SP- 150229
(New)

SPECIAL PROVISIONS FOR DEWATERING

Pottawattamie County
IMN-029-3(198)55--0E-78

Effective Date
February 21, 2017

THE STANDARD SPECIFICATIONS, SERIES 2015, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

150229.01 SCOPE OF WORK.

A. The work of this Section includes site dewatering necessary to lower and control groundwater levels and hydrostatic pressure to permit excavation and construction to be performed properly under dry conditions.

The groundwater shall be lowered and maintained to an absolute minimum of 3 feet or lower below the lowest excavation for the trench at all times during construction.

B. Dewatering operations shall be adequate to assure the integrity of the finished project. The responsibility for conducting the dewatering operation in a manner which will protect adjacent structures and facilities rests solely with the Contractor. The cost of repairing any damage to adjacent structures and restoration of facilities shall be the responsibility of the Contractor.

C. The Contractor shall bear the sole responsibility for the design, installation, operation, monitoring, removal, and abandonment of the dewatering system to comply with the requirements of this section and any applicable regulatory agencies. The Contractor shall be required to install additional dewatering equipment as may be required throughout the duration of the project to maintain groundwater level as described in Article 150229.01, A.

D. The Contractor shall be responsible for submitting the applications and obtaining the required permits for the well construction including obtaining approval from the Council Bluffs Department of Public Health and the Pottawattamie County Office of Planning and Development. Copies of these guidelines are available from the respective agencies. The Contractor shall also be responsible for filing a Field Office Notification (FON) with the Iowa Department of Natural Resources (IDNR) and developing a Well Water Pollution Prevention Plan for the discharge of wastewater from well construction activities per the IDNR NPDES General Permit #6. Copies of these guidelines and blank forms are available from the IDNR.

E. The Contracting Authority will notify the Contractor of any demands brought upon the project by the IDNR. The Contractor shall cooperate with the Contracting Authority in its efforts to comply with the site-specific guidelines provided by the IDNR, including the possibility of adjusting the dewatering system if the discharge exceeds limits imposed by the IDNR. The Contractor shall be responsible for the costs of sampling and testing required by the IDNR. The required sampling and testing parameters, frequencies, and locations are provided in Appendix B.

150229.02 SCHEDULE AND PLAN.

A. Prior to commencement of construction, the Contractor shall submit a detailed dewatering plan as a supplement to the Emergency Action Plan. Contractor shall allow for 9 weeks review by the City of Council Bluffs and the USACE. Submittal shall include:

1. Plan location of dewatering wells and piezometers including the distance from the levee centerline.

2. Well and piezometer construction details including the diameter, depth, screen size, screen location, filter pack location and gradation, list of equipment and estimated pumping rates.

3. Discharge pipe location, size, and details. If a pipe will be run up and over the levee, then a ramp shall be detailed to allow access to be maintained along the crest of the levee. Pipe discharge will not be allowed on the bank. A plan view location of the ramp and discharge pipe shall be included along with a cross section for any levee crossing.

4. Abandonment plan for both the dewatering wells and piezometers. At a minimum, cement bentonite grout backfill shall be used the full depth of the well or piezometer. The top 3 feet of casing below final grade should be cutoff and a 6-inch concrete cap placed over the cutoff casing. The backfill above the concrete cap shall consist of compacted backfill of similar classification as the surrounding soils. If the well casings and screens are removed, then bentonite grout backfill shall be used the full depth of the well or piezometer. Any granular annulus material shall be removed above Elevation 963 feet prior to the placement of bentonite grout backfill. The top 3 feet shall consist of compacted backfill of similar classification as the surrounding soils.

B. Attached for the Contractor's information as Appendix A to these contract documents is geotechnical information collected for the project. Fluctuations of the groundwater level can occur due to seasonal variations in the amount of rainfall, runoff, stage level of the Missouri River, and other factors not evident at the time the borings were completed. The geotechnical information was prepared for design purposes only and may not be adequate for a Contractor to evaluate construction conditions or design the dewatering system. The Contractor should independently interpret the soil/groundwater conditions taking into consideration their intended means and methods of construction. The Contractor may perform additional exploration at their own expense as necessary for design of the dewatering system.

C. Due to possible variations of soil conditions and groundwater levels between soil boring locations, the Contractor shall be responsible for changing or modifying the dewatering system to accommodate such variations.

D. At completion of construction, the Contractor shall submit copies of the drilling logs, finished well construction diagrams, and well abandonment diagrams for the dewatering wells and piezometers. Coordinates for each well and piezometer shall be included with the submittal.

150229.03 CONTROL AND OBSERVATION.

A. Adequate control shall be maintained by the Contractor to ensure that the stability of excavated slopes are not adversely affected by water, that erosion is controlled and that flooding of excavation or damage to structures does not occur. The Contractor is solely responsible for site excavation safety and compliance with OSHA regulations, in particular Standard 29 CFR, part number 1926.

The Engineer assumes no responsibility for site safety; the above information is provided for consideration by the Contractor only.

B. The Contractor shall install piezometers to determine if the groundwater is at the acceptable absolute minimum level or lower as defined in Article 150229.01, A. The USACE Standard Operating Procedure for Piezometers is attached as Appendix C.

1. Piezometers shall be installed at 50 foot intervals along the length of the pipe excavation.

2. The elevation of the top of the piezometer shall be verified by the surveyor.

3. The Contractor shall monitor the groundwater at each active piezometer on a daily basis by measuring from the top of the piezometer to the groundwater surface and maintain the information in a log that shall be provided to the Engineer upon request. The Contractor shall notify the Engineer immediately if the groundwater surface exceeds the required 3 foot minimum clearance.

4. When observation of the groundwater level is complete, the piezometer shall be properly abandoned by a licensed well driller.

150229.04 INSPECTION.

A. During or after any trench excavation, if Contractor observes sufficient soil instability present that may prevent proper installation of pipe bedding, pipelines, backfill or compaction, then Contractor shall call for inspection of conditions by the Engineer. The Engineer will inspect the conditions and determine if they are unacceptable for pipe installation.

B. If after dewatering has lowered the groundwater level as specified and unacceptable trench conditions are found by the Engineer, then the Contractor may be directed to increase dewatering pumping rates or install additional wells to lower the groundwater to an acceptable level lower than that defined in Article 150229.01, A. If more extensive dewatering is required, the Contractor must achieve the revised acceptable groundwater level before construction may continue.

150229.05 EXECUTION.

A. The Contractor shall furnish, install, and operate pumps, pipes, appliances, and equipment of sufficient capability to maintain the absolute minimum or lower groundwater elevation described in Article 150229.01, A within the trench excavation limits until the trench is backfilled, unless otherwise authorized by the Engineer. Installed equipment shall be operated continuously 24 hours a day, 7 days a week.

B. The Contractor shall provide any temporary ground surface piping necessary to convey dewatering well water discharge to an acceptable storm sewer intake or waterway with the capacity to convey said discharge. Any rerouting of temporary ground surface piping, necessary to complete the project, will be provided by the Contractor. Discharge directly onto the ground surface shall not be allowed. The Contractor shall supply a clean tapping device at each well location to allow easy discharge water sampling by the Engineer.

C. If the dewatering system shuts down or if pumping is suspended, the groundwater levels shall be lowered to the required level and verified by the Engineer before continuing any construction, including excavation or backfilling. The Engineer will also require any compaction, moisture and/or other soils testing, as determined necessary, of any backfill that is prematurely subjected to groundwater to verify said soils stability prior to placement of additional backfill. If said soils are determined to be unacceptable, the Contractor will be required to remove and replace damaged soils at their own expense.

If the Contractor cannot maintain the required groundwater levels, the Contractor will be required to backfill the excavation until the required groundwater levels are achieved.

D. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of subgrade soils at the bottom of the proposed excavation.

E. Diversion ditches and dikes shall be used, where necessary, to prevent surface water from entering the excavation.

150229.06 METHOD OF MEASUREMENT AND BASIS OF PAYMENT.

The measurement and payment for all work covered under this section will be made at the contract lump sum price for Dewatering which shall constitute full compensation for obtaining any necessary permits and furnishing all equipment, labor, and materials to install, operate, maintain, monitor, and remove the dewatering system in accordance with all applicable regulations.

A. No payment will be made to the Contractor until copies of the permits are supplied to the Contracting Authority.

B. The cost of piezometers sufficient to meet the requirements stated in Article 150229.03, C shall be considered incidental to the lump sum pay item Dewatering. If any additional piezometers are requested by the Engineer or the Contracting Authority, the Contractor will be paid for said piezometers according to Article 11.09.03, B of the Standard Specifications. If the additional piezometers are needed as a direct result of the Contractor's actions or negligence they will be done at the sole expense of the Contractor.

C. The cost of sampling and testing the discharge water according to Article 150229.01, E shall be considered incidental to the lump sum pay item Dewatering.

D. The Contractor is required to submit a schedule of values to the Engineer to explain the breakdown of the lump sum price. This schedule of values will only be used to determine the appropriate amount of the lump sum to be attributed to each progress payment. The following list contains items that should be used, at a minimum, for the schedule of values:

- Obtaining permits and complying with permit requirements.
- Drilling the wells and piezometers.
- Installing the pumps.
- Installing power supply.
- Discharge and/or manifold piping.
- Sampling and testing the discharge water.
- Removal and abandonment.

APPENDIX A
Geotechnical Information

Thiele Geotech Inc

BORING LOG

WATER LEVEL OBSERVATIONS		PROJECT	DRILLER	LOGGER	JOB NO.	DATE
During Drilling	21.0'	28th St. Storm Sewer Pump Station	Gappa	Gorham	12155.00	6/12/2012
End of Drilling	N/E	LOCATION	DRILLING METHOD		DRILL RIG	BORING NO.
Cave In	22.0'	28th St. & I-29, Council Bluffs, IA	3.25" HSA		CME 55	B-1
		LOCATION OF BORING	TYPE OF SURFACE		ELEVATION	DEPTH
boring backfilled with grout		see Boring Locatio n Plan	grass		984.48'	50'

DEP (ft.)	VISUAL/MANUAL DESCRIPTION: COLOR	MOIST.	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS	SAMPLE DATA: NO. & TYPE	SPT (bpf)	REC (in.)	LABORATORY DATA: MC (%)	γ_d (pcf)	q_u (tsf)	LL/PI CLASS	DEP (ft.)
	brown	dry	hard	lean clay	fill	minor concrete								
	dark brown		soft	silt			U-1		12	8.5	102.0			
	brown	dry	loose	poorly graded sand w/ silt	alluvium	iron and carbon stains	S-2	2 3 2		7.3			P200= 10.0% SP-SM	
5														5
	gray	very moist	soft	fat clay										
						iron and carbon stains	S-3	2 1 3		42.0			LL=67 PI=42 CH	
10														10
				lean clay										
							U-4		8	38.9	83.1	0.27	LL=30 PI=9 CL	
15														15
													P200= 99.5%	
				silt										
						iron and carbon stains	S-5	2 1 2		37.0			P200= 81.0% ML	
20														20
		wet												
			loose	poorly graded sand			S-6	2 1 6		21.4			P200= 5.0% SP	
25														25

Thiele Geotech Inc

BORING LOG

WATER LEVEL OBSERVATIONS		PROJECT	DRILLER	LOGGER	JOB NO.	DATE
During Drilling	21.0'	28th St. Storm Sewer Pump Station	Gappa	Gorham	12155.00	6/12/2012
End of Drilling	N/E	LOCATION	DRILLING METHOD		DRILL RIG	BORING NO.
Cave In	22.0'	28th St. & I-29, Council Bluffs, IA	3.25" HAS		CME 55	B-1 cont.
		LOCATION OF BORING	TYPE OF SURFACE		ELEVATION	DEPTH
boring backfilled with grout		see Boring Location Plan	grass		984.48'	50'

DEP (ft.)	VISUAL/MANUAL DESCRIPTION: COLOR	MOIST.	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS	SAMPLE DATA: NO. & TYPE	SPT (bpf)	REC (in.)	LABORATORY DATA: MC (%)	γ_d (pcf)	q_u (tsf)	LL/PI CLASS	DEP (ft.)
	gray	wet	loose	poorly graded sand	alluvium									
			dense	poorly graded sand w/ silt			S-7	5 12 21		19.3			P200= 8.7% SP-SM	
30														30
			medium dense				S-8	13 13 15						
35														35
				silty sand										
							S-9	8 9 11		25.2			P200= 13.6% SM	
40														40
							S-10	5 8 10						
45														45
			dense				S-11	6 12 20						
50						Bottom of boring @ 50'									50

Thiele Geotech Inc

BORING LOG

WATER LEVEL OBSERVATIONS		PROJECT	DRILLER	LOGGER	JOB NO.	DATE
During Drilling	15.0'	28th St. Storm Sewer Pump Station	Epley	Gorham	12155.00	6/12/2012
End of Drilling	18.0'	LOCATION	DRILLING METHOD		DRILL RIG	BORING NO.
Cave In	23.7'	28th St. & I-29, Council Bluffs, IA	3.25" HSA		CME 55	B-2
		LOCATION OF BORING	TYPE OF SURFACE		ELEVATION	DEPTH
boring backfilled with grout		see Boring Location Plan	grass		984.53'	50'

DEP (ft.)	VISUAL/MANUAL DESCRIPTION: COLOR	MOIST.	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS	SAMPLE DATA: NO. & TYPE	SPT (bpf)	REC (In.)	LABORATORY DATA: MC (%)	γ_d (pcf)	q_u (tsf)	LL/PI CLASS	DEP (ft.)
	brown	moist	hard	lean clay	fill	minor gravel								
	light brown	slightly moist	medium dense	poorly graded sand w/ clay	alluvium		U-1		12					
	brown		loose			minor iron and carbon stains	S-2	2 2 3		10.7			P200= 10.3% SP-SM	
5														5
	gray	very moist	soft	fat clay			S-3	2 2 3		40.1			LL=95 PI=69 CH	
10														10
													P200= 99.2%	
	grayish brown						S-4	2 2 2		42.3				
15														15
	gray	wet		lean clay			U-5		6	34.7	86.8	0.41	LL=37 PI=16 CL	
20														20
													P200= 98.2%	
			medium dense	silty sand			S-6	5 8 2		22.9			P200= 14.8% SM	
25														25

Thiele Geotech Inc

BORING LOG

WATER LEVEL OBSERVATIONS		PROJECT	DRILLER	LOGGER	JOB NO.	DATE
During Drilling	15.0'	28th St. Storm Sewer Pump Station	Epley	Gorham	12155.00	6/12/2012
End of Drilling	18.0'	LOCATION	DRILLING METHOD		DRILL RIG	BORING NO.
Cave In	23.7'	28th St. & I-29, Council Bluffs, IA	3.25" HSA		CME 55	B-2 cont.
		LOCATION OF BORING	TYPE OF SURFACE		ELEVATION	DEPTH
boring backfilled with grout		see Boring Location Plan	grass		984.53'	50'

DEP (ft.)	VISUAL/MANUAL DESCRIPTION: COLOR	MOIST.	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS	SAMPLE DATA: NO. & TYPE	SPT (bpf)	REC (In.)	LABORATORY DATA: MC (%)	γ_d (pcf)	q_u (tsf)	LL/PI CLASS	DEP (ft.)
	gray	wet	medium dense	silty sand	alluvium									
			dense			carbon stains	S-7	8 15 19						
30														30
			loose	poorly graded sand										
							S-8	3 2 4		18.2			P200= 3.2% SP	
35														35
			medium dense			carbon stains	S-9	4 11 14						
40														40
				poorly graded sand w/ silt										
							S-10	5 5 10		19.8			P200= 6.5% SP-SM	
45														45
							S-11	3 6 11						
50						Bottom of boring @ 50'									50

Thiele Geotech Inc

BORING LOG

WATER LEVEL OBSERVATIONS		PROJECT	DRILLER	LOGGER	JOB NO.	DATE
During Drilling	24.0'	28th St. Storm Sewer Pump Station	Epley	Gorham	12155.00	6/13/2012
End of Drilling	17.1'	LOCATION	DRILLING METHOD		DRILL RIG	BORING NO.
Cave In	17.6'	28th St. & I-29, Council Bluffs, IA	3.25" HSA		CME 55	B-3
		LOCATION OF BORING	TYPE OF SURFACE		ELEVATION	DEPTH
boring backfilled with grout		see Boring Location Plan	grass		986.38'	50'

DEP (ft.)	VISUAL/MANUAL DESCRIPTION: COLOR	MOIST.	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS	SAMPLE DATA: NO. & TYPE	SPT (bpf)	REC (In.)	LABORATORY DATA: MC (%)	γ_d (pcf)	q_u (tsf)	LL/PI CLASS	DEP (ft.)
	brown	dry	hard	lean clay	fill	minor concrete								
						roots	U-1		12					
							S-2	3 4 3		7.4			P200= 13.8% SC	
5	brown	dry	loose	clayey sand	alluvium									5
	gray	very moist	soft	fat clay		iron and carbon stains	S-3	2 2 2		35.6			LL=56 PI=32 CH	
10														10
			firm			iron and carbon stains	U-4		12	36.6	83.0	0.80	LL=69 PI=44 CH	
15														15
													P200= 99.6%	
		wet												
	brownish gray		soft	lean clay			S-5	2 2 2		31.8			LL=34 PI=11 CL	
20	brown													20
	gray		medium dense	silty sand			S-6	7 11 12		23.7			P200= 23.9% SM	
25														25

Thiele Geotech Inc

BORING LOG

WATER LEVEL OBSERVATIONS		PROJECT	DRILLER	LOGGER	JOB NO.	DATE
During Drilling	24.0'	28th St. Storm Sewer Pump Station	Epley	Gorham	12155.00	6/13/2012
End of Drilling	17.1'	LOCATION	DRILLING METHOD		DRILL RIG	BORING NO.
Cave In	17.6'	28th St. & I-29, Council Bluffs, IA	3.25" HAS		CME 55	B-3 cont.
		LOCATION OF BORING	TYPE OF SURFACE		ELEVATION	DEPTH
boring backfilled with grout		see Boring Location Plan	grass		986.38'	50'

DEP (ft.)	VISUAL/MANUAL DESCRIPTION: COLOR	MOIST.	CONSIST.	SOIL TYPE	GEOLOGIC ORIGIN	REMARKS	SAMPLE DATA: NO. & TYPE	SPT (bpf)	REC (In.)	LABORATORY DATA: MC (%)	γ_d (pcf)	q_u (tsf)	LL/PI CLASS	DEP (ft.)
	gray	wet	medium dense	silty sand	alluvium									
30							S-7	5 11 13						30
				poorly graded sand										
35							S-8	3 5 7		16.6			P200= 3.6% SP	35
40							S-9	5 11 13		17.3			P200= 3.5% SP	40
45							S-10	3 7 10						45
50						Bottom of boring @ 50'	S-11	8 10 10						50

Thiele Geotech Inc

Well Construction Diagram

Well No.: B-1

No Scale

PROJECT INFORMATION	DRILLING INFORMATION
PROJECT: **12155.00**	DRILLING CO.: **Thiele Geotech, Inc.**
SITE LOCATION: **28th St. Storm Sewer Pump Stn.**	DRILLER: **Gappa**
JOB NO.: **S. 28th St. & I-29, Council Bluffs, IA**	LICENSE NO.: **6537**
LOGGED BY: **Gorham**	RIG TYPE: **CME 55HT**
DATE/TIME DRILLED: **6/12/12**	DRILLING METHOD: **3.25-inch ID HSA**
DATE/TIME INSTALLED: **6/12/12**	SAMPLING METHOD: **2 in. OD x 2.5' Split Barrel**
LATITUDE/NORTHING: **N41.274818 - N/R**	BOREHOLE DIAMETER: **7.25 inches**
LONGITUDE/EASTING: **W95.889159 - N/R**	DRILLING ADDITIVES: **Water**
▼ - **Static Water Level (From Ground Surface)**	BOREHOLE CASING: **None**
NR - Not Reported	

WELL CONSTRUCTION:

Protective Cover: 4" x 5', lockable, steel.

Protective Well Cap: 1", unvented, expandable plug (J-plug).

Casing: 1" PVC.

Casing Joints: Flush Threaded.

Well Screen: 0.010", Factory Slotted, 1" PVC.

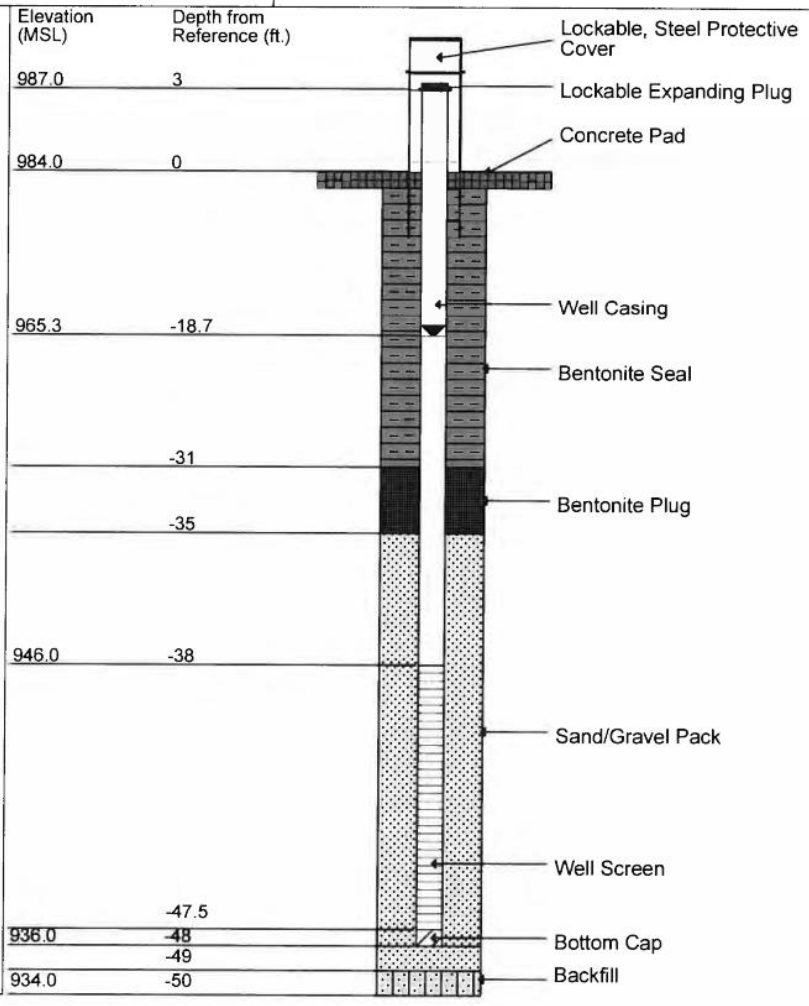
Suface Seal: Sloped, 2 foot diameter concrete pad, 4 inches thick.

Grout: Cement/Bentonite 6 gal. water:94 lb. cement:5 lb. bentonite powder. 4.5 bags Type I cement, 0.25 bag bentonite powder.

Bentonite Plug: 3/8" Bentonite Chips. 2 bags.

Sand/Gravel Pack: 12/20 Silica Sand. 5 bags.

Backfill: Native Alluvium.



Thiele Geotech Inc

SOIL TEST SUMMARY

Project: 28th Street Pump Station

Job No.: 12155.00

Location: 28th Street & I-29, Council Bluffs, IA

Date: 6/25/2012

BORING NO.	SAMPLE NO.	SAMPLE DEPTH (ft.)	SAMPLE DIA. (in.)	MOISTURE CONTENT (%)	UNIT WEIGHT WET (pcf)	UNIT WEIGHT DRY (pcf)	VOID RATIO (e)	SAT. (%)	UNCONFINED COMPRESSION q_u (tsf)	UNCONFINED COMPRESSION STRAIN (%)	SOIL CLASSIFICATION ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	PASS #200 (%)		REMARKS
B-1	U-1	0.5-2		8.5	110.6	102.0	0.652	35								
	S-2	3.5-5		7.3										10.0	SP-SM	
	S-3	8.5-10		42.0							67	25	42		CH	
	U-4	13.5-15	2.85	38.9	115.4	83.1	1.027	100	0.27	5.8	30	21	9	99.5	CL	
	S-5	18.5-20		37.0										81.0	ML	
	S-6	23.5-25		21.4										5.0	SP	
	S-7	28.5-30		19.3										8.7	SP-SM	
	S-8	33.5-35														
	S-9	38.5-40		25.2										13.6	SM	
	S-10	43.5-45														
	S-11	48.5-50														
B-2	U-1	0.5-2														
	S-2	3.5-5		10.7										10.3	SP-SM	
	S-3	8.5-10		40.1							95	26	69	99.2	CH	
	S-4	13.5-15		42.3												
	U-5	18.5-20	2.85	34.7	116.9	86.8	0.940	100	0.41	1.5	37	21	16	98.2	CL	
	S-6	23.5-25		22.9										14.8	SM	
	S-7	28.5-30														
	S-8	33.5-35		18.2										3.2	SP	
	S-9	38.5-40														
	S-10	43.5-45		19.8										6.5	SP-SM	
	S-11	48.5-50														
B-3	U-1	0.5-2														
	S-2	3.5-5		7.4										13.8	SC	
	S-3	8.5-10		35.6							56	24	32		CH	
	U-4	13.5-15	2.85	36.6	113.4	83.0	1.030	96	0.80	1.4	69	25	44	99.6	CH	
	S-5	18.5-20		31.8							34	23	11		CL	
	S-6	23.5-25		23.7										23.9	SM	
	S-7	28.5-30														
	S-8	33.5-35		16.6										3.6	SP	
	S-9	38.5-40		17.3										3.5	SP	
	S-10	43.5-45														
	S-11	48.5-50														

Thiele Geotech Inc

HYDROMETER ANALYSIS

Project	Job No.
28th street Pump Ststion	12155.00
Location	**Date**
28th Street & I-29, Council Bluffs, IA	6/26/2012

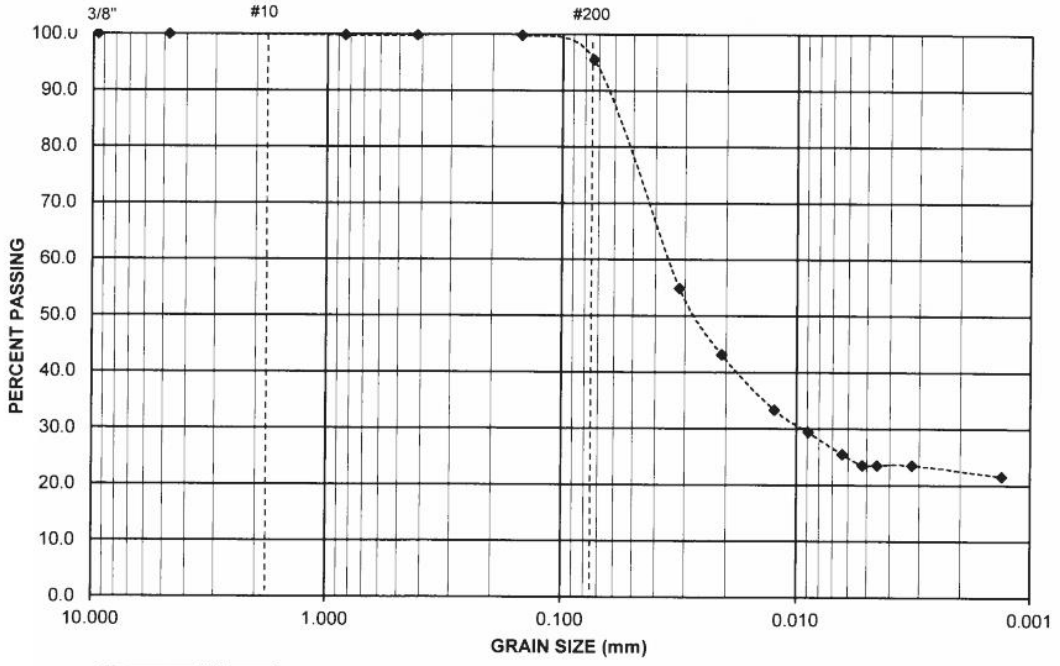
Sample Identification: B-1 U-4

Sample Description: gray lean clay

SIEVE ANALYSIS	
Sieve Size	% FINER
3/8"	100.0
#4	100.0
#20	99.8
#40	99.8
#100	99.8
#200	95.5

HYDROMETER ANALYSIS	
D(mm)	% FINER
0.0317	54.9
0.0209	43.1
0.0124	33.3
0.0089	29.4
0.0064	25.5
0.0052	23.5
0.0045	23.5
0.0032	23.5
0.0013	21.6

Specific gravity of sample: **2.65 (assumed)**



Lab No. _____

Test conducted according to ASTM D 422-63

Thiele Geotech Inc

HYDROMETER ANALYSIS

Project	Job No.
28th street Pump Ststion	12155.00
Location	Date
28th Street & I-29, Council Bluffs, IA	6/26/2012

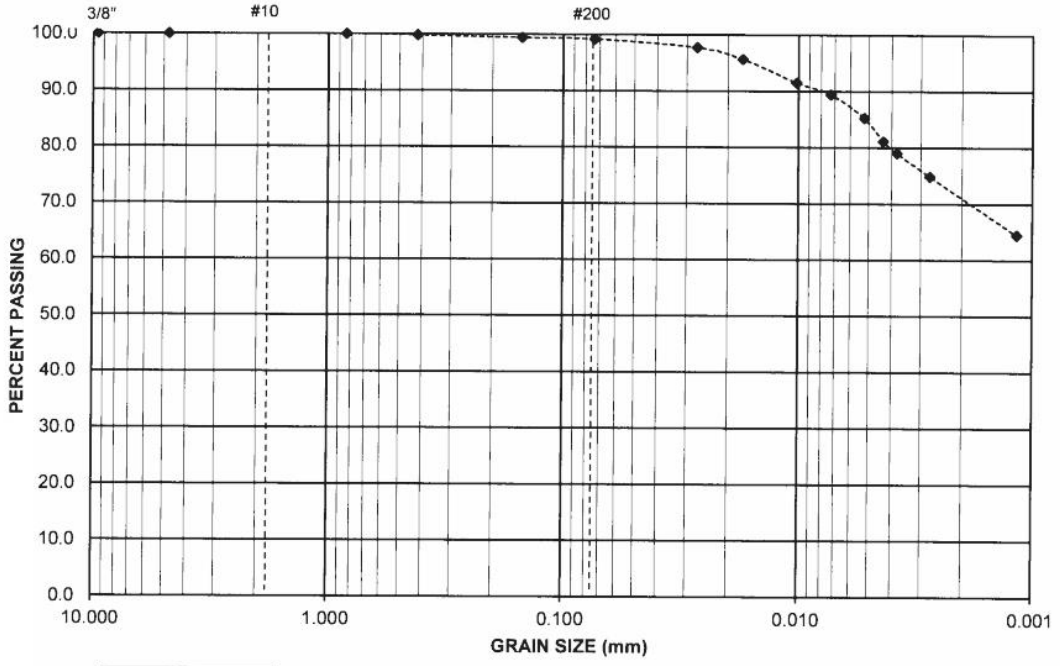
Sample Identification: B-2 S-5

Sample Description: gray fat clay

SIEVE ANALYSIS	
Sieve Size	% FINER
3/8"	100.0
#4	100.0
#20	100.0
#40	99.8
#100	99.4
#200	99.2

HYDROMETER ANALYSIS	
D(mm)	% FINER
0.0271	97.7
0.0173	95.6
0.0102	91.5
0.0073	89.4
0.0052	85.2
0.0043	81.1
0.0038	79.0
0.0027	74.9
0.0012	64.5

Specific gravity of sample: **2.65 (assumed)**



Lab No. _____

Test conducted according to ASTM D 422-63

Thiele Geotech Inc

HYDROMETER ANALYSIS

Project	Job No.
28th street Pump Ststion	12155.00
Location	Date
28th Street & I-29, Council Bluffs, IA	6/26/2012

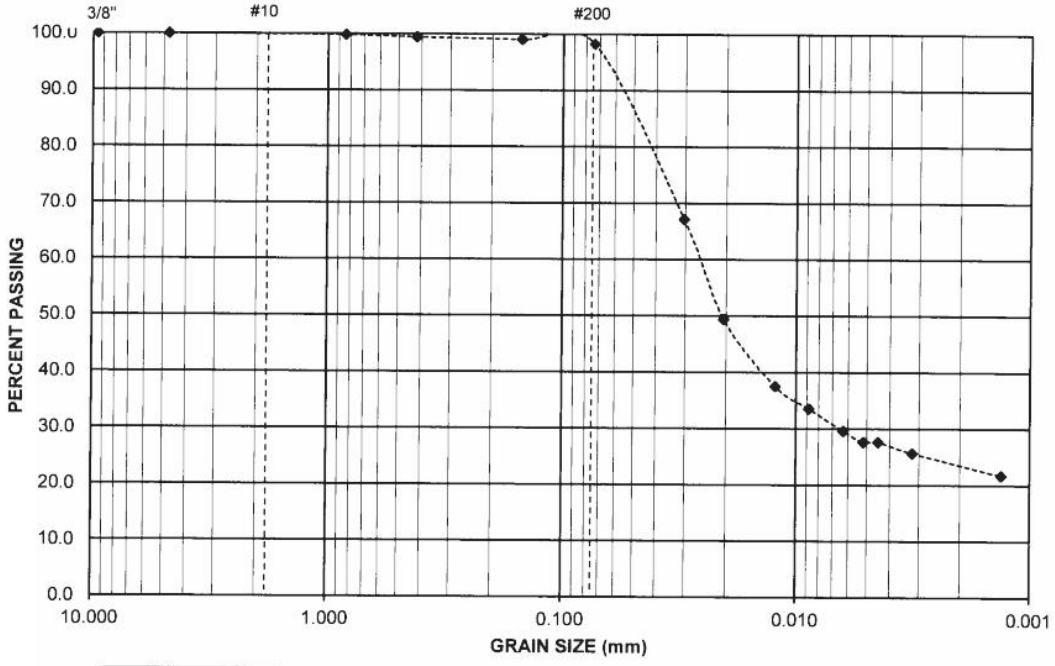
Sample Identification: B-2 U-5

Sample Description: gray lean clay

SIEVE ANALYSIS	
Sieve Size	% FINER
3/8"	100.0
#4	100.0
#20	99.8
#40	99.4
#100	99.0
#200	98.2

HYDROMETER ANALYSIS	
D(mm)	% FINER
0.0303	67.1
0.0205	49.4
0.0123	37.5
0.0088	33.6
0.0063	29.6
0.0052	27.6
0.0045	27.6
0.0032	25.7
0.0013	21.7

Specific gravity of sample: **2.65 (assumed)**



Lab No. _____

Test conducted according to ASTM D 422-63

Thiele Geotech Inc

HYDROMETER ANALYSIS

Project	Job No.
28th street Pump Ststion	12155.00
Location	**Date**
28th Street & I-29, Council Bluffs, IA	6/26/2012

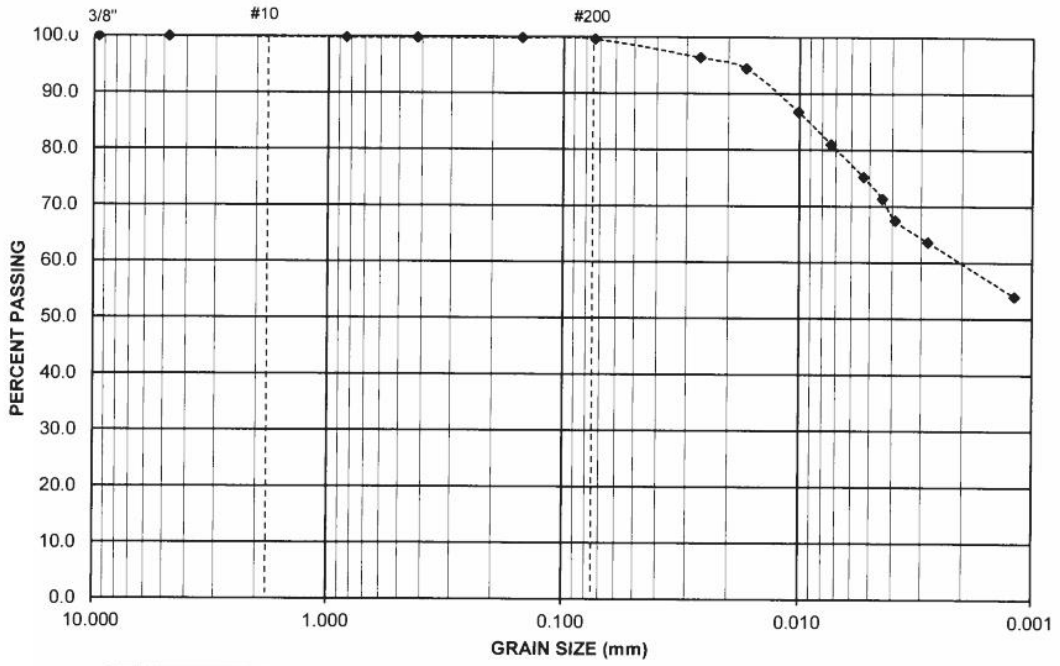
Sample Identification: B-3 U-4

Sample Description: gray fat clay

SIEVE ANALYSIS	
Sieve Size	% FINER
3/8"	100.0
#4	100.0
#20	99.8
#40	99.8
#100	99.8
#200	99.6

HYDROMETER ANALYSIS	
D(mm)	% FINER
0.0263	96.4
0.0168	94.4
0.0101	86.7
0.0073	80.9
0.0053	75.2
0.0044	71.3
0.0039	67.5
0.0028	63.6
0.0012	54.0

Specific gravity of sample: **2.65 (assumed)**



Lab No. _____

Test conducted according to ASTM D 422-63

Thiele Geotech Inc

GRAIN SIZE CURVE

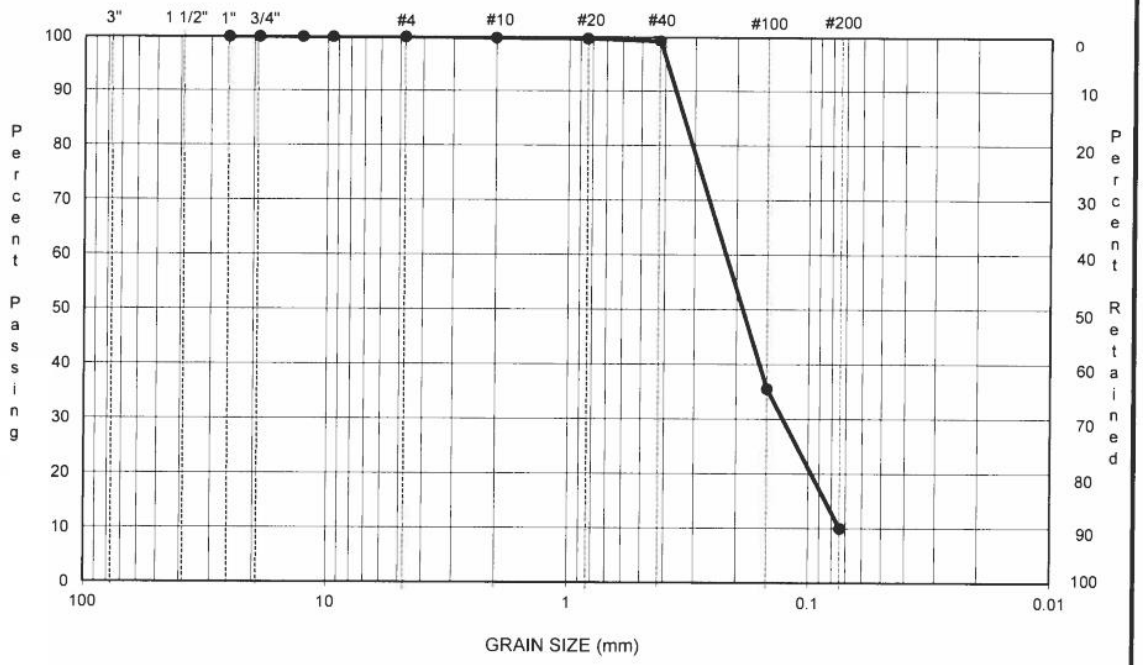
Project	Job No.
28th Street Pump Station	12155.00
Location	Date
28rh Street & I-29, Council Bluffs, IA	6/26/12

Sample Identification: B-1 S-2

Sample Description: brown sand with silt

SIEVE ANALYSIS

Size	% Finer
1"	100
3/4"	100
1/2"	100
3/8"	100
# 4	100
# 10	100
# 20	100
# 40	99
# 100	35
# 200	10.0



UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES

Lab No.: _____

Thiele Geotech Inc

GRAIN SIZE CURVE

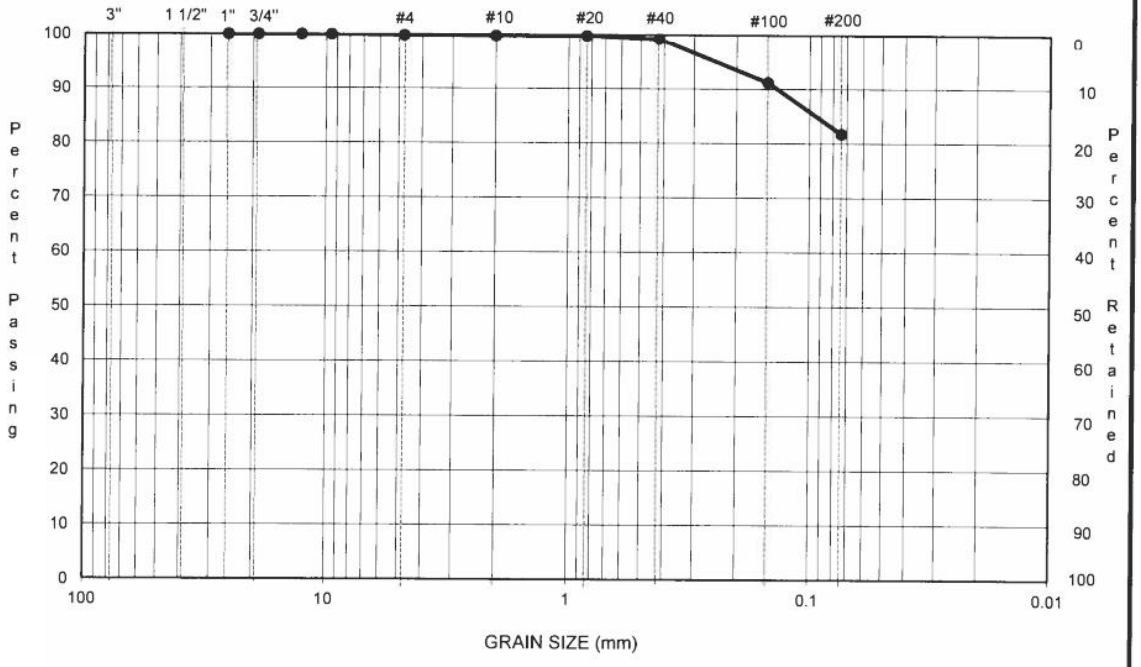
Project	Job No.
28th Street Pump Station	12155.00
Location	**Date**
28rh Street & I-29, Council Bluffs, IA	6/26/12

Sample Identification: B-1 S-5

Sample Description: gray silt

SIEVE ANALYSIS

Size	% Finer
1"	100
3/4"	100
1/2"	100
3/8"	100
# 4	100
# 10	100
# 20	100
# 40	99
# 100	91
# 200	82



UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES

Lab No.: _____

Thiele Geotech Inc

GRAIN SIZE CURVE

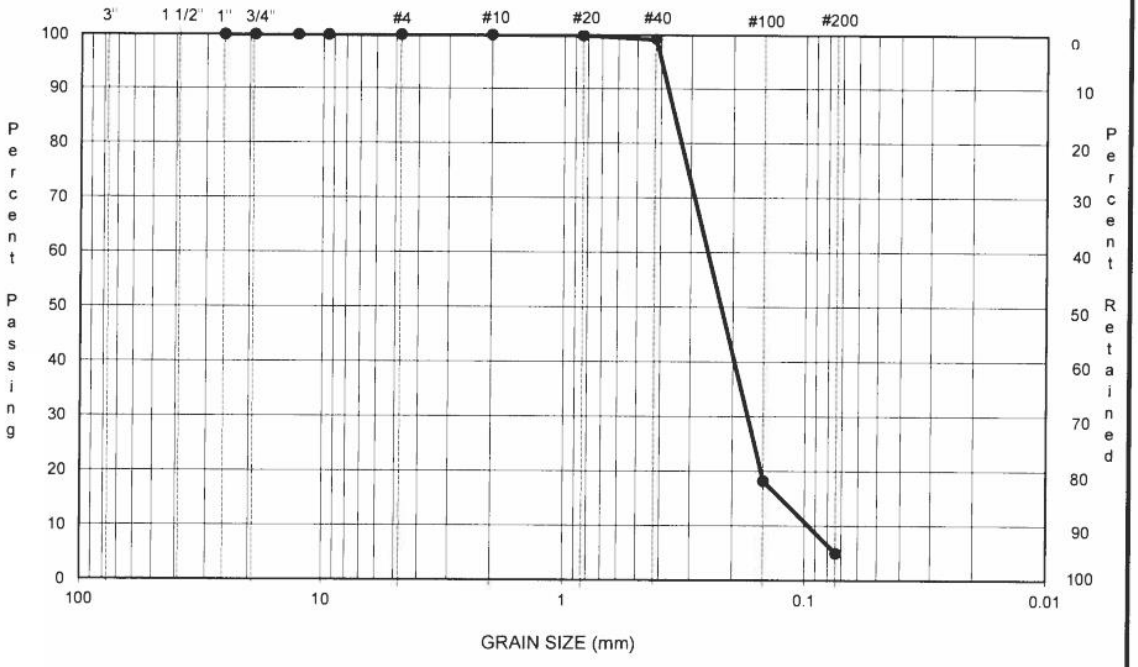
Project	Job No.
28th Street Pump Station	12155.00
Location	**Date**
28rh Street & I-29, Council Bluffs, IA	6/26/12

Sample Identification: B-1 S-6

Sample Description: gray sand

SIEVE ANALYSIS

Size	% Finer
1"	100
3/4"	100
1/2"	100
3/8"	100
# 4	100
# 10	100
# 20	100
# 40	99
# 100	18
# 200	5.0



UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES

Lab No.: _____

Thiele Geotech Inc

GRAIN SIZE CURVE

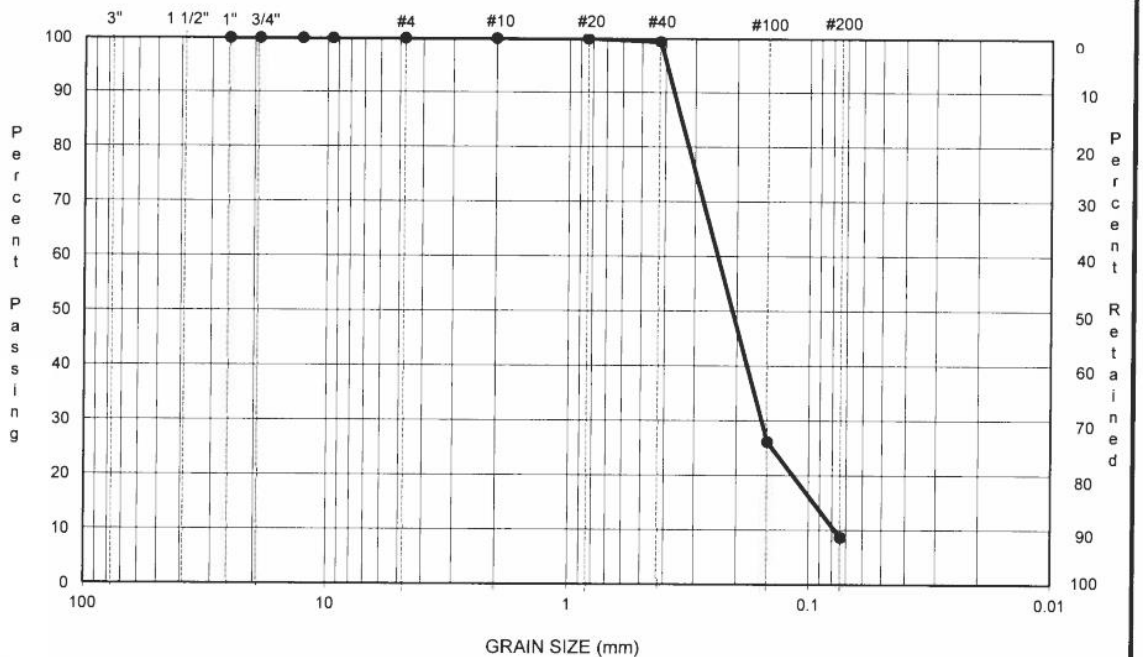
Project	Job No.
28th Street Pump Station	12155.00
Location	**Date**
28rh Street & I-29, Council Bluffs, IA	6/26/12

Sample Identification: B-1 S-7

Sample Description: gray sand with silt

SIEVE ANALYSIS

Size	% Finer
1"	100
3/4"	100
1/2"	100
3/8"	100
# 4	100
# 10	100
# 20	100
# 40	99
# 100	26
# 200	8.7



UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES

Lab No.:

Thiele Geotech Inc

GRAIN SIZE CURVE

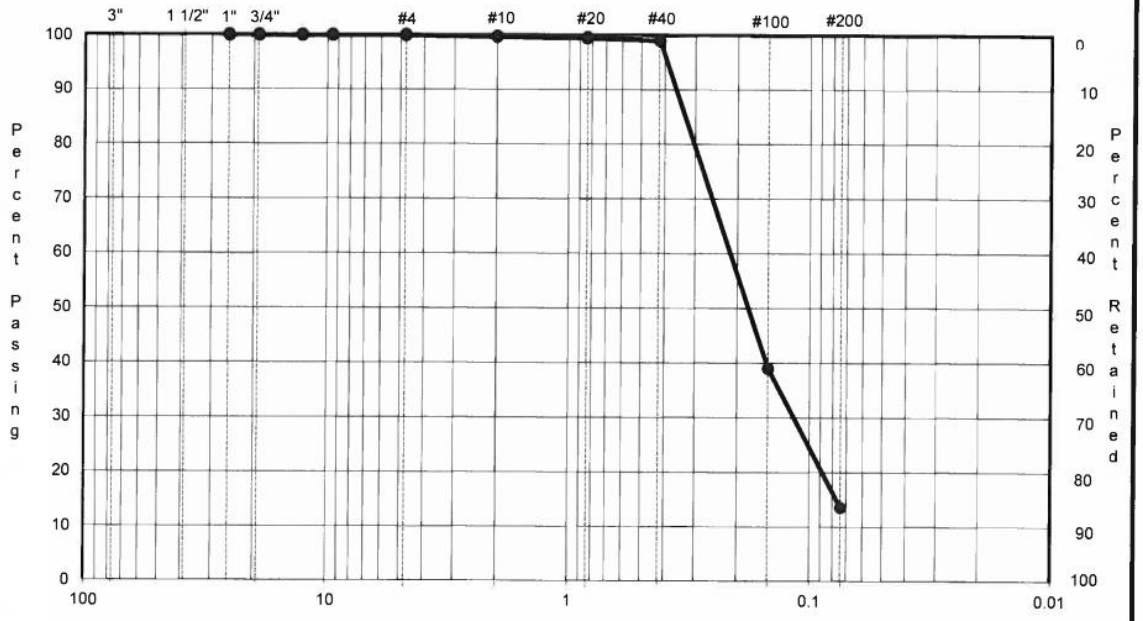
Project	Job No.
28th Street Pump Station	12155.00
Location	**Date**
28rh Street & I-29, Council Bluffs, IA	6/26/12

Sample Identification: B-1 S-9

Sample Description: gray silty sand

SIEVE ANALYSIS

Size	% Finer
1"	100
3/4"	100
1/2"	100
3/8"	100
# 4	100
# 10	100
# 20	100
# 40	99
# 100	39
# 200	14



UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES

Lab No.:

Thiele Geotech Inc

GRAIN SIZE CURVE

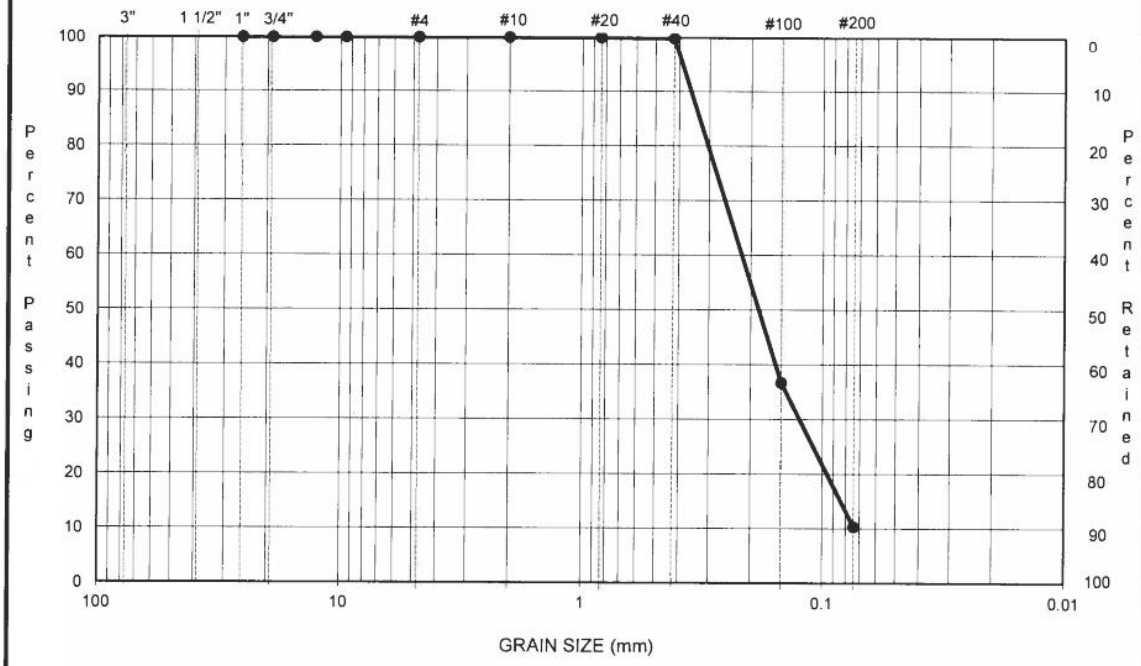
Project	Job No.
28th Street Pump Station	12155.00
Location	Date
28rh Street & I-29, Council Bluffs, IA	6/26/12

Sample Identification: B-2 S-2

Sample Description: brown sand wity silt

SIEVE ANALYSIS

Size	% Finer
1"	100
3/4"	100
1/2"	100
3/8"	100
# 4	100
# 10	100
# 20	100
# 40	100
# 100	37
# 200	10



UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES

Lab No.: _____

Thiele Geotech Inc

GRAIN SIZE CURVE

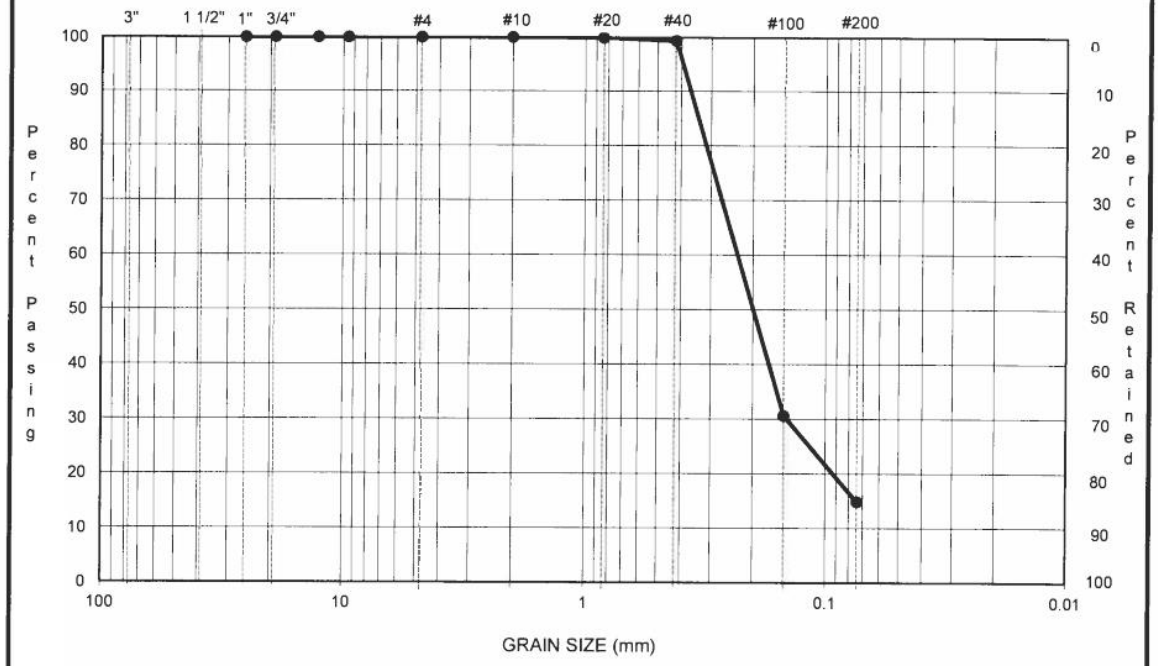
Project: 28th Street Pump Station	Job No.: 12155.00
Location: 28rh Street & I-29, Council Bluffs, IA	Date: 6/26/12

Sample Identification: B-2 S-6

Sample Description: gray silty sand

SIEVE ANALYSIS

Size	% Finer
1"	100
3/4"	100
1/2"	100
3/8"	100
# 4	100
# 10	100
# 20	100
# 40	99
# 100	31
# 200	15



UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES

Lab No.:

Thiele Geotech Inc

GRAIN SIZE CURVE

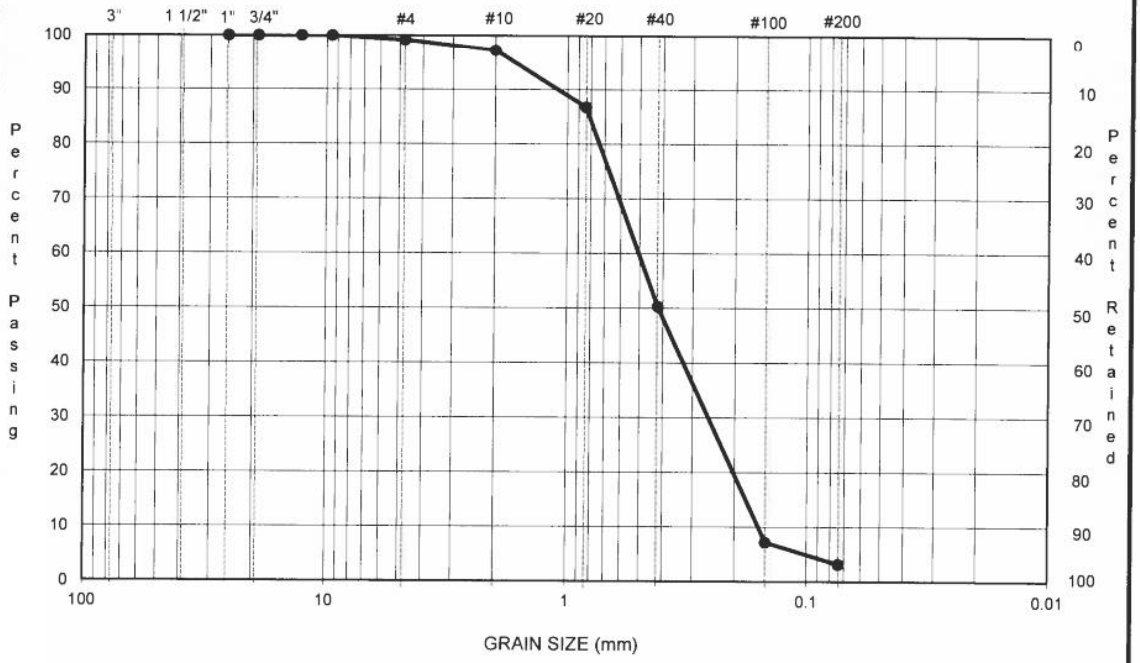
Project	Job No.
28th Street Pump Station	12155.00
Location	Date
28rh Street & I-29, Council Bluffs, IA	6/26/12

Sample Identification: B-2 S-8

Sample Description: gray sand

SIEVE ANALYSIS

Size	% Finer
1"	100
3/4"	100
1/2"	100
3/8"	100
# 4	99
# 10	97
# 20	87
# 40	50
# 100	7.2
# 200	3.2



UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES

Lab No.:

Thiele Geotech Inc

GRAIN SIZE CURVE

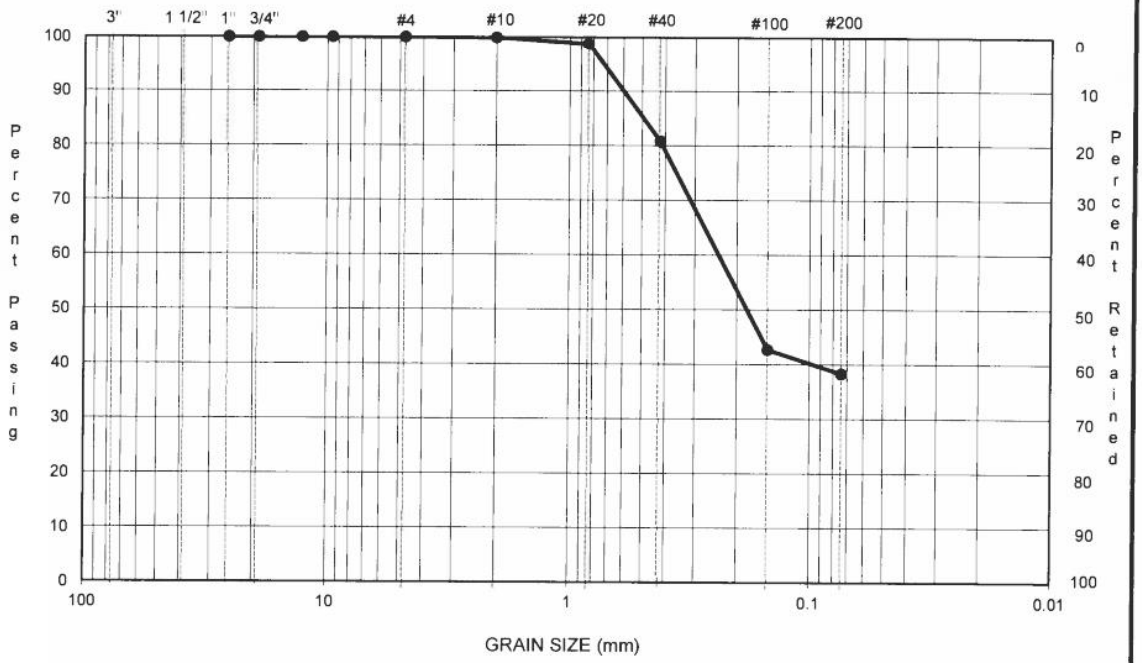
Project	Job No.
28th Street Pump Station	12155.00
Location	**Date**
28rh Street & I-29, Council Bluffs, IA	6/26/12

Sample Identification: B-2 S-10

Sample Description: gray sand with silt

SIEVE ANALYSIS

Size	% Finer
1"	100
3/4"	100
1/2"	100
3/8"	100
# 4	100
# 10	100
# 20	99
# 40	81
# 100	43
# 200	38



UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES

Lab No.: _____

Thiele Geotech Inc

GRAIN SIZE CURVE

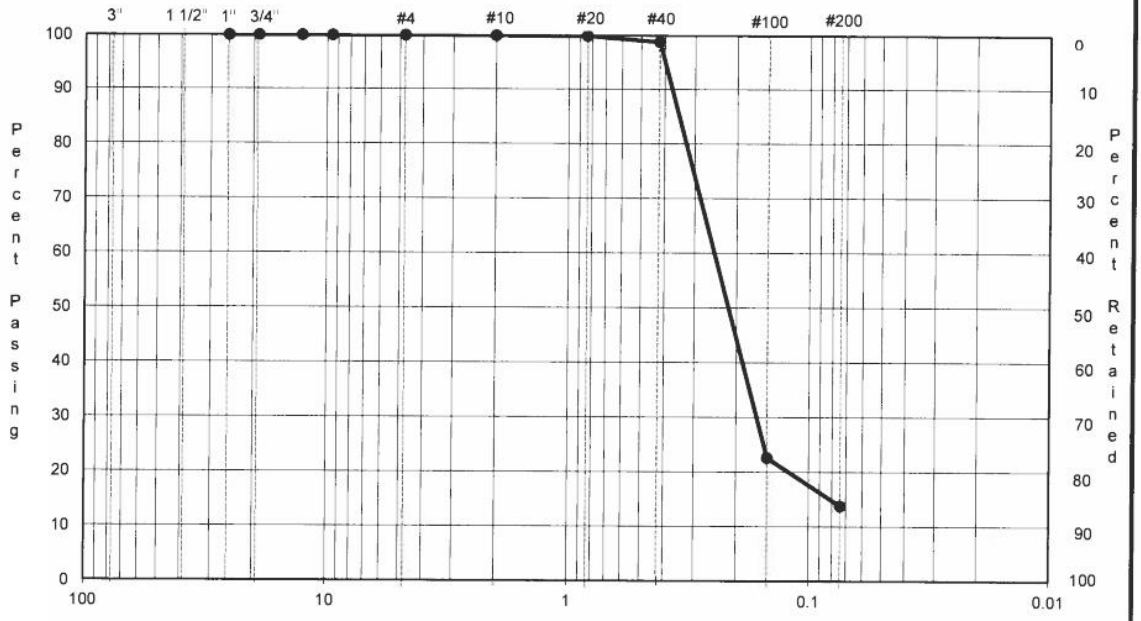
Project: 28th Street Pump Station	Job No.: 12155.00
Location: 28rh Street & I-29, Council Bluffs, IA	Date: 6/26/12

Sample Identification: B-3 S-2

Sample Description: brown clayey sand

SIEVE ANALYSIS

Size	% Finer
1"	100
3/4"	100
1/2"	100
3/8"	100
# 4	100
# 10	100
# 20	100
# 40	99
# 100	23
# 200	14



UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES

Lab No.: _____

Thiele Geotech Inc

GRAIN SIZE CURVE

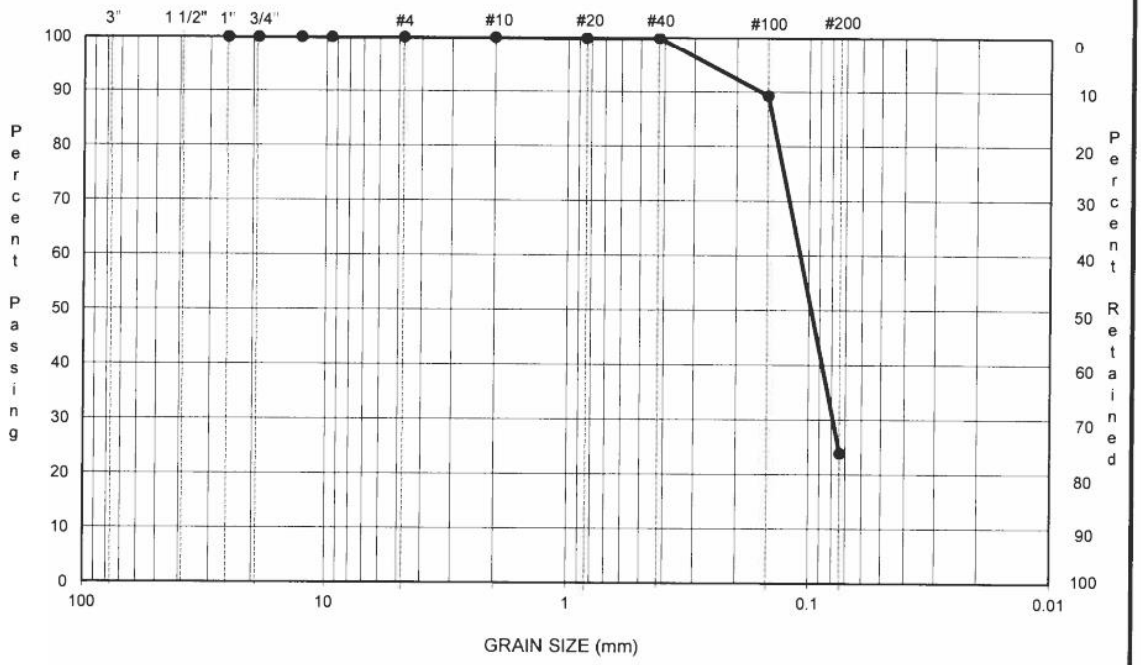
Project	Job No.
28th Street Pump Station	12155.00
Location	Date
28rh Street & I-29, Council Bluffs, IA	6/26/12

Sample Identification: B-3 S-6

Sample Description: gray silty sand

SIEVE ANALYSIS

Size	% Finer
1"	100
3/4"	100
1/2"	100
3/8"	100
# 4	100
# 10	100
# 20	100
# 40	100
# 100	89
# 200	24



UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES

Lab No.: _____

Thiele Geotech Inc

GRAIN SIZE CURVE

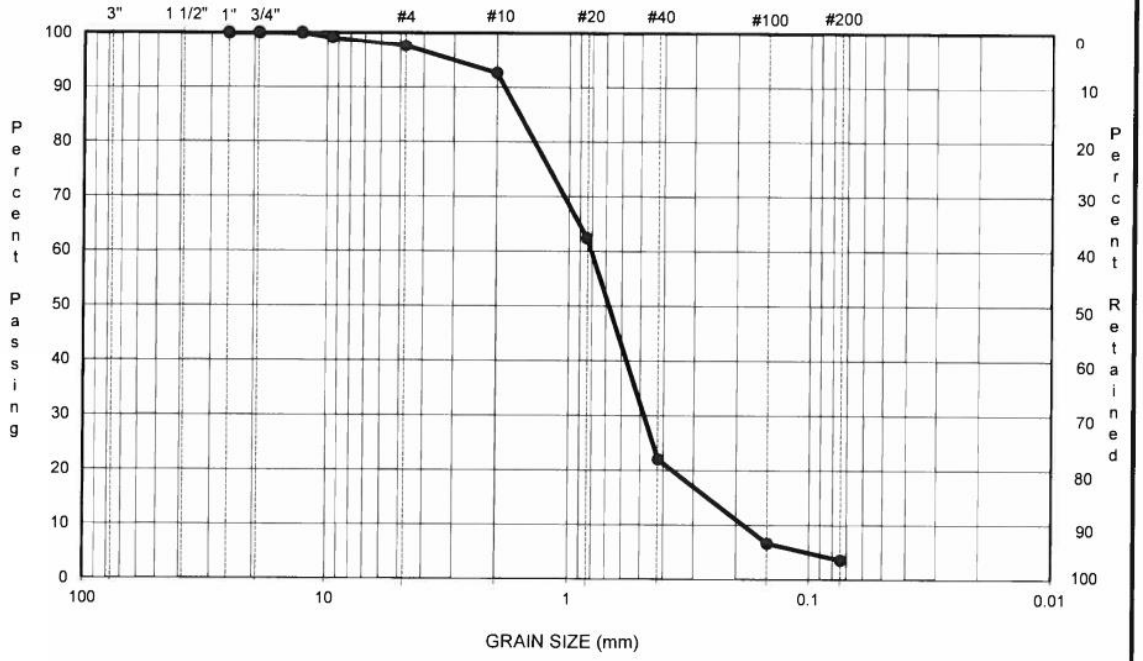
Project	Job No.
28th Street Pump Station	12155.00
Location	**Date**
28rh Street & I-29, Council Bluffs, IA	6/26/12

Sample Identification: B-3 S-8

Sample Description: gray sand

SIEVE ANALYSIS

Size	% Finer
1"	100
3/4"	100
1/2"	100
3/8"	99
# 4	98
# 10	93
# 20	62
# 40	22
# 100	6.7
# 200	3.6



UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES

Lab No.: _____

Thiele Geotech Inc

GRAIN SIZE CURVE

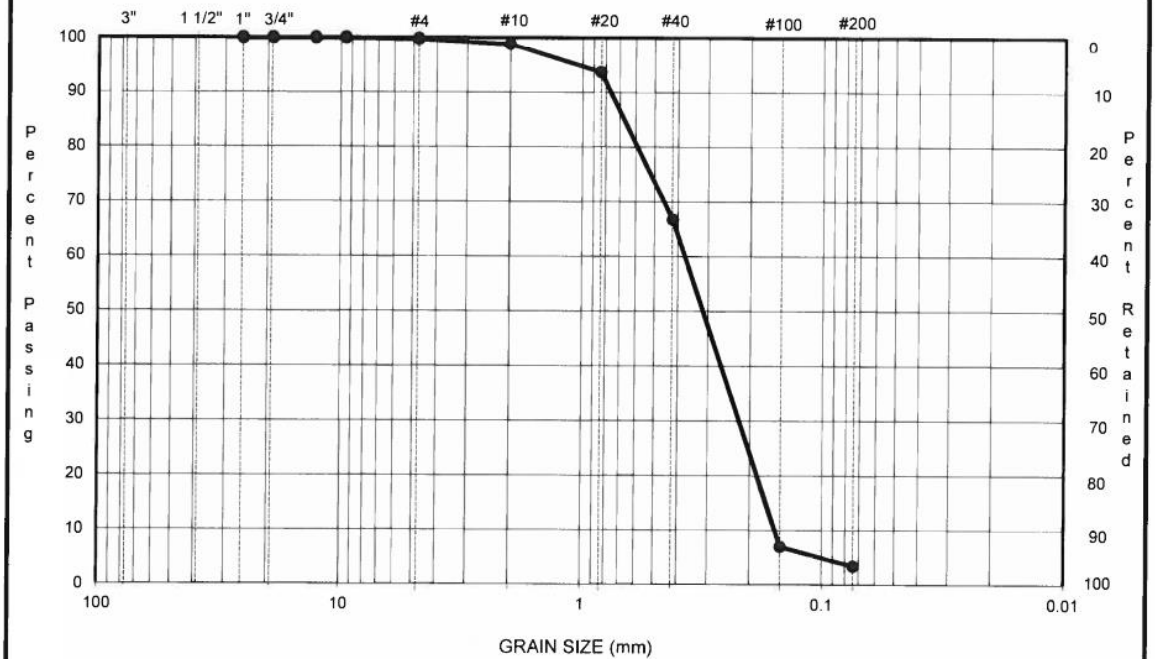
Project	Job No.
28th Street Pump Station	12155.00
Location	**Date**
28rh Street & I-29, Council Bluffs, IA	6/26/12

Sample Identification: B-3 S-9

Sample Description: gray sand

SIEVE ANALYSIS

Size	% Finer
1"	100
3/4"	100
1/2"	100
3/8"	100
# 4	100
# 10	99
# 20	94
# 40	67
# 100	7.0
# 200	3.5



UNIFIED CLASSIFICATION SYSTEM

COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	FINES

Lab No.: _____

APPENDIX B
City of Council Bluffs Dewatering Discharge Sampling and Testing Requirements

Thiele Geotech Inc

13478 Chandler Road
Omaha, Nebraska 68138-3716
402.556.2171 Fax 402.556.7831
www.thielegeotech.com

May 17, 2010

Mr. Jeff Krist
Public Works Department
City of Council Bluffs
209 Pearl Street
Council Bluffs, IA 51503

RE: PROPOSED ENVIRONMENTAL SCREENING POLICY FOR MONITORING THE DISCHARGE OF GROUND WATER FROM DEWATERING ACTIVITIES
TG# 08017.06

Dear Mr. Krist:

This letter outlines a proposed environmental screening policy related to dewatering projects conducted by the City of Council Bluffs. This screening policy has resulted from the recent request from Kirk Mathis of IDNR for the City of Council Bluffs to oversee dewatering activities that occur in the City of Council Bluffs via the City's storm water discharge permit (NPDES General Permit MS4).

Previously the IDNR field office has provided guidance for a schedule of sampling activities to monitor the quality of the discharge waters entering the City's storm sewer during dewatering activities. These monitoring events have taken place on a daily to weekly basis and tested pH, iron content, total dissolved solids, and total suspended solids. If there was potential for a LUST site to be influenced, then select constituents of petroleum hydrocarbons would also be included in the testing regime.

Below is a proposed monitoring plan for a dewatering site. If there is an active LUST site within 1,000 feet of the dewatering well, then the relevant additional parameters should also be included in the sampling events.

PARAMETER	LIMIT	SAMPLING FREQUENCY	LOCATION
Volume of water discharged	NA	Record daily	Prior to discharge to storm sewer
pH	6.0-9.0 SU (Standard Units)	Day 1, 4, & 7 the first week then weekly thereafter	Prior to discharge to storm sewer/outfall
Total suspended solids	45 mg/L	Day 1, 4, & 7 the first week then weekly thereafter	Prior to discharge to storm sewer/outfall
Total iron	August through April: 15 mg/L May through July: 25 mg/L	Day 1, 4, & 7 the first week then weekly thereafter	Prior to discharge to storm sewer/outfall

LUST with gasoline release			
BTEX (OA-1)	Benzene: 5.0 ug/L Toluene: 1, 000 ug/L Ethylbenzene: 700 ug/L Xylenes: 10,000 ug/L	Day 1, 4, & 7 the first week then weekly thereafter	Prior to discharge to storm sewer/outfall
LUST with diesel/waste oil release			
Total Extractable Hydrocarbons (OA-2)	Diesel: 1,200 ug/L Waste Oil: 400 ug/L	Day 1, 4, & 7 the first week then weekly thereafter	Prior to discharge to storm sewer

The intent of this environmental screening policy is to broaden the knowledge of the potential impact upon the storm sewer fallout locations from ground water releases to the City's storm sewer system from dewatering events.

We look forward to receiving your advice on this matter. If you have any questions, or if there is any additional information that we can provide, please feel free to contact us.

Respectfully submitted,
Thiele Geotech, Inc.

Prepared by,

Donna S. Matlock, C.P.G., CHMM
Senior Geologist

APPENDIX C
USACE Standard Operating Procedure
Open Tube Piezometer Installation

SOP #5: Open Tube Piezometer Installation

1 GENERAL

This Standard Operation Procedure (SOP) outlines the general requirements, methodology, and documentation required for this task. Site-specific requirements for the number, location, and other specific information or considerations are specified in **Appendix A** of this Scope of Work.

2 REQUIREMENTS

Installation includes the entire designed length of the open tube piezometer's screen, riser, filter pack, and annular seals along with surface completion. The open tube piezometer is to be fully installed, developed, and response tested (if required) as designed.

The Contractor is responsible for obtaining all equipment, supplies, and personnel required to complete successful installation of all components of the open tube piezometer(s). The Contractor shall review the open-tube piezometer design criteria (provided in the site-specific section of this SOW [**Appendix A**]) and become familiar with the location and level of effort required to fulfill all components of the installation process. All work completed under this SOP shall be detailed in the Contractor's final work plan prior to initiation of any field efforts.

For this task, the Contractor shall adhere to all provisions outlined in the Scope of Work (SOW), this SOP, the site-specific requirements detailed in **Appendix A**, and the most recent revision of the following reference materials, as applicable.

PUBLICATIONS

ER 1110-1-1807. U.S. Army Corps of Engineers, Engineering Regulation (ER) 1110-1-1807, *Procedures for Drilling in Earth Embankments*.

EM 1110-1-1804. U.S. Army Corps of Engineers, Engineering Manual (EM) 1110-1-1804, *Geotechnical Investigations.*

ASTM D 1586. American Society for Testing and Materials (ASTM) D 1586, *Penetration Test and Split-Barrel Sampling of Soils*.

ASTM D 1587. American Society for Testing and Materials (ASTM) D 1587, *Standard Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes*.

ASTM D 2488. American Society for Testing and Materials (ASTM) D 2488, *Standard Practice for Description and Identification of Soils (Visual Manual Procedure).*

FORMS

ENG FORM 1836/1836A. U.S. Army Corps of Engineers, Engineering Form 1836 and/or 1836A, *Drill Log Form.*

ENG FORM 1742. U.S. Army Corps of Engineers, Engineering Form 1742, *Sampling Labels (Example)*

MRO (NWO) FORM 1241. U.S. Army Corps of Engineers, Omaha District Form 1241, *Sample Transmittal Form (Example)*

Piezometer Construction Diagram Form (Example)

Open Tube Piezometer Development Log (Example)

3 PROCEDURES

3.1 Field Activities

Outlined below are the field activities for open tube piezometer drilling and sampling, installation, and development. If required, the response testing shall be preformed using SOP #5: Response Testing. Restoring the site to acceptable pre-work conditions after completion of all work efforts shall also be the responsibility of the Contractor. Procedures used shall be thoroughly described in the Contractor's work plan.

3.1.1 Drilling, Logging, and Sampling

Borings shall be drilled with 3 ¼-inch (or larger) inner diameter hollow stem augers to produce a boring of sufficient diameter and depth to meet design requirements of the open tube piezometer as set forth in **Appendix A**. The drilling method shall be such as to maintain borehole stability and keep the drill string free of heaving formation materials, thereby allowing proper placement of the screen and riser and the subsequent installation of the filter pack and other annular seals. It should be noted that a single boring from which logging and sampling requirements can be fully completed that meets design requirements of the piezometer (i.e., diameter and depth) is acceptable. The drilling method shall allow the open tube piezometer, to include the borehole wall and adjacent formation, filter pack, and screen, to be developed to provide maximum hydraulic connection between the piezometer's screen and the monitoring zone's groundwater.

Soils shall be logged, classified, and sampled in accordance with **SOP #4** and **Appendix A**.

3.1.2 Open Tube Piezometer Installation

The open tube piezometer shall be installed immediately after each boring is complete to the design depth specified in the site-specific section of the SOW (**Appendix A**). Generally, the open tube piezometer shall be constructed of 2-inch nominal diameter, schedule-40, PVC casing with 0.010-inch-slot, continuous wrap screen, with 20-40 gradation clean silica sand filter pack, with specific details supplied in **Appendix A**. Criteria for the anticipated screen placement shall be identified in the Contractor's Work Plan; however, the actual screen placement **shall be confirmed** with the USACE- Primary Technical POC (or the USACE- Dam Safety Engineer) **prior to installation**. If the design screen length is not factory standard or custom manufactures, it can be custom fitted in the field from screen (meeting same construction material type/slot width and type as designed) to meet the design length to reflect the zone targeted for monitoring. The entire length of the open tube piezometer shall be installed centrally and straight in the borehole to allow the required thickness of filter pack to be tremied into place surrounding the well screen, as well as efficiently allowing all other annular seals to be properly placed. All seals shall be placed by tremie methods. Filter pack shall extend 1-foot below the bottom of the

screen and 2-feet above the top of the screen unless otherwise specified in **Appendix A**. A 3-foot-thick layer of ⅜ to ½-inch diameter, bentonite pellets will be placed above the filter pack sand and allowed to hydrate before the remaining borehole annulus is filled with a cement-bentonite grout. The grout will be injected through a tremie pipe to within 1-foot of the ground surface and allowed to settle. After settlement has occurred, the grout will be topped off to 1-foot of the ground surface. Natural soil will be mounded at the ground surface to promote water drainage away from the piezometer. Grout will be a mixture of one bag (94 pounds) of Portland cement, 7 gallons of water, and 3 percent by weight bentonite powder. Grouts shall be placed using a side-discharge tremie pipe that remains submerged in the grout during the grouting process. The remaining borehole annular space and surface completion shall be completed as specified in **Appendix A**. Filter pack gradation, screen slot opening width, screen type, annular seals, and surface completion materials (concrete pad, protective casing, protective posts, lock) planned to be used during installation shall be specified in the Contractor's work plan and be based on design criteria presented in **Appendix A**. An Open Tube Piezometer Installation form shall be completed (**Attachment 4**).

3.1.3 Open Tube Piezometer Development

The water level, depth, and diameter shall be measured and recorded on **Attachment 5**. The piezometer shall be surged with an appropriately functioning surge block supporting a relief valve. Then the water and any sediment in the piezometer shall be evacuated by use of a pumping method (e.g., airlift, etc.) capable of removing water and sediment from the piezometer. Alternating surging and pumping efforts shall continue until all sediment is removed from the piezometer and the water is clear. The Open Tube Piezometer Development Log (**Attachment 5**) shall be fully completed for all development activities and results. A labeled photograph of pre- and post-development water placed in a clear glass jar shall be taken.

3.1.4 Open Tube Piezometer Disinfection

At completion of the rising-head response test (if performed), the piezometer shall be disinfected with a bleach solution. However, if the piezometer's screened zone is in impermeable materials (such as may be found in the embankment and potentially the foundation) the piezometer shall not be disinfected. The amount of bleach solution added to the piezometer shall be two times the static water volume in the piezometer or to a maximum level within 10 feet of the ground surface (if the two times static water volume is greater than 10 feet below the ground surface). The bleach solution shall be ratio of 1:250, 1 gallon of 5% bleach to 250 gallons of water (approximately 3 teaspoons of 5% bleach per 1 gallon of water). The bleach solution shall be added to the piezometer and allowed to infiltrate naturally. This effort shall be documented in the "COMMENTS" block on **Attachment 5**.

4 DOCUMENTATION AND REPORTING

The Contractor shall be responsible for recording, maintaining and submitting all documentation and reports associated with this SOP and the site-specific information provided in **Appendix A**. The following list includes documents and reports that shall be submitted to the Corps of Engineers per this SOP. This submittal list is not inclusive of all submittals required under the SOW. Submittal format requirements, reporting and planning requirements, and submittal deadlines are specified in the main body of the SOW. At a minimum, these include the following:

- Daily Quality Control Report (per SOP #1)
- Drill Log Form (including photo attachments)
- Sample Labels
- Sample Transmittal Record
- Open Tube Piezometer Installation Form
- Open Tube Piezometer Development Log including photo-documentation.
- Photographs at each piezometer location documenting all work efforts and pre-installation and post-installation site conditions

DRILLING LOG	DIVISION	INSTALLATION	HOLE NUMBER

1. PROJECT	10. SIZE AND TYPE OF BIT	SHEET SHEETS OF
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL	
4. HOLE NO. (As shown on drawing title and file number)	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED / UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER	
	16. DATE HOLE	STARTED / COMPLETED
7. THICKNESS OF OVERBURDEN	17. ELEVATION TOP OF HOLE	
8. DEPTH DRILLED INTO ROCK	18. TOTAL CORE RECOVERY FOR BORING	
9. TOTAL DEPTH OF HOLE	19. SIGNATURE OF INSPECTOR	

LOCATION SKETCH/COMMENTS	SCALE

ENG FORM 1836	PROJECT	HOLE NO.

DRILLING LOG (CONT SHEET)

ELEVATION TOP OF HOLE	HOLE NUMBER
PROJECT	INSTALLATION
	SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)

ENG FORM 1836 | PROJECT | HOLE NO.

FROM	PROJECT	LOCATION	
	HOLE NO.	DEPTH: FROM–	TO–
		ELEVATION	
	SAMPLE NO.	CLASSIFICATON	
	J-	TYPE: ☐ DISTURBED	☐ UNDISTURBED
	REMARKS		
	DATE	INSPECTOR	
ENG FORM 1 JAN 49 1742		☐ BAG ☐ JAR	OF

FROM	PROJECT	LOCATION	
	HOLE NO.	DEPTH: FROM–	TO–
		ELEVATION	
	SAMPLE NO.	CLASSIFICATON	
	J-	TYPE: ☐ DISTURBED	☐ UNDISTURBED
	REMARKS		
	DATE	INSPECTOR	
ENG FORM 1 JAN 49 1742		☐ BAG ☐ JAR	OF

FROM	PROJECT	LOCATION	
	HOLE NO.	DEPTH: FROM–	TO–
		ELEVATION	
	SAMPLE NO.	CLASSIFICATON	
	J-	TYPE: ☐ DISTURBED	☐ UNDISTURBED
	REMARKS		
	DATE	INSPECTOR	
ENG FORM 1 JAN 49 1742		☐ BAG ☐ JAR	OF

FROM	PROJECT	LOCATION	
	HOLE NO.	DEPTH: FROM–	TO–
		ELEVATION	
	SAMPLE NO.	CLASSIFICATON	
	J-	TYPE: ☐ DISTURBED	☐ UNDISTURBED
	REMARKS		
	DATE	INSPECTOR	
ENG FORM 1 JAN 49 1742		☐ BAG ☐ JAR	OF

FROM	PROJECT	LOCATION	
	HOLE NO.	DEPTH: FROM–	TO–
		ELEVATION	
	SAMPLE NO.	CLASSIFICATON	
	J-	TYPE: ☐ DISTURBED	☐ UNDISTURBED
	REMARKS		
	DATE	INSPECTOR	
ENG FORM 1 JAN 49 1742		☐ BAG ☐ JAR	OF

FROM	PROJECT	LOCATION	
	HOLE NO.	DEPTH: FROM–	TO–
		ELEVATION	
	SAMPLE NO.	CLASSIFICATON	
	J-	TYPE: ☐ DISTURBED	☐ UNDISTURBED
	REMARKS		
	DATE	INSPECTOR	
ENG FORM 1 JAN 49 1742		☐ BAG ☐ JAR	OF

SAMPLE TRANSMITTAL RECORD

CORPS OF ENGINEERS LABORATORY

PROJECT	HOLE NO.
LOCATION: PLAN	TOP ELEVATION
SAMPLING METHOD	INSPECTOR

DATE SAMPLED	SAMPLE SIZE	SAMPLE TYPE	SAMPLE NO.	LAB. SER.NO.	DEPTH IN FEET	FIELD LOG AND REMARKS

SAMPLE RECEIVED BY: DATE:

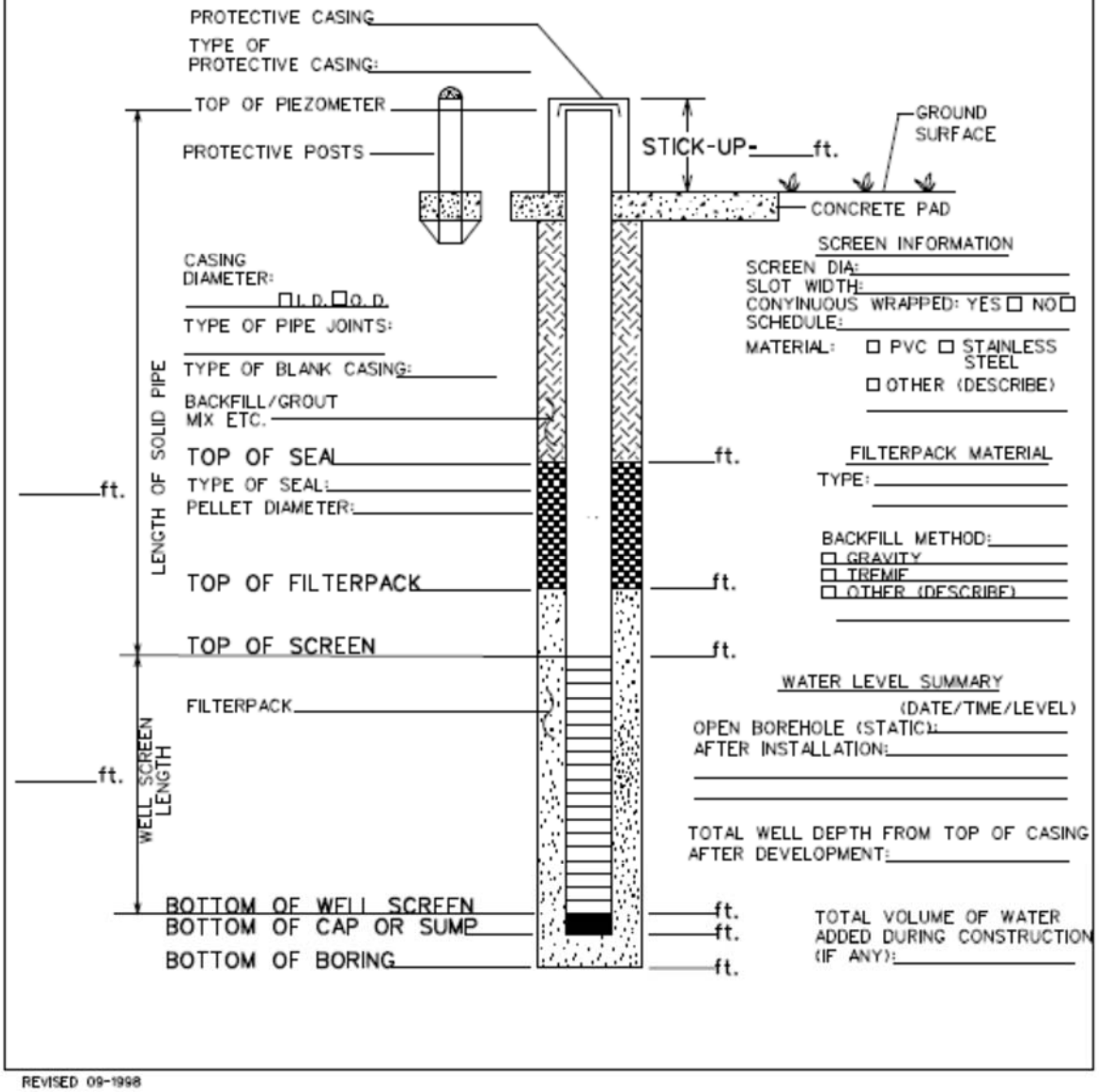
MRO FORM 1241
1 NOV 65

(Formerly MRD Form 0193, Which may be used.)

PROJECT			WELL NUMBER
DATE INSTALLED	STARTED	COMPLETED	LOCATION (Coordinates or Station)
SIGNATURE OF INSPECTOR/INSTALLER			ELEVATION OF HOLE
TOTAL DEPTH OF BOREHOLE	BORING DIAMETER		ELEVATION TOP OF INSTRUMENT CASING

PIEZOMETER CONSTRUCTION DIAGRAM

NO SCALE
(ALL MEASUREMENTS FROM GROUND SURFACE)



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OPEN TUBE PIEZOMETER DEVELOPMENT LOG

PROJECT NAME: _____

PIEZOMETER NUMBER: _____

OPENED: DATE _____ TIME _____		CLOSED: DATE _____ TIME _____	
Water Level (TOC)	ft	Water Level (TOC)	ft
Piezometer Depth (TOC)	ft	Piezometer Depth (TOC)	ft
Design Depth (TOC) *	ft	Design Depth (TOC) *	ft
Est. Sed. In Piezometer	ft	Est. Sed. In Piezometer	ft

* Design depth may have been modified after the surface completion.

SURGING/BAILING DATA

METHOD/EQUIPMENT OF DEVELOPMENT: _____

TIME		GAL RMVD	WATER CLARITY	REMARKS (Amt./Type of Sediment, etc.)
SURGING	PUMPING			

CONTINUOUS PUMPING DATA

PUMPING METHOD: _____

TIME	GAL RMVD *	TURB. (NTU)	REMARKS

* Total includes water removed during surging and bailing.

COMMENTS: _____

INSPECTOR: _____

PIEZOMETER DEVELOPMENT LOG (CONTINUED)

PROJECT NAME: _____

PIEZOMETER NUMBER: _____

TIME	TOTAL GAL. RMVD.	TURB. (NTU)	REMARKS

COMMENTS: _____

_____

_____

_____

_____

_____

INSPECTOR: _____