APPENDIX B

Sample Collection Data

APPENDIX B

SAMPLE COLLECTION DATA

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TABLE B-1
SAMPLE COLLECTION INFORMATION FOR POTENTIAL SOURCE MATERIALS
Low-Level Petroleum Hydrocarbon Evaluation
Pinedale Anticline Project Area, Sublette County, Wyoming

Well / Pad Location [1]	Sample ID	Sample Collection Date	Sample Type [2]	Sample Location
AN 1-16	AN 1-16 PHC	11/18/2010 12/9/2010	LNAPL	Light non-aqueous phase liquid (free-phase material) sample collected at air-water interface in well casing using bailer
Ultra CGF #3	CGF-3-C	12/10/2010	Condensate	Valve at separator at central gathering facility
AN 1-9	AN 1-9 PDW	12/10/2010	Produced Water	After wye strainer of separator
MS 14-16	MS 14-16 PDW	12/9/2010	Produced Water	Discharge pipe exiting separator
RB 16-30	RN 16-30 PW	12/9/2010	Produced Water	Valve at separator
RS 15-12	RS 15-12 PW	12/10/2010	Produced Water	Valve at separator
SP 11-13	SP 13-33 PDW	12/9/2010	Produced Water	Discharge pipe exiting separator
WB 7-15	WB 7-15 PW	12/10/2010	Produced Water	Discharge pipe exiting separator
JEN 1A	JEN 1A MUD	12/10/2010	Drill Mud	Active system of drilling rig (Shell)
MS 12-16	MS 12-16 MUD	12/9/2010	Drill Mud	Active system of drilling rig (QEP)
RS 4-10	RIV 4-10 MUD	12/10/2010	Drill Mud	Active system of drilling rig (Ultra)
MS 3-27	MS3-27-FBF (MS15C2-22D)	2/18/2011	Flowback Fluid	Holding tank (cross-link gel fluid) @ 45 minutes after start of flowback (Ultra)
MS 5-33	MS3c-33D FBF	2/28/2011	Flowback Fluid	Spigot on side of holding tank (cross-link gel and slickwater fluid) @ ~2.6 hours after start of flowback (Shell)
MS 7-21	MSD2-21 FBF	3/17/2011	Flowback Fluid	Pipe discharging to holding tank (cross-link gel and slickwater fluid) @ ~14.7 hours after start of flowback (QEP)
RS 9-2	RS 9-2 FBF	12/8/2010	Flowback Fluid	Discharge piping (cross-link gel fluid) @ 36 hours after start of flowback (Ultra)
BO 1-32	BO 1-32-1	11/18/2010	Pipe Dope	Joint threads on drop pipe
BO 1-32	BO 1-32-2	11/18/2010	Black Film	Black substance on outside of drop pipe
MS 14-16	Mesa-14-16-1	11/11/2010	Pipe Dope	Joint threads on drop pipe
MS 12-28	MS 12-28-1	11/18/2010	Pipe Dope	Joint threads on drop pipe
MS 12-28	MS 12-28-2	11/18/2010	Pipe Dope	Joint threads on drop pipe
RS 11-14	Riverside 11-14-Pump	9/23/2010	Black Film	Black substance on outside of drop pipe
RS 11-14	Riverside 11-14-Pump-2	9/23/2010	Pipe Dope	Joint threads on drop pipe
RS 15-12	Riverside 15-12-Pump	9/23/2010	Pipe Dope	Joint connecting drop-pipe to pump
WB 16-5	WB 16-5-Pump-2	9/23/2010	Pipe Dope	Joint threads on drop pipe
WB 7-15	WB 7-15-Pump	9/23/2010	Pipe Dope	Joint threads on drop pipe
WB 7-5	WB 7-5-1	11/18/2010	Pipe Dope	Joint threads on drop pipe
WB 7-5	WB 7-5-2	11/18/2010	Pipe Dope	Joint threads on drop pipe
RS 1-4	Riverside 1-4-Pump	9/23/2010	Pipe Dope & Grease	Bottom steel joint and top of pump
MS 15-16	Mesa-15-16-1	11/11/2010	Pipe Grease	Joint threads on drop pipe
WB 16-5	WB 16-5-Pump	9/23/2010	Pipe Grease	Third steel joint (above water level)
MS 14-16	Mesa-14-16-2	11/11/2010	Teflon Tape	Drop-pipe (above water level)
None	PD-Baseline	9/23/2010	Pipe Dope	Tube of "environmentally safe" Best-o-Life®
T-3-SW	T-3-SW-Shale	7/13/2010	Carbonaceous Shale	Study well drill cuttings sample collected at 445-455 ft depth
T-4-RW-b	T-4-RWB-Shale	7/26/2010	Carbonaceous Shale	Study well drill cuttings sample collected at 434-455 ft depth

Notes:

1 - AN = Antelope; BO = Boulder; Ultra CGF #3 = Ultra Resources, Inc. Central Gathering Facility; HWY = Highway; JEN = Jensen; MS = Mesa; RB = Rainbow; RS = Riverside; SP = Stewart Point; WB = Warbonnet; T = Study Well

2 - LNAPL = liquid nonaqueous phase liquid

TABLE B-2
SAMPLE COLLECTION INFORMATION FOR CASING GAS AND NATURAL GAS SAMPLES
Low-Level Petroleum Hydrocarbon Evaluation
Pinedale Anticline Project Area, Sublette County, Wyoming

Casing Gas											Natural Gas											
Well ID	Water Supply / Study Well[1]	Flow Rate[2] (liters per minute)	Gas Composition[3]					Isotopes[4]			Associated Gas Well [1]	Gas Type[5]	Gas Composition[3]					Gas Type[5]	Isotopes[4]			
			Sample ID	Date	Lab	Temp	Pressure	Sample ID	Date	Lab			Sample ID	Date	Lab	Temp	Pressure		Sample ID	Cylinder #	Date	Lab
AMI190	RS 11-14	No measureable flow	RS 11-14 Water Well	12/10/10	Precision	38 Deg F	11.3 psi	RS 11-14 Water Well	12/10/10	Isotech	RS 11-14	wet	Riverside 11-14 Wellhead	12/08/10	Precision	65 Deg F	700 psi	wet	RS 11-14 Wellhead	2023	12/08/10	Isotech
AMI248	BO 12A-33	4.9	Boulder 12A-33 Water Well	12/08/10	Precision	ambient	ambient	BO 12A-33 Water Well	12/08/10	Isotech	BO 12A-33	dry	BO 12A-33 [6]	12/06/10	Precision	92.5 Deg F	500 psi	dry	BO 12A-33 [6]	2095	12/06/10	Isotech
AMI248	BO 12A-33	2.1	BR 12A-33 [8]	02/22/12	Precision	ambient	ambient	BO 12A-33 [8]	02/22/12	Isotech												
AMI285	WB 7-5	2.1	WB 7-5 Water Well	12/08/10	Precision	ambient	ambient	WB 7-5 Water Well	12/08/10	Isotech	WB 7-5	wet	Warbonnet 7-5 Wellhead	12/21/10	Questar	65 Deg F	506 psi	dry	Warbonnet 7-5 Wellhead [7]	2033	12/21/10	Isotech
AMI135	WB 7-4	No measureable flow	WB 7-4 Monitoring Well, Run 1	12/06/10	Precision	ambient	used vacuum	WB 7-4 Water Well	12/07/10	Isotech	WB 7-4	wet	WB 7-4 Wellhead	12/08/10	Precision	65 Deg F	600 psi	wet	WB 7-4 Wellhead	2006	12/06/10	Isotech
T-3-SW	T-3-SW	No measureable flow	Ultra T-3-SW	12/08/10	Precision	ambient	ambient	T-3-SW	12/08/10	Isotech	WB 7-15D	wet	WB 7-15D Wellhead	12/08/10	Precision	68 Deg F	600 psi	wet	WB 7-15D Wellhead	2753	12/08/10	Isotech
		NM	NM	NM	NM	NM	NM	T-10-SW [8] (duplicate of T-3-SW)	02/03/11	Isotech												
								T-3-SW [8]	02/03/11	Isotech												
T-4-RW-a	T-4-RWa	No measureable flow	T-4-RWA	10/06/10	Precision	53 Deg F	ambient	T-4-RWA	10/06/10	Isotech	AN 1-9	wet	AN 1-9 Wellhead	12/21/10	Questar	71 Deg F	510 psi	dry	Antelope 1-9 Wellhead [7]	2053	12/21/10	Isotech
T-4-RW-b	T-4-RWb	NM	T-4-RW	10/06/10	Precision	53 Deg F	ambient	T-4-RW	10/06/10	Isotech												
AMI237	AN 11-10D	No measureable flow	AN 11-10D	10/06/10	Precision	53 Deg F	ambient	AN 11-10D WSW	10/06/10	Isotech												
AMI182	HWY 7	NM	Highway Fed #7 Water Well	12/06/10	Precision	ambient	ambient	HW-7 Water Well	12/06/10	Isotech												
AMI187	AN 1-16	No measureable flow	Antelope 1-16 Water Well	12/06/10	Precision	ambient	ambient	AN 1-16 Water Well	12/06/10	Isotech												

Notes:
1 - AN = Antelope; BO = Boulder; RS = Riverside; HWY = Highway; WB = Warbonnet; T = Study Well.
2 - Rate of ambient air flowing from plugged well casing as measured by a rotameter prior to collecting a casing gas sample; NM = not measured.
3 - Gas composition via mobile gas chromatography by Precision Analysis, Inc. of Riverton, Wyoming (Precision) or Questar Applied Technologies (Questar) of Rock Springs, Wyoming. Deg F = degrees Fahrenheit; psi = pounds per square inch.
4 - Isotopes include stable isotopes of methane (carbon and hydrogen) analyzed by Isotech Laboratories (Isotech) of Champaign, Illinois.
5 - A dry gas sample is a processed gas sample collected after natural gas stream was run through production facility at gas well pad, usually at separator/meter run; a wet gas sample is an unprocessed gas sampled collected directly from the gas wellhead.
6 - Gas well BO 12A-33 was inaccessible due to drilling and completions operations, thus natural gas sample collected from meter run.
7 - Sampling contractor for Operator would only collect cylinder samples from separator/meter run.
8 - Follow-up sample

TABLE B-3
GROUNDWATER SAMPLE COLLECTION INFORMATION
Low Level Petroleum Hydrocarbon Evaluation
Pinedale Anticline Project Area, Sublette County, Wyoming

Well ID[1]	Well / Pad Location [2]	Sample ID	Well Sample Group[3]	Well Depth (ft bgs)[4]	Screen / Perforated Interval (ft bgs)[4]	Hydrasleeve™ Sample Depth (ft bgs)[4]	Sample Collection Date	Field Measurements[4]						
								Water Level (ft btc)	%LEL	LNAPL Present	pH	EC (µmhos/cm)	Temp (ºF)	Temp (ºC)
AMI018	AN 15-23	AN 15-23	Control	650	180-650	420	18-Nov-10	175.6	4	No	9.32	1280	44.78	7.1
AMI250	BO 1-32	BO 1-32	Control	770	240-700	475	20-Nov-10	81.8	0	No	8.55	2580	43.34	6.3
AMI119	MS 15-16	MS 15-16	Control	1000	700-1000	850	12-Nov-10	494.8	0	No	9.62	496	47.48	8.6
AMI297	RN 13-29	RN 13-29	Control	900	500-890	700	20-Nov-10	362.2	0	No	9.67	885	44.96	7.2
AMI156	RS 2-24	RS 2-24	Control	700	448-658	558	20-Nov-10	34.7	0	No	9.47	584	45.68	7.6
AMI019	SP 11-34	SP 11-34	Control	930	600-910	910	13-Nov-10	511.7	0	No	9.73	497	44.06	6.7
AMI146	AN 11-10D	AN 11-10D WSW	LEL	680	470-660	565	05-Oct-10	219.61	10	No	10.18	530	59.94	15.52
AMI248	BO 12A-33	BO-12A-33	LEL	450	330-450	390	09-Dec-10	104.2	100	No	9.18	731	46.4	8.0
							23-Feb-12	126.22	100	No	9.54	742	41.74	5.41
AMI182	HWY 7	HW-7	LEL	610	490-610	555	19-Nov-10	319.4	0	No	10.26	246	44.42	6.9
AMI190	RS 11-14	RS 11-14	LEL	410	165-410	292.5	20-Nov-10	24.2	100	No	9.49	552	44.96	7.2
AMI135	WB 7-4	WB 7-4	LEL	470	350-470	410	06-Dec-10	193.2	0	No	9.64	583	46.58	8.1
							23-Feb-12	193.16	0	No	9.62	610	45.21	7.34
AMI285	WB 7-5	WB 7-5	LEL	700	300-680	495	20-Nov-10	137.2	4	No	9.78	918	45.32	7.4
							22-Feb-12	137.2	0	No	9.50	874	47.01	8.34
AMI187	AN 1-16	AN 1-16	LEL	UNK	UNK	800	20-Nov-10	263.7	100	Yes	10.27	601	48.02	8.9
AMI033	HWY 11	HW-11	PHC	700	580-700	645	19-Nov-10	246.8	0	No	9.41	1298	43.52	6.4
AMI160	MS 12-28	MS 12-28	PHC	1020	820-1000	915	21-Nov-10	463.5	5	No	9.67	708	46.58	8.1
							21-Feb-12	464.3	0	No	9.35	551	49.28	9.60
AMI116	MS 14-16	MS 14-16	PHC	930	730-930	832	13-Nov-10	490.6	0	No	9.58	728	49.64	9.8
							21-Feb-12	485.8	0	No	9.47	689	48.33	9.07
AMI228	RN 16-30	RN 16-30	PHC	UNK	UNK	545	18-Nov-10	350.1	1	No	9.70	893	48.56	9.2
AMI258	RS 11-25	RS 11-25	PHC	800	350-760	560	20-Nov-10	63.4	0	No	9.57	994	44.24	6.8
		RS 11-25 PHC [5]	PHC	800	350-760	63.4	19-Nov-10	63.4	0	No	NM	NM	NM	NM
AMI078	RS 1-4	RS 1-4	PHC	610	530-610	575	15-Nov-10	176.5	0	No	9.28	598	48.74	9.3
							22-Feb-12	176.4	1	No	9.09	632	47.89	8.83
AMI132	RS 15-12	RS 15-12	PHC	410	250-410	335	15-Nov-10	21.4	0	No	9.59	432	49.82	9.9
		RS 15-12 PHC [5]	PHC	410	250-410	21.4	14-Nov-10	21.4	0	No	NM	NM	NM	NM
AMI028	SP 11-33	SP 11-33	PHC	980	690-965	832	13-Nov-10	522.8	0	No	9.64	588	49.46	9.7
AMI030	SP 5-20	SP 5-20	PHC	745	493-745	620	15-Nov-10	327.6	0	No	9.38	660	51.08	10.6
							21-Feb-12	326.6	0	No	9.39	665	49.28	9.60
AMI198	WB 16-5	WB 16-5	PHC	390	270-390	335	17-Nov-10	289.4	0	No	9.94	642	45.32	7.4
AMI237	WB 7-15D	WB 7-15	PHC	750	590-750	675	17-Nov-10	404.3	0	No	10.08	450	46.22	7.9
AMI186	WB 8-6	WB 8-6	PHC	740	530-715	627.5	20-Nov-10	87.0	0	No	9.75	1184	43.16	6.2
							23-Feb-12	86.8	0	No	9.40	1160	44.51	6.95

TABLE B-3
GROUNDWATER SAMPLE COLLECTION INFORMATION
Low Level Petroleum Hydrocarbon Evaluation
Pinedale Anticline Project Area, Sublette County, Wyoming

Well ID[1]	Well / Pad Location [2]	Sample ID	Well Sample Group[3]	Well Depth (ft bgs)[4]	Screen / Perforated Interval (ft bgs)[4]	Hydrasleeve™ Sample Depth (ft bgs)[4]	Sample Collection Date	Field Measurements[4]						
								Water Level (ft btc)	%LEL	LNAPL Present	pH	EC (µmhos/cm)	Temp (ºF)	Temp (ºC)
---	T-1-SW	T-1-SW	SAP Study	147.5	127-147	137	14-Jun-11	93.6	0	No	8.71	1085	57.42	14.12
---	T-1-RW	T-1-RW	SAP Study	652	620-650	635	14-Jun-11	174.7	0	No	10.33	602	61.18	16.21
---	T-2-RW	T-2-RW	SAP Study	770	730-770	750	17-Jun-11	499.1	0	No	10.07	582	52.29	11.27
---	T-3-SW	T-3-SW	SAP Study	446.5	405-445	425	15-Jun-11	402.66	43	No	9.95	452	50.63	10.35
---	T-3-RW	T-3-RW	SAP Study	747	705-745	725	15-Jun-11	408.61	47	No	9.67	1471	52.21	11.23
---	T-4-SW	T-4-SW	SAP Study	190	175-190	182.5	15-Jun-11	51.4	0	No	9.41	2198	57.54	14.19
---	T-4-RW-a	T-4-RWa	SAP Study	460	430-460	445	15-Jun-11	215.65	100	No	9.88	422	61.34	16.3
							22-Feb-12	217.01	100	No	10.09	449	44.98	7.21
---	T-4-RW-b	T-4-RWb	SAP Study	675	635-655	645	16-Jun-11	213.9	0	No	10.36	1055	56.66	13.7
							23-Feb-12	219.03	6	No	10.12	566	46.44	8.02
---	T-5-RW	T-5-RW	SAP Study	590.5	550-590	570	16-Jun-11	69.02	0	No	9.95	1165	54.39	12.44

Notes:

1 - Well numbers designated by Sublette County Conservation District (SCCD)

2 - AN = Antelope; SP = Stewart Point; HWY= Highway; RS = Riverside; MS = Mesa; WB = Warbonnet; RB = Rainbow; BO = Boulder; T = Study Well.

3 - Control = well with history of no detectable petroleum hydrocarbons;
LEL = well with history of detectable combustible gas in well casing;
PHC = well with history of detectable petroleum hydrocarbon compounds;
SAP Study = study well sampled for this study.

4 - ft bgs = feet below ground surface; ft btc = feet below top of well casing; %LEL = percent of lower explosive limit for gas; LNAPL = light nonaqueous phase liquid; EC = electrical conductivity; µmhos/cm = micromhos per centimeter; Temp = temperature; ºF = degrees Fahrenheit; ºC = degrees Celsius; UNK = unknown; NM = not measured.

5 - Sample collected from the top of the water column in well with a disposable plastic bailer.

TABLE B-4

LABORATORY SAMPLE NUMBERS

Low-Level Petroleum Hydrocarbon Evaluation

Pinedale Anticline Project Area, Sublette County, Wyoming

Well ID[1]	Well / Pad Location [2]	Sample ID	Well / Sample Type[3]	QC[4]	Sample Collection Date	Laboratory Sample Number[5]										
						General Water Quality Parameters[6]	Total Metals[7]	Volatile Organic Fractions	Semivolatile Organic Fractions	VOC + TIC[8]	SVOC + TIC	Simulation Distillation	Gas Composition	Isotopes of Methane	Isotopes of Water and DIC	Thermal Maturity
NATURAL and DUPLICATE SAMPLES																
AMI018	AN 15-23	AN 15-23	Control	N	11/18/2010	B10111792-001	B10111792-001	B10111792-001	B10111792-001	B10111792-001	B10111792-001		198960	198960	198960	
AMI018	AN 15-23	DUP 6	Control	D	11/18/2010	B10111952-013	B10111952-013	B10111952-013			B10111952-013					
AMI019	SP 11-34	SP 11-34	Control	N	11/13/2010	B10111368-005	B10111368-005	B10111368-005	B10111368-005	B10111368-005	B10111368-005		198378	198378	198378	
AMI119	MS 15-16	MS 15-16	Control	N	11/12/2010	B10111368-002	B10111368-002	B10111368-002	B10111368-002	B10111368-002	B10111368-002					
AMI119	MS 15-16	MS 15-16	Control	N	11/11/2010								198379	198379	198379	
AMI156	RS 2-24	RS 2-24	Control	N	11/20/2010	B10111952-005	B10111952-005	B10111952-005	B10111952-005	B10111952-005	B10111952-005		198967	198967	198967	
AMI156	RS 2-24	DUP 7	Control	D	11/20/2010						B10111952-015					
AMI250	BO 1-32	BO 1-32	Control	N	11/20/2010	B10111952-008	B10111952-008	B10111952-008	B10111952-008	B10111952-008	B10111952-008		198970	198970	198970	
AMI297	RB 13-29	RN 13-29	Control	N	11/20/2010	B10111952-011	B10111952-011	B10111952-011	B10111952-011	B10111952-011	B10111952-011		198963	198963	198963	
AMI135	WB 7-4	WB 7-4	LEL	N	12/6/2010	B10120712-001	B10120712-001	B10120712-001	B10120712-001	B10120712-001	B10120712-001		200351	200351	200351	
AMI146	AN 11-10D	AN 11-10D WSW	LEL	N	10/5/2010	B10100647-001	B10100647-001	B10100647-001	B10100647-001	B10100647-001	B10100647-001		195996	195996	195996	
AMI182	HWY 7	HW-7	LEL	N	11/19/2010	B10111952-002	B10111952-002	B10111952-002	B10111952-002	B10111952-002	B10111952-002		198958	198958	198958	
AMI182	HWY 7	DUP 7	LEL	D	11/19/2010	B10111952-014	B10111952-014	B10111952-014	B10111952-014	B10111952-014			198972	198972	198972	
AMI187	AN 1-16	AN 1-16	LEL	N	11/19/2010	B10111952-001	B10111952-001	B10111952-001	B10111952-001	B10111952-001	B10111952-001		198962	198962	198962	
AMI190	RS 11-14	RS 11-14	LEL	N	11/20/2010	B10111952-010	B10111952-010	B10111952-010	B10111952-010	B10111952-010	B10111952-010		198964	198964	198964	
AMI248	BO 12A-33	BO-12A-33	LEL	N	12/9/2010	B10121230-007	B10121230-007	B10121230-007	B10121230-007	B10121230-007	B10121230-007		200350	200350	200350	
AMI285	WB 7-5	WB 7-5	LEL	N	11/20/2010	B10111952-007	B10111952-007	B10111952-007	B10111952-007	B10111952-007	B10111952-007		198965	198965	198965	
AMI028	SP 11-33	SP 11-33	PHC	N	11/13/2010	B10111368-004	B10111368-004	B10111368-004	B10111368-004	B10111368-004	B10111368-004		198377	198377	198377	
AMI028	SP 11-33	DUP 3	PHC	D	11/13/2010						B10111368-008					
AMI030	SP 5-20	SP 5-20	PHC	N	11/13/2010	B10111442-003	B10111442-003	B10111442-003		B10111442-003			198814	198814	198814	
AMI030	SP 5-20	SP 5-20	PHC	N	11/14/2010						B10111442-004					
AMI030	SP 5-20	SP 5-20	PHC	N	11/15/2010				B10111442-005							
AMI033	HWY 11	HW-11	PHC	N	11/19/2010	B10111952-003	B10111952-003	B10111952-003	B10111952-003	B10111952-003	B10111952-003		198959	198959	198959	
AMI033	HWY 11	DUP 6	PHC	D	11/19/2010								198973	198973	198973	
AMI078	RS 1-4	RS 1-4	PHC	N	11/15/2010	B10111442-001	B10111442-001	B10111442-002	B10111442-001	B10111442-001	B10111442-001		198817	198817	198817	
AMI116	MS 14-16	MS 14-16	PHC	N	11/13/2010	B10111368-001	B10111368-001	B10111368-001	B10111368-001	B10111368-001	B10111368-001					
AMI116	MS 14-16	DUP 2	PHC	D	11/13/2010	B10111368-007	B10111368-007	B10111368-007	B10111368-007	B10111368-007			198375	198375	198375	
AMI132	RS 15-12	RS 15-12	PHC	N	11/15/2010	B10111442-007	B10111442-007	B10111442-007	B10111442-007	B10111442-007	B10111442-007		198818	198818	198818	
AMI132	RS 15-12	RS 15-12 PHC	PHC-Bailer	N	11/14/2010		B10111368-009	B10111368-009	B10111368-009	B10111368-009	B10111368-009					
AMI160	MS 12-28	MS 12-28	PHC	N	11/21/2010	B10111952-012	B10111952-012	B10111952-012	B10111952-012	B10111952-012	B10111952-012		198966	198966	198966	
AMI186	WB 8-6	WB 8-6	PHC	N	11/20/2010	B10111952-009	B10111952-009	B10111952-009	B10111952-009	B10111952-009	B10111952-009		198969	198969	198969	
AMI198	WB 16-5	WB 16-5	PHC	N	11/17/2010	B10111765-001	B10111765-001	B10111765-001	B10111765-001	B10111765-001	B10111765-001		198823	198823	198823	
AMI228	RB 16-30	RN 16-30	PHC	N	11/18/2010	B10111792-002	B10111792-002	B10111792-002	B10111792-002	B10111792-002	B10111792-002		198961	198961	198961	
AMI228	RB 16-30	DUP 6	PHC	D	11/18/2010				B10111952-013	B10111952-013						
AMI237	WB 7-15D	DUP 5	PHC	D	11/17/2010	B10111765-004	B10111765-004	B10111765-004	B10111765-004	B10111765-004	B10111765-004		198820	198820	198820	
AMI237	WB 7-15D	WB 7-15	PHC	N	11/17/2010	B10111765-003	B10111765-003	B10111765-002	B10111765-002	B10111765-002	B10111765-003		198819	198819	198819	
AMI258	RS 11-25	RS 11-25	PHC	N	11/20/2010	B10111952-006	B10111952-006	B10111952-006	B10111952-006	B10111952-006	B10111952-006		198968	198968	198968	
AMI258	RS 11-25	RS 11-25 PHC	PHC-Bailer	N	11/19/2010		B10111952-004	B10111952-004	B10111952-004	B10111952-004	B10111952-004					
--	--	PD-Baseline	Pipe Dope	N	9/23/2010			B10121017-008	B10121017-008	B10121017-008	B10121017-008					
--	SP 13-33	SP 13-33 PDW	Produced Water	N	12/9/2010	B10121230-001	B10121230-001	B10121230-001	B10121230-001	B10121230-001	B10121230-001		200354		200354	
--	RS 1-4	Riverside 1-4-Pump	Pipe Dope and Grease	N	9/23/2010			B10121017-005	B10121017-005	B10121017-005	B10121017-005					
--	JEN 1A	JEN 1A MUD	Drill Mud	N	12/10/2010	B10121229-002	B10121229-002	B10121229-002	B10121229-002	B10121229-002	B10121229-002	B10121229-002				
--	RS 9-2	RS 9-2 FBF	Flowback Fluid	N	12/8/2010	B10121089-001	B10121089-001	B10121089-001	B10121089-001	B10121089-001	B10121089-001					
--	MS 12-16	MS 12-16 MUD	Drill Mud	N	12/9/2010	B10121229-001	B10121229-001	B10121229-001	B10121229-001	B10121229-001	B10121229-001	B10121229-001				
--	MS 14-16	Mesa-14-16-1	Pipe Dope	N	11/11/2010			B10111483-004	B10111483-004	B10111483-004	B10111483-004					
--	MS 14-16	Mesa-14-16-2	Teflon Tape	N	11/11/2010			B10111483-002	B10111483-002	B10111483-002	B10111483-002					
--	MS 14-16	MS 14-16 PDW	Produced Water	N	12/9/2010	B10121230-003	B10121230-003	B10121230-003	B10121230-003	B10121230-003	B10121230-003		200352		200352	

TABLE B-4

LABORATORY SAMPLE NUMBERS

Low-Level Petroleum Hydrocarbon Evaluation

Pinedale Anticline Project Area, Sublette County, Wyoming

Well ID[1]	Well / Pad Location [2]	Sample ID	Well / Sample Type[3]	QC[4]	Sample Collection Date	Laboratory Sample Number[5]										
						General Water Quality Parameters[6]	Total Metals[7]	Volatile Organic Fractions	Semivolatile Organic Fractions	VOC + TIC[8]	SVOC + TIC	Simulation Distillation	Gas Composition	Isotopes of Methane	Isotopes of Water and DIC	Thermal Maturity
--	MS 15-16	Mesa-15-16-1	Pipe Grease	N	11/11/2010			B10111483-003	B10111483-003	B10111483-003	B10111483-003					
--	MS 7-21	MSD2-21 FBF	Flowback Fluid	N	3/17/2011	B11031650-001	B11031650-001	B11031650-001	B11031650-001	B11031650-001	B11031650-001					
--	RS 15-12	RS 15-12 PW	Produced Water	N	12/10/2010	B10121230-005	B10121230-005	B10121230-005	B10121230-005	B10121230-005	B10121230-005		200353		200353	
--	RS 15-12	Riverside 15-12-Pump	Pipe Dope	N	9/23/2010			B10121017-004	B10121017-004	B10121017-004	B10121017-004					
--	MS 12-28	MS 12-28-1	Pipe Dope	N	11/18/2010			B10111974-001	B10111974-001	B10111974-001	B10111974-001	B10111974-001				
--	MS 12-28	MS 12-28-2	Pipe Dope	N	11/18/2010			B10111974-002	B10111974-002	B10111974-002	B10111974-002	B10111974-002				
--	MS 5-33	MS3C-33D FBF	Flowback Fluid	N	2/28/2011	B11030216-001	B11030216-001	B11030216-001	B11030216-001	B11030216-001	B11030216-001					
--	AN 1-16	AN 1-16 PHC	LNAPL	N	11/18/2010		B10112213-001		B10112213-001		B10112213-001	B10112213-001				
--	AN 1-16	AN 1-16 PHC	LNAPL	N	12/9/2010			B10121229-005		B10121229-005						
--	RS 11-14	Riverside 11-14-Pump	Black Film	N	9/23/2010			B10121017-002	B10121017-002	B10121017-002	B10121017-002					
--	RS 11-14	Riverside 11-14-Pump-2	Pipe Dope	N	9/23/2010			B10121017-003	B10121017-003	B10121017-003	B10121017-003					
--	WB 16-5	WB 16-5-Pump	Pipe Grease	N	9/23/2010			B10121017-006	B10121017-006	B10121017-006	B10121017-006					
--	WB 16-5	WB 16-5-Pump-2	Pipe Dope	N	9/23/2010			B10121017-007	B10121017-007	B10121017-007	B10121017-007					
--	RB 16-30	RN 16-30 PW	Produced Water	N	12/9/2010	B10121230-002	B10121230-002	B10121230-002	B10121230-002	B10121230-002	B10121230-002		200356		200356	
--	MS 3-27	MS3-27-FBF (MS15C2-22D)	Flowback Fluid	N	2/18/2011	B11021465-001	B11021465-001	B11021465-001	B11021465-001	B11021465-001	B11021465-001					
--	WB 7-15D	WB 7-15 PW	Produced Water	N	12/10/2010	B10121230-006	B10121230-006	B10121230-006	B10121230-006	B10121230-006	B10121230-006		200357		200357	
--	WB 7-15D	WB 7-15-Pump	Pipe Dope	N	9/23/2010			B10121017-001	B10121017-001	B10121017-001	B10121017-001					
--	BO 1-32	BO 1-32-1	Pipe Dope	N	11/18/2010			B10111974-005	B10111974-005	B10111974-005	B10111974-005	B10111974-005				
--	BO 1-32	BO 1-32-2	Black Film	N	11/18/2010			B10111974-006	B10111974-006	B10111974-006	B10111974-006					
--	WB 7-5	WB 7-5-1	Pipe Dope	N	11/18/2010			B10111974-003	B10111974-003	B10111974-003	B10111974-003	B10111974-003				
--	WB 7-5	WB 7-5-2	Pipe Dope	N	11/18/2010			B10111974-004	B10111974-004	B10111974-004	B10111974-004	B10111974-004				
--	AN 1-9	AN 1-9 PDW	Produced Water	N	12/10/2010	B10121230-004	B10121230-004	B10121230-004	B10121230-004	B10121230-004	B10121230-004		200355		200355	
--	Ultra CGF#3	CGF-3-C	Condensate	N	12/10/2010			B10121229-004	B10121229-004	B10121229-004	B10121229-004	B10121229-004				
--	RS 4-10	RIV 4-10 MUD	Drill Mud	N	12/10/2010		B10121229-003	B10121229-003	B10121229-003	B10121229-003	B10121229-003	B10121229-003				
--	T-3-SW	T-3-SW-Shale	Carbonaceous Shale	N	7/13/2010											134871
--	T-4-RW-b	T-4-RWB-Shale	Carbonaceous Shale	N	7/26/2010											134872
--	T-1-RW	T-1-RW	SAP Study	N	6/14/2011	B11061828-002	B11061828-002	B11061828-002	B11061828-002	B11061828-002	B11061828-002		213938	213938	213938	
--	T-1-SW	T-1-SW	SAP Study	N	6/14/2011	B11061828-001	B11061828-001	B11061828-001	B11061828-001	B11061828-001	B11061828-001		213939	213939	213939	
--	T-2-RW	T-2-RW	SAP Study	N	6/17/2011	B11062112-006	B11062112-006	B11062112-006	B11062112-006	B11062112-006	B11062112-006		213940	213940	213940	
--	T-3-RW	T-3-RW	SAP Study	N	6/15/2011	B11061828-004	B11061828-004	B11061828-004	B11061828-004	B11061828-004	B11061828-004		213936	213936	213936	
--	T-3-SW	T-3-SW	SAP Study	N	6/15/2011	B11061828-003	B11061828-003	B11061828-003	B11061828-003	B11061828-003	B11061828-003		213937	213937	213937	
--	T-3-SW	DUP-2	SAP Study	R	6/15/2011								213945	213945	213945	
--	T-4-RW-a	T-4-RWa	SAP Study	N	6/15/2011	B11062112-003	B11062112-003	B11062112-003	B11062112-003	B11062112-003	B11062112-003		213942	213942	213942	
--	T-4-RW-b	T-4-RWb	SAP Study	N	6/16/2011	B11062112-005	B11062112-005	B11062112-005	B11062112-005	B11062112-005	B11062112-005		213943	213943	213943	
--	T-4-SW	T-4-SW	SAP Study	N	6/15/2011	B11062112-004	B11062112-004	B11062112-004	B11062112-004	B11062112-004	B11062112-004		213941	213941	213941	
--	T-5-RW	T-5-RW	SAP Study	N	6/16/2011	B11062112-002	B11062112-002	B11062112-002	B11062112-002	B11062112-002	B11062112-002		213944	213944	213944	
--	T-6-SW	T-6-SW	HDG Study	N	6/14/2011	B11061811-002	B11061811-002	B11061811-002	B11061811-002	B11061811-002						
--	T-6-RW	T-6-RW	HDG Study	N	6/14/2011	B11061811-001	B11061811-001	B11061811-001	B11061811-001	B11061811-001						
--	T-7-SW	T-7-SW	HDG Study	N	6/13/2011	B11061811-008	B11061811-008	B11061811-008	B11061811-008	B11061811-008						
--	T-7-RW	T-7-RW	HDG Study	N	6/13/2011	B11061811-007	B11061811-007	B11061811-007	B11061811-007	B11061811-007						
--	T-8-A	T-8-A	HDG Study	N	6/15/2011	B11062106-002	B11062106-002	B11062106-002	B11062106-002	B11062106-002						
--	T-8-SW	T-8-SW	HDG Study	N	6/15/2011	B11062106-003	B11062106-003	B11062106-003	B11062106-003	B11062106-003						
--	T-9-RW	T-9-RW	HDG Study	N	6/16/2011	B11062106-005	B11062106-005	B11062106-005	B11062106-005	B11062106-005						
--	X-1-A	X-1-A	HDG Study	N	6/13/2011	B11061811-003	B11061811-003	B11061811-003	B11061811-003	B11061811-003						
--	X-1-SW	X-1-SW	HDG Study	N	6/13/2011	B11061811-004	B11061811-004	B11061811-004	B11061811-004	B11061811-004						
--	X-2-A	X-2-A	HDG Study	N	6/13/2011	B11061811-005	B11061811-005	B11061811-005	B11061811-005	B11061811-005						
--	X-2-SW	X-2-SW	HDG Study	N	6/13/2011	B11061811-006	B11061811-006	B11061811-006	B11061811-006	B11061811-006						
--	X-3-A	X-3-A	HDG Study	N	6/16/2011	B11062106-008	B11062106-008	B11062106-008	B11062106-008	B11062106-008						

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Low-Level Petroleum Hydrocarbon Evaluation

Pinedale Anticline Project Area, Sublette County, Wyoming

Well ID[1]	Well / Pad Location [2]	Sample ID	Well / Sample Type[3]	QC[4]	Sample Collection Date	Laboratory Sample Number[5]										
						General Water Quality Parameters[6]	Total Metals[7]	Volatile Organic Fractions	Semivolatile Organic Fractions	VOC + TIC[8]	SVOC + TIC	Simulation Distillation	Gas Composition	Isotopes of Methane	Isotopes of Water and DIC	Thermal Maturity
--	X-3-SW	X-3-SW	HDG Study	N	6/16/2011	B11062106-009	B11062106-009	B11062106-009	B11062106-009	B11062106-009						
--	X-4-A	X-4-A	HDG Study	N	6/16/2011	B11062106-007	B11062106-007	B11062106-007	B11062106-007	B11062106-007						
--	X-4-SW	X-4-SW	HDG Study	N	6/16/2011	B11062106-006	B11062106-006	B11062106-006	B11062106-006	B11062106-006						
--	X-4-RW	X-4-RW	HDG Study	N	6/17/2011	B11062106-004	B11062106-004	B11062106-004	B11062106-004	B11062106-004						
--	X-5-A	X-5-A	HDG Study	N	6/14/2011	B11061811-010	B11061811-010	B11061811-010	B11061811-010	B11061811-010						
--	X-5-SW	X-5-SW	HDG Study	N	6/14/2011	B11061811-011	B11061811-011	B11061811-011	B11061811-011	B11061811-011						
--	X-1-SW	DUP-1	HDG Study	D	6/13/2011	B11061811-009	B11061811-009	B11061811-009	B11061811-009	B11061811-009						
--	T-1-SW	DUP-2	SAP Study	R	6/14/2011	B11062112-001		B11062112-001	B11062112-001							
--	T-1-RW	DUP-2	SAP Study	R	6/14/2011		B11062112-001			B11062112-001	B11062112-001					
--	T-8-SW	DUP-3	HDG Study	D	6/15/2011	B11062106-001	B11062106-001	B11062106-001	B11062106-001	B11062106-001						
--	WB 7-4	WB 7-4 MONITORING WELL, RUN 1	Casing Gas	N	12/6/2010								X			
--	WB 7-4	WB 7-4 Water Well	Casing Gas	N	12/7/2010									202508		
--	WB 7-4	WB 7-4 WELLHEAD	Natural Gas	N	12/8/2010								X	203209		
--	AN 11-10D	AN 11-10D	Casing Gas	N	10/6/2010								X			
--	AN 11-10D	AN11-10D WSW	Casing Gas	N	10/6/2010								195995	195995		
--	HWY 7	HIGHWAY FED #7 WATER WELL	Casing Gas	N	12/6/2010								X			
--	HWY 7	HW-7 Water Well	Casing Gas	N	12/6/2010									200926		
--	AN 1-16	AN-1-16 Water Well	Casing Gas	N	12/6/2010									200927		
--	AN 1-16	ANTELOPE 1-16 WATER WELL	Casing Gas	N	12/6/2010								X			
--	RS 11-14	RIVERSIDE 11-14 WELLHEAD	Natural Gas	N	12/8/2010								X			
--	RS 11-14	RS 11-14 Well Head	Natural Gas	N	12/8/2010									203207		
--	RS 11-14	RS 11-14 WATER WELL	Casing Gas	N	12/10/2010								X	200925		
--	WB 7-15D	WB 7-15D WELLHEAD	Natural Gas	N	12/8/2010								X	203205		
--	BO 12A-33	BO 12A-33	Natural Gas	N	12/6/2010								X	203206		
--	BO 12A-33	BO 12A-33 Water Well	Casing Gas	N	12/8/2010									200924		
--	BO 12A-33	BOULDER 12A-33 WATER WELL	Casing Gas	N	12/8/2010								X			
--	WB 7-5	WB 7-5 WATER WELL	Casing Gas	N	12/8/2010								X	200923		
--	WB 7-5	Warbonnet 7-5 Wellhead	Natural Gas	N	12/21/2010								X			
		Warbonnet 7-5 Wellhead	Natural Gas	N	12/21/2010									201596		
--	AN 1-9	AN 1-9 Wellhead	Natural Gas	N	12/21/2010								X			
--	AN 1-9	Antelope 1-9 Wellhead	Natural Gas	N	12/21/2010									201597		
--	T-3-SW	ULTRA T-3-SW	Casing Gas	N	12/8/2010								X			
--	T-4-RW-a	T-4-RWA	Casing Gas	N	10/6/2010								195993 / X	195993		
--	T-4-RW-b	T-4-RW	Casing Gas	N	10/6/2010								195994 / X	195994		
FOLLOW-UP SAMPLES																
--	T-3-SW	T-10-SW	Casing Gas	D	2/3/2011								203995	203995		
--	T-3-SW	T-3-SW	Casing Gas	F	2/3/2011								203994	203994		
AMI135	WB 7-4	WB 7-4	LEL	F	2/23/2012								237672	237672		
AMI248	BO 12A-33	BO 12A-33	LEL	F	2/23/2012								237673	237673		
--	BO 12A-33	BR 12A-33 / BO 12A-33	Casing Gas	F	2/22/2012								X	238767		
AMI116	MS 14-16	MS 14-16	PHC	F	2/21/2012					B12021940-001						
AMI186	WB 8-6	WB 8-6	PHC	F	2/23/2012	B12021940-002				B12021940-002						
AMI160	MS 12-28	MS 12-28	PHC	F	2/21/2012					B12021940-003						
AMI030	SP 5-20	SP 5-20	PHC	F	2/21/2012					B12021940-004						
AMI078	RS 1-4	RS 1-4	PHC	F	2/22/2012					B12021940-005	B12021940-005					
AMI248	BO 12A-33	BO 12A-33	LEL	F	2/23/2012					B12021940-006						
AMI285	WB 7-5	WB 7-5	LEL	F	2/22/2012					B12021940-007						
--	T-4-RW-b	T-4-RWb	SAP Study	F	2/23/2012					B12021940-008						

TABLE B-4

LABORATORY SAMPLE NUMBERS

Low-Level Petroleum Hydrocarbon Evaluation

Pinedale Anticline Project Area, Sublette County, Wyoming

Well ID[1]	Well / Pad Location [2]	Sample ID	Well / Sample Type[3]	QC[4]	Sample Collection Date	Laboratory Sample Number[5]										
						General Water Quality Parameters[6]	Total Metals[7]	Volatile Organic Fractions	Semivolatile Organic Fractions	VOC + TIC[8]	SVOC + TIC	Simulation Distillation	Gas Composition	Isotopes of Methane	Isotopes of Water and DIC	Thermal Maturity
--	T-4-RW-a	T-4-Rwa	SAP Study	F	2/22/2012					B12021940-009						
QUALITY CONTROL SAMPLES																
--	--	Trip Blank #4	Trip Blank	TB	11/18/2010					B10111763-002						
--	--	Trip Blank #6	Trip Blank	TB	11/21/2010					B10111947-004						
--	--	SLVBLK	Equipment Blank	EB	11/18/2010	B10111763-001	B10111763-001	B10111763-001	B10111763-001	B10111763-001	B10111763-001		198824	198824	198824	
--	--	EB Weight	Equipment Blank	EB	11/21/2010	B10111947-002	B10111947-002	B10111947-002	B10111947-002	B10111947-002	B10111947-002		198974	198974	198974	
--	--	FB	Field Blank	FB	11/21/2010	B10111947-001	B10111947-001	B10111947-001	B10111947-001	B10111947-001	B10111947-001		198971	198971	198971	
--	--	Trip Blank	Trip Blank	TB	10/5/2010					B10100647-003						
--	--	Mesa-15-16-Blank	Filter Paper Blank	FILTRB	11/11/2010			B10111483-001	B10111483-001	B10111483-001	B10111483-001					
--	--	Trip Blank #1	Trip Blank	TB	11/12/2010					B10111368-003						
--	--	Trip Blank #1	Trip Blank	TB	11/13/2010					B10111442-006						
--	--	Trip Blank #2	Trip Blank	TB	11/13/2010					B10111368-006						
--	--	Trip Blank #3	Trip Blank	TB	11/13/2010					B10111368-010						
--	--	Trip Blank #2	Trip Blank	TB	11/14/2010					B10111442-009						
--	--	Trip Blank #6	Trip Blank	TB	11/17/2010					B10111765-005						
--	--	Trip Blank #7	Trip Blank	TB	11/17/2010					B10111765-006						
--	--	Blank	Filter Paper Blank	FILTRB	11/18/2010			B10111974-008	B10111974-008	B10111974-008	B10111974-008					
--	--	Trip Blank	Trip Blank	TB	11/18/2010					B10111792-003						
--	--	Trip Blank #1	Trip Blank	TB	11/18/2010					B10111952-016						
--	--	Trip Blank #3	Trip Blank	TB	11/19/2010					B10111952-018						
--	--	Trip Blank #4	Trip Blank	TB	11/19/2010					B10111952-019						
--	--	Trip Blank #2	Trip Blank	TB	11/20/2010					B10111952-017						
--	--	Trip Blank #5	Trip Blank	TB	11/20/2010					B10111952-020						
--	--	Trip Blank #7	Trip Blank	TB	11/20/2010					B10111952-021						
--	--	Trip Blank Lot020311 B-TS SHP0253	Trip Blank	TB	3/17/2011					B11031650-002						
--	--	Trip Blank 4 Lot060311 B-TS SHP0253	Trip Blank	TB	6/14/2011					B11062112-010						
--	--	Trip Blank 6 Lot060311 B-TS SHP0253	Trip Blank	TB	6/14/2011					B11061828-005						
--	--	Trip Blank 2 Lot060311 B-TS SHP0253	Trip Blank	TB	6/15/2011					B11062106-011						
--	--	Trip Blank 3 Lot060311 B-TS SHP0253	Trip Blank	TB	6/15/2011					B11062112-009						
--	--	Trip Blank 6 Lot060311 B-TS SHP0253	Trip Blank	TB	6/15/2011					B11062112-012						
--	--	Trip Blank 9 Lot060311 B-TS SHP0253	Trip Blank	TB	6/15/2011					B11061828-007						
--	--	Trip Blank 8 Lot060311 B-TS SHP0253	Trip Blank	TB	6/15/2011					B11061828-006						
--	--	Trip Blank 2 Lot060311 B-TS SHP0253	Trip Blank	TB	6/16/2011					B11062112-008						
--	--	Trip Blank 1 Lot060311 B-TS SHP0253	Trip Blank	TB	6/16/2011					B11062112-007						
--	--	Trip Blank 5 Lot060311 B-TS SHP0253	Trip Blank	TB	6/17/2011					B11062112-011						

Notes:

1 - Well identification numbers established by Sublette County Conservation District (SCCD).

2 - AN = Antelope; BO = Boulder; CGF = central gathering facility; HWY = Highway; JEN = Jensen; MS = Mesa; RB = Rainbow; RS = Riverside; SP = Stewart Point; WB = Warbonnet; T = Study Well

3 - Control = well with no history of detectable petroleum hydrocarbons; LEL = well with history of combustible gas in well casing; PHC = well with history of detectable petroleum hydrocarbons; HDG Study = study well sampled for hydrogeologic data gaps investigation; SAP Study = study well sampled for this study
Casing Gas = gas sampled from water well casings; Natural Gas = gas sampled from directly from natural gas production wellhead; or from gas gathering/metering system; PHC-Bailer = groundwater sample collected from top of water column in well using a disposable plastic bailer.

4 - QC = quality control; N = natural sample; D = duplicate sample; R = rejected; TB = trip blank; FB = field blank; EB = equipment rinse blank; FILTRB = filter paper blank; F = follow-up sample.

5 - VOC = volatile organic compounds; TIC = tentatively identified compounds; SVOC = semivolatile organic compounds; DIC = dissolved inorganic carbon; X = no laboratory identification number associated with sample.

6 - General water quality parameter data for HDG study wells reported in AMEC, 2012a.

7 - Dissolved metals analysis performed on samples from HDG study wells. Data reported in AMEC, 2012a.

8 - Only benzene, toluene, ethylbenzene, and xylenes (BTEX) analyzed on samples from HDG study wells.