Appendix 2: MFWF – 2011 Geotechnical Investigation

Yeh and Associates, Inc.
Consulting Engineers & Scientists

January 24, 2011 Project No. 210-187

Mr. Jeff Schaefer
EnCana Oil & Gas (USA), Inc.
370 17th Street, Suite 1700
Denver, Colorado 80202

Subject: Additional Geotechnical Recommendations, Middle Fork Compressor Station in Garfield County, Colorado.

Dear Mr. Schaefer,

Yeh and Associates, Inc. prepared a Geotechnical Investigation for five proposed water tanks at the Middle Fork Compressor Station in Garfield County, Colorado (Project No. 210-187, report dated December 2, 2010). We recommended tanks be supported on a deep foundation system such as helical piers or micropiles. Yeh and Associates was requested to provide additional shallow foundation and other geotechnical related recommendations. We were informed that storage tanks will be 120 feet in diameter and 42 feet in height. Tank foundation loads will be on the order of 3,000 psf. Based on loads provided, we anticipate foundation loads for the VDU vessels and containment walls will be on the order of 1,500 psf.

SHALLOW FOUNDATION RECOMMENDATIONS

Our investigation encountered existing, uncontrolled fill and natural, soft soils. We estimate settlement due to tank loading to be on the order of 9 to 18 inches. For the VDU vessel and containment walls, we estimate settlements on the order of 1 to 3 inches for foundations placed on the existing fill soils. If estimated settlements cannot be tolerated during the service life of the structure, we recommend subexcavation be performed below these foundations. As an alternative, rammed aggregate piers (Geopiers) could be used to improve shallow soils to allow for the use of shallow foundations. Recommendations for pad, mat, ringwall and spread footing foundations are as follows:

Storage Tanks

1. We recommend removal and replacement of the existing soils as a moisture conditioned fill (subexcavation) to a depth of 9 feet below proposed tank bottoms and/or ringwall foundations, whichever is deeper. The sides of the subexcavation should be sloped at 1H:1V from the base of the excavation. In addition, we recommend the placement of a biaxial geogrid be placed within 2 feet of the bottom of the tank mat or ringwall foundation, whichever is deeper. The geogrid should have a minimum ultimate strength of 1,500 lb/ft in machine and cross-machine direction. After sub-excavation, we anticipate foundation settlement of less than 6 inches.

2. Foundations should be constructed on properly placed fill as recommended in the SUBEXCAVATION FILL section below.

3. For areas where subexcavation is performed, foundations can be designed for a maximum allowable soil pressure of 3,000 psf.

4. Resistance to sliding at the bottom of the ringwall foundation and spread footing can be calculated based on a coefficient of friction of 0.40. Passive pressure against the side of the wall and footing can also be considered for the sliding resistance if foundation soils are properly compacted. Passive pressure can be estimated based on an equivalent fluid density of 375 pcf.

5. The soils below foundations should be protected from freezing. We recommend the bottom of foundations be constructed at least 36 inches below proposed grade.

6. The base of the subexcavation and all foundation excavations should be observed by a representative of the geotechnical engineer prior to the placement of fill or concrete.

Pipe Racks, VDU Vessel and Containment Walls

1. Based on foundation loads provided, we estimated foundation settlement on the order of 1 to 3 inches for foundations placed on the existing fill and soft soils. Provided these movements can be tolerated by the proposed structures, shallow foundations can be designed for a maximum allowable soil pressure of 1500 psf. If higher foundation loads are planned or estimated settlement cannot be tolerated, we recommend subexcavation be performed as recommended above.

2. For pipe rack foundations, drilled friction pier foundations can be used to support pipe and platform legs. Piers should have a minimum length of 10 feet, otherwise, all other recommendations provided in the aforementioned report could be used for design.

3. Resistance to sliding at the bottom of the ringwall foundation and spread footing can be calculated based on a coefficient of friction of 0.30. Passive pressure against the side of the wall and footing can also be considered for the sliding resistance if foundation soils are properly compacted. Passive pressure can be estimated based on an equivalent fluid density of 300 pcf.

4. The soils below foundations should be protected from freezing. We recommend the bottom of foundations be constructed at least 36 inches below proposed grade.

5. The base of all foundation excavations should be observed by a representative of the geotechnical engineer prior to the placement of concrete.

SUBEXCAVATION FILL

The on-site soils free of organic matter, debris, deleterious material and rocks larger than 6 inches can be used in fills provided the materials meet the specification in the table below. Topsoil is not recommended for fill. Processing of on-site soils and/or import material may be required. Import material should also meet the specification below. Fill should be placed in thin, loose lifts of 8 inches thick or less. Fill should be placed at a moisture content within 2 percent of optimum moisture and compacted to at least 95 percent of maximum standard Proctor dry density (ASTM D 698). We recommend earthen berms be placed according to the specifications above and be constructed with side slopes no steeper than

2H:1V. Asbestos was encountered in our original investigation. Caution, notification to officials and on-site monitoring would be advised during excavation. Placement and compaction of fill should be observed and tested by a representative of a geotechnical engineer.

Sieve Size	Percent Passing
6"	100
4"	95-100
1"	65-100
No. 4	30-100
No. 200	5-30

*Liquid limit less than 35 and plasticity index less than 11.

LATERAL EARTH PRESSURE

Retaining walls should be designed to resist lateral earth pressure. Walls can be designed using an equivalent fluid density of 45 pcf. This equivalent fluid density assumes a horizontal, on-site material backfill meeting the specifications above. This value assumed the backfill materials are not saturated. Wall designs should consider the influence of surcharge loading such as traffic, construction equipment and/or sloping backfill.

Retaining walls should be constructed with a drainage system to drain away any excess water immediately behind the wall. The drainage system may consist of free-draining gravel and/or weep holes are commonly used for wall drainage.

If you have questions or require additional information, please call.

Respectfully Submitted,

YEH AND ASSOCIATES, INC.

Keith E. Asay
Staff Engineer

Reviewed By:

Richard D. Johnson, P.E.
Northwest Regional Manager

Cc: Mr. Drew Mathies, E.I.
Project Engineer
ZAP Engineering
12567 W. Cedar Drive, Suite 210
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Geotechnical Investigation

Middle Fork Compressor Station
North Parachute Ranch
10652 County Road 215
Garfield County, Colorado

Project No. 210-187
December 2, 2010

Prepared for:

Mr. Jeff Schaefer
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PURPOSE AND SCOPE

This report presents the results of our geotechnical investigation for design and construction of five new water tanks for EnCana Oil and Gas at the Middle Fork Compressor Station in Garfield County, Colorado. The subsurface investigation was conducted to provide recommendations for foundation design and construction of five new tank foundations at this site. The site investigation consisted of reconnaissance and drilling of exploratory borings to investigate subsurface conditions. EnCana Oil & Gas provided planned structure locations. The exploratory drilling was observed by a representative of Yeh and Associates. Samples obtained during the field exploration were examined by the project personnel and representative samples were subjected to laboratory testing to determine the engineering characteristics of materials encountered.

Based on our investigation, Yeh and Associates completed an engineering analysis of the subsurface conditions. This report summarizes our field investigation, the results of our analysis, and our conclusions and recommendations based on the proposed construction, site reconnaissance, subsurface investigation and results of the laboratory testing.

PROPOSED CONSTRUCTION

We understand the proposed construction will consist of five treated water tanks with an associated containment area. The proposed tanks are planned for 75,000 barrels and will be 116 feet in diameter and 40 feet high. Potentially, the tanks may be reduced in diameter and may be taller. The proposed site plan and approximate test hole locations are presented on Figure 1.

SITE CONDITIONS

The Middle Fork Compressor Station was located approximately 11 miles north of Interstate 70 on Garfield County Road 215 (Parachute, Colorado). The site address was posted as 10652 County Road 215. Middle Fork Compressor Station is a fully operational gas gathering facility complete with structures and equipment necessary for natural gas production, collection and distribution. The proposed site is located west of the current treated pond in the current storage, construction, welding/fabrication yard. The site slopes gently down to the south at a grade of less than 5 percent and is approximately 5793 feet above mean sea level. The site is surrounded by existing structures with exception to the south which is bounded by the

continuation of County Road 215 which parallels East Fork. Vegetation is native scrub, pinyon and juniper trees. Access to the site was gained on an unimproved road.

GEOLOGIC CONDITIONS

The project area was located in the Roan Plateau area of the northern Piceance Basin of western Colorado, a major gas production area made up of high plateaus, mesas, ridges and deep valleys. The site was on the valley floor of the Parachute Creek drainage, near of the confluence of East Fork and Middle Fork of Parachute Creek, and approximately one-fourth mile northeast of the confluence of West Fork and Parachute Creek. The site was bounded to the north by the southwest edge of Long Ridge and to the south by Lindauer Point. The proposed building site was located on commercial/industrial property that is the location of the Encana Oil and Gas Middle Fork Compressor Station.

The project area was located on artificial fill and alluvium, which included material ranging in size from clay and silt to gravel. Underlying the site and in the hillsides in all directions from the site, was the gray shale and marlstone of the Tertiary age Garden Gulch Member of the Green River Formation.

SUBSURFACE CONDITIONS

Subsurface conditions were investigated by drilling 14 holes on a north-south grid line (Test Holes TH-1 through TH-14) as per the client's request, in an effort to investigate potential fill, trash and debris. The client provided the grid line location. Five of these holes (Test Holes TH-3, TH-6, TH-8, TH-11 and TH-14) were deepened and used for tank foundation investigation as well as test holes TH-15 through TH-19. Yeh and Associates personnel selected which holes were to be deepened as well as the locations of the additional 5 test holes. Test holes TH-1 through TH-6, TH-18 and TH-19 were drilled for two future tanks and test holes TH-7 through TH-17 were drilled for three proposed tanks. The approximate locations of exploratory test holes are presented on Figure 1. All test holes were advanced using a CME-55 truck mounted drill rig with 4-inch continuous flight auger to pre-determined depths where a modified California or split spoon sampler was used to record blow counts and obtain samples.

To perform the modified California penetration resistance test, a 2.0-inch inside diameter sampler was seated at the bottom of the test hole, then driven up to 12 inches with blows of an standard hammer weighing 140 pounds and falling a distance of 30 inches. The number of

blows (Blow Count) required to drive the sampler 12 inches or a fraction thereof, constitutes the N-value. The N-value, when properly evaluated, is an index of the consistency or relative density of the material tested. The split spoon sampler was used in the same manner but with a 1.5-inch inside diameter. The results are shown on Figures 2 through 6.

Existing fill was encountered in the majority of the test hole borings. The age of the fill made differentiation from naturally deposited soils difficult. The fill consisted of sand, gravel and silt material. Debris, such as ceramic pieces and metal was encountered in the fill in test holes TH-19 and TH-25 at depths of 9 and 2 feet, respectively. Asbestos was also encountered in the fill in test hole TH-28 within the upper 3 feet. Further potential deleterious material and debris could be encountered upon excavation, but due to the spacing and location of the test holes, was not observed at other test hole locations. We believe that the fill was placed in an uncontrolled manner.

Generally, the subsoils beneath the fill consisted of sand, gravel, silt and clay. Bedrock was encountered in test holes TH-14 and TH-15 at depths of 33.5 and 37.5 feet, respectively. Four fill samples tested had 10 to 54 percent fines (material passing the No. 200 sieve). Atterberg limit testing indicated liquid limits of non-liquid to 40 percent and plastic indices of non-plastic to 23 percent. Five additional fill samples exhibited low collapse (-0.2 to -0.4 percent) when wetted under an applied load of 1,000 psf. Twelve sand samples tested had 8 to 33 percent fines, liquid limits of non-liquid to 46 percent and plastic indices of non-plastic to 16 percent. Four additional sand samples exhibited low collapse (-0.2 to -0.5 percent) when wetted under an applied load of 1,000 psf. Six gravel samples tested had 8 to 10 percent fines, liquid limits of non-liquid to 35 percent and plastic indices of non-plastic to 14 percent. Four silt and clay samples tested had 26 to 65 percent fines, liquid limits of 43 to 47 percent and plastic indices of 15 to 18 percent. Two additional silt samples exhibited low collapse of -0.3 percent when wetted under an applied load of 1,000 psf. One sandstone bedrock sample tested had 45 percent fines, a liquid limit of 34 percent and a plastic index of 16 percent. The fill was medium dense to dense and stiff to very stiff and classified as SP, SM, SC, SW-SM, ML and CL according to the Unified Soil Classification System (USCS). The sand and gravel was very loose to very dense and classified as SP, SW, SP-SM, SW-SM, SM, SC, GP, GW, GP-GM, GW-GM. The silt and clay was medium stiff to stiff and classified as a ML and CL. The laboratory test results are presented in Appendix A and are summarized in the Summary of Laboratory Test Results table.

Groundwater was encountered at depths of 16 to 20 feet during this investigation throughout the site. Subsoils were slightly moist to wet. Variations in groundwater conditions may occur seasonally. The magnitude of the variation will be largely dependent upon the amount of spring snowmelt, duration and intensity of precipitation, site grading changes, and the surface and subsurface drainage characteristics of the surrounding area. Perched water tables may be present, but were not encountered in these borings.

SEISMIC CLASSIFICATION

The 2006 IBC seismic classification is based on extrapolation of test hole data to depths explored and our experience in the area. We consider the project site to be classified as a seismic site Class D. Quantitative, down-hole, shear wave velocity testing could result in a different site classification. Drilling and installation of casing to a depth of at least 100 feet is necessary to perform this testing. If desired, we can provide a proposal for performing this testing.

SITE DEVELOPMENT

We believe fills and cuts should be minable. Areas to receive fill should be stripped of vegetation, organic soils and debris. The on-site soils free of organic matter, debris and rocks larger than 6 inches can be used in fills. Fill should be placed in thin, loose lifts of 8 inches thick or less. Clay soils should be moisture conditioned to 0 to 3 percent above optimum moisture content and compacted to at least 95 percent of maximum standard Proctor dry density (ASTM D 698). Granular soils should be placed at a moisture content within 2 percent of optimum moisture. Placement and compaction of fill should be observed and tested by a representative of a geotechnical engineer.

FOUNDATION RECOMMENDATIONS

The fill and natural soils exhibited low compression during laboratory testing. Additionally, we believe the fill was placed in an uncontrolled manner. Due to the planned weight of the structures and existing conditions, we believe the proposed tanks should be supported on a deep foundation such as drilled friction piers, micropiles or helical piers. Typically, micropiles and helical piers are installed by a specialty design/build contractor. Recommended design and construction criteria for drilled friction piers, micropiles or helical piers are presented below.

Drilled Friction Piers

1. Piers should be designed for an allowable end pressure of 15,000 psf and an allowable skin friction of 1,500 psf for the portion embedded in natural clay, sand and/or gravel. We recommend the upper 5 feet of the pier be ignored for support.

2. Piers should have a minimum length of 20 feet and a minimum diameter of 18 inches.

3. For lateral loading analysis using LPILE program, the following parameters may be used:

Material	Soil Model	Friction Angle, ϕ (deg)	Cohesion, c (psf)	Horizontil Modulus of Subgrade Reaction, k_h (pci)	ε_{50}	Total Unit Weight, γ (pcf)	Saturated Unit Weight, γ (pcf)
Sand and Gravel above groundwater	Sand	32	0	100	-	130	135
Sand and Gravel below groundwater	Sand	32	0	70	-	130	135

4. The minimum spacing requirements between piers should be three diameters from center to center. For lateral loading, recommended P multipliers are 0.5 for tangent piers increasing linearly to 1.0 for piers placed at 3 diameters or greater. Additional capacity reduction factors can be provided if required for conditions other than those anticipated.

5. Groundwater was encountered during our investigation. Relatively deep piers may encounter groundwater. Casing of friction piers should not be performed unless piers were designed as end bearing only. Tremie placement of concrete in pier holes may be necessary.

6. A representative of the soil engineer should observe pier installation on a full-time basis.

Helical Piers or Micropiles

As an alternative, a deep foundation system such as helical piers or micropiles could be utilized for tank foundations. We believe that either of these systems could penetrate the existing fill and softer overburden soils and be founded into the firmer soils. Helical piers and micropiles could be designed for working loads on the order of 20 to 60 kips per pile. Typically, these systems are designed and installed by a specialty contractor. General recommendations for design and construction of micropiles and helical piers are presented below.

1. The structural engineer should determine pier or micropile locations and load requirements for all piers or micropiles. This information should be provided to a specialty design/build contractor to provide shop drawings for the piers or micropiles. Based on our observations, we do not believe downdrag would induce additional loading on the foundation. Therefore, we do not believe the foundation design needs to account for additional loading due to downdrag.

2. Piers or micropiles could penetrate through the existing fill and softer overburden soils and be founded within firmer soils. We recommend a minimum pier or pile length of 20 feet. We recommend piers or piles be founded below the existing fill. Target depths for piers and top of bond zone for micropiles would need to be determined by the designer based on loading. In general, soils generally become denser and stiffer with depth.

3. A representative of the geotechnical engineer should observe pier or micropile installation.

SURFACE DRAINAGE

Surface drainage is crucial to the performance of foundations and flatwork. We recommend the ground surface surrounding structures be sloped to drain away. We recommend a slope of at least 6 inches in the first 10 feet for gravel areas and a minimum slope of 1 percent for paved areas. Backfill around foundations should be moisture conditioned and compacted as recommended in the SITE DEVELOPMENT section.

WATER SOLUBLE SULFATE

We measured water soluble sulfate concentrations of 0.014 and 0.028 percent for two samples of the subsoils. Based laboratory test results, we anticipate a Class 0 exposure for concrete due to the presence of water-soluble sulfate. Based on ACI 201.2R-01, "Guide to Durable Concrete," concentrations between 0.0 and 0.1 percent represent Class 0 exposure (negligible/low). For cast-in-place structures such as foundations, pavements placed on onsite soils and grout for micropiles, ACI recommends ASTM C 150 Type II or equivalent be used for improvements at this site. Structural fill and aggregate base course are assumed to have Class 0 exposure or no effect on concrete.

LIMITATIONS

The analyses and recommendations presented in this report are based upon our data obtained from the test holes at the indicated locations, field observations, laboratory testing, our understanding of the proposed construction and other information discussed in this report. It is

possible that subsurface conditions may vary between or beyond the points explored. The nature and extent of such variations may not become evident until construction. If variations appear, we should be contacted immediately so we can review our report in light of the variations and provide supplemental recommendations as necessary. We should also review the report if the scope of the proposed construction, including the proposed loads, finished elevations or structure locations change from those described in this report. The conclusions and recommendations contained in this report shall not be considered valid unless Yeh and Associates reviews the changes and either verifies or modifies the conclusions of this report in writing.

The scope of services for this project included preliminary environmental study of the fill and debris for asbestos, only. Although our investigation did identify asbestos at one location, the owner should undertake additional studies to determine the extent of the contamination.

The report was prepared in substantial accordance with the generally accepted standards of practice for geotechnical engineering as exist in the site area at the time of our investigation. No warranties, express or implied, are intended or made.

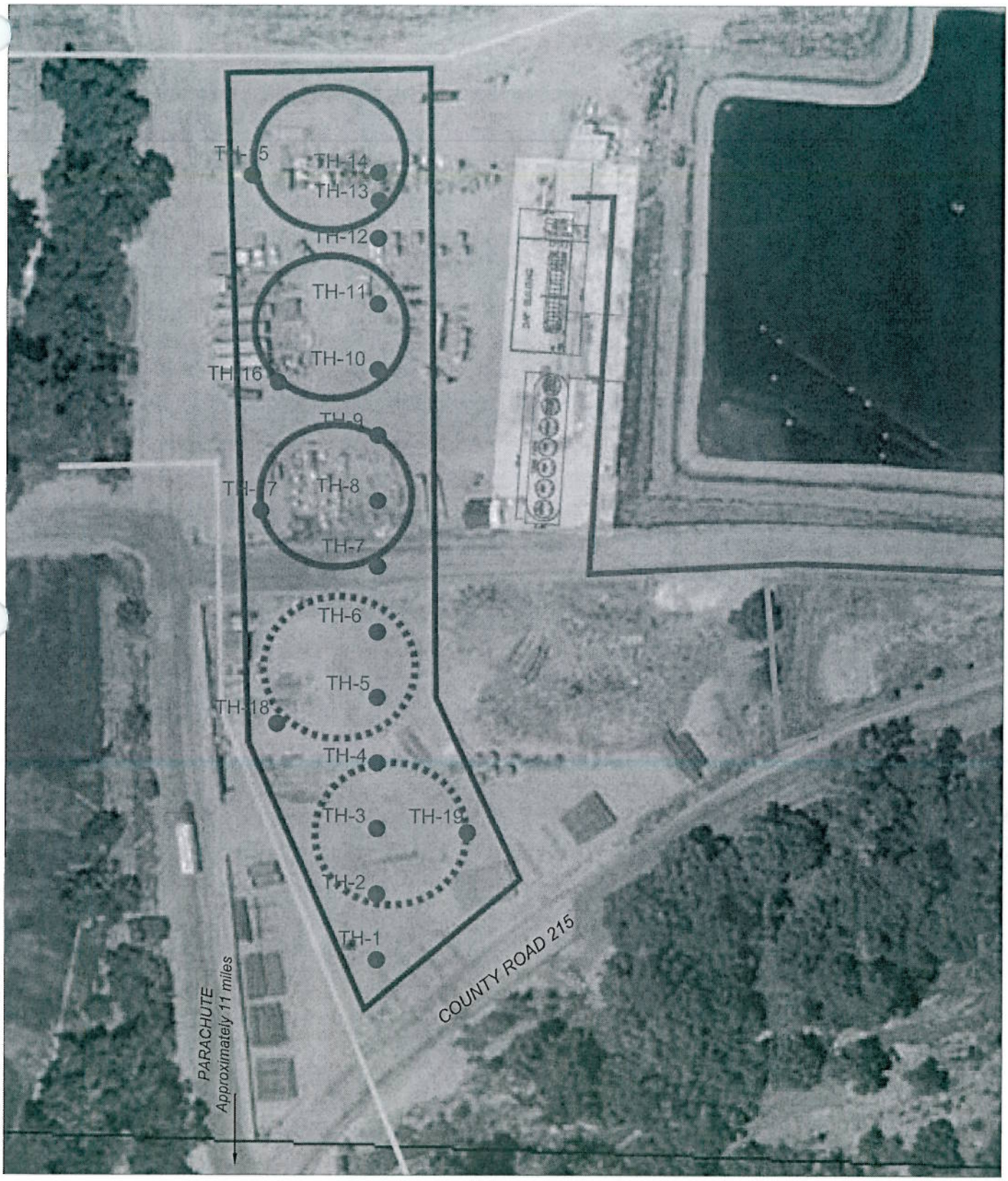
Respectfully Submitted,

YEH AND ASSOCIATES, INC.

Keith E. Asay
Staff Engineer

Reviewed By:

Richard D. Johnson, P.E.
Senior Geotechnical Engineer



Note: Base map/image provided by Encana Oil & Gas, 2010

LEGEND:

TH-1 Indicates approximate location of exploratory test hole

N

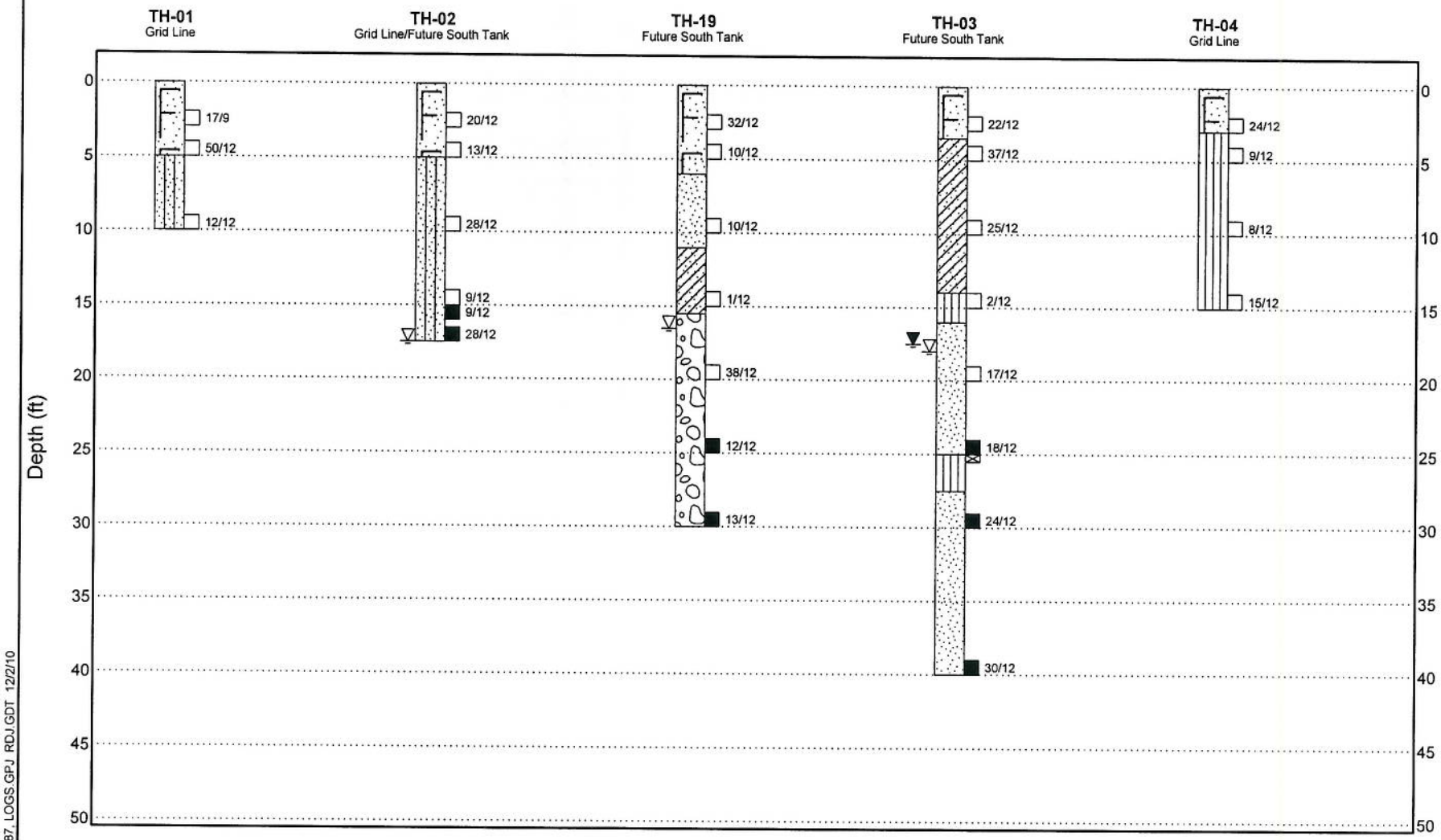
0 50 100

SCALE: 1" = 100'

Approximate Test Hole Location

Project No. 210-187

Figure 1



FENCES BY DEPTH - A SIZE 210-187_LOGS.GPJ RDJ.GDT 12/2/10

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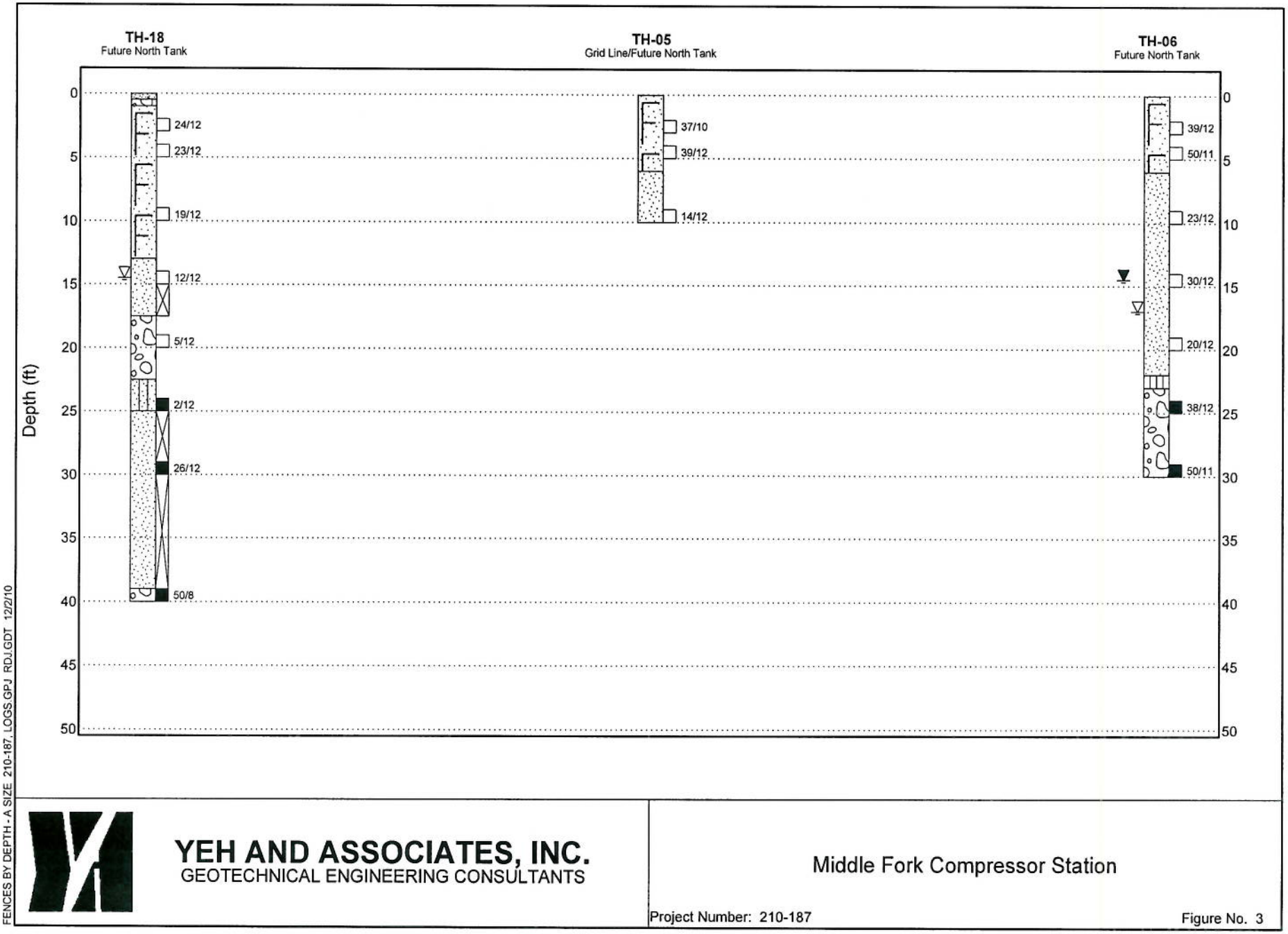
Middle Fork Compressor Station

Project Number: 210-187

Figure No. 2



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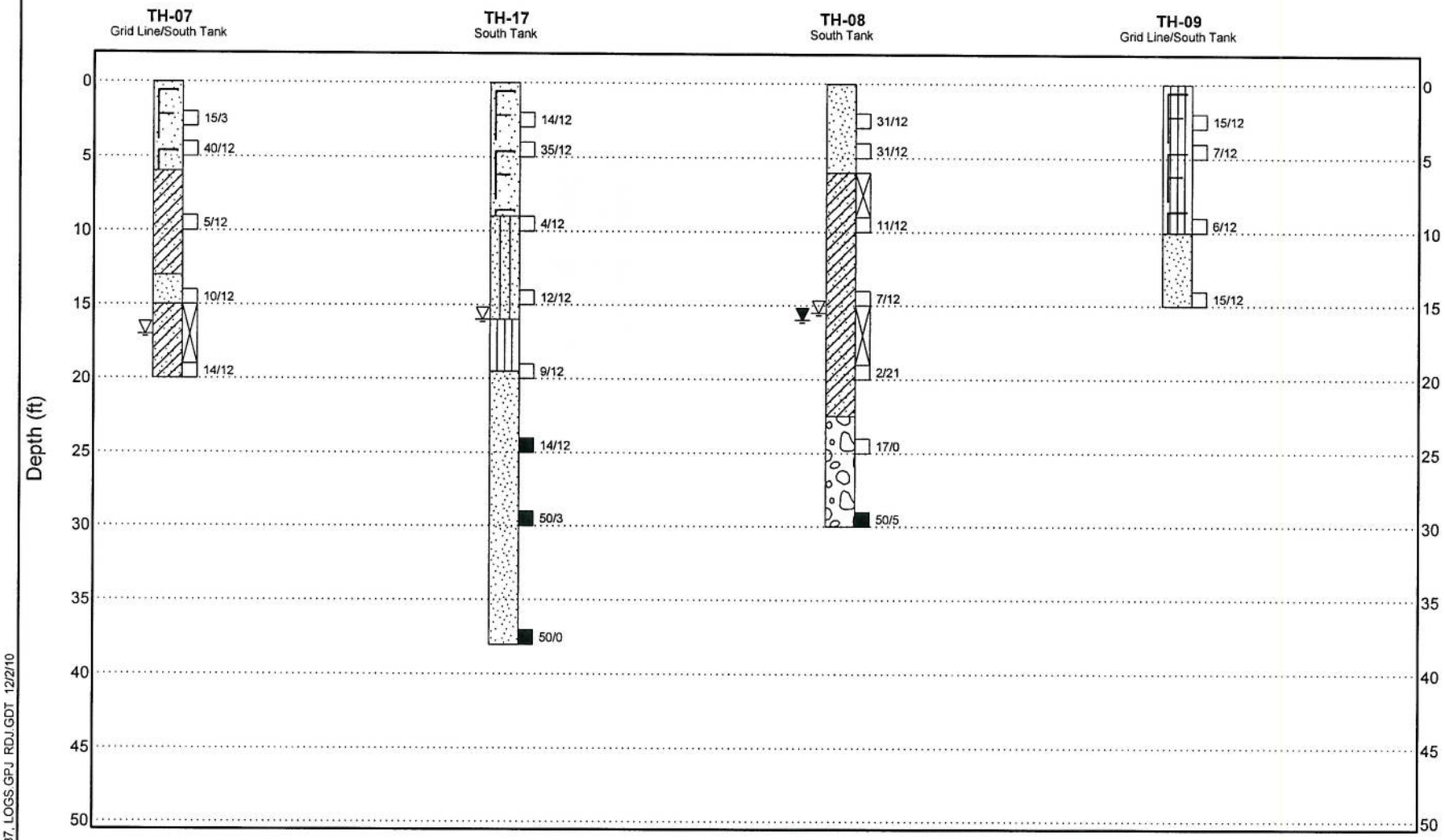
YEH AND ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING CONSULTANTS

Middle Fork Compressor Station

Project Number: 210-187

Figure No. 3



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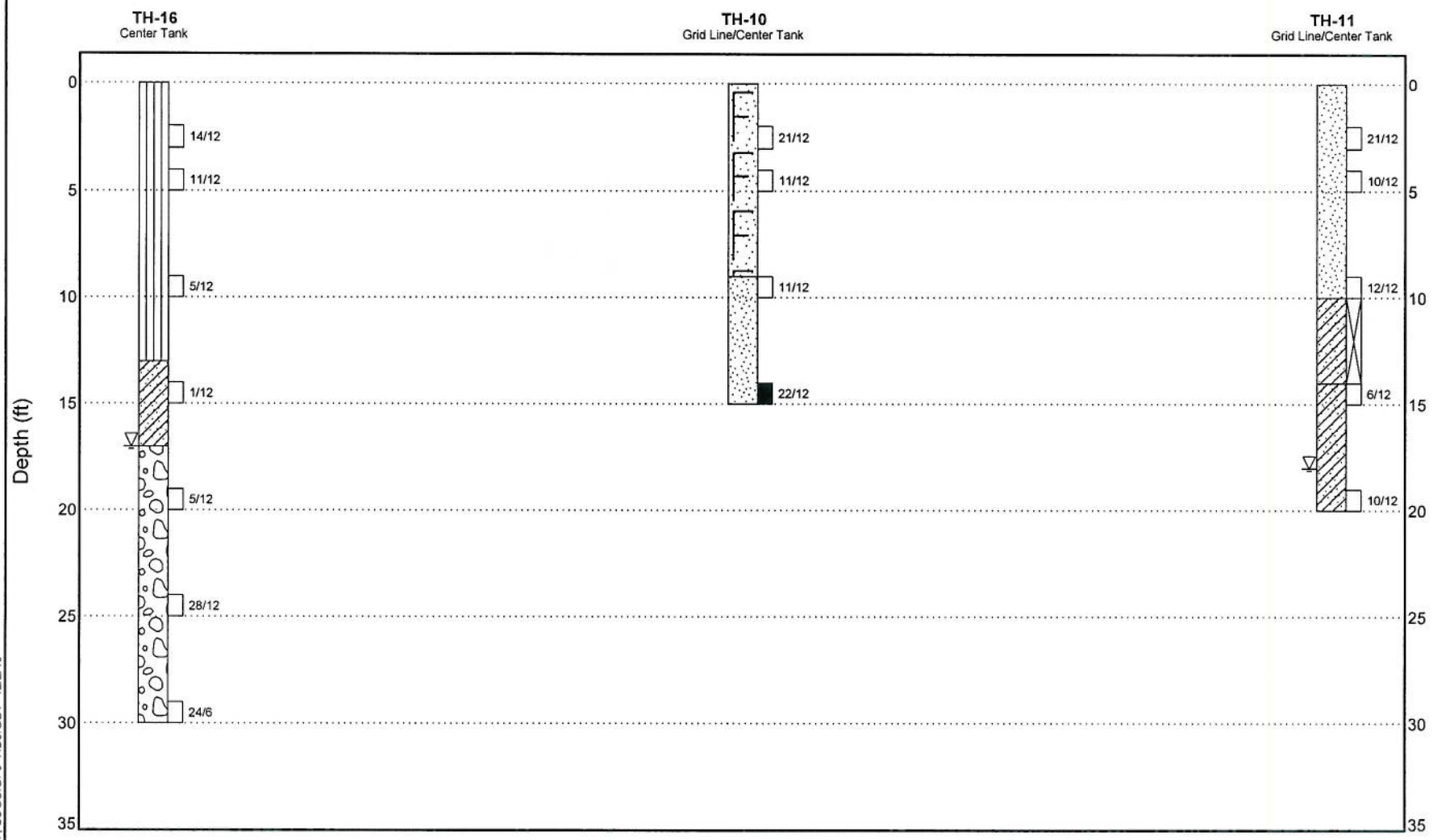
Middle Fork Compressor Station

Project Number: 210-187

Figure No. 4



FENCES BY DEPTH - A SIZE 210-187 LOGS.GPJ RDJ.GDT 12/2/10

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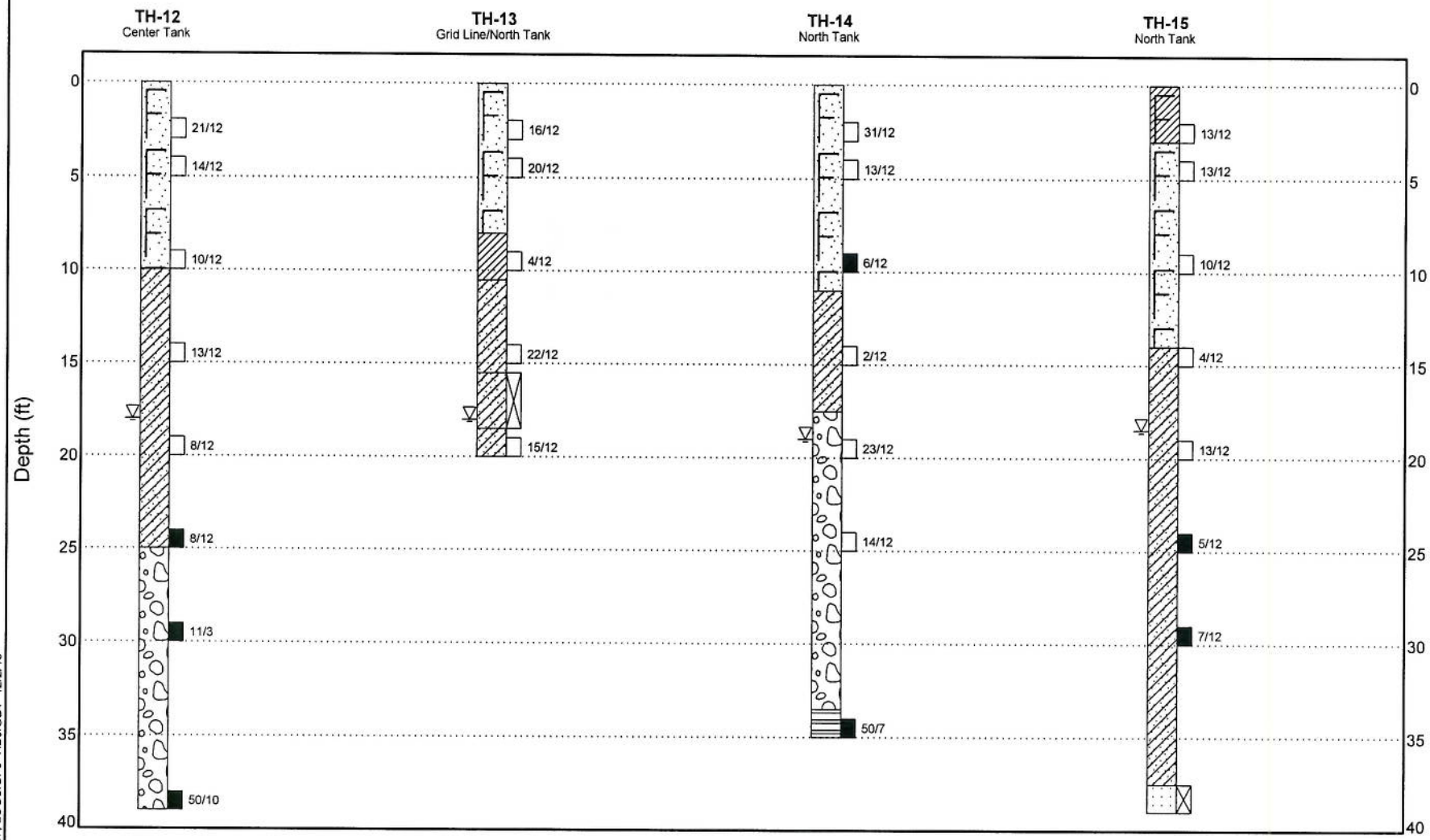
Middle Fork Compressor Station

Project Number: 210-187

Figure No. 5



FENCES BY DEPTH - A SIZE 210-187, LOGS.GPJ RDJ.GDT 12/2/10

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Middle Fork Compressor Station

Project Number: 210-187

Figure No. 6

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Project: Middle Fork Compressor Station
Project Number: 210-187

Legend for Symbols Used on Test Hole Logs

Sample Types

Modified California Sampler. The symbol 20/12 indicates that 20 blows from a 140 pound hammer falling 30 inches was used to drive 2-inch I.D. sampler 12 inches.

Split Spoon Sampler. The symbol 9/12 indicates that 9 blows from a 140 pound hammer falling 30 inches was used to drive 1.5-inch I.D. sampler 12 inches.

Indicates bulk sample.

Other Symbols

Indicates approximate ground water level at time of drilling.

Indicates approximate ground water level 1 day after drilling.

Soil Lithology

Concrete

Fill, gravel, base coarse (GP).

Fill, sand, clean, silty, clayey, occasional bedrock fragments, occasional gravels, occasional debris and asbestos, medium dense to dense, slightly moist to moist, gray, brown, dark brown, rust (SP, SM, SC, SW-SM).

Fill, silt, slightly sandy, occasional bedrock fragments, occasional gravels, medium stiff to very stiff, moist to very moist, brown, dark brown (ML).

Fill, clay, slightly sandy, silty, occasional bedrock fragments, occasional gravels, stiff, moist to very moist, brown, dark brown (CL).

Sand, poorly to well graded with silt, occasional bedrock fragments, occasional gravel, medium dense to very dense, slightly moist to wet, gray, brown, rust (SP, SW, SP-SM, SW-SM).

Sand, silty, occasional bedrock fragments, occasional gravel, loose to medium dense, slightly moist to wet, gray, brown (SM).

Sand, clayey, occasional bedrock fragments, occasional gravel, very loose to medium dense, slightly moist to wet, gray, brown (SC).

Gravel, poorly to well graded with silt, occasional bedrock fragments, medium dense to very dense, wet, gray, brown (GP, GW, GP-GM, GW-GM).

Silt, slightly sandy, stiff, wet, brown, dark brown (ML).

Clay, slightly sandy, medium stiff, wet, brown, dark brown (CL).

Bedrock Lithology

Bedrock sandstone, slighty silty, hard, slightly moist, gray.

Shale bedrock, silty, hard, slightly moist, gray.

Notes:

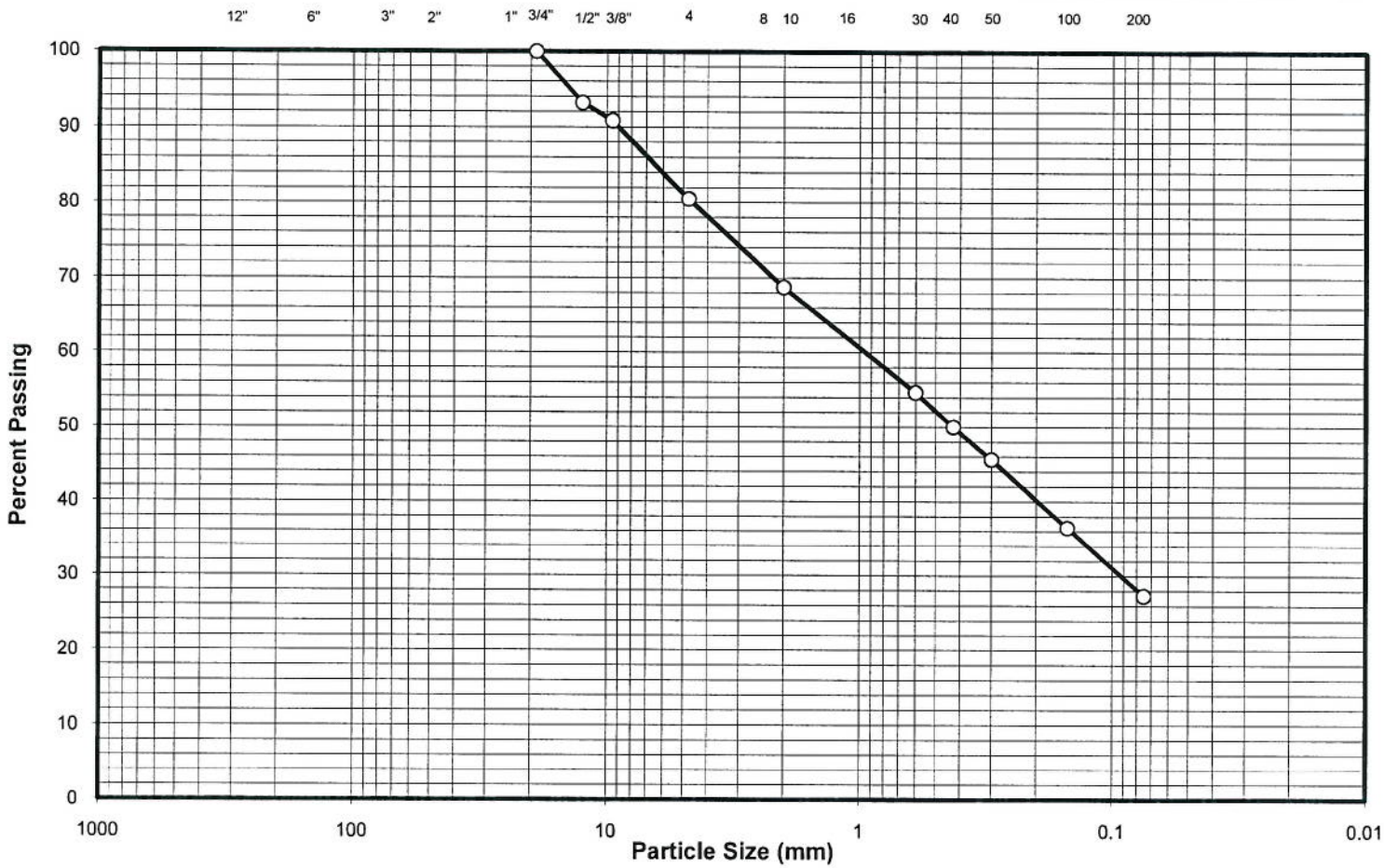
1. Test holes were drilled on October 27, 28 and 29, 2010 using 4-inch continuous flight auger.
2. Test hole descriptions are subject to explanations contained in this report.

Figure No. 7

APPENDIX A

LABORATORY TEST RESULTS

Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	100
½"	93
⅜"	91
#4	80
#10	69
#40	50
#200	27

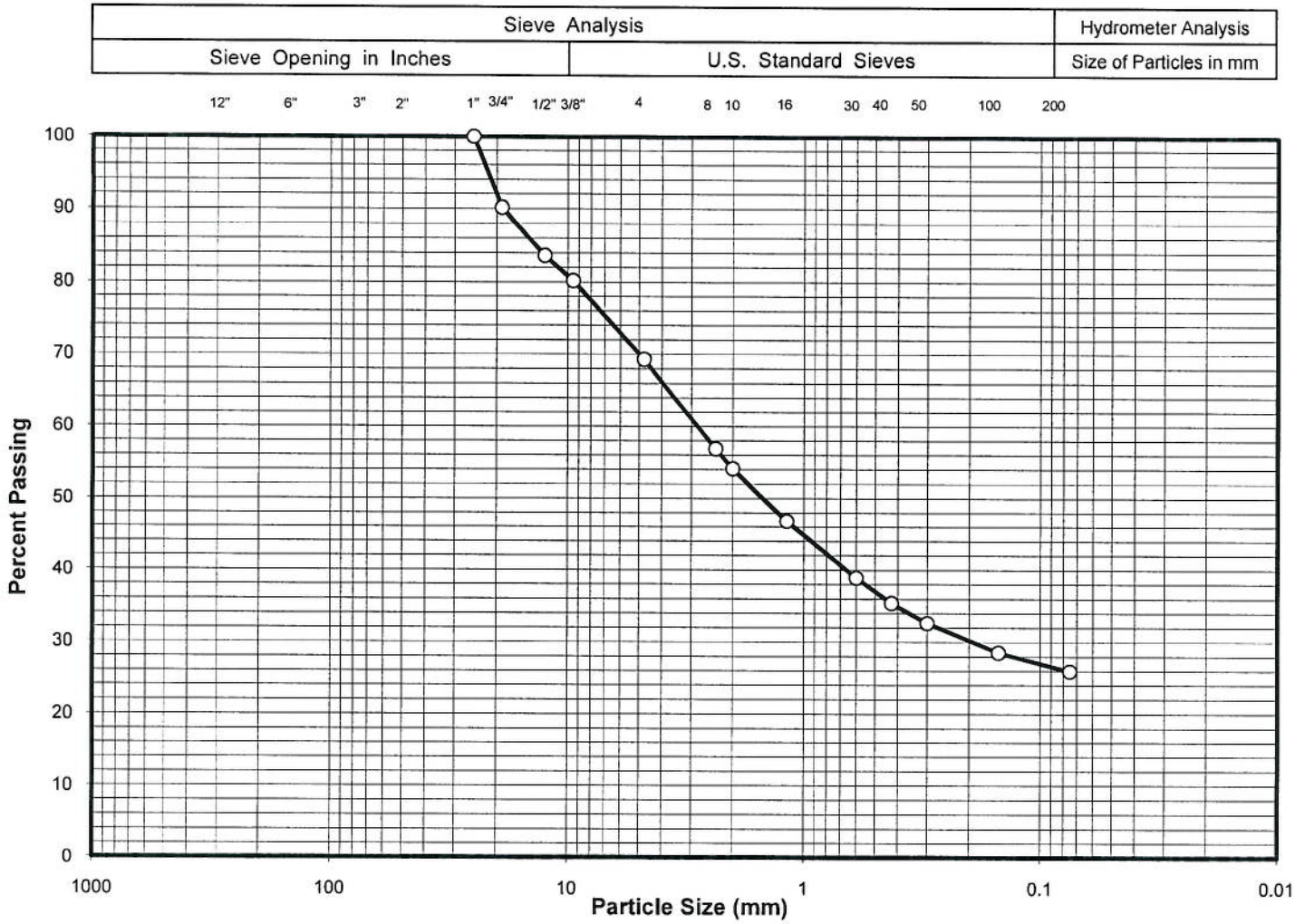
Gravel (%)	20	LL	34	Project Name:	Middle Fork Compressor Station
Sand (%)	53	PL	24	Sample ID:	TH-2
Fines (%)	27	PI	10	Sample Depth (ft.):	15
Sample Description:	Sand, silty (SM)				

Yeh & Associates, Inc.
Geotechnical Engineering Consultants

SIEVE ANALYSIS

Drawn By:	MA	Project No.:	210 - 187
Checked By:	KA	Figure No.:	A-1

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	100
¾ "	90
½"	84
⅜"	80
#4	69
#10	54
#40	35
#200	26

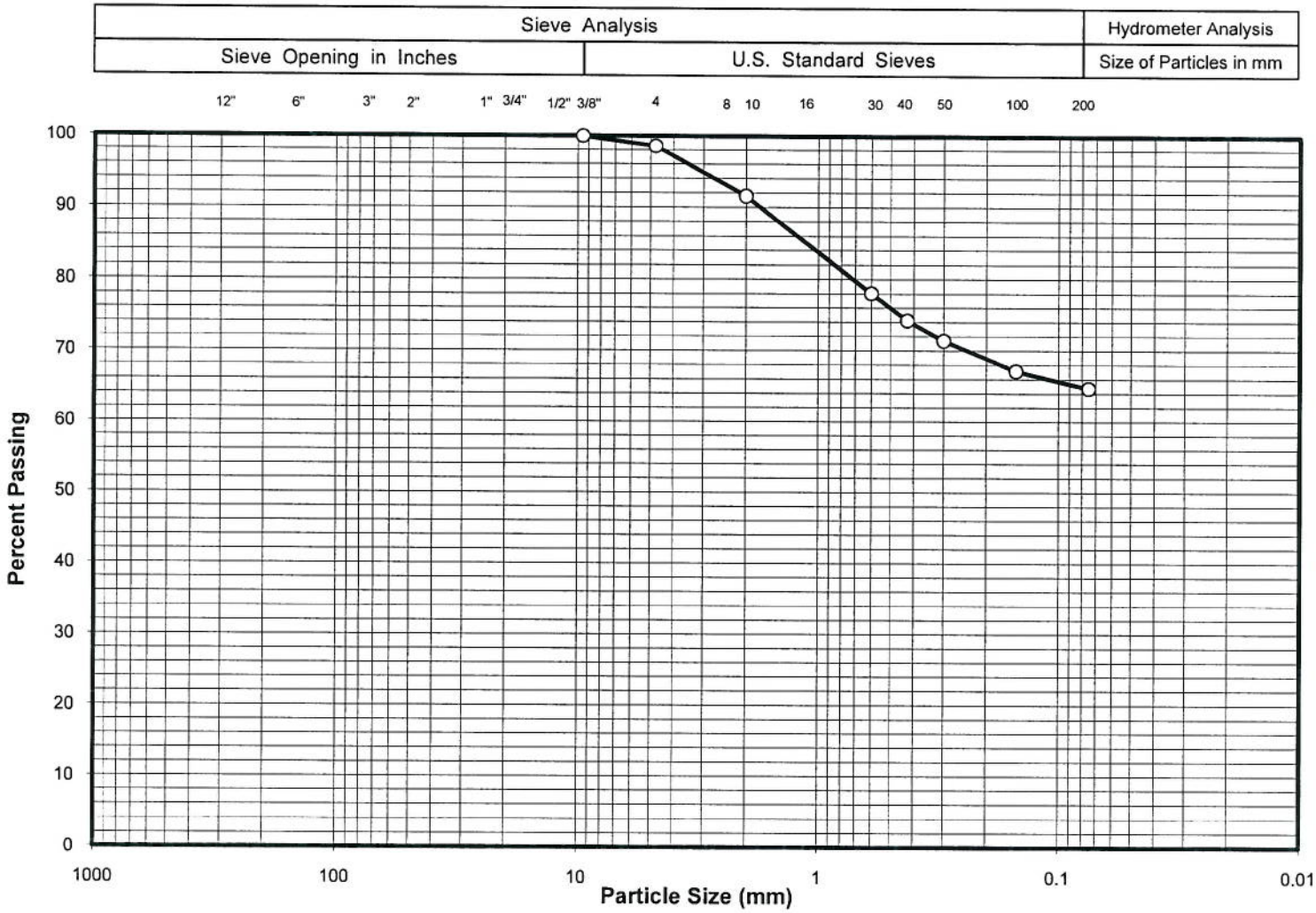
Gravel (%)	31	LL	37	Project Name:	Middle Fork Compressor Station
Sand (%)	43	PL	22	Sample ID:	TH-3
Fines (%)	26	PI	15	Sample Depth (ft.):	4
Sample Description:	Sand, clayey (SC)				

Yeh & Associates, Inc.
Geotechnical Engineering Consultants

SIEVE ANALYSIS

Drawn By:	SW	Project No.:	210-187
Checked By:	KA	Figure No.:	A-2

Revised 04/22/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	-
½"	-
⅜"	100
#4	99
#10	92
#40	74
#200	65

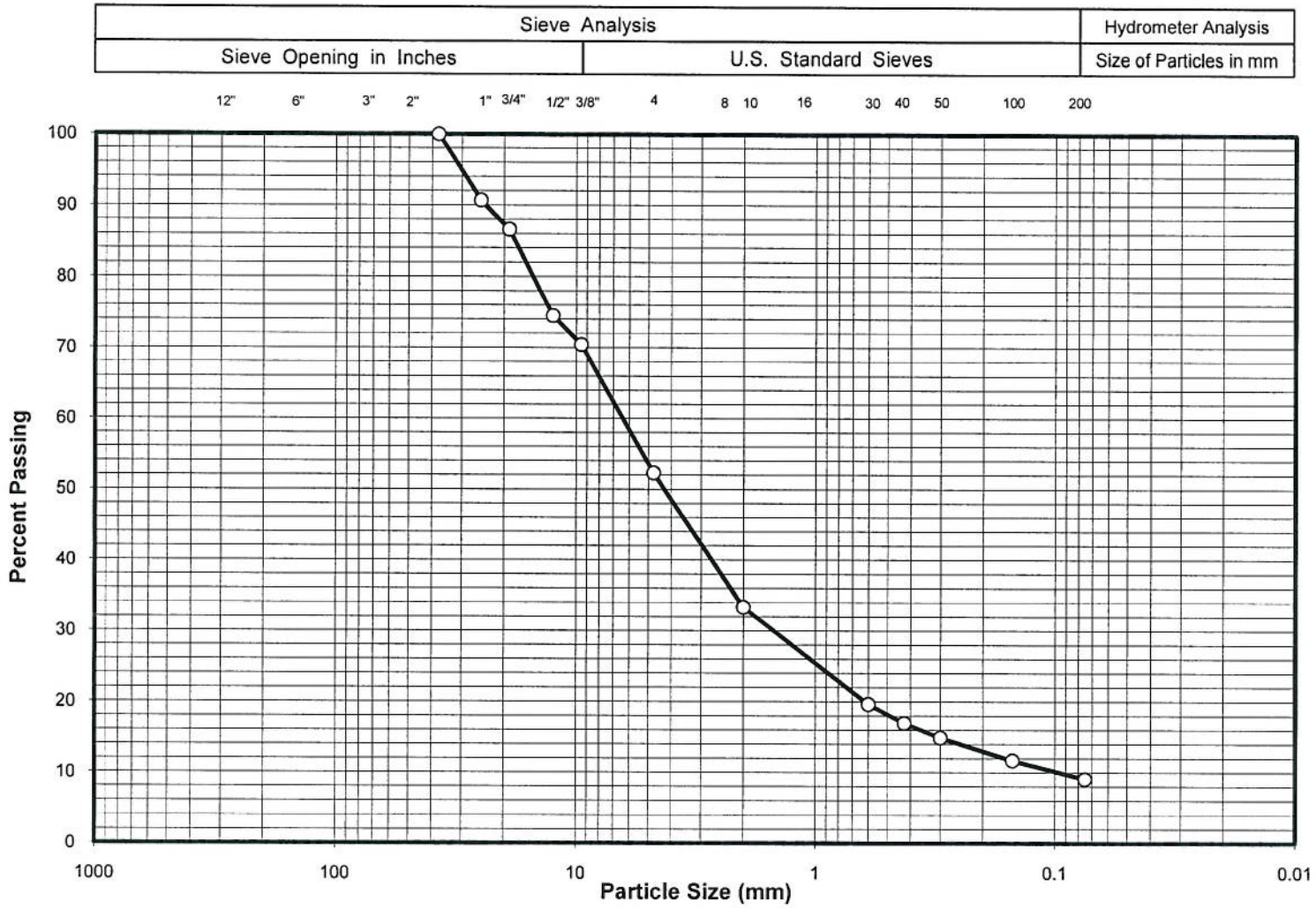
Gravel (%)	1	LL	46	Project Name:	Middle Fork Compressor Station
Sand (%)	34	PL	28	Sample ID:	TH-3
Fines (%)	65	PI	18	Sample Depth (ft.):	25 - 25.5
Sample Description:	Silt, sandy (ML)				

Yeh & Associates, Inc.
Geotechnical Engineering Consultants

SIEVE ANALYSIS

Drawn By:	MA	Project No.:	210 - 187
Checked By:	KA		
Date:	12/01/10	Figure No.:	A-3

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	100
1"	91
¾ "	87
½"	75
⅜"	70
#4	52
#10	33
#40	17
#200	9

Gravel (%)	48	LL	NV	Project Name:	Middle Fork Compressor Station
Sand (%)	43	PL	NP	Sample ID:	TH-6
Fines (%)	9	PI	NP	Sample Depth (ft.):	24
Sample Description:	Gravel, slightly silty (GP-GM)				

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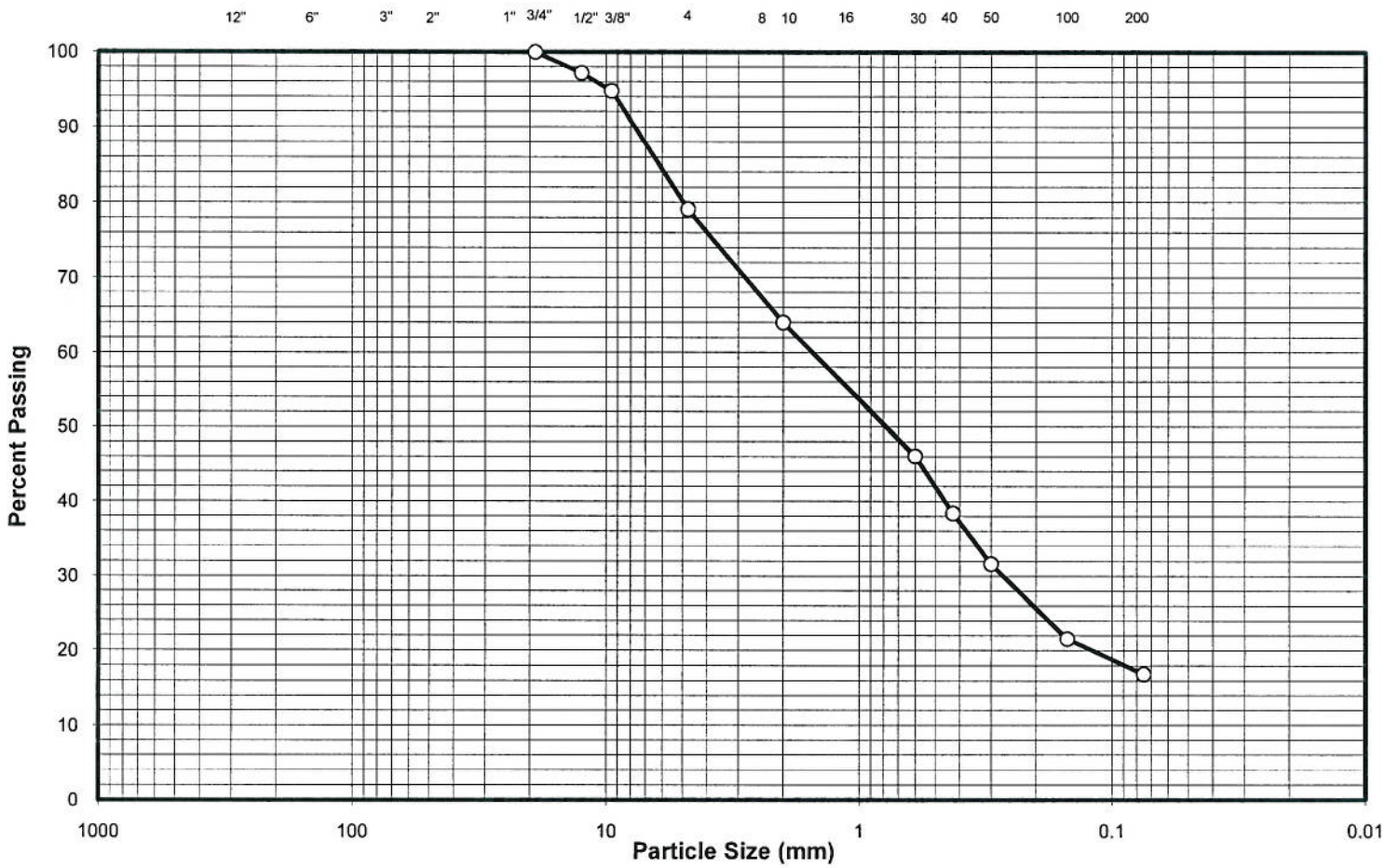
SIEVE ANALYSIS

Drawn By:	MA	Project No.:	210 - 187
Checked By:	KA	Figure No.:	A-4

Revised 04/27/2004

Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	100
½"	97
⅜"	95
#4	79
#10	64
#40	38
#200	17

Gravel (%)	21	LL	33	Project Name:	Middle Fork Compressor Stations
Sand (%)	62	PL	22	Sample ID:	TH-7
Fines (%)	17	PI	11	Sample Depth (ft.):	15 - 19
Sample Description:	Sand, clayey (SC)				

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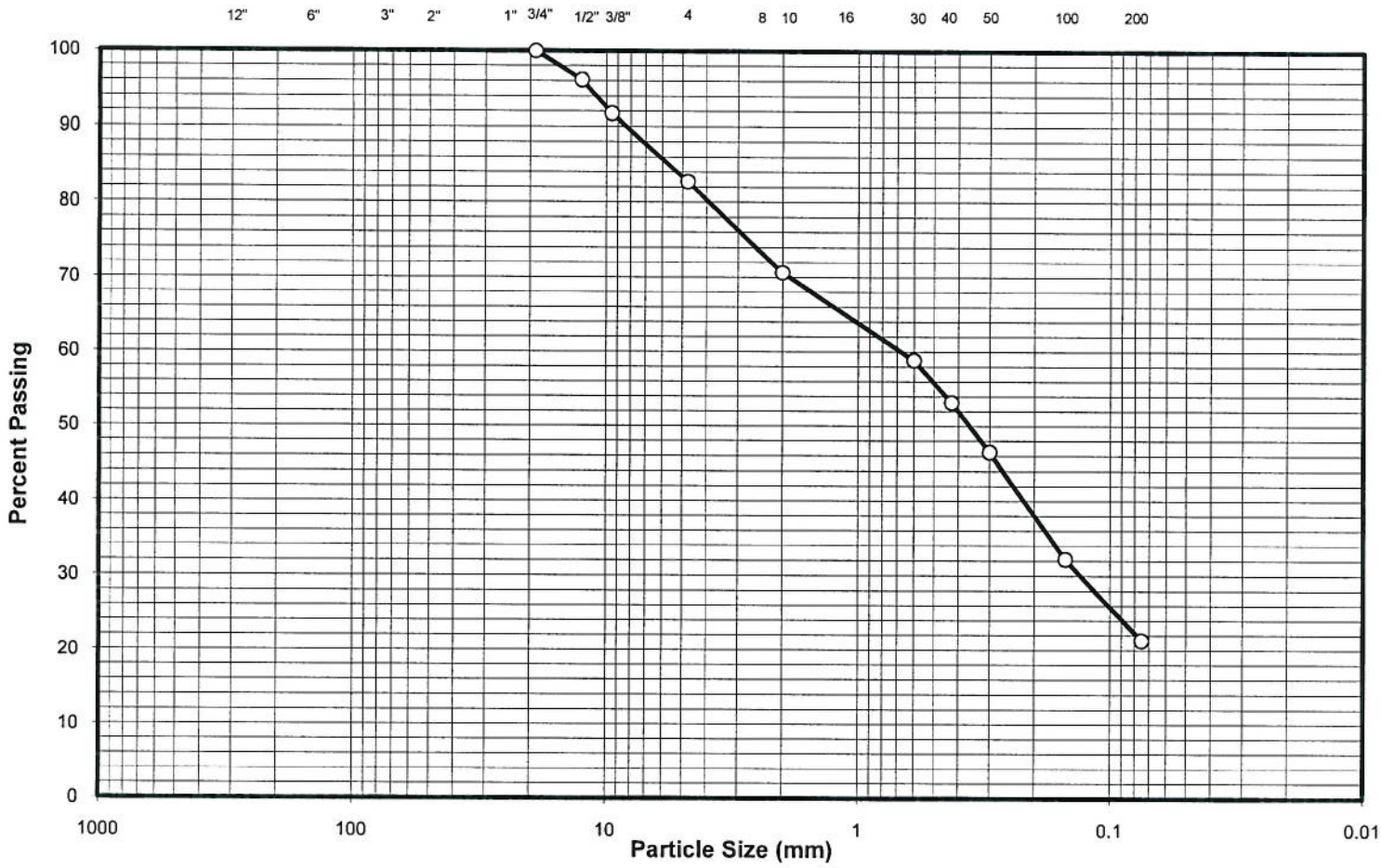
SIEVE ANALYSIS

Drawn By:	MA	Project No.:	210 - 187
Checked By:	KA	Figure No.:	A-5

Revised 04/27/2004

Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	100
½"	96
⅜"	92
#4	83
#10	71
#40	53
#200	21

Gravel (%)	17	LL	35	Project Name:	Middle Fork Compressor Station
Sand (%)	62	PL	24	Sample ID:	TH-8
Fines (%)	21	PI	11	Sample Depth (ft.):	6 - 9
Sample Description:	Sand, clayey (SC)				

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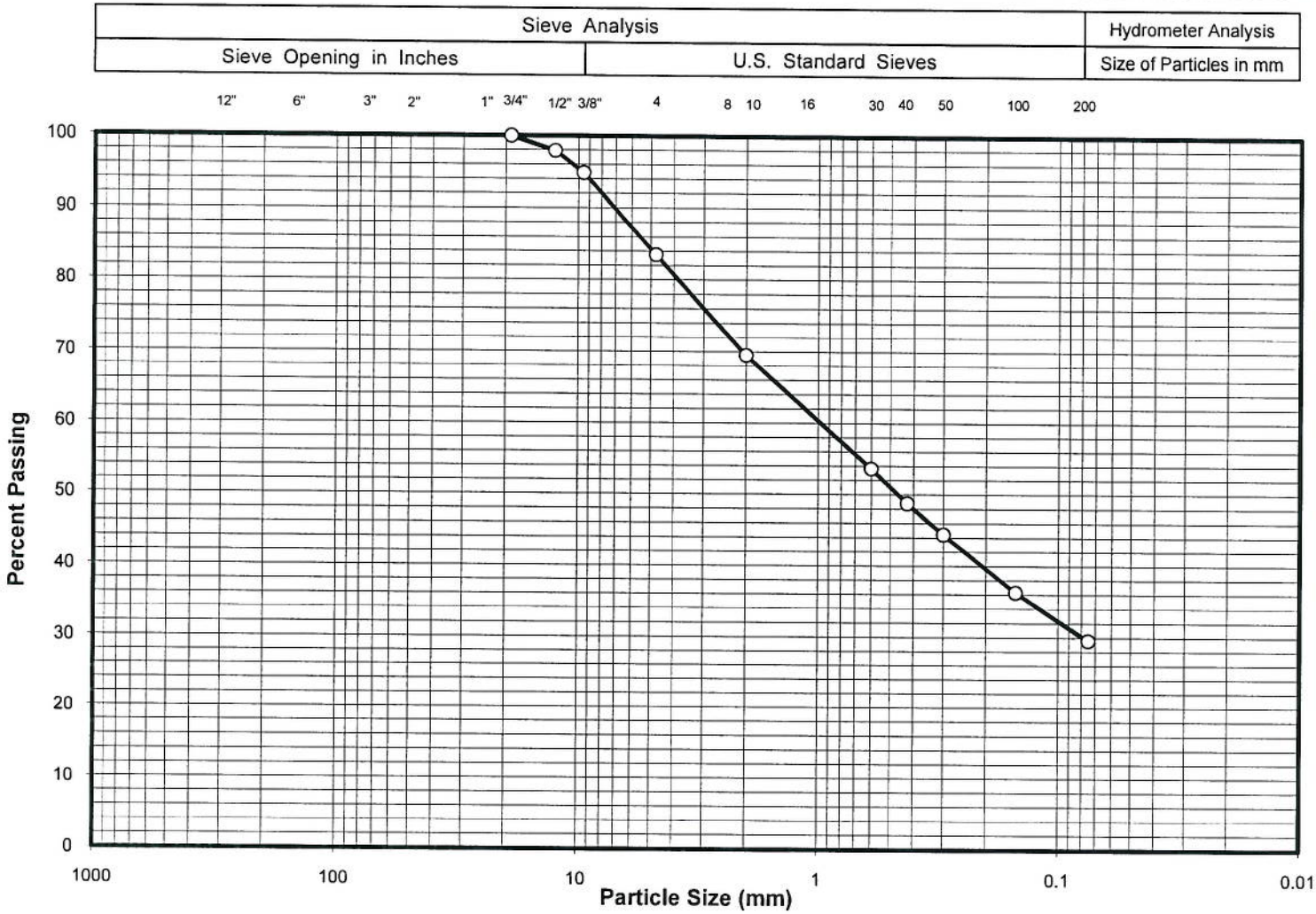
SIEVE ANALYSIS

Drawn By:	MA	Project No.:	210 - 187
Checked By:	KA	Figure No.:	A-6

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	100
½"	98
⅜"	95
#4	84
#10	69
#40	49
#200	30

Gravel (%)	16	LL	37	Project Name:	Middle Fork Compressor Station
Sand (%)	54	PL	23	Sample ID:	TH-8
Fines (%)	30	PI	14	Sample Depth (ft.):	15 - 19
Sample Description:	Sand, clayey (SC)				

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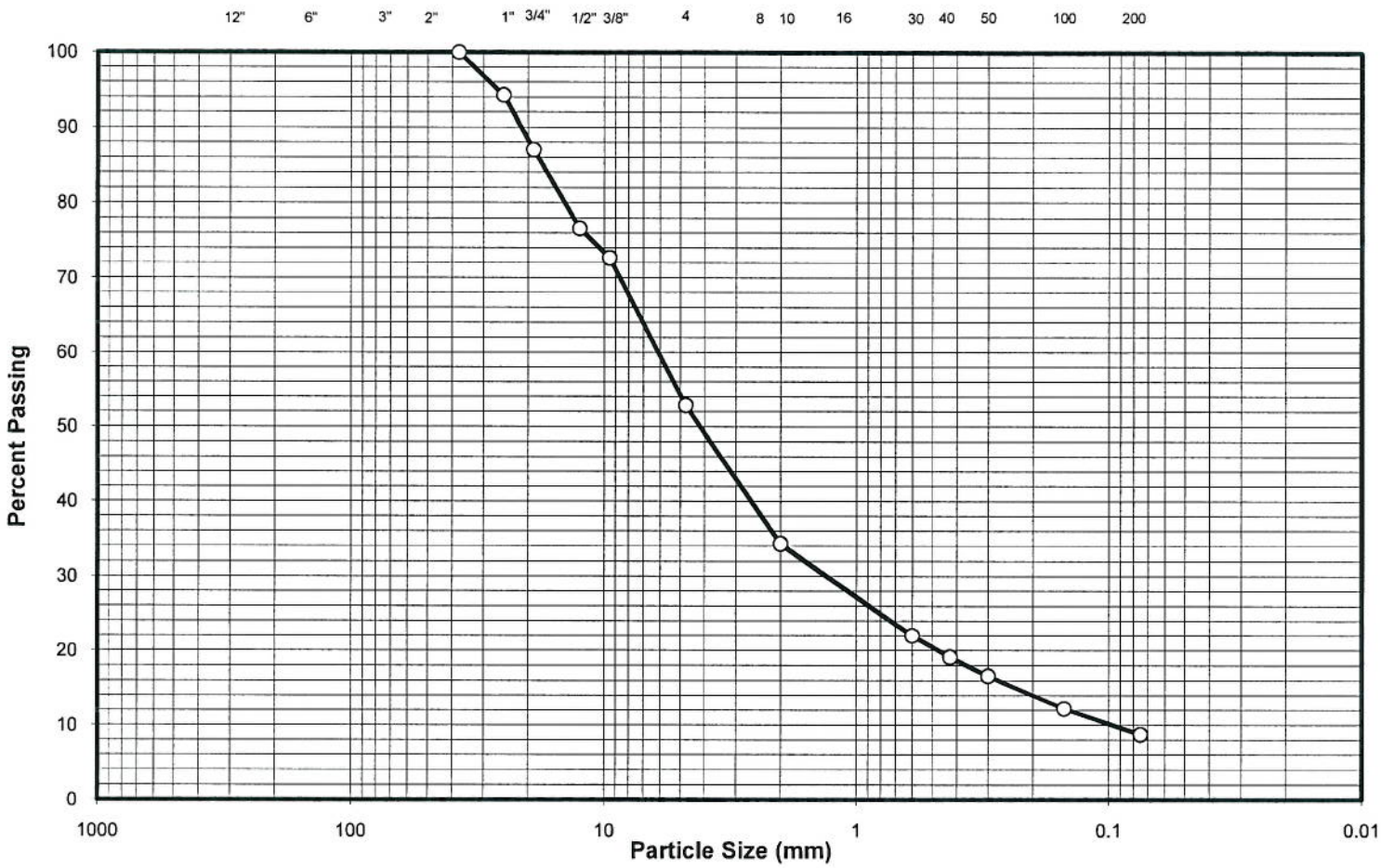
SIEVE ANALYSIS

Drawn By:	MA	Project No.:	210 - 187
Checked By:	KA	Figure No.:	A-7

Revised 04/27/2004

Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	100
1"	94
¾ "	87
½"	77
⅜"	73
#4	53
#10	34
#40	19
#200	9

Gravel (%)	47	LL	NL	Project Name:	Middle Fork Compressor Station
Sand (%)	44	PL	NP	Sample ID:	TH-8
Fines (%)	9	PI	NP	Sample Depth (ft.):	29
Sample Description:	Gravel, slightly silty (GW-GM)				

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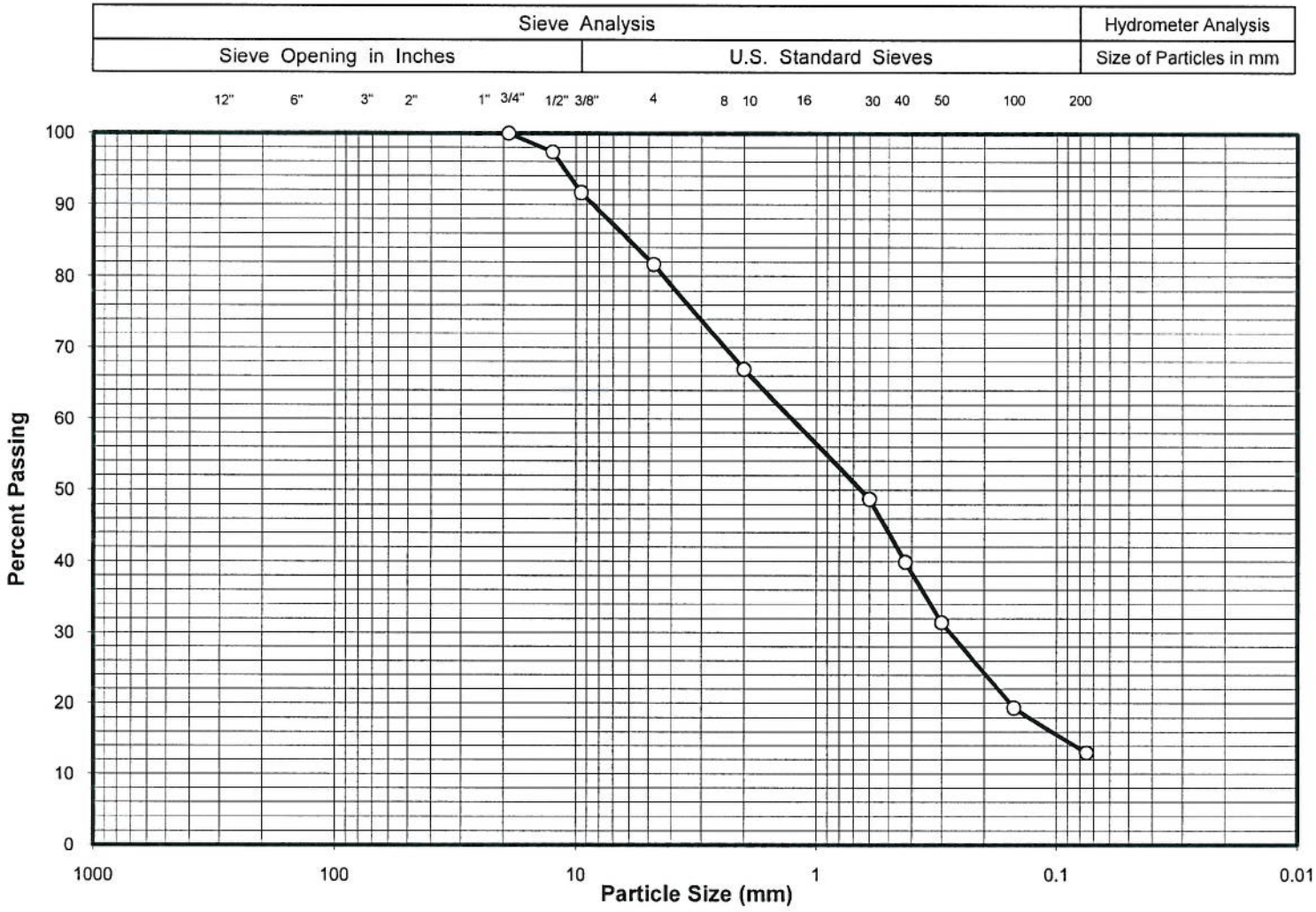
SIEVE ANALYSIS

Drawn By:	MA	Project No.:	210 - 187
Checked By:	KA	Figure No.:	A-8

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	100
½"	97
⅜"	92
#4	82
#10	67
#40	40
#200	13

Gravel (%)	18	LL	35	Project Name:	Middle Fork Compressor Station
Sand (%)	69	PL	23	Sample ID:	TH-11
Fines (%)	13	PI	12	Sample Depth (ft.):	10 - 14
Sample Description:	Sand, clayey (SC)				

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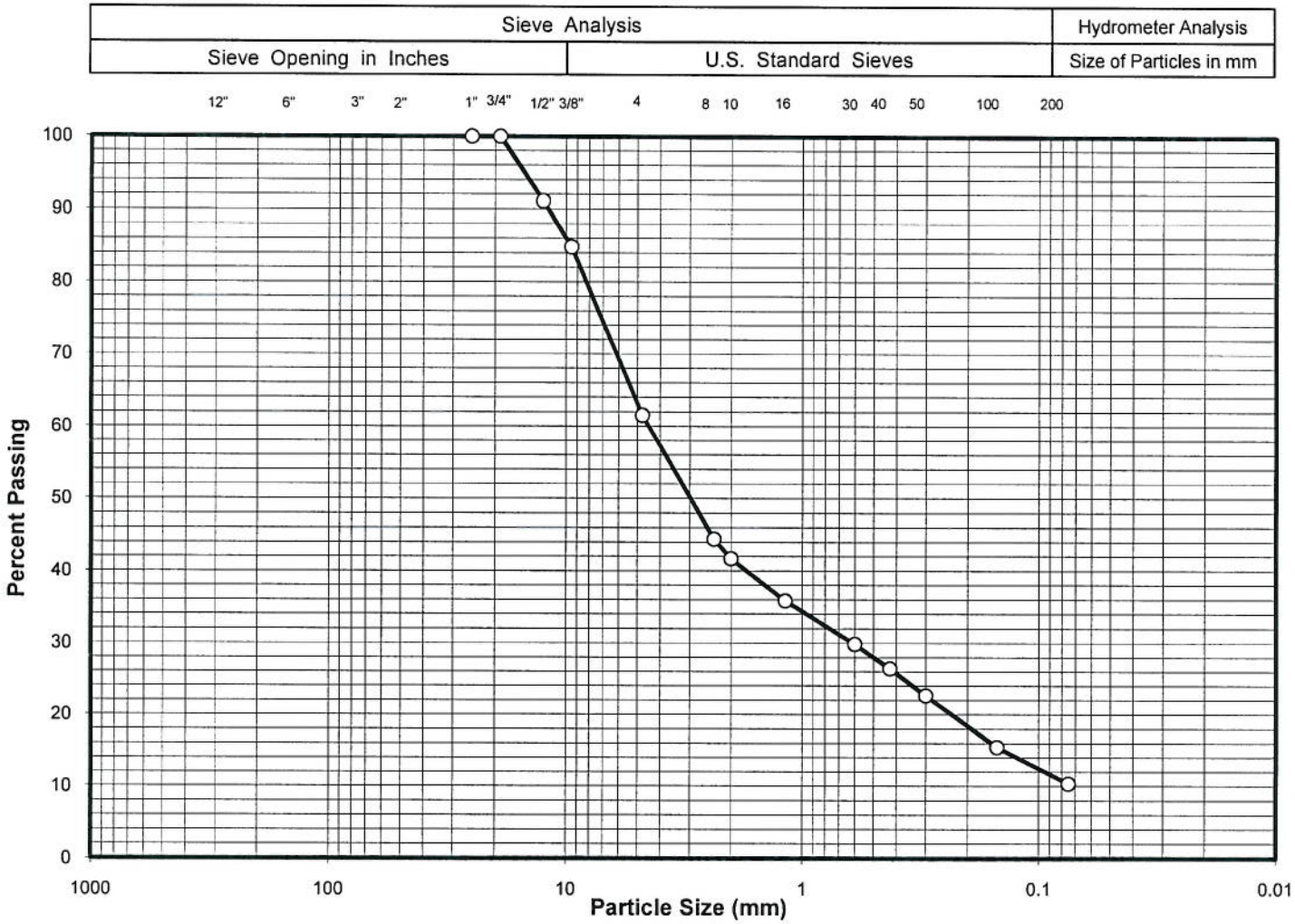
SIEVE ANALYSIS

Drawn By:	MA	Project No.:	210 - 187
Checked By:	KA	Figure No.:	A-9

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	100
¾ "	100
½"	91
⅜"	85
#4	62
#10	42
#40	26
#200	10

Gravel (%)	38	LL	NL	Project Name:	Middle Fork Compressor Station
Sand (%)	52	PL	NP	Sample ID:	TH-12
Fines (%)	10	PI	NP	Sample Depth (ft.):	9
Sample Description:	Fill, sand, silty (SM)				

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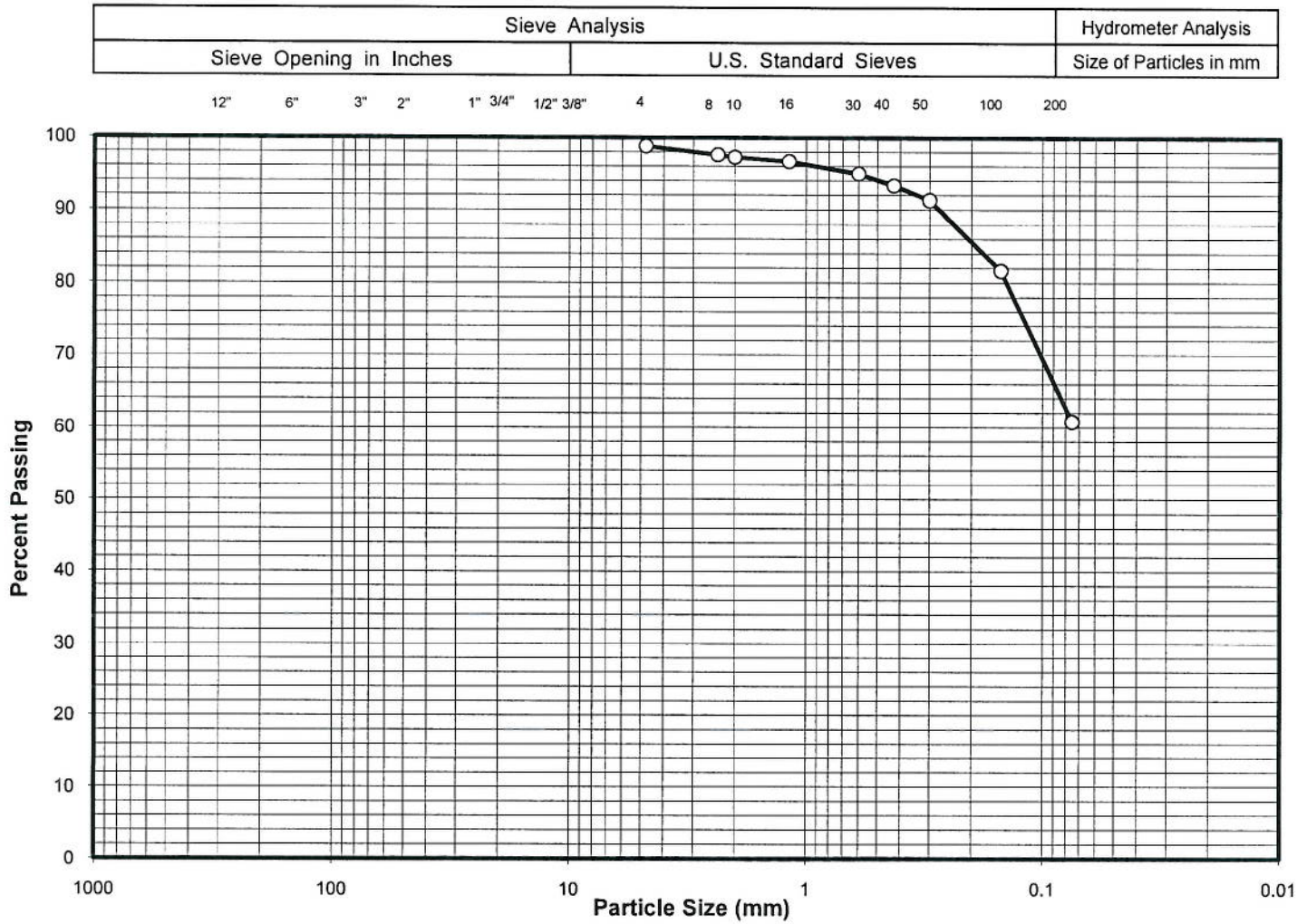
SIEVE ANALYSIS

Drawn By:	SW	Project No.:	210-187
Checked By:	KA	Figure No.:	A-10

Revised 04/22/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	-
½"	-
⅜"	-
#4	99
#10	97
#40	93
#200	61

Gravel (%)	1	LL	43	Project Name:	Middle Fork Compressor Station
Sand (%)	38	PL	25	Sample ID:	TH-13
Fines (%)	61	PI	18	Sample Depth (ft.):	9
Sample Description:	Clay, sandy (CL)				

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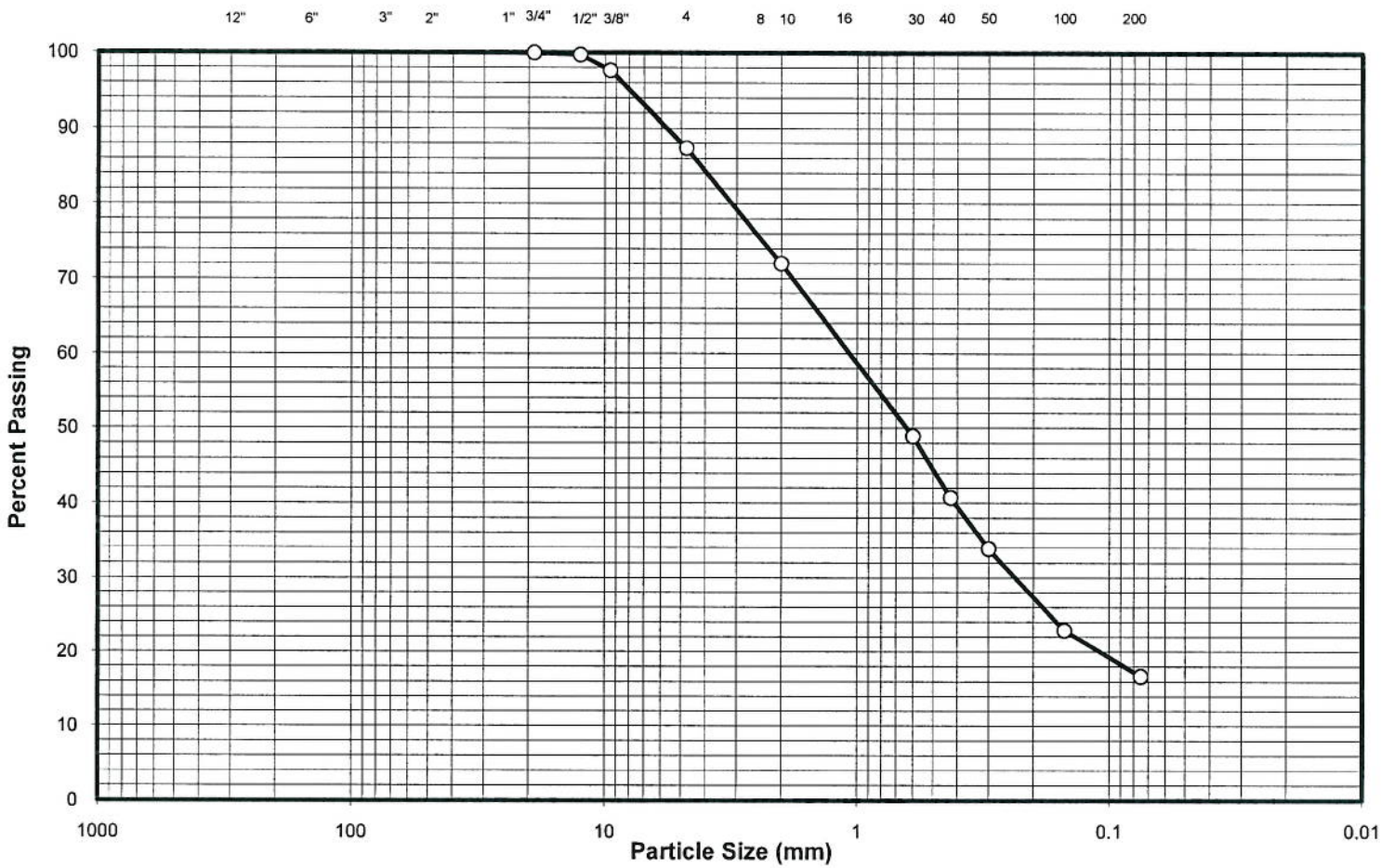
SIEVE ANALYSIS

Drawn By:	SW	Project No.:	210-187
Checked By:	KA	Figure No.:	A-11

Revised 04/22/2004

Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	100
½"	100
⅜"	98
#4	87
#10	72
#40	41
#200	17

Gravel (%)	13	LL	35	Project Name:	Middle Fork Compressor Station
Sand (%)	70	PL	23	Sample ID:	TH-13
Fines (%)	17	PI	12	Sample Depth (ft.):	15.5 - 18.5
Sample Description:	Sand, clayey (SC)				

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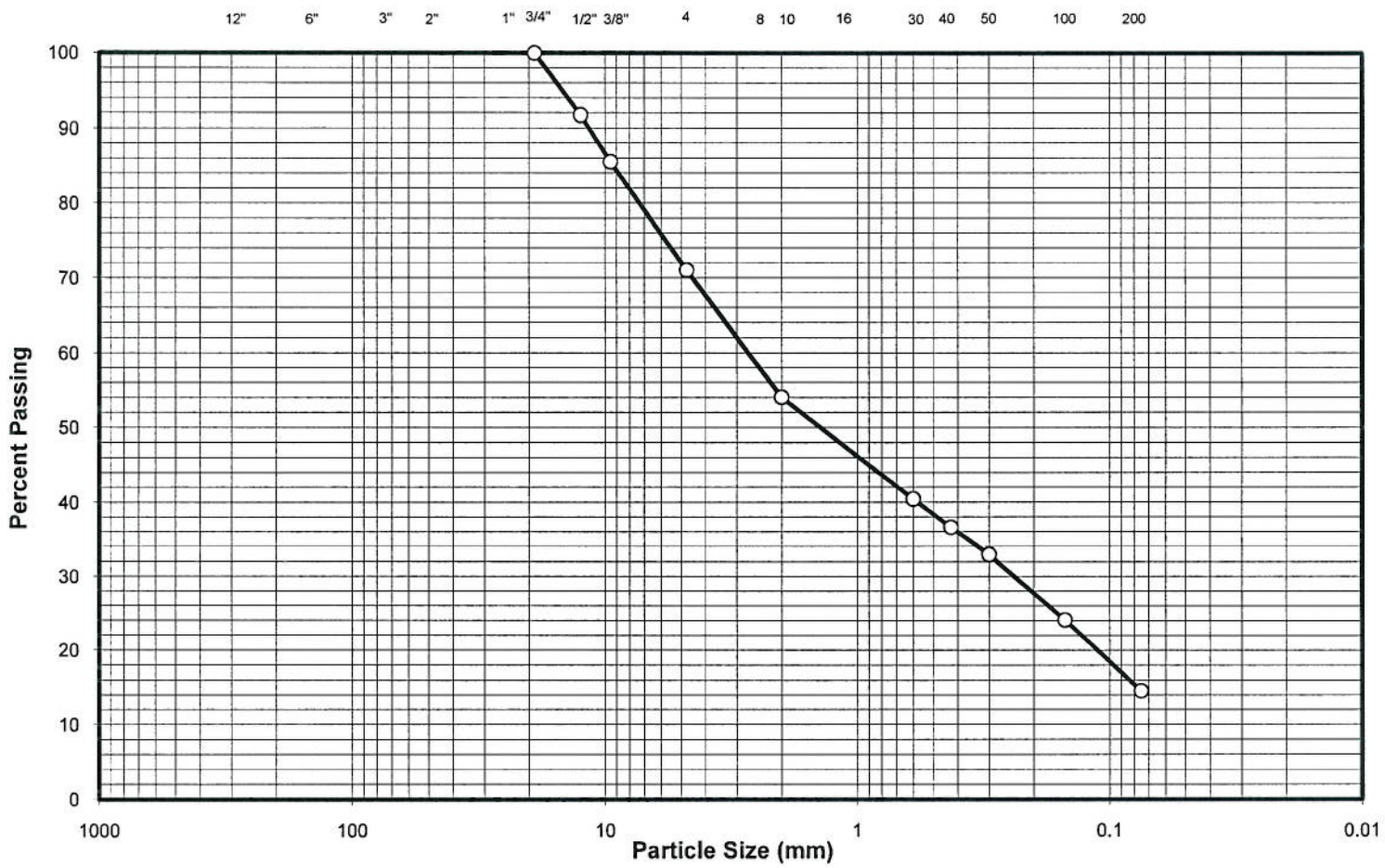
SIEVE ANALYSIS

Drawn By:	MA	Project No.:	210 - 187
Checked By:	KA	Figure No.:	A-12

Revised 04/27/2004

Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	100
½"	92
⅜"	85
#4	71
#10	54
#40	37
#200	15

Gravel (%)	29	LL	40	Project Name:	Middle Fork Compressor Station
Sand (%)	56	PL	17	Sample ID:	TH-14
Fines (%)	15	PI	23	Sample Depth (ft.):	9
Sample Description:	Fill, sand, clayey (SC)				

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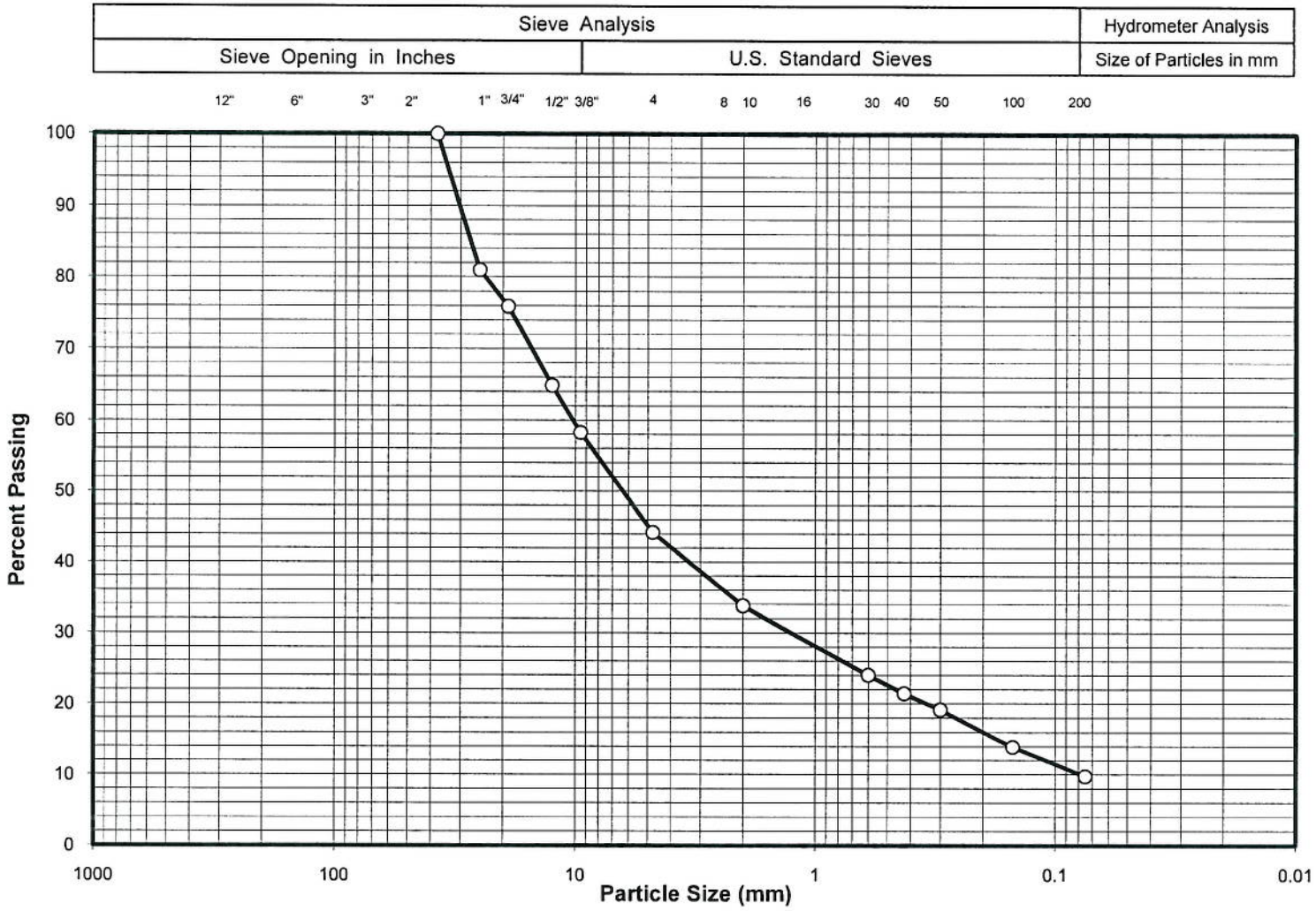
SIEVE ANALYSIS

Drawn By:	MA	Project No.:	210 - 187
Checked By:	KA	Figure No.:	A-13

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	100
1"	81
¾ "	76
½"	65
⅜"	58
#4	44
#10	34
#40	21
#200	10

Gravel (%)	56	LL	35	Project Name:	Middle Fork Compressor Station
Sand (%)	34	PL	21	Sample ID:	TH-14
Fines (%)	10	PI	14	Sample Depth (ft.):	19
Sample Description:	Gravel, clayey (GC)				

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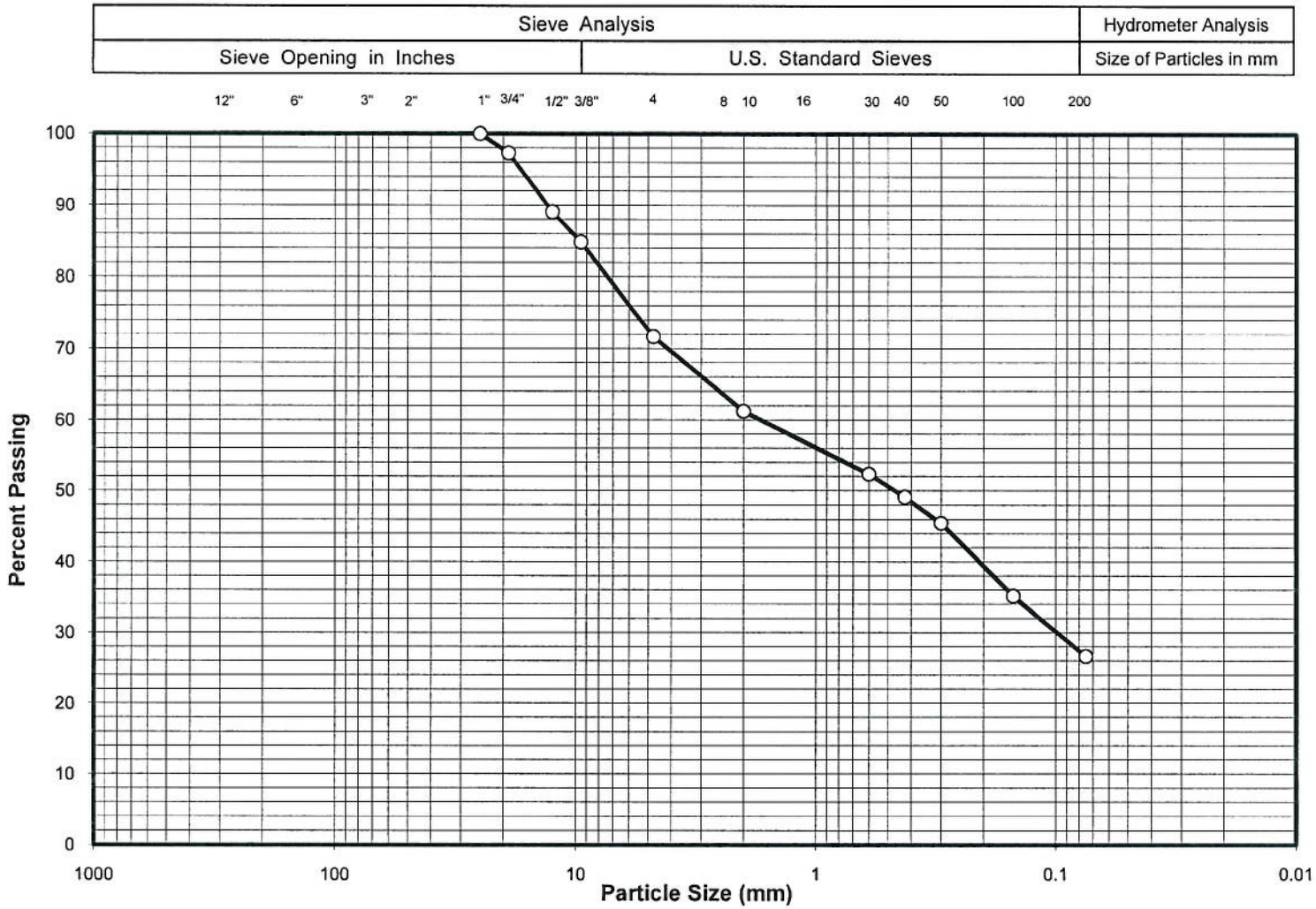
SIEVE ANALYSIS

Drawn By:	MA	Project No.:	210 - 187
Checked By:	KA	Figure No.:	A-14

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	100
¾ "	97
½"	89
⅜"	85
#4	72
#10	61
#40	49
#200	27

Gravel (%)	28	LL	36	Project Name:	Middle Fork Compressor Station
Sand (%)	45	PL	23	Sample ID:	TH-15
Fines (%)	27	PI	13	Sample Depth (ft.):	24
Sample Description:	Sand, clayey (SC)				

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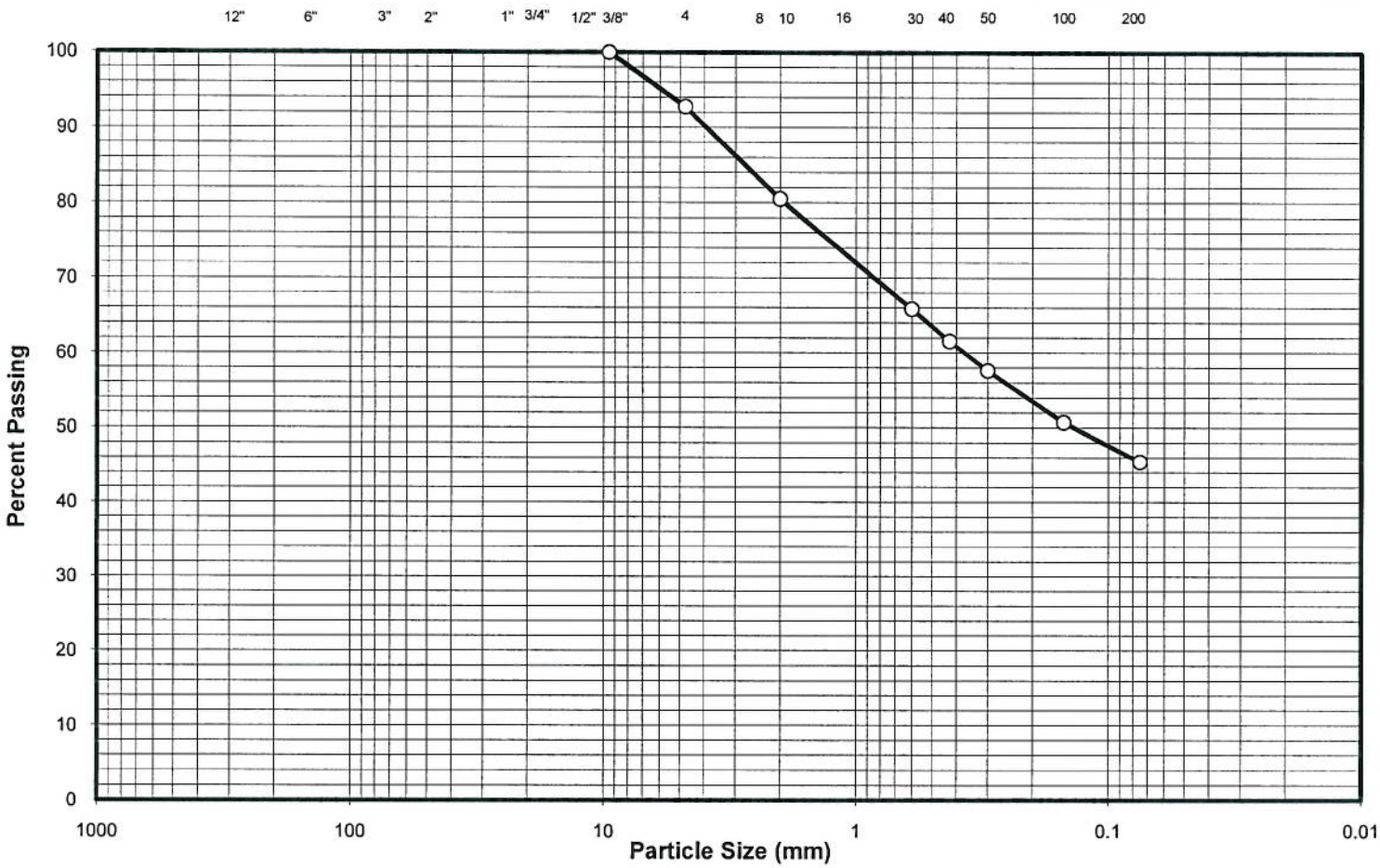
SIEVE ANALYSIS

Drawn By:	MA	Project No.:	210 - 187
Checked By:	KA	Figure No.:	A-15

Revised 04/27/2004

Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	-
½"	-
⅜"	100
#4	93
#10	80
#40	62
#200	45

Gravel (%)	7	LL	34	Project Name:	Middle Fork Compressor Station
Sand (%)	48	PL	18	Sample ID:	TH-15
Fines (%)	45	PI	16	Sample Depth (ft.):	37.5 - 39
Sample Description:	Sandstone Bedrock				

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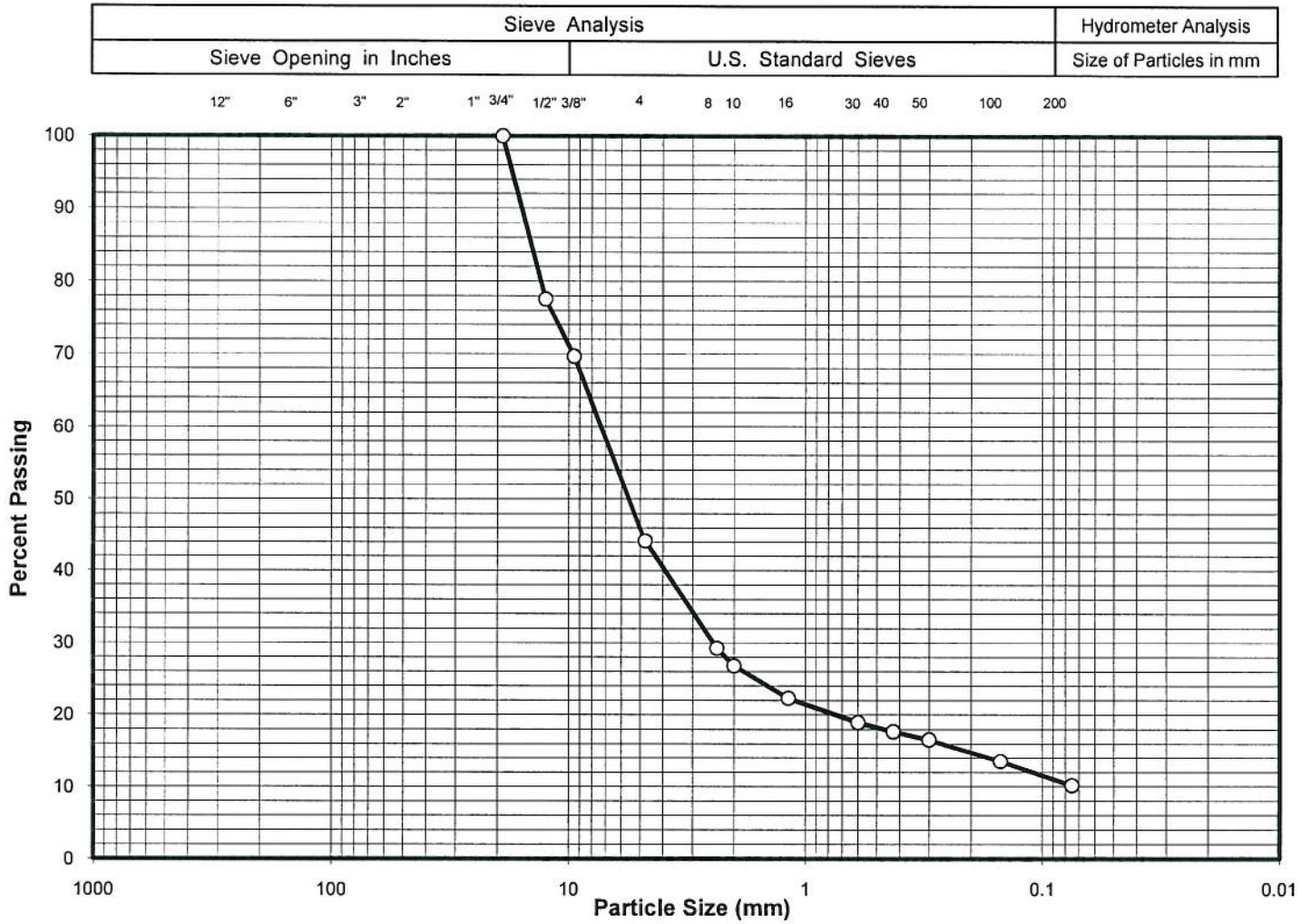
SIEVE ANALYSIS

Drawn By:	MA	Project No.:	210 - 187
Checked By:	Keith	Figure No.:	A-16

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	100
½"	78
⅜"	70
#4	44
#10	27
#40	18
#200	10

Gravel (%)	56	LL	NL	Project Name:	Middle Fork Compressor Station
Sand (%)	34	PL	NP	Sample ID:	TH-16
Fines (%)	10	PI	NP	Sample Depth (ft.):	24
Sample Description:	Gravel, slightly silty (GP-GM)				

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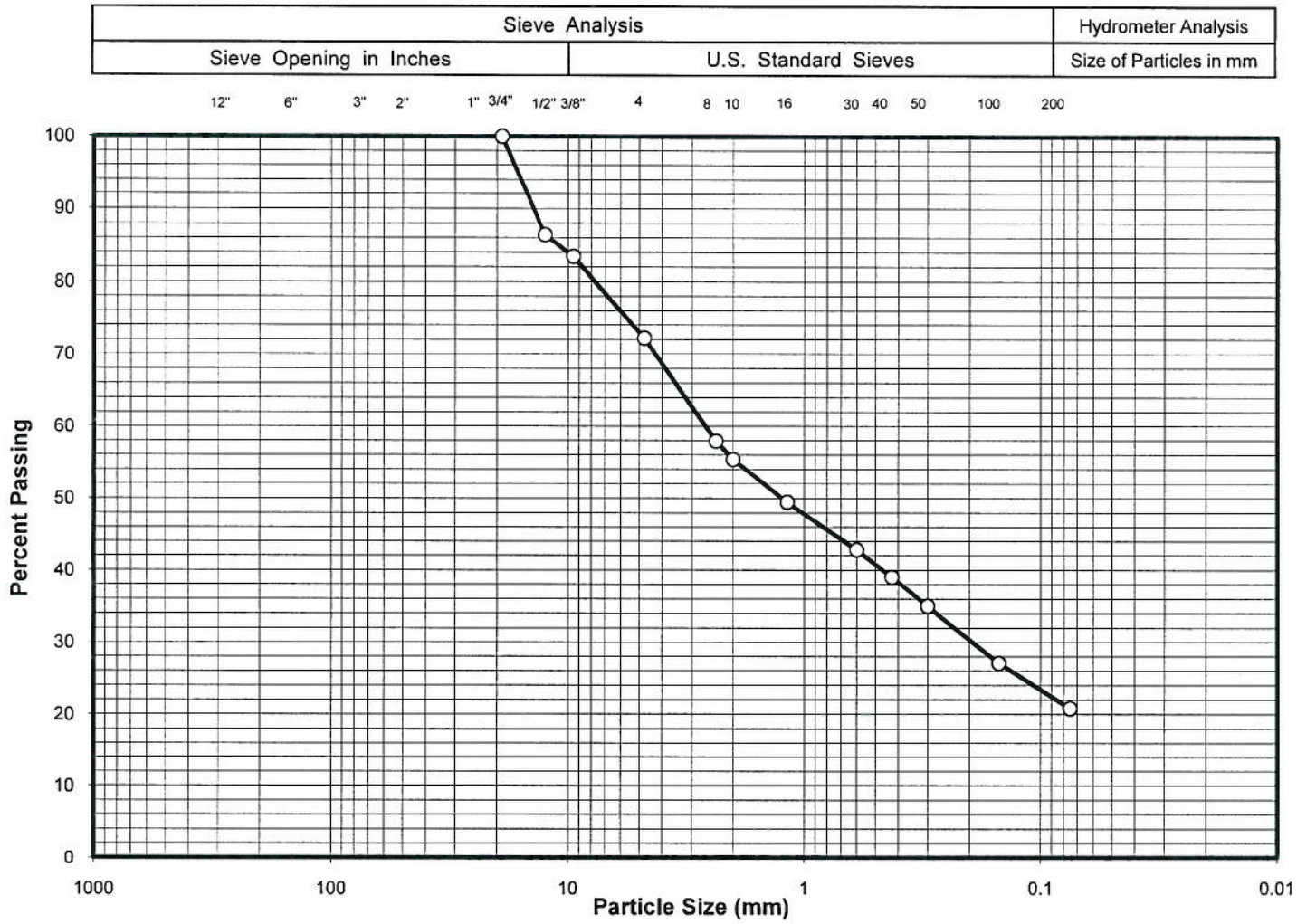
SIEVE ANALYSIS

Drawn By:	SW	Project No.:	210-187
Checked By:	KA	Figure No.:	A-17

Revised 04/22/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	100
½"	86
⅜"	83
#4	72
#10	55
#40	39
#200	21

Gravel (%)	28	LL	NL	Project Name:	Middle Fork Compressor Station
Sand (%)	51	PL	NP	Sample ID:	TH-17
Fines (%)	21	PI	NP	Sample Depth (ft.):	4
Sample Description:	Fill, sand, silty (SM)				

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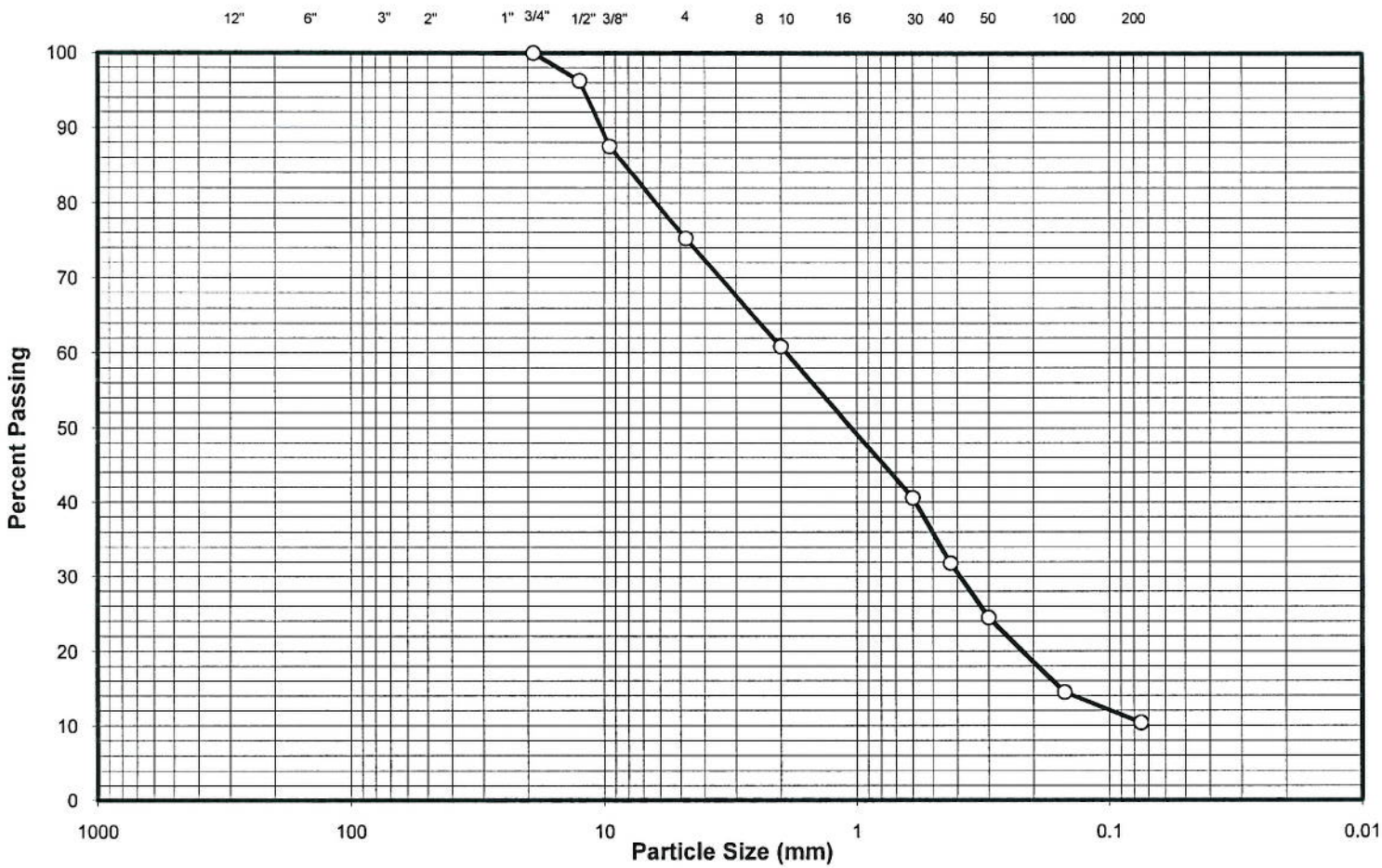
SIEVE ANALYSIS

Drawn By:	SW	Project No.:	210-187
Checked By:	KA	Figure No.:	A-18

Revised 04/22/2004

Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	100
½"	96
⅜"	88
#4	75
#10	61
#40	32
#200	10

Gravel (%)	25	LL	33	Project Name:	Middle Fork Compressor Station
Sand (%)	65	PL	22	Sample ID:	TH-18
Fines (%)	10	PI	11	Sample Depth (ft.):	15 - 17.5
Sample Description:	Sand, slightly silty (SW-SM)				

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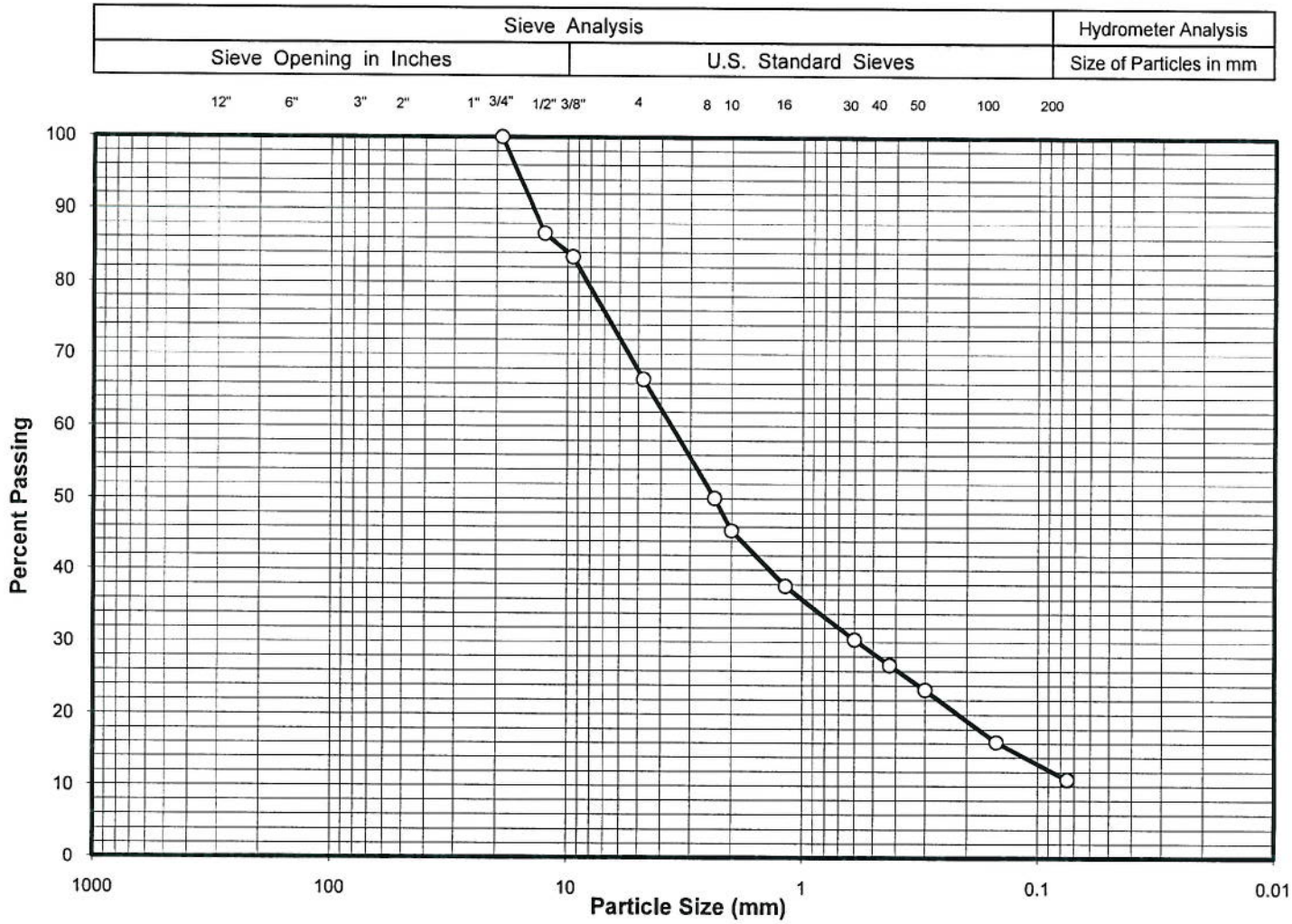
SIEVE ANALYSIS

Drawn By:	MA	Project No.:	210 - 187
Checked By:	KA	Figure No.:	A-19

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	100
½"	87
⅜"	83
#4	67
#10	45
#40	27
#200	11

Gravel (%)	33	LL	NL	Project Name:	Middle Fork Compressor Station
Sand (%)	56	PL	NP	Sample ID:	TH-18
Fines (%)	11	PI	NP	Sample Depth (ft.):	14
Sample Description:	Sand, slightly silty (SW-SM)				

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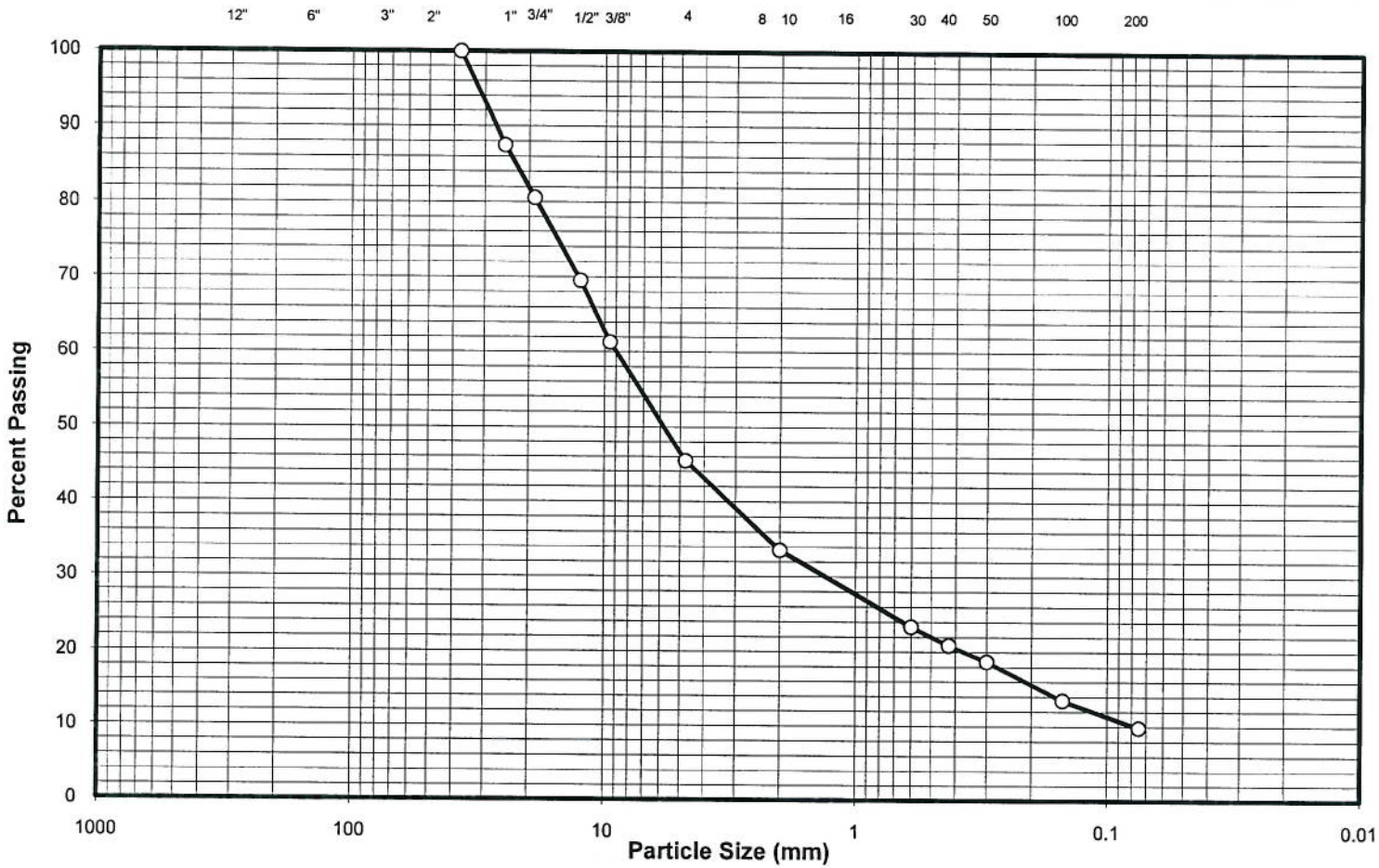
SIEVE ANALYSIS

Drawn By:	SW	Project No.:	210-187
Checked By:	KA	Figure No.:	A-20

Revised 04/22/2004

Sieve Analysis		Hydrometer Analysis
Sieve Opening in Inches	U.S. Standard Sieves	Size of Particles in mm



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	100
1"	88
¾ "	81
½"	70
⅜"	61
#4	45
#10	34
#40	21
#200	10

Gravel (%)	55	LL	NL	Project Name:	Middle Fork Compressor Station
Sand (%)	35	PL	NP	Sample ID:	TH-18
Fines (%)	10	PI	NP	Sample Depth (ft.):	19
Sample Description:	Gravel, slightly silty (GW-GM)				

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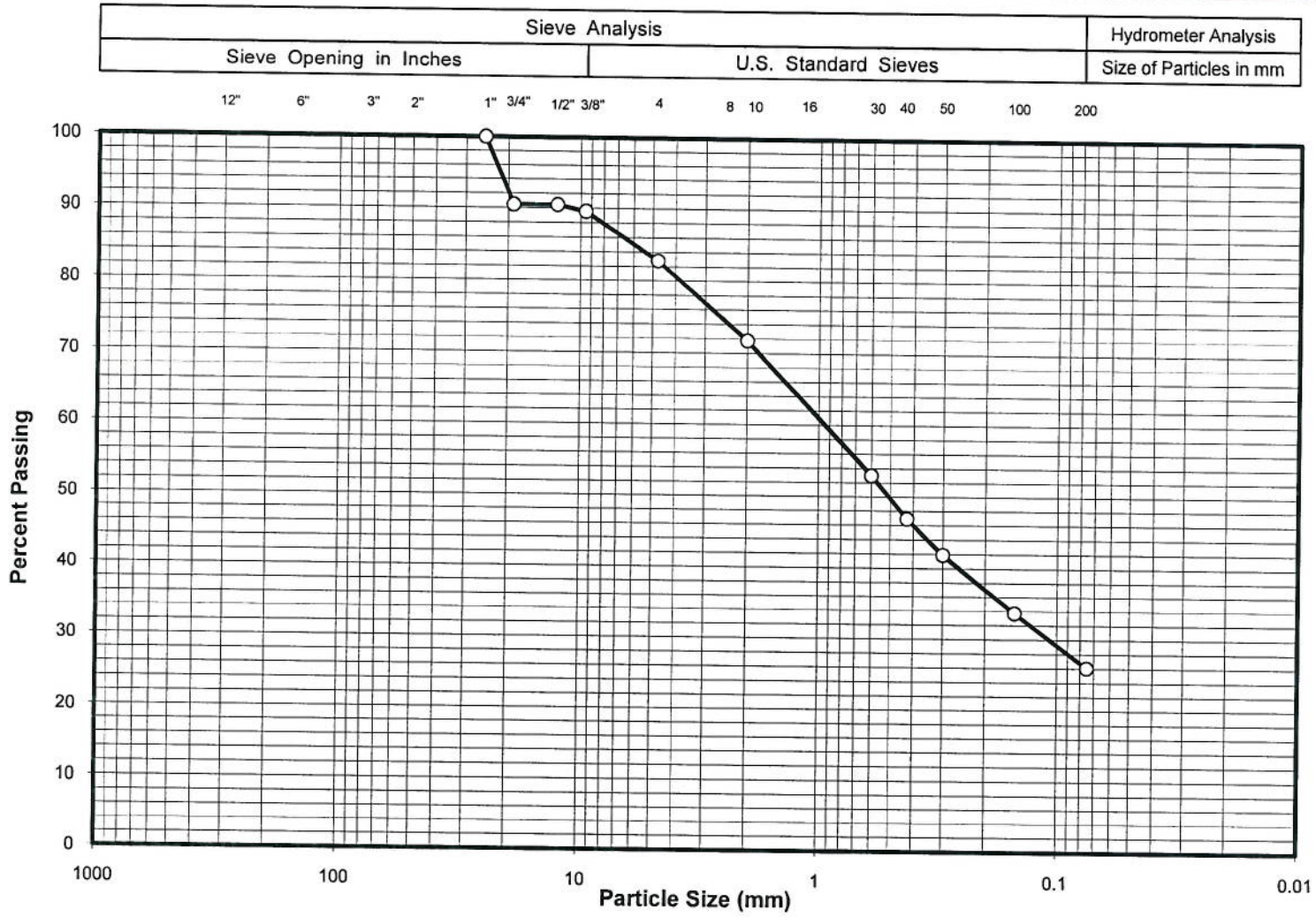
SIEVE ANALYSIS

Drawn By:	MA	Project No.:	210 - 187
Checked By:	KA	Figure No.:	A-21

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	100
¾ "	90
½"	90
⅜"	90
#4	83
#10	72
#40	47
#200	26

Gravel (%)	17	LL	43	Project Name:	Middle Fork Compressor Station
Sand (%)	57	PL	27	Sample ID:	TH-18
Fines (%)	26	PI	16	Sample Depth (ft.):	24
Sample Description:	Sand, silty (SM)				

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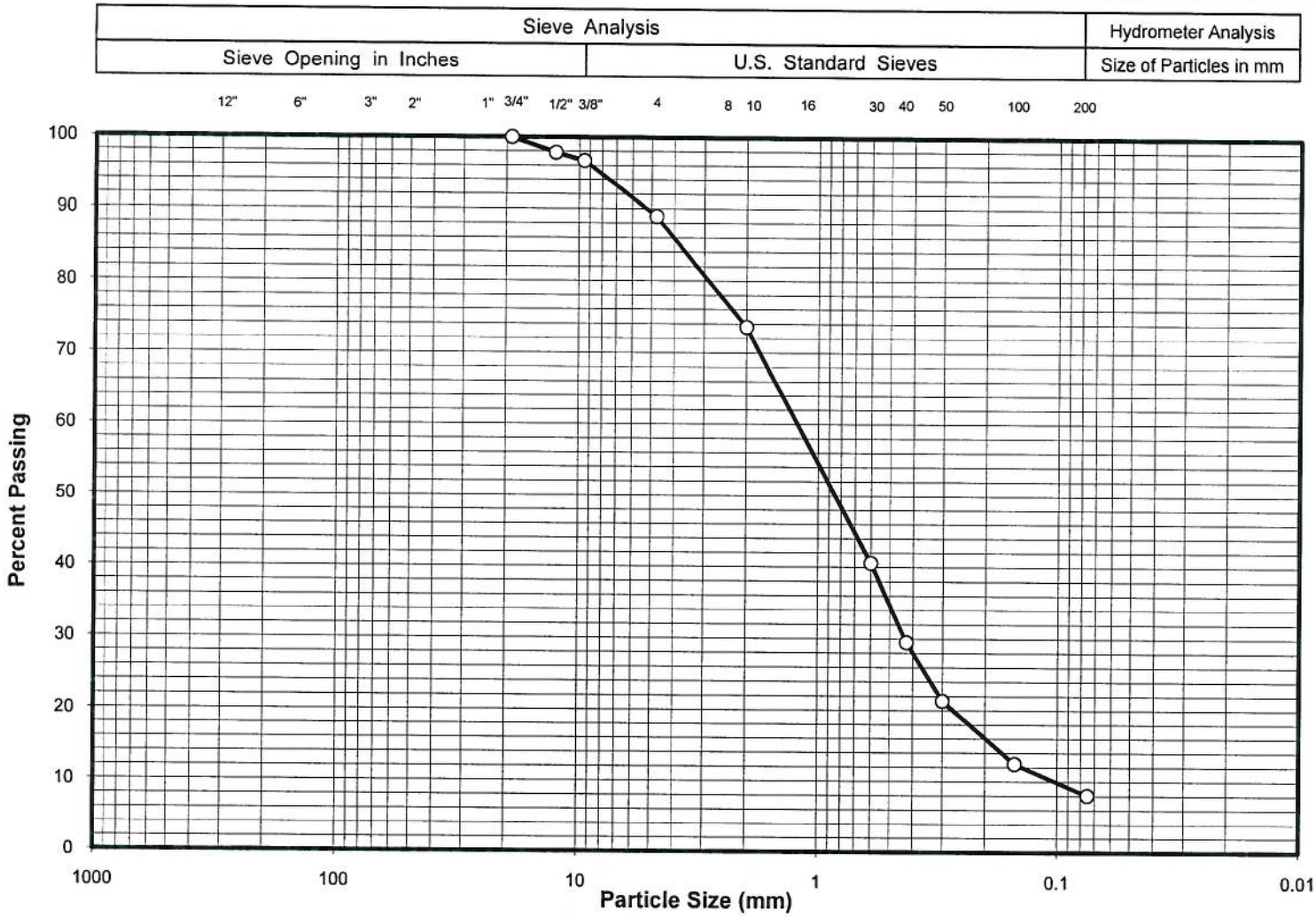
SIEVE ANALYSIS

Drawn By:	MA	Project No.:	210 - 187
Checked By:	KA	Figure No.:	A-22

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	100
½"	98
⅜"	97
#4	89
#10	74
#40	30
#200	8

Gravel (%)	11	LL	38	Project Name:	Middle Fork Compressor Station
Sand (%)	81	PL	25	Sample ID:	TH-18
Fines (%)	8	PI	13	Sample Depth (ft.):	25 - 39
Sample Description:	Sand, slightly silty (SW-SM)				

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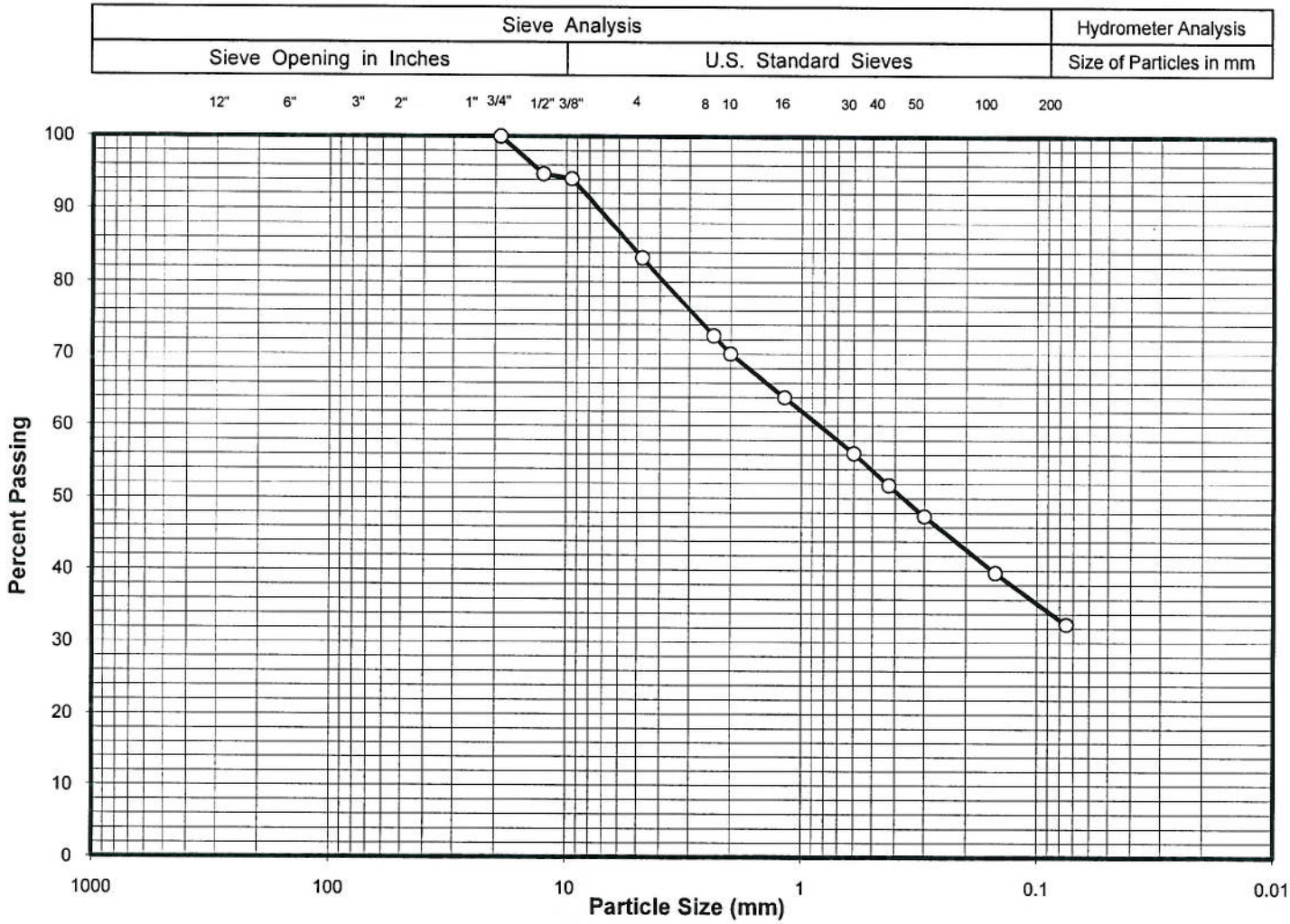
SIEVE ANALYSIS

Drawn By:	MA	Project No.:	210 - 187
Checked By:	KA	Figure No.:	A-23

Revised 04/27/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	-
1"	-
¾ "	100
½"	95
⅜"	94
#4	83
#10	70
#40	52
#200	33

Gravel (%)	17	LL	33	Project Name:	Middle Fork Compressor Station
Sand (%)	50	PL	23	Sample ID:	TH-19
Fines (%)	33	PI	10	Sample Depth (ft.):	14
Sample Description:	Fill, sand, clayey (SC)				

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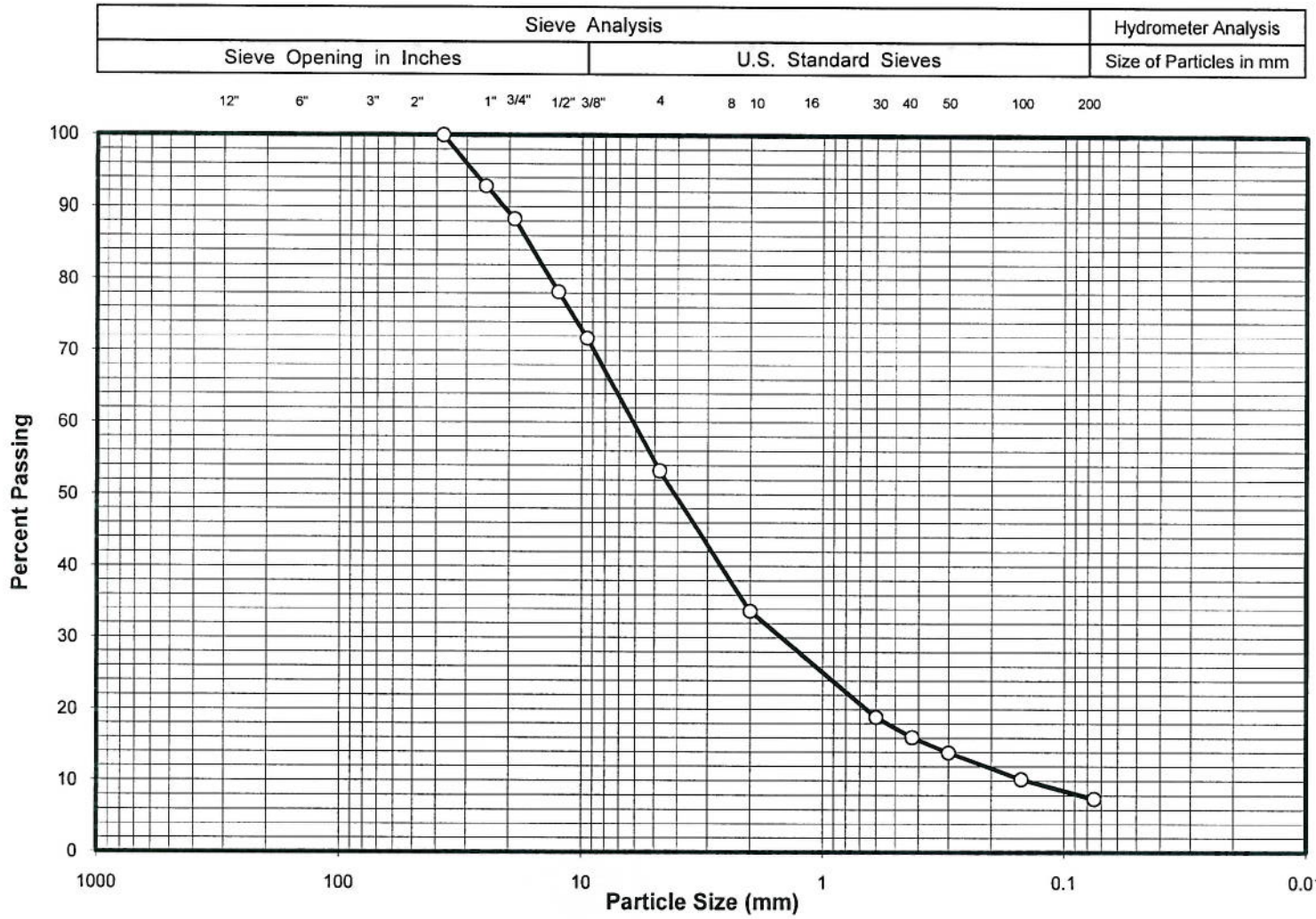
SIEVE ANALYSIS

Drawn By:	SW	Project No.:	210-187
Checked By:	KA	Figure No.:	A-24

Revised 04/22/2004



Sieve Size	% Passing
3"	-
2 ½"	-
2"	-
1 ½"	100
1"	93
¾ "	88
½"	78
⅜"	72
#4	53
#10	34
#40	16
#200	8

Gravel (%)	47	LL	NL	Project Name:	Middle Fork Compressor Station
Sand (%)	45	PL	NP	Sample ID:	TH-19
Fines (%)	8	PI	NP	Sample Depth (ft.):	24
Sample Description:	Gravel, slightly silty (GW-GM)				

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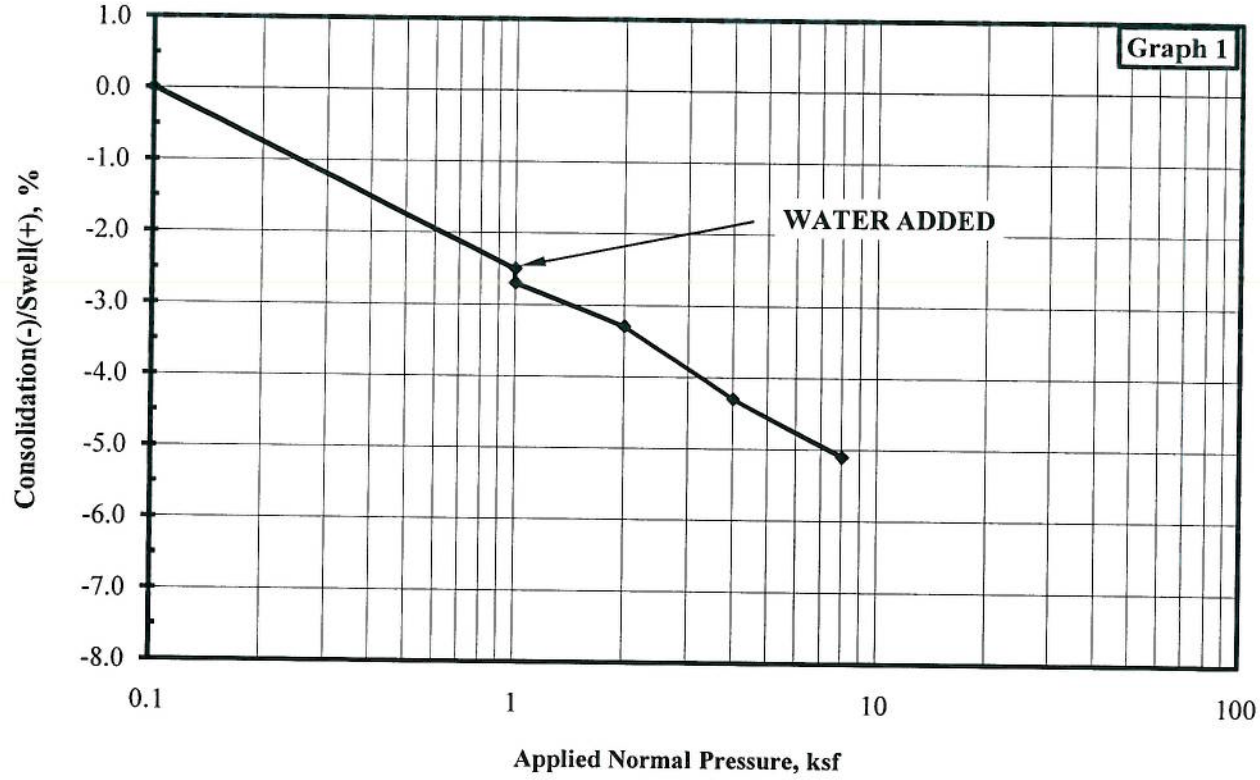
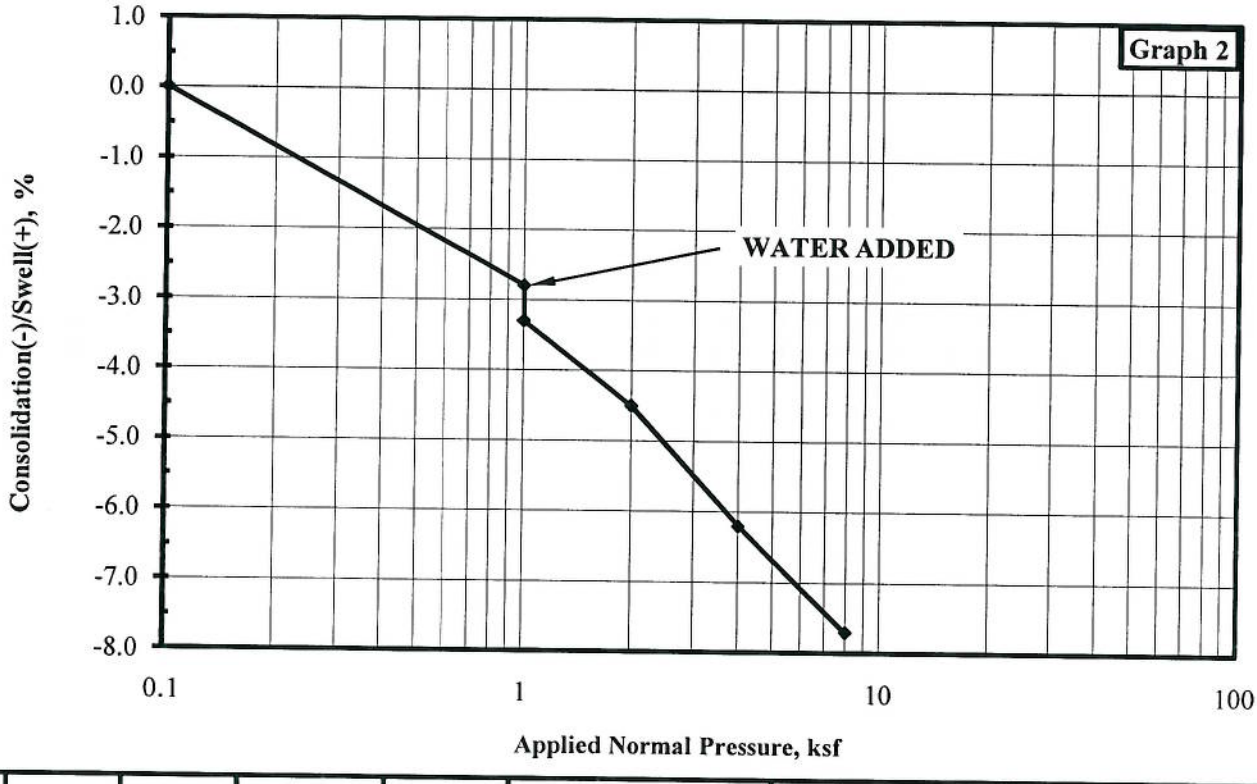
Geotechnical Engineering Consultants

SIEVE ANALYSIS

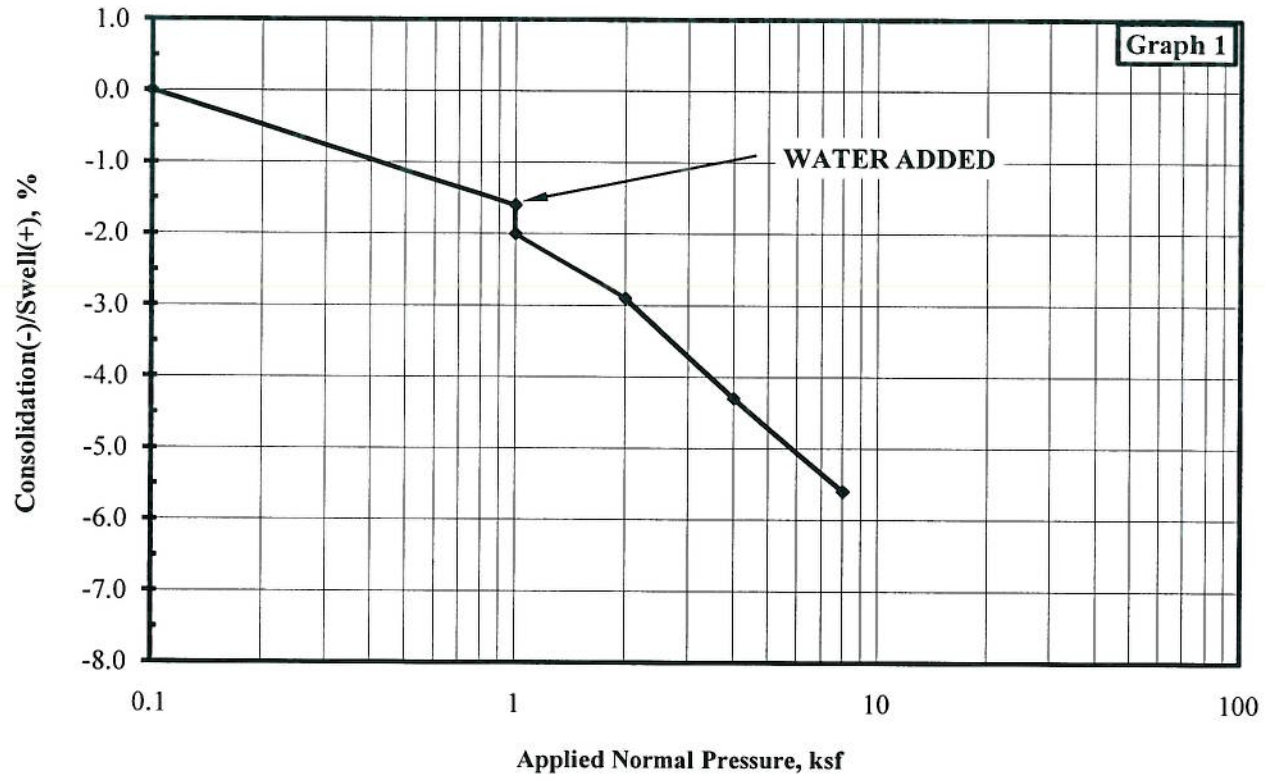
Drawn By:	MA	Project No.:	210 - 187
Checked By:	KA	Figure No.:	A-25

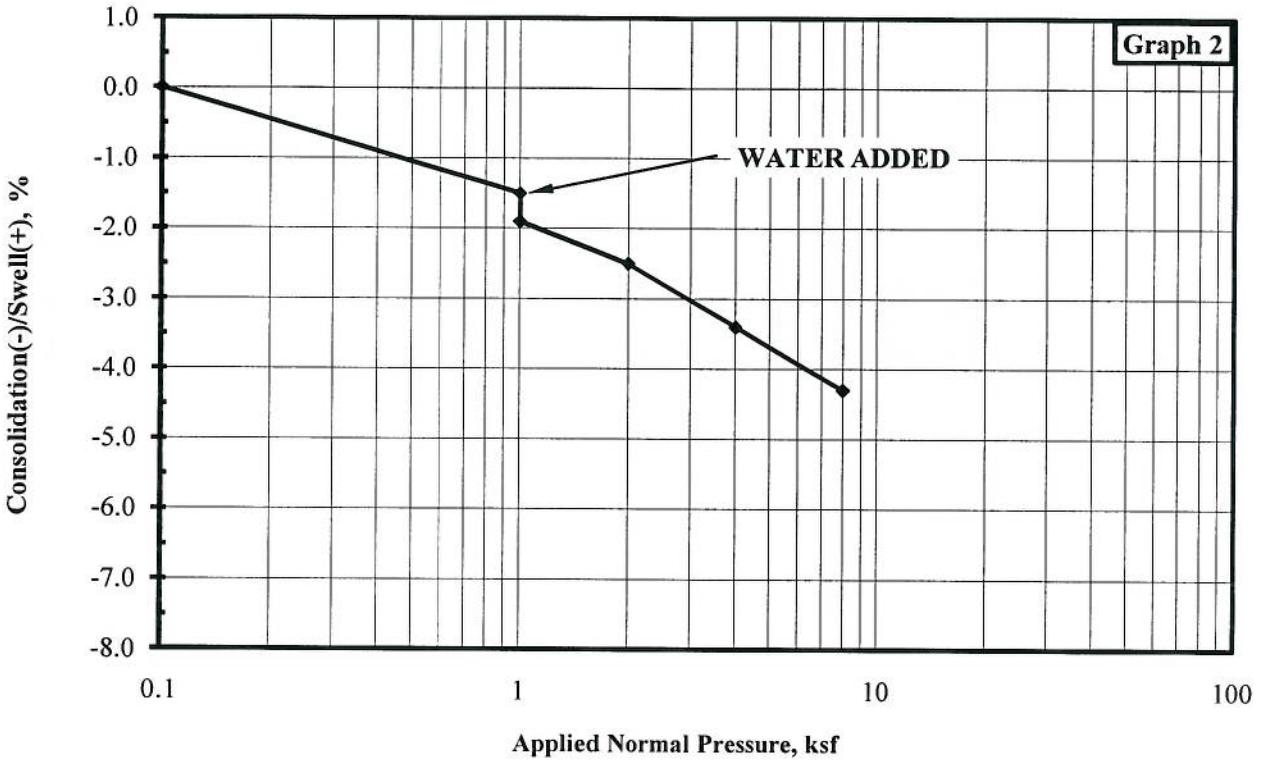
Revised 04/27/2004



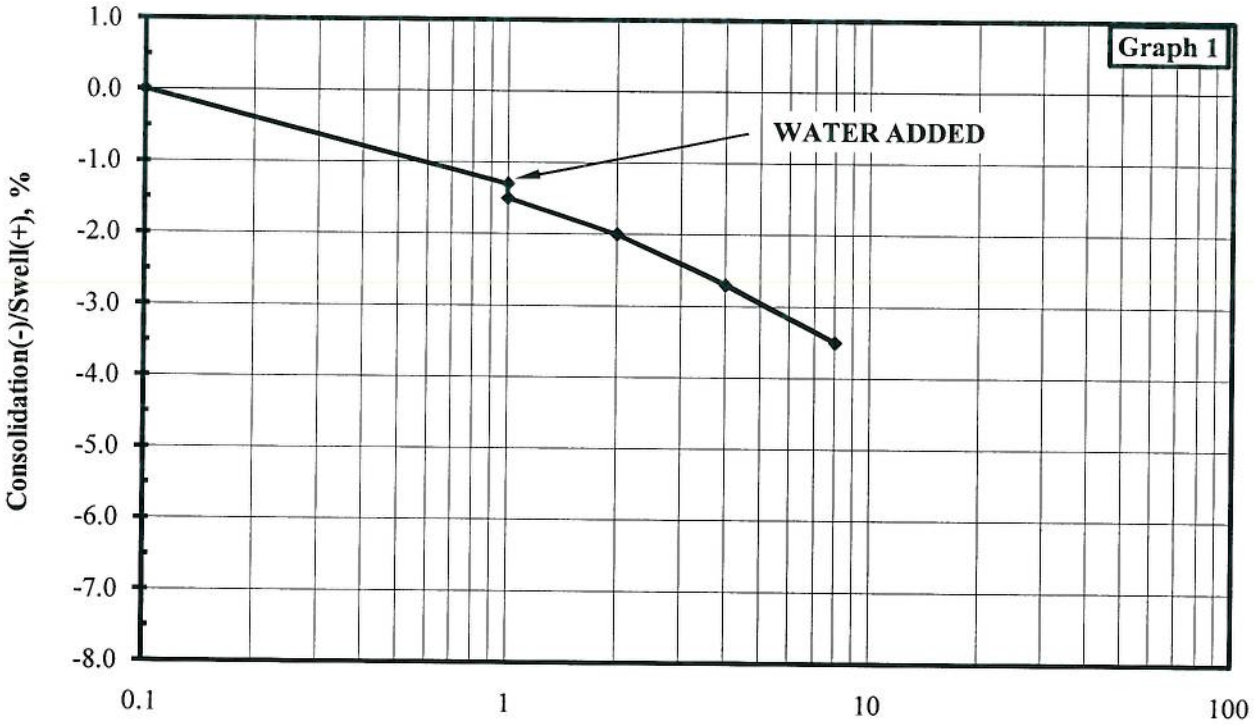


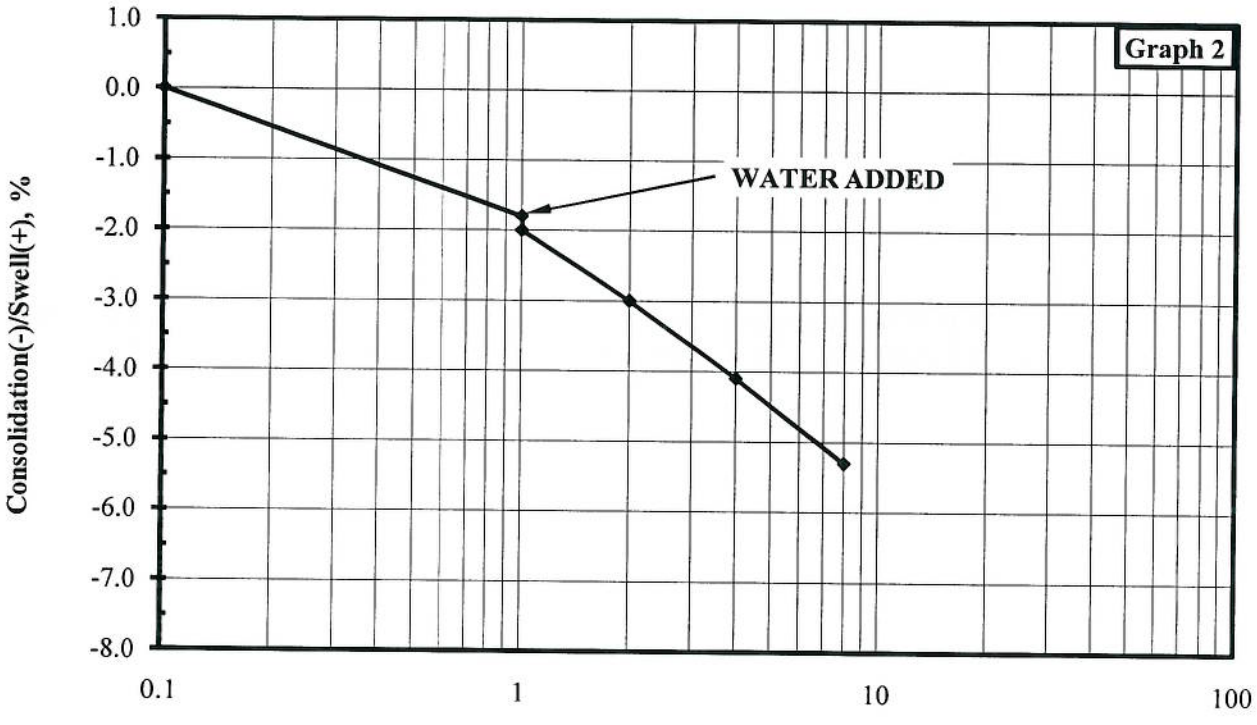
Graph Number	Boring Number	Depth (ft)	Natural Dry Density (pcf)	Moisture Content (%)	Swell(+) / Consolidation(-) (%)	Soil Description	SWELL / CONSOLIDATION GRAPH
1	TH-2	14	109	17.9	-0.2	Sand, silty (SM)	Drawn By: KEA
2	TH-3	14	80	36.5	-0.5	Silt, sandy (ML)	Checked By: RDJ
Job No:	210-187	Project Name:		Middle Fork Compressor Station			Figure A-26
YEH & ASSOCIATES, INC.							



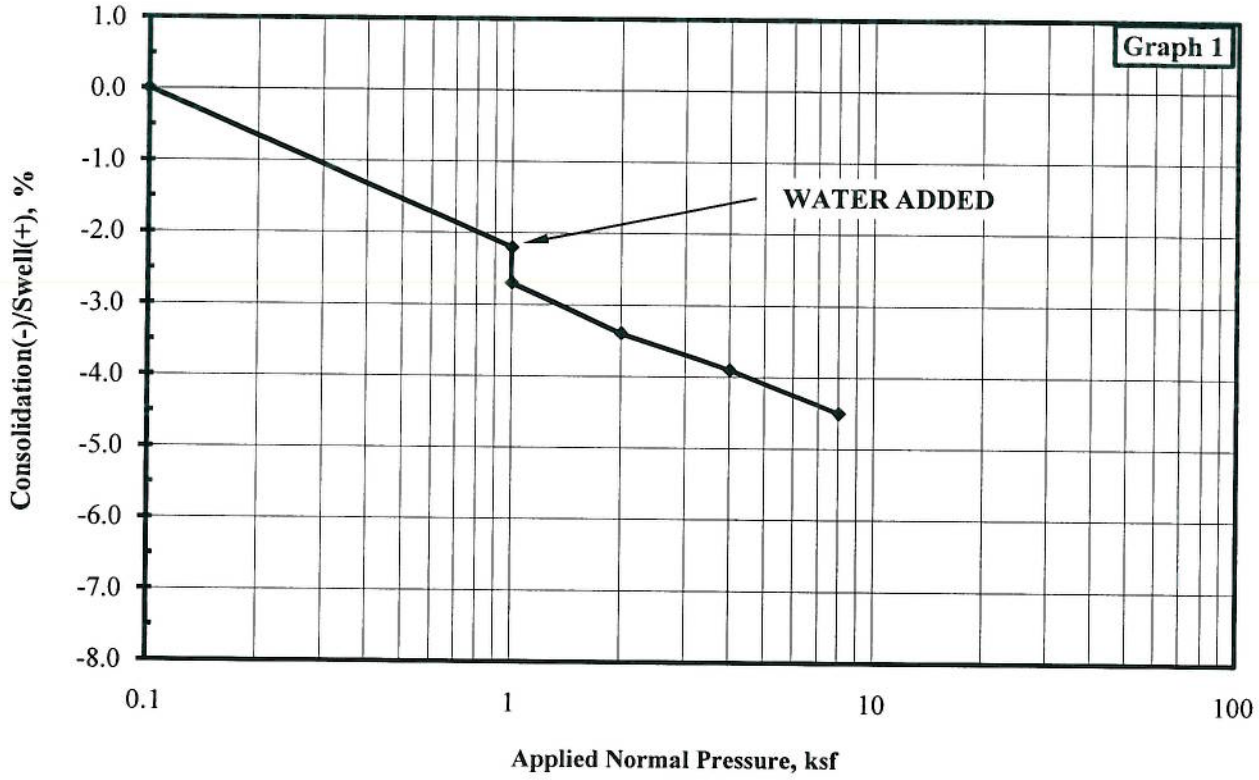


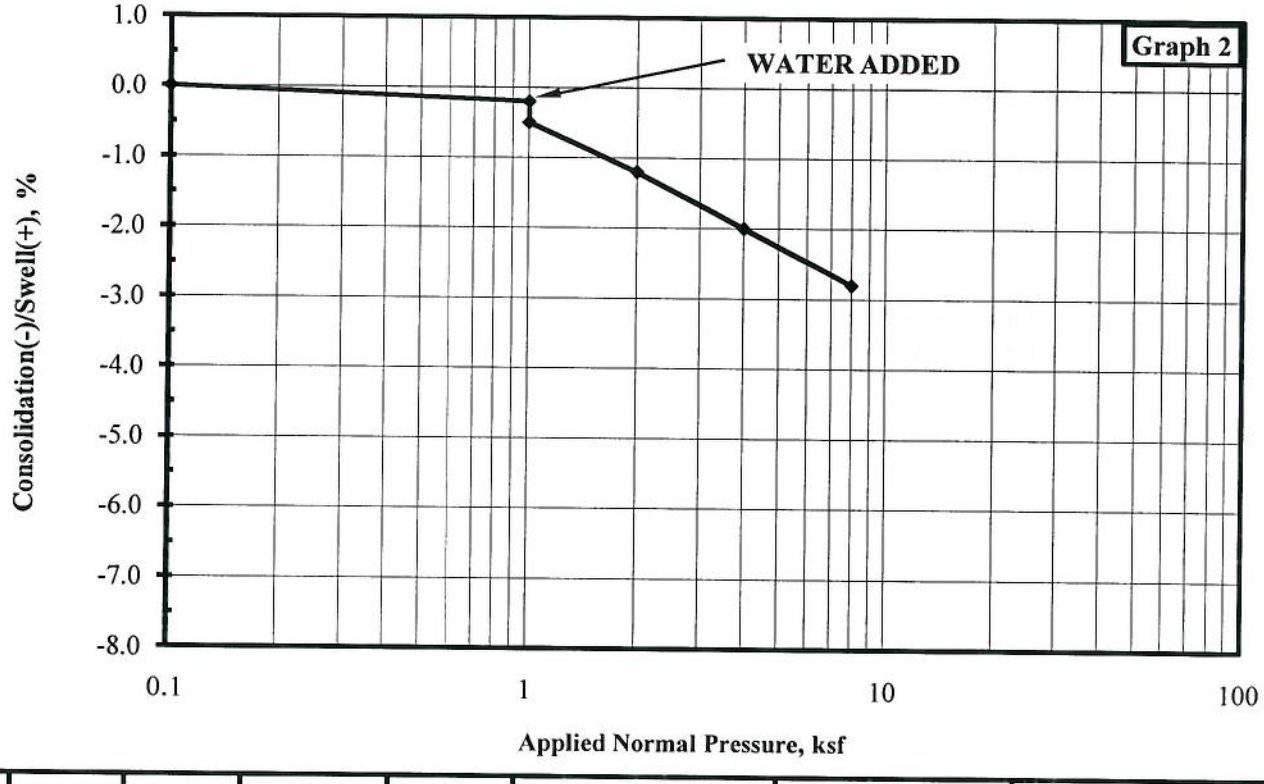
Graph Number	Boring Number	Depth (ft)	Natural Dry Density (pcf)	Moisture Content (%)	Swell(+) / Consolidation(-) (%)	Soil Description	SWELL / CONSOLIDATION GRAPH
1	TH-4	4	88	29.3	-0.4	Silt, sandy (ML)	Drawn By: KEA
2	TH-8	4	111	14.8	-0.4	Sand, clean (SP)	Checked By: RDJ
Job No:	210-187	Project Name:		Middle Fork Compressor Station			Figure A-27
YEH & ASSOCIATES, INC.							



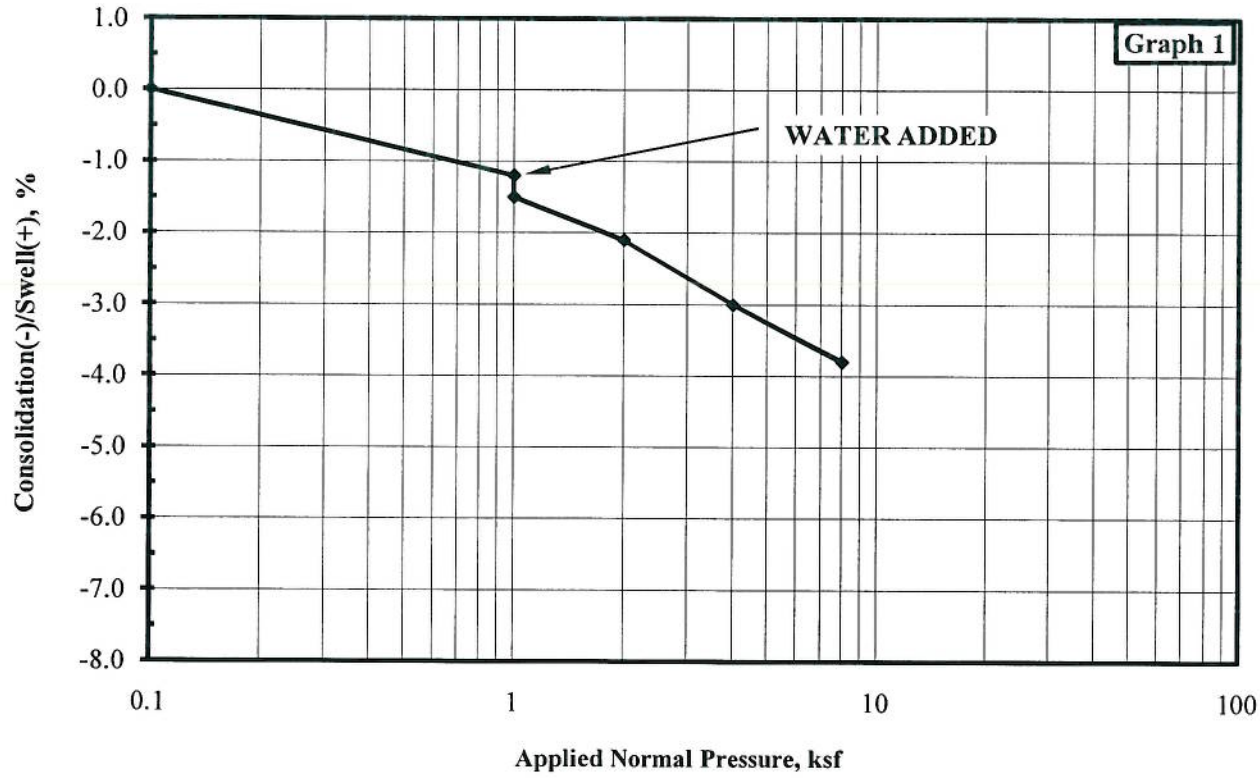


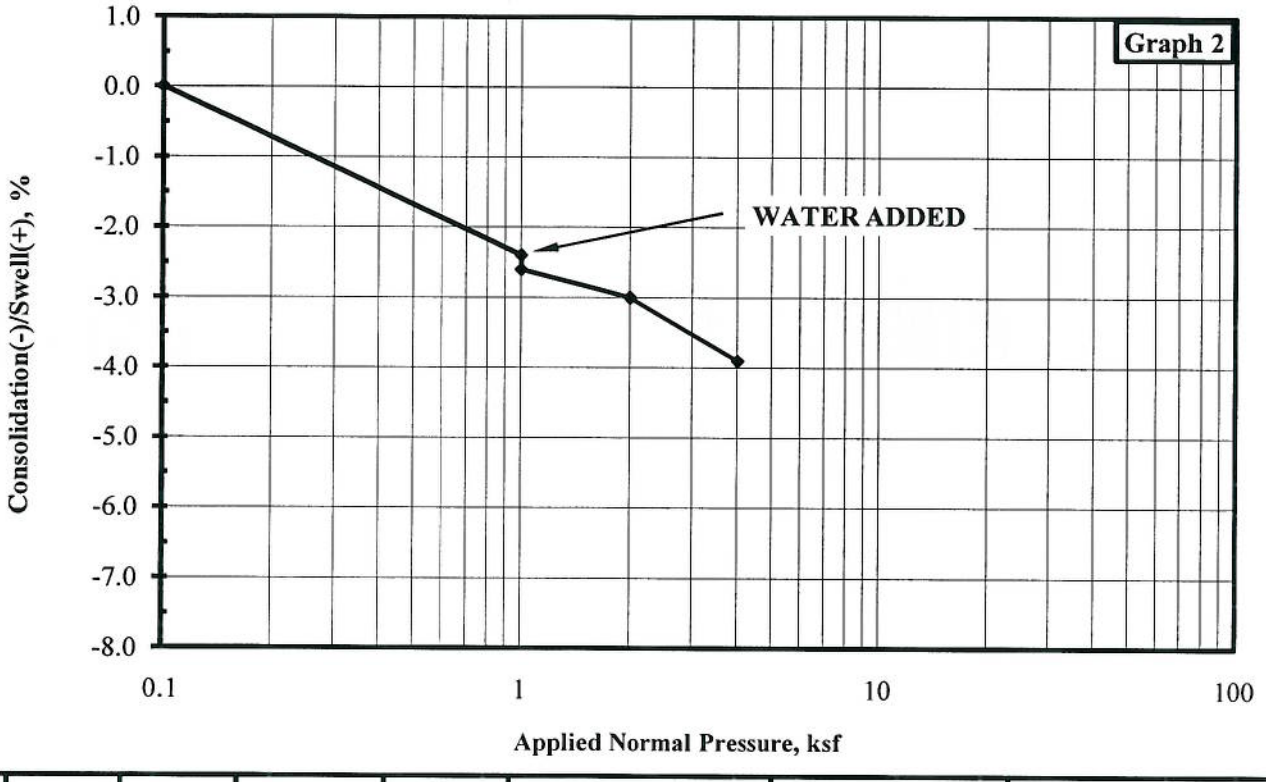
Graph Number	Boring Number	Depth (ft)	Natural Dry Density (pcf)	Moisture Content (%)	Swell(+) / Consolidation(-) (%)	Soil Description	SWELL / CONSOLIDATION GRAPH
1	TH-14	4	88	31.3	-0.2	Fill, sand, clayey (SC)	Drawn By: KEA
2	TH-15	4	89	28.7	-0.2	Fill, sand, clayey (SC)	Checked By: RDJ
Job No:	210-187	Project Name:		Middle Fork Compressor Station			Figure A-28
YEH & ASSOCIATES, INC.							



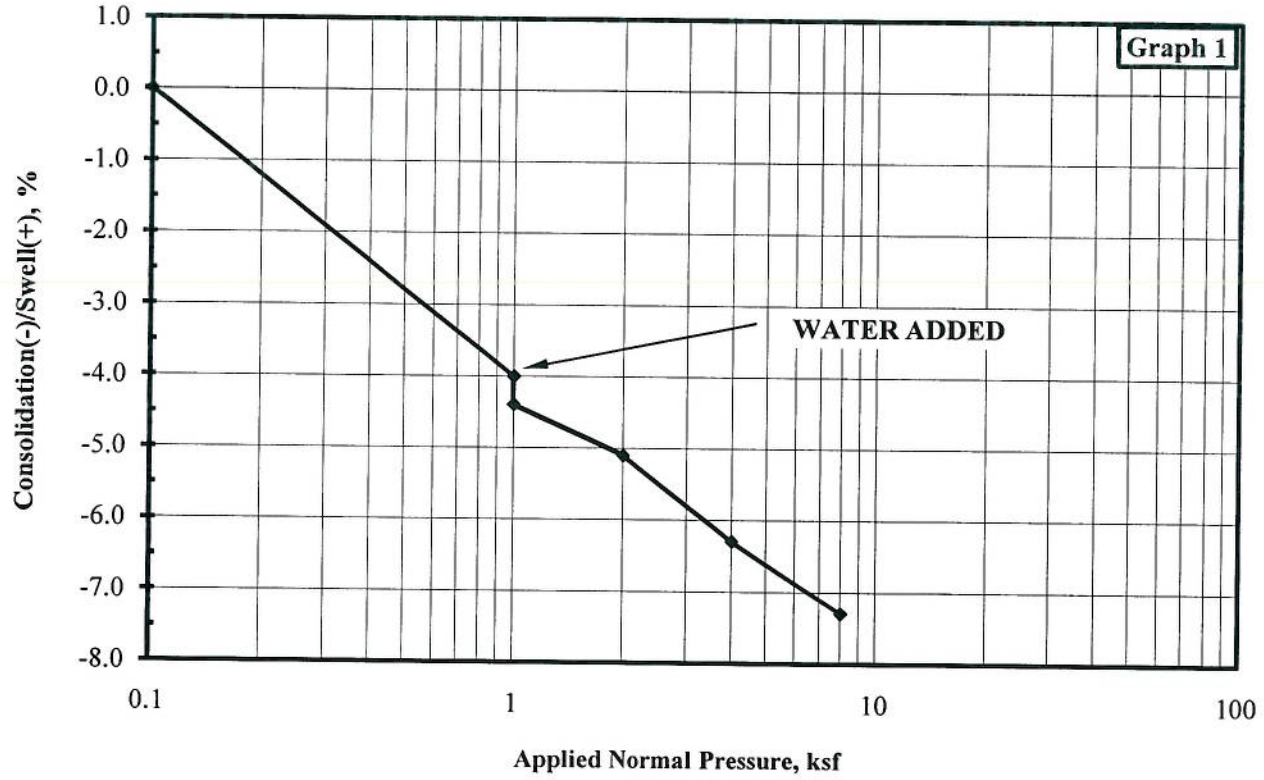


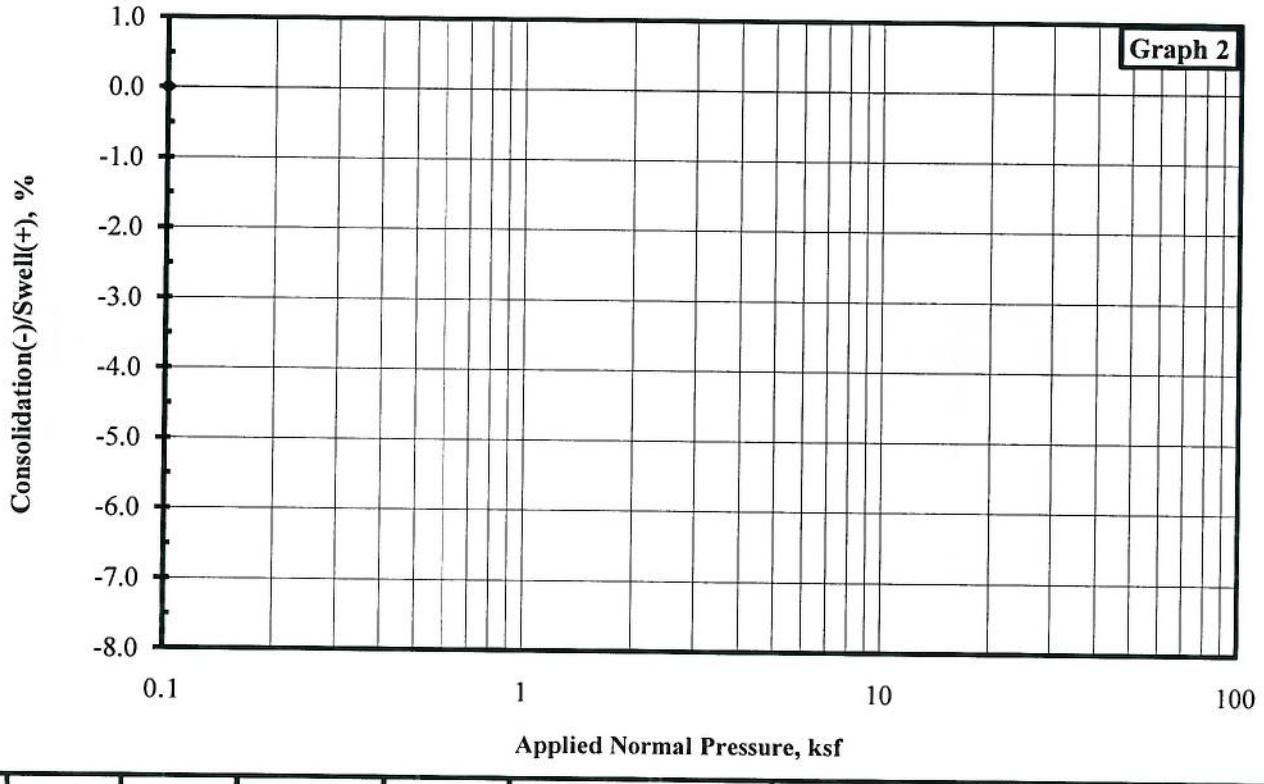
Graph Number	Boring Number	Depth (ft)	Natural Dry Density (pcf)	Moisture Content (%)	Swell(+) / Consolidation(-) (%)	Soil Description	SWELL / CONSOLIDATION GRAPH
1	TH-15	14	98	24.5	-0.5	Sand, clayey (SC)	Drawn By: KEA
2	TH-16	4	89	29.0	-0.3	Silt, sandy (ML)	Checked By: RDJ
Job No:	210-187	Project Name:		Middle Fork Compressor Station			Figure A-29
YEH & ASSOCIATES, INC.							





Graph Number	Boring Number	Depth (ft)	Natural Dry Density (pcf)	Moisture Content (%)	Swell(+) / Consolidation(-) (%)	Soil Description	SWELL / CONSOLIDATION GRAPH
1	TH-16	9	95	19.9	-0.3	Silt, sandy (ML)	Drawn By: KEA
2	TH-18	4	102	22.0	-0.2	Fill, sand, silty (SM)	Checked By: RDJ
Job No:	210-187	Project Name:		Middle Fork Compressor Station			Figure A-30
YEH & ASSOCIATES, INC.							





Graph Number	Boring Number	Depth (ft)	Natural Dry Density (pcf)	Moisture Content (%)	Swell(+) / Consolidation(-) (%)	Soil Description	SWELL / CONSOLIDATION GRAPH
1	TH-19	4	92	25.8	-0.4	Fill, sand, clayey (SC)	Drawn By: KEA
2							Checked By: RDJ
Job No:	210-187	Project Name:		Middle Fork Compressor Station			Figure A-31
YEH & ASSOCIATES, INC.							

YEH & ASSOCIATES, INC

Summary of Laboratory Test Results

Project No: 210-187 Project Name: Middle Fork Compressor Station

Sample Location			Moisture Content (%)	Dry Density (pcf)	Grain Size Analysis			Atterberg Limits			Water Soluble Sulfate (%)	Swell (+) / Consolidation (-) at 1,000 psf (%)	Unconf. Comp. Strength (psf)	Soil Description
Test Hole	Depth (ft)	Sample Type			Gravel > #4 (%)	Sand (%)	Fines < #200 (%)	LL	PL	PI				
TH-2	14	CA	17.9	109								-0.2		Sand, silty (SM)
	15	SS	27.1		20	53	27	34	24	10				Sand, silty (SM)
TH-3	4	CA	9.8	112	31	43	26	37	22	15	0.028			Sand, clayey (SC)
	14	CA	36.5	80				NL	NP	NP		-0.5		Silt, sandy (ML)
	25-25.5	Bulk	49.0		1	34	65	46	28	18				Silt, sandy (ML)
TH-4	4	CA	29.3	88								-0.4		Silt, sandy (ML)
TH-6	14	CA	8.3	119				NL	NP	NP				Sand, clean (SP)
	24	SS	17.3		48	43	9	NL	NP	NP				Gravel, slightly silty (GP-GM)
TH-7	15-19	Bulk	20.2		21	62	17	33	22	11				Sand, clayey (SC)
TH-8	4	CA	14.8	111								-0.4		Sand, clean (SP)
	6-9	Bulk	25.4		17	62	21	35	24	11				Sand, clayey (SC)
	15-19	Bulk	27.4		16	54	30	37	23	14				Sand, clayey (SC)
	29	SS	18.0		47	44	9	NL	NP	NP				Gravel, slightly silty (GW-GM)
TH-9	4	CA	21.9	88				NL	NP	NP			990	Fill, silt, sandy (ML)
TH-11	10-14	Bulk	22.4		18	69	13	35	23	12				Sand, clayey (SC)
TH-12	9	CA	12.4		38	52	10	NL	NP	NP				Fill, sand, silty (SM)

CA - Modified California sampler
SS - Standard split spoon sampler
NL - Indicates non-liquid
NP - Indicates non-plastic

YEH & ASSOCIATES, INC

Summary of Laboratory Test Results

Project No: 210-187 Project Name: Middle Fork Compressor Station

Sample Location			Moisture Content (%)	Dry Density (pcf)	Grain Size Analysis			Atterberg Limits			Water Soluble Sulfate (%)	Swell (+) / Consolidation (-) at 1,000 psf (%)	Unconf. Comp. Strength (psf)	Soil Description
Test Hole	Depth (ft)	Sample Type			Gravel > #4 (%)	Sand (%)	Fines < #200 (%)	LL	PL	PI				
TH-13	9	CA	29.0	84	1	38	61	43	25	18			750	Clay, sandy (CL)
	15.5-18.5	Bulk	23.9		13	70	17	35	23	12				Sand, clayey (SC)
TH-14	4	CA	31.3	88								-0.2		Fill, sand, clayey (SC)
	9	SS	13.9		29	56	15	40	17	23				Fill, sand, clayey (SC)
	19	CA	18.6		56	34	10	35	21	14				Gravel, clayey (GC)
TH-15	2	CA	20.7	101			54	36	19	17				Fill, clay (CL)
	4	CA	28.7	89								-0.2		Fill, sand, clayey (SC)
	14	CA	24.5	98								-0.5		Sand, clayey (SC)
	24	Bulk	30.5		28	45	27	36	23	13				Sand, clayey (SC)
	37.5-39	Bulk	17.8		7	48	45	34	18	16				Sandstone Bedrock
TH-16	4	CA	29.0	89								-0.3		Silt, sandy (ML)
	9	CA	19.9	95								-0.3		Silt, sandy (ML)
	14	CA	41.8					46	26	20				Sand, clayey (SC)
	24	CA	11.8		56	34	10	NL	NP	NP				Gravel, slightly silty (GP-GM)
TH-17	4	CA	12.8	113	28	51	21	NL	NP	NP	0.014			Fill, sand, silty (SM)
TH-18	4	CA	22.0	102								-0.2		Fill, sand, silty (SM)
	14	CA	18.3	98	33	56	11	NL	NP	NP				Sand, slightly silty (SW-SM)

CA - Modified California sampler
SS - Standard split spoon sampler
NL - Indicates non-liquid
NP - Indicates non-plastic

YEH & ASSOCIATES, INC

Summary of Laboratory Test Results

Project No: 210-187 Project Name: Middle Fork Compressor Station

Sample Location			Moisture Content (%)	Dry Density (pcf)	Grain Size Analysis			Atterberg Limits			Water Soluble Sulfate (%)	Swell (+) / Consolidation (-) at 1,000 psf (%)	Unconf. Comp. Strength (psf)	Soil Description
Test Hole	Depth (ft)	Sample Type			Gravel > #4 (%)	Sand (%)	Fines < #200 (%)	LL	PL	PI				
TH-18	15-17.5	Bulk	18.4		25	65	10	33	22	11				Sand, slightly silty (SW-SM)
	19	CA	14.7		55	35	10	NL	NP	NP				Gravel, slightly silty (GW-GM)
	24	SS	23.7		17	57	26	43	27	16				Sand, silty (SM)
	25-39	Bulk	30.4		11	81	8	38	25	13				Sand, slightly silty (SW-SM)
TH-19	4	CA	25.8	92								-0.4		Fill, sand, clayey (SC)
	14	CA	19.3		17	50	33	33	23	10				Sand, clayey (SC)
	24	SS	21.4		47	45	8	NL	NP	NP				Gravel, slightly silty (GW-GM)

CA - Modified California sampler
SS - Standard split spoon sampler
NL - Indicates non-liquid
NP - Indicates non-plastic

Drew Mathies

From: Keith Asay [kasay@yeh-eng.com]
Sent: Thursday, March 10, 2011 9:24 AM
To: Drew Mathies
Cc: 'Schaefer, Jeffrey'; 'Rich Johnson'
Subject: middlefork piers

Hi Drew,

For a 30-inch diameter, 15 foot pier, we would recommend the following:

15,000psf allowable end pressure
1,000psf skin friction

We estimate that worse case the pier may just barely penetrate the existing fill (14 feet).

Let me know if you are able to make these parameters work.

Thanks.

Keith E. Asay
Staff Engineer
kasay@yeh-eng.com

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