

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

FORM 3

AMENDED REPORT
(highlight changes)

| | | | | |
|---|---|---|--|---------------------------|
| APPLICATION FOR PERMIT TO DRILL | | | 5. MINERAL LEASE NO: ML-49170 | 6. SURFACE: State |
| 1A. TYPE OF WORK: DRILL <input checked="" type="checkbox"/> REENTER <input type="checkbox"/> DEEPEN <input type="checkbox"/> | | | 7. IF INDIAN, ALLOTTEE OR TRIBE NAME: NA | |
| B. TYPE OF WELL: OIL <input type="checkbox"/> GAS <input checked="" type="checkbox"/> OTHER _____ SINGLE ZONE <input checked="" type="checkbox"/> MULTIPLE ZONE <input type="checkbox"/> | | | 8. UNIT or CA AGREEMENT NAME: NA | |
| 2. NAME OF OPERATOR: Delta Petroleum Corporation | | | 9. WELL NAME and NUMBER: Greentown State #36-11S | |
| 3. ADDRESS OF OPERATOR: 370 17th St, Suite 4300 CITY Denver STATE CO ZIP 80021 | | PHONE NUMBER: (303) 575-0323 | 10. FIELD AND POOL, OR WILDCAT: Wildcat | |
| 4. LOCATION OF WELL (FOOTAGES) AT SURFACE: 1024' FNL & 429' FWL <i>576863X 38.947345</i> <i>4311100Y -110.113034</i> AT PROPOSED PRODUCING ZONE: Same as surface | | | 11. QTR/QTR, SECTION, TOWNSHIP, RANGE, MERIDIAN: NWNW 36 21S 16E | |
| 14. DISTANCE IN MILES AND DIRECTION FROM NEAREST TOWN OR POST OFFICE: 3 Miles south of Green River, Utah | | | 12. COUNTY: Grand | 13. STATE: UTAH |
| 15. DISTANCE TO NEAREST PROPERTY OR LEASE LINE (FEET) 429' | 16. NUMBER OF ACRES IN LEASE: 1280 | 17. NUMBER OF ACRES ASSIGNED TO THIS WELL: 40 | | |
| 18. DISTANCE TO NEAREST WELL (DRILLING, COMPLETED, OR APPLIED FOR) ON THIS LEASE (FEET) 69' | 19. PROPOSED DEPTH: 3,686 | 20. BOND DESCRIPTION: CPCS-215808 | | |
| 21. ELEVATIONS (SHOW WHETHER DF, RT, GR, ETC.): GR - 4323.3' | 22. APPROXIMATE DATE WORK WILL START: 11/1/2006 | 23. ESTIMATED DURATION: 25 days | | |

PROPOSED CASING AND CEMENTING PROGRAM

| SIZE OF HOLE | CASING SIZE, GRADE, AND WEIGHT PER FOOT | | | SETTING DEPTH | CEMENT TYPE, QUANTITY, YIELD, AND SLURRY WEIGHT | | | |
|---------------|---|-------------|--------------|---------------|---|----------------|-------------|--------------|
| 11" | 8-5/8" | J-55 | 24# | 1,200 | Lead - 85/15/8 Poz A | 215 sxs | 2.14 | 12.5# |
| | | | | | Tail - Type III | 110 sxs | 1.41 | 14.6# |
| 7-7/8" | 4-1/2" | J-55 | 12.6# | 3,686 | Lead - 85/15/8 Poz A | 300 sxs | 2.14 | 12.5# |
| | | | | | Tail - Type III | 140 sxs | 1.41 | 14.6# |
| | | | | | | | | |
| | | | | | | | | |

CONFIDENTIAL

ATTACHMENTS

CONFIDENTIAL

VERIFY THE FOLLOWING ARE ATTACHED IN ACCORDANCE WITH THE UTAH OIL AND GAS CONSERVATION GENERAL RULES:

- | | |
|--|--|
| <input checked="" type="checkbox"/> WELL PLAN OR MAP PREPARED BY LICENSED SURVEYOR OR ENGINEER | <input checked="" type="checkbox"/> COMPLETE DRILLING PLAN |
| <input type="checkbox"/> EVIDENCE OF DIVISION OF WATER RIGHTS APPROVAL FOR USE OF WATER | <input type="checkbox"/> FORM 5, IF OPERATOR IS PERSON OR COMPANY OTHER THAN THE LEASE OWNER |

NAME (PLEASE PRINT) Larry W. Johnson TITLE Agent for Delta Petroleum Corp.

SIGNATURE *Larry W. Johnson* DATE 10/20/06

(This space for State use only)

Terry Hoffman 303/250-0619 cell

API NUMBER ASSIGNED: 43-014-31505

**Approved by the
Utah Division of
Oil, Gas and Mining**

RECEIVED

OCT 23 2006

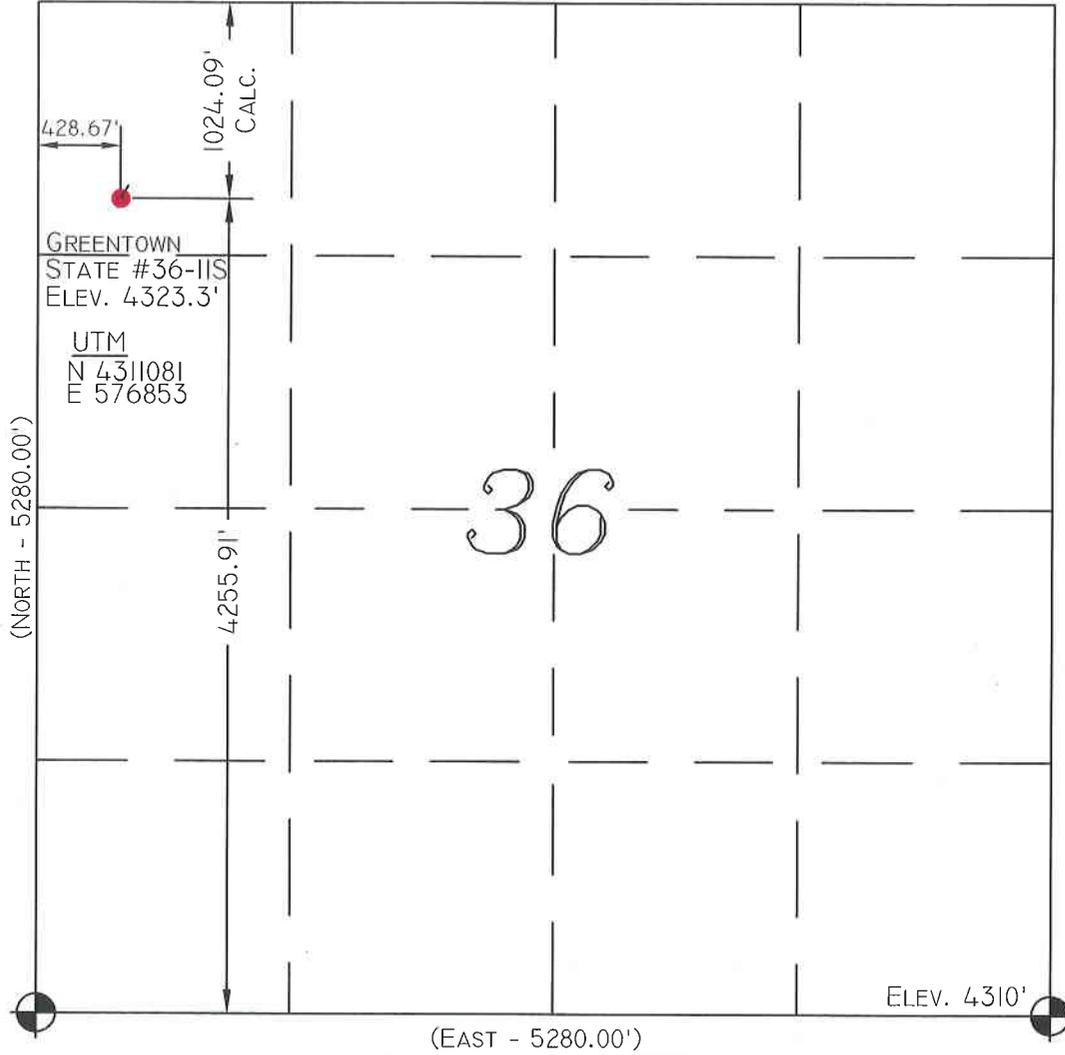
DIV. OF OIL, GAS & MINING

By: *[Signature]*

Range 16 East

(EAST - 5287.92')

Township 21 South



ELEV. 4310'

S89°51'41"E - 5361.24'

Legend

- Drill Hole Location
- Stone Monument (Found)
- Stone Monument (Searched for, but not found)
- Calculated Corner
- () GLO
- GPS Measured

NOTES:

1. UTM and Latitude / Longitude Coordinates are derived using a GPS Pathfinder and are shown in NAD 27 Datum.

| |
|-----------------|
| LAT / LONG |
| 38°56'49.843"N |
| 110°06'47.364"W |

Location:
The well location was determined using a Trimble 5700 GPS survey grade unit.

Basis of Bearing:
The Basis of Bearing is GPS Measured.

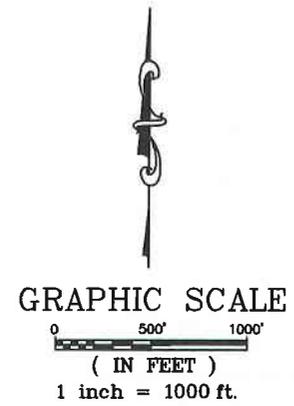
GLO Bearing:
The Bearings indicated are per the recorded plat obtained from the U.S. Land Office.

Basis of Elevation:
Basis of Elevation of 4310' being at the Southeast Section Corner of Section 36, Township 21 South, Range 16 East, Salt Lake Base and Meridian, as shown on the Green River NE Quadrangle 7.5 minute series map.

Description of Location:
Proposed Drill Hole located in the NW/4 NW/4 of Section 36, T21S, R16E, S.L.B.&M., being 4255.91' North and 428.67' East from the Southwest Section Corner of Section 36, T21S, R16E, Salt Lake Base & Meridian.

Surveyor's Certificate:

I, Albert J. Spensko, a Registered Professional Land Surveyor, holding Certificate 146652 State of Utah, do hereby certify that the information on this drawing is a true and accurate survey based on data of record and was conducted under my personal direction and supervision as shown hereon.



TALON RESOURCES, INC.

195 North 100 West P.O. Box 1230
Huntington, Utah 84528
Phone (435)687-5310 Fax (435)687-5311
E-Mail talon @ etv.net



Greentown State #36-11S
Section 36, T21S, R16E, S.L.B.&M.
Grand County, Utah

| | |
|---------------------------|------------------------------|
| Drawn By: N. BUTKOVICH | Checked By: L.W.J./A.J.S. |
| Drawing No. A-1 | Date: 10/19/06 |
| | Scale: 1" = 1000' |
| Sheet 1 of 4 | Job No. 2619 |

TALON RESOURCES INC

October 20, 2006

Ms. Diana Whitney
State of Utah
Division of Oil Gas and Mining
P.O. Box 145801
Salt Lake City, Utah 84114-5801

RE: Request for Exception to State Spacing Rule, (Rule R649-3-3)—Delta Petroleum Corp. Greentown State 36-11S, Grand County, Utah: NW/4 NW/4, 1024' FNL, 429' FWL, Section 36, T21S, R16E, SLB&M.

Dear Ms. Whitney:

Delta Petroleum Corporation respectfully submits the following request for exception to spacing and information to supplement the submitted APD for the above referenced well.

A request for exception to spacing is hereby requested based on topography

A request for exception to spacing is also requested due to multiple eligible cultural sites within the spacing window.

Delta Petroleum Corporation is the only owner and operator within 460' of the proposed well location.

Thank you for your timely consideration of this request. Please feel free to contact myself or Ms. Terry L. Hoffman 303-575-0323 if you have any questions or need additional information.

Sincerely,


Larry W. Johnson
Talon Resources, Inc.

RECEIVED
OCT 23 2006
DIV. OF OIL, GAS & MINING

EXHIBIT "D"
DRILLING PROGRAM

TIGHT HOLE STATUS

Attached to UDOGM Form 3
Delta Petroleum Corporation
Green Town State #36-11S
NW/4 NW/4, Sec. 36, T21S, R16E, SLB & M
1024' FNL, 429' FWL
Grand County, Utah

1. The Geologic Surface Formation

| | <u>TVD</u> | <u>Subsea</u> |
|----------|------------|---------------|
| Morrison | 0' | 4330' |

2. Estimated Tops of Important Geologic Markers

| | <u>TVD</u> | <u>Subsea</u> |
|-------------|------------|---------------|
| Morrison | 0' | 4336' (KB) |
| Entrada | 481' | 3855' |
| Carmel | 1033' | 3303' |
| Navajo | 1198' | 3138' |
| Kayenta | 1634' | 2702' |
| Wingate | 1671' | 2665' |
| Chinle | 2134' | 2202' |
| Shinarump | 2316' | 2020' |
| Moenkopi | 2362' | 1974' |
| Sinbad Is. | 2957' | 1379' |
| White Rim | 3174' | 1162' |
| Total Depth | 3686' | 650' |

3. Projected Gas & Water Zones

| | | <u>TVD</u> | <u>Subsea</u> |
|-----------|-------------|------------|---------------|
| Entrada | Water/Oil | 481' | 3855' |
| Navajo | Water/Oil | 1198' | 3138' |
| Wingate | Water/Oil | 1671' | 2665' |
| White Rim | Oil/Gas/Wtr | 3174' | 1162' |

No Groundwater is anticipated to be encountered. Water encountered will be reported on a Form 7 "Report of Water Encountered During Drilling".

Casing & cementing will be done to protect all fresh water zones, potentially productive hydrocarbons, lost circulation zones, abnormal pressure zones, and prospectively valuable

mineral deposits.
 All indications of usable water will be reported.

Surface casing will be tested to 1500 psi for 15 minutes. Pressure drop is not to exceed 150 psi.

4) The Proposed Casing and Cementing Programs

Casing Program

| Hole Size | Setting Depth | Size (OD) | Weight, Grade & Joint | Condition |
|-----------|---------------|-------------|-----------------------|-----------|
| 11" | 1200' | 8-5/8" | 24#, J-55 & ST&C | New |
| 7-7/8" | 3686' | 4-1/2" 5 | 12.6#, J-55<&C | New |

not specified

Cement Program

Surface Casing:

Lead: 215 sxs 85/15/8
 Weight: 12.5 #/gal
 Yield: 2.14 cu.ft/sk
 Cmt Top 0'

Tail: 110 sxs Type III
 Weight: 14.6 #/gal
 Yield: 1.41 cu.ft/sk
 Cmt Top 900'

Production Casing:

Lead: 300 sxs 85/15/8
 Weight: 12.5 #/gal
 Yield: 2.14 cu.ft/sk
 Cmt Top 0'

Tail: 140 sxs Type III
 Weight: 14.6 #/gal
 Yield: 1.41 cu.ft/sk
 Cmt Top 2900'

The following shall be entered in the driller's log:

- 1) Blowout preventer pressure tests, including test pressures and results;
- 2) Blowout preventer tests for proper functioning;
- 3) Blowout prevention drills conducted;
- 4) Casing run, including size, grade, weight, and depth set;
- 5) How the pipe was cemented, including amount of cement, type, whether cement

- circulated, location of the cementing tools, etc.;
- 6) Waiting on cement time for each casing string;
- 7) Casing pressure tests after cementing, including test pressures and results.

5. The Operator's Minimum Specifications for Pressure Control

Exhibit "G" is a schematic diagram of the blowout preventer equipment. An 11" 3,000 psi Double gate Hydraulic BOP with one (1) blind ram and one (1) pipe ram and Annular Preventer; equipped with a 3,000 psi manual choke manifold. The BOP will be tested and charted using a BOP tester and test plug to 3,000 psi for 10 minutes. The Annular Preventer will be tested to 1,500 psi for 10 minutes. All text will be recorded in the Driller's log book. Pipe rams will be function tested daily, and blind rams tested on each trip.

6. The Type and Characteristics of the Proposed Circulating Muds

| <u>Depth</u> | <u>Type</u> | <u>Weight</u> | <u>Vis</u> | <u>Water Loss</u> |
|--------------|-------------|---------------|------------|-------------------|
| 0-1200' | Wtr | +/-8.5 | +/-28 | NC |
| 1200-3686' | LSND | +/-9.0 | +/-44 | +/-8 |

7. The Testing, Logging and Coring Programs are as followed

Testing - DST's are not planned
 Logging - End of Surface casing – TD Platform Express
 Coring - No coring is planned for this location

Any Anticipated Abnormal Pressures or Temperatures

No abnormal pressures or temperatures have been noted or reported in wells drilled in the area nor at the depths anticipated in this well. Bottom hole pressure expected is 1600 psi max. No hydrogen sulfide or other hazardous gases or fluids have been found, reported or are known to exist at these depths in the area.

8. Anticipated Starting Date and Duration of the Operations.

The well will be drilled in approximately November 1, 2006, (as soon as permit is approved).

Verbal and/or written notifications listed below shall be submitted in accordance with instructions from the Division of Oil, Gas & Mining:

- (a) prior to beginning construction;
- (b) prior to spudding;
- (c) prior to running any casing or BOP tests;
- (d) prior to plugging the well, for verbal plugging instructions.

Spills, blowouts, fires, leaks, accidents or other unusual occurrences shall be reported to the Division of Oil, Gas & Mining immediately.

EXHIBIT "E"
Multipoint Surface Use Plan

Attached to UDOGM Form 3
Summit Operating, LLC
Green Town State #36-11S
NW/4 NW/4, Sec. 36, T21S, R16E, SLB & M
1024' FNL, 429' FWL
Grand County, Utah

1. Existing Roads

- a. The proposed access road is the same access as the Greentown State 36-11 and has been constructed consistent with the State of Utah and Delta Petroleum Corporation, and encroaches on a Grand County Road which is the main access into this area.
- b. The existing road has been repaired where previous storm events have eliminated culverts and road.
- c. Existing roads will be maintained in the same or better condition. See Drawing L-1

2. Planned Access

Approximately 400' (.07 miles) of new access has been constructed (See Drawing L-1) Access is determined by acquired Right of way by the surface owner. Approximately 11,200' (2.1 miles) of Grande County Class D road has been upgraded, and a right-of way with the BLM is in place. This road intersects a Grand County Class B road and a county encroachment permit is in place.

- a. Maximum Width: 24'
- b. Maximum grade: 10 %
- c. Turnouts: None
- d. Drainage design: 1 – 18" culvert may be required along the new portion of the road. Water will be diverted around the road as necessary and practical. 1- 18" and 1 – 48" culvert were replaced along the Class D county road.
- e. If the well is productive, the road will be surfaced and maintained as necessary to prevent soil erosion and accommodate year-round traffic.
- f. Existing trees will be left in place where practical to provide screening and buffer areas.

3. Location of Existing Wells

- a. See Exhibit "B", Drawing L-1.

4. Location of Existing and/or Proposed Facilities

- a. If the well is a producer, installation of production facilities will follow.
- b. Rehabilitation of all pad areas not used for production facilities will be made in accordance with landowner stipulations.

5. Location and Type of Water Supply

- a. Water to be used for drilling will be obtained from Thompson City, Utah
- b. Water will be transported by truck over approved access roads.
- c. No water well is to be drilled for this location.

6. Source of Construction Materials

- a. Any necessary construction materials needed will be obtained locally from a private source and hauled to the location on existing roads.
- b. No construction or surfacing materials will be taken from Federal/Indian land.

7. Methods for handling waste disposal

- a. The existing reserve pit will be used to accommodate the drilling of the well. The pit will be a minimum of one-half the total depth below the original ground surface on the lowest point within the pit. The pit may be lined with a synthetic liner. Three sides of the reserve pit will be fenced within 24 hours after completion of construction and the fourth side within 24 hours after drilling operations cease with four strands of barbed wire, or woven wire topped with barbed wire to a height of not less than four feet. The fence will be kept in good repair while the pit is drying.

- b. Following drilling, the liquid waste will be evaporated from the pit and the pit backfilled and returned to natural grade. No liquid hydrocarbons will be discharged to the reserve pit or location.
- c. In the event fluids are produced, any oil will be retained in tanks until sold and any water produced will be retained until its quality can be determined. The quality and quantity of the water will determine the method of disposal.
- d. Trash will be contained in a portable metal container and will be hauled from location periodically and disposed of at an approved disposal site. Chemical toilets will be placed on location and sewage will be disposed of at an appropriate disposal site.

8. Ancillary Facilities

- a. We anticipate no need for ancillary facilities with the exception of trailers, Portable toilets, and Garbage containers to be located on the drill site.

9. Well-site Layout

- a. Because the well is drilled on an existing pad, available topsoil has been removed from the location and stockpiled. Location of the rig, reserve and blooie pits, and drilling support equipment will be located as shown on Exhibit "C".
- b. A blooie pit will be located at a minimum of 100' from the drill hole. A line will be placed on the surface from the center hole to the blooie pit. The blooie pit will not be lined, but will be fenced on four sides to protect livestock/wildlife.
- c. Access to the well pad will be as shown on Drawing A-2 and L-1.
- d. Natural runoff will be diverted around the well pad.

10. Plans for Restoration of Surface

- a. All surface areas not required for producing operations will be graded to as near original condition as possible and contoured to maintain possible erosion to a minimum.
- b. Available topsoil will be stockpiled and will be evenly distributed over the disturbed areas and the area will be reseeded as prescribed by the landowner.
- c. Pits and any other area that would present a hazard to wildlife or livestock will be fenced off when the rig is released and removed.

- d. Any oil accumulation on the pit will be removed or overhead flagged as dictated by then existed conditions.
- e. Rehabilitation will commence following completion of the well. Rat and mouse holes will be filled immediately upon release of the drilling rig from the location. If the well-site is to be abandoned, all disturbed areas will be recontoured to the natural contour as is possible.

11. Surface Ownership

- a. The well-site and access road will be constructed on lands owned by the School and Institutional Trust Lands Administration, 675 East 500 South, Salt Lake City, Utah 84102-2818; 801-538-5100. The operator shall contact the landowner and the Division of Oil, Gas and Mining 48 hours prior to beginning construction activities.

12. Other Information:

- a. The primary surface use is industrial. The nearest dwelling is approximately 2 miles North. Nearest live water is in Green River, 1.2 miles West.
- b. If there is snow on the ground when construction begins, it will be removed before the soil is disturbed, and piled downhill from the topsoil stockpile location.
- c. The back-slope and fore-slope will be constructed no steeper than 3:1.
- d. All equipment and vehicles will be confined to the access road and well pad.
- e. A complete copy of the approved Application for Permit to Drill (APD) including conditions and stipulations shall be on the well-site during construction and drilling operations.

There will be no deviation from the proposed drilling and/or workover program without prior approval from the Division of Oil, Gas & Mining.

13. **Company Representative**

Terry L. Hoffman
Delta Petroleum Corporation.
370 17th Street
Suite 4300
Denver, CO 80021
1-303-575-0323

Permitting Consultant

Larry W. Johnson
Talon Resources, Inc.
195 North 100 West
Huntington, UT. 84528
1-435-687-5310

Excavation Contractor

Nielson Construction
625 West 1300 North
Huntington, UT 84528
1-435-687-2494

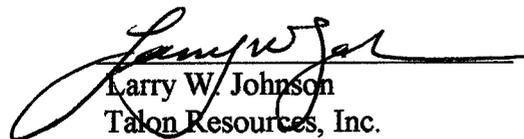
Mail Approved A.P.D. To:

Company Representative

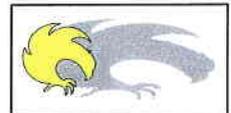
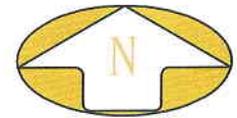
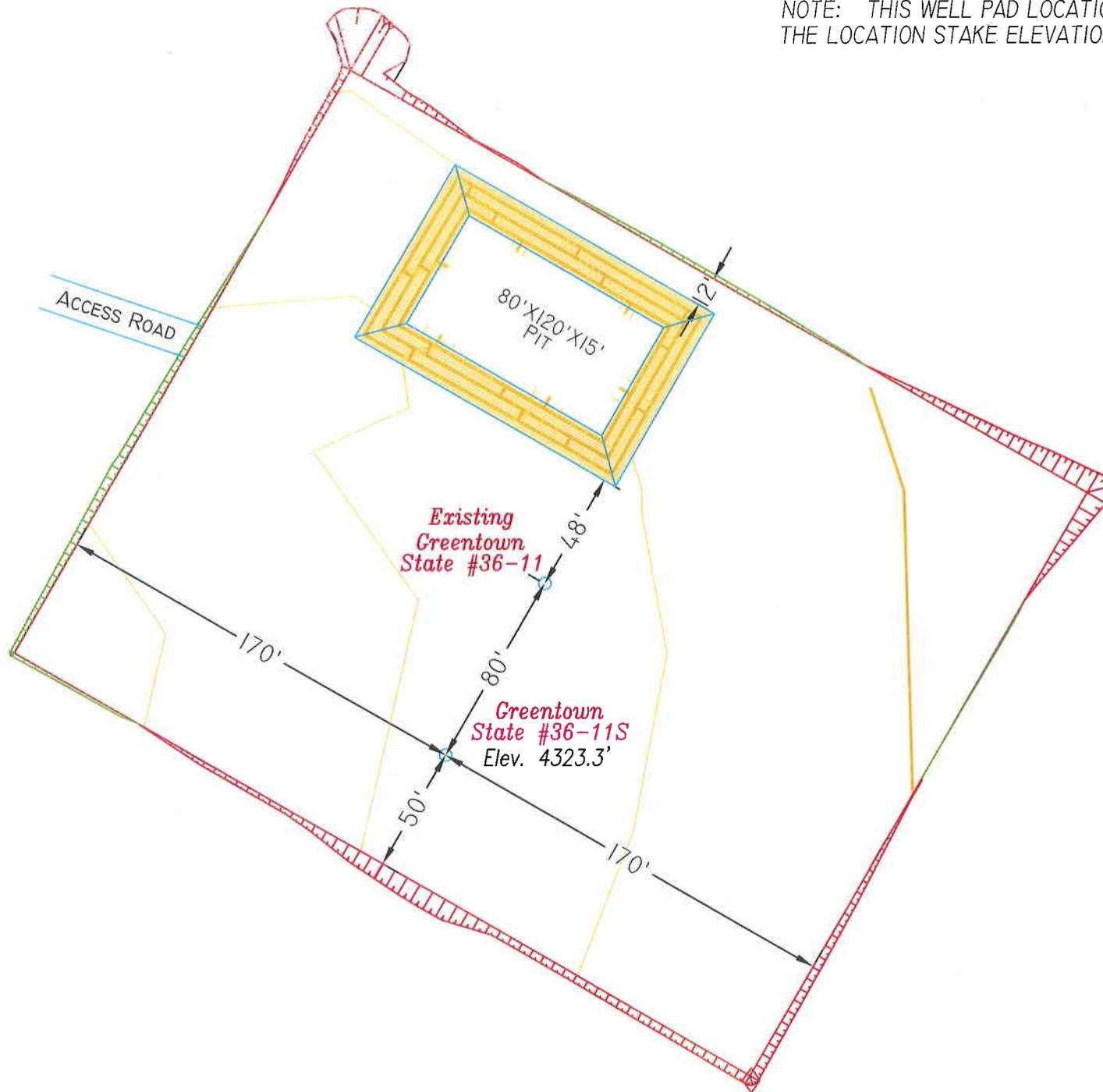
14. **Certification**

I hereby certify that I, or persons under my direct supervision have inspected the proposed drill site and access route; that I am familiar with the conditions which presently exist; that the statements made in this plan are, to the best of my knowledge, true and correct, and that the work associated with the operations proposed herein will be performed by Delta Petroleum Corporation and its subcontractors in conformity with this plan and the terms and conditions under which it is approved.

10/10/06
Date


Larry W. Johnson
Talon Resources, Inc.

NOTE: THIS WELL PAD LOCATION HAS BEEN BUILT.
 THE LOCATION STAKE ELEVATION REFLECTS THE ASBUILT ELEVATION.



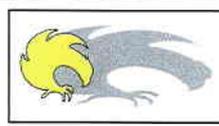
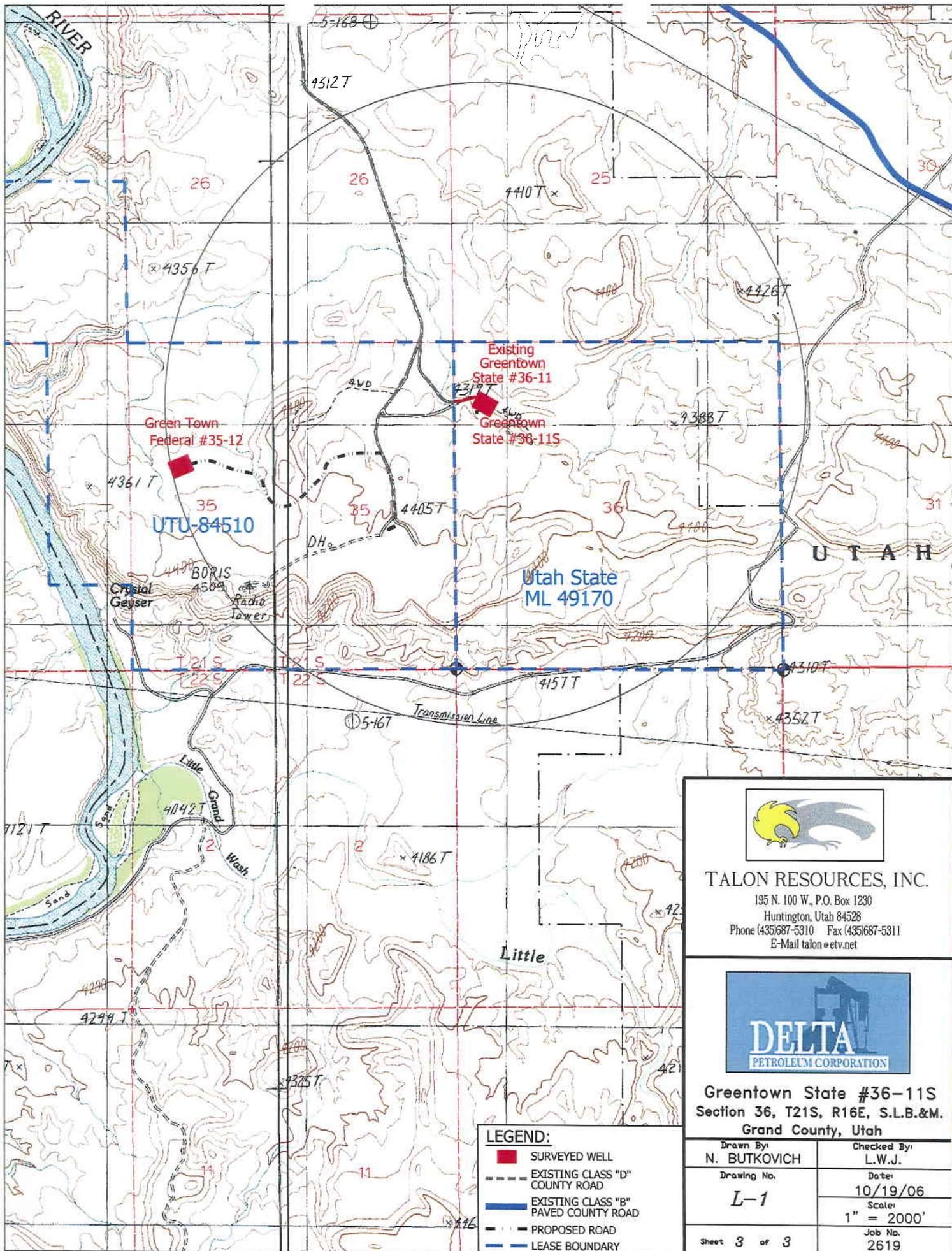
TALON RESOURCES, INC.

195 North 100 West P.O. Box 1230
 Huntington, Utah 84528
 Phone (435)687-5310 Fax (435)687-5311
 E-Mail talon@etv.net



LOCATION LAYOUT
 Section 36, T21S, R16E, S.L.B.&M.
 Greentown State #36-11S

| | |
|---------------------------|-----------------------|
| Drawn By: N. BUTKOVICH | Checked By: L.W.J. |
| Drawing No. A-2 | Date: 10/19/06 |
| | Scale: 1" = 60' |
| Sheet 2 of 3 | Job No. 2619 |



TALON RESOURCES, INC.
 195 N. 100 W., P.O. Box 1230
 Huntington, Utah 84528
 Phone (435)687-5310 Fax (435)687-5311
 E-Mail talon@etv.net



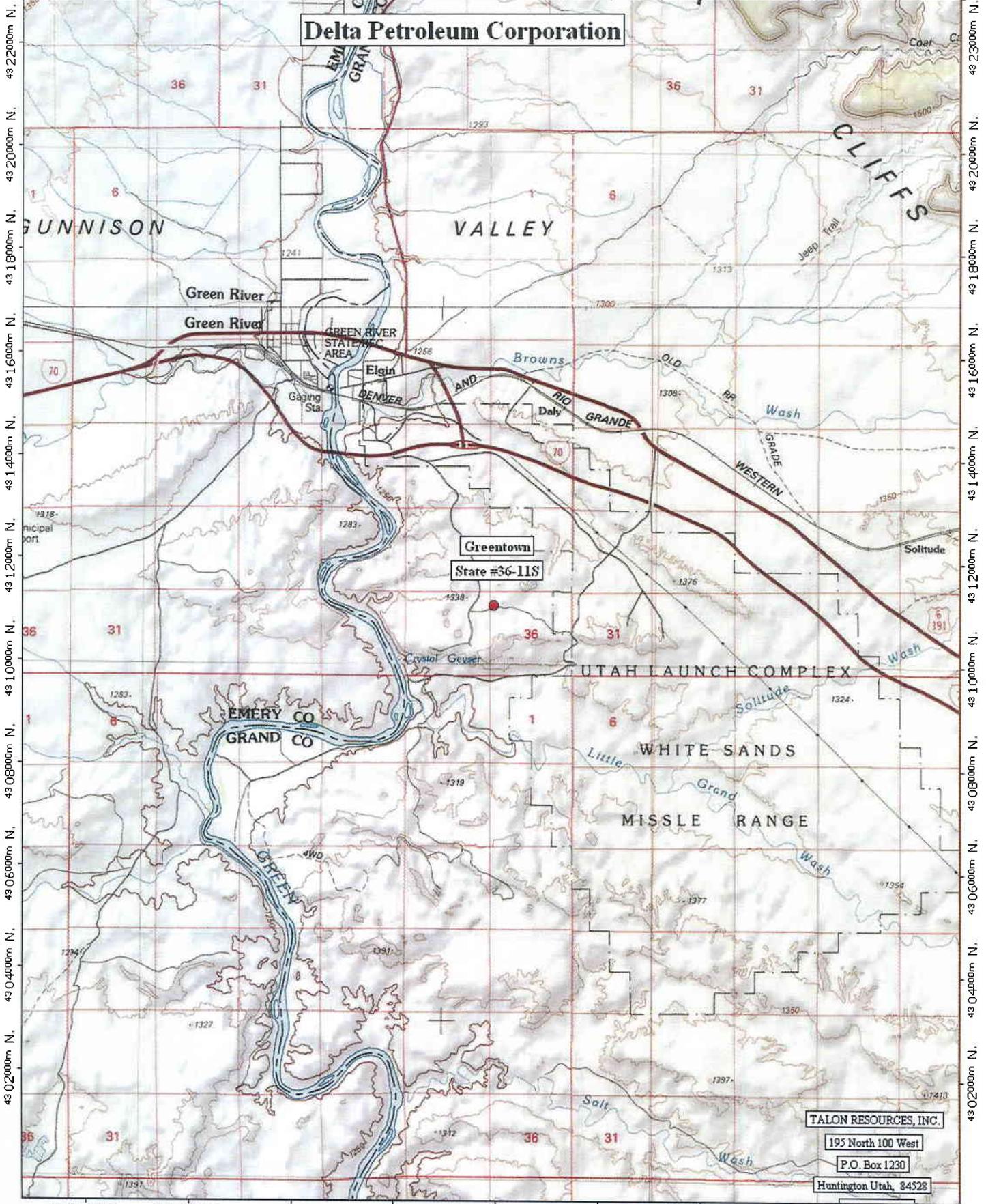
Greentown State #36-11S
 Section 36, T21S, R16E, S.L.B.&M.
 Grand County, Utah

LEGEND:

- SURVEYED WELL
- EXISTING CLASS "D" COUNTY ROAD
- EXISTING CLASS "B" PAVED COUNTY ROAD
- - - PROPOSED ROAD
- LEASE BOUNDARY

| | |
|----------------------------------|------------------------------|
| Drawn By: N. BUTKOVICH | Checked By: L.W.J. |
| Drawing No. L-1 | Date: 10/19/06 |
| | Scale: 1" = 2000' |
| Sheet 3 of 3 | Job No. 2619 |

569000m E. 571000m E. 573000m E. 575000m E. 577000m E. 579000m E. 581000m E. 583000m E. 585000m E.



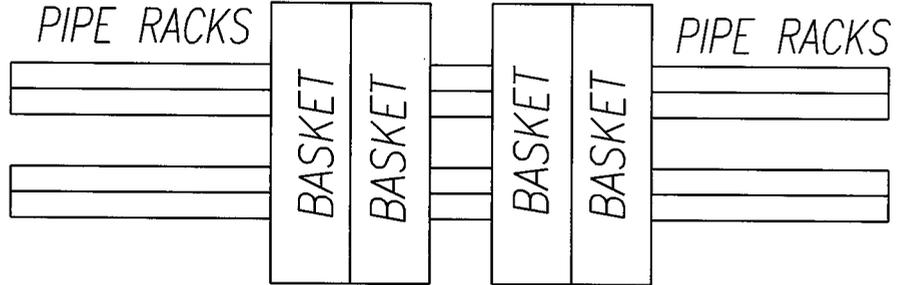
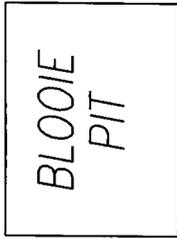
TN 12° MN



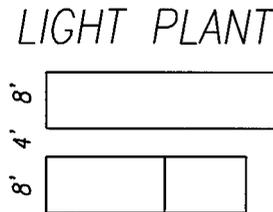
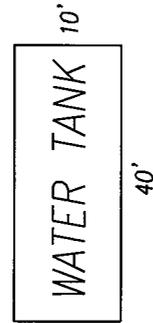
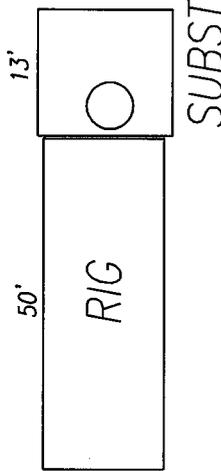
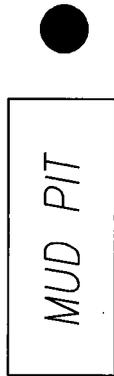
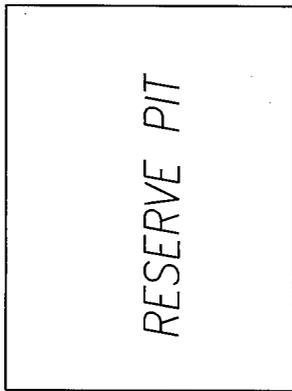
NAD27 Zone 12S 586000m E.

TALON RESOURCES, INC.
 195 North 100 West
 P.O. Box 1230
 Huntington Utah, 84528

Rig and Equipment Layout



EXIST'G DRILL HOLE



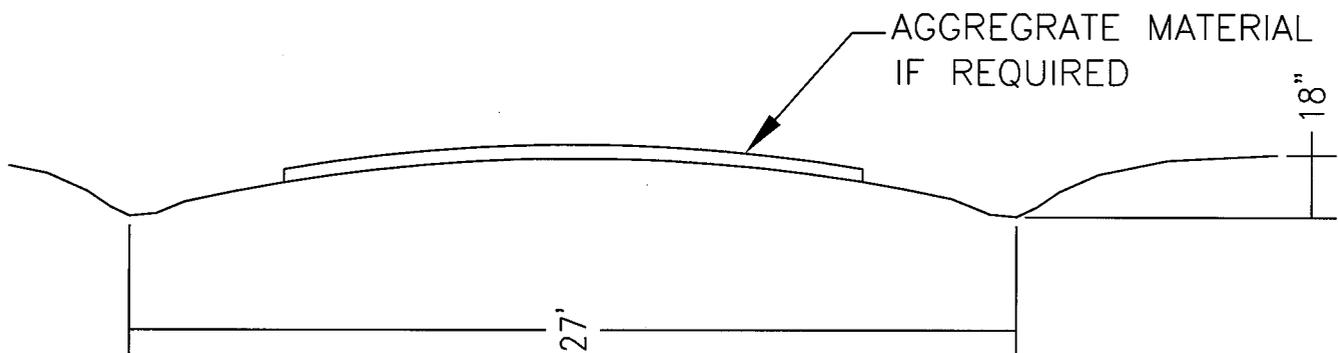
DIESEL FUEL 26' PROPANE



APPROXIMATE LAYOUT OF RIG & EQUIPMENT
(Not to Scale)

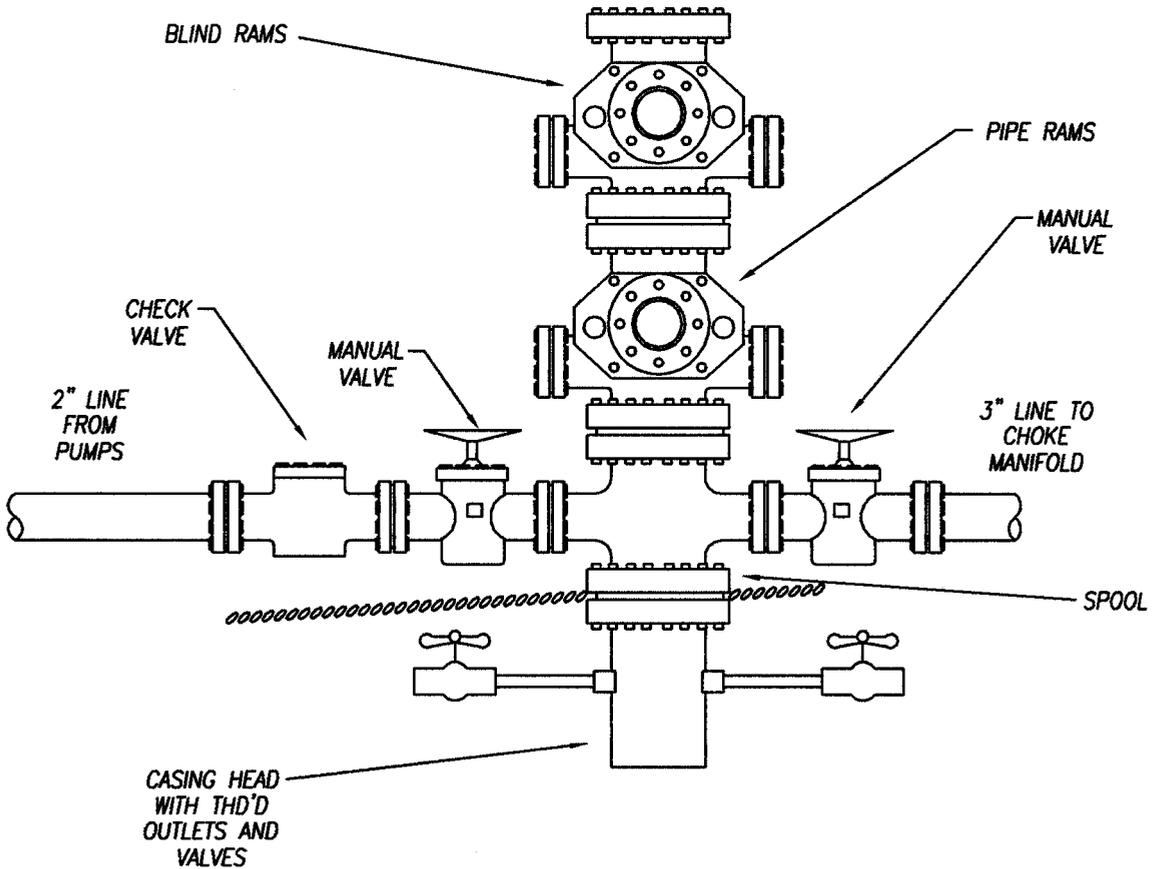


Typical Road Cross-Section





BOP Equipment 3000 psi



CHOKE MANIFOLD

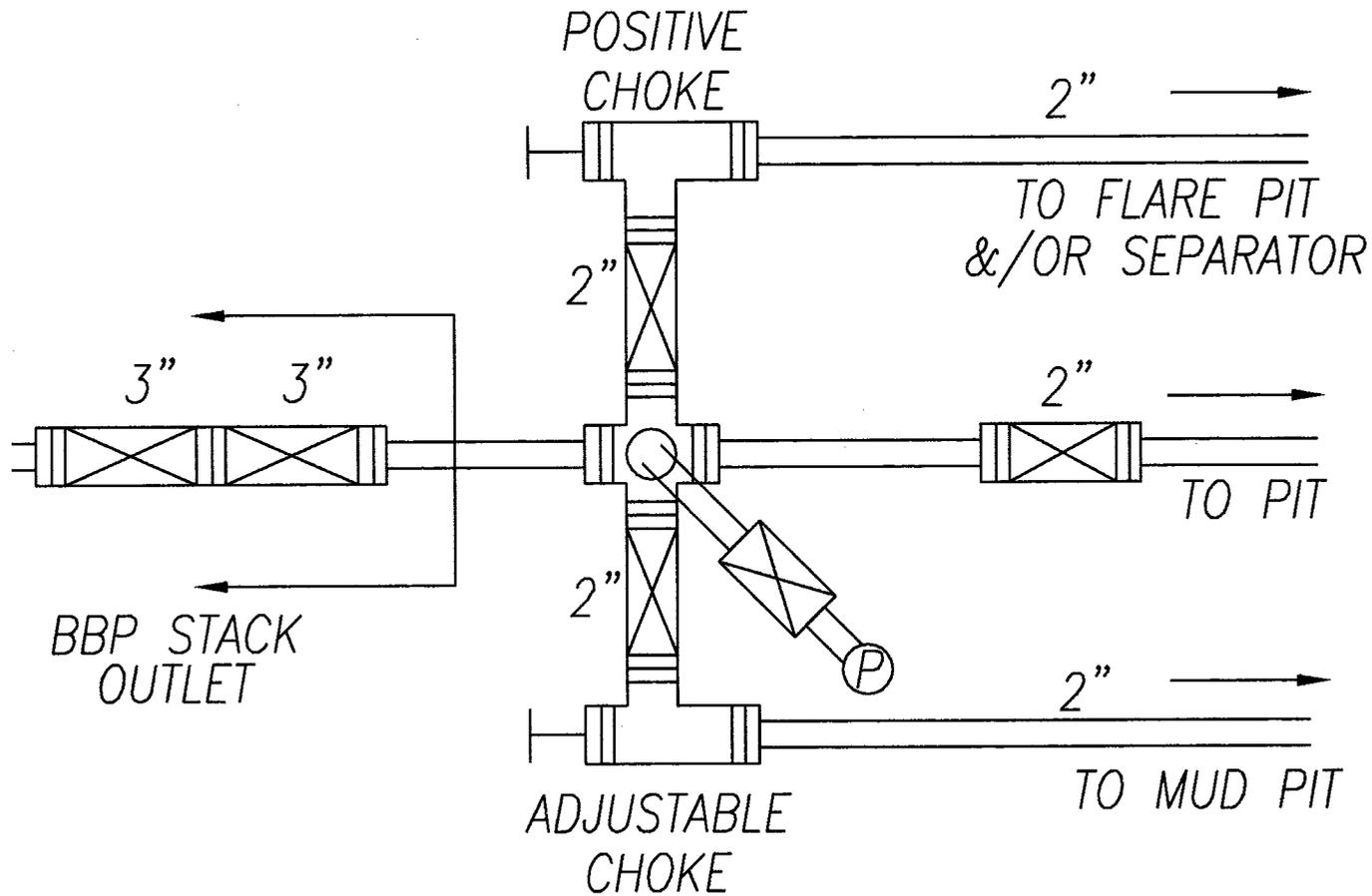
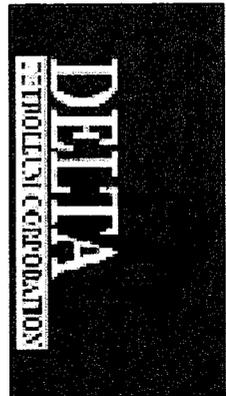


EXHIBIT "H"



**WORKSHEET
APPLICATION FOR PERMIT TO DRILL**

APD RECEIVED: 10/23/2006

| |
|--------------------------------|
| API NO. ASSIGNED: 43-019-31505 |
|--------------------------------|

WELL NAME: GREENTOWN ST 36-11S
 OPERATOR: DELTA PETROLEUM CORP (N2925)
 CONTACT: LARRY JOHNSON

PHONE NUMBER: 303-575-0323

PROPOSED LOCATION:

NWNW 36 210S 160E
 SURFACE: 1024 FNL 0429 FWL
 BOTTOM: 1024 FNL 0429 FWL
 COUNTY: GRAND
 LATITUDE: 38.94735 LONGITUDE: -110.1130
 UTM SURF EASTINGS: 576863 NORTHINGS: 4311100
 FIELD NAME: WILDCAT (1)

| INSPECT LOCATN BY: / / | | |
|------------------------|----------|----------|
| Tech Review | Initials | Date |
| Engineering | DJD | 11/13/06 |
| Geology | | |
| Surface | | |

LEASE TYPE: 3 - State
 LEASE NUMBER: ML-49170
 SURFACE OWNER: 3 - State

PROPOSED FORMATION: WHRM
 COALBED METHANE WELL? NO

RECEIVED AND/OR REVIEWED:

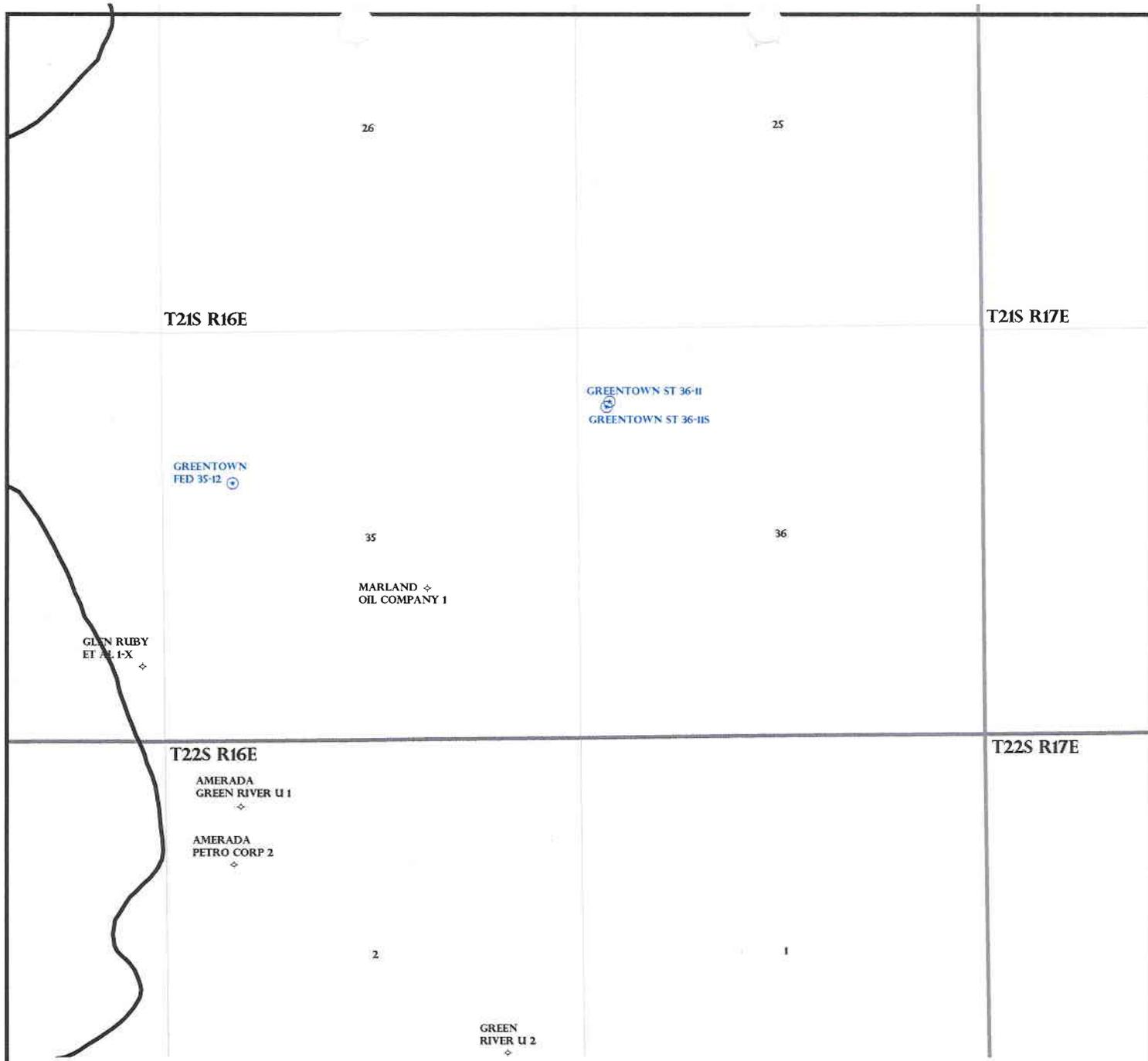
- Plat
- Bond: Fed[] Ind[] Sta[] Fee[]
(No. CPCS 215808)
- Potash (Y/N)
- Oil Shale 190-5 (B) or 190-3 or 190-13
- Water Permit
(No. MUNICIPAL)
- RDCC Review (Y/N)
(Date: _____)
- Fee Surf Agreement (Y/N)
- Intent to Commingle (Y/N)

LOCATION AND SITING:

- ___ R649-2-3.
- Unit: _____
- ___ R649-3-2. General
Siting: 460 From Qtr/Qtr & 920' Between Wells
- R649-3-3. Exception
- ___ Drilling Unit
Board Cause No: _____
Eff Date: _____
Siting: _____
- ___ R649-3-11. Directional Drill

COMMENTS: USE ONSITE FROM 36-11 WELL

STIPULATIONS: AS Spacing Slip
2- STATEMENT OF BASIS

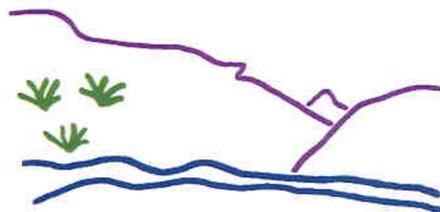


OPERATOR: DELTA PETRO CORP (N2925)
 SEC: 36 T.21S R. 16E
 FIELD: WILDCAT (001)
 COUNTY: GRAND
 SPACING: R649-3-3 / EXCEPTION LOCATION

- Field Status**
- ABANDONED
 - ACTIVE
 - COMBINED
 - INACTIVE
 - PROPOSED
 - STORAGE
 - TERMINATED

- Unit Status**
- EXPLORATORY
 - GAS STORAGE
 - NF PP OIL
 - NF SECONDARY
 - PENDING
 - PI OIL
 - PP GAS
 - PP GEOTHERML
 - PP OIL
 - SECONDARY
 - TERMINATED

- Wells Status**
- GAS INJECTION
 - GAS STORAGE
 - LOCATION ABANDONED
 - NEW LOCATION
 - PLUGGED & ABANDONED
 - PRODUCING GAS
 - PRODUCING OIL
 - SHUT-IN GAS
 - SHUT-IN OIL
 - TEMP. ABANDONED
 - TEST WELL
 - WATER INJECTION
 - WATER SUPPLY
 - WATER DISPOSAL
 - DRILLING



Utah Oil Gas and Mining



PREPARED BY: DIANA WHITNEY
 DATE: 26-OCTOBER-2006

DIVISION OF OIL, GAS AND MINING
APPLICATION FOR PERMIT TO DRILL
STATEMENT OF BASIS

(Original onsite done for the Greentown State 36-11 well)

OPERATOR: Delta Petroleum Corporation
WELL NAME & NUMBER: Greentown State #36-11S
API NUMBER: 43-019-31505
LOCATION: 1/4,1/4 NWNW Sec:36 TWP: 21S RNG: 16E 1024 FNL 429 FWL

Geology/Ground Water:

Significant volumes of high quality ground water are unlikely to be encountered in the bedrock at this location. A poorly permeable soil is likely to be developed on the Jurassic-age Brushy Basin Member of the Morrison Formation. A small but locally important quality ground water resource may be encountered in several permeable Mesozoic aquifers in this area. The proposed casing and cementing program should adequately isolate any zones of fresh water that may be penetrated. No underground water rights have been filed on any area within a mile of the proposed well site.

Reviewer: Christopher J. Kierst **Date:** 1/19/2006

Surface:

On-site conducted January 12, 2006. In attendance: Bart Kettle (DOGM), Ted Smith (DOGM), Larry Johnson (Talon Resources), Nathan Sill (DWR), Ed Bonner (SITLA), Terry Hoffman (Delta) and dirt contractor.

Questions regarding the status of roads used to access the well site. Some roads may not be county roads and require a BLM special use permit to use for drilling purposes. Reserve pit will require fencing on three sides at the time of drilling, with the fourth side being fenced immediately upon the removal of the drilling rig. **Addendum: Well site visited on February 14, 2006 to review changes made to the setting of the well pad. Well has been moved to the south, and as staked now lies on the edge of structures previously used as part of the Utah Launch Complex, White Sands Missile Range. SITLA in not showing an active lease at this site, and is not requesting restriction on the use of the surface. Provided the old building at this site will be tore down SITLA is requesting that it be removed from the site.**

Reviewer: Bart Kettle **Date:** January 13, 2006

Conditions of Approval/Application for Permit to Drill:

1. Fence Reserve Pit on three sides while drilling, with the fourth side being fenced upon the removal of the drilling rig.

2006-11 Delta Greentown 36-11S

Casing Schematic

BHP
 $0.052(3686)(9) = 1725 \text{ psi}$
 anticipate 1600 psi

gas
 $0.12(3686) = 442$
 1283 psi
 MASP

BOPE 3M ✓

Burst 2950
 70% = 2065 psi

Max P @ csg shoe
 $0.22(2486) = 547$
 1178 psi

test to 1200 psi ✓

✓ Adequate DUD
 11/13/06

8-5/8"
 MW 8.4
 Frac 19.3

4-1/2"
 MW 9.

12 1/2"
 18 1/2"

Surface

TOC @ Morrison 1.

481' Entrada ✓

898' TOC tail

TOC @ 1011.
 1033' Carmel

1198' Navajo
 Surface 1200. MD

1634' Kayenta
 1671' Wingate

2134' Chinle

2316' Shinarump
 2362' Moenkopi ✓

2957' Sinbad Is.

3057' TOC tail

3174' White Rim

Production
 3686. MD

| | | |
|--------------|--|-----------------------------|
| Well name: | 2006-11 Delta Greentown ST 36-11S | |
| Operator: | Delta Petroleum Corporation | |
| String type: | Surface | Project ID: 43-019-31505 |
| Location: | Grand County | |

| | | |
|---|------------------------------------|-------------------------------------|
| Design parameters: | Minimum design factors: | Environment: |
| <u>Collapse</u> | <u>Collapse:</u> | H2S considered? No |
| Mud weight: 8.400 ppg | Design factor 1.125 | Surface temperature: 65 °F |
| Design is based on evacuated pipe. | | Bottom hole temperature: 82 °F |
| | | Temperature gradient: 1.40 °F/100ft |
| | | Minimum section length: 250 ft |
| | <u>Burst:</u> | Cement top: 1 ft |
| | Design factor 1.00 | |
| <u>Burst</u> | <u>Tension:</u> | Non-directional string. |
| Max anticipated surface pressure: 1,056 psi | 8 Round STC: 1.80 (J) | |
| Internal gradient: 0.120 psi/ft | 8 Round LTC: 1.80 (J) | |
| Calculated BHP 1,200 psi | Buttress: 1.60 (J) | |
| | Premium: 1.50 (J) | |
| No backup mud specified. | Body yield: 1.50 (B) | Re subsequent strings: |
| | Tension is based on buoyed weight. | Next setting depth: 3,686 ft |
| | Neutral point: 1,049 ft | Next mud weight: 9,000 ppg |
| | | Next setting BHP: 1,723 psi |
| | | Fracture mud wt: 19.250 ppg |
| | | Fracture depth: 1,200 ft |
| | | Injection pressure: 1,200 psi |

| Run Seq | Segment Length (ft) | Size (in) | Nominal Weight (lbs/ft) | Grade | End Finish | True Vert Depth (ft) | Measured Depth (ft) | Drift Diameter (in) | Internal Capacity (ft³) |
|---------|---------------------|-----------|-------------------------|-------|------------|----------------------|---------------------|---------------------|-------------------------|
| 1 | 1200 | 8.625 | 24.00 | J-55 | ST&C | 1200 | 1200 | 7.972 | 429.1 |

| Run Seq | Collapse Load (psi) | Collapse Strength (psi) | Collapse Design Factor | Burst Load (psi) | Burst Strength (psi) | Burst Design Factor | Tension Load (Kips) | Tension Strength (Kips) | Tension Design Factor |
|---------|---------------------|-------------------------|------------------------|------------------|----------------------|---------------------|---------------------|-------------------------|-----------------------|
| 1 | 524 | 1370 | 2.616 | 1200 | 2950 | 2.46 | 25 | 244 | 9.69 J |

Prepared by: Clinton Dworshak
Div of Oil, Gas & Minerals

Phone: 801-538-5280
FAX: 810-359-3940

Date: November 2, 2006
Salt Lake City, Utah

Remarks:
Collapse is based on a vertical depth of 1200 ft, a mud weight of 8.4 ppg. The casing is considered to be evacuated for collapse purposes. Collapse strength is based on the Westcott, Dunlop & Kemler method of biaxial correction for tension.

Burst strength is not adjusted for tension.

Engineering responsibility for use of this design will be that of the purchaser.

| | | |
|--------------|--|-----------------------------|
| Well name: | 2006-11 Delta Greentown ST 36-11S | |
| Operator: | Delta Petroleum Corporation | |
| String type: | Production | Project ID: 43-019-31505 |
| Location: | Grand County | |

Design parameters:

Collapse

Mud weight: 9.000 ppg
Design is based on evacuated pipe.

Minimum design factors:

Collapse:

Design factor 1.125

Burst:

Design factor 1.00

Environment:

H2S considered? No
Surface temperature: 65 °F
Bottom hole temperature: 117 °F
Temperature gradient: 1.40 °F/100ft
Minimum section length: 1,500 ft

Cement top: 1,011 ft

Burst

Max anticipated surface pressure: 912 psi
Internal gradient: 0.220 psi/ft
Calculated BHP 1,723 psi

No backup mud specified.

Tension:

8 Round STC: 1.80 (J)
8 Round LTC: 1.80 (J)
Buttress: 1.60 (J)
Premium: 1.50 (J)
Body yield: 1.50 (B)

Non-directional string.

Tension is based on buoyed weight.

Neutral point: 3,194 ft

| Run Seq | Segment Length (ft) | Size (in) | Nominal Weight (lbs/ft) | Grade | End Finish | True Vert Depth (ft) | Measured Depth (ft) | Drift Diameter (in) | Internal Capacity (ft ³) |
|---------|---------------------|-------------------------|-------------------------|------------------|----------------------|----------------------|---------------------|-------------------------|--------------------------------------|
| 1 | 3686 | 4.5 | 12.60 | J-55 | Buttress | 3686 | 3686 | 3.833 | 314.9 |
| Run Seq | Collapse Load (psi) | Collapse Strength (psi) | Collapse Design Factor | Burst Load (psi) | Burst Strength (psi) | Burst Design Factor | Tension Load (Kips) | Tension Strength (Kips) | Tension Design Factor |
| 1 | 1723 | 5720 | 3.319 | 1723 | 5800 | 3.37 | 40 | 198 | 4.92 J |

Prepared by: Helen Sadik-Macdonald
Div of Oil, Gas & Minerals

Phone: 801-538-5357
FAX: 810-359-3940

Date: November 6, 2006
Salt Lake City, Utah

Remarks:

Collapse is based on a vertical depth of 3686 ft, a mud weight of 9 ppg. The casing is considered to be evacuated for collapse purposes. Collapse strength is based on the Westcott, Dunlop & Kemler method of biaxial correction for tension.

Burst strength is not adjusted for tension.

Engineering responsibility for use of this design will be that of the purchaser.

TALON RESOURCES INC

October 20, 2006

Mrs. Diana Whitney
State of Utah
Division of Oil Gas and Mining
P.O. Box 145801
Salt Lake City, Utah 84114-5801

RE: Application for Permit to Drill—
Greentown State 36-11S, 1024' FNL, 429' FWL Section 36, T21S, R16E, SLB&M. Grand County, Utah

Dear Ms. Whitney:

Delta Petroleum Corporation respectfully submits the enclosed original and two copies of the *Application for Permit to Drill (APD)* for each of the above referenced wells. Please replace the previous submitted APD packages for both wells under the referenced API numbers. Included with each APD is the following supplemental information:

- Exhibit "A" - Survey plats and layouts of the proposed well site;
- Exhibit "B" - Proposed location maps with utility corridors;
- Exhibit "C" - Drilling site layout;
- Exhibit "D" - Drilling Program;
- Exhibit "E" - Multi Point Surface Use Plan;
- Exhibit "F" - Typical road cross-section;
- Exhibit "G" - Typical BOP diagram;
- Exhibit "H" - Typical wellhead manifold diagram.

Please accept this letter as Delta's written request for confidential treatment of all information contained in and pertaining to this application, if said information is eligible for such consideration.

Thank you very much for your timely consideration of this application. Please feel free to contact myself, or Ms. Terry L. Hoffman at 303-575-0323 if you have any questions or need additional information.

Sincerely,



Larry W. Johnson
Talon Resources, Inc.

cc: Mr. Bart Kettle, Oil, Gas and Mining
Mr. Ed Bonner, SITLA
Ms. Terry L. Hoffman, Delta Petroleum Corp.
File

RECEIVED

OCT 23 2006

DIV. OF OIL, GAS & MINING



State of Utah

**Department of
Natural Resources**

MICHAEL R. STYLER
Executive Director

**Division of
Oil, Gas & Mining**

JOHN R. BAZA
Division Director

JON M. HUNTSMAN, JR.
Governor

GARY R. HERBERT
Lieutenant Governor

November 13, 2006

Delta Petroleum Corporation
370 17th Street, Suite 4300
Denver, CO 80021

Re: Greentown State 36-11S Well, 1024' FNL, 429' FWL, NW NW, Sec. 36,
T. 21 South, R. 16 East, Grand County, Utah

Gentlemen:

Pursuant to the provisions and requirements of Utah Code Ann. § 40-6-1 *et seq.*, Utah Administrative Code R649-3-1 *et seq.*, and the attached Conditions of Approval, approval to drill the referenced well is granted.

Appropriate information has been submitted to DOGM and administrative approval of the requested exception location is hereby granted.

This approval shall expire one year from the above date unless substantial and continuous operation is underway, or a request for extension is made prior to the expiration date. The API identification number assigned to this well is 43-019-31505.

Sincerely,

Gil Hunt
Associate Director

mf
Enclosures

cc: Grand County Assessor
SITLA

Operator: Delta Petroleum Corporation
Well Name & Number Greentown State 36-11S
API Number: 43-019-31505
Lease: ML-49170

Location: NW NW Sec. 36 T. 21 South R. 16 East

Conditions of Approval

1. **General**

Compliance with the requirements of Utah Admin. R. 649-1 *et seq.*, the Oil and Gas Conservation General Rules, and the applicable terms and provisions of the approved Application for Permit to Drill.

2. **Notification Requirements**

The operator is required to notify the Division of Oil, Gas and Mining of the following actions during drilling of this well:

- 24 hours prior to cementing or testing casing
- 24 hours prior to testing blowout prevention equipment
- 24 hours prior to spudding the well
- within 24 hours of any emergency changes made to the approved drilling program
- prior to commencing operations to plug and abandon the well

The following are Division of Oil, Gas and Mining contacts and their work telephone numbers (please leave a voice mail message if the person is not available to take the call):

- Dan Jarvis at (801) 538-5338
- Carol Daniels at (801) 538-5284 (spud)

3. **Reporting Requirements**

All required reports, forms and submittals will be promptly filed with the Division, including but not limited to the Entity Action Form (Form 6), Report of Water Encountered During Drilling (Form 7), Weekly Progress Reports for drilling and completion operations, and Sundry Notices and Reports on Wells requesting approval of change of plans or other operational actions.

4. Compliance with the State of Utah Antiquities Act forbids disturbance of archeological, historical, or paleontological remains. Should archeological, historical or paleontological remains be encountered during your operations, you are required to immediately suspend all operations and immediately inform the Trust Lands Administration and the Division of State History of the discovery of such remains.

5. This proposed well is located in an area for which drilling units (well spacing patterns) have not been established through an order of the Board of Oil, Gas and Mining (the "Board"). In order to avoid the possibility of waste or injury to correlative rights, the operator is requested, once the well has been drilled, completed, and has produced, to analyze geological and engineering data generated therefrom, as well as any similar data from surrounding areas if available. As soon as is practicable after completion of its analysis, and if the analysis suggests an area larger than the quarter-quarter section upon which the well is located is being drained, the operator is requested to seek an appropriate order from the Board establishing drilling and spacing units in conformance with such analysis by filing a Request for Agency Action with the Board.
6. Compliance with the Conditions of Approval/Application for Permit to Drill outlined in the Statement of Basis. (Copy Attached)

CONFIDENTIAL

DIVISION OF OIL, GAS AND MINING

SPUDDING INFORMATION

Name of Company: DELTA PETROLEUM COMPANY

Well Name: GREENTOWN ST 36-11S

Api No: 43-019-31505 Lease Type: STATE

Section 36 Township 21S Range 16E County GRAND

Drilling Contractor PETE MARTINS RIG # RATHOLE

SPUDDED:

Date 11/16/06

Time _____

How DRY

Drilling will Commence: _____

Reported by DON KINSLOWE

Telephone # (307) 259-9923

Date 11/17/06 Signed CHD

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

FORM 9

| | | |
|--|--|--|
| SUNDRY NOTICES AND REPORTS ON WELLS | | 5. LEASE DESIGNATION AND SERIAL NUMBER: ML-49170 |
| Do not use this form for proposals to drill new wells, significantly deepen existing wells below current bottom-hole depth, reenter plugged wells, or to drill horizontal laterals. Use APPLICATION FOR PERMIT TO DRILL form for such proposals. | | 6. IF INDIAN, ALLOTTEE OR TRIBE NAME: N/A |
| 1. TYPE OF WELL OIL WELL <input type="checkbox"/> GAS WELL <input checked="" type="checkbox"/> OTHER _____ | | 7. UNIT or CA AGREEMENT NAME: N/A |
| 2. NAME OF OPERATOR: Delta Petroleum Corporation | | 8. WELL NAME and NUMBER: Greentown State #36-11S |
| 3. ADDRESS OF OPERATOR: 370 17th st. Suite4300 CITY Denver STATE CO ZIP 80021 | | 9. API NUMBER: 4301931505 |
| | | 10. FIELD AND POOL, OR WILDCAT: Wildcat |
| 4. LOCATION OF WELL FOOTAGES AT SURFACE: 1024' FNL, 429' FWL | | COUNTY: Grand |
| QTR/QTR, SECTION, TOWNSHIP, RANGE, MERIDIAN: NWNW 36 21S 16E S | | STATE: UTAH |

11. CHECK APPROPRIATE BOXES TO INDICATE NATURE OF NOTICE, REPORT, OR OTHER DATA

| TYPE OF SUBMISSION | TYPE OF ACTION | | |
|---|--|---|--|
| <input checked="" type="checkbox"/> NOTICE OF INTENT (Submit in Duplicate) Approximate date work will start: _____ | <input type="checkbox"/> ACIDIZE | <input type="checkbox"/> DEEPEN | <input type="checkbox"/> REPERFORATE CURRENT FORMATION |
| <input type="checkbox"/> SUBSEQUENT REPORT (Submit Original Form Only) Date of work completion: _____ | <input type="checkbox"/> ALTER CASING | <input type="checkbox"/> FRACTURE TREAT | <input type="checkbox"/> SIDETRACK TO REPAIR WELL |
| | <input type="checkbox"/> CASING REPAIR | <input type="checkbox"/> NEW CONSTRUCTION | <input type="checkbox"/> TEMPORARILY ABANDON |
| | <input checked="" type="checkbox"/> CHANGE TO PREVIOUS PLANS | <input type="checkbox"/> OPERATOR CHANGE | <input type="checkbox"/> TUBING REPAIR |
| | <input type="checkbox"/> CHANGE TUBING | <input type="checkbox"/> PLUG AND ABANDON | <input type="checkbox"/> VENT OR FLARE |
| | <input type="checkbox"/> CHANGE WELL NAME | <input type="checkbox"/> PLUG BACK | <input type="checkbox"/> WATER DISPOSAL |
| | <input type="checkbox"/> CHANGE WELL STATUS | <input type="checkbox"/> PRODUCTION (START/RESUME) | <input type="checkbox"/> WATER SHUT-OFF |
| | <input type="checkbox"/> COMMINGLE PRODUCING FORMATIONS | <input type="checkbox"/> RECLAMATION OF WELL SITE | <input type="checkbox"/> OTHER: _____ |
| | <input type="checkbox"/> CONVERT WELL TYPE | <input type="checkbox"/> RECOMPLETE - DIFFERENT FORMATION | |

12. DESCRIBE PROPOSED OR COMPLETED OPERATIONS. Clearly show all pertinent details including dates, depths, volumes, etc.

Delta is relocating the pit, within the boundaries of the pad, to accommodate the drilling equipment.

Please replace the A-2 drawing with the revised A-2 drawing with revision date of 11/16/06

**Accepted by the
Utah Division of
Oil, Gas and Mining
FOR RECORD ONLY**

| | |
|---|--|
| NAME (PLEASE PRINT) <u>Larry W. Johnson</u> | TITLE <u>Agent for Delta Petroleum</u> |
| SIGNATURE | DATE <u>11/15/2006</u> |

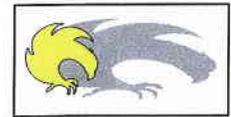
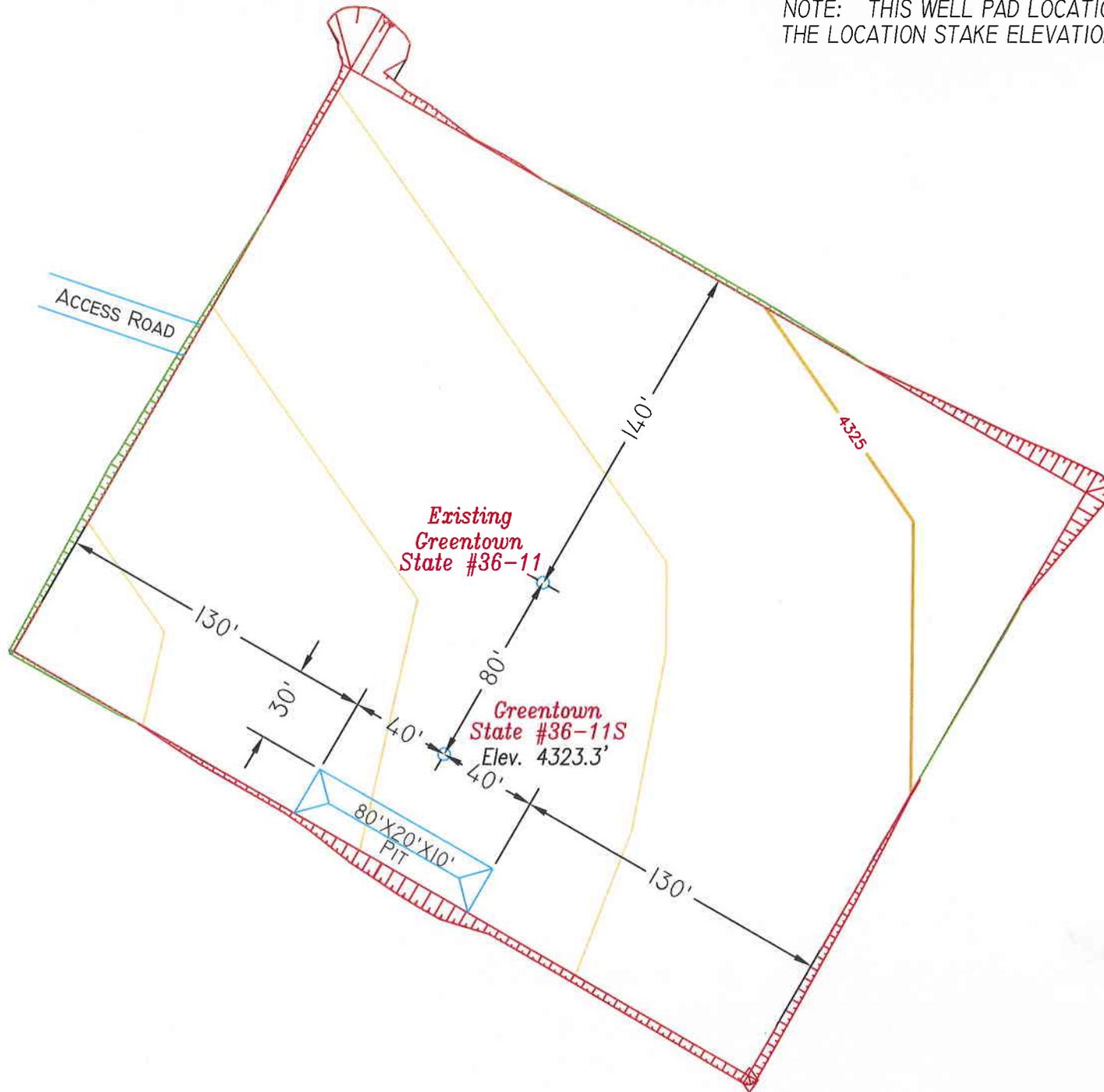
(This space for State use only)

RECEIVED

NOV 22 2006

DIV. OF OIL, GAS & MINING

NOTE: THIS WELL PAD LOCATION HAS BEEN BUILT.
THE LOCATION STAKE ELEVATION REFLECTS THE ASBUILT ELEVATION.



TALON RESOURCES, INC.

195 North 100 West P.O. Box 1230
Huntington, Utah 84528
Phone (435)687-5310 Fax (435)687-5311
E-Mail talon@trv.net



LOCATION LAYOUT
Section 36, T21S, R16E, S.L.B.&M.
Greentown State #36-11S

| | |
|---------------------------|-----------------------|
| Drawn By: N. BUTKOVICH | Checked By: L.W.J. |
| Drawing No. A-2 | Date: 10/19/06 |
| | Scale: 1" = 60' |
| Sheet 2 of 3 | Job No. 2619 |

REVISION: 11/16/06

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

CONFIDENTIAL

FORM 9

| | | |
|--|--|--|
| SUNDRY NOTICES AND REPORTS ON WELLS | | 5. LEASE DESIGNATION AND SERIAL NUMBER: ML-49170 |
| Do not use this form for proposals to drill new wells, significantly deepen existing wells below current bottom-hole depth, reenter plugged wells, or to drill horizontal laterals. Use APPLICATION FOR PERMIT TO DRILL form for such proposals. | | 6. IF INDIAN, ALLOTTEE OR TRIBE NAME: N/A |
| 1. TYPE OF WELL OIL WELL <input type="checkbox"/> GAS WELL <input checked="" type="checkbox"/> OTHER _____ | | 7. UNIT or CA AGREEMENT NAME: N/A |
| 2. NAME OF OPERATOR: Delta Petroleum Corporation | | 8. WELL NAME and NUMBER: Greentown State #36-11S |
| 3. ADDRESS OF OPERATOR: 370 17th st. Suite4300 CITY Denver STATE CO ZIP 80021 | | 9. API NUMBER: 4301931505 |
| 4. LOCATION OF WELL FOOTAGES AT SURFACE: 1024' FNL, 429' FWL | | 10. FIELD AND POOL, OR WILDCAT: Wildcat |
| QTR/QTR, SECTION, TOWNSHIP, RANGE, MERIDIAN: NWNW 36 21S 16E S | | COUNTY: Grand |
| | | STATE: UTAH |

11. CHECK APPROPRIATE BOXES TO INDICATE NATURE OF NOTICE, REPORT, OR OTHER DATA

| TYPE OF SUBMISSION | TYPE OF ACTION | | |
|--|--|---|--|
| <input checked="" type="checkbox"/> NOTICE OF INTENT (Submit in Duplicate) Approximate date work will start: _____ | <input type="checkbox"/> ACIDIZE | <input type="checkbox"/> DEEPEN | <input type="checkbox"/> REPERFORATE CURRENT FORMATION |
| <input type="checkbox"/> SUBSEQUENT REPORT (Submit Original Form Only) Date of work completion: _____ | <input type="checkbox"/> ALTER CASING | <input type="checkbox"/> FRACTURE TREAT | <input type="checkbox"/> SIDETRACK TO REPAIR WELL |
| | <input type="checkbox"/> CASING REPAIR | <input type="checkbox"/> NEW CONSTRUCTION | <input type="checkbox"/> TEMPORARILY ABANDON |
| | <input checked="" type="checkbox"/> CHANGE TO PREVIOUS PLANS | <input type="checkbox"/> OPERATOR CHANGE | <input type="checkbox"/> TUBING REPAIR |
| | <input type="checkbox"/> CHANGE TUBING | <input type="checkbox"/> PLUG AND ABANDON | <input type="checkbox"/> VENT OR FLARE |
| | <input type="checkbox"/> CHANGE WELL NAME | <input type="checkbox"/> PLUG BACK | <input type="checkbox"/> WATER DISPOSAL |
| | <input type="checkbox"/> CHANGE WELL STATUS | <input type="checkbox"/> PRODUCTION (START/RESUME) | <input type="checkbox"/> WATER SHUT-OFF |
| | <input type="checkbox"/> COMMINGLE PRODUCING FORMATIONS | <input type="checkbox"/> RECLAMATION OF WELL SITE | <input type="checkbox"/> OTHER: _____ |
| | <input type="checkbox"/> CONVERT WELL TYPE | <input type="checkbox"/> RECOMPLETE - DIFFERENT FORMATION | |

12. DESCRIBE PROPOSED OR COMPLETED OPERATIONS. Clearly show all pertinent details including dates, depths, volumes, etc.

Delta is changing the Production Casing size to a 5-1/2" OD with a weight of 17 lbs/ft. from the Production Casing size of 4-1/2" OD with a weight of 12.6 lbs/ft. No other changes to the Drilling plan have been made.

Please replace page 2 of the Drilling Plan with the attached, revised, page 2.

COPY SENT TO OPERATOR
Date: 12/19/06
Initials: LWJ

| | |
|---|--|
| NAME (PLEASE PRINT) <u>Larry W. Johnson</u> | TITLE <u>Agent for Delta Petroleum</u> |
| SIGNATURE | DATE <u>11/29/2006</u> |

(This space for State use only)

APPROVED BY THE STATE
OF UTAH DIVISION OF
OIL, GAS, AND MINING
DATE: 12/11/06 (See Instructions on Reverse Side)
BY:

RECEIVED
NOV 30 2006
DIV. OF OIL, GAS & MINING

mineral deposits.

All indications of usable water will be reported.

Surface casing will be tested to 1500 psi for 15 minutes. Pressure drop is not to exceed 150 psi.

4) The Proposed Casing and Cementing Programs

Casing Program

| Hole Size | Setting Depth | Size (OD) | Weight, Grade & Joint | Condition |
|-----------|---------------|-----------|-----------------------|-----------|
| 11" | 1200' | 8-5/8" | 24#, J-55 ST&C | New |
| 7-7/8" | 3686' | 5-1/2" | 17#, J-55 LT&C | New |

Cement Program

Surface Casing:

Lead: 215 sxs 85/15/8 Poz A
Weight: 12.5 #/gal
Yield: 2.14 cu.ft/sk
Cmt Top 0'

Tail: 110 sxs Type III
Weight: 14.6 #/gal
Yield: 1.41 cu.ft/sk
Cmt Top 900'

Production Casing:

Lead: 300 sxs 85/15/8 Poz A
Weight: 12.5 #/gal
Yield: 2.14 cu.ft/sk
Cmt Top 0'

Tail: 140 sxs Type III
Weight: 14.6 #/gal
Yield: 1.41 cu.ft/sk
Cmt Top 2900'

The following shall be entered in the driller's log:

- 1) Blowout preventer pressure tests, including test pressures and results;
- 2) Blowout preventer tests for proper functioning;
- 3) Blowout prevention drills conducted;
- 4) Casing run, including size, grade, weight, and depth set;
- 5) How the pipe was cemented, including amount of cement, type, whether cement

| | | | |
|--------------|--|--|--------------|
| Well name: | 2006-11 Delta Greentown ST 36-11SRev. | | |
| Operator: | Delta Petroleum Corporation | | Project ID: |
| String type: | Production | | 43-019-31505 |
| Location: | Grand County | | |

Design parameters:

Collapse

Mud weight: 9.000 ppg
 Design is based on evacuated pipe.

Minimum design factors:

Collapse:

Design factor 1.125

Burst:

Design factor 1.00

Environment:

H2S considered? No
 Surface temperature: 65 °F
 Bottom hole temperature: 117 °F
 Temperature gradient: 1.40 °F/100ft
 Minimum section length: 1,500 ft

Cement top: 449 ft

Burst

Max anticipated surface pressure: 912 psi
 Internal gradient: 0.220 psi/ft
 Calculated BHP 1,723 psi

No backup mud specified.

Tension:

8 Round STC: 1.80 (J)
 8 Round LTC: 1.80 (J)
 Buttress: 1.60 (J)
 Premium: 1.50 (J)
 Body yield: 1.50 (B)

Non-directional string.

Tension is based on buoyed weight.
 Neutral point: 3,183 ft

| Run Seq | Segment Length (ft) | Size (in) | Nominal Weight (lbs/ft) | Grade | End Finish | True Vert Depth (ft) | Measured Depth (ft) | Drift Diameter (in) | Internal Capacity (ft³) |
|---------|---------------------|-------------------------|-------------------------|------------------|----------------------|----------------------|---------------------|-------------------------|-------------------------|
| 1 | 3686 | 5.5 | 17.00 | J-55 | LT&C | 3686 | 3686 | 4.767 | 481.1 |
| Run Seq | Collapse Load (psi) | Collapse Strength (psi) | Collapse Design Factor | Burst Load (psi) | Burst Strength (psi) | Burst Design Factor | Tension Load (Kips) | Tension Strength (Kips) | Tension Design Factor |
| 1 | 1723 | 4910 | 2.849 | 1723 | 5320 | 3.09 | 54 | 247 | 4.56 J |

Prepared by: Helen Sadik-Macdonald
 Div of Oil, Gas & Minerals

Phone: 801-538-5357
 FAX: 810-359-3940

Date: December 1, 2006
 Salt Lake City, Utah

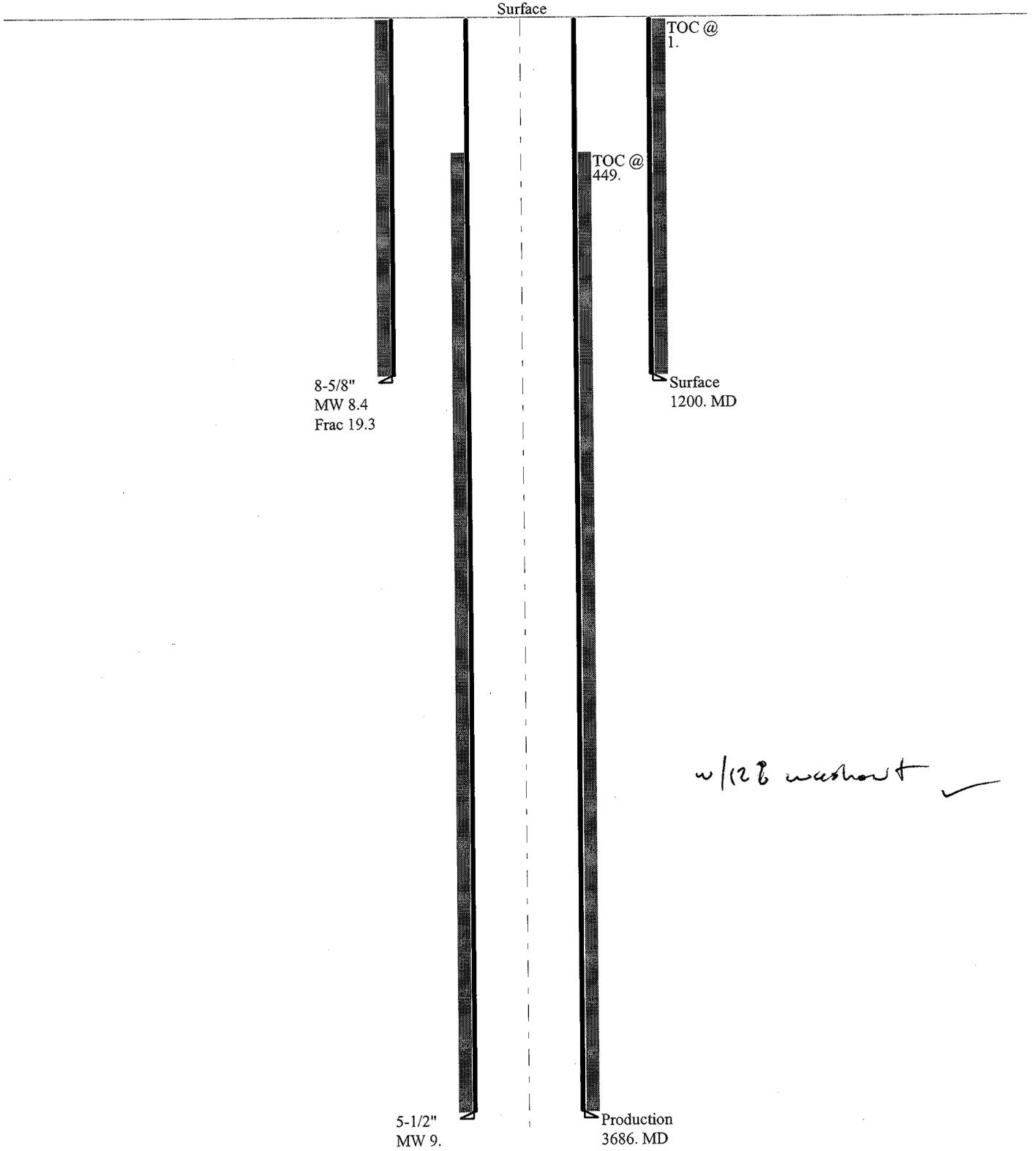
Remarks:

Collapse is based on a vertical depth of 3686 ft, a mud weight of 9 ppg. The casing is considered to be evacuated for collapse purposes. Collapse strength is based on the Westcott, Dunlop & Kemler method of biaxial correction for tension.

Burst strength is not adjusted for tension.

Engineering responsibility for use of this design will be that of the purchaser.

2006-11 Delta Greentown ST 30-11S Rev.
Casing Schematic



STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

FORM 6

ENTITY ACTION FORM

Operator: Delta Petroleum Corporation
Address: 370 17th St, Suite 4300
city Denver
state CO zip 80202

Operator Account Number: N 2925
Phone Number: (303) 575-0323

Well 1

| API Number | Well Name | QQ | Sec | Twp | Rng | County |
|-----------------------|-------------------------|-------------------|------------|-----|----------------------------------|---------------------|
| 4301931505 | Greentown State #36-11S | NWNW | 36 | 21S | 16E | Grand |
| Action Code | Current Entity Number | New Entity Number | Spud Date | | Entity Assignment Effective Date | |
| A | 99999 | 15820 | 11/16/2006 | | 12/13/06 | |
| Comments: <u>WHRM</u> | | | | | | CONFIDENTIAL |

Well 2

| API Number | Well Name | QQ | Sec | Twp | Rng | County |
|-------------|-----------------------|-------------------|-----------|-----|----------------------------------|--------|
| | | | | | | |
| Action Code | Current Entity Number | New Entity Number | Spud Date | | Entity Assignment Effective Date | |
| | | | | | | |
| Comments: | | | | | | |

Well 3

| API Number | Well Name | QQ | Sec | Twp | Rng | County |
|-------------|-----------------------|-------------------|-----------|-----|----------------------------------|--------|
| | | | | | | |
| Action Code | Current Entity Number | New Entity Number | Spud Date | | Entity Assignment Effective Date | |
| | | | | | | |
| Comments: | | | | | | |

ACTION CODES:

- A - Establish new entity for new well (single well only)
- B - Add new well to existing entity (group or unit well)
- C - Re-assign well from one existing entity to another existing entity
- D - Re-assign well from one existing entity to a new entity
- E - Other (Explain in 'comments' section)

Terry L. Hoffman

Name (Please Print)

Terry L. Hoffman

Signature

Regulatory Tech Manager

12/4/2006

Title

Date

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DEC 04 2006

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

CONFIDENTIAL FORM 9

| | | |
|--|--|--|
| SUNDRY NOTICES AND REPORTS ON WELLS | | 5. LEASE DESIGNATION AND SERIAL NUMBER: ML-49170 |
| Do not use this form for proposals to drill new wells, significantly deepen existing wells below current bottom-hole depth, reenter plugged wells, or to drill horizontal laterals. Use APPLICATION FOR PERMIT TO DRILL form for such proposals. | | 6. IF INDIAN, ALLOTTEE OR TRIBE NAME: NA |
| 1. TYPE OF WELL OIL WELL <input type="checkbox"/> GAS WELL <input checked="" type="checkbox"/> OTHER _____ | | 7. UNIT or CA AGREEMENT NAME: NA |
| 2. NAME OF OPERATOR: Delta Petroleum Corporation | | 8. WELL NAME and NUMBER: Greentown State 36-11S |
| 3. ADDRESS OF OPERATOR: 370 17th St., Ste. 4300 CITY Denver STATE CO ZIP 80202 | | 9. API NUMBER: 4301931505 |
| 4. LOCATION OF WELL FOOTAGES AT SURFACE: 1024' FNL & 429' FWL | | 10. FIELD AND POOL, OR WILDCAT: Wildcat |
| QTR/QTR, SECTION, TOWNSHIP, RANGE, MERIDIAN: NWNW 36 21S 16E | | COUNTY: Grand |
| | | STATE: UTAH |

11. CHECK APPROPRIATE BOXES TO INDICATE NATURE OF NOTICE, REPORT, OR OTHER DATA

| TYPE OF SUBMISSION | TYPE OF ACTION | | |
|---|---|---|---|
| <input type="checkbox"/> NOTICE OF INTENT (Submit in Duplicate) Approximate date work will start: _____ | <input type="checkbox"/> ACIDIZE | <input type="checkbox"/> DEEPEN | <input type="checkbox"/> REPERFORATE CURRENT FORMATION |
| | <input type="checkbox"/> ALTER CASING | <input type="checkbox"/> FRACTURE TREAT | <input type="checkbox"/> SIDETRACK TO REPAIR WELL |
| | <input type="checkbox"/> CASING REPAIR | <input type="checkbox"/> NEW CONSTRUCTION | <input type="checkbox"/> TEMPORARILY ABANDON |
| | <input type="checkbox"/> CHANGE TO PREVIOUS PLANS | <input type="checkbox"/> OPERATOR CHANGE | <input type="checkbox"/> TUBING REPAIR |
| | <input type="checkbox"/> CHANGE TUBING | <input type="checkbox"/> PLUG AND ABANDON | <input type="checkbox"/> VENT OR FLARE |
| <input checked="" type="checkbox"/> SUBSEQUENT REPORT (Submit Original Form Only) Date of work completion: _____ | <input type="checkbox"/> CHANGE WELL NAME | <input type="checkbox"/> PLUG BACK | <input type="checkbox"/> WATER DISPOSAL |
| | <input type="checkbox"/> CHANGE WELL STATUS | <input type="checkbox"/> PRODUCTION (START/RESUME) | <input type="checkbox"/> WATER SHUT-OFF |
| | <input type="checkbox"/> COMMINGLE PRODUCING FORMATIONS | <input type="checkbox"/> RECLAMATION OF WELL SITE | <input checked="" type="checkbox"/> OTHER: <u>Monthly Status Report</u> |
| | <input type="checkbox"/> CONVERT WELL TYPE | <input type="checkbox"/> RECOMPLETE - DIFFERENT FORMATION | |

12. DESCRIBE PROPOSED OR COMPLETED OPERATIONS. Clearly show all pertinent details including dates, depths, volumes, etc.

TIGHT HOLE STATUS

11/22/06-02/06/06
See attached "Drilling Chronological Regulatory Report"

Well shut in as of 2/6/06 (waiting on rig availability)

As of 3/22/07 Completion Reports have not been filed because Delta has still not finished completions.

| | |
|---|------------------------------------|
| NAME (PLEASE PRINT) <u>Kate Shirley</u> | TITLE <u>Regulatory Technician</u> |
| SIGNATURE | DATE <u>3/23/2007</u> |

(This space for State use only)

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DIV. OF OIL, GAS & MINING

(5/2000) (See Instructions on Reverse Side)

CONFIDENTIAL

| | | | |
|---|-----------------------------|----------------|------------|
| Well Name: Greentown State 36-11 OS (Offset) | | | |
| Field Name: | Wildcat | S/T/R: | 36/21S/16E |
| Operator: | Delta Petroleum Corporation | County, State: | Grand, UT |
| | Location Desc: | District: | Northern |

| | | | |
|----------------------|------------|-----------------------|--------|
| Daily Summary | | | |
| Activity Date : | 11/22/2006 | Days From Spud : | 1 |
| Current Depth : | 48 Ft | 24 Hr. Footage Made : | 48 Ft |
| Rig Company : | DHS | Rig Name: | DHS #3 |
| Formation : | Surface | Weather: | |

| Operations | | | | | | |
|-------------------|-------|------|-------------------------|-------------|-----------|-----|
| Start | Hrs | Code | Remarks | Start Depth | End Depth | Run |
| 6:00 | 22.50 | 01 | Rig Up | 0 | 0 | NIH |
| 4:30 | 0.50 | 02 | Spud Well | 0 | 48 | 1 |
| 5:00 | 1.00 | 08 | Starter on # 2 pump out | 48 | 48 | 1 |
| Total: | 24.00 | | | | | |

| Mud Properties | | | | | | | | | | | | | | | | |
|-----------------------|------|-------|---------|---------|----|----|-------|------|------|------------|-------|-------|-----------|----------|------|--|
| Depth | Time | Wt In | Wt Out | Vis | PV | YP | Gels | FL | HTFL | FC | HTFC | Solid | Water | Oil | Sand | |
| 60 | | 0.00 | 0.00 | 0 | 0 | 0 | 0/0/0 | 0.0 | 0.0 | 0 | 0.00 | 0.0% | 0.0% | 0.0% | 0.0% | |
| MBT | pH | Pm | Pf | Mf | Cl | Ca | ES | Pom | Lime | Total Sal. | CaCl2 | EDTA | O/W Ratio | Mud Loss | | |
| 0.0 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 | 0.00 | 0.00 | 0 | 0 | 0.00 | | 0 | | |
| Water Loss | LCM | ECD | FL Temp | Remarks | | | | | | | | | | | | |
| 0 | 0.0 | 0.0 | 0 | water | | | | | | | | | | | | |

| | | | |
|----------------------|------------|-----------------------|--------|
| Daily Summary | | | |
| Activity Date : | 11/23/2006 | Days From Spud : | 2 |
| Current Depth : | 150 Ft | 24 Hr. Footage Made : | 102 Ft |
| Rig Company : | DHS | Rig Name: | DHS #3 |
| Formation : | | Weather: | |

| Operations | | | | | | |
|-------------------|-------|------|--|-------------|-----------|-----|
| Start | Hrs | Code | Remarks | Start Depth | End Depth | Run |
| 6:00 | 12.25 | 08 | Repair pump starter & wait on drill crew | 48 | 48 | 1 |
| 18:15 | 10.75 | 02 | Drilling Surface | 48 | 150 | 2 |
| 5:00 | 1.00 | 24 | Waiting on water | 150 | 150 | 2 |
| Total: | 24.00 | | | | | |

| Mud Properties | | | | | | | | | | | | | | | | |
|-----------------------|------|-------|---------|------------------------------|----|----|-------|------|------|------------|-------|-------|-----------|----------|------|--|
| Depth | Time | Wt In | Wt Out | Vis | PV | YP | Gels | FL | HTFL | FC | HTFC | Solid | Water | Oil | Sand | |
| 150 | 6:00 | 0.00 | 0.00 | 0 | 0 | 0 | 0/0/0 | 0.0 | 0.0 | 0 | 0.00 | 0.0% | 0.0% | 0.0% | 0.0% | |
| MBT | pH | Pm | Pf | Mf | Cl | Ca | ES | Pom | Lime | Total Sal. | CaCl2 | EDTA | O/W Ratio | Mud Loss | | |
| 0.0 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 | 0.00 | 0.00 | 0 | 0 | 0.00 | | 0 | | |
| Water Loss | LCM | ECD | FL Temp | Remarks | | | | | | | | | | | | |
| 600 | 0.0 | 0.0 | 0 | water lost 800 + bbls water. | | | | | | | | | | | | |

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DIV. OF OIL, GAS & MINING

Well Name: Greentown State 36-11 OS (Offset)

| | | | | | |
|-------------|-----------------------------|----------------|------------|----------------|-----------|
| Field Name: | Wildcat | S/T/R: | 36/21S/16E | County, State: | Grand, UT |
| Operator: | Delta Petroleum Corporation | Location Desc: | | District: | Northern |

Daily Summary

| | | | | | | | |
|-----------------|------------|------------------|---|-----------------|--------|-----------------------|--------|
| Activity Date : | 11/24/2006 | Days From Spud : | 3 | Current Depth : | 480 Ft | 24 Hr. Footage Made : | 330 Ft |
| Rig Company : | DHS | | | Rig Name: | DHS #3 | | |
| Formation : | | | | Weather: | | | |

Operations

| Start | Hrs | Code | Remarks | Start Depth | End Depth | Run |
|--------|-------|------|-------------------|-------------|-----------|-----|
| 6:00 | 2.00 | 24 | Wait on water | 150 | 150 | 2 |
| 8:00 | 5.00 | 02 | Continue drilling | 150 | 212 | 2 |
| 13:00 | 0.50 | 10 | Survey | 212 | 212 | 2 |
| 13:30 | 12.00 | 02 | Drilling | 212 | 418 | 2 |
| 1:30 | 0.50 | 10 | Survey | 418 | 418 | 2 |
| 2:00 | 4.00 | 02 | Drilling | 418 | 480 | 2 |
| Total: | 24.00 | | | | | |

Mud Properties

| Depth | Time | Wt In | Wt Out | Vis | PV | YP | Gels | FL | HTFL | FC | HTFC | Solid | Water | Oil | Sand |
|------------|------|-------|---------|------------------------------|----|----|-------|------|------|------------|-------|-------|-----------|----------|------|
| | 6:00 | 0.00 | 8.60 | 31 | 0 | 0 | 0/0/0 | 0.0 | 0.0 | 0 | 0.00 | 0.0% | 0.0% | 0.0% | 0.0% |
| MBT | pH | Pm | Pf | Mf | Cl | Ca | ES | Pom | Lime | Total Sal. | CaCl2 | EDTA | O/W Ratio | Mud Loss | |
| 0.0 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 | 0.00 | 0.00 | 0 | 0 | 0.00 | | 0 | |
| Water Loss | LCM | ECD | FL Temp | Remarks | | | | | | | | | | | |
| 600 | 0.0 | 0.0 | 80 | water lost 800 + bbls water. | | | | | | | | | | | |

Daily Summary

| | | | | | | | |
|-----------------|------------|------------------|---|-----------------|--------|-----------------------|--------|
| Activity Date : | 11/25/2006 | Days From Spud : | 4 | Current Depth : | 971 Ft | 24 Hr. Footage Made : | 491 Ft |
| Rig Company : | DHS | | | Rig Name: | DHS #3 | | |
| Formation : | | | | Weather: | | | |

Operations

| Start | Hrs | Code | Remarks | Start Depth | End Depth | Run |
|--------|-------|------|------------------------------------|-------------|-----------|-----|
| 6:00 | 0.25 | 07 | Service Rig | 480 | 480 | 2 |
| 6:15 | 0.75 | 02 | Drilling | 480 | 521 | 2 |
| 7:00 | 0.50 | 10 | Survey Depth 441' | 521 | 521 | 2 |
| 7:30 | 14.25 | 02 | Drilling | 521 | 804 | 2 |
| 21:45 | 1.50 | 10 | Took two runs to get survey | 804 | 804 | 2 |
| 23:15 | 5.25 | 02 | Drilling | 804 | 971 | 2 |
| 4:30 | 1.50 | 08 | Air lines froze & weight indicator | 971 | 971 | 2 |
| Total: | 24.00 | | | | | |

Mud Properties

| Depth | Time | Wt In | Wt Out | Vis | PV | YP | Gels | FL | HTFL | FC | HTFC | Solid | Water | Oil | Sand |
|------------|-------|-------|---------|---------|-----|----|-------|------|------|------------|-------|-------|-----------|----------|------|
| 620 | 17:00 | 9.10 | 0.00 | 32 | 7 | 1 | 1/2/2 | 25.0 | 0.0 | 0 | 0.00 | 3.0% | 0.0% | 0.0% | 0.0% |
| MBT | pH | Pm | Pf | Mf | Cl | Ca | ES | Pom | Lime | Total Sal. | CaCl2 | EDTA | O/W Ratio | Mud Loss | |
| 0.0 | 8.90 | 0.50 | 0.70 | 3.50 | 800 | 0 | 0 | 0.00 | 0.00 | 0 | 0 | 0.00 | | 0 | |
| Water Loss | LCM | ECD | FL Temp | Remarks | | | | | | | | | | | |
| 0 | 0.0 | 0.0 | 80 | | | | | | | | | | | | |

Well Name: Greentown State 36-11 OS (Offset)

| | | | | | |
|-------------|-----------------------------|----------------|------------|----------------|-----------|
| Field Name: | Wildcat | S/T/R: | 36/21S/16E | County, State: | Grand, UT |
| Operator: | Delta Petroleum Corporation | Location Desc: | | District: | Northern |

Daily Summary

| | | | | | | | |
|-----------------|------------|------------------|---|-----------------|---------|-----------------------|--------|
| Activity Date : | 11/26/2006 | Days From Spud : | 5 | Current Depth : | 1186 Ft | 24 Hr. Footage Made : | 215 Ft |
| Rig Company : | DHS | | | Rig Name: | DHS #3 | | |
| Formation : | | | | Weather: | | | |

Operations

| Start | Hrs | Code | Remarks | Start Depth | End Depth | Run |
|--------|-------|------|---|-------------|-----------|-----|
| 6:00 | 2.50 | 08 | weight indicator and air lines pump 2 dwn | 971 | 971 | 2 |
| 8:30 | 2.50 | 02 | Drilling | 971 | 1036 | 2 |
| 11:00 | 0.50 | 08 | Repair oiler pump 1 & Service rig | 1036 | 1036 | 2 |
| 11:30 | 5.50 | 02 | Drilling | 1036 | 1110 | 2 |
| 17:00 | 1.00 | 05 | Circulating | 1110 | 1110 | 2 |
| 18:00 | 5.00 | 06 | Wiper Tooh & Tih | 1110 | 1110 | 2 |
| 23:00 | 7.00 | 02 | Drilling | 1110 | 1186 | 2 |
| Total: | 24.00 | | | | | |

Mud Properties

| Depth | Time | Wt In | Wt Out | Vis | PV | YP | Gels | FL | HTFL | FC | HTFC | Solid | Water | Oil | Sand |
|------------|------|-------|---------|---------|-----|----|-------|------|------|------------|-------|-------|-----------|----------|------|
| 1186 | 6:00 | 9.20 | 9.20 | 35 | 19 | 7 | 4/5/6 | 18.0 | 0.0 | 2 | 0.00 | 3.0% | 0.0% | 0.0% | 0.0% |
| MBT | pH | Pm | Pf | Mf | Cl | Ca | ES | Pom | Lime | Total Sal. | CaCl2 | EDTA | O/W Ratio | Mud Loss | |
| 0.0 | 8.90 | 0.90 | 0.40 | 1.20 | 600 | 0 | 0 | 0.00 | 0.00 | 0 | 0 | 0.00 | | 0 | |
| Water Loss | LCM | ECD | FL Temp | Remarks | | | | | | | | | | | |
| 0 | 0.0 | 0.0 | 85 | | | | | | | | | | | | |

Daily Summary

| | | | | | | | |
|-----------------|------------|------------------|---|-----------------|---------|-----------------------|-------|
| Activity Date : | 11/27/2006 | Days From Spud : | 6 | Current Depth : | 1227 Ft | 24 Hr. Footage Made : | 41 Ft |
| Rig Company : | DHS | | | Rig Name: | DHS #3 | | |
| Formation : | | | | Weather: | | | |

Operations

| Start | Hrs | Code | Remarks | Start Depth | End Depth | Run |
|--------|-------|------|--------------------------------|-------------|-----------|-----|
| 6:00 | 5.00 | 02 | Finish drilling surface | 1186 | 1227 | 2 |
| 11:00 | 1.00 | 05 | Ciculating | 1227 | 1227 | 2 |
| 12:00 | 5.50 | 06 | Drop survey tooh, L/D 8" tools | 1227 | 1227 | 2 |
| 17:30 | 1.00 | 01 | Rig up casing eq. | 1227 | 1227 | 2 |
| 18:30 | 5.50 | 12 | Running in 8 5/8 surface pipe | 1227 | 1227 | 2 |
| 0:00 | 6.00 | 13 | WOC | 1227 | 1227 | 2 |
| Total: | 24.00 | | | | | |

Mud Properties

| Depth | Time | Wt In | Wt Out | Vis | PV | YP | Gels | FL | HTFL | FC | HTFC | Solid | Water | Oil | Sand |
|------------|-------|-------|---------|---------|-----|----|-------|------|------|------------|-------|-------|-----------|----------|------|
| 1227 | 15:00 | 9.10 | 9.20 | 35 | 9 | 0 | 1/1/1 | 30.0 | 0.0 | 1 | 0.00 | 0.0% | 98.5% | 0.0% | 2.0% |
| MBT | pH | Pm | Pf | Mf | Cl | Ca | ES | Pom | Lime | Total Sal. | CaCl2 | EDTA | O/W Ratio | Mud Loss | |
| 9.0 | 8.50 | 0.30 | 0.30 | 0.60 | 600 | 0 | 0 | 0.00 | 0.00 | 0 | 0 | 0.00 | | 0 | |
| Water Loss | LCM | ECD | FL Temp | Remarks | | | | | | | | | | | |
| 0 | 0.0 | 0.0 | 80 | | | | | | | | | | | | |

| Well Name: Greentown State 36-11 OS (Offset) | | | | | | | | | | | | | | | | |
|--|-------|------------|---|---|----|--------------------------|-------|-----------------|------|------------|-------|-----------------------|-------------|-----------|--------|--|
| Field Name: Wildcat | | | S/T/R: 36/21S/16E | | | County, State: Grand, UT | | | | | | | | | | |
| Operator: Delta Petroleum Corporation | | | | | | Location Desc: | | | | | | District: Northern | | | | |
| Daily Summary | | | | | | | | | | | | | | | | |
| Activity Date : | | 11/28/2006 | | Days From Spud : | | 7 | | Current Depth : | | 1227 Ft | | 24 Hr. Footage Made : | | 0 Ft | | |
| Rig Company : | | | | | | DHS | | | | | | Rig Name: | | | DHS #3 | |
| Formation : | | | | | | | | | | | | Weather: | | | | |
| Operations | | | | | | | | | | | | | | | | |
| Start | Hrs | Code | Remarks | | | | | | | | | | Start Depth | End Depth | Run | |
| 6:00 | 5:00 | 13 | Waiting on cement | | | | | | | | | | 1227 | 1227 | 2 | |
| 11:00 | 12:00 | 22 | Cutting off casing and installing 8 /58" wellhead to surface | | | | | | | | | | 1227 | 1227 | 2 | |
| 23:00 | 6:00 | 14 | Nipple up bop and choke line and maifold | | | | | | | | | | 1227 | 1227 | 2 | |
| 5:00 | 1:00 | 15 | Testing bop 250 low pressure test for 5min and 3000lb high pressure testing for 15 min. test casing to 1500 psi for 30 min. | | | | | | | | | | 1227 | 1227 | 2 | |
| Total: | | 24.00 | | | | | | | | | | | | | | |
| Mud Properties | | | | | | | | | | | | | | | | |
| Depth | Time | Wt In | Wt Out | Vis | PV | YP | Gels | FL | HTFL | FC | HTFC | Solid | Water | Oil | Sand | |
| 1227 | 15:00 | 0.00 | 0.00 | 0 | 0 | 0 | 0/0/0 | 0.0 | 0.0 | 0 | 0.00 | 0.0% | 0.0% | 0.0% | 0.0% | |
| MBT | pH | Pm | Pf | Mf | Cl | Ca | ES | Pom | Lime | Total Sal. | CaCl2 | EDTA | O/W Ratio | Mud Loss | | |
| 0.0 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 | 0.00 | 0.00 | 0 | 0 | 0.00 | | 0 | | |
| Water Loss | LCM | ECD | FL Temp | Remarks | | | | | | | | | | | | |
| 0 | 0.0 | 0.0 | 0 | woc and nipping up | | | | | | | | | | | | |
| Depth | Time | Wt In | Wt Out | Vis | PV | YP | Gels | FL | HTFL | FC | HTFC | Solid | Water | Oil | Sand | |
| 1227 | 16:00 | 0.00 | 0.00 | 0 | 0 | 0 | 0/0/0 | 0.0 | 0.0 | 0 | 0.00 | 0.0% | 0.0% | 0.0% | 0.0% | |
| MBT | pH | Pm | Pf | Mf | Cl | Ca | ES | Pom | Lime | Total Sal. | CaCl2 | EDTA | O/W Ratio | Mud Loss | | |
| 0.0 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 | 0.00 | 0.00 | 0 | 0 | 0.00 | | 0 | | |
| Water Loss | LCM | ECD | FL Temp | Remarks | | | | | | | | | | | | |
| 0 | 0.0 | 0.0 | 0 | woc | | | | | | | | | | | | |
| Daily Summary | | | | | | | | | | | | | | | | |
| Activity Date : | | 11/29/2006 | | Days From Spud : | | 8 | | Current Depth : | | 1227 Ft | | 24 Hr. Footage Made : | | 0 Ft | | |
| Rig Company : | | | | | | DHS | | | | | | Rig Name: | | | DHS #3 | |
| Formation : | | | | | | | | | | | | Weather: | | | | |
| Operations | | | | | | | | | | | | | | | | |
| Start | Hrs | Code | Remarks | | | | | | | | | | Start Depth | End Depth | Run | |
| 6:00 | 8:00 | 15 | Testing bops-all rams 3000psi f/ 20 min.manifold,lines and kelly 3000psi f/ 5 min. casing 1000psi f/ 30 min. | | | | | | | | | | 1227 | 1227 | 3 | |
| 14:00 | 4:00 | 14 | Rig up flow nipple and flow line | | | | | | | | | | 1227 | 1227 | 3 | |
| 18:00 | 11:00 | 06 | Lay down 10 joints dp out of derrick & pick up 10 dc off rack & tih | | | | | | | | | | 1227 | 1227 | 3 | |
| 5:00 | 0:50 | 07 | Service rig | | | | | | | | | | 1227 | 1227 | 3 | |
| 5:30 | 0:50 | 08 | Working on pump # 1 stuffing box and un freeze air lines | | | | | | | | | | 1227 | 1227 | 3 | |
| Total: | | 24.00 | | | | | | | | | | | | | | |
| Mud Properties | | | | | | | | | | | | | | | | |
| Depth | Time | Wt In | Wt Out | Vis | PV | YP | Gels | FL | HTFL | FC | HTFC | Solid | Water | Oil | Sand | |
| 1227 | 18:00 | 8.30 | 8.30 | 27 | 1 | 1 | 1/1/1 | 0.0 | 0.0 | 0 | 0.00 | 0.0% | 0.0% | 0.0% | 0.0% | |
| MBT | pH | Pm | Pf | Mf | Cl | Ca | ES | Pom | Lime | Total Sal. | CaCl2 | EDTA | O/W Ratio | Mud Loss | | |
| 0.0 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 | 0.00 | 0.00 | 0 | 0 | 0.00 | | 0 | | |
| Water Loss | LCM | ECD | FL Temp | Remarks | | | | | | | | | | | | |
| 0 | 0.0 | 0.0 | 0 | water finishing test bop and trip in hole | | | | | | | | | | | | |

Well Name: Greentown State 36-11 OS (Offset)

| | | | | | |
|-------------|-----------------------------|----------------|------------|----------------|-----------|
| Field Name: | Wildcat | S/T/R: | 36/21S/16E | County, State: | Grand, UT |
| Operator: | Delta Petroleum Corporation | Location Desc: | | District: | Northern |

Daily Summary

| | | | | | | | |
|-----------------|------------|------------------|---|-----------------|---------|-----------------------|-------|
| Activity Date : | 11/30/2006 | Days From Spud : | 9 | Current Depth : | 1321 Ft | 24 Hr. Footage Made : | 94 Ft |
| Rig Company : | DHS | | | Rig Name: | DHS #3 | | |
| Formation : | | | | Weather: | | | |

Operations

| Start | Hrs | Code | Remarks | Start Depth | End Depth | Run |
|---------------|--------------|------|---|-------------|-----------|-----|
| 6:00 | 2.50 | 02 | Drilling cement from 1176' to 1196' & counting dp on location. Pipe tally was not right | 1227 | 1227 | 3 |
| 8:30 | 1.00 | 08 | Pump # 2 down liner seal blowed, also still repairing # 1 pump stuffing box | 1227 | 1227 | 3 |
| 9:30 | 4.50 | 02 | Drilling cement & float shoe from 1196' to 1227' and drilling ahead | 1227 | 1321 | 3 |
| 14:00 | 0.50 | 06 | Lost circulation, pooh into casing | 1321 | 1321 | 3 |
| 14:30 | 1.50 | 05 | Mixing lcm pill and gel. while mixing we got water flo | 1321 | 1321 | 3 |
| 16:00 | 0.50 | 06 | Trip back in hole | 1321 | 1321 | 3 |
| 16:30 | 1.00 | 05 | Circulating and building vis and wt. | 1321 | 1321 | 3 |
| 17:30 | 2.50 | 23 | Shut well in due to large water flo. trying to unfreeze choke line to be abl to circulate with hydrill close to stop water flo. | 1321 | 1321 | 3 |
| 20:00 | 10.00 | 05 | Open hydrill and start circulating and conditioning mud, lost circulation, now building vis and lcm to gain circulation back | 1321 | 1321 | 3 |
| Total: | 24.00 | | | | | |

Mud Properties

| Depth | Time | Wt In | Wt Out | Vis | PV | YP | Gels | FL | HTFL | FC | HTFC | Solid | Water | Oil | Sand |
|------------|------|-------|---------|---|-----|----|-------|------|------|------------|-------|-------|-----------|----------|------|
| 1321 | | 8.30 | 8.30 | 27 | 1 | 1 | 1/1/0 | 0.0 | 0.0 | 0 | 0.00 | 0.0% | 100.0% | 0.0% | 0.0% |
| MBT | pH | Pm | Pf | Mf | Cl | Ca | ES | Pom | Lime | Total Sal. | CaCl2 | EDTA | O/W Ratio | Mud Loss | |
| 0.0 | 9.00 | 0.30 | 0.30 | 1.00 | 600 | 0 | 0 | 0.00 | 0.00 | 0 | 0 | 0.00 | | 0 | |
| Water Loss | LCM | ECD | FL Temp | Remarks | | | | | | | | | | | |
| 0 | 0.0 | 0.0 | 80 | water finishing test bop and trip in hole | | | | | | | | | | | |

Daily Summary

| | | | | | | | |
|-----------------|-----------|------------------|----|-----------------|---------|-----------------------|------|
| Activity Date : | 12/1/2006 | Days From Spud : | 10 | Current Depth : | 1321 Ft | 24 Hr. Footage Made : | 0 Ft |
| Rig Company : | DHS | | | Rig Name: | DHS #3 | | |
| Formation : | | | | Weather: | | | |

Operations

| Start | Hrs | Code | Remarks | Start Depth | End Depth | Run |
|---------------|--------------|------|--|-------------|-----------|-----|
| 6:00 | 2.00 | 05 | Continue pumping hi lcm pills to regain circulation | 1321 | 1321 | 3 |
| 8:00 | 0.50 | 06 | Pooh two stands | 1321 | 1321 | 3 |
| 8:30 | 1.00 | 05 | Continue pumping hi lcm pills to regain circulation | 1321 | 1321 | 3 |
| 9:30 | 4.50 | 06 | Pooh, hole filled up. Well flowing a little while laying down motor. set back all collars. | 1321 | 1321 | 3 |
| 14:00 | 0.50 | 07 | Service Rig | 1321 | 1321 | NIH |
| 14:30 | 2.50 | 06 | Trip in hole with open end drill pipe for setting cement plug | 1321 | 1321 | NIH |
| 17:00 | 7.00 | 05 | Circulate with returns. Still loosing big amounts of fluid While WO Cementers | 1321 | 1321 | NIH |
| 0:00 | 1.00 | 18 | Rig up schlumberger and cement plug in hole | 1321 | 1321 | NIH |
| 1:00 | 0.50 | 06 | Tooh with drill pipe to woc | 1321 | 1321 | NIH |
| 1:30 | 4.00 | 13 | Woc | 1321 | 1321 | NIH |
| 5:30 | 0.50 | 05 | Fill up casing and watch for loss, no loss no gain well static | 1321 | 1321 | NIH |
| Total: | 24.00 | | | | | |

Mud Properties

| Depth | Time | Wt In | Wt Out | Vis | PV | YP | Gels | FL | HTFL | FC | HTFC | Solid | Water | Oil | Sand |
|------------|-------|-------|---------|---|-----|----|-------|------|------|------------|-------|-------|-----------|----------|------|
| 1321 | 16:00 | 8.30 | 8.30 | 27 | 16 | 2 | 1/1/0 | 0.0 | 0.0 | 1 | 0.00 | 0.0% | 100.0% | 0.0% | 0.0% |
| MBT | pH | Pm | Pf | Mf | Cl | Ca | ES | Pom | Lime | Total Sal. | CaCl2 | EDTA | O/W Ratio | Mud Loss | |
| 0.0 | 9.00 | 0.50 | 0.50 | 3.00 | 700 | 0 | 0 | 0.00 | 0.00 | 0 | 0 | 0.00 | | 0 | |
| Water Loss | LCM | ECD | FL Temp | Remarks | | | | | | | | | | | |
| 0 | 0.0 | 0.0 | 80 | water finishing test bop and trip in hole | | | | | | | | | | | |

Well Name: Greentown State 36-11 OS (Offset)

| | | | | | |
|-------------|-----------------------------|----------------|------------|----------------|-----------|
| Field Name: | Wildcat | S/T/R: | 36/21S/16E | County, State: | Grand, UT |
| Operator: | Delta Petroleum Corporation | Location Desc: | | District: | Northern |

Daily Summary

| | | | | | | | |
|-----------------|-----------|------------------|----|-----------------|---------|-----------------------|------|
| Activity Date : | 12/2/2006 | Days From Spud : | 11 | Current Depth : | 1321 Ft | 24 Hr. Footage Made : | 0 Ft |
| Rig Company : | DHS | | | Rig Name: | DHS #3 | | |
| Formation : | | | | Weather: | | | |

Operations

| Start | Hrs | Code | Remarks | Start Depth | End Depth | Run |
|--------|-------|------|--|-------------|-----------|-----|
| 6:00 | 7.00 | 06 | Trip in hole with drill pipe, lay down 19 joints, Rih with drilling assy. | 1321 | 1321 | 4 |
| 13:00 | 17.00 | 08 | Repair rig, mud pump-winterize rig- mud pump 1 was never put back together | 1321 | 1321 | 4 |
| Total: | 24.00 | | | | | |

Mud Properties

| Depth | Time | Wt In | Wt Out | Vis | PV | YP | Gels | FL | HTFL | FC | HTFC | Solid | Water | Oil | Sand |
|------------|-------|-------|---------|---------|-----|------|-------|------|------|------------|-------|-------|-----------|----------|------|
| 1321 | 13:00 | 8.30 | 8.30 | 27 | 1 | 1 | 0/0/0 | 30.0 | 0.0 | 1 | 0.00 | 0.0% | 100.0% | 0.0% | 0.0% |
| MBT | pH | Pm | Pf | Mf | Cl | Ca | ES | Pom | Lime | Total Sal. | CaCl2 | EDTA | O/W Ratio | Mud Loss | |
| 0.0 | 8.50 | 0.30 | 0.50 | 1.00 | 800 | 1320 | 0 | 0.00 | 0.00 | 0 | 0 | 0.00 | | 0 | |
| Water Loss | LCM | ECD | FL Temp | Remarks | | | | | | | | | | | |
| 0 | 0.0 | 0.0 | 80 | | | | | | | | | | | | |

Daily Summary

| | | | | | | | |
|-----------------|-----------|------------------|----|-----------------|---------|-----------------------|--------|
| Activity Date : | 12/3/2006 | Days From Spud : | 12 | Current Depth : | 1587 Ft | 24 Hr. Footage Made : | 266 Ft |
| Rig Company : | DHS | | | Rig Name: | DHS #3 | | |
| Formation : | | | | Weather: | | | |

Operations

| Start | Hrs | Code | Remarks | Start Depth | End Depth | Run |
|--------|-------|------|---|-------------|-----------|-----|
| 6:00 | 0.50 | 07 | Service rig | 1321 | 1321 | 4 |
| 6:30 | 4.00 | 08 | Kelly froze up. Unfreeze kelly | 1321 | 1321 | 4 |
| 10:30 | 9.50 | 02 | Drilling from 1321, to 1568' with returns. Still loosing fluid at a steady pace (have 40% flo out of a total of 55% flo pumping at a rate of 409 gals. A min) | 1321 | 1568 | 4 |
| 20:00 | 0.50 | 10 | Survey, survey depth is 1534'. Had mis run on survey, will rerun next conn. | 1568 | 1568 | 4 |
| 20:30 | 0.50 | 02 | Drilling from 1568' to 1587' | 1568 | 1587 | 4 |
| 21:00 | 7.00 | 05 | Rebuilding mud volume and unplug yellow dog pump. Stopped up. After unplugging yellow dog pump ,kelly froze up. Try and pump, motor or bit now plugged. | 1587 | 1587 | 4 |
| 4:00 | 0.50 | 10 | Drop survey | 1587 | 1587 | 4 |
| 4:30 | 1.50 | 06 | Tooh | 1587 | 1587 | 4 |
| Total: | 24.00 | | | | | |

Mud Properties

| Depth | Time | Wt In | Wt Out | Vis | PV | YP | Gels | FL | HTFL | FC | HTFC | Solid | Water | Oil | Sand |
|------------|-------|-------|---------|---------|-----|------|-------|------|------|------------|-------|-------|-----------|----------|------|
| 1431 | 13:00 | 8.60 | 8.30 | 31 | 5 | 1 | 1/1/0 | 30.0 | 0.0 | 0 | 0.00 | 0.0% | 98.2% | 0.0% | 0.0% |
| MBT | pH | Pm | Pf | Mf | Cl | Ca | ES | Pom | Lime | Total Sal. | CaCl2 | EDTA | O/W Ratio | Mud Loss | |
| 0.0 | 8.50 | 0.30 | 0.50 | 1.00 | 800 | 1320 | 0 | 0.00 | 0.00 | 0 | 0 | 0.00 | | 0 | |
| Water Loss | LCM | ECD | FL Temp | Remarks | | | | | | | | | | | |
| 0 | 0.0 | 0.0 | 80 | | | | | | | | | | | | |

| Well Name: Greentown State 36-11 OS (Offset) | | | | | | | | | | | | | | | | | | | | | | |
|--|-------|-----------|---|------------------|------|--------------------------|-------|-----------------|---------------------------------------|------------|-------|-----------------------|-------------|-----------|------|--|----------------|--|--|--------------------|--|--|
| Field Name: Wildcat | | | S/T/R: 36/21S/16E | | | County, State: Grand, UT | | | Operator: Delta Petroleum Corporation | | | | | | | | Location Desc: | | | District: Northern | | |
| Daily Summary | | | | | | | | | | | | | | | | | | | | | | |
| Activity Date : | | 12/4/2006 | | Days From Spud : | | 13 | | Current Depth : | | 1810 Ft | | 24 Hr. Footage Made : | | 223 Ft | | | | | | | | |
| Rig Company : | | | | DHS | | | | Rig Name: | | | | DHS #3 | | | | | | | | | | |
| Formation : | | | | | | | | Weather: | | | | | | | | | | | | | | |
| Operations | | | | | | | | | | | | | | | | | | | | | | |
| Start | Hrs | Code | Remarks | | | | | | | | | | Start Depth | End Depth | Run | | | | | | | |
| 6:00 | 2.50 | 06 | Tooh. 3" piece of pipe wrench handel found on top of motor, also survey tool hung in collar above motor | | | | | | | | | | 1587 | 1587 | 4 | | | | | | | |
| 8:30 | 0.50 | 07 | Service rig | | | | | | | | | | 1587 | 1587 | 4 | | | | | | | |
| 9:00 | 3.00 | 22 | Unplugging two drill collars and trying to retrieve survey tool, lay down collar, motor plug as well with lcm, lay down same. Pick up new motor | | | | | | | | | | 1587 | 1587 | 4 | | | | | | | |
| 12:00 | 3.00 | 06 | Tih | | | | | | | | | | 1587 | 1587 | 5 | | | | | | | |
| 15:00 | 1.00 | 10 | Rig up and rehead survey tool and run survey. Clock was not set right, ran out of time and set at 1450. Survey 1 degree | | | | | | | | | | 1587 | 1587 | 5 | | | | | | | |
| 16:00 | 1.00 | 05 | Well flowing, circulate out. | | | | | | | | | | 1587 | 1587 | 5 | | | | | | | |
| 17:00 | 6.00 | 02 | Drilling ahead | | | | | | | | | | 1587 | 1694 | 5 | | | | | | | |
| 23:00 | 1.00 | 10 | Survey Depth 1622'. Shows 1 degree but other mark was 7, will rerun 200'. | | | | | | | | | | 1694 | 1694 | 5 | | | | | | | |
| 0:00 | 6.00 | 02 | Drilling ahead | | | | | | | | | | 1694 | 1810 | 5 | | | | | | | |
| Total: | | 24.00 | | | | | | | | | | | | | | | | | | | | |
| Mud Properties | | | | | | | | | | | | | | | | | | | | | | |
| Depth | Time | Wt In | Wt Out | Vis | PV | YP | Gels | FL | HTFL | FC | HTFC | Solid | Water | Oil | Sand | | | | | | | |
| 1644 | 13:00 | 8.60 | 8.60 | 26 | 1 | 1 | 0/0/0 | 0.0 | 0.0 | 0 | 0.00 | 0.0% | 98.2% | 0.0% | 0.0% | | | | | | | |
| MBT | pH | Pm | Pf | Mf | Cl | Ca | ES | Pom | Lime | Total Sal. | CaCl2 | EDTA | O/W Ratio | Mud Loss | | | | | | | | |
| 0.0 | 8.50 | 0.20 | 0.00 | 0.00 | 1000 | 1650 | 0 | 0.00 | 0.00 | 0 | 0 | 0.00 | | 0 | | | | | | | | |
| Water Loss | LCM | ECD | FL Temp | Remarks | | | | | | | | | | | | | | | | | | |
| 0 | 0.0 | 0.0 | 80 | | | | | | | | | | | | | | | | | | | |
| Daily Summary | | | | | | | | | | | | | | | | | | | | | | |
| Activity Date : | | 12/5/2006 | | Days From Spud : | | 14 | | Current Depth : | | 2008 Ft | | 24 Hr. Footage Made : | | 198 Ft | | | | | | | | |
| Rig Company : | | | | DHS | | | | Rig Name: | | | | DHS #3 | | | | | | | | | | |
| Formation : | | | | | | | | Weather: | | | | | | | | | | | | | | |
| Operations | | | | | | | | | | | | | | | | | | | | | | |
| Start | Hrs | Code | Remarks | | | | | | | | | | Start Depth | End Depth | Run | | | | | | | |
| 6:00 | 1.00 | 02 | Drilling | | | | | | | | | | 1810 | 1820 | 5 | | | | | | | |
| 7:00 | 0.50 | 10 | Survey depth 1755 1.25 degree | | | | | | | | | | 1820 | 1820 | 5 | | | | | | | |
| 7:30 | 8.00 | 02 | Drilling ahead, have returns but loss's running about 800bbls + in the past 12 hrs. | | | | | | | | | | 1820 | 2008 | 5 | | | | | | | |
| 15:30 | 14.50 | 08 | drive chain and sprocket damaged, will get parts and replace. Loosing 12 bbls hr while pumping slowly 33 stks 233 gals. A min., will continue to mix gel to get mud in shape. Mechanic fixed chain and said sprocket will finish hole | | | | | | | | | | 2008 | 2008 | 5 | | | | | | | |
| Total: | | 24.00 | | | | | | | | | | | | | | | | | | | | |
| Mud Properties | | | | | | | | | | | | | | | | | | | | | | |
| Depth | Time | Wt In | Wt Out | Vis | PV | YP | Gels | FL | HTFL | FC | HTFC | Solid | Water | Oil | Sand | | | | | | | |
| 2008 | 17:00 | 8.50 | 8.50 | 29 | 1 | 1 | 1/1/0 | 30.0 | 0.0 | 0 | 0.00 | 1.1% | 98.9% | 0.0% | 0.0% | | | | | | | |
| MBT | pH | Pm | Pf | Mf | Cl | Ca | ES | Pom | Lime | Total Sal. | CaCl2 | EDTA | O/W Ratio | Mud Loss | | | | | | | | |
| 0.0 | 8.50 | 0.20 | 0.30 | 0.90 | 800 | 1320 | 0 | 0.00 | 0.00 | 0 | 0 | 0.00 | | 0 | | | | | | | | |
| Water Loss | LCM | ECD | FL Temp | Remarks | | | | | | | | | | | | | | | | | | |
| 0 | 0.0 | 0.0 | 65 | | | | | | | | | | | | | | | | | | | |

Well Name: Greentown State 36-11 OS (Offset)

| | | | | | |
|-------------|-----------------------------|----------------|------------|----------------|-----------|
| Field Name: | Wildcat | S/T/R: | 36/21S/16E | County, State: | Grand, UT |
| Operator: | Delta Petroleum Corporation | Location Desc: | | District: | Northern |

Daily Summary

| | | | | | | | |
|-----------------|-----------|------------------|----|-----------------|---------|-----------------------|--------|
| Activity Date : | 12/6/2006 | Days From Spud : | 15 | Current Depth : | 2430 Ft | 24 Hr. Footage Made : | 422 Ft |
| Rig Company : | DHS | | | Rig Name: | DHS #3 | | |
| Formation : | Moenkopi | | | Weather: | | | |

Operations

| Start | Hrs | Code | Remarks | Start Depth | End Depth | Run |
|--------|-------|------|--|-------------|-----------|-----|
| 6:00 | 1.00 | 02 | Drill actual | 2008 | 2028 | 5 |
| 7:00 | 2.00 | 10 | Surveys first run was mis run. 2ond run 1.25 degree no brakes on wire line machine. Took awhile to run survey in hole each time. | 2028 | 2028 | 5 |
| 9:00 | 3.50 | 02 | Drill actual | 2028 | 2164 | 5 |
| 12:30 | 0.50 | 07 | Service rig | 2164 | 2164 | 5 |
| 13:00 | 17.00 | 02 | Drill actual | 2164 | 2430 | 5 |
| Total: | 24.00 | | | | | |

Mud Properties

| Depth | Time | Wt In | Wt Out | Vis | PV | YP | Gels | FL | HTFL | FC | HTFC | Solid | Water | Oil | Sand |
|------------|------|-------|---------|---------|-----|------|-------|------|------|------------|-------|-------|-----------|----------|------|
| 2430 | 6:00 | 8.40 | 8.40 | 30 | 2 | 1 | 1/1/0 | 30.0 | 0.0 | 0 | 0.00 | 0.0% | 99.0% | 0.0% | 0.0% |
| MBT | pH | Pm | Pf | Mf | Cl | Ca | ES | Pom | Lime | Total Sal. | CaCl2 | EDTA | O/W Ratio | Mud Loss | |
| 0.0 | 8.50 | 0.20 | 0.30 | 0.90 | 800 | 1320 | 0 | 0.00 | 0.00 | 0 | 0 | 0.00 | | 0 | |
| Water Loss | LCM | ECD | FL Temp | Remarks | | | | | | | | | | | |
| 0 | 0.0 | 0.0 | 85 | | | | | | | | | | | | |

Daily Summary

| | | | | | | | |
|-----------------|-----------|------------------|----|-----------------|---------|-----------------------|--------|
| Activity Date : | 12/7/2006 | Days From Spud : | 16 | Current Depth : | 2625 Ft | 24 Hr. Footage Made : | 195 Ft |
| Rig Company : | DHS | | | Rig Name: | DHS #3 | | |
| Formation : | | | | Weather: | | | |

Operations

| Start | Hrs | Code | Remarks | Start Depth | End Depth | Run |
|--------|-------|------|---|-------------|-----------|-----|
| 6:00 | 10.00 | 02 | Drilling Ahead | 2430 | 2615 | 5 |
| 16:00 | 0.50 | 10 | Survey depth @ 2530' with 2.50 degree | 2615 | 2615 | 5 |
| 16:30 | 1.00 | 05 | Dumping sand trap and shale pit to rid of solids, building tanks full | 2615 | 2615 | 5 |
| 17:30 | 1.00 | 02 | Drilling ahead | 2615 | 2625 | 5 |
| 18:30 | 2.50 | 03 | Working pipe high and reaming slowly back to bottom several times | 2625 | 2625 | 5 |
| 21:00 | 5.00 | 06 | Tooh for bit change, pull slowly to prevent swabbing in water flo | 2625 | 2625 | 5 |
| 2:00 | 2.00 | 22 | Change out bits. | 2625 | 2625 | 6 |
| 4:00 | 2.00 | 06 | Tih slowly to prevent from knocking out hole.hole staying full with no loss's | 2625 | 2625 | 6 |
| Total: | 24.00 | | | | | |

Mud Properties

| Depth | Time | Wt In | Wt Out | Vis | PV | YP | Gels | FL | HTFL | FC | HTFC | Solid | Water | Oil | Sand |
|------------|------|-------|---------|---------|-----|------|-------|------|------|------------|-------|-------|-----------|----------|------|
| 2430 | 6:00 | 8.40 | 8.40 | 30 | 2 | 1 | 1/1/0 | 30.0 | 0.0 | 0 | 0.00 | 0.0% | 99.0% | 0.0% | 0.0% |
| MBT | pH | Pm | Pf | Mf | Cl | Ca | ES | Pom | Lime | Total Sal. | CaCl2 | EDTA | O/W Ratio | Mud Loss | |
| 0.0 | 8.50 | 0.20 | 0.30 | 0.90 | 800 | 1320 | 0 | 0.00 | 0.00 | 0 | 0 | 0.00 | | 0 | |
| Water Loss | LCM | ECD | FL Temp | Remarks | | | | | | | | | | | |
| 0 | 0.0 | 0.0 | 85 | | | | | | | | | | | | |

| Depth | Time | Wt In | Wt Out | Vis | PV | YP | Gels | FL | HTFL | FC | HTFC | Solid | Water | Oil | Sand |
|------------|------|-------|---------|---------|-----|----|-------|------|------|------------|-------|-------|-----------|----------|------|
| 2625 | 0:00 | 8.50 | 8.50 | 46 | 12 | 5 | 3/7/0 | 11.8 | 0.0 | 1 | 0.00 | 0.0% | 99.0% | 0.0% | 0.1% |
| MBT | pH | Pm | Pf | Mf | Cl | Ca | ES | Pom | Lime | Total Sal. | CaCl2 | EDTA | O/W Ratio | Mud Loss | |
| 2.0 | 9.00 | 0.20 | 0.15 | 0.30 | 248 | 80 | 0 | 0.00 | 0.00 | 0 | 0 | 0.00 | | 0 | |
| Water Loss | LCM | ECD | FL Temp | Remarks | | | | | | | | | | | |
| 0 | 0.0 | 0.0 | 60 | | | | | | | | | | | | |

Well Name: Greentown State 36-11 OS (Offset)

| | | | | | |
|-------------|-----------------------------|----------------|------------|----------------|-----------|
| Field Name: | Wildcat | S/T/R: | 36/21S/16E | County, State: | Grand, UT |
| Operator: | Delta Petroleum Corporation | Location Desc: | | District: | Northern |

Daily Summary

| | | | | | | | |
|-----------------|-----------|------------------|----|-----------------|---------|-----------------------|--------|
| Activity Date : | 12/8/2006 | Days From Spud : | 17 | Current Depth : | 2806 Ft | 24 Hr. Footage Made : | 181 Ft |
| Rig Company : | DHS | | | Rig Name: | DHS #3 | | |
| Formation : | | | | Weather: | | | |

Operations

| Start | Hrs | Code | Remarks | Start Depth | End Depth | Run |
|--------|-------|------|--|-------------|-----------|-----|
| 6:00 | 1.50 | 06 | Finish tih slowly to prevent fluid loss. | 2625 | 2625 | 6 |
| 7:30 | 1.00 | 08 | Repair rig, repairing mud hopper | 2625 | 2625 | 6 |
| 8:30 | 2.50 | 03 | Wash and ream 90' to bottom but reaming each joint down few times. | 2625 | 2625 | 6 |
| 11:00 | 2.50 | 02 | Drill actual while loosing 40bbls hr. While running 10per cent lcm return at flow line | 2625 | 2662 | 6 |
| 13:30 | 0.50 | 05 | Building lcm sweep and volume in mud tanks | 2662 | 2662 | 6 |
| 14:00 | 8.50 | 02 | Drilling with no loss. 46 vis 8.6 wt 16% lcm | 2662 | 2764 | 6 |
| 22:30 | 0.50 | 05 | Circulate sweep for survey | 2764 | 2764 | 6 |
| 23:00 | 1.00 | 10 | Survey depth 2690 w/ 2 degree | 2764 | 2764 | 6 |
| 0:00 | 4.00 | 02 | Drilling Vis 46 wt. 8.5 16% lcm | 2764 | 2806 | 6 |
| 4:00 | 2.00 | 08 | Repair rig. Drive chain broke in compound. | 2806 | 2806 | 6 |
| Total: | 24.00 | | | | | |

Mud Properties

| Depth | Time | Wt In | Wt Out | Vis | PV | YP | Gels | FL | HTFL | FC | HTFC | Solid | Water | Oil | Sand |
|------------|-------|-------|---------|---------|-----|----|-------|------|------|------------|-------|-------|-----------|----------|------|
| 2723 | 21:00 | 8.50 | 8.50 | 37 | 7 | 8 | 2/5/0 | 9.2 | 0.0 | 1 | 0.00 | 1.0% | 99.0% | 0.0% | 0.0% |
| MBT | pH | Pm | Pf | Mf | Cl | Ca | ES | Pom | Lime | Total Sal. | CaCl2 | EDTA | O/W Ratio | Mud Loss | |
| 2.0 | 10.00 | 0.40 | 0.40 | 1.00 | 300 | 80 | 0 | 0.00 | 0.00 | 0 | 0 | 0.00 | | 0 | |
| Water Loss | LCM | ECD | FL Temp | Remarks | | | | | | | | | | | |
| 0 | 0.0 | 0.0 | 62 | | | | | | | | | | | | |

Daily Summary

| | | | | | | | |
|-----------------|-----------|------------------|----|-----------------|---------|-----------------------|--------|
| Activity Date : | 12/9/2006 | Days From Spud : | 18 | Current Depth : | 2946 Ft | 24 Hr. Footage Made : | 140 Ft |
| Rig Company : | DHS | | | Rig Name: | DHS #3 | | |
| Formation : | | | | Weather: | | | |

Operations

| Start | Hrs | Code | Remarks | Start Depth | End Depth | Run |
|--------|-------|------|---|-------------|-----------|-----|
| 6:00 | 2.00 | 08 | Repairing rig. Finish putting drive chain back in compound | 2806 | 2806 | 6 |
| 8:00 | 5.00 | 02 | Drilling ahead. Vis41 wt 8.5 11% lcm return. Lost 100bbls in the last 2 hrs even with lcm returns | 2806 | 2946 | 6 |
| 13:00 | 6.00 | 05 | Dumping all pits, rebuilding mud and mixing gilsanite pill to stop loss. | 2946 | 2946 | 6 |
| 19:00 | 1.50 | 08 | Tooh for rig repair. While tooth spear hub fell off. Only 2 bolts holding inplace | 2946 | 2946 | 6 |
| 20:30 | 9.50 | 08 | Draworks and compound oil full with water. Repair and seal spear hub. Wash out draworks and compound with diesel. Repalce with fresh oil. | 2946 | 2946 | 6 |
| Total: | 24.00 | | | | | |

Mud Properties

| Depth | Time | Wt In | Wt Out | Vis | PV | YP | Gels | FL | HTFL | FC | HTFC | Solid | Water | Oil | Sand |
|------------|-------|-------|---------|---------|-----|----|-------|------|------|------------|-------|-------|-----------|----------|------|
| 2946 | 0:00 | 8.50 | 8.50 | 43 | 10 | 6 | 4/9/0 | 10.2 | 0.0 | 1 | 0.00 | 1.0% | 99.0% | 0.0% | 0.0% |
| MBT | pH | Pm | Pf | Mf | Cl | Ca | ES | Pom | Lime | Total Sal. | CaCl2 | EDTA | O/W Ratio | Mud Loss | |
| 2.0 | 10.00 | 0.40 | 0.40 | 1.00 | 300 | 80 | 0 | 0.00 | 0.00 | 0 | 0 | 0.00 | | 0 | |
| Water Loss | LCM | ECD | FL Temp | Remarks | | | | | | | | | | | |
| 0 | 0.0 | 0.0 | 62 | | | | | | | | | | | | |

Well Name: Greentown State 36-11 OS (Offset)

| | | | | | |
|-------------|-----------------------------|----------------|------------|----------------|-----------|
| Field Name: | Wildcat | S/T/R: | 36/21S/16E | County, State: | Grand, UT |
| Operator: | Delta Petroleum Corporation | Location Desc: | | District: | Northern |

Daily Summary

| | | | | | | | |
|-----------------|------------|------------------|----|-----------------|---------|-----------------------|--------|
| Activity Date : | 12/10/2006 | Days From Spud : | 19 | Current Depth : | 3117 Ft | 24 Hr. Footage Made : | 200 Ft |
| Rig Company : | DHS | | | Rig Name: | DHS #3 | | |
| Formation : | | | | Weather: | | | |

Operations

| Start | Hrs | Code | Remarks | Start Depth | End Depth | Run |
|-------|-------|------|---|-------------|-----------|-----|
| 6:00 | 7.00 | 08 | Repair rig. Complete fixing spear hub and changing oil in drawworks and compound, replaced both centrifical pumps in hopper house, finish building mud in mud tanks and working on flywheel on pump # 2 | 2917 | 2917 | 6 |
| 13:00 | 1.00 | 08 | Tih | 2917 | 2917 | 6 |
| 14:00 | 0.50 | 08 | Wash and ream 90' to bottom. Depth has changed due to drillers not adding right on tally. Bottom is 2917'. | 2917 | 2917 | 6 |
| 14:30 | 10.00 | 02 | Drilling ahead with low fluid loss. Vis 40-wt 8.5-lcm 10%. | 2917 | 3076 | 6 |
| 0:30 | 1.00 | 08 | Rig repair. Wireline machine would not run. | 3076 | 3076 | 6 |
| 1:30 | 1.75 | 02 | Drilling ahead. At 3100' started to shake out lcm with 80bbls loss in 1 hr | 3076 | 3117 | 6 |
| 3:30 | 2.50 | 05 | Ciculate and build gilsinite pill. Building volume as well. Fluid loss still high with about 80bbls hr. | 3117 | 3117 | 6 |

Total: 23.75

Mud Properties

| Depth | Time | Wt In | Wt Out | Vis | PV | YP | Gels | FL | HTFL | FC | HTFC | Solid | Water | Oil | Sand |
|------------|------|-------|---------|---|-----|-----|--------|------|------|------------|-------|-------|-----------|----------|------|
| 3048 | 4:00 | 8.60 | 8.60 | 39 | 8 | 6 | 4/10/0 | 8.8 | 0.0 | 1 | 0.00 | 1.5% | 98.5% | 0.0% | 0.0% |
| MBT | pH | Pm | Pf | Mf | Cl | Ca | ES | Pom | Lime | Total Sal. | CaCl2 | EDTA | O/W Ratio | Mud Loss | |
| 2.0 | 9.60 | 0.46 | 0.20 | 0.87 | 350 | 100 | 0 | 0.00 | 0.10 | 0 | 0 | 0.00 | | 0 | |
| Water Loss | LCM | ECD | FL Temp | Remarks | | | | | | | | | | | |
| 0 | 0.0 | 0.0 | 65 | Shaking out lcm at 3100' with high loss of fluid. | | | | | | | | | | | |

Daily Summary

| | | | | | | | |
|-----------------|------------|------------------|----|-----------------|------------|-----------------------|--------|
| Activity Date : | 12/11/2006 | Days From Spud : | 20 | Current Depth : | 3225 Ft | 24 Hr. Footage Made : | 108 Ft |
| Rig Company : | DHS | | | Rig Name: | DHS #3 | | |
| Formation : | | | | Weather: | light snow | | |

Operations

| Start | Hrs | Code | Remarks | Start Depth | End Depth | Run |
|-------|------|------|--|-------------|-----------|-----|
| 6:00 | 1.50 | 02 | Drilling ahead, pumping gilsinte pill to stop high fluid loss. Pill appears to be holding. Loss's have slowed to about 10-20hr. | 3117 | 3135 | 6 |
| 7:30 | 1.00 | 10 | Survey depth at 3083'. Survey was 2.9 degree. Hole stay full while running survey. | 3135 | 3135 | 6 |
| 8:30 | 2.00 | 02 | Drilling ahead with some fluid loss, then loss circulation completely. No returns | 3135 | 3170 | 6 |
| 10:30 | 2.50 | 05 | Building high lcm pill before we pumped all our mud away. Circulate pill and continue pumping trying to regain circulation. No returns | 3170 | 3170 | 6 |
| 13:00 | 8.00 | 02 | Drill ahead. Rop dropped to 6' hr with bouncing. | 3170 | 3225 | 6 |
| 21:00 | 0.50 | 10 | Dropped survey, survey depth will be 3194' | 3225 | 3225 | 6 |
| 21:30 | 8.50 | 22 | Crew walked off. No morning tour circulate and working pipe. While circulating, had 0 fluid loss. Vis 46 wt .8.5 lcm 10 % | 3225 | 3225 | 6 |

Total: 24.00

Mud Properties

| Depth | Time | Wt In | Wt Out | Vis | PV | YP | Gels | FL | HTFL | FC | HTFC | Solid | Water | Oil | Sand |
|------------|-------|-------|---------|---|-----|-----|--------|------|------|------------|-------|-------|-----------|----------|------|
| 3269 | 7:00 | 8.50 | 8.50 | 39 | 10 | 7 | 6/10/0 | 8.4 | 0.0 | 1 | 0.00 | 1.0% | 99.0% | 0.0% | 0.0% |
| MBT | pH | Pm | Pf | Mf | Cl | Ca | ES | Pom | Lime | Total Sal. | CaCl2 | EDTA | O/W Ratio | Mud Loss | |
| 5.1 | 10.60 | 0.68 | 0.36 | 1.10 | 380 | 100 | 0 | 0.00 | 0.10 | 0 | 0 | 0.00 | | 0 | |
| Water Loss | LCM | ECD | FL Temp | Remarks | | | | | | | | | | | |
| 0 | 0.0 | 0.0 | 64 | After circulating lcm back in well, have 0 fluid loss | | | | | | | | | | | |

Well Name: Greentown State 36-11 OS (Offset)

| | | | | | |
|-------------|-----------------------------|----------------|------------|----------------|-----------|
| Field Name: | Wildcat | S/T/R: | 36/21S/16E | County, State: | Grand, UT |
| Operator: | Delta Petroleum Corporation | Location Desc: | | District: | Northern |

Daily Summary

| | | | | | | | |
|-----------------|------------|------------------|----|-----------------|---------|-----------------------|-------|
| Activity Date : | 12/12/2006 | Days From Spud : | 21 | Current Depth : | 3317 Ft | 24 Hr. Footage Made : | 62 Ft |
| Rig Company : | DHS | | | Rig Name: | DHS #3 | | |
| Formation : | | | | Weather: | | | |

Operations

| Start | Hrs | Code | Remarks | Start Depth | End Depth | Run |
|--------|-------|------|---|-------------|-----------|-----|
| 6:00 | 2:00 | 22 | Day crew here but cleaning up mess inside mud house, morning tour dumped pallet of bar in the door way of hopper house. Pump slug | 3255 | 3255 | 6 |
| 8:00 | 2:00 | 06 | Tooh for bit change. Bit 100% wore out | 3255 | 3255 | 6 |
| 10:00 | 2:00 | 07 | Service rig, clean floor, change out bit and test mud motor | 3255 | 3255 | 7 |
| 12:00 | 4:50 | 06 | Tih | 3255 | 3255 | 7 |
| 16:30 | 1:50 | 03 | Wash and ream 90 to bottom as a precautionary. | 3255 | 3255 | 7 |
| 18:00 | 12:00 | 02 | Drilling ahead, penetration rate is very slow from 4.5' hr to 12' hr. vis | 3255 | 3317 | 7 |
| Total: | 24.00 | | | | | |

Mud Properties

| Depth | Time | Wt In | Wt Out | Vis | PV | YP | Gels | FL | HTFL | FC | HTFC | Solid | Water | Oil | Sand |
|------------|------|-------|---------|---|-----|-----|--------|------|------|------------|-------|-------|-----------|----------|------|
| 3317 | 7:00 | 8.80 | 8.80 | 48 | 11 | 7 | 4/11/0 | 9.2 | 0.0 | 1 | 0.00 | 1.8% | 98.2% | 0.0% | 0.0% |
| MBT | pH | Pm | Pf | Mf | Cl | Ca | ES | Pom | Lime | Total Sal. | CaCl2 | EDTA | O/W Ratio | Mud Loss | |
| 7.5 | 8.80 | 0.22 | 0.05 | 0.45 | 900 | 100 | 0 | 0.00 | 0.10 | 0 | 0 | 0.00 | | 0 | |
| Water Loss | LCM | ECD | FL Temp | Remarks | | | | | | | | | | | |
| 0 | 0.0 | 0.0 | 70 | After circulating lcm back in well, have 0 fluid loss | | | | | | | | | | | |
| Depth | Time | Wt In | Wt Out | Vis | PV | YP | Gels | FL | HTFL | FC | HTFC | Solid | Water | Oil | Sand |
| 3317 | 7:00 | 8.80 | 8.80 | 48 | 11 | 7 | 4/11/0 | 9.2 | 0.0 | 1 | 0.00 | 1.8% | 98.2% | 0.0% | 0.2% |
| MBT | pH | Pm | Pf | Mf | Cl | Ca | ES | Pom | Lime | Total Sal. | CaCl2 | EDTA | O/W Ratio | Mud Loss | |
| 7.5 | 8.80 | 0.22 | 0.05 | 0.45 | 900 | 200 | 0 | 0.00 | 0.00 | 0 | 0 | 0.00 | | 0 | |
| Water Loss | LCM | ECD | FL Temp | Remarks | | | | | | | | | | | |
| 0 | 0.2 | 0.0 | 70 | | | | | | | | | | | | |

Daily Summary

| | | | | | | | |
|-----------------|------------|------------------|----|-----------------|---------|-----------------------|-------|
| Activity Date : | 12/13/2006 | Days From Spud : | 22 | Current Depth : | 3386 Ft | 24 Hr. Footage Made : | 69 Ft |
| Rig Company : | DHS | | | Rig Name: | DHS #3 | | |
| Formation : | | | | Weather: | | | |

Operations

| Start | Hrs | Code | Remarks | Start Depth | End Depth | Run |
|--------|-------|------|--|-------------|-----------|-----|
| 6:00 | 1:50 | 02 | Drilling ahead. Only making 4 to 9' hr. | 3317 | 3323 | 7 |
| 7:30 | 0:50 | 05 | Long stroking pipe trying to clean off bit. Pump slug | 3323 | 3323 | 7 |
| 8:00 | 2:50 | 06 | Tooh for bit change. Bit that was tripped out had flat teeth worn half down | 3323 | 3323 | 7 |
| 10:30 | 2:50 | 22 | Clean off floor, pick up one more drill collar (one that we layed down with survey tool stuck inside). Clean and test motor | 3323 | 3323 | 7 |
| 13:00 | 5:00 | 06 | Make up bit and tih. Bit is Smith 617X iadc type mf45h | 3323 | 3323 | 8 |
| 18:00 | 1:50 | 02 | Drill Actual | 3323 | 3330 | 8 |
| 19:30 | 1:00 | 10 | Survey 2.6 degree depth 3247' | 3330 | 3330 | 8 |
| 20:30 | 4:50 | 02 | Drilling ahead. Rop from 7' hr to 15; hr 38 vis 8.8 wt 13 % lcm | 3330 | 3359 | 8 |
| 1:00 | 0:50 | 07 | Rig service on connection | 3359 | 3359 | 8 |
| 1:30 | 4:50 | 02 | Drilling ahead 41 vis 8.6 wt 14 % lcm Rop 11' hr to 5' hr. | 3359 | 3386 | 8 |
| Total: | 24.00 | | | | | |

Mud Properties

| Depth | Time | Wt In | Wt Out | Vis | PV | YP | Gels | FL | HTFL | FC | HTFC | Solid | Water | Oil | Sand |
|------------|-------|-------|---------|--|-----|-----|--------|------|------|------------|-------|-------|-----------|----------|------|
| 3370 | 7:00 | 8.70 | 8.70 | 44 | 13 | 9 | 5/10/0 | 8.0 | 0.0 | 2 | 0.00 | 2.2% | 97.8% | 0.0% | 0.2% |
| MBT | pH | Pm | Pf | Mf | Cl | Ca | ES | Pom | Lime | Total Sal. | CaCl2 | EDTA | O/W Ratio | Mud Loss | |
| 10.0 | 13.00 | 0.60 | 0.30 | 1.10 | 950 | 160 | 0 | 0.00 | 0.10 | 0 | 0 | 0.00 | | 0 | |
| Water Loss | LCM | ECD | FL Temp | Remarks | | | | | | | | | | | |
| 0 | 0.1 | 0.0 | 72 | Last tih took on 20-25 bbls water and oil w/ 2000 chlorides and 560 ca++ | | | | | | | | | | | |

| Well Name: Greentown State 36-11 OS (Offset) | | | | | |
|--|-----------------------------|----------------|------------|----------------|-----------|
| Field Name: | Wildcat | S/T/R: | 36/21S/16E | County, State: | Grand, UT |
| Operator: | Delta Petroleum Corporation | Location Desc: | | District: | Northern |

| Daily Summary | | | | | | | |
|-----------------|------------|------------------|-----------|-----------------|---------|-----------------------|-------|
| Activity Date : | 12/14/2006 | Days From Spud : | 23 | Current Depth : | 3480 Ft | 24 Hr. Footage Made : | 94 Ft |
| Rig Company : | DHS | | Rig Name: | DHS #3 | | | |
| Formation : | | | Weather: | | | | |

| Operations | | | | | | |
|------------|-------|------|---|-------------|-----------|-----|
| Start | Hrs | Code | Remarks | Start Depth | End Depth | Run |
| 6:00 | 13.00 | 02 | Drilling ahead w/ some fluid loss 48vis 8.5 wt 10% lcm | 3386 | 3470 | 8 |
| 19:00 | 0.50 | 07 | Service rig | 3470 | 3470 | 8 |
| 19:30 | 1.50 | 22 | Passon recalibrating all instruments, hook load, rotary rpm, pump displacements, ect. | 3470 | 3470 | 8 |
| 21:00 | 1.50 | 02 | Drilling ahead | 3470 | 3480 | 8 |
| 22:30 | 1.00 | 10 | Survey survey depth 3402 with 2.6 degree | 3480 | 3480 | 8 |
| 23:30 | 6.50 | 02 | Drilling ahead still running small fluid loss 45 vis 8.5 wt 10% lcm | 3480 | 3480 | 8 |
| Total: | 24.00 | | | | | |

| Mud Properties | | | | | | | | | | | | | | | | |
|----------------|------|-------|---------|--|-----|-----|--------|------|------|------------|-------|-------|-----------|----------|------|--|
| Depth | Time | Wt In | Wt Out | Vis | PV | YP | Gels | FL | HTFL | FC | HTFC | Solid | Water | Oil | Sand | |
| 3520 | 7:00 | 8.50 | 8.50 | 46 | 10 | 8 | 4/11/0 | 8.2 | 0.0 | 2 | 0.00 | 1.4% | 98.6% | 0.0% | 0.1% | |
| MBT | pH | Pm | Pf | Mf | Cl | Ca | ES | Pom | Lime | Total Sal. | CaCl2 | EDTA | O/W Ratio | Mud Loss | | |
| 8.0 | 9.90 | 0.45 | 0.18 | 1.00 | 800 | 160 | 0 | 0.00 | 0.10 | 0 | 0 | 0.00 | | 0 | | |
| Water Loss | LCM | ECD | FL Temp | Remarks | | | | | | | | | | | | |
| 0 | 0.1 | 0.0 | 60 | Last tih took on 20-25 bbls water and oil w/ 2000 chlorides and 560 ca++ | | | | | | | | | | | | |

| Daily Summary | | | | | | | |
|-----------------|------------|------------------|-----------|-----------------|---------|-----------------------|-------|
| Activity Date : | 12/15/2006 | Days From Spud : | 24 | Current Depth : | 3550 Ft | 24 Hr. Footage Made : | 70 Ft |
| Rig Company : | DHS | | Rig Name: | DHS #3 | | | |
| Formation : | | | Weather: | | | | |

| Operations | | | | | | |
|------------|-------|------|---|-------------|-----------|-----|
| Start | Hrs | Code | Remarks | Start Depth | End Depth | Run |
| 6:00 | 3.00 | 02 | Drilling ahead with low fluid loss. Wt 8.5 vis 46 lcm 12% | 3480 | 3535 | 8 |
| 9:00 | 1.50 | 05 | Drop survey and mix and pump pill | 3535 | 3535 | 8 |
| 10:30 | 5.50 | 06 | Tooh. Survey was missed. No recording. On tooh had injury to lead tong man Chris Baker. Tongs hit hand knocking him to floor. Brusing both hips, forearm & stomach. Ask if he needed medical attention, said yes, after few minutes tool pusher steve robbins said he was taking him back to rig camp. After asking again if he needed medical treatment , pusher and hand lead tong man did not respond. | 3535 | 3535 | 8 |
| 16:00 | 2.50 | 08 | Redrill holes and replaced guard over lead tong cat head | 3535 | 3535 | 8 |
| 18:30 | 1.50 | 06 | Make up new bit and tih with drill collars | 3535 | 3535 | 9 |
| 20:00 | 2.00 | 09 | Slip and cut 70' - 14 wraps drlg line | 3535 | 3535 | 9 |
| 22:00 | 2.50 | 06 | Continue tih | 3535 | 3535 | 9 |
| 0:30 | 0.50 | 03 | Ream 30' to bottom. | 3535 | 3535 | 9 |
| 1:00 | 5.00 | 02 | Drilling with min loss's. vis 45 wt 8.9 lcm 10% | 3535 | 3550 | 9 |
| Total: | 24.00 | | | | | |

| Mud Properties | | | | | | | | | | | | | | | | |
|----------------|-------|-------|---------|---------|-----|-----|-------|------|------|------------|-------|-------|-----------|----------|------|--|
| Depth | Time | Wt In | Wt Out | Vis | PV | YP | Gels | FL | HTFL | FC | HTFC | Solid | Water | Oil | Sand | |
| 3535 | 6:00 | 8.60 | 8.60 | 40 | 9 | 8 | 8/8/0 | 7.8 | 0.0 | 2 | 0.00 | 1.5% | 98.5% | 0.0% | 0.1% | |
| MBT | pH | Pm | Pf | Mf | Cl | Ca | ES | Pom | Lime | Total Sal. | CaCl2 | EDTA | O/W Ratio | Mud Loss | | |
| 8.0 | 10.20 | 0.58 | 0.22 | 1.20 | 800 | 120 | 0 | 0.00 | 0.10 | 0 | 0 | 0.00 | | 0 | | |
| Water Loss | LCM | ECD | FL Temp | Remarks | | | | | | | | | | | | |
| 0 | 0.1 | 0.0 | 60 | | | | | | | | | | | | | |

| Well Name: Greentown State 36-11 OS (Offset) | | | | | | | | | | | | | | | | |
|--|-------|-----------------------------|--|------------------|----------------|-----|------------|-----------------|--------|----------------|-------|-----------------------|-------------|-----------|------|--|
| Field Name: | | Wildcat | | | S/T/R: | | 36/21S/16E | | | County, State: | | Grand, UT | | | | |
| Operator: | | Delta Petroleum Corporation | | | Location Desc: | | | | | District: | | Northern | | | | |
| Daily Summary | | | | | | | | | | | | | | | | |
| Activity Date : | | 12/16/2006 | | Days From Spud : | | 25 | | Current Depth : | | 3686 Ft | | 24 Hr. Footage Made : | | 136 Ft | | |
| Rig Company : | | DHS | | | | | Rig Name: | | DHS #3 | | | | | | | |
| Formation : | | White Rim ss. | | | | | Weather: | | | | | | | | | |
| Operations | | | | | | | | | | | | | | | | |
| Start | Hrs | Code | Remarks | | | | | | | | | | Start Depth | End Depth | Run | |
| 6:00 | 4.00 | 02 | Drilling ahead with little mud loss's. 45 vis 8.6 wt | | | | | | | | | | 3550 | 3590 | 9 | |
| 10:00 | 2.50 | 08 | Repair rig. Repair air line and change roto seal on rotary clutch | | | | | | | | | | 3590 | 3590 | 9 | |
| 12:30 | 9.50 | 02 | Drilling ahead. T.D. reached 3686' | | | | | | | | | | 3590 | 3686 | 9 | |
| 22:00 | 1.00 | 05 | Circulate and conditioning mud. 44 vis 8.7 wt | | | | | | | | | | 3686 | 3686 | 9 | |
| 23:00 | 0.50 | 06 | PooH 2 stands for short trip. No drag & tih 2 stands with no drag. | | | | | | | | | | 3686 | 3686 | 9 | |
| 23:30 | 1.00 | 05 | Circulate and condition mud for logs. Drop survey | | | | | | | | | | 3686 | 3686 | 9 | |
| 0:30 | 3.00 | 06 | Tooh for logs. Lay down mud motor and stabilizer's. | | | | | | | | | | 3686 | 3686 | 9 | |
| 3:30 | 2.50 | 01 | Rigging up for wire line logs | | | | | | | | | | 3686 | 3686 | 9 | |
| Total: | | 24.00 | | | | | | | | | | | | | | |
| Mud Properties | | | | | | | | | | | | | | | | |
| Depth | Time | Wt In | Wt Out | Vis | PV | YP | Gels | FL | HTFL | FC | HTFC | Solid | Water | Oil | Sand | |
| 3686 | 22:00 | 8.80 | 8.80 | 45 | 17 | 14 | 7/14/0 | 7.0 | 0.0 | 2 | 0.00 | 2.7% | 97.3% | 0.0% | 0.2% | |
| MBT | pH | Pm | Pf | Mf | Cl | Ca | ES | Pom | Lime | Total Sal. | CaCl2 | EDTA | O/W Ratio | Mud Loss | | |
| 13.5 | 10.00 | 0.55 | 0.22 | 1.20 | 500 | 100 | 0 | 0.00 | 0.10 | 0 | 0 | 0.00 | | 0 | | |
| Water Loss | LCM | ECD | FL Temp | Remarks | | | | | | | | | | | | |
| 0 | 0.1 | 0.0 | 65 | | | | | | | | | | | | | |
| Daily Summary | | | | | | | | | | | | | | | | |
| Activity Date : | | 12/17/2006 | | Days From Spud : | | 5 | | Current Depth : | | 3686 Ft | | 24 Hr. Footage Made : | | 0 Ft | | |
| Rig Company : | | DHS | | | | | Rig Name: | | DHS #3 | | | | | | | |
| Formation : | | | | | | | Weather: | | | | | | | | | |
| Operations | | | | | | | | | | | | | | | | |
| Start | Hrs | Code | Remarks | | | | | | | | | | Start Depth | End Depth | Run | |
| 6:00 | 3.50 | 11 | Run open hole logs. Gamma Ray / SP - Array Induction, Density Porosity, & Borehole Profile. Slim TD was 3686-WL TD was 3674'. Hole stayed full with no problems encountered running logs | | | | | | | | | | 3686 | 3686 | 9 | |
| 9:30 | 0.50 | 01 | Rig down Schlumberger | | | | | | | | | | 3686 | 3686 | 9 | |
| 10:00 | 6.00 | 06 | Tih to circulate and condition mud for casing | | | | | | | | | | 3686 | 3686 | 10 | |
| 16:00 | 2.00 | 05 | Circulate and conditioning mud for casing. | | | | | | | | | | 3686 | 3686 | 10 | |
| 18:00 | 6.00 | 06 | Tooh laying down drill pipe and drill collars | | | | | | | | | | 3686 | 3686 | 10 | |
| 0:00 | 3.00 | 01 | Take out wear bushing and rig up casers | | | | | | | | | | 3686 | 3686 | 10 | |
| 3:00 | 3.00 | 12 | Running 5 1/2" 17# production casing | | | | | | | | | | 3686 | 3686 | 10 | |
| Total: | | 24.00 | | | | | | | | | | | | | | |
| Mud Properties | | | | | | | | | | | | | | | | |
| Depth | Time | Wt In | Wt Out | Vis | PV | YP | Gels | FL | HTFL | FC | HTFC | Solid | Water | Oil | Sand | |
| 3686 | 13:00 | 8.80 | 8.80 | 42 | 17 | 11 | 5/12/0 | 7.4 | 0.0 | 2 | 0.00 | 2.6% | 97.4% | 0.0% | 0.2% | |
| MBT | pH | Pm | Pf | Mf | Cl | Ca | ES | Pom | Lime | Total Sal. | CaCl2 | EDTA | O/W Ratio | Mud Loss | | |
| 13.0 | 9.60 | 0.44 | 0.20 | 1.00 | 600 | 80 | 0 | 0.00 | 0.10 | 0 | 0 | 0.00 | | 0 | | |
| Water Loss | LCM | ECD | FL Temp | Remarks | | | | | | | | | | | | |
| 0 | 0.1 | 0.0 | 68 | | | | | | | | | | | | | |

Well Name: Greentown State 36-11 OS (Offset)

| | | | | | |
|-------------|-----------------------------|----------------|------------|----------------|-----------|
| Field Name: | Wildcat | S/T/R: | 36/21S/16E | County, State: | Grand, UT |
| Operator: | Delta Petroleum Corporation | Location Desc: | | District: | Northern |

Daily Summary

| | | | | | | | |
|-----------------|------------|------------------|---|-----------------|---------|-----------------------|---------|
| Activity Date : | 12/18/2006 | Days From Spud : | 6 | Current Depth : | 3686 Ft | 24 Hr. Footage Made : | -188 Ft |
| Rig Company : | DHS | | | Rig Name: | DHS #3 | | |
| Formation : | | | | Weather: | | | |

Operations

| Start | Hrs | Code | Remarks | Start Depth | End Depth | Run |
|--------|-------|------|---|-------------|-----------|-----|
| 6:00 | 1.50 | 12 | Finish rih with 87 joint 5.5 17# casing. Tagged bottom at 3674' | 3874 | 3686 | NIH |
| 7:30 | 3.00 | 22 | keep casing moving while crew pump cellar to close casing valve that was opened by morning tour, also rehook up flow line | 3686 | 3686 | NIH |
| 10:30 | 2.00 | 12 | Cementing. Lead (350 sks 12.5 wt. 2.15 yeild w/ 94.24 bbls water) Premium lite high strength + 25lbs cf + 3% cd-32 + 3lbs kol seal + .5%fl-52 + .5% sms / Tail was planned to pump 141 sks but due to bulk tank air pressure only pumped 85 sks tail (Typelll + .25lbs cf + .2% cd-32 +.3%fl-52 + .2% sms. Calculated that tail top is 2889'. Displacement 67 bbls with full returns then pumped remainder of displacement 17.5 bbls with no returns. | 3686 | 3686 | NIH |
| 12:30 | 8.00 | 13 | .Wait on cement. After bumping plug, it would not hold so woc with 400 psi on plug for 8 hrs. | 3686 | 3686 | NIH |
| 20:30 | 0.50 | 22 | Set slips with 10,000 lb over pull. 90,000#. Cut casing and topped off | 3686 | 3686 | NIH |
| 21:00 | 9.00 | 23 | Released rig at 21:00 hrs 12/17/06 | 3686 | 3686 | NIH |
| Total: | 24.00 | | | | | |

Mud Properties

| Depth | Time | Wt In | Wt Out | Vis | PV | YP | Gels | FL | HTFL | FC | HTFC | Solid | Water | Oil | Sand |
|------------|-------|-------|---------|---------|-----|----|--------|------|------|------------|-------|-------|-----------|----------|------|
| 3686 | 13:00 | 8.80 | 8.80 | 42 | 17 | 11 | 5/12/0 | 7.4 | 0.0 | 2 | 0.00 | 2.6% | 97.4% | 0.0% | 0.2% |
| MBT | pH | Pm | Pf | Mf | Cl | Ca | ES | Pom | Lime | Total Sal. | CaCl2 | EDTA | O/W Ratio | Mud Loss | |
| 13.0 | 9.60 | 0.44 | 0.20 | 1.00 | 600 | 80 | 0 | 0.00 | 0.10 | 0 | 0 | 0.00 | | 0 | |
| Water Loss | LCM | ECD | FL Temp | Remarks | | | | | | | | | | | |
| 0 | 0.1 | 0.0 | 68 | | | | | | | | | | | | |

Formation

| Formation Name | Current Well Top | Subsea Datum | Ref Well Top | Elec Top | Comments |
|----------------|------------------|--------------|--------------|----------|----------|
| Wingate | 0 | 0 | 1671 | 0 | |
| White Rim ss. | 0 | 0 | 3174 | 0 | |
| Sinbad ls | 0 | 0 | 2957 | 0 | |
| Shinarump | 0 | 0 | 2316 | 0 | |
| Navajo | 0 | 0 | 1198 | 0 | |
| Morrison | 0 | 0 | 0 | 0 | |
| Moenkopi | 0 | 0 | 2362 | 0 | |
| Kayenta | 0 | 0 | 1634 | 0 | |
| Entrada | 0 | 0 | 481 | 0 | |
| Chinle | 0 | 0 | 2134 | 0 | |
| Carmel | 0 | 0 | 1033 | 0 | |

Casing

| DateIn | Setting Depth | Jts Run | Type | Size | Weight | Grade | MINID | HoleDiam | TD |
|---|---------------|---------|---------------|-------|--------|-------|-------|----------|------|
| 11/16/2006 | 60 | 3 | 1. Conductor | 16 | 55 | F-25* | | 20 | 60 |
| Stage: 1, Lead, 0, 12, 6 SK Redi-Mix, Redi-mix, 4.5, 0 | | | | | | | | | |
| 11/26/2006 | 1227 | 28 | 3. Surface | 8.625 | 24 | J-55 | | 11 | 1227 |
| Stage: 0, Wash, 20, 0, water water, , 0, 0 | | | | | | | | | |
| Stage: 0, Lead, 0, 245, 2% bwoc cc+0.25 lb/sack cello flake+6% bwoc bentonite+122.3% fresh water, Lightweight, 1.98, 12.5 | | | | | | | | | |
| Stage: 0, Tail, 0, 111, 2% beoc CaCl .025 bwoc celloflake, 44% freshwater, Class G, 1.4, 14.5 | | | | | | | | | |
| Stage: 0, Displacement, 77, 0, water 77 water 75.4 bbls, , 0, 0 | | | | | | | | | |
| 12/16/2006 | 3674.66 | 89 | 5. Production | 5.5 | 17 | J-55 | 0 | 7.875 | 3674 |
| Stage: 1, Lead, 0, 350, Premium lite high strength+25lbscf+3%cd-32+3lbskol seal l+5%fl-52+5%sm, Lightweight, 2.15, 12.5 | | | | | | | | | |
| Stage: 1, Tail, 0, 85, Typelll+.25lbscf+.2%cd-32+.3%fl-52+2%sms Typelll+.25lbscf+.2%cd-32+.3%fl-52+.2%sms, , 1.4, 14.5 | | | | | | | | | |
| Stage: 1, Displacement, 84.4, 0, 8.34 llb freash water, , 0, 0 | | | | | | | | | |



Delta Petroleum Corporation

370 17th Street, Suite 4300
 Denver, CO 80202
 (303) 293-9133

CONFIDENTIAL

**WellWork AFE Chronological
 Regulatory Report**

| Well Name : Greentown State 36-11 OS (Offset) | | | | | | | |
|--|----------------|---|-----------------|-------------|-----------------------------|--------|---|
| Prospect: | | | | AFE #: | 2920 | | |
| Sec/Twp/Rge: | 36 / 21S / 16E | | | Operator: | Delta Petroleum Corporation | | |
| API #: | 4301931505 | Field: | Wildcat | Supervisor: | Cory Knotte | | |
| Work Type: | Completion | County, St.: | Grand, UT | Phone: | 303-575-0000 | | |
| Production Current/Expected | Oil: | 0 / 0 | Gas: | 0 / 0 | Water: | 0 / 0 | |
| Job Purpose : Drill a wildcat well offsetting the #36-11 to test the White Rim Formation. AFE based on 15 drilling | | | | | | | |
| Wellwork Details | | | | | | | |
| Date : | 12/22/2006 | Activity: | Clean location | Rig Name: | M&M #3 | Days : | 1 |
| Daily Report Summary : | | Brought in cat, bobcat, backhoe, dumptruck and loader to make location usable to complete well. Set tubing head. Set BOP on well head. Spotted rig and pipe racks. Finished cleaning up well-site. SDFN. | | | | | |
| Daily Report Detail: | | Brought in cat, bobcat, backhoe, dumptruck and loader to make location usable to complete well. Set tubing head. Set BOP on well head. Spotted rig and pipe racks. Finished cleaning up well-site. SDFN. | | | | | |
| From 0:00 To 7:00 | 7 hrs | Category/Rmks: | SDFN : | | | | |
| From 7:00 To 18:00 | 11 hrs | Category/Rmks: | Other : | | | | |
| From 18:00 To 0:00 | 6 hrs | Category/Rmks: | SDFN : | | | | |
| Date : | 12/23/2006 | Activity: | Wireline | Rig Name: | M&M #3 | Days : | 2 |
| Daily Report Summary : | | Well shut in overnight. SICP 0 psi. MIRU Schlumberger to run CBL and perforate. PU tools and run to bottom. TD 3616'. Correlate with OHL. Run CBL to 1500'. Top of cement 1820'. There is still good cement on top, but it appears to be channeled at 1820'. BHT 96 degrees. Pull out of hole. Lay down tools. PU CCL, Gamma Ray and temperature recorder. RIH. Correlate with gamma ray. Run new collar log to clean up collars to help with perforating. POH. Lay down tools. PU 3 3/8 perf gun. RIH. Correlate with OHL. Run correlation strip. Perforate 3444' to 3456'. Pull out of hole. Lay down tools. All shots fired. No pressure increase noted. RDMO Schlumberger. Shut in well SICP 0 psi. | | | | | |
| Daily Report Detail: | | Well shut in until Tuesday. | | | | | |
| Daily Report Summary : | | Well shut in overnight. SICP 0 psi. MIRU Schlumberger to run CBL and perforate. PU tools and run to bottom. TD 3616'. Correlate with OHL. Run CBL to 1500'. Top of cement 1820'. There is still good cement on top, but it appears to be channeled at 1820'. BHT 96 degrees. Pull out of hole. Lay down tools. PU CCL, Gamma Ray and temperature recorder. RIH. Correlate with gamma ray. Run new collar log to clean up collars to help with perforating. POH. Lay down tools. PU 3 3/8 perf gun. RIH. Correlate with OHL. Run correlation strip. Perforate 3444' to 3456'. Pull out of hole. Lay down tools. All shots fired. No pressure increase noted. RDMO Schlumberger. Shut in well SICP 0 psi. | | | | | |
| Daily Report Detail: | | Well shut in until Tuesday. | | | | | |
| From 0:00 To 7:00 | 7 hrs | Category/Rmks: | SICP : | | | | |
| From 7:00 To 14:00 | 7 hrs | Category/Rmks: | Wireline : | | | | |
| From 14:00 To 0:00 | 10 hrs | Category/Rmks: | SICP : | | | | |
| Date : | 12/24/2006 | Activity: | Cost adjustment | Rig Name: | M&M #3 | Days : | 3 |
| Daily Report Summary : | | Cost Adjustment. | | | | | |
| Daily Report Detail: | | | | | | | |
| Date : | 12/25/2006 | Activity: | SI | Rig Name: | M&M #3 | Days : | 4 |
| Daily Report Summary : | | Well shut in. | | | | | |
| Daily Report Detail: | | Well shut in. | | | | | |
| Date : | 12/26/2006 | Activity: | MIRU | Rig Name: | M&M #3 | Days : | 5 |
| Daily Report Summary : | | Well shut in. SICP 0 psi. MIRU Pure Energy flow back equipment. Fill frac tanks. Well shut in overnight. | | | | | |
| Daily Report Detail: | | Well shut in. SICP 0 psi. MIRU Pure Energy flow back equipment. Fill frac tanks. Well shut in overnight. | | | | | |
| From 0:00 To 8:00 | 8 hrs | Category/Rmks: | SDFWE : | | | | |
| From 8:00 To 18:00 | 10 hrs | Category/Rmks: | MIRU : | | | | |
| From 18:00 To 0:00 | 6 hrs | Category/Rmks: | SDFN : | | | | |

Well Name : Greentown State 36-11 OS (Offset)

| | | | | | | |
|-----------------------------|--|--------------|-----------|-------------|-------------------|-------|
| Prospect: | | | | AFE #: | 2920 | |
| Sec/Twp/Rge: | 36 / 21S / 16E | | | Operator: | Petroleum Corpora | |
| API #: | 4301931505 | Field: | Wildcat | Supervisor: | Cory Knot | |
| Work Type: | Completion | County, St.: | Grand, UT | Phone: | 303-575-0000 | |
| Production Current/Expected | Oil: | 0 / 0 | Gas: | 0 / 0 | Water: | 0 / 0 |
| Job Purpose : | Drill a wildcat well offsetting the #36-11 to test the White Rim Formation. AFE based on 15 drilling | | | | | |

| | | | | | | | |
|--------|------------|-----------|--------------|-----------|--------|--------|---|
| Date : | 12/27/2006 | Activity: | Prep to frac | Rig Name: | M&M #3 | Days : | 6 |
|--------|------------|-----------|--------------|-----------|--------|--------|---|

Daily Report Summary : Well shut in. SICP 0 psi. MIRU M&M well service. Unload pipe. Tally pipe. TIH with bottom of packer at 3401'. Set packer. RU to swab. Swab down tubing in two runs recovering 20 bbls. Wait one hour. Swab run recovered no fluid. SDFN. Fill water tanks. Move in CO2 vessels. RU flowback equipment. Shut in well 0 psi.

Daily Report Detail: Well shut in. SICP 0 psi. MIRU M&M well service. Unload pipe. Tally pipe. TIH with bottom of packer at 3401'. Set packer. RU to swab. Swab down tubing in two runs recovering 20 bbls. Wait one hour. Swab run recovered no fluid. SDFN. Fill water tanks. Move in CO2 vessels. RU flowback equipment. Shut in well 0 psi.

| | | | |
|---------------------|-------|----------------|--------|
| From 0:00 To 7:00 | 7 hrs | Category/Rmks: | SDFN : |
| From 7:00 To 14:00 | 7 hrs | Category/Rmks: | MIRU : |
| From 14:00 To 16:00 | 2 hrs | Category/Rmks: | TIH : |
| From 16:00 To 18:00 | 2 hrs | Category/Rmks: | Swab : |
| From 18:00 To 0:00 | 6 hrs | Category/Rmks: | SDFN : |

| | | | | | | | |
|--------|------------|-----------|------|-----------|--------|--------|---|
| Date : | 12/28/2006 | Activity: | Swab | Rig Name: | M&M #3 | Days : | 7 |
|--------|------------|-----------|------|-----------|--------|--------|---|

Daily Report Summary : SITP 0 psi. SICP 0 psi. Blow down well. No blow whatsoever. Make a swab run. Didn't tag any fluid and no fluid recovered. RU rig pump. Run lines to wellhead. Add 50 bbls of KCL concentrate to rig tank and last frac tank. MIRU hot oil truck. Heat frac tanks to 60 degrees. RDMO hot oil truck. MIRU readymix truck. Fill mouse holes with ready mix. RDMO ready mix truck. Fill tubing with KCL water at 1.5 bpm. Pressure well to 1500 psi (Break). Rig pump went down. Fix rig pump. Pressure well back up to 500 psi. Establish injection rate of 1.5 bpm at 500 psi. Pump 35 bbls total fluid. Shut down. ISIP 0 psi. Open well up to swab. Well flowing back. Well flowed back for about 3 minutes. Make 6 total swab runs. See Drilling mud and a trace of oil on Swab run #3. Recover 26 bbls of water. Release packer. TOO H with tubing and packer. Lay down packer. Stand back tubing in derrick. Remove tubing rams from BOP and put in blind rams in BOP. SDFN. Shut in well for night. MIRU Weatherford frac crew. MIRU Pure wireline crew. MIRU Stinger. Secure well SDFN.

Daily Report Detail: SITP 0 psi. SICP 0 psi. Blow down well. No blow whatsoever. Make a swab run. Didn't tag any fluid and no fluid recovered. RU rig pump. Run lines to wellhead. Add 50 bbls of KCL concentrate to rig tank and last frac tank. MIRU hot oil truck. Heat frac tanks to 60 degrees. RDMO hot oil truck. MIRU readymix truck. Fill mouse holes with ready mix. RDMO ready mix truck. Fill tubing with KCL water at 1.5 bpm. Pressure well to 1500 psi (Break). Rig pump went down. Fix rig pump. Pressure well back up to 500 psi. Establish injection rate of 1.5 bpm at 500 psi. Pump 35 bbls total fluid. Shut down. ISIP 0 psi. Open well up to swab. Well flowing back. Well flowed back for about 3 minutes. Make 6 total swab runs. See Drilling mud and a trace of oil on Swab run #3. Recover 26 bbls of water. Release packer. TOO H with tubing and packer. Lay down packer. Stand back tubing in derrick. Remove tubing rams from BOP and put in blind rams in BOP. SDFN. Shut in well for night. MIRU Weatherford frac crew. MIRU Pure wireline crew. MIRU Stinger. Secure well SDFN.

| | | | |
|---------------------|---------|----------------|--|
| From 0:00 To 7:00 | 7 hrs | Category/Rmks: | SDFN : |
| From 7:00 To 8:00 | 1 hrs | Category/Rmks: | Swab : |
| From 8:00 To 10:00 | 2 hrs | Category/Rmks: | RU : |
| From 10:00 To 10:30 | 0.5 hrs | Category/Rmks: | Other : |
| From 10:30 To 11:00 | 0.5 hrs | Category/Rmks: | Other : fix rig pump & pump into well. |
| From 11:00 To 16:00 | 5 hrs | Category/Rmks: | Swab : |
| From 16:00 To 17:00 | 1 hrs | Category/Rmks: | TOOH : |
| From 17:00 To 18:00 | 1 hrs | Category/Rmks: | Other : rams in bop |

Well Name : Greentown State 36-11 OS (Offset)

| | | | | | | |
|-----------------------------|----------------|--------------|-----------|-------------|-------------------|-------|
| Prospect: | | | | AFE #: | 2920 | |
| Sec/Twp/Rge: | 36 / 21S / 16E | | | Operator: | Petroleum Corpora | |
| API #: | 4301931505 | Field: | Wildcat | Supervisor: | Cory Knot | |
| Work Type: | Completion | County, St.: | Grand, UT | Phone: | 303-575-0000 | |
| Production Current/Expected | Oil: | 0 / 0 | Gas: | 0 / 0 | Water: | 0 / 0 |

Job Purpose : Drill a wildcat well offsetting the #36-11 to test the White Rim Formation. AFE based on 15 drilling

| | | | | | | | |
|--------|------------|-----------|------------|-----------|--------|--------|---|
| Date : | 12/29/2006 | Activity: | Stage Frac | Rig Name: | M&M #3 | Days : | 8 |
|--------|------------|-----------|------------|-----------|--------|--------|---|

Daily Report Summary : SICIP 0 psi. RU Weatherford frac equipment. SICIP 29 psi. Get a break of 1000 at 6.4 bpm. Pump prepad, pad, 1 ppg, 2 ppg, 3 ppg, 4 ppg, 5 ppg, 6 ppg, & flush stages. ISIP 425 psi. Frac Gradient 0.56 psi/ft. Average Pressure 1665 psi. Average Rate 35 bpm. RD Weatherford Frac Crew. SICIP 425 psi. RU Pure wireline. PU Perf guns & Baker CFP. TIH with guns and plug. Set plug at 3411'. Perforate 3362'-3374' (36 total holes). TOOH with perf guns. SICIP 150 psi. TOOH with guns. All shots fired. Lay down guns. RU Weatherford frac equipment. SICIP 118 psi. Get a break of 3196 at 7 bpm. Pump prepad, pad, 1 ppg, 2 ppg, 3 ppg, 4 ppg, 5 ppg, 6 ppg, & flush stages. ISIP 495 psi. Frac Gradient 0.59 psi/ft. Average Pressure 1916 psi. Average Rate 38 bpm. RD Weatherford Frac Crew. SICIP 200 psi. RU Pure wireline. PU Perf guns and Baker CFP. TIH with guns and plug. Set plug at 3350'. Attempt to shoot guns. Have misfire. TOOH with live guns. Lay down guns. Guns Shot low order dentonation. PU different set of guns and TIH with guns. Perforate 3320'-3332' (36 total holes). TOOH with perf guns. SICIP 200 psi. TOOH with guns. All shots fired. Lay down guns. RU Weatherford frac equipment. SICIP 169 psi. Get a break of 1245 at 12.8 bpm. Pump prepad, pad, 1 ppg, 2 ppg, 3 ppg, 4 ppg, 5 ppg, 6 ppg, & flush stages. ISIP 575 psi. Frac Gradient 0.61 psi/ft. Average Pressure 1916 psi. Average Rate 38 bpm. RD Weatherford Frac Crew. RD Stinger. Sting out of well to flowback. RU Pure flowback crew. Open well up with 276 psi on it to open top tank. Pressure comes up quickly to over 500 psi. Divert flow to separator. Flow well throughout the night through separator.

Total Frac Load = 1847
 Total Oil Recovered = 0 bbls
 Total Water Recovered = 0 bbls

Load to Recover = 1856 bbls

Daily Report Detail: SICIP 0 psi. RU Weatherford frac equipment. SICIP 29 psi. Get a break of 1000 at 6.4 bpm. Pump prepad, pad, 1 ppg, 2 ppg, 3 ppg, 4 ppg, 5 ppg, 6 ppg, & flush stages. ISIP 425 psi. Frac Gradient 0.56 psi/ft. Average Pressure 1665 psi. Average Rate 35 bpm. RD Weatherford Frac Crew. SICIP 425 psi. RU Pure wireline. PU Perf guns & Baker CFP. TIH with guns and plug. Set plug at 3411'. Perforate 3362'-3374' (36 total holes). TOOH with perf guns. SICIP 150 psi. TOOH with guns. All shots fired. Lay down guns. RU Weatherford frac equipment. SICIP 118 psi. Get a break of 3196 at 7 bpm. Pump prepad, pad, 1 ppg, 2 ppg, 3 ppg, 4 ppg, 5 ppg, 6 ppg, & flush stages. ISIP 495 psi. Frac Gradient 0.59 psi/ft. Average Pressure 1916 psi. Average Rate 38 bpm. RD Weatherford Frac Crew. SICIP 200 psi. RU Pure wireline. PU Perf guns and Baker CFP. TIH with guns and plug. Set plug at 3350'. Attempt to shoot guns. Have misfire. TOOH with live guns. Lay down guns. Guns Shot low order dentonation. PU different set of guns and TIH with guns. Perforate 3320'-3332' (36 total holes). TOOH with perf guns. SICIP 200 psi. TOOH with guns. All shots fired. Lay down guns. RU Weatherford frac equipment. SICIP 169 psi. Get a break of 1245 at 12.8 bpm. Pump prepad, pad, 1 ppg, 2 ppg, 3 ppg, 4 ppg, 5 ppg, 6 ppg, & flush stages. ISIP 575 psi. Frac Gradient 0.61 psi/ft. Average Pressure 1916 psi. Average Rate 38 bpm. RD Weatherford Frac Crew. RD Stinger. Sting out of well to flowback. RU Pure flowback crew. Open well up with 276 psi on it to open top tank. Pressure comes up quickly to over 500 psi. Divert flow to separator. Flow well throughout the night through separator.

Total Frac Load = 1847
 Total Oil Recovered = 0 bbls
 Total Water Recovered = 0 bbls

Load to Recover = 1856 bbls

| | | | |
|---------------------|---------|----------------|--------|
| From 0:00 To 6:00 | 6 hrs | Category/Rmks: | SDFN : |
| From 6:00 To 8:30 | 2.5 hrs | Category/Rmks: | RU : |
| From 8:30 To 10:30 | 2 hrs | Category/Rmks: | Frac : |
| From 10:30 To 12:00 | 1.5 hrs | Category/Rmks: | Perf : |
| From 12:00 To 13:30 | 1.5 hrs | Category/Rmks: | Frac : |
| From 13:30 To 16:00 | 2.5 hrs | Category/Rmks: | Perf : |
| From 16:00 To 17:15 | .25 hr | Category/Rmks: | Frac : |
| From 17:15 To 18:30 | .25 hr | Category/Rmks: | RD : |
| From 18:30 To 0:00 | 5.5 hrs | Category/Rmks: | Flow : |

Well Name : Greentown State 36-11 OS (Offset)

| | | | | | | |
|-----------------------------|----------------|--------------|-----------|-------------|-------------------|-------|
| Prospect: | | | | AFE #: | 2920 | |
| Sec/Twp/Rge: | 36 / 21S / 16E | | | Operator: | Petroleum Corpora | |
| API #: | 4301931505 | Field: | Wildcat | Supervisor: | Cory Knot | |
| Work Type: | Completion | County, St.: | Grand, UT | Phone: | 303-575-0000 | |
| Production Current/Expected | Oil: | 0 / 0 | Gas: | 0 / 0 | Water: | 0 / 0 |

Job Purpose : Drill a wildcat well offsetting the #36-11 to test the White Rim Formation. AFE based on 15 drilling

| | | | | | | | |
|--------|------------|-----------|------------|-----------|--------|--------|---|
| Date : | 12/30/2006 | Activity: | Stage Frac | Rig Name: | M&M #3 | Days : | 9 |
|--------|------------|-----------|------------|-----------|--------|--------|---|

Daily Report Summary : SICIP 550 psi. RU Stinger. RU Pure wireline. PU Perf guns & Baker CFP. TIH with guns and plug. Set plug at 3305'. Perforate 3274'-3286' (36 total holes). TOOH with perf guns. SICIP 500 psi. TOOH with guns. All shots fired. Lay down guns. RU Weatherford frac equipment. SICIP 478 psi. Get a break of 474 at 7.7 bpm. Pump prepad, pad, 1 ppg, 2 ppg, 3 ppg, 4 ppg, 5 ppg, 6 ppg, & flush stages. ISIP 625 psi. Frac Gradient 0.63 psi/ft. Average Pressure 1300 psi. Average Rate 40 bpm. RD Weatherford Frac Crew. SICIP 275 psi. RU Pure wireline. PU Perf guns and Baker CFP. TIH with guns and plug. Attempt to set plug at 3260'. Have misfire. TOOH with live guns and plug. Lay down guns and plug. Guns full of water. Lay down wet gun and TIH with dry gun and plug. Tag sand high at 3195'. Tag sand plug once more. Sand plug is solid. TOOH with guns and plug. Lay down gun and plug. RU Weatherford. Pressure up to 3150 psi before plug lets go. Pump 12 additional bbls (15 bbls total) at 4 bpm. SD. RD weatherford from wellhead. RU Pure wireline. TIH with plug and guns. Set plug at 3260'. Perforate 3226'-3234' (24 total holes). TOOH with perf guns. SICIP 0 psi. All shots fired. Lay down guns. PU perforating gun. TIH with gun. Perforate 3222'-3226' (12 total holes). TOOH with perf guns. SICIP 0 psi. All shots fired. Lay down perforation gun. RU Weatherford frac equipment. SICIP 105 psi. Get a break of 1408 at 38.1 bpm. Pump prepad, pad, 1 ppg, 2 ppg, 3 ppg, 4 ppg, 5 ppg, 6 ppg, & flush stages. ISIP 600 psi. Frac Gradient 0.62 psi/ft. Average Pressure 1200 psi. Average Rate 40 bpm. RD Weatherford Frac Crew. RD Stinger. Sting out of well to flowback. RU Pure flowback crew. Open well up with 201 psi on it to open top tank. Flow well to open top tank.

Total Daily Water Recovered = 774 bbls
Total Daily Oil Recovered = 0 bbls

Cum Water Recovered = 800 bbls
Cum Oil Recovered = 0 bbls

Daily Report Detail: SICIP 550 psi. RU Stinger. RU Pure wireline. PU Perf guns & Baker CFP. TIH with guns and plug. Set plug at 3305'. Perforate 3274'-3286' (36 total holes). TOOH with perf guns. SICIP 500 psi. TOOH with guns. All shots fired. Lay down guns. RU Weatherford frac equipment. SICIP 478 psi. Get a break of 474 at 7.7 bpm. Pump prepad, pad, 1 ppg, 2 ppg, 3 ppg, 4 ppg, 5 ppg, 6 ppg, & flush stages. ISIP 625 psi. Frac Gradient 0.63 psi/ft. Average Pressure 1300 psi. Average Rate 40 bpm. RD Weatherford Frac Crew. SICIP 275 psi. RU Pure wireline. PU Perf guns and Baker CFP. TIH with guns and plug. Attempt to set plug at 3260'. Have misfire. TOOH with live guns and plug. Lay down guns and plug. Guns full of water. Lay down wet gun and TIH with dry gun and plug. Tag sand high at 3195'. Tag sand plug once more. Sand plug is solid. TOOH with guns and plug. Lay down gun and plug. RU Weatherford. Pressure up to 3150 psi before plug lets go. Pump 12 additional bbls (15 bbls total) at 4 bpm. SD. RD weatherford from wellhead. RU Pure wireline. TIH with plug and guns. Set plug at 3260'. Perforate 3226'-3234' (24 total holes). TOOH with perf guns. SICIP 0 psi. All shots fired. Lay down guns. PU perforating gun. TIH with gun. Perforate 3222'-3226' (12 total holes). TOOH with perf guns. SICIP 0 psi. All shots fired. Lay down perforation gun. RU Weatherford frac equipment. SICIP 105 psi. Get a break of 1408 at 38.1 bpm. Pump prepad, pad, 1 ppg, 2 ppg, 3 ppg, 4 ppg, 5 ppg, 6 ppg, & flush stages. ISIP 600 psi. Frac Gradient 0.62 psi/ft. Average Pressure 1200 psi. Average Rate 40 bpm. RD Weatherford Frac Crew. RD Stinger. Sting out of well to flowback. RU Pure flowback crew. Open well up with 201 psi on it to open top tank. Flow well to open top tank.

Total Daily Water Recovered = 774 bbls
Total Daily Oil Recovered = 0 bbls

Load to Recover = 2490 bbls
Cum Water Recovered = 800 bbls
Cum Oil Recovered = 0 bbls

| | | | |
|---------------------|---------|----------------|--------|
| From 0:00 To 4:00 | 4 hrs | Category/Rmks: | Flow : |
| From 4:00 To 6:00 | 2 hrs | Category/Rmks: | SDFN : |
| From 6:00 To 8:00 | 2 hrs | Category/Rmks: | RU : |
| From 8:00 To 10:30 | 2.5 hrs | Category/Rmks: | Perf : |
| From 10:30 To 12:30 | 2 hrs | Category/Rmks: | Frac : |
| From 12:30 To 15:30 | 3 hrs | Category/Rmks: | Perf : |
| From 15:30 To 17:00 | 1.5 hrs | Category/Rmks: | Frac : |

Well Name : Greentown State 36-11 OS (Offset)

| | | | | | | |
|-----------------------------|----------------|--------------|-----------|-------------|-------------------|-------|
| Prospect: | | | | AFE #: | 2920 | |
| Sec/Twp/Rge: | 36 / 21S / 16E | | | Operator: | Petroleum Corpora | |
| API #: | 4301931505 | Field: | Wildcat | Supervisor: | Cory Knot | |
| Work Type: | Completion | County, St.: | Grand, UT | Phone: | 303-575-0000 | |
| Production Current/Expected | Oil: | 0 / 0 | Gas: | 0 / 0 | Water: | 0 / 0 |

Job Purpose : Drill a wildcat well offsetting the #36-11 to test the White Rim Formation. AFE based on 15 drilling

| | | | |
|---------------------|---------|----------------|--------|
| From 17:00 To 18:30 | 1.5 hrs | Category/Rmks: | RD : |
| From 18:30 To 0:00 | 5.5 hrs | Category/Rmks: | Flow : |

| | | | | | | | |
|--------|------------|-----------|----------------|-----------|--------|--------|----|
| Date : | 12/31/2006 | Activity: | Flow back frac | Rig Name: | M&M #3 | Days : | 10 |
|--------|------------|-----------|----------------|-----------|--------|--------|----|

Daily Report Summary : Open well on 48/64" choke at 201 psi. Flow well throughout night. Flowing pressure dropping steadily. Seeing more and more sand. Dumping sand dump on separator every 15 minutes. Switch well to open top tank. Open choke to 64/64" well flowing at 236 psi. No trace of any sand at 0730 hours. Make a trace of sand throughout day. Continue to flowback well with 64/64" choke.

Total Daily Water Recovered = 2093 bbls
Total Daily Oil Recovered = 0 bbls

Load to Recover = 397 bbls
Cum Water Recovered = 2893 bbls
Cum Oil Recovered = 0 bbls

Daily Report Detail: Open well on 48/64" choke at 201 psi. Flow well throughout night. Flowing pressure dropping steadily. Seeing more and more sand. Dumping sand dump on separator every 15 minutes. Switch well to open top tank. Open choke to 64/64" well flowing at 236 psi. No trace of any sand at 0730 hours. Make a trace of sand throughout day. Continue to flowback well with 64/64" choke.

Total Daily Water Recovered = 2093 bbls
Total Daily Oil Recovered = 0 bbls

Load to Recover = 397 bbls
Cum Water Recovered = 2893 bbls
Cum Oil Recovered = 0 bbls

| | | | |
|-------------------|--------|----------------|--------|
| From 0:00 To 0:00 | 24 hrs | Category/Rmks: | Flow : |
|-------------------|--------|----------------|--------|

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|--------|----------|-----------|----------------|-----------|--------|--------|----|
| Date : | 1/1/2007 | Activity: | Flow back frac | Rig Name: | M&M #3 | Days : | 11 |
|--------|----------|-----------|----------------|-----------|--------|--------|----|

Daily Report Summary :

Daily Report Detail: Continue to flowback frac on 64/64" choke at 176 psi. Flow back well throughout the day. Well flowing at 155 psi on 64/64" choke.

Total Daily Water Recovered = 1883 bbls
Total Daily Oil Recovered = 0 bbls

Load to Recover = -1436 bbls
Cum Water Recovered = 4726 bbls
Cum Oil Recovered = 0 bbls

ALL LOAD RECOVERED !!!

| | | | |
|-------------------|--------|----------------|--------|
| From 0:00 To 0:00 | 24 hrs | Category/Rmks: | Flow : |
|-------------------|--------|----------------|--------|

Well Name : Greentown State 36-11 OS (Offset)

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|-----------------------------|----------------|--------------|-----------|-------------|-------------------|-------|
| Prospect: | | | | AFE #: | 2920 | |
| Sec/Twp/Rge: | 36 / 21S / 16E | | | Operator: | Petroleum Corpora | |
| API #: | 4301931505 | Field: | Wildcat | Supervisor: | Cory Knot | |
| Work Type: | Completion | County, St.: | Grand, UT | Phone: | 303-575-0000 | |
| Production Current/Expected | Oil: | 0 / 0 | Gas: | 0 / 0 | Water: | 0 / 0 |

Job Purpose : Drill a wildcat well offsetting the #36-11 to test the White Rim Formation. AFE based on 15 drilling

| | | | | | | | |
|--------|----------|-----------|----------------|-----------|--------|--------|----|
| Date : | 1/2/2007 | Activity: | Flow back frac | Rig Name: | M&M #3 | Days : | 12 |
|--------|----------|-----------|----------------|-----------|--------|--------|----|

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|------------------------|--|
| Daily Report Summary : | Continue to flowback frac on 64/64" choke at 155 psi. Shut well in at 0800 hours. Recovered almost 150% of load. Continue to monitor pressure. Secure well. MI Dalbo to start hauling water to disposal. Total Daily Water Recovered = 1109 bbls Total Daily Oil Recovered = 0 bbls Load to Recover = -2545 bbls Cum Water Recovered = 5835 bbls Cum Oil Recovered = 0 bbls ALL LOAD RECOVERED !!! |
|------------------------|--|

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|----------------------|--|
| Daily Report Detail: | Continue to flowback frac on 64/64" choke at 155 psi. Shut well in at 0800 hours. Recovered almost 150% of load. Continue to monitor pressure. Secure well. MI Dalbo to start hauling water to disposal. Total Daily Water Recovered = 1109 bbls Total Daily Oil Recovered = 0 bbls Load to Recover = -2545 bbls Cum Water Recovered = 5835 bbls Cum Oil Recovered = 0 bbls ALL LOAD RECOVERED !!! |
|----------------------|--|

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|-------------------|--------|----------------|--------|
| From 0:00 To 8:00 | 8 hrs | Category/Rmks: | Flow : |
| From 8:00 To 0:00 | 16 hrs | Category/Rmks: | SDFN : |

| | | | | | | | |
|--------|----------|-----------|------------------|-----------|--------|--------|----|
| Date : | 1/3/2007 | Activity: | SI - Temporarily | Rig Name: | M&M #3 | Days : | 13 |
|--------|----------|-----------|------------------|-----------|--------|--------|----|

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|------------------------|---|
| Daily Report Summary : | Shut in well. SICP 230 psi. Continue to haul out flowback water to disposal. Total Daily Water Recovered = 0 bbls Total Daily Oil Recovered = 0 bbls Load to Recover = -2545 bbls Cum Water Recovered = 5835 bbls Cum Oil Recovered = 0 bbls ALL LOAD RECOVERED !!! |
|------------------------|---|

| | |
|----------------------|---|
| Daily Report Detail: | Shut in well. SICP 230 psi. Continue to haul out flowback water to disposal. Total Daily Water Recovered = 0 bbls Total Daily Oil Recovered = 0 bbls Load to Recover = -2545 bbls Cum Water Recovered = 5835 bbls Cum Oil Recovered = 0 bbls ALL LOAD RECOVERED !!! |
|----------------------|---|

| | | | |
|-------------------|--------|----------------|--------|
| From 0:00 To 0:00 | 24 hrs | Category/Rmks: | SDFN : |
|-------------------|--------|----------------|--------|

Well Name : Greentown State 36-11 OS (Offset)

| | | | | | | |
|-----------------------------|--|--------------|-----------|-------------|-------------------|-------|
| Prospect: | | | | AFE #: | 2920 | |
| Sec/Twp/Rge: | 36 / 21S / 16E | | | Operator: | Petroleum Corpora | |
| API #: | 4301931505 | Field: | Wildcat | Supervisor: | Cory Knot | |
| Work Type: | Completion | County, St.: | Grand, UT | Phone: | 303-575-0000 | |
| Production Current/Expected | Oil: | 0 / 0 | Gas: | 0 / 0 | Water: | 0 / 0 |
| Job Purpose : | Drill a wildcat well offsetting the #36-11 to test the White Rim Formation. AFE based on 15 drilling | | | | | |

| | | | | | | | |
|--------|----------|-----------|-----------------|-----------|--------|--------|----|
| Date : | 1/4/2007 | Activity: | Drill out plugs | Rig Name: | M&M #3 | Days : | 14 |
|--------|----------|-----------|-----------------|-----------|--------|--------|----|

Daily Report Summary : SICP 216 psi. MI Power Swivel. Replace top blind rams with tubing rams. Flow back well to open top. Get gas for 10 minutes. H2S alarm went off. Evacate location. Meet on other side of location. Have meeting with rig crew and flowback crew. Go back in in 5 minutes after its safe. Continue to monitor H2S levels. Meter showed 40 ppm. Flow well a total of 20 minutes. Get fluid and spin out a sample. Sample shows a trace of oil with all water. Shut well in. Flowed back a total of 20 bbls. RU rig pump to kill well. Pump 50 bbls of 10 ppg salt water. Well dead. TIH with tubing. Mix 9.2 ppg salt water in flowback tank to drill with. Tag sand at 3230' about 30 feet high. Pump at 3 bpm with rig pump with 9.2 ppg salt water. Drill through sand bridge at 3230'. Drill to 3236'. No returns. Do not make connection until returns established. No returns. Pump a total of 70 bbls and no returns. SD. Decide water is too heavy. Pump heavy 9.2 ppg salt water to empty tank and pump in 2% KCL water. Fill flowback tank with 2% kCL and Establish rate again. Pump a total of 70 bbls. SD. No returns. Call for foam unit. Lost a total of 120 bbls to formation. Secure well SDFN.

Daily Report Detail: SICP 216 psi. MI Power Swivel. Replace top blind rams with tubing rams. Flow back well to open top. Get gas for 10 minutes. H2S alarm went off. Evacate location. Meet on other side of location. Have meeting with rig crew and flowback crew. Go back in in 5 minutes after its safe. Continue to monitor H2S levels. Meter showed 40 ppm. Flow well a total of 20 minutes. Get fluid and spin out a sample. Sample shows a trace of oil with all water. Shut well in. Flowed back a total of 20 bbls. RU rig pump to kill well. Pump 50 bbls of 10 ppg salt water. Well dead. TIH with tubing. Mix 9.2 ppg salt water in flowback tank to drill with. Tag sand at 3230' about 30 feet high. Pump at 3 bpm with rig pump with 9.2 ppg salt water. Drill through sand bridge at 3230'. Drill to 3236'. No returns. Do not make connection until returns established. No returns. Pump a total of 70 bbls and no returns. SD. Decide water is too heavy. Pump heavy 9.2 ppg salt water to empty tank and pump in 2% KCL water. Fill flowback tank with 2% kCL and Establish rate again. Pump a total of 70 bbls. SD. No returns. Call for foam unit. Lost a total of 120 bbls to formation. Secure well SDFN.

| | | | |
|---------------------|---------|----------------|-------------|
| From 0:00 To 7:00 | 7 hrs | Category/Rmks: | SDFN : |
| From 7:00 To 9:00 | 2 hrs | Category/Rmks: | RU : |
| From 9:00 To 9:20 | .33 hr | Category/Rmks: | Flow : |
| From 9:20 To 10:00 | .67 hr | Category/Rmks: | Other : |
| From 10:00 To 10:45 | .75 hr | Category/Rmks: | Circulate : |
| From 10:45 To 13:30 | .75 hr | Category/Rmks: | TIH : |
| From 13:30 To 14:30 | 1 hrs | Category/Rmks: | Circulate : |
| From 14:30 To 15:30 | 1 hrs | Category/Rmks: | Other : |
| From 15:30 To 16:30 | 1 hrs | Category/Rmks: | Circulate : |
| From 16:30 To 0:00 | 7.5 hrs | Category/Rmks: | SDFN : |

Well Name : Greentown State 36-11 OS (Offset)

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|-----------------------------|----------------|--------------|-----------|-------------|-------------------|-------|
| Prospect: | | | | AFE #: | 2920 | |
| Sec/Twp/Rge: | 36 / 21S / 16E | | | Operator: | Petroleum Corpora | |
| API #: | 4301931505 | Field: | Wildcat | Supervisor: | Cory Knot | |
| Work Type: | Completion | County, St.: | Grand, UT | Phone: | 303-575-0000 | |
| Production Current/Expected | Oil: | 0 / 0 | Gas: | 0 / 0 | Water: | 0 / 0 |

Job Purpose : Drill a wildcat well offsetting the #36-11 to test the White Rim Formation. AFE based on 15 drilling

| | | | | | | | |
|--------|----------|-----------|-----------------|-----------|--------|--------|----|
| Date : | 1/5/2007 | Activity: | Drill out plugs | Rig Name: | M&M #3 | Days : | 15 |
|--------|----------|-----------|-----------------|-----------|--------|--------|----|

Daily Report Summary : Perform routine maintenance to rig. MIRU Weatherford foam unit. RU transfer pump and line to 400 oil tanks. Tag up on Plug #1 at 3260'. No sand on plug #1. Drill out plug #1 in 20 minutes. Circulate for 20 minutes. SD foam unit to make connection. TIH to Plug #2. Tag up on Plug #2 at 3305'. Drill out plug #2 in 30 minutes. Circulate 20 minutes and SD foam unit to make connection. TIH to Plug #3. Tag Plug #3 at 3350'. Drill on Plug #3 for about 45 minutes. No sand on Plug #3. Circulate for 20 minutes. TIH to Plug #4 at 3411'. Drill on Plug #4 for approximately 45 minutes. Again circulate for 20 minutes before making a connection. TIH to TD. Tag a sand bridge at 3550'. Drill through sand bridge and continue to bottom. Tag TD at 3616 (rig) 3611' (wireline). Circulate for 1.5 hours. Monitor returns to make sure they are clean. SD Foam unit. Pump kill pill into tubing of straight water. Tubing dead. Backside still flowing. TOO H with tubing. PU above top perforations. Shut in backside. Secure well. SDFN.

Daily Report Detail: Perform routine maintenance to rig. MIRU Weatherford foam unit. RU transfer pump and line to 400 oil tanks. Tag up on Plug #1 at 3260'. No sand on plug #1. Drill out plug #1 in 20 minutes. Circulate for 20 minutes. SD foam unit to make connection. TIH to Plug #2. Tag up on Plug #2 at 3305'. Drill out plug #2 in 30 minutes. Circulate 20 minutes and SD foam unit to make connection. TIH to Plug #3. Tag Plug #3 at 3350'. Drill on Plug #3 for about 45 minutes. No sand on Plug #3. Circulate for 20 minutes. TIH to Plug #4 at 3411'. Drill on Plug #4 for approximately 45 minutes. Again circulate for 20 minutes before making a connection. TIH to TD. Tag a sand bridge at 3550'. Drill through sand bridge and continue to bottom. Tag TD at 3616 (rig) 3611' (wireline). Circulate for 1.5 hours. Monitor returns to make sure they are clean. SD Foam unit. Pump kill pill into tubing of straight water. Tubing dead. Backside still flowing. TOO H with tubing. PU above top perforations. Shut in backside. Secure well. SDFN.

| | | | |
|---------------------|---------|----------------|---------|
| From 0:00 To 7:00 | 7 hrs | Category/Rmks: | SDFN : |
| From 7:00 To 11:00 | 4 hrs | Category/Rmks: | RU : |
| From 11:00 To 18:30 | 7.5 hrs | Category/Rmks: | Drill : |
| From 18:30 To 19:00 | 0.5 hrs | Category/Rmks: | RD : |
| From 19:00 To 19:30 | 0.5 hrs | Category/Rmks: | TOOH : |
| From 19:30 To 0:00 | 4.5 hrs | Category/Rmks: | SDFN : |

Well Name : Greentown State 36-11 OS (Offset)

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|-----------------------------|----------------|--------------|-----------|-------------|-------------------|-------|
| Prospect: | | | | AFE #: | 2920 | |
| Sec/Twp/Rge: | 36 / 21S / 16E | | | Operator: | Petroleum Corpora | |
| API #: | 4301931505 | Field: | Wildcat | Supervisor: | Cory Knot | |
| Work Type: | Completion | County, St.: | Grand, UT | Phone: | 303-575-0000 | |
| Production Current/Expected | Oil: | 0 / 0 | Gas: | 0 / 0 | Water: | 0 / 0 |

Job Purpose : Drill a wildcat well offsetting the #36-11 to test the White Rim Formation. AFE based on 15 drilling

| | | | | | | | |
|--------|----------|-----------|----------|-----------|--------|--------|----|
| Date : | 1/6/2007 | Activity: | Wireline | Rig Name: | M&M #3 | Days : | 16 |
|--------|----------|-----------|----------|-----------|--------|--------|----|

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|------------------------|---|
| Daily Report Summary : | <p>Kill well with 15 bbls of 10 ppg brine water. TOOH with tubing. MIRU pure wireline. TIH with Protechics logging tool. Log from 2800 to T.D.. TOOH with tool.. Lay down tool. RD Pure wireline. TIH with weatherford BP. Set BP at 3255'. Open up well to flow. Well still dead. RU swab lubricator. Pull 1 swab. Swab back 10 bbls. Well flowing at 150 psi on 64/64" choke. Flow well for 2 hours. High H2S detected. Shut in well for safety concerns. Secure well. SDFN.</p> <p>Total Daily Water Recovered = 330 bbls Total Daily Oil Recovered = 0 bbls</p> <p>Load to Recover = -2711 bbls Cum Water Recovered = 6165 bbls Cum Oil Recovered = 0 bbls</p> <p>ALL LOAD RECOVERED !!!</p> |
|------------------------|---|

| | |
|----------------------|---|
| Daily Report Detail: | <p>Kill well with 15 bbls of 10 ppg brine water. TOOH with tubing. MIRU pure wireline. TIH with Protechics logging tool. Log from 2800 to T.D.. TOOH with tool.. Lay down tool. RD Pure wireline. TIH with weatherford BP. Set BP at 3255'. Open up well to flow. Well still dead. RU swab lubricator. Pull 1 swab. Swab back 10 bbls. Well flowing at 150 psi on 64/64" choke. Flow well for 2 hours. High H2S detected. Shut in well for safety concerns. Secure well. SDFN.</p> <p>Total Daily Water Recovered = 330 bbls Total Daily Oil Recovered = 0 bbls</p> <p>Load to Recover = -2711 bbls Cum Water Recovered = 6165 bbls Cum Oil Recovered = 0 bbls</p> <p>ALL LOAD RECOVERED !!!</p> |
|----------------------|---|

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|---------------------|--------|----------------|------------|
| From 0:00 To 12:00 | 12 hrs | Category/Rmks: | SDFN : |
| From 12:00 To 15:00 | 3 hrs | Category/Rmks: | Wireline : |
| From 15:00 To 16:00 | 1 hrs | Category/Rmks: | TIH : |
| From 16:00 To 17:00 | 1 hrs | Category/Rmks: | Other : |
| From 17:00 To 18:00 | 1 hrs | Category/Rmks: | Swab : |
| From 18:00 To 19:00 | 1 hrs | Category/Rmks: | Flow : |

Well Name : Greentown State 36-11 OS (Offset)

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|-----------------------------|----------------|--------------|-----------|-------------|-------------------|-------|
| Prospect: | | | | AFE #: | 2920 | |
| Sec/Twp/Rge: | 36 / 21S / 16E | | | Operator: | Petroleum Corpora | |
| API #: | 4301931505 | Field: | Wildcat | Supervisor: | Cory Knot | |
| Work Type: | Completion | County, St.: | Grand, UT | Phone: | 303-575-0000 | |
| Production Current/Expected | Oil: | 0 / 0 | Gas: | 0 / 0 | Water: | 0 / 0 |

Job Purpose : Drill a wildcat well offsetting the #36-11 to test the White Rim Formation. AFE based on 15 drilling

| | | | | | | | |
|------------------------|--|----------------|----------------|-----------|--------|--------|----|
| Date : | 1/7/2007 | Activity: | Flow back frac | Rig Name: | M&M #3 | Days : | 17 |
| Daily Report Summary : | <p>Well shut in. MIRU Oillind Safety. RU H2S safety equipment. Have safety meeting. Discusss safety equipment. Open well up on 64/64" choke. Flow well starting at 1900 hours throughout the night.</p> <p>Total Daily Water Recovered = 0 bbls Total Daily Oil Recovered = 0 bbls</p> <p>Load to Recover = -2711 bbls Cum Water Recovered = 6165 bbls Cum Oil Recovered = 0 bbls</p> <p>ALL LOAD RECOVERED !!!</p> | | | | | | |
| Daily Report Detail: | <p>Well shut in. MIRU Oillind Safety. RU H2S safety equipment. Have safety meeting. Discuss safety equipment. Open well up on 64/64" choke. Flow well starting at 1900 hours throughout the night.</p> <p>Total Daily Water Recovered = 0 bbls Total Daily Oil Recovered = 0 bbls</p> <p>Load to Recover = -2711 bbls Cum Water Recovered = 6165 bbls Cum Oil Recovered = 0 bbls</p> <p>ALL LOAD RECOVERED !!!</p> | | | | | | |
| From 0:00 To 18:00 | 18 hrs | Category/Rmks: | SDFN : | | | | |
| From 18:00 To 0:00 | 6 hrs | Category/Rmks: | Flow : | | | | |

Well Name : Greentown State 36-11 OS (Offset)

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|-----------------------------|----------------|--------------|-----------|-------------|-------------------|-------|
| Prospect: | | | | AFE #: | 2920 | |
| Sec/Twp/Rge: | 36 / 21S / 16E | | | Operator: | Petroleum Corpora | |
| API #: | 4301931505 | Field: | Wildcat | Supervisor: | Cory Knot | |
| Work Type: | Completion | County, St.: | Grand, UT | Phone: | 303-575-0000 | |
| Production Current/Expected | Oil: | 0 / 0 | Gas: | 0 / 0 | Water: | 0 / 0 |

Job Purpose : Drill a wildcat well offsetting the #36-11 to test the White Rim Formation. AFE based on 15 drilling

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|--------|----------|-----------|----------------|-----------|--------|--------|----|
| Date : | 1/8/2007 | Activity: | Flow back frac | Rig Name: | M&M #3 | Days : | 18 |
|--------|----------|-----------|----------------|-----------|--------|--------|----|

Daily Report Summary : Continue to flowback frac from Stage #5. Shut in well for 2 hours because of hydrate problem is flare line. Open well back up and flow on 64/64" choke. Flow for 4 additional hours. Shut well in at 1200 hours. RU rig pump. Pump 15 bbls of 10 ppg brine water down tubing. Well dead. Backside dead. Unset BP. Move BP to 3190'. Set BP at 3190'. RU Rig pump. Chain down tubing. Install TIW valve in tubing. Pressure up casing to 2300 psi. Hold pressure for 15 minutes. Pressure holds. Bleed off well. Unset BP. Move BP to 3350'. Set BP at 3350'. TOOH with tubing. MI Weatherford. PU Weatherford Packer. TIH with Packer on tubing. Set Packer at 3315'. RU Swab lubricator. Pull swab on well. Swab back 10 bbls of fluid. Well flows. Well flowing at 135 psi on 64/64" choke through flow separator. RD swab lubricator. Secure well. Continue to flowback frac (Stage #3) for remainder of night.

Total Daily Water Recovered = 781 bbls
Total Daily Oil Recovered = 0 bbls

Load to Recover = -3544 bbls
Cum Water Recovered = 6998 bbls
Cum Oil Recovered = 0 bbls

ALL LOAD RECOVERED !!!

Daily Report Detail: Continue to flowback frac from Stage #5. Shut in well for 2 hours because of hydrate problem is flare line. Open well back up and flow on 64/64" choke. Flow for 4 additional hours. Shut well in at 1200 hours. RU rig pump. Pump 15 bbls of 10 ppg brine water down tubing. Well dead. Backside dead. Unset BP. Move BP to 3190'. Set BP at 3190'. RU Rig pump. Chain down tubing. Install TIW valve in tubing. Pressure up casing to 2300 psi. Hold pressure for 15 minutes. Pressure holds. Bleed off well. Unset BP. Move BP to 3350'. Set BP at 3350'. TOOH with tubing. MI Weatherford. PU Weatherford Packer. TIH with Packer on tubing. Set Packer at 3315'. RU Swab lubricator. Pull swab on well. Swab back 10 bbls of fluid. Well flows. Well flowing at 135 psi on 64/64" choke through flow separator. RD swab lubricator. Secure well. Continue to flowback frac (Stage #3) for remainder of night.

Total Daily Water Recovered = 781 bbls
Total Daily Oil Recovered = 0 bbls

Load to Recover = -3544 bbls
Cum Water Recovered = 6998 bbls
Cum Oil Recovered = 0 bbls

ALL LOAD RECOVERED !!!

| | | | |
|---------------------|---------|----------------|---|
| From 0:00 To 6:00 | 6 hrs | Category/Rmks: | Flow : |
| From 6:00 To 8:00 | 2 hrs | Category/Rmks: | Other : |
| From 8:00 To 12:00 | 4 hrs | Category/Rmks: | Flow : |
| From 12:00 To 12:30 | 0.5 hrs | Category/Rmks: | TOOH : |
| From 12:30 To 13:00 | 0.5 hrs | Category/Rmks: | Other : pressure test casing to 2300 psi. Hold for 15 minutes |
| From 13:00 To 13:30 | 0.5 hrs | Category/Rmks: | TIH : |
| From 13:30 To 14:30 | 1 hrs | Category/Rmks: | TOOH : |
| From 14:30 To 16:00 | 1.5 hrs | Category/Rmks: | Other : wait for weatherford packer |
| From 16:00 To 17:00 | 1 hrs | Category/Rmks: | TIH : |
| From 17:00 To 18:00 | 1 hrs | Category/Rmks: | Swab : |
| From 18:00 To 0:00 | 6 hrs | Category/Rmks: | Flow : |

Well Name : Greentown State 36-11 OS (Offset)

| | | | | | | |
|-----------------------------|--|--------------|-----------|-------------|-------------------|-------|
| Prospect: | | | | AFE #: | 2920 | |
| Sec/Twp/Rge: | 36 / 21S / 16E | | | Operator: | Petroleum Corpore | |
| API #: | 4301931505 | Field: | Wildcat | Supervisor: | Cory Knot | |
| Work Type: | Completion | County, St.: | Grand, UT | Phone: | 303-575-0000 | |
| Production Current/Expected | Oil: | 0 / 0 | Gas: | 0 / 0 | Water: | 0 / 0 |
| Job Purpose : | Drill a wildcat well offsetting the #36-11 to test the White Rim Formation. AFE based on 15 drilling | | | | | |

| | | | | | | | |
|--------|----------|-----------|----------------|-----------|--------|--------|----|
| Date : | 1/9/2007 | Activity: | Flow back frac | Rig Name: | M&M #3 | Days : | 19 |
|--------|----------|-----------|----------------|-----------|--------|--------|----|

Daily Report Summary : Continue to flowback from Stage #3. Flowing on 64/64" choke. Catch flowback sample from wellhead for H2S reading. H2S measures 10 ppm. Flow until noon. Decide to move BP and packer. Shut in well. RU and pump 15 bbls of 10 ppg salt water to kill. Well dead. Unset packer. Drop down to BP. Tag sand fill 8' high. RU to circulate with water. Pump 75 bbls of flowback water. Cannot establish circulation. TOOH with packer. Lay down packer. TIH with tubing and retrieving head for BP. Set EOT at 3190' for night. Wait for Foam unit to clean up hole. RU swab lubricator. Pull 2 swabs from bottom. Swab a total of 30 bbls. Well flows. Flow well throughout the night on 64/64" choke from stages 3,4, & 5. Secure well. SDFN.

Total Daily Water Recovered = 912 bbls
Total Daily Oil Recovered = 0 bbls

Load to Recover = -4474 bbls
Cum Water Recovered = 7928 bbls
Cum Oil Recovered = 0 bbls

ALL LOAD RECOVERED !!!

Daily Report Detail: Continue to flowback from Stage #3. Flowing on 64/64" choke. Catch flowback sample from wellhead for H2S reading. H2S measures 10 ppm. Flow until noon. Decide to move BP and packer. Shut in well. RU and pump 15 bbls of 10 ppg salt water to kill. Well dead. Unset packer. Drop down to BP. Tag sand fill 8' high. RU to circulate with water. Pump 75 bbls of flowback water. Cannot establish circulation. TOOH with packer. Lay down packer. TIH with tubing and retrieving head for BP. Set EOT at 3190' for night. Wait for Foam unit to clean up hole. RU swab lubricator. Pull 2 swabs from bottom. Swab a total of 30 bbls. Well flows. Flow well throughout the night on 64/64" choke from stages 3,4, & 5. Secure well. SDFN.

Total Daily Water Recovered = 912 bbls
Total Daily Oil Recovered = 0 bbls

Load to Recover = -4474 bbls
Cum Water Recovered = 7928 bbls
Cum Oil Recovered = 0 bbls

ALL LOAD RECOVERED !!!

| | | | |
|---------------------|--------|----------------|-------------|
| From 0:00 To 12:00 | 12 hrs | Category/Rmks: | Flow : |
| From 12:00 To 13:00 | 1 hrs | Category/Rmks: | Circulate : |
| From 13:00 To 14:00 | 1 hrs | Category/Rmks: | TOOH : |
| From 14:00 To 15:00 | 1 hrs | Category/Rmks: | TIH : |
| From 15:00 To 17:00 | 2 hrs | Category/Rmks: | Swab : |
| From 17:00 To 0:00 | 7 hrs | Category/Rmks: | Flow : |

Well Name : Greentown State 36-11 OS (Offset)

| | | | | | | |
|-----------------------------|----------------|--------------|-----------|-------------|-------------------|-------|
| Prospect: | | | | AFE #: | 2920 | |
| Sec/Twp/Rge: | 36 / 21S / 16E | | | Operator: | Petroleum Corpora | |
| API #: | 4301931505 | Field: | Wildcat | Supervisor: | Cory Knot | |
| Work Type: | Completion | County, St.: | Grand, UT | Phone: | 303-575-0000 | |
| Production Current/Expected | Oil: | 0 / 0 | Gas: | 0 / 0 | Water: | 0 / 0 |

Job Purpose : Drill a wildcat well offsetting the #36-11 to test the White Rim Formation. AFE based on 15 drilling

| | | | | | | | |
|--------|-----------|-----------|-----------|-----------|--------|--------|----|
| Date : | 1/10/2007 | Activity: | Circulate | Rig Name: | M&M #3 | Days : | 20 |
|--------|-----------|-----------|-----------|-----------|--------|--------|----|

Daily Report Summary : MIRU Weatherford foam unit. TIH with tubing. Clean off sand fill on top of bridge plug at 3350'. Approximately 8' of fill on top of bridge plug. Clean off fill and circulate for 30 minutes. Monitor returns to make sure they are clean. SD. Unset BP. TOOH with BP. Lay down BP. PU Baker Packer. TIH with packer. Tag fill at 3385'. TOOH with Packer. Lay down packer. TIH with tubing and 4.75" 4 bladed mill. Drill out fill. Fill solid from 3385' to TD at 3611'. Drill out to TD and Circulate for 30 minutes on bottom. SD. TOOH to 3190'. Secure well. SDFN. Shut in well for weekend.

Total Daily Water Recovered = 673 bbls
Total Daily Oil Recovered = 0 bbls

Load to Recover = -5147 bbls
Cum Water Recovered = 8601 bbls
Cum Oil Recovered = 0 bbls

ALL LOAD RECOVERED !!!

Daily Report Detail: MIRU Weatherford foam unit. TIH with tubing. Clean off sand fill on top of bridge plug at 3350'. Approximately 8' of fill on top of bridge plug. Clean off fill and circulate for 30 minutes. Monitor returns to make sure they are clean. SD. Unset BP. TOOH with BP. Lay down BP. PU Baker Packer. TIH with packer. Tag fill at 3385'. TOOH with Packer. Lay down packer. TIH with tubing and 4.75" 4 bladed mill. Drill out fill. Fill solid from 3385' to TD at 3611'. Drill out to TD and Circulate for 30 minutes on bottom. SD. TOOH to 3190'. Secure well. SDFN. Shut in well for weekend.

Total Daily Water Recovered = 673 bbls
Total Daily Oil Recovered = 0 bbls

Load to Recover = -5147 bbls
Cum Water Recovered = 8601 bbls
Cum Oil Recovered = 0 bbls

ALL LOAD RECOVERED !!!

| | | | |
|---------------------|---------|----------------|-------------|
| From 0:00 To 7:00 | 7 hrs | Category/Rmks: | Flow : |
| From 7:00 To 11:00 | 4 hrs | Category/Rmks: | Drill : |
| From 11:00 To 12:00 | 1 hrs | Category/Rmks: | TOOH : |
| From 12:00 To 13:00 | 1 hrs | Category/Rmks: | TIH : |
| From 13:00 To 14:00 | 1 hrs | Category/Rmks: | TOOH : |
| From 14:00 To 18:00 | 4 hrs | Category/Rmks: | Drill : |
| From 18:00 To 18:30 | 0.5 hrs | Category/Rmks: | Circulate : |
| From 18:30 To 0:00 | 5.5 hrs | Category/Rmks: | SDFN : |

| | | | | | | | |
|--------|-----------|-----------|-------|-----------|--------|--------|----|
| Date : | 1/11/2007 | Activity: | SDFWE | Rig Name: | M&M #3 | Days : | 21 |
|--------|-----------|-----------|-------|-----------|--------|--------|----|

Daily Report Summary : SDFWE

Daily Report Detail: SDFWE

| | | | |
|-------------------|--------|----------------|---------|
| From 0:00 To 0:00 | 24 hrs | Category/Rmks: | SDFWE : |
|-------------------|--------|----------------|---------|

| | | | | | | | |
|--------|-----------|-----------|-------|-----------|--------|--------|----|
| Date : | 1/12/2007 | Activity: | SDFWE | Rig Name: | M&M #3 | Days : | 22 |
|--------|-----------|-----------|-------|-----------|--------|--------|----|

Daily Report Summary : SDFWE

Daily Report Detail: SDFWE

| | | | |
|-------------------|--------|----------------|---------|
| From 0:00 To 0:00 | 24 hrs | Category/Rmks: | SDFWE : |
|-------------------|--------|----------------|---------|

| | | | | | | | |
|--------|-----------|-----------|-------|-----------|--------|--------|----|
| Date : | 1/13/2007 | Activity: | SDFWE | Rig Name: | M&M #3 | Days : | 23 |
|--------|-----------|-----------|-------|-----------|--------|--------|----|

Daily Report Summary : SDFWE

Daily Report Detail: SDFWE

| | | | |
|-------------------|--------|----------------|---------|
| From 0:00 To 0:00 | 24 hrs | Category/Rmks: | SDFWE : |
|-------------------|--------|----------------|---------|

| Well Name : Greentown State 36-11 OS (Offset) | | | | | | |
|---|---|----------------|-----------------|-------------|--------------|-------------------|
| Prospect: | | | | | AFE #: | 2920 |
| Sec/Twp/Rge: | 36 / 21S / 16E | | | | Operator: | Petroleum Corpora |
| API #: | 4301931505 | Field: | Wildcat | Supervisor: | Cory Knot | |
| Work Type: | Completion | County, St.: | Grand, UT | Phone: | 303-575-0000 | |
| Production Current/Expected | Oil: | 0 / 0 | Gas: | 0 / 0 | Water: | 0 / 0 |
| Job Purpose : | Drill a wildcat well offsetting the #36-11 to test the White Rim Formation. AFE based on 15 drilling | | | | | |
| Date : | 1/14/2007 | Activity: | SDFWE | Rig Name: | M&M #3 | Days :24 |
| Daily Report Summary : | SDFWE | | | | | |
| Daily Report Detail: | SDFWE | | | | | |
| From 0:00 To 0:00 | 24 hrs | Category/Rmks: | SDFWE : | | | |
| Date : | 1/15/2007 | Activity: | Clean out | Rig Name: | M&M #3 | Days :25 |
| Daily Report Summary : | Well shut in over weekend. SICP 250 psi. Bleed off well. Gas would not burn. TIH from 3100' and tag up at 3436'. RU swivel and Weatherford Foam unit. Circulate clean to 3615'. Circulate for 90 minutes to clean up well bore. TOO H, laying down tubing in singles. Lay down bit and bit sub. ND BOP. NU Production Tree. Shut in well temporarily. | | | | | |
| Daily Report Detail: | Well shut in over weekend. SICP 250 psi. Bleed off well. Gas would not burn. TIH from 3100' and tag up at 3436'. RU swivel and Weatherford Foam unit. Circulate clean to 3615'. Circulate for 90 minutes to clean up well bore. TOO H, laying down tubing in singles. Lay down bit and bit sub. ND BOP. NU Production Tree. Shut in well temporarily. | | | | | |
| From 0:00 To 7:00 | 7 hrs | Category/Rmks: | SDFWE : | | | |
| From 7:00 To 14:00 | 7 hrs | Category/Rmks: | Circulate : | | | |
| From 14:00 To 17:00 | 3 hrs | Category/Rmks: | TOOH : | | | |
| From 17:00 To 0:00 | 7 hrs | Category/Rmks: | SDFN : | | | |
| Date : | 1/16/2007 | Activity: | Final Report | Rig Name: | M&M #3 | Days :26 |
| Daily Report Summary : | Well shut in temporarily. All rental equipment transferred to 36-11. | | | | | |
| Daily Report Detail: | FINAL REPORT Well shut in temporarily. All rental equipment transferred to 36-11. | | | | | |
| From 0:00 To 0:00 | 24 hrs | Category/Rmks: | SDFN : | | | |
| Date : | 1/17/2007 | Activity: | Cost adjustment | Rig Name: | M&M #3 | Days :27 |
| Daily Report Summary : | Cost Adjustment. | | | | | |
| Daily Report Detail: | Cost Adjustment. | | | | | |
| From 0:00 To 0:00 | 24 hrs | Category/Rmks: | SDFN : | | | |
| Date : | 1/19/2007 | Activity: | Cost adjustment | Rig Name: | M&M #3 | Days :29 |
| Daily Report Summary : | Cost adjustment | | | | | |
| Daily Report Detail: | | | | | | |
| Date : | 1/22/2007 | Activity: | Cost adjustment | Rig Name: | M&M #3 | Days :32 |
| Daily Report Summary : | Cost Adjustment. | | | | | |
| Daily Report Detail: | Cost Adjustment | | | | | |
| Date : | 1/23/2007 | Activity: | Cost adjustment | Rig Name: | M&M #3 | Days :33 |
| Daily Report Summary : | | | | | | |
| Daily Report Detail: | | | | | | |
| Date : | 1/25/2007 | Activity: | Cost adjustment | Rig Name: | M&M #3 | Days :35 |
| Daily Report Summary : | Cost Adjustment | | | | | |
| Daily Report Detail: | Cost adjustment | | | | | |
| Date : | 1/29/2007 | Activity: | Cost adjustment | Rig Name: | M&M #3 | Days :39 |
| Daily Report Summary : | Cost Adjustment | | | | | |
| Daily Report Detail: | Cost Adjustment | | | | | |
| Date : | 1/31/2007 | Activity: | Cost adjustment | Rig Name: | | Days :41 |
| Daily Report Summary : | Cost Adjustment | | | | | |
| Daily Report Detail: | | | | | | |
| Date : | 2/3/2007 | Activity: | Cost adjustment | Rig Name: | M&M #3 | Days :44 |
| Daily Report Summary : | Cost Adjustment | | | | | |
| Daily Report Detail: | | | | | | |

Well Name : Greentown State 36-11 OS (Offset)

| | | | | | | |
|-----------------------------|----------------|--------------|-----------|-------------|-------------------|-------|
| Prospect: | | | | AFE #: | 2920 | |
| Sec/Twp/Rge: | 36 / 21S / 16E | | | Operator: | Petroleum Corpora | |
| API #: | 4301931505 | Field: | Wildcat | Supervisor: | Cory Knot | |
| Work Type: | Completion | County, St.: | Grand, UT | Phone: | 303-575-0000 | |
| Production Current/Expected | Oil: | 0 / 0 | Gas: | 0 / 0 | Water: | 0 / 0 |

Job Purpose : Drill a wildcat well offsetting the #36-11 to test the White Rim Formation. AFE based on 15 drilling

| | | | | | | | |
|------------------------|--|-----------|-----------------|-----------|--|--------|----|
| Date : | 2/6/2007 | Activity: | Cost adjustment | Rig Name: | | Days : | 47 |
| Daily Report Summary : | Cost Adjustment. | | | | | | |
| Daily Report Detail: | Well Temporarily shut in. Cost adjustment. | | | | | | |

Casing

| DateIn | Setting Depth | Jts Run | Type | Size | Weight | Grade | MINID | HoleDiam | TD |
|---|---------------|---------|---------------|-------|--------|-------|-------|----------|------|
| 11/16/2006 | 60 | 3 | 1. Conductor | 16 | 55 | F-25* | | 20 | 60 |
| Stage: 1, Lead, 0, 12, 6 SK Redi-Mix, Redi-mix, 4.5, 0 | | | | | | | | | |
| 11/26/2006 | 1227 | 28 | 3. Surface | 8.625 | 24 | J-55 | | 11 | 1227 |
| Stage: 0, Wash, 20, 0, water water, , 0, 0 | | | | | | | | | |
| Stage: 0, Lead, 0, 245, 2% bwoc cc+0.25 lb/sack cello flake+6% bwoc bentonite+122.3% fresh water, Lightweight, 1.98, 12.5 | | | | | | | | | |
| Stage: 0, Tail, 0, 111, 2% beoc CaCl ,0.25 bwoc celloflake, 44% freshwater, Class G, 1.4, 14.5 | | | | | | | | | |
| Stage: 0, Displacement, 77, 0, water 77 water 75.4 bbls, , 0, 0 | | | | | | | | | |
| 12/16/2006 | 3674.66 | 89 | 5. Production | 5.5 | 17 | J-55 | 0 | 7.875 | 3674 |
| Stage: 1, Lead, 0, 350, Premium lite high strength+25lbscf+3%cd-32+3lbskol seal l+5%fl-52+5%sm, Lightweight, 2.15, 12.5 | | | | | | | | | |
| Stage: 1, Tail, 0, 85, Typelll+.25lbscf+.2%cd-32+.3%fl-52+2%sms Typelll+.25lbscf+2%cd-32+.3%fl-52+.2%sms, , 1.4, 14.5 | | | | | | | | | |
| Stage: 1, Displacement, 84.4, 0, 8.34 llb freash water, , 0, 0 | | | | | | | | | |

Perforation

| Date: | Formation | Perf Status | Upper Perf | Lower Perf | Sht / Ft | Description: |
|------------|--------------|-------------|------------|------------|----------|-----------------|
| 12/23/2006 | | Open | 3444 | 3456 | 3 | Stage 1 Perfs |
| 12/29/2006 | Paradox Salt | Open | 3362 | 3374 | 3 | SET CFP @ 3411' |
| 12/29/2006 | Paradox Salt | Open | 3320 | 3332 | 3 | SET CFP @ 3350' |
| 12/30/2006 | Paradox Salt | Open | 3274 | 3286 | 3 | SET CFP @ 3305' |
| 12/30/2006 | Paradox Salt | Open | 3222 | 3234 | 3 | SET CFP @ 3260' |

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

CONFIDENTIAL

FORM 9

| | | |
|--|--|---|
| SUNDRY NOTICES AND REPORTS ON WELLS | | 5. LEASE DESIGNATION AND SERIAL NUMBER: ML-49170 |
| Do not use this form for proposals to drill new wells, significantly deepen existing wells below current bottom-hole depth, reenter plugged wells, or to drill horizontal laterals. Use APPLICATION FOR PERMIT TO DRILL form for such proposals. | | 6. IF INDIAN, ALLOTTEE OR TRIBE NAME: NA |
| 1. TYPE OF WELL OIL WELL <input type="checkbox"/> GAS WELL <input checked="" type="checkbox"/> OTHER _____ | | 7. UNIT or CA AGREEMENT NAME: NA |
| 2. NAME OF OPERATOR: Delta Petroleum Corporation | | 8. WELL NAME and NUMBER: Greentown State 36-11S |
| 3. ADDRESS OF OPERATOR: 370 17th St., Ste. 4300 CITY Denver STATE CO ZIP 80202 | | 9. API NUMBER: 4301931505 |
| | | 10. FIELD AND POOL, OR WILDCAT: Wildcat |
| 4. LOCATION OF WELL FOOTAGES AT SURFACE: 1024' FNL & 429' FWL | | COUNTY: Grand |
| QTR/QTR, SECTION, TOWNSHIP, RANGE, MERIDIAN: NWNW 36 21S 16E | | STATE: UTAH |

| 11. CHECK APPROPRIATE BOXES TO INDICATE NATURE OF NOTICE, REPORT, OR OTHER DATA | | | |
|---|---|---|---|
| TYPE OF SUBMISSION | TYPE OF ACTION | | |
| <input type="checkbox"/> NOTICE OF INTENT (Submit in Duplicate) Approximate date work will start: _____ <input checked="" type="checkbox"/> SUBSEQUENT REPORT (Submit Original Form Only) Date of work completion: _____ | <input type="checkbox"/> ACIDIZE | <input type="checkbox"/> DEEPEN | <input type="checkbox"/> REPERFORATE CURRENT FORMATION |
| | <input type="checkbox"/> ALTER CASING | <input type="checkbox"/> FRACTURE TREAT | <input type="checkbox"/> SIDETRACK TO REPAIR WELL |
| | <input type="checkbox"/> CASING REPAIR | <input type="checkbox"/> NEW CONSTRUCTION | <input type="checkbox"/> TEMPORARILY ABANDON |
| | <input type="checkbox"/> CHANGE TO PREVIOUS PLANS | <input type="checkbox"/> OPERATOR CHANGE | <input type="checkbox"/> TUBING REPAIR |
| | <input type="checkbox"/> CHANGE TUBING | <input type="checkbox"/> PLUG AND ABANDON | <input type="checkbox"/> VENT OR FLARE |
| | <input type="checkbox"/> CHANGE WELL NAME | <input type="checkbox"/> PLUG BACK | <input type="checkbox"/> WATER DISPOSAL |
| | <input type="checkbox"/> CHANGE WELL STATUS | <input type="checkbox"/> PRODUCTION (START/RESUME) | <input type="checkbox"/> WATER SHUT-OFF |
| | <input type="checkbox"/> COMMINGLE PRODUCING FORMATIONS | <input type="checkbox"/> RECLAMATION OF WELL SITE | <input checked="" type="checkbox"/> OTHER: <u>Monthly Status Report</u> |
| | <input type="checkbox"/> CONVERT WELL TYPE | <input type="checkbox"/> RECOMPLETE - DIFFERENT FORMATION | |

12. DESCRIBE PROPOSED OR COMPLETED OPERATIONS. Clearly show all pertinent details including dates, depths, volumes, etc.

TIGHT HOLE STATUS

Well shut in as of 2/6/06 (waiting on rig availability)

As of 4/10/07 Completion Reports have not been filed because Delta has still not finished completions.

RECEIVED
APR 12 2007
DIV. OF OIL, GAS & MINING

| | |
|---|------------------------------------|
| NAME (PLEASE PRINT) <u>Kate Shirley</u> | TITLE <u>Regulatory Technician</u> |
| SIGNATURE | DATE <u>4/10/2007</u> |

(This space for State use only)

PA

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

FORM 9

5. LEASE DESIGNATION AND SERIAL NUMBER:
ML Utah 49170 1539.000

SUNDRY NOTICES AND REPORTS ON WELLS.

6. IF INDIAN, ALLOTTEE OR TRIBE NAME:

Do not use this form for proposals to drill new wells, significantly deepen existing wells below current bottom-hole depth, reenter plugged wells, or to drill horizontal laterals. Use APPLICATION FOR PERMIT TO DRILL form for such proposals.

7. UNIT or CA AGREEMENT NAME:

1. TYPE OF WELL
OIL WELL GAS WELL OTHER _____

8. WELL NAME and NUMBER:
Greentown State 36-11S

2. NAME OF OPERATOR:
Delta Petroleum Corporation

9. API NUMBER:
4301931505

3. ADDRESS OF OPERATOR:
370 17th ST. Suite 4300 CITY Denver STATE CO ZIP 80202

PHONE NUMBER:
(303) 575-0339

10. FIELD AND POOL, OR WILDCAT:
Wildcat

4. LOCATION OF WELL
FOOTAGES AT SURFACE: _____

COUNTY: Grand

QTR/QTR, SECTION, TOWNSHIP, RANGE, MERIDIAN: NWNW 36 21S 16E

STATE: UTAH

11. CHECK APPROPRIATE BOXES TO INDICATE NATURE OF NOTICE, REPORT, OR OTHER DATA

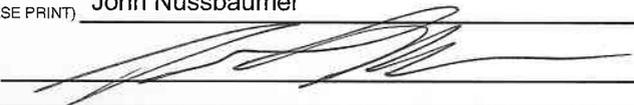
| TYPE OF SUBMISSION | TYPE OF ACTION | | |
|--|---|--|---|
| <input checked="" type="checkbox"/> NOTICE OF INTENT (Submit in Duplicate) Approximate date work will start: _____ | <input type="checkbox"/> ACIDIZE | <input type="checkbox"/> DEEPEN | <input type="checkbox"/> REPERFORATE CURRENT FORMATION |
| | <input type="checkbox"/> ALTER CASING | <input type="checkbox"/> FRACTURE TREAT | <input type="checkbox"/> SIDETRACK TO REPAIR WELL |
| | <input type="checkbox"/> CASING REPAIR | <input type="checkbox"/> NEW CONSTRUCTION | <input type="checkbox"/> TEMPORARILY ABANDON |
| | <input type="checkbox"/> CHANGE TO PREVIOUS PLANS | <input type="checkbox"/> OPERATOR CHANGE | <input type="checkbox"/> TUBING REPAIR |
| | <input type="checkbox"/> CHANGE TUBING | <input type="checkbox"/> PLUG AND ABANDON | <input type="checkbox"/> VENT OR FLARE |
| <input type="checkbox"/> SUBSEQUENT REPORT (Submit Original Form Only) Date of work completion: _____ | <input type="checkbox"/> CHANGE WELL NAME | <input type="checkbox"/> PLUG BACK | <input type="checkbox"/> WATER DISPOSAL |
| | <input type="checkbox"/> CHANGE WELL STATUS | <input type="checkbox"/> PRODUCTION (START/RESUME) | <input type="checkbox"/> WATER SHUT-OFF |
| | <input type="checkbox"/> COMMINGLE PRODUCING FORMATIONS | <input checked="" type="checkbox"/> RECLAMATION OF WELL SITE | <input checked="" type="checkbox"/> OTHER: <u>Reserve Pit Closure</u> |
| | <input type="checkbox"/> CONVERT WELL TYPE | <input type="checkbox"/> RECOMPLETE - DIFFERENT FORMATION | |

12. DESCRIBE PROPOSED OR COMPLETED OPERATIONS. Clearly show all pertinent details including dates, depths, volumes, etc.

Delta would like to remove the top 3 to 7 feet of drilling mud from the small OS pit and put same mud in the much larger pit on site. Delta proposes to stabilize the remaining mud in the OS pit with some material such as gypsum and cover the stabilized mud with clean soil. The mud that is moved into the large pit on site will be tested and if needed, will be stabilized and then covered with clean soil once completion work has is finished in the area. Lab data has been submitted for review.

NAME (PLEASE PRINT) John Nussbaumer

TITLE Manager, EHS

SIGNATURE 

DATE 5/2/2007

(This space for State use only)

RECEIVED

MAY 07 2007

DIV. OF OIL, GAS & MINING

| Sample ID | Specific Conductance (EC) | ESP |
|---|--------------------------------------|--|
| GTS 36-11 Pit Sample | 22000 umhos/cm = 22 mmhos/cm | 84.30% |
| GTS 36-11 Soil Sample | 4800 umhos/cm = 4.8 mmhos/cm | 43.10% |
| GTS 36-11 OSS (i.e. off site soil sample) | 690 umhos/cm = 0.69 mmhos/cm | 18.50% |
| Utah state requirements | electrical conductivity EC<4 mmho/cm | exchangeable sodium percentage ESP<15% |

| SAR | TPH low fraction (GRO) | TPH high fraction (DRO) | Total TPH |
|---------------------------------|------------------------|-------------------------|--|
| 29.1 | 1.8 mg/kg | 740 mg/kg | 741.8 ppm |
| 6.22 | 2.3 mg/kg | 12 mg/kg | 14.3 ppm |
| 4.52 | Non-Detect | Non-Detect | 0 |
| sodium adsorption ration SAR<12 | | | 10,000 ppm total petroleum hydrocarbon |



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Mt. Juliet, TN 37122
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Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

Scotty Mann
Cordilleran Compliance - GJ, CO
826 21 1/2 Road

Grand Junction, CO 81505

Report Summary

Wednesday April 11, 2007

Report Number: L286261

Samples Received: 03/27/07

Client Project: 7062

Description: Green Town State 36-11

The analytical results in this report are based upon information supplied by you, the client, and are for your exclusive use. If you have any questions regarding this data package, please do not hesitate to call.

Reviewed By:

Travis Johnson

Travis Johnson, ESC Representative

Laboratory Certification Numbers

A2LA - 1461-01, AIHA - 09227, AL - 40660, CA - I-2327, CT - PH-0197, FL - E87487
GA - 923, IN - C-TN-01, KY - 90010, KYUST - 0016, NC - ENV375, DW21704, ND - R-140
NJ - TN002, SC - 84004, TN - 2006, VA - 00109, WV - 233
AZ - 0612, MN - 047-999-395, NY - 11742, WI - 998093910, WA - C1915

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REPORT OF ANALYSIS

Scotty Mann
Cordilleran Compliance - GJ, CO
826 21 1/2 Road
Grand Junction, CO 81505

April 11, 2007

Date Received : March 27, 2007
Description : Green Town State 36-11
Sample ID : GTS 36-11 PIT 0-6 IN
Collected By : S R M
Collection Date : 03/24/07 11:00

ESC Sample # : L286261-01

Site ID :

Project # : 7062

| Parameter | Result | Det. Limit | Units | Method | Date | Dil. |
|---------------|--------------|------------|-------|--------|----------|------|
| Miscellaneous | See Attached | | | | 04/06/07 | 1 |

BDL - Below Detection Limit

Det. Limit - Practical Quantitation Limit (PQL)

Note:

The reported analytical results relate only to the sample submitted.

This report shall not be reproduced, except in full, without the written approval from ESC.

Reported: 04/11/07 10:09 Revised: 04/11/07 19:07

L286261-01 (MISC-SUB) - subcontracted to A&L Analytical Labs

Summary of Remarks For Samples Printed
04/11/07 at 19:07:55

TSR Signing Reports: 070
R5 - Desired TAT

cb-1/05; Run ALKs on separate dash, 1 day TAT, R3 priority; Client sends unpreserved vials for all projects; Run BTEXM on separate dash

Sample: L286261-01 Account: CORCOMGCO Received: 03/27/07 09:00 Due Date: 04/10/07 00:00 RPT Date: 04/11/07 10:09
Sub for SAR, ESP to ALANALAB jlc 3/27/07 PO#S9029 . Refer to L286260, L287927



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Cordilleran Compliance - GJ, CO
Scotty Mann
826 21 1/2 Road
Grand Junction, CO 81505

Quality Assurance Report
Level II
L286261

April 11, 2007

Batch number /Run number / Sample number cross reference

WG292998: R313581: L286261-01

* * Calculations are performed prior to rounding of reported values .



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Est. 1970

Cordilleran Compliance - GJ, CO
Scotty Mann
826 21 1/2 Road

Quality Assurance Report
Level II

Grand Junction, CO 81505

L286261

April 11, 2007

The data package includes a summary of the analytic results of the quality control samples required by the SW-846 or CWA methods. The quality control samples include a method blank, a laboratory control sample, and the matrix spike/matrix spike duplicate analysis. If a target parameter is outside the method limits, every sample that is effected is flagged with the appropriate qualifier in Appendix B of the analytic report.

Method Blank - an aliquot of reagent water carried through the entire analytic process. The method blank results indicate if any possible contamination exposure during the sample handling, digestion or extraction process, and analysis. Concentrations of target analytes above the reporting limit in the method blank are qualified with the "B" qualifier.

Laboratory Control Sample - is a sample of known concentration that is carried through the digestion/extraction and analysis process. The percent recovery, expressed as a percentage of the theoretical concentration, has statistical control limits indicating that the analytic process is "in control". If a target analyte is outside the control limits for the laboratory control sample or any other control sample, the parameter is flagged with a "J4" qualifier for all effected samples.

Matrix Spike and Matrix Spike Duplicate - is two aliquots of an environmental sample that is spiked with known concentrations of target analytes. The percent recovery of the target analytes also has statistical control limits. If any recoveries that are outside the method control limits, the sample that was selected for matrix spike/matrix spike duplicate analysis is flagged with either a "J5" or a "J6". The relative percent difference (%RPD) between the matrix spike and the matrix spike duplicate recoveries is all calculated. If the RPD is above the method limit, the effected samples are flagged with a "J3" qualifier.



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Scotty Mann
Cordilleran Compliance - GJ, CO
826 21 1/2 Road

Grand Junction, CO 81505

Report Summary

Monday April 23, 2007

Report Number: L288079

Samples Received: 04/07/07

Client Project: 7062

Description: Green Town State 36-11

The analytical results in this report are based upon information supplied by you, the client, and are for your exclusive use. If you have any questions regarding this data package, please do not hesitate to call.

Reviewed By:

John D. Rose, ESC Representative

Laboratory Certification Numbers

A2LA - 1461-01, AIHA - 09227, AL - 40660, CA - I-2327, CT - PH-0197, FL - E87487
GA - 923, IN - C-TN-01, KY - 90010, KYUST - 0016, NC - ENV375, DW21704, ND - R-140
NJ - TN002, SC - 84004, TN - 2006, VA - 00109, WV - 233
AZ - 0612, MN - 047-999-395, NY - 11742, WI - 998093910, WA - C1915

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Est. 1970

REPORT OF ANALYSIS

Scotty Mann
Cordilleran Compliance - GJ, CO
826 21 1/2 Road
Grand Junction, CO 81505

April 23, 2007

Date Received : April 07, 2007
Description :
Sample ID : GTS 36-11 OSS 0-6 IN
Collected By : S R M
Collection Date : 04/04/07 12:00

ESC Sample # : L288079-01

Site ID :

Project # : 7062

| Parameter | Result | Det. Limit | Units | Method | Date | Dil. |
|-------------------------|--------------|------------|-------|--------|----------|------|
| Miscellaneous | See Attached | | | | 04/20/07 | 1 |
| Sodium Adsorption Ratio | See Attached | | | Calc. | 04/20/07 | 1 |

BDL - Below Detection Limit

Det. Limit - Practical Quantitation Limit (PQL)

Note:

The reported analytical results relate only to the sample submitted.

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Reported: 04/23/07 09:22 Printed: 04/23/07 09:41
L288079-01 (MISC-SUB) - subcontracted to A&L Analytical Labs
L288079-01 (SAR) - subcontracted to A&L Analytical Labs

Summary of Remarks For Samples Printed
04/23/07 at 09:41:09

TSR Signing Reports: 151
R5 - Desired TAT

cb-1/05;Run ALKs on separate dash, 1 day TAT, R3 priority; Client sends unpreserved vials for all projects; Run BTEXM on separate dash

Sample: L288079-01 Account: CORCOMGCO Received: 04/07/07 09:00 Due Date: 04/19/07 00:00 RPT Date: 04/23/07 09:22
Sub for ESP, SAR. Refer to L288077 to ALANALAB jlc 4/9/07 PO#S9076



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Cordilleran Compliance - GJ, CO
Scotty Mann
826 21 1/2 Road
Grand Junction, CO 81505

Quality Assurance Report
Level II
L288079

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Est. 1970

April 23, 2007

Batch number /Run number / Sample number cross reference

WG294776: R315163 R315164: L288079-01 01

* * Calculations are performed prior to rounding of reported values .



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Scotty Mann
826 21 1/2 Road

Quality Assurance Report
Level II

Grand Junction, CO 81505

L288079

April 23, 2007

The data package includes a summary of the analytic results of the quality control samples required by the SW-846 or CWA methods. The quality control samples include a method blank, a laboratory control sample, and the matrix spike/matrix spike duplicate analysis. If a target parameter is outside the method limits, every sample that is effected is flagged with the appropriate qualifier in Appendix B of the analytic report.

Method Blank - an aliquot of reagent water carried through the entire analytic process. The method blank results indicate if any possible contamination exposure during the sample handling, digestion or extraction process, and analysis. Concentrations of target analytes above the reporting limit in the method blank are qualified with the "B" qualifier.

Laboratory Control Sample - is a sample of known concentration that is carried through the digestion/extraction and analysis process. The percent recovery, expressed as a percentage of the theoretical concentration, has statistical control limits indicating that the analytic process is "in control". If a target analyte is outside the control limits for the laboratory control sample or any other control sample, the parameter is flagged with a "J4" qualifier for all effected samples.

Matrix Spike and Matrix Spike Duplicate - is two aliquots of an environmental sample that is spiked with known concentrations of target analytes. The percent recovery of the target analytes also has statistical control limits. If any recoveries that are outside the method control limits, the sample that was selected for matrix spike/matrix spike duplicate analysis is flagged with either a "J5" or a "J6". The relative percent difference (%RPD) between the matrix spike and the matrix spike duplicate recoveries is all calculated. If the RPD is above the method limit, the effected samples are flagged with a "J3" qualifier.

Cordilleran Compliance
 826 21 1/2 Road
 Grand Junction, CO 81505

Alternate billing information:
 Report to: **Scotty Mann**
 Email to: **scottymann@cordcomp.com**

Analysis/Container/Preservative

Chain of Custody
 Page 1 of 1

Prepared by:

**ENVIRONMENTAL
 SCIENCE CORP.**

12065 Lebanon Road
 Mt. Juliet, TN 37122

Phone (615) 758-5858
 Phone (800) 767-5859
 FAX (615) 758-5859

Project Description: _____ City/State Collected: _____
 Phone: (970) 263-7800 Client Project #: 7062 ESC Key: _____
 FAX: (970) 263-7456 Site/Facility ID#: _____ P.O.#: _____

Collected by (signature): *SRM*
 Packed on Ice: N Y
 Rush? (Lab MUST Be Notified)
 Same Day.....200%
 Next Day.....100%
 Two Day.....50%
 Three Day.....25%
 Date Results Needed:
 Email? No Yes
 FAX? No Yes

| Sample ID | Comp/Grab | Matrix* | Depth | Date | Time | No. of Cntrs | TPH (GRO/DRO) | EC/SPC | ESP | SAR | Remarks/Contaminant | Sample # (lab only) |
|---------------------------|-----------|---------|-------|--------|------|--------------|---------------|--------|-----|-----|---------------------|---------------------|
| GTS 36-11 OSS | Grab | SS | 0-6" | 4/4/07 | 1200 | 4 | X | X | X | X | U288079-01 | |
| <i>Please use U288079</i> | | | | | | | | | | | | |
| | | | | | | | | | | | | |
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| | | | | | | | | | | | | |

*Matrix: SS - Soil/Solid GW - Groundwater WW - WasteWater DW - Drinking Water OT - Other _____
 Remarks: _____ pH _____ Temp _____
 Flow _____ Other _____

Refer to U288077

| | | | | | |
|---|---------------------|-------------------|---|---|--|
| Relinquished by: (Signature) <i>[Signature]</i> | Date: <i>4/4/07</i> | Time: <i>1200</i> | Received by: (Signature) <i>[Signature]</i> | Samples returned via: <input checked="" type="checkbox"/> FedEx <input type="checkbox"/> UPS <input type="checkbox"/> Courier | Condition: (lab use only) <i>cc sealed bag</i> |
| Relinquished by: (Signature) <i>[Signature]</i> | Date: _____ | Time: _____ | Received by: (Signature) _____ | Temp: <i>2.6</i> | Bottles Received: <i>4</i> |
| Relinquished by: (Signature) <i>[Signature]</i> | Date: _____ | Time: _____ | Received for lab by: (Signature) <i>Alessa Neal</i> | Date: <i>4-7-07</i> | Time: <i>900</i> |
| | | | | pH Checked: _____ | NCF: _____ |

Report Number
07-100-0201

Page: 1 of 2

Account Number
07705

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MT. JULIET , TN 37122



A&L Analytical Laboratories, Inc.

2790 Whitten Rd. Memphis, TN 38133 • Phone (901) 213-2400 • Fax (901) 213-2440



Project : WG294776

Purchase Order : S9076

Report Date : 4/20/2007

Date Received : 4/10/2007

REPORT OF ANALYSIS

Date Sampled : 4/4/2007

Lab Number : 82147

Sample Id : L288079-01

| Analysis | Result | Quantitation Limit | Method | Date and Time Test Started | Analyst |
|-------------------------------------|--------|-----------------------|------------|-------------------------------|---------|
| Sodium Adsorption Ratio , Calc | 4.52 | 0 | LA 29B SAR | 04/20/2007 14:37 | SH |
| Sodium , ppm | 88.7 | 0.05 | LA 29B SAR | 04/20/2007 14:37 | SH |
| Calcium , ppm | 5.39 | 0.05 | LA 29B SAR | 04/20/2007 14:37 | SH |
| Magnesium , ppm | 14.4 | 0.05 | LA 29B SAR | 04/20/2007 14:37 | SH |
| Exchangeable Sodium Percentage , % | 18.5 | 0.01 | LA 29B ESP | 04/20/2007 14:37 | SH |
| Cation Exchange Capacity , meq/100g | 6 | 0.1 | SW-9081 | 04/20/2007 14:37 | SH |

M. Scott McKee, Technical Director

Report Number
07-100-0201

Page: 2 of 2



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12065 LEBANON RD
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Project : WG294776

Purchase Order : S9076

Report Date : 4/20/2007

Date Received : 4/10/2007

REPORT OF ANALYSIS

Date Sampled : 4/4/2007

Lab Number : 82147

Sample Id : L288079-01

| Analysis | Result | Quantitation Limit | Method | Date and Time Test Started | Analyst |
|----------|--------|-----------------------|--------|-------------------------------|---------|
|----------|--------|-----------------------|--------|-------------------------------|---------|

Method Reference:

Laboratory Procedures for Analysis of Nonhazardous Oilfield Waste, Louisiana Statewide Order Number 29-B, LAC 43.XIX.129.B and M. USEPA, SW-846, Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, 3rd Ed. Current Revision

Comments:

M. Scott McKee, Technical Director

Sample results are reported 'as received' and are not moisture corrected unless noted



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Scotty Mann
Cordilleran Compliance - GJ, CO
826 21 1/2 Road

Grand Junction, CO 81505

Report Summary

Thursday March 29, 2007

Report Number: L286260

Samples Received: 03/27/07

Client Project: 7062

Description: Green Town State 36-11

The analytical results in this report are based upon information supplied by you, the client, and are for your exclusive use. If you have any questions regarding this data package, please do not hesitate to call.

Reviewed By:

Cheli Boucher, ESC Representative

Laboratory Certification Numbers

A2LA - 1461-01, AIHA - 09227, AL - 40660, CA - I-2327, CT - PH-0197, FL - E87487
GA - 923, IN - C-TN-01, KY - 90010, KYUST - 0016, NC - ENV375, DW21704, ND - R-140
NJ - TN002, SC - 84004, TN - 2006, VA - 00109, WV - 233
AZ - 0612, MN - 047-999-395, NY - 11742, WI - 998093910, WA - C1915

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REPORT OF ANALYSIS

March 29, 2007

Scotty Mann
Cordilleran Compliance - GJ, CO
826 21 1/2 Road
Grand Junction, CO 81505

Date Received : March 27, 2007
Description : Green Town State 36-11
Sample ID : GTS 36-11 PIT 0-6 IN
Collected By : S R M
Collection Date : 03/24/07 11:00

ESC Sample # : L286260-01

Site ID :

Project # : 7062

| Parameter | Result | Det. Limit | Units | Method | Date | Dil. |
|--|--------|------------|----------|----------|----------|------|
| Specific Conductance | 22000 | | umhos/cm | 9050AMod | 03/28/07 | 1 |
| TPH (GC/FID) Low Fraction | 1.8 | 0.50 | mg/kg | GRO | 03/27/07 | 5 |
| Surrogate Recovery (70-130) a,a,a-Trifluorotoluene(FID) | 88.4 | | % Rec. | GRO | 03/27/07 | 5 |
| TPH (GC/FID) High Fraction | 740 | 20. | mg/kg | 3546/DRO | 03/27/07 | 5 |
| Surrogate Recovery (50-150) o-Terphenyl | 101. | | % Rec. | 3546/DRO | 03/27/07 | 5 |

BDL - Below Detection Limit

Det. Limit - Practical Quantitation Limit (PQL)

Note:

The reported analytical results relate only to the sample submitted.

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Reported: 03/28/07 18:28 Revised: 03/29/07 09:02



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REPORT OF ANALYSIS

Scotty Mann
Cordilleran Compliance - GJ, CO
826 21 1/2 Road
Grand Junction, CO 81505

March 29, 2007

Date Received : March 27, 2007
Description : Green Town State 36-11

ESC Sample # : L286260-02

Sample ID : GTS 36-11 SS 0-6 IN

Site ID :

Collected By : S R M
Collection Date : 03/24/07 11:00

Project # : 7062

| Parameter | Result | Det. Limit | Units | Method | Date | Dil. |
|---|--------|------------|----------|----------|----------|------|
| Specific Conductance | 4800 | | umhos/cm | 9050AMod | 03/28/07 | 1 |
| TPH (GC/FID) Low Fraction Surrogate Recovery (70-130) a,a,a-Trifluorotoluene(FID) | 2.3 | 0.50 | mg/kg | GRO | 03/28/07 | 5 |
| | 94.8 | | % Rec. | GRO | 03/28/07 | 5 |
| TPH (GC/FID) High Fraction Surrogate Recovery (50-150) o-Terphenyl | 12. | 4.0 | mg/kg | 3546/DRO | 03/27/07 | 1 |
| | 76.3 | | % Rec. | 3546/DRO | 03/27/07 | 1 |

BDL - Below Detection Limit

Det. Limit - Practical Quantitation Limit (PQL)

Note:

The reported analytical results relate only to the sample submitted.

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Reported: 03/28/07 18:28 Revised: 03/29/07 09:02

Summary of Remarks For Samples Printed
03/29/07 at 09:02:14

TSR Signing Reports: 070
R2 - Rush: Next Day

cb-1/05;Run ALKs on separate dash, 1 day TAT, R3 priority; Client sends unpreserved vials for all projects; Run BTEXM on separate dash

Sample: L286260-01 Account: CORCOMGCO Received: 03/27/07 09:00 Due Date: 03/28/07 00:00 RPT Date: 03/28/07 18:28
Refer to L286261.

Sample: L286260-02 Account: CORCOMGCO Received: 03/27/07 09:00 Due Date: 03/28/07 00:00 RPT Date: 03/28/07 18:28
Refer to L286261.



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Cordilleran Compliance - GJ, CO
Scotty Mann
826 21 1/2 Road
Grand Junction, CO 81505

Quality Assurance Report
Level II
L286260

March 29, 2007

| Analyte | Result | Laboratory Blank | | Date Analyzed | Batch |
|----------------------------|--------|------------------|--|----------------|----------|
| | | Units | | | |
| TPH (GC/FID) Low Fraction | < .1 | mg/kg | | 03/28/07 06:28 | WG292921 |
| TPH (GC/FID) High Fraction | < 4 | ppm | | 03/27/07 12:29 | WG292928 |
| TPH (GC/FID) Low Fraction | < .1 | mg/kg | | 03/27/07 11:02 | WG292948 |
| Specific Conductance | 0.710 | umhos/cm | | 03/28/07 07:30 | WG293087 |

| Analyte | Units | Duplicate | | RPD | Limit | Ref Samp | Batch |
|----------------------|-------|-----------|-----------|------|-------|------------|----------|
| | | Result | Duplicate | | | | |
| Specific Conductance | umhos | 866. | 880. | 1.60 | 20 | L286253-01 | WG293087 |

| Analyte | Units | Laboratory Control Sample | | % Rec | Limit | Batch |
|----------------------------|----------|---------------------------|--------|-------|--------|----------|
| | | Known Val | Result | | | |
| TPH (GC/FID) Low Fraction | mg/kg | 5.5 | 5.63 | 102. | 67-135 | WG292921 |
| TPH (GC/FID) High Fraction | ppm | 60 | 41.0 | 68.3 | 50-150 | WG292928 |
| TPH (GC/FID) Low Fraction | mg/kg | 5.5 | 6.24 | 113. | 67-135 | WG292948 |
| Specific Conductance | umhos/cm | 559 | 570. | 102. | 85-115 | WG293087 |

| Analyte | Units | Laboratory Control Sample | | Duplicate RPD | Limit | %Rec | Batch |
|----------------------------|-------|---------------------------|---------|---------------|-------|------|----------|
| | | LCSD Res | Ref Res | | | | |
| TPH (GC/FID) Low Fraction | mg/kg | 5.30 | 5.63 | 6.13 | 20 | 96 | WG292921 |
| TPH (GC/FID) High Fraction | ppm | 41.1 | 41.0 | 0.224 | 20 | 68 | WG292928 |
| TPH (GC/FID) Low Fraction | mg/kg | 6.28 | 6.24 | 0.654 | 20 | 114 | WG292948 |
| Specific Conductance | umhos | 570. | 570. | 0.00 | 20 | 102 | WG293087 |

| Analyte | Units | Matrix Spike | | | TV | % Rec | Limit | Ref Samp | Batch |
|----------------------------|-------|--------------|---------|-----|------|--------|------------|----------|-------|
| | | MS Res | Ref Res | | | | | | |
| TPH (GC/FID) Low Fraction | mg/kg | 22.5 | 0.147 | 5.5 | 81.4 | 55-109 | L285942-04 | WG292921 | |
| TPH (GC/FID) High Fraction | ppm | 36.9 | 7.30 | 60 | 49.3 | 50-150 | L286031-01 | WG292928 | |
| TPH (GC/FID) Low Fraction | mg/kg | 273. | 63.9 | 5.5 | 76.1 | 55-109 | L285543-06 | WG292948 | |

| Analyte | Units | Matrix Spike Duplicate | | RPD | Limit | %Rec | Ref Samp | Batch |
|----------------------------|-------|------------------------|---------|------|-------|------|------------|----------|
| | | MSD Res | Ref Res | | | | | |
| TPH (GC/FID) Low Fraction | mg/kg | 22.0 | 22.5 | 2.28 | 20 | 79.6 | L285942-04 | WG292921 |
| TPH (GC/FID) High Fraction | ppm | 35.0 | 36.9 | 5.26 | 20 | 46.1 | L286031-01 | WG292928 |

Batch number /Run number / Sample number cross reference

WG292948: R312058: L286260-01
WG292928: R312070: L286260-01 02
WG293087: R312162: L286260-01 02
WG292921: R312250: L286260-02

* * Calculations are performed prior to rounding of reported values .



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Scotty Mann
826 21 1/2 Road

Quality Assurance Report
Level II

Grand Junction, CO 81505

L286260

March 29, 2007

The data package includes a summary of the analytic results of the quality control samples required by the SW-846 or CWA methods. The quality control samples include a method blank, a laboratory control sample, and the matrix spike/matrix spike duplicate analysis. If a target parameter is outside the method limits, every sample that is effected is flagged with the appropriate qualifier in Appendix B of the analytic report.

Method Blank - an aliquot of reagent water carried through the entire analytic process. The method blank results indicate if any possible contamination exposure during the sample handling, digestion or extraction process, and analysis. Concentrations of target analytes above the reporting limit in the method blank are qualified with the "B" qualifier.

Laboratory Control Sample - is a sample of known concentration that is carried through the digestion/extraction and analysis process. The percent recovery, expressed as a percentage of the theoretical concentration, has statistical control limits indicating that the analytic process is "in control". If a target analyte is outside the control limits for the laboratory control sample or any other control sample, the parameter is flagged with a "J4" qualifier for all effected samples.

Matrix Spike and Matrix Spike Duplicate - is two aliquots of an environmental sample that is spiked with known concentrations of target analytes. The percent recovery of the target analytes also has statistical control limits. If any recoveries that are outside the method control limits, the sample that was selected for matrix spike/matrix spike duplicate analysis is flagged with either a "J5" or a "J6". The relative percent difference (%RPD) between the matrix spike and the matrix spike duplicate recoveries is all calculated. If the RPD is above the method limit, the effected samples are flagged with a "J3" qualifier.

L287927

Jonah Huckabay

From: John Rose
Sent: Friday, April 06, 2007 10:51 AM
To: Jonah Huckabay; Janice Cozby; Login
Subject: RE: CORCOMGCO L286261

Sorry that number is L286261-02
Sorry for that.

Environmental Science Corp.
Assistant Technical Service Rep.
12065 Lebanon Road
Mt. Juliet, TN 37122
JRose@envsci.com
(615) 758 5863 ext 284
(800) 500 1307 ext 284
(800) 767 5859
Fax (615) 758 5859

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From: Jonah Huckabay
Sent: Friday, April 06, 2007 10:11 AM
To: John Rose; Janice Cozby; Login
Subject: RE: CORCOMGCO L286821

Please check the L#. This is not a CORCOMGCO set.

From: John Rose
Sent: Friday, April 06, 2007 8:52 AM
To: Janice Cozby; Login
Subject: CORCOMGCO L286821

Please split off L286281-02 to its own L-number.
The Client would like to have a report for each SAR, ESP samples.
Thanks

John

Environmental Science Corp.
Assistant Technical Service Rep.
12065 Lebanon Road
Mt. Juliet, TN 37122
JRose@envsci.com
(615) 758 5863 ext 284
(800) 500 1307 ext 284
(800) 767 5859

Report Number

07-087-0213

Page: 1 of 4



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**Account Number**

07705

Send To : ENVIRONMENTAL SCIENCE

12065 LEBANON RD

MT. JULIET , TN 37122

Project : WG292998**Purchase Order :** S9029**Report Date :** 4/9/2007**Date Received :** 3/28/2007**REPORT OF ANALYSIS****Date Sampled :** 3/24/2007

Lab Number : 81425

Sample Id : L286261-01

| Analysis | Result | Quantitation Limit | Method | Date and Time Test Started | Analyst |
|-------------------------------------|--------|-----------------------|------------|-------------------------------|---------|
| Sodium Adsorption Ratio , Calc | 29.1 | | LA 29B SAR | 04/06/2007 10:28 | TJ |
| Sodium , ppm | 4490 | 0.05 | LA 29B SAR | 04/06/2007 10:28 | TJ |
| Calcium , ppm | 1410 | 0.05 | LA 29B SAR | 04/06/2007 10:28 | TJ |
| Magnesium , ppm | 238 | 0.05 | LA 29B SAR | 04/06/2007 10:28 | TJ |
| Exchangeable Sodium Percentage , % | 84.3 | 0.01 | LA 29B ESP | 04/06/2007 10:28 | TJ |
| Cation Exchange Capacity , meq/100g | 14.8 | 0.1 | SW-9081 | 04/06/2007 10:28 | TJ |

M. Scott McKee, Technical Director

Sample results are reported 'as received' and are not moisture corrected unless noted

Report Number

07-087-0213

Page: 2 of 4



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The One Source.

Account Number

07705

Send To : ENVIRONMENTAL SCIENCE

12065 LEBANON RD

MT. JULIET, TN 37122

Project : WG292998**Purchase Order :** S9029**Report Date :** 4/9/2007**Date Received :** 3/28/2007**Date Sampled :** 3/24/2007

REPORT OF ANALYSIS

Lab Number : 81425

Sample Id : L286261-01

| Analysis | Result | Quantitation Limit | Method | Date and Time Test Started | Analyst |
|----------|--------|-----------------------|--------|-------------------------------|---------|
|----------|--------|-----------------------|--------|-------------------------------|---------|

Method Reference:

Laboratory Procedures for Analysis of Nonhazardous Oilfield Waste, Louisiana Statewide Order Number 29-B, LAC 43.XIX.129.B and M. USEPA, SW-846, Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, 3rd Ed. Current Revision

Comments:

M. Scott McKee, Technical Director

Sample results are reported 'as received' and are not moisture corrected unless noted

Report Number

07-087-0213

Page: 3 of 4



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The One Source.

Account Number

07705

Send To : ENVIRONMENTAL SCIENCE

12065 LEBANON RD

MT. JULIET, TN 37122

Project : WG292998**Purchase Order :** S9029**Report Date :** 4/9/2007**Date Received :** 3/28/2007**REPORT OF ANALYSIS****Date Sampled :** 3/24/2007

Lab Number : 81426

Sample Id : L286261-02

| Analysis | Result | Quantitation Limit | Method | Date and Time Test Started | Analyst |
|-------------------------------------|--------|-----------------------|------------|-------------------------------|---------|
| Sodium Adsorption Ratio , Calc | 6.22 | | LA 29B SAR | 04/06/2007 10:28 | TJ |
| Sodium , ppm | 784 | 0.05 | LA 29B SAR | 04/06/2007 10:28 | TJ |
| Calcium , ppm | 146 | 0.05 | LA 29B SAR | 04/06/2007 10:28 | TJ |
| Magnesium , ppm | 641 | 0.05 | LA 29B SAR | 04/06/2007 10:28 | TJ |
| Exchangeable Sodium Percentage , % | 43.1 | 0.01 | LA 29B ESP | 04/06/2007 10:28 | TJ |
| Cation Exchange Capacity , meq/100g | 32.4 | 0.1 | SW-9081 | 04/06/2007 10:28 | TJ |

M. Scott McKee, Technical Director

Sample results are reported 'as received' and are not moisture corrected unless noted

Report Number
07-087-0213

Page: 4 of 4



A&L Analytical Laboratories, Inc.

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Account Number
07705

Send To : ENVIRONMENTAL SCIENCE
12065 LEBANON RD
MT. JULIET, TN 37122

Project : WG292998

Purchase Order : S9029

Report Date : 4/9/2007

Date Received : 3/28/2007

REPORT OF ANALYSIS

Date Sampled : 3/24/2007

Lab Number : 81426

Sample Id : L286261-02

| <u>Analysis</u> | <u>Result</u> | <u>Quantitation Limit</u> | <u>Method</u> | <u>Date and Time Test Started</u> | <u>Analyst</u> |
|-----------------|---------------|-------------------------------|---------------|---------------------------------------|----------------|
|-----------------|---------------|-------------------------------|---------------|---------------------------------------|----------------|

Method Reference:

Laboratory Procedures for Analysis of Nonhazardous Oilfield Waste, Louisiana Statewide Order Number 29-B, LAC 43.XIX.129.B and M. USEPA, SW-846, Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, 3rd Ed. Current Revision

Comments:

M. Scott McKee, Technical Director

Sample results are reported 'as received' and are not moisture corrected unless noted

Cordilleran Compliance
 826 21 1/2 Road
 Grand Junction, CO 81505

Alternate billing information:
 Report to: **Scotty Mann**
 Email to: **scottymann@cordcomp.com**

Analysis/Container/Preservative

Chain of Custody
 Page 1 of 1

Prepared by:

**ENVIRONMENTAL
 SCIENCE CORP.**
 12065 Lebanon Road
 Mt. Juliet, TN 37122
 Phone (615) 758-5858
 Phone (800) 767-5859
 FAX (615) 758-5859

Project Description: **Green Town State 36-11** City/State Collected: **UT**
 Phone: (970) 263-7800 Client Project #: **7062** ESC Key:
 FAX: (970) 263-7456

Collected by: **SRM** Site/Facility ID#: P.O.#:

Collected by (signature): *Scotty Mann* **Rush?** (Lab MUST Be Notified)
 Same Day.....200%
 Next Day.....100%
 Two Day.....50%
 Three Day.....25%
 Date Results Needed:
 Email? No Yes
 Packed on Ice N FAX? No Yes

| No. of Cntrs | TPH (GRO/DRO) | EC | ESP | SAR |
|--------------|---------------|----|-----|-----|
| 1 | X | X | X | X |
| 1 | X | X | X | X |

CoCode: **HAALDRNY** (lab use only)
 Template/Prelogin
 Shipped Via:

| Sample ID | Comp/Grab | Matrix* | Depth | Date | Time | No. of Cntrs | TPH (GRO/DRO) | EC | ESP | SAR | Remarks/Contaminant | Sample # (lab only) |
|-----------------------|-----------|---------|-------|---------|------|--------------|---------------|----|-----|-----|---------------------|---------------------|
| GTS 36-11 Pit Sample | Comp | SS | 0-6" | 3/24/07 | 1100 | 1 | X | X | X | X | 1286261-01 | |
| GTS 36-11 Soil Sample | Comp | SS | 0-6" | 3/24/07 | 1100 | 1 | X | X | X | X | 1286261-02 | |
| PLEASE RUSH | | | | | | | | | | | | |

*Matrix: **SS** - Soil/Solid **GW** - Groundwater **WW** - WasteWater **DW** - Drinking Water **OT** - Other _____ pH _____ Temp _____

Remarks: **Refer to 1286260 8536 664 6525** Flow _____ Other _____

| | | | | | |
|---|----------------------|-------------------|---|---|---|
| Relinquished by: (Signature) <i>Scotty Mann</i> | Date: 3/26/07 | Time: 1600 | Received by: (Signature) <i>[Signature]</i> | Samples returned via: <input type="checkbox"/> UPS <input type="checkbox"/> FedEx <input type="checkbox"/> Courier <input type="checkbox"/> _____ | Condition: OK seal intact (lab use only) |
| Relinquished by: (Signature) <i>[Signature]</i> | Date: | Time: | Received by: (Signature) <i>[Signature]</i> | Temp: 5.10 | Bottles Received: 2 |
| Relinquished by: (Signature) <i>[Signature]</i> | Date: | Time: | Received for lab by: (Signature) <i>[Signature]</i> | Date: 3/27/07 | Time: 900 |
| | | | | pH Checked: | NCF: |

Jonah Huckabay

L286261

From: John Rose
Sent: Friday, April 06, 2007 10:51 AM
To: Jonah Huckabay; Janice Cozby; Login
Subject: RE: CORCOMGCO L286261

Sorry that number is L286261-02
Sorry for that.

Environmental Science Corp.
Assistant Technical Service Rep.
12065 Lebanon Road
Mt. Juliet, TN 37122
JRose@envsci.com
(615) 758 5863 ext 284
(800) 500 1307 ext 284
(800) 767 5859
Fax (615) 758 5859

This E-mail and any attached files are confidential, and may be copyright protected. If you are not the addressee, any dissemination of this communication is strictly prohibited. If you have received this message in error, please contact the sender immediately and delete/destroy all information received.

From: Jonah Huckabay
Sent: Friday, April 06, 2007 10:11 AM
To: John Rose; Janice Cozby; Login
Subject: RE: CORCOMGCO L286821

Please check the L#. This is not a CORCOMGCO set.

From: John Rose
Sent: Friday, April 06, 2007 8:52 AM
To: Janice Cozby; Login
Subject: CORCOMGCO L286821

Please split off L286281-02 to its own L-number.
The Client would like to have a report for each SAR, ESP samples.
Thanks

John

Environmental Science Corp.
Assistant Technical Service Rep.
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JRose@envsci.com
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(800) 500 1307 ext 284
(800) 767 5859

Report Number
07-087-0213

Page: 1 of 4



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Account Number
07705

Send To : ENVIRONMENTAL SCIENCE
12065 LEBANON RD
MT. JULIET , TN 37122

Project : WG292998

Purchase Order : S9029

Report Date : 4/9/2007

Date Received : 3/28/2007

REPORT OF ANALYSIS

Date Sampled : 3/24/2007

Lab Number : 81425

Sample Id : L286261-01

| Analysis | Result | Quantitation Limit | Method | Date and Time Test Started | Analyst |
|-------------------------------------|--------|-----------------------|------------|-------------------------------|---------|
| Sodium Adsorption Ratio , Calc | 29.1 | | LA 29B SAR | 04/06/2007 10:28 | TJ |
| Sodium , ppm | 4490 | 0.05 | LA 29B SAR | 04/06/2007 10:28 | TJ |
| Calcium , ppm | 1410 | 0.05 | LA 29B SAR | 04/06/2007 10:28 | TJ |
| Magnesium , ppm | 238 | 0.05 | LA 29B SAR | 04/06/2007 10:28 | TJ |
| Exchangeable Sodium Percentage , % | 84.3 | 0.01 | LA 29B ESP | 04/06/2007 10:28 | TJ |
| Cation Exchange Capacity , meq/100g | 14.8 | 0.1 | SW-9081 | 04/06/2007 10:28 | TJ |

M. Scott McKee, Technical Director

Sample results are reported 'as received' and are not moisture corrected unless noted

Report Number
07-087-0213

Page: 2 of 4



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Account Number
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12065 LEBANON RD
MT. JULIET, TN 37122

Project : WG292998

Purchase Order : S9029

Report Date : 4/9/2007

Date Received : 3/28/2007

REPORT OF ANALYSIS

Date Sampled : 3/24/2007

Lab Number : 81425

Sample Id : L286261-01

| <u>Analysis</u> | <u>Result</u> | <u>Quantitation Limit</u> | <u>Method</u> | <u>Date and Time Test Started</u> | <u>Analyst</u> |
|-----------------|---------------|-------------------------------|---------------|---------------------------------------|----------------|
|-----------------|---------------|-------------------------------|---------------|---------------------------------------|----------------|

Method Reference:

Laboratory Procedures for Analysis of Nonhazardous Oilfield Waste, Louisiana Statewide Order Number 29-B, LAC 43.XIX.129.B and M. USEPA, SW-846, Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, 3rd Ed. Current Revision

Comments:

M. Scott McKee, Technical Director

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Report Number
07-087-0213

Page: 3 of 4



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Project : WG292998

Purchase Order : S9029

Report Date : 4/9/2007

Date Received : 3/28/2007

REPORT OF ANALYSIS

Date Sampled : 3/24/2007

Lab Number : 81426

Sample Id : L286261-02

| Analysis | Result | Quantitation Limit | Method | Date and Time Test Started | Analyst |
|-------------------------------------|--------|-----------------------|------------|-------------------------------|---------|
| Sodium Adsorption Ratio , Calc | 6.22 | | LA 29B SAR | 04/06/2007 10:28 | TJ |
| Sodium , ppm | 784 | 0.05 | LA 29B SAR | 04/06/2007 10:28 | TJ |
| Calcium , ppm | 146 | 0.05 | LA 29B SAR | 04/06/2007 10:28 | TJ |
| Magnesium , ppm | 641 | 0.05 | LA 29B SAR | 04/06/2007 10:28 | TJ |
| Exchangeable Sodium Percentage , % | 43.1 | 0.01 | LA 29B ESP | 04/06/2007 10:28 | TJ |
| Cation Exchange Capacity , meq/100g | 32.4 | 0.1 | SW-9081 | 04/06/2007 10:28 | TJ |

M. Scott McKee, Technical Director

Sample results are reported 'as received' and are not moisture corrected unless noted

Report Number
07-087-0213

Page: 4 of 4



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Account Number
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Send To : ENVIRONMENTAL SCIENCE
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Project : WG292998

Purchase Order : S9029

Report Date : 4/9/2007

Date Received : 3/28/2007

REPORT OF ANALYSIS

Date Sampled : 3/24/2007

Lab Number : 81426

Sample Id : L286261-02

| <u>Analysis</u> | <u>Result</u> | <u>Quantitation Limit</u> | <u>Method</u> | <u>Date and Time Test Started</u> | <u>Analyst</u> |
|-----------------|---------------|-------------------------------|---------------|---------------------------------------|----------------|
|-----------------|---------------|-------------------------------|---------------|---------------------------------------|----------------|

Method Reference:

Laboratory Procedures for Analysis of Nonhazardous Oilfield Waste, Louisiana Statewide Order Number 29-B, LAC 43.XIX.129.B and M. USEPA, SW-846, Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, 3rd Ed. Current Revision

Comments:

M. Scott McKee, Technical Director

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Est. 1970

Scotty Mann
Cordilleran Compliance - GJ, CO
826 21 1/2 Road

Grand Junction, CO 81505

Report Summary

Tuesday April 10, 2007

Report Number: L288077

Samples Received: 04/07/07

Client Project: 7062

Description: Green Town State 36-11

The analytical results in this report are based upon information supplied by you, the client, and are for your exclusive use. If you have any questions regarding this data package, please do not hesitate to call.

Reviewed By:

Cheli Boucher
Cheli Boucher, ESC Representative

Laboratory Certification Numbers

A2LA - 1461-01, AIHA - 09227, AL - 40660, CA - I-2327, CT - PH-0197, FL - E87487
GA - 923, IN - C-TN-01, KY - 90010, KYUST - 0016, NC - ENV375, DW21704, ND - R-140
NJ - TN002, SC - 84004, TN - 2006, VA - 00109, WV - 233
AZ - 0612, MN - 047-999-395, NY - 11742, WI - 998093910, WA - C1915

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REPORT OF ANALYSIS

Scotty Mann
Cordilleran Compliance - GJ, CO
826 21 1/2 Road
Grand Junction, CO 81505

April 10, 2007

Date Received : April 07, 2007
Description :

ESC Sample # : L288077-01

Sample ID : GTS 36-11 OSS

Site ID :

Collected By : S R M
Collection Date : 04/04/07 12:00

Project # : 7062

| Parameter | Result | Det. Limit | Units | Method | Date | Dil. |
|---|--------|------------|----------|----------|----------|------|
| Specific Conductance | 690 | | umhos/cm | 9050AMod | 04/10/07 | 1 |
| TPH (GC/FID) Low Fraction Surrogate Recovery (70-130) a,a,a-Trifluorotoluene(FID) | BDL | 0.50 | mg/kg | GRO | 04/10/07 | 5 |
| TPH (GC/FID) High Fraction Surrogate Recovery (50-150) o-Terphenyl | BDL | 4.0 | mg/kg | 3546/DRO | 04/10/07 | 1 |
| | 77.7 | | % Rec. | 3546/DRO | 04/10/07 | 1 |

BDL - Below Detection Limit

Det. Limit - Practical Quantitation Limit (PQL)

NOTE:

The reported analytical results relate only to the sample submitted.

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Reported: 04/10/07 14:15 Printed: 04/10/07 16:26

Summary of Remarks For Samples Printed
04/10/07 at 16:26:52

TSR Signing Reports: 070
R3 - Rush: Two Day

cb-1/05;Run ALKs on separate dash, 1 day TAT, R3 priority; Client sends unpreserved vials for all projects; Run BTEXM on separate dash

Sample: L288077-01 Account: CORCOMGCO Received: 04/07/07 09:00 Due Date: 04/10/07 00:00 RPT Date: 04/10/07 14:15
Refer to L288079.



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Cordilleran Compliance - GJ, CO
Scotty Mann
826 21 1/2 Road
Grand Junction, CO 81505

Quality Assurance Report
Level II
L288077

April 10, 2007

| Analyte | Result | Laboratory Blank | | Date Analyzed | Batch |
|----------------------------|--------|------------------|--|----------------|----------|
| | | Units | | | |
| TPH (GC/FID) High Fraction | < 4 | ppm | | 04/09/07 17:46 | WG294624 |
| Specific Conductance | 0.780 | umhos/cm | | 04/10/07 03:30 | WG294712 |
| TPH (GC/FID) Low Fraction | < .1 | mg/kg | | 04/10/07 04:06 | WG294738 |

| Analyte | Units | Duplicate | | RPD | Limit | Ref Samp | Batch |
|----------------------|-------|-----------|-----------|------|-------|------------|----------|
| | | Result | Duplicate | | | | |
| Specific Conductance | umhos | 121. | 110. | 9.69 | 20 | L288074-01 | WG294712 |

| Analyte | Units | Laboratory Control Sample | | % Rec | Limit | Batch |
|----------------------------|----------|---------------------------|---------------|-------|--------|----------|
| | | Known Val | Sample Result | | | |
| TPH (GC/FID) High Fraction | ppm | 60 | 37.0 | 61.7 | 50-150 | WG294624 |
| Specific Conductance | umhos/cm | 559 | 570. | 102. | 85-115 | WG294712 |
| TPH (GC/FID) Low Fraction | mg/kg | 5.5 | 5.13 | 93.3 | 67-135 | WG294738 |

| Analyte | Units | Laboratory Control Sample Duplicate | | RPD | Limit | %Rec | Batch |
|----------------------------|-------|-------------------------------------|---------|------|-------|------|----------|
| | | LCSD Res | Ref Res | | | | |
| TPH (GC/FID) High Fraction | ppm | 42.7 | 37.0 | 14.3 | 20 | 71 | WG294624 |
| Specific Conductance | umhos | 570. | 570. | 0.00 | 20 | 102 | WG294712 |
| TPH (GC/FID) Low Fraction | mg/kg | 4.71 | 5.13 | 8.55 | 20 | 86 | WG294738 |

| Analyte | Units | Matrix Spike | | | % Rec | Limit | Ref Samp | Batch |
|----------------------------|-------|--------------|---------|-----|-------|--------|------------|----------|
| | | MS Res | Ref Res | TV | | | | |
| TPH (GC/FID) High Fraction | ppm | 51.5 | 0.00 | 60 | 85.9 | 50-150 | L287842-02 | WG294624 |
| TPH (GC/FID) Low Fraction | mg/kg | 2.38 | 0.0388 | 5.5 | 39.1 | 55-109 | L287342-12 | WG294738 |

| Analyte | Units | Matrix Spike Duplicate | | | RPD | Limit | %Rec | Ref Samp | Batch |
|----------------------------|-------|------------------------|---------|------|-----|-------|------------|----------|-------|
| | | MSD Res | Ref Res | | | | | | |
| TPH (GC/FID) High Fraction | ppm | 46.0 | 51.5 | 11.3 | 20 | 76.6 | L287842-02 | WG294624 | |
| TPH (GC/FID) Low Fraction | mg/kg | 2.89 | 2.38 | 19.4 | 20 | 47.6 | L287342-12 | WG294738 | |

Batch number /Run number / Sample number cross reference

WG294712: R313651: L288077-01
WG294624: R313658: L288077-01
WG294738: R313714: L288077-01

* * Calculations are performed prior to rounding of reported values .



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Quality Assurance Report
Level II
L288077

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Est. 1970

April 10, 2007

The data package includes a summary of the analytic results of the quality control samples required by the SW-846 or CWA methods. The quality control samples include a method blank, a laboratory control sample, and the matrix spike/matrix spike duplicate analysis. If a target parameter is outside the method limits, every sample that is effected is flagged with the appropriate qualifier in Appendix B of the analytic report.

Method Blank - an aliquot of reagent water carried through the entire analytic process. The method blank results indicate if any possible contamination exposure during the sample handling, digestion or extraction process, and analysis. Concentrations of target analytes above the reporting limit in the method blank are qualified with the "B" qualifier.

Laboratory Control Sample - is a sample of known concentration that is carried through the digestion/extraction and analysis process. The percent recovery, expressed as a percentage of the theoretical concentration, has statistical control limits indicating that the analytic process is "in control". If a target analyte is outside the control limits for the laboratory control sample or any other control sample, the parameter is flagged with a "J4" qualifier for all effected samples.

Matrix Spike and Matrix Spike Duplicate - is two aliquots of an environmental sample that is spiked with known concentrations of target analytes. The percent recovery of the target analytes also has statistical control limits. If any recoveries that are outside the method control limits, the sample that was selected for matrix spike/matrix spike duplicate analysis is flagged with either a "J5" or a "J6". The relative percent difference (%RPD) between the matrix spike and the matrix spike duplicate recoveries is all calculated. If the RPD is above the method limit, the effected samples are flagged with a "J3" qualifier.



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Est. 1970

Scotty Mann
Cordilleran Compliance - GJ, CO
826 21 1/2 Road

Grand Junction, CO 81505

Report Summary

Wednesday April 11, 2007

Report Number: L287927

Samples Received: 03/27/07

Client Project: 7062

Description: Green Town State 36-11

The analytical results in this report are based upon information supplied by you, the client, and are for your exclusive use. If you have any questions regarding this data package, please do not hesitate to call.

Reviewed By:

Travis Johnson, ESC Representative

Laboratory Certification Numbers

A2LA - 1461-01, AIHA - 09227, AL - 40660, CA - I-2327, CT - PH-0197, FL - E87487
GA - 923, IN - C-TN-01, KY - 90010, KYUST - 0016, NC - ENV375, DW21704, ND - R-140
NJ - TN002, SC - 84004, TN - 2006, VA - 00109, WV - 233
AZ - 0612, MN - 047-999-395, NY - 11742, WI - 998093910, WA - C1915

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Est. 1970

REPORT OF ANALYSIS

Scotty Mann
Cordilleran Compliance - GJ, CO
826 21 1/2 Road
Grand Junction, CO 81505

April 11, 2007

Date Received : March 27, 2007
Description : Green Town State 36-11
Sample ID : GTS 36-11 SS 0-6 IN
Collected By : S R M
Collection Date : 03/24/07 11:00

ESC Sample # : L287927-01

Site ID :

Project # : 7062

| Parameter | Result | Det. Limit | Units | Method | Date | Dil. |
|---------------|--------------|------------|-------|--------|----------|------|
| Miscellaneous | See Attached | | | | 04/06/07 | 1 |

BDL - Below Detection Limit

Det. Limit - Practical Quantitation Limit (PQL)

Note:

The reported analytical results relate only to the sample submitted.

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Reported: 04/11/07 10:09 Revised: 04/11/07 19:06
L287927-01 (MISC-SUB) - subcontracted to A&L Analytical Labs

Summary of Remarks For Samples Printed
04/11/07 at 19:06:53

TSR Signing Reports: 070
R5 - Desired TAT

cb-1/05;Run ALKs on separate dash, 1 day TAT, R3 priority; Client sends unpreserved vials for all projects; Run BTEXM on separate dash

Sample: L287927-01 Account: CORCOMGCO Received: 03/27/07 09:00 Due Date: 04/10/07 00:00 RPT Date: 04/11/07 10:09
Sub for SAR, ESP to ALANALAB jlc 3/27/07 PO#S9029 . Refer to L286260, L286261



ENVIRONMENTAL
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Cordilleran Compliance - GJ, CO
Scotty Mann
826 21 1/2 Road
Grand Junction, CO 81505

Quality Assurance Report
Level II
L287927

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Mt. Juliet, TN 37122
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Fax (615) 758-5859

Tax I.D. 62-0814289

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April 11, 2007

Batch number /Run number / Sample number cross reference

WG292998: R313581: L287927-01

* * Calculations are performed prior to rounding of reported values .



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Quality Assurance Report
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L287927

April 11, 2007

The data package includes a summary of the analytic results of the quality control samples required by the SW-846 or CWA methods. The quality control samples include a method blank, a laboratory control sample, and the matrix spike/matrix spike duplicate analysis. If a target parameter is outside the method limits, every sample that is effected is flagged with the appropriate qualifier in Appendix B of the analytic report.

Method Blank - an aliquot of reagent water carried through the entire analytic process. The method blank results indicate if any possible contamination exposure during the sample handling, digestion or extraction process, and analysis. Concentrations of target analytes above the reporting limit in the method blank are qualified with the "B" qualifier.

Laboratory Control Sample - is a sample of known concentration that is carried through the digestion/extraction and analysis process. The percent recovery, expressed as a percentage of the theoretical concentration, has statistical control limits indicating that the analytic process is "in control". If a target analyte is outside the control limits for the laboratory control sample or any other control sample, the parameter is flagged with a "J4" qualifier for all effected samples.

Matrix Spike and Matrix Spike Duplicate - is two aliquots of an environmental sample that is spiked with known concentrations of target analytes. The percent recovery of the target analytes also has statistical control limits. If any recoveries that are outside the method control limits, the sample that was selected for matrix spike/matrix spike duplicate analysis is flagged with either a "J5" or a "J6". The relative percent difference (%RPD) between the matrix spike and the matrix spike duplicate recoveries is all calculated. If the RPD is above the method limit, the effected samples are flagged with a "J3" qualifier.

From: "John Nussbaumer" <jnussbaumer@deltapetro.com>
To: <chriskierst@utah.gov>
Date: 05/23/2007 10:45 AM
Attachments: report049.pdf; PROCEDURE FOR STABILIZATION OF DRILLING MUD AND CUTTINGS IN RESERVE PIT BEFORE CLOSURE.doc
CC: <bartkettle@utah.gov>
Christopher,

Attached is a short procedure for the treatment and closure of the Greentown 36-11OS pit. We are under a timeline for closure by your Department of this and other pits. Your prompt attention to this matter is greatly appreciated. Should you need to reach me, my cell number is the best way. That number is 303.386.5199

Thanks,

John Nussbaumer

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Delta Petroleum Corporation, 370 17th Street, Suite #4300, Denver, CO 80202 www.deltapetro.com

PROCEDURE FOR STABILIZATION OF DRILLING MUD AND CUTTINGS IN RESERVE PIT BEFORE CLOSURE

Liquids will be removed from pit either by evaporation or disposal at a licensed disposal facility. Mud and cuttings will be allowed to dry. (Completed)

Delta will conduct lab analysis on mud and cuttings to determine if the material meets Utah Division of Oil, Gas and Mining's standards for disposal in place. (Completed)

Mud high in chlorides will be treated with gypsum at a calculated rate in order to displace sodium with calcium. (See attached report from University of Oklahoma, School of Engineering and Environmental Science titled Reclamation of Brine Contaminated Soil Section 2.1.3, page 11. April 2000)

(Basic principle is that there is an ion exchange and the sodium gets tied up as calcium sulfate. Calcium sulfate will not migrate.)

The gypsum will be mixed into the mud with a backhoe/tracker to assure adequate contact with the sodium impacted mud.

In the case of the Greentown 36-11OS pit, three to four feet of original topsoil will be placed over the treated mud. The pit will be close and reclaimed to specifications.

Not met!
cation exchange
Gypsum $\frac{15}{CaSO_4 \cdot 2H_2O}$!

Changes to
FINAL REPORT

Reclamation of Brine Contaminated Soil:
Clearview Demonstration Project

SUBMITTED TO:

Oklahoma Conservation Commission

SUBMITTED BY:

Robert C. Knox, PE, Ph.D.

David A. Sabatini, PE, Ph.D.

School of Civil Engineering and Environmental Science
University of Oklahoma

April 1, 2000

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1. INTRODUCTION

1.1 Background

One of the largest breakthroughs for industrial society has been the discovery and subsequent use of the earth's natural resources (i.e., coal, oil, gas, etc.). All aspects of utilizing these natural resources have possible negative environmental implications. Stringent regulations have been enacted within the last 25 years placing due emphasis on the measurement and minimization of the negative consequences associated with resource utilization. Two problems that could impact water quality are addressed in this study are: (1) reclamation of soils that are damaged due to improper handling of brine during oil exploration; and (2) utilization of the ever increasing amount of solid waste produced by the combustion of coal.

Oilfield activities have caused concern due to the production of brine during drilling operations. Typically, this waste by-product is disposed of by deep well injection. Brine is one of the most recognized sources of non-point source pollution in the state of Oklahoma. Improper handling, transport, and disposal of this by-product pose threats to the nearby surface and ground water resources, as well as arable soils with which it may come in contact. The two primary effects of brine on soil and soil fertility are: (1) the degradation of the physical structure of the soil; and (2) the alteration of the normal osmotic gradient existing between plant roots and the soil. Common amendments used for the reclamation of brine contaminated soils include a calcium source, fertilizer, and an organic source (Burley, 1988).

Another problem facing our society today is the ash produced as a result of coal combustion. The combustion of coal is one of the principal methods used to generate electricity; however, it generates in excess of 100 nearly 50 million tons of waste ash each year in the United States (American Coal Ash Association, 1998 Davidson, 1993). Approximately 290% of this waste ash is used commercially while the remaining 7180% must be disposed of, typically in landfills or disposal ponds (Burnet, 1987). New regulations devised to protect surface and ground water require more carefully designed disposal methods which consequently increase the cost of disposal. Due to the problems associated with disposal, efforts are being made to utilize ash, thereby reducing the quantity that must be disposed in landfills. For these reasons, alternative uses for ash require investigation. Currently, the primary uses for waste ash are construction related.

To conform to EPA emission regulations, coal-fired power plants have employed effective methods to remove SO_2 from exhaust gases. One method is through fluidized bed combustion (FBC). In this procedure, a finely ground sorbent (typically limestone) is introduced during the coal combustion phase and the exhaust gas/coal/lime mix is passed through a cyclone. The large char is recycled to increase combustion efficiency (JAPCA, 1987). The addition of limestone produces an ash residue that is primarily composed of calcium constituents and various metal oxides. Therefore, the FBC process results in an ash residue that contains alkaline oxides (specifically CaO) and trace elements which may be useful for reclamation of brine disturbed soils (Stout, et. al., 1988).

1.2 Project Area Description

In Oklahoma, there are a number of brine damaged areas located in wetlands or along riparian corridors. The site selected for this study is consists of 60 acres located along Clearview Creek near the town of Clearview in Okfuskee County (Figure 1.1). The site consists of 60 acres located along Clearview Creek in Sections 19



Figure 1.1 Clearview Demonstration Study Site Location

and 30 of T11N, R11E. The site has been severely impacted from a leaking oilfield disposal pit which discharged its contents across a large segment of Clearview Creek and the surrounding riparian corridor. Previous analyses showed high levels of salt, chromium, and lead at the site, and that these constituents were traveling down Clearview Creek and into Alabama Creek. Alabama Creek was identified in Oklahoma's Section 319 Assessment report as being impaired due to salt and sediment contributions from salt damaged areas.

1.3 Goals and Objectives of this Study

The three goals of the project and their respective measures are listed below:

- Goal 1: Reduction of NPS pollutant discharge from site.
Measure: 70% reduction in concentration of pollutants leaving site.
- Goal 2: Stabilization and re-vegetation of site.
Measure: Photographic and standard ecological measures of vegetation pattern and coverage.
- Goal 3: Transfer of information gathered during this project to other sites with a goal of five site remediation projects per year.
Measure: Number of projects initiated and completed each year.

The specific objectives of this study were to obtain a basic understanding of the physical and chemical properties of brine contaminated soil, to determine the impacts of the brine contaminated area on adjacent water bodies, to determine the advantages of using FBA as a supplemental alternative soil amendment for these types of soils, and to use this information on a specific brine contaminated site to improve both soil quality and productivity.

It was hypothesized that FBA could be used as a supplemental source of calcium for amending brine disturbed soils. It was also hypothesized that the FBA would not only provide some of the calcium necessary for the physical integrity of the soil; but would also provide micro nutrients needed for propagation of vegetation. The FBA amendment could be used in conjunction with a source of organic waste, in the form of turkey litter, which would provide the essential macro nutrients (i.e., nitrogen, phosphorus, and potassium). In addition, gypsum will be employed as the primary supplementary source of calcium.

Calcium amendment from gyp.

An important factor to consider when utilizing FBA as a soil amendment is the pH of the ash being added to the soil. FBA is highly alkaline and can markedly increase the pH of the soil. Because plants thrive within a relatively neutral pH range, it may be necessary to add an amendment that will help maintain the pH of the soil within an acceptable range. The most common agricultural amendment for decreasing soil pH is elemental sulfur.

1.4 Partnerships and Implementation Scope of Study

1.4.1 Participants

The Clearview Brine Reclamation Demonstration Project was a cooperative effort of the University of Oklahoma, the Water Quality Division of the Oklahoma Conservation Commission, the Okfuskee County Conservation District, and the Natural Resource Conservation Service (NRCS). Crucial to the success of the project was the participation and cooperation of the citizens in and around Clearview. Other agencies involved with the initial project include the Office of the

Secretary of the Environment, the Oklahoma Corporation Commission, and the U.S. Environmental Protection Agency. The Oklahoma Conservation District and the Oklahoma Department of Environmental Quality implemented additional remediation activities at the Clearview site after completion of all monitoring activities associated with this project.

Initial field sampling, laboratory testing, and soil amendment design studies were completed by Ms. Terri Pyle at the University of Oklahoma. Portions of her research thesis have been extracted to develop Chapter 3 of this document.

1.4.2 Pre-Implementation Studies

In order to achieve the stated objectives, several work tasks were completed. Prior to implementation of the remediation plan, a thorough site investigation was necessary to obtain background information and determine the extent of damage that had taken place at the Clearview site. Soil samples were collected and analyzed to determine the integrity of the soil, both chemically and physically. A water quality monitoring program was established to determine how the site had impacted water quality in adjacent water bodies. Finally, laboratory experiments were performed to determine optimum application rates for the proposed soil amendments. Laboratory bench-scale experiments were conducted to formulate the most suitable combination of amendments to improve soil quality and productivity of the brine impacted land. A leach study was performed to determine the concentrations of various metals which could leach from the amended soil.

Personnel from NRCS conducted a land survey of the Clearview site and developed design drawings for re-grading and contouring activities (see Appendix A). They also conducted a site inspection prior to implementation of the remediation technology and provided job oversight during implementation.

1.4.3 Implementation Activities

Implementation of the remediation technology commenced with extensive dirt work (i.e., re-grading and contouring) to prepare the site soils. Soil amendments were then incorporated at the specified application rates. The site was sprigged with Bermuda grass and covered with a hay mulch. The restored lands were not irrigated and no further chemicals were added.

1.4.4 Post-Implementation Activities

Post implementation activities consisted of monitoring and site maintenance monitoring. Monitoring activities consisted of periodically collecting and analyzing water samples from the surface water sampling sites, and a limited number of soil samples. The site was visually inspected on a routine basis (i.e., during monthly sampling episodes). Acute maintenance problems were noted and rectified in a timely manner. Approximately one year after implementation of the remediation technology, anchored hay bales were installed to arrest erosion from isolated areas in which vegetation had not been re-established. Re-seeding of these areas was then attempted. Approximately four years after implementation of the original remediation technology, the localized areas of denuded soil were treated with sewage sludge and gypsum and re-seeded. The final re-seeding activities occurred after completion of the monitoring activities associated with this project. The final re-seeding activities consisted of periodically collecting and analyzing water samples from the surface water sampling sites, and a limited number of soil samples.

1.5 Work Plan Task Completeness

The Work Plan for this project identified nine different work tasks. The specific tasks and their dates of completion are outlined below.

1. Quarterly reports detailing project activities - one month after the end of each quarter.
2. Annual report - included with annual report of all 319 activities. (July 1 of each year)
3. Contact with all affected landowners. (January 2, 1994)
4. Completion of site recovery strategy, along with submittal and subsequent approval by the USEPA prior to implementation. (April 1, 1994)
5. Completion of landowner agreements. (May 1, 1994)
6. Implementation of site recovery through erosion control, re-establishment of riparian areas, and wetland development. (Completed by September 1, 1995)
7. Submittal of a Quality Assurance Project Plan 60 days prior to the initiation of monitoring. (August 1, 1994)
8. Initiation of water quality monitoring program. (October 1, 1995)
9. Publication of a brochure detailing project activities and successes. This would include photographic documentation of before/after conditions as well as implementation activities. Brochure will be submitted to EPA prior to publication for review and approval. (August 1, 1999)

2. LITERATURE REVIEW

2.1 Properties of Natural Soils

Soils are classified as either organic or inorganic (mineral) in nature. Organic soils are very productive and can contain as much as 20% organic matter by weight. Inorganic, or mineral, soils are much lower in organic matter, containing roughly 1 to 6% by weight (Brady, 1990). These mineral soils occupy much of the total land.

Mineral soils consist of four major components; inorganic or mineral material, organic matter, soil air, and soil water. The inorganic portion of the soil is comprised of primary and secondary minerals which vary drastically in physical and chemical composition. Primary minerals are those that have persisted with very little change in composition since they were extruded from molten lava (Brady, 1990). These include quartz, mica, and feldspars and are most commonly found in the sand and silt fractions. Secondary minerals are those that have undergone weathering and are altered forms of iron oxides and silicate clays. These minerals are primarily found in the clay and, to a lesser degree, the silt fractions.

Clays consist of very small particles (< 0.002mm) which have a large surface area per unit weight. These finer particles dictate much of the chemical, physical, and biological processes which occur in soils. Clay particles have charges, or exchange sites, on their surfaces which attract ions and water. The attraction and repulsion of particles toward each other are governed by the presence and intensity of the surface charge.

In most clays, a negative charge predominates; therefore, cations are attracted to the negatively charged surface. This attraction gives rise to a micelle, creating an ionic double layer. The inner layer consists of the negatively charged colloid and the associated strongly held cations. The outer layer is made up of the bulk solution containing loosely held cations attracted to the negative surface as well as water molecules. The cations adsorbed onto the particle surface are subject to exchange with other cations present in the soil solution.

The cation exchange capacity (CEC) of a soil is determined by summing the exchangeable cations that the soil can adsorb and is expressed in terms of centimoles of positive charge per kilogram of soil (Brady, 1990). The CEC of a given soil depends on the colloids present in the soil (e.g., a clay soil will have a higher CEC than a sandy soil due to the surface charge present in clays). The pH of a soil can also influence the CEC.

The percentage cation saturation is defined as the fraction of the CEC satisfied by a given cation. The percentage cation saturation of essential elements such as calcium and potassium governs the uptake of these elements by plants (Brady, 1990). Another factor which influences the uptake of essential elements is the other ions adsorbed on the colloid surface. According to Bohn, et. al., (1979), the strength of cation adsorption onto the surface of the colloid is dependent on the charge associated with the cation being adsorbed (e.g., $Al^{3+} > Ca^{2+} > Mg^{2+} > K^+ = NH_4^+ > Na^+$).

Physical properties, such as plasticity, cohesion, dispersion, and flocculation, greatly influence the geotechnical uses of soils. Plasticity is the pliability or capability of a soil to be molded. Soils consisting of > 15% clay exhibit plasticity (Brady, 1990). The liquid limit of a soil is the moisture content at which the soil is no longer plastic but becomes fluid-like. Soils with large ranges between the plastic and liquid limits are hard to deal with in the field. The cohesiveness of a soil indicates the tendency for clay particles in the soil to stick together (Brady, 1990). Cohesion is predominantly due to hydrogen bonding associated with clay surfaces. The dispersion of a soil is due to the repulsion of the negatively charged surfaces. Flocculation is the opposite of dispersion

and is very beneficial to agricultural soils because it leads to formation of stable aggregates.

2.1.1 Salt-Impacted Soils

Saline soils comprise nearly one-third of soils located in arid and semi-arid regions in the United States (Brady, 1990). The basic source of these salts is the weathering of primary minerals exposed on the earth's crust. Additional sources include fossil salts, atmospheric salts, local salt accumulations, and anthropogenic activities. During the process of chemical weathering, salt constituents are gradually released and made soluble. Saline soils often occur in areas that receive salts from other locations, with water being the dominant carrier. In humid regions, these soluble salts are easily flushed into nearby streams and transported to the oceans. In arid regions, however, leaching and transport of soluble salts is limited due to insufficient rainfall and higher evaporation rates. A build-up of soluble salts frequently occurs in soils with low permeability, in depressional areas that collect drainage water, or in areas subject to seepage or occasional flooding (Schaller and Sutton, 1978).

Soluble salts that accumulate in soils consist primarily of Ca^{2+} , Mg^{2+} , and Na^+ as cations and SO_4^{2-} and Cl^- as anions. Other less dominant ions found are: K^+ , HCO_3^- , CO_3^{2-} , and NO_3^- . Salt-affected soils are classified by their content of soluble salts and the exchangeable sodium percentage (ESP) or, more recently, the sodium adsorption ratio (SAR) (Page, et. al., 1982). Soluble salts are estimated by measuring the electrical conductivity (EC) of the soil solution from a saturated soil paste. This has proven to be a valid estimation of soluble salts present since salts are composed of ions which conduct electricity. Brady (1990) defines ESP as the extent to which the adsorption complex of a soil is occupied by sodium. ESP is calculated using the following equation:

$$\text{ESP} = \frac{\text{exchangeable sodium (cmol/kg of soil)}}{\text{cation exchange capacity (cmol/kg of soil)}} \cdot 100 \quad (1)$$

A more simplistic determination which gives information on the comparative concentrations of Na^+ , Ca^{2+} , and Mg^{2+} in the soil solution is referred to as the sodium adsorption ratio (SAR). The SAR is defined as follows:

$$\text{SAR} = \frac{[\text{Na}^+]}{\{ \frac{1}{2}([\text{Ca}^{2+}] + [\text{Mg}^{2+}]) \}^{1/2}} \quad (2)$$

where $[\text{Na}^+]$, $[\text{Ca}^{2+}]$, and $[\text{Mg}^{2+}]$ are expressed in terms of millimoles per liter. The SAR of a soil takes into account that the adverse effect of sodium is controlled by the presence of calcium and magnesium ions.

As shown in Table 2.1, saline soils generally have a pH less than 8.5 because the salts present consist mostly of neutral salts, like chlorides and sulfates of Ca, Mg, and Na. However, sodium seldom comprises more than half of the soluble cations present in the soil which has an

Table 2.1 Classification of Salt-Affected Soils Based on pH, EC, and SAR

| | pH | Electrical Conductivity (EC) mmohs/cm | Sodium Adsorption Ratio (SAR) |
|--------------|-----------|---|----------------------------------|
| Saline | < 8.5 | > 4 | < 13 - 15 |
| Sodic | > 8.5 | < 4 | > 13 - 15 |
| Saline-Sodic | < 8.5 | > 4 | > 13 - 15 |
| Normal | 6.5 - 7.2 | < 4 | < 13 - 15 |

SAR value of less than 15. When adequate drainage is available, the excessive soluble salts can be removed from the root zone. Saline soils are often flocculated, so their permeability to water is similar and sometimes exceeds that of similar non-saline soils (Schaller and Sutton, 1978). These soils can be recognized by the white crust of salt which forms on the surface of the soil. Saline-sodic soils have a high concentration of both soluble salts and adsorbed sodium which can be detrimental to plants. Leaching of these soils in the absence of Ca, may actually lead to the formation of a sodic soil.

Sodic soils contain sufficient sodium to interfere with the growth of most crop plants. The pH of these soils is greater than 8.5 due to the high concentrations of alkali salts. The dominant cation is sodium, which is toxic to plants. As the ESP of soils increase, the soil becomes dispersed, is less permeable to water, and exhibits poor structural stability (Schaller and Sutton, 1978). At high ESP values, most of the clay and humus particles in the soil become unattached or dispersed. When this takes place, the soil will appear discolored as the humus is carried upward by capillary water and deposited on the surface as evaporation occurs. Hence, these soils are often termed black alkali soils. These are the soils which were investigated in this study.

2.1.2 Brine Contaminated Soils

2.1.2.1 Background

The objective of the Federal Water Pollution Control Act (FWPCA), amended as the Clean Water Act in 1987, is to "restore and maintain the chemical, physical, and biological integrity of the Nation's water" (Environmental Statutes, 1993). This includes the protection of both surface and ground water. Recently, protection of our Nation's waters has become a significant concern due to problems arising from non-point source pollution. The purpose of Section 319 of the FWPCA is to specifically manage pollution resulting from non-point sources. Salt-damaged soils resulting from oilfield activities are one of the most common sources of non-point source pollution in the state of Oklahoma.

Oil is found in deep horizons rich in mineral salts. The water existing in these formations is highly concentrated with dissolved salts. Cates (1993) provides a general classification of waters based on TDS as shown in Table 2.2. Typical components which can be found in brines include Na^+ , Ca^{2+} , Mg^{2+} , K^+ , Cl^- , SO_4^{2-} , HCO_3^- , and CO_3^{2-} . Typical concentrations of the major and minor constituents found in brine is shown in Table 2.3. The most abundant ions present in brine are Na^+ (>23,000 mg/L) and Cl^- (>35,500 mg/L).

Contamination of surface and ground water by brine is a major environmental concern facing the oil industry today. Brine is encountered in the subsurface, usually below fresh ground water, and is inadvertently produced when drilling for crude oil. It has little economic value and must be separated from the oil. Brine is typically disposed of by deep-well injection, however, potential threats to the environment result from improper handling, transport, and disposal practices.

2.1.2.2 Impacts of Brine Contamination on the Environment

Brine releases disturb both the physical structure of the soil and alters the normal osmotic gradient existing between the soil and the plant roots (Burley, 1988). Soil structure is sensitive

Table 2.2 Classification of Waster Based on TDS (mg/L) (Cates, 1993)

| Classification | TDS, mg/L |
|-------------------|-----------------|
| Fresh | 0 - 1,000 |
| Slightly Saline | 1,000 - 3,000 |
| Moderately Saline | 3,000 - 10,000 |
| Very Saline | 10,000 - 35,000 |
| Brine | > 35,000 |

Table 2.3 Typical Concentrations (mg/L) of Ionic Constituents Present in Brine (Cates, 1993)

| Descriptive Term | Constituent | Concentration (mg/L) |
|------------------|------------------|----------------------|
| Dominant | Na ⁺ | > 23,000 |
| | Cl ⁻ | > 35,500 |
| Major | Ca ²⁺ | > 4,000 |
| | Mg ²⁺ | > 2,400 |
| Minor | K ⁺ | > 40 |

to brine because the clay particles in the soil act as a sodium-sensitive ion exchange medium. Divalent calcium and magnesium ions bind negatively charged clay particles into aggregates. During a brine spill, these divalent cations are replaced by monovalent sodium which cannot preserve this aggregated state. The soil swells and disperses quite easily, resulting in excessive erosion. The reduction of pore space makes leaching of excess sodium difficult because the collapsed clay structure becomes impervious to water. Poor drainage results when the downward movement of water is impeded due to the low soil permeability. Salts migrate with the soil water and accumulate on the soil surface due to capillarity followed by evaporation. As salts accumulate, the osmotic gradient which exists between the soil and plant roots reverses, decreasing the availability of nutrients and water to plants (Pessarakli, 1991). Vegetation may deteriorate due to dehydration and nutrient deficiencies. The loss of vegetation makes the soil highly susceptible to erosion. The large quantity of soil particles carried by erosion, as well as the excess soluble salts leaching from a brine contaminated area, have detrimental effects on adjacent water bodies

2.1.3 Common Reclamation Strategies for Salt-Impacted Soils

The most common methods used in the reclamation of salt-impacted soils include: (1) employment of an effective drainage system; (2) addition of appropriate soil amendments; and (3) planting salt-tolerant crops.

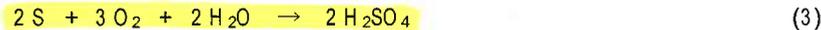
Soil drainage refers to both the speed and the efficiency with which water is removed from the ground surface. This can be achieved by either runoff or percolation through the soil to underground spaces (Pessarakli, 1991). Thus, when applying a drainage system, both the topography and the internal soil drainage are important factors to consider. Because most salts which interfere with plant growth are quite soluble, they can be leached and removed provided that there is proper drainage when water percolates through the soil.

Soil amendments recommended for rehabilitating salt-impacted soils generally consist of a calcium source, organic matter, and, if necessary, a pH adjuster. Calcium is required to displace sodium from the root zone. A traditional source of calcium is gypsum ($\text{CaSO}_4 \cdot x\text{H}_2\text{O}$) because it is inexpensive and readily available. The amount of gypsum required will vary widely, depending upon the percentage of exchangeable sodium and the soil texture. It has a relatively low solubility; therefore, penetration to the root zone is relatively slow. The soil and added amendments should be well mixed by discing or tilling to promote chemical reactions between the added calcium source and the soil surface exchange sites. Additional mineral fertilizers may be required to provide essential nutrients for vegetation.

In addition to gypsum, an organic fertilizer may be needed. The essential plant nutrients (nitrogen, phosphorus, and potassium) may be provided by the addition of an organic waste material. The addition of an organic waste material serves as food for microorganisms and provides protection against surface moisture evaporation. Organic residue remaining in the soil after microbial digestion becomes soil organic matter which is immobile, and therefore does not cause a pollution problem (Rechcigl, 1995). Because water is known to bind to organic matter, this waste material can increase the water available to plants. Organic matter may influence the following physical properties of the soil; bulk density, aggregation and aggregate stability, soil water retention and porosity, hydraulic conductivity, and soil strength (Rechcigl, 1995). It also improves soil infiltration, tilth characteristics, as well as the cation exchange capacity.

Elemental sulfur is the most common amendment used to adjust the pH of alkaline soils.

However, sulfur must first be oxidized to sulfate. According to Rechcigl (1995), several diverse autotrophic bacteria of the *Thiobacillus* genus are the primary oxidizers of S in soil. The reaction is as follows:



The quantity of sulfur required to lower the soil pH into an acceptable range will depend on the initial pH of the soil, the desired pH of the soil, and the acid-buffering capacity of the soil.

The ability of plants to grow in salty soils depends on the properties of the plant, salt, and soil. Factors pertaining to the plant include its physiological makeup, its stage of growth, and its rooting habits (Brady, 1990). Typical salt tolerant plants include barley, Bermuda grass, fescue, salt grass, and wheat (Pessarakli, 1991). Other factors to consider include the salts which are present, their concentrations, and their distribution within the soil. Establishment of vegetation on damaged lands is imperative in order to prevent further degradation.

2.2 Fluidized Bed Ash (FBA)

2.2.1 Background -- Coal Combustion for Energy Production

One of the principal uses of coal in the United States is for generation of electricity. When coal is burned in the presence of an adequate amount of oxygen, carbon dioxide is produced, and as a result of this reaction, energy is generated. There are two problems associated with the combustion of coal which must be considered; (a) the huge amount of ash produced as a result of the combustion process, and (b) the possibility of emitting SO_x and other contaminants into the atmosphere.

In conventional boilers, combustion of coal produces three different kinds of coal combustion byproducts (CCB's) ash; fly ash, bottom ash, and boiler slag. Bottom ash and boiler slag are removed from the bottom of the coal-fired boiler, while fly ash exits with exhaust gases and must be removed by some type of particulate collection device (Burnet, 1987). Often, fabric bag filters or electrostatic precipitators are used to remove particulates.

The production of ash as a by-product has become an increasing environmental concern due to the problems associated with its collection and disposal. Utilities worldwide are currently producing more than 300 million tons of coal ash each year (Burnet, 1987). The United States alone is producing in excess of 100 nearly 50 million tons of fly ash annually ((American Coal Ash Association, 1998 Davidson, et. al., 1993). Disposal of coal combustion solid waste is not a small problem. Even if these wastes were environmentally benign, the quantities produced annually demand attention (Davidson, et. al., 1993). Presently, landfilling is the most common method of ash disposal. However, passage of the Federal Water Pollution Control Act (FWPCA) of 1972 and the Resource Conservation Recovery Act (RCRA) of 1976, have placed additional requirements on the disposal of coal ash due to the chemical and physical properties of the various ashes (Church, et. al., 1980). While there is no single answer for effective management of these wastes, finding alternative uses for these products is becoming increasingly attractive as an alternative to disposal. Clearly, it would be desirable to increase the utilization of fly ash and thereby decrease the amount to be disposed of.

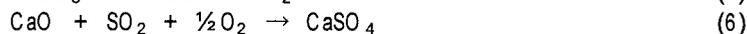
The second problem associated with coal combustion is the possibility of emitting pollutants such as SO_x and particulates into the atmosphere. Unfortunately, all fossil fuels, including natural

gas, coal, gasoline, and oil, are known to contain undesirable inorganic impurities which are converted to oxides that are considered additional air pollutants. At this time it is still not economically feasible to remove impurities prior to the combustion process; therefore, they must be dealt with during the combustion or post-combustion processes. To conform with EPA standards, all large coal-fired power plants constructed after September 1978 are required to employ effective desulfurization systems for removing pollutants from the exhaust gases (Smith and Harris, 1987). In most cases, fabric bag filters or electrostatic precipitators are installed in addition to flue-gas desulfurizers to eliminate the emission of particulates and sulfur oxides into the atmosphere.

2.2.2 The FBC Process

An alternative method for minimizing adverse air quality impacts is the atmospheric fluidized bed combustion (FBC) process. Fluidized bed technology was developed in Germany in the 1920's and has just recently been considered an emerging energy conversion process which allows high efficiency of energy conversion and minimization of adverse air quality impacts. The major advantage of FBC is that coal with a high sulfur content can be burned without the use of flue-gas desulfurization equipment, while still maintaining air quality standards (Grimshaw, et. al., 1985). The FBC process reduces a significant amount of environmental degradation associated with conventional energy production from coal; however, it also produces a significant amount of waste ash which must be disposed.

In the FBC process, crushed coal is burned, at a controlled velocity and an optimum temperature, in a turbulent bed of finely ground sorbent (typically ground limestone). These solids are held in suspension by an upward flow of air, thus exhibiting characteristics of a liquid (Stout, et. al., 1988). During combustion, any sulfur present in the parent coal is oxidized to sulfur oxides (SO_x). When the limestone is exposed to heat during the combustion process, calcination takes place to form calcium oxide (CaO). It is this calcium oxide which reacts with the sulfur oxides to produce $CaSO_4$. The reactions are as follows:



The sorbent requires in excess of the stoichiometric dosage to ensure a complete reaction with any combustion gas which may be present. Therefore, the fluidized bed ash produced is a granular material consisting of $CaSO_4$, unreacted CaO, coal ash, and small quantities of other mineral oxides due to their presence in the parent coal (Adriano, et. al., 1980).

2.2.3 Properties of FBA

The physical and chemical characteristics must be considered prior to using the ash for disposal. Fly ash is defined as the portion of ash produced during coal combustion that has a sufficiently small particle size allowing it to be carried away from the boiler in the flue-gas stream (El-Mogazi, et. al., 1988). It is composed mainly of silicaglasses and minerals enriched with trace metals (Kirby and Rimstidt, 1994). The properties of ash are dependent on the composition of the parent coal, conditions during combustion, efficiency of emission control devices, storage and handling of by-products, and climate.

Fluidized bed ash (FBA) consists of many small, irregularly-shaped particles ranging in size from 25 to 2000 micrometers in diameter, with specific gravities ranging from 2.65 to 3.05 g/cm³ (Kilgour, 1992). Generally, the size of the particles depends on the sorbent material used, the fuel type, the temperature at which the coal is burned, and fluctuations in the operating conditions (Berry and Anthony, 1987).

The inorganic constituents of ash are typically those present in rocks and soils, primarily Si, Al, Fe, and Ca. FBA contains a significant amount of Ca due to the addition of limestone during the combustion process. Because coal is known to contain every naturally occurring element, small quantities of each of these may also be present in the ash material.

Most major elements tend to be present in relatively stable particle cores rather than on the surface of the particle where most chemical and physical reactions take place. It is thought that this is because these elements are not volatilized during combustion, but instead form a melt and remain in this condensed form (El-Mogazi, et. al., 1988). It is also hypothesized that other metals, such as Cd, Ni, Se, Cr, Ni, Zn, and Pb, become volatilized during combustion, then condense onto the surfaces of the ash particles as the flue-gas cools. These trace elements become concentrated on smaller particles due to their larger surface areas (El-Mogazi, et. al., 1988). This information becomes important when trying to determine which trace elements are more likely to become mobile. Other factors which influence the solubility characteristics of various species present in ash are the type of extractant, the ash-to-solution ratio, the number of extractions, and the length of the extraction time (El-Mogazi, et. al., 1988).

2.2.4 Disposal versus Use

Over 70 percent as stated earlier, of the 1050 million tons of ash produced in the U.S. annually, 80% is disposed of as a solid waste. Currently, landfilling is the major means of disposal. However, even this practice is becoming more difficult due to the scarcity of available land, the high costs of the disposal operations, and the possibility of contaminating surface and ground waters (Sheih, 1990). While landfilling remains the least expensive disposal option, new regulations designed to protect surface and ground waters are calling for careful and, consequently, more costly solid waste disposal methods.

The most significant piece of legislation impacting the disposal of coal residue is the Resource Conservation and Recovery Act (RCRA) of 1976. This and the subsequent enactment of the Clean Water Act (CWA) in 1977 imposed serious constraints on ponding ash which was the primary means of disposal at the time (Burnet, 1987). The United States Environmental Protection Agency established drinking water standards which aid in the classification of hazardous solid waste based on concentrations of components found in their leachates. Currently, fly coal ash residues have been exempted from being classified as a hazardous waste; FBA is still being studied pending further study. These decisions were based on a study performed on coal residue using two leaching tests; (1) the EPA Toxicity (TCLP) test, and (2) the ASTM Standard Method B 3987-81 (Burnet, 1987). Results of these tests revealed very low levels of elements present in the leachates. In fact, most were well below drinking water standards. This is expected to lead to a permanent nonhazardous classification of coal ash (Burnet, 1987).

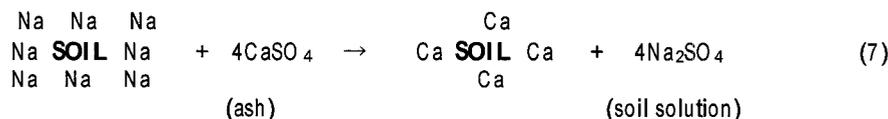
The ever-increasing amount of ash waste that must be disposed of each year is creating a tremendous dilemma. Only about 320% of fly ash waste is being used each year; thus fly ash is the largest fraction of coal residue and is the least utilized. Perhaps the main reason for not utilizing

more of the coal ash waste is the presence of more abundant and inexpensive raw materials. Minimization and utilization are two viable approaches to solving the problems associated with any waste. The most common uses for coal fly ash are as a construction material. These uses include: manufacture of concrete, fill for various construction sites, production of lightweight aggregates, and road base stabilization (Smith and Harris, 1987). Other less extensive uses of coal fly ash include sanitary landfill covers and liners, strip mine reclamation and soil conditioning.

2.3 FBA as an Amendment for Brine Disturbed Soils

Brine contaminated soils are very susceptible to erosion. The two main reasons for this are (1) replacement of divalent cations by sodium which creates a dispersive soil, and (2) loss of vegetation due to osmotic effects that impact water and nutrient uptake. The reclamation of brine contaminated soils requires the following; (a) the establishment of an effective drainage system, (b) the replacement of exchangeable sodium by divalent cations (namely, calcium), (c) the addition of organic matter to improve soil structure and aggregation, (d) a soil pH adjuster, and (e) establishment of vegetation to prevent further degradation.

Because of the FBC process, FBA contains a significant amount of calcium as well as other mineral oxides. As seen in Table 2.4, the main constituents of FBA are CaSO_4 , CaO , and CaSO_3 . The abundance of calcium in FBA makes it useful for the replacement of monovalent sodium. The Ca provided from the FBA reacts with the sodic soils as follows:



It should be noted that CaSO_4 is much more soluble than CaO and CaSO_3 which must be further oxidized to CaSO_4 .

While FBA is not a practical source of essential plant nutrients (nitrogen, phosphorus, and potassium), it can serve as a supplementary supply of micro nutrients in the form of trace elements to the soil. Important micro nutrients typically found in FBA include iron, manganese, boron, copper, and zinc (Stout, et. al., 1988). All of these elements are required by plants in small amounts. Analyses have shown that FBA contains most of the essential nutrients required for plant growth; however, if they are excessive or disproportionate in the soil, they can become toxic to plants or animals (Stout, et. al., 1988). Stout, et. al., (1988) further states that no phytotoxic effects of micro nutrients have been observed when FBA was used as a lime source. Adriano, et. al., (1980) stated that both field and greenhouse studies indicated that CCBSfly ash might benefit plant growth and could improve agronomic properties of the soil. In most cases, the ash is added to the soil at a rate of less than 5-10% by weight. Addition of FBA has also been shown to increase the water holding capacity of the soil. Rechcigl (1995) suggests that this increase could be partly due to the particle size, as well as the porosity of the FBA particles. Although the addition of FBA may change the water-holding capacity, it may not appreciably change the amount of water available to plants (El-Mogazi, et. al., 1988). Other factors affected by the addition of FBA include pH, soluble salt content, soil texture, bulk density, moisture content, and exchangeable capacity (Wyrley-Birch, et. al., 1987).

Table 2.4 Mineralogical Analysis of a Typical Fluidized Bed Combustion Waste (Rechigl, 1995)

| Constituent | FBC (% by weight) |
|---------------------------------------|----------------------|
| CaSO ₄ | 52.00 |
| CaSO ₃ · ½H ₂ O | 0.60 |
| CaO | 33.00 |
| MgO | 0.80 |
| NaCl | 0.30 |
| P ₂ O ₅ | 0.02 |
| Fe ₂ O ₃ | 4.50 |
| SiO ₂ + insolubles | 7.00 |

2.3.1 Environmental Considerations

Important considerations to take into account when selecting an appropriate application rate of FBA include its effect on pH, soil microbial activity, heavy metal loadings, pollution of surface and ground waters, and possible cementing or impedance of water flow due to the pozzolanic properties of the ash (Wyrley-Birch, et. al., 1987). Typically, the application rates are so low that the possibility of cementing is negligible.

The first concern when using FBA as a soil amendment is the effect it has on soil pH. FBA contains many alkaline oxides, particularly CaO, which makes it a good substitute for agricultural limestone. The total lime content, expressed as the neutralizing potential of the material compared to an equal amount of ground limestone (CaCO₃), ranges from 31 to 100%, averaging 60% (Rechcigl, 1995).

When CaO comes in contact with water, Ca(OH)₂ is produced as shown below:



This reaction causes highly alkaline conditions and may result in pH's as high as 12 to 12.5. Depending on the initial pH of the soil, a pH adjuster will probably be necessary to lower the pH to an acceptable value. Plants require a relatively neutral pH (6.5 to 7.2) so it is imperative that the pH be monitored closely. If the pH is elevated above this acceptable range, elemental sulfur may be used to counteract this effect. Elemental sulfur can be oxidized by microbial activity to yield acidic conditions as described in a previous section.

According to Rechcigl (1995), the addition of ash may also interfere with microbially mediated processes of organic matter decomposition and the cycling of nutrients such as C, N, S, and P in the biosphere. This inhibition has been primarily attributed to the effects the FBA has on pH and electrical conductivity in the soil. Other investigations have suggested that the decrease in soil microbial activity could be due to the toxic concentrations of Cd, Cr, and Zn (Rechcigl, 1995). However, the addition of an organic amendment with low C:N ratio will increase the organic matter content and CEC and result in greater microbial activity (Rechcigl, 1995). It should be noted that effects on microbial activity are negligible at low application rates (< 10 to 12%).

Another concern when using FBA as a soil amendment is the possibility of polluting nearby surface and ground waters with heavy metal impurities which may be present in the coal prior to combustion. Several studies have reaffirmed that FBA is not a toxic substance based on the USEPA TCLP test. In Table 2.5, the leaching potential of FBA is compared with the National Primary Drinking Water Standards (NPDWS) and the Oklahoma Water Quality Standards (OWQS) for acute and chronic toxicity in Table 2.5. All toxic metals are below the NPDWS and OWQS standards except Cr, which is nearly twice the standard. However, it has been shown that if FBA is applied to soil at moderate rates (< 2 to 5%), the potential contamination of ground water by toxic metals is not a concern (Rechcigl, 1995).

Ground and surface water pollution is not the only concern heavy metals pose on the environment. Other concerns include crop effects, risk to livestock, and potential food chain bioaccumulation. Consequences from excessive levels of metals in soil depend on numerous complex reactions between the trace ions and components of soil, i.e., solid, liquid, and gaseous phases (Rechcigl, 1995). Acceptable concentrations of trace metals in surface soils will vary depending on the local condition of the soil and the land use. Currently, most research involving

Table 2.5 Leaching Potentials (mg/L) of Fluidized Bed Ash for Toxic Metals in Relation to the National Drinking Water Standards (NPDWS) (Rehncigl, 1995)

| Toxic Metal | FBA | NPDWS | OWQS | |
|-------------|--------|-------|----------|---------|
| | | | Acute | Chronic |
| As | < 0.04 | 0.05 | 0.36 | 0.19 |
| Ba | < 1.00 | 1.00 | NA | NA |
| Cd | < 0.01 | 0.01 | formula* | formula |
| Cr | 0.09 | 0.05 | NA | 0.05 |
| Pb | < 0.04 | 0.05 | formula | formula |
| Hg | 0.0005 | 0.002 | 0.0024 | 0.0013 |
| Se | 0.001 | 0.01 | 0.02 | 0.005 |
| Ag | < 0.04 | 0.05 | NA | NA |

* Standards for cadmium and lead are calculated using stream hardness concentrations.

heavy metals loadings has been in relation to the application of sewage sludge on agricultural land. Stout, et. al., (1988) indicate that FBA has very low levels of heavy metals compared to sewage sludge. Stout, et. al., (1988) also suggest that the oxide form of heavy metals in FBA renders them much less available to plants than the organic forms present in sewage sludge. Table 2.6 shows acceptable ranges of nutrients and heavy metals in soils, as well as ranges present in a typical sample of FBA. It is important to note that the levels of heavy metals in FBA are within ranges normally found in soils. Still, it is important that these heavy metals loadings not exceed loadings recommended for sewage sludge as shown in Table 2.7 (Stout, et. al., 1988).

Table 2.6 Average Concentrations ($\mu\text{g/g}$ of dry material) and Typical Ranges for Some Components Found in Fluidized Bed Ash and Soils (Stout, et al., 1988)

| Group | Component | FBA | | SOILS | |
|---------------------------|-----------|---------------------------------------|-------------------|---------|-----------------|
| | | Average | Range | Average | Usual Range |
| | | (Micrograms per gram of dry material) | | | |
| Essential plant nutrients | Ca | 380,000 | 240,000 - 460,000 | | |
| | Mg | 7,100 | 5,000 - 12,000 | | 100 - 1,500 |
| | K | 2,500 | 500 - 8,000 | | |
| | P | 430 | 380 - 500 | | 400 - 3,000 |
| | Fe | 11,000 | 800 - 16,000 | --- | 14,000 - 40,000 |
| | Mn | 485 | 210 - 685 | 850 | 200 - 3,000 |
| | Mo | 0.19 | 0.12 - 0.28 | 2 | 0.2 - 5 |
| | B | 110 | 95 - 170 | 10 | 2 - 100 |
| Heavy Metals | Cu | 15 | 12 - 19 | 20 | 2 - 100 |
| | Zn | 55 | 29 - 105 | 50 | 10 - 300 |
| | Ni | 21 | 13 - 29 | 40 | 5 - 500 |
| | Pb | 3.2 | 1.5 - 7.5 | 10 | 2 - 200 |
| | Cd | 0.5 | --- | 0.5 | 0.01 - 0.70 |
| | Cr | 15 | 9 - 23 | 200 | 5 - 1,000 |
| Phytotoxics | Se | 0.29 | 0.16 - 0.58 | --- | 0.1 - 2 |
| | Al | 10,000 | 4,000 - 20,000 | --- | 14,000 - 40,000 |

Table 2.7 Maximum Cumulative Heavy Metal Loadings on Soil (pounds/Acre) Based on Textural Class of Soil (Stout, et al., 1988)

| Heavy Metal | Loamy sand, sandy loam | Fine sandy loam, very fine sandy loam, loam, silt loam | Silt, clay loam, sandy clay loam, silty clay loam, sandy clay, silty clay, clay | -----Pounds per Acre----- | | | |
|-------------|------------------------|--|---|---------------------------|--|--|--|
| | | | | | | | |
| Cd | 2 | 3 | 4.5 | | | | |
| Zn | 50 | 150 | 300 | | | | |
| Cu | 25 | 75 | 150 | | | | |
| Ni | 10 | 30 | 60 | | | | |
| Pb | 100 | 300 | 600 | | | | |
| Cr | 100 | 300 | 600 | | | | |

3.0 METHODOLOGY (Pyle, 1996)

3.1 Site Characterization Studies

An initial site assessment was necessary to provide background information and to determine the extent of damage caused by brine at the Clearview site. The site assessment included the following: development of a surface soil sampling plan, analysis of control and composite soils, and assessment of water quality of nearby creeks.

3.1.1 Field Sampling and Analyses

3.1.1.1 Soil Samples

The soil samples used in this study were collected at the Clearview site under the supervision of John Haberer, the Soil Scientist at the Okfuskee County Conservation District (OCCD).

3.1.1.2 Water Samples

Water samples were collected from bodies directly affected by the brine damaged land at the Clearview site. Sampling locations were chosen in collaboration with Dan Butler, Aquatic Biologist, with the Oklahoma Conservation Commission - Water Quality Division (OCC-WQD).

3.1.1.3 Sampling Methodology

Environmental sampling can be tedious because the materials being sampled are quite variable and complicated. It is imperative to develop precise sampling protocols to ensure valid and accurate data. Table 3.1 is an outline of a general sampling protocol for environmental applications (Keith, 1988).

3.1.1.4 Soil Sampling Methodology

Soil sampling locations were determined in collaboration with the area soil scientist at OCCD. Soils were collected for two purposes: (1) to provide a general profile of the affected area, and (2) to provide a representative composite sample to be used in the laboratory studies.

3.1.1.5 Soil Profile

The soil profile was examined to give a general idea of the extent of brine contamination in the affected area. The constituents of concern included pH, EC, total and extractable calcium and sodium, chloride, and sulfate. These parameters were chosen because of their importance in defining brine contaminated soils.

Soil samples were taken at 21 different locations as shown in Figure 3.1. Sampling sites 1 and 2 were chosen to obtain control or unaffected soil samples. These samples were used as a comparison to determine the extent of damage of the affected area. Sites 3 through 13 were chosen to determine spatial variability related to the movement of contaminants as they travel the Clearview Creek corridor. Sites 14 through 21 were chosen for comparison with existing data collected by OCCD in 1989.

At each site, samples were taken from two different depths; (1) 0 to 6 inches, and (2) 6 to 12 inches. Thus, a total of 42 soil samples were collected. Rocks and vegetation were

Table 3.1 Outline of a Generalized Sampling Protocol (Keith, 1988)

| Main Point (Program Purpose) | Subelements |
|---|---|
| Analytes of interest | Primary and secondary chemical constituents and criteria for representativeness |
| Locations | Site, depth, and frequency |
| Sampling points | Design, construction, and performance evaluation |
| Sample collection | Mechanism, materials, and methodology |
| Sample handling | Preservation, filtration, and field control samples |
| Field determinations | Unstable species and additional sampling variables |
| Sample storage and transport | Preservation of sample integrity |

Figure 3.1 Sampling Locations for Soils Collected at the Clearview Site for a Soil Profile

cleared from the surface prior to sampling. Soil samples were collected using a hand auger, then transferred to plastic sample bags with an airtight seal. The samples were transported to the laboratory and immediately prepared for chemical analysis. The samples were allowed to air-dry, then pulverized using a porcelain mortar and pestle and passed through a No. 40 sieve. The sieved soil samples were placed back in plastic sample bags until analyzed.

3.1.1.6 Composite Soil Sample

A composite sample was collected for both physical and chemical analyses. The physical parameters of concern were moisture content, particle size, bulk density, plastic and liquid limits, and dispersivity. The chemical parameters analyzed were pH, electrical conductivity (EC), nutrients, cation-exchange-capacity (CEC), exchangeable sodium percentage (ESP), sodium adsorption ratio (SAR), selected metals, and selected anions. Analytical procedures utilized are outlined in Appendix BA.

Composite sub-samples were collected at four different locations within the affected area, as shown in Figure 3.2. The other four locations were chosen along the Clearview Creek corridor and composited to represent a worst-case scenario. The sample collected outside the area served as a control.

Soil samples were collected from a depth interval of 0 to 8 inches using a shovel. This depth interval was chosen because it represents the plow layer, which is the layer of concern when reclaiming agricultural land. The composite sub-samples were collected, transported, and prepared as described in the previous section. The composite sample was prepared with equal weights of the four individual sub-samples.

3.1.1.7 Water Sampling Methodology

The water monitoring program was designed to assess the impacts of the brine contaminated site on adjacent water bodies. As seen in Figure 3.3, Clearview Creek flows directly through the affected area and then into Alabama Creek. Existing data collected from these creeks has shown elevated concentrations of dissolved ions commonly present in brine; therefore, many of the water samples were analyzed for parameters traditionally associated with brine. Samples were also analyzed for basic water quality parameters.

The sampling locations were chosen to determine impacts on both Clearview Creek and Alabama Creek. The four locations are shown in Figure 3.3. Site 1, located on Clearview Creek immediately downstream from the affected area, was chosen to determine the quality of water exiting the Clearview site. Site 4, located downstream from the confluence of Clearview and Alabama creeks, was chosen to assess the impacts of Clearview Creek on Alabama Creek. Sites 2 and 3 were chosen to assess the water quality of Clearview Creek and Alabama Creek prior to influence from the Clearview site.

Grab samples were collected on a monthly basis at each sampling location. The samples were collected in 500 ml polyethylene bottles. The bottle lids were also polyethylene and had a polyethylene foam liner to prevent leakage. Both the bottles and caps were rinsed several times in the creek, slightly downstream, to prevent stirring up sediment at the actual sampling location. For collection, the bottles were submerged, filled until no head space was left, and then capped tightly.

Figure 3.2 Sampling Locations of Soil Collected at the Clearview Site for Laboratory Studies

Figure 3.3 Water Sampling Locations at the Clearview Site

Samples were also taken following high-flow events using a single-stage sampling device. The device consists of a sample container, an air exhaust, an intake, and a bottle seal. A diagram of these components is shown in Figure 3.4 (OCC-WQD, 1995). The samplers were constructed by

attaching a series of sampling components to a 2" x 8" wooden board. The components were attached so that the intakes were at one foot intervals from the creek bottom. The samplers were installed and maintained according to OCC-WQD guidelines (OCC-WQD, 1995). The samples were collected in half-gallon polyethylene bottles and were composited based on volume following OCC-WQD Standard Operating Procedure (SOP) No. 4 (OCC-WQD, 1995).

When the surface of the water rises to the level of the intake nozzle, water enters the sample bottle. As the creek rises, the water in the intake also rises. As shown in Figure 3.4 (OCC-WQD, 1995), when the elevation of the water level "W" reaches the crown of the intake "C", flow starts over the weir of the intake and siphons water into the sample bottle. The bottle continues to fill until the sample rises to the fill mark "F", and water is forced up to the air exhaust to the elevation of the creek "W". As the creek rises to the level of the exhaust port "D", air is trapped in the air exhaust. No flow can pass through altering the original sample as long as sufficient air remains in the tubes. The exact dimensions used for the single-stage samplers are shown in Figure 3.4 (OCC-WQD, 1995). These dimensions were specific for low-velocity sampling (i.e., velocities less than 4 fps).

3.1.2 Field Analyses

Several basic water quality parameters were measured in the field at the time of sample collection. These parameters include; electrical conductivity (EC), temperature, pH, E_h , dissolved oxygen (DO) and alkalinity. All field measurements followed Standard Operating Procedures (SOP's) as outlined by the OCC-WQD. Field determinations were made at the same locations as the samples collected for laboratory analyses.

3.1.3 Laboratory Measurements

For every sampling episode, three water samples were collected at each location. The samples were labeled as follows: (1) Parameters, (2) Nutrients, and (3) Metals. The parameters sample was collected for turbidity, total suspended solids (TSS) and total dissolved solids (TDS), and anions analyses. The nutrients sample was collected for ammonia, total Kjeldahl nitrogen (TKN), and total phosphorus (TP) analyses. This sample was preserved by the addition of 1 mL of concentrated sulfuric acid (H_2SO_4). The metals sample was collected for selected total metals analyses and was preserved by the addition of 2 ml of concentrated heavy-metals-grade nitric acid (HNO_3). All samples were placed on ice until they were transported to the laboratory. They were stored in a 4°C refrigerator until analysis. Table 3.2 is a list of preservation methods and holding times for all sample analyses used in this study (USEPA, 1983). Analytical procedures are outlined in Appendix BA.

3.2 Rehabilitation Design Studies

3.2.1. Materials

The soil amendments considered in this study included; (a) fluidized bed ash (FBA), (b)

Figure 3.4 Diagram of Sample Components and Dimensions Used in the Single-Stage Sampler
Table 3.2 Preservation and Holding Times Required for Water Analyses (USEPA, 1983)

| Measurement | Preservative | Holding Time |
|----------------------------|---|--------------|
| Turbidity | Cool, 4°C | 48 Hours |
| TSS/TDS | Cool, 4°C | 7 Days |
| Chloride | Cool, 4°C | 28 Days |
| Nitrate | Cool, 4°C | 48 Hours |
| Phosphate | Cool, 4°C | 48 Hours |
| Sulfate | Cool, 4°C | 28 Days |
| Ammonia | Cool, 4°C H ₂ SO ₄ to pH < 2 | 28 Days |
| Total Kjeldahl Nitrogen | Cool, 4°C H ₂ SO ₄ to pH < 2 | 28 Days |
| Total Phosphorus | Cool, 4°C H ₂ SO ₄ to pH < 2 | 28 Days |
| Total Metals | Cool, 4°C HNO ₃ to pH < 2 | 6 Months |

gypsum, (c) sulfur dust, and (d) turkey litter. The FBA was provided by Brazil Creek Minerals Inc, located in Fort Smith, Arkansas. The gypsum and sulfur were purchased from a local nursery. The brand of gypsum used was Hoedown analytical grade 0-0-0, with 23.00% Ca and 16.50% S from CaSO_4 . The brand of sulfur used was Hi-Yield wettable dusting sulfur with the active ingredients being 90.0% sulfur and 10.0% inert ingredients. The turkey litter was provided by Hollingsworth Litter Service located in Springdale, Arkansas. Analysis of the litter was provided with the sample. The analysis was done by the Cooperative Extension Service at the University of Arkansas, Department of Agriculture. The broiler litter contained 56 pounds/ton N, 48 pounds/ton P_2O_5 , 36 pounds/ton K_2O , and had a moisture content of 30%.

3.2.2 Soil Amendment Application Rates

This section describes the procedures used to determine the application rates of the four amendments (i.e., FBA, gypsum, turkey litter, and sulfur). Soil pH was the main criterion used to determine the optimum application rate in the batch studies. All batch studies were conducted on both the control and the composite soil samples.

Gypsum

The gypsum application rate was determined based on literature values and the rate suggested by the manufacturer.

Turkey Litter

The turkey litter application rate was based on literature values and suggestions from the Oklahoma Cooperative Extension Service.

FBA

Batch studies were conducted to determine the optimum application rate for FBA. The first batch study consisted of soil and FBA only. 100 grams of soil was used per sample. FBA was added at the following application rates; (a) 0.1%, (b) 0.5%, and (c) 1.0% by weight. The samples were mixed well and deionized water was added to make a saturated soil paste. The pH of the mixture was measured immediately and in 24 hours to determine the time-dependent effects FBA has on the soil pH. This study was performed in duplicate.

The second batch study consisted of soil, FBA, gypsum, and turkey litter. 300 grams of soil was used for this batch. This batch was similar to the first except gypsum and turkey litter were added to determine the pH effects they had on the system. Gypsum was added at an application rate of 9 tons/acre or 2.13 g/300 g of soil. Turkey litter was added at an application rate of 30 tons/acre or approximately 7.5 g/300 g of soil. FBA was varied at the following application rates; (a) 2 lbs/acre 0.1%, (b) 10 lbs/acre 0.5%, and (c) 20 lbs/acre 1.0% by weight. The samples were mixed and the pH was measured of the saturated soil paste. This study was performed in duplicate.

The third batch study was identical to the second, but sulfur dust was added to help lower the pH of the system. Gypsum and turkey litter were added at the same application rate as above. FBA was added at 2 and 10 lbs/acre 0.1% and 0.5%. The pH of the batches were measured over a 17 day period or until the pH was within an acceptable range for plant growth. This study was performed in duplicate.

Other information considered for determining the application rate of FBA included metals

analyses performed on the soil and FBA.

Sulfur

A batch study was also conducted to determine the optimum application rate of sulfur dust. Gypsum and turkey litter were added at the same application rates discussed previously. FBA was added at an application rate of 20 lbs/acre 1% by weight. Sulfur dust was added at 1, 5, and 10 tons/acre. The pH values of the batches were measured until they reached a level acceptable for plant growth or 24 days, whichever came first.

3.2.3 Leach Studies

Leach studies were conducted to determine concentrations of soluble metals leachable from the amendments applied to the soil at the Clearview site. The samples were as follows: soil only; soil plus each individual amendment; soil plus FBA, sulfur, and turkey litter; soil plus gypsum, sulfur, and turkey litter; and soil plus all amendments. Various combinations of these amendments were added for comparative studies. The amendments were incorporated at the optimum application rates as determined from the batch studies. The studies included both control and composite soil samples, and each was performed in triplicate. The samples were shaken for 24 hours in polyethylene bottles at a 1:10 solid:liquid ratio using deionized water as the extract solution. Following each 24 hour cycle, the samples were centrifuged and filtered through a 0.45 micron cellulose membrane filter. A fresh extract solution was added for the next 24 hour shake cycle. This procedure was repeated a third time. The extracts were analyzed for the following chemical properties: pH, EC, selected soluble metals (Ca, Na, K, Mg, Cd, Pb, Cu, Cr, Fe, Se, and Zn), and selected soluble anions (Cl^- , NO_3^- , PO_4^{3-} , and SO_4^{2-}) according to the methods described previously.

3.3 Rehabilitation Plan Implementation

Site rehabilitation activities included earthwork, adding soil amendments, and revegetation. The high walls created by years of erosion were reduced to < 6 degree slope. Culverts and drop structures were placed in the deep gullies, and diversion ditches were installed to retard incoming overland flow from surrounding fields. The existing channel of Clearview Creek was leveled off to provide a stream bed capable of transmitting a large volume of water over a wide area. Accumulated trash was buried on site, away from the drainage area. After the land had been brought to an acceptable shape, it was tilled and prepared to receive the soil amendments. The amendments were added in the following order: FBA, gypsum, sulfur dust, and turkey litter. Following each amendment, the land was disced to incorporate the amendment into the soil. Bermuda grass (*Cynodon dactylon*) was then sprigged on the reclaimed land. After sprigging, the land was covered with hay mulch to protect the loose soil and amendments from erosion. Prior to the second growing season, hay bales were anchored in isolated locations to reduce runoff and erosion in areas where vegetative cover had not been established.

3.3.1 Materials

The materials utilized during rehabilitation included the native soils, FBA, gypsum, sulfur dust, turkey litter, and Bermuda grass.

3.3.2 Loading Rates

During field implementation, the loading rates for all of the soil amendments were identical to those used in the laboratory studies described previously.

3.4. Post Implementation Monitoring Plan

3.4.1 Water Sampling

The water quality-monitoring program was designed to determine the impacts of the brine-affected area on receiving water bodies. It is important to note that Clearview Creek is an intermittent stream. During prolonged periods without rain, the water table drops below the level of the Clearview Creek channel, leaving only isolated pools separated by the dry creek bed. Even though no measurable flow can be determined between the surface pools, subsurface flow can continue to transport contaminants down the creek channel. Even during dry periods, contaminants can migrate, eventually discharging into Alabama Creek. Therefore, the creeks were monitored on a monthly basis to account for seasonal fluctuations. During periods of low flow, the water sampling stations sometimes did not yield sufficient quantities of water to provide representative samples.

3.4.2 Fluid Levels

Fluid levels were measured daily at the four surface water sampling locations for a period of nine months; two months prior to remediation and seven months after remediation. Rating curves (i.e., stage versus discharge) for Alabama and Clearview Creeks have not been developed; hence, flow rates can not be calculated from the fluid level measurements.

4.0 RESULTS AND DISCUSSION

4.1 Site Soils

Results of soil sample chemistry taken at two different depths (i.e., 0 to 6 inches and 6 to 12 inches) are shown in Tables 4.1. and 4.2, respectively. Soluble salt concentrations are expected to accumulate in surface soils due to capillary movement of water followed by evaporation; however, no correlation could be made with the soil samples. It was also difficult to correlate the elevated concentrations and the movement of contaminants down the Clearview Creek corridor. Soils within the affected area were found to be surprisingly variable from one location to the next, making it difficult to develop isoconcentration contour maps.

Ratios of sample concentrations to the maximum concentration were calculated for selected data (e.g., EC, chloride, and soluble sodium of the soils sampled at 0 to 6 inches) and compared to their distance from a reference site, or site 17 (See Figure 3.1). The samples located down the length of the affected area were used for comparison (i.e., samples from sites 3,4,5,6,8,10,11,12,13, and 17). As observed in Figure 4.1, the contaminant concentrations for EC, chloride, and soluble sodium generally increase with distance from site 17. This can be explained due to their proximity to the Clearview Creek corridor. Those samples taken close to the drainage area are highly concentrated because the contaminants are transported down this drainage channel during rain events. The creek is seasonal and will run dry when there is little precipitation. As the water evaporates, the soluble salts are left behind to precipitate on the soil surface, resulting in high concentrations of salts.

4.1.2 Composite and Control Soil Samples

4.1.2.1 Physical Properties

The physical soil properties of concern included; soil moisture content, bulk density, soil texture, liquid and plastic limits, and dispersivity. The results of these analyses are shown in Table 4.3 for both the composite and control soil samples.

Soil texture of the control and composite samples was determined using the hydrometer method. As shown in Table 4.4, the control sample was a sandy loam and the composite sample was a clay loam. The elevated clay content of the composite soil was assumed to be due to weathered parent material and deposited material which had accumulated over time due to the extensive erosion within the affected area. The pinhole test results for the control sample were inconclusive due to its low clay content.

Bulk densities were determined using two different methods; the excavation method and the clod method. These methods gave inconsistent results. The bulk density of the control sample, at a moisture content of 16.1%, was 1.77 and 1.31 g/cm³, as determined by the excavation and clod methods, respectively. The composite sample was determined to have a bulk density of 1.62 and 1.50 g/cm³, at a moisture content of 14.4%. The discrepancies of the data obtained by the two different methods could be due to experimental error. Specifically, in the excavation method it was imperative to find a level area since the volume of the excavation was measured by dispensing water from a graduated cylinder. Because of the excessive erosion at the Clearview site, it was difficult to find a level area at some sampling locations.

Table 4.1 - Selected Chemical Analyses of a Surficial (0 to 6 inches) Soil Plan of the Affected Area at the Clearview Site

| Site | pH | EC (mS/cm) | Cl ⁻ (ppm) | SO ₄ ²⁻ (ppm) | Soluble Ca ²⁺ (ppm) | Total Ca ²⁺ (ppm) | Soluble Na ⁺ (ppm) | Total Na ⁺ (ppm) |
|------|-----|---------------|--------------------------|--|--------------------------------------|------------------------------------|-------------------------------------|-----------------------------------|
| 1 | 8.1 | 0.384 | 41 | 40 | 45 | 653 | 14 | 41 |
| 2 | 7.9 | 0.480 | 134 | 27 | 200 | 1,021 | 72 | 179 |
| 3 | 7.4 | 47.1 | 20,866 | 81 | 551 | 3,030 | 6,690 | 8,692 |
| 4 | 7.5 | 36.1 | 14,336 | 185 | 1,530 | 7,726 | 5,575 | 9,509 |
| 5 | 7.1 | 46.8 | 7,391 | 112 | 1,101 | 5,890 | 7,680 | 11,309 |
| 6 | 7.2 | 80.6 | 11,746 | 162 | 1,168 | 5,876 | 13,235 | 17,781 |
| 7 | 7.2 | 62.3 | 9,232 | 412 | 1,222 | 6,257 | 10,150 | 10,912 |
| 8 | 7.6 | 43.4 | 10,290 | 117 | 459 | 2,542 | 6,664 | 8,779 |
| 9 | 7.6 | 9.0 | 1,214 | 605 | 2,795 | 9,372 | 961 | 1,441 |
| 10 | 7.6 | 39.2 | 9,245 | 192 | 653 | 2,934 | 6,838 | 9,524 |
| 11 | 7.8 | 24.4 | 4,921 | 61 | 472 | 2,551 | 2,657 | 3,724 |
| 12 | 7.3 | 0.378 | 62 | 22 | 2,713 | 14,956 | 116 | 184 |
| 13 | 7.7 | 19.8 | 4,069 | 58 | 1,289 | 6,852 | 3,197 | 4,697 |
| 14 | 7.7 | 2.95 | 358 | 2,007 | 391 | 1,711 | 438 | 545 |
| 15 | 7.7 | 6.11 | 2,250 | 1,507 | 398 | 2,222 | 1,386 | 1,426 |
| 16 | 7.7 | 10.8 | 3,392 | 95 | 411 | 3,216 | 2,982 | 3,105 |
| 17 | 7.2 | 17.0 | 6,406 | 299 | 442 | 2,272 | 2,662 | 5,418 |
| 18 | 7.5 | 11.7 | 3,941 | 103 | 391 | 2,034 | 1,891 | 3,523 |
| 19 | 6.7 | 40.5 | 18,929 | 63 | 453 | 3,111 | 6,027 | 9,001 |
| 20 | 6.7 | .981 | 3,028 | 56 | 764 | 4,973 | 13,647 | 22,996 |
| 21 | 7.4 | 21.9 | 8,399 | 80 | 716 | 4,721 | 3,575 | 5,788 |

Table 4.2 - Selected Chemical Analyses of a Soil Plan (6 to 12 inches) of the Affected Area at the Clearview Site

| Site | pH | EC (mS/cm) | Cl ⁻ (ppm) | SO ₄ ²⁻ (ppm) | Soluble Ca ²⁺ (ppm) | Total Ca ²⁺ (ppm) | Soluble Na ⁺ (ppm) | Total Na ⁺ (ppm) |
|------|-----|---------------|--------------------------|--|--------------------------------------|------------------------------------|-------------------------------------|-----------------------------------|
| 1 | 7.7 | .152 | 11 | 19 | 10 | 179 | 11 | 38 |
| 2 | 7.4 | .559 | 131 | 29 | 69 | 736 | 110 | 180 |
| 3 | 7.6 | 27.1 | 10,675 | 46 | 1,238 | 4,049 | 3,880 | 6,408 |
| 4 | 7.6 | 25.9 | 5,324 | 96 | 2,003 | 6,715 | 4,157 | 7,422 |
| 5 | 7.0 | 42.0 | 4,297 | 58 | 1,824 | 5,567 | 5,349 | 6,710 |
| 6 | 7.7 | 45.2 | 10,002 | 155 | 1,664 | 5,113 | 7,597 | 9,447 |
| 7 | 7.0 | 17.1 | 3,517 | 124 | 1,982 | 6,441 | 2,197 | 2,690 |
| 8 | 7.6 | 14.4 | 2,522 | 81 | 399 | 2,132 | 2,134 | 3,321 |
| 9 | 7.5 | 17 | 2,417 | 2,020 | 4,226 | 15,255 | 2,417 | 4,121 |
| 10 | 7.8 | 5.81 | 844 | 124 | 1,621 | 2,771 | 1,312 | 1,907 |
| 11 | 7.3 | 27.7 | 6,192 | 46 | 367 | 1,931 | 4,327 | 7,652 |
| 12 | 8.0 | 1.04 | 40 | 29 | 1,998 | 3,429 | 164 | 316 |
| 13 | 7.4 | 18.5 | 3,692 | 64 | 2,001 | 5,852 | 2,757 | 4,697 |
| 14 | 7.5 | 6.79 | 221 | 6,265 | 256 | 1,334 | 1,662 | 2,071 |
| 15 | 7.5 | 6.92 | 1,670 | 1,924 | 1,184 | 2,186 | 1,584 | 2,059 |
| 16 | 6.8 | 31.2 | 13,581 | 172 | 786 | 1,978 | 4,660 | 6,023 |
| 17 | 7.3 | 19.4 | 8,166 | 346 | 840 | 1,799 | 2,919 | 5,351 |
| 18 | 7.3 | 18.1 | 7,287 | 82 | 2,129 | 3,035 | 6,027 | 7,953 |
| 19 | 7.3 | 29.7 | 14,066 | 42 | 1,116 | 2,899 | 5,291 | 6,574 |
| 20 | 7.6 | 8.56 | 3,199 | 39 | 712 | 4,115 | 1,628 | 1,992 |
| 21 | 7.3 | 26.3 | 11,348 | 61 | 801 | 4,671 | 4,295 | 7,475 |

Figure 4.1: Ratio of Soil Concentrations to Maximum Concentrations versus Distance From Sample Site 17 (adapted from Pyle, 1996)

Table 4.3 Various Physical Properties of the Clearview Soil.

| Parameter | Soil Sample | |
|---|----------------|---------------------------|
| | Control | Composite |
| Soil Moisture Content (%) | 16.1 ± 0.35 | 14.4 ± 1.5 |
| Bulk Density - In Situ (g/cm ³) | 1.77 | 1.62 |
| Bulk Density - Clod (g/cm ³) | 1.31 ± .01 | 1.50 ± .01 |
| Particle Size Analysis - Hydrometer | Sandy loam | Clay loam |
| Liquid Limit (%) | 21.8 | 25.1 |
| Plastic Limit (%) | 14.7 | 17.4 |
| Plasticity | 7.1 | 7.7 |
| Dispersivity | Not dispersive | ND3 - Slightly dispersive |

Table 4.4 Textural Analysis of the Clearview Soil.

| Parameter | Soil Sample | |
|----------------|-------------|-----------|
| | Control | Composite |
| Clay (%) | 14 | 36 |
| Silt (%) | 31 | 28 |
| Sand (%) | 55 | 36 |
| Classification | Sandy loam | Clay loam |

4.1.2.2 Chemical Properties

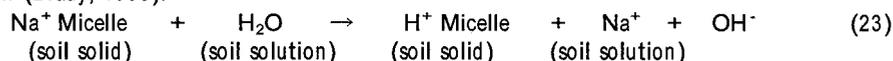
The results of the soluble salts and nutrients analyses are shown in Table 4.5. As expected, concentrations of most constituents typically found in brine were substantially higher in the composite sample than in the control sample. The parameters most significantly influenced by the brine contamination included conductivity, sodium, and chloride concentration.

The negative and positive charges in the soil solution must be equal according to the condition of electroneutrality. The concentrations of soluble cations and soluble anions, in meq/L, were summed for both the control and composite soil samples. The cation-anion charge balance error (CBE) was calculated for each soil sample using the following equation (Cates, 1993):

$$\text{CBE} = \{(\sum \text{Cations} - \sum \text{Anions}) / (\sum \text{Cations} + \sum \text{Anions})\} \times 100. \quad (22)$$

The CBE calculated for the control sample was less than 0.1%; whereas, the CBE calculated for the composite sample was approximately 9%. This slight charge imbalance for the composite sample is probably due to incomplete analysis for all cationic species.

The higher pH value for the composite soil sample can be attributed to the elevated sodium concentrations. The sodium-soil complex (micelle) undergoes hydrolysis according to the following reaction (Brady, 1990):



In turn, the released sodium ions have adverse effects on plant metabolism and nutrient uptake.

Exchangeable cations, cation exchange capacities, exchangeable sodium percentages, and sodium absorption ratios of the soils are shown in Table 4.6. The data suggests that the composite sample is a saline-sodic soil based on the EC and ESP values.

The results of total metals analyses performed on the soils are compared with typical values in Table 4.7. Again, concentrations of alkali and alkaline earth metals are significantly higher in the composite soil due to the brine contamination. Lead and zinc concentrations in the composite soil are higher than average; however, all of the heavy metals concentrations are within the typical ranges outlined by Stout, et. al. (1988).

4.2 Results of FBA Analysis

A sample of the Brazil Creek Minerals FBA was analyzed to determine the lime content, pH, and heavy metals content of the ash. This data was used to determine an optimum application rate for the reclamation of the Clearview site. The results of these analyses are compared to typical ranges as shown in Table 4.8 (Stout, et. al., 1988). The pH of the FBA was 11.9, which was expected due to the large amounts of basic metal oxides present, typically CaO and MgO. It is these metal oxides that make this material suitable as an ideal substitute for agricultural limestone. The lime content in FBA typically ranges from 31 to 100%, averaging 60%, and is expressed as the neutralizing potential of the material compared to an equal amount of ground CaCO₃ or agricultural limestone (Rechcigl, 1995). The FBA used in this study was determined to have a lime content of 55% CaCO₃ equivalency.

Most of the metals of concern in the FBA were determined to be within the typical FBA

Table 4.5 Soluble Cations, Anions, and Nutrient Analysis of the Clearview

Soil.

| Category | Parameter | Clearview Soil | |
|--------------------------|-------------------------------|----------------|-------------|
| | | Control | Composite |
| Soluble Cations (ppm) | pH | 6.6 ± 0.4 | 7.5 ± 0.9 |
| | EC (mS/cm) | 1.95 ± 0.2 | 57.6 ± 4.2 |
| | Na ⁺ | 11 ± 1 | 8,406 ± 607 |
| | Ca ²⁺ | 23 ± 3 | 1,923 ± 152 |
| | K ⁺ | 4.1 ± 0.3 | 8.4 ± 0.3 |
| | Mg ²⁺ | 12.6 ± 0.9 | 483 ± 29 |
| Anions (ppm) | Cl ⁻ | 34.2 | 15,529 |
| | NO ₃ ⁻ | 0.42 | 48.2 |
| | PO ₄ ³⁻ | 0.2 | 0 |
| | SO ₄ ²⁻ | 25.6 | 107 |
| Nutrients* (ppm) | N-NO ₃ | 0 | 65 |
| | P | 27 | 7 |
| | K | 199 | 355 |

* Analyzed by the Oklahoma Cooperative Extension Service

Table 4.6 Exchangeable Cations, CED, ESP, and SAR Analyses of the Clearview Soil.

| Parameter | Soil Sample | |
|--|-------------|------------|
| | Control | Composite |
| Exchangeable Na ⁺ (meq/L) | 2.6 ± 0.3 | 491 ± 9 |
| Exchangeable Ca ²⁺ (meq/L) | 15.6 ± 0.6 | 21.9 ± 0.8 |
| Exchangeable K ⁺ (meq/L) | 41.2 ± 0.2 | 100 ± 1 |
| Exchangeable Mg ²⁺ (meq/L) | 63.4 ± 2 | 19.3 ± 0.6 |
| Cation Exchange Capacity (meq/100g soil) | 79 ± 9 | 495 ± 57 |
| Cation Exchange Capacity (meq/L)* | 94.4 ± 6 | 582 ± 72 |
| Exchangeable Sodium Percentage (%) | 2.1 ± 0.3 | 75.1 ± 0.3 |
| Sodium Adsorption Ratio | 2.6 | 242 |

* Calculated by summation of exchangeable cations.

Table 4.7 Metals Analysis of the Clearview Soil Compared with Typical Ranges for Soils (Stout, et. a., 1988).

| Parameter | Clearview Soil | | Typical Soil | |
|-----------|----------------|----------------|--------------|-----------------|
| | Control | Composite | Average* | Range* |
| Ca (ppm) | 756 ± 54 | 3,209 ± 195 | | |
| Mg (ppm) | 1,177 ± 47 | 3,882 ± 111 | | 100 - 1,500 |
| K (ppm) | 2,056 ± 134 | 5,129 ± 114 | | |
| Na (ppm) | 43.2 ± 1.0 | 9,725 ± 94 | | |
| Al (ppm) | 9,078 ± 722 | 32,375 ± 1,647 | — | 14,000 - 40,000 |
| B (ppm) | 0.5 | 1.93 | 10 | 2 - 100 |
| Cd (ppm) | 0.017 ± 0.008 | 0.085 ± 0.020 | 0.5 | 0.01 - 0.70 |
| Cr (ppm) | 6.64 ± 2.32 | 44.5 ± 3.3 | 200 | 5 - 1,000 |
| Cu (ppm) | 2.17 ± 0.23 | 11.6 ± 0.5 | 20 | 2 - 100 |
| Fe (ppm) | 5,292 ± 220 | 26,434 ± 2,484 | — | 14,000 - 40,000 |
| Mn (ppm) | 87.1 ± 2.2 | 510 ± 68 | 850 | 200 - 3,000 |
| Ni (ppm) | 11.9 ± 1.3 | 28.3 ± 0.8 | 40 | 5 - 500 |
| Pb (ppm) | 3.03 ± 0.19 | 16.7 ± 1.4 | 10 | 2 - 200 |
| Zn (ppm) | 20.7 ± 2.0 | 88.0 ± 11.4 | 50 | 10 - 300 |

* Information from Stout, et. al., 1988.

Table 4.8 Comparison of Results of Total Metals Analysis of Brazil Creek Minerals FBA to Typical FBA Values (Stout, et. al., 1988).

| Parameter | FBA | | |
|--|-----------------|----------|-------------------|
| | Brazil Creek | Average* | Range* |
| pH | 11.9 ± 0.1 | | |
| EC (mS/cm) | 27.2 ± 0.9 | | |
| Lime Content (% CaCO ₃ equiv.) | 55 ± 3 | | |
| Ca (ppm) | 272,620 ± 4,904 | 380,000 | 240,000 - 460,000 |
| Mg (ppm) | 13,085 ± 468 | 7,100 | 5,000 - 12,000 |
| K (ppm) | 3,373 ± 153 | 2,500 | 500 - 8,000 |
| Na (ppm) | 491 ± 9 | | |
| Al (ppm) | 20,578 ± 863 | 10,000 | 4,000 - 20,000 |
| B (ppm) | 0.13 | 110 | 95 - 170 |
| Cd (ppm) | 0.17 ± 0.01 | 0.5 | — |
| Cr (ppm) | 44.2 ± 4.2 | 15 | 9 - 23 |
| Cu (ppm) | 19.1 ± 0.8 | 15 | 12 - 19 |
| Fe (ppm) | 55,423 ± 3,809 | 11,000 | 800 - 16,000 |
| Mn (ppm) | 580 ± 15 | 485 | 210 - 685 |
| Ni (ppm) | 39.1 ± 1.4 | 21 | 13 - 29 |
| Pb (ppm) | 24.3 ± 2.0 | 3.2 | 1.5 - 7.5 |
| Zn (ppm) | 62.7 ± 4.0 | 55 | 29 - 105 |

* Information from Stout, et. al., 1988.

ranges presented in Table 4.8. However, chromium, nickel, and lead were slightly higher than expected; therefore, these metals were analyzed in all extracts obtained from the leach study.

4.3 Application Rates

Recommended application rates for the composite soil sample were determined for each of the proposed amendments (i.e. gypsum, turkey litter, FBA, and sulfur) based on the results of series of batch studies and literature values.

Gypsum

The composite soil sample contained high concentrations of sodium, which had to be addressed for the reclamation strategy. The conventional reclamation practice for the removal of sodium from soil is by leaching. Gypsum is the most common soil amendment for removing sodium from soil particles via the cation exchange mechanism.

The amount of gypsum required is dependent on both the soil texture and the exchangeable sodium percentage. Based on the information in the Oklahoma State Extension Service Fact Sheet No. 2226, gypsum should be added to the Clearview soil at an application rate of 18 tons per acre. However, it should be added in two or more applications of no more than 10 tons (OSCEC < 1995). The application rate used in the laboratory portion of this study was 9 tons per acre as suggested by the manufacturer.

Turkey Litter

Organic matter was used as an amendment because of its influence on physical properties of the soil. The incorporation of 20 to 30 tons per acre of organic matter into the plow layer creates large pores or channels for water to enter the soil (OSCES, 1995). This promotes soil aggregation, improving soil infiltration and tilth characteristics of the soil.

Turkey litter was used as the source of organic matter because of its nutrient content and availability. The type of litter used was a broiler litter, which consisted of bedding (hay, wood shavings, etc.) and manure. At 30% moisture content, the broiler litter contained the following; 56 pounds N per ton, 48 pounds P₂O₅ per ton, and 36 pounds K₂ per ton, as provided by the distributor. Because the Clearview soil was in such poor physical condition, turkey litter was added at an application rate of 2230 tons per acre as suggested by Ray Rydlin of the Oklahoma State Cooperative Extension Service.

FBA

Several batch studies were set up to determine the recommended application rate for FBA. Optimum rates were determined primarily by the effects FBA had on the soil pH.

For the first batch study, FBA was applied at varying application rates and no additional amendments were added. The increase in pH was directly related to the amount of FBA added (Figure 4.2). All batches resulted in pH values above the range of 6.5. to 7.2, which is optimum for plant growth. This was expected due to the alkaline nature of FBA.

The second batch study used soil with gypsum and turkey litter added at an application rates of 5 tons/acre. Results from the previous batches indicated that FBA added at an application rate of 1.0% by weight resulted in a pH greater than 10 for the composite soil; therefore, it was

Figure 4.2 - Effects of FBA on Soil pH (adapted from Pyle, 1996)

eliminated from this batch study. The pH was measured until it reached an appropriate value for plant growth (i.e., approximately 7). It is important to note the immediate effects the varying application rates have on the pH. As shown in Figure 4.3, the pH of the soil mixture with 0.1% FBA was approximately 7.6; remaining in an appropriate range for plant growth. However, the soil mixture containing 0.5% FBA had an initial pH greater than 8. The batches consisting of 0.1% FBA reached an acceptable pH level in approximately 8 days (Figure 4.4). After 17 days, the pH of the 0.5% FBA batch was still above 7.5. Based on the results of these batch studies, the suitable application rate for FBA was determined to be 0.1% by weight, or approximately 1 ton/acre.

The heavy metals loading was calculated by multiplying the concentration of each heavy metal determined, to obtain a total loading. Table 4.9 compares the FBA heavy metals loading to that recommended for sewage sludge (Stout, et. al., 1988).

Sulfur

A batch study was used to determine the application rate of sulfur. The recommended application rates for gypsum, turkey litter, and FBA were added to soil. Sulfur dust was added at the following application rates: 1 ton/acre, 5 tons/acre, and 10 tons/acre. The pH of the batches that were measured until the pH reached 7.5 (Figure 4.5). All three-application rates required followed the same general trend, taking 24 days to reach this final pH. The reason for this delay was that 1% FBA was used instead of 0.1% FBA to demonstrate a worst-case scenario which might be encountered in the field application due to "hot spots". Based on the results in Figure 4.5, a sulfur application rate of 1 ton/acre was deemed adequate to decrease the pH to an acceptable range.

4.4 Leach Studies

As shown in the batch studies, FBA has a considerable effect on soil pH. The FBA is primarily composed of hydrolyzable metal oxides, which react immediately upon wetting. The addition of sulfur has proven to be a successful pH adjuster; however, based on the batch studies the reaction is slow, taking approximately one week to counteract the pH increase. Therefore, of the data collected in the leach study, the results from the first extract are the most important.

Of equal significance is the possibility of heavy metals leaching from the amended site into adjacent water bodies. Alabama Creek is listed by the Oklahoma Water Resources Board as a warm water aquatic community (WWAC); therefore, the heavy metals concentrations must conform to certain criteria as outlined in the water quality standards (OWRB, 1995). The metals concentrations used in the calculation of total heavy metals loading (i.e. Cd, Cr, Cu, Ni, Pb, and Zn) were determined from the extract solutions and compared to these criteria (Table 4.10).

The criteria for the heavy metals of concern were dependent on total hardness. The total hardness was estimated from the calcium and magnesium concentration in the first extract of the composite soil with all amendments, and then used to calculate the acute and chronic water criteria for warm water aquatic communities (Table 4.10).

The pH of the first extract from the composite soil containing all amendments was determined to be 6.88, which was lower than expected. It was anticipated that FBA would have a more significant effect on pH, especially in the first extract.

All of the heavy metal concentrations analyzed were below the calculated acute values for WWAC, but Cd, Cr, Cu, and Pb did not conform to the chronic values calculated. However, it is

Figure 4.3 - Effects of FBA on pH of Soil Amended with Gypsum and Turkey Litter (adapted from Pyle, 1996)

**Figure 4.4 - Effects of FBA on pH of Soil Amended with Gypsum and Turkey Litter and Sulfur
(adapted from Pyle, 1996)**

Table 4.9 Comparison of Heavy Metals Loading with Maximum Loadings for Sewage Sludge (Stout, et. al., 1988).

| Metal | Heavy Metal Loading in Soil (pounds/A) | Heavy Metal Loading in FBA (pounds/A) | Total Heavy Metal Loading (pounds/A) | Maximum Loadings for Sewage Sludge (pounds/A)* |
|--------------|---|--|---|---|
| Cd | 0.17 | 0.00034 | 0.17 | 4.5 |
| Zn | 179 | 0.125 | 179 | 300 |
| Cu | 23.6 | 0.038 | 23.64 | 150 |
| Ni | 65.8 | 0.078 | 57.75 | 60 |
| Pb | 34.0 | 0.048 | 34.05 | 600 |
| Cr | 90.7 | 0.088 | 90.79 | 600 |

* Information from Stout, et. al., 1988.

* (Stout, et. al., 1988)

**Figure 4.5 - Effects of Sulfur on pH of Soil Amended with FBA, Gypsum and Turkey Litter
(adapted from Pyle, 1996)**

Table 4.10 Comparison of Heavy Metal Concentrations Found in the First Extract of the Leach Study with Warm Water Aquatic Community (WWAC) Criteria as Determined by the Oklahoma Water Resources Board (OWRB, 1995).

| Parameter | Composite All Amendments | Acute Criteria (ppm) | Chronic Criteria (ppm) |
|------------------|---------------------------------|-----------------------------|-------------------------------|
| pH | 6.88 | NA | NA |
| Cd | <0.05 | 0.11 | 0.003 |
| Cr | <0.5 | — | 0.05 |
| Cu | 0.07 | 0.07 | 0.04 |
| Ni | <0.1 | 4.10 | 0.46 |
| Pb | <0.1 | 0.4 | 0.02 |
| Zn | 0.06 | 0.34 | 0.31 |

important to note that these values are enforced for Alabama Creek and the extract values were calculated for the soil solution at the Clearview site. It is assumed that the concentrations of these metals would decrease by the time they migrated to Alabama Creek.

4.5 Revegetation

Re-establishment of vegetation at the study site can be evaluated by comparing aerial photographs before (Figure 4.6) and after (Figure 4.7) implementation of the remediation plan (note that both figures are to the same scale). The white areas in Figure 4.6 are indicative of zones of no vegetative cover and/or accelerated soil erosion due to the effects of oilfield brine. The white areas in Figure 4.6 were treated during implementation of the remediation plan. The white areas in Figure 4.7, which are significantly smaller than in Figure 4.6, indicate zones where the remediation activities were not able to re-establish vegetative cover. The denuded soil areas are outlined on each photograph. The difference in white area after and before treatment corresponds to land area successfully revegetated (reclaimed). Thus, this project was very successful at reclaiming denuded land; one of the stated goals of this project.

Qualitatively, the post-implementation photograph shows an obvious improvement in terms of vegetative cover. Comparing the two photographs, it can be conservatively estimated that at least 750 percent of the impacted soils were effectively re-vegetated.

A more quantitative estimate of the degree of revegetation was developed by actually measuring the outlined areas on both photographs and comparing the difference. The outlined areas were measured using a planimeter. The measurements showed that the denuded area depicted in Figure 4.6 is reduced by more than 75% as shown in Figure 4.7.

4.6 Water Quality

4.6.1. Introduction

One of the stated goals for this project was a reduction in the NPS pollutant discharge from the site. The proposed measure of attainment for that goal was a 70% reduction in the concentrations of pollutants leaving site. The specific pollutants identified in the Work Plan included chloride, sulfate, chromium, arsenic, lead, and barium.

The surface water monitoring plan was designed to assess changes in water quality both before and after implementation of the remediation plan. Monitoring stations 2T (upstream) and 1G (downstream) are situated to assess the impacts of the study area on the water quality in Clearview Creek. Monitoring stations 3U (upstream of the confluence) and 4R (downstream of the confluence) are situated to assess water quality impacts of Clearview Creek on Alabama Creek.

Considering the geographic locations of the monitoring stations relative to one another (Figure 4.8), a generic model for the water quality data can be formulated. Prior to implementation of the remediation plan, the impacted area would definitely be expected to contribute excessive loads of brine-related constituents (e.g., chloride, sodium, calcium, magnesium) to waters flowing down Clearview Creek. Constituent concentrations should be significantly higher at monitoring station 1G than at monitoring station 2T. Moreover, the concentrations of these brine-related constituents should decrease, due to dilution, as the water flows downstream toward the confluence with Alabama Creek. The upstream reaches of Alabama Creek are not affected by discharges of oilfield brine or runoff from brine-impacted areas; hence, the concentrations of brine-related

Figure 4.6 Aerial Photograph of Clearview Site Prior to Remediation Activities

Figure 4.7 Aerial Photograph of Clearview Site After Remediation

Figure 4.8 - Schematic Diagram of Clearview Site Water Quality Model

constituents at monitoring station 3U would be expected to be significantly lower than those at 1G. The concentrations at monitoring station 4R should also be lower than those at 1G due to dilution.

The conceptual water quality model described above would also apply immediately after implementation of the remediation plan. However, the concentrations of certain soluble salts (e.g., sodium) at monitoring station 1G should actually increase immediately after remediation. The concentrations at 1G would decrease over time as the excess salts in the soils of the study area are flushed out. Soluble constituents related to the specific soil amendments should also increase immediately after remediation, then decrease over time. Assuming the remediation plan to be effective, concentrations of the brine constituents at the downstream monitoring stations (1G and 4R) would be expected to eventually fall below their pre-remediation levels.

Remediation activities were initiated during June of 1995 and were completed in August of 1995. The pre-implementation monitoring period includes all samples taken before September of 1995. The post-implementation period includes all samples taken after August of 1995.

4.6.2 Pre-Implementation Monitoring

The data in Table 4.11 indicate a definite trend of increased electrical conductivity (EC) of water discharging from the Clearview site. According to the average values shown in Table 4.11, the EC at Site 1G was 40 times greater than the control site located upstream of the affected area (2T).

The extreme increase is related to the high concentrations of soluble salts found in the soils of the study area. However, the impacted area had only a slight effect on the EC values of Alabama Creek. This could be due to dilution from seepage prior to the confluence of the two creeks, and due to the higher rate of flow of Alabama Creek relative to Clearview Creek.

Sodium and chloride analyses also indicate increases in concentrations between upstream and downstream locations on both Clearview and Alabama Creeks (Tables 4.12 and 4.13). Increases in sodium and chloride were more pronounced during extended periods with little to no precipitation. The sodium concentration at the downstream site (1G) was 100 times greater than that found at the upstream site (2T). Chloride exhibited a similar trend, with lower overall increases in concentrations during rainy seasons. As expected, these two parameters showed the greatest impact due to their abundance in brine.

Total suspended solids (TSS) concentrations were most pronounced for 1G (Table 4.14). These high TSS values indicate high sediment loadings during runoff events. During rainfall events, the saline-sodic soils in the affected area disperse quite readily, resulting in these high sediment loadings. The particles washed into Clearview Creek also contributed to the high TSS values found downstream in Alabama Creek.

4.6.3. Post-Implementation Monitoring

The water quality data for the four monitoring stations are plotted in Figures 4.9 through 4.16. The time varying concentrations are plotted for each of the NPS parameters, except lead and chromium which did not show concentrations above detection limits, plus four additional brine related constituents; calcium, magnesium, sodium, and potassium. The graphs for Clearview Creek show water quality data for monitoring stations 1G and 2T. The graphs for Alabama Creek show water quality data for monitoring stations 3U and 4R. The water quality data analytical results are included in

Table 4.11 Conductivity Data for Water Samples Collected at Clearview and Alabama Creeks.

| Date | Conductivity (mS/cm) | | | | | |
|-----------|----------------------|------------|-------|---------------|------------|-------|
| | Clearview Creek | | | Alabama Creek | | |
| | Upstream | Downstream | Ratio | Upstream | Downstream | Ratio |
| 95-01-20 | 0.088 | 0.644 | 7.3 | 0.254 | 0.261 | 1.0 |
| 95-01-27* | 0.066 | 0.428 | 6.5 | 0.112 | 0.159 | 1.4 |
| 95-02-02 | 0.098 | 0.841 | 8.6 | 0.175 | 0.235 | 1.3 |
| 95-03-15* | 0.075 | 0.417 | 5.6 | 0.119 | 0.171 | 1.4 |
| 95-03-22 | 0.134 | 0.807 | 6.0 | 0.223 | 0.298 | 1.3 |
| 95-04-28 | 0.123 | 0.652 | 5.3 | 0.133 | 0.162 | 1.2 |
| 95-05-01* | 0.061 | 0.249 | 4.1 | 0.136 | 0.158 | 1.2 |
| 95-05-19 | 0.188 | 1.234 | 6.6 | 0.250 | 0.321 | 1.3 |
| 95-05-24* | 0.071 | 0.410 | 5.8 | 0.120 | 0.142 | 1.2 |
| 95-06-16 | 0.168 | 0.87 | 5.2 | 0.198 | 0.245 | 1.2 |
| 95-07-18 | 0.336 | no flow | – | 0.621 | 0.659 | 1.1 |
| 95-08-14 | 0.168 | no flow | – | 0.515 | 0.865 | 1.7 |
| 95-09-17 | no flow | 2.33 | – | 0.561 | 2.13 | 3.8 |
| 95-10-05 | 0.133 | 2.66 | 20 | 0.407 | 0.830 | 2.0 |
| 96-01-25 | 0.185 | 8.67 | 47 | 0.398 | 0.430 | 1.1 |
| 96-02-22 | 0.206 | no flow | – | 0.463 | 0.627 | 1.4 |
| 96-03-30 | 0.110 | 1.83 | 17 | 0.332 | 0.460 | 1.4 |
| 96-04-13 | 0.167 | 5.88 | 35 | 0.432 | 0.470 | 1.1 |
| Average | 0.140 | 4.274 | 13 | 0.303 | 0.479 | 1.5 |
| Std Dev | 0.069 | 2.760 | 13 | 0.167 | 0.472 | 0.6 |

* Indicates high-flow events.

Table 4.12 Sodium Concentrations (ppm) Determined in Water Samples Collected at Clearview and Alabama Creeks.

| Date | Sodium (ppm) | | | | | |
|-----------|-----------------|------------|-------|---------------|------------|-------|
| | Clearview Creek | | | Alabama Creek | | |
| | Upstream | Downstream | Ratio | Upstream | Downstream | Ratio |
| 95-01-20 | 5.8 | 76.7 | 13 | 19.6 | 26.9 | 1.4 |
| 95-03-15* | 3.6 | 26.2 | 7 | 12.6 | 20.6 | 1.6 |
| 95-03-22 | 8.1 | 94.9 | 12 | 15.8 | 26.0 | 1.6 |
| 95-04-28 | 8.1 | 75.5 | 9 | 12.4 | 19.9 | 1.6 |
| 95-05-01* | 1.8 | 35.8 | 20 | 9.5 | 13.4 | 1.4 |
| 95-05-19 | 1.9 | 158.4 | 83 | 18.5 | 22.5 | 1.2 |
| 95-05-24* | 1.8 | 197.7 | 110 | 12.0 | 81.4 | 6.8 |
| 95-06-16 | 1.7 | 99.9 | 59 | 12.4 | 18.2 | 1.5 |
| 95-07-18 | 2.3 | no flow | - | 51.9 | 63.6 | 1.2 |
| 95-08-14 | 2.7 | no flow | - | 41.8 | 95.4 | 2.3 |
| 95-09-17 | <D.L. | 886.9 | - | 58.1 | 289.9 | 4.9 |
| 95-10-05 | 7.4 | 374.1 | 51 | 26.9 | 104.9 | 3.9 |
| Average | 3.8 | 203 | 41 | 24.3 | 65 | 2.5 |
| Std Dev | 2.8 | 260 | 37 | 16.9 | 77 | 1.8 |

* Indicates high-flow events.

Table 4.13 Chloride Concentrations (ppm) Determined in Water Samples Collected at Clearview and Alabama Creeks.

| Date | Chloride (ppm) | | | | | |
|-----------|-----------------|------------|-------|---------------|------------|-------|
| | Clearview Creek | | | Alabama Creek | | |
| | Upstream | Downstream | Ratio | Upstream | Downstream | Ratio |
| 95-01-20 | 5.6 | 330.4 | 59 | 33.6 | 45.0 | 1.3 |
| 95-01-27* | 3.2 | 170.8 | 53 | 16.6 | 29.8 | 1.8 |
| 95-02-02 | 6.1 | 223.4 | 37 | 13.1 | 34.4 | 2.6 |
| 95-03-15* | 2.2 | 32.5 | 15 | 20.3 | 27.5 | 1.4 |
| 95-03-22 | 7.9 | 183.6 | 23 | 23.6 | 42.8 | 1.8 |
| 95-04-28 | 7.7 | 137.1 | 18 | 11.7 | 29.7 | 2.5 |
| 95-05-01* | 3.4 | 69.4 | 20 | 10.2 | 19.3 | 1.9 |
| 95-05-19 | 11.5 | 295.7 | 26 | 25.4 | 40.7 | 1.6 |
| 95-05-24* | 2.7 | 301.6 | 112 | 13.6 | 139.5 | 10 |
| 95-06-16 | 9.8 | 202.2 | 21 | 24.8 | 285.8 | 12 |
| 95-07-18 | 31.6 | no flow | – | 84.5 | 94.3 | 1.1 |
| 95-08-14 | 4.1 | no flow | – | 68.2 | 173.6 | 2.5 |
| 95-09-17 | no flow | 2,221.6 | – | 78.9 | 584.5 | 7.4 |
| 95-10-05 | 4.5 | 812.5 | 181 | 40.5 | 195.5 | 4.8 |
| 96-01-25 | 6.6 | 3,070.4 | 465 | 29.9 | 46.7 | 1.6 |
| 96-02-22 | 5.8 | no flow | – | 37.4 | 81.9 | 2.2 |
| 96-03-30 | 3.3 | 460.3 | 139 | 32.5 | 66.2 | 2.0 |
| 96-04-13 | 3.9 | 761.9 | 195 | 42.2 | 53.5 | 1.3 |
| Average | 7.05 | 618 | 97 | 33.7 | 111 | 3.3 |
| Std Dev | 6.82 | 868 | 123 | 22.4 | 138 | |

* Indicates high-flow events.

Table 4.14 Total Suspended Solids (ppm) in Water Samples Collected at Clearview and Alabama Creeks.

| Date | Total Suspended Solids (ppm) | | | | | |
|-----------|------------------------------|------------|-------|---------------|------------|-------|
| | Clearview Creek | | | Alabama Creek | | |
| | Upstream | Downstream | Ratio | Upstream | Downstream | Ratio |
| 95-03-15* | 495 | 8,970 | 18 | 875 | 1,650 | 1.9 |
| 95-03-22 | 11 | 93 | 8.5 | 11 | 21 | 1.9 |
| 95-04-28 | 9 | 24 | 2.7 | 25 | 3 | 0.1 |
| 95-05-01* | 22 | 22 | 1.0 | 38 | 33 | 0.9 |
| 95-05-19 | 5 | 8 | 1.6 | 13 | 3 | 0.2 |
| 95-05-24* | 17 | 18,600 | 1,094 | 1,240 | 6,280 | 5.1 |
| 95-06-16 | 4 | 1 | 0.3 | 4 | 16 | 4.0 |
| 95-07-18 | 6 | no flow | - | 21 | 4 | 0.2 |
| 95-08-14 | 50 | no flow | - | 51 | 51 | 1.0 |
| 95-09-17 | no flow | 7 | - | 46 | 39 | 0.8 |
| 95-10-05 | 35 | 37 | 1.1 | 14 | 40 | 2.9 |
| 96-01-25 | 8.3 | 60 | 7.2 | 22 | 28.3 | 1.3 |
| 96-02-22 | 66.7 | no flow | - | 15 | 30 | 2.0 |
| 96-03-30 | 7.7 | 50 | 6.5 | 52 | 43 | 0.8 |
| 96-04-13 | 9.8 | 36 | 3.7 | 17 | 19 | 1.1 |
| Average | 53.5 | 2,325 | 104 | 163 | 551 | 1.6 |
| Std Dev | 128 | 5,733 | 328 | 369 | 1,639 | 1.4 |

* Indicates high-flow events.

included in Appendix CB.

Impacts of the remediation plan on the water quality of either Clearview Creek or Alabama Creek are not readily discernible for the post-implementation monitoring data. Certain parameters do appear to show a slight increase in concentration immediately following implementation of the remediation plan; as expected since the amendments will leach certain constituents. However, the surge in concentration is relatively short-lived and the latter concentrations seem to remain elevated above the pre-implementation values. For most parameters the latter time data are near or below the water quality standards, as discussed below. The monitoring results for some of the other NPS parameters are contrary to the water quality model described above. Finally, some of the parameters exhibit anomalous behavior that could only be attributed to analytical variability. The results for each parameter are discussed individually below.

4.6.3.1. NPS Parameters

Lead and Chromium

All of the analytical results for lead and chromium were less than their detection limits. Although no comparative analysis can be developed, the data do indicate there is no discernible impact of the soil amendments used in the remediation plan on lead or chromium levels in surface waters flowing through the area of interest.

Chloride

The post-implementation monitoring results for chloride are depicted in Figure 4.9. For Clearview Creek (Figure 4.9a), the concentration of chloride is much higher at the downstream location (1G) than the upstream location (2T). Moreover, the chloride concentration does increase immediately following implementation of the remediation plan; however, the surge in concentration is relatively short-lived and the latter concentrations seem to approach but remain elevated above the pre-implementation values. The chloride data for Alabama Creek (Figure 4.9b) show a similar pattern, although dampened in magnitude. It is important to note that the concentration of chloride in Alabama Creek only exceeds the water quality criteria for one sampling episode immediately following implementation of the remediation plan, as depicted on Figure 4.9b.

Sulfate

The post-implementation monitoring results for sulfate are depicted in Figure 4.10. For Clearview Creek (Figure 4.10a), the concentration of sulfate is higher at the downstream location (1G) than the upstream location (2T). There appears to be a slight increase in sulfate concentration immediately following implementation of the remediation plan, which could possibly be attributed to the sulfur dust used for remediation. However, data for some of the later sampling episodes show even higher sulfate concentrations, which is contrary to the water quality model proposed for the remediated site, i.e., decreasing concentrations over the long term. The elevated concentrations of sulfate during the later sampling episodes might be the result of slow release of sulfate from the sulfur dust used for remediation. Laboratory studies to evaluate leaching of sulfate from the amended soils over time were not conducted.

The increase in the post-implementation sulfate concentrations is more evident for Alabama

Creek (4.10b); however, the concentrations contradict the water quality model proposed for the watershed. The sulfate concentrations in Alabama Creek upstream of the confluence (3U) are higher than the concentrations downstream of the confluence (4R). The elevated sulfate concentrations could be due to activities upstream of the confluence. These results indicate that sulfate cannot be

Figure 4.9a Chloride Concentrations in Clearview Creek

Figure 4.9b Chloride Concentrations in Alabama Creek

Figure 4.10a Sulfate Concentrations in Clearview Creek

Figure 4.10b Sulfate Concentrations in Alabama Creek

Creek (4.10b); however, the concentrations contradict the water quality model proposed for the watershed. The sulfate concentrations in Alabama Creek upstream of the confluence (3U) are higher than the concentrations downstream of the confluence (4R). The elevated sulfate concentrations could be due to activities upstream of the confluence. These results indicate that sulfate cannot be used for assessing water quality impacts due to the remediation plan implemented at the study site. However, all sulfate concentrations are well below the water quality standards, rendering the results inconsequential for this particular site.

Arsenic

The post-implementation monitoring results for arsenic are depicted in Figure 4.11. The arsenic concentrations in Clearview Creek (Figure 4.11a) are highly variable. On at least two occasions, the upstream concentrations actually exceed the downstream concentrations. The arsenic concentrations in Alabama Creek (Figure 4.11b) exhibit similar behavior, with the upstream concentrations actually exceeding the downstream concentrations on more than one occasion. None of the sample results from Alabama Creek exceed the numerical criteria for acute toxicity (0.036 mg/l) or chronic toxicity (0.019 mg/l) for arsenic, rendering the concentration trends inconsequential.

Barium

The post-implementation monitoring results for barium are depicted in Figure 4.12. The limited number of barium samples from Clearview Creek (Figure 4.12a) show wide variability. There is no discernible increase in barium concentrations after implementation of the remediation plan. The barium concentrations in Alabama Creek (Figure 4.12b) also show wide variability. The upstream concentrations exceed the downstream concentrations on more than one occasion which is contrary to the water quality model proposed for the watershed, but may be due simply to normal analytical variability.

4.6.3.2. Brine Parameters

Calcium

The post-implementation monitoring results for calcium are depicted in Figure 4.13. For Clearview Creek (Figure 4.13a), the concentration of calcium is much higher at the downstream location (1G) than the upstream location (2T). There also appears to be an increase in concentration immediately following implementation of the remediation plan; however, there are some inexplicable spikes in the downstream calcium concentration in the early part of 1996. In addition, the spikes in calcium concentration at the downstream location do not necessarily coincide with increased levels of calcium at the downstream monitoring station on Alabama Creek (Figure 4.13b). The calcium concentrations in Alabama Creek show an increase immediately after implementation of the remediation plan, followed by a general decreasing trend. This pattern would seem to indicate that the excess soluble salts were flushed from the impacted soils due to the remediation plan.

Magnesium

The post-implementation monitoring results for magnesium are depicted in Figure 4.14. The

magnesium concentrations for both creeks appear relatively steady until the resumption of sampling in early 1996. It is important to note the dramatic increase in concentration of magnesium starting in 1996. This is most probably attributable to analytical variability. All personnel involved with the project were replaced during the three month period (October 1995 to January 1996) between sampling events, which probably contributed to variations in analytical and reporting procedures. The dramatic increase in magnesium concentrations at all four sampling stations coincides with the

Figure 4.11a Arsenic Concentrations in Clearview Creek

Figure 4.11b Arsenic Concentrations in Alabama Creek

Figure 4.12a Barium Concentrations in Clearview Creek

Figure 4.12b Barium Concentrations in Alabama Creek

Figure 4.13a Calcium Concentrations in Clearview Creek

Figure 4.13b Calcium Concentrations in Alabama Creek

74

Figure 4.14a Magnesium Concentrations in Clearview Creek

75

Figure 4.14b Magnesium Concentrations in Alabama Creek

magnesium concentrations for both creeks appear relatively steady until the resumption of sampling in early 1996. It is important to note the dramatic increase in concentration of magnesium starting in 1996. This is most probably attributable to analytical variability. All personnel involved with the project were replaced during the three month period (October 1995 to January 1996) between sampling events, which probably contributed to variations in analytical and reporting procedures. The dramatic increase in magnesium concentrations at all four sampling stations coincides with the change in project personnel. The underlying cause for the dramatic change in sample results (e.g., change in sampling procedures) is not known.

The elevated concentrations of magnesium might be the result of delayed flushing due to the soil amendments used for remediation. However, laboratory studies to evaluate leaching of magnesium from the amended soils over time were not conducted.

Sodium

The post-implementation monitoring results for sodium are depicted in Figure 4.15. For Clearview Creek (Figure 4.15a), the concentration of sodium is much higher at the downstream location (1G) than the upstream location (2T). There is also a dramatic increase in sodium concentration immediately following implementation of the remediation plan. Similar patterns are exhibited for the monitoring data from Alabama Creek (Figure 4.15b). These trends seem to indicate that the soluble salts were flushed from the impacted soils due to implementation of the remediation plan.

Potassium

The post-implementation monitoring results for potassium are depicted in Figure 4.16. The potassium concentrations for Clearview Creek (Figure 4.16a) appear to increase steadily after implementation of the remediation plan; however, the elevated concentrations through 1996 may be attributable to analytical variability as discussed above. The potassium concentrations for Alabama Creek (Figure 4.16b) appear to show a pattern of slight increase after the remediation plan was implemented; however, the extreme jump in concentrations in 1996 are inconsistent with the water quality model proposed for the watershed.

4.6.4 Summary

The water quality data presented above do not consistently show discernible impacts of the remediation plan. Although some parameters do appear to show slight increases in concentration immediately following implementation of the remediation plan, the increases are relatively short-lived and some of the latter concentrations seem to remain elevated above the pre-implementation values. However, the latter time data for most parameters are near or below the water quality standards developed for Alabama Creek, rendering any trends or changes in concentration inconsequential. The stated goal of a 70% reduction in NPS pollutants is really not applicable does not make sense given that the post-implementation concentrations are below water quality standards.

Figure 4.15a Sodium Concentrations in Clearview Creek

Figure 4.15b Sodium Concentrations in Alabama Creek

Figure 4.16a Potassium Concentrations in Clearview Creek

Figure 4.16b Potassium Concentrations in Alabama Creek

5.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

This project involved laboratory and field investigations of an innovative technology for treating brine impacted soils and waters. Fly ash, a byproduct of coal combustion, is generally considered to be a waste material. However, this study proposed to demonstrate that the calcium contained in fly ash can be used as a soil amendment to better flush accumulated salts from brine-impacted soils.

In order to demonstrate the viability of the proposed technology, a field demonstration site was selected. The demonstration site had been heavily impacted by oilfield brine that had been released due to line leaks and spills. Surface soils were devoid of vegetation and were highly eroded. The accelerated erosion rates had resulted in a scarred landscape and increased accumulations of sediments in surface watercourses.

The physical features of the field demonstration site were characterized through surveillance and surveying activities. Subsequent soil sampling and analysis was used to characterize the spatial distribution of accumulated salts throughout the study area. A site sampling plan was implemented to retrieve soils for laboratory testing.

Laboratory batch and leaching studies were used to develop design parameters for the field demonstration study. Various combinations and loading rates for the soil amendments were tested using brine-impacted soils from the demonstration site.

Field scale application rates for the soil amendments were specified as a result of the laboratory studies. The innovative remediation technology was implemented by re-shaping the land features, incorporating the soil amendments at the specified application rates, and re-seeding the site using salt tolerant Bermuda grass. The performance of the technology was assessed by conducting monthly sampling episodes for one year after implementation. Surface water samples were retrieved and analyzed for chemical constituents of brine and the soil amendments. The concentrations of these constituents over time were studied to assess the long term and short term impacts of the remediation technology.

Best management practices (BMP's), including installation of hay bales for erosion control, spot re-seeding to establish vegetative cover, and a one-year livestock exclusion agreement, were conducted after implementation of the innovative remediation technology. Additional soil stabilization techniques were implemented at the site after at the conclusion of monitoring activities associated with this project.

5.2 Conclusions and Recommendations

From the information presented previously above, a series of conclusions and recommendations can be developed.

5.2.1 Participation and Cooperation

A critical aspect of this project was the participation and cooperation of community leaders, local conservation service staff members, and political office-holders. These efforts were especially notable at the Clearview site due to the complexity of the land ownership patterns and the number of potentially affected parties. The local citizens even agreed to a one-year livestock exclusion from

the site. Only a committed populace could have reached a consensus and allowed the study to proceed.

5.2.2 Laboratory Studies

Laboratory investigations, using site specific media, are essential for successful design and field implementation of this technology. The soil batch studies, used for testing various loading rates of each of the proposed soil amendments, were able to accurately reflect conditions that would result from field applications of the technology. Identification of the changes in soil pH, and measures to control those changes, were especially critical.

5.2.3 Remediation Goals

The goals developed for this study were not totally in concert with the technical objectives of the proposed remediation technology. Moreover, the blanket statements contained in the goals and their associated measures of attainment were presumptuous given the untested status of the proposed remediation technology. The shortcomings of the project goals are discussed individually below.

Goal 1: Reduction of NPS pollutant discharge from site.
Measure: 70% reduction in concentration of pollutants leaving site.

This goal and proposed performance measure conflict with the technical objectives of the remediation technology. The remediation technology is actually designed to cause a dramatic, short-term increase in the concentrations of brine-related parameters, including chloride, leaving the site. The long term objective would be to reduce the concentrations of brine related parameters exiting the site. Hence, a time frame Time frames associated with the performance measure needs to be specified.

More importantly, most of the NPS pollutants delineated in the Work Plan are constituents associated with the various soil amendments proposed to be used at the study site. The concentrations of these parameters in nearby surface waters are expected to increase above background levels after implementation of the remediation technology. It is desirable to minimize the mass flux of these constituents from the site, but it is counterintuitive to expect neither a short term or long term decreases in their concentrations relative to the background (i.e., pre-implementation) concentrations should be expected.

An inherent goal for any remediation project is to achieve prescribed water quality standards. As evidenced by the post-implementation monitoring data, most of the concentrations in Alabama Creek are below the water quality standards. It is not cost-effective to propose ludicrous to propose reducing the concentrations of the constituents that do not pose a water quality problem.

Additional monitoring during an extended post-implementation period would no doubt have shown water quality improvements in Clearview Creek. Over the years, the remediated site would become more stabilized, as the purged contaminants are transported downstream, and the vegetative cover becomes firmly re-established. Experience with similar remediated sites has shown that surface water quality parameters tend to stabilize after 3 to 5 years.

A better and substitute measure of success for in-stream conditions might be attained from

physical and biological assessments. Annual physical evaluations could measure changes and improvements in habitat. Over time, we would expect to see marked improvements in the fish and macro invertebrate community. These improvements could be documented with bio-assessment and/or bioassay studies. Sites such as this, that have high toxicity potentials, should be automatic candidates for bioassay work. All of these methods could be used to show improvements over a longer time frame or extended post implementation period.

At the close of this project, the Okfuskee and Okmulgee County Conservation Districts, the Natural Resource Conservation Service, the Oklahoma Conservation Commission, and the University of Oklahoma are all still involved in addressing some of the problems at the site. All parties involved remain interested and determined to stabilize this project and show it a success.

Goal 2: Stabilization and re-vegetation of site.
Measure: Photographic and standard ecological measures of vegetation pattern and coverage.

Several different photographic measures can be used to document attainment of the stated goal. As discussed earlier (Section 4.5), comparing pre- and post-implementation aerial photographs shows that the denuded acreage at the site decreased by more than 75%. In addition, visual comparisons of pre- and post-implementation still photographs of the site show dramatic improvements in the vegetative cover. Copies of the pre- and post-implementation photographs are found in Appendix E.

A standard ecological measure of vegetation pattern and coverage could include pre- and post-implementation site assessments by qualified experts. Included below are the pre- and post-implementation assessments of the Clearview site.

Pre Implementation Assessment - 1993

Mark Maples
NRCS - District Conservationist
Okfuskee County Conservation District

Prior to the dirt work or any shaping activities at the Clearview Project, the site, approximately 68 acres, appeared to be a total waste land. Spills from the oil field operation and outdated methods of operation had salted the area, killing the vegetation and leaving bare soil. Without adequate ground cover the site was soon at the mercy of the elements, which quickly rendered it a severely eroded area. Dispersed areas made up nearly 100 % of the site. Rills and gullies were so deep and plentiful that not even a four wheeler could traverse the area.

At the site the only remnants of vegetation were a few salt cedars (tamarak) that struggled to exist on top of some non dispersed mounds. Thick stands of little bluestem, India grass, and some switch grass thrived in areas adjacent to the site. Cedars, oaks, and other woody plants also surrounded the area, but nothing survived on the site.

Post Implementation - March 2000

Larry D. Farris

Retired NRCS Agronomist
Okfuskee County Conservation District

The Clearview site has been adequately reclaimed through shaping, soil amendments, and revegetating. The original planting done in 1996 provided Bermuda grass cover on the majority of the site. The west slope of the project from one end to the other is now covered with an excellent Bermuda grass and clover stand. The channel bottom is also well established in vegetation and is stable. There had been no vegetation established on some of the slopes along the side drains. In the fall of 1999 there was another attempt made to get a cover of "Jose" Tall Wheat and Bermuda grass on these areas. So far the results of that planting are only marginally successful. There remains areas that are totally void of any vegetation. It appears that the buffering agents used may not have been evenly distributed. There is a solid cover of young plants in some areas followed by an abrupt change to bare ground.

The reason that bare ground continues to exist is that some of the area is still too high in sodium and chlorides to support vegetation. It is my opinion though that the project is adequately vegetated to maintain the resource base. Overall I would continue to view the site as being sensitive and fragile. I would not recommend that the area be opened up to any prolonged grazing in the near future.

The dramatic improvement in vegetative pattern and coverage is documented from the above site assessments. Combining these on-site assessments with the photographic evidence is clear indication that the project has attained the stated goal.

Goal 3: Transfer of information gathered during this project to other sites with a goal of five site remediation projects per year.

Measure: Number of projects initiated and completed each year.

Although desirable, this goal is premature. I, i.e., it is not reasonable to expect the technology to be adapted prior to completion of technology transfer activities which would describe the technology. Technology transfer activities are typically completed near the end of the project. Moreover, data pertinent to these specified performance measures may not be attainable and certainly would not be generated until after completion of the project.

Certain aspects of the remediation technology developed for the Clearview Project have been implemented at oilfield and other remediation sites throughout the state of Oklahoma (see Table 5.1). The Okmulgee County Conservation District undertook the task of coordinating with various agencies in an effort to remediate severely impacted sites. The District Manager, David Ledford, spearheaded the effort by acquiring all materials and equipment, coordinating with landowners, developing the conservation plans, operating the equipment, and implementing all practices on the ground.

From Table 5.1 it is clear that information developed during the Clearview Project has been transferred to other sites. In fact, the stated goal of five sites per year has been met or exceeded in each of the last three years. It is envisioned that the technology developed for the Clearview Project will see expanded applications as information relative to the technology is distributed. A variety of related information transfer activities have been completed for this project. A brochure describing the innovative technology and the results of the study has been distributed to petroleum production

companies, governmental agencies, and consulting firms. In addition, the project has been summarized in several conference presentations.

Table 5.1 Remediation Sites Utilizing Technology Developed from the Clearview Project

| YEAR FINISHED | ACRES | SITE NAME | PROCESS |
|---------------|---------------------------------------|--|---|
| 1997 | 3 | McCart | Ripped, Gypsum, Bio-Solids, Seeded, Hay Mulched, & Fenced. |
| 1997 | 1 | Smith | Shaped, Ripped, Gypsum, Bio-Solids, Seeded, Wood Chips, & Fenced. |
| 1997 | 0.5 | Viersen | Ripped, Gypsum, Bio-Solids, Seeded, Hay Mulched, & Fenced. |
| 1997 | 9 | Price | Shaped, Gypsum, Bio-Solids, Seeded, Hay Mulched, & Fenced. |
| 1997 | 4 | Carpenter | Shaped, Gypsum, Bio-Solids, Seeded, & Hay Mulched. |
| 1998 | 8 | Roane | OERB-Pond, Shaped, Ripped, Gypsum. OCCD-Bio-Solids, Sprigged, Hay Mulched. |
| 1998 | 4 | Watson 2 | OERB-Shaped, Ripped, Gypsum, Fenced. OCCD-Bio-Solids, Sprigged, Hay Mulched. |
| 1998 | 4 | Watson 3 | OERB-Shaped, Ripped, Gypsum, Fenced. OCCD-Bio-Solids, Sprigged, Hay Mulched. |
| 1998 | 2 | Lawson | OERB-Shaped, Ripped, Gypsum, Fenced. OCCD-Bio-Solids, Sprigged, Hay Mulched. |
| 1998 | 1 | Miller | OERB-Shaped, Gypsum. OCCD-Bio-Solids, Sprigged, Hay Mulched. |
| 1999 | 4 | Robison | Shaped, Ripped, Gypsum, Bio-Solids, Seeded, Hay Mulched, & Fenced. |
| 1999 | 7 | Mims | OERB-Shaped, Ripped, Gypsum, Fenced. OCCD-Bio-Solids, Sprigged, Hay Mulched. |
| 1999 | 120 | Enid | Poultry Litter, Fly Ash. (<i>non oil field site</i>) |
| 1999 | 3 | Red Oak | Poultry Litter, Fly Ash. (<i>non oil field site</i>) |
| 1997 – '99 | 60 60 25 10 70 80 3 | Eagle Pitcher Hamilton Bryan Stites Brannon Jacobs # 2 Brannon Jacobs # 4 | These mining (<i>non oil field</i>) sites were also addressed with much of the same technology. |

| | | | |
|--|--|-----------|--|
| | | Stuccobur | |
|--|--|-----------|--|

Remediation Technology

The proposed remediation technology focused only on liberating the accumulated salts from the impacted soils. Once mobilized, the salts need to be transported offsite or they will simply re-precipitate on soils in low lying areas. The effects of this phenomenon are readily observable at the Clearview site; areas where vegetative cover was not established are predominantly located in the low lying zones near the creek channel. Future studies that involve chemical-based remediation technologies that are designed to flush contaminants should incorporate must include hydraulic measures (e.g., subsurface drains, sumps) to collect and remove the contaminants into the overall design.

Monitoring

The pre- and post-implementation monitoring activities should focus on assessing mass fluxes, rather than simply on dissolved concentrations. As noted previously, the concentrations of most of the NPS pollutants and brine-related parameters are directly affected by weather conditions. Low-flow conditions in the surface watercourses, especially Clearview Creek, can produce elevated concentrations due to evaporation; high-flow conditions can produce low concentrations due to dilution. The concentrations of the target analytes should be accompanied by flow rates to assessing changes in mass flux. Water level measurements were recorded during this study, but stage versus discharge relationships have not been developed for either watercourse.

The pre- and post-implementation monitoring activities should also focus on subsurface media, most notably the shallow ground water. The effectiveness of the remediation technology is influenced largely by subsurface transport and fate processes. Moreover, concentrations in the surface waters can be influenced by numerous sources unrelated to the study site. Ground water monitoring wells and/or soil water lysimeters should be included in the monitoring network for assessing the effectiveness of the remediation technology. Budget constraints did not allow for an extensive ground water monitoring network to be included in this study.

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APPENDIX A
NRCS DESIGN DRAWINGS

APPENDIX B
ANALYTICAL PROCEDURES

APPENDIX CB
WATER QUALITY DATA

APPENDIX DC

BROCHURE AND DISTRIBUTION LIST

APPENDIX ED

PRE AND POST IMPLEMENTATION PHOTOGRAPHS

From: Robert Herbert
To: Chris Kierst
Date: 06/08/2007 4:02 PM
Subject: Re: Fwd: Delta Petroleum Pit Closure Proposal

CC: Jeffrey Studenka

Chris,

I'll have to talk to Jeff Studenka about this on Monday. I don't think it would be considered an NPDES discharge because it is not directly entering a stream or river. I'll get back to you after I talk to Jeff.

Rob

>>> Chris Kierst 6/8/2007 2:48 PM >>>

Your feedback is both appreciated and useful. I don't think the operator would object to such a design configuration for the pit. I'll also float it by our management to bat around. I'd like to ensure that the leach and migration period be so prolonged by the pit encapsulation design as to fall way below the release standards for new industrial point sources, a type of industrial "timed release capsule" if you will. I. A. 1. a. ii and iii of the NPDES Permit Program Policy for Implementation of Colorado River Salinity Standards cite a maximum discharge rate of less than 1 ton per day and a discharge concentration of less than 500 mg/L. If efficacious, do you think such a system would be permissible under the NPDES Permit Program?

>>> Robert Herbert 06/08/2007 1:51 PM >>>

A cover system is a good idea to prevent infiltration of precipitation and through the wastes. I don't think you could just place a plastic liner on top and call it good. The cover would need to have long-term stability and durability. A typical closure cover would have a layered structure with the infiltration barrier or liner at the base, overlain by a drainage layer of coarse sand and gravel, overlain by an erosion barrier of rip rap. Ideally, the cover should have a tortoise shell geometry to promote drainage outward in all directions away from the wastes. You probably know this stuff already but I wanted to tell you just in case. Its probably more information than you wanted.

Rob Herbert, P.G., Manager
Ground Water Protection Section
Division of Water Quality
Utah Department of Environmental Quality
(801) 538-6038
rherbert@utah.gov

>>> Chris Kierst 6/8/2007 11:20 AM >>>

Yes, it does help. Your conclusions are the same as the ones I arrived at and supportive of my position. Do you think it would be constructive to put an impervious (plastic) or "semipervious" (such as bentonite) liner atop the pit(s) to shortstop and deflect the precipitation and perhaps greatly prolong the eventual leaching and migration of the dissolved solids in the subsurface environment?

>>> Robert Herbert 06/08/2007 11:09 AM >>>

Chris,

I reviewed the information you emailed me and do not recommend allowing onsite disposal of the drilling mud. The limited laboratory analytical data suggests that the pit sample contains total dissolved solids in excess of 10,000 mg/l. The results of the Oklahoma study indicate that the proposed remediation method will liberate and mobilize the accumulated salts from the drilling mud into the subsurface environment. Placing a cover of clean soil on top of the "stabilized" drilling mud will not prevent infiltration of precipitation and leaching of salts to ground water. This is a concern to the Colorado Salinity Control Program. Another concern is the precedent that this approval would set for the numerous other drilling sites in the area. Transport to a permitted disposal facility is recommended.

I hope this helps.

Rob Herbert, P.G., Manager
Ground Water Protection Section
Division of Water Quality
Utah Department of Environmental Quality
(801) 538-6038
rherbert@utah.gov

>>> Chris Kierst 6/6/2007 10:52 AM >>>

Rob,

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

FORM 9

| | | |
|--|--|--|
| SUNDRY NOTICES AND REPORTS ON WELLS | | 5. LEASE DESIGNATION AND SERIAL NUMBER: ML-49170 |
| Do not use this form for proposals to drill new wells, significantly deepen existing wells below current bottom-hole depth, reenter plugged wells, or to drill horizontal laterals. Use APPLICATION FOR PERMIT TO DRILL form for such proposals. | | 6. IF INDIAN, ALLOTTEE OR TRIBE NAME: NA |
| 1. TYPE OF WELL OIL WELL <input type="checkbox"/> GAS WELL <input checked="" type="checkbox"/> OTHER _____ | | 7. UNIT or CA AGREEMENT NAME: NA |
| 2. NAME OF OPERATOR: Delta Petroleum Corporation | | 8. WELL NAME and NUMBER: Greentown State 36-11S |
| 3. ADDRESS OF OPERATOR: 370 17th St., Ste. 4300 CITY Denver STATE CO ZIP 80202 | | 9. API NUMBER: 4301931505 |
| 4. LOCATION OF WELL FOOTAGES AT SURFACE: 1024' FNL & 429' FWL | | 10. FIELD AND POOL, OR WILDCAT: Wildcat |
| QTR/QTR, SECTION, TOWNSHIP, RANGE, MERIDIAN: NWNW 36 21S 16E | | COUNTY: Grand |
| | | STATE: UTAH |

| 11. CHECK APPROPRIATE BOXES TO INDICATE NATURE OF NOTICE, REPORT, OR OTHER DATA | | | |
|---|---|---|---|
| TYPE OF SUBMISSION | TYPE OF ACTION | | |
| <input checked="" type="checkbox"/> NOTICE OF INTENT (Submit in Duplicate) Approximate date work will start: _____ | <input type="checkbox"/> ACIDIZE | <input type="checkbox"/> DEEPEN | <input type="checkbox"/> REPERFORATE CURRENT FORMATION |
| | <input type="checkbox"/> ALTER CASING | <input type="checkbox"/> FRACTURE TREAT | <input type="checkbox"/> SIDETRACK TO REPAIR WELL |
| <input type="checkbox"/> SUBSEQUENT REPORT (Submit Original Form Only) Date of work completion: _____ | <input type="checkbox"/> CASING REPAIR | <input type="checkbox"/> NEW CONSTRUCTION | <input type="checkbox"/> TEMPORARILY ABANDON |
| | <input type="checkbox"/> CHANGE TO PREVIOUS PLANS | <input type="checkbox"/> OPERATOR CHANGE | <input type="checkbox"/> TUBING REPAIR |
| | <input type="checkbox"/> CHANGE TUBING | <input type="checkbox"/> PLUG AND ABANDON | <input type="checkbox"/> VENT OR FLARE |
| | <input type="checkbox"/> CHANGE WELL NAME | <input type="checkbox"/> PLUG BACK | <input type="checkbox"/> WATER DISPOSAL |
| | <input type="checkbox"/> CHANGE WELL STATUS | <input type="checkbox"/> PRODUCTION (START/RESUME) | <input type="checkbox"/> WATER SHUT-OFF |
| | <input type="checkbox"/> COMMINGLE PRODUCING FORMATIONS | <input type="checkbox"/> RECLAMATION OF WELL SITE | <input checked="" type="checkbox"/> OTHER: <u>Water Pit Closure</u> |
| | <input type="checkbox"/> CONVERT WELL TYPE | <input type="checkbox"/> RECOMPLETE - DIFFERENT FORMATION | |

12. DESCRIBE PROPOSED OR COMPLETED OPERATIONS. Clearly show all pertinent details including dates, depths, volumes, etc.

TIGHT HOLE STATUS

Delta Petroleum Corporation proposes to close the water pit on the above listed well as follows:

1. Pit has been evaporated of all water.
2. Soil testing was completed and has been previously been submitted to UDOGM office.
3. A new 12 mil liner will be placed over the top of dried material in pit, covered with clean, segregation topsoil (no sharp rocks) and compacted.

RECEIVED
JUL 05 2007
DIV. OF OIL, GAS & MINING

| | |
|---|------------------------------------|
| NAME (PLEASE PRINT) <u>Cheryl Johnson</u> | TITLE <u>Regulatory Technician</u> |
| SIGNATURE <u><i>Cheryl Johnson</i></u> | DATE <u>6/28/2007</u> |

(This space for State use only)

From: "Curtis Larkin" <crlarkin@mstar.net>
To: <chriskierst@utah.gov>
Date: 08/01/2007 11:32 AM
Subject: chemical analysis of fly ash
Attachments: MA 700 chem analysis.pdf

CC: <jnussbaumer@deltapetro.com>
Chris,

Attached please find most recent chemical assay on Hunter #3 fly ash. If you have questions or require additional information, please contact me.

Regards,
Curtis Larkin
Mountain Ash, LLC
Office 801.547.5061
Cell 801.663.1705
Email crlarkin@mstar.net

WYOMING ANALYTICAL LABORATORIES, INC.

1511 Washington Ave., Ste 10
Golden, CO 80401

www.wal-lab.com
Email: walxray@aol.com

(303) 278-2446
Fax: (303) 278-2439

July 11, 2007

Mr. Bud Werner
CTL/Thompson Materials Engineering
22 Lipan St.
Denver, CO 80223

Denver Div. # 07437-10
Sample ID: Mountain Ash #700 CTL 07283

CHEMICAL ANALYSIS WT%, DRY BASIS

| | | |
|---|-------|--------|
| Silicon Dioxide, SiO ₂ | 59.80 | |
| Aluminum Oxide, Al ₂ O ₃ | 15.16 | |
| Iron Oxide, Fe ₂ O ₃ | 4.71 | |
| Total (SiO ₂ + Al ₂ O ₃ + Fe ₂ O ₃) | | 79.67 |
| Calcium Oxide, CaO | 10.44 | |
| Magnesium Oxide, MgO | 3.35 | |
| Sodium Oxide, Na ₂ O | 2.45 | 95.91 |
| Potassium Oxide, K ₂ O | 1.22 | 97.13 |
| Titanium Dioxide, TiO ₂ | 0.87 | 98.01 |
| Manganese Dioxide, MnO ₂ | 0.03 | 98.03 |
| Phosphorus Pentoxide, P ₂ O ₅ | 0.33 | 98.36 |
| Strontium Oxide, SrO | 0.14 | 98.50 |
| Barium Oxide, BaO | 0.22 | 98.72 |
| Sulfur Trioxide, SO ₃ | 0.75 | 99.47 |
| Loss on Ignition | 0.54 | 100.01 |
| Moisture, as Received | 0.07 | 100.08 |


Charles R. Wilson
Division Manager

MEMBER
ACIL

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

CONFIDENTIAL

AMENDED REPORT FORM 8
(highlight changes)

WELL COMPLETION OR RECOMPLETION REPORT AND LOG

1a. TYPE OF WELL: OIL WELL GAS WELL DRY OTHER _____

b. TYPE OF WORK: NEW WELL HORIZ. LATS. DEEP-EN RE-ENTRY DIFF. RESVR. OTHER Offset Well

5. LEASE DESIGNATION AND SERIAL NUMBER:
ML-49170

6. IF INDIAN, ALLOTTEE OR TRIBE NAME
NA

7. UNIT or CA AGREEMENT NAME
NA

8. WELL NAME and NUMBER:
Greentown State 36-11OS

2. NAME OF OPERATOR:
Delta Petroleum Corporation

9. API NUMBER:
4301931505

3. ADDRESS OF OPERATOR: **370 17th St., Ste. 4300** CITY **Denver** STATE **CO** ZIP **80202**

PHONE NUMBER:
(303) 575-0323

10. FIELD AND POOL, OR WILDCAT
Wildcat

4. LOCATION OF WELL (FOOTAGES)
AT SURFACE: **1024' FNL & 429' FWL**
AT TOP PRODUCING INTERVAL REPORTED BELOW: **1024' FNL & 429' FWL**
AT TOTAL DEPTH: **1024' FNL & 429' FWL**

11. QTR/QTR, SECTION, TOWNSHIP, RANGE, MERIDIAN:
NWNW 36 21S 16E

12. COUNTY **Grand** 13. STATE **UTAH**

14. DATE SPUNDED: **11/22/2006** 15. DATE T.D. REACHED: **12/16/2006** 16. DATE COMPLETED: **8/29/2007**

ABANDONED READY TO PRODUCE

17. ELEVATIONS (DF, RKB, RT, GL):

18. TOTAL DEPTH: MD **3,686** TVD _____

19. PLUG BACK T.D.: MD **3,433** TVD **CIBP**

20. IF MULTIPLE COMPLETIONS, HOW MANY? *

21. DEPTH BRIDGE MD **3,433** PLUG SET: TVD _____

22. TYPE ELECTRIC AND OTHER MECHANICAL LOGS RUN (Submit copy of each)
Induction, Density Neutron, CBL
CCL, GR, Rex, AI, SP

23. WAS WELL CORED? NO YES (Submit analysis)
WAS DST RUN? NO YES (Submit report)
DIRECTIONAL SURVEY? NO YES (Submit copy)

24. CASING AND LINER RECORD (Report all strings set in well)

| HOLE SIZE | SIZE/GRADE | WEIGHT (#/ft.) | TOP (MD) | BOTTOM (MD) | STAGE CEMENTER DEPTH | CEMENT TYPE & NO. OF SACKS | SLURRY VOLUME (BBL) | CEMENT TOP ** | AMOUNT PULLED |
|-----------|-------------|----------------|----------|-------------|----------------------|----------------------------|---------------------|---------------|---------------|
| 20" | 16" F-25 | 55 | 0 | 60 | 60 | RediM 12 | 7 | 0 | None |
| 11" | 8.625" J-55 | 24 | 0 | 1,227 | 1,227 | LtWt 245 G 111 | 86 28 | 0 | None |
| 7.875" | 5.5" J-55 | 17 | 0 | 3,675 | 3,675 | PremLt 350 Type 3 85 | 134 21 | 1820 | None |

25. TUBING RECORD

| SIZE | DEPTH SET (MD) | PACKER SET (MD) | SIZE | DEPTH SET (MD) | PACKER SET (MD) | SIZE | DEPTH SET (MD) | PACKER SET (MD) |
|-------|----------------|-----------------|------|----------------|-----------------|------|----------------|-----------------|
| 2 7/8 | 3,416 | | | | | | | |

26. PRODUCING INTERVALS

| FORMATION NAME | TOP (MD) | BOTTOM (MD) | TOP (TVD) | BOTTOM (TVD) |
|----------------|----------|-------------|-----------|--------------|
| (A) White Rim | 3,202 | 3,456 | | |
| (B) | | | | |
| (C) | | | | |
| (D) | | | | |

27. PERFORATION RECORD

| INTERVAL (Top/Bot - MD) | SIZE | NO. HOLES | PERFORATION STATUS |
|-------------------------|------|-----------|---|
| | | | Open <input type="checkbox"/> Squeezed <input type="checkbox"/> |
| | | | Open <input type="checkbox"/> Squeezed <input type="checkbox"/> |
| | | | Open <input type="checkbox"/> Squeezed <input type="checkbox"/> |
| | | | Open <input type="checkbox"/> Squeezed <input type="checkbox"/> |

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28. ACID, FRACTURE, TREATMENT, CEMENT SQUEEZE, ETC.

| DEPTH INTERVAL | AMOUNT AND TYPE OF MATERIAL |
|-----------------------------|---|
| 1) 3222-3234 2) (3274-3286) | 1) 22,545 gal fluid, 489 gal CO2, 76,250# 20/40 Jordan Sand/ 2) 35,713 gal fluid, 9777gal CO2, 120,002# 20/40 Jordan Sand |
| 3) 3320-3332 4) (3362-3374) | 3) 27,064 gal fluid, 19054 gal CO2, 124,989# 20/40 Jordan Sand/ 4) 26,146 gal fluid, 18,138 gal CO2, 118,082# 20/40 Jordan Sand |
| 5) 3444-3456 | 5) 29,904 gal fluid, 24,783 gal CO2, 30,098# 20/40 Jordan Sand |

29. ENCLOSED ATTACHMENTS:

ELECTRICAL/MECHANICAL LOGS GEOLOGIC REPORT DST REPORT DIRECTIONAL SURVEY
 SUNDRY NOTICE FOR PLUGGING AND CEMENT VERIFICATION CORE ANALYSIS OTHER: _____

30. WELL STATUS:
T&A'd

31. INITIAL PRODUCTION

INTERVAL A (As shown in item #26)

| | | | | | | | | | | |
|-----------------------------------|-------------------|------------------------|-------------|---------------------|---------------|---------------------------|-----------------|-----------------|-----------------------|--------------------------|
| DATE FIRST PRODUCED: 8/29/2007 | | TEST DATE: 9/1/2007 | | HOURS TESTED: 24 | | TEST PRODUCTION RATES: → | OIL - BBL: 0 | GAS - MCF: 0 | WATER - BBL: 1,200 | PROD. METHOD: Flowing |
| CHOKE SIZE: 64 | TBG. PRESS. 90 | CSG. PRESS. 10 | API GRAVITY | BTU - GAS | GAS/OIL RATIO | 24 HR PRODUCTION RATES: → | OIL - BBL: 0 | GAS - MCF: 0 | WATER - BBL: 1,200 | INTERVAL STATUS: Open |

INTERVAL B (As shown in item #26)

| | | | | | | | | | | |
|----------------------|-------------|-------------|-------------|---------------|---------------|---------------------------|------------|------------|--------------|------------------|
| DATE FIRST PRODUCED: | | TEST DATE: | | HOURS TESTED: | | TEST PRODUCTION RATES: → | OIL - BBL: | GAS - MCF: | WATER - BBL: | PROD. METHOD: |
| CHOKE SIZE: | TBG. PRESS. | CSG. PRESS. | API GRAVITY | BTU - GAS | GAS/OIL RATIO | 24 HR PRODUCTION RATES: → | OIL - BBL: | GAS - MCF: | WATER - BBL: | INTERVAL STATUS: |

INTERVAL C (As shown in item #26)

| | | | | | | | | | | |
|----------------------|-------------|-------------|-------------|---------------|---------------|---------------------------|------------|------------|--------------|------------------|
| DATE FIRST PRODUCED: | | TEST DATE: | | HOURS TESTED: | | TEST PRODUCTION RATES: → | OIL - BBL: | GAS - MCF: | WATER - BBL: | PROD. METHOD: |
| CHOKE SIZE: | TBG. PRESS. | CSG. PRESS. | API GRAVITY | BTU - GAS | GAS/OIL RATIO | 24 HR PRODUCTION RATES: → | OIL - BBL: | GAS - MCF: | WATER - BBL: | INTERVAL STATUS: |

INTERVAL D (As shown in item #26)

| | | | | | | | | | | |
|----------------------|-------------|-------------|-------------|---------------|---------------|---------------------------|------------|------------|--------------|------------------|
| DATE FIRST PRODUCED: | | TEST DATE: | | HOURS TESTED: | | TEST PRODUCTION RATES: → | OIL - BBL: | GAS - MCF: | WATER - BBL: | PROD. METHOD: |
| CHOKE SIZE: | TBG. PRESS. | CSG. PRESS. | API GRAVITY | BTU - GAS | GAS/OIL RATIO | 24 HR PRODUCTION RATES: → | OIL - BBL: | GAS - MCF: | WATER - BBL: | INTERVAL STATUS: |

32. DISPOSITION OF GAS (Sold, Used for Fuel, Vented, Etc.)

33. SUMMARY OF POROUS ZONES (Include Aquifers):

Show all important zones of porosity and contents thereof. Cored intervals and all drill-stem tests, including depth interval tested, cushion used, time tool open, flowing and shut-in pressures and recoveries.

34. FORMATION (Log) MARKERS:

| Formation | Top (MD) | Bottom (MD) | Descriptions, Contents, etc. | Name | Top (Measured Depth) |
|-------------|----------|-------------|----------------------------------|---------------------------|----------------------|
| 27) | 3,202 | 3,208 | Size .43", 4spf, 24 holes - open | Entrada | 476 |
| White Rim | 3,222 | 3,234 | Size .43", 3spf, 36 holes - open | Carmel | 1,053 |
| Perf Record | 3,274 | 3,286 | Size .43", 3spf, 36 holes - open | Navaio | 1,208 |
| | 3,306 | 3,310 | Size .43", 4spf, 16 holes - open | Kaventa | 1,644 |
| | 3,320 | 3,332 | Size .36", 3spf, 36 holes - open | Winqate | 1,679 |
| | 3,343 | 3,349 | Size .43", 4spf, 24 holes - open | Chinle | 2,145 |
| | 3,362 | 3,374 | Size .36", 3spf, 36 holes - open | Shinarump | 2,338 |
| | 3,402 | 3,406 | Size .43", 4spf, 16 holes - open | Moenkopi | 2,374 |
| | 3,444 | 3,456 | Size .38", 3spf, 36 holes - open | Sinbad Limestone | 2,962 |
| | | | | White Rim/ Cutler - 3544' | 3,180 |

35. ADDITIONAL REMARKS (Include plugging procedure)

CIBP @ 3433'

36. I hereby certify that the foregoing and attached information is complete and correct as determined from all available records.

NAME (PLEASE PRINT) Terry L. Hoffman TITLE Regulatory Manager
 SIGNATURE *Terry L. Hoffman* DATE 10/23/2007

This report must be submitted within 30 days of

- completing or plugging a new well
- reentering a previously plugged and abandoned well
- drilling horizontal laterals from an existing well bore
- significantly deepening an existing well bore below the previous bottom-hole depth
- recompleting to a different producing formation
- drilling hydrocarbon exploratory holes, such as core samples and stratigraphic tests

* ITEM 20: Show the number of completions if production is measured separately from two or more formations.

** ITEM 24: Cement Top - Show how reported top(s) of cement were determined (circulated (CIR), calculated (CAL), cement bond log (CBL), temperature survey (TS)).

Send to: Utah Division of Oil, Gas and Mining Phone: 801-538-5340
 1594 West North Temple, Suite 1210
 Box 145801 Fax: 801-359-3940
 Salt Lake City, Utah 84114-5801

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

CONFIDENTIAL

FORM 9

SUNDRY NOTICES AND REPORTS ON WELLS

Do not use this form for proposals to drill new wells, significantly deepen existing wells below current bottom-hole depth, reenter plugged wells, or to drill horizontal laterals. Use APPLICATION FOR PERMIT TO DRILL form for such proposals.

| | | |
|--|--|---|
| 1. TYPE OF WELL OIL WELL <input type="checkbox"/> GAS WELL <input checked="" type="checkbox"/> OTHER _____ | | 5. LEASE DESIGNATION AND SERIAL NUMBER: ML-49170 |
| 2. NAME OF OPERATOR: Delta Petroleum Corporation | | 6. IF INDIAN, ALLOTTEE OR TRIBE NAME: NA |
| 3. ADDRESS OF OPERATOR: 370 17th St., Ste. 4300 CITY Denver STATE CO ZIP 80202 | | 7. UNIT or CA AGREEMENT NAME: NA |
| 4. LOCATION OF WELL FOOTAGES AT SURFACE: 1024' FNL & 429' FWL COUNTY: Grand QTR/QTR, SECTION, TOWNSHIP, RANGE, MERIDIAN: NWNW 36 21S 16E STATE: UTAH | | 8. WELL NAME and NUMBER: Greentown State 36-11S |
| | | 9. API NUMBER: 4301931505 |
| | | 10. FIELD AND POOL, OR WLD CAT: Wildcat |

11. CHECK APPROPRIATE BOXES TO INDICATE NATURE OF NOTICE, REPORT, OR OTHER DATA

| TYPE OF SUBMISSION | TYPE OF ACTION | | |
|---|---|---|---|
| <input type="checkbox"/> NOTICE OF INTENT (Submit in Duplicate) Approximate date work will start: _____ | <input type="checkbox"/> ACIDIZE | <input type="checkbox"/> DEEPEN | <input type="checkbox"/> REPERFORATE CURRENT FORMATION |
| | <input type="checkbox"/> ALTER CASING | <input type="checkbox"/> FRACTURE TREAT | <input type="checkbox"/> SIDETRACK TO REPAIR WELL |
| | <input type="checkbox"/> CASING REPAIR | <input type="checkbox"/> NEW CONSTRUCTION | <input type="checkbox"/> TEMPORARILY ABANDON |
| | <input type="checkbox"/> CHANGE TO PREVIOUS PLANS | <input type="checkbox"/> OPERATOR CHANGE | <input type="checkbox"/> TUBING REPAIR |
| | <input type="checkbox"/> CHANGE TUBING | <input type="checkbox"/> PLUG AND ABANDON | <input type="checkbox"/> VENT OR FLARE |
| <input checked="" type="checkbox"/> SUBSEQUENT REPORT (Submit Original Form Only) Date of work completion: _____ | <input type="checkbox"/> CHANGE WELL NAME | <input type="checkbox"/> PLUG BACK | <input type="checkbox"/> WATER DISPOSAL |
| | <input type="checkbox"/> CHANGE WELL STATUS | <input type="checkbox"/> PRODUCTION (START/RESUME) | <input type="checkbox"/> WATER SHUT-OFF |
| | <input type="checkbox"/> COMMINGLE PRODUCING FORMATIONS | <input type="checkbox"/> RECLAMATION OF WELL SITE | <input checked="" type="checkbox"/> OTHER: <u>Monthly Status Report</u> |
| | <input type="checkbox"/> CONVERT WELL TYPE | <input type="checkbox"/> RECOMPLETE - DIFFERENT FORMATION | |

12. DESCRIBE PROPOSED OR COMPLETED OPERATIONS. Clearly show all pertinent details including dates, depths, volumes, etc.

TIGHT HOLE STATUS

Completion Report was filed 10/23/07.
Well T&A'd - Final Well History

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| | |
|-----------------------------------|--------------------------|
| NAME (PLEASE PRINT) Terry Hoffman | TITLE Regulatory Manager |
| SIGNATURE <i>Terry L. Hoffman</i> | DATE 11/7/2007 |

(This space for State use only)

PA
11/7/2009

April 29, 2008

United States Department of Interior
Bureau of Land Management
State of Utah

43-019-3150S
36 ~~125~~ 16E
215
7

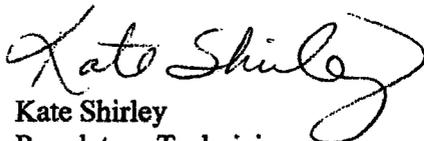
RE: Designated Agent

To Whom It May Concern:

By this letter I, Kate Shirley, as designated agent for Delta Petroleum Corporation do hereby authorize Western Land Services, Inc. and its representatives to receive direct communication for and from certain environmental contractors, Federal, State and local agencies within the State of Utah. Western Land Services, as receiving and delivery agent may be provided with proprietary information for the benefit of and delivery to Delta Petroleum Corporation.

If you have any questions or concerns, please feel free to contact me at 303-575-0397, or via e-mail at kshirley@deltapetro.com. I thank you in advance for your cooperation.

Sincerely,
Delta Petroleum Corporation


Kate Shirley
Regulatory Technician

List of Attachments

- Attachment 1: Injection Well Proposal ✓
 - Attachment 2: UIC Class II Injection Well Report ✓
 - Attachment 3: Greentown State #36-11S APD Approval ✓
 - Attachment 4: Greentown State #36-11S Well Completion Report ✓
 - Attachment 5: Production Water Analysis ✓
 - Attachment 6: Pressure Test Results ✓ - *this will not replace a witnessed MIT*
-
- Figure 1: Resistivity and Porosity Logs ✓
 - Figure 2: Platt showing adjacent wells
 - Figure 3: Cement Bond Log - *not run @ pressure (microannulus?)*
 - Figure 4: Well Bore Diagram

Attachment 1

Delta Injection Well Proposal

It is proposed that the Permian age White Rim Formation be utilized as a water injection interval for produced water at the Delta Petroleum Corporation 36-11S Greentown State well located 1055' fnl and 518' fwl of Section 36, Township 21 South, Range 16 East, Grand County, Utah. The referenced well was drilled to a logger's total depth of 3674', 130' below the base of the White Rim Formation bottoming in the Permian Cutler Formation. The 36-11 S Greentown State was perforated and fracture stimulated over a gross interval from 3222' to 3456' measured depth. After stimulation the well flowed salt water at a high rate. Analysis of the produced water revealed total dissolved solids in a range from 28,100 to 32,500 parts per million. The White Rim Formation at the proposed injection site is 364' in thickness and was encountered in the 36-11 S Greentown State well at a measured depth of 3180'. The White Rim Formation is a quartz arenite believed to be of eolian origin. Porosities as calculated from the density log using a grain density of 2.65 g/mlcm³ ranged from 0.0000% to 14.82%. The anticipated injection surface pressure is 1,700 pounds. ← *This is the maximum pressure - no average given*

The White Rim Formation is overlain unconformably by the Triassic age Moenkopi Formation. The lower 190' of the Moenkopi Formation is an impermeable shale that will form a competent top seal for the injection zone. Underlying the White Rim Formation is the Organ Pipe shale member of the Permian age Cutler Formation. The Organ Pipe shale member is 225' in thickness at the proposed injection site and will form a competent bottom seal. All of the described formations are of a blanket type nature. The White Rim Formation along with the overlying and underlying seal formations is present in all wells of a sufficient depth to have penetrated these formations within the twelve township area surrounding the 36-11 S Greentown State.

Structurally, the 36-11 S Greentown State well is located on the east flank of the northwest plunging Green River anticline approximately 300' down dip from the anticlinal axis. The Green River anticline, a feature that can be mapped both on the surface and in the subsurface, has demonstrated three way closure in excess of 1100'. Just south of the Greentown State 36-11S the Green River anticline is cut by the Little Grand fault, a regional east-west normal fault that juxtaposes the White Rim Formation against the Moenkopi Formation providing an up dip seal up the plunge of the anticline.

The lands within a ½ mile radius of the proposed injection well are owned by the State of Utah Section 36 and Federal lands administered by the BLM, Moab Field Office (See Figure 2). Delta Petroleum Corporation holds the mineral lease on Section 36 and the adjoining Federal lands.

A copy of this application has been provided to Eric Jones in the BLM, Moab Field Office.

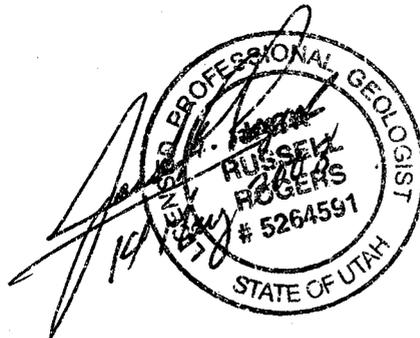
White Rim Sandstone
UIC Class II Injection Well Report

for

Delta Petroleum Corp
c/o
Western Land Services
195 North 100 East
Richfield, UT 84701

Prepared by

LASR Geo Consulting
40 East 970 North
Castle Dale, UT 84513



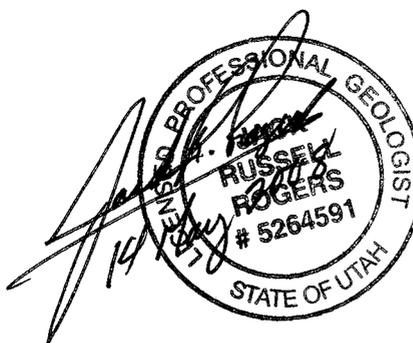
White Rim Sandstone
UIC Class II Injection Well Report

for

Delta Petroleum Corp
c/o
Western Land Services
195 North 100 East
Richfield, UT 84701

Prepared by

LASR Geo Consulting
40 East 970 North
Castle Dale, UT 84513



INTRODUCTION

Western Land Services is assisting Delta Petroleum Corporation in obtaining an underground injection well to dispose of excess water produced from gas and oil well production. Salt water very high in TDS (total dissolved solids) is a by product of oil production for oil wells. Injection of these waters and fluids into an acceptable aquifer is a viable method for disposing of such fluids. The State of Utah has an UIC program administered under the DWQ (Department of Water Quality), which defines several types of injection wells Class I-V. Class II injection well rules are for fluids produced or used in the oil and gas industry and are therefore administered by the DOGM (Division of Oil, Gas, and Mining). Delta Petroleum plans to rehabilitate one of their older wells to use as an injection well. This report will describe the geology and hydrogeology associated with the White Rim Sandstone, which is the target aquifer for the Class II injection well permit application.

WHITE RIM SANDSTONE

Geology

The well selected for use as an injection well is located east of Crystal Geyser in the SW1/4, NW 1/4, NW1/4, section 36 of Township 21 S, Range 16 E. The well is designated GTS 36-11 and was previously drilled as a gas well; it is going to be rehabilitated and used as an injection well.

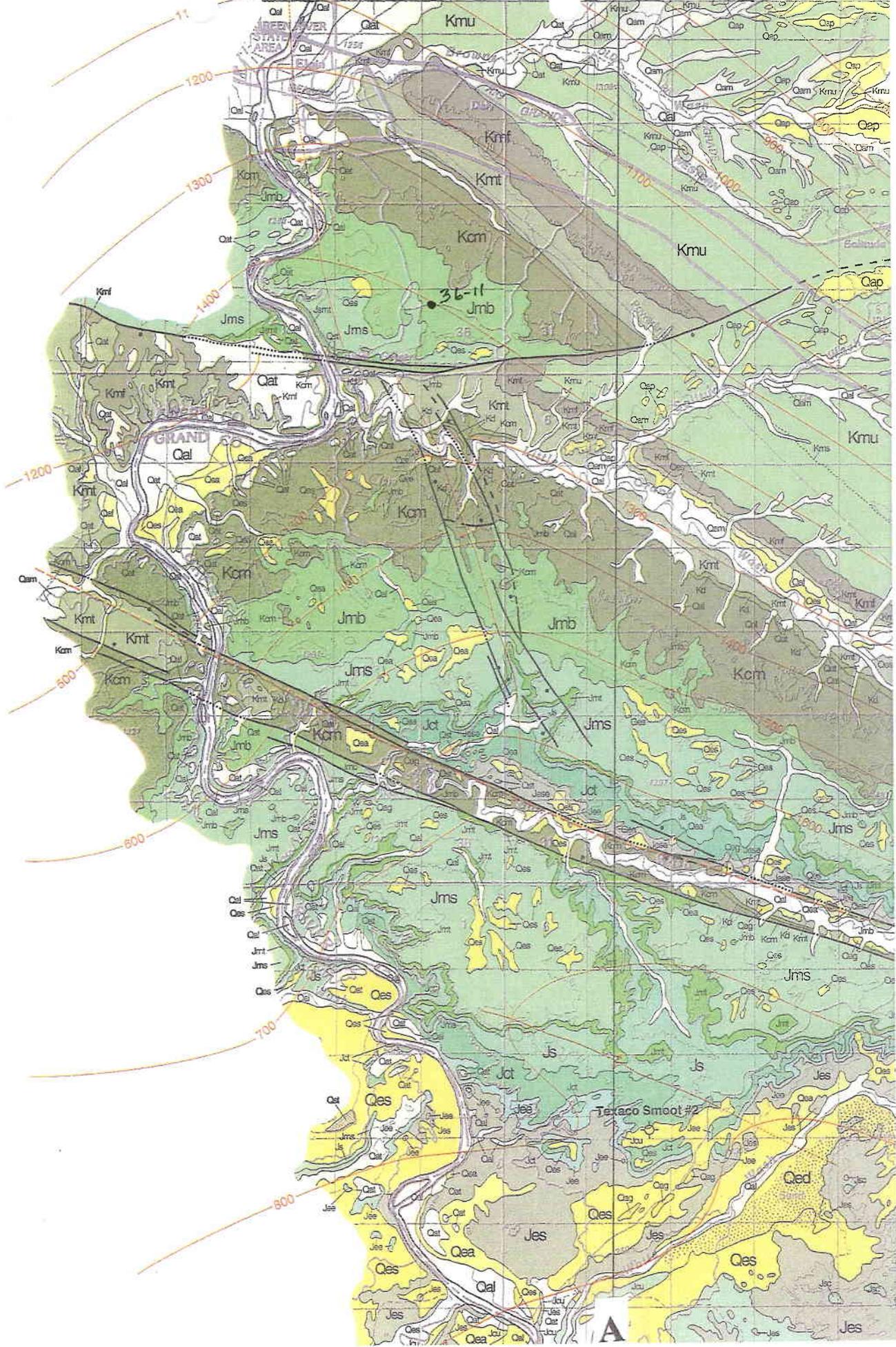
The collar of the well is in the Brushy Basin Member of the Jurassic Morrison Formation (see map) and is drilled into at least the White Rim Sandstone of the Cutler Group. Information from Delta Petroleum Corporation indicates that the lower member of the Morrison Formation

R 16 E

2 400 000 FEET

A'

R 17 E



Formations on the Doelling map are as noted:

Quaternary Deposits

All shades of yellow and white designated Qal, Qa, Qe are Quaternary alluvial or eolian deposits.

Cretaceous Deposits

Kmu is the upper shale member of the Mancos Shale

Kmf is the Ferron Member of the Mancos Shale

Kmt is the Tununk Member of the Mancos Shale

Kd is the Dakota Sandstone

Kcm is the Cedar Mountain Formation

Jurassic Deposits

Jmb is the Brushy Basin Member of the Morrison Formation

Jms is the Salt Wash Member of the Morrison Formation

Jmt is the Tidwell Member of the Morrison Formation

Js is the Summerville Formation

Jct is the Curtis Formation

Je* is the Entrada Sandstone

Jc* is the Carmel Formation

Jn is the Navajo Sandstone

Jk is the Kayenta Formation

Jw is the Wingate Formation

Triassic Deposits

TRc is the Chinle Formation

TRm is the Moenkopi Formation including several members such as the Sinbad Limestone

Permian Deposits

Pc is the Cutler Formation

Pennsylvanian Deposits

PP are shades of purple and are all together as one age unit

(Salt Wash Member) is the surface or collar of the well. Total depth of the hole was not available from the DOGM computer data base, nor was it available from Delta Petroleum Corporation. Known formations encountered during drilling were: Morrison Formation, Entrada Sandstone, Carmel Formation, Navajo Sandstone, Kayenta Formation, Wingate Sandstone, Chinle Formation, Moenkopi Formation, and White Rim Sandstone. The top of the White Rim Formation is 3,149 feet from the surface – based upon sea level the top of the White Rim Formation is 1,174 feet above sea level.

TD?
3686' from
completion
form

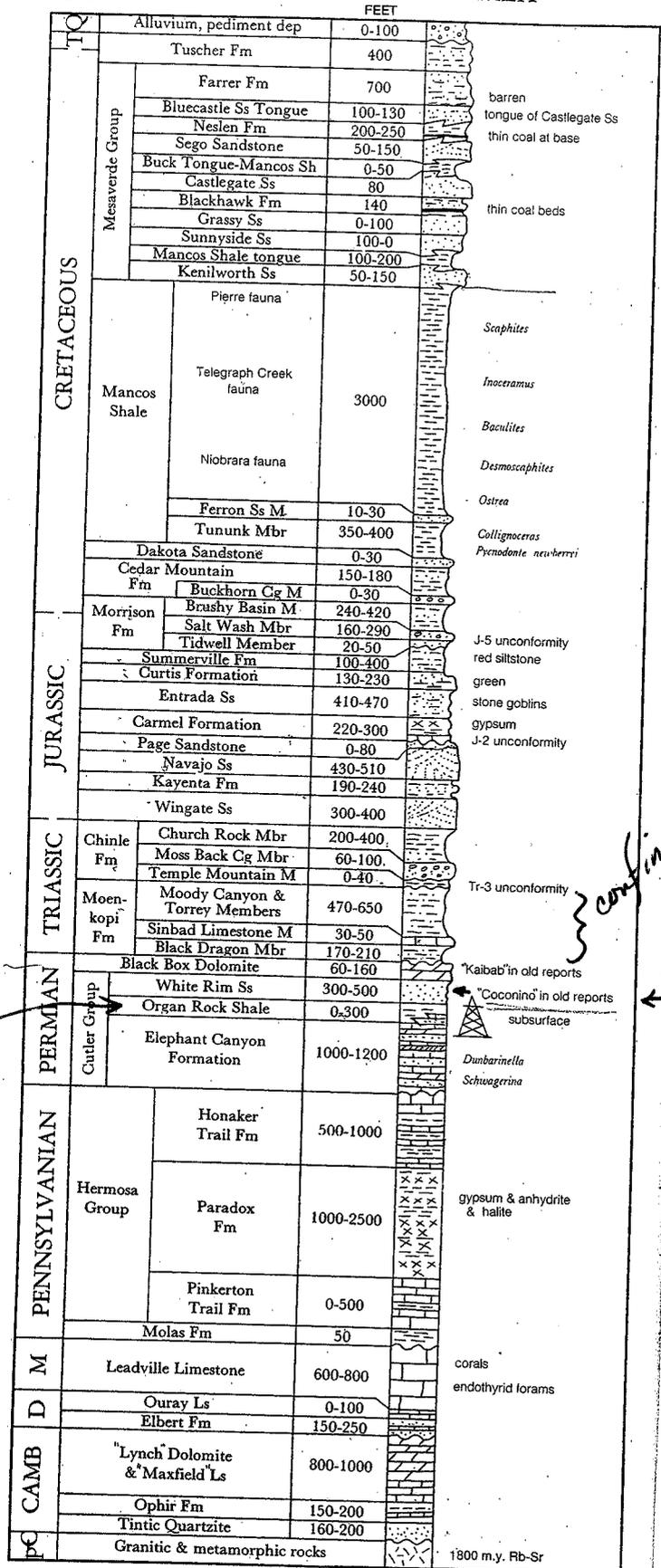
The White Rim Sandstone is a largely an eolian blanket sandstone that is exposed at the surface mainly west of the Colorado River in southeastern Utah. Where exposed, it forms a highly visible white band along canyon rims. Condon (1997) described the sandstone as a cliff forming, grayish-white to white, fine-to coarse-grained sandstone displaying large-scale, high-angle cross-beds and flat beds. A major component of this sandstone is an eolian dune facies (Huntoon and Chan, 1987; Steele, 1987; Kamola and Chan, 1988; and Chan, 1989) facies displays high angle cross-beds, high-index wind-ripple laminae, grain flow, and grain fall strata, and inversely graded laminae, which together are indicative of an eolian environment. Where the Kaibab Limestone is absent, the Lower to Middle Triassic Moenkopi Formation unconformably overlies the White Rim Sandstone (Condon, 1997). In the area between the Colorado and the Green Rivers, the sandstone is not exposed at the surface and is only encountered at depth. Logs from Delta Petroleum Corporation show that the Kaibab Limestone is absent in this well and a Lower to Middle Triassic limestone of the Moenkopi Formation overlies the White Rim Sandstone. It is conformably underlain by the Organ Rock Formation in the Green River area (Hintze, 1988).

The Sinbad Limestone Member of the Moenkopi Formation unconformably overlies the White Rim Sandstone as noted above. It is a thin limestone unit within the Moenkopi Formation and is stratigraphically designated as a member. The limestone is yellowish-gray to light-brown, thin-to medium-bedded, crystalline, and locally oolitic. It forms a resistant cap separating beds of shale above and below where they exist and long dip slopes. It ranges in thickness from 40 to 150 feet.

The Organ Rock Shale is composed of reddish-brown to light red sandy siltstone; silty sandstone; mudstone; and limestone nodule conglomerate. Alternating resistant and nonresistant beds give the formation a horizontally banded appearance. The geophysical log response of the Organ Rock contrasts with the underlying Cedar Mesa Sandstone and the overlying White Rim sandstone. The Organ Rock mostly represents a fluvial environment although there is abundant eolian deposition near the middle of the middle of the formation as noted by Condon (1997).

Formations tops of the 36-11 well from Delta Petroleum Corporation suggest that some formations are missing or have not been included such as the Tidwell Member, Summerville and Curtis Formations, and several members of the Chinle and Moenkopi Formations. This may be due to "in house" formation descriptions by company personnel during the drilling of the well and may be included with descriptions of adjacent formations. These formations thin to the west and can locally be absent. Hintze (1988) included the presents^{ce} of these formations in a generalized stratigraphic column from surface exposures and drilling records, and Doelling (2001) actually mapped the Tidwell Member of the Morrison Formation and the Summerville and Curtis Formations, near the proposed injection well site. There is a Permian limestone unit that is similar to the Sinbad Limestone Member of the Moenkopi Formation in thickness. If these two

GREEN RIVER AREA



confining below

confining above interval

MAPS WITH TEXT—Trimble & Doelling, 1978; Williams & Hackman, 1971; CRETACEOUS—Young, 1955, 1966; McGooley, 1972; Fisher et al, 1960; Lawton, 1963; Lessard, 1973; Harris, 1980; JURASSIC—O'Sullivan, 1980b; Wright & Dickey, 1963; Derr, 1974; TRIASSIC—Stewart et al, 1972a, 1972b; Blakey, 1974; Orgill, 1971; Lupe, 1979; PERMIAN—Baars, 1962; Raccoe & Baars, 1972; PENNSYLVANIAN—Mallory, 1972; MISSISSIPPIAN—Craig, 1972; DEVONIAN—Baars, 1972; Parker & Roberts, 1966; CAMBRIAN—Lochman-Balk, 1972.

limestones are confused and the Sinbad is really the Permian Kaibab, it should not affect the confining layers of the proposed aquifer (White Rim Sandstone).

Since the Organ Rock Shale is not mentioned on the formation data from Delta Petroleum Corporation, it is not known if drilling encountered the unit. Information about 36-11 was also not available from the DOGM well data library, so it is unknown if the Organ Rock Shale is continuous from southern Utah to the San Rafael Swell. Mapping done by Doelling (2001) suggests that Permian age units are present and Hintze (1988) does indicate that the shale is present in the Green River area, but information about composition and thickness are not available for this report.

Structural geology of the area is a result of large salt anticlines between the Green River and the La Sal Mountains. These salt anticlines deformed the near horizontal sedimentary rock of the Colorado Plateau into gently dipping strata. There are three sets of normal faults in the area of the well; two of the set have east-west trends and one has a north-south trend.

The first set bisects the lower portion of section 36 and is known as the Little Grand fault. It trends east to west and is a ⁿdominant feature in the area. It is an oblique normal fault with right lateral strike slip movement; the southern block is displaced down in relation to the northern uplifted block. Displacement is not able to be determined because beds along the southern block appear to be deformed by fault drag providing no marker bed from which to measure net slip. Near Crystal Geysers the fault is segmented into two limbs.

The second and third sets form graben structures composed of one group of west-northwest trending faults and another group of north-northwest trending faults. Even though it is unclear from the map whether these faults are solely normal or if they have a strike slip component, it is probable that a strike slip component does exist but is also unmeasurable. There

is a direct relationship between both graben structures and the anticline structures: they both have similar trends. The west-northwest graben structure is very long and narrow and thus is named Tenmile graben. As shown in the cross section A-A' these faults probably terminate at depth possibly in pliable salt formations of the Pennsylvanian Hermosa Group.

Hydrogeology of the White Rim Sandstone

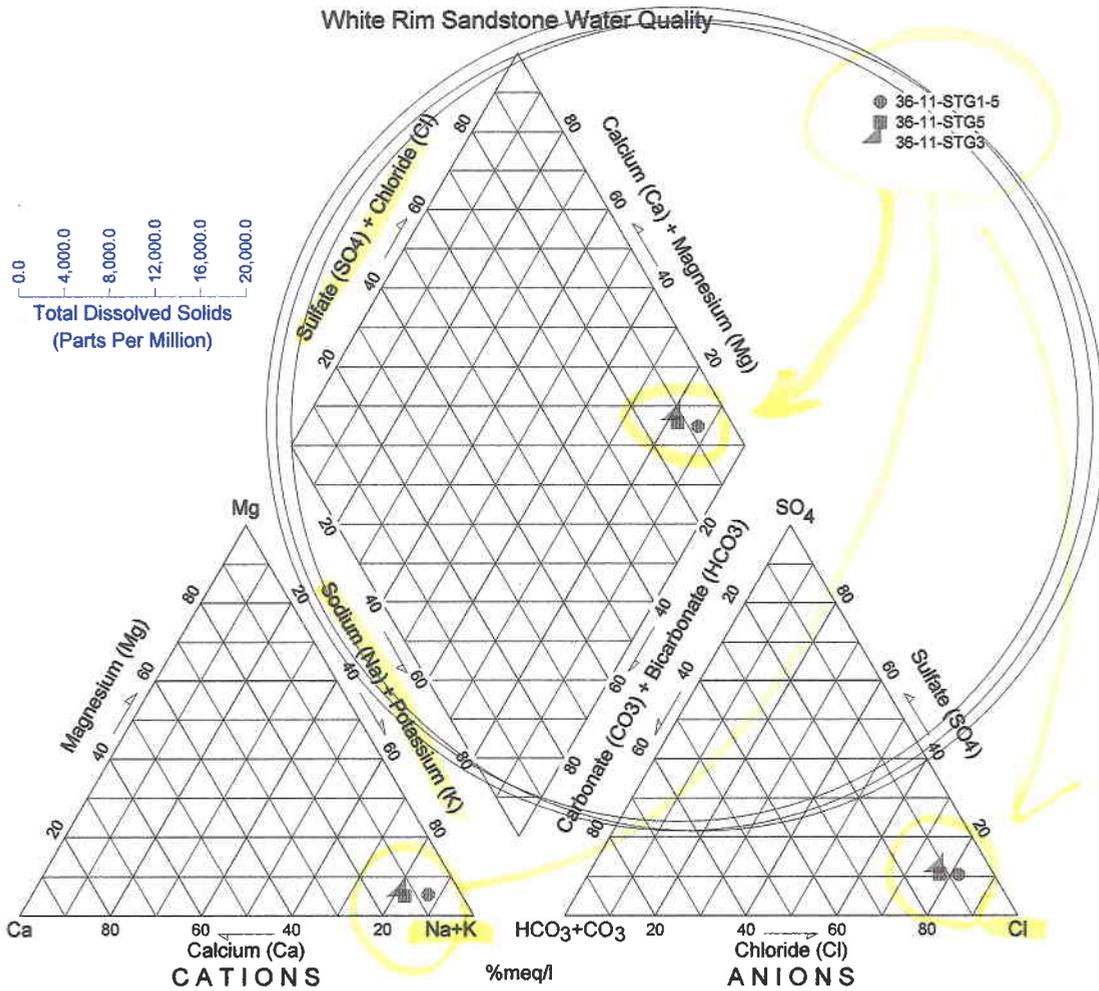
The hydrogeology of the White Rim Sandstone would be similar to the eolian Navajo Sandstone deposited during the Jurassic period. The description suggests that the porosity is equal or greater than the Navajo Sandstone. Exposures of the White Rim Sandstone in the Elaterite basin in southern Utah show tar seeping out of the unit during the hot summer months. Thus, the formation exhibits reservoir storage capacity. No data for hydraulic parameters of the White Rim Sandstone were available for this report; however, since the Navajo and the White Rim are similar eolian deposits, hydraulic properties are also probably similar. The (T) transmissivity, of the Navajo near Cainville was calculated to be 2,560 feet squared per day (Hood and Danielson, 1979).

Three water samples were taken from the White Rim Sandstone: GTS 36-11-OS Stg 1-5, GTS 36-11-OS stg 3, and GTS 36-11-OS Stg 5. Depth of the samples range from 3,222 to 3,456 feet in the interval of the target aquifer (verbal communication from Glen Nebeker of Western Land Services). Depth intervals for each water sample are unknown, but it is understood that sample GTS 36-11-OS Stg 1-5 is a composite of samples taken from each of the five zones. Sample GTS 36-11-OS Stg 3 and 5 represent the third and fifth zone sampled in the White Rim Sandstone. Water samples from the White Rim Sandstone collected from the 36-11 well are shown in the Piper diagram in Figure 3. They are sodium-chloride type waters and are very high

Composite sample of 5 zones

Piper Diagram

White Rim Sandstone Water Quality



in TDS (total dissolved solids) typical of connate water produced as a by product from oil fields. Sample GTS36-11-OS Stg1-5 measured a TDS value of 32,600 mg/L.

CONCLUSION

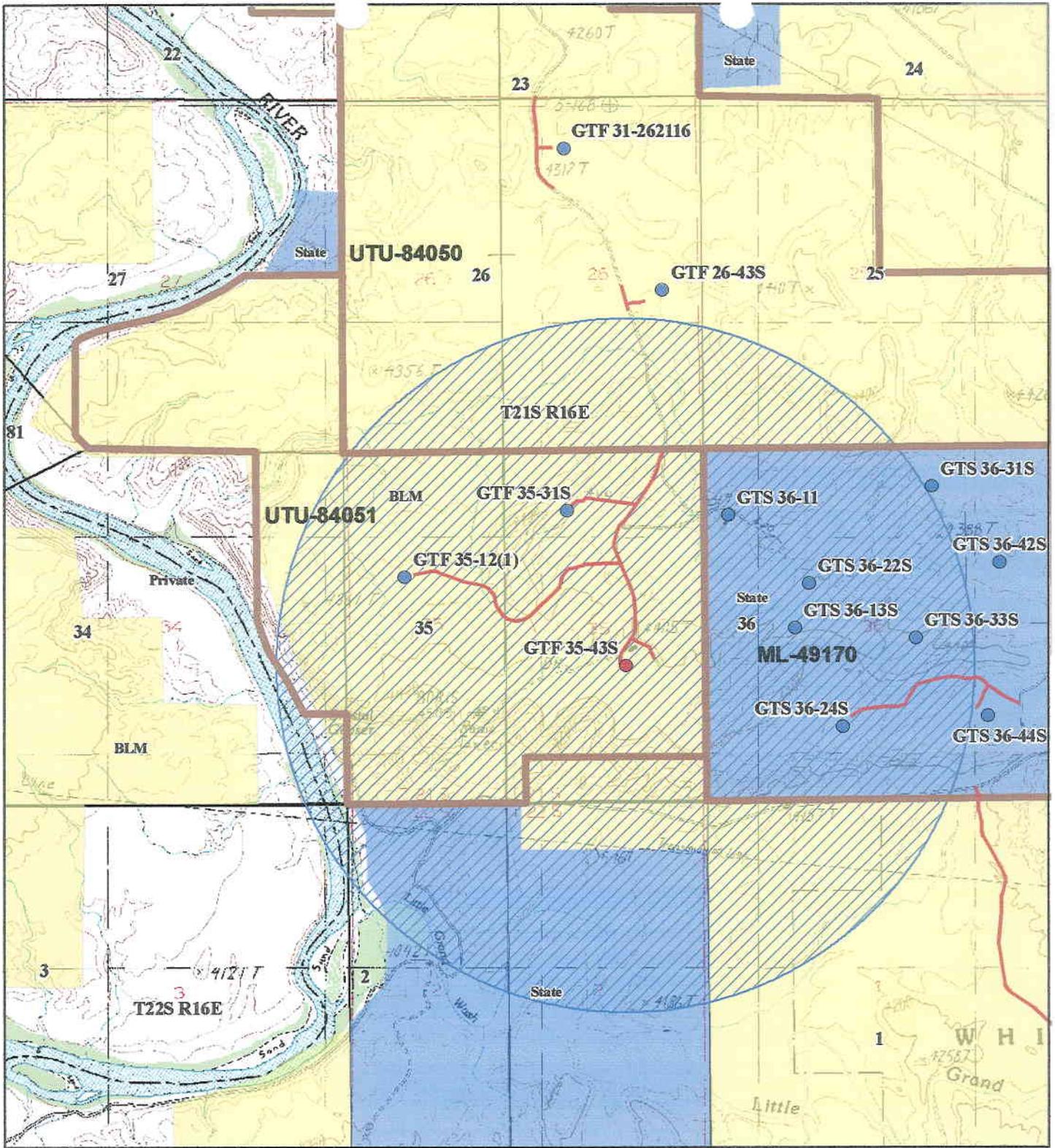
The GTS 36-11 well appears to be a reasonable choice for an injection well targeting the White Rim Sandstone as an aquifer for water disposal. The overlying limestone whether it be the Sinbad or the Kaibab Limestone should serve well as an aquiclude. The only porosity that might exist would be of a secondary nature via fractures, joints, or solution channels resulting from dissolution of the carbonate cement binding the limestone. If this were the case, then the formation overlying the limestone, which is the Moenkopi Formation consisting of silt and clay would also be a confining layer. The Organ Rock Shale underlying the White Rim Sandstone is also an aquiclude; it is composed of very fine sands, silts, and clays and is poorly sorted allowing for poor transmissibility. Fresh water aquifers nearest the White Rim Sandstone would be the Entrada and the Navajo Sandstones that are almost 2,500 feet above the White Rim Sandstone. Although the area of the proposed injection well (GTS 36-11) is structurally deformed by faulting and folding from salt diapirism in the area between the Colorado and Green Rivers, the faults do not appear to be conduits for recharge between aquifers or from the surface to aquifers below 1,646 feet. This is possibly due to the composition of the formations juxtaposed against the faults and also the amount of fault gouge filling the fault planes and lack of fault dilation. Further evidence suggesting a lack of hydraulic conductivity between the White Rim Sandstone aquifer and the favorable aquifers of the Navajo, Wingate, and Entrada sandstones is the absence of connate water (similar in quality) found in the other formations. A water sample taken from the Crystal Geyser (Mayo, Shrum, and Chidsey, 1991) are calcium and magnesium (cations) sulfate

(ions) dominateⁿ water. The amount of bicarbonate (HCO_3^-) approximately 36 percent versus 9 percent for GTS 36-11 OS Stg 1-5 suggest that there is no hydraulic connection between aquifers, and that water from Crystal Geyser is most likely younger being recharged from aquifers with hydraulic connections to surface recharge. The amount of halite (NaCl) in the samples suggests that water in the White Rim Sandstone is or has been in contact with the salt formations of the Hermosa Group or has evolved to a Na^+ Cl^- rich connate water. The White Rim Sandstone is a suitable target aquifer for Delta Petroleum Corporation to inject water using the proposed GTS 36-11 well as an injection well.

References Cited

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- Kamola, D.L., and Chan, M.A., 1988, Coastal dunes facies, Permian Cutler Formation (White Rim Sandstone), Capitol Reef Nation Park area, southern Utah, in Kocurek, Gary ed., *Late Paleozoic and Mesozoic Eolian Deposits of the western interior of the United States: Sedimentary Geology*, v. 56, p. 341-356.
- Mayo, A.L., Shrum, D.B., and Chidsey, T.C. Jr., 1991, Factors contributing to exsolving carbon dioxide in ground water systems in the Colorado Plateau, Utah, in Chidsey, T.C. Jr., ed., *Geology of east-central Utah: Utah Geological Association Publication 19*, p. 335-341.
- Steel, B.A., 1987, Depositional environments of the White Rim Sandstone Member of the Permian Cutler Group, Canyon Land National Park, Utah: U.S. Geological Survey Bulletin 1592, 20 p.

Appendix



Legend

- | | | | |
|--|-----------------|--|---------|
| | Other Wells | | NPS |
| | Well | | PRIVATE |
| | Access Roads | | STATE |
| | Leases | | TRIBAL |
| | 1mi Well Buffer | | USFS |
| | BLM | | USFWS |
| | DOD | | |



1:24,000

Delta Petroleum

Greentown Federal 35-43S



WESTERN LAND SERVICES

Richfield, UT 84701 (435) 896-5501

CONFIDENTIAL

Prepared by: DTJ

Date: July 5, 2007

LABORATORY ANALYTICAL REPORT

Client: Delta Petroleum Corporation
Project: Not Indicated
Lab ID: C07010683-002
Client Sample ID: GTS 36-11-OS Stg 1-5 Water

Report Date: 01/30/07
Collection Date: Not Provided
Date Received: 01/18/07
Matrix: Aqueous

| Analyses | Result | Units | Qualifiers | RL | MCL/ QCL | Method | Analysis Date / By |
|-------------------------------------|--------|----------|------------|------|-------------|-------------------------|----------------------|
| MAJOR IONS | | | | | | | |
| Carbonate as CO ₃ | ND | mg/L | | 1 | | A2320 B | 01/18/07 15:39 / jaj |
| Bicarbonate as HCO ₃ | 2880 | mg/L | | 1 | | A2320 B | 01/18/07 15:39 / jaj |
| Calcium | 798 | mg/L | D | 0.6 | | E200.7 | 01/26/07 16:49 / ts |
| Chloride | 17400 | mg/L | | 1 | | A4500-Cl B | 01/26/07 12:46 / jl |
| Magnesium | 357 | mg/L | D | 0.5 | | E200.7 | 01/26/07 16:49 / ts |
| Potassium | 1220 | mg/L | D | 0.5 | | E200.7 | 01/26/07 16:49 / ts |
| Sodium | 10200 | mg/L | D | 0.6 | | E200.7 | 01/26/07 16:49 / ts |
| Sulfate | 3010 | mg/L | D | 30 | | A4500-SO ₄ E | 01/22/07 16:52 / lji |
| PHYSICAL PROPERTIES | | | | | | | |
| Conductivity | 48600 | umhos/cm | | 1.0 | | A2510 B | 01/18/07 16:23 / lji |
| pH | 6.85 | s.u. | | 0.01 | | A4500-H B | 01/18/07 16:23 / lji |
| Solids, Total Dissolved TDS @ 180 C | 32600 | mg/L | | 10 | | A2540 C | 01/18/07 16:36 / lji |
| METALS - TOTAL | | | | | | | |
| Iron | 0.52 | mg/L | D | 0.04 | | E200.7 | 01/26/07 16:49 / ts |
| DATA QUALITY | | | | | | | |
| A/C Balance (± 5) | -4.83 | % | | | | Calculation | 01/30/07 08:44 / cp |
| Anions | 600 | meq/L | | | | Calculation | 01/30/07 08:44 / cp |
| Cations | 545 | meq/L | | | | Calculation | 01/30/07 08:44 / cp |
| Solids, Total Dissolved Calculated | 34400 | mg/L | | | | Calculation | 01/30/07 08:44 / cp |
| TDS Balance (0.80 - 1.20) | 0.950 | dec. % | | | | Calculation | 01/30/07 08:44 / cp |

Report RL - Analyte reporting limit.

Definitions: QCL - Quality control limit.

D - RL increased due to sample matrix interference.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.

PRELIMINARY

LABORATORY ANALYTICAL REPORT

Client: Delta Petroleum Corporation
Project: Not Indicated
Lab ID: C07010683-004
Client Sample ID: GTS 36-11-OS Stg 3 Water

Report Date: 01/30/07
Collection Date: Not Provided
Date Received: 01/18/07
Matrix: Aqueous

| Analyses | Result | Units | Qualifiers | RL | MCL/ QCL | Method | Analysis Date / By |
|-------------------------------------|--------|----------|------------|------|-------------|-------------|----------------------|
| MAJOR IONS | | | | | | | |
| Carbonate as CO3 | ND | mg/L | | 1 | | A2320 B | 01/18/07 15:46 / jaj |
| Bicarbonate as HCO3 | 3920 | mg/L | | 1 | | A2320 B | 01/18/07 15:46 / jaj |
| Calcium | 1460 | mg/L | D | 0.6 | | E200.7 | 01/26/07 16:56 / ts |
| Chloride | 16100 | mg/L | | 1 | | A4500-Cl B | 01/18/07 14:50 / jl |
| Magnesium | 363 | mg/L | D | 0.5 | | E200.7 | 01/26/07 16:56 / ts |
| Potassium | 973 | mg/L | D | 0.5 | | E200.7 | 01/26/07 16:56 / ts |
| Sodium | 10500 | mg/L | D | 0.6 | | E200.7 | 01/26/07 16:56 / ts |
| Sulfate | 3130 | mg/L | D | 30 | | A4500-SO4 E | 01/22/07 16:56 / ljl |
| PHYSICAL PROPERTIES | | | | | | | |
| Conductivity | 42100 | umhos/cm | | 1.0 | | A2510 B | 01/18/07 16:25 / ljl |
| pH | 6.91 | s.u. | | 0.01 | | A4500-H B | 01/18/07 16:25 / ljl |
| Solids, Total Dissolved TDS @ 180 C | 28100 | mg/L | | 10 | | A2540 C | 01/18/07 16:36 / ljl |
| METALS - TOTAL | | | | | | | |
| Iron | 8.97 | mg/L | D | 0.04 | | E200.7 | 01/26/07 16:56 / ts |
| DATA QUALITY | | | | | | | |
| A/C Balance (± 5) | 0.003 | % | | | | Calculation | 01/30/07 08:46 / cp |
| Anions | 584 | meq/L | | | | Calculation | 01/30/07 08:46 / cp |
| Cations | 584 | meq/L | | | | Calculation | 01/30/07 08:46 / cp |
| Solids, Total Dissolved Calculated | 34500 | mg/L | | | | Calculation | 01/30/07 08:46 / cp |
| TDS Balance (0.80 - 1.20) | 0.810 | dec. % | | | | Calculation | 01/30/07 08:46 / cp |

Report RL - Analyte reporting limit.

Definitions: QCL - Quality control limit.

D - RL increased due to sample matrix interference.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.

PRELIMINARY

4/4 Waiting currently for information

LABORATORY ANALYTICAL REPORT

Client: Delta Petroleum Corporation
Project: Not Indicated
Lab ID: C07010683-003
Client Sample ID: GTS 36-11-OS Stg 5 Water

Report Date: 01/30/07
Collection Date: Not Provided
Date Received: 01/18/07
Matrix: Aqueous

| Analyses | Result | Units | Qualifiers | RL | MCL/ QCL | Method | Analysis Date / By |
|-------------------------------------|--------|----------|------------|------|-------------|-------------------------|----------------------|
| MAJOR IONS | | | | | | | |
| Carbonate as CO ₃ | ND | mg/L | | 1 | | A2320 B | 01/18/07 15:42 / jaj |
| Bicarbonate as HCO ₃ | 4130 | mg/L | | 1 | | A2320 B | 01/18/07 15:42 / jaj |
| Calcium | 1420 | mg/L | D | 0.6 | | E200.7 | 01/26/07 16:52 / ts |
| Chloride | 15600 | mg/L | | 1 | | A4500-Cl B | 01/18/07 14:49 / jl |
| Magnesium | 344 | mg/L | D | 0.5 | | E200.7 | 01/26/07 16:52 / ts |
| Potassium | 998 | mg/L | D | 0.5 | | E200.7 | 01/26/07 16:52 / ts |
| Sodium | 9970 | mg/L | D | 0.6 | | E200.7 | 01/26/07 16:52 / ts |
| Sulfate | 2900 | mg/L | D | 30 | | A4500-SO ₄ E | 01/22/07 16:54 / ljl |
| PHYSICAL PROPERTIES | | | | | | | |
| Conductivity | 42600 | umhos/cm | | 1.0 | | A2510 B | 01/18/07 16:25 / ljl |
| pH | 6.86 | s.u. | | 0.01 | | A4500-H B | 01/18/07 16:25 / ljl |
| Solids, Total Dissolved TDS @ 180 C | 28600 | mg/L | | 10 | | A2540 C | 01/18/07 16:36 / ljl |
| METALS - TOTAL | | | | | | | |
| Iron | 5.40 | mg/L | D | 0.04 | | E200.7 | 01/26/07 16:52 / ts |
| DATA QUALITY | | | | | | | |
| A/C Balance (± 5) | -0.943 | % | | | | Calculation | 01/30/07 08:45 / cp |
| Anions | 569 | meq/L | | | | Calculation | 01/30/07 08:45 / cp |
| Cations | 558 | meq/L | | | | Calculation | 01/30/07 08:45 / cp |
| Solids, Total Dissolved Calculated | 33300 | mg/L | | | | Calculation | 01/30/07 08:45 / cp |
| TDS Balance (0.80 - 1.20) | 0.860 | dec. % | | | | Calculation | 01/30/07 08:45 / cp |

Report RL - Analyte reporting limit.

Definitions: QCL - Quality control limit.

D - RL increased due to sample matrix interference.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.

PRELIMINARY

GTF 35-31S

Surface Formation and Estimated Formation Tops:

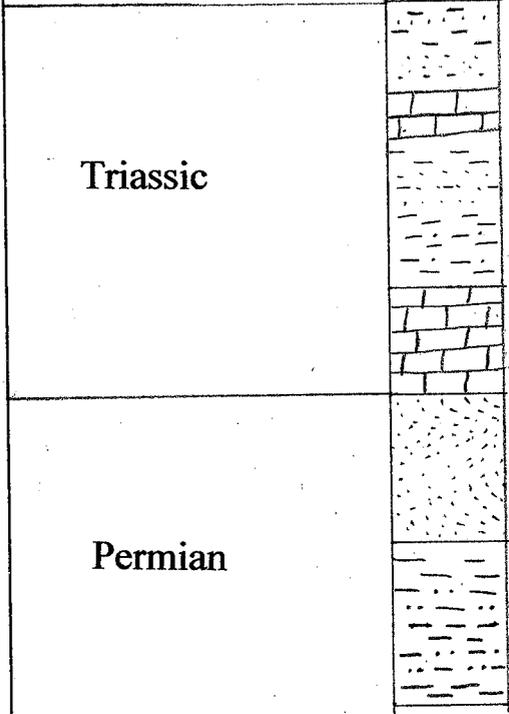
| | |
|--------------------|-----------|
| Morrison-Salt Wash | 0 ft. |
| Entrada | 456 ft. |
| Carmel | 1,008 ft. |
| Navajo | 1,173 ft. |
| Kayenta | 1,609 ft. |
| Wingate | 1,646 ft. |
| Chinle | 2,109 ft. |
| Shinarump | 2,291 ft. |
| Moenkopi | 2,337 ft. |
| Sinbad Is. | 2,932 ft. |
| White Rim | 3,149 ft. |

Estimated Depth at Which Oil, Gas, Water or Other Mineral Bearing Zones are Expected to be Encountered

| | | <u>Depth/Formation</u> |
|-----------------------|-----------|------------------------|
| Expected Oil Zones: | | |
| Primary Target: | White Rim | 3,149 ft. |
| Expected Gas Zones: | | |
| Primary Target: | White Rim | 3,149 ft. |
| Secondary Targets: | Entada | 456 ft. |
| | Navajo | 1,173 ft. |
| | Wingate | 1,646 ft. |
| Expected Water Zones: | | |
| Primary Target: | White Rim | 3,149 ft. |
| Secondary Targets: | Entada | 456 ft. |
| | Navajo | 1,173 ft. |
| | Wingate | 1,646 ft. |

Stratigraphic column of target aquifer and confining layers

22-141 50 SHEETS
22-142 100 SHEETS
22-144 200 SHEETS



Triassic

Moenkopi

Sinbad LS

White Rim Sandstone

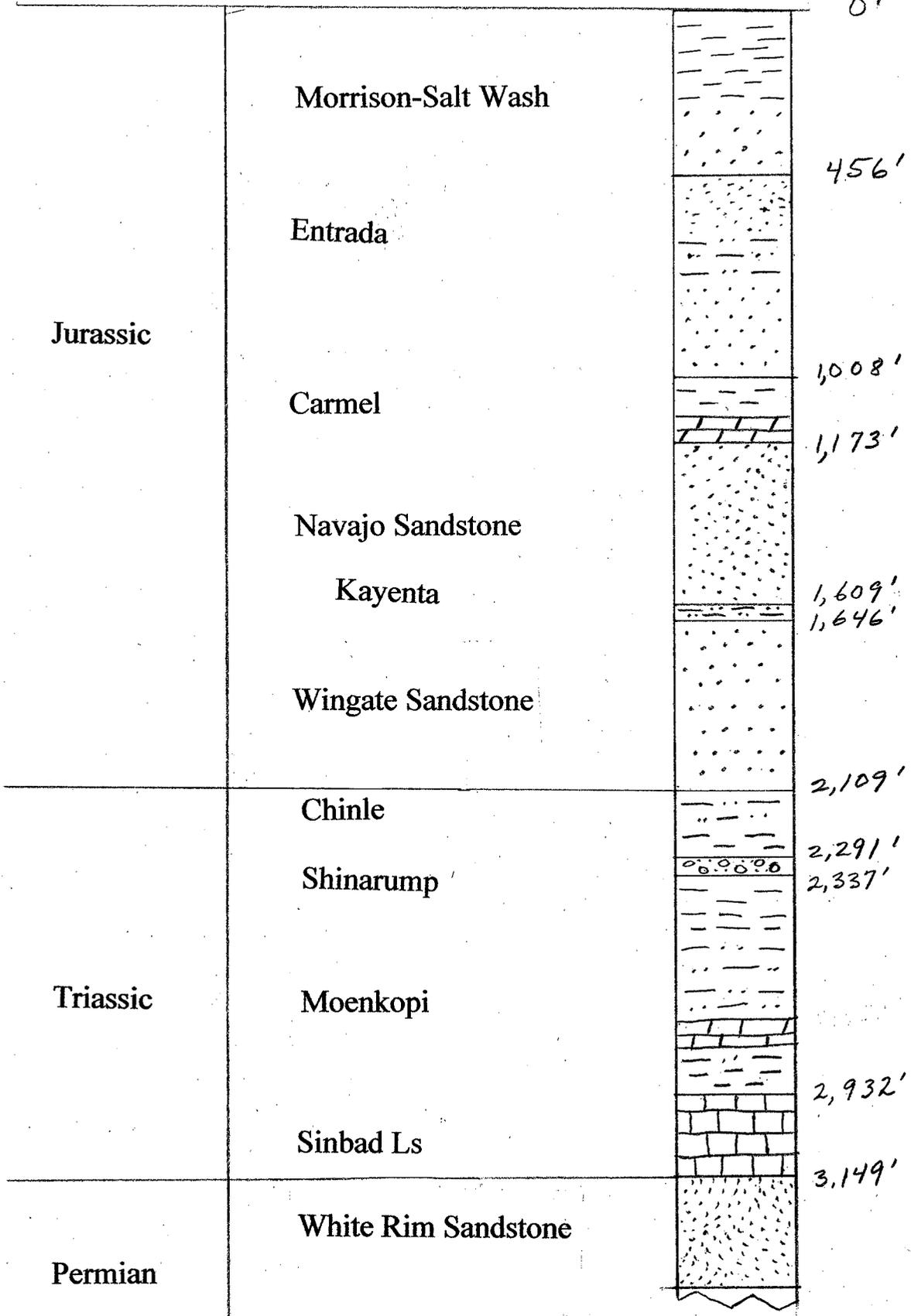
Permian

Organ Rock Shale

Straigraphic column from Well GTS 31-11

6
 ???
 should this be
 36-11?

22-141 50 SHEETS
 22-142 100 SHEETS
 22-144 200 SHEETS



STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

UIC FORM 1

APPLICATION FOR INJECTION WELL

| | | |
|---|--------------------------------|---|
| Name of Operator Delta Petroleum Corporaton, Attn. Kate Shirley | Utah Account Number N | Well Name and Number Greentown State 36-11OS |
| Address of Operator 370 17th St Suite 4300 ^{CITY} Denver STATE CO ZIP 80202 | Phone Number (303) 575-0397 | API Number 4301931505 |
| Location of Well Footage : 1024' FNL & 429' FWL County : Grand QQ, Section, Township, Range: NWNW 36 12S 16E State : UTAH | | Field or Unit Name Wildcat Lease Designation and Number ML-49170 |

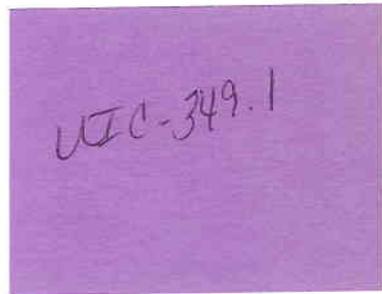
Is this application for expansion of an existing project? Yes No

Will the proposed well be used for:

| | | |
|--------------------|---|--|
| Enhanced Recovery? | Yes <input type="checkbox"/> | No <input checked="" type="checkbox"/> |
| Disposal? | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/> |
| Storage? | Yes <input type="checkbox"/> | No <input checked="" type="checkbox"/> |

Is this application for a new well to be drilled? Yes No

If this application is for an existing well, has a casing test been performed? Yes No
Date of test: 5/31/2008



Proposed injection interval: from 3,222 to 3,456

Proposed maximum injection: rate 2,000 bpd pressure 1,700 psig

Proposed injection zone contains oil , gas , and / or fresh water within 1/2 mile of the well.

List of attachments: See attached list

**ATTACH ADDITIONAL INFORMATION AS REQUIRED BY CURRENT
UTAH OIL AND GAS CONSERVATION GENERAL RULES**

I hereby certify that this report is true and complete to the best of my knowledge.

Name (Please Print) Glen T. Nebeker Title NEPA Specialist/Project Manager
Signature Glen T. Nebeker Date 6-11-08

RECEIVED

JUN 12 2008



State of Utah

Department of
Natural Resources

MICHAEL R. STYLER
Executive Director

Division of
Oil, Gas & Mining

JOHN R. BAZA
Division Director

JON M. HUNTSMAN, JR.
Governor

GARY R. HERBERT
Lieutenant Governor

November 13, 2006

Delta Petroleum Corporation
370 17th Street, Suite 4300
Denver, CO 80021

Re: Greentown State 36-11S Well, 1024' FNL, 429' FWL, NW NW, Sec. 36,
T. 21 South, R. 16 East, Grand County, Utah

Gentlemen:

Pursuant to the provisions and requirements of Utah Code Ann. § 40-6-1 *et seq.*, Utah Administrative Code R649-3-1 *et seq.*, and the attached Conditions of Approval, approval to drill the referenced well is granted.

Appropriate information has been submitted to DOGM and administrative approval of the requested exception location is hereby granted.

This approval shall expire one year from the above date unless substantial and continuous operation is underway, or a request for extension is made prior to the expiration date. The API identification number assigned to this well is 43-019-31505.

Sincerely,

Gil Hunt
Associate Director

mf
Enclosures

cc: Grand County Assessor
SITLA

**DIVISION OF OIL, GAS AND MINING
APPLICATION FOR PERMIT TO DRILL
STATEMENT OF BASIS**

(Original onsite done for the Greentown State 36-11 well)

OPERATOR: Delta Petroleum Corporation
WELL NAME & NUMBER: Greentown State #36-11S
API NUMBER: 43-019-31505
LOCATION: 1/4,1/4 NWNW Sec:36 TWP: 21S RNG: 16E 1024 FNL 429 FWL

Geology/Ground Water:

Significant volumes of high quality ground water are unlikely to be encountered in the bedrock at this location. A poorly permeable soil is likely to be developed on the Jurassic-age Brushy Basin Member of the Morrison Formation. A small but locally important quality ground water resource may be encountered in several permeable Mesozoic aquifers in this area. The proposed casing and cementing program should adequately isolate any zones of fresh water that may be penetrated. No underground water rights have been filed on any area within a mile of the proposed well site.

Reviewer: Christopher J. Kierst **Date:** 1/19/2006

Surface:

On-site conducted January 12, 2006. In attendance: Bart Kettle (DOGM), Ted Smith (DOGM), Larry Johnson (Talon Resources), Nathan Sill (DWR), Ed Bonner (SITLA), Terry Hoffman (Delta) and dirt contractor.

Questions regarding the status of roads used to access the well site. Some roads may not be county roads and require a BLM special use permit to use for drilling purposes. Reserve pit will require fencing on three sides at the time of drilling, with the fourth side being fenced immediately upon the removal of the drilling rig. Addendum: Well site visited on February 14, 2006 to review changes made to the setting of the well pad. Well has been moved to the south, and as staked now lies on the edge of structures previously used as part of the Utah Launch Complex, White Sands Missile Range. SITLA in not showing an active lease at this site, and is not requesting restriction on the use of the surface. Provided the old building at this site will be tore down SITLA is requesting that it be removed from the site.

Reviewer: Bart Kettle **Date:** January 13, 2006

Conditions of Approval/Application for Permit to Drill:

1. Fence Reserve Pit on three sides while drilling, with the fourth side being fenced upon the removal of the drilling rig.

Operator: Delta Petroleum Corporation
Well Name & Number Greentown State 36-11S
API Number: 43-019-31505
Lease: ML-49170

Location: NW NW **Sec.** 36 **T.** 21 South **R.** 16 East

Conditions of Approval

1. **General**

Compliance with the requirements of Utah Admin. R. 649-1 *et seq.*, the Oil and Gas Conservation General Rules, and the applicable terms and provisions of the approved Application for Permit to Drill.

2. **Notification Requirements**

The operator is required to notify the Division of Oil, Gas and Mining of the following actions during drilling of this well:

- 24 hours prior to cementing or testing casing
- 24 hours prior to testing blowout prevention equipment
- 24 hours prior to spudding the well
- within 24 hours of any emergency changes made to the approved drilling program
- prior to commencing operations to plug and abandon the well

The following are Division of Oil, Gas and Mining contacts and their work telephone numbers (please leave a voice mail message if the person is not available to take the call):

- Dan Jarvis at (801) 538-5338
- Carol Daniels at (801) 538-5284 (spud)

3. **Reporting Requirements**

All required reports, forms and submittals will be promptly filed with the Division, including but not limited to the Entity Action Form (Form 6), Report of Water Encountered During Drilling (Form 7), Weekly Progress Reports for drilling and completion operations, and Sundry Notices and Reports on Wells requesting approval of change of plans or other operational actions.

4. Compliance with the State of Utah Antiquities Act forbids disturbance of archeological, historical, or paleontological remains. Should archeological, historical or paleontological remains be encountered during your operations, you are required to immediately suspend all operations and immediately inform the Trust Lands Administration and the Division of State History of the discovery of such remains.

5. This proposed well is located in an area for which drilling units (well spacing patterns) have not been established through an order of the Board of Oil, Gas and Mining (the "Board"). In order to avoid the possibility of waste or injury to correlative rights, the operator is requested, once the well has been drilled, completed, and has produced, to analyze geological and engineering data generated therefrom, as well as any similar data from surrounding areas if available. As soon as is practicable after completion of its analysis, and if the analysis suggests an area larger than the quarter-quarter section upon which the well is located is being drained, the operator is requested to seek an appropriate order from the Board establishing drilling and spacing units in conformance with such analysis by filing a Request for Agency Action with the Board.
6. Compliance with the Conditions of Approval/Application for Permit to Drill outlined in the Statement of Basis. (Copy Attached)

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

FORM 3

AMENDED REPORT
(highlight changes)

| | | | | | |
|---|--|---|--|--|-----------------------------|
| APPLICATION FOR PERMIT TO DRILL | | | | 6. MINERAL LEASE NO: ML-49170 | 8. SURFACE: State |
| 1A. TYPE OF WORK: DRILL <input checked="" type="checkbox"/> REENTER <input type="checkbox"/> DEEPEN <input type="checkbox"/> | | | | 7. IF INDIAN, ALLOTTEE OR TRIBE NAME: NA | |
| 8. TYPE OF WELL: OIL <input type="checkbox"/> GAS <input checked="" type="checkbox"/> OTHER _____ SINGLE ZONE <input checked="" type="checkbox"/> MULTIPLE ZONE <input type="checkbox"/> | | | | 8. UNIT or CA AGREEMENT NAME: NA | |
| 2. NAME OF OPERATOR: Delta Petroleum Corporation | | | | 9. WELL NAME and NUMBER: Greentown State #36-11S | |
| 3. ADDRESS OF OPERATOR: 370 17th St, Suite 4300 CITY Denver STATE CO ZIP 80021 | | | PHONE NUMBER: (303) 575-0323 | 10. FIELD AND POOL, OR WILDCAT: Wildcat | |
| 4. LOCATION OF WELL (FOOTAGES) AT SURFACE: 1024' FNL & 429' FWL <i>576863X 38 447345</i> <i>4311100y -110.113034</i> AT PROPOSED PRODUCING ZONE: Same as surface | | | | 11. QTR/CTR, SECTION, TOWNSHIP, RANGE, MERIDIAN: NWNW 36 21S 16E | |
| 14. DISTANCE IN MILES AND DIRECTION FROM NEAREST TOWN OR POST OFFICE: 3 Miles south of Green River, Utah | | | | 12. COUNTY: Grand | 13. STATE: UTAH |
| 15. DISTANCE TO NEAREST PROPERTY OR LEASE LINE (FEET) 429' | | 16. NUMBER OF ACRES IN LEASE: 1280 | | 17. NUMBER OF ACRES ASSIGNED TO THIS WELL: 40 | |
| 18. DISTANCE TO NEAREST WELL (DRILLING, COMPLETED, OR APPLIED FOR) ON THIS LEASE (FEET) 69' | | 19. PROPOSED DEPTH: 3,686 | | 20. BOND DESCRIPTION: CPCS-215808 | |
| 21. ELEVATIONS (SHOW WHETHER DF, RT, GR, ETC.): GR - 4323.3' | | 22. APPROXIMATE DATE WORK WILL START: 11/1/2006 | | 23. ESTIMATED DURATION: 25 days | |

24. **PROPOSED CASING AND CEMENTING PROGRAM**

| SIZE OF HOLE | CASING SIZE, GRADE, AND WEIGHT PER FOOT | SETTING DEPTH | CEMENT TYPE, QUANTITY, YIELD, AND SLURRY WEIGHT | | | |
|---------------|---|---------------|---|----------------|-------------|--------------|
| 11" | 8-5/8" J-55 24# | 1,200 | Lead - 85/15/8 Poz A | 215 sxs | 2.14 | 12.5# |
| | | | Tail - Type III | 110 sxs | 1.41 | 14.6# |
| 7-7/8" | 4-1/2" J-55 12.6# | 3,686 | Lead - 85/15/8 Poz A | 300 sxs | 2.14 | 12.5# |
| | | | Tail - Type III | 140 sxs | 1.41 | 14.6# |
| | | | | | | |
| | | | | | | |

25. **CONFIDENTIAL** **CONFIDENTIAL**

ATTACHMENTS

VERIFY THE FOLLOWING ARE ATTACHED IN ACCORDANCE WITH THE UTAH OIL AND GAS CONSERVATION GENERAL RULES:

| | |
|--|--|
| <input checked="" type="checkbox"/> WELL FLAT OR MAP PREPARED BY LICENSED SURVEYOR OR ENGINEER | <input checked="" type="checkbox"/> COMPLETE DRILLING PLAN |
| <input type="checkbox"/> EVIDENCE OF DIVISION OF WATER RIGHTS APPROVAL FOR USE OF WATER | <input type="checkbox"/> FORM 5, IF OPERATOR IS PERSON OR COMPANY OTHER THAN THE LEASE OWNER |

NAME (PLEASE PRINT) Larry W. Johnson TITLE Agent for Delta Petroleum Corp.

SIGNATURE *Larry W. Johnson* DATE 10/20/06

(This space for State use only) Terry Hoffman 303/250-0619 cell

API NUMBER ASSIGNED: 43-014-31505

Approved by the Utah Division of Oil, Gas and Mining

Date: 11/13/06
By: *[Signature]*

RECEIVED
OCT 23 2006
DIV. OF OIL, GAS & MINING

(11/2001)

Range 16 East

Location:
The well location was determined using a Trimble 5700 GPS survey grade unit.

Basis of Bearing:
The Basis of Bearing is GPS Measured.

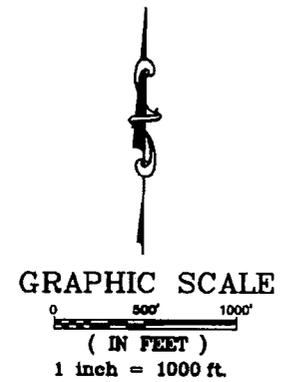
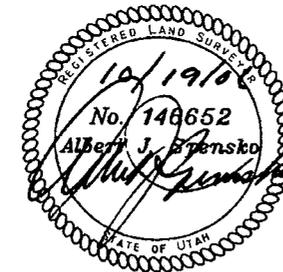
GLO Bearing:
The Bearings indicated are per the recorded plat obtained from the U.S. Land Office.

Basis of Elevation:
Basis of Elevation of 4310' being at the Southeast Section Corner of Section 36, Township 21 South, Range 16 East, Salt Lake Base and Meridian, as shown on the Green River NE Quadrangle 7.5 minute series map.

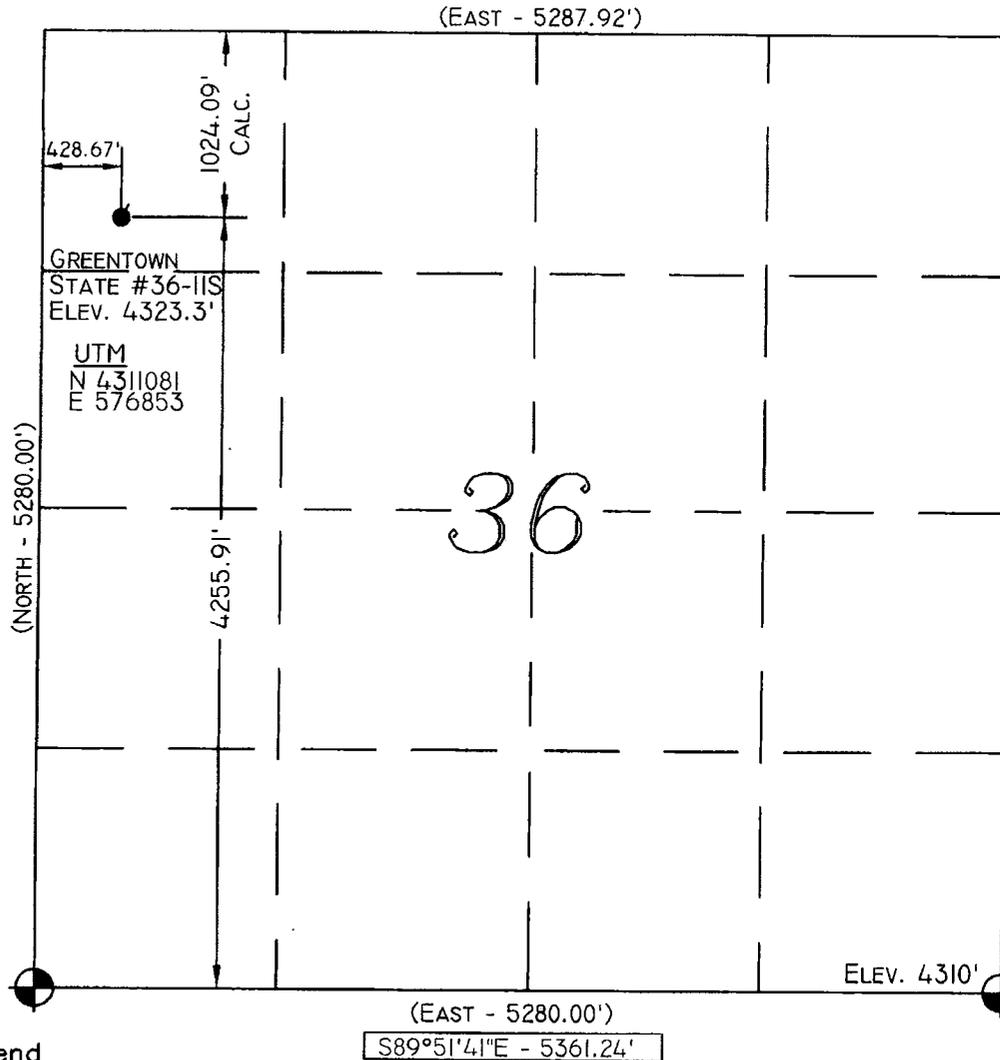
Description of Location:
Proposed Drill Hole located in the NW/4 NW/4 of Section 36, T21S, R16E, S.L.B.&M., being 4255.91' North and 428.67' East from the Southwest Section Corner of Section 36, T21S, R16E, Salt Lake Base & Meridian.

Surveyor's Certificate:

I, Albert J. Spensko, a Registered Professional Land Surveyor, holding Certificate 146652 State of Utah, do hereby certify that the information on this drawing is a true and accurate survey based on data of record and was conducted under my personal direction and supervision as shown hereon.



Township 21 South



Legend

- Drill Hole Location
- ⊙ Stone Monument (Found)
- Stone Monument (Searched for, but not found)
- △ Calculated Corner
- () GLO
- GPS Measured

NOTES:
1. UTM and Latitude / Longitude Coordinates are derived using a GPS Pathfinder and are shown in NAD 27 Datum.

LAT / LONG
38°56'49.843"N
110°06'47.364"W

TALON RESOURCES, INC.
195 North 100 West P.O. Box 1230
Huntington, Utah 84528
Phone (435)687-5310 Fax (435)687-5311
E-Mail talon@ctv.net

DELTA
PETROLEUM CORPORATION

Greentown State #36-11S
Section 36, T21S, R16E, S.L.B.&M.
Grand County, Utah

| | |
|---------------------------------|------------------------------------|
| Drawn By N. BUTKOVICH | Checked By L.W.J./A.J.S. |
| Drawing No. A-1 | Date 10/19/06 |
| | Scale 1" = 1000' |
| Sheet 1 of 4 | Job No. 2619 |

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

AMENDED REPORT FORM 8
(highlight changes)

WELL COMPLETION OR RECOMPLETION REPORT AND LOG

1a. TYPE OF WELL: OIL WELL GAS WELL DRY OTHER _____

b. TYPE OF WORK: NEW WELL HORIZ. LATS. DEEP-EN RE-ENTRY DIFF. RESVR. OTHER **Offset Well**

2. NAME OF OPERATOR:
Delta Petroleum Corporation

3. ADDRESS OF OPERATOR:
370 17th St., Ste. 4300 CITY **Denver** STATE **CO** ZIP **80202** PHONE NUMBER: **(303) 575-0323**

4. LOCATION OF WELL (FOOTAGES)
AT SURFACE: **1024' FNL & 429' FWL**
AT TOP PRODUCING INTERVAL REPORTED BELOW: **1024' FNL & 429' FWL**
AT TOTAL DEPTH: **1024' FNL & 429' FWL**

5. LEASE DESIGNATION AND SERIAL NUMBER:
ML-49170

6. IF INDIAN, ALLOTTEE OR TRIBE NAME
NA

7. UNIT or CA AGREEMENT NAME
NA

8. WELL NAME and NUMBER:
Greentown State 36-110S

9. API NUMBER:
4301931505

10. FIELD AND POOL, OR WILDCAT
Wildcat

11. QTR/QTR, SECTION, TOWNSHIP, RANGE, MERIDIAN:
NWNW 36 21S 16E

12. COUNTY
Grand

13. STATE
UTAH

14. DATE SPUNNED: **11/22/2006** 15. DATE T.D. REACHED: **12/16/2006** 16. DATE COMPLETED: **8/29/2007** ABANDONED READY TO PRODUCE

18. TOTAL DEPTH: MD **3,686** TVD _____ 19. PLUG BACK T.D.: MD **3,433** TVD _____ 20. IF MULTIPLE COMPLETIONS, HOW MANY? * _____ 21. DEPTH BRIDGE MD **3,433** PLUG SET: TVD _____

22. TYPE ELECTRIC AND OTHER MECHANICAL LOGS RUN (Submit copy of each)
Induction, Density Neutron, CBL

23. WAS WELL CORED? NO YES (Submit analysis)
WAS DST RUN? NO YES (Submit report)
DIRECTIONAL SURVEY? NO YES (Submit copy)

24. CASING AND LINER RECORD (Report all strings set in well)

| HOLE SIZE | SIZE/GRADE | WEIGHT (#/ft.) | TOP (MD) | BOTTOM (MD) | STAGE CEMENTER DEPTH | CEMENT TYPE & NO. OF SACKS | SLURRY VOLUME (BBL) | CEMENT TOP ** | AMOUNT PULLED |
|-----------|-------------|----------------|----------|-------------|----------------------|----------------------------|---------------------|---------------|---------------|
| 20" | 16" F-25 | 55 | 0 | 60 | 60 | RediM 12 | 7 | 0 | None |
| 11" | 8.625" J-55 | 24 | 0 | 1,227 | 1,227 | LtWt 245 G 111 | 86 28 | 0 | None |
| 7.875" | 5.5" J-55 | 17 | 0 | 3,675 | 3,675 | PremLt 350 Type 3 85 | 134 21 | 1820 | None |

25. TUBING RECORD

| SIZE | DEPTH SET (MD) | PACKER SET (MD) | SIZE | DEPTH SET (MD) | PACKER SET (MD) | SIZE | DEPTH SET (MD) | PACKER SET (MD) |
|-------|----------------|-----------------|------|----------------|-----------------|------|----------------|-----------------|
| 2 7/8 | 3,416 | | | | | | | |

26. PRODUCING INTERVALS

| FORMATION NAME | TOP (MD) | BOTTOM (MD) | TOP (TVD) | BOTTOM (TVD) |
|----------------|----------|-------------|-----------|--------------|
| (A) White Rim | 3,202 | 3,456 | | |
| (B) | | | | |
| (C) | | | | |
| (D) | | | | |

27. PERFORATION RECORD

| INTERVAL (Top/Bot - MD) | SIZE | NO. HOLES | PERFORATION STATUS |
|-------------------------|------|-----------|---|
| | | | Open <input type="checkbox"/> Squeezed <input type="checkbox"/> |
| | | | Open <input type="checkbox"/> Squeezed <input type="checkbox"/> |
| | | | Open <input type="checkbox"/> Squeezed <input type="checkbox"/> |
| | | | Open <input type="checkbox"/> Squeezed <input type="checkbox"/> |

28. ACID, FRACTURE, TREATMENT, CEMENT SQUEEZE, ETC.

| DEPTH INTERVAL | AMOUNT AND TYPE OF MATERIAL |
|-----------------------------|---|
| 1) 3222-3234 2) (3274-3286) | 1) 22,545 gal fluid, 489 gal CO2, 76,250# 20/40 Jordan Sand/ 2) 35,713 gal fluid, 9777gal CO2, 120,002# 20/40 Jordan Sand |
| 3) 3320-3332 4) (3362-3374) | 3) 27,064 gal fluid, 19054 gal CO2, 124,989# 20/40 Jordan Sand/ 4) 26,146 gal fluid, 18,138 gal CO2, 118,082# 20/40 Jordan Sand |
| 5) 3444-3456 | 5) 29,904 gal fluid, 24,783 gal CO2, 30,098# 20/40 Jordan Sand |

29. ENCLOSED ATTACHMENTS:

ELECTRICAL/MECHANICAL LOGS GEOLOGIC REPORT DST REPORT DIRECTIONAL SURVEY
 SUNDRY NOTICE FOR PLUGGING AND CEMENT VERIFICATION CORE ANALYSIS OTHER: _____

30. WELL STATUS:
T&A'd

RECEIVED

JUN 12 2008

31. INITIAL PRODUCTION

INTERVAL A (As shown in item #26)

| | | | | | | | | | | |
|-----------------------------------|-------------------|------------------------|-------------|---------------------|---------------|---------------------------|-----------------|-----------------|-----------------------|--------------------------|
| DATE FIRST PRODUCED: 8/29/2007 | | TEST DATE: 9/1/2007 | | HOURS TESTED: 24 | | TEST PRODUCTION RATES: → | OIL - BBL: 0 | GAS - MCF: 0 | WATER - BBL: 1,200 | PROD. METHOD: Flowing |
| CHOKE SIZE: 64 | TBG. PRESS. 90 | CSG. PRESS. 10 | API GRAVITY | BTU - GAS | GAS/OIL RATIO | 24 HR PRODUCTION RATES: → | OIL - BBL: 0 | GAS - MCF: 0 | WATER - BBL: 1,200 | INTERVAL STATUS: Open |

INTERVAL B (As shown in item #26)

| | | | | | | | | | | |
|----------------------|-------------|-------------|-------------|---------------|---------------|---------------------------|------------|------------|--------------|------------------|
| DATE FIRST PRODUCED: | | TEST DATE: | | HOURS TESTED: | | TEST PRODUCTION RATES: → | OIL - BBL: | GAS - MCF: | WATER - BBL: | PROD. METHOD: |
| CHOKE SIZE: | TBG. PRESS. | CSG. PRESS. | API GRAVITY | BTU - GAS | GAS/OIL RATIO | 24 HR PRODUCTION RATES: → | OIL - BBL: | GAS - MCF: | WATER - BBL: | INTERVAL STATUS: |

INTERVAL C (As shown in item #26)

| | | | | | | | | | | |
|----------------------|-------------|-------------|-------------|---------------|---------------|---------------------------|------------|------------|--------------|------------------|
| DATE FIRST PRODUCED: | | TEST DATE: | | HOURS TESTED: | | TEST PRODUCTION RATES: → | OIL - BBL: | GAS - MCF: | WATER - BBL: | PROD. METHOD: |
| CHOKE SIZE: | TBG. PRESS. | CSG. PRESS. | API GRAVITY | BTU - GAS | GAS/OIL RATIO | 24 HR PRODUCTION RATES: → | OIL - BBL: | GAS - MCF: | WATER - BBL: | INTERVAL STATUS: |

INTERVAL D (As shown in item #26)

| | | | | | | | | | | |
|----------------------|-------------|-------------|-------------|---------------|---------------|---------------------------|------------|------------|--------------|------------------|
| DATE FIRST PRODUCED: | | TEST DATE: | | HOURS TESTED: | | TEST PRODUCTION RATES: → | OIL - BBL: | GAS - MCF: | WATER - BBL: | PROD. METHOD: |
| CHOKE SIZE: | TBG. PRESS. | CSG. PRESS. | API GRAVITY | BTU - GAS | GAS/OIL RATIO | 24 HR PRODUCTION RATES: → | OIL - BBL: | GAS - MCF: | WATER - BBL: | INTERVAL STATUS: |

32. DISPOSITION OF GAS (Sold, Used for Fuel, Vented, Etc.)

33. SUMMARY OF POROUS ZONES (Include Aquifers):

Show all important zones of porosity and contents thereof; Cored intervals and all drill-stem tests, including depth interval tested, cushion used, time tool open, flowing and shut-in pressures and recoveries.

34. FORMATION (Log) MARKERS:

| Formation | Top (MD) | Bottom (MD) | Descriptions, Contents, etc. | Name | Top (Measured Depth) |
|---------------------------------|----------|-------------|----------------------------------|---|----------------------|
| 27) White Rim Perf Record | 3,202 | 3,208 | Size .43", 4spf, 24 holes - open | Entrada | 476 |
| | 3,222 | 3,234 | Size .43", 3spf, 36 holes - open | Carmel | 1,053 |
| | 3,274 | 3,286 | Size .43", 3spf, 36 holes - open | Navaio | 1,208 |
| | 3,306 | 3,310 | Size .43", 4spf, 16 holes - open | Kayenta | 1,644 |
| | 3,320 | 3,332 | Size .36", 3spf, 36 holes - open | Wingate | 1,679 |
| | 3,343 | 3,349 | Size .43", 4spf, 24 holes - open | Chinle | 2,145 |
| | 3,362 | 3,374 | Size .36", 3spf, 36 holes - open | Shinarump | 2,338 |
| | 3,402 | 3,406 | Size .43", 4spf, 16 holes - open | Moenkopi | 2,374 |
| | 3,444 | 3,456 | Size .38", 3spf, 36 holes - open | Sinbad Limestone White Rim/ Cutler - 3544' | 2,962 3,180 |

35. ADDITIONAL REMARKS (Include plugging procedure)

CIBP @ 3433'

36. I hereby certify that the foregoing and attached information is complete and correct as determined from all available records.

NAME (PLEASE PRINT) Terry L. Hoffmann TITLE Regulatory Manager
 SIGNATURE *Terry L. Hoffmann* DATE 10/23/2007

This report must be submitted within 30 days of

- completing or plugging a new well
- drilling horizontal laterals from an existing well bore
- recompleting to a different producing formation
- reentering a previously plugged and abandoned well
- significantly deepening an existing well bore below the previous bottom-hole depth
- drilling hydrocarbon exploratory holes, such as core samples and stratigraphic tests

* ITEM 20: Show the number of completions if production is measured separately from two or more formations.

** ITEM 24: Cement Top - Show how reported top(s) of cement were determined (circulated (CIR), calculated (CAL), cement bond log (CBL), temperature survey (TS)).

Send to: Utah Division of Oil, Gas and Mining
 1594 West North Temple, Suite 1210
 Box 145801
 Salt Lake City, Utah 84114-5801
 Phone: 801-538-5340
 Fax: 801-359-3940

| | |
|--|---|
| Analytical Laboratory Report for: Delta Petroleum |  Chemical Services Account Representative: Monty Frost |
|--|---|

Production Water Analysis

Listed below please find water analysis report from: Greentown State, 36-116 05

Lab Test No: 2008401300 Sample Date: 03/04/2008
Specific Gravity: 1.029
TDS: 43686
pH: 8.30

| Cations: | mg/L | as: |
|------------------|-------|----------------------------------|
| Calcium | 1120 | (Ca ⁺⁺) |
| Magnesium | 1671 | (Mg ⁺⁺) |
| Sodium | 12075 | (Na ⁺) |
| Iron | 8.00 | (Fe ⁺⁺) |
| Manganese | 0.10 | (Mn ⁺⁺) |
| Anions: | mg/L | as: |
| Bicarbonate | 732 | (HCO ₃ ⁻) |
| Sulfate | 3300 | (SO ₄ ⁼) |
| Chloride | 24780 | (Cl ⁻) |
| Gases: | | |
| Carbon Dioxide | 12 | (CO ₂) |
| Hydrogen Sulfide | 1 | (H ₂ S) |

*from what zone is this?
Connate Water
White Rim SS*

Lab Comments:
Compatibility tests were run with Fed 28-11 & no precipitate was found.
The water was mixed at 10%, 25% & 50%.

LABORATORY ANALYTICAL REPORT

Client: Delta Petroleum Corporation
Project: Not Indicated
Lab ID: C07010683-001
Client Sample ID: GTS 36-11-OS Stg 1-5 Oil

*3 sample
is from White Rim
cuttles*

Report Date: 01/30/07
Collection Date: Not Provided
Date Received: 01/18/07
Matrix: Oil

| Analyses | Result | Units | Qualifiers | RL | MCL/ QCL | Method | Analysis Date / By |
|----------------------------|--------|---------|------------|--------|-------------|----------|------------------------|
| OIL CHARACTERISTICS | | | | | | | |
| Asphaltenes | 0.16 | wt% | | 0.10 | | UOP46-64 | 01/25/07 16:03 / eli-g |
| Paraffin | 0.2 | wt% | | 0.1 | | UOP46-64 | 01/25/07 16:03 / eli-g |
| Pour Point | 40 | °F | | | | D97 | 01/25/07 23:04 / eli-g |
| OIL GRAVITY | | | | | | | |
| Gravity, API @ 60 F | 33.1 | degrees | | 0.1 | | D287 | 01/25/07 23:04 / eli-g |
| Specific Gravity @ 60 F | 0.8600 | g/cc | | 0.0010 | | D1298 | 01/25/07 23:04 / eli-g |

Composite sample

Report Definitions: RL - Analyte reporting limit MCL - Maximum contaminant level
 QCL - Quality control limit ND - Not detected at the reporting limit

PRELIMINARY

LABORATORY ANALYTICAL REPORT

Client: Delta Petroleum Corporation
Project: Not Indicated
Lab ID: C07010683-002
Client Sample ID: GTS 36-11-OS Stg 1-5 Water

*Sample
is from White Kim
Cutler*

Report Date: 01/30/07
Collection Date: Not Provided
Date Received: 01/18/07
Matrix: Aqueous

| Analyses | Result | Units | Qualifiers | RL | MCL/ QCL | Method | Analysis Date / By |
|-------------------------------------|--------|----------|------------|------|-------------|-------------|----------------------|
| MAJOR IONS | | | | | | | |
| Carbonate as CO3 | ND | mg/L | | 1 | | A2320 B | 01/18/07 15:39 / jaj |
| Bicarbonate as HCO3 | 2880 | mg/L | | 1 | | A2320 B | 01/18/07 15:39 / jaj |
| Calcium | 798 | mg/L | D | 0.6 | | E200.7 | 01/26/07 16:49 / ts |
| Chloride | 17400 | mg/L | | 1 | | A4500-Cl B | 01/26/07 12:46 / jl |
| Magnesium | 357 | mg/L | D | 0.5 | | E200.7 | 01/26/07 16:49 / ts |
| Potassium | 1220 | mg/L | D | 0.5 | | E200.7 | 01/26/07 16:49 / ts |
| Sodium | 10200 | mg/L | D | 0.6 | | E200.7 | 01/26/07 16:49 / ts |
| Sulfate | 3010 | mg/L | D | 30 | | A4500-SO4 E | 01/22/07 16:52 / ljl |
| PHYSICAL PROPERTIES | | | | | | | |
| Conductivity | 48600 | umhos/cm | | 1.0 | | A2510 B | 01/18/07 16:23 / ljl |
| pH | 6.85 | s.u. | | 0.01 | | A4500-H B | 01/18/07 16:23 / ljl |
| Solids, Total Dissolved TDS @ 180 C | 32600 | mg/L | | 10 | | A2540 C | 01/18/07 16:36 / ljl |
| METALS - TOTAL | | | | | | | |
| Iron | 0.52 | mg/L | D | 0.04 | | E200.7 | 01/26/07 16:49 / ts |
| DATA QUALITY | | | | | | | |
| A/C Balance (± 5) | -4.83 | % | | | | Calculation | 01/30/07 08:44 / cp |
| Anions | 600 | meq/L | | | | Calculation | 01/30/07 08:44 / cp |
| Cations | 545 | meq/L | | | | Calculation | 01/30/07 08:44 / cp |
| Solids, Total Dissolved Calculated | 34400 | mg/L | | | | Calculation | 01/30/07 08:44 / cp |
| TDS Balance (0.80 - 1.20) | 0.950 | dec. % | | | | Calculation | 01/30/07 08:44 / cp |

composite sample

Report Definitions: RL - Analyte reporting limit
 QCL - Quality control limit
 D - RL increased due to sample matrix interference.

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

PRELIMINARY

LABORATORY ANALYTICAL REPORT

Client: Delta Petroleum Corporation
Project: Not Indicated
Lab ID: C07010683-003
Client Sample ID: GTS 36-11-OS Stg 5 Water

*Sample is from
White Rim Cutley*

Report Date: 01/30/07
Collection Date: Not Provided
Date Received: 01/18/07
Matrix: Aqueous

| Analyses | Result | Units | Qualifiers | RL | MCL/ QCL | Method | Analysis Date / By |
|-------------------------------------|--------|----------|------------|------|-------------|-------------|----------------------|
| MAJOR IONS | | | | | | | |
| Carbonate as CO3 | ND | mg/L | | 1 | | A2320 B | 01/18/07 15:42 / jaj |
| Bicarbonate as HCO3 | 4130 | mg/L | | 1 | | A2320 B | 01/18/07 15:42 / jaj |
| Calcium | 1420 | mg/L | D | 0.6 | | E200.7 | 01/26/07 16:52 / ts |
| Chloride | 15600 | mg/L | | 1 | | A4500-Cl B | 01/18/07 14:49 / jl |
| Magnesium | 344 | mg/L | D | 0.5 | | E200.7 | 01/26/07 16:52 / ts |
| Potassium | 998 | mg/L | D | 0.5 | | E200.7 | 01/26/07 16:52 / ts |
| Sodium | 9970 | mg/L | D | 0.6 | | E200.7 | 01/26/07 16:52 / ts |
| Sulfate | 2900 | mg/L | D | 30 | | A4500-SO4 E | 01/22/07 16:54 / ljl |
| PHYSICAL PROPERTIES | | | | | | | |
| Conductivity | 42600 | umhos/cm | | 1.0 | | A2510 B | 01/18/07 16:25 / ljl |
| pH | 6.86 | s.u. | | 0.01 | | A4500-H B | 01/18/07 16:25 / ljl |
| Solids, Total Dissolved TDS @ 180 C | 28600 | mg/L | | 10 | | A2540 C | 01/18/07 16:36 / ljl |
| METALS - TOTAL | | | | | | | |
| Iron | 5.40 | mg/L | D | 0.04 | | E200.7 | 01/26/07 16:52 / ts |
| DATA QUALITY | | | | | | | |
| A/C Balance (± 5) | -0.943 | % | | | | Calculation | 01/30/07 08:45 / cp |
| Anions | 569 | meq/L | | | | Calculation | 01/30/07 08:45 / cp |
| Cations | 558 | meq/L | | | | Calculation | 01/30/07 08:45 / cp |
| Solids, Total Dissolved Calculated | 33300 | mg/L | | | | Calculation | 01/30/07 08:45 / cp |
| TDS Balance (0.80 - 1.20) | 0.860 | dec. % | | | | Calculation | 01/30/07 08:45 / cp |

Report Definitions: RL - Analyte reporting limit
 QCL - Quality control limit
 D - RL increased due to sample matrix interference.

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

PRELIMINARY

LABORATORY ANALYTICAL REPORT

Client: Delta Petroleum Corporation
Project: Not Indicated
Lab ID: C07010683-004
Client Sample ID: GTS 36-11-OS Stg 3 Water

*Sample is from
white Rim bottles*

Report Date: 01/30/07
Collection Date: Not Provided
Date Received: 01/18/07
Matrix: Aqueous

| Analyses | Result | Units | Qualifiers | RL | MCL/ QCL | Method | Analysis Date / By |
|-------------------------------------|--------|----------|------------|------|-------------|-------------|----------------------|
| MAJOR IONS | | | | | | | |
| Carbonate as CO3 | ND | mg/L | | 1 | | A2320 B | 01/18/07 15:46 / jaj |
| Bicarbonate as HCO3 | 3920 | mg/L | | 1 | | A2320 B | 01/18/07 15:46 / jaj |
| Calcium | 1460 | mg/L | D | 0.6 | | E200.7 | 01/26/07 16:56 / ts |
| Chloride | 16100 | mg/L | | 1 | | A4500-Cl B | 01/18/07 14:50 / jl |
| Magnesium | 363 | mg/L | D | 0.5 | | E200.7 | 01/26/07 16:56 / ts |
| Potassium | 973 | mg/L | D | 0.5 | | E200.7 | 01/26/07 16:56 / ts |
| Sodium | 10500 | mg/L | D | 0.6 | | E200.7 | 01/26/07 16:56 / ts |
| Sulfate | 3130 | mg/L | D | 30 | | A4500-SO4 E | 01/22/07 16:56 / ljl |
| PHYSICAL PROPERTIES | | | | | | | |
| Conductivity | 42100 | umhos/cm | | 1.0 | | A2510 B | 01/18/07 16:25 / ljl |
| pH | 6.91 | s.u. | | 0.01 | | A4500-H B | 01/18/07 16:25 / ljl |
| Solids, Total Dissolved TDS @ 180 C | 28100 | mg/L | | 10 | | A2540 C | 01/18/07 16:36 / ljl |
| METALS - TOTAL | | | | | | | |
| Iron | 8.97 | mg/L | D | 0.04 | | E200.7 | 01/26/07 16:56 / ts |
| DATA QUALITY | | | | | | | |
| A/C Balance (± 5) | 0.003 | % | | | | Calculation | 01/30/07 08:46 / cp |
| Anions | 584 | meq/L | | | | Calculation | 01/30/07 08:46 / cp |
| Cations | 584 | meq/L | | | | Calculation | 01/30/07 08:46 / cp |
| Solids, Total Dissolved Calculated | 34500 | mg/L | | | | Calculation | 01/30/07 08:46 / cp |
| TDS Balance (0.80 - 1.20) | 0.810 | dec. % | | | | Calculation | 01/30/07 08:46 / cp |

Report Definitions: RL - Analyte reporting limit. MCL - Maximum contaminant level.
 QCL - Quality control limit. ND - Not detected at the reporting limit.
 D - RL increased due to sample matrix interference.

PRELIMINARY

Delta Petroleum Corporation

370 17th St. Suite #4300
 Denver, CO 80202
 (303) 293-9133



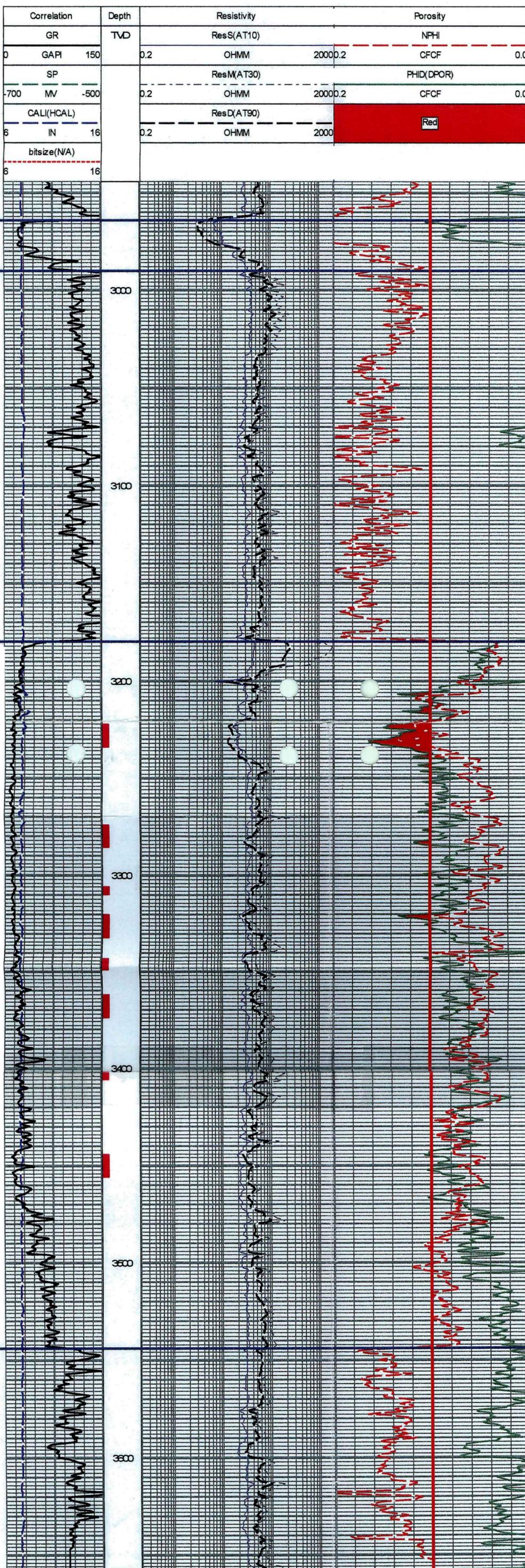
**WellWork LOE
 Chronological
 Regulatory**

| Well Name : Greentown State 36-11 OS (Offset) | | | | | | |
|--|-------------------------|-----------------|--------------|-------------------|------------|-------|
| Prospect: | | | | API # | 4301931505 | |
| Sec/Twp/Rge: | 36 / 21S / 16E | County, St.: | Grand, UT | Work Type | Drilling | |
| Field: | Wildcat | Supervisor: | | WI: | 0.7 | |
| Operator: | Ita Petroleum Corporati | Phone: | 303-575-0324 | NRI: | 0.5705 | |
| Production Current/Expected | Oil: | 0 / 0 | Gas: | 0 / 0 | Water | 0 / 0 |
| Job Purpose : Drill a wildcat well offsetting the #46-11 to test the White Rim Formation. AFE based on 15 drilling | | | | | | |
| Date : | 5/30/2008 | Activity Type : | TOOH | Days On WellWork: | 1 | |
| Daily Detail : Well shut in. MIRU M&M#3. Unland tubing hanger. TOOH with 104 hrs. PU 5 3/4 scraper and 4 3/4 bit. TIH. Tag at 3431". TOOH. PU 5 1/2" Baker Retrievomatic Packer. TIH and set packer @ 3190'. RU pump to pressure to pressure test casing. Pump 4 bbls of fresh water and pressure casing to 2175 psi. SD pump and isolate guage at well head. Leave well shut in for 12 hrs. Pressure after 2 hrs. SDFN. Well shut in. | | | | | | |
| Date : | 5/31/2008 | Activity Type : | RDMO | Days On WellWork: | 2 | |
| Daily Detail : Well shut in overnight. SICP 2150 psi. Bled well down to 0 psi. Release packer. TOOH. Lay down packer. TIH, opened to 3399'. Land tubing in tubing hanger. ND BOP. NU Production Tree. RDMO. SICP 0 psi. SITP 0 psi. | | | | | | |

This is not a substitute for a witnessed MIT

43019315050000

DELTA PETROLEUM CORP
GREENTOWN STATE 36-11S
1055 FNL 518 FWL
TWP: 21 S - Range: 16 E - Sec. 36



Moenkopi Fm

Sinbad

Moenkopi Fm

Moenkopi Fm

White Rim Fm

White Rim Fm

Cutler Fm
Organ Pipe shale m

RECEIVED

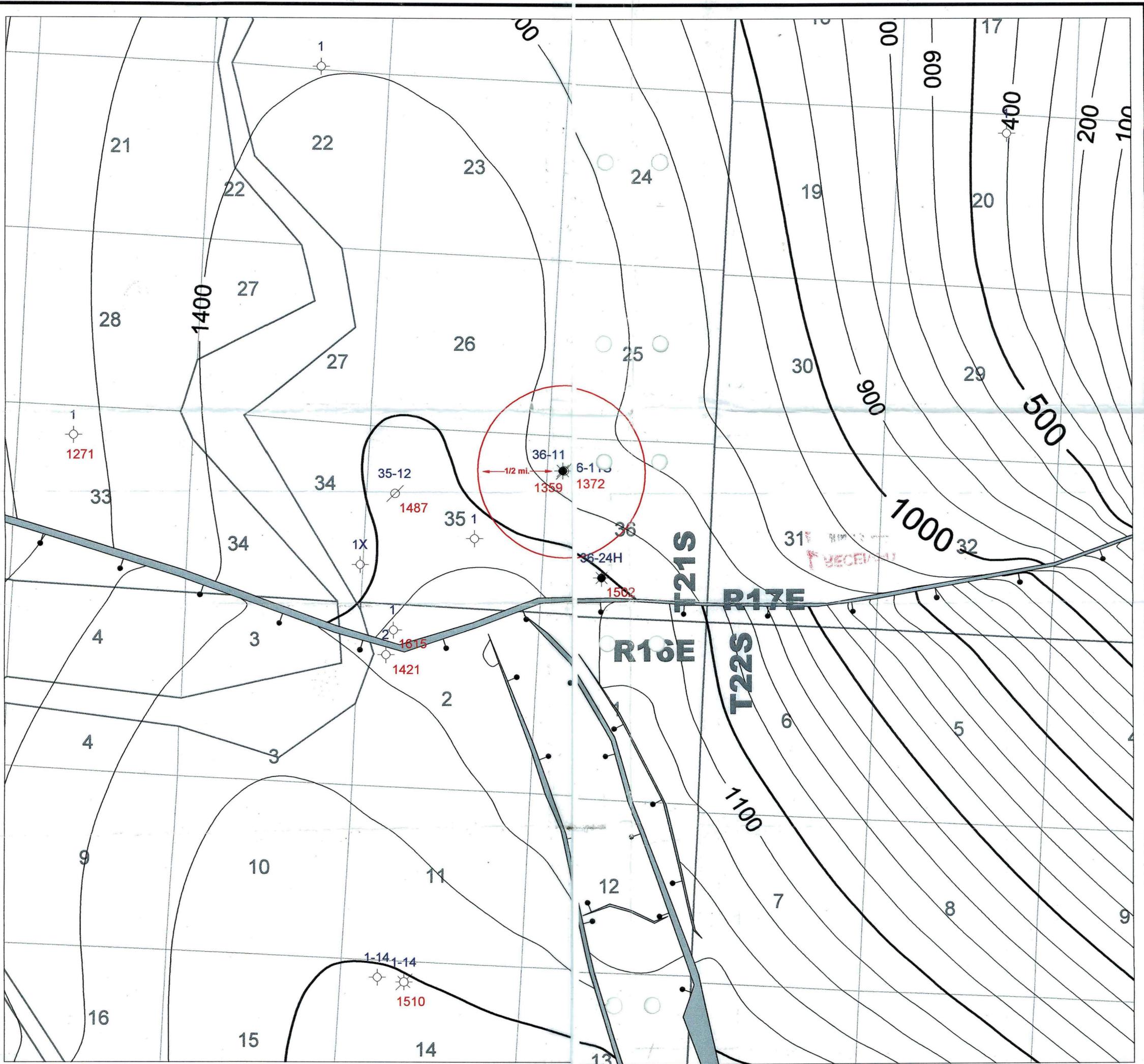
JUN 12 2008

DIV. OF OIL, GAS & MINING

TD=3674

10% density porosity

Figure 1



Faults from Surface Mapping by Joelling, USGS, 2002

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JUN 12 2008
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Figure 2

| | |
|---|---------------------------------|
| | |
| Delta Petroleum Corporation Paradox Basin Green Town Prospect Sinsab Ls. Structure | |
| Author: H. Helm | Date: 10 March 2008 |
| Scale: 1" = 2000' | File Name: Sinsab Structure.gmp |

From: "Kate Shirley" <kshirley@deltapetro.com>
To: "Shawn Burd" <shawn.burd@westernls.com>, <chriskierst@utah.gov>, "Wayne ... Wise"
Date: 07/01/2008
Time: 8:00 AM - 8:30 AM
Subject: Updated: Greentown State 36-11OS Disposal Well
Place: Conference Call
Attachments: meeting.ics

When: Tuesday, July 01, 2008 8:00 AM-8:30 AM (GMT-07:00) Mountain Time (US & Canada).
 Where: Conference Call

~~*~*~*~*~*~*~*~*

Good Afternoon,

Chris Kierst from Utah Division of Oil, Gas, and Mining has called and explained how we will need to clarify Delta's plan with the Greentown State 36-11OS Disposal well. Delta employees will need to meet in the conference room by the double doors and I will conference call Western Land Services and UDOGM. Thank you all for taking the time out so that we can continue with the permitting process.

Thanks,

Kate Shirley

This email and any attachments are confidential and intended solely for the use of the individual or entity to whom this email is addressed. If you have received this email in error please notify the sender immediately by email and delete this email from your system. If you are not the intended recipient, you are notified that disclosing, copying, distributing or taking any action in reliance on the contents of this communication is strictly prohibited.

WARNING: Although the Company has taken reasonable precautions to ensure that no viruses are present in this email, the Company cannot accept responsibility for any loss or damage arising from the use of this email or attachments.

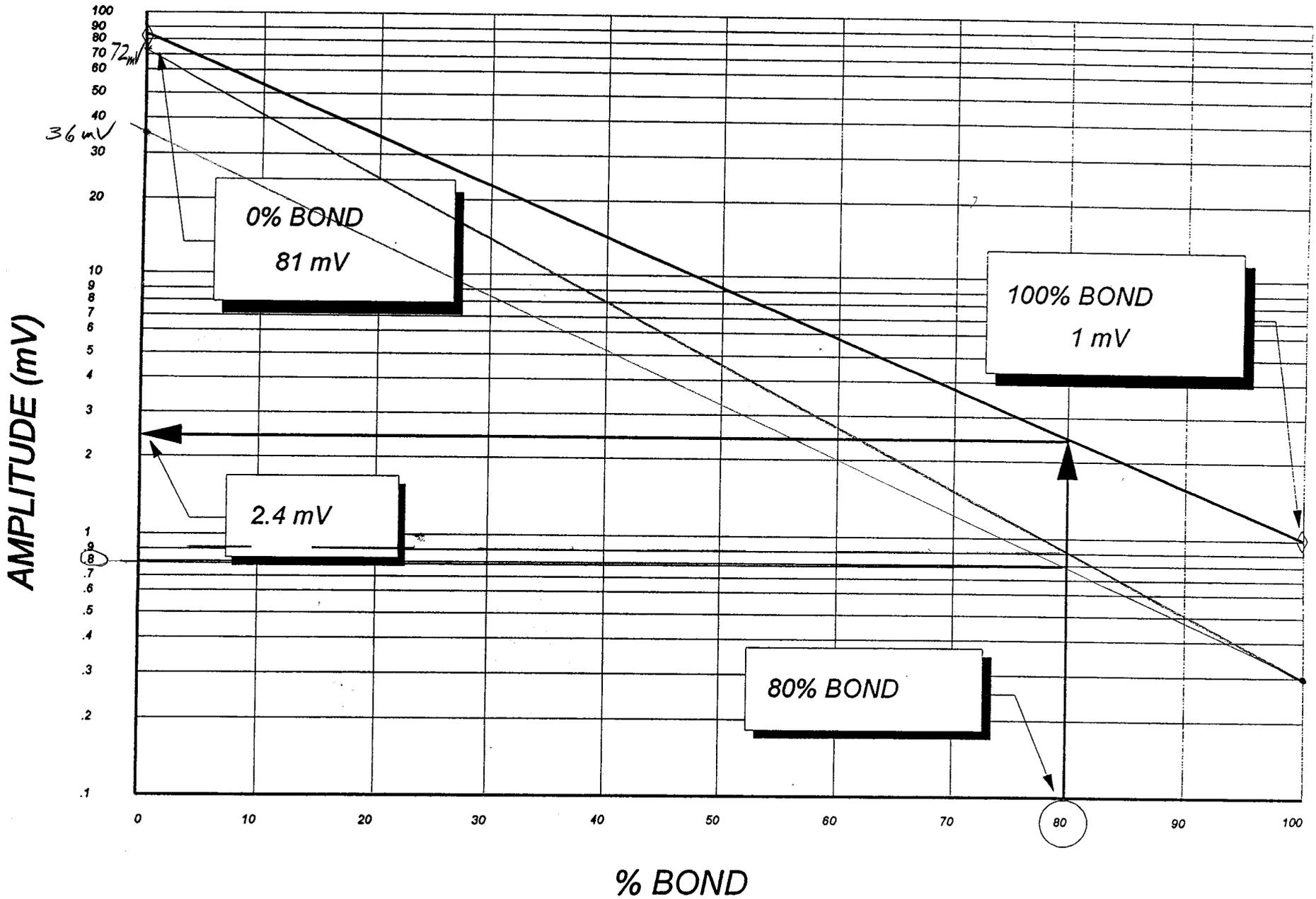
Delta Petroleum Corporation, 370 17th Street, Suite #4300, Denver, CO 80202 www.deltapetro.com

Call completed about 8:45 AM

[Signature] 7/1/08

Greentown State 36-1105

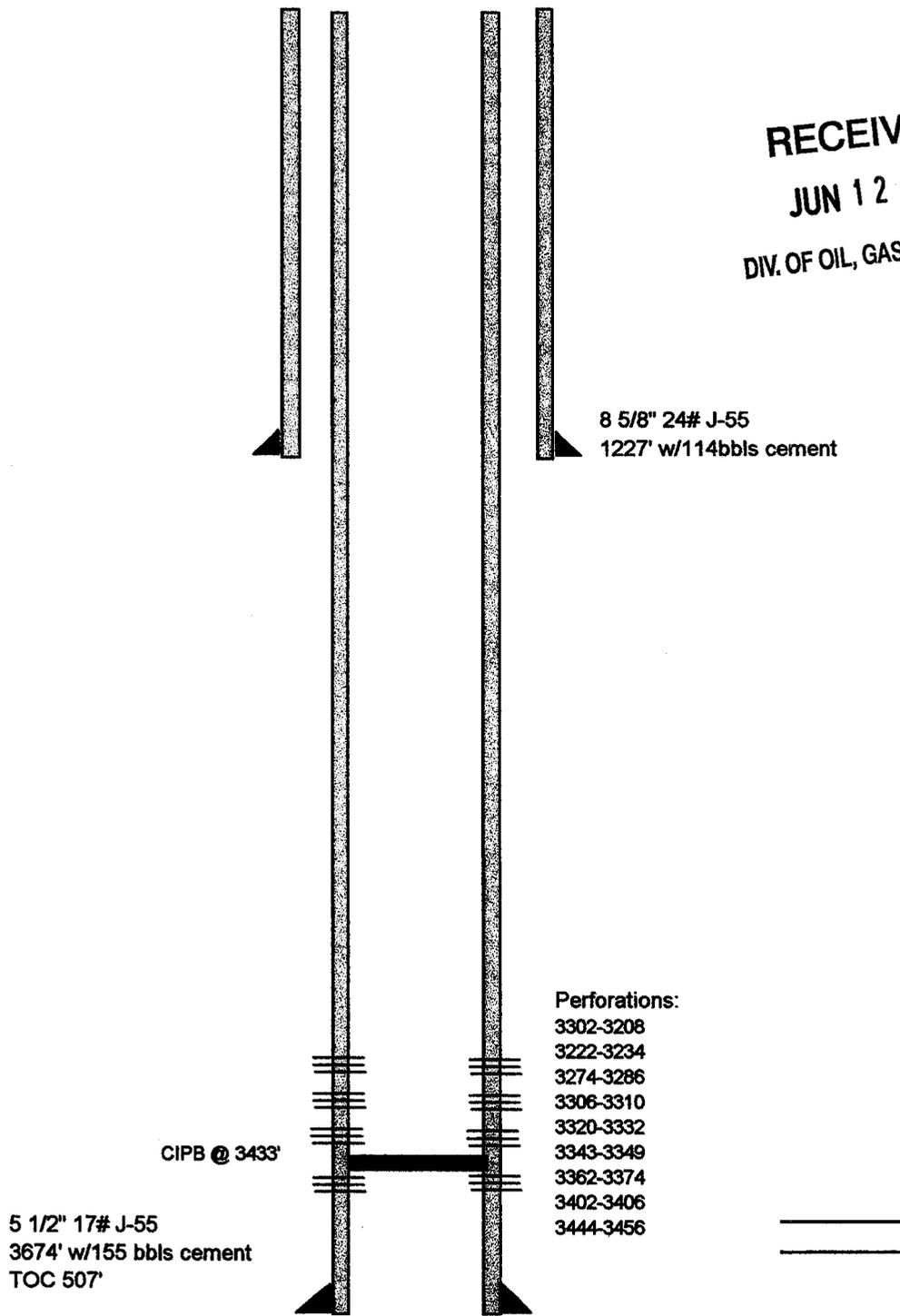
4301931505



● Figure 4
well Bore

Greentown State 36-11OS

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JUN 12 2008
DIV. OF OIL, GAS & MINING





JON M. HUNTSMAN, JR.
Governor

GARY R. HERBERT
Lieutenant Governor

State of Utah

DEPARTMENT OF NATURAL RESOURCES

MICHAEL R. STYLER
Executive Director

Division of Oil, Gas and Mining

JOHN R. BAZA
Division Director

October 1, 2008

CERTIFIED MAIL NO. 7004 2510 0004 1824 6473

Mr. Brian Macke
Delta Petroleum Corp
370 17th Street, Suite 4300
Denver, CO 80021

Re: Greentown St 36-11S API 43-019-31505 21S 16E 36
Extended Shut-in and Temporarily Abandoned Well Requirements for Wells on Fee or State Leases

Dear Mr. Macke:

As of July 2008, Delta Petroleum Corporation has one (1) Mineral Lease Well (see attachment A) that is in non-compliance with the requirements for extended shut-in or temporarily abandoned (SI/TA) status. Wells SI/TA beyond twelve (12) consecutive months require the filing of a Sundry Notice in accordance with R649-3-36-1 for Utah Division of Oil, Gas & Mining ("Division") approval. Wells with five (5) years non-activity or non-productivity shall be plugged, unless the Division grants approval for extended shut-in time upon a showing of good cause by the operator (R649-3-36-1.3.3).

For extended SI/TA consideration the operator shall provide the Division with the following:

1. Reasons for SI/TA of the well (R649-3-36-1.1).
2. The length of time the well is expected to be SI/TA (R649-3-36-1.2), and
3. An explanation and supporting data if necessary, for showing the well has integrity, meaning that the casing, cement, equipment condition, static fluid level, pressure, existence or absence of Underground Sources of Drinking Water and other factors do not make the well a risk to public health and safety or the environment (R649-3-36-1.3).

Page 2
October 1, 2008
Mr. Macke

Submitting the information suggested below may help show well integrity and may help qualify your well for extended SI/TA. **Note: As of July 1, 2003, wells in violation of the SI/TA rule R649-3-36 may be subject to full cost bonding (R649-3-1-4.2, 4.3).**

1. Wellbore diagram, and
2. Copy of recent casing pressure test, and
3. Current pressures on the wellbore (tubing pressure, casing pressure, and casing/casing annuli pressure) showing wellbore has integrity, and
4. Fluid level in the wellbore, and
5. An explanation of how the submitted information proves integrity.

If the required information is not received within 30 days of the date of this notice, further actions may be initiated. If you have any questions concerning this matter, please contact me at (801) 538-5281.

Sincerely,



Dustin K. Doucet
Petroleum Engineer

JP/js

cc: Jim Davis, SITLA
Compliance File
Well File

ATTACHMENT A

| | Well Name | Location | API | Lease Type | Years Inactive |
|---|---------------------|-----------------------|--------------|-------------------|-----------------------|
| 1 | Greentown St 36-11S | NWNW Sec 36-T21S-R16E | 43-019-31505 | ML-49170 | 1 year 0 months |

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

FORM 9

SUNDRY NOTICES AND REPORTS ON WELLS

Do not use this form for proposals to drill new wells, significantly deepen existing wells below current bottom-hole depth, reenter plugged wells, or to drill horizontal laterals. Use APPLICATION FOR PERMIT TO DRILL form for such proposals.

| | | |
|--|--|--|
| | | 5. LEASE DESIGNATION AND SERIAL NUMBER: ML-49170 |
| | | 6. IF INDIAN, ALLOTTEE OR TRIBE NAME: NA |
| | | 7. UNIT or CA AGREEMENT NAME: NA |
| 1. TYPE OF WELL OIL WELL <input type="checkbox"/> GAS WELL <input checked="" type="checkbox"/> OTHER _____ | | 8. WELL NAME and NUMBER: Greentown State 36-11S |
| 2. NAME OF OPERATOR: Delta Petroleum Corporation | | 9. API NUMBER: 4301931505 |
| 3. ADDRESS OF OPERATOR: 370 17th St., Ste. 4300 CITY Denver STATE CO ZIP 80202 | PHONE NUMBER: (303) 575-0386 | 10. FIELD AND POOL, OR WILDCAT: Wildcat |
| 4. LOCATION OF WELL FOOTAGES AT SURFACE: 1024' FNL & 429' FWL QTR/QTR, SECTION, TOWNSHIP, RANGE, MERIDIAN: NWNW 36 21S 16E | | COUNTY: Grand STATE: UTAH |

| 11. CHECK APPROPRIATE BOXES TO INDICATE NATURE OF NOTICE, REPORT, OR OTHER DATA | | | |
|--|---|---|---|
| TYPE OF SUBMISSION | TYPE OF ACTION | | |
| <input checked="" type="checkbox"/> NOTICE OF INTENT (Submit in Duplicate) Approximate date work will start: _____ | <input type="checkbox"/> ACIDIZE | <input type="checkbox"/> DEEPEN | <input type="checkbox"/> REPERFORATE CURRENT FORMATION |
| | <input type="checkbox"/> ALTER CASING | <input type="checkbox"/> FRACTURE TREAT | <input type="checkbox"/> SIDETRACK TO REPAIR WELL |
| <input type="checkbox"/> SUBSEQUENT REPORT (Submit Original Form Only) Date of work completion: _____ | <input type="checkbox"/> CASING REPAIR | <input type="checkbox"/> NEW CONSTRUCTION | <input checked="" type="checkbox"/> TEMPORARILY ABANDON |
| | <input type="checkbox"/> CHANGE TO PREVIOUS PLANS | <input type="checkbox"/> OPERATOR CHANGE | <input type="checkbox"/> TUBING REPAIR |
| | <input type="checkbox"/> CHANGE TUBING | <input type="checkbox"/> PLUG AND ABANDON | <input type="checkbox"/> VENT OR FLARE |
| | <input type="checkbox"/> CHANGE WELL NAME | <input type="checkbox"/> PLUG BACK | <input type="checkbox"/> WATER DISPOSAL |
| | <input type="checkbox"/> CHANGE WELL STATUS | <input type="checkbox"/> PRODUCTION (START/RESUME) | <input type="checkbox"/> WATER SHUT-OFF |
| | <input type="checkbox"/> COMMINGLE PRODUCING FORMATIONS | <input type="checkbox"/> RECLAMATION OF WELL SITE | <input checked="" type="checkbox"/> OTHER: Request to Extend T&A/SI Status |
| | <input type="checkbox"/> CONVERT WELL TYPE | <input type="checkbox"/> RECOMPLETE - DIFFERENT FORMATION | |

12. DESCRIBE PROPOSED OR COMPLETED OPERATIONS. Clearly show all pertinent details including dates, depths, volumes, etc.

Delta Petroleum Corporation requests an extension of Temporarily Abandoned/Shut In status for the Greentown State 36-11S well for an additional year. Delta's plans are to utilize this wellbore as a disposal well in the White Rim. A disposal well application had been previously submitted, but was returned with requests for additional information. The mechanical integrity of the casing was tested on 5/30/08 by pressure testing it to 2175 psi. The well was then shut in overnight and the SICP was 2150 psi the next day. The well was bled down to 0 psi. The integrity of the casing is believed to be sound based on observing the casing and tubing pressures at zero (0) psi on 5/31/08.

The production casing was cemented from 3675' to 507' (back inside the surface casing shoe) and there is a CIBP set at 3,433' (see attached wellbore diagram)."

COPY SENT TO OPERATOR
Date: 11.25.2008
Initials: KS

TIGHT HOLE STATUS

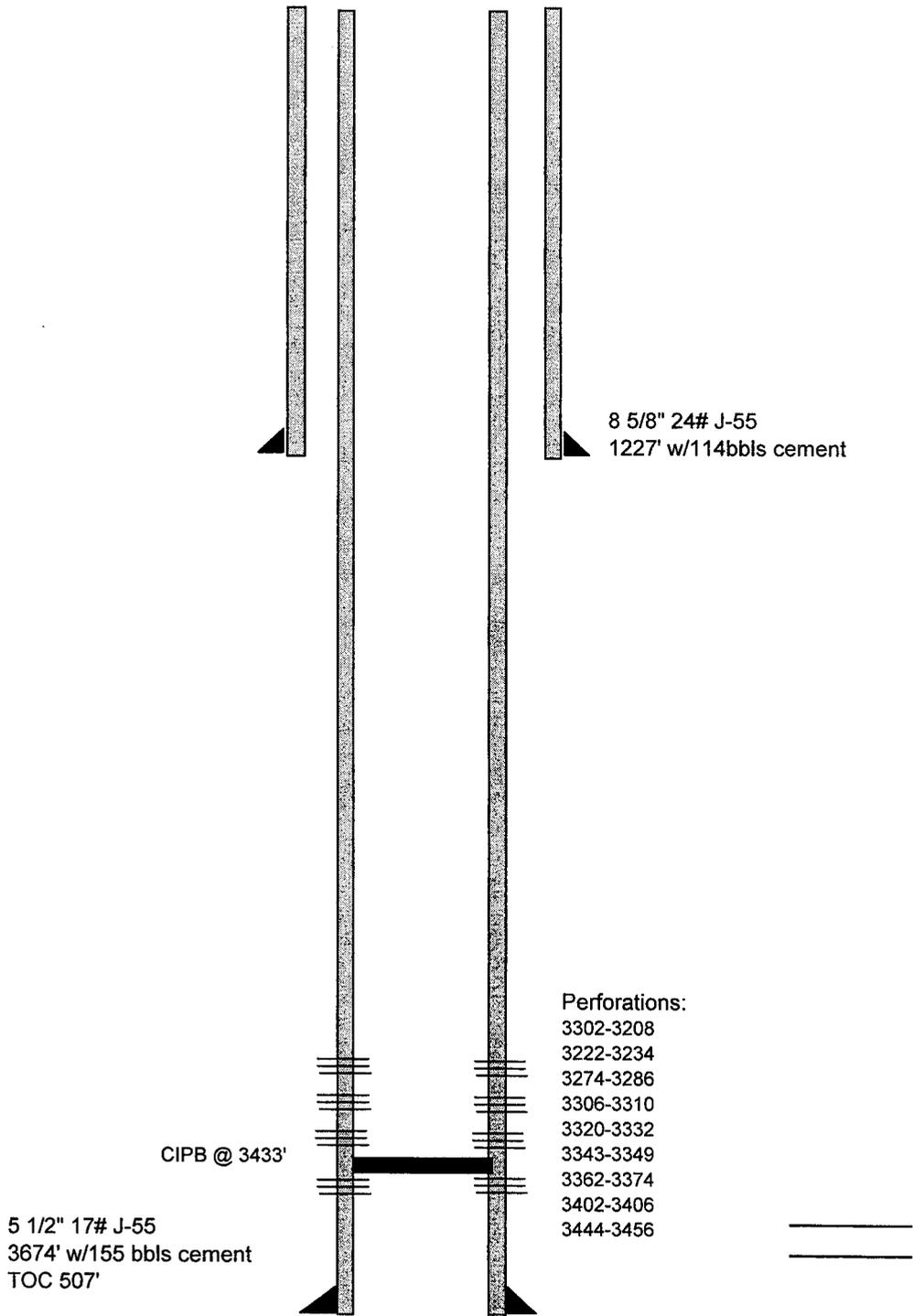
| | |
|--|--|
| NAME (PLEASE PRINT) <u>Brian Macke</u> | TITLE <u>Regulatory Compliance Manager</u> |
| SIGNATURE <u><i>Brian Macke</i></u> | DATE <u>10/29/2008</u> |

(This space for State use only)

APPROVED BY THE STATE OF UTAH DIVISION OF OIL, GAS, AND MINING
DATE: 11/18/08
BY: *[Signature]*
(See Instructions on Reverse Side)
**Valid through 10/1/2009*

RECEIVED
OCT 30 2008
DIV. OF OIL, GAS & MINING

Greentown State 36-11OS



STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

FORM 9

SUNDRY NOTICES AND REPORTS ON WELLS

Do not use this form for proposals to drill new wells, significantly deepen existing wells below current bottom-hole depth, reenter plugged wells, or to drill horizontal laterals. Use APPLICATION FOR PERMIT TO DRILL form for such proposals.

| | | |
|---|--|---|
| 1. TYPE OF WELL OIL WELL <input type="checkbox"/> GAS WELL <input checked="" type="checkbox"/> OTHER _____ | | 5. LEASE DESIGNATION AND SERIAL NUMBER: ML-49170 |
| 2. NAME OF OPERATOR: Delta Petroleum Corporation | | 6. IF INDIAN, ALLOTTEE OR TRIBE NAME: N/A |
| 3. ADDRESS OF OPERATOR: 370 17th St. Suite 4300 CITY Denver STATE CO ZIP 80202 | | 7. UNIT or CA AGREEMENT NAME: N/A |
| 4. LOCATION OF WELL FOOTAGES AT SURFACE: 1,024' FNL & 429' FWL COUNTY: Grand | | 8. WELL NAME and NUMBER: Greentown State 36-11S |
| QTR/QTR, SECTION, TOWNSHIP, RANGE, MERIDIAN: NWNW 36 21S 16E STATE: UTAH | | 9. API NUMBER: 4301931505 |
| | | 10. FIELD AND POOL, OR WILDCAT: Wildcat |
| 11. CHECK APPROPRIATE BOXES TO INDICATE NATURE OF NOTICE, REPORT, OR OTHER DATA | | |

| TYPE OF SUBMISSION | TYPE OF ACTION | | |
|---|---|---|--|
| <input checked="" type="checkbox"/> NOTICE OF INTENT (Submit in Duplicate) Approximate date work will start: _____ | <input type="checkbox"/> ACIDIZE | <input type="checkbox"/> DEEPEN | <input type="checkbox"/> REPERFORATE CURRENT FORMATION |
| | <input type="checkbox"/> ALTER CASING | <input type="checkbox"/> FRACTURE TREAT | <input type="checkbox"/> SIDETRACK TO REPAIR WELL |
| <input checked="" type="checkbox"/> SUBSEQUENT REPORT (Submit Original Form Only) Date of work completion: _____ | <input type="checkbox"/> CASING REPAIR | <input type="checkbox"/> NEW CONSTRUCTION | <input type="checkbox"/> TEMPORARILY ABANDON |
| | <input type="checkbox"/> CHANGE TO PREVIOUS PLANS | <input type="checkbox"/> OPERATOR CHANGE | <input type="checkbox"/> TUBING REPAIR |
| | <input type="checkbox"/> CHANGE TUBING | <input type="checkbox"/> PLUG AND ABANDON | <input type="checkbox"/> VENT OR FLARE |
| | <input type="checkbox"/> CHANGE WELL NAME | <input type="checkbox"/> PLUG BACK | <input type="checkbox"/> WATER DISPOSAL |
| | <input type="checkbox"/> CHANGE WELL STATUS | <input type="checkbox"/> PRODUCTION (START/RESUME) | <input type="checkbox"/> WATER SHUT-OFF |
| | <input type="checkbox"/> COMMINGLE PRODUCING FORMATIONS | <input type="checkbox"/> RECLAMATION OF WELL SITE | <input checked="" type="checkbox"/> OTHER: <u>Request to Extend T&A Status</u> |
| | <input type="checkbox"/> CONVERT WELL TYPE | <input type="checkbox"/> RECOMPLETE - DIFFERENT FORMATION | |

12. DESCRIBE PROPOSED OR COMPLETED OPERATIONS. Clearly show all pertinent details including dates, depths, volumes, etc.

Tight Hole Status

Delta Petroleum Corporation requests an extension of Temporarily Abandoned status for the Greentown State 36-11S well until October 1, 2010, which is an additional year from the current T&A expiration date. Delta is requesting the extension to allow additional time to evaluate the potential future utility of the wellbore.

The Production casing was cemented from 3675' to 507' (back inside the surface casing shoe) and there is a CIBP set at 3,433'.

Delta Petroleum Corporation will run a Mechanical Integrity Test on this well within the next 30 days or submit a sundry to P&A the well.

COPY SENT TO OPERATOR

Date: 11.24.2009

Initials: KS

RECEIVED

OCT 05 2009

DIV. OF OIL, GAS & MINING

| | |
|---|-----------------------------------|
| NAME (PLEASE PRINT) <u>Richard Bonham</u> | TITLE <u>Completions Engineer</u> |
| SIGNATURE <u>Richard Bonham</u> | DATE <u>09/30/09</u> |

(This space for State use only)

Accepted by the
Utah Division of
Oil, Gas and Mining
For Record Only

*insufficient information to approve extended TA
(See Instructions on Reverse Side)
** well plugged 11/7/09

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

FORM 9

5. LEASE DESIGNATION AND SERIAL NUMBER:
ML-49170

6. IF INDIAN, ALLOTTEE OR TRIBE NAME:
N/A

7. UNIT or CA AGREEMENT NAME:
N/A

8. WELL NAME and NUMBER:
Greentown State 36-11S

9. API NUMBER:
4301931505

10. FIELD AND POOL, OR WILDCAT:
Wildcat

SUNDRY NOTICES AND REPORTS ON WELLS

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1. TYPE OF WELL
OIL WELL GAS WELL OTHER _____

2. NAME OF OPERATOR:
Delta Petroleum Corporation

3. ADDRESS OF OPERATOR:
370 17th St. Suite 4300 CITY Denver STATE CO ZIP 80202 PHONE NUMBER: (303) 575-0376

4. LOCATION OF WELL

FOOTAGES AT SURFACE: 1,024' FNL & 429' FWL

COUNTY: Grand

QTR/QTR, SECTION, TOWNSHIP, RANGE, MERIDIAN: NWNW 36 21S 16E

STATE: UTAH

11. CHECK APPROPRIATE BOXES TO INDICATE NATURE OF NOTICE, REPORT, OR OTHER DATA

| TYPE OF SUBMISSION | TYPE OF ACTION | | |
|--|---|---|--|
| <input checked="" type="checkbox"/> NOTICE OF INTENT (Submit in Duplicate) Approximate date work will start: <u>11/2/2009</u> | <input type="checkbox"/> ACIDIZE | <input type="checkbox"/> DEEPEN | <input type="checkbox"/> REPERFORATE CURRENT FORMATION |
| <input type="checkbox"/> SUBSEQUENT REPORT (Submit Original Form Only) Date of work completion: | <input type="checkbox"/> ALTER CASING | <input type="checkbox"/> FRACTURE TREAT | <input type="checkbox"/> SIDETRACK TO REPAIR WELL |
| | <input type="checkbox"/> CASING REPAIR | <input type="checkbox"/> NEW CONSTRUCTION | <input type="checkbox"/> TEMPORARILY ABANDON |
| | <input type="checkbox"/> CHANGE TO PREVIOUS PLANS | <input type="checkbox"/> OPERATOR CHANGE | <input type="checkbox"/> TUBING REPAIR |
| | <input type="checkbox"/> CHANGE TUBING | <input checked="" type="checkbox"/> PLUG AND ABANDON | <input type="checkbox"/> VENT OR FLARE |
| | <input type="checkbox"/> CHANGE WELL NAME | <input type="checkbox"/> PLUG BACK | <input type="checkbox"/> WATER DISPOSAL |
| | <input type="checkbox"/> CHANGE WELL STATUS | <input type="checkbox"/> PRODUCTION (START/RESUME) | <input type="checkbox"/> WATER SHUT-OFF |
| | <input type="checkbox"/> COMMINGLE PRODUCING FORMATIONS | <input type="checkbox"/> RECLAMATION OF WELL SITE | <input type="checkbox"/> OTHER: _____ |
| | <input type="checkbox"/> CONVERT WELL TYPE | <input type="checkbox"/> RECOMPLETE - DIFFERENT FORMATION | |

12. DESCRIBE PROPOSED OR COMPLETED OPERATIONS. Clearly show all pertinent details including dates, depths, volumes, etc.

Tight Hole Status

Delta Petroleum Corporation plans to plug the subject well in accordance with the attached proposed procedure. It is anticipated that the plugging work will begin on 11/2/2009.

Please see attached P&A procedure and wellbore diagram.

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OCT 26 2009

DIV. OF OIL, GAS & MINING

APPROVED BY THE STATE
OF UTAH DIVISION OF
OIL, GAS, AND MINING

DATE: October 27, 2009
BY: John Sabik MacDonald for
Dustin Doucet

NAME (PLEASE PRINT) Linda Cool TITLE Sr. Regulatory Technician

SIGNATURE Linda Cool DATE 10/26/2009

(This space for State use only)

COPY SENT TO OPERATOR

Date: 11-2-2009
Initials: KS

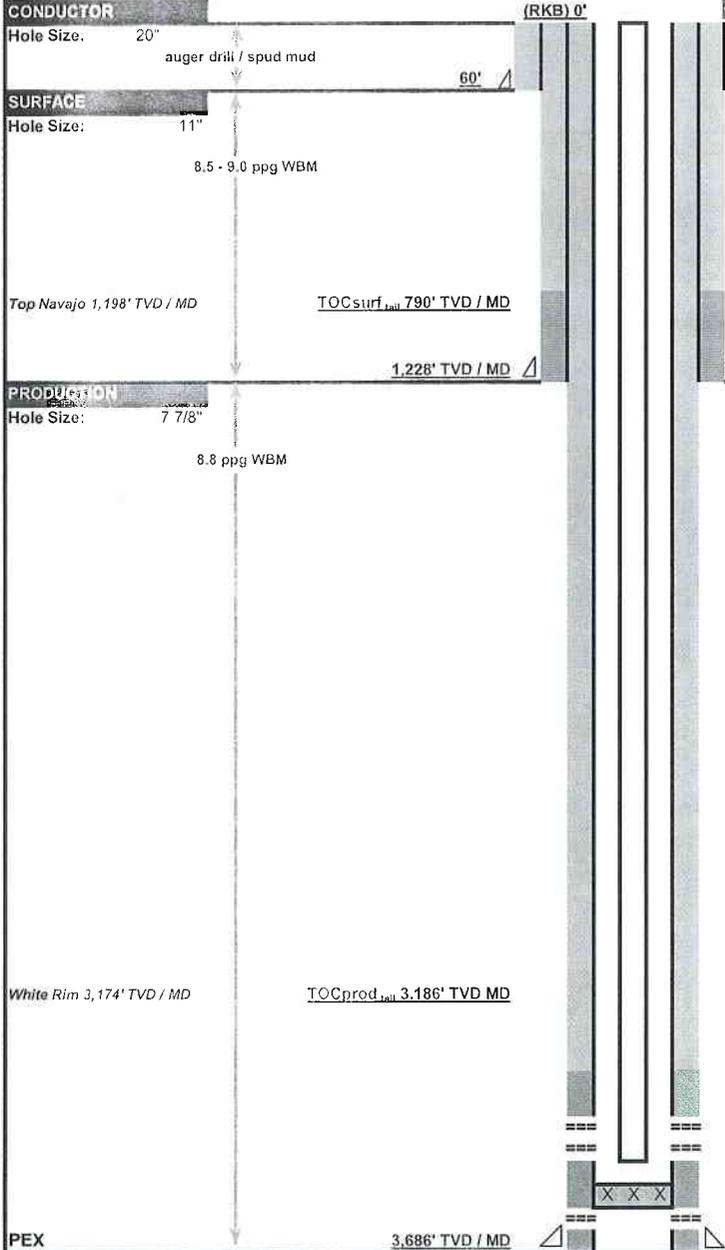
Delta Petroleum Corporation
Greentown State 36-11OS
API 4301931505
P&A Procedure (for Sundry)
October 22, 2009

1. MIRU workover rig and equipment.
2. ND tree and NU BOPE under full well control.
3. Unland 2 7/8" tubing and TOH to check tubing. MU bit and TIH to tag CIBP at ~ 3433'. TOH.
4. Set CICR at ~ 3150'. Sting-in and establish injection. Pump ~ 30 ft³ Class G, 15.8 ppg cement. Sting-out and place 100' minimum cap on CICR. Circulate plugging mud to surface and pressure test 5 1/2" casing to 500 psi.
 - a. If casing tests good, continue with PA steps below.
 - b. If casing does not test:
 - i. TOH and MU test packer – bridge plug combo.
 - ii. RIH and locate casing hole working up from ~ 3000'.
 - iii. Modify PA steps below to address casing hole(s) and plug wellbore.
5. Recover 5 1/2" OR squeeze 5 1/2" casing at the surface casing shoe.
 - a. Recover casing:
 - i. RU e-line, free point, and cut 5 1/2" above TOC at ~ 1800'. **Note:** TOC is at 1820' per Schlumberger CBL log ran 12/23/06. POH and lay down 5 1/2".
 - ii. RIH w/ 2 7/8" and enter casing stub by 50'. Establish circulation and pump 100 ft minimum stub plug w/ 25% excess.
 - iii. POH to ~ 1275' and pump 100 ft minimum surface casing shoe plug w/ 20% excess.
 - iv. POH to ~ 200' and pump surface / top of Navajo plug. POH w/ 2 7/8" tubing.
 - b. Squeeze casing:
 - i. RU e-line and shoot 4 holes at ~ 1275'.
 - ii. Set CICR at ~ 1225'. Sting in and establish injection. Pump 100 ft minimum surface casing shoe plug w/ 20% excess. Sting out and place 100' minimum cap on CICR. POH.
 - iii. Shoot 4 holes at ~ 200'. Connect pump and establish circulation down 5 1/2" casing and up 5 1/2" – 8 5/8" annulus. Pump surface / top of Navajo plug down 5 1/2" casing and up 5 1/2" – 9 5/8" annulus to surface.
6. Cut casings and weld on plate 5' below surface grade. Install dry hole marker.
7. Clean location and RDMO all equipment.

Greentown State 36-110S
Straight hole to 3,686'
Grand County, Utah

9/30/09 JB
 04/17/09 CJN

COMPLETION NOTES:



(RKB) 0'

4664' GL + 25' Sub (DHS # 11)

{ 8 5/8" SOW head x 11" 3M x 7 1/16" 5M x 2 1/6" 5M }

Casing: 60', 16" 55 ppf F25 15.376" ID, butt weld (bbl/ft: 0.2222 csg / 0.1399 OH ann)
Cement: (est. 50% OH excess) 12.8 bbl / 3 yd³ of 3500 psi Redi-Mix, furnished w/ conductor pipe
TOC: 1" or grout to surface
Casing: 1,227', 8.625" 24.0 ppf J55 STC (bbl/ft: 0.0636 csg vol / 0.0453 OH ann vol / .1499 CH ann vol)
Cmt Lead: (790) (50% OH excess) 245 sx Premium Light+ 2% CaCl + 0.25 pps Cello-Flake + 6% Gel
 1.98 yld, 12.5 ppg slurry
 24 / 72 hr compressive strength (est. 80°F): 1000 / 2000 psi
Cmt Tail: (438') (50% OH excess) 111 sx Class G + 2% CaCl + 0.25 pps Cello-Flake, 1.40 yld, 14.5 ppg slurry
 24 / 72 hr compressive strength (est. 80°F): 400 / 800 psi
Csg. Test: 1,000 psi / 30 min
FIT / LOT:
Notes: 1. bowspring centralizers: one 10' from shoe then top of every two joints after that. (5 Total)
 2. 1 shoe joint

Casing: 3,674', 5.5" 17.0 ppf J55 LTC (bbl/ft: 0.0232 csg vol / 0.0309 OH ann vol / 0.0343 CH ann vol)
Cmt Lead: (3,186) (30% OH excess) 350 sks Premium Lite + 0.25 pps Cello-Flake + 0.3% CD-32+ 3 lbs Kol-seal + 0.5% FL-52 + 0.5% SM, 2.15 yld, 12.5 ppg slurry.
 24 / 72 hr compressive strength (est. 80°F): 1000 / 2000 psi
Cmt Tail: (500) (30% OH excess) 85 sx Type III + 0.25 pps Cello-Flake + 0.2% CD-32+ 0.3% FL-52 + 2% SMS, 1.40 yld, 14.5 ppg slurry.
 1.46 yld, 13.5 ppg slurry.
 24 / 72 hr compressive strength (est. 80°F): 1000 / 2000 psi
Csg. Test:
FIT / LOT:
Notes: 1. bowspring centralizers: one 10' from shoe then from top of second joint every for eight joints and then after that every third joint for 27 joints. (14 Total)
 2. 1 shoe joint

Perf 3,444' - 3,456' 3 spf
 CIBP @ 3,433'
 Perf 3,402' - 3,406' 3 spf
 Perf 3,362' - 3,374' 4 spf
 Perf 3,343' - 3,349' 3 spf
 Perf 3,320' - 3,332' 3 spf
 Perf 3,306' - 3,310' 3 spf
 Perf 3,274' - 3,286' 3 spf
 Perf 3,222' - 3,234' 3 spf
 Perf 3,202' - 3,208' 3 spf
 Left in hole:
 104 jts 2 7/8" 6.5 ppf
 EUE 8rd
 Tree installed on well
 CIBP @ 3,360' on 8/9/07
 drilled out- 8/28/07
 CIBP @ 3,318' on 8/14/07
 drilled out- 8/27/07
 CIBP @ 3,218' on 8/16/07
 drilled out- 8/17/07

Wellbore Diagram

API Well No: 43-019-31505-00-00 Permit No:
 Company Name: DELTA PETROLEUM CORP
 Location: Sec: 36 T: 21S R: 16E Spot: NWNW
 Coordinates: X: 576863 Y: 4311100
 Field Name: WILDCAT
 County Name: GRAND

Well Name/No: GREENTOWN ST 36-11S

String Information

| String | Bottom (ft sub) | Diameter (inches) | Weight (lb/ft) | Length (ft) |
|--------|-----------------|-------------------|----------------|-------------|
| HOL1 | 60 | 20 | | |
| COND | 60 | 16 | 55 | 0 |
| HOL2 | 1227 | 11 | | |
| SURF | 1227 | 8.625 | 24 | 1227 |
| HOL3 | 3675 | 7.875 | | |
| PROD | 3675 | 5.5 | 17 | 3675 |
| T1 | 3416 | 2.875 | | |

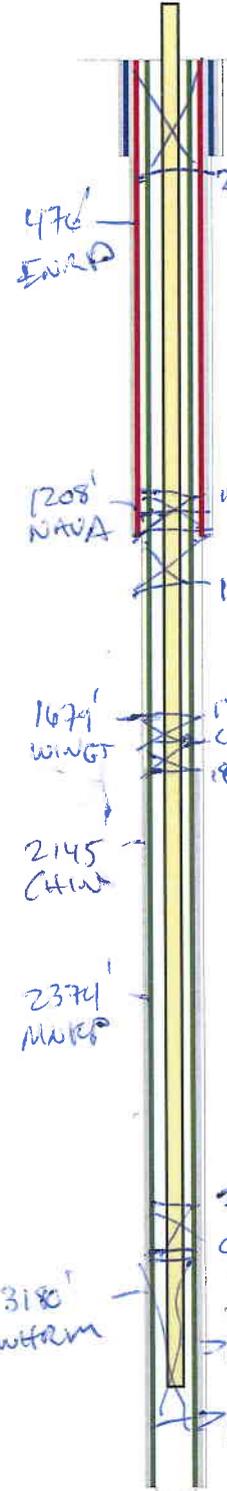
Capacity (F/C/F)

2.797

7.601

2443

7 7/8" oH (108)



Cement from 60 ft. to surface
 Conductor: 16 in. @ 60 ft.
 Hole: 20 in. @ 60 ft.

Cement from 1227 ft. to surface
 Surface: 8.625 in. @ 1227 ft.
 Hole: 11 in. @ 1227 ft.

Cement from 3675 ft. to 1820 ft.
 Tubing: 2.875 in. @ 3416 ft.
 Production: 5.5 in. @ 3675 ft.
 Hole: 7.875 in. @ 3675 ft.
 Hole: Unknown

Plug #4
 $200' / (1.15)(2.797) = 62.5x \text{ req.}$

Plug #3
 $50' = 10.5x$
 $8 7/8" \text{ oH } 50' / (1.15)(2.797) = 16.5x$
 39.5x total req. min.

Plug #2
 $50' = 6.5x$
 $50' / (1.15)(2.443) = 18.5x$
 24.5x total req. min.

Plug #1
 Below: $(30 \text{ cf})(7.601) = 230'$
 $\pm 26.5x$
 $30 \text{ max } = 3590'$

Above: $100' / (1.15)(7.601) = 12.5x$
 12.5x min. req.

Cement Information

| String | BOC (ft sub) | TOC (ft sub) | Class | Sacks |
|--------|--------------|--------------|-------|-------|
| COND | 60 | 0 | UK | 12 |
| PROD | 3675 | 1820 | T3 | 85 |
| PROD | 3675 | 1820 | PM | 350 |
| SURF | 1227 | 0 | G | 111 |
| SURF | 1227 | 0 | LT | 245 |

Perforation Information

| Top (ft sub) | Bottom (ft sub) | Shts/Ft | No Shts | Dt Squeeze |
|--------------|-----------------|---------|---------|------------|
| 3202 | 3456 | | | |

Formation Information

| Formation | Depth |
|-----------|-------|
| ENRD | 476 |
| CARM | 1053 |
| NAVA | 1208 |
| KAYT | 1644 |
| WINGT | 1679 |
| CHIN | 2145 |
| SRMP | 2338 |
| MNKP | 2374 |
| SNBDL | 2962 |
| WHRM | 3180 |

TD: 3686 TVD: 3686 PBD: 3433

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

FORM 9

| | | |
|--|---|--|
| SUNDRY NOTICES AND REPORTS ON WELLS | | 5. LEASE DESIGNATION AND SERIAL NUMBER: ML-49170 |
| | | 6. IF INDIAN, ALLOTTEE OR TRIBE NAME: N/A |
| Do not use this form for proposals to drill new wells, significantly deepen existing wells below current bottom-hole depth, reenter plugged wells, or to drill horizontal laterals. Use APPLICATION FOR PERMIT TO DRILL form for such proposals. | | 7. UNIT or CA AGREEMENT NAME: N/A |
| | | 8. WELL NAME and NUMBER: Greentown State 36-11S |
| 1. TYPE OF WELL OIL WELL <input type="checkbox"/> GAS WELL <input checked="" type="checkbox"/> OTHER _____ | 9. API NUMBER: 4301931505 | |
| 2. NAME OF OPERATOR: Delta Petroleum Corporation | 10. FIELD AND POOL, OR WILDCAT: Wildcat | |
| 3. ADDRESS OF OPERATOR: 370 17th St. Suite 4300 CITY Denver STATE CO ZIP 80202 | PHONE NUMBER: (303) 575-0383 | |
| 4. LOCATION OF WELL FOOTAGES AT SURFACE: 1,024' FNL & 429' FWL | | COUNTY: Grand |
| QTR/QTR, SECTION, TOWNSHIP, RANGE, MERIDIAN: NWNW 36 21S 16E | | STATE: UTAH |

| 11. CHECK APPROPRIATE BOXES TO INDICATE NATURE OF NOTICE, REPORT, OR OTHER DATA | | | |
|--|---|---|--|
| TYPE OF SUBMISSION | TYPE OF ACTION | | |
| <input type="checkbox"/> NOTICE OF INTENT (Submit in Duplicate) Approximate date work will start: _____ <input checked="" type="checkbox"/> SUBSEQUENT REPORT (Submit Original Form Only) Date of work completion: 11/7/2009 | <input type="checkbox"/> ACIDIZE | <input type="checkbox"/> DEEPEN | <input type="checkbox"/> REPERFORATE CURRENT FORMATION |
| | <input type="checkbox"/> ALTER CASING | <input type="checkbox"/> FRACTURE TREAT | <input type="checkbox"/> SIDETRACK TO REPAIR WELL |
| | <input type="checkbox"/> CASING REPAIR | <input type="checkbox"/> NEW CONSTRUCTION | <input type="checkbox"/> TEMPORARILY ABANDON |
| | <input type="checkbox"/> CHANGE TO PREVIOUS PLANS | <input type="checkbox"/> OPERATOR CHANGE | <input type="checkbox"/> TUBING REPAIR |
| | <input type="checkbox"/> CHANGE TUBING | <input checked="" type="checkbox"/> PLUG AND ABANDON | <input type="checkbox"/> VENT OR FLARE |
| | <input type="checkbox"/> CHANGE WELL NAME | <input type="checkbox"/> PLUG BACK | <input type="checkbox"/> WATER DISPOSAL |
| | <input type="checkbox"/> CHANGE WELL STATUS | <input type="checkbox"/> PRODUCTION (START/RESUME) | <input type="checkbox"/> WATER SHUT-OFF |
| | <input type="checkbox"/> COMMINGLE PRODUCING FORMATIONS | <input type="checkbox"/> RECLAMATION OF WELL SITE | <input type="checkbox"/> OTHER: _____ |
| | <input type="checkbox"/> CONVERT WELL TYPE | <input type="checkbox"/> RECOMPLETE - DIFFERENT FORMATION | |

12. DESCRIBE PROPOSED OR COMPLETED OPERATIONS. Clearly show all pertinent details including dates, depths, volumes, etc.

Delta Petroleum Corporation plugged and abandoned the Greentown State 36-11S as follows:
 11/3/2009- MIRU. ND wellhead. PU 1 joint tubing and tagged CIBP. Backside started flowing water @ about 35 bbls per hour. TOH and tallied tubing, tag @ 3427.8'.
 11/4/2009- Pumped water down surface casing. Pumped 100 sacks of Class G, 15.8 lb/gal, 1.15 ft3/sack yield cement and flushed with 50 bbls water to try to shut off water flow. Shut in backside until Thursday morning. Approved by Dustin Doucet, UDOGM. Witnessed by Mark Jones, UDOGM. Set CICR @ 3145'. Pressure tested casing to 550 psi, casing good. Stung in to retainer. Pumped 42 sacks of Class G, 15.8 lb/gal, 1.15 ft3/sack yield cement, 30 under retainer and 12 sacks on top.
 11/5/2009- Checked surface casing and water is still flowing. TIH to 1863.5' and pumped 12 sack balanced plug using Class G, 15.8 lb/gal, 1.15 ft3/sack yield cement. TOH and WOC. Pumped 100 sacks of Class G, 15.8 lb/gal, 1.15 ft3/sack yield cement down surface casing. Estimated TOC in surface casing will be 1,175'.
 11/6/2009- Checked surface casing, finally dead. TIH and tagged @ 1729'. Witnessed by Mark Jones, UDOGM. Cut wellhead and let drop. Cut @ 1170'. TOH 28 joints casing. TIH tubing inside stub to 50' below shoe to 1275'. Mixed and pumped 150 sacks of Class G, 15.8 lb/gal, 1.15 ft3/sack yield cement. Mark Jones, UDOGM, on site for all procedures.
 11/7/2009- TIH and tagged plug @ 817.9'. TOH to 100'. Mixed and pumped 48 sacks of Class G, 15.8 lb/gal, 1.15 ft3/sack yield cement to surface. Dug wellhead and cut off casing. Welded on cap and dry hole marker. Backfilled wellbore.

Completion report to follow

| | |
|---|-----------------------------------|
| NAME (PLEASE PRINT) <u>Richard Bonham</u> | TITLE <u>Completions Engineer</u> |
| SIGNATURE <u><i>Richard Bonham</i></u> | DATE <u>11/16/09</u> |

(This space for State use only)

RECEIVED

NOV 19 2009

DIV. OF OIL, GAS & MINING



Delta Petroleum Corporation

370 17th St. Suite #4300
 Denver, CO 80202
 (303) 293-9133

**WellWork AFE Chronological
 Regulatory Report**

| | | | | | | |
|--|----------------|--------------|-----------|-------------|-----------------------------|-------|
| Well Name : Greentown State 36-11 OS (Offset) | | | | | | |
| Prospect: | | | | AFE #: | 090292910 | |
| Sec/Twp/Rge: | 36 / 21S / 16E | | | Operator: | Delta Petroleum Corporation | |
| API #: | 43019315050000 | Field: | Wildcat | Supervisor: | Richard Bonham | |
| Work Type: | P&A | County, St.: | Grand, UT | Phone: | | |
| Production Current/Expected | Oil: | 0 / 0 | Gas: | 0 / 0 | Water: | 0 / 0 |
| Job Purpose : P&A Well | | | | | | |

| Wellwork Details | | | | | | | |
|------------------------|--|-----------|---------------------|-----------|--|--------|---|
| Date : | 11/3/2009 | Activity: | MIRU | Rig Name: | | Days : | 1 |
| Daily Report Summary : | 9:00 Moved equipment to the Greentown State 36-11OS MIRU ND wellhead NU BOP PU 1 joint tubing and tagged CIBP. Backside started flowing water @ about 35 bbls per hour. Plumbed backside into flat tank. TOH and tallied tubing. Tag3427.8'. PU bit and TIH to 3205.5' TOH LD bit. | | | | | | |
| Daily Report Detail: | 9:00 Moved equipment to the Greentown State 36-11OS MIRU ND wellhead NU BOP PU 1 joint tubing and tagged CIBP. Backside started flowing water @ about 35 bbls per hour. Plumbed backside into flat tank. TOH and tallied tubing. Tag3427.8'. PU bit and TIH to 3205.5' TOH LD bit. | | | | | | |
| Date : | 11/4/2009 | Activity: | Set Cement Retainer | Rig Name: | | Days : | 2 |
| Daily Report Summary : | Pumped water down surface casing. Established IR of 3 bpm @0psi. Pumped 100 sacks cement and flushed with 50 bbls water to try to shut off water flow. Shut in backside until Thursday am. Approved by Dustin Doucet, U DOGM Witnessed by Mark Jones , U DOGM. PU CICR and TIH to 3145' and set. Established IR of 3 bpm @100psi. Stung out and pressure tested casing. Pressured to 550psi and held. Casing good. Stung in to retainer. Mixed and pumped 42 sacks cement, 30 under retainer and 12 sacks cement on top. TOH LD stinger. | | | | | | |
| Daily Report Detail: | Pumped water down surface casing. Established IR of 3 bpm @0psi. Pumped 100 sacks cement and flushed with 50 bbls water to try to shut off water flow. Shut in backside until Thursday am. Approved by Dustin Doucet, U DOGM Witnessed by Mark Jones , U DOGM. PU CICR and TIH to 3145' and set. Established IR of 3 bpm @100psi. Stung out and pressure tested casing. Pressured to 550psi and held. Casing good. Stung in to retainer. Mixed and pumped 42 sacks cement, 30 under retainer and 12 sacks cement on top. TOH LD stinger. | | | | | | |
| Date : | 11/5/2009 | Activity: | Cement | Rig Name: | | Days : | 3 |
| Daily Report Summary : | Checked Surface casing, water still flowing. TIH to 1863.5 and pumped 12 sack balanced plug. TOH WOC Pumped 100 sacks cement down surface casing. Flushed with 40 bbls. Shut in overnight. Est TOC in surface casing will be 1'175'. Went over to the Greentown Federal 35-12D and checked location. | | | | | | |
| Daily Report Detail: | Checked Surface casing, water still flowing. TIH to 1863.5 and pumped 12 sack balanced plug. TOH WOC Pumped 100 sacks cement down surface casing. Flushed with 40 bbls. Shut in overnight. Est TOC in surface casing will be 1'175'. Went over to the Greentown Federal 35-12D and checked location. | | | | | | |
| Date : | 11/6/2009 | Activity: | P&A | Rig Name: | | Days : | 4 |
| Daily Report Summary : | Checked Surface casing. Finally dead! TIH wireline and tagged @1729'. Witnessed by Mark Jones, U DOGM. ND BOP Cut wellhead and let casing drop. Ran freepoint. 100% free @ 1250', but decided to cut above the shoe to be safe. Cut @ 1170'. RDMO wireline. TOH 28 joints casing. TIH tubing inside stub to 50' below shoe to 1275'. Mixed and pumped 150 sacks cement. TOH WOC Mark Jones, U DOGM, on site for all procedures. | | | | | | |
| Daily Report Detail: | Checked Surface casing. Finally dead! TIH wireline and tagged @1729'. Witnessed by Mark Jones, U DOGM. ND BOP Cut wellhead and let casing drop. Ran freepoint. 100% free @ 1250', but decided to cut above the shoe to be safe. Cut @ 1170'. RDMO wireline. TOH 28 joints casing. TIH tubing inside stub to 50' below shoe to 1275'. Mixed and pumped 150 sacks cement. TOH WOC Mark Jones, U DOGM, on site for all procedures. | | | | | | |

Well Name : Greentown State 36-11 OS (Offset)

| | | | | | | |
|-----------------------------|----------------|--------------|-----------|-------------|-------------------|-------|
| Prospect: | | | | AFE #: | 090292910 | |
| Sec/Twp/Rge: | 36 / 21S / 16E | | | Operator: | Petroleum Corpore | |
| API #: | 43019315050000 | Field: | Wildcat | Supervisor: | Richard Bonham | |
| Work Type: | P&A | County, St.: | Grand, UT | Phone: | | |
| Production Current/Expected | Oil: | 0 / 0 | Gas: | 0 / 0 | Water: | 0 / 0 |
| Job Purpose : P&A Well | | | | | | |

| | | | | | | | |
|------------------------|--|-----------|-----|-----------|--|--------|---|
| Date : | 11/7/2009 | Activity: | P&A | Rtg Name: | | Days : | 5 |
| Daily Report Summary : | TIH and tagged plug @ 817.9'. TOH to 100'. Mixed and pumped 48 sacks to surface. TOH RDMO Dug wellhead and cut off casing. Welded on cap and dry hole marker. Backfilled wellbore. 2:00 Moved equipment to the Greentown Federal35-12D MIRU | | | | | | |
| Daily Report Detail: | TIH and tagged plug @ 817.9'. TOH to 100'. Mixed and pumped 48 sacks to surface. TOH RDMO Dug wellhead and cut off casing. Welded on cap and dry hole marker. Backfilled wellbore. 2:00 Moved equipment to the Greentown Federal35-12D MIRU | | | | | | |

Casing

| DateIn | Setting Depth | Jts Run | Type | Size | Weight | Grade | MINID | HoleDiam | TD |
|---|---------------|---------|---------------|-------|--------|-------|-------|----------|------|
| 11/16/2006 | 60 | 3 | 1. Conductor | 16 | 55 | F-25* | | 20 | 60 |
| Stage: 1, Lead, 0, 12, 6 SK Redi-Mix, Redi-mix, 4.5, 0 | | | | | | | | | |
| 11/26/2006 | 1227 | 28 | 3. Surface | 8.625 | 24 | J-55 | | 11 | 1227 |
| Stage: 0, Wash, 20, 0, water water, , 0, 0 | | | | | | | | | |
| Stage: 0, Lead, 0, 245, 2% bwoc cc+0.25 lb/sack cello flake+6% bwoc bentonite+122.3% fresh water, Lightweight, 1.98, 12.5 | | | | | | | | | |
| Stage: 0, Tail, 0, 111, 2% beoc CaCl ,0.25 bwoc celloflake, 44% freshwater, Class G, 1.4, 14.5 | | | | | | | | | |
| Stage: 0, Displacement, 77, 0, water 77 water 75.4 bbls, , 0, 0 | | | | | | | | | |
| 12/16/2006 | 3674.66 | 89 | 5. Production | 5.5 | 17 | J-55 | 0 | 7.875 | 3674 |
| Stage: 1, Lead, 0, 350, Premium lite high strength+25lbscf+3%cd-32+3lbskol seal l+5%fl-52+5%sm, Lightweight, 2.15, 12.5 | | | | | | | | | |
| Stage: 1, Tail, 0, 85, Typelll+.25lbscf+.2%cd-32+.3%fl-52+2%sms Typelll+.25lbscf+2%cd-32+.3%fl-52+.2%sms, , 1.4, 14.5 | | | | | | | | | |
| Stage: 1, Displacement, 84.4, 0, 8.34 llb freash water, , 0, 0 | | | | | | | | | |

| | |
|--|---|
| STATE OF UTAH DEPARTMENT OF NATURAL RESOURCES DIVISION OF OIL, GAS, AND MINING | FORM 9 5. LEASE DESIGNATION AND SERIAL NUMBER: ML-49170 |
| SUNDRY NOTICES AND REPORTS ON WELLS Do not use this form for proposals to drill new wells, significantly deepen existing wells below current bottom-hole depth, reenter plugged wells, or to drill horizontal laterals. Use APPLICATION FOR PERMIT TO DRILL form for such proposals. | 6. IF INDIAN, ALLOTTEE OR TRIBE NAME: 7. UNIT or CA AGREEMENT NAME: |
| 1. TYPE OF WELL | 8. WELL NAME and NUMBER: GREENTOWN ST 36-11S |
| 2. NAME OF OPERATOR: DELTA PETROLEUM CORP | 9. API NUMBER: 43019315050000 |
| 3. ADDRESS OF OPERATOR: 370 17th Street, Suite 4300 , Denver, CO, 80202 | PHONE NUMBER: 303 293-9133 Ext |
| 4. LOCATION OF WELL FOOTAGES AT SURFACE: 1024 FNL 0429 FWL QTR/QTR, SECTION, TOWNSHIP, RANGE, MERIDIAN: Qtr/Qtr: NWNW Section: 36 Township: 21.0S Range: 16.0E Meridian: S | 9. FIELD and POOL or WILDCAT: WILDCAT COUNTY: GRAND STATE: UTAH |

11. CHECK APPROPRIATE BOXES TO INDICATE NATURE OF NOTICE, REPORT, OR OTHER DATA

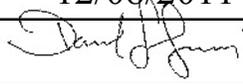
| TYPE OF SUBMISSION | TYPE OF ACTION | | |
|--|---|--|--|
| <input type="checkbox"/> NOTICE OF INTENT Approximate date work will start: | <input type="checkbox"/> ACIDIZE <input type="checkbox"/> CHANGE TO PREVIOUS PLANS <input type="checkbox"/> CHANGE WELL STATUS <input type="checkbox"/> DEEPEN <input type="checkbox"/> OPERATOR CHANGE <input type="checkbox"/> PRODUCTION START OR RESUME <input type="checkbox"/> REPERFORATE CURRENT FORMATION <input type="checkbox"/> TUBING REPAIR <input type="checkbox"/> WATER SHUTOFF <input type="checkbox"/> WILDCAT WELL DETERMINATION | <input type="checkbox"/> ALTER CASING <input type="checkbox"/> CHANGE TUBING <input type="checkbox"/> COMMINGLE PRODUCING FORMATIONS <input type="checkbox"/> FRACTURE TREAT <input type="checkbox"/> PLUG AND ABANDON <input checked="" type="checkbox"/> RECLAMATION OF WELL SITE <input type="checkbox"/> SIDETRACK TO REPAIR WELL <input type="checkbox"/> VENT OR FLARE <input type="checkbox"/> SI TA STATUS EXTENSION <input type="checkbox"/> OTHER | <input type="checkbox"/> CASING REPAIR <input type="checkbox"/> CHANGE WELL NAME <input type="checkbox"/> CONVERT WELL TYPE <input type="checkbox"/> NEW CONSTRUCTION <input type="checkbox"/> PLUG BACK <input type="checkbox"/> RECOMPLETE DIFFERENT FORMATION <input type="checkbox"/> TEMPORARY ABANDON <input type="checkbox"/> WATER DISPOSAL <input type="checkbox"/> APD EXTENSION OTHER: <input style="width: 50px;" type="text"/> |
| <input checked="" type="checkbox"/> SUBSEQUENT REPORT Date of Work Completion: 10/28/2010 | | | |
| <input type="checkbox"/> SPUD REPORT Date of Spud: | | | |
| <input type="checkbox"/> DRILLING REPORT Report Date: | | | |

12. DESCRIBE PROPOSED OR COMPLETED OPERATIONS. Clearly show all pertinent details including dates, depths, volumes, etc.

Per State approvals the site was reclaimed as follows: Work was performed Oct 15-21 & Oct 28, 2010. 1. Dig up and haul off rig anchors and oilfield trash. 2. Reslope berms on south and west sides of location. Grade smooth dirt piles on location. 3. Fully reclaim 0.2 mi of access road by grading and ripping. 4. Reseed location and access road with State seed mix and back drag to cover seed. *State Mix: 3 bls/ac Crested wheatgrass; 4 lbs/ac Siberian wheatgrass; 2 lbs./ac Blue Gramma; 2 lbs/ac Forage Kochia; 1 lb/ac Scarlet globemallow; 4 lbs/ac Fourwing Saltbrush. **Use 2 lbs/ac Gooseberry-globemallow if scarlet globemallow is not available. Please contact Richard Bonham at 303-575-0383 if you should have any questions or concerns.

Accepted by the
Utah Division of
Oil, Gas and Mining
FOR RECORD ONLY

| | | |
|--|-------------------------------------|--|
| NAME (PLEASE PRINT) Linda Cool | PHONE NUMBER 303 575-0376 | TITLE Senior Regulatory Technician |
| SIGNATURE N/A | | DATE 12/28/2010 |

| | | |
|--|---|--|
| STATE OF UTAH DEPARTMENT OF NATURAL RESOURCES DIVISION OF OIL, GAS, AND MINING | | FORM 9 |
| SUNDRY NOTICES AND REPORTS ON WELLS | | 5. LEASE DESIGNATION AND SERIAL NUMBER: ML-49170 |
| Do not use this form for proposals to drill new wells, significantly deepen existing wells below current bottom-hole depth, reenter plugged wells, or to drill horizontal laterals. Use APPLICATION FOR PERMIT TO DRILL form for such proposals. | | 6. IF INDIAN, ALLOTTEE OR TRIBE NAME: |
| | | 7. UNIT or CA AGREEMENT NAME: |
| 1. TYPE OF WELL | | 8. WELL NAME and NUMBER: GREENTOWN ST 36-11S |
| 2. NAME OF OPERATOR: DELTA PETROLEUM CORP | | 9. API NUMBER: 43019315050000 |
| 3. ADDRESS OF OPERATOR: 370 17th Street, Suite 4300 , Denver, CO, 80202 | | 9. FIELD and POOL or WILDCAT: WILDCAT |
| 4. LOCATION OF WELL FOOTAGES AT SURFACE: 1024 FNL 0429 FWL QTR/QTR, SECTION, TOWNSHIP, RANGE, MERIDIAN: Qtr/Qtr: NWNW Section: 36 Township: 21.0S Range: 16.0E Meridian: S | | COUNTY: GRAND |
| | | STATE: UTAH |
| 11. CHECK APPROPRIATE BOXES TO INDICATE NATURE OF NOTICE, REPORT, OR OTHER DATA | | |
| TYPE OF SUBMISSION | TYPE OF ACTION | |
| <input type="checkbox"/> NOTICE OF INTENT Approximate date work will start: | <input type="checkbox"/> ACIDIZE <input type="checkbox"/> CHANGE TO PREVIOUS PLANS <input type="checkbox"/> CHANGE WELL STATUS <input type="checkbox"/> DEEPEN <input type="checkbox"/> OPERATOR CHANGE <input type="checkbox"/> PRODUCTION START OR RESUME <input type="checkbox"/> REPERFORATE CURRENT FORMATION <input type="checkbox"/> TUBING REPAIR <input type="checkbox"/> WATER SHUTOFF <input type="checkbox"/> WILDCAT WELL DETERMINATION | <input type="checkbox"/> ALTER CASING <input type="checkbox"/> CHANGE TUBING <input type="checkbox"/> COMMINGLE PRODUCING FORMATIONS <input type="checkbox"/> FRACTURE TREAT <input type="checkbox"/> PLUG AND ABANDON <input type="checkbox"/> RECLAMATION OF WELL SITE <input type="checkbox"/> SIDETRACK TO REPAIR WELL <input type="checkbox"/> VENT OR FLARE <input type="checkbox"/> SI TA STATUS EXTENSION <input checked="" type="checkbox"/> OTHER |
| <input checked="" type="checkbox"/> SUBSEQUENT REPORT Date of Work Completion: 10/28/2010 | | <input type="checkbox"/> CASING REPAIR <input type="checkbox"/> CHANGE WELL NAME <input type="checkbox"/> CONVERT WELL TYPE <input type="checkbox"/> NEW CONSTRUCTION <input type="checkbox"/> PLUG BACK <input type="checkbox"/> RECOMPLETE DIFFERENT FORMATION <input type="checkbox"/> TEMPORARY ABANDON <input type="checkbox"/> WATER DISPOSAL <input type="checkbox"/> APD EXTENSION OTHER: <input type="text" value="Request final inspection"/> |
| <input type="checkbox"/> SPUD REPORT Date of Spud: | | |
| <input type="checkbox"/> DRILLING REPORT Report Date: | | |
| 12. DESCRIBE PROPOSED OR COMPLETED OPERATIONS. Clearly show all pertinent details including dates, depths, volumes, etc. | | |
| Surface reclamation and seeding was completed October 28, 2010. Delta respectfully requests final inspection for release of this site. | | |
| | | Accepted by the Utah Division of Oil, Gas and Mining |
| | | Date: <u>12/08/2011</u> |
| | | By: <u></u> |
| NAME (PLEASE PRINT) Linda Cool | PHONE NUMBER 303 575-0376 | TITLE Senior Regulatory Technician |
| SIGNATURE N/A | | DATE 11/16/2011 |