AP-51-0

Caribou Refinery/Maverik Country Stores

2019 AGWR

From:	Jayroe, Jason
To:	Chavez, Carl J, EMNRD
Subject:	[EXT] Former Caribou Refinery 2019 Groundwater Report
Date:	Thursday, November 5, 2020 1:38:37 PM
Attachments:	image001.png May 2019 Annual Rpt.pdf

Carl-

Gearing up to sample this site next month for 2020. The 2019 report is attached. Please disregard if I've sent this twice.

Thank you.

Jason Jayroe
Senior Geologist

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April 21, 2020

Carl J. Chavez, CHMM
NMOCD
1220 South St. Francis Drive
Santa Fe, New Mexico 87505

Subject: **2019 Annual Groundwater Report, Maverik Country Stores (Former Caribou Refinery), Kirtland, New Mexico**

Dear Mr. Chavez:

This report provides the results of the 2019 Site activities for the Maverik Country Stores site (former Caribou Refinery) in Kirtland, New Mexico (**Figure 1**). These activities were completed during the 2019 calendar year to meet the annual monitoring requirements for the site. The scope of work completed included:

- Annual fluid level measurements of 17 on-site wells;
- Annual low-flow groundwater sampling of 6 on-site wells;
- Annual analytical evaluation of VOCs and dissolved sulfate in groundwater samples from 5 on-site wells, along with analytical evaluation of VOCs only from 1 on-site well.

Field methods, results, and the conclusions from the 2019 field events are discussed below.

Discontinue Sampling and Well Abandonment

Since 1998, groundwater sampling results have indicated that impacts to groundwater at the site are limited to within the slurry wall impoundment area. Due to the robust dataset for the site demonstrating no impacts to groundwater downgradient of the slurry wall impoundment, the New Mexico Oil Conservation Division (OCD) approved Maverik's proposal to discontinue sampling off-site and on-site monitoring wells outside of the slurry wall impoundment area (MW-10, MW-18, MW-19, MW-20, and MW-21), as well as plugging and abandoning all eight off-site monitoring wells (MW-3, MW-5, MW-7, MW-8, MW-9, MW-14, MW-15, and MW-16). Wells were plugged and abandoned in accordance with the State of New Mexico guidelines during the week of November 19th, 2018. The OCD approved of Maverik's proposal to continue gauging and groundwater sampling the six monitoring wells inside the slurry wall area (INJ-N, INJ-E, INJ-S, INJ-W, MW-17, and MW-22) and gauging the remaining on-site monitoring wells (MW-10, MW-18, MW-19, MW-20, and MW-21).

Annual Groundwater Sampling

Annual groundwater sampling activities were conducted on December 2, 2019. Prior to well sampling, site-wide fluid levels were measured using an oil/water interface probe (**Table 1**) for compilation of the site potentiometric surface map (**Figure 2**). Fluid levels were not obtainable from the following site wells:

- MW-01: The well has a blockage approximately 2 feet below ground surface that prevented collection of a fluid level measurement

None of the monitoring wells contained measurable thicknesses of LNAPL during this event. Based on the December 2019 groundwater elevations, the groundwater flow direction is to the south-southwest across the site toward the San Juan River. This flow direction is consistent with past monitoring events. The average of horizontal gradient calculations at the site was 0.009 ft/ft (**Figure 2**).

Two monitoring wells and the four injection wells were sampled as part of the regular annual groundwater sampling event. All wells were sampled utilizing a peristaltic pump and flow-through cell. Groundwater field parameters pH, temperature, conductivity, dissolved oxygen (DO), and oxidation reduction potential (ORP) were measured using a flow through cell and YSI 556 MPS during groundwater sampling. Groundwater samples were sent to ALS in Fort Collins, Colorado under chain-of-custody (COC) protocol and analyzed for volatile organic compounds (VOCs) using EPA Method 8260C. In addition, the groundwater samples collected from MW-17 and the four injection wells (INJ-North, INJ-South, INJ-East, and INJ-West) were analyzed for dissolved sulfate using EPA Method 300.0. Laboratory deliverables are provided in **Attachment A**. Results of the groundwater sampling are summarized in **Table 2**. The results show that there was one exceedance of constituent of concern 1,2-Dichloroethane (1,2-DCA) (**Figure 3**). 1,2-DCA exceeded the New Mexico Groundwater Standard of 10 µg/L at down-gradient well MW-22 with a concentration of 18 µg/L. There were two exceedances of dissolved sulfate in two injection wells. The Groundwater Standard of 6,000,000 µg/L was exceeded at INJ-North with a concentration of 14,000,000 µg/L and at INJ-West with a concentration of 15,000,000 µg/L. Dissolved sulfate was also detected in MW-17 and the remaining two injection wells **(Table 2)**.

Summary and Conclusions

The annual groundwater sampling was completed during the week of December 2, 2019. Fluid levels were measured in 17 wells to establish groundwater flow conditions. Across the site, groundwater flow is to the south-southwest, toward the San Juan River. Groundwater results were below New Mexico Groundwater Standards for all 8260 VOCs with the exception of well MW-22 inside of the slurry wall impoundment area. Groundwater sampled from MW-22 exceeded the New Mexico Groundwater Standards of 10 µg/L for 1,2-DCA with a detection of 18 µg/L. This detection is consistent with previous sampling events.

The groundwater sampling data suggest that the In Situ Chemical Oxidation (ISCO) injections were successful in decreasing the concentrations of VOCs within the slurry wall. Overall, the slurry wall impoundment is functioning as designed and no off-site migration of constituents of

concern is occurring. In 2019, Maverik conducted an additional round of ISCO injections to treat the VOCs that persist within the slurry wall.

Sincerely,

Jason Jayroe
Project Manager

Tables

Figures

Attachments

Table 1
Monitoring Well Construction Summary and December 2019 Fluid Levels, Maverik Country Stores, Inc. (Former Caribou Refinery)

Well ID	Completion Date	Total Depth (ft. BGS)	Well Diameter (in.)	Top of Steel Casing Elevation (ft. AMSL)	Top of PVC Casing Elevation (ft. AMSL)	Ground Surface Elevation (ft. AMSL)	Top of Screen (ft. BGS)	Bottom of Screen (ft. BGS)	Screen Length (ft.)	Top of Screen Elevation (ft. AMSL)	Bottom of Screen Elevation (ft. AMSL)	Depth to Groundwater (ft.) December 2019	Product Thickness (ft.)	Groundwater Elevation (ft. AMSL)	Comments
MW-1	1987	21.5	2	5207.79	5207.24	5205.75	11.5	21.5	10	5194.25	5184.25	NA	NA	NA	Well damaged
MW-2	1987	15	2	5197.10	5196.93	5195.25	5	15	10	5190.25	5180.25	7.76	NA	5189.17	
MW-10	1987	12.5	2	5189.80	5189.30	5187.47	2.5	12.5	10	5184.97	5174.97	5.46	NA	5183.84	
MW-17	1993	15	2	5196.49	5195.91	5193.43	5	15	10	5188.43	5178.43	9.22	NA	5186.69	
MW-18	1993	15	2	5202.27	5201.75	5199.14	5	15	10	5194.14	5184.14	11.61	NA	5190.14	
MW-19	1990	12.5	2	NA	5189.54	5188.28	2.5	12.5	10	5185.78	5175.78	5.57	NA	5183.97	
MW-20	1990	12	2	NA	5191.05	5190.10	2	12	10	5188.10	5178.10	6.81	NA	5184.24	
MW-21	1990	13	2	NA	5194.81	5193.62	3	13	10	5190.62	5180.62	9.04	NA	5185.77	
MW-22	1990	13	2	NA	5195.86	5194.58	3	13	10	5191.58	5181.58	9.37	NA	5186.49	
P-1	1993	8	2	NA	5197.66	5195.74	3	8	5	5192.74	5187.74	9.89	NA	5187.77	
P-2	1993	8	2	NA	5192.32	5190.50	3	8	5	5187.50	5182.50	6.31	NA	5186.01	
P-3	1993	8	2	NA	5193.21	5191.44	3	8	5	5188.44	5183.44	6.94	NA	5186.27	
P-4	1993	8	2	NA	5198.82	5197.06	3	8	5	5194.06	5189.06	dry	NA	dry	
INJ-N	2012	15	2	NA	NA	NA	5	15	10	NA	NA	9.01	NA	NA	
INJ-E	2012	15	2	NA	NA	NA	5	15	10	NA	NA	9.43	NA	NA	
INJ-S	2012	15	2	NA	NA	NA	5	15	10	NA	NA	9.26	NA	NA	
INJ-W	2012	15	2	NA	NA	NA	5	15	10	NA	NA	8.48	NA	NA	

Notes:

AMSL = Above mean sea level
BGS = Below ground surface
NM = Not Measured
NA = Not Applicable
ft =feet
in = inches

TABLE 2
SUMMARY OF GROUNDWATER QUALITY DATA

WELL IDENTIFICATION	DATE	ANALYTE CONCENTRATIONS (µg/L)					
		BENZENE	TOLUENE	EHTYL-BENZENE	TOTAL XYLENES	1,2 -DCA	DIS. SULFATE
MW-9	12/07/14	<1	<1	<1	<1	<1	NS
MW-9	12/10/15	<1	<1	<1	<1	<1	NS
MW-9	12/28/16	<1	<1	<1	<1	<1	NS
MW-9	12/27/17	<1	<1	<1	<1	<1	NS
MW-10	12/07/14	<1	<1	<1	<1	<1	NS
MW-10	12/10/15	<1	<1	<1	<1	<1	NS
MW-10	12/27/16	<1	<1	<1	<1	<1	NS
MW-10	12/27/17	<1	<1	<1	<1	<1	NS
MW-16	12/07/14	<1	<1	<1	<1	<1	NS
MW-16	12/10/15	<1	<1	<1	<1	<1	NS
MW-16	12/28/16	<1	<1	<1	<1	<1	NS
MW-16	12/27/17	<1	<1	<1	<1	<1	NS
MW-17	12/07/14	<1	<1	<1	<1	<1	**355,000**
MW-17	12/11/15	**290**	**11**	**151**	**227**	<1	**2,914,000**
MW-17	12/27/16	**1.1**	<1	**3.4**	**13.2**	**0.44**	**4,400,000**
MW-17	12/28/17	**2.7**	<1	**0.35**	**1.4**	<1	**3,300,000**
MW-17	11/21/18	<1	<1	<1	<1	<1	**5,600,000**
MW-17	12/02/19	**1.2**	<1	<1	**0.57 J**	**0.26 J**	**5,900,000**
MW-18	12/07/14	<1	<1	<1	<1	<1	NS
MW-18	12/10/15	<1	<1	<1	<1	<1	NS
MW-18	12/27/16	<1	<1	<1	<1	<1	NS
MW-19	12/07/14	<1	<1	<1	<1	<1	NS
MW-19	12/10/15	<1	<1	<1	<1	<1	NS
MW-19	12/27/16	<1	<1	<1	<1	<1	NS
MW-19	12/27/17	<1	<1	<1	<1	<1	NS
MW-20	12/07/14	<1	<1	<1	<1	<1	NS
MW-20	12/10/15	<1	<1	<1	<1	<1	NS
MW-20	12/27/16	<1	<1	<1	<1	<1	NS
MW-20	12/27/17	<1	<1	<1	<1	<1	NS
Groundwater Standard		**10**	**750**	**750**	**100**	**10**	**6,000,000**

Notes:

* Groundwater Standards based on the New Mexico Administrative Code Section 20.6.2.3103

NS - Not sampled

J - Estimated result. Result is less than RL

U - Undetected at the reporting limit or at the reported concentration; result is considered to be a false positive

Bold - Detected result

Highlighted - Result Exceeds New Mexico Groundwater Standard

TABLE 2
SUMMARY OF GROUNDWATER QUALITY DATA

WELL IDENTIFICATION	DATE	ANALYTE CONCENTRATIONS (µg/L)					
		BENZENE	TOLUENE	EHTYL-BENZENE	TOTAL XYLENES	1,2 -DCA	DIS. SULFATE
MW-21	12/07/14	<1	<1	<1	<1	<1	NS
MW-21	12/10/15	<1	<1	<1	<1	<1	NS
MW-21	12/27/16	<1	<1	<1	<1	<1	NS
MW-21	12/27/17	<1	<1	<1	<1	<1	NS
MW-22	12/07/14	**4**	<1	<1	<1	<1	NS
MW-22	12/27/16	**2.5**	<1	**0.67**	**7.12**	**1.7**	NS
MW-22	11/21/18	**1.3**	<1	<1	<1	**36**	NS
MW-22	12/02/19	**0.52 J**	<1	<1	<1	**18**	NS
Injection North	12/07/14	1	<1	<1	<1	**18**	**1,275,000**
Injection North	12/11/15	**370**	**229**	**402**	**2,270**	<1	**5,815,000**
Injection North	12/27/16	**48**	**19**	**10**	**1,070**	<1	**3,100,000**
Injection North	12/28/17	**58**	**2.3**	**2.6**	**56**	<1	**2,800,000**
Injection North	11/21/18	**0.36 J**	<1	<1	<1	<1	**4,200,000**
Injection North	12/02/19	**0.53 J**	<1	<1	**0.4 J**	**0.98 J**	**14,000,000**
Injection West	12/07/14	<1	<1	<1	<1	<1	**675,000**
Injection West	12/11/15	<1	<1	<1	<1	<1	**5,423,000**
Injection West	12/27/16	<1	<1	<1	<1	<1	**4,400,000**
Injection West	12/28/17	<1	<1	<1	<1	<1	**2,700,000**
Injection West	11/21/18	<1	<1	<1	<1	<1	**2,000,000**
Injection West	12/02/19	<1	<1	<1	<1	<1	**15,000,000**
Injection South	12/07/14	<1	<1	<1	<1	<1	**295,000**
Injection South	12/11/15	<1	<1	<1	<1	<1	**2,305,000**
Injection South	12/27/16	<1	<1	<1	**0.33**	<1	**1,900,000**
Injection South	12/27/17	<1	<1	<1	<1	<1	**1,800,000**
Injection South	11/21/18	<1	<1	<1	<1	<1	**2,300,000**
Injection South	12/02/19	<1	<1	<1	<1	<1	**5,800,000**
Injection East	12/07/14	<1	<1	<1	<1	<1	**295,000**
Injection East	12/11/15	<1	<1	<1	<1	<1	**3,002,000**
Injection East	12/27/16	<1	<1	<1	<1	<1	**1,600,000**
Injection East	12/27/17	<1	<1	<1	<1	<1	**1,800,000**
Injection East	11/21/18	<1	<1	<1	<1	<1	**1,900,000**
Injection East	12/02/19	<1	<1	<1	<1	<1	**3,300,000**
Groundwater Standard		**10**	**750**	**750**	**100**	**10**	**6,000,000**

Notes:

* Groundwater Standards based on the New Mexico Administrative Code Section 20.6.2.3103

NS - Not sampled

J - Estimated result. Result is less than RL

U - Undetected at the reporting limit or at the reported concentration; result is considered to be a false positive

Bold - Detected result

Highlighted - Result Exceeds New Mexico Groundwater Standard

LEGEND

- MW-2 — MONITORING WELL
- MW-7 — PLUG AND ABANDONED WELL
- P1 — PIEZOMETER
- E. Gray — PRIVATE WELL
- SLURRY WALL
- MAVERIK CARIBOU FORMER REFINERY BOUNDARY
- WESTSIDE IRRIGATION DITCH FILLED IN LOCATION

Co. Road 6261

Co. Road 6257

O. Curley

I. Hull

Co. Road D 6255

E. Mclemore

E. Gray

J.L. Flack

R. Neff

Co. Road D 6259

Co. Road D 6263

MW-15

(Out of Service)

MW-3

G. Nelson

MW-7

R. Jackson

A. Jackson

Ryan

Co. Road D 6271

MW-8

WM. H. Walker

M. Stone

MW-5

CO. Road 6100

U.S. Highway 64

Road

MW-1

MW-2

MW-21

MW-20

MW-10

MW-19

MW-18

MW-22

MW-17

P1

P2

P3

P4

MW-16

MW-14

MW-9

WESTSIDE IRRIGATION DITCH

MURRAY PROPERTY DITCH

DITCH IS FILLED IN AT THIS LOCATION

DITCH IS FILLED IN AT THIS LOCATION

FARMER'S MUTUAL IRRIGATION DITCH

100 0 200

SCALE IN FEET

TRC

2019 ANNUAL GROUNDWATER REPORT
MAVERIK CARIBOU FORMER REFINERY
KIRTLAND, NEW MEXICO

DATE: 02-18-20 | DRWN: NCP

SITE LOCATION MAP
DECEMBER 2019

FIGURE 1

LEGEND

- MW-2 — MONITORING WELL
- MW-7 — PLUG AND ABANDONED WELL
- P1 — PIEZOMETER
- E. Gray — PRIVATE WELL
- SLURRY WALL
- MAVERIK CARIBOU FORMER REFINERY BOUNDARY
- GROUNDWATER ELEVATION CONTOURS
- WESTSIDE IRRIGATION DITCH FILLED IN LOCATION

Co. Road 6257

Co. Road 6261

Co. Road D 6259

Co. Road D 6263

Co. Road D 6271

CO. Road 6100

U.S. Highway 64

Road

E. Mclemore

E. Gray

J.L. Flack

R. Neff

O. Curley

I. Hull

MW-1

MW-2
5189.17

MW-21
5185.77

MW-20
5184.24

MW-10
5183.84

MW-19
5183.97

MW-18
5190.14

MW-22

MW-17

P1

P2

P3

P4

MW-16

MW-14

MW-9

5188

5187

5186

5185

5184

WESTSIDE IRRIGATION DITCH

FARMER'S MUTUAL IRRIGATION DITCH

MURRAY PROPERTY DITCH

MW-15

DITCH IS FILLED IN AT THIS LOCATION

(Out of Service)

MW-3

G. Nelson

MW-7

DITCH IS FILLED IN AT THIS LOCATION

R. Jackson

Ryan

A. Jackson

MW-8

M. Stone

WM. H. Walker

MW-5

100 0 200

SCALE IN FEET

TRC

2019 ANNUAL GROUNDWATER REPORT
MAVERIK CARIBOU FORMER REFINERY
KIRTLAND, NEW MEXICO

DATE: 02-18-20 | DRWN: NCP

POTENTIOMETRIC SURFACE MAP
DECEMBER 2019

FIGURE 2

LEGEND

- MW-2 — MONITORING WELL
- MW-7 — PLUG AND ABANDONED WELL
- P1 — PIEZOMETER
- INJ-W — INJECTION WELLS
- E. Gray — PRIVATE WELL
- SLURRY WALL
- MAVERIK CARIBOU FORMER REFINERY BOUNDARY
- WESTSIDE IRRIGATION DITCH FILLED IN LOCATION

ALL RESULTS ARE IN MICROGRAMS PER LITER (µg/L)
J - ESTIMATED CONCENTRATION

Co. Road 6257

Co. Road 6261

O. Curley

I. Hull

E. Mclemore

E. Gray

J.L. Flack

R. Neff

Co. Road D 6259

Co. Road D 6263

G. Nelson

U.S. Highway 64

Road

MW-1

MW-2

MW-3

MW-5

MW-7

MW-8

MW-9

MW-10

MW-14

MW-15

MW-16

MW-17

MW-18

MW-19

MW-20

MW-21

MW-22

P1

P2

P3

P4

INJ-W

INJ-N

INJ-E

INJ-S

SW13

SW2

(Out of Service)

R. Jackson

A. Jackson

Ryan

WM. H. Walker

M. Stone

CO. Road 6100

Co. Road D 6271

INJ-W (Within Slurry Wall)	12/02/19
Benzene	<1
Toluene	<1
Ethylbenzene	<1
Total Xylenes	<1
1,2-DCA	<1

MW-17 (Within Slurry Wall)	12/02/19
Benzene	1.1
Toluene	<1
Ethylbenzene	<1
Total Xylenes	0.53 J
1,2-DCA	0.26 J

MW-22 (On-Site)	12/02/19
Benzene	0.52 J
Toluene	<1
Ethylbenzene	<1
Total Xylenes	<1
1,2-DCA	**18**

INJ-N (Within Slurry Wall)	12/02/19
Benzene	0.53 J
Toluene	<1
Ethylbenzene	<1
Total Xylenes	0.40 J
1,2-DCA	0.98 J

INJ-E (Within Slurry Wall)	12/02/19
Benzene	<1
Toluene	<1
Ethylbenzene	<1
Total Xylenes	<1
1,2-DCA	<1

INJ-S (Within Slurry Wall)	12/02/19
Benzene	<1
Toluene	<1
Ethylbenzene	<1
Total Xylenes	<1
1,2-DCA	<1

WESTSIDE IRRIGATION DITCH

FARMER'S MUTUAL IRRIGATION DITCH

MURRAY PROPERTY DITCH

DITCH IS FILLED IN AT THIS LOCATION

DITCH IS FILLED IN AT THIS LOCATION

100 0 200

SCALE IN FEET

TRC

2019 ANNUAL GROUNDWATER REPORT
MAVERIK CARIBOU FORMER REFINERY
KIRTLAND, NEW MEXICO

DATE: 02-18-20 | DRWN: NCP

BTEX CONCENTRATION MAP
DECEMBER 2019

FIGURE 3