COGCC OIL AND GAS FIELD SCOUT CARD

Date	04/18/2016
Document No.	2056125

FIELD NAME	**RULISON**
FIELD NUMBER	**75400**

LOCATION

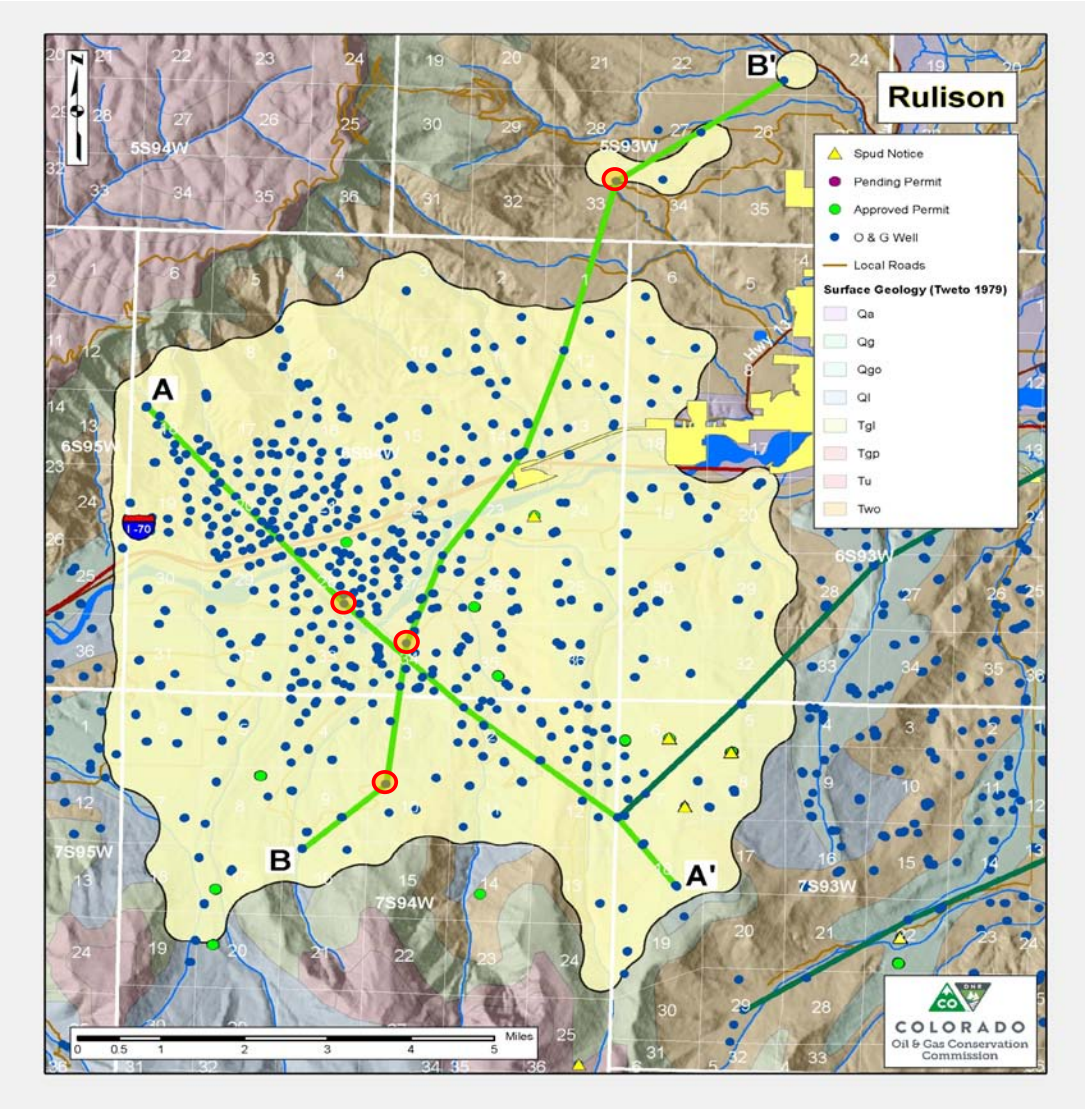
Basin	Piceance
Township(s)	5S to 7S
Range(s)	93W to 95W

SURFACE GEOLOGY

Surface Geology consists of the Green River Formation overlying the Wasatch Formation in higher elevation areas to the south (near the top of Battlement Mesa). The Colorado River generally flows from east to west through the north-central portion of the field. Landslide deposits are prevalent in areas with steep slopes, primarily on the south side of the valley. Alluvium is prevalent along the Colorado River and tributary creeks, primarily on the south side of the valley. These other Tertiary formations are underlain by the Wasatch Formation, which outcrops at the surface in the valley and along larger tributaries at lower elevations.

GEOLOGIC STRUCTURE

None within this field on COGCC's 250K GIS Geology layer. However, northwestern extensions of anticlines and synclines to the east of this field may affect structure to a limited extent, particularly in the eastern and northeastern portions of this field. A northwest-southeast trending, southwesterly-dipping monocline (the Grand Hogback Monocline along the northeastern edge of the basin) is present within three miles of the extreme northeastern portion of the field.



Type Log Wells

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				A - Northwest					A' - Southeast
STRATIGRAPHY			**API Number =>**	**045-09956**	**045-06975**	**045-06595**	**045-07181**	**045-18422**	**045-09224**
			Surface Elevation =>	**6,164**	**5,443**	**5,205**	**5,869**	**7,357**	**8,554**
All depths are measured depths			**Well Type =>**	**Directional**	**Drifted**	**Vertical**	**Vertical**	**Directional**	**Directional**
Group	**Formation**	**Interval/Member**	**Isolation Concern**	**Log Top**	**Log Top**	**Log Top**	**Log Top**	**Log Top**	**Log Top**
	Alluvium		Water		0				0
	Landslide Deposit		Water			0	0	0	
	Uinta		Water						
	Green River		Water						
	Wasatch	Upper	Shallow Water	0					
	Wasatch	G-Sand*	Gas	2,810/2,964*	1,831/1,960*	1,303/1,457*	1,830/1,954*	3,308/3,410*	4,732/4,836*
	Wasatch	Fort Union*	None	3,344*	2,333*	1,810*	2,303*	3,820*	5,310*
	Wasatch	Middle	None						
	Wasatch	Lower*	Water	4,633*	3,674*	3,383*	3,860*	5,390*	6,876*
Mesaverde	Williams Fork	Ohio Creek	Water	4,925*	3,975*	3,662*	4,000*	5,510*	7,216*
Mesaverde	Williams Fork	U. Mesaverde	Water / UIC	5,298	4,321	3,825	4,279	5,783*	7,390*
Mesaverde	Williams Fork	Top of Gas	Gas						8,076
Mesaverde	Williams Fork	Cameo	Gas	7,927	7,010	6,558	7,016	8,476	
Mesaverde	Iles	Rollins	Gas	8,863	7,938	7,421		9,352	10,952
Mesaverde	Iles	Cozzette	Gas / UIC		8,282	7,762			
Mesaverde	Iles	Corcoran	Gas / UIC		8,576	8,044			
	Mancos		Possible Gas						
	Niobrara		Possible Gas						

Annotated Type Log for 045-06595: COGCC Document Number 2056089

Stippled cells indicate that the respective log top was not apparent on logs or the top may be covered by a shallower casing string above the logged interval. "Middle Wasatch" is an interval that may include multiple formation members, and therefore, log tops are not presented for the Middle Wasatch.

** COGCC log picks (Operators commonly report the upper interval or the lower interval of the Wasatch G-Sand [as shown above], or some point in between, but not both; the Fort Union is not commonly recognized by operators in this field; "Lower" Wasatch, as shown herein for water isolation, is not recognized in geologic literature)*

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				B - Southwest							B' - Northeast
STRATIGRAPHY			**API Number =>**	**045-06673**	**045-07186**	**045-07197**	**045-07680**	**045-06232**	**045-11942**	**045-10518**	**045-11304**
			Surface Elevation =>	**7,091**	**6,689**	**5,361**	**5,255**	**5,319**	**5,460**	**5,807**	**5,915**
All depths are measured depths			**Well Type =>**	**Vertical**	**Vertical**	**Vertical**	**Directional**	**Vertical**	**Directional**	**Directional**	**Directional**
Group	**Formation**	**Member**	**Isolation Concern**	**Log Top**	**Log Top**	**Log Top**	**Log Top**	**Log Top**	**Log Top**	**Log Top**	**Log Top**
	Alluvium		Water			0	0	0			
	Landslide Deposit		Water	0	0						
	Uinta		Water								
	Green River		Water								
	Wasatch	Upper	Shallow Water						0	0	0
	Wasatch	G-Sand*	Gas	3,210/3,377*	2,740/2,905*	1,321/1,457*	1,327/1,440*	1,694/1,833*	2,226/2,348*	3,273/3,393*	3,148/3,279*
	Wasatch	Fort Union*	None	3,743*	3,267*	1,830*	1,819*	2,258*	2,714*	3,750*	3,630
	Wasatch	Middle	None								
	Wasatch	Lower*	Water	4,836*	4,556*	3,008*	3,170*		4,270*	5,697*	5,800*
Mesaverde	Williams Fork	Ohio Creek	Water	5,194*	4,875*	3,340*	3,470*		4,600*	5,950*	6,125*
Mesaverde	Williams Fork	U. Mesaverde	Water / UIC	5,670	5,209	3,796	3,854		4,922	6,098	6,290*
Mesaverde	Williams Fork	Top of Gas	Gas								
Mesaverde	Williams Fork	Cameo	Gas	8,170	7,730	6,446	6,560		7,706	8,994	9,207
Mesaverde	Iles	Rollins	Gas	9,126			7,568*		8,669	9,841	10,134
Mesaverde	Iles	Cozzette	Gas / UIC								10,525
Mesaverde	Iles	Corcoran	Gas / UIC								
	Mancos		Possible Gas								
	Niobrara		Possible Gas								

Annotated Type Log for 045-07186: COGCC Document Number 2056093
Annotated Type Log for 045-07197: COGCC Document Number 2056192 (specifically illustrates variability of reported Fort Union, Ohio Creek, and Mesaverde log tops in the nearby MWX-1 well)
Annotated Type Log for 045-10518: COGCC Document Number 2056094

Stippled cells indicate that the respective log top was not apparent on logs or the top may be covered by a shallower casing string above the logged interval. "Middle Wasatch" is an interval that may include multiple formation members, and therefore, log tops are not presented for the Middle Wasatch.

** COGCC log picks (Operators commonly report the upper interval or the lower interval of the Wasatch G-Sand [as shown above], or some point in between, but not both; the Fort Union is not commonly recognized by operators in this field; "Lower" Wasatch, as shown herein for water isolation, is not recognized in geologic literature)*

WATER RESOURCE ISOLATION

Alluvium, landslide deposits, Uinta, Green River, Upper Wasatch (weathered portion in which water supply wells are screened), Lower Wasatch, Ohio Creek, and Upper Mesaverde.
Water wells within the field are more prevalent on the south side of the valley. Water wells are typically screened in alluvium or upper, weathered portions of the Wasatch Formation. Two water wells within the field are 600' deep and several water wells are 300' to 500' deep, but the majority of water wells in the field are less than 300' deep. Operator's Geologic Prognosis for RWF 12-12 (045-11942, COGCC Document No. 1622320) indicates, "Water zones may be encountered within the upper portion of the Mesaverde." Several gas production wells were permitted as water wells by Laramie Energy II LLC. The operator informed COGCC staff that at the time, they assumed that water well permitting was required for produced water in those gas wells as potential tributary coalbed methane water sources. The gas well total depths are in the range of approximately 8,000' to 10,000', but they are not water supply wells.

PRODUCING ZONE ISOLATION

Primary Objectives: Wasatch G, Mesaverde Group (Williams Fork and Iles)
Secondary Objectives: Two vertical wells drilled, targeting the Mancos B and Niobrara (045-14756 and 045-22157)

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UNDERGROUND INJECTION CONTROL

API Number	Well Name and No.	Type	Zone	Sample Top	Sample Bot.	TDS	Source
045-07465	Clough #RMV 215-21	Disposal	Williams Fork	4,483	5,208	14,379	SWAB1 - 3/26/2012
045-07465	Clough #RMV 215-21	Disposal	Williams Fork	4,483	5,208	17,695	SWAB2 - 3/26/2012
045-07465	Clough #RMV 215-21	Disposal	Williams Fork	4,483	5,208	19,748	SWAB3 - 3/26/2012
045-10389	Clough #RWF 623-21	Disposal	Williams Fork	4,124	5,229		N/A[1]
045-10469	Clough #RWF 434-21	Disposal	Williams Fork	4,055	5,261		N/A[1]
045-07325	Clough #RMV 94-21-H	Source	Corcoran	8,398	8,398	15,755	SWAB - 4/23/2012
045-07325	Clough #RMV 94-21-H	Source	Corcoran	8,398	8,398	18,200	SWAB - 8/9/2012
045-22176	Clough #RWF 911-28D	Disposal	Cozzette - Corcoran	8,180	8,608		N/A[2]
045-22333	Clough #RWF 933-19D	Disposal	Cozzette - Corcoran	9,017	9,394	17,119	WH - 7/7/2014

(1) Injection formation water sample not available. TDS data from offset well 045-07465 was used for the UIC Application.

(2) Injection formation water sample not available. TDS data from offset well 045-07325 (Corcoran sample) was used for the UIC Application.

COMMISSION ORDER SUMMARY (Significant Engineering and Spacing Issues)

139-1 (12/10/1959)	Mesaverde: Recognized the Mesaverde as a **Common Source** of supply. Established 640-acre drilling and spacing units, with wells no closer than 990' from quarter-section lines, located in NW/4 or SE/4 of each section. Order specified minimum 200' surface casing, formation integrity monitoring/testing requirements below the surface casing shoe (500 psi for 30 minutes with 100 psi leakoff allowance), minimum 100 sack cement requirement for production casing, production casing pressure testing requirements (1,000 psi for 30 minutes with 100 psi leakoff allowance), tubing required with top perforation limit to no more than 250' from the bottom of the tubing for oil wells, and installation of tubing, casing, and bradenhead valves.
139-2 (2/21/1961)	Wasatch: Established 640-acre drilling units, with wells no closer than 600 feet from section boundaries. Mesaverde: Reiterated certain requirements of Order 139-1.
Various (1967-68)	Orders related to instrumentation and nuclear emplacement wells for Project Rulison.
139-8 (7/16/1979)	Wasatch: Established 160-acre drilling and spacing units, with wells no closer than 600' from unit line, 1200' well-to-well spacing. Mesaverde: Established 320-acre drilling and spacing units, with wells no closer than 600' from unit line, 1200' well-to-well spacing.
139-14 (3/19/1990)	Mesaverde: **Common Source** of supply definition expanded to include Mesaverde, Cameo, Rollins, Cozzette, and Corcoran.
139-21 (6/14/1991)	Mesaverde: Defines interval to be spaced in certain parts of Townships 6S-93W and 7S-93W to include the interval from 5142' to 9950', as found on the Dual Induction Log for the R.H. Ranch #1 well (SWSW 34-6S-93W, located in the adjoining Mamm Creek Field, 045-06377, linear-scale log Document No. 1005953). COGCC staff correlates the referenced log interval to include all of the Mesaverde Group represented in the Stratigraphy chart shown above in this Field Scout Card document, including the bottom portion of the Ohio Creek Member of the Williams Fork Formation, down through all members of the Iles Formation. This order further specifies minimum 300' surface casing, and blow out preventors and kill line installation prior to drilling out surface casing. Initial and final completion reports, Form 5s required with geologic data, and Sundry Notices, Form 4s required for cathodic protection boreholes, to be permitted and constructed per State Division of Water Resources requirements.
Various (1992-93)	Mesaverde: **Common Source** of supply definition cited as Upper Mesaverde, Upper Cozzette, Lower Cozzette, and Corcoran. Defines intervals to be spaced in certain areas of Township 6S-94W and Township 7S-94W to include 3862' to 7666' (Upper Mesaverde, inclusive of the Rollins Member of the Iles Formation), 7830' to 7895' (Upper Cozzette), 7949' to 7996' (Lower Cozzette), and 8110' to 8270' (Corcoran), as found on the Dual Induction Log for the DOE/CER MWX #1 well (SWNW 34-6S-94W, 045-06325, now renamed as Superior MWX #1). The Upper Mesaverde (including Rollins) was assigned 320-acre drilling and spacing units, and the Cozzette and Corcoran were assigned 640-acre drilling and spacing units, with wells no closer than 600' from unit line, 1200' well-to-well spacing.
139-26 (2/22/1994)	Williams Fork: Defined the Williams Fork Formation of the Mesaverde Group as a **Common Source** of supply. Established 640-acre drilling and spacing units (with eight wells per unit) and 320-acre drilling and spacing units (with four wells per unit) in certain parts of this field, with wells no closer than 600' from unit line, 1200' well-to-well spacing (80-acre well spacing). Defines Williams Fork Formation to include the interval from 3,920' to 7,268', as found on the Dual Induction Log for the Barrett GV #53-34 well (SWNE 34-6S-95W, located in the adjoining Parachute Field, 045-06650, now renamed as Arco GV #53-34, Document No. 1036744). COGCC staff correlates the referenced log interval to include all of the Williams Fork Formation represented in the Stratigraphy chart shown above in this Field Scout Card document, excluding the Ohio Creek Member of the Williams Fork Formation.
139-27 (3/18/1994)	Williams Fork: Changed 80-acre density drilling and spacing unit setbacks in certain areas of the field to wells no closer than 400' from unit line, 800' well-to-well spacing.
139-28 (2/21/1995)	Williams Fork: First field order allowing 40-acre well density, with wells no closer than 400' from unit line, 800' well-to-well spacing.

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COMMISSION ORDER SUMMARY (Significant Engineering and Spacing Issues)

139-32 (1/7/1998)	Williams Fork: First field order allowing 20-acre well density, with wells no closer than 200' from unit line, 400' well-to-well spacing.
139-34 (10/31/2000)	Williams Fork: Amends prior orders to allow 20-acre spacing, 200' from unit line, 400' bottom hole well-to-well spacing. Requires compliance with Garfield County Notice to Operators for surface casing setting depth (10% of TVD), formation integrity tests, loss of well control notices to residents within one mile, water sampling, reclamation plans, and air emission controls within 1,000' of occupied buildings, among other requirements. Order requires additional wells to be drilled as multi-well pads.
139-37 (7/9/2001)	Williams Fork: First field order allowing 10-acre well density, with wells no closer than 200' from unit line.
139-38 (4/21/2003)	Williams Fork: Eliminates bottom hole well-to-well spacing requirement for 10-acre well density and allows bottom holes within 100' of unit boundaries for new wells.
139-43 (2/10/2004)	Project Rulison Area Half-Mile Hearing Requirement: "any wells proposed to be drilled within one half (½) mile of the Austral Oil Hayward #25-95 (R-E) Well in Lot 11 of the NE¼ SW¼ of Section 25, Township 7 South, Range 95 West, 6th P.M., a hearing before the Commission shall be held prior to approval of any Application for Permit-to-Drill, Form 2."
139-46 (3/22/2005)	Iles: First field order allowing 20-acre well spacing density, with wells no closer than 200' from unit line, 400' well-to-well spacing.
139-50 (9/26/2005)	Williams Fork and Iles: Requires that wells drilled to the Iles Formation shall be drilled only in connection with the drilling of Williams Fork Formation wells, using a single wellbore to reach both formations.
139-47 (6/6/2005)	First order requiring compliance with "Well Cementing Procedure and Reporting Requirements in the Notice to Operators Drilling Mesaverde Group or Deeper Wells in the Mamm Creek Field Area dated July 23, 2004," which applies to part of the Rulison Field.
139-56 (9/20/2004)	Established Bradenhead Monitoring Area, including part of the Rulison Field.
139-61 (6/5/2006)	Williams Fork and Iles: First field order allowing 10-acre well spacing density when drilling to both formations, with wells no closer than 100' from unit line.
139-78 (7/23/2007)	Wasatch: First field order for an 80-acre drilling and spacing unit, with one pad per 40 acres and wells no closer than 600' from unit line and 1200' from other Wasatch wells.
139-101 (9/22/2008)	Williams Fork and Iles: Field order allowing 9-acre well spacing density on two lots, with wells no closer than 100' from unit line.
139-113 (6/27/2011)	Deep Formations (Mancos, Niobrara, Frontier, and Mowry): First field order allowing 40-acre drilling and spacing units with 10-acre density, with wells no closer than 600' from unit line.
139-120 (7/28/2014)	Deep Formations (Mancos, Sego, Niobrara, Frontier, Mowry, and Dakota): 1280-acre exploratory drilling and spacing unit for up to 40 horizontal, vertical or directional wells within the unit, for the production from the Mancos (including the Sego Sandstone), Niobrara, Frontier, Mowry, and Dakota Formations, with the productive interval of the wellbore located no closer than 300' from the southern and northern unit boundaries and no more than 600' from the eastern and western unit boundaries, and no closer than 300' from the productive interval of any other wellbore located in the unit.

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HISTORIC WELL CONSTRUCTION

Historic surface casing setting depths vary throughout the field as a function of age of the well and ground surface elevation. Older wells drilled during early development of the field commonly have surface casing setting depths less than 1,000' deep. Effective 10/3/1997, the minimum surface casing setting depth standard was changed to 1,100' in the Rulison Overpressured Area, which includes most of this field. Surface casing setting depths for newer wells are generally set between 1,000' to 3,000', but deeper surface casing (3,000' to 4,000') has been used in isolated areas of the field. Production casing generally terminates in the Iles Formation or the underlying Mancos Formation. Wasatch G wells may terminate shallow at depths generally ranging from 2,000' to 3,500'. Production casing cement (or intermediate casing cement, if used) may be limited to coverage of the producing intervals, and coverage may be lacking across parts of the Mesaverde Group and Wasatch Formation.

NEW WELL CONSTRUCTION (effective 04/18/2016)

Minimum surface casing of 1,100' (in the Rulison Overpressured Area) or 10% TVD for well control and to cover water resources in the upper interval of the Wasatch Formation; use the most stringent criteria. Recommend setting depth of at least 50 feet below the Wasatch Formation top for high-elevation wells that must drill through the Green River Formation. Check for deep alluvium on offset logs in wells drilled near the Colorado River (COGCC staff review of wells with shallow surface casing of 300' to 400' near the river showed that current, minimum surface casing setting depths will likely provide full coverage of alluvium). Full cement coverage of the Mesaverde Group and Ohio Creek is required in the Piceance Basin through 2015. New Standards require cementing intermediate (if used) or production casing at least 200' above Lower Wasatch sands in the western portion of the field (Ranges 94W and 95W), or at least 500' above Lower Wasatch sands in the eastern portion of the field (Range 93W).

PLUGGING OBJECTIVES

Plug(s) above Mancos and other deeper formations (if penetrated) to address potential future horizontal wells; plug above Mesaverde Group completions; plug above Ohio Creek and across Lower Wasatch (squeeze if no annular cement coverage); Wasatch G plug if produced within one mile; stray gas isolation squeezes (if no annular cement) or in-casing stabilization plugs (if annular cement present) at 3,000' intervals if plugs are not already planned in those intervals as described above; surface casing shoe plug and surface plug. Consider setting plug(s) from 1,000' into the surface casing for shallow surface casing strings that are less than 1,000' deep.

WELL CONTROL

Except for a rig fire that occurred while drilling 045-15694 on 8/27/2008, well control events summarized below were controlled without incident. Well Control events have been reported in 6S-94W and 7S-94W.
Well Control Reports (Form 23s) by Year: 2008 (1), 2009 (4), 2010 (6), 2011 (8), 2012 (none), 2013 (4), 2014 (none), and 2015 (none). Reporting was inconsistent prior to 2009, when requirements for Form 23 reporting was emphasized with the operators.
Form 23s by Formation: Williams Fork (13) and Iles (10)

NOTES

The southwestern portion of the field is in the Project Rulison Sampling and Analysis Plan area. Special requirements and Form 2 Conditions of Approval apply.
The approximate western two thirds of the field is in the Rulison Overpressured Area. Special requirements and Form 2 Conditions of Approval apply.
The eastern portion of the field in R93W is located within the Mamm Creek Field Cementing Notice to Operators Area. Special requirements and Form 2 Conditions of Approval apply.
The eastern portion of the field in R93W is located within the Bradenhead Monitoring Area. Special requirements and Form 2 Conditions of Approval apply.
A Uranium Mill Tailings Remedial Action area is located along I-70 and the Colorado River in the northeast portion of the field. Special requirements and Form 2 Conditions of Approval apply.