Pumping Test and Sampling of Headwaters Groundwater Conservation District

Monitor Well 15

Kerr County, Texas

LBG-Guyton Associates

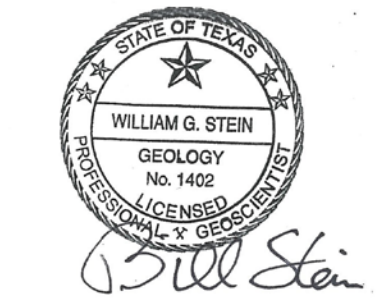
Professional Groundwater and Environmental Engineering Services

A Division of Leggette, Brashears & Graham, Inc.

Pumping Test and Sampling of
Headwaters Groundwater Conservation District
Monitor Well 15
Kerr County, Texas

Prepared For

Mr. Gene Williams
General Manager
Headwaters Groundwater Conservation District



May 17, 2016

LBG-GUYTON ASSOCIATES
Professional Groundwater and Environmental Services
12702 Toepperwein Road, Suite 212
San Antonio, Texas 78233

INTRODUCTION

Mr. Gene William, General Manager of the Headwaters Groundwater Conservation District, asked LBG-Guyton Associates to perform a pumping test and retrieve a water sample from a newly constructed Monitor Well 15 located in the central portion of Kerr County approximately 6 miles south-southwest of Hunt, Texas (Figure 1). The well was constructed in March 2016 by Aqua Tech Drilling Inc. of Pipe Creek, Texas. The Driller's Report is included in Appendix 1.

The latitude and longitude for the monitor well are listed in the following table, along with surface elevations:

Well	**Latitude**	**Longitude**	**Approximate Surface Elevation** (feet above MSL)	**Water-Level Depth** (feet below land surface)
Monitor Well 15	30º 00' 34.05"	99º 22' 49.63"	1867	335.5

The approximate surface elevations, latitude and longitude were taken from Google Earth.

PUMPING TEST ANALYSES

General Information on Pumping Tests

When a well is pumped and water is withdrawn from an aquifer, water levels in the vicinity are drawn down to form an inverted cone with its apex located at the pumping well. This is referred to as a cone of depression. Groundwater flows from higher water levels to lower water levels and, therefore, in the case of a pumping well, toward the well or the center of the cone of depression. The shape and size of the cone is directly related to the aquifer parameters.

Various hydrologic parameters are required to make a quantitative evaluation of an aquifer. The primary aquifer characteristics of concern are transmissivity (T), which is an index of the aquifer's ability to transmit water measured in gallons per day per foot (gpd/ft), and its storage coefficient (unitless), which is an index of the amount of water released from or taken

into storage as water levels change. Hydraulic conductivity can be calculated by dividing the calculated T by the aquifer thickness; the unit of measurement is gallons per day per foot squared (gpd/ft^2). Important measurements made during a pumping test are well discharge and water-level decline versus time.

One of the basic assumptions in determining these parameters from pumping-test data is that flow takes place through a homogeneous medium having the same properties in all directions. In properly applying the results, however, one must be mindful of their limitations and take into consideration the physical characteristics of the aquifer, which are usually not the same in all directions.

Monitor Well 15 Pumping Test

Aquatech Drilling installed a 30-horsepower, Grundfos submersible pump at a depth of about 600 feet in Monitor Well 15 with the bottom of the pump at the top of the lap section in the well. A trailer-mounted generator was used to supply energy to the pump. A totalizing water meter was installed in the discharge line to observe flow rate and total number of gallons discharged during testing.

LBG-Guyton Associates installed an In-Situ Level Troll transducer in the well just above the pump prior to testing. The transducer is rated for 100 pounds per square inch (psi) (2.31 feet/psi x 100 psi = 231 feet) and records water pressure, which is converted to feet of water above the probe. These data are then converted to depth of water from land surface by comparing the transducer readings to measurements made with a calibrated electrical tape. The transducer recorded water levels during pumping and recovery of the well. Data from the pumping test were analyzed using the Cooper-Jacob method. This method is described in detail in a number of hydrology textbooks, including Freeze and Cherry (1979) and Driscoll (1986).

Hydrographs of the water levels measured in Monitor Well 15 are shown in Figures 2. The results are graphed on a semi-log scale and calculations are shown in Figures 3. The following table lists the pumping rate and summarizes the results calculated from the pumping tests:

Date Pumping Test Started	**Average Pumping Rate** (gpm)	**Draw-down** (feet)	**Specific Capacity** (gpm/ft)	**Transmissivity** (gpd/ft)
3/30/16	164	79.4	2.1	2,730

WATER QUALITY ANALYSES

All groundwater contains minerals that are dissolved and transported in solution. The types and concentrations of the minerals depend upon the history of the water, its source, movement and environment. Specifically, the dissolved solids depend upon the solubility of the minerals present in the rocks through which the water moves, the length of time the water is in contact with the rocks and the chemical activity of the water. In general, the concentration of dissolved minerals in groundwater increases with depth. This is especially true where circulation in the deeper sediments is restricted by low permeability. Restricted circulation retards the flushing action of water moving through the aquifer and causes the water to become more stagnant and highly mineralized. The Trinity Aquifer in Central Texas generally yield water that ranges from fresh, which is less than 1,000 milligrams per liter (mg/l) total dissolved solids (TDS), to slightly saline (1,000 to 3,000 mg/l TDS).

LBG-Guyton Associates collected a water sample from the well approximately 4 hours after the pumping test started. The following table lists the field parameters measured near the time of sampling.

Date	**Temperature** (ºC)	**Specific Conductivity** (µmhos)	**pH**
3/30/16	25.2	970	7.7

Even though this is a monitor well with the water not intended for public consumption, the Primary and Secondary Safe Drinking Water Standards mandated by the U. S. Environmental Protection Agency and the Texas Commission on Environmental Quality are listed below for comparison. Primary Standards are concerned with dissolved constituents that are known to

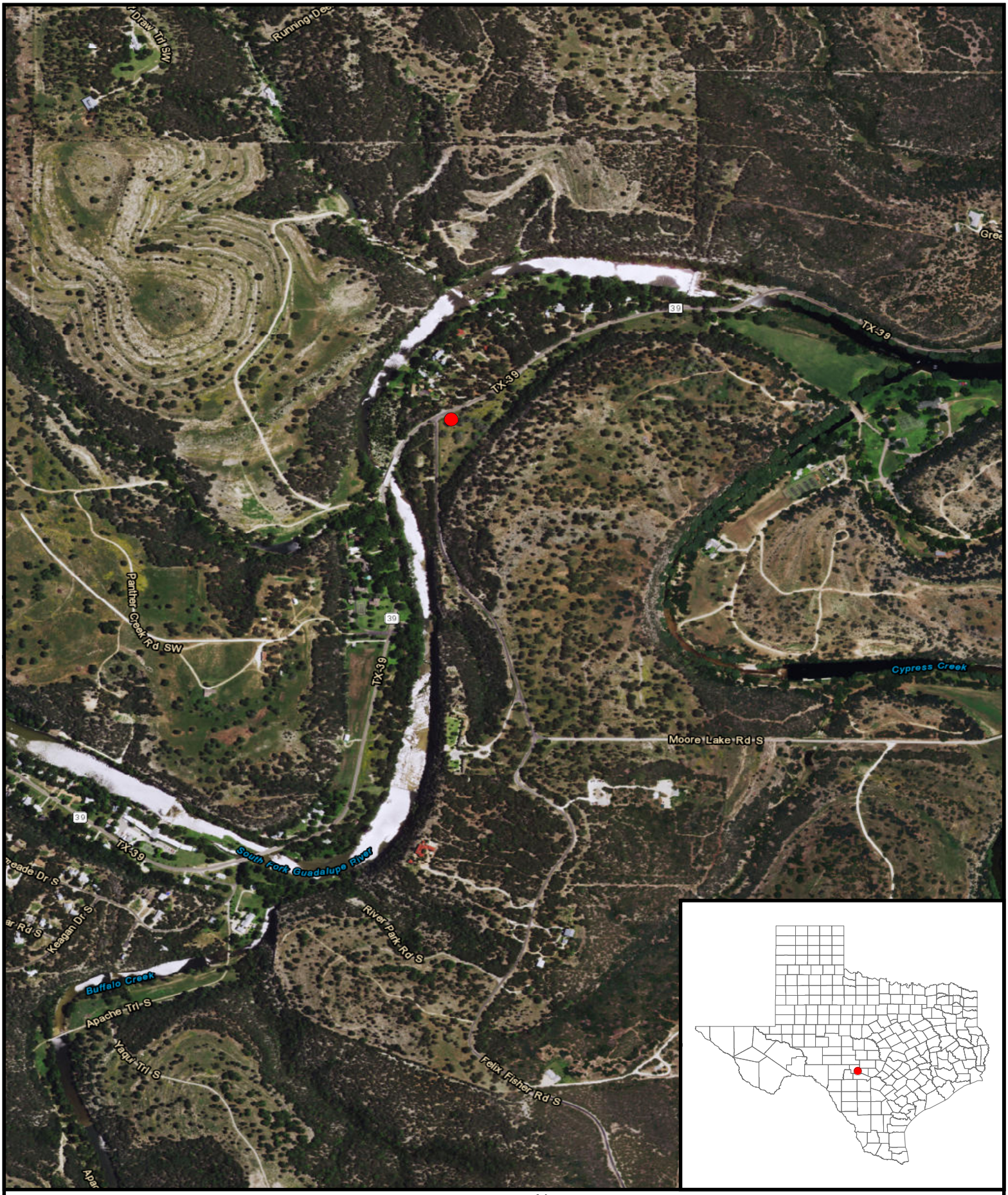
have adverse effects on human health. Secondary Standards are concerned with aesthetic qualities of drinking water (e.g., taste and odor).

The samples were analyzed for metals (calcium, iron, magnesium, potassium and sodium), minor metals (aluminum, arsenic, copper, manganese, and zinc), anions (chloride, fluoride, nitrate and nitrite as N, sulfate and bicarbonate alkalinity as $CaCO_3$), total dissolved solids and radionuclide. The Pollution Control Services in San Antonio, Texas performed the analyses. The laboratory reports for these analyses are provided in Appendix 2. The results are summarized in the following tables listed with standards for public drinking water for comparison:

Primary Standards		**Well 15 (mg/l)**
Constituent		
Fluoride (mg/l)	4	**1.19**
Nitrate (mg/l as N)	10	**<0.2**
Nitrite (mg/l as N)	1	**<0.20**
Arsenic (mg/l)	0.05	**<0.0005**
Secondary Standards		
Constituent		
Aluminum (mg/l)	0.2	**0.134**
Chloride (mg/l)	300	**58**
Copper (mg/l)	1	**<0.005**
Fluoride (mg/l)	2	**1.19**
Iron (mg/l)	0.3	**0.378**
Manganese (mg/l)	0.05	**<0.010**
Sulfate (mg/l)	300	**58**
Zinc (mg/l)	5.0	**0.085**
Dissolved Solids (mg/l)	1,000	**468**

Radionuclide Primary Standards		
Constituents		
Gross alpha (pCi/l)	15	11.9 +/- 3.36
Radium-226/228 (pCi/l)	5	2.67+/- 0.964
Beta particle (pCi/l)	50	10.0 +/- 2.21
Uranium (µg/l)	30	3.87 +/- 0.071

FIGURES



LBG GUYTON

Legend

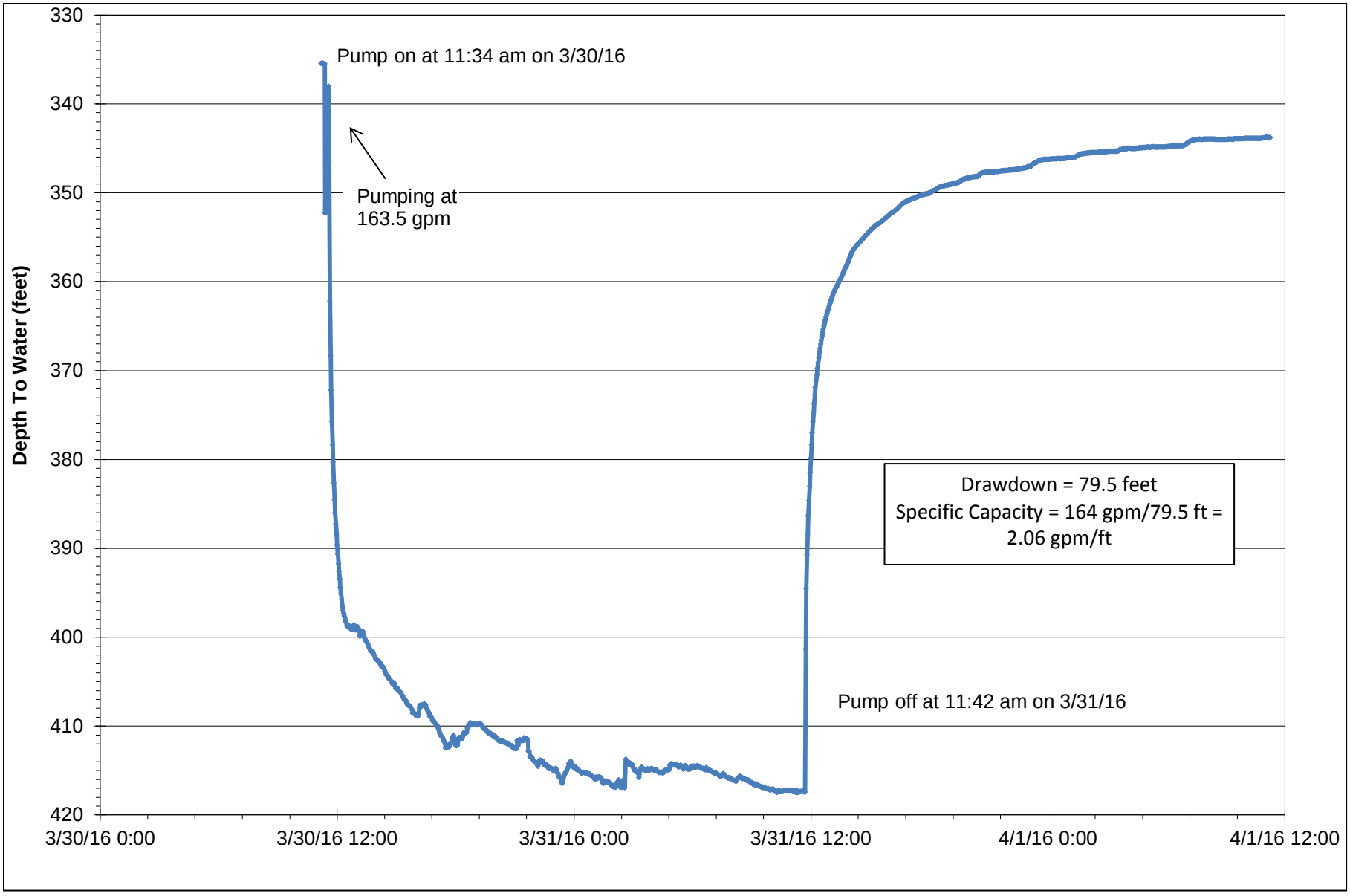
- Well Location

N

0 250 500 1,000 1,500 2,000

Feet

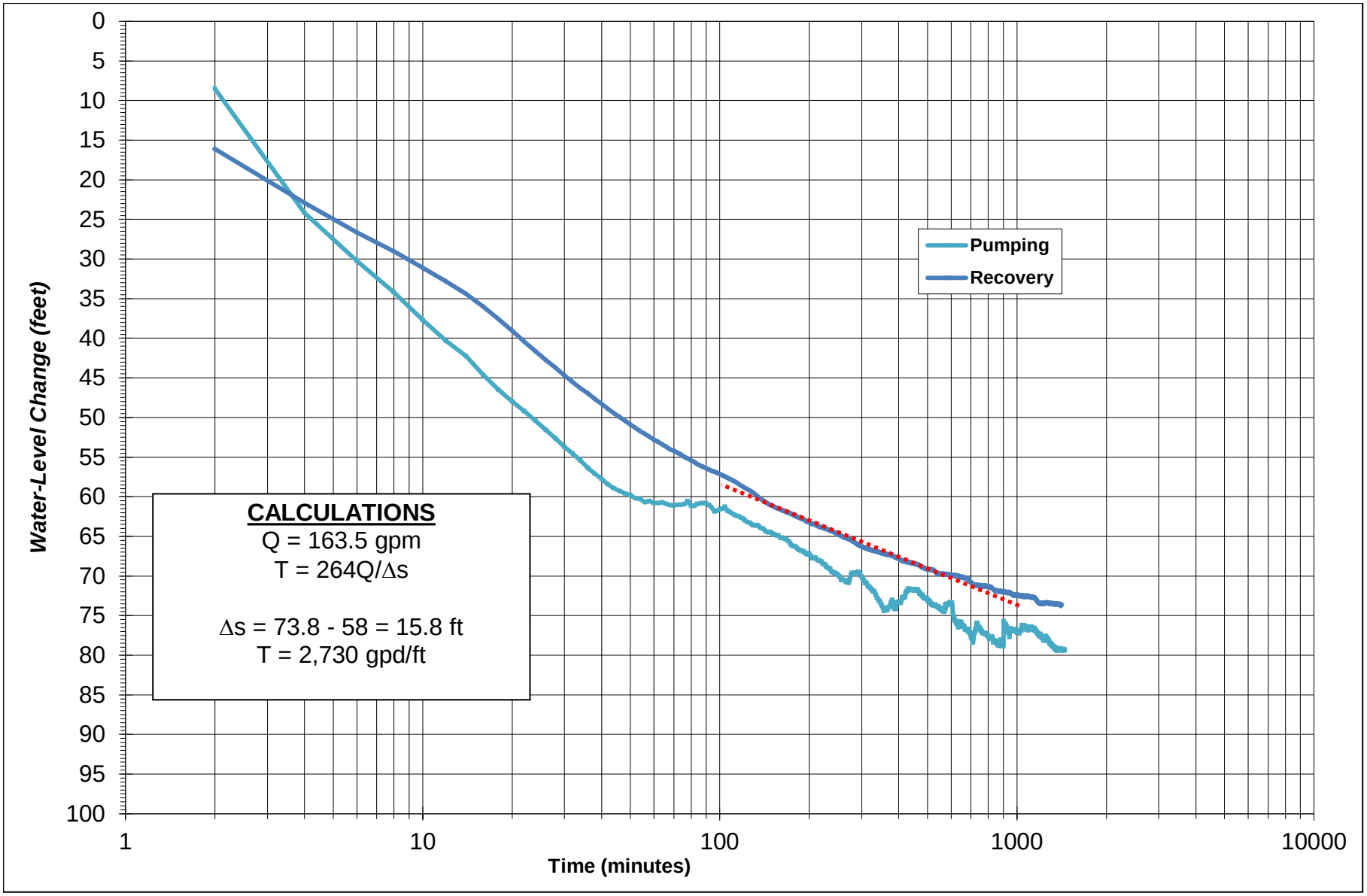
Figure 1
Well Location Map



HYDROGRAPH OF HEADWATERS
MONITOR WELL 15 PUMPING TEST

LBG-GUYTON ASSOCIATES

FIGURE 2



SEMI-LOG PLOT AND CALCULATIONS FOR HEADWATERS MONITOR WELL 15

LBG-GUYTON ASSOCIATES

FIGURE 3

APPENDIX 1 - DRILLER'S REPORTS

STATE OF TEXAS WELL REPORT for Tracking #422259

Owner:	**Headwaters Grounwater Cons. Dist.**	Owner Well #:	**Monitor #15**
Address:	**125 Lehmann Dr., Ste. 201 Kerrville, TX 78028**	Grid #:	**56-61-9**
		Latitude:	**30° 00' 33.5" N**
Well Location:	**Hwy 39 west of Hunt to intersection of Fisher Rd. Well on private property 105.54 ac. tract Hunt, TX 78024**	Longitude:	**099° 22' 49.3" W**
		Elevation:	**1868 ft. above sea level**
Well County:	**Kerr**		
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **7/15/2015** Drilling End Date: **2/17/2016**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
18	**0**	**40**
12.75	**40**	**610**
7.875	**610**	**980**

Drilling Method: **Air Rotary**

Borehole Completion: **Open Hole**

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	**2**	**Cement 5 Bags/Sacks**
2	**610**	**Bentonite 71 Bags/Sacks**

Seal Method: **Pressure**

Sealed By: **Driller**

Distance to Property Line (ft.): **60**

Distance to Septic Field or other concentrated contamination (ft.): **N/A**

Distance to Septic Tank (ft.): **N/A**

Method of Verification: **Steel tape**

Surface Completion: **Surface Slab Installed** **Surface Completion by Driller**

Water Level: **347 ft.** below land surface on **2015-07-24** Measurement Method: **Electric Line**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **Estimated** **Yield: 300 GPM**

Plug Information:

Description (number of sacks & material)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
Bentonite	**880**	**980**

	Strata Depth (ft.)	Water Type
Water Quality:	600 - 880	Lower Trinity

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **Aquatech Drilling, Inc.**
P.O. Box 3340
Bandera, TX 78003

Driller Name: **Reed Scruby** License Number: **54402**

Apprentice Name: **Jesse Stoufflet**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	26	Cream shale & conglomorate quaternary
26	402	Light gray silty sandstone & marl top of Hensell
402	480	Light gray sandstone & shale
480	490	Light gray shale
490	562	White-Light gray limestone
562	570	Clay - orange=red silt sandstone & sand top of Hosston
570	620	Orange-red silty sandstone & san - top of Hosston
620	680	Orange loose coarse sand
680	700	Orange-red silty paleosol - levee
700	880	Gravel and sand
880	980	Gray Pennsylvanian shale

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
14	Blank	New Plastic (PVC)	SDR21	0	40
8.625	Blank	New Steel	220 Wall	2	610
6.625	Blank	New Steel	220 Wall	610	810

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 463-7880

Well Log

Strata Geological Services, Inc.

Tarpley, Texas

830-562-3680

Strata Geological Services

Well HEADWATERS MW-15 CAMP MYSTIC

Location AQUATECH

Geologist WM FEATHERGAIL WILSON PG 21

Driller AQUATEC

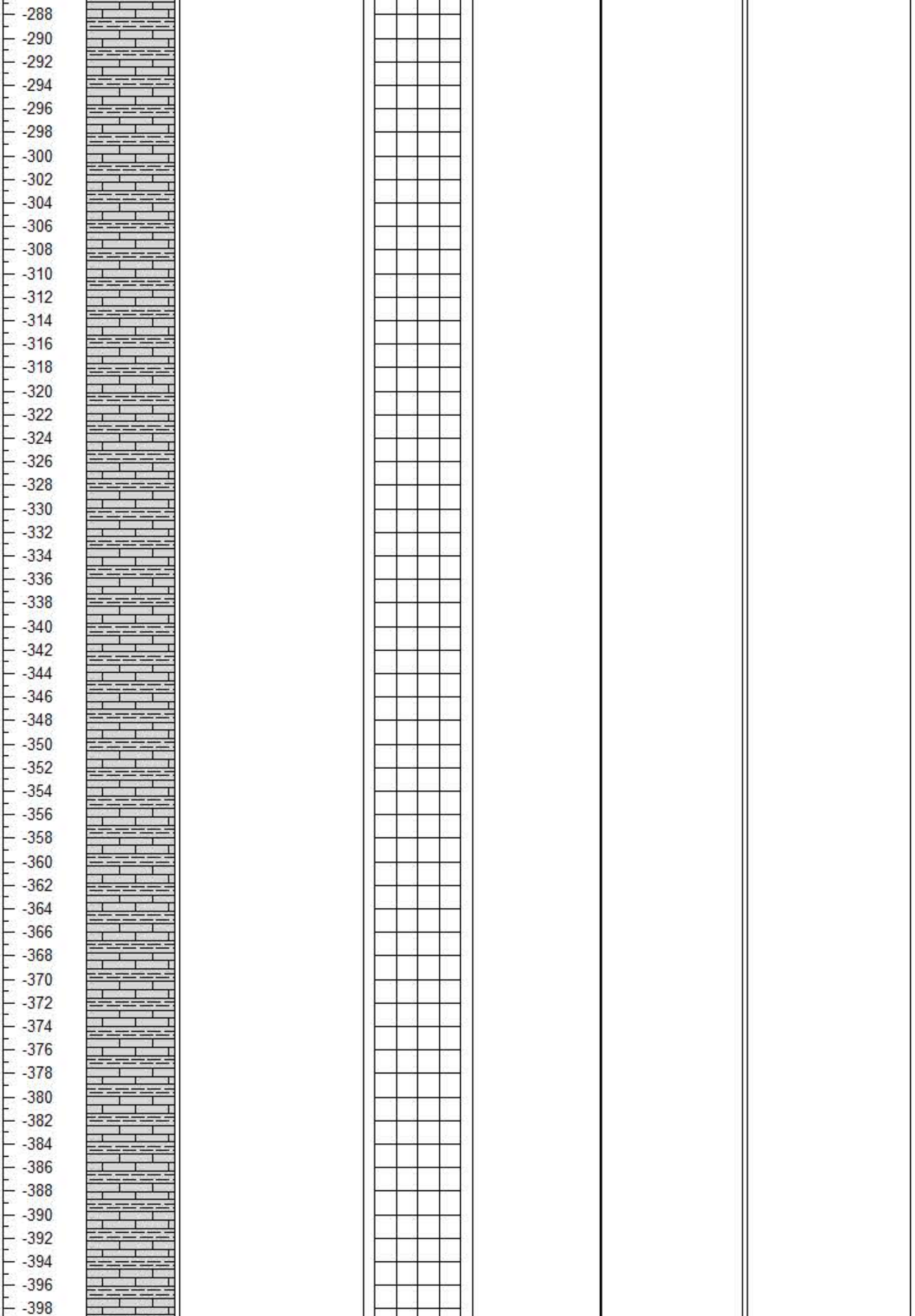
Rig Type AIR ROTARY

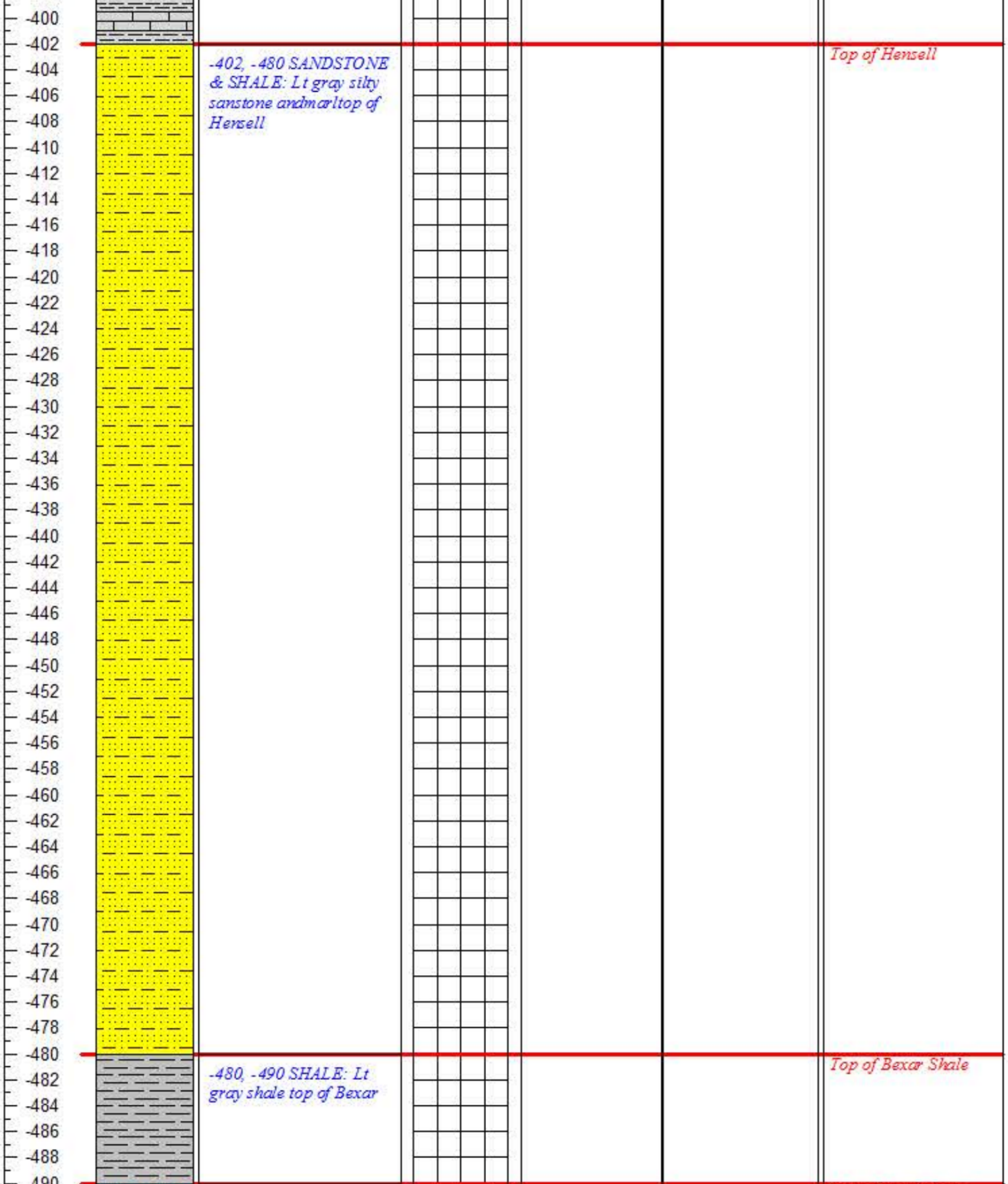
Total Depth 980'

Depth	Water	Lithology	Description	Eff. Porosity (0 10 20)	Well Construction	Micro-graphs	Comments
0			0, -26 CONGLOMERATE: Cream shale and conglomorate Quaternary				Quaternary at surface
-26			-26, -402 INTERBEDDED MARL & LIMESTONE: Lt gray silty sanstone andmarl top of Hensell				Top of Glen Rose undifferentiated; 17" hole to 40' set 14" PVC to 40' -- 12" hole to 610' set 8 5/8" steel casing to 610'

-72
-74
-76
-78
-80
-82
-84
-86
-88
-90
-92
-94
-96
-98
-100
-102
-104
-106
-108
-110
-112
-114
-116
-118
-120
-122
-124
-126
-128
-130
-132
-134
-136
-138
-140
-142
-144
-146
-148
-150
-152
-154
-156
-158
-160
-162
-164
-166
-168
-170
-172
-174
-176
-178

-180
-182
-184
-186
-188
-190
-192
-194
-196
-198
-200
-202
-204
-206
-208
-210
-212
-214
-216
-218
-220
-222
-224
-226
-228
-230
-232
-234
-236
-238
-240
-242
-244
-246
-248
-250
-252
-254
-256
-258
-260
-262
-264
-266
-268
-270
-272
-274
-276
-278
-280
-282
-284
-286


-288
-290
-292
-294
-296
-298
-300
-302
-304
-306
-308
-310
-312
-314
-316
-318
-320
-322
-324
-326
-328
-330
-332
-334
-336
-338
-340
-342
-344
-346
-348
-350
-352
-354
-356
-358
-360
-362
-364
-366
-368
-370
-372
-374
-376
-378
-380
-382
-384
-386
-388
-390
-392
-394
-396
-398


-400
-402
-404
-406
-408
-410
-412
-414
-416
-418
-420
-422
-424
-426
-428
-430
-432
-434
-436
-438
-440
-442
-444
-446
-448
-450
-452
-454
-456
-458
-460
-462
-464
-466
-468
-470
-472
-474
-476
-478
-480
-482
-484
-486
-488
-490
-402, -480 SANDSTONE & SHALE: Lt gray silty sanstone andmarltop of Hensell
Top of Hensell
-480, -490 SHALE: Lt gray shale top of Bexar
Top of Bexar Shale

-490
-492
-494
-496
-498
-500
-502
-504
-506
-508
-510
-512
-514
-516
-518
-520
-522
-524
-526
-528
-530
-532
-534
-536
-538
-540
-542
-544
-546
-548
-550
-552
-554
-556
-558
-560
-562
-564
-566
-568
-570
-572
-574
-576
-578
-580
-582
-584
-586
-588
-590
-592
-594
-596

Top of Cow Creek

-490, -562 LIMESTONE: White-lt gray biosparite and biomicrite with micodolomite top of Cow Creek

To of Hammett Clay

-562, -570 CLAY: Orange-red silty sandstone and sand top of Hosston

Top of Hosston

-570, -620 SANDSTONE & SAND: Orange-red silty sandstone and sand top of Hosston

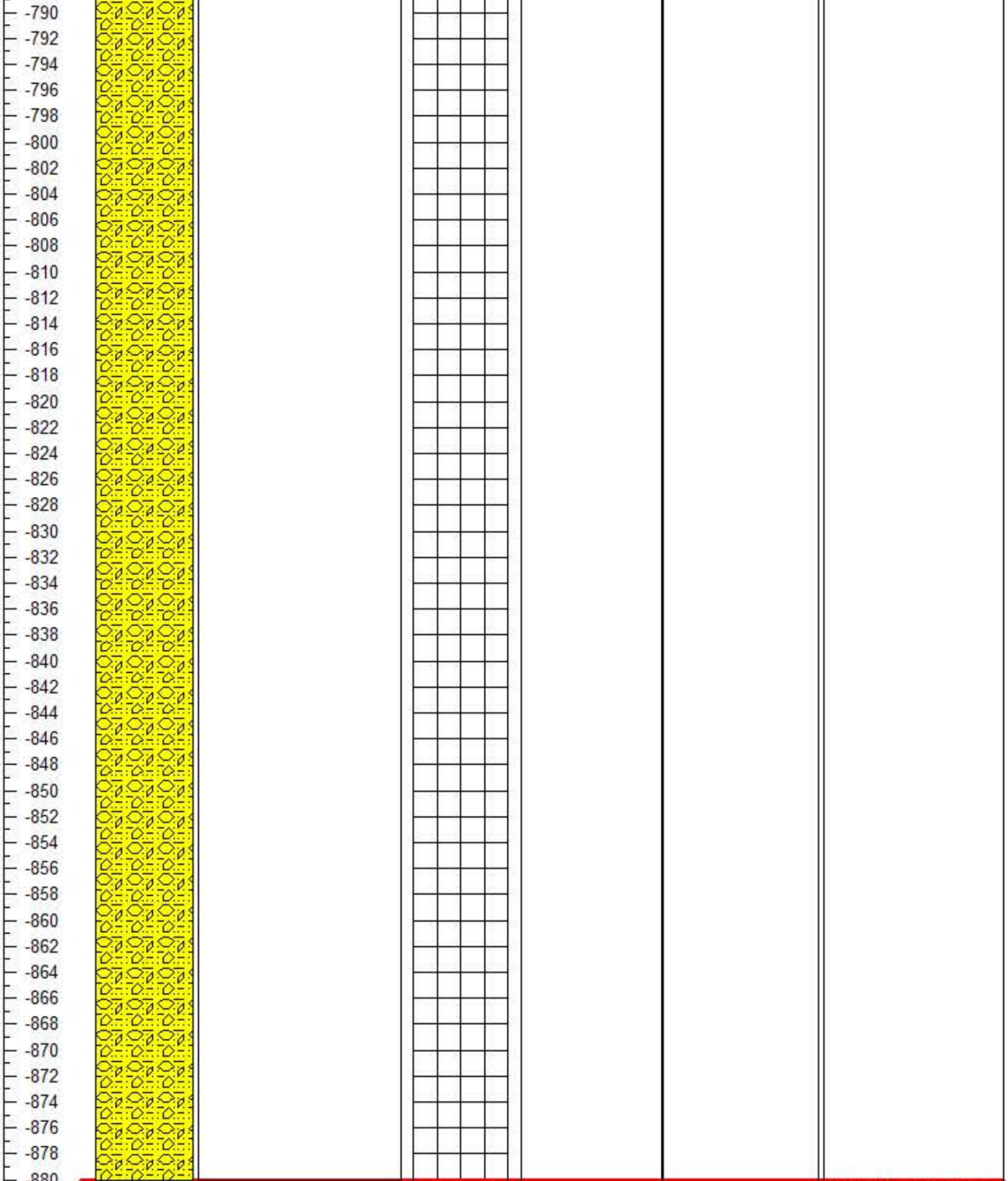
-598
-600
-602
-604
-606
-608
-610
-612
-614
-616
-618
-620
-622
-624
-626
-628
-630
-632
-634
-636
-638
-640
-642
-644
-646
-648
-650
-652
-654
-656
-658
-660
-662
-664
-666
-668
-670
-672
-674
-676
-678
-680
-682
-684
-686
-688
-690
-692
-694
-696

-620, -680 SAND: Orange loose coarse grained well rounded poorly sorted sand - reworke Hickory

-680, -700 PALEOSOL: Orange-red silty paleosol - levee

-698
-700
-702
-704
-706
-708
-710
-712
-714
-716
-718
-720
-722
-724
-726
-728
-730
-732
-734
-736
-738
-740
-742
-744
-746
-748
-750
-752
-754
-756
-758
-760
-762
-764
-766
-768
-770
-772
-774
-776
-778
-780
-782
-784
-786
-788

-700, -880 GRAVEL AND SAND: Orange and white loose sand and gravel


-790
-792
-794
-796
-798
-800
-802
-804
-806
-808
-810
-812
-814
-816
-818
-820
-822
-824
-826
-828
-830
-832
-834
-836
-838
-840
-842
-844
-846
-848
-850
-852
-854
-856
-858
-860
-862
-864
-866
-868
-870
-872
-874
-876
-878
-880

-880

-882

-884

-886

-888

-890

-892

-894

-896

-898

-900

-902

-904

-906

-908

-910

-912

-914

-916

-918

-920

-922

-924

-926

-928

-930

-932

-934

-936

-938

-940

-942

-944

-946

-948

-950

-952

-954

-956

-958

-960

-962

-964

-966

-968

-970

-972

-974

-976

-978

-880, -980 SHALE: Gray Pennsylvanian shale

Top of Pennsylvanian

GEO CAM

Water Well Logging & Video Recording Services

Geo Cam , Inc. 17118 classen rd., San Antonio, TX 210-495-9121

Borehole: HEADWATER 15-MW

Logs: GAMMA, RESISITIVITY, SP, SPR

Project: HEADWATER 15-MW

Client: HEADWATERS GCD

Location: N30.0320 W99.2249

Date: 07-20-15

County: KERR

State: TX

Drilling Contractor: AQUA TECH

Elevation: 1870'

Depth Ref: G.L.

Driller T.D. (ft) : 610'

Logger T.D. (ft) :597'

Date Drilled: 07-20-15

BIT RECORD				CASING RECORD		
RUN	BIT SIZE (in)	FROM (ft)	TO (ft)	SIZE/WGT/THK	FROM (ft)	TO (ft)
1	8"	0'	610'	14" PVC	1.3'	40'
2	"	"	"	"	"	"
3	"	"	"	"	"	"

Drill Method: AIR

Hole Medium:

Viscosity:

Weight:

Mud Type:

Rm: at:

Fluid Level (ft) : G.L.

Time Since Circ:

Deg C

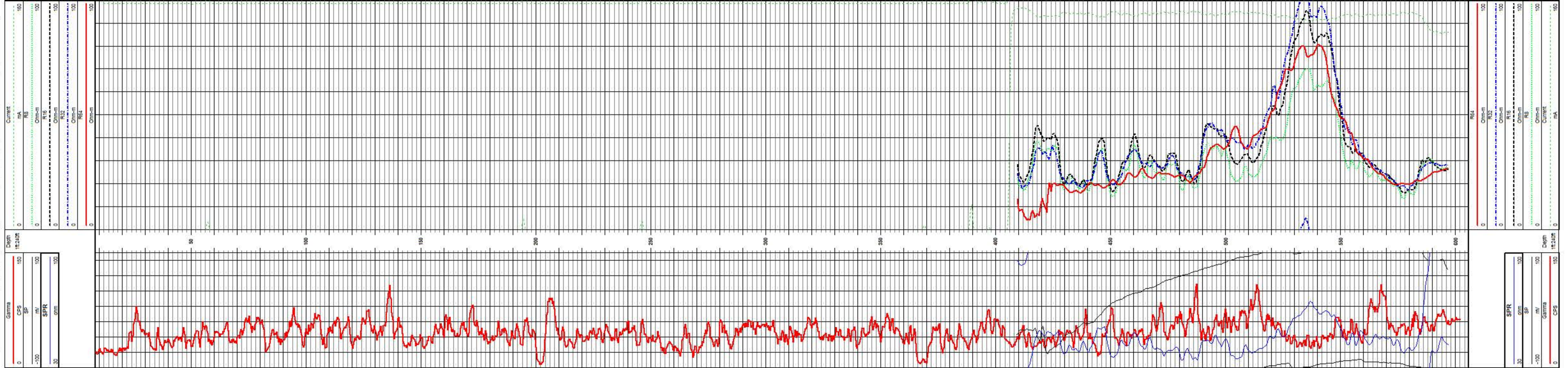
Logged By: ROBERT C. BECKNAL

Witness: W.F. WILSON

Unit/Truck: 06

LOG TYPE	RUN NO	SPEED (ft/min)	FROM (ft)	TO (ft)	FT./ IN.
GAMMA	1	30	602'	8'	20
RESISTIVITY,SP,SPR	1	30	597'	409'	20
"	"	"	"	"	"

Comments:



APPENDIX 2 - LABORATORY REPORT

POLLUTION CONTROL SERVICES

Report of Sample Analysis

Client Information	Sample Information	Laboratory Information
Landon Yosko LBG — Guyton Associates - SA 12702 Toepperwein Road, Suite 212 San Antonio, TX 78233	Project Name: Hunt Sample ID: Headwaters MW 15 Matrix: Drinking Water Date/Time Taken: 03/30/2016 1500	**PCS Sample #: 428125** **Page 1 of 4** Date/Time Received: 03/31/2016 07:00 Report Date: 04/14/2016 Approved by: Chuck Wallgren Chuck Wallgren, President

Test Description	Flag	Result	Units	RL	Analysis Date/Time	Method	Analyst
pH	!, I	7.2	S.U.	N/A	04/01/2016 10:45	SM 4500-H+ B	SH
Conductivity, Specific		856	umhos/cm	1	03/31/2016 11:50	SM 2510B	JAS
Total Dissolved Solids		468	mg/L	10	03/31/2016 14:49	SM 2540C	JAS
Nitrate-N		<0.2	mg/L	0.1	03/31/2016 10:35	EPA 300.0	GWF
Chloride		58	mg/L	1	03/31/2016 10:35	EPA 300.0	GWF
Sulfate		58	mg/L	1	03/31/2016 10:35	EPA 300.0	GWF
Nitrite-N		<0.20	mg/L	0.1	03/31/2016 10:35	EPA 300.0	GWF

Quality Assurance Summary

Test Description	Precision	Limit	LCL	MS	MSD	UCL	LCS	LCS Limit
pH	N/A	N/A	N/A			N/A		
Conductivity, Specific	N/A	N/A	N/A			N/A		
Total Dissolved Solids	6	10	N/A	N/A	N/A	N/A		
Nitrate-N	3	20	70	102	98	130	101	85 - 115
Chloride	<1	10	90	99	99	110	99	85 - 115
Sulfate	1	10	80	99	99	116	97	85 - 115
Nitrite-N	<1	10	82	104	104	109	100	85 - 115

Quality Statement: ***All supporting quality control data adhered to data quality objectives and test results meet the requirements of NELAC unless otherwise noted as flagged exceptions or in a case narrative attachment. Reports with full quality data deliverables are available on request. TCEQ Certificate No. T104704361-08-TX***

! *Not NELAP Certifiable Parameter*

I *Informational purposes only*

These analytical results relate only to the sample tested.
All data is reported on an "As Is" basis unless designated as "Dry Wt."
RL = Reporting Limits

QC Data Reported in %, Except BOD in mg/L

Web Site: www.pcslab.net
e-mail: chuck@pcslab.net
Toll Free 800-880-4616
1532 Universal City Blvd, Suite 100
Universal City, TX 78148-3318
210-340-0343
FAX # 210-658-7903

POLLUTION CONTROL SERVICES

Report of Sample Analysis

Client Information	Sample Information	Laboratory Information
Landon Yosko LBG — Guyton Associates - SA 12702 Toepperwein Road, Suite 212 San Antonio, TX 78233	Project Name: Hunt Sample ID: Headwaters MW 15 Matrix: Drinking Water Date/Time Taken: 03/30/2016 1500	**PCS Sample #: 428125** **Page 2 of 4** Date/Time Received: 03/31/2016 07:00 Report Date: 04/14/2016

Test Description	Flag	Result	Units	RL	Analysis Date/Time	Method	Analyst
Fluoride		1.19	mg/L	0.10	03/31/2016 10:35	EPA 300.0	GWF
Alkalinity, Bicarbonate	!	302	mg/L	10	04/04/2016 10:50	SM 2320 B	SLH
Alkalinity, Total	!	302	mg/L	10	04/04/2016 10:50	SM 2320 B	SLH
Copper/ICP (Total)		<0.005	mg/L	0.005	04/12/2016 10:23	EPA 200.7 / 6010 B	DL
Calcium/ICP (Total)		41.0	mg/L	0.50	04/12/2016 14:15	EPA 200.7 / 6010 B	DL
Calcium Hardness as CaCO3		102.4	mg/L	N/A	04/12/2016 14:15	Calculated	DL
Iron/ICP (Total)		0.378	mg/L	0.010	04/12/2016 10:23	EPA 200.7 / 6010 B	DL

Quality Assurance Summary

Test Description	Precision	Limit	LCL	MS	MSD	UCL	LCS	LCS Limit
Fluoride	2	10	83	99	100	111	104	85 - 115
Alkalinity, Bicarbonate	1	10	95	102	101	107	108	85 - 115
Alkalinity, Total	1	10	95	102	101	107	108	85 - 115
Copper/ICP (Total)	1	20	75	84	85	125	101	85 - 115
Calcium/ICP (Total)	<1	20	75	99	100	125	98	85 - 115
Calcium Hardness as CaCO3	N/A	N/A	N/A			N/A		
Iron/ICP (Total)	1	20	75	84	85	125	100	85 - 115

Quality Statement: ***All supporting quality control data adhered to data quality objectives and test results meet the requirements of NELAC unless otherwise noted as flagged exceptions or in a case narrative attachment. Reports with full quality data deliverables are available on request. TCEQ Certificate No. T104704361-08-TX***

! *Not NELAP Certifiable Parameter*

These analytical results relate only to the sample tested.
All data is reported on an "As Is" basis unless designated as "Dry Wt."
RL = Reporting Limits

QC Data Reported in %, Except BOD in mg/L

POLLUTION CONTROL SERVICES

Report of Sample Analysis

Client Information	Sample Information	Laboratory Information
Landon Yosko LBG — Guyton Associates - SA 12702 Toepperwein Road, Suite 212 San Antonio, TX 78233	Project Name: Hunt Sample ID: Headwaters MW 15 Matrix: Drinking Water Date/Time Taken: 03/30/2016 1500	**PCS Sample #: 428125** **Page 3 of 4** Date/Time Received: 03/31/2016 07:00 Report Date: 04/14/2016

Test Description	Result	Units	RL	Analysis Date/Time	Method	Analyst
Magnesium/ICP (Total)	34.4	mg/L	0.50	04/12/2016 14:15	EPA 200.7 / 6010 B	DL
Aluminum/ICP (Total)	0.134	mg/L	0.010	04/12/2016 10:23	EPA 200.7 / 6010 B	DL
Strontium/ICP (Total)	4.92	mg/L	0.005	04/12/2016 10:23	EPA 200.7 / 6010 B	DL
Iron/ICP (Dissolved)	<0.010	mg/L	0.010	04/12/2016 10:23	EPA 200.7 / 6010 B	DL
Potassium/ICP (Total)	13.2	mg/L	0.50	04/12/2016 14:15	EPA 200.7 / 6010 B	DL
Sodium/ICP (Total)	291	mg/L	0.50	04/12/2016 14:15	EPA 200.7 / 6010 B	DL
Manganese/ICP (Total)	0.011	mg/L	0.010	04/12/2016 10:23	EPA 200.7 / 6010 B	DL

Quality Assurance Summary

Test Description	Precision	Limit	LCL	MS	MSD	UCL	LCS	LCS Limit
Magnesium/ICP (Total)	2	20	75	98	100	125	99	85 - 115
Aluminum/ICP (Total)	1	20	75	81	82	125	101	85 - 115
Strontium/ICP (Total)	<1	20	75	91	91	125	104	85 - 115
Iron/ICP (Dissolved)	1	20	75	84	85	125	100	85 - 115
Potassium/ICP (Total)	2	20	75	108	110	125	96	85 - 115
Sodium/ICP (Total)	<1	20	75	*N/C	*N/C	125	96	85 - 115
Manganese/ICP (Total)	<1	20	75	84	85	125	101	85 - 115

Quality Statement: ***All supporting quality control data adhered to data quality objectives and test results meet the requirements of NELAC unless otherwise noted as flagged exceptions or in a case narrative attachment. Reports with full quality data deliverables are available on request. TCEQ Certificate No. T104704361-08-TX***

* *Approved for release per QA Plan, Exception to Limits - QAM Section 13-4*

These analytical results relate only to the sample tested.
All data is reported on an "As Is" basis unless designated as "Dry Wt."
RL = Reporting Limits

QC Data Reported in %, Except BOD in mg/L
N/C = Not Calculated, Sample Concentration Greater than 5 Times the Spike Level

Web Site: www.pcslab.net
e-mail: chuck@pcslab.net
Toll Free 800-880-4616
1532 Universal City Blvd, Suite 100
Universal City, TX 78148-3318
210-340-0343
FAX # 210-658-7903

POLLUTION CONTROL SERVICES

Report of Sample Analysis

Client Information	Sample Information	Laboratory Information
Landon Yosko LBG — Guyton Associates - SA 12702 Toepperwein Road, Suite 212 San Antonio, TX 78233	Project Name: Hunt Sample ID: Headwaters MW 15 Matrix: Drinking Water Date/Time Taken: 03/30/2016 1500	**PCS Sample #: 428125** **Page 4 of 4** Date/Time Received: 03/31/2016 07:00 Report Date: 04/14/2016

Test Description	Result	Units	RL	Analysis Date/Time	Method	Analyst
Zinc/ICP (Total)	0.085	mg/L	0.010	04/12/2016 10:23	EPA 200.7 / 6010 B	DL
Arsenic/ICP MS	<0.0005	mg/L	0.0005	04/05/2016 10:41	EPA 200.8	DL

Quality Assurance Summary

Test Description	Precision	Limit	LCL	MS	MSD	UCL	LCS	LCS Limit
Zinc/ICP (Total)	<1	20	75	91	92	125	100	85 - 115
Arsenic/ICP MS	1	20	70	92	91	130	92	85 - 115

Quality Statement: ***All supporting quality control data adhered to data quality objectives and test results meet the requirements of NELAC unless otherwise noted as flagged exceptions or in a case narrative attachment. Reports with full quality data deliverables are available on request. TCEQ Certificate No. T104704361-08-TX***

These analytical results relate only to the sample tested.
All data is reported on an "As Is" basis unless designated as "Dry Wt."
RL = Reporting Limits

QC Data Reported in %, Except BOD in mg/L

Web Site: www.pcslab.net
e-mail: chuck@pcslab.net
Toll Free 800-880-4616
1532 Universal City Blvd, Suite 100
Universal City, TX 78148-3318
210-340-0343
FAX # 210-658-7903

Pollution Control Services
Mineral Analysis QA Check - Stabler Formula

PCS Sample#: **428125**

Cation Results

mg/L		me/L
<0.010	Iron/ICP (Dissolved)	0.0000
0.378	Iron/ICP (Total)	0.0135
291	Sodium/ICP (Total)	12.6585
41.0	Calcium/ICP (Total)	2.0459
34.4	Magnesium/ICP (Total)	2.8277
0.011	Manganese/ICP (Total)	0.0004
	Sum Cations (me/L):	17.5460

Anion Results

mg/L		me/L
<0.2	Nitrate-N	0.0000
302	Alkalinity, Bicarbonate	6.0424
58	Sulfate	1.2064
58	Chloride	1.6356
1.19	Fluoride	0.0626
	Sum Anions (me/L):	8.9470
	%Error:	32.4576

Report Checked by: Chuck Wallgren

POLLUTION CONTROL SERVICES

Chain of Custody Number
4 2 8 1 2 5

MULTIPLE SAMPLE ANALYSIS REQUEST AND CHAIN OF CUSTODY FORM

Stamp 1st sample and COC as same number

CUSTOMER INFORMATION

Name: ~~Landen Yosko~~ LBG Guyton

REPORT INFORMATION

Attention: Landon Yosko

Phone: 830 623-0135

Fax:

SAMPLE INFORMATION

Project Information: ~~Headwaters~~ LY Hunt

Report "Soils" ☐ As Is ☐ Dry Wt.

Collected By:

Requested Analysis

Instructions/Comments:

Matrix: **DW**-Drinking Water; **NPW**-Non-potable water; **WW**-Wastewater; **LW**-Liquid Waste

Client / Field Sample ID	**Collected Date**	**Collected Time**	Field Chlorine Residual mg/L	Composite or Grab	**Matrix**	**Container Type**	**Container Number**	**Preservative**	TCEQ	Stein List	Sr						**PCS Sample Number**
Headwaters MW 15	Start: 3/30/16 End:	Start: 3:00pm End:		☐ C ☑ G	☑ DW ☐ NPW ☐ WW ☐ Soil ☐ Sludge ☐ LW ☐ Other	☐P ☐G ☐O		☐ H_2SO_4 ☐ HNO_3 ☐ H_3PO_4 ☐ NaOH ☑ ICE ☐	✓	✓	✓						4 2 8 1 2 5 ☐S ☐B ☒N ☐HEM Other:
	Start: End:	Start: End:		☐ C ☐ G	☐ DW ☐ NPW ☐ WW ☐ Soil ☐ Sludge ☐ LW ☐ Other	☐P ☐G ☐O		☐ H_2SO_4 ☐ HNO_3 ☐ H_3PO_4 ☐ NaOH ☐ ICE ☐									☐S ☐B ☐N ☐HEM Other:
	Start: End:	Start: End:		☐ C ☐ G	☐ DW ☐ NPW ☐ WW ☐ Soil ☐ Sludge ☐ LW ☐ Other	☐P ☐G ☐O		☐ H_2SO_4 ☐ HNO_3 ☐ H_3PO_4 ☐ NaOH ☐ ICE ☐									☐S ☐B ☐N ☐HEM Other:
	Start: End:	Start: End:		☐ C ☐ G	☐ DW ☐ NPW ☐ WW ☐ Soil ☐ Sludge ☐ LW ☐ Other	☐P ☐G ☐O		☐ H_2SO_4 ☐ HNO_3 ☐ H_3PO_4 ☐ NaOH ☐ ICE ☐									☐S ☐B ☐N ☐HEM Other:
	Start: End:	Start: End:		☐ C ☐ G	☐ DW ☐ NPW ☐ WW ☐ Soil ☐ Sludge ☐ LW ☐ Other	☐P ☐G ☐O		☐ H_2SO_4 ☐ HNO_3 ☐ H_3PO_4 ☐ NaOH ☐ ICE ☐									☐S ☐B ☐N ☐HEM Other:
	Start: End:	Start: End:		☐ C ☐ G	☐ DW ☐ NPW ☐ WW ☐ Soil ☐ Sludge ☐ LW ☐ Other	☐P ☐G ☐O		☐ H_2SO_4 ☐ HNO_3 ☐ H_3PO_4 ☐ NaOH ☐ ICE ☐									☐S ☐B ☐N ☐HEM Other:
	Start: End:	Start: End:		☐ C ☐ G	☐ DW ☐ NPW ☐ WW ☐ Soil ☐ Sludge ☐ LW ☐ Other	☐P ☐G ☐O		☐ H_2SO_4 ☐ HNO_3 ☐ H_3PO_4 ☐ NaOH ☐ ICE ☐									☐S ☐B ☐N ☐HEM Other:
	Start: End:	Start: End:		☐ C ☐ G	☐ DW ☐ NPW ☐ WW ☐ Soil ☐ Sludge ☐ LW ☐ Other	☐P ☐G ☐O		☐ H_2SO_4 ☐ HNO_3 ☐ H_3PO_4 ☐ NaOH ☐ ICE ☐									☐S ☐B ☐N ☐HEM Other:

Required Turnaround: ☐ Routine (6-10 days) *EXPEDITE*: (See Surcharge Schedule) ☐ < 8 Hrs. ☐ < 16 Hrs. ☐ < 24 Hrs. ☐ 5 days ☐ Other: ________ ***Rush Charges Authorized by:***

Sample Archive/Disposal: ☐ Laboratory Standard ☐ Hold for client pick up

Container Type: P = Plastic, G = Glass, O = Other ________ Carrier ID: ________

Relinquished By:		Date:	3/31/16	Time:	7:00am	Received By:		Date:	3/31/16
Relinquished By:		Date:		Time:		Received By:		Date:	

Time: 0710

Time:

Rev. Multiple Sample COC 20120201

Pollution Control Services

Sample Log-In Checklist

PCS Sample No(s) 428125 COC No. 428125

Client/Company Name: LBG Checklist Completed by: EV

Sample Delivery to Lab Via:

Client Drop Off ✓ Commercial Carrier: Bus ____ UPS ____ Lone Star ____ FedEx ____ USPS ____

PCS Field Services: Collection/Pick Up ____ Other: ____

Sample Kit/Coolers

Sample Kit/Cooler? Yes ✓ No ____ Sample Kit/Cooler: Intact? Yes ✓ No ____

Custody Seals on Sample Kit/Cooler: Not Present ✓ If Present, Intact ____ Broken ____

Sample Containers Intact; Unbroken and Not Leaking? Yes ✓ No ____

Custody Seals on Sample Bottles: Not Present ✓ If Present, Intact ____ Broken ____

COC Present with Shipment or Delivery or Completed at Drop Off? Yes ✓ No ____

Has COC sample date/time and other pertinent information been provided by client/sampler? Yes: ✓ No: ____

Has COC been properly Signed when Received/Relinquished? Yes ✓ No ____

Does COC agree with Sample Bottle Information, Bottle Types, Preservation, etc.? Yes ✓ No ____

All Samples Received before Hold Time Expiration? Yes ✓ No ____

Sufficient Sample Volumes for Analysis Requested? Yes ✓ No ____

Zero Headspace in VOA Vial if Present? Yes ____ No ____

Sample Preservation

* ***Cooling:*** **Not Required** ____ or **Required** ✓ If Required, record temperature of submitted samples 6 °C

Is Ice Present in Sample Kit/Cooler? ✓ Yes ____ No Samples received same day as collected? ____ Yes ✓ No

Lab Thermometer Make and Serial Number: EX Tech 42529 ✓ Other: ____

Acid Preserved Sample - If present, is pH <2? **Yes** ____ **No** ____ ** ____H_2SO_4 ____HNO_3 ____H_3PO_4

Base Preserved Sample - If present, is pH >12? Yes ____ No ____ ____NaOH

Other Preservation: ____ If Present, Meets Requirements? Yes ____ No ____

Sample Preservations Checked by: ____ Date ____ Time ____

pH paper used to check sample preservation (PCS log #): ____ (HEM pH checked at analysis).

Samples Preserved/Adjusted by Lab:	Lab #	Parameters Preserved	Preservative Used	Log #
	____	metals	HNO_3	011121
	____	____	____	____
	____	____	____	____

Adjusted by Tech/Analyst: CV Date: 3/3/16 Time: 0800

Client Notification/ Documentation for "No" Responses Above/ Discrepancies/ RevisionComments

Person Notified: ____ Contacted by: ____

Notified Date: ____ Time: ____

Method of Contact: At Drop Off: ____ Phone ____ Left Voice Mail ____ E-Mail ____ Fax ____

Unable to Contact ____ Authorized Laboratory to Proceed : ____ (Lab Director)

Regarding: ____

Comments: ____

Actions taken to correct problems/discrepancies: ____

Revision Comments ____

** Samples submitted for Metals Analysis (except Hex Cr) or Drinking Water for Coliform Bacteria Only are not required to be iced. Samples collected prior day to receipt at the laboratory must meet method specific thermal cooling requirements, "or will be flagged accordingly". Samples delivered the same day as collected may not meet thermal criteria, but shall be considered acceptable if evidence that the chilling process has begun, such as arrival on ice (EPA 815-F-08-006, June 2008). ** Water samples for metals analysis that are not acid preserved prior to shipment may be acceptably preserved by the laboratory on receipt – however, the sample digestion procedure must be delayed for at least 24 hours after preservation by the laboratory.*

POLLUTION CONTROL SERVICES

Report of Sample Analysis

Client Information	Sample Information	Laboratory Information
Landon Yosko LBG — Guyton Associates - SA 12702 Toepperwein Road, Suite 212 San Antonio, TX 78233	Project Name: Hunt Sample ID: Headwaters MW-15 Matrix: Drinking Water Date/Time Taken: 04/01/2016 1130	**PCS Sample #: 428371** **Page 1 of 1** Date/Time Received: 04/01/2016 14:52 Report Date: 04/26/2016 Approved by: Chuck Wallgren, President

Test Description	Result	Units	RL	Analysis Date/Time	Method	Analyst
Uranium (Total)	See Attached					Pace Analytical Services - Greens
Combined Radium 226/228	See Attached					Pace Analytical Services - Greens
Gross Alpha/Beta	See Attached					Pace Analytical Services - Greens

Quality Assurance Summary

Test Description	Precision	Limit	LCL	MS	MSD	UCL	LCS	LCS Limit
Uranium (Total)	See Attached Subout Report for Quality Assurance Information							
Combined Radium 226/228	See Attached Subout Report for Quality Assurance Information							
Gross Alpha/Beta	See Attached Subout Report for Quality Assurance Information							

Quality Statement: ***All supporting quality control data adhered to data quality objectives and test results meet the requirements of NELAC unless otherwise noted as flagged exceptions or in a case narrative attachment. Reports with full quality data deliverables are available on request. TCEQ Certificate No. T104704361-08-TX***

These analytical results relate only to the sample tested.
All data is reported on an "As Is" basis unless designated as "Dry Wt."
RL = Reporting Limits

QC Data Reported in %, Except BOD in mg/L

Web Site: www.pcslab.net
e-mail: chuck@pcslab.net
Toll Free 800-880-4616
1532 Universal City Blvd, Suite 100
Universal City, TX 78148-3318
210-340-0343
FAX # 210-658-7903

Pace Analytical Services, Inc.
400 West Bethany Drive - Suite 190
Allen, TX 75013
(972)727-1123

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: 428371
Pace Project No.: 7542110

Sample: 428371 **Lab ID: 7542110001** Collected: 04/01/16 11:30 Received: 04/05/16 10:00 Matrix: Water
PWS: Site ID: Sample Type:

Comments: • Upon receipt at the laboratory, 6 mls of nitric acid were added to the sample to meet the sample preservation requirement of pH <2 for radiochemistry analysis.

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Gross Alpha	EPA 900.0	**11.9 ± 3.36 (2.78) C:NA T:NA**	pCi/L	04/12/16 20:30	12587-46-1	
Gross Beta	EPA 900.0	**10.0 ± 2.21 (1.45) C:NA T:NA**	pCi/L	04/12/16 20:30	12587-47-2	
Radium-226	EPA 903.1	**2.67 ± 0.964 (0.220) C:NA T:89%**	pCi/L	04/20/16 21:56	13982-63-3	
Radium-228	EPA 904.0	**0.616 ± 0.425 (0.818) C:82% T:77%**	pCi/L	04/21/16 12:42	15262-20-1	
Total Uranium	ASTM D5174-97	**3.87 ± 0.071 (0.193) C:NA T:NA**	ug/L	04/21/16 17:22	7440-61-1	

REPORT OF LABORATORY ANALYSIS

POLLUTION CONTROL SERVICES

Chain of Custody Number
4 2 8 3 7 1

MULTIPLE SAMPLE ANALYSIS REQUEST AND CHAIN OF CUSTODY FORM

Stamp 1st sample and COC as same number

CUSTOMER INFORMATION	**REPORT INFORMATION**
Name: LBG	Attention: Phone: Fax:

SAMPLE INFORMATION

Project Information: Hunt

Report "Soils" ☐ As Is ☐ Dry Wt.

Collected By:

Requested Analysis

Instructions/Comments:

Client / Field Sample ID	Collected Date	Collected Time	Field Chlorine Residual mg/L	Composite or Grab	Matrix (DW-Drinking Water; NPW-Non-potable water; WW-Wastewater; LW-Liquid Waste)	Container Type	Container Number	Preservative	Radiological								PCS Sample Number
Headwaters MW-15	Start: 4/1/16 End:	Start: 11:30 End:		☐ C ☑ G	☑ DW ☐ NPW ☐ WW ☐ Soil ☐ Sludge ☐ LW ☐ Other	☑ P ☐ G ☐ O	4	☐ H_2SO_4 ☐ HNO_3 ☐ H_3PO_4 ☐ NaOH ☑ ICE ☐ ______	✓								4 2 8 3 7 1 ☐S ☐B ☐N ☐HEM Other:
	Start: End:	Start: End:		☐ C ☐ G	☐ DW ☐ NPW ☐ WW ☐ Soil ☐ Sludge ☐ LW ☐ Other	☐ P ☐ G ☐ O		☐ H_2SO_4 ☐ HNO_3 ☐ H_3PO_4 ☐ NaOH ☐ ICE ☐ ______									☐S ☐B ☐N ☐HEM Other:
	Start: End:	Start: End:		☐ C ☐ G	☐ DW ☐ NPW ☐ WW ☐ Soil ☐ Sludge ☐ LW ☐ Other	☐ P ☐ G ☐ O		☐ H_2SO_4 ☐ HNO_3 ☐ H_3PO_4 ☐ NaOH ☐ ICE ☐ ______									☐S ☐B ☐N ☐HEM Other:
	Start: End:	Start: End:		☐ C ☐ G	☐ DW ☐ NPW ☐ WW ☐ Soil ☐ Sludge ☐ LW ☐ Other	☐ P ☐ G ☐ O		☐ H_2SO_4 ☐ HNO_3 ☐ H_3PO_4 ☐ NaOH ☐ ICE ☐ ______									☐S ☐B ☐N ☐HEM Other:
	Start: End:	Start: End:		☐ C ☐ G	☐ DW ☐ NPW ☐ WW ☐ Soil ☐ Sludge ☐ LW ☐ Other	☐ P ☐ G ☐ O		☐ H_2SO_4 ☐ HNO_3 ☐ H_3PO_4 ☐ NaOH ☐ ICE ☐ ______									☐S ☐B ☐N ☐HEM Other:
	Start: End:	Start: End:		☐ C ☐ G	☐ DW ☐ NPW ☐ WW ☐ Soil ☐ Sludge ☐ LW ☐ Other	☐ P ☐ G ☐ O		☐ H_2SO_4 ☐ HNO_3 ☐ H_3PO_4 ☐ NaOH ☐ ICE ☐ ______									☐S ☐B ☐N ☐HEM Other:
	Start: End:	Start: End:		☐ C ☐ G	☐ DW ☐ NPW ☐ WW ☐ Soil ☐ Sludge ☐ LW ☐ Other	☐ P ☐ G ☐ O		☐ H_2SO_4 ☐ HNO_3 ☐ H_3PO_4 ☐ NaOH ☐ ICE ☐ ______									☐S ☐B ☐N ☐HEM Other:
	Start: End:	Start: End:		☐ C ☐ G	☐ DW ☐ NPW ☐ WW ☐ Soil ☐ Sludge ☐ LW ☐ Other	☐ P ☐ G ☐ O		☐ H_2SO_4 ☐ HNO_3 ☐ H_3PO_4 ☐ NaOH ☐ ICE ☐ ______									☐S ☐B ☐N ☐HEM Other:

Required Turnaround: ☐ Routine (6-10 days) | ***EXPEDITE***: (See Surcharge Schedule) | ☐ < 8 Hrs. ☐ < 16 Hrs. ☐ < 24 Hrs. ☐ 5 days ☐ Other: ______ ***Rush Charges Authorized by:***

Sample Archive/Disposal: ☑ Laboratory Standard ☐ Hold for client pick up | **Container Type:** P = Plastic, G = Glass, O = Other | Carrier ID: ______

Relinquished By:		Date:	4/1/16	Time:	2:52pm	Received By:		Date: 4-1-16	Time: 1452
Relinquished By:		Date:		Time:		Received By:		Date:	Time:

Rev. Multiple Sample COC 20120201

1532 Universal City Blvd., Ste. 100, Universal City, Texas 78148
P (210) 340-0343 or (800) 880-4616 - F (210) 658-7903

Login at www.pcslab.net
TCEQ NELAP T104704361-TX

Pace Analytical Services, Inc.
400 West Bethany Drive - Suite 190
Allen, TX 75013
(972)727-1123

April 25, 2016

Chuck Wallgren
Pollution Control Services
1532 Universal City Blvd. #100
Universal City, TX 78148

RE: Project: 428371
Pace Project No.: 7542110

Dear Chuck Wallgren:
Enclosed are the analytical results for sample(s) received by the laboratory on April 05, 2016. The results relate only to the samples included in this report. Results reported herein conform to the most current TNI standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Ayisha Raza
ayisha.raza@pacelabs.com
Project Manager

Enclosures

cc: Michael Klang

Pace Analytical®
www.pacelabs.com

Pace Analytical Services, Inc.
400 West Bethany Drive - Suite 190
Allen, TX 75013
(972)727-1123

CERTIFICATIONS

Project: 428371
Pace Project No.: 7542110

Pennsylvania Certification IDs
Georgia Certification #: C040
1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601
L-A-B DOD-ELAP Accreditation #: L2417
Alabama Certification #: 41590
Arizona Certification #: AZ0734
Arkansas Certification
California Certification #: 04222CA
Colorado Certification
Connecticut Certification #: PH-0694
Delaware Certification
Florida/TNI Certification #: E87683
Georgia Certification #: C040
Guam Certification
Hawaii Certification
Idaho Certification
Illinois Certification
Indiana Certification
Iowa Certification #: 391
Kansas/TNI Certification #: E-10358
Kentucky Certification #: 90133
Louisiana DHH/TNI Certification #: LA140008
Louisiana DEQ/TNI Certification #: 4086
Maine Certification #: PA00091
Maryland Certification #: 308
Massachusetts Certification #: M-PA1457
Michigan/PADEP Certification
Missouri Certification #: 235
Montana Certification #: Cert 0082
Nebraska Certification #: NE-05-29-14
Nevada Certification #: PA014572015-1
New Hampshire/TNI Certification #: 2976
New Jersey/TNI Certification #: PA 051
New Mexico Certification #: PA01457
New York/TNI Certification #: 10888
North Carolina Certification #: 42706
North Dakota Certification #: R-190
Oregon/TNI Certification #: PA200002
Pennsylvania/TNI Certification #: 65-00282
Puerto Rico Certification #: PA01457
Rhode Island Certification #: 65-00282
South Dakota Certification
Tennessee Certification #: TN2867
Texas/TNI Certification #: T104704188-14-8
Utah/TNI Certification #: PA014572015-5
USDA Soil Permit #: P330-14-00213
Vermont Dept. of Health: ID# VT-0282
Virgin Island/PADEP Certification
Virginia/VELAP Certification #: 460198
Washington Certification #: C868
West Virginia DEP Certification #: 143
West Virginia DHHR Certification #: 9964C
Wisconsin Certification
Wyoming Certification #: 8TMS-L

Pace Analytical Services, Inc.
400 West Bethany Drive - Suite 190
Allen, TX 75013
(972)727-1123

SAMPLE SUMMARY

Project: 428371
Pace Project No.: 7542110

Lab ID	Sample ID	Matrix	Date Collected	Date Received
7542110001	428371	Water	04/01/16 11:30	04/05/16 10:00

Pace Analytical Services, Inc.
400 West Bethany Drive - Suite 190
Allen, TX 75013
(972)727-1123

SAMPLE ANALYTE COUNT

Project: 428371
Pace Project No.: 7542110

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
7542110001	428371	EPA 900.0	NEG	2	PASI-PA
		EPA 903.1	WRR	1	PASI-PA
		EPA 904.0	JLW	1	PASI-PA
		ASTM D5174-97	RMK	1	PASI-PA

Pace Analytical Services, Inc.
400 West Bethany Drive - Suite 190
Allen, TX 75013
(972)727-1123

QUALITY CONTROL - RADIOCHEMISTRY

Project: 428371
Pace Project No.: 7542110

QC Batch: RADC/28852
QC Batch Method: EPA 900.0
Analysis Method: EPA 900.0
Analysis Description: 900.0 Gross Alpha/Beta
Associated Lab Samples: 7542110001

METHOD BLANK: 1056270
Matrix: Water
Associated Lab Samples:

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Gross Alpha	0.287 ± 0.626 (1.47) C:NA T:NA	pCi/L	04/13/16 07:30	
Gross Beta	0.967 ± 0.896 (1.84) C:NA T:NA	pCi/L	04/13/16 07:30	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, Inc.
400 West Bethany Drive - Suite 190
Allen, TX 75013
(972)727-1123

QUALITY CONTROL - RADIOCHEMISTRY

Project: 428371
Pace Project No.: 7542110

QC Batch: RADC/28917
QC Batch Method: EPA 903.1
Analysis Method: EPA 903.1
Analysis Description: 903.1 Radium-226
Associated Lab Samples: 7542110001

METHOD BLANK: 1058344
Matrix: Water
Associated Lab Samples:

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	0.157 ± 0.358 (0.577) C:NA T:97%	pCi/L	04/20/16 20:19	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

Pace Analytical Services, Inc.
400 West Bethany Drive - Suite 190
Allen, TX 75013
(972)727-1123

QUALITY CONTROL - RADIOCHEMISTRY

Project: 428371
Pace Project No.: 7542110

QC Batch: RADC/28853
QC Batch Method: ASTM D5174-97
Analysis Method: ASTM D5174-97
Analysis Description: D5174.97 Total Uranium KPA
Associated Lab Samples: 7542110001

METHOD BLANK: 1056271
Matrix: Water
Associated Lab Samples:

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Total Uranium	0.059 ± 0.002 (0.193) C:NA T:NA	ug/L	04/19/16 15:02	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, Inc.
400 West Bethany Drive - Suite 190
Allen, TX 75013
(972)727-1123

QUALITY CONTROL - RADIOCHEMISTRY

Project: 428371
Pace Project No.: 7542110

QC Batch: RADC/28921
QC Batch Method: EPA 904.0
Analysis Method: EPA 904.0
Analysis Description: 904.0 Radium 228
Associated Lab Samples: 7542110001

METHOD BLANK: 1058348
Matrix: Water
Associated Lab Samples:

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	-0.0439 ± 0.309 (0.732) C:84% T:89%	pCi/L	04/21/16 12:40	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, Inc.
400 West Bethany Drive - Suite 190
Allen, TX 75013
(972)727-1123

QUALIFIERS

Project: 428371
Pace Project No.: 7542110

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Act - Activity

Unc - Uncertainty: SDWA = 1.96 sigma count uncertainty, all other matrices = Expanded Uncertainty (95% confidence interval). Gamma Spec = Expanded Uncertainty (95.4% Confidence Interval)

(MDC) - Minimum Detectable Concentration

Trac - Tracer Recovery (%)

Carr - Carrier Recovery (%)

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The Nelac Institute

LABORATORIES

PASI-PA Pace Analytical Services - Greensburg

Pace Analytical Services, Inc.
400 West Bethany Drive - Suite 190
Allen, TX 75013
(972)727-1123

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: 428371
Pace Project No.: 7542110

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
7542110001	**428371**	EPA 900.0	RADC/28852		
7542110001	**428371**	EPA 903.1	RADC/28917		
7542110001	**428371**	EPA 904.0	RADC/28921		
7542110001	**428371**	ASTM D5174-97	RADC/28853		

POLLUTION CONTROL SERVICES

1532 Universal City Blvd, Suite 100
Universal City, TX 78148-3318
Facsimilie 210.658.7903
210.340.0343

CHAIN OF CUSTODY & SUBCONTRACT TRACKING SHEET

TO: Pace Analytical Services, Inc. (G)
1638 Roseytown Road,
Suite 2, 3 & 4
Greensburg, PA 15601

Relinquished by: Emily Voges

Date/Time: 4/1/2016

Received by: Alma R. Mckinney Pace

Date/Time: 4/5/16 1000

PCS#	Date	Time	Analysis Requested	Pres	T. A. T. 001
428371	04/01/2016	1130	Combined Radium 226/228	non c	
428371	----------	----	Gross Alpha/Beta		----
428371	----------	----	Uranium (Total)		----

WO#: 7542110

7542110

Comments/Special Instructions: _____

Unless otherwise requested, send results and invoice to:

Chuck Wallgren
Pollution Control Services
1532 Universal City Blvd, Suite 100
Universal City, TX 78148-3318

Authorized by: _____ Date: 4-1-16

Sample Condition Upon Receipt

Pace Analytical

Client Name: Pollution Control Project #: _____

Courier: ☐ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace Other _____

Tracking #: 776020911226

Custody Seal on Cooler/Box Present: ☐ yes ☑ no Seals Intact: ☐ yes ☐ no Biological Tissue Is Frozen: Yes No

Packing Material: Bubble Wrap ✓ Bubble Bags ___ None ___ Other _____

Thermometer Used N/A Type of Ice: Wet Blue (None) ☐ Samples on ice, cooling process has begun

Cooler Temp.: Observed Temp.: ____ °C Correction Factor: ____ °C Final Temp: ____ °C

Date and initials of person examining contents: APM 4/20/20

Temp should be above freezing to 6°C

		Comments:
Chain of Custody Present:	☑Yes ☐No ☐N/A	1.
Chain of Custody Filled Out:	☑Yes ☐No ☐N/A	2.
Chain of Custody Relinquished:	☑Yes ☐No ☐N/A	3.
Sampler Name & Signature on COC:	☑Yes ☐No ☐N/A	4.
Samples Arrived within Hold Time:	☑Yes ☐No ☐N/A	5.
Short Hold Time Analysis (<72hr):	☐Yes ☑No ☐N/A	6.
Rush Turn Around Time Requested:	☐Yes ☑No ☐N/A	7.
Sufficient Volume:	☑Yes ☐No ☐N/A	8.
Correct Containers Used:	☑Yes ☐No ☐N/A	9.
-Pace Containers Used:	☑Yes ☐No ☐N/A	
Containers Intact:	☑Yes ☐No ☐N/A	10. Received two broken and empty
Filtered volume received for Dissolved tests	☐Yes ☐No ☑N/A	11. half gallon jugs
Sample Labels match COC:	☑Yes ☐No ☐N/A	12. I.D on bottles is MW-15
-Includes date/time/ID/Analysis Matrix: WW		
All containers needing preservation have been checked.	☑Yes ☐No ☐N/A	13. Added 6mL HNO_3 to each bottle.
All containers needing preservation are found to be in compliance with EPA recommendation.	☑Yes ☐No ☐N/A	pH<2. APM. 4/20/20 1300
exceptions: VOA, coliform, TOC, O&G, Phenols	☐Yes ☑No	Initial when completed: APM Lot # of added preservative: DLIQ-02601
Samples checked for dechlorination:	☐Yes ☐No ☑N/A	14.
Headspace in VOA Vials (>6mm):	☐Yes ☐No ☑N/A	15.
Trip Blank Present:	☐Yes ☐No ☑N/A	16.
Trip Blank Custody Seals Present	☐Yes ☐No ☑N/A	
Pace Trip Blank Lot # (if purchased): _____		

Client Notification/ Resolution: Field Data Required? Y / N

Person Contacted: _____ Date/Time: _____

Comments/ Resolution: _____

Project Manager Review: _____ Date: _____

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e out of hold, incorrect preservative, out of temp, incorrect containers)

Chain of Custody

Pace Analytical®
www.pacelabs.com

Workorder: 7542110 **Workorder Name:** 428371 **Owner Received Date:** 4/5/2016 **Results Requested By:** 4/14/2016

Report To	Subcontract To
Ayisha Raza Pace Analytical Dallas 400 West Bethany Drive Suite 190 Allen, TX 75013 Phone (972)727-1123	Pace Analytical Pittsburgh 1638 Roseytown Road Suites 2,3, & 4 Greensburg, PA 15601 Phone (724)850-5600

WO#:30178981

Item	Sample ID	Sample Type	Collect Date/Time	Lab ID	Matrix	Preserved Containers: HNO3	Requested Analysis: Combined Rad 226/228	Gross Alpha	Gross Beta	Uranium (total)	LAB USE ONLY
1	428371	PS	4/1/2016 11:30	7542110001	Water	1	X	X	X	X	CDJ
2											
3											
4											
5											

Transfers	Released By	Date/Time	Received By	Date/Time
1	Fedex Client direct shipped			4/5/16 1000
2				
3				

Comments

Cooler Temperature on Receipt N/A °C | Custody Seal Y or (N) | Received on Ice Y or (N) | Samples Intact (Y) or N

***In order to maintain client confidentiality, location/name of the sampling site, sampler's name and signature may not be provided on this COC document.
This chain of custody is considered complete as is since this information is available in the owner laboratory.

30178981

POLLUTION CONTROL SERVICES

1532 Universal City Blvd, Suite 100
Universal City, TX 78148-3318
Facsimilie 210.658.7903
210.340.0343

CHAIN OF CUSTODY & SUBCONTRACT TRACKING SHEET

TO: Pace Analytical Services, Inc. (G)
1638 Roseytown Road,
Suite 2, 3 & 4
Greensburg, PA 15601

Relinquished by: Emily Voges
Date/Time: 4/1/2016
Received by: Alma R. Mudmey Pace
Date/Time: 4/5/16 1000

PCS#	Date	Time	Analysis Requested	Pres	T. A. T 001
428371	04/01/2016	1130	Combined Radium 226/228	non c	
428371	----------	----	Gross Alpha/Beta	↓	---
428371	----------	----	Uranium (Total)	↓	---

Comments/Special Instructions: _____

Unless otherwise requested, send results and invoice to:

Chuck Wallgren
Pollution Control Services
1532 Universal City Blvd, Suite 100
Universal City, TX 78148-3318

Authorized by: E. [signature] Date: 4-1-16

Sample Condition Upon Receipt

30178981

Pace Analytical

Client Name: Pollution Control Project #: _____

Courier: ☐ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace Other _____

Tracking #: 770209111225

Custody Seal on Cooler/Box Present: ☐ yes ☑ no Seals intact: ☐ yes ☐ no Biological Tissue is Frozen: Yes No

Packing Material: Bubble Wrap ✓ Bubble Bags ___ None ___ Other _____

Thermometer Used N/A Type of Ice: Wet Blue (None) ☐ Samples on ice, cooling process has begun

Cooler Temp.: Observed Temp.: ___ °C Correction Factor: ___ °C Final Temp: ___ °C

Date and initials of person examining contents: ARM 4/6/16

Temp should be above freezing to 6°C

		Comments:
Chain of Custody Present:	☑Yes ☐No ☐N/A	1.
Chain of Custody Filled Out:	☑Yes ☐No ☐N/A	2.
Chain of Custody Relinquished:	☑Yes ☐No ☐N/A	3.
Sampler Name & Signature on COC:	☑Yes ☐No ☐N/A	4.
Samples Arrived within Hold Time:	☑Yes ☐No ☐N/A	5.
Short Hold Time Analysis (<72hr):	☑Yes ☐No ☐N/A	6.
Rush Turn Around Time Requested:	☑Yes ☐No ☐N/A	7.
Sufficient Volume:	☑Yes ☐No ☐N/A	8.
Correct Containers Used:	☑Yes ☐No ☐N/A	9.
-Pace Containers Used:	☑Yes ☐No ☐N/A	
Containers Intact:	☑Yes ☐No ☐N/A	10. Received two broken and empty
Filtered volume received for Dissolved tests	☑Yes ☐No ☐N/A	11. half gallon jugs
Sample Labels match COC:	☑Yes ☐No ☐N/A	12. I.D on bottles is MW-15 2 of 2
-Includes date/time/ID/Analysis Matrix: WT		
All containers needing preservation have been checked.	☑Yes ☐No ☐N/A	13. Added 6mL HNO_3 to ~~each bottle~~ bottles
All containers needing preservation are found to be in compliance with EPA recommendation.	☑Yes ☐No ☐N/A	pH<2. ARM. 4/6/16 1300
exceptions: VOA, coliform, TOC, O&G, Phenols	☑Yes ☐No	Initial when completed: ARM Lot # of added preservative: DLW-02601 ARM 4/8/16
Samples checked for dechlorination:	☑Yes ☐No ☐N/A	14.
Headspace in VOA Vials (>6mm):	☑Yes ☐No ☐N/A	15.
Trip Blank Present:	☑Yes ☐No ☐N/A	16.
Trip Blank Custody Seals Present	☑Yes ☐No ☐N/A	
Pace Trip Blank Lot # (if purchased):		

Client Notification/ Resolution: Field Data Required? Y / N

Person Contacted: _____ Date/Time: _____

Comments/ Resolution: 2- 1/2 gallon jugs

Project Manager Review: Anna Sorrin **Date:** 4/8/16

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e out of hold, incorrect preservative, out of temp, incorrect containers)

Pollution Control Services
Sample Log-In Checklist

PCS Sample No(s) 428371 **COC No.** 428371

Client/Company Name: LBG **Checklist Completed by:** EV

Sample Delivery to Lab Via:
Client Drop Off ✓ Commercial Carrier: Bus ____ UPS ____ Lone Star ____ FedEx ____ USPS ____
PCS Field Services: Collection/Pick Up____ Other:____

Sample Kit/Coolers
Sample Kit/Cooler? Yes ✓ No____ Sample Kit/Cooler: Intact? Yes ✓ No___
Custody Seals on Sample Kit/Cooler: Not Present ✓ If Present, Intact ___ Broken ___
Sample Containers Intact; Unbroken and Not Leaking? Yes ✓ No ___
Custody Seals on Sample Bottles: Not Present ✓ If Present, Intact ___ Broken ___
COC Present with Shipment or Delivery or Completed at Drop Off? Yes ✓ No ___
Has COC sample date/time and other pertinent information been provided by client/sampler? Yes: ✓ No: ___
Has COC been properly Signed when Received/Relinquished? Yes ✓ No ___
Does COC agree with Sample Bottle Information, Bottle Types, Preservation, etc.? Yes ✓ No ___
All Samples Received before Hold Time Expiration? Yes ✓ No ___
Sufficient Sample Volumes for Analysis Requested? Yes ✓ No ___
Zero Headspace in VOA Vial if Present? Yes ___ No ___

Sample Preservation
* ***Cooling:*** **Not Required** ✓ or **Required** ____ If Required, record temperature of submitted samples 2 °C
Is Ice Present in Sample Kit/Cooler? ✓ Yes ____ No Samples received same day as collected? ✓ Yes ____ No
Lab Thermometer Make and Serial Number: EX Tech 42529 ✓ Other:____

Acid Preserved Sample - If present, is pH <2? **Yes** ____ **No** ____** ____H_2SO_4 ____HNO_3 ____H_3PO_4
Base Preserved Sample - If present, is pH >12? Yes ____ No ____ ____NaOH
Other Preservation:____ If Present, Meets Requirements? Yes____ No____
Sample Preservations Checked by:____ Date ____ Time ____
pH paper used to check sample preservation (PCS log #): ____ (HEM pH checked at analysis).

Samples Preserved/Adjusted by Lab:	Lab #	Parameters Preserved	Preservative Used	Log #

Adjusted by Tech/Analyst:____ Date :____Time:____

Client Notification/ Documentation for "No" Responses Above/ Discrepancies/ RevisionComments
Person Notified: ____ Contacted by:____
Notified Date:____Time: ____
Method of Contact: At Drop Off:____ Phone ___ Left Voice Mail ____ E-Mail ____ Fax ____
Unable to Contact____ Authorized Laboratory to Proceed :____(Lab Director)
Regarding:____
Comments:____
Actions taken to correct problems/discrepancies:____
Revision Comments____

** Samples submitted for Metals Analysis (except Hex Cr) or Drinking Water for Coliform Bacteria Only are not required to be iced. Samples collected prior day to receipt at the laboratory must meet method specific thermal cooling requirements, "or will be flagged accordingly". Samples delivered the same day as collected may not meet thermal criteria, but shall be considered acceptable if evidence that the chilling process has begun, such as arrival on ice (EPA 815-F-08-006, June 2008). ** Water samples for metals analysis that are not acid preserved prior to shipment may be acceptably preserved by the laboratory on receipt – however, the sample digestion procedure must be delayed for at least 24 hours after preservation by the laboratory.*