

**Table 3-1**  
**Well Construction Details**  
**Offsite Site Characterization Report - 2013 Addendum**  
**Flint Hills Resources Alaska, LLC**  
**North Pole Refinery, North Pole, Alaska**

Well	New Well Name	Proximity	Boring Completion Date	Survey Date	Riser Elevation (feet MSL)	Riser Sticcup (feet)	Ground Surface Elevation (feet MSL)	Well Depth (feet BGS)	Well Bottom Elevation (feet MSL)	Depth to Top of Permafrost (feet BGS)	Well Diameter (inches)	Well Screen					Material	Riser Material	Filter Pack		WATER TABLE		ALASKA STATE PLANE					
												Depth to Top (feet BGS)	Top Elevation (feet MSL)	Depth to Bottom (feet BGS)	Bottom Elevation (feet MSL)	Length (feet)			Screen Slot Size (inches)	Depth to Top (feet BGS)	Depth to Bottom (feet BGS)	Approx Depth (ft BGS)	In Screen	Feet above top of Screen	NORTHING	EASTING		
MW-101	MW-101-60	On-site	3/19/1987	Nov-2012	494.59	3.45	491.1	61.00	430.14	—	2.00	56.00	435.14	61.00	430.14	5.00	0.02	ss	ss?	?	?	8.0	N	48.0	3927588.78	1429199.67		
MW-101A	MW-101A-25	On-site	3/28/1987	Nov-2012	495.01	4.00	491.0	23.00	468.01	—	2.00	17.80	473.21	22.80	468.21	5.00	0.02	ss	ss?	?	?	8.0	N	9.8	3927590.29	1429209.63		
MW-102	MW-102-70	On-site	4/4/1987	Nov-2012	496.02	3.46	492.6	71.50	421.06	—	2.50	61.50	431.06	71.50	421.06	10.00	0.01	PVC	PVC?	?	?	9.0	N	62.5	3927955.12	1429113.91		
MW-104	MW-104-65	On-site	4/2/1987	Nov-2012	496.02	2.99	493.0	67.00	426.03	—	2.50	63.00	430.03	67.00	426.03	4.00	0.02	PVC	PVC?	?	?	7.0	N	56.0	3927958.82	1429747.75		
MW-105	MW-105-65	On-site	3/21/1987	Nov-2012	497.66	2.46	495.2	63.00	432.20	—	2.00	58.00	437.20	63.00	432.20	5.00	0.02	ss	ss?	?	?	8.0	N	50.0	3924919.0	1430402.38		
MW-105A	MW-105A-25	On-site	3/21/1987	Nov-2012	499.21	3.58	495.6	23.00	472.63	—	2.00	18.00	477.63	23.00	472.63	5.00	0.02	ss	ss?	?	?	8.0	N	10.0	3924910.02	1430404.24		
MW-106	MW-106-25	On-site	9/14/1987	Nov-2012	499.28	1.51	497.8	23.00	474.77	—	2.00	18.50	479.27	23.00	474.77	4.50	0.02	PVC	PVC?	?	?	12.4	N	6.1	3926112.10	1428065.05		
MW-109	MW-109-15	On-site	8/9/1988	Aug-2013	495.16	0.32	494.8	14.00	480.84	—	2.00	9.50	485.34	14.00	480.84	4.50	0.02	PVC	PVC?	?	?	4.5	N	5.0	3925855.20	1428674.99		
MW-110	MW-110-20	On-site	8/10/1988	Nov-2012	496.73	3.26	493.5	18.00	475.47	—	2.00	13.50	479.97	18.00	475.47	4.50	0.02	PVC	PVC?	?	?	5.0	N	8.5	3925975.36	1428873.06		
MW-110-65	MW-110-65	On-site	8/23/2013	Nov-2012	496.38	2.70	493.9	65.87	428.05	—	2.00	60.78	479.22	65.84	428.05	4.50	0.01	PVC	PVC	?	?	6.6	N	54.23	3925984.07	1428984.82		
MW-113	MW-113-15	On-site	9/19/1988	Sept-2013	494.50	3.11	491.4	16.00	473.39	—	2.00	11.50	479.89	16.00	473.39	4.50	0.02	PVC	PVC?	?	?	8.3	N	3.2	3926957.71	1428771.98		
MW-115	MW-115-15	On-site	9/20/1988	Nov-2012	495.84	2.55	493.3	17.00	476.29	—	2.00	12.50	480.79	17.00	476.29	4.50	0.02	ss	ss?	?	?	9.0	N	3.2	3925758.76	1429540.81		
MW-116	MW-116-15	On-site	9/22/1988	Nov-2012	496.17	2.91	493.3	17.00	476.26	—	2.00	12.00	481.26	17.00	476.26	5.00	0.02	ss	ss?	?	?	9.0	N	3.0	3925670.10	1429332.64		
MW-118	MW-118-45	On-site	3/9/1990	Nov-2012	496.50	4.26	492.6	43.00	449.64	—	2.00	38.50	454.14	43.00	449.64	4.50	0.02	ss	PVC	?	?	7.0	N	31.5	3927467.01	1429638.43		
MW-124	MW-124-25	On-site	6/6/1990	Nov-2012	497.39	3.36	494.0	24.50	469.53	—	2.00	20.00	474.03	24.50	469.53	4.50	0.02	PVC	PVC?	?	?	8.0	N	12.0	3927015.09	1429816.83		
MW-125	MW-125-25	On-site	6/6/1990	Sept-2013	496.19	3.16	493.0	24.00	469.03	—	2.00	19.50	473.53	24.00	469.03	4.50	0.02	PVC	PVC	?	?	8.0	N	11.5	3927032.49	1429569.75		
MW-126	MW-126-25	On-site	6/4/1991	Nov-2012	495.53	3.72	491.8	24.50	467.31	—	2.00	20.00	471.81	24.50	467.31	4.50	0.02	PVC	PVC	?	?	7.0	N	13.0	3927426.37	1429419.17		
MW-127	MW-127-25	On-site	6/4/1991	Nov-2012	496.53	3.68	492.9	24.50	468.35	—	2.00	20.00	472.85	24.50	468.35	4.50	0.02	PVC	PVC	?	?	8.5	N	11.5	3927476.29	1429065.47		
MW-129	MW-129-40	On-site	10/21/1996	Nov-2012	496.05	3.12	492.9	41.50	451.43	—	2.00	37.00	455.93	41.50	451.43	4.50	0.02	PVC	PVC	?	?	8.2	N	26.8	3927205.45	1429720.22		
MW-130	MW-130-25	On-site	4/22/1997	Sept-2013	496.92	3.09	493.8	23.00	470.83	—	2.00	19.00	474.83	23.00	470.83	4.50	0.02	PVC	PVC	?	?	9.0	N	10.0	3926825.66	1429354.64		
MW-131	MW-131-25	On-site	8/5/1988	Nov-2012	495.75	2.00	493.8	24.50	469.25	—	2.00	20.00	473.75	24.50	469.25	4.50	0.02	PVC	PVC	?	?	9.0	N	11.0	3927936.24	1429024.82		
MW-132	MW-132-20	On-site	9/1/1999	Nov-2012	499.41	2.69	496.7	22.00	474.72	—	2.00	17.50	479.22	22.00	474.72	4.50	0.02	PVC	PVC	?	?	9.0	N	8.5	3926600.34	1429997.01		
MW-133	MW-133-20	On-site	9/1/1999	Nov-2012	499.34	2.69	495.8	22.00	473.75	—	2.00	17.50	478.25	22.00	473.75	4.50	0.02	PVC	PVC	?	?	9.0	N	8.5	3926597.42	1429993.18		
MW-134	MW-134-20	On-site	9/2/1999	Nov-2012	497.76	2.56	495.2	22.00	473.50	—	2.00	17.00	478.50	22.00	473.50	4.50	0.02	PVC	PVC	?	?	8.0	N	8.4	3926000.91	1430170.28		
MW-135	MW-135-20	On-site	3/8/2001	Sept-2013	496.93	3.74	493.2	19.50	473.69	—	2.00	10.60	482.59	19.50	473.69	8.90	0.02	PVC	PVC	?	?	9.0	N	1.6	3927024.53	1429730.91		
MW-136	MW-136-20	On-site	3/8/2001	Sept-2013	496.90	3.46	493.4	19.10	474.34	—	2.00	10.10	483.34	19.10	474.34	9.00	0.02	PVC	PVC	?	?	9.0	N	1.1	3927024.41	1429778.02		
MW-137	MW-137-20	On-site	3/8/2001	Sept-2013	497.41	3.17	494.2	19.30	474.94	—	2.00	10.40	483.94	19.30	474.94	8.90	0.02	PVC	PVC	?	?	9.0	N	1.4	3927083.81	1429737.46		
MW-138	MW-138-20	On-site	4/12/2001	Nov-2012	496.34	3.14	493.2	18.10	475.10	—	2.00	3.90	489.30	18.10	475.10	14.20	0.02	PVC	PVC	?	?	9.0	Y	-5.1	3925738.32	1429686.77		
MW-139	MW-139-25	On-site	5/29/2001	Nov-2012	497.25	1.96	495.3	25.00	470.29	—	2.00	5.70	489.59	25.00	470.29	19.30	0.02	PVC	PVC	?	?	9.0	Y	-3.3	3927427.97	1428848.56		
MW-140	MW-140-25	On-site	5/30/2001	Nov-2012	494.90	2.83	492.1	23.50	468.57	—	2.00	4.20	487.87	23.50	468.57	19.30	0.02	PVC	PVC	?	?	8.0	Y	-3.8	3927683.10	1429244.57		
MW-141	MW-141-20	On-site	10/5/2001	Nov-2012	492.38	2.17	490.2	22.40	467.81	—	2.00	7.90	482.31	22.40	467.81	14.50	0.02	PVC	PVC	?	?	5.4	N	2.5	3927598.03	1427540.67		
MW-142	MW-142-20	On-site	8/10/2001	Nov-2012	495.73	2.73	493.0	19.40	473.60	—	2.00	5.40	487.60	19.40	473.60	14.00	0.02	PVC	PVC	?	?	9.1	Y	-3.7	3927602.87	1428813.48		
MW-143	MW-143-20	On-site	8/15/2005	Nov-2012	495.37	3.36	492.0	19.50	472.51	—	2.00	4.70	487.31	19.50	472.51	14.80	0.02	PVC	PVC	?	?	7.5	Y	-2.8	3927688.65	1428487.50		
MW-144	MW-144A-25	On-site	9/15/2005	Nov-2012	495.35	2.95	492.4	24.70	467.70	—	2.00	5.70	486.70	24.70	467.70	19.00	0.02	PVC	PVC	?	?	6.8	Y	-1.1	3927485.68	1429623.04		
MW-144B	MW-144B-20	On-site	9/21/2011	Nov-2012	494.98	2.98	492.1	24.50	467.58	—	2.00	5.40	482.58	24.50	467.58	14.47	0.01	PVC	PVC	?	?	80.0	Y	78.9	3927463.2	1429333.05		
MW-145	MW-145-20	On-site	8/15/2005	Nov-2012	495.61	2.78	492.9	19.00	473.85	—	2.00	4.70	488.15	19.00	473.85	14.30	0.02	PVC	PVC	?	?	8.0	Y	-3.3	3927121.61	1429712.57		
MW-146	MW-146A-15	On-site	9/29/2008	Nov-2012	495.09	2.52	492.6	16.00	476.57	—	2.00	6.00	486.57	16.00	476.57	10.00	0.02	PVC	PVC	?	?	7.0	Y	-1.0	3927201.05	1427049.42		
MW-146B	MW-146B-30	On-site	9/29/2008	Nov-2012	494.98	2.39	492.6	28.00	464.59	—	2.00	22.00	470.59	27.00	465.59	5.00	0.02	PVC	PVC	?	?	16.0	N	15.0	3927193.28	1427048.17		
MW-147A	MW-147A-15	On-site	10/1/2008	Nov-2012	491.93	2.26	489.7	13.00	476.67	—	2.00	3.00	486.67	13.00	476.67	10.00	0.02	PVC	PVC	?	?	2.4	13.0	5.5	Y	-2.5	3927723.21	1427288.46
MW-147B	MW-147B-25	On-site	9/30/2008	Nov-2012	492.59	2.90	489.7	26.00	463.69	—	2.00	20.50	469.19	25.50	464.19	5.00	0.02	PVC	PVC	?	?	17.5	25.0	5.5	N	15.0	3927729.22	1427290.37
MW-148	MW-148A-15	Off-site	10/2/2008	Sept-2013	493.07	2.17	490.9	15.00	475.90	—	2.00	5.00	485.90	15.00	475.90	10.00	0.02	PVC	PVC	?	?	4.0	15.0	6.9	Y	-1.9	3928675.03	1428153.49
MW-148B	MW-148B-30	Off-site	10/2/2008	Sept-2013	492.86	2.60	490.3	29.00	461.26	—	2.00	22.00	468.26	27.00	463.26	5.00	0.02	PVC	PVC	?	?	17.0	27.0	6.9	N	15.1	3928677.21	1428158.65
MW-148C	MW-148C-55	Off-site	9/27/2011	Sept-2013	493.33	2.74	490.6	55.74	434.85	—	2.00	50.72	439.87	55.15	435.44	4.43	0.01	PVC	PVC	?	?	45.0	56.0	9	N	41.7	3928670.73	1428140.18
MW-148D	MW-148D-150	Off-site	9/26/2011	Sept-2013	493.36	3.01	490.4	150.96	339.39	151.5	2.00	145.92	344.43	150.36	339.99	4.44	0.01	PVC	PVC	?	?	140.0	152.0	9.0	N	136.9	3928673.10	1428146.93
MW-148-100	MW-148-100	Off-site	10/3/2013	Oct-2013	493.04	2.72	490.1	100.40	—	—	2	95.38	—	99.93	—	4.55	0.01	PVC	PVC	?	?	92	100.40	7.3	N	88.08	3928677.4	142814

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Flint Hills Resources Alaska, LLC  
North Pole Refinery, North Pole, Alaska

Well	New Well Name	Proximity	Boring Completion Date	Survey Date	Riser Elevation (feet MSL)	Riser Sticcup (feet)	Ground Surface Elevation (feet MSL)	Well Depth (feet BGS)	Well Bottom Elevation (feet MSL)	Depth to Top of Permafrost (feet BGS)	Well Diameter (inches)	Well Screen					Material	Riser Material	Filter Pack			WATER TABLE		ALASKA STATE PLANE		
												Depth to Top (feet BGS)	Top Elevation (feet MSL)	Depth to Bottom (feet BGS)	Bottom Elevation (feet MSL)	Length (feet)			Screen Slot Size (inches)	Depth to Top (feet BGS)	Depth to Bottom (feet BGS)	Approx Depth (ft BGS)	In Screen	Feet above top of Screen	NORTHING	EASTING
MW-176C	MW-176C-90	On-site	10/1/2010	Nov-2012	496.86	3.15	493.7	90.49	403.28	—	2.00	85.43	89.93	403.78	4.50	0.02	PVC	PVC	75.0	91.5	9.5	N	75.9	3926056.80	1429407.76	
MW-177	MW-177-90	On-site	9/22/2010	Nov-2012	497.92	3.01	494.9	89.71	405.20	—	2.00	84.71	410.20	89.19	4.08	0.02	PVC	PVC	70.0	91.5	7.5	N	77.2	3925072.46	1430037.88	
MW-178A	MW-178A-15	On-site	9/18/2010	Nov-2012	496.48	2.32	494.2	16.06	478.10	—	2.00	5.90	488.26	15.84	4.78	0.02	PVC	PVC	3.0	16.5	7.0	Y	-1.1	3926117.29	1429586.63	
MW-178B	MW-178B-50	On-site	9/18/2010	Nov-2012	496.10	2.19	493.9	51.17	442.74	—	2.00	46.01	447.90	50.73	4.43	0.02	PVC	PVC	40.0	51.5	7.5	N	38.5	3926117.08	1429579.97	
MW-178C	MW-178C-90	On-site	9/17/2010	Nov-2012	497.27	3.03	494.2	90.15	404.09	—	2.00	85.16	409.08	89.93	4.04	0.02	PVC	PVC	75.0	91.5	7.5	N	77.7	3926117.30	1429573.58	
MW-179A	MW-179A-15	On-site	9/21/2010	Aug-2013	496.96	3.05	493.9	15.61	478.30	—	2.00	5.56	488.35	15.20	4.78	0.02	PVC	PVC	5.0	16.5	8.0	Y	-2.4	3926050.54	1429676.64	
MW-179B	MW-179B-50	On-site	9/21/2010	Aug-2013	496.75	2.68	494.1	50.82	443.25	—	2.00	45.80	448.27	50.29	44.38	0.02	PVC	PVC	40.0	51.5	8.0	N	37.8	3926047.16	1429680.75	
MW-179C	MW-179C-90	On-site	9/20/2010	Aug-2013	497.26	2.85	494.4	90.43	403.98	—	2.00	85.41	409.00	89.90	4.04	0.02	PVC	PVC	75.0	91.5	8.5	N	76.9	3926045.58	1429674.43	
MW-179D	MW-179D-135	On-site	8/12/2011	Aug-2013	497.06	3.08	494.0	134.05	359.93	140.5	2.00	128.95	365.03	133.05	3.60	0.02	PVC	PVC	115.0	140.5	8.0	N	121.0	3926048.88	1429668.63	
MW-180A	MW-180A-15	On-site	9/27/2010	Nov-2012	497.42	3.09	494.3	15.39	478.94	—	2.00	5.25	489.08	14.97	4.79	0.02	PVC	PVC	3.0	16.5	7.5	Y	-2.3	3925874.85	1429928.62	
MW-180B	MW-180B-50	On-site	9/27/2010	Nov-2012	496.87	2.65	494.2	50.72	443.50	—	2.00	44.81	448.51	50.19	44.03	0.02	PVC	PVC	35.0	51.5	7.5	N	38.2	3925879.52	1429922.58	
MW-180C	MW-180C-90	On-site	9/25/2010	Nov-2012	497.05	2.65	494.2	90.42	403.78	—	2.00	85.33	408.87	89.87	4.04	0.02	PVC	PVC	70.0	91.5	7.5	N	77.9	3925873.80	1429924.19	
MW-181A	MW-181A-15	Off-site	10/6/2010	Mar-2013	475.92	-0.57	476.5	15.16	461.33	—	2.00	5.05	471.44	14.75	4.61	0.02	PVC	PVC	4.0	16.5	10.0	Y	-5.0	3944095.46	1425755.04	
MW-181B	MW-181B-50	Off-site	10/6/2010	Mar-2013	475.86	-0.50	476.4	50.78	425.58	—	2.00	45.77	430.59	50.30	42.06	0.02	PVC	PVC	35.0	51.5	10.0	N	35.8	3944099.95	1425752.10	
MW-181C	MW-181C-150	Off-site	10/3/2011	Mar-2013	475.99	-0.41	476.4	150.45	325.95	—	2.00	145.43	330.97	149.86	326.54	4.43	0.01	PVC	PVC	140.0	150.5	10.3	N	135.1	3944089.21	1425759.17
MW-182A	MW-182A-15	Off-site	10/8/2010	Sept-2013	475.54	-1.26	476.8	15.83	460.97	—	2.00	5.70	471.10	15.42	4.61	0.02	PVC	PVC	4.0	16.5	7.0	Y	-1.3	3941132.12	1423038.13	
MW-182B	MW-182B-45	Off-site	8/22/2011	Nov-2012	475.40	-0.46	475.9	44.67	431.19	46.0	2.00	39.57	436.29	44.27	431.59	4.70	0.02	PVC	PVC	30.0	50.5	7.0	N	32.6	3941136.42	1423037.29
MW-183A	MW-183A-15	Off-site	10/8/2010	July-2013	478.07	-0.57	478.6	15.88	462.76	—	2.00	5.77	472.87	15.47	4.63	0.02	PVC	PVC	4.0	16.5	7.0	Y	-1.2	3937529.71	1420159.70	
MW-183B	MW-183B-60	Off-site	8/29/2011	Nov-2012	478.06	-0.58	478.6	59.74	418.90	59.0	2.00	54.64	424.00	59.34	419.30	4.70	0.02	PVC	PVC	45.0	60.0	7.0	N	47.6	3937532.14	1420157.14
MW-184	MW-184-45	Off-site	10/1/2010	Nov-2012	486.64	-0.65	487.3	45.23	442.06	—	2.00	40.12	447.17	44.75	44.75	4.63	0.02	PVC	PVC	30.0	45.5	7.0	N	33.1	3932560.61	1428756.36
MW-185A	MW-185A-15	Off-site	10/12/2010	Mar-2013	478.06	-0.63	478.7	15.57	463.12	—	2.00	5.48	473.21	15.10	4.63	0.02	PVC	PVC	4.0	16.5	7.0	Y	-1.5	3940802.50	1428251.19	
MW-185B	MW-185B-50	Off-site	10/12/2010	Nov-2012	478.09	-0.41	478.5	51.41	427.09	—	2.00	46.30	432.20	50.93	427.57	4.63	0.02	PVC	PVC	35.0	51.5	7.0	N	39.3	3940797.61	1428251.05
MW-185C	MW-185C-120	Off-site	10/12/2010	Nov-2012	478.48	-0.21	478.7	120.99	357.70	121.0	2.00	115.98	362.73	120.40	358.39	4.44	0.01	PVC	PVC	110.0	121.0	9.5	N	106.5	3940802.50	1428251.19
MW-186A	MW-186A-15	On-site	10/18/2010	Sept-2013	495.86	3.25	492.7	5.11	477.49	—	2.00	5.11	487.60	14.79	4.77	0.02	PVC	PVC	4.0	16.5	10.0	Y	-1.9	3927026.87	1429092.83	
MW-186B	MW-186B-60	On-site	10/18/2010	Sept-2013	495.84	3.13	492.7	60.80	431.91	—	2.00	50.69	442.02	60.37	432.34	9.88	0.02	PVC	PVC	40.0	61.5	7.0	N	43.7	3927021.15	1429092.67
MW-186C	MW-186C-100	On-site	10/15/2010	Sept-2013	495.76	3.13	492.6	100.79	391.84	—	2.00	90.69	401.94	100.32	392.31	9.63	0.02	PVC	PVC	80.0	101.5	7.0	N	83.7	3927017.05	1429092.45
MW-186D	MW-186D-135	On-site	12/4/2011	Sept-2013	495.75	3.03	492.7	134.99	357.73	—	2.00	129.83	362.89	134.62	358.10	4.79	0.01	PVC	PVC	124.0	136.5	7.0	N	122.8	3927010.35	1429093.23
MW-186E	MW-186E-75	On-site	4/25/2012	Sept-2013	495.77	3.05	492.7	75.90	416.82	—	2.00	70.76	421.96	75.42	417.30	4.66	0.01	PVC	PVC	Natural pack	—	7.0	N	63.8	3927030.39	1429093.30
MW-187	MW-187-15	Off-site	10/21/2010	Sept-2013	485.24	2.84	482.4	17.38	465.02	—	2.00	7.28	475.12	16.91	4.65	0.02	PVC	PVC	4.0	16.5	10.5	Y	-3.2	3934464.24	1420335.62	
MW-188A	MW-188A-15	Off-site	4/28/2012	Nov-2012	461.84	-0.15	462.0	15.33	446.66	—	2.00	5.20	456.79	14.98	4.47	0.01	PVC	PVC	3.0	15.3	10.0	Y	-4.8	3951510.80	1410365.41	
MW-188B	MW-188B-40	Off-site	11/24/2010	Nov-2012	461.53	-0.37	461.9	40.90	421.00	45.5	2.00	35.40	426.50	40.40	421.50	5.00	0.02	PVC	PVC	35.5	42.5	4.5	N	30.9	3951521.8	1410365.52
MW-189A	MW-189A-15	Off-site	8/19/2011	July-2013	470.19	-0.67	470.9	16.54	454.32	—	2.00	6.49	464.37	16.16	4.54	0.01	PVC	PVC	4.0	17.5	7.0	Y	-0.5	3945399.36	1424696.44	
MW-189B	MW-189B-60	Off-site	8/19/2011	Nov-2012	470.25	-0.74	471.0	60.52	410.47	—	2.00	55.42	415.57	60.07	410.92	4.65	0.01	PVC	PVC	45.0	61.5	7.0	N	48.4	3945399.24	1424692.19
MW-190A	MW-190A-15	Off-site	8/23/2011	July-2013	481.87	-0.36	482.2	5.49	466.54	—	2.00	5.49	476.74	15.20	4.67	0.01	PVC	PVC	4.0	16.0	7.0	Y	-1.5	3938370.96	1429592.42	
MW-190B	MW-190B-60	Off-site	8/23/2011	Nov-2012	481.58	-0.36	482.2	60.71	421.55	—	2.00	42.80	421.55	60.71	421.55	4.56	0.01	PVC	PVC	45.0	61.5	7.0	N	48.5	3938370.16	1429592.16
MW-190B-60	MW-190B-60	Off-site	8/21/2013	Aug-2013	481.91	-0.39	482.2	59.87	422.31	—	2.00	54.85	427.33	59.41	422.77	4.56	0.01	PVC	PVC	Natural pack	—	7.0	N	47.9	3938372.08	1429596.48
MW-190-150	MW-190-150	Off-site	4/19/2013	Aug-2013	481.98	-0.30	482.2	150.38	331.80	—	2.00	145.38	336.83	149.91	332.27	4.56	0.01	PVC	PVC	Natural pack	—	7.0	N	138.4	3938379.86	1429596.16
MW-191A	MW-191A-15	Off-site	8/24/2011	July-2013	475.64	-0.89	476.5	15.28	461.25	—	2.00	5.18	471.35	14.90	4.61	0.01	PVC	PVC	4.0	16.0	8.0	Y	-2.8	3937781.57	1417713.87	
MW-191B	MW-191B-60	Off-site	8/24/2011	Nov-2012	475.51	-0.78	476.3	60.29	416.00	—	2.00	55.22	421.07	59.84	416.45	4.62	0.01	PVC	PVC	45.0	61.5	8.0	N	47.2	3937777.89	1417714.18
MW-192A	MW-192A-15	On-site	8/25/2011	Nov-2012	495.90	2.44	493.5	14.64	478.82	—	2.00	4.54	488.92	14.24	4.79	0.02	PVC	PVC	5.0	15.0	4.5	Y	0.0	3924992.22	1428899.36	
MW-192B	MW-192B-55	On-site	8/26/2011	Nov-2012	495.47	2.22	493.3	55.51	437.74	—	2.00	5														

Table 3-1  
Well Construction Details  
Offsite Site Characterization Report - 2013 Addendum  
Flint Hills Resources Alaska, LLC  
North Pole Refinery, North Pole, Alaska

Well	New Well Name	Proximity	Boring Completion Date	Survey Date	Riser Elevation (feet MSL)	Riser Stickup' (feet)	Ground Surface Elevation (feet MSL)	Well Depth (feet BGS)	Well Bottom Elevation (feet MSL)	Depth to Top of Permafrost (feet BGS)	Well Diameter (inches)	Well Screen					Material	Riser Material	Filter Pack		WATER TABLE		ALASKA STATE PLANE			
												Depth to Top (feet BGS)	Top Elevation (feet MSL)	Depth to Bottom (feet BGS)	Bottom Elevation (feet MSL)	Length (feet)			Screen Slot Size (inches)	Depth to Top (feet BGS)	Depth to Bottom (feet BGS)	Approx Depth (ft BGS)	In Screen	Feet above top of Screen	NORTHING	EASTING
MW-307	MW-307-150	On-site	12/3/2011	Sept-2013	495.48	3.67	492.8	149.90	342.91	—	2.00	144.76	48.0	0.01	PVC	PVC	140.0	151.5	9.0	N	135.8	3926951.83	1429734.66			
MW-308-15	MW-308-15	Off-site	4/13/2012	Nov-2012	476.90	3.94	473.0	14.95	458.01	—	2.00	4.91	468.05	14.36	4.58	0.01	PVC	PVC	3.5	15.0	9.0	N	-4.1	3943105.50	1420578.30	
MW-308-30	MW-308-30	Off-site	4/12/2012	Nov-2012	475.35	3.67	471.7	30.42	441.26	41.0	2.00	25.21	446.47	30.02	441.66	4.81	0.01	PVC	PVC	Natural pack	—	10.0	N	15.2	3943026.01	1420463.62
MW-309-15	MW-309-15	On-site	4/19/2012	Sept-2013	494.90	2.87	492.0	15.06	476.97	—	2.00	4.92	487.11	14.72	477.31	9.80	0.01	PVC	PVC	3.2	15.0	7.0	Y	-2.1	3927042.65	1428539.04
MW-309-150	MW-309-150	On-site	4/19/2012	Aug-2013	494.80	2.78	492.0	149.75	342.77	—	2.00	144.61	347.41	149.27	342.75	4.66	0.01	PVC	PVC	Natural pack	—	7.0	N	137.6	3927043.93	1428525.49
MW-309-66	MW-309-66	On-site	4/23/2012	Sept-2013	495.15	3.14	492.0	65.85	426.16	—	2.00	59.43	432.58	64.10	427.91	4.67	0.01	PVC	PVC	Natural pack	—	7.0	N	52.4	3927043.2	1428532.39
MW-310-110	MW-310-110	On-site	5/29/2012	Aug-2013	494.28	3.33	491.0	110.42	380.53	—	2.00	105.28	385.67	109.94	381.01	4.66	0.01	PVC	PVC	Natural pack	—	6.0	N	99.3	3926802.76	1428044.57
MW-310-15	MW-310-15	On-site	4/26/2012	Aug-2013	494.26	3.01	491.3	14.72	476.53	—	2.00	4.58	486.67	14.38	476.87	9.80	0.01	PVC	PVC	3.2	14.7	6.0	Y	-1.4	3926810.88	1428028.92
MW-310-65	MW-310-65	On-site	4/20/2012	Nov-2012	494.38	3.00	491.4	65.53	425.85	—	2.00	60.47	430.91	65.13	426.25	4.66	0.01	PVC	PVC	Natural pack	—	6.0	N	54.5	3926805.71	1428036.73
MW-311-15	MW-311-15	Off-site	4/26/2012	Aug-2013	466.78	-0.50	467.3	15.43	451.85	—	2.00	5.20	462.04	15.04	452.24	9.80	0.01	PVC	PVC	3.2	15.4	4.5	N	0.7	3946536.13	1415602.20
MW-311-46	MW-311-46	Off-site	4/28/2012	Aug-2013	468.96	-0.14	467.1	45.74	421.36	48.0	2.00	40.60	435.60	45.26	421.84	4.66	0.01	PVC	PVC	Natural pack	—	7.0	N	4.5	3946534.99	1415612.88
MW-312-15	MW-312-15	Off-site	4/28/2012	Aug-2013	464.3	-0.28	464.6	15.62	449.06	—	2.00	5.34	469.24	15.13	449.45	9.79	0.01	PVC	PVC	2.7	15.5	5.7	Y	-0.4	3951394.25	1415642.38
MW-312-50	MW-312-50	Off-site	5/2/2012	Aug-2013	464.25	-0.39	464.6	50.36	414.28	50.0	2.00	44.90	419.74	49.56	415.08	4.66	0.01	PVC	PVC	Natural pack	—	7.0	N	37.9	3951399.72	1415642.19
MW-313-15	MW-313-15	Off-site	4/30/2012	Nov-2012	465.79	-0.43	466.2	15.18	451.04	—	2.00	4.99	461.23	14.79	451.43	9.80	0.01	PVC	PVC	3.0	15.2	9.5	Y	-4.5	3951374.78	1423235.06
MW-313-150	MW-313-150	Off-site	5/8/2012	Nov-2012	465.88	-0.29	466.2	149.94	316.23	—	2.00	144.69	321.48	149.34	316.83	4.65	0.01	PVC	PVC	Natural pack	—	9.5	N	135.2	3951370.40	1423237.65
MW-314-15	MW-314-15	Off-site	4/30/2012	Nov-2012	476.29	-0.29	476.6	15.56	461.02	—	2.00	5.38	471.20	15.16	461.42	9.78	0.01	PVC	PVC	3.0	15.6	7.0	Y	-1.6	3943869.90	1427115.02
MW-315-15	MW-315-15	Off-site	5/1/2012	Nov-2012	458.44	-0.74	459.2	15.83	443.35	—	2.00	5.70	453.48	15.49	443.69	9.79	0.01	PVC	PVC	3.0	15.8	7.0	Y	-1.3	3949804.15	1403467.06
MW-315-150	MW-315-150	Off-site	5/2/2012	Nov-2012	458.96	-0.41	459.4	150.63	308.74	—	2.00	145.58	313.79	150.23	309.14	4.65	0.01	PVC	PVC	Natural pack	—	7.0	N	138.6	3949809.75	1403467.06
MW-316-15	MW-316-15	Off-site	5/1/2012	Nov-2012	486.34	-0.29	486.6	15.67	470.96	—	2.00	5.46	481.17	15.26	471.37	9.80	0.01	PVC	PVC	3.0	15.0	7.0	Y	-1.5	3932950.20	1428372.65
MW-316-56	MW-316-56	Off-site	5/16/2012	Nov-2012	486.15	-0.48	486.6	56.00	430.63	57.0	2.00	50.95	435.68	55.59	431.04	4.64	0.01	PVC	PVC	Natural pack	—	7.0	N	44.0	3932950.03	1428377.41
MW-317-15	MW-317-15	Off-site	5/3/2012	Nov-2012	488.86	-0.44	489.3	15.66	473.64	—	2.00	5.46	483.84	15.25	474.05	9.79	0.01	PVC	PVC	3.0	15.7	9.0	Y	-3.5	3930184.86	1428701.63
MW-317-71	MW-317-71	Off-site	5/21/2012	Nov-2012	488.79	-0.56	489.4	71.23	418.12	—	2.00	42.25	470.73	70.73	418.62	4.63	0.01	PVC	PVC	Natural pack	—	9.0	N	57.1	3930185.90	1428666.62
MW-318-20	MW-318-20	Off-site	5/3/2012	Sept-2013	483.05	2.98	480.1	20.48	469.59	—	2.00	10.28	479.78	20.08	469.99	9.79	0.01	PVC	PVC	8.0	20.5	10.0	Y	0.3	3926861.23	1424728.43
MW-318-135	MW-318-135	Off-site	5/10/2012	Sept-2013	493.10	3.29	489.8	135.29	354.52	—	2.00	130.15	368.66	134.80	356.01	4.65	0.01	PVC	PVC	Natural pack	—	7.0	N	123.2	3928883.99	1424703.15
MW-319-15	MW-319-15	Off-site	5/4/2012	Nov-2012	456.10	-0.35	456.5	15.28	441.17	—	2.00	5.08	451.37	14.89	441.56	9.80	0.01	PVC	PVC	3.0	15.3	7.0	Y	-1.9	3953109.18	1404197.93
MW-319-45	MW-319-45	Off-site	5/7/2012	Nov-2012	455.96	-0.69	456.7	45.52	411.13	45.5	2.00	40.44	416.21	45.10	411.55	4.66	0.01	PVC	PVC	Natural pack	—	7.0	N	33.4	3953109.18	1404192.73
MW-320-130	MW-320-130	Off-site	5/9/2012	Mar-2013	450.96	-0.53	451.5	131.38	320.11	—	2.00	126.32	325.17	130.97	320.52	4.65	0.01	PVC	PVC	Natural pack	—	10.0	N	116.3	3963539.90	1402678.14
MW-320-20	MW-320-20	Off-site	5/4/2012	Mar-2013	450.89	-0.31	451.2	20.15	431.05	—	2.00	9.96	441.24	19.76	431.44	9.80	0.01	PVC	PVC	7.9	20.2	10.2	Y	-0.2	3963542.54	1402682.33
MW-321-15	MW-321-15	On-site	5/5/2012	Nov-2012	495.59	2.74	492.9	15.77	477.08	—	2.00	5.62	487.23	15.41	477.44	9.79	0.01	PVC	PVC	3.9	15.8	7.0	Y	-1.4	3926256.76	1428855.78
MW-321-151	MW-321-151	On-site	5/26/2012	Nov-2012	495.13	2.20	492.9	150.54	342.39	—	2.00	145.41	347.52	150.06	342.87	4.65	0.01	PVC	PVC	Natural pack	—	7.0	N	138.4	3926273.73	1428856.06
MW-321-65	MW-321-65	On-site	5/5/2012	Nov-2012	495.26	2.44	492.8	66.04	426.78	—	2.00	60.89	431.93	65.55	427.27	4.66	0.01	PVC	PVC	Natural pack	—	7.0	N	53.9	3926265.14	1428856.30
MW-322-15	MW-322-15	Off-site	5/8/2012	June-2013	472.14	2.77	469.4	15.73	453.64	—	2.00	5.55	463.82	15.34	454.03	9.79	0.01	PVC	PVC	3.0	15.7	7.0	Y	-1.5	3940670.73	1410082.02
MW-322-150	MW-322-150	Off-site	10/9/2012	June-2013	472.04	2.65	469.4	151.07	318.32	—	2.00	145.94	323.45	150.39	318.80	4.65	0.01	PVC	PVC	Natural pack	—	7.0	N	138.9	3940646.94	1410074.03
MW-323-15	MW-323-15	Off-site	5/7/2012	Nov-2012	485.27	3.01	482.3	15.55	466.71	—	2.00	5.42	476.84	15.21	467.05	9.79	0.01	PVC	PVC	3.0	15.6	7.0	Y	-1.6	3931840.58	1422094.72
MW-323-50	MW-323-50	Off-site	10/8/2012	Sept-2013	484.76	3.29	481.5	47.96	432.56	55.0	2.00	44.30	437.38	47.96	432.56	4.66	0.01	PVC	PVC	Natural pack	—	7.0	N	37.2	3931840.58	1422094.72
MW-324-15	MW-324-15	Off-site	5/8/2012	Nov-2012	463.41	-0.37	463.8	15.35	448.43	—	2.00	5.17	458.61	14.96	448.82	9.79	0.01	PVC	PVC	3.0	15.4	7.0	Y	-1.8	3945444.19	1409655.19
MW-324-151	MW-324-151	Off-site	5/23/2012	Nov-2012	462.90	-0.70	463.6	150.92	312.68	—	2.00	145.78	317.82	150.44	313.16	4.66	0.01	PVC	PVC	Natural pack	—	7.0	N	138.8	3945446.0	1404958.62
MW-325-150	MW-325-150	Off-site	5/14/2012	Mar-2013	486.85	-0.60	487.5	150.54	336.91	—	2.00	145.48	341.97	150.13	337.32	4.65	0.01	PVC	PVC	Natural pack	—	12.0	N	133.5	3937085.15	1430633.64
MW-325-18	MW-325-18	Off-site	5/18/2012	Mar-2013	486.13	-0.81	486.9	18.68	468.26	—	2.00	8.53	478.41	18.33	468.61	9.80	0.01	PVC	PVC	6.5	18.7	12.0	Y	-3.5	3937079.28	1430639.29
MW-326-150	MW-326-150	Off-site	5/15/2012	June-2013	500.48	3.09	497.4	150.51	346.88	—	2.00	145.45	351.94	150.10	347.29	4.65	0.01	PVC	PVC	Natural pack	—	7.0	N	138		

Table 3-1  
Well Construction Details  
Offsite Site Characterization Report - 2013 Addendum  
Flint Hills Resources Alaska, LLC  
North Pole Refinery, North Pole, Alaska

Well	New Well Name	Proximity	Boring Completion Date	Survey Date	Riser Elevation (feet MSL)	Riser Sticcup* (feet)	Ground Surface Elevation (feet MSL)	Well Depth (feet BGS)	Well Bottom Elevation (feet MSL)	Depth to Top of Formation (feet BGS)	Well Diameter (inches)	Well Screen				Material	Riser Material	Filter Pack		WATER TABLE		ALASKA STATE PLANE		
												Depth to Top (feet BGS)	Top Elevation (feet MSL)	Depth to Bottom (feet BGS)	Bottom Elevation (feet MSL)			Length (feet)	Screen Slot Size (inches)	Depth to Top (feet BGS)	Depth to Bottom (feet BGS)	Approx Depth (ft BGS)	In Screen	Feet above top of Screen
MW-356-65	MW-356-65	Off-site	10/17/2013	Nov-2013	478.75	-0.46	479.28	65.77	--	--	2.00	60.68	65.24	4.56	0.01	PVC	PVC	54	65.77	9.0	N	51.68	3941376.9	1429218.74
MW-356-90	MW-356-90	Off-site	10/16/2013	Nov-2013	478.74	-0.43	479.49	88.73	--	90.0	2.00	83.72	88.24	4.52	0.01	PVC	PVC	76	88.73	9.0	N	74.72	3941371.87	1429221.14
MW-357-15	MW-357-15	Off-site	10/21/2013	Nov-2013	487.73	2.80	484.99	15.99	--	--	2.00	5.80	15.27	9.78	0.01	PVC	PVC	3	15.99	8.5	Y	-3.01	3935720.9	1430665.73
MW-357-150	MW-357-150	Off-site	10/18/2013	Nov-2013	488.01	3.09	484.92	150.46	--	--	2.00	145.47	149.97	4.50	0.01	PVC	PVC	139	150.46	8.5	Y	136.97	3935727.84	1430665.06
MW-357-65	MW-357-65	Off-site	10/21/2013	Nov-2013	487.9	2.87	485.05	66.00	--	--	2.00	60.93	65.44	4.51	0.01	PVC	PVC	8.5	66	8.5	N	52.43	3935724.61	1430661.02
MW-358-150	MW-358-150	On-site	10/30/2013	--	#N/A	3.11	--	150.57	--	--	2.00	145.61	150.11	4.50	0.01	PVC	PVC	139	150.57	10.0	N	135.61	--	--
MW-358-20	MW-358-20	On-site	11/2/2013	--	#N/A	3.15	--	20.72	--	--	2.00	15.68	20.23	4.55	0.01	PVC	PVC	14	20.72	9.57	N	6.11	--	--
MW-358-40	MW-358-40	On-site	11/2/2013	--	#N/A	2.98	--	40.25	--	--	2.00	35.24	39.78	4.54	0.01	PVC	PVC	29	40.25	9.63	N	25.81	--	--
MW-358-60	MW-358-60	On-site	10/31/2013	--	#N/A	2.96	--	60.69	--	--	2.00	55.66	60.22	4.56	0.01	PVC	PVC	50	60.22	8.5	N	47.16	--	--
MW-359-15	MW-359-15	On-site	11/5/2013	--	#N/A	2.69	--	15.51	--	--	2.00	5.49	15.05	9.56	0.01	PVC	PVC	3.1	15.51	9.3	Y	-3.81	--	--
MW-359-35	MW-359-35	On-site	11/18/2013	--	#N/A	2.99	--	35.06	--	--	2.00	30.02	34.58	4.56	0.01	PVC	PVC	29	35.06	9.3	N	20.72	--	--
MW-359-60	MW-359-60	On-site	11/1/2013	--	#N/A	2.99	--	60.52	--	--	2.00	55.42	60.08	4.66	0.01	PVC	PVC	49	60.52	7.0	N	48.42	--	--
MW-359-80	MW-359-80	On-site	11/11/2013	--	#N/A	2.65	--	80.58	--	--	2.00	75.57	80.04	4.47	0.01	PVC	PVC	69	80.58	9.5	N	66.07	--	--
MW-359-150	MW-359-150	On-site	10/31/2013	--	#N/A	2.90	--	150.31	--	--	2.00	145.29	149.80	4.51	0.01	PVC	PVC	139	150.31	10.0	N	135.29	--	--
MW-359-60	MW-359-60	On-site	11/1/2013	--	#N/A	2.85	--	60.52	--	--	2.00	55.42	60.08	4.66	0.01	PVC	PVC	49	60.52	7.0	N	48.42	--	--
MW-360-15	MW-360-15	On-site	11/6/2013	--	#N/A	2.99	--	15.41	--	--	2.00	5.37	14.94	9.57	0.01	PVC	PVC	3	15.41	9.5	Y	-4.13	--	--
MW-360-150	MW-360-150	On-site	11/4/2013	--	#N/A	2.73	--	150.01	--	--	2.00	144.91	149.57	4.66	0.01	PVC	PVC	5	150.01	9.5	N	135.41	--	--
MW-360-35	MW-360-35	On-site	11/6/2013	--	#N/A	2.98	--	35.76	--	--	2.00	30.76	35.23	4.47	0.01	PVC	PVC	24.5	35.76	9.59	N	21.17	--	--
MW-360-50	MW-360-50	On-site	11/5/2013	--	#N/A	2.71	--	50.60	--	--	2.00	45.58	50.06	4.48	0.01	PVC	PVC	39	50.6	10.0	N	35.58	--	--
MW-360-80	MW-360-80	On-site	11/12/2013	--	#N/A	2.89	--	80.23	--	--	2.00	74.90	79.37	4.47	0.01	PVC	PVC	70	80.23	10.0	N	64.90	--	--
MW-361-15	MW-361-15	On-site	11/5/2013	--	#N/A	2.73	--	15.29	--	--	2.00	5.27	14.85	9.58	0.01	PVC	PVC	3.5	15.29	8.0	Y	-2.73	--	--
MW-362-15	MW-362-15	On-site	11/16/2013	--	#N/A	3.46	--	15.19	--	--	2.00	5.20	14.75	9.55	0.01	PVC	PVC	2.9	15.19	7.0	Y	-1.80	--	--
MW-362-25	MW-362-25	On-site	11/19/2013	--	#N/A	3.48	--	25.06	--	--	2.00	19.92	24.39	4.47	0.01	PVC	PVC	15	25.06	7.0	N	13.92	--	--
MW-362-35	MW-362-35	On-site	11/17/2013	--	#N/A	3.21	--	35.67	--	--	2.00	30.56	35.13	4.57	0.01	PVC	PVC	25	35.67	7.0	N	23.56	--	--
MW-362-50	MW-362-50	On-site	11/17/2013	--	#N/A	3.02	--	49.92	--	--	2.00	44.91	49.39	4.48	0.01	PVC	PVC	40	49.92	7.0	N	37.91	--	--
MW-362-80	MW-362-80	On-site	11/16/2013	--	#N/A	3.02	--	80.31	--	--	2.00	75.29	79.79	4.50	0.01	PVC	PVC	70	80.31	7.0	N	68.29	--	--
MW-362-150	MW-362-150	On-site	11/7/2013	--	#N/A	3.00	--	150.65	--	--	2.00	145.91	150.47	4.56	0.01	PVC	PVC	139	150.65	10.0	N	135.91	--	--
MW-363-15	MW-363-15	On-site	11/9/2013	--	#N/A	3.16	--	15.69	--	--	2.00	5.66	15.24	9.58	0.01	PVC	PVC	3	15.69	9.5	Y	-3.84	--	--
MW-364-15	MW-364-15	On-site	11/25/2013	--	#N/A	3.68	--	15.54	--	N/A	2	5.37	14.94	9.57	0.01	PVC	PVC	2.4	15.54	9.0	Y	-3.63	--	--
MW-364-30	MW-364-30	On-site	11/25/2013	--	#N/A	3.42	--	30.29	--	N/A	2	25.18	29.65	4.47	0.01	PVC	PVC	19	30.29	9.0	N	16.18	--	--
MW-364-65	MW-364-65	On-site	11/12/2013	--	#N/A	3.10	--	65.79	--	N/A	2	60.75	65.23	4.48	0.01	PVC	PVC	54	65.79	9.0	N	51.75	--	--
MW-364-90	MW-364-90	On-site	11/24/2013	--	#N/A	3.30	--	90.29	--	N/A	2	85.28	89.76	4.48	0.01	PVC	PVC	79	90.29	9.0	N	76.28	--	--
MW-364-150	MW-364-150	On-site	11/11/2013	--	#N/A	3.17	--	150.81	--	N/A	2	145.64	150.12	4.48	0.01	PVC	PVC	139	150.81	9.0	N	136.64	--	--
MW-365-15	MW-365-15	On-site	Installation Pending	--	--	--	--	--	--	N/A	2	--	--	--	0.01	PVC	PVC	--	--	--	Y	--	--	--
MW-366-15	MW-366-15	On-site	Installation Pending	--	--	--	--	--	--	N/A	2	--	--	--	0.01	PVC	PVC	--	--	--	Y	--	--	--
MW-367-15	MW-367-15	On-site	Installation Pending	--	2.91	--	--	16.17	--	N/A	2	5.98	15.53	9.55	0.01	PVC	PVC	3	16.17	9.5	Y	-3.52	--	--
MW-368-15	MW-368-15	On-site	Installation Pending	--	2.75	--	--	15.78	--	--	2.00	5.72	15.29	9.57	0.01	PVC	PVC	3	15.78	9.5	Y	-3.78	--	--
MW-369-15	MW-369-15	On-site	Installation Pending	--	--	--	--	--	--	--	2.00	--	--	--	0.01	PVC	PVC	--	--	--	Y	--	--	--
MW-369-55	MW-369-55	On-site	Installation Pending	--	--	--	--	--	--	--	2.00	--	--	--	0.01	PVC	PVC	--	--	--	N	--	--	--
MW-369-75	MW-369-75	On-site	Installation Pending	--	--	--	--	--	--	--	2.00	--	--	--	0.01	PVC	PVC	--	--	--	N	--	--	--
MW-370-15	MW-370-15	On-site	Installation Pending	--	--	--	--	--	--	--	2.00	--	--	--	0.01	PVC	PVC	--	--	--	Y	--	--	--
MW-370-55	MW-370-55	On-site	Installation Pending	--	--	--	--	--	--	--	2.00	--	--	--	0.01	PVC	PVC	--	--	--	N	--	--	--
MW-370-75	MW-370-75	On-site	Installation Pending	12/6/2013	--	#N/A	3.00	75.8	--	N/A	2.00	70.59	75.14	4.55	0.01	PVC	PVC	65	75.8	7.0	N	63.59	--	--
MW-371-15	MW-371-15	On-site	Installation Pending	--	--	--	--	--	--	--	2.00	--	--	--	0.01	PVC	PVC	--	--	--	Y	--	--	--
MW-371-55	MW-371-55	On-site	Installation Pending	--	--	--	--	--	--	--	2.00	--	--	--	0.01	PVC	PVC	--	--	--	N	--	--	--
MW-371-75	MW-371-75	On-site	Installation Pending	--	--	--	--	--	--	--	2.00	--	--	--	0.01	PVC	PVC	--	--	--	N	--	--	--
MW-371-PF	MW-371-PF	On-site	Installation Pending	--	--	--	--	--	--	--	2.00	--	--	--	0.01	PVC	PVC	--	--	--	N	--	--	--
PW ID 1230	PW-1230	Off-site	10/6/1982	Aug-2013	486.05	1.18	484.9	231.00	253.87	33.0	6.00	no screen- open casir	--	--	0.01	steel	steel	--	--	7.0	--	--	3933784.83	1428231.43
O-1	O-1	On-site	9/23/2010	Nov-2012	497.14	2.60	494.5	15.09	479.45	--	2.00	4.94	489.60	14.67	0.02	PVC	PVC	4.0	17.0	9.2	Y	-4.3	3925973.83	1429619.47
O-10	O-10	On-site	9/16/2011	Nov-2012	496.36	2.76	493.6	16.37	477.23	--	4.00	6.38	487.22	16.03	0.01	PVC	PVC	4.0	16.0	6.1	Y	0.3	3926386.30	1429760.78
O-11	O-11	On-site	9/20/2011	Aug-2013	497.90	3.20	494.7	16.00	478.30	--	2.00	6.41	488.29	15.90	0.01	PVC	PVC	3.6	15.5	7.8	Y	-1.4	3927247.94	1429025.71
O-12	O-12	On-site	9/21/2011	Sept-2013	496.28	3.66	492.6	16.99																

**Table 3-1**  
**Well Construction Details**  
**Offsite Site Characterization Report - 2013 Addendum**  
**Flint Hills Resources Alaska, LLC**  
**North Pole Refinery, North Pole, Alaska**

Well	New Well Name	Proximity	Boring Completion Date	Survey Date	Riser Elevation (feet MSL)	Riser Stickup* (feet)	Ground Surface Elevation (feet MSL)	Well Depth (feet BGS)	Well Bottom Elevation (feet MSL)	Depth to Top of Permafrost (feet BGS)	Well Diameter (inches)	Well Screen					Riser Material	Filter Pack		WATER TABLE		ALASKA STATE PLANE					
												Depth to Top (feet BGS)	Top Elevation (feet MSL)	Depth to Bottom (feet BGS)	Bottom Elevation (feet MSL)	Length (feet)		Screen Slot Size (inches)	Material	Depth to Top (feet BGS)	Depth to Bottom (feet BGS)	Approx Depth (ft BGS)	In Screen	Feet above top of Screen	NORTHING	EASTING	
R-40	R-40	On-site	6/15/1989	Sept-2013	494.47	1.77	492.7	25.17	467.53	—	10.00	6.00	486.70	25.17	467.53	19.17	?	steel	steel	Natural pack	--	13.0	Y	-7.0	3927004.81	1429396.89	
R-42	R-42	On-site	5/15/2011	Aug-2013	493.29	1.49	491.8	35.00	456.80	—	8.00	15.00	476.80	35.00	456.80	20.00	0.04	ss	steel	Natural pack	--	12.0	Y	3.0	3926974.24	1428686.38	
R-43	R-43	On-site	11/28/2012	Aug-2013	495.45	2.17	493.3	40.98	452.30	—	12.00	5.84	487.44	40.98	452.30	35.14	0.008	ss	ss	Natural pack	--	7.0	Y	-1.2	3927046.41	1428881.33	
R-44	R-44	On-site	3/2/2013	Aug-2013	496.25	1.77	494.5	40.78	453.70	—	12.00	6.00	488.48	40.78	453.70	34.78	0.008	ss	ss	Natural pack	--	9.0	Y	-3.0	3927011.88	1429149.46	
R-45	R-45	On-site	3/8/2013	Aug-2013	495.97	2.91	493.1	32.25	460.81	—	12.00	7.26	485.80	32.25	460.81	24.99	0.008	ss	ss	Natural pack	--	7.0	Y	0.3	3927018.85	1429353.89	
R-46	R-46	On-site	3/15/2013	Aug-2013	496.10	1.92	494.2	30.88	463.30	—	12.00	6.00	488.18	30.88	463.30	24.88	0.008	ss	ss	Natural pack	--	8.0	Y	-2.0	3927033.10	1429663.67	
R-5	R-5	On-site	6/15/1986	Nov-2012	495.33	1.83	493.5	7.23	486.27	—	38.00	?	?	?	?	?	NA	culvert	--	--	--	9.0	?	?	3925824.93	1429309.40	
S-21	S-21	On-site	5/15/1987	Nov-2012	497.19	2.84	494.4	13.40	480.95	—	2.00	2.92	491.43	12.67	481.68	9.75	0.02	PVC	PVC	--	--	--	9.0	Y	-6.1	3926670.65	1429597.64
S-39	S-39	On-site	12/15/1989	Nov-2012	494.07	1.02	493.1	13.00	480.05	—	2.00	7.53	485.52	12.53	480.52	5.00	?	PVC	PVC	--	--	--	9.0	Y	-1.5	3927009.82	1429395.60
S-41R	S-41R	On-site	10/4/2013	Nov-2013	496.68	3.23	493.37	14.84	--	—	2.00	9.76	--	14.28	--	4.52	0.01	PVC	PVC	7.5	15	7.5	N	2.26	3925833.81	1429199.24	
S-43	S-43	On-site	6/15/1991	Sept-2013	496.29	2.21	494.1	13.00	481.08	—	4.00	3.37	490.71	12.70	481.38	9.33	?	PVC	PVC	--	--	--	9.0	Y	-5.8	3926779.88	1429530.33
S-44	S-44	On-site	6/15/1991	Sept-2013	495.03	2.47	492.6	13.00	479.56	—	4.00	3.16	489.40	12.64	479.92	9.48	?	PVC	PVC	--	--	--	9.0	Y	-5.8	3926922.12	1429493.61
S-50	S-50	On-site	7/15/1997	Sept-2013	496.70	2.77	493.9	15.00	478.93	—	4.00	3.88	490.05	13.56	480.37	9.68	0.02	PVC	PVC	--	--	--	9.0	Y	-5.1	3926779.29	1429065.48
S-51	S-51	On-site	6/15/1997	Sept-2013	495.92	2.94	493.0	15.00	477.98	—	2.00	4.75	488.23	14.43	478.55	9.68	0.02	PVC	PVC	--	--	--	9.0	Y	-4.3	3926824.07	1429045.61
S-54	S-54	On-site	7/15/1998	Nov-2012	497.01	3.03	494.0	15.00	478.98	—	2.00	10.00	483.98	15.00	478.98	5.00	0.02	PVC	PVC	--	--	--	12.0	Y	-2.0	3928055.37	1429680.65
S-9	S-9	On-site	8/15/2001	Nov-2012	495.12	2.89	492.2	19.80	472.43	—	2.00	4.88	487.35	18.88	473.35	14.00	0.01	PVC	PVC	--	--	--	7.5	Y	-2.6	3927494.32	1429112.46

**Notes:**  
BGS below ground surface  
CMT continuous multi-channel tubing  
MSL mean sea level  
ss stainless steel  
PVC polyvinyl chloride  
ABS acrylonitrile butadiene styrene  
NS not surveyed  
NA not applicable  
PF permafrost

**Table 3-2  
Total Organic Carbon Soil Analytical Data**

**Offsite Site Characterization Report - 2013 Addendum  
North Pole Refinery, North Pole, Alaska  
Flint Hills Resources Alaska, LLC**

Location	Sample Name	Sample Date	Work Order	Depth	Total Organic Carbon
					%
MW-347-150	MW-347-150 (90.7-91.0)	8/5/2013	1138213	90.7-91.0	0.0301J
MW-347-150	MW-347-150 (148.4-148.7)	8/5/2013	1138213	148.4-148.7	0.0624
MW-347-65	MW-347-65 (35.5-36.5)	9/2/2013	1138375	35.5-36.5	0.0648
MW-347-65	MW-347-65 (62-63)	9/2/2013	1138375	62-63	0.0594
MW-350-50	MW-350-50(20-21.5)	8/18/2013	1138300	20-21.5	0.0542J
MW-350-50	MW-350-50(50-51.5)	8/18/2013	1138300	50-51.1	0.0783
MW-352-40	MW-352-40 (15-16.5)	9/2/2013	1138375	15-16.5	0.0599
MW-352-40	MW-352-40 (42.5-44)	9/2/2013	1138375	42.5-44	0.0825
MW-353-100	MW-353-100(50.0-51.5)	9/5/2013	1138413	50.0-51.5	0.0708
MW-353-100	MW-353-100(110-111.5)	9/5/2013	1138413	110-111.5	0.0386J
MW-353-65	MW-353-65(35-36.5)	9/6/2013	1138413	35-36.5	0.0522J
MW-353-65	MW-353-65(62-63.5)	9/6/2013	1138413	62-63.5	0.118

**Acronyms and Abbreviations:**

mg/kg = milligrams per kilogram

J = estimated concentration; detected above the detection limit (DL) but below the limit of quantitation (LOQ)

JL\* = result is considered estimated, biased low

% = percent

**Table 5-1**  
**Hydraulic Conductivity and Grain Size Summary**  
**Offsite Site Characterization Report - 2013 Addendum**  
**North Pole Refinery, North Pole, Alaska**  
**Flint Hills Resources Alaska, LLC**

Boring <sup>a</sup>	Sample ID	Sample Depth (ft)	Blow Count	Relative Density Classification	Grain Size Analysis Results					Soil Type	Hazen			Prugh			Barr			
					Gravel Content (%)	Sand Content (%)	Fines Content (%)	D10 (mm)	D20 (mm)		D50 (mm)	D60 (mm)	Cu	K D10 (m/s)	K D10 (cm/s)	K D10 (ft/day)		K D50 (m/s)	K D50 (cm/s)	K D50 (ft/day)
MW-110-65	S-7	15.0-16.5	4	L	46.3	29.4	24.3	0.010	0.041	0.870	7.710	770	GM							1.2
MW-110-65	S-11	25.0-26.5	17	MD	62.3	33.1	4.6	0.160	0.230	7.320	10.220	64	GP							91
MW-110-65	S-13	30.0-31.5	22	MD	64.2	32.9	2.9	0.210	0.420	7.480	10.160	48	GP							170
MW-110-65	S-15	35.0-36.5	21	MD	54.4	41.3	4.3	0.170	0.270	5.430	7.350	43	GP							100
MW-110-65	S-20	62.5-64.0	63	VD	29.9	60.0	10.1	0.070	0.200	2.100	3.150	45	SP-SM							33
MW-144BR	S-17	92'-95'	29	D	48.0	50.9	1.1	2.220	2.800	4.570	5.870	2.6	SP	5.91E-02	5.91E+00	17000	4.30E-03	4.30E-01	1200	1800
MW-148-100	S-5	10.0-11.5	20	MD	61.0	33.9	5.1	0.160	0.380	7.760	11.480	72	GW-GM							96
MW-148-100	S-11	40.0-41.5	17	MD	64.2	33.1	2.7	0.260	0.940	7.700	10.530	41	GW							240
MW-148-100	S-13	60.0-61.5	20	MD	61.7	34.7	3.6	0.270	0.780	7.550	10.970	41	GW							190
MW-148-100	S-16	90.0-91.5	26	MD	63.0	31.6	5.4	0.200	0.860	7.840	11.620	58	GW-GM							120
MW-148-100	S-18	107.5-109.0	32	D	50.0	42.2	7.8	0.110	0.340	4.760	6.480	59	GW-GM							59
MW-148-80	S-1	77.5-79.0	21	MD	37.6	58.4	4.0	0.160	0.230	2.130	4.060	25	SP							85
MW-148D	S-13	150'-152'	50 for 6"	VD	22.0	72.8	5.2	0.110	0.180	0.280	0.350	3.2	SP-SM	1.09E-04	1.09E-02	31	1.10E-04	1.10E-02	31	26
MW-151C	S-151C-1	15' - 16.5'	14	MD	52.0	43.5	4.5	0.150	0.220	5.400	9.740	65	GP							87
MW-151C	S-151C-2	25' - 26.5'	23	MD	0.0	94.0	6.0	0.100	0.170	0.610	4.430	44	SP-SM							35
MW-151C	S-151C-3	40' - 41.5'	24	MD	2.0	95.3	2.7	0.110	0.160	0.220	0.250	2.3	SP	1.21E-04	1.21E-02	34	2.00E-04	2.00E-02	57	24
MW-152C	S-4	60'-62'	20	MD	55.0	39.7	5.3	0.190	0.370	5.800	8.690	46	GP-GM							97
MW-153	S-3	59' - 60'	50/3"	D	47.0	48.4	4.6	0.160	0.230	3.070	7.290	46	SP							84
MW-154B	S-154-1	75' 76.5'	22	MD	43.0	36.7	6.3	0.110	0.190	2.340	5.730	52	SP-SM							19
MW-154B	S-154-2	90' - 91.5'	30	MD	0.0	94.7	5.3	0.160	0.250	2.190	4.360	27	SP-SM							69
MW-154B	S-154-3	103.5' - 104'	50/6"	D	0.0	85.6	14.4	0.020	0.160	2.500	4.440	220	SM							4.5
MW-156B	S-156-1	20' - 21.5'	28	MD	51.0	43.4	5.6	0.130	0.230	4.940	8.270	64	GP-GM							71
MW-156B	S-156-2	55' - 56'	50	D	48.0	46.8	5.2	0.140	0.230	3.160	6.960	50	GP-GM							73
MW-157B	S-2	25'-27'	22	MD	38.0	56.1	5.9	0.130	0.190	0.590	3.340	26	SP-SM							41
MW-158B	S-12	60' - 60.5'	50/5"	D	56.0	41.1	2.9	0.250	0.330	5.880	8.550	34	GP							170
MW-159C	S-7	70'-72'	26	MD	42.0	54.1	3.9	0.170	0.270	2.470	5.140	30	SP							96
MW-160B	S-160-1	20' - 21'	18	MD	0.0	96.3	3.7	0.150	0.180	0.280	0.310	2.1	SP	2.25E-04	2.25E-02	64	3.10E-04	3.10E-02	88	30
MW-160B	S-160-2	38' - 39.5'	19	MD	59.0	38.4	2.6	0.370	0.640	6.840	9.900	27	GW							270
MW-160B	S-160-3	55' - 56.5'	19	MD	69.0	28.3	2.7	0.230	0.620	9.370	11.990	52	GP							210
MW-160B	S-160-4	70' - 71.5'	22	MD	64.0	33.3	2.7	0.270	0.820	9.760	13.600	50	GW							240
MW-160B	S-160-5	90' - 91.5'	59	D	44.0	50.9	5.1	0.160	0.270	2.860	5.990	37	SP-SM							80
MW-161-30	S-4	25.0-26.5	31	D	5.1	86.3	8.6	0.080	0.130	0.220	0.250	3.1	SP-SM				7.70E-05	7.70E-03	22	15
MW-161B	S-11	50' - 51.5'	77	D	74.0	24.6	1.4	0.320	2.710	10.910	14.210	44	GP							550
MW-162B	S-162-1	10' - 12'	26	MD	44.0	52.7	3.3	0.160	0.210	2.250	6.060	38	SP							93
MW-162B	S-162-2	30' - 32'	34	D	60.0	34.7	5.3	0.150	0.280	7.650	11.570	77	GP-GM							84
MW-162B	S-162-3	55' - 56.5'	20	MD	62.0	35.4	2.6	0.220	0.770	7.460	10.350	47	GP							210
MW-162B	S-162-4	65' - 66.1'	66	D	63.0	30.5	6.5	0.140	0.370	9.240	13.600	97	GW-GM							76
MW-163B	S	40' - 41.5'	50/2"	D	38.0	54.8	7.2	0.120	0.190	0.410	3.190	27	SP-SM							32
MW-164B	S	50' - 51.5'	18	MD	66.0	30.9	3.1	0.240	0.540	9.770	12.360	52	GP							190
MW-164C	S-1	50'-51.5'	19	MD	59.0	36.4	4.6	0.180	0.320	7.100	11.080	62	GP							100
MW168B	S-5	50'-52'	41	D	51.0	45.1	3.9	0.180	0.290	5.030	7.690	43	GP							110
MW-169B	S-1	50' - 51.5'	64	D	60.0	36.0	4.0	0.180	0.370	7.630	11.660	65	GW							120
MW-169C	S-1	60'-61.5'	14	MD	68.0	30.1	1.9	0.190	0.380	10.370	15.450	81	GP							200
MW-170C	S-170C-3	55' - 56.5'	41	D	58.0	37.0	5.0	0.170	0.450	6.450	9.350	55	GP							100
MW-170C	S-170C-4	80' - 81.5'	26	MD	54.0	37.3	8.7	0.080	0.150	6.130	10.700	130	GP-GM							41
MW-170C	S-170C-5	95' - 96.5'	30	D	8.0	84.8	7.2	0.090	0.160	0.260	0.300	3.3	SP-SM				1.00E-04	1.00E-02	28	19
MW-170D	S-1	50' - 51.5'	31	D	68.0	27.2	4.8	0.180	0.400	11.620	15.830	88	SP							110
MW-174-15	S-1	0.0-1.5	12	MD	58.2	35.1	6.7	0.140	0.290	6.800	9.950	71	GW-GM							69
MW-174-15	S-2	2.5-4.5	5	L	2.8	10.4	86.8	NM	0.006	0.020	0.030	NM	ML							0.088
MW-174-15	S-3	5.0-7.0	8	L	11.3	27.0	61.7	0.010	0.013	0.050	0.070	7	ML							0.39
MW-174-15	S-4	7.5-9.5	23	MD	56.8	38.7	4.5	0.170	0.310	6.210	9.990	59	GP							100
MW-174-15	S-5	10.0-12.0	18	MD	58.0	34.1	7.9	0.100	0.250	6.970	10.970	110	GW-GM							54
MW-174-15	S-6	12.5-14.5	17	MD	69.2	24.0	6.8	0.100	0.300	12.960	31.400	310	GP-GM							65
MW-174B	S-14	90' - 91.5'	32	D	33.0	60.1	6.9	0.120	0.250	2.040	3.350	28	SP-SM							54
MW-176A	S-1	15' - 16.5'	12	MD	61.0	36.0	3.0	0.180	0.390	7.830	11.380	63	GW							150
MW-176B	S-2	50' - 51.5'	13	MD	80.0	18.9	1.1	0.750	4.520	13.240	17.780	24	GP							1400
MW-176C	Sample	90' - 91.5'	33	D	45.0	51.0	4.0	0.190	0.270	3.250	6.500	34	SP							100
MW-177	S-14	90' - 91.5'	22	MD	14.0	80.2	5.8	0.110	0.340	0.280	0.330	3	GP	9.68E-05	9.68E-03	27	2.20E-04	2.20E-02	62	41
MW-178C	S-14	90' - 91.5'	43	D	57.0	40.3	2.7	0.210	0.170	6.770	10.590	50	GP							150
MW-179C	S-14	90' - 91.5'	28	MD	57.0	39.9	3.1	0.270	0.760	6.370	9.790	36	GW							210
MW-179D	S-4A	130'-131.1'	47	D	5.0	78.8	6.2	0.090	0.170	0.210	0.240	2.7	SP-SM				9.00E-05	9.00E-03	26	12
MW-181A	Sample	15' - 16.5'	14	MD	48.0	50.3	1.7	0.190	0.300	4.030	6.800	36	SP							170
MW-181B	Sample	50' - 51.5'	34	D	43.0	53.5	3.5	0.160	0.210	2.250	6.160	39	SP							91
MW-181C	S-10	150'-152'	32	D	38.0	57.6	4.4	0.170	0.290	1.590	4.030	24	SP							82

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Boring <sup>a</sup>	Sample ID	Sample Depth (ft)	Blow Count	Relative Density Classification	Grain Size Analysis Results						Soil Type	Hazen			Prugh			Barr		
					Gravel Content (%)	Sand Content (%)	Fines Content (%)	D10 (mm)	D20 (mm)	D50 (mm)		D60 (mm)	Cu	K D10 (m/s)	K D10 (cm/s)	K D10 (ft/day)	K D50 (m/s)		K D50 (cm/s)	K D50 (ft/day)
MW-182	S-1	15' - 16.5'	5	L	34.0	61.4	4.6	0.130	0.180	0.400	2.470	19	GP							38
MW-183	S-1	15' - 16.5'	6	L	18.0	76.4	5.6	0.100	0.160	0.280	0.340	3.4	SP-SM				2.20E-04	2.20E-02	62	23
MW-183B	S-4B	58'-59.5'	50 for 6"	VD	59.0	34.8	6.2	0.120	0.330	7.100	10.590	88	GW-GM							73
MW-184	S-1	44' - 44.5'	50/1"	D	26.0	68.4	5.6	0.140	0.210	0.350	0.410	2.9	SP-SM	1.57E-04	1.57E-02	44	1.60E-04	1.60E-02	45	32
MW-185A	S-1	15' - 16.5'	10	L	46.0	52.7	1.3	0.180	0.250	2.270	6.960	39	SP							150
MW-185B	S-1	50' - 51.5'	21	MD	47.0	50.0	3.0	0.170	0.240	3.450	6.460	38	SP							110
MW-185C	S-8	120'-122'	72	VD	28.0	67.3	4.7	0.150	0.200	0.370	0.680	4.5	SP	1.80E-04	1.80E-02	51	1.10E-04	1.10E-02	31	37
MW-186	B-1	10' - 11.5'	4	L	72.0	25.3	2.7	0.380	2.640	7.560	9.330	25	GP							350
MW-186	B-2	20' - 21.5'	5	L	74.0	24.1	1.9	0.240	2.680	10.800	13.620	57	GP							360
MW-186	B-3	30' - 31.5'	16	MD	57.0	38.6	4.4	0.160	0.280	6.470	9.990	62	GP							98
MW-186	B-4	40' - 41.5'	10	L	76.0	22.5	1.5	0.450	3.260	12.360	16.640	37	GP							700
MW-186	B-5	50' - 51.5'	23	MD	74.0	23.5	2.5	0.330	2.700	12.030	17.500	53	GP							360
MW-186	B-6	60' - 61.5'	59	D	51.0	44.8	4.2	0.160	0.240	4.920	7.650	48	GP							95
MW-186C	S-1	100' - 101.5'	41	D	53.0	42.2	4.8	0.200	0.730	5.440	8.080	40	GW							120
MW-186D	S-2	130'-131.5'	44	D	46.0	48.0	6.0	0.180	0.310	3.960	5.980	33	Sw-SM							79
MW-187	S-1	15' - 16.5'	29	MD	55.0	40.8	4.2	0.180	0.300	5.780	8.660	48	GP							110
MW-188A	S-1	15'-17'	21	MD	63.0	33.6	3.4	0.190	0.600	8.080	11.180	59	GP							160
MW-189B	S-12	60'-61.5'	44	D	46.0	50.1	3.9	0.170	0.270	2.960	6.540	38	SP							99
MW-190-150	S-11	80.0-81.5'	39	D	42.6	47.9	9.5	0.080	0.190	2.290	6.030	75	SP-SM							38
MW-190-150	S-12	100.0-101.5'	38	D	45.6	46.4	8.0	0.100	0.190	3.120	7.060	71	SP-SM							46
MW-190-150	S-13	115.0-116.5'	64	VD	50.4	42.3	7.3	0.130	0.280	4.870	9.540	73	GP-GM							61
MW-190-150	S-14	130.0-131.5'	33	D	48.2	44.4	7.4	0.130	0.380	4.230	6.720	52	GW-GM							64
MW-190-150	S-15	150.0-151.5'	56	VD	35.1	60.3	4.6	0.110	0.280	0.730	2.460	22	SP-SM							53
MW-190A	S-1	14'-15.5'	11	MD	54.0	42.4	3.6	0.170	0.290	5.680	9.130	54	GP							120
MW-190B	S-10	60'-61.5'	21	MD	42.0	54.2	3.8	0.150	0.210	2.300	5.390	36	SP							84
MW-190BR	S-8R	40.0-41.5'	19	MD	61.4	33.3	5.3	0.170	0.380	8.250	13.050	77	GP-GM							96
MW-190BR	S-10R	60.0-61.5'	21	MD	9.4	78.4	12.2	0.050	0.130	0.330	0.400	8	SM				2.00E-05	2.00E-03	5.7	11
MW-191A	S-1	13'-15'	20	MD	59.0	36.3	4.7	0.160	0.290	6.900	10.160	64	GP							95
MW-191B	S-10	60'-61.5'	60	VD	56.0	38.6	5.4	0.150	0.300	6.040	8.870	59	GW-GM							84
MW-193A	S-8	15'-17'	2	VL	0.0	62.5	37.5	0.030	0.044	0.100	0.130	4.3	SM				2.00E-05	2.00E-03	5.7	2.4
MW-193B	S-10	58'-60'	50 for 6"	VD	5.0	90.5	4.5	0.160	0.220	0.330	0.380	2.4	SP	2.05E-04	2.05E-02	58	2.10E-04	2.10E-02	60	35
MW-194B	S-6	11'-13'	18	MD	51.0	43.4	5.6	0.150	0.310	4.910	7.290	49	GP-GM							81
MW-194B	S-8	30'-31.5'	19	MD	70.0	24.0	6.0	0.150	1.100	13.080	17.730	120	GP-GM							100
MW-195	S-8	14'-16'	17	MD	1.0	90.8	8.2	0.080	0.130	0.190	0.210	2.6	SP-SM				1.40E-04	1.40E-02	40	14
MW-195B	MW-195B-150-150-151	150'-151'	72	VD	46.0	47.1	6.9	0.130	0.310	3.740	6.070	47	SP-SM							64
MW-196	S-8	14'-16'	21	MD	51.0	45.1	3.9	0.150	0.230	5.070	9.520	63	GP							96
MW-197B	S-12	150'-152'	50-6"	VD	58.0	35.2	6.8	0.130	0.340	6.500	9.710	75	GW-GM							69
MW-198	S-8	150'-152'	34	D	27.0	67.9	5.1	0.160	0.250	0.560	0.820	5.1	SP-SM				1.60E-04	1.60E-02	45	47
MW-199	S-10-(PF-2)	150'-151.5'	37	D	46.0	47.2	6.8	0.130	0.290	3.400	6.390	49	SP-SM							63
MW-300	MW-300-150-150-151	150'-150.5'	50-6"	VD	41.0	50.2	8.8	0.090	0.200	1.680	5.080	56	SP-SM							39
MW-302-110	S-7	110'-112'	39	D	43.0	47.1	9.9	0.080	0.270	2.580	5.390	67	SP-SM							41
MW-302-70	S-302-70-1	65'-67'	33	D	60.0	32.8	7.2	0.130	0.280	8.360	13.010	100	GW-GM							64
MW-302-80	S-302-80-1	75'-77'	19	MD	62.0	32.0	6.0	0.140	0.270	9.390	13.880	99	SM							75
MW-303-130	S-9A	130'-131'	50 for 5"	VD	47.0	48.3	4.7	0.160	0.270	3.460	6.610	41	SP							88
MW-303-130	S-9B	131'-132'	50 for 5"	VD	36.0	50.0	14.0	0.040	0.180	0.840	3.290	82	SM							11
MW-303-70	S-1&2	65'-67'&70'-72'	20&16	MD	49.0	45.5	5.5	0.170	0.300	4.440	6.820	40	GP-GM							84
MW-303-80	S-303-80-1	75'-77'	57	VD	38.0	49.4	12.6	0.040	0.170	0.810	3.770	94	SM							12
MW-304-150	S-2	150'-152'	46	D	52.0	39.3	8.7	0.100	0.310	5.140	7.960	80	GW-GM							52
MW-304-70	S-1	65'-67'	48	D	58.0	35.3	6.7	0.150	0.340	6.820	10.630	71	GW-GM							73
MW-304-80	S-304-80-1	75'-77'	29	MD	56.0	37.6	6.4	0.150	0.300	6.420	10.220	68	GP							73
MW-305-80	MW-305-80-1	75'-77'	30	MD	55.0	37.6	7.4	0.120	0.320	5.950	9.580	80	GP							62
MW-305A	S-6	100'-102'	39	D	44.0	51.7	4.3	0.150	0.240	3.020	5.820	39	SP							85
MW-306-70	S-306-70-1	65'-67'	21	MD	49.0	45.7	5.3	0.160	0.410	4.600	6.300	39	GW-GM							92
MW-306-70	S-14	70'-72'	66	VD	30.0	64.4	5.6	0.130	0.190	0.390	0.920	7.1	SP-SM				2.00E-05	2.00E-03	5.7	34
MW-306-80	S-306-80-1	75'-77'	32	D	66.0	28.0	6.0	0.150	0.370	10.280	14.180	95	SM							83
MW-306A	S-150	150'-152'	61	VD	45.0	49.9	5.1	0.160	0.290	3.090	5.750	36	SP-SM							83
MW-307	S-9	110.0'-111.5'	35	D	47.0	45.0	8.0	0.110	0.280	3.820	5.960	54	GP-GM							54
MW-332-110	S-10N	80.0-81.5'	23	MD	54.1	40.2	5.7	0.160	0.310	5.590	8.310	52	GP-GM							82
MW-332-110	S-12N	110.0-111.5'	22	MD	47.0	47.4	5.6	0.160	0.310	4.030	6.140	38	SP-SM							81
MW-332-41	S-8N	40.0-41.5'	67	VD	65.7	30.5	3.5	0.200	0.550	9.380	12.560	63	GP							150
MW-332-75	S-9N	60.0-61.5'	25	MD	62.9	32.4	4.7	0.220	0.850	9.370	14.450	66	GW							140
MW-332-75	S-10N	75.3-76.5'	30	MD	2.4	90.6	7.0	0.090	0.140	0.200	0.220	2.4	SP-SM				1.30E-04	1.30E-02	37	16
MW-334-85	S-2	6.5-8.0'	12	MD	0.4	29.4	69.4	0.010	0.020	0.050	0.060	6	ML							0.42
MW-334-85	S-4	75.0-76.5'	32	D	58.0	37.0	5.0	0.170	0.300	7.260	11.370	67	GP							94



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Boring <sup>a</sup>	Sample ID	Sample Depth (ft)	Blow Count	Relative Density Classification	Grain Size Analysis Results						Soil Type	Hazen			Prugh			Barr	
					Gravel Content (%)	Sand Content (%)	Fines Content (%)	D10 (mm)	D20 (mm)	D50 (mm)		D60 (mm)	Cu	K D10 (m/s)	K D10 (cm/s)	K D10 (ft/day)	K D50 (m/s)		K D50 (cm/s)
MW-334-85	S-5	82.5-84.0	54	VD	30.2	64.3	55.0	0.150	0.220	0.560	1.840	12	GP-GM						44
MW-336-15	S-2	2.5-4.0	29	MD	53.7	38.5	7.8	0.100	0.250	5.530	8.360	84	GP-GM						54
MW-336-15	S-5	10.0-11.5	16	MD	49.1	46.4	4.5	0.160	0.240	4.260	7.470	47	GP						90
MW-336-20	S-7	12.5-14.0	13	MD	55.8	41.2	3.0	0.220	0.340	6.210	9.740	44	GP						160
MW-336-20	S-9	17.5-19.0	14	MD	62.7	32.6	4.7	0.160	0.290	8.610	14.420	90	GW						96
MW-336-35	S-1	32.0-33.5	35	D	64.7	30.8	4.5	0.190	0.600	8.780	12.310	65	GP						130
MW-336-55	S-14 Top	30.0-30.9	21	MD	51.8	41.3	6.9	0.180	0.410	16.540	21.770	120	GP						77
MW-336-55	S-14 Bottom	30.9-31.5	21	MD	51.8	41.3	6.9	0.110	0.210	5.290	9.720	88	GP-GM						57
MW-336-55	S-15	40.0-41.5	31	D	58.7	36.5	4.8	0.170	0.370	6.580	9.550	56	GW						100
MW-336-55	S-16	50.0-51.5	6	L	54.9	42.5	2.6	0.180	0.270	5.720	8.350	46	GP						140
MW-336-55	S-17	51.5-53.0	21	MD	65.9	30.7	3.4	0.220	0.860	7.940	10.690	49	GP						180
MW-337-20	S-3	7.5-9.5	29	MD	53.9	41.7	4.4	0.180	0.330	5.520	8.050	45	GP						110
MW-337-20	S-5	12.5-14.5	13	MD	53.2	42.8	4.0	0.150	0.250	5.390	7.980	53	GP						97
MW-337-20	S-7	17.5-19.5	24	MD	71.0	24.4	4.6	0.160	0.510	12.690	16.780	100	GP						120
MW-338-15	HS-1	2.5-4.0	40	D	0.0	41.6	58.4	0.020	0.041	0.070	0.080	4	ML						1.3
MW-338-15	HS-2	5.0-6.5	50 (6)	D	37.5	44.6	17.9	0.050	0.080	0.230	3.290	66	SM						8.8
MW-338-15	HS-3	7.5-9.0	42	D	68.1	28.0	3.9	0.210	1.000	11.120	16.250	77	GP						170
MW-338-15	HS-5	12.5-14.0	20	MD	39.1	58.0	2.9	0.180	0.280	6.740	9.310	52	SP						130
MW-338-15	HS-6	14.5-16.0	18	MD	55.8	41.5	2.7	0.180	0.260	5.660	7.660	43	GP						140
MW-338-50	S-7	20.0-21.5	11	MD	71.3	26.5	2.2	0.250	1.600	12.020	17.050	68	GP						310
MW-338-50	S-8	25.0-26.5	11	MD	41.0	54.9	4.1	0.140	0.200	0.920	4.950	35	SP						61
MW-338-50	S-9	30.0-31.5	25	MD	60.7	36.4	2.9	0.210	0.390	7.010	10.000	48	GW						160
MW-338-50	S-10	50.0-51.5	80	VD	57.6	36.8	5.6	0.150	0.300	7.280	11.710	78	GP-GM						82
MW-339-15	S-6N	15.0-16.5	17	MD	58.1	38.3	3.6	0.180	0.320	6.760	10.290	57	GP						120
MW-339-50	S-3	7.5-9.0	18	MD	50.4	38.5	11.1	0.060	0.180	4.820	6.960	120	GP-GM						27
MW-339-50	S-5	12.5-14.0	24	MD	38.9	57.3	3.8	0.120	0.180	0.520	3.910	33	SP						46
MW-339-50	S-7	20.0-21.5	14	MD	50.4	46.5	3.1	0.170	0.280	4.810	6.810	40	GP						120
MW-339-50	S-8	25.0-26.5	22	MD	59.0	37.4	3.6	0.190	0.310	7.290	10.720	56	GP						130
MW-339-50	S-12	55.0-56.0	50 (4")	D	66.2	29.9	3.9	0.240	1.100	8.690	11.670	49	GP						180
MW-340-150	S-5	12.5-14.0	11	MD	47.3	49.5	3.2	0.320	1.000	4.270	5.680	18	SW						220
MW-340-150	S-10	35.0-36.5	29	MD	57.9	38.0	4.1	0.180	0.390	6.520	9.690	54	GW						120
MW-340-150	S-14	90.0-91.5	21	MD	57.3	36.7	6.0	0.170	0.650	6.770	11.580	68	GW						95
MW-340-150	S-16	130.0-131.5	45	D	49.2	44.0	6.8	0.150	0.380	4.530	6.720	45	GW-GM						72
MW-340-150	S-17	150.0-151.5	36	D	49.2	44.3	6.5	0.160	0.500	4.560	6.610	41	GW						81
MW-340-65	S-12N	65.0-66.5	17	MD	43.4	51.8	4.8	0.150	0.230	2.600	5.710	38	SP						77
MW-341-40	S-1	3.0-4.0	31	D	0.0	56.4	43.6	0.020	0.039	0.080	0.100	5	SM						1.4
MW-341-40	S-2	5.0-6.5	50 (5")	MD	0.0	55.4	44.6	0.010	0.018	0.090	0.120	12	SM						0.57
MW-341-40	S-4	10.0-11.5	13	MD	57.7	38.9	3.4	0.230	0.360	6.440	9.540	41	GP						150
MW-341-40	S-8	30.0-31.5	19	MD	56.8	39.6	3.6	0.180	0.310	6.100	8.820	49	GP						120
MW-341-40	S-9	43.0-43.8	36-50 (3")	D	72.8	22.2	5.0	0.210	1.700	16.090	24.730	120	GP						150
MW-343-50	S-1	2.5-4.0	4	VL	0.0	26.3	73.7	NM	0.005	0.030	0.040	NM	ML						0.1
MW-343-50	S-2	5.0-6.5	10	L	62.3	33.2	4.5	0.170	0.380	8.090	11.930	70	GW						110
MW-343-50	S-4	10.0-11.5	13	MD	56.6	39.9	3.5	0.160	0.250	6.730	11.240	70	GP						110
MW-343-50	S-6	20.0-21.5	24	MD	62.4	34.2	3.4	0.200	0.450	8.490	11.710	59	GW						150
MW-343-50	S-8	30.0-31.5	12	MD	62.4	34.2	3.4	0.270	0.450	7.630	10.360	38	GW						170
MW-344-55	S-1N	17.0-19.0	10	MD	60.2	36.6	3.2	0.170	0.340	7.510	10.960	64	GW						130
MW-344-55	S-2N	22.0-24.0	14	MD	37.6	57.5	4.9	0.140	0.190	0.400	3.060	22	SP						40
MW-344-55	S-3N	27.0-29.0	35	D	49.6	43.7	6.7	0.120	0.230	4.560	7.260	61	GP-GM						61
MW-344-55	S-5N	45.0-47.0	29	MD	68.6	27.7	3.7	0.230	1.210	11.160	15.740	68	GP						190
MW-344-55	S-6N	53.0-55.0	28	MD	63.2	33.3	3.5	0.190	0.440	9.100	13.590	72	GW						140
MW-344-75	S-1	6.0-8.0	29	MD	62.6	31.0	6.4	0.140	0.280	5.210	7.470	53	GP-GM						71
MW-344-75	S-3	20.0-22.0	17	MD	62.0	34.0	4.0	0.150	0.280	8.410	13.290	89	GP						100
MW-344-75	S-5	30.0-32.0	49	D	46.8	49.3	3.9	0.160	0.230	1.910	6.740	42	SP						85
MW-344-75	S-8	60.0-62.0	46	D	52.9	41.6	5.5	0.130	0.220	5.750	10.780	83	GP-GM						72
MW-344-75	S-9	70.0-72.0	64	VD	55.5	38.5	6.0	0.160	0.370	6.420	10.730	67	GW-GM						83
MW-345-15	S-1	7.5-9.0	8	L	69.2	27.9	2.9	0.220	0.650	10.700	15.020	68	GP						200
MW-345-15	S-2	10.0-11.5	16	MD	55.5	38.5	6.0	0.110	0.210	7.030	12.350	110	GP-GM						63
MW-345-15	S-3	12.5-13.5	24	MD	2.7	79.8	17.5	0.040	0.080	0.160	0.180	4.5	SM			2.80E-05	2.80E-03	7.9	5.2
MW-345-15	S-5	15.0-16.5	25	MD	60.5	36.1	3.4	0.170	0.300	8.570	13.150	77	GP						120
MW-345-55	S-3	20.0-21.5	13	MD	35.5	60.6	3.9	0.160	0.200	0.380	1.340	8.4	SP			1.90E-05	1.90E-03	5.4	44
MW-345-55	S-5	30.0-31.5	17	MD	61.0	35.7	3.3	0.220	0.570	7.100	10.170	46	GW						170
MW-345-55	S-6	40.0-41.5	13	MD	64.5	32.1	3.4	0.190	0.370	8.820	11.830	62	GW						140
MW-345-55	S-7B	50.7-51.5	29	MD	0.3	88.7	11.0	0.060	0.100	0.170	0.190	3.2	SP-SM			6.80E-05	6.80E-03	19	8.8
MW-345-55	S-8	52.5-54.0	26	MD	26.4	67.9	5.7	0.100	0.160	0.260	0.350	3.5	SP-SM			1.40E-05	1.40E-03	4	23

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Offsite Site Characterization Report - 2013 Addendum  
North Pole Refinery, North Pole, Alaska  
Flint Hills Resources Alaska, LLC

Boring <sup>a</sup>	Sample ID	Sample Depth (ft)	Blow Count	Relative Density Classification	Grain Size Analysis Results							Soil Type	Hazen			Prugh		Barr		
					Gravel Content (%)	Sand Content (%)	Fines Content (%)	D10 (mm)	D20 (mm)	D50 (mm)	D60 (mm)		Cu	K D10 (m/s)	K D10 (cm/s)	K D10 (ft/day)	K D50 (m/s)		K D50 (cm/s)	K D50 (ft/day)
MW-345-75	S-1	60.0-61.5	27	MD	63.4	30.3	6.3	0.120	0.350	8.420	11.980	100	GP-GM							74
MW-345-75	S-2	70.0-71.5	22	MD	58.2	36.8	5.1	0.170	0.680	6.460	9.380	55	GP-GM							110
MW-345-75	S-3	72.5-74.0	25	MD	50.5	44.5	5.0	0.180	0.350	4.840	7.150	40	GP							97
MW-346-150	S-2	5.0-6.5	3	VL	41.3	51.6	7.1	0.100	0.230	2.260	5.050	51	SP-SM							51
MW-346-150	S-5	15.0-16.5	14	MD	43.2	52.6	4.2	0.180	0.280	2.450	5.370	30	SP							95
MW-346-150	S-9	50.0-51.5	57	VD	51.3	45.0	3.7	0.019	0.310	4.980	7.180	380	GP							6.6
MW-346-150	S-12	110.0-111.5	27	MD	57.3	39.2	3.5	0.260	0.500	6.960	11.370	44	GP							170
MW-346-150	S-14	145.0-146.5	58	VD	48.9	42.5	8.6	0.100	0.280	4.270	7.280	73	GP-GM							51
MW-346-65	S-1	10.0-11.5	10	MD	49.4	47.9	2.7	0.180	0.290	4.510	6.350	35	GP							140
MW-346-65	S-1	10.0-11.5	10	MD	49.4	47.9	2.7	0.180	0.290	4.510	6.350	35	GP							140
MW-346-65	S-2	30.0-31.5	17	MD	17.5	78.1	4.4	0.130	0.190	0.330	0.380	2.9	SP	1.69E-04	1.69E-02	48	2.20E-04	2.20E-02	62	32
MW-346-65	S-2	30.0-31.5	17	MD	17.5	78.1	4.4	0.130	0.190	0.330	0.380	2.9	SP	1.69E-04	1.69E-02	48	2.80E-04	2.80E-02	79	32
MW-346-65	S-3	62.5-64.0	35	D	43.2	51.4	5.4	0.150	0.260	2.600	5.500	37	SP-SM							73
MW-346-65	S-3	62.5-64.0	35	D	43.2	51.4	5.4	0.150	0.260	2.600	5.500	37	SP-SM							73
MW-347-150	S-2	5.0-6.5	7	L	14.1	19.5	66.4	0.010	0.021	0.050	0.070	7	ML							0.45
MW-347-150	S-5	15.0-16.5	9	L	0.0	84.4	15.6	0.050	0.085	0.170	0.190	3.8	SM				6.60E-05	6.60E-03	19	6.8
MW-347-150	S-9	50.0-51.5	55	VD	0.0	88.5	11.5	0.060	0.090	0.150	0.170	2.8	SM				6.00E-05	6.00E-03	17	7.9
MW-347-150	S-12	110.0-111.5	53	VD	39.1	53.3	7.6	0.100	0.200	2.240	4.460	45	SP-SM							46
MW-347-150	S-14	147.5-148.8	77 (9")	VD	53.5	40.6	5.9	0.170	0.450	5.280	7.110	42	GW-GM							88
MW-347-20	S-1	12.0-14.0	3	VL	0.2	61.9	37.9	0.020	0.040	0.090	0.100	5	SM							1.5
MW-347-65	S-1	35.0-37.0	16	MD	43.6	44.4	12.0	0.050	0.120	2.530	6.380	130	SM							18
MW-347-65	S-2	61.0-63.0	29	MD	55.0	37.7	7.3	0.120	0.330	6.020	9.660	81	GW-GM							63
MW-348-15	S-1&2	6.0-14.0	25, 26	MD	61.4	32.6	6.0	0.150	0.350	7.660	10.750	72	GW-GM							81
MW-348-65	S-1	2.5-4.0	29	MD	57.6	37.9	4.5	0.190	0.350	6.080	8.430	44	GW							110
MW-348-65	S-2	5.0-6.5	29	MD	56.8	36.0	7.2	0.120	0.280	6.320	9.580	80	GP-GM							62
MW-348-65	S-5	15.0-16.5	18	MD	64.3	33.3	2.4	0.180	0.400	8.180	11.070	62	GP							170
MW-348-65	S-6	20.0-21.5	28	MD	62.0	33.6	4.4	0.150	0.340	7.700	10.630	71	GP							100
MW-348-65	S-9	35.0-36.5	27	MD	66.0	31.8	2.2	0.270	0.850	9.050	12.570	47	GP							280
MW-348-65	S-10	50.0-51.5	36	D	61.5	34.5	4.0	0.190	0.400	7.660	10.970	58	GW							130
MW-348-65	S-11	62.5-64.0	31	D	73.1	24.2	2.7	0.240	1.700	18.610	37.850	160	GP							270
MW-349-15	S-4N	12.5-14.0	8	L	58.2	36.8	5.0	0.170	0.340	6.950	11.260	66	GP							97
MW-349-45	S-2	5.0-6.5	5	L	0.0	26.8	73.2	0.010	0.020	0.050	0.060	6	ML							0.41
MW-349-45	S-3	7.5-9.0	21	MD	63.5	28.8	7.7	0.110	0.580	8.760	12.680	120	GP-GM							69
MW-349-45	S-4	10.0-11.5	11	MD	63.0	33.8	3.2	0.250	0.430	8.060	11.810	47	GW							170
MW-349-45	S-6	20.0-21.5	20	MD	60.2	35.0	4.8	0.180	0.370	6.800	9.670	54	GW							100
MW-349-45	S-7	25.0-26.5	12	MD	59.9	35.8	4.3	0.190	0.390	6.910	9.950	52	GW							120
MW-349-45	S-9	50.0-51.0	86 for 12"	VD	62.0	32.3	5.7	0.170	0.590	6.890	9.930	55	GP-GM							98
MW-350-15	S-1	9.0-10.5	25	MD	50.5	42.1	7.4	0.120	0.300	4.840	6.930	58	GW-GM							61
MW-350-50	S-3	7.5-9.0	13	MD	19.0	60.0	21.0	0.040	0.065	0.160	0.210	5.3	SM				2.00E-05	2.00E-03	5.7	4.9
MW-350-50	S-5	12.5-14.0	21	MD	52.2	43.2	4.6	0.160	0.280	5.290	8.700	54	GP							94
MW-350-50	S-9	25.0-26.5	24	MD	54.7	40.6	4.7	0.160	0.260	5.970	9.670	60	GP							91
MW-350-50	S-10	30.0-31.5	13	MD	58.6	36.8	4.6	0.160	0.300	7.050	11.320	71	GP							97
MW-350-50	S-11	50.0-51.5	50 (6")	D	51.4	41.4	7.5	0.090	0.180	5.260	11.340	130	GP-GM							50
MW-351-150	S-2	60.0-61.5	34	D	66.9	29.5	3.6	0.230	0.920	10.640	16.640	72	GP							180
MW-351-150	S-5	90.0-91.5	26	MD	57.9	37.8	4.3	0.220	0.560	6.640	10.060	46	GW							130
MW-351-150	S-8A	120.0-120.9	32	D	1.3	94.4	4.3	0.120	0.170	0.260	0.300	2.5	SP	1.44E-04	1.44E-02	41	1.50E-04	1.50E-02	43	25
MW-351-150	S-8B	120.9-121.5	32	D	48.4	44.1	7.5	0.130	0.400	4.290	6.330	49	GW-GM							64
MW-351-150	S-9	130.0-131.5	58	VD	49.8	43.7	6.5	0.150	0.320	4.690	7.200	48	GP-GM							72
MW-351-150	S-11	150.0-151.5	43	D	59.2	35.4	5.4	0.190	0.750	6.900	10.180	54	GW-GM							110
MW-351-55	S-2	52.5-54.0	31	D	66.9	29.5	3.6	0.230	0.920	10.640	16.610	72	GP							180
MW-351-75	S-3	12.5-14.5	13	MD	16.4	80.9	2.7	0.160	0.200	0.320	0.350	2.2	SP	2.82E-04	2.82E-02	80	4.00E-04	4.00E-02	110	40
MW-351-75	S-6	25.0-27.0	21	MD	62.6	33.6	3.8	0.170	0.300	8.800	13.310	78	GW							120
MW-351-75	S-8	40.0-42.0	39	D	50.0	44.2	5.8	0.160	0.280	4.760	7.980	50	GP-GM							79
MW-351-75	S-9	50.0-52.0	48	D	55.5	39.8	4.7	0.180	0.330	6.180	9.880	55	GP							100
MW-351-75	S-11	71.0-73.0	29	MD	56.6	38.3	5.1	0.180	0.460	6.280	9.570	53	GW-GM							100
MW-352-40	S-3	7.5-9.0	13	MD	47.2	45.6	7.2	0.100	0.180	3.730	6.430	64	GP-GM							50
MW-352-40	S-4&5	10.4-13.6	8, 9	L	7.4	87.7	4.9	0.110	0.160	0.220	0.250	2.3	SP	1.21E-04	1.21E-02	34	2.30E-04	2.30E-02	65	21
MW-352-40	S-8	25.0-26.5	13	MD	69.6	28.0	2.4	0.200	0.410	11.410	16.140	81	GP							190
MW-352-40	S-9	30.0-31.5	15	MD	63.5	33.3	3.2	0.200	0.410	7.600	10.540	53	GP							150
MW-352-40	S-10	42.5-44.0	50 (5")	D	83.4	14.4	2.2	1.320	5.960	32.350	38.430	29	GW							880
MW-353-100	S-4&5	10.5-14.0	18, 16	MD	57.5	38.0	4.5	0.170	0.320	6.630	10.290	61	GP							100
MW-353-100	S-6&7	15.0-21.5	16	MD	58.6	37.7	3.7	0.180	0.320	7.300	11.290	63	GP							120
MW-353-100	S-9	30.0-31.5	16	MD	56.6	39.6	3.8	0.230	0.390	5.870	8.120	35	GP							140
MW-353-100	S-12	90.0-91.5	42	D	49.0	45.1	5.9	0.160	0.330	4.400	6.960	44	GP-GM							80

Table 5-1  
Hydraulic Conductivity and Grain Size Summary

Offsite Site Characterization Report - 2013 Addendum  
North Pole Refinery, North Pole, Alaska  
Flint Hills Resources Alaska, LLC

Boring <sup>a</sup>	Sample ID	Sample Depth (ft)	Blow Count	Relative Density Classification	Grain Size Analysis Results					Soil Type	Hazen			Prugh		Barr					
					Gravel Content (%)	Sand Content (%)	Fines Content (%)	D10 (mm)	D20 (mm)		D50 (mm)	D60 (mm)	Cu	K D10 (m/s)	K D10 (cm/s)		K D10 (ft/day)	K D50 (m/s)	K D50 (cm/s)	K D50 (ft/day)	
MW-353-100	S-13	110.0-111.5	50 (6")	VD	56.5	37.2	6.3	0.140	0.440	6.240	9.510	68	GW-GM					80			
MW-353-15	S-1	10.0-11.5	13	MD	57.3	37.3	5.4	0.150	0.230	6.530	9.860	66	GP-GM					78			
MW-353-65	S-1	35.0-36.5	24	MD	66.4	30.4	3.2	0.240	0.590	9.850	14.040	59	GP					190			
MW-353-65	S-2	62.0-63.5	32	D	59.7	34.9	5.4	0.160	0.320	7.600	11.250	70	GP					88			
MW-354-15	S-2a	7.0-7.7	7	MD	49.6	44.8	5.6	0.120	0.210	4.530	6.210	52	GP-GM					67			
MW-354-15	S-2-b	7.7-9.0	7	MD	6.2	84.1	7.7	0.080	0.100	0.180	0.200	2.5	SP-SM			1.10E-04	1.10E-02	31	11		
MW-354-15	S-3	9.0-11.0	17	MD	69.8	26.9	3.3	0.170	0.640	10.460	13.770	81	GP					160			
MW-354-15	S-4	11.0-13.0	18	MD	59.8	34.8	5.4	0.160	0.390	7.170	10.780	67	GW-GM					92			
MW-354-35	S-1	7.5-9.0	13	MD	46.8	48.9	4.3	0.160	0.250	3.250	6.440	40	SP					90			
MW-354-35	S-2	10.0-11.5	15	MD	77.5	20.6	1.9	0.290	3.640	15.850	20.230	70	GP					440			
MW-354-60	S-6	12.5-14.0	20	MD	53.5	42.3	4.2	0.170	0.290	5.530	8.550	50	GP					100			
MW-354-60	S-9	24.0-25.5	18	MD	56.2	39.6	4.2	0.160	0.250	6.250	9.680	61	GP					98			
MW-354-60	S-10	30.5-32.0	32	D	69.0	27.1	3.9	0.190	1.110	11.410	15.530	82	GP					160			
MW-354-60	S-11	42.0-43.5	21	MD	59.8	36.5	3.7	0.190	0.480	7.150	11.140	59	GW					140			
MW-354-60	S-13	62.3-63.5	30	D	67.3	28.2	4.5	0.170	0.810	9.300	13.310	78	GP					130			
MW-355-15	S-1	7.0-8.5	15	MD	55.4	37.9	6.7	0.130	0.290	5.840	8.550	66	GP-GM					67			
MW-355-15	S-2	15.0-16.5	5	L	35.1	55.6	9.3	0.080	0.130	0.330	1.050	13	SP-SM					19			
MW-355-55	S-5	10.0-11.5	4	L	49.3	44.5	6.2	0.120	0.220	4.430	6.480	54	GP-GM					63			
MW-355-55	S-6	12.5-14.0	5	L	12.5	80.6	6.9	0.090	0.140	0.220	0.260	2.9	SP-SM			1.90E-04	1.90E-02	54	17		
MW-355-55	S-9	25.0-26.5	8	L	20.2	70.6	9.2	0.080	0.120	0.230	0.280	3.5	SP-SM			1.30E-04	1.30E-02	37	15		
MW-355-55	S-11	40.0-41.5	26	MD	59.5	36.7	3.8	0.200	0.350	6.900	9.990	50	GP					130			
MW-355-55	S-13	55.0-56.5	24	MD	49.1	46.8	4.1	0.160	0.240	4.280	7.290	46	GP					96			
MW-356-15	S-1	12.5-14.0	6	L	52.0	45.7	2.3	0.240	0.350	5.060	6.870	29	GP					190			
MW-356-90	S-3	7.5-9.0	16	MD	5.4	89.4	5.2	0.120	0.170	0.270	0.300	2.5	SP-SM	1.15E-04	1.15E-02	33	2.20E-04	2.20E-02	62	24	
MW-356-90	S-4	10.0-11.5	9	L	58.5	38.3	3.2	0.220	0.370	6.820	10.200	46	GP					150			
MW-356-90	S-7	20.0-21.5	17	MD	63.5	33.0	3.5	0.200	0.400	9.130	13.330	67	GW					140			
MW-356-90	S-9	30.0-31.5	19	MD	61.5	34.4	4.1	0.210	0.420	8.410	12.340	59	GW					130			
MW-356-90	S-15	90.0-91.5	74	VD	50.9	42.4	6.7	0.150	0.400	4.910	7.100	47	GW-GM					74			
MW-357-15	S-4	10.0-10.5	5	L	9.0	61.0	30.0	0.020	0.040	0.140	0.180	9	SM					1.8			
MW-357-15	S-6	15.0-16.5	14	MD	48.9	47.2	3.9	0.180	0.280	4.220	7.080	39	GP					110			
MW-357-150	S-8	25.0-26.5	17	MD	57.6	37.1	5.3	0.160	0.330	6.550	9.990	62	GP-GM					89			
MW-357-150	S-13	90.0-91.5	24	MD	55.2	39.7	5.1	0.170	0.320	6.060	9.690	57	GP-GM					93			
MW-357-150	S-14	110.0-111.5	33	D	52.7	38.6	8.7	0.100	0.320	5.530	9.720	97	GP-GM					53			
MW-357-150	S-15	130.0-131.5	77 (12")	VD	19.1	76.4	4.5	0.170	0.250	0.410	0.550	3.2	SP	2.89E-04	2.89E-02	82	2.20E-04	2.20E-02	62	43	
MW-357-150	S-16	147.5-149.0	36	D	41.1	52.2	6.7	0.090	0.160	1.300	5.120	57	SP-SM					41			
MW-357-65	S-11	62.5-64.0	24	MD	67.6	29.1	3.3	0.210	0.790	10.020	13.970	67	GP					180			
O-1	S-5	15' - 16.5'	46	D	61.0	33.8	5.2	0.160	0.310	8.630	12.670	79	GW-GM					90			
O-11	S-8	14'-16'	13	MD	61.0	36.4	2.6	0.200	0.390	7.670	11.080	55	GW					170			
O-12-65	S-3	7.5-9.5	8	L	5.6	69.1	25.3	0.030	0.058	0.120	0.140	4.7	SM					3			
O-12-65	S-6	15.5-16.5	11	MD	24.4	72.9	2.7	0.160	0.220	0.340	0.380	2.4	SP	2.82E-04	2.82E-02	80	2.00E-05	2.00E-03	5.7	44	
O-12-65	S-8	25.0-26.5	45	D	70.9	25.8	3.3	0.230	0.800	14.210	18.700	81	GP					200			
O-12-65	S-10	40.0-41.5	22	MD	59.1	37.6	3.3	0.180	0.310	6.850	10.220	57	GP					130			
O-12-65	S-12	62.5-64.0	56	VD	62.7	33.5	3.8	0.180	0.440	10.060	15.830	88	GW					130			
O-13	PO-7	12'-15.2'	33	D	66.0	27.4	6.6	0.110	0.320	9.510	12.810	120	GP-GM					68			
O-14	PO-11-12	10'-14'	28	MD	57.0	38.1	4.9	0.150	0.260	6.190	8.920	59	GP					87			
O-15	PO-14	10'-14'	18	MD	66.0	32.2	1.8	0.210	0.600	9.950	14.040	67	GP					250			
O-16	S-6	10'-14'	21	MD	56.0	40.0	4.0	0.160	0.280	6.480	10.090	63	GP					100			
O-17	S-8	14'-16'	15	MD	48.0	48.7	3.3	0.170	0.290	4.130	6.230	37	GP					120			
O-18	S-7	14'-15'	31	D	50.0	44.2	5.8	0.110	0.200	4.500	7.620	69	GP-GM					62			
O-2	S-5	15' - 16.5'	7	L	62.0	34.3	3.7	0.180	0.340	6.920	9.560	53	GW					120			
O-20	S-8	14'-16'	28	MD	52.0	40.2	7.8	0.100	0.240	3.950	6.500	65	GP-GM					52			
O-21	S-8	14'-16'	30	D	59.0	33.7	7.3	0.090	0.180	3.530	8.170	91	GP-GM					48			
O-24-65	S-6	12.5-14.0	9	L	53.0	37.2	9.8	0.080	0.200	5.440	8.570	110	GW-GM					41			
O-24-65	S-7	15.0-16.5	10	L	61.6	29.3	9.1	0.080	0.220	7.820	10.950	140	GP-GM					45			
O-24-65	S-10	30.0-31.5	25	MD	70.2	26.5	3.3	0.180	0.600	11.700	18.890	100	GP					160			
O-24-65	S-11	50.0-51.5	35	D	62.3	33.9	3.8	0.220	0.540	8.440	12.720	58	GW					150			
O-24-65	S-12	62.0-63.5	27	MD	71.0	26.1	2.9	0.210	1.000	9.510	12.160	58	GP					210			
O-26-65	S-5	10.0-11.5	5	L	0.2	91.8	8.0	0.080	0.110	0.190	0.210	2.6	SP-SM			2.00E-04	2.00E-02	57	13		
O-26-65	S-6	12.5-14.0	13	MD	52.0	44.5	3.5	0.160	0.260	5.180	7.990	50	GP					110			
O-26-65	S-9	25.0-26.5	5	L	50.4	47.6	2.0	0.200	0.300	4.840	7.700	39	GP					170			
O-26-65	S-10	30.0-31.5	2	VL	18.6	77.0	4.4	0.150	0.210	0.330	0.380	2.5	SP	2.48E-04	2.48E-02	70	4.00E-04	4.00E-02	110	35	
O-26-65	S-12	62.5-64.0	15	MD	54.3	42.4	3.3	0.270	0.550	5.400	7.300	27	GW					180			
O-3	S-5	15' - 16.5'	4	L	0.0	55.1	44.9	0.030	0.040	0.080	0.100	3.3	SM					2.30E-05	2.30E-03	6.5	2.1
O-4	S-5	15' - 16.5'	19	MD	28.0	69.3	2.7	0.150	0.200	0.360	0.420	2.8	SP	2.25E-04	2.25E-02	64	4.20E-04	4.20E-02	120	43	

**Table 5-1  
Hydraulic Conductivity and Grain Size Summary**

Offsite Site Characterization Report - 2013 Addendum  
North Pole Refinery, North Pole, Alaska  
Flint Hills Resources Alaska, LLC

Boring <sup>a</sup>	Sample ID	Sample Depth (ft)	Blow Count	Relative Density Classification	Grain Size Analysis Results					Soil Type	Hazen			Prugh			Barr		
					Gravel Content (%)	Sand Content (%)	Fines Content (%)	D10 (mm)	D20 (mm)		D50 (mm)	D60 (mm)	Cu	K D10 (m/s)	K D10 (cm/s)	K D10 (ft/day)		K D50 (m/s)	K D50 (cm/s)
S-41R	S-2	2.5-4.0	5	L	0.3	41.3	58.4	0.010	0.020	0.060	0.080	8	ML						0.51
S-41R	S-4	7.5-9.0	19	MD	59.6	35.2	5.2	0.160	0.340	7.470	11.510	72	GW-GM						92
S-41R	S-5	10.0-11.5	15	MD	58.4	36.7	4.9	0.180	0.340	6.41	9.810	55	GW						100
S-41R	S-6	12.5-14.0	19	MD	55.9	38.2	5.9	0.160	0.340	6.390	10.360	65	GW-GM						82
S-41R	S-7	15.0-16.5	9	L	63.4	34.3	2.3	0.230	0.360	8.650	12.610	55	GW						200

**Footnotes:**

a. Well names in ***bold italics*** are located offsite, others are onsite.

**Acronyms and Abbreviations:**

L = loose  
MD = medium dense  
D = dense  
VD = very dense  
K = hydraulic conductivity  
ft = feet  
ft/day = feet per day  
cm/s = centimeters per second  
mm = millimeters  
% = percent  
m/s = meters per second  
GW = well-graded gravel  
GP = poorly-graded gravel  
GM = silty gravel  
SP = poorly-graded sand  
SW = well-graded sand  
SM = silty sand  
ML = silt

**Table 5-2**  
**Summary of Hydraulic Conductivity Values from Grain Size Analyses**

**Offsite Site Characterization Report - 2013 Addendum**  
**North Pole Refinery, North Pole, Alaska**  
**Flint Hills Resources Alaska, LLC**

<b>Hydraulic Conductivity Range <sup>a</sup></b>	<b>Number of Samples</b>	<b>Percentage of Samples</b>
0.1 to 0.99 ft/day (-1 to 0)	7	2.20%
1.0 to 9.9 ft/day (0 to 1)	17	5.20%
10 to 99 ft/day (1 to 2)	222	68.50%
100 to 999 ft/day (2 to 3)	75	23.10%
1,000 to 9,999 ft/day (3 to 4)	2	0.60%
>10,000 ft/day (> 4)	1	0.30%

**Footnotes:**

- a. Log base 10 of range indicated in parentheses.

Table 5-3

Ranges of Hydraulic Conductivity based on Barr (2001) and Specific Yield as a Function of Hydraulic Conductivity based on USBR (1993) for the Various Soil Types Identified by the Grain Size Analyses

Offsite Site Characterization Report - 2013 Addendum  
 North Pole Refinery, North Pole, Alaska  
 Flint Hills Resources Alaska, LLC

Soil Classification		Number of Samples	Hydraulic Conductivity (ft/day)		Specific Yield (fraction by volume)	
Group Symbol	Group Name		Maximum	Minimum	Maximum	Minimum
GP	Poorly graded gravel	102	1400	6.6	0.33	0.16
GW	Well-graded gravel	40	880	81	0.33	0.28
GP-GM	Poorly graded to silty gravel	45	110	27	0.3	0.23
GW-GM	Well graded to silty gravel	30	120	41	0.3	0.25
GM	Silty gravel	1	1.2	1.2	0.077	0.077
SP	Poorly graded sand	38	1800	21	0.32	50.9
SW	Well-graded sand	1	220	220	0.34	0.34
SP-SM	Poorly graded to silty sand	40	83	8.8	0.28	0.17
SW-SM	Well graded to silty sand	1	79	79	0.28	0.28
SM	Silty sand	19	83	0.57	0.28	0.043
ML	Silt	8	1.3	0.088	0.081	0.03

Notes:

ft/day    feet per day

**Table 5-4**  
**Summary of Aquifer Parameter Estimates from the 2011 Recovery Well Pumping Test**

**Offsite Site Characterization Report - 2013 Addendum**  
**North Pole Refinery, North Pole, Alaska**  
**Flint Hills Resources Alaska, LLC**

Observation Wells	Parameter				
	T	S	Sy	Kz/Kr	Kx
	(m <sup>2</sup> /day)	(unit less)	(unit less)	(unit less)	(m/day)
Recovery and Pumping Phases:					
MW-186A, MW-186B	1.86E+04	1.53E-05	0.029	0.062	410
MW-186C					
Other observation wells combined with MW-186b and MW-186c:					
MW-111, MW-186B, MW-186C	2.04E+04	1.53E-05	0.024	0.04	450
MW-113, MW-186B, MW-186C	2.00E+04	1.50E-05	0.016	0.011	440
MW-125, MW-186B, MW-186C	1.88E+04	1.50E-05	0.022	0.014	410
MW-130, MW-186B, MW-186C	1.94E+04	1.50E-05	0.022	0.023	420
MW-135, MW-186B, MW-186C	1.90E+04	1.50E-05	0.025	0.03	420
O-2, MW-186b, MW-186c	1.62E+04	1.50E-03	0.032	0.054	350
Other observation wells combined with MW-186b:					
MW-111, MW-186B	1.75E+04	1.50E-03	0.027	0.28	380
MW-113, MW-186B	1.86E+04	1.50E-05	0.018	0.015	410
MW-125, MW-186B	1.76E+04	1.50E-05	0.023	0.017	380
MW-130, MW-186B	1.73E+04	1.50E-05	0.022	0.04	380
MW-135, MW-186B	1.65E+04	1.50E-03	0.022	0.058	360
O-2, MW-186B	1.43E+04	1.50E-03	0.021	1	310
Pumping Phase with correction for continued recovery:					
MW-186A, MW-186B	2.06E+04	1.50E-05	0.017	0.066	450
MW-186C					
Mean value	1.82E+04		0.023	0.122	398
Minimum Value	1.43E+04		0.016	0.011	310
Maximum Value	2.06E+04		0.032	1	450
With recharge boundary at Tanana River (for discussion purposes only):					
MW-186A, MW-186C	1.80E+04	1.50E-05	0.049	0.05	450

**Acronyms and Abbreviations:**

m<sup>2</sup>/day = square meter per day

m/day = meters per day

**Table 5-5  
Summary of Single Well Pumping Test Analyses**

**Offsite Site Characterization Report - 2013 Addendum  
North Pole Refinery, North Pole, Alaska  
Flint Hills Resources Alaska, LLC**

<b>Well Name</b>	<b>Well Depth (ft bgs)</b>	<b>Transmissivity<sup>a</sup> (ft<sup>2</sup>/d)</b>	<b>Screen Top (ft bgs)</b>	<b>Screen Bottom (ft bgs)</b>	<b>Saturated Screen Length<sup>b</sup> (ft)</b>	<b>Hydraulic Conductivity (ft/d)</b>
MW-101	61	645	56	61	5	130
MW-101A	23	627	17.8	22.8	5	130
MW-102	71.5	503	61.5	71.5	10	50
MW-118	43	1365	38.5	43	4.5	300
MW-127	24.5	1096	20	24.5	4.5	240
MW-131	24.5	1360	20	24.5	4.5	300
MW-139 <sup>c</sup>	25	2610	5.7	25	14	190
MW-143 <sup>c</sup>	19.5	7231	50.9	19.5	10	720
MW-144A <sup>c</sup>	24.7	1039	5.7	24.7	14	74
MW-144B	90	1840	84.9	89.5	4.6	400
MW-154A	75.5	42960	71	75	4	10,700
MW-154B	95	1405	90.2	94.8	4.6	310
MW-186B	60.8	1045	50.7	60.4	9.7	110
MW-186C	100.8	4035	90.7	100.3	9.6	420
Geometric Mean of the Hydraulic Conductivities (all tests)						270
Geometric Mean of the Hydraulic Conductivities (excluding MW-154A)						200
Minimum Hydraulic Conductivity						50
Maximum Hydraulic Conductivity						10,700
Standard Deviation of Hydraulic Conductivity (all tests)						2,800
Standard Deviation of Hydraulic Conductivity (excluding MW-154A)						180

**Footnotes:**

- a. Estimated from AQTESOLV using the Theis solution.
- b. Based on static water level and well construction information.
- c. Estimate based on Theis unconfined analysis.

**Acronyms and Abbreviations:**

ft bgs = feet below ground surface  
ft<sup>2</sup>/d = square feet per day  
ft/d = feet per day



**Table 5-6  
Single Well Tracer Test Results**

**Offsite Site Characterization Report - 2013 Addendum  
North Pole Refinery, North Pole, Alaska  
Flint Hills Resources Alaska, LLC**

Well ID	Measured Well Depth (ft btoc)	Screen Length (ft)	2011 Hydraulic Conductivity Values from Single Well Pump Tests (ft/day) <sup>b</sup>	Aquifer Flux from SWTTs (q <sub>A</sub> ) (ft/day)
MW-101 <sup>a</sup>	64.59	5	130	0.022 - 0.25
MW-101A	27.79	5	130	0.37
MW-102	68.15	10	50	NC
MW-131 <sup>a</sup>	26.66	4.5	300	0.05 - 0.16
MW-139	26.95	19.3	190	0.17
MW-142	22.49	14	NA	0.04
MW-143	22.85	14.8	720	0.061
MW-144A	25.81	19	74	0.013
MW-145	22.82	14.3	NA	0.02
MW-150A	10.46	4.4	NA	0.01
MW-151A	14.64	5	NA	0.12
MW-152A	15.76	4.4	NA	0.066
MW-154A <sup>a</sup>	78.38	4	10,700	0.04 - 0.57
MW-154B <sup>a</sup>	97.57	4.6	310	0.008 - 0.13
MW-155A	14.21	9.7	NA	0.039
MW-170A	14.51	9.8	NA	0.044

**Footnotes:**

- a. Well column was likely not fully mixed. Therefore, a range of estimates are provided.
- b. Single well pump tests were conducted during Additional Site Characterization Activities in 2011.

**Acronyms and Abbreviations:**

- NA = not available
- NC = test not complete
- ft = feet
- ft btoc = feet below top of casing
- ft/day = feet per day

**Table 5-7  
Summary of Results of the 2013 Recovery Systems Start-Up Test Analyses and  
NPR Production Well Analysis**

**Offsite Site Characterization Report - 2013 Addendum  
North Pole Refinery, North Pole, Alaska  
Flint Hills Resources Alaska, LLC**

Well	Parameter †	Mean Value	Minimum Value	Maximum Value	Number of Solutions
R-42	T (m <sup>2</sup> /day)	14,700	9,060	23,000	8
	K (m/day)	320	200	500	
	Sc (unit less)	0.01	0.0026	0.088	
	Ss (1/m)	2.20E-04	5.70E-05	1.90E-03	
	Kz/Kr (unit less)	0.03	0.006	0.12	
R-43	T (m <sup>2</sup> /day)	15,100	10,250	22,200	7
	K (m/day)	330	220	490	
	Sc (unit less)	0.0031	0.0022	0.004	
	Ss (1/m)	6.80E-05	4.80E-05	8.70E-05	
	Kz/Kr (unit less)	0.024	0.0081	0.05	
R-44	T (m <sup>2</sup> /day)	16,700	11,600	22,400	5
	K (m/day)	370	250	490	
	Sc (unit less)	0.011	0.0055	0.024	
	Ss (1/m)	2.40E-04	1.20E-04	5.20E-04	
	Kz/Kr (unit less)	0.025	0.0033	0.07	
R-45	T (m <sup>2</sup> /day)	9,000	4,080	18,000	4
	K (m/day)	200	90	390	
	Sc (unit less)	0.0208	0.00108	0.05	
	Ss (1/m)	4.50E-04	2.40E-05	1.10E-03	
	Kz/Kr (unit less)	0.035	0.012	0.12	
NPR-1, 2	T (m <sup>2</sup> /day)	15,900			1
	K (m/day)	350			
	Sc (unit less)	0.0035			
	Ss (1/m)	7.70E-05			
	Kz/Kr (unit less)	0.031			

**Acronyms and Abbreviations:**

† = Parameter definitions

T = transmissivity

K = hydraulic conductivity (horizontal)

Sc = storage coefficient

Ss = specific storage

Kz/Kr = anisotropy (vertical K / radial or horizontal K)

m = meters

m<sup>2</sup>/day = square meters per day

m/day = meters per day

**Table 5-8**  
**Summary of Well Nests Monitored with Data Loggers in which Vertical Gradients are Quantified**

**Offsite Site Characterization Report - 2013 Addendum**  
**North Pole Refinery, North Pole, Alaska**  
**Flint Hills Resources Alaska, LLC**

<b>Wells (Shallower Deeper)</b>	<b>Sense of Gradient</b>	<b>Agreement with Manual Measurements <sup>a</sup></b>
MW-164A-15 MW-164C-60	Upward	NM
MW-179A-15 MW-179B-50	Upward	NM
MW-181A-15 MW-181C-150	Upward	NM
MW-181B-50 MW-181C-150	Upward	NM
MW-186B-60 MW-186C-100	Upward	Agree
MW-186E-75 MW-186C-100	Upward	Agree
MW-304-15 MW-304-125	Upward	Agree
MW-304-15 MW-304-150	Upward	Agree
MW-306-15 MW-306-150	Downward	Agree
MW-309-15 MW-309-66	Upward	Agree
MW-310-15 MW-310-110	Upward	Agree
MW-318-20 MW-318-135	Downward	Agree
MW-326-20 MW-326-150	Upward	NM
MW-333-16 MW-333-150	Upward	NM
S-43 MW-175-90	Upward	NM

**Footnotes:**

<sup>a</sup>. Manual measurements may be at other times than data logger results.

**Acronyms and Abbreviations:**

NM = not measured

**Table 5-9A  
Summary of Groundwater Elevations Based on Manual Measurements with Concurrent  
Surveys in Selected offsite Nested Wells**

**Offsite Site Characterization Report - 2013 Addendum  
North Pole Refinery, North Pole, Alaska  
Flint Hills Resources Alaska, LLC**

<b>Well ID</b>	<b>3/18/2013</b>	<b>4/19/2013</b>	<b>5/20/2013</b>	<b>6/19/2013</b>	<b>7/25/2013</b>	<b>8/20/2013</b>	<b>9/23/2013</b>	<b>10/21/2013</b>
MW-148A-15	NM	482.91	483.25	484.03	484.21	484.23	483.45	482.65
MW-148B-30	NM	482.9	483.21	484.03	484.21	484.23	483.4	482.62
MW-148C-55	NM	482.95	483.24	484.06	484.24	484.28	483.44	482.64
MW-148D-150	NM	482.95	483.22	484.05	484.24	484.27	483.42	482.64
MW-160AR-15	NM	478.77	479.26	479.56	479.43	479.33	479.24	478.66
MW-160B-90	NM	478.84	479.23	479.64	479.51	479.45	479.27	478.71
MW-162A-15	476.04	Frozen	Frozen	Frozen	Frozen	50.9	476.52	476.01
MW-162B-65	475.98	476.04	Frozen	Frozen	Frozen	476.38	476.49	475.9
MW-318-20	481.74	481.66	481.53	Frozen	Frozen	Frozen	481.76	481.07
MW-318-135	481.64	481.57	481.39	482.94	483.29	483.45	481.63	480.96

**Acronyms and Abbreviations:**

NM = not measured

**Table 5-9B**  
**Summary of Manually Measured Vertical Head Differences †**  
**in Selected Offsite Nested Wells**

**Offsite Site Characterization Report - 2013 Addendum**  
**North Pole Refinery, North Pole, Alaska**  
**Flint Hills Resources Alaska, LLC**

<b>Well ID</b>	<b>3/18/2013</b>	<b>4/19/2013</b>	<b>5/20/2013</b>	<b>6/19/2013</b>	<b>7/25/2013</b>	<b>8/20/2013</b>	<b>9/23/2013</b>	<b>10/21/2013</b>
MW-148A-15								
MW-148B-30	NM	0.01	0.04	0	0	0	0.05	0.03
MW-148C-55	NM	-0.05	-0.03	-0.03	-0.03	-0.05	-0.04	-0.02
MW-148D-150	NM	0	0.02	0.01	0	0.01	0.02	0
MW-160AR-15								
MW-160B-90	NM	-0.07	0.03	-0.08	-0.08	-0.12	-0.03	-0.05
MW-162A-15						50.9		
MW-162B-65	0.06	Frozen	Frozen	Frozen	Frozen	0.04	0.03	0.11
MW-318-20								
MW-318-135	0.1	0.09	0.14	Frozen	Frozen	Frozen	0.13	0.11

**General Notes:**

† Head in shallower well minus head in deeper well. Negative numbers indicate an upward component of flow. Errors associated with these calculated head differences are ±0.02 feet.

**Acronyms and Abbreviations:**

NM = not measured

**Table 5-10A**  
**Summary of Groundwater Elevations Based on Manual Measurements with Concurrent**  
**Surveys in Selected Onsite Nested Wells**

**Offsite Site Characterization Report - 2013 Addendum**  
**North Pole Refinery, North Pole, Alaska**  
**Flint Hills Resources Alaska, LLC**

Well ID	3/18/2013	4/19/2013	5/20/2013	6/19/2013	7/25/2013	8/20/2013	9/23/2013	10/21/2013
MW-186A-15	484.14	484.11	484.38	485.11	485.38	485.4	484.25	483.65
MW-186B-60	484.22	484.21	484.52	485.33	485.59	485.64	484.42	483.83
MW-186E-75	484.24	484.22	484.53	485.38	485.65	485.71	484.46	483.88
MW-186C-100	484.27	484.25	484.57	485.46	485.73	485.77	484.52	483.92
MW-186D-135	NM	484.31	484.6	485.52	485.77	485.84	484.57	483.98
MW-304-15	Frozen	Frozen	Frozen	484.81	485.03	485.09	483.94	483.39
MW-304-80	NM	483.69	483.99	484.85	485.07	50.9	483.99	483.41
MW-304-125	483.81	483.71	484	484.87	485.06	485.14	483.96	483.4
MW-304-150	483.79	483.71	484.01	484.87	485.06	485.13	483.95	483.4
MW-306-15	483.62	483.53	483.84	484.63	484.8	484.86	483.82	483.3
MW-306-80	NM	483.49	483.79	484.57	484.78	484.82	483.76	483.21
MW-306-150	483.54	483.45	483.75	484.55	484.72	484.8	483.74	483.19

**Acronyms and Abbreviations:**

NM = not measured

**Table 5-10B**  
**Summary of Manually Measured Vertical Head Differences †**  
**in Selected Onsite Nested Wells**

**Offsite Site Characterization Report - 2013 Addendum**  
**North Pole Refinery, North Pole, Alaska**  
**Flint Hills Resources Alaska, LLC**

Well ID	3/18/2013	4/19/2013	5/20/2013	6/19/2013	7/25/2013	8/20/2013	9/23/2013	10/21/2013
MW-186A-15								
MW-186B-60	-0.08	-0.1	-0.14	-0.22	-0.21	-0.24	-0.17	-0.18
MW-186E-75	-0.02	-0.01	-0.01	-0.05	-0.06	-0.07	-0.04	-0.05
MW-186C-100	-0.03	-0.03	-0.04	-0.08	-0.08	-0.06	-0.06	-0.04
MW-186D-135	NM	-0.06	-0.03	-0.06	-0.04	-0.07	-0.05	-0.06
MW-304-15								
MW-304-80	Frozen	Frozen	Frozen	-0.04	-0.04	50.9	-0.05	-0.02
MW-304-125	NM	-0.02	-0.01	-0.02	0.01	-0.01	0.03	0.01
MW-304-150	0.02	0	-0.01	0	0	0.01	0.01	0
MW-306-15								
MW-306-80	NM	0.04	0.05	0.06	0.02	0.04	0.06	0.09
MW-306-150	NM	0.04	0.04	0.02	0.06	0.02	0.02	0.02

**General Notes:**

† Head in shallower well minus head in deeper well. Negative numbers indicate an upward component of flow. Errors associated with these calculated head differences are ±0.02 feet.

**Acronyms and Abbreviations:**

NM = not measured

**Table 5-11**  
**Summary of Vertical Head Differences in Nested Wells During the**  
**2013 Startup Aquifer Testing (Table 18 of Barr, 2013b)**

**Offsite Site Characterization Report - 2013 Addendum**  
**North Pole Refinery, North Pole, Alaska**  
**Flint Hills Resources Alaska, LLC**

Well ID	6/3/2013		6/6/2013		Change‡
	Hydraulic Head	Head Difference†	Hydraulic Head	Head Difference	
MW-174-15	486.33		486.43		
MW-174A-50	486.29	0.04	486.42	0.01	0.03
MW-174B-90	486.22	0.07	486.35	0.07	0
MW-179A-15	Frozen				
MW-179B-50	Frozen				
MW-179C-90	Frozen				
MW-179D-135	Frozen				
MW-186A-15	485.75		485.52		
MW-186B-60	485.86	-0.11	485.8	-0.28	0.17
MW-186E-75	485.82	0.04	485.82	-0.02	0.06
MW-186C-100	485.86	-0.04	485.91	-0.09	0.05
MW-186D-135	485.89	-0.03	485.95	-0.04	0.01
MW-197A-65	485.94		485.94		
MW-197B-150	486	-0.06	486.05	-0.11	0.05
MW-304-15	485.15		485.23		
MW-304-125	485.18	-0.04	485.27	-0.04	0.01
MW-304-150	485.19	-0.01	485.29	-0.02	0.01
MW-306-15	484.89		485		
MW-306-150	484.81	0.08	484.94	0.06	0.02
MW-309-15	485.74		485.77		
MW-309-66	485.74	0	485.82	-0.05	0.05
MW-309-150	485.72	0.02	485.82	0	0.02
MW-310-15	485.54		485.77		
MW-310-110	485.86	-0.32	485.98	-0.21	-0.11
MW-334-15	485.78		485.27		
MW-334-65	485.82	-0.04	485.81	-0.54	0.51
O-5	485.85		485.75		
MW-199-150	485.85	0	495.95	-0.2	0.2

**General Notes:**

S-32 is nested with MW-307, but MW-307 was frozen.

**Acronyms and Abbreviations:**

† = Head in shallower well minus head in deeper well. Negative numbers indicate an upward component of flow.

Errors associated with these calculated head differences are ±0.02 feet.

‡ = Head difference on 6/3 minus head difference on 6/6. Positive numbers indicate an amplified head difference

due to the recovery system. Errors associated with these calculated head difference changes are ±0.028 feet.



**Table 5-12  
Summary of Vertical Head Differences in Nested Wells at 2440 Tanana Drive**

**Offsite Site Characterization Report - 2013 Addendum  
North Pole Refinery, North Pole, Alaska  
Flint Hills Resources Alaska, LLC**

Well ID	8/22/2013		10/21/2013	
	Hydraulic Head	Head Difference†	Hydraulic Head	Head Difference†
Suprapermafrost Wells				
MW-349-15	477.76		477.12	
MW-349-45	477.69	0.07	477.05	0.07
Subpermafrost Well				
PW-1230	477.99	-0.3	476.92	0.13

**Acronyms and Abbreviations:**

† Head in shallower well minus head in deeper well. Negative numbers indicate an upward component of flow. Errors associated with these calculated head differences are ±0.02 feet.

**Table 7-1  
2013 Deep Private Well Construction Details**

**Offsite Site Characterization Report - 2013 Addendum  
North Pole Refinery, North Pole, Alaska  
Flint Hills Resources Alaska, LLC**

Well ID	Reported Well Depth (ft bgs)	Top of Permafrost <sup>(a)</sup> (ft bgs)	Bottom of Permafrost <sup>(a)</sup> (ft bgs)	Distance between bottom of permafrost and bottom of well (ft)	Permafrost Thickness (ft)	Casing Diameter (inches)	Intake Length (ft above base of well <sup>(b)</sup> )	Intake Interval (ft bgs)	Heat Tape	Installation Year
<b>Perimeter Private Well Locations</b>										
PW-1458	30	--	--	--	--	1	--	--	--	--
PW-0972	236	17	230	6	213	4	5	--	yes	1984
PW-0259	287	16	204	83	188	6	--	282-287	--	--
PW-0332	266	3	92	174	89	4	5	--	yes	1985
PW-1343	94	12	71	23	59	4	5	--	yes	1984
<b>Internal Private Well Locations</b>										
PW-1230	231	33	205	26	172	--	--	--	--	--
PW-1626	305	--	--	--	--	--	--	--	--	1976
PW-1099	140	23	105	35	82	6	5	--	--	2012
PW-0217	238	6	215	23	209	6	5	--	--	1986
PW-1155	215	5	205	10	200	6	--	--	yes	2000
PW-0358	105	20	103	2	83	5	--	--	--	1995
PW-0658	196	12	180	16	168	--	--	--	yes	1981
PW-0466	122	5	110	12	105	4	--	117-122	--	2004
PW-0464	98	25	90	8	65	6	--	--	yes	2000
PW-0463	89	22	70	19	48	6	--	--	--	1996
PW-0943	120	36	105	15	69	--	--	--	yes	--
PW-0932	255	19	146	109	127	4	6	--	yes	1986
PW-0297	24	--	--	--	--	2	--	--	--	--
PW-0296	220	20	210	10	190	5	--	--	--	1985
PW-1109	305	8	228	77	220	6	5	--	yes	1985

**General Notes:**

All construction details from well logs generated by drillers at the time of well installation.

**Footnotes:**

- a. Permafrost depths as reported in well logs at the time of installation.
- b. Perforations assumed to be at base of well.

**Acronyms and Abbreviations:**

- = unknown or not applicable
- ft = feet
- bgs = below ground surface

**Table 7-2  
2013 Deep Private Well Field Parameter Results**

**Offsite Site Characterization Report - 2013 Addendum  
North Pole Refinery, North Pole, Alaska  
Flint Hills Resources Alaska, LLC**

Well ID	Sampling Date	Temperature (°C)	DO (mg/L)	Conductivity (µS/cm)	pH	ORP (mV)	Water Clarity	Notes
<b>Perimeter Private Well Locations</b>								
PW-1458	6/20/2013	3.0	0.25	252.0	7.18	-94.0	Clear	
PW-1458	9/5/2013	4.8	0.30	259.5	7.08	-66.9	Clear	
PW-0972	3/17/2013	1.0	0.11	188.0	7.43	-170.0	Clear	
PW-0972	6/20/2013	2.9	0.73	187.5	7.35	-195.0	Clear	
PW-0972	9/5/2013	1.5	0.45	179.3	7.33	-172.5	Clear	
PW-0259	4/4/2013	4.2	0.63	193.0	7.69	-200.8	Initially turbid, finally clear	
PW-0259	6/19/2013	4.5	0.58	193.2	7.53	-188.2	Clear	
PW-0332	4/19/2013	2.6	0.06	208.2	7.65	-161.6	Clear	Owner purged well prior to arrival washing cars
PW-0332	6/20/2013	2.5	0.18	187.6	7.57	-176.6	Clear	
PW-0332	9/24/2013	2.0	1.31	207.2	7.34	-184.7	Clear	
PW-1343	3/20/2013	0.6	0.14	271.9	7.08	-87.3	Clear	
PW-1343	6/13/2013	1.5	0.55	332.3	6.92	19.0	Clear	
PW-1343	9/10/2013	0.6	0.65	289.8	6.88	-65.8	Clear	
<b>Internal Private Well Locations</b>								
PW-1230	3/11/2013	5.2	0.09	230.6	8.09	-294.0	Initially gas bubbles and sediment, finally clear	
PW-1230	3/28/2013	2.0	0.06	212.2	8.16	-295.9	Initially gas bubbles and turbidity, dark brown, finally slightly turbid	
PW-1230	6/27/2013	2.5	0.06	201.7	8.08	-250.3	Black to very turbid to slightly turbid, finally turbid	
PW-1230	9/12/2013	1.9	0.16	185.8	7.95	-271.7	Very turbid to turbid	
PW-1626	10/16/2013	1.0	2.00	184.3	7.10	-208.0	Initially clear, finally slightly turbid	
PW-1099	3/12/2013	0.4	0.14	184.0	7.07	-109.1	Clear	
PW-1099	6/4/2013	1.1	0.16	209.9	7.20	-140.3	Clear	
PW-1099	9/26/2013	0.8	0.41	201.5	6.81	-106.4	Clear	
PW-0217	3/11/2013	0.5	0.13	229.5	7.33	-171.2	Initially turbid, finally clear	
PW-0217	6/5/2013	1.0	0.16	260.5	7.40	-189.5	Clear	

**Table 7-2  
2013 Deep Private Well Field Parameter Results**

**Offsite Site Characterization Report - 2013 Addendum  
North Pole Refinery, North Pole, Alaska  
Flint Hills Resources Alaska, LLC**

Well ID	Sampling Date	Temperature (°C)	DO (mg/L)	Conductivity (µS/cm)	pH	ORP (mV)	Water Clarity	Notes
PW-0217	9/5/2013	1.2	0.56	227.4	7.51	-256.9	Clear	
PW-1155	3/18/2013	0.8	0.13	233.4	7.25	-123.1	Clear	
PW-1155	6/5/2013	1.4	0.14	256.8	7.69	-203.6	Clear	
PW-1155	9/11/2013	1.0	0.63	235.1	7.08	-193.1	Clear	
PW-0358	3/25/2013	0.6	0.13	171.9	7.27	-88.2	Turbid to slightly turbid	Debris created from steaming/thawing well was cleared with purging
PW-0358	6/12/2013	1.0	0.30	202.4	7.15	-168.4	Clear	
PW-0358	9/10/2013	1.0	0.33	182.6	7.01	-160.8	Turbid	
PW-0658	3/18/2013	0.6	0.15	228.5	7.55	-163.5	Clear	
PW-0658	6/12/2013	0.8	0.16	248.9	7.24	-169.1	Clear	
PW-0658	9/11/2013	0.8	0.51	241.4	7.05	-149.7	Clear	
PW-0466	4/18/2013	0.6	0.10	244.1	7.15	-95.4	Clear	
PW-0466	6/12/2013	0.8	0.23	250.0	6.98	-119.7	Clear	
PW-0466	9/9/2013	0.7	0.44	226.3	6.95	-119.3	Clear	
PW-0464	3/28/2013	0.3	0.10	176.1	7.42	-142.5	Initially gas bubbles and turbidity, finally clear	
PW-0464	6/27/2013	0.6	0.25	184.2	7.15	-158.8	Clear	
PW-0464	9/25/2013	0.5	1.64	198.6	6.92	-128.5	Clear	
PW-0463	4/4/2013	1.0	0.12	180.0	7.25	-119.2	Clear	FHRA arranged to repair broken spigot; water flows in off position
PW-0463	6/27/2013	1.0	0.20	184.9	7.30	-166.6	Clear	
PW-0463	9/12/2013	1.2	0.25	191.4	7.19	-135.5	Clear	
PW-0943	3/12/2013	0.6	0.06	241.2	7.01	-123.9	Clear	
PW-0943	6/6/2013	0.7	0.07	261.5	6.96	-140.5	Clear	
PW-0943	9/11/2013	0.6	0.40	250.1	6.91	-132.0	Clear	
PW-0932	3/20/2013	0.9	0.08	184.4	7.82	-206.1	Clear	
PW-0932	6/19/2013	1.1	0.06	189.7	7.98	-190.6	Clear	
PW-0932	9/16/2013	1.1	0.33	205.0	7.32	-188.8	Clear	
PW-0297	3/21/2013	0.2	0.13	216.6	6.99	-81.0	Initially sediment, finally clear	
PW-0297	6/13/2013	1.6	0.29	267.4	7.07	-78.7	Clear	
PW-0297	9/12/2013	2.0	0.24	254.4	6.93	-93.7	Initially slightly turbid, finally clear	

**Table 7-2  
2013 Deep Private Well Field Parameter Results**

**Offsite Site Characterization Report - 2013 Addendum  
North Pole Refinery, North Pole, Alaska  
Flint Hills Resources Alaska, LLC**

Well ID	Sampling Date	Temperature (°C)	DO (mg/L)	Conductivity (µS/cm)	pH	ORP (mV)	Water Clarity	Notes
PW-0296	3/21/2013	0.6	0.10	199.8	7.36	-170.6	Initially sediment, finally clear	
PW-0296	6/13/2013	0.8	0.16	234.2	7.33	-192.2	Clear	
PW-0296	9/12/2013	0.7	0.34	213.1	7.09	-178.0	Clear	
PW-1109	3/13/2013	0.5	0.11	407.3	6.74	-82.3	Clear	
PW-1109	3/13/2013	0.5	0.11	407.3	6.74	-82.3	Clear	
PW-1109	6/5/2013	0.9	0.18	442.0	6.96	-65.9	Clear	
PW-1109	9/9/2013	0.9	0.45	400.0	6.67	-104.8	Clear	

**General Notes:**

All reported parameter values are last measured values following stabilization and immediately prior to sampling.

**Acronyms and Abbreviations:**

ft = feet

bgs = below ground surface

°C = degrees celcius

DO = dissolved oxygen

mg/L = milligrams per liter

µS/cm = microsemens per centimeter

ORP = oxidation-reduction potential

mV = millivolts

Table 7-3  
2013 Deep Private Well Analytical Results

Offsite Site Characterization Report - 2013 Addendum  
North Pole Refinery, North Pole, Alaska  
Flint Hills Resources Alaska, LLC

PW ID	Well Depth	Zone	Sample Type	Sample Date	Sulfolane	Alkalinity	Ammonia as N	Calcium	Chloride	CO3 Alkalinity	HCO3 Alkalinity	Dissolved Iron	Magnesium	Manganese	Methane	Nitrate/Nitrite Total <sup>a</sup>	Nitrate	Nitrite	OH Alkalinity	Potassium	Sodium	Sulfate	Total Iron	Total Manganese	Total Organic Carbon
					µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
PW-0217	238	>160	PS	03/11/2013	173	157	<0.0620	46.5	11.0	<6.20	157	4.96	11.0	0.830	0.11	--	<0.0620	0.0930J	<6.20	4.10	10.2	23.7	12.7	0.862	2.65
PW-0217	238	>160	PS	06/05/2013	163	152	0.0830J	46.8	10.7	<6.20	152	12.9	10.9	0.891	0.0830	--	0.0490J	<0.0620	<6.20	4.16	9.97	23.3	13.5	0.886	2.49
PW-0217	238	>160	PS	09/05/2013	152	148	0.0859J	45.8	10.0	<6.20	148	12.8	10.7	0.833	0.0990	--	<0.0620	<0.0620	<6.20	4.09	9.49	21.7	14.1	0.842	2.58
PW-0259	287	>160	PS	04/04/2013	<6.74	132	0.245	37.2	1.47	<6.20	132	5.41	8.86	0.815	0.025	--	0.0620JL*	0.0595JL*	<6.20	2.90	4.18	16.9	5.57	0.849	2.33
PW-0259	287	>160	PS	06/19/2013	<6.20	134	0.152	37.7	1.63	<6.20	134	4.55	8.81	0.845	0.0210	--	0.0600J	<0.0620	<6.20	2.91	4.11	16.6	5.76	0.870	2.40
PW-0296	220	>160	PS	03/21/2013	11.9	155	0.0951J	44.8	3.12	<6.20	155	6.44	9.95	0.624	0.059	--	0.0590J	<0.0620	<6.20	3.08	4.17	22.2	6.59	0.620	2.39
PW-0296	220	>160	PS	06/13/2013	12.6	140	0.119	51.1	3.20	<6.20	140	6.85	11.1	0.659	0.0390	--	0.0600J	<0.0620	<6.20	3.51	4.65	22.8	7.17	0.667	2.48
PW-0296	220	>160	DUP	06/13/2013	12.5	150	0.120	52.2	3.19	<6.20	150	6.91	11.2	0.673	0.0430	--	0.0590J	<0.0620	<6.20	3.54	4.71	22.9	7.13	0.669	2.48
PW-0296	220	>160	PS	09/12/2013	11.2	147	0.109	48.3	3.05	<6.20	147	6.47	10.6	0.645	0.0560	--	<0.0620	<0.0620	<6.20	3.33	4.57	22.2	6.60	0.643	2.29
PW-0297 <sup>b</sup>	24	10-55	PS	03/21/2013	9.12J	172	0.217	52.3	7.20	<6.20	172	2.52	12.7	1.47	0.069	--	0.0620J	<0.0620	<6.20	3.95	7.77	24.3	2.46	1.43	3.41
PW-0297 <sup>b</sup>	24	10-55	PS	06/13/2013	10.5	170	0.197	55.4	7.92	<6.20	170	2.08	13.0	1.44	0.0230	--	0.0590J	<0.0620	<6.20	4.09	8.74	25.7	3.02	1.45	3.83
PW-0297 <sup>b</sup>	24	10-55	PS	09/12/2013	10.0J	172	0.166	53.5	8.61	<6.20	172	1.96	12.9	1.40	0.0180	--	<0.0620	<0.0620	<6.20	4.08	8.11	24.1	2.09	1.43	3.33
PW-0332	266	>160	PS	04/19/2013	<6.66J§	150J§	0.0994J§	<0.300J§	1.05J§	<6.20J§	150J§	<0.156J§	<0.0300J§	0.000477J§	0.080J§	--	<0.0620J§	0.0645J§	<6.20J§	<0.300J§	77.7J§	15.8J§	0.192J§	0.000949J§	1.18J§
PW-0332	266	>160	PS	06/20/2013	<6.20	143	0.103	43.8	0.958	<6.20	143	2.16	8.87	0.368	0.00860	--	0.0590J	<0.0620	<6.20	3.14	4.63	15.6	2.16	0.378	1.13
PW-0332	266	>160	PS	09/24/2013	<6.20	143	0.0956J	44.2	0.944	<6.20	143	2.47	9.13	0.351	0.00940	--	0.0440J	0.0310J	<6.20	3.25	4.62	15.3	2.94	0.365	<1.69B*
PW-0358	105	90-160	PS	03/25/2013	73.8	113	0.181	39.5	3.90	<6.20	113	4.22	8.88	0.433	0.019	--	0.0570J	0.0530J	<6.20	3.05	4.17	23.3	8.00	0.610	3.70
PW-0358	105	90-160	PS	06/12/2013	80.2	116	0.0848J	44.1	2.53	<6.20	116	3.73	9.09	0.599	0.0180	--	0.0600J	<0.0620	<6.20	3.26	4.20	32.5	4.42	0.603	1.25
PW-0358	105	90-160	PS	09/10/2013	88.7	120	0.0331J	39.5	2.62	<6.20	120	4.67	8.88	0.582	0.0290	--	<0.0620	<0.0620	<6.20	3.11	4.24	24.5	5.93	0.570	<1.75B*
PW-0463	89	55-90	PS	04/04/2013	27.9	124	0.207	41.6	3.57	<6.20	124	1.70	9.09	0.647	0.020	--	<0.0620	0.0510J	<6.20	3.09	4.52	29.4	1.77	0.638	1.41
PW-0463	89	55-90	PS	06/27/2013	33.2	124	0.0999J	43.5	3.68	<6.20	124	2.21	9.27	0.667	0.00910	<0.0620J*	--	--	<6.20	3.16	4.56	28.4	2.94	0.684	1.29
PW-0463	89	55-90	PS	09/12/2013	34.7	122	0.0656J	42.7	3.82	<6.20	122	2.08	9.07	0.670	0.0280	--	<0.0620	<0.0620	<6.20	3.06	4.39	28.5	2.17	0.676	<1.39B*
PW-0464	98	55-90	PS	03/28/2013	40.3	126	0.0459J	41.4	4.07	<6.20	126	1.16	9.17	0.581	0.031	--	0.0560J	0.0520J	<6.20	3.02	4.41	28.5	2.17	0.592	1.57
PW-0464	98	55-90	PS	06/27/2013	44.2	126	0.0967J	43.2	4.01	<6.20	126	1.68	9.22	0.624	0.0260	<0.0620J*	--	--	<6.20	3.09	4.45	29.7	1.74	0.639	1.43
PW-0464	98	55-90	PS	09/25/2013	45.3	127	0.0688J	45.1	4.01JH*	<6.20	127	1.35	9.70	0.620	0.0350	--	<0.0620	<0.0620	<6.20	3.17	4.60	28.8	1.62	0.619	1.88
PW-0466	122	90-160	DUP	04/18/2013	23.9	162	0.176	51.6	6.13	<6.20	162	2.86	11.5	0.749	0.061	--	<0.0620	<0.0620	<6.20	3.41	4.69	26	2.97	0.765	2.85
PW-0466	122	90-160	PS	04/18/2013	23.1	159	0.186	51.0	6.28	<6.20	159	2.84	11.0	0.738	0.078	--	0.0440J	<0.0620	<6.20	3.34	4.43	26.4	3.00	0.753	2.95
PW-0466	122	90-160	PS	06/12/2013	26.8	157	0.0895J	55.5	6.36	<6.20	157	3.17	12.0	0.762	0.0580	--	0.0600J	<0.0620	<6.20	3.60	4.77	25.9	3.14	0.754	2.90
PW-0466	122	90-160	PS	09/09/2013	29.5	164	0.111	52.6	6.54	<6.20	164	3.06	12.0	0.741	0.0970	--	<0.0620	<0.0620	<6.20	3.53	4.76	25.6	3.19	0.759	3.89
PW-0466	122	90-160	DUP	09/09/2013	29.0	164	0.0923J	54.0	6.51	<6.20	164	3.10	12.3	0.749	0.0810	--	<0.0620	<0.0620	<6.20	3.57	4.85	25.4	3.20	0.770	3.92
PW-0658	196	>160	PS	03/18/2013	48.4	169	0.139	48.4	7.40	<6.20	169	6.92	12.1	0.673	0.089	--	0.0610J	<0.0620	<6.20	3.65	4.49	15.2	9.25	0.693	3.43
PW-0658	196	>160	PS	06/12/2013	51.1	164	0.0646J	53.5	7.41	<6.20	164	7.00	12.3	0.691	0.0860	--	0.0580J	<0.0620	<6.20	3.94	4.62	14.6	7.92	0.672	3.63
PW-0658	196	>160	PS	09/11/2013	63.7	173	0.0597J	52.9	7.59	<6.20	173	7.24	12.3	0.748	0.120	--	<0.0620	<0.0620	<6.20	3.73	4.49	15.3	7.50	0.735	4.37
PW-0932	255	>160	PS	03/20/2013	5.09J	139	<0.124B*	46.1	2.93	<6.20	139	5.54	9.95	0.543	0.044	--	0.0560J	<0.0620	<6.20	3.37	4.48	23	7.01	0.554	1.90
PW-0932	255	>160	PS	06/19/2013	5.04J	138	0.0921J	42.4	2.95	<6.20	138	4.24	9.08	0.527	0.0270	--	0.0940J	<0.0620	<6.20	3.13	4.23	24.6	4.40	0.509	1.84
PW-0932	255	>160	PS	09/16/2013	8.05J	135	0.0845J	44.2	3.19	<6.20	135	3.45	9.90	0.536	0.0290	--	<0.100B*	0.0590J	<6.20	3.36	4.42	24.9	3.66	0.534	2.05
PW-0943	120	90-160	PS	03/12/2013	25.7	167	0.157	47.8	6.62	<6.20	167	12.3	13.2	1.08	0.0090	--	0.0750J	<0.100B*	<6.20	3.33	4.86	20.6	15.6	1.06	4.13
PW-0943	120	90-160	PS	06/06/2013	25.8	174	0.149	50.1	6.94	<6.20	174	16.6	13.1	1.14	0.0660	--	0.0315J	<0.0620	<6.20	3.43	4.73	23.1	17.3	1.12	4.17
PW-0943	120	90-160	PS	09/11/2013	30.3	167	0.114	50.6	7.35	<6.20	167	15.6	13.8	1.12	0.0640	--	0.0660J	<0.0620	<6.20	3.51	5.09	20.4	16.7	1.07	4.89
PW-0972	236	>160	PS	03/17/2013	<6.74	121	0.0724J	36.5	2.67	<6.20	121	4.10	10.6	0.880	0.011	--	0.0600J	<0.0620	<6.20	2.97	4.25	30.9	4.06	0.838	1.51
PW-0972	236	>160	PS	06/20/2013	<6.50	121	0.0400J	37.6	2.30	<6.20	121	4.20	10.1	0.895	0.0110	--	0.0850J	<0.0620	<6.20	3.01	4.22	30.3	4.57	0.884	1.40
PW-0972	236	>160	DUP	06/20/2013	<6.46	123	0.0465J	37.0	2.27	<6.20	123	4.19	10.1	0.884	0.0110	--	0.0960J	<0.0620	<6.20	2.96	4.16	30	4.38	0.883	1.41
PW-0972	236	>160	PS	09/05/2013	<6.32	119	0.116	37.2	2.41	<6.20	119	4.36	10.4	0.859	0.0170	--	<0.0620	<0.0620	<6.20	3.02	4.17	29.3	4.35	0.830	2.39
PW-1099	140	90-160	DUP	03/12/2013	105	124	0.105	39.6	3.18	<6.20	124	3.01	11.2	0.737	0.010J*	--	0.0630J	<0.0620	<6.20	2.98	4.24	31.6	3.52	0.762	1.75
PW-1099	140	90-160	PS	03/12/2013	107	123	0.0997J	38.6	3.20	<6.20	123	3.14	11.0	0.740	0.074J*	--	0.0670J	<0.0620	<6.20	2.92	4.16	31.7	3.42	0.734	1.73
PW-1099	140	90-160	PS	06/04/2013	103	125	<0.0620	41.5	<0.0620	<6.20	125	4.48	11.6	0.777	0.00960	--	<0.0620	<0.0620	<6.20	3.21	4.40	<0.0620	4.51	0.781	1.67
PW-1099	140	90-160	PS	09/26/2013	97.2	124	0.0527J	40.3	3.03	<6.20	124	2.68	11.1	0.694	0.0100JL*	--	0.0555J	<0.0620</							

**Table 7-3  
2013 Deep Private Well Analytical Results**

**Offsite Site Characterization Report - 2013 Addendum  
North Pole Refinery, North Pole, Alaska  
Flint Hills Resources Alaska, LLC**

PW ID	Well Depth	Zone	Sample Type	Sample Date	Sulfolane	Alkalinity	Ammonia as N	Calcium	Chloride	CO3 Alkalinity	HCO3 Alkalinity	Dissolved Iron	Magnesium	Manganese	Methane	Nitrate/Nitrite Total <sup>a</sup>	Nitrate	Nitrite	OH Alkalinity	Potassium	Sodium	Sulfate	Total Iron	Total Manganese	Total Organic Carbon
					µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
PW-1458 <sup>b</sup>	30	10-55	PS	09/05/2013	<6.40	163	0.0557J	52.4	12.7	<6.20	163	0.646	14.5	1.65	0.0290	--	<0.0620	<0.0620	<6.20	4.15	8.56	27.3	0.687	1.73	1.59
PW-1626	305	>160	PS	10/16/2013	307	122	0.0651J	43.1	5.17	<6.20	122	2.77	10.8	0.480	0.0130	--	<0.0620	0.0320J	<6.20	3.74	6.02	32.5	16.3	0.543	<1.51B*

**Footnotes:**

- a. Laboratory performed total analysis for samples received outside of hold time due to delivery truck delay.
- b. Garden well location.
- c. Location was resampled to verify sulfolane results from the sample collected on 3/11/2013.

**Acronyms and Abbreviations:**

PW ID = Private Well Identification Number  
 § = result biased. Sample location was downstream of a water-treatment system. The sample was collected from the appropriate spigot during the second and third quarter sampling events.  
 J = result is estimated; analyte was detected below the limit of quantitation (LOQ).  
 JL\* = results is considered an estimate, biased low; flag applied by SWI based on sample-handling or analytical QC issues, see data-review checklist for details  
 JH\* = results is considered an estimate, biased high; flag applied by SWI based on sample-handling or analytical QC issues, see data-review checklist for details  
 B\* = result is considered non-detect; flag applied by SWI based on analytical QC issues, see data-review checklist for details  
 µg/L = micrograms per liter  
 < = analyte not detected; limit of detection listed  
 DUP = duplicate sample  
 PF = project sample

**Table 7-4  
2013 Deep Private Well Groundwater Types**

**Offsite Site Characterization Report - 2013 Addendum  
North Pole Refinery, North Pole, Alaska  
Flint Hills Resources Alaska, LLC**

Well ID	Temperature (°C)	DO (mg/L)	Specific Conductivity (µS/cm)	pH	ORP (mV)
Type A Q1 Average	0.6	0.1	339.6	6.9	-84.8
Type A Q1 Standard Deviation	0.1	0.0	95.7	0.2	3.5
Type B Q1 Average	1.4	0.2	186.5	7.5	-160.8
Type B Q1 Standard Deviation	1.4	0.2	13.4	0.4	70.6
Type C Q1 Average	0.8	0.1	220.6	7.3	-144.0
Type C Q1 Standard Deviation	0.7	0.0	20.0	0.2	40.6
<b>Q1 Average</b>	<b>1.0</b>	<b>0.1</b>	<b>220.6</b>	<b>7.3</b>	<b>-144.0</b>
Q1 Standard Deviation	1.0	0.1	54.2	0.3	55.4
Type A Q2 Average	1.0	0.2	326.0	7.1	-103.1
Type A Q2 Standard Deviation	0.1	0.0	164.1	0.2	52.6
Type B Q2 Average	1.9	0.4	212.0	7.3	-156.1
Type B Q2 Standard Deviation	1.5	0.3	8.2	0.4	33.5
Type C Q2 Average	1.4	0.2	240.9	7.3	-155.5
Type C Q2 Standard Deviation	0.8	0.1	28.9	0.3	44.6
<b>Q2 Average</b>	<b>1.6</b>	<b>0.2</b>	<b>239.3</b>	<b>7.3</b>	<b>-151.0</b>
Q2 Standard Deviation	1.0	0.2	63.1	0.3	61.5
Type A Q3 Average	0.8	0.6	344.9	6.8	-85.3
Type A Q3 Standard Deviation	0.2	0.1	77.9	0.1	27.6
Type B Q3 Average	1.1	0.7	189.1	7.2	-169.1
Type B Q3 Standard Deviation	0.5	0.7	8.4	0.4	56.0
Type C Q3 Average	1.5	0.5	232.0	7.1	-156.3
Type C Q3 Standard Deviation	1.3	0.3	19.5	0.2	55.5
<b>Q3 Average</b>	<b>1.3</b>	<b>0.6</b>	<b>228.0</b>	<b>7.1</b>	<b>-153.5</b>
Q3 Standard Deviation	1.0	0.5	51.7	0.3	57.0
Type A Average	0.8	0.3	357.2	6.9	-64.5
Type A Standard Deviation	0.4	0.2	69.2	0.1	43.4
Type B Average	1.5	0.4	190.1	7.4	-170.3
Type B Standard Deviation	1.2	0.5	10.8	0.4	53.8
Type C Average	1.2	0.3	231.5	7.3	-152.2
Type C Standard Deviation	1.0	0.3	24.0	0.3	46.1
<b>Overall Average</b>	<b>1.3</b>	<b>0.3</b>	<b>229.5</b>	<b>7.2</b>	<b>-149.6</b>
Overall Standard Deviation	1.0	0.4	56.1	0.3	57.1

**Acronyms and Abbreviations:**

- °C = degrees celsius
- DO = dissolved oxygen
- mg/L = milligrams per liter
- µS/cm = microsiemens per centimeter
- mV = millivolts



**Table 7-5  
Offsite Initial Phase 8 Groundwater Analytical Results**

**Offsite Site Characterization Report - 2013 Addendum  
North Pole Refinery, North Pole, Alaska  
Flint Hills Resources Alaska, LLC**

Proposed Well ID <sup>1</sup>	Location <sup>2</sup>	Proximity	Zone	Sample Name	Sample Type	Sample Date	Sulfolane µg/L
MW-148E	MW-148-80	Off-site	55-90	MW-148-80		10/31/2013	13.6
MW-148F	MW-148-100	Off-site	55-90	MW-148-100		10/31/2013	<6.66
8-O	MW-160AR-15	Off-site	Water Table	MW-160AR		5/14/2013	<6.20
	MW-160AR-15	Off-site	Water Table	MW-260AR	DUP	5/14/2013	<6.20
8-AE	MW-161-30	Off-site	10-55	MW-161-30		5/13/2013	210
8-Z	MW-190BR-60	Off-site	10-55	MW-190BR		5/24/2013	<6.20
	MW-190-150	Off-site	90-160	MW-190-150		6/4/2013	<6.20
8-X	MW-332-41	Off-site	10-55	MW-332-41		5/17/2013	<6.20
	MW-332-41	Off-site	10-55	MW-432-41	DUP	5/17/2013	<6.20
	MW-332-75	Off-site	55-90	MW-332-75		5/17/2013	<6.20
	MW-332-110	Off-site	90-160	MW-332-110		5/17/2013	25.7
8-Q	MW-338-15	Off-site	Water Table	MW-338-15		5/13/2013	56.2
	MW-338-50	Off-site	10-55	MW-338-50		5/13/2013	46.1
8-AB	MW-339-15	Off-site	Water Table	MW-339-15		5/14/2013	57.0
	MW-339-50	Off-site	10-55	MW-339-50		5/14/2013	35.4
8-Y	MW-340-18	Off-site	Water Table	MW-340-18		5/16/2013	<6.20
	MW-340-65	Off-site	10-55	MW-340-65		5/16/2013	<6.20
	MW-340-150	Off-site	90-160	MW-340-150		5/16/2013	<6.20
8-T	MW-341-15	Off-site	Water Table	MW-341-15		5/24/2013	121
	MW-341-40	Off-site	10-55	MW-341-40		5/24/2013	93.6
8-R	MW-342-15	Off-site	Water Table	MW-342-15		6/4/2013	158
	MW-342-65	Off-site	10-55	MW-342-65		6/4/2013	159
	MW-342-65	Off-site	10-55	MW-442-65	DUP	6/4/2013	168
8-W	MW-343-15	Off-Site	Water Table	MW-343-15		9/26/2013	<6.32
	MW-343-50	Off-site	10-55	MW-343-50		6/25/2013	<6.42
8-AC	MW-346-15	Off-Site	Water Table	MW-346-15		9/26/2013	7.19J
	MW-346-65	Off-Site	10-55	MW-446-65	DUP	9/26/2013	21.6
	MW-346-65	Off-Site	10-55	MW-346-65		9/26/2013	22.7
	MW-346-150	Off-Site	90-160	MW-346-150		9/26/2013	<6.20
8-AA	MW-347-20	Off-Site	Water Table	MW-347-20		9/27/2013	12.9
	MW-347-65	Off-Site	10-55	MW-347-65		9/27/2013	27.4
	MW-347-150	Off-site	90-160	MW-347-150		9/27/2013	9.57J
8-AF	MW-349-15	Off-site	Water Table	MW-349-15		8/16/2013	59.3
	MW-349-45	Off-site	10-55	MW-349-45		8/16/2013	58.4
8-V	MW-350-15	Off-site	Water Table	MW-350-15		9/27/2013	30.3
	MW-350-50	Off-site	10-55	MW-350-50		9/27/2013	47.7
8-AD	MW-352-15	Off-site	Water Table	MW-352-15		9/30/2013	5.10J
	MW-352-40	Off-site	10-55	MW-352-40		9/30/2013	8.73J
8-S	MW-353-15	Off-site	Water Table	MW-353-15		9/25/2013	157
	MW-353-65	Off-site	10-55	MW-353-65		9/25/2013	204
	MW-353-100	Off-site	90-160	MW-353-100		9/25/2013	198
8-BA	MW-356-15	Off-site	Water Table	MW-356-15		10/21/2013	<6.20
	MW-356-65	Off-site	10-55	MW-356-65		10/21/2013	<6.66
	MW-356-90	Off-site	55-90	MW-356-90		10/21/2013	<6.82
	MW-356-90	Off-site	55-90	MW-456-90	DUP	10/21/2013	<6.88

**Table 7-5  
Offsite Initial Phase 8 Groundwater Analytical Results**

**Offsite Site Characterization Report - 2013 Addendum  
North Pole Refinery, North Pole, Alaska  
Flint Hills Resources Alaska, LLC**

Proposed Well ID <sup>1</sup>	Location <sup>2</sup>	Proximity	Zone	Sample Name	Sample Type	Sample Date	Sulfolane µg/L
8-BB	MW-357-15	Off-site	Water Table	MW-357-15		10/31/2013	<6.74
	MW-357-65	Off-site	10-55	MW-357-65		10/31/2013	<6.74
	MW-357-150	Off-site	90-160	MW-357-150		10/31/2013	<6.66

**Footnotes:**

- a. Well names were proposed in the Revised 2013 Offsite Site Characterization Work Plan (ARCADIS 2013) for planning purposes only. Permanent well names were applied upon installation.
- b. Well depths are noted at the end of each location ID.

**Acronyms and Abbreviations:**

DUP = quality-control field-duplicate sample

µg/L = micrograms per liter

J = estimated concentration; detected above the detection limit (DL) but below the limit of quantitation (LOQ)

**Table 7-6  
Total Organic Carbon Analytical Results in Offsite Groundwater Monitoring Wells**

**Offsite Site Characterization Report - 2013 Addendum  
North Pole Refinery, North Pole, Alaska  
Flint Hills Resources Alaska, LLC**

Location Name	Zone	Proximity	Sample Name	Sample Date	Sample Type	Analyte	Display	Units
MW-148A-15	Water Table	Off-site	MW-148A	3/7/2011		Total Organic Carbon	9.56	mg/L
MW-148A-15	Water Table	Off-site	MW-148A	4/8/2011		Total Organic Carbon	10.2	mg/L
MW-148A-15	Water Table	Off-site	MW-148A	8/18/2011		Total Organic Carbon	11.1	mg/L
MW-148A-15	Water Table	Off-site	MW-148A	10/11/2011		Total Organic Carbon	15.4	mg/L
MW-148A-15	Water Table	Off-site	MW-148A	5/3/2012		Total Organic Carbon	11.4	mg/L
MW-148A-15	Water Table	Off-site	MW-148A	10/22/2012		Total Organic Carbon	15.8	mg/L
MW-148A-15	Water Table	Off-site	MW-148A	5/6/2013		Total Organic Carbon	12.6	mg/L
MW-148B-30	10-55	Off-site	MW-148B	3/7/2011		Total Organic Carbon	3.41	mg/L
MW-148B-30	10-55	Off-site	MW-148B	4/8/2011		Total Organic Carbon	3.44	mg/L
MW-148B-30	10-55	Off-site	MW-248B	8/12/2011	DUP	Total Organic Carbon	3.57	mg/L
MW-148B-30	10-55	Off-site	MW-148B	8/12/2011		Total Organic Carbon	3.66	mg/L
MW-148B-30	10-55	Off-site	MW-148B	10/11/2011		Total Organic Carbon	3.30	mg/L
MW-148B-30	10-55	Off-site	MW-148B	5/1/2012		Total Organic Carbon	3.12	mg/L
MW-148B-30	10-55	Off-site	MW-148B	11/11/2012		Total Organic Carbon	3.02	mg/L
MW-148B-30	10-55	Off-site	MW-148B	4/15/2013		Total Organic Carbon	2.95	mg/L
MW-151A-15	Water Table	Off-site	MW-151A	2/10/2011		Total Organic Carbon	1.80	mg/L
MW-151A-15	Water Table	Off-site	MW-251A	5/25/2011	DUP	Total Organic Carbon	2.26	mg/L
MW-151A-15	Water Table	Off-site	MW-151A	5/25/2011		Total Organic Carbon	2.27	mg/L
MW-151A-15	Water Table	Off-site	MW-151A	8/9/2011		Total Organic Carbon	2.53	mg/L
MW-151A-15	Water Table	Off-site	MW-151A	10/11/2011		Total Organic Carbon	2.92	mg/L
MW-151A-15	Water Table	Off-site	MW-151A	4/30/2012		Total Organic Carbon	3.27	mg/L
MW-151A-15	Water Table	Off-site	MW-151A	11/10/2012		Total Organic Carbon	2.10J*	mg/L
MW-151A-15	Water Table	Off-site	MW-151A	3/7/2013		Total Organic Carbon	1.93	mg/L
MW-151B-25	10-55	Off-site	MW-151B	2/18/2011		Total Organic Carbon	1.94	mg/L
MW-151B-25	10-55	Off-site	MW-151B	5/25/2011		Total Organic Carbon	1.81	mg/L
MW-151B-25	10-55	Off-site	MW-151B	8/9/2011		Total Organic Carbon	2.24	mg/L
MW-151B-25	10-55	Off-site	MW-151B	10/11/2011		Total Organic Carbon	2.29	mg/L
MW-151B-25	10-55	Off-site	MW-151B	4/30/2012		Total Organic Carbon	2.19	mg/L
MW-151B-25	10-55	Off-site	MW-151B	11/10/2012		Total Organic Carbon	1.71	mg/L
MW-151B-25	10-55	Off-site	MW-151B	4/15/2013		Total Organic Carbon	1.69	mg/L
MW-152A-15	Water Table	Off-site	MW-152A	8/8/2011		Total Organic Carbon	3.33	mg/L
MW-152A-15	Water Table	Off-site	MW-152A	10/11/2011		Total Organic Carbon	2.50	mg/L
MW-152A-15	Water Table	Off-site	MW-152A	7/31/2012		Total Organic Carbon	2.52	mg/L
MW-152A-15	Water Table	Off-site	MW-152A	11/9/2012		Total Organic Carbon	2.11	mg/L
MW-152B-25	10-55	Off-site	MW-152B	8/8/2011		Total Organic Carbon	2.26	mg/L
MW-152B-25	10-55	Off-site	MW-152B	10/11/2011		Total Organic Carbon	2.15	mg/L
MW-152B-25	10-55	Off-site	MW-152B	11/9/2012		Total Organic Carbon	1.81	mg/L

**Table 7-6  
Total Organic Carbon Analytical Results in Offsite Groundwater Monitoring Wells**

**Offsite Site Characterization Report - 2013 Addendum  
North Pole Refinery, North Pole, Alaska  
Flint Hills Resources Alaska, LLC**

Location Name	Zone	Proximity	Sample Name	Sample Date	Sample Type	Analyte	Display	Units
MW-156A-15	Water Table	Off-site	MW-156A	3/7/2011		Total Organic Carbon	6.97	mg/L
MW-156A-15	Water Table	Off-site	MW-256A	8/9/2011	DUP	Total Organic Carbon	8.11	mg/L
MW-156A-15	Water Table	Off-site	MW-156A	8/9/2011		Total Organic Carbon	7.84	mg/L
MW-156A-15	Water Table	Off-site	MW-156A	10/11/2011		Total Organic Carbon	10.1	mg/L
MW-156A-15	Water Table	Off-site	MW-156A	4/27/2012		Total Organic Carbon	4.46	mg/L
MW-156A-15	Water Table	Off-site	MW-256A	10/31/2012	DUP	Total Organic Carbon	8.08	mg/L
MW-156A-15	Water Table	Off-site	MW-156A	10/31/2012		Total Organic Carbon	8.09	mg/L
MW-156A-15	Water Table	Off-site	MW-156A	3/9/2013		Total Organic Carbon	4.27	mg/L
MW-156B-50	10-55	Off-site	MW-156B	3/7/2011		Total Organic Carbon	1.80	mg/L
MW-156B-50	10-55	Off-site	MW-156B	8/10/2011		Total Organic Carbon	2.42	mg/L
MW-156B-50	10-55	Off-site	MW-156B	10/11/2011		Total Organic Carbon	1.82	mg/L
MW-156B-50	10-55	Off-site	MW-156B	10/31/2012		Total Organic Carbon	1.72	mg/L
MW-156B-50	10-55	Off-site	MW-156B	3/9/2013		Total Organic Carbon	1.66	mg/L
MW-157A-15	Water Table	Off-site	MW-157	2/18/2011		Total Organic Carbon	2.66	mg/L
MW-157A-15	Water Table	Off-site	MW-157	4/12/2011		Total Organic Carbon	3.13	mg/L
MW-157A-15	Water Table	Off-site	MW-157	8/8/2011		Total Organic Carbon	3.29	mg/L
MW-157A-15	Water Table	Off-site	MW-157A	10/11/2011		Total Organic Carbon	3.41	mg/L
MW-157A-15	Water Table	Off-site	MW-157A	4/27/2012		Total Organic Carbon	2.53	mg/L
MW-157A-15	Water Table	Off-site	MW-157A	10/31/2012		Total Organic Carbon	2.66	mg/L
MW-157A-15	Water Table	Off-site	MW-257A	4/12/2013	DUP	Total Organic Carbon	2.73	mg/L
MW-157A-15	Water Table	Off-site	MW-157A	4/12/2013		Total Organic Carbon	2.51	mg/L
MW-158A-15	Water Table	Off-site	MW-158A	3/8/2011		Total Organic Carbon	18.2	mg/L
MW-158A-15	Water Table	Off-site	MW-158A	3/10/2011		Total Organic Carbon	16.8	mg/L
MW-158A-15	Water Table	Off-site	MW-158A	8/10/2011		Total Organic Carbon	25.2	mg/L
MW-158A-15	Water Table	Off-site	MW-158A	10/11/2011		Total Organic Carbon	34.4	mg/L
MW-158A-15	Water Table	Off-site	MW-258A	4/28/2012	DUP	Total Organic Carbon	14.0	mg/L
MW-158A-15	Water Table	Off-site	MW-158A	4/28/2012		Total Organic Carbon	14.1	mg/L
MW-158A-15	Water Table	Off-site	MW-258A	7/31/2012	DUP	Total Organic Carbon	15.7	mg/L
MW-158A-15	Water Table	Off-site	MW-158A	7/31/2012		Total Organic Carbon	15.3	mg/L
MW-158A-15	Water Table	Off-site	MW-158A	11/9/2012		Total Organic Carbon	15.4	mg/L
MW-158B-60	10-55	Off-site	MW-158B	3/10/2011		Total Organic Carbon	2.05	mg/L
MW-158B-60	10-55	Off-site	MW-158B	7/31/2012		Total Organic Carbon	1.67	mg/L
MW-159A-15	Water Table	Off-site	MW-259	4/15/2011	DUP	Total Organic Carbon	3.00	mg/L
MW-159A-15	Water Table	Off-site	MW-159	4/15/2011		Total Organic Carbon	2.52	mg/L
MW-159A-15	Water Table	Off-site	MW-159	8/10/2011		Total Organic Carbon	4.80	mg/L
MW-159A-15	Water Table	Off-site	MW-159A	10/11/2011		Total Organic Carbon	5.29	mg/L
MW-159A-15	Water Table	Off-site	MW-159A	4/28/2012		Total Organic Carbon	2.62	mg/L

**Table 7-6  
Total Organic Carbon Analytical Results in Offsite Groundwater Monitoring Wells**

**Offsite Site Characterization Report - 2013 Addendum  
North Pole Refinery, North Pole, Alaska  
Flint Hills Resources Alaska, LLC**

Location Name	Zone	Proximity	Sample Name	Sample Date	Sample Type	Analyte	Display	Units
MW-159A-15	Water Table	Off-site	MW-159A	10/31/2012		Total Organic Carbon	4.37	mg/L
MW-159A-15	Water Table	Off-site	MW-159A	4/12/2013		Total Organic Carbon	2.40	mg/L
MW-160B-90	55-90	Off-site	MW-160B	7/31/2012		Total Organic Carbon	1.42	mg/L
MW-161A-15	Water Table	Off-site	MW-161A	3/8/2011		Total Organic Carbon	3.36	mg/L
MW-161A-15	Water Table	Off-site	MW-161A	5/25/2011		Total Organic Carbon	3.51	mg/L
MW-161A-15	Water Table	Off-site	MW-261A	8/6/2011	DUP	Total Organic Carbon	3.58	mg/L
MW-161A-15	Water Table	Off-site	MW-161A	8/6/2011		Total Organic Carbon	3.70	mg/L
MW-161A-15	Water Table	Off-site	MW-161A	10/11/2011		Total Organic Carbon	3.44	mg/L
MW-161A-15	Water Table	Off-site	MW-261A	10/11/2011	DUP	Total Organic Carbon	4.01	mg/L
MW-161A-15	Water Table	Off-site	MW-161A	5/3/2012		Total Organic Carbon	3.41	mg/L
MW-161A-15	Water Table	Off-site	MW-161A	10/22/2012		Total Organic Carbon	3.19	mg/L
MW-161A-15	Water Table	Off-site	MW-161A	5/3/2013		Total Organic Carbon	3.22	mg/L
MW-161B-50	10-55	Off-site	MW-161B	10/11/2011		Total Organic Carbon	3.10	mg/L
MW-161B-50	10-55	Off-site	MW-161B	5/1/2012		Total Organic Carbon	11.2	mg/L
MW-161B-50	10-55	Off-site	MW-161B	10/25/2012		Total Organic Carbon	2.20	mg/L
MW-161B-50	10-55	Off-site	MW-261B	5/3/2013	DUP	Total Organic Carbon	2.40	mg/L
MW-161B-50	10-55	Off-site	MW-161B	5/3/2013		Total Organic Carbon	2.37	mg/L
MW-162A-15	Water Table	Off-site	MW-162A	2/18/2011		Total Organic Carbon	5.79	mg/L
MW-162A-15	Water Table	Off-site	MW-262A	3/10/2011	DUP	Total Organic Carbon	6.46	mg/L
MW-162A-15	Water Table	Off-site	MW-162A	3/10/2011		Total Organic Carbon	6.54	mg/L
MW-162A-15	Water Table	Off-site	MW-162A	8/6/2011		Total Organic Carbon	8.05	mg/L
MW-162A-15	Water Table	Off-site	MW-162A	10/11/2011		Total Organic Carbon	7.94	mg/L
MW-162A-15	Water Table	Off-site	MW-162A	10/31/2012		Total Organic Carbon	7.62	mg/L
MW-162B-65	10-55	Off-site	MW-162B	2/18/2011		Total Organic Carbon	2.30	mg/L
MW-162B-65	10-55	Off-site	MW-162B	3/10/2011		Total Organic Carbon	2.17	mg/L
MW-162B-65	10-55	Off-site	MW-162B	8/6/2011		Total Organic Carbon	2.54	mg/L
MW-162B-65	10-55	Off-site	MW-162B	10/11/2011		Total Organic Carbon	2.26	mg/L
MW-162B-65	10-55	Off-site	MW-162B	10/31/2012		Total Organic Carbon	2.09	mg/L
MW-163A-15	Water Table	Off-site	MW-163A	2/25/2011		Total Organic Carbon	2.24	mg/L
MW-163A-15	Water Table	Off-site	MW-163A	3/9/2011		Total Organic Carbon	2.72	mg/L
MW-163A-15	Water Table	Off-site	MW-163A	4/12/2011		Total Organic Carbon	2.86	mg/L
MW-163A-15	Water Table	Off-site	MW-163A	8/5/2011		Total Organic Carbon	3.84	mg/L
MW-163A-15	Water Table	Off-site	MW-163A	10/11/2011		Total Organic Carbon	3.29	mg/L
MW-163A-15	Water Table	Off-site	MW-163A	4/26/2012		Total Organic Carbon	2.75	mg/L
MW-163A-15	Water Table	Off-site	MW-163A	10/30/2012		Total Organic Carbon	2.79	mg/L
MW-163A-15	Water Table	Off-site	MW-263A	5/3/2013	DUP	Total Organic Carbon	2.50	mg/L
MW-163A-15	Water Table	Off-site	MW-163A	5/3/2013		Total Organic Carbon	2.74	mg/L

**Table 7-6  
Total Organic Carbon Analytical Results in Offsite Groundwater Monitoring Wells**

**Offsite Site Characterization Report - 2013 Addendum  
North Pole Refinery, North Pole, Alaska  
Flint Hills Resources Alaska, LLC**

Location Name	Zone	Proximity	Sample Name	Sample Date	Sample Type	Analyte	Display	Units
MW-163B-40	10-55	Off-site	MW-163B	3/9/2011		Total Organic Carbon	2.31	mg/L
MW-163B-40	10-55	Off-site	MW-163B	10/11/2011		Total Organic Carbon	2.50	mg/L
MW-164A-15	Water Table	Off-site	MW-164A	2/24/2011		Total Organic Carbon	3.94	mg/L
MW-164A-15	Water Table	Off-site	MW-164A	3/10/2011		Total Organic Carbon	4.62	mg/L
MW-164A-15	Water Table	Off-site	MW-164A	4/6/2011		Total Organic Carbon	4.40	mg/L
MW-164A-15	Water Table	Off-site	MW-164A	8/9/2011		Total Organic Carbon	13.3	mg/L
MW-164A-15	Water Table	Off-site	MW-164A	10/11/2011		Total Organic Carbon	5.71	mg/L
MW-164A-15	Water Table	Off-site	MW-164A	4/26/2012		Total Organic Carbon	4.94	mg/L
MW-164A-15	Water Table	Off-site	MW-164A	10/25/2012		Total Organic Carbon	7.11	mg/L
MW-164A-15	Water Table	Off-site	MW-164A	5/2/2013		Total Organic Carbon	5.25	mg/L
MW-164B-50	10-55	Off-site	MW-164B	3/10/2011		Total Organic Carbon	3.48	mg/L
MW-165A-15	Water Table	Off-site	MW-165A	2/24/2011		Total Organic Carbon	3.29	mg/L
MW-165A-15	Water Table	Off-site	MW-165A	8/9/2011		Total Organic Carbon	3.91	mg/L
MW-165A-15	Water Table	Off-site	MW-165A	10/11/2011		Total Organic Carbon	3.99	mg/L
MW-165A-15	Water Table	Off-site	MW-165A	4/26/2012		Total Organic Carbon	11.3	mg/L
MW-165A-15	Water Table	Off-site	MW-165A	10/26/2012		Total Organic Carbon	4.48	mg/L
MW-166A-15	Water Table	Off-site	MW-166A	10/11/2011		Total Organic Carbon	7.28	mg/L
MW-166A-15	Water Table	Off-site	MW-166A	10/8/2012		Total Organic Carbon	6.26	mg/L
MW-166B-30	10-55	Off-site	MW-166B	10/11/2011		Total Organic Carbon	5.16	mg/L
MW-166B-30	10-55	Off-site	MW-266B	10/23/2012	DUP	Total Organic Carbon	4.56	mg/L
MW-166B-30	10-55	Off-site	MW-166B	10/23/2012		Total Organic Carbon	4.71	mg/L
MW-167A-15	Water Table	Off-site	MW-167A	2/24/2011		Total Organic Carbon	5.52	mg/L
MW-167A-15	Water Table	Off-site	MW-167A	3/9/2011		Total Organic Carbon	6.25	mg/L
MW-167A-15	Water Table	Off-site	MW-167A	4/7/2011		Total Organic Carbon	7.12	mg/L
MW-167A-15	Water Table	Off-site	MW-167A	8/5/2011		Total Organic Carbon	7.34	mg/L
MW-167A-15	Water Table	Off-site	MW-167A	10/11/2011		Total Organic Carbon	5.87	mg/L
MW-167A-15	Water Table	Off-site	MW-167A	4/25/2012		Total Organic Carbon	5.53	mg/L
MW-167A-15	Water Table	Off-site	MW-167A	10/25/2012		Total Organic Carbon	5.95	mg/L
MW-167A-15	Water Table	Off-site	MW-167A	5/2/2013		Total Organic Carbon	6.08	mg/L
MW-167B-35	10-55	Off-site	MW-167B	2/24/2011		Total Organic Carbon	5.30	mg/L
MW-167B-35	10-55	Off-site	MW-167B	3/9/2011		Total Organic Carbon	5.82	mg/L
MW-167B-35	10-55	Off-site	MW-167B	4/7/2011		Total Organic Carbon	6.26	mg/L
MW-167B-35	10-55	Off-site	MW-167B	8/5/2011		Total Organic Carbon	6.28	mg/L
MW-167B-35	10-55	Off-site	MW-167B	10/11/2011		Total Organic Carbon	5.48	mg/L
MW-167B-35	10-55	Off-site	MW-167B	4/25/2012		Total Organic Carbon	5.42	mg/L
MW-167B-35	10-55	Off-site	MW-167B	10/25/2012		Total Organic Carbon	5.75	mg/L
MW-167B-35	10-55	Off-site	MW-167B	5/2/2013		Total Organic Carbon	5.32	mg/L

**Table 7-6  
Total Organic Carbon Analytical Results in Offsite Groundwater Monitoring Wells**

**Offsite Site Characterization Report - 2013 Addendum  
North Pole Refinery, North Pole, Alaska  
Flint Hills Resources Alaska, LLC**

Location Name	Zone	Proximity	Sample Name	Sample Date	Sample Type	Analyte	Display	Units
MW-168A-15	Water Table	Off-site	MW-168	2/25/2011		Total Organic Carbon	3.52	mg/L
MW-168A-15	Water Table	Off-site	MW-168	10/11/2011		Total Organic Carbon	3.81	mg/L
MW-168A-15	Water Table	Off-site	MW-168A	10/26/2012		Total Organic Carbon	3.97	mg/L
MW-169A-15	Water Table	Off-site	MW-169A	4/27/2012		Total Organic Carbon	2.42	mg/L
MW-169A-15	Water Table	Off-site	MW-269A	10/23/2012	DUP	Total Organic Carbon	2.34	mg/L
MW-169A-15	Water Table	Off-site	MW-169A	10/23/2012		Total Organic Carbon	2.34	mg/L
MW-169A-15	Water Table	Off-site	MW-169A	3/22/2013		Total Organic Carbon	1.82	mg/L
MW-169C-60	10-55	Off-site	MW-169C	4/27/2012		Total Organic Carbon	1.72	mg/L
MW-169C-60	10-55	Off-site	MW-169C	10/23/2012		Total Organic Carbon	1.72JH*	mg/L
MW-169C-60	10-55	Off-site	MW-169C	3/22/2013		Total Organic Carbon	2.45	mg/L
MW-170A-15	Water Table	Off-site	MW-170A	3/6/2011		Total Organic Carbon	5.00	mg/L
MW-170A-15	Water Table	Off-site	MW-170A	4/7/2011		Total Organic Carbon	6.01	mg/L
MW-170A-15	Water Table	Off-site	MW-170A	8/8/2011		Total Organic Carbon	6.54	mg/L
MW-170A-15	Water Table	Off-site	MW-170A	10/11/2011		Total Organic Carbon	8.47	mg/L
MW-170A-15	Water Table	Off-site	MW-270A	10/11/2011	DUP	Total Organic Carbon	7.31	mg/L
MW-170A-15	Water Table	Off-site	MW-170A	4/30/2012		Total Organic Carbon	5.83	mg/L
MW-170A-15	Water Table	Off-site	MW-170A	10/31/2012		Total Organic Carbon	6.23	mg/L
MW-170A-15	Water Table	Off-site	MW-270A	5/6/2013	DUP	Total Organic Carbon	5.70	mg/L
MW-170A-15	Water Table	Off-site	MW-170A	5/6/2013		Total Organic Carbon	5.69	mg/L
MW-171A-15	Water Table	Off-site	MW-171A	3/4/2011		Total Organic Carbon	6.98	mg/L
MW-171A-15	Water Table	Off-site	MW-171A	3/4/2011		Total Organic Carbon	7.00	mg/L
MW-171A-15	Water Table	Off-site	MW-171A	4/7/2011		Total Organic Carbon	6.76	mg/L
MW-171A-15	Water Table	Off-site	MW-171A	8/5/2011		Total Organic Carbon	10.9	mg/L
MW-171A-15	Water Table	Off-site	MW-171A	10/11/2011		Total Organic Carbon	10.7	mg/L
MW-171A-15	Water Table	Off-site	MW-271A	4/26/2012	DUP	Total Organic Carbon	6.05	mg/L
MW-171A-15	Water Table	Off-site	MW-171A	4/26/2012		Total Organic Carbon	6.21	mg/L
MW-171A-15	Water Table	Off-site	MW-171A	10/30/2012		Total Organic Carbon	10.5	mg/L
MW-171A-15	Water Table	Off-site	MW-271A	4/1/2013	DUP	Total Organic Carbon	5.33	mg/L
MW-171A-15	Water Table	Off-site	MW-171A	4/1/2013		Total Organic Carbon	5.49	mg/L
MW-171B-40	10-55	Off-site	MW-271B	3/4/2011	DUP	Total Organic Carbon	4.11	mg/L
MW-171B-40	10-55	Off-site	MW-171B	3/4/2011		Total Organic Carbon	4.09	mg/L
MW-171B-40	10-55	Off-site	MW-171B	3/4/2011		Total Organic Carbon	4.07	mg/L
MW-171B-40	10-55	Off-site	MW-171B	4/7/2011		Total Organic Carbon	4.30	mg/L
MW-171B-40	10-55	Off-site	MW-171B	8/5/2011		Total Organic Carbon	3.76	mg/L
MW-171B-40	10-55	Off-site	MW-171B	10/11/2011		Total Organic Carbon	3.35	mg/L
MW-171B-40	10-55	Off-site	MW-171B	4/26/2012		Total Organic Carbon	3.43	mg/L
MW-171B-40	10-55	Off-site	MW-171B	10/30/2012		Total Organic Carbon	3.39	mg/L

**Table 7-6  
Total Organic Carbon Analytical Results in Offsite Groundwater Monitoring Wells**

**Offsite Site Characterization Report - 2013 Addendum  
North Pole Refinery, North Pole, Alaska  
Flint Hills Resources Alaska, LLC**

Location Name	Zone	Proximity	Sample Name	Sample Date	Sample Type	Analyte	Display	Units
MW-171B-40	10-55	Off-site	MW-171B	4/2/2013		Total Organic Carbon	3.46	mg/L
MW-182A-15	Water Table	Off-site	MW-182A	10/11/2011		Total Organic Carbon	5.25	mg/L
MW-182A-15	Water Table	Off-site	MW-182A	4/25/2012		Total Organic Carbon	5.07	mg/L
MW-182A-15	Water Table	Off-site	MW-182A	10/19/2012		Total Organic Carbon	8.14JL*	mg/L
MW-182A-15	Water Table	Off-site	MW-182A	5/2/2013		Total Organic Carbon	5.00	mg/L
MW-193A-15	Water Table	Off-site	MW-193A	4/27/2012		Total Organic Carbon	7.27	mg/L
MW-193A-15	Water Table	Off-site	MW-193A	10/18/2012		Total Organic Carbon	5.00	mg/L
MW-193A-15	Water Table	Off-site	MW-193A	5/7/2013		Total Organic Carbon	6.15J*	mg/L
MW-193B-60	10-55	Off-site	MW-193B	4/27/2012		Total Organic Carbon	2.06	mg/L
MW-193B-60	10-55	Off-site	MW-193B	10/18/2012		Total Organic Carbon	2.02	mg/L
MW-193B-60	10-55	Off-site	MW-293B	5/7/2013	DUP	Total Organic Carbon	1.87	mg/L
MW-193B-60	10-55	Off-site	MW-193B	5/7/2013		Total Organic Carbon	1.76	mg/L

**Acronyms and Abbreviations:**

mg/L = milligrams per liter



**Table 7-7  
Total Organic Carbon Analytical Results in Private Wells  
with Point of Entry Treatment Systems**

**Offsite Site Characterization Report - 2013 Addendum  
North Pole Refinery, North Pole, Alaska  
Flint Hills Resources Alaska, LLC**

<b>Date</b>	<b>Category</b>	<b>Location</b>	<b>TOC (mg/L)</b>
12/15/2010	In Home Pilot	PW-1098	4.29 JH
12/15/2010	In Home Pilot	PW-1098	2.84 JH
2/16/2011	In Home Pilot	PW-1098	1.590
2/23/2011	In Home Pilot	PW-1098	1.970
3/2/2011	In Home Pilot	PW-1098	2.570
3/9/2011	In Home Pilot	PW-1098	1.840
3/16/2011	In Home Pilot	PW-1098	2.620
3/23/2011	In Home Pilot	PW-1098	3.190
3/30/2011	In Home Pilot	PW-1098	3.000
4/6/2011	In Home Pilot	PW-1098	2.730
4/13/2011	In Home Pilot	PW-1098	2.550
4/20/2011	In Home Pilot	PW-1098	2.440
4/27/2011	In Home Pilot	PW-1098	2.670
5/4/2011	In Home Pilot	PW-1098	2.510
5/11/2011	In Home Pilot	PW-1098	2.590
6/8/2011	In Home Pilot	PW-1098	2.140
7/11/2011	In Home Pilot	PW-1098	3.050
8/9/2011	In Home Pilot	PW-1098	3.060
10/12/2011	In Home Pilot	PW-1098	2.280
11/14/2011	In Home Pilot	PW-1098	3.040
2/16/2011	In Home Pilot	PW-0657	3.630
2/23/2011	In Home Pilot	PW-0657	3.920
3/2/2011	In Home Pilot	PW-0657	4.880
3/9/2011	In Home Pilot	PW-0657	4.930
3/16/2011	In Home Pilot	PW-0657	5.060
3/23/2011	In Home Pilot	PW-0657	5.670
3/30/2011	In Home Pilot	PW-0657	5.610
4/6/2011	In Home Pilot	PW-0657	4.930
4/13/2011	In Home Pilot	PW-0657	4.920
4/20/2011	In Home Pilot	PW-0657	4.760
4/27/2011	In Home Pilot	PW-0657	5.230
5/4/2011	In Home Pilot	PW-0657	5.520
5/11/2011	In Home Pilot	PW-0657	5.140
6/8/2011	In Home Pilot	PW-0657	4.810
7/11/2011	In Home Pilot	PW-0657	4.990
8/9/2011	In Home Pilot	PW-0657	4.930
10/12/2011	In Home Pilot	PW-0657	5.700
11/14/2011	In Home Pilot	PW-0657	4.630
2/16/2011	In Home Pilot	PW-0157	1.620
2/23/2011	In Home Pilot	PW-0157	1.650
3/2/2011	In Home Pilot	PW-0157	2.020
3/9/2011	In Home Pilot	PW-0157	1.970
3/16/2011	In Home Pilot	PW-0157	2.030
3/23/2011	In Home Pilot	PW-0157	2.380
3/30/2011	In Home Pilot	PW-0157	2.780
4/6/2011	In Home Pilot	PW-0157	2.200
4/13/2011	In Home Pilot	PW-0157	2.150
4/20/2011	In Home Pilot	PW-0157	2.000
4/27/2011	In Home Pilot	PW-0157	2.180
5/4/2011	In Home Pilot	PW-0157	2.090
5/11/2011	In Home Pilot	PW-0157	2.140

**Table 7-7  
Total Organic Carbon Analytical Results in Private Wells  
with Point of Entry Treatment Systems**

**Offsite Site Characterization Report - 2013 Addendum  
North Pole Refinery, North Pole, Alaska  
Flint Hills Resources Alaska, LLC**

<b>Date</b>	<b>Category</b>	<b>Location</b>	<b>TOC (mg/L)</b>
6/8/2011	In Home Pilot	PW-0157	1.770
7/11/2011	In Home Pilot	PW-0157	2.020
8/9/2011	In Home Pilot	PW-0157	2.210
10/12/2011	In Home Pilot	PW-0157	2.810
11/14/2011	In Home Pilot	PW-0157	2.100
2/16/2011	In Home Pilot	PW-0232	1.560
2/23/2011	In Home Pilot	PW-0232	1.700
3/2/2011	In Home Pilot	PW-0232	2.100
3/9/2011	In Home Pilot	PW-0232	1.970
3/16/2011	In Home Pilot	PW-0232	2.090
3/23/2011	In Home Pilot	PW-0232	3.040
4/6/2011	In Home Pilot	PW-0232	2.200
4/13/2011	In Home Pilot	PW-0232	2.110
4/20/2011	In Home Pilot	PW-0232	2.060
4/27/2011	In Home Pilot	PW-0232	2.450
5/4/2011	In Home Pilot	PW-0232	1.950
5/11/2011	In Home Pilot	PW-0232	2.250
2/16/2011	In Home Pilot	PW-0225	1.470
2/23/2011	In Home Pilot	PW-0225	1.440
3/16/2011	In Home Pilot	PW-0225	1.860
3/23/2011	In Home Pilot	PW-0225	2.170
3/30/2011	In Home Pilot	PW-0225	2.200
4/6/2011	In Home Pilot	PW-0225	2.030
4/13/2011	In Home Pilot	PW-0225	1.960
4/20/2011	In Home Pilot	PW-0225	1.860
4/27/2011	In Home Pilot	PW-0225	1.990
5/4/2011	In Home Pilot	PW-0225	1.890
5/11/2011	In Home Pilot	PW-0225	1.880
1/26/2011	Accelerated Pilot 1	PW-1348	2.500
1/27/2011	Accelerated Pilot 1	PW-1348	3.200
1/27/2011	Accelerated Pilot 1	PW-1348	2.300
1/27/2011	Accelerated Pilot 1	PW-1348	2.500
1/28/2011	Accelerated Pilot 1	PW-1348	2.600
1/28/2011	Accelerated Pilot 1	PW-1348	2.300
1/28/2011	Accelerated Pilot 1	PW-1348	2.300
1/29/2011	Accelerated Pilot 1	PW-1348	2.200
1/29/2011	Accelerated Pilot 1	PW-1348	2.200
1/29/2011	Accelerated Pilot 1	PW-1348	3.400
1/30/2011	Accelerated Pilot 1	PW-1348	2.400
1/30/2011	Accelerated Pilot 1	PW-1348	2.100
1/30/2011	Accelerated Pilot 1	PW-1348	2.100
1/31/2011	Accelerated Pilot 1	PW-1348	2.100
1/31/2011	Accelerated Pilot 1	PW-1348	2.100
1/31/2011	Accelerated Pilot 1	PW-1348	2.500
2/1/2011	Accelerated Pilot 1	PW-1348	2.400
2/1/2011	Accelerated Pilot 1	PW-1348	3.600
2/1/2011	Accelerated Pilot 1	PW-1348	2.500
2/2/2011	Accelerated Pilot 1	PW-1348	2.700
2/2/2011	Accelerated Pilot 1	PW-1348	2.600
2/16/2011	Accelerated Pilot 2	PW-1348	3.200
2/17/2011	Accelerated Pilot 2	PW-1348	2.700

**Table 7-7  
Total Organic Carbon Analytical Results in Private Wells  
with Point of Entry Treatment Systems**

**Offsite Site Characterization Report - 2013 Addendum  
North Pole Refinery, North Pole, Alaska  
Flint Hills Resources Alaska, LLC**

<b>Date</b>	<b>Category</b>	<b>Location</b>	<b>TOC (mg/L)</b>
2/18/2011	Accelerated Pilot 2	PW-1348	2.300
2/19/2011	Accelerated Pilot 2	PW-1348	2.200
2/20/2011	Accelerated Pilot 2	PW-1348	2.200
2/21/2011	Accelerated Pilot 2	PW-1348	2.500
2/22/2011	Accelerated Pilot 2	PW-1348	2.100
2/23/2011	Accelerated Pilot 2	PW-1348	2.700
2/24/2011	Accelerated Pilot 2	PW-1348	2.700
2/25/2011	Accelerated Pilot 2	PW-1348	2.900
2/26/2011	Accelerated Pilot 2	PW-1348	2.800
2/27/2011	Accelerated Pilot 2	PW-1348	2.600
2/28/2011	Accelerated Pilot 2	PW-1348	2.600
3/1/2011	Accelerated Pilot 2	PW-1348	2.400
3/2/2011	Accelerated Pilot 2	PW-1348	2.400
3/3/2011	Accelerated Pilot 2	PW-1348	2.300
3/4/2011	Accelerated Pilot 2	PW-1348	2.400
3/5/2011	Accelerated Pilot 2	PW-1348	2.600
3/6/2011	Accelerated Pilot 2	PW-1348	2.400
3/7/2011	Accelerated Pilot 2	PW-1348	2.600
12/15/2011	Treatment System Port A	PW-0648	5.9
12/15/2011	Treatment System Port B	PW-0648	5.4
12/15/2011	Treatment System Port C	PW-0648	2.7
12/15/2011	Treatment System Port D	PW-0648	1.8
12/15/2011	Kitchen	PW-0648	1
12/16/2011	Treatment System Port A	PW-1315	1.6
12/16/2011	Treatment System Port B	PW-1315	0.85
12/16/2011	Treatment System Port C	PW-1315	1.1
12/16/2011	Treatment System Port D	PW-1315	ND
12/16/2011	Mop	PW-1315	ND
12/16/2011	Kitchen	PW-1315	ND
12/15/2011	Tank	PW-0543	1.8
12/15/2011	Tub	PW-0543	1.8
12/15/2011	Kitchen	PW-0543	1.6
12/16/2011	Tank	PW-1376	1.7
12/16/2011	Kitchen	PW-1376	4.7
12/16/2011	Bathroom	PW-1376	1.5
12/16/2011	Treatment System Port A	PW-0504	13.6
12/16/2011	Treatment System Port B	PW-0504	2.9
12/16/2011	Treatment System Port C	PW-0504	ND
12/16/2011	Treatment System Port D	PW-0504	ND
12/16/2011	Kitchen	PW-0504	ND

**Acronyms and Abbreviations:**

JH = estimated result, biased high due to quality control sample failures.

**Table 7-8  
Total Organic Carbon Analytical Results in the Deep Private Well Monitoring Program**

**Offsite Site Characterization Report - 2013 Addendum  
North Pole Refinery, North Pole, Alaska  
Flint Hills Resources Alaska, LLC**

Location Name	Sample Name	Sample Date	Sample Type	Analyte	Display	Units
PW-0217	290190	3/10/2011		Total Organic Carbon	2.87	mg/L
PW-0217	290190	3/11/2013		Total Organic Carbon	2.65	mg/L
PW-0217	290190	6/5/2013		Total Organic Carbon	2.49	mg/L
PW-0259	296406	4/4/2013		Total Organic Carbon	2.33	mg/L
PW-0259	296406	6/19/2013		Total Organic Carbon	2.40	mg/L
PW-0296	296937	3/21/2013		Total Organic Carbon	2.39	mg/L
PW-0296	296937	6/13/2013		Total Organic Carbon	2.48	mg/L
PW-0296	296937D	6/13/2013	DUP	Total Organic Carbon	2.48	mg/L
PW-0297	296937.1	3/21/2013		Total Organic Carbon	3.41	mg/L
PW-0297	296937.1	6/13/2013		Total Organic Carbon	3.83	mg/L
PW-0332	301671	4/19/2013		Total Organic Carbon	1.18J\$*	mg/L
PW-0332	301671	6/20/2013		Total Organic Carbon	1.13	mg/L
PW-0355	302058	3/11/2011		Total Organic Carbon	2.63	mg/L
PW-0358	302082D	3/10/2011	DUP	Total Organic Carbon	1.57	mg/L
PW-0358	302082	3/10/2011		Total Organic Carbon	1.53	mg/L
PW-0358	302082	3/25/2013		Total Organic Carbon	3.70	mg/L
PW-0358	302082	6/12/2013		Total Organic Carbon	1.25	mg/L
PW-0359	302091	3/11/2011		Total Organic Carbon	2.63	mg/L
PW-0463	315192	4/4/2013		Total Organic Carbon	1.41	mg/L
PW-0463	315192	6/27/2013		Total Organic Carbon	1.29	mg/L
PW-0464	315206	3/28/2013		Total Organic Carbon	1.57	mg/L
PW-0464	315206	6/27/2013		Total Organic Carbon	1.43	mg/L
PW-0466	315290D	4/18/2013	DUP	Total Organic Carbon	2.85	mg/L
PW-0466	315290	4/18/2013		Total Organic Carbon	2.95	mg/L
PW-0466	315290	6/12/2013		Total Organic Carbon	2.90	mg/L
PW-0649	333778	3/12/2011		Total Organic Carbon	4.05	mg/L
PW-0658	333883	3/18/2013		Total Organic Carbon	3.43	mg/L
PW-0658	333883	6/12/2013		Total Organic Carbon	3.63	mg/L
PW-0659	333891	3/11/2011		Total Organic Carbon	1.71	mg/L
PW-0932	391409	3/20/2013		Total Organic Carbon	1.90	mg/L
PW-0932	391409	6/19/2013		Total Organic Carbon	1.84	mg/L
PW-0943	391565	3/12/2013		Total Organic Carbon	4.13	mg/L
PW-0943	391565	6/6/2013		Total Organic Carbon	4.17	mg/L
PW-0972	395200	3/17/2013		Total Organic Carbon	1.51	mg/L
PW-0972	395200D	6/20/2013	DUP	Total Organic Carbon	1.41	mg/L
PW-0972	395200	6/20/2013		Total Organic Carbon	1.40	mg/L
PW-1099	429724.1D	3/12/2013	DUP	Total Organic Carbon	1.75	mg/L
PW-1099	429724.1	3/12/2013		Total Organic Carbon	1.73	mg/L
PW-1099	429724.1	6/4/2013		Total Organic Carbon	1.67	mg/L
PW-1109	429929	3/13/2013		Total Organic Carbon	5.39	mg/L
PW-1109	429929	6/5/2013		Total Organic Carbon	5.42	mg/L
PW-1155	445657	3/18/2013		Total Organic Carbon	2.68	mg/L
PW-1155	445657	6/5/2013		Total Organic Carbon	2.65	mg/L
PW-1230	502774	3/11/2013		Total Organic Carbon	1.81	mg/L
PW-1230	502774	6/27/2013		Total Organic Carbon	3.28	mg/L
PW-1343	563579	3/20/2013		Total Organic Carbon	2.51	mg/L
PW-1343	563579	6/13/2013		Total Organic Carbon	2.06J\$*	mg/L
PW-1458	395200.1	6/20/2013		Total Organic Carbon	2.31	mg/L

**Acronyms and Abbreviations:**

mg/L = milligrams per liter