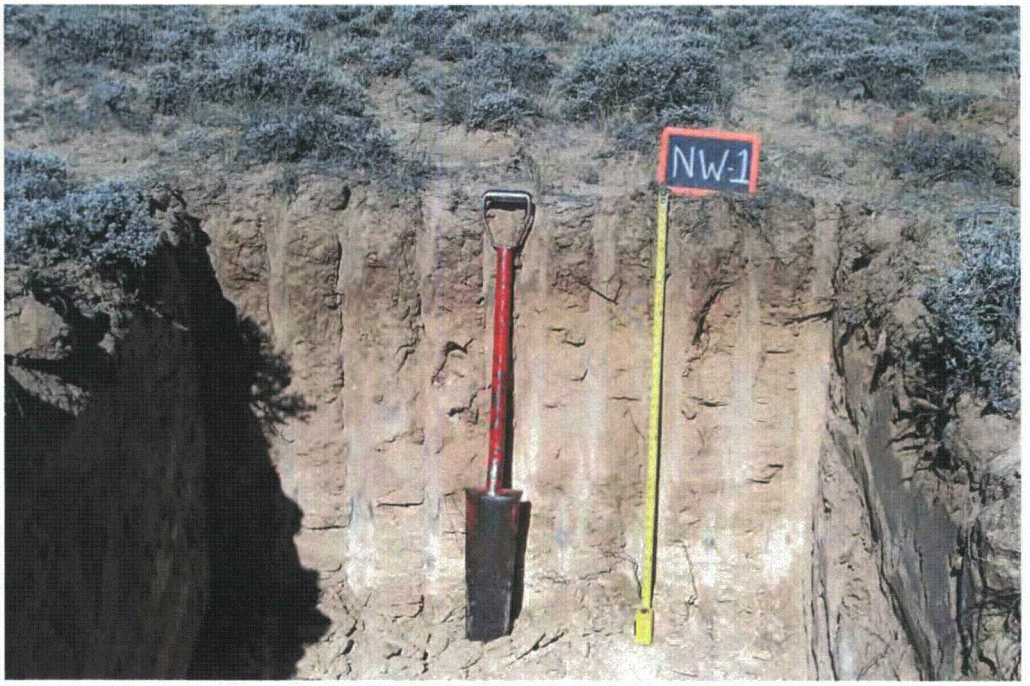
Addendum OP-5b-2

Soil Profile Photographs

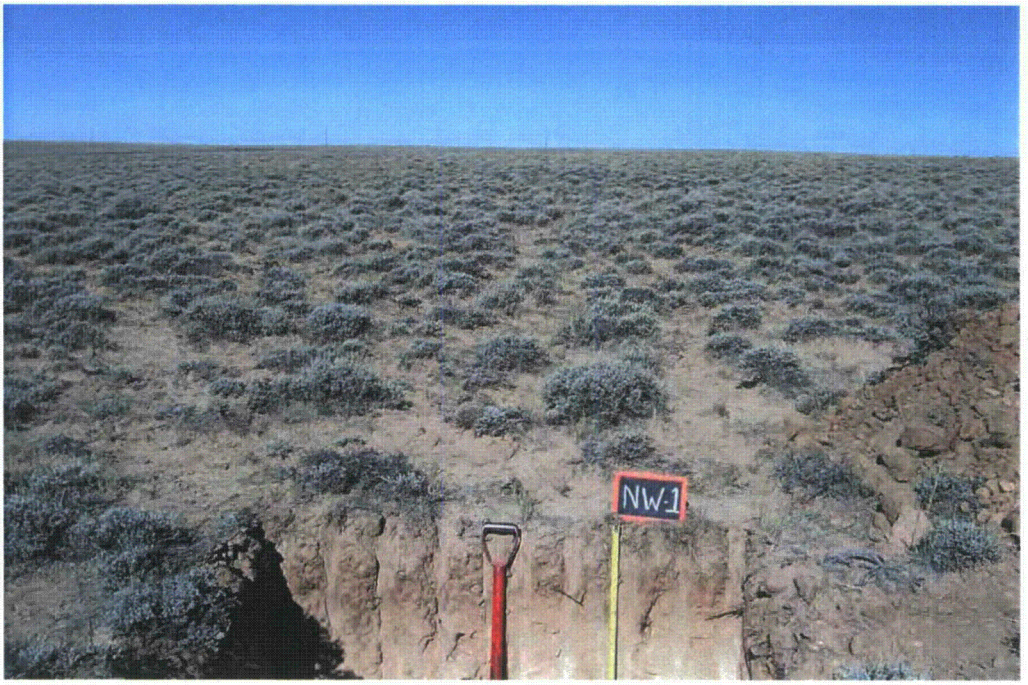
Order 1 Soil Survey Photolog

No.	File Name	Easting	Northing	Date	Description
1	019_19	261463	4668821	13-Sep-09	Photo of NWPadPr1 pit
2	023_23	261463	4668821	13-Sep-09	Photo of NWPadPr1 landscape
3	034_34	263500	4668834	13-Sep-09	Photo of NCPadPr1 landscape
4	038_38	263500	4668834	13-Sep-09	Photo of NCPadPr1 pit
5	046_46	264221	4667085	13-Sep-09	Photo of SEPadPr1 pit
6	049_49	264221	4667085	13-Sep-09	Photo of SEPadPr1 landscape
7	057_57	266288	4669157	13-Sep-09	Photo of NEPadPr1 landscape
8	062_62	266288	4669157	13-Sep-09	Photo of NEPadPr1 pit
9	067_67	265955	4669129	13-Sep-09	Photo of NEPadPr2 pit
10	070_70	265955	4669129	13-Sep-09	Photo of NEPadPr2 landscape
11	074_74	262682	4668495	13-Sep-09	Photo of EWPadPr2 pit
12	077_77	262682	4668495	13-Sep-09	Photo of EWPadPr2 landscape
13	082_82	262604	4668494	13-Sep-09	Photo of EWPadPr1 pit
14	099_99	263079	4668535	13-Sep-09	Photo of EWPadPr4 pit
15	105_105	263946	4668649	13-Sep-09	Photo of EWPadPr5 pit
16	106_106	263946	4668649	13-Sep-09	Photo of EWPadPr5 landscape
17	110_110	264859	4668795	13-Sep-09	Photo of EWPadPr7 pit
18	113_113	264859	4668795	13-Sep-09	Photo of EWPadPr7 landscape
19	121_121	264554	4668677	13-Sep-09	Photo of EWPadPr6 pit
20	123_123	264554	4668677	13-Sep-09	Photo of EWPadPr6 landscape
21	127_127	265777	4668445	13-Sep-09	Photo of EWPadPr8 pit
22	129_129	265777	4668445	13-Sep-09	Photo of EWPadPr8 landscape
23	133_133	263794	4667093	13-Sep-09	Photo of SEPad2Pr1 landscape
24	136_136	263794	4667093	13-Sep-09	Photo of SEPad2Pr1 pit

Photos by J. Nyenhuis

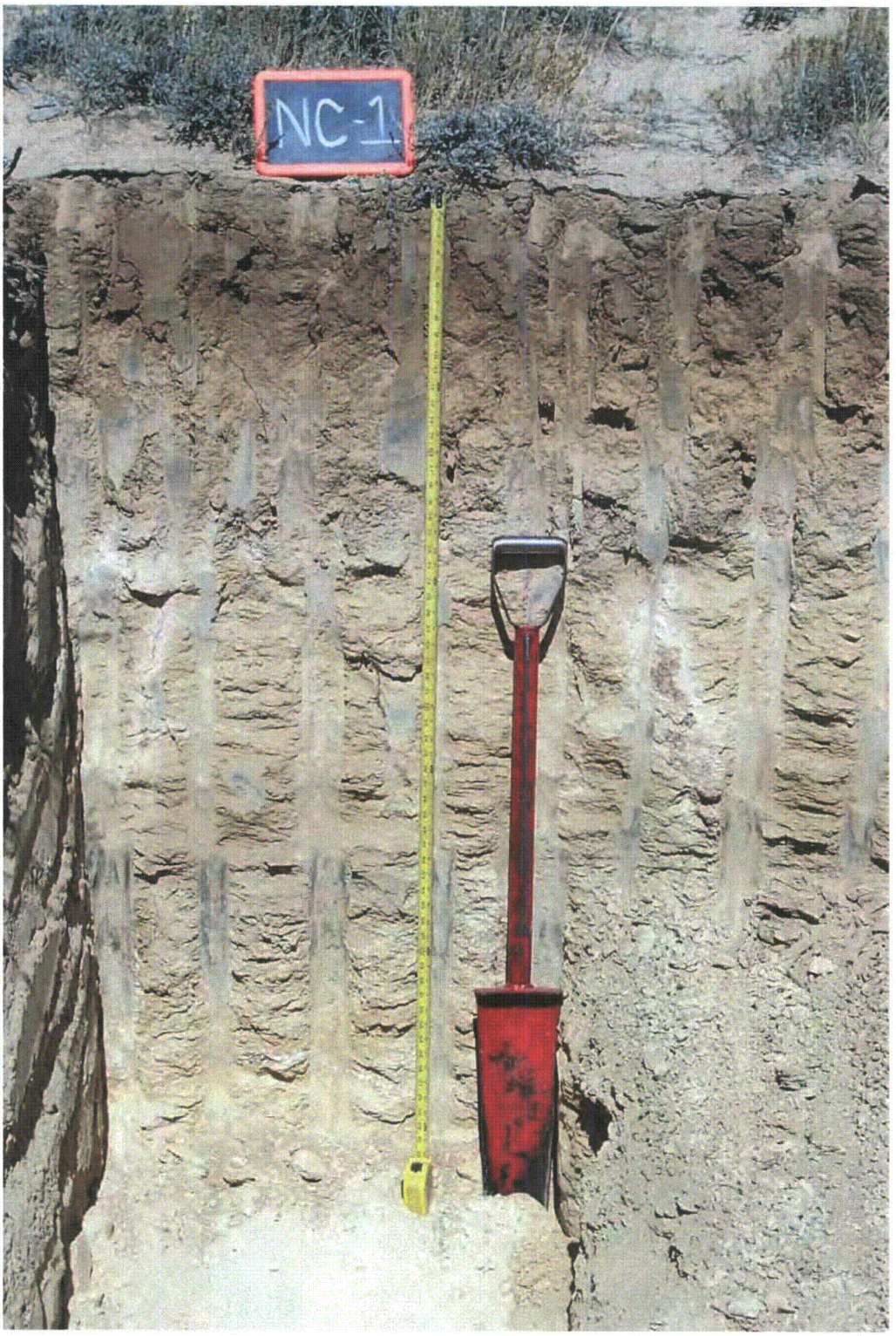


1. Photo of NWPadPr1 pit.



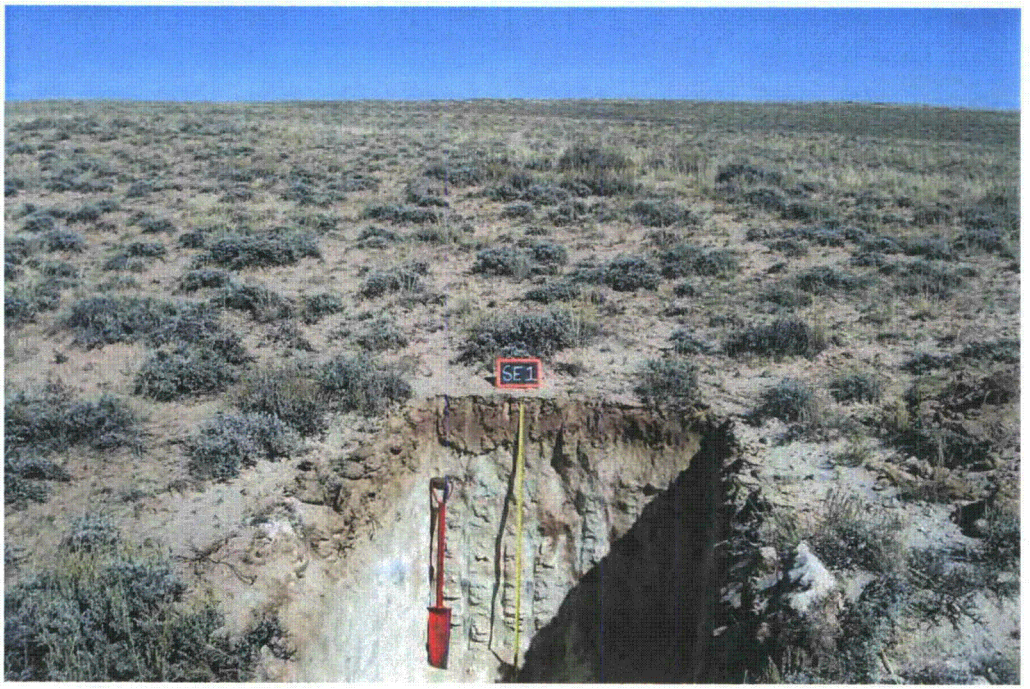
2. Photo of NWPadPr1 landscape.

3. Photo of NCPadPr1 landscape.



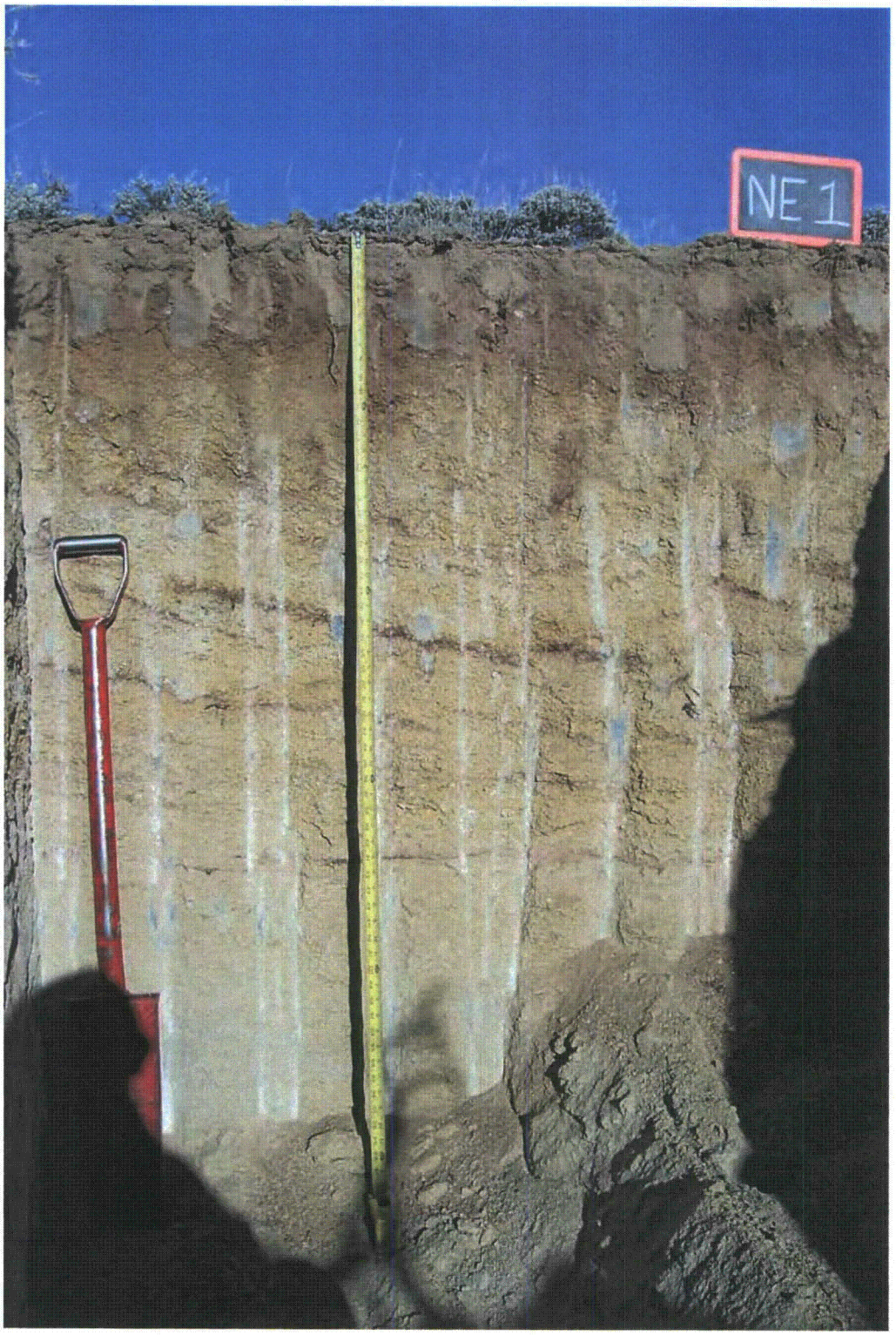
4. Photo of NCPadPr1 pit.

5. Photo of SEPadPr1 pit.



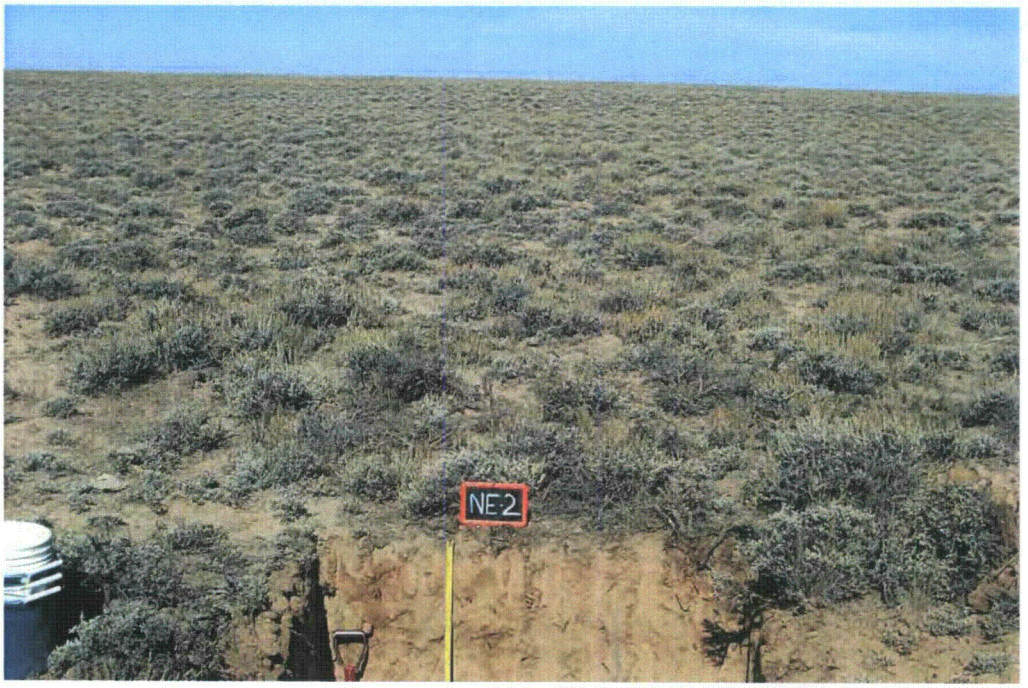
6. Photo of SEPadPr1 landscape.

7. Photo of NEPadPr1 landscape.

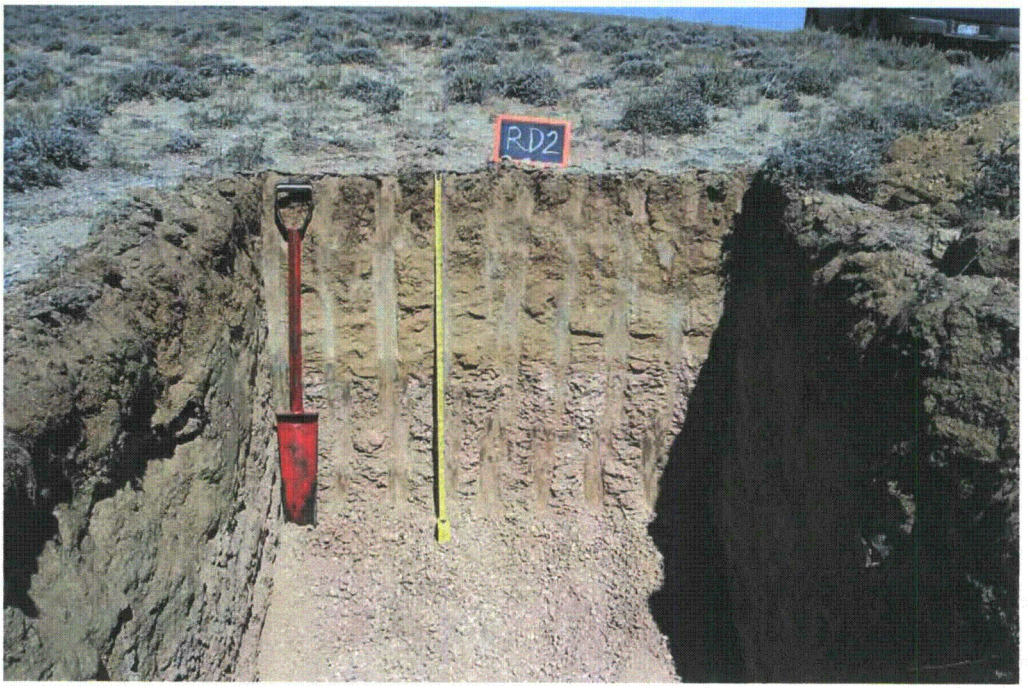


8. Photo of NEPadPr1 pit.

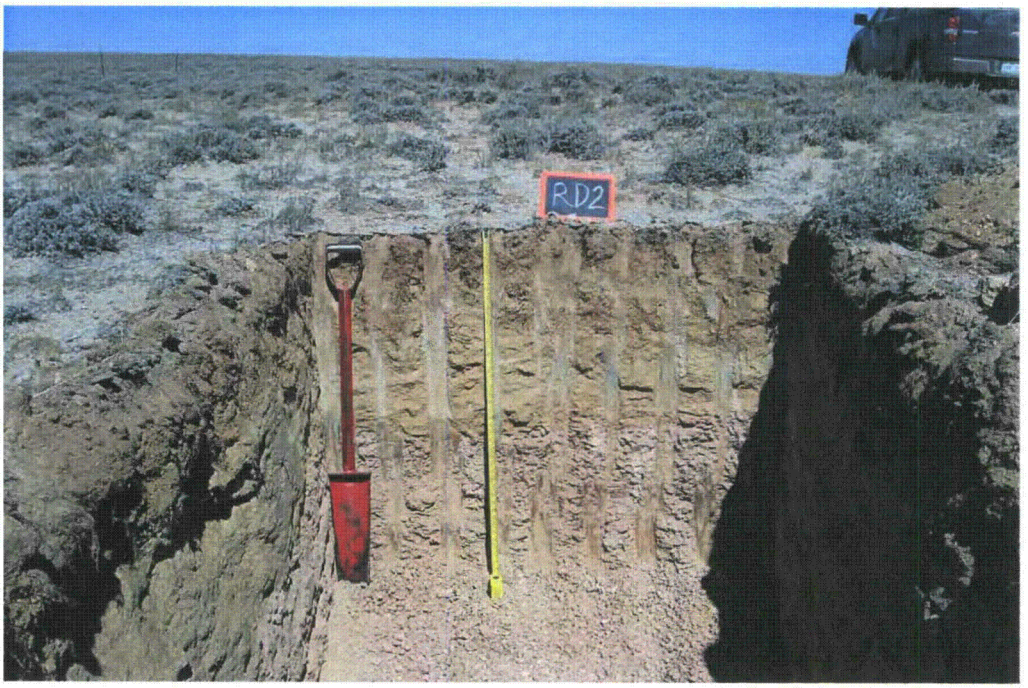
9. Photo of NEPadPr2 pit.



10. Photo of NEPadPr2 landscape.

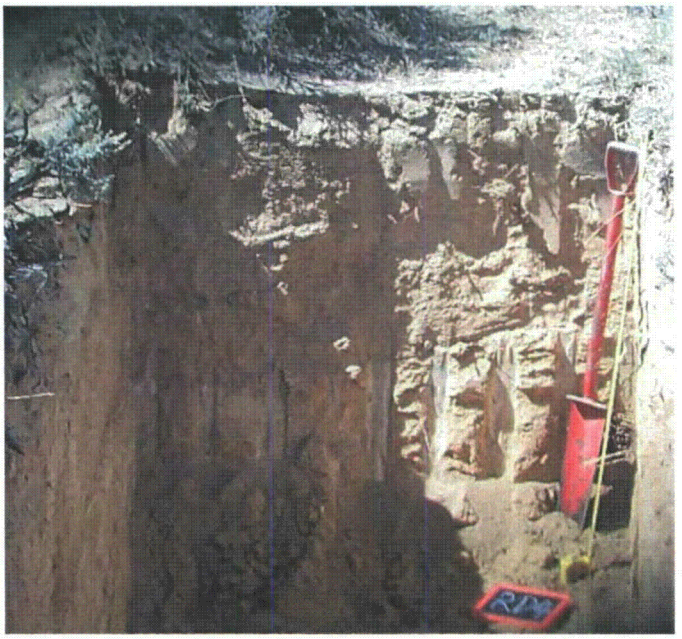


11. Photo of EWPadPr2 pit.



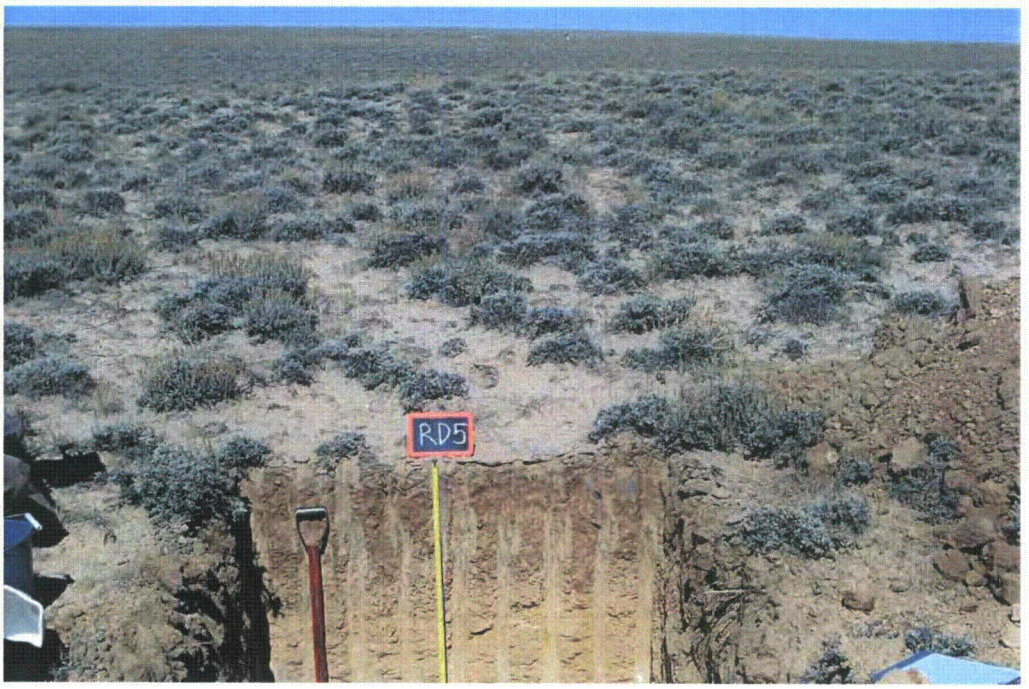
12. Photo of EWPadPr2 landscape.

13. Photo of EWPadPr1 pit.

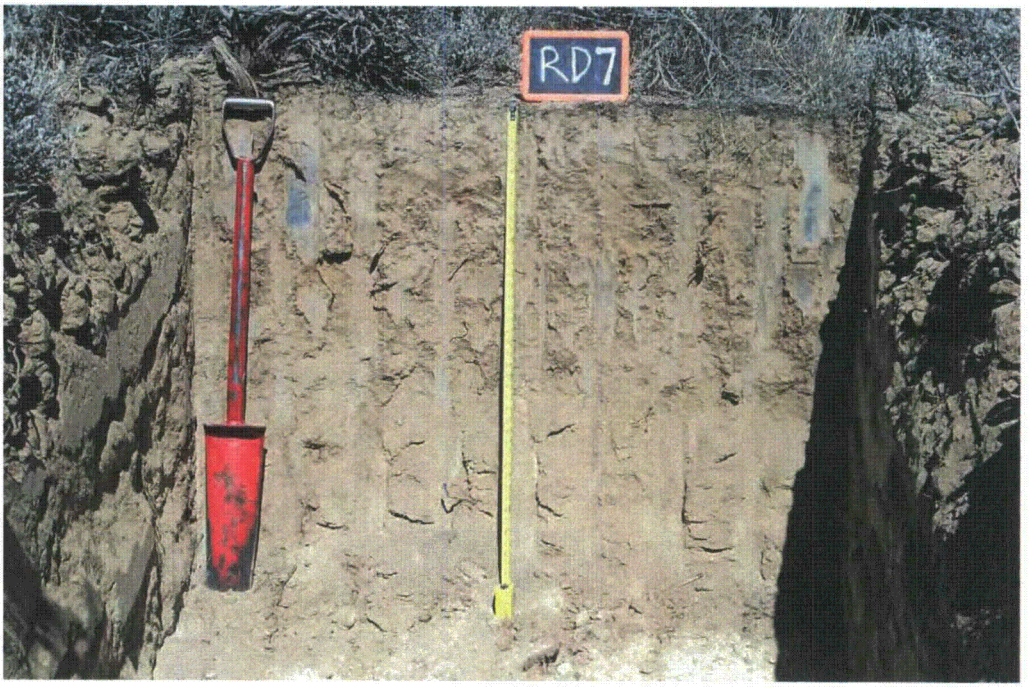


14. Photo of EWPadPr4 pit.

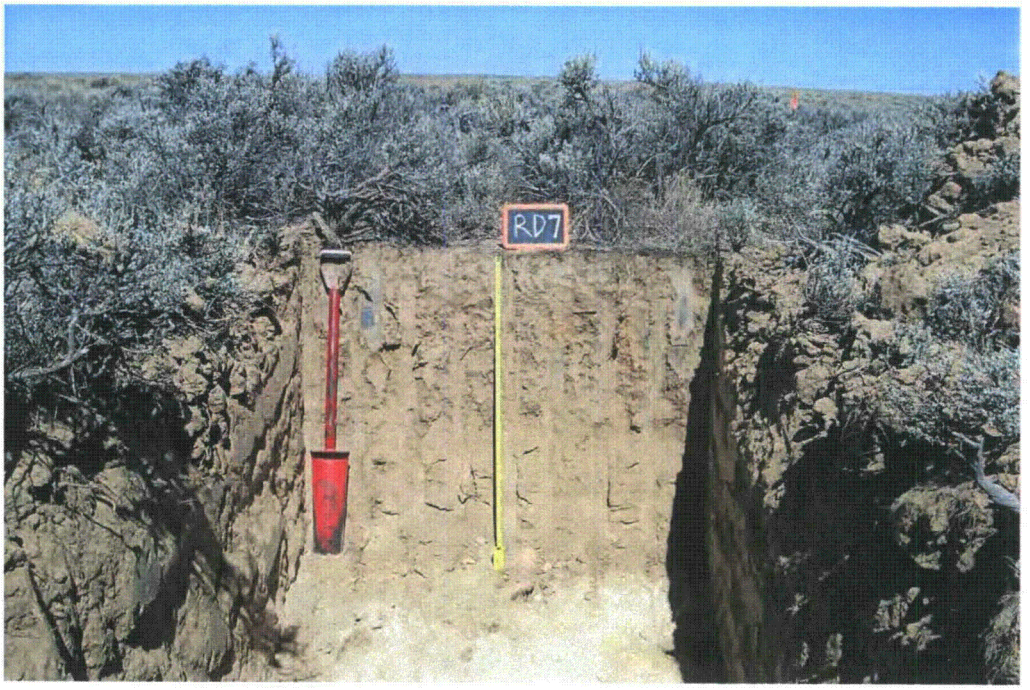
15. Photo of EWPadPr5 pit.



16. Photo of EWPadPr5 landscape.

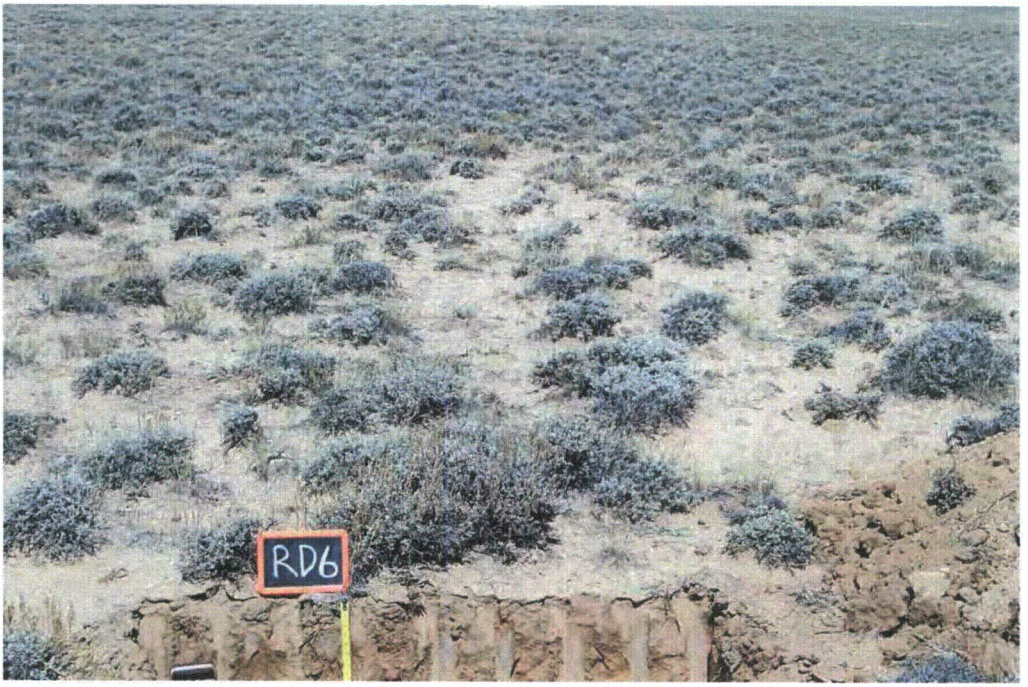


17. Photo of EWPadPr7 pit.



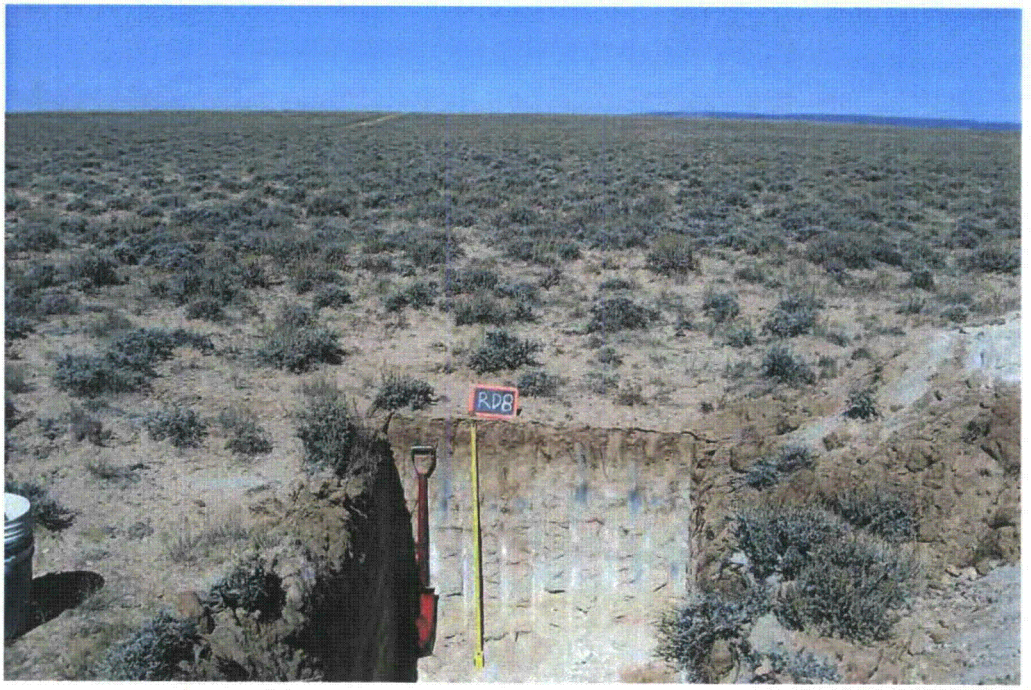
18. Photo of EWPadPr7 landscape.

19. Photo of EWPadPr6 pit.



20. Photo of EWPadPr6 landscape.

21. Photo of EWPadPr8 pit.



22. Photo of EWPadPr8 landscape.

23. Photo of SEPad2Pr1 landscape.

24. Photo of SEPad2Pr1 pit.

Addendum OP-5b-3

Laboratory Report

AATA International
300 E Boardwalk Suite 4A
Fort Collins CO 80525

Colorado State University
Soil, Water and Plant Testing Laboratory
Natural & Environmental Sciences Bldg - A319

Fort Collins, CO 80523-1120

(970) 491-5061 FAX: 491-2930

DATE RECEIVED: 09-24-2009
DATE REPORTED: 10-14-2009

BILLING: **TW105784**

Project name: Ur Energy/Lost Creek Uranium ISR Project
Sweetwater County, WY

RESEARCH SOIL ANALYSIS

Lab #	Sample ID #	paste pH	paste EC mmhos/cm	% saturation	Lime Estimate	% OM	AB-DTPA ppm NO_3-N	P	K	Zn	Fe	Mn	Cu
R668	NE PAD PR-2 0-3"	5.5	0.2	28.1	Low	1.1	5.9	8.1	180	0.76	20.9	5.09	1.86
R669	NE PAD PR-2 3-16"	7.0	0.1	27.2	Low	0.5	10.3	0.6	63.8	0.11	4.75	1.04	1.07
R670	NE PAD PR-2 16-30"	8.2	0.3	26.9	High	0.7	10.3	0.9	54.9	0.05	2.62	0.68	0.75
R671	NE PAD PR-2 30-62"	8.2	3.7	27.7	High	0.5	8.3	11.2	51.7	0.10	2.32	0.50	0.85
R672	NE PAD PR-1 0-3"	7.0	0.3	22.1	Low	1.2	5.5	3.7	153	0.27	6.17	1.13	1.40
R673	NE PAD PR-1 3-8"	7.4	0.1	28.1	Low	0.9	9.2	0.9	77.4	0.08	3.30	0.52	1.10
R674	NE PAD PR-1 8-16"	7.7	0.2	28.1	Low	0.4	5.5	1.2	25.3	0.03	1.38	0.24	0.65
R675	NE PAD PR-1 16-34"	8.5	0.2	27.8	Medium	0.3	6.2	6.5	19.5	<0.01	0.88	0.15	0.47
R676	NE PAD PR-1 34-68"	8.8	0.3	23.7	Medium	0.2	6.7	7.4	17.3	0.03	1.25	0.35	0.57
R677	EWRD PR-1 0-3.5"	6.4	0.2	31.1	Low	2.4	6.5	7.4	252	0.68	22.9	3.85	1.67
R678	EWRD PR-1 3. 5-14"	6.4	0.2	26.8	Low	1.0	6.0	2.5	190	0.21	19.1	0.96	1.25
R679	EWRD PR-1 14-24"	6.9	0.1	22.7	Low	0.4	9.2	2.5	54.8	0.06	9.42	0.53	0.65
R680	EWRD PR-1 24-35"	6.9	0.1	34.5	Low	0.8	4.8	1.8	32.0	0.04	3.20	0.25	0.98
R681	EWRD PR-2 0-2"	7.0	0.1	22.9	Low	0.7	5.7	3.1	114	0.23	6.34	1.11	0.92
R682	EWRD PR-2 2-7"	7.2	0.1	31.2	Low	0.9	4.3	1.2	42.8	<0.01	2.67	0.36	1.03
R683	EWRD PR-2 7-14"	7.4	0.2	29.3	Low	0.4	4.3	1.2	27.6	<0.01	1.31	0.01	0.89
R684	EWRD PR-2 14-27"	8.2	0.2	31.8	Medium	0.2	3.9	0.9	24.6	<0.01	0.97	<0.01	0.23

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R685	EWRD PR-3 0-3"	7.1	0.2	27.7	Low	1.0	3.8	4.3	235	<0.01	5.60	1.63	1.10
R686	EWRD PR-3 3-16"	7.7	0.2	26.4	Low	0.7	4.5	<0.1	70.4	<0.01	3.97	0.28	0.91
R687	EWRD PR-3 16-30"	8.3	0.9	29.8	High	0.6	5.3	0.9	29.2	<0.01	1.62	0.18	0.70
R688	EWRD PR-3 30-55"	8.3	5.7	31.6	High	0.5	8.0	11.2	40.9	<0.01	0.93	0.06	0.52
R689	EWRD PR-4 0-4"	6.1	0.3	34.6	Low	1.7	7.7	10.6	246	0.57	27.7	3.88	1.51
R690	EWRD PR-4 4-19"	6.7	0.1	29.0	Low	0.9	4.2	10.6	122	<0.01	21.5	0.64	0.92
R691	EWRD PR-4 19-34"	6.2	0.1	25.7	Low	0.3	8.2	3.1	49.8	<0.01	5.53	0.18	0.87
R692	EWRD PR-4 34-58"	6.5	0.1	22.4	Low	0.5	4.3	3.1	42.7	<0.01	9.32	0.08	0.44
R693	EWRD PR 4 34-58"D	6.3	0.1	22.6	Low	0.5	3.8	3.1	47.0	<0.01	9.02	0.09	0.46
R694	NCPAD PR-1 0-3"	6.9	0.2	29.1	Low	1.1	3.0	2.5	119	<0.01	4.85	0.83	0.88
R695	NCPAD PR-1 3-11"	7.3	0.2	29.9	Low	0.8	3.3	0.6	50.3	<0.01	2.96	0.28	0.69
R696	NCPAD PR-1 11-18"	8.1	0.2	26.4	Low	0.7	5.9	0.6	34.1	0.03	2.05	0.39	0.55
R697	NCPAD PR-1 18-40"	8.5	1.1	28.3	High	0.5	4.8	0.6	29.8	<0.01	1.61	<0.01	0.41
R698	NCPAD PR-1 40-62"	8.0	4.8	29.0	High	0.4	8.8	1.2	76.4	0.48	3.11	0.66	0.30
R699	SE PAD2 PR-1 0-3"	6.5	0.2	20.6	Low	0.9	3.9	3.7	83.9	0.17	7.03	1.27	0.87
R700	SE PAD2 PR-1 3-16"	7.1	0.1	26.1	Low	0.5	4.9	0.9	43.7	0.11	3.47	0.53	1.18
R701	SE PAD2 PR-1 16-30"	8.7	1.3	29.0	Medium	0.5	2.3	6.2	54.0	0.04	1.12	0.32	0.42
R702	SE PAD2 PR-1 30-52"	8.3	0.3	26.5	Low	0.4	3.5	2.5	19.3	0.03	1.03	0.20	0.55

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R703	NW PAD PR-1 0-3"	6.3	0.1	26.1	Low	1.0	10.7	6.2	99.2	0.28	9.43	1.93	0.83
R704	NW PAD PR-1 3-12"	7.1	0.2	30.4	Low	1.3	4.6	1.8	51.6	0.06	2.53	0.47	0.75
R705	NW PAD PR-1 12-16"	7.4	0.2	33.8	Low	0.6	6.6	0.3	24.9	0.06	0.89	0.37	0.54
R706	NW PAD PR-1 16-48"	8.8	0.7	32.9	Very High	0.9	7.7	0.6	24.4	0.03	0.45	0.21	0.50
R707	NW PAD PR-2 0-3"	7.2	0.2	24.0	Low	1.1	5.3	2.8	110	0.22	4.44	0.95	1.19
R708	NW PAD PR-2 3-10"	7.3	0.2	31.2	Low	0.9	2.2	0.3	53.3	0.11	2.32	0.54	0.95
R709	NW PAD PR-2 10-18"	7.8	1.9	31.6	Medium	0.7	5.7	0.3	27.2	0.10	0.90	0.29	0.93
R710	NW PAD PR-2 18-38"	8.3	5.2	38.4	Very High	0.5	8.7	3.1	17.0	0.08	0.73	0.22	0.67
R711	NW PAD PR-2 18-38"I	8.3	5.4	35.3	Very High	0.5	8.9	3.1	16.9	0.08	0.79	0.20	0.65
R712	EWRD PR-7 0-4"	6.2	0.3	47.5	Low	4.0	11.4	14.9	320	1.85	39.5	5.83	3.04
R713	EWRD PR-7 4-12"	5.9	0.1	53.1	Low	1.6	4.7	3.1	158	0.24	14.6	0.74	1.13
R714	EWRD PR-7 12-22"	6.4	0.1	29.1	Low	0.8	4.9	0.6	92.1	0.07	5.50	0.34	0.71
R715	EWRD PR-7 22-47"	7.6	0.2	28.2	Low	0.3	8.9	0.6	23.5	0.06	1.21	0.16	0.48
R716	EWRD PR-6 0-3"	7.0	0.2	25.4	Low	1.0	2.8	3.7	129	0.24	4.54	1.34	0.79
R717	EWRD PR-6 3-14"	7.3	0.1	27.9	Low	0.6	1.3	0.3	29.1	0.05	1.49	0.28	0.61
R718	EWRD PR-6 14-28"	8.6	0.2	30.4	Very High	0.5	4.9	0.3	10.1	0.04	0.48	0.19	0.33
R719	EWRD PR-6 28-56"	8.3	2.1	29.6	High	0.9	8.3	1.2	47.6	0.04	0.66	0.19	1.02

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RESEARCH SOIL ANALYSIS

Lab #	Sample ID #	paste pH	paste EC mmhos/cm	% saturation	Lime Estimate	% OM	AB-DTPA ppm NO_3-N	AB-DTPA ppm P	AB-DTPA ppm K	AB-DTPA ppm Zn	AB-DTPA ppm Fe	AB-DTPA ppm Mn	AB-DTPA ppm Cu
R720	EWRD PR-5 0-3"	7.1	0.2	23.6	Low	1.0	12.0	2.8	117	0.21	3.86	1.19	0.97
R721	EWRD PR-5 3-10"	7.6	0.1	32.2	Low	0.8	3.1	<0.1	28.0	0.09	1.44	0.28	1.49
R722	EWRD PR-5 10-16"	8.1	0.2	28.2	Low	0.4	1.2	<0.1	15.2	0.04	0.96	0.20	1.21
R723	EWRD PR-5 16-25"	8.3	0.2	22.4	Very High	0.8	4.2	<0.1	11.7	0.01	1.02	0.18	0.60
R724	EWRD PR-5 25-53"	8.3	2.2	40.7	Medium	0.4	7.5	0.6	14.0	0.01	0.77	0.15	0.42
R725	EWRD PR-8 0-2"	7.0	0.2	21.1	Low	0.8	7.6	2.5	84.2	0.23	4.46	0.86	0.77
R726	EWRD PR-8 2-6"	7.4	0.1	31.1	Low	0.7	11.2	0.6	34.0	0.08	2.03	0.38	0.70
R727	EWRD PR-8 6-15"	7.7	0.8	29.1	Low	0.4	3.5	<0.1	14.8	0.33	1.05	0.45	0.61
R728	EWRD PR-8 15-27"	8.4	0.2	27.8	High	0.3	6.2	0.3	8.89	0.08	0.52	0.21	0.33
R729	EWRD PR-8 27-53"	8.5	0.3	28.2	Medium	0.2	9.2	2.5	7.06	0.07	0.43	0.17	0.54
R730	EWRD PR-8 27-53"D	8.6	0.3	28.2	Medium	0.3	9.7	2.1	7.96	0.07	0.46	0.18	0.49

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RESEARCH SOIL ANALYSIS

Lab #	Sample ID #	meq/L Ca	meq/L Mg	meq/L Na	meq/L K	SAR	% Sand	% Silt	% Clay	Texture	Extractable ppm Se	Hot Water mg/kg B
R668	NE PAD PR-2 0-3"	0.6	0.2	0.5	0.3	0.8	65	19	16	Sandy Loam	0.042	0.03
R669	NE PAD PR-2 3-16"	0.5	<0.1	0.6	<0.1	1.3	58	25	17	Sandy Loam	0.048	0.03
R670	NE PAD PR-2 16-30"	1.6	0.8	1.4	<0.1	1.3	55	27	18	Sandy Loam	0.045	0.02
R671	NE PAD PR-2 30-62"	26.7	16.6	25.6	0.3	5.5	79	8	13	Sandy Loam	0.047	0.11
R672	NE PAD PR-1 0-3"	0.8	0.3	0.9	0.2	1.2	67	21	12	Sandy Loam	0.035	0.02
R673	NE PAD PR-1 3-8"	0.7	0.1	0.5	<0.1	0.9	58	20	22	Sandy Clay Loam	0.036	0.03
R674	NE PAD PR-1 8-16"	0.8	0.1	0.6	<0.1	0.8	78	7	15	Sandy Loam	0.037	0.02
R675	NE PAD PR-1 16-34"	1.1	0.1	0.7	<0.1	0.9	84	4	12	Loamy Sand	0.035	0.01
R676	NE PAD PR-1 34-68"	1.5	0.2	1.9	<0.1	2.0	80	8	12	Sandy Loam	0.036	0.00
R677	EWRD PR-1 0-3.5"	0.6	0.1	0.7	0.3	1.1	61	27	12	Sandy Loam	0.032	0.03
R678	EWRD PR-1 3. 5-14"	0.4	0.1	0.7	0.4	1.5	63	22	15	Sandy Loam	0.022	0.02
R679	EWRD PR-1 14-24"	0.2	<0.1	0.5	<0.1	1.6	73	13	14	Sandy Loam	0.029	0.01
R680	EWRD PR-1 24-35"	0.2	<0.1	0.4	<0.1	1.2	82	4	14	Sandy Loam	0.019	0.01
R681	EWRD PR-2 0-2"	0.7	0.1	0.5	0.1	0.8	73	14	13	Sandy Loam	0.013	0.02
R682	EWRD PR-2 2-7"	0.6	0.1	0.5	<0.1	0.9	74	12	14	Sandy Loam	0.026	0.02
R683	EWRD PR-2 7-14"	1.1	0.3	0.5	<0.1	0.7	82	5	13	Sandy Loam	0.024	0.02
R684	EWRD PR-2 14-27"	1.0	0.1	0.8	<0.1	1.0	86	2	12	Loamy Sand	0.023	0.01

AATA International
300 E Boardwalk Suite 4A
Fort Collins CO 80525

Colorado State University
Soil, Water and Plant Testing Laboratory
Natural & Environmental Sciences Bldg - A319
Fort Collins, CO 80523-1120

(970) 491-5061 FAX: 491-2930

DATE RECEIVED: 09-24-2009
DATE REPORTED: 10-14-2009

BILLING: **TW105784**

Project name: Ur Energy/Lost Creek Uranium ISR Project
Sweetwater County, WY

RESEARCH SOIL ANALYSIS

Lab #	Sample ID #	meq/L Ca	meq/L Mg	meq/L Na	meq/L K	SAR	% Sand	% Silt	% Clay	Texture	Extractable ppm Se	Hot Water mg/kg B
R685	EWRD PR-3 0-3"	1.0	0.4	0.5	1.1	0.6	77	13	10	Sandy Loam	0.028	0.03
R686	EWRD PR-3 3-16"	0.9	0.3	1.1	0.1	1.5	54	27	19	Sandy Loam	0.033	0.04
R687	EWRD PR-3 16-30"	3.0	1.3	7.2	0.1	4.9	66	15	19	Sandy Loam	0.024	0.02
R688	EWRD PR-3 30-55"	43.3	21.2	40.3	0.5	7.1	80	6	14	Sandy Loam	0.030	0.11
R689	EWRD PR-4 0-4"	1.1	0.4	0.9	0.5	1.1	49	37	14	Loam	0.025	0.03
R690	EWRD PR-4 4-19"	0.3	<0.1	0.6	0.1	1.4	54	30	16	Sandy Loam	0.013	0.01
R691	EWRD PR-4 19-34"	<0.1	<0.1	0.4	0.1	2.6	75	8	17	Sandy Loam	0.016	0.01
R692	EWRD PR-4 34-58"	<0.1	<0.1	0.4	0.1	2.7	79	8	13	Sandy Loam	0.031	0.01
R693	EWRD PR 4 34-58"D	<0.1	<0.1	0.4	<0.1	3.2	79	7	14	Sandy Loam	0.032	0.01
R694	NCPAD PR-1 0-3"	0.7	0.2	0.6	0.2	0.9	70	15	15	Sandy Loam	0.019	0.02
R695	NCPAD PR-1 3-11"	1.5	0.6	0.7	<0.1	0.6	61	15	24	Sandy Clay Loam	0.025	0.03
R696	NCPAD PR-1 11-18"	0.4	0.1	1.7	<0.1	3.3	52	27	21	Sandy Clay Loam	0.039	0.02
R697	NCPAD PR-1 18-40"	3.2	1.4	9.2	0.1	6.1	65	19	16	Sandy Loam	0.022	0.03
R698	NCPAD PR-1 40-62"	44.1	14.4	44.4	0.8	8.2	65	19	16	Sandy Loam	0.045	0.16
R699	SE PAD2 PR-1 0-3"	0.7	0.2	0.8	0.2	1.3	71	16	13	Sandy Loam	0.032	0.01
R700	SE PAD2 PR-1 3-16"	0.3	0.0	0.7	<0.1	1.6	65	19	16	Sandy Loam	0.028	0.01
R701	SE PAD2 PR-1 16-30"	3.1	1.0	14.9	0.1	10.5	70	15	15	Sandy Loam	0.045	0.03
R702	SE PAD2 PR-1 30-52"	1.3	0.4	1.1	<0.1	1.2	79	7	14	Sandy Loam	0.057	0.02

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Fort Collins CO 80525

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RESEARCH SOIL ANALYSIS

Lab #	Sample ID #	meq/L Ca	meq/L Mg	meq/L Na	meq/L K	SAR	% Sand	% Silt	% Clay	Texture	Extractable ppm Se	Hot Water mg/kg B
R703	NW PAD PR-1 0-3"	0.4	0.1	0.6	0.2	1.2	69	16	15	Sandy Loam	0.049	0.01
R704	NW PAD PR-1 3-12"	0.8	0.2	0.8	<0.1	1.1	51	26	23	Sandy Clay Loam	0.045	0.03
R705	NW PAD PR-1 12-16"	1.4	0.4	0.7	<0.1	0.7	62	20	18	Sandy Loam	0.015	0.02
R706	NW PAD PR-1 16-48"	3.0	0.6	6.7	<0.1	5.0	69	9	22	Sandy Clay Loam	0.040	0.02
R707	NW PAD PR-2 0-3"	0.7	0.2	1.2	0.2	1.8	59	27	14	Sandy Loam	0.041	0.03
R708	NW PAD PR-2 3-10"	0.5	0.1	1.9	<0.1	3.4	43	29	28	Clay Loam	0.019	0.03
R709	NW PAD PR-2 10-18"	5.7	1.9	16.7	<0.1	8.6	51	29	20	Loam	0.032	0.02
R710	NW PAD PR-2 18-38"	31.0	9.2	53.7	0.1	12.0	50	37	13	Loam	0.034	0.11
R711	NW PAD PR-2 18-38"I	31.6	9.5	54.8	0.1	12.1	50	36	14	Loam	0.035	0.13
R712	EWRD PR-7 0-4"	1.2	0.4	0.9	0.3	1.0	33	52	15	Silt Loam	0.038	0.04
R713	EWRD PR-7 4-12"	0.6	0.2	0.6	0.1	0.9	38	43	19	Loam	0.040	0.04
R714	EWRD PR-7 12-22"	0.2	<0.1	0.5	<0.1	1.3	49	26	25	Sandy Clay Loam	0.033	0.02
R715	EWRD PR-7 22-47"	0.9	0.2	0.3	0.1	0.5	80	6	14	Sandy Loam	0.027	0.01
R716	EWRD PR-6 0-3"	0.7	0.3	0.5	0.1	0.6	65	18	17	Sandy Loam	0.015	0.03
R717	EWRD PR-6 3-14"	0.3	0.1	0.5	<0.1	1.1	59	17	24	Sandy Clay Loam	0.051	0.02
R718	EWRD PR-6 14-28"	1.5	0.3	0.9	<0.1	1.0	79	7	14	Sandy Loam	0.045	0.01
R719	EWRD PR-6 28-56"	6.3	3.3	19.5	0.2	8.9	80	8	12	Sandy Loam	0.030	0.05

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Sweetwater County, WY

RESEARCH SOIL ANALYSIS

Lab #	Sample ID #	meq/L Ca	meq/L Mg	meq/L Na	meq/L K	SAR	% Sand	% Silt	% Clay	Texture	Extractable ppm Se	Hot Water mg/kg B
R720	EWRD PR-5 0-3"	0.7	0.3	0.8	0.2	1.1	72	13	15	Sandy Loam	0.033	0.02
R721	EWRD PR-5 3-10"	0.4	0.1	0.7	<0.1	1.4	49	26	25	Sandy Clay Loam	0.044	0.03
R722	EWRD PR-5 10-16"	<0.1	<0.1	0.0	<0.1	<0.1	50	30	20	Loam	0.036	0.02
R723	EWRD PR-5 16-25"	0.8	<0.1	1.7	<0.1	2.5	61	26	13	Sandy Loam	0.040	0.02
R724	EWRD PR-5 25-53"	8.8	2.7	15.7	<0.1	6.5	69	17	14	Sandy Loam	0.046	0.05
R725	EWRD PR-8 0-2"	0.7	0.2	0.9	<0.1	1.3	67	19	14	Sandy Loam	0.038	0.02
R726	EWRD PR-8 2-6"	0.1	<0.1	0.1	<0.1	0.4	67	15	18	Sandy Loam	0.041	0.01
R727	EWRD PR-8 6-15"	<0.1	<0.1	0.0	<0.1	<0.1	80	4	16	Sandy Loam	0.040	<0.01
R728	EWRD PR-8 15-27"	1.8	0.4	0.6	<0.1	0.6	81	2	17	Sandy Loam	0.044	0.01
R729	EWRD PR-8 27-53"	1.9	0.3	1.8	<0.1	1.7	81	4	15	Sandy Loam	0.015	0.01
R730	EWRD PR-8 27-53"D	1.8	0.2	1.6	<0.1	1.5	80	6	14	Sandy Loam	0.016	0.01

Addendum OP-5b-4

NRCS Official Soil Series Descriptions

LOCATION PEPAL WY

Tentative Series
Rev. HBR/PSD
12/1999

PEPAL SERIES

The Pepal series are deep, well drained soils that formed in calcareous alluvium and residuum. Pepal soils are on late Pleistocene terraces and alluvial fans. Slopes are 0 to 8 percent. The mean annual precipitation is about 8 inches. The mean annual temperature is about 43 degrees F.

TAXONOMIC CLASS: Coarse-loamy, mixed, superactive, frigid Typic Haplocalcids

TYPICAL PEDON: Pepal fine sandy loam, rangeland - (Colors are for dry soil unless otherwise noted).

A1--0 to 1 inch; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine platy structure; soft, very friable, nonsticky, nonplastic; few very fine roots; strongly effervescent, lime disseminated; moderately alkaline (pH 8.0); clear wavy boundary. (1 to 3 inches)

B2--1 to 15 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; soft very friable,nonsticky, nonplastic; common very fine an fine roots; strongly effervescent, lime in filaments and threads; moderately alkaline (pH 8.2); clear wavy boundary. (5 to 18 inches thick)

C1ca--15 to 30 inches; very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; few fine roots; violently effervescent, lime segregated in soft small masses and lenses and as crusts on gravel; moderately alkaline (pH 8.2); gradual wavy boundary. (6 to 50 inches thick)

C2--30 to 60 inches; light brownish gray (10YR 6/2) fine sandy loam, grayish brown (10YR 5/2) moist; massive; soft, very friable, slightly sticky, slightly plastic; few fine roots; strongly effervescent, lime mostly disseminated; moderately alkaline (pH 8.2).

TYPE LOCATION: Sweetwater County, Wyoming; NW1/4, NW1/4, Sec. 27, T21N, R110W about 8 miles west of Big Island Bridge on the Green River.

RANGE IN CHARACTERISTICS: The mean annual soil temperature is 43 degrees to 47 degrees F. The mean summer air temperature is 64 degrees to 68 degrees F. Gravel content is typically less than 15 percent but may range from 0 to 25 percent in any substratum. Depth to continuous horizons of carbonate accumulation ranges from 6 to 20 inches.

The A horizon has hue of 10YR or 2.5Y, value of 5 through 7 dry and 4 through 6 moist, and chroma of 2 or 3 dry and moist. Texture is fine sandy loam, sandy loam, or gravelly sandy loam with less than 25 percent gravel. The structure is platy or granular. Effervescence typically ranges from slight to strong, but some pedons may be leached free of carbonates in the thin strata. Reaction is mildly or moderately alkaline.

The C horizon has hue of 10YR or 2.5Y, value of 6 through 8 dry and 4 through 7 moist, and chroma of 2 through 4 dry and moist. Textures are fine sandy loam, sandy loam, or gravelly sandy loam. Thin strata of very gravelly sandy loam occur in some pedons. Coarse fragments range from 0 to 25 percent. Effervescence is strong or violent. Reaction is moderately or strongly alkaline. Calcium carbonate equivalent ranges from 15 to 35 percent in the calcic horizon.

COMPETING SERIES: These are McGinty and Teagulf (P) series. McGinty soils formed in alluvium from basalt and have 5 to 20 percent dark colored ferromagnesian mineral fragments. Teagulf soils have a paralithic contact at 20 to 40 inches.

GEOGRAPHIC SETTING: Pepal soils are on nearly level to sloping terraces and alluvial fans. Slopes range from 0 to 8 percent. They formed in mixed alluvium generated during the late Pliestocene epoch. Elevations range from 6,000to 7,000 feet. The mean annual precipitation is 6 to 9 inches. The mean annual air temperature is 38 to 45 degrees F., and summer air temperature is 61 degrees to 66 degrees F. The frost-free season is about 80 to 110 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are Cambarge (P), Leckman (P), and competing Teagulf (P) soils. Cambarge soils are loamy-skeletal. Leckman soils do not have a calcic horizon. Teagulf soils have a paralithic contact at a 20 to 40 inch depth. These soils may occur intermixed with the Pepal soils depending upon the degree of dissection of the land form.

DRAINAGE AND PERMEABILITY: Well drained; slow to medium runoff; moderately rapid permeability.

USE AND VEGETATION: These soils support native vegetation used mostly for domestic livestock grazing and wildlife habitat. Native vegetation at the type location is mainly big sagebrush, spiny hopsage, low rabbitbrush, shadscale, needleandthread, thickspike wheatgrass, Indian ricegrass, Sandberg bluegrass, pricklypear cactus, and phlox. These soils are well suited for irrigated cropland where water is available and are well suited for urban sites.

DISTRIBUTION AND EXTENT: Pepal soils occur in the Green River Basin of southwestern Wyoming. They are of moderate extent.

MLRA OFFICE RESPONSIBLE: Lakewood, Colorado

SERIES PROPOSED: 1979, Sweetwater County, Wyoming.

Classification updated to superactive Typic Haplocalcids from Typic Calciorthids December 1999. Description last updated by state March 1980.

National Cooperative Soil Survey
U.S.A.

LOCATION TEAGULF WY

Tentative Series
Rev. HBR/PSD
12/1999

TEAGULF SERIES

The Teagulf series consists of moderately deep, well drained soils that formed in modified residuum and slopewash alluvium from calcareous sedimentary rocks. Teagulf soils are on erosional upland plains and alluvial fans. Slopes are 0 to 8 percent. The mean annual precipitation is about 8 inches. The mean annual temperature is about 43 degrees F.

TAXONOMIC CLASS: Coarse-loamy, mixed, superactive, frigid Typic Haplocalcids

TYPICAL PEDON: Teagulf fine sandy loam - rangeland. (Colors are for dry soil unless otherwise stated).

A1--0 to 3 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; strongly effervescent, lime disseminated; moderately alkaline (pH 8.2); clear wavy boundary. (2 to 5 inches thick)

B2--3 to 10 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure; slightly hard, friable; slightly sticky, nonplastic; common fine roots; slightly effervescent, lime segregated in lower part; moderately alkaline (pH 8.2); clear wavy boundary. (5 to 16 inches thick)

C1ca--10 to 35 inches; light olive brown (2.5Y 5/4) fine sandy loam, olive brown (2.5Y 4/4) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; few fine roots; strongly effervescent, lime is segregated in soft masses; strongly alkaline (pH 9.0).

C2r--35 inches; soft sandstone.

TYPE LOCATION: Sweetwater County, Wyoming; NW1/4, NE1/4, of Sec. 28, T20N, R110W. About 4 miles north of Westvaco.

RANGE IN CHARACTERISTICS: The mean annual soil temperature is 43 degrees to 47 degrees F. The mean summer soil temperature is 63 degrees to 68 degrees F. Coarse fragment content is typically less than 5 percent but ranges in some pedons from 0 to 15 percent and consists of gravel and channers. Depth to horizons of continuous carbonate accumulation is 7 to 20 inches. Depth to bedrock is typically 28 to 35 inches but may range from 20 to 40 inches.

The A horizon has hue of 10YR or 2.5Y; values of 5 through 7 dry, 4 or 5 moist; and chroma of 2 through 4 dry and moist. Textures are fine sandy loam, sandy loam, or loamy fine sand. Reaction is mildly or moderately alkaline. Effervescence ranges from none to strong. Salinity is 0 to 2 mmhos/cm.

The B horizon has hue of 10YR or 2.5Y; values of 5 through 7 dry, 4 or 5 moist; and chroma of 2 through 6 dry and moist. Textures are fine sandy loam or sandy loam. Reaction is mildly or moderately

alkaline. Structure is weak prismatic or weak subangular blocky. Effervescence is slight to strong. Salinity is 0 to 2 mmhos/cm.

The Cca horizon has hues of 10YR or 2.5Y; values of 6 or 8 dry, 4 to 6 moist; and chroma of 2 through 6 dry and moist. Textures are fine sandy loam or sandy loam. Reaction is moderately or strongly alkaline. Effervescence is strong or violent. Salinity is 0 to 4 mmhos/cm. Carbonate equivalent ranges from 8 to 25 percent.

COMPETING SERIES: These are McGinty and Pepal (P) series. Both soils are over 40 inches deep to bedrock and McGinty soils formed in alluvium from basalt.

GEOGRAPHIC SETTING: Teagulf soils are on nearly level and gently sloping erosional upland plains and alluvial fans. The soils formed in modified residuum and slopewash alluvium from sedimentary rocks. Slopes are 0 to 8 percent. Elevations range from 6,000 to 7,300 feet. Average annual precipitation is 6 to 9 inches. The mean annual air temperature is 38 degrees to 45 degrees F., and the mean summer air temperature is 61 degrees to 66 degrees F. The frost-free season is about 80 to 110 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Huguston, Terada, and competing Pepal soils. Huguston soils are less than 20 inches deep to bedrock. Terada soils lack calcic horizons. These soils occupy relative positions on the landscape.

DRAINAGE AND PERMEABILITY: Well drained; slow to medium runoff; moderately rapid permeability.

USE AND VEGETATION: These soils support native vegetation used for domestic livestock grazing and for wildlife habitat. Native vegetation at the type location is mainly big sagebrush, shadscale, low rabbitbrush, needleandthread, Indian ricegrass, thickspike wheatgrass, needleleaf sedge, pricklypear cactus, and phlox.

DISTRIBUTION AND EXTENT: Throughout the Green River basin of southwestern Wyoming. The series is extensive.

MLRA OFFICE RESPONSIBLE: Lakewood, Colorado

SERIES PROPOSED: Sweetwater County, Wyoming; 1979.

Classification updated to superactive Typic Haplocalcids from Typic Calciorthids December 1999. Description last updated by the state February 1980.

National Cooperative Soil Survey
U.S.A.

LOCATION POPOSHIA WY+UT

Established Series
Rev. JEI/MCS/SSP
06/2009

POPOSHIA SERIES

The Poposhia series consists of very deep, well drained soils formed in alluvium and slope alluvium derived from shale interbedded with sandstone. The Poposhia soils are on coalescing fans, footslopes, fan aprons, hillslopes, and terraces. Slopes are 0 to 30 percent. The mean annual precipitation is 12 inches, and the mean annual temperature is 42 degrees F.

TAXONOMIC CLASS: Fine-loamy, mixed, superactive, frigid Ustic Haplocambids

TYPICAL PEDON: Poposhia loam on southwest-facing convex slope of 3 percent-native range. (Colors are for dry soil unless otherwise stated.)

A--0 to 3 inches; brown (10YR 5/3) loam, brown (10YR 4/3) moist; weak fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic many very fine, fine and few medium roots; slightly effervescent, carbonates disseminated; moderately alkaline (pH 8.0); abrupt smooth boundary. (2 to 8 inches thick)

Bk--3 to 15 inches; pale brown (10YR 6/3) clay loam, light olive brown (2.5Y 5/4) moist; weak medium prismatic structure; hard, firm, moderately sticky and moderately plastic; common very fine, fine, and few medium roots; slightly effervescent, carbonates disseminated and as few fine threads and seams; moderately alkaline (pH 8.2); clear wavy boundary. (6 to 20 inches thick)

C--15 to 60 inches; pale brown (10YR 6/3) loam, light olive brown (2.5Y 5/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine, fine and medium roots to 22 inches; slightly effervescent, carbonates disseminated; moderately alkaline (pH 8.0).

TYPE LOCATION: Fremont County, Wyoming, about 5.8 miles south and 2.9 east of Hudson; 800 feet east, 2,975 feet south of the NW corner of sec. 23, T. 33 N., R. 98 W.

RANGE IN CHARACTERISTICS:
Soil moisture: The soil moisture control section is usually dry, but is moist in some parts for 30 to 50 cumulative days between June 10 and October 10; and is moist 50 to 65 percent of the time when the soil temperature is above 5 deg. C.; aridic regime bordering ustic.
Mean annual soil temperature: 42 to 47 degrees F.
Mean summer temperature: 59 to about 63 degrees F.
Depth to cambic horizon: 2 to 8 inches
The soil is typically calcareous throughout but may be leached a few inches in some pedons.

Particle-size control section: is loam, clay loam, or sandy clay loam with 18 to 35 percent clay, 20 to 50 percent silt, and 20 to 55 percent sand

A horizon:

Hue: 7.5YR through 2.5Y
Value: 4 through 7 dry, 3 through 5 moist
Chroma: 2 through 4 dry or moist
EC: 1 to 4 mmhos.
Rock fragments: 0 to 15 percent
Reaction: is slightly through strongly alkaline

Bk horizon:
Hue: 7.5YR through 2.5Y
Value: 5 through 8 dry, 4 through 6 moist
Chroma: 2 through 4 dry
Texture: loam, clay loam, and less commonly sandy clay loam
Rock fragments: 0 to 20 percent
Calcium carbonate equivalent: 4 to 14 percent
EC: 1 to 8 mmhos
Reaction: slightly through strongly alkaline

C horizon
Hue: 7.5YR through 2.5Y
Value: 5 through 7 dry, 4 through 6 moist
Chroma: 2 through 4 dry or moist
Texture: loam, clay loam, or sandy clay loam
Rock fragments: 0 to 20 percent
EC: 1 to 8 mmhos
Reaction: moderately or strongly alkaline

COMPETING SERIES: These are the Chaperton, Piceance, and Yamo series.
Chaperton: have a paralithic contact between 20 and 40 inches deep
Piceance: have a lithic contact between 20 and 40 inches deep
Yamo: have soil moisture control sections that are drier during the months of May and June

GEOGRAPHIC SETTING:
Parent material: alluvium and slope alluvium derived from shale interbedded with sandstone
Landform: gently sloping and moderately sloping coalescing fans, footslopes, hillslopes, and terraces
Slopes: 0 to 30 percent
Elevation: 5,200 to 7,800 feet
Mean annual temperature: 39 to 45 degrees F.
Mean annual precipitation: 8 to 15 inches
Frost-free period: 85 to 120 days

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Absher, Blackhall, Blazon, Diamondville, Ryan Park, Tisworth, and the competing Delphill and Sinkson soils. Absher and Tisworth soils have a natric horizon. Blackhall, Blazon, and Diamondville soils have bedrock above 40 inches. Ryan Park soils are coarse-loamy. Diamondville and Ryan Park soils have argillic horizons.

DRAINAGE AND PERMEABILITY: Well drained; runoff is slow or medium; permeability is moderate.

USE AND VEGETATION: Mainly native range but some is used for irrigated small grain, hay, and pasture. Native vegetation is western wheatgrass, big sagebrush, Canby bluegrass, sheep fescue,

needleandthread, and some annual forbs (mustards). Poposhia soils are mainly correlated to ecological sites in the 10 to 14 inch zone in Wyoming. At the type location the potential native vegetation is mainly big sagebrush, thickspike wheatgrass, green needlegrass, bluebunch wheatgrass, and bottlebrush squirreltail.

DISTRIBUTION AND EXTENT: Southern and western Wyoming. The series is moderately extensive.

MLRA OFFICE RESPONSIBLE: Lakewood, Colorado

SERIES ESTABLISHED: Fremont County, Wyoming, East Part; 1985.

REMARKS: Diagnostic horizons and features recognized in this pedon are:
Ochric epipedon - 0 to 3 inches (A)
Cambic horizon - 3 to 15 inches (Bk)
Secondary calcium carbonate - 3 to 15 inches (Bk)

Classification was changed from Ustic Torriorthents to Ustic Haplocambids 5/1999.
Taxonomic version: Tenth Edition, 2006.

National Cooperative Soil Survey
U.S.A.

Attachment OP-6

Wildlife Protection Plan and Wildlife Monitoring Plan

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ADDENDUM

Attachment OP-6
Wildlife Protection and Monitoring Plans

LC ISR, LLC has completed extensive baseline wildlife surveys to evaluate existing wildlife resources in and adjacent to the Permit Area (**Appendix D9**). In addition, LC ISR, LLC has implemented protection measures as appropriate to the on-going exploration activities at the site, such as drilling restrictions based on location or timing for wildlife activities and use of appropriate fencing around activity areas. LC ISR, LLC will continue a combination of protection measures and monitoring to improve the current understanding of ISR impacts on wildlife and minimize the impacts.

The Wildlife Protection Plan and the Wildlife Monitoring Plan, in **Sections 1.0** and **2.0** of this attachment, respectively, were developed to prevent impacts to wildlife, where possible; and if impacts are identified or anticipated, the Plans will help minimize those impacts. If needed, additional wildlife protection or monitoring measures can be designed and implemented to minimize or offset anticipated impacts. The Plans were developed to be consistent with recommendations and requirements of USFWS, BLM, WGFD and WDEQ-LQD.

The results and conclusions from each year's wildlife protection and monitoring measures will be included in LC ISR, LLC's Annual Report to WDEQ-LQD, BLM, and NRC.

1.0 WILDLIFE PROTECTION PLAN

LC ISR, LLC recognizes that ISR activities have the potential to impact wildlife, including: loss of habitat; changes in habitat usage due to increased human presence, reductions in food sources, displacement to new areas; and collisions with structures and vehicles. The following protection measures include both impact avoidance and mitigation measures. Those measures that are currently in use during exploration drilling, that are also applicable to ISR operations, will be continued, and new measures will also be implemented as on-site activities increase during ISR operations.

The protection measures include a range of options, from activity restrictions to reclamation. Proposed measures are designed to be consistent with those recommended by the USFWS, BLM, and WGFD. The discussion of the measures is organized into those relating to: Activity Restrictions and Reporting; Infrastructure; Human Disturbance; Site Maintenance and Reclamation; and Habitat Enhancements.

Particular attention was given to protection measures for sage grouse, raptors, and MBHFI because of their presence in the area. The measures for sage grouse were adapted from the Core Population Area Stipulations (WGFD, 2008) to be practical in an ISR environment. The stipulations and their application are included in **Table OP-A6-1**. The project is located on the edge of the South Pass Sage-Grouse Core Breeding Area, as shown on **Figure OP-A6-1** (WGFD, 2008).

1.1 Observation and Reporting of Wildlife Activity

Wildlife observed within and near the Permit Area is described in detail in Appendix D9. The on-going wildlife monitoring plan, which includes annual reporting, is described in detail in **Section 2.0** of this attachment. However, there may be times at which more immediate reporting may be necessary. In particular, any unanticipated new or unusual wildlife activity which could interfere with site operations will be reported to the WDEQ-LQD (and other WDEQ divisions as necessary), USFWS, and WGFD. Similarly, any mortality that could be caused by exposure to toxic substances or other unusual project-related concern will be reported immediately to the WDEQ-LQD (and other WDEQ divisions as necessary), USFWS, and WGFD. The goal of such reporting will be to identify and solve the problem as quickly as possible.

1.2 Timing Restrictions

The major phases of the Lost Creek Project include: *exploration* for ore; *facility construction*; *delineation* of mine units (economic portions of the ore zone); mine unit *installation*; *production* and groundwater *restoration*; and surface *reclamation*. Six mine units are planned within the Lost Creek Permit Area. The units are brought on-line and reclaimed in scheduled succession during the life-of-mine, which is anticipated to be 12 years. The ISR operations and reclamation are described in detail in the main portion of the permit application; and the schedule is included in **Figure OP-4a** of the Operations Plan.

During *exploration* drilling, the standard timing restrictions identified by BLM will continue to be followed, unless otherwise approved by BLM. The timing restrictions for protection of specific species which occur in the vicinity of the Lost Creek Project are listed in **Table OP-A6-2**. It should be noted that exploration drilling took place at the site several times in the past (**Appendix D2**); and LC ISR, LLC has been conducting exploration and delineation drilling at the site since 2005 under Notice WYW-166224 with BLM.

Facility construction, i.e., construction of the on-site office building, the Plant, and associated support facilities, is anticipated to take six to seven months. Construction will begin once agency approvals are obtained.

The *delineation* and subsequent *installation* of the mine unit can be considered as the first step in accessing the ore - similar to topsoil stripping prior to opening a pit at a surface mine - and will occur year-round. However, the similarity ends there as topsoil removal is not necessary over the entire mine unit. Topsoil removal is only necessary at the mud pits, and the topsoil is replaced after drilling. Also, although vegetation is affected in the mine unit, removal throughout the mine unit is not generally required, and the surface area of the mine unit is largely reclaimed, with a native seed mix, prior to production. (In fact, topsoil and vegetation removal over the entire mine unit could be detrimental to shrub recovery given the relative resilience of sagebrush to mechanical disturbance). In addition, installation of injection and production wells and the associated facilities requires about 14 months rather than the several years a surface pit may be open.

During *production* and ground water *restoration*, the wellheads, header houses, and tertiary access roads are the only long-term ISR features on the surface in the mine units. In addition, activities within the mine unit are almost all restricted to daytime hours. A mine unit operator is present at night for security and for process control. Because of the limited surface disturbance during production, surface *reclamation* generally results in minimal disturbance.

1.3 Infrastructure

The infrastructure for the Lost Creek Project is shown on **Figure OP-2a** and **Plate OP-1**. A discussion of which items in the infrastructure are life-of-mine (e.g., the Plant) and which are shorter term (e.g., header houses in Mine Units) is included in **Section OP 2.1**. The reclamation of the infrastructure is described in **Sections RP 3.0 and 4.0**. The steps that will be taken to mitigate impacts of the infrastructure are discussed in the following subsections.

1.3.1 Locations and Disturbance Area

The locations for the mine units are dependent on the ore distribution (**Figure OP-2b**). Within the Lost Creek Permit Area (as in much of Wyoming), the ore occurs in long, narrow, sinuous 'roll front' deposits. The deposits are usually in sandstones, which are vertically separated by shales, so there may be mine units at different depths at overlapping locations. The ISR process is iterative; new mine units are brought into

production as older mine units are reclaimed. Therefore, not all of the disturbance occurs at once, and the disturbance is clustered, which will minimize disruptions to wildlife.

The proportion of disturbance within the Permit Area is less than 10% of the Permit Area (**Table OP-A6-3**). In addition, ISR minimizes surface disturbance since in most cases topsoil and vegetation are left intact. In areas where vegetation is removed, revegetation efforts will commence at the next appropriate season, using native seed mixes approved by BLM and WDEQ-LQD. Consideration was also given to use of existing roadways wherever possible to minimize disturbance of new lands (**Table OP-A6-1**).

The orientation of the project facilities and existing sage grouse leks are shown on **Figure OP-A6-2**. The majority of the mine units are outside the two-mile buffers for the closest active and occupied leks, which are the Green Ridge Satellite Lek to the east and the Discover 2 Lek to the west. (Although the two-mile buffers are no longer applicable in the Core Breeding Areas, the buffers were recognized when wildlife monitoring for the Project began in 2006.) The necessary support facilities were sited, in part, based on distance from existing occupied sage grouse leks. In particular, the Plant was sited between the two-mile buffers for the closest active and occupied leks. The closest lek (Crooked Well lek) is considered "occupied and inactive" based on data from the last several years (**Attachment D9-4**).

For comparison with the current sage grouse Core Population Area Stipulations, the disturbance is broken down by section in **Table OP-A6-3.**

Existing raptor nests are located greater than one mile away from proposed ISR activities (**Figure D9-7**). If the annual raptor nest survey locates a new raptor nest (Section 2.3), the USFWS and WGFD will be consulted to determine appropriate mitigation measures. If needed, appropriate mitigation permits will be obtained from the USFWS and WGFD.

Based on breeding bird surveys, the Lowland Big Sagebrush habitat, described in **Appendix D8**, provides the most important breeding habitat for MBHFI passerine bird species in the area. Only a small portion of this habitat will be disturbed (**Table OP-A6-3**), and where possible, project activities will be located outside of this habitat area.

1.3.2 Roads and Utilities

Access roads will follow existing two-track roads to the extent possible to help minimize disturbance of habitat. Road widths will be minimized while still conforming to the International Fire Code, as requested by county zoning. The existing two-track road network is shown on **Figure D7-3**, and proposed road locations and improvements are

discussed in **Section OP 2.6**. Existing two-track roads that are adjacent to the main access road and Plant will be gated (only if approved by the BLM) and or signed to help prevent additional traffic disturbances in the area. Travel outside of primary construction and drilling areas will be minimized through the installation of main and secondary access roads.

Because of the proximity of existing public roads and the access roads to some of the leks, line-of-sight analyses were conducted with GIS and in the field. The GIS analyses evaluated what was visible if the viewer's line of sight were one meter above the ground (slightly taller than a sage grouse) and two meters above the ground. The results for the leks that are 'Occupied and Active' are included on **Figures OP-A6-3a** (Green Ridge Lek), **OP-A6-3b** (Green Ridge Satellite Lek), **OP-A6-3c** (Discovery Lek), and **OP-A6-3d** (Discovery Satellite [or Discovery 2] Lek). The results for the Crooked Well Lek that is 'Occupied and Inactive' are included on **Figure OP-A6-3e**. Purple is used to show areas that are visible from the lek at a line of sight one meter above the ground, and blue is used to show additional areas that are visible from two meters above the ground. (On the figures, the green triangle is a relatively large symbol because the dimensions of the lek are not precise.)

From the Green Ridge Lek, part of the Sooner Road, which is an existing public road (BLM Road 3215), and the East Access Road may be visible from the eastern side of the lek. Portions of the Permit Area may also be visible, although those portions are three miles away or more. Less of the roads may be visible from the Green Ridge Satellite Lek, a closer portion of the Permit Area may be visible. However, the only facility in this portion of the Permit Area is one of the deep wells (**Plate OP-1**). From the Discover Lek, parts of the Wamsutter-Crooks Gap Road, which is an existing public road (County Road 23), the West Access Road, and the main portion of the Permit Area are visible. However, most of the closest of these features, the West Access Road, is not visible. (At its closest point, the West Access Road is about 0.5 miles north of the Discover Lek.) From the Discover 2 Lek, even less is visible as it sits in a topographic low. The GIS results for the Discover and Discover 2 Leks were confirmed by field observations in September 2009. **Figure OP-A6-4** includes 360° panoramic views standing at the approximate locations of the Discover and Discover 2 leks. In both cases, a subtle ridgeline to the north obstructs a clear view of the West Access Road. The Crooked Well Lek is apparently in a topographic low given the scattered visibility from the lek.

LC ISR, LLC will complete a detailed analysis of potential road and disturbance impacts to sage grouse in the Permit Area and a larger regional monitoring area (Section 2.3.3).

The proposed pipelines, transmission line, and any other utilities will be placed in or adjacent to the access road ROW to help minimize habitat impacts where possible. To prevent the electrocution of raptors, the primary and secondary transmission lines and

power poles will be built to the latest approved methods (Olendorf et al., 1996). This will include cross-arm design, and transformer design. Tertiary transmission lines will be buried in order to minimize risks to raptors and large birds. In addition, to discourage roosting by raptors and corvids (and, in turn, increased predation on sage-grouse), appropriate anti-perching and anti-roosting devices will be placed on power poles and cross-arms.

1.3.3 Fencing or Screening

The ISR activities that require a visual deterrent, fencing, or screening include: the mine units; mud pits used during well installation; and the storage ponds. The specific types of deterrent, fencing, or screening for these activities are outlined below.

1.3.3.1 Plant and Mine Units

The Plant and mine units will be fenced to keep out cattle and wild horses but will be constructed to allow the passage of antelope and other wildlife (Type III fencing per LQD Guideline 10). The fences will be removed after ISR operations are complete and vegetation has become reestablished in accordance with permit requirements (**Section RP 4.5.4**) unless otherwise approved and agreed upon with the landowner (BLM).

1.3.3.2 Mud Pits

As during exploration drilling, LC ISR, LLC will continue to fence mud pits outside of the fenced portion of the Mine Units. Inside the fenced portion of the mine units, mud pits will not be fenced, in part due to the limited time the pits are open and the level of activity around the pits while they are open. Mud pits have not been the cause for significant wildlife mortality at other ISR operations. If conditions are found to differ from those at other ISR operations, more protective measures, such as temporary fencing, will be evaluated.

1.3.3.3 Storage Ponds

The only fluid-holding structures will be the storage ponds, which are described in detail in **Section OP 2.9.4**. The ponds will be fenced to prevent access by wildlife on the ground and for safety reasons (Type I fencing per LQD Guideline 10). Based on the anticipated quality of the water in the ponds (**Table OP-A6-4**), fencing and deterrents will be used and algae and plankton growth will be prevented. If birds are attracted to the ponds, it will most likely be waterfowl that would be exposed via water ingestion. If sage grouse and local sagebrush endemic passerine bird species use the ponds as a regular water source there is an exposure potential. However, the amount of freeboard, and water depth maintained for the two ponds should make it difficult for land birds (such as

sage grouse), passerine birds, and wading birds (such as herons) to drink from the ponds. An exception might be swallows, if present in the area, that drink water on the wing. Waterfowl are not expected to reside on the ponds for more than a few days. A study of wastewater ponds in central Idaho noted that waterfowl resided from 1 to 25 days, with an average residence time at the ponds of 6 days (Halford et al., 1982).

Recommended drinking water quality guidelines for wild birds are not known to exist (although there are water quality standards that are thought to indirectly protect wild birds). However, guidelines for drinking water quality do exist for poultry (Carter and Sneed, 1996). The list of major constituents in the storage ponds (**Table OP-A6-4**) are not considered hazardous to poultry, with the exception of radium-226, which is discussed in more detail below. High concentrations of chloride, magnesium, sodium, and sulfate cause mild symptoms such as metabolic effects or loose droppings or act as a diuretic or laxative, respectively, in poultry (Carter and Sneed, 1996). Maximum recommended concentrations for poultry were not available in the North Carolina Cooperative Extension publication (Carter and Sneed, 1996) for the trace parameters listed above non-detect levels.

A document published by the National Academy of Sciences (NAS, 1980) provides "maximum tolerable levels" (MTLs) of various minerals in the diet for poultry, among other domestic animals. The MTLs for poultry regarding aluminum, arsenic, fluoride, manganese, selenium, and vanadium match or are greater than the anticipated maximum concentrations listed for these analytes in **Table OP-A6-4**.

Selenium

A study focused on waterfowl determined that water concentrations of 20 micrograms per liter (µg/L) [or 0.020 milligrams per liter (mg/L)] and greater are hazardous to aquatic birds (Skorupa and Ohlendorf, 1991). This value is ten times less than the anticipated maximum concentration in the storage ponds (**Table OP-A6-4**). Another study of waterfowl using irrigation drainwater ponds in California with abnormally high concentrations of selenium up to 300 parts per billion (equivalent to 0.3 mg/L) noted severe reproductive effects (Ohlendorf et al., 1986). Selenium is known to greatly bioconcentrate in aquatic ecosystems between concentrations in water and that in primary producer organisms such as algae and plankton, as well as bioaccumulate many-fold between primary producers and waterfowl (Lemly, 1993). If algae and plankton were allowed to flourish in the storage ponds, even higher concentrations of selenium might become available to waterfowl while feeding.

Contrary toxicological evidence is manifested using methods from the practice of ecological risk assessment. A comparison of avian toxicity criteria for selenium used in California was made by the California Department of Toxic Substances Control

(CalEPA, 2000). The values ranged from 0.23 to 0.5 mg/kg body weight (BW)/day. The maximum anticipated storage pond concentration of 0.2 mg/L can be compared to the lowest criterion of 0.23 mg/kg BW/day by multiplying the pond concentration by a calculated water ingestion rate of 0.0514 L/day for various bird species (EPA, 1993) and dividing the product by the approximate body weight of a lesser scaup duck (EPA, 1993), 0.8 kg, as follows:

0.2 mg Se/L pond water x 0.0514 L water ingested/day = 0.010 mg Se/day;

0.010 mg Se/day from pond water / 0.8 kg body weight of duck =
0.013 mg Se/kg BW/day;

Hazard Quotient = Dose / Toxicity Criteria = 0.013 / 0.23 = 0.06.

When the hazard quotient is less than 1, it can be assumed that there are no risks to the organism from the contaminant. These calculations apply only to selenium exposure from drinking water and assume that there is no selenium exposure (and bioaccumulation) from food items in the water.

WDEQ recently published a literature review of health effects of inorganic contaminants in drinking water for livestock and wildlife (Raisbeck et al., 2007). The document, however, does not contain information on avian species. There is discussion of aquatic life criterion and whole body tissue concentrations for fish and macroinvertebrates and the relationship of those parameters to risk to avian species. However, fish will not be present in the ponds. In addition, algae and plankton growth will be controlled and the pond habitat will not be suitable for macroinvertebrates, so these parameters are not applicable.

Radium-226

The anticipated maximum concentration of radium-226 is 1,500 picoCuries per liter (pCi/L). Radium-226 is a radionuclide that emits alpha and gamma particles, meaning that waterfowl would receive both internal and external doses of radiation when sitting on the ponds and drinking water. It is a long-lived radionuclide with a decay half-life of 1,620 years. Acting similarly to calcium, radium-226 is stored in bone tissue and is slow to be released from bone. Radium-226 has been shown to bioconcentrate in plankton at 100 to 2,750 times that of the concentration in the water column (Whicker and Schultz, 1982).

In a study of waterfowl using wastewater ponds at the Idaho National Engineering Laboratory, the maximum total dose to any waterfowl was calculated to be 5,600 millirad for American coots that resided on the ponds for 20 days (Halford et al., 1982). No tissue

abnormalities were noted and no long-term effects from the radiation were expected. The anticipated dose from the storage ponds at the Lost Creek Project is being evaluated.

For comparative purposes, the WDEQ-WQD Rules and Regulations (WDEQ, 2007a) state that the total radium-226 concentration shall not exceed 60 pCi/L for effluent-dependent waters. This narrative standard is less than the anticipated concentrations. However, the ponds are not 'surface waters of the State' (WDEQ, 2007b) and are only in place to provide for temporary storage prior to deep disposal (**Section OP 5.2.3.1**).

Mitigation

As described in **Section OP 2.9.4**, the water quality in the ponds will be checked quarterly, to ensure unanticipated changes in the water quality are detected, and whenever a process change may result in a significant change in water quality. The location of the ponds adjacent to the Plant, and associated human activity (including daily checks of the ponds), is anticipated to reduce the attractiveness of the ponds to wildlife. Deterrents, such as flagging and predator silhouettes or decoys, will also be used. The growth of algae and plankton will be monitored, and if necessary, a herbicide approved for use in pond settings will be used to reduce or eliminate such growth.

1.4 Human Activity

All employees will be informed of applicable wildlife laws and penalties associated with unlawful take and harassment of wildlife and will be trained to recognize types of wildlife in the area.

1.4.1 Road and Equipment Use

Mitigating the impacts of the roads and equipment will depend on the number of vehicles and the way in which they are used. For example, use of carpools will help minimize traffic, and use of designated roadways (especially in the mine units) will help limit disturbance.

1.4.1.1 Type and Amount of Equipment

The vehicles used to operate the site are classified in three categories: Company Owned - On Site Only; Company Owned - On and Off Site; and Contractor Owned - On and Off Site. The types and numbers of vehicles that will be used when the Project is at peak production are listed below. Many of the vehicles will only be working in a specific portion of the site at one time, e.g., in the Plant or in a given mine unit.

1. Company Owned - On Site Only
   a. Pickups: A total of approximately 24 ½-ton, ¾-ton and 1-ton pickups for supervision, construction, operations and maintenance in production, exploration and monitoring areas.
   b. Equipment: Approximately 3 All Wheel Drive (AWD) Forklifts: 2 Hard Surface Forklifts; 1 Motor Grader; 2 Backhoes; 3 Geophysical Logging Trucks; 1 All Terrain Vehicle (ATV); 3 Flat Bed Trailers; 3 Reel Trailers; 1 High-Density Polyethylene (HDPE) Fusion Cart; 9 Generators; 2 Water Trucks; 1 Mechanical Integrity Testing (MIT) Truck; and 6 Cementers; 1 Pulling Unit and 1 Grout Trailer.

2. Company Owned - On and Off Site
   a. Pickups: Approximately 3 ½-ton or ¾-ton pickups used by supervisors on site and to travel to and from the site.
   b. Vans: Approximately 4 vans to transport personnel to and from the site and Casper, Rawlins, or other town.
   c. Tractor/Trailer: One tractor will be used to mobilize two slurry trailers at the site. In addition, a side-dump or end-dump trailer (in conjunction with the tractor) is planned for off-site waste transport.

3. Contractor Owned - On and Off Site
   a. Pickups: Approximately 10 ¾-ton and/or 1-ton pickups may be used by drilling contractors for travel to and from the site as well as travel on the site.
   b. Water Trucks: Approximately 10 80-barrel to 100-barrel water trucks will be used on site to support contract drilling operations.
   c. Truck-Mounted Drilling Rigs: Approximately 10 1500-Class drill rigs will be used on site to support contract drilling operations.
   d. Deliveries: Standard deliveries will occur of materials used for construction, operations, as well as maintenance of the site. Frequency of deliveries will be based on production rate, usage, time of year and other needs. The materials can be separated into the following categories:
      i. Chemicals (weekly to monthly): Carbon dioxide, oxygen, salt, soda ash, peroxide, gasoline, and diesel;
      ii. Yellowcake shipments (weekly to monthly);
      iii. Construction (weekly to monthly): Steel, polyvinyl chloride (PVC) and HDPE pipe, wire, valves, fittings, and structural steel;
      iv. Operations (weekly): Potable water, trash, and office supplies; and
      v. Maintenance (weekly to monthly): Grease, oils, pipe, wire, and fittings.

1.4.1.2 Road Use

All employees and contractors will be trained to recognize types of wildlife in the area, their susceptibility to disturbance or to collisions with motor vehicles, and measures that should be taken to avoid disturbance and wildlife/vehicle collisions. Speed limits will be set at 30 mph on main access routes and no greater than 20 mph on secondary roads. All new employees will receive training on these speed limits with refresher training at least once per year. LC ISR, LLC will enforce these traffic rules to minimize the likelihood of vehicle collisions with wildlife.

Speed limits within the permit area will be set based on the following considerations: the condition of the road, design of the road, safety factors, protection of equipment, wildlife and livestock protection, and dust mitigation measures. Generally, the speed limit on main roads will be 30 miles per hour and on secondary roads the speed limit will be 20 miles per hour. However, in no case shall the speed limit be greater than 30 miles per hour. All employees will receive training regarding speed limits during indoctrination training. Site visitors will be advised of the site speed limits during site specific training. Speed limits signs will be posted on the main roadways with the permission of BLM.

Compliance to safety rules is of utmost importance. Supervisors will be responsible for ensuring their employees abide by traffic safety rules; including speed limits. Employees who don't abide by traffic rules will be subject to progressive discipline up to and including dismissal. The Safety Department will from time to time monitor speed limits to ensure compliance.

1.4.2 Hours of Operation

Normal field operations at the facility will take place between the hours of 7 a.m. and 5 p.m. Mining operations, i.e., pumping and injection of production solutions, will continue around the clock. However, during a routine night shift, only one employee will be in the field in a light truck to monitor equipment.

1.4.3 Noise

Background noise in the Permit Area under calm wind conditions is representative of a quiet rural area. Field measurements were made using a Sper Scientific Sound Meter 840005, which accurately measures noise between 40 and 80 A-weighted decibels dB(A) to within ±3.0 dB(A). At eight cardinal directions, noise levels were measured for three 30-second intervals facing a cardinal direction. The peak noise level of each interval was

recorded. The mean of the peak noise levels for each of the eight cardinal directions is presented in **Table OP-A6-5a**.

Initial noise measurements were made on the afternoon of June 13, 2007. Meteorological conditions at the time of measurement were relatively calm, with an east wind averaging 4.8 meters per second (m/s). As shown in **Table OP-A6-5a**, the measured noise levels were below the instrument detection limit of 40 dB(A).

Noise measurements at the Plant site were repeated on the morning of April 28, 2009, when no workers were on site and no heavy equipment was operational. Meteorological conditions at the time of measurement were windy, with a south-southwest wind averaging 11 m/s, and gusts up to 15 m/s. **Table OP-A6-5a** shows the measured noise levels ranged from 68 to 89 dB(A), with the greatest noise levels measured while facing west and southwest. The maximum peak noise level of a 30-second interval was 94 dB(A) facing east and west. The minimum peak noise level was 66 dB(A), facing north and south. The noise levels measured on April 28, 2009 were greater than on June 13, 2007 due to the high winds present.

An in situ mine is unlike conventional mines in that it does not use large equipment such as haul trucks, drag lines, and large loaders. The transfer of production and injection fluids is done by submersible pumps in wells, similar to water well pumps, and the metering of the solutions occurs in enclosed buildings (header houses). There is no conventional ore processing, only the filtration of production fluid inside the Plant. Therefore, most noise is generated by the field equipment listed in **Section 1.4.1** (Road Use). Of the field equipment, the drill rigs generate the most noise. **Figure OP-A6-5** is a graph of noise levels versus distance from two of the drill rigs typical for use on site. While the rig noise is on the order of 95 dB(A) at the rigs, the noise attenuates to background levels, as measured on a windy day, within a couple of hundred feet of the rig. **Table OP-A6-5b** is a table of the noise levels versus distance from machinery typical for use on site. The highest levels measured were on the order of 80 dB(A), with wind noise over-riding the equipment noise within a couple of hundred feet of the equipment. On a calm day, noise levels are also not anticipated to be elevated at distances of concern because noise levels diminish by 6 dB(A) for each doubling of the distance from the source (Golden et al., 1979).

1.4.4 Hunting

For health and safety reasons, public access to the Plant and mine units is restricted. Hunting and other recreation will also be restricted to the extent allowable under BLM guidelines, within the Permit Area.

1.4.5 Cumulative Impacts

Information on cumulative impacts is based on publicly available information on existing and proposed projects, general knowledge of the conditions in Wyoming, reasonably foreseeable changes to existing conditions, and will be reviewed based on the Project monitoring information (Section 2.0). The primary concern in the evaluation of cumulative impacts is the resurgence in interest in mining and oil and gas development within the last few years. This resurgence has not necessarily translated into projects on the ground as of yet, making it difficult to evaluate cumulative impacts because of the lack of definitive information. For example, uranium exploration, including exploration by LC ISR, LLC, is ongoing in the Great Divide Basin, but uranium mines have not been established. The Sweetwater Uranium Project, which includes a reclaimed surface mine and associated milling facility, currently on standby, is located about two miles south of the Lost Creek Project. An application for the Antelope-Jab ISR Project, about six miles north of the Lost Creek Project, was submitted to federal and state agencies in 2008; however, in October 2009, the applicant requested that NRC defer review of its application (NRC, 2009).

ISR operations will minimize disturbance by chemically removing the uranium and leaving the matrix surrounding the ore intact. After mining, ground water restoration is required to return water quality to specified conditions based on pre-mine conditions and potential uses. Disturbed areas (mine units, the Plant, pipelines, and access roads) will be reseeded with a native seed mix as soon as conditions allow. Ultimately, the disturbed areas will be reclaimed to their pre-operational contours and revegetated to support the approved land uses. Due to this reclamation and restoration, long-term impacts to ecological resources are not anticipated.

1.4.6 Climate Change

According to the Nuclear Energy Institute, in 2007, U.S. nuclear power plants prevented the emission of 1 million short tons of nitrogen oxides and 3 million tons of sulfur dioxide. The amount of nitrogen oxide emissions that nuclear plants prevent annually is the equivalent of taking more than 51 million passenger cars off the road. Also in 2007, U.S. nuclear plants prevented the emissions of almost 693 million metric tons of carbon dioxide. This is nearly as much carbon dioxide as is released from all U.S. passenger cars (see http:/www.nei.org/keyissues/protectingtheenvironment/factsheets/nuclearenergyandtheenvironment/). Environmentally responsible production of uranium from the Lost Creek Project will minimize the emissions of carbon dioxide and other greenhouse gases.