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## Notes on the Well Completion Logs in Attachment D6-3 (Page 1 of 2)

### Well Completion:

For several wells, the log indicates there is an open hole (or 'rat hole') between the bottom of the screen and the total drilled depth (TD). If there is no record of the rat-hole having been backfilled, it can be assumed the hole below the screen is either open or caved naturally. As long as the TD is still within the target sand for the screened interval, the presence of an open or partially caved 'rat hole' is not of concern.

For a drill hole or well, the TD that is recorded in the LC ISR, LLC database is the total depth penetrated by the driller when drilling the 'pilot' hole and as recorded on the log header. At the time some of the wells were installed, the field geologists thought that the screen liner had to be landed *right on* the hole bottom. Therefore, it was common for the drillers, just prior to underreaming and screening, to clean out the hole to a depth a few feet deeper than the original TD (but still within the target sand), in case there was any caving into the hole. This results in a discrepancy regarding TD in some holes. The following table provides additional information on the discrepancies.

WELL #	Total Depth shown on the Well Completion Log (feet below surface)	True Total Depth (feet below surface)
HJMP-105	460	465
HJMU-101	535	539
HJMU-104	550	552
HJMU-107	855	Backplugged with grout 580-855
UKMO-101	488	490
UKMO-103	438	439
UKMP-101	575	577

In one of the DE wells (MB-1), the drilling may have penetrated the EF shale below the DE Sand. However, the EF shale is not a true confining shale because it splits in several areas. As is discussed elsewhere and illustrated in Cross Sections F-F', G-G' and H-H' (Plates D5-1e through D5-1g), the EF aquitard represents not a single ubiquitous shale, but a shaly, low permeability sequence which may contain multiple overlapping shales. In MB-01, the portion of the EF shale penetrated by the drill hole is underlain by an associated shaly interval which can be observed at depths of 307'-317' in the log for well MB-04. This shaly interval is associated with the EF aquitard sequence and serves as a supplementary overlying aquitard at the top of the FG Horizon.

## **Notes on the Well Completion Logs in Attachment D6-3 (Page 2 of 2)**

### Well Development:

All monitor wells were airlifted with the drill rig after placement of the screen. No additional efforts were made to develop wells with poor yield from airlifting for the following reasons:

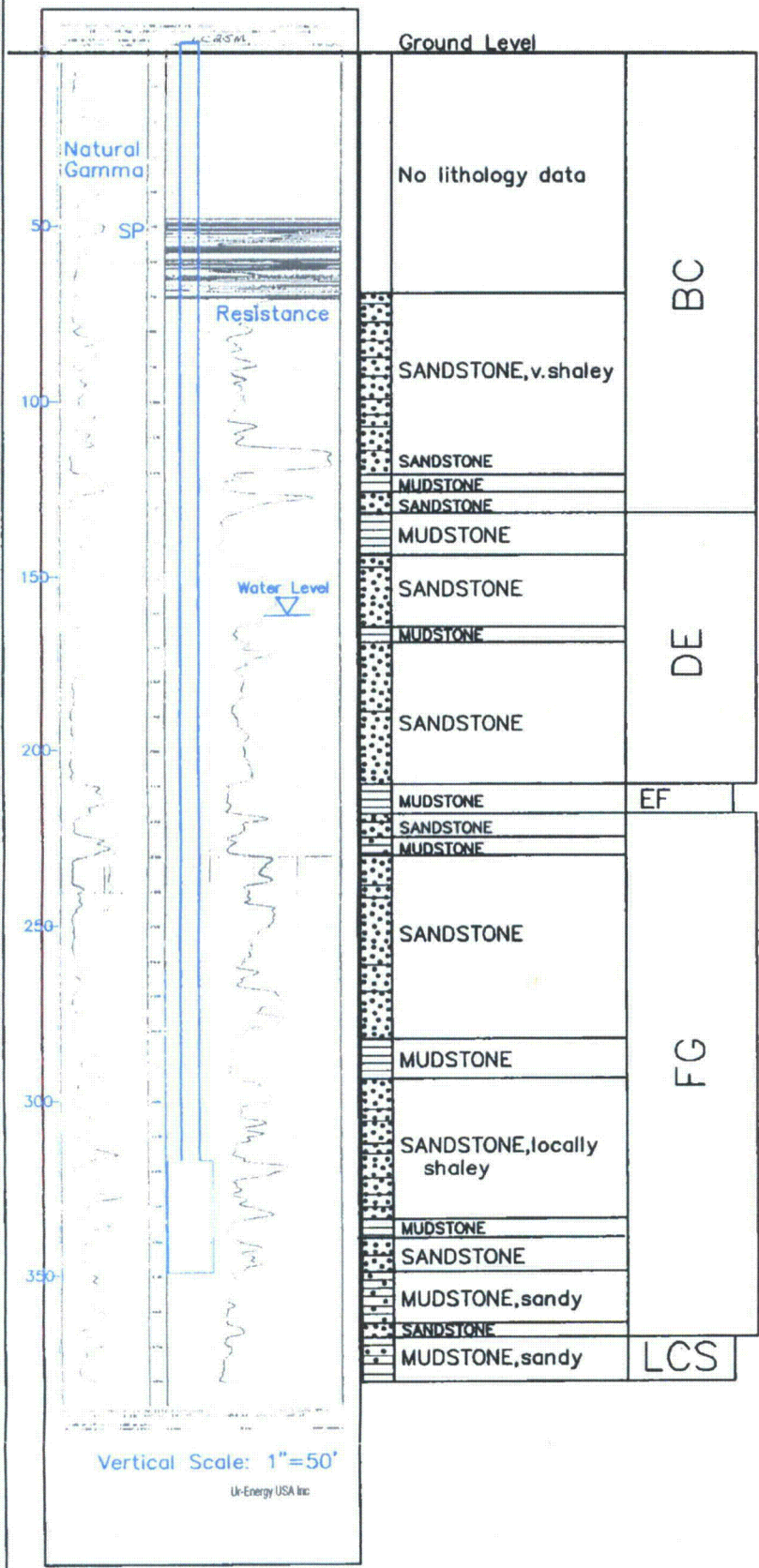
- Wells such as HJT-106, MB-7, MB-10 barely penetrated the static water table. Therefore, additional efforts to produce more water from these wells would be unproductive.
- Some wells are completed in shaly sands and therefore are expected to not yield additional flow.
- Some wells produced flow rates which were low, yet sufficient for the intended purposes.

Before sampling, each monitor well was swabbed to provide further development. Finally, wells were purged of at least three casing volume prior to collecting a baseline sample.

LC25M

LC25M

Lost Creek ISR, LLC  
WELL COMPLETION REPORT



WELL # LC25M SEO # 175264 Date Drilled: 9-19-06

Location: E 743,397 / N 534,601 (NAD 27)

Ground Elev: 6935.00 Measure Point Elev: 6936.52

TD: 380 ft. Hole Dia.: 7-7/8"

CASED to: 316' Casing: PVC SDR17 ID: 4.5" OD: 5"

GROUT: Portland Cement – Type I/II  
Pumped thru casing, displaced to surface with water

COMPLETION Aquifer: LFG Sand  
Static Water Level: Depth 161' Elev: 6775' (avg.)

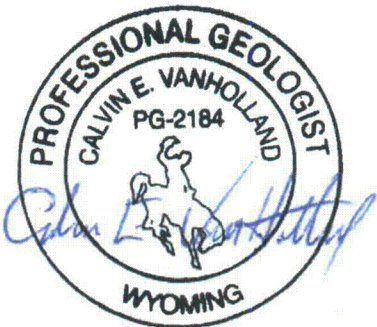
UNDERREAM: Blade Dia: 10-1/2"  
Intervals: from 316' to 349' / length 33'  
from \_\_\_\_\_ to \_\_\_\_\_ / length \_\_\_\_\_

OPEN-HOLE COMPLETION				
Description	Depth		Elev.	
	From	To	From	To
K-packer	N/A			
Open-hole	316'	349'	6620'	6587'

SCREEN SPECIFICATIONS:  
Slot: \_\_\_\_\_ Composition N/A

FILTER PACKING:  
Volume: \_\_\_\_\_ (bags)(ft<sup>3</sup>) Sand Specs. \_\_\_\_\_  
Method: N/A

WELL STIMULATION: Method Airlift  
Yield: Good / Moderate / Poor

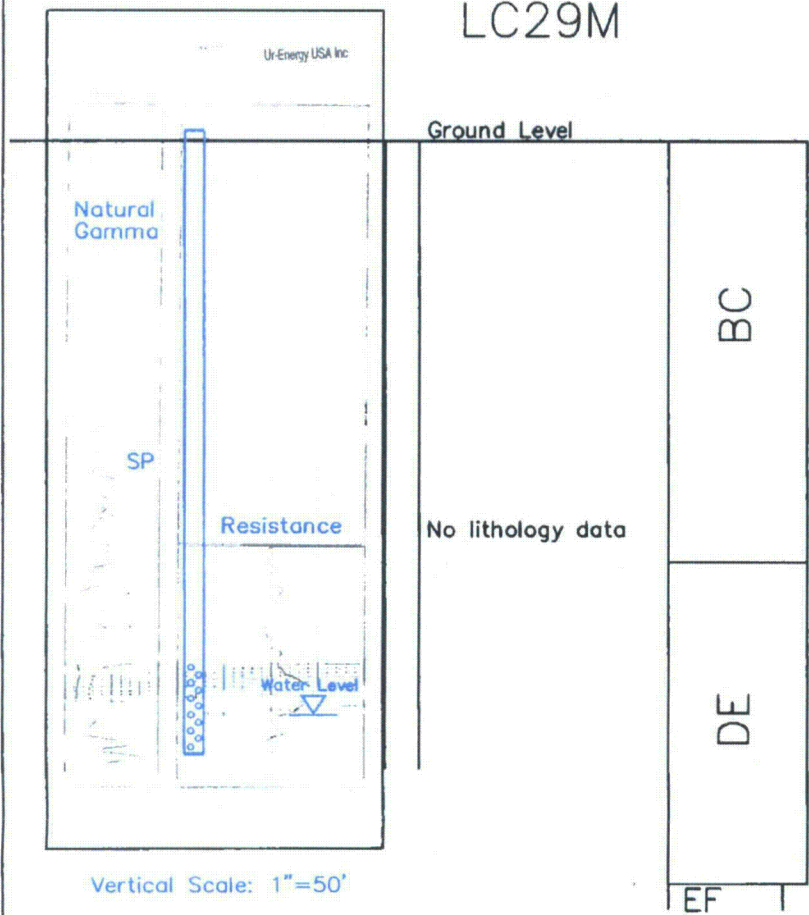


LC25M



LC29M

Lost Creek ISR, LLC  
WELL COMPLETION REPORT



WELL # LC29M SEO # 175260 Date Drilled: 8-30-06

Location: E 744,547 / N 534,837 (NAD 27)

Ground Elev: 6935.8' Measure Point Elev: 6937.55'

TD: 171 ft. Hole Dia.: 7-7/8"

CASED to: 140' Casing: PVC SDR17 ID: 4.5" OD: 5"

GROUT: Portland Cement – Type I/II  
Pumped thru casing, displaced to surface with water

COMPLETION Aquifer: DE Sand  
Static Water Level: Depth 155' Elev: 6783' (avg.)

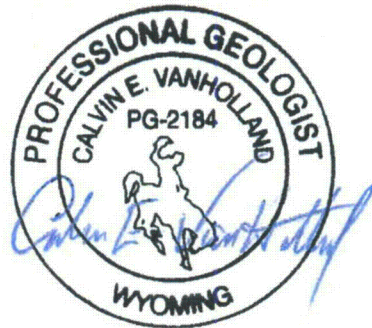
UNDERREAM: Blade Dia: N/A  
Intervals: from \_\_\_\_\_ to \_\_\_\_\_ / length \_\_\_\_\_  
from \_\_\_\_\_ to \_\_\_\_\_ / length \_\_\_\_\_

Description	Depth		Elev.		Length
	From	To	From	To	
<u>Perf. Casing</u>	<u>140'</u>	<u>164'</u>	<u>6796'</u>	<u>6772'</u>	<u>24'</u>
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

SCREEN SPECIFICATIONS:  
Slot: \_\_\_\_\_ Composition N/A

FILTER PACKING:  
Volume: \_\_\_\_\_ (bags)(ft<sup>3</sup>) Sand Specs. \_\_\_\_\_  
Method: N/A

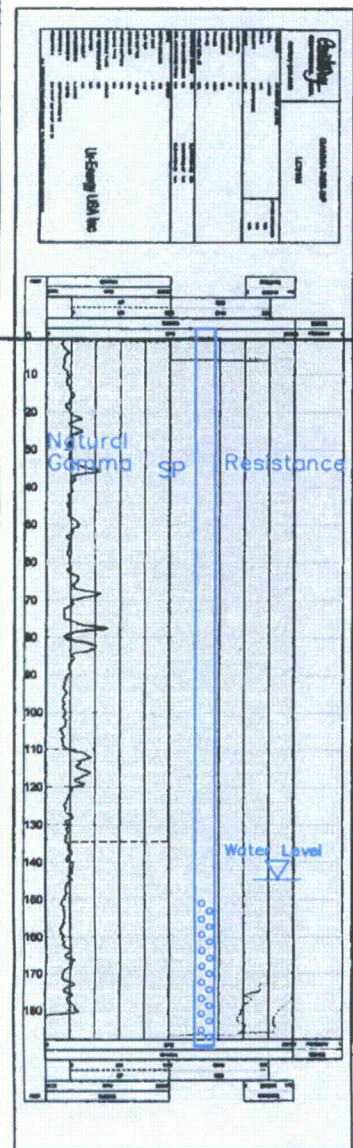
WELL STIMULATION: Method Airlift  
Yield: Good / Moderate / Poor



LC29M



LC31M



LC31M

Ground Level

No lithology data

BC

DE

EF

Lost Creek ISR, LLC

## WELL COMPLETION REPORT

WELL # LC31M SEO # 175268 Date Drilled: 9-19-06

Location: E 733,380 / N 524,434 (NAD 27)

Ground Elev: 6804.1' Measure Point Elev: 6806.05'

TD: 191 ft. Hole Dia.: 7-7/8"

CASED to: 150' Casing: PVC SDR17 ID: 4.5" OD: 5"

GROUT: Portland Cement - Type I/II

Pumped thru casing, displaced to surface with water

COMPLETION Aquifer: DE Sand

Static Water Level: Depth 144' Elev: 6662' (avg.)

UNDERREAM: Blade Dia: N/A

Intervals: from        to        / length       

from        to        / length       

### PERFORATED CASING COMPLETION:

Description	Depth		Elev.		Length
	From	To	From	To	
<u>Perf. Casing</u>	<u>150'</u>	<u>190'</u>	<u>6654'</u>	<u>6614'</u>	<u>40'</u>

### SCREEN SPECIFICATIONS:

Slot:        Composition N/A

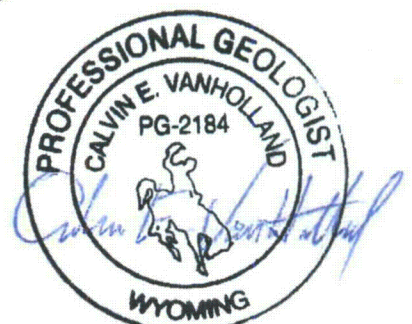
### FILTER PACKING:

Volume:        (bags)(ft<sup>3</sup>) Sand Specs.       

Method: N/A

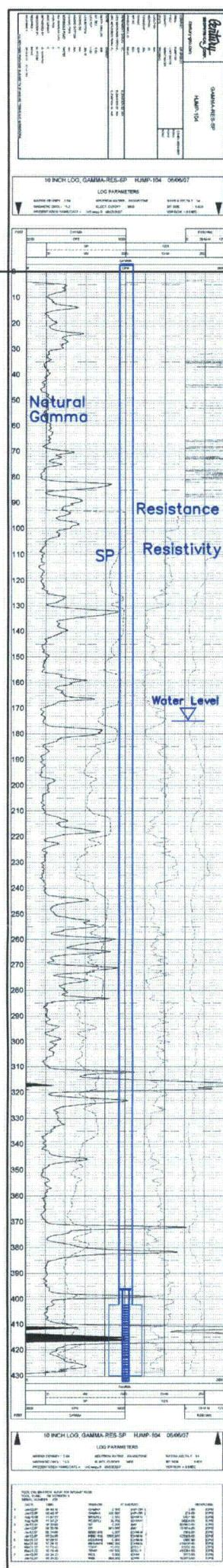
WELL STIMULATION: Method Airlift

Yield: Good / Moderate / Poor



LC31M





Lost Creek ISR, LLC  
WELL COMPLETION REPORT

WELL # HJMP-104 SEO # 179873 Date Drilled: 7-6-07

Location: E 742,886 / N 534,897 (NAD 27)

Ground Elev: 6939.04' Measure Point Elev: 6941.04'

TD: 432'      Hole Dia.: 7-7/8"

CASED to: 402' Casing: PVC SDR17 ID: 4.5" OD: 5"

GROUT: Portland Cement - Type I/II  
Pumped thru casing, displaced to surface with water

COMPLETION Aquifer: HJ Sand

Static Water Level: Depth 175' Elev: 6766' (avg.)

UNDERREAM: Blade Dia: 10.5"

Intervals: from 402' to 430' / length 28'  
from \_\_\_\_\_ to \_\_\_\_\_ / length \_\_\_\_\_

## SCREEN LINER ASSEMBLY

Description	Depth		Elev.		Length
	From	To	From	To	
K-packer		396'		6545'	
Screen	402'	432'	6539'	6509'	30'

SCREEN SPECIFICATIONS:

Slot: 0.030" Composition 3" PVC

FILTER PACKING:

Volume: \_\_\_\_\_(bags)(ft<sup>3</sup>) Sand Specs. \_\_\_\_\_

Method: N/A

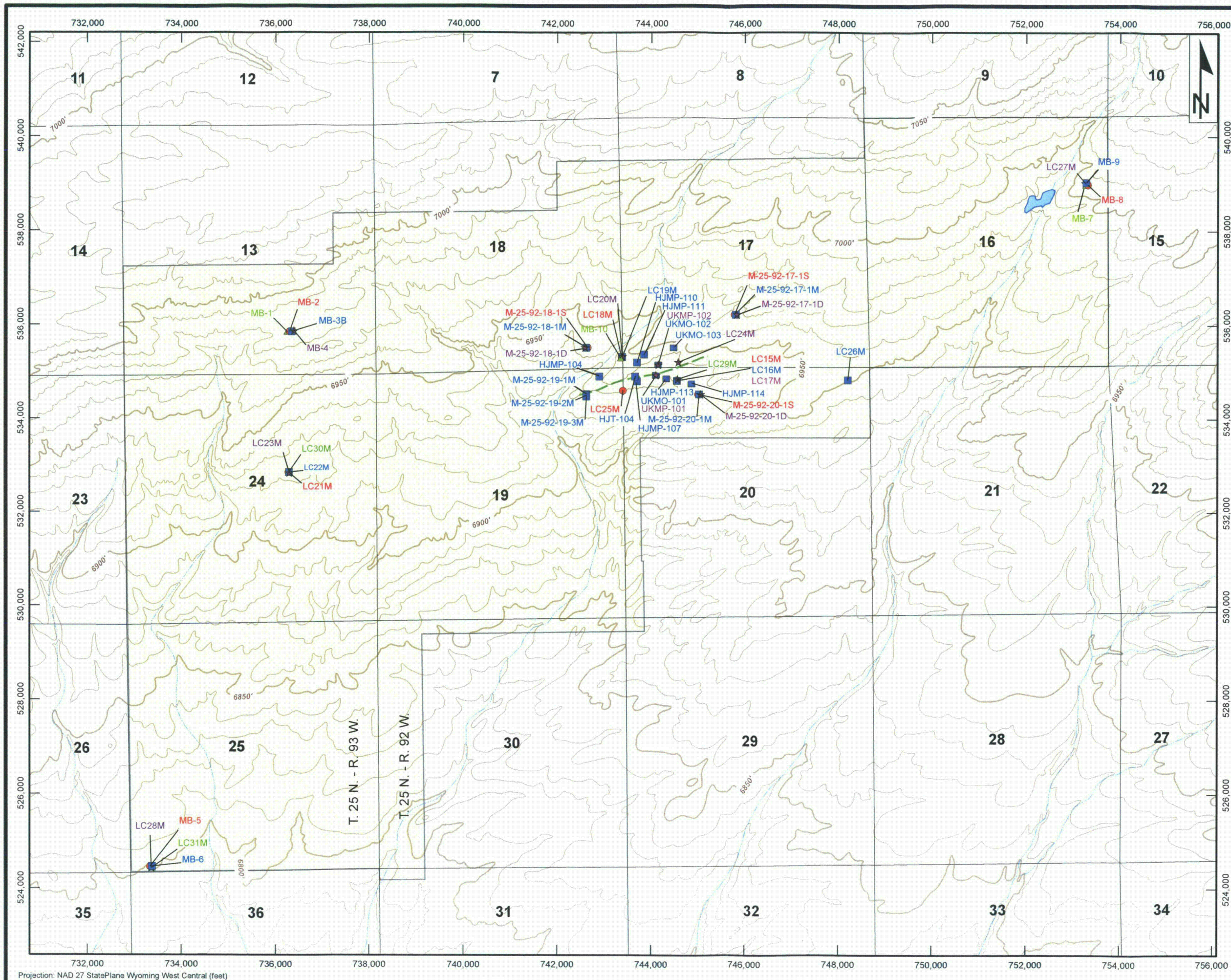
WELL STIMULATION: Method AirliftYield: Good / Moderate / Poor

HJMP-104



Yield: Good / Moderate / Poor





## Legend

### Monitor Wells

- ▲ DE Horizon
- LFG Horizon
- HJ Horizon
- ★ UKM Horizon
- Lost Creek Fault
- Lost Creek Permit Boundary

### Notes:

- 1) Wells numbered as: 'M-Township-Range-Section-depth' (e.g., M-25-92-17-1S) were installed by Conoco-TexasGulf in the 1980s and subsequently abandoned.
- 2) All other wells shown on the map were installed as part of the Lost Creek Project for the LC16M and LC19M pump tests and baseline water quality sampling.
- 3) Plate D5-3 shows all the Lost Creek Project wells.

Scale: 1:24,000



Lost Creek ISR, LLC  
Littleton, Colorado, USA

**Petrotek** [www.petrotek.com](http://www.petrotek.com)  
Littleton, CO USA

### FIGURE D6-9 Location Map, Early Lost Creek Monitor Wells

#### Lost Creek Permit Area

Issued For: WDEQ-LQD 1.0 Drawn By: JM

Issued/ Revised: 04.06.09

Drawing No.: WDEQ\_LQD\_FIG\_D6-9.mxd

0 2,000 4,000 Feet



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D11.3	Results and Discussion .....	D11-2

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Figure D11-2c Photos of Crooked Well Reservoir - April 2009  
Figure D11-3 Photos of Potential Wetland, per National Wetland Inventory, in T25N,  
R93W, Section 24  
Figure D11-4 Photos of Potential Wetland, per National Wetland Inventory, T25N,  
R92W, Section 21

# D11 WETLANDS

## D11.1 Introduction

The purpose of the wetland study is to evaluate the Permit Area for the presence of wetlands, and to describe cover and species compositions in any identified wetlands.

## D11.2 Methods

Evaluation of potential wetland areas was initially conducted by reviewing aerial photographs of the Permit Area for topographic low areas and drainages. Other than the Crooked Well Reservoir, no potential wetland areas were identified from the aerial photographs. Three potential wetlands were identified using the GIS layers from the National Wetlands Inventory (NWI) database (National Wetlands Inventory, 2006) (**Figure D11-1**).

The potential wetland areas were visited in the field during the 2006 growing season and again in the spring of 2009. The sites were evaluated using the criteria listed in the US Army Corps of Engineers wetland delineation manual (Department of the Army, 1987). Two of the three locations were not wetlands as none of the criteria related to hydrology, soils, or vegetation were met. A more detailed evaluation of the vegetation at one potential location, the Crooked Well Reservoir, was done because of the potential for inundation of the area during some seasons.

Wetland vegetation delineation is based on the presence and abundance of obligate wetland plants, facultative wetland plants, facultative plants, facultative upland plants and obligate upland plants. The indicator status for wetland species has been developed by the US Fish and Wildlife Service, and a specific publication for Region 9 (which includes western Wyoming) is available (Reed, 1988). Specific categories include the following.

- Obligate Wetland Species: Under natural conditions, occur almost always (estimated probability greater than 99 percent) in wetlands.
- Facultative Wetland Species: Usually occur in wetlands (estimated probability 67 to 99 percent), but occasionally found in non-wetlands.
- Facultative Species: Equally likely to occur in wetlands or non-wetlands (estimated probability 34 to 66 percent).
- Facultative Upland Species: Usually occur in non-wetlands (estimated probability 67 to 99 percent), but occasionally found in wetlands (estimated probability 1 to 33 percent).

- Obligate Upland Species: Occur almost always (estimated probability greater than 99 percent) in non-wetlands under natural conditions in this region.

Had wetlands been identified during the April 2006 vegetation survey (Appendix D8) using indicator species, a point-intercept approach would have been used to sample species composition and cover. Areas that met the wetland determination criteria based on the field evaluations would have been delineated and mapped.

## D11.3 Results and Discussion

All potential wetlands identified by aerial photo analysis and the National Wetlands Inventory were field-checked in April 2006 and again in April 2009. No wetlands were identified. The Permit Area consists almost entirely of upland environments dominated by big sagebrush (*Artemisia tridentata*). The Permit Area is dissected by several small ephemeral drainages, but none of these areas support wetlands. The channels are dominated by big sagebrush, which tends to have higher cover percentages and grow larger in the lowland areas. However, flow in the drainages is occasional, and none of the areas has the hydrology to support wetland vegetation. For nearly the entire growing season, the Permit Area has no standing surface water.

Of the three potential wetlands in the NWI, only one appeared to be a potential wetland based on initial field observations, specifically the Crooked Well Reservoir, located near the center of T25N, R92W, Section 16. This stock pond is an off-channel reservoir next to the Battle Spring Draw in the northeastern part of the Permit Area (**Figure D11-1**). However, based on more detailed field observations during the April 2006 vegetation survey (Appendix D8), surface water sampling (Appendix D6), and other site activities, this site is not a wetland under the 1987 ACOE criteria (hydrology, soils, and vegetation). Figures 11-2a, 2b, and 2c show the reservoir conditions in April of 2006, 2007, and 2009, respectively. Hydrology is the criteria most likely to be met in a given year; however, the variability and timing of precipitation do not result in inundation for at least five days during the growing season each year. There may be sufficient snowmelt for water to accumulate for five days in some years, but because of the variability in temperatures, snowmelt often occurs (and the reservoir dries) before the growing season starts in June (National Climatic Data Center, 2008). There may also be water present after an intense summer thunderstorm, but only at rare intervals from year to year. The bottom of the reservoir is composed of sand, silt, and clay, with no surficial evidence of extensive organic material or anaerobic conditions. The bottom of the reservoir is essentially bare, probably due in part to wind scour. Although there is no specific vegetation density requirement for wetlands, the density is a factor that should be taken into account (Department of the Army, 1987). Scattered small sagebrush and grasses are present

along the edges of the bare area, and these grade quickly to the more dense sagebrush community.

Of the other two potential wetlands identified in the NWI, one is off-channel and may have been an old turn-around off the east-west road in the northern portion of T25N, R93W, Section 24 (Figure D11-3). The other location is near a channel and just south of the Permit Area. It was apparently associated with the BLM Battle Spring Draw Well No. 4551 in the northern portion of T25N, R92W, Section 21. When the site was first visited in April 2006, and again in November 2007, the well was apparently not in use (Figure D11-4). However, when the site was visited in April 2009, the well had apparently been put back into service and a dirt 'tank' established (Figure D11-4).

**Figure D11-2a**      **Photos of Crooked Well Reservoir**  
**T25N, R92W, Section 16**  
**April 2006**



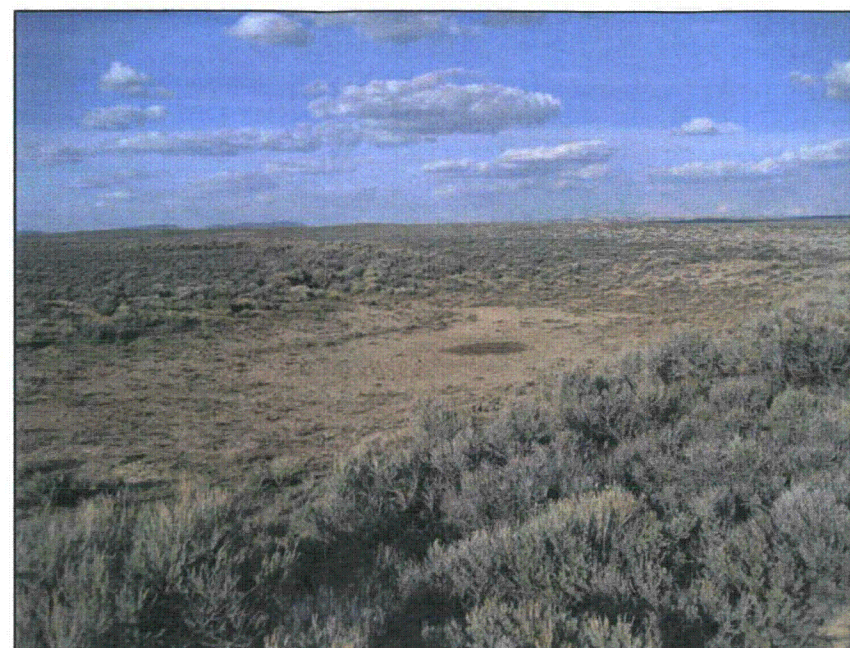
Looking southwest.



**Figure D11-2b**    **Photos of Crooked Well Reservoir**  
**T25N, R92W, Section 16**  
**April 2007**



Looking southwest.



Looking north.



Looking north.



Looking north.



Looking north.



**Figure D11-2c**    **Photos of Crooked Well Reservoir**  
**T25N, R92W, Section 16**  
**April 2009**



Looking north.



Looking east.



Looking west.



Looking south.



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