UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

In the Matter of CROW BUTTE RESOURCES, INC. (Marsland Expansion Area)	Docket No. 40-8943-MLA-2 ASLBP No. 13-926-01-MLA-BD01

Hearing Exhibit

Exhibit Number: CBR009

Exhibit Title: Technical Report Tables

Table 1.7-1 Current Crow Butte Production Area Mine Unit Status

Mine Unit	Production Initiated	Current Status
Mine Unit 1	April 1991	Groundwater Restored
Mine Unit 2	March 1992	Groundwater Restoration
Mine Unit 3	January 1993	Groundwater Restoration
Mine Unit 4	March 1994	Groundwater Restoration
Mine Unit 5	January 1996	Groundwater Restoration
Mine Unit 6	March 1998	Groundwater Restoration
Mine Unit 7	July 1999	Production
Mine Unit 8	July 2002	Production
Mine Unit 9	October 2003	Production
Mine Unit 10	August 2007	Production
Mine Unit 11	November 2010	Production

Table 2.1-1 Latitude and Longitude and Coordinates for Marsland License Boundary and Satellite Facility

Layer	Geographic Projection: NAD 83 (Degrees)		Geographic Projection: NAD 27 (Degree)		NAD1983 StatePlane Nebraska North FIPS 2600(US Foot)		NAD1927 StatePlane Nebraska North FIPS 2601(US Foot)	
	Latitude	Longitude	Latitude	Longitude	Northing	Easting	Northing	Easting
A	42.4959	-103.2345	42.4959	-103.2340	986214	768453	440230	1128008
A	42.4957	-103.2345	42.4957	-103.2340	986145	768451	440161	1128006
A	42.4957	-103.2296	42.4957	-103.2291	986095	769765	440111	1129321
A	42.4884	-103.2299	42.4884	-103.2294	983444	769586	437459	1129139
A	42.4885	-103.2250	42.4885	-103.2245	983427	770914	437441	1130468
A	42.4809	-103.2248	42.4810	-103.2243	980670	770852	434685	1130405
A	42.4810	-103.2296	42.4810	-103.2291	980731	769563	434746	1129115
A	42.4739	-103.2297	42.4739	-103.2293	978161	769430	432176	1128981
A	42.4740	-103.2149	42.4741	-103.2144	978059	773427	432071	1132978
A	42.4666	-103.2151	42.4666	-103.2146	975348	773274	429360	1132823
A	42.4599	-103.2149	42.4599	-103.2144	972907	773242	426919	1132790
A	42.4591	-103.2173	42.4591	-103.2168	972635	772574	426647	1132122
A	42.4591	-103.2245	42.4591	-103.2241	972703	770633	426716	1130180
A	42.4591	-103.2295	42.4591	-103.2290	972750	769297	426765	1128845
A	42.4665	-103.2295	42.4666	-103.2290	975471	769397	429485	1128946
A	42.4665	-103.2344	42.4666	-103.2339	975519	768070	429534	1127619
A	42.4741	-103.2345	42.4741	-103.2341	978271	768138	432286	1127689
A	42.4740	-103.2443	42.4741	-103.2438	978352	765502	432369	1125052
A	42.4810	-103.2443	42.4811	-103.2438	980907	765597	434925	1125149
A	42.4811	-103.2496	42.4811	-103.2492	980966	764164	434985	1123716
A	42.4887	-103.2494	42.4887	-103.2489	983740	764329	437759	1123882
A	42.4886	-103.2544	42.4887	-103.2539	983778	762998	437797	1122551
A	42.4956	-103.2542	42.4956	-103.2537	986289	763143	440309	1122697
A	42.4954	-103.2647	42.4954	-103.2642	986336	760312	440357	1119866
A	42.5065	-103.2644	42.5065	-103.2639	990378	760549	444400	1120105
A	42.5064	-103.2692	42.5065	-103.2687	990402	759254	444424	1118811
A	42.5097	-103.2690	42.5098	-103.2686	991603	759327	445626	1118884
A	42.5097	-103.2739	42.5097	-103.2734	991631	758025	445654	1117582
A	42.5099	-103.2739	42.5100	-103.2734	991725	758032	445749	1117589
A	42.5172	-103.2738	42.5172	-103.2733	994360	758153	448384	1117712
A	42.5171	-103.2835	42.5171	-103.2831	994421	755527	448446	1115085
A	42.5244	-103.2835	42.5244	-103.2830	997082	755635	451107	1115195
A	42.5463	-103.2834	42.5463	-103.2829	1005052	755961	459078	1115525
A	42.5465	-103.2639	42.5465	-103.2634	1004932	761230	458955	1120795
A	42.5465	-103.2637	42.5465	-103.2632	1004932	761272	458955	1120838
A	42.5389	-103.2637	42.5389	-103.2633	1002164	761161	456187	1120724
A	42.5312	-103.2638	42.5312	-103.2633	999351	761048	453374	1120610
A	42.5314	-103.2545	42.5314	-103.2540	999330	763551	453351	1123113
A	42.5248	-103.2544	42.5249	-103.2539	996960	763475	450981	1123036
A	42.5246	-103.2544	42.5246	-103.2539	996874	763473	450895	1123033
A	42.5243	-103.2544	42.5244	-103.2539	996770	763469	450790	1123030
A	42.5244	-103.2492	42.5244	-103.2487	996740	764875	450760	1124436
A	42.5100	-103.2492	42.5100	-103.2487	991491	764681	445510	1124239
A	42.5100	-103.2440	42.5101	-103.2436	991461	766067	445480	1125625
A	42.5100	-103.2392	42.5101	-103.2387	991410	767368	445428	1126926
A	42.5031	-103.2393	42.5031	-103.2388	988886	767250	442903	1126807
A	42.5031	-103.2344	42.5031	-103.2340	988839	768558	442855	1128115
A	42.4959	-103.2345	42.4959	-103.2340	986214	768453	440230	1128008
B	42.5013	-103.2555	42.5013	-103.2550	988395	762875	442416	1122430

Notes:

A = Marsland Permit Boundary

B = Center of Satellite Facility

Table 2.2-1 Major Land Use Definitions

Croplands (C)	Harvested cropland, including grasslands cut for hay, cultivated summer-fallow, and idle cropland.
Commercial and Services (C/S)	Areas used predominantly for the sale of products and services. Institutional land uses, such as various educational, religious, health, and military facilities, are also components of this category.
Forested Land (F)	Areas with a tree-crown density of 10 percent or more that are stocked with trees capable of producing timber or other wood products and exert an influence on the climate or water regime. This category does not indicate economic use.
Habitat (H)	Land dedicated wholly or partially to the production, protection, or management of species of fish or wildlife.
Industrial (I)	Areas such as rail yards, warehouses, and other facilities used for industrial manufacturing or other industrial purposes.
Mines, Quarries, or Gravel Pits (M)	Those extractive mining activities that have significant surface expression.
Pastureland (P)	Land used primarily for the long-term production of adapted, domesticated forage plants to be grazed by livestock or occasionally cut and cured for livestock feed.
Rangeland (R)	Land, roughly west of the 100th meridian, where the natural vegetation is predominantly grasses, grass-like plants, forbs, or shrubs, which is used wholly or partially for the grazing of livestock. This category includes wooded areas where grasses are established in clearings and beneath the overstory.
Urban Residential (UR)	Residential land uses range from high-density, represented by multi-family units, to low-density, where houses are on lots of more than 1 acre. These areas are found in and around Crawford and Ft. Robinson. Areas of sparse residential land use, such as farmsteads, will be included in categories to which they are related.
Water (W)	Areas of land mass that are persistently water-covered.
Recreational (RC)	Land used for public or private leisure, including developed recreational facilities such as parks, camps, and amusement areas, as well as areas for less intensive use such as hiking, canoeing, and other undeveloped recreational uses.

Table 2.2-2 Present Major Land Use Within a 2.25-Mile (3.6-KM) Radius of the Proposed Marsland Expansion Area License Boundary

COMPASS SECTOR[1]	LAND USE[2, 3] (ACRES)					TOTAL ACRES
	Cropland	Drainage/Potential Wetland	Forest Land	Rangeland	Recreational Land	
E	9.0	38.5	-	1,580.7	-	1,628.2
ENE	42.8	37.4	414.5	859.8	-	1,354.5
ESE	764.1	66.0	-	1,793.2	-	2,623.4
N	59.2	77.4	653.0	2,537.3	244.8	3,571.8
NE	177.4	35.8	535.4	772.7	-	1,521.4
NNE	108.0	49.6	636.4	1,679.7	-	2,473.7
NNW	1.0	71.8	613.8	2,464.3	802.9	3,953.8
NW	47.2	63.3	1,024.8	1,769.7	187.3	3,092.3
S	379.5	138.3	-	2,393.8	-	2,911.6
SE	314.3	200.0	-	3,352.9	-	3,867.2
SSE	169.3	81.2	-	3,694.3	-	3,944.8
SSW	585.6	64.2	-	884.2	-	1,534.1
SW	34.6	25.0	0.1	981.2	-	1,040.9
W	70.8	45.8	489.0	782.1	-	1,387.6
WNW	121.1	63.2	679.6	1,102.8	-	1,966.8
WSW	40.5	17.7	25.0	923.7	-	1,006.8
TOTAL	2,924.4	1,075.3	5,071.6	27,572.4	1,235.0	37,878.6

[1] 22 1/2° sectors centered on each of the 16 compass points

[2] See Table 2.2-1 for an explanation of major land use types: C = cropland; F = forested land; R = rangeland; RR = rangeland rehabilitation; SB = structural biotope; RC = recreational. Land uses not identified: mines, quarries or gravel pits; pastureland; water; habitat; commercial/services; urban residential; industrial

[3] Values are inclusive of MEA

Table 2.2-3 Present Land Use Within the Proposed Marsland Expansion Area License Boundary

COMPASS SECTOR[1]	LAND USE (ACRES)				
	Cropland	Drainage/Potential Wetland	Forest Land	Rangeland	TOTAL ACRES
E	4.9	3.8	-	121.6	130.4
ENE	40.5	4.0	-	61.9	106.4
ESE	44.4	8.1	-	174.3	226.7
N	59.2	21.1	127.5	395.1	602.9
NE	46.6	4.5	-	44.0	95.1
NNE	55.7	5.4	11.1	73.8	146.1
NNW	1.0	26.0	164.3	1,009.5	1,200.7
NW	0.4	10.6	57.1	300.8	368.8
S	4.6	0.9	-	42.0	47.5
SE	144.8	17.2	-	552.5	714.5
SSE	37.5	19.1	-	778.1	834.7
SSW	3.1	0.7	-	17.6	21.4
SW	0.6	0.4	-	34.2	35.3
W	0.2	0.4	-	25.8	26.5
WNW	0.2	1.0	-	31.5	32.7
WSW	0.3	0.3	-	32.0	32.7
TOTAL	443.9	123.7	360.1	3,694.6	4,622.3

Table 2.2-4 Agricultural Yields for Croplands in Dawes County 2010

Crop	Harvested		Yield		Production
	Acres[a]	km^2	Per acre	Per km^2	
Corn (bu)	1,900	7.7	121.6 bu	30,049.17 bu	231,000 bu
Oats (bu)	400	1.6	38.0 bu	9,391.99 bu	15,200 bu
Wheat (bu)	35,200	142.4	33.9 bu	8,390.72 bu	1,195,000 bu
Forage (tons)	52,700	213.2	1.8 tons	453.04 tons	96,600 tons

Source: NASS 2011
Notes: bu bushels
[a]1 acre = 0.0040469 km^2

Table 2.2-5 Livestock Inventory for Dawes County 2007

Livestock	Number	Percentage of Total	Animal Units [a]	
			Pounds (000s)	Percent
All cattle, except dairy	69,405	96.2	69,405	99.5
Dairy cattle	24	0.03	24	0.03
Hogs and pigs	321	0.4	71	0.1
Sheep and lambs	1,294	1.8	259	0.4
Chickens	1,092	1.5	5	0.008
Total animals	72,136	100.0	69,764	100.0

Source: NASS 2009a

Notes: [a] Animal unit conversions:
1 cow = 1,000 lb.
1 hog = 220 lb.
1 sheep = 200 lb.
1 chicken = 5 lb.
1 animal unit = 1,000 lb.

Table 2.2-6 Recreational Facilities Within 50 Miles (80 km) of the Proposed Marsland Expansion Area

Name of Recreational Facility	Distance From MEA Boundary (miles)
Box Butte Reservoir and Wildlife Area	~3
Ponderosa Wildlife Management Area	~5
Bighorn WMA	~7
Fort Robinson State Park	~9
Legend Buttes Golf Course	~11
Roberts Trailhead and Campground Pine Ridge National Recreation Area	~11
Crawford City Park	~12
Peterson Wildlife Management Area	~14
Chadron Creek Ranch WMA	~15
Fort Robinson WMA	~15
Chadron State Park	~16
Soldier Creek and Red Cloud Campgrounds Fort Robinson State Park	~16
Soldier Creek Wilderness Area Nebraska National Forest	~16
Whitney Lake	~16
Ridgeview Country Club Golf Course City of Chaldron	~21
Hudson-Meng Bison Bonebed	~22
Agate Fossil Beds National Monument	~24
Toadstool Geologic Park	~24
Bordeaux WMA	~26
Museum of the Fur Trade, City of Chadron	~26
Walgren Lake State Recreation Area	~32
Gilbert-Baker Wildlife Area	~34
Metcalf WMA	~35
Warbonnet Battlefield	~35
North Platte NWR	~38

Table 2.2-6 Recreational Facilities Within 50 Miles (80 km) of the Proposed Marsland Expansion Area

Name of Recreational Facility	Distance From MEA Boundary (miles)
Smith Lake WMA	~39
Nine Mile Creek WMA	~40
Arnold Trupp WMA	~43

Sources: DeLorme 2005; Nebraska Game and Fish 2013

Table 2.2-7 Distance to Nearest Residence and Site Boundary from Center of MEA for each Compass Sector

Compass Sector[1]	Nearest Residence (ft.)	Nearest Site Boundary (ft.)
North	None	8,490
North-Northeast	None	3,688
Northeast	10,849	3,853
East-Northeast	None	4,481
East	3,070	4,403
East-Southeast	None	5,731
Southeast	21,364	8,106
South-Southeast	15,560	4,732
South	11,562	2,017
South-Southwest	7,305	2,046
Southwest	None	2,383
West-Southwest	3,335	2,480
West	None	2,404
West-Northwest	16,407	2,430
Northwest	None	2,799
North-Northwest	6,899	8,693

[1] 22 $^{1}/_{2}$° Sectors centered on each of the 16 compass points
None = No residence within the 2.25-mile radius of the MEA boundary for this specific sector.

Table 2.2-8 Uranium Recovery Activities in Region of Proposed Marsland Expansion Area

Company	Site	Design	Location (County)	Status
Eastern Wyoming				
Uranium One	Willow Creek	ISR-Restart	Johnson & Campbell	License approved
Uranerz Energy Corp.	Nichols Ranch	ISR-New	Johnson & Campbell	License approved
Uranium One	Moore Ranch	ISR-New	Converse	License approved
Uranium One	Allemand-Ross	ISR-Expansion	Converse	Application pending
Uranium One	Ludeman	ISR-New	Converse	Reapplication pending
Strategy Energy, Inc.	Ross	ISR-New	Oshoto & Cook	Technical review
Power Resources, Inc.	Smith Ranch Highland CPP	ISR-Expansion	Converse	Renewal
AUC LLC	Reno Creek	ISR-New	Campbell	Pre-submittal audit
Power Resources, Inc.	Ruby Ranch	ISR-Expansion	Campbell	Application pending
Power Resources, Inc.	Ruth	ISR-Expansion (for Smith Ranch Highland CPP)	Campbell	Pending operations plan approval (satellite facility)
Power Resources, Inc.	North Butte	ISR-Operations Plan	Campbell	Pending operations plan approval
The Bootheel Project, LLC	Bootheel	ISR-New	Albany	Application pending
Western Nebraska				
Crow Butte Resources, Inc.	Crow Butte Production Facilities	ISR-License Renewal	Dawes	License renewal (draft license issued)
Crow Butte Resources, Inc.	North Trend	ISR-Expansion	Dawes	Draft License Issued
Crow Butte Resources, Inc.	Three Crow	ISR-Expansion	Dawes	Reapplication Pending
Crow Butte Resources, Inc.	Marsland	ISR-Expansion	Dawes	Technical review
Western South Dakota				
Powertech Uranium Corp.	Dewey Burdock	ISR-New	Custer & Fall River	Technical review

Notes: ISR – In-situ Recovery
RAI – Request for Additional Information

Table 2.2-9 USGS Estimated Water Use in Dawes County 2005

Total Population Served	Public Supply (Mgpd)				Irrigation (Mgpd)			1000s
	Ground-water Withdrawals	Surface Water Withdrawals	Total Withdrawals	Domestic Deliveries	Ground-water Withdrawals	Surface Water Withdrawals	Total Withdrawals	Acres Irrigated Total
8,636	1.47	1.12	2.59	1.77	14.24	10.31	24.55	13

Source: USGS 2005
Mgpd = million gallons per day

Table 2.2-10 Summary of Non-Abandoned Registered Water Wells for Dawes County, Ne on File as of April 08, 2013

Number of Registered Wells								
Commercial		**Domestic**		**Irrigation**	**Monitoring [a]**		**Other Wells [b]**	**Total**
497		251		85	607		4,388	**5,828**
Other Wells (Registered)								
Ground Heat Exchange	Injection	Observation [d]	Other [e]	Recovery	Livestock	Public Water Supply [f]	Public Water Supply [g]	Total Other Wells
7	916	7	16	3,174	232	16	20	**4,388**

Source: NDNR 2013a

[a] Monitoring (Ground Water Quality)

[b] Listed below [Other Wells (Registered)]

[c] The same acres may be reported under more than one well registration.

[d] Observation (Ground Water Levels)

[e] Other (Lake Supply, Fountain, Geothermal, Wildlife, Wetlands, Recreation, Plant & Lagoon, Sprinkler, Test, Vapor Monitoring)

[f] With spacing protection (A well owned and operated by a city, village, municipal corporation, metropolitan utilities district, reclamation district, or sanitary improvement district that provides water to the public fit for human consumption through at least 15 service connections, or regularly serve at least 5 individuals.

[g] Without spacing protection (A well *not* owned or operated by a city, village, municipal corporation, metropolitan utilities district, reclamation district, or sanitary improvement district that provides the public water fit for human consumption through at least 15 service connections or regularly serves at least 25 individuals.

Table 2.2-11 Active, Inactive, Seasonal and Abandoned Water Supply Wells in the Marsland Expansion Area and 2.25 mile AOR

Well No.	Estimated Depth (ft)	Formation	Well Use	Well Status
ACTIVE AND INACTIVE WELLS				
Wells Located Within License Boundary (10 active, 5 inactive, 1 seasonal)				
700	180-200	Brule	Livestock	Active
701	180-200	Brule	Livestock	Inactive [d]
705	Unknown	Arikaree [a]	Livestock	Active
720	240	Arikaree/Brule	Other [e]	Active
721	360	Arikaree/Brule	Other [e]	Active
722	160	Brule	Livestock	Active
727	180	Arikaree/Brule	Livestock	Active
728	260	Brule	Livestock	Active
730	Unknown	Unknown[a]	Domestic	Inactive [d]
731	180	Brule	Livestock	Inactive [d]
732	280	Brule	Agricultural	Seasonal [c]
733	Unknown	Unknown[a]	Livestock	Inactive [d]
744	80	Arikaree	Livestock	Active
747	225	Arikaree/Brule	Livestock	Active
787	130	Brule	Livestock	Inactive [d]
788	130-140	Arikaree	Livestock	Active
Wells Located Within 1 km Radius of License Boundary (18 active, 12 inactive, 3 s easonal)				
702	180-200	Brule	Livestock	Active
703	280	Brule	Domestic/Livestock	Active
704	Unknown	Unknown[a]	Livestock	Active
707	Unknown	Unknown[a]	Livestock	Active
719	160	Brule	Livestock	Active
723	220	Brule	Domestic/Livestock	Inactive [d]
724	Unknown	Unknown[a]	Domestic/Livestock	Inactive [d]
725	240	Brule	Livestock	Active
729	Unknown	Unknown[a]	Livestock	Inactive [d]
735	375	Brule[b]	Livestock	Inactive [d]
736	200	Brule[b]	Agricultural	Seasonal [c]
739	60	Arikaree	Livestock/Garden	Active
740	110	Brule	Agricultural	Seasonal [c]
741	190	Brule	Agricultural	Inactive [d]
743	140	Brule[b]	Livestock	Active
745	140[c]	Brule	Livestock	Active
746	Unknown	Unknown[a]	Livestock	Active
748	Unknown	Unknown[a]	Livestock	Active
749	Unknown	Unknown[a]	Livestock	Inactive [d]
750	Unknown	Unknown[a]	Livestock	Active
752	200-300	Brule	Domestic/Livestock	Active
753	200-300	Brule	Domestic/Livestock	Active
754	200-300	Brule	Livestock	Active
755	200-300	Brule	Livestock	Active
756	200-300	Brule	Livestock	Inactive [d]

Table 2.2-11 Active, Inactive, Seasonal and Abandoned Water Supply Wells in the Marsland Expansion Area and 2.25 mile AOR

Well No.	Estimated Depth (ft)	Formation	Well Use	Well Status
759	200-300	Brule	Livestock	Inactive [d]
777	60	Arikaree	Domestic/Garden	Active
778	60	Arikaree	Livestock	Inactive [d]
802	180-200	Brule	Livestock	Active
834	300	Brule	Domestic/Livestock	Inactive [d]
843	300	Brule[b]	Livestock	Inactive [d]
869	Unknown	Unknown[a]	Livestock	Inactive [d]
Wells Located Between1 km and 2 km Radius(15 active, 5 inacti ve, 4 seasonal)				
706	Unknown	Unknown[a]	Livestock	Active
714	135	Brule[b]	Domestic/Livestock	Active
715	135	Arikaree	Agricultural	Seasonal [c]
716	135	Brule	Agricultural	Seasonal [c]
734	300	Brule[b]	Livestock	Active
737	340	Brule[b]	Livestock	Seasonal [c]
742	60	Arikaree	Livestock	Active
760	Unknown	Unknown[a]	Livestock	Seasonal [c]
790	Unknown	Unknown[a]	Livestock	Inactive [d]
794	300	Arikaree/Brule[b]	Domestic/Livestock	Active
795	350	Arikaree/Brule[b]	Domestic/Livestock	Active
796	350	Arikaree/Brule[b]	Domestic/Livestock	Inactive [d]
799	250	Brule	Livestock	Active
809	300	Brule	Livestock	Active
810	<300	Unknown[a]	Domestic/Livestock	Active
811	<300	Unknown[a]	Domestic/Livestock	Active
815	140	Brule	Domestic	Active
816	140	Brule	Livestock	Inactive [d]
817	160	Brule	Livestock	Inactive [d]
821	160	Brule[b]	Livestock	Active
835	300	Brule	Livestock	Inactive [d]
836	220	Brule	Livestock	Active
841	220	Brule[b]	Livestock	Active
845	Unknown	Unknown[a]	Domestic/Livestock	Active
Wells Located Between 2 km Radius and AOR Boundary (54 active, 9 inactive)				
708	200	Brule	Livestock	Active
709	Unknown	Unknown[a]	Livestock	Active
710	Unknown	Unknown[a]	Livestock	Active
711	Unknown	Unknown[a]	Livestock	Active
712	Unknown	Unknown[a]	Livestock	Active
713	Unknown	Unknown[a]	Livestock	Active
717	160	Arikaree/Brule	Livestock	Active
738	260	Arikaree/Brule[b]	Livestock	Active
751	Unknown	Unknown[a]	Livestock	Active
762	200-300	Arikaree/Brule[b]	Livestock	Active
763	200-300	Arikaree/Brule[b]	Livestock	Active

Table 2.2-11 Active, Inactive, Seasonal and Abandoned Water Supply Wells in the Marsland Expansion Area and 2.25 mile AOR

Well No.	Estimated Depth (ft)	Formation	Well Use	Well Status
764	200-300	Arikaree/Brule[b]	Livestock	Active
765	200-300	Arikaree/Brule[b]	Livestock	Active
767	200-300	Arikaree/Brule[b]	Livestock	Active
768	200-300	Arikaree/Brule[b]	Domestic	Active
769	200-300	Arikaree/Brule[b]	Livestock	Active
771	200-300	Arikaree/Brule[b]	Livestock	Active
772	200-300	Arikaree/Brule[b]	Livestock	Active
773	200-300	Arikaree/Brule[b]	Livestock	Active
775	220	Arikaree/Brule[b]	Livestock	Active
776	200-300	Arikaree/Brule[b]	Livestock	Active
781	60	Arikaree/Brule	Livestock	Active
782	100	Brule[b]	Agricultural	Active
783	70	Arikaree/Brule[b]	Domestic	Active
784	40-60	Arikaree/Brule[b]	Livestock	Inactive [d]
785	140	Arikaree/Brule[b]	Livestock	Inactive [d]
786	140	Arikaree/Brule[b]	Livestock	Inactive [d]
791	Unknown	Unknown[a]	Livestock	Active
792	Unknown	Unknown[a]	Livestock	Active
793	300	Arikaree/Brule[b]	Livestock	Active
798	200	Brule	Livestock	Active
800	Unknown	Unknown[a]	Livestock	Active
801	220	Arikaree/Brule[b]	Domestic/Garden	Active
803	Unknown	Unknown[a]	Livestock	Active
804	260	Arikaree/Brule[b]	Domestic/Livestock	Active
805	Shallow	Unknown[a]	Livestock	Inactive [d]
806	Unknown	Unknown[a]	Livestock	Inactive [d]
808	160	Arikaree/Brule[b]	Domestic/Livestock	Active
812	260	Unknown[a]	Domestic/Livestock	Active
813	280	Unknown[a]	Livestock	Active
818	140	Arikaree/Brule[b]	Livestock	Active
819	140	Arikaree/Brule[b]	Livestock	Active
822	140	Brule[b]	Livestock	Active
823	100	Arikaree/Brule[b]	Livestock	Active
827	Unknown	Unknown[a]	Livestock	Active
828	160	Arikaree/Brule[b]	Domestic	Active
837	300	Brule[b]	Livestock	Active
838	300	Arikaree/Brule[b]	Livestock	Active
839	300	Arikaree/Brule[b]	Livestock	Active
840	300	Arikaree/Brule[b]	Livestock	Active
842	300	Arikaree/Brule[b]	Livestock	Active
846	Unknown	Unknown[a]	Livestock	Active
849	Unknown	Unknown[a]	Livestock	Active
850	200	Arikaree/Brule[b]	Agricultural	Active
851	140	Arikaree/Brule[b]	Agricultural	Active

Table 2.2-11 Active, Inactive, Seasonal and Abandoned Water Supply Wells in the Marsland Expansion Area and 2.25 mile AOR

Well No.	Estimated Depth (ft)	Formation	Well Use	Well Status
852	140	Arikaree/Brule[b]	Agricultural	Inactive
853	150	Arikaree/Brule[b]	Agricultural	Active
856	Unknown	Unknown[a]	Agricultural	Inactive [d]
857	40-50	Arikaree/Brule[b]	Domestic/Agricultural	Inactive [d]
858	200	Arikaree/Brule[b]	Agricultural	Active
859	120	Arikaree/Brule[b]	Domestic	Inactive [d]
861	40	Arikaree/Brule[b]	Domestic/Livestock/ Agricultural	Active
862	155	Arikaree/Brule[b]	Domestic/Agricultural	Active
ABANDONED WELLS				
726A	300	Brule	Unknown	Abandoned[f]
863A	1110	Basal Chadron	Monitor	Abandoned[g]
864A	1045	Basal Chadron	Monitor	Abandoned[g]
865A	1010	Basal Chadron	Monitor	Abandoned[g]
866A	935	Basal Chadron	Monitor	Abandoned[g]
867A	60	Arikaree	Domestic	Abandoned[f]
868A	Unknown	Unknown[a]	Unknown	Abandoned[f]

[a] Discussions with land owners regarding known estimated completion depths of private water wells in the area suggest that these wells are completed within the Arikaree formation or the Brule Formation or a combination of both.

[b] Information provided by private well owner and nearby well data indicate that one or more aquifer is used, but cannot be specifically determined. Assigned formation based on available information.

[c] Wells are not active year-round. Wells are used seasonally and sampled when active, resulting in irregular sampling events.

[d] Well is inoperable, resulting in partial sampling events.

[e] CBR driller water supply.

[f] Abandonment record unavailable from Nebraska Department of Natural Resources.

[g] Records available in Appendix D-2.

Table 2.2-12 Minimal Horizontal Distance Separating a Municipal Water Well from Potential Sources of Contamination

Potential Source of Contamination	Distance	
	Feet	Meters
Water well	1,000	305
Sewage lagoon	1,000	305
Land application of municipal/industrial waste material	1,000	305
Feedlot or feedlot runoff	1,000	305
Underground disposal system (septic system, cesspool, etc.)	500	153
Corral	500	153
Pit toilet/vault toilet	500	153
Wastewater holding tanks	500	153
Sanitary landfill/dump	500	153
Chemical or petroleum product storage	500	153
Sanitary treatment plant	500	153
Sewage wet well	500	153
Sanitary sewer connection	100	153
Sanitary sewer manhole	100	153
Sanitary sewer line	50	15

Source: NDHHS 2010.

Table 2.3-1 Historical and Current Population Change for Counties and Cities within 80 Km of the Marsland Expansion Area,1970-2010

State County City	Population					Average Annual Percent Change			
	1970	1980	1990	2000	2010	1970/ 1980	1980/ 1990	1990/ 2000	2000/ 2010
Nebraska									
Dawes County	**9,761**	**9,609**	**9,021**	**9,060**	**9,182**	**-1.6%**	**-6.1%**	**0.4%**	**1.3%**
Chadron	5,921	5,933	5,588	5,634	5,851	0.2%	-5.8%	0.8%	3.9%
Crawford	1,291	1,315	1,115	1,107	997	1.9%	-15.2%	-0.7%	-9.9%
Fort Robinson	NA	NA	NA	NA	NA	NA	NA	NA	NA
Marsland	17	27	NA	NA	NA	58.8%	NA	NA	NA
Whitney	82	72	38	87	77	-12.2%	-47.2%	128.9%	-11.5%
Box Butte County	**10,094**	**13,696**	**13,130**	**12,158**	**11,308**	**35.7%**	**-4.1%**	**-7.4%**	**-7.0%**
Alliance	6,862	9,869	9,765	8,959	8,491	43.8%	-1.1%	-8.3%	-5.2%
Berea	NA	NA	NA	NA	41	NA	NA	NA	NA
Hemingford	734	1,023	953	993	803	39.4%	-6.8%	4.2%	-19.1%
Garden County	**2,929**	**2,802**	**2,460**	**2,292**	**2,057**	**-4.3%**	**-12.2%**	**-6.8%**	**-10.3%**
Morrill County	**5,813**	**6,085**	**5,423**	**5,440**	**5,042**	**4.7%**	**-10.9%**	**0.3%**	**-7.3%**
Scotts Bluff County	**36,432**	**38,344**	**36,025**	**36,951**	**36,970**	**5.2%**	**-6.0%**	**2.6%**	**0.1%**
Minatare	939	969	807	810	816	3.2%	-16.7%	0.4%	0.7%
Mintle	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mitchell	1,842	1,956	1,743	1,831	1,702	6.2%	-10.9%	5.0%	-7.0%
Scottsbluff	14,507	14,156	13,711	14,732	15,039	-2.4%	-3.1%	7.4%	2.1%
Sheridan County	**7,285**	**7,544**	**6,750**	**6,198**	**5,469**	**3.6%**	**-10.5%**	**-8.2%**	**-11.8%**
Clinton	NA	NA	NA	30	41	NA	NA	NA	36.7%
Hay Springs	682	794	693	652	570	16.4%	-12.7%	-5.9%	-12.6%
Pine Ridge	NA	NA	16	14	NA	NA	NA	-12.5%	NA
Rushville	1,137	1,217	1,127	999	890	7.0%	-7.4%	-11.4%	-10.9%
Sioux County	**2,034**	**1,845**	**1,549**	**1,475**	**1,311**	**-9.3%**	**-16.0%**	**-4.8%**	**-11.1%**
Harrison	377	361	241	279	251	-4.2%	-33.2%	15.8%	-10.0%

Table 2.3-1 Historical and Current Population Change for Counties and Cities within 80 Km of the Marsland Expansion Area,1970-2010

State County City	Population					Average Annual Percent Change			
	1970	1980	1990	2000	2010	1970/ 1980	1980/ 1990	1990/ 2000	2000/ 2010
South Dakota									
Fall River County	**7,505**	**8,439**	**7,353**	**7,453**	**7,044**	**12.4%**	**-12.9%**	**1.4%**	**-5.5%**
Hot Springs	4,434	4,742	4,325	4,129	3,711	6.9%	-8.8%	-4.5%	-10.1%
Oelrichs	94	124	138	145	126	31.9%	11.3%	5.1%	-13.1%
Rumford	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ardmore	14	16	NA	NA	NA	14.3%	NA	NA	NA
Shannon County	**8,198**	**11,323**	**9,902**	**12,466**	**13,586**	**38.1%**	**-12.5%**	**25.9%**	**9.0%**
Wyoming									
Goshen County	**10,885**	**12,040**	**12,373**	**12,538**	**13,249**	**10.6%**	**2.8%**	**1.3%**	**5.7%**
Niobrara County	**2,924**	**2,924**	**2,499**	**2,407**	**2,484**	**0.0%**	**-14.5%**	**-3.7%**	**3.2%**
Van Tassell	21	10	8	19	15	-52.4%	-20.0%	137.5%	-21.1%

[1] 1980 was the last year that Ardmore had a recorded population.
Sources: U.S. Bureau of the Census 2011

Table 2.3-2 Population by Age and Sex for Counties Within the 80-Kilometer Radius of the Marsland Expansion Area 2010

County	Age	Male	Female	Total	Total Percent Breakdown
Nebraska					
Box Butte	Under 18	1,433	1,416	2,849	25.2%
	18 - 64	3,395	3,351	6,746	59.7%
	65+	713	1,000	1,713	15.1%
	Total	5,541	5,767	11,308	100.0%
Dawes	Under 18	906	860	1,766	19.2%
	18 - 64	2,999	2,917	5,916	64.4%
	65+	654	846	1,500	16.3%
	Total	4,559	4,623	9,182	100.0%
Morrill	Under 18	615	595	1,210	24.0%
	18 - 64	1,462	1,389	2,851	56.5%
	65+	440	541	981	19.5%
	Total	2,517	2,525	5,042	100.0%
Scotts Bluff	Under 18	4,637	4,515	9,152	24.7%
	18 - 64	10,574	11,029	21,603	58.3%
	65+	2,602	3,613	6,215	17.0%
	Total	17,813	19,157	36,970	100.0%
Sheridan	Under 18	661	632	1,293	23.6%
	18 - 64	1,473	1,491	2,964	54.2%
	65+	520	692	1,212	22.2%
	Total	2,654	2,815	5,469	100.0%
Sioux	Under 18	159	134	293	22.3%
	18 - 64	384	354	738	56.3%
	65+	130	150	280	21.4%
	Total	673	638	1,311	100.0%
South Dakota					
Fall River	Under 18	706	628	1,334	18.8%
	18 - 64	2,106	2,016	4,122	58.1%
	65+	291	1,347	1,638	23.1%
	Total	3,103	3,991	7,094	100.0%
Shannon	Under 18	2,737	2,605	5,342	39.3%
	18 - 64	3,636	3,809	7,445	54.8%
	65+	328	471	799	5.9%
	Total	6,701	6,885	13,586	100.0%
Wyoming					
Goshen	Under 18	1,411	1,290	2,701	20.4%
	18 - 64	4,340	3,708	8,048	60.7%
	65+	1,155	1,345	2,500	18.9%
	Total	6,906	6,343	13,249	100.0%
Niobrara	Under 18	259	211	470	18.9%
	18 - 64	665	836	1,501	60.4%
	65+	235	278	513	20.7%
	Total	1,159	1,325	2,484	100.0%

Source: USCB 2009a

Table 2.3-3 Population Projections for Counties Within an 80-Kilometer Radius of the Current Crow Butte Project Area 2000 - 2020

County	Census 2000	Census 2010	Projected 2020	Projected 2025	Projected 2030
Box Butte	12,158	11,308	9,588	8,827	8,050
Dawes	9,060	9,182	8,646	8,451	8,207
Garden	2,292	2,057	1,737	1,664	1,595
Morrill	5,423	5,042	4,886	4,761	4,625
Scotts Bluff	36,025	36,970	35,627	35,148	34,647
Sheridan	6,198	5,469	5,261	5,170	5,086
Sioux	1,475	1,311	1,271	1,189	1,103
Fall River	7,453	7,094	N/A	N/A	N/A
Shannon	12,466	13,586	N/A	N/A	N/A
Goshen	12,538	13,249	11,820	11,790	11,800
Niobrara	2,407	2,484	2,330	2,330	2,240

Sources: University of Nebraska-Lincoln, Bureau of Business Research 2009.
Wyoming Department of Administration and Information 2010.

N/A No projection available

Table 2.3-4 2010 Population Within an 80-Kilometer Radius of the Marsland Expansion Area

	0-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	Total
N	0	0	0	1	1	525	37	58	73	107	137	162	183	1,284
NNE	0	0	0	1	1	327	44	63	88	113	137	169	289	1,232
NE	0	0	0	1	1	7	33	60	249	233	134	133	682	1,533
ENE	0	0	0	1	1	7	29	48	679	5,100	138	159	437	6,599
E	0	0	0	1	1	7	29	48	70	103	282	733	247	1,521
ESE	0	0	0	1	1	7	29	48	68	114	187	128	63	646
SE	0	0	0	1	1	7	29	58	161	242	262	471	8,230	9,462
SSE	0	0	0	1	1	7	29	111	188	211	158	185	640	1,531
S	0	0	0	1	1	7	29	88	128	136	133	193	875	1,591
SSW	0	0	0	1	1	6	15	21	29	62	97	115	1,083	1,430
SW	0	0	0	1	1	3	13	21	29	41	69	103	315	596
WSW	0	0	0	0	0	3	13	21	29	38	58	85	98	345
W	0	0	0	0	0	3	13	21	29	38	52	62	72	290
WNW	0	0	0	0	0	3	13	21	29	38	33	32	37	206
NW	0	0	0	1	1	3	13	21	29	38	60	89	66	321
NNW	0	0	0	1	11	270	17	21	29	65	133	153	168	868
Total	0	0	0	13	23	1,192	385	729	1,907	6,679	2,070	2,972	13,485	29,455

Notes:
[a] Current population living between 10 km and 80 km of the mine site was estimated using 2010 Census data. See Section 2.3.1 for a detailed description of the methodology.

Table 2.3-5 Annual Average Labor Force and Employment Economic Sectors for Dawes and Box Butte Counties 1994 and 2009

Sectors	Dawes		Box Butte	
	1994	**2009**	**1994**	**2009**
Labor Force	4,490	4,788	6,156	5,821
Unemployment	149	210	235	397
Unemployment Rate	3.3	4.4	3.8	6.8
Employment	4,341	4,578	5,921	5,424
Farm Employment	862	877	763	213
Non-Farm Employment Total	3,479	3,701	5,446	5,315
Manufacturing	165	13	402	N/A
Construction and Mining	136	228	80	126
Transportation, Communication, and Utilities	N/A	N/A	1,909	2,305
Retail	824	673	840	429
Wholesale	128	87	265	298
Financial, Insurance, and Real Estate	77	123	215	168
Information	N/A	46	N/A	103
Professional and Business Services	N/A	N/A	N/A	170
Education and Health Services	N/A	449	N/A	428
Leisure and Hospitality	N/A	507	N/A	433
Other Services	N/A	119	N/A	145
Government	1,384	1,000	955	1,095
Federal	144	124	65	61
State	721	297	67	75
Local	519	579	824	960

N/A = not available
Sources: NDOL 2010

Table 2.3-6 Population and Demographics for Census Blocks Overlain or Adjacent to the MEA with Populations Recorded in 2010 Census

Population	Nebraska	Percent of Nebraska Pop.	Dawes County	Percent of Dawes County Pop.	Block Group 3, Census Tract 9506, Dawes County									
					Block 3332	% of Block 3332	Block 3446	% of Block 3446	Block 3457	% of Block 3457	Block 3572	% of Block 3572	Block 3573	% of Block 3573
Total Population	1,826,341	100.0%	9,182	100.0%	19	100%	1	100%	1	100%	3	100%	8	100%
White alone	1,572,838	86.1	8,208	89.4	19	100%	1	100%	1	100%	3	100%	8	100%
Black or African American	82,885	4.5	134	1.5	0	0%	0	0%	0	0%	0	0%	0	0%
American Indian and Alaska Native	18,427	1.0	362	3.9	0	0%	0	0%	0	0%	0	0%	0	0%
Asian alone	32,293	1.8	95	1.0	0	0%	0	0%	0	0%	0	0%	0	0%
Native Hawaiian and Other Pacific Islander	1,279	0.1	46	0.5	0	0%	0	0%	0	0%	0	0%	0	0%
Some other race	79,109	4.3	104	1.1	0	0%	0	0%	0	0%	0	0%	0	0%
Two or more races	39,510	2.2	233	2.5	0	0%	0	0%	0	0%	0	0%	0	0%
Hispanic or Latino	167,405	9.2	306	3.3	1	5.3%	0	0%	0	0%	0	0%	0	0%
Percent below poverty level +	12.2%	-	20.4%	-	-	-	-	-	-	-	-	-	-	-

* data for Block Group only
\+ USCB 2009b [SAIPE data for 2009 (SAPIE = Small Are Income and Poverty estimates)
Source: USCB 2011

Table 2.4-1 Scenic Quality Inventory and Evaluation for the Marsland Expansion Area

Key Factor	Rating Criteria	Score
Landform	Flat to rolling terrain with no interesting landscape features	1
Vegetation	Some variety of vegetation; cropland, range, riparian	3
Water	Water is present, but not evident as viewed from residences and roads	0
Color	Some variety in colors and contrasts with vegetation and soil	3
Influence of adjacent scenery	Low influence due to lack of topographical relief and similar adjacent scenery	1
Scarcity	Landscape is common for the region	1
Cultural modifications	Existing modifications are agricultural, and introduce no discordant elements	0
	Total Score	9

Table 2.4-2 Determining BLM Visual Resource Inventory Classes

Visual Sensitivity		High			Medium			Low
Special Areas		I	I	I	I	I	I	I
Scenic Quality	A	II	II	II	II	II	II	II
	B	II	III	III/IV	III	IV	IV	IV
	C	III	IV	IV	IV	IV	IV	IV
Distance Zones		f/m	b	ss	f/m	b	ss	ss

f/m = foreground-middleground
b = background
ss = seldom seen

Table 2.5-1 Meteorological Stations Included in Climate Analysis

Name	Agency	X	Y	Z (ft)	Years Operation
Alliance	NWS	−102° 54'	42° 6'	3,990	1894 – 2010
Atkinson	NWS	−98° 58'	42° 33'	2,130	1906 – 2010
North Platte	NWS	−100° 41'	41° 8'	2,780	1948 – 2010
Gregory	NWS	−99° 26'	43° 14'	2,160	1906 – 2010
Rapid City	NWS	−103° 4'	44° 3'	3,160	1948 – 2009
Long Valley	NWS	−101° 30'	43° 28'	2,470	1927 – 2010
Lusk	NWS	−104° 29'	42° 45'	5,090	1893 – 2007
Springview	NWS	−99° 45'	42° 49'	2,450	1893 – 2010
Ainsworth	NWS	−99° 52'	42° 33'	2,510	1905 – 2010
Mullen	NWS	−101° 3'	42° 3'	3,250	1893 – 2010
Kimball	NWS	−103° 40'	41° 14'	4,710	1893 – 2010
Newcastle	NWS	−104° 13'	43° 51'	4,410	1906 – 2010
Chugwater	NWS	−104° 49'	41° 45'	5,300	1900 – 2010
Cheyenne	NWS	−104° 49'	41° 09'	6,120	1915 – 2010
Sidney	NWS	−103° 0'	41° 14'	4,320	1908 – 2010
Scottsbluff	NWS	−103° 36'	41° 52'	3,950	1893 – 2010
Valentine	NWS	−100° 33'	42° 52'	2,590	1948 – 2010
Rushville	NWS	−102° 26'	42° 43'	3,760	1941 – 2010
Hay Springs	NWS	−102° 42'	42° 30'	3,810	1951 – 2010
Oelrichs	NWS	−103° 14'	43° 11'	3,350	1893 – 2010
Mt Rushmore	NWS	-103° 27'	43° 53'	5,170	1962 - 2010
MEA (on-site)	Cameco	-103° 15’	42° 30’	4,200	2010 - 2011

Source: National Climate Data Center 2011; Cameco Resources, Inc. 2011.

Note: NWS = National Weather Service

MEA: Marsland Expansion Area

Table 2.5-2 Annual and Monthly Temperature Statistics for Scottsbluff Airport, NE

Month	Temperature Statistics (º Fahrenheit)				
	Monthly Average	Monthly Maximum	Monthly Minimum	Average Daily High	Average Daily Low
Jan	26.8	69	−28	39.4	12.3
Feb	29.2	74	−22	43.2	15.4
Mar	37.5	81	−7	50.9	22.5
Apr	45.6	86	1	61.5	32.1
May	56.2	99	18	71.3	42.4
Jun	66.6	104	32	82.0	52.1
Jul	74.5	107	32	89.4	58.0
Aug	71.0	103	32	87.5	55.7
Sep	60.8	102	25	78.2	45.2
Oct	46.9	90	1	65.9	33.2
Nov	35.5	79	−13	51.2	21.9
Dec	26.0	72	−26	40.8	13.9

Source: National Climate Data Center 2011, hourly data from 1996 through 2011

Table 2.5-3 Scottsbluff Airport Monthly Wind Parameters Summary

Month	Hourly Average Wind Speeds (mph)		
	Monthly Average	Monthly Maximum	Monthly Minimum
Jan	8.9	39	0
Feb	9.5	44	0
Mar	10.1	43	0
Apr	10.7	43	0
May	10.4	49	0
Jun	9.1	48	0
Jul	7.7	49	0
Aug	7.3	32	0
Sep	7.4	56	0
Oct	8.3	39	0
Nov	8.5	45	0
Dec	8.6	40	0

Source: National Climate Data Center 2011, hourly data from 1996 through 2011

Table 2.5-4 Scottsbluff Airport 15-Year Wind Frequency Distribution

Relative Frequency (% of Recorded Winds) for Wind Rose at Scottsbluff Airport, NE							
11/01/1996 Hr. 1 to 8/31/2011 Hr. 23							
Wind Direction (degrees)	**0.0 – 4.0**	**4.0 – 7.4**	**7.4 – 12.1**	**12.1 – 19.0**	**19.0 – 25.8**	**25.8 – 100.0**	**Row Total**
	mph						
0.0	1.1	1.8	1.4	1.1	0.3	0.1	5.8
22.5	0.6	1.0	1.0	0.6	0.2	0.0	3.4
45.0	0.6	0.9	0.9	0.6	0.1	0.0	3.1
67.5	0.7	1.3	1.0	0.5	0.1	0.0	3.5
90.0	1.5	4.8	3.5	0.7	0.0	0.0	10.5
112.5	0.9	3.2	5.0	2.2	0.2	0.0	11.5
135.0	0.6	1.6	2.5	1.5	0.2	0.0	6.4
157.5	0.4	1.0	1.1	0.9	0.2	0.0	3.6
180.0	0.5	0.8	0.8	0.5	0.1	0.0	2.7
202.5	0.2	0.4	0.3	0.2	0.0	0.0	1.1
225.0	0.2	0.2	0.2	0.1	0.0	0.0	0.8
247.5	0.2	0.3	0.2	0.1	0.0	0.0	0.9
270.0	0.7	1.6	2.0	1.5	0.6	0.2	6.6
292.5	0.9	3.1	4.3	2.8	0.8	0.3	12.2
315.0	1.2	3.8	3.5	2.0	0.8	0.6	11.9
337.5	1.1	2.2	1.5	1.5	0.7	0.3	7.3
TOTAL	**11.3**	**28.0**	**29.3**	**16.7**	**4.3**	**1.6**	**91.2**
0 mph (8.8%) Invalid readings: 4,453 Number of possible readings: 149,723 Valid readings: 146,270 Data capture: 97.03%							

Source: National Climate Data Center 2011, hourly data from 1996 through 2011

Table 2.5-5 Marsland Expansion Area Maximum, Minimum and Average Monthly Temperatures

Month	Temperature Statistics (º Fahrenheit)		
	Monthly Average	Monthly Minimum	Monthly Maximum
Jan	23.4	−14.4	55.6
Feb	21.9	−27.9	63.4
Mar	35.4	3.1	69.2
Apr	41.9	22.5	78.9
May	49.0	22.1	82.9
Jun	62.7	41.3	92.1
Jul	73.7	50.3	98.6
Aug	72.1	39.7	99.0
Sep	59.7	30.3	90.1
Oct	49.9	18.5	82.7
Nov	33.1	−4.7	72.3
Dec	27.1	−3.3	55.6

Source: Crow Butte Resources, Inc. 2011 data from 8/24/2010 to 8/29/2011

Table 2.5-6 Marsland Meteorological Summary

Meteorological Data Summary 8/24/2010 – 8/29/2011			
Hourly Data			
Parameter	**Average/Total**	**Maximum**	**Minimum**
Wind Speed (mph)	10.6	40.5	0.0
Sigma-Theta (°)	21.6	99.9	0.0
Temperature (°F)	46.3	99.0	–27.9
10m Temperature (°F)	47.1	97.2	–22.3
Relative Humidity (%)	64.5	163.6	6.5
Precipitation (inches)	16.90	0.59	--
Solar Radiation (w/m^{-2})	173.1	939.0	--
Data Recovery			
Parameter	**Possible (Hours)**	**Reported (Hours)**	**Recovery (Percent)**
Wind Speed	8,893	8,708	97.92
Wind Direction	8,893	8,708	97.92
Sigma-Theta	8,893	8,708	97.92
Temperature	8,893	8,884	99.90
10m Temperature	8,893	8,884	99.90
Relative Humidity	8,893	8,884	99.90
Precipitation	8,893	8,884	99.90
Solar Radiation	8,893	8,884	99.90

Source: Crow Butte Resources, Inc. 2011, data from 8/24/2010 to 8/29/2011

Note: Predominant wind direction was from the NNW sector, accounting for 13.0% of the possible winds.

Table 2.5-7 Marsland Expansion Area Meteorological Station

Relative Frequency (% of Recorded Winds) for Wind Rose							
8/24/2010 Hr. 2 to 8/29/2011 Hr. 15							
Wind Direction (degrees)	**0.0 – 4.0**	**4.0 – 7.4**	**7.4 – 12.1**	**12.1 – 19.0**	**19.0 – 25.8**	**25.8 – 100.0**	**Row Total**
	mph						
0.0	1.3	1.6	2.4	2.5	0.7	0.2	8.8
22.5	0.8	0.8	1.5	1.2	0.3	0.1	4.8
45.0	0.7	0.7	0.9	0.8	0.0	0.0	3.3
67.5	0.6	0.9	1.0	0.6	0.0	0.0	3.2
90.0	0.6	1.2	1.4	0.7	0.0	--	3.9
112.5	0.8	1.6	1.8	0.6	0.1	0.0	4.9
135.0	1.0	1.7	1.9	0.7	0.1	--	5.4
157.5	1.0	1.6	1.9	1.6	0.4	0.1	6.6
180.0	1.1	1.3	1.7	1.8	0.5	0.0	6.4
202.5	1.2	1.4	1.4	1.0	0.2	0.0	5.3
225.0	0.8	1.3	1.6	0.7	0.2	0.0	4.7
247.5	0.9	1.5	2.0	1.3	0.4	0.0	6.2
270.0	0.7	0.9	1.5	1.6	0.5	0.3	5.4
292.5	0.7	1.0	1.4	2.4	1.0	0.4	7.0
315.0	0.8	1.5	2.2	3.2	2.3	0.9	10.9
337.5	1.6	2.9	3.0	3.2	1.5	0.7	13.0
TOTAL	**14.8**	**22.1**	**27.6**	**24.1**	**8.3**	**2.8**	**99.7**
0 mph (1.0%) Invalid readings: 185 Number of possible readings: 8,894 Valid readings: 8,708 Data capture: 97.92%							

Source: Cameco Resources, Inc. 2011. Meteorological data from 8/24/2010 to 8/29/2011.

Table 2.5-8 Marsland Expansion Annual Wind Summary

8/24/2010 2:00:00 AM – 8/29/2011 3:00:00 PM			
Hourly Data			
Parameter	**Average**	**Maximum**	**Minimum**
Wind Speed (mph)	10.59	40.51	--
Sigma Theta (°)	21.61	99.90	--
Wind Speed by Direction (mph)			
N	10.82	32.70	0.16
NNE	10.13	39.89	0.27
NE	8.64	26.80	1.07
ENE	8.16	27.72	0.79
E	8.27	22.53	--
ESE	7.79	29.17	--
SE	7.93	22.80	--
SSE	9.81	28.86	--
S	10.28	29.51	--
SSW	8.41	26.62	0.00
SW	8.52	26.31	0.58
WSW	9.80	32.57	0.87
W	12.01	36.62	0.76
WNW	13.24	40.51	1.04
NW	14.46	39.91	--
NNW	11.89	40.22	--
Data Recovery			
	Possible (Hours)	Reported (Hours)	Recovery (%)
Wind Speed	8,917	8,708	97.66
Sigma Theta	8,917	8,708	97.66
Wind Direction	8,917	8,708	97.66

Source: Cameco Resources, Inc. 2011, data from 8/24/2010 to 8/29/2011
Note: Predominant wind direction was from the NNW sector, accounting for 13% of the winds; the average wind direction was 307°.

Table 2.5-9 Marsland Annual Joint Frequency Distribution

Stability Class	Wind Direction	Wind Speed (mph) – One Year (Calm = 1.0%)					
		0 – 3	4 – 7	8 – 12	13 – 18	19 – 24	> 24
A	N	0.001414	0.002357				
	NNE	0.000236	0.001532				
	NE	0.000707	0.001886				
	ENE	0.000825	0.001768				
	E	0.000943	0.001768				
	ESE	0.001296	0.002593				
	SE	0.001061	0.002004				
	SSE	0.002121	0.002121				
	S	0.001768	0.002121				
	SSW	0.003536	0.002593				
	SW	0.001414	0.002239				
	WSW	0.000943	0.004007				
	W	0.001179	0.001179				
	WNW	0.000825	0.001179				
	NW	0.000589	0.002004				
	NNW	0.000589	0.002121				
B	N		0.002004	0.000236			
	NNE		0.002239				
	NE		0.002475	0.000118			
	ENE		0.001768				
	E		0.001768	0.000118			
	ESE	0.000354	0.002475	0.000354			
	SE	0.000118	0.003418	0.000354			
	SSE	0.000471	0.002475	0.000236			
	S	0.000471	0.002357	0.000707			
	SSW	0.000943	0.003182	0.000589			
	SW	0.000118	0.003064				
	WSW		0.002593	0.000471			
	W	0.000118	0.001296	0.000236			
	WNW	0.000118	0.001650	0.000118			
	NW		0.002357	0.000707			
	NNW		0.002121	0.000471			
C	N	0.000118	0.000589	0.010253			
	NNE		0.000589	0.004714			
	NE		0.000589	0.002946			
	ENE		0.000825	0.003418			
	E		0.001179	0.003300			
	ESE		0.001768	0.005539			
	SE	0.000354	0.001886	0.004125			
	SSE	0.000118	0.001532	0.004361			
	S	0.000354	0.001532	0.004950			
	SSW	0.000236	0.001414	0.004361			
	SW	0.000118	0.001886	0.005657			
	WSW		0.000825	0.006600			
	W		0.000707	0.004361			
	WNW		0.000471	0.004714			
	NW		0.000589	0.008132			
	NNW		0.000943	0.007778			

Table 2.5-9 Marsland Annual Joint Frequency Distribution

Stability Class	Wind Direction	Wind Speed (mph) - One Year (Calm = 1.0%)					
		0 - 3	4 - 7	8 - 12	13 - 18	19 - 24	> 24
D	N	0.000236	0.007307	0.019093	0.017796	0.004125	0.001414
	NNE	0.000236	0.004714	0.010725	0.008603	0.002239	0.000118
	NE		0.001886	0.009193	0.003064	0.000118	
	ENE		0.003064	0.007307	0.002004		0.000118
	E	0.000118	0.005775	0.010371	0.003182	0.000118	
	ESE	0.000471	0.008839	0.009193	0.003064	0.000236	0.000118
	SE	0.000236	0.010489	0.012139	0.003889	0.000354	
	SSE	0.000118	0.007543	0.016500	0.009546	0.003418	0.000118
	S	0.000118	0.005186	0.013082	0.013789	0.002829	0.000118
	SSW	0.000118	0.003889	0.008957	0.006718	0.001179	
	SW	0.000236	0.004832	0.007896	0.003654	0.001414	
	WSW	0.000118	0.005068	0.014614	0.008721	0.002475	0.000236
	W		0.004125	0.012728	0.012610	0.002946	0.002357
	WNW	0.000118	0.003771	0.014850	0.019564	0.007189	0.002946
	NW	0.000118	0.006836	0.019093	0.030053	0.016971	0.005893
	NNW	0.000707	0.013553	0.023689	0.028167	0.012375	0.004478
E	N	0.001532	0.002357	0.000471			
	NNE	0.000707	0.001296	0.000354			
	NE		0.001650	0.000236			
	ENE		0.002004	0.000471			
	E	0.000589	0.001532	0.000589			
	ESE	0.000354	0.003064	0.000236			
	SE	0.000825	0.002004	0.000236			
	SSE	0.000707	0.002475	0.000471			
	S	0.000354	0.002711	0.000236			
	SSW		0.002004	0.000236			
	SW	0.000354	0.002946	0.000589			
	WSW	0.000354	0.002829	0.001061			
	W	0.000118	0.002004	0.000943			
	WNW	0.000707	0.001296	0.000825			
	NW	0.000589	0.003536	0.001414			
	NNW	0.000943	0.009664	0.001886			
F	N	0.009782	0.007071				
	NNE	0.006953	0.002829				
	NE	0.006364	0.001179				
	ENE	0.005421	0.002593				
	E	0.004478	0.003536				
	ESE	0.005186	0.003182				
	SE	0.006718	0.003418				
	SSE	0.006128	0.004832				
	S	0.007543	0.003418				
	SSW	0.006600	0.004950				
	SW	0.005775	0.004361				
	WSW	0.007307	0.004714				
	W	0.005657	0.002946				
	WNW	0.005775	0.005539				
	NW	0.006718	0.004596				
	NNW	0.013318	0.008368				

Source: Crow Butte Resources, Inc. 2011, data from 8/24/2010 to 8/29/2011

Table 2.5-10 Marsland Winter Joint Frequency Distribution

Stability Class	Wind Direction	Wind Speed (mph) – Winter (Calm = 1.7%)						Row Total
		< 3	4 – 7	8 – 12	13 – 18	19 – 24	> 24	
A	N	0.000512	0.000463					0.000975
	NNE		0.000463					0.000463
	NE	0.001025	0.000463					0.001488
	ENE							
	E	0.001025	0.000926					0.001951
	ESE	0.000512	0.001389					0.001901
	SE	0.001537	0.001389					0.002926
	SSE	0.001025	0.000463					0.001488
	S	0.000512	0.001389					0.001901
	SSW	0.002562	0.001389					0.003951
	SW	0.002050	0.001852					0.003902
	WSW	0.001025	0.001389					0.002414
	W	0.000512	0.001389					0.001901
	WNW	0.000512	0.000926					0.001438
	NW	0.000512	0.002778					0.003290
	NNW	0.000512	0.001852					0.002364
B	N		0.000463					0.000463
	NNE		0.000926					0.000926
	NE		0.001852					0.001852
	ENE		0.000463					0.000463
	E		0.000463	0.000463				0.000926
	ESE	0.001025	0.000926					0.001951
	SE		0.000463					0.000463
	SSE	0.000512	0.001389					0.001901
	S		0.000463					0.000463
	SSW		0.001852	0.000463				0.002315
	SW		0.002315					0.002315
	WSW		0.000463					0.000463
	W		0.001389					0.001389
	WNW		0.002778					0.002778
	NW		0.001852					0.001852
	NNW		0.000926	0.000463				0.001389
C	N		0.000463	0.005093				0.005556
	NNE			0.003704				0.003704
	NE		0.000463	0.001852				0.002315
	ENE			0.000463				0.000463
	E		0.000463	0.000463				0.000926
	ESE		0.001389					0.001389
	SE	0.000512	0.003241	0.001389				0.005142
	SSE		0.000926	0.001852				0.002778
	S	0.000512	0.000926	0.001389				0.002827
	SSW	0.000512	0.000463	0.000926				0.001901
	SW	0.000512	0.001852	0.002315				0.004679
	WSW			0.004630				0.004630
	W		0.000926	0.001389				0.002315
	WNW			0.003704				0.003704
	NW		0.000463	0.005556				0.006019
	NNW		0.000463	0.005556				0.006019

Table 2.5-10 Marsland Winter Joint Frequency Distribution

Stability Class	Wind Direction	Wind Speed (mph) – Winter (Calm = 1.7%)						Row Total
		< 3	4 – 7	8 – 12	13 – 18	19 – 24	> 24	
D	N	0.000512	0.008333	0.026852	0.014815	0.003241	0.001389	0.055142
	NNE	0.000512	0.005556	0.013426	0.003704			0.023198
	NE		0.001389	0.009259	0.001389	0.000463		0.012500
	ENE		0.003704	0.009259	0.000463		0.000463	0.013889
	E	0.000512	0.005556	0.005556	0.000463			0.012086
	ESE	0.001537	0.009259	0.009259	0.000926			0.020982
	SE		0.007407	0.010648	0.004167	0.000926		0.023148
	SSE		0.004167	0.013889	0.005093	0.002315		0.025463
	S		0.004630	0.011574	0.011111	0.001389		0.028704
	SSW		0.002778	0.007407	0.003704	0.000463		0.014352
	SW		0.003241	0.006944	0.002315	0.000463		0.012963
	WSW	0.000512	0.006944	0.021296	0.012037	0.005093		0.045883
	W		0.008333	0.023148	0.021296	0.006019	0.002778	0.061574
	WNW	0.000512	0.004167	0.025000	0.033796	0.012500	0.002778	0.078753
	NW	0.000512	0.007407	0.023148	0.047222	0.025926	0.003241	0.107457
	NNW	0.000512	0.009259	0.029167	0.036111	0.011111	0.006481	0.092642
E	N	0.000512	0.002315	0.000926				0.003753
	NNE	0.001537	0.000463					0.002000
	NE		0.000926	0.000463				0.001389
	ENE		0.001852					0.001852
	E	0.000512	0.000926	0.000463				0.001901
	ESE		0.000926	0.000463				0.001389
	SE	0.000512	0.001389					0.001901
	SSE	0.000512	0.000926					0.001438
	S	0.000512	0.002778					0.003290
	SSW		0.001389	0.000926				0.002315
	SW	0.000512	0.003241	0.000463				0.004216
	WSW	0.001025	0.004630	0.001389				0.007043
	W		0.002778	0.003241				0.006019
	WNW	0.001537	0.000926	0.001389				0.003852
	NW	0.000512	0.004630	0.001852				0.006994
	NNW	0.001537	0.006019	0.000926				0.008482
F	N	0.013323	0.005556					0.018878
	NNE	0.008199	0.001852					0.010051
	NE	0.006149						0.006149
	ENE	0.005124	0.003241					0.008365
	E	0.004612	0.003241					0.007853
	ESE	0.008199	0.002315					0.010514
	SE	0.007686	0.003241					0.010927
	SSE	0.010248	0.003704					0.013952
	S	0.010761	0.002778					0.013539
	SSW	0.012298	0.004630					0.016928
	SW	0.009736	0.005556					0.015292
	WSW	0.010761	0.005093					0.015853
	W	0.009736	0.005093					0.014829
	WNW	0.005124	0.006944					0.012069
	NW	0.006149	0.005556					0.011705
	NNW	0.012810	0.005093					0.017903

Source: Crow Butte Resources, Inc. 2011, data from 8/24/2010 to 8/29/2011

Table 2.5-11 Marsland Spring Joint Frequency Distribution

Stability Class	Wind Direction	Wind Speed (mph) – Spring (Calm = 0.6%)						Row Total
		< 3	4 – 7	8 – 12	13 – 18	19 – 24	> 24	
A	N	0.001473	0.001836					0.003309
	NNE		0.001836					0.001836
	NE	0.000491	0.001377					0.001868
	ENE	0.000982	0.000918					0.001900
	E	0.000982	0.002295					0.003277
	ESE	0.000491	0.002295					0.002786
	SE		0.002295					0.002295
	SSE	0.001473	0.000918					0.002391
	S	0.001473	0.002754					0.004226
	SSW	0.001473	0.002295					0.003767
	SW	0.000491	0.002295					0.002786
	WSW	0.000491	0.005507					0.005998
	W	0.000982	0.001377					0.002359
	WNW	0.001964	0.002295					0.004258
	NW	0.000491	0.000918					0.001409
	NNW	0.000491	0.002295					0.002786
B	N		0.001836					0.001836
	NNE		0.001836					0.001836
	NE		0.002295					0.002295
	ENE		0.000918					0.000918
	E		0.001836					0.001836
	ESE		0.001377	0.001377				0.002754
	SE		0.003212					0.003212
	SSE	0.000491	0.002295					0.002786
	S	0.000491	0.003671	0.000918				0.005080
	SSW		0.002754	0.000459				0.003212
	SW		0.002754					0.002754
	WSW		0.003212	0.000918				0.004130
	W		0.002295	0.000459				0.002754
	WNW		0.001836					0.001836
	NW		0.002754	0.000459				0.003212
	NNW		0.001836					0.001836
C	N			0.015603				0.015603
	NNE		0.000459	0.007802				0.008261
	NE		0.000459	0.005048				0.005507
	ENE		0.000918	0.006425				0.007343
	E		0.000918	0.003212				0.004130
	ESE		0.001836	0.006884				0.008720
	SE		0.001377	0.005048				0.006425
	SSE		0.001377	0.005507				0.006884
	S		0.002295	0.007343				0.009637
	SSW		0.000459	0.004589				0.005048
	SW		0.001377	0.007802				0.009179
	WSW		0.000459	0.009179				0.009637
	W		0.000459	0.005966				0.006425
	WNW			0.005048				0.005048
	NW		0.000459	0.009637				0.010096
	NNW		0.000918	0.009637				0.010555

Table 2.5-11 Marsland Spring Joint Frequency Distribution

Stability Class	Wind Direction	Wind Speed (mph) – Spring (Calm = 0.6%)						Row Total
		< 3	4 – 7	8 – 12	13 – 18	19 – 24	> 24	
D	N		0.005048	0.020193	0.033043	0.005048		0.063332
	NNE		0.005507	0.013768	0.012391	0.004130		0.035796
	NE		0.002754	0.012850	0.006884			0.022487
	ENE		0.002754	0.006884	0.004130			0.013768
	E		0.005048	0.015603	0.009179	0.000459		0.030289
	ESE		0.008720	0.010096	0.006425	0.000459		0.025700
	SE	0.000491	0.011014	0.011473	0.006425			0.029403
	SSE		0.006884	0.019734	0.010555	0.009637	0.000459	0.047269
	S		0.003671	0.010096	0.012850	0.007343	0.000459	0.034419
	SSW		0.005507	0.010096	0.010555	0.003212		0.029371
	SW	0.000491	0.004130	0.007343	0.001377	0.000918		0.014259
	WSW		0.001377	0.013768	0.008261	0.001836	0.000918	0.026159
	W		0.001836	0.010096	0.015603	0.003212	0.006425	0.037173
	WNW		0.002295	0.018816	0.014227	0.008720	0.003671	0.047728
	NW		0.006884	0.019275	0.033961	0.013309	0.008261	0.081689
	NNW		0.007343	0.024782	0.032584	0.015603	0.003212	0.083525
E	N	0.000491	0.001377	0.000459				0.002327
	NNE	0.000491	0.000918	0.000459				0.001868
	NE		0.002754					0.002754
	ENE		0.001836					0.001836
	E	0.000491	0.002754	0.001377				0.004621
	ESE		0.003671	0.000459				0.004130
	SE	0.000982	0.002295					0.003277
	SSE	0.000491	0.002754					0.003245
	S	0.000491	0.002295					0.002786
	SSW		0.000459					0.000459
	SW	0.000491	0.002295	0.000459				0.003245
	WSW		0.001377					0.001377
	W		0.000459					0.000459
	WNW	0.000982	0.002295					0.003277
	NW	0.000491	0.001377	0.000918				0.002786
	NNW	0.000491	0.005048	0.001377				0.006916
F	N	0.004418	0.005507					0.009926
	NNE	0.004909	0.001836					0.006745
	NE	0.003928	0.000918					0.004845
	ENE	0.001473	0.002295					0.003767
	E	0.003437	0.003671					0.007108
	ESE	0.003437	0.004589					0.008026
	SE	0.004418	0.002295					0.006713
	SSE	0.004909	0.004130					0.009040
	S	0.004909	0.002754					0.007663
	SSW	0.000982	0.005048					0.006030
	SW	0.002946	0.002295					0.005240
	WSW	0.002455	0.002754					0.005208
	W	0.001964	0.002754					0.004717
	WNW	0.004418	0.002754					0.007172
	NW	0.006873	0.003671					0.010545
	NNW	0.007364	0.004130					0.011494

Source: Crow Butte Resources, Inc. 2011, data from 8/24/2010 to 8/29/2011

Table 2.5-12 Marsland Summer Joint Frequency Distribution

Stability Class	Wind Direction	Wind Speed (mph) – Summer (Calm = 0.2%)						Row Total
		< 3	4 – 7	8 – 12	13 – 18	19 – 24	> 24	
A	N	0.002875	0.004710					0.007585
	NNE	0.000958	0.003297					0.004256
	NE		0.004710					0.004710
	ENE	0.001438	0.005181					0.006619
	E	0.001438	0.002826					0.004264
	ESE	0.001438	0.005181					0.006619
	SE	0.000958	0.003768					0.004727
	SSE	0.002875	0.005652					0.008527
	S	0.003833	0.003297					0.007131
	SSW	0.005750	0.005652					0.011403
	SW	0.001917	0.002355					0.004272
	WSW	0.000958	0.005652					0.006611
	W	0.001917	0.001413					0.003330
	WNW		0.000942					0.000942
	NW	0.000958	0.002355					0.003314
	NNW		0.003297					0.003297
B	N		0.004239	0.000942				0.005181
	NNE		0.005181					0.005181
	NE		0.005652	0.000471				0.006123
	ENE		0.005652					0.005652
	E		0.003768					0.003768
	ESE	0.000479	0.007537					0.008016
	SE		0.008008	0.000942				0.008950
	SSE	0.000479	0.005652	0.000942				0.007074
	S	0.000479	0.005181	0.001413				0.007074
	SSW	0.000479	0.003768	0.000942				0.005189
	SW		0.003768					0.003768
	WSW		0.003768	0.000942				0.004710
	W	0.000479	0.001413	0.000471				0.002363
	WNW	0.000479	0.001413	0.000471				0.002363
	NW		0.002826	0.001884				0.004710
	NNW		0.003768	0.001413				0.005181
C	N	0.000479	0.000471	0.013660				0.014610
	NNE		0.000471	0.006123				0.006594
	NE		0.000471	0.003768				0.004239
	ENE		0.001884	0.005652				0.007537
	E		0.002355	0.008008				0.010363
	ESE		0.003297	0.015073				0.018370
	SE		0.002355	0.009421				0.011776
	SSE		0.003297	0.007537				0.010834
	S		0.000942	0.009421				0.010363
	SSW		0.002826	0.007537				0.010363
	SW		0.002355	0.008008				0.010363
	WSW		0.002355	0.010363				0.012718
	W		0.000471	0.007537				0.008008
	WNW		0.001884	0.007065				0.008950
	NW		0.001413	0.007065				0.008479
	NNW		0.000471	0.008479				0.008950

Table 2.5-12 Marsland Summer Joint Frequency Distribution

Stability Class	Wind Direction	Wind Speed (mph) – Summer (Calm = 0.2%)						Row Total
		< 3	4 – 7	8 – 12	13 – 18	19 – 24	> 24	
D	N		0.005652	0.014131	0.009892	0.002826	0.000942	0.033443
	NNE	0.000479	0.005181	0.009421	0.010834	0.002355	0.000471	0.028741
	NE		0.001413	0.012718	0.002355			0.016486
	ENE		0.005181	0.009421	0.003297			0.017899
	E		0.008950	0.013660	0.002826			0.025436
	ESE	0.000479	0.009421	0.013660	0.003768			0.027328
	SE	0.000479	0.015073	0.016957	0.003297			0.035807
	SSE		0.008950	0.014131	0.009892	0.001413		0.034385
	S		0.007065	0.015544	0.021196	0.000942		0.044748
	SSW		0.005652	0.012247	0.009421	0.000942		0.028262
	SW		0.004239	0.010834	0.005181	0.001413		0.021667
	WSW		0.005181	0.007537	0.005181	0.001413		0.019312
	W		0.001413	0.006594	0.001884	0.000471		0.010363
	WNW		0.001884	0.000471	0.002826			0.005181
	NW		0.002826	0.003297	0.013189	0.003768		0.023081
	NNW	0.000958	0.009892	0.016486	0.016015	0.004239	0.000942	0.048533
E	N	0.000958	0.003297	0.000471				0.004727
	NNE		0.001884					0.001884
	NE		0.000942					0.000942
	ENE		0.002826	0.000942				0.003768
	E		0.001884					0.001884
	ESE		0.002826					0.002826
	SE	0.000479	0.003297					0.003776
	SSE	0.000958	0.004239	0.000942				0.006140
	S		0.003768	0.000942				0.004710
	SSW		0.004239					0.004239
	SW		0.003768					0.003768
	WSW	0.000479	0.002826	0.000471				0.003776
	W		0.002355					0.002355
	WNW		0.000471					0.000471
	NW	0.000479	0.003297	0.000471				0.004247
	NNW		0.010363	0.002826				0.013189
F	N	0.008625	0.011305					0.019930
	NNE	0.006229	0.002826					0.009056
	NE	0.007667	0.001884					0.009551
	ENE	0.005750	0.002355					0.008105
	E	0.003833	0.006123					0.009957
	ESE	0.004792	0.003768					0.008560
	SE	0.008146	0.005181					0.013327
	SSE	0.003354	0.008008					0.011362
	S	0.007188	0.004710					0.011898
	SSW	0.007667	0.005181					0.012848
	SW	0.003833	0.003297					0.007131
	WSW	0.005750	0.004710					0.010460
	W	0.005271	0.001884					0.007155
	WNW	0.004792	0.005652					0.010444
	NW	0.006229	0.003297					0.009527
	NNW	0.012938	0.008950					0.021887

Source: Crow Butte Resources, Inc. 2011, data from 8/24/2010 to 8/29/2011

Table 2.5-13 Marsland Fall Joint Frequency Distribution

Stability Class	Wind Direction	Wind Speed (mph) – Fall (Calm = 1.7%)						Row Total
		< 3	4 – 7	8 – 12	13 – 18	19 – 24	> 24	
A	N	0.001028	0.002364					0.003392
	NNE		0.000473					0.000473
	NE	0.001541	0.000946					0.002487
	ENE	0.001028	0.000946					0.001973
	E	0.000514	0.000946					0.001459
	ESE	0.003083	0.001418					0.004501
	SE	0.002055	0.000473					0.002528
	SSE	0.003596	0.001418					0.005015
	S	0.001541	0.000946					0.002487
	SSW	0.005138	0.000946					0.006083
	SW	0.001541	0.002364					0.003905
	WSW	0.001541	0.003310					0.004851
	W	0.001541	0.000473					0.002014
	WNW	0.001028	0.000473					0.001500
	NW	0.000514	0.001891					0.002405
	NNW	0.001541	0.000946					0.002487
B	N		0.001418					0.001418
	NNE		0.000946					0.000946
	NE							
	ENE							
	E		0.000946					0.000946
	ESE							
	SE	0.000514	0.001891	0.000473				0.002878
	SSE	0.000514	0.000473					0.000987
	S	0.001028		0.000473				0.001500
	SSW	0.003596	0.004255	0.000473				0.008325
	SW	0.000514	0.003310					0.003823
	WSW		0.002837					0.002837
	W							
	WNW		0.000473					0.000473
	NW		0.001891	0.000473				0.002364
	NNW		0.001891					0.001891
C	N		0.001418	0.006147				0.007565
	NNE		0.001418	0.000946				0.002364
	NE		0.000946	0.000946				0.001891
	ENE		0.000473	0.000946				0.001418
	E		0.000946	0.001418				0.002364
	ESE		0.000473					0.000473
	SE	0.001028	0.000473	0.000473				0.001973
	SSE	0.000514	0.000473	0.002364				0.003351
	S	0.001028	0.001891	0.001418				0.004337
	SSW	0.000514	0.001891	0.004255				0.006660
	SW		0.001891	0.004255				0.006147
	WSW		0.000473	0.001891				0.002364
	W		0.000946	0.002364				0.003310
	WNW			0.002837				0.002837
	NW			0.009929				0.009929
	NNW		0.001891	0.007092				0.008983

Table 2.5-13 Marsland Fall Joint Frequency Distribution

Stability Class	Wind Direction	Wind Speed (mph) – Fall (Calm = 1.7%)						Row Total
		< 3	4 – 7	8 – 12	13 – 18	19 – 24	> 24	
D	N	0.000514	0.009929	0.014184	0.012293	0.005201	0.003310	0.045431
	NNE		0.002364	0.005674	0.007092	0.002364		0.017494
	NE		0.001891	0.001418	0.001418			0.004728
	ENE		0.000473	0.003310				0.003783
	E		0.003310	0.006147				0.009456
	ESE		0.007565	0.003310	0.000946	0.000473	0.000473	0.012766
	SE		0.008038	0.008983	0.001418	0.000473		0.018913
	SSE	0.000514	0.009929	0.017494	0.012293			0.040230
	S	0.000514	0.005674	0.014657	0.009456	0.001418		0.031719
	SSW	0.000514	0.001418	0.005674	0.002837			0.010443
	SW	0.000514	0.007565	0.006147	0.005674	0.002837		0.022736
	WSW		0.006619	0.015130	0.008983	0.001418		0.032151
	W		0.004728	0.010402	0.010875	0.001891		0.027896
	WNW		0.006619	0.014184	0.026478	0.007092	0.005201	0.059574
	NW		0.009929	0.029787	0.024113	0.024113	0.011820	0.099764
	NNW	0.001541	0.027423	0.023168	0.026478	0.017967	0.007092	0.103669
E	N	0.004624	0.002364					0.006988
	NNE	0.001028	0.001891	0.000946				0.003864
	NE		0.001891	0.000473				0.002364
	ENE		0.001418	0.000946				0.002364
	E	0.001541	0.000473	0.000473				0.002487
	ESE	0.001541	0.004728					0.006269
	SE	0.001541	0.000946	0.000946				0.003433
	SSE	0.001028	0.001891	0.000946				0.003864
	S	0.000514	0.001891					0.002405
	SSW		0.001891					0.001891
	SW	0.000514	0.002364	0.001418				0.004296
	WSW		0.002364	0.002364				0.004728
	W	0.000514	0.002364	0.000473				0.003351
	WNW	0.000514	0.001418	0.001891				0.003823
	NW	0.001028	0.004728	0.002364				0.008120
	NNW	0.002055	0.017021	0.002364				0.021440
F	N	0.015413	0.005674					0.036053
	NNE	0.010276	0.004728					0.030110
	NE	0.009248	0.001891					0.019538
	ENE	0.010789	0.002364					0.009591
	E	0.007193	0.000946					0.011140
	ESE	0.005652	0.001891					0.011165
	SE	0.008221	0.002837					0.009100
	SSE	0.007707	0.003310					0.017032
	S	0.009248	0.003310					0.014060
	SSW	0.007193	0.004728					0.011682
	SW	0.008221	0.006147					0.012097
	WSW	0.012331	0.006147					0.011656
	W	0.007707	0.001891					0.013519
	WNW	0.010276	0.006619					0.018945
	NW	0.009248	0.005674					0.021865
	NNW	0.023634	0.015130					0.041199

Source: Crow Butte Resources, Inc. 2011, data from 8/24/2010 to 8/29/2011

Table 2.5-14 Marsland Onsite Meteorological Station Description

Equipment	Description
10-meter tower	Free-standing 10-meter (or 33-foot) aluminum town, which is self supporting with typical sets of instruments at wind levels up to 110 miles per hour (mph).
Model 034B wind sensor	Model 034B wind sensor combines wind speed and direction measurements into a single sensing unit. The sensor is constructed of aluminum and stainless steel. Specifications: 1. Wind Speed • Range: 0 to 167 mph (0 to 75 meters/second [m/s]) • Starting threshold: 0.9 mph (0.4 m/s) • Accuracy : <22.7 mph (0.25 mph [0.1 m/s]) • Accuracy: >22.7 mph (± 1.1 percent of true) 2. Wind Direction • Range: Mechanical: 0 to 360º Electrical: 0 to 356º • Starting threshold: 0.9 mph (0.4 m/s) • Accuracy: 0.4º • Damping ratio: 0.25 standard (0.4 to 0.6 optional) • Resolution: <0.5º 3. Temperature Range • –30 ºC to +70 ºC (minimal icing conditions) 4. Output Signal • Wind speed: Pulsed contact closure • Wind direction: Potentiometer output (0 to 10 kohms) 5. Height • 10 meters
Air temperature sensor	Met One Model 062 MP Specifications: 1. General • Sensing element: Multi-stage state thermistor, highly linearized • Time constant: Less than 10 seconds in still air • Self-heating: None 2. Housing: 3/8 in (9.5 mm) x 6 in (152.4 mm) 3. Range: –50 ºC to +50 ºC 4. Accuracy: ±0.05 ºC, PSD compliant 5. For a system range of: Maximum Error/Degree of Maximum Error differential temperature: / over range: –5 ºF to +5 ºF: 0.02 ºF / 0.05 ºF –5 ºC to +5 ºC: 0.02 ºC / 0.05 ºC –5 ºF to +10 ºF: 0.02 ºF / 0.1 ºF –5 ºC to +10 ºC: 0.02 ºC / 0.1 ºC –10 ºF to +20 ºF: 0.02 ºF / 0.2 ºF 6. Height • 2 meters • 10 meters

Table 2.5-14 Marsland Onsite Meteorological Station Description

Equipment	Description
Relative humidity and temperature probes; solar radiation shield	Model HMP45AC Specifications: • Operating temperature range: –40 to +60 ºC (–40 to +140 ºF) • Storage temperature range: –40 to +80 ºC (–40 to +176 ºF) • Supply voltage: 7 to 35 VDC • Settling time: 500 m/s • Power consumption: <4 milliamperes (mA) • Relative humidity: • Measuring range: 0.8 to 100% RH • Output scale: 0 to 100% RH equals 0.1 VDC • Accuracy at +20 ºC (+68 ºF) (including nonlinearity and hysteresis) against calibration against references: ±1% RH field calibration against references: ±2% RH (0 to 90% RH) ±3% RH (90 to 100% RH) • Typical long-term stability: <1% RH/year • Temperature dependence: ±0.05% RH/ºC (±0.03% RH/ºF) • Response time (90% at +20 ºC): 10 seconds with membrane filter • Humidity sensor: HUMICAP 180 7. Temperature • Measurement range: –39.2 to +60 ºC (–32 to +140 ºF) • Output scale: –40 to +60 ºC (–40 to +140 ºF) equals 0 to 1 VDC • Accuracy at +20 ºC (+68 ºF) 8. Height • 2 meters
Solar radiation	LiCor 200 Pyranometer Designed for field measurement if global solar radiation. Specifications: 1. Sensitivity: Typically 90 microamperes (µA) per 1000 W m^{-2} 2. Linearity: maximum deviation of 1% up to 3000 W m^{-2} 3. Stability: <± 2% change over a 1-year period 4. Response time: 10 microseconds (µs) 5. Temperature dependence: 0.15% per ºC maximum 6. Cosine correction: cosine corrected up to 80º angle of incidence 7. Azimuth: <±1% error over 360º at 45º elevation 8. Operating temperature: –40 to 65 ºC 9. Relative humidity: 0 to 100% 10. Height: 1.3 meters
Datalogger	Campbell Scientific CR 1000 programmable control and data acquisition system Provides direct communications and telecommunications, reduces data, controls external devices, and stores data and programs in on-board, non-volatile storage. Sensor data can be directly downloaded from the datalogger.

Table 2.5-14 Marsland Onsite Meteorological Station Description

Equipment	Description
	Specifications: 1. Analog inputs: 16 single-ended or 8 differential, individually configured 2. Pulse counters: 2 3. Switched voltage excitations: 3 4. Control/digital ports: 8 5. RS-232 port: 1 6. CS I/O port: 1 7. Scan rate: 100 Hz 8. Burst mode: 1500 HZ 9. Programming: CR Basic 10. Data storage: Table
Tipping bucket rain gage	Texas Electronics TE525WS tipping bucket rain gage Specifications: 1. Orifice diameter: 8 inches (20.3 cm) 2. Rainfall per tip: 0.01 inch (0.254 mm) 3. Accuracy: • Up to 1 inch/hr: ±1% • 1 to 2 inches/hr: +0, –2.5% • 2 to 3 inches/hr: +0, –3.5% 4. Temperature: 0 °C to +50 °C 5. Resolution: 1 tip 6. Magnetic reed switch 7. Height: .91 meters

Source: Cameco Resources, Inc.

Source: Application for Amendment of USNRC Source Materials License SUA-1534 , Marsland Expansion Area, Crow Butte Resources, Inc., Technical Report, Appendix B.

Table 2.5-15 Rapid City Mixing Heights

Time Period (Filtered)	Average Mixing/Inversion Height
Morning (2 a.m. – 6 a.m.)	333 meters
Afternoon (12 p.m. – 4 p.m.)	1,547 meters

Table 2.5-16 EPA National Ambient Air Quality Standards (NAAQS)

Pollutant [final rule cite]		Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide [76 FR 54294, Aug 31, 2011]		primary	8-hour	9 ppm	Not to be exceeded more than once per year
			1-hour	35 ppm	
Lead [73 FR 66964, Nov 12, 2008]		primary and secondary	Rolling 3-month average	0.15 μg/m^3 (1)	Not to be exceeded
Nitrogen Dioxide [75 FR 6474, Feb 9, 2010] [61 FR 52852, Oct 8, 1996]		primary	1-hour	100 ppb	98th percentile, averaged over 3 years
		primary and secondary	Annual	53 ppb (2)	Annual mean
Ozone [73 FR 16436, Mar 27, 2008]		primary and secondary	8-hour	0.075 ppm (3)	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particle Pollution [71 FR 61144, Oct 17, 2006]	$PM_{2.5}$	primary and secondary	Annual	15 μg/m^3	Annual mean, averaged over 3 years
			24-hour	35 μg/m^3	98th percentile, averaged over 3 years
	PM_{10}	primary and secondary	24-hour	150 μg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide [75 FR 35520, Jun 22, 2010] [38 FR 25678, Sept 14, 1973]		primary	1-hour	75 ppb (4)	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year

Source: EPA 2013.

(1) Final rule signed October 15, 2008. The 1978 lead standard (1.5 μg/m^3 as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978 standard, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.

(2) The official level of the annual NO2 standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of clearer comparison to the 1-hour standard.

(3) Final rule signed March 12, 2008. The 1997 ozone standard (0.08 ppm, annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years) and related implementation rules remain in place. In 1997, EPA revoked the 1-hour ozone standard (0.12 ppm, not to be exceeded more than once per year) in all areas, although some areas have continued obligations under that standard ("anti-backsliding"). The 1-hour ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is less than or equal to 1.

(4) Final rule signed June 2, 2010. The 1971 annual and 24-hour SO2 standards were revoked in that same rulemaking. However, these standards remain in effect until one year after an area is designated for the 2010 standard, except in areas designated nonattainment for the 1971 standards, for which the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standard are approved.

Table 2.5-17 Nebraska and South Dakota Ambient Air Monitoring Network Near Marsland Expansion Area

Site	Operating Agency	Location			Parameters Monitored	Monitoring Objective	Distance from MEA [c]
		State	County	Coordinates [o]			
Wind Cave National Park	SD DENR	SD	Custer	UTM Zone 13, NAD 83 E 622,471.56 N 4,823, 856.93	PM_{10} $PM_{2.5}$ SO_2 NO_2 Ozone	Background (Regional) Pollutant Transport	70 miles
Badlands National Park	SD DENR	SD	Jackson	UTM Zone 14, NAD 83 E 263, 173.81 N 4,847, 799.95	PM_{10} $PM_{2.5}$ SO_2 NO_2 Ozone	$PM_{2.5}$: Regional Others: Background (Regional) and Pollutant Transport	107 miles
Black Hawk	SD DENR	SD	Meade	UTM Zone 13, NAD 83 E 634,683.07 N 4,890, 309.65	PM_{10} Ozone	PM_{10}: Population and Urban Background Ozone: Population and High Concentration	110 miles
Agate Fossil Beds [a]	National Park Service	NE	Sioux	42.429300 −103.729400	Ozone	Background (regional)	23 miles
Scottsbluff (Library) [b]	NDEQ	NE	Scotts Bluff	41.865000 −103.664444	$PM_{2.5}$	Background (Regional) Population (Closed)	45 miles
Scottsbluff (Senior High School)	NDEQ	NE	Scotts Bluff	40.942099 −98.364967	$PM_{2.5}$	Background (Regional) Population	45 miles
Rapid City National Guard	SD DENR	SD	Pennington	UTM Zone 13, NAD 83 E 638,543.08 N 4,882, 373.72	PM_{10}	Population High Concentration	105 miles
Rapid City Credit Union	SD DENR	SD	Pennington	UTM Zone 13, NAD 83 E 638,199.75 N 4,882, 811.92	$PM_{2.5}$ PM_{10}	Background (Regional) Population	105 miles

Sources: NDEQ 2009; SD DENR 2011

[a] data not suitable for NAAQS compliance determination – only for general trend information.

[b] closed May 11, 2009; replaced by monitors at Scottsbluff Senior High School

[c] Distances are approximate measured to the nearest license boundary of the Marsland Expansion Area.

Note: Clarification of mining objectives:

- **Background Level** monitoring is used to determine general background levels of air pollutants. This can be applied to regions, neighborhoods, and urban areas.
- **High Concentration** monitoring is conducted at sites to find the highest concentration of an air pollutant in an area within a given monitoring network. A monitoring network may have multiple high concentration sites as a result of varying meteorology, source area variability, etc.
- **Population Exposure** monitoring is conducted to represent the air pollutant concentrations to which a populated area is exposed.
- **Pollutant Transport** is the movement of pollutant(s) between air basins or areas within an air basin. Pollutant transport monitoring is used to assess and address sources from upwind areas when those transported pollutant(s) affect neighboring downwind areas. Transport monitoring can also be used to determine the extent of regional pollutant transport.

Table 2.5-18 Comparison of Ambient Particulate Matter (PM_{10}) Monitoring Data for Regional Monitoring Sites

Site	2006	2007	2008	2009	2010	3-Year Average	Attainment with NAAQS[a]
PM_{10} Annual Averages for Monitoring Sites							
Wind Cave, SD	7	7	10	9	8	9	[b]
Badlands, SD	9	9	12	7	8	11	[b]
Black Hawk, NE	15	16	18	16	14	16	[b]
Rapid City, SD (National Guard)	27	29	32	26	30	28	[b]
Second Highest 24-Hour Concentration							
Wind Cave, SD	26	43	47	141	67	80	Yes
Badlands, SD	30	40	56	32	31	40	Yes
Black Hawk, NE	47	42	36	34	29	33	Yes
Rapid City, SD (National Guard)	91	89	84	65	73	74	Yes

Source: SD DENR 2011.
[a] Standard of 150 $\mu g/m^3$ is not to be exceeded more than once per year on average over 3 years.
[b] Annual PM_{10} standard was revoked by the USEPA in 2006 and later removed by the states of Nebraska and South Dakota.

Table 2.5-19 PM_{10} Annual Average Monitoring Data for South Dakota Monitoring Sites

Year	Wind Cave		Badlands		Black Hawk		Rapid City (National Guard)	
	Annual Average	Maximum 24-Hour Average	Annual Average	Maximum 24-Hour Average	Annual Average	Maximum 24-Hour Average	Annual Average	Maximum 24-Hour Average
	µg/m³							
1992	--	--	--	--	--	--	37	No Data
1993	--	--	--	--	--	--	34	No Data
1994	--	--	--	--	--	--	39	No Data
1995	--	--	--	--	--	--	33	No Data
1996	--	--	--	--	--	--	35	No Data
1997	--	--	--	--	--	--	41	No Data
1998	--	--	--	--	--	--	31	87
1999	--	--	--	--	--	--	28	117
2000	--	--	12	39	--	--	32	97
2001	--	--	12	48	21	70	35	82
2002	--	--	10	26	19	77	34	105
2003	--	--	16	74	21	77	36	92
2004	--	--	10	24	20	42	35	72
2005	7	32	9	40	15	52	27	94
2006	7	28	9	30	16	50	29	124
2007	10	44	12	50	18	42	32	93
2008	9	47	11	56	16	36	26	124
2009	9	141	7	32	16	34	26	124
2010	8	67	8	31	14	29	30	97

Source: EPA 2011a; SD DENR 2011.
Note: Standard of 150 µg/m³ is not to be exceeded more than once per year on average over 3 years.

Table 2.5-20 $PM_{2.5}$ Annual Average Monitoring Data for Regional Monitoring Sites

Year	Wind Cave		Badlands		Black Hawk		Rapid City (National Guard)		Scottsbluff	
	Annual Average	Maximum 24-Hour Average	Annual Average	Maximum 24-Hour Average	Annual Average	Maximum 24-Hour Average	Annual Average	Maximum 24-Hour Average	Annual Average	Maximum 24-Hour Average
	µg/m³									
1998	--	--	--	--	--	--	--	--	--	--
1999	--	--	--	--	--	--	--	--	8.17	32.0
2000	--	--	5.38	13.9	--	--	7.94	29.5	6.31	21.8
2001	--	--	5.60	12.7	6.09	23.2	8.44	24.5	6.21	16.9
2002	--	--	5.15	15.1	6.29	35.5	7.73	26.7	5.69	19.8
2003	--	--	5.77	24.0	6.38	26.6	7.71	21.2	6.10	23.0
2004	--	--	5.25	13.5	6.29	24.4	8.09	13.6	5.69	15.4
2005	5.4	16.2	5.35	15.4	--	--	8.6 [a]	--	5.28	20.1
2006	5.3	16.5	5.38	15.7	--	--	9.3 [a]	--	5.76	27.3
2007	6.2	22.4	5.49	18.7	--	--	8.3 [a]	--	7.10	19.8
2008	4.9	41.6	5.2	51.2	--	--	7.7 [a]	--	6.77	31.1
2009	4.7	--	4.0	--	--	--	6.7 [a]	--	5.13	--
2010	4.7	--	3.9	--	--	--	6.6 [a]	--	5.27 [b]	--

Source: NDEQ 2011; SD DENR 2011; EPA 2011a and b.

-- data not available.

[a] New monitor location for determination of $PM_{2.5}$ compliance in Rapid City, SD (Rapid City Credit Union).

[b] Scottsbluff site was relocated from 1809 3rd Street (shut down on 5/11/2009) to Scottsbluff High School at Highway 26 and 5th Street (start-up on 5/13/2010). Combined data for both sites is presented here.

Table 2.5-21 Comparison of Ambient Particulate Matter ($PM_{2.5}$) Monitoring Data for Regional Monitoring Sites

Site	2006	2007	2008	2009	2010	3-Year Average	Attainment with NAAQS
	µg/m³						
Comparison of 98th Percentile, 24-Hour Concentrations for $PM_{2.5}$ to NAAQS [a]							
Wind Cave, SD	12.2	17.5	10.8	9.6	12.4	14.0	Yes
Badlands, SD	12.2	12.4	12.8	10.4	13.6	13.0	Yes
Scottsbluff, NE	19.0	17.7	19.3	12.0	14.0	15.1	Yes
Rapid City, SD (Credit Union)	--	--	18.7	14.3	14.0	15.7	Yes
Comparison of 3-Year Annual Averages for $PM_{2.5}$ to NAAQS [b]							
Wind Cave, SD	5.3	6.2	4.9	4.7	4.7	5.5	Yes
Badlands, SD	5.3	5.5	5.2	4.0	3.9	5.3	Yes
Scottsbluff, NE [c]	5.76	7.10	6.77	5.13	5.27	6.68	Yes
Rapid City, SD (National Guard)	--	--	--	--	--	--	--

[a] To determine attainment status, the 3-year average of the annual 98th percentile value is compared to the 35 µg/m³ NAAQS. The 98th percentile value is higher than 98 percent of 24-hour values for the year.
[b] To determine attainment status, the 3-year average of the annual averages is compared to the 15 µg/m³ NAAQS.
[c] Scottsbluff site was relocated from 1809 3rd Street (shut down on 5/11/2009) to Scottsbluff High School at Highway 26 and 5th Street (start-up on 5/13/2010). Combined data for both sites is presented here.

Table 2.5-22 Comparison of Sulfur Dioxide Values for Wind Cave and Badlands, SD Monitor Sites

Monitor Site	SO_2 Annual Average Concentration	SO_2 1-Hour Design Values (Effective in 2010)		
		99th Percentile Concentration	3-Year Average	Attainment Status
	parts per billion (ppb)			
Wind Cave				
2005	0.4	--	--	
2006	0.8	--	--	
2007	0.4	--	--	
2008	0.2	3	6	Yes
2009	0.5	10		
2010	2.6	5		
Badlands				
2005	3.0			
2006	2.1			
2007	2.4			
2008	1.3	5	6	Yes
2009	0.8	5		
2010	3.3	9		

SD DENR Standards: 1-hour standard at 75 ppb; 24-hour and annual SO_2 standards revoked. Note: Compliance is met when the 99th percentile daily maximum 1-hour SO_2 concentration, averaged over 3 years, does not exceed 70 ppb. The 3-year averages shown above are used to evaluate compliance with the sulfur dioxide standard.

Table 2.5-23 Comparison of Nitrogen Dioxide 1-Hour 98th Percentile Concentrations for Wind Cave and Badlands, SD

Site	98th Percentile Concentration	3-Year Average	Attainment Status
	parts per billion (ppb)		
Wind Cave			
2008	3	3	Yes
2009	3		
2010	3		
Badlands			
2008	4	4	Yes
2009	4		
2010	5		

Source: SD DENR 2011

Table 2.5-24 Comparison of Nitrogen Dioxide Annual Average Values for Wind Cave and Badlands, SD Monitor Sites

Monitoring Site	2005	2006	2007	2008	2009	2010
	parts per billion (ppb)					
Wind Cave	0.8	0.9	1.1	0.2	0.6	0.2
Badlands	1.3	1.2	0.5	0.8	0.5	0.5

SD DENR Standards: Nitrogen Dioxide: 0.053 ppm (annual mean)

Table 2.5-25 Ozone Yearly 4th Highest 8-Hour Averages for Regional Monitoring Sites [a, b]

Location	2003	2004	2005	2006	2007	2008	2009	2010	3-Year Average (2008–2010)	Attainment Status [c]
	parts per million (ppm)									
Wind Cave, SD	ND	ND	0.070	0.073	0.069	0.059	0.062	0.059	0.060	Yes
Badlands, SD	0.067	0.063	0.069	0.071	0.064	0.053	0.055	0.058	0.055	Yes
Black Hawk, SD	ND	ND	ND	ND	0.053	0.060	0.058	0.057	0.058	Yes
Agate Fossil Beds [d]	ND	ND	ND	ND	0.066	0.067	0.062	ND	0.066	--

[a] The design value is the 3-year average of the 4th highest maximum for each year. The 4th highest 8-hour average is used to evaluate compliance with the ozone standard.
[b] NAAQS = 0.075 ppm (8-hour average). Standard promulgated 3/27/2008. The EPA has proposed new standards for ozone that are expected to lower the standards to between 60 and 70 ppb (action is currently pending).
[c] Attainment status is for the current standard of 0.075 ppm.
[d] The ozone monitor at the Agate Fossil beds operated by the National Park Service does not generate data acceptable for determinations of NAAQS compliance (for general reference only).
ND = No data

Table 2.5-26 Prevention of Significant Deterioration (PSD) of Air Quality Allowable Increments

Pollutant	Averaging Time	PSD Increment µg/m3	
		Class I	Class II
Particulate Matter (PM_{10})	24-Hour Maximum	8	30
	Annual Arithmetic Mean	4	17
Sulfur Dioxide (SO_2)	24-Hour Maximum	5	91
	3-Hour Maximum	25	512
	Annual Arithmetic Mean	2	20
Nitrogen Dioxide (NO_2)	Annual Arithmetic Mean	2.5	25

Table 2.6-1 General Stratigraphic Chart for Northwest Nebraska

Geologic Period	Series	Formation or Group	Rock Types[1]	Thickness (ft)
Tertiary	Miocene	Ogallala	SS, Slt	1560*
	Oligocene/Eocene	Arikaree	SS, Slt	1070*
		White River	SS, Slt, Cly	1450*
Cretaceous	Upper	Pierre	Sh	1500
		Niobrara	Chalk, Ls, Sh	300
		Carlile	Sh	200-250
		Greenhorn	Ls	30
		Graneros	Sh	250-280
		D Sand	SS	5-30
		D Shale	Sh	60
		G Sand	SS	10-45
		Huntsman	Sh	60-80
	Lower	J Sand	SS	10-30
		Skull Creek	Sh	220
		Dakota	SS, Sh	180
Jurassic	Upper	Morrison	Sh, SS	300
		Sundance	SS, Sh, Ls	300
Permian	Guadalupe	Satanka	Ls, Sh, Anhy	450
	Leonard	Upper	Ls, Anhy	150
		Lower	Sh	150
	Wolfcamp	Chase	Anhy	80
		Council Grove	Anhy, Sh	300
		Admire	Dolo, Ls	70
Pennsylvanian	Virgil	Shawnee	Ls	80
	Missouri	Kansas City	Ls, Sh	80
	Des Moines	Marmaton/ Cherokee	Ls, Sh	130
	Atoka	Upper/Lower	Ls, Sh	200
Mississippian	Lower	Lower	Ls, Sh	30
Pre-Cambrian			Granite	

[1]Rock Type Abbreviations: Anhy: Anhydrate; Cly: claystone; Dolo: Dolomite; Ls: limestone; Sh: shale; Slt: siltstone; SS: sandstone

* Maximum thickness based on Swinehart, et. al, 1985

Sources: Cobban 1972; HCA & RTG 1993; Swinehart et al 1985

Table 2.6-2 Representative Stratigraphic Section – Marsland Expansion Area

Elevation (ft amsl)	Average Depth (ft bgs)	Group	Formation & Member (Schultz and Stout 1955)			Formation and Member (Revised)		References (Revised)	Formation & Member (USGS)		Formation & Member (MEA)		
Varying 4,380 -4,080	15 - 135	Arikaree Group	Monroe Creek Formation			Upper Harrison Beds		Swinehart et al. (1985)	Arikaree Group	Harrison Sandstone	Arikaree Group	Upper Harrison Beds	
						Harrison-Monroe Creek Formation				Monroe Creek Sandstone		Harrison – Monroe Creek Formation	
			Gering Formation			Gering Formation				Gering Formation		Gering Formation	
Varying 4,080 -3,620	135 - 460	White River Group	Brule Formation	Whitney Member		Brule Formation	Brown Siltstone Member	LaGarry (1998)	Brule Formation	Whitney Member	White River Group	Brule Formation	Brown Siltstone Member
							Whitney Member						Whitney Member
				Orella Member	Orella D		Orella Member			Orella Member			
					Orella C								
					Orella B								
					Orella A		Big Cottonwood Creek Member	Terry (1998) Terry and LaGarry (1998)					Orella Member
3,620 – 3,480	460 – 600		Chadron Formation	Upper Chadron	Chadron C	Chadron Formation			Chadron Formation			Chadron Formation	Upper Chadron
				Upper/Middle Chadron	Chadron B								
3,480 – 3,230	600 -850			Middle Chadron			Peanut Peak Member	Terry (1998) Terry and LaGarry (1998)					Middle Chadron
3,230 -3,180	850 – 1,200			Upper Interior Paleosol	Chadron A	Chamberlain Pass Formation	Upper Interior Paleosol	Terry (1998)					basal sandstone of the Chadron Formation
				basal sandstone of the Chadron Formation			Channel Sandstone	Terry (1998) Terry and LaGarry (1998)					
3,180 – 3,130	1,200 - ? (Bottom not seen in logs)	Montana Group	Pierre Shale	Interior Paleosol		Pierre Shale	Yellow Mounds Paleosol	Retallack (1983) Terry (1998)	Pierre Shale		Montana Group	Pierre Shale	
				Pierre Shale			Pierre Shale	Terry (1998) Terry and LaGarry (1998)					

Notes:

1) The Shultz and Stout conventions for Formation & Member are utilized throughout this document for consistency with historical permitting, with the exception of the Red Clay Horizon, which is referred to as the Upper Interior Paleosol.
2) Topsoil, colluvial and alluvial deposits are not shown, but are Quaternary in age and range in thickness from 0 to 30 ft-bgs.
3) The terms "Arikaree Group", "Arikaree Formation", and "Arikaree Sandstone" are accepted usages by USGS in Nebraska.
4) The terms "Gering Formation" and "Gering Sandstone" are both accepted usages by USGS in Nebraska.
5) Subdivisions of the Chadron Formation are not formally recognized by USGS in Nebraska.
6) ft amsl = feet above mean sea level; ft bgs = feet below ground surface.
7) Elevations are representative averages for MEA only, and based on Log M-1252.

Table 2.6-3 Marsland Expansion Area Coring Summary

Boring ID Date Completed	Latitude Longitude (deg min sec)	Core Interval (feet bgs)	Core Barrel Type	Geologic Unit	Observed Field Lithologies	Core Runs Collected	Laboratory Grain Size Analysis Median Grain Size in mm	Laboratory Mean Grain Size Description [(2)]	Laboratory Grain Size % Sand	Laboratory Grain Size % Silt	Laboratory Grain Size % Clay
Borings Completed in 2011											
M-1454C 3/23/2011	42 30 45.96736 -103 15 39.46470	600-605	Randolf	Upper Chadron	Siltstone	Run 1	0.056	Fine Sand	43.11	47.25	9.64
		910-915	Randolf	Middle Chadron	Siltstone	Run 2	0.027	Silt	32.99	46.36	20.65
		1051-1056	Randolf	Basal Sandstone[1]	Sandstone	Run 3	0.075	Fine Sand	50.23	29.85	19.92
		1056-1061	Randolf	Pierre Shale	Shale	Run 4	0.007	Silt	0.45	60.15	39.40
M-1624C 3/28/2011	42 30 02.24164 -103 14 49.32652	580-585	Randolf	Upper Chadron	Siltstone	Run 1	0.049	Silt	36.62	54.65	8.73
		860-865	Randolf	Middle Chadron	Siltstone	Run 2	0.065	Fine Sand	48.49	34.96	16.54
		1020-1025	Randolf	Basal Sandstone[1]	Sandstone	Run 3	N/A	N/A	NA	NA	NA
		1025-1030	Randolf	Basal Sandstone[1]	Sandstone	Run 4	0.711	Medium Sand	83.94	11.56	4.5
		1035-1040	Randolf	Pierre Shale	Shale	Run 5	0.005	Silt	1.28	50.88	47.85
Borings Completed in 2013											
M-2169C 8/12/2013	42 32 11.26329 -103 15 53.03808	110-110.5	Randolf	Arikaree	Silt	Run 1 Sample 1	0.037	Silt	20.58	65.73	13.69
		156.5-157.2	Randolf	Arikaree	Sandstone	Run 2 Sample 3	0.059	Silt	37.21	54.28	8.51
		355.0-356.0	Randolf	Brule	Sandstone	Run 3 Sample 1	0.036	Silt	15.97	74.53	9.51
		470.0-470.5	Christensen	Brule	Siltstone/Mudstone	Run 4 Sample 1	0.040	Silt	25.72	64.33	9.95
		608.9-609.5	Christensen	Brule	Mudstone	Run 5 Sample 1	0.050	Fine Sand	37.67	52.86	9.46
		1103-1113	Christensen	Basal Sandstone[1]	Sandstone	Run 6	N/A	N/A	N/A	N/A	N/A
		1135.5-1136.0	Christensen	Pierre Shale	Shale	Run 7 Sample 1	0.004	Silt	0.00	45.40	54.60
M-533C 8/12/2013	42 30 44.61003 -103 15 38.52320	63.9-64.9	Christensen	Arikaree	Sandstone	Run 1 Sample 1	0.238	Fine Sand	90.37	8.22	1.41
		68.8-69.8	Christensen	Arikaree	Siltstone	Run 1 Sample 2	0.033	Silt	20.53	63.04	16.44
		299.0-300.0	Christensen	Brule	Siltstone/Mudstone	Run 3 Sample 1	0.034	Silt	12.97	81.45	5.57
		306.0-307.0	Christensen	Brule	Sandstone/Siltstone	Run 3 Sample 2	0.051	Silt	26.00	70.23	3.77
		1038-1043	Randolf	Basal Sandstone[1]	Sandstone	Run 4	N/A	N/A	N/A	N/A	N/A
		1052.5-1053.0	Christensen	Pierre Shale	Shale	Run 5 Sample 1	0.003	Clay	0.00	34.81	65.19
M-1956C 8/20/2013	42 29 39.82221 -103 14 27.90156	42.0-43.0	Christensen	Arikaree	Sandstone	Run 1 Sample 1	0.266	Fine Sand	96.33	2.75	0.92
		78.0-79.0	Christensen	Arikaree	Siltstone	Run 3 Sample 1	0.054	Silt	33.36	60.43	6.21
		196.5-197.1	Christensen	Brule	Siltstone/Mudstone	Run 4 Sample 1	0.062	Silt	39.31	56.30	4.39
		202.0-202.5	Christensen	Brule	Siltstone/Mudstone	Run 4 Sample 2	0.052	Silt	27.65	67.34	5.00
		425.6-426.2	Christensen	Brule	Mudstone/Siltstone	Run 5 Sample 1	0.029	Silt	12.54	73.63	13.84
		431.0-431.6	Christensen	Brule	Mudstone/Siltstone	Run 5 Sample 2	0.046	Silt	32.57	60.64	6.79
		1004-1014	Christensen	Basal Sandstone[1] / Pierre Shale	Sandstone/Shale	Run 6	N/A	N/A	N/A	N/A	N/A
		1011.8-1012.4	Christensen	Pierre Shale	Shale	Run 6 Sample 1	0.004	Clay	0.00	39.14	60.86
M-1912C 8/15/2013	42 29 07.30429 -103 14 02.26635	63.0-64.0	Christensen	Arikaree	Sandstone	Run 1 Sample 1	0.135	Fine Sand	80.39	17.60	2.01
		130.7-131.7	Christensen	Arikaree	Siltstone	Run 2 Sample 1	0.087	Fine Sand	56.86	36.10	7.03
		255.0-255.5	Christensen	Brule	Sandstone/Siltstone	Run 3 Sample 1	0.072	Fine Sand	48.09	48.95	2.96
		260.4-260.9	Christensen	Brule	Siltstone/Mudstone	Run 3 Sample 2	0.062	Silt	36.63	59.98	3.40
		974.5-975.0	Christensen	Pierre Shale	Shale	Run 4 Sample 1	0.003	Clay	0.00	28.79	71.21
		968.7-969.7	Christensen	Basal Sandstone[1]	Sandstone	Run 4 Sample 2	0.850	Medium Sand	81.13	7.90	10.97
M-1635C 8/23/2013	42 28 23.73852 -103 13 32.61933	70.0-70.5	Christensen	Arikaree	Sandstone/Siltstone	Run 1 Sample 1	0.046	Silt	27.88	60.57	11.55
		79.5-80.0	Christensen	Arikaree	Sandstone	Run 1 Sample 2	0.063	Silt	39.61	53.90	6.50
		197.0-197.5	Christensen	Brule	Sandstone/Siltstone	Run 2 Sample 1	0.041	Silt	13.73	81.80	4.47
		206.5-207.0	Christensen	Brule	Siltstone/Mudstone	Run 2 Sample 2	0.055	Silt	29.24	67.17	3.59
		530-540	Christensen	Upper Chadron	Siltstone/Mudstone	Run 3 Sample 1	0.040	Silt	28.79	61.01	10.20
		960-965	Randolf	Basal Sandstone[1]	Sandstone	Run 4	N/A	N/A	N/A	N/A	N/A
		965-975	Christensen	Basal Sandstone[1]	Sandstone	Run 5	N/A	N/A	N/A	N/A	N/A
		993.0-994.0	Christensen	Pierre Shale	Shale	Run 6	0.003	Clay	0.00	24.05	75.95

Notes:

(1) Basal Sandstone of the Chadron Formation

(2) Based on Mean from Trask

Table 2.6-4 USGS Abbreviated Modified Mercalli (MM) Intensity Scale

Richter Magnitude	Modified Mercalli Scale	Description of MM Scale
1.0 – 3.0	I	Not felt except by a very few under especially favorable conditions.
3.0 – 3.9	II	Felt only by a few persons at rest, especially on upper floors of buildings.
	III	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
4.0 – 4.9	IV	Felt indoors by many, outdoors by a few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rock noticeably.
	V	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
5.0 – 5.9	VI	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
	VII	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
6.0 – 6.9	VIII	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
	IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
7.0 and higher	X	Some well-built wooded structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
	XI	Few, if any, (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
	XII	Few, if any, (masonry) structures remain standing. Bridges destroyed. Rails bent greatly. Damage total. Lines of sight and level are distorted. Objects thrown into the air.

Source: FOO 2002

Table 2.6-5 Historical Earthquakes in Northwestern Nebraska in Proximity to the Chadron and Cambridge Arches (1884 – 2009)

Date	Location	Latitude	Longitude	Depth (km)[a]	Richter Magnitude[b]	Modified Mercalli Intensity[b]	Source
3/17/1884	North Platte, NE	41.133	100.75			IV	A
				--	--		
12/16/1916	Stapleton, NE	41.55	100.467	--	--	II–III	A
9/24/1924	Gothenberg, NE	40.95	100.133	--	--	IV	A
8/08/1933	Scottsbluff, NE	41.867	103.667	--	--	IV–V	A
7/30/1934	Chadron, NE	42.85	103	--	--	VI	A
3/24/1938	Fort Robinson, NE	42.683	103.417	--	--	IV	A
3/09/1963	Chadron, NE	42.85	103	--	--	II–III	A
3/28/1964	Merriman, NE	42.8	101.667	--	--	VII	A
5/7/1978	SW Cherry County, NE	42.26	101.95	--	--	V	B
3/06/1983	NE Sheridan, NE	42.96	102.2	--	--	III	B
1/01/1987	Crawford, NE	42.79	103.48	--	--	III	B
2/08/1989	Merriman, NE	42.8	101.6	--	--	IV	B
2/09/1989	39 Miles SE of White Clay, NE	42 41 21 38	101 54 00 32	5 (3.21 miles)	3.8	III	C
7/18/1990	7 miles SSE of Ord, NE	41 30 16 72 N	98 57 39 74 W	5 (3.21 miles)	3.0	II	C
9/30/1990	18 miles SE of Hyannis, NE	41 48 52 97 N	101 30 12 67 W	5 (3.21 miles)	3.0	II	C
8/26/1991	10 miles SE of Brownlee, NE	42 09 46 40 N	100 32 03 25 W	5 (3.21 miles)	3.4	II	C

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Table 2.6-5 Historical Earthquakes in Northwestern Nebraska in Proximity to the Chadron and Cambridge Arches (1884 – 2009)

Date	Location	Latitude	Longitude	Depth (km)[a]	Richter Magnitude[b]	Modified Mercalli Intensity[b]	Source
2/20/1993	14 miles SE of Merriman, NE	42 49 48 00 N	101 27 44 36 W	5 (3.21 miles)	3.5	II–III	C
1/25/1994	5 miles ESE of Wood Lake, NE	42 37 36 39 N	100 08 25 90 W	5 (3.21 miles)	3.3	II	C
2/06/1996	1 mile N of Wausa, NE	42 30 47 42 N	97 32 35 99 W	5 (3.21 miles)	3.6	III	C
8/09/1997	5.5 miles NW of Chadron, NE	41 47 43 66 N	98 11 08 76 W	5 (3.21 miles)	3.4	II	C
6/18/1998	21 miles SE of Crawford, NE	42 37 23 70 N	103 00 16 58 W	5 (3.21 miles)	3.4	II	C
6/20/2002	5 miles NE of Scotia, NE	41 30 35 65 N	98 37 15 12 W	5 (3.21 miles)	3.5	II–III	C
11/03/2002	4 miles NW of Bassett, NE	42 46 02 38 N	98 54 10 63 W	5 (3.21 miles)	4.0	IV	C
2/14/2003	8 miles SE of Cambridge, NE	40 14 39 46 N	100 01 14 97 W	5 (3.21 miles)	2.9	I	C
2/01/2006	4 miles NE of Bassett, NE	42 36 55 52 N	99 28 23 72 W	5 (3.21 miles)	2.9	I	C
9/07/2006	16 miles SE of Whiteclay, NE	42 58 32 63 N	102 14 15 90 W	5 (3.21 miles)	3.1	II	C
4/16/2007	61 miles SE of Ogallala	40 36 40 42 N	100 44 50 99 W	5 (3.21 miles)	3.0	II	C
4/24/2007	25 miles SE of Crawford, NE	40 35 04 82 N	102 56 13 78 W	5 (3.21 miles)	2.7	I	C
12/16/2009	7 miles E of Johnson, NE	40 24 N	95.857 W	5 (3.21 miles)	3.5	II–III	D

Source: A Docekal 1970 (Note: Locations [latitude and longitude] based on USGS Google Earth Files for USGS/NEIC Catalog, so locations are approximate.)
Source: B National Earthquake Information Center
Source: C USGS 2009[e]
Source: D USGE 2009[c]
[a] Depth where the earthquake begins to rupture (default values used).
[b] Ratings as per Table 2.6-3.

Table 2.6-6 Earthquakes in Wyoming and South Dakota Within 125 Miles of City of Crawford, NE (1992 – 2007)

Date	Location	Latitude	Longitude	Depth (km)[a]	Richter Magnitude[b]	Modified Mercalli Intensity[b]	Source
Wyoming							
8/29/2004	10 miles NW of Douglas, WY	42 54 05 38 N	105 30 33 39 W	5 (3.1 miles)	3.8	III	A
2/15/2004	12 miles N of Douglas, WY	42 56 27 51 N	105 24 12 32 W	10 (6.2 miles)	3.5	II–III	A
4/09/1996	5 miles SE of Redbird, WY	43 03 43 28 N	104 05 54 17 W	5 (3.1 miles)	3.7	III	A
12/13/1993	9 miles SW of Esterbrook, WY	42 20 11 47 N	105 30 04 15 W	5 (3.1 miles)	3.5	II–III	A
10/10/1993	26 miles W of Esterbrook, WY	42 25 25 99 N	105 52 21 90 W	5 (3.1 miles)	3.7	III	A
7/23/1993	18 miles WNW of Esterbrook, WY	42 28 34 03 N	105 42 18 29 W	5 (3.1 miles)	3.7	III	A
6/30/1993	15 miles N of Douglas, WY	42 59 02 58 N	105 22 48 50 W	5 (3.1 miles)	3.0	II	A
2/24/1993	11 miles SE of Wright, WY	43 42 46 50	105 17 20 18 W	0	3.6	III	A
11/02/1992	3 miles SE of Lusk, WY	42 44 49 37 N	104 53 22 98 W	5 (3.1 miles)	3.0	II	A
South Dakota							
2/07/2007	1 mile SW of Owanka, SD	44 01 56 13 N	102 34 47 35 W	5 (3.1 miles)	3.1	II	A
5/25/2003	35 miles E of Pine Ridge, SD	43.08 N	101.84 W	5 (3.1 miles)	4.0	IV	B
5/03/1996	18 miles NW of Ardmore, SD	43 02 32 88 N	104 01 11 30 W	5 (3.1 miles)	3.1	II	A

Table 2.6-6 Earthquakes in Wyoming and South Dakota Within 125 Miles of City of Crawford, NE (1992 – 2007)

Date	Location	Latitude	Longitude	Depth (km)[a]	Richter Magnitude[b]	Modified Mercalli Intensity[b]	Source
2/06/1996	8.3 miles NW of Hill City, SD	43 58 52 67 N	103 43 41 52 W	5 (3.1 miles)	3.7	III	A
3/20/1994	3 miles SW of Hot Springs, SD	43 23 51 02 N	103 29 57 16 W	5 (3.1 miles)	2.3	I	A
3/18/1994	3 miles SW of Hot Springs, SD	43 23 51 02 N	103 29 57 16 W	5 (3.1 miles)	2.8	I	A
9/05/1993	2.5 miles NW of Central City, SD	44 24 11 63 N	103 48 07 76 W	5 (3.1 miles)	2.7	I	A
11/05/1991	1.5 miles SE of Central City, SD	44 21 10 54 N	103 45 01 27 W	0	2.5	I	A
3/02/1990	13 miles NW of Wounded Knee, SD	43 19 00 23 N	102 30 04 97 W	5 (3.1 miles)	3.2	II	A
1/28/1990	13 miles NW of Wounded Knee, SD	43 19 00 23 N	102 30 04 97 W	5 (3.1 miles)	4.0	IV	A

Source: A USGS 2009f (Note: Locations [latitude and longitude] based on USGS Google Earth Files for USGS/NEIC Catalog, so locations are approximate.)
Source: B USGS 2009c
[a] Depth where the earthquake begins to rupture (default values used).
[b] Rating as per Table 2.6-3.

Table 2.6-7 Summary of MEA Soil Resources

Map Unit	Map Unit Name	Acres	Percent of Project Area
1013	Bankard loamy coarse sand, frequently flooded	127.2	2.8
1014	Bankard loamy fine sand, frequently flooded	188.6	4.1
1036	Glenberg loamy very fine sand, 0 to 3 percent slopes	8.5	0.2
1356	Bridget silt loam, 1 to 3 percent slopes	269.1	5.8
1357	Bridget silt loam, 3 to 6 percent slopes	105.0	2.3
1620	Keith silt loam, 1 to 3 percent slopes	53.3	1.2
1742	Rosebud-Canyon loams, 3 to 9 percent slopes	188.3	4.1
1881	Valent and Dwyer loamy fine sands, 0 to 3 percent slopes	283.5	6.1
1882	Valent and Dwyer loamy fine sands, 3 to 20 percent slopes	786.1	17.0
5070	Vetal and Bayard soils, 1 to 6 percent slopes	110.6	2.4
5105	Alliance silt loam, 1 to 3 percent slopes	242.0	5.2
5106	Alliance silt loam, 3 to 9 percent slopes	87.5	1.9
5107	Alliance silt loam, 3 to 9 percent slopes, eroded	29.3	0.6
5118	Busher and Tassel loamy very fine sands, 6 to 20 percent slopes	185.1	4.0
5123	Busher loamy very fine sand, 1 to 6 percent slopes	142.2	3.1
5124	Busher loamy very fine sand, 1 to 6 percent slopes, eroded	131.2	2.8
5126	Busher loamy very fine sand, 6 to 9 percent slopes	162.3	3.5
5128	Busher loamy very fine sand, 6 to 9 percent slopes, eroded	134.5	2.9
5129	Busher loamy very fine sand, 9 to 20 percent slopes	141.3	3.1
5152	Canyon soils, 3 to 30 percent slopes	13.3	0.3
5153	Canyon soils, 30 to 50 percent slopes	536.7	11.6
5200	Oglala loam, 9 to 30 percent slopes	2.0	0.0
5211	Oglala-Canyon loams, 9 to 20 percent slopes	235.9	5.1
5254	Schamber soils, 3 to 30 percent slopes	12.7	0.3
5640	Haverson loam, frequently flooded	49.7	1.1
5871	Tripp silt loam, 1 to 3 percent slopes	19.5	0.4
5947	Duroc very fine sandy loam, 1 to 3 percent slopes	0.1	0.0
5978	Jayem loamy very fine sand, 1 to 6 percent slopes	10.9	0.2
6028	Tassel soils, 3 to 30 percent slopes	345.7	7.5
6043	Tassel-Ponderosa-Rock outcrop association, 9 to 70 percent slopes	1.0	0.0
6091	Sarben fine sandy loam, 1 to 6 percent slopes	19.4	0.4
TOTAL		**4622.3**	**100.0**

Table 2.7-1 Stream Classification of Niobrara River Subbasin N14

Stream Segment [a]	Segment Number	Recreation	Aquatic Life		Water Supply	Aesthetics	Key Species	Comments
			Cold Water	Warm Water	Agricultural			
Niobrara R. – NE- WY border to Whistle Creek (Sioux Co.)	50000	•	B		A	•	5	Threatened Species
Whistle Creek (Sioux Co.)	40100		B		A	•		
Niobrara R. to Box Butte Reservoir Dam (Dawes Co.)	40000	a	B		A	•	5	Threatened Species
Niobrara R. – Box Butte Reservoir Dam to Mirage Flats Canal Diversion (Dawes Co.)	30000	a	B		A	•	d, e	
Cottonwood Creek (Dawes Co.)	20200		B		A	•		
Pepper Creek (Dawes Co.)	20100		B		A	•		
Lake Name								
Box Butte Reservoir (Dawes Co.)	N14-L0080	•		A	A	•		Northern Pike [b]

Source: NAC 2009a and NAC 2009b. Stream segments as occurring in vicinity of Marsland Expansion Area: from Wyoming/Nebraska state line (Sioux County) to the Dawes/Sheridan county line (Dawes County) (**Figure 2.7-3**). Marsland south permit boundary located approximately 1/4 mile north of Niobrara River in Subbasin N14.

a = Impaired for beneficial use: Total Maximum Daily Load (TMDL) for *E coli* approved 1/06/2010 (NDEQ 2010).
b = Fish consumption advisory for mercury in Northern Pike tissue (NDEQ 2011).

Species codes used in basin tables: to identify key species that typically occur in a stream segment:
5 = Finescale Dace; d = Brown Trout; e = Rainbow Trout

Coldwater Class A: These waters provide a habitat that supports natural reproduction of a salmonid (trout) population. These waters also are capable of maintaining year-round populations of a variety of other coldwater fish and associated vertebrate and invertebrate organisms and plants.

Coldwater Class B: These are waters that provide, or could provide, a habitat capable of maintaining year-round populations of a variety of coldwater fish and associated vertebrate and invertebrate organisms and plants or which support the seasonal migration of salmonids. These waters do not support natural reproduction of salmonid populations due to limitations of flow, substrate composition, or other habitat conditions, but salmonid populations may be maintained year-round if periodically stocked.

Warmwater Class A: These waters provide, or could provide, a habitat suitable for maintaining one or more identified key species on a year-round basis. These waters also are capable of maintaining year-round populations of a variety of other warmwater fish and associated vertebrate and invertebrate organisms and plants.

Agricultural Class A: These are waters used for general agricultural purposes (e.g., irrigation and livestock watering) without treatment.

Aesthetics: This use applies to all surface waters of the state. To be aesthetically acceptable, waters shall be free from human-induced pollution that causes: 1) noxious odors; 2) floating, suspended, colloidal, or settleable materials that produce objectionable films, colors, turbidity, or deposits; and 3) the occurrence of undesirable or nuisance aquatic life (e.g., algal blooms). Surface waters shall also be free of junk, refuse, and discarded dead animals.

Primary Contact Recreation: This use applies to surface waters that are used, or have a high potential to be used, for primary contact recreational activities. Primary contact recreation includes activities where the body may come into prolonged or intimate contact with the water, such that water may be accidentally ingested and sensitive body organs (e.g., eyes, ears, nose, etc.) may be exposed. Although the water may be accidentally ingested, it is not intended to be used as a potable water supply unless acceptable treatment is applied. These waters may be used for swimming, water skiing, canoeing, and similar activities. These criteria apply during the recreational period of May 1 through September 30.

Table 2.7-2 Summary of 2011 Marsland Pumping Test #8 Well Information

Well	Distance to Pumping Well	Northing (ft)	Easting (ft)	Township and Range	Section	TOC Elevation (ft amsl)	Surface Elevation (ft amsl)	Casing Stickup (ft)	Depth Drilled (ft bgs)	Casing Depth (ft bgs)	Top Screen (ft bgs)	Bottom Screen (ft bgs)	Screen Length (ft)	Casing O.D. (in.)	Static Water Elevation* (ft amsl)
Basal Chadron Sandstone Pumping Well															
CPW-1A	0.00	446,202.00	1,121,450.00	1	T29N R51W	4,262.70	4,261.10	1.60	1,055	1,019	1,022	1,052	30	4.95	NM
Basal Chadron Sandstone Observation Wells															
CPW-1	67	446,225.00	1,121,528.00	1	T29N R51W	4,261.85	4,259.80	2.10	1070	1,009	1,015	1,048	33	4.95	3,710.75
Monitor-2	8,800	439,439.00	1,126,362.00	18	T29N R50W	4,198.40	4,197.20	1.20	1027	974	970	1,010	40	4.95	3,713.83
Monitor-3	100	446,288.00	1,121,519.00	1	T29N R51W	4,261.30	4,260.20	1.10	1069	1,008	1,016	1,043	27	4.95	3,710.27
Monitor-4A	4,067	450,084.00	1,121,344.00	1	T29N R51W	4,327.49	4,326.30	1.60	1134	1,079	1,088	1,110	22	4.95	3,709.69
Monitor-5	2,800	447,734.00	1,119,236.00	1	T29N R51W	4,339.50	4,337.40	2.10	1120	1,069	1070	1,120	50	4.95	3,711.05
Monitor-6	4,667	442,856.00	1,124,385.00	12	T29N R51W	4,215.00	4,213.80	1.20	1050	989	990	1,023	33	4.95	3,712.83
Monitor-7	6,200	440,358.00	1,120,757.00	12	T29N R51W	4,244.38	4,243.20	1.20	1050	999	1,000-1,013	1,023-1,043	33	4.95	3,713.39
Monitor-8	6,800	450,974.00	1,117,005.00	2	T29N R51W	4,353.70	4,352.40	1.30	1,180	1,079	1,085	1,125	40	4.95	3,709.23
Brule Formation Observation Wells															
BOW-2010-1	133	446,250.00	1,121,572.00	1	T29N R51W	4,260.10	4,259.20	0.90	370	279	285-305	325-365	60	4.95	4,133.97
BOW-2010-2	4,167.00	450,154.00	1,121,367.00	1	T29N R51W	4,323.40	4,322.30	1.10	400	339	339-369	389-399	40	4.95	4,173.04
BOW-2010-3	6,867	450,974.00	1,117,056.00	2	T29N R51W	4,350.30	4,349.80	0.50	415	339	345-365	385-415	50	4.95	4,212.81

Notes:

1. NM = not measured
2. TOC = top of casing
3. ft = feet
4. in. = inches
5. ft bgs = feet below ground surface
6. ft amsl = feet above mean sea level

* = Baseline static water elevations were measured on November 12, 2010.

Table 2.7-3 Summary of 2011 Marsland Pumping Test Results

Well	Distance from Pumping Well (feet)	Analytical Results	Theis Drawdown	Theis Recovery	Averages
CPW-1A*	Pumping Well	Transmissivity (ft^2/day)	--	573	573
		Hyd. Cond. (ft/day)	--	14	14
		Storativity	--	--	--
CPW-1*	67	Transmissivity (ft^2/day)	430	523	477
		Hyd. Cond. (ft/day)	11	13	12
		Storativity	8.32E-05	--	8.32E-05
Monitor 2**	8,800	Transmissivity (ft^2/day)	1781	2469	2,125
		Hyd. Cond. (ft/day)	45	62	54
		Storativity	4.72E-05	--	4.72E-05
Monitor 3	100	Transmissivity (ft^2/day)	230	299	265
		Hyd. Cond. (ft/day)	6	7	7
		Storativity	1.70E-03	--	1.70E-03
Monitor 4A	4,067	Transmissivity (ft^2/day)	903	1,377	1,140
		Hyd. Cond. (ft/day)	23	34	29
		Storativity	5.41E-05	--	5.41E-05
Monitor 5	2,800	Transmissivity (ft^2/day)	915	971	943
		Hyd. Cond. (ft/day)	23	24	24
		Storativity	5.50E-05	--	5.50E-05
Monitor 6	4,667	Transmissivity (ft^2/day)	901	1063	982
		Hyd. Cond. (ft/day)	23	27	25
		Storativity	3.44E-05	--	3.44E-05
Monitor 7	6,200	Transmissivity (ft^2/day)	983	1,315	1,149
		Hyd. Cond. (ft/day)	25	33	29
		Storativity	3.57E-05	--	3.57E-05
Monitor 8**	6,800	Transmissivity (ft^2/day)	989	1,596	1,293
		Hyd. Cond. (ft/day)	25	40	33
		Storativity	3.95E-05	--	3.95E-05
Discharge Rate: 27.08 (U.S. gallons/min)				Avg. Transmissivity (ft^2/day)	1,012
Aquifer Thickness: 40 (feet)				Avg. Hyd. Cond. (ft/day)	25
				Avg. Storativity	7.46E-05

Notes:

1. * = Water level data for CPW-1A and CPW-1 were not corrected for barometric variations due to the logging interval of the pressure transducers.
2. ** = Monitor 2 and Monitor 8 were monitored and analyzed as described in the origional pumping test plan, but are not part of the formal monitoring network used to establish the radius of influence.
3. Pumping started at 5:03 am on 5/16/2011 and ended at 12:00 pm on 5/20/11.
4. Hydraulic conductivity calculated based on a typical net sand thickness of 40 feet.
5. ft^2/day = square feet per day
6. ft/day = feet per day

Table 2.7-4 Summary of Marsland Pumping Test Results Compared to Previous Testing

	Tests #1-#3 Existing Class III Permit Area (mean)	Test #4 Existing Class III Permit Area (mean)	Test #6 North Trend 2006 (mean)	Test #7 Three Crow 2008 (mean)	Test #8 Marsland 2011 (mean)
Transmissivity (ft^2/day)	363	826	60	477	1,012
Formation Thickness (feet)	39.0	39.0	26	64	40
Hyd. Cond. (ft/day)	9.3	20.6	2.3	7.5	25
Storativity	9.7E-05	6.2E-05	5.3E-05	8.8E-04	2.56E-04

Notes:

1. ft^2/day = square feet per day
2. ft/day = feet per day

Table 2.7-5 Baseline and Restoration Values for Mine Unit 1 of Current Commercial License Area

Parameter	Groundwater Standard [2]	MU-1 Baseline	MU-1 Standard Deviation	MU-1 NDEQ Restoration Value [3]
Ammonium (mg/L)	10.0	<0.372	N/A	10.0
Arsenic (mg/L)	0.05	<0.00214	N/A	0.05
Barium (mg/L)	1.0	<0.1	N/A	1.0
Cadmium (mg/L)[1]	0.01	<0.00644	N/A	0.005[1]
Chloride (mg/L)	250.0	203.9	38	250.0
Copper (mg/L)	1.0	<0.017	N/A	1.0
Fluoride (mg/L)	4.0	0.686	0.04	4.0
Iron (mg/L)	0.3	<0.0441	N/A	0.3
Mercury (mg/L)	0.002	<0.001	N/A	0.002
Manganese (mg/L)	0.05	<0.011	N/A	0.05
Molybdenum (mg/L)	1.0	<0.0689	N/A	1.0
Nickel (mg/L)	0.15	<0.0340	N/A	0.15
Nitrate (mg/L)	10.0	<0.050	N/A	10.0
Lead (mg/L)	0.05	0.0315	N/A	0.05
Radium (pCi/L)	5.0	229.7	177.1	584.0
Selenium (mg/L)	0.01	<0.00323	N/A	0.05
Sodium (mg/L)	N/A	412	19.2	4120
Sulfate (mg/L)	250.0	356.2	9.4	375
Uranium (mg/L)	5.0	0.0922	0.089	5.0
Vanadium (mg/L)	0.2	<0.0663	N/A	0.2
Zinc (mg/L)	5.0	<0.036	N/A	5.0
pH (Std. Units)	6.5 - 8.5	8.46	0.2	6.5 – 8.5
Calcium (mg/L)	N/A	12.5	3.2	125.0
Total Carbonate (mg/L)	N/A	351	31.1	585
Potassium (mg/L)	N/A	12.5	1.5	125.0
Magnesium (mg/L)	N/A	3.2	0.8	32.0
TDS (mg/L)	N/A	1170.2	47.6	1170.2

1 Standard for Cadmium lowered in modification to UIC permit dated March 9, 2001 following NDEQ approval of Mine Unit 1 restoration.
2 Title 118 numerical standards in effect at the time the Notice of Intent was filed with the NDEQ.
3 Restoration values based on Title 118 numerical standards and well field averages at the time the Notice of Intent was submitted to the NDEQ.
N/A = Not Applicable

Table 2.7-6 Anticipated Changes in Water Quality During Mining

Analyte	Average Ore Zone Water Quality		
	Units	Pre-Mining (Well W-007)	Typical Water Quality During Mining at CPF
Alkalinity, Total as $CaCO_3$	mg/l	328	1,600
Carbonate as CO_3	mg/l	0	<1.0
Bicarbonate as HCO_3	mg/l	401	2,050
Calcium	mg/l	29.6	77
Chloride	mg/l	202	600
Fluoride	mg/l	1.23	0.6
Magnesium	mg/l	5.3	23
Ammonia as N	mg/l	0.74	<0.05
Nitrate+Nitrite as N	mg/l	--	0.46
Potassium	mg/l	15.0	35
Silica	mg/l	11.3	21
Sodium	mg/l	567	1,310
Sulfate	mg/l	737	900
Conductivity	umhos/cm	2,723	6,000
pH	s.u.	8.1	7.8
Total Dissolved Solids	mg/l	1,804	4,080
Aluminum	mg/l	<0.10	<0.1
Arsenic	mg/l	<0.002	0.06
Barium	mg/l	<0.10	<0.1
Boron	mg/l	1.61	1.1
Cadmium	mg/l	<0.01	<0.005
Chromium	mg/l	<0.05	<0.05
Copper	mg/l	<0.01	0.04
Iron	mg/l	<0.05	<0.030
Lead	mg/l	<0.05	<0.05
Manganese	mg/l	0.01	0.05
Mercury	mg/l	<0.001	<0.001
Molybdenum	mg/l	<0.10	0.5
Nickel	mg/l	<0.05	<0.05
Selenium	mg/l	<0.175	0.07
Uranium	mg/l	<0.0032	44
Vanadium	mg/l	<0.10	2.5
Zinc	mg/l	<0.02	0.02
Radium 226	pCi/L	11.9	1,090

Source: Nebraska Title 118, Chapter 4, Section 002

CPF = Crow Butte Production Facility

Table 2.8-1 Monthly Climate Summary for Scottsbluff WSO Airport, NE (257665)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
Average Maximum Temperature (ºF)	39.4	43.2	50.9	61.5	71.3	82.0	89.4	87.5	78.2	65.9	51.2	40.8	63.4
Average Minimum Temperature (ºF)	12.3	15.4	22.5	32.1	42.4	52.1	58.0	55.7	45.2	33.2	21.9	13.9	33.8
Average Total Precipitation (Inches)	0.39	0.50	0.92	1.76	2.61	2.72	1.84	1.24	1.25	0.93	0.55	0.50	15.23
Average Total Snowfall (Inches)	5.3	5.6	7.6	5.1	0.9	0.0	0.0	0.0	0.3	2.5	4.8	6.1	38.3
Average Snow Depth (Inches)	1	1	1	0	0	0	0	0	0	0	1	1	0

Source: HPRCC 2011. Period of Record: 1/ 1/1893 to 12/31/2010

Table 2.8-2 Marsland Expansion Area Vegetation and Land Cover Types

Habitat	Acres	Percent
Mixed-grass prairie	2978.2	64.4
Degraded rangeland	645.9	14.0
Mixed conifer	418.4	9.1
Cultivated	299.7	6.5
Drainage	132.5	2.9
Range rehabilitation	69.7	1.5
Structure biotope	67.9	1.5
Deciduous streambank forest	10.0	0.2
Total	**4622.3**	**100.0**

Source: HWA 2011 and Crow Butte Resources, Inc.

Table 2.8-3 Federal and State Threatened, Endangered, and Candidate Species with the Potential to Occur Within the Vicinity of the Marsland Expansion Area

Species	Scientific Name	Potential Occurrence[2]	Status
Mammals			
Black-footed ferret	*Mustela nigripes*	U	Endangered – Federally
Gray wolf	*Canis lupus*	U	Threatened – Federally
Swift fox	*Vulpes velox*	L	Endangered – State
Birds			
Whooping crane	*Grus americana*	U	Endangered – Federally
Fish			
Blacknose shiner[1]	*Notropis heterolepis*	P, PAD	Endangered – State
Finescale dace[1]	*Phoxinus neogaeus*	P, PAD	Threatened – State
Northern redbelly dace[1]	*Phoxinus eos*	P, PAD	Threatened – State

Sources: USFWS 2011b; NGPC 2008b
[1]Presence in the Niobrara River system downstream of the project area.
[2]Potential Occurrence: likely (L), possible (P), unlikely (U), and potentially affected downstream (PAD).

Table 2.9-1 Locations of Environmental Sampling Stations, SAT Facility and MET Station at the Marsland Expansion Area Site

Environmental Sampling Station	Geographic Cartesian Coordinates (ft)		Section\Township/Range	Elevation (ft)	Locations as per NUREG-4.14
	Easting	Northing			
MAR-1	1119537.74	440509.22	SE Qtr of SE Qtr of Section 11, T29N, R51W	4250	Nearest Residence
MAR-2	1122400.98	434909.68	NE Qtr of NW Qtr of Section 24, T29N, R51W	4175	Site Boundary
MAR-3	1132760.45	426936.82	SE Qtr of NW Qtr of Section 29, T29N, R50W	4073	Site Boundary
MAR-4	1128689.68	426950.02	SW Qtr of NE Qtr of Section 30, T29N, R50W	4093	Site Boundary
MAR-5	1103038.51	425031.57	SE Qtr of SE Qtr of Section 29, T29N, R51W	4175	Background
MAR-6[a]	1126040.30	438868.61	SW Qtr of NW Qtr of Section 18, T29N, R50W	4190	Estimated Maximum Dose Concentration
Satellite Facility	1122432.30	442424.53	NE Qtr of SW Qtr of Section 12, T29N, R51W	4244	--
MET Station	1124820.50	443837.11	SE Qtr of NE Qtr of Section 12, T29N, R51W	4236	--

[a]MAR-6: Operational Monitoring

Table 2.9-2 Airborne Particulate Concentrations for Marsland Expansion Area

Analyte	Result pCi/filter	Precision ± pCi/filter	Result uCi/ml	Precision ± uCi/ml	RL uCi/ml	10 CFR Pt 20 Effluent Limit	Effluent Class	% Effluent Concentration
Fourth Quarter 2011								
MA-1 [Sample Air Volume 3,850,477 liters]								
Lead 210	72.2	6.4	2E-14	2E-15	2E-15	6E-13	Day	3.33
Radium 226	<0.3	--	<1E-16	--	1E-16	9E-13	Week	0.00
Thorium 230	<0.3	--	<1E-16	--	1E-16	3E-14	Year	0.00
Uranium	<0.3	--	<1E-26	--	1E-16	9E-14	Year	0.00
MA-2 [Sample Air Volume 3,851,229 liters]								
Lead 210	86.9	6.9	2E-14	2E-15	2E-15	6E-13	Day	3.33
Radium 226	<0.3	--	<1E-16	--	1E-16	9E-13	Week	0.00
Thorium 230	<0.3	--	<1E-16	--	1E-16	3E-14	Year	0.00
Uranium	<0.3	--	<1E-16	--	1E-16	9E-14	Year	0.00
MA-3 [Sample Air Volume 3,852,794 liters]								
Lead 210	83.0	6.2	2E-14	2E-15	2E-15	6E-13	Day	3.33
Radium 226	<0.3	--	<1E-16	--	1E-16	9E-13	Week	0.00
Thorium 230	0.4	0.4	<1E-16	--	1E-16	3E-14	Year	0.00
Uranium	0.3	--	<1E-16	--	1E-16	9E-14	Year	0.00
MA-4 [Sample Air Volume 3,853,046 liters]								
Lead 210	91.2	7.2	2E-14	2E-15	2E-15	6E-13	Day	3.33
Radium 226	<0.3	--	<1E-16	--	1E-16	9E-13	Week	0.00
Thorium 230	<0.3	--	<1E-16	--	1E-16	3E-14	Year	0.00
Uranium	<0.3	--	<1E-16	--	1E-16	9E-14	Year	0.00
MA-5 (Sample Air Volume 3,856,136 liters]								
Lead 210	70.5	6.0	2E-14	2E-15	2E-15	6E-13	Day	3.33
Radium 226	<0.3	--	<1E-16	--	1E-16	9E-13	Week	0.00
Thorium 230	0.4	0.4	1E-16	1E-16	1E-16	3E-14	Year	0.00
Uranium	<0.3	--	<1E-16	--	1E-16	9E-14	Year	0.00

Analyte	Result pCi/filter	Precision ± pCi/filter	Result uCi/ml	Precision ± uCi/ml	RL uCi/ml	10 CFR Pt 20 Effluent Limit	Effluent Class	% Effluent Concentration
First Quarter 2012								
MA-1 [Sample Air Volume 6,334,637 liters]								
Lead 210	115	7.5	2E-14	1E-15	2E-15	6E-13	Day	3.33
Radium 226	<0.3	--	<1E-16	--	1E-16	9E-13	Week	0.00
Thorium 230	<0.2	--	<1E-16	--	1E-16	3E-14	Year	0.00
Uranium	1.4	--	2E-16	--	1E-16	9E-14	Year	0.22
MA-2 [Sample Air Volume 6,337,547 liters]								
Lead 210	108	7.7	2E-14	1E-15	2E-15	6E-13	Day	3.33
Radium 226	<0.3	--	<1E-16	--	1E-16	9E-13	Week	0.00
Thorium 230	<0.2	--	<1E-16	--	1E-16	3E-14	Year	0.00
Uranium	1.8	--	3E-16	--	1E-16	9E-14	Year	0.33
MA-3 [Sample Air Volume 6,322,001 liters]								
Lead 210	109	7.0	2E-14	1E-15	2E-15	6E-13	Day	3.33
Radium 226	0.6	0.2	1E-16	3E-17	1E-16	9E-13	Week	0.01
Thorium 230	1.0	0.4	2E-16	6E-17	1E-16	3E-14	Year	0.67
Uranium	1.9	--	3E-16	--	1E-16	9E-14	Year	0.33
MA-4 [Sample Air Volume 6,333,500 liters]								
Lead 210	120	7.9	2E-14	1E-15	2E-15	6E-13	Day	3.33
Radium 226	0.4	0.1	<1E-16	--	1E-16	9E-13	Week	0.00
Thorium 230	0.3	0.2	<1E-16	--	1E-16	3E-14	Year	0.00
Uranium	1.6	--	3E-16	--	1E-16	9E-14	Year	0.33
MA-5 (Sample Air Volume 6,338,171 liters]								
Lead 210	116	7.2	2E-14	1E-15	2E-15	6E-13	Day	3.33
Radium 226	<0.3	--	<1E-16	--	1E-16	9E-13	Week	0.00
Thorium 230	0.2	0.2	<1E-16	--	1E-16	3E-14	Year	0.00
Uranium	1.4	--	2E-16	--	1E-16	9E-14	Year	0.22

Analyte	Result pCi/filter	Precision ± pCi/filter	Result uCi/ml	Precision ± uCi/ml	RL uCi/ml	10 CFR Pt 20 Effluent Limit	Effluent Class	% Effluent Concentration
Second Quarter 2012								
MA-1 [Sample Air Volume 6,196,200 liters]								
Lead 210	68.9	6.1	1E-14	1E-15	2E-15	6E-13	Day	1.67
Radium 226	<0.3	--	<1E-16	--	1E-16	9E-13	Week	0.00
Thorium 230	<0.2	--	<1E-16	--	1E-16	3E-14	Year	0.00
Uranium	<0.3	--	<1E-16	--	1E-16	9E-14	Year	0.00
MA-2 [Sample Air Volume 6,203,400 liters]								
Lead 210	82.7	5.4	1E-14	9E-16	2E-15	6E-13	Day	1.67
Radium 226	<0.3	--	<1E-16	--	1E-16	9E-13	Week	0.00
Thorium 230	<0.2	--	<1E-16	--	1E-16	3E-14	Year	0.00
Uranium	<0.3	--	<1E-16	--	1E-16	9E-14	Year	0.00
MA-3 [Sample Air Volume 6,067,000 liters]								
Lead 210	75.7	5.1	1E-14	8E-16	2E-15	6E-13	Day	1.67
Radium 226	0.5	0.1	<1E-16	--	1E-16	9E-13	Week	0.00
Thorium 230	<0.2	--	<1E-16	--	1E-16	3E-14	Year	0.00
Uranium	0.3	--	<1E-16	--	1E-16	9E-14	Year	0.00
MA-4 [Sample Air Volume 6,049,000 liters]								
Lead 210	78.2	5.2	1E-14	9E-16	2E-15	6E-13	Day	1.67
Radium 226	0.3	0.1	<1E-16	--	1E-16	9E-13	Week	0.00
Thorium 230	<0.2	--	<1E-16	--	1E-16	3E-14	Year	0.00
Uranium	0.4	--	<1E-16	--	1E-16	9E-14	Year	0.00
MA-5 [Sample Air Volume 5,575,200 liters]								
Lead 210	62.2	4.8	1E-14	9E-16	2E-15	6E-13	Day	1.67
Radium 226	<0.3	--	<1E-16	--	1E-16	9E-13	Week	0.00
Thorium 230	<0.2	--	<1E-16	--	1E-16	3E-14	Year	0.00
Uranium	<0.3	--	<1E-16	--	1E-16	9E-14	Year	0.00

Analyte	Result pCi/filter	Precision ± pCi/filter	Result uCi/ml	Precision ± uCi/ml	RL uCi/ml	10 CFR Pt 20 Effluent Limit	Effluent Class	% Effluent Concentration
Third Quarter 2012								
MA-1 [Sample Air Volume 6,108,764 liters]								
Lead 210	116	7.0	2E-14	1E-15	2E-15	6E-13	Day	3.33
Radium 226	0.4	0.1	<1E-16	--	1E-16	9E-13	Week	0.00
Thorium 230	<0.2	--	<1E-16	--	1E-16	3E-14	Year	0.00
Uranium	0.3	--	<1E-16	--	1E-16	9E-14	Year	0.00
MA-2 [Sample Air Volume 6,002,630 liters]								
Lead 210	122	7.4	2E-14	1E-15	2E-15	6E-13	Day	3.33
Radium 226	3.0	0.4	5E-16	7E-17	1E-16	9E-13	Week	0.06
Thorium 230	<0.2	--	<1E-16	--	1E-16	3E-14	Year	0.00
Uranium	<0.3	--	<1E-16	--	1E-16	9E-14	Year	0.00
MA-3 [Sample Air Volume 6,532,003 liters]								
Lead 210	129	7.6	2E-14	1E-15	2E-15	6E-13	Day	3.33
Radium 226	0.9	0.2	1E-16	3E-17	1E-16	9E-13	Week	0.01
Thorium 230	<0.2	--	<1E-16	--	1E-16	3E-14	Year	0.00
Uranium	0.4	--	<1E-16	--	1E-16	9E-14	Year	0.00
MA-4 [Sample Air Volume 5,889,397 liters]								
Lead 210	103	6.3	2E-14	1E-15	2E-15	6E-13	Day	3.33
Radium 226	0.6	0.2	1E-16	3E-17	1E-16	9E-13	Week	0.01
Thorium 230	<0.2	--	<1E-16	--	1E-16	3E-14	Year	0.00
Uranium	0.5	--	<1E-16	--	1E-16	9E-14	Year	0.00
MA-5 [Sample Air Volume 5,337,479 liters]								
Lead 210	103	6.6	2E-14	1E-15	2E-15	6E-13	Day	3.33
Radium 226	<0.3	--	<1E-16	--	1E-16	9E-13	Week	0.00
Thorium 230	<0.2	--	<1E-16	--	1E-16	3E-14	Year	0.00
Uranium	<0.3	--	<1E-16	--	1E-16	9E-14	Year	0.00

Analyte	Result pCi/filter	Precision ± pCi/filter	Result uCi/ml	Precision ± uCi/ml	RL uCi/ml	10 CFR Pt 20 Effluent Limit	Effluent Class	% Effluent Concentration
Fourth Quarter 2012								
MA-1 [Sample Air Volume 6,682,410 liters]								
Lead 210	129	5.8	2E-14	9E-16	2E-15	6E-13	Day	3.33
Radium 226	0.3	0.1	<1E-16	--	1E-16	9E-13	Week	0.00
Thorium 230	<0.2	--	<1E-16	--	1E-16	3E-14	Year	0.00
Uranium	0.4	--	<1E-16	--	1E-16	9E-14	Year	0.00
MA-2 [Sample Air Volume 6,581,476 liters]								
Lead 210	128	6.1	2E-14	9E-16	2E-15	6E-13	Day	3.33
Radium 226	<0.3	--	<1E-16	--	1E-16	9E-13	Week	0.00
Thorium 230	<0.2	0.2	<1E-16	--	1E-16	3E-14	Year	0.00
Uranium	<0.3	--	<1E-16	--	1E-16	9E-14	Year	0.00
MA-3 [Sample Air Volume 6,575,697 liters]								
Lead 210	128	5.8	2E-14	9E-16	2E-15	6E-13	Day	3.33
Radium 226	<0.3	--	<1E-16	--	1E-16	9E-13	Week	0.00
Thorium 230	<0.2	--	<1E-16	--	1E-16	3E-14	Year	0.00
Uranium	<0.3	--	<1E-16	--	1E-16	9E-14	Year	0.00
MA-4 [Sample Air Volume 6,582,882 liters]								
Lead 210	132	5.8	2E-14	9E-16	2E-15	6E-13	Day	3.33
Radium 226	0.4	0.1	<1E-16	--	1E-16	9E-13	Week	0.00
Thorium 230	<0.2	--	<1E-16	--	1E-16	3E-14	Year	0.00
Uranium	<0.3	--	<1E-16	--	1E-16	9E-14	Year	0.00
MA-5 [Sample Air Volume 6,584,474 liters]								
Lead 210	134	6.1	2E-14	9E-16	2E-15	6E-13	Day	3.33
Radium 226	<0.3	--	<1E-16	--	1E-16	9E-13	Week	0.00
Thorium 230	<0.2	--	<1E-16	--	1E-16	3E-14	Year	0.00
Uranium	<0.3	--	<1E-16	--	1E-16	9E-14	Year	0.00

RL – Reporting Limit
uCi/ml – microuries per milliliter
pCi/filter – picocuries per filter

Table 2.9-3 Ambient Atmospheric Radon-222 Concentration for Marsland Expansion Area

Location	Date	Gross Count	Average Radon Concentration	Accuracy	Percent Effluent Concentration
			x 10^{-9} uCi/ml		
MAR-1	11/11/2011 – 1/04/2012	132	0.3	0.03	3.0
MAR-2		136	0.3	0.03	3.0
MAR-3		130	0.2	0.02	2.0
MAR-4		167	0.6	0.05	6.0
MAR-5		173	0.7	0.05	7.0
	Average	**148**	**0.4**	**0.04**	**4.2**
MAR-1	1/04/2012 – 4/02/2012	120	0.7	0.06	7.0
MAR-2		87	0.3	0.03	3.0
MAR-3		47	0.07	0.01	0.7
MAR-4		43	0.07	0.01	0.7
MAR-5		251	1.0	0.06	10.0
	Average	**110**	**0.4**	**0.03**	**4.2**
MAR-1	4/02/2012 – 6/29/2012	241	0.8	0.05	8.0
MAR-2		362	1.6	0.08	16.0
MAR-3		271	1.0	0.06	10.0
MAR-4		244	0.9	0.06	9.0
MAR-5		255	0.9	0.06	9.0
	Average	**275**	**1.0**	**0.06**	**10.0**
MAR-1		76	0.2	0.02	2.0
MAR-2	6/29/2012 – 10/01/2012	81	0.2	0.02	2.0
MAR-3		77	0.2	0.02	2.0
MAR-4		79	0.2	0.02	2.0
MAR-5		70	0.1	0.01	1.0
	Average	**77**	**0.2**	**0.2**	**2.0**
MAR-1	10/01/2012 – 1/02/2013	290	0.8	0.05	8.0
MAR-2		256	0.6	0.04	6.0
MAR-3		216	0.4	0.03	4.0
MAR-4		196	0.3	0.02	3.0
MAR-5		206	0.3	0.02	3.0
	Average	**233**	**0.5**	**0.03**	**5.0**

LLD (x 10^{-9} uCi/ml): 0.2
Effluent Concentration Limit, 10 CFR 20 App B Column 2: 10
Equipment: Track Etch Cup
LLD – Lower Limit of Detection
uCi/ml – microcuries per milliliter

Table 2.9-4 Summary of Water Quality for the Marsland Expansion Area and Vicinity (2011-2014)

Constituent	Units	Active Private Wells[a]		MEA Wells					
		Arikaree Group and Brule Formations		Arikaree Formation [b]		Brule Formation [c]		Basal Sandstone of Chadron Formation [d]	
		Range	Mean	Range	Mean	Range	Mean	Range	Mean
Calcium	mg/l	21-73	38.9	31 - 48	36.5	4 - 35	21.7	2 - 19	7.14
Magnesium[e]	mg/l	3 - 13	8.8	6 - 18	9.3	<1 - 10	3.84	<1 U - 3	1.17
Sodium	mg/l	8 - 49	19.8	6 - 26	16.5	18 - 408	104	298 - 514	394
Potassium	mg/l	2 -13	4.2	1 - 5	3.6	3 - 38	11.16	8 - 40	20.2
Bicarbonate as HCO_3	mg/l	160 - 480	201.9	155 - 221	186.7	<1 - 205	26.2	140 - 918	357
Sulfate	mg/l	3 - 44	10.2	1 - 12	7.1	7 - 62	26.2	45 - 388	172
Chloride	mg/l	2 - 9	3.5	0.5 - 10	4.2	2 - 502	92.1	137 - 605	259
Conductivity @ 25 °C	µmhos/cm	241 - 578	329.9	248 - 398	330.8	289 - 2300	669	1340 - 2740	1835
Total Dissolved Solids @ 180 C	mg/l	202 - 400	250.2	220 - 300	254.4	200 - 1280	440	791 - 1400	1076
Total Dissolved Solids Calculated	mg/l	166 - 870	270.7	210 - 270	244.4	220 - 1410	439	770 - 1450	1063
pH	s.u.	7.64 - 8.5	8.1	8.3 - 8.5	8.4	8.1 - 10.8	8.9	8.29 - 9.72	8.81
Cations	meq/l	2.75 - 6.29	3.6	2.76 - 3.99	3.4	1.92 - 20.32	6.14	13.5 - 23.8	18.2
Anions	meq/l	2.94 - 6.71	3.7	2.76 - 4.09	3.5	3.07 - 21.67	6.42	13.6 - 24.6	17.4
Uranium, Suspended[e]	mg/l	<0.0003 U - 0.001[f]	0.0002	<0.0003-0.0017	0.0003	<0.0003 U - 0.0007	0.0002	<0.0003 U - 0.0295	0.0011
Uranium, Dissolved[e]	mg/l	0.0028 - 0.0282	0.0071	0.0038-0.0087	0.0062	0.0003 - 0.0282	0.007	<0.0003 U - 0.0771	0.0068
Radium-226, Dissolved[e]	µCi/ml	<1.3E-10 - 9.5E-9[g]	2.3E-10	<2E-10 - 4E-10	1.22E-10	<2E-10 - 1E-9	2.25E-10	2E-10 - 3.48E-7	1.91E-08
Radium-226, Suspended[e]	µCi/ml	3E-11 - 2E-10[h]	8.5E-11	<2E-10 - 6E-10	1.28E-10	<2E-10 - 9E-10	1.27E-10	<1E-10 - 9E-10	1.86E-10
Uranium Activity, Dissolved[e]	uCi/mL	3.8E-10 - 3.9E-9	2.14E-09	2.6E-9 - 5.9E-9	4.23E-09	<2E-10 - 9E-9	3.17E-09	<2.E-10 - 9.5	3.47E-10
Uranium Activity, Suspended[e]	uCi/mL	<2.E-10 - 6.5E-10[i]	1E-10	<2E-10-6E-10	3.44E-10	<2E-10 - 5E-10	1.9E - 10	<2.E-10 - 6E-10	1E-10

Notes:

[a] Active private water supply wells within 2k (700, 702, 703, 704, 705, 706, 707, 714, 715, 716, 719, 720, 721, 722, 723, 725, 727, 728, 730, 731, 732, 734, 735, 736, 737, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 750, 752, 753, 754, 755, 759, 760, 777, 788, 794, 795, 799, 802, 809, 810, 811, 815, 821, 836, 841, 845) (March 2011 - March 2013).

[b] 8 CBR MEA Arikaree monitor wells (AOW-3, AOW-4, AOW-5, AOW-6, AOW-8, AOW-9, AOW-10, AOW-11) (November 2013 - September 2014)

[c] 11 CBR MEA Brule monitor wells (BOW-2010-1, BOW-2010-2, BOW-2010-3, BOW-2010-4A, BOW-2010-5, BOW-2010-6, BOW-2010-7, BOW-2010-8, BOW-9, BOW-10, BOW-11) (December 2013 - September 2014).

[d] 11 CBR MEA Basal Chadron monitor wells (Monitor-1, Monitor-2, Monitor-4A, Monitor-5, Monitor-6, Monitor-7, Monitor-8, Monitor-9, Monitor-10, Monitor-11, CPW-2010-1) (November 2011 - August 2012).

[e] Values less than detection limits reduced by one-half in order to provide a conservative estimate.

[f] 198 of 202 sample analyses were less than RL 0.0003 mg/L

[g] 184 of 202 sample analyses were less than RLs rannging from <1.3E-10 to 2.4E-10 uCi/mL.

[h] 200 of 202 sample analyses were less than RLs ranging from <9E-11 to 2E-10 uCi/mL, with 96 being less than 2E-10 uCi/mL.

[i] 197 of 202 sample analyses were less than RL of 2E-10 uCi/mL.

mg/l = milligrams/liter
meq/l = milliequivalents per liter
pCi/l = picocuries per liter

<0.0003 U = non-detect result and detection limit
µmhos/cm = micromhos per centimeter
s.u. = standard units

AOR = Area of Review
CBR = Crow Butte Resources, Inc.
MEA = Marsland Expansion Area

Table 2.9-5 Radiological Analyses for Private Water Supply Wells in Marsland Area of Review

	Location ID:	700		700		700		700		702		702		702		702		703		703	
	Date Collected:	6/18/2012		9/17/2012		11/26/2012		3/18/2013		6/18/2012		9/17/2012		11/26/2012		3/18/2013		6/20/2012		9/7/2012	
Analyte	Units	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL
RADIONUCLIDES-DISSOLVED																					
Lead 210	µCi/mL	<8E-10 U	8E-10	1.3E-10	1E-9	<8E-10 U	8E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	<1E-9	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	1.9E-09	1E-9
Lead 210 MDC	µCi/mL	8E-10		-		8E-10		-		8E-10		-		7E-10		-		8E-10		-	
Lead 210 precision (±)	µCi/mL	5E-10		4E-10		5E-10		-		5E-10		-		4E-10		-		5E-10		6E-10	
Polonium 210	µCi/mL	1.7E-9	6E-10	<1E-10 U	1E-9	<1E-9 U	1E-9	<1E-9 U	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	<1E-9 U	1E-9	<6E-10 U	6E-10	<1E-9 U	1E-9
Polonium 210 MDC	µCi/mL	6E-10		-		1E-9		-		7E-10		-		8E-10		-		6E-10		-	
Polonium 210 precision (±)	µCi/mL	9E-10		-		4E-10		-		5E-10		-		3E-10		-		4E-10		-	
Radium 226	µCi/mL	<1.8E-10 U	1.8E-10	<2E-10 U	2E-10	<1.4E-10 U	1.4E-10	<2E-10 U	2E-10	<1.5E-10 U	1.5E-10	<2E-10 U	2E-10	<1.5E-10	1.5E-10	<2E-10 U	2E-10	<1.5E-10	1.5E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	1.8E-10		-		1.4E-10		-		1.5E-10		-		1.5E-10		-		1.5E-10		-	
Radium 226 precision (±)	µCi/mL	7E-11		-		1E-10		-		1E-10		-		6E-11		-		9E-10		-	
Thorium 230	µCi/mL	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10U	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	2E-10		-		2E-10		-		1E-10		-		1E-10		-		2E-10		-	
Thorium 230 precision (±)	µCi/mL	5E-11		-		6E-11		-		4E-11		-		4E-11		-		8E-11		-	
RADIONUCLIDES-SUSPENDED																					
Lead 210	µCi/mL	<6E-10 U	6E-10	1.3E-9	1E-9	<5E-10 U	5E-10	<1E-9 U	1E-9	<6E-10 U	6E-10	<1E-9 U	1E-9	<5E-10 U	5E-10	<1E-9 U	1E-9	<5E-10 U	5E-10	<1E-9 U	1E-9
Lead 210 MDC	µCi/mL	6E-10		-	-	5E-10		-		6E-10		-		5E-10		-		5E-10		-	
Lead 210 precision (±)	µCi/mL	4E-10		-	-	3E-10		-		4E-10		-		3E-10		-		3E-10		-	
Polonium 210	µCi/mL	3E-10	2E-10	<1E-9	1E-9	<9E-10 U	9E-10	<1E-9 U	1E-9	6E-10	3E-10	<1E-9 U	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9	<3E-10	3E-10	<1E-9 U	1E-9
Polonium 210 MDC	µCi/mL	2E-10		-	-	9E-10		-		3E-10		-		7E-10		-		3E-10		-	
Polonium 210 precision (±)	µCi/mL	2E-10		-	-	3E-10		-		4E-10		-		3E-10		-		2E-10		-	
Radium 226	µCi/mL	<1.2E-10 U	1.2E-10	<2E-10 U	2E-10	<1.2E-10 U	1.2E-10	<2E-10 U	2E-10	<1.3E-10 U	1.3E-10	<2E-10 U	2E-10	<1.1E-10 U	1.1E-10	<2E-10 U	2E-10	<1.2E-10	1.2E-10	<2E-10	2E-10
Radium 226 MDC	µCi/mL	1.2E-10		-	-	1.2E-10		-		1.3E-10		-		1.1E-10		-		1.2E-10		-	
Radium 226 precision (±)	µCi/mL	7E-11		-	-	6E-11		-		7E-11		-		6E-11		-		7E-11		-	
Thorium 230	µCi/mL	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<1E-10	1E-10	<2E-10	2E-10
Thorium 230 MDC	µCi/mL	1E-10		-	-	1E-10		-		1E-10		-		2E-10		-		1E-10		-	
Thorium 230 precision (±)	µCi/mL	4E-11		-	-	4E-11		-		5E-11		-		7E-11		-		6E-11		-	
METALS, DISSOLVED	µCi/mL																				
Uranium	mg/L	0.0060	0.0003	0.0066	0.0003	0.0073	0.0003	0.0072	0.0003	0.0034	0.0003	0.0039	0.0003	0.0041	0.0003	0.0040	0.0003	0.0036	0.0003	0.0049	0.0003
Uranium Activity	µCi/mL	4.1E-9	2E-10	4.5E-9	2E-10	4.9E-9	2E-10	4.9E-9	2E-10	2.3E-9	2E-10	2.6E-9	2E-10	2.8E-9	2E-10	2.7E-9	2E-10	2.5E-9	2E-10	3.3E-9	2E-10
METALS, SUSPENDED																					
Uranium	mg/L	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003
Uranium Activity	µCi/mL	<2.E-10	2E-10	<2E-10	2E-10	<2.E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10

Notes:

RL - Analyte reporting limit.

U - Not detected at minimum detectable concentration

B- Analyete detected in the associated method blank

µCi/mL - microcuries per milliter

mg/l - milligrams per liter

[a] Discussions with land owners regarding known completion depths of private water wells in the area suggest that these wells are completed within the Arikaree Formation or the Brule Formation or a combination of both.

[b] Information provided by private well owner and nearby well data indicate that one or more aquifer is used, but cannot be specifically determined. Assigned formation based on available information.

[c] Wells are not active year-around. Wells are used seasonally and sampled when active, resulting in irregular sampling events.

[d] Well is inoperable, resulting in partial sampling events.

[e] CBR driller water supply.

Table 2.9-5 Radiological Analyses for Private Water Supply Wells in Marsland Area of Review

Location ID:		703		703		704 [a]		704 [a]		704 [a]		704 [a]		705 [a]		705 [a]		705 [a]		705 [a]	
Date Collected:		11/27/2012		3/21/2013		6/20/2012		9/7/2012		11/27/2012		3/21/2013		6/20/2012		9/19/2012		11/28/2012		3/21/2013	
Analyte	Units	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL
RADIONUCLIDES-DISSOLVED																					
Lead 210	µCi/mL	<7E-10 U	7E-10	<1E-9	1E-9	<8E-10 U	8E-10	1.3E-9	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9	<9E-10 U	9E-10	<1E-9 U	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9
Lead 210 MDC	µCi/mL	7E-10		-		8E-10		-		7E-10		-		9E-10		-		7E-10		-	
Lead 210 precision (±)	µCi/mL	4E-10		-		5E-10		5E-10		4E-10		-		5E-10		-		4E-10		-	
Polonium 210	µCi/mL	<7E-10 U	7E-10	<1E-9	1E-9	<6E-10 U	6E-10	<1E-9 U	1E-9	<9E-10 U	9E-10	<1E-9 U	1E-9	<6E-10 U	6E-10	1.3E-9	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9
Polonium 210 MDC	µCi/mL	7E-10		-		6E-10		-		9E-10		-		6E-10		-		7E-10		-	
Polonium 210 precision (±)	µCi/mL	4E-10		-		6E-10		-		3E-10		-		3E-10		8E-10		3E-10		-	
Radium 226	µCi/mL	<2E-10 U	2E-10	<2E-10 U	2E-10	<1.7E-10 U	1.7E-10	<2E-10 U	2E-10	<1.6E-10 U	1.6E-10	<2E-10 U	2E-10	<1.6E-10 U	1.6E-10	<2E-10 U	2E-10	<1.8E-10	1.8E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	2E-10		-		1.7E-10		-		1.6E-10		-		1.6E-10		-		1.8E-10		-	
Radium 226 precision (±)	µCi/mL	1.2E-10		-		9E-10		-		9E-11		-		9E-10		-		8E-10		-	
Thorium 230	µCi/mL	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	2E-10		-		2E-10		-		2E-10		-		1E-10		-		1E-10		-	
Thorium 230 precision (±)	µCi/mL	6E-11		-		7E-11		-		8E-11		-		6E-11		-		7E-11		-	
RADIONUCLIDES-SUSPENDED																					
Lead 210	µCi/mL	<5E-10 U	5E-10	<1E-9 U	1E-9	<6E-10 U	6E-10	<1E-9 U	1E-9	<5E-10 U	5E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	3.8E-9 B	1E-9	9E-10	6E-10	1E-9	1E-9
Lead 210 MDC	µCi/mL	5E-10		-		6E-10		-		5E-10		-		8E-10		-		6E-10		-	
Lead 210 precision (±)	µCi/mL	3E-10		-		4E-10		-		3E-10		-		5E-10		6E-10 B		4E-10		4E-10	
Polonium 210	µCi/mL	<7E-10 U	7E-10	<1E-9 U	1E-9	<3E-10 U	3E-10	<1E-9 U	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9	<2E-10 U	2E-10	<1E-10 U	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9
Polonium 210 MDC	µCi/mL	7E-10		-		3E-10		-		7E-10		-		2E-10		-		7E-10		-	
Polonium 210 precision (±)	µCi/mL	3E-10		-		1E-10		-		5E-10		-		2E-10		-		5E-10		-	
Radium 226	µCi/mL	<1.E-10 U	1E-10	<2E-10 U	2E-10	<1.2E-10 U	1.2E-10	<2E-10 U	2E-10	<1.1E-10 U	1.1E-10	<2E-10 U	2E-10	<1.3E-10 U	1.3E-10	<2E-10 U	2E-10	1.7E-10	1.2E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	1E-10		-		1.2E-10		-		1.1E-10		-		1.3E-10		-		1.2E-10		-	
Radium 226 precision (±)	µCi/mL	6E-11		-		6E-11		-		5E-11		-		5E-11		-		1E-10		-	
Thorium 230	µCi/mL	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1.E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	1E-10		-		1E-10		-		1E-10		-		1E-10		-		1E-10		-	
Thorium 230 precision (±)	µCi/mL	5E-11		-		6E-11		-		5E-11		-		4E-11		-		7E-11		-	
METALS, DISSOLVED	µCi/mL																				
Uranium	mg/L	0.0051	0.0003	0.0055	0.0003	0.0032	0.0003	0.0052	0.0003	0.0053	0.0003	0.0051	0.0003	0.0056	0.0003	0.0064	0.0003	0.0059	0.0003	0.0052	0.0003
Uranium Activity	µCi/mL	3.5E-9	2E-10	3.7E-9	2E-10	2.2E-9	2E-10	3.5E-9	2E-10	3.6E-9	2E-10	3.5E-9	2E-10	3.8E-10	2E-10	4.3E-9	2E-10	4E-9	2E-10	3.5E-9	2E-10
METALS, SUSPENDED																					
Uranium	mg/L	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003
Uranium Activity	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10

Notes:

RL - Analyte reporting limit.

U - Not detected at minimum detectable concentration

B- Analyete detected in the associated method blank

µCi/mL - microcuries per milliter

mg/l - milligrams per liter

[a] Discussions with land owners regarding known completion depths of private water wells in the area suggest that these wells are completed within the Arikaree Formation or the Brule Formation or a combination of both.

[b] Information provided by private well owner and nearby well data indicate that one or more aquifer is used, but cannot be specifically determined. Assigned formation based on available information.

[c] Wells are not active year-around. Wells are used seasonally and sampled when active, resulting in irregular sampling events.

[d] Well is inoperable, resulting in partial sampling events.

[e] CBR driller water supply.

Table 2.9-5 Radiological Analyses for Private Water Supply Wells in Marsland Area of Review

	Location ID:	706 [a]		706 [a]		706 [a]		706 [a]		707 [a]		707 [a]		707 [a]		707 [a]		714 [b]		714 [b]	
	Date Collected:	6/20/2012		9/7/2012		11/28/2012		3/20/2013		6/19/2012		9/7/2012		11/28/2012		3/21/2013		6/21/2012		9/18/2012	
Analyte	Units	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL
RADIONUCLIDES-DISSOLVED																					
Lead 210	µCi/mL	<9E-10 U	9E-10	<1E-9 U	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	1.2E-9	1E-9	<7E-10 U	7E-10	1.1E-9	1E-9	<9E-10 U	9E-10	1.1E-9	1E-9
Lead 210 MDC	µCi/mL	9E-10		-		7E-10		-		8E-10		-		7E-10		-		9E-10		-	
Lead 210 precision (±)	µCi/mL	5E-10		-		4E-10		-		5E-10		5E-10		4E-10		4E-10		5E-10		5E-10	
Polonium 210	µCi/mL	<1E-9 U	1E-9	1.2E-10	1E-9	<8E-10 U	8E-10	<1E-9 U	1E-9	<3E-10 U	3E-10	<1.E-9 U	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9	<1E-9 U	1E-9	<1E-10 U	1E-9
Polonium 210 MDC	µCi/mL	1E-9		-		8E-10		-		3E-10		-		7E-10		-		1E-9		-	
Polonium 210 precision (±)	µCi/mL	7E-10		8E-10		4E-10		-		2E-10		-		3E-10		-		8E-10		-	
Radium 226	µCi/mL	<1.6E-10	1.6E-10	<2E-10 U	2E-10	<1.6E-10 U	1.6E-10	<2E-10 U	2E-10	<1.6E-10 U	1.6E-10	<2E-10 U	2E-10	<1.4E-10 U	1.4E-10	<2E-10	2E-10	<1.7E-10	1.7E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	1.6E-10		-		1.6E-10		-		1.6E-10		-		1.4E-10		-		1.7E-10		-	
Radium 226 precision (±)	µCi/mL	1E-10		-		8E-10		-		9E-11		-		9E-11		-		1E-10		-	
Thorium 230	µCi/mL	<2E-10 U	2E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<9E-11 U	9E-11	<2E-10	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	2E-10		-		1E-10		-		2E-10		-		9E-11		-		2E-10		-	
Thorium 230 precision (±)	µCi/mL	1E-10		-		3E-11		-		6E-11		-		6E-11		-		5E-11		-	
RADIONUCLIDES-SUSPENDED																					
Lead 210	µCi/mL	<5E-10 U	5E-10	<1E-9 U	1E-9	6E-10	6E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	<1E-9 U	1E-9	7E-10	6E-10	1.1E-9	1E-9	<6E-10 U	6E-10	1.4E-9	1E-9
Lead 210 MDC	µCi/mL	5E-10		-		6E-10		-		8E-10		-		6E-10		-		6E-10		-	
Lead 210 precision (±)	µCi/mL	3E-10		-		4E-10		-		5E-10		-		4E-10		4E-10		4E-10		4E-10	
Polonium 210	µCi/mL	<2E-10 U	2E-10	<1E-9 U	1E-9	<5E-10 U	5E-10	<1E-9 U	1E-9	<3E-10 U	3E-10	<1E-9 U	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9	<3E-10 U	3E-10	<1E-9 U	1E-9
Polonium 210 MDC	µCi/mL	2E-10		-		5E-10		-		3E-10		-		7E-10		-		3E-10		-	
Polonium 210 precision (±)	µCi/mL	1E-10		-		4E-10		-		2E-10		-		5E-10		-		1E-10		-	
Radium 226	µCi/mL	<1E-10 U	1E-10	<2E-10 U	2E-10	<1.2E-10 U	1.2E-10	<2E-10 U	2E-10	<1.2E-10 U	1.2E-10	<2E-10 U	2E-10	<1.2E-10	1.2E-10	<2E-10	2E-10	<1.3E-10 U	1.3E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	1E-10		-		1.2E-10		-		1.2E-10		-		1.2E-10		-		1.3E-10		-	
Radium 226 precision (±)	µCi/mL	5E-11		-		7E-10		-		5E-11		-		7E-10		-		6E-11		-	
Thorium 230	µCi/mL	<9E-11 U	9E-11	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	9E-11		-		1E-10		-		1E-10		-		1E-10		-		1E-10		-	
Thorium 230 precision (±)	µCi/mL	4E-11		-		5E-11		-		6E-11		-		6E-11		-		9E-11		-	
METALS, DISSOLVED	µCi/mL																				
Uranium	mg/L	0.0038	0.0003	0.0056	0.0003	0.0059	0.0003	0.0058	0.0003	0.0036	0.0003	0.005	0.0003	0.0048	0.0003	0.0052	0.0003	0.0086	0.0003	0.0055	0.0003
Uranium Activity	µCi/mL	2.5E-9	2E-10	3.5E-9	2E-10	4E-9	2E-10	3.9E-9	2E-10	2.4E-9	2E-10	3.4E-9	2E-10	3.2E-9	2E-10	3.5E-9	2E-10	5.8E-9	2.00E-10	3.7E-9	2E-10
METALS, SUSPENDED																					
Uranium	mg/L	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003
Uranium Activity	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10

Notes:

RL - Analyte reporting limit.

U - Not detected at minimum detectable concentration

B- Analyete detected in the associated method blank

µCi/mL - microcuries per milliter

mg/l - milligrams per liter

[a] Discussions with land owners regarding known completion depths of private water wells in the area suggest that these wells are completed within the Arikaree Formation or the Brule Formation or a combination of both.

[b] Information provided by private well owner and nearby well data indicate that one or more aquifer is used, but cannot be specifically determined. Assigned formation based on available information.

[c] Wells are not active year-around. Wells are used seasonally and sampled when active, resulting in irregular sampling events.

[d] Well is inoperable, resulting in partial sampling events.

[e] CBR driller water supply.

Table 2.9-5 Radiological Analyses for Private Water Supply Wells in Marsland Area of Review

Location ID:		714 [b]		714 [b]		715 [c]		716 [c]		719		719		719		719		720 [e]		720 [e]	
Date Collected:		11/28/2012		3/21/2013		6/21/2012		6/21/2012		6/21/2012		9/18/2012		11/27/2012		3/18/2013		6/21/2012		9/17/2012	
Analyte	Units	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL
RADIONUCLIDES-DISSOLVED																					
Lead 210	µCi/mL	<7E-10 U	7E-10	<1E-9	1E-9	<9E-10 U	9E-10	<9E-10 U	9E-10	<9E-10 U	9E-10	1.4E-9	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	<1E-9 U	1E-9
Lead 210 MDC	µCi/mL	7E-10		-		9E-10		9E-10		9E-10		-		7E-10		-		8E-10		-	
Lead 210 precision (±)	µCi/mL	4E-10		-		5E-10		5E-10		5E-10		5E-10		4E-10		-		5E-10		-	
Polonium 210	µCi/mL	<8E-10 U	8E-10	<1E-9	1E-9	<1E-9 U	1E-9	<1E-9	1E-9	<6E-10 U	6E-10	<1E-9 U	1E-9	<9E-10 U	9E-10	<1E-9 U	1E-9	1.5E-9	7E-10	<1E-9 U	1E-9
Polonium 210 MDC	µCi/mL	8E-10		-		1E-9		1E-9		6E-10		-		9E-10		-		9E-10		-	
Polonium 210 precision (±)	µCi/mL	3E-10		-		5E-10		4E-10		4E-10		-		3E-10		-		7E-10		-	
Radium 226	µCi/mL	<1.6E-10 U	1.6E-10	<2E-10 U	2E-10	<1.7E-10 U	1.7E-10	<1.7E-10 U	1.7E-10	<1.7E-10 U	1.7E-10	<2E-10 U	2E-10	<1.7E-10 U	1.7E-10	<2E-10 U	2E-10	<1.8E-10	1.8E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	1.6E-10		-		1.7E-10		1.7E-10		1.7E-10		-		1.7E-10		-		1.8E-10		-	
Radium 226 precision (±)	µCi/mL	8E-11		-		1E-10		8E-11		8E-11		-		5E-11		-		9E-11		-	
Thorium 230	µCi/mL	<2E-10	2E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	2E-10		-		1E-10		1E-10		2E-10		-		2E-10		-		2E-10		-	
Thorium 230 precision (±)	µCi/mL	7E-11		-		6E-11		5E-11		6E-11		-		8E-11		-		9E-11		-	
RADIONUCLIDES-SUSPENDED																					
Lead 210	µCi/mL	<5E-10 U	5E-10	3.5E-9	1E-9	<7E-10 U	7E-10	<7E-10 U	7E-10	<7E-10 U	7E-10	1.3E-9 B	1E-9	<5E-10 U	5E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	<1E-9 U	1E-9
Lead 210 MDC	µCi/mL	5E-10		-		7E-10		7E-10		7E-10		-		5E-10		-		8E-10		-	
Lead 210 precision (±)	µCi/mL	3E-10		6E-10		4E-10		4E-10		4E-10		5E-10 B		3E-10		-		5E-10		-	
Polonium 210	µCi/mL	<7E-10 U	7E-10	2.9E-9	1E-9	<3E-10 U	3E-10	<4E-10 U	4E-10	<3E-10 U	3E-10	<1E-9 U	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9	<3E-10 U	3E-10	<1E-9 U	1E-9
Polonium 210 MDC	µCi/mL	7E-10		-		3E-10		4E-10		3E-10		-		7E-10		-		3E-10		-	
Polonium 210 precision (±)	µCi/mL	3E-10		9E-10		2E-10		1E-10		2E-10		-		4E-10		-		2E-10		-	
Radium 226	µCi/mL	<1.1E-10 U	1E-10	<2E-10 U	2E-10	<1.3E-10 U	1.3E-10	<1.3E-10 U	1.3E-10	1.1E-10 U	1.1E-10	<2E-10 U	2E-10	<1.1E-10 U	1.1E-10	<2E-10 U	2E-10	<1.5E-10	1.5E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	1.1E-10		-		1.3E-10		1.3E-10		1.1E-10		-		1.1E-10		-		1.5E-10		-	
Radium 226 precision (±)	µCi/mL	7E-11		-		6E-11		0.07		6E-11		-		6E-11		-		6E-11		-	
Thorium 230	µCi/mL	<1E-10 U	1E-10	<2E-10 U	2E-10	<9E-11 U	9E-11	<1E-10 U	1E-10	<9E-11	9E-11	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10	1E-10	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	1E-10		-		9E-11		1E-10		9E-11		-		1E-10		-		1E-10		-	
Thorium 230 precision (±)	µCi/mL	5E-10		-		6E-11		8E-11		6E-11		-		4E-11		-		6E-11		-	
METALS, DISSOLVED	µCi/mL																				
Uranium	mg/L	0.006	0.0003	0.006	0.0003	0.0058	0.0003	0.0059	0.0003	0.0072	0.0003	0.0087	0.0003	0.0065	0.0003	0.006	0.0003	0.0067	0.0003	0.0073	0.0003
Uranium Activity	µCi/mL	4.1E-9	2E-10	4.1E-9	2E-10	3.9E-09	2E-10	4E-9	2E-10	4.9E-9	2E-10	5.9E-9	2E-10	4.4E-9	2E-10	4.1E-9	2E-10	4.6E-9	2E-10	4.9E-9	2E-10
METALS, SUSPENDED																					
Uranium	mg/L	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003
Uranium Activity	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10

Notes:

RL - Analyte reporting limit.

U - Not detected at minimum detectable concentration

B- Analyete detected in the associated method blank

µCi/mL - microcuries per milliter

mg/l - milligrams per liter

[a] Discussions with land owners regarding known completion depths of private water wells in the area suggest that these wells are completed within the Arikaree Formation or the Brule Formation or a combination of both.

[b] Information provided by private well owner and nearby well data indicate that one or more aquifer is used, but cannot be specifically determined. Assigned formation based on available information.

[c] Wells are not active year-around. Wells are used seasonally and sampled when active, resulting in irregular sampling events.

[d] Well is inoperable, resulting in partial sampling events.

[e] CBR driller water supply.

Table 2.9-5 Radiological Analyses for Private Water Supply Wells in Marsland Area of Review

Location ID:		720 [e]		720 [e]		721 [e]		721 [e]		721 [e]		721 [e]		722		722		722		722	
Date Collected:		11/27/2012		3/21/2013		6/21/2012		9/17/2012		11/27/2012		3/18/2013		6/21/2012		9/17/2012		11/27/2012		3/21/2013	
Analyte	Units	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL
RADIONUCLIDES-DISSOLVED																					
Lead 210	µCi/mL	<7E-10 U	7E-10	<1E-9 U	1E-9	<9E-10 U	9E-10	1.3E-9	1E-9	<7E-10 U	7E-10	1E-9	1E-9	<9E-10 U	9E-10	1.3E-9	1E-9	<7E-10 U	7E-10	1.6	1E-9
Lead 210 MDC	µCi/mL	7E-10		-		9E-10		-		7E-10		-		9E-10		-		7E-10		-	
Lead 210 precision (±)	µCi/mL	4E-10		-		5E-10		4E-10		4E-10		4E-10		5E-10		4E-10		4E-10		7E-10	
Polonium 210	µCi/mL	<7E-10 U	7E-10	<1E-9 U	1E-9	<1.7E-9 U	1.7E-9	<1E-9 U	1E-9	<9E-10 U	9E-10	<1E-9 U	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9	<9E-10 U	9E-10	<1E-9 U	1E-9
Polonium 210 MDC	µCi/mL	7E-10		-		1.7E-9		-		9E-10		-		7E-10		-		9E-10		-	
Polonium 210 precision (±)	µCi/mL	4E-10		-		1E-9		-		3E-10		-		3E-10		-		3E-10		-	
Radium 226	µCi/mL	<1.4E-10	1.4E-10	<2E-10 U	2E-10	1.3E-9 U	1E-10	<2E-10 U	2E-10	<1.5E-10	1.5E-10	<2E-10 U	2E-10	<1.7E-10	1.7E-10	<2E-10 U	2E-10	<1.5E-10	1.5E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	1.4E-10		-		1E-10		-		1.5E-10		-		1.7E-10		-		1.5E-10		-	
Radium 226 precision (±)	µCi/mL	8E-11		-		2.6E-10		-		9E-11		-		7E-11		-		9E-11		-	
Thorium 230	µCi/mL	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	2E-10		-		2E-10		-		2E-10		-		2E-10		-		2E-10		-	
Thorium 230 precision (±)	µCi/mL	7E-11		-		7E-11		-		7E-11		-		5E-11		-		7E-11		-	
RADIONUCLIDES-SUSPENDED																					
Lead 210	µCi/mL	<5E-10 U	5E-10	<1E-9 U	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9	<5E-10 U	5E-10	<1E-9 U	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9	<5E-10 U	5E-10	<1E-9 U	1E-9
Lead 210 MDC	µCi/mL	5E-10		-		7E-10		-		5E-10		-		7E-10		-		5E-10		-	
Lead 210 precision (±)	µCi/mL	3E-10		-		4E-10		-		3E-10		-		4E-10		-		3E-10		-	
Polonium 210	µCi/mL	<9E-10 U	9E-10	<1E-9 U	1E-9	<4E-10 U	4E-10	<1E-9 U	1E-9	<6E-10 U	6E-10	<1E-9 U	1E-9	<4E-10 U	4E-10	<1E-9 U	1E-9	<6E-10 U	6E-10	<1E-9 U	1E-9
Polonium 210 MDC	µCi/mL	9E-10		-		4E-10		-		6E-10		-		4E-10		-		6E-10		-	
Polonium 210 precision (±)	µCi/mL	4E-10		-		1E-10		-		4E-10		-		1E-10		-		4E-10		-	
Radium 226	µCi/mL	<1E-10 U	1E-10	<2E-10 U	2E-10	<1.3E-10 U	1.3E-10	<2E-10 U	2E-10	<1.1E-10	1.1E-10	<2E-10 U	2E-10	<1.3E-10 U	1.3E-10	<2E-10 U	2E-10	<1.1E-10 U	1.1E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	1E-10		-		1.3E-10		-		1.1E-10		-		1.3E-10		-		1.1E-10		-	
Radium 226 precision (±)	µCi/mL	6E-11		-		6E-11		-		7E-10		-		6E-11		-		7E-11		-	
Thorium 230	µCi/mL	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10	1E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	1E-10		-		1E-10		-		1E-10		-		1E-10		-		2E-10		-	
Thorium 230 precision (±)	µCi/mL	4E-11		-		7E-11		-		4E-11		-		7E-11		-		7E-11		-	
METALS, DISSOLVED	µCi/mL																				
Uranium	mg/L	0.0082	0.0003	0.0077	0.0003	0.0074	0.0003	0.0055	0.0003	0.0056	0.0003	0.0054	0.0003	0.0088	0.0003	0.0061	0.0003	0.0086	0.0003	0.0084	0.0003
Uranium Activity	µCi/mL	5.6E-9	2E-10	5.2E-9	2E-10	5E-9	2E-10	3.7E-9	2E-10	3.8E-9	2E-10	3.7E-9	2E-10	6E-9	2E-10	4.1E-9	2E-10	5.8E-9	2E-10	5.7E-9	2E-10
METALS, SUSPENDED																					
Uranium	mg/L	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003
Uranium Activity	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10

Notes:

RL - Analyte reporting limit.

U - Not detected at minimum detectable concentration

B- Analyete detected in the associated method blank

µCi/mL - microcuries per milliter

mg/l - milligrams per liter

[a] Discussions with land owners regarding known completion depths of private water wells in the area suggest that these wells are completed within the Arikaree Formation or the Brule Formation or a combination of both.

[b] Information provided by private well owner and nearby well data indicate that one or more aquifer is used, but cannot be specifically determined. Assigned formation based on available information.

[c] Wells are not active year-around. Wells are used seasonally and sampled when active, resulting in irregular sampling events.

[d] Well is inoperable, resulting in partial sampling events.

[e] CBR driller water supply.

Table 2.9-5 Radiological Analyses for Private Water Supply Wells in Marsland Area of Review

	Location ID:	723 [d]		723 [d]		725		725		725		725		725		725		727		727	
	Date Collected:	6/19/2012		9/17/2012		3/31/2011		6/15/2011		6/21/2012		9/18/2012		11/29/2012		3/20/2013		6/19/2012		9/18/2012	
Analyte	Units	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL
RADIONUCLIDES-DISSOLVED																					
Lead 210	µCi/mL	<8E-10 U	8E-10	1.5E-9	1E-9	<8E-10 U	8E-10	<8E-10 U	8E-10	<8E-10 U	8E-10	1.7E-9	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9	<9E-10 U	9E-10	1.9E-9	1E-9
Lead 210 MDC	µCi/mL	8E-10		-		8E-10		8E-10		8E-10		-		7E-10		-		9E-10		-	
Lead 210 precision (±)	µCi/mL	5E-10		6E-10		5E-10		5E-10		5E-10		6E-10		4E-10		-		5E-10		5E-10	
Polonium 210	µCi/mL	<6E-10 U	6E-10	<1E-9 U	1E-9	<5E-10 U	5E-10	<5E-10 U	5E-10	<5E-10 U	5E-10	1.2E-9	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9	<7E-10 U	7E-10	1.8E-9	1E-9
Polonium 210 MDC	µCi/mL	6E-10		-		5E-10		5E-10		5E-10		-		7E-10		-		7E-10		-	
Polonium 210 precision (±)	µCi/mL	5E-10		-		3E-10		3E-10		4E-10		7E-10		4E-10		-		4E-10		9E-10	
Radium 226	µCi/mL	<1.6E-10 U	1.6E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	3E-10	9E-11	<1.6E-10 U	1.6E-10	<2E-10 U	2E-10	<1.6E-10 U	1.6E-10	<2E-10 U	2E-10	<1.5E-10 U	1.5E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	1.6E-10		-		2E-10		9E-11		1.6E-10		-		1.6E-10		-		1.5E-10		-	
Radium 226 precision (±)	µCi/mL	8E-11		-		6E-11		1E.10		7E-11		-		7E-11		-		7E-11		-	
Thorium 230	µCi/mL	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	1E-10		-		1E-10		1E-10		2E-10		-		2E-10		-		2E-10		-	
Thorium 230 precision (±)	µCi/mL	6E-11		-		6E-11		7E-11		5E-11		-		6E-11		-		6E-11		-	
RADIONUCLIDES-SUSPENDED																					
Lead 210	µCi/mL	<8E-10 U	8E-10	<1E-9 U	1E-9	<7E-10 U	7E-10	<6E-10 U	6E-10	<8E-10 U	8E-10	1.1E-9 B	1E-9	<6E-10 U	6E-10	1.8E-9	1E-9	<8E-10 U	8E-10	1.5E-9 B	1E-9
Lead 210 MDC	µCi/mL	8E-10		-		7E-10		6E-10		8E-10		-		6E-10		-		8E-10		-	
Lead 210 precision (±)	µCi/mL	5E-10		-		4E-10		3E-10		5E-10		5E-10 B		4E-10		5E-10		5E-10		5E-10 B	
Polonium 210	µCi/mL	<3E-10 U	3E-10	<1E-9 U	1E-9	<2E-10 U	2E-10	<2E-10 U	2E-10	<3E-10 U	3E-10	<1E-9 U	1E-9	<6E-10 U	6E-10	<1E-9 U	1E-9	<3E-10 U	3E-10	<1E-9 U	1E-9
Polonium 210 MDC	µCi/mL	3E-10		-		2E-10		2E-10		3E-10		-		6E-10		-		3E-10		-	
Polonium 210 precision (±)	µCi/mL	1E-10		-		1E-10		8E-11		1E-10		-		3E-10		-		2E-10		-	
Radium 226	µCi/mL	<1.2E-10 U	1.2E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<1E-10 U	1E-10	<1.4E-10 U	1.4E-10	<2E-10 U	2E-10	<1.3E-10 U	1.3E-10	<2E-10 U	2E-10	<1.2E-10 U	1E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	1.2E-10		-		1E-10		1E-10		1.4E-10		-		1.3E-10		-		1.2E-10		-	
Radium 226 precision (±)	µCi/mL	6E-11		-		6E-11		5E-11		7E-11		-		9E-11		-		5E-11		-	
Thorium 230	µCi/mL	<2E-10	2E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<1E-10 U	1E-10	<1E-10 U	1E-10	2E-10	2E-10	<9E-11 U	9E-11	<2E-10 U	2E-10	<1E-10 U	1E-10	2E-10	2E-10
Thorium 230 MDC	µCi/mL	2E-10		-		1E-10		1E-10		1E-10		-		9E-11		-		1E-10		-	
Thorium 230 precision (±)	µCi/mL	8E-11		-		7E-11		4E-11		5E-11		1E-10		4E-11		-		6E-11		1E-10	
METALS, DISSOLVED	µCi/mL																				
Uranium	mg/L	0.0056	0.0003	0.0078	0.0003	0.0071	0.0003	0.0065	0.0003	0.0047	0.0003	0.006	0.0003	0.0075	0.0003	0.0059	0.0003	0.0089	0.0003	0.009	0.0003
Uranium Activity	µCi/mL	3.8E-9	2E-10	5.3E-9	2E-10	4.8E-9	2E-10	4.4E-9	2E-10	3.2E-9	2E-10	4.1E-9	2E-10	5.1E-9	2E-10	4E-9	2E-10	6.1E-9	2E-10	6.1E-9	2E-10
METALS, SUSPENDED																					
Uranium	mg/L	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003
Uranium Activity	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10

Notes:

RL - Analyte reporting limit.

U - Not detected at minimum detectable concentration

B- Analyete detected in the associated method blank

µCi/mL - microcuries per milliter

mg/l - milligrams per liter

[a] Discussions with land owners regarding known completion depths of private water wells in the area suggest that these wells are completed within the Arikaree Formation or the Brule Formation or a combination of both.

[b] Information provided by private well owner and nearby well data indicate that one or more aquifer is used, but cannot be specifically determined. Assigned formation based on available information.

[c] Wells are not active year-around. Wells are used seasonally and sampled when active, resulting in irregular sampling events.

[d] Well is inoperable, resulting in partial sampling events.

[e] CBR driller water supply.

Table 2.9-5 Radiological Analyses for Private Water Supply Wells in Marsland Area of Review

	Location ID:	727		727		728		728		728		728		730 [a, d]		730 [a, d]		731 [d]		731 [d]	
	Date Collected:	11/29/2012		3/18/2013		6/19/2012		9/17/2012		12/5/2012		3/18/2013		6/19/2012		9/17/2012		6/20/2012		9/18/2012	
Analyte	Units	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL
RADIONUCLIDES-DISSOLVED																					
Lead 210	µCi/mL	<7E-10 U	7E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	<1E-9	1E-9	<7E-10 U	7E-10	1.2E-9	1E-9	<8E-10 U	8E-10	1.5E-9	1E-9	<8E-10 U	8E-10	<1E-9 U	1E-9
Lead 210 MDC	µCi/mL	7E-10		-		8E-10		-		7E-10		-		8E-10		-		8E-10		-	
Lead 210 precision (±)	µCi/mL	4E-10		-		5E-10		-		4E-10		4E-10		5E-10		5E-10		5E-10		-	
Polonium 210	µCi/mL	<9E-10 U	9E-10	<1E-9 U	1E-9	<6E-10 U	6E-10	<1E-9 U	1E-9	<1E-9 U	1E-9	<1E-9 U	1E-9	<5E-10 U	5E-10	<1E-9 U	1E-9	5E-10	5E-10	<1E-9 U	1E-9
Polonium 210 MDC	µCi/mL	9E-10		-		6E-10		-		1E-9		-		5E-10		-		5E-10		-	
Polonium 210 precision (±)	µCi/mL	3E-10		-		2E-10		-		6E-10		-		3E-10		-		5E-10		-	
Radium 226	µCi/mL	<1.6E-10 U	1.6E-10	<2E-10 U	2E-10	<1.6E-10 U	1.6E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<1.6E-10 U	1.6E-10	<2E-10 U	2E-10	<1.7E-10 U	1.7E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	1.6E-10		-		1.6E-10		-		2E-10		-		1.6E-10		-		1.7E-10		-	
Radium 226 precision (±)	µCi/mL	9E-11		-		6E-11		-		1E-10		-		7E-11		-		1E-10		-	
Thorium 230	µCi/mL	<1E-10 U	1E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	1E-10		-		2E-10		-		1E-10		-		1E-10		-		2E-10		-	
Thorium 230 precision (±)	µCi/mL	7E-11		-		5E-11		-		4E-11		-		5E-11		-		6E-11		-	
RADIONUCLIDES-SUSPENDED																					
Lead 210	µCi/mL	7E-10	6E-10	1.4E-9	1E-9	<8E-10 U	8E-10	<1E-9 U	1E-9	<6E-10 U	6E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	1.1E-9	1E-9
Lead 210 MDC	µCi/mL	6E-10		-		8E-10		-		6E-10		-		8E-10		-		8E-10		-	
Lead 210 precision (±)	µCi/mL	4E-10		4E-10		5E-10		-		4E-10		-		5E-10		-		5E-10		5E-10	
Polonium 210	µCi/mL	<7E-10 U	7E-10	<1E-9 U	1E-9	<2E-10 U	2E-10	<1E-9 U	1E-9	<5E-10 U	5E-10	<1E-9 U	1E-9	<3E-10 U	3E-10	<1E-9 U	1E-9	<2E-10 U	2E-10	<1E-9U	1E-9
Polonium 210 MDC	µCi/mL	7E-10		-		2E-10		-		5E-10		-		3E-10		-		2E-10		-	
Polonium 210 precision (±)	µCi/mL	4E-10		-		0.07		-		2E-10		-		1E-10		-		2E-10		-	
Radium 226	µCi/mL	<1.2E-10 U	1.2E-10	<2E-10 U	2E-10	<1.3E-10 U	1.3E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1.3E-10 U	1.3E-10	<2E-10 U	2E-10	<1.3E-10 U	1.3E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	1.2E-10		-		1.3E-10		-		1E-10		-		1.3E-10		-		1.3E-10		-	
Radium 226 precision (±)	µCi/mL	8E-11		-		7E-11		-		5E-11		-		6E-11		-		5E-11		-	
Thorium 230	µCi/mL	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	2E-10	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	2E-10	2E-10	<1E-10 U	1E-10	2E-10	2E-10
Thorium 230 MDC	µCi/mL	1E-10		-		1E-10		-		1E-10		-		2E-10		-		1E-10		-	
Thorium 230 precision (±)	µCi/mL	5E-11		-		4E-11		1E-10		7E-11		-		6E-11		1E-10		6E-11		1E-10	
METALS, DISSOLVED	µCi/mL																				
Uranium	mg/L	0.0104	0.0003	0.0084	0.0003	0.0063	0.0003	0.0066	0.0003	0.0077	0.0003	0.0067	0.0003	0.0056	0.0003	0.0079	0.0003	0.0055	0.0003	0.0073	0.0003
Uranium Activity	µCi/mL	7E-9	2E-10	5.7E-9	2E-10	4.3E-9	2E-10	4.5E-9	2E-10	5.2E-9	2E-10	4.5E-9	2E-10	3.8E-9	2E-10	5.4E-9	2E-10	3.7E-9	2E-10	4.9E-9	2E-10
METALS, SUSPENDED																					
Uranium	mg/L	<0.0003	0.0003	0.0006	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003
Uranium Activity	µCi/mL	<2E-10	2E-10	4E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10

Notes:

RL - Analyte reporting limit.

U - Not detected at minimum detectable concentration

B- Analyete detected in the associated method blank

µCi/mL - microcuries per milliter

mg/l - milligrams per liter

[a] Discussions with land owners regarding known completion depths of private water wells in the area suggest that these wells are completed within the Arikaree Formation or the Brule Formation or a combination of both.

[b] Information provided by private well owner and nearby well data indicate that one or more aquifer is used, but cannot be specifically determined. Assigned formation based on available information.

[c] Wells are not active year-around. Wells are used seasonally and sampled when active, resulting in irregular sampling events.

[d] Well is inoperable, resulting in partial sampling events.

[e] CBR driller water supply.

Table 2.9-5 Radiological Analyses for Private Water Supply Wells in Marsland Area of Review

	Location ID:	732 [c]		732 [c]		734 [b]		734 [b]		734 [b]		734 [b]		735 [b, d]		736 [b, c]		736 [b, c]		737 [b, c]	
	Date Collected:	6/19/2012		9/7/2012		6/20/2012		9/7/2012		12/5/2012		3/21/2013		6/20/2012		6/2012		9/7/2012		6/29/2012	
Analyte	Units	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL
RADIONUCLIDES-DISSOLVED																					
Lead 210	µCi/mL	<8E-10 U	8E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	1.6E-9	1E-9	<8E-10 U	8E-10	2.5E-9	1E-9	<8E-10 U	8E-10	<9E-10 U	9E-10	<1E-9 U	1E-9	<9E-10 U	9E-10
Lead 210 MDC	µCi/mL	8E-10		-		8E-10		-		8E-10		-		8E-10		9E-10		-		9E-10	
Lead 210 precision (±)	µCi/mL	5E-10		-		5E-10		6E-10		5E-10		4E-10		5E-10		5E-10		-		5E-10	
Polonium 210	µCi/mL	<6E-10	6E-10	<1E-9 U	1E-9	7E-10	6E-10	<1E-9 U	1E-9	<1E-9 U	1E-9	<1E-9 U	1E-9	<7E-10 U	7E-10	<8E-10 U	8E-10	<1E-9 U	1E-9	<1E-9 U	1E-9
Polonium 210 MDC	µCi/mL	6E-10		-		6E-10		-		1E-9		-		7E-10		8E-10		-		1E-9	
Polonium 210 precision (±)	µCi/mL	4E-10		-		7E-10		-		7E-10		-		4E-10		3E-10		-		7E-10	
Radium 226	µCi/mL	<1.6E-10 U	1.6E-10	<2E-10 U	2E-10	<1.6E-10 U	1.6E-10	<2E-10 U	2E-10	<1.7E-10 U	1.7E-10	<2E-10 U	2E-10	<1.6E-10 U	1.6E-10	<1.9E-10 U	1.9E-10	<2E-10 U	2E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	1.6E-10		-		1.6E-10		-		1.7E-10		-		1.6E-10		1.9E-10		-		2E-10	
Radium 226 precision (±)	µCi/mL	9E-11		-		6E-11		-		9E-11		-		1E-10		1.2E-10		-		1E-10	
Thorium 230	µCi/mL	<2E-10 U	2E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	2E-10		-		1E-10		-		1E-10		-		2E-10		2E-10		-		2E-10	
Thorium 230 precision (±)	µCi/mL	7E-11		-		6E-11		-		6E-11		-		1E-10		7E-11		-		6E-11	
RADIONUCLIDES-SUSPENDED																					
Lead 210	µCi/mL	<9E-10 U	9E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	1E-9	1E-9	8E-10	6E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	<8E-10 U	8E-10	<1E-9 U	1E-9	<7E-10 U	7E-10
Lead 210 MDC	µCi/mL	9E-10		-		8E-10		-		6E-10		-		8E-10		8E-10		-		7E-10	
Lead 210 precision (±)	µCi/mL	5E-10		-		5E-10		4E-10		4E-10		-		5E-10		5E-10		-		4E-10	
Polonium 210	µCi/mL	<2E-10 U	2E-10	<1E-9 U	1E-9	<3E-10 U	3E-10	<1E-9 U	1E-9	<5E-10 U	5E-10	<1E-9 U	1E-9	<3E-10 U	3E-10	<4E-10 U	4E-10	<1E-9 U	1E-9	<4E-10 U	4E-10
Polonium 210 MDC	µCi/mL	2E-10		-		3E-10		-		5E-10		-		3E-10		4E-10		-		4E-10	
Polonium 210 precision (±)	µCi/mL	1E-10		-		2E-10		-		4E-10		-		1E-10		2E-10		-		2E-10	
Radium 226	µCi/mL	<1.2E-10 U	1.2E-10	<2E-10 U	2E-10	<1.3E-10 U	1.3E-10	<2E-10 U	2E-10	<1.1E-10 U	1.1E-10	<2E-10 U	2E-10	<1.3E-10 U	1.3E-10	<6E-11 U	6E-11	<2E-10 U	2E-10	<6E-11 U	6E-11
Radium 226 MDC	µCi/mL	1.2E-10		-		1.3E-10		-		1.1E-10		-		1.3E-10		6E-11		-		6E-11	
Radium 226 precision (±)	µCi/mL	5E-11		-		6E-11		-		6E-11		-		5E-11		3E-11		-		3E-11	
Thorium 230	µCi/mL	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	6E-11	4E-11	<2E-10 U	2E-10	5E-11	4E-11
Thorium 230 MDC	µCi/mL	1E-10		-		1E-10		-		1E-10		-		1E-10		4E-11		-		4E-11	
Thorium 230 precision (±)	µCi/mL	6E-11		-		8E-11		-		7E-11		-		4E-11		3E-11		-		3E-11	
METALS, DISSOLVED	µCi/mL																				
Uranium	mg/L	0.0066	0.0003	0.0075	0.0003	0.0078	0.0003	0.0089	0.0003	0.009	0.0003	0.0069	0.0003	0.0063	0.0003	0.0081	0.0003	0.0069	0.0003	0.0086	0.0003
Uranium Activity	µCi/mL	4.5E-9	2E-10	5.1E-9	2E-10	5.2E-9	2E-10	6E-9	2E-10	6.1E-9	2E-10	4.7E-9	2E-10	4.2E-9	2E-10	5.5E-9	2E-10	4.7E-9	2E-10	5.8E-9	2E-10
METALS, SUSPENDED																					
Uranium	mg/L	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	0.001	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003
Uranium Activity	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	6.5E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2.0E-10

Notes:

RL - Analyte reporting limit.

U - Not detected at minimum detectable concentration

B- Analyete detected in the associated method blank

µCi/mL - microcuries per milliter

mg/l - milligrams per liter

[a] Discussions with land owners regarding known completion depths of private water wells in the area suggest that these wells are completed within the Arikaree Formation or the Brule Formation or a combination of both.

[b] Information provided by private well owner and nearby well data indicate that one or more aquifer is used, but cannot be specifically determined. Assigned formation based on available information.

[c] Wells are not active year-around. Wells are used seasonally and sampled when active, resulting in irregular sampling events.

[d] Well is inoperable, resulting in partial sampling events.

[e] CBR driller water supply.

Table 2.9-5 Radiological Analyses for Private Water Supply Wells in Marsland Area of Review

	Location ID:	737 [b, c]		737 [b, c]		739		739		739		739		740 [c]		740 [c]		741		741	
	Date Collected:	9/28/2012		3/21/2013		6/20/2012		9/18/2012		11/27/2012		3/21/2013		6/20/2012		9/18/2012		3/31/2011		6/10/2011	
Analyte	Units	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL
RADIONUCLIDES-DISSOLVED																					
Lead 210	µCi/mL	<1E-9 U	1E-9	1.5E-9	1E-9	<8E-10 U	8E-10	1.5E-9	1E-9	<8E-10 U	8E-10	3E-9	1E-9	<8E-10 U	8E-10	1.7E-9	1E-9	<8E-10 U	8E-10	<1.1E-9 U	1.1E-9
Lead 210 MDC	µCi/mL	-		-		8E-10		-		8E-10		-		8E-10		-		8E-10		1.1E-9	
Lead 210 precision (±)	µCi/mL	-		4E-10		5E-10		5E-10		5E-10		1E-9		5E-10		5E-10		5E-10		6E-10	
Polonium 210	µCi/mL	<1E-9 U	1E-9	<1.E-9	1E-9	<8E-10 U	8E-10	<1E-9 U	1E-9	<7E-10 U	7E-10	1.1E-9	1E-9	<6E-10 U	6E-10	<1E-9 U	1E-9	<5E-10 U	5E-10	<5E-10 U	5E-10
Polonium 210 MDC	µCi/mL	-		-		8E-10		-		7E-10		-		6E-10		-		5E-10		5E-10	
Polonium 210 precision (±)	µCi/mL	-		-		4E-10		-		4E-10		4E-10		5E-10		-		4E-10		3E-10	
Radium 226	µCi/mL	<2E-10 U	2E-10	<2E-10 U	2E-10	<1.5E-10 U	1.5E-10	<2E-10 U	2E-10	<1.6E-10 U	1.6E-10	<2E-10 U	2E-10	<1.3E-10 U	1.3E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	2.9E-10	1E-10
Radium 226 MDC	µCi/mL	-		-		1.5E-10		-		1.6E-10		-		1.3E-10		-		2E-10		1E-10	
Radium 226 precision (±)	µCi/mL	-		-		1E-10		-		7E-11		-		9E-11		-		6E-11		1E-10	
Thorium 230	µCi/mL	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	-		-		2E-10		-		2E-10		-		2E-10		-		2E-10		2E-10	
Thorium 230 precision (±)	µCi/mL	-		-		6E-11		-		6E-11		-		8E-11		-		8E-11		7E-10	
RADIONUCLIDES-SUSPENDED																					
Lead 210	µCi/mL	<1E-9 U	1E-9	<1E-9 U	1E-9	<8E-10 U	8E-10	1.2E-9	1E-9	<5E-10 U	5E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	<1E-9 U	1E-9	<7E-10 U	7E-10	<6E-10 U	6E-10
Lead 210 MDC	µCi/mL	-		-		8E-10		-		5E-10		-		8E-10		-		7E-10		6E-10	
Lead 210 precision (±)	µCi/mL	-		-		4E-10		5E-10		3E-10		-		5E-10		-		4E-10		4E-10	
Polonium 210	µCi/mL	<1E-9 U	1E-9	<1E-9 U	1E-9	<3E-10 U	3E-10	2.8E-9	1E-9	<1E-9 U	1E-9	<1E-9 U	1E-9	<2E-10 U	2E-10	1.2E-9	1E-9	<2E-10 U	2E-10	<2E-10 U	2E-10
Polonium 210 MDC	µCi/mL	-		-		3E-10		-		1E-9		-		2E-10		-		2E-10		2E-10	
Polonium 210 precision (±)	µCi/mL	-		-		2E-10		6E-10		5E-10		-		2E-10		5E-10		1E-10		1E-10	
Radium 226	µCi/mL	<2E-10 U	2E-10	<2E-10 U	2E-10	<1.2E-10 U	1.2E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1.3E-10 U	1.3E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<1E-10 U	1E-10
Radium 226 MDC	µCi/mL	-		-		1.2E-10		-		1E-10		-		1.3E-10		-		1E-10		1E-10	
Radium 226 precision (±)	µCi/mL	-		-		5E-11		-		4E-11		-		6E-11		-		6E-11		5E-11	
Thorium 230	µCi/mL	<2E-10 U	2E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<1E-10 U	1E-10
Thorium 230 MDC	µCi/mL	-		-		1E-10		-		1E-10		-		1E-10		-		2E-10		1E-10	
Thorium 230 precision (±)	µCi/mL	-		-		5E-11		-		4E-11		-		6E-11		-		9E-11		7E-11	
METALS, DISSOLVED	µCi/mL																				
Uranium	mg/L	0.0061	0.0003	0.0059	0.0003	0.0089	0.0003	0.0097	0.0003	0.0114	0.0003	0.0102	0.0003	0.013	0.0003	0.0191	0.0003	0.0058	0.0003	0.0081	0.0003
Uranium Activity	µCi/mL	4.1E-9	2E-10	4E-9	2E-10	6E-9	2E-10	6.6E-9	2E-10	7.7E-9	2E-10	6.9E-9	2E-10	8.8E-9	2E-10	1.29E-8	2E-10	3.9E-9	2E-10	5.5E-9	2E-10
METALS, SUSPENDED																					
Uranium	mg/L	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	0.001	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003
Uranium Activity	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	6.5E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10

Notes:

RL - Analyte reporting limit.

U - Not detected at minimum detectable concentration

B- Analyete detected in the associated method blank

µCi/mL - microcuries per milliter

mg/l - milligrams per liter

[a] Discussions with land owners regarding known completion depths of private water wells in the area suggest that these wells are completed within the Arikaree Formation or the Brule Formation or a combination of both.

[b] Information provided by private well owner and nearby well data indicate that one or more aquifer is used, but cannot be specifically determined. Assigned formation based on available information.

[c] Wells are not active year-around. Wells are used seasonally and sampled when active, resulting in irregular sampling events.

[d] Well is inoperable, resulting in partial sampling events.

[e] CBR driller water supply.

Table 2.9-5 Radiological Analyses for Private Water Supply Wells in Marsland Area of Review

	Location ID:	741		741		742		742		742		742		743 [b]		743 [b]		743 [b]		743 [b]	
	Date Collected:	9/22/2011		12/15/2011		6/20/2012		9/18/2012		11/27/2012		3/21/2013		6/18/2012		9/17/2012		11/26/2012		3/18/2013	
Analyte	Units	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL
RADIONUCLIDES-DISSOLVED																					
Lead 210	µCi/mL	<7E-10	7E-10	<7E-10	7E-10	<7E-10 U	7E-10	2.2E-9	1E-9	<8E-10 U	8E-10	1.5E-9	1E-9	<8E-10 U	8E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	<1E-9 U	1E-9
Lead 210 MDC	µCi/mL	7E-10		7E-10		7E-10		-		8E-10		-		8E-10		-		8E-10		-	
Lead 210 precision (±)	µCi/mL	4E-10		4E-10		5E-10		5E-10		5E-10		5E-10		5E-10		-		5E-10		-	
Polonium 210	µCi/mL	6E-10	5E-10	1.7E-9	1.3E-9	<8E-10 U	8E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	<1E-9 U	1E-9	1.6E-9	6E-10	<1E-9 U	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9
Polonium 210 MDC	µCi/mL	5E-10		1.3E-9		8E-10		-		8E-10		-		6E-10		-		7E-10		-	
Polonium 210 precision (±)	µCi/mL	5E-10		1.5E-9		3E-10		-		6E-10		-		1E-9		-		3E-10		-	
Radium 226	µCi/mL	2.4E-9	2E-10	5E-10	1E-10	<1.5E-10 U	1.5E-10	<2E-10 U	2E-10	<1.5E-10 U	1.5E-10	<2E-10 U	2E-10	4.2E-10	1.8E-10	<2E-10 U	2E-10	<1.5E-10 U	1.5E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	2E-10		1E-10		1.5E-10		-		1.5E-10		-		1.8E-10		-		1.5E-10		-	
Radium 226 precision (±)	µCi/mL	3E-10		1E-10		9E-11		-		1E-10		-		1.7E-10		-		8E-11		-	
Thorium 230	µCi/mL	<2E-10	2E-10	<1E-10	1E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	2E-10		1E-10		2E-10		-		2E-10		-		1E-10		-		2E-10		-	
Thorium 230 precision (±)	µCi/mL	6E-11		5E-11		6E-11		-		5E-11		-		5E-11		-		9E-11		-	
RADIONUCLIDES-SUSPENDED																					
Lead 210	µCi/mL	<6E-10	6E-10	<8E-10	8E-10	<8E-10 U	8E-10	1.5E-9	1E-9	<5E-10 U	5E-10	1.9E-9	1E-9	<6E-10 U	6E-10	<1E-9 U	1E-9	<5E-10 U	5E-10	<1E-9 U	1E-9
Lead 210 MDC	µCi/mL	6E-10		8E-10		8E-10		-		5E-10		-		6E-10		-		5E-10		-	
Lead 210 precision (±)	µCi/mL	3E-10		5E-10		5E-10		5E-10		3E-10		4E-10		4E-10		-		3E-10		-	
Polonium 210	µCi/mL	<2E-10	2E-10	<6E-10	6E-10	<2E-10 U	2E-10	<1E-9 U	1E-9	<1E-9 U	1E-9	<1E-9 U	1E-9	7E-10	3E-10	<1E-9 U	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9
Polonium 210 MDC	µCi/mL	2E-10		6E-10		2E-10		-		1E-9		-		3E-10		-		7E-10		-	
Polonium 210 precision (±)	µCi/mL	8E-11		2E-10		1E-10		-		4E-10		-		4E-10		-		3E-10		-	
Radium 226	µCi/mL	<1E-10	1E-10	<1E-10	1E-10	<1.3E-10 U	1.3E-10	<2E-10 U	2E-10	<1.2E-10 U	1.2E-10	<2E-10 U	2E-10	<1.4E-10	1.4E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	1E-10		1E-10		1.3E-10		-		1.2E-10		-		1.4E-10		-		1E-10		-	
Radium 226 precision (±)	µCi/mL	3E-11		8E-11		5E-11		-		6E-11		-		5E-11		-		7E-11		-	
Thorium 230	µCi/mL	2E-10	1E-10	<1E-10	1E-10	<1E-10 U	1E-10	3E-10	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	1E-10		1E-10		1E-10		-		1E-10		-		1E-10		-		1E-10		-	
Thorium 230 precision (±)	µCi/mL	1E-10		5E-11		6E-11		1E-10		4E-11		-		5E-11		-		5E-11		-	
METALS, DISSOLVED	µCi/mL																				
Uranium	mg/L	0.0091	0.0003	0.0057	0.0003	0.0128	0.0003	0.0116	0.0003	0.0128	0.0003	0.0095	0.0003	0.0165	0.0003	0.0057	0.0003	0.0077	0.0003	0.0075	0.0003
Uranium Activity	µCi/mL	6.2E-9	2E-10	3.9E-9	2E-10	8.6E-9	2E-10	7.9E-9	2E-10	8.7E-9	2E-10	6.4E-9	2E-10	1.1E-8	2E-10	3.9E-9	2E-10	5.2E-9	2E-10	5.1E-9	2E-10
METALS, SUSPENDED																					
Uranium	mg/L	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003
Uranium Activity	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10

Notes:

RL - Analyte reporting limit.

U - Not detected at minimum detectable concentration

B- Analyete detected in the associated method blank

µCi/mL - microcuries per milliter

mg/l - milligrams per liter

[a] Discussions with land owners regarding known completion depths of private water wells in the area suggest that these wells are completed within the Arikaree Formation or the Brule Formation or a combination of both.

[b] Information provided by private well owner and nearby well data indicate that one or more aquifer is used, but cannot be specifically determined. Assigned formation based on available information.

[c] Wells are not active year-around. Wells are used seasonally and sampled when active, resulting in irregular sampling events.

[d] Well is inoperable, resulting in partial sampling events.

[e] CBR driller water supply.

Table 2.9-5 Radiological Analyses for Private Water Supply Wells in Marsland Area of Review

	Location ID:	744		744		744		744		745 [c]		745 [c]		745 [c]		745 [c]		746 [a]		746 [a]	
	Date Collected:	6/18/2012		9/17/2012		11/26/2012		3/18/2013		6/18/2012		9/17/2012		11/26/2012		3/18/2013		6/18/2012		9/18/2012	
Analyte	Units	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL
RADIONUCLIDES-DISSOLVED																					
Lead 210	µCi/mL	<8E-10 U	8E-10	<1.E-9U	1E-9	<7E-10 U	7E-10	1.3E-9	1E-9	<8E-10 U	8E-10	2.8E-9	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	<1E-9 U	1E-9
Lead 210 MDC	µCi/mL	8E-10		-		7E-10		-		8E-10		-		7E-10		-		8E-10		-	
Lead 210 precision (±)	µCi/mL	5E-10		-		4E-10		4E-10		5E-10		7E-10		4E-10		-		5E-10		-	
Polonium 210	µCi/mL	1E-9	5E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	<1E-9 U	1E-9	<4E-10 U	4E-10	<1E-9 U	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9
Polonium 210 MDC	µCi/mL	5E-10		-		8E-10		-		4E-10		-		7E-10		-		7E-10		-	
Polonium 210 precision (±)	µCi/mL	6E-10		-		3E-10		-		4E-10		-		3E-10		-		5E-10		-	
Radium 226	µCi/mL	4.6E-10	2E-10	<2E-10 U	2E-10	1.9E-10	1.6E-10	<2E-10 U	2E-10	<2.4E-10 U	2.4E-10	<2E-10 U	2E-10	<1.6E-10	1.6E-10	<2E-10 U	2E-10	1.7E-10	1.7E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	2E-10		-		1.6E-10		-		2.4E-10		-		1.6E-10		-		1.7E-10		-	
Radium 226 precision (±)	µCi/mL	1.9E-10		-		1.3-E10		-		1.5E-10		-		7E-11		-		1E-10		-	
Thorium 230	µCi/mL	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	2E-10		-		2E-10		-		1E-10		-		2E-10		-		2E-10		-	
Thorium 230 precision (±)	µCi/mL	9E-11		-		7E-11		-		5E-11		-		6E-11		-		8E-11		-	
RADIONUCLIDES-SUSPENDED																					
Lead 210	µCi/mL	<6E-10 U	6E-10	<1E-9 U	1E-9	<5E-10 U	5E-10	<1E-9 U	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9	<5E-10 U	5E-10	<1E-9 U	1E-9	<6E-10 U	6E-10	<1E-9 U	1E-9
Lead 210 MDC	µCi/mL	6E-10		-		5E-10		-		7E-10		-		5E-10		-		6E-10		-	
Lead 210 precision (±)	µCi/mL	4E-10		-		3E-10		-		4E-10		-		3E-10		-		4E-10		-	
Polonium 210	µCi/mL	<2E-10 U	2E-10	<1E-9 U	1E-9	<9E-10 U	9E-10	<1E-9 U	1E-9	5E-10	3E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	<1E-9 U	1E-9	<2E-10 U	2E-10	<1E-9 U	1E-9
Polonium 210 MDC	µCi/mL	2E-10		-		9E-10		-		3E-10		-		8E-10		-		2E-10		-	
Polonium 210 precision (±)	µCi/mL	2E-10		-		3E-10		-		3E-10		-		3E-10		-		1E-10		-	
Radium 226	µCi/mL	<1.5E-10	1.5E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1.7E-10 U	1.7E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1.6E-10	1.6E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	1.5E-10		-		1E-10		-		1.7E-10		-		1E-10		-		1.6E-10		-	
Radium 226 precision (±)	µCi/mL	1E-10		-		7E-11		-		7E-11		-		7E-11		-		9E-11		-	
Thorium 230	µCi/mL	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	1E-10		-		1E-10		-		1E-10		-		1E-10		-		1E-10		-	
Thorium 230 precision (±)	µCi/mL	4E-11		-		5E-11		-		4E-11		-		5E-11		-		4E-11		-	
METALS, DISSOLVED	µCi/mL																				
Uranium	mg/L	0.0043	0.0003	0.0038	0.0003	0.0034	0.0003	0.0028	0.0003	0.0072	0.0003	0.0268	0.0003	0.0282	0.0003	0.0179	0.0003	0.0114	0.0003	0.0069	0.0003
Uranium Activity	µCi/mL	2.9E-9	2E-10	2.6E-9	2E-10	2.3E-9	2E-10	1.9E-9	2E-10	4.8E-9	2E-10	1.81E-8	2E-10	1.9E-8	2E-10	1.21E-8	2E-10	7.8E-9	2E-10	4.7E-9	2E-10
METALS, SUSPENDED																					
Uranium	mg/L	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003
Uranium Activity	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10 U	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10

Notes:

RL - Analyte reporting limit.

U - Not detected at minimum detectable concentration

B- Analyete detected in the associated method blank

µCi/mL - microcuries per milliter

mg/l - milligrams per liter

[a] Discussions with land owners regarding known completion depths of private water wells in the area suggest that these wells are completed within the Arikaree Formation or the Brule Formation or a combination of both.

[b] Information provided by private well owner and nearby well data indicate that one or more aquifer is used, but cannot be specifically determined. Assigned formation based on available information.

[c] Wells are not active year-around. Wells are used seasonally and sampled when active, resulting in irregular sampling events.

[d] Well is inoperable, resulting in partial sampling events.

[e] CBR driller water supply.

Table 2.9-5 Radiological Analyses for Private Water Supply Wells in Marsland Area of Review

	Location ID:	746 [a]		746 [a]		747		747		747		747		748 [a]		748 [a]		748 [a]		748 [a]	
	Date Collected:	11/29/2012		3/18/2013		6/18/2012		9/17/2012		11/26/2012		3/18/2013		6/18/2012		9/17/2012		11/26/2012		3/21/2013	
Analyte	Units	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL
RADIONUCLIDES-DISSOLVED																					
Lead 210	µCi/mL	<7E-10 U	7E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	1.6E-9	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	1.3E-9	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9
Lead 210 MDC	µCi/mL	7E-10		-		8E-10		-		7E-10		-		8E-10		-		7E-10		-	
Lead 210 precision (±)	µCi/mL	4E-10		-		5E-10		4E-10		4E-10		-		5E-10		4E-10		4E-10		-	
Polonium 210	µCi/mL	<1E-9 U	1E-9	<1E-9 U	1E-9	<4E-10 U	4E-10	<1E-9 U	1E-9	<1E-9 U	1E-9	<1E-9 U	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	<1E-9 U	1E-9
Polonium 210 MDC	µCi/mL	1E-9		-		4E-10		-		1E-9		-		7E-10		-		8E-10		-	
Polonium 210 precision (±)	µCi/mL	4E-10		-		3E-10		-		4E-10		-		4E-10		-		3E-10		-	
Radium 226	µCi/mL	<1.5E-10	1.5E-10	<2E-10 U	2E-10	<1.7E-10	1.7E-10	<2E-10 U	2E-10	<1.4E-10	1.4E-10	<2E-10 U	2E-10	<1.7E-10 U	1.7E-10	<2E-10 U	2E-10	<1.5E-10 U	1.5E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	1.5E-10		-		1.7E-10		-		1.4E-10		-		1.7E-10		-		1.5E-10		-	
Radium 226 precision (±)	µCi/mL	6E-11		-		1.1E-10		-		7E-11		-		1.2E-10		-		9E-11		-	
Thorium 230	µCi/mL	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	2E-10		-		2E-10		-		1E-10		-		2E-10		-		2E-10		-	
Thorium 230 precision (±)	µCi/mL	7E-11		-		7E-11		-		5E-11		-		7E-11		-		7E-11		-	
RADIONUCLIDES-SUSPENDED																					
Lead 210	µCi/mL	<6E-10 U	6E-10	<1E-9 U	1E-9	<6E-10 U	6E-10	<1E-9 U	1E-9	<5E-10 U	5E-10	<1E-9 U	1E-9	<6E-10 U	6E-10	<1E-9 U	1E-9	<5E-10 U	5E-10	1.9E-9	1E-9
Lead 210 MDC	µCi/mL	6E-10		-		6E-10		-		5E-10		-		6E-10		-		5E-10		-	
Lead 210 precision (±)	µCi/mL	4E-10		-		4E-10		-		3E-10		-		4E-10		-		3E-10		4E-10	
Polonium 210	µCi/mL	<5E-10 U	5E-10	<1E-9 U	1E-9	<3E-10 U	3E-10	<1E-9 U	1E-9	<5E-10 U	5E-10	<1E-9 U	1E-9	<2E-10 U	2E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	<1E-9 U	1E-9
Polonium 210 MDC	µCi/mL	5E-10		-		3E-10		-		5E-10		-		2E-10		-		8E-10		-	
Polonium 210 precision (±)	µCi/mL	3E-10		-		1E-10		-		3E-10		-		1E-10		-		5E-10		-	
Radium 226	µCi/mL	<1.2E-10	1.2E-10	<2E-10 U	2E-10	<1.5E-10	1.5E-10	<2E-10 U	2E-10	<9E-11 U	9E-11	<2E-10 U	2E-10	<1.3E-10 U	1.3E-10	<2E-10 U	2E-10	<1.1E-10 U	1.1E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	1E-10		-		1.5E-10		-		9E-11		-		1.3E-10		-		1.1E-10		-	
Radium 226 precision (±)	µCi/mL	7E-11		-		6E-11		-		5E-11		-		9E-11		-		5E-11		-	
Thorium 230	µCi/mL	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	1E-10		-		1E-10		-		1E-10		-		1E-10		-		1E-10		-	
Thorium 230 precision (±)	µCi/mL	6E-11		-		7E-11		-		6E-11		-		5E-11		-		5E-11		-	
METALS, DISSOLVED	µCi/mL																				
Uranium	mg/L	0.0075	0.0003	0.0073	0.0003	0.0134	0.0003	0.0078	0.0003	0.0061	0.0003	0.0047	0.0003	0.0082	0.0003	0.0051	0.0003	0.0043	0.0003	0.0042	0.0003
Uranium Activity	µCi/mL	5.1E-9	2E-10	4.9E-9	2E-10	9.1E-9	2E-10	5.3E-9	2E-10	4.2E-9	2E-10	3.2E-9	2E-10	5.6E-9	2E-10	3.5E-9	2E-10	2.9E-9	2E-10	2.8E-9	2E-10
METALS, SUSPENDED																					
Uranium	mg/L	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	0.0003	0.0003	<0.0003	0.0003
Uranium Activity	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2.E-10	2E-10	<2E-10	2E-10

Notes:

RL - Analyte reporting limit.

U - Not detected at minimum detectable concentration

B- Analyete detected in the associated method blank

µCi/mL - microcuries per milliter

mg/l - milligrams per liter

[a] Discussions with land owners regarding known completion depths of private water wells in the area suggest that these wells are completed within the Arikaree Formation or the Brule Formation or a combination of both.

[b] Information provided by private well owner and nearby well data indicate that one or more aquifer is used, but cannot be specifically determined. Assigned formation based on available information.

[c] Wells are not active year-around. Wells are used seasonally and sampled when active, resulting in irregular sampling events.

[d] Well is inoperable, resulting in partial sampling events.

[e] CBR driller water supply.

Table 2.9-5 Radiological Analyses for Private Water Supply Wells in Marsland Area of Review

	Location ID:	750 [a]		750 [a]		750 [a]		750 [a]		752		752		752		752		753		753	
	Date Collected:	6/18/2012		9/17/2012		11/26/2012		3/18/2013		6/21/2012		9/7/2012		11/27/2012		3/21/2013		6/21/2012		9/7/2012	
Analyte	Units	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL
RADIONUCLIDES-DISSOLVED																					
Lead 210	µCi/mL	<7E-10 U	7E-10	2,1E-9	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9	<9E-10 U	9E-10	1.5E-9	1E-9	<7E-10 U	7E-10	1.3E-9	1E-9	<9E-10 U	9E-10	1.3E-9	1E-9
Lead 210 MDC	µCi/mL	7E-10		-		7E-10		-		9E-10		-		7E-10		-		9E-10		-	
Lead 210 precision (±)	µCi/mL	4E-10		7E-10		4E-10		-		5E-10		5E-10		4E-10		5E-10		5E-10		4E-10	
Polonium 210	µCi/mL	<6E-10 U	6E-10	<1E-9 U	1E-9	<1E-9 U	1E-9	<1E-9 U	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9	<1E-9 U	1E-9	<1E-9 U	1E-9	<1E-9 U	1E-9	<1E-9 U	1E-9
Polonium 210 MDC	µCi/mL	6E-10		-		1E-9		-		7E-10		-		1E-9		-		1E-9		-	
Polonium 210 precision (±)	µCi/mL	5E-10		-		7E-10		-		5E-10		-		6E-10		-		4E-10		-	
Radium 226	µCi/mL	<1.7E-10 U	1.7E-10	<2E-10 U	2E-10	<1.5E-10 U	1.5E-10	<2E-10 U	2E-10	2.9E-10	1.9E-10	<2E-10 U	2E-10	<1.5E-10 U	1.5E-10	<2E-10 U	2E-10	<1.9E-10 U	1.9E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	1.7E-10		-		1.5E-10		-		1.9E-10		-		1.5E-10		-		1.9E-10		-	
Radium 226 precision (±)	µCi/mL	8E-11		-		9E-11		-		1.6E-10		-		9E-11		-		8E-11		-	
Thorium 230	µCi/mL	<1E-10 U	1E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	1E-10		-		2E-10		-		1E-10		-		2E-10		-		2E-10		-	
Thorium 230 precision (±)	µCi/mL	9E-11		-		7E-11		-		6E-11		-		8E-11		-		1E-10		-	
RADIONUCLIDES-SUSPENDED																					
Lead 210	µCi/mL	<6E-10 U	6E-10	<1E-9 U	1E-9	<5E-10 U	5E-10	<1E-9 U	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9	<6E-10 U	6E-10	<1E-9 U	1E-9	<7E-10 U	7E-10	1.4E-9	1E-9
Lead 210 MDC	µCi/mL	6E-10		-		5E-10		-		7E-10		-		6E-10		-		7E-10		-	
Lead 210 precision (±)	µCi/mL	4E-10		-		3E-10		-		4E-10		-		4E-10		-		4E-10		4E-10	
Polonium 210	µCi/mL	<3E-10 U	3E-10	<1E-9 U	1E-9	<9E-10 U	9E-10	<1E-9 U	1E-9	<4E-10 U	4E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	<1E-9 U	1E-9	<3E-10 U	3E-10	<1E-9 U	1E-9
Polonium 210 MDC	µCi/mL	3E-10		-		9E-10		-		4E-10		-		8E-10		-		3E-10		-	
Polonium 210 precision (±)	µCi/mL	1E-10		-		4E-10		-		1E-10		-		3E-10		-		1E-10		-	
Radium 226	µCi/mL	<1.3E-10 U	1.3E-10	<2E-10 U	2E-10	<1.1E-10 U	1.1E-10	<2E-10 U	2E-10	<1.3E-10 U	1.3E-10	<2E-10 U	2E-10	<1.2E-10 U	1.2E-10	<2E-10 U	2E-10	<1.3E-10 U	1.3E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	1.3E-10		-		1.1E-10		-		1.3E-10		-		1.2E-10		-		1.3E-10		-	
Radium 226 precision (±)	µCi/mL	6E-11		-		6E-11		-		8E-11		-		6E-11		-		7E-11		-	
Thorium 230	µCi/mL	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	1E-10		-		1E-10		-		1E-10		-		1E-10		-		1E-10		-	
Thorium 230 precision (±)	µCi/mL	5E-11		-		4E-11		-		7E-11		-		4E-11		-		7E-11		-	
METALS, DISSOLVED	µCi/mL																				
Uranium	mg/L	0.0054	0.0003	0.0059	0.0003	0.0058	0.0003	0.0066	0.0003	0.0096	0.0003	0.0087	0.0003	0.0084	0.0003	0.007	0.0003	0.0059	0.0003	0.0057	0.0003
Uranium Activity	µCi/mL	3.7E-9	2E-10	4E-9	2E-10	3.9E-9	2E-10	4.5E-9	2E-10	6.5E-9	2E-10	5.9E-9	2E-10	5.9E-9	2E-10	4.7E-9	2E-10	4E-9	2E-10	3.9E-9	2E-10
METALS, SUSPENDED																					
Uranium	mg/L	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003
Uranium Activity	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10 U	2E-10	<2E-10	2E-10	<2E-10 U	2E-10	<2E-10	2E-10

Notes:

RL - Analyte reporting limit.

U - Not detected at minimum detectable concentration

B- Analyete detected in the associated method blank

µCi/mL - microcuries per milliter

mg/l - milligrams per liter

[a] Discussions with land owners regarding known completion depths of private water wells in the area suggest that these wells are completed within the Arikaree Formation or the Brule Formation or a combination of both.

[b] Information provided by private well owner and nearby well data indicate that one or more aquifer is used, but cannot be specifically determined. Assigned formation based on available information.

[c] Wells are not active year-around. Wells are used seasonally and sampled when active, resulting in irregular sampling events.

[d] Well is inoperable, resulting in partial sampling events.

[e] CBR driller water supply.

Table 2.9-5 Radiological Analyses for Private Water Supply Wells in Marsland Area of Review

	Location ID:	753		753		754		754		754		754		755		755		755		755	
	Date Collected:	11/27/2012		3/21/2013		6/21/2012		9/7/2012		11/27/2012		3/21/2013		6/21/2012		9/7/2012		11/28/2012		3/21/2013	
Analyte	Units	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL
RADIONUCLIDES-DISSOLVED																					
Lead 210	µCi/mL	<7E-10 U	7E-10	1.3E-9	1E-9	<9E-10 U	9E-10	<1E-9 U	1E-9	<7E-10 U	7E-10	1.8E-9	1E-9	<9E-10 U	9E-10	1.8E-9	1E-9	<7E-10 U	7E-10	1.8E-9	1E-9
Lead 210 MDC	µCi/mL	7E-10		-		9E-10		-		7E-10		-		9E-10		-		7E-10		-	
Lead 210 precision (±)	µCi/mL	4E-10		4E-10		5E-10		-		4E-10		7E-10		5E-10		5E-10		4E-10		6E-10	
Polonium 210	µCi/mL	<8E-10 U	8E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	<1E-9 U	1E-9	<1E-9 U	1E-09	<1E-9 U	1E-9	<8E-10 U	8E-10	<1E-9 U	1E-9
Polonium 210 MDC	µCi/mL	8E-10		-		8E-10		-		8E-10		-		1E-9		-		8E-10		-	
Polonium 210 precision (±)	µCi/mL	4E-10		-		3E-10		-		4E-10		-		8E-10		-		3E-10		-	
Radium 226	µCi/mL	<1.8E-10	1.8E-10	<2E-10 U	2E-10	9.5E-9	1.9E-10	<2E-10 U	2E-10	<1.9E-10 U	1.9E-10	<2E-10 U	2E-10	2.4E-9	1.7E-10	<2E-10 U	2E-10	<1.5E-10 U	1.5E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	1.8E-10		-		1.9E-10		-		1.9E-09		-		1.7E-10		-		1.5E-10		-	
Radium 226 precision (±)	µCi/mL	9E-11		-		6.7E-10		-		1E-10		-		3E-10		-		8E-11		-	
Thorium 230	µCi/mL	<1E-10 U	1E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	1E-10		-		2E-10		-		1E-10		-		2E-10		-		2E-10		-	
Thorium 230 precision (±)	µCi/mL	4E-11		-		7E-11		-		6E-11		-		7E-11		-		1E-10		-	
RADIONUCLIDES-SUSPENDED																					
Lead 210	µCi/mL	6E-10	6E-10	<1E-9 U	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9	6E-10	6E-10	<1E-9 U	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9	9E-10	6E-10	<1E-9 U	1E-9
Lead 210 MDC	µCi/mL	6E-10		-		7E-10		-		6E-10		-		7E-10		-		6E-10		-	
Lead 210 precision (±)	µCi/mL	4E-10		-		4E-10		-		4E-10		-		4E-10		-		4E-10		-	
Polonium 210	µCi/mL	<6E-10 U	6E-10	<1E-9 U	1E-9	<3E-10 U	3E-10	<1E-9 U	1E-9	<6E-10 U	6E-10	<1E-9 U	1E-9	<4E-10 U	4E-10	<1E-9 U	1E-9	<6E-10 U	6E-10	<1E-9 U	1E-9
Polonium 210 MDC	µCi/mL	6E-10		-		3E-10		-		6E-10		-		4E-10		-		6E-10		-	
Polonium 210 precision (±)	µCi/mL	3E-10		-		2E-10		-		2E-10		-		2E-10		-		3E-10		-	
Radium 226	µCi/mL	<1.2E-10 U	1E-10	<2E-10 U	2E-10	<1.3E-10 U	1.3E-10	<2E-10 U	2E-10	<1.3E-10 U	1.3E-10	<2E-10 U	2E-10	<1.4E-10 U	1.4E-10	<2E-10 U	2E-10	<1.2E-10 U	1.2E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	1.2E-10		-		1.3E-10		-		1.3E-10		-		1.4E-10		-		1.2E-10		-	
Radium 226 precision (±)	µCi/mL	8E-11		-		7E-11		-		8E-11		-		8E-11		-		7E-11		-	
Thorium 230	µCi/mL	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	1E-10		-		1E-10		-		1E-10		-		1E-10		-		1E-10		-	
Thorium 230 precision (±)	µCi/mL	6E-11		-		9E-11		-		4E-11		-		7E-11		-		4E-11		-	
METALS, DISSOLVED	µCi/mL																				
Uranium	mg/L	0.0055	0.0003	0.0054	0.0003	0.0082	0.0003	0.0065	0.0003	0.0077	0.0003	0.0067	0.0003	0.0075	0.0003	0.0051	0.0003	0.0052	0.0003	0.0051	0.0003
Uranium Activity	µCi/mL	3.7E-9	2E-10	3.7E-9	2E-10	5.5E-9	2E-10	4.4E-9	2E-10	5.2E-9	2E-10	4.5E-9	2E-10	5.1E-9	2E-10	3.5E-9	2E-10	3.5E-9	2E-10	3.5E-9	2E-10
METALS, SUSPENDED																					
Uranium	mg/L	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003
Uranium Activity	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10 U	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10 U	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10

Notes:

RL - Analyte reporting limit.

U - Not detected at minimum detectable concentration

B- Analyete detected in the associated method blank

µCi/mL - microcuries per milliter

mg/l - milligrams per liter

[a] Discussions with land owners regarding known completion depths of private water wells in the area suggest that these wells are completed within the Arikaree Formation or the Brule Formation or a combination of both.

[b] Information provided by private well owner and nearby well data indicate that one or more aquifer is used, but cannot be specifically determined. Assigned formation based on available information.

[c] Wells are not active year-around. Wells are used seasonally and sampled when active, resulting in irregular sampling events.

[d] Well is inoperable, resulting in partial sampling events.

[e] CBR driller water supply.

Table 2.9-5 Radiological Analyses for Private Water Supply Wells in Marsland Area of Review

	Location ID:	759 [d]		759 [d]		759 [d]		759 [d]		760 [a, c]		760 [a, c]		777		777		777		777	
	Date Collected:	3/31/2011		6/10/2011		9/22/2011		12/15/2011		11/28/2012		3/21/2013		6/20/2012		9/18/2012		11/27/2012		3/21/2013	
Analyte	Units	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL
RADIONUCLIDES-DISSOLVED																					
Lead 210	µCi/mL	<8E-10 U	8E-10	<1.1E-9 U	1.1E-9	<8E-10 U	8E-10	<7E-10 U	7E-10	<7E-10 U	7E-10	1.2 E-9	1E-9	<8E-10 U	8E-10	3E-9	1E-9	<7E-10 U	7E-10	2.2E-9	1E-9
Lead 210 MDC	µCi/mL	8E-10		1.1E-9		8E-10		7E-10		7E-10		-		8E-10		-		7E-10		-	
Lead 210 precision (±)	µCi/mL	5E-10		7E-10		5E-10		4E-10		4E-10		4E-10		5E-10		6E-10		4E-10		7E-10	
Polonium 210	µCi/mL	<6E-10 U	6E-10	<5E-10 U	5E-10	<5E-10 U	5E-10	<6E-10 U	6E-10	<8E-10 U	8E-10	<1E-9 U	1E-9	<6E-10 U	6E-10	<1E-9 U	1E-9	<1E-9 U	1E-9	<1E-9 U	1E-9
Polonium 210 MDC	µCi/mL	6E-10		5E-10		5E-10		6E-10		8E-10		-		6E-10		-		1E-9		-	
Polonium 210 precision (±)	µCi/mL	2E-10		2E-10		4E-10		2E-10		3E-10		-		4E-10		-		4E-10		-	
Radium 226	µCi/mL	<2E-10 U	2E-10	<2E-10 U	2E-10	7E-10	2E-10	1E-9	1E-10	<1.6E-10 U	1.6E-10	<2E-10 U	2E-10	<1.4E-10 U	1.4E-10	<2E-10 U	2E-10	<1.7E-10 U	1.7E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	2E-10		2E-10		2E-10		1E-10		1.6E-10		-		1.4E-10		-		1.7E-10		-	
Radium 226 precision (±)	µCi/mL	7E-11		1E-10		2E-10		2E-10		9E-11		-		8E-11		-		8E-11		-	
Thorium 230	µCi/mL	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	2E-10		2E-10		2E-10		2E-10		1E-10		-		2E-10		-		1E-10		-	
Thorium 230 precision (±)	µCi/mL	9E-11		7E-11		8E-11		7E-11		7E-11		-		9E-11		-		6E-11		-	
RADIONUCLIDES-SUSPENDED																					
Lead 210	µCi/mL	<7E-10 U	7E-10	<6E-10 U	6E-10	<6E-10 U	6E-10	<8E-10 U	8E-10	<6E-10 U	6E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	1.5E-9 B	1E-9	7E-10	6E-10	<1E-9 U	1E-9
Lead 210 MDC	µCi/mL	7E-10		6E-10		6E-10		8E-10		6E-10		-		8E-10		-		6E-10		-	
Lead 210 precision (±)	µCi/mL	4E-10		4E-10		3E-10		5E-10		4E-10		-		5E-10		5E-10 B		4E-10		-	
Polonium 210	µCi/mL	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<5E-10 U	5E-10	<7E-10 U	7E-10	<1E-9 U	1E-9	<2E-10 U	2E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	<1E-9 U	1E-9
Polonium 210 MDC	µCi/mL	2E-10		2E-10		2E-10		5E-10		7E-10		-		2E-10		-		8E-10		-	
Polonium 210 precision (±)	µCi/mL	1E-10		1E-10		1E-10		2E-10		3E-10		-		1E-10		-		4E-10		-	
Radium 226	µCi/mL	<1E-10 U	1E-10	<1E-10 U	1E-10	<1E-10 U	1E-10	<1E-10 U	1E-10	<1.2E-10 U	1.2E-10	<2E-10 U	2E-10	<1.3E-10 U	1.3E-10	<2E-10 U	2E-10	<1.2E-10 U	1.2-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	1E-10		1E-10		1E-10		1E-10		1.2E-10		-		1.3E-10		-		1.2E-10		-	
Radium 226 precision (±)	µCi/mL	6E-11		6E-11		4E-11		4E-11		8E-11		-		6E-11		-		5E-11		-	
Thorium 230	µCi/mL	<1E-10 U	1E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	1E-10		1E-10		2E-10		1E-10		1E-10		-		1E-10		-		2E-10		-	
Thorium 230 precision (±)	µCi/mL	8E-11		5E-11		1E-10		6E-11		5E-11		-		4E-11		-		9E-11		-	
METALS, DISSOLVED	µCi/mL																				
Uranium	mg/L	0.0072	0.0003	0.0064	0.0003	0.0075	0.0003	0.0049	0.0003	0.0069	0.0003	0.0065	0.0003	0.0113	0.0003	0.0148	0.0003	0.0136	0.0003	0.0132	0.0003
Uranium Activity	µCi/mL	4.9E-9	2E-10	4.3E-9	2E-10	5.1E-9	2E-10	3.3E-9	2E-10	4.7E-9	2E-10	4.4E-9	2E-10	7.7E-9	2E-10	1E-8	2E-10	9.2E-9	2E-10	8.9E-9	2E-10
METALS, SUSPENDED																					
Uranium	mg/L	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003
Uranium Activity	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10

Notes:

RL - Analyte reporting limit.

U - Not detected at minimum detectable concentration

B- Analyete detected in the associated method blank

µCi/mL - microcuries per milliter

mg/l - milligrams per liter

[a] Discussions with land owners regarding known completion depths of private water wells in the area suggest that these wells are completed within the Arikaree Formation or the Brule Formation or a combination of both.

[b] Information provided by private well owner and nearby well data indicate that one or more aquifer is used, but cannot be specifically determined. Assigned formation based on available information.

[c] Wells are not active year-around. Wells are used seasonally and sampled when active, resulting in irregular sampling events.

[d] Well is inoperable, resulting in partial sampling events.

[e] CBR driller water supply.

Table 2.9-5 Radiological Analyses for Private Water Supply Wells in Marsland Area of Review

	Location ID:	788		788		788		788		794 [b]		794 [b]		794 [b]		794 [b]		795 [b]		795 [b]	
	Date Collected:	6/22/2012		9/18/2012		12/5/2012		3/20/2013		6/19/2012		9/6/2012		12/5/2012		3/21/2013		6/19/2012		9/6/2012	
Analyte	Units	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL
RADIONUCLIDES-DISSOLVED																					
Lead 210	µCi/mL	<9E-10 U	9E-10	1.7E-9	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	1.9E-9	1E-9	<7E-10 U	7E-10	<1E-9	1E-9	<9E-10 U	9E-10	1.2E-9	1E-9
Lead 210 MDC	µCi/mL	9E-10		-		7E-10		-		8E-10		-		7E-10		-		9E-10		-	
Lead 210 precision (±)	µCi/mL	5E-10		6E-10		4E-10		-		5E-10		6E-10		4E-10		-		5E-10		5E-10	
Polonium 210	µCi/mL	<6E-10 U	6E-10	<1E-9 U	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9	<5E-10 U	5E-10	<1E-9 U	1E-9	<9E-10 U	9E-10	<1E-9 U	1E-9	<6E-10 U	6E-10	<1E-9 U	1E-9
Polonium 210 MDC	µCi/mL	6E-10		-		7E-10		-		5E-10		-		9E-10		-		6E-10		-	
Polonium 210 precision (±)	µCi/mL	5E-10		-		3E-10		-		3E-10		-		4E-10		-		3E-10		-	
Radium 226	µCi/mL	<1.9E-10	1.9E-10	<2E-10 U	2E-10	2.1E-10	1.8E-10	<2E-10 U	2E-10	<1.6E-10	1.6E-10	<2E-10 U	2E-10	<1.8E-10	1.8E-10	<2E-10 U	2E-10	<1.8E-10	1.8E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	1.9E-10		-		1.8E-10		-		1.6E-10		-		1.8E-10		-		1.8E-10		-	
Radium 226 precision (±)	µCi/mL	1.2E-10		-		1.4E-10		-		6E-11		-		1.1E-10		-		8E-11		-	
Thorium 230	µCi/mL	<2E-10 U	2E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	2E-10		-		1E-10		-		2E-10		-		2E-10		-		2E-10		-	
Thorium 230 precision (±)	µCi/mL	8E-11		-		7E-11		-		7E-11		-		6E-11		-		8E-11		-	
RADIONUCLIDES-SUSPENDED																					
Lead 210	µCi/mL	<7E-10 U	7E-10	<1E-9 U	1E-9	<6E-10 U	6E-10	<1E-9 U	1E-9	<6E-10 U	6E-10	<1E-9 U	1E-9	7E-10	6E-10	<1E-9 U	1E-9	<6E-10 U	6E-10	1.1E-9	1E-9
Lead 210 MDC	µCi/mL	7E-10		-		6E-10		-		6E-10		-		6E-10		-		6E-10		-	
Lead 210 precision (±)	µCi/mL	4E-10		-		4E-10		-		4E-10		-		4E-10		-		4E-10		5E-10	
Polonium 210	µCi/mL	<4E-10 U	4E-10	<1E-9 U	1E-9	<4E-10 U	4E-10	<1E-9 U	1E-9	<2E-10 U	2E-10	<1E-9 U	1E-9	<5E-10 U	5E-10	<1E-9 U	1E-9	<3E-10 U	3E-10	<1E-9 U	1E-9
Polonium 210 MDC	µCi/mL	4E-10		-		4E-10		-		2E-10		-		5E-10		-		3E-10		-	
Polonium 210 precision (±)	µCi/mL	2E-10		-		2E-10		-		1E-10		-		4E-10		-		2E-10		-	
Radium 226	µCi/mL	<1.4E-10	1.4E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1.3E-10 U	1.3E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1.3E-10 U	1.3E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	1.4E-10		-		1E-10		-		1.3E-10		-		1E-10		-		1.3E-10		-	
Radium 226 precision (±)	µCi/mL	7E-11		-		6E-11		-		7E-11		-		5E-11		-		8E-11		-	
Thorium 230	µCi/mL	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1.3E-10 U	1.3E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	1E-10		-		1E-10		-		1E-10		-		1E-10		-		1E-10		-	
Thorium 230 precision (±)	µCi/mL	6E-11		-		6E-11		-		4E-11		-		6E-11		-		6E-11		-	
METALS, DISSOLVED	µCi/mL																				
Uranium	mg/L	0.0081	0.0003	0.0069	0.0003	0.0076	0.0003	0.0062	0.0003	0.0055	0.0003	0.0063	0.0003	0.0063	0.0003	0.006	0.0003	0.005	0.0003	0.0058	0.0003
Uranium Activity	µCi/mL	5.5E-9	2E-10	4.7E-9	2E-10	5.1E-9	2E-10	4.2E-9	2E-10	3.8E-9	2E-10	4.3E-9	2E-10	4.3E-9	2E-10	4.1E-9	2E-10	3.4E-9	2E-10	3.9E-9	2E-10
METALS, SUSPENDED																					
Uranium	mg/L	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003
Uranium Activity	µCi/mL	<2E-10	2E-10	<2E-10	2.0E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2.E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10

Notes:

RL - Analyte reporting limit.

U - Not detected at minimum detectable concentration

B- Analyete detected in the associated method blank

µCi/mL - microcuries per milliter

mg/l - milligrams per liter

[a] Discussions with land owners regarding known completion depths of private water wells in the area suggest that these wells are completed within the Arikaree Formation or the Brule Formation or a combination of both.

[b] Information provided by private well owner and nearby well data indicate that one or more aquifer is used, but cannot be specifically determined. Assigned formation based on available information.

[c] Wells are not active year-around. Wells are used seasonally and sampled when active, resulting in irregular sampling events.

[d] Well is inoperable, resulting in partial sampling events.

[e] CBR driller water supply.

Table 2.9-5 Radiological Analyses for Private Water Supply Wells in Marsland Area of Review

	Location ID:	795 [b]		795 [b]		799		799		799		799		802		802		802		802	
	Date Collected:	12/5/2012		3/21/2013		6/19/2012		9/18/2012		11/29/2012		3/20/2013		6/18/2012		9/18/2012		11/29/2012		3/18/2013	
Analyte	Units	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL
RADIONUCLIDES-DISSOLVED																					
Lead 210	µCi/mL	<7E-10 U	7E-10	1E-9	1E-9	<8E-10 U	8E-10	1.2E-9	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	1.1E-9	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9
Lead 210 MDC	µCi/mL	7E-10		-		8E-10		-		7E-10		-		8E-10		-		7E-10		-	
Lead 210 precision (±)	µCi/mL	4E-10		4E-10		5E-10		8E-10		4E-10		-		5E-10		5E-10		4E-10		-	
Polonium 210	µCi/mL	<1E-9 U	1E-9	<1E-9 U	1E-9	<5E-10 U	5E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	<1E-9 U	1E-9	<5E-10 U	5E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	<1E-9 U	1E-9
Polonium 210 MDC	µCi/mL	1E-9		-		5E-10		-		8E-10		-		5E-10		-		8E-10		-	
Polonium 210 precision (±)	µCi/mL	4E-10		-		3E-10		-		3E-10		-		3E-10		-		4E-10		-	
Radium 226	µCi/mL	<1.9E-10	1.9E-10	<2E-10 U	2E-10	3<1.8E-10 UB	1.8E-10	<2E-10 U	2E-10	<1.5E-10 U	1.5E-10	<2E-10 U	2E-10	<1.7E-10 U	1.7E-10	<2E-10 U	2E-10	<1.7E-10 U	1.7E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	1.9E-10		-		1.8E-10		-		1.5E-10		-		1.7E-10		-		1.7E-10		-	
Radium 226 precision (±)	µCi/mL	1.3E-10		-		1.2E-10		-		6E-11		-		8E-11		-		1E-10		-	
Thorium 230	µCi/mL	<1E-10 U	1E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	1E-10		-		2E-10		-		1E-10		-		2E-10		-		1E-10		-	
Thorium 230 precision (±)	µCi/mL	6E-11		-		6E-11		-		4E-11		-		5E-11		-		7E-11		-	
RADIONUCLIDES-SUSPENDED																					
Lead 210	µCi/mL	6E-10	6E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	1.1E-9	1E-9	6E-10	6E-10	<1E-9 U	1E-9	<9E-10 U	9E-10	1.1E-9	1E-9	<6E-10 U	6E-10	<1E-9 U	1E-9
Lead 210 MDC	µCi/mL	6E-10		-		8E-10		-		6E-10		-		9E-10		-		6E-10		-	
Lead 210 precision (±)	µCi/mL	4E-10		-		5E-10		4E-10		4E-10		-		6E-10		4E-10		4E-10		-	
Polonium 210	µCi/mL	<5E-10 U	5E-10	<1E-9 U	1E-9	<2E-10 U	2E-10	<1E-9 U	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9	8E-10	4E-10	<1E-9 U	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9
Polonium 210 MDC	µCi/mL	5E-10		-		2E-10		-		7E-10		-		4E-10		-		7E-10		-	
Polonium 210 precision (±)	µCi/mL	2E-10		-		9E-11		-		3E-10		-		5E-10		-		3E-10		-	
Radium 226	µCi/mL	<1.1E-10	1.1E-10	<2E-10 U	2E-10	<1.3E-10 U	1.3E-10	<2E-10 U	2E-10	<1.3E-10 U	1.3E-10	<2E-10 U	2E-10	<1.9E-10 U	1.9E-10	<2E-10 U	2E-10	<1.3E-10 U	1.3E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	1.1E-10		-		1.3E-10		-		1.3E-10		-		1.9E-10		-		1.3E-10		-	
Radium 226 precision (±)	µCi/mL	8E-11		-		5E-11		-		7E-11		-		1E-10		-		7E-11		-	
Thorium 230	µCi/mL	<2E-10 U	2E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	2E-10	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	2E-10		-		1E-10		-		1E-10		-		2E-10		-		1E-10		-	
Thorium 230 precision (±)	µCi/mL	9E-11		-		6E-11		-		5E-11		-		6E-11		1E-10		4E-11		-	
METALS, DISSOLVED	µCi/mL																				
Uranium	mg/L	0.0062	0.0003	0.0062	0.0003	0.0063	0.0003	0.0079	0.0003	0.0086	0.0003	0.0076	0.0003	0.0045	0.0003	0.0046	0.0003	0.005	0.0003	0.0043	0.0003
Uranium Activity	µCi/mL	4.2E-9	2E-10	4.2E-9	2E-10	4.3E-9	2E-10	5.4E-9	2E-10	5.9E-9	2E-10	5.2E-9	2E-10	3E-9	2E-10	3.1E-9	2E-10	3.4E-9	2E-10	2.9E-9	2E-10
METALS, SUSPENDED																					
Uranium	mg/L	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003
Uranium Activity	µCi/mL	<2.E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10

Notes:

RL - Analyte reporting limit.

U - Not detected at minimum detectable concentration

B- Analyete detected in the associated method blank

µCi/mL - microcuries per milliter

mg/l - milligrams per liter

[a] Discussions with land owners regarding known completion depths of private water wells in the area suggest that these wells are completed within the Arikaree Formation or the Brule Formation or a combination of both.

[b] Information provided by private well owner and nearby well data indicate that one or more aquifer is used, but cannot be specifically determined. Assigned formation based on available information.

[c] Wells are not active year-around. Wells are used seasonally and sampled when active, resulting in irregular sampling events.

[d] Well is inoperable, resulting in partial sampling events.

[e] CBR driller water supply.

Table 2.9-5 Radiological Analyses for Private Water Supply Wells in Marsland Area of Review

	Location ID:	809		809		809		809		810 [a]		810 [a]		810 [a]		810 [a]		811 [a]		811 [a]	
	Date Collected:	6/21/2012		9/18/2012		11/29/2012		3/18/2013		6/21/2012		9/18/2012		11/29/2012		3/18/2013		6/21/2012		9/18/2012	
Analyte	Units	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL
RADIONUCLIDES-DISSOLVED																					
Lead 210	µCi/mL	<9E-10 U	9E-10	1.6E-9	1E-9	<7E-10 U	7E-10	1.1E-9	1E-9	<9E-10 U	9E-10	<1E-9 U	1E-9	<7E-10 U	7E-10	5.9E-9	1E-9	<9E-10 U	9E-10	1.5E-9	1E-9
Lead 210 MDC	µCi/mL	9E-10		-		7E-10		-		9E-10		-		7E-10		-		9E-10		-	
Lead 210 precision (±)	µCi/mL	5E-10		5E-10		4E-10		4E-10		5E-10		-		4E-10		7E-10		5E-10		5E-10	
Polonium 210	µCi/mL	<9E-10 U	9E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	<1E-9 U	1E-9	<9E-10 U	9E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	4.4E-9	1E-9	<1E-9 U	1E-9	<1E-9 U	1E-9
Polonium 210 MDC	µCi/mL	9E-10		-		8E-10		-		9E-10		-		8E-10		-		1E-9		-	
Polonium 210 precision (±)	µCi/mL	6E-10		-		3E-10		-		6E-10		-		4E-10		1E-9		5E-10		-	
Radium 226	µCi/mL	5.7E-10	1.7E-10	<2E-10 U	2E-10	<1.7E-10 U	1.7E-10	<2E-10 U	2E-10	1.1E-9	1.7E-10	<2E-10 U	2E-10	<1.5E-10 U	1.5E-10	<2E-10 U	2E-10	9.5E-10	1.7E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	1.7E-10		-		1.7E-10		-		1.7E-10		-		1.5E-10		-		1.7E-10		-	
Radium 226 precision (±)	µCi/mL	1.8E-10		-		7E-11		-		2.3E-10		-		8E-11		-		2.2E-10		-	
Thorium 230	µCi/mL	<1E-10 U	1E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	1E-10		-		2E-10		-		2E-10		-		1E-10		-		1E-10		-	
Thorium 230 precision (±)	µCi/mL	5E-11		-		7E-11		-		5E-11		-		7E-11		-		6E-11		-	
RADIONUCLIDES-SUSPENDED																					
Lead 210	µCi/mL	<7E-10 U	7E-10	1.1E-9	1E-9	<6E-10 U	6E-10	<1E-9 U	1E-9	<6E-10 U	6E-10	<1E-9 U	1E-9	<6E-10 U	6E-10	<1E-9 U	1E-9	<1E-9	1E-9	1.2E-9 B	1E-9
Lead 210 MDC	µCi/mL	7E-10		-		6E-10		-		6E-10		-		6E-10		-		1E-9		-	
Lead 210 precision (±)	µCi/mL	4E-10		4E-10		3E-10		-		4E-10		-		4E-10		-		6E-10		4E-10 B	
Polonium 210	µCi/mL	<5E-10 U	5E-10	<1E-9 U	1E-9	<6E-10 U	6E-10	<1E-9 U	1E-9	<3E-10 U	3E-10	2.1E-9	1E-9	<5E-10 U	5E-10	<1E-9 U	1E-9	<5E-10 U	5E-10	<1E-9 U	1E-9
Polonium 210 MDC	µCi/mL	5E-10		-		6E-10		-		3E-10		-		5E-10		-		5E-10		-	
Polonium 210 precision (±)	µCi/mL	3E-10		-		2E-10		-		1E-10		6E-10		2E-10		-		2E-10		-	
Radium 226	µCi/mL	<1.3E-10 U	1.3E-10	<2E-10 U	2E-10	<1.2E-10 U	1.2E-10	<2E-10 U	2E-10	<1.5E-10	1.5E-10	<2E-10 U	2E-10	<1.4E-10 U	1.4E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	1.3E-10		-		1.2E-10		-		1.5E-10		-		1.4E-10		-		2E-10		-	
Radium 226 precision (±)	µCi/mL	8E-11		-		5E-11		-		9E-11		-		7E-11		-		8E-11		-	
Thorium 230	µCi/mL	<1E-10 U	1E-10	2E-10	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	1E-10		-		1E-10		-		1E-10		-		1E-10		-		2E-10		-	
Thorium 230 precision (±)	µCi/mL	6E-11		1E-10		4E-11		-		5E-11		-		4E-11		-		7E-11		-	
METALS, DISSOLVED	µCi/mL																				
Uranium	mg/L	0.0067	0.0003	0.0083	0.0003	0.0079	0.0003	0.0072	0.0003	0.0064	0.0003	0.0053	0.0003	0.0039	0.0003	0.0056	0.0003	0.0077	0.0003	0.0055	0.0003
Uranium Activity	µCi/mL	4.6E-8	2E-10	5.6E-9	2E-10	5.4E-9	2E-10	4.9E-9	2E-10	4.4E-8	2E-10	3.6E-9	2E-10	2.6E-9	2E-10	3.8E-9	2E-10	5.2E-8	2E-10	3.7E-9	2E-10
METALS, SUSPENDED																					
Uranium	mg/L	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003
Uranium Activity	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10

Notes:

RL - Analyte reporting limit.

U - Not detected at minimum detectable concentration

B- Analyete detected in the associated method blank

µCi/mL - microcuries per milliter

mg/l - milligrams per liter

[a] Discussions with land owners regarding known completion depths of private water wells in the area suggest that these wells are completed within the Arikaree Formation or the Brule Formation or a combination of both.

[b] Information provided by private well owner and nearby well data indicate that one or more aquifer is used, but cannot be specifically determined. Assigned formation based on available information.

[c] Wells are not active year-around. Wells are used seasonally and sampled when active, resulting in irregular sampling events.

[d] Well is inoperable, resulting in partial sampling events.

[e] CBR driller water supply.

Table 2.9-5 Radiological Analyses for Private Water Supply Wells in Marsland Area of Review

Location ID:		811 [a]		811 [a]		815		815		815		815		821 [b]		821 [b]		821 [b]		821 [b]	
Date Collected:		11/29/2012		3/18/2013		6/21/2012		9/18/2012		11/29/2012		3/21/2013		6/21/2012		9/18/2012		11/29/2012		3/21/2013	
Analyte	Units	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL
RADIONUCLIDES-DISSOLVED																					
Lead 210	µCi/mL	<7E-10 U	7E-10	<1E-9 U	1E-9	<9E-10 U	9E-10	2.3E-9	1E-9	<7E-10 U	7E-10	1.2E-9	1E-9	<9E-10 U	9E-10	1.4E-9	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9
Lead 210 MDC	µCi/mL	7E-10		-		9E-10		-		7E-10		-		9E-10		-		7E-10		-	
Lead 210 precision (±)	µCi/mL	4E-10		-		5E-10		5E-11		4E-10		4E-10		5E-10		5E-10		4E-10		-	
Polonium 210	µCi/mL	<7E-10 U	7E-10	<1E-9 U	1E-9	<1E-9 U	1E-9	2.9E-9	1E-9	<8E-10 U	8E-10	<1E-9 U	1E-9	<1E-9 U	1E-9	1E-9	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9
Polonium 210 MDC	µCi/mL	7E-10		-		1E-9		-		8E-10		-		1E-9		-		7E-10		-	
Polonium 210 precision (±)	µCi/mL	3E-10		-		7E-10		1.1E-9		3E-10		-		9E-10		7E-10		4E-10		-	
Radium 226	µCi/mL	<1.7E-10 U	1.7E-10	<2E-10 U	2E-10	<1.7E-10 U	1.7E-10	<2E-10 U	2E-10	<1.4E-10 U	1.4E-10	<2E-10 U	2E-10	<1.7E-10 U	1.7E-10	<2E-10 U	2E-10	<1.5E-10 U	1.5E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	1.7E-10		-		1.7E-10		-		1.4E-10		-		1.7E-10		-		2E-10		-	
Radium 226 precision (±)	µCi/mL	8E-11		-		9E-11		-		7E-11		-		8E-11		-		8E-11		-	
Thorium 230	µCi/mL	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	1E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<8E-11 U	8E-11	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	2E-10		-		2E-10		-		2E-10		-		2E-10		-		8E-11		-	
Thorium 230 precision (±)	µCi/mL	9E-11		-		6E-11		-		6E-11		-		6E-11		-		5E-11		-	
RADIONUCLIDES-SUSPENDED																					
Lead 210	µCi/mL	<7E-10 U	7E-10	2.5E-9	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9	<6E-10 U	6E-10	<1E-9 U	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9	<6E-10 U	6E-10	<1E-9 U	1E-9
Lead 210 MDC	µCi/mL	7E-10		-		7E-10		-		6E-10		-		7E-10		-		6E-10		-	
Lead 210 precision (±)	µCi/mL	4E-10		5E-10		4E-10		-		4E-10		-		4E-10		-		4E-10		-	
Polonium 210	µCi/mL	<6E-10 U	6E-10	1.5E-9	1E-9	<4E-10 U	4E-10	<1E-9 U	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9	<4E-10 U	4E-10	<1E-9 U	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9
Polonium 210 MDC	µCi/mL	6E-10		-		4E-10		-		7E-10		-		4E-10		-		7E-10		-	
Polonium 210 precision (±)	µCi/mL	3E-10		1E-9		2E-10		-		3E-10		-		2E-10		-		3E-10		-	
Radium 226	µCi/mL	<1.4E-10 U	1.4E-10	<2E-10 U	2E-10	<1.4E-10 U	1.4E-10	<2E-10 U	2E-10	<1.2E-10 U	1.2E-10	<2E-10 U	2E-10	<1.3E-10 U	1.3E-10	<2E-10 U	2E-10	<1.2E-10 U	1.2E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	1.4E-10		-		1.4E-10		-		1.2E-10		-		1.3E-10		-		1.2E-10		-	
Radium 226 precision (±)	µCi/mL	5E-11		-		8E-11		-		7E-11		-		5E-11		-		7E-11		-	
Thorium 230	µCi/mL	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<9E-11 U	9E-11	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	1E-10		-		1E-10		-		1E-10		-		9E-11		-		1E-10		-	
Thorium 230 precision (±)	µCi/mL	5E-11		-		6E-11		-		3E-11		-		3E-11		-		4E-11		-	
METALS, DISSOLVED	µCi/mL																				
Uranium	mg/L	0.0071	0.0003	0.0059	0.0003	0.0058	0.0003	0.0046	0.0003	0.0055	0.0003	0.0052	0.0003	0.0057	0.0003	0.0053	0.0003	0.0060	0.0003	0.0057	0.0003
Uranium Activity	µCi/mL	4.8E-9	2E-10	4E-9	2E-10	3.9E-9	2E-10	3.1E-9	2E-10	3.7E-9	2E-10	3.5E-9	2E-10	3.9E-9	2E-10	3.6E-9	2E-10	4.1E-9	2E-10	3.9E-9	2E-10
METALS, SUSPENDED																					
Uranium	mg/L	0.0004	0.0003	0.0004	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003
Uranium Activity	µCi/mL	2.5E-10	2E-10	3E-10	2E-10	<2E-10 U	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10

Notes:

RL - Analyte reporting limit.

U - Not detected at minimum detectable concentration

B- Analyete detected in the associated method blank

µCi/mL - microcuries per milliter

mg/l - milligrams per liter

[a] Discussions with land owners regarding known completion depths of private water wells in the area suggest that these wells are completed within the Arikaree Formation or the Brule Formation or a combination of both.

[b] Information provided by private well owner and nearby well data indicate that one or more aquifer is used, but cannot be specifically determined. Assigned formation based on available information.

[c] Wells are not active year-around. Wells are used seasonally and sampled when active, resulting in irregular sampling events.

[d] Well is inoperable, resulting in partial sampling events.

[e] CBR driller water supply.

Table 2.9-5 Radiological Analyses for Private Water Supply Wells in Marsland Area of Review

Location ID:		836		836		836		836		841 [b]		841 [b]		841 [b]		841 [b]		845 [a]		845 [a]	
Date Collected:		6/19/2012		9/17/2012		11/26/2012		3/20/2013		6/19/2012		9/17/2012		11/26/2012		3/20/2013		6/19/2012		9/17/2012	
Analyte	Units	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL
RADIONUCLIDES-DISSOLVED																					
Lead 210	µCi/mL	<9E-10 U	9E-10	1.2E-9	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9	<9E-10 U	9E-10	1.6E-9	1E-9	<8E-10 U	8E-10	<1E-9 U	1E-9	<1E-9 U	1E-9	<1E-9	1E-9
Lead 210 MDC	µCi/mL	9E-10		-		7E-10		-		9E-10		-		8E-10		-		1E-09		-	
Lead 210 precision (±)	µCi/mL	5E-10		5E-10		4E-10		-		5E-10		6E-10		5E-10		-		6E-10		-	
Polonium 210	µCi/mL	<6E-10 U	6E-10	<1E-9 U	1E-9	<1E-9 U	1E-9	<1E-9 U	1E-9	2.8E-9	6E-10	<1E-9 U	1E-9	<1E-9 U	1E-9	<1E-9 U	1E-9	<7E-10	7E-10	<1E-9 U	1E-9
Polonium 210 MDC	µCi/mL	6E-10		-		1E-9		-		6E-10		-		1E-9		-		7E-10		-	
Polonium 210 precision (±)	µCi/mL	5E-10		-		6E-10		-		1.2E-9		-		5E-10		-		3E-10		-	
Radium 226	µCi/mL	<1.9E-10	1.9E-10	<2E-10 U	2E-10	<1.6E-10 U	1.6E-10	<2E-10 U	2E-10	<1.7E-10 U	1.7E-10	<2E-10 U	2E-10	<1.5E-10 U	1.5E-10	<2E-10 U	2E-10	<1.7E-10 U	1.7E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	1.9E-10		-		1.6E-10		-		1.7E-10		-		1.5E-10		-		1.7E-10		-	
Radium 226 precision (±)	µCi/mL	1.1E-10		-		7E-11		-		1E-10		-		6E-11		-		1.2E-10		-	
Thorium 230	µCi/mL	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	2E-10		-		2E-10		-		2E-10		-		2E-10		-		2E-10		-	
Thorium 230 precision (±)	µCi/mL	7E-11		-		5E-11		-		6E-11		-		7E-11		-		6E-11		-	
RADIONUCLIDES-SUSPENDED																					
Lead 210	µCi/mL	<8E-10 U	8E-10	1.4E-9	1E-9	<5E-10 U	5E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	<1E-9 U	1E-9	<5E-10 U	5E-10	<1E-9 U	1E-9	<8E-10 U	8E-10	1.1E-9	1E-9
Lead 210 MDC	µCi/mL	8E-10		-		5E-10		-		8E-10		-		5E-10		-		8E-10		-	
Lead 210 precision (±)	µCi/mL	5E-10		5E-10		3E-10		-		5E-10		-		3E-10		-		5E-10		5E-10	
Polonium 210	µCi/mL	<3E-10 U	3E-10	<1E-9 U	1E-9	<5E-10 U	5E-10	<1E-9 U	1E-9	<2E-10 U	2E-10	<1E-9 U	1E-9	<7E-10 U	7E-10	<1E-9 U	1E-9	<3E-10 U	3E-10	<1E-9 U	1E-9
Polonium 210 MDC	µCi/mL	3E-10		-		5E-10		-		2E-10		-		7E-10		-		3E-10		-	
Polonium 210 precision (±)	µCi/mL	1E-10		-		2E-10		-		1E-10		-		3E-10		-		2E-10		-	
Radium 226	µCi/mL	<1.3E-10 U	1.3E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1.3E-10 U	1.3E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1.3E-10 U	1.3E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	1.3E-10		-		1E-10		-		1.3E-10		-		1E-10		-		1.3E-10		-	
Radium 226 precision (±)	µCi/mL	7E-11		-		6E-11		-		5E-11		-		6E-11		-		6E-11		-	
Thorium 230	µCi/mL	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10	<1E-10 U	1E-10	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	1E-10		-		1E-10		-		2E-10		-		1E-10		-		1E-10		-	
Thorium 230 precision (±)	µCi/mL	6E-11		-		4E-11		-		6E-11		-		4E-11		-		6E-11		-	
METALS, DISSOLVED	µCi/mL																				
Uranium	mg/L	0.0048	0.0003	0.0068	0.0003	0.0066	0.0003	0.0068	0.0003	0.0038	0.0003	0.0053	0.0003	0.0055	0.0003	0.0053	0.0003	0.0039	0.0003	0.0064	0.0003
Uranium Activity	µCi/mL	3.2E-9	2E-10	4.6E-9	2E-10	4.5E-9	2E-10	4.6E-9	2E-10	2.6E-9	2E-10	3.6E-9	2E-10	3.7E-9	2E-10	3.6E-9	2E-10	2.6E-9	2E-10	4.3E-9	2E-10
METALS, SUSPENDED																					
Uranium	mg/L	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003
Uranium Activity	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10 U	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E.10	2E-10	<2E-10	2E-10

Notes:

RL - Analyte reporting limit.

U - Not detected at minimum detectable concentration

B- Analyete detected in the associated method blank

µCi/mL - microcuries per milliter

mg/l - milligrams per liter

[a] Discussions with land owners regarding known completion depths of private water wells in the area suggest that these wells are completed within the Arikaree Formation or the Brule Formation or a combination of both.

[b] Information provided by private well owner and nearby well data indicate that one or more aquifer is used, but cannot be specifically determined. Assigned formation based on available information.

[c] Wells are not active year-around. Wells are used seasonally and sampled when active, resulting in irregular sampling events.

[d] Well is inoperable, resulting in partial sampling events.

[e] CBR driller water supply.

Table 2.9-5 Radiological Analyses for Private Water Supply Wells in Marsland Area of Review

	Location ID:	845 [a]		845 [a]	
	Date Collected:	11/26/2012		3/21/2013	
Analyte	Units	RESULT	RL	RESULT	RL
RADIONUCLIDES-DISSOLVED					
Lead 210	µCi/mL	<7E-10 U	7E-10	<1E-9 U	1E-9
Lead 210 MDC	µCi/mL	7E-10		-	
Lead 210 precision (±)	µCi/mL	4E-10		-	
Polonium 210	µCi/mL	<1E-9 U	1E-9	<1E-9 U	1E-9
Polonium 210 MDC	µCi/mL	1E-9		-	
Polonium 210 precision (±)	µCi/mL	4E-10		-	
Radium 226	µCi/mL	<1.8E-10	1.8E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	1.8E-10		-	
Radium 226 precision (±)	µCi/mL	8E-11		-	
Thorium 230	µCi/mL	<2E-10 U	2E-10	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	2E-10		-	
Thorium 230 precision (±)	µCi/mL	6E-11		-	
RADIONUCLIDES-SUSPENDED					
Lead 210	µCi/mL	<5E-10 U	5E-10	<1E-9 U	1E-9
Lead 210 MDC	µCi/mL	5E-10		-	
Lead 210 precision (±)	µCi/mL	3E-10		-	
Polonium 210	µCi/mL	<6E-10 U	6E-10	<1E-9 U	1E-9
Polonium 210 MDC	µCi/mL	6E-10		-	
Polonium 210 precision (±)	µCi/mL	3E-10		-	
Radium 226	µCi/mL	<1.1E-10	1.1E-10	<2E-10 U	2E-10
Radium 226 MDC	µCi/mL	1.1E-10		-	
Radium 226 precision (±)	µCi/mL	6E-11		-	
Thorium 230	µCi/mL	<1E-10 U	1.1E-10	<2E-10 U	2E-10
Thorium 230 MDC	µCi/mL	1E-10		-	
Thorium 230 precision (±)	µCi/mL	6E-11		-	
METALS, DISSOLVED	µCi/mL				
Uranium	mg/L	0.00565	0.0003	0.0056	0.0003
Uranium Activity	µCi/mL	3.8E-9	2E-10	3.8E-9	2E-10
METALS, SUSPENDED					
Uranium	mg/L	<0.0003	0.0003	<0.0003	0.0003
Uranium Activity	µCi/mL	<2E-10	2E-10	<2E-10	2E-10

Notes:
RL - Analyte reporting limit.
U - Not detected at minimum detectable concentration
B- Analyete detected in the associated method blank
µCi/mL - microcuries per milliter
mg/l - milligrams per liter
[a] Discussions with land owners regarding known completion depths of private water wells in the area suggest that these wells are completed within the Arikaree Formation or the Brule Formation or a combination of both.
[b] Information provided by private well owner and nearby well data indicate that one or more aquifer is used, but cannot be specifically determined. Assigned formation based on available information.
[c] Wells are not active year-around. Wells are used seasonally and sampled when active, resulting in irregular sampling events.
[d] Well is inoperable, resulting in partial sampling events.
[e] CBR driller water supply.

Table 2.9-6 Non-Radiological Analyses for Private Water Supply Wells in Marsland Area of Review

Location ID:		703		703		703		703		705		705		714		719		723		723	
Date Collected:		3/31/2011		6/10/2011		9/22/2011		12/15/2011		3/24/2011		9/19/2012		9/18/2012		9/18/2012		3/31/2011		6/10/2011	
	UNITS	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL
MAJOR IONS																					
Alkalinity Total as CaCO3	mg/L	158	1	160	1	148	1	144	1	153	1	167	5	148	5	157	5	156	1	159	1
Bicarbonate as HCO3	mg/L	193	1	195	1	181	1	176	1	187	1	199	5	181	5	188	5	191	1	194	1
Carbonate as CO3	mg/L	<1	1	<1	1	<1	1	<1	1	<1	1	<5	5	<5	5	<5	5	<1	1	<1	1
Chloride	mg/L	3	1	3	1	3	1	3	1	3	1	3	1	9	1	<1	1	2	1	3	1
Fluoride	mg/L	0.5	0.1	0.5	0.1	0.5	0.1	0.5	0.1	0.6	0.1	0.4	0.1	0.4	0.1	0.4	0.1	0.6	0.1	0.7	0.1
Magnesium	mg/L	8	1	8	1	8	1	8	1	8	1	8	1	8	1	8	1	8	1	9	1
Nitrogen Ammonia as N	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.05	0.05	<0.05	0.05
Nitrogen Nitrate+Nitrite as N	mg/L	1.6	0.1	1.7	0.1	1.7	0.1	1.7	0.1	1.4	0.1	1.7	0.1	7	0.1	1.3	0.1	0.8	0.1	0.9	0.1
Potassium	mg/L	3	1	3	1	3	1	3	1	4	1	4	1	4	1	3	1	4	1	3	1
Silica	mg/L	69.7	0.2	64.9	0.2	68.5	0.2	65.7	0.2	70.6	0.2	60	1	61	1	67	1	80.8	0.2	77.3	0.2
Sodium	mg/L	16	1	15	1	13	1	16	1	19	1	21	1	17	1	20	1	20	1	17	1
Sulfate	mg/L	7	1	7	1	7	1	7	1	9	1	8	1	9	1	6	1	9	1	8	1
PHYSICAL PROPERTIES																					
Conductivity @ 25 C	umhos/cm	317	1	311	1	315	1	325	1	307	1	315	1	338	1	299	1	310	1	304	1
pH	s.u.	7.78	0.01	7.81	0.01	7.99	0.01	7.79	0.01	7.94	0.01	8.4	0.1	8.4	0.1	8.4	0.1	7.76	0.01	7.77	0.01
Solids Total Dissolved TDS @ 180 C	mg/L	238	10	230	10	231	10	208	10	216	10	250	10	260	10	220	10	228	10	240	10
METALS, DISSOLVED																					
Aluminum	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Arsenic	mg/L	0.004	0.001	0.004	0.001	0.004	0.001	0.004	0.001	0.004	0.001	0.001	0.001	0.0003	0.001	0.002	0.001	0.006	0.001	0.007	0.001
Barium	mg/L	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	<0.1	0.1	0.1	0.1	0.1	0.1
Boron	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Cadmium	mg/L	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005
Calcium	mg/L	41	1	42	1	41	1	42	1	33	1	35	1	43	1	32	1	33	1	38	1
Chromium	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Copper	mg/L	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	0.05	0.01	<0.01	0.01
Iron	mg/L	<0.03	0.03	<0.03	0.03	<0.03	0.03	<0.03	0.03	<0.03	0.03	0.06	0.03	<0.03	0.03	<0.03	0.03	<0.03	0.03	<0.03	0.03
Lead	mg/L	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	0.002	0.001	<0.001	0.001
Manganese	mg/L	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	0.02	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01
Mercury	mg/L	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001
Molybdenum	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Nickel	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Selenium	mg/L	0.002	0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	0.002	0.001	0.002	0.001
Vanadium	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.02	<0.1	0.02	<0.1	0.02	<0.1	0.1	<0.1	0.1
Zinc	mg/L	0.04	0.01	0.05	0.01	0.07	0.01	0.11	0.01	0.08	0.01	0.05	0.01	<0.01	0.01	0.01	0.01	0.21	0.01	0.03	0.01
DATA QUALITY																					
A/C Balance (± 5)	%	-1.31		-0.711		0.341		3.88		-3.67		4.13		3.51		2.1		-2.04		-0.463	
Anions	meq/L	3.53		3.58		3.33		3.25		3.46		3.74		3.9		3.38		3.47		3.53	
Cations	meq/L	3.44		3.53		3.36		3.51		3.22		3.44		3.63		3.24		3.33		3.5	
Solids Total Dissolved Calculated	mg/L	268		265		259		173		268		250		870		240		277		277	

Notes:

RL - Analyte reporting limit

Reference: See Table 2.2-11 for well status during sampling event

Table 2.9-6 Non-Radiological Analyses for Private Water Supply Wells in Marsland Area of Review

Location ID:		723		723		725		725		725		725		727		727		727		727	
Date Collected:		9/22/2011		12/20/2011		3/31/2011		6/15/2011		9/29/2011		12/16/2011		3/24/2011		6/15/2011		9/22/2011		12/15/2011	
	UNITS	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL
MAJOR IONS																					
Alkalinity Total as CaCO3	mg/L	154	1	149	1	149	1	149	1	156	1	141	1	160	1	158	1	150	1	146	1
Bicarbonate as HCO3	mg/L	187	1	182	1	181	1	182	1	182	1	172	1	195	1	193	1	182	1	178	1
Carbonate as CO3	mg/L	<1	1	<1	1	<1	1	<1	1	4	1	<1	1	<1	1	<1	1	<1	1	<1	1
Chloride	mg/L	3	1	2	1	2	1	3	1	3	1	2	1	5	1	5	1	5	1	5	1
Fluoride	mg/L	0.7	0.1	0.6	0.1	0.7	0.1	0.8	0.1	0.7	0.1	0.7	0.1	0.4	0.1	0.5	0.1	0.5	0.1	0.5	0.1
Magnesium	mg/L	8	1	9	1	6	1	7	1	7	1	6	1	12	1	13	1	13	1	13	1
Nitrogen Ammonia as N	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Nitrogen Nitrate+Nitrite as N	mg/L	0.8	0.1	0.7	0.1	0.6	0.1	0.7	0.1	0.8	0.1	0.7	0.1	1.4	0.1	1.3	0.1	1.4	0.1	1.6	0.1
Potassium	mg/L	3	1	3	1	5	1	4	1	4	1	4	1	4	1	4	1	4	1	4	1
Silica	mg/L	78.3	0.2	75.6	0.2	64.4	0.2	72.2	0.2	72.0	0.2	68.4	0.2	77.8	0.2	84.5	0.2	81.8	0.2	83	1
Sodium	mg/L	17	1	22	1	33	1	26	1	25	1	31	1	19	1	20	1	17	1	19	1
Sulfate	mg/L	9	1	9	1	19	1	11	1	13	1	16	1	9	1	9	1	9	1	8	1
PHYSICAL PROPERTIES																					
Conductivity @ 25 C	umhos/cm	308	1	306	1	313	1	296	1	309	1	241	1	325	1	312	1	325	1	344	1
pH	s.u.	7.99	0.01	7.72	0.01	7.95	0.01	8.15	0.01	8.00	0.01	7.95	0.01	8.05	0.01	8.19	0.01	8.01	0.01	7.73	0.01
Solids Total Dissolved TDS @ 180 C	mg/L	235	10	215	10	230	10	234	10	248	10	234	10	290	10	245	10	244	10	229	10
METALS, DISSOLVED																					
Aluminum	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Arsenic	mg/L	0.007	0.001	0.006	0.001	0.003	0.001	0.006	0.001	0.005	0.001	0.004	0.001	0.002	0.001	0.003	0.001	0.003	0.001	0.002	0.001
Barium	mg/L	0.1	0.1	0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	0.1	0.1	<0.1	0.1
Boron	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Cadmium	mg/L	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005
Calcium	mg/L	34	1	34	1	30	1	29	1	30	1	33	1	30	1	32	1	31	1	34	1
Chromium	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Copper	mg/L	0.04	0.01	0.06	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01
Iron	mg/L	<0.03	0.03	<0.03	0.03	0.08	0.03	0.06	0.03	0.04	0.03	0.06	0.03	<0.03	0.03	0.05	0.03	<0.03	0.03	0.03	0.03
Lead	mg/L	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001
Manganese	mg/L	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01
Mercury	mg/L	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001
Molybdenum	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Nickel	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Selenium	mg/L	0.002	0.001	0.001	0.001	<0.001	0.001	0.001	0.001	<0.001	0.001	<0.001	0.001	0.003	0.001	0.003	0.001	0.003	0.001	0.002	0.001
Vanadium	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<.1	0.1	<0.1	0.1
Zinc	mg/L	0.1	0.01	0.19	0.01	0.32	0.01	0.29	0.01	0.18	0.01	0.24	0.01	0.28	0.01	0.25	0.01	0.3	0.01	0.49	0.01
DATA QUALITY																					
A/C Balance (± 5)	%	-3.11		1.91		-0.0053		-2.8		-5.17		4.47		-2.51		0.0438		0.00487		5.25	
Anions	meq/L	3.41		3.31		3.5		3.42		3.56		3.3		3.65		3.61		3.44		3.37	
Cations	meq/L	3.21		3.44		3.5		3.23		3.21		3.61		3.47		3.61		3.44		3.74	
Solids Total Dissolved Calculated	mg/L	269		172		268		174		270		181		290		183		279		179	

Notes:

RL - Analyte reporting limit

Reference: See Table 2.2-11 for well status during sampling event

Table 2.9-6 Non-Radiological Analyses for Private Water Supply Wells in Marsland Area of Review

Location ID:		731		739		740		741		741		741		741		742		745		745	
Date Collected:		9/18/2012		9/18/2012		9/18/2012		3/31/2011		6/10/2011		9/22/2011		12/15/2011		9/18/2012		3/31/2011		6/10/2011	
	UNITS	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL
MAJOR IONS																					
Alkalinity Total as CaCO3	mg/L	151	5	223	5	228	5	159	1	199	1	179	1	173	1	244	5	185	1	175	1
Bicarbonate as HCO3	mg/L	180	5	269	5	272	5	194	1	243	1	218	1	211	1	293	5	226	1	209	1
Carbonate as CO3	mg/L	<5	5	<5	5	<5	5	<1	1	<1	1	<1	1	<1	1	<5	5	<1	1	2	1
Chloride	mg/L	3	1	4	1	7	1	4	1	5	1	5	1	5	1	8	1	4	1	3	1
Fluoride	mg/L	0.4	0.1	0.4	0.1	0.5	0.1	0.6	0.1	0.6	0.1	0.6	0.1	0.6	0.1	0.6	0.1	0.4	0.1	0.4	0.1
Magnesium	mg/L	8	1	10	1	11	1	7	1	9	1	8	1	9	1	12	1	11	1	10	1
Nitrogen Ammonia as N	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.1	0.1	<0.05	0.05	<0.05	0.05
Nitrogen Nitrate+Nitrite as N	mg/L	1.9	0.1	8.7	0.1	1.6	0.1	1.8	0.1	3.3	0.1	3.2	0.2	3.1	0.1	0.8	0.1	6.9	0.5	3.9	0.2
Potassium	mg/L	3	1	7	1	9	1	5	1	5	1	5	1	5	1	13	1	3	1	2	1
Silica	mg/L	67	1	53	1	53	1	70	0.2	65.1	0.2	66.2	0.2	64.4	0.2	40	1	72.6	0.2	70.1	0.2
Sodium	mg/L	19	1	23	1	31	1	19	1	26	1	22	1	26	1	28	1	9	1	8	1
Sulfate	mg/L	8	1	12	1	44	1	11	1	13	1	13	1	12	1	24	1	19	1	11	1
PHYSICAL PROPERTIES																					
Conductivity @ 25 C	umhos/cm	292	1	476	1	519	1	324	1	413	1	403	1	327	1	507	1	432	1	356	1
pH	s.u.	8.4	0.1	8.3	0.1	8.3	0.1	7.72	0.01	7.72	0.01	7.99	0.01	7.86	0.01	8.3	0.1	7.64	0.01	7.78	0.01
Solids Total Dissolved TDS @ 180 C	mg/L	230	10	320	10	370	10	244	10	289	10	277	10	259	10	330	10	334	10	280	10
METALS, DISSOLVED																					
Aluminum	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<.1	0.1	<0.1	0.1	<.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Arsenic	mg/L	0.003	0.001	0.005	0.001	0.008	0.001	0.005	0.001	0.006	0.001	0.006	0.001	0.006	0.001	0.01	0.001	0.003	0.001	0.003	0.001
Barium	mg/L	0.1	0.1	0.2	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.2	0.1	<0.1	0.1	<0.1	0.1
Boron	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<.1	0.1	<0.1	0.1	0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Cadmium	mg/L	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005
Calcium	mg/L	30	1	61	1	62	1	38	1	52	1	50	1	49	1	59	1	65	1	57	1
Chromium	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Copper	mg/L	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01
Iron	mg/L	<0.03	0.03	<0.03	0.03	<0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	<0.03	0.03	<0.5	0.05	<0.03	0.03	<0.03	0.03
Lead	mg/L	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.05	0.001	0.001	<0.001	0.001
Manganese	mg/L	<0.01	0.01	<0.01	0.01	0.08	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	0.14	0.01	<0.01	0.01	<0.01	0.01
Mercury	mg/L	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001
Molybdenum	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Nickel	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Selenium	mg/L	<0.001	0.001	<0.001	0.001	<0.001	0.001	0.002	0.001	0.002	0.001	0.002	0.001	0.002	0.001	<0.001	0.001	0.002	0.001	0.002	0.001
Vanadium	mg/L	<0.1	0.02	<0.1	0.02	<0.1	0.02	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.02	<0.1	0.1	<0.1	0.1
Zinc	mg/L	0.23	0.01	0.01	0.01	<0.01	0.01	0.03	0.01	0.02	0.01	0.03	0.01	0.02	0.01	<0.01	0.01	0.43	0.01	0.14	0.01
DATA QUALITY																					
A/C Balance (± 5)	%	4.44		4.42		2.69		-2.98		-0.33		0.0941		3.69		2.48		-0.785		-0.713	
Anions	meq/L	3.41		5.45		5.82		3.67		4.67		4.24		4.1		5.68		4.7		4.13	
Cations	meq/L	3.12		4.99		5.51		3.46		4.64		4.25		4.42		5.41		4.63		4.07	
Solids Total Dissolved Calculated	mg/L	240		340		360		277		329		308		224		330		344		303	

Notes:

RL - Analyte reporting limit

Reference: See Table 2.2-11 for well status during sampling event

Table 2.9-6 Non-Radiological Analyses for Private Water Supply Wells in Marsland Area of Review

Location ID:		745		745		746		747		759		759		759		759		777		788	
Date Collected:		9/22/2011		12/15/2011		9/18/2012		3/25/2011		3/31/2011		6/10/2011		9/22/2011		12/15/2011		9/18/2012		3/24/2011	
	UNITS	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL
MAJOR IONS																					
Alkalinity Total as CaCO3	mg/L	172	1	164	1	155	5	131	1	163	1	153	1	144	1	140	1	302	5	154	1
Bicarbonate as HCO3	mg/L	209	1	200	1	184	5	160	1	199	1	187	1	175	1	170	1	369	5	187	1
Carbonate as CO3	mg/L	<1	1	<1	1	<5	5	<1	1	<1	1	<1	1	<1	1	<1	1	<5	5	<1	1
Chloride	mg/L	3	1	4	1	2	1	3	1	2	1	2	1	2	1	2	1	4	1	3	1
Fluoride	mg/L	0.4	0.1	0.4	0.1	0.5	0.1	1	0.1	0.6	0.1	0.5	0.1	0.6	0.1	0.6	0.1	0.4	0.1	0.4	0.1
Magnesium	mg/L	11	1	11	1	12	1	7	1	3	1	6	1	6	1	6	1	10	1	9	1
Nitrogen Ammonia as N	mg/L	<0.05	0.05	<0.05	0.05	<0.1	0.1	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.1	0.1	<0.05	0.05
Nitrogen Nitrate+Nitrite as N	mg/L	6.5	0.5	5	0.1	1.1	0.1	1	0.1	0.8	0.1	0.8	0.1	0.8	0.1	0.8	0.1	3	0.1	2.2	0.1
Potassium	mg/L	2	1	2	1	2	1	3	1	6	1	5	1	5	1	5	1	7	1	4	1
Silica	mg/L	70.9	0.2	67.2	0.2	75	1	85.5	0.2	74.9	0.2	69.1	0.2	75.3	0.2	71.9	0.2	53	1	69.2	0.2
Sodium	mg/L	8	1	8	1	10	1	13	1	49	1	25	1	23	1	25	1	38	1	19	1
Sulfate	mg/L	16	1	16	1	3	1	5	1	15	1	8	1	8	1	7	1	15	1	7	1
PHYSICAL PROPERTIES																					
Conductivity @ 25 C	umhos/cm	419	1	327	1	278	1	255	1	323	1	294	1	299	1	307	1	578	1	307	1
pH	s.u.	7.94	0.01	7.79	0.01	8.4	0.1	8.07	0.01	7.7	0.01	7.97	0.01	8.05	0.01	7.76	0.01	8.2	0.1	7.98	0.01
Solids Total Dissolved TDS @ 180 C	mg/L	315	10	292	10	220	10	202	10	236	10	212	10	217	10	203	10	400	10	231	10
METALS, DISSOLVED																					
Aluminum	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Arsenic	mg/L	0.003	0.001	0.003	0.001	0.003	0.001	0.005	0.001	0.006	0.001	0.004	0.001	0.004	0.001	0.003	0.001	0.006	0.001	0.003	0.001
Barium	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.2	0.1	0.1	0.1
Boron	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	0.1	0.1	0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Cadmium	mg/L	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005
Calcium	mg/L	64	1	61	1	33	1	31	1	21	1	31	1	31	1	32	1	73	1	34	1
Chromium	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Copper	mg/L	<0.1	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01
Iron	mg/L	<0.03	0.03	<0.03	0.03	0.15	0.03	<0.03	0.03	<0.03	0.03	<0.03	0.03	<0.03	0.03	<0.03	0.03	<0.03	0.03	<0.03	0.03
Lead	mg/L	0.001	0.001	0.002	0.001	<0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001
Manganese	mg/L	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01
Mercury	mg/L	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001
Molybdenum	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Nickel	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Selenium	mg/L	0.002	0.001	0.002	0.001	<0.001	0.001	0.001	0.001	0.001	0.001	<0.001	0.001	0.001	0.001	<0.001	0.001	<0.001	0.001	0.001	0.001
Vanadium	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.02	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.02	<0.1	0.1
Zinc	mg/L	0.51	0.01	0.72	0.01	0.03	0.01	0.07	0.01	0.01	0.01	0.01	0.01	0.04	0.01	0.1	0.01	0.03	0.01	0.07	0.01
DATA QUALITY																					
A/C Balance (± 5)	%	2.15		3.13		3.59		-3.49		-1.48		-1.77		0.123		4.27		3.2		-1.8	
Anions	meq/L	4.35		4.1		3.31		2.94		3.7		3.35		3.17		3.08		6.71		3.48	
Cations	meq/L	4.54		4.36		3.08		2.75		3.59		3.24		3.18		3.35		6.29		3.36	
Solids Total Dissolved Calculated	mg/L	327		223		230		255		292		262		260		166		400		275	

Notes:
RL - Analyte reporting limit
Reference: See Table 2.2-11 for well status during sampling event

Table 2.9-6 Non-Radiological Analyses for Private Water Supply Wells in Marsland Area of Review

Location ID:		788		799		802		809		810		811		815		821		845	
Date Collected:		9/18/2012		9/18/2012		9/18/2012		9/18/2012		9/18/2012		9/18/2012		9/18/2012		9/18/2012		9/18/2012	
	UNITS	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL	RESULT	RL
MAJOR IONS																			
Alkalinity Total as CaCO3	mg/L	148	5	173	5	161	5	170	5	171	5	165	5	168	5	149	5	158	5
Bicarbonate as HCO3	mg/L	480	5	199	5	190	5	198	5	201	5	195	5	198	5	175	5	187	5
Carbonate as CO3	mg/L	<5	5	6	5	<5	5	<5	5	<5	5	<5	5	<5	5	<5	5	<5	5
Chloride	mg/L	3	1	3	1	3	1	3	1	4	1	2	1	4	1	4	1	2	1
Fluoride	mg/L	0.4	0.1	0.4	0.1	0.5	0.1	0.8	0.1	0.9	0.1	0.7	0.1	0.04	0.1	0.5	0.1	0.4	0.1
Magnesium	mg/L	9	1	10	1	8	1	9	1	9	1	10	1	8	1	6	1	7	1
Nitrogen Ammonia as N	mg/L	0.2	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Nitrogen Nitrate+Nitrite as N	mg/L	3.7	0.1	0.9	0.1	2.7	0.1	0.8	0.1	0.9	0.1	0.5	0.1	5.5	0.1	2.4	0.1	1.4	0.1
Potassium	mg/L	4	1	3	1	2	1	5	1	5	1	5	1	3	1	6	1	4	1
Silica	mg/L	62	1	63	1	61	1	62	1	63	1	54	1	58	1	62	1	60	1
Sodium	mg/L	19	1	8	1	8	1	17	1	18	1	8	1	16	1	30	1	18	1
Sulfate	mg/L	6	1	5	1	3	1	4	1	6	1	3	1	7	1	17	1	7	1
PHYSICAL PROPERTIES																			
Conductivity @ 25 C	umhos/cm	305	1	314	1	298	1	313	1	314	1	289	1	335	1	321	1	302	1
pH	s.u.	8.4	0.1	8.5	0.1	8.4	0.1	8.4	0.1	8.4	0.1	8.4	0.1	8.4	0.1	8.4	0.1	8.4	0.1
Solids Total Dissolved TDS @ 180 C	mg/L	305	10	240	10	220	10	240	10	240	10	220	10	260	10	250	10	250	10
METALS, DISSOLVED																			
Aluminum	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Arsenic	mg/L	0.002	0.001	0.004	0.001	0.003	0.001	0.006	0.001	0.008	0.001	0.003	0.001	0.003	0.001	0.003	0.001	0.003	0.001
Barium	mg/L	0.2	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Boron	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Cadmium	mg/L	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005
Calcium	mg/L	32	1	45	1	45	1	37	1	37	1	39	1	45	1	29	1	35	1
Chromium	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Copper	mg/L	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01
Iron	mg/L	0.07	0.03	0.04	0.03	0.09	0.03	0.07	0.03	<0.03	0.03	0.04	0.03	<0.03	0.03	<0.03	0.03	<0.03	0.03
Lead	mg/L	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001
Manganese	mg/L	<0.01	0.01	<0.01	0.01	<0.01	0.01	0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01
Mercury	mg/L	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001
Molybdenum	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Nickel	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Selenium	mg/L	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Vanadium	mg/L	<0.1	0.02	<0.1	0.02	<0.1	0.02	<0.1	0.02	<0.1	0.02	<0.1	0.02	<0.1	0.02	<0.1	0.02	<0.1	0.02
Zinc	mg/L	0.11	0.01	0.06	0.01	0.06	0.01	0.3	0.01	0.18	0.01	0.29	0.01	0.29	0.01	0.29	0.01	0.29	0.01
DATA QUALITY																			
A/C Balance (± 5)	%	3.4		3.66		4.27		3.1		3.92		4.17		4.87		3.1		3.57	
Anions	meq/L	3.46		3.74		3.58		3.67		3.76		3.48		4.02		3.64		3.47	
Cations	meq/L	3.23		3.47		3.29		3.45		3.48		3.2		3.65		3.42		3.23	
Solids Total Dissolved Calculated	mg/L	240		250		220		240		250		220		270		260		230	

Notes:
RL - Analyte reporting limit
Reference: See Table 2.2-11 for well status during sampling event

Table 2.9-7 Water Levels - Arikaree Group, Brule Formation and Basal Sandstone of Chadron Formation

Well	TOC Elevation (ft amsl)	10/17/2013 Water Level (ft TOC)	10/17/2013 Groundwater Elevation (ft amsl)	TOC Elevation (ft amsl)	714/2014 Water Level (ft TOC)	7/14/2014 Groundwater Elevation (ft amsl)
ARIKAREE GROUP						
AOW-1	4261.64	126.4	4135.24	4261.64	126.3	4135.34
AOW-3	4351.97	142.2	4209.77	4351.97	142.2	4209.77
AOW-4	4161.91	87.3	4074.61	4161.91	86.5	4075.40
AOW-5	4125.42	72.0	4053.42	4125.42	71.8	4053.60
AOW-6	4068.60	20.0	4048.60	4068.60	19.4	4049.20
AOW-7	4243.94	DRY	NA	4243.94	DRY	NA
AOW-8	4365.07	71.7	4293.32	4365.07	71.5	4293.57
AOW-9	4146.41	74.9	4071.51	4146.41	76.0	4070.40
AOW-10	4198.60	113.3	4085.30	4198.60	113.5	4085.10
AOW-11	4091.02	35.4	4055.62	4091.02	34.8	4056.22
BRULE FORMATION						
BOW 2010-1	4260.10	124.9	4135.20	4260.10	124.9	4135.20
BOW 2010-2	4324.96	151.4	4173.56	4323.70	150.0	4173.70
BOW 2010-3	4352.80	139.6	4213.20	4350.50	137.2	4213.30
BOW 2010-4A	4163.13	93.7	4069.43	4163.13	90.4	4072.73
BOW 2010-5	4127.88	74.0	4053.88	4127.88	73.0	4054.88
BOW 2010-6	4100.43	50.3	4050.13	4100.43	49.6	4050.83
BOW-2010-7	4248.37	155.6	4092.77	4248.37	155.2	4093.17
BOW-2010-8	4369.29	74.0	4295.29	4366.89	71.3	4295.59
BOW-9	4145.90	74.6	4071.30	4145.90	74.6	4071.30
BOW-10	4197.84	113.8	4084.04	4197.84	112.7	4085.14
BOW-11	4091.87	37.4	4054.47	4091.87	36.9	4054.97
BASAL SANDSTONE OF CHADRON FORMATION						
CPW-2010-1	4261.35	565.3	3696.05	4261.35	570.8	3690.55
CPW-2010-1A	4263.28	567.0	3696.28	4263.28	572.4	3690.88
Monitor 1	4103.28	399.4	3703.88	4103.28	405.6	3697.68
Monitor 2	4199.50	500.3	3699.20	4199.50	505.5	3694.00
Monitor 3	4261.40	565.5	3695.90	4261.40	570.0	3691.40
Monitor 4A	4329.72	634.3	3695.42	4329.72	640.1	3689.62
Monitor 5	4340.80	645.4	3695.40	4340.80	650.7	3690.10
Monitor 6	4216.40	518.2	3698.20	4216.40	523.3	3693.10
Monitor 7	4246.28	548.0	3698.28	4246.28	553.3	3692.98
Monitor 8	4355.90	660.5	3695.40	4355.90	667.1	3688.80
Monitor 9	4367.02	669.7	3697.32	4367.02	680.1	3686.92
Monitor 10	4163.99	465.0	3698.99	4163.99	469.3	3694.69
Monitor 11	4128.07	427.9	3700.17	4126.67	431.7	3694.97

NOTES:

Groundwater
TOC = top of casing
ft TOC = feet below top of casing
ft amsl = feet above mean sea level
DRY = measurable water not present in well at time of sampling

Table 2.9-8 Non-Radiological Analytical Results for Brule Formation Monitoring Well Quarterly Sampling 2013-2014

Location ID:		BOW 2010-1		BOW 2010-1		BOW 2010-1		BOW 2010-1		BOW 2010-2		BOW 2010-2		BOW 2010-2	
Date Collected:		12/10/2013		2/25/2014		6/16/2014		9/16/2014		12/10/2013		2/25/2014		6/16/2014	
	UNITS	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL
MAJOR IONS															
Alkalinity, Total as $CaCO_3$	mg/L	308	5	268	5	252	5	236	5	255	5	243	5	224	5
Bicarbonate as HCO_3	mg/L	<1	1	<1	1	<1	1	<1	1	<1	1	<1	1	<1	1
Carbonate as CO_3	mg/L	69	1	70	1	64	1	62	1	112	1	113	1	117	1
Chloride	mg/L	502	1	435	1	326	1	326	1	339	1	251	1	182	1
Fluoride	mg/L	0.5	0.1	0.5	0.1	0.5	0.1	0.5	0.1	0.5	0.1	0.5	0.1	0.5	0.1
Magnesium	mg/L	<1	1	<1	1	<1	1	<1	1	<1	1	<1	1	<1	1
Nitrogen, Ammonia as N	mg/L	<0.05	0.05	0.30	0.05	0.11	0.05	0.35	0.05	<0.05	0.05	0.10	0.05	<0.05	0.05
Nitrogen, Nitrate+Nitrite as N	mg/L	0.5	0.1	0.6	0.1	1.0	0.1	0.9	0.1	0.6	0.1	0.8	0.1	1.0	0.1
Potassium	mg/L	38	1	31	1	27	1	23	1	35	1	27	1	23	1
Silica as SiO2	mg/L	183	1	180	1	178	1	174	1	126	1	122	1	108	1
Sodium	mg/L	409	1	358	1	326	1	288	1	300	1	253	1	211	1
Sulfate	mg/L	62	1	43	1	43	1	37	1	33	1	33	1	34	1
PHYSICAL PROPERTIES															
pH	s.u.	10.7	0.1	10.7	0.1	10.8	0.1	10.7	0.1	10.4	0.1	10.4	0.1	10.3	0.1
Conductivity @ 25 °C	umhos/cm	2300	1	2030	1	1650	1	1520	1	1730	1	1370	1	1060	1
Total Dissolved Solids @ 180 °C	mg/L	1280	10	1190	10	1070	10	1030	10	970	10	850	10	700	10
Nitrogen, Nitrite as N	mg/L	0.1	0.1 L	0.2	0.1 L	0.3	0.1 L	0.4	0.1	<0.1	0.1 L	0.1	0.1 L	<0.1	0.1 L
METALS, DISSOLVED															
Aluminum	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.05	0.05	<0.1	0.1	<0.1	0.1	<0.1	0.1
Arsenic	mg/L	0.007	0.001	0.007	0.001	0.008	0.001	0.009	0.001	0.006	0.001	0.006	0.001	0.006	0.001
Barium	mg/L	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	<0.1	0.1	<0.1	0.1
Boron	mg/L	<0.1	0.1	<0.1	0.1	0.1	0.1	0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Cadmium	mg/L	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005
Calcium	mg/L	31	1	29	1	23	1	19	1	20	1	17	1	12	1
Chromium	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Copper	mg/L	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01
Iron	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Lead	mg/L	<0.001	0.001	<0.001	0.001	<0.001	0.001	0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001
Manganese	mg/L	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01
Mercury	mg/L	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001
Molybdenum	mg/L	<0.1	0.1	<0.1	0.1	<0.01	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Nickel	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Selenium	mg/L	0.008	0.001	0.008	0.001	0.009	0.001	0.012	0.001	0.001	0.001	0.002	0.001	0.001	0.001
Vanadium	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Zinc	mg/L	0.07	0.01	0.11	0.01	0.09	0.01	0.1	0.01	0.11	0.01	0.20	0.01	0.23	0.01
DATA QUALITY															
A/C Balance (± 5)	%	3.22	0.01	2.10	0.01	2.53	0.01	2.33	0.01	1.60	0.01	0.70	0.01	0.42	0.01
Anions	meq/L	21.67	0.01	18.58	0.01	15.22	0.01	14.77	0.01	15.42	0.01	12.70	0.01	10.43	0.01
Cations	meq/L	20.32	0.01	17.82	0.01	16.01	0.01	14.1	0.01	14.93	0.01	12.52	0.01	10.35	0.01
Solids Total Dissolved Calculated	mg/L	1410	10	1240	10	1080	10	1010	10	1010	10	850	10	710	10
Calculated TDS/TDS Ratio (0.80-1.20)	dec. %	0.91	0.01	0.96	0.01	0.99	0.01	1.02	0.01	0.96	0.01	1.00	0.01	0.99	0.01

Notes:
mg/L = milligrams per Liter
umhos/cm = micromhos per centimeter
s.u. = standard unti
meq/L = milliequivalents per Liter
RL = Analyte Reporting Limit
L = Analyzed by a contract laboratory

Table 2.9-8 Non-Radiological Analytical Results for Brule Formation Monitoring Well Quarterly Sampling 2013-2014

	Location ID:	BOW 2010-2		BOW 2010-3	
	Date Collected:	9/16/2014		12/10/2013	
	UNITS	RESULTS	RL	RESULTS	RL
MAJOR IONS					
Alkalinity, Total as $CaCO_3$	mg/L	201	5	97	5
Bicarbonate as HCO_3	mg/L	<1	1	72	1
Carbonate as CO_3	mg/L	116	1	23	1
Chloride	mg/L	136	1	37	1
Fluoride	mg/L	0.5	0.1	0.7	0.1
Magnesium	mg/L	<1	1	<1	1
Nitrogen, Ammonia as N	mg/L	<0.05	0.05	<0.05	0.05
Nitrogen, Nitrate+Nitrite as N	mg/L	1	0.1	0.2	0.1
Potassium	mg/L	18	1	8	1
Silica as SiO2	mg/L	100	1	68	1
Sodium	mg/L	168	1	79	1
Sulfate	mg/L	28	1	52	1
PHYSICAL PROPERTIES					
pH	s.u.	10.2	0.1	9.2	0.1
Conductivity @ 25 °C	umhos/cm	891	1	486	1
Total Dissolved Solids @ 180 °C	mg/L	620	10	340	10
Nitrogen, Nitrite as N	mg/L	<0.1	0.1	<0.1	0.1 L
METALS, DISSOLVED					
Aluminum	mg/L	0.05	0.05	<0.1	0.1
Arsenic	mg/L	0.006	0.001	0.010	0.001
Barium	mg/L	<0.1	0.1	<0.1	0.1
Boron	mg/L	<0.1	0.1	0.1	0.1
Cadmium	mg/L	<0.005	0.005	<0.005	0.005
Calcium	mg/L	8	1	4	1
Chromium	mg/L	<0.05	0.05	<0.05	0.05
Copper	mg/L	<0.01	0.01	<0.01	0.01
Iron	mg/L	<0.05	0.05	<0.05	0.05
Lead	mg/L	<0.001	0.001	<0.001	0.001
Manganese	mg/L	<0.01	0.01	<0.01	0.01
Mercury	mg/L	<0.001	0.001	<0.001	0.001
Molybdenum	mg/L	<0.1	0.1	<0.1	0.1
Nickel	mg/L	<0.05	0.05	<0.05	0.05
Selenium	mg/L	0.001	0.001	0.004	0.001
Vanadium	mg/L	<0.1	0.1	<0.1	0.1
Zinc	mg/L	0.11	0.01	<0.01	0.01
DATA QUALITY					
A/C Balance (± 5)	%	2.53	0.01	3.27	0.01
Anions	meq/L	8.56	0.01	4.12	0.01
Cations	meq/L	8.14	0.01	3.86	0.01
Solids Total Dissolved Calculated	mg/L	580	10	310	10
Calculated TDS/TDS Ratio (0.80-1.20)	dec. %	1.07	0.01	1.10	0.01

Notes:
mg/L = milligrams per Liter
umhos/cm = micromhos per centimeter
s.u. = standard unti
meq/L = milliequivalents per Liter
RL = Analyte Reporting Limit
L = Analyzed by a contract laboratory

Table 2.9-8 Non-Radiological Analytical Results for Brule Formation Monitoring Well Quarterly Sampling 2013-2014

Location ID:		BOW 2010-3		BOW 2010-3		BOW 2010-3		BOW 2010-4A		BOW 2010-4A		BOW 2010-4A		BOW 2010-4A		BOW 2
Date Collected:		2/25/2014		6/16/2014		9/16/2014		12/10/2013		2/25/2014		6/16/2014		9/16/2014		12/16/
	UNITS	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS
MAJOR IONS																
Alkalinity, Total as $CaCO_3$	mg/L	109	5	117	5	123	1	38	5	56	5	58	5	63	5	150
Bicarbonate as HCO_3	mg/L	94	1	104	1	112	1	46	1	68	1	70	1	73	1	184
Carbonate as CO_3	mg/L	19	1	19	1	19	1	<1	1	<1	1	<1	1	2	1	<1
Chloride	mg/L	36	1	23	1	23	1	367	1	293	1	300	1	267	1	3
Fluoride	mg/L	0.6	0.1	0.6	0.1	0.6	0.1	0.4	0.1	0.4	0.1	0.4	0.1	0.4	0.1	1.8
Magnesium	mg/L	<1	1	<1	1	<1	1	2	1	2	1	2	1	2	1	7
Nitrogen, Ammonia as N	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05
Nitrogen, Nitrate+Nitrite as N	mg/L	<0.1	0.1	0.4	0.1	0.5	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	0.8
Potassium	mg/L	8	1	9	1	8	1	23	1	18	1	18	1	17	1	4
Silica as SiO2	mg/L	71	1	77	1	77	1	26	1	35	1	39	1	37	1	66
Sodium	mg/L	86	1	91	1	84	1	210	1	188	1	188	1	177	1	22
Sulfate	mg/L	59	1	52	1	54	1	40	1	43	1	39	1	41	1	7
PHYSICAL PROPERTIES																
pH	s.u.	9.1	0.1	9.1	0.1	9	0.1	8.1	0.1	8.3	0.1	8.3	0.1	8.4	0.1	8.2
Conductivity @ 25 °C	umhos/cm	468	1	450	1	468	1	1420	1	1160	1	1110	1	1070	1	327
Total Dissolved Solids @ 180 °C	mg/L	340	10	340	10	360	10	730	10	640	10	630	10	610	10	200
Nitrogen, Nitrite as N	mg/L	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1 L	<0.1
METALS, DISSOLVED																
Aluminum	mg/L	<0.1	0.1	<0.1	0.1	<0.05	0.05	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.05	0.05	<0.1
Arsenic	mg/L	0.010	0.001	0.012	0.001	0.011	0.001	0.003	0.001	0.005	0.001	0.006	0.001	0.005	0.001	0.003
Barium	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	0.1
Boron	mg/L	0.1	0.1	0.1	0.1	0.1	0.1	<0.1	0.1	0.1	0.1	<0.1	0.1	0.1	0.1	<0.1
Cadmium	mg/L	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005
Calcium	mg/L	5	1	4	1	4	1	33	1	24	1	25	1	22	1	29
Chromium	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05
Copper	mg/L	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	0.02	0.01	<0.01	0.01	<0.01	0.01	<0.01
Iron	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05
Lead	mg/L	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	0.003	0.001	0.003	0.001	0.002	0.001	<0.001
Manganese	mg/L	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01
Mercury	mg/L	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001
Molybdenum	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1
Nickel	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05
Selenium	mg/L	0.004	0.001	0.005	0.001	0.004	0.001	0.003	0.001	0.002	0.001	0.004	0.001	0.004	0.001	0.001
Vanadium	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1
Zinc	mg/L	<0.01	0.01	<0.01	0.01	<0.02	0.02	0.39	0.01	1.90	0.01	1.35	0.01	0.63	0.01	0.12
DATA QUALITY																
A/C Balance (± 5)	%	3.29	0.01	3.23	0.01	2.86	0.01	1.96	0.01	1.53	0.01	2.03	0.01	1.49	0.01	4.59
Anions	meq/L	4.44	0.01	4.1	0.01	4.3	0.01	11.97	0.01	10.26	0.01	10.44	0.01	9.66	0.01	3.38
Cations	meq/L	4.16	0.01	4.38	0.01	4.06	0.01	11.51	0.01	9.95	0.01	10.03	0.01	9.37	0.01	3.08
Solids Total Dissolved Calculated	mg/L	330	10	330	10	330	10	720	10	640	10	650	10	600	10	230
Calculated TDS/TDS Ratio (0.80-1.20)	dec. %	1.03	0.01	1.03	0.01	1.09	0.01	1.00	0.01	1.00	0.01	0.97	0.01	1.02	0.01	0.87

Notes:
mg/L = milligrams per Liter
umhos/cm = micromhos per centimeter
s.u. = standard unti
meq/L = milliequivalents per Liter
RL = Analyte Reporting Limit
L = Analyzed by a contract laboratory

Table 2.9-8 Non-Radiological Analytical Results for Brule Formation Monitoring Well Quarterly Sampling 2013-2014

	Location ID: 010-5		BOW 2010-5	
	Date Collected: 2013		2/26/2014	
	UNITS	RL	RESULTS	RL
MAJOR IONS				
Alkalinity, Total as $CaCO_3$	mg/L	5	151	5
Bicarbonate as HCO_3	mg/L	5	181	1
Carbonate as CO_3	mg/L	1	1	1
Chloride	mg/L	1	3	1
Fluoride	mg/L	0.1	0.6	0.1
Magnesium	mg/L	1	7	1
Nitrogen, Ammonia as N	mg/L	0.05	<0.05	0.05
Nitrogen, Nitrate+Nitrite as N	mg/L	0.1	0.9	0.1
Potassium	mg/L	1	4	1
Silica as SiO2	mg/L	1	68	1
Sodium	mg/L	1	22	1
Sulfate	mg/L	1	8	1
PHYSICAL PROPERTIES				
pH	s.u.	0.1	8.3	0.1
Conductivity @ 25 °C	umhos/cm	1	314	1
Total Dissolved Solids @ 180 °C	mg/L	10	240	10
Nitrogen, Nitrite as N	mg/L	0.1 L	<0.1	0.1 L
METALS, DISSOLVED				
Aluminum	mg/L	0.1	<0.1	0.1
Arsenic	mg/L	0.001	0.003	0.001
Barium	mg/L	0.1	0.1	0.1
Boron	mg/L	0.1	<0.1	0.1
Cadmium	mg/L	0.005	<0.005	0.005
Calcium	mg/L	1	30	1
Chromium	mg/L	0.05	<0.05	0.05
Copper	mg/L	0.01	<0.01	0.01
Iron	mg/L	0.05	<0.05	0.05
Lead	mg/L	0.001	<0.001	0.001
Manganese	mg/L	0.01	<0.01	0.01
Mercury	mg/L	0.001	<0.001	0.001
Molybdenum	mg/L	0.1	<0.1	0.1
Nickel	mg/L	0.05	<0.05	0.05
Selenium	mg/L	0.001	<0.001	0.001
Vanadium	mg/L	0.1	<0.1	0.1
Zinc	mg/L	0.01	0.13	0.01
DATA QUALITY				
A/C Balance (± 5)	%	0.01	316	0.01
Anions	meq/L	0.01	3.34	0.01
Cations	meq/L	0.01	3.14	0.01
Solids Total Dissolved Calculated	mg/L	10	240	10
Calculated TDS/TDS Ratio (0.80-1.20)	dec. %	0.01	1.00	0.01

Notes:
mg/L = milligrams per Liter
umhos/cm = micromhos per centimeter
s.u. = standard unti
meq/L = milliequivalents per Liter
RL = Analyte Reporting Limit
L = Analyzed by a contract laboratory

Table 2.9-8 Non-Radiological Analytical Results for Brule Formation Monitoring Well Quarterly Sampling 2013-2014

Location ID:		BOW 2010-5		BOW 2010-5		BOW 2010-6		BOW 2010-6		BOW 2010-6		BOW 2010-6		BOW 2010-7		BOW
Date Collected:		6/17/2014		9/17/2014		12/16/2013		2/26/2014		6/19/2014		9/17/2014		12/16/2013		2/25/
	UNITS	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS
MAJOR IONS																
Alkalinity, Total as $CaCO_3$	mg/L	148	5	147	5	137	5	139	5	129	5	140	5	176	5	183
Bicarbonate as HCO_3	mg/L	177	1	169	1	153	5	162	1	148	1	158	1	184	5	203
Carbonate as CO_3	mg/L	2	1	5	1	7	1	4	1	4	1	6	1	15	1	10
Chloride	mg/L	4	1	2	1	13	1	11	1	7	1	5	1	24	1	16
Fluoride	mg/L	0.5	0.1	0.6	0.1	0.7	0.1	0.6	0.1	0.6	0.1	0.6	0.1	0.7	0.1	0.6
Magnesium	mg/L	7	1	7	1	6	1	6	1	5	1	6	1	<1	1	<1
Nitrogen, Ammonia as N	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05
Nitrogen, Nitrate+Nitrite as N	mg/L	0.9	0.1	0.9	0.1	0.9	0.1	0.9	0.1	1.0	0.1	1	0.1	0.7	0.1	0.9
Potassium	mg/L	5	1	4	1	5	1	5	1	5	1	5	1	10	1	10
Silica as SiO2	mg/L	69	1	67	1	60	1	60	1	61	1	61	1	67	1	68
Sodium	mg/L	24	1	22	1	26	1	25	1	21	1	20	1	97	1	98
Sulfate	mg/L	7	1	7	1	10	1	11	1	10	1	9	1	46	1	50
PHYSICAL PROPERTIES																
pH	s.u.	8.3	0.1	8.4	0.1	8.5	0.1	8.4	0.1	8.5	0.1	8.4	0.1	8.7	0.1	8.6
Conductivity @ 25 °C	umhos/cm	299	1	315	5	348	1	330	1	289	1	312	1	558	1	513
Total Dissolved Solids @ 180 °C	mg/L	250	10	250	10	250	10	260	10	220	10	240	10	360	10	370
Nitrogen, Nitrite as N	mg/L	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1	<0.1	0.1 L	<0.1
METALS, DISSOLVED																
Aluminum	mg/L	<0.1	0.1	<0.05	0.05	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.05	0.05	<0.1	0.1	<0.1
Arsenic	mg/L	0.003	0.001	0.003	0.001	0.004	0.001	0.004	0.001	0.004	0.001	0.005	0.001	0.026	0.001	0.024
Barium	mg/L	0.1	0.1	0.1	0.1	<0.1	0.1	0.1	0.1	<0.1	0.1	0.1	0.1	<0.1	0.1	<0.1
Boron	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	0.1	0.1	0.1
Cadmium	mg/L	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005
Calcium	mg/L	28	1	28	1	29	1	31	1	26	1	30	1	8	1	9
Chromium	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05
Copper	mg/L	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01
Iron	mg/L	<0.05	0.05	<0.05	0,05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05
Lead	mg/L	<0.001	0.001	<0.001	0.001	<0.001	0.001	0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001
Manganese	mg/L	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01
Mercury	mg/L	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001
Molybdenum	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1
Nickel	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05
Selenium	mg/L	0.001	0.001	<0.001	0.001	0.001	0.001	<0.001	0.001	0.001	0.001	0.001	0.001	0.139	0.001	0.143
Vanadium	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1
Zinc	mg/L	0.13	0.01	0.12	0.01	0.03	0.01	0.43	0.01	0.02	0.01	0.06	0.01	0.03	0.01	0.09
DATA QUALITY																
A/C Balance (± 5)	%	3.02	0.01	2.75	0.01	3.52	0.01	2.61	0.01	4.79	0.01	3.05	0.01	3.51	0.01	3.23
Anions	meq/L	3.30	0.01	3.25	0.01	3.41	0.01	3.42	0.01	3.07	0.01	3.22	0.01	5.22	0.01	5.27
Cations	meq/L	3.10	0.01	3.08	0.01	3.18	0.01	3.25	0.01	2.79	0.01	3.02	0.01	4.86	0.01	4.94
Solids Total Dissolved Calculated	mg/L	240	10	230	10	240	10	240	10	220	10	230	10	360	10	370
Calculated TDS/TDS Ratio (0.80-1.20)	dec. %	1.04	0.01	1.09	0.01	1.04	0.01	1.08	0.01	1.00	0.01	1.04	0.01	1.00	0.01	1.00

Notes:
mg/L = milligrams per Liter
umhos/cm = micromhos per centimeter
s.u. = standard unti
meq/L = milliequivalents per Liter
RL = Analyte Reporting Limit
L = Analyzed by a contract laboratory

Table 2.9-8 Non-Radiological Analytical Results for Brule Formation Monitoring Well Quarterly Sampling 2013-2014

	Location ID:	2010-7	BOW 2010-7	
	Date Collected:	2014	6/16/2014	
	UNITS	RL	RESULTS	RL
MAJOR IONS				
Alkalinity, Total as $CaCO_3$	mg/L	5	184	5
Bicarbonate as HCO_3	mg/L	1	205	1
Carbonate as CO_3	mg/L	1	10	1
Chloride	mg/L	1	12	1
Fluoride	mg/L	0.1	0.6	0.1
Magnesium	mg/L	1	<1	1
Nitrogen, Ammonia as N	mg/L	0.05	<0.05	0.05
Nitrogen, Nitrate+Nitrite as N	mg/L	0.1	1.0	0.1
Potassium	mg/L	1	10	1
Silica as SiO2	mg/L	1	73	1
Sodium	mg/L	1	106	1
Sulfate	mg/L	1	43	1
PHYSICAL PROPERTIES				
pH	s.u.	0.1	8.7	0.1
Conductivity @ 25 °C	umhos/cm	1	502	1
Total Dissolved Solids @ 180 °C	mg/L	10	370	10
Nitrogen, Nitrite as N	mg/L	0.1 L	<0.1	0.1 L
METALS, DISSOLVED				
Aluminum	mg/L	0.1	<0.1	0.1
Arsenic	mg/L	0.001	0.028	0.001
Barium	mg/L	0.1	<0.1	0.1
Boron	mg/L	0.1	0.1	0.1
Cadmium	mg/L	0.005	<0.005	0.005
Calcium	mg/L	1	8	1
Chromium	mg/L	0.05	<0.05	0.05
Copper	mg/L	0.01	<0.01	0.01
Iron	mg/L	0.05	<0.05	0.05
Lead	mg/L	0.001	<0.001	0.001
Manganese	mg/L	0.01	<0.01	0.01
Mercury	mg/L	0.001	<0.001	0.001
Molybdenum	mg/L	0.1	<0.1	0.1
Nickel	mg/L	0.05	<0.05	0.05
Selenium	mg/L	0.001	0.197	0.001
Vanadium	mg/L	0.1	<0.1	0.1
Zinc	mg/L	0.01	0.01	0.01
DATA QUALITY				
A/C Balance (± 5)	%	0.01	2.23	0.01
Anions	meq/L	0.01	5.02	0.01
Cations	meq/L	0.01	5.25	0.01
Solids Total Dissolved Calculated	mg/L	10	370	10
Calculated TDS/TDS Ratio (0.80-1.20)	dec. %	0.01	1.00	0.01

Notes:
mg/L = milligrams per Liter
umhos/cm = micromhos per centimeter
s.u. = standard unti
meq/L = milliequivalents per Liter
RL = Analyte Reporting Limit
L = Analyzed by a contract laboratory

Table 2.9-8 Non-Radiological Analytical Results for Brule Formation Monitoring Well Quarterly Sampling 2013-2014

Location ID:		BOW 2010-7		BOW 2010-8		BOW 2010-8		BOW 2010-8		BOW 2010-8		BOW 9		BOW 9	
Date Collected:		9/16/2014		12/10/2013		2/26/2014		6/16/2014		9/16/2014		11/8/2013		2/26/2014	
	UNITS	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL
MAJOR IONS															
Alkalinity, Total as $CaCO_3$	mg/L	179	5	160	5	175	5	172	5	168	5	155	5	160	5
Bicarbonate as HCO_3	mg/L	199	1	130	1	153	1	136	1	145	1	176	5	187	1
Carbonate as CO_3	mg/L	9	1	32	1	30	1	37	1	30	1	6	1	4	1
Chloride	mg/L	14	1	8	1	5	1	4	1	4	1	10	1	7	1
Fluoride	mg/L	0.6	0.1	0.7	0.1	0.6	0.1	0.5	0.1	0.6	0.1	0.5	0.1	0.5	0.1
Magnesium	mg/L	<1	1	<1	1	<1	1	<1	1	<1	1	8	1	9	1
Nitrogen, Ammonia as N	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Nitrogen, Nitrate+Nitrite as N	mg/L	0.9	0.1	0.7	0.1	0.9	0.1	0.9	0.1	0.8	0.1	1.1	0.1	1.0	0.1
Potassium	mg/L	9	1	9	1	8	1	9	1	8	1	4	1	4	1
Silica as SiO2	mg/L	71	1	78	1	77	1	81	1	81	1	66	1	67	1
Sodium	mg/L	97	1	76	1	81	1	87	1	79	1	28	1	20	1
Sulfate	mg/L	45	1	28	1	27	1	22	1	24	1	9	1	7	1
PHYSICAL PROPERTIES															
pH	s.u.	8.6	0.1	9.2	0.1	9.1	0.1	9.3	0.1	9.2	0.1	8.5	0.1	8.4	0.1
Conductivity @ 25 °C	umhos/cm	529	1	419	1	423	1	396	1	414	1	346	1	344	1
Total Dissolved Solids @ 180 °C	mg/L	390	10	280	10	340	10	320	10	330	10	230	10	270	10
Nitrogen, Nitrite as N	mg/L	<0.1	0.1	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1	<0.1	0.1 L	<0.1	0.1 L
METALS, DISSOLVED															
Aluminum	mg/L	<0.05	0.05	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.05	0.05	<0.1	0.1	<0.1	0.1
Arsenic	mg/L	0.028	0.001	0.008	0.001	0.008	0.001	0.007	0.001	0.007	0.001	0.003	0.001	0.003	0.001
Barium	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0/1	0.1	<0.1	0.1	0.1	0.1
Boron	mg/L	0.1	0.1	<0.1	0.1	<0.1	0.1	0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Cadmium	mg/L	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005
Calcium	mg/L	8	1	4	1	5	1	5	1	5	1	30	1	34	1
Chromium	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Copper	mg/L	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	<0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01
Iron	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Lead	mg/L	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.005	0.005	<0.001	0.001
Manganese	mg/L	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01
Mercury	mg/L	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001
Molybdenum	mg/L	<0/1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Nickel	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Selenium	mg/L	0.153	0.001	0.001	0.001	<0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.002	0.001
Vanadium	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Zinc	mg/L	<0.01	0.01	0.05	0.01	0.05	0.01	0.05	0.01	0.04	0.01	0.03	0.01	<0.01	0.01
DATA QUALITY															
A/C Balance (± 5)	%	1.66	0.01	3.95	0.01	4.55	0.01	1.70	0.01	2.72	0.01	2.59	0.01	3.59	0.01
Anions	meq/L	4.99	0.01	4.07	0.01	4.29	0.01	4.11	0.01	4.06	0.01	3.66	0.01	3.65	0.01
Cations	meq/L	4.83	0.01	3.76	0.01	3.92	0.01	4.25	0.01	3.85	0.01	3.48	0.01	3.40	0.01
Solids Total Dissolved Calculated	mg/L	360	10	300	10	310	10	320	10	300	10	250	10	250	10
Calculated TDS/TDS Ratio (0.80-1.20)	dec. %	1.08	0.01	0.93	0.01	1.10	0.01	1.00	0.01	1.1	0.01	0.92	0.01	1.08	0.01

Notes:
mg/L = milligrams per Liter
umhos/cm = micromhos per centimeter
s.u. = standard unti
meq/L = milliequivalents per Liter
RL = Analyte Reporting Limit
L = Analyzed by a contract laboratory

Table 2.9-8 Non-Radiological Analytical Results for Brule Formation Monitoring Well Quarterly Sampling 2013-2014

Location ID:		BOW 9		BOW 9	
Date Collected:		6/16/2014		9/17/2014	
	UNITS	RESULTS	RL	RESULTS	RL
MAJOR IONS					
Alkalinity, Total as $CaCO_3$	mg/L	166	5	154	5
Bicarbonate as HCO_3	mg/L	196	1	175	1
Carbonate as CO_3	mg/L	3	1	6	1
Chloride	mg/L	5	1	5	1
Fluoride	mg/L	0.5	0.1	0.5	0.1
Magnesium	mg/L	9	1	9	1
Nitrogen, Ammonia as N	mg/L	<0.05	0.05	<0.05	0.05
Nitrogen, Nitrate+Nitrite as N	mg/L	1.2	0.1	1.1	0.1
Potassium	mg/L	4	1	4	1
Silica as SiO2	mg/L	71	1	66	1
Sodium	mg/L	20	1	19	1
Sulfate	mg/L	7	1	7	1
PHYSICAL PROPERTIES					
pH	s.u.	8.4	0.1	8.4	0.1
Conductivity @ 25 °C	umhos/cm	323	1	337	1
Total Dissolved Solids @ 180 °C	mg/L	250	10	260	10
Nitrogen, Nitrite as N	mg/L	<0.1	0.1 L	<0.1	0.1
METALS, DISSOLVED					
Aluminum	mg/L	<0.1	0.1	<0.05	0.05
Arsenic	mg/L	0.003	0.001	0.003	0.001
Barium	mg/L	0.1	0.1	0.1	0.1
Boron	mg/L	<0.1	0.1	<0.1	0.1
Cadmium	mg/L	<0.005	0.005	<0.005	0.005
Calcium	mg/L	35	1	32	1
Chromium	mg/L	<0.05	0.05	<0.05	0.05
Copper	mg/L	<0.01	0.01	<0.01	0.01
Iron	mg/L	<0.05	0.05	<0.05	0.05
Lead	mg/L	<0.001	0.001	<0.001	0.001
Manganese	mg/L	0.01	0.01	<0.01	0.01
Mercury	mg/L	<0.001	0.001	<0.001	0.001
Molybdenum	mg/L	<0.1	0.1	<0.1	0.1
Nickel	mg/L	<0.05	0.05	<0.05	0.05
Selenium	mg/L	0.001	0.001	0.001	0.001
Vanadium	mg/L	<0.1	0.1	<0.1	0.1
Zinc	mg/L	<0.01	0.01	0.01	0.01
DATA QUALITY					
A/C Balance (± 5)	%	3.03	0.01	3.65	0.01
Anions	meq/L	3.70	0.01	3.46	0.01
Cations	meq/L	3.48	0.01	3.22	0.01
Solids Total Dissolved Calculated	mg/L	260	10	240	10
Calculated TDS/TDS Ratio (0.80-1.20)	dec. %	0.96	0.01	1.08	0.01

Notes:
mg/L = milligrams per Liter
umhos/cm = micromhos per centimeter
s.u. = standard unti
meq/L = milliequivalents per Liter
RL = Analyte Reporting Limit
L = Analyzed by a contract laboratory

Table 2.9-8 Non-Radiological Analytical Results for Brule Formation Monitoring Well Quarterly Sampling 2013-2014

Location ID:		BOW 10		BOW 10		BOW 10		BOW 10		BOW 11		BOW 11		BOW 11	
Date Collected:		11/8/2013		2/25/2014		6/16/2014		9/17/2014		11/8/2013		2/26/2014		6/17/2014	
	UNITS	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL
MAJOR IONS															
Alkalinity, Total as $CaCO_3$	mg/L	147	5	171	5	153	5	146	5	144	5	148	5	147	5
Bicarbonate as HCO_3	mg/L	172	5	205	1	185	1	166	1	170	5	178	1	177	1
Carbonate as CO_3	mg/L	4	1	1	1	1	1	6	1	3	1	1	1	1	1
Chloride	mg/L	11	1	8	1	6	1	4	1	5	1	5	1	4	1
Fluoride	mg/L	0.5	0.1	0.5	0.1	0.4	0.1	0.6	0.1	0.6	0.1	0.6	0.1	0.6	0.1
Magnesium	mg/L	9	1	10	1	10	1	9	1	7	1	7	1	7	1
Nitrogen, Ammonia as N	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Nitrogen, Nitrate+Nitrite as N	mg/L	1.4	0.1	1.4	0.1	1.4	0.1	1.4	0.1	1.5	0.1	1.5	0.1	1.5	0.1
Potassium	mg/L	4	1	4	1	4	1	3	1	4	1	5	1	5	1
Silica as SiO2	mg/L	66	1	68	1	72	1	66	1	59	1	61	1	61	1
Sodium	mg/L	26	1	27	1	22	1	21	1	19	1	20	1	18	1
Sulfate	mg/L	10	1	8	1	7	1	11	1	11	1	11	1	11	1
PHYSICAL PROPERTIES															
pH	s.u.	8.4	0.1	8.4	0.1	8.3	0.1	8.4	0.1	8.4	0.1	8.4	0.1	8.3	0.1
Conductivity @ 25 °C	umhos/cm	346	1	329	1	328	1	333	1	325	1	330	1	309	1
Total Dissolved Solids @ 180 °C	mg/L	230	10	250	10	250	10	260	10	250	10	260	10	240	10
Nitrogen, Nitrite as N	mg/L	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1 L
METALS, DISSOLVED															
Aluminum	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.05	0.05	<0.1	0.1	<0.1	0.1	<0.1	0.1
Arsenic	mg/L	0.003	0.001	0.003	0.001	0.003	0.001	0.003	0.001	0.005	0.001	0.005	0.001	0.005	0.001
Barium	mg/L	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Boron	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Cadmium	mg/L	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005
Calcium	mg/L	29	1	31	1	32	1	29	1	34	1	35	1	35	1
Chromium	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.005	0.005	<0.05	0.05	<0.05	0.05	<0.05	0.05
Copper	mg/L	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01
Iron	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Lead	mg/L	<0.005	0.005	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.005	0.005	<0.001	0.001	<0.001	0.001
Manganese	mg/L	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01
Mercury	mg/L	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001
Molybdenum	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Nickel	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Selenium	mg/L	0.002	0.001	0.003	0.001	0.002	0.001	0.001	0.001	0.002	0.001	<0.001	0.001	0.002	0.001
Vanadium	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Zinc	mg/L	0.02	0.01	0.04	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	0.02	0.01	<0.01	0.01
DATA QUALITY															
A/C Balance (± 5)	%	1.89	0.01	3.51	0.01	0.60	0.01	2.8	0.01	2.90	0.01	2.09	0.01	3.00	0.01
Anions	meq/L	3.57	0.01	3.91	0.01	3.52	0.01	3.39	0.01	3.38	0.01	3.45	0.01	3.41	0.01
Cations	meq/L	3.44	0.01	3.65	0.01	3.48	0.01	3.2	0.01	3.19	0.01	3.31	0.01	3.21	0.01
Solids Total Dissolved Calculated	mg/L	250	10	260	10	250	10	240	10	230	10	240	10	240	10
Calculated TDS/TDS Ratio (0.80-1.20)	dec. %	0.92	0.01	0.96	0.01	1.00	0.01	1.08	0.01	1.09	0.01	1.08	0.01	1.00	0.01

Notes:
mg/L = milligrams per Liter
umhos/cm = micromhos per centimeter
s.u. = standard unti
meq/L = milliequivalents per Liter
RL = Analyte Reporting Limit
L = Analyzed by a contract laboratory

Table 2.9-8 Non-Radiological Analytical Results for Brule Formation Monitoring Well Quarterly Sampling 2013-2014

	Location ID:	BOW 11	
	Date Collected:	9/17/2014	
	UNITS	RESULTS	RL
MAJOR IONS			
Alkalinity, Total as $CaCO_3$	mg/L	153	5
Bicarbonate as HCO_3	mg/L	178	1
Carbonate as CO_3	mg/L	4	1
Chloride	mg/L	5	1
Fluoride	mg/L	0.5	0.1
Magnesium	mg/L	7	1
Nitrogen, Ammonia as N	mg/L	<0.05	0.05
Nitrogen, Nitrate+Nitrite as N	mg/L	1.6	0.1
Potassium	mg/L	5	1
Silica as SiO2	mg/L	59	1
Sodium	mg/L	19	1
Sulfate	mg/L	7	1
PHYSICAL PROPERTIES			
pH	s.u.	8.4	0.1
Conductivity @ 25 °C	umhos/cm	336	1
Total Dissolved Solids @ 180 °C	mg/L	260	10
Nitrogen, Nitrite as N	mg/L	<0.1	0.1
METALS, DISSOLVED			
Aluminum	mg/L	<0.05	0.05
Arsenic	mg/L	0.005	0.001
Barium	mg/L	0.1	0.1
Boron	mg/L	<0.1	0.1
Cadmium	mg/L	<0.005	0.005
Calcium	mg/L	34	1
Chromium	mg/L	<0.05	0.05
Copper	mg/L	<0.01	0.01
Iron	mg/L	<0.05	0.05
Lead	mg/L	<0.001	0.001
Manganese	mg/L	<0.01	0.01
Mercury	mg/L	<0.001	0.001
Molybdenum	mg/L	<0.1	0.1
Nickel	mg/L	<0.05	0.05
Selenium	mg/L	0.002	0.001
Vanadium	mg/L	<0.1	0.1
Zinc	mg/L	<0.01	0.01
DATA QUALITY			
A/C Balance (± 5)	%	4.18	0.01
Anions	meq/L	3.47	0.01
Cations	meq/L	3.19	0.01
Solids Total Dissolved Calculated	mg/L	230	10
Calculated TDS/TDS Ratio (0.80-1.20)	dec. %	1.13	0.01

Notes:
mg/L = milligrams per Liter
umhos/cm = micromhos per centimeter
s.u. = standard unti
meq/L = milliequivalents per Liter
RL = Analyte Reporting Limit
L = Analyzed by a contract laboratory

Table 2.9-9 Radiological Analytical Results for Brule Formation Monitoring Well Quarterly Sampling 2013-2014

Location ID:		BOW 2010-1		BOW 2010-1		BOW 2010-1		BOW 2010-1		BOW 2010-2		BOW 2010-2		BOW 2010-2		BOW 2010-2		BOW 2010-3	
Date Collected:		12/10/2013		2/25/2014		6/16/2014		9/16/2014		12/10/2013		2/25/2014		6/16/2014		9/16/2014		12/10/2013	
	UNITS	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL
RADIONUCLIDES-DISSOLVED																			
Lead 210	µCi/mL	<1E-9	1E-9	<1E-9	1E-9	1.8E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Lead 210 precision (±)	µCi/mL	NA		5E-10		7E-10		NA		NA		4E-10		3E-10		NA		NA	
Polonium 210	µCi/mL	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-09
Polonium 210 precision (±)	µCi/mL	NA		1E-10		2E-10		NA		NA		2E-10		1E-10		NA		NA	
Radium 226	µCi/mL	5E-10	2E-10	3E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	3E-10	2E-10	<2E-10	2E-10
Radium 226 precision (±)	µCi/mL	1E-10		1E-10		1E-10		NA		NA		1E-10		1E-10		1E-10		NA	
Thorium 230	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Thorium 230 precision (±)	µCi/mL	NA		2E-11		1E-10		NA		NA		1E-10		1E-10		NA		NA	
Thorium 229 Tracer (30-120)	%	120		80		79		80		100		94		87		74		110	
METALS - DISSOLVED																			
Uranium	mg/L	0.0004	0.0003	0.0004	0.0003	<0.0003	0.0003	<0.0003	0.0003	0.0016	0.0003	0.0014	0.0003	0.0018	0.0003	0.0017	0.0003	0.0023	0.0003
Uranium Activity	uCi/mL	3E-10	2E-10	3E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	1.1E-9	2E-10	9E-10	2E-10	1.2E-9	2E-10	1.2E-9	2E-10	1.6E-9	2E-10
RADIONUCLIDES-SUSPENDED																			
Lead 210	µCi/mL	<1E-9	1E-9	1.1E-9	1E-9	1.3E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Lead 210 precision (±)	µCi/mL	NA		5E-10		4E-10		NA		NA		5E-10		4E-10		NA		NA	
Polonium 210	µCi/mL	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-09	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-09
Polonium 210 precision (±)	µCi/mL	NA		2E-10		2E-10		NA		NA		2E-10		1E-10		NA		NA	
Radium 226	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Radium 226 precision (±)	µCi/mL	NA		4E-11		0.0		NA		NA		1E-10		0.0		NA		NA	
Thorium 230	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	4E-10	2E-10	<2E-10	2E-10
Thorium 230 precision (±)	µCi/mL	NA		4E-11		4E-11		NA		NA		4E-11		2E-11	NA	2E-10		NA	
Thorium 229 Tracer (30-120)	%	81		92		78		73		90		96		95	74	74		90	
METALS - SUSPENDED																			
Uranium	mg/L	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003
Uranium Activity	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10

Notes:

uCi/mL = microcuries per milliliter

mg/L = milligrams per Liter

RL - Analyte reporting limit.

Table 2.9-9 Radiological Analytical Results for Brule Formation Monitoring Well Quarterly Sampling 2013-2014

Location ID:		BOW 2010-3		BOW 2010-3		BOW 2010-3		BOW 2010-4A		BOW 2010-4A		BOW 2010-4A		BOW 2010-4A		BOW 2010-5		BOW 2010-5	
Date Collected:		2/25/2014		6/16/2014		9/16/2014		12/10/2013		2/25/2014		6/16/2014		9/17/2014		12/16/2013		2/26/2014	
	UNITS	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL
RADIONUCLIDES-DISSOLVED																			
Lead 210	µCi/mL	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Lead 210 precision (±)	µCi/mL	4E-10		4E-10		NA		NA		4E-10		3E-10		5E-10		NA		4E-10	
Polonium 210	µCi/mL	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-10	1E-10	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Polonium 210 precision (±)	µCi/mL	2E-10		2E-10		NA		NA		2E-10		2E-10		2E-10		NA		2E-10	
Radium 226	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	1E-9	2E-10	8E-10	2E-10	5E-10	2E-10	5E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Radium 226 precision (±)	µCi/mL	4E-11		3E-11		NA		1E-10		1E-10		1E-10		2E-10		NA		4E-11	
Thorium 230	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Thorium 230 precision (±)	µCi/mL	3E-11		1E-10		NA		NA		5E-11		2E-11		1E-10		NA		3E-11	
Thorium 229 Tracer (30-120)	%	97		81		89		120		98		79		79		90		77	
METALS - DISSOLVED																			
Uranium	mg/L	0.0024	0.0003	0.0032	0.0003	0.0035	0.0003	0.0008	0.0003	0.0014	0.0003	0.0017	0.0003	0.0016	0.0003	0.0067	0.0003	0.0076	0.0003
Uranium Activity	uCi/mL	1.6E-9	2E-10	2.2E-9	2E-01	2.4E-9	2E-10	5E-9	2E-10	9E-9	2E-10	1.2E-9	2E-10	1.1E-9	1E-10	4.5E-9	2E-10	5.2-9	2E-01
RADIONUCLIDES-SUSPENDED																			
Lead 210	µCi/mL	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	1E-9	1E-9	<1E-9	1E-9	1.1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Lead 210 precision (±)	µCi/mL	5E-10		4E-10		NA		NA		5E-10		4E-10		5E-10		NA		4E-10	
Polonium 210	µCi/mL	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Polonium 210 precision (±)	µCi/mL	2E-10		2E-10		NA		NA		2E-10		2E-10		2E-10		NA		2E-10	
Radium 226	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	9E-10	2E-10	3E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Radium 226 precision (±)	µCi/mL	2E-11		0.0		NA		1E-10		0.0		0.0		1E-10		NA		2E-11	
Thorium 230	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Thorium 230 precision (±)	µCi/mL	3E-11		2E-11		NA		NA		1E-10		4E-11		5E-11		NA		3E-11	
Thorium 229 Tracer (30-120)	%	100		95		77		80		74		94		41		82		89	
METALS - SUSPENDED																			
Uranium	mg/L	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003
Uranium Activity	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10

Notes:

uCi/mL = microcuries per milliliter

mg/L = milligrams per Liter

RL - Analyte reporting limit.

Table 2.9-9 Radiological Analytical Results for Brule Formation Monitoring Well Quarterly Sampling 2013-2014

Location ID:		BOW 2010-5		BOW 2010-5		BOW 2010-6		BOW 2010-6		BOW 2010-6		BOW 2010-6		BOW 2010-7		BOW 2010-7		BOW 2010-7	
Date Collected:		6/17/2014		9/17/2014		12/16/2013		2/26/2014		6/19/2014		9/17/2014		12/16/2013		2/25/2014		6/16/2014	
	UNITS	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL
RADIONUCLIDES-DISSOLVED																			
Lead 210	µCi/mL	<1E-9	1E-9	1.1E-9	1E-9	<1E-9	1E-9	1.2E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Lead 210 precision (±)	µCi/mL	4E-10		5E-10		NA		4E-10		NA		5E-10		NA		4E-10		4E-10	
Polonium 210	µCi/mL	<1E-9	1E-9	4E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Polonium 210 precision (±)	µCi/mL	1E-10		9E-10		NA		2E-10		NA		1E-10		NA		2E-10		3E-10	
Radium 226	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	3E-10	2E-10	8E-10	2E-10	2E-10	2E-10	<2E-10	2E-10	5E-10	2E-10	4E-10	2E-10	4E-10	2E-10
Radium 226 precision (±)	µCi/mL	0.0		4E-11		1E-10		1E-10		0.0		5E-11		0.1		1E-10		1E-10	
Thorium 230	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Thorium 230 precision (±)	µCi/mL	0.0		2E-11		NA		2E-11		NA		0.0		NA		1E-10		2E-11	
Thorium 229 Tracer (30-120)	%	85		95		85		99		90		84		77		85		88	
METALS - DISSOLVED																			
Uranium	mg/L	0.0070	0.0003	0.0070	0.0003	0.0049	0.0003	0.0056	0.0003	0.0047	0.0003	0.0052	0.0003	0.0035	0.0003	0.0041	0.0003	0.0048	0.0003
Uranium Activity	uCi/mL	4.7E-9	2E-10	4.7E-9	2E-10	3.3E-9	2E-10	3.8E-9	2E-10	3.2E-9	2E-10	3.5E-9	2E-10	2.4E-9	2E-10	2.8E-9	2E-10	3.3E-9	2E-10
RADIONUCLIDES-SUSPENDED																			
Lead 210	µCi/mL	1.5E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	1.1E-9	1E-9	<1E-9	1E-9
Lead 210 precision (±)	µCi/mL	6E-10		5E-10		NA		4E-10		4E-10		4E-10		NA		5E-10		4E-10	
Polonium 210	µCi/mL	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-09	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Polonium 210 precision (±)	µCi/mL	1E-10		2E-10		NA		3E-10		NA		2E-10		NA		2E-10		2E-10	
Radium 226	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Radium 226 precision (±)	µCi/mL	0.0		3E-11		NA		3E-11		NA		3E-11		1E-10		4E-11		0.0	
Thorium 230	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Thorium 230 precision (±)	µCi/mL	0.0		1E-10		NA		4E-11		NA		1E-10		NA		2E-11		2E-11	
Thorium 229 Tracer (30-120)	%	83		61		81		100		91		76		87		89		86	
METALS - SUSPENDED																			
Uranium	mg/L	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003
Uranium Activity	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10

Notes:

uCi/mL = microcuries per milliliter

mg/L = milligrams per Liter

RL - Analyte reporting limit.

Table 2.9-9 Radiological Analytical Results for Brule Formation Monitoring Well Quarterly Sampling 2013-2014

Location ID:		BOW 2010-7		BOW 2010-8		BOW 2010-8		BOW 2010-8		BOW 2010-8		BOW 9		BOW 9		BOW 9		BOW 9	
Date Collected:		9/16/2014		12/10/2013		2/26/2014		6/16/2014		9/16/2014		11/8/2013		2/26/2014		6/16/2014		9/17/2014	
	UNITS	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL
RADIONUCLIDES-DISSOLVED																			
Lead 210	µCi/mL	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Lead 210 precision (±)	µCi/mL	NA		NA		4E-10		3E-10		NA		NA		4E-10		3E-10		4E-10	
Polonium 210	µCi/mL	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Polonium 210 precision (±)	µCi/mL	NA		NA		2E-10		2E-10		NA		NA		2E-10		2E-10		2E-10	
Radium 226	µCi/mL	4E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Radium 226 precision (±)	µCi/mL	1E-10		NA		3E-11		3E-11		NA		NA		4E-11		0.0		4E-11	
Thorium 230	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Thorium 230 precision (±)	µCi/mL	NA		NA		3E-11		1E-10		NA		NA		0.0		3E-11		4E-11	
Thorium 229 Tracer (30-120)	%	78		89		87		92		64		67		94		82		89	
METALS - DISSOLVED																			
Uranium	mg/L	0.0049	0.0003	0.0034	0.0003	0.0041	0.0003	0.0043	0.0003	0.0042	0.0003	0.0073	0.0003	0.0081	0.0003	0.0076	0.0003	0.0080	0.0003
Uranium Activity	uCi/mL	3.3E-9	2E-10	2.3E-9	2E-10	2.8E-9	2E-10	2.9E-9	2E-10	2.8E-9	2E-10	4.9E-9	2E-10	5.5E-09	2E-10	5.2E-9	2E-10	5.4E-9	2E-10
RADIONUCLIDES-SUSPENDED																			
Lead 210	µCi/mL	1.5E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	2.9E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Lead 210 precision (±)	µCi/mL	6E-10		NA		4E-10		4E-10		7E-10		NA		4E-10		4E-10		5E-10	
Polonium 210	µCi/mL	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Polonium 210 precision (±)	µCi/mL	NA		NA		2E-10		2E-10		NA		NA		2E-10		1E-10		3E-10	
Radium 226	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	2E-10	2E-10
Radium 226 precision (±)	µCi/mL	NA		NA		2E-11		0.0		NA		NA		3E-11		0.0		1E-10	
Thorium 230	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	2E-10	2E-10
Thorium 230 precision (±)	µCi/mL	NA		NA		3E-11		2E-11		NA		NA		1E-10		3E-11		1E-10	
Thorium 229 Tracer (30-120)	%	76		110		92		87		80		71		99		92		87	
METALS - SUSPENDED																			
Uranium	mg/L	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003
Uranium Activity	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10

Notes:

uCi/mL = microcuries per milliliter

mg/L = milligrams per Liter

RL - Analyte reporting limit.

Table 2.9-9 Radiological Analytical Results for Brule Formation Monitoring Well Quarterly Sampling 2013-2014

Location ID:		BOW 10		BOW 10		BOW 10		BOW 10		BOW 11		BOW 11		BOW 11		BOW 11	
Date Collected:		11/8/2013		2/25/2014		6/16/2014		9/17/2014		11/8/2013		2/26/2014		6/17/2014		9/17/2014	
	UNITS	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL
RADIONUCLIDES-DISSOLVED																	
Lead 210	µCi/mL	<1E-9	1E-9	1.4	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Lead 210 precision (±)	µCi/mL	NA		5E-10		3E-10		5E-10		NA		4E-10		3E-10		5E-10	
Polonium 210	µCi/mL	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Polonium 210 precision (±)	µCi/mL	NA		2E-10		2E-10		1E-10		NA		2E-10		2E-10		3E-10	
Radium 226	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Radium 226 precision (±)	µCi/mL	NA		3E-11		0.0		4E-11		NA		5E-11		0.0		4E-11	
Thorium 230	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Thorium 230 precision (±)	µCi/mL	NA		5E-11		3E-11		4E-11		NA		4E-11		0.0		1E-10	
Thorium 229 Tracer (30-120)	%	55		82		81		70		65		95		82		54	
METALS - DISSOLVED																	
Uranium	mg/L	0.0075	0.0003	0.0074	0.0003	0.0073	0.0003	0.0071	0.0003	0.0053	0.0003	0.0050	0.0003	0.0051	0.0003	0.0051	0.0003
Uranium Activity	uCi/mL	5.1E-9	2E-10	5E-9	2E-10	4.9E-9	2E-10	4.8E-9	2E-10	3.6E-9	2E-10	3.4E-9	2E-10	3.5E-9	2E-10	3.5E-9	2E-10
RADIONUCLIDES-SUSPENDED																	
Lead 210	µCi/mL	<1E-9	1E-9	<1E-9	1E-9	1.6E-9	1E-9	<1E-9	1E-9	2.5E-9	1E-9	<1E-9	1E-9	1.3E-9	1E-9	1.5E-9	1E-9
Lead 210 precision (±)	µCi/mL	NA		5E-10		6E-10		4E-10		1.3E-10		4E-10		4E-10		5E-10	
Polonium 210	µCi/mL	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Polonium 210 precision (±)	µCi/mL	NA		2E-10		1E-10		2E-10		NA		3E-10		2E-10		2E-10	
Radium 226	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Radium 226 precision (±)	µCi/mL	NA		3E-11		0.0		5E-11		NA		2E-11		0.0		3E-11	
Thorium 230	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Thorium 230 precision (±)	µCi/mL	NA		5E-11		3E-11		1E-10		NA		3E-11		4E-11		1E-10	
Thorium 229 Tracer (30-120)	%	60		94		93		51		70		91		92		73	
METALS - SUSPENDED																	
Uranium	mg/L	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	0.0007	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003
Uranium Activity	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	5E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10

Notes:

uCi/mL = microcuries per milliliter

mg/L = milligrams per Liter

RL - Analyte reporting limit.

Table 2.9-10 Marsland Expansion Area Non-Radiological Analytical Results (November 2011 to August 2012) Chadron Wells

Location ID:		Monitor 1		Monitor 1		Monitor 1		Monitor 1		Monitor 2		Monitor 2		Monitor 2		Monitor 2		CPW-2
Date Collected:		11/7/2011		2/13/2012		6/4/2012		8/20/2012		11/7/2011[a]		2/13/2012		6/4/2012		8/20/2012		11/7/
Formation:		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON		CHAD
	UNITS	RESULTS	RL[a]	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL[a]	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS
MAJOR IONS																		
Alkalinity Total as $CaCO_3$	mg/L	288	1	398	5	411	5	416	5	374	1	394	5	398	5	410	5	288
Bicarbonate as HCO_3	mg/L	193	1	486	5	488	5	475	5	439	1	480	5	475	5	471	5	193
Carbonate as CO_3	mg/L	78	1	<5	5	7	5	16	5	9	1	<5	5	5	5	14	5	78
Chloride	mg/L	605	4	180	1	170	1	177	1	176	1	168	1	161	1	166	1	605
Fluoride	mg/L	0.9	0.1	0.6	0.1	0.6	0.1	0.5	0.1	0.5	0.1	0.6	0.1	0.6	0.1	0.5	0.1	0.9
Magnesium	mg/L	<1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	<1
Nitrogen Ammonia as N	mg/L	0.7	0.05	0.3	0.1	0.22	0.05	0.1	0.1	0.27	0.05	0.2	0.1	0.24	0.05	0.1	0.1	0.7
Nitrogen Nitrate+Nitrite as N	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1
Potassium	mg/L	35	1	11	1	8	1	11	1	8	1	12	1	8	1	11	1	35
Silica	mg/L	20.7	0.2	14	1	15.2	0.2	15	1	15.6	0.2	15	1	17.2	0.2	16	1	20.7
Sodium	mg/L	514	2	330	1	307	1	349	1	299	1	322	1	298	1	337	1	514
Sulfate	mg/L	80	8	48	1	60	4	49	1	57	1	47	1	56	4	46	1	80
PHYSICAL PROPERTIES																		
Conductivity @ 25 °C	umhos/cm	2740	1	1490	1	1410	1	1350	1	1410	1	1450	1	1380	1	1340	1	2740
pH	s.u.	9.62	0.01	8.3	0.01	8.29	0.01	8.6	0.1	8.32	0.01	8.3	0.01	8.29	0.01	8.6	0.1	9.62
Total Dissolved Solids @ 180 °C	mg/L	1400	10	830	10	853	10	840	10	791	10	830	10	818	10	850	10	1400
METALS, DISSOLVED																		
Aluminum	mg/L	0.3	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	0.1	0.1	0.1	0.1	<0.1	0.1	<0.1	0.1	0.3
Arsenic	mg/L	0.001	0.001	0.001	0.001	0.002	0.001	0.002	0.001	0.003	0.001	0.002	0.001	0.002	0.001	0.001	0.001	0.001
Barium	mg/L	0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	0.1
Boron	mg/L	1.2	0.1	1.4	0.1	1.4	0.1	1.6	0.1	1.3	0.1	1.4	0.1	1.5	0.1	1.5	0.1	1.2
Cadmium	mg/L	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005
Calcium	mg/L	10	1	4	1	5	1	5	1	4	1	5	1	5	1	5	1	10
Chromium	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05
Copper	mg/L	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.1	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.1	<0.01
Iron	mg/L	0.04	0.03	<0.05	0.05	0.03	0.03	<0.05	0.05	0.05	0.03	0.05	0.05	<0.05	0.03	<0.05	0.05	0.04
Lead	mg/L	<0.001	0.001	<0.001	0.05	0.001	0.001	<0.001	0.05	<0.001	0.001	<0.001	0.05	<0.001	0.001	<0.001	0.05	<0.001
Manganese	mg/L	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01
Mercury	mg/L	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001
Molybdenum	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1
Nickel	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05
Selenium	mg/L	0.006	0.001	0.002	0.001	0.002	0.001	<0.001	0.001	0.003	0.001	<0.001	0.001	0.002	0.001	<0.001	0.001	0.006
Vanadium	mg/L	<0.1	0.1	<0.02	0.02	<0.1	0.1	<0.02	0.02	<0.1	0.1	<0.02	0.02	<0.1	0.1	<0.02	0.02	0.1
Zinc	mg/L	<0.01	0.01	<0.01	0.01	0.03	0.01	<0.01	0.01	0.02	0.01	0.03	0.01	0.5	0.01	0.09	0.01	<0.01
DATA QUALITY																		
A/C Balance (± 5)	%	-1.57		3.04		-1.19		4.77		-0.51		3.49		-0.691		4.81		-1.57
Anions	meq/L	24.6		14.08		14.3		14.34		13.7		13.61		13.7		13.85		24.6
Cations	meq/L	23.8		14.96		13.9		15.78		13.5		14.6		13.6		15.26		23.8
Solids Total Dissolved Calculated	mg/L	1450		830		800		860		789		810		770		830		1450

Notes:

umhos/cm - micromhos per centimeter

mg/L = milligrams per liter

meq/L = milliequuivalents per liter

RL = analyte reporting limit

s.u. = standard unit

[a] A different lab was use for 11/7/2011 bicarbonate analyses than for the other analytical dates (RL of 1 vs RL of 5 mg/L).

Table 2.9-10 Marsland Expansion Area Non-Radiological Analytical Results (November 2011 to August 2012) Chadron Wells

Location ID:		2010-1	CPW-2010-1		CPW-2010-1		CPW-2010-1		Monitor 4A		Monitor 4A		Monitor 4A		Monitor 4A		Monitor 5	
Date Collected:		2011	2/13/2012		6/4/2013		8/20/2012		11/7/2011		2/13/2012		6/4/2012		8/20/2012		11/7/2011	
Formation:		DRON	CHADRON		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON	
	UNITS	RL[a]	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL[a]	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL[a]
MAJOR IONS																		
Alkalinity Total as $CaCO_3$	mg/L	1	281	5	281	5	298	5	323	1	358	5	360	5	390	5	248	1
Bicarbonate as HCO_3	mg/L	1	286	5	306	5	311	5	342	1	414	5	405	5	432	5	140	1
Carbonate as CO_3	mg/L	1	28	5	18	5	26	5	25	1	11	5	17	5	22	5	80	1
Chloride	mg/L	4	563	1	368	5	327	1	258	2	226	1	209	1	196	1	320	2
Fluoride	mg/L	0.1	0.8	0.1	0.8	0.1	0.6	0.1	0.8	0.1	0.7	0.1	0.8	0.1	0.6	0.1	0.7	0.1
Magnesium	mg/L	1	<1	1	<1	1	<1	1	<1	1	<1	1	1	1	<1	1	1	1
Nitrogen Ammonia as N	mg/L	0.05	0.5	0.1	0.49	0.05	0.4	0.1	0.36	0.05	0.3	0.1	0.33	0.05	0.1	0.1	0.54	0.05
Nitrogen Nitrate+Nitrite as N	mg/L	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Potassium	mg/L	1	40	1	21	1	23	1	18	1	23	1	16	1	19	1	31	1
Silica	mg/L	0.2	17	1	17.8	0.2	15	1	15.3	0.2	14	1	18.1	0.2	17	1	25	0.2
Sodium	mg/L	2	488	1	393	1	399	1	365	1	367	1	340	1	357	1	438	1
Sulfate	mg/L	8	76	1	88	4	73	1	113	2	103	1	115	4	95	1	312	4
PHYSICAL PROPERTIES																		
Conductivity @ 25 °C	umhos/cm	1	2360	1	1890	1	1740	1	1750	1	1710	1	1580	1	1510	1	2260	1
pH	s.u.	0.01	9	0.1	8.98	0.01	8.9	0.1	8.91	0.01	8.6	0.01	8.78	0.01	8.7	0.1	9.72	0.01
Total Dissolved Solids @ 180 °C	mg/L	10	1260	10	1090	10	1070	10	958	10	940	10	951	10	930	10	1290	10
METALS, DISSOLVED																		
Aluminum	mg/L	0.1	<0.1	0.1	0.3	0.1	0.2	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	0.3	0.1
Arsenic	mg/L	0.001	0.001	0.001	<0.001	0.001	<0.001	0.001	0.005	0.001	0.002	0.001	0.003	0.001	0.002	0.001	0.002	0.001
Barium	mg/L	0.1	<0.1	0.1	0.1	0.1	0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Boron	mg/L	0.1	1.5	0.1	1.4	0.1	1.3	0.1	1.3	0.1	1.6	0.1	1.4	0.1	1.5	0.1	1.1	0.1
Cadmium	mg/L	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005
Calcium	mg/L	1	10	1	19	1	14	1	3	1	4	1	5	1	4	1	4	1
Chromium	mg/L	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Copper	mg/L	0.01	<0.01	0.1	<0.01	0.1	<0.01	0.1	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.1	<0.01	0.01
Iron	mg/L	0.03	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.03	<0.05	0.05	<0.05	0.03	<0.05	0.05	0.04	0.03
Lead	mg/L	0.001	<0.001	0.05	<0.001	0.05	<0.001	0.05	<0.001	0.001	<0.001	0.05	<0.001	0.001	<0.001	0.05	<0.001	0.001
Manganese	mg/L	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01
Mercury	mg/L	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001
Molybdenum	mg/L	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Nickel	mg/L	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Selenium	mg/L	0.001	<0.001	0.001	0.002	0.001	0.008	0.001	0.003	0.001	0.024	0.001	0.002	0.001	<0.001	0.001	0.005	0.001
Vanadium	mg/L	0.1	0.05	0.02	<0.1	0.1	<0.02	0.02	<0.1	0.1	<0.02	0.02	<0.1	0.1	<0.02	0.02	<0.1	0.1
Zinc	mg/L	0.01	0.09	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	0.02	0.01
DATA QUALITY																		
A/C Balance (± 5)	%		0.8		2.28		4.63		1.32		3.17		0.175		2.72		-8.37	
Anions	meq/L		23.12		17.9		16.99		16.1		15.71		15.5		15.34		20.6	
Cations	meq/L		22.75		18.7		18.64		16.6		16.74		15.6		16.2		20.2	
Solids Total Dissolved Calculated	mg/L		1360		1100		1030		971		950		900		920		1290	

Notes:

umhos/cm - micromhos per centimeter

mg/L = milligrams per liter

meq/L = milliequuivalents per liter

RL = analyte reporting limit

s.u. = standard unit

[a] A different lab was use for 11/7/2011 bicarbonate analyses than for the other analytical dates (RL of 1 vs RL of 5 mg/L).

Table 2.9-10 Marsland Expansion Area Non-Radiological Analytical Results (November 2011 to August 2012) Chadron Wells

Location ID:		Monitor 5		Monitor 5		Monitor 5		Monitor 6		Monitor 6		Monitor 6		Monitor 6		Monitor 7		Moni
Date Collected:		2/13/2012		6/4/2012		8/20/2012		11/7/2011		2/13/2012		6/4/2012		8/20/2012		11/7/2011		2/13/
Formation:		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON		CHAD
	UNITS	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL[a]	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL[a]	RESULTS
MAJOR IONS																		
Alkalinity Total as $CaCO_3$	mg/L	260	5	260	5	266	5	271	1	292	5	260	5	322	5	245	1	283
Bicarbonate as HCO_3	mg/L	214	5	234	5	230	5	280	1	334	5	234	5	345	5	264	1	321
Carbonate as CO_3	mg/L	51	5	43	5	47	5	25	1	11	5	43	5	23	5	17	1	12
Chloride	mg/L	280	1	254	1	233	1	398	4	361	1	254	1	304	1	241	1	216
Fluoride	mg/L	0.6	0.1	0.7	0.1	0.5	0.1	0.8	0.1	0.8	0.1	0.7	0.1	0.6	0.1	0.8	0.1	0.8
Magnesium	mg/L	1	1	2	1	1	1	<1	1	<1	1	2	1	1	1	2	1	2
Nitrogen Ammonia as N	mg/L	0.2	0.1	0.41	0.05	0.2	0.1	0.53	0.05	0.4	0.1	0.41	0.05	0.3	0.1	0.33	0.05	0.2
Nitrogen Nitrate+Nitrite as N	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1
Potassium	mg/L	36	1	27	1	29	1	22	1	25	1	27	1	23	1	16	1	21
Silica	mg/L	23	1	22.9	0.2	20	1	15.5	0.2	15	1	22.9	0.2	16	1	15.8	0.2	16
Sodium	mg/L	454	1	421	1	429	1	377	1	381	1	421	1	378	1	410	1	422
Sulfate	mg/L	269	1	308	4	275	1	53	1	45	1	308	4	46	1	305	2	266
PHYSICAL PROPERTIES																		
Conductivity @ 25 °C	umhos/cm	2220	1	2010	1	1880	1	1950	1	1920	1	2010	1	1660	1	1960	1	1970
pH	s.u.	9.3	0.01	9.48	0.01	9.3	0.1	8.82	0.01	8.6	0.01	9.48	0.01	8.8	0.1	8.86	0.01	8.6
Total Dissolved Solids @ 180 °C	mg/L	1220	10	1270	10	1190	10	1040	10	1000	10	1270	10	970	10	1110	10	1130
METALS, DISSOLVED																		
Aluminum	mg/L	0.2	0.1	0.1	0.1	<0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1
Arsenic	mg/L	<0.001	0.001	0.002	0.001	<0.001	0.001	0.002	0.001	<0.001	0.001	0.002	0.001	<0.001	0.001	0.002	0.001	0.001
Barium	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	0.1	0.1	<0.1	0.1	<0.1	0.1	0.1	0.1	<0.1	0.1	<0.1
Boron	mg/L	1.2	0.1	1.3	0.1	1.3	0.1	1.2	0.1	1.2	0.1	1.3	0.1	1.4	0.1	1.3	0.1	1.4
Cadmium	mg/L	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005
Calcium	mg/L	5	1	7	1	5	1	13	1	5	1	7	1	9	1	6	1	7
Chromium	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05
Copper	mg/L	<0.01	0.01	<0.01	0.01	<0.01	0.1	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.1	<0.01	0.01	<0.01
Iron	mg/L	<0.05	0.05	<0.05	0.03	<0.05	0.05	<0.05	0.03	<0.05	0.05	<0.05	0.03	<0.05	0.05	<0.05	0.03	<0.05
Lead	mg/L	<0.001	0.05	<0.001	0.001	<0.001	0.05	<0.001	0.001	<0.001	0.05	<0.001	0.001	<0.001	0.05	<0.001	0.001	<0.001
Manganese	mg/L	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01
Mercury	mg/L	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001
Molybdenum	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1
Nickel	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05
Selenium	mg/L	0.068	0.001	0.003	0.001	0.006	0.001	0.004	0.001	0.068	0.001	0.003	0.001	0.001	0.001	0.004	0.001	0.011
Vanadium	mg/L	<0.02	0.02	<0.1	0.1	<0.02	0.02	<0.1	0.1	<0.02	0.02	<0.1	0.1	<0.02	0.02	<0.1	0.1	<0.02
Zinc	mg/L	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	0.01	0.01	0.04
DATA QUALITY																		
A/C Balance (± 5)	%	4.76		1.17		4.62		0.32		2.56		1.17		4.62		1.67		4.86
Anions	meq/L	19.11		19.1		17.99		17.8		17.01		19.1		16		18.1		17.59
Cations	meq/L	21.03		19.6		19.73		17.7		17.9		19.6		17.55		18.7		19.39
Solids Total Dissolved Calculated	mg/L	1220		1200		1150		1050		1020		1200		970		1150		1120

Notes:

umhos/cm - micromhos per centimeter

mg/L = milligrams per liter

meq/L = milliequuivalents per liter

RL = analyte reporting limit

s.u. = standard unit

[a] A different lab was use for 11/7/2011 bicarbonate analyses than for the other analytical dates (RL of 1 vs RL of 5 mg/L).

Table 2.9-10 Marsland Expansion Area Non-Radiological Analytical Results (November 2011 to August 2012) Chadron Wells

Location ID:		tor 7	Monitor 7		Monitor 7		Monitor 8		Monitor 8		Monitor 8		Monitor 8		Monitor 9		Monitor 9	
Date Collected:		2012	6/4/2012		8/20/2012		11/7/2011		2/13/2012		6/4/2012		8/20/2012		11/7/2011		2/13/2012	
Formation:		RON	CHADRON		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON	
	UNITS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL[a]	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL[a]	RESULTS	RL
MAJOR IONS																		
Alkalinity Total as $CaCO_3$	mg/L	5	301	5	311	5	253	1	274	5	282	5	296	5	307	1	336	5
Bicarbonate as HCO_3	mg/L	5	338	5	339	5	267	1	918	5	323	5	336	5	297	1	381	5
Carbonate as CO_3	mg/L	5	14	5	20	5	20	1	5	5	10	5	13	5	38	1	14	5
Chloride	mg/L	1	188	1	192	1	250	2	197	1	177	1	169	1	269	2	252	1
Fluoride	mg/L	0.1	0.8	0.1	0.6	0.1	0.7	0.1	0.7	0.1	0.7	0.1	0.5	0.1	0.8	0.1	0.8	0.1
Magnesium	mg/L	1	2	1	2	1	2	1	2	1	3	1	3	1	<1	1	<1	1
Nitrogen Ammonia as N	mg/L	0.1	0.29	0.05	0.1	0.1	0.39	0.05	0.3	0.1	0.32	0.05	0.1	0.1	0.33	0.05	0.3	0.1
Nitrogen Nitrate+Nitrite as N	mg/L	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Potassium	mg/L	1	15	1	18	1	20	1	24	1	17	1	23	1	15	1	19	1
Silica	mg/L	1	18.5	0.2	16	1	18.9	0.2	16	1	18.5	0.2	15	1	14.9	0.2	15	1
Sodium	mg/L	1	386	1	423	1	445	1	441	1	425	1	430	1	344	1	362	1
Sulfate	mg/L	1	306	4	278	1	388	2	349	1	388	4	362	1	91	2	78	1
PHYSICAL PROPERTIES																		
Conductivity @ 25 °C	umhos/cm	1	1810	1	1730	1	2180	1	2090	1	1950	1	1830	1	1700	1	1690	1
pH	s.u.	0.01	8.76	0.01	8.8	0.1	8.91	0.01	8.5	0.01	8.65	0.01	8.6	0.1	8.91	0.01	8.7	0.01
Total Dissolved Solids @ 180 °C	mg/L	10	1130	10	1080	10	1260	10	1190	10	1220	10	1250	10	946	10	890	10
METALS, DISSOLVED																		
Aluminum	mg/L	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Arsenic	mg/L	0.001	0.002	0.001	0.001	0.001	0.001	0.001	<0.001	0.001	0.001	0.001	<0.001	0.001	0.002	0.001	<0.001	0.001
Barium	mg/L	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Boron	mg/L	0.1	1.5	0.1	1.4	0.1	1.2	0.1	1.2	0.1	1.4	0.1	1.3	0.1	1.1	0.1	1.2	0.1
Cadmium	mg/L	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005
Calcium	mg/L	1	10	1	8	1	12	1	10	1	12	1	10	1	2	1	10	1
Chromium	mg/L	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Copper	mg/L	0.01	<0.01	0.01	<0.01	0.1	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.1	<0.01	0.01	<0.01	0.01
Iron	mg/L	0.05	<0.05	0.03	<0.05	0.05	<0.05	0.03	<0.05	0.05	<0.05	0.03	<0.05	0.05	<0.05	0.03	<0.05	0.05
Lead	mg/L	0.05	<0.001	0.001	<0.001	0.05	<0.001	0.001	<0.001	0.05	<0.001	0.001	<0.001	0.05	<0.001	0.001	<0.001	0.05
Manganese	mg/L	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01
Mercury	mg/L	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001
Molybdenum	mg/L	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Nickel	mg/L	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Selenium	mg/L	0.001	0.002	0.001	<0.001	0.001	0.003	0.001	0.012	0.001	0.002	0.001	<0.001	0.001	0.004	0.001	0.011	0.001
Vanadium	mg/L	0.02	<0.1	0.1	<0.02	0.02	<0.1	0.1	<0.02	0.02	<0.1	0.1	<0.02	0.02	<0.1	0.1	<0.02	0.02
Zinc	mg/L	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01
DATA QUALITY																		
A/C Balance (± 5)	%		0.403		4.57		0.971		4.86		2.74		4.72		-0.463		2.77	
Anions	meq/L		17.7		17.72		20.2		18.6		18.7		18.23		15.7		15.51	
Cations	meq/L		17.9		19.42		20.6		20.51		19.8		20.04		15.5		16.4	
Solids Total Dissolved Calculated	mg/L		1100		1120		1290		1200		1200		1190		925		930	

Notes:

umhos/cm - micromhos per centimeter

mg/L = milligrams per liter

meq/L = milliequuivalents per liter

RL = analyte reporting limit

s.u. = standard unit

[a] A different lab was use for 11/7/2011 bicarbonate analyses than for the other analytical dates (RL of 1 vs RL of 5 mg/L).

Table 2.9-10 Marsland Expansion Area Non-Radiological Analytical Results (November 2011 to August 2012) Chadron Wells

Location ID:		Monitor 9		Monitor 9		Monitor 10		Monitor 10		Monitor 10		Monitor 10		Monitor 11		Monitor 11		Monit
Date Collected:		6/4/2012		8/20/2012		11/7/2011		2/13/2012		6/4/2012		8/20/2012		11/7/2011		2/13/2012		6/4/2
Formation:		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON		CHAD
	UNITS	RESULTS	RL	RESULTS	RL	RESULTS	RL[a]	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL[a]	RESULTS	RL	RESULTS
MAJOR IONS																		
Alkalinity Total as $CaCO_3$	mg/L	343	5	356	5	274	1	307	5	314	5	361	5	323	1	352	5	365
Bicarbonate as HCO_3	mg/L	387	5	390	5	301	1	363	5	360	5	412	5	330	1	393	5	403
Carbonate as CO_3	mg/L	16	5	22	5	16	1	6	5	11	5	14	5	32	1	18	5	21
Chloride	mg/L	232	1	224	1	151	1	143	1	141	1	137	1	370	4	318	1	292
Fluoride	mg/L	0.8	0.1	0.6	0.1	0.8	0.1	0.7	0.1	0.8	0.1	0.6	0.1	0.7	0.1	0.8	0.1	0.7
Magnesium	mg/L	<1	1	<1	1	1	1	2	1	<1	1	2	1	1	1	1	1	2
Nitrogen Ammonia as N	mg/L	0.34	0.05	0.2	0.1	0.37	0.05	0.4	0.1	0.38	0.05	0.2	0.1	0.37	0.05	0.3	0.1	0.32
Nitrogen Nitrate+Nitrite as N	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1
Potassium	mg/L	14	1	18	1	11	1	15	1	11	1	16	1	21	1	28	1	21
Silica	mg/L	17.3	0.2	15	1	17.2	0.2	16	1	18	0.2	16	1	12.4	0.2	13	1	14.7
Sodium	mg/L	341	1	361	1	386	1	405	1	392	1	425	1	425	1	439	1	403
Sulfate	mg/L	95	4	79	1	347	2	307	1	347	4	300	1	124	2	107	1	131
PHYSICAL PROPERTIES																		
Conductivity @ 25 °C	umhos/cm	1570	1	1500	1	1810	1	1880	1	1770	1	1710	1	2120	1	2060	1	1890
pH	s.u.	8.75	0.01	8.8	0.1	8.66	0.01	8.4	0.01	8.54	0.01	8.6	0.1	8.99	0.01	8.7	0.01	8.85
Total Dissolved Solids @ 180 °C	mg/L	910	10	1180	10	1080	10	1090	10	1120	10	1180	10	1160	10	1110	10	1130
METALS, DISSOLVED																		
Aluminum	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1
Arsenic	mg/L	0.001	0.001	0.001	0.001	0.002	0.001	<0.001	0.001	0.001	0.001	<0.001	0.001	0.003	0.001	0.002	0.001	0.003
Barium	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1
Boron	mg/L	1.3	0.1	1.4	0.1	1.3	0.1	1.3	0.1	1.4	0.1	1.5	0.1	1.2	0.1	1.3	0.1	1.4
Cadmium	mg/L	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005
Calcium	mg/L	4	1	3	1	6	1	7	1	8	1	7	1	5	1	6	1	8
Chromium	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05
Copper	mg/L	<0.01	0.01	<0.01	0.1	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.1	<0.01	0.01	<0.01	0.01	<0.01
Iron	mg/L	<0.05	0.03	<0.05	0.05	<0.05	0.03	<0.05	0.05	<0.05	0.03	<0.05	0.05	<0.05	0.03	<0.05	0.05	<0.05
Lead	mg/L	<0.001	0.001	<0.001	0.05	<0.001	0.001	<0.001	0.05	<0.001	0.001	<0.001	0.05	<0.001	0.001	<0.001	0.05	<0.001
Manganese	mg/L	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01
Mercury	mg/L	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001
Molybdenum	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1
Nickel	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05
Selenium	mg/L	0.003	0.001	<0.001	0.001	0.003	0.001	<0.001	0.001	0.001	0.001	<0.001	0.001	0.0005	0.001	0.022	0.001	0.002
Vanadium	mg/L	<0.1	0.1	<0.02	0.02	<0.1	0.1	<0.02	0.02	<0.1	0.1	<0.02	0.02	<0.1	0.1	<0.02	0.02	<0.1
Zinc	mg/L	<0.01	0.01	<0.01	0.01	<0.01	0.01	0.03	0.01	0.02	0.01	0.04	0.01	<0.01	0.01	<0.01	0.01	<0.01
DATA QUALITY																		
A/C Balance (± 5)	%	0.0047		3.85		1.52		4.67		1.4		4.96		-0.277		4.45		0.897
Anions	meq/L	15.5		15.1		17		16.87		17.5		17.61		19.5		18.5		18.3
Cations	meq/L	15.5		16.31		17.5		18.53		18		19.45		19.4		20.22		18.6
Solids Total Dissolved Calculated	mg/L	890		910		1090		1080		1100		1120		1160		1120		1100

Notes:

umhos/cm - micromhos per centimeter

mg/L = milligrams per liter

meq/L = milliequuivalents per liter

RL = analyte reporting limit

s.u. = standard unit

[a] A different lab was use for 11/7/2011 bicarbonate analyses than for the other analytical dates (RL of 1 vs RL of 5 mg/L).

Table 2.9-10 Marsland Expansion Area Non-Radiological Analytical Results (November 2011 to August 2012) Chadron Wells

Location ID:		tor 11	Monitor 11	
Date Collected:		2012	8/20/2012	
Formation:		DRON	CHADRON	
	UNITS	RL	RESULTS	RL
MAJOR IONS				
Alkalinity Total as $CaCO_3$	mg/L	5	369	5
Bicarbonate as HCO_3	mg/L	5	394	5
Carbonate as CO_3	mg/L	5	28	5
Chloride	mg/L	2	270	1
Fluoride	mg/L	0.1	0.6	0.1
Magnesium	mg/L	1	1	1
Nitrogen Ammonia as N	mg/L	0.05	0.2	0.1
Nitrogen Nitrate+Nitrite as N	mg/L	0.1	<0.1	0.1
Potassium	mg/L	1	26	1
Silica	mg/L	0.2	13	1
Sodium	mg/L	1	414	1
Sulfate	mg/L	4	110	1
PHYSICAL PROPERTIES				
Conductivity @ 25 °C	umhos/cm	1	1760	1
pH	s.u.	0.01	8.8	0.1
Total Dissolved Solids @ 180 °C	mg/L	10	1120	10
METALS, DISSOLVED				
Aluminum	mg/L	0.1	<0.1	0.1
Arsenic	mg/L	0.001	0.001	0.001
Barium	mg/L	0.1	<0.1	0.1
Boron	mg/L	0.1	1.4	0.1
Cadmium	mg/L	0.005	<0.005	0.005
Calcium	mg/L	1	6	1
Chromium	mg/L	0.05	<0.05	0.05
Copper	mg/L	0.01	<0.01	0.1
Iron	mg/L	0.03	<0.05	0.05
Lead	mg/L	0.001	<0.001	0.05
Manganese	mg/L	0.01	<0.01	0.01
Mercury	mg/L	0.001	<0.001	0.001
Molybdenum	mg/L	0.1	<0.1	0.1
Nickel	mg/L	0.05	<0.05	0.05
Selenium	mg/L	0.001	<0.001	0.001
Vanadium	mg/L	0.1	<0.02	0.02
Zinc	mg/L	0.01	<0.01	0.01
DATA QUALITY				
A/C Balance (± 5)	%		4.88	
Anions	meq/L		17.31	
Cations	meq/L		19.09	
Solids Total Dissolved Calculated	mg/L		1060	

Notes:

umhos/cm - micromhos per centimeter

mg/L = milligrams per liter

meq/L = milliequuivalents per liter

RL = analyte reporting limit

s.u. = standard unit

[a] A different lab was use for 11/7/2011 bicarbonate analyses than for the other analytical dates (RL of 1 vs RL of 5 mg/L).

Table 2.9-11 Marsland Expansion Area Radiological Analytical Results (November 2011 to August 2012) - Chadron Wells

Location ID:		NRC LLDs	Monitor 1		Monitor 1		Monitor 1		Monitor 1		Monitor 2		Monitor 2		Monitor 2		Monitor 2	
Date Collected:			11/7/2011		2/13/2012		6/4/2012		8/20/2012		11/7/2011		2/13/2012		6/4/2012		8/20/2012	
Formation:			CHADRON		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON	
	UNITS		RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL
RADIONUCLIDES-DISSOLVED																		
Lead 210	uCi/mL	1E-9	1.35E-7	8E-10	1.1E-8	1E-9	3.96E-8	1.1E-9	1.97E-8	1E-9	9E-10	8E-10	<1E-9	1E-9	<8E-10	8E-10	2.8E-9	1E-9
Lead 210 precision (±)	uCi/mL		1.1E-9		9E-10		1.2E-9		1.1E-09		5E-10		NA		5E-10		5E-10	
Lead 210 MDC	uCi/mL		8E-10		-		1.1E-9		-		8E-10		-		8E-10		-	
Polonium 210	uCi/mL	1E-9	1.7E-8	9E-10	<1E-9	1E-9	4.9E-9	6E-10	1E-9	1E-9	3.3E-9	9E-10	<1E-9	1E-9	<5E-10	5E-10	<1E-9	1E-9
Polonium 210 precision (±)	uCi/mL		5.7E-9		NA		1.8E-9		8E-10		1.7E-9		NA		3E-10		NA	
Polonium 210 MDC	uCi/mL		9E-10		-		6E-10		-		9E-10		-		5E-10		-	
Radium 226	uCi/mL	2E-10	1.5E-8	1E-10	1.23E-8	2E-10	1.7E-8	1.7E-10	1.29E-8	2E-10	1.7E-9	1E-10	<1.2E-9	2E-10	1.E-9	1.6E-10	1.9E-9	2E-10
Radium 226 precision (±)	uCi/mL		7E-10		4E-10		8.3E-10		5E-10		3E-10		1E-10		2.8E-10		1E-10	
Radium 226 MDC	uCi/mL		1E-10		-		1.7E-10		-		1E-10		-		1.6E-10		-	
Thorium 230	uCi/mL	2E-10	6E-10	2E-10	<2E-10	2E-10	4E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Thorium 230 precision (±)	uCi/mL		2E-10		NA		2E-10		NA		9E-11		NA		7E-11		NA	
Thorium 230 MDC	uCi/mL		2E-10		-		2E-10		-		2E-10		-		2E-10		-	
METALS, DISSOLVED																		
Uranium	mg/L	0.0003	0.0060	0.0003	0.0064	0.0003	0.0062	0.0003	0.0073	0.0003	0.0023	0.0003	0.0034	0.0003	0.0021	0.0003	0.0017	0.0003
Uranium Activity	uCi/mL	2E-10	4E-9	2E-10	4.3E-10	2E-10	4.2E-9	2E-10	4.9E-10	2E-10	1.6E-9	2E-10	2.3E-10	2E-10	1.4E-9	2E-10	1.2E-10	2E-10
RADIONUCLIDES-SUSPENDED																		
Lead 210	uCi/mL	1E-9	6.5E-8	1.1E-9	6.12E-8	1E-9	4.49E-8	8E-10	5.3E-8	1E-9	1.2E-9	9E-10	1.1E-9	1E-9	<8E-10	8E-10	1.2E-9	1E-9
Lead 210 precision (±)	uCi/mL		1.4E-9		2.1E-9		1E-9		1.5E-9		6E-10		5E-10		5E-10		3E-10	
Lead 210 MDC	uCi/mL		1.1E-9		-		8E-10		-		9E-10		-		8E-10		-	
Polonium 210	uCi/mL	1E-9	2.3E-8	2E-10	8.8E-9	1E-9	1.48E-8	6E-10	2.5E-9	1E-9	3E-10	3E-10	<1E-9	1E-9	<3E-10	3E-10	<1E-9	1E-9
Polonium 210 precision (±)	uCi/mL		5.2E-9		1E-9		5.4E-9		8E-10		2E-10		NA		3E-10		NA	
Polonium 210 MDC	uCi/mL		2E-10		-		6E-10		-		3E-10		-		3E-10		-	
Radium 226	uCi/mL	2E-10	1.8E-8	1E-10	8.8E-9	2E-10	1.7E-8	1.2E-10	7.8E-9	1E-10	9E-10	1E-10	5E-10	2E-10	3.2E-10	1.3E-10	3E-10	1E-10
Radium 226 precision (±)	uCi/mL		6E-10		5E-10		7.2E-10		3E-10		1E-10		1E-10		1.3E-10		1E-10	
Radium 226 MDC	uCi/mL		1E-10		-		1.2E-10		-		1E-10		-		1.3E-10		-	
Thorium 230	uCi/mL	2E-10	1E-8	1E-10	4.3E-9	2E-10	1.01E-8	1E-10	3E-9	2E-10	2E-10	1E-10	<2E-10	2E-10	<1E-10	1.0E-10	<2E-10	2E-10
Thorium 230 precision (±)	uCi/mL		1.2E-9		6E-10		1.5E-9		5E-10		1E-10		NA		9E-11		NA	
Thorium 230 MDC	uCi/mL		1E-10		-		1E-10		-		1E-10		-		1E-10		-	
METALS, SUSPENDED																		
Uranium	mg/L	0.0003	0.0403	0.0003	0.0008	0.0003	0.0295	0.0003	0.0092	0.0003	0.0010	0.0003	<0.0003	0.0003	0.0003	0.0003	<0.0003	0.0003
Uranium Activity	uCi/mL	2E-10	2.7E-8	2E-10	5E-10	2E-10	2E-8	2E-10	6.9E-10	2E-10	6.9E-10	2E-10	<2E-10	2E-10	2.1E-10	2E-10	<2E-10	2E-10

uCi/ml - microcuries per milliliter
mg/L- milligrams per liter
MDC - minimum detectable concentration
LLD - lower limit of detection
RL - reporting limit

Table 2.9-11 Marsland Expansion Area Radiological Analytical Results (November 2011 to August 2012) - Chadron Wells

Location ID:		CPW-2010-1		CPW-2010-1		CPW-2010-1		CPW-2010-1		Monitor 4A		Monitor 4A		Monitor 4A		Monitor 4A	
Date Collected:		11/7/2011		2/13/2012		6/4/2012		8/20/2012		11/7/2011		2/13/2012		6/4/2012		8/20/2012	
Formation:		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON	
	UNITS	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL
RADIONUCLIDES-DISSOLVED																	
Lead 210	uCi/mL	1.53E-8	1.3E-9	3.6E-9	1E-9	4.9E-9	1.1E-09	5.8E-9	1E-9	1.13E-6	1.30E-09	5.91E-7	1E-9	6.04E-7	1.1E-9	5.4E-07	1E-9
Lead 210 precision (±)	uCi/mL	9E-10		5E-10		7E-10		6E-10		4.6E-9		5.3E-9		4.1E-9		5.4E-09	
Lead 210 MDC	uCi/mL	1.3E-9		-		1.1E-10		-		1.3E-9		-		1.1E-9		-	
Polonium 210	uCi/mL	6.6E-9	6E-10	<1E-9	1E-9	<5E-10	5E-10	<1E-9	1E-9	1.65E-7	1.20E-09	6.26E-8	1E-9	1.04E-7	5E-10	1E-07	1E-9
Polonium 210 precision (±)	uCi/mL	2.2E9		NA		3E-10		NA		5.4E-8		3.2E-9		2.11E-8		4.3E-09	
Polonium 210 MDC	uCi/mL	6E-10		-		5E-10		-		1.2E-9		-		5E-10		-	
Radium 226	uCi/mL	2.3E-08	1E-10	2.75E-8	2E-10	2.4E-8	1.7E-10	1.43E-8	2E-10	2.62E-7	2.00E-10	3.2E-7	2E-10	3.9E-7	1.7E-10	3.48E-07	2E-10
Radium 226 precision (±)	uCi/mL	8E-10		6E-10		9.8E-10		4E-10		3E-9		2.2E-9		4E-09		2.3E-09	
Radium 226 MDC	uCi/mL	1E-10		-		1.7E-10		-		1E-10		-		1.7E-10		-	
Thorium 230	uCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2.00E-10	7E-11	2E-10	<2E-10	2E-10	<2E-10	2E-10
Thorium 230 precision (±)	uCi/mL	9E-11		NA		8E-11		NA		1E-10		2E-10		9E-09		NA	
Thorium 230 MDC	uCi/mL	2E-10		-		2E-10		-		2E-10		-		2E-10		-	
METALS, DISSOLVED																	
Uranium	mg/L	0.0142	0.0003	0.0091	0.0003	0.0090	0.0003	0.0037	0.0003	0.0771	0.0003	0.0457	0.0003	0.0475	0.0003	0.0346	0.0003
Uranium Activity	uCi/mL	9.6E-9	2E-10	6.2E-9	2E-10	6.1E-9	2E-10	2.5E-9	2E-10	5.2E-8	2E-10	3.09E-8	2E-10	3.2E-8	2E-10	2.34E-8	2E-10
RADIONUCLIDES-SUSPENDED																	
Lead 210	uCi/mL	1.5E-9	9E-10	5.6E-9	1E-9	2.3E-9	9E-10	6.4E-9	1E-9	2.2E-8	9E-10	4.97E-8	1E-9	1.76E-8	8E-10	6.04E-08	1E-9
Lead 210 precision (±)	uCi/mL	6E-10		6E-10		6E-10		7E-10		9E-10		1.5E-9		7E-10		2.20E-09	
Lead 210 MDC	uCi/mL	9E-10		-		9E-10		-		9E-10		-		8E-10		-	
Polonium 210	uCi/mL	8E-10	2E-10	<1E-9	1E-9	3E-10	3E-10	<1E-9	1E-9	6.2E-9	2E-10	3.97E-8	1E-9	4.5E-9	3E-10	1.72E-8	1E-9
Polonium 210 precision (±)	uCi/mL	4E-10		NA		3E-10		NA		1.4E-9		2.6E-9		1.6E-9		1.5E-9	
Polonium 210 MDC	uCi/mL	2E-10		-		3E-10		-		2E-10		-		3E-10		-	
Radium 226	uCi/mL	1.6E-9	1E-10	1.7E-9	1E-10	2.2E-9	1.2E-10	3.5E-9	1E-10	9E-10	1E-10	5E-10	2E-10	3.2E-10	1.1E-10	3E-10	1E-10
Radium 226 precision (±)	uCi/mL	2E-10		2E-10		2.6E-10		2E-10		1E-10		1E-10		1.1E-10		1E-10	
Radium 226 MDC	uCi/mL	1E-10		-		1.2E-10		-		1E-10		-		1.1E-10		-	
Thorium 230	uCi/mL	<1E-10	1E-10	<2E-10	2E-10	<1E-10	1E-10	<2E-10	2E-10	3E-10	1E-10	<2E-10	2E-10	4E-10	1E-10	<2E-10	2E-10
Thorium 230 precision (±)	uCi/mL	6E-11		NA		6E-11		NA		1E-10		NA		1E-10		NA	
Thorium 230 MDC	uCi/mL	1E-10		-		1E-10		-		1E-10		-		1E-10		-	
METALS, SUSPENDED																	
Uranium	mg/L	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	0.0008	0.0003	<0.0003	0.0003	0.0005	0.0003	0.0004	0.0003
Uranium Activity	uCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	5.6E-10	2E-10	<2E-10	2E-10	3.6E-10	2E-10	3E-10	2E-10

uCi/ml - microcuries per milliliter
mg/L- milligrams per liter
MDC - minimum detectable concentration
LLD - lower limit of detection
RL - reporting limit

Table 2.9-11 Marsland Expansion Area Radiological Analytical Results (November 2011 to August 2012) - Chadron Wells

Location ID:		Monitor 5		Monitor 5		Monitor 5		Monitor 5		Monitor 6		Monitor 6		Monitor 6		Monitor 6	
Date Collected:		11/7/2011		2/13/2012		6/4/2012		8/20/2012		11/7/2011		2/13/2012		6/4/2012		8/20/2012	
Formation:		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON	
	UNITS	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL
RADIONUCLIDES-DISSOLVED																	
Lead 210	uCi/mL	<8E-10	8E-10	<1E-9	1E-9	<8E-10	8E-10	1.6E-9	1E-9	<2.2E-9	1.3E-9	1.6E-9	1E-9	<8E-10	8E-10	1.5E-9	1E-9
Lead 210 precision (±)	uCi/mL	5E-10		NA		5E-10		4E-10		<8E-10		4E-10		5E-10		4E-10	
Lead 210 MDC	uCi/mL	8E-10		-		8E-10		-		1.3E-09		-		8E-10		-	
Polonium 210	uCi/mL	<7E-10	7E-10	<1E-9	1E-9	<5E-10	5E-10	<1E-9	1E-9	9E-10	8E-10	<1E-9	1E-9	<9E-10	9.00E-10	<1E-9	1E-9
Polonium 210 precision (±)	uCi/mL	5E-10		NA		3E-10		NA		9E-10		NA		4E-10		NA	
Polonium 210 MDC	uCi/mL	7E-10		-		5E-10		-		8E-10		-		9E-10		-	
Radium 226	uCi/mL	3.5E-9	1E-10	9E-10	2E-10	3.4E-9	1.7E-10	5.5E-10	2E-10	1.9E-9	1E-10	1.8E-9	2E-10	9E-9	1.7E-10	2.7E-9	2E-10
Radium 226 precision (±)	uCi/mL	3E-10		1E-10		3.9E-10		3E-10		3E-10		2E-10		6.1E-10		2E-10	
Radium 226 MDC	uCi/mL	1E-10		-		1.7E-10		-		1E-10		-		1.7E-10		-	
Thorium 230	uCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	4E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Thorium 230 precision (±)	uCi/mL	1E-10		NA		8E-11		NA		9E-11		2E-10		9E-11		NA	
Thorium 230 MDC	uCi/mL	2E-10		-		2E-10		-		2E-10		-		2E-10		-	
METALS, DISSOLVED																	
Uranium	mg/L	0.0007	0.0003	<0.0003	0.0003	0.0006	0.0003	0.0004	0.0003	0.0014	0.0003	0.0011	0.0003	0.0011	0.0003	0.0011	0.0003
Uranium Activity	uCi/mL	4.6E-10	2E-10	<2E-10	2E-10	3.9E-10	2E-10	3E-10	2E-10	9.5E-10	2E-10	7E-10	2E-10	7.3E-10	2E-10	7E-10	2E-10
RADIONUCLIDES-SUSPENDED																	
Lead 210	uCi/mL	<9E-10	9E-10	<1E-9	1E-9	<8E-10	8E-10	<1E-9	1E-9	<9E-10	9E-10	1.4E-9	1E-9	<8E-10	8E-10	<1E-9	1E-9
Lead 210 precision (±)	uCi/mL	6E-10		NA		4E-10		NA		6E-10		4E-10		4E-10		NA	
Lead 210 MDC	uCi/mL	9E-10		-		8E-10		-		9E-10		-		8E-10		-	
Polonium 210	uCi/mL	<2E-10	2E-10	<1E-9	1E-9	<3E-10	3E-10	<1E-9	1E-9	<2E-10	2E-10	<1E-9	1E-9	<5E-10	5E-10	<1E-9	1E-9
Polonium 210 precision (±)	uCi/mL	1E-10		NA		2E-10		NA		2E-10		NA		2E-10		NA	
Polonium 210 MDC	uCi/mL	2E-10		-		3E-10		-		2E-10		-		5E-10		-	
Radium 226	uCi/mL	<1E-10	1E-10	<2E-10	2E-10	<1.3E-10	1.3E-10	<1E-10	1E-10	<1E-10	1E-10	<2E-10	2E-10	<1.2E-10	1.2E-10	<1E-10	1E-10
Radium 226 precision (±)	uCi/mL	5E-11		NA		7E-9		NA		3E-11		NA		9E-11		NA	
Radium 226 MDC	uCi/mL	1E-10		-		1.3E-10		-		1E-10		-		1.2E-10		-	
Thorium 230	uCi/mL	<1E-10	1E-10	<2E-10	2E-10	<9E-11	9E-11	<2E-10	2E-10	<1E-10	1E-10	<2E-10	2E-10	<1E-10	1E-10	<2E-10	2E-10
Thorium 230 precision (±)	uCi/mL	6E-11		NA		7E-11		NA		7E-11		NA		8E-11		NA	
Thorium 230 MDC	uCi/mL	1E-10		-		9E-11		-		1E-10		-		1E-10		-	
METALS, SUSPENDED																	
Uranium	mg/L	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	0.0004	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003
Uranium Activity	uCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	3E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10

uCi/ml - microcuries per milliliter
mg/L- milligrams per liter
MDC - minimum detectable concentration
LLD - lower limit of detection
RL - reporting limit

Table 2.9-11 Marsland Expansion Area Radiological Analytical Results (November 2011 to August 2012) - Chadron Wells

Location ID:		Monitor 7		Monitor 7		Monitor 7		Monitor 7		Monitor 8		Monitor 8		Monitor 8		Monitor 8	
Date Collected:		11/7/2011		2/13/2012		6/4/2012		8/20/2012		11/7/2011		2/13/2012		6/4/2012		8/20/2012	
Formation:		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON	
	UNITS	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL
RADIONUCLIDES-DISSOLVED																	
Lead 210	uCi/mL	<8E-10	8E-10	<1E-9	1E-9	<8E-10	8E-10	<1E-9	1.00E-09	<8E-10	8E-10	1.1E-9	1E-9	<8E-10	8E-10	1.2E-9	1E-9
Lead 210 precision (±)	uCi/mL	5E-10		NA		5E-10		NA		5E-10		4E-10		5E-10		4E-10	
Lead 210 MDC	uCi/mL	8E-10		-		8E-10		-		8E-10		-		8E-10		-	
Polonium 210	uCi/mL	<7E-10	7E-10	<1E-9	1E-9	1.6E-09	6E-10	<1E-9	1.00E-09	1E-9	5E-10	<E-9	1E-9	<7E-10	7E-10	<1E-9	1E-9
Polonium 210 precision (±)	uCi/mL	4E-10		NA		9E-10		NA		7E-10		NA		4E-10		NA	
Polonium 210 MDC	uCi/mL	7E-10		-		6E-10		-		5E-10		-		7E-10		-	
Radium 226	uCi/mL	9E-10	1E-10	3E-10	2E-10	5.3E-10	1.7E-10	9E-10	2.00E-10	2.3E-9	1E-10	4E-10	2E-10	2.1E-09	1.7E-10	5E-10	2E-10
Radium 226 precision (±)	uCi/mL	2E-10		1E-10		1.7E-10		1E-10		3E-10		1E-10		3.1E-10		1E-10	
Radium 226 MDC	uCi/mL	1E-10		-		1.7E-10		-		1E-10		-		1.7E-10		-	
Thorium 230	uCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2.00E-10	<2E-10	2E-10	<2E-10	2E-10	<1E-10	1E-10	<2E-10	2E-10
Thorium 230 precision (±)	uCi/mL	1E-10		NA		6E-11		NA		1E-10		NA		5E-11		NA	
Thorium 230 MDC	uCi/mL	2E-10		-		2E-10		-		2E-10		-		1E-10		-	
METALS, DISSOLVED																	
Uranium	mg/L	0.0005	0.0003	0.0004	0.0003	<0.0003	0.0003	<0.0003	0.0003	0.0006	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003
Uranium Activity	uCi/mL	3.10E-10	2E-10	3E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	4.1E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
RADIONUCLIDES-SUSPENDED																	
Lead 210	uCi/mL	<9E-10	9E-10	1.2E-9	1E-9	<8E-10	8E-10	1.5E-9	1E-9	<9E-10	9E-10	<1E-9	1E-9	<8E-10	8E-10	1.2E-9	1E-9
Lead 210 precision (±)	uCi/mL	5E-10		4E-10		5E-10		4E-10		5E-10		NA		5E-10		4E-10	
Lead 210 MDC	uCi/mL	9E-10		-		8E-10		-		9E-10		-		8E-10		-	
Polonium 210	uCi/mL	<2E-10	2E-10	<1E-9	1E-9	<3E-10	3E-10	<1E-9	1E-9	2E-10	2E-10	<1E-9	1E-9	<4E-10	4E-10	<1E-9	1E-9
Polonium 210 precision (±)	uCi/mL	2E-10		NA		2E-10		NA		2E-10		NA		3E-10		NA	
Polonium 210 MDC	uCi/mL	2E-10		-		3E-10		-		2E-10		-		4E-10		-	
Radium 226	uCi/mL	<1E-10	1E-10	<2E-10	2E-10	<1.3E-10	1.3E-10	<1E-10	1E-10	2E-10	1E-10	<2E-10	2E-10	<1.3E-10	1.3E-10	<2E-10	2E-10
Radium 226 precision (±)	uCi/mL	5E-11		NA		8E-11		NA		7E-11		NA		9E-11		NA	
Radium 226 MDC	uCi/mL	1E-10		-		1.3E-10		-		1E-10		-		1.3E-10		-	
Thorium 230	uCi/mL	<1E-10	1E-10	<2E-10	2E-10	<1E-10	1E-10	<2E-10	2E-10	<1E-10	1E-10	1E-10	2E-10	<1E-10	1E-10	3E-10	2E-10
Thorium 230 precision (±)	uCi/mL	5E-11		NA		9E-11		NA		6E-11		1E-10		5E-11		2E-10	
Thorium 230 MDC	uCi/mL	1E-10		-		1E-10		-		1E-10		-		1E-10		-	
METALS, SUSPENDED																	
Uranium	mg/L	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003
Uranium Activity	uCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10

uCi/ml - microcuries per milliliter
mg/L- milligrams per liter
MDC - minimum detectable concentration
LLD - lower limit of detection
RL - reporting limit

Table 2.9-11 Marsland Expansion Area Radiological Analytical Results (November 2011 to August 2012) - Chadron Wells

Location ID:		Monitor 9		Monitor 9		Monitor 9		Monitor 9		Monitor 10		Monitor 10		Monitor 10		Monitor 10	
Date Collected:		11/7/2011		2/13/2012		6/4/2012		8/20/2012		11/7/2011		2/13/2012		6/4/2012		8/20/2012	
Formation:		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON		CHADRON	
	UNITS	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL
RADIONUCLIDES-DISSOLVED																	
Lead 210	uCi/mL	1.3E-9	1.3E-9	1.9E-9	1E-9	<8E-10	8E-10	2.9E-9	1E-9	<8E-10	8E-10	<1E-9	1E-9	<8E-10	8E-10	<1E-9	1E-9
Lead 210 precision (±)	uCi/mL	8E-10		4E-10		5E-10		5E-10		5E-10		NA		5E-10		NA	
Lead 210 MDC	uCi/mL	1.3E-9		-		8E-10		-		8E-10		-		8E-10		-	
Polonium 210	uCi/mL	9E-10	7E-10	<1E-9	1E-9	8E-10	5E-10	<1E-9	1E-9	<6E-10	6E-10	<1E-9	1E-9	2.1E-9	5E-10	<1E-9	1E-9
Polonium 210 precision (±)	uCi/mL	7E-10		NA		6E-10		NA		3E-10		NA		1E-9		NA	
Polonium 210 MDC	uCi/mL	7E-10		-		5E-10		-		6E-10		-		5E-10		-	
Radium 226	uCi/mL	3E-10	1E-10	3E-10	2E-10	1.5E-9	1.7E-10	8E-10	2E-10	8E-10	1E-10	5E-10	2E-10	6.6E-9	1.7E-10	6E-10	2E-10
Radium 226 precision (±)	uCi/mL	1E-10		1E-10		2.6E-10		1E-10		2E-10		1E-10		5.3E-10		1E-10	
Radium 226 MDC	uCi/mL	1E-10		-		1.7E-10		-		1E-10		-		1.7E-10		-	
Thorium 230	uCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Thorium 230 precision (±)	uCi/mL	9E-11		NA		7E-11		NA		9E-11		NA		7E-11		NA	
Thorium 230 MDC	uCi/mL	2E-10		-		2E-10		-	1E-9	2E-10		-		2E-10		-	
METALS, DISSOLVED																	
Uranium	mg/L	0.0040	0.0003	0.0022	0.0003	0.0021	0.0003	0.0015	0.0003	0.0005	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003
Uranium Activity	uCi/mL	2.7E-9	2E-10	1.5E-9	2E-10	1.4E-9	2E-10	1E-10	2E-10	3.4E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
RADIONUCLIDES-SUSPENDED																	
Lead 210	uCi/mL	<9E-10	9E-10	1.4E-9	1E-9	<7E-10	7E-10	1.43E-8	1E-9	<9E-10	9E-10	<1E-9	1E-9	<8E-10	8E-10	3E-9	1E-9
Lead 210 precision (±)	uCi/mL	6E-10		4E-10		5E-10		1E-9		6E-10		NA		5E-10		6E-10	
Lead 210 MDC	uCi/mL	9E-10		-		7E-10		-		9E-10		-		6E-10		-	
Polonium 210	uCi/mL	<3E-10	3E-10	<1E-9	1E-9	<3E-10	3E-10	<1E-9	1E-9	<2E-10	2E-10	<1E-9	1E-9	<4E-10	4E-10	<1E-9	1E-9
Polonium 210 precision (±)	uCi/mL	2E-10		NA		2E-10		NA		1E-10		NA		2E-10		NA	
Polonium 210 MDC	uCi/mL	3E-10		-		3E-10		-		2E-10		-		4E-10		-	
Radium 226	uCi/mL	<1E-10	1E-10	<2E-10	2E-10	<1.1E-10	1.1E-10	<2E-10	2E-10	<1E-10	1E-9	2E-10	2E-10	1.1E-10	1.1E-10	<2E-10	2E-10
Radium 226 precision (±)	uCi/mL	4E-11		NA		7E-11		NA		3E-11		NA		8E-11		NA	
Radium 226 MDC	uCi/mL	1E-10		-		1.1E-10		-		1E-10		-		1.1E-10		-	
Thorium 230	uCi/mL	<1E-10	1E-10	1E-10	2E-10	<1E-10	1E-10	<2E-10	2E-10	<1E-10	1E-10	<2E-10	2E-10	2E-10	8E-11	<2E-10	2E-10
Thorium 230 precision (±)	uCi/mL	6E-11		NA		7E-11		NA		4E-11		NA		1E-10		NA	
Thorium 230 MDC	uCi/mL	1E-10		-		1E-10		-		1E-10		-		8E-11		-	
METALS, SUSPENDED																	
Uranium	mg/L	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003
Uranium Activity	uCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10

uCi/ml - microcuries per milliliter
mg/L- milligrams per liter
MDC - minimum detectable concentration
LLD - lower limit of detection
RL - reporting limit

Table 2.9-11 Marsland Expansion Area Radiological Analytical Results (November 2011 to August 2012) - Chadron Wells

Location ID:		Monitor 11		Monitor 11		Monitor 11		Monitor 11	
Date Collected:		11/7/2011		2/13/2012		6/4/2012		8/20/2012	
Formation:		CHADRON		CHADRON		CHADRON		CHADRON	
	UNITS	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL
RADIONUCLIDES-DISSOLVED									
Lead 210	uCi/mL	<8E-10	8E-10	<1E-9	1E-9	<8E-10	8E-10	1.3E-9	1E-9
Lead 210 precision (±)	uCi/mL	5E-10		NA		5E-10		4E-10	
Lead 210 MDC	uCi/mL	8E-10		-		8E-10		-	
Polonium 210	uCi/mL	<7E-10	7E-10	<1E-9	1E-9	<5E-10	5E-10	<1E-9	1E-9
Polonium 210 precision (±)	uCi/mL	4E-10		NA		3E-10		NA	
Polonium 210 MDC	uCi/mL	7E-10		-		5E-10		-	
Radium 226	uCi/mL	4E-10	1E-10	2E-10	2E-10	2.4E-9	1.7E-10	4E-10	2E-10
Radium 226 precision (±)	uCi/mL	1E-10		1E-10		3.2E-10		1E-10	
Radium 226 MDC	uCi/mL	1E-10		-		1.7E-10		-	
Thorium 230	uCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Thorium 230 precision (±)	uCi/mL	9E-11		NA		6E-11		NA	
Thorium 230 MDC	uCi/mL	2E-10		-		2E-10		-	
METALS, DISSOLVED									
Uranium	mg/L	0.0014	0.0003	0.0008	0.0003	0.0007	0.0003	0.0005	0.0003
Uranium Activity	uCi/mL	9.3E-10	2E-10	5E-10	2E-10	4.8E-10	2E-10	3E-10	2E-10
RADIONUCLIDES-SUSPENDED									
Lead 210	uCi/mL	<9E-10	9E-10	<1E-9	1E-9	<8E-10	8E-10	1.55E-8	1E-09
Lead 210 precision (±)	uCi/mL	5E-10		NA		5E-10		1E-9	
Lead 210 MDC	uCi/mL	9E-10		-		8E-10		-	
Polonium 210	uCi/mL	<2E-10	2E-10	<1E-9	1E-9	<4E-10	4E-10	<1E-9	1E-9
Polonium 210 precision (±)	uCi/mL	1E-10		NA		1E-10		NA	
Polonium 210 MDC	uCi/mL	2E-10		-		4E-10		-	
Radium 226	uCi/mL	<1E-10	1E-10	<2E-10	2E-10	<1.2E-10	1E-10	<2E-10	2E-10
Radium 226 precision (±)	uCi/mL	4E-11		NA		7E-11		NA	
Radium 226 MDC	uCi/mL	1E-10		-		1.2E-10		-	
Thorium 230	uCi/mL	<1E-10	1E-10	<2E-10	2E-10	<9E-11	9E-11	<2E-10	2E-10
Thorium 230 precision (±)	uCi/mL	5E-11		NA		6E-11		NA	
Thorium 230 MDC	uCi/mL	1E-10		-		9E-11		-	
METALS, SUSPENDED									
Uranium	mg/L	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003
Uranium Activity	uCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10

uCi/ml - microcuries per milliliter
mg/L- milligrams per liter
MDC - minimum detectable concentration
LLD - lower limit of detection
RL - reporting limit

Table 2.9-12 Stream Gaging Stations on Niobrara River in Vicinity of Headwaters of Niobrara River

Identification No.[a]	Latitude/Longitude		Township/ Range Section	Location Description
06454000	42° 39′ 10″	104° 03′ 07″	T31N R57W Section 19 (NE1/4NE1/4)	1 mile downstream of Van Tassel on county road and 0.1 mile from WY-NE state line
06454100	42° 25′ 22″	103° 47′ 28″	T28N R55W Section 6 (SW1/4)	0.2 mile north of Agate and 14.5 miles upstream of Whistle Creek
06454500 SNI4NIOBR402	42° 27′ 35″	103° 10′ 15″	T29N R50W Section 27 (NE1/4)	1 mile upstream of high water line of Box Butte Reservoir and 1 mile east of Marsland
06455500 SNI4NIOBRA20	42° 27′ 25″	103° 04′ 05″	T29N R49W Section 28 (SE1/4)	0.2 mile downstream of Box Butte Reservoir and 9 miles north of Hemingford
06455000	42° 27′ 30″	103° 04′ 03″	T29N R49W Section 28 (SW1/4NE1)	Box Butte Reservoir

Gage: Continuous stage recorders

[a] USGS stream designation numbers are "064…" series and NDEQ station numbers are "SNI4IO…" series.

Note: Data for stream gaging station of Niobrara River at Agate not included. Period of record is discontinuous (1957 – 1992; 2007 – current).

Table 2.9-13 Summary of Niobrara River Flow Measurements 1999 - 2012

Stream Sampling Location	Flow (cubic feet per second [cfs])		
	Average Flow	Minimum Flow	Maximum Flow
Niobrara River at Wyoming State Line 06454000	3.03 (1.7 – 4.4)	2.4 (0.6 – 5.3)	4.2 (1.6 – 13.0)
Niobrara River at Agate 06454100 Stream flow data for 2006 – 2010.	10.5 (5.4 – 17.9)	8.1 (0.9 – 20.0)	14.0 (4.8 – 55.0)
Niobrara River above Box Butte Reservoir 06454500	19.6 (10.1 – 34.9)	14.5 (3.8 – 40.0)	28.3 (8.1 – 129)
Niobrara River below Box Butte Reservoir 06455500	14.5 (0.7 – 87)	3.8 (0.4 – 84.0)	29.7 (0.54 – 180.0)

Extremes for Period of Record and By Year (1999 – 2012[l])

Peak Discharge			Minimum Discharge		Drainage Area
Date	Flow ft3/sec	Gage Height feet	Date	ft3/sec	Square Miles
Niobrara River at Wyoming State Line (USGS 06454000)					455
3/06/2012	115	Information Not Available	7/11/2012	1.75	
3/11/2011	451	Information Not Available	2/09/2011	2.32	
12/31/2010	10.2	Information Not Available	10/01/2010	2.09	
7/02/2009	11.2	4.56	9/12/2009	1.59	
5/03/2008	18.0	4.80	8/28/2008	1.1	
4/02/2007	7.1	3.34	7/25/2007		
3/30/2006	7.5	3.22	8/24/2006	0.96	
6/13/2005	13.0	4.38	7/23/2005	1.4	
9/05/2004	21.0	3,61[e]	9/02/2004	0.57	
4/29/2003	8.6	3.10[f]	8/22-23/2003	1.3	
4/26/2002	12.0	2.94[g]	8/17-18/2002	1.4	
5/06/2001	11.0	2.76[i]	9/05/2001	1.6	
2/22/2000	21	3.69	9/18/2000	1.3	
4/28/1999	9.9	2.37[j]	9/15-16/1999	1.4	
8/16/1977	2,120	8.28	8/09/1975	0.54	

Table 2.9-13 Summary of Niobrara River Flow Measurements 1999 - 2012

Peak Discharge			Minimum Discharge	Drainage Area	
Date	Flow ft3/sec	Gage Height feet	Date	ft3/sec	Square Miles
Niobrara River at Agate (USGS 06454100) [a]					840
3/11/2012	35.8	Information Not Available	8/23/2012	1.08	
3/14/2011	223	Information Not Available	8/18/2011	3.32	
2/26/2010	278	Information Not Available	8/14/2010	3.7	
6/14/2009	63	6.18	12/27/2009	5.1	
3/04/2008	23	4.05	8/02-4/2008	3.0	
3/08/2007	20	4.02	5/29/2007	9.6	
7/02/2006	24.6	Information Not Available	2/25/2006	0.83	
12/29/2005	13.5	Information Not Available	11/28/2005	5.48	
2004	ND				
2003	ND				
2002	ND				
2001	ND				
1999	ND				
Niobrara River above Box Butte Reservoir (USGS 06454500)					1,400
1/12/2012	100	Information Not Available	9/02/2012	2.2	
2/01/2011	108	Information Not Available	7/21/2011	5.7	
12/31/2010	57.3	--	12/11//2010	6.3	
7/23/2009	187	5.78	8/21/2009	8.5	
7/09/2008	384	7.26	10/03/2008	8.0	
7/28/2007	41	4.18	7/26/2007	3.8	
11/28/2006	167	5.53[b]	6/06-07/2006	6.7	
6/13/2005	80	4.41[c]	5/29/2005	9.6	
3/09/2004	51	3.75[d]	6/15-16/2004	6.2	
3/20/2003	43	3.58	8/15/2003	5.8	
3/29/2002	53	3.76[h]	7/31 – 8/02/2002	4.1	
3/14/2001	52	3.79	7/08-09/2001	7.9	
7/11/2000	202	5.59	8/24/2000	8.7	
4/13/1999	45	3.63[k]	8/13-30/1999	11.0	
7/28/1951	4,950	10.3	9/26/1953	1.6	
Niobrara River below Box Butte Reservoir (USGS 06455500)					460
7/20/2012	160	Information Not Available	5/18/2012	0.63	
7/14/2011	148	Information Not Available	10/30/2011	0.80	
12/31/2010	0.935	--	10/01/2010	0.72	
7/17/2009	157	4.29	11/05/2009	0.56	
7/30/2008	165	4.29	11/05-06/2008	0.56	

Table 2.9-13 Summary of Niobrara River Flow Measurements 1999 - 2012

Peak Discharge			Minimum Discharge	Drainage Area	
Date	**Flow ft3/sec**	**Gage Height feet**	**Date**	**ft3/sec**	**Square Miles**
7/15/2007	153	4.23	11/15-16/2007	0.40	
7/17/2006	164	4.26	8/23/2006	0.70	
7/24/2005	143	4.16	10/11/2005	0.63	
7/20/2004	152	4.20	9/12/2004	0.65	
7/16/2003	151	4.14	8/27/2003	0.47	
6/30/2002	170	4.32	9/02-07/2002	0.52	
7/02/1968	616	5.04	Many days in 1947 & 1951	0.1	
8/01/2001	148	4.26	9/27-30/2001	0.64	
7/09/2000	148	4.21	9/14/2000	0.75	
7/27/1999	195	4.43	10/01/1999	0.87	
Period of Record					
Niobrara River at Wyoming State Line (USGS 06454000)			1955 to Quarter 3 2012		
Niobrara River at Agate (USGS 06454100)			3rd Quarter 2005 – Quarter 3 2012		
Niobrara River above Box Butte Reservoir (USGS 06454500)			Oct. 1946 to Quarter 3 2012		
Niobrara River below Box Butte reservoir (USGS 06455500)			Oct. 1946 to Quarter 3 2012		

[a] Stream flow data for 2006 – 2010 in Table 2.9-14; Records are fair, except estimated records are poor.
[b] Maximum gage height of 5.64 feet February 10 due to backwater from ice.
[c] Maximum gage height of 4.66 feet January 05 due to backwater from ice.
[d] Maximum gage height of 4.82 feet due to backwater from ice conditions.
[e] Maximum gage height of 4.59 feet due to backwater from ice conditions.
[f] Maximum gage height 3.34 feet February 3 due to backwater from ice conditions.
[g] Maximum gage height of 3.56 feet due to backwater from ice conditions.
[h] Maximum gage height of 4.67 feet on March 1 due to backwater from ice conditions.
[i] Maximum gage height of 3.01 feet December 16 due to backwater from ice conditions.
[j] Maximum gage height of 2.64 feet from a high water mark.
[k] Maximum gage height of 5.07 feet December 20 due to backwater from ice.
[l] 2012 data is for Quarters 1 through 3; Quarter 4 data not yet available.
ND = No data
ft^3/sec = cubic feet per second
USGS = U.S. Geological survey
Sources: NDNR. 2013.
Williams.2013

Table 2.9-14 Water Flow Measurements for Upper Reaches of Niobrara River – 1999 to 2012

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	cubic feet per second (cfs) - Mean											
Niobrara River at Wyoming State Line (USGS 06454000)												
1999												
Mean	4.03	4.40	5.08	6.85	5.02	5.48	3.24	1.95	2.47	2.94	3.44	3.64
Maximum	4.3	4.40	7.5	8.4	7.7	6.8	6.0	2.8	4.2	3.4	4.6	4.1
Minimum	3.5	3.9	4.2	5.3	3.9	4.1	2.3	1.4	1.6	2.7	2.8	3.2
2000												
Mean	3.66	5.12	5.94	6.79	5.51	3.00	1.97	1.77	1.80	2.54	3.09	2.85
Maximum	4.1	13.0	9.0	12.0	8.9	4.5	2.6	2.1	2.5	3.2	4.8	3.0
Minimum	3.3	3.4	4.8	4.4	4.1	2.5	1.5	1.5	1.3	2.3	2.7	2.6
2001												
Mean	3.08	3.26	5.50	6.07	4.68	3.11	2.36	1.78	2.03	2.56	3.37	3.20
Maximum	3.4	3.7	6.8	9.5	9.0	4.9	3.4	2.0	2.7	2.9	3.9	4.0
Minimum	2.9	2.9	3.6	4.9	3.2	2.5	1.9	1.6	1.6	2.0	2.8	2.7
2002												
Mean	3.36	3.54	3.77	5.09	3.63	2.64	1.98	1.54	1.94	1.86	2.54	3.17
Maximum	3.7	3.8	6.1	7.1	5.1	3.5	2.5	1.6	2.4	2.3	3.4	3.4
Minimum	2.6	3.2	3.2	4.2	3.0	2.0	1.6	1.4	1.5	1.5	1.4	2.9
2003												
Mean	3.23	3.52	4.56	4.66	4.41	3.03	1.87	1.58	2.37	2.45	2.6	2.65
Maximum	3.6	3.8	6.0	6.8	5.6	4.2	2.5	2.5	3.4	2.9	2.6	2.8
Minimum	2.9	3.3	3.5	3.9	3.7	2.3	1.5	1.3	2.0	2.4	2.6	2.6
2004												
Mean	2.85	3.08	3.79	3.12	2.81	1.72	2.18	1.40	2.17	2.6	3.0	3.3
Maximum	3.1	4.0	5.5	3.6	3.3	2.7	6.4	2.1	11.0	3.4	3.3	3.5
Minimum	2.7	2.5	2.0	2.5	2.5	1.1	1.2	0.83	0.57	2.1	2.6	3.0
2005												
Mean	2.9	3.4	3.5	3.4	3.1	3.1	2.1	2.2	1.8	2.0	3.0	2.7
Maximum	3.5	3.6	4.0	5.3	6.3	12.0	3.1	5.3	2.2	2.6	3.3	3.0
Minimum	2.5	3.2	3.2	2.7	2.4	1.8	1.4	1.5	1.5	1.4	2.6	2.2

Table 2.9-14 Water Flow Measurements for Upper Reaches of Niobrara River – 1999 to 2012

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	cubic feet per second (cfs) - Mean											
2006												
Mean	2.9	3.0	4.2	3.5	3.2	2.2	1.9	1.5	2.0	2.7	2.8	2.9
Maximum	3.3	4.3	6.7	5.5	4.2	4.3	4.1	3.0	3.1	3.0	3.2	3.3
Minimum	2.6	2.7	3.5	2.6	2.7	1.5	1.4	0.96	1.7	2.3	2.4	2.5
2007												
Mean	2.8	2.9	3.4	3.7	2.9	1.9	1.6	1.3	1.5	2.2	2.3	2.0
Maximum	3.4	3.5	5.3	6.2	3.1	2.2	2.8	1.7	1.9	2.7	2.8	2.3
Minimum	2.4	2.3	2.8	3.2	2.3	1.6	0.82	1.0	1.1	1.6	1.7	1.7
2008												
Mean	2.3	3.2	3.0	2.9	4.1	2.9	2.2	1.7	1.7	2.0	2.4	2.6
Maximum	3.0	4.1	4.2	4.1	6.9	4.9	2.8	2.6	2.5	2.5	2.8	3.2
Minimum	1.4	2.0	2.4	2.3	2.4	2.1	1.8	1.1	1.3	1.6	2.1	2.2
2009												
Mean	2.6	3.2	6.6	3.6	3.3	3.7	3.4	2.2	1.8	2.2	2.6	2.7
Maximum	3.7	3.8	12.0	4.6	4.5	4.9	6.7	2.5	2.0	1.9	2.5	2.6
Minimum	1.9	2.1	3.5	3.0	2.9	2.3	2.0	2.0	1.6	2.5	2.7	3.1
2010 [a]												
Mean	2.9	2.9	3.6	3.5	3.9	4.0	2.3	2.0	1.8	2.4	2.8	2.9
Maximum	3.0	4.5	4.6	3.7	4.6	7.4	2.9	2.1	2.1	2.11	2.7	2.8
Minimum	2.4	2.4	3.4	3.4	3.2	2.5	2.0	1.9	1.9	2.73	2.9	3.0
2011 [a]												
Mean	3.3	17.6	16.6	5.1	7.3	5.4	3.4	2.8	2.7	3.2	3.7	3.7
Maximum	4.5	136	142	5.7	11.4	8.1	4.5	2.9	2.8	3.6	3.8	3.9
Minimum	2.8	3.1	5.2	4.9	4.7	4.3	2.7	2.7	2.5	2.9	3.4	3.2
2012 [a, b]												
Mean	3.8	3.9	7.2	3.5	3.1	2.2	2.0	2.1	2.2	NA	NA	NA
Maximum	3.9	4.3	46.3	3.8	3.7	2.7	2.2	2.3	2.5	NA	NA	NA
Minimum	3.6	3.7	3.7	3.0	2.6	1.9	1.8	2.0	1.9	NA	NA	NA

Table 2.9-14 Water Flow Measurements for Upper Reaches of Niobrara River – 1999 to 2012

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	cubic feet per second (cfs) - Mean											
Niobrara River at Agate (USGS 06454100)												
2006												
Mean	13.0	13.6	19.0	14.7	9.3	5.9	6.0	4.1	6.0	6.1	9.5	9.9
Maximum	14.0	17.0	21.0	20.0	13.0	10.0	14.0	5.9	7.9	7.4	12.0	11.0
Minimum	11.0	0.9	17.0	12.0	5.1	3.8	2.1	3.0	4.5	5.1	5.7	8.2
2007												
Mean	9.7	9.6	14.7	13.3	8.3	6.2	3.4	4.1	5.5	6.8	8.3	7.7
Maximum	10.0	14.0	17.0	18.0	11.0	8.4	4.8	5.6	6.2	8.0	9.0	9.0
Minimum	9.0	8.0	11.0	11.0	6.1	2.9	2.2	2.8	4.7	6.0	7.0	7.0
2008												
Mean	7.0	8.1	14.8	10.9	9.4	10.8	5.4	4.9	7.8	8.0	8.8	7.1
Maximum	7.0	14.0	18.0	13.0	17.0	16.0	8.0	7.0	9.0	9.2	11.0	10.0
Minimum	7.0	7.0	13.0	7.0	6.0	8.0	4.0	3.0	6.0	6.8	7.0	5.1
2009												
Mean	6.2	10.1	15.3	19.6	12.1	21.2	9.9	8.1	8.6	14.1	15.4	10.2
Maximum	7.3	15.0	18.0	28.0	19.0	55.0	15.0	5.7	9.7	19.0	22.0	12.0
Minimum	5.2	7.3	15.0	15.0	5.3	9.4	6.5	11.0	7.4	10.0	11.0	11.0
2010 [a]												
Mean	10.7	12.1	25.7	24.1	20.5	17.5	8.5	5.8	6.6	8.7	11.3	12.7
Maximum	11.0	20.0	31.0	31.0	27.0	33.0	11.0	7.0	8.0	7.0	8.0	10.0
Minimum	10.0	11.0	20.0	19.0	11.0	8.0	7.0	4.0	6.0	12.0	14.0	15.0
2011												
Mean	12.6	22.9	32.3	18.2	24.8	14.8	7.5	5.9	7.2	10.4	14.3	11.6
Maximum	16	63	102	22	36	25	10	9	10	13.3	15.7	14.4
Minimum	10	12	20	16	17	9	6	4	6	6.86	12.4	10.1
2012 [b]												
Mean	9.6	6.2	11.6	6.2	3.7	3.5	2.5	2.9	3.6	N/A	N/A	N/A
Maximum	11.8	7.1	31.4	8.6	4.9	5.1	3.7	4.1	5.2	N/A	N/A	N/A
Minimum	7.2	5.3	6.9	4.8	2.3	2.1	2.0	1.6	2.6	N/A	N/A	N/A

Table 2.9-14 Water Flow Measurements for Upper Reaches of Niobrara River – 1999 to 2012

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	cubic feet per second (cfs) - Mean											
Niobrara River above Box Butte Reservoir (USGS 06454500)												
1999												
Mean	26.9	34.1	34.4	36.6	26.3	22.2	18.3	12.5	18.9	21.9	24.9	26.5
Maximum	30	39	37	43	37	31	26	17	22	25	28	29
Minimum	19	28	32	40	15	14	13	11	14	18	21	24
2000												
Mean	28.1	32.3	42.7	43.1	47.7	15.0	15.6	11.2	11.4	19.8	22.9	18.4
Maximum	31	40	60	65	74	24	44	17	15	33	29	22
Minimum	20	20	36	33	30	8.8	11	8.7	9.3	10	18	16
2001												
Mean	22.7	25.6	40.8	43.0	28.8	15.8	13.9	9.04	10.9	16.7	20.1	21.9
Maximum	28	28	48	48	47	22	28	11	14	19	22	24
Minimum	19	23	29	38	11	11	9.4	7.9	8.2	11	18	17
2002												
Mean	22.1	25.7	32.2	35.7	19.5	9.47	6.33	6.27	10.1	11.2	16.8	19.9
Maximum	25	32	47	45	31	11	8.7	8.1	15	14	21	22
Minimum	19	21	21	21	10	8.2	4.1	4.1	6.4	10	14	19
2003												
Mean	20.1	23.8	31.9	28.0	22.6	12.2	9.18	7.84	8.48	10.4	14.0	16.4
Maximum	23	26	41	39	31	15	12	9.5	9.7	12	15	18
Minimum	18	20	23	21	13	9.8	7.6	5.8	7.0	9.1	12	15
2004												
Mean	17.5	19.7	31.4	19.8	10.5	8.6	10.2	10.0	13.1	17.0	16.8	17.4
Maximum	19	37	46	26	16	15	14	16	16	18	18	18
Minimum	16	16	24	15	7.1	6.2	7.1	6.9	8.8	16	15	17
2005												
Mean	18.9	26.3	27.5	32.4	23.6	33.4	12.3	14.2	13.6	16.5	18.9	16.3
Maximum	24	28	30	49	43	72	17	17	15	19	23	21
Minimum	15	24	26	28	9.6	14	9.7	10	13	14	14	12

Table 2.9-14 Water Flow Measurements for Upper Reaches of Niobrara River – 1999 to 2012

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	cubic feet per second (cfs) - Mean											
2006												
Mean	19.9	22.8	35.9	29.0	15.6	11.0	9.6	8.1	10.1	11.1	15.0	13.6
Maximum	26	27	42	39	34	22	13	11	12	13	17	15
Minimum	12	19	23	11	10	6.7	8.1	6.9	8.7	10	11	13
2007												
Mean	15.9	18.4	26.8	22.9	13.4	8.3	8.4	6.4	6.7	9.4	10.8	10.9
Maximum	19	22	30	27	20	18	20	8.6	14	10	14	16
Minimum	14	15	22	19	7.8	4.2	3.8	4.5	5.4	8	9.9	10
2008												
Mean	11.2	12.4	25.2	27.6	24.0	16.0	13.5	9.0	10.9	11.3	14.4	11.8
Maximum	15	19	33	42	110	28	50	9	12	13	18	14
Minimum	9.7	11	20	10	13	12	10	9	9.8	9.7	13	9.6
2009												
Mean	12.5	16.4	24.2	57.1	24.5	28.0	29.6	14.7	13.4	23.2 [a]	29.2 [a]	20.7 [a]
Maximum	16	20	30	129	41	50	92	28	19	35 [a]	42 [a]	23 [a]
Minimum	9.8	13	21	28	9.8	9.3	11	8.5	9.3	14 [a]	21 [a]	16 [a]
2010 [a]												
Mean	15.8	13.9	52.1	43.5	43.0	41.2	18.8	11.7	9.8	13.1	22.4	22.2
Maximum	23	35	104	75	82	76	28	21	11	9.1	17.8	18.4
Minimum	13	9	36	28	23	14	12	8	9	22.3	27.0	26.0
2011 [a]												
Mean	17.9	20.9	49.5	36.8	48.4	34.7	12.5	10.7	12.1	16.1	12.3	26.4
Maximum	26.7	26	68.1	43.3	95.2	59	25.7	13	31.4	19	26.7	42.1
Minimum	12.7	14	37.4	32	26	24.7	7.23	6.99	6.88	12.6	2.26	21.3
2012 [a, b]												
Mean	27.4	24.6	40.1	27.5	11.2	7.5	5.8	5.7	5.8	N/A	N/A	N/A
Maximum	83.2	38.9	49.1	45.8	13.6	8.8	6.9	6.4	7.0	N/A	N/A	N/A
Minimum	15.2	17.4	23.5	12.3	8.4	6.9	5.2	5.0	3.3	N/A	N/A	N/A

Table 2.9-14 Water Flow Measurements for Upper Reaches of Niobrara River – 1999 to 2012

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	cubic feet per second (cfs) - Mean											
Niobrara River below Box Butte Reservoir (USGS 06455500)												
1999												
Mean	1.14	1.25	1.30	1.41	1.27	1.11	96.6	104	7.23	0.93	0.93	0.93
Maximum	1.2	1.4	1.4	1.7	1.4	1.3	180	128	89	1.0	1.0	.95
Minimum	1.1	1.1	1.2	1.3	1.2	1.0	1.0	64	0.95	0.85	0.86	0.87
2000												
Mean	0.94	0.99	1.15	1.22	1.23	13.7	116	84.5	3.55	0.74	0.79	0.72
Maximum	0.97	1.1	1.3	1.9	1.6	110	145	122	64	0.84	0.82	0.78
Minimum	0.90	0.93	1.1	1.1	1.1	1.1	84	61	0.75	0.70	0.75	0.67
2001												
Mean	0.71	0.70	0.74	0.79	0.87	0.79	83.1	105	14.4	0.65	0.66	0.66
Maximum	0.73	0.72	0.76	0.86	0.97	1.1	144	146	67	0.80	0.74	0.70
Minimum	0.67	0.70	0.72	0.72	0.82	0.72	0.76	68	0.64	0.60	0.64	0.64
2002												
Mean	0.71	0.69	0.74	0.79	0.78	18.9	121	57.4	0.59	0.54	0.56	0.54
Maximum	0.73	0.72	0.79	0.92	0.92	148	161	108	0.91	0.54	0.62	0.57
Minimum	0.64	0.66	0.70	0.76	0.73	0.70	76	0.53	0.52	0.52	0.54	0.52
2003												
Mean	0.53	0.56	0.60	0.71	0.72	0.71	96.9	77.3	0.86	0.77	0.75	0.74
Maximum	0.54	0.57	0.67	0.96	0.82	0.76	146	125	3.4	0.85	0.77	0.78
Minimum	0.52	0.54	0.57	0.64	0.67	0.67	0.63	0.47	0.49	0.72	0.71	0.70
2004												
Mean	0.77	0.77	0.82	0.88	0.84	0.86	71.8	65.9	2.21	0.71	0.71	0.72
Maximum	0.79	0.84	1.0	0.93	0.89	0.93	143	119	45	0.85	0.74	0.77
Minimum	0.74	0.74	0.73	0.85	0.77	0.76	0.87	0.75	0.65	0.63	0.66	0.69
2005												
Mean	0.76	0.79	0.82	0.93	0.95	1.0	76	76.3	13.1	0.77	0.79	0.83
Maximum	0.82	0.89	0.87	1.4	1.2	1.5	140	129	104	0.89	1.1	1.1
Minimum	0.69	0.72	0.79	0.83	0.79	0.94	0.88	0.87	0.69	0.74	0.74	0.79

Table 2.9-14 Water Flow Measurements for Upper Reaches of Niobrara River – 1999 to 2012

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	cubic feet per second (cfs) - Mean											
2006												
Mean	0.77	0.82	0.85	0.92	0.93	9.3	111.6	47	14.0	0.54	0.46	0.60
Maximum	0.84	1.1	0.87	1.0	1.1	69	158	109	77	0.61	0.58	0.64
Minimum	0.72	0.80	0.81	0.85	0.86	0.85	70	0.70	0.72	0.45	0.40	0.53
2007												
Mean	0.66	0.73	0.87	0.77	0.79	1.2	94.6	24.7	0.59	0.63	0.68	0.67
Maximum	0.80	0.83	1.0	0.87	0.86	9.7	147	127	0.62	0.69	0.79	0.80
Minimum	0.63	0.65	0.74	0.69	0.72	0.76	1.2	0.63	0.56	0.58	0.56	0.62
2008												
Mean	0.64	0.63	0.75	0.87	0.97	0.95	70.0	30.6	0.67	0.63	0.69	0.67
Maximum	0.68	0.69	0.83	0.94	1.2	1.1	157	140	0.84	0.74	0.80	0.78
Minimum	0.59	0.60	0.69	0.80	0.90	0.90	0.75	0.64	0.61	0.62	0.61	0.60
2009												
Mean	0.64	0.67	0.72	0.95	0.98	1.0	60.2	69.0	6.24	0.79 [a]	0.82 [a]	0.80 [a]
Maximum	0.69	0.68	0.80	1.3	1.1	1.2	135	132	29	0.9 [a]	0.85 [a]	0.93 [a]
Minimum	0.62	0.65	0.68	0.77	0.88	0.96	0.90	0.85	0.72	0.75 [a]	0.78 [a]	0.83 [a]
2010 [a]												
Mean	0.77	0.81	0.87	0.78	1.1	1.24	45.8	108.7	0.75	0.78	0.81	0.83
Maximum	0.79	0.86	0.89	1.41	1.2	1.88	165	165	0.96	0.74	0.78	0.80
Minimum	0.73	0.78	0.84	0.90	0.95	1.02	1.23	18.6	0.73	0.83	0.83	0.90
2011 [a]												
Mean	0.9	0.9	0.9	1.0	1.1	1.3	100	76.8	20	2.4	0.9	0.9
Maximum	0.9	0.9	1.0	1.1	2.1	2.3	138	115	109	31.2	0.9	0.9
Minimum	0.8	0.8	0.9	0.9	1.0	1.2	1.1	1.0	0.9	0.8	0.9	0.9
2012 [a, b]												
Mean	0.9	1.0	0.9	0.9	3.5	15.9	141.5	46.2	0.7	N/A	N/A	N/A
Maximum	0.9	1.0	1.1	1.0	30.8	88.7	157	142	0.8	N/A	N/A	N/A
Minimum	0.9	0.9	0.8	0.7	0.6	0.8	95.1	0.7	0.7	N/A	N/A	N/A

Notes:
[a] Provisional data starting 10/01/2010 – no QA/QC by the NDNR at the time of posting (Williams 2013).
[b] Data only available for January through September, 2013 (Williams 2013).
N/A = Not Available from NDNR (Williams 2013).

USGS = U.S. Geological Survey
NDNR = Nebraska Department of Natural Resources
QA/QC = quality assurance/quality control
Source: NDNR 2011a; Lindeman 2011; Williams 2013

Table 2.9-15 NDEQ 2002 Field Measurements of pH and Dissolved Oxygen for Station Number SNI4NIOBR402 (Niobrara River above Box Butte Reservoir)

Measurement Date/Time	Parameter	Result	Units
1/2/2002 12:40:00 PM	pH-Field	8.08	s.u.
1/3/2002 10:30:00 AM	pH-Field	8.06	s.u.
1/3/2002 12:14:00 PM	pH-Field	8.06	s.u.
1/7/2002 8:45:00 AM	Dissolved Oxygen (Winkler)	8.09	mg/L
1/8/2002 2:30:00 PM	pH-Field	8.1	s.u.
1/10/2002 2:35:00 PM	pH-Field	8.1	s.u.
2/5/2002 7:30:00 AM	pH-Field	8.05	s.u.
2/5/2002 3:15:00 PM	pH-Field	8.1	s.u.
2/5/2002 4:15:00 PM	pH-Field	8.0	s.u.
2/5/2002 4:30:00 PM	pH-Field	8.0	s.u.
3/4/2002 10:15:00 AM	pH-Field	8.0	s.u.
3/5/2002 10:45:00 AM	pH-Field	8.07	s.u.
3/5/2002 11:00:00 AM	pH-Field	8.08	s.u.
3/5/2002 12:35:00 PM	pH-Field	8.07	s.u.
3/7/2002 8:20:00 AM	pH-Field	8.09	s.u.
4/1/2002 10:45:00 AM	pH-Field	8.05	s.u.
4/3/2002 3:00:00 PM	pH-Field	8.09	s.u.
5/7/2002 8:36:00 AM	pH-Field	8.05	s.u.
5/7/2002 9:00:00 AM	pH-Field	8.01	s.u.
5/7/2002 10:30:00 AM	pH-Field	8.07	s.u.
5/7/2002 10:59:00 AM	pH-Field	8.05	s.u.
5/9/2002 11:00:00 AM	pH-Field	8.04	s.u.
6/11/2002 11:40:00 AM	Dissolved Oxygen (Winkler)	8.03	mg/L
6/12/2002 11:00:00 AM	Dissolved Oxygen (Winkler)	8.06	mg/L
6/12/2002 11:30:00 AM	Dissolved Oxygen (Winkler)	8.09	mg/L
6/12/2002 1:35:00 PM	pH-Field	8.0	s.u.
6/17/2002	pH-Field	8.0	s.u.
6/18/2002 9:25:00 AM	pH-Field	8.07	s.u.
6/18/2002 9:51:00 AM	pH-Field	8.02	s.u.
7/8/2002 9:10:00 AM	Dissolved Oxygen (Winkler)	8.0	mg/L
7/9/2002 8:45:00 AM	pH-Field	8.07	s.u.
7/9/2002 5:15:00 PM	pH-Field	8.06	s.u.
7/9/2002 6:20:00 PM	Dissolved Oxygen (Winkler)	8.06	mg/L
7/10/2002 2:15:00 PM	pH-Field	8.04	s.u.
7/16/2002 9:18:00 AM	Dissolved Oxygen (Winkler)	8.06	mg/L
7/16/2002 12:50:00 PM	pH-Field	8.08	s.u.
7/16/2002 1:00:00 PM	Dissolved Oxygen (Winkler)	8.06	mg/L
7/16/2002 1:00:00 PM	pH-Field	8.03	s.u.
7/18/2002 10:25:00 AM	pH-Field	8.06	s.u.
8/5/2002 2:45:00 PM	pH-Field	8.08	s.u.

Table 2.9-15 NDEQ 2002 Field Measurements of pH and Dissolved Oxygen for Station Number SNI4NIOBR402 (Niobrara River above Box Butte Reservoir)

Measurement Date/Time	Parameter	Result	Units
8/6/2002 11:45:00 AM	pH-Field	8.06	s.u.
8/6/2002 12:00:00 PM	Dissolved Oxygen (Winkler)	8.06	mg/L
8/7/2002 2:30:00 PM	Dissolved Oxygen (Winkler)	8.01	mg/L
9/3/2002 7:25:00 AM	pH-Field	8.0	s.u.
9/3/2002 11:45:00 AM	pH-Field	8.02	s.u.
9/3/2002 2:00:00 PM	pH-Field	8.05	s.u.
9/10/2002 11:45:00 AM	pH-Field	8.04	s.u.
9/11/2002 9:45:00 AM	Dissolved Oxygen (Winkler)	8.06	mg/L
9/11/2002 10:15:00 AM	pH-Field	8.02	s.u.
10/7/2002 11:20:00 AM	pH-Field	8.04	s.u.
10/7/2002 1:00:00 PM	pH-Field	8.06	s.u.
10/7/2002 1:45:00 PM	pH-Field	8.07	s.u.
10/7/2002 2:40:00 PM	pH-Field	8.0	s.u.
10/8/2002 12:00:00 PM	pH-Field	8.08	s.u.
11/4/2002 9:45:00 AM	pH-Field	8.02	s.u.
11/4/2002 11:00:00 AM	pH-Field	8.09	s.u.
11/5/2002 10:30:00 AM	pH-Field	8.01	s.u.
11/5/2002 2:30:00 PM	pH-Field	8.01	s.u.
11/5/2002 3:00:00 PM	pH-Field	8.05	s.u.
11/8/2002 8:45:00 AM	pH-Field	8.0	s.u.
12/2/2002 8:05:00 AM	pH-Field	8.09	s.u.
12/2/2002 9:15:00 AM	pH-Field	8.03	s.u.
12/2/2002 10:30:00 AM	pH-Field	8.04	s.u.
12/2/2002 12:20:00 PM	pH-Field	8.01	s.u.
12/2/2002 12:30:00 PM	pH-Field	8.06	s.u.
12/2/2002 1:30:00 PM	pH-Field	8.04	s.u.
12/2/2002 3:00:00 PM	pH-Field	8.06	s.u.
12/3/2002 10:00:00 AM	pH-Field	8.07	s.u.

Notes:
mg/L = milligrams per liter
NDEQ = Nebraska Department of Environmental Quality
s.u. = standard unit
Source: Ihrie 2013a

Table 2.9-16 NDEQ Water Quality Data for Niobrara River Above Box Butte Reservoir (SNI4NIOBR402) – 2002

Constituent	Unit	6/07/2022	7/08/2002	8/06/2002	9/03/2002	10/07/2002	11/04/2002	12/02/2002	RL
Major Ions									
Calcium, Dissolved	mg/L	ND	45.7	ND	ND	44.6	ND	ND	0.15
Chloride, Total	mg/L	4.01	3.90	4.09	4.05	4.44	4.88	4.97	0.15
Magnesium, Dissolved as Mg	mg/L	ND	7.65	ND	ND	7.79	ND	ND	0.15
Nitrogen, Total Ammonia as N	mg/L	0.059	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05
Nitrogen, Total (Nitrate + Nitrite as N)	mg/L	0.95	1.03	0.84	0.80	1.22	1.37	1.23	0.05
Nitrogen as N, Total Kjeldahl	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5
Phosphorus, Total	mg/L	0.059	<0.04	0.041	0.043	<0.04	0.046	<0.04	0.04
Sodium, Dissolved	mg/L	ND	23.2	ND	ND	23.3	ND	ND	0.15
Physical Properties									
Specific Conductance	µmhos/cm @25ºC	367	244	369	368	361	397	410	N/A
Alkalinity, Total	mg/L	176	162	170	172	169	184	193	N/A
Chemical Oxygen Demand (COD)	mg/L	<12	<12	<12	<12	<12	<12	12.5	12
Dissolved Oxygen, Field	mg/L	9.31	7.89	9.4	10.46	9.73	12.66	12.06	N/A
pH, Field	s.u.	8.34	7.5	8.11	8.22	8.29	8.48	8.17	N/A
Suspended Solids, Total (TSS)	mg/L	9.5	14	11.5	5.5	18.5	33	20	N/A
Temperature, Water (Field)	ºC	22.7	29	20.8	16.9	16.4	3.54	3.84	N/A
Turbidity, Lab	NTU	6.64	8.73	ND	ND	ND	ND	ND	N/A
Turbidity, Field	NTU	ND	ND	5.7	6.2	10.8	17	13.5	N/A
Metals									
Arsenic, Dissolved	ug/L	ND	<10	ND	ND	<10	ND	ND	10
Cadmium, Dissolved	µg/L	ND	<1	ND	ND	<1	ND	ND	1
Chromium, Dissolved	µg/L	ND	<10	ND	ND	<10	ND	ND	10
Copper	µg/L	ND	<10	ND	ND	<10	ND	ND	10
Lead, Dissolved	µg/L	ND	<5	ND	ND	<5	ND	ND	5
Mercury, Dissolved as Hg	µg/L	ND	<1	ND	ND	<1	ND	ND	1
Nickel, Dissolved	µg/L	ND	<10	ND	ND	<10	ND	ND	10
Selenium, Total	µg/L	ND	<5	ND	ND	<5	ND	ND	5
Silver, Dissolved	µg/L	ND	<1	ND	ND	<1	ND	ND	1

Table 2.9-16 NDEQ Water Quality Data for Niobrara River Above Box Butte Reservoir (SNI4NIOBR402) – 2002

Constituent	Unit	6/07/2022	7/08/2002	8/06/2002	9/03/2002	10/07/2002	11/04/2002	12/02/2002	RL
Zinc, Dissolved	µg/L	ND	ND	ND	ND	ND	ND	ND	10
Stream Flow									
Gage Height	inches	3.07	3.0	3.0	3.02	3.11	3.18	3.29	N/A
Stream Discharge	cfs	ND	ND	ND	ND	ND	ND	ND	N/A

Notes:
cfs = cubic feet per second
µg/L = micrograms per liter
mg/L = milligrams per Liter
NTU = Nephelometric Turbidity Units
s.u. = standard unit
umhos/cm = micromhos per centimeter
< = less than
NA = No data
N/A = not applicable
ND = not detected
NDEQ = Nebraska Department of Environmental Quality
RL = reporting limit
Source: Ihrie 2013a

Table 2.9-17 NDEQ Water Quality Data for Niobrara River Above Box Butte Reservoir (SNI4NIOBR402) - 2003

Constituent	Unit	Jan 13	Feb 1	Mar 7	Apr 8	May 5	Jun 9	Jul 7	Aug 5	Sept 8	Oct 6	Nov 3	Dec 1	RL
Major Ions														
Calcium, Dissolved	mg/L	58.2	ND	ND	54.7	ND	ND	46.3	ND	47.8	ND	ND	ND	0.15
Chloride, Total	mg/L	4.5	4.6	5.2	5.7	6.1	5.0	4.8	4.8	4.3	4.6	4.68	5.2	1.0
Magnesium, Dissolved	mg/L	9.18	ND	ND	10.3	ND	ND	7.99	ND	ND	8.28	ND	ND	0.15
Nitrogen, Total Ammonia as N	mg/L	<0.05	<0.05	0.08	0.05	0.05	<0.05	0.11	<0.05	0.05	<0.05	<0.05	<0.05	0.05
Nitrogen, Total (Nitrate + Nitrite as N)	mg/L	1.34	1.26	1.26	0.48	0.59	0.76	0.97	1.00	1.11	1.14	1.18	1.13	0.05
Nitrogen as N, Total Kjeldahl	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.05	0.53	0.56	<0.5	<0.5	<0.5	<0.5	0.5
Phosphorus, Total	mg/L	<0.04	0.06	0.04	0.04	<0.04	0.05	0.08	0.07	0.04	0.06	<0.04	<0.04	0.04
Sodium, Dissolved	mg/L	23.4	ND	ND	25.2	ND	ND	24.6	ND	ND	24.6	ND	ND	0.15
Physical Properties														
Specific Conductance	µmhos/cm @25°C	400	377	402	429	440	388	374	343	ND	384	383	420	N/A
Alkalinity	mg/L	207	180	199	212	ND	ND	ND	ND	ND	ND	ND	ND	N/A
Chemical Oxygen Demand (COD)	mg/L	<12	<12	<12	20.3	ND	ND	ND	ND	ND	ND	ND	ND	12
Dissolved Oxygen, Field	mg/L	12.19	11.52	11.69	9.72	9.57	8.65	8.27	8.06	ND	9.41	9.88	9.9	N/A
pH, Field	s.u.	8.2	7.76	8.17	8.36	8.37	8.45	8.1	8.2	ND	8.18	8.0	8.17	N/A
Suspended Solids, Total (TSS)	mg/L	9.0	23.5	13.0	18.5	20.0	12.5	35.0	36.0	12.0	22.5	5.0	8.0	N/A
Temperature, Water (Field)	°C	3.84	3.92	4.02	10.55	11.11	21.09	22.26	24.52	ND	10.49	4.17	3.76	N/A
Turbidity, Lab	NTU	ND	ND	ND	ND	ND	6.01	ND	ND	ND	ND	ND	ND	N/A
Turbidity, Field	NTU	0.2	16.1	6.6	10	12.4	10.5	24.8	41.9	ND	35.3	8.9	8.5	N/A
Metals, Dissolved														
Arsenic, Dissolved	µg/L	<10	ND	ND	<10	ND	ND	<10	ND	ND	<10	ND	ND	10
Cadmium, Dissolved	µg/L	<1	ND	ND	<1	ND	ND	<1	ND	ND	<1	ND	ND	1
Chromium, Dissolved	µg/L	<10	ND	ND	<10	ND	ND	<10	ND	ND	<10	ND	ND	10
Copper, Dissolved	µg/L	<10	ND	ND	<10	ND	ND	<10	ND	ND	<10	ND	ND	10
Lead, Dissolved	µg/L	<5	ND	ND	<5	ND	ND	<5	ND	ND	<5	ND	ND	5
Mercury, Dissolved as Hg	µg/L	<1	ND	ND	<1	ND	ND	<1	ND	ND	<1	ND	ND	1
Nickel, Dissolved	µg/L	<10	ND	ND	<10	ND	ND	<10	ND	ND	<10	ND	ND	10
Selenium, Total	µg/L	<5	ND	ND	<5	ND	ND	<5	ND	ND	<5	ND	ND	5
Silver, Dissolved	µg/L	<1	ND	ND	<1	ND	ND	<1	ND	ND	<1	ND	ND	1

Table 2.9-17 NDEQ Water Quality Data for Niobrara River Above Box Butte Reservoir (SNI4NIOBR402) - 2003

Constituent	Unit	Jan 13	Feb 1	Mar 7	Apr 8	May 5	Jun 9	Jul 7	Aug 5	Sept 8	Oct 6	Nov 3	Dec 1	RL
Zinc, Dissolved	µg/L	ND	ND	ND	ND	ND	ND	<10	ND	ND	<10	ND	ND	10
Stream Flow														
Gage Height	inches	3.25	3.35	3.3	3.49	3.33	ND	3.07	3.05	3.05	3.11	3.14	3.19	N/A
Stream Discharge	cfs	ND	27	23.3	39	25.5	13.6	10.3	9.04	9.44	11.8	13.6	16.3	N/A

Notes:
cfs = cubic feet per second
µg/L = micrograms per liter
mg/L = milligrams per Liter
NTU = Nephelometric Turbidity Units
s.u. = standard unit
µmhos/cm = micromhos per centimeter
< = less than
NA = No data
N/A = not applicable
ND = not detected
NDEQ = Nebraska Department of Environmental Quality
RL = reporting limit
Source: Ihrie 2013a

Table 2.9-18 NDEQ Water Quality Data for Niobrara River Above Box Butte Reservoir (SNI4NIOBR402) – 2004

Parameter	Unit	Jan 12	Feb 2	Feb 29	Apr 5	Apr 19	May 2	May 17	Jun 7	Jun 21	July 6	Jul 19	Reporting Limit
Major Ions													
Calcium, Dissolved	mg/L	51.3	ND	ND	55.6	ND	ND	ND	ND	ND	43.1	ND	0.15
Chloride, Total	mg/L	5.2	4.59	5.08	5.44	5.29	4.92	4.33	4.32	4.06	3.92	4.30	1
Magnesium, Dissolved as Mg	mg/L	9.3	ND	ND	11	ND	ND	ND	ND	ND	8.07	ND	0.15
Nitrogen, Total Ammonia as N	mg/L	<0.05	<0.05	<0.05	<0.05	0.060	<0.05	<0.05	1.05	<0.05	<0.05	<0.05	0.05
Nitrogen, Total (Nitrate + Nitrite as N)	mg/L	1.36	1.28	0.606	0.469	0.679	0.908	1.03	0.882	0.896	0.964	0.963	0.05
Nitrogen as N, Total Kjeldahl	mg/L	<0.5	<0.5	0.603	0.528	<0.5	0.635	<0.5	<0.5	<0.5	<0.5	<0.5	0.5
Phosphorus, Total	mg/L	<0.04	<0.04	0.073	0.045	<0.04	0.13	<0.04	<0.04	<0.04	0.053	<0.04	0.04
Sodium, Dissolved	mg/L	24.3	ND	ND	ND	ND	ND	ND	ND	ND	24.5	ND	0.15
Physical Properties													
Specific Conductance	µmhos/cm @25ºC	408	408	345	377	364	359	314	345	364	348	336	N/A
Alkalinity	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	N/A
Chemical Oxygen Demand (COD)	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	12
Dissolved Oxygen, Field	mg/L	9.32	8.64	6.1	9.09	9.55	8.98	9.15	8.93	9.48	8.39	8.22	N/A
pH, Field	s.u.	8.05	7.59	7.8	8.15	8.26	8.48	8.43	8.35	8.3	8.19	8.11	N/A
Suspended Solids, Total (TSS)	mg/L	10.5	8.5	33	11.5	5	<5	5.5	<5	<5	23	19	5
Temperature, Water (Field)	ºC	4.7	0.82	0.69	10.17	10.23	15.23	12.61	16.13	13.79	17	19.21	N/A
Turbidity, Lab	NTU	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	N/A
Turbidity, Field	NTU	5.6	11.5	41.7	10.4	4.3	3.8	3.2	8.5	85.4	21.4	20.9	N/A
Metals, Dissolved													
Arsenic, Dissolved	µg/L	<10	ND	ND	<10	ND	ND	ND	ND	ND	<10	ND	10
Cadmium, Dissolved	µg/L	<1	ND	ND	<1	ND	ND	ND	ND	ND	<1	ND	1
Chromium, Dissolved	µg/L	<10	ND	ND	<10	ND	ND	ND	ND	ND	<10	ND	10
Copper, Dissolved	µg/L	<10	ND	ND	<10	ND	ND	ND	ND	ND	<10	ND	10
Lead, Dissolved	µg/L	<5	ND	ND	<5	ND	ND	ND	ND	ND	<5	ND	5
Mercury, Dissolved as Hg	µg/L	<1	ND	ND	<1	ND	ND	ND	ND	ND	<1	ND	1
Nickel, Dissolved	µg/L	<10	ND	ND	<10	ND	ND	ND	ND	ND	<10	ND	10
Selenium, Total	µg/L	<5	ND	ND	<5	ND	ND	ND	ND	ND	<5	ND	5
Silver, Dissolved	µg/L	<1	ND	ND	<1	ND	ND	ND	ND	ND	<1	ND	1
Zinc, Dissolved	µg/L	<10	ND	ND	<10	ND	ND	ND	ND	ND	<10	ND	10
Stream Flow													
Gage Height	inches	ND	ND	3.5	3.38	3.27	3.22	ND	3.08	3.11	3.12	3.08	N/A
Stream Discharge	cfs	18.7	19.3	40	29.4	21.3	18.1	11.12	10.3	12.1	12.6	10.7	N/A

Table 2.9-18 NDEQ Water Quality Data for Niobrara River Above Box Butte Reservoir (SNI4NIOBR402) – 2004

Parameter	Concentration	Aug 1	Aug 16	Sept 6	Sept 20	Oct 4	Nov 2	Dec 6	Reporting Limit
Major Ions	Suspended								
Calcium, Dissolved	mg/L	ND	ND	ND	ND	53	ND	ND	0.15
Chloride, Total	mg/L	4.24	4.64	6.52	5.25	4.82	5.34	5.13	1
Magnesium, Dissolved as Mg	mg/L	ND	ND	ND	ND	8.86	ND	ND	0.15
Nitrogen, Total Ammonia as N	mg/L	<0.05	<0.05	0.054	<0.05	0.070	<0.05	0.212	0.05
Nitrogen, Total (Nitrate + Nitrite as N)	mg/L	0.962	0.927	0.920	0.837	0.790	0.896	1.10	0.05
Nitrogen as N, Total Kjeldahl	mg/L	0.678	0.770	1.13	<0.5	<0.5	<0.5	<0.5	0.5
Phosphorus, Total	mg/L	0.061	0.074	0.119	<0.04	<0.04	<0.04	<0.04	0.04
Sodium, Dissolved	mg/L	ND	ND	ND	ND	25	ND	ND	0.15
Physical Properties									
Specific Conductance	µmhos/cm @25ºC	331	356	382	387	357	383	421	N/A
Alkalinity	mg/L	ND	ND	ND	ND	ND	ND	ND	N/A
Chemical Oxygen Demand (COD)	mg/L	ND	ND	ND	ND	ND	ND	ND	12
Dissolved Oxygen, Field	mg/L	7.17	8.42	8.83	8.14	9.27	10.22	10.55	N/A
pH, Field	s.u.	8.18	7.96	7.09	7.17	8.03	8.05	7.77	N/A
Suspended Solids, Total (TSS)	mg/L	25	36	61.5	20	25.5	9	6.5	5
Temperature, Water (Field)	ºC	26.45	16.45	14.98	16.46	10.21	3.96	1.67	N/A
Turbidity, Lab	NTU	ND	ND	ND	ND	ND	ND	4.23	N/A
Turbidity, Field	NTU	17.7	207	94.1	14.8	23.3	15.2	ND	N/A
Metals, Dissolved									
Arsenic, Dissolved	µg/L	ND	ND	ND	ND	<10	ND	ND	10
Cadmium, Dissolved	µg/L	ND	ND	ND	ND	<`1	ND	ND	1
Chromium, Dissolved	µg/L	ND	ND	ND	ND	<10	ND	ND	10
Copper, Dissolved	µg/L	ND	ND	ND	ND	<10	ND	ND	10
Lead, Dissolved	µg/L	ND	ND	ND	ND	<5	ND	ND	5
Mercury, Dissolved as Hg	µg/L	ND	ND	ND	ND	<1	ND	ND	1
Nickel, Dissolved	µg/L	ND	ND	ND	ND	<10	ND	ND	10
Selenium, Total	µg/L	ND	ND	ND	ND	<5	ND	ND	5
Silver, Dissolved	µg/L	ND	ND	ND	ND	<1	ND	ND	1
Zinc, Dissolved	µg/L	ND	ND	ND	ND	<10	ND	ND	10
Stream Flow									
Gage Height	inches	3.05	3.12	3.22	3.18	3.21	3.22	3.23	N/A
Stream Discharge	cfs	9.44	12.6	18.1	15.8	17.5	16.9	18.7	N/A

Notes:
cfs = cubic feet per second
µg/L = micrograms per liter
mg/L = milligrams per Liter
NTU = Nephelometric Turbidity Units
s.u. = standard unit
umhos/cm = micromhos per centimeter
< = less than
NA = No data
N/A = not applicable
ND = not detected
NDEQ = Nebraska Department of Environmental Quality
Source: Ihrie 2013a

Table 2.9-19 NDEQ Water Quality Data for Niobrara River Above Box Butte Reservoir (SNI4NIOBR402) – 2005

Parameter	Concentration	Jan 10	Feb 7	Mar 7	Apr 4	Apr 18	May 1	May 16	Jun 6	Jun 20	July 11	Jul 25	Reporting Limit
Major Ions	Suspended												
Calcium	mg/L	49.8	ND	ND	52.3	ND	ND	ND	ND	ND	50.4	ND	0.15
Chloride, Total	mg/L	4.76	4.44	4.69	5.24	5.1	6.4	4.94	5.22	7.21	5.46	4.58	1
Magnesium, Dissolved as Mg	mg/L	9.14	ND	ND	10.7	ND	ND	ND	ND	ND	9.7	ND	0.15
Nitrogen, Total Ammonia as N	mg/L	<0.05	0.064	<0.05	<0.05	<0.05	0.173	<0.05	<0.05	0.089	<0.05	<0.05	0.05
Nitrogen, Total (Nitrate + Nitrite as N)	mg/L	1.279	0.670	0.431	0.393	0.427	0.330	0.297	0.323	0.194	0.658	0.917	0.05
Nitrogen as N, Total Kjeldahl	mg/L	<0.5	<0.5	<0.5	<0.5	0.637	0.680	0.672	0.804	1.102	0.598	<0.5	0.5
Phosphorus, Total as P	mg/L	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.047	0.054	0.708	<0.04	<0.04	0.04
Sodium, Dissolved	mg/L	23.8	ND	ND	26.1	ND	ND	ND	ND	ND	24.4		
Physical Properties													
Dissolved Oxygen, Field	mg/L	9.39	8.93	7.37	7.28	5.39	5.1	9.13	9.17	8.42	8.35	7.64	N/A
pH, Field	s.u.	7.81	7.84	7.5	8.12	8.21	8.26	8.24	8.06	8.33	8.14	7.94	N/A
Total Suspended Solids (TSS)	mg/L	7.0	10.5	8	5	<5	5	12.5	21	19.5	24	20	5
Specific Conductance, Field	µmhos/cm @25ºC	360	381	404	416	428	470	432	454	347	340	368	N/A
Temperature, Field (Celsius)	ºC	2.01	0.24	4.41	9.39	13.28	9.43	14.86	16.87	18.92	21.25	21.25	N/A
Turbidity, Lab	NTU	ND	ND	14.8	ND	ND	ND	ND	ND	ND	ND	ND	N/A
Turbidity, Field	NTU	8	59.4	14.8	2.3	2.7	2.5	7.7	11.8	7.8	17.1	18.3	N/A
Metals, Dissolved													
Arsenic	µg/L	<10	ND	ND	<10	ND	ND	ND	ND	ND	<10	ND	10
Cadmium	µg/L	<1	ND	ND	<1	ND	ND	ND	ND	ND	<1	ND	1
Chromium	µg/L	<10	ND	ND	<10	ND	ND	ND	ND	ND	<10	ND	10
Copper	µg/L	<10	ND	ND	<10	ND	ND	ND	ND	ND	<10	ND	10
Lead	µg/L	<5	ND	ND	<5	ND	ND	ND	ND	ND	<5	ND	5
Mercury	µg/L	<l	ND	ND	<1	ND	ND	ND	ND	ND	<1	ND	1
Nickel	µg/L	<10	ND	ND	<10	ND	ND	ND	ND	ND	<10	ND	10
Mercury	µg/L	<1	ND	ND	<1	ND	ND	ND	ND	ND	<1	ND	1
Selenium	µg/L	<5	ND	ND	<5	ND	ND	ND	ND	ND	<5	ND	5
Silver	Ug/L	<1	ND	ND	<1	ND	ND	ND	ND	ND	<1	ND	1
Zinc	µg/L	<10	ND	ND	<10	ND	ND	ND	ND	ND	<10	ND	10
Stream Flow													
Gage height	inches	3.2	3.37	3.51	3.79	3.69	3.97	3.78	3.73	ND	ND	3.1	N/A
Stream discharge	cfs	16.9	28.6	40.6	58.6	50.9	68.1	56.2	53.2	0.351	16.3	11.6	N/A

Table 2.9-19 NDEQ Water Quality Data for Niobrara River Above Box Butte Reservoir (SNI4NIOBR402) – 2005

Parameter	Concentration	Aug 8	Aug 22	Sept 11	Sept 26	Oct 11	Nov 07	Dec 5	Reporting Limit
Major Ions	Suspended								
Calcium	mg/L	ND	ND	ND	ND	49.3	ND	ND	0.15
Chloride, Total	mg/L	4.30	5.28	5.26	4.91	6.79	4.49	4.95	1
Magnesium, Dissolved as Mg	mg/L	ND	ND	ND	ND	9.17	ND	ND	0.15
Nitrogen, Total Ammonia as N	mg/L	0.071	<0.05	<0.05	0.075	0.102	0.078	0.058	0.05
Nitrogen, Total (Nitrate + Nitrite as N)	mg/L	0.961	0.560	0.785	0.976	0.925	0.907	1.266	0.05
Nitrogen as N, Total Kjeldahl	mg/L	<0.5	1.206	<0.5	<0.5	<0.5	1.130	<0.5	0.5
Phosphorus, Total as P	mg/L	<0.04	0.047	0.050	0.048	<0.04	0.052	<0.04	0.04
Sodium, Dissolved	mg/L	ND	ND	ND	ND	26.2	ND	ND	5
Physical Properties									
Dissolved Oxygen, Field	mg/L	7.98	7.9	8	9.1	9.32	10.15	10.57	N/A
pH, Field	s.u.	8.19	8.18	8	8.08	8.1	8.05	8.27	N/A
Total Suspended Solids, TSS	mg/L	21	40.5	30.5	27.5	21	17	6	5
Specific Conductance, Field	µmhos/cm @25ºC	367	409	353	389	413	402	418	N/A
Temperature, Field (Celsius),	ºC	18.41	17.97	22.47	10.16	9.04	6.35	-0.25	N/A
Turbidity, Lab	NTU	ND	ND	43.9	ND	ND	ND	ND	N/A
Turbidity, Field	NTU	15.5	24.6	26.1	28.8	19.4	15.5	11.4	N/A
Metals, Dissolved									
Arsenic	µg/L	ND	ND	ND	ND	<10	ND	ND	10
Cadmium	µg/L	ND	ND	ND	ND	<1	ND	ND	1
Chromium	µg/L	ND	ND	ND	ND	<10	ND	ND	10
Copper	µg/L	ND	ND	ND	ND	<10	ND	ND	10
Lead	µg/L	ND	ND	ND	ND	<5	ND	ND	5
Mercury	µg/L	ND	ND	ND	ND	<1	ND	ND	1
Nickel	µg/L	ND	ND	ND	ND	<10	ND	ND	10
Selenium	µg/L	ND	ND	ND	ND	<5	ND	ND	5
Silver	Ug/L	ND	ND	ND	ND	<1	ND	ND	1
Zinc	µg/L	ND	ND	ND	ND	<10	ND	ND	10
Stream Flow									
Gage height	inches	3.1	3.2	3.2	3.21	3.27	3.27	4.0	N/A
Stream discharge	cfs	11.6	16.9	16.9	17.5	21.3	21	70	N/A

Notes:
cfs = cubic feet per second
µg/L = micrograms per liter
mg/L = milligrams per Liter
NTU = Nephelometric Turbidity Units
s.u. = standard unit
umhos/cm = micromhos per centimeter
< = less than
NA = No data
N/A = not applicable
ND = not detected
NDEQ = Nebraska Department of Environmental Quality
Source: Ihrie 2013a

Table 2.9-20 NDEQ Water Quality Data for Niobrara River Above Box Butte Reservoir (SNI4NIOBR402) – 2006

Parameter	Unit	Jan 9	Feb 6	Mar 8	Apr 3	Apr 17	May 1	May 15	Jun 5	Jun 20	July 10	Aug 8	Reporting Limit
Major Ions, Suspended													
Calcium	mg/L	50.5	ND	ND	56.3	ND	ND	ND	ND	ND	44.8	ND	1
Chloride, Total	mg/L	4.90	4.50	14.83	6.31	5.17	5.30	3.61	3.75	3.42	4.09	4.14	1
Magnesium, Dissolved as Mg	mg/L	9.3	ND	ND	11.3	ND	ND	ND	ND	ND	8.09	ND	0.15
Nitrogen, Total Ammonia as N	mg/L	<0.05	<0.05	0.065	0.195	0.053	0.091	<0.05	0.154	0.071	<0.05	0.058	0.05
Nitrogen, Total (Nitrate + Nitrite as N)	mg/L	1.005	1.063	0.379	0.257	0.301	0.165	0.468	0.544	1.012	0.997	1.012	0.05
Nitrogen as N, Total Kjeldahl	mg/L	<0.50	<0.50	<0.50	0.581	0.652	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.5
Phosphorus, Total as P	mg/L	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.05	0.045	0.04
Sodium, Dissolved	mg/L	24.4	ND	ND	34.3	ND	ND	ND	ND	ND	23.27	ND	5
Physical Properties													
Dissolved Oxygen, Field	mg/L	10.3	11.0	8.9	8.71	7.49	8.88	7.69	6.86	6.09	5.37	4.78	N/A
pH, Field	s.u.	7.48	7.94	8.01	7.83	8.05	8.08	8.18	8.24	8.39	7.98	8.22	N/A
Total Suspended Solids, TSS	mg/L	5	6	9	9.0	12.0	8.5	15.5	10.0	20.0	28.5	32.5	5
Specific Conductance, Field	µmhos/cm @ 25ºC	359	361	394	407	439	423	405	360	345	329	362	N/A
Temperature, Field (Celsius)	°C	1.47	1.68	5.75	7	13.66	12.96	13.7	16.62	17.47	16.36	19.51	N/A
Turbidity, Field	NTU	6	14.2	7.7	6.3	6.8	5.3	ND	18.1	30	41.2	35.1	N/A
Turbidity, Lab	NTU	ND	ND	ND	ND	ND	ND	10.1	ND	ND	ND	ND	N/A
Metals, Dissolved													
Arsenic	µg/L	<10	ND	ND	<10	ND	ND	ND	ND	ND	<10	ND	10
Cadmium	µg/L	<1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Chromium	µg/L	<10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
Copper	µg/L	<10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
Lead	µg/L	<5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5
Mercury	µg/L	<1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Mercury	µg/L	<1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Nickel	µg/L	<10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
Selenium	µg/L	<5	ND	ND	<5	ND	ND	ND	ND	ND	<5	ND	5
Silver	µg/L	<1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Zinc	µg/L	<10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
Stream Flow													
Gage Height	inches	4.21	3.94	4.31	4.34	4.11	4.12	3.68	3.23	3.15	3.13	3.09	N/A
Stream discharge	cfs	85	66.2	92.5	94.8	ND	77.7	50.3	18.7	14.1	0.3	11.2	N/A

Table 2.9-20 NDEQ Water Quality Data for Niobrara River Above Box Butte Reservoir (SNI4NIOBR402) – 2006

Parameter	Unit	Aug 21	Sept 11	Sept 25	Oct 2	Nov 6	Dec 4	Reporting Limit
Major Ions, Suspended								
Calcium	mg/L	ND	ND	ND	47.5	ND	ND	0.15
Chloride	mg/L	4.25	4.49	3.84	4.09	4.41	5.14	1
Magnesium, Dissolved as Mg	mg/L	ND	ND	ND	8.2	ND	ND	0.15
Nitrogen, Total Ammonia as N	mg/L	0.050	0.064	0.081	<0.05	0.099	<0.05	0.05
Nitrogen, Total (Nitrate + Nitrite as N) (mg/L)	mg/L	1.130	1.153	1.30	1.220	1.166	1.376	0.05
Nitrogen as N, Total Kjeldahl	mg/L	<0.50	0.664	<0.50	0.86	<0.50	<0.50	0.5
Phosphorus, Total as P	mg/L	<0.04	0.092	<0.04	<0.04	<0.04	<0.04	0.04
Sodium, Dissolved	mg/L	ND	ND	ND	24.05	ND	ND	5
Physical Properties								
Dissolved Oxygen	mg/L	8.1	8.62	9.36	8.61	9.69	11.18	N/A
pH	s.u.	7.83	7.93	7.82	7.88	7.87	7.96	N/A
Total Suspended Solids, TSS	mg/L	30.5	25	31.5	32.5	31	7.0	5
Specific Conductance	µmhos/cm @ 25ºC	357	340	363	355	390	404	N/A
Temperature, Celsius	ºC	16.27	13.51	10.04	11.37	5.06	1.16	N/A
Turbidity, Field	NTU	27.2	28.5	30	25.9	28.5	24.8	N/A
Turbidity, Lab	NTU	ND	ND	ND	ND	ND	ND	
Metals, Dissolved								
Arsenic	µg/L	ND	ND	ND	<1	ND	ND	10
Cadmium	µg/L	ND	ND	ND	ND	ND	ND	1
Chromium	µg/L	ND	ND	ND	ND	ND	ND	10
Copper	µg/L	ND	ND	ND	ND	ND	ND	10
Lead	µg/L	ND	ND	ND	ND	ND	ND	5
Mercury	µg/L	ND	ND	ND	ND	ND	ND	1
Nickel	µg/L	ND	ND	ND	ND	ND	ND	10
Mercury	µg/L	ND	ND	ND	ND	ND	ND	1
Selenium	µg/L	ND	ND	ND	<5	ND	ND	5
Silver	µg/L	ND	ND	ND	ND	ND	ND	1
Zinc	µg/L	ND	ND	ND	ND	ND	ND	10
Stream Flow								
Gage Height	inches	3.1	3.14	3.14	3.11	3.22	3.24	N/A
Stream discharge	cfs	11.6	13.6	13.6	12.1	18.1	19.3	N/A

Notes:
cfs = cubic feet per second
µg/L = micrograms per liter
mg/L = milligrams per Liter
NTU = Nephelometric Turbidity Units
s.u. = standard unit
µmhos/cm = micromhos per centimeter
< = less than
NA = No data
N/A = not applicable
ND = not detected
NDEQ = Nebraska Department of Environmental Quality
Source: Ihrie 2013a

Table 2.9-21 NDEQ Water Quality Data for Niobrara River Above Box Butte Reservoir (SNI4NIOBR402) – 2007

Parameter	Concentration	Jan 8	Feb 5	Mar 5	Apr 2	Apr 16	May 7	May 21	Jun 4	Jun 11	Jul 9	Reporting Limit
Major Ions, Suspended												
Calcium	mg/L	55.17	ND	ND	53.61	ND	ND	ND	ND	ND	ND	0.15
Chloride, Total	mg/L	4.98	ND	4.79	5.95	5.13	4.80	4.26	4.10	3.77	4.64	1
Magnesium, Dissolved as Mg	mg/L	9.51	ND	ND	10.63	ND	ND	ND	ND	ND	ND	0.15
Nitrogen, Total Ammonia as N	mg/L	0.10	<0.05	<0.05	0.05	<0.05	0.07	ND	<0.05	0.05	0.06	0.05
Nitrogen, Total (Nitrate + Nitrite as N)	mg/L	1.37	1.58	0.85	0.23	0.36	0.46	0.56	0.80	0.84	0.67	0.05
Nitrogen as N, Total Kjeldahl	mg/L	<0.5	<0.5	<0.5	<0.5	0.534	0.508	<0.5	<0.5	<0.5	0.77	0.5
Phosphorus, Total as P	mg/L	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.050	0.217	<0.04	0.057	0.04
Sodium, Dissolved	mg/L	25.44	ND	ND	28.34	ND	ND	ND	ND	ND	ND	0.15
Physical Properties												
Dissolved Oxygen, Field	mg/L	9.8	9.5	9.6	9.6	9.1	ND	7.1	8.1	8.2	6.2	N/A
pH, Field	s.u.	7.73	7.3	7.2	7.75	7.95	ND	9.92	7.81	8.14	7.61	N/A
Total Suspended Solids, TSS	mg/L	<5	<5	<5	<5	<5	<5	<5	5	<5	25.5	5
Specific Conductance	µmhos/cm @ 25ºC	385	372	338	416	419	ND	362	374	371	368	N/A
Temperature, Water (Field)	ºC	1.5	0.2	1.0	8.6	9.5	ND	15.1	14.4	17.2	18.9	N/A
Turbidity, Field	NTU	8.2	23.5	29.9	0.9	14.3	ND	37.8	14.6	25.3	63.3	N/A
Metals, Dissolved												
Arsenic	µg/L	<10	ND	ND	<10	ND	ND	ND	ND	ND	ND	10
Cadmium	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Chromium	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
Copper	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
Lead	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5
Mercury	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Nickel	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
Selenium	µg/L	<5	ND	ND	<5	ND	ND	ND	ND	ND	ND	5
Zinc	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
Stream Flow												
Gage Height		3.88	4.63	5.25	5.56	4.49	ND	4.86	4.09	4.85	3.98	N/A
Stream Discharge		62.4	117.8	172.1	201.6	194.8	ND	137.1	76.3	136.3	68.7	N/A

Table 2.9-21 NDEQ Water Quality Data for Niobrara River Above Box Butte Reservoir (SNI4NIOBR402) – 2007

Parameter	Concentration	Jul 23	Aug 6	Aug 20	Sept 10	Sept 24	Oct 1	Nov 5	Dec 3	Reporting Limit
Major Ions, Suspended										
Calcium	mg/L	ND	48.84	ND	ND	ND	45.21	ND	ND	0.15
Chloride	mg/L	3.65	3.92	4.03	3.81	3.63	3.83	4.22	4.21	1
Magnesium, Dissolved as Mg	mg/L	ND	8.35	ND	ND	ND	7.94	ND	ND	0.15
Nitrogen, Total Ammonia as N	mg/L	0.23	<0.05	<0.05	<0.05	<0.05	<0.05	0.12	<0.05	0.05
Nitrogen, Total (Nitrate + Nitrite as N)	mg/L	0.88	0.93	0.96	1.12	1.08	1.12	1.21	1.38	0.05
Nitrogen as N, Total Kjeldahl	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5
Phosphorus, Total as P	mg/L	<0.04	<0.04	0.056	<0.04	0.053	<0.04	<0.04	<0.04	0.04
Sodium, Dissolved	mg/L	23.87	ND	ND	ND	ND	22.32	ND	ND	0.15
Physical Properties										
Dissolved Oxygen, Field	mg/L	6.6	7.0	7.3	8.5	7.9	9.0	8.3	8.5	N/A
pH, Field	s.u.	7.74	7.76	7.84	7.38	7.66	7.38	7.36	7.63	N/A
Total Suspended Solids, TSS	mg/L	33.0	26.5	25.5	18.0	24.0	18.5	13.5	9.0	5
Specific Conductance	µmhos/cm @ 25ºC	369	364	356	356	342	341	340	349	N/A
Temperature, Water (Field)	ºC	19.7	19.6	18.4	11.6	12.9	10.6	5.5	2.0	N/A
Turbidity, Field	NTU	37.5	22.9	15.7	21.7	42.1	30.9	28.6	--	N/A
Metals, Dissolved										
Arsenic	µg/L	<10	ND	<10	ND	ND	<10	ND	ND	10
Cadmium	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	1
Chromium	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	10
Copper	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	10
Lead	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	5
Mercury	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	1
Nickel	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	10
Selenium	µg/L	<5	ND	<5	ND	ND	<5	ND	ND	5
Zinc	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	10
Stream Flow										
Gage Height	inches	3.68	3.53	3.72	3.09	3.00	3.04	3.04	10.7	N/A
Stream Discharge	cfs	50.3	41.7	37.2	11.2	7.5	9.0	9.0	10.7	N/A

Notes:
cfs = cubic feet per second
µg/L = micrograms per liter
mg/L = milligrams per Liter
NTU = Nephelometric Turbidity Units
s.u. = standard unit
µmhos/cm = micromhos per centimeter
< = less than
NA = No data
N/A = not applicable
ND = not detected
NDEQ – Nebraska Department of Environmental Quality
Source: Ihrie 2013a

Table 2.9-22 NDEQ Water Quality Data for Niobrara River Above Box Butte Reservoir – 2008

Parameter	Concentration	Jan 7	Feb 4	Mar 3	Apr 7	May 5	May 12	May 19	May 27	Jun 2	Jun 9	Reporting Limit
Major Ions, Suspended												
Calcium	mg/L	42.82	ND	ND	52.23	ND	ND	ND	ND	ND	ND	0.15
Chloride, Total	mg/L	4.47	3.95	5.01	5.12	4.81	6.59	4.81	4.41	6.33	4.54	1
Magnesium, Dissolved as Mg	mg/L	8.33	ND	ND	10.39	ND	ND	ND	ND	ND	ND	0.15
Nitrogen, Total Ammonia as N	mg/L	0.09	0.14	0.07	<0.05	0.08	<0.05	0.08	<0.05	0.06	<0.05	0.05
Nitrogen, Total (Nitrate + Nitrite as N)	mg/L	1.34	1.4	0.64	0.31	0.72	0.3	0.44	0.53	0.51	0.36	0.05
Nitrogen as N, Total Kjeldahl	mg/L	<0.5	<0.5	0.77	0.53	<0.5	0.8	0.69	0.53	0.97	0.69	0.5
Phosphorus, Total as P	mg/L	<0.04	<0.04	0.06	0.04	<0.04	0.05	0.06	<0.04	0.06	0.06	0.04
Sodium, Dissolved	mg/L	24.56	ND	ND	26.53	ND	ND	ND	ND	ND	ND	0.15
Physical Properties												
Dissolved Oxygen, Field	mg/L	11.43	11.23	11.71	9.63	9.39	9.38	8.44	9.78	8.25	9.38	N/A
pH, Field	s.u.	8.58	8.46	8.42	7.88	8.15	8.26	8.12	8.07	8.13	8.38	N/A
Total Suspended Solids, TSS	mg/L	17	6	37.5	16	6.5	27.5	22	14	38	14.5	5
Specific Conductance	µmhos/cm @ 25ºC	396	328	334	395	356	410	100	374	471	464	N/A
Temperature, Water (Field)	ºC	1.52	1.64	2.32	5	10.5	11.97	15.14	10.3	14.8	14.47	N/A
Turbidity, Field	NTU	ND	ND	ND	ND	13.6	10.6	9.2	11.3	27.7	13.2	N/A
Metals, Dissolved												
Arsenic	µg/L	<10	ND	ND	<10	ND	ND	ND	ND	ND	ND	10
Cadmium	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Chromium	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
Copper	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
Lead	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5
Mercury	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Nickel	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
Selenium	µg/L	<5	ND	ND	<5	ND	ND	ND	ND	ND	ND	5
Zinc	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
Stream Flow												
Gage Height	inches	3.12	3.09	3.51	3.53	3.28	3.36	3.19	3.22	3.20	3.2	N/A
Stream Discharge	cfs	12.6	11.2	40.6	41.7	78.2	27.8	16.3	18.1	16.9	16.9	N/A

Table 2.9-22 NDEQ Water Quality Data for Niobrara River Above Box Butte Reservoir – 2008

Parameter	Concentration	Jun 16	Jun 23	Jun 30	Jul 7	Jul 14	Jul 21	Jul 28	Aug 4	Aug 11	Aug 18	Reporting Limit
Major Ions, Suspended												
Calcium	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.15
Chloride, Total	mg/L	4.15	4.52	4.08	4.3	ND	ND	ND	ND	3.46	3.58	1
Magnesium, Dissolved as Mg	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.15
Nitrogen, Total Ammonia as N	mg/L	0.09	0.07	<0.05	<0.05	<0.05	ND	ND	ND	<0.05	0.05	0.05
Nitrogen, Total (Nitrate + Nitrite as N)	mg/L	0.54	0.3	0.59	0.7	0.82	ND	ND	ND	ND	0.91	0.05
Nitrogen as N, Total Kjeldahl	mg/L	0.64	1.41	0.55	0.62	<0.5	ND	ND	ND	0.62	<0.5	0.5
Phosphorus, Total as P	mg/L	0.07	0.17	0.04	0.05	<0.04	ND	ND	ND	0.05	<0.04	0.04
Sodium, Dissolved	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.15
Physical Properties												
Dissolved Oxygen, Field	mg/L	8.91	8.53	8.45	8.10	8.23	7.71	7.69	7.84	8.14	8.50	N/A
pH, Field	s.u.	8.11	8.21	8.36	8.07	8.14	8.19	7.99	8.19	7.92	8.07	N/A
Total Suspended Solids, TSS	mg/L	30.5	177	38	45	26	ND	ND	ND	ND	41.5	5
Specific Conductance	µmhos/cm @ 25ºC	539	503	489	393	391	378	458	456	490	502	N/A
Temperature, Water (Field)	ºC	14.47	19.0	16.82	18.21	16.68	18.56	18.6	18.2	18.1	15.5	N/A
Turbidity, Lab, Field	NTU	13.3	117	83.8	39.6	48.2	34	34.5	39.7	32.7	28.7	N/A
Metals, Dissolved												
Arsenic	µg/L	ND	ND	<10	ND	ND	ND	ND	ND	ND	ND	10
Cadmium	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Chromium	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
Copper	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
Lead	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5
Mercury	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Nickel	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
Selenium	µg/L	ND	ND	<5	ND	ND	<5	ND	ND	ND	ND	5
Zinc	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
Stream Flow												
Gage Height	inches	3.11	3.14	3.11	3.11	2.99	3.1	3.05	2.87	2.77	2.81	N/A
Stream Discharge	cfs	12.1	13.6	12.1	12.1	7.24	11.6	9.44	4.42	2.54	3.24	N/A

Table 2.9-22 NDEQ Water Quality Data for Niobrara River Above Box Butte Reservoir – 2008

Parameter	Concentration	Aug 25	Sept 1	Sept 8	Sept 15	Sept 22	Sept 29	Oct 6	Nov 3	Dec 01	Reporting Limit
Major Ions, Suspended											
Calcium	mg/L	ND	ND	ND	ND	ND	ND	44.43	ND	ND	0.15
Chloride	mg/L	4.31	4.32	5.19	4.75	ND	4.96	4.64	4.67	5.32	1
Magnesium, Dissolved as Mg	mg/L	ND	ND	ND	ND	ND	ND	7.91	ND	ND	0.15
Nitrogen, Total Ammonia as N	mg/L	<0.05	0.08	<0.05	<0.05	ND	0.05	0.07	0.13	<0.05	0.05
Nitrogen, Total (Nitrate + Nitrite as N)	mg/L	1.04	1.25	0.91	0.89	ND	0.98	1.01	1.06	1.01	0.05
Nitrogen as N, Total Kjeldahl	mg/L	<0.5	<0.5	<0.5	<0.5	ND	<0.5	<0.5	<0.5	<0.5	0.5
Phosphorus, Total as P	mg/L	0.04	0.04	<0.04	0.04	ND	0.04	0.13	0.06	<0.04	0.04
Sodium, Dissolved	mg/L	ND	ND	ND	ND	ND	ND	23.87	ND	ND	0.15
Physical Properties											
Dissolved Oxygen, Field	mg/L	8.34	8.32	9.03	9.12	ND	9.17	8.92	6.29	ND	N/A
pH, Field	s.u.	7.79	8.14	8.17	8.37	ND	7.98	8.15	8.11	8.01	N/A
Total Suspended Solids, TSS	mg/L	35	14.5	23.5	15.5	ND	21.5	15.5	10	5.5	5
Specific Conductance	Umhos/cm @ 25ºC	349	343	348	366	ND	363	352	359	374	N/A
Temperature, Water (Field)	ºC	17.79	15.7	10.4	11	ND	10.5	12.2	8.7	1.48	N/A
Turbidity, Field	NTU	21.6	19	20.6	15.5	ND	35.4	122	9.5	5.3	N/A
Metals, Dissolved											
Arsenic	µg/L	ND	ND	ND	ND	ND	ND	5.41	ND	ND	10
Cadmium	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Chromium	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
Copper	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
Lead	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	5
Mercury	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Nickel	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
Selenium	µg/L	ND	ND	ND	ND	ND	ND	<5	ND	ND	5
Zinc	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
Stream Flow											
Gage Height	inches	2.76	3.49	3.78	3.5	ND	3.58	3.08	3.12	3.19	N/A
Stream Discharge	cfs	2.38	39	56.2	40	ND	41.7	10.7	14.7	16.3	N/A

Notes:
cfs = cubic feet per second
µg/L = micrograms per liter
mg/L = milligrams per Liter
NTU = Nephelometric Turbidity Units
s.u. = standard unit
umhos/cm = micromhos per centimeter
< = less than
ND = No data
N/A = not applicable
ND = not detected
NDEQ = Nebraska Department of Environmental Quality
Source: Ihrie 2013a

Table 2.9-23 NDEQ Water Quality Data for the Niobrara River Above Box Butte Reservoir – 2009

Parameter	Unit	Jan 5	Feb 2	Mar 2	Apr 6	Apr 7	May 4	Jun 2	RL
Major Ions, Suspended									
Calcium	mg/L	48.96	ND	ND	ND	46.68	ND	ND	0.15
Chloride, Total	mg/L	4.56	4.30	4.41	ND	6.34	5.96	4.21	1
Magnesium, Dissolved	mg/L	8.60	ND	ND	ND	11.54	ND	ND	0.15
Nitrogen, Total Ammonia as N	mg/L	<0.05	0.08	<0.05	ND	<0.05	<0.05	<0.05	0.05
Nitrogen, Total (Nitrate + Nitrite as N)	mg/L	1.50	1.05	0.44	ND	0.41	0.16	0.39	0.05
Nitrogen as N, Total Kjeldahl	mg/L	<0.5	<0.5	<0.5	ND	0.83	0.63	<0.5	0.5
Phosphorus, Total as P	mg/L	<0.04	<0.04	0.04	ND	<0.04	0.05	0.26	0.04
Sodium, Dissolved	mg/L	25.71	ND	ND	ND	40.55	ND	ND	ND
Physical Properties									
Dissolved Oxygen, Field	mg/L	ND	ND	6.85	3.34	ND	5.40	ND	N/A
pH, Field	s.u.	7.81	8.02	8.01	8.09	ND	ND	8.87	N/A
Total Suspended Solids, TSS	mg/L	8.5	8	<5	ND	18.5	<5	14.5	5
Specific Conductance	µmhos/cm @ 25°C	395	371	378	428	ND	465	409	N/A
Temperature, Water (Field)	°C	−0.22	0.44	3.01	−0.24	ND	9.68	13.65	N/A
Turbidity, Field	NTU	4.2	36.8	6.1	60	ND	2.7	10.6	N/A
Metals, Dissolved									
Arsenic	µg/L	5.69	ND	ND	ND	<10	ND	ND	10
Cadmium	µg/L	ND	ND	ND	ND	ND	ND	ND	1
Chromium	µg/L	ND	ND	ND	ND	ND	ND	ND	10
Copper	µg/L	ND	ND	ND	ND	ND	ND	ND	10
Lead	µg/L	ND	ND	ND	ND	ND	ND	ND	5
Mercury	µg/L	ND	ND	ND	ND	ND	ND	ND	1
Nickel	µg/L	ND	ND	ND	ND	ND	ND	ND	10
Selenium	µg/L	<5	ND	ND	ND	ND	ND	ND	5
Zinc	µg/L	ND	ND	ND	ND	ND	ND	ND	10
Stream Flow									
Gage Height	inches	4.03	3.29	3.57	ND	ND	4.04	3.65	N/A
Stream Discharge	cfs	72.1	22.6	43.9	ND	ND	72.8	48.5	N/A

Table 2.9-23 NDEQ Water Quality Data for the Niobrara River Above Box Butte Reservoir – 2009

Parameter	Concentration	Jul 21	Aug 10	Sept 8	Oct 5	Nov 2	Nov 3	Dec 7	Reporting Limit
Major Ions, Suspended									
Calcium	mg/L	53.07	ND	ND	ND	ND	ND	ND	0.15
Chloride, Total	mg/L	3.99	4.13	4.92	6.10	ND	7.35	5.57	1
Magnesium, Dissolved	mg/L	11.27	ND	ND	ND	ND	ND	ND	0.15
Nitrogen, Total Ammonia as N	mg/L	0.08	<0.05	<0.05	<0.05	ND	<0.05	<0.05	0.05
Nitrogen, Total (Nitrate + Nitrite as N)	mg/L	0.60	0.58	0.84	0.78	ND	0.34	0.87	0.05
Nitrogen as N, Total Kjeldahl	mg/L	1.03	0.75	<0.5	<0.5	ND	<0.5	<0.5	0.5
Phosphorus, Total as P	mg/L	0.08	0.10	0.05	0.05	ND	<0.04	<0.04	0.04
Sodium, Dissolved	mg/L	29.44	ND	ND	ND	ND	ND	ND	ND
Physical Properties									
Dissolved Oxygen, Field	mg/L	8.12	8.33	8.83	9.81	11.10	ND	11.94	N/A
pH, Field	s.u.	8.24	8.18	8.18	8.86	8.42	ND	8.23	N/A
Total Suspended Solids, TSS	mg/L	52	51.5	28	28.5	ND	22	12	5
Specific Conductance	µmhos/cm @ 25ºC	431	383	363	377	424	ND	433	N/A
Temperature, Water (Field)	ºC	17.8	16.58	17.53	7.84	5.51	ND	-0.25	N/A
Turbidity, Field	NTU	21.8	24.9	24.1	16.6	14.3	ND	34	N/A
Metals, Dissolved									
Arsenic	µg/L	7.26	ND	ND	ND	ND	ND	ND	10
Cadmium	µg/L	ND	ND	ND	ND	ND	ND	ND	1
Chromium	µg/L	ND	ND	ND	ND	ND	ND	ND	10
Copper	µg/L	ND	ND	ND	ND	ND	ND	ND	10
Lead	µg/L	ND	ND	ND	ND	ND	ND	ND	5
Mercury	µg/L	ND	ND	ND	ND	ND	ND	ND	1
Nickel	µg/L	ND	ND	ND	ND	ND	ND	ND	10
Selenium	µg/L	<5	ND	ND	ND	ND	ND	ND	5
Zinc	µg/L	ND	ND	ND	ND	ND	ND	ND	10
Stream Flow									
Gage Height	inches	3.31	3.36	3.14	3.32	3.47	ND	4.12	N/A
Stream Discharge	cfs	24.0	27.8	13.6	24.8	37.2	ND	78.5	N/A

Source: Ihrie 2013a; Ihrie 2011. cfs = cubic feet per second µg/L = micrograms per liter mg/L = milligrams per Liter NTU = Nephelometric Turbidity Units s.u. = standard unit umhos/cm = micromhos per centimeter < = less than NA = No data N/A = not applicable ND = not detected NDEQ = Nebraska Department of Environmental Quality

Table 2.9-24 NDEQ Water Quality Data for Niobrara River Above Box Butte Reservoir (SNI4NIOBR402) – 2010

Constituent	Unit	Jan 4	Feb 1	Mar 1	Apr 5	May 3	Jun 7	Jul 19	Aug 3	Sept 7	Oct 11	Nov 1	Dec 6	RL
Major Ions														
Calcium, Dissolved	mg/L	53.75	ND	ND	52	ND	ND	48.1	ND	ND	43.2	ND	ND	0.15
Chloride, Total	mg/L	5.35	5.44	5.15	5.98	6.15	4.27	3.97	5.01	4.13	4.73	5.23	5.78	1.0
Magnesium, Dissolved	mg/L	10.12	ND	ND	<0.15	ND	ND	<0.15	ND	ND	8.0	ND		0.15
Nitrogen, Total Ammonia as N	mg/L	<0.05	<0.05	0.196	<0.05	<0.05	0.0879	<0.05	<0.05	0.068	<0.05	<0.05	<0.05	0.05
Nitrogen, Total (Nitrate + Nitrite as N)	mg/L	1.392	1.323	0.725	0.205	0.226	0.329	1.09	1.2	1.07	1.09	0.961	1.4	0.05
Nitrogen as N, Total Kjeldahl	mg/L	<0.50	<0.50	1.734	0.607	0.778	1.02	1.15	1.08	<0.50	<0.50	0.518	<0.50	0.5
Phosphorus, Total	mg/L	<0.04	<0.04	0.201	<0.04	<0.04	0.074	0.179	0.183	<0.04	0.065	0.077	<0.04	0.04
Sodium, Dissolved	mg/L	26.97	ND	ND	25.8	ND	ND	25.3	ND	ND	22.3	ND	ND	0.15
Physical Properties														
Specific Conductance	µmhos/cm @25°C	385	385	297	458	353	ND	414	408	337	379	395	410	N/A
Alkalinity	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	N/A
Chemical Oxygen Demand (COD)	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	12
Dissolved Oxygen, Field	mg/L	12.14	9.97	9.56	10.48	10.83	ND	7.11	7.8	ND	11.47	11.31	11.21	N/A
pH, Field	s.u.	8.45	8.43	8.57	8.25	8.26	ND	8.19	8.27	8.46	8.59	8.65	8.43	N/A
Suspended Solids, Total (TSS)	mg/L	21	18	32	10	15	41.5	129	114	30	23.5	55.5	38.5	5
Temperature, Water (Field)	°C	0.96	0.82	1.62	5.72	10.92	ND	18.63	20.16	11.66	10.76	7.77	1.39	N/A
Turbidity, Lab	NTU	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	N/A
Turbidity, Field	NTU	233	19.9	26.2	9.5	40.3	ND	ND	ND	ND	24.2	44	24.9	N/A
Metals, Dissolved														
Arsenic, Dissolved	µg/L	<10	ND	ND	4.98	ND	ND	7.19	ND	ND	5.47	ND	ND	10
Cadmium, Dissolved	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Chromium, Dissolved	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
Copper, Dissolved	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
Lead, Dissolved	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5
Mercury, Dissolved	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Nickel, Dissolved	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
Selenium, Total	µg/L	<5	ND	ND	<5	ND	ND	<5	ND	ND	<5	ND	ND	5
Silver, Dissolved	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Zinc, Dissolved	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10

Table 2.9-24 NDEQ Water Quality Data for Niobrara River Above Box Butte Reservoir (SNI4NIOBR402) – 2010

Constituent	Unit	Jan 4	Feb 1	Mar 1	Apr 5	May 3	Jun 7	Jul 19	Aug 3	Sept 7	Oct 11	Nov 1	Dec 6	RL
Stream Flow														
Gage Height	inches	3.42	3.46	3.95	4.05	2.29	3.71	3.25	3.11	3.11	3.17	3.38	3.41	N/A
Stream Discharge	cfs	32.7	36.2	66.8	73.5	24.2	52	20	12.1	12.1	15.2	29.4	31.9	N/A

cfs = cubic feet per second
µg/L = micrograms per liter
mg/L = milligrams per Liter
NTU = Nephelometric Turbidity Units
s.u. = standard unit
umhos/cm = micromhos per centimeter
< = less than
NA = No data
N/A = not applicable
ND = not detected
NDEQ = Nebraska Department of Environmental Quality
RL = reporting limit
Source: Ihrie 2013a

Table 2.9-25 NDEQ Water Quality Data for Niobrara River Above Box Butte Reservoir (SNI4NIOBR402) – 2011

Constituent	Unit	Jan 3	Feb 14	Mar 6	Apr 11	May 3	Jun 6	Jul 18	Aug 1	Sept 6	Oct 3	Nov 7	Dec 5	RL
Major Ions														
Calcium, Dissolved	mg/L	49.2	ND	ND	49.6	ND	ND	45.6	ND	ND	46.5	ND	ND	0.15
Chloride, Total	mg/L	4.88	4.95	4.75	5.63	4.57	5.2	4.96	4.74	4.0	4.43	4.89	5.14	1.0
Magnesium, Dissolved	mg/L	9.2	ND	ND	9.67	ND	ND	8.26	ND	ND	8.0	ND	ND	0.15
Nitrogen, Total Ammonia as N	mg/L	0.070	0.066	0.094	<0.05	<0.05	<0.05	0.086	<0.05	<0.05	0.068	<0.05	<0.05	0.05
Nitrogen, Total (Nitrate + Nitrite as N)	mg/L	1.5	1.34	0.276	0.43	0.351	0.27	1.16	1.07	1.16	1.18	1.09	1.34	0.05
Nitrogen as N, Total Kjeldahl	mg/L	<0.50	0.732	0.89	<0.50	<0.50	0.884	2.17	0.571	<0.50	<0.50	<0.50	<0.50	0.5
Phosphorus, Total	mg/L	<0.04	0.099	0.081	0.041	<0.04	0.071	0.45	0.090	0.045	0.048	<0.04	0.163	0.04
Sodium, Dissolved	mg/L	24	ND	ND	21.4	ND	ND	23.1	ND	ND	24.4	ND	ND	0.15
Physical Properties														
Specific Conductance	µmhos/cm @25°C	388	405	347	441	437	501	401	396	388	358	435	528	N/A
Alkalinity	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	N/A
Chemical Oxygen Demand (COD)	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	12
Dissolved Oxygen, Field	mg/L	8.94	10.94	12.78	12.62	13.06	7.61	6.9	10.31	10.2	10.24	12.43	12.92	N/A
pH, Field	s.u.	8.32	8.53	8.18	8.0	8.48	8.31	8.3	8.23	8.32	8.23	9.04	8.54	N/A
Suspended Solids, Total (TSS)	mg/L	11.5	77	59	36.5	16.5	49.5	297	61	34	36.3	32.5	57.5	5
Temperature, Water (Field)	°C	0.06	3.1	1.66	8.25	10.79	20.37	24.79	20.71	15.89	14.02	3.36	-0.26	N/A
Turbidity, Lab	NTU	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	N/A
Turbidity, Field	NTU	17.5	34.6	29.4	20.7	12.1	36.5	193	61.4	29.9	36.9	22.9	12.6	N/A
Metals, Dissolved														
Arsenic, Dissolved	µg/L	5.81	ND	ND	6.46	ND	ND	7.33	ND	ND	5.57	ND	ND	10
Cadmium, Dissolved	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Chromium, Dissolved	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
Copper, Dissolved	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
Lead, Dissolved	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5
Mercury, Dissolved	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Nickel, Dissolved	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
Selenium, Total	µg/L	<5	ND	ND	<5	ND	ND	<5	ND	ND	<5	ND	ND	5
Silver, Dissolved	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Zinc, Dissolved	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10

Table 2.9-25 NDEQ Water Quality Data for Niobrara River Above Box Butte Reservoir (SNI4NIOBR402) – 2011

Constituent	Unit	Jan 3	Feb 14	Mar 6	Apr 11	May 3	Jun 6	Jul 18	Aug 1	Sept 6	Oct 3	Nov 7	Dec 5	RL
Stream Flow														
Gage Height	inches	4.42	3.49	4.17	3.8	3.8	3.93	3.3	3.1	3.14	3.14	3.3	3.72	N/A
Stream Discharge	cfs	101	39	82.1	57.5	57.5	65.5	23.3	11.7	13.6	13.6	23.3	52.6	N/A

cfs = cubic feet per second
µg/L = micrograms per liter
mg/L = milligrams per Liter
NTU = Nephelometric Turbidity Units
s.u. = standard unit
µmhos/cm = micromhos per centimeter
< = less than
NA = No data
N/A = not applicable
ND = not detected
NDEQ = Nebraska Department of Environmental Quality
RL = reporting limit
Source: Ihrie 2013a

Table 2.9-26 Summary of NDEQ Non-Radiological Water Quality Data for Niobrara River Above Box Butte Reservoir 2003 - 2011

Constituent	Unit	Average Value	Minimum Value	Maximum Value	Total Observations	Number of Values Less Than RL	RL
Major Ions							
Calcium, Dissolved	mg/L	49.95	42.82	58.2	36	0	0.15
Chloride	mg/L	4.83	3.46	7.35	131	0	1.0
Magnesium, Dissolved	mg/L	8.92	<0.15	11.54	35	1	0.15
Nitrogen, Total Ammonia as N	mg/L	0.06	<0.05 [a]	1.05	150	90	0.05
Nitrogen, Total (Nitrate + Nitrite as N)	mg/L	0.85	0.16	1.58	146	0	0.05
Nitrogen as N, Total Kjeldahl	mg/L	0.44	0.5 [a]	2.17	151	100	0.5
Phosphorus, Total	mg/L	0.05	<0.04 [a]	0.71	152	78	0.04
Sodium, Dissolved	mg/L	25.5	21.4	40.6	35	0	0.15
Physical Properties							
Alkalinity	mg/L	184	162	212	13	--	--
Dissolved Oxygen	mg/L	8.85	3.34	12.9	139	--	--
Chemical Oxygen Demand (COD)	mg/L	7.9	<12 [a]	20.3	12	9	12
pH	s.u.	8.09	7.1	9.92	211	--	--
Specific Conductance	µmhos/cm @25°C	386	100	539	151	--	--
Suspended Solids, Total (TSS)	mg/L	24.7	<5 [a]	297	150	14	5.0
Temperature	°C	11.13	-0.26	29.0	142	--	--
Turbidity, Field	NTU	27.7	0.2	233	139	--	--
Metals, Dissolved							
Arsenic, Dissolved [b]	µg/L	5.93	<10 [a]	7.33	39	29	10
Cadmium, Dissolved	µg/L	<1	<1	<1	16	16	1
Chromium, Dissolved	µg/L	<10	<10	<10	16	16	10
Copper, Dissolved	µg/L	<10	<10	<10	16	16	10
Lead , Dissolved	µg/L	<5	<5	<5	16	16	5
Mercury, Dissolved as Hg	µg/L	<1	<1	<1	16	16	1
Nickel, Dissolved	µg/L	<10	<10	<10	16	16	10
Selenium, Total	µg/L	<5	<5	<5	39	39	5
Silver, Dissolved	µg/L	<1	<1	<1	16	16	1
Zinc, Dissolved	µg/L	<10	<10	<10	16	16	10
Stream Flow							
Gage Height	inches	3.5	2.3	10.7	144	--	--
Stream Discharge	cfs	36.3	0.35	201.6	142	--	

Source: Ihrie 2013a RL = Reporting Limit cfs = cubic feet per second µg/L = micrograms per Liter mg/L = milligrams per Liter NTU = Nephelometric Turbidity Units
s.u. = standard unit µmhos/cm = micromhos per centimeter < = less than NDEQ = Nebraska Department of Environmental Quality

[a] Value of one-half of Less Than Reporting Limit used for calculating average values.

[b] Arsenic values were below the RL of 10 ug/L for 2002 – 2007, with detected values for years 2008 through 2011.

Table 2.9-27 NDEQ Water Quality Data for Niobrara River Below Box Butte Reservoir – 2008

Parameter	Concentration	May 12	May 19	May 27	Jun 2	Jun 9	Jun16	Jun 23	Jun 30	Jul 7	Jul 14	Aug 11	Aug 18	Aug 25	Sept 1	Sept 8	Sept 15	Sept 29	RL
Major Ions, Suspended																			
Chloride	mg/L	5.66	--	3.53	3.63	4.11	3.61	3.63	3.8	3.97	--	4.09	3.28	4.31	4.56	4.06	4.16	4.47	1
Magnesium, Dissolved	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	--	--	--	--	--	--	--	--	--	1
Nitrogen, Total Ammonia as N	mg/L	<0.05	<0.05	<0.05	<0.05	0.1	<0.05	<0.05	<0.05	0.05	<0.05	<0.05	<0.05	<0.05	0.16	<0.05	<0.05	<0.05	0.05
Nitrogen, Total (Nitrate + Nitrite as N)	mg/L	<0.05	0.57	0.51	0.4	0.42	0.37	0.3	0.39	0.36	<0.05	--	0.9	0.93	0.91	0.7	0.85	0.82	0.05
Nitrogen as N, Total Kjeldahl	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.51	<0.5	0.7	<0.5	0.73	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5
Phosphorus, Total as P	mg/L	<0.04	0.05	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.05	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.04
Sodium, Dissolved	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	--	--	--	--	--	--	--	--	--	--
Physical Properties																			
Dissolved Oxygen, Field	mg/L	9.04	7.21	10.57	8.71	10.07	8.69	8.77	9.22	7.75	7.13	--	--	--	--	--	--	--	N/A
pH, Field	s.u.	8.04	8.05	8.15	8.17	8.33	-8.13	8.19	8.3	8.03	8.31	--	--	--	--	--	--	--	N/A
Total Suspended Solids, TSS	mg/L	5	<5	<5	8	<5	<5	6.5	<5	5.5	27.5	--	6.0	5.0	5.0	<5	<5	<5	5
Specific Conductance	µmhos/cm @ 25ºC	408	312	325	357	380	440	431	434	360	348	--	--	--	--	--	--	--	N/A
Temperature, Water (Field)	°C	9.82	13.97	9.09	14.99	13.45	14.89	18.88	16.23	18.48	20.2	--	--	--	--	--	--	--	N/A
Turbidity, Field	NTU	1.0	4.5	4.5	9.8	2.6	39.1	17.1	5.9	55.9	20.4	--	--	--	--	--	--	--	N/A
Metals, Dissolved																			
Arsenic	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	--	--	--	--	--	10
Cadmium	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	--	--	--	--	--	1
Chromium	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	--	--	--	--	--	10
Copper	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	--	--	--	--	--	10
Lead	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	--	--	--	--	--	5
Mercury	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	--	--	--	--	--	1
Nickel	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	--	--	--	--	--	10
Selenium	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	--	--	--	--	--	5
Zinc	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	--	--	--	--	--	10
Stream Flow																			
Gage Height	inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--	--	--	--	--	--	--
Stream Discharge	cfs	0.9	0.9	1	1	1	0.9	0.9	0.9	0.9	127	--	--	--	--	--	--	--	--

Notes:
cfs = cubic feet per second
µg/L = micrograms per liter
mg/L = milligrams per Liter
NTU = Nephelometric Turbidity Units
s.u. = standard unit
µmhos/cm = micromhos per centimeter
< = less than
-- = No data
N/A = not applicable
ND = not detected
NDEQ = Nebraska Department of Environmental Quality
Source: Ihrie 2013a

Table 2.9-28 Summary of NDEQ Water Quality for Niobrara River Below Box Butte Reservoir 2008

Parameter	Minimum	Maximum
	mg/L	
Chloride	3.28	5.66
Nitrogen, Total Ammonia as N[a]	<0.05	0.16
Nitrogen, Total (Nitrate + Nitrite as N)[b]	<0.05	0.93
Nitrogen as N, Total Kjeldahl	<0.05	0.73
Phosphorus, Total[c]	<0.04	0.05
Suspended Solids, Total (TSS)[d]	<5.0	27.5

[a] 15 of 17 measurements <0.05 mg/L
[b] 14 of 17 measurements <0.05 mg/L
[c] 15 of 17 measurements below <0.04 mg/L
[d] 15 of 16 measurements below 8.0 mg/L
mg/L = milligrams per liter
NDEQ = Nebraska Department of Environmental Quality

Table 2.9-29 Niobrara River N-1 Radiological Results 2013-2014

Location ID:		N-1																	
Date Collected:		9/16/2013		10/18/2013		11/20/2013		12/27/2013		1/17/2014		2/14/2014		3/7/2014		4/15/2014		5/2/2014	
	UNITS	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL
RADIONUCLIDES-DISSOLVED																			
Lead 210	µCi/mL	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	1.2E-09	1E-9	1-1E-9	1E-9	2E-9	1E-9
Lead 210 precision (±)	µCi/mL	NA		NA		NA		NA		4E-10		5E-10		5E-10		6E-10		6E-10	
Polonium 210	µCi/mL	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Polonium 210 precision (±)	µCi/mL	NA		NA		NA		NA		2E-10		2E-10		2E-10		NA		NA	
Radium 226	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Radium 226 precision (±)	µCi/mL	NA		NA		NA		NA		4E-11		3E-11		4E-11		NA		NA	
Thorium 230	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Thorium 230 precision (±)	µCi/mL	NA		NA		NA		NA		4E-11		2E-10		4E-11		NA		NA	
Thorium 210 Tracer (30-120)	%	74		85		56		90		95		87		91		94		92	
METALS, DISSOLVED																			
Uranium	mg/L	0.0051	0.0003	0.0051	0.0003	0.0082	0.0003	0.0061	0.0003	0.0067	0.0003	0.0112	0.0003	0.0056	0.0003	0.0081	0.0003	0.0053	0.0003
Uranium Activity	µCi/mL	3.5E-9	2E-10	3.5E-9	2E-10	5.6E-9	2E-10	4.1E-9	2E-10	4.5E-9	2E-10	7.6E-9	2E-10	3.8E-9	2E-10	5.5E-9	2E-10	3.6E-9	2E-10
RADIONUCLIDES-SUSPENDED																			
Lead 210	µCi/mL	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	1.1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Lead 210 precision (±)	µCi/mL	NA		NA		NA		NA		5E-10		5E-10		4E-10		NA		NA	
Polonium 210	µCi/mL	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Polonium 210 precision (±)	µCi/mL	NA		NA		NA		NA		4E-10		2E-10		4E-10		NA		NA	
Radium 226	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	1.9E-9	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Radium 226 precision (±)	µCi/mL	NA		NA		NA		NA		2E-10		3E-11		4E-11		NA		NA	
Thorium 230	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Thorium 230 precision (±)	µCi/mL	NA		NA		NA		NA		2E-10		2E-10		1E-10		NA		NA	
Thorium 229 Tracer (30-120)	%	85		71		84		88		85		87		110		89		93	
METALS, SUSPENDED																			
Uranium	mg/L	<0.0003	0.0003	0.0051	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003
Uranium Activity	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10

µCi/mL - microcuries per milliliter
mg/l - milligrams per liter
RL - Reporting Limit
NA - Not Applicable

Table 2.9-29 Niobrara River N-1 Radiological Results 2013-2014

Location ID:		N-1					
Date Collected:		6/6/2014		7/8/2014		8/8/2014	
	UNITS	RESULTS	RL	RESULTS	RL	RESULTS	RL
RADIONUCLIDES-DISSOLVED							
Lead 210	µCi/mL	1E-9	1E-9	<1E-9	1E-9	1.1E-9	1E-9
Lead 210 precision (±)	µCi/mL	6E-10		3E-10		4E-10	
Polonium 210	µCi/mL	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Polonium 210 precision (±)	µCi/mL	NA		2E-10		4E-10	
Radium 226	µCi/mL	5E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Radium 226 precision (±)	µCi/mL	1E-10		1E-10		4E-11	
Thorium 230	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Thorium 230 precision (±)	µCi/mL	NA		0.0		0.0	
Thorium 210 Tracer (30-120)	%	76		63		62	
METALS, DISSOLVED							
Uranium	mg/L	0.0035	0.0003	0.0130	0.0003	0.0050	0.0003
Uranium Activity	µCi/mL	2.4E-9	2E-10	8.8E-9	2E-10	3.4E-9	2E-10
RADIONUCLIDES-SUSPENDED							
Lead 210	µCi/mL	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Lead 210 precision (±)	µCi/mL	NA		3E-10		5E-10	
Polonium 210	µCi/mL	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Polonium 210 precision (±)	µCi/mL	NA		4E-10		2E-10	
Radium 226	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	3E-10	2E-10
Radium 226 precision (±)	µCi/mL	NA		3E-11		1E-10	
Thorium 230	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Thorium 230 precision (±)	µCi/mL	NA		4E-11		4E-11	
Thorium 229 Tracer (30-120)	%	86		77		77	
METALS, SUSPENDED							
Uranium	mg/L	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003
Uranium Activity	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10

µCi/mL - microcuries per milliliter
mg/l - milligrams per liter
RL - Reporting Limit
NA - Not Applicable

Table 2.9-30 Niobrara River N-2 Radiological Results 2013-2014

Location ID:		N-2															
Date Collected:		9/16/2013		10/18/2014		11/20/2014		12/27/2014		1/17/2014		2/14/2014		3/7/2014		4/15/2014	
	UNITS	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL
RADIONUCLIDES-DISSOLVED																	
Lead 210	µCi/mL	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	1.1E-9	1E-9
Lead 210 precision (±)	µCi/mL	NA		NA		NA		NA		5E-10		5E-10		5E-10		6E-10	
Polonium 210	µCi/mL	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Polonium 210 precision (±)	µCi/mL	NA		NA		NA		NA		2E-10		2E-10		2E-10		NA	
Radium 226	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	4.00E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Radium 226 precision (±)	µCi/mL	NA		NA		NA		NA		1E-10		1E-10		2E-11		NA	
Thorium 230	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Thorium 230 precision (±)	µCi/mL	NA		NA		NA		NA		5E-11		4E-11		4E-11		NA	
Thorium 210 Tracer (30-120)	%	88		77		89		92	9.20E+01	70		100		76		85	
METALS, DISSOLVED																	
Uranium	mg/L	0.0051	0.0003	0.0059	0.0003	0.0062	0.0003	0.0060	0.0003	0.0062	0.0003	0.0100	0.0003	0.0018	0.0003	0.0068	0.0003
Uranium Activity	µCi/mL	3.5E-9	2E-10	4E-9	2E-10	4.2E-9	2E-10	4.1E-9	2E-10	4.2E-9	2E-10	6.8E-9	2E-10	1.2E-9	2E-10	4.6E-9	2E-10
RADIONUCLIDES-SUSPENDED																	
Lead 210	µCi/mL	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Lead 210 precision (±)	µCi/mL	NA		NA		NA		NA		4E-10		6E-10		4E-10		NA	
Polonium 210	µCi/mL	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Polonium 210 precision (±)	µCi/mL	NA		NA		NA		NA		3E-10		2E-10		3E-10		NA	
Radium 226	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Radium 226 precision (±)	µCi/mL	NA		NA		NA		NA		3E-11		3E-11		5E-11		NA	
Thorium 230	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Thorium 230 precision (±)	µCi/mL	NA		NA		NA		NA		2E-10		1E-10		1E-10		NA	
Thorium 229 Tracer (30-120)	%	85		68		110		82		91		90		110		89	
METALS, SUSPENDED																	
Uranium	mg/L	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	0.00	0.0003	<0.0003	0.0003
Uranium Activity	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	8.00E-10	2E-10	<2E-10	2E-10

µCi/mL - microcuries per milliliter
mg/l - milligrams per liter
RL - Reporting Limit
NA - Not Applicable

Table 2.9-30 Niobrara River N-2 Radiological Results 2013-2014

Location ID:		N-2							
Date Collected:		5/2/2014		6/6/2014		7/8/2014		8/8/2014	
	UNITS	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL
RADIONUCLIDES-DISSOLVED									
Lead 210	µCi/mL	1.1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	2.1E-9	1E-9
Lead 210 precision (±)	µCi/mL	5E-10		NA		3E-10		4E-10	
Polonium 210	µCi/mL	<1E-9	1E-9	3E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Polonium 210 precision (±)	µCi/mL	NA		7.00E-10		2E-10		5E-10	
Radium 226	µCi/mL	5.00E-10	2E-10	2E-10	2E-10	2.00E-10	2E-10	<2E-10	2E-10
Radium 226 precision (±)	µCi/mL	2.00E-10		1E-10		1E-10		4E-11	
Thorium 230	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Thorium 230 precision (±)	µCi/mL	NA		NA		0.0		0.0	
Thorium 210 Tracer (30-120)	%	87		84		80		60	
METALS, DISSOLVED									
Uranium	mg/L	0.0055	0.0003	0.0037	0.0003	0.0072	0.0003	0.0052	0.0003
Uranium Activity	µCi/mL	3.7E-9	2E-10	2.5E-9	2E-10	4.9E-9	2E-10	3.5E-9	2E-10
RADIONUCLIDES-SUSPENDED									
Lead 210	µCi/mL	<1E-9	1E-9	<1E-9	1E-9	1.6E-9	1E-9	<1E-9	1E-9
Lead 210 precision (±)	µCi/mL	NA		NA		4E-10		5E-10	
Polonium 210	µCi/mL	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Polonium 210 precision (±)	µCi/mL	NA		NA		4E-10		2E-10	
Radium 226	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	4E-10	2E-10
Radium 226 precision (±)	µCi/mL	NA		NA		3E-11		1E-10	
Thorium 230	µCi/mL	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Thorium 230 precision (±)	µCi/mL	NA		NA		3E-11		1E-10	
Thorium 229 Tracer (30-120)	%	80		87		77		46	
METALS, SUSPENDED									
Uranium	mg/L	<0.0003	0.0003	0.00	0.0003	<0.0003	0.0003	<0.0003	0.0003
Uranium Activity	µCi/mL	<2E-10	2E-10	2.00E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10

µCi/mL - microcuries per milliliter
mg/l - milligrams per liter
RL - Reporting Limit
NA - Not Applicable

Table 2.9-31 Summary of Radiological Baseline Data for Niobrara River Near Marsland Expansion Area Collected by Crow Butte

Analyte	Concentration (µCi/mL) [a]		Non-Detection Frequency [b]	Non-Detection Value [c]	
	Minimum	Maximum		Minimum	Maximum
NIOBRARA RIVER UPGRADIENT SAMPLING POINT N-1					
Dissolved Radiological Analytes					
Lead 210	<1E-9	2E-9	8/12	<1E-9	<1E-9
Polonium 210	<1E-9	<1E-9	12/12	<1E-9	<1E-9
Radium 226	<2E-10	5E-10	11/12	<2E-10	<2E-10
Thorium 230	<2E-10	<2E-10	12/12	<2E-10	<2E-10
Uranium Activity (µCi/ml)	8.8E-9	2.4E-9	0/12	N/A	N/A
Uranium (mg/l)	0.0035	0.0130	0/24	N/A	N/A
Suspended Radiological Analytes					
Lead 210	<1E-9	1.1E-9	11/12	<1E-9	<1E-9
Polonium 210	<1E-9	<1E-9	12/12	<1E-9	<1E-9
Radium 226	<2E-10	3E-10	10/12	<2E-10	<2E-10
Thorium 230	<2E-10	<2E-10	12/12	<2E-10	<2E-10
Uranium Activity (µCi/ml)	<2E-10	<2E-10	12/12	<2E-10	<2E-10
Uranium (mg/l)	<0.0003	0.0051	11/12	<0.0003	<0.0003
NIOBRARA RIVER DOWNGRADIENT SAMPLING POINT N-2					
Dissolved Radiological Analytes					
Lead 210	<1E-9	2.1E-9	9/12	<1E-9	<1E-9
Polonium 210	<1E-9	3E-9	11/12	<1E-9	<1E-9
Radium 226	<2E-10	5E-10	8/12	<2E-10	<2E-10
Thorium 230	<2E-10	<2E-10	12/12	<2E-10	<2E-10
Uranium Activity (µCi/ml)	1.2E-9	6.8E-9	0/12	N/A	N/A
Uranium (mg/l)	0.0018	0.0100	0/12	N/A	N/A
Suspended Radiological Analytes					
Lead 210	<1E-9	1.6E-9	11/12	<1E-9	<1E-9
Polonium 210	<1E-9	<1E-9	12/12	<1E-9	<1E-9
Radium 226	<2E-10	4E-10	11/12	<2E-10	<2E-10
Thorium 230	<2E-10	<2E-10	12/12	<2E-10	<2E-10
Uranium Activity (µCi/ml)	<2E-10	8E-10	10/12	<2E-10	<2E-10
Uranium (mg/l)	<0.0003	0.0012	10/12	<0.0003	<0.0003

[a] Unless noted otherwise.

[b] Number of samples with values less than the Non-Detection Limit; 5/6 = five of six samples with values below the detection limit.

[c] The minimum and maximum non-detection values for all samples during that testing period.
µCi/mL - microcuries per milliliter
mg/l - milligrams per liter

Table 2.9-32 MEA Vegetation Seasonal Radiological Laboratory Analysis

Location ID:		Marsland West						Marsland Middle						Marsland East					
Date Collected:		6/26/2013		7/19/2013		9/13/2013		6/26/2013		7/19/2013		9/13/2013		6/26/2013		7/19/2013		9/13/2013	
	UNITS	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL
RADIONUCLIDES																			
Lead 210	µCi/kg	4.6E-05	4.6E-06	1.0E-04	8.2E-06	1.5E-04	3.3E-06	1.2E-04	5.0E-06	1.1E-05	4.5E-06	9.8E-05	2.8E-06	2.5E-05	2.6E-06	2.7E-05	2.4E-06	7.5E-05	2.5E-06
Lead 210 precision (±)	µCi/kg	4.0E-06		8.0E-06		4.6E-06		6.2E-06		3.1E-06		3.5E-06		2.3E-06		2.2E-06		3.0E-06	
Lead 210 MDC	µCi/kg	4.6E-06		8.2E-06		3.3E-06		5.0E-06		4.5E-06		2.8E-06		2.6E-06		2.4E-06		2.5E-06	
Polonium 210	µCi/kg	4.6E-06	4.4E-06	2.9E-05	2.5E-06	5.9E-05	2.8E-06	2.4E-05	3.1E-06	2.1E-06	1.2E-06	3.5E-05	2.4E-06	2.7E-06	1.3E-06	3.4E-06	1.3E-06	1.4E-05	2.1E-06
Polonium 210 precision (±)	µCi/kg	4.2E-06		7.0E-06		1.0E-05		8.6E-06		1.4E-06		6.7E-06		1.4E-06		1.7E-06		1.6E-06	
Polonium MDC	µCi/kg	4.4E-06		2.5E-06		2.8E-06		3.1E-06		1.2E-06		2.4E-06		1.3E-06		1.3E-06		2.9E-06	
Radium 226	µCi/kg	1.1E-06	1.0E-06	2.7E-06	1.7E-07	4.7E-06	3.1E-07	9.1E-06	9.6E-07	4.0E-07	8.0E-08	2.8E-06	2.5E-07	1.8E-06	4.7E-07	1.8E-06	2.4E-08	2.6E-06	1.8E-07
Radium 226 precision (±)	µCi/kg	6.7E-07		3.0E-07		5.0E-07		1.0E-06		8.9E-08		3.6E-07		3.8E-07		1.2E-08		2.9E-07	
Radium MDC	µCi/kg	1.0E-06		1.7E-07		3.1E-07		9.6E-07		8.0E-08		2.5E-07		4.7E-07		2.4E-08		1.8E-07	
Thorium 230	µCi/kg	4.6E-06	2.2E-06	3.6E-06	1.8E-06	9.3E-06	1.6E-06	7.4E-06	4.9E-06	9.3E-07	7.2E-07	6.2E-06	1.8E-06	1.6E-06	1.5E-06	2.3E-06	1.5E-06	3.1E-06	1.1E-06
Thorium 230 precision (±)	µCi/kg	2.1E-06		1.6E-06		2.4E-06		4.2E-06		5.7E-07		1.9E-06		1.1E-06		1.2E-06		1.2E-06	
Thorium MDC	µCi/kg	2.2E-06		1.8E-06		1.6E-06		4.9E-06		7.2E-07		1.8E-06		1.5E-06		1.5E-06		1.1E-06	
METALS																			
Uranium	mg/kg	0.63 D	0.0031	0.0093	0.00073	0.08	0.02	0.043 D	0.0015	0.0023	0.00040	0.20	0.02	0.0010 D	0.00072	0.0021	0.00030	0.16	0.02
Uranium Activity	µCi/kg	4.2E-04 D	2.1E-06	6.3E-06	4.9E-07	5.0E-05	1.0E-05	2.9E-05 D	9.9E-07	1.6E-06	2.7E-07	1.3E-04	1.0E-05	6.8E-07 D	4.9E-07	1.4E-06	2.0E-07	1.1E-04	1.0E-05

µCi/kg - microcuries per kilogram
mg/g - milligrams per gram
RL - Analyte Reporting Limit
D - RL increased due to sample matrix
LLD - Lower Limit of Detection
MDC - Minimum Detectable Concentration

Table 2.9-33 MEA Radionuclide Analyses for Livestock Samples						
Radionuclide, Total	**Units**	**Reporting Limit (RL)**	**Beef Sample No. 1**	**Beef Sample No. 2**	**Beef Samples No. 3**	**Average Value**
Lead 210	*u*Ci/kg	1.0E-6	8.8E-6	5.0E-6	6.1E-6	6.6E-6
Lead 210 Precision (+)	*u*Ci/kg		4.0E-6	2.5E-6	6.2E-6	
Polonium 210	*u*Ci/kg	1.0E-6	-4.0E-7	-4.0E-7	-9.0E-7	-6.0E-7
Polonium 210 Precision (+)	uCi/kg		6.0E-7	4.0E-7	7.0E-7	
Radium 226	*u*Ci/kg	5.0E-8	1.2E-6	2.0E-7	1.5E-7	5.2E-7
Radium 226 Precision (+)	*u*Ci/kg		4.0E-7	2.0E-7	3.0E-7	
Thorium 230	*u*Ci/kg	2.0E-7	1.0E-7	5.0E-8	1.0E-6	3.8E-7
Thorium 230 Precision (+)	*u*Ci/kg		1.0E-7	9.0E-8	6.0E-7	
Thorium 229 Tracer (30-120)	Percent		95.6	102	107	
Uranium	*u*Ci/kg	2.0E-7	9.0E-7	2.0E-7	<2.0E-7	4.0E-7

Source: Inter-Mountain Labs Sample Analysis Reports presented in Appendix DD.

Table 2.9-34 Daily Contents in Acre-Feet of Water for Box Butte Reservoir (USGS 06455000)– 2003 to August 2013

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Spt	Oct	Nov	Dec
	Acre-feet											
2003												
Mean	8,489	9,899	11,053	12,365	13,503	13,380	11,134	5,236	4,151	4,841	5,587	6,376
Minimum	7,740	9,449	10,394	11,743	12,775	11,865	7,922	3,517	3,848	4,455	5,209	5,992
Maximum	9,390	10,359	11,818	13,167	14,000	14,588	14,051	7,805	4,434	5,176	5,974	6,950
2004												
Mean	7,182	8,138	9,232	9,969	11,743	11,610	9,468	4,779	4,018	5,142	6,205	7,266
Minimum	6,856	7,755	8,586	8,965	10,822	11,537	6,890	2,803	3,460	4,604	5,730	6,745
Maximum	7,683	8,775	9,976	11,158	11,865	11,715	11,658	7,137	4,566	5,695	6,712	7,769
2005												
Mean	8,285	9,482	10,710	12,018	13,504	14,668	12,782	7,578	5,691	6,752	7,668	8,662
Minimum	7,805	8,878	10,140	11,361	12,912	13,970	9,660	5,678	5,270	6,053	7,143	8,188
Maximum	8,839	10,089	11,324	12,872	13,949	15,158	15,137	9,593	6,035	7,110	8,151	9,169
2006												
Mean	9,811	10,956	12,473	14,207	14,968	14,703	9,481	4,465	3,891	4,084	4,497	4,815
Minimum	9,202	10,429	11,537	13,555	14,715	13,687	5,962	3,522	3,599	3,834	4,096	4,588
Maximum	10,385	11,500	13,475	14,683	15,094	14,936	13,535	5,968	4,366	4,229	4,802	5,081
2007												
Mean	5,381	6,102	6,791	--	--	11,312	7,073	3,603	3,830	4,311	4,912	5,559
Minimum	5,065	5,760	6,583	--	--	11,090	3,809	2,352	3,628	4,054	4,631	5,215
Maximum	5,730	6,524	7,063	--	--	11,445	11,213	4,721	4,019	4,609	5,192	5,895
2008												
Mean	5,019	5,570	6,636	7,923	9,034	9,502	7,200	4,212	4,308	4,699	5,474	6,130
Minimum	4,759	5,293	5,970	7,306	8,415	9,278	4,677	3,608	4,039	4,546	5,125	5,821
Maximum	5,275	5,914	7,272	8,361	9,220	9,572	9,563	4,999	4,536	4,875	5,797	6,375
2009												
Mean	6,682	7,375	8,360	10,159	11,859	12,619	11,155	7,021	6,273	7,029	8,508	9,733
Minimum	6,394	7,020	7,816	8,992	11,398	12,174	7,852	5,177	6,158	6,466	7,794	9,204
Maximum	7,000	7,765	8,943	11,313	12,095	12,950	13,512	8,562	6,446	7,743	9,171	10,213

Table 2.9-34 Daily Contents in Acre-Feet of Water for Box Butte Reservoir (USGS 06455000)– 2003 to August 2013

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Spt	Oct	Nov	Dec
	Acre-feet											
2010												
Mean	10,650	11,550	13,893	16,421	18,491	20,587	20,265	13,904	11,666	12,048	12,884	13,938
Minimum	10,240	11,096	12,363	15,293	17,669	19,479	16,939	11,303	11,560	11,782	12,403	13,396
Maximum	11,068	12,293	15,180	17,644	19,440	21,432	21,500	18,366	11,782	12,373	13,344	14,523
2011												
Mean	14,909	15,942	18,007	20,264	22,174	24,478	21,075	14,939	12,694	13,044	13,860	15,278
Minimum	14,512	15,407	16,569	19,427	21,147	23,930	17,546	12,695	12,164	12,644	13,470	15,090
Maximum	15,384	16,510	19,349	21,120	23,844	24,927	24,942	16,819	12,868	13,428	14,304	15,464
2012												
Mean	15,973	17,002	18,440	19,820	20,026	18,998	11,713	6,090	6,211	6.,680	7,311	7,969
Minimum	15,498	16,486	17,620	19,284	19,739	17,424	7,445	5,275	6,057	6,394	7,007	7,650
Maximum	16,463	17,583	19,272	20,291	20,318	19,726	16,939	7,142	6,388	6.986	7,628	8,308
2013												
Mean	8,648	9,329	10,229	11,497	12,336	12,965	12,412	6,541	5,295	ND	ND	ND
Minimum	8,338	9,000	9,699	10,837	5,322	12,960	8,855	5,209	5,121	ND	ND	ND
Maximum	8,976	9,673	10,800	12,393	12,981	12,971	12,971	8,280	5,977	ND	ND	ND
2003-2013 Summary												
Mean [a]	9,184	10,122	11,439	13,464	14,764	14,984	12,160	5,271	16,184	6,196	7,691	8,573
Minimum	4,759	5,293	5,970	7,306	5,322	9,278	3,809	2,352	3,460	3,834	4,096	4,588
Maximum	16,463	17,583	19,349	21,120	23,844	21,927	24,942	18,366	12,868	13,428	14,304	15,464

Source: USBR 2013 b
[a]Average of average values presented in table.
ND = No data
USGS = U.S. Geological Survey

Table 2.9-35 Range Values for Box Butte Reservoir Water Contents

Date	Average	Minimum	Maximum
	Acre-feet		
2003 – 2013	6,196 – 14,984	2,352 – 9,278	12,868 – 24,942

USGS Station 06455000
USGS = U.S. Geological Survey
Source: USBR 2011b

Table 2.9-36 MEA Garden Soil Radiological Laboratory Analysis

Location ID:		Furman		Metz		Richardson		Tollman		Troester 1		Troester 2		Walters	
Date Collected:		8/1/2013		8/1/2013		8/1/2013		8/15/2013		8/1/2013		8/2/2013		8/1/2013	
	UNITS	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL
RADIONUCLIDES															
Lead 210	pCi/g	1.2	1	1.6	1	1.3	1	1.4	1	1.3	1	0.8	1	1.3	1
Lead 210 precision (±)	pCi/g	0.4		0.4		0.4		0.4		0.4		0.4		0.4	
Polonium 210	pCi/g	<2	2	<2	2	<2	2	<2	2	<2	2	<2	2	<2	2
Polonium 210 precision (±)	pCi/g	NA		NA		NA		NA		NA		NA		NA	
Radium 226	pCi/g	0.6	0.2	0.7	0.2	0.6	0.2	0.8	0.2	0.9	0.2	0.8	0.2	0.3	0.2
Radium 226 precision (±)	pCi/g	0.4		0.4		0.5		0.4		0.4		0.3		0.4	
Thorium 230	pCi/g	0.4	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.4	0.2	0.3	0.2	0.3	0.2
Thorium 230 precision (±)	pCi/g	0.1		0.1		0.1		0.1		0.1		0.1		0.2	
Thorium229 Tracer (30-120)	pCi/g	93.9		97.0		92.3		98.1		105.0		95.0		52.5	
METALS															
Uranium	pCi/g	0.5	0.2	0.5	0.2	0.6	0.2	0.6	0.2	0.8	0.2	0.6	0.2	0.5	0.2

RL - Analyte Reporting Limit

Table 2.9-37 Total Radionuclides and Metals in Tissue of Northern Pike Collected from Inlet of Box Butte Reservoir

	May 25, 2014		September 26, 2014		
Radionuclide - Total	**Result [a]**	**Units**	**Result [a]**	**Units**	**RL**
Lead 210	2.8E-05	uCi/kg	6.0E-7	uCi/kg	1.0E-06
Lead 210 Precision (+)	1.5E-05	uCi/kg	2.9E-06	uCi/kg	--
Lead 210 MDC	1.0E-06	uCi/kg	1.0E-06	uCi/kg	--
Polonium 210	8.1E-06	uCi/kg	-2.0E-7	uCi/kg	1.0E-06
Polonium 210 Precision (+)	7.0E-06	uCi/kg	8.0E-07	uCi/kg	--
Polonium 210 MDC	1.0E-06	uCi/kg	1.0E-06	uCi/kg	--
Radium 226	4.1E-06	uCi/kg	8.0E-07	uCi/kg	5.0E-08
Radium 226 Precision (+)	2.2E-06	uCi/kg	3.0E-07	uCi/kg	--
Radium 226 MDC	5.0E-08	uCi/kg	5.0E-08	uCi/kg	--
Thorium 230	8.0E-07	uCi/kg	4.0E-07	uCi/kg	2.0E-07
Thorium 230 Precision (+)	1.6E-06	uCi/kg	3.0E-07	uCi/kg	--
Thorium 230 MDC	2.0E-07	uCi/kg	2.0E-07	uCi/kg	--
Metals - Total					--
Uranium, Total	.0031	mg/kg	.0023	mg/kg	0.0003
Uranium Activity	2.1E-6	uCi/kg	1.5E-06	uCi/kg	2.0E-07

[a] Results reported on a wet weight basis (as received) for composite of two or more samples (digestion, radiochemistry).
uCi/kg = microcuries per kilogram.
RL = Analyte reporting limit.
MDC = Minimum detectable concentration.
mg/kg – milligram per kilogram

Table 2.9-38 Radionuclide and Metal Analyses for Niobrara River Sample Locations N-1 and N-2 Sediment Samples

Radionuclide	Units	10/25/2013 (Fall Collection Date)		5/02/2014 (Spring Collection Date)	
		Result	Reporting Limit (RL)	Result	Reporting Limit (RL)
N-1					
RADIONUCLIDES - TOTAL					
Lead-210	µCi/g - dry	1.0E-6	2.0E-7	1.3E-6	2.0E-7
Lead 210 precision (+)	µCi/g - dry	4.0E-7		2.0E-7	
Radium 226	µCi/g - dry	6.0E-7	2.0E-7	7.0E-7	2.0E-7
Radium 226 precision (+)	µCi/g - dry	3.0E-7		3.0E-7	
Thorium 230	µCi/g - dry	3.0E-7	2.0E-7	2.0E-7	2.0E-7
Thorium 230 precision (+)	µCi/g - dry	1.0E-7		1.0E-7	
Thorium 229 Tracer (30-120)	%	51.2		107	
METALS - TOTAL					
Uranium Activity	µCi/g - dry	3.0E-7	2.0E-7	6.0E-7	2.0E-7
N-2					
RADIONUCLIDES - TOTAL					
Lead-210	µCi/g - dry	3.0E-7	2.0E-7	5.0E-7	2.0E-7
Lead 210 precision (+)	µCi/g - dry	1.0E-7		1.0E-7	
Radium 226	µCi/g - dry	4.0E-7	2.0E-7	5.0E-7	2.0E-7
Radium 226 precision (+)	µCi/g - dry	3.0E-7		2.0E-7	
Thorium 230	µCi/g - dry	1.0E-7	2.0E-7	1.0E-7	2.0E-7
Thorium 230 precision (+)	µCi/g - dry	1.0E-7		1.0E-7	
Thorium 229 Tracer (30-120)	%	70.7		93.0	
METALS - TOTAL					
Uranium Activity	µCi/g - dry	2.0E-7	2.0E-7	4.0E-7	2.0E-7

RL - Analyte reporting limit
MDC – Minimum detectable concentration
mg/kg-dry – milligram/kilogram-dry weight
pCi/g-dry – picocuries per gram -dry weight

Table 2.9-39 Radionuclide and Metal Analyses for Marsland Ephemeral Drainage (MED)

Radionuclide	Units	Result	Reporting Limit (RL)		Result	Reporting Limit (RL)
		10/25/2013 (Fall Collection Date)			5/02/2014 (Spring Collection Date)	
MED - 1						
Lead-210	µCi/g-dry	2.1E-6	2.0E-7		3.0E-7	2.0E-7
Lead 210 precision (+)	µCi/g-dry	4.0E-7			1.0E-7	
Radium 226	µCi/g-dry	3.0E-7	2.0E-7		3.0E-7	2.0E-7
Radium 226 precision (+)	µCi/g-dry	3.0E-7			2.0E-7	
Thorium 230	µCi/g-dry	2.0E-7	2.0E-7		1.9E-7	2.0E-7
Thorium 230 precision (+)	µCi/g-dry	1.0E-7			1.0E-7	
Thorium 229 Tracer (30-120)	%	92.8			95.2	
METALS						
Uranium Activity	µCi/g-dry	4.0E-7	2.0E-7		3.0E-7	2.0E-7
MED - 2						
Lead-210	µCi/g-dry	6.0E-7	2.0E-7		1.3E-6	2.0E-7
Lead 210 precision (+)	µCi/g-dry	2.0E-7			2.0E-7	
Radium 226	µCi/g-dry	4.0E-7	2.0E-7		5.0E-7	2.0E-7
Radium 226 precision (+)	µCi/g-dry	3.0E-7			4.0E-7	
Thorium 230	µCi/g-dry	1.9E-7	2.0E-7		4.0E-7	2.0E-7
Thorium 230 precision (+)	µCi/g-dry	1.0E-7			1.0E-7	
Thorium 229 Tracer (30-120)	%	96.6			98.9	
METALS						
Uranium Activity	µCi/g-dry	2.0E-7	2.0E-7		6.0E-7	2.0E-7
MED - 3						
Lead-210	µCi/g-dry	4.0E-7	2.0E-7		1.4E-6	2.0E-7
Lead 210 precision (+)	µCi/g-dry	2.0E-7			2.0E-7	
Radium 226	µCi/g-dry	2.0E-7	2.0E-7		8.0E-7	2.0E-7
Radium 226 precision (+)	µCi/g-dry	3.0E-7			3.0E-7	
Thorium 230	µCi/g-dry	1.0E-7	2.0E-7		3.0E-7	2.0E-7
Thorium 230 precision (+)	µCi/g-dry	1.0E-7			1.0E-7	
Thorium 229 Tracer (30-120)	%	95.6			94.1	
METALS						
Uranium Activity	µCi/g-dry	2.0E-7	2.0E-7		5.0E-7	2.0E-7

Table 2.9-39 Radionuclide and Metal Analyses for Marsland Ephemeral Drainage (MED)

Radionuclide	Units	Result	Reporting Limit (RL)		Result	Reporting Limit (RL)
		10/25/2013 (Fall Collection Date)			5/02/2014 (Spring Collection Date)	
MED - 4						
Lead-210	µCi/g-dry	1.7E-6	2.0E-7		2.1E-6	2.0E-7
Lead 210 precision (+)	µCi/g-dry	4.0E-7			3.0E-7	
Radium 226	µCi/g-dry	7.0E-7	2.0E-7		8.0E-7	2.0E-7
Radium 226 precision (+)	µCi/g-dry	4.0E-7			4.0E-7	
Thorium 230	µCi/g-dry	5.0E-7	2.0E-7		5.0E-7	2.0E-7
Thorium 230 precision (+)	µCi/g-dry	1.0E-7			1.0E-7	
Thorium 229 Tracer (30-120)	%	87.2			90.3	
METALS						
Uranium Activity	µCi/g-dry	5.0E-7	2.0E-7		5.0E-7	2.0E-7
MED - 5						
Lead-210	µCi/g-dry	1.2E-6	2.0E-7		2.0E-6	2.0E-7
Lead 210 precision (+)	µCi/g-dry	3.0E-7			2.0E-7	
Radium 226	µCi/g-dry	6.0E-7	2.0E-7		1.2E-6	2.0E-7
Radium 226 precision (+)	µCi/g-dry	4.0E-7			5.0E-7	
Thorium 230	µCi/g-dry	1.9E-7	2.0E-7		5.0E-7	2.0E-7
Thorium 230 precision (+)	µCi/g-dry	1.0E-7			2.0E-7	
Thorium 229 Tracer (30-120)	%	54			85.4	
METALS						
Uranium Activity	µCi/g-dry	4.0E-7	2.0E-7		6.0E-7	2.0E-7
MED - 6						
Lead-210	µCi/g-dry	9.0E-7	2.0E-7		1.0E-6	2E-7
Lead 210 precision (+)	µCi/g-dry	4.0E-7			2.0E-7	
Radium 226	µCi/g-dry	7.0E-7	2.0E-7		7.0E-7	2E-7
Radium 226 precision (+)	µCi/g-dry	3.0E-7			3.0E-7	
Thorium 230	µCi/g-dry	4.0E-7	2.0E-7		2.0E-7	2E-7
Thorium 230 precision (+)	µCi/g-dry	1.0E-7			1.0E-7	
Thorium 229 Tracer (30-120)	%	93.5	93.5		88.3	
METALS						
Uranium Activity	µCi/g-dry	4.0E-7	2.0E-7		5.0E-7	2.0E-7

Table 2.9-39 Radionuclide and Metal Analyses for Marsland Ephemeral Drainage (MED)

Radionuclide	Units	Result	Reporting Limit (RL)		Result	Reporting Limit (RL)
		10/17/2014 (Fall Collection Date)			4/30/2015 (Spring Collection Date)	
MED-7 [b]						
Lead-210	µCi/g-dry	7.0E-7	2.0E-7		1.8E-6	2.0E-7
Lead 210 precision (+)	µCi/g-dry	1.0E-7			5.0E-7	
Radium 226	µCi/g-dry	6.0E-7	2.0E-7		1.0E-6	2.0E-7
Radium 226 precision (+)	µCi/g-dry	1.0E-7			3.0E-7	
Thorium 230	µCi/g-dry	1.5E-6	2.0E-7		4.0E-7	2.0E-7
Thorium 230 precision (+)	µCi/g-dry	1.7E-6			2.0E-7	
Thorium 229 Tracer (30-120)	%	80.5			38.4	
METALS						
Uranium Activity	µCi/g-dry	7.2E-6	2.0E-7		5.4E-6	2.0E-7

MED - Marsland Ephermeral Drainage
RL - Analyte reporting limit
µCi/g-dry - microcuries/gram-dry weight
[b] New sampling point added after sampling of MED-1 through MED-6 was completed.

Table 2.9-40 Marsland Expansion Area Gamma Exposure Results (2011 – 2012)

Location	Exposure of Dosimeter (mrems ambient dose equivalent)		Net Cumulative Totals			Number of Dosimeters Reported
	Gross	Net	Calendar Quarter	Year to Date	Permanent	
	Q4 - 2011					
Transient Control	13.9	-1.0	--	--	--	--
Deploy Control	15.0	0.0	--	--	--	--
MA-1	21.7	6.7	6.7	6.7	6.7	1
MA-2	21.6	6.7	6.7	6.7	6.7	1
MA-3	21.4	6.5	6.5	6.5	6.5	1
MA-4	19.9	5.0	5.0	5.0	5.0	1
MA-5	20.9	5.9	5.9	5.9	5.9	1

Location	Exposure of Dosimeter (mrems ambient dose equivalent)		Net Cumulative Totals			Number of Dosimeters Reported
	Gross	Net	Calendar Quarter	Year to Date	Permanent	
	Q1 - 2012					
Transient Control	25.7	-0.6	--	--	--	--
Deploy Control	26.3	0.0	--	--	--	--
MA-1	32.8	6.5	6.5	6.5	13.2	2
MA-2	33.8	7.5	7.5	7.5	14.2	2
MA-3	31.4	5.1	5.1	5.1	11.6	2
MA-4	40.8	14.5	14.5	14.5	19.5	2
MA-5	32.5	6.2	6.2	6.2	12.1	2

Location	Exposure of Dosimeter (mrems ambient dose equivalent)		Net Cumulative Totals			Number of Dosimeters Reported
	Gross	Net	Calendar Quarter	Year to Date	Permanent	
	Q2 - 2012					
Transient Control			--	--	--	--
Deploy Control	30.4	0.0	--	--	--	--
MA-1	40.0	9.6	9.6	16.1	22.8	1
MA-2	Badge lost at the monitor site			7.5	14.2	1
MA-3	34.9	4.6	4.6	9.7	16.2	1
MA-4	40.9	10.5	10.5	25.0	30.0	1
MA-5	38.1	7.7	7.7	13.9	19.8	1

Table 2.9-40 Marsland Expansion Area Gamma Exposure Results (2011 – 2012)

Location	Exposure of Dosimeter (mrems ambient dose equivalent)		Net Cumulative Totals			Number of Dosimeters Reported
	Gross	Net	Calendar Quarter	Year to Date	Permanent	
	Q3 - 2012					
Transient Control			--	--	--	--
Deploy Control	28.8	0.0	--	--	--	--
MA-1	38.6	9.9	9.9	26.0	32.7	1
MA-2	39.2	10.4	10.4	17.9	24.6	1
MA-3	37.5	8.7	8.7	18.3	24.8	1
MA-4	39.2	10.4	10.4	35.5	40.5	1
MA-5	33.3	4.5	4.5	18.4	24.3	1

Location	Exposure of Dosimeter (mrems ambient dose equivalent)		Net Cumulative Totals			Number of Dosimeters Reported
	Gross	Net	Calendar Quarter	Year to Date	Permanent	
	Q4 - 2012					
Transient Control			--	--	--	--
Deploy Control	27.3	0.0	--	--	--	--
MA-1	39.2	11.9	11.9	37.9	44.6	1
MA-2	36.8	9.5	9.5	27.4	34.1	1
MA-3	34.5	7.2	7.2	25.6	32.1	1
MA-4	37.3	10.0	10.0	45.5	50.5	1
MA-5	34.0	6.8	6.8	25.2	31.1	1

mrem – millirems
MA-1 air sampling locations
Minimum Detectable Dose = 0.1 mrems ambient dose equivalent

Table 2.9-41 Marsland Expansion Area Preoperational/Preconstruction Monitoring Program

	Sample Collection				Sample Analysis	
Type of Sample	**Number**	**Location**	**Method**	**Frequency**	**Frequency**	**Type of Analysis**
Air Particulates	3	On MEA southern boundary	Continuous	Weekly filter change	Quarterly composites of weekly samples	Natural uranium, Ra-226, Th-230, and Pb-210
	1	Nearest Resident	Continuous	Weekly filter change	Quarterly composites of weekly samples	Natural uranium, Ra-226, Th-230, and Pb-210
	1	Control background location west of MEA License Boundary	Continuous	Weekly filter change	Quarterly composites of weekly samples	Natural uranium, Ra-226, Th-230, and Pb-210
Radon Gas	3	On MEA southern boundary	Continuous	Quarterly	Quarterly	Rn-222
	1	Nearest Resident	Continuous	Quarterly	Quarterly	Rn-222
	1	Control background location west of MEA License Boundary	Continuous	Quarterly	Quarterly	Rn-222
Groundwater	1	Wells within MEA license boundary and 2 km radius: • Private Wells • MEA Arikaree Wells • MEA Brule Wells • MEA Ore Zone Wells	Grab	Quarterly	Quarterly	Suspended & Dissolved Natural Uranium, Ra-226, Th-230, Pb-210 & Po-210
Surface Water	2 [a]	Niobrara River (N-1 and N-2) Ephemeral Drainages	Grab	Monthly	Monthly	Suspended & Dissolved Natural Uranium, Ra-226, Th-230
			Grab	Semiannually	Semiannually	Suspended & Dissolved Pb-210 & Po-210
Vegetation	3	Grazing areas near the site in different sectors that will have the highest predicted air particulate concentrations during milling operations	Grab	3 times during grazing season	3 Times	Natural Uranium, Ra-226, Th-230, Pb-210, & Po-210
Food	3	Crops (alternate of garden soil sampling used)	Grab	Time of Harvest or Slaughter	1	Natural Uranium, Ra-226, Th-230, Pb-210, & Po-210
	3	Livestock			1	

Table 2.9-41 Marsland Expansion Area Preoperational/Preconstruction Monitoring Program

	Sample Collection				Sample Analysis	
Type of Sample	**Number**	**Location**	**Method**	**Frequency**	**Frequency**	**Type of Analysis**
Fish	Each Body of Water	Box Butte Reservoir	Grab	Semiannually	2	Natural Uranium, Ra-226, Th-230, Pb-210, & Po-210
Surface Soil [b]	Up to 40	300 meter intervals to a distance of 1500 meters in each of 8 directions from center-point of satellite facility; additional transects through wellfields	Grab	Once prior to construction. Repeat for location disturbed by excavation, leveling or contouring	1	All samples for Ra-226, 10% of samples natural uranium, Th-230 & Pb-210
	5	Same location used for collection of air particulates	Grab	Once prior to construction	1	Natural Uranium, Ra-226, Th-230 & Pb-210
Subsurface Soil [c]	5	At center-point of satellite facility & at distances of 750 meters in each of 4 directions	Grab	Once prior to construction. Repeat for location disturbed by construction	1	Ra-226 (all samples) Natural Uranium, Th-230 & Pb-210 (one set of samples)
Sediment [d]	1 from each stream (2) & ephemeral drainage (7) sampling points	Up and down gradient samples from ephemeral drainages (total of 7 samples) & Niobrara River (N-1 & N-2)	Grab (Composite samples)	Once following spring runoff & late summer following period of extended low flow	2	Natural Uranium, Ra-226, Th-230 & Pb-210
Direct Radiation (Survey)	Up to 80	150 meter intervals to a distance of 1500 meters in each of 8 directions from center-point of satellite facility	Grab	Once prior to construction. Repeat for areas disturbed by site preparation or construction	1	Gamma exposure using sodium iodide scintillometer
Direct Radiation (Continuous)	5	Same location used for collection of air particulates	Grab	Once prior to construction	1	Gamma exposure using a continuous integrating device
Radon Flux [e]	-	-	-	-	-	-

[a] Two samples from the Niobrara River per sampling event and one (1) from each sampling point (total of 7) located on ephemeral streams (**Figure 2.7-4**) .
[b] Surface soil samples collected to a depth of 5 cm and 15 cm using a consistent technique.
[c] Subsurface soil samples collected to a depth of 1 meter; samples divided into 3 equal sections for analysis.
[d] Sediment sample locations shown in Figure 2.7-4
[e] Radon Flux measurements are not applicable to ISR facilities.

Table 2.9-42 Marsland Expansion Area Radiological Analytical Results (Q4 2013 - Q3 2014) – Arikaree Wells

	Location ID:	AOW-3		AOW-3		AOW-3		AOW-3		AOW-4		AOW-4		AOW-4		AOW-4		AOW-5	
	Date Collected:	11/8/2013		2/25/2014		6/16/2014		9/16/2014		11/8/2013		2/25/2014		6/16/2014		9/17/2014		11/8/2013	
	UNITS	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL
RADIONUCLIDES-DISSOLVED																			
Lead 210	µCi/ml	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Lead 210 precision (±)	µCi/ml	NA		4E-10		3E-10		NA		NA		4E-10		3E-9		4E-10		NA	
Polonium 210	µCi/ml	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Polonium 210 precision (±)	µCi/ml	NA		2E-10		2E-10		NA		NA		2E-10		2E-10		1E-10		NA	
Radium 226	µCi/ml	<2E-10	2E-10	2E-10	2E-10	3E-10	2E-10	4E-10	2E-10	<2E-10	2E-10	2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Radium 226 precision (±)	µCi/ml	NA		1E-10		1E-10		1E-10		NA		1E-10		1E-10		4E-11		NA	
Thorium 230	µCi/ml	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Thorium 230 precision (±)	µCi/ml	NA		1E-10		0.0		NA		NA		1E-10		4E-11		4E-11		NA	
Thorium 229 Tracer (30-120)	%	66		87		100		76		61		100		91		86		57	
METALS - DISSOLVED																			
Uranium	mg/L	0.0087	0.0003	0.0068	0.0003	0.0052	0.0003	0.0041	0.0003	0.0052	0.0003	0.0041	0.0003	0.0051	0.0003	0.0044	0.0003	0.0077	0.0003
Uranium Activity	µCi/ml	5.9E-9	2E-10	4.6E-9	2E-10	3.5E-9	2E-10	2.8E-9	2E-10	3.5E-9	2E-10	2.8E-9	2E-10	3.5E-9	2E-10	3E-9	2E-10	5.2E-9	2E-10
RADIONUCLIDES-SUSPENDED																			
Lead 210	µCi/ml	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	1.1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	1.2E-9	1E-9	1.3E-9	1E-9	<1E-9	1E-9
Lead 210 precision (±)	µCi/ml	NA		5E-10		4E-10		6E-10		NA		4E-10		4E-10		6E-10		NA	
Polonium 210	µCi/ml	2E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	1.2E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	1.1E-9	1E-9	<1E-9	1E-9
Polonium 210 precision (±)	µCi/ml	7E-10		2E-10		2E-10		5E-10		NA		2E-10		1E-10		5E-10		NA	
Radium 226	µCi/ml	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	6E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	3E-10	2E-10	<2E-10	2E-10
Radium 226 precision (±)	µCi/ml	NA		4E-11		0.0		1E-10		NA		3E-11		0.0		1E-10		NA	
Thorium 230	µCi/ml	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Thorium 230 precision (±)	µCi/ml	NA		3E-11		3E-11		NA		NA		4E-11		1E-10		1E-10		NA	
Thorium 229 Tracer (30-120)	%	68		100		90		99		64		98		96		78		68	
METALS - SUSPENDED																			
Uranium	mg/L	0.0004	0.0003	0.0006	0.0003	<0.0003	0.0003	0.0004	0.0003	0.0017	0.0003	<0.0003	0.0003	<0.0003	0.0003	0.0004	0.0003	0.0004	0.0003
Uranium Activity	µCi/ml	3E-10	2E-10	4E-10	2E-10	<2E-10	2E-10	3E-10	2E-10	1.2E-9	2E-10	<2E-10	2E-10	<2E-10	2E-10	3E-10	2E-10	3E-10	2E-10

Notes:

uCi/mL = microcuries per milliliter

mg/L = milligrams per Liter

RL - Analyte reporting limit

AOW-1 & AOW-7; Do not produce sufficient water volume to produce sample

AOW-2 - Not drilled

Table 2.9-42 Marsland Expansion Area Radiological Analytical Results (Q4 2013 - Q3 2014) – Arikaree Wells

Location ID:		AOW-5		AOW-5		AOW-5		AOW-6		AOW-6		AOW-6		AOW-6		AOW-8		AOW-8	
Date Collected:		2/26/2014		6/17/2014		9/17/2014		11/8/2013		2/26/2014		6/17/2014		9/17/2014		11/8/2013		2/26/2014	
	UNITS	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL
RADIONUCLIDES-DISSOLVED																			
Lead 210	µCi/ml	<1E-9	1E-9	1.3E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	1.3E-9	1E-9	<1E-9	1E-9
Lead 210 precision (±)	µCi/ml	4E-10		4E-10		4E-10		NA		4E-10		0.3		4E-10		4E-10		4E-10	
Polonium 210	µCi/ml	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Polonium 210 precision (±)	µCi/ml	2E-10		1E-10		1E-10		NA		1E-10		2E-10		2E-10		NA		2E-10	
Radium 226	µCi/ml	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Radium 226 precision (±)	µCi/ml	3E-11		0.0		5E-11		NA		4E-11		0.0		3E-11		NA		4E-11	
Thorium 230	µCi/ml	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Thorium 230 precision (±)	µCi/ml	1E-10		2E-11		1E-10		NA		0.0		0.03		0.0		NA		5E-11	
Thorium 229 Tracer (30-120)	%	100		95		86		63		94		87		75		63		71	
METALS - DISSOLVED																			
Uranium	mg/L	0.0077	0.0003	0.0072	0.0003	0.0071	0.0003	0.0069	0.0003	0.0070	0.0003	0.0062	0.0003	0.0062	0.0003	0.0039	0.0003	0.0041	0.0003
Uranium Activity	µCi/ml	5.2E-9	2E-10	4.9E-9	2E-10	4.8E-9	2E-10	4.7E-9	2E-10	4.7E-9	2E-10	4.2E-9	2E-10	4.2E-9	2E-10	2.6E-9	2E-10	2.8E-9	2E-10
RADIONUCLIDES-SUSPENDED																			
Lead 210	µCi/ml	<1E-9	1E-9	2E-9	1E-9	1.4E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	1.1E-9	1E-9	3.1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Lead 210 precision (±)	µCi/ml	4E-10		6E-10		6E-10		NA		4E-10		7E-10		7E-10		NA		4E-10	
Polonium 210	µCi/ml	<1E-9	1E-9	<1E-9	1E-9	1.9E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Polonium 210 precision (±)	µCi/ml	2E-10		1E-10		6E-10		NA		2E-10		2E-10		4E-10		NA		2E-10	
Radium 226	µCi/ml	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Radium 226 precision (±)	µCi/ml	3E-11		0.0		4E-11		NA		2E-11		0.0		4E-11		NA		3E-11	
Thorium 230	µCi/ml	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Thorium 230 precision (±)	µCi/ml	3E-11		4E-11		2E-11		NA		2E-11		2E-11		5E-11		NA		1E-10	
Thorium 229 Tracer (30-120)	%	100		91		93		69		96		79		70		74		110	
METALS - SUSPENDED																			
Uranium	mg/L	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	0.0009	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	0.0004	0.0003	<0.0003	0.0003
Uranium Activity	µCi/ml	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	6E-9	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	3E-10	2E-10	<2E-10	2E-10

Notes:

uCi/mL = microcuries per milliliter

mg/L = milligrams per Liter

RL - Analyte reporting limit

AOW-1 & AOW-7; Do not produce sufficient water volume to produce sample

AOW-2 - Not drilled

Table 2.9-42 Marsland Expansion Area Radiological Analytical Results (Q4 2013 - Q3 2014) – Arikaree Wells

Location ID:		AOW-8		AOW-8		AOW-9		AOW-9		AOW-9		AOW-9		AOW-10		AOW-10		AOW-10	
Date Collected:		6/16/2014		9/16/2014		11/8/2013		2/26/2014		6/17/2014		9/17/2014		11/8/2013		2/25/2014		6/16/2014	
	UNITS	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL
RADIONUCLIDES-DISSOLVED																			
Lead 210	µCi/ml	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	1E-9	1E-9	1.4E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Lead 210 precision (±)	µCi/ml	3E-10		NA		NA		7E-10		6E-10		5E-10		NA		4E-10		3E-10	
Polonium 210	µCi/ml	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Polonium 210 precision (±)	µCi/ml	2E-10		NA		NA		2E-10		1E-10		3E-10		NA		1E-10		1E-10	
Radium 226	µCi/ml	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Radium 226 precision (±)	µCi/ml	0.0		NA		NA		3E-11		0.0		4E-11		NA		4E-11		3E-11	
Thorium 230	µCi/ml	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Thorium 230 precision (±)	µCi/ml	2E-11		NA		NA		3E-11		3E-11		0		NA		5E-11		0.0	
Thorium 229 Tracer (30-120)	%	89		69		71		100		82		82		74		85		75	
METALS - DISSOLVED																			
Uranium	mg/L	0.0039	0.0003	0.0038	0.0003	0.0083	0.0003	0.0074	0.0003	0.0077	0.0003	0.0077	0.0003	0.0069	0.0003	0.0069	0.0003	0.0069	0.0003
Uranium Activity	µCi/ml	2.6E-9	2E-10	2.6E-9	2E-10	5.6E-9	2E-10	5E-9	2E-10	5.2E-9	2E-10	5.2E-9	1E-10	4.7E-9	2E-10	4.7E-9	2E-10	4.7E-9	2E-10
RADIONUCLIDES-SUSPENDED																			
Lead 210	µCi/ml	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	4.8E-9	1E-9	<1E-9	1E-9	1.1E-9	1E-9	<1E-9	1E-9
Lead 210 precision (±)	µCi/ml	4E-10		NA		NA		6E-10		4E-10		8E-10		NA		5E-10		4E-10	
Polonium 210	µCi/ml	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	1.3E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Polonium 210 precision (±)	µCi/ml	2E-10		NA		NA		2E-10		2E-10		6E-10		NA		3E-10		2E-10	
Radium 226	µCi/ml	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	3E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Radium 226 precision (±)	µCi/ml	0.0		NA		NA		4E-11		0.0		1E-10		NA		3E-11		0.0	
Thorium 230	µCi/ml	<2E-10	2E-10	2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Thorium 230 precision (±)	µCi/ml	2E-11		2E-10		NA		1E-10		1E-10		1E-10		NA		4E-11		1E-10	
Thorium 229 Tracer (30-120)	%	96		32		71		110		93		80		72		96		95	
METALS - SUSPENDED																			
Uranium	mg/L	<0.0003	0.0003	<0.0003	0.0003	0.0004	0.0003	0.0003	0.0003	<0.0003	0.0003	0.0008	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003
Uranium Activity	µCi/ml	<2E-10	2E-10	<2E-10	2E-10	3E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	5E-9	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10

Notes:

uCi/mL = microcuries per milliliter

mg/L = milligrams per Liter

RL - Analyte reporting limit

AOW-1 & AOW-7; Do not produce sufficient water volume to produce sample

AOW-2 - Not drilled

Table 2.9-42 Marsland Expansion Area Radiological Analytical Results (Q4 2013 - Q3 2014) – Arikaree Wells

	Location ID:	AOW-10		AOW-11		AOW-11		AOW-11		AOW-11	
	Date Collected:	9/17/2014		11/8/2013		2/26/2014		6/17/2014		9/17/2014	
	UNITS	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL
RADIONUCLIDES-DISSOLVED											
Lead 210	µCi/ml	1.2E-9	1E-9	<1E-9	1E-9	1.1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Lead 210 precision (±)	µCi/ml	5E-10		NA		4E-10		3E-10		5E-10	
Polonium 210	µCi/ml	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Polonium 210 precision (±)	µCi/ml	2E-10		NA		1E-10		1E-10		2E-10	
Radium 226	µCi/ml	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Radium 226 precision (±)	µCi/ml	4E-11		NA		3E-11		0.0		5E-11	
Thorium 230	µCi/ml	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Thorium 230 precision (±)	µCi/ml	1E-10		NA		3E-11		0.0		2E-11	
Thorium 229 Tracer (30-120)	%	88		76		88		75	76	85	
METALS - DISSOLVED											
Uranium	mg/L	0.0068	0.0003	0.0067	0.0003	0.0064	0.0003	0.0065	0.0067	0.0067	0.0003
Uranium Activity	µCi/ml	4.6E-9	2E-10	4.5E-9	2E-10	4.3E-9	2E-10	4.4E-9	2E-10	4.5E-9	2E-10
RADIONUCLIDES-SUSPENDED											
Lead 210	µCi/ml	4.1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Lead 210 precision (±)	µCi/ml	7E-10		NA		4E-10		4E-10		5E-10	
Polonium 210	µCi/ml	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9	<1E-9	1E-9
Polonium 210 precision (±)	µCi/ml	4E-10		NA		1E-10		0.1		1E-10	
Radium 226	µCi/ml	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Radium 226 precision (±)	µCi/ml	4E-11		NA		2E-11		0.0		4E-11	
Thorium 230	µCi/ml	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10
Thorium 230 precision (±)	µCi/ml	1E-10		NA		4E-11		4E-11		1E-10	
Thorium 229 Tracer (30-120)	%	84		74		110		95	74	81	
METALS - SUSPENDED											
Uranium	mg/L	<0.0003	0.0003	<0.0003	0.0003	<0.0003	0.0003	<0.0003	<0.0003	<0.0003	0.0003
Uranium Activity	µCi/ml	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10	<2E-10	2E-10

Notes:

uCi/mL = microcuries per milliliter

mg/L = milligrams per Liter

RL - Analyte reporting limit

AOW-1 & AOW-7; Do not produce sufficient water volume to produce sample

AOW-2 - Not drilled

Table 2.9-43 Marsland Expansion Area Non-Radiological Analytical Results (Q4 2013 - Q3 2014) – Arikaree Wells

Location ID:		AOW-3		AOW-3		AOW-3		AOW-3		AOW-4		AOW-4		AOW-4		AOW-4		AOW-5	
Date Collected:		11/8/2013		2/25/2014		6/16/2014		9/16/2014		11/8/2013		2/25/2014		6/16/2014		9/17/2014		11/8/2013	
	UNITS	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL
MAJOR IONS																			
Alkalinity, Total as $CaCO_3$	mg/L	188	5	185	5	181	5	169	5	148	5	148	5	150	5	145	5	149	5
Bicarbonate as HCO_3	mg/L	220	5	219	1	221	1	206	1	170	5	174	1	179	1	173	1	174	5
Carbonate as CO_3	mg/L	4	1	3	1	<1	1	<1	1	5	1	3	1	2	1	2	1	4	1
Chloride	mg/L	1	1	2	1	1	1	2	1	7	1	5	1	4	1	4	1	2	1
Fluoride	mg/L	0.7	0.1	0.7	0.1	0.7	0.1	0.5	0.1	0.6	0.1	0.6	0.1	0.6	0.1	0.6	0.1	0.5	0.1
Magnesium	mg/L	18	1	17	1	16	1	14	1	7	1	6	1	7	1	6	1	8	1
Nitrogen, Ammonia as N	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Nitrogen, Nitrate+Nitrite as N	mg/L	1.9	0.1	2.0	0.1	1.4	0.1	1	0.3	0.8	0.1	0.8	0.1	0.9	0.1	0.5	0.1	1.2	0.1
Potassium	mg/L	2	1	2	1	3	1	2	1	4	1	4	1	4	1	4	1	4	1
Silica as SiO2	mg/L	76	1	73	1	77	1	64	1	60	1	63	1	66	1	60	1	64	1
Sodium	mg/L	13	1	14	1	12	1	13	1	19	1	26	1	17	1	18	1	19	1
Sulfate	mg/L	4	1	4	1	4	1	4	1	9	1	9	1	8	1	8	1	7	1
PHYSICAL PROPERTIES																			
pH	s.u.	8.4	0.1	8.4	0.1	8.3	0.1	8.3	0.1	8.5	0.1	8.4	0.1	8.4	0.1	8.5	0.1	8.4	0.1
Conductivity @ 25 °C	umhos/cm	370	1	360	1	347	1	348	1	324	1	316	1	310	1	308	1	313	1
Total Dissolved Solids @ 180 °C	mg/L	280	10	240	10	280	10	300	10	230	10	240	10	240	10	240	10	220	10
Nitrogen, Nitrite as N	mg/L	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1 L
METALS, DISSOLVED																			
Aluminum	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.05	0.05	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.05	0.05	<0.1	0.1
Arsenic	mg/L	0.0003	0.001	0.003	0.001	0.003	0.001	0.002	0.001	0.005	0.001	0.004	0.001	0.004	0.001	0.005	0.001	0.003	0.001
Barium	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	0.1	0.1
Boron	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Cadmium	mg/L	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005
Calcium	mg/L	37	1	37	1	36	1	34	1	35	1	36	1	38	1	35	1	31	1
Chromium	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Copper	mg/L	0.03	0.01	0.01	0.01	0.02	0.01	0.01	0.01	<0.01	0.01	0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01
Iron	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Lead	mg/L	<0.005	0.005	0.002	0.001	0.002	0.001	0.002	0.001	<0.005	0.005	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.005	0.005
Manganese	mg/L	<0.01	0.01	<0.01	0.01	0.01	0.01	0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01
Mercury	mg/L	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001
Molybdenum	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Nickel	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Selenium	mg/L	0.001	0.001	0.002	0.001	<0.001	0.001	<0.001	0.001	0.002	0.001	0.002	0.001	0.002	0.001	0.001	0.001	0.002	0.001
Vanadium	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Zinc	mg/L	1.97	0.01	1.08	0.01	2.15	0.01	1.38	0.01	0.23	0.01	0.29	0.01	0.31	0.01	0.23	0.01	0.11	0.01
DATA QUALITY																			
A/C Balance (± 5)	%	1.80	0.01	1.15	0.01	2.33	0.01	1.36	0.01	2.56	0.01	3.04	0.01	0.40	0.01	1.64	0.01	2.21	0.01
Anions	meq/L	4.04	0.01	4.01	0.01	3.88	0.01	3.61	0.01	3.41	0.01	3.37	0.01	3.35	0.01	3.27	0.01	3.30	0.01
Cations	meq/L	3.89	0.01	3.92	0.01	3.70	0.01	3.51	0.01	3.24	0.01	3.58	0.01	3.32	0.01	3.16	0.01	3.16	0.01
Solids Total Dissolved Calculated	mg/L	270	10	270	10	260	10	240	10	230	10	240	10	240	10	230	10	230	10
Calculated TDS/TDS Ratio (0.80-1.20)	dec. %	1.04	0.01	0.89	0.01	1.08	0.01	1.25	0.01	1.00	0.01	1.00	0.01	1.00	0.01	1.04	0.01	0.96	0.01

Notes:
mg/L = milligrams per Liter
umhos/cm = micromhos per centimeter
s.u. = standard unti
meq/L = milliequivalents per Liter
RL = Analyte Reporting Limit
L = Analytical by a contract laboratory
AOW-1 & AOW-7; Do not produce sufficient water volume to produce sample
AOW-2 - Not drilled

Table 2.9-43 Marsland Expansion Area Non-Radiological Analytical Results (Q4 2013 - Q3 2014) – Arikaree Wells

	Location ID:	AOW-5		AOW-5		AOW-5		AOW-6		AOW-6		AOW-6		AOW-6		AOW-8		AOW-8	
	Date Collected:	2/26/2014		6/17/2014		9/15/2014		11/8/2013		2/26/2014		6/17/2014		9/17/2014		11/8/2013		2/26/2014	
	UNITS	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL
MAJOR IONS																			
Alkalinity, Total as $CaCO_3$	mg/L	154	5	153	5	147	5	163	5	163	5	159	5	162	5	133	5	138	5
Bicarbonate as HCO_3	mg/L	188	1	183	1	179	1	193	5	199	1	193	1	185	1	155	5	169	1
Carbonate as CO_3	mg/L	<1	1	2	1	<1	1	3	1	<1	1	<1	1	6	1	3	1	<1	1
Chloride	mg/L	3	1	2	1	2	1	8	1	5	1	4	1	4	1	8	1	5	1
Fluoride	mg/L	0.5	0.1	0.5	0.1	0.5	0.1	0.6	0.1	0.6	0.1	0.5	0.1	0.6	0.1	0.4	0.1	0.4	0.1
Magnesium	mg/L	8	1	8	1	8	1	8	1	8	1	7	1	8	1	12	1	11	1
Nitrogen, Ammonia as N	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Nitrogen, Nitrate+Nitrite as N	mg/L	1.1	0.1	1.2	0.1	1.2	0.1	2.6	0.1	2.3	0.1	2.4	0.1	2.5	0.1	1.2	0.1	1.6	0.1
Potassium	mg/L	4	1	4	1	4	1	5	1	5	1	5	1	5	1	1	1	1	1
Silica as SiO2	mg/L	67	1	67	1	64	1	57	1	60	1	59	1	57	1	72	1	74	1
Sodium	mg/L	18	1	18	1	20	1	20	1	19	1	18	1	18	1	6	1	6	1
Sulfate	mg/L	7	1	7	1	7	1	12	1	11	1	10	1	10	1	3	1	3	1
PHYSICAL PROPERTIES																			
pH	s.u.	8.3	0.1	8.3	0.1	8.4	0.1	8.4	0.1	8.3	0.1	8.3	0.1	8.4	0.1	8.4	0.1	8.3	0.1
Conductivity @ 25 °C	umhos/cm	319	1	300	1	312	1	377	1	362	1	341	1	360	1	287	1	288	1
Total Dissolved Solids @ 180 °C	mg/L	250	10	250	10	240	10	260	10	280	10	260	10	260	10	220	10	240	10
Nitrogen, Nitrite as N	mg/L	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1 L
METALS, DISSOLVED																			
Aluminum	mg/L	<0.1	0.1	<0.1	0.1	<0.05	0.05	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.05	0.05	<0.1	0.1	<0.1	0.1
Arsenic	mg/L	0.003	0.001	0.003	0.001	0.003	0.001	0.005	0.001	0.005	0.001	0.005	0.001	0.005	0.001	0.002	0.001	0.002	0.001
Barium	mg/L	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	<0.1	0.1	<0.1	0.1
Boron	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Cadmium	mg/L	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005
Calcium	mg/L	33	1	32	1	32	1	42	1	42	1	40	1	40	1	33	1	33	1
Chromium	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Copper	mg/L	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01
Iron	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Lead	mg/L	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.005	0.005	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.005	0.005	<0.001	0.001
Manganese	mg/L	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01
Mercury	mg/L	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001
Molybdenum	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Nickel	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Selenium	mg/L	<0.001	0.001	<0.001	0.001	0.001	0.001	0.002	0.001	<0.001	0.001	0.001	0.001	0.001	0.001	<0.001	0.001	<0.001	0.001
Vanadium	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Zinc	mg/L	0.10	0.01	0.10	0.01	0.1	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	0.19	0.01	0.20	0.01
DATA QUALITY																			
A/C Balance (± 5)	%	2.83	0.01	3.61	0.01	0.32	0.01	2.62	0.01	2.64	0.01	2.37	0.01	3.12	0.01	1.95	0.01	3.74	0.01
Anions	meq/L	3.40	0.01	3.36	0.01	3.25	0.01	3.93	0.01	3.82	0.01	3.70	0.01	3.77	0.01	3.03	0.01	3.09	0.01
Cations	meq/L	3.22	0.01	3.13	0.01	3.23	0.01	3.73	0.01	3.62	0.01	3.53	0.01	3.54	0.01	2.91	0.01	2.86	0.01
Solids Total Dissolved Calculated	mg/L	240	10	230	10	230	10	260	10	260	10	250	10	250	10	220	10	220	10
Calculated TDS/TDS Ratio (0.80-1.20)	dec. %	1.04	0.01	1.09	0.01	1.04	0.01	1.00	0.01	1.08	0.01	1.04	0.01	1.04	0.01	1.00	0.01	1.09	0.01

Notes:
mg/L = milligrams per Liter
umhos/cm = micromhos per centimeter
s.u. = standard unti
meq/L = milliequivalents per Liter
RL = Analyte Reporting Limit
L = Analytical by a contract laboratory
AOW-1 & AOW-7; Do not produce sufficient water volume to produce sample
AOW-2 - Not drilled

Table 2.9-43 Marsland Expansion Area Non-Radiological Analytical Results (Q4 2013 - Q3 2014) – Arikaree Wells

	Location ID:	AOW-8		AOW-8		AOW-9		AOW-9		AOW-9		AOW-9		AOW-10		AOW-10		AOW-10	
	Date Collected:	6/16/2014		9/16/2014		11/8/2013		2/26/2014		6/17/2014		9/17/2014		11/8/2013		2/25/2014		6/16/2014	
	UNITS	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL
MAJOR IONS																			
Alkalinity, Total as $CaCO_3$	mg/L	131	5	136	5	153	5	160	5	161	5	154	6	150	5	156	5	154	5
Bicarbonate as HCO_3	mg/L	160	1	163	1	178	5	194	1	194	1	179	1	182	5	186	1	186	1
Carbonate as CO_3	mg/L	<1	1	2	1	4	1	<1	1	<1	1	4	1	<1	1	2	1	<1	1
Chloride	mg/L	1	1	<1	1	4	1	4	1	4	1	4	1	4	1	6	1	3	1
Fluoride	mg/L	0.4	0.1	0.4	0.1	0.5	0.1	0.5	0.1	0.4	0.1	0.5	0.1	0.5	0.1	0.5	0.1	0.4	0.1
Magnesium	mg/L	11	1	10	1	8	1	8	1	8	1	8	1	9	1	9	1	9	1
Nitrogen, Ammonia as N	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Nitrogen, Nitrate+Nitrite as N	mg/L	0.9	0.1	1.4	0.1	1.2	0.1	1.3	0.1	1.4	0.1	1.3	0.1	2.1	0.1	2.1	0.1	2.4	0.1
Potassium	mg/L	1	1	1	1	4	1	4	1	4	1	4	1	3	1	3	1	4	1
Silica as SiO2	mg/L	77	1	78	1	64	1	67	1	65	1	64	1	63	1	65	1	68	1
Sodium	mg/L	6	1	6	1	19	1	18	1	18	1	18	1	21	1	24	1	20	1
Sulfate	mg/L	1	1	2	1	8	1	8	1	8	1	7	1	8	1	8	1	6	1
PHYSICAL PROPERTIES																			
pH	s.u.	8.3	0.1	8.3	0.1	8.4	0.1	8.3	0.1	8.3	0.1	8.4	0.1	8.4	0.1	8.3	0.1	8.3	0.1
Conductivity @ 25 °C	umhos/cm	248	1	281	1	325	1	333	1	327	1	331	1	328	1	332	1	324	1
Total Dissolved Solids @ 180 °C	mg/L	220	10	270	10	220	10	270	10	260	10	250	10	230	10	240	10	260	10
Nitrogen, Nitrite as N	mg/L	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1 L
METALS, DISSOLVED																			
Aluminum	mg/L	<0.1	0.1	<0.05	0.05	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.05	0.05	<0.1	0.1	<0.1	0.1	<0.1	0.1
Arsenic	mg/L	0.002	0.001	0.001	0.001	0.003	0.001	0.002	0.001	0.002	0.001	0.003	0.001	0.002	0.001	0.002	0.001	0.002	0.001
Barium	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	0.1	0.1	0.1	0.1
Boron	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Cadmium	mg/L	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005
Calcium	mg/L	34	1	32	1	34	1	35	1	36	1	34	1	32	1	34	1	34	1
Chromium	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Copper	mg/L	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01
Iron	mg/L	<0.05	0.05	<0.05	0.05	0.06	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Lead	mg/L	<0.001	0.001	<0.001	0.001	<0.005	0.005	<0.001	0.001	<0.001	0.001	0.002	0.001	<0.005	0.005	<0.001	0.001	<0.001	0.001
Manganese	mg/L	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01
Mercury	mg/L	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001
Molybdenum	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Nickel	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Selenium	mg/L	<0.001	0.001	<0.001	0.001	0.002	0.001	<0.001	0.001	0.002	0.001	0.001	0.001	0.002	0.001	0.002	0.001	0.001	0.001
Vanadium	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Zinc	mg/L	0.28	0.01	0.21	0.01	0.22	0.01	0.31	0.01	0.40	0.01	0.42	0.01	0.21	0.01	0.23	0.01	0.26	0.01
DATA QUALITY																			
A/C Balance (± 5)	%	2.53	0.01	2.12	0.01	2.25	0.01	4.65	0.01	4.11	0.01	3.14	0.01	1.92	0.01	<0.01	0.01	0.92	0.01
Anions	meq/L	2.76	0.01	2.88	0.01	3.44	0.01	3.58	0.01	3.61	0.01	3.46	0.01	3.46	0.01	3.61	0.01	3.51	0.01
Cations	meq/L	2.91	0.01	2.76	0.01	3.29	0.01	3.26	0.01	3.33	0.01	3.25	0.01	3.33	0.01	3.61	0.01	3.44	0.01
Solids Total Dissolved Calculated	mg/L	210	10	220	10	240	10	240	10	250	10	240	10	240	10	250	10	250	10
Calculated TDS/TDS Ratio (0.80-1.20)	dec. %	1.05	0.01	1.23	0.01	0.92	0.01	1.12	0.01	1.04	0.01	1.04	0.01	0.96	0.01	0.96	0.01	1.04	0.01

Notes:
mg/L = milligrams per Liter
umhos/cm = micromhos per centimeter
s.u. = standard unti
meq/L = milliequivalents per Liter
RL = Analyte Reporting Limit
L = Analytical by a contract laboratory
AOW-1 & AOW-7; Do not produce sufficient water volume to produce sample
AOW-2 - Not drilled

Table 2.9-43 Marsland Expansion Area Non-Radiological Analytical Results (Q4 2013 - Q3 2014) – Arikaree Wells

	Location ID:	AOW-10		AOW-11		AOW-11		AOW-11		AOW-11	
	Date Collected:	9/17/2014		11/8/2013		2/26/2014		6/17/2014		9/17/2014	
	UNITS	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL	RESULTS	RL
MAJOR IONS											
Alkalinity, Total as $CaCO_3$	mg/L	154	5	166	5	171	5	167	5	165	5
Bicarbonate as HCO_3	mg/L	177	1	195	5	207	1	201	1	194	1
Carbonate as CO_3	mg/L	6	1	4	1	1	1	1	1	4	1
Chloride	mg/L	6	1	10	1	7	1	7	1	4	1
Fluoride	mg/L	3	1	0.6	0.1	0.5	0.1	0.5	0.1	0.5	0.1
Magnesium	mg/L	9	1	9	1	8	1	8	1	8	1
Nitrogen, Ammonia as N	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Nitrogen, Nitrate+Nitrite as N	mg/L	2.3	0.1	3.6	0.1	3.1	0.1	3.3	0.1	3.2	0.1
Potassium	mg/L	4	1	5	1	4	1	5	1	5	1
Silica as SiO2	mg/L	63	1	57	1	59	1	59	1	58	1
Sodium	mg/L	20	1	18	1	16	1	16	1	15	1
Sulfate	mg/L	7	1	10	1	9	1	9	1	9	1
PHYSICAL PROPERTIES											
pH	s.u.	8.4	0.1	8.4	0.1	8.3	0.1	8.3	0.1	8.4	0.1
Conductivity @ 25 °C	umhos/cm	295	1	398	1	379	1	366	1	338	1
Total Dissolved Solids @ 180 °C	mg/L	270	10	260	10	290	10	280	10	290	1
Nitrogen, Nitrite as N	mg/L	<0.1	0.1	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1 L	<0.1	0.1
METALS, DISSOLVED											
Aluminum	mg/L	<0.05	0.05	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.05	0.05
Arsenic	mg/L	0.003	0.001	0.004	0.001	0.004	0.001	0.004	0.001	0.004	0.001
Barium	mg/L	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Boron	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Cadmium	mg/L	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005
Calcium	mg/L	32	1	48	1	46	1	46	1	44	1
Chromium	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Copper	mg/L	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01
Iron	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Lead	mg/L	<0.001	0.001	<0.005	0.005	<0.001	0.001	<0.001	0.001	<0.001	0.001
Manganese	mg/L	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01
Mercury	mg/L	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001
Molybdenum	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Nickel	mg/L	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05	<0.05	0.05
Selenium	mg/L	0.001	0.001	0.002	0.001	<0.001	0.001	0.001	0.001	0.002	0.001
Vanadium	mg/L	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.1
Zinc	mg/L	0.26	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01
DATA QUALITY											
A/C Balance (± 5)	%	3.72	0.01	1.23	0.01	4.15	0.01	2.30	0.01	2.6	0.01
Anions	meq/L	3.52	0.01	4.09	0.01	4.05	0.01	3.99	0.01	3.86	0.01
Cations	meq/L	3.26	0.01	3.99	0.01	3.72	0.01	3.81	0.01	3.66	0.01
Solids Total Dissolved Calculated	mg/L	240	10	270	10	270	10	270	10	260	10
Calculated TDS/TDS Ratio (0.80-1.20)	dec. %	1.12	0.01	0.96	0.01	1.07	0.01	1.04	0.01	1.12	0.01

Notes:
mg/L = milligrams per Liter
umhos/cm = micromhos per centimeter
s.u. = standard unti
meq/L = milliequivalents per Liter
RL = Analyte Reporting Limit
L = Analytical by a contract laboratory
AOW-1 & AOW-7; Do not produce sufficient water volume to produce sample
AOW-2 - Not drilled

Table 3.1-1 Background Information for Logging Probes Used at the Marsland Expansion Area

Logging Tool	Tool Specifications
9060	Natural Gamma, Spontaneous Potential, Single Point Resistance
9055	Vertical Deviation, Natural Gamma, Neutron Detector, Neutron Porosity, Spontaneous Potential, Single Point Resistance
9144	Natural Gamma, 64-inch Normal Resistivity, 16-inch Resistivity, Fluid Resistivity, 48-inch Lateral Resistivity, Spontaneous Potential, Single Point Resistance, Temperature and Delta Temperature, Slant Angle and Aximuth
9057	Natural Gamma, 64-inch Normal Resistivity, 16-inch Normal Resistivity, Neutron-Neutron, 48-inch Lateral Resistivity, Spontaneous Potential, Single Point Resistance, Temperature and Delta Temperature, Slant Angle and Azimuth

Table 3.1-2 Summary of Risk of Erosion for Proposed Marsland Expansion Area Mine Units

Mining Unit	MU Maximum Soil Loss (ton/acre/year)	MU Maximum Erosion Risk	Percent MU Area of Moderate to High Erosion Risk	Drainage Lines Crossing MU
MU-A	3.3	Low	N/A	N/A
MU-1	3.4	Low	N/A	N/A
MU-2	18.7	High	5	21
MU-3	22.2	High	2	21
MU-4	24.5	High	7	21
MU-5	13.5	Moderate	11	21
MU-B	20.0	High	6	N/A
MU-C	2.7	Very Low	N/A	N/A
MU-D	0.9	Very Low	N/A	30
MU-E	1.1	Very Low	N/A	N/A
MU-F	0.7	Very Low	N/A	N/A

Table 3.1-3 The Peak Flow for Hydrologic Project South

Return Periods		100-year		50-year		25-year		10-year	
Hydrologic Element	Drainage Area (Km^2)	Peak Discharge (M^3/S)	Peak Discharge (Ft^3/S)	Peak Discharge (M^3/S)	Peak Discharge (Ft^3/S)	Peak Discharge (M^3/S)	Peak Discharge (Ft^3/S)	Peak Discharge (M^3/S)	Peak Discharge (Ft^3/S)
W310	0.65	2.5	88	2.1	74	1.7	60	1.2	42
W300	0.45	2.9	102	2.5	88	2.1	74	1.6	57
W290	0.36	2.5	88	2.1	74	1.7	60	1.2	42
W280	0.49	2.1	74	1.8	64	1.4	49	1.1	39
W270	1.50	4.9	173	4.1	145	3.4	120	2.5	88
W260	1.20	4.5	159	3.8	134	3.1	109	2.2	78
W250	0.87	4.0	141	3.4	120	2.8	99	2.0	71
W240	1.94	8.3	293	7.0	247	5.7	201	4.2	148
W230	0.78	5.8	205	5.0	177	4.2	148	3.2	113
W220	0.66	6.4	226	5.5	194	4.6	162	3.5	124
W210	4.18	10.9	385	9.1	321	7.5	265	5.7	201
W200	0.74	6.2	219	5.3	187	4.4	155	3.3	117
W190	1.39	8.9	314	7.6	268	6.4	226	4.8	170
W180	0.48	4.8	170	4.1	145	3.4	120	2.5	88
W170	2.12	12.0	424	10.2	360	8.5	300	6.4	226
Outlet S	17.82	41.7	1473	34.8	1229	28.8	1017	22.1	780
R40	2.60	12.6	445	10.7	378	9.0	318	6.8	240
R80	1.44	8.9	314	7.6	268	6.4	226	4.9	173
R90	4.73	17.3	611	14.6	516	12.2	431	9.3	328
R110	12.29	38.1	1345	31.9	1127	26.6	939	20.3	717
R120	14.36	38.9	1374	32.5	1148	27.0	953	20.6	727
R140	16.35	41.6	1469	34.8	1229	28.7	1014	22.0	777
R160	17.16	41.2	1455	34.4	1215	28.5	1006	21.9	773

Km^2 – square kilometer M^3/S – cubic meter per second Ft^3/S – cubic feet per second

Table 3.1-4 The Peak Flow for Hydrologic Project East

Return Periods		100-year		50-year		25-year		10-year	
Hydrologic Element	Drainage Area (Km^2)	Peak Discharge (M^3/S)	Peak Discharge (Ft^3/S)	Peak Discharge (M^3/S)	Peak Discharge (Ft^3/S)	Peak Discharge (M^3/S)	Peak Discharge (Ft^3/S)	Peak Discharge (M^3/S)	Peak Discharge (Ft^3/S)
W127490	3.01	7.4	261	6.1	215	5.0	177	3.8	134
W127480	0.03	0.2	7	0.2	7	0.1	4	0.1	4
W127470	0.99	4.7	166	4.0	141	3.3	117	2.5	88
W127460	0.06	0.3	11	0.2	7	0.2	7	0.1	4
W127450	1.40	10.4	367	8.9	314	7.5	265	5.7	201
W127440	0.70	3.7	131	3.1	109	2.6	92	1.9	67
W127430	1.23	6.4	226	5.4	191	4.6	162	3.4	120
W127420	0.70	5.7	201	4.8	170	4.0	141	3.0	106
W127410	0.28	2.3	81	1.9	67	1.6	57	1.1	39
W127400	1.50	5.7	201	4.8	170	4.0	141	3.1	109
W127390	1.52	10.0	353	8.6	304	7.2	254	5.5	194
W127380	1.19	8.6	304	7.3	258	6.2	219	4.6	162
W127370	1.38	9.2	325	7.9	279	6.7	237	5.0	177
W127360	1.87	11.1	392	9.4	332	7.9	279	5.9	208
W127350	3.24	17.7	625	15.0	530	12.6	445	9.4	332
W127340	0.79	5.8	205	4.9	173	4.1	145	3.0	106
W127330	1.79	10.1	357	8.6	304	7.2	254	5.4	191
W127320	0.45	3.3	117	2.8	99	2.3	81	1.7	60
W127310	0.59	4.1	145	3.5	124	2.9	102	2.2	78
W127300	2.13	11.2	396	9.5	335	7.9	279	5.9	208
W127290	1.17	9.6	339	8.1	286	6.8	240	5.1	180
W127280	2.21	11.5	406	9.7	343	8.1	286	6.1	215
W127270	2.18	13.1	463	11.1	392	9.3	328	7.0	247
Outlet E	30.42	75.3	2659	63.2	2232	52.7	1861	40.9	1444
R127080	4.34	20.2	713	17.1	604	14.3	505	10.8	381
R127100	3.35	18.1	639	15.4	544	12.9	456	9.7	343
R127110	6.58	28.4	1003	24.0	848	20.1	710	15.2	537
R127120	11.31	45.0	1589	38.0	1342	31.7	1119	24.2	855
R127140	16.42	59.9	2115	50.4	1780	42.1	1487	32.3	1141
R127160	18.99	66.1	2334	55.6	1963	46.5	1642	35.8	1264
R127180	20.79	69.4	2451	58.5	2066	48.8	1723	37.7	1331

Table 3.1-4 The Peak Flow for Hydrologic Project East

Return Periods		100-year		50-year		25-year		10-year	
Hydrologic Element	**Drainage Area (Km^2)**	**Peak Discharge (M^3/S)**	**Peak Discharge (Ft^3/S)**	**Peak Discharge (M^3/S)**	**Peak Discharge (Ft^3/S)**	**Peak Discharge (M^3/S)**	**Peak Discharge (Ft^3/S)**	**Peak Discharge (M^3/S)**	**Peak Discharge (Ft^3/S)**
R127200	22.99	72.6	2564	61.1	2158	51.0	1801	39.4	1391
R127220	24.92	75.4	2663	63.5	2242	52.9	1868	41.0	1448
R127240	25.97	76.9	2716	64.8	2288	54.0	1907	41.8	1476
R127260	27.41	71.3	2518	59.9	2115	50.0	1766	38.8	1370

Km^2 – square kilometer M^3/S – cubic meter per second Ft^3/S – cubic feet per second

Table 3.1-5 Typical Lixiviant Concentrations

Species	Range (in mg/l)	
	Low	High
Na	≤ 400	6,000
Ca	≤ 20	500
Mg	≤ 3	100
K	≤ 15	300
CO_3	≤ 0.5	2,500
HCO_3	≤ 400	5,000
Cl	≤ 200	5,000
SO_4	≤ 400	5,000
U_3O_8	≤ 0.01	500
V_2O_5	≤ 0.01	100
TDS	≤ 1650	12,000
pH	≤ 6.5	10.5

Note:
The above values represent the concentration ranges that could be found in barren lixiviant or pregnant lixiviant and would include the concentration normally found in "injection fluid."

Table 3.1-6 Lixiviant Parameters Measured in the Injection Stream at Crow Butte MU-3, MU-4, MU-5 and MU-6

Parameter	Concentration	Mine Unit Results				Reporting Limit
		MU-3	MU-4	MU-5	MU-6	
Major Ions, Suspended						
Alkalinity, Total as $CaCO_3$	mg/L	1,180	1,680	1,200	1,740	1.0
Bicarbonate as HCO_3	mg/L	1,440	2,050	1,540	2,120	1.0
Carbonate	mg/L	<1.0	<1.0	<1.0	<5.0	1.0 – 5.0
Calcium	mg/L	95	77.4	75.0	73 [a]	1.0 – 2.0
Chloride	mg/L	681	603	581	714 [a]	1.0 – 4.0
Fluoride	mg/L	0.47	0.6	0.6	0.5	0.1
Magnesium	mg/L	25	22.9	22.0	23.0	1.0
Nitrogen, Total Ammonia as N	mg/L	<0.05	<0.05	<0.05	<0.05	0.05
Nitrite, as N	mg/L	<0.10	<0.1	<0.10	ND	0.10
Nitrite + Nitrate as Nitrogen	mg/L	0.49	0.46	0.5	0.4	0.05 – 0.1
Potassium	mg/L	40	35.3	34.0	32	1.0
Silica		21.5	21.0	22.2	24.1	1.0
Sodium	mg/L	1,240	1,310	1,220	1,460 [a]	1.0 – 3.0
Sulfate	mg/L	740	901	915	708 [a]	1.0 - 20
Physical Properties						
Conductivity @ 25° C	µmhos/cm	6,020	6,260	5,260	5,930	1.0
pH, Field	s.u.	7.81	8.19	7.67	7.99	0.1
Total Dissolved Solids, TDS @ 180 °C	mg/L	3,680	4,080	3,330	4,110 [a]	2.0 - 16
Metals, Dissolved						
Aluminum	mg/L	<0.1	<0.1	<0.1	<0.1	0.10
Arsenic	mg/L	0.062	0.057 [a]	0.046	0.049	0.001- 0.002
Barium	mg/L	<0.10	<0.1	<0.1	<0.1	0.10
Boron	mg/L	1.0	1.10	1.2	1.3	0.10
Cadmium	mg/L	<0.005	<0.005	<0.005	<0.005	0.005
Chromium	mg/L	<0.05	<0.05	<0.05	<0.05	0.05
Copper	mg/L	0.06	0.04	0.02	0.02	0.01
Iron	mg/L	<0.05	<0.05	<0.03	<0.03	0.03 - 0.05
Lead	mg/L	<0.05	<0.05	0.001	<0.001	<0.001 0.03 - 0.05
Manganese	mg/L	0.07	0.05	0.04	0.03	0.01
Mercury	mg/L	<0.001	<0.001	<0.001	<0.001	0.001
Molybdenum	mg/L	0.40	0.5	1.4	0.4	0.10
Nickel	mg/L	<0.05	<,0.05	<0.05	<0.05	0.05
Selenium	mg/L	0.065	0.073 [a]	0.096	0.128	0.001- 0.005
Vanadium	mg/L	1.10	2.2	1.3	0.8	0.01
Zinc	mg/L	0.10	0.02		0.01	0.01
Radionuclides						
Uranium	mg/L	2.10	3.70 [a]	0.636	0.951	0.0003
Uranium, Activity	µC i/mL	ND	ND	ND	6.4E-07	2.0E-10
Ra-226	pCi/L	991	ND	969	1,150	0.2
Radium Error Estimate ±	--	9.4	--	34.7	7.0	--
Radium 226 MDC	pCi/L	ND	ND	ND	0.18	--
Quality Assurance Data	--	--	--	--	--	**Target Range**
Anion	meq	58.26	ND	ND	ND	--
Cation	meq	61.80	ND	ND	ND	--
WYDEQ A/C Balance	%	2.95	ND	ND	ND	-5 - + 5
Calc. TDS	mg/L	3,565	ND	ND	ND	--

mg/L = milligrams per liter s.u = standard unit µCi/mL = microCuries per milliter meq = milliequivalent pCi/L= picoCuries per liter
µmhos/cm =µ mhos/cm = micromhos per centimeter < = less than MDC = minimum detectable concentration ND = No data
[a] Reporting Limit increased due to sample matrix WYDEQ = Wyoming Department of Environmental Quality

Table 3.1-7 Disposal Water Balance (Marsland Expansion Area), Crow Butte Resources, Inc., Crawford, NE

Year	2015				2016				2017				2018			
Elapsed Time (Quarters)	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Prod Flow	1100	1700	2100	2100	2100	2700	3400	3600	3500	3900	4500	4700	4500	4800	5300	5400
Prod Bleed 1.2%	13	20	25	25	25	32	41	43	42	47	54	56	54	58	64	65
IX Bleed 2.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MU1 RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MU2 RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MU3 RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MU4 RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MU5 RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MUA RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MUB RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MUC RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MUD RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MUE RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MUF RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Production bleed capacity needed (gpm)	13	20	25	25	25	32	41	43	42	47	54	56	54	58	64	65
Restoration capacity needed (gpm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total disposal capacity needed (gpm)	**13**	**20**	**25**	**25**	**25**	**32**	**41**	**43**	**42**	**47**	**54**	**56**	**54**	**58**	**64**	**65**
Disposal Option(s)	DDW1	DDW1	DDW1	DDW1	DDW1	DDW1	DDW1	DDW1	DDW1	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)

Notes:

(1) Additional deep disposal wells will be installed as needed

Assumed start date = 1Q 2015

gpm - gallons per minute

hr - hours

DDW1 - Deep Disposal Well 1

DDW2 - Deep Disposal Well 2

Assumed sustainable DDW injection rates = 45 gpm

Storage Tanks Capacity = 100,000 gallons

Table 3.1-7 Disposal Water Balance (Marsland Expansion Area), Crow Butte Resources, Inc., Crawford, NE

Year	2019				2020				2021				2022			
Elapsed Time (Quarters)	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Prod Flow	5100	5300	5300	5300	4500	4500	4200	4100	4100	4600	4500	4300	4300	4800	4800	4500
Prod Bleed 1.2%	61	64	64	64	54	54	50	49	49	55	54	52	52	58	58	54
IX Bleed 2.0%	0	0	0	0	0	16	16	16	4	16	16	16	8	16	16	16
MU1 RO Bleed (30%)	0	0	0	0	0	0	0	0	150	150	150	150	150	150	150	150
MU2 RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	75	75	75	75
MU3 RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MU4 RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MU5 RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MUA RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MUB RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MUC RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MUD RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MUE RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MUF RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Production bleed capacity needed (gpm)	61	64	64	64	54	54	50	49	49	55	54	52	52	58	58	54
Restoration capacity needed (gpm)	0	0	0	0	0	16	16	16	154	166	166	166	233	241	241	241
Total disposal capacity needed (gpm)	**61**	**64**	**64**	**64**	**54**	**70**	**66**	**65**	**203**	**221**	**220**	**218**	**285**	**299**	**299**	**295**
Disposal Option(s)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)

Notes:

(1) Additional deep disposal wells will be installed as needed

Assumed start date = 1Q 2015

gpm - gallons per minute

hr - hours

DDW1 - Deep Disposal Well 1

DDW2 - Deep Disposal Well 2

Assumed sustainable DDW injection rates = 45 gpm

Storage Tanks Capacity = 100,000 gallons

Table 3.1-7 Disposal Water Balance (Marsland Expansion Area), Crow Butte Resources, Inc., Crawford, NE

Year	2023				2024				2025				2026			
Elapsed Time (Quarters)	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Prod Flow	4500	5000	5100	4800	4800	5300	5400	5100	5300	5300	5200	4700	4300	3700	3900	3600
Prod Bleed 1.2%	54	60	61	58	58	64	65	61	64	64	62	56	52	44	47	43
IX Bleed 2.0%	16	8	8	8	8	16	16	16	8	8	8	8	8	8	8	8
MU1 RO Bleed (30%)	150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MU2 RO Bleed (30%)	75	150	150	150	150	150	150	150	0	0	0	0	0	0	0	0
MU3 RO Bleed (30%)	0	75	75	75	75	75	75	75	150	150	150	150	150	150	0	0
MU4 RO Bleed (30%)	0	0	0	0	0	0	0	0	75	75	75	75	75	75	150	150
MU5 RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75	75
MUA RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MUB RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MUC RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MUD RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MUE RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MUF RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Production bleed capacity needed (gpm)	54	60	61	58	58	64	65	61	64	64	62	56	52	44	47	43
Restoration capacity needed (gpm)	241	233	233	233	233	241	241	241	233	233	233	233	233	233	233	233
Total disposal capacity needed (gpm)	**295**	**293**	**294**	**291**	**291**	**305**	**306**	**302**	**297**	**297**	**295**	**289**	**285**	**277**	**280**	**276**
Disposal Option(s)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)

Notes:

(1) Additional deep disposal wells will be installed as needed

Assumed start date = 1Q 2015

gpm - gallons per minute

hr - hours

DDW1 - Deep Disposal Well 1

DDW2 - Deep Disposal Well 2

Assumed sustainable DDW injection rates = 45 gpm

Storage Tanks Capacity = 100,000 gallons

Table 3.1-7 Disposal Water Balance (Marsland Expansion Area), Crow Butte Resources, Inc., Crawford, NE

Year	2027				2028				2029				2030			
Elapsed Time (Quarters)	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Prod Flow	3400	3700	3900	3500	3200	2900	2600	2400	2200	1800	1600	1500	1400	1300	1200	900
Prod Bleed 1.2%	41	44	47	42	38	35	31	29	26	22	19	18	17	16	14	11
IX Bleed 2.0%	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
MU1 RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MU2 RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MU3 RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MU4 RO Bleed (30%)	150	150	150	150	0	0	0	0	0	0	0	0	0	0	0	0
MU5 RO Bleed (30%)	75	75	75	75	150	150	150	150	150	150	0	0	0	0	0	0
MUA RO Bleed (30%)	0	0	0	0	75	75	75	75	75	75	150	150	150	150	150	150
MUB RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	75	75	75	75	75	75
MUC RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MUD RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MUE RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MUF RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Production bleed capacity needed (gpm)	41	44	47	42	38	35	31	29	26	22	19	18	17	16	14	11
Restoration capacity needed (gpm)	233	233	233	233	233	233	233	233	233	233	233	233	233	233	233	233
Total disposal capacity needed (gpm)	**274**	**277**	**280**	**275**	**271**	**268**	**264**	**262**	**259**	**255**	**252**	**251**	**250**	**249**	**247**	**244**
Disposal Option(s)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)

Notes:

(1) Additional deep disposal wells will be installed as needed

Assumed start date = 1Q 2015

gpm - gallons per minute

hr - hours

DDW1 - Deep Disposal Well 1

DDW2 - Deep Disposal Well 2

Assumed sustainable DDW injection rates = 45 gpm

Storage Tanks Capacity = 100,000 gallons

Table 3.1-7 Disposal Water Balance (Marsland Expansion Area), Crow Butte Resources, Inc., Crawford, NE

Year	2031				2032				2033				2034			
Elapsed Time (Quarters)	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Prod Flow	800	700	600	500	400	200	200	200	200	200	200	0	0	0	0	0
Prod Bleed 1.2%	10	8	7	6	5	2	2	2	2	2	2	0	0	0	0	0
IX Bleed 2.0%	8	8	8	8	8	8	8	8	8	8	8	0	0	0	0	0
MU1 RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MU2 RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MU3 RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MU4 RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MU5 RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MUA RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MUB RO Bleed (30%)	150	150	150	150	150	150	0	0	0	0	0	0	0	0	0	0
MUC RO Bleed (30%)	75	75	75	75	75	75	150	150	150	150	150	150	0	0	0	0
MUD RO Bleed (30%)	0	0	0	0	0	0	75	75	75	75	75	75	150	150	150	150
MUE RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	75	75	75	75
MUF RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Production bleed capacity needed (gpm)	10	8	7	6	5	2	2	2	2	2	2	0	0	0	0	0
Restoration capacity needed (gpm)	233	233	233	233	233	233	233	233	233	233	233	225	225	225	225	225
Total disposal capacity needed (gpm)	**243**	**241**	**240**	**239**	**238**	**235**	**235**	**235**	**235**	**235**	**235**	**225**	**225**	**225**	**225**	**225**
Disposal Option(s)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)

Notes:

(1) Additional deep disposal wells will be installed as needed

Assumed start date = 1Q 2015

gpm - gallons per minute

hr - hours

DDW1 - Deep Disposal Well 1

DDW2 - Deep Disposal Well 2

Assumed sustainable DDW injection rates = 45 gpm

Storage Tanks Capacity = 100,000 gallons

Table 3.1-7 Disposal Water Balance (Marsland Expansion Area), Crow Butte Resources, Inc., Crawford, NE

Year	2035				2036				2037				2038				2039	
Elapsed Time (Quarters)	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
Prod Flow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Prod Bleed 1.2%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IX Bleed 2.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MU1 RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MU2 RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MU3 RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MU4 RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MU5 RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MUA RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MUB RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MUC RO Bleed (30%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MUD RO Bleed (30%)	150	150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MUE RO Bleed (30%)	75	75	150	150	150	150	150	150	0	0	0	0	0	0	0	0	0	0
MUF RO Bleed (30%)	0	0	75	75	75	75	75	75	225	225	225	225	0	0	0	0	0	0
Production bleed capacity needed (gpm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Restoration capacity needed (gpm)	225	225	225	225	225	225	225	225	225	225	225	225	0	0	0	0	0	0
Total disposal capacity needed (gpm)	**225**	**225**	**225**	**225**	**225**	**225**	**225**	**225**	**225**	**225**	**225**	**225**	**0**	**0**	**0**	**0**	**0**	**0**
Disposal Option(s)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	DDW1, DDW2(1)	--	--	--	--	--	--

Notes:

(1) Additional deep disposal wells will be installed as needed

Assumed start date = 1Q 2015

gpm - gallons per minute

hr - hours

DDW1 - Deep Disposal Well 1

DDW2 - Deep Disposal Well 2

Assumed sustainable DDW injection rates = 45 gpm

Storage Tanks Capacity = 100,000 gallons

Table 4.2-1 Deep Disposal Well No. 1 Injection Radiological Data for Crow Butte Central Processing Facility (2008 – 2012)

Month	Total Gallons Injected	Average Natural Uranium (mg/l)[a]	Total Natural Uranium Injected (mg)	Total Natural Uranium Injected (uCi)	Average Radium-226 (uCi/l)[a]	Total Radium-226 Injected (uCi/l)
January 2012	7,785,326	4	1.18E+08	7.98E+04	857	2.53E+04
February 2012	6,463,164	5	1.22E+08	8.28E+04	1,030	2.52E+04
March 2012	7,498,767	8	2.27E+08	1.54E+05	773	2.19E+04
April 2012	6,285,700	5	1.19E+08	8.05E+04	723	1.72E+04
May 2012	6,986,706	5	1.32E+08	8.95E+04	795	2.10E+04
June 2012	6,369,456	9	2.17E+08	1.47E+05	713	1.72E+04
Semiannual Totals	**41,389,119**	**--**	**9.35E+08**	**6.33E+05**	**--**	**1.28E+05**
July 2012	5,615,358	2	4.25E+07	2.88E+04	593	1.26E+04
August 2012	5,290,499	4	8.01E+07	5.42E+04	568	1.14E+04
September 2012	4,598,394	4	6.96E+07	4.71E+04	712	1.24E+04
October 2012	5,688,878	3	6.46E+07	4.37E+04	794	1.71E+04
November 2012	6,458,651	5	1.22E+08	8.28E+04	1,110	2.71E+04
December 20122	8,157,401	4	124E=08	8.36E+04	828	2.56E+04
Semiannual Totals	**35,809,181**	**--**	**5.03E+08**	**3.40E+05**	**--**	**1.06E+05**
January 2011	7,114,952	11	2.96E+08	2.01E+05	893	2.41E+04
February 2011	6,385,945	7	1.69E+08	1.15E+05	668	1.61E+04
March 2011	7,617,730	6	1.73E+08	1.17E+05	579	1.67E+04
April 2011	7,170,161	5	1.36E+08	9.19E+04	969	2.63E+04
May 2011	7,759,529	6	1.76E+08	1.19E+05	721	2.12E+04
June 2011	8,271,982	8	2.50E+08	1.70E+05	766	2.40E+04
Semiannual Totals	**44,320,299**	**--**	**1.20E+09**	**8.13E+05**	**--**	**1.28E+05**
July 2011	8,399,906	5	1.59E+08	1.08E+05	645	2.05E+04
August 2011	8,561,281	7	2.27E+08	1.54E+05	906	2.94E+04
September 2011	8,408,541	7	2.23E+08	1.51E+05	779	2.48E+04
October 2011	7,720,546	6	1.75E+08	1.19E+05	769	2.25E+04

Table 4.2-1 Deep Disposal Well No. 1 Injection Radiological Data for Crow Butte Central Processing Facility (2008 – 2012)

Month	Total Gallons Injected	Average Natural Uranium (mg/l)[a]	Total Natural Uranium Injected (mg)	Total Natural Uranium Injected (uCi)	Average Radium-226 (uCi/l)[a]	Total Radium-226 Injected (uCi/l)
November 2011	7,982,590	7	2.12E+08	1.43E+05	875	2.64E+04
December 2011	7,542,422	6	1.71E+08	1.16E+05	1,100	3.14E+04
Semiannual Totals	**44,615,286**	**--**	**1.17E+09**	**7.90E+05**	**--**	**1.55E+05**
January 2010	6,934,560	5	1.31E+08	8.89E+04	946	2.48E+04
February 2010	6,582,075	6	1.49E+08	1.01E+05	1,400	3.49E+04
March 2010	7,419,844	7	1.97+08	1.33E+05	1,170	3.29E+04
April 2010	7,129,607	8	2.16E+08	1.46E+05	1,490	4.02E+04
May 2010	7,103,123	7	1.88E+08	1.27E+05	1,660	4.46E+04
June 2010	6,914,870	9	2.36E+08	1.59E+05	1,420	3.72E+04
Semiannual Totals	**42,084,079**	**--**	**1.12E+09**	**7.56E+05**	**--**	**2.15E+05**
July 2010	6,827,844	12	3.10E+08	2.01E+05	1,600	4.14E+04
August 2010	7,485,430	11	3.12E+08	2.11E+05	876	2.48E+04
September 2010	6,979,672	9	2.38E+08	1.61E+05	851	2.25E+04
October 2010	7,360,919	9	2.51E+08	1.70E+05	964	2.69E+04
November 2010	6,484,832	10	2.45E+08	1.66E+05	1,470	3.61E+04
December 2010	6,838,592	14	3.62E+08	2.45E+05	931	2.41E+04
Semiannual Totals	**41,977,289**	**--**	**1.72E+09**	**1.16E+06**	**--**	**1.76E+05**
January 2009	4,656,906	5	8.81E+07	5.97E+04	707	1.25E+04
February 2009	4,208,406	3	4.78E+07	3.24E+04	752	1.20E+04
March 2009	3,849,464	3	4.37E+07	2.96E+04	656	9.56E+03
April 2009	3,761,898	5	7.12E+07	4.82E+04	686	9.77E+03
May 2009	4,821,589	4	7.30E+07	4.94E+04	892	1.63E+04
June 2009	5,634,712	4	8.53E+07	5.78E+04	1,000	2.13E+04
Semiannual Totals	**26,932,975**	**--**	**4.09E+08**	**2.77E+05**	**--**	**8.14E+04**

Table 4.2-1 Deep Disposal Well No. 1 Injection Radiological Data for Crow Butte Central Processing Facility (2008 – 2012)

Month	Total Gallons Injected	Average Natural Uranium (mg/l)[a]	Total Natural Uranium Injected (mg)	Total Natural Uranium Injected (uCi)	Average Radium-226 (uCi/l)[a]	Total Radium-226 Injected (uCi/l)
July 2009	5,467,407	3	6.21E+07	4.20E+04	1,120	2.32E+04
August 2009	5,519,131	6	1.25E+08	8.49E+04	991	2.07E+04
September 2009	5,418,568	5	1.03E+08	6.94E+04	652	1.34E+04
October 2009	5,791,232	4	8.77E+07	5.94E+04	866	1.90E+04
November 2009	6,060,190	6	1.38E+08	9.32E+04	1,090	2.50E+04
December 2009	6,730,245	7	1.78E+08	1.21E+05	1,250	3.18E+04
Semiannual Totals	**34,986,773**	**--**	**6.94E+08**	**4.70E+05**	**--**	**1.33E+05**
January 2008	5,132,667	3	5.83E+07	3.95E+04	669	1.30E+04
February 2008	3,388,598	4	5.13E+07	3.47E+04	751	9.63E+03
March 2008	2,565,135	5	4.85E+07	3.29E+04	795	7.72E+03
April 2008	3,724,924	3	4.23E+07	2.86E+04	818	1.15E+04
May 2008	3,650,359	4	5.53E+07	3.74E+04	818	1.13E+04
June 2008	3,946,776	3	4.48E+07	3.03E+04	739	1.10E+04
Semiannual Totals	**22,408,459**	**--**	**3.01E+08**	**2.03E+05**	**--**	**6.42 E+04**
July 2008	4,051,240	4	6.13E+07	4.15E+04	698	1.07E+04
August 2008	4,664,934	5	8.83E+07	5.98E+04	775	1.37E+04
September 2008	4,823,374	6	1.10E+08	7.42E+04	753	1.37E+04
October 2008	5,202,468	5	9,85E+07	6.67E+04	693	1.36E+04
November 2008	4,823,009	4	7.30E+07	4.94E+04	763	1.39E+04
December 2008	4,553,541	6	1.03E+08	7.00E+04	741	1.28E+04
Semiannual Totals	**28,118,566**	**--**	**5.34E+08**	**3.62E+05**	**--**	**7.85E+04**

[a] Maximum deep well injection limits: ra-226 – 5,000 uCi/l; U-Natural – 25 mg/l

Table 4.2-2 Deep Disposal Well No. 2 Injection Radiological Data for Crow Butte Central Processing Facility (2012)

Month	Total Gallons Injected	Average Natural Uranium (mg/l)[a]	Total Natural Uranium Injected (mg)	Total Natural Uranium Injected (uCi)	Average Radium-226 (uCi/l)[a]	Total Radium-226 Injected (uCi/l)
January 2012	884,393	1	3.35E+06	2.27E+03	861	2.88E+03
February 2012	1,387,183	1	5.25E+06	3.55E+03	929	4.88E+03
March 2012	1,967,755	2	1.49E+07	1.01E+04	732	5.45E+03
April 2012	2,000,692	1	7.57E=06	5.13E+03	810	6.13E+03
May 2012	1,615,176	1	6.11E+06	4.14E+03	965	5.90E+03
June 2012	1,891,017	2	1.43E+07	9.69E+03	878	6.28E+03
Semiannual Totals	**9,746,216**	**--**	**5.15E+07**	**3.49E+04**	**--**	**3.15E+04**
July 2012	1,873,150	1	7.09E+06	4.80E+03	895	6.35E+03
August 2012	1,859,679	1	7.04E+06	4.77E+03	836	5.88E+03
September 2012	1,779,184	1	6.73E+06	4.56E+03	896	6.03E+03
October 2012	1,823,402	1	6.90E+06	4.67E+03	894	6.17E+03
November 2012	1,758,934	2	1.33E+07	9.02E+03	824	5.49E+03
December 2012	1,773,377	2	1.34E+07	9.09E+03	1,370	9.20E+03
Semiannual Totals	**10,867,726**	**--**	**5.45E+07**	**3.69E+04**	**--**	**3.91E+04**

[a] Maximum deep well injection limits: ra-226 – 5,000 uCi/l; U-Natural – 25 mg/l

Table 4.2-3 Deep Disposal Wells Injection Non-Radiological Data for Current Crow Butte Operations for 2012

Parameter	Annual Composite Results		Maximum Injection Level
	mg/l[a]		
	Annual Average	Range	
DDW #1			
Sodium	3,180	1,334 – 6,506	40,000
Calcium	104	91 – 148	Report Only
Sulfate	1,406	933 – 1,930	10,000
Chloride	3.148	558 – 8,243	40,000
Vanadium	4.0	1.0 – 9.0	100
Alkalinity	1,623	1,400 – 2,300	4,100
pH (std. units)	8.22	7.83 – 8.51	5.0 – 9.5
Arsenic	0.1	<0.1 – 0.2	5
Barium	<0.1	<0.1 – <0.1	100
Cadmium	<0.1	<0.1 – <0.1	1
Chromium	<0.5	<0.5 – <0.5	5
Lead	<0.5	<0.5 – <0.5	5
Mercury	<0.0001	<0.0001 – <0.0001	0.2
Selenium	<0.1	<0.1 – <0.1	1
Silver	<0.5	<0.5 – <0.5	5
Total Gallons Injected: 77,193,300			
DDW #2			
Sodium	1,487	1,392 – 1,582	40,000
Calcium	83	76 – 88	Report Only
Sulfate	995	952 – 1,034	10,000
Chloride	697	565 – 877	40,000
Vanadium	1.7	1 – 2	100
Alkalinity	1,482	1,412 – 1,650	4,100
pH (std. units)	8.06	7.94 – 8.2	5.0 – 9.5
Arsenic	<0.1	<0.1 - <0.1	5
Barium	<0.1	<0.1 - <0.1	100
Cadmium	<0.1	<0.1 - <0.1	1
Chromium	<0.5	<0.5 - <0.5	5
Lead	<0.5	<0.5 - <0.5	5
Mercury	<0.0001	<0.0001 - <0.0001	0.2
Selenium	0.25	0.2 – 0.4	1
Silver	<0.5	<0.5 - <0.5	5
Total Gallons Injected: 20,613,942			

[a] mg/l unless noted otherwise.

Note: Reporting data based on 12 monthly samples (January – December 2012) for Deep Disposal Well No. 1 and 2.

Table 5.7-1 Marsland Expansion Area Operational Effluent and Environmental Monitoring Plan

Type of Sample	Sample Collection			Sample Analysis		
	Number	Location	Method	Frequency	Frequency	Type of Analysis
AIR						
Particulates	3	On MEA southern boundary	Continuous	Weekly filter change or more frequently as required by dust loading	Quarterly composites of weekly samples	Nat-Uranium, Ra-226, Th-230, Pb-210
	1	In the sector having the highest predicted concentration of airborne particulate	Continuous	Weekly filter change or more frequently as required by dust loading	Quarterly composites of weekly samples	Nat-Uranium, Ra-226, Th-230, Pb-210
	1	At or close to nearest residence(s)[a]	Continuous	Weekly filter change or more frequently as required by dust loading	Quarterly composites of weekly samples	Nat-Uranium, Ra-226, Th-230, Pb-210
	1	Control or background location West of MEA License Boundary[a]	Continuous	Weekly filter change or more frequently as required by dust loading	Quarterly composites of weekly samples	Nat-Uranium, Ra-226, Th-230, Pb-210
Radon Gas	6	Same locations as air particulates[a]	Continuous using RadTrak type DRNF	Continuous	Continuous	Rn-222
WATER						
Groundwater	One each	Wells (within license boundary and 2 km radius [c] • Private wells • MEA Brule wells • MEA Ore Zone wells	Grab	Quarterly	Quarterly	Dissolved and suspended Nat-Uranium, Ra-226, Th-230, Pb-210, Po-210
Surface Water	7 sampling points along the two ephemeral drainages	Surface waters passing through license area (subject to available flow)[b, d]	Grab	Quarterly	Quarterly	Suspended and dissolved Nat-Uranium, Ra-226, Th-230, Pb-210, Po-210

Table 5.7-1 Marsland Expansion Area Operational Effluent and Environmental Monitoring Plan

Type of Sample	Sample Collection			Sample Analysis		
	Number	Location	Method	Frequency	Frequency	Type of Analysis
VEGETATION	3	Grazing areas near the site in different sectors that will have the highest predicted air particulate concentrations during milling operations	Grab	3 times during the grazing season	3 Times	Nat-Uranium, Ra-226, Th-230, Pb-210, Po-210
FOOD	3	Crops	Grab	Time of harvest or slaughter	Annually	Nat-Uranium, Ra-226, Th-230, Pb-210, Po-210
	3	Livestock				
FISH	1	Box Butte Reservoir	Grab	Semi-Annually	Twice	Ra-226, Pb-210
SOIL AND SEDIMENT						
Soil	6	At same locations used for collection of air particulate samples[a]	Grab (0 to 5 cm)	Annually	Annually	Nat-Uranium, Ra-226, Pb-210
Sediment	7 sampling points along each of two ephemeral drainages (total of 7 samples)	Same as surface water sample locations[b, d]	Grab (minimum of 3 samples for each sample composite)	Annually	Annually	Nat-Uranium, Ra-226, Th-230, Pb-210
DIRECT RADIATION						
Continuous	One each	Air monitoring stations[a]	Dosimeter	Continuous	Quarterly	Gamma exposure rate, using Sodium Iodide scintillometer

[a] Figure 2.9-2
[b] Figure 2.7-4
[c] Figures 2.2-4 and 2.9-3
[d] upstream and downstream
[e] The number of gardens planted within a 3 km area around the license boundary
N/A = not applicable
MEA = Marsland Expansion Area

Table 6.1-1 NRC and NDEQ Groundwater Restoration Standards

Parameter	NDEQ Title 118 Groundwater Standard	NDEQ Restoration Standard[1]	NRC UMTRCA Groundwater Protection Standards
Ammonia (mg/l)	10.0	10.0	--
Arsenic (mg/l)	0.010	0.010	0.05
Barium (mg/l)	2.0	2.0	1.0
Cadmium (mg/l)	0.005	0.005	0.01
Chloride (mg/l)	250	250	--
Chromium (mg/l)	--	--	0.05
Copper (mg/l)	1.3	1.3	--
Fluoride (mg/l)	4.0	4.0	--
Iron (mg/l)	0.3	0.3	--
Mercury (mg/l)	0.002	0.002	0.002
Manganese (mg/l)	0.05	0.05	--
Molybdenum (mg/l)	1.0	1.0	--
Nickel (mg/l)	0.15	0.15	--
Nitrate (mg/l)	10.0	10.0	--
Lead (mg/l)	0.015	0.015	0.05
Radium (pCi/l)	5.0	5.0	--
Selenium (mg/l)	0.05	0.05	0.01
Sodium (mg/l)	N/A	Note [2]	--
Sulfate (mg/l)	250	250	--
Uranium (mg/l)	0.030	0.030	--
Ra-226 (pCi/l)	5.0	5.0	5.0
Vanadium (mg/l)	0.2	0.2	--
Zinc (mg/l)	5.0	5.0	--
pH (Std. Units)	6.5 – 8.5	6.5 – 8.5	--
Calcium (mg/l)	N/A	Note [2]	--
Total Carbonate (mg/l)	N/A	Note [3]	--
Potassium (mg/l)	N/A	Note [2]	--
Magnesium (mg/l)	N/A	Note [2]	--
Total Dissolved Solids (mg/l)	N/A	Note [4]	--

Sources: NDEQ Class III UIC Permit Number NE0122611 (except for NRC UMTRCA Groundwater Protection Standards)
NRC UMTRCA Groundwater Protection Standards (Criterion 5B (5) of 10 CFR Part 40, Appendix A of UMTRCA)

Notes:

[1] NDEQ Restoration Standard based on groundwater standard (MCL) from Title 118. For parameters where the baseline concentration exceeds the applicable MCL, the standard is set as the mine unit baseline average plus two standard deviations.

[2] One order of magnitude above baseline is used as the restoration value for some parameters due to the ability of some major ions to vary one order of magnitude depending on pH.

[3] Total carbonate shall not exceed 50% of the total dissolved solids value.

[4] The restoration value for Total Dissolved Solids (TDS) shall be the baseline mean plus one standard deviation.

Table 6.1-2 Typical Reverse Osmosis Membrane Rejection Percentages

Name [a]	Symbol	Percent Rejection [a]
Cations		
Aluminum	Al^{+3}	97-98
Ammonium	NH_4^{+1}	85-95
Cadmium	Cd^{+2}	96-98
Calcium	Ca^{+2}	96-98
Chromium	Cr^{+2}	96-98
Copper	Cu^{+2}	97-99
Hardness	Ca and Mg	96-98
Iron	Fe^{+2}	98-99
Lead	Pb^{2}	96-98
Magnesium	Mg^{+2}	96-98
Manganese	Mn^{+2}	96-98
Mercury	Hg^{+2}	96-98
Nickel	Ni^{+2}	97-99
Potassium	K^{+1}	92
Radium	Ra^{2+}	97
Silver	Ag^{+1}	97
Sodium	Na^{+}	92-98
Strontium	Sr^{+2}	96-99
Zinc	Zn^{+2}	98-99
Anions		
Bicarbonate	HCO_3^{-1}	95-96
Bromide	Br^{-1}	93-96
Chloride	Cl^{-1}	94-95
Cyanide	CN^{-1}	90-95
Ferrocyanide	$Fe(CN)_6^{-3}$	98-99
Fluoride	F^{-1}	94-96
Nitrate	NO_3^{-1}	93-96
Phosphate	PO_4^{-3}	99+
Selenium	Se	97
Silicate	SiO_2^{-1}	95-97
Sulfate	SO_4^{-2}	99+
Sulfite	SO_3^{-2}	96-98
Thiosulfate	$S_7O_3^{-2}$	99+
Other		
Boron	B	50-70
Radioactivity	-	95-98

Source: [a] Pure Water Products 2013

Table 6.4-1 Soil Cleanup Criteria and Goals

Layer Depth	Radium-226 (pCi/gm)		Natural Uranium (pCi/gm)	
	Limit	Goal	Limit	Goal
Surface (0 – 15 cm)	5	5	230	150
Subsurface (15 cm layers)	15	10	230	230

pCi/gm – picocuries per gram

Table 7.1-1 Estimated Acres Disturbed by Marsland Expansion Area Project Development

Disturbed Area	Type of Habitat Cover								Total
	Cultivated	Mixed Grass Prairie	Range Rehabilita-tion	Structure Biotype	Degraded Rangeland	Drainage	Deciduous Streambank Forest	Mixed Conifer	
	Acres								
Initial Acres Disturbed by MEA Satellite Facility, 11 Mine Units, Deep Disposal Well and Access Routes									
Mine Units (11)	71.7	343.7	6.9	8.9	143.6	7.2	0	5.6	587.6
SAT		1.8							1.8
Access Route to SAT		1.6				0.1			1.7
DDW's (6)		3.0							3.0
INITIAL DISTURBED ACRES	**71.7**	**350.1**	**6.9**	**8.9**	**143.6**	**7.3**	**0**	**5.6**	**594.1**
Long-Term Acres Disturbed by Additional Site Operations									
All Additional Long-Term Activities [a]	**56.7**	**795.1**	**0.2**	**8.0**	**84.4**	**23.9**	**4.7**	**189.0**	**1,162.0**
TOTAL DISTURBED ACRES	**128.4**	**1142.7**	**7.1**	**16.9**	**228.0**	**31.2**	**4.7**	**194.6**	**1,756.0**

SAT = Satellite Facility

[a]Multiple new activities such as roadways, exploration/delineation drilling, new and expanded MUs, wellhouses, and underground piping.

Table 7.2-1 Crow Butte Resources Excursion Summary

Monitor Well ID	Date On Excursion	Date Off Excursion	Causal Factor(s)
SM4-5	January 25, 1995	March 9, 1995	Poor well development
SM4-2	April 2, 1995	March 13, 1996	Poor well development
SM4-7	December 27, 1995	March 13, 1996	Poor well development
I-196	March 29, 1996	August 19, 1999	Casing leak
I-752	November 8, 1996	May 7, 1997	Casing leak
SM6-26	March 19, 1998	No record available	High water table
CM6-6	July 1, 1999	September 23, 1999	Excursion of mining solutions
I-567	September 20, 1999	October 12, 1999	Casing leak
PR-15	January 13, 2000	March 23, 2000	Mine Unit 1 interior monitor well affected by adjacent groundwater restoration (unrelated to mining activities)
SM6-18	March 6, 2000	April 11, 2001	Natural fluctuation of shallow groundwater quality (unrelated to mining activities)
IJ-13	April 20, 2000	July 20, 2000	Mine Unit 1 interior monitor well affected by adjacent groundwater restoration (unrelated to mining activities)
SM7-23	April 27, 2000	January 13, 2004	Natural fluctuation of shallow groundwater quality (unrelated to mining activities)
SM6-28	May 25, 2000	June 22, 2000	Natural fluctuation of shallow groundwater quality (unrelated to mining activities)
SM6-13	May 25, 2000	July 20, 2000	Natural fluctuation of shallow groundwater quality (unrelated to mining activities)
SM6-12	September 8, 2000	November 2, 2000	Surface leak
SM6-13	March 1, 2001	April 12, 2001	Natural fluctuation of shallow groundwater quality (unrelated to mining activities)
SM7-23	December 4, 2001	January 9, 2004	Natural fluctuation of shallow groundwater quality (unrelated to mining activities)
CM5-11	September 10, 2002	June 3, 2003	Excursion of mining solutions
CM6-7	April 4, 2002	April 25, 2002	Excursion of mining solutions
PR-8	December 23, 2003	July 27, 2010	Mine Unit 1 interior monitor well affected by adjacent groundwater restoration (unrelated to mining activities)
CM5-19	May 2, 2005	July 26, 2005	Excursion of mining solutions
SM6-28	June 16, 2005	July 5, 2005	High water table due to heavy spring rains (unrelated to mining activities)
SM6-12	June 27, 2005	July 26, 2005	High water table due to heavy spring rains (unrelated to mining activities)
CM9-16	August 4, 2005	November 8, 2005	Excursion of mining solutions
CM8-21	January 18, 2006	April 4, 2006	Excursion of mining solutions
PR-15	September 26, 2006	February 4, 2011	See IJ-13 and PR-8
CM9-5	May 15, 2008	June 24, 2008	Excursion of mining solutions

Table 7.2-1 Crow Butte Resources Excursion Summary

Monitor Well ID	Date On Excursion	Date Off Excursion	Causal Factor(s)
CM9-3	May 30, 2008	July 15, 2008	Excursion of mining solutions
SM6-20	April 27, 2009	August 25, 2009	Excursion of mining solutions
CM9-4	June 11, 2009	July 21, 2009	Excursion of mining solutions
SM6-20	March 16, 2010	July 26, 2011	Natural fluctuation of shallow groundwater quality (unrelated to mining activities)
SM8-6	April 12, 2010	August 31, 2010	Natural fluctuation of shallow groundwater quality (unrelated to mining activities)
SM6-23	June 16, 2010	July 29, 2010	Natural fluctuation of shallow groundwater quality (unrelated to mining activities)
SM6-28	June 16, 2010	July 29, 2010	Natural fluctuation of shallow groundwater quality (unrelated to mining activities)
SM8-28	June 16, 2010	July 29, 2010	Natural fluctuation of shallow groundwater quality (unrelated to mining activities)
SM6-21	June 22, 2010	August 10, 2010	Natural fluctuation of shallow groundwater quality (unrelated to mining activities)
SM8-5	June 22, 2010	August 3, 2010	Natural fluctuation of shallow groundwater quality (unrelated to mining activities)
CM8-12	July 8, 2010	August 19, 2010	Excursion of mining solutions
CM-8	March 15, 2011	June 28, 2011	Excursion of mining solutions
SM6-20	May 23, 2011	July 26, 2011	Excursion of mining solutions
SM8-6	May 24, 2011	August 23, 2011	Excursion of mining solutions
SM6-28	May 26, 2011	July 20, 2011	Natural fluctuation of shallow groundwater quality (unrelated to mining activities)
SM8-28	May 26, 2011	July 20, 2011	Excursion of mining solutions
IJ13P	October 4, 2011	February 24, 2012	Excursion of mining solutions
CM11-10	September 13, 2013	November 8, 2013	Excursion of mining solutions
SM10-18	December 11, 2013	January 27, 2014	Purge water collected around the well
CM8-28	May 9, 2014	June 17, 2014	Excursion of mining solutions
SM8-6	May 21, 2014	July 7, 2014	Natural fluctuation of shallow groundwater quality (unrelated to mining activities)
SM10-18	June 23, 2014	September 16, 2014	Chloride plume from purge water
CM11-3	February 12, 2015	March 31, 2015	Excursion of mining solutions
SM10-18	April 15, 2015	June 2, 2015	Chloride plume from purge water
SM8-6	May 20, 2015	July 7, 2015	Natural fluctuation of shallow groundwater quality (unrelated to mining activities)
SM6-23	May 22, 2015	July 9, 2015	Natural fluctuation of shallow groundwater quality (unrelated to mining

Table 7.2-1 Crow Butte Resources Excursion Summary

Monitor Well ID	Date On Excursion	Date Off Excursion	Causal Factor(s)
			activities)
SM6-28	May 22, 2015	August 3, 2015	Natural fluctuation of shallow groundwater quality (unrelated to mining activities)
SM8-28	May 22, 2015	August 3, 2015	Natural fluctuation of shallow groundwater quality (unrelated to mining activities)
SM10-21	May 28, 2015	July 29, 2015	Chloride plume from purge water
SM8-5	June 4, 2015	July 28, 2015	Natural fluctuation of shallow groundwater quality (unrelated to mining activities)
SM8-21	July 10, 2015	July 29, 2015	Natural fluctuation of shallow groundwater quality (unrelated to mining activities)
SM6-24	August 14, 2015	September 3, 2015	Natural fluctuation of shallow groundwater quality (unrelated to mining activities)

Table 7.3-1 Radiation Dose Rates to Receptors From MEA Only and Cumulative Dose Rates

Description	Distance from MEA Satellite Facility (km)	Radiation Dose Rates (mrem/yr)[a]		
		MEA Only	Nearby Existing and Proposed ISR Operations	MEA plus Nearby Existing and Proposed ISR operations
Alliance	54.4	0.5	0.7	1
Berea	39.1	0.7	0.9	2
Chadron	42.2	0.4	0.8	1
Clinton	79.9	0.2	0.3	1
Crawford	24.1	0.7	4.9	6
Harrison	55.4	0.3	0.7	1
Hay Springs	50.7	0.3	0.5	1
Hemingford	24.9	1.4	1.4	3
Marsland	7.2	1.3	2.1	3
Minatare	79.1	.2	.4	1
Mitchell	77.2	0.1	0.3	0
Oelrichs	75.5	0.2	0.6	1
Rushville	69.6	0.2	0.4	1
Scottsbluff	77.9	0.2	0.4	1
Van Tassell	70.7	0.2	0.5	1
Whitney	31.4	0.5	1.7	2
Residence 1	1.0	15.0	3.3	18
Residence 2	1.0	24.2	3.0	27
Residence 3	2.2	6.7	2.9	10
Residence 4	3.5	5.0	2.5	7
Residence 5	4.8	7.3	2.1	9
Residence 6	5.0	4.7	4.2	9
Residence 7	4.2	7.1	3.1	10
Residence 8	6.5	3.1	1.8	5
Residence 9	2.7	5.1	1.9	7
Residence 10	1.5	4.3	2.0	6
Unoccupied 1	2.1	28.6	3.8	32

Table 7.3-1 Radiation Dose Rates to Receptors From MEA Only and Cumulative Dose Rates

Description	Distance from MEA Satellite Facility (km)	Radiation Dose Rates (mrem/yr)[a]		
		MEA Only	Nearby Existing and Proposed ISR Operations	MEA plus Nearby Existing and Proposed ISR operations
Unoccupied 2	3.3	9.5	3.2	13
East Boundary	1.4	13.6	2.7	16
South Boundary	0.5	51.9	3.3	55
West Boundary	0.7	38.5	3.6	42
North Boundary #1	5.2	13.1	4.5	18
North Boundary #2	3.4	12.6	3.9	17

[a] Wastewater flow rate of 315 gallons per minute
mrem/yr = millirems per year
MU = Mine Unit
km = kilometer

Table 7.3-2 Public and Occupational Doses for Marsland Expansion Area

Radon Sources Distribution	Public Dose/Deliveries	Occupational
Location of Dose	**mrem/yr from 10 hrs/month Onsite**	**mrem/yr from 2,000 hrs/yr Onsite**
North Boundary #1	0.08	15
East Boundary	0.02	3
South Boundary	0.12	25
West Boundary	0.09	17
MU-1	0.10	20
MU-2	0.16	32
MU-3	0.12	25
MU-4	0.13	27
MU-5	0.10	19
MU-A	0.13	26
MU-B	0.13	26
MU-C	0.02	4
MU-D	0.02	3
MU-E	0.01	2
MU-F	0.01	2
Satellite	0.02	3
Southeast (1.5 Km)	0.21	41
Average	**0.09**	**17**

Notes:
mrem/yr = millirems per year

Table 7.6-1 Tax Revenues from the Current Crow Butte Project

Type of Taxes	2010	2009	2008	2007	2006	2005
Property Taxes	$997,000	$914,000	$1,120,000	$1,102,000	$627,000	$351,000
Sales and Use Taxes	$83,000	$136,000	$140,000	$90,000	$238,000	$185,000
Severance Taxes	$292,000	$403,000	$512,000	$1,066,000	$545,000	$338,000
Total	**$1,372,000**	**$1,453,000**	**$1,772,000**	**$2,258,000**	**$1,410,000**	**$874,000**

Table 7.6-2 Current Economic Impact of Crow Butte Uranium Project and Projected Impact from Marsland Expansion Area

Activity	Current Crow Butte Operation	Estimated Economic Impact due to Marsland Expansion Area
Employment		
Full-Time Employees	68	+ 10 to 12
Full-Time Contractor Employees	14	+ 4 to 7
Part-Time Employees and Short-Term Contractors	3	+ 4 to 7**
CBR Payroll, 2010	$4,200,000	+ $400,000 to $480,000
Taxes		
Property Taxes	$997,000	—
Sales and Use Taxes	$83,000	—
Severance Taxes	$292,000	—
Total Taxes	$1,372,000	+ $0.95 million
Production Royalties		
Royalty Payments, 2010	$532,000	+ $325,000
Local Purchases		
Local Purchases, 2010	$4,332,000	+ $3,650,000 to $4,350,000
Total Direct Economic Impacts	**$10,435,000**	**+ $5,325,000 to $6,105,000**

**All construction workers

Table 8.6-1 Comparison of Predicted Environmental Impacts

Impacts of Operation	No-Action Alternative	Preferred Alternative	Process Alternatives	
			Alternate Lixiviant Chemistry	Alternate Waste Management
Land Surface Impacts	None	Minimal temporary impacts in wellfield areas, significant surface and subsurface disturbance confined to a portion of the ~12-acre satellite facility site.	Same as Preferred Alternative.	Same as Preferred Alternative. Potential additional impacts from land application of treated wastewater.
Land Use Impacts	None	Loss of crop and cattle production in 562-acre area for duration of project.	Same as Preferred Alternative.	Same as Preferred Alternative plus a potential long-term land use impact from onsite disposal of 11(e)2 byproduct material.
Transportation Impacts	None	Minimal impact on current traffic levels. Estimated additional heavy truck traffic of 500 trips per year; additional 6 to 8 vehicle trips per day light-duty trucks.	Same as Preferred Alternative.	Same as Preferred Alternative.
Geology and Soil Impacts	None	None	None	None
Surface Water Impacts	None	None	None	None
Groundwater Impacts	None	Consumption of Chadron groundwater for control of mining solutions and restoration (estimated at 50 gpm average)	Same as Preferred Alternative. Increased difficulty with groundwater restoration and stabilization.	Same as Preferred Alternative.
Ecological Impacts	None	No substantive impairment of ecological stability or diminishing of biological diversity.	Same as Preferred Alternative.	Same as Preferred Alternative.
Air Quality Impacts	None	Additional 23.7 tons per year of total dust emissions due to vehicle traffic on gravel roads.	Same as Preferred Alternative.	Same as Preferred Alternative.

Table 8.6-1 Comparison of Predicted Environmental Impacts

Impacts of Operation	No-Action Alternative	Preferred Alternative	Process Alternatives	
			Alternate Lixiviant Chemistry	Alternate Waste Management
Noise Impacts	None	Barely perceptible increase over background noise levels in the area.	Same as Preferred Alternative.	Same as Preferred Alternative.
Historic and Cultural Impacts	None	None	None	None
Visual/Scenic Impacts	None	Moderate impact; noticeable minor industrial component in sensitive viewing areas.	Same as Preferred Alternative.	Same as Preferred Alternative plus possible long- term visual and scenic impacts from onsite disposal cell for 11(e)2 byproduct material.
Socioeconomic Impacts	Eventual loss over the next 5 to 10 years of positive economic impact of $10.4 million to the local area as reserves deplete in the current licensed operation.	Extension of the current annual direct economic impact of $10.4 million plus the addition of between $5.3 million and $6.1 million in annual direct economic impact to local area.	Same as Preferred Alternative.	Same as Preferred Alternative.
Non-radiological Health Impacts	None	None	None	None
Radiological Health Impacts	None	The estimated additional maximum dose rate was 1.6 person-rem/yr within 80 km of the MEA and 0 person-rem/yr beyond 80 km.	Same as Preferred Alternative.	Same as Preferred Alternative.
Waste Management Impacts	None	Generation of additional liquid and solid waste for proper disposal.	Same as Preferred Alternative. Mobilization of additional hazardous elements in lixiviant requiring disposal.	Same as Preferred Alternative. Potential additional long- term impact from onsite disposal of 11(e)2 byproduct material.

Table 8.6-1 Comparison of Predicted Environmental Impacts

Impacts of Operation	No-Action Alternative	Preferred Alternative	Process Alternatives	
			Alternate Lixiviant Chemistry	Alternate Waste Management
Mineral Resource Recovery Impacts	Loss of a valuable domestic energy resource. CBR estimated reserves are under development but the current estimated recoverable resource is 9.5 million pounds with a current spot market value (8/2011) of $475 million.	Recovery and use of a domestic energy resource.	Same as Preferred Alternative.	Same as Preferred Alternative.

Table 10.1-1 Environmental Approvals for Crow Butte Project

Issuing Agency	Permit Description
U.S. Nuclear Regulatory Commission Washington, DC 20555	Source Material License SUA – 1534 Issued December 29, 1989 1st Renewal: February 28, 1998 2nd Renewal: November 5, 2014 Source Materials License SUA – 1534 Amendment to Increase Flow Issued: November 30, 2007 Source Material License SUA – 1534 Amendment for New Satellite Facility: North Trend Expansion Area Submitted: May 30, 2007 NRC Approval: Pending
U.S. Environmental Protection Agency 1200 Pennsylvania Avenue, NW Washington, DC 20460	Aquifer Exemption – Crow Butte Project Approval Effective: March 23, 1984 Aquifer Exemption – North Trend Expansion Area Approval Effective: April 18, 2011
Nebraska Department of Environmental Quality PO Box 98922 Lincoln, NE 68509-8922	Underground Injection Control Class III Authorization NE0122611 Crow Butte Project Approved: April 24, 1990 Modified: June 12, 2014
	Underground Injection Control Class III Authorization NE0210740 North Trend Expansion Area Submitted: August 15, 2008 (re-submittal) Approval: August 10, 2011
	Underground Injection Control Class I Authorization Deep Disposal Well #1 NE0211670 Crow Butte Project Approved: June 12, 2014
	Underground Injection Control Class I Authorization Deep Disposal Well #2 NE0210825 Crow Butte Project Approved: November 14, 2011
	National Pollutant Discharge Elimination System Permit NE0130613 Approved: September 27, 2011
	Mineral Exploration Permit NE0211334 Crawford Exploration Approved: July 16, 2012
	Mineral Exploration Permit NE0210824 Panhandle of Nebraska Approved: August 19, 2009
	Authorization for Class V Well Underground Injection

Table 10.1-1 Environmental Approvals for Crow Butte Project

Issuing Agency	Permit Description
	NE0210917 Approved: May 14, 2010
	Evaporation Pond Design Approved: July 21, 1988
	Construction Stormwater NPDES General Permit NER 100000 Authorization #: NER 104581 Approved: January 19, 2006
Nebraska Department of Natural Resources 301 Centennial Mall South Lincoln, NE 68509-4676	Industrial Ground Water Permit (I-2A) Approved: October 30, 2014
Nebraska Department of Health and Human Services Regulation and Licensure PO Box 95007 Lincoln, NE 68509-5007	Class IV Public Water Supply Permit NE3121024 Approved: April 12, 2002

Table 10.1-2 Environmental Approvals for Proposed Marsland Expansion Area

Issuing Agency	Description	Status
U.S. Nuclear Regulatory Commission Washington, DC 20555	Amendment to Source Materials License SUA-1534 (10 CFR 40)	The document containing this table has been submitted as a License Amendment for the Marsland Expansion Area
U.S. Environmental Protection Agency 1200 Pennsylvania Ave, NW Washington, DC 20460	Aquifer exemption application forwarded to EPA following NDEQ action	Aquifer exemption application forwarded to EPA by NDEQ following NDEQ action
Nebraska Department of Environmental Quality PO Box 98922 Lincoln, NE 68509-8922	Underground Injection Control Class III Permit (NDEQ Title 122)	Class III UIC Permit application submitted to NDEQ in July 2012 (approval pending)
	Aquifer Exemption (NDEQ Title 122)	Aquifer exemption application submitted to NDEQ in July 2012
	Underground Injection Control Class I (NDEQ Title 122)	Class I UIC Permit application submitted to NDEQ in April 2013
	Industrial Stormwater NPDES Permit (NDEQ Title 119)	An Industrial Stormwater NPDES may not be required for a satellite facility depending on processes included and the final facility design. If required, an application will be submitted as per NDEQ requirements.
	Construction Stormwater NPDES Permit (NDEQ Title 119)	Construction Stormwater NPDES authorizations are applied for and issued annually under a general permit based on projected construction activities. The Notice of Intent will be filed at least 30 days before construction activities begin in accordance with NDEQ requirements.
	Mineral Exploration Permit (NDEQ Title 135)	Mineral Exploration Permit NE0209317 Approved: June 3, 2003 Replaced: July 16, 2007
	Underground Injection Control Class V (NDEQ Title 122)	The Class V UIC Permit will be applied for following installation of an approved site septic system during facility construction.
Nebraska Department of Natural Resources 301 Centennial Mall South Lincoln, NE 68509-4676	Industrial Ground Water Permit (NDNR Title 456)	The Industrial Groundwater Permit application will be prepared for submittal to NDNR; to be submitted following approval of Class III UIC permit.