



Kerr-McGee Oil & Gas Onshore LP
1099 18th Street, Suite 1800
Denver, Colorado 80202
720-929-6000 Fax 720-929-7000

June 22, 2017

Mr. Chris Canfield
Environmental Protection Specialist
Colorado Oil and Gas Conservation Commission
1120 Lincoln Street, Suite 801
Denver, Colorado 80203

**Re: Centralized E&P Waste Management Facility Application
Aggregate State 37C-16HZ Fluid Recycling Facility
Weld County, Colorado
SE Section 9-2N-66W**

Dear Mr. Canfield:

Enclosed please find a Form 28 application for a *Centralized E&P Waste Management Facility Permit* proposed for the above-referenced location. Kerr-McGee Oil & Gas Onshore LP plans to utilize the subject property as a facility to recycle fluids generated by Kerr-McGee, per the Colorado Oil and Gas Conservation Commission (COGCC) Rules.

Feel free to contact me at 720-929-6368 if you have any questions regarding this information.

Sincerely,

Kerr-McGee Oil & Gas Onshore LP

A handwritten signature in blue ink, appearing to read 'Mike Dinkel'.

Mike Dinkel
Staff HSE Representative

Attachments



State of Colorado Oil and Gas Conservation Commission



1120 Lincoln Street, Suite 801, Denver, Colorado 80203 (303) 894-2100 Fax: (303) 894-2109

CENTRALIZED E&P WASTE MANAGEMENT FACILITY PERMIT

Submit this Form and accompanying documents for each facility per Rule 908. Financial Assurance in the amount of \$50,000 is required to operate each facility.

FOR OGCC USE ONLY

Surety ID: _____

OGCC Operator Number: 47120 Name of Operator: Kerr-McGee Oil & Gas Onshore Address: P O Box 173779 City: Denver State: CO Zip: 80217-3779		Contact Name and Telephone: Mike Dinkel No: 720-929-6368 Fax: 720-929-7368	
Surface Owner (if different than above): Anadarko E&P Company LP Address: P O Box 173779 City: Denver State: CO Zip: 80217-3779 Phone: 720-929-6368			
Facility Name: Aggregate State 37C-16HZ Fluid Recycling Facility Address: Weld County Roads 22 & 31, North 0.25 miles, West into City: _____ State: CO Zip: _____ Phone: _____ Fax: _____		Location (QtrQtr, Sec, Twp, Rng, Mer): NESE Sec 9-T2N-66W Latitude: 40.15143 Longitude: -104.77646	

Complete the Attachment Checklist	
	Oper OGCC
Site description (topo, geol, hydro)	✓
Adjacent land use description	✓
Topographic map	✓
Site drainage map with structures	✓
Scaled drawing and survey map	✓
Facility design & engineering	✓
Operating plan	✓
Water analysis report	
Financial assurance	
Closure plan	✓
Local gov't zoning compliance	✓
Local gov't permits and notice	

1. Is the site in a sensitive area? <input type="checkbox"/> Y <input checked="" type="checkbox"/> N	2. What are the average annual precipitation and evaporation rates for the site? Precipitation: 14 inches/year Evaporation: 41 inches/year
3. Has a description of the site's general topography, geology and hydrology been attached? <input checked="" type="checkbox"/> Y <input type="checkbox"/> N	
4. Has a description of the adjacent land use been attached? <input checked="" type="checkbox"/> Y <input type="checkbox"/> N	5. Has a 1:24,000 topographic map showing the site location been attached? <input checked="" type="checkbox"/> Y <input type="checkbox"/> N
6. Has a site plan showing drainage patterns, diversion or containment structures, roads, fencing, tanks, pits, buildings and any other pertinent construction details been attached? <input checked="" type="checkbox"/> Y <input type="checkbox"/> N	
7. If site is not owned by the operator, is written authorization of the surface owner attached? <input type="checkbox"/> Y <input type="checkbox"/> N	8. Has a scaled drawing and survey showing the entire section(s) containing the proposed facility been attached? <input checked="" type="checkbox"/> Y <input type="checkbox"/> N
9. What measures have been implemented to limit access to the facility by wildlife, domestic animals or by members of the public? Briefly explain. The site is manned 24 hours per day, 7-days per week, and 365 days per year.	
10. Is there a planned firelane of at least 10 feet in width around the active treatment areas and within the perimeter fence? <input checked="" type="checkbox"/> Y <input type="checkbox"/> N	11. Is there an additional buffer zone of at least 10 feet within the perimeter firelane? <input checked="" type="checkbox"/> Y <input type="checkbox"/> N
12. Have surface water diversion structures been constructed to accommodate a 100-year, 24-hour event? <input type="checkbox"/> Y <input checked="" type="checkbox"/> N	13. Has a waste profile been calculated according to Rule 908.b.6? <input checked="" type="checkbox"/> Y <input type="checkbox"/> N
14. Has facility design and engineering been provided as required by Rule 908.b.7? <input checked="" type="checkbox"/> Y <input type="checkbox"/> N	15. Has an operating plan been completed as required by Rule 908.b.8? <input checked="" type="checkbox"/> Y <input type="checkbox"/> N
16. Has ground water monitoring for the site been provided? <input checked="" type="checkbox"/> Y <input type="checkbox"/> N ***Attach Water Analysis Report, Form 25, for each monitoring well installed.***	
17. Has financial assurance been provided as required by Rule 704? <input type="checkbox"/> Y <input checked="" type="checkbox"/> N	18. Has a closure plan been provided? <input checked="" type="checkbox"/> Y <input type="checkbox"/> N
19. Have local government requirements for zoning and construction been complied with? <input checked="" type="checkbox"/> Y <input type="checkbox"/> N	20. Have permits and notifications required by local governments and other agencies been provided? <input type="checkbox"/> Y <input checked="" type="checkbox"/> N

Print Name: Mike Dinkel

Signed: [Signature] Title: Staff HSE Representative Date: 6/22/17

OGCC Approved: _____ Title: _____ Date: _____

CONDITIONS OF APPROVAL, IF ANY:

Facility Number: _____

Centralized Exploration and Production (E&P) Waste Management Facility Aggregate State 37C-16HZ Permit Application

Kerr-McGee Oil and Gas Onshore LP (Kerr-McGee) is providing the following summary of requirements that have been fulfilled in order to establish a fluid recycling operation (Facility) at the Aggregate State 37C-16HZ location as a centralized E & P waste management facility. Kerr-McGee is providing this document as an attachment to a Form 28 that follows the requirements outlined in Colorado Oil and Gas Conservation Commission (COGCC) Rule 908.

General Description

The Facility is currently located at the Aggregate State 37C-16HZ location (COGCC Location ID 434766) which is owned by Anadarko E & P Company, LP (Anadarko). Kerr-McGee is a wholly owned subsidiary of Anadarko.

The purpose of this Facility is to recycle and recondition used mud/fluids from completions, midstream and production for re-use in workover, completions and drilling operations. In addition, if needed the Facility can be used for the production of fresh mud for workover and drilling activities. The Facility was initially intended to be temporary in nature where it could be mobilized quickly to a new location. Due to the proximity of the Facility to existing operations, Kerr-McGee is submitting a Form 28 permit to the COGCC for permanent use. The initial waste management plan for the temporary Facility was approved for use by the COGCC on a Form 4 submitted in 2015 (Document #400784314).

Application Requirements

- (1) The name address, phone and fax number for Kerr-McGee are provided on the attached cover letter.
- (2) Anadarko is the surface owner of the Facility. Kerr-McGee is a wholly owned subsidiary of Anadarko.
- (3) The Facility is 5.43 acres and is located in the northeast quarter of the southeast quarter of Section 9, Township 2 North, Range 66 West in Weld County, Colorado.
- (4) Topography at the Facility slopes slightly from the southeast to the northwest. A topographic map is provided as Figure 1. Within the Facility boundary there are two soil

series: Olney fine sandy loam 1 to 3 percent slopes and Vona sandy loam 1 to 3 percent slopes. National Resource Conservation Service (NRCS) soil survey data is presented on Figure 2. Subsurface soils generally consisted of a sand clay mixture underlain by a well compacted claystone. Depth to groundwater ranges from approximately 8 feet (ft.) below ground surface (bgs) to 16 ft. bgs. Average annual precipitation for the Fort Lupton area is 15 total inches. The average annual evapotranspiration rates for grasses in the Fort Lupton area is 47.33 total inches.

Surrounding land use is cropland, rangeland and residential. The closest residence to the Facility is approximately 0.25 mile east across County Road 31. Additional residences are located along County Road 31 to the northeast and to the south along County Road 22.

(5) **Centralized facility siting requirements**

- A. A containment drainage plan showing drainage patterns, diversions containment structures and facilities is provided in Attachment 1.
- B. A scaled drawing of the entire section containing the Facility is provided in Attachment 2.
- C. The Facility is manned 24-hours a day, 7 days a week by a Kerr-McGee contractor to control access, prevent unauthorized traffic, provide site security and prevent illegal dumping of wastes. All fluids at the Facility are stored within enclosed tanks. All open top containers used for mixing, provide access and egress for any wildlife or domestic animals that may enter the Facility.
- D. The Facility maintains a fire lane of approximately 21 ft. around the recycling/mixing equipment.
- E. Quandary calculated a 100-year 24-hour storm event will produce 5 inches of precipitation at the Facility. In order to divert this sheeting flow, Kerr-McGee will construct an 18-inch berm around the Facility. Within the Facility boundary, the berm will prevent any runoff from leaving or entering the Facility. In the event the site receives precipitation exceeding the 25-year 4-hour event, overflow ponds will be constructed to provide positive drainage away from both the north and south areas of Facility. All calculations used for the containment pond sizing are provided in Attachment 3.

(6) **Waste Profile**

Muds/fluids are brought to the Facility by truck and run through the active mud system and dewatering trailer initially to remove solids content. Depending upon the operational requirements in the field, the mud/fluids are then conditioned to meet the desired specifications for reuse in oil and gas operations. Any resulting E&P solid waste is taken to a licensed commercial disposal or to the Kerr-McGee landfarm for treatment.

A list of wastes which are expected to be generated at the Facility:

- Approximately 150 truckloads of contaminated solids per month
- Approximately 4 to 6 dumpsters of trash/debris per month
- Approximately 4 to 6 port-a-lets per month

All waste profile records are maintained at the Facility and Kerr-McGee's closest field office.

(7) **Facility Design and Engineering**

A. Geologic Data

Quandary installed a total of five soil borings on March 24 and March 25, 2017 at the Facility in order to characterize subsurface soil and groundwater conditions. The borings were advanced using a drilling rig operated by Elite Drilling Services and equipped with 4-inch solid stem augers. Each of the borings were logged from soil samples collected using a 2-foot stainless steel split spoon. Borings installed on the Facility surface (MW03 and B01) indicated recycling/mixing equipment is underlain by a graded and compacted sand clay mixture to depths ranging between 3 ft. and 5 ft. bgs. Subsurface soils generally consisted of a sand clay mixture to 11 ft. bgs or 13 ft. bgs (depending on the boring) underlain by a well compacted claystone to a depth drilled of approximately 30 ft. bgs. Boring log/Monitoring well completions logs are presented in Attachment 4.

Sample cores of native soil were collected at depths just below the Facility pad surface for geotechnical analysis. Samples cores were collected from soil boring B01 at depths of 4 ft. to 6 ft. bgs and 9 ft. to 11 ft. bgs. Sample cores were collected from soil boring

MW03 at depths of 8 ft. to 10 ft. bgs and 12 ft. to 14 ft. bgs. A total of four core samples were submitted to Advanced Terra Testing in Lakewood, Colorado for physical soil characteristics including porosity, permeability, moisture content, organic matter and grain size distribution. Geotechnical analysis is presented in Table 1. Geotechnical reports are provided in Attachment 5. In addition to geotechnical analysis, background soil samples were collected from the two-soil series within the Facility boundary. Composite soil samples were collected from soil borings MW01 (Vona Sandy Loam) and B02 (Olney fine sandy loam) at depths from surface to 12 inches bgs. Two samples were submitted to Origins Laboratory in Denver, Colorado for analysis of analytes listed in COGCC Table 910-1 Soil analytical results are presented in Table 2. The soil analytical report is provided In Attachment 6.

B. Hydrologic Data

The entrance to the Facility crosses the Fulton Extension Ditch by bridge from County Road 31. The Fulton Extension Ditch is located approximately 937 ft. east of the Facility equipment and flows south to north toward Mose Davis Lake and Mose Davis Lake No 2. An irrigation ditch is located is located 310 ft. north of the Aggregate State wellheads. Several unnamed reservoirs, an abandoned canal, the Platteville Ditch and intermittent drainages are located within a 2-mile radius of the Facility. No 100-year floodplains are located within a 2-mile radius of the Facility.

At the time of drilling, groundwater was only encountered in soil borings B01 and MW03. Three of the five boring were completed as monitoring wells and the following depths to groundwater were measured on April 13, 2017:

Monitoring Well	Depth to Water (ft. bgs)
MW01	15.94
MW02	12.05
MW03	8.05

On March 29, 2017, the Facility and ground water monitoring wells were surveyed to determine hydraulic gradient and flow direction. Survey data indicates flow direction is to the northwest and gradient is 0.027 ft. per foot. A groundwater contour maps is provided on Figure 3.

Prior to sampling ground water monitoring wells, wellbores were purged of stagnant groundwater to collect representative samples of actual aquifer conditions. Groundwater samples were collected from monitoring wells MW01, MW02 and MW03 on April 13, 2017. A total of three samples were submitted to Origins Laboratory for analysis of analytes listed in COGCC Rule 318 A f. Water quality analytical results are presented in Table 3. The groundwater analytical report is provided in Attachment 7.

Quandary performed a search of offsite water wells within a 1-mile radius of the Facility. The well type, well depth, depth to static water level, screened intervals, yields and aquifer name are presented in Table 4. A water well map depicting the locations of well is presented ad Figure 4.

The use of containment structures, onsite personnel and permeability of subsurface soils reduces the risk of impact to surface water and or ground water. All storage tanks will be kept within a lined containment area. All materials will be kept off of the ground surface and covered in accordance with Rule 1002.f.(2) A. Kerr-McGee maintains a spill control/release kit at the Facility. Personnel are present onsite 24 hours' day 7 days a week to maintain operation spill controls and minimize waste. The working surface of the Facility where mixing and recycling occurs is underlain by sandy clay and claystone with relative permeability's that are impervious. Due to the reduced potential for impacted to water resources, Kerr-McGee proposes sampling monitoring wells quarterly for Benzene, Toluene, Ethylbenzene and Xylenes (total).

(8) Operating Plan

Based on Facility conditions, roads in and out will be watered and or sprayed with tackifier to reduce dust. The Facility is currently within the Kerr-McGee stormwater inspection program where best management practices (BMPs) are utilized to reduce runoff. Additional stormwater BMPs will be added as necessary and the Facility will be maintained in accordance with Kerr-McGee's Colorado Department of Public Health and Environment (CDPHE) stormwater water construction permit and COGCC Rule 1002 f.

The Facility is manned 24 hours a day 7 days a week by a Kerr-McGee contractor where inspections and maintenance are built into routine daily operations of the Facility. A detailed emergency response plan is maintained at the Facility and emergency response drills are conducted periodically. Kerr-McGee's contractor provides orientations in

emergency awareness to all new personnel entering the Facility. Records of all orientations, emergency response drills, and logs of individuals on location are maintained by Kerr-McGee's contractor onsite.

Light plants are utilized at the Facility for operations and to provide additional security for onsite personnel at night. This Facility is powered using electric line power rather than a diesel generator. Additionally, Kerr-McGee has evaluated potential emissions associated with the facility and determined that it would be below the threshold necessary for an APEN with the CDPHE Air Quality Control Division. Kerr-McGee will continue to evaluate emissions and throughput and will submit an APEN if necessary as emissions approach the required threshold.

The recycled mud/fluids produced at the Facility will be transported back to the location where they were originally produced via truck. Recycled mud/fluids will be used for the following application:

- Spacing fluid between cemented intervals below surface casing
- Kill fluid/workover fluids below surface casing
- Drilling fluids below surface casing
- Completions fluids

Recycled mud/fluids will NOT be used for the following applications:

- Drilling fluid for the surface casing interval
- Fluid for cement
- Workover fluids that have the potential for contact with fresh water aquifers.

(9) **Ground Water Monitoring**

The direction of flow, groundwater gradient and water quality at the Facility was established by completing two downgradient soil borings and one up gradient soil boring as monitoring wells. Monitoring wells MW01 through MW03 will serve as points of compliance for the Facility.

(10) **Contingency Plan**

Kerr McGee's contractor maintains an emergency response plan onsite that outlines 24-hour contact information for the person in charge to initiate emergency response actions,

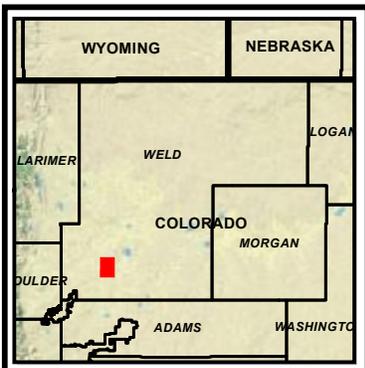
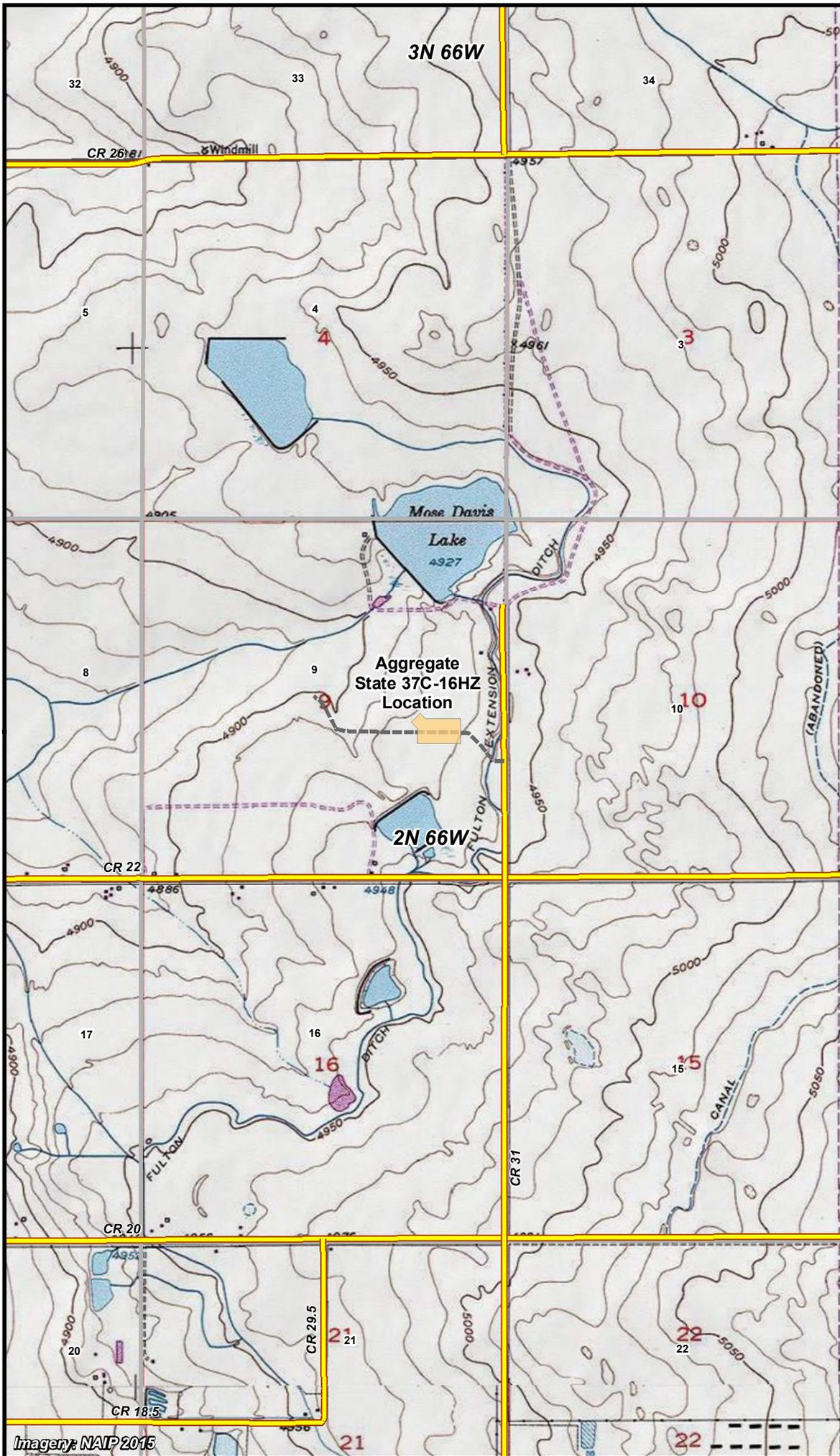
and outlines responsibilities under the joint operating agreement regarding maintenance, closure and monitoring of the Facility.

(11) **Financial Assurance**

Upon approval of the permit, Kerr-McGee will submit financial assurance per COGCC Rule 704.

(12) **Closure Plan**

Upon closure of the Facility, all surface equipment will be removed that is not at the active oil and gas location, and the Facility will be graded and contoured. Once the Facility equipment is removed, Kerr-McGee proposes collecting confirmation soil samples from the working area for the analytes listed in COGCC Table 910-1. The Facility and access roads no longer within use will be reclaimed. As applicable, compaction alleviation, restoration, and re-vegetation will be performed within 12 months. Successful Final Reclamation of the location and access roads will be considered completed when reclamation of non-crop land has been performed and the total cover of live perennial vegetation, excluding noxious weeds, reflects 80% of pre-disturbance levels.



Legend

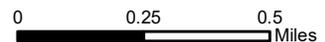
Proposed Location

Type

-  Facility Location
-  Access Roads
-  Major Road
-  Local Road



1:24,000



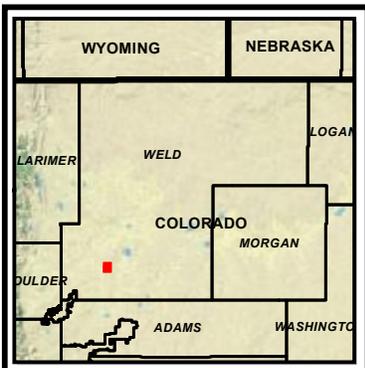
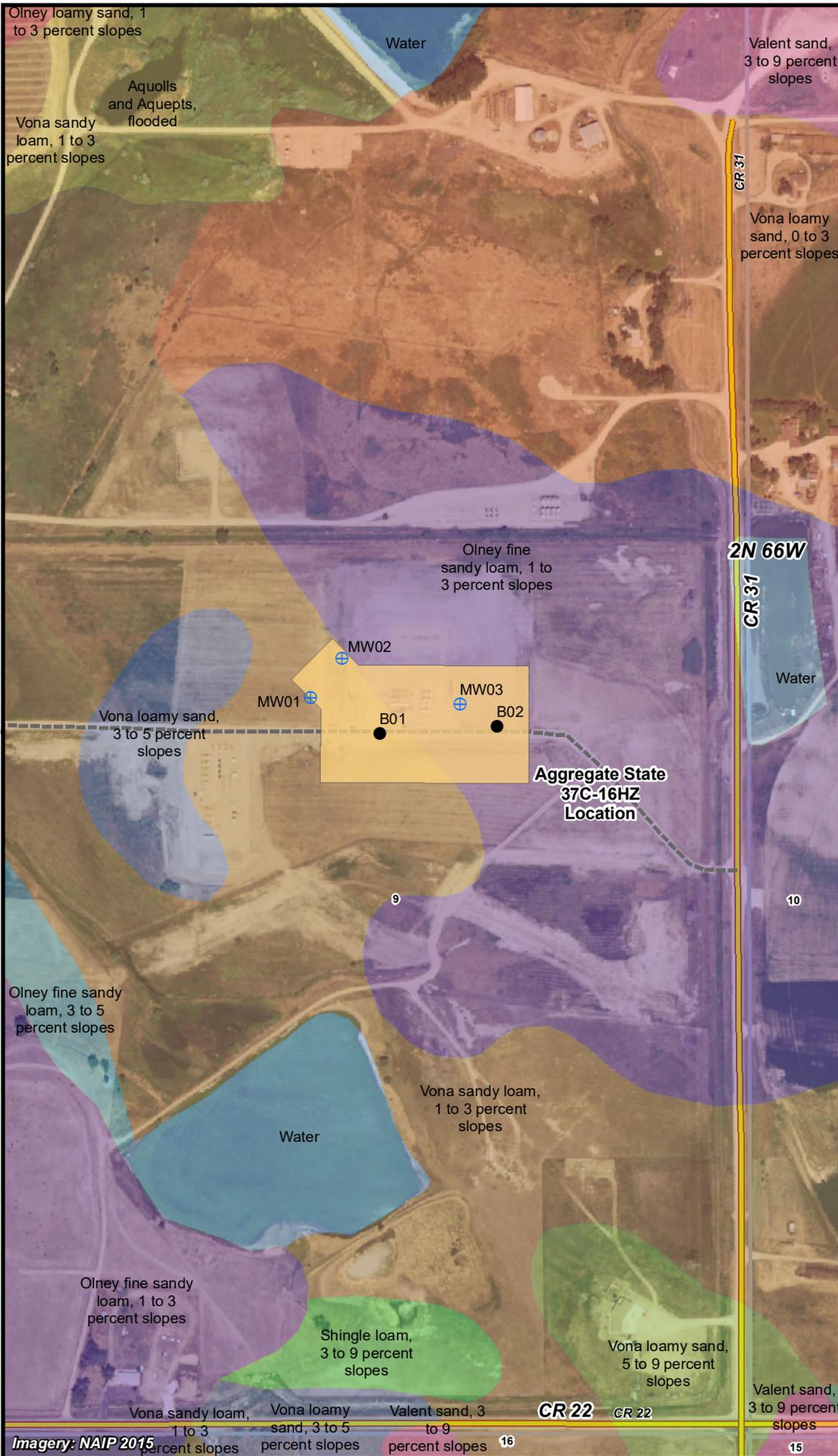
**Figure 1.
Site Location Map**

Author: CGEO Date: 5/25/2017

NAD 1983 UTM Zone 13N

IEA_Quandary_Template.mxd

Imagery: NAIP 2015



Legend

- Monitor Points**
- Soil Boring
 - ⊕ Water Monitoring Well

Proposed Location

- Type**
- Facility Location
 - Access Roads
 - Major Road
 - Local Road

NRCS Soil Survey

- Aquolls and Aquepts, flooded
- Olney fine sandy loam, 1 to 3 percent slopes
- Olney fine sandy loam, 3 to 5 percent slopes
- Olney loamy sand, 1 to 3 percent slopes
- Shingle loam, 3 to 9 percent slopes
- Valent sand, 0 to 3 percent slopes
- Valent sand, 3 to 9 percent slopes
- Vona loamy sand, 0 to 3 percent slopes
- Vona loamy sand, 3 to 5 percent slopes
- Vona loamy sand, 5 to 9 percent slopes
- Vona sandy loam, 1 to 3 percent slopes
- Water



1:5,000

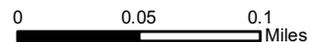
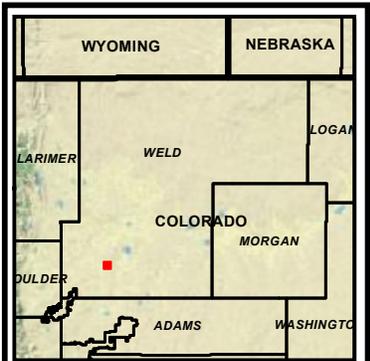
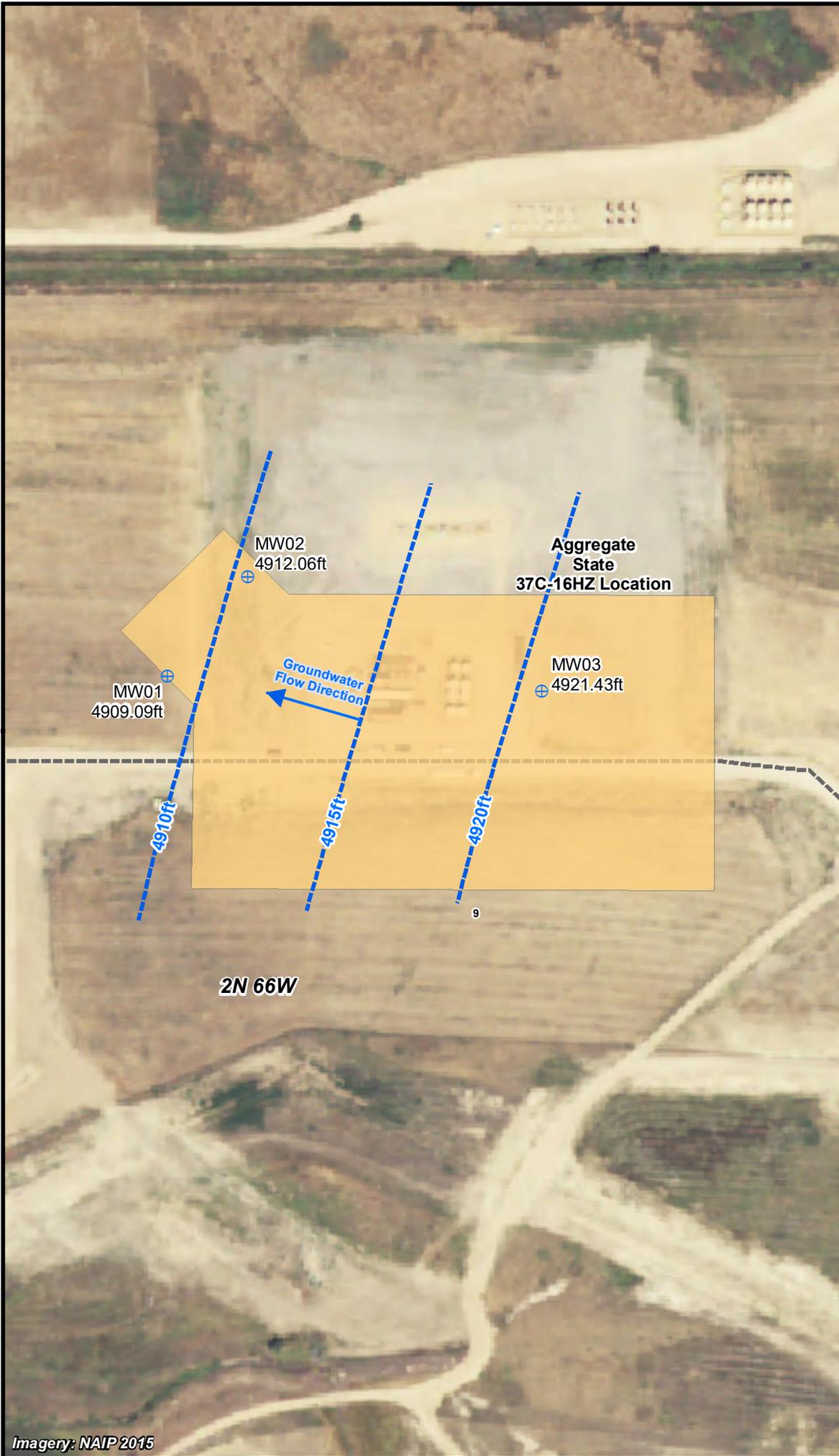


Figure 2. Soil Boring and Groundwater Monitoring Well Location Map

Author: CGEO Date: 5/22/2017

NAD 1983 UTM Zone 13N

IEA_Quandary_Template.mxd



Legend

Proposed Location

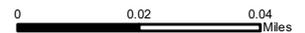
- Type
- Facility Location
- Access Roads

Monitor Points

- Water Monitoring Well
- Groundwater Elevation Contours
- Groundwater Flow Direction



1:2,000

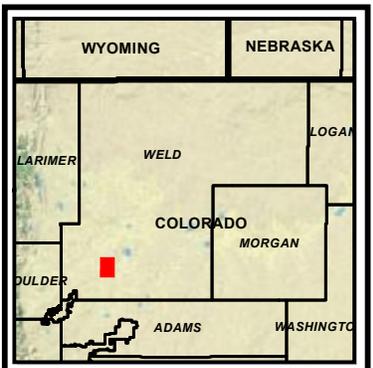
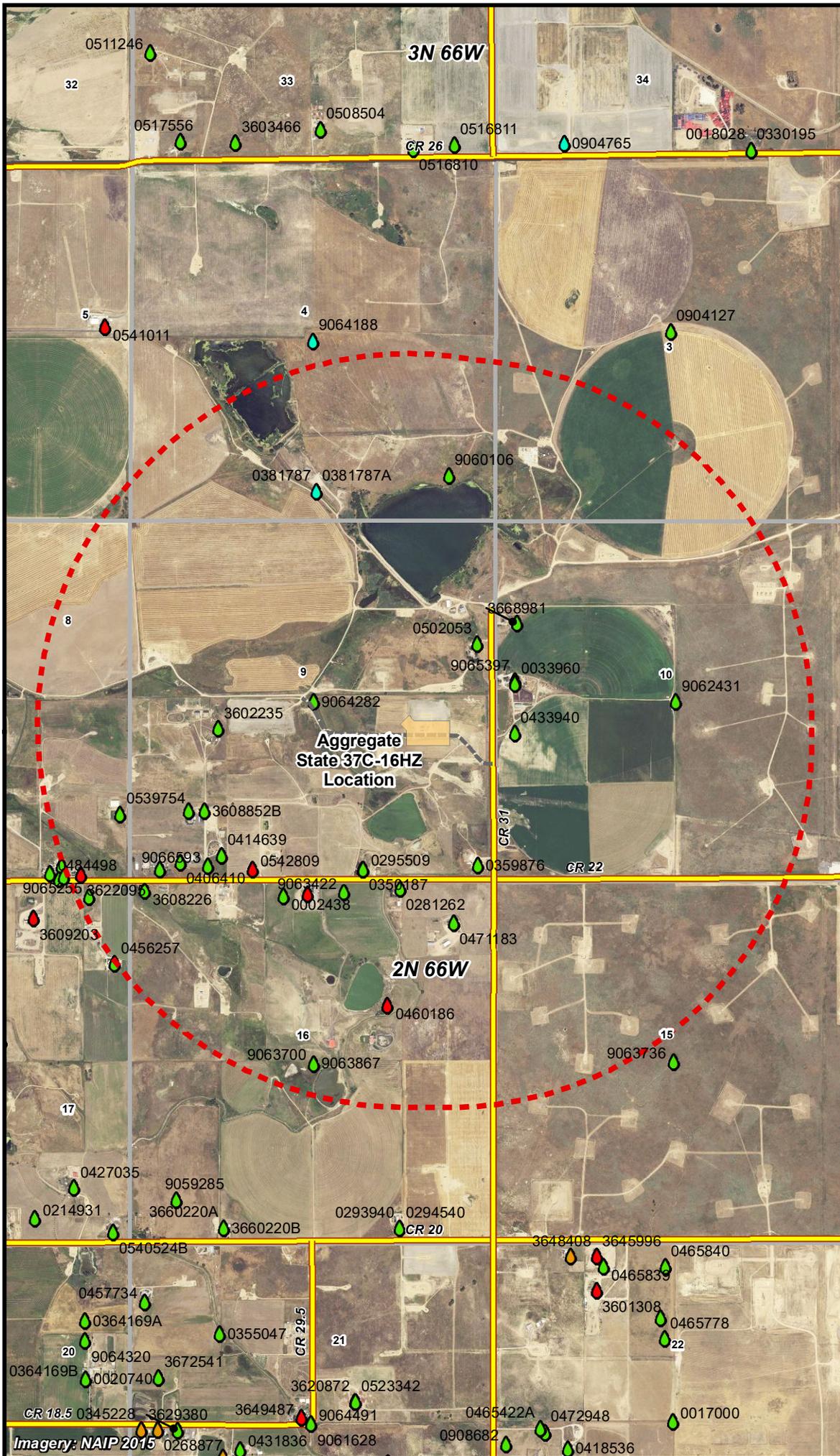


**Figure 3.
Groundwater Contour Map**

Author: CGEO Date: 5/22/2017

NAD 1983 UTM Zone 13N

IEA_Quandary_Template.mxd



Legend

Proposed Location

- Type**
- Facility Location
 - Location Buffer - 1 mile
 - Access Roads

CDWR - Water Wells

USE:

- Commercial
- Domestic
- Household
- Stock
- Major Road
- Local Road



1:24,000



**Figure 4.
Water Well Map**

Author: CGEO Date: 5/18/2017

NAD 1983 UTM Zone 13N

IEA_Quandary_Template.mxd

Imagery: NAIP 2015

Table 1
 Geotechnical Analysis
 Aggregate State Recycling Facility
 Kerr-McGee Oil and Gas Onshore LP

Analysis	Sample ID	Sample ID	Sample ID	Sample ID
	B01 4-6'	B01 9-11'	MW03 - 8-10'	MW03 12'-14'
	Date Sampled	Date Sampled	Date Sampled	Date Sampled
	3/24/2017	3/24/2017	3/25/2017	3/25/2017
	Sample Result	Sample Result	Sample Result	Sample Result
Porosity	37.88%	48.81%	45.17%	49.51%
Permeability	3.0E-08 cm/S	6.6E-09 cm/S	8.8E-09 cm/s	6.1E-09 cm/S
Moisture Content	14.7%	19.6%	2.5%	2.8%
Organic Matter	2.9%	3.5%	4.4%	4.8%
Soil Grain Size Distribution				
2.000 mm to >.850 mm	10.4%	0.6%	0%	0%
.850 mm to > .425 mm	5.5%	0.8%	0%	0%
.425 mm to >.250 mm	16.1%	1.3%	0%	0%
.250 mm to > .150 mm	22.2%	1.1%	0%	0.1%
.150 mm to > 0.75mm	14.2%	1.3%	0.7%	0.1%
Particles <0.75 mm	31.6%	94.9%	99.2%	99.8%

< -less than

> - greater than

cm/S - centimeter per second

E - mutilplied by 10 to the power of an exponent

mm - millimeter

% - percentage



Table 2
Soil Analytical Results
Aggregate State Recycling Facility
Kerr-McGee Oil and Gas Onshore LP

Analyte	Sample ID	Sample ID
	MW01 0-12"	B02 0-12"
	Date Sampled	Date Sampled
	3/25/2017	4/13/2017
	Sample Result	Sample Result
Benzene	<0.002 mg/kg	<0.002 mg/kg
Toluene	<0.002 mg/kg	<0.002 mg/kg
Ethylbenzene	<0.002 mg/kg	<0.002 mg/kg
Xylenes, total	<0.002 mg/kg	<0.002 mg/kg
TPH - GRO	<50 mg/kg	<50 mg/kg
TPH - DRO	<50 mg/kg	<50 mg/kg
pH	8.52	7.96
SAR	4.17	5.43
EC	0.0912 mmhos/cm	0.583 mmhos/cm
Barium	80.5 mg/kg	85.2 mg/kg
Cadmium	<0.528 mg/kg	0.231 mg/kg
Chromium	9.05 mg/kg	5.48 mg/kg
Copper	7.78 mg/kg	20.6 mg/kg
Lead	8.48 mg/kg	17.5 mg/kg
Nickel	8.47 mg/kg	18.8 mg/kg
Selenium	<3.17 mg/kg	<3.45 mg/Kg
Silver	<0.528 mg/kg	<0.576 mg/kg
Zinc	26.6 mg/kg	69.5 mg/kg
Arsenic	8.31 mg/kg	2.97 mg/kg
Hexavalent Chromium	0.246 mg/kg	<0.431 mg/kg
Trivalent Chromium	8.80 mg/kg	5.48 mg/kg
Mercury	0.00955 mg/kg	0.0713 mg/kg

mg/kg - milligrams per kilogram

< Less than the laboratory practical quantitation limit

TPH -GRO - total petroleum hydrocarbons gasoline range organics

TPH - DRO - total petroleum hydrocarbons diesel range organics

SAR - sodium absorption ratio

EC - specific conductance

mmhos/cm - millimhos per centimeter



Table 3
Water Quality Analytical Results
Aggregate State Recycling Facility
Kerr-McGee Oil and Gas Onshore LP

Analyte	Sample ID	Sample ID	Sample ID
	MW01	MW02	MW03
	Date Sampled	Date Sampled	Date Sampled
	4/13/2017	4/13/2017	4/13/2017
	Sample Result	Sample Result	Sample Result
Total Alkalinity as CaCO ₃	445 mg/L	270 mg/L	528 mg/L
Bicarbonate as CaCO ₃	445 mg/L	270 mg/L	528 mg/L
Carbonate as CaCO ₃	<4 mg/L	<4 mg/L	< 4 mg/L
Bromide	4.7 mg/L	8.77 mg/L	<2 mg/L
Chloride	1,450 mg/L	2,260 mg/L	448 mg/L
Fluoride	<1 mg/L	<1 mg/L	<1 mg/L
Nitrate	2.76 mg/L	13.5 mg/L	1.19 mg/L
Nitrite	1.6 mg/L	2.17 mg/L	<1 mg/L
Sulfate	4,990 mg/L	5,540 mg/L	4,080 mg/L
Benzene	<1 ug/L	<1 ug/L	<1 ug/L
Toluene	<1ug/L	<1 ug/L	<1 ug/L
Ethylbenzene	<1 ug/L	<1 ug/L	<1 ug/L
Total Xylenes	<1 ug/L	<1 ug/L	<1 ug/L
Barium	0.0555 mg/L	0.0467 mg/L	0.0179 mg/L
Boron	0.179 mg/L	0.157 mg/L	0.4 mg/L
Calcium	517mg/L	529 mg/L	283 mg/L
Iron	0.5 mg/L	<0.5 mg/L	<0.5
Magnesium	219 mg/L	284 mg/L	136 mg/L
Manganese	0.216 mg/L	0.318 mg/L	0.528 mg/L
Potassium	19.7 mg/L	20.5 mg/L	13.9 mg/L
Selenium	0.155 mg/L	0.267 mg/L	0.0317 mg/L
Sodium	2,370 mg/L	3,320 mg/L	1,720 mg/L
Strontium	11.8 mg/L	12.9 mg/L	6.91 mg/L
Diesel Range Organics	<2.5 mg/L	<2.5 mg/L	<2.5 mg/L
Gasoline Range Organics	<2.5 mg/L	<2.5 mg/L	<2.5 mg/L
pH	7.06 su	7.04 su	6.98
Specific Conductance	11,800 uS/cm	15,000 uS/cm	8,850 uS/cm
TDS	9,840 mg/L	12,200 mg/L	6,850 mg/L
Total Phosphorous	0.0919 mg/L	0.217 mg/L	1.08 mg/L

< Less than the laboratory practical quantitation limit

umhos/cm - micromhos per centimeter

su - standard units

ug/l - micrograms per liter

mg/L - milligrams per liter

umhos/cm - microohms per centimeter

TDS - total dissolved solids



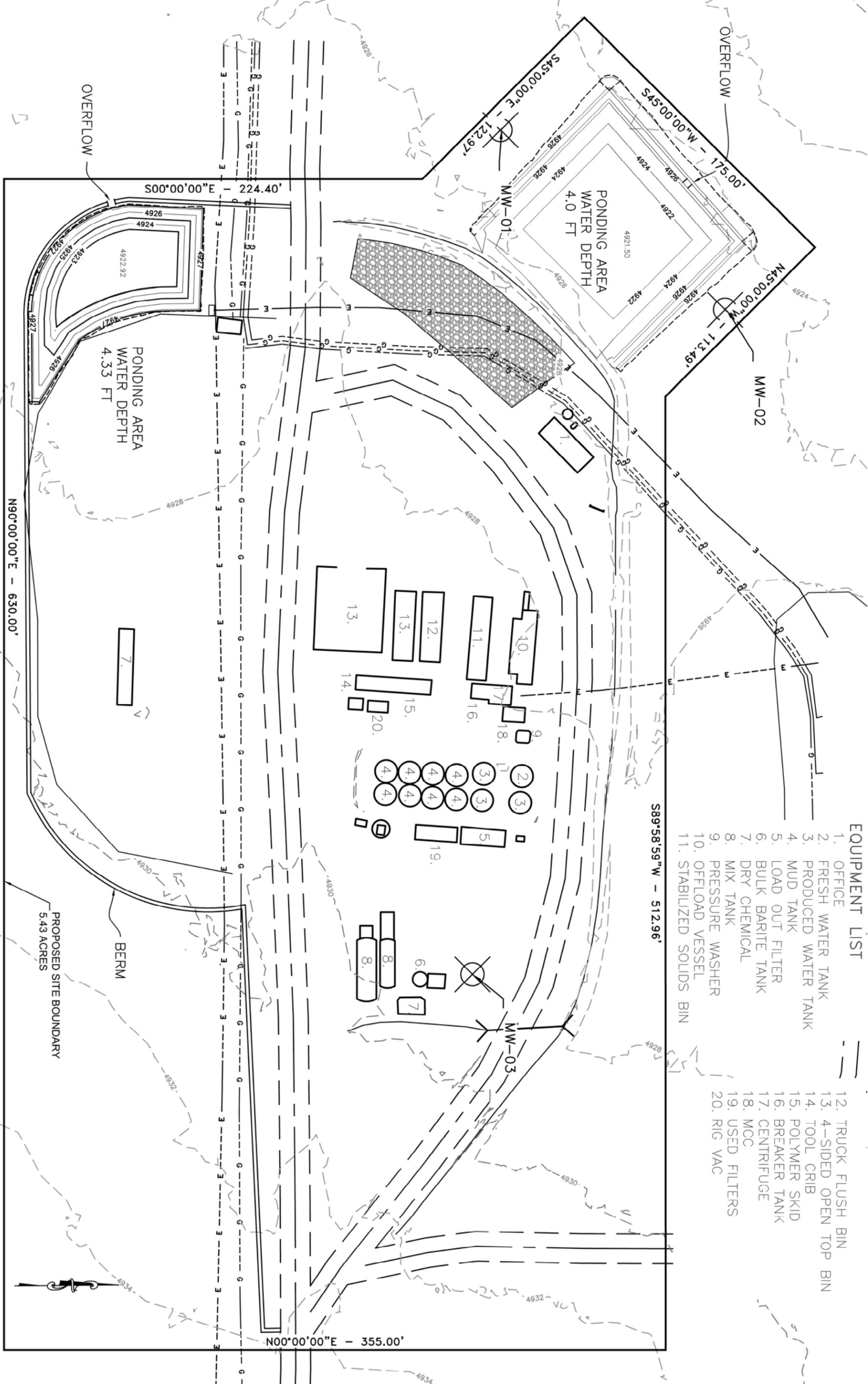
Table 4
Water Wells Within a 1-Mile Radius
Aggregate State Recycling Facility
Kerr, McGee Oil and Gas Onshore LP

Permit #	Permit Date	Approximate Distance From Facility (miles)	Use/Type	Coordinates (N/E)	Location	Well Depth (feet)	Top Perforation (feet)	Bottom Perforation (feet)	Static GW Level (feet)	Pumping Rate (gal/min)	Aquifer
37557-M	8/14/1990	0.82	Monitoring	4445806.8, 519626.8	SWSW Sec 3, T2N-R66W	13	3	13	-	-	All Unnamed Aquifers
37458-M	8/14/1990	0.79	Monitoring	4445818.3, 519566.5	SWSW Sec 3, T2N-R66W	15	5	15	-	-	All Unnamed Aquifers
37459-M	8/14/1990	0.79	Monitoring	4445806.8, 519485.1	SWSW Sec 3, T2N-R66W	15	5	15	-	-	All Unnamed Aquifers
37460-M	8/14/1990	0.75	Monitoring	4445784.3, 519484.0	SWSW Sec 3, T2N-R66W	15	5	15	-	-	All Unnamed Aquifers
37461-M	8/14/1990	0.74	Monitoring	4445763.3, 519526.6	SWSW Sec 3, T2N-R66W	15	5	15	-	-	All Unnamed Aquifers
37462-M	8/14/1990	0.76	Monitoring	4445756.8, 519558.9	SWSW Sec 3, T2N-R66W	15	5	15	-	-	All Unnamed Aquifers
37463-M	8/14/1990	0.76	Monitoring	4445748.3, 519571.1	SWSW Sec 3, T2N-R66W	15	5	15	-	-	All Unnamed Aquifers
37464-M	8/14/1990	0.76	Monitoring	4445743.3, 519590.8	SWSW Sec 3, T2N-R66W	15	5	15	-	-	All Unnamed Aquifers
37465-M	8/14/1990	0.75	Monitoring	4445787.3, 519542.0	SWSW Sec 3, T2N-R66W	15	5	15	-	-	All Unnamed Aquifers
37466-M	8/14/1990	0.75	Monitoring	4445824.8, 519572.0	SWSW Sec 3, T2N-R66W	13	3	13	-	-	All Unnamed Aquifers
37467-M	8/14/1990	0.75	Monitoring	4445774.8, 519447.4	SWSW Sec 3, T2N-R66W	13	3	13	-	-	All Unnamed Aquifers
37468-M	8/14/1990	0.74	Monitoring	4445748.8, 519516.2	SWSW Sec 3, T2N-R66W	12	2	12	-	-	All Unnamed Aquifers
37469-M	8/14/1990	0.84	Monitoring	4445857.3, 519605.1	SWSW Sec 3, T2N-R66W	13	3	13	-	-	All Unnamed Aquifers
285688	5/17/2011	0.80	Monitoring	4445797.0, 519480.0	SWSW Sec 3, T2N-R66W	16	4	14	-	-	Quaternary Alluvium
285689	5/17/2011	0.80	Monitoring	4445821.8, 519493.1	SWSW Sec 3, T2N-R66W	16	4	14	-	-	Quaternary Alluvium
285690	5/17/2011	0.80	Monitoring	4445823.7, 519535.4	SWSW Sec 3, T2N-R66W	16	4	14	-	-	Quaternary Alluvium
09000	6/29/61	0.68	Domestic	4445711.3, 519161.0	SESE Sec 4, T2N-R66W	190	0	0	52	7	All Unnamed Aquifers
40596-A	4/17/1995	0.72	Stock	4445641.8, 518572.0	SWSE Sec 4, T2N-R66W	575	490	575	285	10	Laramie Fox Hills
47762-MH	4/1/2008	0.88	Monitoring	4445776.0, 518303.9	SESW Sec 4, T2N-R66W	8	3	8	-	-	All Unnamed Aquifers
277301	4/23/2008	0.88	Monitoring	4445776.0, 518303.9	SESW Sec 4, T2N-R66W	8	3	8	-	-	All Unnamed Aquifers
264754	8/3/2005	0.89	Domestic	4444205.0, 517701.5	SESE Sec 8, T2N-R66W	615	440	615	160	15	Laramie Fox Hills
42713	8/24/1970	0.31	Domestic/Stock	4444706.5, 518559.1	SENE Sec 9, T2N-R66W	580	0	0	120	20	All Unnamed Aquifers
173128	9/24/1993	0.43	Domestic	4443980.8, 519288.9	SESE Sec 9, T2N-R66W	695	450	695	220	11	Laramie Fox Hills
177217	4/13/1994	0.44	Domestic/Stock	4443962.8, 518778.4	SWSE Sec 9, T2N-R66W	580	410	580	285	10	Laramie Fox Hills
268941	5/16/2006	0.57	Domestic	4444587.5, 518135.9	NWSW Sec 9, T2N-R66W	620	365	620	262	-	Laramie Fox Hills
266119	10/20/2005	0.62	Commercial	4443963.0, 518288.3	SESW Sec 9, T2N-R66W	600	450	600	250	15	Laramie Fox Hills
202281	4/22/1997	0.78	Domestic	4443992.8, 517968.2	SWSW Sec 9, T2N-R66W	600	380	590	242	10	Laramie Fox Hills
203511	6/18/1997	0.78	Domestic	4444023.8, 518151.1	SWSW Sec 9, T2N-R66W	635	420	635	240	15	Laramie Fox Hills
268944	5/16/2006	0.67	Domestic	4444024.0, 518151.1	SWSW Sec 9, T2N-R66W	635	420	635	240	-	Laramie Fox Hills
271316	10/24/2006	0.66	Domestic/Stock	4443993.0, 517968.2	SWSW Sec 9, T2N-R66W	600	380	590	298	-	Laramie Fox Hills
271325	10/25/2006	0.65	Domestic	4444221.5, 518074.9	SWSW Sec 9, T2N-R66W	630	0	0	330	14	Laramie Fox Hills
271325-A	6/3/2014	0.70	Domestic	4444221.5, 518006.3	SWSW Sec 9, T2N-R66W	620	460	600	280	15	Laramie Fox Hills
75762	8/3/2008	0.37	Domestic/Stock	4444797.0, 519454.4	SWNW Sec 10, T2N-R66W	510	0	0	210	15	All Unnamed Aquifers
17137	8/26/1963	0.27	Domestic	4444706.0, 520167.6	SWNW Sec 10, T2N-R66W	100	0	0	10	3	All Unnamed Aquifers
75762-A	7/24/1998	0.26	Domestic/Stock	4444565.5, 519453.2	SWNW Sec 10, T2N-R66W	660	400	660	342	10	Laramie Fox Hills
98311-VE	7/24/1998	0.27	Domestic	4444784.8, 519454.5	SWNW Sec 10, T2N-R66W	660	400	660	342	15	All Unnamed Aquifers
33466-MH	5/21/1998	1.00	Domestic/Monitoring	4443710.2, 520361.4	NWNE Sec 15, T2N-R66W	22	12	22	-	-	All Unnamed Aquifers
231049	1/16/2021	0.57	Domestic/Stock	4443721.3, 519181.7	NENE Sec 16, T2N-R66W	710	710	500	393	10	All Unnamed Aquifers
28967	9/28/1966	0.63	Domestic	4443841.5, 518425.2	NWNE Sec 16, T2N-R66W	655	477	648	125	20	All Unnamed Aquifers
29967-A	6/27/1978	0.53	Domestic	4443857.3, 518694.5	NWNE Sec 16, T2N-R66W	655	530	655	225	15	All Unnamed Aquifers
54079-F	6/28/2000	0.79	Commercial/Domestic	4443354.8, 518887.6	SWNE Sec 16, T2N-R66W	580	460	580	389	28	Laramie Fox Hills
75437-FR	2/23/2016	0.56	Irrigation/Commercial	4443869.0, 518546.9	NENW Sec 16, T2N-R66W	600	500	600	339	15	Laramie Fox Hills
75437-F	8/12/2011	0.56	Commercial/Domestic	4443851.0, 518531.9	NENW Sec 16, T2N-R66W	655	530	655	340	-	Laramie Fox Hills

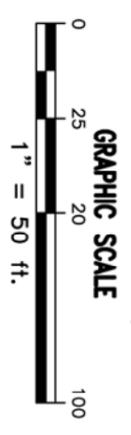
GW - Groundwater
gal/min - Gallons per minute



Attachment 1
Containment Drainage Plan



- EQUIPMENT LIST**
1. OFFICE
 2. FRESH WATER TANK
 3. PRODUCED WATER TANK
 4. MUD TANK
 5. LOAD OUT FILTER
 6. BULK BARITE TANK
 7. DRY CHEMICAL
 8. MIX TANK
 9. PRESSURE WASHER
 10. OFFLOAD VESSEL
 11. STABILIZED SOLIDS BIN
 12. TRUCK FLUSH BIN
 13. 4-SIDED OPEN TOP BIN
 14. TOOL CRIB
 15. POLYMER SKID
 16. BREAKER TANK
 17. CENTRIFUGE
 18. MCC
 19. USED FILTERS
 20. RIG VAC



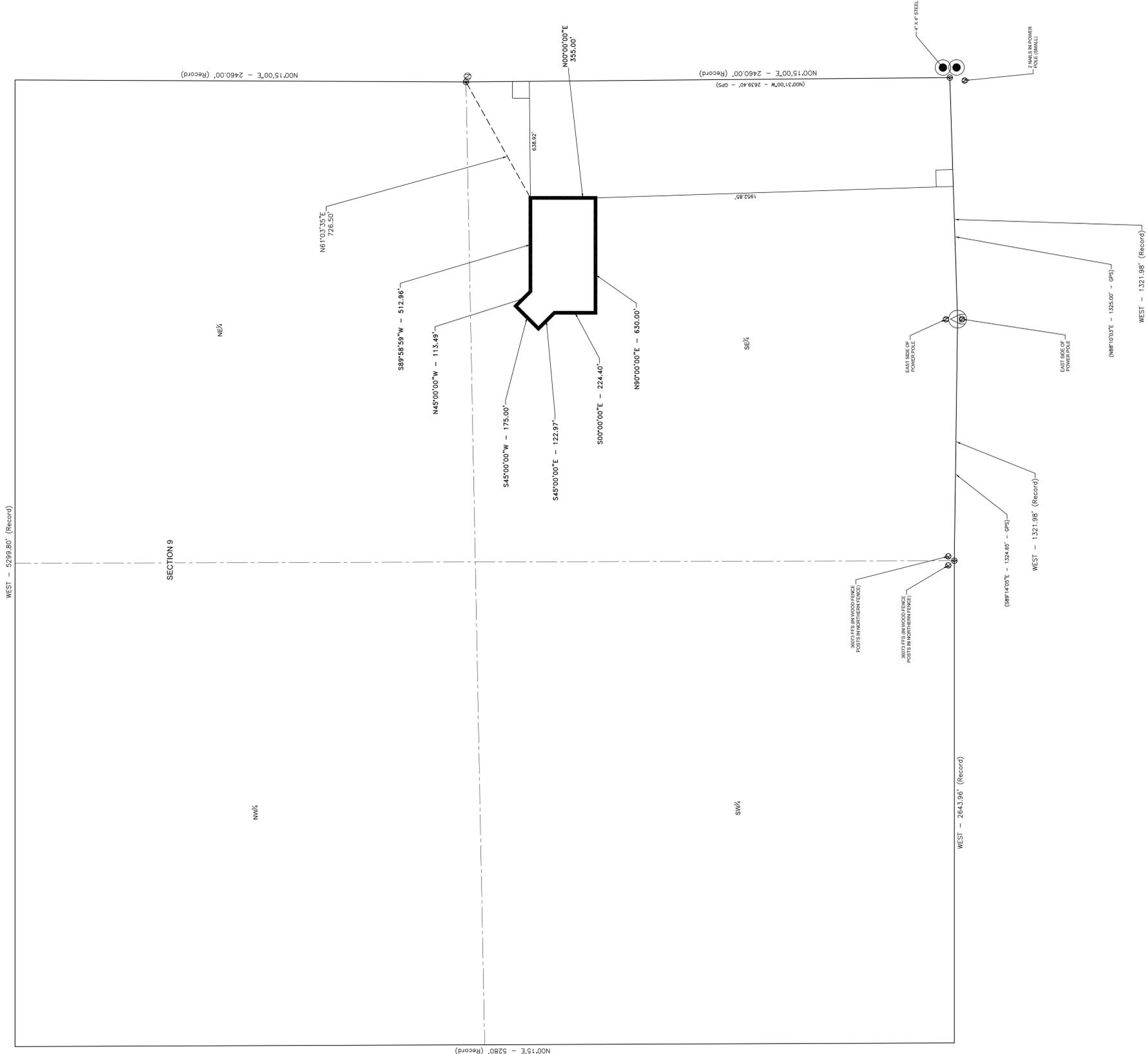
CONTAINMENT PLAN
1" = 50'

PROJECT TITLE: DRILLING FLUID RECYCLING FACILITY
SITE PLAN
QUANDRY
WELD COUNTY, COLORADO
Copyright © by JFC, Reproduction or other use of this drawing is prohibited unless authorized by JFC
DRAWING TITLE: CONTAINMENT PLAN
DRAWN BY: DRK/GSF/JML
SCALE: AS NOTED
DATE: 5/24/17
PROJECT NO: 9593-17S
SHEET NO: 1

JFC ENGINEERS SURVEYORS

PO BOX 2026
ROCK SPRINGS, WY 82902
PHONE (307) 362-7519
FAX (307) 362-7569
<http://www.jfc-wyo.com>

Attachment 2
Scaled Facility Drawing



LEGAL DESCRIPTION

A parcel of land located in the Sd of Section 9, Township 2, North, Range 66 West of the Sixth Principal Meridian, Weld County, Colorado and being more particularly described as follows:

Beginning at a point which lies South 61°03'35" West a distance of 726.50 feet from the East Quarter corner of said Section 9;

Thence South 89°58'59" West for a distance of 512.96 feet;

Thence North 45°00'00" West for a distance of 113.49 feet;

Thence South 45°00'00" West for a distance of 175.00 feet;

Thence South 45°00'00" East for a distance of 122.97 feet;

Thence South 00°00'00" East for a distance of 224.40 feet;

Thence North 90°00'00" East for a distance of 630.00 feet;

Thence North 00°00'00" East for a distance of 355.00 feet;

Thence North 61°03'35" East for a distance of 726.50 feet to the point of beginning.

The above described parcel contains an area of 236,649.43 square feet or 5.43 acres and is subject to any rights-of-way and/or easements which have been legally acquired. The basis of bearing for said parcel is True North derived from GPS observation.

STATEMENT OF SURVEYOR

Timothy Adolpho Koumo states he is by occupation a Licensed Professional Surveyor in the State of Colorado and is duly qualified to make the survey of Drilling Fluid Recycling Facility Boundary as described and shown on this map.

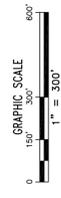
That the survey of said works was made under his direction and authority commencing on the ? day of ?, 2017 and that said survey is accurately represented upon this map.

NOTE:

Lease boundary - no permanent monuments on described on subject parcel.

FOUND:

- ① ALUMINUM PIPE MONUMENT STAMPED LS 4274
- ② REBAR WITH ALUMINUM CAP STAMPED PLS 23519
- ③ PK NAIL PLS 36073
- ④ NAIL ASSESSORY
- ⑤ WARNING POST FOR GAS PIPELINE



SCALE: 1"=1000'
SEC. 9, T2N, R66W

JFC ENGINEERS SURVEYORS

PO BOX 2026
ROCK SPRINGS, WY 82902
PHONE (307) 362-7519
FAX (307) 362-7569
http://www.jfc-wyo.com

PROJECT TITLE:
**QUADARY CONSULTANTS
DRILLING FLUID RECYCLING FACILITY - RECORD OF SURVEY**
WELD COUNTY, COLORADO

DRAWING TITLE:

DRAWN BY:	MAW
CHECKED BY:	
SCALE:	AS NOTED
DATE:	5/23/17
PROJECT NO:	9593-17S
SHEET NO:	1

Attachment 3
Containment Pond Sizing Calculations



Containment Calculation

DRILLING FLUID RECYCLING FACILITY

Precipitation

NOAA Atlas 14, Volume 8 Version 2

25 YEAR-24 HOUR PERCIPICATION

On site- 3.01-3.5 inches

Use 3.5 Inches

100 YEAR-24 HOUR PERCIPICATION

Off site- 4.01-5.0 Inches

Use 5 Inches

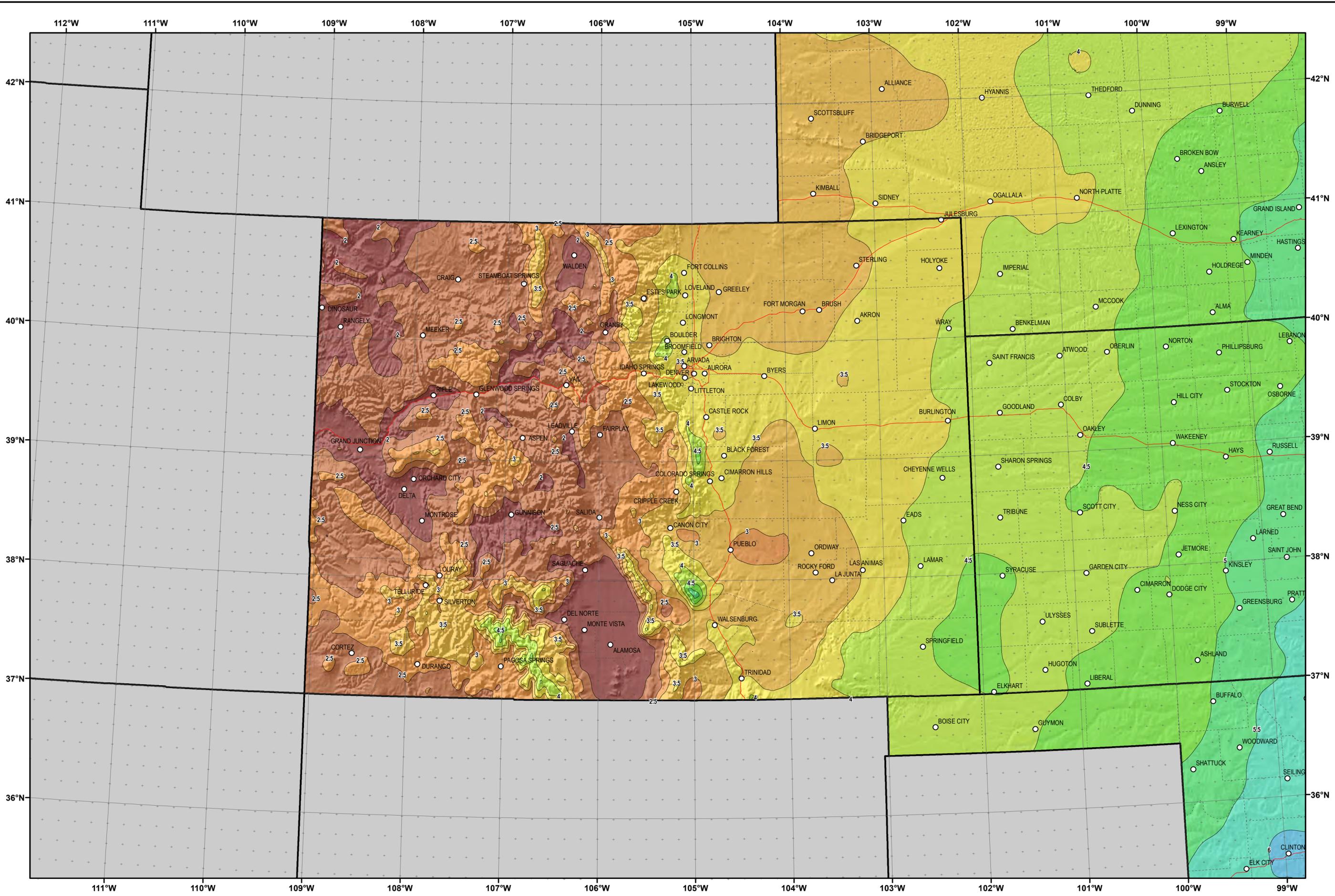
Off Site

The area around the site is relatively flat with a slope to the north west. There are no defined drainage adjacent to the site indicating that the surface flows are typically sheeting flows. The 100 year 24hour event produces five inch of precipitation. The sheeting flow will be diverted around the site utilizing a 18 inch berm.

On Site

The site is topographically divided into a north area and a south area. The boundaries of these two areas is the road way bisecting the site. With the division of the site, two containment areas are provided, one for the north and one for the south. The site is to be surrounded by a containment berm to prevent any runoff from leaving or entering the site. If the site receive precipitation exceeding the 25 year 24hour event, an overflow has been provided on the at a location that provides positive drainage away from both the north and south areas of the site. Below are the volume calculation for the containment pond sizing. These volumes are conservative in that they don't take into account infiltration.

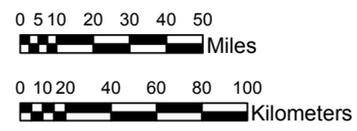
Total site	South Area	North Area
144594 area sf	53350 area sf	91244 area sf
3.319421 area ac	1.224747 area ac	2.094674 area ac
0.968165 vol ac-ft	0.357218 vol ac-ft	0.610947 vol ac-ft
42173.25 vol ft ³	15560.42 vol ft ³	26612.83 vol ft ³
1561.972 vol CY	576.3117 vol CY	985.6605 vol CY



**NOAA Atlas 14, Volume 8, Version 2
Midwestern States**



Prepared by U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE
OFFICE OF HYDROLOGIC DEVELOPMENT
HYDROMETEOROLOGICAL DESIGN STUDIES CENTER
April 2013



COLORADO

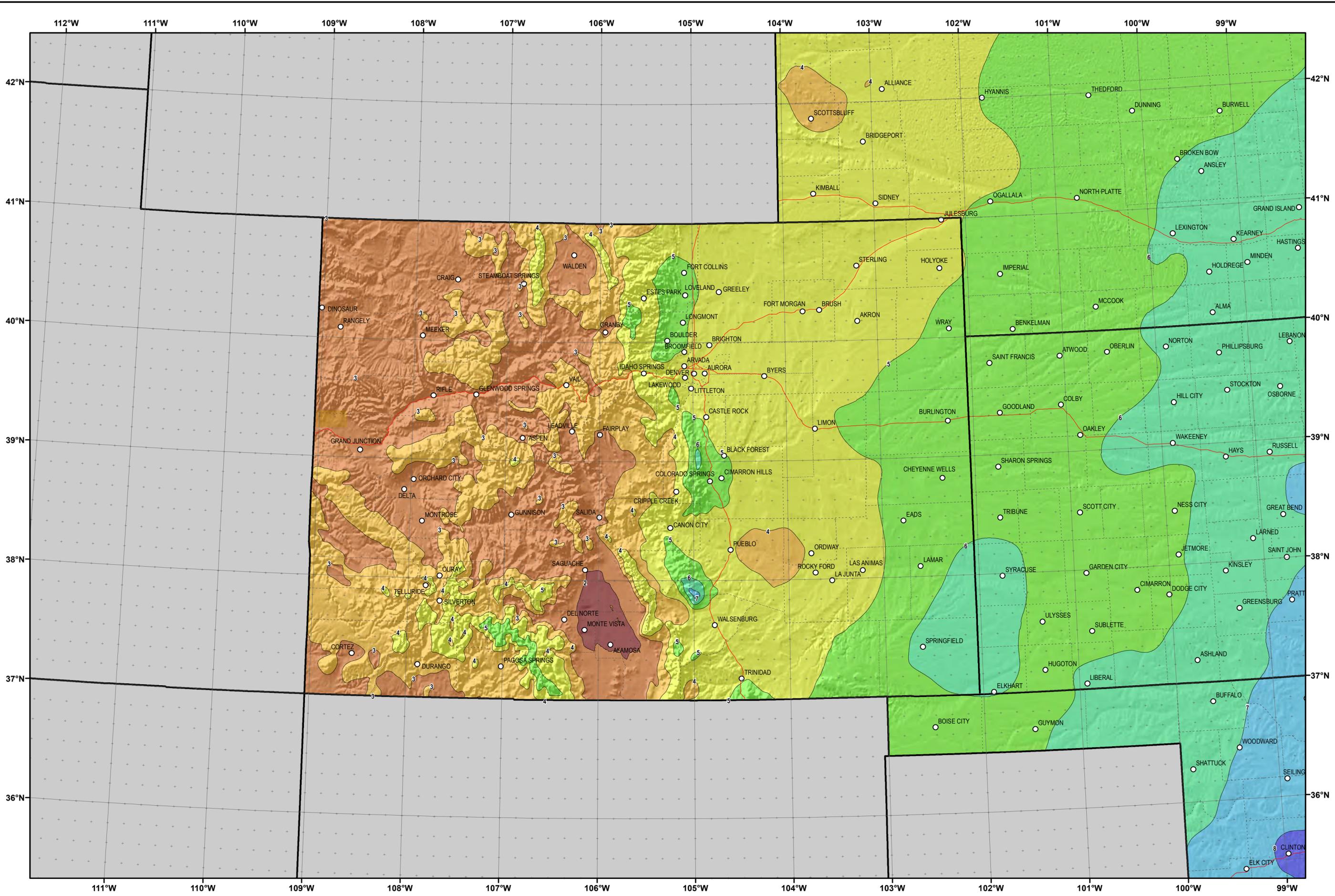
Isopluvials of 25-year 24-hour precipitation in inches

SCALE 1:2,250,000

Projection: Lambert Conformal Conic; Datum NAD83; Standard Parallels: 38° N and 40° N; Central Meridian 105.5° W.

1.52 - 2.00	3.51 - 4.00	5.51 - 6.00	7.51 - 8.00
2.01 - 2.50	4.01 - 4.50	6.01 - 6.50	8.01 - 8.50
2.51 - 3.00	4.51 - 5.00	6.51 - 7.00	8.51 - 9.00
3.01 - 3.50	5.01 - 5.50	7.01 - 7.50	9.01 - 9.24

Legend based on entire Volume 8 project area.



**NOAA Atlas 14, Volume 8, Version 2
Midwestern States**

COLORADO

Isopluals of 100-year 24-hour precipitation in inches

SCALE 1:2,250,000



Prepared by U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE
OFFICE OF HYDROLOGIC DEVELOPMENT
HYDROMETEOROLOGICAL DESIGN STUDIES CENTER
April 2013

0 5 10 20 30 40 50

Miles

0 10 20 40 60 80 100

Kilometers

1.88 - 2.00	4.01 - 5.00	7.01 - 8.00	10.01 - 11.00
2.01 - 3.00	5.01 - 6.00	8.01 - 9.00	11.01 - 11.93
3.01 - 4.00	6.01 - 7.00	9.01 - 10.00	

Legend based on entire Volume 8 project area.

Projection: Lambert Conformal Conic; Datum NAD83; Standard Parallels: 38° N and 40° N; Central Meridian 105.5° W.

Attachment 4
Geotechnical Report

ORGANIC MATTER CONTENT (PHYSICAL)
ASTM D 2974



Moisture & Organic Content Determinations

ASTM D 2974

CLIENT:	Quandary Consultants	JOB NO.:	2978-1
PROJECT	Aggregate State		
PROJECT NUMBER	--		
LOCATION	--		

SAMPLE IDENTIFICATION

BORING	B01	B01
DEPTH	4-6'	9-11'
SAMPLE NO.	--	--
DATE SAMPLED	3/24/2017	3/24/2017
DATE TESTED	3/27/2017	3/27/2017
TECHNICIAN	CAL	CAL

MOISTURE DETERMINATIONS

Wt. Wet Soil & Dish (gms)	388.70	403.07
Wt. Dry Soil & Dish (gms)	355.43	360.21
Net Loss of Moisture (gms)	33.27	42.86
Wt. of Dish (gms)	128.45	142.03
Wt. of Dry Soil (gms)	226.98	218.18
Moisture Content (%)	14.7	19.6

ORGANIC CONTENT DETERMINATIONS

Wt. Dry Soil & Dish (gms)	355.43	360.21
Wt. Ash & Dish (gms)	348.89	352.47
Wt. Organic Matter [A] (gms)	6.54	7.74
Wt. of Dish (gms)	128.45	142.03
Wt. of Ash [B] (gms)	220.44	210.44
Organic Matter Content (%)	2.9	3.5

$$\% \text{ Organic Matter} = [A/(A+B)] * 100$$

Data entered by:
 Data checked by: _____
 FileName:

KR
BDF
 2978_1_OrganicContent_ASTMD-2974-R0_0.xls

Date: 03/29/2017
 Date: 04/05/17

Mechanical Analysis with Hydrometer
ASTM D 422

Particle Size Analysis of Soils ASTM D 422

Client: Quandary Consultants
 Job Number: 2978-1
 Project: Aggregate State
 Location: --
 Project Number: --

Boring Number: B01
 Depth: 4-6'
 Sample Number: --
 Sampled Date: --
 Wash Date: 4/21/2017
 Sampled By: --
 Wash Technician: SKS

Grain Size Data

Sieve Number	Sieve Size (mm)	Weight of Retained Soil & Pan (g)	Weight of Pan (g)	Weight of Retained Soil (g)	Calculated Weight of Retained Soil (g)	Percent Passing by Weight (%)
3"	76.2	0.00	0.00	0.00	0.00	100.0
1.5"	38.10	0.00	0.00	0.00	0.00	100.0
3/4"	19.05	0.00	0.00	0.00	0.00	100.0
3/8"	9.525	2.78	0.00	2.78	2.78	98.7
#4	4.750	1.76	0.00	1.76	1.76	97.9
#10	2.000	9.70	0.00	9.70	9.70	93.5
78.178g split out of -#10 material.						
#20	0.850	6.35	3.14	3.21	8.69	89.6
#40	0.425	7.61	3.11	4.50	12.18	84.1
#60	0.250	16.20	3.13	13.08	35.42	68.0
#100	0.150	21.19	3.11	18.08	48.98	45.8
#200	0.075	14.67	3.07	11.60	31.42	31.6

Hygroscopic Moisture of Fines

Weight of Wet Soil & Pan (g): 56.29
 Weight of Dry Soil & Pan (g): 55.01
 Weight of Water (g): 1.28
 Weight of Pan (g): 6.64
 Weight of Dry Soil (g): 48.37
 Moisture (%): 2.6

General Sample Data

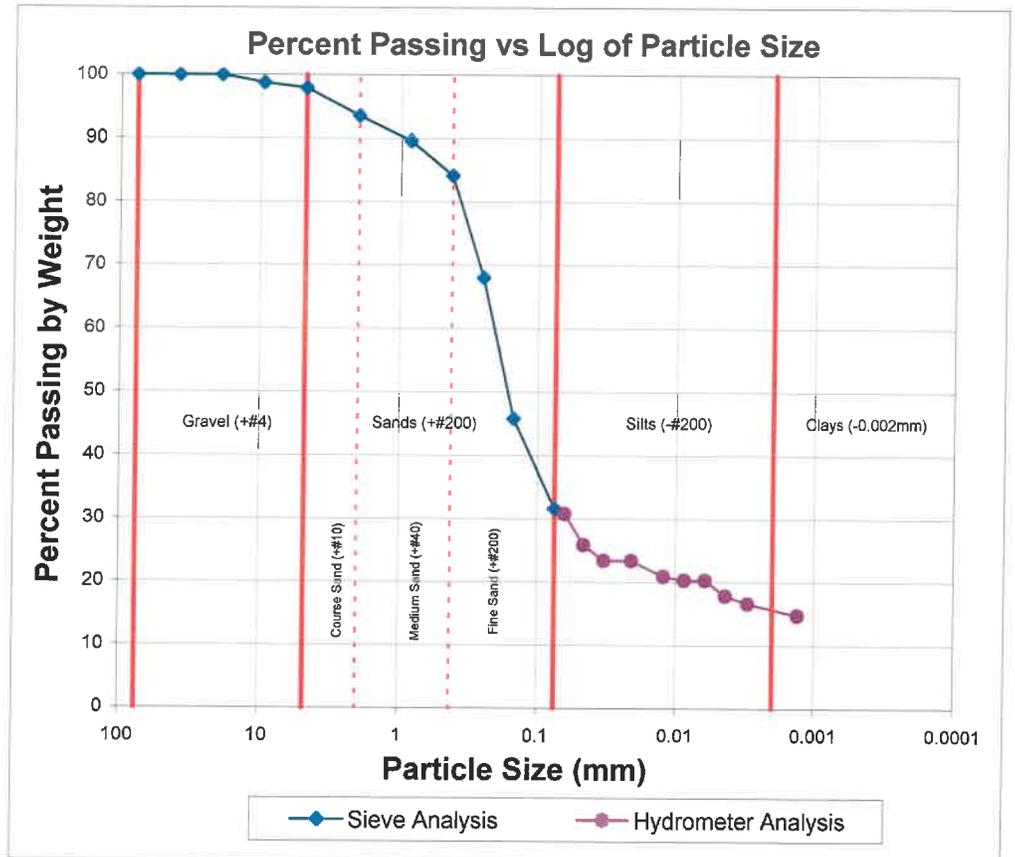
Total Wet Weight of Sample (g): 226.03
 Total Dry Weight of Sample (g): 220.60
 Calculated Weight Plus #200 (g): 150.94
 Moisture of Total Sample (%): 2.5
 Percent Retained #200 Sieve (%): 68.4

Plus Split Data

Original Weight of +#10 (g): 15.07
 Calculated Weight of +#10 (g): 14.24

Minus Split Data

Original Weight of -#10 (g): 210.96
 Calculated Dry Weight of -#10 (g): 206.35



Data Entered By: KR
 Date: 4/25/2017
 File Name: 2978_1_hydrometer-ASTM-D422-R3_2.xls

Checked By: CKP
 Date: 4/25/17

**Particle Size Analysis of Soils
ASTM D 422**

Client:	Quandary Consultants	Boring Number:	B01		
Job Number:	2978-1	Depth:	4-6'		
Project:	Aggregate State	Sample Number:	--		
Location:	--	Sampled Date:	--	Sampled By:	--
Project Number:	--	Test Date:	4/20/2017	Technician:	CAL

Hydrometer Data

Test Configuration

Hydrometer Type:	152H	Total Wet Weight of Sample (g):	226.03
Specific Gravity:	2.65	Total Dry Weight of Sample (g):	220.60
Deflocculant:	Sodium Hexametaphosphate	Wet Weight of Sub-Sample (g):	78.178
Deflocculant Correction:	4.0	Dry Weight of Sub-Sample (g):	76.170
Specific Gravity Correction Factor	1.00	Corrected Dry Weight of Sub-Sample - W(g):	81.466

Elapsed Time (min)	Hydrometer Reading	Corrected Hydrometer Reading	Temperature (°C)	Temperature Coefficient (K)	Effective Depth (L)	Grain Diameter (mm)	Percent in Suspension (%)	Calculated Weight of Retained Soil (g)	Percent Passing by Weight (%)
0	-	-	-	-	-	-	-	-	-
0.5	29.0	25.0	23.6	0.0132	11.54	0.0633	30.7	67.79	30.7
1	25.0	21.0	23.6	0.0132	12.19	0.0460	25.8	56.94	25.8
2	23.0	19.0	23.6	0.0132	12.52	0.0330	23.4	51.52	23.4
5	23.0	19.0	23.6	0.0132	12.52	0.0208	23.4	51.52	23.4
15	21.0	17.0	23.6	0.0132	12.85	0.0122	20.9	46.10	20.9
30	20.5	16.5	23.6	0.0132	12.93	0.0086	20.3	44.74	20.3
60	20.5	16.5	23.7	0.0132	12.93	0.0061	20.3	44.74	20.3
120	18.5	14.5	23.8	0.0132	13.26	0.0044	17.8	39.32	17.8
250	17.5	13.5	24.2	0.0130	13.42	0.0030	16.6	36.61	16.6
1440	16.0	12.0	22.9	0.0133	13.67	0.0013	14.8	32.54	14.8

Data Entered By: KR
 Date: 4/25/2017
 File Name: 2978_1_hydrometer-ASTM-D422-R3_2.xls

Checked By:
 Date:

CKP
4/25/17

Particle Size Analysis of Soils ASTM D 422

Client: Quandary Consultants
 Job Number: 2978-1
 Project: Aggregate State
 Location: --
 Project Number: --

Boring Number: B01
 Depth: 9-11'
 Sample Number: --
 Sampled Date: --
 Wash Date: 4/21/2017
 Sampled By: --
 Wash Technician: SKS

Grain Size Data

Sieve Number	Sieve Size (mm)	Weight of Retained Soil & Pan (g)	Weight of Pan (g)	Weight of Retained Soil (g)	Calculated Weight of Retained Soil (g)	Percent Passing by Weight (%)
3"	76.2	0.00	0.00	0.00	0.00	100.0
1.5"	38.10	0.00	0.00	0.00	0.00	100.0
3/4"	19.05	0.00	0.00	0.00	0.00	100.0
3/8"	9.525	0.00	0.00	0.00	0.00	100.0
#4	4.750	0.49	0.00	0.49	0.49	99.7
#10	2.000	0.11	0.00	0.11	0.11	99.6
63.094g split out of #10 material.						
#20	0.850	3.37	3.20	0.17	0.46	99.4
#40	0.425	3.54	3.09	0.45	1.22	98.6
#60	0.250	3.91	3.13	0.78	2.10	97.3
#100	0.150	3.82	3.11	0.71	1.91	96.2
#200	0.075	3.89	3.12	0.78	2.10	94.9

Hygroscopic Moisture of Fines

Weight of Wet Soil & Pan (g): 66.23
 Weight of Dry Soil & Pan (g): 63.69
 Weight of Water (g): 2.54
 Weight of Pan (g): 3.17
 Weight of Dry Soil (g): 60.52
 Moisture (%): 4.2

General Sample Data

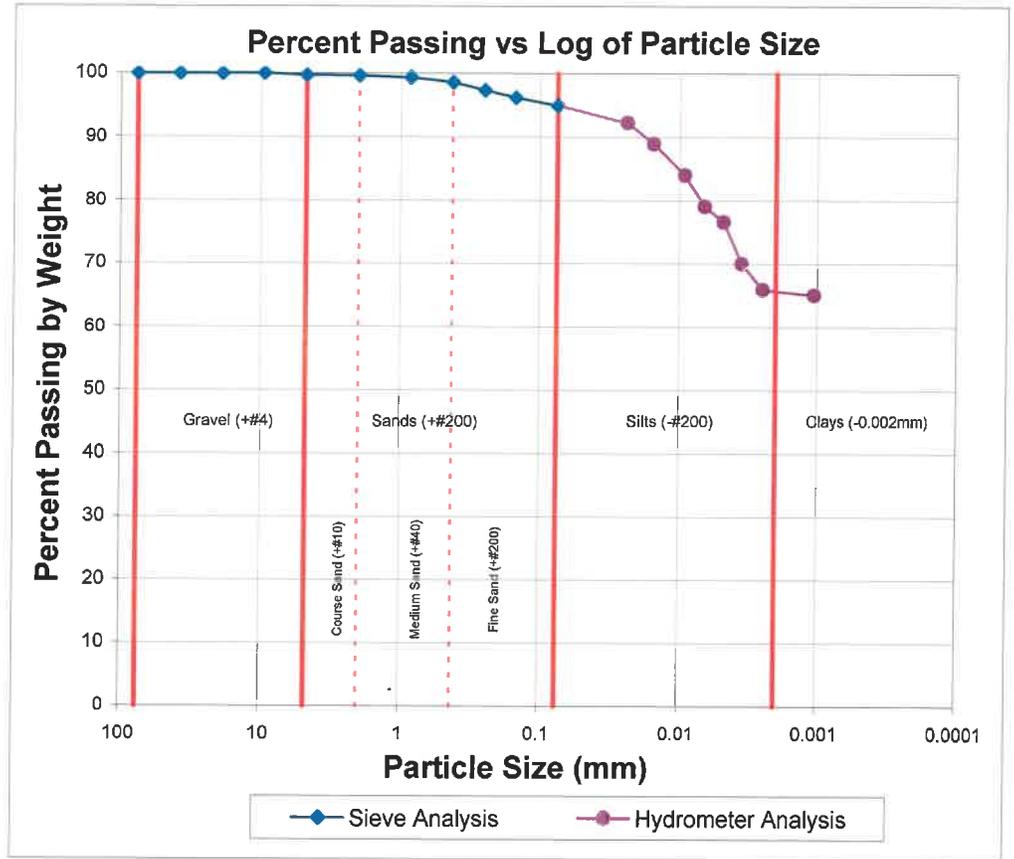
Total Wet Weight of Sample (g): 171.18
 Total Dry Weight of Sample (g): 164.30
 Calculated Weight Plus #200 (g): 8.37
 Moisture of Total Sample (%): 4.2
 Percent Retained #200 Sieve (%): 5.1

Plus Split Data

Original Weight of + #10 (g): 0.62
 Calculated Weight of + #10 (g): 0.60

Minus Split Data

Original Weight of - #10 (g): 170.56
 Calculated Dry Weight of - #10 (g): 163.70



Data Entered By: KR
 Date: 4/25/2017
 File Name: 2978_1_hydrometer-ASTM-D422-R3_3.xls

Checked By:
 Date:

Particle Size Analysis of Soils ASTM D 422

Client: Quandary Consultants	Boring Number: B01	
Job Number: 2978-1	Depth: 9-11'	
Project: Aggregate State	Sample Number: --	
Location: --	Sampled Date: --	Sampled By: --
Project Number: --	Test Date: 4/20/2017	Technician: CAL

Hydrometer Data

Test Configuration

Hydrometer Type: 152H	Total Wet Weight of Sample (g): 171.18
Specific Gravity: 2.65	Total Dry Weight of Sample (g): 164.30
Deflocculant: Sodium Hexametaphosphate	Wet Weight of Sub-Sample (g): 63.094
Deflocculant Correction: 4.0	Dry Weight of Sub-Sample (g): 60.551
Specific Gravity Correction Factor 1.00	Corrected Dry Weight of Sub-Sample - W(g): 60.794

Elapsed Time (min)	Hydrometer Reading	Corrected Hydrometer Reading	Temperature (°C)	Temperature Coefficient (K)	Effective Depth (L)	Grain Diameter (mm)	Percent in Suspension (%)	Calculated Weight of Retained Soil (g)	Percent Passing by Weight (%)
0	-	-	-	-	-	-	-	-	-
2	60.0	56.0	23.4	0.0132	6.45	0.0237	92.2	151.55	92.2
5	58.0	54.0	23.4	0.0132	6.78	0.0153	88.9	146.14	88.9
15	55.0	51.0	23.5	0.0132	7.27	0.0092	84.0	138.02	84.0
31	52.0	48.0	23.6	0.0132	7.77	0.0066	79.1	129.90	79.1
60	50.5	46.5	23.6	0.0132	8.01	0.0048	76.6	125.84	76.6
120	46.5	42.5	23.7	0.0132	8.67	0.0035	70.0	115.02	70.0
250	44.0	40.0	24.1	0.0130	9.08	0.0025	65.9	108.25	65.9
1440	43.5	39.5	23.0	0.0132	9.16	0.0011	65.1	106.90	65.1

Data Entered By: KR
 Date: 4/25/2017
 File Name: 2978_1_hydrometer-ASTM-D422-R3_3.xls

Checked By: _____
 Date: _____

Particle Size Analysis of Soils ASTM D 422

Client: Quandary Consultants
 Job Number: 2978-1
 Project: Aggregate State
 Location: --
 Project Number: --

Boring Number: [REDACTED] MW03
 Depth: 8-10'
 Sample Number: --
 Sampled Date: 3/25/2017 Sampled By: --
 Wash Date: 4/12/2017 Wash Technician: SKS

Grain Size Data

Sieve Number	Sieve Size (mm)	Weight of Retained Soil & Pan (g)	Weight of Pan (g)	Weight of Retained Soil (g)	Calculated Weight of Retained Soil (g)	Percent Passing by Weight (%)
3"	76.2	0.00	0.00	0.00	0.00	100.0
1.5"	38.10	0.00	0.00	0.00	0.00	100.0
3/4"	19.05	0.00	0.00	0.00	0.00	100.0
3/8"	9.525	0.00	0.00	0.00	0.00	100.0
#4	4.750	0.00	0.00	0.00	0.00	100.0
#10	2.000	0.00	0.00	0.00	0.00	100.0
46.8g split out of #10 material.						
#20	0.850	0.00	0.00	0.00	0.00	100.0
#40	0.425	3.22	3.22	0.00	0.02	100.0
#60	0.250	3.18	3.17	0.01	0.02	100.0
#100	0.150	3.15	3.13	0.02	0.06	99.9
#200	0.075	3.42	3.09	0.32	1.32	99.2

Hygroscopic Moisture of Fines

Weight of Wet Soil & Pan (g): 149.94
 Weight of Dry Soil & Pan (g): 136.42
 Weight of Water (g): 13.52
 Weight of Pan (g): 6.56
 Weight of Dry Soil (g): 129.86
 Moisture (%): 10.4

General Sample Data

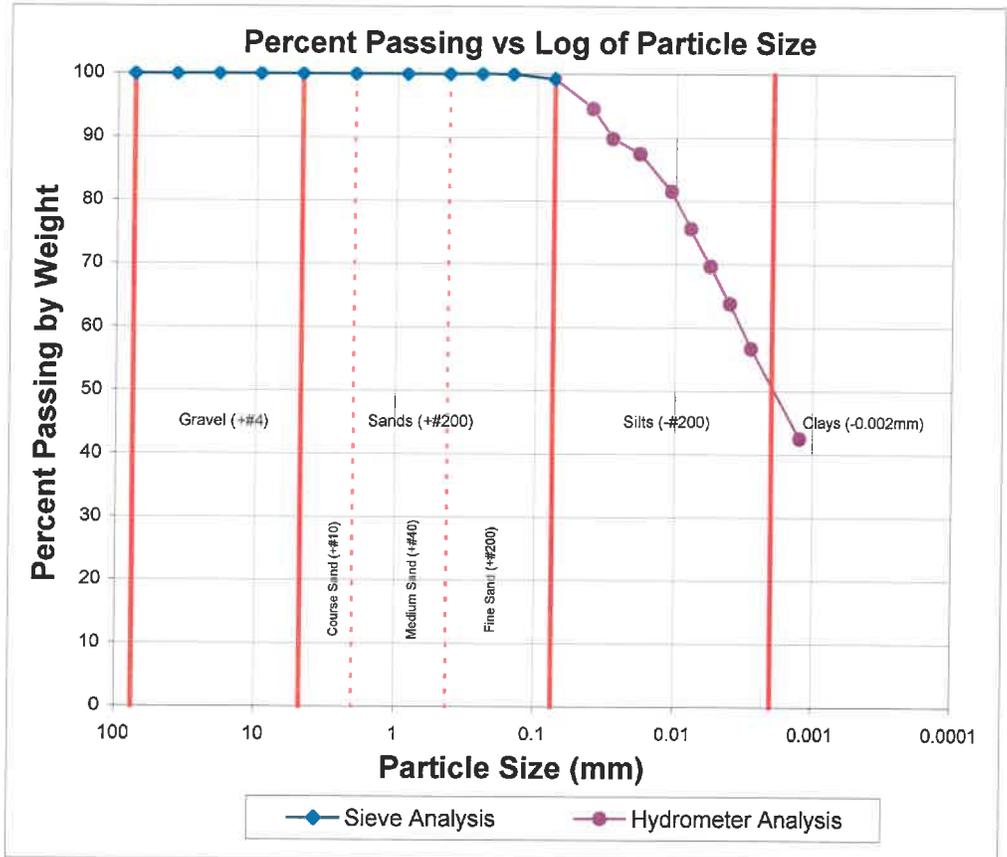
Total Wet Weight of Sample (g): 190.88
 Total Dry Weight of Sample (g): 172.88
 Calculated Weight Plus #200 (g): 1.42
 Moisture of Total Sample (%): 10.4
 Percent Retained #200 Sieve (%): 0.8

Plus Split Data

Original Weight of + #10 (g):
 Calculated Weight of + #10 (g): 0.00

Minus Split Data

Original Weight of #10 (g): 190.88
 Calculated Dry Weight of #10 (g): 172.88



Data Entered By: KR
 Date: 4/14/2017
 File Name: 2978_1_hydrometer-ASTM-D422-R3_1.xls

Checked By:
 Date: 4/18/17

Particle Size Analysis of Soils ASTM D 422

Client: Quandary Consultants
 Job Number: 2978-1
 Project: Aggregate State
 Location: --
 Project Number: --

Boring Number: MW03
 Depth: 12-14'
 Sample Number: Split Spoon
 Sampled Date: 3/25/2017 Sampled By: --
 Wash Date: 4/7/2017 Wash Technician: SKS

Grain Size Data

Sieve Number	Sieve Size (mm)	Weight of Retained Soil & Pan (g)	Weight of Pan (g)	Weight of Retained Soil (g)	Calculated Weight of Retained Soil (g)	Percent Passing by Weight (%)
	3"	76.2	0.00	0.00	0.00	100.0
	1.5"	38.10	0.00	0.00	0.00	100.0
	3/4"	19.05	0.00	0.00	0.00	100.0
	3/8"	9.525	0.00	0.00	0.00	100.0
	#4	4.750	0.00	0.00	0.00	100.0
	#10	2.000	0.00	0.00	0.00	100.0
59.842g split out of -#10 material.						
	#20	0.850	3.18	3.17	0.10	100.0
	#40	0.425	3.11	3.11	0.05	100.0
	#60	0.250	3.17	3.16	0.09	99.9
	#100	0.150	3.15	3.13	0.11	99.9
	#200	0.075	3.23	3.14	0.65	99.8

Hygroscopic Moisture of Fines

Weight of Wet Soil & Pan (g): 64.65
 Weight of Dry Soil & Pan (g): 63.03
 Weight of Water (g): 1.61
 Weight of Pan (g): 6.69
 Weight of Dry Soil (g): 56.35
 Moisture (%): 2.9

General Sample Data

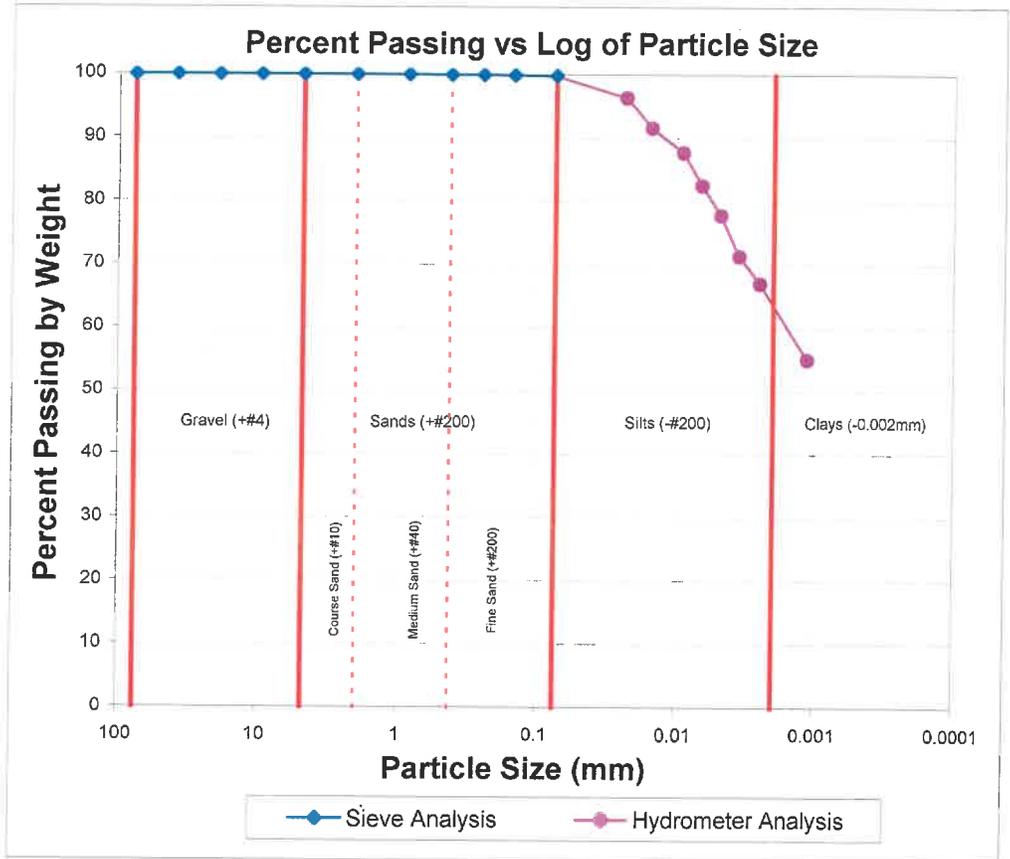
Total Wet Weight of Sample (g): 459.70
 Total Dry Weight of Sample (g): 446.91
 Calculated Weight Plus #200 (g): 0.99
 Moisture of Total Sample (%): 2.9
 Percent Retained #200 Sieve (%): 0.2

Plus Split Data

Original Weight of +#10 (g):
 Calculated Weight of +#10 (g): 0.00

Minus Split Data

Original Weight of -#10 (g): 459.70
 Calculated Dry Weight of -#10 (g): 446.91



Data Entered By: KR
 Date: 4/10/2017
 File Name: 2978_1_hydrometer-ASTM-D422-R3_0.xls

Checked By:
 Date: 4/11/17

Particle Size Analysis of Soils ASTM D 422

Client: Quandary Consultants
 Job Number: 2978-1
 Project: Aggregate State
 Location: --
 Project Number: --

Boring Number: [REDACTED] MW03
 Depth: 12-14'
 Sample Number: Split Spoon
 Sampled Date: 3/25/2017 Sampled By: --
 Test Date: 4/6/2017 Technician: DPM

Hydrometer Data

Test Configuration

Hydrometer Type: 152H	Total Wet Weight of Sample (g): 459.70
Specific Gravity: 2.65	Total Dry Weight of Sample (g): 446.91
Deflocculant: Sodium Hexametaphosphate	Wet Weight of Sub-Sample (g): 59.842
Deflocculant Correction: 5.0	Dry Weight of Sub-Sample (g): 58.178
Specific Gravity Correction Factor 1.00	Corrected Dry Weight of Sub-Sample - W(g): 58.178

Elapsed Time (min)	Hydrometer Reading	Corrected Hydrometer Reading	Temperature (°C)	Temperature Coefficient (K)	Effective Depth (L)	Grain Diameter (mm)	Percent in Suspension (%)	Calculated Weight of Retained Soil (g)	Percent Passing by Weight (%)
0	-	-	-	-	-	-	-	-	-
2	61.0	56.0	23.0	0.0132	6.29	0.0234	96.4	430.77	96.4
5	58.3	53.3	23.0	0.0132	6.74	0.0153	91.7	409.62	91.7
15	56.0	51.0	23.0	0.0132	7.11	0.0091	87.8	392.31	87.8
30	53.0	48.0	23.0	0.0132	7.60	0.0066	82.6	369.23	82.6
60	50.3	45.3	23.2	0.0132	8.05	0.0048	77.9	348.08	77.9
120	46.5	41.5	23.3	0.0132	8.67	0.0035	71.4	319.23	71.4
250	44.0	39.0	23.6	0.0132	9.08	0.0025	67.1	300.00	67.1
1440	37.0	32.0	22.5	0.0133	10.23	0.0011	55.1	246.16	55.1

Data Entered By: KR
 Date: 4/10/2017
 File Name: 2978_1_hydrometer-ASTM-D422-R3_0.xls

Checked By:
 Date: 4/11/17

PERMEABILITY TEST
Flow Pump
ASTM D 5084, Method D



PERMEABILITY TEST - BACK PRESSURE SATURATED - FLOW PUMP METHOD

ASTM D5084 Method D

CLIENT Quandary Consultants	JOB NO. 2978-1
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PROJECT Aggregate State	
PROJECT NO.	SAMPLED 3/24/2017 By: --
BORING NO. B01	TEST STARTED 3/27/2017
DEPTH 4-6'	TEST FINISHED 4/3/2017 By: CAL
SAMPLE NO. --	CELL NUMBER 5P
LOCATION --	PERMEANT Tap Water
SOIL DESC split spoon	CONF. PRES. - (psf) 720

MOISTURE / DENSITY DATA	BEFORE TEST	AFTER TEST
Wt. Soil + Moisture - (g)	123.35	127.47
Wt. Wet Soil & Pan - (g)	129.93	134.05
Wt. Dry Soil & Pan - (g)	112.76	112.76
Wt. Lost Moisture - (g)	17.17	21.29
Wt. of Pan Only - (g)	6.58	6.58
Wt. of Dry Soil - (g)	106.18	106.18
Moisture Content - (%)	16.2	20.1
Wet Density - (pcf)	132.8	141.6
Dry Density - (pcf)	114.3	118.0
Init. Diameter - (in)	1.391	
Init. Area - (sq in)	1.520	
Init. Height - (in)	2.328	
Vol. Bef. Consol. - (cu ft)	0.00205	
Vol. After Consol. - (cu ft)	0.00198	
Porosity - (%)	37.88	

FLOW PUMP CALCULATIONS

Pump Setting	25
Velocity - (cm/sec)	1.66E-04
Q - (cc/s)	5.32E-06
Height - (in)	2.314
Diameter - (in)	1.374
Pressure - (psi)	1.562
Area after consol. - (cm*cm)	9.560
Gradient	18.685
Permeability k - (cm/s)	3.0E-08
Permeability k - (m/s)	3.0E-10
Back Pressure - (psi)	48.0
Cell Pressure - (psi)	53.0
Ave. Effective Stress - (psi)	4.219
Average Temperature Degree - (C°)	22.2

Data entry by: CAL	Date: 04/04/2017
Checked by: <i>OPM</i>	Date: <i>4/5/17</i>



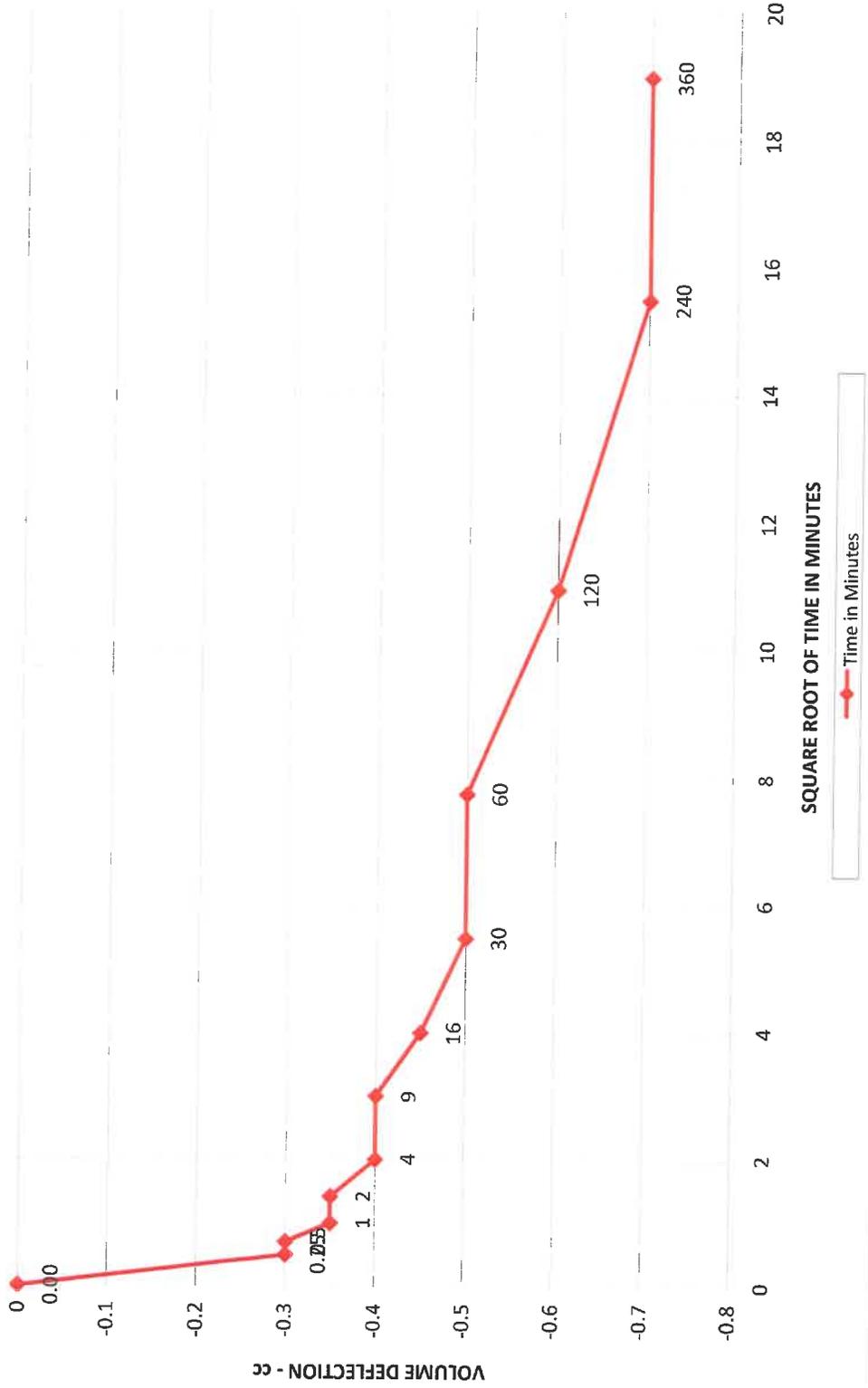
PERMEABILITY TEST - BACK PRESSURE SATURATED - FLOW PUMP METHOD
ASTM D5084 Method D

CLIENT Quandary Consultants

JOB NO. 2978-1

CONSOLIDATION DATA

B01, 4-6'



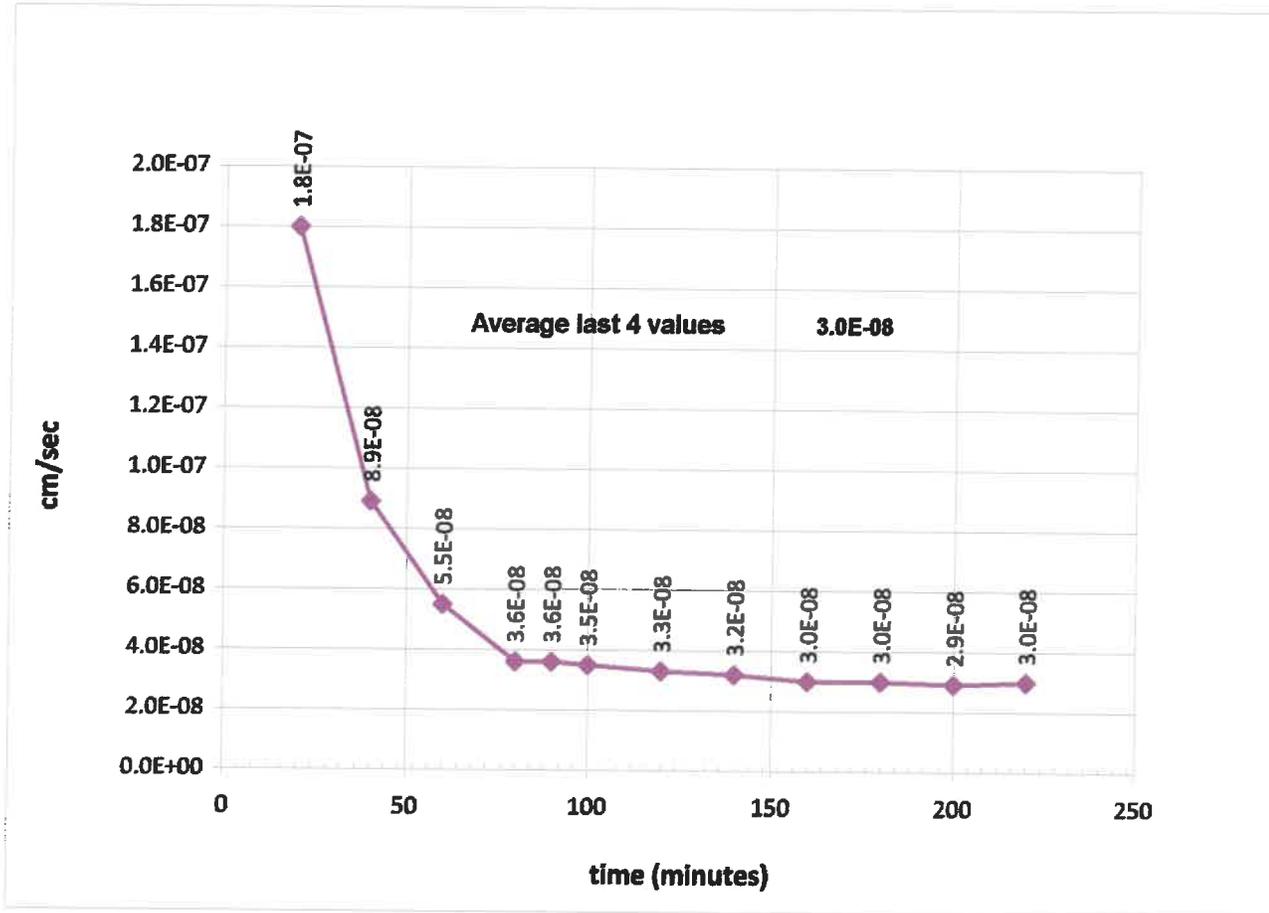


Preliminary Flow Pump Test Data ASTM D5084 Method D

Client: Quandary Consultants
Job Number: 2978-1
Project: Aggregate State
Location: --
Project Number: --

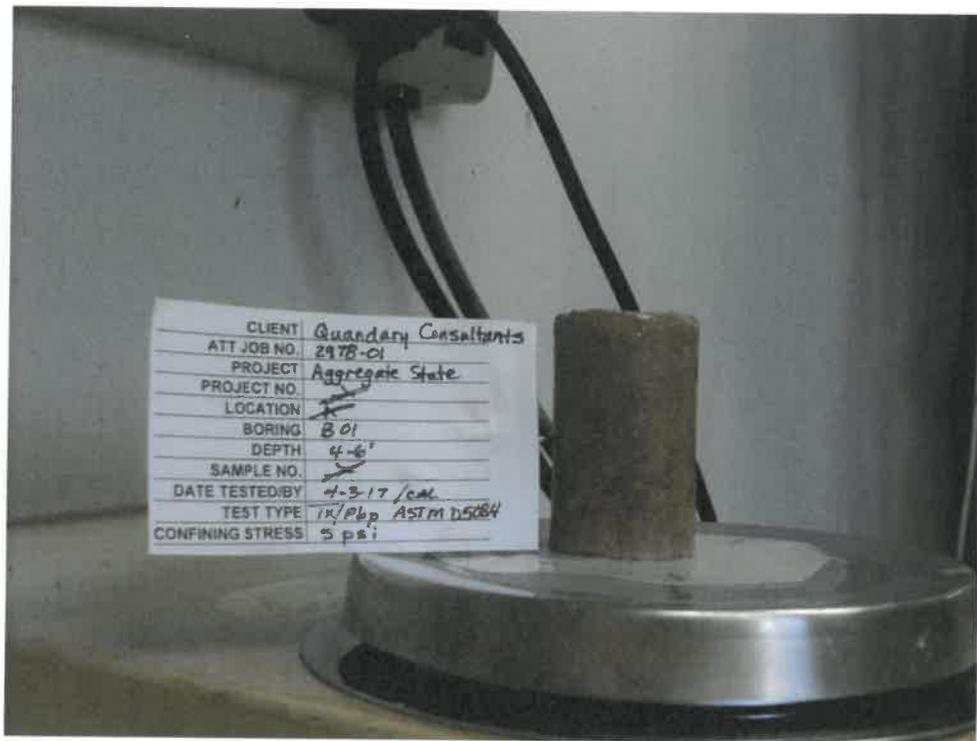
Boring Number: B01
Depth: 4-6'
Sample Number: --
Sampled Date: 3/24/2017
Test Date: 4/3/2017

Sampled By: --
Technician: CAL



Data Entered By: CAL
Date: 4/3/2017
File Name: 2978_1_PrelimPerm_ASTMD-5084-methodD-R0_0.xls

Checked By: OPM
Date: 4/5/17



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PERMEABILITY TEST - BACK PRESSURE SATURATED - FLOW PUMP METHOD

ASTM D5084 Method D

CLIENT **Quandary Consultants** JOB NO. **2978-1**

PROJECT	Aggregate State	SAMPLED	3/24/2017	By: --
PROJECT NO.		TEST STARTED	3/27/2017	
BORING NO.	B01	TEST FINISHED	4/5/2017	By: CAL
DEPTH	9-11'	CELL NUMBER	4P	
SAMPLE NO.	--	PERMEANT	Tap Water	
LOCATION	--	CONF. PRES. - (psf)	720	
SOIL DESC	Split Spoon			

MOISTURE / DENSITY DATA	BEFORE TEST	AFTER TEST
Wt. Soil + Moisture - (g)	140.39	148.98
Wt. Wet Soil & Pan - (g)	165.91	174.50
Wt. Dry Soil & Pan - (g)	140.22	140.22
Wt. Lost Moisture - (g)	25.69	34.28
Wt. of Pan Only - (g)	25.52	25.52
Wt. of Dry Soil - (g)	114.70	114.70
Moisture Content - (%)	22.4	29.9
Wet Density - (pcf)	127.8	132.4
Dry Density - (pcf)	104.4	102.0
Init. Diameter - (in)	1.375	
Init. Area - (sq in)	1.485	
Init. Height - (in)	2.819	
Vol. Bef. Consol. - (cu ft)	0.00242	
Vol. After Consol. - (cu ft)	0.00248	
Porosity - (%)	48.81	

FLOW PUMP CALCULATIONS

Pump Setting	5
Velocity - (cm/sec)	3.48E-05
Q - (cc/s)	1.11E-06
Height - (in)	2.816
Diameter - (in)	1.392
Pressure - (psi)	1.739
Area after consol. - (cm*cm)	9.817
Gradient	17.094
Permeability k - (cm/s)	6.6E-09
Permeability k - (m/s)	6.6E-11
Back Pressure - (psi)	78.0
Cell Pressure - (psi)	83.0
Ave. Effective Stress - (psi)	4.131
Average Temperature Degree - (C°)	22.5

Data entry by: **KR** Date: **04/06/2017**
 Checked by: *CK* Date: *04/06/2017*



PERMEABILITY TEST - BACK PRESSURE SATURATED - FLOW PUMP METHOD

ASTM D5084 Method D

CLIENT	Quandary Consultants	JOB NO.	2978-1
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PROJECT	Aggregate State	SAMPLED	3/24/2017	By: --
PROJECT NO.		TEST STARTED	3/27/2017	
BORING NO.	B01	TEST FINISHED	4/5/2017	By: CAL
DEPTH	9-11'	CELL NUMBER	4P	
SAMPLE NO.	--	PERMEANT	Tap Water	
LOCATION	--	CONF. PRES. - (psf)	720	
SOIL DESC	Split Spoon			

SATURATION DATA

Cell Pres. (psi)	Back Pres. (psi)	Burette Reading (cc)		Pore Pressure (psi)		Change	B
		Close	Open	Close	Open		
40.0	38.0	1.6	9.8				
50.0	48.0	11.6	12.6	38.4	46.5	8.1	0.81
60.0	58.0	12.0	12.9	48.5	57.2	8.7	0.87
70.0	68.0	12.2	13.0	58.4	67.7	9.3	0.93
80.0	78.0	12.6	13.2	68.1	77.4	9.3	0.93
90.0	88.0	13.2	13.2	78.3	87.9	9.6	0.96

CONSOLIDATION DATA

Elapsed Time (min)	SQRT Time (min)	Burette Reading (cc)	Volume Defl. (cc)
0.00	0.00	13.20	0.00
0.25	0.50	13.50	-0.30
0.5	0.71	13.50	-0.30
1	1.00	13.50	-0.30
2	1.41	13.50	-0.30
4	2.00	13.50	-0.30
9	3.00	13.50	-0.30
16	4.00	13.55	-0.35
30	5.48	13.60	-0.40
60	7.75	13.65	-0.45
120	10.95	13.70	-0.50
180	13.42	13.75	-0.55
240	15.49	13.80	-0.60

Initial Height - (in)	2.819	Init. Vol. - (cc)	68.61
Height Change - (in)	0.003	Vol. Change - (cc)	12.50
Ht. After Cons. - (in)	2.816	Cell Exp. - (cc)	14.13
Initial Area - (sq in)	1.485	Net Change - (cc)	-1.63
Area After Cons.-(sq in)	1.522	Cons. Vol. - (cc)	70.23



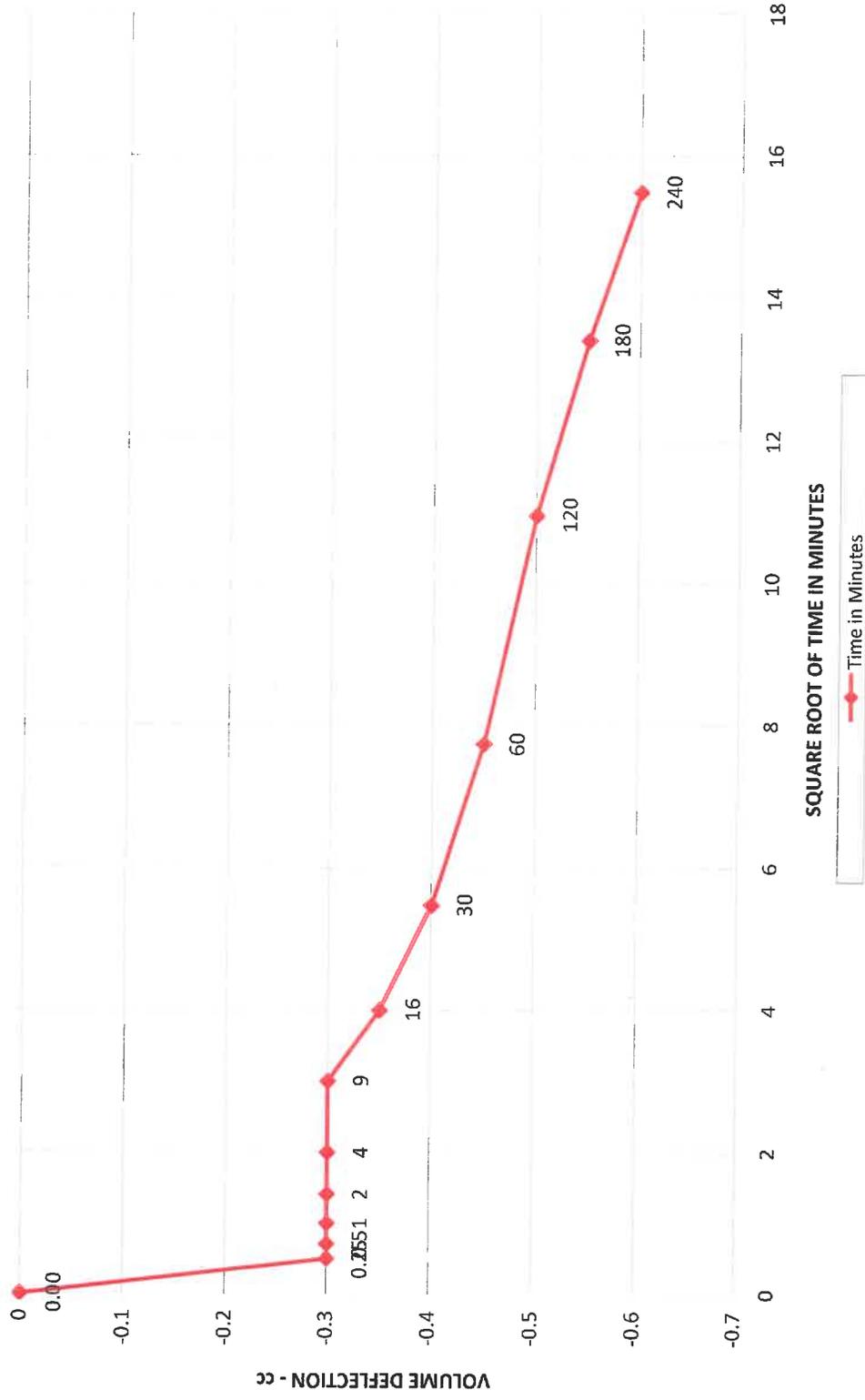
PERMEABILITY TEST - BACK PRESSURE SATURATED - FLOW PUMP METHOD
ASTM D5084 Method D

CLIENT Quandary Consultants

JOB NO. 2978-1

CONSOLIDATION DATA

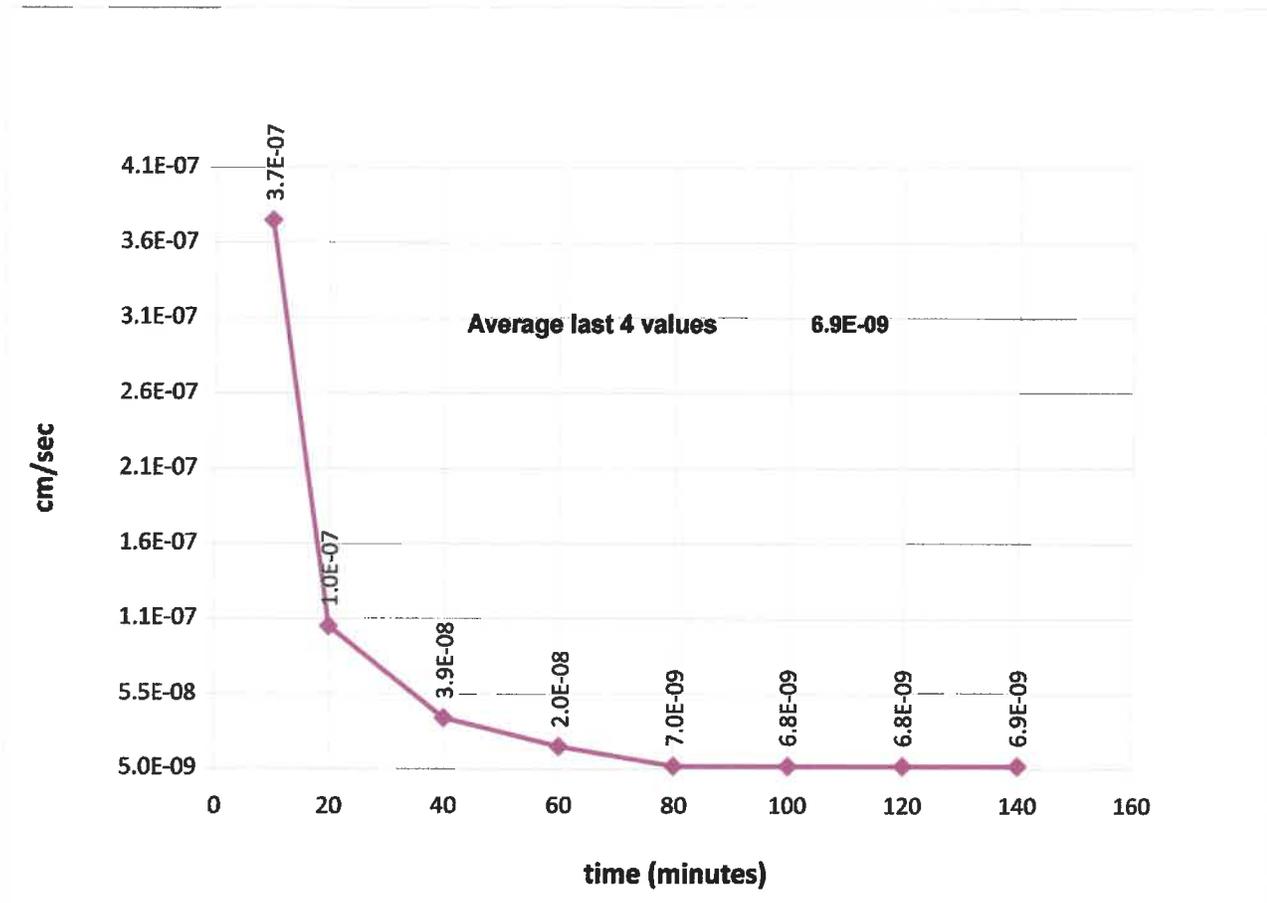
B01,--,9-11'





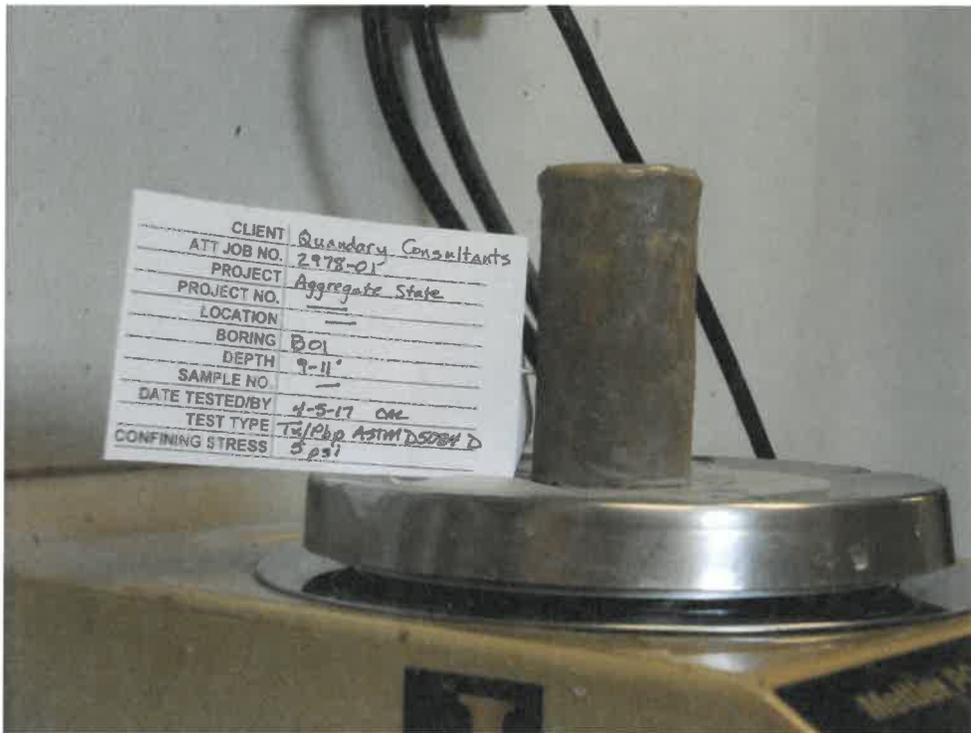
Preliminary Flow Pump Test Data ASTM D5084 Method D

Client:	Quandary Consultants	Boring Number:	B01	Sampled By:	--
Job Number:	2978-1	Depth:	9-11'	Technician:	CAL
Project:	Aggregate State	Sample Number:	--		
Location:	--	Sampled Date:	3/24/2017		
Project Number:		Test Date:	4/5/2017		



Data Entered By: CAL
Date: 4/5/2017
File Name: 2978_1_PrelimPerm_ASTMD-5084-methodD-R0_1.xls

Checked By:
Date: 4/6/17



CLIENT	Quandary Consultants
ATT JOB NO.	2978-01
PROJECT	Aggregate State
PROJECT NO.	
LOCATION	
BORING	B01
DEPTH	9-11'
SAMPLE NO.	
DATE TESTED/BY	4-5-17 CAC
TEST TYPE	Tripod ASTM D5084 D
CONFINING STRESS	5 psi

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PERMEABILITY TEST - BACK PRESSURE SATURATED - FLOW PUMP METHOD

ASTM D5084 Method D

CLIENT	Quandary Consultants	JOB NO.	2978-1
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PROJECT	Aggregate State	SAMPLED	3/25/2017	By: --
PROJECT NO.		TEST STARTED	3/29/2017	
BORING NO.	● MW03	TEST FINISHED	4/12/2017	By: CAL
DEPTH	8-10'	CELL NUMBER	8P	
SAMPLE NO.	--	PERMEANT	Tap Water	
LOCATION	--	CONF. PRES. - (psf)	720	
SOIL DESC	Split Spoon			

MOISTURE / DENSITY DATA	BEFORE TEST	AFTER TEST
Wt. Soil + Moisture - (g)	154.75	167.05
Wt. Wet Soil & Pan - (g)	161.45	173.75
Wt. Dry Soil & Pan - (g)	135.58	135.58
Wt. Lost Moisture - (g)	25.87	38.17
Wt. of Pan Only - (g)	6.70	6.70
Wt. of Dry Soil - (g)	128.88	128.88
Moisture Content - (%)	20.1	29.6
Wet Density - (pcf)	128.6	123.4
Dry Density - (pcf)	107.1	95.2
Init. Diameter - (in)	1.370	
Init. Area - (sq in)	1.474	
Init. Height - (in)	3.110	
Vol. Bef. Consol. - (cu ft)	0.00265	
Vol. After Consol. - (cu ft)	0.00298	
Porosity - (%)	45.17	

FLOW PUMP CALCULATIONS

Pump Setting	5	Unable to achieve Skempton's parameter > 0.93.
Velocity - (cm/sec)	3.48E-05	
Q - (cc/s)	1.11E-06	
Height - (in)	3.108	
Diameter - (in)	1.453	
Pressure - (psi)	1.333	
Area after consol. - (cm*cm)	10.702	
Gradient	11.872	
Permeability k - (cm/s)	8.8E-09	
Permeability k - (m/s)	8.8E-11	
Back Pressure - (psi)	118.0	
Cell Pressure - (psi)	123.0	
Ave. Effective Stress - (psi)	4.334	
Average Temperature Degree - (C°)	22.2	

Data entry by: KR	Date: 04/14/2017
Checked by: CAL	Date: 04/17/2017



PERMEABILITY TEST - BACK PRESSURE SATURATED - FLOW PUMP METHOD

ASTM D5084 Method D

CLIENT	Quandary Consultants	JOB NO.	2978-1
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PROJECT		Aggregate State	
PROJECT NO.		SAMPLED	3/25/2017 By: --
BORING NO.	● MW03	TEST STARTED	3/29/2017
DEPTH	8-10'	TEST FINISHED	4/12/2017 By: CAL
SAMPLE NO.	--	CELL NUMBER	8P
LOCATION	--	PERMEANT	Tap Water
SOIL DESC	Split Spoon	CONF. PRES. - (psf)	720

SATURATION DATA

Cell Pres. (psi)	Back Pres. (psi)	Burette Reading (cc)		Pore Pressure (psi)		Change	B
		Close	Open	Close	Open		
		2.2	13.5				
40.0	38.0	2.2	13.5				
50.0	48.0	12.9	13.8	38.7	46.7	8.0	0.80
60.0	58.0	12.5	13.3	48.7	57.3	8.6	0.86
70.0	68.0	12.2	13.0	58.7	67.3	8.6	0.86
80.0	78.0	12.9	13.6	69.0	77.8	8.8	0.88
90.0	88.0	13.6	14.3	78.9	87.8	8.9	0.89
100.0	98.0	14.4	15.1	88.9	97.9	9.0	0.90
110.0	108.0	15.3	16.0	98.5	107.8	9.3	0.93
120.0	118.0	16.2	16.9	108.4	117.7	9.3	0.93
130.0		17.0	17.0	118.4	127.7	9.3	0.93

CONSOLIDATION DATA

Elapsed Time (min)	SQRT Time (min)	Burette Reading (cc)	Volume Defl. (cc)
0.00	0.00	17.00	0.00
0.25	0.50	17.35	-0.35
0.5	0.71	17.35	-0.35
1	1.00	17.40	-0.40
2	1.41	17.40	-0.40
4	2.00	17.40	-0.40
9	3.00	17.40	-0.40
16	4.00	17.45	-0.45
30	5.48	17.45	-0.45
60	7.75	17.45	-0.45
120	10.95	17.50	-0.50
240	15.49	17.55	-0.55
360	18.97	17.60	-0.60

Initial Height - (in)	3.110	Init. Vol. - (cc)	75.14
Height Change - (in)	0.002	Vol. Change - (cc)	15.60
Ht. After Cons. - (in)	3.108	Cell Exp. - (cc)	24.96
Initial Area - (sq in)	1.474	Net Change - (cc)	-9.36
Area After Cons.-(sq in)	1.659	Cons. Vol. - (cc)	84.50



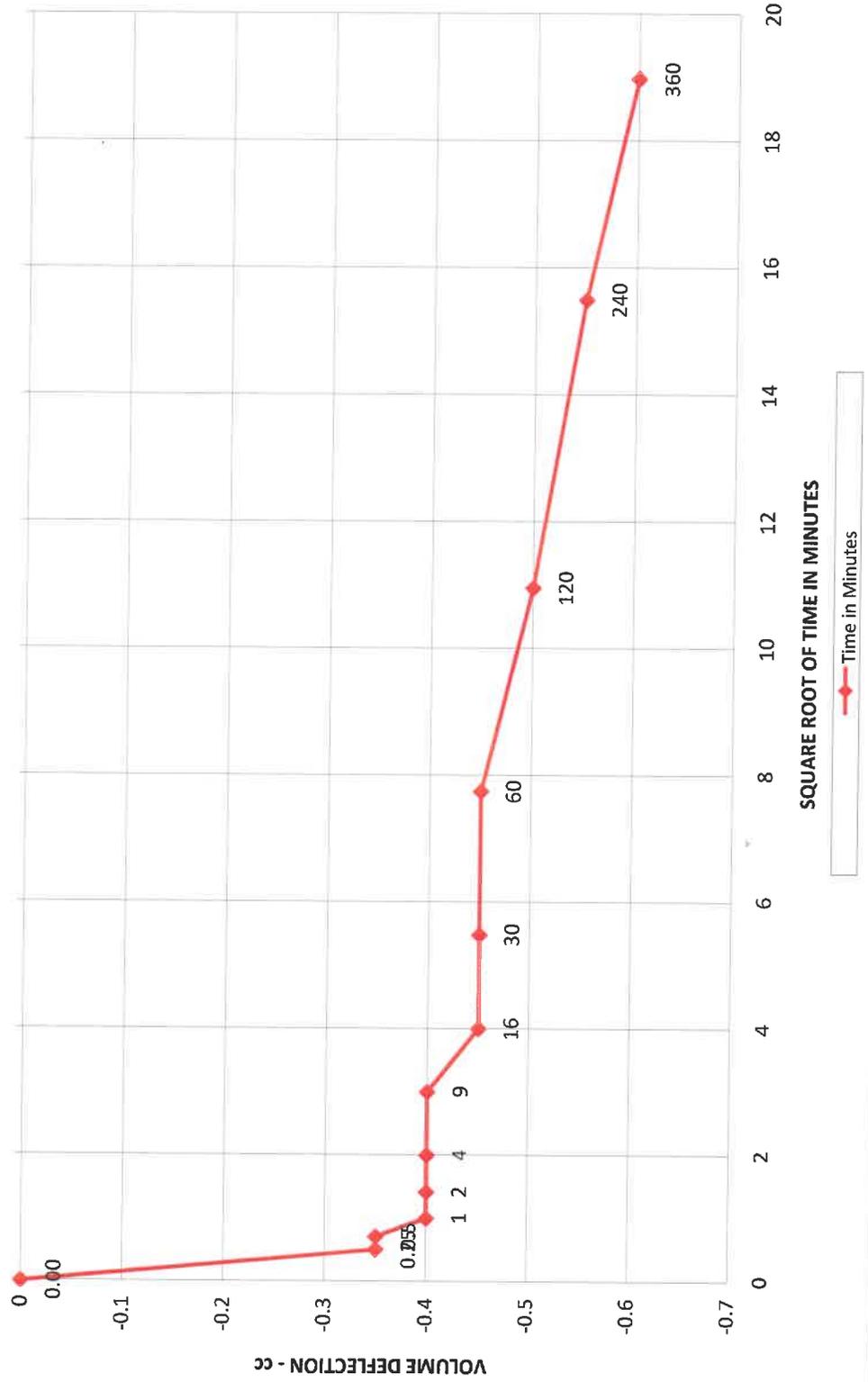
PERMEABILITY TEST - BACK PRESSURE SATURATED - FLOW PUMP METHOD
ASTM D5084 Method D

CLIENT Quandary Consultants

JOB NO. 2978-1

CONSOLIDATION DATA

B03, --, 8-10'



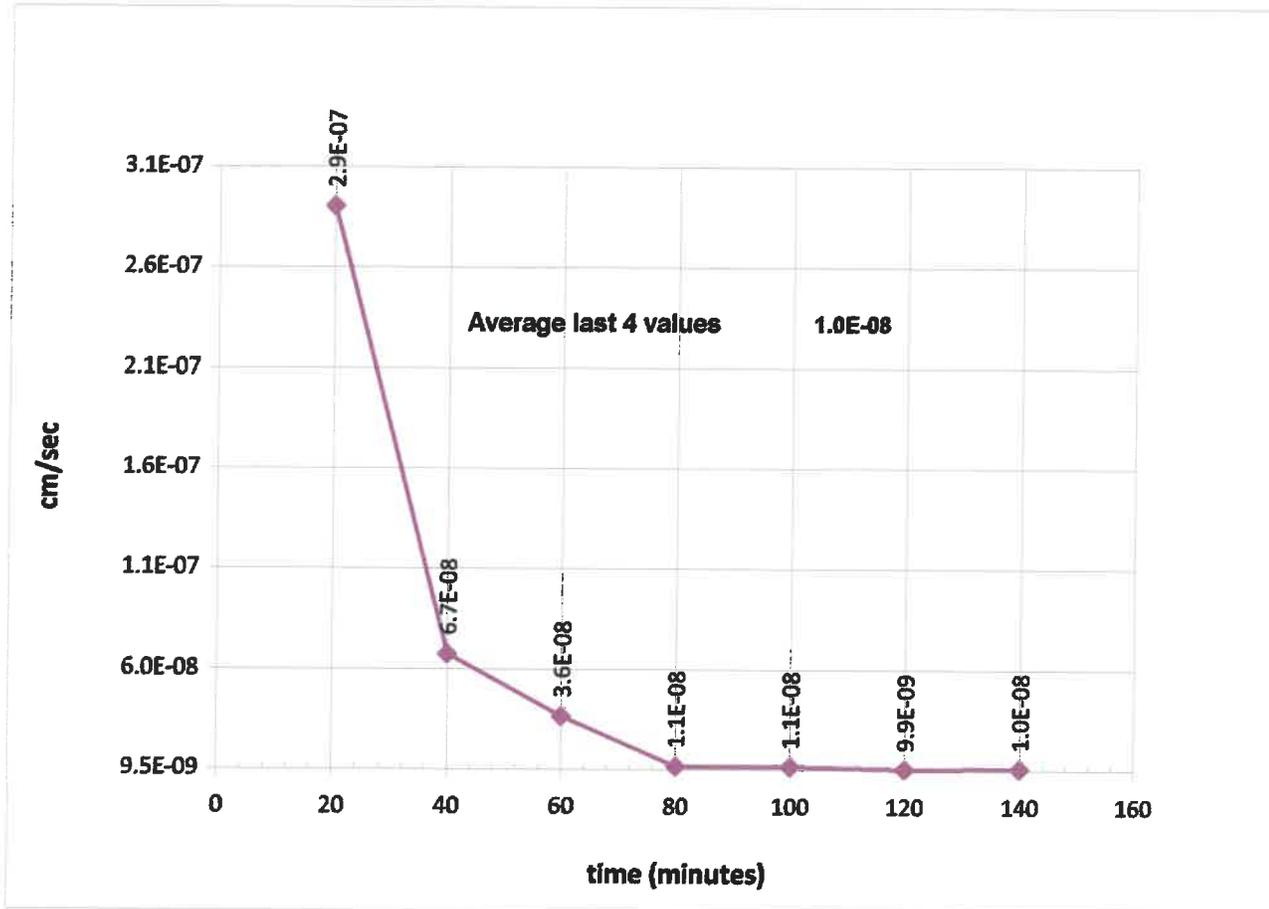


Preliminary Flow Pump Test Data ASTM D5084 Method D

Client: Quandary Consultants
Job Number: 2978-1
Project: Aggregate State
Location: --
Project Number:

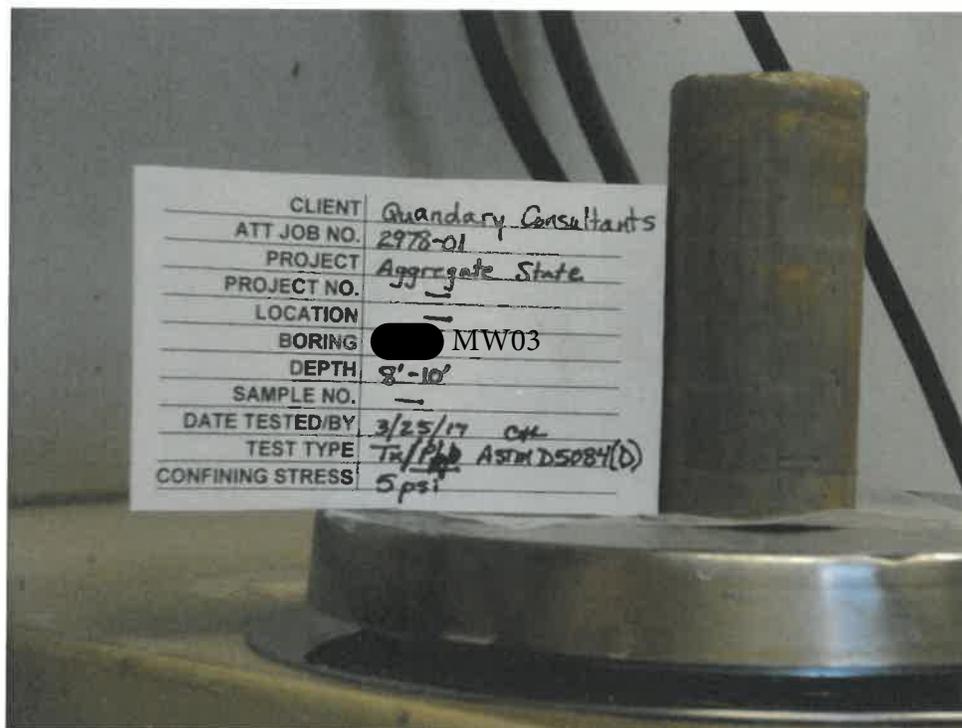
Boring Number: [REDACTED] MW03
Depth: 8-10'
Sample Number: --
Sampled Date: 3/25/2017
Test Date: 4/12/2017

Sampled By: --
Technician: CAL



Data Entered By: CAL
Date: 4/12/2017
File Name: 2978_1_PrelimPerm_ASTMD-5084-methodD-R0_2.xls

Checked By: KR
Date: 4/19/17



Q:\Client Data File\2978\1\PICTURE\DSCF6610.JPG



PERMEABILITY TEST - BACK PRESSURE SATURATED - FLOW PUMP METHOD

ASTM D5084 Method D

CLIENT **Quandary Consultants** JOB NO. **2978-1**

PROJECT Aggregate State	SAMPLED 3/25/2017	By: --
PROJECT NO.	TEST STARTED 3/30/2017	
BORING NO. MW03	TEST FINISHED 4/17/2017	By: CAL
DEPTH 12-14'	CELL NUMBER 3P	
SAMPLE NO. --	PERMEANT Tap Water	
LOCATION --	CONF. PRES. - (psf) 720	
SOIL DESC Split Spoon		

MOISTURE / DENSITY DATA	BEFORE TEST	AFTER TEST
Wt. Soil + Moisture - (g)	151.43	160.76
Wt. Wet Soil & Pan - (g)	177.05	186.38
Wt. Dry Soil & Pan - (g)	151.78	151.78
Wt. Lost Moisture - (g)	25.26	34.59
Wt. of Pan Only - (g)	25.62	25.62
Wt. of Dry Soil - (g)	126.17	126.17
Moisture Content - (%)	20.0	27.4
Wet Density - (pcf)	130.7	143.7
Dry Density - (pcf)	108.9	112.8
Init. Diameter - (in)	1.388	
Init. Area - (sq in)	1.513	
Init. Height - (in)	2.917	
Vol. Bef. Consol. - (cu ft)	0.00255	
Vol. After Consol. - (cu ft)	0.00247	
Porosity - (%)	49.51	

FLOW PUMP CALCULATIONS

Pump Setting	5
Velocity - (cm/sec)	3.48E-05
Q - (cc/s)	1.11E-06
Height - (in)	2.911
Diameter - (in)	1.365
Pressure - (psi)	2.030
Area after consol. - (cm*cm)	9.447
Gradient	19.303
Permeability k - (cm/s)	6.1E-09
Permeability k - (m/s)	6.1E-11
Back Pressure - (psi)	108.0
Cell Pressure - (psi)	113.0
Ave. Effective Stress - (psi)	3.985
Average Temperature Degree - (C°)	22.6

Data entry by: **KR** Date: **04/18/2017**
 Checked by: **Ch** Date: **04/18/2017**



PERMEABILITY TEST - BACK PRESSURE SATURATED - FLOW PUMP METHOD

ASTM D5084 Method D

CLIENT	Quandary Consultants	JOB NO.	2978-1
---------------	----------------------	----------------	--------

PROJECT	Aggregate State	SAMPLED	3/25/2017	By:	--
PROJECT NO.		TEST STARTED	3/30/2017		
BORING NO.	● MW03	TEST FINISHED	4/17/2017	By:	CAL
DEPTH	12-14'	CELL NUMBER	3P		
SAMPLE NO.	--	PERMEANT	Tap Water		
LOCATION	--	CONF. PRES. - (psf)	720		
SOIL DESC	Split Spoon				

SATURATION DATA

Cell Pres. (psi)	Back Pres. (psi)	Burette Reading (cc)		Pore Pressure (psi)		Change	B
		Close	Open	Close	Open		
		2.1	11.0				
40.0	38.0	10.3	11.7	38.0	45.4	7.4	0.74
50.0	48.0	11.5	12.8	48.6	56.7	8.1	0.81
60.0	58.0	12.7	13.9	58.2	66.7	8.5	0.85
70.0	68.0	13.9	15.1	68.5	77.6	9.1	0.91
80.0	78.0	15.2	16.4	78.5	87.7	9.2	0.92
90.0	88.0	16.7	17.8	88.4	97.8	9.4	0.94
100.0	98.0	18.0	19.2	98.6	108.0	9.4	0.94
110.0	108.0	19.4	19.5	108.5	117.9	9.4	0.94
120.0							

CONSOLIDATION DATA

Elapsed Time (min)	SQRT Time (min)	Burette Reading (cc)	Volume Defl. (cc)
0.00	0.00	19.50	0.00
0.25	0.50	19.85	-0.35
0.5	0.71	19.85	-0.35
1	1.00	19.90	-0.40
2	1.41	19.90	-0.40
4	2.00	19.90	-0.40
9	3.00	19.90	-0.40
16	4.00	19.90	-0.40
30	5.48	19.90	-0.40
60	7.75	19.95	-0.45
120	10.95	20.00	-0.50
240	15.49	20.00	-0.50
360	18.97	20.10	-0.60

Initial Height - (in)	2.917	Init. Vol. - (cc)	72.34
Height Change - (in)	0.006	Vol. Change - (cc)	19.10
Ht. After Cons. - (in)	2.911	Cell Exp. - (cc)	16.63
Initial Area - (sq in)	1.513	Net Change - (cc)	2.47
Area After Cons.-(sq in)	1.464	Cons. Vol. - (cc)	69.87



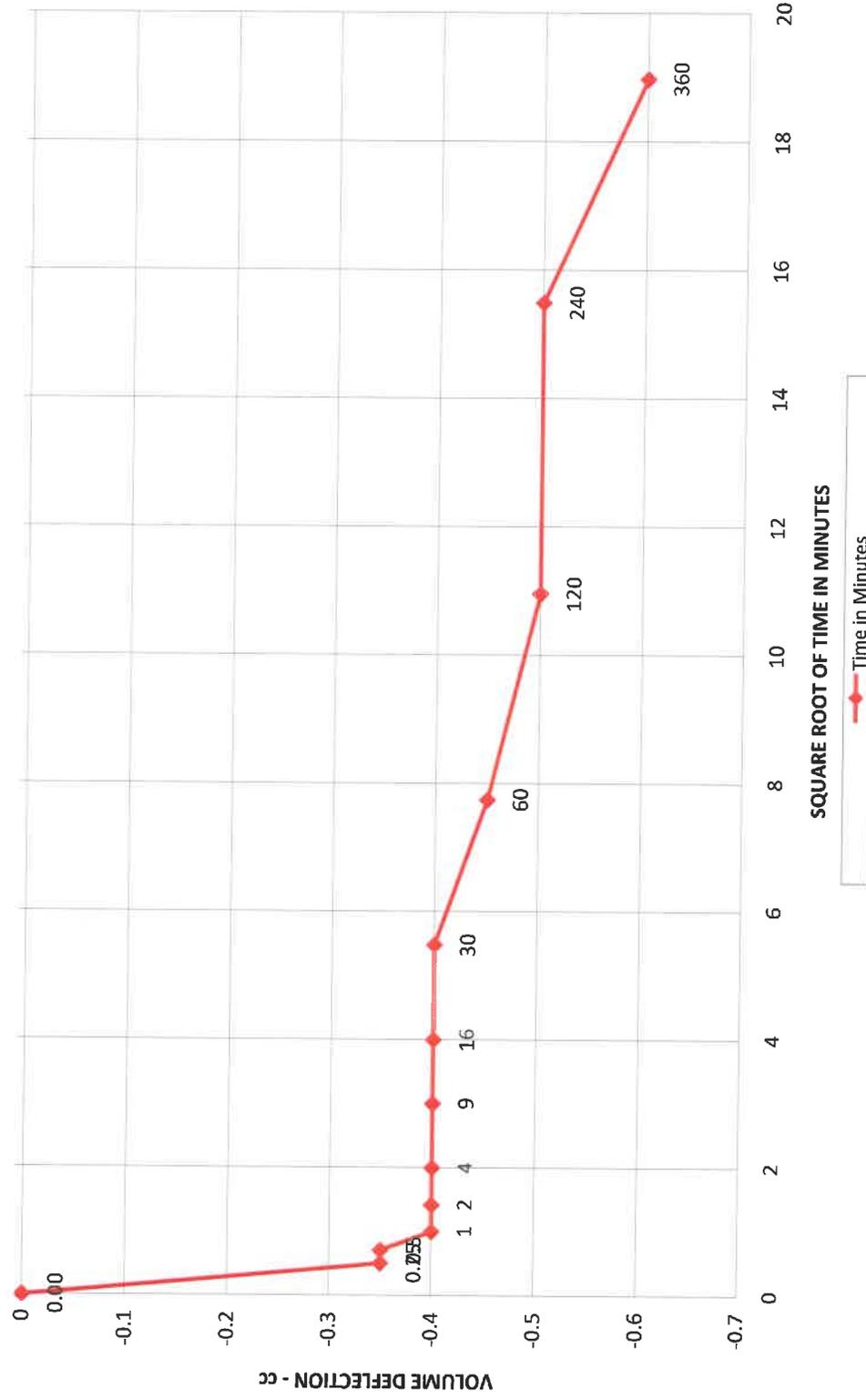
PERMEABILITY TEST - BACK PRESSURE SATURATED - FLOW PUMP METHOD
ASTM D5084 Method D

CLIENT Quandary Consultants

JOB NO. 2978-1

CONSOLIDATION DATA

B03,--,12-14'



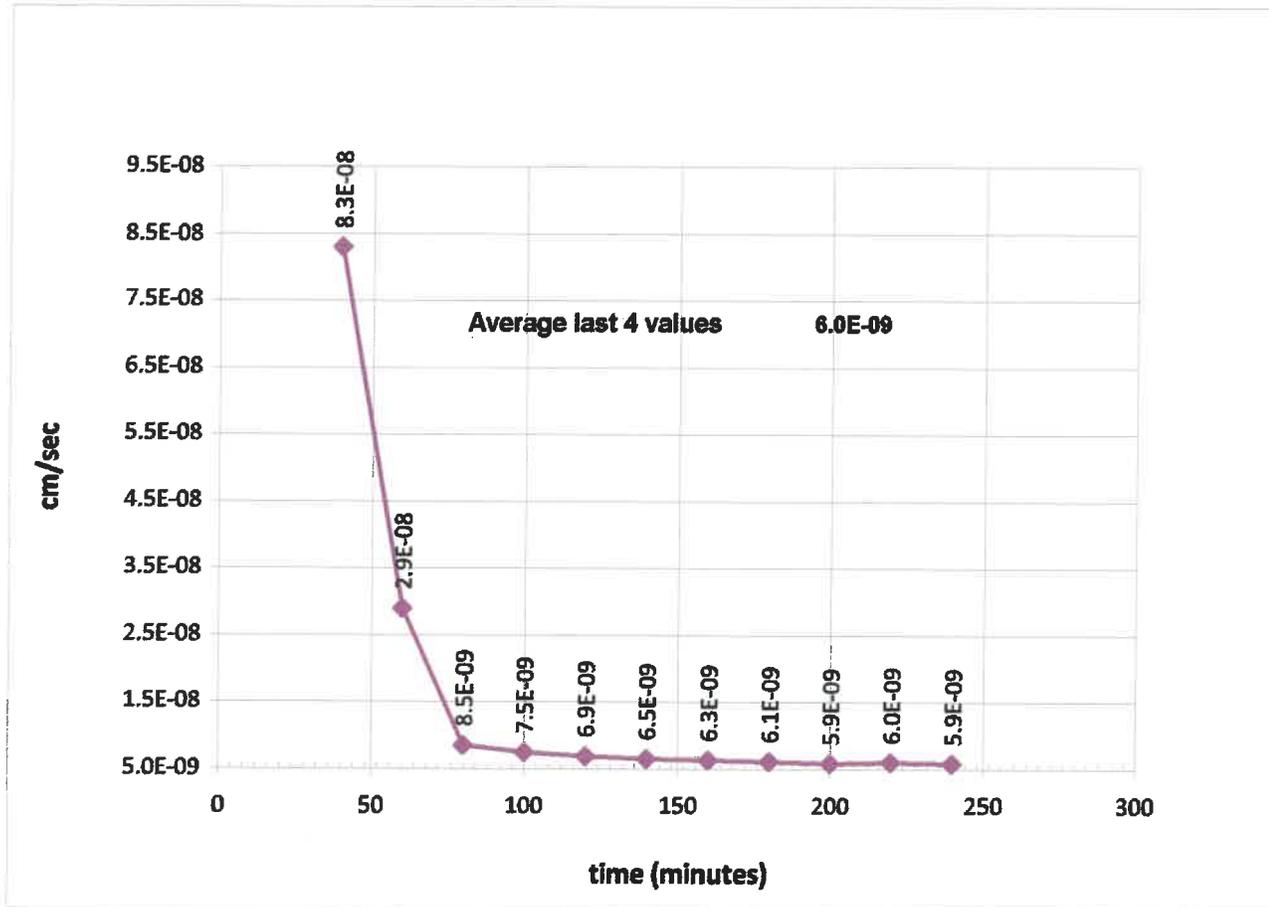


Preliminary Flow Pump Test Data ASTM D5084 Method D

Client: Quandary Consultants
Job Number: 2978-1
Project: Aggregate State
Location: --
Project Number: --

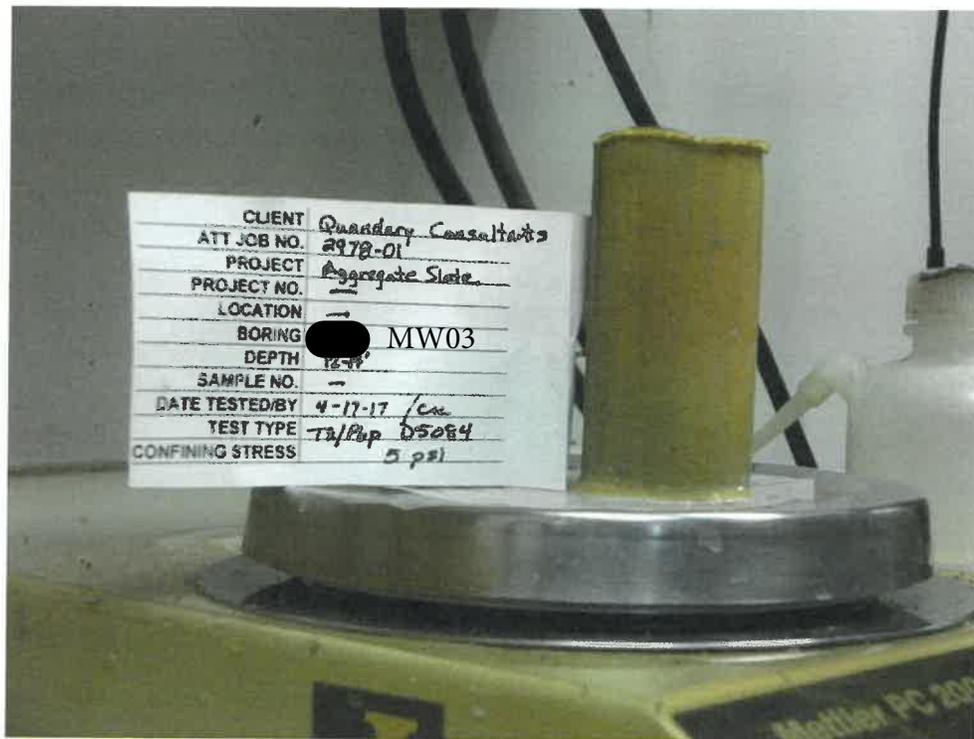
Boring Number: [REDACTED] MW03
Depth: 12-14'
Sample Number: --
Sampled Date: 3/25/2017
Test Date: 4/17/2017

Sampled By: --
Technician: CAL



Data Entered By: CAL
Date: 4/17/2017
File Name: 2978_1_PrelimPerm_ASTMD-5084-methodD-R0_3.xls

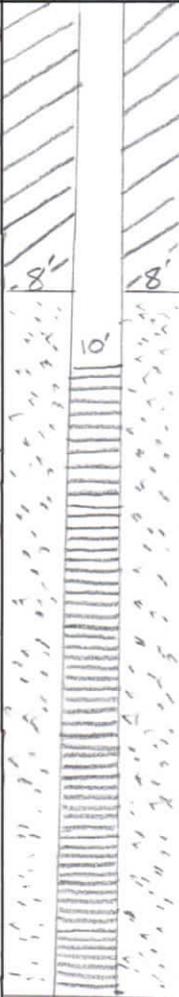
Checked By: KR
Date: 4/18/17



Q:\Client Data File\2978\1\PICTURE\DSCF6614.JPG

Attachment 5
Boring Logs

QUANDARY CONSULTANTS		BORING LOG/MONITORING WELL COMPLETION LOG					
Date: 3/25/19		Boring/Well Number: MW01		Project #: APc00a		Aggregate State 37C-16HZ	
Drilling Method: Solid Stem Auger		Logged By: Asher Weinberg		Driller: Elite Drilling Services		Field Screening Equipment: Mini Rae 2000 PID	
Gravel Pack: Silica Sand		Seal: Bentonite		Grout: Cement		Casing Type: PVC-SCH40 2" Diameter: 2" Length: 15'	
Screen Type: PVC-SCH40 0.02 Slot: 0.02 Diameter: 2" Length: 20'		Total Depth (ft.): 30'		Depth to Water (ft. bgs): 16W not encountered during drilling			
Moisture Content	Vapor (ppm)	Staining (Y/N)	Sample	Depth (ft. bgs)	Sample Run/Recovery	Lithology/Remarks	Well Completion
	0.0	No Staining	MW01 0-12"	0		0 to 11' SC-Sand Clay Mixture, unconsolidated becoming harder and more consolidated @ 11'. Light brown trending to grey coloring at depth. No staining or odor.	
				2			
				4	4' to 6' 2/2		
				6			
				8	9' to 11' 1.5/2		
				10			
				12		11' to 30' CL-claystone inorganic clay/silt well compacted, little to no plasticity sand lenses interspersed no groundwater encountered no staining or odor	
				14	13' to 15' 2/2		
				16			
				18	17' to 19' 2/2		
				20			
				22	21' to 23' 2/2		
				24			
				26	25' to 27' 1.5/2		
				28		Lat 40.151443 Long -104.777408	
				30			
Dry							
Slightly Moist from 21' to 23'							
Dry							

 QUANDARY CONSULTANTS		BORING LOG/MONITORING WELL COMPLETION LOG							
Boring/Well Number: MW02		Project #: APC002 Aggregate State 37C-16HZ							
Date: 3/25/17		Logged By: Asher Weinberg		Driller: Elite Drilling Services					
Drilling Method: Solid Stem Auger		Sampling Method: Split Spoon		Field Screening Equipment: Mini Rae 2000 PID					
Gravel Pack: Silica Sand		Seal: Bentonite		Grout: Cement					
Casing Type: PVC-SCH 40		Diameter: 2"		Length: 15'		Depth to Water (ft. bgs): GW not encountered during drilling			
Screen Type: PVC-SCH 40		Slot: 0.02		Diameter: 2"		Length: 20'		Total Depth (ft.): 30'	
Moisture Content	Vapor (ppm)	Staining (Y/N)	Sample	Depth (ft. bgs)	Sample Run/ Recovery	Lithology/Remarks	Well Completion		
Dry	0.0	NO staining	No Samples collected	0		0 to ~13' SC - Sand clay mixture unconsolidated becoming more consolidated at 13' Light brown trending to grey coloring at depth no staining or odor			
	2								
	4								
	6								
	8								
	10								
	12								
	14								
	16								
	18								
21' to 23' Slightly moist	21' to 23' 0.2 0.0			20	21' to 23' 2/2	~13' to 30' CL - claystone inorganic clay/silt well compacted, blocky calcite fractures grey w/orange hues more fractured from 21' to 23' no staining or odor 2" monitoring well w/ 3' metal stickup Set at 30' bgs Lat 40.151772 Long -104.779058			
22									
24									
26									
28									
30									



QUANDARY
CONSULTANTS

BORING LOG/MONITORING WELL COMPLETION LOG

Boring/Well Number: MW03		Project #: AFC002 Aggregate State 37C-16HZ	
Date: 3/25/17	Logged By: Asher Weinberg	Driller: Elite Drilling Services	
Drilling Method: Solid Stem Auger	Sampling Method: Split Spoon	Field Screening Equipment: Mini Rae 2000 PID	
Gravel Pack: Silica Sand	Seal: Bentonite	Grout: Cement	
Casing Type: PVC-SCH 40	Diameter: 2"	Length: 15'	Depth to Water (ft. bgs): ~28'
Screen Type: PVC-SCH 40	Slot: 0.02	Diameter: 2"	Length: 20'
			Total Depth (ft.): 30'

Moisture Content	Vapor (ppm)	Staining (Y/N)	Sample	Depth (ft. bgs)	Sample Run/ Recovery	Lithology/Remarks	Well Completion
	0.0	NO staining		0		0 to ~5' sand clay mixture pad fill material, well compacted	
				2			
				4	4' to 6'		
				6	2/2		
			MW03 8' to 10'	8	8' to 10'	5' to ~12' native material, SC - sand clay mixture unconsolidated becoming more consolidated at 12'	
				10	2/2		
			MW03 12' to 14'	12	12' to 14'	12' to ~30' CL-claystone inorganic clay/silt well compacted blocky, fractured grey	
				14	1/2		
				16	16' to 18'		
				18	2/2		
				20	18' to 20'		
				22	2/2		
				24	22' to 24'	2" monitoring well w/ 3' metal stickup	
				26	1/2		
				28	24' to 26'	Set at 30' bgs	
				30	1/2		
						Lat 40.151390 Long -104.115377	

Wet at
28'

QUANDARY CONSULTANTS		BORING LOG/MONITORING WELL COMPLETION LOG					
Date: 3/24/17		Boring/Well Number: B01		Project #: APC002		Aggregate State 37C-16HZ	
Drilling Method: Solid Stem Auger		Logged By: Asher Weinberg		Driller: Elite Drilling Services		Field Screening Equipment: Mini Rae 2000 PID	
Gravel Pack: N/A		Seal: N/A		Grout: N/A		Casing Type: N/A	
Diameter: N/A		Length: N/A		Depth to Water (ft. bgs): ~17		Screen Type: N/A	
Slot: N/A		Diameter: N/A		Length: N/A		Total Depth (ft.): 20	
Moisture Content	Vapor (ppm)	Staining (Y/N)	Sample	Depth (ft. bgs)	Sample Run/Recovery	Lithology/Remarks	Well Completion
	0.0	No staining		0		0 to ~3.5' Sand clay mixture, pad fill material, well compacted.	
			B01 4'-6'	4	4' to 6' 2/2	3.5 to ~11' SC - sand clay mixture unconsolidated becoming more consolidated and blockey at 10.5'	
			B01 9'-11'	8	9' to 11' 1/2	Light brown trending to grey at depth	N/A
				10			
				12	13' to 15' 2/2	11' to ~20' CI - claystone inorganic clay/silt well compacted. Little to no plasticity. Blockey. Grey w/ orange hues.	
				14			
				16			
				18		GW encountered at 17'. Boring used to characterize subsurface beneath pad surface. Back filled w bentonite & native fill hydrated.	
				20		Lat 40.151206 Long -104.195377	

Wet at 17'

QUANDARY CONSULTANTS		BORING LOG/MONITORING WELL COMPLETION LOG					
Date: 3/25/17		Boring/Well Number: B02			Project #: APC002 Aggregate State 37C-16HZ		
Drilling Method: Solid Stem Auger		Logged By: Asher Weinberg			Driller: Elite Drilling Services		
Gravel Pack: N/A		Sampling Method: Split Spoon			Field Screening Equipment: Mini Rae 2000 PID		
Casing Type: N/A		Diameter: N/A		Length: N/A		Grout: N/A	
Screen Type: N/A		Slot: N/A		Diameter: N/A		Length: N/A	
						Total Depth (ft.): 26	
Moisture Content	Vapor (ppm)	Staining (Y/N)	Sample	Depth (ft. bgs)	Sample Run/recovery	Lithology/Remarks	Well Completion
Dry	0.0	No Staining	B02 0-12"	0		0 to ~12'	
				2		SC - sand clay	
				4	4' to 6'	mixture unconsolidated	
				6	2/2	becoming more consolidated and blocky	
				8	8' to 10'	at 12' Light Brown trending to grey	
				10	1/2	at depth, no staining or odor	
				12	12' to 14'		
				14	2/2	12' to ~26'	
				16		CL - claystone	
				18	16' to 18'	inorganic clay/silt well compacted, little to no plasticity, blocky	
				20	1.5/2	fractured, grey w/ orange hues.	
				22		Had planned to set GW monitoring well	
				24		however no GW encountered to 26'	
				26		Backfilled w/ bentonite + native fill hydrated	
						Lat 40.151206	
						Long -104.115377	N/A

Attachment 6
Soil Analytical Report

April 03, 2017

Quandary Consultants

Asher Weinberg

2252 Emerson St.

Denver CO 80205

Project Name - Aggregate State

Project Number - APC002

Attached are your analytical results for Aggregate State received by Origins Laboratory, Inc. March 27, 2017. This project is associated with Origins project number Y703362-01.

The analytical results in the following report were analyzed under the guidelines of EPA Methods. These methods are identified as follows; "SW" are defined in SW-846, "EPA" are defined in 40CFR part 136 and "SM" are defined in the most current revision of Standard Methods For the Examination of Water and Wastewater.

The analytical results apply specifically to the samples and analyses specified per the attached Chain of Custody. As such, this report shall not be reproduced except in full, without the written approval of Origin's laboratory.

Unless otherwise noted, the analytical results for all soil samples are reported on a wet weight basis. All analytical analyses were performed under NELAP guidelines unless noted by a data qualifier.

Any holding time exceedances, deviations from the method specifications or deviations from Origins Laboratory's Standard Operating Procedures are outlined in the case narrative.

Thank you for selecting Origins for your analytical needs. Please contact us with any questions concerning this report, or if we can help with anything at all.

Origins Laboratory, Inc.
303.433.1322
o-squad@oelabinc.com



Quandary Consultants
2252 Emerson St.
Denver CO 80205

Asher Weinberg
Project Number: APC002
Project: Aggregate State

CROSS REFERENCE REPORT

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
MW01 0-12"	Y703362-01	Soil	March 25, 2017 8:15	03/27/2017 09:25
B02 0-12"	Y703362-02	Soil	March 25, 2017 12:41	03/27/2017 09:25

Origins Laboratory, Inc.



The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Jen Pellegrini For Noelle Doyle Mathis, President

Quandary Consultants
 2252 Emerson St.
 Denver CO 80205

Asher Weinberg
 Project Number: APC002
 Project: Aggregate State

Origins Laboratory

F-012207-01-R1
 Effective Date: 01/09/12

Sample Receipt Checklist

Origins Work Order: 1703362

Client: Quandary Consultants

Client Project ID: Aggregate State

Checklist Completed by: DAW

Shipped Via: HP
 (UPS, FedEx, Hand Delivered, Pick-up, etc.)

Date/time completed: 3-27-17 12:43

Airbill #: N/A

Matrix(s) Received: (Check all that apply): 1 Soil/Solid Water Other:

Cooler Number/Temperature: 1 / 4.8 °C / °C / °C (Describe) °C

Thermometer ID: 7003

Requirement Description	Yes	No	N/A	Comments (if any)
If samples require cooling, was the temperature between 0°C to ≤ 6°C ⁽¹⁾ ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Is there ice present (document if blue ice is used)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Are custody seals present on cooler? (if so, document in comments if they are signed and dated, broken or intact)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Are custody seals present on each sample container? (if so, document in comments if they are signed and dated, broken or intact)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Were all samples received intact ⁽¹⁾ ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Was adequate sample volume provided ⁽¹⁾ ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Are short holding time analytes or samples with HTs due within 48 hours present ⁽¹⁾ ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<u>pH, SA, Cr, Pb, Cu, Cd</u>
Is a chain-of-custody (COC) present and filled out completely ⁽¹⁾ ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Does the COC agree with the number and type of sample bottles received ⁽¹⁾ ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Do the sample IDs on the bottle labels match the COC ⁽¹⁾ ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Is the COC properly relinquished by the client with date and time recorded ⁽¹⁾ ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
For volatiles in water – is there headspace (> ¼ inch bubble) present? If yes, contact client and note in narrative.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Are samples preserved that require preservation and was it checked ⁽¹⁾ ? (note ID of confirmation instrument used in comments) / (preservation is not confirmed for subcontracted analyses in order to insure sample integrity)/(pH <2 for samples preserved with HNO ₃ , HCL, H ₂ SO ₄) / (pH >10 for samples preserved with NaAsO ₂ +NaOH, ZnAc+NaOH)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Additional Comments (if any):				

⁽¹⁾If NO, then contact the client before proceeding with analysis and note date/time and person contacted as well as the corrective action to in the additional comments (above) and the case narrative.

Reviewed by (Project Manager) DAW

Date/Time Reviewed 3-27-17 12:43

Origins Laboratory, Inc.



The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Quandary Consultants
 2252 Emerson St.
 Denver CO 80205

Asher Weinberg
 Project Number: APC002
 Project: Aggregate State

MW01 0-12"
3/25/2017 8:15:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
---------	--------	-----------------	-------	----------	-------	----------	----------	-------

Origins Laboratory, Inc.
Y703362-01 (Soil)

BTEX by EPA 8260C

Benzene	ND	0.002	mg/kg	1	B7C2803	03/28/2017	03/28/2017	Ua
Toluene	ND	0.002	"	"	"	"	"	Ua
Ethylbenzene	ND	0.002	"	"	"	"	"	Ua
Xylenes, total	ND	0.002	"	"	"	"	"	Ua

Surrogate: 1,2-Dichloroethane-d4	110 %	70-130			"	"	"	
Surrogate: Toluene-d8	97.8 %	70-130			"	"	"	
Surrogate: 4-Bromofluorobenzene	99.6 %	70-130			"	"	"	

GRO (TVPH)/DRO (TEPH)by EPA 8015C

Gasoline (C6-C10)	ND	50.0	mg/kg	1	B7C2804	03/28/2017	03/28/2017	Ua
Diesel (C10-C28)	ND	50.0	"	"	"	"	"	Ua

Surrogate: o-Terphenyl	87.5 %	59-131			"	"	"	
------------------------	--------	--------	--	--	---	---	---	--

Metals (Saturated Paste Prep)

Calcium	3.48		me/L	1	'[none]'	03/30/2017	03/31/2017	
Magnesium	1.36		"	"	"	"	"	
Sodium	6.48		"	"	"	"	"	

pH in Soil by EPA 9045D

pH	8.52		pH Units	1	B7C2805	03/28/2017	03/28/2017	
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Quandary Consultants
 2252 Emerson St.
 Denver CO 80205

Asher Weinberg
 Project Number: APC002
 Project: Aggregate State

MW01 0-12"
3/25/2017 8:15:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
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Origins Laboratory, Inc.
Y703362-01 (Soil)

SAR by 20B Saturated Paste

SAR	4.17			1	'[none]'	03/30/2017	03/31/2017	
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Specific Conductance by Modified 9050A

Specific Conductance (EC)	0.0912		mmhos/cm	1	B7C2806	03/28/2017	03/28/2017	
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Total Metals by 6010C

Barium	80.5	0.528	mg/kg dry	1	1651450	03/28/2017	03/29/2017	
Cadmium	ND	0.528	"	"	"	"	"	U
Chromium	9.05	0.528	"	"	"	"	"	
Copper	7.78	1.06	"	"	"	"	"	
Lead	8.48	1.06	"	"	"	"	"	
Nickel	8.47	0.528	"	"	"	"	"	
Selenium	ND	3.17	"	"	"	"	"	U
Silver	ND	0.528	"	"	"	"	"	U
Zinc	26.6	1.06	"	"	"	"	"	

Total Metals by 6020A

Arsenic	8.31	1.07	mg/kg dry	2	1651466	"	03/31/2017	
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Total Metals by 7196A

Hexavalent Chromium	0.246	0.434	mg/kg dry	1	1652019	03/31/2017	03/31/2017	J
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2252 Emerson St.
Denver CO 80205

Asher Weinberg
Project Number: APC002
Project: Aggregate State

MW01 0-12"
3/25/2017 8:15:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
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GEL Laboratories, LLC
Y703362-01 (Soil)

Total Metals by 7196A/6010

Trivalent Chromium	8.80	0.528	mg/kg	1	1652557		04/01/2017	
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Total Metals by 7471A

Mercury	0.00955	0.0129	mg/kg dry	1	1651724	03/29/2017	03/30/2017	J
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Asher Weinberg
 Project Number: APC002
 Project: Aggregate State

B02 0-12"

3/25/2017 12:41:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
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Origins Laboratory, Inc.
Y703362-02 (Soil)

BTEX by EPA 8260C

Benzene	ND	0.002	mg/kg	1	B7C2803	03/28/2017	03/28/2017	Ua
Toluene	ND	0.002	"	"	"	"	"	Ua
Ethylbenzene	ND	0.002	"	"	"	"	"	Ua
Xylenes, total	ND	0.002	"	"	"	"	"	Ua

Surrogate: 1,2-Dichloroethane-d4	118 %	70-130			"	"	"	
Surrogate: Toluene-d8	95.5 %	70-130			"	"	"	
Surrogate: 4-Bromofluorobenzene	97.9 %	70-130			"	"	"	

GRO (TVPH)/DRO (TEPH)by EPA 8015C

Gasoline (C6-C10)	ND	50.0	mg/kg	1	B7C2804	03/28/2017	03/28/2017	Ua
Diesel (C10-C28)	ND	50.0	"	"	"	"	"	Ua

Surrogate: o-Terphenyl	76.9 %	59-131			"	"	"	
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Metals (Saturated Paste Prep)

Calcium	6.70		me/L	1	'[none]'	03/30/2017	03/31/2017	
Magnesium	2.87		"	"	"	"	"	
Sodium	11.87		"	"	"	"	"	

pH in Soil by EPA 9045D

pH	7.96		pH Units	1	B7C2805	03/28/2017	03/28/2017	
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Asher Weinberg
 Project Number: APC002
 Project: Aggregate State

B02 0-12"

3/25/2017 12:41:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
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Origins Laboratory, Inc.
Y703362-02 (Soil)

SAR by 20B Saturated Paste

SAR	5.43			1	'[none]'	03/30/2017	03/31/2017	
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Specific Conductance by Modified 9050A

Specific Conductance (EC)	0.583		mmhos/cm	1	B7C2806	03/28/2017	03/28/2017	
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Total Metals by 6010C

Barium	85.2	0.576	mg/kg dry	1	1651450	03/28/2017	03/29/2017	
Cadmium	0.231	0.576	"	"	"	"	"	J
Chromium	5.48	0.576	"	"	"	"	"	
Copper	20.6	1.15	"	"	"	"	"	
Lead	17.5	1.15	"	"	"	"	"	
Nickel	18.8	0.576	"	"	"	"	"	
Selenium	ND	3.45	"	"	"	"	"	U
Silver	ND	0.576	"	"	"	"	"	U
Zinc	69.5	1.15	"	"	"	"	"	

Total Metals by 6020A

Arsenic	2.97	1.15	mg/kg dry	2	1651466	"	03/31/2017	
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Total Metals by 7196A

Hexavalent Chromium	ND	0.431	mg/kg dry	1	1652019	03/31/2017	03/31/2017	U
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Project Number: APC002
Project: Aggregate State

B02 0-12"

3/25/2017 12:41:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
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GEL Laboratories, LLC
Y703362-02 (Soil)

Total Metals by 7196A/6010

Trivalent Chromium	5.48	0.576	mg/kg	1	1652557		04/01/2017	
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Total Metals by 7471A

Mercury	0.0713	0.0136	mg/kg dry	1	1651724	03/29/2017	03/30/2017	
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 Project: Aggregate State

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch B7C2803 - EPA 5030 (soil)

Blank (B7C2803-BLK1)

Prepared: 03/28/2017 Analyzed: 03/28/2017

Benzene	ND	0.002	mg/kg							Ua
Toluene	ND	0.002	"							Ua
Ethylbenzene	ND	0.002	"							Ua
Xylenes, total	ND	0.002	"							Ua
Surrogate: 1,2-Dichloroethane-d4	66		ug/kg	62.5		106	70-130			
Surrogate: Toluene-d8	62		"	62.5		99.1	70-130			
Surrogate: 4-Bromofluorobenzene	63		"	62.5		100	70-130			

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Asher Weinberg
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 Project: Aggregate State

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch B7C2803 - EPA 5030 (soil)

LCS (B7C2803-BS1)

Prepared: 03/28/2017 Analyzed: 03/28/2017

Benzene	0.101	0.002	mg/kg	0.100		101	77.1-124			
Toluene	0.104	0.002	"	0.100		104	74.5-128			
Ethylbenzene	0.108	0.002	"	0.100		108	66.4-127			
m,p-Xylene	0.217	0.004	"	0.200		108	76.6-124			
o-Xylene	0.103	0.002	"	0.100		103	76.6-124			
Surrogate: 1,2-Dichloroethane-d4	62		ug/kg	62.5		99.2	70-130			
Surrogate: Toluene-d8	61		"	62.5		97.9	70-130			
Surrogate: 4-Bromofluorobenzene	60		"	62.5		95.4	70-130			

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 Project: Aggregate State

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch B7C2803 - EPA 5030 (soil)

Matrix Spike (B7C2803-MS1)	Source: Y703379-01			Prepared: 03/28/2017 Analyzed: 03/28/2017						
Benzene	0.108	0.002	mg/kg	0.100	ND	108	71.8-126			
Toluene	0.112	0.002	"	0.100	ND	112	65.1-130			
Ethylbenzene	0.113	0.002	"	0.100	ND	113	62.2-130			
m,p-Xylene	0.226	0.004	"	0.200	ND	113	46.5-137			
o-Xylene	0.109	0.002	"	0.100	ND	109	54.2-134			
Surrogate: 1,2-Dichloroethane-d4	65		ug/kg	62.5		104	70-130			
Surrogate: Toluene-d8	61		"	62.5		97.0	70-130			
Surrogate: 4-Bromofluorobenzene	60		"	62.5		96.3	70-130			

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Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch B7C2803 - EPA 5030 (soil)

Matrix Spike Dup (B7C2803-MSD1)	Source: Y703379-01			Prepared: 03/28/2017 Analyzed: 03/28/2017						
Benzene	0.105	0.002	mg/kg	0.100	ND	105	71.8-126	3.46	11.3	
Toluene	0.107	0.002	"	0.100	ND	107	65.1-130	4.29	15.4	
Ethylbenzene	0.105	0.002	"	0.100	ND	105	62.2-130	6.87	19.6	
m,p-Xylene	0.214	0.004	"	0.200	ND	107	46.5-137	5.58	19.2	
o-Xylene	0.104	0.002	"	0.100	ND	104	54.2-134	4.70	17.9	
Surrogate: 1,2-Dichloroethane-d4	64		ug/kg	62.5		103	70-130			
Surrogate: Toluene-d8	61		"	62.5		97.2	70-130			
Surrogate: 4-Bromofluorobenzene	59		"	62.5		94.8	70-130			

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Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Extractable Petroleum Hydrocarbons by 8015C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch B7C2804 - EPA 3580

Blank (B7C2804-BLK1)

Prepared: 03/28/2017 Analyzed: 03/28/2017

Gasoline (C6-C10)	ND	50.0	mg/kg							Ua
Diesel (C10-C28)	ND	50.0	"							Ua
Surrogate: o-Terphenyl	44		"	50.0		87.9	59-131			

LCS (B7C2804-BS1)

Prepared: 03/28/2017 Analyzed: 03/28/2017

Gasoline (C6-C10)	886	50.0	mg/kg	1000		88.6	59-133			
Diesel (C10-C28)	888	50.0	"	1000		88.8	64-121			
Surrogate: o-Terphenyl	41		"	50.0		81.2	59-131			

Matrix Spike (B7C2804-MS1)

Source: Y703388-01

Prepared: 03/28/2017 Analyzed: 03/28/2017

Gasoline (C6-C10)	942	50.0	mg/kg	1000	19.1	92.3	57-139			
Diesel (C10-C28)	891	50.0	"	1000	36.0	85.5	53-125			
Surrogate: o-Terphenyl	43		"	50.0		86.4	59-131			

Matrix Spike Dup (B7C2804-MSD1)

Source: Y703388-01

Prepared: 03/28/2017 Analyzed: 03/28/2017

Gasoline (C6-C10)	909	50.0	mg/kg	1000	19.1	89.0	57-139	3.66	20	
Diesel (C10-C28)	829	50.0	"	1000	36.0	79.3	53-125	7.25	20	
Surrogate: o-Terphenyl	39		"	50.0		77.4	59-131			

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Asher Weinberg
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Classical Chemistry Parameters - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B7C2805 - NO PREP										
Duplicate (B7C2805-DUP1)		Source: Y703362-01			Prepared: 03/28/2017 Analyzed: 03/28/2017					
pH	8.53		pH Units		8.52			0.117	25	
Batch B7C2806 - NO PREP										
Blank (B7C2806-BLK1)		Prepared: 03/28/2017 Analyzed: 03/28/2017								
Specific Conductance (EC)	0.00380		mmhos/cm							
Duplicate (B7C2806-DUP1)		Source: Y703362-01			Prepared: 03/28/2017 Analyzed: 03/28/2017					
Specific Conductance (EC)	0.110		mmhos/cm		0.0912			18.4	25	

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Asher Weinberg
 Project Number: APC002
 Project: Aggregate State

Total Metals by 6010C - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch 1651450 - SW846 3050B

BLANK (1203756831-BLK)

Prepared: 03/28/2017 Analyzed: 03/29/2017

Copper	ND	0.943	mg/kg				-			U
Chromium	0.462	0.472	"				-			J
Barium	ND	0.472	"				-			U
Lead	ND	0.943	"				-			U
Nickel	0.259	0.472	"				-			J
Selenium	ND	2.83	"				-			U
Silver	ND	0.472	"				-			U
Zinc	ND	0.943	"				-			U
Cadmium	ND	0.472	"				-			U

LCS (1203756832-BKS)

Prepared: 03/28/2017 Analyzed: 03/29/2017

Silver	44.6	0.463	mg/kg	46.3	96.4	80-120				
Zinc	46.0	0.926	"	46.3	99.4	80-120				
Selenium	48.1	2.78	"	46.3	104	80-120				
Nickel	47.7	0.463	"	46.3	103	80-120				
Copper	47.6	0.926	"	46.3	103	80-120				
Chromium	46.1	0.463	"	46.3	99.5	80-120				
Barium	45.5	0.463	"	46.3	98.4	80-120				
Cadmium	45.8	0.463	"	46.3	99	80-120				
Lead	46.3	0.926	"	46.3	100	80-120				

DUP (1203756833 D)

Source: Y703362-01

Prepared: 03/28/2017 Analyzed: 03/29/2017

Copper	8.54	1.08	mg/kg dry	7.78	0-20	9.24	20			
Silver	ND	0.538	"	<0.108	0-20	96.4	20			U
Selenium	ND	3.23	"	<0.538	0-20	37.8	20			U
Barium	98.2	0.538	"	80.5	0-20	19.9	20			
Lead	8.62	1.08	"	8.48	0-20	1.62	20			

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Asher Weinberg
 Project Number: APC002
 Project: Aggregate State

Total Metals by 6010C - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1651450 - SW846 3050B										
DUP (1203756833 D)			Source: Y703362-01			Prepared: 03/28/2017 Analyzed: 03/29/2017				
Chromium	8.78	0.538	mg/kg dry		9.05		0-20	3.02	20	
Cadmium	ND	0.538	"		<0.108		0-20	49.1	20	U
Zinc	28.3	1.08	"		26.6		0-20	5.97	20	
Nickel	7.64	0.538	"		8.47		0-20	10.3	20	
MS (1203756834 S)			Source: Y703362-01			Prepared: 03/28/2017 Analyzed: 03/29/2017				
Nickel	58.6	0.520	mg/kg dry	52.0	8.47	96.3	75-125			
Zinc	76.5	1.04	"	52.0	26.6	95.8	75-125			
Silver	49.5	0.520	"	52.0	<0.104	95.2	75-125			
Selenium	51.4	3.12	"	52.0	<0.520	98.8	75-125			
Lead	57.8	1.04	"	52.0	8.48	94.7	75-125			
Copper	61.9	1.04	"	52.0	7.78	104	75-125			
Chromium	59.1	0.520	"	52.0	9.05	96.2	75-125			
Barium	119	0.520	"	52.0	80.5	73.7	75-125			
Cadmium	49.1	0.520	"	52.0	<0.104	94.2	75-125			
PS (1203758533 S)			Source: Y703362-01			Prepared: 03/28/2017 Analyzed: 03/30/2017				
Barium	1.39	0.00549	mg/kg dry	0.500		102	80-120			

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 Project: Aggregate State

Total Metals by 6020A - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1651466 - SW846 3050B										
BLANK (1203756871-BLK)					Prepared: 03/28/2017 Analyzed: 03/31/2017					
Arsenic	ND	0.951	mg/kg				-			U
LCS (1203756872-BKS)					Prepared: 03/28/2017 Analyzed: 03/31/2017					
Arsenic	4.46	0.984	mg/kg	4.92		90.6	80-120			
DUP (1203756873 D)					Source: Y703362-01 Prepared: 03/28/2017 Analyzed: 03/31/2017					
Arsenic	3.30	1.02	mg/kg dry		8.31		0-20	86.3	20	
MS (1203756874 S)					Source: Y703362-01 Prepared: 03/28/2017 Analyzed: 03/31/2017					
Arsenic	8.95	1.03	mg/kg dry	5.15	8.31	12.4	75-125			
PS (1203757984 S)					Source: Y703362-01 Prepared: 03/28/2017 Analyzed: 03/31/2017					
Arsenic	0.125	0.011	mg/kg dry	0.025		72.6	75-125			

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Asher Weinberg
 Project Number: APC002
 Project: Aggregate State

Total Metals by 7196A - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1652019 - SW846 3060A										
BLANK (1203758204-BLK)					Prepared: 03/31/2017 Analyzed: 03/31/2017					
Hexavalent Chromium	ND	0.230	mg/kg				-			U
LCS (1203758205-BKS)					Prepared: 03/31/2017 Analyzed: 03/31/2017					
Hexavalent Chromium	3.34	0.321	mg/kg	3.21		104	80-120			
ILCS (1203758206-ILCS)					Prepared: 03/31/2017 Analyzed: 03/31/2017					
Hexavalent Chromium	8.84	0.385	mg/kg	7.70		115	80-120			
DUP (1203758207 D)					Source: Y703362-01 Prepared: 03/31/2017 Analyzed: 03/31/2017					
Hexavalent Chromium	ND	0.434	mg/kg dry		0.246		0-50	38.3	50	U
MS (1203758208 S)					Source: Y703362-01 Prepared: 03/31/2017 Analyzed: 03/31/2017					
Hexavalent Chromium	2.76	0.378	mg/kg dry	3.78	0.246	66.6	75-125			
MSD (1203758210 SD)					Source: Y703362-01 Prepared: 03/31/2017 Analyzed: 03/31/2017					
Hexavalent Chromium	2.97	0.378	mg/kg dry	3.78	0.246	72	75-125	7.24	30	

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Quandary Consultants
 2252 Emerson St.
 Denver CO 80205

Asher Weinberg
 Project Number: APC002
 Project: Aggregate State

Total Metals by 7471A - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1651724 - SW846 7471A Prep										
BLANK (1203757464-BLK)					Prepared: 03/29/2017 Analyzed: 03/30/2017					
Mercury	ND	0.0118	mg/kg				-			U
LCS (1203757465-BKS)					Prepared: 03/29/2017 Analyzed: 03/30/2017					
Mercury	0.114	0.0115	mg/kg	0.115		98.4	80-120			
DUP (1203757472 D)					Source: 419294018 Prepared: 03/29/2017 Analyzed: 03/30/2017					
Mercury	0.153	0.0328	mg/kg dry		0.147		0-20	3.82	20	
MS (1203757474 S)					Source: 419294018 Prepared: 03/29/2017 Analyzed: 03/30/2017					
Mercury	0.446	0.0323	mg/kg dry	0.323	0.147	92.3	80-120			

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Quandary Consultants
2252 Emerson St.
Denver CO 80205

Asher Weinberg
Project Number: APC002
Project: Aggregate State

Notes and Definitions

- Ua Sample is Non-Detect.
- U Result not detected above the detection limit
- J Greater than the detection limit but less than the reporting limit
- ND Analyte NOT DETECTED at or above the reporting limit
- RPD Relative Percent Difference
- All soil results are reported at a wet weight basis.

Origins Laboratory, Inc.



The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Attachment 7
Groundwater Analytical Report

April 26, 2017

Quandary Consultants

Asher Weinberg

2252 Emerson St.

Denver

CO 80205

Project Name - Aggregate State

Project Number - APC002

Attached are your analytical results for Aggregate State received by Origins Laboratory, Inc. April 13, 2017. This project is associated with Origins project number Y704159-01.

The analytical results in the following report were analyzed under the guidelines of EPA Methods. These methods are identified as follows; "SW" are defined in SW-846, "EPA" are defined in 40CFR part 136 and "SM" are defined in the most current revision of Standard Methods For the Examination of Water and Wastewater.

The analytical results apply specifically to the samples and analyses specified per the attached Chain of Custody. As such, this report shall not be reproduced except in full, without the written approval of Origin's laboratory.

Unless otherwise noted, the analytical results for all soil samples are reported on a wet weight basis. All analytical analyses were performed under NELAP guidelines unless noted by a data qualifier.

Any holding time exceedances, deviations from the method specifications or deviations from Origins Laboratory's Standard Operating Procedures are outlined in the case narrative.

Thank you for selecting Origins for your analytical needs. Please contact us with any questions concerning this report, or if we can help with anything at all.

Origins Laboratory, Inc.
303.433.1322
o-squad@oelabinc.com



Quandary Consultants
2252 Emerson St.
Denver CO 80205

Asher Weinberg
Project Number: APC002
Project: Aggregate State

CROSS REFERENCE REPORT

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
MW01	Y704159-01	Water	April 13, 2017 9:55	04/13/2017 14:36

Origins Laboratory, Inc.



The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Jen Pellegrini For Noelle Doyle Mathis, President

Quandary Consultants
 2252 Emerson St.
 Denver CO 80205

Asher Weinberg
 Project Number: APC002
 Project: Aggregate State

Origins Laboratory F-012207-01-R1
Effective Date: 01/09/12

Sample Receipt Checklist

Origins Work Order: Y704199 Client: Quandary Cons
 Client Project ID: Aggregate State

Checklist Completed by: DW Shipped Via: HD
(UPS, FedEx, Hand Delivered, Pick-up, etc.)
 Date/time completed: 4-13-12 1545 Airbill #: N/A

Matrix(s) Received: (Check all that apply): Soil/Solid Water Other: _____
(Describe)

Cooler Number/Temperature: 1 / 3.4 °C _____ °C _____ °C _____ °C
 Thermometer ID: 103

Requirement Description	Yes	No	N/A	Comments (if any)
If samples require cooling, was the temperature between 0°C to ≤ 6°C ⁽¹⁾ ?	<input checked="" type="checkbox"/>			
Is there ice present (document if blue ice is used)	<input checked="" type="checkbox"/>			
Are custody seals present on cooler? (if so, document in comments if they are signed and dated, broken or intact)		<input checked="" type="checkbox"/>		
Are custody seals present on each sample container? (if so, document in comments if they are signed and dated, broken or intact)		<input checked="" type="checkbox"/>		
Were all samples received intact ⁽¹⁾ ?	<input checked="" type="checkbox"/>			
Was adequate sample volume provided ⁽¹⁾ ?	<input checked="" type="checkbox"/>			
Are short holding time analytes or samples with HTs due within 48 hours present ⁽¹⁾ ?	<input checked="" type="checkbox"/>			pH, Anions
Is a chain-of-custody (COC) present and filled out completely ⁽¹⁾ ?	<input checked="" type="checkbox"/>			
Does the COC agree with the number and type of sample bottles received ⁽¹⁾ ?	<input checked="" type="checkbox"/>			
Do the sample IDs on the bottle labels match the COC ⁽¹⁾ ?	<input checked="" type="checkbox"/>			
Is the COC properly relinquished by the client with date and time recorded ⁽¹⁾ ?	<input checked="" type="checkbox"/>			
For volatiles in water – is there headspace (> ¼ inch bubble) present? If yes, contact client and note in narrative.		<input checked="" type="checkbox"/>		
Are samples preserved that require preservation and was it checked ⁽¹⁾ ? (note ID of confirmation instrument used in comments) / (preservation is not confirmed for subcontracted analyses in order to insure sample integrity)/(pH < 2 for samples preserved with HNO ₃ , HCl, H ₂ SO ₄) / (pH > 10 for samples preserved with NaAsO ₂ +NaOH, ZnAc+NaOH)		<input checked="" type="checkbox"/>		
Additional Comments (if any):				

⁽¹⁾If NO, then contact the client before proceeding with analysis and note date/time and person contacted as well as the corrective action to in the additional comments (above) and the case narrative.

Reviewed by [Signature] Project Manager) Date/Time Reviewed 4/14/12

Origins Laboratory, Inc.

Jefe Pellegrini

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Quandary Consultants
 2252 Emerson St.
 Denver CO 80205

Asher Weinberg
 Project Number: APC002
 Project: Aggregate State

MW01
4/13/2017 9:55:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
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GEL Laboratories, LLC
Y704159-01 (Water)

Alkalinity by SM 2320B

Alkalinity, Total as CaCO ₃	445	4.00	mg/L	1	1656970		04/18/2017	
Bicarbonate alkalinity (CaCO ₃)	445	4.00	"	"	"	"	"	
Carbonate alkalinity (CaCO ₃)	ND	4.00	"	"	"	"	"	U

Anions by EPA 300.0

Bromide	4.70	2.00	mg/L	10	1656288	"	04/14/2017	
Chloride	1450	100	"	500	"	"	"	
Fluoride	ND	1.00	"	10	"	"	"	U
Nitrate	2.76	1.00	"	"	"	"	"	
Nitrite	1.60	1.00	"	"	"	"	"	
Sulfate	4990	200	"	500	"	"	"	

BTEX by EPA 8260C

Benzene	ND	1.00	ug/L	1	B7D1802	04/18/2017	04/18/2017	Ua
Toluene	ND	1.00	"	"	"	"	"	Ua
Ethylbenzene	ND	1.00	"	"	"	"	"	Ua
Xylenes, total	ND	1.00	"	"	"	"	"	Ua

Surrogate: 1,2-Dichloroethane-d4	90.1 %	84-121			"	"	"	
Surrogate: Toluene-d8	94.8 %	85-115			"	"	"	
Surrogate: 4-Bromofluorobenzene	87.8 %	84-114			"	"	"	

Origins Laboratory, Inc.



The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Quandary Consultants
 2252 Emerson St.
 Denver CO 80205

Asher Weinberg
 Project Number: APC002
 Project: Aggregate State

MW01
4/13/2017 9:55:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
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GEL Laboratories, LLC
Y704159-01 (Water)

Dissolved Metals by 6020A

Barium-Dissolved	0.0555	0.01	mg/L	5	1656491	04/17/2017	04/18/2017	
Boron-Dissolved	0.179	0.075	"	"	"	"	"	
Calcium-Dissolved	517	20	"	100	"	"	"	
Iron-Dissolved	ND	0.5	"	5	"	"	"	U
Magnesium-Dissolved	219	0.15	"	"	"	"	"	
Manganese-Dissolved	0.216	0.025	"	"	"	"	04/20/2017	
Potassium-Dissolved	19.7	1.5	"	"	"	"	04/18/2017	
Selenium-Dissolved	0.155	0.025	"	"	"	"	"	
Sodium-Dissolved	2370	25	"	100	"	"	"	
Strontium-Dissolved	11.8	1	"	"	"	"	"	

GRO (TVPH)/DRO (TEPH)by EPA 8015C

Gasoline (C6-C10)	ND	2.50	mg/L	1	B7D2506	04/25/2017	04/25/2017	Ua
Diesel (C10-C28)	ND	2.50	"	"	"	"	"	Ua

Surrogate: o-Terphenyl 100 % 54-117 " " "

Nitrate/Nitrite by EPA 353.2

Nitrogen, Nitrate/Nitrite	5.35	0.500	mg/L	25	1657335		04/20/2017	
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pH in Water by EPA 9040C

pH	7.06		pH Units	1	B7D1906	04/19/2017	04/19/2017	
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Quandary Consultants
 2252 Emerson St.
 Denver CO 80205

Asher Weinberg
 Project Number: APC002
 Project: Aggregate State

MW01
4/13/2017 9:55:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
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Origins Laboratory, Inc.
Y704159-01 (Water)

Phosphorus by EPA 365.4

Phosphorus, Total as P	0.0919	0.050	mg/L	1	1655331	04/17/2017	04/18/2017
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Specific Conductance by Modified 9050A

Specific Conductance (EC)	11800	10.0	uS/cm	1	B7D1907	04/19/2017	04/19/2017
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TDS by SM2540C

Total Dissolved Solids	9840	14.3	mg/L	1	1656615		04/19/2017
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Quandary Consultants
 2252 Emerson St.
 Denver CO 80205

Asher Weinberg
 Project Number: APC002
 Project: Aggregate State

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch B7D1802 - EPA 5030B (Water)

Blank (B7D1802-BLK1)

Prepared: 04/18/2017 Analyzed: 04/18/2017

Benzene	ND	1.00	ug/L							Ua
Toluene	ND	1.00	"							Ua
Ethylbenzene	ND	1.00	"							Ua
Xylenes, total	ND	1.00	"							Ua
<i>Surrogate: 1,2-Dichloroethane-d4</i>	<i>54</i>		<i>"</i>	<i>62.5</i>		<i>85.7</i>	<i>84-121</i>			
<i>Surrogate: Toluene-d8</i>	<i>61</i>		<i>"</i>	<i>62.5</i>		<i>97.1</i>	<i>85-115</i>			
<i>Surrogate: 4-Bromofluorobenzene</i>	<i>55</i>		<i>"</i>	<i>62.5</i>		<i>88.1</i>	<i>84-114</i>			

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Quandary Consultants
 2252 Emerson St.
 Denver CO 80205

Asher Weinberg
 Project Number: APC002
 Project: Aggregate State

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch B7D1802 - EPA 5030B (Water)

LCS (B7D1802-BS1)

Prepared: 04/18/2017 Analyzed: 04/18/2017

Benzene	46.3	1.00	ug/L	50.0		92.7	73.3-129			
Toluene	47.8	1.00	"	50.0		95.7	76.2-123			
Ethylbenzene	47.9	1.00	"	50.0		95.8	73.6-130			
m,p-Xylene	96.3	2.00	"	100		96.3	76.1-126			
o-Xylene	47.2	1.00	"	50.0		94.4	76.6-124			
Surrogate: 1,2-Dichloroethane-d4	54		"	62.5		86.4	84-121			
Surrogate: Toluene-d8	61		"	62.5		98.2	85-115			
Surrogate: 4-Bromofluorobenzene	55		"	62.5		88.8	84-114			

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 Denver CO 80205

Asher Weinberg
 Project Number: APC002
 Project: Aggregate State

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch B7D1802 - EPA 5030B (Water)

Matrix Spike (B7D1802-MS1)	Source: Y704152-01			Prepared: 04/18/2017 Analyzed: 04/18/2017						
Benzene	49.6	1.00	ug/L	50.0	0.350	98.5	74-130			
Toluene	50.3	1.00	"	50.0	ND	101	73-131			
Ethylbenzene	50.9	1.00	"	50.0	ND	102	76-132			
m,p-Xylene	103	2.00	"	100	ND	103	69-139			
o-Xylene	49.9	1.00	"	50.0	ND	99.9	74-131			
Surrogate: 1,2-Dichloroethane-d4	52		"	62.5		84.0	84-121			
Surrogate: Toluene-d8	60		"	62.5		95.9	85-115			
Surrogate: 4-Bromofluorobenzene	56		"	62.5		88.9	84-114			

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Asher Weinberg
 Project Number: APC002
 Project: Aggregate State

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch B7D1802 - EPA 5030B (Water)

Matrix Spike Dup (B7D1802-MSD1)	Source: Y704152-01			Prepared: 04/18/2017 Analyzed: 04/18/2017						
Benzene	47.0	1.00	ug/L	50.0	0.350	93.2	74-130	5.49	20	
Toluene	47.2	1.00	"	50.0	ND	94.4	73-131	6.34	20	
Ethylbenzene	47.4	1.00	"	50.0	ND	94.8	76-132	7.04	20	
m,p-Xylene	95.5	2.00	"	100	ND	95.5	69-139	7.46	20	
o-Xylene	47.1	1.00	"	50.0	ND	94.1	74-131	5.90	20	
Surrogate: 1,2-Dichloroethane-d4	52		"	62.5		82.5	84-121			
Surrogate: Toluene-d8	59		"	62.5		94.0	85-115			
Surrogate: 4-Bromofluorobenzene	55		"	62.5		88.1	84-114			

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 Denver CO 80205

Asher Weinberg
 Project Number: APC002
 Project: Aggregate State

Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Extractable Petroleum Hydrocarbons by 8015C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch B7D2506 - EPA 3511 Mod.

Blank (B7D2506-BLK1)

Prepared: 04/25/2017 Analyzed: 04/25/2017

Gasoline (C6-C10)	ND	5.00	mg/L							Ua
Diesel (C10-C28)	ND	5.00	"							Ua
Surrogate: o-Terphenyl	5.0		"	5.00		99.4	54-117			

LCS (B7D2506-BS1)

Prepared: 04/25/2017 Analyzed: 04/25/2017

Gasoline (C6-C10)	93.6	5.00	mg/L	100		93.6	69-125			
Diesel (C10-C28)	102	5.00	"	100		102	61-120			
Surrogate: o-Terphenyl	4.4		"	5.00		88.3	54-117			

Matrix Spike (B7D2506-MS1)

Source: Y704251-01

Prepared: 04/25/2017 Analyzed: 04/25/2017

Gasoline (C6-C10)	76.9	5.00	mg/L	100	ND	76.9	70-127			
Diesel (C10-C28)	85.0	5.00	"	100	1.12	83.9	54-126			
Surrogate: o-Terphenyl	3.9		"	5.00		77.1	54-117			

Matrix Spike Dup (B7D2506-MSD1)

Source: Y704251-01

Prepared: 04/25/2017 Analyzed: 04/25/2017

Gasoline (C6-C10)	98.3	5.00	mg/L	100	ND	98.3	70-127	24.4	20	QR-02
Diesel (C10-C28)	108	5.00	"	100	1.12	107	54-126	24.1	20	QR-02
Surrogate: o-Terphenyl	5.1		"	5.00		101	54-117			

Origins Laboratory, Inc.



The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Quandary Consultants
 2252 Emerson St.
 Denver CO 80205

Asher Weinberg
 Project Number: APC002
 Project: Aggregate State

Classical Chemistry Parameters - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B7D1906 - NO PREP										
Duplicate (B7D1906-DUP1)		Source: Y704154-01			Prepared: 04/19/2017 Analyzed: 04/19/2017					
pH	7.45		pH Units		7.45			0.00	200	
Batch B7D1907 - NO PREP										
Blank (B7D1907-BLK1)		Prepared: 04/19/2017 Analyzed: 04/19/2017								
Specific Conductance (EC)	3.10	10.0	uS/cm							
Duplicate (B7D1907-DUP1)		Source: Y704159-01			Prepared: 04/19/2017 Analyzed: 04/19/2017					
Specific Conductance (EC)	11800	10.0	uS/cm		11800			0.00	10	

Origins Laboratory, Inc.



The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Quandary Consultants
 2252 Emerson St.
 Denver CO 80205

Asher Weinberg
 Project Number: APC002
 Project: Aggregate State

Alkalinity by SM 2320B - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1656970 -										
LCS (1203769846-BKS)					Prepared: Analyzed: 04/18/2017					
Alkalinity, Total as CaCO3	108	4.00	mg/L	100		108	90-110			
DUP (1203769847 D)					Source: 420080002 Prepared: Analyzed: 04/18/2017					
Carbonate alkalinity (CaCO3)	ND	4.00	mg/L		<1.45		0-20	0	20	U
Bicarbonate alkalinity (CaCO3)	129	4.00	"		128		0-20	0.778	20	
Alkalinity, Total as CaCO3	129	4.00	"		128		0-20	0.778	20	
MS (1203769848 S)					Source: 420080002 Prepared: Analyzed: 04/18/2017					
Alkalinity, Total as CaCO3	229	4.00	mg/L	100	128	101	80-120			

Origins Laboratory, Inc.



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Quandary Consultants
 2252 Emerson St.
 Denver CO 80205

Asher Weinberg
 Project Number: APC002
 Project: Aggregate State

Anions by EPA 300.0 - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch 1656288 -

BLANK (1203768217-BLK)

Prepared: Analyzed: 04/14/2017

Nitrate	ND	0.100	mg/L				-			U
Nitrite	ND	0.100	"				-			U
Fluoride	ND	0.100	"				-			U
Chloride	ND	0.200	"				-			U
Bromide	ND	0.200	"				-			U
Sulfate	ND	0.400	"				-			U

LCS (1203768218-BKS)

Prepared: Analyzed: 04/14/2017

Bromide	1.31	0.200	mg/L	1.25		105	90-110			
Chloride	4.52	0.200	"	5.00		90.3	90-110			
Fluoride	2.35	0.100	"	2.50		94	90-110			
Nitrate	2.30	0.100	"	2.50		92.1	90-110			
Nitrite	2.33	0.100	"	2.50		93.2	90-110			
Sulfate	9.45	0.400	"	10.0		94.5	90-110			

DUP (1203768219 D)

Source: Y704159-01

Prepared: Analyzed: 04/14/2017

Sulfate	4990	200	mg/L		4990		0-20	0.116	20	
Bromide	4.68	2.00	"		4.70		0-20	0.448	20	
Chloride	1450	100	"		1450		0-20	0.238	20	
Fluoride	ND	1.00	"		0.597		0-20	0.841	20	U
Nitrate	2.79	1.00	"		2.76		0-20	0.937	20	
Nitrite	1.59	1.00	"		1.60		0-20	0.689	20	

PS (1203768220 S)

Source: Y704159-01

Prepared: Analyzed: 04/14/2017

Bromide	17.7	2.00	mg/L	1.25		104	90-110			
Chloride	4040	100	"	5.00		103	90-110			
Fluoride	24.4	1.00	"	2.50		95	90-110			

Origins Laboratory, Inc.



The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Quandary Consultants
 2252 Emerson St.
 Denver CO 80205

Asher Weinberg
 Project Number: APC002
 Project: Aggregate State

Anions by EPA 300.0 - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch 1656288 -

PS (1203768220 S)

Source: Y704159-01

Prepared: Analyzed: 04/14/2017

Nitrate	26.6	1.00	mg/L	2.50	95.5	90-110				
Nitrite	25.9	1.00	"	2.50	97.4	90-110				
Sulfate	10300	200	"	10.0	107	90-110				

Origins Laboratory, Inc.



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Quandary Consultants
 2252 Emerson St.
 Denver CO 80205

Asher Weinberg
 Project Number: APC002
 Project: Aggregate State

Dissolved Metals by 6020A - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch 1656491 -

FLTB (1203768285-BLK)

Prepared: 04/17/2017 Analyzed: 04/18/2017

Iron-Dissolved	ND	0.1	mg/L				-			U
Sodium-Dissolved	ND	0.25	"				-			U
Selenium-Dissolved	ND	0.005	"				-			U
Potassium-Dissolved	ND	0.3	"				-			U
Magnesium-Dissolved	ND	0.03	"				-			U
Strontium-Dissolved	ND	0.01	"				-			U
Calcium-Dissolved	ND	0.2	"				-			U
Boron-Dissolved	ND	0.015	"				-			U
Barium-Dissolved	ND	0.002	"				-			U
Manganese-Dissolved	0.0508	0.005	"				-			U

BLANK (1203768662-BLK)

Prepared: 04/17/2017 Analyzed: 04/18/2017

Magnesium-Dissolved	ND	0.03	mg/L				-			U
Strontium-Dissolved	ND	0.01	"				-			U
Sodium-Dissolved	ND	0.25	"				-			U
Selenium-Dissolved	ND	0.005	"				-			U
Potassium-Dissolved	ND	0.3	"				-			U
Manganese-Dissolved	ND	0.005	"				-			U
Iron-Dissolved	ND	0.1	"				-			U
Calcium-Dissolved	ND	0.2	"				-			U
Boron-Dissolved	ND	0.015	"				-			U
Barium-Dissolved	ND	0.002	"				-			U

LCS (1203768663-BKS)

Prepared: 04/17/2017 Analyzed: 04/18/2017

Potassium-Dissolved	2.03	0.3	mg/L	2000	101	80-120
Selenium-Dissolved	0.0575	0.005	"	50.0	115	80-120
Iron-Dissolved	2.08	0.1	"	2000	104	80-120

Origins Laboratory, Inc.



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Quandary Consultants
 2252 Emerson St.
 Denver CO 80205

Asher Weinberg
 Project Number: APC002
 Project: Aggregate State

Dissolved Metals by 6020A - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch 1656491 - SW846 3005A

LCS (1203768663-BKS)

Prepared: 04/17/2017 Analyzed: 04/20/2017

Manganese-Dissolved	0.0487	0.005	mg/L	50.0		97.4	80-120			
Strontium-Dissolved	0.0505	0.01	"	50.0		101	80-120			
Magnesium-Dissolved	2.16	0.03	"	2000		108	80-120			
Sodium-Dissolved	2.18	0.25	"	2000		109	80-120			
Boron-Dissolved	0.118	0.015	"	100		118	80-120			
Barium-Dissolved	0.0558	0.002	"	50.0		112	80-120			
Calcium-Dissolved	2.11	0.2	"	2000		105	80-120			

DUP (1203768664 D)

Source: 420719002

Prepared: 04/17/2017 Analyzed: 04/18/2017

Calcium-Dissolved	517	20	mg/L		517000		0-20	0.106	20	
Sodium-Dissolved	2370	25.0	"		2370000		0-20	0.26	20	
Selenium-Dissolved	0.153	0.025	"		155		0-20	1.33	20	
Potassium-Dissolved	20.1	1.5	"		19700		0-20	1.89	20	
Manganese-Dissolved	0.219	0.025	"		216		0-20	1.52	20	
Iron-Dissolved	ND	0.5	"		<330		0-20	2.9	20	U
Strontium-Dissolved	12.2	1.0	"		11800		0-20	3.33	20	
Boron-Dissolved	0.177	0.075	"		179		0-20	1.41	20	
Barium-Dissolved	0.0579	0.01	"		55.5		0-20	4.24	20	
Magnesium-Dissolved	224	0.15	"		219000		0-20	2.2	20	

MS (1203768665 S)

Source: 420719002

Prepared: 04/17/2017 Analyzed: 04/18/2017

Iron-Dissolved	1.87	0.5	mg/L	2000	<330	91	75-125			
Potassium-Dissolved	21	1.5	"	2000	19700	66.9	75-125			
Selenium-Dissolved	0.210	0.025	"	50.0	155	110	75-125			
Sodium-Dissolved	2310	25.0	"	2000	2370000	0	75-125			
Strontium-Dissolved	11.6	1.0	"	50.0	11800	0	75-125			
Manganese-Dissolved	0.263	0.025	"	50.0	216	94.1	75-125			

Origins Laboratory, Inc.



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Quandary Consultants
 2252 Emerson St.
 Denver CO 80205

Asher Weinberg
 Project Number: APC002
 Project: Aggregate State

Dissolved Metals by 6020A - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch 1656491 - SW846 3005A

MS (1203768665 S)

Source: 420719002

Prepared: 04/17/2017 Analyzed: 04/18/2017

Magnesium-Dissolved	215	0.15	mg/L	2000	219000	0	75-125			
Calcium-Dissolved	504	20.0	"	2000	517000	0	75-125			
Barium-Dissolved	0.098	0.01	"	50.0	55.5	84.9	75-125			
Boron-Dissolved	0.257	0.075	"	100	179	78.1	75-125			

Origins Laboratory, Inc.



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Quandary Consultants
 2252 Emerson St.
 Denver CO 80205

Asher Weinberg
 Project Number: APC002
 Project: Aggregate State

Nitrate/Nitrite by EPA 353.2 - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1657335 -										
BLANK (1203770663-BLK)					Prepared: Analyzed: 04/20/2017					
Nitrogen, Nitrate/Nitrite	ND	0.050	mg/L				-			U
LCS (1203770664-BKS)					Prepared: Analyzed: 04/20/2017					
Nitrogen, Nitrate/Nitrite	0.999	0.050	mg/L	1.00		99.9	90-110			
DUP (1203770665 D)					Prepared: Analyzed: 04/20/2017					
Nitrogen, Nitrate/Nitrite	0.520	0.250	mg/L		0.545		0-20	4.69	20	
PS (1203770668 S)					Prepared: Analyzed: 04/20/2017					
Nitrogen, Nitrate/Nitrite	5.55	0.250	mg/L	1.00		100	90-110			

Origins Laboratory, Inc.



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Quandary Consultants
 2252 Emerson St.
 Denver CO 80205

Asher Weinberg
 Project Number: APC002
 Project: Aggregate State

Phosphorus by EPA 365.4 - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1655331 - EPA 365.4 Prep										
BLANK (1203766106-BLK)					Prepared: 04/17/2017 Analyzed: 04/18/2017					
Phosphorus, Total as P	ND	0.050	mg/L				-			U
LCS (1203766107-BKS)					Prepared: 04/17/2017 Analyzed: 04/18/2017					
Phosphorus, Total as P	0.997	0.050	mg/L	1.00		99.7	80-124			
DUP (1203766779 D)					Prepared: 04/17/2017 Analyzed: 04/18/2017					
Phosphorus, Total as P	ND	0.050	mg/L		0.034		0-27		27	U
MS (1203766780 S)					Prepared: 04/17/2017 Analyzed: 04/18/2017					
Phosphorus, Total as P	0.982	0.050	mg/L	1.00	0.034	94.8	63-139			

Origins Laboratory, Inc.



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Quandary Consultants
 2252 Emerson St.
 Denver CO 80205

Asher Weinberg
 Project Number: APC002
 Project: Aggregate State

TDS by SM2540C - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1656615 -										
BLANK (1203769058-BLK)					Prepared: Analyzed: 04/19/2017					
Total Dissolved Solids	ND	14.3	mg/L				-			U
LCS (1203769059-BKS)					Prepared: Analyzed: 04/19/2017					
Total Dissolved Solids	297	14.3	mg/L	300		99	95-105			
DUP (1203769061 D)		Source: 420675003			Prepared: Analyzed: 04/19/2017					
Total Dissolved Solids	150	14.3	mg/L		157		0-5	4.65	5	

Origins Laboratory, Inc.



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Quandary Consultants
2252 Emerson St.
Denver CO 80205

Asher Weinberg
Project Number: APC002
Project: Aggregate State

Notes and Definitions

Ua Sample is Non-Detect.

U Result not detected above the detection limit

QR-02 The RPD result exceeded the QC control limits; however, both percent recoveries were acceptable. Sample results for the QC batch were accepted based on percent recoveries and completeness of QC data.

ND Analyte NOT DETECTED at or above the reporting limit

RPD Relative Percent Difference

All soil results are reported at a wet weight basis.

Origins Laboratory, Inc.



The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Jen Pellegrini For Noelle Doyle Mathis, President

April 26, 2017

Quandary Consultants

Asher Weinberg

2252 Emerson St.

Denver

CO 80205

Project Name - Aggregate State

Project Number - APC002

Attached are your analytical results for Aggregate State received by Origins Laboratory, Inc. April 13, 2017. This project is associated with Origins project number Y704160-01.

The analytical results in the following report were analyzed under the guidelines of EPA Methods. These methods are identified as follows; "SW" are defined in SW-846, "EPA" are defined in 40CFR part 136 and "SM" are defined in the most current revision of Standard Methods For the Examination of Water and Wastewater.

The analytical results apply specifically to the samples and analyses specified per the attached Chain of Custody. As such, this report shall not be reproduced except in full, without the written approval of Origin's laboratory.

Unless otherwise noted, the analytical results for all soil samples are reported on a wet weight basis. All analytical analyses were performed under NELAP guidelines unless noted by a data qualifier.

Any holding time exceedances, deviations from the method specifications or deviations from Origins Laboratory's Standard Operating Procedures are outlined in the case narrative.

Thank you for selecting Origins for your analytical needs. Please contact us with any questions concerning this report, or if we can help with anything at all.

Origins Laboratory, Inc.
303.433.1322
o-squad@oelabinc.com



Quandary Consultants
2252 Emerson St.
Denver CO 80205

Asher Weinberg
Project Number: APC002
Project: Aggregate State

CROSS REFERENCE REPORT

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
MW02	Y704160-01	Water	April 13, 2017 11:15	04/13/2017 14:36
MW03	Y704160-02	Water	April 13, 2017 12:13	04/13/2017 14:36

Origins Laboratory, Inc.



The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Jen Pellegrini For Noelle Doyle Mathis, President

Quandary Consultants
 2252 Emerson St.
 Denver CO 80205

Asher Weinberg
 Project Number: APC002
 Project: Aggregate State

Origins Laboratory

F-012207-01-R1
 Effective Date: 01/09/12

Sample Receipt Checklist

Origins Work Order: 1704166 Client: Quandary Cons.
 Client Project ID: Aggregate State
 Checklist Completed by: De Lu Shipped Via: HL
 (UPS, FedEx, Hand Delivered, Pick-up, etc.)
 Date/time completed: 4-13-12 1656 Airbill #: NA
 Matrix(s) Received: (Check all that apply): Soil/Solid Water Other:
 (Describe)
 Cooler Number/Temperature: 1 / 34 °C 1 °C 1 °C 1 °C
 Thermometer ID: 103

Requirement Description	Yes	No	N/A	Comments (if any)
If samples require cooling, was the temperature between 0°C to ≤ 6°C ⁽¹⁾ ?	<input checked="" type="checkbox"/>			
Is there ice present (document if blue ice is used)	<input checked="" type="checkbox"/>			
Are custody seals present on cooler? (if so, document in comments if they are signed and dated, broken or intact)		<input checked="" type="checkbox"/>		
Are custody seals present on each sample container? (if so, document in comments if they are signed and dated, broken or intact)		<input checked="" type="checkbox"/>		
Were all samples received intact ⁽¹⁾ ?	<input checked="" type="checkbox"/>			
Was adequate sample volume provided ⁽¹⁾ ?	<input checked="" type="checkbox"/>			
Are short holding time analytes or samples with HTs due within 48 hours present ⁽¹⁾ ?	<input checked="" type="checkbox"/>			<u>pH, Arsenic</u>
Is a chain-of-custody (COC) present and filled out completely ⁽¹⁾ ?	<input checked="" type="checkbox"/>			
Does the COC agree with the number and type of sample bottles received ⁽¹⁾ ?	<input checked="" type="checkbox"/>			
Do the sample IDs on the bottle labels match the COC ⁽¹⁾ ?	<input checked="" type="checkbox"/>			
Is the COC properly relinquished by the client with date and time recorded ⁽¹⁾ ?	<input checked="" type="checkbox"/>			
For volatiles in water – is there headspace (> ¼ inch bubble) present? If yes, contact client and note in narrative.		<input checked="" type="checkbox"/>		
Are samples preserved that require preservation and was it checked ⁽¹⁾ ? (note ID of confirmation instrument used in comments) / (preservation is not confirmed for subcontracted analyses in order to insure sample integrity)/(pH <2 for samples preserved with HNO ₃ , HCL, H ₂ SO ₄) / (pH >10 for samples preserved with NaAsO ₂ +NaOH, ZnAc+NaOH)		<input checked="" type="checkbox"/>		
Additional Comments (if any):				

⁽¹⁾If NO, then contact the client before proceeding with analysis and note date/time and person contacted as well as the corrective action to in the additional comments (above) and the case narrative.

Reviewed by (Project Manager) [Signature]

Date/Time Reviewed 4/14/12

Origins Laboratory, Inc.

Jefe Pellegrini

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Quandary Consultants
 2252 Emerson St.
 Denver CO 80205

Asher Weinberg
 Project Number: APC002
 Project: Aggregate State

MW02
4/13/2017 11:15:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
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GEL Laboratories, LLC
Y704160-01 (Water)

Alkalinity by SM 2320B

Alkalinity, Total as CaCO3	270	4.00	mg/L	1	1656970		04/18/2017	
Bicarbonate alkalinity (CaCO3)	270	4.00	"	"	"	"	"	
Carbonate alkalinity (CaCO3)	ND	4.00	"	"	"	"	"	U

Anions by EPA 300.0

Bromide	8.77	2.00	mg/L	10	1656288	"	04/14/2017	
Chloride	2260	100	"	500	"	"	"	
Fluoride	ND	1.00	"	10	"	"	"	U
Nitrate	13.5	1.00	"	"	"	"	"	
Nitrite	2.17	1.00	"	"	"	"	"	
Sulfate	5540	200	"	500	"	"	"	

BTEX by EPA 8260C

Benzene	ND	1.00	ug/L	1	B7D1803	04/18/2017	04/19/2017	Ua
Toluene	ND	1.00	"	"	"	"	"	Ua
Ethylbenzene	ND	1.00	"	"	"	"	"	Ua
Xylenes, total	ND	1.00	"	"	"	"	"	Ua

Surrogate: 1,2-Dichloroethane-d4	108 %	84-121			"	"	"	
Surrogate: Toluene-d8	93.5 %	85-115			"	"	"	
Surrogate: 4-Bromofluorobenzene	88.4 %	84-114			"	"	"	

Origins Laboratory, Inc.



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Quandary Consultants
 2252 Emerson St.
 Denver CO 80205

Asher Weinberg
 Project Number: APC002
 Project: Aggregate State

MW02
4/13/2017 11:15:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
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GEL Laboratories, LLC
Y704160-01 (Water)

Dissolved Metals by 6020A

Barium-Dissolved	0.0467	0.01	mg/L	5	1656491	04/17/2017	04/18/2017	
Boron-Dissolved	0.157	0.075	"	"	"	"	"	
Calcium-Dissolved	529	20.0	"	100	"	"	"	
Iron-Dissolved	ND	0.5	"	5	"	"	"	U
Magnesium-Dissolved	284	3.0	"	100	"	"	"	
Manganese-Dissolved	0.318	0.025	"	5	"	"	04/20/2017	
Potassium-Dissolved	20.5	1.5	"	"	"	"	04/18/2017	
Selenium-Dissolved	0.267	0.025	"	"	"	"	"	
Sodium-Dissolved	3320	25	"	100	"	"	"	
Strontium-Dissolved	12.9	1.0	"	"	"	"	"	

GRO (TVPH)/DRO (TEPH)by EPA 8015C

Gasoline (C6-C10)	ND	2.50	mg/L	1	B7D2506	04/25/2017	04/25/2017	Ua
Diesel (C10-C28)	ND	2.50	"	"	"	"	"	Ua

Surrogate: o-Terphenyl 81.1 % 54-117 " " "

Nitrate/Nitrite by EPA 353.2

Nitrogen, Nitrate/Nitrite	16.1	1.00	mg/L	50	1657335		04/20/2017	
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pH in Water by EPA 9040C

pH	7.04		pH Units	1	B7D1906	04/19/2017	04/19/2017	
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Origins Laboratory, Inc.



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Quandary Consultants
2252 Emerson St.
Denver CO 80205

Asher Weinberg
Project Number: APC002
Project: Aggregate State

MW02
4/13/2017 11:15:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
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Origins Laboratory, Inc.
Y704160-01 (Water)

Specific Conductance by Modified 9050A

Specific Conductance (EC)	15000	10.0	uS/cm	"	B7D1907	04/19/2017	04/19/2017
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TDS by SM2540C

Total Dissolved Solids	12200	14.3	mg/L	1	1656615		04/19/2017
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Total Phosphorus by EPA 365.4

Phosphorus, Total as P	0.217	0.050	mg/L	1	1655331	04/17/2017	04/18/2017
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Origins Laboratory, Inc.



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Quandary Consultants
 2252 Emerson St.
 Denver CO 80205

Asher Weinberg
 Project Number: APC002
 Project: Aggregate State

MW03
4/13/2017 12:13:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
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GEL Laboratories, LLC
Y704160-02 (Water)

Alkalinity by SM 2320B

Alkalinity, Total as CaCO ₃	528	4.00	mg/L	1	1656970		04/18/2017	
Bicarbonate alkalinity (CaCO ₃)	528	4.00	"	"	"	"	"	
Carbonate alkalinity (CaCO ₃)	ND	4.00	"	"	"	"	"	U

Anions by EPA 300.0

Bromide	ND	2.00	mg/L	10	1656288	"	04/14/2017	U
Chloride	448	20.0	"	100	"	"	"	
Fluoride	ND	1.00	"	10	"	"	"	U
Nitrate	1.19	1.00	"	"	"	"	"	
Nitrite	ND	1.00	"	"	"	"	"	U
Sulfate	4080	200	"	500	"	"	"	

BTEX by EPA 8260C

Benzene	ND	1.00	ug/L	1	B7D1803	04/18/2017	04/19/2017	Ua
Toluene	ND	1.00	"	"	"	"	"	Ua
Ethylbenzene	ND	1.00	"	"	"	"	"	Ua
Xylenes, total	ND	1.00	"	"	"	"	"	Ua

Surrogate: 1,2-Dichloroethane-d4	102 %	84-121			"	"	"	
Surrogate: Toluene-d8	96.4 %	85-115			"	"	"	
Surrogate: 4-Bromofluorobenzene	91.3 %	84-114			"	"	"	

Origins Laboratory, Inc.



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Quandary Consultants
 2252 Emerson St.
 Denver CO 80205

Asher Weinberg
 Project Number: APC002
 Project: Aggregate State

MW03
4/13/2017 12:13:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
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GEL Laboratories, LLC
Y704160-02 (Water)

Dissolved Metals by 6020A

Barium-Dissolved	0.0179	0.01	mg/L	5	1656491	04/17/2017	04/19/2017	
Boron-Dissolved	0.4	0.15	"	10	"	"	04/18/2017	
Calcium-Dissolved	283	20.0	"	100	"	"	04/19/2017	
Iron-Dissolved	ND	0.5	"	5	"	"	"	U
Magnesium-Dissolved	136	0.15	"	"	"	"	"	
Manganese-Dissolved	0.528	0.05	"	10	"	"	04/20/2017	
Potassium-Dissolved	13.9	1.5	"	5	"	"	04/19/2017	
Selenium-Dissolved	0.0317	0.025	"	"	"	"	"	
Sodium-Dissolved	1720	25.0	"	100	"	"	"	
Strontium-Dissolved	6.91	0.05	"	5	"	"	"	

GRO (TVPH)/DRO (TEPH)by EPA 8015C

Gasoline (C6-C10)	ND	2.50	mg/L	1	B7D2506	04/25/2017	04/25/2017	Ua
Diesel (C10-C28)	ND	2.50	"	"	"	"	"	Ua

Surrogate: o-Terphenyl 111 % 54-117 " " "

Nitrate/Nitrite by EPA 353.2

Nitrogen, Nitrate/Nitrite	1.08	0.100	mg/L	5	1657335		04/20/2017	
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pH in Water by EPA 9040C

pH	6.98		pH Units	1	B7D1906	04/19/2017	04/19/2017	
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Asher Weinberg
Project Number: APC002
Project: Aggregate State

MW03
4/13/2017 12:13:00PM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Notes
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Origins Laboratory, Inc.
Y704160-02 (Water)

Specific Conductance by Modified 9050A

Specific Conductance (EC)	8580	10.0	uS/cm	"	B7D1907	04/19/2017	04/19/2017
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TDS by SM2540C

Total Dissolved Solids	6850	14.3	mg/L	1	1656615		04/19/2017
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Total Phosphorus by EPA 365.4

Phosphorus, Total as P	1.08	0.050	mg/L	1	1655331	04/17/2017	04/18/2017
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Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch B7D1803 - EPA 5030B (Water)

Blank (B7D1803-BLK1)

Prepared: 04/18/2017 Analyzed: 04/18/2017

Benzene	ND	1.00	ug/L							Ua
Toluene	ND	1.00	"							Ua
Ethylbenzene	ND	1.00	"							Ua
Xylenes, total	ND	1.00	"							Ua
<i>Surrogate: 1,2-Dichloroethane-d4</i>	66		"	62.5		105	84-121			
<i>Surrogate: Toluene-d8</i>	63		"	62.5		100	85-115			
<i>Surrogate: 4-Bromofluorobenzene</i>	62		"	62.5		99.1	84-114			

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Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch B7D1803 - EPA 5030B (Water)

LCS (B7D1803-BS1)

Prepared: 04/18/2017 Analyzed: 04/18/2017

Benzene	50.9	1.00	ug/L	50.0		102	73.3-129			
Toluene	51.9	1.00	"	50.0		104	76.2-123			
Ethylbenzene	52.1	1.00	"	50.0		104	73.6-130			
m,p-Xylene	106	2.00	"	100		106	76.1-126			
o-Xylene	52.6	1.00	"	50.0		105	76.6-124			
Surrogate: 1,2-Dichloroethane-d4	61		"	62.5		98.1	84-121			
Surrogate: Toluene-d8	63		"	62.5		101	85-115			
Surrogate: 4-Bromofluorobenzene	63		"	62.5		101	84-114			

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Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch B7D1803 - EPA 5030B (Water)

Matrix Spike (B7D1803-MS1)	Source: Y704145-01			Prepared: 04/18/2017 Analyzed: 04/18/2017						
Benzene	52.4	1.00	ug/L	50.0	ND	105	74-130			
Toluene	55.5	1.00	"	50.0	ND	111	73-131			
Ethylbenzene	54.1	1.00	"	50.0	ND	108	76-132			
m,p-Xylene	108	2.00	"	100	ND	108	69-139			
o-Xylene	55.5	1.00	"	50.0	ND	111	74-131			
Surrogate: 1,2-Dichloroethane-d4	63		"	62.5		101	84-121			
Surrogate: Toluene-d8	64		"	62.5		102	85-115			
Surrogate: 4-Bromofluorobenzene	64		"	62.5		102	84-114			

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Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch B7D1803 - EPA 5030B (Water)

Matrix Spike Dup (B7D1803-MSD1)	Source: Y704145-01			Prepared: 04/18/2017 Analyzed: 04/18/2017						
Benzene	52.2	1.00	ug/L	50.0	ND	104	74-130	0.249	20	
Toluene	52.8	1.00	"	50.0	ND	106	73-131	4.88	20	
Ethylbenzene	54.2	1.00	"	50.0	ND	108	76-132	0.0554	20	
m,p-Xylene	109	2.00	"	100	ND	109	69-139	0.406	20	
o-Xylene	56.3	1.00	"	50.0	ND	113	74-131	1.47	20	
Surrogate: 1,2-Dichloroethane-d4	61		"	62.5		97.6	84-121			
Surrogate: Toluene-d8	62		"	62.5		100	85-115			
Surrogate: 4-Bromofluorobenzene	65		"	62.5		103	84-114			

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Volatile Organic Compounds by GC/MS SW846 8260C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Extractable Petroleum Hydrocarbons by 8015C - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch B7D2506 - EPA 3511 Mod.

Blank (B7D2506-BLK1)

Prepared: 04/25/2017 Analyzed: 04/25/2017

Gasoline (C6-C10)	ND	5.00	mg/L							Ua
Diesel (C10-C28)	ND	5.00	"							Ua
Surrogate: o-Terphenyl	5.0		"	5.00		99.4	54-117			

LCS (B7D2506-BS1)

Prepared: 04/25/2017 Analyzed: 04/25/2017

Gasoline (C6-C10)	93.6	5.00	mg/L	100		93.6	69-125			
Diesel (C10-C28)	102	5.00	"	100		102	61-120			
Surrogate: o-Terphenyl	4.4		"	5.00		88.3	54-117			

Matrix Spike (B7D2506-MS1)

Source: Y704251-01

Prepared: 04/25/2017 Analyzed: 04/25/2017

Gasoline (C6-C10)	76.9	5.00	mg/L	100	ND	76.9	70-127			
Diesel (C10-C28)	85.0	5.00	"	100	1.12	83.9	54-126			
Surrogate: o-Terphenyl	3.9		"	5.00		77.1	54-117			

Matrix Spike Dup (B7D2506-MSD1)

Source: Y704251-01

Prepared: 04/25/2017 Analyzed: 04/25/2017

Gasoline (C6-C10)	98.3	5.00	mg/L	100	ND	98.3	70-127	24.4	20	QR-02
Diesel (C10-C28)	108	5.00	"	100	1.12	107	54-126	24.1	20	QR-02
Surrogate: o-Terphenyl	5.1		"	5.00		101	54-117			

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Classical Chemistry Parameters - Quality Control
Origins Laboratory, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B7D1906 - NO PREP										
Duplicate (B7D1906-DUP1)		Source: Y704154-01			Prepared: 04/19/2017 Analyzed: 04/19/2017					
pH	7.45		pH Units		7.45			0.00	200	
Batch B7D1907 - NO PREP										
Blank (B7D1907-BLK1)		Prepared: 04/19/2017 Analyzed: 04/19/2017								
Specific Conductance (EC)	3.10	10.0	uS/cm							
Duplicate (B7D1907-DUP1)		Source: Y704159-01			Prepared: 04/19/2017 Analyzed: 04/19/2017					
Specific Conductance (EC)	11800	10.0	uS/cm		11800			0.00	10	

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 Project: Aggregate State

Alkalinity by SM 2320B - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1656970 -										
LCS (1203769846-BKS)					Prepared: Analyzed: 04/18/2017					
Alkalinity, Total as CaCO3	108	4.00	mg/L	100		108	90-110			
DUP (1203769847 D)					Source: 420080002 Prepared: Analyzed: 04/18/2017					
Bicarbonate alkalinity (CaCO3)	129	4.00	mg/L		128		0-20	0.778	20	
Alkalinity, Total as CaCO3	129	4.00	"		128		0-20	0.778	20	
Carbonate alkalinity (CaCO3)	ND	4.00	"		<1.45		0-20	0	20	U
MS (1203769848 S)					Source: 420080002 Prepared: Analyzed: 04/18/2017					
Alkalinity, Total as CaCO3	229	4.00	mg/L	100	128	101	80-120			

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 Project: Aggregate State

Anions by EPA 300.0 - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch 1656288 -

BLANK (1203768217-BLK)

Prepared: Analyzed: 04/14/2017

Chloride	ND	0.200	mg/L				-			U
Fluoride	ND	0.100	"				-			U
Nitrate	ND	0.100	"				-			U
Nitrite	ND	0.100	"				-			U
Bromide	ND	0.200	"				-			U
Sulfate	ND	0.400	"				-			U

LCS (1203768218-BKS)

Prepared: Analyzed: 04/14/2017

Bromide	1.31	0.200	mg/L	1.25		105	90-110			
Sulfate	9.45	0.400	"	10.0		94.5	90-110			
Nitrite	2.33	0.100	"	2.50		93.2	90-110			
Nitrate	2.30	0.100	"	2.50		92.1	90-110			
Chloride	4.52	0.200	"	5.00		90.3	90-110			
Fluoride	2.35	0.100	"	2.50		94	90-110			

DUP (1203768219 D)

Source: 420719001

Prepared: Analyzed: 04/14/2017

Sulfate	4990	200	mg/L		4990		0-20	0.116	20	
Bromide	4.68	2.00	"		4.70		0-20	0.448	20	
Nitrate	2.79	1.00	"		2.76		0-20	0.937	20	
Nitrite	1.59	1.00	"		1.60		0-20	0.689	20	
Fluoride	ND	1.00	"		0.597		0-20	0.841	20	U
Chloride	1450	100	"		1450		0-20	0.238	20	

PS (1203768220 S)

Source: 420719001

Prepared: Analyzed: 04/14/2017

Bromide	17.7	2.00	mg/L	1.25		104	90-110			
Chloride	4040	100	"	5.00		103	90-110			
Fluoride	24.4	1.00	"	2.50		95	90-110			

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Anions by EPA 300.0 - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
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Batch 1656288 -

PS (1203768220 S)

Source: 420719001

Prepared: Analyzed: 04/14/2017

Nitrate	26.6	1.00	mg/L	2.50	95.5	90-110				
Nitrite	25.9	1.00	"	2.50	97.4	90-110				
Sulfate	10300	200	"	10.0	107	90-110				

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Nitrate/Nitrite by EPA 353.2 - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1657335 -										
BLANK (1203770663-BLK)					Prepared: Analyzed: 04/20/2017					
Nitrogen, Nitrate/Nitrite	ND	0.050	mg/L				-			U
LCS (1203770664-BKS)					Prepared: Analyzed: 04/20/2017					
Nitrogen, Nitrate/Nitrite	0.999	0.050	mg/L	1.00		99.9	90-110			
DUP (1203770665 D)					Source: 420166003 Prepared: Analyzed: 04/20/2017					
Nitrogen, Nitrate/Nitrite	0.520	0.250	mg/L		0.545		0-20	4.69	20	
PS (1203770668 S)					Source: 420166003 Prepared: Analyzed: 04/20/2017					
Nitrogen, Nitrate/Nitrite	5.55	0.250	mg/L	1.00		100	90-110			

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TDS by SM2540C - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1656615 -										
BLANK (1203769058-BLK)					Prepared: Analyzed: 04/19/2017					
Total Dissolved Solids	ND	14.3	mg/L				-			U
LCS (1203769059-BKS)					Prepared: Analyzed: 04/19/2017					
Total Dissolved Solids	297	14.3	mg/L	300		99	95-105			
DUP (1203769061 D)					Source: 420675003 Prepared: Analyzed: 04/19/2017					
Total Dissolved Solids	150	14.3	mg/L		157		0-5	4.65		5

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Total Phosphorus by EPA 365.4 - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1655331 - EPA 365.4 Prep										
DUP (1203766779 D)		Source: 420408001			Prepared: 04/17/2017 Analyzed: 04/18/2017					
Phosphorus, Total as P	ND	0.050	mg/L		0.034		0-27		27	U
MS (1203766780 S)		Source: 420408001			Prepared: 04/17/2017 Analyzed: 04/18/2017					
Phosphorus, Total as P	0.982	0.050	mg/L	1.00	0.034	94.8	63-139			

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Notes and Definitions

Ua Sample is Non-Detect.

U Result not detected above the detection limit

QR-02 The RPD result exceeded the QC control limits; however, both percent recoveries were acceptable. Sample results for the QC batch were accepted based on percent recoveries and completeness of QC data.

ND Analyte NOT DETECTED at or above the reporting limit

RPD Relative Percent Difference

All soil results are reported at a wet weight basis.

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Jen Pellegrini For Noelle Doyle Mathis, President