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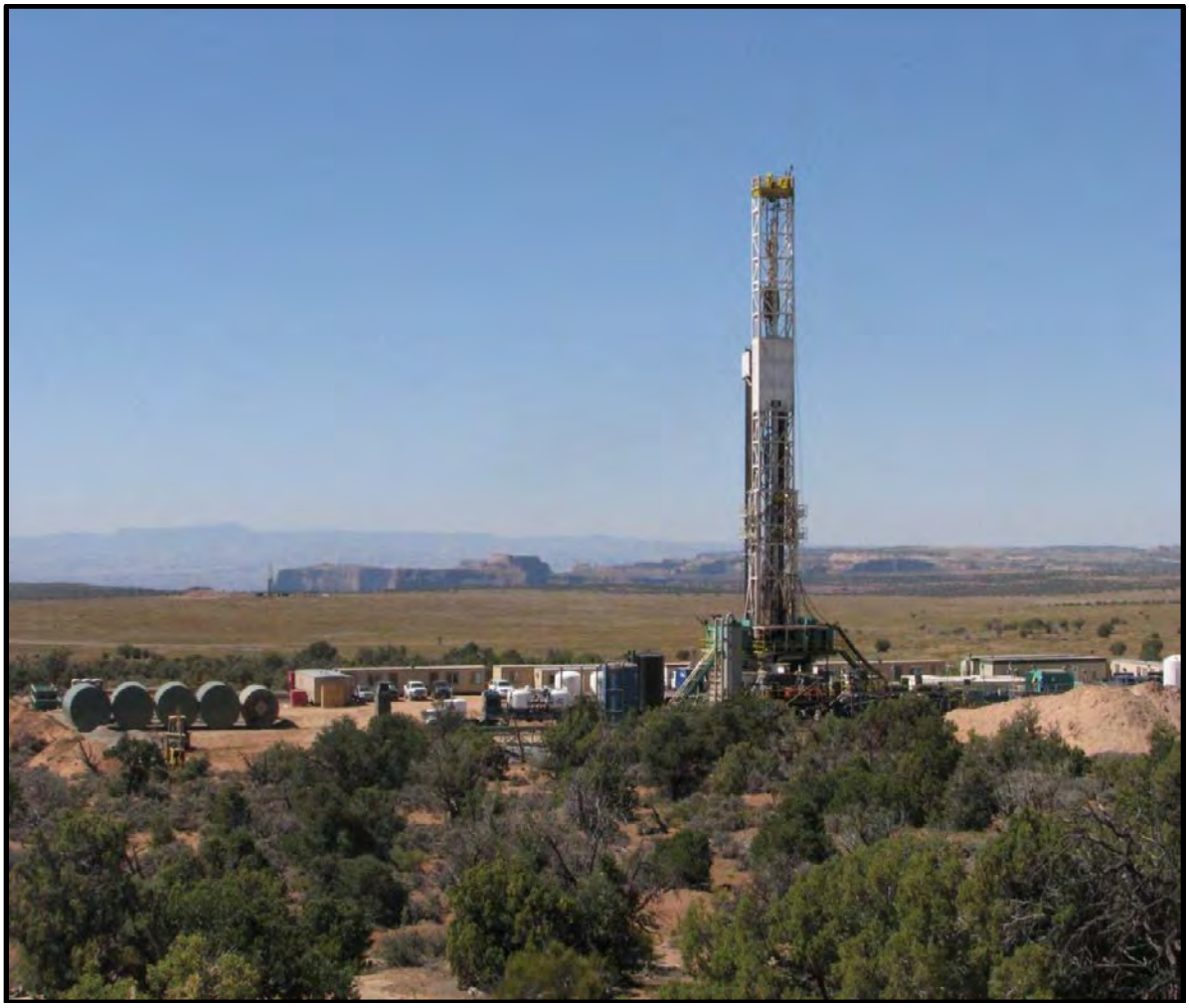
REASONABLY FORESEEABLE DEVELOPMENT SCENARIO FOR OIL AND GAS IN THE MOAB MASTER LEASING PLAN AREA, CANYON COUNTRY DISTRICT



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REASONABLY FORESEEABLE DEVELOPMENT (RFD) SCENARIO FOR OIL AND GAS IN THE MOAB MASTER LEASING PLAN (MMLP) AREA, CANYON COUNTRY DISTRICT

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Cover - photograph of the Frontier No. 10 drilling rig on Fidelity Exploration and Production Company's Cane Creek Unit 12-1 horizontal well in the Big Flat field, T. 26 S., R. 19 E., Section 12, NESW, Grand County, Utah. Photo was taken by Jeff Brown on May 31, 2012.

REASONABLY FORESEEABLE DEVELOPMENT (RFD) SCENARIO FOR OIL AND GAS IN THE MOAB MASTER LEASING PLAN (MMLP) AREA, CANYON COUNTRY DISTRICT

I. Summary

A Reasonably Foreseeable Development (RFD) Scenario for oil and gas is a long-term projection of oil and gas activity. The following RFD Scenario projects the level of oil and gas activity that can reasonably be expected to occur in the Moab Master Leasing Plan Area (MMLPA) during the next 15 years. This RFD document is intended to project a baseline scenario of oil and gas exploration, development, production, and reclamation activity to aid the BLM with land use planning by providing a mechanism to analyze the effects that discretionary management decisions may have on oil and gas development, local and regional economies and important resource values such as air quality, cultural resources and wildlife habitat.

The MMLPA encompasses a total of 946,469 acres in Grand County and San Juan County, Utah. The majority of lands within the MMLPA (83 percent) are public lands administered by the Bureau of Land Management (BLM). State lands total 14 percent of the MMLPA and the remaining 3 percent are private lands.

The following RFD projections are based largely on local geology, current and historical trends in oil and gas activity, and forecasts of crude oil and natural gas markets. The MMLPA is wholly or partially within five oil and gas "Plays" defined by the U.S. Geological Survey (USGS). Four of the five plays are of special interest relative to future exploration and development activity in the MMLPA. These four plays, the Cretaceous Dakota to Jurassic Play (Play 2004), the Buried Fault Block Play (Play 2101), the Fractured Interbed Play (Play 2103) and the Salt Anticline Flank Play (Play 2105) are all associated with the commercial production of oil and gas and therefore, have a high development potential within the MMLPA.

The U.S. Energy Information Administration (EIA) projects the price of oil to escalate gradually and continuously through the year 2035 (final year of projection) at which time a barrel of crude oil would be $145 in 2010 dollars. Natural gas prices are presently very low, both in terms of historical trend and relative to oil on a Btu (energy equivalency) basis. The EIA projects gas prices to escalate to a final projected price of $6.52 (corrected to 2010 dollars) in the year 2035. For the purpose of projecting oil and gas drilling activity in the MMLPA, it is assumed that the demand and price for crude oil will remain strong and, that the natural gas market will generally improve during the next 15 years.

There have been a total of 66 wells drilled in the MMLPA during the past 30 years, or an average of roughly 2 wells per year during that period. The average number of wells drilled in the MMLPA since 2007 has been 4.5 wells per year and active drilling continues at present (June, 2012). Drilling success in the MMLPA has increased over the past 30 years due largely to advances in horizontal drilling and geophysical technology. This upward trend in drilling and drilling success rates, combined with current and forecasted market conditions, favor a projected level of drilling activity above the recent 6-year average (2007-2012) rather than the 30-year historical average.

Future oil and gas drilling for the next 15 years is projected to average 8.5 wells per year for a total of 128 wells. This would result in a total surface disturbance of 1,050 acres from construction of new well pads and associated infrastructure, including roads and pipelines. The estimated total existing surface disturbance from oil and gas activity in the MMLPA is 318 acres, including well pads and access roads.

Total surface disturbance to be successfully reclaimed during the next 15 years, including dry holes, existing abandoned wells, future abandoned wells and interim reclamation of future producing wells, will be 611 acres. Therefore, over the next 15 years a total of 1,368 acres will be disturbed by oil and gas drilling activity and of that total; 611 acres will be successfully reclaimed giving a net surface disturbance of 757 acres.

For geophysical exploration, 915 linear miles of source lines with an associated surface disturbance of 1,109 acres are projected over the next 15 years. Total geophysical related surface disturbance that will be reclaimed during the next 15 years will be 888 acres, leaving a net surface disturbance of 221 acres.

The baseline RFD scenario for the MMLPA is summarized as follows:

- Existing surface disturbance for 29 active wells, 24 abandoned wells, and associated roads, is about 318 acres. This amounts to about 6 acres of surface disturbance per existing well.
- The average area of surface disturbance for each new well projected to be drilled during the next 15 years will be 8.2 acres.
- Future oil and gas drilling for the next 15 years is projected to average 8.5 wells per year for a total of 128 wells.
- Future surface disturbance for 128 projected new wells and associated infrastructure will be about 1,050 acres.
- A total of 611 acres of surface disturbance will be successfully reclaimed during the next 15 years; including 17 dry holes, 24 existing abandoned wells, 13 future abandoned wells and interim reclamation of 77 future producing wells.
- The total net surface disturbance for all drilling activity in the MMLPA over the next 15 years will equal roughly 757 acres.
- Future surface disturbance over the next 15 years for geophysical exploration (915 linear miles of source lines) will be about 1,109 acres.
- Total geophysical related surface disturbance to be successfully reclaimed during the next 15 years will be 888 acres.
- The total net surface disturbance for geophysical activity in the MMLPA over the next 15 years will be roughly 221 acres.

These baseline projections represent average activity levels over the next 15 years and are not intended to be thresholds for limiting future activity. Oil and gas exploration and development activity tends to be sporadic over time due to market influences and other factors affecting the oil and gas industry. Because of this, it is recognized that during the next 15 years there may be some years when oil and gas activity in the MMLPA would be much less than the projected average levels and other years when activity may be much greater.

II. Introduction

In 2005, the two Bureau of Land Management (BLM) field offices within the Canyon County District (Moab and Monticello) released Mineral Potential Reports (MPR) and Reasonably Foreseeable Development (RFD) Scenario documents assessing oil and gas within their respective planning areas. The RFD scenarios released in 2005 for the Moab and Monticello RMPs projected oil and gas activity for the entire planning areas in each field office (totaling approximately 6.3 million acres). In 2008, Resource Management Plans (RMP) for the Moab and Monticello Field Offices were approved.

The BLM is now preparing the Moab Master Leasing Plan (MMLP) to consider oil and gas leasing on approximately 783,000 acres of public lands within the Canyon Country District in accordance with BLM Washington Office Instruction Memorandum No. 2010-117. The MMLP area (MMLPA) includes lands within both the Moab and Monticello Field Offices (Map 1). The following RFD Scenario projects the level of oil and gas activity that can reasonably be expected to occur in the MMLPA during the next 15 years. In preparing this RFD scenario for the MMLPA, the BLM relied on the 2005 MPR and RFD documents for information about the area's geology and its mineral occurrence and development potential. The conclusions of oil and gas occurrence and development potential are unchanged since 2005. However, the following RFD projections take into account updated information about current and historical oil and gas activities specific to the MMLPA, including; leasing, geophysical exploration, drilling and production. Projections of future oil and gas activity in the MMLPA also take into consideration current and forecasted trends in the crude oil and natural gas markets.

The MLP may require amendments to the Moab and Monticello RMPs if new leasing stipulations and development constraints are proposed. As part of the planning process, the BLM will prepare an Environmental Impact Statement (EIS) to comply with the requirements of the Nation Environmental Policy Act (NEPA). This RFD is neither a planning decision nor the "No Action Alternative" in the NEPA document. This RFD is a technical report intended to project a baseline scenario of oil and gas exploration, development, production, and reclamation activity to aid the BLM with land use planning by providing a mechanism to analyze the effects that discretionary management decisions may have on oil and gas development, local and regional economies and important resource values, such as air quality, cultural resources and wildlife habitat.

Pursuant to Instruction Memorandum No. 2004-089, an RFD projection assumes that all potentially productive areas are open for leasing under standard lease terms and conditions except those areas designated as closed to leasing by law, regulation or executive order. Since there are no lands within the MMLPA that are closed to leasing by such authority, the following RFD baseline projection assumes that all lands in the MMLPA are available for leasing with standard lease terms. The MMLPA includes Federal, private and state lands. Lands within the MMLPA total approximately 946,469 acres, of which, approximately 783,381 acres are public lands administered by the BLM. The MMLPA includes lands where Federally owned minerals underlie surface acreage that is not administered by the BLM (split estate). Table 1 shows the status and acreage breakdown of all lands within the MMLPA.

Table 1. Status of lands in the MMLPA

Land status	Moab FO	Monticello FO	MMLPA Total
	acres	acres	acres
BLM	579,438	203,943	783,381
State	93,971	32,310	126,281
State Parks	4,337	40	4,377
Private	17,873	14,557	32,430
Split Estate*	9,599	5,281	14,880
Total	**695,619**	**250,850**	**946,469**

*Acreage not Additive
Source: BLM Canyon Country District

III. Description of Geology

The geology of the MMLPA is described in detail in the Mineral Potential Reports for the Moab and Monticello Resource Management Plans (BLM, 2005a; BLM, 2005b). The MMLPA is within the Paradox Fold and Fault Belt of the Paradox Basin. As part of its 1995 National Assessment of United States Oil and Gas Resources, the U.S. Geological Survey (USGS) delineated oil and gas "Plays" in the Paradox Basin (Gautier, 1996). The MMLPA is wholly or partially within five of the oil and gas plays defined by the USGS. In March 2012, the USGS published the results of a more recent assessment of the petroleum systems of the Paradox Basin that was based on the total petroleum system (TPS) rather than the plays concept (USGS 2012). However, to maintain consistency with the Moab and Monticello RMPs in describing oil and gas resources throughout the Moab and Monticello field offices, the 1995 data are used. Map 2 shows the areal extent of each oil and gas play within the MMLPA. Four of the five plays are of special interest relative to future exploration and development activity in the MMLPA. These four plays are:

Play 2004 Cretaceous Dakota to Jurassic Play
Play 2101 Buried Fault Block Play
Play 2103 Fractured Interbed Play
Play 2105 Salt Anticline Flank Play

Play 2004 (Cretaceous Dakota to Jurassic Play) underlies a small area in the northern part of the MMLPA. This play includes oil and gas in conventional sandstone reservoirs in the Dakota Sandstone and Cedar Mountain Formation of Cretaceous age and the Morrison and Entrada Formations of Jurassic age. The Cretaceous and Morrison reservoirs are mostly fluvial in origin whereas the Entrada is eolian. Source rocks may be coal in the Dakota and/or organic-rich shales in the overlying Mowry and Mancos Shales. Oil and gas accumulations in this play include fields in the Greater Cisco and San Arroyo areas 10 to 40 miles north and northwest of the MMLPA.

Play 2101 (Buried Fault Block Play) is present in the entire MMLPA except a small area in the southwest part. This play includes oil and gas trapped in porous dolomite or dolomitic limestone beds of the Upper Devonian McCracken Sandstone Member of the Elbert Formation and the Mississippian Leadville Limestone (Huffman, 1996). The seals for these traps are the Pennsylvanian Paradox Formation evaporates that overlie the carbonate reservoirs or are in fault communication with them. Probable source rocks are the organic-rich black dolomitic shales of the Pennsylvanian Paradox Formation. Within the

MMLPA, accumulations of oil and gas in this play include the Salt Wash, Big Flat and Hatch Point fields. The largest accumulation of oil and gas in this play (Lisbon field) is located approximately 6 miles east of the MMLPA. The Lisbon field is one of the largest producing fields in Utah.

Play 2103 (Fractured Interbed play) underlies the entire MMLPA. This play is an unconventional continuous-type play that depends on extensive fracturing in the organic-rich dolomitic shale and mudstone in the interbeds between evaporites of the Paradox Formation or carbonate and clastic rocks of the related cycles on the shelf of the Paradox evaporite basin. Jointing and fracturing of the interbeds in the Paradox Fold and Fault Belt are controlled by regional tectonics and more localized salt movement, dissolution and collapse (Chidsey, 2004). This play is thought to be sourced from the same organic-rich black dolomitic shales and mudstones of the Paradox Formation (Huffman, 1996). The Cane Creek Shale discoveries within the MMLPA are found in this play. Oil and gas fields in this play include the Big Flat, Long Canyon, Park Road, Hell Roaring, Kane Creek, Threemile, LaSal and Golden Eagle fields. In addition to the Cane Creek Shale, there are other organic shales in the play, notably the Chimney Rock, Gothic, and Hovenweep Shales, which may provide additional drilling targets for hydrocarbon accumulations (USGS, 2012).

Play 2105 (Salt Anticline Flank play) is found underlying all but a small area in the southwest part of the MMLPA (Map 2). This play is characterized by oil and gas productive Permian and Pennsylvanian reservoirs along the flanks of northwest-trending salt anticlines in the axial part of the Paradox Basin. Source rocks are thought to be organic-rich black dolomitic shales of the Hermosa Group, as well as coaly carbonaceous shale locally present at the Cutler-Hermosa contact (Huffman, 1996). Extensive fracturing along the anticlines can also provide conduits from source rocks to reservoirs. There is no production from reservoirs in this play within the MMLPA. The largest accumulations in this play include the South Pine Ridge and Big Indian South fields in Utah and the Andy's Mesa and Hamilton Creek fields in the Paradox Fold and Fault Belt province of western Colorado.

The MMLPA is at the northern margin of Play 2102, the Porous Carbonate Buildup Play. This play is characterized by oil and gas accumulations in mounds of algal limestone and dolomitic reservoirs in five informal zones of the Pennsylvanian Hermosa Group within the Paradox Formation. Probable source rocks are the interbedded organic-rich black dolomitic shale and mudstone and laterally equivalent carbonate rocks within the Paradox Formation (Huffman, 1996). Significant oil and gas accumulations occur in reservoirs in this play within the Blanding sub-basin approximately 20 to 50 miles to the southeast of the MMLPA. These include the Greater Aneth field, one of Utah's largest fields. However, only a very small acreage (roughly 700 acres) in the extreme southwest part of the MMLPA is within this play (Map 2). Therefore, Play 2102 is considered inconsequential to future oil and gas development in the MMLPA.

IV. Past and Present Oil and Gas Exploration

Geophysical Exploration

Geophysical exploration has occurred in all portions of the MMLPA in the past. The BLM records indicate there have been at least 15 geophysical projects completed in the MMLPA since 1982 (BLM, 2012a). These are listed and briefly described below in Table 2 to show the types of surveys that have been conducted in the MMLPA. The Utah Division of Oil, Gas and Mining keeps a database of seismic surveys conducted within the state of Utah. Map 3 shows the locations of these surveys within the MMLPA; however, this is not an exhaustive list (UDOGM, 2012).

Table 2. Geophysical surveys conducted in the MMLPA

Year	Geographic Area	Description	Surface Area	Development Area
1982	White Ranch	2D shothole, heli-portable	25 linear miles*	E. Paradox
1984	Hatch Point	2D shothole, truck drill/heli-portable	16 linear miles (4 lines)	Hatch Point
1984	Behind Rocks	3D vibroseis, buggy truck	6 square miles	Hatch Point
1989	Hart Point	2D shothole, truck mounted drill	5 linear miles (1 line)	Hart Point
1990	The Knoll	2D shothole, truck mounted drill	7 linear miles	Slt Wsh-B. Flat
1990	Hatch Point	2D shothole, truck mounted drill	11 linear miles	Hatch Point
1990	Peters Point	2D shothole, truck drill/heli-portable	13.5 linear miles (1 line)*	Hart Point
1991	The Knoll	3D shothole, truck drill/vibroseis buggy	26 square miles	Slt Wsh-B. Flat
1991	Hatch Point	3D shothole, truck mounted drill	8 square miles	Hatch Point
1992	Castle Valley	2D shothole, truck drill/heli-portable	29.5 linear miles*	E. Paradox
1993	Dry Valley	2D shothole, truck mounted drill	3.7 linear miles (1 line)	Hart Point
2001	Dry Valley	3D vibroseis, buggy truck	26.4 square miles*	Hart Point
2001	The Knoll	3D vibroseis, buggy truck	36 square miles	Slt Wsh-B. Flat
2002	Yellow Cat	3D vibroseis, buggy truck	36 square miles*	E. Paradox
2007	Hatch Point	3D vibroseis, buggy truck	35 square miles	Hatch Point

*Project extends outside MMLPA boundary
Source: BLM, 2012a

V. Past and Present Oil and Gas Development Activity

Oil and Gas Leasing Activity

Authorized and pending Federal oil and gas leases within the MMLPA cover a total of 228,428 acres. This is approximately 24 percent of the MMLPA. Federal oil and gas leases in the MMLPA are shown on Map 4.

Historical Drilling Activity

The wells listed in Table 3 were updated from the Utah Division of Oil, Gas and Mining (UDOGM) data and are current as of June 1, 2012 (UDOGM, 2012). There have been 227 wells drilled in the MMLPA, of which, 198 wells have been plugged and abandoned (Map 5). Of the remaining 29 active wells, 12 wells are currently producing oil, 15 wells are capable of producing oil or gas, 1 well is used for water injection/disposal and 1 well is actively being drilled.

There have been a total of 66 wells drilled in the MMLPA during the past 30 years, or an average of approximately 2 wells per year during that period (Table 4). Of the total 66 wells drilled, 18 were oil well completions, 3 were gas well completions and 45 were dry holes. Based on these historical well drilling statistics, there has been a 32 percent drilling success rate in the MMLPA over the past 30 years. There have been several relatively short lived periods of slightly higher average drilling activity during the past 30 years (Figure 1). During a 3-year period between 1982 and 1984, the average drilling rate was just over 3 wells per year. A total of 8 wells were drilled during 1991 and 1992. Drilling activity in the MMLPA has increased since 2007. The average number of wells drilled annually during the past 6 years has been 4.5 or a total of 27 wells.

Table 3. Status of wells located in the MMLPA

Well status	Number of wells
Producing oil wells	12
Shut-in oil wells	11
Shut-in gas wells	2
Temporarily abandoned wells	2
Plugged and abandoned wells	198
Approved drilling permits (not drilled)*	6
Pending drilling permits*	14
Active drilling	1
Active water injection/disposal well	1
Total Wells	**227**

*Pending wells are not additive
Source: Modified from UDOGM, 2012

Table 4. Wells drilled in the MMLPA during the past 30 years.

	Eastern Paradox Area			Salt Wash-Big Flat Area			Hatch Point Area			Hart Point Area			
Year	Oil Wells	Gas Wells	Dry Holes	Oil Wells	Gas Wells	Dry Holes	Oil Wells	Gas Wells	Dry Holes	Oil Wells	Gas Wells	Dry Holes	**Total MMLPA**
1982						3						1	4
1983			1									2	3
1984						2			1				3
1985						1							1
1986						1						1	2
1987													0
1988						1						1	2
1989												2	2
1990													0
1991				1		1			2				4
1992				2			1					1	4
1993													0
1994													0
1995						2						2	4
1996													0
1997													0
1998						1							1
1999				1									1
2000						1							1
2001													0
2002												1	1
2003				1		1							2
2004				1									1
2005						3							3
2006													0
2007		1	1	1		4							7
2008				1		6							7
2009		1		2			1						4
2010		1				2	1						4
2011							2						2
2012				3									3
Total	0	3	2	13	0	29	5	0	3	0	0	11	**66**

Total Eastern Paradox	**5**
Total Salt Wash-Big Flat	**42**
Total Hatch Point	**8**
Total Hart Point	**11**

Source: Modified from UDOGM, 2012

Historical Oil and Gas Production

The MPLA encompasses 15 oil and gas fields that produce from reservoirs in both the Buried Fault Block Play (Play 2101) and the Fractured Interbed Play (Play 2103). Table 5 presents the cumulative production data for the oil and gas fields within the MMLPA, which includes 9 active fields, 4 inactive fields, and 2 abandoned fields (modified from UDOGM, 2012). Total cumulative production from fields within the MMLPA has been roughly 5.5 million barrels of oil and nearly 15.5 billion cubic feet of natural gas.

Table 5. Cumulative production of oil and gas fields in the MMPLA

Field Name	USGS Play #	Field Type	Producing Formation	Status	Discovery year	Active Wells	Cumulative Production		
							Oil (bbl)	Natural Gas (Mcf)	Water (bbl)
Big Flat/ Bartlett Flat	2101/03	Oil/Gas	Leadville/ Paradox	Active	1955	5	1,639,822	1,514,453	155,308
Big Flat West	2103	NA	Paradox	Inactive	1993	1	0	0	0
Hatch Point	2101/03	Oil	Leadville/ Paradox	Active	1993	2	30,367	21,933	344
Hell Roaring	2103	Oil	Paradox	Active	1992	1	628,496	556,950	42,349
Kane Creek	2103	Gas	Paradox	Abandoned	1925	0	1,887	25,000	0
Lion Mesa	2103	Oil	Paradox	Inactive	1984	3	1,624	0	8
Long Canyon	2103	Oil	Paradox	Active	1962	1	1,145,635	1,193,917	550,018
Park Road	2103	Oil	Paradox	Active	1991	1	381,172	341,689	28,323
Salt Wash	2101	Oil	Leadville	Active	1961	4	1,630,478	11,749,677	6,063,589
Shafer Canyon	2103	Oil	Paradox	Abandoned	1963	0	67,554	63,805	1,408
Ten Mile	2103	Oil	Paradox	Inactive	1990	1	962	0	599
Golden Eagle*	2103	Gas	Paradox	Inactive	2006	2	0	0	0
Threemile *	2103	Oil	Paradox	Active	2009	2	13,218	1,821	62,778
LaSal*	2103	Oil	Paradox	Active	2011	1	4,149	3,538	0
					Total	24	5,545,364	15,472,783	6,904,716

Source: modified from UDOGM, 2011
*Field undefined

Figure 2 shows the total annual production of oil and gas from all wells within the MMLPA since 1984, while Figures 3, 4 and 5 show production trends for the three largest fields in the MMLPA during the period 1984 to 2012 (UDOGM, 2012). Fields in the MMLPA produce both oil and natural gas. The natural gas is produced in association with oil (Figure 1). At the present time, there are no gas production pipelines in the MMLPA so all natural gas production is used on site (for benefit of lease), flared or vented. There have only been 21 wells drilled in the MMLPA during the past 30 years that have been capable of production (Table 4). For that reason, small changes in the total number of producing wells due to new drilling or well maintenance activities can have a considerable impact on total annual production from wells in the MMLPA. This may help explain periodic swings in total annual production since 1990 (Figures 1 and 2).

Well Spacing

Pursuant to Utah Administrative Code R649-3-2, the standard well spacing for a vertical oil and gas well in Utah is 40 acres (UDOGM, 2012). Horizontal wells can be located anywhere on a lease since it is the horizontal interval (lateral) not the surface location that is critical for the orderly development of a pool. The Utah Board of Oil, Gas and Mining has the authority to issue special orders establishing drilling units

or authorizing different well density or location patterns for particular pools to promote efficient development and protect correlative rights. For example, as fields mature, exceptions can be made to increase well density to maximize oil and gas recovery. The BLM generally defers to State of Utah well spacing rules.

Infrastructure

Road Systems

The primary roads providing access to oil and gas fields in the MMLPA are part of the Grand and San Juan County Class B road systems and are maintained by the counties on a regular basis. Numerous secondary roads connecting to the B road systems provide access to individual wells and facilities. Class B road systems in the MMLPA are shown on Map 6.

Pipeline Systems and Gas Plants

There are two interstate gas pipeline systems running through the MMLPA, Williams Pipeline and Enterprise Products Partners, L.P. Pipeline. The interstate pipelines are within a designated utility corridor that parallels portions of Interstate 70 and Highway 191 (Map 6). The two pipelines are buried side-by-side except in the northeast part of the MMLPA where the 26-inch Williams Pipeline takes a more direct route northeast from the junction of Highway 191 and Highway 313 through Arches National Park.

In 2008, Delta Petroleum constructed a 16 inch pipeline and well gathering lines that cross the northern part of the MMLPA. Currently (June 1, 2012), the pipeline system transports gas from two wells, the 28-11 well and the 25-12 well. Both wells are located just outside the MMLPA to the north in T. 22 S., R. 17 E., Section 28 and T. 22 S., R. 19 E., Section 25, respectively. The pipeline system is currently owned and operated by Pacific Energy and Mining Company (Pacific Energy).

There are no gas plants within the MMLPA. Patara Oil and Gas LLC's Lisbon Gas Plant is located on private land approximately 5 miles east of the southeast part of the MMLPA in T. 30 S. R. 24 E., Section 22. The facilities at the Lisbon Gas Plant were upgraded in the early 1990's, and the plant currently produces various natural gas products, including natural gas liquids and helium. The facilities at the Lisbon Gas Plant are adequate to process future natural gas production, and in the event that additional facilities are needed, there is room for expansion at the existing location (BLM, 2005c). A second gas plant, the Pacific Energy Gas Plant, is located approximately 1 mile north of the of MMLPA in T. 22 S., R. 18 E., Section 32. That plant processes natural gas, separating natural gas liquids from dry gas.

Produced Water and Disposal Facilities

There is currently one active water injection/disposal well within the MMLPA, (UDOGM, 2012). The injection well in the Big Flat field, the State No. 16-1, is authorized by UDOGM for disposal of produced water.

In the past, water produced at the Long Canyon No. 1 was evaporated at a pond located next to the well or hauled to an authorized water disposal site. The water produced from the well has a high concentration of calcium chloride and magnesium chloride (BLM, 2005c), compounds that are commonly used for dust control, road base stabilization, ice and snow melting, and workover fluid at some oil wells. Mining claims were filed on the well site for the mineral content in the water. In the past the water produced at

Long Canyon No. 1 well was cleaned, concentrated and marketed for use as a road treatment; however, the evaporation pond, an essential component of processing, is presently slated to be closed and reclaimed.

There are no commercial water disposal facilities within the MMLPA. All produced water in the MMLPA is hauled by trucks to an authorized commercial water disposal site outside the MMLPA or disposed of in an approved injection well or evaporation pond within the MMLPA. One water disposal facility, the Danish Flat disposal facility, is located approximately 12 miles northeast of the MMLPA. The facility is on private land in T. 20 S., R. 24 E. Section 17. There is also one water injection well approved for commercial use in the Lisbon Valley area approximately 10 miles east of the MMLPA. The Lisbon well would be available for disposal of produced water from wells outside the Lisbon and Big Indian Units.

Hydrogen Sulfide Gas (H_2S)

Hydrogen Sulfide (H_2S) is a poisonous gas that can occur in association with oil and gas operations. The Mississippian age Leadville Limestone is known to contain naturally high concentrations of H_2S. Fields producing from this formation in the MMLPA have potential to encounter H_2S. One well in the Hatch Point field, the Hatch Point No. 1, is reported to have had some H_2S in the past (Brown, 2012). H_2S can also develop in wells used for water injection, particularly when the injection zone also contains oil. However, no H_2S has been identified at the water injection well in the Big Flat field.

Warning signs for H_2S are installed at well sites where H_2S has been identified. In some cases, gates are installed at the edge of the well pads or along the roads to the wells to further warn the public of the H_2S safety concerns.

Conflicts with other Mineral Development

As discussed below in section VII, the MMLPA has a high potential for development of oil and gas. In addition to the high potential for development of oil and gas resources in the MMLPA, there is also a moderate potential for development of uranium and associated vanadium (BLM, 2005a; BLM, 2005b). A strong potash market in recent years has spurred activity in the MMLPA, including a total of approximately 200 prospecting permit applications since 2008 and three exploration drill holes on state lands since 2010. This activity suggests that potash development in the MMLPA during the next 15 years is also likely. Map 4 and Map 7 show the mineral interests in the MMLPA, including mining claims, oil and gas leases and potash prospecting permit applications and leases.

There is little potential for conflict between uranium mining operations and oil, gas or potash drilling. The Mesozoic sandstones which are the primary host to the uranium deposits in the MMLPA are much shallower (less than 2,000 feet) than are the deeper (6,000 – 9,000 feet) Paleozoic formations hosting the oil and gas reservoirs and potash deposits in the MMLPA. Although oil, gas and potash drilling would penetrate the potential uranium formations, uranium mines have been historically small enough that oil and gas exploration and development could easily be sited to avoid small underground uranium mining operations. In the past, there have been no unresolved conflicts between oil and gas and uranium operations. The same would be expected for uranium operations and any future potash drilling.

Nearly a quarter of the MMLPA is covered by Federal oil and gas leases. These leased lands overlap, in large part, with the area of pending potash prospecting permit applications (roughly 424,000 acres).

Potash deposits occur in the Pennsylvanian Paradox Formation. Oil and gas wells penetrate potential potash bearing intervals in the Paradox Formation to reach the Cane Creek Shale interval and the deeper Paleozoic reservoirs. In most cases, there would be adequate leeway in selecting well sites for either oil and gas, or potash exploration drilling to avoid conflicts.

It is likely that any future potash development would involve solution mining methods. Potash mining operations would be more problematic than exploratory drilling in terms of avoiding conflicts between oil and gas, and potash development. Underground voids created by solution mining in potash zones could introduce more challenges and costs to drilling for oil and gas in order to address lost circulation of drilling fluids and, to ensure adequate measures for well control. Oil and gas development may also be encumbered by surface facilities associated with potential potash solution mining operations, depending on size and location. However, potential conflicts between potash and, oil and gas development may be mitigated somewhat by enhanced horizontal drilling technology which provides greater latitude in well site selection.

VI. Oil and Gas Occurrence Potential

The oil and gas occurrence potential within the Moab and Monticello Field Offices is described in detail in the Mineral Potential Reports (MPRs) for the Moab and Monticello Field Office RMPs. As described in the MPRs, the oil and gas plays covering the MMLPA have a high potential for the occurrence of oil and gas (BLM, 2005a; BLM, 2005b).

VII. Oil and Gas Development Potential

As described in the Moab and Monticello Field Office MPRs and summarized in section III above, four oil and gas plays underlie the MMLPA which are important for future exploration and development activity. The plays are all associated with the commercial production of oil and gas and, therefore have a high development potential (BLM, 2005a; BLM, 2005b). Map 2 shows the oil and gas plays/fields within the MMLPA.

All of the 15 oil and gas fields in the MMLPA produce from reservoirs in the Buried Fault Block and/or the Fractured Interbed Play (Play 2101 and Play 2103, respectively). The Buried Fault Block Play underlies all but a small area in the southwest part of the MMLPA and the Fractured Interbed Play underlies the entire MMLPA. Within the MMLPA, there has been no commercial production of oil and gas from reservoirs in the Cretaceous Dakota to Jurassic Play (Play 2004) or the Salt Anticline Flank Play (Play 2105). All commercial production of oil and gas from these two plays is from nearby fields in the Fold and Fault Belt of the Paradox Basin. Play 2004 underlies a small area in the northern part of the MMLPA and Play 2105 is present in all but a small area in the southwest part of the MMLPA.

It is anticipated that most of the development in the MMLPA during the next 15 years will probably occur in the Fractured Interbed play given the existing fields in this play and also the increased drilling success rates in this play due to continued technological advances being made in the areas of horizontal drilling, fracture identification tools, hydraulic fracture stimulation, underbalanced drilling, and completions in fractured shales, all of which will help in the discovery of new fields in this play. In addition to the Cane Creek Shale, there are other organic shales, notably the Chimney Rock, Gothic, and Hovenweep Shales, that may also provide new drilling targets for hydrocarbon accumulations in this play. Some development is anticipated in the Salt Anticline Flank play as seismic technology continues to improve, allowing better definition of the location and nature of the structural traps in the play and promoting increased drilling

and recompletion opportunities along the flanks of the salt anticlines. As discussed in the MPRs for the Moab and Monticello Field Office RMPs, the complexity in reservoir development may explain the scarce number of reservoirs in the Buried Fault Block play. Therefore, little development is anticipated in this play for reservoirs that are moderate in size with more than minimal oil columns (BLM, 2005d).

The MPLA has been divided into four geographic areas for the purpose of discussing development activities. Map 6 shows the locations of the four development areas located within the MMLPA. The following areas are each addressed separately when considering future oil and gas development:

Eastern Paradox
Salt Wash-Big Flat
Hatch Point
Hart Point

Eastern Paradox Area

The Eastern Paradox area comprises an enclave in the northeast part of the MPLA with Arches National Park roughly located at its center. This area includes the Dome Plateau, Yellow Cat and Klondike areas. The area also extends southeast to include Fisher Valley and the southwest rim of Castle Valley. The Eastern Paradox area is largely unproven since there are no producing oil or gas fields within this area. The Golden Eagle Exploration LLC, drilled three deep wells, the Paradox No. 1, 2 and 3, on Dome Plateau between 2006 and 2010. The Paradox No. 1 targeted the Cambrian age Lynch Dolomite at a depth of over 18,000 feet. The well reached a total depth of 16, 471 feet, short of its targeted depth. The well tested gas in the Paradox Formation and it was determined that the well was capable of production. However, due to the lack of a production pipeline, the well was shut-in (UDOGM, 2012). The Paradox No. 2 also tested commercial quantities of gas in the Paradox Formation and was shut-in. One producing oil well, the Salt Valley State 25-12, is located on State land approximately ¼ mile west of the MMLPA in T. 22 S., R. 19 E., Section 25, NW ¼. The well was drilled by Delta Petroleum in 2006. The well produces oil from the Paradox Formation (UDOGM, 2012).

The BLM has received an APD from Golden Eagle Exploration LLC for the Paradox Basin No. 4 well in T. 23 E., R. 23 E., Section 17 and also a pipeline right-of-way (ROW) application to construct a 6-inch surface pipeline to transport gas production from the Paradox No.1, 2, and 3 wells to the main interstate gas pipeline owned by Williams Pipeline. The APD and the pipeline ROW are presently pending with the BLM (June 1, 2012).

Salt Wash-Big Flat Area

The Salt Wash-Big Flat area is located north of the Colorado River and Canyonlands National Park and, west of the Eastern Paradox area. The Green River is the western boundary of the area. This area includes the Big Flat, Bartlett Flat, Ten Mile and Salt Wash areas. There are nine oil or gas fields within this area, including six active fields, two inactive fields and one abandoned field. Oil and gas production in this area is from reservoirs in the Buried Fault Block and Fractured Interbed Plays. The BLM has approved Applications for Permit to Drill (APDs) for nine wells in the Big Flat area. Fidelity Exploration and Production Company has drilled and completed two of the nine wells as of June 1, 2012. Both wells, the Cane Creek Unit No. 26-2 and the 18-1 were successfully completed in the Cane Creek Shale of the Paradox Formation. A third well, the Cane Creek Unit No. 12-1 is currently awaiting completion (see front cover description). An additional seven APDs are pending with the BLM at this time (BLM, 2012b).

A pipeline ROW was issued in 1991 to transport gas and oil (two pipelines in the same trench) from the Big Flat Field, approximately thirty miles to Williams Pipeline Company's interstate natural gas transmission pipeline near Canyonlands Field airport. The pipeline has not yet been constructed; however, Fidelity Exploration and Production Company now holds that ROW and has recently proposed some amendments to it. One amendment would include realignment of the ROW to intersect a 16 inch natural gas pipeline operated by Pacific Energy (Map 6). Fidelity would possibly construct a gas plant at that intersection in T. 22 S. R. 19 E., Section 29, and transport gas through the Pacific Energy pipeline which taps into the Williams Pipeline. In association with the gas plant, Fidelity would possibly lay an oil line, parallel to the Pacific Energy gas line, from the gas plant to a load-out facility that would be constructed adjacent to Highway 191 and the Union Pacific Railroad track in T. 24 S. R. 20 E., Section 8. Finally, Fidelity is also proposing to add an oil pipeline from their westernmost Kane Springs Federal 10-1 well, to tie that remote well into the ROW from Big Flat to Williams Pipeline.

Fidelity is currently conducting a large 3-D geophysical survey in the Big Flat area. The survey is planned to cover 60 square miles and is utilizing a combination of shothole (heli-portable and truck mounted drills) and vibroseis trucks (BLM, 2012a). The survey will add to existing 3-D data giving Fidelity 3-D geophysical data covering the entire Cane Creek Unit.

Hatch Point Area

The Hatch Point area is located in the central part of the MMLPA. The Colorado River forms the northern boundary of the area and the southern boundary is roughly the north rim of Hart Draw and the Needles Overlook road. This area includes the Hatch Point, Lockhart Basin and the lower Indian Creek areas. Two formally defined oil fields have been discovered within this area, the Hatch Point and Lion Mesa fields. The Hatch Point field has two active oil wells. One well, the Hatch Point No. 1 is producing from the Mississippian Leadville Formation and the second well, the 12-7H is producing from the Paradox Formation. Three wells in the Lion Mesa field have produced a small amount of oil from the Paradox Formation. The field is currently inactive (UDOGM, 2012).

In 2007, a 3-D geophysical survey was conducted in the Hatch Point area. The survey covered 35 square miles (BLM, 2012). Recent horizontal drilling in the Hatch Point area by Whiting Oil and Gas Corporation and Stone Energy has resulted in two new discoveries (Threemile and LaSal) in the Cane Creek Shale of the Paradox Formation (UDOGM, 2012). In 2009, Whiting Oil and Gas Corporation successfully completed the 43-18H well in the Threemile area in T. 29 S., R. 22 E., Section 18. Then in 2010 and 2011, Stone Energy drilled two successful wells, the 12-7H and the LaSal 29-28. The 12-7H well was drilled within the Hatch Point field but the LaSal 29-28 and the 43-18H are considered separate undefined pools. A second well drilled by Stone Energy in 2011, the 16-17 well, was temporarily abandoned. At present (June 1, 2012), the BLM has APDs pending for six additional wells in the Hatch Point area.

Hart Point Area

The Hart Point area comprises the southernmost part of the MMLPA which includes the Indian Creek, Hart Point and Dry Valley areas. There have been no seismic surveys or exploration drilling in this area since the RFD for Monticello Field Office RMP was issued in 2005. The Hart Point area is unproven. Past drilling within the area has resulted in no wells which are capable of producing oil or gas in commercial quantities, although shows of oil and gas have been reported from several wells in the area. Two small nearby oil fields, the Lightning Draw and Lightning Draw Southeast, are located ¼ mile to 3

miles east of the Hart Point area. At present (June 1, 2012), the BLM has no APDs pending for additional wells in the Hart Point area.

VIII. RFD Baseline Scenario Assumptions

Assumptions for Deep Wells

A few deep wells (10,000 feet or deeper) have been drilled in the MMLPA in the past. Three deep wells were drilled in the Eastern Paradox area between 2006 and 2010 (UDOGM, 2012). It is likely that some deep wells will be drilled in the next 15 years. The likelihood of a deep well being drilled is highest in the Eastern Paradox area, but it is also feasible in other areas of the MMLPA. The drilling of a deep well requires a larger drill rig and a larger drill pad, typically 400 feet by 450 feet (4.1 acres). The typical vertical well in the MMLPA is 7,000 to 9,000 feet deep and normally requires a drill pad of approximately 250 feet by 350 feet (2 acres). Although the size of a well pad for a deep well would be larger than a well pad for a typical vertical well, the expected number of deep wells is relatively few in comparison to the total number of wells likely to be drilled during the next 15 years. Therefore, for purposes of RFD projections, the relatively few expected deep wells would not substantially affect the long-term average drill pad size for the MMLPA. Depending on the depth, total drilling time for a deep well can be significantly longer than a typical vertical well (6 to 12 weeks for deep well and 2 to 4 weeks for typical vertical well).

Assumptions for Horizontal Wells

Horizontal drilling technology has been used in the MPLA to target unconventional reservoirs in the Fractured Interbed Play. This technology has been used successfully in the Salt Wash-Big Flat and Hatch Point areas to produce oil from the Cane Creek Shale of the Paradox Formation. The Cane Creek Shale is an ideal target for horizontal drilling because it is a fractured self-sourced oil reservoir that is highly over pressured. Horizontal drilling increases the probability of encountering the near-vertical fractures needed for economic oil production. The use of horizontal drilling in the Cane Creek has greatly improved the success rate of new economical discoveries (Chidsey, 2004). Most of the Cane Creek discoveries since 1990 have been made using horizontal drilling technology. The recent success of horizontal drilling in the Big Flat and Hatch Point areas suggests that horizontal drilling will continue in these areas and may lead to new discoveries in the MMLPA, particularly as technology advances are being made in the areas of horizontal drilling, fracture identification tools, hydraulic fracture stimulation, underbalanced drilling and completions in fractured shales.

Based on past drilling in the MMLPA, a typically horizontal well requires a 4.4 acre drill pad (roughly 440 feet by 440 feet) in comparison to a 2-acre drill pad for a typical vertical well. The larger pad size for a horizontal well is to accommodate a larger drill rig and sufficient area for additional equipment such as, specialized mud systems, directional tools, drill pipe and casing, and portable storage tanks.

It is estimated that the majority (60-80 percent) of new drilling in the MMLPA during the next 15 years will be accomplished using horizontal drilling technology to test the Cane Creek Shale or similar

fractured shale interbeds of the Paradox Formation. Depending on the length of lateral sections, drilling time for a horizontal well in the MMLPA is typically 6-8 weeks.

The BLM expects that directional and horizontal drilling technology will be used in the MMLPA during the next 15 years to: (1) drill multiple wells from the same well pad, or (2) drill multiple laterals from a single vertical wellbore. Directional drilling is occurring and/or proposed outside the MMLPA in the South Pine Ridge and Lisbon fields for multiple wells from the same well pad.

Projected Level of Oil and Gas Activity

In addition to local geology, reasonable projections of future oil and gas activity in the MMLPA can be made based on consideration of current and forecasted market conditions, historical drilling activity, and professional judgment.

Current and Forecasted Trends in Crude Oil and Natural Gas Markets

Crude oil is traded widely on the world market, largely because crude oil and the fuel products derived from it are highly transportable at low pressure. This means that, although there are regional price influences, the global marketplace establishes the price of locally produced oil. Demand for liquid fuels, including crude oil derived fuels and biofuels, is primarily driven by transportation. Domestic crude oil production has increased in recent years, and is projected to continue this trend through 2020. Likewise, biofuels production, which is largely domestically produced, is expected to continue to increase. Reductions in demand are also anticipated due in part to new efficiency standards and rising energy prices. These conditions will decrease the volume of imported crude oil; however, oil imports will continue to be the principal source of crude oil through 2035. The U.S. Energy Information Administration (EIA), in an overview of its Annual Energy Outlook for 2012, projects the price of oil to escalate gradually and continuously through the year 2035 (final year of the projection), at which time a barrel of crude oil would be $145 in 2010 dollars (EIA, 2012).

The trade of natural gas is more closely tied to pipeline infrastructure than is crude oil. Because of this, gas is traded on a regional and continental basis, rather than globally, like oil. This results in sometimes dramatic regional price variation. Exploration and development of domestic natural gas has been so successful in recent years, particularly through advances in shale gas production, that supply has outreached demand, resulting in a sharp decline in natural gas prices even while crude oil prices have surged. The use of natural gas as a transportation fuel has not been widely developed, so the end uses that drive its demand are substantially different than with crude oil. Although the two are produced commonly, the difference in their respective end uses, in part, accounts for the wide gap that has developed in recent years between the values of oil and natural gas, on a Btu basis. Natural gas prices are presently very low, both in terms of historical trend, and relative to oil on a Btu (energy equivalency) basis. The EIA projects natural gas prices to escalate to a final projected price of $6.52 in the year 2035 (corrected to 2010 dollars) (EIA, 2012).

For the purpose of projecting oil and gas drilling activity in the MMLPA, it is assumed that the demand and price for crude oil will remain strong and, that the natural gas market will generally improve during the 15-year planning term (Jones, 2012).

Historical Drilling Trends for Development Areas

Historical drilling activity can be used as an indicator for estimating future drilling activity. The information below includes private, state, and federal lands within the MMLPA.

There have been a total of 66 wells drilled in the MMLPA during the past 30 years, or an average of approximately 2 wells per year during that period. Of the total 66 wells drilled, 18 were oil well completions, 3 were gas well completions and 45 were dry holes. Based on these historical well drilling statistics, there has been a 32 percent drilling success rate in the MMLPA over the past 30 years. During that time there were several relatively short lived periods of slightly higher average drilling activity. During a 3-year period between 1982 and 1984, the average drilling rate was just over 3 wells per year. A total of 8 wells were drilled in 1991 and 1992 or an average of 4 wells each year. Drilling activity in the MMLPA has increased since 2007. Between 2007 and 2012, a total of 27 wells were drilled in the MMLPA. The average number of wells drilled annually during this 6-year period was 4.5 and drilling continues at present (June 1, 2012). During the past 6 years, the drilling success rate increased to 52 percent, due largely to the successful use of improved horizontal drilling technology in targeting unconventional reservoirs in the Cane Creek Shale.

Although the previous activity can be an indicator of future activity, the reliability of these forecasts is limited by unforeseen factors, such as changes in economic conditions and technology. Table 4 shows the wells drilled in each of the four development areas during the past 30 years.

There have been a combined total of 50 wells drilled in the Salt Wash-Big Flat and Hatch Point areas during the past 30 years. This is an average of 1.7 wells per year or 5 wells every 3 years. All but 4 of the 27 wells drilled in the MMLPA since 2007 were drilled within the Salt Wash-Big Flat and Hatch Point areas. This gives a 6-year combined average for these two areas of nearly 4 wells per year.

There have only been 5 wells drilled in the Eastern Paradox area during the past 30 years, or 1 well every 6 years. Four of the 5 wells were drilled since 2007. This is an average of 2 wells every 3 years since 2007. Of the 4 wells drilled in the Eastern Paradox area since 2007, 3 wells successfully tested gas capable of production and are presently (June 1, 2012) shut-in awaiting construction of a gas production pipeline.

A total of 11 wells were drilled in the Harts Point area over the past 30 years. This is roughly an average of 1 well every 3 years. The last well drilled in the Harts Point area was in 2002.

Projected Drilling Activity for Development Areas

In order to project future drilling activity, the following assumptions were made:

1. The demand and price for crude oil will remain strong and the natural gas market will generally improve during the 15-year planning term;
2. Drilling activity will maintain or exceed the recent (2007 - 2012) level due largely to the success of improved horizontal drilling technology; and,
3. At least one small boom in oil and gas drilling, similar to the early 1980s and early 1990s, is probable during the 15-year planning term.

Based on these assumptions, it is predicted that a total of 128 wells would be drilled on federal, state, and private lands within the MMLPA during the next 15 years. This amounts to an average of about 8.5 wells per year. These projections are shown in Table 6.

There has only been an average of 1 well drilled every 6 years in the Eastern Paradox area during the past 30 years. However, that average increases to 2 wells every 3 years for wells drilled since 2007. Golden Eagle Exploration LLC drilled 3 deep wells between 2007 and 2010, from which they flow tested

commercial quantities of natural gas. These wells are presently (June 1, 2012) shut-in pending pipeline access. An additional APD for the Paradox No. 4 well and a right-of-way application for construction of a gas production pipeline are pending with the BLM. Based on the recent success of deep well drilling in the Eastern Paradox area, it is projected that an average of 1 well per year will be drilled in that area during the next 15 years.

The majority of all drilling in the MMLPA during the past 30 years has occurred in the Salt Wash-Big Flat and Hatch Point areas. Nearly 76 percent of the total wells drilled in the MMLPA during the last 30 years were in these two areas. These two areas contain all of the producing oil and gas fields in the MMLPA. All but 4 of the 27 wells drilled in the MMLPA since 2007 have been drilled within the Salt Wash-Big Flat and Hatch Point areas. Drilling activity since 2007 has averaged 4 wells per year. It is expected that these two areas will continue to see the majority of oil and gas drilling activity in the MMLPA during the next 15 years. It is projected that the average number of wells drilled per year in the Salt Wash-Big Flat area and the Hatch Point area during the next 15 years will be 4 wells and 3 wells, respectively. These projections are based largely on past drilling and on recent trends in drilling activity in these two areas, including an increase in drilling and drilling success rate as a result of improved horizontal drilling technology. Also, there continues to be strong interest by the oil and gas industry in these two areas as indicated by the number of project approvals and pending applications received by the BLM. These include: a total of 7 approved APDs (not yet drilled), 13 pending APDs for additional wells, 1 pipeline right-of-way (ROW) application and 1 approved notice of intent for a large 3-D geophysical survey (BLM, 2012b).

The Hart Point area is unproven in terms of oil and gas production. There have been 11 wells drilled in the past 30 years with no success. However, several wells have reported shows of oil and gas and two small 1 to 2 well fields are located just east of the Hart Point area. For these reasons and because of advances in horizontal drilling technology, it is likely that some exploratory drilling will continue in the Hart Point area during the next 15 years. It is projected that an average of 1 well will be drilled every 2 years (0.5 well per year) in the Hart Point area during the next 15 years.

Table 6. Wells predicted to be drilled in the MMLPA and associated surface disturbance.

Development Area	Average number wells projected (wells/year)	Average number wells projected (Total 15 years)	Estimated future surface disturbance (acres)
Eastern Paradox	1	15	123
Salt Wash – Big Flat	4	60	492
Hatch Point	3	45	369
Hart Point	0.5	≈8	66
Total for next 15 years	**8.5**	**128**	**1,050**

Future drilling is affected by economic situations that cannot be accurately forecasted; therefore, an average was utilized to reflect the potential numbers of future wells. It is recognized that future drilling activity and future wells will not be evenly distributed throughout the development areas. When new wells are drilled, and especially if new fields are discovered, there could be additional drilling activity concentrated around the new wells.

The average annual drilling projections in Table 6 are not thresholds for limiting future annual drilling activity. It is recognized that there would be some years when annual drilling activity would be much less

than the projected average and other years when annual drilling activity would exceed the average number of wells projected.

The total number of wells projected for the four development areas averages about 8.5 wells per year, which is considerably higher than the historical 30-year average of 2 wells per year. Horizontal drilling technology has been used successfully in the MMLPA to target unconventional reservoirs in the Cane Creek Shale of the Paradox Formation. The use of horizontal drilling in the Cane Creek has greatly improved the success rate of new economical discoveries (Chidsey, 2004). The upward trend in drilling activity since 2007 and the increased drilling success rates, combined with the current and forecasted market conditions, favor a projected level of drilling activity above the recent 6-year average (2007-2012) rather than the 30-year historical average.

IX. Surface Disturbance Due to Oil and Gas Activity on All Lands

A wide range of variables will affect the surface disturbances from oil and gas drilling and production operations in the MMLPA. Factors affecting the estimates for existing and future surface disturbances include the size of the well pad, the topography, the length of access road and pipelines, and the reclamation time frames.

The primary factor affecting the size of a well pad is the size of the drill rig needed to reach the total depth of the well. The typical size of existing well pads in the MMLPA is 2 acres for a vertical well (excluding wells over 10,000 feet deep) and 4.4 acres for a horizontal well. As of June 1, 2012, there are approximately 29 active well sites in the MMLPA for which reclamation is pending (Table 3). Of the 29 active wells in the MMLPA, 14 are vertical wells and 15 are horizontal wells. Therefore, the weighted average for each existing well site in the MMLPA is 3.2 acres of surface disturbance. The use of horizontal drilling in the Cane Creek has greatly improved the success rate of new economical discoveries (Chidsey, 2004). For this reason, it is assumed that 60 to 80 percent of new wells in the MMLPA will be drilled using horizontal technology which will likely increase the drilling success rate to 50 to 70 percent. Because of the increased percentage of horizontal wells, the average future well pad size is also expected to increase slightly during the next 15 years.

Based on a review of the Grand and San Juan County road systems, there are at least 35.4 miles of roads within the MMLPA that provide access to 29 active oil and gas wells and associated well facilities and 24 plugged and abandoned wells for which reclamation is not complete. Therefore, the average length of existing well access roads is 3, 527 feet. The county Class B roads, state highways and the paved road to Needles Overlook were not included in the mileage estimate. Oil and gas activities in the MMLPA are not the primary use of these roads. These roads are considered a permanent part of the Grand and San Juan County road infrastructure and will not be reclaimed upon cessation of oil and gas activity. The total mileage estimate for existing access roads is the sum distance of each access road from a well site to its nearest county Class B road. The average length of well access road in the MMLPA is expected to increase slightly (5 - 25 percent) as new wells are drilled in areas outside of existing fields and more distant from the county Class B road networks. The well access roads are constructed with a 15 to 20 feet travel surface but typically have a disturbance width of 30 to 40 feet (4.2 acres/mile), depending on topography.

Three gas pipelines cross the MMLPA, the 16 inch Pacific Energy pipeline and the two interstate pipeline systems (Williams Pipeline and Enterprise Pipeline). These three pipelines were not included in the estimates of existing surface disturbance because, although the pipelines pass through the MMLPA, these larger transmission pipelines are not related to oil and gas activity within the MMLPA.

The BLM approved a pipeline right-of-way approximately 27 miles long and 50 feet wide, to transport gas and oil to market from Fidelity Exploration and Production Company's wells in the Big Flat area. Fidelity, which now holds the right-of-way, has not yet constructed the pipeline, but has proposed amendments to the right-of-way, as well as, a separate right-of-way for a pipeline that would tie-in to the approved right-of-way. In total, Fidelity would construct approximately 39 miles of pipeline. In addition, Golden Eagle Exploration LLC has submitted a right-of-way application to the BLM for the construction of a pipeline to gather and transport production from their field in the Eastern Paradox area. The Golden Eagle pipeline corridor would be 10.4 miles long 10 feet wide. It is also reasonable to assume, that during the next 15 years, a third pipeline would be constructed in the Hatch Point area to transport production from that area to the nearest transmission pipeline, a distance of roughly 12 to 15 miles. Pipelines constructed in the MMLPA during the next 15 years would have an average disturbance width of 20 feet (2.4 acres/mile).

Other factors to consider for estimating future surface disturbance is the time required for reclamation. It is assumed that all surface disturbances associated with well drilling and production operations would be successfully reclaimed within a scope of 10 years, depending on soils, vegetation, and rainfall (BLM, 2005c; BLM, 2005d). Geophysical operations are temporary in nature and do not require the use of mechanized earth moving equipment to construct new roads or to prepare drill sites. Although geophysical operations may crush vegetation and cause soil compaction, they do not generally result in the complete clearing or removal of vegetation. Therefore, surface disturbance caused by geophysical operations typically requires less time to reclaim (1-5 years) than does the surface disturbance resulting from well drilling operations, including the construction of roads, drill pads and buried pipelines. The average length of time needed to successfully reclaim surface disturbances caused by geophysical operations is assumed to be 3 years. There are no existing surface disturbances attributed to geophysical operations in the MMLPA since there have been no geophysical operations conducted in the MMLPA during the past 3 years (Table 2).

In addition to final reclamation, interim reclamation is done on portions of well sites and pipelines which are not needed for production and maintenance operations and, on areas of access roads that are not needed for vehicle travel. This minimizes the footprint of construction disturbances, including well pads, pipelines and roads. The amount of interim reclamation can vary widely for each disturbance depending on factors such as topography and area needed for future workover rigs and other equipment use and access. It is estimated that the footprint of each new construction disturbance in the MMLPA would be reduced by 25 to 50 percent through interim reclamation.

In addition to the 29 active wells, 198 wells in the MMLPA have been plugged and abandoned (PA). For the vast majority of PA well sites, sufficient time (more than 10 years) has passed since the wells were plugged so that it is reasonable to assume that reclamation is successful. There are 24 wells in the MMLPA that have been in PA status less than 10 years. These wells are included in the estimate of existing surface disturbance below.

Estimated Existing Surface Disturbance

Using the data and assumptions above, the estimated total surface disturbance for existing oil and gas wells and access roads is 318 acres (29 active wells x 3.2 acres of disturbance per well + 24 PA wells x 3.2 acres of disturbance per well + 35.4 linear miles of access road x 4.2 acres per mile). This equates to an average existing surface disturbance of 6 acres per well in the MMLPA. The total existing surface disturbance is shown in Table 7.

Total Estimated Future Surface Disturbance for Well Pads, Roads, and Pipelines

It is assumed that the average existing surface disturbance of 6 acres per well will increase slightly during the next 15 years because of the construction of three gas production pipelines, an increase in the percentage of horizontal wells drilled, and an increase in the average length of access roads.

The total length of the two proposed pipelines and the one projected pipeline in the MMLPA will be 63 miles. The average pipeline disturbance width will be 20 feet. This gives a total pipeline disturbance of 153 acres or 1.2 acres per well for each of the 128 wells projected to be drilled over the next 15 years.
It is assumed that 70 percent of wells drilled during the next 15 years will be horizontal wells with an average well pad size of 4.4 acres. Well pads for the remaining 30 percent of wells would average 2 acres. Therefore, the weighted average well pad size for the 128 wells projected to be drilled during the next 15 years is 3.7 acres.

The average length of access road for each active well in the MMLPA is 3,527 feet. It is reasonable to assume that there would be a 15 percent (529 feet) increase in the average access road length during the next 15 years as drilling occurs outside of known fields and more distant from the county Class B road network. With that assumption, the average length of access roads would be 4,056 feet or 3.3 acres per well during the next 15 years.

Total surface disturbance per well, including well pad, access roads and pipelines, would be 8.2 acres per well or a total of 1,050 acres of surface disturbance resulting from oil and gas drilling activity during the next 15 years (Table 7). This estimate is for the average surface disturbance during future drilling, but it is not a threshold for limiting future exploratory drilling programs.

Based on recent drilling success rates for horizontal wells drilled in the MMLPA, it is assumed that 60 percent of the 128 wells drilled (77 wells) will be productive and 40 percent (51 wells) will be dry holes which would be abandoned and successfully reclaimed within a 10-year period. The 77 productive wells would result in 631 total acres of surface disturbance. It is estimated that the surface disturbance (footprint) associated with each new productive well in the MMLPA would be reduced by 35 percent through interim reclamation during the next 15 years. Interim reclamation of surface disturbances associated with the 77 productive wells would total 221acres.

It is also reasonable to assume that the number of wells to be abandoned over the next 15 years will equal approximately one-half the number of wells going into production (77 productive wells ÷ 2 = 39 abandoned wells or an average of 2.6 abandoned wells per year). Only the wells plugged and abandoned during the first 5 years, or 13 abandoned wells totaling 107 acres, would be successfully reclaimed during the next 15 years.

Table 7. Surface disturbance from drilling and reclamation activities in the MMLPA

	Number of wells	Total surface disturbance
Existing surface disturbance - Total	**53**	**318**
Active wells	*29*	*174*
*Plugged and Abandoned wells (PA)**	*24*	*144*
Future surface disturbance for the next 15 years	**128**	**1,050**
Gross surface disturbance for the next 15 years	**181**	**1,368**
Predicted reclamation in the next 15 years - Total	**81**	**611**
*Interim Reclamation of future producing wells***	*27*	*221*
Reclamation of future dry wells	*17*	*139*
Reclamation of existing PA wells	*24*	*144*
Reclamation of future PA wells	*13*	*107*
Total net surface disturbance for the next 15 years	**100**	**757**

*Wells in PA status less than 10 years
**Interim reclamation of 35% of construction disturbance associated with 77 producing wells

The estimated total surface disturbance for future wells, roads, and pipelines in the MMLPA is 1,050 acres for the 128 wells projected over the next 15 years. Adding in the existing surface disturbance, the gross surface disturbance for the MMLPA for the next 15 years is 1,368 acres.

About 40 percent of the total projected wells drilled will probably be dry. Only the dry holes drilled during the first 5 years would be successfully reclaimed over the next 15 years (8.5 wells per year x 5 years x 40% = 17 dry holes). Reclamation of future dry holes would therefore total 139 acres. It is also assumed that all 24 existing abandoned wells will be reclaimed in the next 15 years, totaling 144 acres of reclaimed land. In addition, there will be some reclamation of future abandoned wells. It is assumed that 2.6 wells will be abandoned per year and only wells abandoned in the first 5 years will be successfully reclaimed over the next 15 years. Reclamation of these 13 abandoned wells will total 107 acres. In total, 611 acres would be reclaimed in the next 15 years. The existing surface disturbance, plus the predicted disturbance, minus all acres expected to be reclaimed, leaves a total net surface disturbance of 757 acres (Table 7).

Total Estimated Future Surface Disturbance for Geophysical Exploration

Geophysical exploration operations have been conducted throughout the entire MMLPA in the past (Map 3). Table 2 gives an indication of the types of geophysical surveys conducted within each of the four oil and gas development areas during the past 30 years. Although geophysical data may have been collected from an area in the past, previous geophysical activity does not preclude the gathering of additional data. Old data is continuously being reprocessed, but there are limits to the quality of data that can be interpreted from the older data. Based on geophysical activities during the last 30 years, it is reasonable to assume that new geophysical exploration could occur anywhere within the MMLPA during the next 15 years.

In the past, geophysical operations in the MMLPA utilized either two-dimensional (2-D) or, more recently, three-dimensional (3-D) data acquisition technology. The activities require spreading cables and

geophones for receiver lines and utilizing vibroseis trucks or shotholes along source lines to supply the source of energy for creating seismic reflections (seismic acoustic waves). Vibroseis buggies or buggies transporting drills typically travel cross-country. Buggies transporting drills usually follow a single route and make a single pass or round trip along the source lines. Vibroseis buggies have normally been run in single file with each buggy following the previous buggy. However, vibroseis buggies can be spread 3 to 4 abreast and run parallel to each other when recording source lines. The buggy routes can be zig-zagged (weaved) to avoid long, straight visual impacts. When vehicles travel cross-country, there is no dozing of vehicle access routes. The surface impacts from the buggies are the vehicle tracks along the buggy routes and a drill hole if it is a shothole project. Helicopters are utilized to distribute receiver cables on most big projects and for moving portable drilling equipment in terrain that is too steep for buggies. Some companies and/or geophysicists prefer vibroseis technology for gathering data, because the frequency of the source can be varied and data can be collected at several different frequencies while the vibroseis buggy is on the line. The depths and types of formations may also affect the preference of one type of source equipment over another.

Geophysical surveys measuring gravity, magnetic, or electrical conductivity, and soil sampling have been completed in the past. It would be likely that these types of geophysical surveys would be utilized during the next 15 years. Typically, the gravity/magnetic/electrical geophysical surveys would be low-impact actions that could be classified as casual use, as long as vehicles stayed on existing roads.

Past geophysical projects are good indicators of project parameters for future geophysical surveys in the MMLPA. The distances between the receiver lines and the distances between the source lines would vary depending upon the depth of the target formations. For shallow depths, such as potential reservoirs in the Cretaceous Dakota to Jurassic Play area (Play 2004) in the northern part of the MMLPA, the receiver/source lines for a 3-D project would probably be approximately 660 feet apart, and there would be 8 linear miles of source lines for every 1 square mile of project area. Based on the previous 3-D projects and depths of the oil and gas formations (7,000 – 9,000 feet deep) throughout the majority of the MMLPA, most of the 3-D projects in the MMLPA would likely have receiver/source lines spaced at roughly 1320 feet intervals with an average of 4 linear miles of source lines per square mile of project area. In the Eastern Paradox development area where deeper reservoirs may be targeted, the spacing interval for 3-D source lines could exceed 1320 feet (2-3 linear miles of source lines per square mile of project area).

Since 2001, one 3-D geophysical project has been conducted in each of the four oil and gas development areas within the MMLPA (Table 2). Each project area averaged 34 square miles. Currently (as of August, 2012), Fidelity Exploration and Production Company is conducting one large 3-D geophysical survey in the Big Flat area. The survey is planned to cover 60 square miles and would utilize a combination of shothole (heli-portable and truck mounted drills) and vibroseis trucks (BLM, 2012a). Survey parameters for the project include 33 source lines spaced 1,244 feet apart totaling 256.4 linear miles. This equates to 4.25 linear miles of source lines for each square mile of project area. A 30 to 50 square mile area would be typical for future 3-D projects in the MMLPA during the next 15 years. An average 40 square mile 3-D project would require at least 160 linear miles of source lines where a vibroseis buggy or drill buggy would be driven. Depending on the network of existing roads and trails in the project area, it may be feasible to move some of the source points to the roads and avoid some cross-country travel with the buggy vehicles. The use of heli-portable drills in steeper terrain would also reduce the amount of source line traveled by vibroseis buggies or drill equipment.

During the past 30 years, geophysical exploration in the MMLPA averaged at least 27 linear miles of source lines per year. However, during the past 15 years the average increases to 36 linear miles of source lines per year due largely to an increase in the size of 3-D projects and an increase in the overall

percentage of 3-D projects compared to 2-D projects. This trend is expected to continue during the next 15 years.

In addition to 3-D projects, it is anticipated that some 2-D projects will also continue to occur in the MMLPA during the next 15 years. Based on past projects, future 2-D geophysical surveys could vary from 1-2 lines of 1-2 miles each, or multiple lines several miles long.

Projections for future geophysical exploration projects in the MMLPA are based on the following assumptions:

1. Geophysical exploration would likely occur in each of the four oil and gas development areas within the MMLPA during the next 15 years;
2. Geophysical exploration would be cyclic and would increase at times to correspond with increases in other oil and gas activity;
3. Geophysical exploration in the MMLPA during the past 15 years forms a reasonable basis for projecting future geophysical activity in the MMLPA.
4. Data acquisition would involve the use of 2-D, 3-D, or similar technology;
5. The number and size of 3-D projects will probably increase in the future;
6. Measuring the exploration in linear miles of source lines would be more meaningful than the number of geophysical projects;
7. An estimate of 4 linear miles of source lines for every square mile of 3-D project would be representative for the majority of projects in the MMLPA;
8. Surface disturbance would be successfully reclaimed within a scope of 3 years.
9. Casual use activities would not be included in the projections.

Using these assumptions, the 15-year projection for geophysical exploration on federal, state, and private lands within the MMLPA during the next 15 years averages 61 linear miles of source lines per year, or a total of 915 linear miles of source lines. This projection takes into account the average linear miles of source lines for the past 15 years (36 linear miles per year) and adjusts that average upward to take into consideration an upward trend in geophysical activity since 2001 which indicates an increasing percentage and size for future 3-D projects in the MMLPA. Fidelity Exploration's pending 60-square mile 3-D project in the Big Flat area is further indication of this upward trend of 3-D geophysical projects in the MMLPA. The projection of future geophysical activity also assumes one boom cycle with 1 to 3 larger 3-D projects each totaling roughly 40 square miles.

It is predicted that the Salt Wash-Big Flat and Hatch Point areas will see a majority (at least 65 percent) of the total projected geophysical activity in the MMLPA during the next 15 years. This equates to a combined total of 594 linear miles of source lines for these two areas. Of the 594 linear miles of source lines projected for these two areas, the Salt Wash-Big Flat area is likely to see a slightly larger percentage (55-60 percent). The Salt Wash-Big Flat and Hatch Point areas contain all of the current oil fields in the MMLPA and recent industry activity suggests that these two areas will continue to be an emphasis for exploration in the next 15 years. It is estimated that the East Paradox area would receive 20 percent of the projected activity (183 linear miles of source lines) and the remaining 15 percent of source lines would be in the Hart Point area (138 linear miles of source lines). Assuming an average disturbance width of 10 feet for each of the 915 total linear miles of projected source lines, the total surface disturbance would be 1,109 acres over the next 15 years (Table 8). This would be an average surface disturbance of roughly 74 acres per year.

It is assumed that reclamation of surface disturbance would be successful within a scope of 3 years depending on reclamation times related to soils, vegetation, and rainfall. Therefore, surface disturbance resulting from geophysical activity during the first 12 years would be successfully reclaimed over the next

15 years. Using an average surface disturbance of 74 acres per year, total surface disturbance that would be reclaimed during the next 15 years would be 888 acres. Subtracting the acres projected to be reclaimed (888 acres) from the acres projected to be disturbed (1,109 acres), gives a net surface disturbance of 221 acres during the 15-year period.

The projections in Table 8 provide an average predicted activity level based on past activity and current trends. The projections are not intended to be thresholds for limiting future geophysical activity. It is recognized that there would be some years with no or relatively few linear miles of sources lines and other years that the number of linear miles of source lines could exceed the average substantially.

Table 8. Surface disturbance from geophysical and reclamation activities in the MMLPA

Development Area	Projected geophysical survey source lines (linear miles)	Total future surface disturbance (acres)
Eastern Paradox	183	222
Salt Wash-Big Flat	327	396
Hatch Point	267	324
Hart Point	138	167
Future surface disturbance for next 15 years	**915**	**1,109**
Average per year for next 15 years	**61**	**74**
Predicted reclamation in the next 15 years - Total	**732**	**888**
Total net surface disturbance for the next 15 years	**183**	**221**

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APPENDIX A

Figures 1 - 5

Figure 1. Total wells drilled annually in the MMLPA during the last 30 years

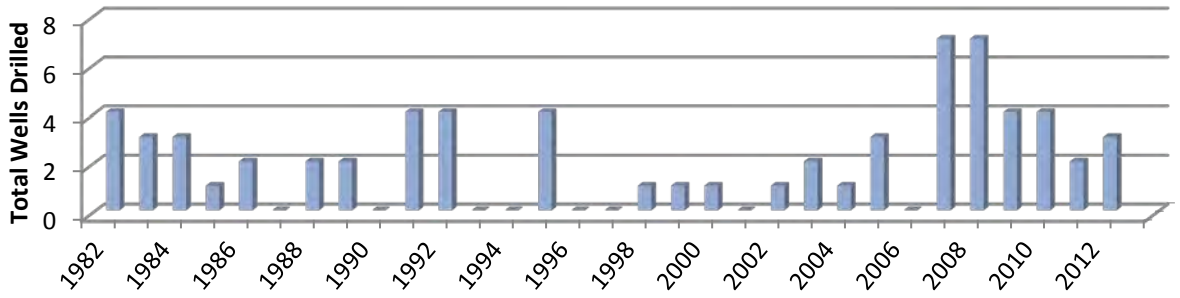


Figure 2. Annual production of oil and gas, all wells within the MMLPA

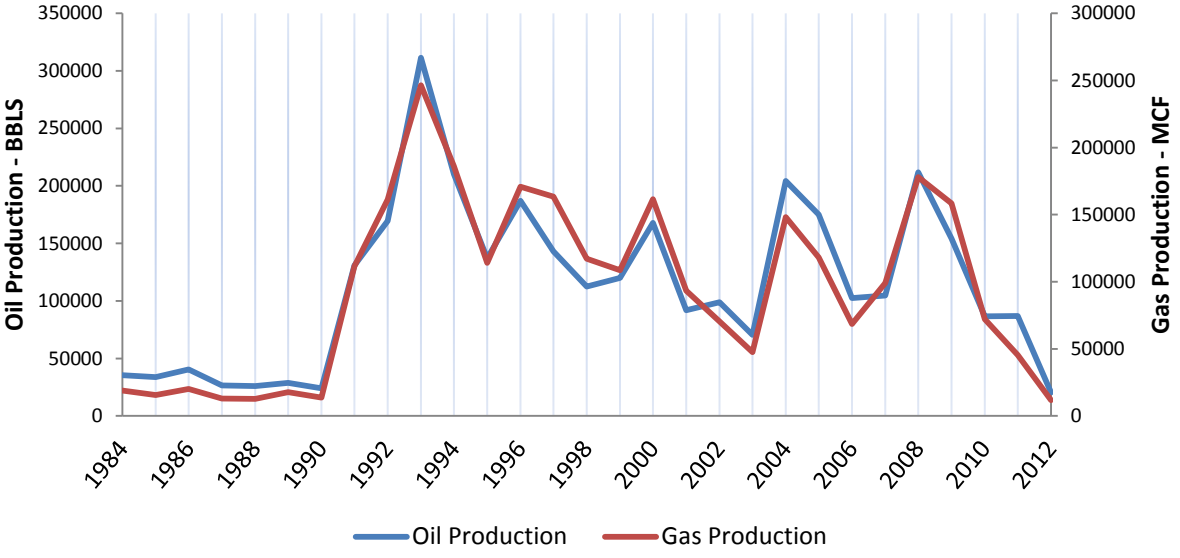


Figure 3. Annual production of oil and gas, Big Flat Field

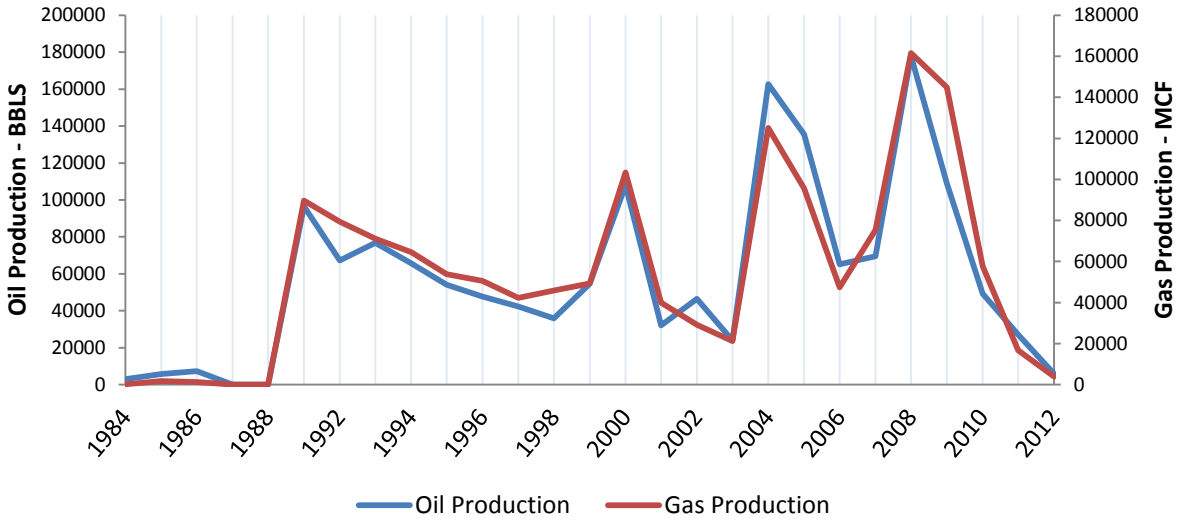


Figure 4. Annual production of oil and gas, Salt Wash Field

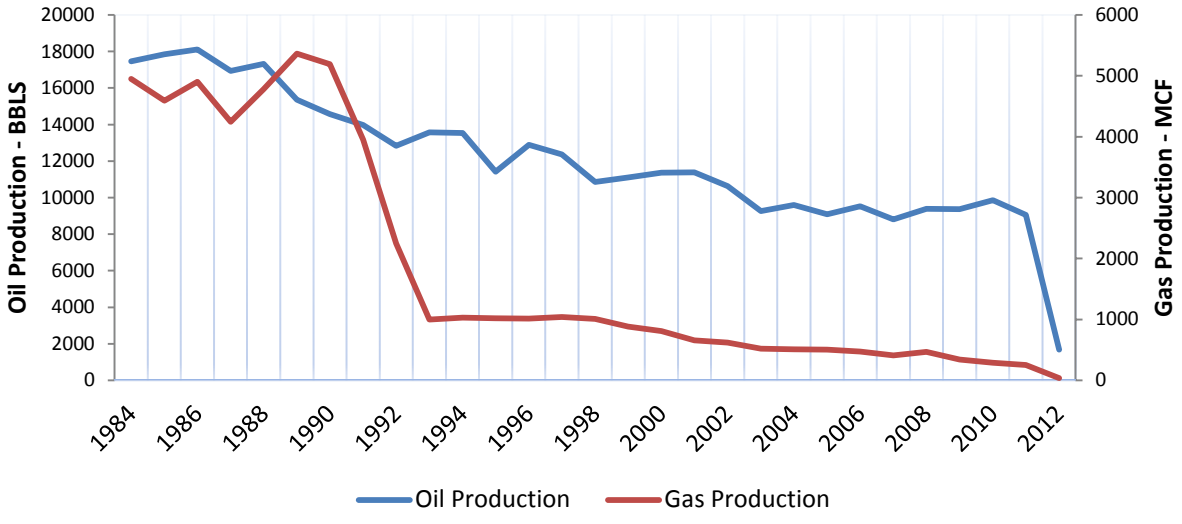
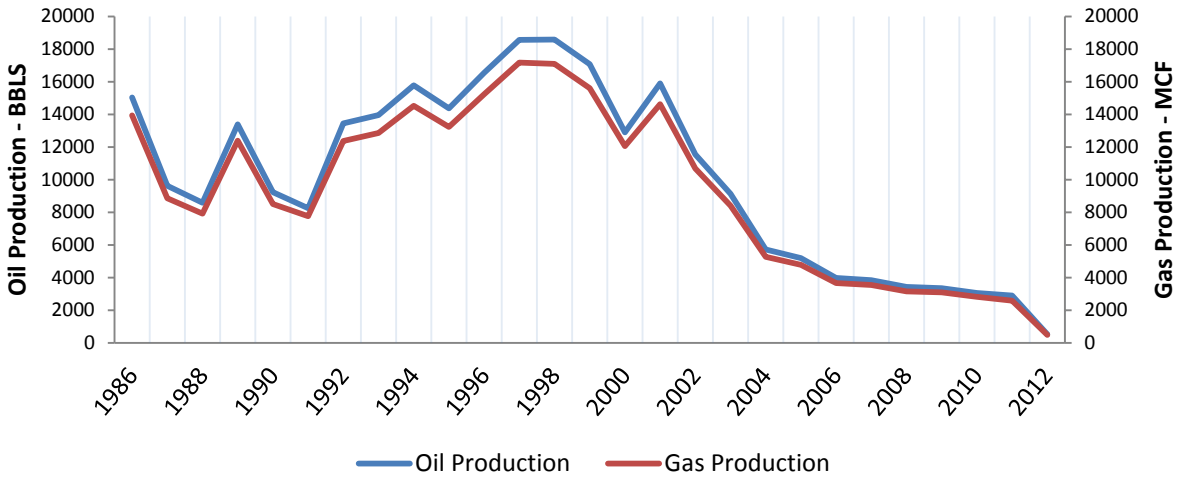


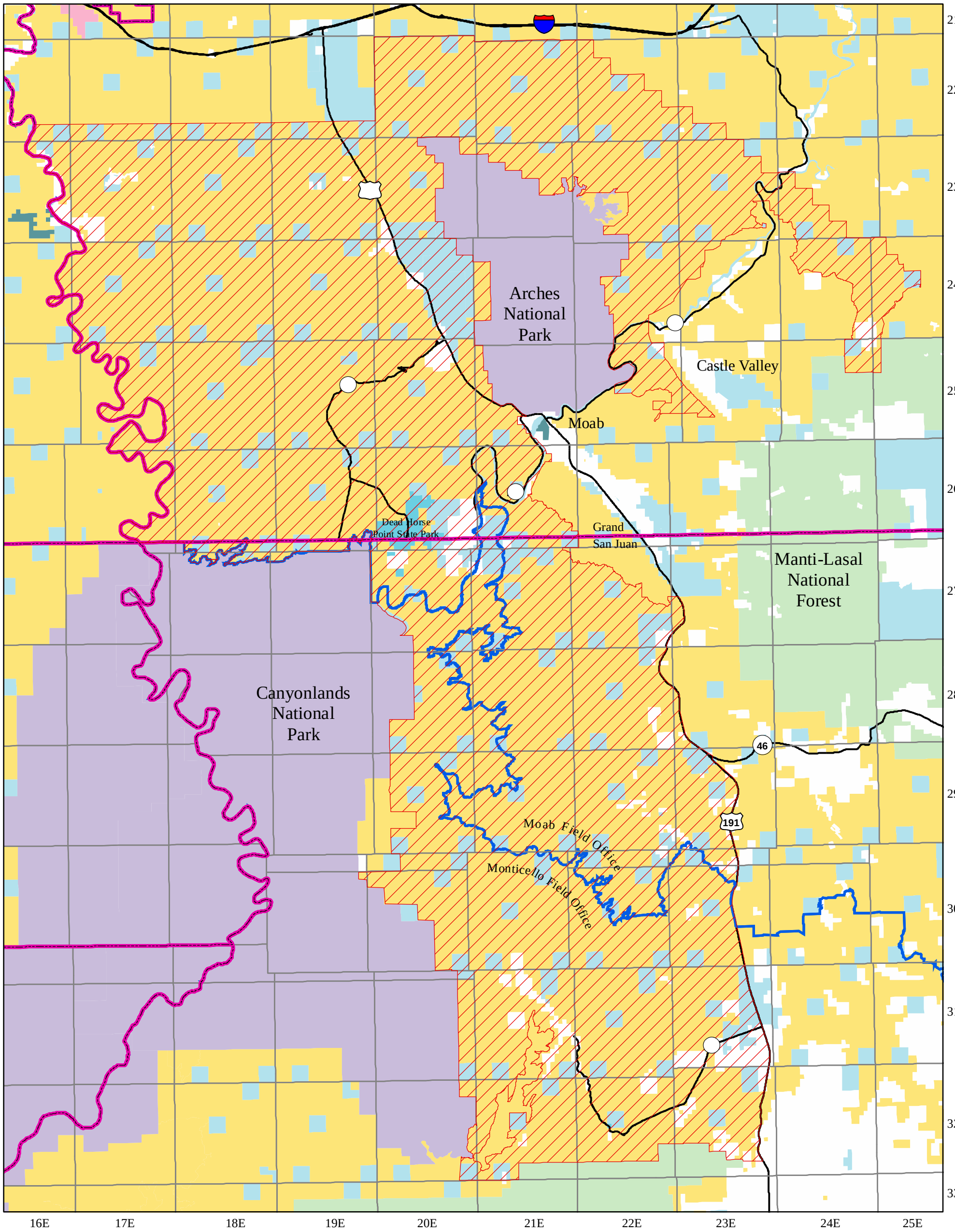
Figure 5. Annual production of oil and gas, Long Canyon Field



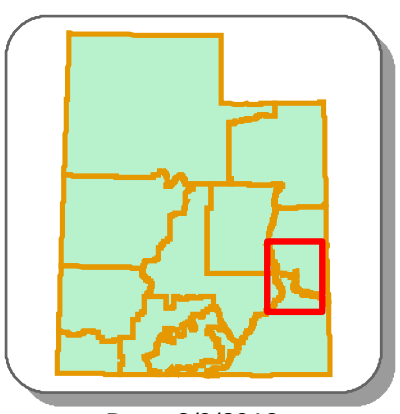
APPENDIX – B

Maps 1 - 7

Map 1 - Moab Master Leasing Plan Area (MMLPA)



Location Map
Utah BLM Field Office Boundaries



Date: 8/9/2012

Field Office Boundary
Master Leasing Plan Area
County Boundaries
State and Federal Highways

0 5 10
Kilometers
0 5 10
Miles

Land Status

Bureau of Land Management
BLM Wilderness Area
US Forest Service
National Park Service
Indian Reservation
Military Reservations
State
State Parks and Recreation
Private

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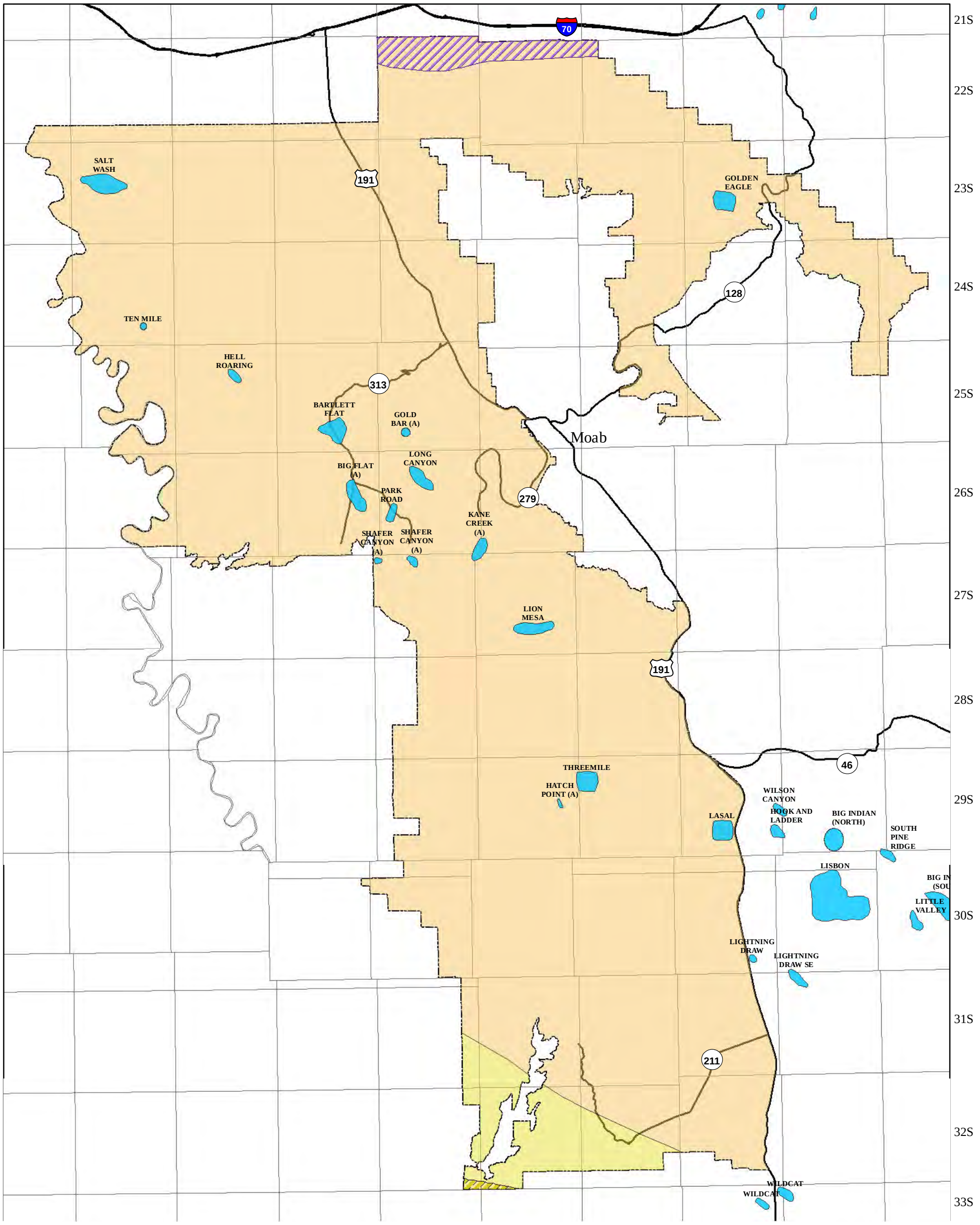
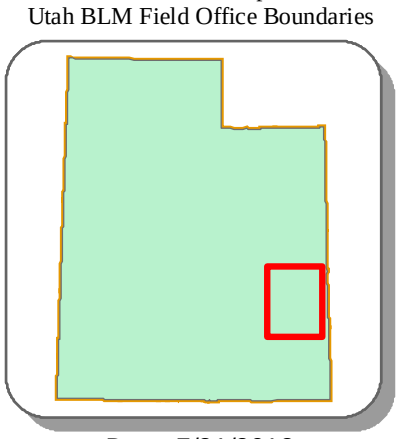
Map 2 - Oil and Gas Plays/Fields



Location Map
Utah BLM Field Office Boundaries



Date: 7/31/2012

State and Federal Highways
Master Leasing Plan Area
Oil and Gas Fields
Play 2004
Play 2102
Play 2103
Plays 2101-2103-2105

0 5 10
Kilometers
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Miles

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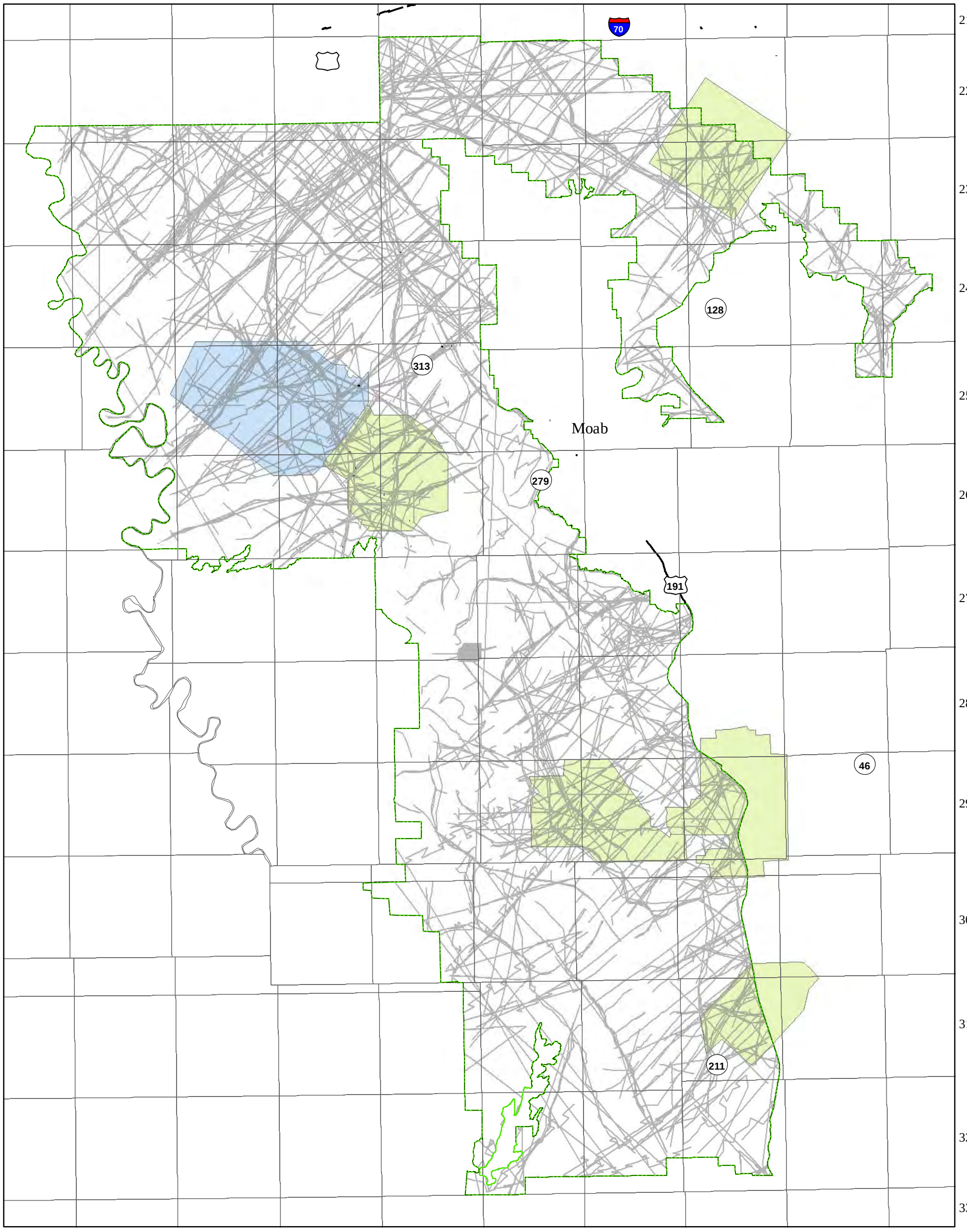
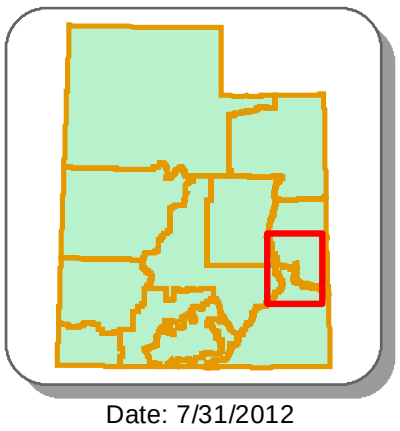
Map 3 - Geophysical Surveys



Location Map
Utah BLM Field Office Boundaries



Date: 7/31/2012

State and Federal Highways
Historic seismic lines
Master Leasing Plan Area
Township Lines
Proposed 3D Geophysical Project
3D Geophysical Projects Completed Since 2001

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0 5 10
Kilometers
0 5 10
Miles

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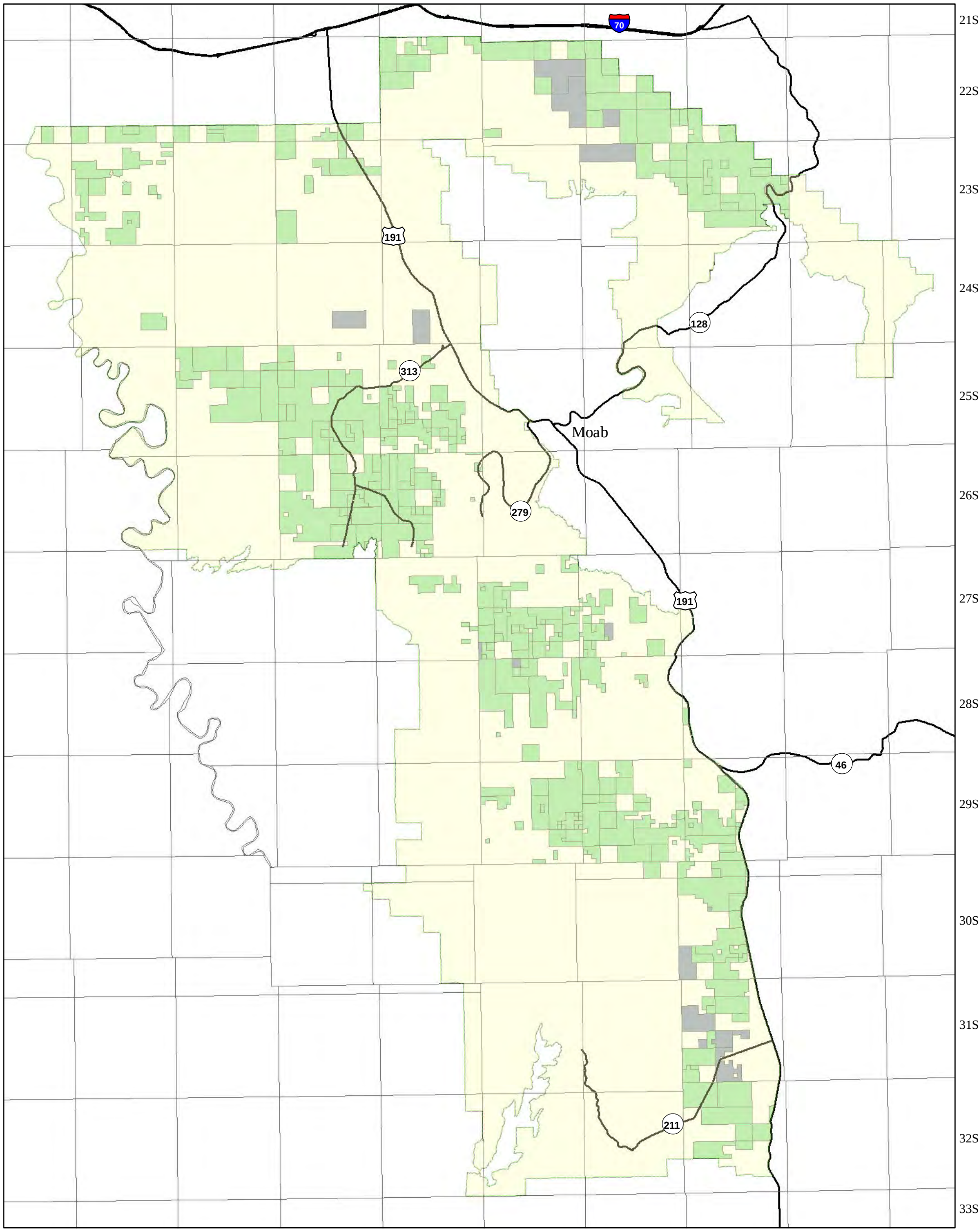
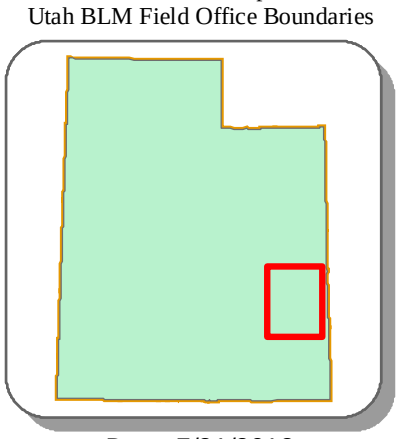
Map 4 - Federal Oil and Gas Leases



Location Map
Utah BLM Field Office Boundaries



Date: 7/31/2012

State and Federal Highways
Master Leasing Plan Area
Township Lines
Pending Leases
Authorized Leases

0 5 10
Kilometers
0 5 10
Miles

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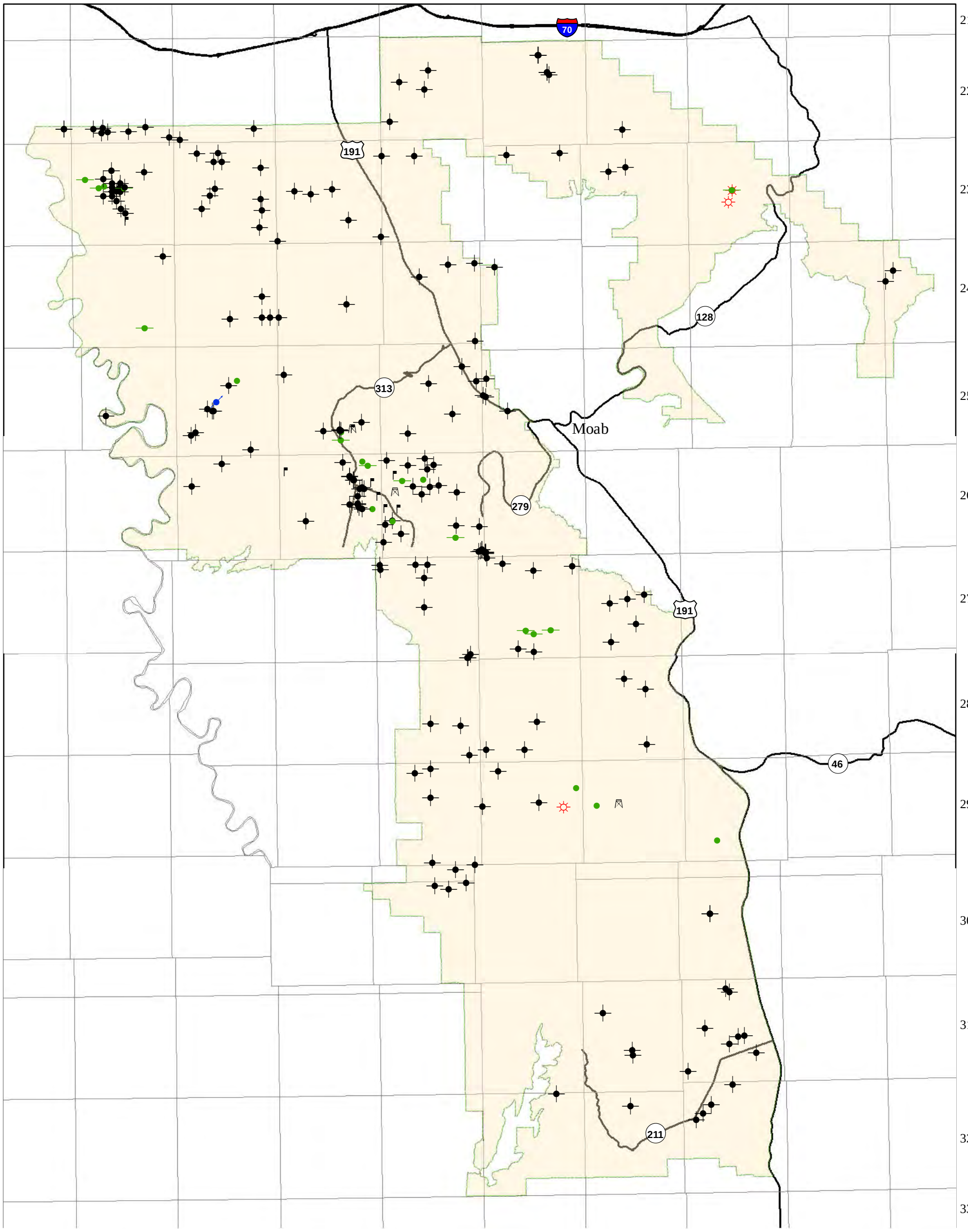
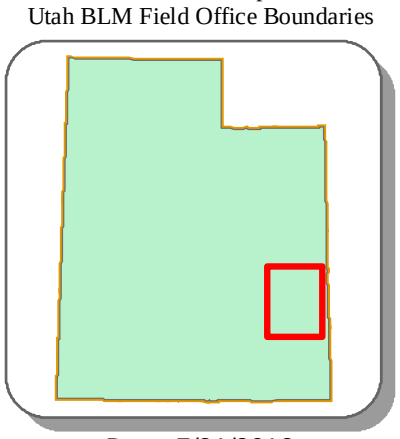
Map 5 - Oil and Gas Wells



Location Map
Utah BLM Field Office Boundaries



Date: 7/31/2012

Master Leasing Plan Area
Township Lines
State and Federal Highways
Pending APD
Drilling
Plugged and Abandoned Well
Producing Gas Well
Producing Oil Well
Shut-in Gas Well
Shut-in Oil Well
Temp Abandoned Well
Water Disposal Well

0 5 10
Kilometers
0 5 10
Miles

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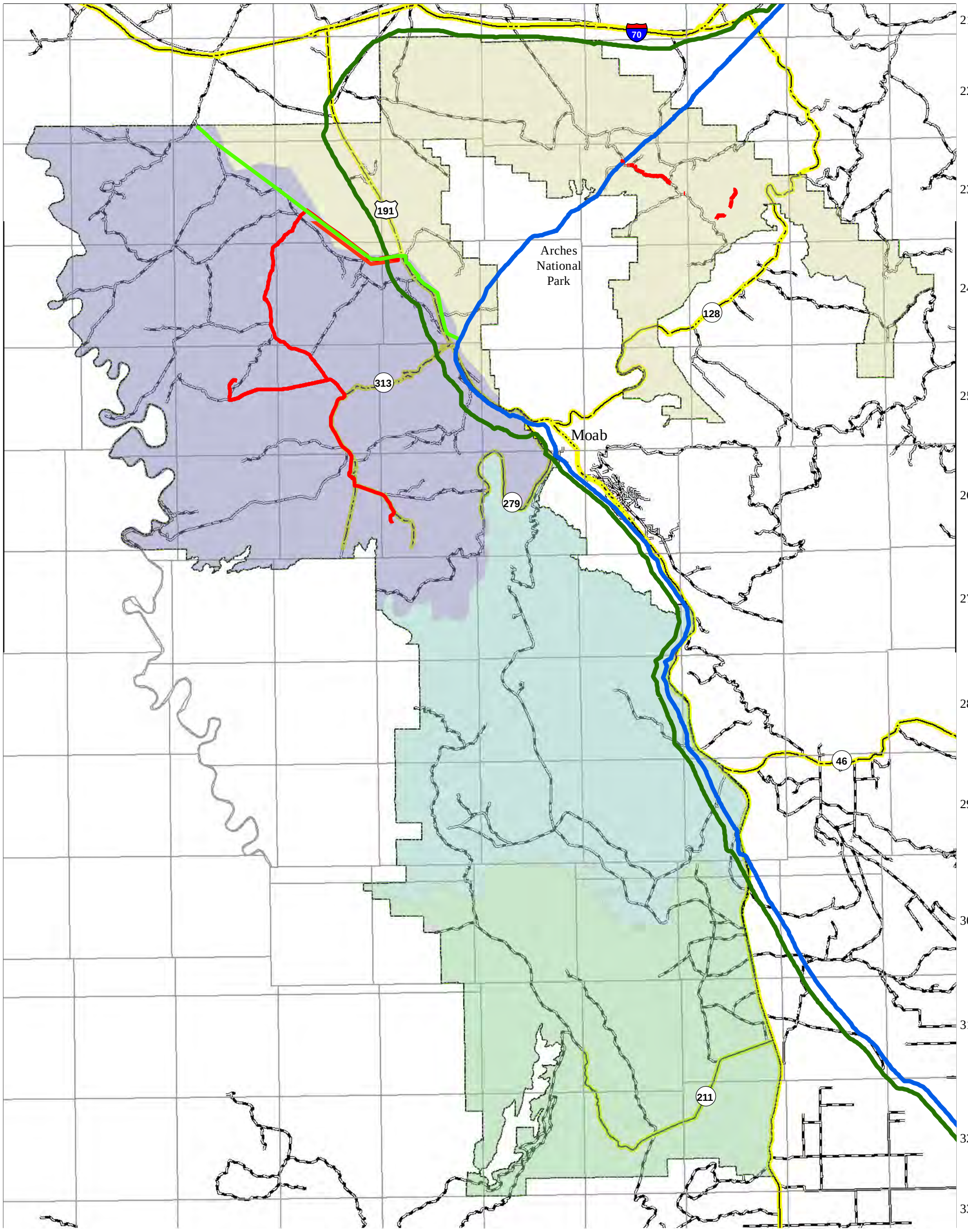
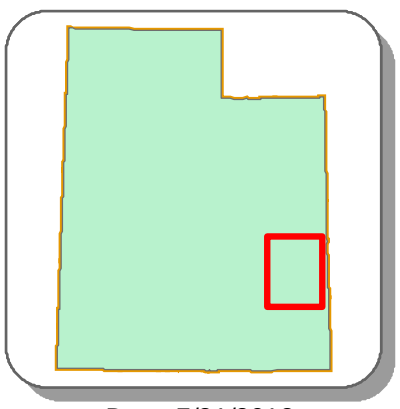
Map 6 - Development Areas, Roads and Pipelines



Location Map
Utah BLM Field Office Boundaries



Date: 7/31/2012

- State and Federal Highways
- County Class B Roads
- Williams Northwest Gas Pipeline
- Enterprise Products Partners, L.P. Pipeline
- Pacific Energy 16 inch Pipeline
- Proposed Pipelines
- Master Leasing Plan Area
- Township Lines
- Salt Wash - Big Flat Development Area
- Eastern Paradox Development Area
- Hart Point Development Area
- Hatch Point Development Area

NATIONAL SYSTEM OF PUBLIC LANDS

0 5 10
Kilometers
0 5 10
Miles

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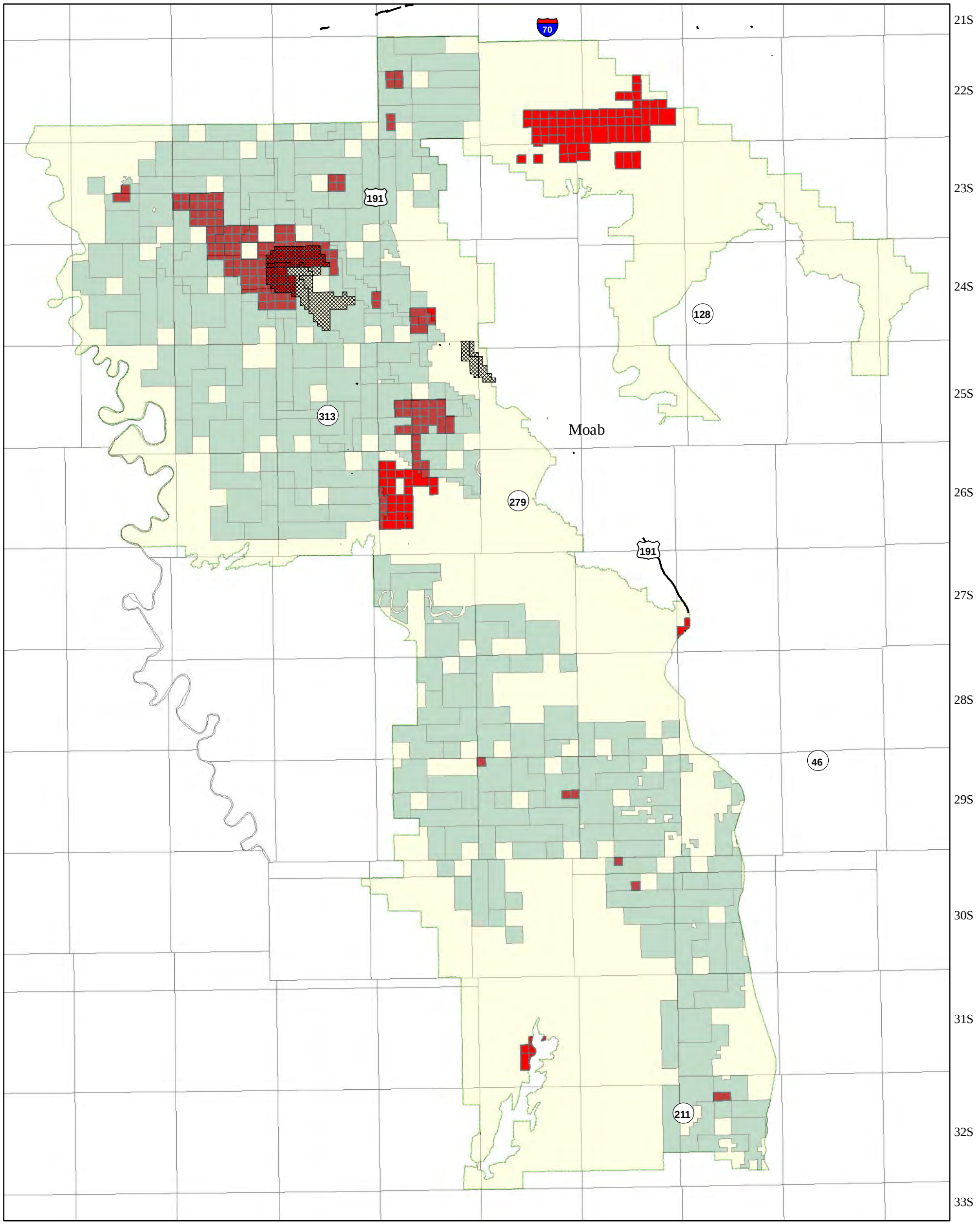
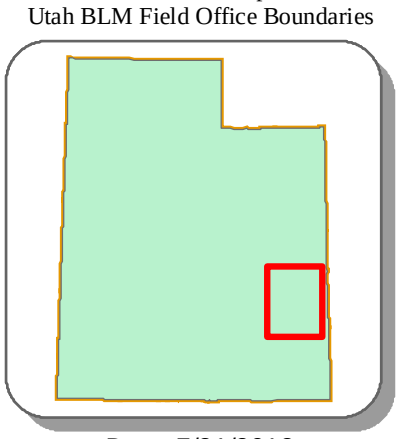
Map 7 - Potash Prospecting Permit Applications and Mining Claims



Location Map
Utah BLM Field Office Boundaries



Date: 7/31/2012

State and Federal Highways
Potash Preference Right Leases
Prospecting Permit Applications
Active Mining Claims
Master Leasing Plan Area
Township Lines

0 5 10
Kilometers
0 5 10
Miles

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