		1		ASA33-8.1	10/27/05 11:42 / srm			

Report Definitions: RL - Analyte reporting limit. QCL - Quality control limit.



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-054 Client Sample ID: 3XTP-7Ai, 3-4' 
 Report Date:
 11/02/05

 Collection Date:
 06/07/05

 Date Received:
 10/13/05

 Matrix:
 Soil

		MCL/							
Analyses	Result	Units	Qual	RL	QCL	Method	Analysis Date / By		
PHYSICAL CHARACTERISTICS									
Coarse Fragments	36	wt%		2		ASA15-5	10/25/05 15:56 / srm		
Sand	44	%		1		ASA15-5	10/31/05 08:36 / srm		
Silt	27	%		1		ASA15-5	10/31/05 08:36 / srm		
Clay	29	%		1		ASA15-5	10/31/05 08:36 / srm		
Texture	CL					ASA15-5	10/31/05 08:36 / srm		
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)									
SATURATED PASTE									
pH, sat. paste	7.70	s.u.		0.10		ASAM10-3.2	10/31/05 08:36 / srm		
Conductivity, sat. paste	1.69	mmhos/cm		0.01		ASA10-3	10/31/05 08:36 / srm		
Saturation	47.1	%		0.1		USDA27a	10/31/05 08:36 / srm		
CHEMICAL CHARACTERISTICS									
Organic Carbon	0.12	wt%		0.02		ASA29-3	11/01/05 12:43 / srm		
Phosphorus, Olsen	2	mg/kg		1		ASA24-5	10/28/05 15:30 / srm		
Nitrate as N, KCL Extract	5	mg/kg		1		ASA33-8.1	10/27/05 11:43 / srm		



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-055 Client Sample ID: 3XTP-7C, 0-1' 
 Report Date:
 11/02/05

 Collection Date:
 06/07/05

 Date Received:
 10/13/05

 Matrix:
 Soil

		MCL/								
Analyses	Result	Units	Qual	RL (	QCL	Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS										
Coarse Fragments	35	wt%		2		ASA15-5	10/25/05 15:56 / srm			
Sand	76	%		1		ASA15-5	10/31/05 08:36 / srm			
Silt	10	%		1		ASA15-5	10/31/05 08:36 / srm			
Clay	14	%		1		ASA15-5	10/31/05 08:36 / srm			
Texture	SL					ASA15-5	10/31/05 08:36 / srm			
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)	I									
SATURATED PASTE										
pH, sat. paste	7.90	s.u.		0.10		ASAM10-3.2	10/31/05 08:36 / srm			
Conductivity, sat. paste	0.37	mmhos/cm		0.01		ASA10-3	10/31/05 08:36 / srm			
Saturation	24.2	%		0.1		USDA27a	10/31/05 08:36 / srm			
CHEMICAL CHARACTERISTICS										
Organic Carbon	ND	wt%		0.02		ASA29-3	11/01/05 12:43 / srm			
Phosphorus, Olsen	2	mg/kg		1		ASA24-5	10/28/05 15:31 / srm			
Nitrate as N, KCL Extract	ND	mg/kg		1		ASA33-8.1	10/27/05 11:44 / srm			



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-056 Client Sample ID: 3XTP-7C, 38-50" 
 Report Date:
 11/02/05

 Collection Date:
 06/07/05

 Date Received:
 10/13/05

 Matrix:
 Soil

	MCL/								
Analyses	Result	Units	Qual	RL	QCL	Method	Analysis Date / By		
PHYSICAL CHARACTERISTICS									
Coarse Fragments	33	wt%		2		ASA15-5	10/25/05 15:56 / srm		
Sand	82	%		1		ASA15-5	10/31/05 08:36 / srm		
Silt	5	%		1		ASA15-5	10/31/05 08:36 / srm		
Clay	13	%		1		ASA15-5	10/31/05 08:36 / srm		
Texture	SL					ASA15-5	10/31/05 08:36 / srm		
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)									
SATURATED PASTE									
pH, sat. paste	7.80	s.u.		0.10		ASAM10-3.2	10/31/05 08:36 / srm		
Conductivity, sat. paste	0.67	mmhos/cm		0.01		ASA10-3	10/31/05 08:36 / srm		
Saturation	23.3	%		0.1		USDA27a	10/31/05 08:36 / srm		
CHEMICAL CHARACTERISTICS									
Organic Carbon	ND	wt%		0.02		ASA29-3	11/01/05 12:43 / srm		
Phosphorus, Olsen	2	mg/kg		1		ASA24-5	10/28/05 15:33 / srm		
Nitrate as N, KCL Extract	ND	mg/kg		1		ASA33-8.1	10/27/05 11:45 / srm		



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-057 Client Sample ID: 3XTP-7D, 0-1' 
 Report Date:
 11/02/05

 Collection Date:
 06/07/05

 Date Received:
 10/13/05

 Matrix:
 Soil

		MCL/								
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By				
PHYSICAL CHARACTERISTICS										
Coarse Fragments	34	wt%		2	ASA15-5	10/25/05 15:56 / srm				
Sand	72	%		1	ASA15-5	10/31/05 08:36 / srm				
Silt	11	%		1	ASA15-5	10/31/05 08:36 / srm				
Clay	17	%		1	ASA15-5	10/31/05 08:36 / srm				
Texture	SL				ASA15-5	10/31/05 08:36 / srm				
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)										
SATURATED PASTE										
pH, sat. paste	7.80	s.u.		0.10	ASAM10-3.2	10/31/05 08:36 / srm				
Conductivity, sat. paste	0.67	mmhos/cm		0.01	ASA10-3	10/31/05 08:36 / srm				
Saturation	27.1	%		0.1	USDA27a	10/31/05 08:36 / srm				
CHEMICAL CHARACTERISTICS										
Organic Carbon	ND	wt%		0.02	ASA29-3	11/01/05 12:43 / srm				
Phosphorus, Olsen	2	mg/kg		1	ASA24-5	10/28/05 15:34 / srm				
Nitrate as N, KCL Extract	ND	mg/kg		1	ASA33-8.1	10/27/05 11:45 / srm				



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-058 Client Sample ID: 3XTP-7D, 37-49" 
 Report Date:
 11/02/05

 Collection Date:
 06/07/05

 Date Received:
 10/13/05

 Matrix:
 Soil

	MCL/								
Analyses	Result	Units	Qual	RL Q	CL Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS									
Coarse Fragments	27	wt%		2	ASA15-5	10/25/05 15:56 / srm			
Sand	54	%		1	ASA15-5	10/31/05 08:36 / srm			
Silt	25	%		1	ASA15-5	10/31/05 08:36 / srm			
Clay	21	%		1	ASA15-5	10/31/05 08:36 / srm			
Texture	SCL				ASA15-5	10/31/05 08:36 / srm			
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)									
SATURATED PASTE									
pH, sat. paste	7.70	s.u.		0.10	ASAM10-3.2	10/31/05 08:36 / srm			
Conductivity, sat. paste	0.92	mmhos/cm		0.01	ASA10-3	10/31/05 08:36 / srm			
Saturation	31.0	%		0.1	USDA27a	10/31/05 08:36 / srm			
CHEMICAL CHARACTERISTICS									
Organic Carbon	0.03	wt%		0.02	ASA29-3	11/01/05 12:43 / srm			
Phosphorus, Olsen	2	mg/kg		1	ASA24-5	10/28/05 15:36 / srm			
Nitrate as N, KCL Extract	ND	mg/kg		1	ASA33-8.1	10/27/05 11:46 / srm			


Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100810-059 Client Sample ID: 3XTP-7E, 0-1' **Report Date:** 11/02/05 **Collection Date:** 06/07/05 **Date Received:** 10/13/05 **Matrix:** Soil

				MCL/		
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS						
Coarse Fragments	31	wt%		2	ASA15-5	10/25/05 15:56 / srm
Sand	76	%		1	ASA15-5	10/31/05 08:36 / srm
Silt	7	%		1	ASA15-5	10/31/05 08:36 / srm
Clay	17	%		1	ASA15-5	10/31/05 08:36 / srm
Texture	SL				ASA15-5	10/31/05 08:36 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)						
SATURATED PASTE						
pH, sat. paste	7.90	s.u.		0.10	ASAM10-3.2	10/31/05 08:36 / srm
Conductivity, sat. paste	0.49	mmhos/cm		0.01	ASA10-3	10/31/05 08:36 / srm
Saturation	25.3	%		0.1	USDA27a	10/31/05 08:36 / srm
CHEMICAL CHARACTERISTICS						
Organic Carbon	ND	wt%		0.02	ASA29-3	11/01/05 12:43 / srm
Phosphorus, Olsen	2	mg/kg		1	ASA24-5	10/28/05 15:37 / srm
Nitrate as N, KCL Extract	ND	mg/kg		1	ASA33-8.1	10/27/05 11:47 / srm



Client: Golder Associates Inc **Project:** Tailing Test Plots **Lab ID:** B05100810-060 **Client Sample ID:** 3XTP-7E, 40-52" 
 Report Date:
 11/02/05

 Collection Date:
 06/07/05

 Date Received:
 10/13/05

 Matrix:
 Soil

				1	MCL/		
Analyses	Result	Units	Qual	RL	QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS							
Coarse Fragments	53	wt%		2		ASA15-5	10/25/05 15:56 / srm
Sand	50	%		1		ASA15-5	10/31/05 08:36 / srm
Silt	19	%		1		ASA15-5	10/31/05 08:36 / srm
Clay	31	%		1		ASA15-5	10/31/05 08:36 / srm
Texture	SCL					ASA15-5	10/31/05 08:36 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)							
SATURATED PASTE							
pH, sat. paste	7.60	s.u.		0.10		ASAM10-3.2	10/31/05 08:36 / srm
Conductivity, sat. paste	1.62	mmhos/cm		0.01		ASA10-3	10/31/05 08:36 / srm
Saturation	49.6	%		0.1		USDA27a	10/31/05 08:36 / srm
CHEMICAL CHARACTERISTICS							
Organic Carbon	0.31	wt%		0.02		ASA29-3	11/01/05 12:43 / srm
Phosphorus, Olsen	3	mg/kg		1		ASA24-5	10/28/05 15:38 / srm
Nitrate as N, KCL Extract	5	mg/kg		1		ASA33-8.1	10/27/05 11:47 / srm

## Energy Laboratories Inc

## Sample Receipt Checklist

Client Name Golder Associates Inc			Date and Time	e Received:	10/13/2005		
Work Order Number B05100810	1		Received by	sba			
Checklist completed by:		-13-05	Reviewed by	Initials		Date	
	Camer name	UPS ARS Grou	ina				
Shipping container/cooler in good condition?		Yes 🗹	No 🗌	Not Present			
Custody seals intact on shipping container/c	ooler?	Yes 🗹		Not Present			
Custody seals intact on sample bottles?		Yes	No 🗌	Not Present			
Chain of custody present?		Yes 🗹	No 🗀				
Chain of custody signed when relinquished a	nd received?	Yes 🗹	No 🗌				
Chain of custody agrees with sample labels?		Yes 🗹	No 🗌				
Samples in proper container/bottle?		Yes 🗹	No 🗌				
Sample containers intact?		Yes 🗹	No 🗌				
Sufficient sample volume for indicated test?		Yes 🗹	No 🗌				
All samples received within holding time?		Yes 🗹	No 🗌				
Container/Temp Blank temperature in compli	ance?	Yes 🗋	No 🗹 🛛 NA 🤋	С			
Water - VOA vials have zero headspace?		Yes 🗔	No 🗌 No VO	A vials subm	itted 🗹		
Water - pH acceptable upon receipt?		Yes 🗌	No 🗌 Not	Applicable			
	Adjusted?	Che	ecked by				
Any No and/or NA (not applicable) response	must be detailed in the c	comments section	below.				: :
Client contacted	Date contacted:		Person	contacted			
Contacted by:	Regarding:						
Comments:							
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Corrective Action			······	, <b>_</b>			
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ENERGY Chain of Cus LABORATORIES PLEASE PRINT, provide a	stody and Analytic as much information as possible. Re	cal Requerer to corresponding	est Record Pa	ge of {	
Company Name:	Project Name, PWS # Permit #, Etc.: Tailing Test Plot	. 0			
4910 ALAMEDA NE, STE.A	Contact Name, Phone, Fax, E-mail: LEWIS MWK 505	1821-304	Sampler Name if other than Contact 3		
ALBUQUERQUE, NM 87113	Imunkegolder. com				
Invoice Address:	Invoice Contact & Phone #:		Purchase Order #: EL	l Quote #:	
same as above	SAME AS ABOVE				
Report Required For: POTW/WWTP DW DW		SOUESTED	Notify ELI prior to RUS sample submittal for addit	H Shipped by:	
Curst Connect Formats - El 1 must be notified prior to		() () () () () () () () () () () () () (	charges and schedulin	g Cooler (D(s)	
sample submittal for the following:			Comments: Comments:	Receipt Temp	
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<sup>2</sup> 3XTP-1Ai 13-25" 6/13/05			X	NC	ิ
3XTP-1B, 0-12" 6/14/05			X	E	3
* 3XTP-1B, 13-25" 6/14/05	1		×	sn	$\mathcal{T}$
" 3XTP-16, 0-12" 6/17/05			X	ر بر	5
" 3XTP-1C 11-23" 6/17/05	11 IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII		X	R R R R R	10
2XTP-10, 0-12" WILLER			X	ΤA	ア
" 3XTP-10' 15-27" 6/14/05			×	<u>ч</u>	60 -
" 3XTP - 16. 0-12" 6/17/05			×	B	<u> </u>
" 3XTP-1-6, 25-37" 6/12/05		イアマ	X	77	0
Custody Reinquished by (pmi): Date Time Boody Elizabeth Field (2/10/	05 9 million 3.	Received by (print):	Date/Time:	Signature:	
MUST be Date/Time Date/Time	e: Signaturë:	Received by (print).	Date/Time:	Sentemer	
Signed Sample Disposal: Return to client X	Lab Disposal:	Sample Type:	LABORATORY USE O # of fraction		
In certain circumstances, samples submitted to Energy This serves as notice of Visit our web site at <i>www.energ</i>	y Laboratories, Inc. may be subcontracte i this possibility. All sub-contract data wi gy <i>lab.com</i> for additional informatic	ed to other certified la ill be clearly notated ( ion, downloadable	iboratories in order to complete the a on your analytical report. 9 fee schedule, forms, & links.	nalysis requested.	

<b>ENERGY</b> LABORATORIES	C	hain of Cus	s much inform	and AI	<b>nalyti</b> <sub>ossible. Re</sub>	<b>cal Re</b> ( fer to corresp	<b>quest</b> onding no	t Record tes on reverse side.	Page_	۲۲ م	2
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Visit our web site at www.energy/ab.com for additional information, downloadable fee schedule, forms, & links.

ENERGY Ché Laboratories Pleas	ain of Cus E PRINT, provide as	tody a	<b>nd A</b> nation as p	<b>naly</b> ossible.	<b>tical  </b> Refer to co	<b>Requ</b>	est R ng notes o	<b>ecord</b> n reverse side.	Page	oť	Υг
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Report Required For: POTW/WMTP		tion	ANAL	YSIS F	Equi	STED	Ż	otify ELI prior to	RUSH additional	Shipped by:	<b>r</b> –
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Signed	Bottim to client:	- - -	Dismeal:		Sam	ple Type:		ABORATORY 1	ISE ONLY f fractions	Di s	
In certain circumstances, sample	es submitted to Energy	Laboratories,	Inc. may b	e subcontr	acted to oth	er certified	laboratories	in order to compl	ete the analysi	is requested.	

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<b>ENERGY</b> LABORATORIES		<b>Aain of Cu</b> Ase print, provide	stody as much info	and /	Anal s possible	<b>ytica</b> Refer	al Re to corresp		t Record stes on reverse side.	Page	of	
Company Name: GOLDER ASSOC	ARS		Project Name,	AG T	est. Est	Plot	Y					_
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<b>ENERGY</b> LABORATORIES	Ch	Iain of C SE PRINT, prov	<b>CuStc</b> vide as m	ody ar uch informa	<b>Id Analyti</b> tion as possible. Re	ical Req	uest Ro	ecord reverse side.	Page	of I	Г
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MUST be	inquished by (print):		Date/Time:		U Signature	Received by (print):		Date/Time:	Mar (RE	anneline .	
Signed	omala Dianacal.	Rehim to client		Lab Di	isposal:	Sample Type		BORATORY U # of	SE ONLY /		
In certain cit	rcumstances, sam	ples submitted to	Energy Lal	boratories, In	NC. may be subcontrac	ted to other certif	ed laboratories	in order to comple Ivtical report.	te the analysis	s requested.	
		This serves as no	otice of this	s possibility.	All sub-conuract uata additional information	tion download	ahle fee sch	edule. forms, &	links.		

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LABORATORIES PLEAS	ain of Cus se PRINT, provide a	s much information	<b>d Ana</b> on as possit	<b>Iytical F</b> ble. Refer to co	Reque Diresponding	<b>St Record</b> notes on reverse side.	Page		٥
GOLDER ASSOCIATES		Project Name, PWS	#, Permit #, Et	Plots					
4910 ALAMEDA NE, 576	ĘA	Contact Name, Public M	μ	05/821	-3043	ampler Name if other than Con	tact:		
ALBUQVEROUE, NM 07	HIS	Imun K@	golder	. com					
Invoice Address: SAME AS ABOVE		SANG AS	ABOV(	5		Purchase Order #:	ELI Quote	·#	
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SAMPLE IDENTIFICATION ( (Name, Location, Interval, etc.)	Collection Collection Date Time	MATRIX A	LUS 273	NU DKP Kod	33S	LHSNY		Match Lab ID	
1 3XTP-7A, 0-1'	617/05	Soils/solid 1						Bran 19 510-0	- A
<sup>2</sup> 3XTP-7A', 3-4' (	6/7/05	lı						N(	-56
"3XTP-7A1, AD-1'	0/7/05	u						E	μ δ β
" ATTP-TAI (S' HE- 9TXE"	617105	11				X		Isr	54
3 XTP-7C , 016-1	617105							1	2
" 3XTP-7C, 38-50"	617105	<i>u</i>						нc	р6 Р
7 3XTP-70, 0-1' (	6/F/05	h						) <b>T</b> ∕	2
* 3XTP-7D_ 37-49%	617105	t1						יי אנ	<u>v</u>
"3XTP-76, 0-1/ (	617105	11						, BC	6
" 3XTP-76, 40-52%	6/7/03	n V	トトト	、ケイト	7			<b>V</b> T	è S
Custody Refinquished by (print): Record Elizabeth Field	Date/Time: ]0/10/05	5 Eliza	Signature:	Received by	/ (print):	Date/Time:		Signature:	
MUST be Relinquished by (print):	Date/Time:	<b>A</b>	Signature:	Received by	/ (print):	Date/Time:		- Balanta	
Signed Sample Disposal: R	tetum to client: X	Lab Dispos	sal:	Sample	• Type:	LABORATORY USE # of fract	ONE		
In certain circumstances, samplee Thi	s submitted to Energy i is serves as notice of th	aboratories, Inc. m dis nossibility All s	ay be subcor	ntracted to other	certified labo	ratories in order to complete th	e anałysis ı	requested.	-
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Visit our web site at www.energylab.com for additional information, downloadable fee schedule, forms, & links.



## ANALYTICAL SUMMARY REPORT

November 02, 2005

Golder Associates Inc 4910 Alameda Blvd NE, Ste A Albuquerque, NM 87113

Workorder No.: B05100945

Quote ID: B856 - 40 Soil/Rock Samples

Project Name: Tailing Test Plots

Energy Laboratories Inc received the following 13 samples from Golder Associates Inc on 10/17/2005 for analysis.

Sample ID	Client Sample ID	Collect Date	<b>Receive</b> Date	Matrix	Test
B05100945-001	3TP4E-1, 0-9 in	07/14/05 0:00	10/17/05	Soil	Coarse Fragments Conductivity Nitrate as N, KCL Extract Organic Carbon-Walkley/Black pH, Saturated Paste Phosphorus-Olsen Particle Size Analysis Saturation Percentage Texture
B05100945-002	3TP4E-2, 9-18 in	07/14/05 0:00	10/17/05	Soil	Same As Above
B05100945-003	3TP4A-1, 0-9 in	07/14/05 0:00	10/17/05	Soil	Same As Above
B05100945-004	3TP4A-2, 15-24 in	07/14/05 0:00	10/17/05	Soil	Same As Above
B05100945-005	3TP4B-1, 0-9 in	07/14/05 0:00	10/17/05	Soil	Same As Above
B05100945-006	3TP4B-2, 10-19 in	07/14/05 0:00	10/17/05	Soil	Same As Above
B05100945-007	3TP4C-1, 0-9 in	07/14/05 0:00	10/17/05	Sail	Same As Above
B05100945-008	3TP4C-2, 12-21 in	07/14/05 0:00	10/17/05	Soil	Same As Above
B05100945-009	3TP4D-1, 0-9 in	07/14/05 0.00	10/17/05	Soil	Same As Above
B05100945-010	3TP4D-2, 14-23 in	07/14/05 0:00	10/17/05	Soil	Same As Above
B05100945-011	4B-3DAM, 0-2 ft	07/14/05 0:00	10/17/05	Soil	Conductivity pH, Saturated Paste Particle Size Analysis Saturation Percentage Texture
B05100945-012	4C-3DAM, 0-2 ft	07/14/05 0:00	10/17/05	Soil	Same As Above
B05100945-013	4D-3DAM, 0-2 ft	07/14/05 0:00	10/17/05	Soil	Same As Above

There were no problems with the analyses and all data for associated QC met EPA or laboratory specifications except if noted in report comments of the Case Narrative.

If you have any questions regarding these tests results, please call.

Report Approved By:



Client: Golder Associates Inc **Project:** Tailing Test Plots Lab ID: B05100945-001 Client Sample ID: 3TP4E-1, 0-9 in Report Date: 11/02/05 Collection Date: 07/14/05 Date Received: 10/17/05 Matrix: Soil

				MCL/		
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS						
Coarse Fragments	37	wt%		2	ASA15-5	10/25/05 15 58 / srm
Sand	62	%		1	ASA15-5	11/02/05 09:58 / srm
Silt	16	%		1	ASA15-5	11/02/05 09:58 / srm
Clay	22	%		1	ASA15-5	11/02/05 09:58 / srm
Texture	SCL				ASA15-5	11/02/05 09:58 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)						
SATURATED PASTE						
pH. sat, paste	7.60	s.u.		0.10	ASAM10-3.2	10/31/05 08:43 / srm
Conductivity, sat, paste	3.13	mmhos/cm		0.01	A\$A10-3	10/31/05 08:43 / srm
Saturation	30.4	%		0.1	USDA27a	10/31/05 08:43 / srm
CHEMICAL CHARACTERISTICS						
Organic Carbon	0.11	wt%		0.02	ASA29-3	11/02/05 09:58 / srm
Phosphorus, Olsen	3	mg/kg		1	ASA24-5	10/31/05 07:56 / srm
Nitrate as N, KCL Extract	1	mg/kg		1	ASA33-8.1	10/27/05 11:58 / srm

 Report
 RL - Analyte reporting limit.

 Definitions:
 QCL - Quality control limit.



Client: Golder Associates Inc **Project:** Tailing Test Plots Lab ID: B05100945-002 Client Sample ID: 3TP4E-2, 9-18 in Report Date: 11/02/05 Collection Date: 07/14/05 Date Received: 10/17/05 Matrix: Soil

				MCL/	1	
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS						
Coarse Fragments	25	wt%		2	ASA15-5	10/25/05 15:58 / srm
Sand	62	%		1	ASA15-5	11/02/05 09:58 / srm
Silt	16	%		1	ASA15-5	11/02/05 09:58 / srm
Clay	22	%		1	ASA15-5	11/02/05 09:58 / srm
Texture	SCL				ASA15-5	11/02/05 09:58 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)						
SATURATED PASTE						
pH, sat, paste	7.70	s.u.		0.10	ASAM10-3.2	10/31/05 08:43 / srm
Conductivity, sat, paste	2.38	mmhos/cm		0.01	ASA10-3	10/31/05 08:43 / srm
Saturation	30.6	%		0.1	USDA27a	10/31/05 08:43 / srm
CHEMICAL CHARACTERISTICS						
Organic Carbon	0.11	wt%		0.02	ASA29-3	11/02/05 09 58 / srm
Phosphorus, Olsen	2	mg/kg		1	ASA24-5	10/31/05 07:56 / srm
Nitrate as N, KCL Extract	ND	mg/kg		1	ASA33-8.1	10/27/05 11·59 / srm

ReportRL - Analyte reporting limit.Definitions:QCL - Quality control limit.



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100945-003 Client Sample ID: 3TP4A-1, 0-9 in 
 Report Date:
 11/02/05

 Collection Date:
 07/14/05

 Date Received:
 10/17/05

 Matrix:
 Soil

	MCL/							
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By		
PHYSICAL CHARACTERISTICS								
Coarse Ergements	36	wt%		2	ASA15-5	10/25/05 15.58 / srm		
Coarse magnents	66	%		1	ASA15-5	11/02/05 09:58 / srm		
Sano	12	%		1	ASA15-5	11/02/05 09:58 / srm		
Sit	22	%		1	ASA15-5	11/02/05 09:58 / srm		
Clay	501	75			ASA15-5	11/02/05 09:58 / srm		
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)	00L							
SATURATED PASTE				0.10	ASAM10.3.2	10/31/05 08:43 / sm		
pH, sat. paste	7.70	s.u.		010	AGAN10-3.2	10/31/05 08:43 / srm		
Conductivity, sat. paste	2.98	mmhos/cm	l	0.01		10/31/05 08:43 / srm		
Saturation	31.9	%		0.1	USDAZIA			
CHEMICAL CHARACTERISTICS					10100 0	11/02/05 00:58 / srm		
Organic Carbon	0.21	wt%		0.02	ASA29-3	1 (/02/05 05:50 / Sim		
Phosphorus, Olsen	5	mg/kg		1	ASA24-5	10/31/05 07.507 Sm		
Nitrate as N, KCL Extract	2	mg/kg		1	ASA33-8.1	10/27/05 11:597 Shi		

 Report
 RL - Analyte reporting limit.

 Definitions:
 QCL - Quality control limit.



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100945-004 Client Sample ID: 3TP4A-2, 15-24 in **Report Date:** 11/02/05 **Collection Date:** 07/14/05 **Date Received:** 10/17/05 **Matrix:** Soil

	MCL/								
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS									
Control Fragments	25	wt%		2	ASA15-5	10/25/05 15:58 / srm			
Coalse Flagments	70	%		1	ASA15-5	11/02/05 09:58 / srm			
Sanu	9	%		1	ASA15-5	11/02/05 09:58 / srm			
	21	%		1	ASA15-5	11/02/05 09:58 / srm			
Clay	SCI				ASA15-5	11/02/05 09:58 / srm			
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)	001								
SATURATED PASTE						10/04/05 00:40 / 200			
pH, sat. paste	7.60	s.u.		0.10	ASAM10-3.2	10/31/05 08:43 / stm			
Conductivity, sat. paste	2.67	mmhos/cm		0.0 <b>1</b>	ASA10-3	10/31/05 08:43 / srm			
Saturation	31.4	%		0.1	USDA27a	10/31/05 08:43 / srm			
CHEMICAL CHARACTERISTICS									
Organic Carbon	0.02	wt%		0.02	ASA29-3	11/02/05 09:58 / srm			
Phosphorus, Olsen	3	mg/kg		1	ASA24-5	10/31/05 07:56 / srm			
Nitrate as N, KCL Extract	ND	mg/kg		1	ASA33-8.1	10/27/05 12:00 / s/m			



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100945-005 Client Sample ID: 3TP4B-1, 0-9 in **Report Date:** 11/02/05 **Collection Date:** 07/14/05 **Date Received:** 10/17/05 **Matrix:** Soil

	MCL/								
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS									
Coarse Fragments	26	wt%		2	ASA15-5	10/25/05 15:58 / srm			
Sand	69	%		1	ASA15-5	11/02/05 09:58 / srm			
	10	%		1	ASA15-5	11/02/05 09·58 / srm			
Silt	21	%		1	ASA15-5	11/02/05 09:58 / srm			
Clay	SCL				ASA15-5	11/02/05 10:01 / srm			
- C = Clay, S = Sand(y), St = Silt(y), L = Loam(y)									
SATURATED PASTE						40/04/05 08:43 Larm			
pH, sat, paste	7.60	s.u.		0.10	ASAM10-3.2	10/31/05 08:43 / sim			
Conductivity, sat. paste	2.73	mmhos/cm		0.01	ASA10-3	10/31/05 08:437 500			
Saturation	29.8	%		0.1	USDA27a	10/31/05 08:437 Shi			
CHEMICAL CHARACTERISTICS						44/00/05 00/58 / orm			
Organic Carbon	0.06	wt%		0.02	ASA29-3	11/02/05 09:56 / 5111			
Phosphorus, Olsen	2	mg/kg		1	ASA24-5	10/31/05 07:56 / SIM			
Nitrate as N, KCL Extract	1	mg/kg		1	ASA33-8.1	10/27/05 12:01 / Sm			

Report Definitions: RL - Analyte reporting limit. QCL - Quality control limit.



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100945-006 Client Sample ID: 3TP4B-2, 10-19 m Report Date: 11/02/05 Collection Date: 07/14/05 Date Received: 10/17/05 Matrix: Soil

	MCL/								
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS									
Coarse Fragments	30	wt%		2	ASA15-5	10/25/05 15:58 / srm			
Sand	71	%		1	ASA15-5	11/02/05 09:58 / srm			
Silt	9	%		1	ASA15-5	11/02/05 09:58 / srm			
Clav	20	%		1	ASA15-5	11/02/05 09:58 / srm			
Texture	SCL				ASA15-5	11/02/05 10:01 / srm			
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)									
SATURATED PASTE						10/01/05 00:12 / 05			
pH, sat. paste	7.70	s.u.		0.10	ASAM10-3.2	10/31/05 08:43 / 500			
Conductivity, sat. paste	3.37	mmhos/cm		0.01	ASA10-3	10/31/05 08:43 / srm			
Saturation	29.1	%		0.1	USDA27a	10/31/05 08:43 / srm			
CHEMICAL CHARACTERISTICS						44100105-00-58-4 8400			
Organic Carbon	ND	wt%		0.02	ASA29-3	11/02/05 09:58 / sm			
Phosphorus, Olsen	2	mg/kg		1	ASA24-5	10/31/05 07:56 / sm			
Nitrate as N, KCL Extract	ND	mg/kg		1	ASA33-8.1	10/27/05 12:02 / srm			

Report Definitions:

RL - Analyte reporting limit. QCL - Quality control limit.



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100945-007 Client Sample ID: 3TP4C-1, 0-9 in Report Date: 11/02/05 Collection Date: 07/14/05 Date Received: 10/17/05 Matrix: Soil

····	MCL/								
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS	_								
Coarse Fragments	38	wt%		2	ASA15-5	10/25/05 15:58 / srm			
Sand	62	%		1	ASA15-5	11/02/05 09:58 / srm			
Sand	16	%		1	ASA15-5	11/02/05 09:58 / srm			
Sin	22	%		1	ASA15-5	11/02/05 09:58 / srm			
Texture	SCL	, <b>c</b>			ASA15-5	11/02/05 09°58 / srm			
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)									
SATURATED PASTE						10/21/05 09:43 / erm			
pH, sat. paste	7,60	s.u.		0.10	ASAM10-3 2	10/31/05 00:437 SITE			
Conductivity, sat. paste	2.89	mmhos/cm		0.01	ASA10-3	10/3 (/05 06.43 / 500			
Saturation	32.2	%		0.1	USDA27a	10/31/05 08:437 Shin			
CHEMICAL CHARACTERISTICS									
Organic Carbon	0.07	wt%		0.02	ASA29-3	11/02/05 09:58 / srm			
Phoenborus Alsen	3	mg/kg		1	ASA24-5	10/31/05 07:56 / srm			
Nitrate as N. KCL Extract	1	mg/kg		1	ASA33-8.1	10/27/05 12:04 / srm			

ReportRL - Analyte reporting limit.Definitions:QCL - Quality control limit.



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100945-008 Client Sample ID: 3TP4C-2, 12-21 in Report Date: 11/02/05 Collection Date: 07/14/05 Date Received: 10/17/05 Matrix: Soil

-	MCL/								
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS	in the second								
PHYSICAL CHARACTERIC HOC	26	wt%		2	ASA15-5	10/25/05 15:58 / srm			
Coarse Fragments	66	0/2		1	ASA15-5	11/02/05 09:58 / srm			
Sand	12	97.		1	ASA15-5	11/02/05 09:58 / srm			
Silt	13	70 07		1	ASA15-5	11/02/05 09:58 / srm			
Clay	21	70			ASA15-5	11/02/05 09:58 / srm			
Texture	SUL								
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)									
SATURATED PASTE						10101105 00:42 ( 055			
pH, sat, paste	7.60	s.u.		0.10	ASAM10-3.2	10/31/05 08:43 / sm			
Conductivity, sat, paste	2.77	mmhos/cm		0.01	ASA10-3	10/31/05 08:43 / srm			
Saturation	31.9	%		0.1	USDA27a	10/31/05 08:43 / srm			
CHEMICAL CHARACTERISTICS									
Organia Carbon	ND	wt%		0.02	ASA29-3	11/02/05 09:58 / srm			
	2	ma/ka		1	ASA24-5	10/31/05 07:56 / srm			
Phospholus, Visen		ma/ka		1	ASA33-8.1	10/27/05 12:04 / srm			
INITALE AS IN, NUC EXILAGI	110								

ReportRL - Analyte reporting limit.Definitions:QCL - Quality control limit.



Client:Golder Associates IncProject:Tailing Test PlotsLab ID:B05100945-009Client Sample ID:3TP4D-1, 0-9 in

Report Date: 11/02/05 Collection Date: 07/14/05 Date Received: 10/17/05 Matrix: Soil

	MCL/								
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS									
Coarse Fragments	35	wt%		2	ASA15-5	10/25/05 15:58 / srm			
Pood	60	%		1	ASA15-5	11/02/05 09:58 / srm			
Salio	16	%		1	ASA15-5	11/02/05 09:58 / srm			
Sill	24	%		1	ASA15-5	11/02/05 09:58 / srm			
Clay	SCI				ASA15-5	11/02/05 09:58 / srm			
- C = Clay, S = Sand(y), Si = Sill(y), L = Loam(y)	ÇOL								
SATURATED PASTE						10/01/05 00/42 / arm			
oH. sat. paste	7.70	s.u.		0.10	ASAM10-3.2	10/31/05 08:437 Sm			
Conductivity, sat, paste	2.79	mmhos/cm		0.01	ASA10-3	10/31/05 08:43 / Srift			
Saturation	33.9	%		0.1	USDA27a	10/31/05 U8:43 / srm			
CHEMICAL CHARACTERISTICS									
Organic Carbon	0.06	wt%		0.02	ASA29-3	11/02/05 09:58 / srm			
Phosphorus Olsen	2	mg/kg		1	ASA24-5	10/28/05 17:09 / srm			
Nitrate as N, KCL Extract	1	mg/kg		1	ASA33-8 1	10/27/05 12:05 / srm			



### LABORATORY ANALYTICAL REPORT

Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100945-010 Client Sample ID: 3TP4D-2, 14-23 in Report Date: 11/02/05 Collection Date: 07/14/05 Date Received: 10/17/05 Matrix: Soil

	- MCL/								
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS									
Coarse Fragments	21	wt%		2	ASA15-5	10/25/05 15:58 / srm			
Sand	62	%		1	A\$A15-5	11/02/05 09·58 / srm			
	15	%		1	ASA15-5	11/02/05 09:58 / srm			
Clay	23	%		1	ASA15-5	11/02/05 09 58 / srm			
Toyture	SCL				ASA15-5	11/02/05 09:58 / srm			
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)	_								
SATURATED PASTE						10/01/05 08·43 / erm			
pH, sat. paste	7.70	s.u.		0,10	ASAM10-3.2	10/31/05 00:43 / sm			
Conductivity, sat. paste	1.54	mmhos/cm		0.01	ASA10-3	10/31/05 08:43 / sm			
Saturation	34.1	%		0.1	USDA27a	10/31/05 06.437 Sint			
CHEMICAL CHARACTERISTICS						14/02/05 00:58 / crm			
Organic Carbon	ND	wt%		0.02	ASA29-3	11/02/05 09:567 Sm			
Phosphorus, Olsen	3	mg/kg		1	ASA24-5	10/20/05 17:107 Smi			
Nitrate as N, KCL Extract	ND	mg/kg		1	ASA33-8.1	10/27/05 12:067 500			



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100945-011 Client Sample ID: 4B-3DAM, 0-2 ft Report Date: 11/02/05 Collection Date: 07/14/05 Date Received: 10/17/05 Matrix: Soil

Analyses	Result	Units	Qual	MCL/ RL QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS Sand Silt Clay	38 42 20	% % %		1 1 1	ASA15-5 ASA15-5 ASA15-5 ASA15-5	11/02/05 09:58 / srm 11/02/05 09:58 / srm 11/02/05 09:58 / srm 11/02/05 09:58 / srm
Texture - C = Clay, S = Sand(y), SI = Silt(y), L = Loam(y) SATURATED PASTE pH, sat. paste Conductivity, sat. paste Saturation	L 2.40 11.0 35.0	s.u. mmhos/cm %		0.10 0.01 0.1	ASAM10-3.2 ASAM10-3 USDA27a	10/31/05 08:43 / srm 10/31/05 08:43 / srm 10/31/05 08:43 / srm



#### LABORATORY ANALYTICAL REPORT

Golder Associates Inc Client: Project: Tailing Test Plots Lab ID: B05100945-012 Client Sample ID: 4C-3DAM, 0-2 ft

Report Date: 11/02/05 Collection Date: 07/14/05 Date Received: 10/17/05 Matrix: Soil

Analyses	- Result	Units	Qual	MCL/ RL QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS						
Sand	32	%		1	ASA15-5	11/02/05 09:58 / srm
Sand	49	%		1	ASA15-5	11/02/05 09 58 / srm
Sin	19	%		1	ASA15-5	11/02/05 09:58 / srm
Texture	L				ASA15-5	11/02/05 09:58 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)						
SATURATED PASTE						40/04/05 08:43 / arm
pH, sat. paste	2.40	s.u.		0.10	ASAM10-3.2	10/31/05 08:437 500
Conductivity, sat, paste	7.61	mmhos/cm	l I	0.01	ASA10-3	10/31/05 08:43 / srm
Saturation	38.8	%		0.1	USDA27a	10/31/05 08:43 / srm

- ---Report Definitions:

-- - · · RL - Analyte reporting limit. QCL - Quality control limit.

- -- ---



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100945-013 Client Sample ID: 4D-3DAM, 0-2 ft Report Date: 11/02/05 Collection Date: 07/14/05 Date Received: 10/17/05 Matrix: Soil

Analyses	MCL/							
	Result	Units	Qual	RL QCL	Method	Analysis Date / By		
PHYSICAL CHARACTERISTICS								
Sand	38	%		1	ASA15-5	11/02/05 09:58 / srm		
Silt	42	%		1	ASA15-5	11/02/05 09:58 / srm		
Clav	20	%		1	ASA15-5	11/02/05 09:58 / srm		
Texture	L				ASA15-5	11/02/05 09:58 / srm		
- C = Clay, S = Sand(y), SI = Silt(y), L = Loam(y)								
SATURATED PASTE								
pH, sat. paste	2.10	s.u.		0.10	ASAM10-3.2	10/31/05 08:43 / srm		
Conductivity, sat. paste	9.88	mmhos/cm	l	0.01	ASA10 3	10/31/05 08·43 / srm		
Saturation	35.5	%		01	USDA27a	10/31/05 08·43 / srm		

-----Report Definitions:

RL - Analyte reporting limit. QCL - Quality control limit.

# Energy Laboratories Inc

## Sample Receipt Checklist

Client Name Golder Associates Inc			Date an	d Time Received:	10/17/2005	
Work Order Number B05100945			Receive	d by klm		
	Incla-10/1 Date	7/05	Reviewe	ed by Initials		Date
	Carrier name	<u>UPS ARS G</u>	Bround			
Shipping container/cooler in good condition?		Yes 🗹	No 🗌	Not Present		
Custody seals intact on shipping container/coole	r?	Yes 🗹	No 🗌	Not Present		
Custody seals intact on sample bottles?		Yes 🗌	No 🗌	Not Present	$\checkmark$	
Chain of custody present?		Yes 🗹	No 🗋			
Chain of custody signed when relinquished and r	eceived?	Yes 🗹	No 🗌			
Chain of custody agrees with sample labels?		Yes 🗹	No 🗌			
Samples in proper container/bottle?		Yes 🗹	No 🗌			
Sample containers Intact?		Yes 🗹	No 🗆			
Sufficient sample volume for indicated test?		Yes 🗹	No 🗌			
All samples received within holding time?		Yes 🗹	No 🗌			
Container/Temp Blank temperature in compliance	e?	Yes 🗌	No 🗹	na °C		
Water - VOA vials have zero headspace?		Yes 🗌	No 🗌	No VOA vials subr	nitted 🔽	
Water - pH acceptable upon receipt?		Yes 🗌	No 🗌	Not Applicable		
	Adjusted?		Checked by			
Any No and/or NA (not applicable) response mu	at he detailed in the c	comments ser	tion below			
				· · · · · · · · · ·		
Client contacted	Date contacted:			Person contacted		
Contacted by:	Regarding					
Comments:						
			·			
Corrective Action						

ENENCINES Ch	Nain of Cus	tody and AIyti s much information as possible. Re	ical Reque	est Record P g notes on reverse side.	age oi
Company Name:		Tailin & Plot Test	H		
REPORT MAIL Address: 44910 ALAMEDA NE, STE	4	LEWIS MUNK 505	5/821-30	Sampler Name if other than Conta 43	÷
ALBUDVERDUE, NM B7	113	Imunk@golder.com		Durchase Order #-	11 Ottoba #-
SAME AS ABOVE		SAME AS ABOVE			
Report Required For: POTW/WMTP C		BO BANALYSIS RE ANALYSIS RE	EQUESTED	Notify ELI prior to RU sample submittal for add	SH Shipped by: itional
Special Report Formats - ELI must be not sample submittal for the following:	tified prior to	Containe Solids Yeg V 2116r	1ED	Comments: [▲ ]] Comments:	rig Cooler IJ (s) Receipt Temp
NELAC AZLA Level IV	Ū	Per of years		.Т) bлио Т) bлио	WIA ° C Custody Seal P.N
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SAMPLE IDENTIFICATION (Name: Location: Interval: etc.)	Collection Collection Date Time	MATRIX PICE A	338 570 UN 970	Norma	Match Lab ID
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"37P4A-1, 0-9"	Hintost			X	Ш. З
"3TP4A"2" 15-24"	7/14/05	1		X	بز SU
"37P4B-1, 0-9"	HH/05	5		X	\ر ا
"31848-2, 10-19"	741465			X	7
7 3TP 4C-1. 0-9"	HIHAS	N		X	
"3TP4C-2, 12-21"	HILLES	1		X	RO
"37040-1 ()-9"	H/14/65	1		X	8
"52-HI Z-OH 9-12 "	7/14/65	1 1 1 1 1 N 1 N	トート	X	<b>1</b>
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MUST be	Date/Time:	Signatuke:	Received by (print):	Date/Time: Date/Time: Date/Time: //	LIN I. M. DUVIN
Signed Samole Disposal:	Return to client:	Lab Disposal:	Sample Type:		DNLY DNS
In certain circumstances, sampl	bles submitted to Energy This serves as notice of t	Laboratories, Inc. may be subcontracte this moscihility. All sub-contract data wi	ed to other certified lai vill be clearly notated o	boratories in order to complete the in your analytical report.	analysis requested.
Visit our wet	b site at <i>www.energ</i>	viab.com for additional informati	ion, downloadable	fee schedule, forms, & link	

ENE D	Ch	ASE PRINT, provide a	stody a as much inform	nd A. ation as poss	<b>Jytic</b> ible. Refe	<b>tal Requ</b> er to correspondi	est Record ng notes on reverse side.	Page	ō	
Company Name:	455 OCIATES		Project Name, PV	NS#, Permit#, E	Pot	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~				
1910 ALA	MEDA NE,	STE, A	Contact Name	MUN Fax. E-I		:05/821-	Sampler Name if other than <b>3043</b>	Contact:		
ALBUQUE	Rave, NM	87H13	1mmK(	0 40 Ltr	505.		Purchase Order #		++	
SAME AS	S ABOVE		SHAME I	45 ABON	Ý					
Report Required F	or: POTW/WWTP[		S O Ation	ANALYSI	IS RE(	puestep	Notify ELI prior t	o RUSH r additional	Shipped by:	and the second se
Special Report For	Other	diffed prior to	rtainer V S V B S <u>V</u> eget ther ther	2			charges and sch	reduling	Cooler ID(s)	
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SAMPLE ID (Name, Local	ENTIFICATION tion, Interval, etc.)	Collection Collection Date Time				338	втои Нг∪я		Match Lab ID	
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MUST be	Relinquished by (print)	Data/Time	0	Signature:	•	keceived by (print):	10/17/05 050 /	hut a	Signature:	
Signed	Sample Disposal:	Return to client:	Lab Dis	posal		Sample Type:	LABORATORY U # of	ISE ONLY fractions		
In cert	ain circumstances, sampl	les submitted to Energy This serves as notice of	/ Laboratories, Inc	c. may be subcr M sub-contract	ontracted t	to other certified la	boratories in order to comple	te the analysis	requested.	
	- Visit our wet	nis serves as nouce or D site at <i>WWW.ener</i> g	mis possiumy.	ut sup-contact tdditional info	ormation	e clearry notateu - , downloadable	in your anaryucar report. fee schedule, forms, &	links.		

## APPENDIX B

## CHEMICAL AND PHYSICAL LABORATORY DATA TAILING



## ANALYTICAL SUMMARY REPORT

November 01, 2005

Lewis Munk Golder Associates Inc 4910 Alameda Blvd NE, Ste A Albuquerque, NM 87113

Workorder No.: B05100807 Project Name: Tailing Test Plots Quote ID: B856 - 40 Soil/Rock Samples

-----\_.\_\_ \_\_ \_ - --- -. \_ . \_ \_ \_... Energy Laboratories Inc received the following 37 samples from Golder Associates Inc on 10/13/2005 for analysis.

Sample ID	Client Sample ID	Collect Date	<b>Receive</b> Date	Matrix	Test
B05100807-001	3X-IA, 32-38"	03/18/05 0:00	10/13/05	Soil	Conductivity pH, Saturated Paste Particle Size Analysis Saturation Percentage Texture
B05100807-002	3X-1A, 0-2'	03/02/05 0:00	10/13/05	Soil	Same As Above
B05100807-003	3X-1B, 0-2'	03/02/05 0:00	10/13/05	Soil	Same As Above
B05100807-004	3X-1A-L, 23" BGS	03/02/05 0:00	10/13/05	Soil	Same As Above
B05100807-005	3X-1A-L, 40" BGS	03/02/05 0:00	10/13/05	Soil	Same As Above
B05100807-006	3X-1A-L, 0" TL	03/02/05 0:00	10/13/05	Soil	Same As Above
B05100807-007	3X-1A-L, 38" BL	03/02/05 0:00	10/13/05	Soil	Same As Above
B05100807-008	3X-2A, 0-2'	03/02/05 0:00	10/13/05	Soil	Same As Above
B05100807-009	3X-2B, 0-2'	03/02/05 0:00	10/13/05	Soil	Same As Above
B05100807-010	3X-2C, 0-2'	03/02/05 0:00	10/13/05	Soil	Same As Above
B05100807-011	3X-2A-L, 24" BGS	03/02/05 0:00	10/13/05	Soil	Same As Above
B05100807-012	3X-2A-L, 35" BGS	03/02/05 0:00	10/13/05	Soil	Same As Above
B05100807-013	3X-2A-L, 0" TL	03/02/05 0:00	10/13/05	Soil	Same As Above
B05100807-014	3X-2A-L, 6" BL	03/02/05 0:00	10/13/05	Soil	Same As Above
B05100807-015	3X-2A-L, 24" BTL	03/02/05 0:00	10/13/05	Soil	Same As Above
B05100807-016	3X-3A, 0-2'	03/02/05 0:00	10/13/05	Soil	Same As Above
B05100807-017	3X-3B, 0-2'	03/02/05 0:00	10/13/05	Soil	Same As Above
B05100807-018	3X-5A, 0-2'	02/16/05 0:00	10/13/05	Soil	Same As Above
B05100807-019	3X-5A, 34-38"	02/16/04 0:00	10/13/05	Soil	Same As Above
B05100807-020	3X-5A, 53-57"	02/16/05 0:00	10/13/05	Soil	Same As Above
B05100807-021	3X-5B,0-2'	02/16/05 0:00	10/13/05	Soil	Same As Above
B05100807-022	3X-5B, 34-37"	02/16/05 0:00	10/13/05	Soil	Same As Above



B05100807-023	3X-5B, 54-57"	02/16/05 0:00	10/13/05	Soil	Same As Above
B05100807-024	3X-5B-L, 24"	03/18/05 0:00	10/13/05	Soil	Same As Above
B05100807-025	3X-5B-L, 40"	03/18/05 0:00	10/13/05	Soil	Same As Above
B05100807-026	3X-5 <b>B-</b> L, 60"	03/18/05 0:00	10/13/05	Soil	Same As Above
B05100807-027	3X-5B-L, 90"	03/18/05 0:00	10/13/05	Soil	Same As Above
B05100807-028	3X-5C, 0-2'	02/16/05 0:00	10/13/05	Soil	Same As Above
B05100807-029	3X-5C, 0-2'	03/02/05 0:00	10/13/05	Soil	Same As Above
B05100807-030	3X-5C, 34-38"	02/16/05 0:00	10/13/05	Soil	Same As Above
B05100807-031	3X-5C, 52-58"	03/18/05 0.00	10/13/05	Soil	Same As Above
B05100807-032	3X-6A, 0-2'	02/16/04 0:00	10/13/05	Soil	Same As Above
B05100807-033	3X-6B, 0-2'	02/16/04 0:00	10/13/05	Soil	Same As Above
B05100807-034	3X-6B, 39-45"	02/16/04 0:00	10/13/05	Soil	Same As Above
B05100807-035	3X-6C, 0-24"	03/18/05 0:00	10/13/05	Soil	Same As Above
B05100807-036	3X-7A, 0-20"	02/16/05 0:00	10/13/05	Soil	Same As Above
B05100807-037	3X-7B, 0-2'	02/16/05 0:00	10/13/05	Soil	Same As Above

There were no problems with the analyses and all data for associated QC met EPA or laboratory specifications except if noted in report comments or the Case Narrative.

If you have any questions regarding hese/tests result pleas**é** call **Report Approved By:** 



Client: Golder Associates Inc **Project:** Tailing Test Plots **Lab ID:** B05100807-001 Client Sample ID: 3X-1A, 32-38" 
 Report Date:
 11/01/05

 Collection Date:
 03/18/05

 Date Received:
 10/13/05

 Matrix:
 Soil

		-		MCL/		
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS						
Sand	74	%		1	ASA15-5	10/28/05 15:13 / srm
Silt	20	%		1	ASA15-5	10/28/05 15.13 / srm
Clay	6	%		1	ASA15-5	10/28/05 15:13 / srm
Texture	SL				ASA15-5	10/28/05 15:13 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)						
SATURATED PASTE						
pH. sat. paste	2.00	s.u.		0.10	ASAM10-3.2	10/28/05 15:13 / srm
Conductivity, sat, paste	11.1	mmhos/cm		0.01	ASA10-3	10/28/05 15:13 / srm
Saturation	25.3	%		0.1	USDA27a	10/28/05 15:13 / srm



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100807-002 Client Sample ID: 3X-1A, 0-2' 
 Report Date:
 11/01/05

 Collection Date:
 03/02/05

 Date Received:
 10/13/05

 Matrix:
 Soil

· · · · ·				MCL/		
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By
Sand	74	%		1	ASA15-5	10/28/05 15:13 / srm
Silt	19	%		1	ASA15-5	10/28/05 15:13 / srm
Clav	7	%		1	ASA15-5	10/28/05 15:13 / srm
Texture	SL				ASA15-5	10/28/05 15:13 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)						
SATURATED PASTE						
pH, sat. paste	1.90	s.u.		0.10	ASAM10-3.2	10/28/05 15:13 / srm
Conductivity, sat. paste	12.8	mmhos/cm		0.01	ASA10-3	10/28/05 15:13 / srm
Saturation	24.6	%		0.1	USDA27a	10/28/05 15:13 / srm

Report Definitions:

RL - Analyte reporting limit. QCL - Quality control limit.



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100807-003 Client Sample ID: 3X-1B, 0-2' **Report Date:** 11/01/05 **Collection Date:** 03/02/05 **Date Received:** 10/13/05 **Matrix:** Soil

				MCL/		
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS						
Sand	76	%		1	ASA15-5	10/28/05 15 <sup>.</sup> 13 / srm
Silt	16	%		1	ASA15-5	10/28/05 15:13 / srm
Clav	8	%		1	ASA15-5	10/28/05 15:13 / srm
Texture	SL				ASA15-5	10/28/05 15:13 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)						
SATURATED PASTE						
pH, sat, paste	2.50	s.u.		0.10	ASAM10-3.2	10/28/05 15:13 / srm
Conductivity, sat, paste	11.5	mmhos/cm		0.01	ASA10-3	10/28/05 15:13 / srm
Saturation	25.8	%		0.1	USDA27a	10/28/05 15:13 / srm

Report Definitions: RL - Analyte reporting limit. QCL - Quality control limit.



Client: Golder Associates Inc **Project:** Tailing Test Plots **Lab ID:** B05100807-004 **Client Sample ID:** 3X-1A-L, 23" BGS **Report Date:** 11/01/05 **Collection Date:** 03/02/05 **Date Received:** 10/13/05 **Matrix:** Soil

				MCL/		
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS						
Sand	73	%		1	ASA15-5	10/28/05 15:13 / srm
Silt	17	%		1	ASA15-5	10/28/05 15:13 / srm
Clay	10	%		1	ASA15-5	10/28/05 15:13 / srm
Texture	SL				ASA15-5	10/28/05 15:13 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)						
SATURATED PASTE						
pH, sat, paste	2.00	s.u.		0.10	ASAM10-3.2	10/28/05 15:13 / srm
Conductivity, sat. paste	11.0	mmhos/cm		0.01	ASA10-3	10/28/05 15:13 / srm
Saturation	26.2	%		0.1	USDA27a	10/28/05 15:13 / srm

 Report
 RL - Analyte reporting limit.

 Definitions:
 QCL - Quality control limit.



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100807-005 Client Sample ID: 3X-1A-L, 40" BGS 
 Report Date:
 11/01/05

 Collection Date:
 03/02/05

 Date Received:
 10/13/05

 Matrix:
 Soil

				MCL/		
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS						
Sand	74	%		1	ASA15-5	10/28/05 15:13 / srm
Silt	17	%		1	ASA15-5	10/28/05 15·13 / srm
Clay	9	%		1	ASA15-5	10/28/05 15:13 / srm
Texture	SL				ASA15-5	10/28/05 15:13 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)						
SATURATED PASTE						
pH, sat. paste	2.00	s.u.		0.10	ASAM10-3.2	10/28/05 15:13 / srm
Conductivity, sat, paste	10.4	mmhos/cm		0.01	ASA10-3	10/28/05 15:13 / srm
Saturation	26.4	%		01	USDA27a	10/28/05 15:13 / srm

ReportRL - Analyte reporting limit.Definitions:QCL - Quality control limit.



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100807-006 Client Sample ID: 3X-1A-L, 0" TL **Report Date:** 11/01/05 **Collection Date:** 03/02/05 **Date Received:** 10/13/05 **Matrix:** Soil

				MCL/		
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS						
Sand	78	%		1	ASA15-5	10/28/05 15.13 / srm
Silt	14	%		1	ASA15-5	10/28/05 15·13 / srm
Clav	8	%		1	ASA15-5	10/28/05 15:13 / srm
Texture	SL				ASA15-5	10/28/05 15:13 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)						
SATURATED PASTE						
pH, sat, paste	2.40	s.u.		0.10	ASAM10-3.2	10/28/05 15:13 / srm
Conductivity, sat. paste	8.89	mmhos/cm	l	0.01	ASA10-3	10/28/05 15:13 / srm
Saturation	27.6	%		0.1	USDA27a	10/28/05 15:13 / srm

Report Definitions:



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100807-007 Client Sample ID: 3X-1A-L, 38" BL **Report Date:** 11/01/05 **Collection Date:** 03/02/05 **Date Received:** 10/13/05 **Matrix:** Soil

				MCL/		
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS						
Sand	76	%		1	ASA15-5	10/28/05 15:13 / srm
Silt	15	%		1	ASA15-5	10/28/05 15:13 / srm
Clay	9	%		1	ASA15-5	10/28/05 15:13 / srm
Texture	SL				ASA15-5	10/28/05 15:13 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)						
SATURATED PASTE						
pH, sat, paste	2.30	s.u.		0.10	ASAM10-3.2	10/28/05 15:13 / srm
Conductivity, sat, paste	9.92	mmhos/cm		0.01	ASA10-3	10/28/05 15·13 / srm
Saturation	25.5	%		0.1	USDA27a	10/28/05 15:13 / srm


Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100807-008 Client Sample ID: 3X-2A, 0-2' 
 Report Date:
 11/01/05

 Collection Date:
 03/02/05

 Date Received:
 10/13/05

 Matrix:
 Soil

	MCL/							
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By		
PHYSICAL CHARACTERISTICS								
Sand	74	%		1	ASA15-5	10/28/05 15:13 / srm		
Silt	17	%		1	ASA15-5	10/28/05 15:13 / srm		
Clav	9	%		1	ASA15-5	10/28/05 15:13 / srm		
Texture	SL				ASA15-5	10/28/05 15:13 / srm		
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)								
SATURATED PASTE								
pH. sat. paste	2.20	s.u.		0.10	ASAM10-3.2	10/28/05 15:13 / srm		
Conductivity, sat, paste	10.7	mmhos/cm		0.01	ASA10-3	10/28/05 15:13 / srm		
Saturation	25.0	%		0.1	USDA27a	10/28/05 15:13 / srm		

ReportRL - Analyte reporting limit.Definitions:QCL - Quality control limit.



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100807-009 Client Sample ID: 3X-2B, 0-2' **Report Date:** 11/01/05 **Collection Date:** 03/02/05 **Date Received:** 10/13/05 **Matrix:** Soil

Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By		
PHYSICAL CHARACTERISTICS								
Sand	72	%		1	ASA15-5	10/28/05 15:13 / srm		
Silt	16	%		1	ASA15-5	10/28/05 15:13 / srm		
Clay	12	%		1	ASA15-5	10/28/05 15:13 / srm		
Texture	SL				ASA15-5	10/28/05 15:13 / srm		
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)								
SATURATED PASTE								
pH, sat, paste	2.00	s.u.		0.10	ASAM10-3.2	10/28/05 15:13 / srm		
Conductivity, sat, paste	10.6	mmhos/cm		0.01	ASA10-3	10/28/05 15:13 / srm		
Saturation	23.7	%		0.1	USDA27a	10/28/05 15:13 / srm		



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100807-010 Client Sample ID: 3X-2C, 0-2' **Report Date:** 11/01/05 **Collection Date:** 03/02/05 **Date Received:** 10/13/05 **Matrix:** Soil

	MCL/							
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By		
PHYSICAL CHARACTERISTICS								
Sand	75	%		1	ASA15-5	10/28/05 15:13 / srm		
Silt	15	%		1	ASA15-5	10/28/05 15:13 / srm		
Clay	10	%		1	ASA15-5	10/28/05 15:13 / srm		
Texture	SL				ASA15-5	10/28/05 15:13 / srm		
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)								
SATURATED PASTE								
pH, sat. paste	1.70	s.u.		0.10	ASAM10-3.2	10/28/05 15:13 / srm		
Conductivity, sat, paste	11.9	mmhos/cm		0.01	ASA10-3	10/28/05 15:13 / srm		
Saturation	26.4	%		0.1	USDA27a	10/28/05 15:13 / srm		



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100807-011 Client Sample ID: 3X-2A-L, 24" BGS 
 Report Date:
 11/01/05

 Collection Date:
 03/02/05

 Date Received:
 10/13/05

 Matrix:
 Soil

· · ··· · · ·	MCL/							
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By		
PHYSICAL CHARACTERISTICS								
Sand	75	%		1	ASA15-5	10/28/05 15:13 / srm		
Silt	16	%		1	ASA15-5	10/28/05 15:13 / srm		
Clav	9	%		1	ASA15-5	10/28/05 15:13 / srm		
Texture	SL				ASA15-5	10/28/05 15:13 / srm		
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)								
SATURATED PASTE								
pH, sat. paste	2.20	s.u.		0.10	ASAM10-3.2	10/28/05 15:13 / srm		
Conductivity, sat. paste	11.0	mmhos/cm		0.01	ASA10-3	10/28/05 15:13 / srm		
Saturation	24.3	%		0.1	USDA27a	10/28/05 15:13 / srm		



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100807-012 Client Sample ID: 3X-2A-L, 35" BGS 
 Report Date:
 11/01/05

 Collection Date:
 03/02/05

 Date Received:
 10/13/05

 Matrix:
 Soil

	MCL/							
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By		
PHYSICAL CHARACTERISTICS								
Sand	74	%		1	ASA15-5	10/28/05 15:13 / srm		
Silt	18	%		1	ASA15-5	10/28/05 15:13 / srm		
Clay	8	%		1	ASA15-5	10/28/05 15:13 / srm		
Texture	SL				ASA15-5	10/28/05 15:13 / srm		
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)								
SATURATED PASTE								
pH, sat, paste	2.10	s.u.		0 10	ASAM10-3.2	10/28/05 15:13 / srm		
Conductivity, sat, paste	10.9	mmhos/cm		0.01	ASA10-3	10/28/05 15:13 / srm		
Saturation	24.9	%		0.1	USDA27a	10/28/05 15:13 / srm		

ReportRL - Analyte reporting limit.Definitions:QCL - Quality control limit.



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100807-013 Client Sample ID: 3X-2A-L, 0" TL 
 Report Date:
 11/01/05

 Collection Date:
 03/02/05

 Date Received:
 10/13/05

 Matrix:
 Soil

	MCL/							
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By		
PHYSICAL CHARACTERISTICS								
Sand	74	%		1	ASA15-5	10/28/05 15:13 / srm		
Silt	17	%		1	ASA15-5	10/28/05 15:13 / srm		
Clay	9	%		1	ASA15-5	10/28/05 15:13 / srm		
Texture	SL.				ASA15-5	10/28/05 15:13 / srm		
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)								
SATURATED PASTE								
pH, sat, paste	2.20	s.u.		0.10	ASAM10-3.2	10/28/05 15:13 / srm		
Conductivity, sat, paste	10.6	mmhos/cm		0.01	ASA10-3	10/28/05 15:13 / srm		
Saturation	23.6	%		0.1	USDA27a	10/28/05 15:13 / srm		

Report Definitions:



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100807-014 Client Sample ID: 3X-2A-L, 6" BL **Report Date:** 11/01/05 **Collection Date:** 03/02/05 **Date Received:** 10/13/05 **Matrix:** Soil

			,			
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS						
Sand	75	%		1	ASA15-5	10/28/05 15:13 / srm
Silt	17	%		1	ASA15-5	10/28/05 15:13 / srm
Clay	8	%		1	ASA15-5	10/28/05 15:13 / srm
Texture	SL				ASA15-5	10/28/05 15:13 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)						
SATURATED PASTE						
pH, sat, paste	2.50	s.u.		0 10	ASAM10-3.2	10/28/05 15.13 / srm
Conductivity sat, paste	9.49	mmhos/cm		0.01	ASA10-3	10/28/05 15:13 / srm
Saturation	25.3	%		0.1	USDA27a	10/28/05 15:13 / srm



Client: Golder Associates Inc **Project:** Tailing Test Plots **Lab ID:** B05100807-015 **Client Sample ID:** 3X-2A-L, 24" BTL 
 Report Date:
 11/01/05

 Collection Date:
 03/02/05

 Date Received:
 10/13/05

 Matrix:
 Soil

	MCL/							
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By		
PHYSICAL CHARACTERISTICS								
Sand	75	%		1	ASA15-5	10/28/05 15:13 / srm		
Silt	16	%		1	ASA15-5	10/28/05 15:13 / srm		
Clav	9	%		1	ASA15-5	10/28/05 15:13 / srm		
Texture	SL				ASA15-5	10/28/05 15:13 / srm		
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)								
SATURATED PASTE								
pH, sat. paste	2.10	s.u.		0.10	ASAM10-3.2	10/28/05 15:13 / srm		
Conductivity, sat, paste	10.9	mmhos/cm		0.01	ASA10-3	10/28/05 15:13 / srm		
Saturation	24.9	%		0.1	USDA27a	10/28/05 15:13 / srm		



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100807-016 Client Sample ID: 3X-3A, 0-2' **Report Date:** 11/01/05 **Collection Date:** 03/02/05 **Date Received:** 10/13/05 **Matrix:** Soil

Analyses	Result	Units	Qual	MCL/ RL QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS	70	0/		1	ASA15-5	10/28/05 15:13 / srm
Sano	70	70		1	ASA15-5	10/28/05 15:13 / srm
Silt	20	% 0(		1	AGA10-0	10/28/05 15:13 / erm
Clay	10	%		1	A5A15-5	10/20/05 15:15 / Sim
Texture	SL				ASA15-5	10/28/05 15:13 / sm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)						
SATURATED PASTE						
pH, sat, paste	1.90	s.u.		0.10	ASAM10-3.2	10/28/05 15.13 / srm
Conductivity, sat, paste	13.4	mmhos/cm	l	0.01	ASA10-3	10/28/05 15:13 / srm
Saturation	24.3	%		0.1	USDA27a	10/28/05 15:13 / srm

Report Definitions: RL - Analyte reporting limit. QCL - Quality control limit.



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100807-017 Client Sample ID: 3X-3B, 0-2'

-

 Report Date:
 11/01/05

 Collection Date:
 03/02/05

 Date Received:
 10/13/05

 Matrix:
 Soil

	MCL/							
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By		
PHYSICAL CHARACTERISTICS								
Sand	76	%		1	ASA15-5	10/28/05 15:13 / srm		
Silt	18	%		1	ASA15-5	10/28/05 15.13 / srm		
Clav	6	%		1	ASA15-5	10/28/05 15:13 / srm		
Texture	SL				ASA15-5	10/28/05 15:13 / srm		
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)								
SATURATED PASTE								
pH, sat, paste	3.50	s.u.		0.10	ASAM10-3.2	10/28/05 15:13 / srm		
Conductivity, sat, paste	7.89	mmhos/cm		0.01	ASA10-3	10/28/05 15:13 / srm		
Saturation	28.0	%		0.1	USDA27a	10/28/05 15:13 / srm		



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100807-018 Client Sample ID: 3X-5A, 0-2' **Report Date:** 11/01/05 **Collection Date:** 02/16/05 **Date Received:** 10/13/05 **Matrix:** Soil

Analyses	Result	Units	Qual	MCL/ RL QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS						
Sand	48	%		1	ASA15-5	10/28/05 15:13 / srm
Silt	33	%		1	ASA15-5	10/28/05 15:13 / srm
Clay	19	%		1	ASA15-5	10/28/05 15:13 / srm
Texture	Ł				ASA15-5	10/28/05 15:13 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)						
SATURATED PASTE						
pH, sat, paste	2.10	s.u.		0.10	ASAM10-3.2	10/28/05 15:13 / srm
Conductivity sat paste	13.2	mmhos/cm		0.01	ASA10-3	10/28/05 15:13 / srm
Saturation	29.7	%		0 1	USDA27a	10/28/05 15·13 / srm



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100807-019 Client Sample ID: 3X-5A, 34-38" **Report Date:** 11/01/05 **Collection Date:** 02/16/04 **Date Received:** 10/13/05 **Matrix:** Soil

	MCL/								
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS									
Sand	53	%		1	ASA15-5	10/28/05 15:13 / srm			
Silt	30	%		1	ASA15-5	10/28/05 15:13 / srm			
Clay	17	%		1	ASA15-5	10/28/05 15:13 / srm			
Texture	SL				ASA15-5	10/28/05 15:13 / srm			
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)									
SATURATED PASTE									
pH, sat. paste	2.30	s.u.		0.10	ASAM10-3.2	10/28/05 15:13 / srm			
Conductivity, sat. paste	11.7	mmhos/cm		0.01	ASA10-3	10/28/05 15:13 / srm			
Saturation	28.3	%		0.1	USDA27a	10/28/05 15:13 / srm			

 Report
 RL - Analyte reporting limit.

 Definitions:
 QCL - Quality control limit.



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100807-020 Client Sample ID: 3X-5A, 53-57" **Report Date:** 11/01/05 **Collection Date:** 02/16/05 **Date Received:** 10/13/05 **Matrix:** Soil

	MCL/								
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS									
Sand	48	%		1	ASA15-5	10/28/05 15:13 / srm			
Silt	36	%		1	ASA15-5	10/28/05 15:13 / srm			
Clay	16	%		1	ASA15-5	10/28/05 15:13 / srm			
Texture	L				ASA15-5	10/28/05 15:13 / srm			
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)									
SATURATED PASTE									
pH, sat. paste	2.10	s.u.		0.10	ASAM10-3.2	10/28/05 15:13 / srm			
Conductivity, sat. paste	12.7	mmhos/cm		0.01	ASA10-3	10/28/05 15.13 / srm			
Saturation	31.3	%		0.1	USDA27a	10/28/05 15:13 / srm			

Report RL Definitions: QC



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100807-021 Client Sample ID: 3X-5B,0-2' 
 Report Date:
 11/01/05

 Collection Date:
 02/16/05

 Date Received:
 10/13/05

 Matrix:
 Soil

	MCL/							
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By		
PHYSICAL CHARACTERISTICS								
Sand	42	%		1	ASA15-5	10/28/05 15 13 / srm		
Silt	38	%		1	ASA15-5	10/28/05 15:13 / srm		
Clav	20	%		1	ASA15-5	10/28/05 15:13 / srm		
Texture	L				ASA15-5	10/28/05 15:13 / srm		
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)								
SATURATED PASTE								
pH, sat. paste	2.10	s.u.		0.10	ASAM10-3.2	10/28/05 15:13 / srm		
Conductivity, sat. paste	11.9	mmhos/cm	I	0.01	ASA10-3	10/28/05 15:13 / srm		
Saturation	34.5	%		0.1	USDA27a	10/28/05 15:13 / srm		



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100807-022 Client Sample ID: 3X-5B, 34-37" **Report Date:** 11/01/05 **Collection Date:** 02/16/05 **Date Received:** 10/13/05 **Matrix:** Soil

	MCL/								
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS									
Sand	44	%		1	ASA15-5	10/28/05 15:13 / srm			
Silt	36	%		1	ASA15-5	10/28/05 15:13 / srm			
Clav	20	%		1	ASA15-5	10/28/05 15:13 / srm			
Texture	L				ASA15-5	10/28/05 15:13 / srm			
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)									
SATURATED PASTE									
pH, sat. paste	2.10	s.u.		0.10	ASAM10-3.2	10/28/05 15:13 / srm			
Conductivity, sat. paste	12.2	mmhos/cm		0.01	ASA10-3	10/28/05 15:13 / srm			
Saturation	34.1	%		0.1	USDA27a	10/28/05 15:13 / srm			

Report Definitions:



Client: Golder Associates Inc **Project:** Tailing Test Plots **Lab ID:** B05100807-023 **Client Sample ID:** 3X-5B, 54-57" **Report Date:** 11/01/05 **Collection Date:** 02/16/05 **Date Received:** 10/13/05 **Matrix:** Soil

	MCL/									
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By				
PHYSICAL CHARACTERISTICS										
Sand	50	%		1	ASA15-5	10/28/05 15:13 / srm				
Silt	33	%		1	ASA15-5	10/28/05 15:13 / srm				
Clay	17	%		1	ASA15-5	10/28/05 15:13 / srm				
Texture	L				ASA15-5	10/28/05 15.13 / srm				
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)										
SATURATED PASTE										
pH, sat, paste	2.00	s.u.		0.10	ASAM10-3 2	10/28/05 15·13 / srm				
Conductivity, sat, paste	12.4	mmhos/cm		0.01	ASA10-3	10/28/05 15:13 / srm				
Saturation	30.6	%		0.1	USDA27a	10/28/05 15:13 / srm				

Report Definitions:



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100807-024 Client Sample ID: 3X-5B-L, 24" **Report Date:** 11/01/05 **Collection Date:** 03/18/05 **Date Received:** 10/13/05 **Matrix:** Soil

	MCL/								
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS									
Sand	45	%		1	ASA15-5	10/28/05 15:13 / srm			
Silt	38	%		1	ASA15-5	10/28/05 15:13 / srm			
Clav	17	%		1	ASA15-5	10/28/05 15:13 / srm			
Texture	L				ASA15-5	10/28/05 15:13 / srm			
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)									
SATURATED PASTE									
pH, sat. paste	2.20	s.u.		0.10	ASAM10-3.2	10/28/05 15:13 / srm			
Conductivity, sat, paste	10.8	mmhos/cm		0.01	ASA10-3	10/28/05 15:13 / srm			
Saturation	32.4	%		0.1	USDA27a	10/28/05 15:13 / srm			

 Report
 RL - Analyte reporting limit.

 Definitions:
 QCL - Quality control limit.



Client: Golder Associates Inc **Project:** Tailing Test Plots **Lab ID:** B05100807-025 Client Sample ID: 3X-5B-L, 40" **Report Date:** 11/01/05 **Collection Date:** 03/18/05 **Date Received:** 10/13/05 **Matrix:** Soil

	MCL/							
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By		
PHYSICAL CHARACTERISTICS								
Sand	44	%		1	ASA15-5	10/28/05 15:13 / srm		
Silt	38	%		1	ASA15-5	10/28/05 15:13 / srm		
Clay	18	%		1	ASA15-5	10/28/05 15:13 / srm		
Texture	L				ASA15-5	10/28/05 15:13 / srm		
- C = Clay, S = Sand(y), SI = Silt(y), L = Loam(y)								
SATURATED PASTE								
pH, sat, paste	2.10	s.u.		0.10	ASAM10-3.2	10/28/05 15:13 / srm		
Conductivity, sat, paste	12.6	mmhos/cm		0.01	ASA10-3	10/28/05 15:13 / srm		
Saturation	32.4	%		0.1	USDA27a	10/28/05 15:13 / srm		

 Report
 RL - Analyte reporting limit.

 Definitions:
 QCL - Quality control limit.



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100807-026 Client Sample ID: 3X-5B-L, 60" 
 Report Date:
 11/01/05

 Collection Date:
 03/18/05

 Date Received:
 10/13/05

 Matrix:
 Soil

	MCL/							
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By		
PHYSICAL CHARACTERISTICS								
Sand	38	%		1	ASA15-5	10/28/05 15:13 / srm		
Silt	45	%		1	ASA15-5	10/28/05 15:13 / srm		
Clav	17	%		1	ASA15-5	10/28/05 15:13 / srm		
Texture	L				ASA15-5	10/28/05 15:13 / srm		
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)								
SATURATED PASTE								
pH, sat. paste	2.40	s.u.		0.10	ASAM10-3.2	10/28/05 15:13 / srm		
Conductivity, sat. paste	10.5	mmhos/cm		0.01	ASA10-3	10/28/05 15:13 / srm		
Saturation	37.9	%		0.1	USDA27a	10/28/05 15:13 / srm		

 Report
 RL - Analyte reporting limit.

 Definitions:
 QCL - Quality control limit.



Client: Golder Associates Inc **Project:** Tailing Test Plots Lab ID: B05100807-027 Client Sample ID: 3X-5B-L, 90" **Report Date:** 11/01/05 **Collection Date:** 03/18/05 **Date Received:** 10/13/05 **Matrix:** Soil

	MCL/							
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By		
PHYSICAL CHARACTERISTICS								
Sand	46	%		1	ASA15-5	10/28/05 15:13 / srm		
Silt	40	%		1	ASA15-5	10/28/05 15:13 / srm		
Clay	14	%		1	ASA15-5	10/28/05 15:13 / srm		
Texture	L				ASA15-5	10/28/05 15:13 / srm		
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)								
SATURATED PASTE								
pH, sat, paste	3.10	s.u.		0.10	ASAM10-3.2	10/28/05 15:13 / srm		
Conductivity, sat, paste	6.86	mmhos/cm		0.01	ASA10-3	10/28/05 15:13 / srm		
Saturation	32.8	%		0.1	USDA27a	10/28/05 15:13 / srm		

Report Definitions: RL - Analyte reporting limit. QCL - Quality control limit.



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100807-028 Client Sample ID: 3X-5C, 0-2' 
 Report Date:
 11/01/05

 Collection Date:
 02/16/05

 Date Received:
 10/13/05

 Matrix:
 Soil

	MCL/								
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS									
Sand	39	%		1	ASA15-5	10/28/05 15:13 / srm			
Silt	41	%		1	ASA15-5	10/28/05 15:13 / srm			
Clav	20	%		1	ASA15-5	10/28/05 15:13 / srm			
Texture	L				ASA15-5	10/28/05 15:13 / srm			
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)									
SATURATED PASTE									
pH, sat. paste	2.20	s.u.		0.10	ASAM10-3.2	10/28/05 15:13 / srm			
Conductivity, sat. paste	10.2	mmhos/cm	l	0.01	ASA10-3	10/28/05 15:13 / srm			
Saturation	36.6	%		0.1	USDA27a	10/28/05 15:13 / srm			

Report Definitions:



Client: Golder Associates Inc **Project:** Tailing Test Plots **Lab ID:** B05100807-029 **Client Sample ID:** 3X-5C, 0-2' **Report Date:** 11/01/05 **Collection Date:** 03/02/05 **Date Received:** 10/13/05 **Matrix:** Soil

Analyzas	Result	Units	Oual	MCL/ RL OCL	Method	Analysis Date / By
Analyses	Kesun	Chits	Quii			
PHYSICAL CHARACTERISTICS						
Sand	45	%		1	ASA15-5	10/28/05 15:13 / srm
Silt	35	%		1	ASA15-5	10/28/05 15:13 / srm
Clay	20	%		1	ASA15-5	10/28/05 15:13 / srm
Texture	L				ASA15-5	10/28/05 15:13 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)						
SATURATED PASTE						
pH, sat, paste	2.20	s.u.		0.10	ASAM10-3.2	10/28/05 15.13 / srm
Conductivity, sat, paste	10.2	mmhos/cm		0.01	ASA10-3	10/28/05 15:13 / srm
Saturation	34.2	%		0.1	USDA27a	10/28/05 15:13 / srm

ReportRL - Analyte reporting limit.Definitions:QCL - Quality control limit.



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100807-030 Client Sample ID: 3X-5C, 34-38" **Report Date:** 11/01/05 **Collection Date:** 02/16/05 **Date Received:** 10/13/05 **Matrix:** Soil

	MCL/							
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By		
PHYSICAL CHARACTERISTICS								
Sand	47	%		1	ASA15-5	10/28/05 15:13 / srm		
Silt	35	%		1	ASA15-5	10/28/05 15:13 / srm		
Clav	18	%		1	ASA15-5	10/28/05 15:13 / srm		
Texture	L				ASA15-5	10/28/05 15:13 / srm		
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)								
SATURATED PASTE								
pH, sat. paste	2.00	s.u.		0.10	ASAM10-3.2	10/28/05 15:13 / srm		
Conductivity, sat, paste	13.4	mmhos/cm		0.01	ASA10-3	10/28/05 15:13 / srm		
Saturation	28.3	%		0.1	USDA27a	10/28/05 15:13 / srm		

Report Definitions:



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100807-031 Client Sample ID: 3X-5C, 52-58" **Report Date:** 11/01/05 **Collection Date:** 03/18/05 **Date Received:** 10/13/05 **Matrix:** Soil

	MCL/								
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By			
PHYSICAL CHARACTERISTICS									
Sand	40	%		1	ASA15-5	10/28/05 15:13 / srm			
Silt	42	%		1	ASA15-5	10/28/05 15:13 / srm			
Clay	18	%		1	ASA15-5	10/28/05 15:13 / srm			
Texture	L				ASA15-5	10/28/05 15:13 / srm			
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)									
SATURATED PASTE									
pH, sat. paste	2.80	s.u.		0.10	ASAM10-3.2	10/28/05 15:13 / srm			
Conductivity, sat. paste	10.3	mmhos/cm		0.01	ASA10-3	10/28/05 15:13 / srm			
Saturation	36.1	%		0.1	USDA27a	10/28/05 15 <sup>.</sup> 13 / srm			

Report Definitions:



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100807-032 Client Sample ID: 3X-6A, 0-2' **Report Date:** 11/01/05 **Collection Date:** 02/16/04 **Date Received:** 10/13/05 **Matrix:** Soil

				MCL/		
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS						
Sand	45	%		1	ASA15-5	10/28/05 15:13 / srm
Silt	35	%		1	ASA15-5	10/28/05 15:13 / srm
Clay	20	%		1	ASA15-5	10/28/05 15:13 / srm
Texture	L				ASA15-5	10/28/05 15.13 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)						
SATURATED PASTE						
pH, sat. paste	2.40	s.u.		0.10	ASAM10-3.2	10/28/05 15:13 / srm
Conductivity, sat, paste	10.2	mmhos/cm		0.01	ASA10-3	10/28/05 15:13 / srm
Saturation	34.3	%		0.1	USDA27a	10/28/05 15:13 / srm

Report Definitions:



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100807-033 Client Sample ID: 3X-6B, 0-2' **Report Date:** 11/01/05 **Collection Date:** 02/16/04 **Date Received:** 10/13/05 **Matrix:** Soil

				MCL/		
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS						
Sand	47	%		1	ASA15-5	10/28/05 15:13 / srm
Silt	33	%		1	ASA15-5	10/28/05 15:13 / srm
Clay	20	%		1	ASA15-5	10/28/05 15:13 / srm
Texture	L				ASA15-5	10/28/05 15:13 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)						
SATURATED PASTE						
pH, sat, paste	2.20	s.u.		0.10	ASAM10-3.2	10/28/05 15:13 / srm
Conductivity, sat, paste	11.4	mmhos/cm		0.01	ASA10-3	10/28/05 15:13 / srm
Saturation	33.3	%		0.1	USDA27a	10/28/05 15:13 / srm



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100807-034 Client Sample ID: 3X-6B, 39-45" **Report Date:** 11/01/05 **Collection Date:** 02/16/04 **Date Received:** 10/13/05 **Matrix:** Soil

		· · ·		MCL/		
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS						
Sand	45	%		1	ASA15-5	10/28/05 15:13 / srm
Silt	35	%		1	ASA15-5	10/28/05 15:13 / srm
Clay	20	%		1	ASA15-5	10/28/05 15·13 / srm
Texture	L				ASA15-5	10/28/05 15:13 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)						
SATURATED PASTE						
pH. sat. paste	2.10	s.u.		0.10	ASAM10-3.2	10/28/05 15:13 / srm
Conductivity, sat, paste	12.8	mmhos/cm		0.01	ASA10-3	10/28/05 15:13 / srm
Saturation	31.9	%		0.1	USDA27a	10/28/05 15:13 / srm

ReportRL - Analyte reporting limit.Definitions:QCL - Quality control limit.



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100807-035 Client Sample ID: 3X-6C, 0-24" **Report Date:** 11/01/05 **Collection Date:** 03/18/05 **Date Received:** 10/13/05 **Matrix:** Soil

<u> </u>				MCL/		
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS						
Sand	35	%		1	ASA15-5	10/28/05 15:13 / srm
Silt	43	%		1	ASA15-5	10/28/05 15:13 / srm
Clay	22	%		1	ASA15-5	10/28/05 15:13 / srm
Texture	L				ASA15-5	10/28/05 15:13 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)						
SATURATED PASTE						
pH, sat, paste	2.30	s.u.		0.10	ASAM10-3.2	10/28/05 15:13 / srm
Conductivity, sat, paste	10.4	mmhos/cm		0.01	ASA10-3	10/28/05 15:13 / srm
Saturation	40.6	%		0.1	USDA27a	10/28/05 15:13 / srm



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100807-036 Client Sample ID: 3X-7A, 0-20" **Report Date:** 11/01/05 **Collection Date:** 02/16/05 **Date Received:** 10/13/05 **Matrix:** Soil

				MCL/		
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS						
Sand	40	%		1	ASA15-5	10/28/05 15:13 / srm
Silt	39	%		1	ASA15-5	10/28/05 15:13 / srm
Clay	21	%		1	ASA15-5	10/28/05 15:13 / srm
Texture	L				ASA15-5	10/28/05 15:13 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)						
SATURATED PASTE						
pH, sat, paste	2.30	s.u.		0.10	ASAM10-3.2	10/28/05 15 13 / srm
Conductivity, sat, paste	12.9	mmhos/cm		0.01	ASA10-3	10/28/05 15.13 / srm
Saturation	35.7	%		0.1	USDA27a	10/28/05 15:13 / srm

Report Definitions:



Client: Golder Associates Inc Project: Tailing Test Plots Lab ID: B05100807-037 Client Sample ID: 3X-7B, 0-2' 
 Report Date:
 11/01/05

 Collection Date:
 02/16/05

 Date Received:
 10/13/05

 Matrix:
 Soil

				MCL/		
Analyses	Result	Units	Qual	RL QCL	Method	Analysis Date / By
PHYSICAL CHARACTERISTICS						
Sand	33	%		1	ASA15-5	10/28/05 15:13 / srm
Silt	45	%		1	ASA15-5	10/28/05 15:13 / srm
Clay	22	%		1	ASA15-5	10/28/05 15:13 / srm
Texture	L				ASA15-5	10/28/05 15:13 / srm
- C = Clay, S = Sand(y), Si = Silt(y), L = Loam(y)						
SATURATED PASTE						
pH. sat. paste	2.30	s.u.		0.10	ASAM10-3.2	10/28/05 15:13 / srm
Conductivity, sat, paste	9.23	mmhos/cm		0.01	ASA10-3	10/28/05 15:13 / srm
Saturation	41.3	%		0.1	USDA27a	10/28/05 15:13 / srm

# Energy Laboratories Inc

### Sample Receipt Checklist

Client Name Golder Associates Inc			Date an	d Time Received:	10/13/2005	
Work Order Number B05100807			Receive	d by sba		
Checklist completed by		13-05	Reviewe	ed by Initials		Date
	Carrier name	UPS ARS Groun	d			
Shipping container/cooler in good condition?		Yes 🗹	No 🗌	Not Present		
Custody seals intact on shipping container/cooler	?	Yes 🗹	No 🗌	Not Present		
Custody seals intact on sample bottles?		Yes 🗀	No 🗌	Not Present		
Chain of custody present?		Yes 🗹	No 🗌			
Chain of custody signed when relinquished and r	eceived?	Yes 🗹	No 🗌			
Chain of custody agrees with sample labels?		Yes 🗹	No 🗔			
Samples in proper container/bottle?		Yes 🗹	No 🗌			
Sample containers intact?		Yes 🗹	No 🗌			
Sufficient sample volume for indicated test?		Yes 🗹	No 🗌			
All samples received within holding time?		Yes 🗹	No 🗌			
Container/Temp Blank temperature in complianc	e?	Yes 🗌	No 🗹	NA °C	_	
Water - VOA vials have zero headspace?		Yes 🗌	No 🗌	No VOA vials subr	nitted 🗹	
Water - pH acceptable upon receipt?		Yes 🗌	No 🗆	Not Applicable		
	Adjusted?	Che	cked by		_	
Any No and/or NA (not applicable) response mus	t be detailed in the c	comments section	below.		== .= .	
Client contacted	Date contacted:			Person contacted		
Contacted by:	Regarding:					
Comments:						
Corrective Action		=				

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X - IA - L $40^{\circ}$ BGS $3266$ II         III         IIII         IIII         IIII         IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	X-1A-L .23" BGS	3/2/05	1			×		sn	<u>'~t'</u>
X-1A-L       O*TL       X2/05       "       "       Display in the image of the image	K- IA-L, 40" BGS	3/2/05	11			×		1	$\sim$
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X-2C     O-2     3/2/b5     n     V/V/V     I     N       Sustody     Felinquished by (pmi):     Date/Time:     Bate/Time:     Bate/Time:     Signature:       Sustody     Filzabe/X     Field     10/10/05     Filzabe/X     Pate/Time:     Signature:       Record     Reinquished by (pmi):     Date/Time:     Bate/Time:     Bate/Time:     Signature:       Record     Record     N/N/N     N/N     N/N/N     Date/Time:     Signature:       Record     Reinquished by (pmi):     Date/Time:     Bate/Time:     Signature:     I/N/B/NS       Record     Reinquished by (pmi):     Date/Time:     Signature:     Received by (pmi):     Date/Time:     Signature:       IUST be     IUST be     I/N/B/NS     Date/Time:     Signature:     I/N/B/NS     Signature:       Signed     IUST be     I/N/B/NS     I/N/B/NS     Doversioned by (pmi):     Date/Time:     I/N/B/NS	X-2B. O-2'	3/2/05				×		B	<u>ۍ</u>
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Visit our web site at www.energylab.com for additional information, downloadable fee schedule, forms, & links.

ENERGY LABORATORIES PLE	hain of Cus	s much information a	Analyti as possible Re	<b>cal Requ</b> (	<b>est Record</b> g notes on reverse side.	Page	v	)
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Signed Sample Disposal:	Return to client:	Lab Disposal:		Sample Type:	LABORATORY U # of	SE ONEF ractions		
In certain circumstances, sam	ples submitted to Energy This serves as notice of t	Laboratories, Inc. may his possibility. All sub	be subcontracte -contract data wi	d to other certified lat If be clearly notated o	ioratories in order to complet n your analytical report.	e the analysis	requested.	
Visit our we	sb site at www.energ	vlab.com for additic	onal informatio	on, downloadable	fee schedule, forms, &	inks.		

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Visit our web site at www.energylab.com for additional information, downloadable fee schedule, forms, & links.

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Visit our web site at www.energy/ab.com for additional information, downloadable fee schedule, forms, & links.

# **APPENDIX C**

## SOIL HYDRAULIC LABORATORY DATA COVER MATERIALS
# Laboratory Report for Golder Associates, Inc.

Project #053-2365 & #053-2366

#### September 5, 2006



Daniel B. Stephens & Associates, Inc.

6020 Academy NE, Suite 100 • Albuquerque, New Mexico 87109



September 5, 2006

Mr. Lewis Munk Golder Associates, Inc. 5200 Pasadena Ave NE, Suite C Albuquerque, NM 87113

Re: DBS&A Laboratory Report for Golder Associates, Inc. Project # 053-2365 and 053-2366

Dear Mr. Munk:

Enclosed is the final report for the Golder Associates, Inc. (Project # 053-2365 and 053-2366). Please review this report and provide any comments as samples will be held for a maximum of 30 days. After 30 days samples will be returned or disposed of in an appropriate manner.

All testing results were evaluated subjectively for consistency and reasonableness, and the results appear to be reasonably representative of the material tested. However, DBS&A does not assume any responsibility for interpretations or analyses based on the data enclosed, nor can we guarantee that these data are fully representative of the undisturbed materials at the field site. We recommend that careful evaluation of these laboratory results be made for your particular application.

The testing utilized to generate the enclosed final report employs methods that are standard for the industry. The results do not constitute a professional opinion by DBS&A, nor can the results affect any professional or expert opinions rendered with respect thereto by DBS&A. You have acknowledged that all the testing undertaken by us, and the final report provided, constitutes mere test results using standardized methods, and cannot be used to disqualify DBS&A from rendering any professional or expert opinion, having waived any claim of conflict of interest by DBS&A.

We are pleased to provide this service to Golder Associates, Inc. and look forward to future laboratory testing on other projects. If you have any questions about the enclosed data, please do not hesitate to call.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC. LABORATORY / TESTING FACILITY

ole

Joleen Hines Laboratory Supervising Manager

Enclosure

Daniel B. Stephens & Associates, Inc.

6020 Academy NE, Suite 100

Albuquerque, NM 87109

505-822-9400 FAX 505-822-8877

### Summaries

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# **Summary of Tests Performed**

		Saturated							1/3, 15 Bar		
	Initial Soil	Hydraulic	Moisture	Unsaturated	Particle				Points and		·
Laboratory	Properties <sup>1</sup>	Conductivity <sup>2</sup>	Characteristics <sup>3</sup>	Hydraulic	Size4	Effective	Particle	Air	Water Holding	Atterberg	Proctor
Sample Number	(θ, ρ <sub>d</sub> , φ)	CH FH	HC PP TH WP RH	Conductivity	H SW SO	Porosity	Density	Permeability	Capacity	Limits	Compaction
3XTP-5Ai	×	×	× × ×	×			×				
3XTP-5Ci	×	×	× × × ×	×			×				
3XTP-6Bi	×	×	××××	×			×				
3XTP-6D	×	×	x x x x	×			×				
3XTP-7Ai	×	×	× × ×	×			×				
3XTP-7D	×	×	××××	×			×				

<sup>1</sup> θ = Initial moisture content, p<sub>d</sub> = Dry bulk density, φ = Calculated porosity
<sup>2</sup> CH = Constant head, FH = falling head
<sup>3</sup> HC = Hanging column, PP = Pressure plate, TH = Thermocouple psychrometer, WP = Water activity meter, RH = Relative humidity box
<sup>4</sup> DS = Dry sieve, WS = Wet sieve, H = Hydrometer

#### **Summary of Sample Preparation**

	Target Remold Values*		Act	Actual Remold Data			easured )ensities**
	Target Remold Densities	Target Remold Densities	Moisture Content	Dry Bulk Density	% of Target Density	Final Measured Dry Bulk Density	Final % Volume Change
Sample Number	(% g/g)	(g/cm <sup>3</sup> )	(%, g/g)	(g/cm <sup>3</sup> )	(%)	(g/cm³)	(%)
3XTP-5Ai	15.0	1.40	15.4	1.39	99.3	1.52	-8.0
3XTP-5Ci	15.0	1.40	15.7	1.39	99.3		
3XTP-6Bi	15.0	1.40	16.5	1.38	98.6	1.59	-13.0
3XTP-6D	15.0	1.40	15.7	1.39	99.3	·	
3XTP-7Ai	15.0	1.40	15.9	1.39	99.3	1.44	-3.4
3XTP-7D	15.0	1.40	14.7	1.40	100.0	1.46	-4.0

\*Provided by the client: Target density = 1.4 g/cm3, target moisture content = 15% g/g. All testing for each sample was performed on the fraction passing the #10 sieve, as directed by the client.

\*\*Final Measured Changed Densities: Volume change measurements were obtained after saturated hydraulic conductivity testing and throughout unsaturated hydraulic conductivity testing. The reported values are the final sample dimensions.

Note: (+) denotes observed sample swelling, and (-) denotes observed sample settling.

---- = No volume change occurred

# Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity

	Calculated	Porosity (%)	48.3	48.2	48.7	47.9	48.1	47.1	
	Wet Bulk	Density (g/cm <sup>3</sup> )	1.61	1.61	1.61	1.61	1.61	1.61	
	Dry Bulk	Density (g/cm <sup>3</sup> )	1.39	1.39	1.38	1.39	1.39	1.40	
	olded	Volumetric (%, cm³/cm³)	21.5	21.8	22.8	21.8	22.1	20.7	
Content	Rem	Gravimetric (%, g/g)	15.4	15.7	16.5	15.7	15.9	14.7	
Moisture	sceived	Volumetric (%, cm³/cm³)	NA	NA	NA	NA	NA	NA	
	As Re	Gravimetric (%, g/g)	NA	NA	NA	NA	NA	NA	
		Sample Number	3XTP-5Ai	3XTP-5Ci	3XTP-6Bi	3XTP-6D	3XTP-7Ai	3XTP-7D	

NA = Not analyzed --- = This sample was not remolded



#### Summary of Saturated Hydraulic Conductivity Tests

	K <sub>sat</sub>	Oversize Corrected K <sub>sat</sub>	Method of	Analysis
Sample Number	(cm/sec)	(cm/sec)	Constant Head	Falling Head
3XTP-5Ai	6.0E-02	3.5E-02	х	
3XTP-5Ci	8.4E-04	5.0E-04	х	
3XTP-6Bi	7.9E-02	3.9E-02	X	
3XTP-6D	6.8E-04	4.0E-04	X	
3XTP-7Ai	2.3E-02	1.3E-02	X	
3XTP-7D	2.9E-02	1.7E-02	х	

CHARTER CONTRACTOR

Daniel B. Stephens & Associates, Inc.

#### **Pressure Head** Moisture Content (%, cm<sup>3</sup>/cm<sup>3</sup>) Sample Number (-cm water) 3XTP-5Ai 0 44.1 5 42.0 9 36.9 56 25.9 196 22.1 5813 10.6 851293 2.6 48.1 3XTP-5Ci 0 10 45.8 44.8 33 98 36.2 510 28.5 17.9 6323 851293 4.0 3XTP-6Bi 0 42.4 38.1 4 10 33.7 50 27.0 189 22.9 7241 10.2 851293 2.7 3XTP-6D 0 45.5 10 44.0 33 43.2 98 34.4 510 28.3 8362 16.4 851293 5.4

# Summary of Moisture Characteristics of the Initial Drainage Curve

	Pressure Head	Moisture Content
Sample Number	(-cm water)	<u>(%, cm<sup>3</sup>/cm<sup>3</sup>)</u>
3XTP-7Ai	0	43.4
	5	42.2
	10	36.9
	54	27.5
	191	22.0
	7343	10.4
	851293	2.8
3XTP-7D	0	45.1
	6	44.5
	10	40.2
	52	29.9
	192	21.9
	9688	9.8
	851203	26

# Summary of Moisture Characteristics of the Initial Drainage Curve (Continued)



#### Summary of Calculated Unsaturated Hydraulic Properties

						Oversize	Corrected
	Sample Number	α. (cm⁻¹)	N (dimensionless)	θ <sub>r</sub> (% vol)	θ <sub>s</sub> (% vol)	θ <sub>r</sub> (% vol)	θ <sub>s</sub> (% vol)
· · · · ·	3XTP-5Ai	0.1628	1.2172	0.00	44.66	0.00	32.71
	3XTP-5Ci	0.0239	1.2122	0.00	47.88	0.00	35.56
	3XTP-6Bi	0.2031	1.1892	0.00	42.05	0.00	27.67
	3XTP-6D	0.0247	1.1984	0.00	45.67	0.00	33.50
e a com	3XTP-7Ai	0.1296	1.2195	0.00	44.03	0.00	30.56
	3XTP-7D	0.0869	1.2603	0.79	46.00	0.58	33.58
		the state of the s					

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass NA = Not analyzed



#### Summary of Particle Density Tests

Particle Density (g/cm <sup>3</sup> )
2.70
2.69
2.69
2.67
2.68
2.65

## Laboratory Data and Graphical Plots

# **Initial Properties**

# Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity

	k Calculatec	Porosity (%)	48.3	48.2	48.7	47.9	48.1	47.1	
	Wet Bull	Density (g/cm <sup>3</sup> )	1.61	1.61	1.61	1.61	1.61	1.61	
	Dry Bulk	Density (g/cm <sup>3</sup> )	1.39	1.39	1.38	1.39	1.39	1.40	
	nolded	Volumetric (%, cm³/cm³)	21.5	21.8	22.8	21.8	22.1	20.7	
e Content	Rer	Gravimetric (%, g/g)	15.4	15.7	16.5	15.7	15.9	14.7	
Moistur	eceived	Volumetric (%, cm³/cm³)	NA	AN	AN	AN	AN	AN	
	As R	Gravimetric (%, g/g)	NA	NA	NA	NA	NA	NA	
	· · ·	Sample Number	3XTP-5Ai	3XTP-5Ci	3XTP-6Bi	3XTP-6D	3XTP-7Ai	3XTP-7D	

NA = Not analyzed



#### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

#### Job Name: Golder Associates Job Number: LB06.0147.00 Sample Number: 3XTP-5Ai Ring Number: NA Depth: NA

	As Received	Remolded
Test Date:	NA	17-Jul-06
Field weight* of sample (g): Tare weight, ring (g): Tare weight, pan/plate (g): Tare weight, other (g):		343.59 118.60 0.00 0.00
Dry weight of sample (g): Sample volume (cm <sup>3</sup> ): Measured particle density (g/cm <sup>3</sup> ):		194.94 139.76 2.70

Gravimetric Moisture Content (% g/g):	15.4
Volumetric Moisture Content (% vol):	21.5
Dry bulk density (g/cm <sup>3</sup> ):	1.39
Wet bulk density (g/cm <sup>3</sup> ):	1.61
Calculated Porosity (% vol):	48.3
Percent Saturation:	44.5

Laboratory analysis by: Data entered by: Checked by:

T. Bowekaty D. O'Dowd J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



#### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

#### Job Name: Golder Associates Job Number: LB06.0147.00 Sample Number: 3XTP-5Ci Ring Number: NA Depth: NA

	As Received	Remolded
Test Date:	NA	17-Jul-06
Field weight* of sample (g): Tare weight, ring (g): Tare weight, pan/plate (g): Tare weight, other (g):		332.35 109.70 0.00 0.00
Dry weight of sample (g): Sample volume (cm <sup>3</sup> ): Measured particle density (g/cm <sup>3</sup> ):		192.51 138.28 2.69

Gravimetric Moisture Content (% g/g):	15.7
Volumetric Moisture Content (% vol):	21.8
Dry bulk density (g/cm <sup>3</sup> ):	1.39
Wet bulk density (g/cm <sup>3</sup> ):	1.61
Calculated Porosity (% vol):	48.2
Percent Saturation:	45.2

Laboratory analysis by: Data entered by: Checked by: T. Bowekaty D. O'Dowd J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed

#### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

#### Job Name: Golder Associates Job Number: LB06.0147.00 Sample Number: 3XTP-6Bi Ring Number: NA Depth: NA

	As Received	<b>Remolded</b>
Test Date:	NA	17-Jul-06
Field weight* of sample (g): Tare weight, ring (g): Tare weight, pan/plate (g): Tare weight, other (g):		334.72 110.75 0.00 0.00
Dry weight of sample (g): Sample volume (cm <sup>3</sup> ): Measured particle density (g/cm <sup>3</sup> ):		192.21 139.16 2.69
Gravimetric Moisture Content (% g/g):		16.5
Volumetric Moisture Content (% vol):		22.8
Dry bulk density (g/cm <sup>3</sup> ):		1.38
Wet bulk density (g/cm <sup>3</sup> ):		1.61
Calculated Porosity (% vol):	·	48.7
Percent Saturation:	··· ··· ··· ··· ··· ··· ··· ··· ··· ··	46.9
Laboratory analysis by:		T Bowekaty

aboratory analysis by: Data entered by: Checked by:

# I. Bowekaty D. O'Dowd J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed

#### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

#### Job Name: Golder Associates Job Number: LB06.0147.00 Sample Number: 3XTP-6D Ring Number: NA Depth: NA

	As Received	<u>Remolded</u>
Test Date:	NA	17-Jul-06
Field weight* of sample (g): Tare weight, ring (g): Tare weight, pan/plate (g): Tare weight, other (g):		340.06 114.62 0.00 0.00
Dry weight of sample (g): Sample volume (cm <sup>3</sup> ): Measured particle density (g/cm <sup>3</sup> ):		194.87 140.11 2.67

Gravimetric Moisture Content (% g/g):	15.7
Volumetric Moisture Content (% vol):	21.8
Dry bulk density (g/cm <sup>3</sup> ):	1.39
Wet bulk density (g/cm <sup>3</sup> ):	1.61
Calculated Porosity (% vol):	47.9
Percent Saturation:	45.6

Laboratory analysis by:T. BowekatyData entered by:D. O'DowdChecked by:J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



#### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

#### Job Name: Golder Associates Job Number: LB06.0147.00 Sample Number: 3XTP-7Ai Ring Number: NA Depth: NA

	As Received	<u>Remolded</u>
Test Date:	NA	17-Jul-06
Field weight* of sample (g): Tare weight, ring (g): Tare weight, pan/plate (g): Tare weight, other (g):		333.72 108.98 0.00 0.00
Dry weight of sample (g): Sample volume (cm³): Measured particle density (g/cm³):		193.96 139.53 2.68

Gravimetric Moisture Content (% g/g):	15.9
Volumetric Moisture Content (% vol):	22.1
Dry bulk density (g/cm <sup>3</sup> ):	1.39
Wet bulk density (g/cm <sup>3</sup> ):	1.61
Calculated Porosity (% vol):	48.1
Percent Saturation:	45.8

Laboratory analysis by: Data entered by: Checked by: T. Bowekaty

D. O'Dowd

J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed



#### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

#### Job Name: Golder Associates Job Number: LB06.0147.00 Sample Number: 3XTP-7D Ring Number: NA Depth: NA

	As Received	<u>Remolded</u>
Test Date:	NA	17-Jul-06
Field weight* of sample (g): Tare weight, ring (g): Tare weight, pan/plate (g): Tare weight, other (g):		340.79 116.06 0.00 0.00
Dry weight of sample (g): Sample volume (cm <sup>3</sup> ): Measured particle density (g/cm <sup>3</sup> ):		195.86 139.62 2.65
weddared paraole density (gronn ).		2.00

Gravimetric Moisture Content (% g/g): 14.7				
Volumetric Moisture Content (% vol):	20.7			
Dry bulk density (g/cm <sup>3</sup> ):	1.40			
Wet bulk density (g/cm <sup>3</sup> ):	1.61			
Calculated Porosity (% vol):	47.1			
Percent Saturation:	43.9			

Laboratory analysis by: Data entered by: Checked by: T. Bowekaty D. O'Dowd J. Hines

#### Comments:

\* Weight including tares

NA = Not analyzed

## Saturated Hydraulic Conductivity



#### Summary of Saturated Hydraulic Conductivity Tests

		Oversize Corrected K <sub>sat</sub> K <sub>sat</sub>			Analysis
	Sample Number	(cm/sec)	(cm/sec)	Constant Head	Falling Head
· .	3XTP-5Ai	6.0E-02	3.5E-02	х	
•	3XTP-5Ci	8.4E-04	5.0E-04	X	
· ·	3XTP-6Bi	7.9E-02	3.9E-02	Х	
1.	3XTP-6D	6.8E-04	4.0E-04	Х	
	3XTP-7Ai	2.3E-02	1.3E-02	Х	
	3XTP-7D	2.9E-02	1.7E-02	X	



#### Saturated Hydraulic Conductivity Constant Head Method

Job name:	Golder Associates	Type of water used:	TAP
Job number:	LB06.0147.00	Collection vessel tare (g):	1 <b>1.9</b> 2
Sample number:	3XTP-5Ai	Sample length (cm):	7.63
Ring Number:	NA	Sample diameter (cm):	4.83
Depth:	NA	Sample x-sectional area (cm <sup>2</sup> ):	18.31

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm <sup>3</sup> )	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1: 24-Jul-06 24-Jul-06	10:14:59 10:16:51	21.0	0.5	20.6	8.7	112	6.5E-02	6.3E-02
Test # 2: 24-Jul-06 24-Jul-06	13:16:39 13:20:59	21.0	0.7	38.8	26.9	260	6.2E-02	6.0E-02
Test # 3: 24-Jul-06 24-Jul-06	13:47:24 13:48:32	21.0	0.9	20.5	8.6	68	5.9E-02	5.7E-02

Average Ksat (cm/sec): 6.0E-02

Oversize Corrected Ksat (cm/sec): 3.5E-02

#### Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not analyzed





#### Saturated Hydraulic Conductivity Constant Head Method

Job name: Golder Associates	Type of water used: TAP
Job number: LB06.0147.00	Collection vessel tare (g): 10.70
Sample number: 3XTP-5Ci	Sample length (cm): 7.59
Ring Number: NA	Sample diameter (cm): 4.82
Depth: NA	Sample x-sectional area (cm <sup>2</sup> ): 18.22

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm <sup>3</sup> )	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1: 24-Jul-06 24-Jul-06	12:29:34 12:39:13	21.0	1.2	12.1	1.4	579	8.5E-04	8.3E-04
Test # 2: 24-Jul-06 24-Jul-06	13:13:57 13:26:08	21.0	1.6	13.1	2.4	731	8.5E-04	8.3E-04
Test # 3: 24-Jul-06 24-Jul-06	13:54:29 14:06:04	21.0	2.0	13.6	2.9	695	8.7E-04	8.5E-04

Average Ksat (cm/sec): 8.4E-04

Oversize Corrected Ksat (cm/sec): 5.0E-04

#### Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not analyzed





#### Saturated Hydraulic Conductivity Constant Head Method

Job name: Golder Associates	Type of water used: TAP
Job number: LB06.0147.00	Collection vessel tare (g): 6.64
Sample number: 3XTP-6Bi	Sample length (cm): 7.63
Ring Number: NA	Sample diameter (cm): 4.82
Depth: NA	Sample x-sectional area (cm <sup>2</sup> ): 18.24

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm <sup>3</sup> )	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1: 24-Jul-06 24-Jul-06	12:32:48 12:34:20	21.0	0.5	15.5	8.9	92	8.1E-02	7.9E-02
Test # 2: 24-Jul-06 24-Jul-06	13:16:02 13:19:51	21.0	0.7	37.0	30.4	229	7.9E-02	7.7E-02
Test # 3: 24-Jul-06 24-Jul-06	13:48:05 13:49:16	21.0	0.9	19.2	12.6	71	8.2E-02	8.0E-02

Average Ksat (cm/sec): 7.9E-02

Oversize Corrected Ksat (cm/sec): 3.9E-02

#### Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not analyzed





#### Saturated Hydraulic Conductivity Constant Head Method

Job name:	Golder Associates	Type of water used: TAP
Job number:	LB06.0147.00	Collection vessel tare (g): 10.83
Sample number:	3XTP-6D	Sample length (cm): 7.61
Ring Number:	NA	Sample diameter (cm): 4.84
Depth:	NA	Sample x-sectional area (cm <sup>2</sup> ): 18.41

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm <sup>3</sup> )	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1: 24-Jul-06 24-Jul-06	10:15:38 10:23:13	21.0	1.4	11.9	1.1	455	6.8E-04	6.7E-04
Test # 2: 24-Jul-06 24-Jul-06	13:16:28 13:25:22	21.0	1.8	12.4	1.5	534	6.6E-04	6.5E-04
Test # 3: 26-Jul-06 26-Jul-06	13:47:52 13:48:55	21.0	2.2	11.1	0.3	63	7.5E-04	7.3E-04

Average Ksat (cm/sec): 6.8E-04

Oversize Corrected Ksat (cm/sec): 4.0E-04

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not analyzed





#### Saturated Hydraulic Conductivity Constant Head Method

Job name: Golder Associates	Type of water used: TAP
Job number: LB06.0147.00	Collection vessel tare (g): 6.37
Sample number: 3XTP-7Ai	Sample length (cm): 7.63
Ring Number: NA	Sample diameter (cm): 4.82
Depth: NA	Sample x-sectional area (cm <sup>2</sup> ): 18.28

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm <sup>3</sup> )	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1: 24-Jul-06 24-Jul-06	12:33:23 12:35:03	21.0	0.8	12.4	6.1	100	3.2E-02	3.1E-02
Test # 2: 24-Jul-06 24-Jul-06	13:15:35 13:21:51	21.0	0.6	20.8	14.4	376	2.7E-02	2.6E-02
Test # 3: 24-Jul-06 24-Jul-06	13:53:19 13:57:32	21.0	0.4	9.6	3.3	253	1.3E-02	1.3E-02

Average Ksat (cm/sec): 2.3E-02

Oversize Corrected Ksat (cm/sec): 1.3E-02

Comments:

- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not analyzed





#### Saturated Hydraulic Conductivity Constant Head Method

Job name:	Golder Associates	Type of water used:	TAP
Job number:	LB06.0147.00	Collection vessel tare (g):	10.70
Sample number:	3XTP-7D	Sample length (cm):	7.62
Ring Number:	NA	Sample diameter (cm):	4.83
Depth:	NA	Sample x-sectional area (cm <sup>2</sup> ):	18.32

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm <sup>3</sup> )	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1: 24-Jul-06 24-Jul-06	12:32:33 12:36:03	21.0	1.1	28.0	17.3	210	3.1E-02	3.0E-02
Test # 2: 24-Jul-06 24-Jul-06	13:15:51 13:21:23	21.0	0.9	30.9	20.2	332	2.8E-02	2.7E-02
Test # 3: 24-Jul-06 24-Jul-06	13:53:04 13:57:04	21.0	0.7	22.6	11.9	240	2.9E-02	2.9E-02

Average Ksat (cm/sec): 2.9E-02

Oversize Corrected Ksat (cm/sec): 1.7E-02

#### Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not analyzed



#### Moisture Retention Characteristics



#### **Pressure Head** Moisture Content $(\%, cm^{3}/cm^{3})$ Sample Number (-cm water) 3XTP-5Ai 44.1 0 5 42.0 9 36.9 56 25.9 196 22.1 5813 10,6 851293 2.6 48.1 3XTP-5Ci 0 10 45.8 44.8 33 98 36.2 510 28.5 17.9 6323 851293 4.0 42.4 3XTP-6Bi 0 4 38.1 10 33.7 50 27.0 189 22.9 7241 10.2 851293 2.7 3XTP-6D 0 45.5 10 44.0 33 43.2 98 34.4 28.3 510 16.4 8362 851293 5.4

#### Summary of Moisture Characteristics of the Initial Drainage Curve



Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm <sup>3</sup> /cm <sup>3</sup> )
3XTP-7Ai	0	43.4
	5	42.2
	10	36.9
the second s	54	27.5
	191	22.0
	7343	10.4
	851293	2.8
3XTP-7D	0	45.1
	6	44.5
	10	40.2
	52	29.9
	192	21.9
	9688	9.8
	851293	2.6

# Summary of Moisture Characteristics of the Initial Drainage Curve (Continued)



#### Summary of Calculated Unsaturated Hydraulic Properties

						Oversize	Corrected	_
	Sample Number	. <b>α</b> (cm⁻¹)	N (dimensionless)	θ <sub>r</sub> (% vol)	θ <sub>s</sub> (% vol)	θ <sub>r</sub> (% vol)	θ <sub>s</sub> (% vol)	-
	3XTP-5Ai	0.1628	1.2172	0.00	44.66	0.00	32.71	-
	3XTP-5Ci	0.0239	1.2122	0.00	47.88	0.00	35.56	
•	3XTP-6Bi	0.2031	1.1892	0.00	42.05	0.00	27.67	
· .	3XTP-6D	0.0247	1.1984	0.00	45.67	0.00	33.50	
÷.,	3XTP-7Ai	0.1296	1.2195	0.00	44.03	0.00	30.56	
	3XTP-7D	0.0869	1.2603	0.79	46.00	0.58	33.58	

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass NA = Not analyzed



#### Moisture Retention Data

Hanging Column/Pressure Plate/Thermocouple

(Main Drainage Curve)

Job Name:	Golder Associates	Dry wt. of sample (g):	194.94
Job Number:	LB06.0147.00	Tare wt., ring (g):	118.60
Sample Number:	3XTP-5Ai	Tare wt., screen & clamp (g):	25.47
Ring Number:	NA	Sample volume (cm <sup>3</sup> ):	139.76
Denth:	NA	( / / / / /	

Saturated weight\* at 0 cm tension (g): 400.66 Volume of water<sup>T</sup> in saturated sample (cm<sup>3</sup>): 61.65 Saturated moisture content (% vol): 44.11 Sample butk density (g/cm<sup>3</sup>): 1.39

		Weight*	Matric Potential	Moisture Content <sup>T</sup>
	Date/Time	(g)	(-cm water)	(% vol)
Hanging column:	25-Jul-06 / 13:05	400.66	0.00	44.11
	01-Aug-06 / 15:30	397.68	4.50	41.98
	07-Aug-06 / 08:25	390.55	9.00	36.88
•	14-Aug-06 / 10:40	375.21	55.50	25.90
	21-Aug-06 / 09:05	369.86	196.00	22.07

Comments:

\* Weight including tares

1 Assumed density of water is 1.0 g/cm°



#### Moisture Retention Data Water Activity Meter/Relative Humidity Box (Main Drainage Curve)

Job Name: Golder Associates Job Number: LB06.0147.00 Sample Number: 3XTP-5Ai Ring Number: NA Depth: NA

Dry weight\* of water activity meter sample (g): 167.88 Tare weight, jar (g): 112.93 Sample bulk density (g/cm³): 1.39

			Matric	Moisture
		Weight*	Potential	Content <sup>™</sup>
	Date/Time	(g)	(-cm water)	(% vol)
Water Activity Meter:	25-Jul-06 / 14:30	172.06	5812.9	10.61
•				

Dry weight\* of relative humidity box sample (g): 89.49 Tare weight (g): 41.66 Sample bulk density (g/cm<sup>3</sup>): 1.39

			Matric	Moisture
		Weight*	Potential	Content <sup>™</sup>
	Date/Time	(g)	(-cm water)	(% vol)
Relative humidity box:	02-Aug-06 / 13:15	90.37	851293	2.57

#### Comments:

\* Weight including tares

<sup>†</sup> Assumed density of water is 1.0 g/cm<sup>3</sup>



Water Retention Data Points

Sample Number: 3XTP-5Ai



Daniel B. Stephens & Associates, Inc. Predicted Water Retention Curve and Data Points Sample Number: 3XTP-5Ai 1.E+06 1.E+05 1.E+04 Hanging column Pressure plate Thermocouple Water activity meter Pressure Head (-cm water) . ٠ 1.E+03 Rh box х Predicted curve Oversize corrected 1.E+02 1.E+01 1.E+00 1.E-01 10 20 30 0 40 50

Moisture Content (%,cm<sup>3</sup>/cm<sup>3</sup>)

60


Plot of Relative Hydraulic Conductivity vs Moisture Content

Sample Number: 3XTP-5Ai



## Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: 3XTP-5Ai





Plot of Relative Hydraulic Conductivity vs Pressure Head



## Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: 3XTP-5Ai



## **Oversize Correction Data Sheet**

Job Name: Golder Associates Job Number: LB06.0147.00 Sample Number: 3XTP-5Ai Ring Number: NA Depth: NA

Split (3/4", 3/8", #4): #10 Calculated Porosity of Fines (% vol): 48.3

	Coarse Fraction	Fines Fraction	<u>Composite</u>
Subsample Mass (g):	1356.00	1920.00	3276.00
Bulk Density (g/cm <sup>3</sup> ):	2.70	1.39	1.74
Volume of Solids (cm <sup>3</sup> ):	502.91	712.09	1215.00
Volume of Voids (cm <sup>3</sup> ):	0.00	664.41	664.41
<i>Total Volume</i> (cm <sup>3</sup> ):	502.91	1376.50	1879.41
Volumetric Fraction (%):	26.76	73.24	100.00
Initial Moisture Content (% vol):	0.00	21.50	15.75
Saturated Moisture Content (% vol):	0.00	44.66	32.71
Residual Moisture Content (% vol):	0.00	0.00	0.00
Ksat (cm/sec):	NA	6.0E-02	3.5E-02

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not analyzed



## Moisture Retention Data

Hanging Column/Pressure Plate/Thermocouple

(Main Drainage Curve)

Job Name: Golder Associate	s Dry wt. of sample (g):	192.51
Job Number: LB06.0147.00	Tare wt., ring (g):	109.70
Sample Number: 3XTP-5Ci	Tare wt., screen & clamp (g):	24.92
Ring Number: NA	Sample volume (cm <sup>3</sup> );	138.28
Depth: NA		

Saturated weight\* at 0 cm tension (g): 393.60 Volume of water<sup>™</sup> in saturated sample (cm<sup>°</sup>): 66.47 Saturated moisture content (% vol): 48.07 Sample bulk density (g/cm<sup>°</sup>): 1.39

		Weight*	Matric Potential	Moisture Content <sup>T</sup>
	Date/Time	(g)	(-cm water)	(% vol)
Hanging column:	25-Jul-06 / 14:00	393.60	0.00	48.07
	01-Aug-06 / 16:05	390.53	9.50	45.85
	07-Aug-06 / 09:38	389.11	32.50	44.82
	14-Aug-06 / 13:45	377.16	97.50	36.18
Pressure plate:	23-Aug-06 / 13:05	366.56	509.90	28.51

Comments:

\* Weight including tares

' Assumed density of water is 1.0 g/cm°



## Moisture Retention Data Water Activity Meter/Relative Humidity Box (Main Drainage Curve)

Job Name: Golder Associates Job Number: LB06.0147.00 Sample Number: 3XTP-5Ci Ring Number: NA Depth: NA

Dry weight\* of water activity meter sample (g): 157.99 Tare weight, jar (g): 113.41 Sample bulk density (g/cm<sup>3</sup>): 1.39

•			Matric	Moisture
· .		Weight*	Potential	Content <sup>1</sup>
	Date/Time	(g)	(-cm water)	(% vol)
Water Activity Meter:	26-Jul-06 / 12:00	163.72	6322.8	17.89
_				

Dry weight\* of relative humidity box sample (g): 71.64 Tare weight (g): 36.88 Sample bulk density (g/cm<sup>3</sup>): 1.39

			Matric	Moisture
		Weight*	Potential	Content <sup>1</sup>
	Date/Time	(g)	(-cm water)	(% vol)
Relative humidity box:	02-Aug-06 / 13:15	72.63	851293	3.97

#### Comments:

\* Weight including tares

<sup>†</sup> Assumed density of water is 1.0 g/cm<sup>3</sup>



Water Retention Data Points





Predicted Water Retention Curve and Data Points



Plot of Relative Hydraulic Conductivity vs Moisture Content



# Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: 3XTP-5Ci



Plot of Relative Hydraulic Conductivity vs Pressure Head



## Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: 3XTP-5Ci



## **Oversize Correction Data Sheet**

Job Name: Golder Associates Job Number: LB06.0147.00 Sample Number: 3XTP-5Ci Ring Number: NA Depth: NA

Split (3/4", 3/8", #4): #10 Calculated Porosity of Fines (% vol): 48.2

	Coarse Fraction	Fines Fraction	<u>Composite</u>
Subsample Mass (g):	1061.00	1586.00	2647.00
Bulk Density (g/cm <sup>3</sup> ):	2.69	1.39	1.73
Volume of Solids (cm <sup>3</sup> ):	394.85	590.23	985.09
Volume of Voids (cm <sup>3</sup> ):	0.00	549.00	549.00
Total Volume (cm <sup>3</sup> ):	394.85	1139.23	1534.08
Volumetric Fraction (%):	25.74	74.26	100.00
Initial Moisture Content (% vol):	0.00	21.80	16.19
Saturated Moisture Content (% vol):	0.00	47.88	35.56
Residual Moisture Content (% vol):	0.00	0.00	0.00
Ksat (cm/sec):	NA	8.4E-04	5.0E-04

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not analyzed



### Moisture Retention Data

Hanging Column/Pressure Plate/Thermocouple

(Main Drainage Curve)

Job Name:	Golder Associates	Dry wt. of sample (g):	192.21
Job Number:	LB06.0147.00	Tare wt., ring (g):	110.75
Sample Number:	3XTP-6Bi	Tare wt., screen & clamp (g):	25.93
Ring Number:	NA	Sample volume (cm <sup>3</sup> ):	139.16
Depth:	NA		

Saturated weight\* at 0 cm tension (g): 387.94 Volume of water<sup>⊤</sup> in saturated sample (cm<sup>3</sup>): 59.05 Saturated moisture content (% vol): 42.43 Sample bulk density (g/cm<sup>3</sup>): 1.38

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content <sup>⊤</sup> (% vol)
Hanging column:	25-Jul-06 / 13:30	387.94	0.00	42.43
	01-Aug-06 / 15:30	381.90	3.80	38.09
	07-Aug-06 / 08:30	375.74	9.50	33.67
	14-Aug-06 / 10:45	366.43	50.30	26.98
	21-Aug-06 / 09:15	360.70	188.50	22.86

Comments:

\* Weight including tares

<sup>1</sup> Assumed density of water is 1.0 g/cm<sup>2</sup>



### Moisture Retention Data Water Activity Meter/Relative Humidity Box (Main Drainage Curve)

Job Name: Golder Associates Job Number: LB06.0147.00 Sample Number: 3XTP-6Bi Ring Number: NA Depth: NA

Dry weight\* of water activity meter sample (g): 160.53 Tare weight, jar (g): 112.71 Sample bulk density (g/cm<sup>3</sup>): 1.38

	·		Matric	Moisture
		Weight*	Potential	Content <sup>T</sup>
	Date/Time	(g)	(-cm water)	(% vol)
Water Activity Meter:	26-Jul-06 / 13:45	164.06	7240.6	10.20
-				

Dry weight\* of relative humidity box sample (g): 86.16 Tare weight (g): 40.97 Sample bulk density (g/cm<sup>3</sup>): 1.38

			Matric	Moisture
		Weight*	Potential	Content <sup>⊤</sup>
	Date/Time	(g)	(-cm water)	(% vol)
Relative humidity box:	02-Aug-06 / 13:15	87.05	851293	2.72

#### Comments:

\* Weight including tares

<sup>†</sup> Assumed density of water is 1.0 g/cm<sup>3</sup>



## Water Retention Data Points

Sample Number: 3XTP-6Bi





**Predicted Water Retention Curve and Data Points** 

Sample Number: 3XTP-6Bi



Plot of Relative Hydraulic Conductivity vs Moisture Content



Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: 3XTP-6Bi





Plot of Relative Hydraulic Conductivity vs Pressure Head



Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: 3XTP-6Bi



## **Oversize Correction Data Sheet**

Job Name: Golder Associates Job Number: LB06.0147.00 Sample Number: 3XTP-6Bi Ring Number: NA Depth: NA

Split (3/4", 3/8", #4): #10 Calculated Porosity of Fines (% vol): 48.7

· .	Coarse Fraction	Fines Fraction	<u>Composite</u>
Subsample Mass (g):	3629.00	3585.00	7214.00
Bulk Density (g/cm <sup>3</sup> ):	2.69	1.38	1.83
Volume of Solids (cm <sup>3</sup> ):	1348.64	1332.29	2680.94
Volume of Voids (cm <sup>3</sup> ):	0.00	1263.33	1263.33
Total Volume (cm <sup>3</sup> ):	1348.64	2595.62	3944.27
Volumetric Fraction (%):	34.19	65.81	100.00
Initial Moisture Content (% vol):	0.00	22.82	15.02
Saturated Moisture Content (% vol):	0.00	42.05	27.67
Residual Moisture Content (% vol):	0.00	0.00	0.00
Ksat (cm/sec):	NA	7.9E-02	3.9E-02

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not analyzed



## **Moisture Retention Data**

Hanging Column/Pressure Plate/Thermocouple

(Main Drainage Curve)

Job Name:	Golder Associates	Dry wt. of sample (g):	194.87
Job Number:	LB06.0147.00	Tare wt., ring (g):	114.62
Sample Number:	3XTP-6D	Tare wt., screen & clamp (g):	25.55
Ring Number:	NA	Sample volume (cm <sup>3</sup> ):	140.11
Depth:	NA		

Saturated weight\* at 0 cm tension (g): 398.80 Volume of water<sup>⊤</sup> in saturated sample (cm³): 63.76 Saturated moisture content (% vol): 45.51 Sample bulk density (g/cm³): 1.39

		147 1 1 14	Matric	Moisture
		vv eight"	Potential	Content
-	Date/Time	(g)	(-cm water)	(% vol)
Hanging column:	25-Jul-06 / 13:25	398.80	0.00	45.51
	01-Aug-06 / 16:05	396.69	9.50	44.00
	07-Aug-06 / 09:37	395.57	32.50	43.20
	14-Aug-06 / 13:45	383.26	97.50	34.42
Pressure plate:	23-Aug-06 / 13:06	374.76	509.90	28.35

#### Comments:

\* Weight including tares

' Assumed density of water is 1.0 g/cm°



### Moisture Retention Data Water Activity Meter/Relative Humidity Box (Main Drainage Curve)

Job Name: Golder Associates Job Number: LB06.0147.00 Sample Number: 3XTP-6D Ring Number: NA Depth: NA

Dry weight\* of water activity meter sample (g): 156.48 Tare weight, jar (g): 112.87 Sample bulk density (g/cm<sup>°</sup>): 1.39

			Matric	Moisture
		Weight*	Potential	Content <sup>⊤</sup>
	Date/Time	(g)	(-cm water)	(% vol)
Water Activity Meter:	26-Jul-06 / 14:30	161.62	8362.4	16.39
-				

Dry weight\* of relative humidity box sample (g): 77.71 Tare weight (g): 38.35 Sample bulk density (g/cm<sup>3</sup>): 1.39

			Matric	Moisture
		Weight*	Potential	Content <sup>T</sup>
_	Date/Time	(g)	(-cm water)	(% vol)
Relative humidity box:	02-Aug-06 / 13:15	79.24	851293	5.41

Comments:

\* Weight including tares

<sup>†</sup> Assumed density of water is 1.0 g/cm<sup>3</sup>



Water Retention Data Points

Sample Number: 3XTP-6D



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Predicted Water Retention Curve and Data Points

Sample Number: 3XTP-6D



## Plot of Relative Hydraulic Conductivity vs Moisture Content



Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: 3XTP-6D



Plot of Relative Hydraulic Conductivity vs Pressure Head



Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: 3XTP-6D



## **Oversize Correction Data Sheet**

Job Name: Golder Associates Job Number: LB06.0147.00 Sample Number: 3XTP-6D Ring Number: NA Depth: NA

Split (3/4", 3/8", #4): #10 Calculated Porosity of Fines (% vol): 47.9

	Coarse Fraction	Fines Fraction	<u>Composite</u>
Subsample Mass (g):	1655.00	2375.00	4030.00
Bulk Density (g/cm <sup>3</sup> ):	2.67	1.39	1.73
Volume of Solids (cm <sup>3</sup> ):	619.95	889.65	1509.60
Volume of Voids (cm <sup>3</sup> ):	0.00	817.91	817.91
Total Volume (cm <sup>3</sup> ):	619.95	1707.57	2327.51
Volumetric Fraction (%):	26.64	73.36	100.00
Initial Moisture Content (% vol):	0.00	21.82	16.01
Saturated Moisture Content (% vol):	0.00	45.67	33.50
Residual Moisture Content (% vol):	0.00	0.00	0.00
Ksat (cm/sec):	NA	6.8E-04	4.0E-04

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not analyzed



### **Moisture Retention Data**

Hanging Column/Pressure Plate/Thermocouple

(Main Drainage Curve)

Job Name: Golder Associates	Dry wt. of sample (g): 193.96
Job Number: LB06.0147.00	Tare wt., ring (g): 108.98
Sample Number: 3XTP-7Ai	Tare wt., screen & clamp (g): 24.66
Ring Number: NA	Sample volume (cm <sup>3</sup> ): 139.53
Depth: NA	

Saturated weight\* at 0 cm tension (g): 388.10 Volume of water<sup>⊤</sup> in saturated sample (cm<sup>3</sup>): 60.50 Saturated moisture content (% vol): 43.36 Sample bulk density (g/cm<sup>3</sup>): 1.39

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content <sup>⊤</sup> (% vol)
Hanging column:	25-Jul-06 / 13:50	388.10	0.00	43.36
	01-Aug-06 / 15:38	386.54	4.50	42.24
	07-Aug-06 / 08:36	379.03	9.50	36.86
	14-Aug-06 / 11:40	366.01	53.50	27.53
	21-Aug-06 / 09:25	358.31	190.50	22.01

Comments:

\* Weight including tares

<sup>1</sup> Assumed density of water is 1.0 g/cm°



## Moisture Retention Data Water Activity Meter/Relative Humidity Box

(Main Drainage Curve)

Job Name: Golder Associates Job Number: LB06.0147.00 Sample Number: 3XTP-7Ai Ring Number: NA Depth: NA

Dry weight\* of water activity meter sample (g): 157.99 Tare weight, jar (g): 112.66 Sample bulk density (g/cm<sup>3</sup>): 1.39

			Matric	Moisture
		Weight*	Potential	Content <sup>T</sup>
	Date/Time	(g)	(-cm water)	(% vol)
Water Activity Meter:	26-Jul-06 / 11:15	161.39	7342.6	10.43

Dry weight\* of relative humidity box sample (g): 89.62 Tare weight (g): 47.61 Sample bulk density (g/cm<sup>3</sup>): 1.39

			Matric	Moisture
		Weight*	Potential	Content <sup>T</sup>
	Date/Time	(g)	(-cm water)	(% vol)
Relative humidity box:	02-Aug-06 / 13:15	90.46	851293	2.78

Comments:

\* Weight including tares

<sup>†</sup> Assumed density of water is 1.0 g/cm<sup>3</sup>

Water Retention Data Points

Sample Number: 3XTP-7Ai





Predicted Water Retention Curve and Data Points

Sample Number: 3XTP-7Ai


Plot of Relative Hydraulic Conductivity vs Moisture Content



Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: 3XTP-7Ai



Plot of Relative Hydraulic Conductivity vs Pressure Head



## Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: 3XTP-7Ai



#### **Oversize Correction Data Sheet**

Job Name: Golder Associates Job Number: LB06.0147.00 Sample Number: 3XTP-7Ai Ring Number: NA Depth: NA

Split (3/4", 3/8", #4): #10 Calculated Porosity of Fines (% vol): 48.1

	Coarse Fraction	Fines Fraction	<u>Composite</u>
Subsample Mass (g):	1750.00	2060.00	3810.00
Bulk Density (g/cm <sup>3</sup> ):	2.68	1.39	1.78
Volume of Solids (cm <sup>3</sup> ):	652.84	768.49	1421.33
Volume of Voids (cm <sup>3</sup> ):	0.00	713.39	713.39
Total Volume (cm <sup>3</sup> ):	652.84	1481.88	2134.72
Volumetric Fraction (%):	30.58	69.42	100.00
Initial Moisture Content (% vol):	0.00	22.06	15.31
Saturated Moisture Content (% vol):	0.00	44.03	30.56
Residual Moisture Content (% vol):	0.00	0.00	0.00
Ksat (cm/sec):	NA	2.3E-02	1.3E-02

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not analyzed

Laboratory analysis by: D. O'Dowd Data entered by: D. O'Dowd Checked by: J. Hines



#### Moisture Retention Data

Hanging Column/Pressure Plate/Thermocouple

(Main Drainage Curve)

Job Name: Golder Associates Job Number: LB06.0147.00 Sample Number: 3XTP-7D Ring Number: NA Depth: NA Dry wt. of sample (g): 195.86 Tare wt., ring (g): 116.06 Tare wt., screen & clamp (g): 25.62

Sample volume (cm<sup>3</sup>): 139.62

Saturated weight\* at 0 cm tension (g): 400.51 Volume of water<sup>⊤</sup> in saturated sample (cm<sup>3</sup>): 62.97 Saturated moisture content (% vol): 45.10 Sample bulk density (g/cm<sup>3</sup>): 1.40

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content <sup>⊤</sup> (% vol)
Hanging column:	25-Jul-06 / 13:40	400.51	0.00	45.10
	01-Aug-06 / 15:35	399.65	5.50	44.49
·	07-Aug-06 / 08:35	393.73	10.00	40.25
	14-Aug-06 / 10:50	379.33	51.50	29.93
	21-Aug-06 / 09:20	368.18	192.00	21.95

Comments:

\* Weight including tares

<sup>1</sup> Assumed density of water is 1.0 g/cm<sup>°</sup>

Laboratory analysis by: D. O'Dowd Data entered by: D. O'Dowd Checked by: J. Hines



#### Moisture Retention Data Water Activity Meter/Relative Humidity Box (Main Drainage Curve)

Job Name: Golder Associates Job Number: LB06.0147.00 Sample Number: 3XTP-7D Ring Number: NA Depth: NA

Dry weight\* of water activity meter sample (g): 163.94 Tare weight, jar (g): 112.94 Sample bulk density (g/cm<sup>3</sup>): 1.40

			Matric	Moisture	
		Weight*	Potential	Content <sup>⊤</sup>	
	Date/Time	(g)	(-cm water)	(% vol)	
Water Activity Meter:	26-Jul-06 / 14:00	167.50	9688.1	9.79	

Dry weight\* of relative humidity box sample (g): 81.23 Tare weight (g): 39.02 Sample bulk density (g/cm<sup>3</sup>): 1.40

			Matric	Moisture
		Weight*	Potential	Content <sup>T</sup>
	Date/Time	(g)	(-cm water)	(% vol)
Relative humidity box:	02-Aug-06 / 13:15	82.00	851293	2.56

#### Comments:

\* Weight including tares

<sup>†</sup> Assumed density of water is 1.0 g/cm<sup>3</sup>

Laboratory analysis by: D. O'Dowd/T. Bowekaty Data entered by: D. O'Dowd Checked by: J. Hines



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**Predicted Water Retention Curve and Data Points** 

Sample Number: 3XTP-7D



Plot of Relative Hydraulic Conductivity vs Moisture Content



Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: 3XTP-7D





Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: 3XTP-7D



#### **Oversize Correction Data Sheet**

Job Name: Golder Associates Job Number: LB06.0147.00 Sample Number: 3XTP-7D Ring Number: NA Depth: NA

Split (3/4", 3/8", #4): #10 Calculated Porosity of Fines (% vol): 47.1

	Coarse Fraction	Fines Fraction	<u>Composite</u>
Subsample Mass (g):	1769.00	2534.00	4303.00
Bulk Density (g/cm <sup>3</sup> ):	2.65	1.40	1.74
Volume of Solids (cm <sup>3</sup> ):	667.57	956.26	1623.84
Volume of Voids (cm <sup>3</sup> ):	0.00	850.08	850.08
Total Volume (cm <sup>3</sup> ):	667.57	1806.34	2473.91
Volumetric Fraction (%):	26.98	73.02	100.00
Initial Moisture Content (% vol):	0.00	20.68	15.10
Saturated Moisture Content (% vol):	0.00	46.00	33.58
Residual Moisture Content (% vol):	0.00	0.79	0.58
Ksat (cm/sec):	NA	2.9E-02	1.7E-02

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not analyzed

Laboratory analysis by: D. O'Dowd Data entered by: D. O'Dowd Checked by: J. Hines

## Particle Density



## Summary of Particle Density Tests

Sample Number	Particle Density (g/cm <sup>3</sup> )
3XTP-5Ai	2.70
3XTP-5Ci	2.69
3XTP-6Bi	2.69
3XTP-6D	2.67
3XTP-7Ai	2.68
3XTP-7D	2.65



### **Particle Density**

#### Job Name: Golder Associates Job Number: LB06.0147.00 Sample Number: 3XTP-5Ai Ring Number: NA Depth: NA

Test Date: 20-Jul-06

#### Trial 1

Weight of pycnometer filled w/air (g):
Weight of pycnometer filled w/soil (g):
Weight of pycnometer filled w/soil & water (g):
Weight of pycnometer filled w/water (g):
Observed temperature (°C):
Density of water at observed temperature (g/cm <sup>3</sup> ):
Particle Density (g/cm <sup>3</sup> ):
Correction factor, K:
Particle Density at 20°C (g/cm <sup>3</sup> ):

#### Trial 2

Weight of pycnometer filled w/air (g):	89.42
Weight of pycnometer filled w/soil (g):	139.99
Weight of pycnometer filled w/soil & water (g):	370.30
Weight of pycnometer filled w/water (g):	338.46
Observed temperature (°C):	24.00
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9973
Particle Density (g/cm <sup>3</sup> ):	2.69
Correction factor, K:	0.9991
Particle Density at 20°C (g/cm <sup>3</sup> ):	2.70

#### Average Particle Density (g/cm<sup>3</sup>): 2.70

Comments:



## **Particle Density**

Job Name:	Golder Associates
Job Number:	LB06.0147.00
Sample Number:	3XTP-5Ci
Ring Number:	NA
Depth:	NA

Test Date: 20-Jul-06

#### Trial 1

Weight of py	cnometer filled w/air (g):	99.92
Weight of pyc	cnometer filled w/soil (g):	149.91
Weight of pycnometer	r filled w/soil & water (g):	380.23
Weight of pycne	ometer filled w/water (g):	348.83
Obs	served temperature (°C):	24.20
Density of water at observ	<i>ved temperature</i> (g/cm <sup>3</sup> ):	0.9972
	Particle Density (g/cm <sup>3</sup> ):	2.68
	Correction factor, K:	0.9990
Particle	Density at 20°C (g/cm³):	2.68

#### Trial 2

Weight of pycnometer filled w/air (g):	92.10
Weight of pycnometer filled w/soil (g):	143.71
Weight of pycnometer filled w/soil & water (g):	373.48
Weight of pycnometer filled w/water (g):	341.02
Observed temperature (°C):	24.10
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9973
Particle Density (g/cm <sup>3</sup> ): Correction factor, K:	2.69 0.9991
Particle Density at 20°C (g/cm <sup>3</sup> ):	2.69

Average Particle Density (g/cm<sup>3</sup>): 2.69

Comments:



## Particle Density

#### Job Name: Golder Associates Job Number: LB06.0147.00 Sample Number: 3XTP-6Bi Ring Number: NA Depth: NA

Test Date: 20-Jul-06

#### Trial 1

Weight of pycnometer filled w/air (g):	91.77
Weight of pycnometer filled w/soil (g):	142.93
Weight of pycnometer filled w/soil & water (g):	373.01
Weight of pycnometer filled w/water (g):	340.77
Observed temperature (°C):	24.10
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9973
Particle Density (g/cm <sup>3</sup> ):	2.70
Correction factor, K:	0.9991
Particle Density at 20°C (g/cm <sup>3</sup> ):	2.70

Weight of pycnometer filled w/air (g):	100.37
Weight of pycnometer filled w/soil (g):	151.50
Weight of pychometer filled w/soil & water (g):	381.52
weight of pychometer filled w/water (g):	349.41
Observed temperature (°C):	24.00
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9973
Particle Density (g/cm <sup>3</sup> ):	2.68
Correction factor, K:	0.9991
Particle Density at 20°C (g/cm <sup>3</sup> ):	2.68

Average Particle Density (g/cm<sup>3</sup>): 2.69

Comments:



## **Particle Density**

#### Job Name: Golder Associates Job Number: LB06.0147.00 Sample Number: 3XTP-6D Ring Number: NA Depth: NA

Test Date: 19-Jul-06

#### Trial 1

Weight of pycnometer filled w/air (g):	88.47
Weight of pycnometer filled w/soil (g):	139.13
Weight of pycnometer filled w/soil & water (g):	369.19
Weight of pycnometer filled w/water (g):	337.47
Observed temperature (°C):	24.00
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9973
Particle Density (g/cm <sup>3</sup> ):	2.67
Correction factor, K:	0.9991
Particle Density at 20°C (g/cm <sup>3</sup> ):	2.67
Trial 2	
Weight of pycnometer filled w/air (g):	85.92
Weight of pycnometer filled w/soil (g):	136.36
Weight of pycnometer filled w/soil & water (g):	366.60
Weight of pycnometer filled w/water (g):	335.03

Observed temperature (°C):24.00Density of water at observed temperature (g/cm³):0.9973Particle Density (g/cm³):2.67

Correction factor, K: 0.9991

Particle Density at 20°C (g/cm<sup>3</sup>): 2.67

Average Particle Density (glcm<sup>3</sup>): 2.67

Comments:



## **Particle Density**

#### Job Name: Golder Associates Job Number: LB06.0147.00 Sample Number: 3XTP-7Ai Ring Number: NA Depth: NA

Test Date: 20-Jul-06

#### Trial 1

Weight of pycnometer filled w/air (g):	91.23
Weight of pycnometer filled w/soil (g):	143.82
Weight of pycnometer filled w/soil & water (g):	373.20
Weight of pycnometer filled w/water (g):	340.14
Observed temperature (°C): Density of water at observed temperature (g/cm <sup>3</sup> ):	24.00 0.9973
Particle Density (g/cm <sup>3</sup> ): Correction factor, K:	2.69 0.9991
Particle Density at 20°C (g/cm <sup>3</sup> ):	2.69

#### Trial 2

Weight of pycnometer filled w/air (g):	102.01
Weight of pycnometer filled w/soil (g):	153.85
Weight of pycnometer filled w/soil & water (g):	383.59
Weight of pycnometer filled w/water (g):	351.11
Observed temperature (°C):	24.00
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9973
Particle Density (g/cm <sup>3</sup> ):	2.67
Correction factor, K:	0.9991
<i>Particle Density at 20</i> °C (g/cm <sup>3</sup> ):	2.67

Average Particle Density (g/cm<sup>3</sup>): 2.68

Comments:



## **Particle Density**

#### Job Name: Golder Associates Job Number: LB06.0147.00 Sample Number: 3XTP-7D Ring Number: NA Depth: NA

Test Date: 20-Jul-06

#### Trial 1

Weight of pycnometer filled w/air (g):	100.50
Weight of pycnometer filled w/soil (g):	152.92
Weight of pycnometer filled w/soil & water (g):	382.22
Weight of pycnometer filled w/water (g):	349.55
Observed temperature (°C):	24.00
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9973
Particle Density (g/cm <sup>3</sup> ): Correction factor, K:	2.65 0.9991
Particle Density at 20°C (g/cm <sup>3</sup> ):	2.65

#### Trial 2

Average Particle Density (g/cm<sup>3</sup>): 2.65

Comments:

## Laboratory Tests and Methods



#### **Tests and Methods**

Analysis, American Society of Agronomy, Madison, WI

Dry Bulk Density:

ASTM D4531; ASTM D6836

ASTM D2216; ASTM D6836

ASTM D6836; ASTM D2325

Moisture Content:

Calculated Porosity:

Saturated K:

Constant Head: (Rigid Wall) ASTM D 2434 (modified apparatus)

ASTM D6836; Klute, A. 1986. Porosity. Chp.26, in A. Klute (ed.), Methods of Soil Analysis, American Society of Agronomy, Madison, WI

Klute, A. 1986. Porosity. Chp.18-2.1, pp. 444-445, in A. Klute (ed.), Methods of Soil

Pressure Plate Method:

Hanging Column Method:

Water Potential Method:

ASTM D6836; Rawlins, S.L. and G.S. Campbell, 1986. Water Potential: Thermocouple Psychrometry. Chp. 24, pp. 597-619, in A. Klute (ed.), Methods of Soil Analysis, Part 1. American Society of Agronomy, Madison, WI.

Relative Humidity Box:

Karathanasis & Hajek. 1982. Quantitative Evaluation of Water Adsorption on Soil Clays.SSA Journal 46:1321-1325

Calc. Kunsat:

ASTM D6836; van Genuchten, M.T. 1980. A closed-form equation for predicting the hydraulic conductivity of unsaturated soils. SSSAJ 44:892-898; van Genuchten, M.T., F.J. Leij, and S.R. Yates. 1991. The RETC code for quantifying the hydraulic functions of unsaturated soils. Robert S. Kerr Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Ada, Oklahoma. EPA/600/2091/065. December 1991

Particle Density (Fine)

ASTM D854

Course Fraction (Gravel) Correction (calc): ASTM D4718; Bouwer, H. and Rice, R.C. 1984. Hydraulic Properties of Stony Vadose Zones. Groundwater Vol. 22, No. 6

## APPENDIX D

### SOIL HYDRAULIC LABORATORY DATA TAILING

Laboratory Report for Golder Associates, Inc (Project # 053-2366 Batch 1)

July 8, 2005



Daniel B. Stephens & Associates, Inc.

6020 Academy NE, Suite 100 • Albuquerque, New Mexico 87109



July 8, 2005

Lewis Munk, PhD Golder Associates, Inc. 4910 Alameda Blvd. NE, Suite A Albuquerque, NM 87113 (505)-821-3043

Re: Laboratory Report for Golder Associates, Inc. (053-2365)

Dear Dr. Munk:

Enclosed is the final report for the Golder Associates, Inc. samples (053-2365). Please review this report and provide any comments as samples will be held for a maximum of 30 days. After 30 days samples will be returned or disposed of in an appropriate manner.

All testing results were evaluated subjectively for consistency and reasonableness, and the results appear to be reasonably representative of the material tested. However, DBS&A does not assume any responsibility for interpretations or analyses based on the data enclosed, nor can we guarantee that these data are fully representative of the undisturbed materials at the field site. We recommend that careful evaluation of these laboratory results be made for your particular application.

The testing utilized to generate the enclosed final report employs methods that are standard for the industry. The results do not constitute a professional opinion by DBS&A, nor can the results affect any professional or expert opinions rendered with respect thereto by DBS&A. You have acknowledged that all the testing undertaken by us, and the final report provided, constitutes mere test results using standardized methods, and cannot be used to disqualify DBS&A from rendering any professional or expert opinion, having waived any claim of conflict of interest by DBS&A.

We are pleased to provide this service to Golder Associates, Inc. and look forward to future laboratory testing on other projects. If you have any questions about the enclosed data, please do not hesitate to call.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC. LABORATORY / TESTING FACILITY

Joleen Hines, Laboratory Supervising Manager Enclosure

Daniel B. Stephens & Associates, Inc.



6020 Academy NE, Suite 100

Albuquerque, NM 87109

## **Summaries**

**Summary of Tests Performed** 

		Satul	rated										1/3, 15 Bar		
	Initial Soil	Hydr	aulic		Moistu	el l		Unsaturated	Particle			Percent	Points and		
Laboratory	Properties <sup>1</sup>	Condu	ctivity <sup>2</sup>	ΰ	naracter	istics	<i></i>	Hydraulic	Size <sup>4</sup>	Effective	Particle	Sand, Silt,	Water Holding	Atterberg	Proctor
Sample Number	(θ, ρ <sub>d</sub> , φ)	СН	ΕH	HC	PP TH	Ą	RH	Conductivity	DS WS H	Porosity	Density	Clay	Capacity	Limits	Compaction
3X-4A (3-9")	×	×		×	×	×	×	×			×	×			
3X-4A (58-64")	×		×	×	×	×	×	×			×	×			
3X-5C (2-8")	×	×		×	×	×	×	×			×	×			
3X-5C (56-62")	×		×	×	×	×	×	×			×	×			
3X-6A (2-8")	×		×	×	×	×	×	×			×	×			
3X-6A (39-45")	×		×	×	×		×	×			×	×			
3X-7A (26-32")	×		×	×	×		×	×			×	×			
TP-1-1A (3-9")	×	×		×	×	×	×	×			×	×			
TP-1-1A (52-58")	×	×		×	×	×	×	×			×	×			
2A (1-7")	×	×		×	×	×	×	×			×	×			
2A (40-46")	×	×		×	×	×	×	×			×	×			
3A (9-15")	×	•••••	×	×	 	×	×	×			×	×			
3A (28-34")	×		×	×	×	×	×	×			×	×			

<sup>1</sup> θ = Initial moisture content, <sub>β</sub> = Dry bulk density, φ = Calculated porosity
<sup>2</sup> CH = Constant head, FH = falling head
<sup>3</sup> HC = Hanging column, PP = Pressure plate, TH = Thermocouple psychrometer, WP = Water activity meter, RH = Relative humidity box
<sup>4</sup> DS = Dry sieve, WS = Wet sieve, H = Hydrometer

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	Initial Moist	ure Content	Dry Bulk	Wet Bulk	Calculated
Sample Number	Gravimetric (%, g/g)	Volumetric	Density (g/cm <sup>3</sup> )	Density (a/cm <sup>3</sup> )	Porosity (%)
	(10) 3.37		(g/onr /	(g/citri /	(70)
3X-4A (3-9")	14.2	22.3	1.58	1.80	43.2
3X-4A (58-64")	19.1	32.0	1.68	2.00	40.0
3X-5C (2-8")	20.2	31.4	1.55	1.87	43.2
3X-5C (56-62")	18.7	31.2	1.66	1.98	40.1
3X-6A (2-8")	35.4	48.5	1.37	1.85	49.9
3X-6A (39-45")	20.9	35.0	1.67	2.02	39.5
3X-7A (26-32")	18.9	30.5	1.61	1.91	41.4
TP-1-1A (3-9")	10.5	15.2	1.45	1.60	47.0
TP-1-1A (52-58")	10.8	16.4	1.52	1.68	44.2
2A (1-7")	10.0	15.6	1.57	1.72	43.2
2A (40-46")	10.8	18.2	1.69	1.87	38.2
3A (9-15")	13.8	24.3	1.77	2.01	35.7
3A (28-34")	14.1	24.5	1.74	1.99	36.5

## Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity



## Summary of Saturated Hydraulic Conductivity Tests

	K <sub>sat</sub>	Method of	Analysis
Sample Number	(cm/sec)	Constant Head	Falling Head
3X-4A (3-9")	1.5E-04	Х	
3X-4A (58-64'')	1.6E-07		х
3X-5C (2-8")	1.3E-04	х	
3X-5C (56-62")	2.9E-08		Х
3X-6A (2-8")	7.0E-07	2	Х
3X-6A (39-45")	4.4E-07		X
3X-7A (26-32")	5.8E-07		Х
TP-1-1A (3-9")	3.9E-03	х	
TP-1-1A (52-58")	3.0E-03	х	
2A (1-7")	4.5E-03	х	
2A (40-46'')	9.8E-04	х	
3A (9-15")	1.5E-06		Х
3A (28-34")	4.5E-05		Х



Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm <sup>3</sup> /cm <sup>3</sup> )
3X-4A (3-9")	0 27 52 146 510 15297 851293	44.8 41.3 38.8 24.4 17.2 8.5 1.7
3X-4A (58-64'')	0 30 128 510 9076 16215 851293	36.6 35.8 34.0 31.0 20.6 11.9 1.9
3X-5C (2-8'')	0 22 53 151 510 14889 851293	45.3 40.7 38.2 32.5 28.7 15.8 1.6
3X-5C (56-62")	0 24 136 510 6935 15195 851293	36.1 35.5 34.0 31.5 24.2 14.8 2.0

# Summary of Moisture Characteristics of the Initial Drainage Curve

	Pressure Head	Moisture Content
Sample Number	(-cm water)	(%, cm <sup>3</sup> /cm <sup>3</sup> )
3X-6A (2-8")	0	51.0
× ,	27	47.6
	128	44.0
	510	41.5
	10096	17.5
	19274	12.9
	851293	1.3
3X-6A (39-45")	0	41 2
	26	38.4
	127	35.4
	510	30.9
	9688	13.5
	851293	2.7
	0	27.0
3A-7A (20-32)	20	37.0 36.6
	126	33.0
	510	28.7
	9688	8.8
	851293	2.2
TP-1-1A (3-9")	0	44.5
	13	41.6
	44 05	36.9
	00 510	21.1 12.4
	10402	13.4
	851293	0.0 1 0
	001200	1.0

# Summary of Moisture Characteristics of the Initial Drainage Curve (Continued)



	Pressure Head	Moisture Content
Sample Number	(-cm water)	(%, cm <sup>3</sup> /cm <sup>3</sup> )
		46.1
TP-1-1A (52-58")	11	41.3
	43	31.9
	76	23.4
	510	14.6
	13053	8.8
	851293	0.7
	0	45.2
2A (1-7")	15	41.6
	42	39.9
	77	27.8
	337	17.0
	12544	7.5
	851293	0.8
0 A (40 46")	0	43.3
2A (40-46 )	22	39.9
	51	36.0
	140	18.3
	510	15.3
	16215	7.0
	851293	1.8
0A (0.45%)	0	32.4
3A (9-15 )	27	29.7
	123	23.5
	337	20.7
	11320	12.6
	29064	7.2
	851293	1.3

## Summary of Moisture Characteristics of the Initial Drainage Curve (Continued)

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# Summary of Moisture Characteristics of the Initial Drainage Curve (Continued)

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm <sup>3</sup> /cm <sup>3</sup> )
3A (28-34")	0	45.3
	24	41.5
	52	40.3
	147	29.1
	510	23.6
	17337	14.3
	851293	1.3



## Summary of Calculated Unsaturated Hydraulic Properties

Sample Number	<b>α</b> (cm <sup>-1</sup> )	<b>N</b> (dimensionless)	θ <sub>r</sub>	θ <sub>s</sub>
	0.0201	1.4820	0.0331	0.4550
3X-4A (58-64")	0.0001	2.1662	0.0000	0.3439
3X-5C (2-8")	0.0203	1.2090	0.0000	0.4417
3X-5C (56-62")	0.0002	1.6881	0.0000	0.3440
3X-6A (2-8")	0.0016	1.3784	0.0000	0.4824
3X-6A (39-45")	0.0036	1.3059	0.0000	0.3961
3X-7A (26-32")	0.0025	1.4615	0.0095	0.3659
TP-1-1A (3-9")	0.0317	1.5552	0.0369	0.4496
TP-1-1A (52-58")	0.0805	1.3216	0.0118	0.4663
2A (1-7")	0.0253	1.4785	0.0226	0.4538
2A (40-46")	0.0227	1.6113	0.0395	0.4393
3A (9-15")	0.0251	1.2117	0.0000	0.3232
3A (28-34")	0.0302	1.2299	0.0000	0.4574


# Summary of Percent Sand, Silt & Clay Tests

Osmala Number	% Sand	% Silt	% Clay
Sample Number	// Curia		
3X-4A (3"-9")	55.1	28.3	16.6
3X-4A (58"-64")	39.8	41.8	18.5
3X-5C (2"-8")	38.3	41.2	20.6
3X-5C (56"-62")	45.9	37.3	16.8
3X-6A (2"-8")	28.9	47.4	23.7
2X 6A (39"-45")	55.0	30.0	15.0
3X-0A (26" 32")	50.5	33.5	16.0
3X-/A (20 -32 )	79.8	13.3	6.9
TP-1-1A (3 <sup></sup> 9 <sup></sup> )	75.0		
TP-1-1A 52"-58"()	80.1	13.4	6.5
2A (1"-7")	78.5	14.5	7.0
2A (40"-46")	79.5	12.5	8.0
3A (9"-15")	76.0	16.0	8.0
3A (28"-34")	73.3	17.1	9.6
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### Summary of Particle Density Tests

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Sample Number	Particle Density (g/cm <sup>3</sup> )
3X-4A (3-9")	2.77
3X-4A (58-64")	2.80
3X-5C (2-8")	2.73
3X-5C (56-62")	2.78
3X-6A (2-8")	2.74
3X-6A (39-45")	2.76
3X-7A (26-32")	2.75
TP-1-1A (3-9")	2.73
TP-1-1A (52-58")	2.72
2A (1-7")	2.76
2A (40-46")	2.73
3A (9-15")	2.75
3A (28-34")	2.75

# Laboratory Data and Graphical Plots

# **Initial Properties**



	Initial Moist Gravimetric	Initial Moisture Content Gravimetric Volumetric		Wet Bulk Density (a/cm <sup>3</sup> )	Calculated Porosity (%)
Sample Number	(%, g/g)	(%, CIII /CIII )	(g/on /		12.2
3X-4A (3-9")	14.2	22.3	1.58	1.80	40.2
3X-4A (58-64")	19.1	32.0	1.68	2.00	40.0
3X-5C (2-8")	20.2	31.4	1.55	1.87	43.2
3X-5C (56-62")	18.7	31.2	1.66	1.98	40.1
	35.4	48.5	1.37	1.85	49.9
3X-6A (2-8)	20.9	35.0	1.67	2.02	39.5
3X-6A (39-43)	40.0	30.5	1.61	1.91	41.4
3X-7A (26-32")	18.9	50.5		1 60	<i>4</i> 7 0
TP-1-1A (3-9")	10.5	15.2	1.45	1.00	47.0
TP-1-1A (52-58")	10.8	16.4	1.52	1.68	44.2
24 (1-7")	10.0	15.6	1.57	1.72	43.2
20 (40 46")	10.8	18.2	1.69	1.87	38.2
ZA (40-40)	13.8	24.3	1.77	2.01	35.7
3A (9-15")	10.0		1 74	1 99	36.5
3A (28-34")	14.1	24.5	1.74	1.00	

### Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity

NA = Not analyzed



#### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Golder Job Number: LB05.0055.00 Sample Number: 3X-4A (3-9") Ring Number: NA Depth: NA

Test Date: 21-Mar-05

Field weight\* of sample (g): 132.70 Tare weight, ring (g): 12.74 Tare weight, cap/plate/epoxy (g): 0.00

> Dry weight of sample (g): 105.08 Sample volume (cm<sup>3</sup>): 66.67 Measured particle density: 2.77

Initial Volumetric Moisture Content (% vol): 22.3
Initial Gravimetric Moisture Content (% g/g): 14.2
Dry bulk density (g/cm <sup>3</sup> ): 1.58
Wet bulk density (g/cm <sup>3</sup> ): 1.80
Calculated Porosity (% vol): 43.2
Percent Saturation: 51.7

Comments:

\* Weight including tares NA = Not analyzed



#### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Golder Job Number: LB05.0055.00 Sample Number: 3X-6A (2-8") Ring Number: NA Depth: NA Test Date: 21-Mar-05

Field weight\* of sample (g): 94.71 Tare weight, ring (g): 8.56 Tare weight, cap/plate/epoxy (g): 0.00

> Dry weight of sample (g): 63.62 Sample volume (cm<sup>3</sup>): 46.46 Measured particle density: 2.74

Initial Volumetric Moisture Content (% vol): 48.5 Initial Gravimetric Moisture Content (% g/g): 35.4 Dry bulk density (g/cm<sup>3</sup>): 1.37 Wet bulk density (g/cm<sup>3</sup>): 1.85 Calculated Porosity (% vol): 49.9 Percent Saturation: 97.1

Comments:

\* Weight including tares NA = Not analyzed



### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Golder
Job Number:	LB05.0055.00
Sample Number:	3X-4A (58-64")
Ring Number:	NA
Depth:	NA
Test Date:	21-Mar-05

Field weight\* of sample (g): 140.72 Tare weight, ring (g): 11.93 Tare weight, cap/plate/epoxy (g): 0.00

> Dry weight of sample (g): 108.17 Sample volume (cm³): 64.40 Measured particle density: 2.80

Initial Volumetric Moisture Content (% vol): 32.0 Initial Gravimetric Moisture Content (% g/g): 19.1 Dry bulk density (g/cm<sup>3</sup>): 1.68 Wet bulk density (g/cm<sup>3</sup>): 2.00 Calculated Porosity (% vol): 40.0 Percent Saturation: 80.0

Comments:

\* Weight including tares

NA = Not analyzed



### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Golder Job Number: LB05.0055.00 Sample Number: 3X-5C (2-8") Ring Number: NA Depth: NA Test Date: 21-Mar-05

Field weight\* of sample (g): 109.19 Tare weight, ring (g): 10.02 Tare weight, cap/plate/epoxy (g): 0.00

> Dry weight of sample (g): 82.47 Sample volume (cm<sup>3</sup>): 53.10 Measured particle density: 2.73

Initial Volumetric Moisture Content (% vol): 31.4 Initial Gravimetric Moisture Content (% g/g): 20.2 Dry bulk density (g/cm<sup>3</sup>): 1.55 Wet bulk density (g/cm<sup>3</sup>): 1.87 Calculated Porosity (% vol): 43.2 Percent Saturation: 72.8

Comments:

\* Weight including tares NA = Not analyzed



### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name:	Golder
Job Number:	LB05.0055.00
Sample Number:	3X-5C (56-62")
Ring Number:	NA
Depth:	NA
Test Date:	21-Mar-05
Field weight* c	of sample (q): 133

Field weight\* of sample (g): 133.18 Tare weight, ring (g): 11.38 Tare weight, cap/plate/epoxy (g): 0.00

Dry weight of sample (g): 102.59 Sample volume (cm³): 61.63 Measured particle density: 2.78

Initial Volumetric Moisture Content (% vol): 31.2 Initial Gravimetric Moisture Content (% g/g): 18.7 Dry bulk density (g/cm<sup>3</sup>): 1.66 Wet bulk density (g/cm<sup>3</sup>): 1.98 Calculated Porosity (% vol): 40.1 Percent Saturation: 77.8

Comments:

\* Weight including tares

NA = Not analyzed



### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Golder Job Number: LB05.0055.00 Sample Number: 3X-6A (39-45") Ring Number: NA Depth: NA

Test Date: 21-Mar-05

Field weight\* of sample (g): 97.91 Tare weight, ring (g): 8.32 Tare weight, cap/plate/epoxy (g): 0.00

> Dry weight of sample (g): 74.08 Sample volume (cm3): 44.36 Measured particle density: 2.76

Initial Volumetric Moisture Content (% vol): 35.0 Initial Gravimetric Moisture Content (% g/g): 20.9 Dry bulk density (g/cm<sup>3</sup>): 1.67 Wet bulk density (g/cm<sup>3</sup>): 2.02 Calculated Porosity (% vol): 39.5

Percent Saturation: 88.6

Comments:

\* Weight including tares

NA = Not analyzed



### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Golder Job Number: LB05.0055.00 Sample Number: 3X-7A (26-32") Ring Number: NA Depth: NA

Test Date: 21-Mar-05

Field weight\* of sample (g): 103.78 Tare weight, ring (g): 9.10 Tare weight, cap/plate/epoxy (g): 0.00

> Dry weight of sample (g): 79.62 Sample volume (cm<sup>3</sup>): 49.44 Measured particle density: 2.75

Initial Volumetric Moisture Content (% vol): 30.5

Initial Gravimetric Moisture Content (% g/g): 18.9 Dry bulk density (g/cm<sup>3</sup>): 1.61

Wet bulk density (g/cm<sup>3</sup>): 1.91

Calculated Porosity (% vol): 41.4

Percent Saturation: 73.6

Comments:

\* Weight including tares NA = Not analyzed



### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Golder Job Number: LB05.0055.00 Sample Number: TP-1-1A (3-9") Ring Number: NA Depth: NA Test Date: 21-Mar-05 Field weight\* of sample (g): 93.09 Tare weight, ring (g): 9.01 Tare weight, cap/plate/epoxy (g): 0.00

> Dry weight of sample (g): 76.09 Sample volume (cm<sup>3</sup>): 52.53 Measured particle density: 2.73

Initial Volumetric Moisture Content (% vol): 15.2 Initial Gravimetric Moisture Content (% g/g): 10.5 Dry bulk density (g/cm<sup>3</sup>): 1.45

Wet bulk density (g/cm<sup>3</sup>): 1.60

Calculated Porosity (% vol): 47.0

Percent Saturation: 32.4

Comments:

\* Weight including tares

NA = Not analyzed



#### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Golder Job Number: LB05.0055.00 Sample Number: TP-1-1A (52-58") Ring Number: NA Depth: NA

Test Date: 21-Mar-05

Field weight\* of sample (g): 91.54 Tare weight, ring (g): 8.52 Tare weight, cap/plate/epoxy (g): 0.00

> Dry weight of sample (g): 74.94 Sample volume (cm<sup>3</sup>): 49.37 Measured particle density: 2.72

Initial Volumetric Moisture Content (% vol): 16.4 Initial Gravimetric Moisture Content (% g/g): 10.8 Dry bulk density (g/cm<sup>3</sup>): 1.52 Wet bulk density (g/cm<sup>3</sup>): 1.68 Calculated Porosity (% vol): 44.2 Percent Saturation: 37.0

Comments:

\* Weight including tares

NA = Not analyzed



#### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Golder Job Number: LB05.0055.00 Sample Number: 2A (1-7") Ring Number: NA Depth: NA

Test Date: 21-Mar-05

Field weight\* of sample (g): 110.03 Tare weight, ring (g): 10.70 Tare weight, cap/plate/epoxy (g): 0.00

> Dry weight of sample (g): 90.32 Sample volume (cm<sup>3</sup>): 57.62 Measured particle density: 2.76

Initial Volumetric Moisture Content (% vol): 15.6

Initial Gravimetric Moisture Content (% g/g): 10.0

Dry bulk density (g/cm<sup>3</sup>): 1.57

Wet bulk density (g/cm<sup>3</sup>): 1.72

Calculated Porosity (% vol): 43.2

Percent Saturation: 36.2

Comments:

\* Weight including tares

NA = Not analyzed



#### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Golder Job Number: LB05.0055.00 Sample Number: 2A (40-46") Ring Number: NA Depth: NA Test Date: 21-Mar-05 Field weight\* of sample (g): 129.38 Tare weight, ring (g): 11.79

Tare weight, cap/plate/epoxy (g): 0.00

*Dry weight of sample* (g): 106.16 *Sample volume* (cm<sup>3</sup>): 62.97 *Measured particle density*: 2.73

Initial Volumetric Moisture Content (% vol):	18.2
Initial Gravimetric Moisture Content (% g/g):	10.8
Dry bulk density (g/cm <sup>3</sup> ):	1.69
Wet bulk density (g/cm <sup>3</sup> ):	1.87
Calculated Porosity (% vol): 3	38.2
Percent Saturation:	47.5

Comments:

\* Weight including tares

NA = Not analyzed



#### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Golder Job Number: LB05.0055.00 Sample Number: 3A (9-15") Ring Number: NA Depth: NA Test Date: 21-Mar-05

Field weight\* of sample (g): 127.23 Tare weight, ring (g): 10.71 Tare weight, cap/plate/epoxy (g): 0.00

> Dry weight of sample (g): 102.41 Sample volume (cm<sup>3</sup>): 57.95 Measured particle density: 2.75

Initial Volumetric Moisture Content (% vol): 24.3

Initial Gravimetric Moisture Content (% g/g): 13.8

Dry bulk density (g/cm<sup>3</sup>): 1.77

Wet bulk density (g/cm<sup>3</sup>): 2.01

Calculated Porosity (% vol): 35.7

Percent Saturation: 68.1

Comments:

\* Weight including tares

NA = Not analyzed



#### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Golder Job Number: LB05.0055.00 Sample Number: 3A (28-34") Ring Number: NA Depth: NA

Test Date: 21-Mar-05

Field weight\* of sample (g): 114.79 Tare weight, ring (g): 9.92 Tare weight, cap/plate/epoxy (g): 0.00

> Dry weight of sample (g): 91.94 Sample volume (cm<sup>3</sup>): 52.71

Measured particle density: 2.75

Initial Volumetric Moisture Content (% vol): 24.5

Initial Gravimetric Moisture Content (% g/g): 14.1

Dry bulk density (g/cm<sup>3</sup>): 1.74

Wet bulk density (g/cm<sup>3</sup>): 1.99

Calculated Porosity (% vol): 36.5

Percent Saturation: 67.2

Comments:

\* Weight including tares

NA = Not analyzed

## Saturated Hydraulic Conductivity



	K <sub>sat</sub>	Method of Analysis		
Sample Number	(cm/sec)	Constant Head	Falling Head	
3X-4A (3-9")	1.5E-04	Х		
3X-4A (58-64")	1.6E-07		Х	
3X-5C (2-8")	1.3E-04	x		
3X-5C (56-62")	2.9E-08		Х	
3X-6A (2-8")	7.0E-07		Х	
3X-6A (39-45")	4.4E-07		Х	
3X-7A (26-32")	5.8E-07		Х	
TP-1-1A (3-9")	3.9E-03	Х		
TP-1-1A (52-58")	3.0E-03	Х		
2A (1-7")	4.5E-03	x		
2A (40-46")	9.8E-04	Х		
3A (9-15")	1.5E-06		х	
3A (28-34")	4.5E-05		х	

### Summary of Saturated Hydraulic Conductivity Tests



#### Saturated Hydraulic Conductivity Constant Head Method

Job name:	Golder	Type of water used:	TAP
Job number:	LB05.0055.00	Collection vessel tare (g):	10.72
Sample number:	3X-4A (3-9")	Sample length (cm):	3.77
Ring Number:	NA	Sample diameter (cm):	4.74
Depth:	NA	Sample x-sectional area (cm <sup>2</sup> );	17.68

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm³)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1: 25-Mar-05 25-Mar-05	08:22:40 08:28:42	19.5	66.8	28.2	17.5	362	1.5E-04	1.6E-04
Test # 2: 25-Mar-05 25-Mar-05	13:36:35 13:43:42	19.5	44.2	23.9	13.2	427	1.5E-04	1.5E-04
Test # 3: 28-Mar-05 28-Mar-05	12:40:57 12:44:17	20.0	54.7	18.6	7.8	200	1.5E-04	1.5E-04

#### Average Ksat (cm/sec): 1.5E-04



Comments:



#### Saturated Hydraulic Conductivity **Falling Head Method**

Job name: Golder Type of water used: TAP Job number: LB05.0055.00 Backpressure (psi): 0.0 Sample number: 3X-4A (58-64") Offset (cm): 2.3 Ring Number: NA Sample length (cm): 3.60 Sample x-sectional area (cm<sup>2</sup>): 17.92 Depth: NA

Reservoir x-sectional area (cm<sup>2</sup>): 0.70

Date	Time	Temp (°C)	Reservoir head (cm)	Corrected head (cm)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:							
24-Mar-05	09:39:20	19.5	103.0	100.7	3712	1.7E-07	1.7E-07
24-Mar-05	10:41:12	19.5	102.6	100.3			
Test # 2:							
24-Mar-05	10:41:12	19.5	102.6	100.3	10770	1.8E-07	1.8E-07
24-Mar-05	13:40:42	19.5	101.2	98.9			
Test # 3:							
24-Mar-05	13:40:42	19.5	101.2	98.9	67757	1.4E-07	1.4E-07
25-Mar-05	08:29:59	19.5	94.8	92.5			

Average Ksat (cm/sec):

1.6E-07



Comments:



### Saturated Hydraulic Conductivity Constant Head Method

JOD name:	Golder		
Job number:	L B05 0055 00	Type of water used:	TAP
Sample number	3X-5C (2 0")	Collection vessel tare (g):	11.65
Ring Number:	NA	Sample length (cm):	2.98
Denth:		Sample diameter (cm):	4.76
Deptn:	NA	Sample x-sectional area (cm <sup>2</sup> ):	17.80

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm <sup>3</sup> )	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C
Test # 1: 25-Mar-05 25-Mar-05	12:54:27 12:57:21	19.5	69.5	21.1	9.5	174	1.3E-04	1.3E-04
Test # 2: 28-Mar-05 28-Mar-05	12:41:56 12:45:08	20.0	56.8	20.0	8.3	192	1.3E-04	1.3E-04
Test # 3: 28-Mar-05 28-Mar-05	15:10:40 15:16:30	20.0	46.3	24.8	13.1	350	1.4E-04	1.4E-04

Average Ksat (cm/sec): 1.3E-04

Velocity vs. Hydraulic Gradient 3.50E-03 3.00E-03 Velocity (cm/s) 2.50E-03 2.00E-03 1.50E-03 1.00E-03 5.00E-04 0.00E+00 14 15 16 17 18 19 20 21 22 23 24 Hydraulic Gradient (cm/cm)

Comments:



### Saturated Hydraulic Conductivity Falling Head Method

Job name:	Golder	Type of water used.	TAP
Job number:	LB05.0055.00	Backpressure (psi):	0.0
Sample number:	3X-5C (56-62")	Offset (cm);	1.5
Ring Number:	NA	Sample length (cm):	3.44
Depth:	NA	Sample x-sectional area (cm <sup>2</sup> ):	17.90
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Reservoir x-sectional area	(cm²):	0.70

Date	Time	(°C)	Reservoir head (cm)	Corrected head (cm)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1: 24-Mar-05 25-Mar-05	13:40:57 08:30:30	19.5 19.5	108.9 107.4	107.4 105.9	67773	2.9E-08	2.9E-08
Test # 2: 25-Mar-05 25-Mar-05	13:03:30 16:37:40	19.5 19.5	106.9 106.6	105.4 105.1	12850	3.0E-08	3.0E-08
Test # 3: 25-Mar-05 28-Mar-05	16:37:40 09:46:50	19.5 19.5	106.6 101.6	105.1 100.1	234550	2.8E-08	2.8E-08

Average Ksat (cm/sec): 2.98

2.9E-08



Comments:



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### Saturated Hydraulic Conductivity Falling Head Method

Job name:	Golder	Type of water used:	TAP
Job number:	LB05.0055.00	Backpressure (psi):	0.0
Sample number:	3X-6A (2-8")	Offset (cm):	0.1
Ring Number:	NA	Sample length (cm);	2 60
Depth:	NA	Sample x-sectional area (cm <sup>2</sup> ):	17.88
	L	Poponicis y anatic y 1 2	

Reservoir x-sectional area (cm<sup>2</sup>): 0.70

Date	Time	Temp (°C)	Reservoir head (cm)	Corrected head (cm)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1: 24-Mar-05 25-Mar-05	13:42:06 08:31:45	19.5 19.5	98.3 59.1	98.3 59.1	67779	7.6E-07	7.7E-07
Test # 2: 25-Mar-05 25-Mar-05	08:31:45 13:03:59	19.5 19.5	59.1 53.0	59.1 53.0	16334	6.8E-07	6.8E-07
Test # 3: 25-Mar-05 25-Mar-05	13:03:59 16:38:30	19.5 19.5	53.0 48.8	53.0 48.8	12871	6.5E-07	6.6E-07

Average Ksat (cm/sec): 7.0E-07



Comments:



#### Saturated Hydraulic Conductivity Falling Head Method

Job name:	Golder	Type of water used:	TAP
Job number:	LB05.0055.00	Backpressure (psi):	0.0
Sample number:	3X-6A (39-45")	Offset (cm):	1.8
Ring Number:	NA	Sample length (cm):	2.47
Depth:	NA	Sample x-sectional area (cm <sup>2</sup> ):	17.94
	F	<i>Reservoir x-sectional area</i> (cm <sup>2</sup> ):	0.70

Date	Time	Temp (°C)	Reservoir head (cm)	Corrected head (cm)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:							
24-Mar-05	09:44:09	19.5	83.5	81.7	3461	4.3E-07	4.3E-07
24-Mar-05	10:41:50	19.5	82.3	80.5			
Test # 2:							
24-Mar-05	10:41:50	19.5	82.3	80.5	10777	4.4E-07	4.4E-07
24-Mar-05	13:41:27	19.5	78.4	76.6			
Test # 3:							
24-Mar-05	13:41:27	19.5	78.4	76.6	67773	4.4E-07	4.4E-07
25-Mar-05	08:31:00	19.5	58.0	56.2			

Average Ksat (cm/sec): 4.4E-07



Comments:



#### Saturated Hydraulic Conductivity Falling Head Method

Job name:	Golder	Type of water used:	TAP
Job number:	LB05.0055.00	Backpressure (psi):	0.0
Sample number:	3X-7A (26-32")	Offset (cm):	1.6
Ring Number:	NA	Sample length (cm):	2.73
Depth:	NA	Sample x-sectional area (cm <sup>2</sup> ):	<b>18</b> .11
	R	eservoir x-sectional area (cm <sup>2</sup> ):	0.70

Date	Time	Temp (°C)	Reservoir head (cm)	Corrected head (cm)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:							
24-Mar-05	09:46:20	19.5	77.5	75.9	3345	5.5E-07	5.5E-07
24-Mar-05	10:42:05	19.5	76.2	74.6			
Test # 2:							
24-Mar-05	10:42:05	19.5	76.2	74.6	10774	5.8E-07	5.9E-07
24-Mar-05	13:41:39	19.5	71.9	70.3			
Test # 3:							
24-Mar-05	13:41:39	19.5	71.9	70.3	67781	6.0E-07	6.0E-07
25-Mar-05	08:31:20	19.5	49.4	47.8			

Average Ksat (cm/sec): 5.8E-07



Comments:



#### Saturated Hydraulic Conductivity Constant Head Method

Job name:	Golder	Type of water used:	TAP
Job number:	LB05.0055.00	Collection vessel tare (g):	10.70
Sample number:	TP-1-1A (3-9")	Sample length (cm):	2.87
Ring Number:	NA	Sample diameter (cm):	4.83
Depth:	NA	Sample x-sectional area (cm <sup>2</sup> ):	18.31

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm³)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1: 25-Mar-05 25-Mar-05	08:25:18 08:26:37	19.5	12.7	35.1	24.4	79	3.8E-03	3.8E-03
Test # 2: 25-Mar-05 25-Mar-05	13:25:44 13:26:50	19.5	14.7	34.4	23.7	66	3.8E-03	3.9E-03
Test # 3: 25-Mar-05 25-Mar-05	15:28:07 15:28:39	19.5	19.5	26.0	15.3	32	3.8E-03	3.9E-03

Average Ksat (cm/sec): 3.9E-03



Comments:



### Saturated Hydraulic Conductivity **Constant Head Method**

Job name: Golder	Type of water used: TAD
Job number: LB05.0055.00	Collection vessel ters (a): 14 oc
Sample number: TP-1-1A (52-58")	Sample longth (cm): 0.70
Ring Number: NA	Sample dismotor (cm): 2.73
Depth: NA	Sample x-soctional area (
	Cample x-sectional area (cm <sup>-</sup> ): 18.06

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm <sup>3</sup> )	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1: 25-Mar-05 25-Mar-05	12:56:14 12:57:44	19.5	13.7	35.2	23.4	90	2.9E-03	2.9E-03
Test # 2: 28-Mar-05 28-Mar-05	12:56:44 12:58:29	20.0	2.9	17.9	6.1	105	3.0E-03	3.0E-03
Test # 3: 28-Mar-05 28-Mar-05	15:09:58 15:10:56	20.0	18.5	34.3	22.5	58	3.2E-03	3.2E-03

Average Ksat (cm/sec): 3.0E-03



Comments:



#### Saturated Hydraulic Conductivity **Constant Head Method**

Job name:	Golder	Type of water used:	TAP
Job number:	LB05.0055.00	Collection vessel tare (g):	10.85
Sample number:	2A (1-7")	Sample length (cm):	3.25
Ring Number:	NA	Sample diameter (cm):	4.75
Depth:	NA	Sample x-sectional area (cm <sup>2</sup> ):	17.74

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm³)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1: 01-Apr-05 01-Apr-05	09:05:14 09:10:00	19.0	0.7	15.9	5.0	286	4.6E-03	4.7E-03
Test # 2: 01-Apr-05 01-Apr-05	14:54:14 14:58:15	21.0	2.9	28.7	17.8	241	4.7E-03	4.6E-03
Test # 3: 04-Apr-05 04-Apr-05	09:32:49 09:36:04	20.5	5.2	35.2	24.3	195	4.4E-03	4.3E-03

Average Ksat (cm/sec):

4.5E-03



Comments:

### Saturated Hydraulic Conductivity Constant Head Method

lob name: Golder	Type of water used: TAP
	Collection vessel tare (g): 11.80
	Sample length (cm): 3.57
Sample number: 2A (40-46)	Sample diameter (cm): 4.74
Ring Number: NA	$\alpha_{\rm mpi}$ and $\alpha_{\rm mpi}$ and $\alpha_{\rm mpi}$ (cm <sup>2</sup> ): 17.65
Depth: NA	Sample x-sectional area (cm). 11.00

		Temp	Head	Q + Tare	Q (cm <sup>3</sup> )	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Date	Time	(-0)	(Cili)	(9)				
Test # 1: 08-Apr-05 08-Apr-05	14:39:26 14:56:40	20.5	3.5	29.0	17.2	1034	9.6E-04	9.5E-04
Test # 2: 13-Apr-05 13-Apr-05	13:37:17 13:42:13	20.5	6.0	20.5	8.7	296	9.9E-04	9.7E-04
Test # 3: 13-Apr-05 13-Apr-05	16:39:39 16:44:06	21.0	8.9	24.1	12.3	267	1.0E-03	1.0E-03

Average Ksat (cm/sec): 9.8E-04



Comments:



### Saturated Hydraulic Conductivity **Falling Head Method**

Job name:	Golder	Type of water used:	TAP
Job number:	LB05.0055.00	Backpressure (psi):	0.0
Sample number:	3A (9-15")	Offset (cm):	1.5
Ring Number:	NA	Sample length (cm)	3.31
Depth:	NA	Sample x-sectional area (cm <sup>2</sup> ):	17 53
		Poppanie in the second se	

Reservoir x-sectional area (cm<sup>2</sup>): 0.70

Date	Time	Temp (°C)	Reservoir head (cm)	Corrected head (cm)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1: 04-Apr-05 04-Apr-05	10:30:40 12:39:59	19.5 19.5	80.3 74.2	78.8 72.7	7759	1.4E-06	1.4E-06
Test # 2: 04-Apr-05 04-Apr-05	12:39:59 16:32:25	19.5 19.5	74.2 64.7	72.7 63.2	13946	1.3E-06	1.3E-06
Test # 3: 08-Apr-05 08-Apr-05	09:35:50 14:44:20	19.5 20.0	53.0 42.3	51.5 40.8	18510	1.7E-06	1.7E-06

Average Ksat (cm/sec):

1.5E-06



Comments:



### Saturated Hydraulic Conductivity Falling Head Method

Job name: G	Golder	Type of water used:	ΤΔΡ
Job number: L	.B05.0055.00	Backpressure (psi):	
Sample number: 3/	A (28-34")	Offset (cm):	0.0
Ring Number: N	IA	Sample length (cm);	-0.6
Depth: N	IA	Sample x-sectional area (cm <sup>2</sup> )	2.98
			1/ /

Reservoir x-sectional area (cm<sup>2</sup>): 0.70

area (cm²): 17.71

Date	Time	Temp (°C)	Reservoir head (cm)	Corrected head (cm)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1: 11-Apr-05 11-Apr-05	08:31:35 08:52:15	19.5 19.5	59.3 36.6	59.9 37.2	1240	4.5E-05	4.6E-05
Test # 2: 13-Apr-05 13-Apr-05	09:07:10 09:33:15	20.0 20.0	68.2 36.8	68.8 37.4	1565	4.6E-05	4.6E-05
Test # 3: 13-Apr-05 13-Apr-05	09:34:30 10:38:40	20.0 20.0	68.7 16.4	69.3 17.0	3850	4.3E-05	4.3E-05

#### Average Ksat (cm/sec): 4.5E-05

Velocity vs. Hydraulic Gradient 9.00E-04 8.00E-04 7.00E-04 Velocity (cm/s) 6.00E-04 5.00E-04 4.00E-04 3.00E-04 2.00E-04 1.00E-04 0.00E+00 14 14.5 15 15.5 16 16.5 17 17.5 18 18.5 Hydraulic Gradient (cm/cm)

Comments:

# Unsaturated Hydraulic Conductivity



Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm <sup>3</sup> /cm <sup>3</sup> )
3X-4A (3-9")	0 27 52 146 510 15297 851293	44.8 41.3 38.8 24.4 17.2 8.5 1.7
3X-4A (58-64")	0 30 128 510 9076 16215 851293	36.6 35.8 34.0 31.0 20.6 11.9 1.9
3X-5C (2-8")	0 22 53 151 510 14889 851293	45.3 40.7 38.2 32.5 28.7 15.8 1.6
3X-5C (56-62")	0 24 136 510 6935 15195 851293	36.1 35.5 34.0 31.5 24.2 14.8 2.0

# Summary of Moisture Characteristics of the Initial Drainage Curve



	Pressure Head	Moisture Content
Sample Number	(-cm water)	(%, cm <sup>3</sup> /cm <sup>3</sup> )
3X-6A (2-8")	0	51.0
	27	47.6
	128	44.0
	510	41.5
	10096	17.5
•	19274	12.9
	851293	1.3
3X-6A (39-45")	0	41 2
	26	38.4
	127	35.4
	510	30.9
	9688	13.5
	851293	2.7
3X-7A (26-32")	0	37.6
	30	36.6
	126	33.0
	510	28.7
	9688	8.8
	851293	2.2
TP-1-1A (3-9")	0	44.5
	13	44.5
	44	36.9
	85	21.1
	510	13.4
	10402	8.6
	851293	1.0

# Summary of Moisture Characteristics of the Initial Drainage Curve (Continued)


	Pressure Head	Moisture Content
Sample Number	(-cm water)	(%, cm <sup>3</sup> /cm <sup>3</sup> )
TP-1-1A (52-58")	0	46.1
	11	41.3
	43	31.9
	76	23.4
	510	14.6
	13053	8.8
	851293	0.7
2A (1-7")	0	45.2
	15	41.6
	42	39.9
	77	27.8
	337	17.0
	12544	7.5
	851293	0.8
2A (40-46")	0	43.3
	22	39.9
	51	36.0
	140	18.3
	510	15.3
	16215	7.0
	851293	1.8
3A (9-15")	0	32.4
	27	29.7
	123	23.5
	337	20.7
	11320	12.6
	29064	7.2
	851293	1.3

# Summary of Moisture Characteristics of the Initial Drainage Curve (Continued)



# Summary of Moisture Characteristics of the Initial Drainage Curve (Continued)

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm <sup>3</sup> /cm <sup>3</sup> )
3A (28-34")	0	45.3
	24	41.5
	52	40.3
	147	29.1
	510	23.6
	17337	14.3
	851293	1.3



## Summary of Calculated Unsaturated Hydraulic Properties

Sample Number	<b>α</b> (cm <sup>-1</sup> )	N (dimensionless)	θ <sub>r</sub>	$\theta_{s}$
3X-4A (3-9")	0.0201	1.4820	0.0331	0.4550
3X-4A (58-64")	0.0001	2.1662	0.0000	0.3439
3X-5C (2-8")	0.0203	1.2090	0.0000	0.4417
3X-5C (56-62")	0.0002	1.6881	0.0000	0.3440
3X-6A (2-8")	0.0016	1.3784	0.0000	0.4824
3X-6A (39-45")	0.0036	1.3059	0.0000	0.3961
3X-7A (26-32" <u>)</u>	0.0025	1.4615	0.0095	0.3659
TP-1-1A (3-9")	0.0317	1.5552	0.0369	0.4496
TP-1-1A (52-58")	0.0805	1.3216	0.0118	0.4663
2A (1-7")	0.0253	1.4785	0.0226	0.4538
2A (40-46")	0.0227	1.6113	0.0395	0.4393
3A (9-15")	0.0251	1.2117	0.0000	0.3232
3A (28-34")	0.0302	1.2299	0.0000	0.4574



#### **Moisture Retention Data** Hanging Column/Pressure Plate/Thermocouple (Main Drainage Curve)

)5.08
3.37
2.74
00
3.67
) 32(3)

Saturated weight\* at 0 cm tension (g): 174.03 Volume of water<sup>T</sup> in saturated sample (cm<sup>3</sup>): 29.84 Saturated moisture content (% vol): 44.76 Sample bulk density (g/cm<sup>3</sup>): 1.58

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content <sup>⊤</sup> (% vol)
Hanging column:	28-Mar-05 / 14:50	174.03	0.00	44.76
	11-Apr-05 / 15:50	170.06	52.00	41.32 38.80
	18-Apr-05 / 09:30	160.43	146.00	24.36
Pressure plate:	26-Apr-05 / 11:20	155.69	509.90	17.25

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#### Comments:

\* Weight including tares

'Assumed density of water is 1.0 g/cm°

Laboratory analysis by: M. Devine Data entered by: D. O'Dowd Checked by: J. Hines



#### Moisture Retention Data Water Activity Meter/Relative Humidity Box (Main Drainage Curve)

Job Name: Golder Job Number: LB05.0055.00 Sample Number: 3X-4A (3-9") Ring Number: NA Depth: NA

Dry weight\* of water activity meter sample (g): 132.30 Tare weight, jar (g): 113.34 Sample bulk density (g/cm<sup>3</sup>): 1.58

			Matric	Moisture
		Weight*	Potential	Content <sup>T</sup>
	Date/Time	(g)	(-cm water)	(% vol)
Water Activity Meter:	05-Apr-05 / 15:58	133.32	15297.0	8.48

Dry weight\* of relative humidity box sample (g): 66.54 Tare weight (g): 41.04 Sample bulk density (g/cm<sup>3</sup>): 1.58

			Matric	Moisture
		Weight*	Potential	Content <sup>⊤</sup>
	Date/Time	(g)	(-cm water)	(% vol)
Relative humidity box:	23-Mar-05 / 10:00	66.82	851293	1.74

Comments:

\* Weight including tares

<sup>†</sup> Assumed density of water is 1.0 g/cm<sup>3</sup>

Laboratory analysis by: M. Carillo/D. O'Dowd Data entered by: D. O'Dowd Checked by: J. Hines





Water Retention Data Points



### **Predicted Water Retention Curve and Data Points**

Sample Number: 3X-4A (3-9")





Plot of Relative Hydraulic Conductivity vs Moisture Content



# Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: 3X-4A (3-9")







### Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: 3X-4A (3-9")



#### Moisture Retention Data Hanging Column/Pressure Plate/Thermocouple (Main Drainage Curve)

Job Name:	Golder	Dry wt. of sample (g): 1	08.17
JOD NUMDER:	LB05.0055.00	i are wt., screen & ciamp (g): 2	3.06
Sample Number:	3X-4A (58-64")	Tare wt., ring (g): 1	1.93
Ring Number:	NA	Tare wt., epoxy (g): 0	.00
Depth:	NA	Sample volume (cm <sup>3</sup> ): 6	4.40

Saturated weight\* at 0 cm tension (g): 166.75 Volume of water<sup>T</sup> in saturated sample (cm<sup>3</sup>): 23.59 Saturated moisture content (% vol): 36.63 Sample bulk density (g/cm<sup>3</sup>): 1.68

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content <sup>T</sup> (% vol)
Hanging column:	28-Mar-05 / 11:10	166.75	0.00	36.63
	04-Apr-05 / 15:00	166.24	30.00	35.84
	11-Apr-05 / 16:10	165.03	128.20	33.96
Pressure plate:	18-Apr-05 / 09:05	163.14	509.90	31.02

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Comments:

\* Weight including tares

' Assumed density of water is 1.0 g/cm°

Laboratory analysis by: M. Devine Data entered by: D. O'Dowd Checked by: J. Hines



#### Moisture Retention Data Water Activity Meter/Relative Humidity Box (Main Drainage Curve)

Job Name: Golder Job Number: LB05.0055.00 Sample Number: 3X-4A (58-64") Ring Number: NA Depth: NA

Dry weight\* of water activity meter sample (g): 129.91 Tare weight, jar (g): 112.96 Sample bulk density (g/cm<sup>3</sup>): 1.68

		Weight*	Matric Potential	Moisture Content <sup>⊤</sup>
	Date/Time	(g)	(-cm water)	(% vol)
Water Activity Meter:	05-Apr-05 / 10:00	131.99	9076.2	20.61
	05-Apr-05 / 09:10	131.11	16214.8	<b>1</b> 1.89

Dry weight\* of relative humidity box sample (g): 69.77 Tare weight (g): 39.99 Sample bulk density (g/cm<sup>3</sup>): 1.68

		Weight*	Matric Potential	Moisture Content <sup>T</sup>
	Date/Time	(g)	(-cm water)	(% vol)
Relative humidity box:	23-Mar-05 / 10:00	70. <b>1</b> 1	851293	1.91

Comments:

\* Weight including tares

<sup>†</sup> Assumed density of water is 1.0 g/cm<sup>3</sup>

Laboratory analysis by: M. Carillo/D. O'Dowd Data entered by: D. O'Dowd Checked by: J. Hines



1.E+06 X 1.E+05 1.E+04 Pressure Head (-cm water) Hanging column ▲ Pressure plate Thermocouple ♦ Water activity meter ×Rh box 1.E+03 ۸ 1.E+02 1.E+01 1.E+00 0 20 10 30 40 50 60 Moisture Content (%,cm<sup>3</sup>/cm<sup>3</sup>)

Water Retention Data Points

Sample Number: 3X-4A (58-64")



Predicted Water Retention Curve and Data Points

Sample Number: 3X-4A (58-64")







## Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: 3X-4A (58-64")



Pressure Head (-cm water)

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### Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: 3X-4A (58-64")



#### **Moisture Retention Data** Hanging Column/Pressure Plate/Thermocouple (Main Drainage Curve)

Job Name:	Golder	Dry wt. of sample (g): 82.47
Job Number:	LB05.0055.00	Tare wt., screen & clamp (g): 25.39
Sample Number:	3X-5C (2-8")	Tare wt., ring (g): 10.02
Ring Number:	NA	Tare wt., epoxy (g): 0.00
Depth:	NA	Sample volume (cm³): 53.10

Saturated weight\* at 0 cm tension (g): 141.94 Volume of water<sup>T</sup> in saturated sample (cm<sup>3</sup>): 24.06 Saturated moisture content (% vol): 45.31 Sample bulk density (g/cm<sup>3</sup>): 1.55

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content <sup>⊤</sup> (% vol)
Hanging column:	29-Mar-05 / 16:15	141.94	0.00	45.31
	04-Apr-05 / 15:25	139.51	22.00	40.73
	11-Apr-05 / 16:00	138.15	53.00	38.17
	18-Apr-05 / 09:40	135.15	150.50	32.52
Pressure plate:	26-Apr-05 / 11:20	133.14	509.90	28.74

#### Comments:

\* Weight including tares

' Assumed density of water is 1.0 g/cm°

Laboratory analysis by: M. Devine Data entered by: D. O'Dowd Checked by: J. Hines



#### Moisture Retention Data Water Activity Meter/Relative Humidity Box (Main Drainage Curve)

Job Name: Golder Job Number: LB05.0055.00 Sample Number: 3X-5C (2-8") Ring Number: NA Depth: NA

Dry weight\* of water activity meter sample (g): 136.96 Tare weight, jar (g): 112.74 Sample bulk density (g/cm<sup>3</sup>): 1.55

			Matric	Moisture
		Weight*	Potential	Content <sup>™</sup>
	Date/Time	(g)	(-cm water)	(% vol)
Water Activity Meter:	05-Apr-05 / 14:32	139.42	14889.1	15.77

Dry weight\* of relative humidity box sample (g): 71.51

Tare weight (g): 42.07

Sample bulk density (g/cm<sup>3</sup>): 1.55

			Matric	Moisture
		Weight*	Potential	Content <sup>⊤</sup>
	Date/Time	(g)	(-cm water)	(% vol)
Relative humidity box:	23-Mar-05 / 10:00	71.81	851293	1.55

Comments:

\* Weight including tares

<sup>†</sup> Assumed density of water is 1.0 g/cm<sup>3</sup>

Laboratory analysis by: M. Carillo/D. O'Dowd Data entered by: D. O'Dowd Checked by: J. Hines



Water Retention Data Points

Sample Number: 3X-5C (2-8")





**Predicted Water Retention Curve and Data Points** 







# Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: 3X-5C (2-8")



Plot of Relative Hydraulic Conductivity vs Pressure Head



### Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: 3X-5C (2-8")



#### Moisture Retention Data Hanging Column/Pressure Plate/Thermocouple (Main Drainage Curve)

 Job Name:
 Golder
 Dry wt. of sample (g):
 102.59

 Job Number:
 LB05.0055.00
 Tare wt., screen & clamp (g):
 23.50

 Sample Number:
 3X-5C (56-62")
 Tare wt., ring (g):
 11.38

 Ring Number:
 NA
 Tare wt., epoxy (g):
 0.00

 Depth:
 NA
 Sample volume (cm³):
 61.63

Saturated weight\* at 0 cm tension (g): 159.72 Volume of water<sup>⊤</sup> in saturated sample (cm<sup>3</sup>): 22.25 Saturated moisture content (% vol): 36.10 Sample bulk density (g/cm<sup>3</sup>): 1.66

		Weight*	Matric Potential	Moisture Content <sup>T</sup>
	Date/Time	(g)	(-cm water)	(% vol)
Hanging column:	28-Mar-05 / 14:00	159.72	0.00	36.10
0.0	04-Apr-05 / 15:25	159.32	23.50	35.45
	18-Apr-05 / 09:35	158.45	136.40	34.04
Pressure plate:	26-Apr-05 / 11:20	156.87	509.90	31.48

Comments:

\* Weight including tares

' Assumed density of water is 1.0 g/cm°

Laboratory analysis by: M. Devine Data entered by: D. O'Dowd Checked by: J. Hines



#### **Moisture Retention Data** Water Activity Meter/Relative Humidity Box (Main Drainage Curve)

Job Name: Golder Job Number: LB05.0055.00 Sample Number: 3X-5C (56-62") Ring Number: NA Depth: NA

Dry weight\* of water activity meter sample (g): 138.86 Tare weight, jar (g): 113.98 Sample bulk density (g/cm3): 1.66

		Weight*	Matric Potential	Moisture Content <sup>⊤</sup>
	Date/Time	(g)	(-cm water)	(% vol)
Water Activity Meter:	19-Apr-05 / 16:10	142.48	6934.6	24.22
-	19-Apr-05 / 14:00	141.07	15195.0	14.79

Dry weight\* of relative humidity box sample (g): 81.25 Tare weight (g): 39.51 Sample bulk density (g/cm<sup>3</sup>): 1.66

			Matric	Moisture
		Weight*	Potential	Content <sup>⊤</sup>
	Date/Time	(g)	(-cm water)	(% vol)
Relative humidity box:	23-Mar-05 / 10:00	81.74	851293	1.96

Comments:

\* Weight including tares

<sup>†</sup> Assumed density of water is 1.0 g/cm<sup>3</sup>

#### Laboratory analysis by: M. Carillo/D. O'Dowd Data entered by: D. O'Dowd Checked by: J. Hines



Sample Number: 3X-5C (56-62") 1.E+06 X 1.E+05 1.E+04 Pressure Head (-cm water) Hanging column A Pressure plate Thermocouple Water activity meter × Rh box 1.E+03 1.E+02 1.E+01 1.E+00 10 0 20 30 40 50 60 Moisture Content (%,cm<sup>3</sup>/cm<sup>3</sup>)

Water Retention Data Points



### **Predicted Water Retention Curve and Data Points**

Sample Number: 3X-5C (56-62")



# Plot of Relative Hydraulic Conductivity vs Moisture Content



# Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: 3X-5C (56-62")









# Plot of Hydraulic Conductivity vs Pressure Head



#### **Moisture Retention Data** Hanging Column/Pressure Plate/Thermocouple

(Main Drainage Curve)

Job Name: Golder	Dry wt. of sample (g); 63.62
Job Number: LB05.0055.00	Tare wt., screen & clamp (g): 23.54
Sample Number: 3X-6A (2-8")	Tare wt., ring (g): 8.56
Ring Number: NA	Tare wt., epoxy (g): 0.00
Depth: NA	Sample volume (cm <sup>3</sup> ): 46.46

Saturated weight\* at 0 cm tension (g): 119.40 Volume of water<sup>T</sup> in saturated sample (cm<sup>3</sup>): 23.68 Saturated moisture content (% vol): 50.96 Sample bulk density (g/cm<sup>3</sup>): 1.37

	Date/Time	Weight*	Matric Potential	Moisture Content <sup>T</sup>
Hanaina column <sup>.</sup>	28 Mar 05 / 14:20	(9)		<u>(% vol)</u>
nanging column.	20-1Viai-05 / 14.30	119.40	0.00	50.96
	04-Apr-057 15:15	117.83	27.20	47.59
	11-Apr-05 / 16:15	116.17	128.20	44.01
Pressure plate:	18-Apr-05 / 09:15	114.98	509.90	41.45

Comments:

\* Weight including tares

' Assumed density of water is 1.0 g/cm°

Laboratory analysis by: M. Devine Data entered by: D. O'Dowd Checked by: J. Hines


### Moisture Retention Data Water Activity Meter/Relative Humidity Box (Main Drainage Curve)

Job Name: Golder Job Number: LB05.0055.00 Sample Number: 3X-6A (2-8") Ring Number: NA Depth: NA

Dry weight\* of water activity meter sample (g): 217.03 Tare weight, jar (g): 198.67 Sample bulk density (g/cm³): 1.37

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content <sup>⊤</sup> (% vol)
Water Activity Meter:	21-Apr-05 / 10:20	219.38	10096.0	17.53
	25-Apr-05 / 16:20	218.76	19274.2	12.90

Dry weight\* of relative humidity box sample (g): 69.73 Tare weight (g): 44.93 Sample bulk density (g/cm<sup>3</sup>): 1.37

			Matric	Moisture
		Weight*	Potential	Content <sup>™</sup>
	Date/Time	(g)	(-cm water)	(% vol)
Relative humidity box:	23-Mar-05 / 10:00	69.96	851293	1.25

Comments:

\* Weight including tares

<sup>†</sup> Assumed density of water is 1.0 g/cm<sup>3</sup>

Laboratory analysis by: M. Carillo/D. O'Dowd Data entered by: D. O'Dowd Checked by: J. Hines





Water Retention Data Points



Predicted Water Retention Curve and Data Points

Sample Number: 3X-6A (2-8")





# Plot of Relative Hydraulic Conductivity vs Moisture Content



# Plot of Hydraulic Conductivity vs Moisture Content









# Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: 3X-6A (2-8")



#### Moisture Retention Data Hanging Column/Pressure Plate/Thermocouple (Main Drainage Curve)

 Job Name:
 Golder
 Dry wt. of sample (g): 74.08

 Job Number:
 LB05.0055.00
 Tare wt., screen & clamp (g): 23.26

 Sample Number:
 3X-6A (39-45")
 Tare wt., ring (g): 8.32

 Ring Number:
 NA
 Tare wt., epoxy (g): 0.00

 Depth:
 NA
 Sample volume (cm<sup>3</sup>): 44.36

Saturated weight\* at 0 cm tension (g): 123.92 Volume of water<sup>T</sup> in saturated sample (cm<sup>3</sup>): 18.26 Saturated moisture content (% vol): 41.16 Sample bulk density (g/cm<sup>3</sup>): 1.67

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content <sup>⊤</sup> (% vol)	
Hanging column:	28-Mar-05 / 14:15	123.92	0.00	41.16	-
	04-Apr-05 / 15:15	122.70	26.20	38.41	
	11-Apr-05 / 16:10	121.37	127.00	35.42	
Pressure plate:	18-Apr-05 / 09:15	119.35	509.90	30.86	
	04-May-05 / 12:00	315.02	9688.10	13.48	_SS1

#### Comments:

\* Weight including tares

' Assumed density of water is 1.0 g/cm°

SS1 = Analysis using subsample #1: Dry wt\* = 313.13 g, Tare wt = 289.71 g.

Laboratory analysis by: M. Devine Data entered by: D. O'Dowd Checked by: J. Hines



# Moisture Retention Data

Water Activity Meter/Relative Humidity Box

(Main Drainage Curve)

Job Name: Golder Job Number: LB05.0055.00 Sample Number: 3X-6A (39-45") Ring Number: NA Depth: NA

*Dry weight\* of relative humidity box sample* (g): 81.79 *Tare weight* (g): 42.60 *Sample bulk density* (g/cm<sup>3</sup>): 1.67

			Matric	Moisture
		Weight*	Potential	Content <sup>⊤</sup>
	Date/Time	(g)	(-cm water)	(% vol)
Relative humidity box:	23-Mar-05 / 10:00	82.43	851293	2.72

Comments:

\* Weight including tares

<sup>†</sup> Assumed density of water is 1.0 g/cm<sup>3</sup>

Laboratory analysis by: D. O'Dowd Data entered by: D. O'Dowd Checked by: J. Hines



# Water Retention Data Points

Sample Number: 3X-6A (39-45")





# **Predicted Water Retention Curve and Data Points**

Sample Number: 3X-6A (39-45")





Plot of Relative Hydraulic Conductivity vs Moisture Content Sample Number: 3X-6A (39-45")



Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: 3X-6A (39-45")



# Plot of Relative Hydraulic Conductivity vs Pressure Head



# Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: 3X-6A (39-45")



### Moisture Retention Data

Hanging Column/Pressure Plate/Thermocouple

(Main Drainage Curve)

Job Name:	Golder	Dry wt. of sample (g):	79.62
Job Number:	LB05.0055.00	Tare wt., screen & clamp (g):	25.63
Sample Number:	3X-7A (26-32")	Tare wt., ring (g):	9.10
Ring Number:	NA	Tare wt., epoxy (g):	0.00
Depth:	ŅA	Sample volume (cm <sup>3</sup> ):	49.44

Saturated weight\* at 0 cm tension (g): 132.92 Volume of water<sup>T</sup> in saturated sample (cm<sup>3</sup>): 18.57 Saturated moisture content (% vol): 37.56 Sample bulk density (g/cm<sup>3</sup>): 1.61

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content <sup>⊤</sup> (% vol)	
Hanging column:	28-Mar-05 / 14:30	132.92	0.00	37.56	-
	04-Apr-05 / 15:15	132.43	30.00	36.57	
	11-Apr-05 / 16:15	130.65	125.50	32.97	
Pressure plate:	18-Apr-05 / 09:15	128.55	509.90	28.72	
	04-May-05 / 12:00	300.50	9688.10	8.79	_SS1

Comments:

\* Weight including tares

<sup>1</sup> Assumed density of water is 1.0 g/cm<sup>°</sup>

SS1 = Analysis using subsample #1: Dry wt\* = 299.50 g, Tare wt = 281.18 g.

Laboratory analysis by: M. Devine Data entered by: D. O'Dowd Checked by: J. Hines



### Moisture Retention Data Water Activity Meter/Relative Humidity Box (Main Drainage Curve)

Job Name: Golder Job Number: LB05.0055.00 Sample Number: 3X-7A (26-32") Ring Number: NA Depth: NA

Dry weight\* of relative humidity box sample (g): 65.80 Tare weight (g): 38.34 Sample bulk density (g/cm<sup>3</sup>): 1.61

			Matric	Moisture
		Weight*	Potential	Content <sup>T</sup>
	Date/Time	(g)	(-cm water)	(% vol)
Relative humidity box:	23-Mar-05 / 10:00	66.17	851293	2.18

Comments:

\* Weight including tares

<sup>†</sup> Assumed density of water is 1.0 g/cm<sup>3</sup>

Laboratory analysis by: D. O'Dowd Data entered by: D. O'Dowd Checked by: J. Hines





Water Retention Data Points

Sample Number: 3X-7A (26-32")



# Predicted Water Retention Curve and Data Points

Sample Number: 3X-7A (26-32")



# Plot of Relative Hydraulic Conductivity vs Moisture Content





# Plot of Hydraulic Conductivity vs Moisture Content Sample Number: 3X-7A (26-32")









# Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: 3X-7A (26-32")



#### Moisture Retention Data Hanging Column/Pressure Plate/Thermocouple (Main Drainage Curve)

Job Name: Golder Job Number: LB05.0055.00 Sample Number: TP-1-1A (3-9") Ring Number: NA Depth: NA

Dry wt. of sample (g):	76.09
Tare wt., screen & clamp (g):	23.14
Tare wt., ring (g):	9.01
Tare wt., epoxy (g):	0.00
Sample volume (cm³):	52.53

Saturated weight\* at 0 cm tension (g): 131.59 Volume of water<sup>T</sup> in saturated sample (cm<sup>3</sup>): 23.35 Saturated moisture content (% vol): 44.45 Sample bulk density (g/cm<sup>3</sup>): 1.45

		Weight*	Matric Potential	Moisture Content <sup>T</sup>
	Date/Time	(g)	(-cm water)	(% vol)
Hanging column:	28-Mar-05 / 15:10	131.59	0.00	44.45
	04-Apr-05 / 15:20	130.08	13.00	41.58
	11-Apr-05 / 15:54	127.63	44.00	36.91
	18-Apr-05 / 09:35	119.33	84.80	21.11
Pressure plate:	26-Apr-05 / 11:20	115.26	509.90	13.36

#### Comments:

\* Weight including tares

' Assumed density of water is 1.0 g/cm°

Laboratory analysis by: M. Devine Data entered by: D. O'Dowd Checked by: J. Hines



### Moisture Retention Data

Water Activity Meter/Relative Humidity Box

(Main Drainage Curve)

Job Name: Golder Job Number: LB05.0055.00 Sample Number: TP-1-1A (3-9") Ring Number: NA Depth: NA

Dry weight\* of water activity meter sample (g): 220.92 Tare weight, jar (g): 198.83 Sample bulk density (g/cm<sup>3</sup>): 1.45

			Matric	Moisture
		Weight*	Potential	Content <sup>T</sup>
_	Date/Time	(g)	(-cm water)	(% vol)
Water Activity Meter:	20-Apr-05 / 09:20	222.23	10402.0	8.59

Dry weight\* of relative humidity box sample (g): 71.85 Tare weight (g): 42.80 Sample bulk density (g/cm<sup>3</sup>): 1.45

			Matric	Moisture
		Weight*	Potential	Content <sup>T</sup>
	Date/Time	(g)	(-cm water)	(% vol)
Relative humidity box:	23-Mar-05 / 10:00	72.04	851293	0.96

Comments:

\* Weight including tares

<sup>†</sup> Assumed density of water is 1.0 g/cm<sup>3</sup>

Laboratory analysis by: M. Carillo/D. O'Dowd Data entered by: D. O'Dowd Checked by: J. Hines







# **Predicted Water Retention Curve and Data Points**

Sample Number: TP-1-1A (3-9")





# Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: TP-1-1A (3-9")







Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: TP-1-1A (3-9")



### Moisture Retention Data Hanging Column/Pressure Plate/Thermocouple

(Main Drainage Curve)

Job Name: Golder Job Number: LB05.0055.00 Ta Sample Number: TP-1-1A (52-58") Ring Number: NA Depth: NA

Dry wt. of sample (g): 74.94 Tare wt., screen & clamp (g): 23.34 Tare wt., ring (g): 8.52 Tare wt., epoxy (g): 0.00 Sample volume (cm<sup>3</sup>): 49.37

. . . .

Saturated weight\* at 0 cm tension (g): 129.58 Volume of water<sup>T</sup> in saturated sample (cm<sup>3</sup>): 22.78 Saturated moisture content (% vol): 46.14 Sample bulk density (g/cm<sup>3</sup>): 1.52

	Date/Time	Weight* (g)	Natric Potential (-cm water)	Moisture Content <sup>⊤</sup> (% vol)
Hanging column:	28-Mar-05 / 16:20	129.58	0.00	46.14
	04-Apr-05 / 15:30	127.18	11.00	41.28
	11-Apr-05 / 16:00	122.54	43.20	31.88
	18-Apr-05 / 09:45	118.33	75.50	23.35
Pressure plate:	26-Apr-05 / 11:20	113.99	509.90	14.56

#### Comments:

\* Weight including tares

Assumed density of water is 1.0 g/cm°

Laboratory analysis by: M. Devine Data entered by: D. O'Dowd Checked by: J. Hines



### Moisture Retention Data Water Activity Meter/Relative Humidity Box (Main Drainage Curve)

Job Name: Golder Job Number: LB05.0055.00 Sample Number: TP-1-1A (52-58") Ring Number: NA Depth: NA

Dry weight\* of water activity meter sample (g): 217.69 Tare weight, jar (g): 198.47 Sample bulk density (g/cm<sup>3</sup>): 1.52

			Matric	Moisture
		Weight*	Potential	Content <sup>⊤</sup>
	Date/Time	(g)	(-cm water)	(% vol)
Water Activity Meter:	14-Apr-05 / 15:45	218.81	13053.4	8.85

Dry weight\* of relative humidity box sample (g): 76.36 Tare weight (g): 47.61

Sample bulk density (g/cm<sup>3</sup>): 1.52

			Matric	Moisture
		Weight*	Potential	Content <sup>⊤</sup>
	Date/Time	(g)	(-cm water)	(% vol)
Relative humidity box:	23-Mar-05 / 10:00	76.49	851293	0.67

Comments:

\* Weight including tares

<sup>+</sup> Assumed density of water is 1.0 g/cm<sup>3</sup>

Laboratory analysis by: M. Carillo/D. O'Dowd Data entered by: D. O'Dowd Checked by: J. Hines



# Water Retention Data Points

Sample Number: TP-1-1A (52-58")





**Predicted Water Retention Curve and Data Points** 

Sample Number: TP-1-1A (52-58")






# Plot of Hydraulic Conductivity vs Moisture Content



Plot of Relative Hydraulic Conductivity vs Pressure Head



# Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: TP-1-1A (52-58")



## **Moisture Retention Data** Hanging Column/Pressure Plate/Thermocouple

(Main Drainage Curve)

Dry wt. of sample (g):	90.32
Tare wt., screen & clamp (g):	24.23
Tare wt., ring (g):	10.70
Tare wt., epoxy (g):	0.00
Sample volume (cm³):	57.62

Saturated weight\* at 0 cm tension (g): 151.30 Volume of water<sup>T</sup> in saturated sample (cm<sup>3</sup>): 26.05 Saturated moisture content (% vol): 45.21 Sample bulk density (g/cm<sup>3</sup>): 1.57

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content <sup>⊤</sup> (% vol)
Hanging column:	04-Apr-05 / 14:15	151.30	0.00	45.21
	11-Apr-05 / 15:45	149.20	14.90	41.56
•	18-Apr-05 / 09:30	148.23	41.50	39.88
	25-Apr-05 / 13:37	141.29	77.00	27.84
Pressure plate:	01-May-05 / 16:45	135.05	336.53	17.01

#### Comments:

\* Weight including tares

' Assumed density of water is 1.0 g/cm°

Laboratory analysis by: M. Devine Data entered by: D. O'Dowd Checked by: J. Hines



#### Moisture Retention Data Water Activity Meter/Relative Humidity Box (Main Drainage Curve)

Job Name: Golder Job Number: LB05.0055.00 Sample Number: 2A (1-7") Ring Number: NA Depth: NA

Dry weight\* of water activity meter sample (g): 228.87 Tare weight, jar (g): 198.13 Sample bulk density (g/cm<sup>°</sup>): 1.57

		Weight*	Matric Potential	Moisture Content <sup>⊤</sup>
	Date/Time	(g)	(-cm water)	(% vol)
Water Activity Meter:	13-Apr-05 / 15:25	230.35	12543.5	7.55

Dry weight\* of relative humidity box sample (g): 59.45 Tare weight (g): 37.09 Sample bulk density (g/cm<sup>3</sup>): 1.57

	Data (Time	Weight*	Matric Potential	Moisture Content <sup>T</sup>
	Date/Time	<u>(g)</u>	(-cm water)	<u>(% VOI)</u>
Relative humidity box:	23-Mar-05 / 10:00	59.56	851293	0.79

Comments:

\* Weight including tares

<sup>†</sup> Assumed density of water is 1.0 g/cm<sup>3</sup>

Laboratory analysis by: M. Carillo/D. O'Dowd Data entered by: D. O'Dowd Checked by: J. Hines





### **Predicted Water Retention Curve and Data Points**

Sample Number: 2A (1-7")







# Plot of Hydraulic Conductivity vs Moisture Content





Pressure Head (-cm water)



## Moisture Retention Data Hanging Column/Pressure Plate/Thermocouple

(Main Drainage Curve)

Job Name:	Golder
Job Number:	LB05.0055.00
Sample Number:	2A (40-46")
Ring Number:	NA
Depth:	NA

Dry wt. of sample (g):	106.16
Tare wt., screen & clamp (g):	27.32
Tare wt., ring (g):	11.79
Tare wt., epoxy (g):	0.00
Sample volume (cm <sup>3</sup> ):	62.97

Saturated weight\* at 0 cm tension (g): 172.52 Volume of water<sup>⊤</sup> in saturated sample (cm<sup>°</sup>): 27.25 Saturated moisture content (% vol): 43.27 Sample bulk density (g/cm<sup>°</sup>): 1.69

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content <sup>⊤</sup> (% vol)
Hanging column:	15-Apr-05 / 11:30	172.52	0.00	43.27
	21-Apr-05 / 15:15	170.38	21.70	39.88
	27-Apr-05 / 08:50	167.95	50.70	36.02
	03-May-05 / 13:47	156.79	140.00	18.29
Pressure plate:	09-May-05 / 14:30	154.93	509.90	15.34

Comments:

\* Weight including tares

<sup>1</sup> Assumed density of water is 1.0 g/cm°

Laboratory analysis by: M. Devine Data entered by: D. O'Dowd Checked by: J. Hines



#### Moisture Retention Data Water Activity Meter/Relative Humidity Box (Main Drainage Curve)

Job Name: Golder Job Number: LB05.0055.00 Sample Number: 2A (40-46") Ring Number: NA Depth: NA

Dry weight\* of water activity meter sample (g): 223.89 Tare weight, jar (g): 197.25 Sample bulk density (g/cm<sup>3</sup>): 1.69

			Matric	Moisture	
		Weight*	Potential	Content <sup>⊤</sup>	
	Date/Time	(g)	(-cm water)	(% vol)	
Water Activity Meter:	21-Apr-05 / 14:15	224.99	16214.8	6.96	
					·

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Dry weight\* of relative humidity box sample (g): 72.02 Tare weight (g): 40.74 Sample bulk density (g/cm<sup>3</sup>): 1.69

			Matric	Moisture
		Weight*	Potential	Content <sup>T</sup>
	Date/Time	(g)	(-cm water)	(% vol)
Relative humidity box:	23-Mar-05 / 10:00	72.35	851293	1.76

Comments:

\* Weight including tares

<sup>†</sup> Assumed density of water is 1.0 g/cm<sup>3</sup>

Laboratory analysis by: M. Carillo/D. O'Dowd Data entered by: D. O'Dowd Checked by: J. Hines



## Water Retention Data Points

Sample Number: 2A (40-46")





**Predicted Water Retention Curve and Data Points** 

Sample Number: 2A (40-46")



# Plot of Relative Hydraulic Conductivity vs Moisture Content



Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: 2A (40-46")





# Plot of Relative Hydraulic Conductivity vs Pressure Head





# Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: 2A (40-46")



#### Moisture Retention Data Hanging Column/Pressure Plate/Thermocouple

(Main Drainage Curve)

Job Name: Golder Job Number: LB05.0055.00 Sample Number: 3A (9-15") Ring Number: NA Depth: NA

Dry wt. of sample (g):	102.41
Tare wt., screen & clamp (g):	25.23
Tare wt., ring (g):	10.71
Tare wt., epoxy (g):	0.00
Sample volume (cm³):	57.95

Saturated weight\* at 0 cm tension (g): 157.13 Volume of water<sup>T</sup> in saturated sample (cm<sup>3</sup>): 18.78 Saturated moisture content (% vol): 32.41 Sample bulk density (g/cm<sup>3</sup>): 1.77

		Maight	Matric	Moisture
		weight	Potential	Content
	Date/ I ime	(g)	(-cm water)	(% vol)
Hanging column:	13-Apr-05 / 11:45	157.13	0.00	32.41
	20-Apr-05 / 11:30	155.59	26.80	29.75
	26-Apr-05 / 10:07	151.97	123.00	23.50
Pressure plate:	03-May-05 / 13:30	150.32	336.53	20.66

Comments:

\* Weight including tares

<sup>1</sup> Assumed density of water is 1.0 g/cm<sup>3</sup>

Laboratory analysis by: M. Devine Data entered by: D. O'Dowd Checked by: J. Hines



#### Moisture Retention Data Water Activity Meter/Relative Humidity Box (Main Drainage Curve)

Job Name: Golder Job Number: LB05.0055.00 Sample Number: 3A (9-15") Ring Number: NA Depth: NA

Dry weight\* of water activity meter sample (g): 219.86 Tare weight, jar (g): 198.90 Sample bulk density (g/cm³): 1.77

Water Activity Meter:	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content <sup>T</sup> (% vol)
	22-Apr-05 / 15:20	221.36	11319.8	12.65
	18-Apr-05 / 13:30	220.71	29064.3	7.17

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Dry weight\* of relative humidity box sample (g): 64.59 Tare weight (g): 40.93 Sample bulk density (g/cm<sup>3</sup>): 1.77

		141-1-1-14	Matric	Moisture
	Date/Time	vveight <sup>*</sup>	Potential	Content <sup>1</sup>
- · · · ·	Bater fille	(9/	(-cill water)	
Relative humidity box:	23-Mar-05 / 10:00	64.76	851293	1.28

Comments:

\* Weight including tares

<sup>†</sup> Assumed density of water is 1.0 g/cm<sup>3</sup>

#### Laboratory analysis by: M. Carillo/D. O'Dowd Data entered by: D. O'Dowd Checked by: J. Hines





Water Retention Data Points

Sample Number: 3A (9-15")



Predicted Water Retention Curve and Data Points

Daniel B. Stephens & Associates, Inc. Plot of Relative Hydraulic Conductivity vs Moisture Content Sample Number: 3A (9-15") 1.E+00 1.E-01 1.E-02 1.E-03 **Relative Hydraulic Conductivity** 1.E-04 1.E-05 1.E-06 1.E-07 1.E-08 1.E-09 20 0 10 30 40 50 60

Moisture Content (%,cm<sup>3</sup>/cm<sup>3</sup>)



# Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: 3A (9-15")



.





# Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: 3A (9-15")



# Moisture Retention Data

Hanging Column/Pressure Plate/Thermocouple

(Main Drainage Curve)

Job Name:	Golder	Dry wt. of sample (g): 91.94
Job Number:	LB05.0055.00	Tare wt., screen & clamp (g): 23.58
Sample Number:	3A (28-34")	Tare wt., ring (g): 9.92
Ring Number:	NA	Tare wt., epoxy (g): 0.00
Depth:	NA	Sample volume (cm <sup>3</sup> ): 52.71

Saturated weight\* at 0 cm tension (g): 149.30 Volume of water<sup>T</sup> in saturated sample (cm<sup>3</sup>): 23.86 Saturated moisture content (% vol): 45.26 Sample bulk density (g/cm<sup>3</sup>): 1.74

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content <sup>T</sup> (% vol)
Hanging column:	15-Apr-05 / 11:45	149.30	0.00	45.26
	21-Apr-05 / 15:30	147.34	23.50	41.54
	27-Apr-05 / 09:05	146.67	51.50	40.27
	03-May-05 / 13:55	140.80	147.00	29.14
Pressure plate:	09-May-05 / 14:45	137.88	509.90	23.60

#### Comments:

\* Weight including tares

' Assumed density of water is 1.0 g/cm°

Laboratory analysis by: M. Devine Data entered by: D. O'Dowd Checked by: J. Hines



#### Moisture Retention Data Water Activity Meter/Relative Humidity Box (Main Drainage Curve)

Job Name: Golder Job Number: LB05.0055.00 Sample Number: 3A (28-34") Ring Number: NA Depth: NA

Dry weight\* of water activity meter sample (g): 218.24 Tare weight, jar (g): 196.72 Sample bulk density (g/cm<sup>3</sup>): 1.74

			Matric	Moisture
		Weight*	Potential	Content <sup>⊤</sup>
	Date/Time	(g)	(-cm water)	(% vol)
Water Activity Meter:	20-Apr-05 / 10:30	220.01	17336.6	14.35

Dry weight\* of relative humidity box sample (g): 54.19 Tare weight (g): 37.08 Sample bulk density (g/cm<sup>3</sup>): 1.74

			Matric	Moisture
		Weight*	Potential	Content <sup>⊤</sup>
	Date/Time	(g)	(-cm water)	(% vol)
Relative humidity box:	23-Mar-05 / 10:00	54.32	851293	1.30

Comments:

\* Weight including tares

<sup>†</sup> Assumed density of water is 1.0 g/cm<sup>3</sup>

Laboratory analysis by: M. Carillo/D. O'Dowd Data entered by: D. O'Dowd Checked by: J. Hines





Water Retention Data Points





# Predicted Water Retention Curve and Data Points

Sample Number: 3A (28-34")



# Plot of Relative Hydraulic Conductivity vs Moisture Content

Sample Number: 3A (28-34")





Plot of Hydraulic Conductivity vs Moisture Content Sample Number: 3A (28-34")





Plot of Relative Hydraulic Conductivity vs Pressure Head

Sample Number: 3A (28-34")



# Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: 3A (28-34")

# Particle Size Analysis


Sample Number	% Sand	% Silt	% Clay
3X-4A (3"-9")	55.1	28.3	16.6
3X-4A (58"-64")	39.8	41.8	18.5
3X-5C (2"-8")	38.3	41.2	20.6
3X-5C (56"-62")	45.9	37.3	16.8
3X-6A (2"-8")	28.9	47.4	23.7
3X-6A (39"-45")	55.0	30.0	15.0
3X-7A (26"-32")	50.5	33.5	16.0
TP-1-1A (3"-9")	79.8	13.3	6.9
TP-1-1A 52"-58"()	80.1	13.4	6.5
2A (1"-7")	78.5	14.5	7.0
2A (40"-46")	79.5	12.5	8.0
3A (9"-15")	76.0	16.0	8.0
3A (28"-34")	73.3	17.1	9.6

# Summary of Percent Sand, Silt & Clay Tests



### Particle Size Analysis Hydrometer Data

Job Name: Golder (3-05) Job Number: LB05.0055.00 Sample Number: 3X-4A (3"-9") Ring Number: NA Depth: NA Test Date: 7-Jun-05 Start Time: 10:21 Type of Water Used: DISTILLED Alkaline Buffer: Na<sub>2</sub>CO<sub>3</sub> Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub> Assumed particle density: 2.65

Initial Wt. (g): 60.15

Date	Time (hr:min:sec)	Temp (°C)	R (g/L)	R∟ (g/L)	R <sub>corr</sub> (g/L)
7-Jun-05	10:21:40	21.9	33.5	6.5	27.0
7-Jun-05	18:21	19.8	17.0	7.0	10.0

% Clay	16.6
% Silt	28.3
% Sand	55.1

Comments:

\* Dispersion device: mechanically operated stirring device



### Particle Size Analysis Hydrometer Data

Job Name: Golder (3-05) Job Number: LB05.0055.00 Sample Number: 3X-4A (58"-64") Ring Number: NA Depth: NA Test Date: 17-Jun-05 Start Time: 8:34 Type of Water Used: DISTILLED Alkaline Buffer: Na<sub>2</sub>CO<sub>3</sub> Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub> Assumed particle density: 2.65

Initial Wt. (g): 51.49

Date	Time (hr:min:sec)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)
17-Jun-05	8:34:40	23.7	37.0	6.0	31.0
17-Jun-05	16:34	18.9	16.5	7.0	9.5

% Clay	18.5
% Silt	41.8
% Sand	39.8

Comments:

\* Dispersion device: mechanically operated stirring device



### Particle Size Analysis Hydrometer Data

Job Name: Golder (3-05) Job Number: LB05.0055.00 Sample Number: 3X-5C (2"-8") Ring Number: NA Depth: NA Test Date: 7-Jun-05 Start Time: 10:30 Type of Water Used: DISTILLED Alkaline Buffer: Na<sub>2</sub>CO<sub>3</sub> Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub> Assumed particle density: 2.65 Initial Wt. (g): 38.87

Date	Time (hr:min:sec)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)
7-Jun-05	10:30:40	21.8	30.5	6.5	24.0
7-Jun-05	18:30	19.8	15.0	7.0	8.0

% Clay	20.6
% Silt	41.2
% Sand	38.3

Comments:

\* Dispersion device: mechanically operated stirring device



### Particle Size Analysis Hydrometer Data

Job Name: Golder (3-05) Job Number: LB05.0055.00 Sample Number: 3X-5C (56"-62") Ring Number: NA Depth: NA Test Date: 8-Jun-05

Start Time: 9:36

Type of Water Used: DISTILLED Alkaline Buffer: Na<sub>2</sub>CO<sub>3</sub> Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub> Assumed particle density: 2.65

Initial Wt. (g): 65.67

Date	Time (hr:min:sec)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)
8-Jun-05	9:36:40	21.0	42.0	6.5	35.5
8-Jun-05	17:35	18.9	18.0	7.0	11.0

% Clay	16.8
% Silt	37.3
% Sand	45.9

Comments:

\* Dispersion device: mechanically operated stirring device



### Particle Size Analysis Hydrometer Data

Job Name: Golder (3-05) Job Number: LB05.0055.00 Sample Number: 3X-6A (2"-8") Ring Number: NA Depth: NA Test Date: 7-Jun-05 Start Time: 9:12 Type of Water Used: DISTILLED Alkaline Buffer: Na<sub>2</sub>CO<sub>3</sub> Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub> Assumed particle density: 2.65 Initial Wt. (g): 37.95

Date	Time (hr:min:sec)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)
8-Jun-05	9:12:40	21.0	33.5	6.5	27.0
8-Jun-05	17:12	18.9	16.0	7.0	9.0

% Clay	23.7
% Silt	47.4
% Sand	28.9

Comments:

\* Dispersion device: mechanically operated stirring device



### Particle Size Analysis Hydrometer Data

Job Name: Golder (3-05) Job Number: LB05.0055.00 Sample Number: 3X-6A (39"-45") Ring Number: NA Depth: NA Test Date: 8-Jun-05 Start Time: 9:21 Type of Water Used: DISTILLED Alkaline Buffer: Na<sub>2</sub>CO<sub>3</sub> Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub> Assumed particle density: 2.65 Initial Wt. (g): 100.04

Date	Time (hr:min:sec)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)
8-Jun-05	9:21:40	21.0	51.5	6.5	45.0
8-Jun-05	17:21	18.9	22.0	7.0	15.0

% Clay	15.0
% Silt	30.0
% Sand	55.0

### Comments:

\* Dispersion device: mechanically operated stirring device



### Particle Size Analysis Hydrometer Data

Job Name: Golder (3-05) Job Number: LB05.0055.00 Sample Number: 3X-7A (26"-32") Ring Number: NA Depth: NA Test Date: 8-Jun-05 Start Time: 9:33 Type of Water Used: DISTILLED Alkaline Buffer: Na<sub>2</sub>CO<sub>3</sub> Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub> Assumed particle density: 2.65 Initial Wt. (g): 100.05

Date	Time (hr:min:sec)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)
8-Jun-05	9:33:40	21.0	56.0	6.5	49.5
8-Jun-05	17:33	18.9	23.0	7.0	16.0

% Clay	16.0
% Silt	33.5
% Sand	50.5

### Comments:

\* Dispersion device: mechanically operated stirring device



# Particle Size Analysis Hydrometer Data

Job Name: Golder (3-05) Job Number: LB05.0055.00 Sample Number: TP-1-1A (3"-9") Ring Number: NA Depth: NA Test Date: 8-Jun-05 Start Time: 9:18 Type of Water Used: DISTILLED Alkaline Buffer: Na<sub>2</sub>CO<sub>3</sub> Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub> Assumed particle density: 2.65 Initial Wt. (g): 101.41

Date	Time (hr:min:sec)	Temp (°C)	R (g/L)	R∟ (g/L)	R <sub>corr</sub> (g/L)
8-Jun-05	9:18:40	21.0	27.0	6.5	20.5
8-Jun-05	17:18	18.9	14.0	7.0	7.0

% Clay	6.9
% Silt	13.3
% Sand	79.8

### Comments:

\* Dispersion device: mechanically operated stirring device



# Particle Size Analysis Hydrometer Data

Job Name:	Golder (3-05)	Type of Water Used:	DISTILLED
Job Number:	LB05.0055.00	Alkaline Buffer:	Na <sub>2</sub> CO <sub>3</sub>
Sample Number:	TP-1-1A (52"-58")	Dispersant*:	(NaPO <sub>3</sub> ) <sub>6</sub>
Ring Number:	NA	Assumed particle density:	2.65
Depth:	NA	Initial Wt. (g):	100.51
Test Date:	8-Jun-05		
Start Time:	9:42		

Date	Time (hr:min:sec)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)
8-Jun-05	9:42:40	21.0	26.5	6.5	20.0
8-Jun-05	17:41	18.9	13.5	7.0	6.5

% Clay	6.5
% Silt	13.4
% Sand	80.1

### Comments:

\* Dispersion device: mechanically operated stirring device



### Particle Size Analysis Hydrometer Data

Job Name: Golder (3-05) Job Number: LB05.0055.00 Sample Number: 2A (1"-7") Ring Number: NA Depth: NA Test Date: 7-Jun-05 Start Time: 10:24 Type of Water Used: DISTILLED Alkaline Buffer: Na<sub>2</sub>CO<sub>3</sub> Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub> Assumed particle density: 2.65 Initial Wt. (g): 100.04

Date	Time (hr:min:sec)	Temp (°C)	R (g/L)	R∟ (g/L)	R <sub>corr</sub> (g/L)
7-Jun-05	10:24:40	21.8	28.0	6.5	21.5
7-Jun-05	18:24	19.8	14.0	7.0	7.0

% Clay	7.0
% Silt	14.5
% Sand	78.5

Comments:

\* Dispersion device: mechanically operated stirring device



# Particle Size Analysis Hydrometer Data

Job Name:	Golder (3-05)	Type of Water Used:	DISTILLED
Job Number:	LB05.0055.00	Alkaline Buffer:	Na <sub>2</sub> CO <sub>3</sub>
Sample Number:	2A (40"-46")	Dispersant*:	(NaPO <sub>3</sub> ) <sub>6</sub>
Ring Number:	NA	Assumed particle density:	2.65
Depth:	NA	Initial Wt. (g):	100.03
Test Date:	8-Jun-05		
Start Time:	9:30		

Date	Time (hr:min:sec)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)
7-Jun-05	9:30:40	21.0	27.0	6.5	20.5
7-Jun-05	17:30	18.9	15.0	7.0	8.0

% Clay	8.0
% Silt	12.5
% Sand	79.5

Comments:

\* Dispersion device: mechanically operated stirring device



### Particle Size Analysis Hydrometer Data

Job Name: Golder (3-05) Job Number: LB05.0055.00 Sample Number: 3A (9"-15") Ring Number: NA Depth: NA Test Date: 8-Jun-05 Start Time: 9:15

Type of Water Used: DISTILLED Alkaline Buffer: Na<sub>2</sub>CO<sub>3</sub> Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub> Assumed particle density: 2.65 Initial Wt. (g): 100.00

Date	Time (hr:min:sec)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)
7-Jun-05	9:15:40	21.0	30.5	6.5	24.0
7-Jun-05	17:15	18.9	15.0	7.0	8.0

% Clay	8.0
% Silt	16.0
% Sand	76.0

Comments:

\* Dispersion device: mechanically operated stirring device



# Particle Size Analysis Hydrometer Data

Job Name: Golder (3-05) Job Number: LB05.0055.00 Sample Number: 3A (28"-34") Ring Number: NA Depth: NA

> Test Date: 8-Jun-05 Start Time: 9:09

Type of Water Used: DISTILLED Alkaline Buffer: Na<sub>2</sub>CO<sub>3</sub> Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub> Assumed particle density: 2.65 Initial Wt. (g): 99.19

**T**ime **T**error

Date	l'ime (hr:min:sec)	l'emp (°C)	R (a/L)	R <sub>L</sub> (a/L)	R <sub>corr</sub> (a/L)	
7-Jun-05	9:09:40	21.0	33.0	6.5	26.5	
7-Jun-05	17:09	18.9	16.5	7.0	9.5	

% Clay	9.6
% Silt	17.1
% Sand	73.3

Comments:

\* Dispersion device: mechanically operated stirring device

# Specific Gravity



Sample Number	Particle Density (g/cm <sup>3</sup> )
3X-4A (3-9")	2.77
3X-4A (58-64")	2.80
3X-5C (2-8")	2.73
3X-5C (56-62")	2.78
3X-6A (2-8")	2.74
3X-6A (39-45")	2.76
3X-7A (26-32")	2.75
TP-1-1A (3-9")	2.73
TP-1-1A (52-58")	2.72
2A (1-7")	2.76
2A (40-46")	2.73
3A (9-15")	2.75
3A (28-34")	2.75

# Summary of Particle Density Tests



# **Particle Density**

Job Name:	Golder
Job Number:	LB05.0055.00
Sample Number:	3X-4A (3-9")
Ring Number:	NA
Depth:	NA

Test Date: 18-Apr-05

### Trial 1

Trial 2	
Particle Density at 20°C (g/cm <sup>3</sup> ):	2.77
Particle Density (g/cm³):	2.77
Correction factor, K:	0.9998
Observed temperature (°C):	21.00
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9980
Weight of pycnometer filled w/air (g):	91.07
Weight of pycnometer filled w/soil (g):	142.14
Weight of pycnometer filled w/soil & water (g):	372.94
Weight of pycnometer filled w/water (g):	340.30

Weight of pycnometer filled w/air (g):	100.49
. Weight of pycnometer filled w/soil (g):	150.98
Weight of pycnometer filled w/soil & water (g):	382.08
Weight of pycnometer filled w/water (g):	349.72
Observed temperature (°C):	20.90
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9980
Particle Density (g/cm³):	2.78
Correction factor, K:	0.9998
Particle Density at 20°C (g/cm <sup>3</sup> ):	2.78

Average Particle Density (g/cm<sup>3</sup>): 2.77

Comments:



# **Particle Density**

Job Name:	Golder
Job Number:	LB05.0055.00
Sample Number:	3X-4A (58-64")
Ring Number:	NA
Depth:	NA

Test Date: 12-Apr-05

### Trial 1

Weight of pycnometer filled w/air (g):	85.90
Weight of pycnometer filled w/soil (g):	136.52
Weight of pycnometer filled w/soil & water (g):	367.75
Weight of pycnometer filled w/water (g):	335.20
Observed temperature (°C):	20.70
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9981
Particle Density (g/cm <sup>3</sup> ):	2.80
Correction factor, K:	0.9999
Particle Density at 20°C (g/cm <sup>3</sup> ):	2.80

### Trial 2

Weight of pycnometer filled w/air (g):	92.10
Weight of pycnometer filled w/soil (g):	139.93
Weight of pycnometer filled w/soil & water (g):	372.01
Weight of pycnometer filled w/water (g):	341.21
Observed temperature (°C):	20.70
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9981
Particle Density (g/cm <sup>3</sup> ):	2.80
Correction factor, K:	0.9999
Particle Density at 20°C (g/cm <sup>3</sup> ):	2.80

### Average Particle Density (g/cm<sup>3</sup>): 2.80

Comments:



# **Particle Density**

Job Name:	Golder
Job Number:	LB05.0055.00
Sample Number:	3X-5C (2-8")
Ring Number:	NA
Depth:	NA

Test Date: 18-Apr-05

### Trial 1

Weight of pycnometer filled w/air (g):	91.75
Weight of pycnometer filled w/soil (g):	142.23
Weight of pycnometer filled w/soil & water (g):	373.13
Weight of pycnometer filled w/water (g):	341.14
· Observed temperature (°C):	20.90
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9980
Particle Density (g/cm <sup>3</sup> ):	2.72
Correction factor, K:	0.9998
Particle Density at 20°C (g/cm <sup>3</sup> ):	2.73

### Trial 2

Particle Density at 20°C (g/cm <sup>3</sup> ):	2.74
Particle Density (glcm <sup>3</sup> ):	2.74
Correction factor. K:	0.9996
Observed temperature (°C):	21.90
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9978
Weight of pycnometer filled w/soil (g):	149.64
Weight of pycnometer filled w/soil & water (g):	380.56
Weight of pycnometer filled w/water (g):	348.72
Weight of pychometer filled w/air (g):	99.57
Weight of pychometer filled w/soil (g):	149.64

### Average Particle Density (g/cm<sup>3</sup>): 2.73

Comments:



# **Particle Density**

Job Name:	Golder
Job Number:	LB05.0055.00
Sample Number:	3X-5C (56-62")
Ring Number:	NA
Depth:	NA

Test Date: 18-Apr-05

### Trial 1

Weight of pycnometer filled w/air (g):	88.79
Weight of pycnometer filled w/soil (g):	138.86
Weight of pycnometer filled w/soil & water (g):	370.01
Weight of pycnometer filled w/water (g):	337.89
Observed temperature (°C):	20.80
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9980
Particle Density (g/cm <sup>3</sup> ):	2.78
Correction factor, K:	0.9998
Particle Density at 20°C (g/cm <sup>3</sup> ):	2.78

### Trial 2

Weight of pycnometer filled w/air (g):	90.96
Weight of pycnometer filled w/soil (g):	132.65
Weight of pycnometer filled w/soil & water (g):	366.95
Weight of pycnometer filled w/water (g):	340.26
Observed temperature (°C):	20.90
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9980
Particle Density (g/cm <sup>3</sup> ):	2.77
Correction factor, K:	0.9998
Particle Density at 20°C (g/cm <sup>3</sup> ):	2.77

### Average Particle Density (g/cm<sup>3</sup>): 2.78

Comments:



# **Particle Density**

Job Name:	Golder
Job Number:	LB05.0055.00
Sample Number:	3X-6A (2-8")
Ring Number:	NA
Depth:	NA

Test Date: 12-Apr-05

### Trial 1

Weight of pycnometer filled w/air (g):	100.87
Weight of pycnometer filled w/soil (g):	151.30
Weight of pycnometer filled w/soil & water (g):	382.11
Weight of pycnometer filled w/water (g):	350.12
Observed temperature (°C):	20.80
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9980
Particle Density (g/cm³):	2.73
Correction factor, K:	0.9998
Particle Density at 20°C (g/cm <sup>3</sup> ).	2.73
Trial 2	
Weight of pycnometer filled w/air (g):	92.46
Weight of pycnometer filled w/soil (g):	142.53

1.12,00	(g).
373.47	Weight of pycnometer filled w/soil & water (g):
341.64	Weight of pycnometer filled w/water (g):
20.90	Observed temperature (°C):
0.9980	Density of water at observed temperature (g/cm <sup>3</sup> ):
2.74	Particle Density (alom <sup>3</sup> ):
2.74	Fanicle Density (growth).
0.9998	Correction factor, K:
2.74	Particle Density at 20°C (g/cm <sup>3</sup> ):

### Average Particle Density (g/cm<sup>3</sup>): 2.74

Comments:



# **Particle Density**

Job Name:	Golder
Job Number:	LB05.0055.00
Sample Number:	3X-6A (39-45")
Ring Number:	NA
Depth:	NA

Test Date: 12-Apr-05

### Trial 1

Weight of pycnometer filled w/air (g):	100.08
Weight of pycnometer filled w/soil (g):	150.67
Weight of pycnometer filled w/soil & water (g):	381.48
Weight of pycnometer filled w/water (g):	349.26
Observed temperature (°C):	22.40
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9977
Particle Density (g/cm <sup>3</sup> ):	2.75
Correction factor, K:	0.9995
Destinte Demetter ( 0000 ( 1 3)	
Particle Density at 20°C (g/cm°):	2.75
Trial 2	2.75
Trial 2 Weight of pycnometer filled w/air (g):	92.29
Trial 2 Weight of pycnometer filled w/air (g): Weight of pycnometer filled w/soil (g):	2.75 92.29 142.86
Trial 2 Weight of pycnometer filled w/air (g): Weight of pycnometer filled w/soil (g): Weight of pycnometer filled w/soil & water (g):	2.75 92.29 142.86 373.71
Trial 2 Weight of pycnometer filled w/air (g): Weight of pycnometer filled w/soil (g): Weight of pycnometer filled w/soil & water (g): Weight of pycnometer filled w/water (g):	92.29 142.86 373.71 341.37
Trial 2 Weight of pycnometer filled w/air (g): Weight of pycnometer filled w/soil (g): Weight of pycnometer filled w/soil & water (g): Weight of pycnometer filled w/water (g): Weight of pycnometer filled w/water (g):	2.75 92.29 142.86 373.71 341.37 22.40
Trial 2 Weight of pycnometer filled w/air (g): Weight of pycnometer filled w/soil (g): Weight of pycnometer filled w/soil & water (g): Weight of pycnometer filled w/water (g): Observed temperature (°C): Density of water at observed temperature (g/cm <sup>3</sup> ):	2.75 92.29 142.86 373.71 341.37 22.40 0.9977
Trial 2 Weight of pycnometer filled w/air (g): Weight of pycnometer filled w/soil (g): Weight of pycnometer filled w/soil & water (g): Weight of pycnometer filled w/water (g): Observed temperature (°C): Density of water at observed temperature (g/cm <sup>3</sup> ): Particle Density (g/cm <sup>3</sup> ):	2.75 92.29 142.86 373.71 341.37 22.40 0.9977 2.77

Particle Density at 20°C (g/cm<sup>3</sup>): 2.77

# Average Particle Density (g/cm<sup>3</sup>): 2.76

Comments:



# **Particle Density**

Job Name:	Golder
Job Number:	LB05.0055.00
Sample Number:	3X-7A (26-32")
Ring Number:	NA
Depth:	NA

Test Date: 12-Apr-05

### Trial 1

99.26 150.20 380.92
348.46
22.40 0.9977
2.75 0.9995
2.75

### Trial 2

Weight of pycnometer filled w/soil (g): 136.4 Weight of pycnometer filled w/soil & water (g): 367.2 Weight of pycnometer filled w/water (g): 334.9	9
Weight of pycnometer filled w/soil & water (g): 367.2 Weight of pycnometer filled w/water (g): 334.9	7
Weight of pycnometer filled w/water (g) 334.9	2
(g). 004.0	8
Observed temperature (°C): 22.1	0
Density of water at observed temperature (g/cm <sup>3</sup> ): 0.997	8
Particle Density (g/cm <sup>3</sup> ): 2.7	4
Correction factor, K: 0.999	5
Particle Density at 20°C (g/cm <sup>3</sup> ): 2.74	4

# Average Particle Density (g/cm<sup>3</sup>): 2.75

Comments:



# **Particle Density**

Job Name:	Golder
Job Number:	LB05.0055.00
Sample Number:	TP-1-1A (3-9")
Ring Number:	NA
Depth:	NA

Test Date: 12-Apr-05

### Trial 1

Weight of pycnometer filled w/air (g):	100.37
Weight of pycnometer filled w/soil (g):	151.00
Weight of pycnometer filled w/soil & water (g):	381.70
Weight of pycnometer filled w/water (g):	349.54
Observed temperature (°C):	21.80
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9978
Particle Density (g/cm <sup>3</sup> ):	2.74
Correction factor, K:	0.9996
Particle Density at 20°C (g/cm <sup>3</sup> ):	2.74

### Trial 2

Weight of pycnometer filled w/air (g):	91.07
Weight of pycnometer filled w/soil (g):	141.21
<ul> <li>Weight of pycnometer filled w/soil &amp; water (g):</li> </ul>	372.02
Weight of pycnometer filled w/water (g):	340.24
Observed temperature (°C):	22.00
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9978
Particle Density (g/cm <sup>3</sup> ).	2.72
Correction factor, K:	0.9996
Particle Density at 20°C (g/cm <sup>3</sup> ):	2.73

### Average Particle Density (g/cm<sup>3</sup>): 2.73

Comments:



# **Particle Density**

Job Name:	Golder
Job Number:	LB05.0055.00
Sample Number:	TP-1-1A (52-58")
Ring Number:	NA
Depth:	NA

Test Date: 12-Apr-05

### Trial 1

Weight of pycnometer filled w/air (g):	99.59
Weight of pycnometer filled w/soil (g):	149.78
Weight of pycnometer filled w/soil & water (g):	380.46
Weight of pycnometer filled w/water (g):	348.74
Observed temperature (°C):	22.00
Density of water at observed temperature (glcm <sup>3</sup> ):	0.9978
Particle Density (g/cm³):	2.71
Correction factor, K:	0.9996
Particle Density at 20°C (g/cm <sup>3</sup> ):	2.71
Trial 2	
Weight of pycnometer filled w/air (g):	99.92
Weight of pycnometer filled w/soil (g):	149.99
Weight of pycnometer filled w/soil & water (g):	380.69
Weight of pycnometer filled w/water (g):	348.96

Observed temperature (°C):22.00Density of water at observed temperature (g/cm³):0.9978

Particle Density (g/cm<sup>3</sup>): 2.72 Correction factor, K: 0.9996

Particle Density at 20°C (g/cm<sup>3</sup>): 2.73

### Average Particle Density (g/cm<sup>3</sup>): 2.72

Comments:



# **Particle Density**

Job Name:	Golder
Job Number:	LB05.0055.00
Sample Number:	2A (1-7")
Ring Number:	NA
Depth:	NA

Test Date: 18-Apr-05

### Trial 1

Weight of pycnometer filled w/air (g):	102.42
Weight of pycnometer filled w/soil (g):	152.60
Weight of pycnometer filled w/soil & water (g):	383.68
Weight of pycnometer filled w/water (g):	351.64
· Observed temperature (°C):	21.00
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9980
Particle Density (g/cm <sup>3</sup> ):	2.76
Correction factor, K:	0.9998
Particle Density at 20°C (g/cm <sup>3</sup> ):	2.76

### Trial 2

Weight of pycnometer filled w/air (g):	85.28
Weight of pycnometer filled w/soil (g):	136.42
Weight of pycnometer filled w/soil & water (g):	367.17
Weight of pycnometer filled w/water (g):	334.54
Observed temperature (°C):	20.80
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9980
Particle Density (g/cm <sup>3</sup> ):	2.76
Correction factor, K:	0.9998
Particle Density at 20°C (g/cm <sup>3</sup> ):	2.76

### Average Particle Density (g/cm<sup>3</sup>): 2.76

### Comments:



# **Particle Density**

Job Name:	Golder
Job Number:	LB05.0055.00
Sample Number:	2A (40-46")
Ring Number:	NA
Depth:	NA

Test Date: 12-Apr-05

### Trial 1

Weight of pycnometer filled w/air (g):	92.43
Weight of pycnometer filled w/soil (g):	142.69
Weight of pycnometer filled w/soil & water (g):	373.29
Weight of pycnometer filled w/water (g):	341 42
Observed temperature (°C).	22.40
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9977
Particle Density (g/cm³):	2.73
Correction factor, K:	0.9995
Particle Density at 20°C (g/cm <sup>3</sup> ):	2.73

Trial 2	
Weight of pycnometer filled w/air (g):	93.33
Weight of pycnometer filled w/soil (g):	146.41
Weight of pycnometer filled w/soil & water (g):	376.05
Weight of pycnometer filled w/water (g):	342.38
Observed temperature (°C):	22.40
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9977
Particle Density (g/cm <sup>3</sup> ):	2.73
Correction factor, K:	0.9995
Particle Density at 20°C (g/cm³):	2.73

### Average Particle Density (g/cm<sup>3</sup>): 2.73

Comments:



# **Particle Density**

Job Name:	Golder
Job Number:	LB05.0055.00
Sample Number:	3A (9-15")
Ring Number:	NA
Depth:	NA

Test Date: 12-Apr-05

### Trial 1

Weight of pycnometer filled w/air (g): Weight of pycnometer filled w/soil (g): Weight of pycnometer filled w/soil & water (g): Weight of pycnometer filled w/water (g):	98.67 148.96 380.48 348.50
Observed temperature(°C): Density of water at observed temperature(g/cm <sup>3</sup> ):	20.90 0.9980
Particle Density (g/cm³): Correction factor, K:	2.74 0.9998
Particle Density at 20°C (g/cm <sup>3</sup> ):	2.74
Trial 2	
Weight of pycnometer filled w/air (g):	91.23
Weight of pycnometer filled w/soil (g):	142.30
Weight of pycnometer filled w/soil & water (g):	372.89
Weight of pycnometer filled w/water (g):	340.31

-		
Density of water at c	Observed temperature (°C): observed temperature (g/cm <sup>3</sup> ):	21.00 0.9980
•	Particle Density (g/cm <sup>3</sup> ): Correction factor, K:	2.76 0.9998
Pa	article Density at 20°C (g/cm <sup>3</sup> ):	2.76

### Average Particle Density (g/cm<sup>3</sup>): 2.75

Comments:



# **Particle Density**

Job Name:	Golder
Job Number:	LB05.0055.00
Sample Number:	3A (28-34")
Ring Number:	NA
Depth:	NA

Test Date: 12-Apr-05

### Trial 1

Weight of pycnometer filled w/air (g):	91.76
Weight of pycnometer filled w/soil (g):	142.56
Weight of pycnometer filled w/soil & water (g):	373.21
Weight of pycnometer filled w/water (g):	340.91
Observed temperature (°C):	21.60
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9979
Particle Density (g/cm <sup>3</sup> ):	2.74
Correction factor, K:	0.9997
Particle Density at 20°C (g/cm <sup>3</sup> ):	2.74

Trial 2	
Weight of pycnometer filled w/air (g):	88.79
Weight of pycnometer filled w/soil (g):	139.05
Weight of pycnometer filled w/soil & water (g):	369.87
Weight of pycnometer filled w/water (g):	337.83
Observed temperature (°C):	21.90
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9978
Particle Density (g/cm <sup>3</sup> ):	2.75
Correction factor, K:	0.9996
Particle Density at 20°C (g/cm <sup>3</sup> ):	2.75

### Average Particle Density (g/cm<sup>3</sup>): 2.75

Comments:

# Laboratory Tests and Methods



### **Tests and Methods**

Dry Bulk Density:	ASTM D4531
Moisture Content:	ASTM D2216
Calculated Porosity:	Klute, A. 1986. Porosity. Chp.18-2.1, pp. 444-445, in A. Klute (ed.), Methods of Soil Analysis, American Society of Agronomy, Madison, Wl
Saturated K:	
Constant Head: Falling Head:	ASTM D 2434 (modified apparatus) Klute, A. and C. Dirkson. 1986. Hydraulic Conductivity and Diffusivity: Laboratory Methods.Chp. 28, pp. 200-203, in A. Klute (ed.), Methods of Soil Analysis, American Society of Agronomy, Madison, WI
Hanging Column Method:	ASTM D6836; Klute, A. 1986. Porosity. Chp.26, in A. Klute (ed.), Methods of Soil Analysis, American Society of Agronomy, Madison, WI
Pressure Plate Method:	ASTM D6836; ASTM D2325
Water Potential Method:	ASTM D6836; Rawlins, S.L. and G.S. Campbell, 1986. Water Potential: Thermocouple Psychrometry. Chp. 24, pp. 597-619, in A. Klute (ed.), Methods of Soil Analysis, Part 1. American Society of Agronomy, Madison, WI.
Relative Humidity Box:	Karathanasis & Hajek. 1982. Quantitative Evaluation of Water Adsorption on Soil Clays.SSA Journal 46:1321-1325
Calc. Kunsat:	ASTM D6836; Soil Sci. Soc. Am. J. 1980 44:892-898
Particle Density	ASTM D854
Percent Sand, Silt, Clay:	Bureau of Reclamation, Series 510, Part 514 (modified per L. Munk)

Laboratory Report for Golder Associates, Inc (Project # 053-2366 Batch 2)

July 8, 2005



Daniel B. Stephens & Associates, Inc.

6020 Academy NE, Suite 100 • Albuquerque, New Mexico 87109



July 8, 2005

Lewis Munk, PhD Golder Associates, Inc. 4910 Alameda Blvd. NE, Suite A Albuquerque, NM 87113 (505)-821-3043

Re: Laboratory Report for Golder Associates, Inc. (053-2366)

Dear Dr. Munk:

Enclosed is the final report for the Golder Associates, Inc. samples (053-2366). Please review this report and provide any comments as samples will be held for a maximum of 30 days. After 30 days samples will be returned or disposed of in an appropriate manner.

All testing results were evaluated subjectively for consistency and reasonableness, and the results appear to be reasonably representative of the material tested. However, DBS&A does not assume any responsibility for interpretations or analyses based on the data enclosed, nor can we guarantee that these data are fully representative of the undisturbed materials at the field site. We recommend that careful evaluation of these laboratory results be made for your particular application.

The testing utilized to generate the enclosed final report employs methods that are standard for the industry. The results do not constitute a professional opinion by DBS&A, nor can the results affect any professional or expert opinions rendered with respect thereto by DBS&A. You have acknowledged that all the testing undertaken by us, and the final report provided, constitutes mere test results using standardized methods, and cannot be used to disqualify DBS&A from rendering any professional or expert opinion, having waived any claim of conflict of interest by DBS&A.

We are pleased to provide this service to Golder Associates, Inc. and look forward to future laboratory testing on other projects. If you have any questions about the enclosed data, please do not hesitate to call.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC. LABORATORY / TESTING FACILITY

Joleen Hines, Laboratory Supervising Manager Enclosure

Daniel B. Stephens & Associates, Inc.

6020 Academy NE, Suite 100

Albuquerque, NM 87109

505-822-9400 FAX 505-822-8877

# Summaries



# **Summary of Tests Performed**

		Saturated		-					1/3, 15 Bar		
	Initial Soil	Hydraulic	Moisture	Unsaturated	Particle			Percent	Points and		
Laboratory	Properties <sup>1</sup>	Conductivity <sup>2</sup>	Characteristics <sup>3</sup>	Hydraulic	Size <sup>4</sup>	Effective	Particle	Sand, Silt,	Water Holding	Atterberg	Proctor
Sample Number	(θ, ρ <sub>d</sub> , φ)	CH FH	HC PP TH WP RH	Conductivity	DS WS H	Porosity	Density	Clay	Capacity	Limits	Compaction
3X-5B (3-9)	×	×	× × × ×	×			×	×			
3X-5B (52-58)	×	×	× × × ×	×			×	×			

 $^1$   $\theta$  = Initial moisture content,  $_{\rm B}$  = Dry bulk density,  $\phi$  = Calculated porosity  $^2$  CH = Constant head, FH = falling head

<sup>3</sup> HC = Hanging column, PP = Pressure plate, TH = Thermocouple psychrometer, WP = Water activity meter, RH = Relative humidity box <sup>4</sup> DS = Dry sieve, WS = Wet sieve, H = Hydrometer



v	Vet Bulk Density and Calculated Porosity				
	Initial Moist	ure Content	Dry Bulk	Wet Bulk	Calculated
Sample Number	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )	Density (g/cm <sup>3</sup> )	Density (g/cm <sup>3</sup> )	Porosity (%)
3X-5B (3-9)	18.5	29.4	1.59	1.89	42.6
3X-5B (52-58)	22.0	37.4	1.70	2.08	39.3

# Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity


## Summary of Saturated Hydraulic Conductivity Tests

	κ <sub>sat</sub>	Method of	f Analysis
Sample Number	(cm/sec)	Constant Head	Falling Head
3X-5B (3-9)	1.3E-05		х
3X-5B (52-58)	7.1E-06		X



Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm <sup>3</sup> /cm <sup>3</sup> )
3X-5B (3-9)	0	44 5
	23	41.6
	52	40.2
	153	31.3
	510	29.4
	18458	14.6
	851293	1.6
3X-5B (52-58)	0	43.7
	26	41.9
	126	39.0
	510	34.9
	8158	23.0
	22538	13.6
	851293	1.9

# Summary of Moisture Characteristics of the Initial Drainage Curve



# Summary of Calculated Unsaturated Hydraulic Properties

Sample Number	<b>α</b> (cm <sup>-1</sup> )	N (dimensionless)	θ <sub>r</sub>	$\theta_{s}$
3X-5B (3-9)	0.0168	1.2207	0.0000	0.4412
3X-5B (52-58)	0.0013	1.3101	0.0000	0.4151



# Summary of Percent Sand, Silt & Clay Tests

Sample Number	% Sand	% Silt	% Clay
3X-5B (3"-9")	53.6	30.9	15.5
3X-5B (52"-58")	47.0	38.2	14.9



## Summary of Particle Density Tests

Sample Number	Particle Density (g/cm <sup>3</sup> )
3X-5B (3-9)	2.78
3X-5B (52-58)	2.81

# Laboratory Data and Graphical Plots

# **Initial Properties**



## Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity

	Initial Mois	Dry Bulk	Wet Bulk	Calculated	
 Sample Number	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )	Density (g/cm <sup>3</sup> )	Density (g/cm <sup>3</sup> )	Porosity (%)
3X-5B (3-9)	18.5	29.4	1.59	1.89	42.6
3X-5B (52-58)	22.0	37.4	1.70	2.08	39.3



### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Golder (3-05) Batch 2 Job Number: LB05.0055.00 Sample Number: 3X-5B (3-9) Ring Number: NA Depth: NA

Test Date: 18-Apr-05

Field weight\* of sample (g): 136.50 Tare weight, ring (g): 12.62 Tare weight, cap/plate/epoxy (g): 0.00

> Dry weight of sample (g): 104.57 Sample volume (cm<sup>3</sup>): 65.68 Measured particle density: 2.78

Initial Volumetric Moisture Content (% vol): 29.4 Initial Gravimetric Moisture Content (% g/g): 18.5 Dry bulk density (g/cm<sup>3</sup>): 1.59 Wet bulk density (g/cm<sup>3</sup>): 1.89 Calculated Porosity (% vol): 42.6 Percent Saturation: 69.0

Comments:

\* Weight including tares NA = Not analyzed

> Laboratory analysis by: M. Devine Data entered by: D. O'Dowd Checked by: J. Hines



### Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Golder (3-05) Batch 2 Job Number: LB05.0055.00 Sample Number: 3X-5B (52-58) Ring Number: NA Depth: NA Test Date: 18-Apr-05

Field weight\* of sample (g): 155.94 Tare weight, ring (g): 13.28 Tare weight, cap/plate/epoxy (g): 0.00

> Dry weight of sample (g): 116.98 Sample volume (cm<sup>3</sup>): 68.61 Measured particle density: 2.81

Initial Volumetric Moisture Content (% vol): 37.4 Initial Gravimetric Moisture Content (% g/g): 22.0 Dry bulk density (g/cm<sup>3</sup>): 1.70 Wet bulk density (g/cm<sup>3</sup>): 2.08 . Calculated Porosity (% vol): 39.3 Percent Saturation: 95.3

Comments:

\* Weight including tares NA = Not analyzed

> Laboratory analysis by: M. Devine Data entered by: D. O'Dowd Checked by: J. Hines

# Saturated Hydraulic Conductivity



## Summary of Saturated Hydraulic Conductivity Tests

	K <sub>sat</sub>	Method of Analysis		
 Sample Number	(cm/sec)	Constant Head	Falling Head	
3X-5B (3-9)	1.3E-05		х	
3X-5B (52-58)	7.1E-06		х	

### Saturated Hydraulic Conductivity Falling Head Method

Job name:	Golder (3-05)	) Batch 2 Type of water used:	TAP
Job number:	LB05.0055.00	0 Backpressure (psi):	0.0
Sample number:	3X-5B (3-9)	Offset (cm):	0.4
Ring Number:	NA	Sample length (cm):	3.73
Depth:	NA	Sample x-sectional area (cm <sup>2</sup> ):	17.63
		Reservoir x-sectional area (cm <sup>2</sup> ):	0.70

Date	Time	Temp (°C)	Reservoir head (cm)	Corrected head (cm)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1							
27-Apr-05	13:39:30	20.0	64.5	64.1	12929	1.3E-05	1.3E-05
27-Apr-05	17:14:59	20.0	20.2	19.8			1.012 00
Test # 2:							
29-Apr-05	08:39:40	21.0	64.8	64.4	17460	1.3E-05	1.2E-05
29-Apr-05	13:30:40	20.5	15.0	14.6			
Test # 3:							
02-May-05	08:19:35	20.0	53.6	53.2	1385	1.3E-05	1.3E-05
02-May-05	08:42:40	20.0	47.4	47.0			

### Average Ksat (cm/sec): 1.3E-05



Comments:

Laboratory analysis by: M. Devine Data entered by: M. Devine Checked by: J. Hines

## Saturated Hydraulic Conductivity Falling Head Method

Job name:	Golder (3-05) B	latch 2	Type of water used:	TAP
Job number:	LB05.0055.00		Backpressure (psi):	0.0
Sample number:	3X-5B (52-58)		Offset (cm):	0.4
Ring Number:	NA		Sample length (cm):	3.93
Depth:	NA	Sample x-s	sectional area (cm <sup>2</sup> ):	17.45
	R	eservoir x-s	sectional area (cm <sup>2</sup> ):	0.70

Date	Time	Temp (°C)	Reservoir head (cm)	Corrected head (cm)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:							
29-Apr-05	11:36:10	20.0	34.0	33.6	6829	7.0E-06	7.0E-06
29-Apr-05	13:29:59	20.5	25.2	24.8			
Test # 2:							
30-Apr-05	14:30:29	20.0	40.2	39.8	4151	6.7E-06	6.7E-06
30-Apr-05	15:39:40	1 <del>9</del> .5	33.8	33.4			
Test # 3:							
02-May-05	08:18:40	20.0	59.5	59.1	1410	7.7E-06	7.7E-06
02-May-05	08:42:10	20.0	55.5	55.1			

Average Ksat (cm/sec): 7.1E-06



Comments:

Laboratory analysis by: M. Devine Data entered by: M. Devine Checked by: J. Hines

# Unsaturated Hydraulic Conductivity



# Summary of Moisture Characteristics of the Initial Drainage Curve

Sample Number	eressure Head (-cm water)	(%, cm <sup>3</sup> /cm <sup>3</sup> )
3X-5B (3-9)	0	44.5
	23	41.6
	52	40.2
	153	31.3
	510	29.4
	18458	14.6
	851293	1.6
3X-5B (52-58)	0	43.7
	26	41.9
	126	39.0
	510	34.9
	8158	23.0
	22538	13.6
	851293	1.9



## Summary of Calculated Unsaturated Hydraulic Properties

Sample Number	<b>α</b> (cm <sup>-1</sup> )	<b>N</b> (dimensionless)	θr	$\theta_{s}$
3X-5B (3-9)	0.0168	1.2207	0.0000	0.4412
3X-5B (52-58)	0.0013	1.3101	0.0000	0.4151



#### Moisture Retention Data Hanging Column/Pressure Plate/Thermocouple (Main Drainage Curve)

 Job Name:
 Golder (3-05) Batch 2
 Dry wt. of sample (g): 104.57

 Job Number:
 LB05.0055.00
 Tare wt., screen & clamp (g): 25.89

 Sample Number:
 3X-5B (3-9)
 Tare wt., ring (g): 12.62

 Ring Number:
 NA
 Tare wt., epoxy (g): 0.00

 Depth:
 NA
 Sample volume (cm³): 65.68

Saturated weight\* at 0 cm tension (g): 172.30 Volume of water<sup>T</sup> in saturated sample (cm<sup>3</sup>): 29.22 Saturated moisture content (% vol): 44.49 Sample bulk density (g/cm<sup>3</sup>): 1.59

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content <sup>⊤</sup> (% vol)
Hanging column:	02-May-05 / 12:00	172.30	0.00	44.49
	09-May-05 / 15:40	170.40	22.70	41.60
	16-May-05 / 12:04	169.46	51.50	40.17
Pressure plate:	23-May-05 / 09:30	163.63	152.97	31.29
	31-May-05 / 13:45	162.36	509.90	29.36

Comments:

\* Weight including tares

' Assumed density of water is 1.0 g/cm°

Laboratory analysis by: M Carillo Data entered by: D. O'Dowd Checked by: J. Hines



#### Moisture Retention Data Water Activity Meter/Relative Humidity Box (Main Drainage Curve)

Job Name: Golder (3-05) Batch 2 Job Number: LB05.0055.00 Sample Number: 3X-5B (3-9) Ring Number: NA Depth: NA

Dry weight\* of water activity meter sample (g): 125.67 Tare weight, jar (g): 113.42 Sample bulk density (g/cm<sup>°</sup>): 1.59

			Matric	Moisture
		Weight*	Potential	Content <sup>T</sup>
	Date/Time	(g)	(-cm water)	(% vol)
Water Activity Meter:	06-May-05 / 09:30	126.79	18458.4	14.56

Dry weight\* of relative humidity box sample (g): 50.14 Tare weight (g): 40.70 Sample bulk density (g/cm<sup>3</sup>): 1.59

			Matric	Moisture
		Weight*	Potential	Content <sup>⊤</sup>
	Date/Time	(g)	(-cm water)	(% vol)
Relative humidity box:	10-May-05 / 14:00	50.24	851293	1.60

Comments:

\* Weight including tares

<sup>†</sup> Assumed density of water is 1.0 g/cm<sup>3</sup>

Laboratory analysis by: M. Carillo/D. O'Dowd Data entered by: D. O'Dowd Checked by: J. Hines





Water Retention Data Points



## **Predicted Water Retention Curve and Data Points**

Sample Number: 3X-5B (3-9)



## Plot of Relative Hydraulic Conductivity vs Moisture Content



# Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: 3X-5B (3-9)



Plot of Relative Hydraulic Conductivity vs Pressure Head



## Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: 3X-5B (3-9)



#### Moisture Retention Data Hanging Column/Pressure Plate/Thermocouple (Main Drainage Curve)

 Job Name:
 Golder (3-05) Batch 2
 Dry wt. of sample (g): 116.98

 Job Number:
 LB05.0055.00
 Tare wt., screen & clamp (g): 23.22

 Sample Number:
 3X-5B (52-58)
 Tare wt., ring (g): 13.28

 Ring Number:
 NA
 Tare wt., epoxy (g): 0.00

 Depth:
 NA
 Sample volume (cm³): 68.61

Saturated weight\* at 0 cm tension (g): 183.44 Volume of water<sup>T</sup> in saturated sample (cm<sup>3</sup>): 29.96 Saturated moisture content (% vol): 43.66 Sample bulk density (g/cm<sup>3</sup>): 1.70

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content <sup>T</sup> (% vol)
Hanging column:	02-May-05 / 15:11	183.44	0.00	43.66
	09-May-05 / 15:45	182.25	26.30	41.93
	16-May-05 / 15:19	180.22	125.50	38.97
Pressure plate:	23-May-05 / 09:30	177.43	509.90	34.91

#### Comments:

\* Weight including tares

' Assumed density of water is 1.0 g/cm°

Laboratory analysis by: M Carillo Data entered by: D. O'Dowd Checked by: J. Hines



#### Moisture Retention Data Water Activity Meter/Relative Humidity Box (Main Drainage Curve)

Job Name: Golder (3-05) Batch 2 Job Number: LB05.0055.00 Sample Number: 3X-5B (52-58) Ring Number: NA Depth: NA

Dry weight\* of water activity meter sample (g): 135.49 Tare weight, jar (g): 113.52 Sample bulk density (g/cm<sup>°</sup>): 1.70

		EUICIIIAI	Content
Date/Time	(g)	(-cm water)	(% vol)
May-05 / 13:09	138.45	8158.4	22.97
May-05 / 15:45	137.24	22537.6	13.58
	May-05 / 13:09 May-05 / 15:45	May-05 / 13:09 138.45 May-05 / 15:45 137.24	Date/Time         (g)         (-cm water)           May-05 / 13:09         138.45         8158.4           May-05 / 15:45         137.24         22537.6

Dry weight\* of relative humidity box sample (g): 63.68 Tare weight (g): 40.97 Sample bulk density (g/cm<sup>3</sup>): 1.70

			Matric	Moisture
		Weight*	Potential	Content <sup>T</sup>
	Date/Time	(g)	(-cm water)	(% vol)
Relative humidity box:	10-May-05 / 14:00	63.93	851293	1.91

Comments:

\* Weight including tares

<sup>†</sup> Assumed density of water is 1.0 g/cm<sup>3</sup>

Laboratory analysis by: M. Carillo/D. O'Dowd Data entered by: D. O'Dowd Checked by: J. Hines



Sample Number: 3X-5B (52-58) 1.E+06 X 1.E+05 1.E+04 Pressure Head (-cm water) Hanging column ▲ Pressure plate • Thermocouple ♦ Water activity meter ×Rh box 1.E+03 1.E+02 1.E+01 1.E+00 0 10 20 30 40 50 60 Moisture Content (%,cm<sup>3</sup>/cm<sup>3</sup>)

Water Retention Data Points



## **Predicted Water Retention Curve and Data Points**



Plot of Relative Hydraulic Conductivity vs Moisture Content

Sample Number: 3X-5B (52-58)



Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: 3X-5B (52-58)





Plot of Relative Hydraulic Conductivity vs Pressure Head



Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: 3X-5B (52-58)

# Particle Size Analysis



# Summary of Percent Sand, Silt & Clay Tests

Sample Number	% Sand	% Silt	% Clay
3X-5B (3"-9")	53.6	30.9	15.5
3X-5B (52"-58")	47.0	38.2	14.9



### Particle Size Analysis Hydrometer Data

Job Name:Golder (3-05)Type of Water Used:DISTILLEDJob Number:LB05.0055.00Alkaline Buffer:Na2CO3Sample Number:3X-5B (3"-9")Dispersant\*:(NaPO3)6Ring Number:NAAssumed particle density:2.65Depth:NAInitial Wt. (g):100.25Test Date:8-Jun-05539100.25

Date	Time (min)	Temp (°C)	R (g/L)	R∟ (g/L)	R <sub>corr</sub> (g/L)
8-Jun-05	9:39:40	21.0	53.0	6.5	46.5
8-Jun-05	17:38	18.9	22.5	7.0	15.5

% Clay	15.5
% Silt	30.9
% Sand	53.6

Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: D. O'Dowd Data entered by: D. O'Dowd Checked by: J. Hines


## Particle Size Analysis Hydrometer Data

Job Name: Golder (3-05) Job Number: LB05.0055.00 Sample Number: 3X-5B (52"-58") Ring Number: NA Depth: NA Test Date: 8-Jun-05 Start Time: 9:27

Type of Water Used: DISTILLED Alkaline Buffer: Na<sub>2</sub>CO<sub>3</sub> Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub> Assumed particle density: 2.65 Initial Wt. (g): 100.89

Date	Time (min)	Temp (°C)	R (g/L)	R∟ (g/L)	R <sub>corr</sub> (g/L)
8-Jun-05	9:27:40	21.0	60.0	6.5	53.5
8-Jun-05	17:27	18.9	22.0	7.0	15.0

% Clay	14.9
% Silt	38.2
% Sand	47.0

Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: D. O'Dowd Data entered by: D. O'Dowd Checked by: J. Hines

# Specific Gravity



# Summary of Particle Density Tests

Sample Number	Particle Density (g/cm <sup>3</sup> )
3X-5B (3-9)	2.78
. 3X-5B (52-58)	2.81



# **Particle Density**

Job Name:	Golder (3-05) Batch	2
Job Number:	LB05.0055.00	
Sample Number:	3X-5B (3-9)	
Ring Number:	NA	
Depth:	NA	

Test Date: 18-Apr-05

#### Trial 1

Weight of pycnometer filled w/air (g):	100.88
Weight of pycnometer filled w/soil (g):	152.11
Weight of pycnometer filled w/soil & water (g):	382.95
Weight of pycnometer filled w/water (g):	350.12
Observed temperature (°C):	20.80
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9980
Particle Density (g/cm <sup>3</sup> ):	2.78
Correction factor, K:	0.9998
Particle Density at 20°C (g/cm <sup>3</sup> ):	2.78

Trial 2	
Weight of pycnometer filled w/air (g):	100.50
Weight of pycnometer filled w/soil (g):	150.15
Weight of pycnometer filled w/soil & water (g):	381.50
Weight of pycnometer filled w/water (g):	349.73
· Observed temperature (°C):	20.80
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9980
Particle Density (g/cm <sup>3</sup> ):	2.77
Correction factor, K:	0.9998
Particle Density at 20°C (g/cm <sup>3</sup> ):	2.77

## Average Particle Density (g/cm<sup>3</sup>): 2.78

Comments:

Laboratory analysis by: D. O'Dowd Data entered by: D. O'Dowd Checked by: J. Hines



# **Particle Density**

Job Name:	Golder (3-05) Batch	2
Job Number:	LB05.0055.00	
Sample Number:	3X-5B (52-58)	
Ring Number:	NA	
Depth:	NA	

Test Date: 18-Apr-05

#### Trial 1

Weight of pycnometer filled w/air (g):	90.98
Weight of pycnometer filled w/soil (g):	141.66
Weight of pycnometer filled w/soil & water (g):	372.88
Weight of pycnometer filled w/water (g):	340.29
· Observed temperature (°C):	20.80
Density of water at observed temperature (g/cm <sup>3</sup> ).	0.9980
Particle Density (g/cm <sup>3</sup> ):	2.80
Correction factor, K:	0.9998
Particle Density at 20°C (glcm <sup>3</sup> ):	2.80

#### Trial 2

Weight of pycnometer filled w/air (g):	88.79
Weight of pycnometer filled w/soil (g):	138.53
Weight of pycnometer filled w/soil & water (g):	370.01
Weight of pycnometer filled w/water (g):	337.90
Observed temperature (°C):	20.80
Density of water at observed temperature (glcm <sup>3</sup> ):	0.9980
Particle Density (g/cm³):	2.82
Correction factor, K:	0.9998
Particle Density at 20°C (g/cm <sup>3</sup> ):	2.82

#### Average Particle Density (g/cm<sup>3</sup>): 2.81

Comments:

Laboratory analysis by: D. O'Dowd Data entered by: D. O'Dowd Checked by: J. Hines

# Laboratory Tests and Methods



### **Tests and Methods**

Dry Bulk Density:	ASTM D4531
Moisture Content:	ASTM D2216
Calculated Porosity:	Klute, A. 1986. Porosity. Chp.18-2.1, pp. 444-445, in A. Klute (ed.), Methods of Soil Analysis, American Society of Agronomy, Madison, WI
Saturated K: Constant Head: Falling Head:	ASTM D 2434 (modified apparatus) Klute, A. and C. Dirkson. 1986. Hydraulic Conductivity and Diffusivity: Laboratory Methods.Chp. 28, pp. 200-203, in A. Klute (ed.), Methods of Soil Analysis, American Society of Agronomy, Madison, WI
Hanging Column Method:	ASTM D6836; Klute, A. 1986. Porosity. Chp.26, in A. Klute (ed.), Methods of Soil Analysis, American Society of Agronomy, Madison, WI
Pressure Plate Method:	ASTM D6836; ASTM D2325
Water Potential Method:	ASTM D6836; Rawlins, S.L. and G.S. Campbell, 1986. Water Potential: Thermocouple Psychrometry. Chp. 24, pp. 597-619, in A. Klute (ed.), Methods of Soil Analysis, Part 1. American Society of Agronomy, Madison, WI.
Relative Humidity Box:	Karathanasis & Hajek. 1982. Quantitative Evaluation of Water Adsorption on Soil Clays.SSA Journal 46:1321-1325
Calc. Kunsat:	ASTM D6836; Soil Sci. Soc. Am. J. 1980 44:892-898
Particle Density	ASTM D854
Percent Sand, Silt, Clay:	Bureau of Reclamation, Series 510, Part 514 (modified per L. Munk)

**APPENDIX E** 

HDS CALIBRATION DATA



September 29, 2005

Celebrating` 20 Years

> Todd Stein Golder Associates, Inc. 4910 Alameda Boulevard, Suite Albuquerque, NM 87113

Re: Transmittal of Heat Disspation Sensor Calibration Results

Dear Mr. Stein:

Enclosed are the results of calibrations performed for 221 heat dissipation sensors in the DBS&A soils laboratory.

We appreciate the opportunity to provide these services, and look forward to working with Golder in the future.

If you have any questions regarding the calibrations, please feel free to contact me at (505) 822-9400.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC.

John Kav

Hydrologist

Daniel B. Stephens & Associates, Inc.

6020 Academy NE, Suite 100

Albuquerque, NM 87109

505-822-9400 FAX 505-822-8877

# **Calibration Coefficients**

Sensor SN:	Alpha	Ν	deltaT(dry)	deltaT(wet)
9959	0.0036	1.5746	2.704	0.73
9960	0.0043	1.5358	2.882	0.763
9961	0.0033	1.6600	2.818	0.771
9962	0.0036	1.5841	2.895	0.779
9963	0.0034	1.6561	2.8	0.738
9964	0.0078	1.4681	2.7	0.771
9965	0.0042	1.5762	2.812	0.77
9966	0.0037	1.5948	2.998	0.763
9967	0.0036	1.6146	2.923	0.755
9968	0.0034	1.5790	2.858	0.779
9969	0.0039	1.5578	2.818	0.754
9970	0.0039	1.5609	2.862	0.754
9971	0.0036	1.5674	2.872	0.779
9972	0.0040	1.5388	2.895	0.77
9973	0.0037	1.5245	2.909	0.738
9974	0.0032	1.6234	2.788	0.73 *

Golds-Batch I

Calibration Data Points

	174	000	000	453	228	106
_	6	 ö		ò	0	0
	679	0.000	1.000	0.478	0.276	0.137
	9972	0.000	1.000	0.456	0.249	0.130
	9971	0.000	1.000	0.463	0.245	0.125
	0266	0.000	1.000	0.443	0.238	0.119
	9646	0.000	1.000	0.447	0.242	0.120
	9968	0.000	1.000	0.468	0.244	0.123
Number	2966	0.000	1.000	0.432	0.219	0.102
obe Serial	9966	0.000	1.000	0.438	0.224	0.111
T* by Pro	9965	0.000	1.000	0.418	0.226	0.103
-	9964	0.000	1.000	0.366	0.240	0.109
	<b>6963</b>	0.000	1.000	0.423	0.210	0.087
	9962	0.000	1.000	0.449	0.234	0.115
	9961	0.000	1.000	0.430	0.212	0.089
	0966	0.000	1.000	0.439	0.243	0.124
	9959	0.000	1.000	0.455	0.244	0.117
	Pressure (cm)	764,850	-	1,020	3,059	13,257

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1,000,000 F 100,000 10,000 1,000 100 9 0.2 0 1.2 -0.8 0.6 0.4 ~ (ssəlnoisnəmib) \*T

Pressure (-cm)







Campbell Scientific 229 Heat Dissipation Sensor SN: 9963 T\* vs Pressure

(ssəlnoisnəmib) \*T







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# **Calibration Coefficients**

Sensor SN:	Alpha	N	deltaT(dry)	deltaT(wet)	
9990	0.0045	1.6276	2.917	0.705	
9991	0.0042	1.5984	2.725	0.688	
9988	0.0108	1,4329	2.654	0.729	
9989	0.0046	1.5831	2.685	0.696	
9999	0.0039	1.6301	2.776	0.696	
9996	0.0058	1.4615	2.499	0.647	
9997	0.0046	1.5968	2.794	0.713	
9998	0.0034	1.6938	2.544	0.688	

Golder Batch Z.1

# Calibration Data Points

<b></b>		 -	· · · · ·			
-						
nber				-		
T* by Probe Serial Nur		 00	0	5	02	8
	666	0.00	1.00	0.40	0.20	0.05
	666	0.000	1.000	0.384	0.202	0.082
	9666	0.000	1.000	0.436	0.245	0.150
	6666	0.000	1.000	0.411	0.190	0.103
	6866	0.000	1.000	0.401	0.199	0.102
	9988	0.000	1.000	0.347	0.226	0.114
	9991	 0.000	1.000	0.411	0.205	0.097
	0666	 0.000	1.000	0.384	0.172	0.104
	Pressure (cm)	764,850	1	1,020	3,059	15,297









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Pressure (-cm)



Pressure (-cm)






# Calibration Coefficients

Sensor SN:	Alpha	N	deltaT(dry)	deltaT(wet)
9975	0.0045	1.5142	2.869	0.738
9976	0.0034	1.6147	2.63	0.787
9977	0.0053	1.4894	2.663	0.779
9978	0.0073	1.4536	2.739	0.763
9979	0.0044	1.4956	2.637	0.713
9980	0.0036	1.6275	3.315	0.787
9981	0.0038	1.5587	2.803	0.754
9982	0.0051	1.5438	3.074	0.754
9983	0.0043	1.5170	2.851	0.713
9984	0.0063	1.4600	2.826	0.705
9985	0.0043	1.5055	2.915	0.745
9986	0.0064	1.4692	2.828	0.754
9987	0.0037	1.6000	3.036	0.754
9992	0.0043	1.5069	2.732	0.77
9993	0.0037	1.5544	2.828	0.721
9994	0.0038	1.5642	2.985	0,738

Cyolder Batch 2.2

# Calibration Data Points

T* by Probe Serial Number	<u>3980 9981 9982 9983 9984 9646 9986 9987 9992 9993 9994</u>	0000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000	1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000	0.427 0.452 0.397 0.452 0.413 0.459 0.403 0.433 0.457 0.459 0.449	0.205 0.245 0.217 0.254 0.256 0.259 0.250 0.219 0.266 0.247 0.235	
	9646	0.000	1.000	0.459	0.259	
	9984	0.000	1.000	0.413	0.256	107 U
I Number	9983	0.000	1.000	0.452	0.254	0.100
obe Seria	9982	 0.000	1.000	0.397	0.217	0,100
T* by Pro	9981	0.000	1.000	0.452	0.245	0 4 7 7
	9980	0.000	1.000	0.427	0.205	105
	6266	0.000	1.000	0.458	0.272	1111
	9978	0.000	1.000	0.390	0.254	0 126
	9977	0.000	1.000	0.425	0.261	0 177
	9266	0.000	1.000	0.444	0.235	0000
	9975	0.000	1.000	0.443	0.251	0 122
	Pressure (cm)	764,850	1	1,020	3,059	13 257





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1,000,000 100,000 F 10,000 Pressure (-cm) 1,000 100 10 0 sealnoianemib) \*T ص ش 1.2 0.8 0.2 -0.4 ~









Campbell Scientific 229 Heat Dissipation Sensor SN: 9992 T\* vs Pressure







# **Calibration Coefficients**

Sensor SN:	Alpha	N	deltaT(dry)	deltaT(wet)
9995	0.0053	1.3739	2.711	0.681
10000	0.0043	1.3701	2.715	0.689
10001	0.0052	1.4003	2.643	0.714
10002	0.0101	1.4571	2.677	0.705
10003	0.0042	1.4012	2.637	0.705

Golder Batch 2.3

# Calibration Data Points

_		 		_	_	_
Serial Number						
T* by Probe						
	10003	2.637	0.705	0.410	0.232	0.102
	10002	 2.677	0.705	0.409	0.223	0.095
	10001	2.643	0.714	0.421	0.231	0.101
	10000	 2.715	0.689	0.402	0.208	0.089
	3995	2.711	0.681	0.386	0.201	0.082
	Pressure (cm)	764,850	-	1,020	3,059	13.257





Campbell Scientific 229 Heat Dissipation Sensor SN: 10001 T\* vs Pressure



Pressure (-cm)





**APPENDIX F** 

FDR CALIBRATION DATA

### No. 3X Outslope Tailing Material Calibration Data

3X Outslope 30'cable								
V	V <sub>w</sub>	E <sup>1/2</sup>	V <sub>w</sub> (est)					
0.13	0	1.8176	0.000	Estimated `	V @ 0.0 V <sub>W</sub>			
0.15	0.012	1.9019	0.011	a <sub>0=e0</sub> <sup>1/2</sup>				
0.61	0.225	3.6594	0.244	a1=(ew <sup>1/2</sup> -e	e0 <sup>1/2</sup> )/thetaW			
0.71	0.298	4.0699	0.298	a1=	7.558316839			
		3X Outslo	pe 150'cab	ole				
V	' V <sub>w</sub>	E <sup>1/2</sup>	V <sub>w</sub> (est)					
0.12	0	1.738208	0.000	Estimated	V @ 0.0 V <sub>W</sub>			
0.13	0.012	1.804166	0.008	a <sub>0=e0</sub> <sup>1/2</sup>				
0.66	0.225	3.857391	0.261	a1=(ew <sup>1/2</sup> -e	e0 <sup>1/2</sup> )/thetaW			
0.73	0.298	4.15982	0.298	a1=	8.126213114			

## Polynomial Relationship

Notes:

V = voltage measured with FDR sensor

 $V_{\rm w}$  = volumetric moisture content of core sample measured by DBS&A Lab

E1/2 = estimated dielectric constant of tailing/cover material

 $V_w$  (est) = estimated volumetric moisture content based on FDR calibration





# No. 3X Top Cover Material Calibration Data

3X Top Cover NE Borrow Pit 30' cable								
V	V <sub>w</sub>	E <sup>1/2</sup>	V <sub>w</sub> (est)					
0.08	0	1.5603	0.000	Estimated '	V @ 0.0 V <sub>W</sub>			
0.17	0.029	1.9961	0.045	a <sub>0=e0</sub> <sup>1/2</sup>				
0.46	0.197	3.1172	0.162	a1=(ew <sup>1/2</sup> -e	e0 <sup>1/2</sup> )/thetaW			
0.77	0.29	4.3491	0.290	a1=	9.616565103			
	3Х Тор	Cover NE	Borrow Pit	150' cable				
V	V <sub>w</sub>	E <sup>1/2</sup>	V <sub>w</sub> (est)					
0.09	0	1.617356	0.000	Estimated '	V @ 0.0 V <sub>W</sub>			
0.20	0.029	2.1316	0.041	a <sub>0=e0</sub> <sup>1/2</sup>				
0.55	0.197	3.435963	0.145	a1=(ew <sup>1/2</sup> -e	e0 <sup>1/2</sup> )/thetaW			
0.93	0.29	5.267118	0.290	a1=	12.58538424			

## Polynomial Relationship

Notes:

V = voltage measured with FDR sensor

 $V_{\rm w}$  = volumetric moisture content of core sample measured by DBS&A Lab

E1/2 = estimated dielectric constant of tailing/cover material

 $V_w$  (est) = estimated volumetric moisture content based on FDR calibration





# No. 3X Tailing Impoundment Outslope Cover Material Calibration Data

Polynomial Relationship								
3X Outslope Cover NW Borrow Pit 30' cable								
V	V <sub>w</sub>	E <sup>1/2</sup>	V <sub>w</sub> (est)					
0.16	0	1.9705	0.000	Estimated '	V @ 0.0 V <sub>W</sub>			
0.19	0.02	2.0872	0.012	a <sub>0=e0</sub> <sup>1/2</sup>				
0.54	0.137	3.3998	0.142	a1=(ew <sup>1/2</sup> -e	e0 <sup>1/2</sup> )/thetaW			
0.89	0.303	5.0099	0.303	a1=	10.03095138			
	<b>3X Outslo</b>	pe Cover N	W Borrow	Pit 150' ca	ble			
V	V <sub>w</sub>	E <sup>172</sup>	V <sub>w</sub> (est)					
0.10	0	1.633814	0.000	Estimated '	V @ 0.0 V <sub>W</sub>			
0.18	0.02	2.04205	0.037	a <sub>0=e0</sub> <sup>1/2</sup>				
0.39	0.137	2.871359	0.111	a1=(ew <sup>1/2</sup> -e	e0 <sup>1/2</sup> )/thetaW			
0.89	0.303	5.009914	0.303	a1=	11.1422467			

# Polynomial Relationship

### Notes:

V = voltage measured with FDR sensor

 $V_{\rm w}$  = volumetric moisture content of core sample measured by DBS&A Lab

E1/2 = estimated dielectric constant of tailing/cover material

 $V_w$  (est) = estimated volumetric moisture content based on FDR calibration




APPENDIX G

SOIL DENSITY MEASUREMENTS

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#### MOISTURE DENSITY RELATIONSHIP OF SOILS

Customer:	Golder Associates, Inc.		
Date Tested:	February 11, 2005	Test Type:	Gradation & Proctor
Project Nome:	Lysimeter Installation Program		
	Tyrone Mine No, 3X Tailing Pond	Procedure:	ASTM C-117, ASTM C-136, & ASTM D-1557 A
Project No.:	013-1595	Soil Type:	Tailings, Sand is yellow & brown in color.

3X Top Surface - Test Plot - Sample #1 Location:

Sieve	Total Sample	Spec's.
Size	% Passing	% Passing
50mm (2")		
37.5mm (1½")		
25mm (1")		
19.0mm (‡")		
12.5mm ( <sup>2</sup> / <sub>2</sub> ")		
9.5mm (3/8")		
4,75mm (No.4)		
2.00mm (No.10)	100	
425um (No.40)	91	
180um (No.80)	60	
75um (No.200)	34.4	
DUST RATIO	0.02	± <0.30 %

Maximum Dry Density:	125.8	lbs./cu.ft.
Optimum Moisture:	9.7%	-

% Material Field Moisture: <u>10.0%</u>

ASTM C-117: 30.6%

Fractured Faces	
Liquid Limit	
Plasticity Index	
Soils Classification	
Estimated R-Value	

Lab Mangger This report was prepared by:

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#### MOISTURE DENSITY RELATIONSHIP OF SOILS

Customer: Date Tested:	Golder Associates, Inc. February 11, 2005	Test Type:	Gradation & Proctor
Project Name: Project Na.:	Lysimeter Installation Program Tyrone Mine No. 3X Tailing Pond 013–1595	Procedure: Soil Type:	ASTM C-117, ASTM C-136, & ASTM D-1557 A Tailings, Sand is yellow & brown in color.

Location: 3X Top Surface - Test Plot - Sample #2

Sieve	Total Sample	Spec's.
Size	% Passing	% Passing
50mm (2")		
37.5mm (1½")		
25mm (1*)		
19.0mm (‡")		
12,5mm ( <sup>1</sup> / <sub>2</sub> ")		
9.5mm (3/8")		
4.75mm (No.4)		
2.00mm (No.10)	100	
425um (No.40)	94	
180um (No.80)	65	
75um (No.200)	35,7	ł
DUSTRATIO	0.04	± <0.30 %

Maximum Dry Density:	122.4	lbs,/cu. ft.
Optimum Moisture:	10.4%	-
•		•

% Material Field Moisture: 12.8%

ASTM C-117: 30.4%

Fractured Faces	
Liquid Limit	
Plasticity Index	
Soils Classification	
Estimated R-Value	

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#### MOISTURE DENSITY RELATIONSHIP OF SOILS

Customer: Dote Tested:	Golder Associates, Inc. February 11, 2005	Test Type:	Gradation & Proctor
Project Name:	Lysimeter Installation Program Tyrone Mine No. 3X Tailing Pond	Procedure:	ASTM C-117, ASTM C-136, & ASTM D-1557 A
Project No.:	013-1595	Soli Type:	Tallings, Santris yellow & brown in color .

Location:	3X	Dom	NW	Slope	-	Test	Plot

Sieve	Total Sample	Spec's.
Size	% Passing	% Passing
50mm (2*)		
37,5mm (1½")		
25mm (1")	L,-,	
19.0mm $(\frac{1}{4}^{n})$		
$12.5mm(\frac{1}{2})$		
9.5mm (3/8")	{	
4.75mm (No.4)		
2,00mm (No.10)	100	
425um (No.40)	95	
180um (No.80)	52	
75um (No.200)	22.2	
DUST RATIO	0.03	± <0.30 %

Fractured Faces	
Liquid Limit	
Plasticity Index	 
Soils Classification	
Estimated R-Value	

<u>Yeley Loslar</u> Lab Magager This report was prepared by:

Maximum Dry Density: 119. Optimum Moisture: 8.2

119.3 |bs./cu. ft. 8.2%

% Material Field Moisture: \_\_\_\_\_7.2%

ASTM C-117: 19.0%

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FIELD RESULTS FOR SOIL DENSITIES

Date:	February 14, 2005
Customer:	Golder Associates, Inc.
Project:	Lysimeter Installation Program
	Tyrone Mine No. 3X Tailing Pond
Project No.:	013-1595

#### Proctor

#### Top Surface (Sample # 2) 122,4 lbs./cu.ft. ⊕ 10.4% Moisture

Test No. 1		Test No. 4	
Wet Density	114,5	Wet Density	108,5
Moisture	20.2	Moisture	19.9
Dry Density	94.3	Dry Density	88.6
% Moisture	21.4	% Moisture	22.5
% Compaction:	77.0	ኤ Compaction፡	72.4
Location:	Center (58) Top Surface	Location	North (59) 22" Below Top

Test No. 2		Test No. 5	
Wet Density	113,0	Wet Density	89.4
Moisture	1B_3	Moisture	17.9
Dry Density	94.8	Dry Density	71,5
% Maisture	19.3	% Moisture	25.0
% Compaction:	77,5	% Compaction:	58.4
Location:	East (58) Top Surface	Location	South (58) 22" Below Top

Test No. 3		Test No. 6	
Wet Density	105.1	Wet Density	<del>9</del> 9.3
Maisture	15.5	Moisture	19.4
Dry Density	89,6	Dry Density	79.9
% Moisture	17.3	% Moisture	24,3
% Compaction:	73,2	% Compaction:	65.3
Location:	West (5B) Top Surface	Location:	West (58) 23" Below Top

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FIELD RESULTS FOR SOIL DENSITIES

Date:	February 14, 2005
Customer:	Golder Associates, Inc.
Project:	Lysimeter Installation Program
-	Tyrone Mine No. 3X Tailing Pond
Project No.:	013-1595

#### Proctor

#### Top Surface (Sample # 2) 122,4 lbs./cu.ft. © 10,4% Moisture

Test No 7		Test No. 10	
Wet Density	99.5	Wet Density	107,3
Moisture	19.0	Moisture	19.0
Dry Density	80.6	Dry Density	88.3
% Moisture	23.5	% Moisture	21,6
% Compaction:	65.8	% Compaction:	72.1
Location:	Northwest (5B) 55" Below Top	Location	West (5B) 7' Below Top

Test No. 8		Test No. 11	
Wet Density	85.4	Wet Density	108.1
Moisture	20.6	Moisture	26.4
New Density	84 4	Dry Density	81,7
% Moisture	241	% Moisture	32.3
% Compaction:	69.0	% Compaction:	66,7
Location:	North (5B) 56" Below Top	Location	Center (5B) 7'3" Below Top

Test No. 9		Test No. 12	
Wet Density	56.7	Wet Density	107.1
Maisture	17.6	Maisture	25,8
Dry Density	39.1	Dry Dehsity	81.3
% Ministure	23.0	% Moisture	31.7
% Compaction:	31.9	% Compaction:	66.4
Location:	East (5B) 54" Below Top	Location:	South (58) 7' Below Top

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#### FIELD RESULTS FOR SOIL DENSITIES

Date:February 14, 2005Customer:Golder Associates, Inc.Project:Lysimeter Installation ProgramTyrane Mine No. 3X Tailing PondProject No.:013-1595

#### Proctor Top Surface (Sample # 2)

122.4 lbs/cu.ft. @ 10.4% Moisture

Test No. 13		Test No.
Wet Density	104,7	Wet Density
Moisture	21.4	Moisture
Dry Density	B3.3	Dry Density
% Moisture	25,6	% Moisture
% Compaction:	68.1	% Compaction:
Location	Southwest (5B) 9.5' Below Top	[_acation:

Test No. 14		Test No.
Wet Density	102.7	Wet Density
Moisture	23,9	Maisture
Dry Density	78.7	Dry Density
% Maisture	30.4	% Moisture
% Compaction:	64,3	% Comportion:
Location:	Center (58) 9.5' Below Top	Location:

Test No. 15		Test No.
Wet Density	107,6	Wet Density
Moisture	24.2	Moisture
Dry Density	83.4	Dry Density
% Moisture	29.0	% Moisture
% Compaction:	68.1	% Compaction:
Location:	North (5B) 9.5' Below Top	Location:

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#### FIELD RESULTS FOR SOIL DENSITIES

Date;	February 14, 2005
Cystomer:	Golder Associates, Inc.
Project:	Lysimeter Installation Program
-	Tyrone Mine No. 3X Tailing Pond
Project No.:	013-1595

Proctor Top Surface (Sample # 2) 122.4 |bs./cu.ft. @ 10.4% Maisture

Tast No. 1	Test No. 4		
Mat Nondity	104.9	Wet Density	102.2
Mointrune	17.9	Moisture	15.4
housing e	87.0	Dry Density	86.8
". Moisture	20.5	% Maisture	17.7
% Compaction:	71.1	% Compaction:	70,9
Location:	Center (6 C) Top Surface	Location	Northwest (6 C) 2.1' Below Top of Surface

Test No 2		Test No. 5	
Wet Dansity	107.5	Wet Density	108.9
Moidture	20.4	Maisture	19.3
Nor Density	87.1	Dry Density	89.6
S Moietura	23.4	% Maisture	21,5
" Compaction"	71.2	% Compaction:	73.2
Location:	West (6 C) Top Surface	Location	Center (6 C) 2.3' Below Top of Surface

Test No 3		Test No. 6	
Wet baneity	106.6	Wet Density	100.5
Wei Denarry Meiotueo	19.7	Maisture	26,3
Mulaidre Deu Nordiau	84.0	Dry Density	74.2
Dry Density	22.7	% Moisture	35.5
	71.0	% Compaction:	60,6
% composition		( ocation:	Northeast (6 C) 2.2' Below Top of Surface
Location	East (6 C) LOD SALLACE	Evolution.	

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## FIELD RESULTS FOR SOIL DENSITIES

Date:	February 14, 2005
Customer:	Galder Associates, Inc.
Project:	Lysimeter Installation Program
v	Tyrone Mine No. 3X Tailing Pond
Project No.:	013-1595

#### Proctor Top Surface (Sample # 2) 122.4 lbs./cu.ft. @ 10.4% Moisture

Test No. 7		Test No.
Mot Density	107.5	Wet Density
M - Cotring	17.9	Moisture
Mois Iure	89.6	Dry Density
Dry Densny	109	% Moisture
& MOISIUNE	73.2	% Compaction:
% Compaction:	13.5 No. + 14 Ch & 2' Palaw Two of Surface	Location
Location:	NORTH (OC) 4.2 BEING LOP DI SUITAGE	

Test Na B		Test No.
: EST IND. U Wiat Daneitu	102.3	Wet Density
Maitture	16.3	Moisture
Mularure Neu Naneitu	85 B	Dry Density
V Heistung	16.3	% Moisture
N Compartient	70 t	% Comportion:
A COMPLETION	14 CL 2 D' Below Top of Surface	Location:
Location	(d c) 3.3 BERNA INPOL CELLET	

		Test No.
Test INO. 7 Wat Density	108.8	Wet Density
Moisture	19.8	Moisture
Dry Density	88,9	Dry Density
% Moisture	19.8	% Moisture
% Composition:	72.6	% Compaction
Location:	(6 C) 4.3' Below Top of Surface	Location:

oisture mpaction tion:

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FIELD RESULTS FOR SOIL DENSITIES

#### February 15, 2005 Date: Golder Associates, Inc. Customer: Lysimeter Installation Program Project: Tyrone Mine No. 3X Tailing Pond 013-1595 Project No.: Proctor Top Surface (Sample # 2) 122,4 lbs,/cu,ft. @ 10.4% Moisture Test No. 5 Test No. 1 114.5 Wet Density 94.0 Wet Density 17.3 Moisture 13,1 Moisture 97.2 Dry Density 80.9 Dry Density 17.8 % Moisture 16,2 % Moisture 79,4 % Compaction: 66.1 % Compaction: East (5 B) 31" Chitside Lysimeter Locationa East (5 B) 32.5" (A) Below Top of Lysimeter Location: (Backfill) (Backfill) Test No. 6 Test No. 2 110.9 Wet Density 106,0 Wet Density 15.7 Moisture 18.1 Moisture. 95.2 Dry Density 87.8 Dry Density % Moisture 16.4 20.6 % Moisture 77,6 % Compaction: 71.7 % Compaction: 26" Outside Lysimeter Location: Location: North (5 B) 32.5" (B) Below Top of Lysimeter (Backfill) (Backfill) Test No. 7 Test No. 3 107.1 Wet Density 108.8 Wet Density 17.1 Moisture 18.4 Moisture 90.0 Dry Density 90.4 Dry Density 19.0 % Moisture 20.4 % Moisture 73.5 % Compaction: 73,9 % Compaction: 3.5" Below Top of Lysimeter Center of Tank (5 B) 15" Below Top of Lysimeter Location: Location: (Sockfill) (Beckfill) Test No. 8 Test No. 4 104.3 Wet Density 111 B Wet Density 11,5 Moisture 14.9 Moisture Dry Density 92.8 96.9 Dry Dersity 12,4 % Moisture 15.4 % Moisture 75.8 % Compaction: 79.2 % Compaction: 3.5" Below Top of Lysimeter West-inside Tank (5 B) 15" Below Top of Lysimeter Location: Location: (Backfili) (Backfill)

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FIELD RESULTS FOR SOIL DENSITIES

#### Date: February 15, 2005 Customer: Golder Associates, Inc. Project: Lysimeter Installation Program Tyrone Mine No, 3X Tailing Pond Project No.: 013-1595

#### Proctor

Top Surface (Sample # 2) 122,4 lbs./cu.ft. @ 10.4% Moisture

Test No. 9		Test No. 13	
Wet Density	106.5	Wet Density	109.2
Moisture	13,9	Moisture	15.9
Dry Density	92.6	Dry Density	93.3
% Moisture	15,0	% Moisture	17.1
% Compaction:	75.7	% Compaction:	76.2
Location	(5 B) Center inside Top of Lysimeter	Lecation	(5 B) 54" Below Ground Surface
	(Backfill)		(Backfill)

	(Backfill)	
Location:	North (5 B) Top of Lysimeter	Lacation:
% Composition:	67.3	% Compaction:
% Moisture	16.8	% Moisture
Dry Density	82,4	Dry Density
Moisture	13.9	Moisture
Wet Density	96,2	Wet Density
Test No. 10		Test No.

Test No. 11		Test No.
Wet Density	100,8	Wet Density
Moisture	13.3	Moisture
Dry Density	87,4	Dry Density
% Moisture	15.3	% Moisture
% Compaction;	71.4	% Compaction:
Location:	West (58) 54" Below Ground Surface	Location;
	(Backfill)	

Test No. 12		Test No.
Wet Density	109.1	Wet Density
Moisture	13.9	Moisture
Dry Density	95.3	Dry Density
% Moisture	14,5	% Moisture
% Compaction:	77.9	% Compaction:
Location:	(5 B) 54" Below Ground Surface	Location:
-	(Backfill)	

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## FIELD RESULTS FOR SOLL DENSITIES

Date: Customer:	February 15, 2005 Golder Associates, Inc.
Project:	Lysimeter Installation Program
	Tyrone Mine No. 3X Tailing Pond
Project No.:	013-1595

Practor Tap Surface (Sample # 2) 122.4 lbs./cu.ft. @ 10.4% Moisture

Test No. 10			
Wet Density	94.2	Test No. 13	
Moisture	92	Wet Density	109.1
Dry Density	85.0	Moisture	13.3
% Moisture	10,9	Dry Density	95,9
% Compaction:	69.4	% Moisture	13.8
Location:	Southeast (6 C) 6' Below Top of Surface	% Compaction:	78.3
	a second op al santace	Location:	North (6 C) 7.5' Below Top of Surface

Test No. 11			
Wet Density	<b>99</b> 6	Test No. 14	
Moisture	6.1	Wet Density	109.7
Dry Density	93.5	Maisture	15.0
% Moisture	6.5	Dry Density	94.7
% Compaction:	76.4	% Moisture	15.8
Location;	Southwest (6 C) 5 10' Below Top of Such	% Compaction:	77.4
	- Finance	Location:	Northwest (6 C) 7.9' Below Top of Surface

Test No. 12			
Wet Density	94.2	Test No. 15	
Moisture	9.2	Wet Density	109,0
Dry Density	B3.6	Moisture	16.5
% Moisture	11.0	Dry Density	92.5
% Compaction:	68,3	% Moisture	17.8
Location:	North (6 C) 5.9' Below Tan of Sunface	% Composition:	75.6
	S S S S S S S S S S S S S S S S S S S	Location;	Southwest (6 C) 7.0' Below Top of Surface

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#### FIELD RESULTS FOR SOIL DENSITIES

Date: February 15, 2005 Customera Golder Associates, Inc. Project: Lysimeter Installation Program Tyrone Mine No. 3X Tailing Pond 013-1595 Project No.:

#### Proctor

#### Top Surface (Sample # 2) 122.4 lbs./cu.ft. @ 10,4% Maisture

Test No. 16		Test No.
Wet Density	96.5	Wet Density
Moisture	12,1	Moisture
Dry Density	84,5	Dry Density
% Moisture	14.3	% Moisture
% Compaction:	69,0	% Compaction:
Location:	Southeast (6 C) 9.9" Below Top of Surface	Location:

Test No. 17		Test No,
Wet Density	105,5	Wet Density
Moisture	21.9	Moisture
Dry Density	83.5	Dry Density
% Moisture	26,2	% Moisture
% Composition:	68.2	% Compaction:
Location:	West (6 C) 9.9' Below Top of Surface	Location:

Test No. 18		Test No.
Wet Density	105.9	Wet Density
Moisture	22,7	Moisture
Dry Density	83.2	Dry Density
% Moisture	27.3	% Moisture
% Compaction:	68.O	% Compaction:
Location:	(6 C) 9.8' Below Top of Surface	Location

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#### FIELD RESULTS FOR SOIL DENSITIES

Date:	February 16, 2005
Customer:	Golder Associates, Inc.
Project:	Lysimeter Installation Program
	Tyrone Mine No, 3X Tailing Pond
Project No.:	013-1595

#### Proctor

#### Top Surface (Somple # 2) 122,4 lbs./cu.ft. @ 10.4% Moisture

Test No. 1		Test No. 5		
Wet Den≲ity	110.2	Wet Density	100,9	
Maisture	15.0	Moisture	10.0	
Dry Density	95.2	Dry Density	90.9	
% Moisture	15.7	% Maisture	11.1	
% Compaction:	77.8	% Compaction:	74,3	
Lacation:	West (6 C) 35" Below Top of Lysimeter	Location:	North (6 C)	18.5" Below Top of Lysimeter
podanon.	(Backfill)		(Backfiil)	
	•			

Test No. 2 Wet Densily Moisture Dry Density % Moisture % Compaction: Location:	109.2 13.2 96.0 13.8 78.4 Center (6 C) 35" Below Top of Lysimeter	Test No, 6 Wet Density Moisture Dry Density % Moisture % Compaction: Location:	103.8 11.2 92.6 12.1 75.7 West (6 C) 18.5" Below Top of Lysimeter
Location:	(Backfill)		(Backfill)

Test No. 3		Test No. 7		
Wet Density	102,5	Wet Density	102.0	
Maisture	16.2	Moisture	9.9	
Dry Density	86,3	Dry Density	92.1	
% Moisture	18.8	% Moisture	10,7	
% Compaction:	70.5	% Compaction:	75.2	_
Location:	North (6 C) 35" Below Top of Lysimeter	Location	Center (6 C) E	" Below Top of Lysimeter
	(Backfill)		(Backfil <del>l</del> )	

Test No. 4		Test No. 8	
Wet Density	109.1	Wet Density	98.2
Moisture	10.9	Maisture	10,5
New Density	98.2	Dry Density	87.7
4 Maistures	111	% Moisture	11,9
Y Compaction'	80.2	% Compaction:	71.7
Location:	South (6 C) 18.5" Below Top of Lysimeter	Location:	Southwest (6 C) 5" Below Top of Lysimeter
•	(Backfill)		(Backfill)

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#### FIELD RESULTS FOR SOIL DENSITIES

Date:	February 16, 2005
Customer:	Golder Associates, Inc.
Project:	Lysimeter Installation Program
	Tyrons Mine No. 3X Tailing Pond
Project No.:	013-1595

#### Proctor Top Surface (Sample # 2) 122.4 lbs./cu.ft. @ 10.4% Moisture

Location:	North (6 C) 5" Below Top of Lysimeter (Backfill)	Location:	South (6 C) 17" Below Top of Lysimeter - Outside (Backfill)
% Compaction:	70.0	% Compaction:	64.5
% Moisture	13_4	% Moisture	21,6
Ory Density	85.7	Dry Density	79.0
Moisture	11,5	Moisture	17,1
Wet Density	97.2	Wet Density	96.1
Test No. 9		Test No. 13	

Test No. 10		Test No, 14	
Wet Density	104.3	Wet Density	108.3
Moisture	15,8	Moisture	15.8
Dry Density	88.4	Dry Density	92.4
% Moisture	17.9	% Moisture	17,2
% Compaction:	72.2	% Compaction:	75.5
Location	South (6 C) 7,5' Below Ground Surface	Location:	Center (6 C) 4' Below Ground Surface
	(Backfill)		(Backfill)

Test No. 11		Test No. 15	
Wet Density	111,B	Wet Density	102,4
Moisture	16.1	Koisture	16.5
Dry Density	95.7	Dry Density	65,8
% Moisture	16.8	% Moisture	19.3
% Compaction:	78.2	% Compaction:	70,1
Location:	North (6 C) 7.5' Below Ground Surface	Location	East (6 C) 4' Below Ground Surface
	(Backfill)		(Backfill)

	(Backfill)		(Backfill)
Location:	Northwest (6 C) 17" Below Top of Lysimeter - Outside	Location:	South (6 C) 4' Below Ground Surface
% Compaction:	74.5	% Compaction:	77.5
% Moisture	18_4	% Maisture	14.4
Dry Density	91.2	Dry Density	94.8
Moisture	16,8	Moisture	13,7
Wet Density	108.0	Wet Density	108.5
Test No. 12		Test No. 16	

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Page 3 of 3

505-537-3466 505-537-3774 (fox)

#### FIELD RESULTS FOR SOIL DENSITIES

Date:	February 16, 2005
Customer:	Golden Associates, Inc.
Project:	Lysimeter Installation Program
-	Tyrone Mine No. 3X Tailing Pond
Project No.:	013-1595

Proctor

#### Top Surface (Sample # 2) 122,4 lbs./cu.ft, @ 10.4% Moisture

Test No. 17		Test No.
Wat Nancity	t12.2	Wet Density
Majetuna	23.0	Moisture
New Density	89.2	Dry Density
V Maisture	25.B	% Moisture
% Compaction:	72.9	% Compaction:
Location:	Northeast (6 C) 32" Below Ground Surface	Location:
-	(Backfill)	

Teet Na 18		Test No.
Wet Density	107.5	Wet Density
Moisture	18.1	Moisture
hey Density	89,4	Dry Density
% Moisture	20.2	% Moisture
% Compartion:	73.0	% Compaction:
Location:	South (6 C) 32" Below Ground Surface	Location
-	(Backfill)	

Tast Na 10		Test No.
Wet Dansity	100.0	Wet Density
Woistune	15.9	Moisture
Now Density	84.1	Dry Density
% Moi≼ture	18.9	% Moisture
% Composition:	68,7	% Compaction:
Incation:	North (6 C) 32" Below Ground Surface	Location:
Frent al.	(Bockfill)	

Test No. Wet Density Molsture Dry Density % Moisture % Compaction: Location: Test No. Wet Density Moisture Dry Density & Moisture & Compaction: Location:

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#### FIELD RESULTS FOR SOIL DENSITIES

Date:	February 16, 2005	
Customer:	Golder Associates, Inc.	
Project:	Lysimeter Installation Program	
•	Tyrone Mine No. 3X Tailing Pond	
Project No.:	013-1595	

#### Proctor

Top Surface (Sample # 2) 122,4 lbs./au.ft. @ 10.4% Moisture

Test No. 14		Test No. 18	
Wet Density	96.9	Wet Density	99.8
Moisture	14,1	Maisture	17.7
Dry Density	82.6	Dry Density	82.1
% Moisture	17_0	% Moisture	21.5
% Compaction:	67.6	% Compaction:	67,1
Location;	(5 B) 54 <sup>M</sup> Below Ground Surface	Location: (5)	<ol> <li>28" Below Ground Surface</li> </ol>
-	(Backfill)	(Br	ackfill)

Test No. 15		Test No. 19		
Wet Density	106.6	Wet Density	108.5	
Moisture	17.2	Moisture	15.2	
Dov Density	89.4	Dry Density	93.3	
% Moisture	19.3	% Moisture	16.3	2
A Composition:	73.0	% Compaction:	76,2	ζ.2
Location:	West (5 B) 28" Below Ground Surface	Location	Southwest (5 B)	Final Top Surface
	(Backfill)		(Backfill)	

Test No. 16			Test No. 20	
Wet Density	107.0		Wet Density	119.2
Maisture	14.7		Moisture	20.5
Day Depeity	92.3		Dry Density	98,7
% Moisture	t4.7		% Moisture	20.8
<sup>a</sup> ) Compaction:	75.4		% Compaction:	80,6
location.	Center (5 B) 31"	Relow Ground Surface	Location:	East (5 B) Final Top Surface
Location-	(Backfill)			(Bockfill)

Test No. 17			Test No. 21	
Wet Density	108,4		Wet Density	114,5
Maisture	19		Moisture	18.5
Dev Density	89.4		Dry Density	96,1
% Maisture	21.2		% Moisture	19.2
% Compaction:	73.0		% Compaction:	78,5
Lacation:	Fast (5 B) 30"	Below Ground Surface	Location:	Center (5 9) Final Top Surface
Locelien	(Backfill)			(Backfill)

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#### FIELD RESULTS FOR SOIL DENSITIES

February 17, 2005 Date: Golder Associates, Inc. Customer: Lysimeter Installation Program Project: Tyrone Mine No. 3X Failing Pond 013-1595 Project No.:

Proctor

#### Top Surface (Somple # 2) 122.4 lbs./cu.ft. @ 10.4% Moisture

Test No. 20		Test No.
Wet Density	111.B	Wet Density
Moisture	20.6	Moisture
Dry Density	91.1	Dry Density
% Moisture	22.6	% Moisture
% Composition:	74.4	% Compaction:
Location:	South (6 C) Final Top Surface	(Location)
	(Backfill)	

Test No. 21		Test No.
Wet Density	114.6	Wet Density
Moisture	24,0	Moisture
Dry Density	90.6	Dry Density
% Moisture	26,5	% Moisture
% Compaction:	74.0	% Compaction:
Location:	North (6 C) Final Top Surface	Location:
	(Backfill)	

Test No. 22		Test No.
Wet Density	114.4	Wet Density
Moisture	22,3	Moisture
Dry Density	92.1	Dry Density
% Moisture	24,2	% Moisture
% Compaction:	75.2	% Compaction:
Location:	Northwest (6 C) Final Top Surface	Location:
	(Backfill)	

Test No,
Wet Density
Maisture
Dry Density
% Moisture
% Compaction:
Location:

Test No. Wer Density Moisture Dry Density % Moisture % Compaction: Location:

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#### FIELD RESULTS FOR SOIL DENSITIES

Date:	March 1, 2005
Customer:	Golder Associates, Inc.
Project:	Lysimeter Installation Program
-	Tyrone Mire No. 3X Tailing Pond
Project No.:	<b>G13-1595</b>

#### Proctor

#### NW Slope (Test Plot) 119.3 lbs./cu.ft. © 8.2% Moisture

Test No. 1		Test No. 5	
Wet Density	89.5	Wet Density	67,7
Moisture	4.9	Moisture	3. <del>6</del>
Dry Debsity	84.6	Dry Density	64.1
% Maisture	5,8	% Moisture	5.6
% Combaction:	70.9	% Compaction:	53,7
Location	SW (1 A) 39" Selow Top of Lysimeter	Locations	(1 A) 15" Below Top of Lysimeter
	(Backfill)		(Backfill)

Location:	SW (1 A) 39" Below Top of i-ysimeter (Backfill)	Location:	(I A) 15" Below top of Lysimeter (Backfill)
% Compaction:	73.3	% Compaction:	53.3 
% Moisture	4.6	% Moisture	5.7
Dry Density	87.4	Dry Density	63.6
Moisture	4.0	Maisture	3,6
Wet Density	87.4	Wet Density	67.2
Test No. 2		Test No. 6	

% Compaction: Location:	69.8 SW (1 A) 39" Below Top of Lysimeter <b>(Backfill)</b>	% Compaction: Location:	55.2 (1 A) O" Below Top of Lysimeter (Backfill)
% Moisture	5.2	% Moisture	5.7
Moisture Dev Dandity	4.4 83 3	Dry Density	65.8
Wet Density	87.7	Wet Density Maisture	69.6 3.8
Test No. 3		Test No. 7	

% Compaction: Location: (1 A) 15"	i)		(Backfill)
% Compaction:	Below Top of Lysimeter	Locotian:	(I A) O BEIOW TOP OF LYSIMICTO
	03.1	Se compaction	(1 A) D <sup>e</sup> Balow Tes of Lysimater
JS 201011510115		% Construction:	53.9
9 Maidtuna	66	% Moisture	6.3
ስrv Density 👘	53.3	Dry Density	64.3
Moisture	4 2	Moisture	4.0
Wet Density (	57.5	WEI DENSITY	40
Test No. 4		Test No. 8	

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#### FIELD RESULTS FOR SOIL DENSITIES

# Date: March 1, 2005 Customer: Golder Associates, Inc. Project: Lysimeter Installation Program Tyrone Mine No. 3X Tailing Pond Project No.: 013-1595

#### Proctor

#### NW Slope (Test Piot) 119,3 lbs./cu.ft. @ 8.2% Moisture

Test No. 9		Test No 13	
Wat Density	69.0	Wet Density	91.9
Moisture	3,6	Moistane	5.3
Dry Density	65.3	Dry Density	86.6
% Moisture	5,6	% Moisture	6.1
% Compaction:	54.7	% Compaction:	72,6
Location:	(1 A) O" Below Top of Lysinuter	Location:	(1 A) 40" Below Ground Surface
·	(Backfill)		(Backfill)

	(Backfill)		(Backfill)
Location:	(1 A) 4' Below Ground Surface	[.ocation:	(1 A) 40" Below Ground Surface
% Compaction:	50.9	The Compaction:	ALC AND ADD ADD ADD ADD ADD ADD ADD ADD ADD
% Moisture	10.3	A MOISTURE	7.0
Ory Density	6U.7		70
Moisture	0.2	Der Densitu	84.9
M interes	6.2	Moisture	6,Û
Wet Density	66,9	Wet Density	90.9
Test No. 10		Test No. 14	

	(Backfill)		(BacKtill)
Location	(1 A) 4' Below Ground Sustace	μοσαξιοη:	
% Compaction:	52.6	% Composition:	70.3 To AN 103 Delaw Convert Surface
% Moisture	10.1		75.2
Dry Defisity	02,0	Y Muisture	79
N	4.2 R	Dry Density	89.8
Moisture	6.3	Moisture	7.1
Wei Density	691	Wet Densily	96.8
Test No. 11		Test No. 15	

	(Backfill)		(Backfill)
Location:	(1 A) 4' Below Ground Surface	Location:	(1 A) 23" Below Ground Surface
% Compaction:	65.7	% Composition:	69.8
% Moisture	4.8	% Moisture	8,2
Ory Density	78.4	Dry Density	83.3
Moisture	3.8	Moisture	6,8
Wet Density	82.2	Wet Density	50 1
Test No. 12		Test No. 16	

This report was prepared by:

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#### FIELD RESULTS FOR SOIL DENSITIES

Date:March 1, 2005Customer:Golder Associates, Inc.Project:Lysimeter Installation ProgramTyrone Mine No. 3X Tailing PandProject No.:013-1595

#### Proctor

#### NW Slope (Test Plot) 119.3 lbs./cn.ft. @ 8.2% Moisture

Test No. 17		Test No.
Wet Density	94,5	Wet Density
Maisture	8.8	Moisture
Dev Density	85.7	Dry Density
% Moisture	10 2	% Moisture
% Composition:	71.8	% Compaction:
Lacation:	(1 A) 23" Below Ground Surface	Location:
-	(Backfill)	

Test No. 1B		Test No.
Wet Density	95,8	Wet Density
Moisture	5.9	Moisture
Dry Density	89.9	Dry Density
% Moisture	6.6	% Moisture
% Composition:	75.4	% Compaction:
Location	(1 A) 23" Below Ground Surface	Location:
	(Backfill)	

Test Na. Wet Density Moisture Dry Density % Moisture % Compaction: Location:

Test No. Wet Density Moisture Dry Density % Muisture % Compaction: Location:

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Test No Wet Density Moisture Dry Density % Moisture % Compaction: Location:

Test No, Wet Density Moisture Dry Density % Moisture % Compaction: Location:

als Mand

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#### FIELD RESULTS FOR SOIL DENSITIES

Oote: March 1, 2005 Customer: Golder Associates, Irc. Project: Lysimeter Installation Program Tyrone Mine No. 3X Tailing Pand Project No.: 013-1595

#### Proctor

#### NW Slope (Test Plot) 119,3 lbs./cu.ft. @ 8.2% Maisture

Text No. 1		Test No. 5	
Vest Newsity	93.8	Wet Density	66.3
Mosture	8.5	Moisture	<u>ь.2</u>
Dry Dersity	85.2	Dry Density	60.1
% Moisture	10.0	% Moisture	10.4
% Compaction:	71,4	% Compaction:	50.4
Location:	(1 A) 24" Below Ground Surface	(noiteoa)	(1 A) 45" Selew Ground Surface
	(Embankment)		(Embankment)

	(Embankment)		(Empankment)
Location:	(LA) 20" Below Ground Surface		(I A) 43 Below (Found Surface)
% Compaction:	47,4	76 COMIDECTION	(1. A) A98 B-Jaw Geouxá Surface
% Moistine	15.3		74.4
Dry Density	0.0	V Maisture	71
MOISTURE	0.7	Dry Density	<b>88</b> ,7
the future	 07	Mossture	6.3
Wat Density	65.3	Wet Density	95,1
Test No. 2		Test No. 6	

	(Embankment)		(Embankment)
Location:	(1 A) 20" Below Ground Surface	Localism	(*
a compaction.		Location:	(1 A) 72" Below Ground Surface
W. C	67.6	% Compaction:	49.0
% Moisture	9,3	% Moisture	32,1
Dry Density	B0.6	Dry Density	58.4
Maisture	7.5	MOISTARE	59.4
Wet Density	88.1	WEI Designing	73
Test No. 3		lest INO, 7 Valat Dubsitu	65.5
		Test No. 7	

	(Embankment)		(Empanament)
Location:	(1 A) 20" Below Ground Surface	LOCATION	(Fight culture =====
% содрасное	00	l - cetion:	(1 A) 58° Below Ground Surface
20 F	75.0	% Compaction:	49.6
2. Muisture	7.t	% Moisture	17.7
Dry Density	89.5	Dry Density	59.2
Moisture	6.4		50.2
Wet Gensity	ל הג	Moretues	7.5
1631440.4	DE D	Wet Dersity	66,7
Tast No. 4		Test No. B	

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#### FIELD RESULTS FOR SOIL DENSITIES

# Date:March 1, 2005Custonier:Golder Associates, IXC.Project:Lysimeter Installation ProgramTyrore Mine No. 3X Tailing PondProject No.:013-1595

#### Proctor

#### NW Slope (Test Plat) 119.3 lbs./cu.ft. @ 8,2% Moisture

Test No. 9		Test No. 13	
Wat Density	64.6	Wet Density	67.2
Waisture	7.8	Mossiure	6,3
norshans nev Density	56,8	Dry Density	60.8
% Moisture	13.8	% Moisture	10.4
% Compaction:	47.6	% Compaction:	51.0
2 ocation;	(1 A) B'1/2" Below Ground Surface	Location:	(1 A) 48" Beiow Ground Surface
	(Embankment)		(Embankment)

	(Embankment)		(Embankment)
Location	(1A) 8'1/2" Below Ground Surface	Locations	
% Compaction:	40.7	·····-	(1 A) A' Palow Ground Surface
	46 7	% Compaction:	67.4
% Moisture	13.0	% Maisture	8.0
Dry Depsity	55.7	Dry Density	8U.4
Moisture	7_2	MOISTINE	0.4
Wet Density	63.0	MET MENSITY	2 A
Test No 10		Test No. 14	4 K K

% Composition: Location:	(1 A) 8'1/2" Below Ground Surface (Embankment)	Location:	(1 A) 40' N from Lysimeter Top Surface (Embankment)
W. Commentings		% Compaction:	74,7
% Moistuce	10,9	% Moisture	8.0
Dry Density	57.3	Dry Density	89.1
Moisture	6,2	Moisture	7.2
Wet Density	63.6	Wet Density	96.3
Test No. 11		Test No. 15	

	(Embankment)		(Embankment)
Location	(1 A) 28" Below Ground Surface	Location;	(1 A) 50° N from Lystmeter top Surface
% Compaction:	77,1	% Compaction:	51.7 Mail Folklin, Lucia about Ten Sumford
% Maisture	6.6	76 Moisture	10.9
Dry Density	92	Dry Dehsity	61,7 10.0
Moisture	8.1	Moisture	6.7
Wet Density	100.8	Wet Density	68,4
Test No 12		Test No. 16	

This report was prepared by:

Jacky Lenbe

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#### FIELD RESULTS FOR SOIL DENSITIES

Date:	Morch 1, 2005
Customer:	Golder Associates, Inc.
Project:	Eysimeter Installation Program
	Tyrone Mine No. 3X Tailing Pond
Project No.:	013-1595

#### Proctor

#### NW Slope (Test Plot) 119.3 lbs./cu.ft. @ 8.2% Moisture

2000/1014	(Embarkment)	
i ocation;	(1 A) 90' SE from Lysimeter Top Surface	Location:
% Compaction:	72,2	% Compaction:
% Moisture	6.8	% Moisture
Dry Density	86.1	Dry Density
Moisture	5.9	Moisture
Wet Density	92,0	Wet Density
Test No. 17		Test No.

ĩ'est No. 1B		Rest No.
Wet Density	90,0	Wet Density
Moisture	5.1	Moisture
Ony Density	64,9	Dry Density
% Moisture	6.0	% Moisture
% Compaction:	71 2	% Compaction:
Location:	(1 A) 120° S from Lysimeter Top Surface	Location:
	(Embankment)	

Test No.
Wet Density
Moisture
Dry Density
% Moisture
% Compaction:
Lacation:

This report was prepared by:

Test No. Wet Density Molsture Dry Density % Moisture % Compaction: Location: Test No. Wet Density Maisture Dry Density % Maisture % Compaction: Locotion:

Test No. Wet Density Moisture Dry Density % Moisture % Compaction: Location:

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Frage J. O. X.

FIELD RESULTS FOR SOIL DENSITIES

#### March 1, 2005 Date: Golder Associates, Inc. Customer: Lysimeter Installation Program Project: Tyrone Mine No. 3X Tailing Pond 013-1595 Project No.

#### Proctor

#### NW Slope (Test Plot) 119.3 lbs./cu.ft. @ 8.2% Moisture

	(Embankment)		(Embankment)
Locations	(2 A) Z' Below Ground Surface	Location:	(2 A) 4' Below Ground Surface
% Compaction:	75.1	% Compaction	65.5
% Maisture	13,4	% Moisture	8.2
Dry Density	89.6	Dry Dersity	78.1
Moisture	10,2	Moisture	6.4
Wet Density	99.8	Wet Density	84.5
Test No. 1		Test No. 3	

Test No. 2		₹est No. 6	
Wet Density	66.2	Wet Density	92.8
, Moisture	7.4	Moisture	9.0
Dry Density	58.8	Dry Density	83.7
% Maisture	12,6	% Moisture	10 8
% Combaction:	49.3	% Compaction:	70.2
Locations	(2 A) 2' Below Ground Surface	Location:	(2 A) 4' Below Ground Surface
-	(Embankment)		(Embankment)

	(Embaskment)		(Embankment)
Location:	(2 A) 2' Below Ground Surface	Location:	(2 A) 6' Below Ground Surface
% Compaction:	50,3	% Compaction:	67,9
% Moisture	12.8	% Moisture	9.2
Dry Density	60,0	Dry Density	81,0
Moisture	6.5	Maisture	7.4
Wet Density	66.4	Wet Dansity	88.4
Test No. 3		Test No. 7	

	(Embankment)		(Embankment)
Lacations	(2 A) 4' Below Ground Surface	Location:	(2 A) 6' Below Ground Surface
% Compaction:	66.1	% Compacition:	50.5
% Moisture	9.6	% Moisture	11.2
Dry Density	78.8	Dry Density	60.2
Moisture	7.6	Moisture	6.7
Wet Density	86.4	Wet Density	66.9
Test No. 4		Test No. 8	

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#### FIELD RESULTS FOR SOIL DENSITIES

Date:	March 1, 2005
Customer:	Golden Associates, Inc.
Project:	Lysimeter Installation Program
	Tyrone Mine No. 3X Tailing Pund
Project No.:	013-1595

#### Proctor NW Slope (Test Plot)

119.3 [bs./cu.ft. @ 8.2% Moisture

Test No. 9		Test No. 13	
Wet Depsity	93.5	Wet Density	102,9
Moisture	6.0	Moisture	8.8
Dry Density	87.6	Dry Density	94,1
% Moisture	68	% Moisture	9.3
% Compaction:	73.4	% Compaction:	78,9
Location:	(2 A) 6' Beiow Ground Surface	Location:	(2 A) 100' SE Top Surface
	(Embankment)		(Embankment)

Test No. 10		Test No. 14	
Wet Density	67,6	Wet Dersity	98.5
Moisture.	6.4	Moisture	8,0
Dry Density	614	Dry Density	98.5
% Moisture	10.4	% Moisture	8.1
% Compaction:	51,5	% Compaction:	B2.6
Location:	(2 A) 8' Below Ground Surface	Location:	(2 A) 50' E
	(Embankment)		(Embankment)

	(Embonkment)		(Embankment)
Location:	(2 A) 8' Below Ground Surface	Location	(2 A) 50' NW
% Compaction:	47,2	% ζοπραστιση:	79.2
% Moisture	13.6	% Muisture	1,7
Ory Density	56,3	Dry Density	94.5
Moisture	7.7	Moisture	8.3
Wet Density	64.0	Wet Density	102.8
Test No. 11		Test No. 15	

Test No. 12		Test No.
Wet Density	65,9	Wat Density
Moisture	7.1	Moisture
Dry Density	58.9	Dry Density
% Moisture	(2.0	% Moisture
% Compaction:	49.4	% Composition:
Locations	(2 A) 8' Below Ground Surface	Location:
	(Embankment)	

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Page 1 of 4

505-537 3774 (fox)

#### FIELD RESULTS FOR SOIL DENSITIES

Date: March 2, 2005 Customer: Golder Associates, Inc. Project: Lysimeter Installation Program Tyrone Mine No. 3X Tailing Pond Project No.: 013-1595

## Proctor

NW Slope (Test Plat) 139,3 ibs./cu.ft. @ 8.2% Moisture

Test No. 1		Test No. 5	
Wet Density	88.0	Wet Density	66.5
Moisture	85	Moisture	7,1
Dry Density	79.5	Dry Density	59.4
% Moisture	10,7	% Moisture	ti,9
% Compaction:	66.6	% Compaction:	49.8
Location:	(2 A) 26" Below Top of Lysimeter	Location;	(Z A) 26" Below Top of Lysimeter
•- · · · ·	(Backfill)		(Backfill)

Test No. 2		Test No. 6	
Wet Density	65.7	Wet Density	68.3
Moisture	6.2	Moisture	6.7
Dry Density	59.4	Dry Density	61.6
% Moisture	10.5	% Moisture	20.9
% Composition:	49.8	% Compaction:	51.6
Location:	(Z A) 26" Below Top of Lysimeter	Location	(2 A) O" Below Top of Lysimeter
Locarron.	(Backfill)		(Backfill)

	(Backfill)		(Backfill)
Location	(2 A) 26" Below Top of Lysimeter	Location:	(2 A) O" Below Top of Lysinetes
% Compaction:	49.8	% Compution:	52,1
% Moisture	14.0	% Moisture	8.5
Dry Density	59.4	Dry Density	62,1
Moisture	8.4	Moisture	5.3
Wet Density	67.8	Wet Density	67,4
Test No. 3		Test No. 7	

	(Backfill)	
Lacation:	(2 A) 26" Below Top of Lysimeter	
% Compaction:	49.0	
% Moisture	11,7	
Dry Density	58.5	
Moisture	6,8	
Wet Dersity	66.3	
Test No. 4		

(Backfill) Test No. 8 Wet Density 69.0 Moisture 4.6 Dry Density 64.4

% Moisture 7.2 % Compaction: 54.0 Location: (2 A) O" Below Top of Lysimeter (Backfill)

Lab Monager/

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P.O. 8ox 475 Boyard, NM 88023 505-537-3466

Page 2 of A

505-537-3774 (tax)

#### FIELD RESULTS FOR SOIL DENSITIES

#### March 2, 2005 Date: Customer: Golder Associates, Inc. Lysimeter Installation Program Project: Tyrone Mine No. 3X Tailing Pond 013-1595 Project No.: Proctor NW Slope (Test Plot) 119.3 lbs./cu.ft. @ 8.2% Moisture Test No. 13 Test No. 9 Wet Density 68.0 68.0 Wet Density Maisture 6.2 5,9 Moisture Dry Density 61.8 62.1 Dry Density % Moisture 10 1 9.5 % Maisture % Compaction: 51.8 521 % Compaction: (2 A) O" Below Top of Lysimeter (Outside) (2 A) 0° Below Top of Lysimeter Location Location: (Backfill) (Backfill) Test No. 14 Test No. 10 68,2 Wet Density 67.5 Wet Density Moisture 7.4 5,0 Moisture 60,7 Dry Density Dry Density 62.5 12.2 % Moisture % Moisture 7,9 50,9 % Compaction: % Compaction: 52.4 (2 A) O" Below Top of Lysimeter (Outside) Location: Location (2 A) O" Below Top of Lysunctor (Backfill) (Backfill) Test No. 15 Test No. 11 Wet Density 94,9 67.0 Wet Density Moisture 8.4 6.9 Moisture 86,5 60.0 Dry Density Dry Density % Maisture 9.8 115 % Muisture % Compaction: 72,5 % Compaction: 50.3 (2 A) O" Below Top of Lysimeter (Outside) Location: Locations (2 A) 24° Below Top of Lysimeter (Outside) (Backfill) (Backfill) Test No. 16 Test No. 12 Wet Density 94,4 89.9 Wet Density Moisture 6.6 Moisture 6,7 67.B Dry Density 63.3 Dry Density % Moisture 7.5 8.0 % Moisture % Compaction: 73.6 69.B % Cumpaction: (2 A) 3'1/2" Below Ground Surface Location: (2 A) 24" Below Top of Lysimeter (Outside) Location: (Backfill) (Backfill)

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Face 5 of 4

605-537-3774 (fux)

#### FIELD RESULTS FOR SOIL DENSITIES

March 2, 2005 Dute: Customer: Galder Associates, Inc. Lysimeter Installation Program Project: Tyrone Mine No. 3X Tailing Pond 013-1595 Project No.: Proctor NW Slope (Test Piot) 119.3 lbs./cu.ft. @ 8.2% Moisture Test No. 17 Test No. 21 Wet Density 88.7 93.7 Well Density Moisture 4,8 Moisture 7.1 Dry Density 83.9 86.1 Dry Density % Moisture 5.78.2 % Moisture 70.3 % Compaction: 72.2 % Compaction: (2 A) 2' Below Ground Surface (2 A) 3'1/2" Below Ground Surface Location: Location: (Backfill) (Backfill) Test No. 22 Test No. 1B 94.7 94.9 Wet Density Wet Density Moisture 5,6 6.9 Moisture 88.5 88.0 Dry Density Dry Density 6,9 % Moisture % Moisture 7.8 74.2 73.8 % Compaction: % Compaction: (2 A) O" Below Ground Surface (2 A) 3°1/2" Below Ground Surface Location: Location: (Backfill) (Backfill) Test No. 23 Test No. 19 91.0 Wet Density 93.0 Wet Density Moisture 7.3 Moisture 5.8 85.7 85.2 Dry Density Dry Sensity % Moisture 6,6 6.8 % Maisture % Compaction: 71.8 71.4 % Compaction: (2 A) O" Below Ground Surface Location: (2 A) 2' Below Ground Surface Location: (Backfill) (Backfill) Test No. 24 Test No. 20 Wet Density 69.7 Wet Density 84.3

Moisture 5,5 Moisture 7.Z Dry Density 84.2 Dry Density 77,1 % Moisture 6,5 % Moisture 9.4 % Compaction: 70.6 64.6 % Compaction: (2 A) O" Below Ground Surface Location: (2 A) 2' Below Ground Surface Location: (Backfill) (Backfill)

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P.D. Box 475 Bayand, NM 88023 EAE 500

Page 4 of 4

505 537 3466 505-537-3774 (fux)

#### FIELD RESULTS FOR SOIL DENSITIES

Date: March 2, 2005 Customer: Golder Associates, Inc. Project: Lysimeter Installation Program Tyrone Mine No. 3X Tailing Pond Project No.: 013-1595

Proctor

#### NW Słope (Test Plot) 119.3 ibs./cu.ft. @ 8.2% Moisture

Test No. 25		Test No.
Wet Density	111.5	Wet Density
Moisture	7.6	Maisture
Drv Density	103.9	Dry Density
% Moisture	7.3	% Moisture
% Compuction:	87.1	% Compaction:
.acation: (2	A) Final Grade	Location:
(E	lackfill)	
Test No. 26		Test No.
Wet Density	96,9	Wet Density
Mnisture.	5.9	Moisture
Dry Density	91_0	Dry Density
% Maisture	6.5	% Moisture
% Compaction:	76.3	% Compaction:
location: {á	A) Final Grade	{Jocation:
0	3ackfill)	
Test No. 27		Test No.
Wet Density	105,9	Wet Density
Moisture	8.2	Moisture
Dry Density	97,7	Ory Density
% Moisture	8.4	% Moisture
% Compaction:	81,9	% Compaction:
Location: (	2 A) Final Grode	Location:
(	Backfill)	

Test No. Wet Density Moisture Dry Density % Moisture % Compaction: Location:

This report was prepared by:

Test No. Wat Dansity Moisture Dry Dansity % Moisture % Compaction: Location:

Cher Re la

**APPENDIX H** 

## METEOROLOGICAL STATION CALIBRATION DOCUMENTATION

# No.3K Tailing

## **Calibration Certificate**

#1A3X 3:1 Slope 2' cover

Calibration Date:	April 1, 2005
Work Order No.:	PO1786
Transducer Type:	PDCR 1830-8388
Serial Number:	2104243
Range:	5 psi g
Supply:	10 Volts
Sensitivity:	49.30mV
Non-linearity & Hysteresis:	±0.1% BSL
Temperature Operating Range:	
Compensated Temperature Range:	-2° to +30°C
Temperature Error Band:	±0.3%
Thermal Zero Shift:	
Thermal Sensitivity Shift:	

Electrical C	onnection	Monitor
Supply Positi	Ve: RED	ORANGE
Supply Nego	itive: WHITE	BLACK
Output Posit	ive: YELLOW	
Output Nego	tive: BLUE	
Screen:	CONNECTED TO BO	DDY

Notes:

## 220 ft. of depth caple

GE Infrastructure Sensing 4 Dunham Drive New Fairfield, CT 06812 T 203-746-0400 F 203-746-2494 www.gesensing.com





QSF-A116 Rev. B

## No.3X Tailing

#ZA3X

## Calibration Certificate

3:1 Slope 3' Cover

Calibration Date:	April 1, 2005
Work Order No.:	PO1786
Transducer Type:	PDCR 1330-8388
Serial Number:	2104241
Range:	5 psi g
Supply:	10 Volts
Sensitivity:	49.14mV
Non-linearity & Hysteresis:	±0.1% BSL
Temperature Operating Range:	
Compensated Temperature Range:	-2° to +30°C
Temperature Error Band	±0.3%
Thermal Zero Shift:	
Thermal Sensitivity Shift:	
Electrical Connection	Monitor
Supply Positive: RED	ORANGE

Supply Positive:	RED	ORANG
Supply Negative	2: WHITE	BLACK
Output Positive:	YELLOW	
Output Negative	BLUE	
screen:	COMMECTED TO BODY	

Notes:

## 30 ft. of depth cable

GE Infrastructure Sensing 4 Dunham Drive New Fairfield, CT 06812 T 203-746-0400 F 203-746-2494 www.gesensing.com





QSF-A116 Rev. B.

# No.3x Tailing

## Calibration Certificate

2' Top Surface cover

> Monitor ORANGE

Calibration Date:	April 1, 2005
Work Order No.:	PO1786
Transducer Type:	PDCR 1830-8388
Serial Number:	2104244
Range:	5 psi g
Supply:	10 Volts
Sensivity:	49.35mV
Non-linearity & Hysteresis:	±0.1% BSL
Temperature Operating Range:	
Compensated Temperature Range:	-2° to +30°C
Temperature Error Band:	±0.3%
Thermal Zero Shift:	
Thermal Sensitivity Shift:	

Electrical Conn	lection
Supply Positive:	RED

Supply Nego	Itive: WHITE	BLACK
<b>Output Posit</b>	ive: YELLOW	
Output Nego	tive: BLUE	
Screen	CONNECTED TO BO	DV

Notes:

## 250 ft. of depth cable

GE Infrastructure Sensing 4 Dunham Drive New Fairfield, CT 06812 T 203-746-0400 F 203-746-2494 www.gesensing.com





QSF-A116 Rev B

## No.3x Tailing



#LC3X 3' COVER TOP SUIFACE

	Calibration Date:	April 1, 2005
	Work Order No.:	P01786
	Transducer Type:	PDCR 1830-8388
	Serial Number:	2104242
	Range:	5 psi g
	Supply:	10 Volts
	Sensivity:	49.52mV
	Non-linearity & Hysteresis:	±0.1% BSL
	Temperature Operating Range:	
	Compensated Temperature Range:	-2° to +30°C
1	Temperature Error Band:	±0.3%
	Thermal Zero Shift:	
	Thermal Sensitivity Shift:	
	Electrical Connection	Monitor
	· 그것 위치 : · · · · · · · · · · · · · · · · · ·	

	reation	110.1101
Supply Positive:	RED	ORANGE
Supply Negative	: WHITE	BLACK
Output Positive:	YELLOW	
Output Negative	: BLUE	
Screen	CONNECTED TO BODY	

Notes:

/70 ft. of depth cable

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QSF-A116 Rev. B



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# CALIBRATION CERTIFICATE PYRANOMETER

PYRANOMETER MODEL	:	SP LITE

SERIAL NUMBER : 042719

SENSITIVITY : 10.23 µV/Wm<sup>-2</sup>

**REFERENCE PYRANOMETER:** 

Kipp & Zonen SP LITE PROTO 1 active from February 10, 2003.

CALIBRATION PROCEDURE :

A 1000W tungsten-halogen filament lamp produces a directed vertical beam (divergence 3.5°). The irradiance at the pyranometer stand is approx. 500 W/m<sup>2</sup>. First the signal of the reference SP LITE is registered. Next the signal is registered of a test SP LITE in the same position as the reference SP LITE. Finally the reference SP LITE signal is registered again. A stability check is done and if OK, the test SP LITE sensitivity is calculated from the ratio; test signal / mean reference signal. Because test and reference SP LITE are of the same model, the indoor conditions have at principle no influence on the transfer of calibration. The above sensitivity is theoretically best for conditions as during the calibration of the reference SP LITE outdoors in Delft.

HIERARCHY OF TRACEABILITY: The SP LITE PROTO1 has been compared in Delft on August 13, 2002 with the sun and sky and reflected ground radiation as source under clear sky conditions. The total hemispherical radiation is measured with a pyranometer CM 11 sn966086. This "transfer" pyranometer is calibrated in 2002 against the reference CM 11 sn913550 which on his turn was calibrated in Davos against the Word Standard Group in August 2001. The instruments were placed side by side on a tracking platform in such a way that the direct radiation was always normal incident.

During the calibration in Delft, the sky was blue with 1/8 cumulus clouds. The instrument temperature was approx. 20°C.

Because the sensitivity of the SP Lite is spectrum dependent Kipp & Zonen decided to calibrate at the "mean" Airmass 1.5. At the two moments with Airmass 1.5 the reference SP Lite received stationary irradiances of 940 resp. 960 W/m<sup>2</sup>. The sensitivity is determined from a direct calculation and recording of the momentaneous sensitivity of the SP LITE. We found that the sensitivity of the SP Lite has a minimum of 84  $\mu$ V/W/m<sup>2</sup> at solar noon (Airmass 1.25) and sensitivities of 86.4 at 11:10 civil time and 86.0 at 16:30 (both at z= 48° and Airmass 1.5). The mean sensitivity and estimated uncertainty of the SP LITE PROTO 1 for Airmass 1.5 radiation is 86.2 +/- 0.5  $\mu$ V/W/m<sup>2</sup>.

IN CHARGE OF TEST

F.de Wit, 16-Apr-04, Kipp & Zonen, Delft, Holland



Certificate report nr. H09-04410009

# **CALIBRATION CERTIFICATE**

Instrument	HMP45AC Humidity and temperature pr	
Serial number	Z4020133	
Manufacturer	Vaisala Oyj, Finland	
Calibration date	4th October 2004	
Test procedure	Doc210426-A	

The above instrument was calibrated by comparing the relative humidity and temperature readings to two HMP233 factory working standards. At the time of shipment, the instrument described above met its operating specifications.

The relative humidity readings of the two HMP233 factory working standards have been calibrated at the Vaisala factory by using Hygro M-3 dewpoint meter. Hygro M-3 dewpoint meter has been calibrated at Vaisala Measurement Standards Laboratory (MSL) by using the MSL primary standard traceable to the NIST. The temperature readings of the two HMP233 factory working standards have been calibrated at MSL by using the MSL working standard traceable to the NIST. The temperature calibrated traceable to the NIST. The temperature readings of the two HMP233 factory working standards have been calibrated at MSL by using the MSL working standard traceable to the NIST. The temperature calibration at MSL has been accredited by the FINAS according to the ISO/IEC 17025.

#### **Calibration results**

Reference humidity* % RH	Observed humidity % RH	Difference %RH	Permissible difference %RH	
0.5	1.3	+ 0.8	±2.0	
36.3	36.0	- 0.3	±2.0	
75.9	76.6	+ 0.7	± 2.0	
Reference temperature* °C	Observed temperature °C	Difference °C	Permissible difference °C	
+ 21.84	+21.87	+ 0.03	± 0.2	

\*Average of two references.

#### Equipment used in calibration

Туре	Serial number	Calibration date	Certificate number
HMP233 / RH	623114	2004-06-24	
HMP233 / RH	P1740018	2004-06-24	
Vaisala HMP233 / T	623114	2004-02-16	K008-M00235
Vaisala HMP233 / T	P1740018	2004-02-16	K008-M00236
HYGRO M-3	361095	2003-11-10	L01625
HP 34401A	3146A47883	2004-08-31	K004-04S486

#### Uncertainties (95 % confidence level, k=2)

Humidity ±1.0%RH @ 0..15%RH, ±1.5%RH @ 15..78%RH Temperature ± 0.13 °C **Ambient conditions** / Humidity 32 ± 5%RH, Temperature 22 ± 1 °C, Pressure 1021 ± 1 hPa.

For Vaisala Oyj

Birgitta Pennanen

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Doc210425-B

Vaisala Oyj Vanha Nurmijärventie 21 FIN-01670 Vantaa, Finland Tel. (+ 358 9) 8949 2658 Fax (+ 358 9) 8949 2295 http://www.vaisala.com

Domicile Vantaa, Finland Trade Reg. No. 96.607

#### MODEL 525 SERIES CERTIFICATION/CALIBRATION INFORMATION

The sequence for calibration after the sensors are completely assembled is as follows:

- The completed tipping bucket assembly is tested using a high-speed digital counter to check for multiple counts or missed counts and proper positioning of the sensor and actuator, then the assembly is installed into the main housing in which it will be shipped.
- 2. Sensors are than moved to the calibration stand that incorporates a bank of Micro Metering Pumps that output at the rate of 1 inch per hour and a volume equal to 100 counts. The sensors are run through the calibration cycle until achieving 99 to 101 counts 3 times in a row.

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2 SN	34698-1104
10	s qq.1 SN And Junt

### NOTICE!

During shipment the tipping assembly has been secured to avoid possible damage to the pivot assembly. Lift off collector and remove rubber band from inside to release tipping mechanism before installation.


1.75 DEGREE DEADBAND

NOTE: Azimuth Position vs Accuracy graphs are accurate to within 0.5 degrees. The accuracy shown in the potentiometer deadband region between 355 and 0 degrees is the result of no resistance change while position changes. The gap represents the actual deadband (open circuit).



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### CALIBRATION CERTIFICATE PYRANOMETER

PYRANOMETER MODEL	:	SP LITE
SERIAL NUMBER	:	042851
SENSITIVITY	:	10.28 µV/Wm <sup>-2</sup>
REFERENCE PYRANOMET	ER:	Kipp & Zonen SP LITE PROTO 1 active from February 10, 2003.
CALIBRATION PROCEDURE	E :	A 1000W tungsten-halogen filament lamp produces a directed vertical beam (divergence 3.5°). The irradiance at the pyranometer stand is approx. 500 W/m <sup>2</sup> . First the signal of the reference SP LITE is registered. Next the signal is registered of a test SP LITE in the same position as the reference SP LITE. Finally the reference SP LITE signal is registered again. A stability check is done and if OK, the test SP LITE sensitivity is calculated from the ratio; test signal / mean reference signal. Because test and reference SP LITE are of the same model, the indoor conditions have at principle no influence on the transfer of calibration. The above sensitivity is theoretically best for conditions as during the calibration of the reference SP LITE outdoors in Delft.
HIERARCHY OF TRACEABIL	ITY:	The SP LITE PROTO1 has been compared in Delft on August 13, 2002 with the sun and sky and reflected ground radiation as source under clear sky conditions. The total hemispherical radiation is measured with a pyranometer CM 11 sn966086. This "transfer" pyranometer is calibrated in 2002 against the reference CM 11 sn913550 which on his turn was calibrated in Davos against the Word Standard Group in August 2001. The instruments were placed side by side on a tracking platform in such a way that the direct radiation was always normal incident. During the calibration in Delft, the sky was blue with 1/8 cumulus clouds. The instrument temperature was approx. 20°C. Because the sensitivity of the SP Lite is spectrum dependent Kipp & Zonen decided to calibrate at the "mean" Airmass 1.5. At the two moments with Airmass 1.5 the reference SP Lite received stationary irradiances of 940 resp. 960 W/m <sup>2</sup> . The sensitivity is determined from a direct calculation and recording of the momentaneous sensitivity of the SP LITE. We found that the sensitivity of the SP Lite has a minimum of 84 $\mu$ V/W/m <sup>2</sup> at solar noon (Airmass 1.25) and sensitivities of 86.4 at 11:10 civil time and 86.0 at 16:30 (both at z= 48° and Airmass 1.5). The mean sensitivity and estimated uncertainty of the SP LITE PROTO 1 for Airmass 1.5 radiation is 86.2 +/- 0.5 $\mu$ V/W/m <sup>2</sup> .
IN CHARGE OF TEST	:	G. v/d Wilt, 28-Jun-04, Kipp & Zonen, Delft, Holland

# 🏽 VAISALA

Certificate report nr. H09-05130033

## **CALIBRATION CERTIFICATE**

Instrument	HMP45AC Humidity and temperature probe
Serial number	A1320034
Manufacturer	Vaisala Oyj, Finland
Calibration date	29th March 2005
Test procedure	Doc210426-A

The above instrument was calibrated by comparing the relative humidity and temperature readings to two HMP233 factory working standards. At the time of shipment, the instrument described above met its operating specifications.

The relative humidity readings of the two HMP233 factory working standards have been calibrated at the Vaisala factory by using Hygro M-3 dewpoint meter. Hygro M-3 dewpoint meter has been calibrated at Vaisala Measurement Standards Laboratory (MSL) by using the MSL primary standard traceable to the NIST. The temperature readings of the two HMP233 factory working standards have been calibrated at MSL by using the MSL working standard traceable to the NIST. The temperature calibrated at MSL by using the MSL working standard traceable to the NIST. The temperature calibrated at MSL by using the MSL working standard traceable to the NIST. The temperature calibrated at MSL has been accredited by the FINAS according to the ISO/IEC 17025.

#### Calibration results

Reference humidity* % RH	Observed humidity % RH	Difference %RH	Permissible difference %RH
0.5	1.4	+ 0.9	±2.0
44.3	44.4	+ 0.1	±2.0
71.1	71.7	+ 0.6	± 2.0
Reference temperature* °C	Observed temperature °C	Difference °C	Permissible difference °C
+ 23.00	+22.95	- 0.05	± 0.2

\*Average of two references.

#### Equipment used in calibration

Туре	Serial number	Calibration date	Certificate number
HMP233 / RH	623114	2005-01-11	H09-05020022
HMP233 / RH	P1740018	2005-01-11	H09-05020023
Vaisala HMP233 / T	623114	2004-02-16	K008-M00235
Vaisala HMP233 / T	P1740018	2004-02-16	K008-M00236
HYGRO M-3	361095	2005-01-26	N00160
HP 34401A	3146A47883	2004-08-31	K004-04S486

#### Uncertainties (95 % confidence level, k=2)

Humidity ±1.0%RH @ 0..15%RH, ±1.5%RH @ 15..78%RH Temperature ± 0.13 °C

Ambient conditions / Humidity  $37 \pm 5\%$ RH, Temperature  $23 \pm 1$  °C, Pressure  $1024 \pm 1$  hPa.

For Vaisala Oyj

Eero Kärkinen

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NOTE: Azimuth Position V3 Accuracy graphs are accurate to within 0.5 degrees. The accuracy shown in the potentiometer deadband region between 355 and 0 degrees is the result of no resistance change while position changes. The grap represents the actual deadband (open circuit).