

GW - 028

**2015 REVISED
FACILITY-WIDE GW
MONITORING WP**

December 21, 2015



March 18, 2016

Mr. John Kieling
Chief, Hazardous Waste Bureau
New Mexico Environmental Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505

**RE: Response to Approval with Modifications Letter for the 2015 Facility Wide Groundwater Monitoring Work Plan - Revised
HollyFrontier Navajo Refining, L.L.C., Artesia Refinery
RCRA Permit No. NMD048918817
HWB-NRC-15-008**

Dear Mr. Kieling:

This letter provides detailed responses to the New Mexico Environment Department (NMED) letter dated February 19, 2016 regarding the *2015 Facility Wide Groundwater Monitoring Workplan - Revised* dated December 21, 2015. The December 21, 2015 letter included comments from the New Mexico Energy, Minerals, and Natural Resources Department Oil Conservation Division (OCD).

The NMED and OCD comments made in the December 21, 2015 letter are provided below in italics font and responses from HollyFrontier Navajo Refining, LLC (Navajo) are provided following each comment.

Comment 1

In the Response to Comment 1, the Permittee states that "boron, cadmium, cobalt, nickel and uranium should not be considered facility-wide COCs and should not be added to the Work Plan." The Permittee provided additional information for each inorganic compound referencing the results from the Reverse Osmosis Reject Water Discharge Fields Investigation Final Report, February 2014 and the Background Groundwater Investigation Report, September 2015 (Background Study). It is not appropriate to utilize results from the Background Study because the report has not been approved. Therefore, the Permittee must incorporate OCD's requirements to include boron, cadmium, cobalt, nickel and uranium with the analytical suite and revise Table 1 (Revised Monitoring Program and Schedule) to include them in the Spring 2016 monitoring event. After the Background Study has been approved, the inclusion of the inorganic compounds (boron, cadmium, cobalt, nickel and uranium) for future sampling events will be reevaluated.

Response

The requested additional compounds (boron, cadmium, cobalt, nickel, and uranium) will be included in the analytical suite for samples collected during the Spring 2016 event. These five compounds will be analyzed as dissolved metals, unless already included in the analytical suite for total metals analyses. Navajo will evaluate the data obtained from this sampling event and will discuss the need to include these compounds during future sampling events with OCD and NMED. A revised version of Table 1 has been included with this response letter.

Comment 2

Item c.4 of the Footnotes section in Table 1 (Revised Monitoring Program and Schedule) does not reference the dissolved metals. Include this analysis in the Footnotes section in the revised Table 1 and indicate that the dissolved metals will be analyzed during the Spring sampling event.

Response

The footnotes section of Table 1 has been updated to include appropriate references to dissolved metals analyses. A revised version of Table 1 has been included with this response letter.

As stated in the responses above, a revised version of Table 1 (Revised Monitoring Program and Schedule) has been included as an attachment to this response letter. Two paper copies of the table have been provided as replacement pages to be inserted in the two hard copies of the revised document submitted in December 2015. An electronic copy of the revised table is also provided on CD. One paper copy and one electronic copy of the revised table will be provided to OCD along with a copy of this response letter.

If you have any questions or comments regarding this request, please feel free to contact me at 575-746-5487 or Robert Combs at 575-746-5382.

Sincerely,



Scott M. Denton
Environmental Manager
HollyFrontier Navajo Refining LLC

c: Carl Chavez, OCD
Robert Combs, Navajo

Table 1
Revised Monitoring Program and Schedule
Navajo Refining Company - Artesia Refinery, Artesia, New Mexico

Well ID	Well Type	Location Information		Well Construction Information ^a								PSH Expected? ^b	Gauging Frequency	Analytical Suite and Frequency ^c										
		Associated Area of Concern	Approximate Location	Install Date	Diameter (in)	Top of Casing (ft MSL)	Ground Surface (ft MSL)	Total Depth (ft btoc)	Screen Interval (ft bgs)	Water Bearing Zone	Surface Finish			Purge Parameters	DRO	GRO	VOCs	Metals (As, Ba, Cr, Fe, Pb, Mn, Se)	Metals (As, Ba, Cr, Fe, Pb, Mn, Hg, Ni, Se, V)	Metals (B, Cd, Co, Ni, U)	Cyanide	Cations/Anions	Nitrates / Nitrites as Nitrogen	Total Dissolved Solids
KWB-1A	Monitoring	Field E of Refinery	S of ED, W of BR	2/11/92	2	3353.46	3351.25	33.49	18 to 32	Shallow	flush mount		SA	SA	SA	-	SA	-	SA	S16	SA	SA	SA	SA
KWB-1B	Monitoring	Field E of Refinery	S of ED, W of BR	2/15/92	4	3352.83	3351.14	33.95	18 to 32	Shallow	stickup		SA	No analytical samples to be collected										
KWB-1C	Monitoring	Field E of Refinery	S of ED, W of BR	9/29/92	4	3351.38	3351.18	52.71	30.5 to 49.5	Valley Fill	stickup		SA	B	B	-	B	B	-	-	-	B	B	B
KWB-2R	Monitoring	Field E of Refinery	S of US82 on Armstrong & Son		2	3364.32	3364.56	39.86		Shallow	flush mount	Y	SA	SA ^d	SA ^d	SA ^d	SA ^d	SA ^d	-	S16 ^d	-	SA ^d	SA ^d	SA ^d
KWB-3AR	Monitoring	Field E of Refinery	S of US82, replaced KWB #3R	9/3/03	2	3347.08	3347.36	no access	17 to 33	Shallow	flush mount		SA ^f	SA ^f	SA ^f	SA ^f	SA ^f	-	SA ^f	S16	SA ^f	SA ^f	SA ^f	SA ^f
KWB-4	Monitoring	S Refinery	N of US82, W of BR	2/17/92	2	3370.25	3368.36	41.74	20 to 39	Shallow	stickup	Y	SA	SA ^d	SA ^d	-	SA ^d	SA ^d	-	S16 ^d	-	SA ^d	SA ^d	SA ^d
KWB-5	Monitoring	Field E of Refinery	N of US82, W of BR	2/11/92	2	3364.72	3362.60	37.68	24.7 to 38.7	Shallow	stickup		SA	SA	SA	-	SA	SA	-	S16	-	SA	SA	SA
KWB-6	Monitoring	Field E of Refinery	N of US82, W of BR	2/12/92	2	3360.30	3358.02	36.38	17.5 to 36.5	Shallow	stickup	Y	SA	SA ^d	SA ^d	-	SA ^d	SA ^d	-	S16 ^d	-	SA ^d	SA ^d	SA ^d
KWB-7	Monitoring	Field E of Refinery	N of US82, between BR & Dirt Rd	2/13/92	2	3346.16	3343.00	34.83	18 to 32	Shallow	stickup		SA	SA	SA	-	SA	-	SA	S16	SA	SA	SA	SA
KWB-8	Monitoring	Field E of Refinery	N of US82, between BR & Dirt Rd	2/12/92	2	3350.41	3347.90	35.83	15 to 34	Shallow	stickup	Y	SA	SA ^d	SA ^d	-	SA ^d	-	SA ^d	S16 ^d	SA ^d	SA ^d	SA ^d	SA ^d
KWB-9	Monitoring	Field E of Refinery	S of US82, E of BR	2/13/92	2	3354.53	3351.81	obstructed	20 to 34	Shallow	stickup		SA ^f	A ^f	A ^f	A ^f	A ^f	-	A ^f	S16	A ^f	A ^f	A ^f	A ^f
KWB-10R	Monitoring	Field E of Refinery	S of ED, N of US82	10/1/10	4	3350.97	3351.23	29.48	9 to 29	Shallow	flush mount	Y	SA	SA ^d	SA ^d	-	SA ^d	SA ^d	-	S16 ^d	-	SA ^d	SA ^d	SA ^d
KWB-11A	Monitoring	Field E of Refinery	N of US82, between BR & Dirt Rd	10/4/92	4	3348.72	3346.13	42.32	30 to 39.5	Shallow	stickup		SA	SA	SA	SA	SA	-	SA	S16	SA	SA	SA	SA
KWB-11B	Monitoring	Field E of Refinery	N of US82, between BR & Dirt Rd	10/4/92	4	3348.03	3345.91	72.47	50 to 69.5	Valley Fill	stickup		SA	SA	SA	SA	SA	-	SA	S16	SA	SA	SA	SA
KWB-12A	Monitoring	Field E of Refinery	S of US82, E of BR	10/4/92	4	3351.81	3352.01	25.03	15.5 to 24.5	Shallow	flush mount		SA	SA	SA	SA	SA	-	SA	S16	SA	SA	SA	SA
KWB-12B	Monitoring	Field E of Refinery	S of US82, E of BR	10/4/92	4	3351.63	3351.84	39.39	25.5 to 39.5	Valley Fill	flush mount		SA	SA	SA	SA	SA	-	SA	S16	SA	SA	SA	SA
KWB-13	Monitoring	Crossgradient	S of US82, W of BR		2	3365.67	3366.02	33.10		Shallow	flush mount		SA	A	A	-	A	-	A	S16	A	A	A	A
KWB-P4	Monitoring	Field E of Refinery	Haines House		2	3305.39	3305.76	30.26		Shallow	flush mount		B	B	B	-	B	-	-	-	-	-	-	-
MW-1R	Monitoring	EP	W of the EPs	9/3/03	2	3313.28	3311.58	20.64	8 to 23	Shallow	stickup		SA	A	A	-	A	A	-	S16	-	A	A	A
MW-2A	Monitoring	EP	W of the EPs	6/18/86	2	3312.97	3310.55	17.35		Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA
MW-2B	Monitoring	EP	W of the EPs	12/12/92	2	3312.49	3309.94	51.98	38.5 to 48	Valley Fill	stickup		SA	No analytical samples to be collected										
MW-3	Monitoring	EP	S of EP 1 & 2	6/17/86	2	3310.32	3309.07	20.08		Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA
MW-4A	Monitoring	EP	S of EP 1 & 2	6/17/86	4	3312.71	3308.64	obstructed		Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA
MW-4B	Monitoring	EP	S of EP 1 & 2	2/24/95	4	3312.01	3308.73	72.37	60.25 to 70	Valley Fill	stickup		SA	B	B	B	B	B	-	-	-	B	B	B
MW-5A	Monitoring	EP	S of EP 2	6/19/86	2	3308.62	3306.59	20.19		Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA
MW-5B	Monitoring	EP	S of EP 2	12/16/92	2	3308.95	3306.71	53.54	41.5 to 50.5	Valley Fill	stickup		SA	B	B	B	B	B	-	-	-	B	B	B
MW-5C	Monitoring	EP	S of EP 2	1/19/95	2	3309.28	3306.55	71.64	59.25 to 68.75	Valley Fill	stickup		SA	B	B	B	B	B	-	-	-	B	B	B
MW-6A	Monitoring	EP	S of EP 1	6/19/86	2	3313.46	3310.40	19.05		Shallow	stickup		SA	A	A	A	A	A	-	S16	-	A	A	A
MW-6B	Monitoring	EP	S of EP 1	10/12/93	2	3313.35	3310.09	52.27	39.5 to 49	Valley Fill	stickup		SA	B	B	B	B	B	-	-	-	B	B	B
MW-7A	Monitoring	EP	S of EP 3	6/19/86	2	3309.24	3306.04	17.40		Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA
MW-7B	Monitoring	EP	S of EP 3	1/18/93	4	3307.87	3306.05	52.56	39.5 to 49	Valley Fill	stickup		SA	B	B	B	B	B	-	-	-	B	B	B

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Navajo Refining Company - Artesia Refinery, Artesia, New Mexico

Well ID	Well Type	Location Information		Well Construction Information ^a								PSH Expected? ^b	Gauging Frequency	Analytical Suite and Frequency ^c											
		Associated Area of Concern	Approximate Location	Install Date	Diameter (in)	Top of Casing (ft MSL)	Ground Surface (ft MSL)	Total Depth (ft btoc)	Screen Interval (ft bgs)	Water Bearing Zone	Surface Finish			Purge Parameters	DRO	GRO	VOCs	Metals (As, Ba, Cr, Fe, Pb, Mn, Se)	Metals (As, Ba, Cr, Fe, Pb, Mn, Hg, Ni, Se, V)	Metals (B, Cd, Co, Ni, U)	Cyanide	Cations/Anions	Nitrates / Nitrites as Nitrogen	Total Dissolved Solids	
MW-8	Monitoring	TMD	S of ED between BR & HR	6/20/86	2	3336.42	3334.81	20.33		Shallow	stickup		SA	A	A	A	A	A	-	S16	-	A	A	A	
MW-9	Monitoring	TMD	S of ED between BR & HR	6/20/86	2	3336.20	3334.50	20.20		Shallow	stickup		SA	No analytical samples to be collected											
MW-10	Monitoring	EP	S of EPs	11/18/92	2	3304.76	3304.14	18.53		Shallow	stickup		SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA		
MW-11A	Monitoring	EP	NE of EP 6	12/10/92	4	3310.76	3308.42	22.01	5.5 to 20	Shallow	stickup		SA	A	A	A	A	A	-	S16	-	SA	SA	SA	
MW-11B	Monitoring	EP	NE of EP 6	12/14/92	2	3310.76	3308.34	47.30	35.5 to 45	Valley Fill	stickup		SA	B	B	B	B	B	-	-	-	B	B	B	
MW-12	Monitoring	EP	N of OCD #1	12/16/92	4	3312.73	3310.37	17.93	6.5 to 16	Shallow	stickup		SA	Not included in monitoring program due to location (north of river)											
MW-13	Monitoring	EP	N of EP 1	12/16/92	4	3314.24	3311.95	21.13	9.5 to 19	Shallow	stickup		SA	Not included in monitoring program due to location (north of river)											
MW-14	Monitoring	EP	E of OCD #7	12/16/92	4	3311.84	3309.44	obstructed	5.5 to 20	Shallow	stickup		SA	Not included in monitoring program due to location (north of river)											
MW-15	Monitoring	EP	W of EP 1	12/16/92	4	3313.72	3310.97	21.70	9 to 19	Shallow	stickup		SA	A	A	A	A	A	-	S16	-	A	A	A	
MW-16	Monitoring	TMD	E of HR, N of ED	1/19/93	4	3316.12	3313.50	21.24	8.5 to 19	Shallow	stickup		SA	A	A	-	A	A	-	S16	-	A	A	A	
MW-17	Monitoring	Crossgradient	NE of Artesia POTW	1/20/93	4	3322.01	3319.43	34.41	17 to 32	Shallow	stickup		Not included in monitoring program due to distance from impacts												
MW-18	Monitoring	NCL	N Refinery, E of NCL	6/8/82	8	3365.42	3363.06	22.20	15 to 19	Shallow	stickup		SA	A	A	-	A	-	A	S16	A	A	A	A	
MW-18A	Monitoring	EP	S of EPs	1/21/93	4	3308.58	3306.33	22.59	10 to 20	Shallow	stickup		SA	SA	SA	-	SA	-	SA	S16	SA	SA	SA	SA	
MW-18B	Monitoring	EP	S of EPs	1/22/93	2	3308.74	3306.23	50.59	37 to 47	Valley Fill	stickup		SA	B	B	B	B	B	-	-	-	B	B	B	
MW-18T	Monitoring	EP	S of EPs	1/22/93	4	3308.55	3306.30	50.40	37 to 47	Valley Fill	stickup		SA	No analytical samples to be collected											
MW-19	Monitoring	NCL	S of NCL		2	3368.00	3366.00	22.10		Shallow	stickup		SA	No analytical samples to be collected											
MW-20	Monitoring	TMD	E of BR, S of ED	1/21/93	4	3340.91	3338.43	26.86	9.5 to 23.5	Shallow	stickup		SA	A	A	-	A	A	-	S16	-	A	A	A	
MW-21	Monitoring	TMD	S of ED between BR & HR	1/23/93	4	3337.31	3334.65	25.06	7.5 to 22	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
MW-22A	Monitoring	EP	S of EPs	1/27/93	4	3307.62	3305.24	22.70	5.5 to 20.5	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
MW-22B	Monitoring	EP	S of EPs	1/28/93	2	3307.63	3305.08	54.66	42.3 to 52	Valley Fill	stickup		SA	B	B	B	B	B	-	-	-	B	B	B	
MW-23	Monitoring	N Refinery	W of TEL	6/28/82	6	3368.38	3365.09	19.90	15 to 20	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
MW-24	Monitoring	EP	E of OCD #6	7/5/82	6	3312.85	3310.33	23.50	15 to 20	Shallow	stickup		SA	Not included in monitoring program due to location (east of river)											
MW-25	Monitoring	TMD	S of ED, E of HR	1/13/95	2	3312.29	3310.35	28.18	15.75 to 25.25	Shallow	stickup		SA	A	A	-	A	A	-	S16	-	A	A	A	
MW-26	Monitoring	TMD	S of ED, E of HR	1/13/95	2	3314.87	3312.08	27.60	15.25 to 24.25	Shallow	stickup		SA	A	A	-	A	A	-	S16	-	A	A	A	
MW-27	Monitoring	TMD	E of HR, S of ED	1/12/95	2	3320.85	3319.46	29.98	18.25 to 27.75	Shallow	stickup		SA	A	A	-	A	A	-	S16	-	A	A	A	
MW-28	Monitoring	S Refinery	E of SE Tankfarm	7/8/82	6	3370.27	3366.79	34.48	25 to 30	Shallow	stickup		SA	SA	SA	SA	SA	-	SA	S16	SA	SA	SA	SA	
MW-29	Monitoring	N Refinery	N of TEL	1/10/95	2	3360.64	3359.79	22.00	9.75 to 19.25	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
MW-30	Monitoring	N Refinery	W of BR		8	3361.98	3359.14	23.50		Shallow	stickup		SA	No analytical samples to be collected											
MW-39	Monitoring	N Refinery	N of TEL	6/13/84	2	3358.79	3357.94	22.85	14 to 24	Shallow	stickup		SA	SA	SA	SA ^d	SA	SA	-	S16	-	SA	SA	SA	
MW-40	Monitoring	N Refinery	N of TEL	6/14/84	2	3356.93	3356.56	24.75		Shallow	stickup		SA	A	A	A	A	A	-	S16	-	A	A	A	
MW-41	Monitoring	N Refinery	N of TEL	6/15/84	2	3356.58	3356.38	21.56	14 to 19	Shallow	stickup		SA	A	A	A	A	A	-	S16	-	A	A	A	
MW-42	Monitoring	N Refinery	N of TEL	6/19/84	2	3358.44	3355.64	24.34		Shallow	stickup		SA	A	A	A	A	A	-	S16	-	A	A	A	
MW-43	Monitoring	N Refinery	NW of TEL	7/17/84	6	3365.49	3363.38	21.40	15.5 to 20.5	Shallow	stickup		SA	SA	SA	SA	SA	-	SA	S16	SA	SA	SA	SA	
MW-45	Monitoring	NCL	E of Refinery, S of ED	8/22/84	2	3351.51	3351.32	15.05	10.5 to 15.5	Shallow	flush mount		SA	SA	SA	-	SA	-	SA	S16	SA	SA	SA	SA	
MW-46R	Monitoring	TMD	E of Refinery, S of ED	10/1/10	2	3350.11	3350.41	19.38	3.5 to 18.5	Shallow	flush mount		SA	SA	SA	-	SA	SA	-	S16	-	SA	SA	SA	

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		Associated Area of Concern	Approximate Location	Install Date	Diameter (in)	Top of Casing (ft MSL)	Ground Surface (ft MSL)	Total Depth (ft btoc)	Screen Interval (ft bgs)	Water Bearing Zone	Surface Finish			Purge Parameters	DRO	GRO	VOCs	Metals (As, Ba, Cr, Fe, Pb, Mn, Se)	Metals (As, Ba, Cr, Fe, Pb, Mn, Hg, Ni, Se, V)	Metals (B, Cd, Co, Ni, U)	Cyanide	Cations/Anions	Nitrates / Nitrites as Nitrogen	Total Dissolved Solids	
MW-48	Monitoring	S Refinery	S of SE Tankfarm	12/14/94	2	3362.97	3363.04	31.89	19 to 34	Shallow	flush mount	Y	SA	SA ^d	SA ^d	SA ^d	SA ^d	SA ^d	-	S16 ^d	-	SA ^d	SA ^d	SA ^d	
MW-49	Monitoring	TEL	E Refinery, midway from ED to US82	12/20/94	2	3359.77	3359.69	33.15	19 to 34	Shallow	stickup		SA	SA	SA	SA	SA	-	SA	S16	SA	SA	SA	SA	
MW-50	Monitoring	S Refinery	W of Refinery, E of US285, N of US 82	12/21/94	2	3371.05	3368.91	28.28	12 to 27	Shallow	stickup		SA	SA	SA	-	SA	SA	-	S16	-	SA	SA	SA	
MW-52	Monitoring	S Refinery	S of Refinery & US82	1/14/95	2	3368.30	3368.36	34.70	19 to 34	Shallow	flush mount		SA	SA	SA	SA	SA	-	SA	S16	SA	SA	SA	SA	
MW-53	Monitoring	NCL	W of Refinery, E of rail	6/25/95	2	3368.73	3368.86	23.60	13.8 to 23.8	Shallow	flush mount		SA	A	A	-	A	A	-	S16	-	A	A	A	
MW-54A	Monitoring	NCL	NW of NCL	12/11/95	2	3366.49	3363.55	31.34	12.7 to 27.7	Shallow	stickup		SA	SA	SA	-	SA	SA	-	S16	-	SA	SA	SA	
MW-54B	Monitoring	NCL	NW of NCL	12/20/95	2	3366.47	3363.47	46.83	33.8 to 43.8	Valley Fill	stickup		SA	B	B	B	B	B	-	-	-	B	B	B	
MW-55	Monitoring	NCL	E of NCL	6/25/95	2	3364.77	3361.90	26.58	13.7 to 23.7	Shallow	stickup		SA	SA	SA	SA	SA	-	SA	S16	SA	SA	SA	SA	
MW-56	Monitoring	NCL	NE of Refinery	8/7/95	2	3357.44	3354.84	26.50	13.4 to 23.4	Shallow	stickup		SA	SA	SA	-	SA	SA	-	S16	-	SA	SA	SA	
MW-57	Monitoring	Field E of Refinery	S BR	9/8/03	2	3350.91	3350.95	34.36	10 to 30	Shallow	flush mount		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
MW-58	Monitoring	Field E of Refinery	S of US82, W of BR	9/5/03	4	3362.22	3362.56	33.06	13 to 28	Shallow	flush mount	Y	SA	SA ^d	SA ^d	-	SA ^d	-	SA ^d	S16 ^d	SA ^d	SA ^d	SA ^d	SA ^d	
MW-59	Monitoring	N Refinery	Boneyard	9/4/03	2	3362.43	3359.44	32.82	15 to 30	Shallow	stickup		SA	A	A	A	A	A	-	S16	-	A	A	A	
MW-60	Monitoring	N Refinery	Boneyard	9/4/03	2	3361.98	3359.26	37.70	15 to 30	Shallow	stickup		SA	SA	SA	SA	SA	-	SA	S16	SA	SA	SA	SA	
MW-61	Monitoring	N Refinery	SW of TEL	4/27/05	4	3369.47	3369.45	29.50	14 to 29	Shallow	flush mount		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
MW-62	Monitoring	N Refinery	SW of TEL	4/27/05	4	3368.81	3369.01	23.00	14 to 29	Shallow	flush mount		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
MW-64	Monitoring	S Refinery	SW of SE Tankfarm	4/28/05	4	3369.52	3365.56	34.08	15 to 30	Shallow	stickup	Y	SA	SA ^d	SA ^d	SA ^d	SA ^d	SA ^d	-	S16 ^d	-	SA ^d	SA ^d	SA ^d	
MW-65	Monitoring	S Refinery	S of SE Tankfarm	4/26/05	4	3363.60	3363.84	28.80	14.5 to 29.5	Shallow	flush mount	Y	SA	SA ^d	SA ^d	SA ^d	SA ^d	SA ^d	-	S16 ^d	-	SA ^d	SA ^d	SA ^d	
MW-66	Monitoring	S Refinery	E of SE Tankfarm	4/26/05	4	3363.46	3363.66	29.80	14.6 to 29.6	Shallow	flush mount		SA	SA	SA	SA	SA	-	SA	S16	SA	SA	SA	SA	
MW-67	Monitoring	N Refinery	E of Diesel Tank Farm	4/25/05	4	3365.45	3365.59	27.30	12 to 27	Shallow	flush mount		SA	SA	SA	SA	SA	-	SA	S16	SA	SA	SA	SA	
MW-68	Monitoring	TMD	S of ED, west of HR, formerly MW #28	1/11/95	2	3328.21	3325.81	26.52	14.75 to 24.5	Shallow	stickup		SA	A	A	-	A	A	-	S16	-	A	A	A	
MW-69	Monitoring	EP	N of River, formerly MW #23	1/27/93	2	3313.86	3311.40	22.51	5 to 20	Shallow	stickup		SA	Not included in monitoring program due to location (north of river)											
MW-70	Monitoring	EP	S of EPs, formerly MW #19	1/23/93	4	3306.30	3303.84	22.06	5 to 20	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	A	A	A	
MW-71	Monitoring	TMD	S of ED, formerly MW #29	1/10/95	2	3335.29	3332.99	21.85	9.75 to 19.5	Shallow	stickup		SA	A	A	-	A	-	A	S16	A	A	A	A	
MW-72	Monitoring	EP	EP 6	3/29/07	4	3308.45	3306.40	13.93	2 to 12	Shallow	stickup		SA	A	A	A	A	A	-	S16	-	A	A	A	
MW-73	Monitoring	EP	EP 3	3/29/07	4	3310.18	3308.02	19.60	2 to 17	Shallow	stickup		SA	A	A	A	A	A	-	S16	-	A	A	A	
MW-74	Monitoring	EP	EP 2	3/29/07	4	3310.03	3307.78	20.16	2 to 17	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
MW-75	Monitoring	EP	EP 2	3/29/07	4	3310.21	3307.80	23.71	3 to 18	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
MW-76	Monitoring	EP	EP 2	3/29/07	4	3311.84	3309.70	20.35	3 to 18	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
MW-77	Monitoring	EP	EP 2	3/29/07	4	3310.07	3307.97	20.57	3 to 18	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
MW-78	Monitoring	EP	EP 2	3/29/07	4	3310.14	3307.94	19.61	2 to 17	Shallow	stickup		SA	A	A	A	A	A	-	S16	-	A	A	A	
MW-79	Monitoring	EP	EP 5	3/29/07	4	3311.43	3309.08	19.32	2 to 17	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
MW-80	Monitoring	EP	EP 5	3/29/07	4	3310.79	3308.73	19.67	2 to 17	Shallow	stickup		SA	A	A	A	A	A	-	S16	-	A	A	A	
MW-81	Monitoring	EP	EP 5	3/29/07	4	3312.34	3310.19	18.70	2 to 17	Shallow	stickup		SA	A	A	A	A	A	-	S16	-	A	A	A	
MW-82	Monitoring	EP	EP 1	3/29/07	4	3310.75	3308.64	20.00	2 to 17	Shallow	stickup		SA	A	A	A	A	A	-	S16	-	A	A	A	
MW-83	Monitoring	EP	EP 1	3/29/07	4	3310.19	3307.93	19.95	2 to 17	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	

Table 1
Revised Monitoring Program and Schedule
Navajo Refining Company - Artesia Refinery, Artesia, New Mexico

Well ID	Well Type	Location Information		Well Construction Information ^a								PSH Expected? ^b	Gauging Frequency	Analytical Suite and Frequency ^c											
		Associated Area of Concern	Approximate Location	Install Date	Diameter (in)	Top of Casing (ft MSL)	Ground Surface (ft MSL)	Total Depth (ft btoc)	Screen Interval (ft bgs)	Water Bearing Zone	Surface Finish			Purge Parameters	DRO	GRO	VOCs	Metals (As, Ba, Cr, Fe, Pb, Mn, Se)	Metals (As, Ba, Cr, Fe, Pb, Mn, Hg, Ni, Se, V)	Metals (B, Cd, Co, Ni, U)	Cyanide	Cations/Anions	Nitrates / Nitrites as Nitrogen	Total Dissolved Solids	
MW-84	Monitoring	EP	EP 1	3/29/07	4	3311.59	3309.83	20.56	2 to 17	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
MW-85	Monitoring	EP	EP 1	3/29/07	4	3311.09	3308.99	20.34	3 to 18	Shallow	stickup	Y	SA	SA ^d	SA ^d	SA ^d	SA ^d	SA ^d	-	S16 ^d	-	SA ^d	SA ^d	SA ^d	
MW-86	Monitoring	EP	EP 1	3/29/07	4	3311.06	3308.98	19.21	2 to 17	Shallow	stickup	Y	SA	SA ^d	SA ^d	SA ^d	SA ^d	-	SA ^d	S16 ^d	SA ^d	SA ^d	SA ^d		
MW-87	Monitoring	EP	S of EPs	3/29/07	4	3307.64	3305.42	20.41	2 to 17	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	A	A	A	
MW-88	Monitoring	EP	S of EPs	3/29/07	4	3308.68	3306.43	20.33	3 to 18	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	A	A	A	
MW-89	Monitoring	TMD	S of ED, E of HR	3/29/07	4	3318.32	3316.38	20.24	2 to 17	Shallow	stickup		SA	A	A	-	A	A	-	S16	-	A	A	A	
MW-90	Monitoring	N Refinery	S of Diesel Tankfarm	6/29/07	4	3369.42	3367.13	22.80	5 to 20	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
MW-91	Monitoring	N Refinery	S of Diesel Tankfarm	6/28/07	4	3367.73	3365.72	25.31	7 to 22	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
MW-92	Monitoring	N Refinery	S of ED, N of NAPI	6/28/07	4	3368.72	3366.75	22.62	5 to 20	Shallow	stickup	Y	SA	SA ^d	SA ^d	SA ^d	SA ^d	SA ^d	-	S16 ^d	-	SA ^d	SA ^d	SA ^d	
MW-93	Monitoring	N Refinery	S of ED, NE of NAPI	6/29/07	4	3363.79	3364.22	20.23	5 to 20	Shallow	flush mount		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
MW-94	Monitoring	N Refinery	SE of Diesel Tankfarm, N of ED	7/2/07	4	3367.97	3365.82	23.48	5 to 20	Shallow	stickup	Y	SA	SA ^d	SA ^d	SA ^d	SA ^d	SA ^d	-	S16 ^d	-	SA ^d	SA ^d	SA ^d	
MW-95	Monitoring	N Refinery	NE of Diesel Tankfarm	7/2/07	4	3368.70	3366.48	25.40	7 to 22	Shallow	stickup		SA	A	A	A	A	A	-	S16	-	A	A	A	
MW-96	Monitoring	N Refinery	S of Diesel Tankfarm	7/3/07	4	3368.92	3366.83	25.55	7 to 22	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
MW-97	Monitoring	N Refinery	SE of NAPI	7/3/07	4	3365.92	3366.38	21.24	8 to 23	Shallow	flush mount	Y	SA	SA ^d	SA ^d	SA ^d	SA ^d	SA ^d	-	S16 ^d	-	SA ^d	SA ^d	SA ^d	
MW-98	Monitoring	N Refinery	E of Former Diesel Storage Tank Area	7/3/07	4	3361.36	3358.96	26.80	13 to 23	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
MW-99	Monitoring	S Refinery	NE of Loading Rack	7/5/07	4	3364.07	3362.33	27.90	12 to 27	Shallow	flush mount		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
MW-101	Monitoring	S Refinery	E Loading Rack	7/6/07	4	3364.23	3362.07	26.86	8 to 23	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
MW-102	Monitoring	S Refinery	E West Firewater Pond	7/6/07	4	3367.64	3365.51	26.48	12 to 27	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
MW-103	Monitoring	S Refinery	Old Rail ROW	8/18/08	4	3372.47	3370.89	25.22	7 to 22	Shallow	stickup		SA	A	A	A	A	A	-	S16	-	A	A	A	
MW-104	Monitoring	S Refinery	Old Rail ROW	8/19/08	4	3371.43	3369.41	21.95	3 to 18	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
MW-105	Monitoring	S Refinery	W of Crude Tankfarm	2/19/09	4	3364.99	3365.20	17.24	8 to 18	Shallow	flush mount		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
MW-106	Monitoring	S Refinery	E of Crude Tankfarm	2/9/09	4	3358.98	3359.29	22.80	0 to 11	Shallow	flush mount		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
MW-107	Monitoring	S Refinery	NE of SE Tankfarm	2/24/09	4	3359.44	3359.63	19.05	12 to 22	Shallow	flush mount		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
MW-108	Monitoring	NCL	S of NCL	7/17/09	4	3369.11	3366.25	27.75	9 to 24	Shallow	stickup		SA	SA	SA	-	SA	SA	-	S16	-	SA	SA	SA	
MW-109	Monitoring	S Refinery	S of Highway 82 at warehouse	1/6/11	2	3368.09	3368.27	29.50	15 to 29.5	Shallow	flush mount		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
MW-110	Monitoring	S Refinery	S of Highway 82 at warehouse	1/5/11	2	3368.03	3368.46	29.75	15 to 29.5	Shallow	flush mount		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
MW-111	Monitoring	Field E of Refinery	E of Refinery, N of Highway 82, W of BR	2/2/13	2	3365.51	3362.52	40.84	25 to 40	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
MW-112	Monitoring	Field E of Refinery	E of Refinery, N of Highway 82, W of BR	2/1/13	2	3358.38	3355.38	37.53	25 to 35	Shallow	stickup	Y	SA	SA ^d	SA ^d	SA ^d	SA ^d	SA ^d	-	S16 ^d	-	SA ^d	SA ^d	SA ^d	
MW-113	Monitoring	Field E of Refinery	E of Refinery, N of Highway 82, W of BR	2/2/13	2	3352.93	3350.06	37.68	20 to 35	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
MW-114	Monitoring	S RO Reject Field	SW corner (outfall) of S RO Reject Field	1/28/13	2	3361.68	3358.62	38.20	20 to 35	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
MW-115	Monitoring	S RO Reject Field	NW corner of S RO Reject Field	1/29/13	2	3359.31	3356.48	27.49	10 to 25	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
MW-116	Monitoring	S RO Reject Field	NE corner of S RO Reject Field	1/30/13	2	3353.77	3350.99	27.62	10 to 25	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
MW-117	Monitoring	N RO Reject Field	SW corner (outfall) of N RO Reject Field	1/31/13	2	3363.01	3360.07	27.24	10 to 25	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
MW-118	Monitoring	N RO Reject Field	NW corner of N RO Reject Field	2/4/13	2	3361.95	3359.62	28.29	10 to 25	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
MW-119	Monitoring	N RO Reject Field	NE corner of N RO Reject Field	2/4/13	2	3356.11	3353.83	28.16	10 to 25	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	

Table 1
Revised Monitoring Program and Schedule
Navajo Refining Company - Artesia Refinery, Artesia, New Mexico

Well ID	Well Type	Location Information		Well Construction Information ^a								PSH Expected? ^b	Gauging Frequency	Analytical Suite and Frequency ^c												
		Associated Area of Concern	Approximate Location	Install Date	Diameter (in)	Top of Casing (ft MSL)	Ground Surface (ft MSL)	Total Depth (ft btoc)	Screen Interval (ft bgs)	Water Bearing Zone	Surface Finish			Purge Parameters	DRO	GRO	VOCs	Metals (As, Ba, Cr, Fe, Pb, Mn, Se)	Metals (As, Ba, Cr, Fe, Pb, Mn, Hg, Ni, Se, V)	Metals (B, Cd, Co, Ni, U)	Cyanide	Cations/Anions	Nitrates / Nitrites as Nitrogen	Total Dissolved Solids		
MW-120	Monitoring	EP	Between EP1 outfall and Pecos River	5/8/13	2	3313.55	3310.66	27.98	10 to 25	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA		
MW-121	Monitoring	EP	Between EP1 berm and Pecos River	5/8/13	2	3314.68	3311.77	27.28	10 to 25	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA		
MW-122	Monitoring	EP	Between EP5 berm and Pecos River	5/8/13	2	3311.69	3308.78	23.31	10 to 20	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA		
MW-123	Monitoring	EP	S of EPs, N of 82	5/11/13	2	3303.98	3302.78	25.81	10 to 25	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA		
MW-124	Monitoring	EP	S of EPs, N of 82	5/11/13	2	3305.84	3302.99	22.01	5 to 20	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA		
MW-125	Monitoring	Field E of Refinery	E of fire water pond, S of S RO Reject Field	2/5/14	2	3358.81	3355.60	28.30	15 to 25	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA		
126A	Monitoring	Field E of Refinery	E of stormwater pond, W of irrigated field	1/29/14	2	3356.60	3353.60	37.56	19 to 34	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA		
126B	Monitoring	Field E of Refinery	E of stormwater pond, W of irrigated field	1/27/14	2	3356.67	3353.60	51.99	40 to 50	Valley Fill	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA		
MW-127	Monitoring	Field E of Refinery	E of laydown yard, W of irrigated field	1/23/14	2	3358.39	3355.50	53.25	20 to 50	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA		
MW-128	Monitoring	Field E of Refinery	In laydown yard	1/29/14	2	3358.77	3358.80	35.38	15 to 35	Shallow	flush mount		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA		
MW-129	Monitoring	Field E of Refinery	W of irrigated field	1/22/14	2	3364.38	3361.60	53.20	20 to 50	Shallow	stickup	Y	SA	SA ^d	SA ^d	SA ^d	SA ^d	SA ^d	-	S16 ^d	-	SA ^d	SA ^d	SA ^d		
MW-130	Monitoring	S Refinery	In refinery office parking lot	2/7/14	2	3369.86	3370.20	44.90	30 to 45	Shallow	flush mount		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA		
MW-131	Monitoring	Field E of Refinery	SW edge of irrigated field	1/23/14	2	3363.49	3360.40	53.48	20 to 50	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA		
MW-132	Monitoring	Field E of Refinery	Near 82 at E end of parking area	1/30/14	2	3357.12	3354.30	42.71	15 to 40	Shallow	stickup	Y	SA	SA ^d	SA ^d	SA ^d	SA ^d	SA ^d	-	S16 ^d	-	SA ^d	SA ^d	SA ^d		
MW-133	Monitoring	Field E of Refinery	E edge of irrigated field, N of RW-14	2/4/14	2	3349.45	3343.40	37.64	15 to 35	Shallow	stickup	Y	SA	SA ^d	SA ^d	SA ^d	SA ^d	SA ^d	-	S16 ^d	-	SA ^d	SA ^d	SA ^d		
MW-134	Monitoring	Field E of Refinery	NE of irrigated field	2/4/14	2	3346.23	3343.10	32.89	20 to 30	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA		
MW-135	Monitoring	Field E of Refinery	E edge of pecan orchard	2/11/14	2	3337.65	3338.00	65.55	35 to 65	Shallow	flush mount		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA		
MW-136	Monitoring	Crossgradient	North of North RO Field	7/28/14	2	3360.83	3358.62	27.42	10 to 25	Shallow	stickup		SA	SA	SA	SA	SA	-	SA	S16	SA	SA	SA	SA		
MW-137	Monitoring	N Refinery	Main API Separator	11/9/14	2	TBD	TBD	31	10 to 30	Shallow	stickup		SA	SA	SA	SA	SA	-	SA	S16	SA	SA	SA	SA		
MW-138	Monitoring	N Refinery	Main API Separator	2015	2	TBD	TBD	TBD	TBD	Shallow	stickup		SA	SA	SA	SA	SA	-	SA	S16	SA	SA	SA	SA		
NCL-31	Monitoring	NCL	NCL	10/19/82	2	3367.54	3366.21	20.16	13 to 18	Shallow	stickup		SA	SA	SA	-	SA	SA	-	S16	-	SA	SA	SA		
NCL-32	Monitoring	NCL	NCL	10/20/82	2	3364.91	3364.96	17.23	17 to 22	Shallow	flush mount		SA	SA	SA	-	SA	SA	-	S16	-	SA	SA	SA		
NCL-33	Monitoring	NCL	NCL	10/20/82	2	3363.97	3364.26	19.62	13 to 18	Shallow	stickup		SA	SA	SA	-	SA	SA	-	S16	-	SA	SA	SA		
NCL-34	Monitoring	NCL	NCL	10/20/82	2	3365.49	3364.82	19.31	16 to 21	Shallow	stickup		SA	SA	SA	-	SA	SA	-	S16	-	SA	SA	SA		
NCL-44	Monitoring	NCL	NCL		2	3364.45	3364.01	21.61		Shallow	stickup		SA	SA	SA	-	SA	SA	-	S16	-	SA	SA	SA		
NCL-49	Monitoring	NCL	NCL	5/17/90	2	3371.13	3368.26	32.20	16.8 to 17.8	Shallow	stickup		SA	SA	SA	-	SA	SA	-	S16	-	SA	SA	SA		
NP-1	Monitoring	TMD	S of ED, E of BR	1/22/93	2	3342.40	3339.69	21.53	9.5 to 19	Shallow	stickup		SA	SA	-	-	SA	-	-	S16	-	A	A	A		
NP-2	Monitoring	TMD	S of ED, E of BR	1/21/93	2	3342.77	3340.58	21.48	9.5 to 18.5	Shallow	stickup		SA	No analytical samples to be collected												
NP-3	Monitoring	TMD	N of ED, NE of BR	1/22/93	2	3342.93	3340.40	21.92	9.5 to 18.5	Shallow	stickup		SA	No analytical samples to be collected												
NP-4	Monitoring	TMD	NE of NP #3	1/23/93	2	3345.73	3343.24	36.72	24.5 to 33.5	Shallow	stickup		SA	No analytical samples to be collected												
NP-5	Monitoring	Crossgradient	S of RR, N of ED, W of BR	1/11/95	2	3349.29	3346.31	25.09	10.25 to 20	Shallow	stickup		SA	B	B	-	B	B	-	-	-	B	B	B		
NP-6	Monitoring	TMD	S of ED, W of BR	1/10/95	2	3338.05	3336.31	20.35	8.75 to 18.75	Shallow	stickup		SA	B	-	-	B	-	-	S16	-	-	-	-		
NP-8	Monitoring	TMD	S of ED, E of HR		2	3314.67	3310.53	15.22		Shallow	stickup		SA	No analytical samples to be collected												
NP-9	Monitoring	TMD	S of RR, N of ED, W of BR		2	3360.62	3357.86	25.90		Shallow	stickup		SA	No analytical samples to be collected												
OCD-1R	Monitoring	EP	NW of EP 6, replaced OCD-1		2	3314.27	3310.69	23.90		Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA		

Table 1
Revised Monitoring Program and Schedule
Navajo Refining Company - Artesia Refinery, Artesia, New Mexico

Well ID	Well Type	Location Information		Well Construction Information ^a								PSH Expected? ^b	Gauging Frequency	Analytical Suite and Frequency ^c											
		Associated Area of Concern	Approximate Location	Install Date	Diameter (in)	Top of Casing (ft MSL)	Ground Surface (ft MSL)	Total Depth (ft btoc)	Screen Interval (ft bgs)	Water Bearing Zone	Surface Finish			Purge Parameters	DRO	GRO	VOCs	Metals (As, Ba, Cr, Fe, Pb, Mn, Se)	Metals (As, Ba, Cr, Fe, Pb, Mn, Hg, Ni, Se, V)	Metals (B, Cd, Co, Ni, U)	Cyanide	Cations/Anions	Nitrates / Nitrites as Nitrogen	Total Dissolved Solids	
OCD-2A	Monitoring	EP	N of EP 6	4/28/88	2	3314.16	3310.83	27.60	8.5 to 23.5	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	A	A	A	
OCD-2B	Monitoring	EP	N of EP 6	12/14/92	2	3313.07	3310.66	50.40	38.5 to 48	Valley Fill	stickup		SA	No analytical samples to be collected											
OCD-3	Monitoring	EP	NE of EP 6	4/28/88	2	3314.43	3310.89	25.48	6.5 to 21.5	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	A	A	A	
OCD-4	Monitoring	EP	NE of EP 6	4/28/88	2	3313.68	3310.31	25.44	6.5 to 21.5	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	A	A	A	
OCD-5	Monitoring	EP	NE of EP 6	4/26/88	2	3311.27	3308.76	25.44		Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
OCD-6	Monitoring	EP	E of EP 6	4/26/88	2	3311.40	3308.11	26.91	8 to 23	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
7AR	Monitoring	EP	SE of EP 6	12/15/92	4	3310.03	3308.86	21.28	5.5 to 19.5	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
OCD-7B	Monitoring	EP	SE of EP 6	12/15/92	2	3310.26	3307.57	56.85	43.5 to 52.5	Valley Fill	stickup		SA	B	B	B	B	B	-	-	-	B	B	B	
OCD-7C	Monitoring	EP	SE of EP 6	1/20/95	2	3310.10	3307.74	71.87	50.25 to 69.75	Valley Fill	stickup		SA	No analytical samples to be collected											
OCD-8A	Monitoring	EP	SE of EP 3	4/25/88	2	3308.72	3306.43	20.76	3 to 18	Shallow	stickup		SA	SA	SA	SA	SA	-	SA	S16	SA	SA	SA	SA	
OCD-8B	Monitoring	EP	SE of EP 3	12/14/92	2	3309.19	3306.11	56.65	43.5 to 53	Valley Fill	stickup		SA	B	B	B	B	B	-	-	-	B	B	B	
TEL-1	Monitoring	TEL	E of TEL cap	5/1/90	2	3358.23	3356.79	27.00	13 to 23	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
TEL-2	Monitoring	TEL	E of TEL cap	5/1/90	2	3359.12	3356.80	27.20	13 to 23	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
TEL-3	Monitoring	TEL	E of TEL cap	5/1/90	2	3358.33	3356.43	27.19	13 to 23	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
TEL-4	Monitoring	TEL	W of TEL cap	5/1/90	2	3360.24	3358.21	27.28	13 to 23	Shallow	stickup		SA	SA	SA	SA	SA	SA	-	S16	-	SA	SA	SA	
UG-1	Monitoring	Upgradient	W of Refinery, James Street	7/28/08	4	3372.94	3373.02	24.10	8 to 23	Shallow	flush mount		A	A	A	A	A	-	A	S16	A	A	A	A	
UG-2	Monitoring	Upgradient	W of Refinery, Roselawn	7/28/08	4	3380.41	3380.30	29.26	15 to 30	Shallow	flush mount		A	A	A	A	A	-	A	S16	A	A	A	A	
UG-3R	Monitoring	Upgradient	W of Refinery, 7th Street	9/8/08	4	3384.08	3384.62	38.58	17 to 37	Shallow	flush mount		A	A	A	A	A	-	A	S16	A	A	A	A	
UG-4	Monitoring	Upgradient	W of Refinery, Logan at 4th Street	9/2/14	2	3384.08	3384.62	39.25	19.5 to 39.5	Shallow	flush mount		A	A	A	A	A	-	A	S16	A	A	A	A	
RA-1227	Irrigation	Field E of Refinery	S of US82, E of BR	12/30/35	10 / 8	3352.80	3352.27	246	194 to 246	Artesian	irrigation well		NA	A ^f	-	-	A ^f	-	-	-	-	A ^f	A ^f	A ^f	
RA-313	Irrigation	S Refinery	N of US82, W of BR	10/1/40	10	3370.62	3369.96	1157	904 to 1157	Artesian	irrigation well		NA	A	-	-	A	-	-	-	-	A	A	A	
RA-3156	Irrigation	Field E of Refinery	S of US82, E of BR	11/5/53	4	3353.28	3353.02		182 to ?	Artesian	irrigation well		NA	A	-	-	A	-	-	-	-	A	A	A	
RA-4196	Irrigation	Field E of Refinery	N of US82, E of BR	4/26/60	8	3351.52	3350.75	294	280 to 292	Artesian	irrigation well		NA	SA	-	-	SA	-	-	-	-	SA	SA	SA	
RA-4798	Irrigation	Field E of Refinery	E of BR, N of US82	5/23/63	7	3348.31	3347.65	850	840 to 850	Artesian	irrigation well		NA	SA	-	-	SA	-	-	-	-	SA	SA	SA	
RW-1R	Recovery ^d	N Refinery	S of ED, NW portion of Refinery	10/16/13	12	3367.27	3365.29	pump	15 to 35	Shallow	recovery well		SA	A	A	A	A	A	-	S16	-	A	A	A	
RW-2R	Recovery ^d	N Refinery	S of ED, NW portion of Refinery	10/15/13	12	3368.23	3368.17	pump	14.5 to 34.5	Shallow	recovery well		SA	A	A	A	A	A	-	S16	-	A	A	A	
RW-4R	Recovery ^d	S Refinery	NW of SE Tankfarm	10/21/13	12	3370.32	3364.41	pump	14.5 to 34.5	Shallow	recovery well		SA	A	A	A	A	A	-	S16	-	A	A	A	
RW-5R	Recovery ^d	S Refinery	SW Tankfarm	8/24/11	12	3368.56	3362.79	pump	13 to 33	Shallow	recovery well	Y	SA	A ^d	A ^d	-	A ^d	A ^d	-	S16 ^d	-	A ^d	A ^d	A ^d	
RW-6R	Recovery ^d	S Refinery	W of SE Tankfarm	10/22/13	12	3372.12	3366.03	pump	14.5 to 34.5	Shallow	recovery well		SA	A	A	A	A	A	-	S16	-	A	A	A	
RW-7R	Recovery ^d	N Refinery	N of ED, NW portion of Refinery	10/17/13	12	3367.25	3365.03	pump	14.5 to 34.5	Shallow	recovery well		SA	A	A	A	A	A	-	S16	-	A	A	A	
RW-8R	Recovery ^d	N Refinery	N of ED, S of NCL	10/18/13	12	3367.00	3364.89	pump	14.5 to 34.5	Shallow	recovery well		SA	A	A	A	A	A	-	S16	-	A	A	A	
RW-9	Recovery ^d	N Refinery	N of TEL		36	3359.51	3356.30	21.97		Shallow	recovery well		SA	A	A	A	A	A	-	S16	-	A	A	A	
RW-10	Recovery ^d	N Refinery	N of TEL		36	3360.61	3356.12	23.77		Shallow	recovery well		SA	A	A	A	A	A	-	S16	-	A	A	A	
RW-11 ^e	Recovery ^d	Field E of Refinery	S of US82, W side of BR		36	3353.95	3351.48	22.20		Shallow	recovery well		SA	A	A	-	A	A	-	S16	-	A	A	A	
RW-12R	Recovery ^d	Field E of Refinery	N of US 82, W of BR	8/21/11	12	3351.54	3350.58	pump	15 to 35	Shallow	recovery well	Y	SA	A ^d	A ^d	-	A ^d	A ^d	-	S16 ^d	-	A ^d	A ^d	A ^d	

Table 1
Revised Monitoring Program and Schedule
Navajo Refining Company - Artesia Refinery, Artesia, New Mexico

Well ID	Well Type	Location Information		Well Construction Information ^a								PSH Expected? ^b	Gauging Frequency	Analytical Suite and Frequency ^c										
		Associated Area of Concern	Approximate Location	Install Date	Diameter (in)	Top of Casing (ft MSL)	Ground Surface (ft MSL)	Total Depth (ft btoc)	Screen Interval (ft bgs)	Water Bearing Zone	Surface Finish			Purge Parameters	DRO	GRO	VOCs	Metals (As, Ba, Cr, Fe, Pb, Mn, Se)	Metals (As, Ba, Cr, Fe, Pb, Mn, Hg, Ni, Se, V)	Metals (B, Cd, Co, Ni, U)	Cyanide	Cations/Anions	Nitrates / Nitrites as Nitrogen	Total Dissolved Solids
RW-13R	Recovery ^d	Field E of Refinery	N of US 82, W of BR	8/21/11	12	3351.54	3349.60	pump	15 to 35	Shallow	recovery well	Y	SA	A ^d	A ^d	-	A ^d	A ^d	-	S16 ^d	-	A ^d	A ^d	A ^d
RW-14R	Recovery ^d	Field E of Refinery	N of US 82, W of BR	8/21/11	12	3349.37	3347.39	pump	15 to 35	Shallow	recovery well	Y	SA	A ^d	A ^d	-	A ^d	A ^d	-	S16 ^d	-	A ^d	A ^d	A ^d
RW-15 ^e	Recovery ^d	S Refinery	S of SE Tankfarm		36	3362.30	3363.58	18.35		Shallow	recovery well	Y	SA	A ^d	A ^d	-	A ^d	A ^d	-	S16 ^d	-	A ^d	A ^d	A ^d
RW-16 ^e	Recovery ^d	N Refinery	NE of Refinery, S of ED		36	3360.01	3357.51	17.70		Shallow	recovery well		SA	A	A	-	A	A	-	S16	-	A	A	A
RW-17 ^e	Recovery ^d	N Refinery	N of ED, E of NCL		36	3366.15	3362.58	16.02		Shallow	recovery well		SA	A	A	A	A	A	-	S16	-	A	A	A
RW-18 ^e	Recovery ^d	Field E of Refinery	S of ED, W of BR		36	3352.05	3349.53	17.75		Shallow	recovery well		SA	A	-	-	A	A	-	S16	-	A	A	A
RW-19	Recovery ^d	S Refinery	N of US 82, near KWB-4	8/20/11	12	3369.11	3367.09	pump	11 to 46	Shallow	recovery well	Y	SA	A ^d	A ^d	-	A ^d	A ^d	-	S16 ^d	-	A ^d	A ^d	A ^d
RW-20	Recovery ^d	Field E of Refinery	E of BR, at pecan orchard building		4	3348.44	3347.75	pump		Shallow	recovery well		SA	A	A	A	A	A	-	S16	-	A	A	A
RW-22	Recovery ^d	Field E of Refinery	E of BR, in pecan orchard, near KWB-8	8/23/11	12	3350.84	3349.04	pump	11.5 to 39	Shallow	recovery well	Y	SA	A ^d	A ^d	-	A ^d	A ^d	-	S16 ^d	-	A ^d	A ^d	A ^d

Note: Blank cells indicate that information is not available or applicable.

Abbreviations:

A = Annual (March/April event)	NW = Northwest
B = Biennial (starts March/April 2011)	OCD = Oil Conservation District
BR = Bolton Road	PSH = Phase Separated Hydrocarbons
DRO = TPH Diesel Range Organics	ROW = right of way
E = East	RR = Richey Road
ED = Eagle Draw	S = South
EP = Evaporation Ponds	S16 = Spring 2016 event (March/April)
ft bgs = feet below ground surface	SA = Semi-annual (March/April and September/October events)
ft btoc = feet below top of casing	SE = Southeast
ft MSL = feet Mean Sea Level	SW = Southwest
GRO = TPH Gasoline Range Organics	TEL = Tetra Ethyl Lead Impoundment
HR = Haldeman Road	TMD = Three Mile Ditch
in = inches	TPH = Total Petroleum Hydrocarbons
N = North	UG = Upgradient
NA = Not accessible	US285 = U.S. Highway 285
NAPI = North API Separator	US82 = U.S. Highway 82
NCL = North Colony Landfarm	VOCs = Volatile Organic Compounds
NE = Northeast	W = West
NS = Not surveyed yet	Y = Yes

Footnotes:

- ^a Well construction information provided where available. Top of casing and ground surface elevations relative to benchmark G-416. Total depth based on 4/2015 measurements, as available.
- ^b PSH was present during at least one of the 2015 groundwater monitoring events or a recovery pump is in place. Note that recovery wells are also gauged at least monthly.
- ^c Analytical Suite to include the following:
- Purge parameters to be measured and recorded in the field will include pH, temperature, specific conductivity, dissolved oxygen, and oxygen-reduction potential.
 - DRO by Method 8015 Modified.
 - GRO by Method 8015 Modified.
 - VOCs by Method 8260, to include methyl tert butyl ether (MTBE) and naphthalene.
 - Total metals by Method 6010/6020 and/or 7470. Specific metals shown in heading, abbreviations from periodic chart.
 - Dissolved metals - same list as total metals but only analyzed during March/April event
 - Additional dissolved metals analyses (boron, cadmium, cobalt, nickel, and uranium) will be performed during Spring 2016 event, indicated by S16 in the analytical suite column.
 - Cyanide by Method SM4500.
 - Cations/anions to include Calcium, Potassium, and Sodium by Method 6010 or 6020 and Sulfate, Chloride and Fluoride by Method 300.
 - Nitrates/Nitrites as Nitrogen by Method 300.
 - Total Dissolved Solids by Method 2540C.
- "-" indicates parameter not required.
- Note - samples will not be collected from any well where PSH is measured to be 0.03 feet thick or greater.*
- ^d Samples to be collected at frequency indicated only if <0.03 feet of PSH is present.
- ^e Recovery trenches 11, 15, 16, 17 and 18 have multiple "wells". Gauging and sampling points are as follows: RW #11-0, RW #15C, RW #16B, RW #17A and RW #18A.
- ^f Wells will be gauged and/or sampled only if the landowner grants access. If landowner continues to deny access, wells will be removed from monitoring program.

Chavez, Carl J, EMNRD

From: Martinez, Cynthia, NMENV
Sent: Friday, February 19, 2016 2:25 PM
To: scott.denton@hollyfrontier.com
Cc: Kieling, John, NMENV; Cobrain, Dave, NMENV; Dhawan, Neelam, NMENV; VanHorn, Kristen, NMENV; Tsinnajinnie, Leona, NMENV; Chavez, Carl J, EMNRD; Griswold, Jim, EMNRD; Mike.Holder@hollyfrontier.com; Robert.Combs@hollyfrontier.com; king.laurie@epa.gov
Subject: Letter to Mr. Denton
Attachments: HWB-NRC-15-008 Approval with Mods. 2015 Facility Wide Groundwater Monitoring Workplan Revised.pdf

*Good Afternoon All,
The attached letter was mailed today.*

*Cynthia Martínez
New Mexico Environment Department
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Bldg.1
Santa Fe, New Mexico 87505
Phone 505-476-6000*



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RYAN FLYNN
Cabinet Secretary
BUTCH TONGATE
Deputy Secretary

CERTIFIED MAIL – RETURN RECEIPT REQUESTED

February 19, 2016

Mr. Scott M. Denton
Environmental Manager
HollyFrontier Navajo Refining L.L.C.
P.O. Box 159
Artesia, New Mexico 88211-0159

**RE: APPROVAL WITH MODIFICATIONS
2015 FACILITY WIDE GROUNDWATER MONITORING
WORKPLAN - REVISED
HOLLYFRONTIER NAVAJO REFINING L.L.C. - ARTESIA REFINERY
EPA ID NO. NMD048918817
HWB-NRC-15-008**

Dear Mr. Denton:

The New Mexico Environment Department (NMED) has completed its review of HollyFrontier Navajo Refining L.L.C.'s, Artesia Refinery's (the Permittee) *2015 Facility Wide Groundwater Monitoring Workplan – Revised* (Work Plan), dated December 21, 2015. In addition, the New Mexico Energy, Minerals, and Natural Resources Department (NMEMRND) Oil Conservation Division (OCD) has reviewed the Work Plan and provided comments. NMED hereby issues this Approval with the following modifications.

Comment 1

In the *Response to Comment 1*, the Permittee states that “boron, cadmium, cobalt, nickel and uranium should not be considered facility-wide COCs and should not be added to the Work Plan.” The Permittee provided additional information for each inorganic compound referencing the results from the *Reverse Osmosis Reject Water Discharge Fields Investigation Final Report, February 2014* and the *Background Groundwater Investigation Report, September 2015*

(Background Study). It is not appropriate to utilize results from the Background Study because the report has not been approved. Therefore, the Permittee must incorporate OCD's requirements to include boron, cadmium, cobalt, nickel and uranium with the analytical suite and revise Table 1 (Revised Monitoring Program and Schedule) to include them in the Spring 2016 monitoring event. After the Background Study has been approved, the inclusion of the inorganic compounds (boron, cadmium, cobalt, nickel and uranium) for future sampling events will be reevaluated.

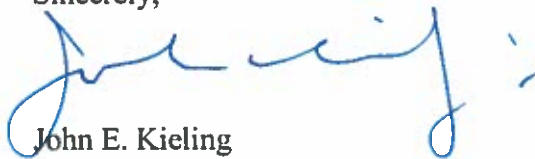
Comment 2

Item c.4 of the Footnotes section in Table 1 (Revised Monitoring Program and Schedule) does not reference the dissolved metals. Include this analysis in the Footnotes section in the revised Table 1 and indicate that the dissolved metals will be analyzed during the Spring sampling event.

The Permittee must address these comments in this Approval with Modifications and incorporate OCD's additional inorganic compounds referenced in Comment 1 with the Spring 2016 event. The Permittee must submit the revised Table 1 to NMED and a copy to OCD by **March 18, 2016**.

If you have any questions regarding this letter, please contact Leona Tsinnajinnie of my staff at (505) 476-6057.

Sincerely,



John E. Kielling
Chief
Hazardous Waste Bureau

cc: D. Cobrain, NMED HWB
N. Dhawan, NMED HWB
K. Van Horn, NMED HWB
L. Tsinnajinnie, NMED HWB
J. Griswold, NMEMNRD OCD
C. Chavez, NMEMNRD OCD
M. Holder, HollyFrontier, Dallas, Texas
R. Combs, HollyFrontier Navajo Refining L.L.C. - Artesia Refinery
L. King, EPA 6PD-N

File: Reading File and NRC 2016
HWB-NRC-15-008



**2015 Facility Wide Groundwater
Monitoring Workplan
NMD048918817 and DP GW-028**

June 2015



A handwritten signature in blue ink, appearing to read "Pamela R. Krueger", written over a horizontal line.

Pamela R. Krueger
Senior Project Manager, ARCADIS

**2015 Facility Wide
Groundwater Monitoring
Workplan
NMD048918817
and DP GW-028**

Prepared for:
New Mexico Environment Department,
Hazardous Waste Bureau and
New Mexico Energy, Minerals and Natural
Resources Department Oil Conservation
Division

Prepared by:
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Date:
June 29, 2015



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Monitoring Workplan**
Navajo Refining Company
– Artesia, New Mexico

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Figure 2	Well Locations
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Appendices

A	Well Completion Logs
B	Statistical Comparison between Dissolved and Total Concentrations of Metals
C	Development of Human Health PCLs for Total Petroleum Hydrocarbon Mixtures (TRRP-27)



**2015 Facility Wide
Groundwater
Monitoring Workplan**
Navajo Refining Company
– Artesia, New Mexico

Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

A handwritten signature in blue ink, appearing to read "Scott Denton", written over a horizontal line.

Scott Denton
Environmental Manager, Navajo Refining Company, LLC

Acronyms and Abbreviations

%	percent
CMI	Corrective Measures Implementation
DO	Dissolved Oxygen
DRO	Diesel Range Organics
EP	Evaporation Ponds
EPA	United States Environmental Protection Agency
FWGMWP	Facility Wide Groundwater Monitoring Workplan
GC/FID	Gas Chromatography/Flame Ionization Detection
GRO	Gasoline Range Organics
HFC	HollyFrontier Corporation
HSWA	Hazardous and Solid Waste Amendment
mg/L	milligrams per liter
mm	millimeters
NCL	North Colony Landfarm
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NRC	Navajo Refining Company, L.L.C.
OCD	New Mexico Energy, Minerals and Natural Resources Department Oil Conservation Division
ORP	Oxidation-Reduction Potential
OSE	Office of the State Engineer
PCC Permit	Post Closure Care Permit
PIANO	paraffins, isoparaffins, aromatics, naphthenes and olefins
PSH	Phase Separated Hydrocarbons
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SWMU	Solid Waste Management Unit
TCEQ	Texas Commission on Environmental Quality
TDS	Total Dissolved Solids
TEL	Tetra ethyl lead
TMD	Three Mile Ditch
TPH	Total Petroleum Hydrocarbons
TRRP	Texas Risk Reduction Program
VOC	Volatile Organic Compounds
WQCC	Water Quality Control Commission



Executive Summary

The HollyFrontier Corporation (HFC) owns the Navajo Refining Company, L.L.C. (NRC), which operates the Artesia Refinery (Refinery) located in Artesia, New Mexico. HFC is an independent energy company engaged in crude oil refining and wholesale marketing of refined petroleum products.

In October 2003, the Secretary of the New Mexico Environment Department (NMED) issued a Post-Closure Care Permit (PCC Permit) for the Refinery, which has United States Environmental Protection Agency (EPA) ID Number NMD048918817. The PCC Permit was modified in December 2010. Among other action items, the PCC Permit authorizes and requires NRC (the Permittee) to conduct facility wide groundwater monitoring, with the purpose of evaluating the presence, nature and extent of hazardous and regulated constituents pursuant to Section 20.4.1.500 of the New Mexico Administrative Code (NMAC) and the Water Quality Control Commission (WQCC) standards included in NMAC 20.6.2.

Additionally, the New Mexico Energy, Minerals and Natural Resources Department Oil Conservation Division (OCD) issued a renewal to Discharge Permit GW-028 dated August 22, 2012. The Discharge Permit also requires facility wide groundwater monitoring and submittal of an annual report summarizing the groundwater monitoring and abatement conducted throughout each year.

This annual update to the Facility Wide Groundwater Monitoring Workplan (FWGMWP) is being submitted as per the requirements of Section 4.7.6.a of the PCC Permit and Section 5.A of the Discharge Permit. This FWGMWP is an update of the previous workplan submitted to NMED and OCD in June 2014, which was approved by NMED on February 18, 2015. The purpose of this FWGMWP is to direct the observation and characterization of the nature and extent of groundwater contamination beneath or migrating from the Refinery. This FWGMWP contains all groundwater monitoring activities that will be conducted to satisfy both the NMED PCC Permit and the OCD Discharge Permit requirements.

The groundwater monitoring program is focused specifically on monitoring the following areas:

- The closed Tetra Ethyl Lead (TEL) Impoundment;
- The closed North Colony Landfarm (NCL);



**2015 Facility Wide
Groundwater
Monitoring Workplan**
Navajo Refining Company
– Artesia, New Mexico

- The inactive Evaporation Ponds (EP);
- Three Mile Ditch (TMD); and
- The impacted vadose zone located beneath the Refinery, extending east along the direction of flow.

This FWGMWP follows the general outline suggested for a workplan provided in Appendix E of the PCC Permit, while incorporating the requirements of Section 5 of the Discharge Permit.

1. Introduction

The HollyFrontier Corporation (HFC) owns the Navajo Refining Company, L.L.C. (NRC), which operates the Artesia Refinery (Refinery) located in Artesia, New Mexico (Figure 1). HFC is an independent energy company engaged in crude oil refining and wholesale marketing of refined petroleum products.

In October 2003, the Secretary of the New Mexico Environment Department (NMED) issued a Post-Closure Care Permit (PCC Permit) for the Refinery, which has United States Environmental Protection Agency (EPA) ID Number NMD048918817 (NMED 2003). The PCC Permit was modified in December 2010 (NMED 2010). Among other action items, the PCC Permit authorizes and requires NRC (the Permittee) to conduct facility wide groundwater monitoring, with the purpose of evaluating the presence, nature and extent of hazardous and regulated constituents pursuant to Section 20.4.1.500 of the New Mexico Administrative Code (NMAC) and the Water Quality Control Commission (WQCC) standards included in NMAC 20.6.2.

Additionally, the New Mexico Energy, Minerals and Natural Resources Department Oil Conservation Division (OCD) issued a renewal to Discharge Permit GW-028 dated August 22, 2012 (OCD 2012). The Discharge Permit also requires facility wide groundwater monitoring and submittal of an annual report summarizing the groundwater monitoring and abatement conducted throughout each year.

This annual update to the Facility Wide Groundwater Monitoring Workplan (FWGMWP) is being submitted as per the requirements of Section 4.7.6.a of the updated PCC Permit and Section 5.A of the Discharge Permit. This FWGMWP is an update of the previous workplan submitted to NMED and OCD in June 2014 (ARCADIS 2014a), which was approved on February 18, 2015 (NMED 2015). The purpose of this FWGMWP is to direct the observation and characterization of the nature and extent of groundwater contamination beneath or migrating from the Refinery. This FWGMWP contains all groundwater monitoring activities that will be conducted to satisfy both the NMED PCC Permit and the OCD Discharge Permit requirements.

The groundwater monitoring program is focused specifically on monitoring the following areas:

- The closed Tetra Ethyl Lead (TEL) Impoundment;
- The closed North Colony Landfarm (NCL);



- The inactive Evaporation Ponds (EP)
- Three Mile Ditch (TMD); and
- The impacted vadose zone located beneath the Refinery, extending east along the direction of flow.

The closed TEL Impoundment is located near the eastern boundary of the active Refinery and south of Eagle Creek (Figure 2). The closed NCL is located near the northwestern corner of the Refinery (Figure 2). The inactive EP area is located approximately three miles east of the active Refinery, south and west of the Pecos River. Figure 2 shows the locations of wells included in the monitoring program. Figure 3 shows information about tanks located within the Refinery boundary along with a more detailed view of well locations within the Refinery.

This FWGMWP describes the planned activities that will be conducted in 2016 to continue monitoring the groundwater and continue recovery of phase separated hydrocarbons (PSH). The format of this FWGMWP follows the general outline specified for a workplan in Appendix E of the PCC, while incorporating the requirements of Section 5 of the Discharge Permit.

2. Background

The Refinery is an active petroleum refinery located at 501 East Main Street in the city of Artesia, Eddy County, New Mexico. The facility has been in operation since the 1920's and processes crude oil into asphalt, fuel oil, gasoline, diesel, jet fuel, and liquefied petroleum gas. There are no plans to close the facility or reduce the size of the operation. Figure 1 depicts the general location of the Refinery and the inactive EPs, while Figure 2 shows the locations of wells included in the facility wide groundwater monitoring program.

The Refinery is regulated under Resource Conservation and Recovery Act (RCRA), having EPA ID Number NMD 048918817. The NMED issued a Hazardous Waste Facility Permit to NRC effective August 21, 1989 (NMED 1989).

Included as part of the 1989 Hazardous Waste Facility Permit was a Hazardous and Solid Waste Amendment (HSWA) Permit issued by the EPA. This permit required NRC to identify all historical and current non-hazardous solid waste management units (SWMUs) and investigate those that had the potential to pose a threat to human health or the environment. SWMUs which pose a potential threat must undergo additional investigation (a RCRA Facility Investigation [RFI] and possibly Corrective Measures Implementation [CMI]) to minimize the threat.

Following completion of the Phase I RFI in December, 1990 (Mariah Associates, Inc. 1990), it was agreed by EPA and NMED that additional investigations were required for TMD and the EPs located east of the Refinery. The second phase of investigation of those areas was conducted from 1991 through 1993, resulting in the RFI Phase II Report finalized in November, 1993 (K.W. Brown Environmental Services 1993). A final Phase III Investigation Report addressing comments from the EPA and NMED was submitted in January 1996 along with a proposed workplan for removal of waste soils from TMD (K.W. Brown Environmental Services 1996). In December 1997, a consolidated report was submitted to NMED that summarized the various investigations performed up to that time along with recommendations for corrective actions in the TMD and the EP areas (Foster Wheeler 1997). Investigations were also performed at the NCL between 1994 and 1997, as summarized in the Revised RFI Phase II Report (Covenant Technical Associates, Inc. 1997). The investigations of NCL, TMD, and the EPs included installation of monitoring wells in these areas and identified groundwater impacts due to historical operations.



At the request of NMED, NRC submitted a Post-Closure Permit Application in June 1998, with revisions to the application in 2001 (NRC 2001). The original intent of this application, to address only closure and post-closure activities at the EPs and TMD, was expanded to include a complete RCRA Permit renewal application.

The Secretary of the NMED issued a Post-Closure Care Permit (PCC Permit) to NRC, the owner and operator of the Refinery (EPA ID number NMD 048918817) effective October 5, 2003 (NMED 2003). The PCC Permit was modified in December 2010 (NMED 2010). The PCC Permit authorizes and requires the Permittee to monitor the groundwater, maintain all groundwater monitoring wells and comply with applicable regulations of 20.4.1.500 NMAC during the post-closure period. Specific groundwater monitoring requirements are included in the PCC Permit for the areas of the TEL Impoundment, the NCL, the EP area, and other areas identified through implementation of the investigations of various SWMUs.

The OCD issued a renewal of Discharge Permit GW-028 dated August 22, 2012 (OCD 2012). The Discharge Permit authorizes and requires the Permittee to maintain PSH recovery systems and to conduct semiannual groundwater monitoring. The Discharge Permit requires submittal of an annual report summarizing the results of the monitoring and recovery programs.

In 2006, NRC submitted a Groundwater Monitoring Workplan that combined the requirements of the two permits into a comprehensive monitoring program (NRC 2006). This 2015 FWGMWP comprises the annual update of the workplan, as required by Section 4.7.6.a of the PCC Permit and Section 5.A of the Discharge Permit. This FWGMWP includes a revised monitoring schedule based on recent changes to the groundwater monitoring network, as described in the following sections.



3. Site Conditions

3.1 Surface Conditions

3.1.1 Area Land Uses

The area north, south and east of the facility is sparsely populated and used primarily for agricultural and ranching purposes (Figures 1 and 2). The primary business and residential areas of the City of Artesia are located to the west, southwest and northwest of the Refinery. There are a few commercial businesses south of the Refinery along Highway 82, including an oil-field pipe company located at the southeast corner of the plant. Much of the property for one-half mile north of Highway 82 to East Richey Avenue and east of Highway 285 toward Bolton Road is owned by NRC. Much of the area east and northeast of Bolton Road to Haldeman Road is a cultivated pecan orchard or used for other agricultural and ranching purposes.

The active Refinery and much of the surrounding property owned by NRC is fenced and guarded with controlled entry points.

3.1.2 Topography

The Refinery is located on the east side of the City of Artesia in the broad Pecos River Valley of Eastern New Mexico. The topography of the site and surrounding areas is shown in Figure 1. The average elevation of the city is 3,380 feet above mean sea level. The plain on which Artesia is located slopes eastward at about 20 feet per mile or 0.378 percent (%).

3.1.3 Surface Water Drainage Features

Surface drainage in the area is dominated by small ephemeral creeks and arroyos that flow eastward to the Pecos River, located approximately three miles east of the city. The major drainage in the immediate area of the site is Eagle Creek (or Eagle Draw), an ephemeral watercourse normally flowing only following rain events, that runs southwest to northeast through the northern process area of the Refinery and then eastward to the Pecos River. Upstream of the Refinery, Eagle Draw functions as a major stormwater conveyance for the community. It also drains outlying areas west of the city and is periodically scoured by intense rain events.

Natural surface drainage at the Refinery is to the north and east. Stormwater within the process areas is captured and routed to the Refinery wastewater treatment system. Stormwater from non-process areas is contained within the Refinery property inside stormwater berms and routed to stormwater retention basins. Stormwater from within the Refinery boundary is not allowed to discharge to Eagle Draw.

The elevation of Eagle Draw is 3,360 feet at its entrance to the Refinery and decreases to approximately 3,305 feet at its confluence with the Pecos River. Eagle Draw was channelized from west of Artesia to the Pecos River to help control and minimize flood events. In the vicinity of the Refinery, the Eagle Draw channel was cemented to provide further protection during flood events. A check dam was also constructed west of Artesia along Eagle Draw. Federal floodplain maps indicate that most of the city and the Refinery have been effectively removed from the 100 year floodplain.

3.2 Subsurface Conditions

3.2.1 Soils

Soils at the Refinery are primarily of the Pima and Karro series. Soils characterized for permitting the NCL were about 60% Pima and 40% Karro soils. The Pima and Karro soils have similar properties. Pima soils are deep, well drained, dark colored, calcareous soils, which occur on floodplains of narrow drainageways (such as Eagle Creek). These soils have moderate shrink-swell potential and were subject to periodic flooding. Runoff from Pima soils is slow, permeability is moderately low and the water-holding capacity is high. The effective rooting depth is greater than five feet and the water table is deeper than five feet.

The Karro soils are highly calcareous. Calcium carbonate typically accumulates as caliche at a depth of about 45 inches. These soils are found on level to gently sloping terrains and are susceptible to wind erosion. Runoff is slow and water-holding capacity is high. Permeability is moderate and the effective rooting depth and depth to groundwater are both over five feet.

3.2.2 Regional Geology

Artesia is located on the northwest shelf of the Permian Basin. In this region, the deposits are comprised of approximately 250 to 300 feet of Quaternary alluvium uncomformably overlying approximately 2,000 feet of Permian clastic and carbonate rocks. These Permian deposits uncomformably overlie Precambrian syenite, gneiss

and diabase crystalline rocks. The relationships between the sedimentary deposits are discussed below.

3.2.2.1 Quaternary Alluvium

The Quaternary alluvium in the Refinery area is dominantly comprised of clays, silts, sands and gravels deposited in the Pecos River Valley. These “valley fill” deposits extend in a north-south belt approximately 20 miles wide, generally west of the Pecos River. The thickness of the valley fill varies from a thin veneer on the western margins of the Pecos River valley to a maximum of 300 feet in depressions, one of which is located beneath the Refinery. These depressions have resulted from dissolution of the underlying Permian carbonates and evaporites. The sedimentology and mineralogy of the valley fill deposits can be divided into three units: the uppermost carbonate gravel unit, the interbedded clay unit, and the underlying quartzose unit.

The carbonate gravel unit blankets the other valley fill units and forms a fairly uniform slope from the Permian rock outcrop areas on the west side of the Permian Valley east to the Pecos River floodplain. The unit consists of coarse-grained carbonate gravel deposits along major drainage ways to the Pecos River, which grade into brown calcareous silts and thin masses of caliche in the interstream regions. The carbonate gravel unit includes the Orchard Park, Blackdom and Lakewood terrace deposits of Fielder and Nye as well as Holocene and Pleistocene Pecos River alluvial deposits.

The agricultural land around Artesia is part of the Orchard Park terrace deposit, which forms a thin veneer overlying older valley fill alluvium. The Orchard Park terrace surface gently rises in elevation to between 5 and 25 feet above the Lakewood terrace. The Orchard Park is generally less than 20 feet in thickness in the Refinery area and is comprised of silt interbedded with poorly sorted lenses of mixed size pebbles in a silt and sand matrix. Chalky caliche commonly occurs in the upper layers.

The Blackdom terrace is about 40 to 50 feet in elevation above the Orchard Park terrace west of Artesia. However, the deposits associated with the Blackdom terrace are generally less than 20 feet in thickness. The Blackdom terrace deposits are coarser grained than the deposits associated with the Orchard Park and Lakewood terraces. In addition, the caliche soils have a higher density than those developed on the Orchard Park terrace.

The Lakewood deposits, the lowest of the three terrace units, are essentially the current alluvial sediments in the floodplain along the river. They consist of brown sandy silt interbedded with lenses of gravel and sand and some localized caliche in higher parts. The Lakewood terrace is confined to the area immediately adjacent to the river and is underlain by Pleistocene alluvium deposited by the Pecos River and its tributaries.

The clay unit is not laterally continuous throughout the valley fill deposits, but occurs in isolated lenses generally overlying the quartzose unit. The clay unit is comprised of light-to-medium-gray clays and silts deposited in localized ponds and lakes. These ponds and lakes may have formed in conjunction with dissolution and collapse of the underlying Permian rocks.

The quartzose unit consists primarily of fragments of quartz and igneous rocks cemented by calcium carbonate. This unit is laterally contiguous throughout the Pecos River Valley and is generally less than 250 feet thick. The quartzose unit unconformably overlies Permian Rocks and lower quartzose gravels are commonly used for groundwater production.

3.2.2.2 Permian Artesian Group

The Permian Artesian Group is comprised of five formations (from shallowest to deepest): the Tansill, Yates, Seven Rivers, Queen and Grayburg Formations. The Tansill and Yates Formations outcrop at the surface east of the Pecos River and are not present in the vicinity of the Refinery.

The uppermost Permian formation in the Artesia area is the Seven Rivers Formation, which outcrops east of the Pecos River. This eastward-dipping formation is eroded and buried by the valley fill alluvium at a depth of 300 feet in the area between the river and the Refinery. Nearer the Refinery, the formation thins and disappears farther west. Where the formation is present, it consists of a sequence of evaporites, carbonates, gypsum and shale with isolated sand and fractured anhydrite/gypsum lenses.

An examination of available borehole logs provided no indication that the Seven Rivers formation has been encountered beneath the Refinery. However, the lithologic logs of wells completed in the Refinery area describe unconsolidated alluvial deposits from depths of about 20 feet to over 250 feet.

In the area of the Refinery, the Queen and Grayburg Formations have been mapped as a single unit by geologists as consisting of about 700 feet of interbedded dolomite and calcareous dolomite, gypsum, fine-grained sandstone, carbonates, siltstone and mudstone. In locations where the Seven Rivers Formation is absent, the upper portion of the Queen Formation acts as a confining bed between the deep artesian aquifer and the valley fill aquifer.

3.2.2.3 San Andres Formation

The San Andres Formation lies beneath the Grayburg and Queen Formations and immediately above the Precambrian crystalline basement rocks. The San Andres Formation is composed mainly of limestone and dolomite containing irregularly and erratic solution cavities, which range up to several feet in diameter. Its thickness is greater than 700 feet. The upper portion of the formation is composed of oolitic dolomite with some anhydrite cement.

3.2.3 Regional Groundwater

The principal aquifers in the Artesia area are within the San Andres Formation and the valley fill alluvium. A near-surface water-bearing zone is present in the vicinity of the Refinery process area, which is apparently limited in vertical extent, is shallow with respect to the surface, but exhibits artesian properties at some monitoring wells. The deeper carbonate aquifer is referred to as the deep artesian aquifer, whereas the water-bearing zones of the shallower valley fill alluvium are referred to as the shallow saturated zone and the valley fill zone.

3.2.3.1 Shallow Saturated Zone

Lithologic logs from monitor wells installed within and near the Refinery document a near-surface saturated zone overlying the main valley fill alluvium and containing water of variable quality in fractured caliche and sand and gravel lenses at depths of 15 to 30 feet below ground surface. This water is under artesian pressure for at least some or most of the year with static water levels 3 to 5 feet above the saturated zones.

Figure 2 depicts the monitoring wells installed in the area of the Refinery and the EPs east of the Refinery. Isopleths of the potentiometric surface, as measured in November 2014 in the shallow saturated zone, are shown in Figure 4. The general direction of flow in this near-surface saturated zone is to the east toward the Pecos River; however, localized groundwater depressions are present surrounding portions of

the recovery system wells and slight groundwater mounding is observed in the immediate vicinity of the discharge locations where reverse osmosis reject fluids are discharged.

The water in the shallow saturated zone is highly variable in quality, volume, areal extent and saturated thickness. Concentrations of total dissolved solids (TDS) exceeding 2,000 milligrams per liter (mg/L) and sulfate exceeding 500 mg/L have been recorded on the northwest side of the Refinery near the NCL. The most probable sources of the water present in the shallow saturated zone are thought to be recharge from Eagle Creek and lawn watering runoff from the grass-covered urban park that occupies the Eagle Creek Channel immediately upstream of the Refinery.

As reported in the *2014 Annual Groundwater Report* (ARCADIS 2015), the shallow groundwater beneath the Refinery and beneath the EPs is impacted with constituents typically associated with hydrocarbons. Concentrations of the organic constituents in the shallow groundwater exhibit an overall stable or declining trend in most locations (ARCADIS 2015).

Recharge of the shallow water bearing zone is generally attributed to irrigation return flow from pumpage of the aquifers and from infiltration from the Pecos River. The general direction of groundwater flow in the shallow saturated zone follows the regional stratigraphic dip eastward toward the Pecos River, then southward subparallel to the river.

3.2.3.2 Valley Fill Zone

Quaternary alluvial deposits of sand, silt, clay and gravel are the main components of the valley fill zone. These sediments are about 300 feet thick in the area between the City of Artesia near the Refinery and the Pecos River. The three principal units in the valley fill are the carbonate gravel, clay and quartzose.

The carbonate gravel unit, described in an earlier section, is the uppermost alluvial unit in the valley fill. Coarse-grained gravels deposited in the major tributaries to the Pecos River grade to calcareous silts and thin zones of caliche in the interstream areas. Near the surface, groundwater is localized in thin discontinuous gravel beds typical of braided channel material deposited during flood events originating in the foothills and Sacramento Mountains to the west.

Irrigation and water production wells completed in the valley fill zone typically are screened across from one to five water-producing zones. Thicknesses of up to 170 feet have been reported for water-production zones, but most are less than 20 feet. Producing zones are principally sand and gravel separated by less permeable lenses of silt and clay. Wells in the valley fill range from 40 to 60 feet below ground level and the formation yields water containing TDS ranging from 500 to 1,500 mg/L. The average transmissivity of the alluvium has been estimated at 100,000 to 150,000 gallons per day per square foot.

Figure 2 depicts the locations of monitoring wells that have been installed in the valley fill zone in the vicinity of the Refinery and the evaporation ponds. In areas of the valley where the San Andres aquifer and valley fill zone are hydraulically connected in the subsurface, water tends to flow up from the deep aquifer to the shallow water bearing zones, except in areas of heavy San Andres pumpage. Adjacent to the Pecos River, the valley fill alluvium contains groundwater beginning at a depth of 6 to 12 feet. The alluvium is predominately silty sand, which possibly contains lenses of higher permeability material.

Silt and clay deposits in the valley fill zone are not continuous, but occur as isolated lenses, generally overlying the quartzose unit. Most logs of wells located immediately to the north and east of the Refinery show considerable thicknesses of clays or clay mixtures. However, these clays may be more closely related to the fine-grained materials of the carbonate gravel unit found in the interstream areas between the major drainage ways.

The thickness of these clay/clay mixtures ranges from 20 to 160 feet. The intervals of occurrence differ from well to well, and thin zones or gravels are interspersed in the upper 100 feet. Drillers seeking deep artesian water drill through the valley fill zone and usually log large intervening zones as “clay and cap”. This lack of detail makes it difficult to correlate specific zones of coarse-grained sediments within the silt and clay deposits.

The quartzose unit is considered the primary production unit in the valley fill zone. Away from the Pecos River, the unit consists of fragments of sandstone, quartzite, quartz chert, igneous and carbonate rocks. The fragments range from medium grained (1/4 mm) to pebble size (16 mm) and are commonly cemented with calcium carbonate. By contrast, in the vicinity of the river, the unit contains principally medium to coarse uncemented quartz grains.

3.2.3.3 Deep Artesian Aquifer

The deep artesian aquifer is closely related to the Permian San Andres Limestone and generally consists of one or more water producing zones of variable permeability located in the upper portion of the carbonate rocks. However, in the Artesia area, the producing interval rises stratigraphically and includes the lower sections of the overlying Grayburg and Queen formations. Near the Refinery, the depth to the top of the producing interval is estimated to be about 440 feet. The Seven Rivers formation and the other members of the Artesia Group are generally considered confining beds although some pumpage occurs locally from fractures and secondary porosity in the lower Grayburg and Queen members.

The deep artesian aquifer has been extensively developed for industrial, municipal and agricultural use. The quality of water from this aquifer ranges from 500 mg/L to more than 5,000 mg/L TDS depending on location. In the Artesia area, water is generally derived from depths ranging from 850 feet to 1,250 feet below ground surface. The aquifer recharge is in the Sacramento Mountains to the west of Artesia. Extensive use of this aquifer in recent decades has lowered the potentiometric head in the aquifer in some locations from 50 to 80 feet below ground level, although extensive rainfall in some years may bring the water levels in some wells close to the surface.

Information available for irrigation well RA-4798 indicates that it is screened at 840 to 850 feet below ground surface, in the deep artesian aquifer. Historic analytical data from this well does not indicate the presence of hydrocarbon impacts from refinery operations.

4. Modifications to the Groundwater Monitoring Network

This section of the FWGMWP discusses the modifications to the groundwater monitoring network that have occurred since submittal of the 2014 FWGMWP (ARCADIS 2014a).

4.1 New Monitoring Wells

The following new permanent monitoring wells have been installed since the 2014 FWGMWP was submitted.

- Monitoring wells MW-136 and UG-4 were installed in July and August 2014 according to an approved work plan for performance of a background groundwater evaluation (ARCADIS 2014d).
- MW-137 was installed in November 2014 near the Main API Separator (SWMU 22) according to the well installation work plan (ARCADIS 2014c).

The locations of the new wells are shown in Figure 2 while well construction details are provided in Table 1.

MW-138 was also to be installed in November 2014 near the Main API Separator, but installation was delayed due to the presence of hydrogen sulfide in the area. MW-138 is scheduled to be installed prior to the second semiannual monitoring event of 2015.

Copies of the well construction logs for MW-136 and UG-4 were provided to NMED in the 2014 annual report (ARCADIS 2015). The well completion log for MW-137 is provided in Appendix A of this 2015 FWGMWP.

4.2 Well Abandonments

No wells were plugged and abandoned in 2014. A work plan to plug and abandon the former recovery wells RW-12, RW-13, and RW-14 adjacent to Bolton Road north of Highway 82 was submitted to the Office of the State Engineer (OSE) in November 2014 (ARCADIS 2014c). These three recovery wells are no longer required since replacement wells were installed in 2012. Abandonment of the wells was recommended due to the proximity of the wells to a public roadway.

OSE approved the work plan and abandonment activities were initiated in November 2014. However, high levels of hydrogen sulfide were encountered and work was halted. The abandonment activities were delayed until the groundwater levels have declined, reducing the conditions that are believed to have led to the high levels of hydrogen sulfide, and to design effective methods to mitigate hydrogen sulfide if the conditions do not change. Abandonment activities should be completed in 2015 and will be documented in the 2015 annual groundwater monitoring report.

4.3 Well Repairs and Modifications

In November 2014, the following repairs and/or modifications were made to existing monitoring wells:

- MW-2A: replaced concrete pad and installed outer metal shroud with locking cap
- MW-6A: replaced concrete pad and installed outer metal shroud with locking cap
- MW-80: cut well casing down so that it did not extend above the outer steel shroud
- OCD-1R: replaced concrete pad, no modifications to well
- OCD-7AR: unburied the concrete pad, no modifications to well or pad
- OCD-7B: unburied the concrete pad, no modifications to well or pad
- OCD-7C: unburied the concrete pad, no modifications to well or pad

MW-80 was re-surveyed to determine the new top of casing elevation following the modification described above. None of the remaining modifications affected the elevations of the wells.

5. Scope of Services

This section of the FWGMWP provides a detailed description of groundwater monitoring activities to be conducted.

5.1 Health and Safety Considerations

Groundwater monitoring activities will be performed in both active and historical process areas of the Refinery, in the inactive EP area, along TMD, and in agricultural fields adjacent to the Refinery. The primary health and safety considerations associated with the monitoring activities include the potential for the presence of harmful vapors and environmental hazards.

Any deviations from proposed sample collection procedures due to health and safety considerations will be documented and discussed in the annual monitoring report.

5.2 Routine Monitoring Activities

The groundwater monitoring program includes the following activities:

- Semiannual gauging of monitoring and recovery wells.
- Semiannual collection of analytical samples from monitoring wells as well as from select recovery and irrigation wells.
- Collection and disposal of purge water generated during sample collection and decontamination water generated during gauging and sample collection.

5.3 Groundwater Sample Analyses

5.3.1 2014 Groundwater Analytical Requirements

The 2014 FWGMWP included the following general sampling and analysis plan described below:

- All active and accessible monitoring and recovery wells will be gauged semiannually with an oil/water interface probe to monitor the presence and thickness of PSH and to measure the depth to groundwater and total depth of each well.



- Monitoring wells that contain PSH, as indicated by an oil/water interface probe, will not be sampled during any event that PSH is present with a thickness of 0.03 feet or greater.
- Monitoring wells located along or near the downgradient edges of the impacted areas will be sampled semiannually.
- Select monitoring wells within the impacted areas will be sampled semiannually to monitor the concentrations within the dissolved phase plume areas. The wells selected to be sampled on a semiannual basis should provide adequate information to assess the fate of dissolved phase constituents within known impacted areas.
- Wells interior to known impacted areas will be sampled annually to monitor the concentrations throughout the dissolved phase plume areas.
- Upgradient wells will be sampled annually.
- Active and accessible irrigation wells will be sampled either semiannually or annually based on the proximity to known PSH presence.
- Recovery wells will be sampled annually, if PSH is not present or is present with a thickness of less than 0.03 feet.
- Selected wells completed in the deeper valley fill zone will be sampled biennially, beginning in the spring of 2011.

Groundwater samples were required to be analyzed for some or all of the following parameters:

- Volatile organic compounds (VOCs) by EPA Method 8260;
- Diesel Range Organics (DRO) by EPA Method 8015B;
- Gasoline Range Organics (GRO) by EPA Method 8015B;
- Total Metals (arsenic, barium, chromium, lead, selenium, iron, manganese, mercury, nickel and vanadium);

- Dissolved Metals (arsenic, barium, chromium, lead, selenium, iron, manganese, nickel and vanadium) – to be analyzed only in the samples collected during the spring events;
- Cyanide;
- Major cations and anions;
- TDS; and,
- Nitrates/nitrites.

Not all wells were required to be analyzed for all of the parameters listed above. Table 1 of the 2014 FWGMWP summarized the analyses performed under that approved monitoring plan.

5.3.2 Revised Groundwater Monitoring Program

This section provides a description of revisions to the groundwater sample analyses recommended to occur in 2016. The revisions described below relate to analytical methods for metals and total petroleum hydrocarbons (TPH) only.

No changes to the sample collection frequency described in the approved 2014 FWGMWP have been proposed in this 2015 FWGMWP. Figure 5 provides a graphical depiction of the monitoring plan, specifically the frequency of sampling proposed for each well.

5.3.2.1 Dissolved Metals Analyses

In 2011, NRC proposed to remove dissolved metals analyses from the monitoring program because the monitoring program includes analysis of total metals. After discussions with both NMED and OCD, it was determined that total metals would be analyzed during both semiannual monitoring events of each year and that dissolved metals analyses would be performed only during the first semiannual event of each year.

A statistical evaluation of the analytical results of total and dissolved metals analyses obtained for samples collected between 2012 and 2014 was performed. A copy of the statistical analysis memo is provided in Appendix B to this 2015 FWGMWP. The

purpose of the evaluation was to determine whether analysis of total metals in groundwater provides a conservative measure of the presence of specific metals concentrations in groundwater. To answer the question, a series of comparisons were performed to compare the dissolved metals data set to the total metals data set. The statistical correlations between the data sets were evaluated.

A total of 313 pairs of dissolved and total metals data points were used to conduct the evaluation. The means and variances of the data were evaluated using non-parametric tests, including the Mann-Whitney U test (comparison of means) and the Kruskal-Wallis test (comparison of variances).

A summary of the statistical tests is shown in Table 2, which shows that the arithmetic mean of the total metals data is always higher than the arithmetic mean of the dissolved metals data, for each metal evaluated. This statistical evaluation supports the expectation that the dissolved metals result is less than the total metals result, since the dissolved metals samples are field filtered to remove suspended solids, which are expected to contain some metals.

The arithmetic mean of chromium and iron were found to be statistically elevated for total concentrations when compared to the dissolved concentrations. This result supports the belief that chromium and iron are present in colloidal mass included in the suspended solids. The difference in adjusted arithmetic mean of the remaining metals was not statistically significant for total concentrations when compared to the dissolved concentrations.

The statistical evaluation also included development of correlation coefficients that may be used to estimate the dissolved concentration of a metal based on the total concentration. The correlation equation takes the form of:

$$C_d = (C_t * a) + b$$

where

C_d = dissolved metal concentration

C_t = total metal concentration

a = slope

b = intercept

Table 3 provides a summary of values for the slope and intercept of the correlation equation for each of the metals, and a crossover concentration below which the equation is no longer valid. It should be noted that the crossover concentration for each of the metals is below the WQCC standard for each of the metal compounds. It should be noted that correlation for lead was poor due to the low number of detected concentrations in the dissolved samples.

The statistical evaluation of dissolved and total metals concentrations has confirmed that dissolved metals concentrations are less than the total metals concentrations. Thus, NRC proposes to analyze groundwater samples for total metals only, and will continue to compare the total metals results to the WQCC standards, which are based on a dissolved metals concentration. This approach provides a conservative evaluation of potential impacts by overestimating the concentration of dissolved metals in the groundwater.

5.3.2.2 Total Petroleum Hydrocarbons Analytical Method

The analysis of TPH in groundwater has been performed as part of the facility-wide groundwater monitoring for many years. TPH provides a screening level evaluation of the presence of a complex mixture of compounds, including both regulated and non-regulated constituents. TPH analyses have historically been performed by EPA Method 8015 Modified (Method 8015) with the analyses reported as Gasoline Range Organics (GRO) and Diesel Range Organics (DRO). Method 8015 results for GRO correspond to hydrocarbon compounds in the C6 to C10 range while the results for DRO correspond to hydrocarbon compounds in the C10 to C28 range.

The December 2014 guidance document removed the groundwater screening value for TPH included in previous versions of this guidance document. The previous versions of the guidance document provided a screening value only for DRO and not for GRO in groundwater. Thus, the annual groundwater reports have included a discussion of the concentrations of GRO present in samples analyzed for that parameter along with a trend in the concentrations in each well. The DRO results have been compared to the groundwater screening values included in the previous version of the guidance document and reported results exceeding those values have been utilized to define the extent of impacted groundwater.

The December 2014 version of the NMED guidance document (NMED 2014) states "...site cleanup decisions cannot be based solely on the results of TPH sampling." However, the evaluation of TPH in groundwater provides a useful evaluation of impacts

to groundwater. In order to improve the evaluation of TPH in groundwater, a change in analytical methodology is recommended, utilizing the TPH analytical methods developed by the Texas Commission on Environmental Quality (TCEQ). The Texas Risk Reduction Program (TRRP) was developed by the TCEQ and is used to evaluate potential site impacts and develop remediation goals utilizing protective concentration levels (PCLs) for contaminants of concern. TCEQ publishes tables of PCLs for various compounds based on potential exposure pathways which are quite similar to the exposure pathways utilized in the NMED guidance document. A copy of the guidance document “Development of Human Health PCLs for Total Petroleum Hydrocarbon Mixtures” (TRRP-27, TCEQ 2010) is provided as Appendix C for reference.

As described in TRRP-27, there are two analytical methods that have been developed to evaluate TPH: TCEQ Method 1005 (Method 1005) and TCEQ Method 1006 (Method 1006). Method 1005 utilizes an n-pentane extraction followed by gas chromatography/flame ionization detection (GC/FID) analysis to quantify the hydrocarbon compounds in the C6 to C35 ranges. The analytical results from Method 1005 are reported for three separate boiling point ranges: C6 to C12, C12 to C28, and C28 to C35. Method 1006 uses a silica gel fractionation of the n-pentane extract to separate the sample into aliphatic and aromatic compounds within several different boiling point ranges (seven aliphatic ranges and six aromatic ranges).

The results of the Method 1005 analyses are typically used for screening level evaluations and to identify unique source areas, utilizing the chromatogram from the analyses. The results from this method may be compared to default screening level PCLs (Tier 1 PCLs) for either residential or commercial/industrial exposure pathways, as appropriate. If warranted, samples from the locations with the highest TPH concentration reported by Method 1005 from each unique source area can then be analyzed by Method 1006. The Method 1006 results may then be compared to default screening level PCLs for each aliphatic and aromatic boiling point range, or they may be used to calculate a source-specific PCL using risk-based calculations. The TRRP-27 guidance document provides the calculations used to develop a source-specific PCL. TCEQ provides an electronic spreadsheet on the website that contains the equations listed in TRRP-27, simplifying and standardizing the calculation process.

Analytical results obtained utilizing Method 1005 are expected to be similar to but not directly comparable to the analytical results obtained utilizing Method 8015. To evaluate the similarity of the results, duplicate samples will be collected during the fall 2015 monitoring event from 10 monitoring wells to be analyzed by Method 1005 in addition to analyses by Method 8015, as follows:



- EP Area:
 - o MW-22A
 - o MW-77
 - o MW-120
 - o MW-122
 - o MW-123

- Refinery and Field East of Refinery:
 - o MW-49
 - o MW-127
 - o MW-130
 - o MW-131
 - o MW-135

The selected locations include wells that are listed in the approved 2014 FWGMWP as having both DRO and GRO analyses by Method 8015. Five of the wells were selected in the area of the EPs and five of the wells were selected within the known dissolved phase plume located within the Refinery and emanating to the east. One of the five wells selected from each area has historically contained no detectable DRO or GRO. One of the five wells selected from each area had the highest reported concentration of either DRO or GRO during the spring 2014 sampling event. The remaining three wells in each area were selected based on location to provide a geographically diverse data set, but each well that was selected contained reportable DRO during the spring 2014 sampling event.

The analytical results obtained by Method 1005 will be compared to the GRO and DRO results obtained by Method 8015 and a qualitative comparison will be made between the results in the 2015 annual groundwater monitoring report. If the results are comparable, then the recommendation will be made to cease the Method 8015 analyses and begin analyses using Method 1005 beginning with the spring 2016 event.

The chromatograms for the Method 1005 analyses will be obtained for all of the samples analyzed by this method during the spring 2016 event. An evaluation of the chromatograms will be performed to establish unique “source” areas. During the fall 2016 event, all of the samples scheduled for TPH analyses will be analyzed by Method 1005 and samples collected from the well that contained the highest TPH reported by Method 1005 for each unique source area will also be analyzed by Method 1006. The Method 1006 results will be used to develop a risk-based screening level for



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groundwater within each unique source area. The results of the evaluation of the Method 1005 chromatograms and the calculations of the source-specific risk-based screening levels will be included in the 2016 annual groundwater report.

6. Groundwater Sampling Methodology

This section provides a summary of the procedures that will be used to implement this FWGMWP.

6.1 Well Gauging

At the beginning of each semiannual sampling event, all monitoring and recovery wells listed on Table 1 will be gauged to record the depth to PSH (if present), the depth to water, and the total depth of the well. The gauging will be performed using an oil/water interface probe attached to a measuring tape capable of recording measurements to the nearest 0.01 foot. All readings will be made in relation to the marked survey datum at the top of casing of each well. All survey measurements were made at the northern edge of each well casing. In the event that the survey datum mark is not present, the measurements will be made at the top of the well casing, on the northern side of well casing.

In order to provide accurate data for development of groundwater potentiometric surface contours, the groundwater gauging will be performed in as short a time period as possible, typically in no more than two 48-hour periods. All wells located within the Refinery security fence, wells located immediately south of the Refinery and those wells located east of the Southeast Tank Farm will be gauged within one 48-hour period. All remaining wells, including those wells in and near the Evaporation Ponds and those wells between the Refinery and the Evaporation Ponds, will be gauged within a second 48-hour period, if necessary. Every effort will be made to ensure that, if necessary, the two 48-hour gauging periods are sequential.

Gauging measurements will be recorded either on a paper field gauging form, or in an electronic format in a database used for electronic data capture. The date, time and measurements will be recorded for each well during each event. Any weather events that occur during and/or between the gauging periods will be recorded.

Data obtained from the gauging will be reported in the annual groundwater monitoring report. The data will be used to develop groundwater contour maps and PSH thickness isopleths, which will also be included in the annual report.

6.2 Well Purging

All zones in each monitoring well shall be purged by removing groundwater prior to sampling in order to ensure that formation water is being sampled. Purging will be accomplished with the use of either a peristaltic or submersible pump. The peristaltic pump will be used where practical to apply low-flow purging and sampling procedures. A submersible pump will be used where the depth to water in a monitoring well is greater than 25 feet (limitation of peristaltic pump) and for sample collection from recovery wells. In the event that purge parameters do not stabilize, as specified below, a maximum of ten well casing volumes will be removed prior to sample collection.

Irrigation wells located on adjacent property are included in the groundwater monitoring program. These wells have dedicated electric pumps and do not have access to allow for gauging of the water level; thus, the volume of water present in the well casing cannot be calculated. If access is available and power is provided to the pump, these wells will be purged using the irrigation pump. Purging will continue until the purge parameters stabilize, as described below.

Parameters that will be monitored during purging include, at a minimum, groundwater pH, specific conductance, temperature, dissolved oxygen (DO) concentrations, and oxidation-reduction potential (ORP). These measurements will be made using appropriate equipment, such as a multiparameter water quality monitoring meter such as a YSI 600XL or similar device, and a flow-through cell. The readings and the volume of water purged between intervals will be obtained at routine intervals during the purging process and recorded either on a paper sampling log or in the electronic data gathering form.

Purging will be considered complete when four of the five purge parameters have stabilized. The specified stabilization criteria for pH, temperature and DO are plus or minus 0.2 units (standard pH units for pH, degrees Celsius for temperature, and mg/L for DO), specific conductance is plus or minus 0.02 units (Siemens per meter or milliSiemens per centimeter) and ORP is plus or minus 20 units (millivolts). The units used for measurement of purge parameters will be recorded.

If a well should purge dry, then it will be allowed to recover. When the water level has returned to a minimum of 75 % of the level measured at the beginning of the sampling event, a sample will be collected for analysis.

The equipment used for the field measurements (such as a YSI multiparameter water quality meter or similar device) will be calibrated at least once during each day of the sampling event. Calibration will be performed according to the equipment manufacturer's directions. Calibration data will be recorded in the daily field notes.

Purged groundwater will be collected and disposed of properly, as described in Section 6.7.

6.3 Groundwater Sample Collection and Handling

Samples will be collected following purging and will consist of pumping groundwater directly into the laboratory provided sample containers. Dedicated tubing will be used for each well to prevent the potential for cross-contamination. Unfiltered samples will be collected for organic and total metals analyses.

As discussed in Section 5.3.2.1, routine analyses of dissolved metals is no longer recommended. However, if dissolved metals analyses are required for a specific event, a 0.45 micron filter will be attached to the tubing after all other containers have been filled, and the filtered samples for analysis of dissolved metals will be collected.

Containers will be labeled and placed into appropriate containers (coolers) with ice for shipment to the analytical laboratory. Each label will clearly identify the sample identifier, the date and time of collection, the analytical method to be performed, and the sampler's initials. Separate sample identifications will be used to indicate filtered samples for analysis of dissolved metals, as necessary.

Shipping containers (coolers) will be packed with ice or similar cooling materials to maintain appropriate sample temperatures. Adequate padding will be provided to prevent breakage or puncture of sample containers during shipment. The containers will be shipped via express courier to the laboratory for analyses. Chain-of-custody forms will be shipped inside each container to properly track the samples in each container. A chain-of-custody seal will be placed on each shipping container and inspected upon arrival at the laboratory to ensure the integrity of the shipped samples.

6.4 Analytical Methods

The groundwater samples will be analyzed for the parameters listed in Table 1, which include the following COCs:

- TPH;
- VOCs;
- Total Metals (arsenic, barium, chromium, iron, lead, manganese and selenium for all samples, and mercury, nickel, and vanadium from select wells);
- Cyanide;
- Major cations and anions (calcium, chloride, fluoride, potassium, sodium, sulfate);
- Nitrates/nitrites (as nitrogen); and
- TDS.

Not all of the COCs will be analyzed for every sample or during every sampling event. Table 1 summarizes which samples will be analyzed for which parameters during each event.

6.5 Quality Assurance/Quality Control Samples

Quality assurance/quality control (QA/QC) samples will be collected to monitor the validity of the sample collection procedures. The following samples will be collected for QA/QC purposes:

- Field duplicates will be collected at a rate of 10 %, or one field duplicate for every ten groundwater samples. Field duplicates will be analyzed for the same COCs as the parent sample.
- Equipment blanks will be collected from non-dedicated sampling apparatus at a frequency of 5 %, with a minimum of one equipment blank per day. Equipment blanks will consist of laboratory-provided deionized water poured over non-dedicated sampling equipment into sample containers, after the equipment has

been decontaminated. Equipment blank samples will be analyzed for the same COCs as the sample associated with the equipment blank (sample collected immediately prior to the equipment blank). When dedicated sampling materials are used, such as dedicated tubing and a peristaltic pump, no equipment blank samples will be collected.

- Trip blanks will accompany each shipping container (cooler) that contains samples to be analyzed for VOCs.

Laboratory QA/QC samples will be performed according to the test methodologies specified for each method run on a field sample. The laboratory QA/QC samples will include reagent or method blanks, surrogates, matrix spike/matrix spike duplicates, blank spike/blank spike duplicates and/or laboratory duplicates, as appropriate for each method. The laboratory QA/QC samples will be run at the frequency specified by each method.

6.6 PSH Sample Collection

In the event that PSH is present in any of the monitoring wells that have not historically contained PSH, samples may be collected when sufficient volume (80 mL) is present for analysis. The desired analyses for evaluation of PSH include paraffins, isoparaffins, aromatics, naphthenes, and olefins (PIANO) as well as specific gravity and simulated distillation. In the event that PSH is present in locations where PSH has not previously been encountered, NRC will notify the NMED within seven calendar days, as required by the PCC Permit.

PSH samples will be collected using a hand bailer. The bailer will be lowered into the well slightly into the PSH and water column. The bailer will be slowly removed and groundwater decanted from the bottom of the bailer. The PSH remaining in the bailer will then be placed into the sample container, and the container will be sealed and properly labeled for shipment. Excess groundwater and PSH will be collected and disposed of in the Refinery wastewater treatment system, upstream of the oil/water separator.

6.7 Decontamination Procedures and Investigation Derived Wastes

6.7.1 Liquid Wastes

All reusable groundwater sampling and gauging equipment will be decontaminated prior to coming in contact with the sample media to minimize the potential for cross-contamination of samples. This equipment includes all downhole well gauging devices, submersible pumps, water quality parameter meters and flow-through cell. The equipment will be washed with a brush in a bath of soap and water, then rinsed twice with distilled water. The soap and water bath will consist of clean water and a non-phosphate detergent such as Liquinox™ or Alconox™ or similar.

Decontamination fluids will be contained and placed in a 55 gallon drum or similar container for later disposal in the plant wastewater treatment system, upstream of the oil/water separator.

Groundwater removed from each well during purging will be containerized in a labeled drum or similar container then disposed of within the plant wastewater treatment system, upstream of the oil/water separator.

Records of the volume of liquid wastes disposed of at the Refinery will be maintained and included in the annual report.

6.7.2 Solid Wastes

Dedicated disposable sampling equipment, including tubing and bailers, will be containerized in appropriate containers, a waste determination will be made, and the waste will be properly disposed of in accordance with applicable requirements.

All sampling personnel will wear disposable latex or nitrile gloves while collecting and handling samples. Gloves will be replaced prior to collection of each sample in order to ensure that field-induced cross-contamination does not affect the monitoring results. Gloves will be collected and disposed of along with tubing and bailers, as described above.

7. Reporting

Both the PCC Permit and the Discharge Permit require submittal of an annual report that summarizes the results of the groundwater monitoring program as well as remediation activities conducted for groundwater. NRC currently submits a combined annual report that meets the requirements of both permits. The report follows the general outline provided in Appendix E of the PCC Permit and incorporates the requirements of Sections 2.F and 2.G of the Discharge Permit.

At a minimum, the report will contain the following:

- Description of groundwater monitoring and remediation activities conducted throughout the reporting period, including sample collection procedures, decontamination procedures, sample handling procedures and management of wastes;
- Summary table of semiannual groundwater and PSH gauging data, with corrected water table elevation for all wells containing PSH;
- Summary table of groundwater quality parameters recorded in the field (purge parameters);
- Summary of laboratory analytical data with comparison to screening levels;
- Summary of QA/QC data review and validation;
- Groundwater contour maps depicting the groundwater gradient for each semiannual monitoring event of the reporting period, including site features and the direction and magnitude of the hydraulic gradient;
- PSH thickness isopleths maps for each semiannual monitoring event during the reporting period;
- Isoconcentration maps for major constituents of concern;
- Plots of static water elevation versus time in key wells, specifically those that contain PSH;



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- Tabulation of the monthly and cumulative volume of PSH removed from recovery wells or monitoring wells throughout the reporting period; and
- Recommendations, including any recommended changes to the groundwater monitoring program.

The annual report will be submitted in hardcopy and electronic format to both NMED and OCD for their review.



8. Schedule

The groundwater monitoring program is conducted on a semiannual basis. The first semiannual event will occur no more than 30 days prior to the start of the irrigation season but no later than April 30 of each year. Typically, the first semiannual event occurs in March or April of each calendar year.

The second semiannual event will occur no later than 30 days after the conclusion of the irrigation season or November 15 each year. Typically, the second semiannual event occurs in September or October of each calendar year.

The wells that will be sampled on an annual basis only will be sampled during the first semiannual event of each calendar year.

Wells that are to be sampled biennially will be sampled every other year, beginning in the first semiannual event of 2011. As such, these wells will be sampled during the first semiannual event of each odd numbered year.

NRC will notify both NMED and OCD at least 15 calendar days prior to the initiation of each semiannual sampling event.

The annual groundwater monitoring report will be submitted to NMED and OCD no later than February 28 of the calendar year following sample collection.



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9. References

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- ARCADIS 2014b. Background Groundwater Evaluation Work Plan, July 3, 2014.
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- NMED 2003. Navajo Refining Company Artesia Refinery Post-Closure Care Permit, September 2003.



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Tables

Table 1
Revised Monitoring Program and Schedule
Navajo Refining Company - Artesia Refinery, Artesia, New Mexico

Well ID	Well Type	Location Information		Well Construction Information ^a								PSH Expected? ^b	Gauging Frequency	Analytical Suite and Frequency ^c									
		Associated Area of Concern	Approximate Location	Install Date	Diameter (in)	Top of Casing (ft MSL)	Ground Surface (ft MSL)	Total Depth (ft btoc)	Screen Interval (ft bgs)	Water Bearing Zone	Surface Finish			Purge Parameters	TPH	VOCs	Metals (As, Ba, Cr, Fe, Pb, Mn, Se)	Metals (Hg, Ni, Va)	Cyanide	Cations/Anions	Nitrates / Nitrites as Nitrogen	Total Dissolved Solids	
KWB-1A	Monitoring	Field E of Refinery	S of ED, W of BR	2/11/92	2	3353.46	3351.25	33.49	18 to 32	Shallow	stickup		SA	SA	SA	SA	SA	SA	SA	SA	SA		
KWB-1B	Monitoring	Field E of Refinery	S of ED, W of BR	2/15/92	4	3352.83	3351.14	33.95	18 to 32	Shallow	stickup		SA	No analytical samples to be collected									
KWB-1C	Monitoring	Field E of Refinery	S of ED, W of BR	9/29/92	4	3351.38	3351.18	52.71	30.5 to 49.5	Valley Fill	stickup		SA	B	B	B	B	-	-	B	B	B	
KWB-2R	Monitoring	Field E of Refinery	S of US82 on Armstrong & Son		2	3364.32	3364.56	39.86		Shallow	flush mount	Y	SA	SA ^d	SA ^d	SA ^d	SA ^d	-	-	SA ^d	SA ^d	SA ^d	
KWB-3AR	Monitoring	Field E of Refinery	S of US82, replaced KWB #3R	9/3/03	2	3347.08	3347.36	no access	17 to 33	Shallow	flush mount		SA ^f	SA ^f	SA ^f	SA ^f	SA ^f	SA ^f	SA ^f	SA ^f	SA ^f		
KWB-4	Monitoring	S Refinery	N of US82, W of BR	2/17/92	2	3370.25	3368.36	41.74	20 to 39	Shallow	stickup	Y	SA	SA ^d	SA ^d	SA ^d	SA ^d	-	-	SA ^d	SA ^d	SA ^d	
KWB-5	Monitoring	Field E of Refinery	N of US82, W of BR	2/11/92	2	3364.72	3362.60	37.68	24.7 to 38.7	Shallow	stickup	Y	SA	SA ^d	SA ^d	SA ^d	SA ^d	-	-	SA ^d	SA ^d	SA ^d	
KWB-6	Monitoring	Field E of Refinery	N of US82, W of BR	2/12/92	2	3360.30	3358.02	36.38	17.5 to 36.5	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
KWB-7	Monitoring	Field E of Refinery	N of US82, between BR & Dirt Rd	2/13/92	2	3346.16	3343.00	34.83	18 to 32	Shallow	stickup		SA	SA	SA	SA	SA	SA	SA	SA	SA		
KWB-8	Monitoring	Field E of Refinery	N of US82, between BR & Dirt Rd	2/12/92	2	3350.41	3347.90	35.83	15 to 34	Shallow	stickup	Y	SA	SA ^d	SA ^d	SA ^d	SA ^d	SA ^d	SA ^d	SA ^d	SA ^d		
KWB-9	Monitoring	Field E of Refinery	S of US82, E of BR	2/13/92	2	3354.53	3351.81	obstructed	20 to 34	Shallow	stickup		SA ^f	A ^f	A ^f	A ^f	A ^f	A ^f	A ^f	A ^f	A ^f		
KWB-10R	Monitoring	Field E of Refinery	S of ED, N of US82	10/1/10	4	3350.97	3351.23	29.48	9 to 29	Shallow	flush mount	Y	SA	SA ^d	SA ^d	SA ^d	SA ^d	-	-	SA ^d	SA ^d	SA ^d	
KWB-11A	Monitoring	Field E of Refinery	N of US82, between BR & Dirt Rd	10/4/92	4	3348.72	3346.13	42.32	30 to 39.5	Shallow	stickup		SA	SA	SA	SA	SA	SA	SA	SA	SA		
KWB-11B	Monitoring	Field E of Refinery	N of US82, between BR & Dirt Rd	10/4/92	4	3348.03	3345.91	72.47	50 to 69.5	Valley Fill	stickup		SA	SA	SA	SA	SA	SA	SA	SA	SA		
KWB-12A	Monitoring	Field E of Refinery	S of US82, E of BR	10/4/92	4	3351.81	3352.01	25.03	15.5 to 24.5	Shallow	flush mount		SA	SA	SA	SA	SA	SA	SA	SA	SA		
KWB-12B	Monitoring	Field E of Refinery	S of US82, E of BR	10/4/92	4	3351.63	3351.84	39.39	25.5 to 39.5	Valley Fill	flush mount		SA	SA	SA	SA	SA	SA	SA	SA	SA		
KWB-13	Monitoring	Crossgradient	S of US82, W of BR		2	3365.67	3366.02	33.10		Shallow	flush mount		SA	A	A	A	A	A	A	A	A		
KWB-P4	Monitoring	Field E of Refinery	Haines House		2	3305.39	3305.76	30.26		Shallow	flush mount		B	B	B	B	-	-	-	-	-		
MW-1R	Monitoring	EP	W of the EPs	9/3/03	2	3313.28	3311.58	20.64	8 to 23	Shallow	stickup		SA	A	A	A	A	-	-	A	A	A	
MW-2A	Monitoring	EP	W of the EPs	6/18/86	2	3312.97	3310.55	17.35		Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-2B	Monitoring	EP	W of the EPs	12/12/92	2	3312.49	3309.94	51.98	38.5 to 48	Valley Fill	stickup		SA	No analytical samples to be collected									
MW-3	Monitoring	EP	S of EP 1 & 2	6/17/86	2	3310.32	3309.07	20.08		Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-4A	Monitoring	EP	S of EP 1 & 2	6/17/86	4	3312.71	3308.64	obstructed		Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-4B	Monitoring	EP	S of EP 1 & 2	2/24/95	4	3312.01	3308.73	72.37	60.25 to 70	Valley Fill	stickup		SA	B	B	B	B	-	-	B	B	B	
MW-5A	Monitoring	EP	S of EP 2	6/19/86	2	3308.62	3306.59	20.19		Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-5B	Monitoring	EP	S of EP 2	12/16/92	2	3308.95	3306.71	53.54	41.5 to 50.5	Valley Fill	stickup		SA	B	B	B	B	-	-	B	B	B	
MW-5C	Monitoring	EP	S of EP 2	1/19/95	2	3309.28	3306.55	71.64	59.25 to 68.75	Valley Fill	stickup		SA	B	B	B	B	-	-	B	B	B	
MW-6A	Monitoring	EP	S of EP 1	6/19/86	2	3313.46	3310.40	19.05		Shallow	stickup		SA	A	A	A	A	-	-	A	A	A	
MW-6B	Monitoring	EP	S of EP 1	10/12/93	2	3313.35	3310.09	52.27	39.5 to 49	Valley Fill	stickup		SA	B	B	B	B	-	-	B	B	B	
MW-7A	Monitoring	EP	S of EP 3	6/19/86	2	3309.24	3306.04	17.40		Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-7B	Monitoring	EP	S of EP 3	1/18/93	4	3307.87	3306.05	52.56	39.5 to 49	Valley Fill	stickup		SA	B	B	B	B	-	-	B	B	B	
MW-8	Monitoring	TMD	S of ED between BR & HR	6/20/86	2	3336.42	3334.81	20.33		Shallow	stickup		SA	A	A	A	A	-	-	A	A	A	
MW-9	Monitoring	TMD	S of ED between BR & HR	6/20/86	2	3336.20	3334.50	20.20		Shallow	stickup		SA	No analytical samples to be collected									
MW-10	Monitoring	EP	S of EPs	11/18/92	2	3304.76	3304.14	18.53		Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	

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Navajo Refining Company - Artesia Refinery, Artesia, New Mexico

Well ID	Well Type	Location Information		Well Construction Information ^a								PSH Expected? ^b	Gauging Frequency	Analytical Suite and Frequency ^c									
		Associated Area of Concern	Approximate Location	Install Date	Diameter (in)	Top of Casing (ft MSL)	Ground Surface (ft MSL)	Total Depth (ft btoc)	Screen Interval (ft bgs)	Water Bearing Zone	Surface Finish			Purge Parameters	TPH	VOCs	Metals (As, Ba, Cr, Fe, Pb, Mn, Se)	Metals (Hg, Ni, Va)	Cyanide	Cations/Anions	Nitrates / Nitrites as Nitrogen	Total Dissolved Solids	
MW-11A	Monitoring	EP	NE of EP 6	12/10/92	4	3310.76	3308.42	22.01	5.5 to 20	Shallow	stickup		SA	A	A	A	A	-	-	SA	SA	SA	
MW-11B	Monitoring	EP	NE of EP 6	12/14/92	2	3310.76	3308.34	47.30	35.5 to 45	Valley Fill	stickup		SA	B	B	B	B	-	-	B	B	B	
MW-12	Monitoring	EP	N of OCD #1	12/16/92	4	3312.73	3310.37	17.93	6.5 to 16	Shallow	stickup		SA	Not included in monitoring program due to location (north of river)									
MW-13	Monitoring	EP	N of EP 1	12/16/92	4	3314.24	3311.95	21.13	9.5 to 19	Shallow	stickup		SA	Not included in monitoring program due to location (north of river)									
MW-14	Monitoring	EP	E of OCD #7	12/16/92	4	3311.84	3309.44	obstructed	5.5 to 20	Shallow	stickup		SA	Not included in monitoring program due to location (north of river)									
MW-15	Monitoring	EP	W of EP 1	12/16/92	4	3313.72	3310.97	21.70	9 to 19	Shallow	stickup		SA	A	A	A	A	-	-	A	A	A	
MW-16	Monitoring	TMD	E of HR, N of ED	1/19/93	4	3316.12	3313.50	21.24	8.5 to 19	Shallow	stickup		SA	A	A	A	A	-	-	A	A	A	
MW-17	Monitoring	Crossgradient	NE of Artesia POTW	1/20/93	4	3322.01	3319.43	34.41	17 to 32	Shallow	stickup		Not included in monitoring program due to distance from impacts										
MW-18	Monitoring	NCL	N Refinery, E of NCL	6/8/82	8	3365.42	3363.06	22.20	15 to 19	Shallow	stickup		SA	A	A	A	A	A	A	A	A	A	
MW-18A	Monitoring	EP	S of EPs	1/21/93	4	3308.58	3306.33	22.59	10 to 20	Shallow	stickup		SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	
MW-18B	Monitoring	EP	S of EPs	1/22/93	2	3308.74	3306.23	50.59	37 to 47	Valley Fill	stickup		SA	B	B	B	B	-	-	B	B	B	
MW-18T	Monitoring	EP	S of EPs	1/22/93	4	3308.55	3306.30	50.40	37 to 47	Valley Fill	stickup		SA	No analytical samples to be collected									
MW-19	Monitoring	NCL	S of NCL		2	3368.00	3366.00	22.10		Shallow	stickup		SA	No analytical samples to be collected									
MW-20	Monitoring	TMD	E of BR, S of ED	1/21/93	4	3340.91	3338.43	26.86	9.5 to 23.5	Shallow	stickup		SA	A	A	A	A	-	-	A	A	A	
MW-21	Monitoring	TMD	S of ED between BR & HR	1/23/93	4	3337.31	3334.65	25.06	7.5 to 22	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-22A	Monitoring	EP	S of EPs	1/27/93	4	3307.62	3305.24	22.70	5.5 to 20.5	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-22B	Monitoring	EP	S of EPs	1/28/93	2	3307.63	3305.08	54.66	42.3 to 52	Valley Fill	stickup		SA	B	B	B	B	-	-	B	B	B	
MW-23	Monitoring	N Refinery	W of TEL	6/28/82	6	3368.38	3365.09	19.90	15 to 20	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-24	Monitoring	EP	E of OCD #6	7/5/82	6	3312.85	3310.33	23.50	15 to 20	Shallow	stickup		SA	Not included in monitoring program due to location (east of river)									
MW-25	Monitoring	TMD	S of ED, E of HR	1/13/95	2	3312.29	3310.35	28.18	15.75 to 25.25	Shallow	stickup		SA	A	A	A	A	-	-	A	A	A	
MW-26	Monitoring	TMD	S of ED, E of HR	1/13/95	2	3314.87	3312.08	27.60	15.25 to 24.25	Shallow	stickup		SA	A	A	A	A	-	-	A	A	A	
MW-27	Monitoring	TMD	E of HR, S of ED	1/12/95	2	3320.85	3319.46	29.98	18.25 to 27.75	Shallow	stickup		SA	A	A	A	A	-	-	A	A	A	
MW-28	Monitoring	S Refinery	E of SE Tankfarm	7/8/82	6	3370.27	3366.79	34.48	25 to 30	Shallow	stickup		SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	
MW-29	Monitoring	N Refinery	N of TEL	1/10/95	2	3360.64	3359.79	22.00	9.75 to 19.25	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-30	Monitoring	N Refinery	W of BR		8	3361.98	3359.14	23.50		Shallow	stickup		SA	No analytical samples to be collected									
MW-39	Monitoring	N Refinery	N of TEL	6/13/84	2	3358.79	3357.94	22.85	14 to 24	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-40	Monitoring	N Refinery	N of TEL	6/14/84	2	3356.93	3356.56	24.75		Shallow	stickup		SA	A	A	A	A	-	-	A	A	A	
MW-41	Monitoring	N Refinery	N of TEL	6/15/84	2	3356.58	3356.38	21.56	14 to 19	Shallow	stickup		SA	A	A	A	A	-	-	A	A	A	
MW-42	Monitoring	N Refinery	N of TEL	6/19/84	2	3358.44	3355.64	24.34		Shallow	stickup		SA	A	A	A	A	-	-	A	A	A	
MW-43	Monitoring	N Refinery	NW of TEL	7/17/84	6	3365.49	3363.38	21.40	15.5 to 20.5	Shallow	stickup		SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	
MW-45	Monitoring	NCL	E of Refinery, S of ED	8/22/84	2	3351.51	3351.32	15.05	10.5 to 15.5	Shallow	stickup		SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	
MW-46R	Monitoring	TMD	E of Refinery, S of ED	10/1/10	2	3350.11	3350.41	19.38	3.5 to 18.5	Shallow	flush mount		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-48	Monitoring	S Refinery	S of SE Tankfarm	12/14/94	2	3362.97	3363.04	31.89	19 to 34	Shallow	flush mount	Y	SA	SA ^d	SA ^d	SA ^d	SA ^d	-	-	SA ^d	SA ^d	SA ^d	
MW-49	Monitoring	TEL	E Refinery, midway from ED to US82	12/20/94	2	3359.77	3359.69	33.15	19 to 34	Shallow	flush mount		SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	

Table 1
Revised Monitoring Program and Schedule
Navajo Refining Company - Artesia Refinery, Artesia, New Mexico

Well ID	Well Type	Location Information		Well Construction Information ^a								PSH Expected? ^b	Gauging Frequency	Analytical Suite and Frequency ^c									
		Associated Area of Concern	Approximate Location	Install Date	Diameter (in)	Top of Casing (ft MSL)	Ground Surface (ft MSL)	Total Depth (ft btoc)	Screen Interval (ft bgs)	Water Bearing Zone	Surface Finish			Purge Parameters	TPH	VOCs	Metals (As, Ba, Cr, Fe, Pb, Mn, Se)	Metals (Hg, Ni, Va)	Cyanide	Cations/Anions	Nitrates / Nitrites as Nitrogen	Total Dissolved Solids	
MW-50	Monitoring	S Refinery	W of Refinery, E of US285, N of US 82	12/21/94	2	3371.05	3368.91	28.28	12 to 27	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-52	Monitoring	S Refinery	S of Refinery & US82	1/14/95	2	3368.30	3368.36	34.70	19 to 34	Shallow	flush mount		SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	
MW-53	Monitoring	NCL	W of Refinery, E of rail	6/25/95	2	3368.73	3368.86	23.60	13.8 to 23.8	Shallow	flush mount		SA	A	A	A	A	-	-	A	A	A	
MW-54A	Monitoring	NCL	NW of NCL	12/11/95	2	3366.49	3363.55	31.34	12.7 to 27.7	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-54B	Monitoring	NCL	NW of NCL	12/20/95	2	3366.47	3363.47	46.83	33.8 to 43.8	Valley Fill	stickup		SA	B	B	B	B	-	-	B	B	B	
MW-55	Monitoring	NCL	E of NCL	6/25/95	2	3364.77	3361.90	26.58	13.7 to 23.7	Shallow	stickup		SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	
MW-56	Monitoring	NCL	NE of Refinery	8/7/95	2	3357.44	3354.84	26.50	13.4 to 23.4	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-57	Monitoring	Field E of Refinery	S BR	9/8/03	2	3350.91	3350.95	34.36	10 to 30	Shallow	flush mount		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-58	Monitoring	Field E of Refinery	S of US82, W of BR	9/5/03	4	3362.22	3362.56	33.06	13 to 28	Shallow	flush mount	Y	SA	SA ^d	SA ^d	SA ^d	SA ^d	SA ^d	SA ^d	SA ^d	SA ^d	SA ^d	
MW-59	Monitoring	N Refinery	Boneyard	9/4/03	2	3362.43	3359.44	32.82	15 to 30	Shallow	stickup		SA	A	A	A	A	-	-	A	A	A	
MW-60	Monitoring	N Refinery	Boneyard	9/4/03	2	3361.98	3359.26	37.70	15 to 30	Shallow	stickup		SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	
MW-61	Monitoring	N Refinery	SW of TEL	4/27/05	4	3369.47	3369.45	29.50	14 to 29	Shallow	flush mount		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-62	Monitoring	N Refinery	SW of TEL	4/27/05	4	3368.81	3369.01	23.00	14 to 29	Shallow	flush mount		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-64	Monitoring	S Refinery	SW of SE Tankfarm	4/28/05	4	3369.52	3365.56	34.08	15 to 30	Shallow	flush mount	Y	SA	SA ^d	SA ^d	SA ^d	SA ^d	-	-	SA ^d	SA ^d	SA ^d	
MW-65	Monitoring	S Refinery	S of SE Tankfarm	4/26/05	4	3363.60	3363.84	28.80	14.5 to 29.5	Shallow	flush mount	Y	SA	SA ^d	SA ^d	SA ^d	SA ^d	-	-	SA ^d	SA ^d	SA ^d	
MW-66	Monitoring	S Refinery	E of SE Tankfarm	4/26/05	4	3363.46	3363.66	29.80	14.6 to 29.6	Shallow	flush mount		SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	
MW-67	Monitoring	N Refinery	E of Diesel Tank Farm	4/25/05	4	3365.45	3365.59	27.30	12 to 27	Shallow	flush mount		SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	
MW-68	Monitoring	TMD	S of ED, west of HR, formerly MW #28	1/11/95	2	3328.21	3325.81	26.52	14.75 to 24.5	Shallow	stickup		SA	A	A	A	A	-	-	A	A	A	
MW-69	Monitoring	EP	N of River, formerly MW #23	1/27/93	2	3313.86	3311.40	22.51	5 to 20	Shallow	stickup		SA	Not included in monitoring program due to location (north of river)									
MW-70	Monitoring	EP	S of EPs, formerly MW #19	1/23/93	4	3306.30	3303.84	22.06	5 to 20	Shallow	stickup		SA	SA	SA	SA	SA	-	-	A	A	A	
MW-71	Monitoring	TMD	S of ED, formerly MW #29	1/10/95	2	3335.29	3332.99	21.85	9.75 to 19.5	Shallow	stickup		SA	A	A	A	A	A	A	A	A	A	
MW-72	Monitoring	EP	EP 6	3/29/07	4	3308.45	3306.40	13.93	2 to 12	Shallow	stickup		SA	A	A	A	A	-	-	A	A	A	
MW-73	Monitoring	EP	EP 3	3/29/07	4	3310.18	3308.02	19.60	2 to 17	Shallow	stickup		SA	A	A	A	A	-	-	A	A	A	
MW-74	Monitoring	EP	EP 2	3/29/07	4	3310.03	3307.78	20.16	2 to 17	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-75	Monitoring	EP	EP 2	3/29/07	4	3310.21	3307.80	23.71	3 to 18	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-76	Monitoring	EP	EP 2	3/29/07	4	3311.84	3309.70	20.35	3 to 18	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-77	Monitoring	EP	EP 2	3/29/07	4	3310.07	3307.97	20.57	3 to 18	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-78	Monitoring	EP	EP 2	3/29/07	4	3310.14	3307.94	19.61	2 to 17	Shallow	stickup		SA	A	A	A	A	-	-	A	A	A	
MW-79	Monitoring	EP	EP 5	3/29/07	4	3311.43	3309.08	19.32	2 to 17	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-80	Monitoring	EP	EP 5	3/29/07	4	3310.79	3308.73	19.67	2 to 17	Shallow	stickup		SA	A	A	A	A	-	-	A	A	A	
MW-81	Monitoring	EP	EP 5	3/29/07	4	3312.34	3310.19	18.70	2 to 17	Shallow	stickup		SA	A	A	A	A	-	-	A	A	A	
MW-82	Monitoring	EP	EP 1	3/29/07	4	3310.75	3308.64	20.00	2 to 17	Shallow	stickup		SA	A	A	A	A	-	-	A	A	A	
MW-83	Monitoring	EP	EP 1	3/29/07	4	3310.19	3307.93	19.95	2 to 17	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-84	Monitoring	EP	EP 1	3/29/07	4	3311.59	3309.83	20.56	2 to 17	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	

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Navajo Refining Company - Artesia Refinery, Artesia, New Mexico

Well ID	Well Type	Location Information		Well Construction Information ^a								PSH Expected? ^b	Gauging Frequency	Analytical Suite and Frequency ^c									
		Associated Area of Concern	Approximate Location	Install Date	Diameter (in)	Top of Casing (ft MSL)	Ground Surface (ft MSL)	Total Depth (ft btoc)	Screen Interval (ft bgs)	Water Bearing Zone	Surface Finish			Purge Parameters	TPH	VOCs	Metals (As, Ba, Cr, Fe, Pb, Mn, Se)	Metals (Hg, Ni, Va)	Cyanide	Cations/Anions	Nitrates / Nitrites as Nitrogen	Total Dissolved Solids	
MW-85	Monitoring	EP	EP 1	3/29/07	4	3311.09	3308.99	20.34	3 to 18	Shallow	stickup	Y	SA	SA ^d	SA ^d	SA ^d	SA ^d	-	-	SA ^d	SA ^d	SA ^d	
MW-86	Monitoring	EP	EP 1	3/29/07	4	3311.06	3308.98	19.21	2 to 17	Shallow	stickup	Y	SA	SA ^d	SA ^d	SA ^d	SA ^d	SA ^d	SA ^d	SA ^d	SA ^d	SA ^d	
MW-87	Monitoring	EP	S of EPs	3/29/07	4	3307.64	3305.42	20.41	2 to 17	Shallow	stickup		SA	SA	SA	SA	SA	-	-	A	A	A	
MW-88	Monitoring	EP	S of EPs	3/29/07	4	3308.68	3306.43	20.33	3 to 18	Shallow	stickup		SA	SA	SA	SA	SA	-	-	A	A	A	
MW-89	Monitoring	TMD	S of ED, E of HR	3/29/07	4	3318.32	3316.38	20.24	2 to 17	Shallow	stickup		SA	A	A	A	A	-	-	A	A	A	
MW-90	Monitoring	N Refinery	S of Diesel Tankfarm	6/29/07	4	3369.42	3367.13	22.80	5 to 20	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-91	Monitoring	N Refinery	S of Diesel Tankfarm	6/28/07	4	3367.73	3365.72	25.31	7 to 22	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-92	Monitoring	N Refinery	S of ED, N of NAPI	6/28/07	4	3368.72	3366.75	22.62	5 to 20	Shallow	stickup	Y	SA	SA ^d	SA ^d	SA ^d	SA ^d	-	-	SA ^d	SA ^d	SA ^d	
MW-93	Monitoring	N Refinery	S of ED, NE of NAPI	6/29/07	4	3363.79	3364.22	20.23	5 to 20	Shallow	flush mount		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-94	Monitoring	N Refinery	SE of Diesel Tankfarm, N of ED	7/2/07	4	3367.97	3365.82	23.48	5 to 20	Shallow	stickup	Y	SA	SA ^d	SA ^d	SA ^d	SA ^d	-	-	SA ^d	SA ^d	SA ^d	
MW-95	Monitoring	N Refinery	NE of Diesel Tankfarm	7/2/07	4	3368.70	3366.48	25.40	7 to 22	Shallow	stickup		SA	A	A	A	A	-	-	A	A	A	
MW-96	Monitoring	N Refinery	S of Diesel Tankfarm	7/3/07	4	3368.92	3366.83	25.55	7 to 22	Shallow	flush mount		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-97	Monitoring	N Refinery	SE of NAPI	7/3/07	4	3365.92	3366.38	21.24	8 to 23	Shallow	flush mount	Y	SA	SA ^d	SA ^d	SA ^d	SA ^d	-	-	SA ^d	SA ^d	SA ^d	
MW-98	Monitoring	N Refinery	E of Former Diesel Storage Tank Area	7/3/07	4	3361.36	3358.96	26.80	13 to 23	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-99	Monitoring	S Refinery	NE of Loading Rack	7/5/07	4	3364.07	3362.33	27.90	12 to 27	Shallow	flush mount		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-101	Monitoring	S Refinery	E Loading Rack	7/6/07	4	3364.23	3362.07	26.86	8 to 23	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-102	Monitoring	S Refinery	E West Firewater Pond	7/6/07	4	3367.64	3365.51	26.48	12 to 27	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-103	Monitoring	S Refinery	Old Rail ROW	8/18/08	4	3372.47	3370.89	25.22	7 to 22	Shallow	stickup		SA	A	A	A	A	-	-	A	A	A	
MW-104	Monitoring	S Refinery	Old Rail ROW	8/19/08	4	3371.43	3369.41	21.95	3 to 18	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-105	Monitoring	S Refinery	W of Crude Tankfarm	2/19/09	4	3364.99	3365.20	17.24	8 to 18	Shallow	flush mount		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-106	Monitoring	S Refinery	E of Crude Tankfarm	2/9/09	4	3358.98	3359.29	22.80	0 to 11	Shallow	flush mount		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-107	Monitoring	S Refinery	NE of SE Tankfarm	2/24/09	4	3359.44	3359.63	19.05	12 to 22	Shallow	flush mount		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-108	Monitoring	NCL	S of NCL	7/17/09	4	3369.11	3366.25	27.75	9 to 24	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-109	Monitoring	S Refinery	S of Highway 82 at warehouse	1/6/11	2	3368.09	3368.27	29.50	15 to 29.5	Shallow	flush mount		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-110	Monitoring	S Refinery	S of Highway 82 at warehouse	1/5/11	2	3368.03	3368.46	29.75	15 to 29.5	Shallow	flush mount		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-111	Monitoring	Field E of Refinery	E of Refinery, N of Highway 82, W of BR	2/2/13	2	3365.51	3362.52	40.84	25 to 40	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-112	Monitoring	Field E of Refinery	E of Refinery, N of Highway 82, W of BR	2/1/13	2	3358.38	3355.38	37.53	25 to 35	Shallow	stickup	Y	SA	SA ^d	SA ^d	SA ^d	SA ^d	-	-	SA ^d	SA ^d	SA ^d	
MW-113	Monitoring	Field E of Refinery	E of Refinery, N of Highway 82, W of BR	2/2/13	2	3352.93	3350.06	37.68	20 to 35	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-114	Monitoring	S RO Reject Field	SW corner (outfall) of S RO Reject Field	1/28/13	2	3361.68	3358.62	38.20	20 to 35	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-115	Monitoring	S RO Reject Field	NW corner of S RO Reject Field	1/29/13	2	3359.31	3356.48	27.49	10 to 25	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-116	Monitoring	S RO Reject Field	NE corner of S RO Reject Field	1/30/13	2	3353.77	3350.99	27.62	10 to 25	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-117	Monitoring	N RO Reject Field	SW corner (outfall) of N RO Reject Field	1/31/13	2	3363.01	3360.07	27.24	10 to 25	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-118	Monitoring	N RO Reject Field	NW corner of N RO Reject Field	2/4/13	2	3361.95	3359.62	28.29	10 to 25	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-119	Monitoring	N RO Reject Field	NE corner of N RO Reject Field	2/4/13	2	3356.11	3353.83	28.16	10 to 25	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	

Table 1
Revised Monitoring Program and Schedule
Navajo Refining Company - Artesia Refinery, Artesia, New Mexico

Well ID	Well Type	Location Information		Well Construction Information ^a								PSH Expected? ^b	Gauging Frequency	Analytical Suite and Frequency ^c									
		Associated Area of Concern	Approximate Location	Install Date	Diameter (in)	Top of Casing (ft MSL)	Ground Surface (ft MSL)	Total Depth (ft btoc)	Screen Interval (ft bgs)	Water Bearing Zone	Surface Finish			Purge Parameters	TPH	VOCs	Metals (As, Ba, Cr, Fe, Pb, Mn, Se)	Metals (Hg, Ni, Va)	Cyanide	Cations/Anions	Nitrates / Nitrites as Nitrogen	Total Dissolved Solids	
MW-120	Monitoring	EP	Between EP1 outfall and Pecos River	5/8/13	2	3313.55	3310.66	27.98	10 to 25	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-121	Monitoring	EP	Between EP1 berm and Pecos River	5/8/13	2	3314.68	3311.77	27.28	10 to 25	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-122	Monitoring	EP	Between EP5 berm and Pecos River	5/8/13	2	3311.69	3308.78	23.31	10 to 20	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-123	Monitoring	EP	S of EPs, N of 82	5/11/13	2	3303.98	3302.78	25.81	10 to 25	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-124	Monitoring	EP	S of EPs, N of 82	5/11/13	2	3305.84	3302.99	22.01	5 to 20	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-125	Monitoring	Field E of Refinery	E of fire water pond, S of S RO Reject Field	2/5/14	2	3358.81	3355.60	28.30	15 to 25	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-126A	Monitoring	Field E of Refinery	E of stormwater pond, W of irrigated field	1/29/14	2	3356.60	3353.60	37.56	19 to 34	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-126B	Monitoring	Field E of Refinery	E of stormwater pond, W of irrigated field	1/27/14	2	3356.67	3353.60	51.99	40 to 50	Valley Fill	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-127	Monitoring	Field E of Refinery	E of laydown yard, W of irrigated field	1/23/14	2	3358.39	3355.50	53.25	20 to 50	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-128	Monitoring	Field E of Refinery	In laydown yard	1/29/14	2	3358.77	3358.80	35.38	15 to 35	Shallow	flush mount		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-129	Monitoring	Field E of Refinery	W of irrigated field	1/22/14	2	3364.38	3361.60	53.20	20 to 50	Shallow	stickup	Y	SA	SA ^d	SA ^d	SA ^d	SA ^d	-	-	SA ^d	SA ^d	SA ^d	
MW-130	Monitoring	S Refinery	In refinery office parking lot	2/7/14	2	3369.86	3370.20	44.90	30 to 45	Shallow	flush mount		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-131	Monitoring	Field E of Refinery	SW edge of irrigated field	1/23/14	2	3363.49	3360.40	53.48	20 to 50	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-132	Monitoring	Field E of Refinery	Near 82 at E end of parking area	1/30/14	2	3357.12	3354.30	42.71	15 to 40	Shallow	stickup	Y	SA	SA ^d	SA ^d	SA ^d	SA ^d	-	-	SA ^d	SA ^d	SA ^d	
MW-133	Monitoring	Field E of Refinery	E edge of irrigated field, N of RW-14	2/4/14	2	3349.45	3343.40	37.64	15 to 35	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-134	Monitoring	Field E of Refinery	NE of irrigated field	2/4/14	2	3346.23	3343.10	32.89	20 to 30	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-135	Monitoring	Field E of Refinery	E edge of pecan orchard	2/11/14	2	3337.65	3338.00	65.55	35 to 65	Shallow	flush mount		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
MW-136	Monitoring	Crossgradient	North of North RO Field	7/28/14	2	3360.83	3358.62	27.42	10 to 25	Shallow	stickup		SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	
MW-137	Monitoring	N Refinery	Main API Separator	11/9/14	2	TBD	TBD	31	10 to 30	Shallow	stickup		SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	
MW-138	Monitoring	N Refinery	Main API Separator	2015	2	TBD	TBD	TBD	TBD	Shallow	stickup		SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	
NCL-31	Monitoring	NCL	NCL	10/19/82	2	3367.54	3366.21	20.16	13 to 18	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
NCL-32	Monitoring	NCL	NCL	10/20/82	2	3364.91	3364.96	17.23	17 to 22	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
NCL-33	Monitoring	NCL	NCL	10/20/82	2	3363.97	3364.26	19.62	13 to 18	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
NCL-34	Monitoring	NCL	NCL	10/20/82	2	3365.49	3364.82	19.31	16 to 21	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
NCL-44	Monitoring	NCL	NCL		2	3364.45	3364.01	21.61		Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
NCL-49	Monitoring	NCL	NCL	5/17/90	2	3371.13	3368.26	32.20	16.8 to 17.8	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA	
NP-1	Monitoring	TMD	S of ED, E of BR	1/22/93	2	3342.40	3339.69	21.53	9.5 to 19	Shallow	stickup		SA	SA	-	SA	-	-	-	A	A	A	
NP-2	Monitoring	TMD	S of ED, E of BR	1/21/93	2	3342.77	3340.58	21.48	9.5 to 18.5	Shallow	stickup		SA	No analytical samples to be collected									
NP-3	Monitoring	TMD	N of ED, NE of BR	1/22/93	2	3342.93	3340.40	21.92	9.5 to 18.5	Shallow	stickup		SA	No analytical samples to be collected									
NP-4	Monitoring	TMD	NE of NP #3	1/23/93	2	3345.73	3343.24	36.72	24.5 to 33.5	Shallow	stickup		SA	No analytical samples to be collected									
NP-5	Monitoring	Crossgradient	S of RR, N of ED, W of BR	1/11/95	2	3349.29	3346.31	25.09	10.25 to 20	Shallow	stickup		SA	B	B	B	B	-	-	B	B	B	
NP-6	Monitoring	TMD	S of ED, W of BR	1/10/95	2	3338.05	3336.31	20.35	8.75 to 18.75	Shallow	stickup		SA	B	-	B	-	-	-	-	-	-	
NP-8	Monitoring	TMD	S of ED, E of HR		2	3314.67	3310.53	15.22		Shallow	stickup		SA	No analytical samples to be collected									
NP-9	Monitoring	TMD	S of RR, N of ED, W of BR		2	3360.62	3357.86	25.90		Shallow	stickup		SA	No analytical samples to be collected									

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Well ID	Well Type	Location Information		Well Construction Information ^a								PSH Expected? ^b	Gauging Frequency	Analytical Suite and Frequency ^c										
		Associated Area of Concern	Approximate Location	Install Date	Diameter (in)	Top of Casing (ft MSL)	Ground Surface (ft MSL)	Total Depth (ft btoc)	Screen Interval (ft bgs)	Water Bearing Zone	Surface Finish			Purge Parameters	TPH	VOCs	Metals (As, Ba, Cr, Fe, Pb, Mn, Se)	Metals (Hg, Ni, Va)	Cyanide	Cations/Anions	Nitrates / Nitrites as Nitrogen	Total Dissolved Solids		
OCD-1R	Monitoring	EP	NW of EP 6, replaced OCD-1		2	3314.27	3310.69	23.90		Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA		
OCD-2A	Monitoring	EP	N of EP 6	4/28/88	2	3314.16	3310.83	27.60	8.5 to 23.5	Shallow	stickup		SA	SA	SA	SA	SA	-	-	A	A	A		
OCD-2B	Monitoring	EP	N of EP 6	12/14/92	2	3313.07	3310.66	50.40	38.5 to 48	Valley Fill	stickup		SA	No analytical samples to be collected										
OCD-3	Monitoring	EP	NE of EP 6	4/28/88	2	3314.43	3310.89	25.48	6.5 to 21.5	Shallow	stickup		SA	SA	SA	SA	SA	-	-	A	A	A		
OCD-4	Monitoring	EP	NE of EP 6	4/28/88	2	3313.68	3310.31	25.44	6.5 to 21.5	Shallow	stickup		SA	SA	SA	SA	SA	-	-	A	A	A		
OCD-5	Monitoring	EP	NE of EP 6	4/26/88	2	3311.27	3308.76	25.44		Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA		
OCD-6	Monitoring	EP	E of EP 6	4/26/88	2	3311.40	3308.11	26.91	8 to 23	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA		
OCD-7AR	Monitoring	EP	SE of EP 6	12/15/92	4	3310.03	3308.86	21.28	5.5 to 19.5	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA		
OCD-7B	Monitoring	EP	SE of EP 6	12/15/92	2	3310.26	3307.57	56.85	43.5 to 52.5	Valley Fill	stickup		SA	B	B	B	B	-	-	B	B	B		
OCD-7C	Monitoring	EP	SE of EP 6	1/20/95	2	3310.10	3307.74	71.87	60.25 to 69.75	Valley Fill	stickup		SA	No analytical samples to be collected										
OCD-8A	Monitoring	EP	SE of EP 3	4/25/88	2	3308.72	3306.43	20.76	3 to 18	Shallow	stickup		SA	SA	SA	SA	SA	SA	SA	SA	SA	SA		
OCD-8B	Monitoring	EP	SE of EP 3	12/14/92	2	3309.19	3306.11	56.65	43.5 to 53	Valley Fill	stickup		SA	B	B	B	B	-	-	B	B	B		
TEL-1	Monitoring	TEL	E of TEL cap	5/1/90	2	3358.23	3356.79	27.00	13 to 23	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA		
TEL-2	Monitoring	TEL	E of TEL cap	5/1/90	2	3359.12	3356.80	27.20	13 to 23	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA		
TEL-3	Monitoring	TEL	E of TEL cap	5/1/90	2	3358.33	3356.43	27.19	13 to 23	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA		
TEL-4	Monitoring	TEL	W of TEL cap	5/1/90	2	3360.24	3358.21	27.28	13 to 23	Shallow	stickup		SA	SA	SA	SA	SA	-	-	SA	SA	SA		
UG-1	Monitoring	Upgradient	W of Refinery, James Street	7/28/08	4	3372.94	3373.02	24.10	8 to 23	Shallow	flush mount		A	A	A	A	A	A	A	A	A	A		
UG-2	Monitoring	Upgradient	W of Refinery, Roselawn	7/28/08	4	3380.41	3380.30	29.26	15 to 30	Shallow	flush mount		A	A	A	A	A	A	A	A	A	A		
UG-3R	Monitoring	Upgradient	W of Refinery, 7th Street	9/8/08	4	3384.08	3384.62	38.58	17 to 37	Shallow	flush mount		A	A	A	A	A	A	A	A	A	A		
UG-4	Monitoring	Upgradient	W of Refinery, Logan at 4th Street	9/2/14	2	3384.08	3384.62	39.25	19.5 to 39.5	Shallow	flush mount		A	A	A	A	A	A	A	A	A	A		
RA-1227	Irrigation	Field E of Refinery	S of US82, E of BR	12/30/35	10 / 8	3352.80	3352.27	246	194 to 246	Artesian	irrigation well		NA	A ^f	-	A ^f	-	-	-	A ^f	A ^f	A ^f		
RA-313	Irrigation	S Refinery	N of US82, W of BR	10/1/40	10	3370.62	3369.96	1157	904 to 1157	Artesian	irrigation well		NA	A	-	A	-	-	-	A	A	A		
RA-3156	Irrigation	Field E of Refinery	S of US82, E of BR	11/5/53	4	3353.28	3353.02		182 to ?	Artesian	irrigation well		NA	A	-	A	-	-	-	A	A	A		
RA-4196	Irrigation	Field E of Refinery	N of US82, E of BR	4/26/60	8	3351.52	3350.75	294	280 to 292	Artesian	irrigation well		NA	SA	-	SA	-	-	-	SA	SA	SA		
RA-4798	Irrigation	Field E of Refinery	E of BR, N of US82	5/23/63	7	3348.31	3347.65	850	840 to 850	Artesian	irrigation well		NA	SA	-	SA	-	-	-	SA	SA	SA		
RW-1R	Recovery ^d	N Refinery	S of ED, NW portion of Refinery	10/16/13	12	3367.27	3365.29	pump	15 to 35	Shallow	recovery well	Y	SA	A ^d	A ^d	A ^d	A ^d	-	-	A ^d	A ^d	A ^d		
RW-2R	Recovery ^d	N Refinery	S of ED, NW portion of Refinery	10/15/13	12	3368.23	3368.17	pump	14.5 to 34.5	Shallow	recovery well	Y	SA	A ^d	A ^d	A ^d	A ^d	-	-	A ^d	A ^d	A ^d		
RW-4R	Recovery ^d	S Refinery	NW of SE Tankfarm	10/21/13	12	3370.32	3364.41	pump	14.5 to 34.5	Shallow	recovery well	Y	SA	A ^d	A ^d	A ^d	A ^d	-	-	A ^d	A ^d	A ^d		
RW-5R	Recovery ^d	S Refinery	SW Tankfarm	8/24/11	12	3368.56	3362.79	pump	13 to 33	Shallow	recovery well	Y	SA	A ^d	A ^d	A ^d	A ^d	-	-	A ^d	A ^d	A ^d		
RW-6R	Recovery ^d	S Refinery	W of SE Tankfarm	10/22/13	12	3372.12	3366.03	pump	14.5 to 34.5	Shallow	recovery well	Y	SA	A ^d	A ^d	A ^d	A ^d	-	-	A ^d	A ^d	A ^d		
RW-7R	Recovery ^d	N Refinery	N of ED, NW portion of Refinery	10/17/13	12	3367.25	3365.03	pump	14.5 to 34.5	Shallow	recovery well	Y	SA	A ^d	A ^d	A ^d	A ^d	-	-	A ^d	A ^d	A ^d		
RW-8R	Recovery ^d	N Refinery	N of ED, S of NCL	10/18/13	12	3367.00	3364.89	pump	14.5 to 34.5	Shallow	recovery well	Y	SA	A ^d	A ^d	A ^d	A ^d	-	-	A ^d	A ^d	A ^d		
RW-9	Recovery ^d	N Refinery	N of TEL		36	3359.51	3356.30	21.97		Shallow	recovery well		SA	A	A	A	A	-	-	A	A	A		
RW-10	Recovery ^d	N Refinery	N of TEL		36	3360.61	3356.12	23.77		Shallow	recovery well		SA	A	A	A	A	-	-	A	A	A		

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Well ID	Well Type	Location Information		Well Construction Information ^a								PSH Expected? ^b	Gauging Frequency	Analytical Suite and Frequency ^c								
		Associated Area of Concern	Approximate Location	Install Date	Diameter (in)	Top of Casing (ft MSL)	Ground Surface (ft MSL)	Total Depth (ft btoc)	Screen Interval (ft bgs)	Water Bearing Zone	Surface Finish			Purge Parameters	TPH	VOCs	Metals (As, Ba, Cr, Fe, Pb, Mn, Se)	Metals (Hg, Ni, Va)	Cyanide	Cations/Anions	Nitrates / Nitrites as Nitrogen	Total Dissolved Solids
RW-11 ^e	Recovery ^d	Field E of Refinery	S of US82, W side of BR		36	3353.95	3351.48	22.20		Shallow	recovery well		SA	A	A	A	A	-	-	A	A	A
RW-12R	Recovery ^d	Field E of Refinery	N of US 82, W of BR	8/21/11	12	3351.54	3350.58	pump	15 to 35	Shallow	recovery well	Y	SA	A ^d	A ^d	A ^d	A ^d	-	-	A ^d	A ^d	A ^d
RW-13R	Recovery ^d	Field E of Refinery	N of US 82, W of BR	8/21/11	12	3351.54	3349.60	pump	15 to 35	Shallow	recovery well	Y	SA	A ^d	A ^d	A ^d	A ^d	-	-	A ^d	A ^d	A ^d
RW-14R	Recovery ^d	Field E of Refinery	N of US 82, W of BR	8/21/11	12	3349.37	3347.39	pump	15 to 35	Shallow	recovery well	Y	SA	A ^d	A ^d	A ^d	A ^d	-	-	A ^d	A ^d	A ^d
RW-15 ^e	Recovery ^d	S Refinery	S of SE Tankfarm		36	3362.30	3363.58	18.35		Shallow	recovery well	Y	SA	A ^d	A ^d	A ^d	A ^d	-	-	A ^d	A ^d	A ^d
RW-16 ^e	Recovery ^d	N Refinery	NE of Refinery, S of ED		36	3360.01	3357.51	17.70		Shallow	recovery well		SA	A	A	A	A	-	-	A	A	A
RW-17 ^e	Recovery ^d	N Refinery	N of ED, E of NCL		36	3366.15	3362.58	16.02		Shallow	recovery well		SA	A	A	A	A	-	-	A	A	A
RW-18 ^e	Recovery ^d	Field E of Refinery	S of ED, W of BR		36	3352.05	3349.53	17.75		Shallow	recovery well		SA	A	-	A	A	-	-	A	A	A
RW-19	Recovery ^d	S Refinery	N of US 82, near KWB-4	8/20/11	12	3369.11	3367.09	pump	11 to 46	Shallow	recovery well	Y	SA	A ^d	A ^d	A ^d	A ^d	-	-	A ^d	A ^d	A ^d
RW-20	Recovery ^d	Field E of Refinery	E of BR, at pecan orchard building		4	3348.44	3347.75	pump		Shallow	recovery well	Y	SA	A ^d	A ^d	A ^d	A ^d	-	-	A ^d	A ^d	A ^d
RW-22	Recovery ^d	Field E of Refinery	E of BR, in pecan orchard, near KWB-8	8/23/11	12	3350.84	3349.04	pump	11.5 to 39	Shallow	recovery well	Y	SA	A ^d	A ^d	A ^d	A ^d	-	-	A ^d	A ^d	A ^d

Note: Blank cells indicate that information is not available or applicable.

Abbreviations:

A = Annual (March/April event)	OCD = Oil Conservation District
B = Biennial (starts March/April 2011)	PSH = Phase Separated Hydrocarbons
BR = Bolton Road	ROW = right of way
E = East	RR = Richey Road
ED = Eagle Draw	S = South
EP = Evaporation Ponds	SA = Semi-annual (March/April and September/October events)
ft bgs = feet below ground surface	SE = Southeast
ft btoc = feet below top of casing	SW = Southwest
ft MSL = feet Mean Sea Level	TEL = Tetra Ethyl Lead Impoundment
HR = Haldeman Road	TMD = Three Mile Ditch
in = inches	TPH = Total Petroleum Hydrocarbons
N = North	UG = Upgradient
NA = Not accessible	US285 = U.S. Highway 285
NAPI = North API Separator	US82 = U.S. Highway 82
NCL = North Colony Landfarm	VOCs = Volatile Organic Compounds
NE = Northeast	W = West
NS = Not surveyed yet	Y = Yes
NW = Northwest	

Footnotes:

- ^a Well construction information provided where available. Top of casing and ground surface elevations relative to benchmark G-416. Total depth based on 4/2015 measurements
- ^b PSH was present during 4/2015 groundwater monitoring event or a recovery pump is in place. Note that recovery wells are also gauged at least monthly.
- ^c Analytical Suite to include the following:
- Purge parameters to be measured and recorded in the field will include pH, temperature, specific conductivity, dissolved oxygen, and oxygen-reduction potential.
 - TPH by TX Method 1005 (select samples may also be analyzed by TX Method 1006).
 - VOCs by Method 8260, to include methyl tert butyl ether (MTBE) and naphthalene.
 - Total metals by Method 6010/6020 and/or 7470. Specific metals shown in heading, abbreviations from periodic chart.
 - Cyanide by Method SM4500.
 - Cations/anions to include Calcium, Potassium, and Sodium by Method 6010 or 6020 and Sulfate, Chloride and Fluoride by Method 300.
 - Nitrates/Nitrites as Nitrogen by Method 300.
 - Total Dissolved Solids by Method 2540C.
- "-" indicates parameter not required.
- Note - samples will not be collected from any well where PSH is measured to be 0.03 feet thick or greater.
- ^d Samples to be collected at frequency indicated only if <0.03 feet of PSH is present.
- ^e Recovery trenches 11, 15, 16, 17 and 18 have multiple "wells". Gauging and sampling points are as follows: RW #11-0, RW #15C, RW #16B, RW #17A and RW #18A.
- ^f Wells will be gauged and/or sampled only if the landowner grants access.

**Table 2. Statistical Comparison of the Dissolved and Total Concentrations of Nine Metals
Navajo Refinery, Artesia, New Mexico**

Metal	Data Points	Detections	Detection Rate (Percent)	Arithmetic Mean^a (mg/L)	Adjusted Arithmetic Mean^b (mg/L)	Statistical Significance^c	Correlation Coefficient	Correlation Coefficient^b
Arsenic, total	313	201	64.20%	0.02327	0.03402			
Arsenic, dissolved	313	206	65.80%	0.02049	0.02938	none	97%	97%
Barium, total	313	278	88.80%	0.1884	0.1986			
Barium, dissolved	313	291	93.00%	0.1633	0.1721	none	99%	99%
Chromium, total	313	34	10.90%	0.00611	0.02732	Total is		
Chromium, dissolved	313	21	6.70%	0.00310	0.00632	elevated	32%	25%
Iron, total	313	173	55.30%	1.848	3.222	Total is		
Iron, dissolved	313	128	40.90%	1.250	2.154	elevatedb	79%	75%
Lead, total	313	32	10.20%	0.00323	0.00516			
Lead, dissolved	313	22	7.00%	0.00264	0.00296	none	61%	30%
Manganese, total	313	285	91.10%	0.7766	0.8527			
Manganese, dissolved	313	278	88.80%	0.7475	0.8207	none	99%	99%
Nickel, total	63	29	46.00%	0.00630	0.00980			
Nickel, dissolved	63	30	47.60%	0.00609	0.01035	none	96%	94%
Selenium, total	313	97	31.00%	0.00666	0.01046			
Selenium, dissolved	313	96	30.70%	0.00623	0.01062	none	93%	95%
Vanadium, total	63	38	60.30%	0.01062	0.01482			
Vanadium, dissolved	63	39	61.90%	0.01037	0.01449	none	97%	93%

Footnotes:

mg/L: Milligrams per liter

a. Non-detects were replaced by one half of the detection limit.

b. Based upon dissolved-total data pairs with at least one detection.

c. Based on a Mann-Whitney test (or a t-test if the data were parametric).

**Table 3. Slope and Intercept for Computing the Dissolved Concentration from the Total Metal Concentration
Navajo Refinery, Artesia, New Mexico**

Metal	Slope (Dimensionless)	Intercept (mg/L)	Cross-over (mg/L)	Regulatory Threshold (mg/L)	Comment
Arsenic	0.8040	0.0018	0.0092	0.010	
Barium	0.8959	-0.0055	n.a.	1.000	
Lead	0.4448	0.0012	0.0022	0.015	Poor correlation, low detection rate
Manganese	0.9553	0.0056	0.1253	0.200	
Nickel	0.9356	0.0002	0.0031	0.200	
Selenium	0.9800	-0.0002	n.a.	0.050	
Vanadium	0.9637	0.0001	0.0028	0.063	

Footnotes:

mg/L: Milligrams per liter.

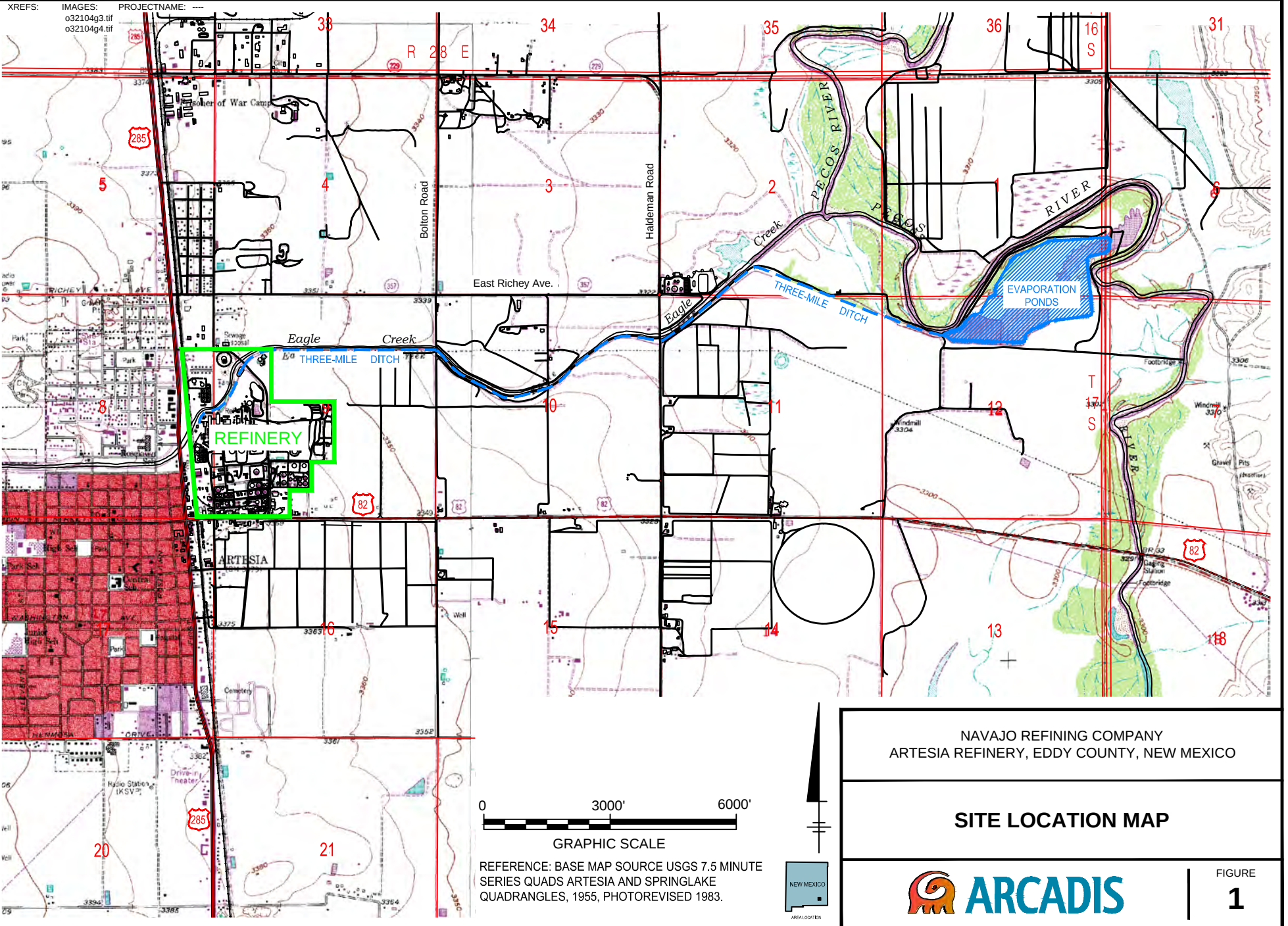
n.a.: Not Applicable

Negative concentrations are not possible

The crossover is the total concentration above which the predicted dissolved concentration will always be less than the total concentration. If the cross-over point was a negative value, then "n.a." was recorded.

The regulatory threshold concentrations are from the New Mexico Environment Department (NMED).

Figures

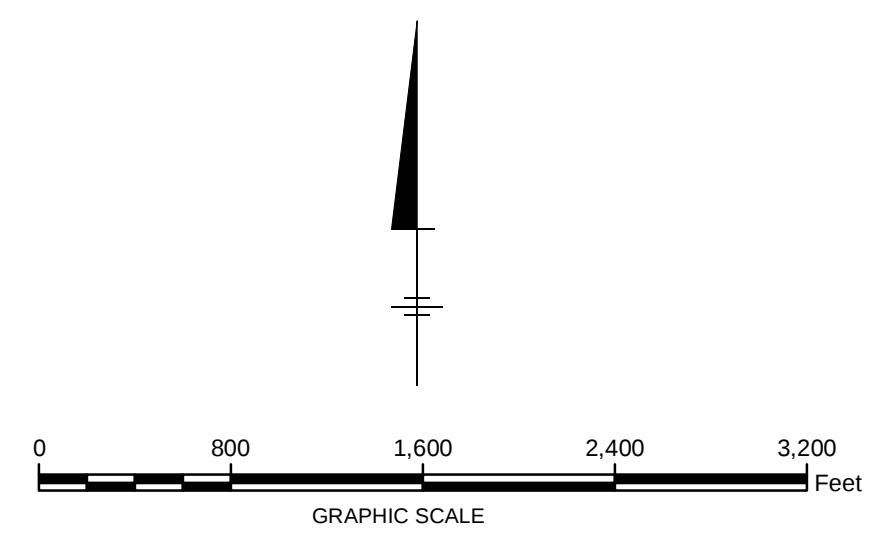




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LEGEND:

- MONITORING WELL
- RECOVERY WELL
- IRRIGATION WELL
- ABANDONED WELL



NAVAJO REFINING COMPANY
ARTESIA REFINERY, EDDY COUNTY, NEW MEXICO
2015 FACILITY WIDE GROUNDWATER MONITORING WORK PLAN

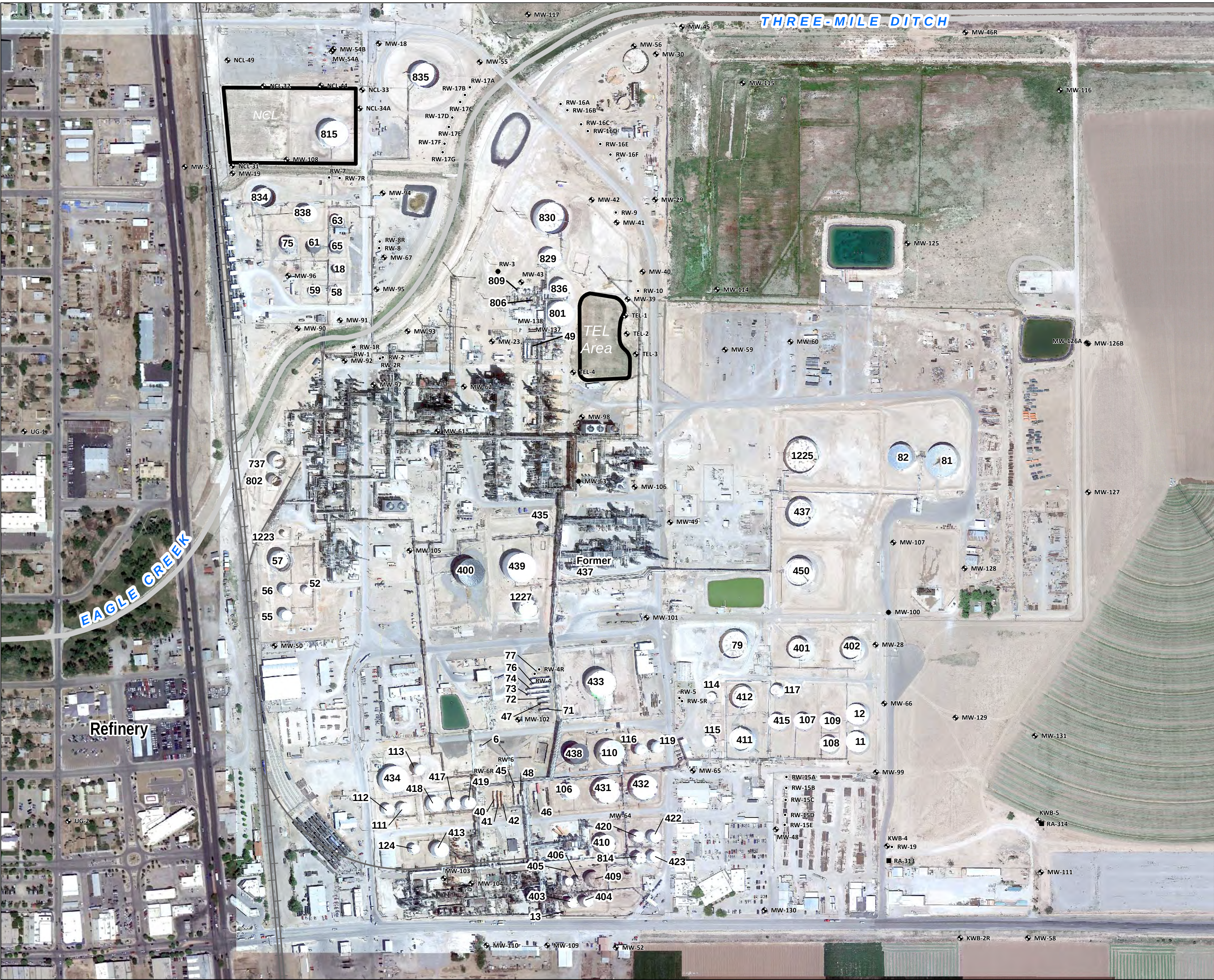
WELL LOCATIONS



FIGURE

2

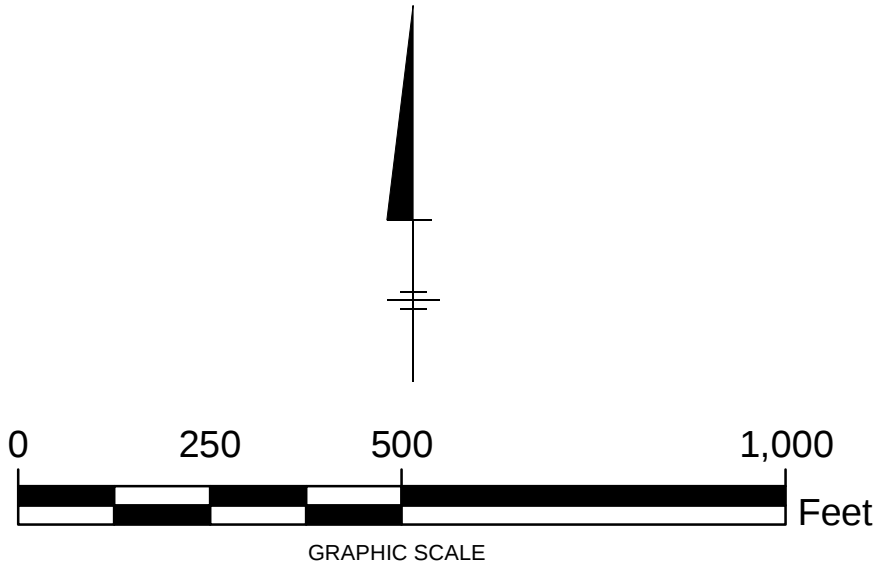
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LEGEND:

- ◆ MONITORING WELL
- ◊ RECOVERY WELL
- IRRIGATION WELL
- ABANDONED WELL

TANK TABLE NOTES:
AOC = AREA OF CONCERN
B. = BEFORE DATE SHOWN, ACTUAL DATE UNKNOWN
RBLT = REBUILT DATE SHOWN
SWMU = SOLID WASTE MANAGEMENT UNIT
BLANK CELLS INDICATE DATA IS UNKNOWN OR UNAVAILABLE AT THIS TIME.



Tank Number	Location in Relation to AOCs & SWMUs	Diameter (feet)	Height / Length (feet)	Capacity (barrels)	Date Constructed	Contents (2013)
6	RW-6 between AOC 3 & AOC 4					Out of Service
11	AOC 3	89	29	31,500	B. 1983	Reformate
12	AOC 3	89	29	31,500	B. 1983	Reformate
13	AOC 8	10	20	250	1990	Slop
18	SWMU 17	29	24	2,250	B. 1979	Out of Service
40	Between AOC 3 & AOC 4	9	72	730		Spent Caustic
41	Between AOC 3 & AOC 4	9	72	730		Spent Caustic
42	Between AOC 3 & AOC 4	9	67	700		Wild Naphtha
45	Between AOC 3 & AOC 4	11	90	1,400		Butane
46	Between AOC 3 & AOC 4	12	47	920		Isobutane
47	West of AOC 3	11	36	700		Out of Service
48	Between AOC 3 & AOC 4	11	36	700		Butane
52	AOC 7					Out of Service
55	AOC 7	45	36	10,800	RBLT 1979	Stripped Sour Water
56	AOC 7	48	36	10,800	B. 1976	Sweet Naphtha
57	AOC 7	90	49	55,000	1981	Benfree Unit Feed
58	SWMU 17	35	30	4,700	B. 1979	Out of Service
59	SWMU 17	35	30	4,700	B. 1979	Light Cycle Oil
61	SWMU 17	50	30	9,700	B. 1987	Light Cycle Oil
63	SWMU 17	51	30	10,000	B. 1987	Carbon Black Oil
65	SWMU 17	50	30	10,380	1999	Carbon Black Oil
71	West of AOC 3	10.5	44	714		Propane
72	West of AOC 3	10.5	44	714		Propane
73	West of AOC 3	10	103	1,525		Propane
74	West of AOC 3	10	103	1,525		Propane
75	SWMU 17	65	32	18,900	2003	Carbon Black Oil
76	West of AOC 3	11	79			Propane
77	West of AOC 3	11	79			Propane
79	AOC 3	125	40	70,000	2008	Reformate
81	AOC 6	108.5	40	60,000	2009	PG Asphalt
82	AOC 6	140	40	100,000	2009	PG Asphalt
106	AOC 3	67	40	22,500	B. 1971	Sour Water
107	AOC 3	67	40	22,500	B. 1971	Casing Head
108	AOC 3	67	40	22,500	1951	Alkylate
109	AOC 3	67	40	22,500	B. 1971	Alkylate
110	AOC 3	108	35	54,000	1929	Asphalt
111	AOC 4	49	30	9,100	B. 1981	Splitter Bottoms
112	AOC 4	49	30	9,100	B. 1981	Splitter Bottoms
113	AOC 4	48		10,300		Out of Service
114	AOC 3	38		5,100		N-Butane
115	AOC 3	51		12,300		N-Butane
116	AOC 3	48				Isobutane
117	AOC 3	48	48	15,470	1960	Splitter Bottoms
119	AOC 3	51		12,300		Isobutane
124	AOC 4	40	30	6,700	1955	Gasoline
400	AOC 5	120	48	96,786	1983	Gas Oil
401	AOC 3	90	50	55,000	1982	Benfree Product
402	AOC 3	90	50	55,000	1983	Light Cat Naphtha
403	AOC 8	45	36	8,250		Out of Service
404	AOC 8	45	36	8,250		Out of Service
405	AOC 8	37	28	4,575		Out of Service
406	AOC 8	38	28	5,400		Out of Service
409	AOC 8	67	40	21,450		Out of Service
410	AOC 8	79	40	30,850		Asphalt
411	AOC 3	100	40	52,000	1951	Casing Head
412	AOC 3	100	40	52,000	1951	Gasoline Blend
413	AOC 4	67	39	22,500	about 1960	Raw Kerosene
415	AOC 3	67	40	25,000	1953	Alkylate
417	AOC 4	50	30	9,300	B. 1981	Gasoline
418	AOC 4	67	33	25,000	B. 1987	Raw Kerosene
419	AOC 4	53	28	10,300	B. 1981	Diesel
420	AOC 8	50	30	8,200	B. 1989	Asphalt
422	AOC 8	50	30	8,200		Light Cycle Oil
423	AOC 8	50	30	8,200	B. 1970	Light Cycle Oil
431	AOC 3	109	32	45,800	B. 1984	Fuel Oil
432	AOC 3	109	32	45,800	B. 1973	Fuel Oil
433	AOC 3	117	42	72,500	B. 1984	Gas Oil
434	AOC 4	117	42	7,600		Raw Diesel
435	AOC 5	30	40	5,000	Reloc. 1997	Sour Water
437	AOC 6	120	45	80,000	1976/2009	Crude Oil
438	AOC 3	90	48	54,500	1978	Gas Oil
439	AOC 5	130	46	107,900	1978	Sour Naphtha
450	AOC 3	120	40	80,570	1997	Sour Naphtha
737	AOC 7	63	40	20,000	2009	Sour Water
801	AOC 9	110	32	54,000	1987	Wastewater
802	AOC 7	45	40	10,000	2002	Sour Water
806	AOC 11	30	7	800		Separator (OOS)
809	West of AOC 11	20	16	850	1954	Treated Wastewater
814	AOC 8	50	32	10,000	2005	Pitch
815	SWMU 6	116	43	90,000	2005	ULSD
829	AOC 9					Wastewater (OOS)
830	AOC 9					Stormwater
834	AOC 1	85	40	40,000	1967	Diesel
835	Northeast of SWMU 6	111	40	68,000		Diesel
836	AOC 9	82.5	32	30,460	1998	Wastewater
838	AOC 1	74	40	29,900		Diesel
1223	AOC 7	25	24	2,000	2002	Caustic
1225	AOC 6	150	40	100,000	2009	Crude Oil
1227	AOC 5	77	40	30,000	2009	Pitch

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WELL LOCATIONS AND TANK
INFORMATION WITHIN REFINERY

