OPERABLE UNIT 1
OPERATION & MAINTENANCE
ANNUAL REPORT 2024-2025

TAR CREEK SUPERFUND SITE
OTTAWA COUNTY, OKLAHOMA

PREPARED BY:
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For

OKLAHOMA
Environmental
Quality

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1. Introduction

Operation and Maintenance (O&M) of Operable Unit (OU) 1 at the Tar Creek Superfund Site (the Site) in Ottawa County, Oklahoma is conducted under the authority of the Oklahoma Department of Environmental Quality (DEQ). Historically, OU1 O&M activities have included annual monitoring of Roubidoux Aquifer groundwater wells within Ottawa County and visual inspection of the Lytle Creek diversion dike. In May 2021, Picher #5 (P5) and Quapaw #5 (Q5) were plugged due to previous monitoring results exceeding Tolerance Limits and Secondary Maximum Contaminant Levels (SMCLs) (DEQ, 2021). In 2022, two additional wells were added to the annual monitoring - Picher #6 (P6) and Cardin #1 (CA1). DEQ continues to monitor Commerce #5 (C5), Quapaw #4 (Q4), and Picher #7 (P7).

The five monitoring wells sampled (CA1, Q4, C5, P6, and P7) were constructed to public water supply (PWS) well standards. The City of Commerce owns and operates C5 but is not currently using C5 other than for monitoring. The Town of Quapaw owns and operates Q4 as part of the town's public water supply system. P6 is in the former town of Picher, OK and is owned by Quapaw Nation after temporarily being owned by a private citizen. P6 is used for filling water tankers utilized by the Quapaw Services Authority (QSA) for activities associated with remediation such as dust suppression and irrigation. The Quapaw Nation also owns and operates both P7 and CA1. P7 is in the former town of Picher and is used as the primary well in the Quapaw Nation's public water supply system. CA1 is in the former town of Cardin, CA1 is being used as a backup well for Quapaw Nation at this time. The well locations are presented in ***Figure 1***. Well attributes are outlined in ***Appendix C***. All wells are sampled for lead (Pb), cadmium (Cd), iron (Fe), zinc (Zn), and sulfates (SO_4). Fe, Zn, and SO_4 are considered indicator parameters for identifying impacts by mine water (MW). The development of these indicator parameters was described in a technical memorandum during the first phase of After-Action Monitoring (AAM) (DEQ, 1993). Results from groundwater analyses for site contaminants and indicator parameters are compared to background levels, tolerance limits, Maximum Contaminant Levels (MCLs), and Secondary Maximum Contaminant Levels (SMCLs). This comparison helps to determine whether water from the Roubidoux Aquifer wells is being impacted by MW contamination originating from the Boone Aquifer. The three indicator parameters were chosen primarily because comparisons between MW impacted groundwater, and non-impacted groundwater showed the greatest numerical difference for these constituents.

Also included in annual OU1 O&M activities, is the visual inspection of the Lytle Creek diversion dike in the Douthat area (O-3). O-3 is located within the southwest quarter (SW/4) of Section 29, Township 29 North, Range 23 East. Visual inspection of the Lytle Creek diversion dike is used to assess the integrity and functionality of the dike and diversion channel. This O-3 diversion dike was conceived as part of the remedy to reduce surface water recharge into mines, thus reducing the volume of MW that can eventually upwell to the surface and into water bodies such as Tar Creek. While the remedy functions as intended, it has not been successful in reducing the volume of mine water discharging in the Douthat area.

2. Methods

Groundwater sampling was conducted by DEQ personnel under a DEQ approved Quality Assurance Project Plan (QAPP) (DEQ, October 2022) and followed Standard Operating Procedures (SOPs) with strict chain-of-custody protocols. Wells Q4, C5, and the C5 duplicate were sampled on November 13, 2024. Wells P6, P7, and CA1 were sampled on November 14, 2024.

Groundwater is the only matrix sampled. Samples are collected at the wellhead (without chlorination) under reduced flow conditions via a spigot. Date, time, weather conditions, and sampling team personnel are recorded in the field logbook. Prior to sample collection, water stability parameters are measured using a YSI Multiparameter Meter and recorded in the field logbook: pH, temperature, specific conductivity (SC), dissolved oxygen (DO), and oxidation-reduction potential (ORP). Any observed, unusual characteristics (e.g., relating to the presence of gas bubbles, odor, coloration, or clarity) of the water samples are also noted. Field notes and recorded logbook data are in ***Appendix D***.

During sampling, all total metals and SO_4 samples are collected directly from the well spigot into pre-labeled sample containers. Dissolved metal samples are filtered using a peristaltic pump and 0.45 micron high-capacity filter prior to being collected in pre-labeled sample containers. For occasions where field filtering is not an option, the sample is lab filtered using the same method. It is not necessary to preserve samples collected for metals analyses with acid in the field because all samples are scheduled to reach the Oklahoma State Environmental Laboratory Services (SELS) within the time frames determined for each analysis.

Sample containers are stored and delivered to SELS on ice to meet the requirements of EPA Method 375.4, EPA Method 200.7, and EPA Method 200.8. Samples are analyzed by SELS using EPA Method 200.7 for dissolved & total Fe and Zn; EPA Method 200.8 for dissolved & total Pb, and Cd; and EPA Method 375.4 for SO_4. On any occasion in which SELS must outsource analysis, the outsourced lab is NELAP (National Environmental Laboratory Accreditation Program) certified. Any necessary outsourcing is documented with a QAPP deviation memo.

Sterile sample containers and analytical grade deionized (DI) water are supplied by SELS prior to the sampling event. Sample containers are prelabeled for each well to avoid cross contamination between wells. Dedicated filters and hoses are used for dissolved metals samples.

The Diversion Dike inspection took place October 23, 2024. SKEO attended the inspection with DEQ as part of the seventh Tar Creek Five-Year Review. The O-3 Inspection Form (***Appendix B***) is used to assess and document the integrity of the dike, channel, and mineshaft seal on-site (***Figure 2***).

3. Quality Assurance/Quality Control

Duplicate samples are used to evaluate the precision of the laboratory performance and sampling method. Duplicate samples were collected for all analytes at well C5 on November 13, 2024. The duplicate samples were pre-labeled with unique IDs that did not reveal which samples were duplicated. The specific well associated with each duplicate sample is recorded in the field logbook.

As defined in the QAPP, for each analyte, the relative percent difference (RPD) between the two reported results of the sample and its duplicate were calculated and compared to the required laboratory precision of +/- 30% difference. For the November 13, 2024 sampling event, the RPD for Total Iron was 59% (C5=92.2 ug/L; Duplicate=169 ug/L), and the RPD for Dissolved Fe was 52% (C5=123 ug/L; Duplicate=72.6 ug/L). These exceed the standard of +/- 30% allowed for RPD which will trigger an additional QA/QC evaluation. Although there is some inconsistency identified in our duplicate samples, the results do not change the overall status of C5 as "not impacted." ***See Table 1***.

4. Results and Discussion

The EPA has established primary MCLs for both Pb and Cd. Results show Pb and Cd were ***below detection limits*** for all five wells sampled.

The indicator parameters (Fe, SO_4, and Zn) have SMCLs, Tolerance Limits, and Background Levels assigned to help interpret the results of the analytical data reported by SELS. These laboratory results are shown in ***Table 1*** for all three indicator parameters. The graphs in ***Figures 3 A&B through Figures 7 A&B*** show any recent and historical exceedances of indicator parameters.

The RPD between the primary sample (C5) and its duplicate was more than 50% for both Total Fe and Dissolved Fe. This difference does not change the status of the well as "Not Impacted." Results for SO_4 and Zn were nearly identical. For the purposes of calculating the RPD, data reported as being between zero and the reporting limit was assigned a numerical value equal to the reporting limit, itself (e.g., "<20 ppb" was interpreted to be exactly 20 ppb). This was done to minimize the chance of estimated values needlessly triggering QA/QC contingencies.

Table 1: *Concentrations of Indicator Parameters in OU1 O&M Wells (November 2024)*

LIMITS	**Fe (ug/L)**	**SO_4 (mg/L)**	**Zn (ug/L)**	
Background Level	61.5	25	8.8	
Tolerance Limit	207	82	43	
SMCL	300	250	5,000	
WELL	**Total/Dissolved**	**Total**	**Total/Dissolved**	**AMW Evaluation**
CA1	147/146	**104***	<5.0/<5.0	*Possibly impacted*
C5	92.2/123	15.9	<5.0/<5.0	Not impacted
P6	**1020*/992***	**532***	20.8/21.6	**Probably impacted**
P7	121/128	**152***	<5.0/<5.0	*Possibly impacted*
Q4	<20.0/<20.0	23.5	<5.0/<5.0	Not impacted
Duplicate (C5)	169/72.6	15.4	<5.0/<5.0	Not impacted

***Bold** text indicates an exceedance of the corresponding Tolerance Limit. **Underlined** text indicates an exceedance of the corresponding SMCL.

The following evaluation criteria are used in evaluating the groundwater data obtained from the monitoring activities:

- A well producing water with concentrations less than the Tolerance Limit for all three indicator parameters indicates the Roubidoux Aquifer is not impacted by MW locally near the well site.
- A well producing water with concentrations more than the Background Levels for *two* (2) of the three indicator parameters **and** above the **Tolerance Limits** for *one* (1) of the indicator parameters indicates the Roubidoux Aquifer is *possibly impacted* by MW locally near the well site.
- A well producing water with concentrations more than the Background Levels for all *three (3)* indicator parameters **and** above the **Tolerance Limits** for *two* (2) of the indicator parameters indicates the Roubidoux Aquifer is ***probably impacted*** by MW locally near the well site.
- A well producing water with concentrations more than the **Tolerance Limits** for *all three (3)* indicator parameters indicates the Roubidoux Aquifer ***is impacted*** by MW locally near the well site.

Table 2. *Evaluation Summary*

Categories exceeding Background Level	**Categories exceeding Tolerance Limits**	**MW Evaluation**
N/A	0	Not Impacted
2	1	*Possibly Impacted*
3	2	**Probably Impacted**
3	3	**Is Impacted**

The above evaluation criteria do not directly address whether contaminants with primary MCLs, such as Pb and Cd, are present in each wells' groundwater, but rather use indicator parameters to determine if the Roubidoux Aquifer is likely being contaminated by Boone Aquifer groundwater.

5. Conclusions

Roubidoux Groundwater

Based on the evaluation criteria for indicator parameters presented in the previous section, the Q4 and C5 wells are considered not impacted. The C5 duplicate samples confirm this result. The CA1 and P7 wells exceed Background Levels for *two (2)* indicator parameters (Total Fe and SO_4) and exceed at least *one (1)* Tolerance Limit (Total Fe and SO_4); they are considered *possibly impacted*. The P6 well exceeds Background Levels for all *three (3)* indicator parameters and exceeds *two (2)* Tolerance Limits (Total Fe and SO_4); it is considered ***probably impacted***.

Due to the designation of the Q4 and C5 wells as "not impacted," no further action is necessary at these wells until the next annual O&M sampling event. C5 briefly tested high for Total Fe but has returned to normal levels. The change is potentially a result of the City of Commerce's upgrade to several main water pipes. C5 will continue to be monitored annually.

CA1 continues to test above the Tolerance Limit for SO_4 (***Figure 3A***). The exceedance warrants additional sampling based on the general response action plan (***Figure 8***).

SO_4 concentrations at P7 have historically exceeded the Tolerance Limit, as shown in ***Figure 6A***. This remains consistent, but stable. Total Fe concentrations tested high at P7 for a couple of sampling events but have since trended down. Total Fe concentrations are currently below the Tolerance Limit (***Figure 6B***).

The P6 well was privately owned and had not been tested from 2014 to 2021. Since testing resumed in 2022, P6 has consistently exceeded the Tolerance Limits **and** SMCLs for both SO_4 and Fe, as well as the Background Level for Zn. All levels continue to increase slowly, but the well remains categorized as "Probably Impacted" (***Figures 5A&B***). P6 has been recommended for an investigation to outline details of its current defect and will most likely be plugged in the future. The well will continue to be monitored every 6 months.

Although Pb and Cd concentrations were below detection limits, the wells considered possibly or probably impacted will require additional monitoring. CA1, P6, and P7 wells will resume testing every 6 months. C5 and Q4 can be monitored annually.

Diversion Dike

The diversion dike is in good condition for now. There is some evidence of erosion along the banks in a narrowing portion covering no more than 20 feet which may require some type of reinforcement. The area has shown no signs of change in several years and seems to have integrity for now, but there are concerns about additional damage to the area in the event of heavy flooding. In October 2024, water levels in the creek could be described as low. The streambeds were visible and there is no evidence of recent beaver activity. Any remaining materials from previous beaver dams appear to be abandoned. Average streamflow for the nearby Spring River on this date was recorded by the United States Geological Society (USGS) as 118 cubic feet per second (cfs). This is "below normal" for Spring River's mean flow of 900 cfs. Although the water level and streamflow are below normal, there does not appear to be anything that might impede the flow once the water rises. Flow from the watershed to the north of the dike is being conveyed through the constructed channel that diverts Lytle Creek into an upper reach of Tar Creek.

Overall, O-3 is functioning as designed, though the benefit of this surface water diversion has only been partially effective. The original intent of O-3 was to divert surface water away from open mine shafts, and diking projects in Kansas were expected to change the Douthat O-3 area from a location of groundwater upwelling to a location of groundwater inflow, which could generate undesired MW. Unfortunately, the area remains a point of discharge of MW into Tar Creek, but the promotion of drainage in the area provided by O-3 is assumed to help reduce immediate rises in mine water levels.

6. Recommendations

DEQ recommends continued annual monitoring of all chemicals of concern, Pb, Cd, Fe, Zn, and SO_4 at wells Q4 and C5. The CA1, P6, and P7 wells are recommended for annual and semi-annual testing for all chemicals of concern.

In addition to groundwater sampling, the Douthat O-3 inspection should be upgraded to a semi-annual inspection until the need for bank stabilization due to erosion can be determined. If the property owner stops maintaining the area and vegetation growth becomes excessive hindering O-3 inspections, DEQ should take steps to have it mowed and maintained.

7.0 Abbreviations

AAM	After Action Monitoring
BGL	Below Ground Level
C5	Commerce 5 Well
CA1	Cardin 1 Well
Cd	Cadmium
COC	Chemicals of Concern
DEQ	Oklahoma Department of Environmental Quality
DI	Deionized
DO	Dissolved Oxygen
EPA	United States Environmental Protection Agency
Fe	Iron
FYR	Five-Year Review
GWMP	Groundwater Monitoring Plan
MCL	Maximum Contaminant Level
MW	Mine Water
O&M	Operation and Maintenance
O-3	Douthat Diversion Dike Site
ORP	Oxidation-Reduction Potential
OU	Operable Unit
OWRB	Oklahoma Water Resources Board
P5	Picher 5 Well
P6	Picher 6 Well
P7	Picher 7 Well
Pb	Lead
PWS	Public Water Supply
Q4	Quapaw 4 Well
Q5	Quapaw 5 Well
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RA	Remedial Action
RPD	Relative Percent Difference
ROD	Record of Decision
SC	Specific Conductance
SELS	State Environmental Laboratory Services
SMCL	Secondary Maximum Contaminant Level
SO_4	Sulfate
SOP	Standard Operating Procedure
USGS	United States Geological Survey
Zn	Zinc

8. References

1) U. S. Environmental Protection Agency (EPA). *Record of Decision, Remedial Alternative Selection.* June 6, 1984.

2) Oklahoma Department of Environmental Quality (DEQ). *Technical Memo: "Sampling Results of Public Water Supply Wells, August 1992 through January 1993, Tar Creek Superfund Site", OK*. December 1993.

3) Oklahoma Department of Environmental Quality (DEQ). *After Action Monitoring of the Roubidoux Aquifer at the Tar Creek Superfund Site, Ottawa County, OK*. 2014.

4) Oklahoma Department of Environmental Quality (DEQ). *Sixth Five-Year Review for Tar Creek Superfund Site*. July 2020.

5) Oklahoma Department of Environmental Quality (DEQ). *Operable Unit 1 Operation & Maintenance Annual Reports for Tar Creek Superfund Site*. 2017-2021.

6) Oklahoma Department of Environmental Quality (DEQ). *Operation & Maintenance Plan, Tar Creek Superfund Site, OU1*. February 28, 2018.

7) Oklahoma Department of Environmental Quality (DEQ). *Roubidoux Aquifer Groundwater Monitoring Plan, Tar Creek Superfund Site, OU1*. February 28, 2018.

8) Oklahoma Department of Environmental Quality (DEQ). *Quality Assurance Project Plan for Tar Creek Operable Unit 1 Operation & Maintenance*. October 2022.

9) Oklahoma Department of Environmental Quality (DEQ). *Roubidoux Well Plugging Project at the Tar Creek Superfund Site, Ottawa County, Oklahoma*. July 2021

APPENDIX A:

FIGURES

Figure 1: OU1 O&M Wells

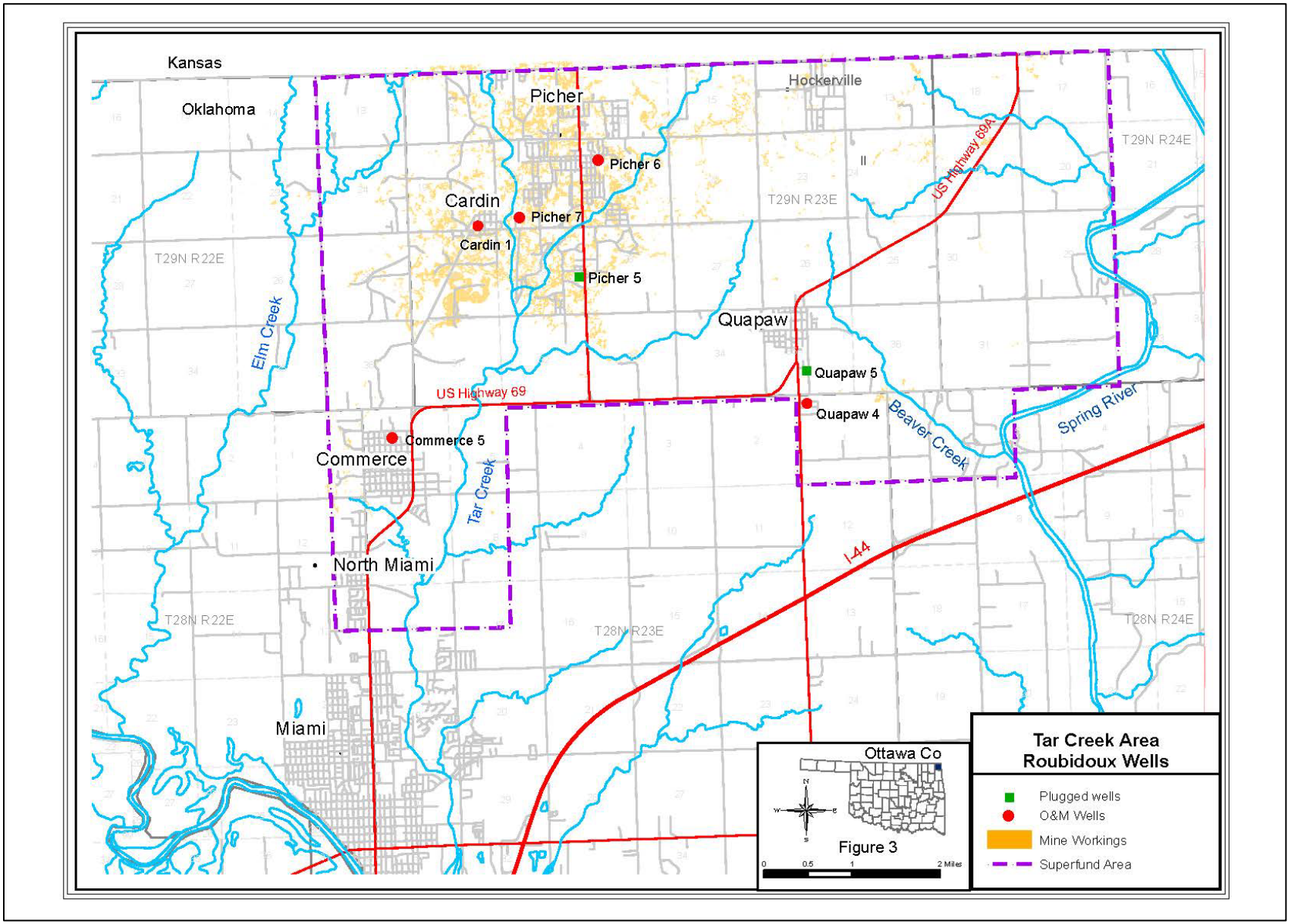
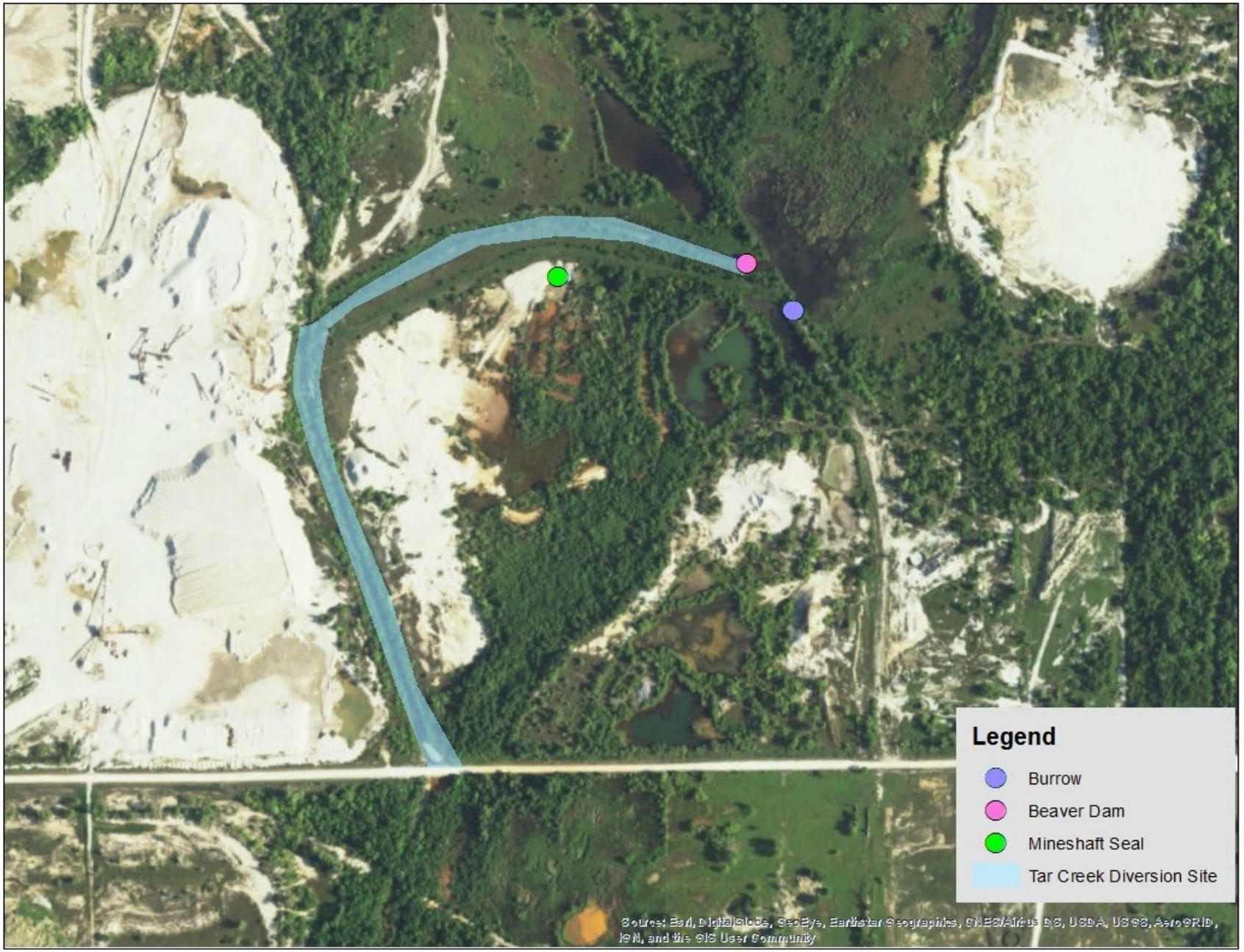
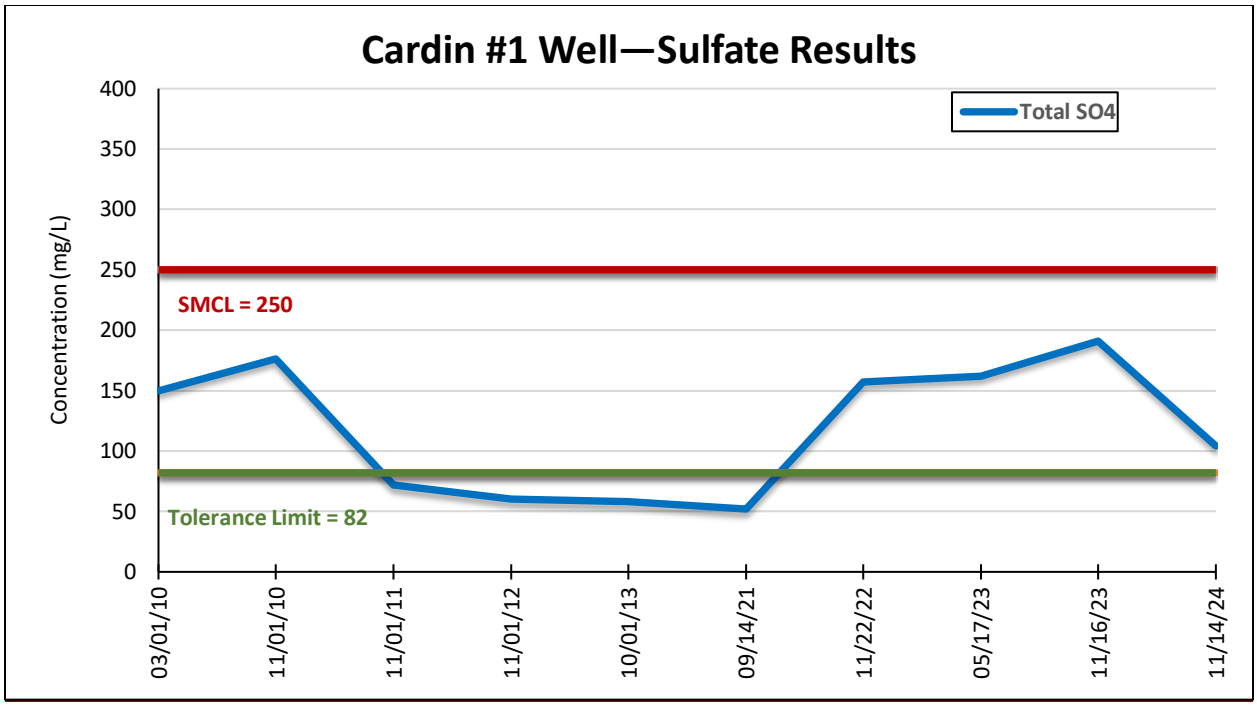
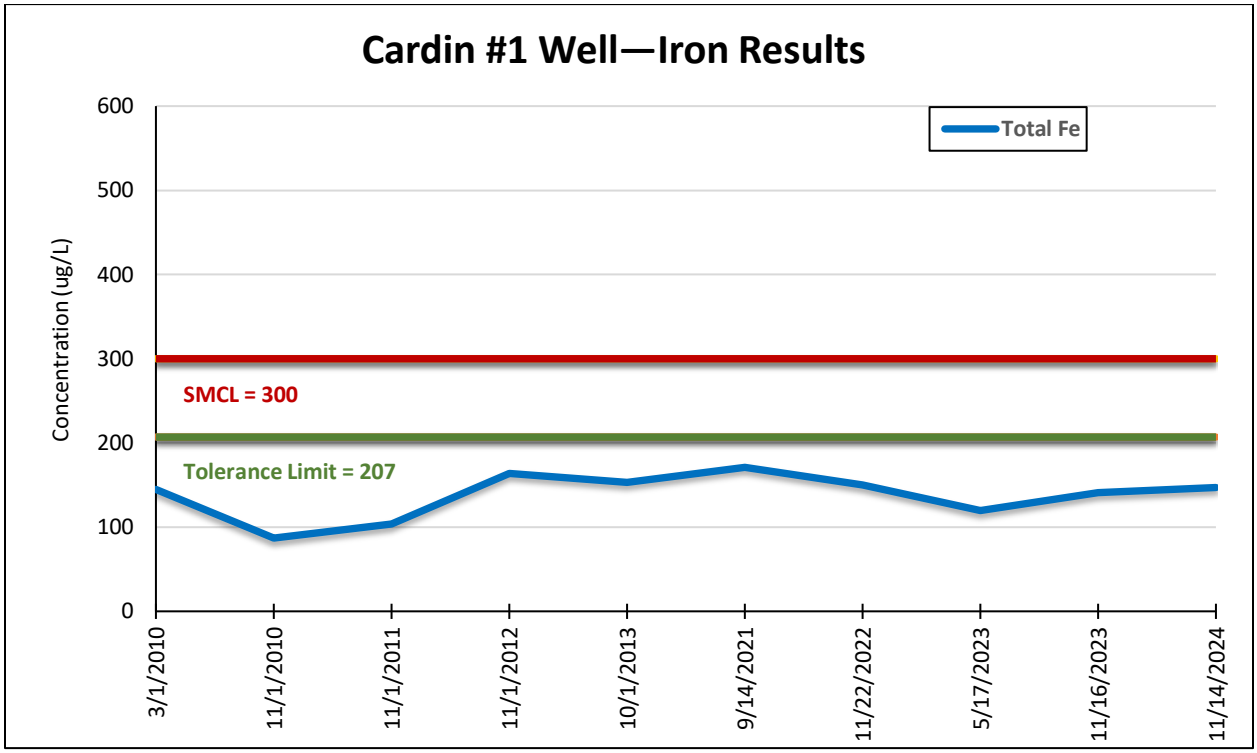


Figure 2: The Douthat Diversion Site (O-3) as observed during O&M inspection

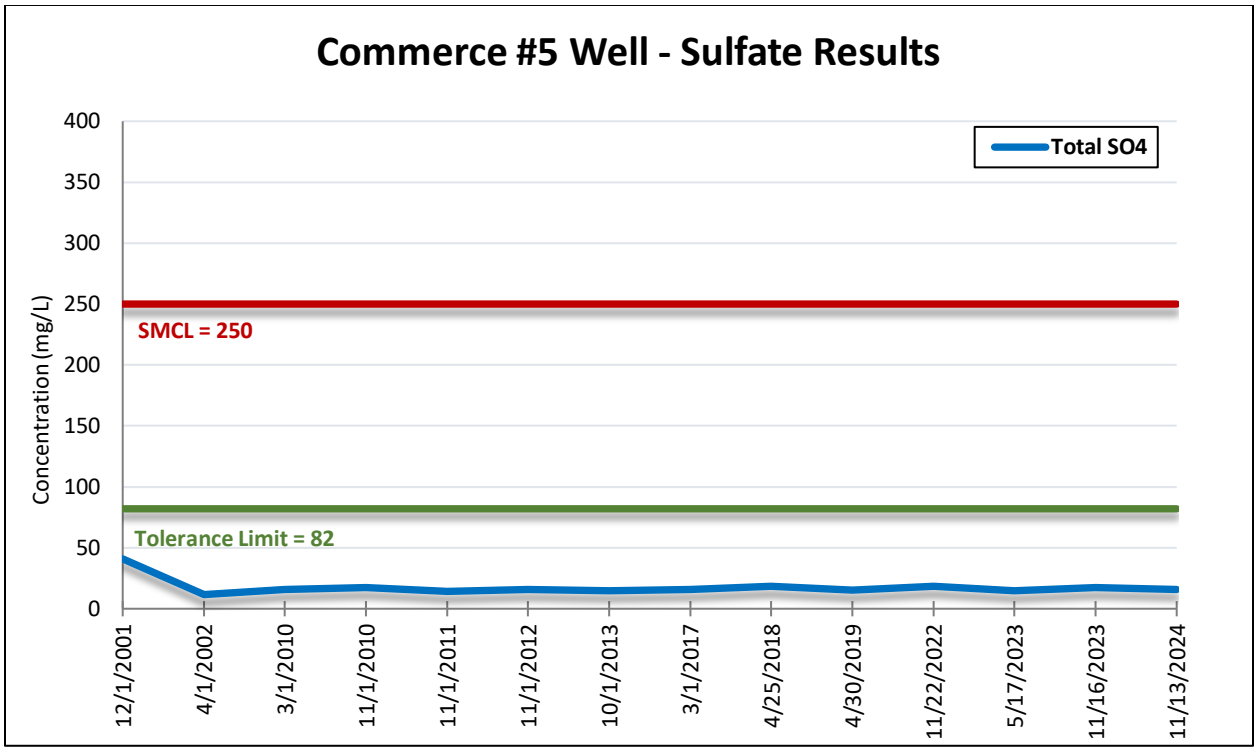


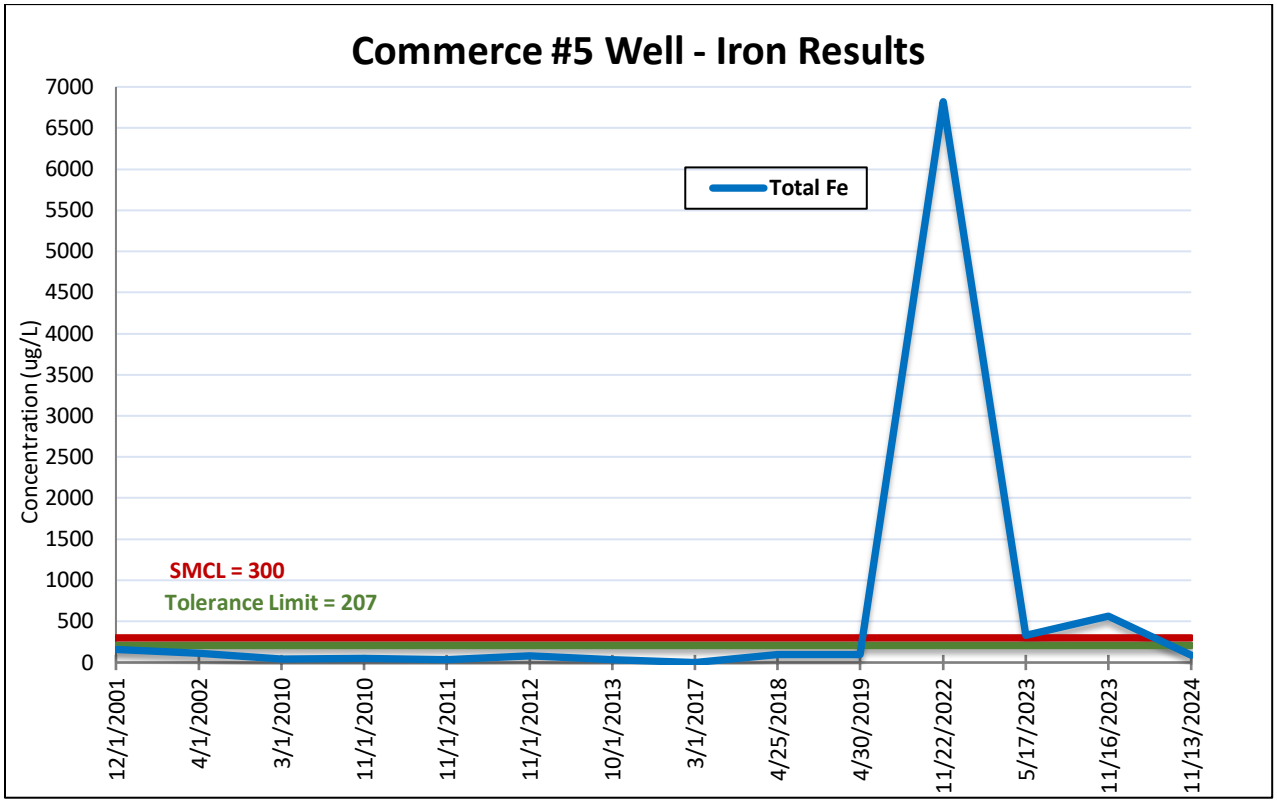
Figures 3A and 3B: Sulfate and Iron concentrations at Cardin #1 well compared to tolerance limits and SMCLs



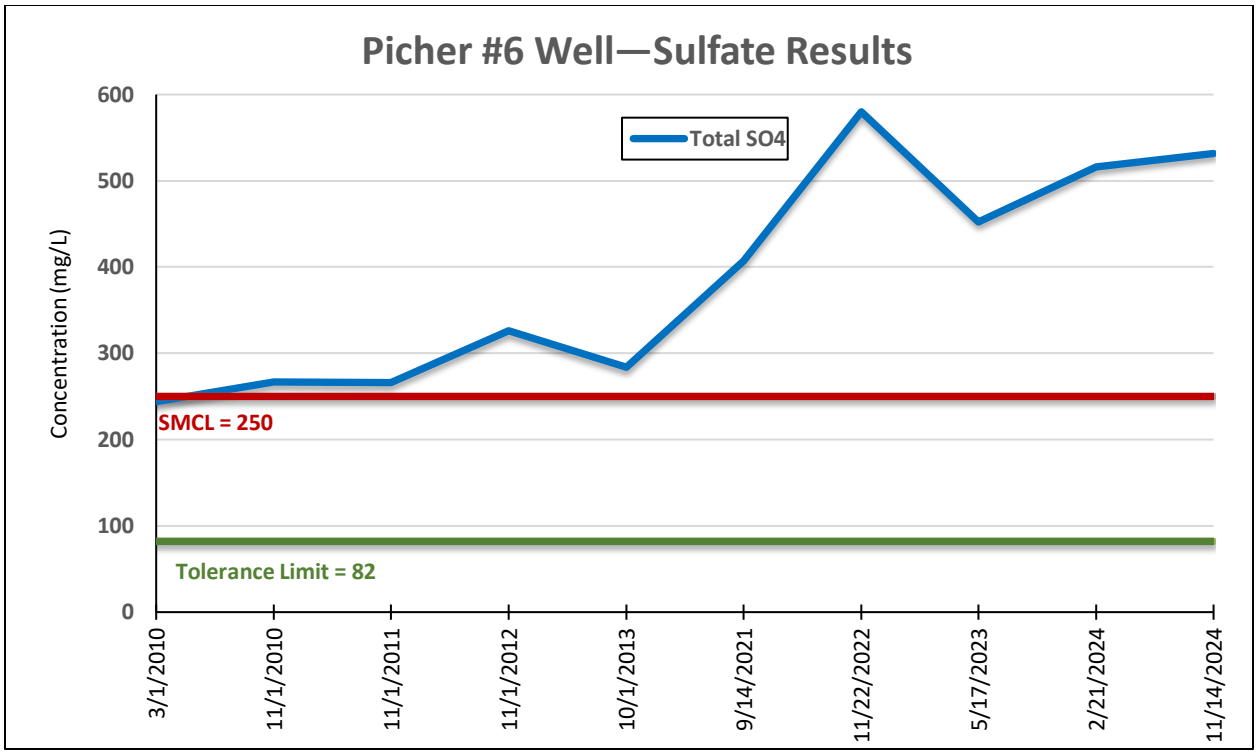


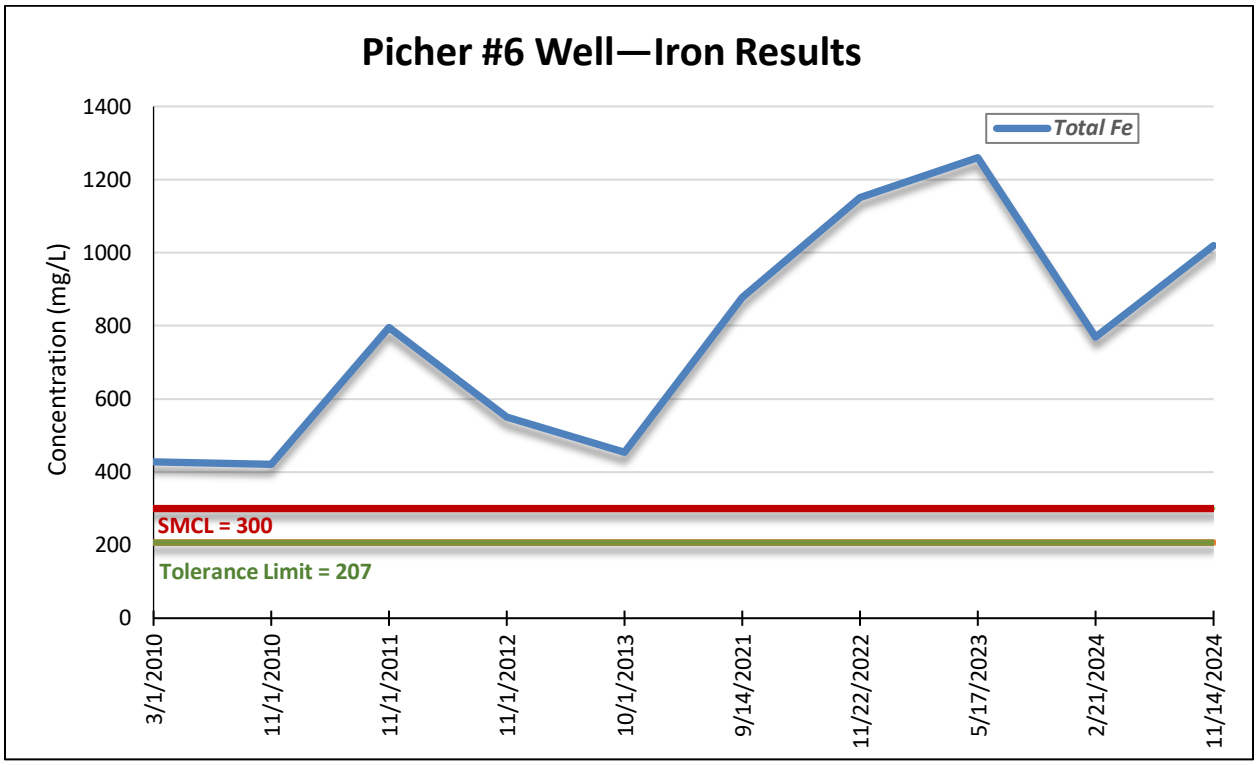
Figures 4A and 4B: Sulfate and Iron concentrations at Commerce #5 well compared to tolerance limits and SMCLs



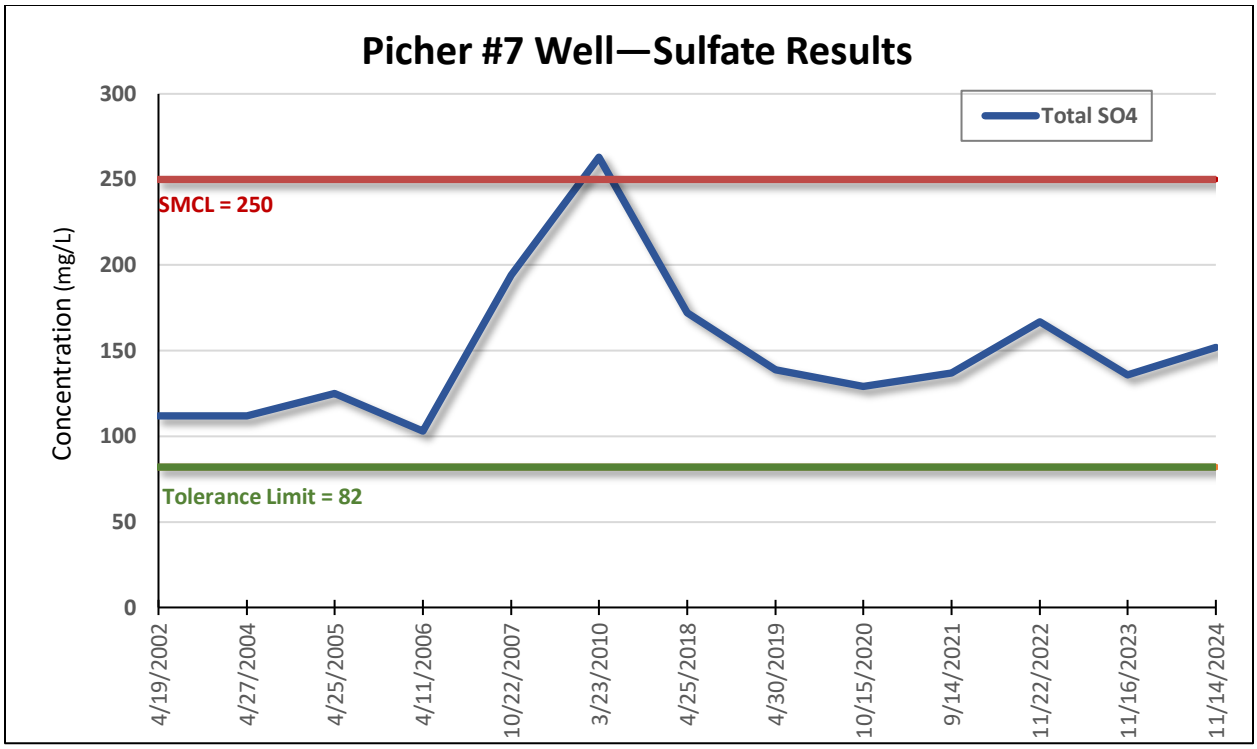


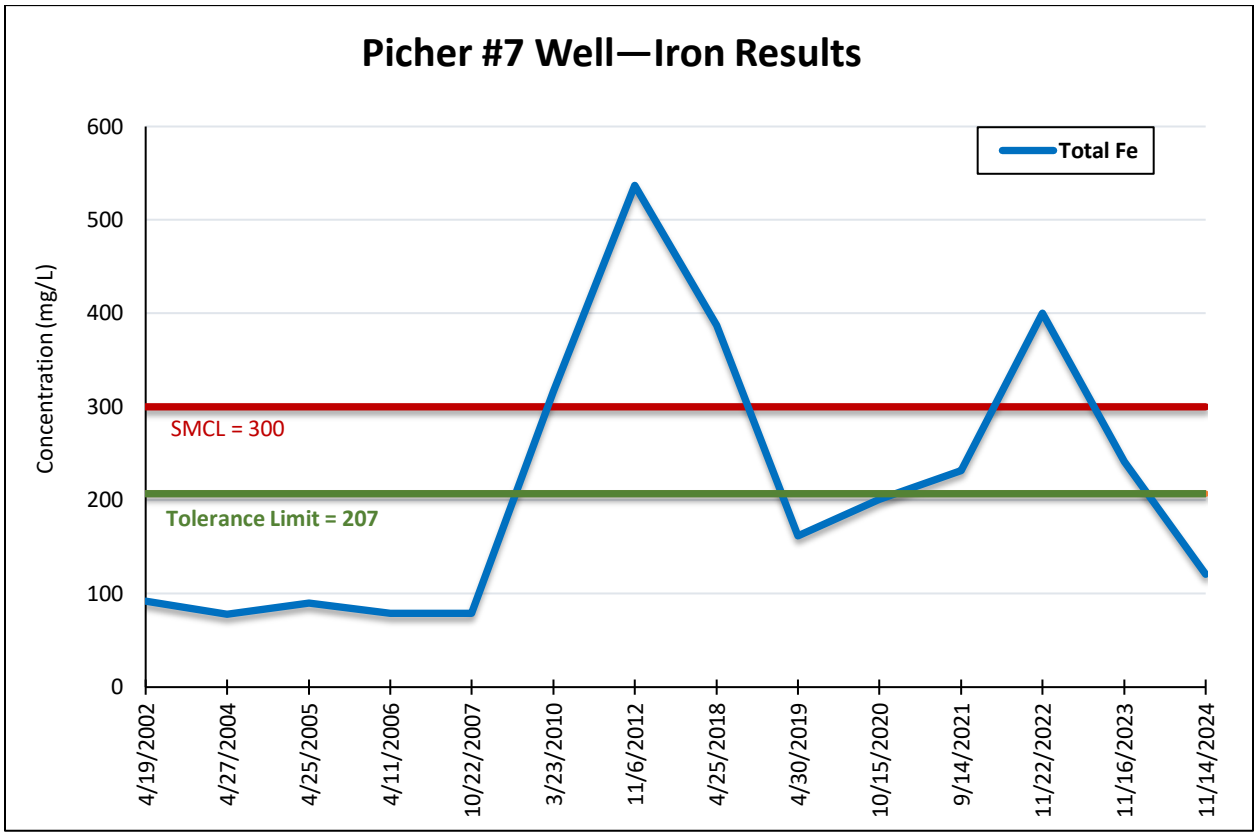
Figures 5A and 5B: Sulfate and Iron concentrations at Picher #6 well compared to tolerance limits and SMCLs



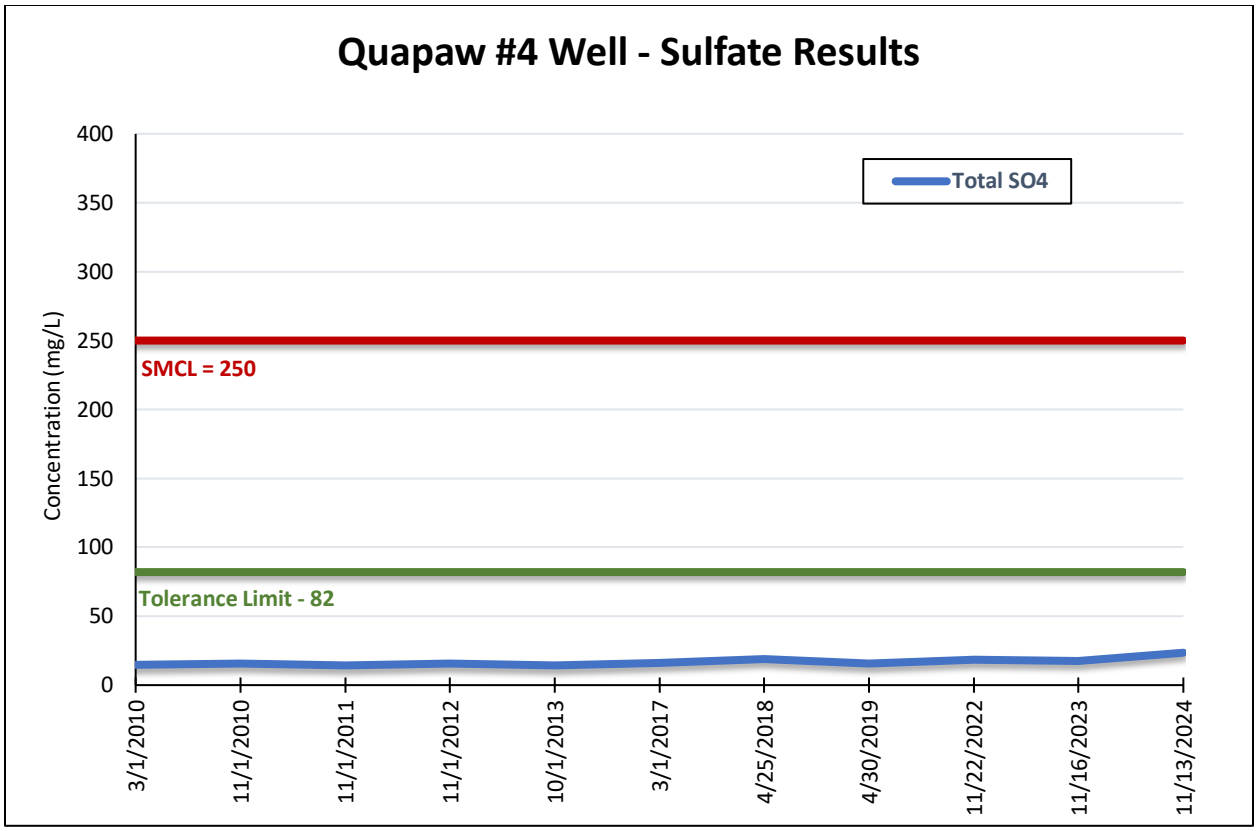


Figures 6A and 6B: Sulfate and Iron concentrations at Picher #7 well compared to tolerance limits and SMCLs





Figures 7A and 7B: Sulfate and Iron concentrations at Quapaw #4 well compared to tolerance limits and SMCLs



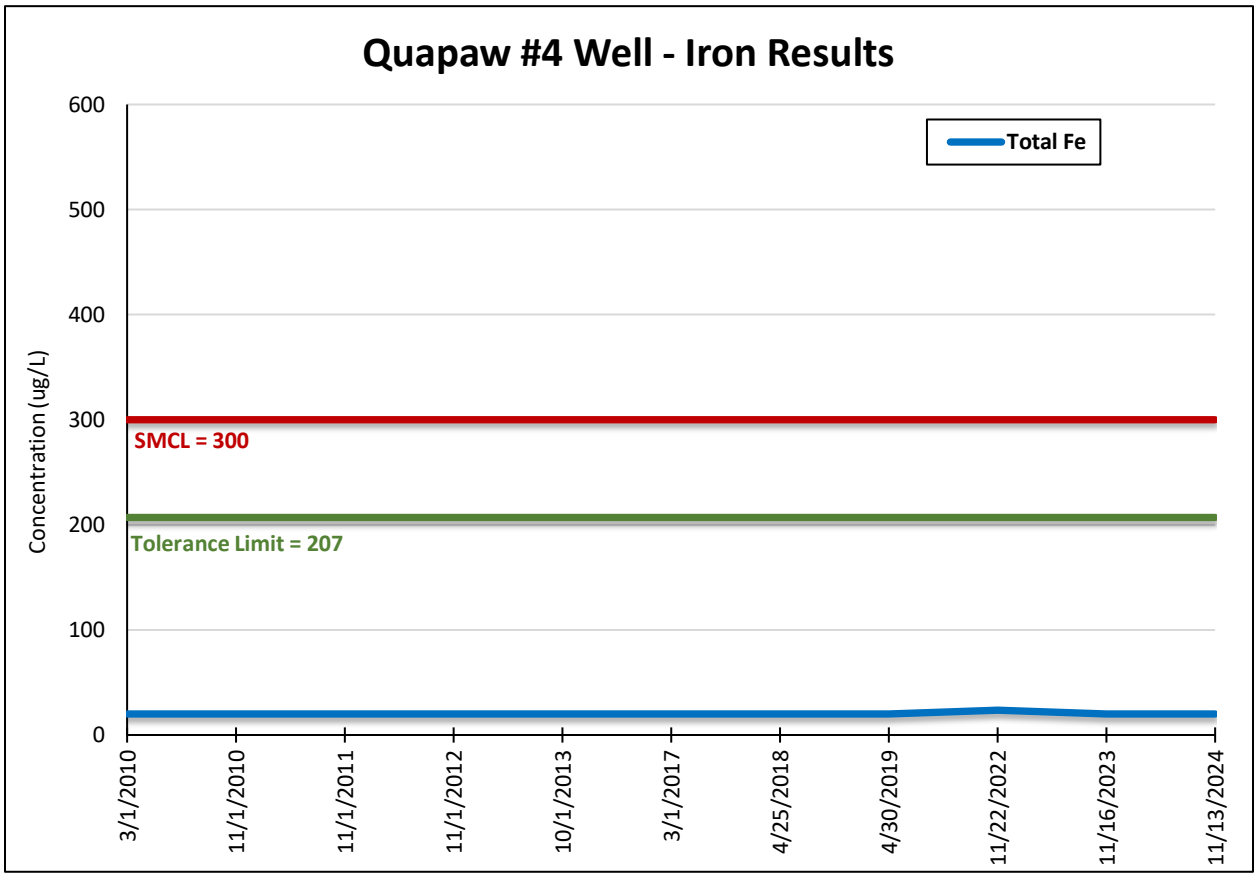
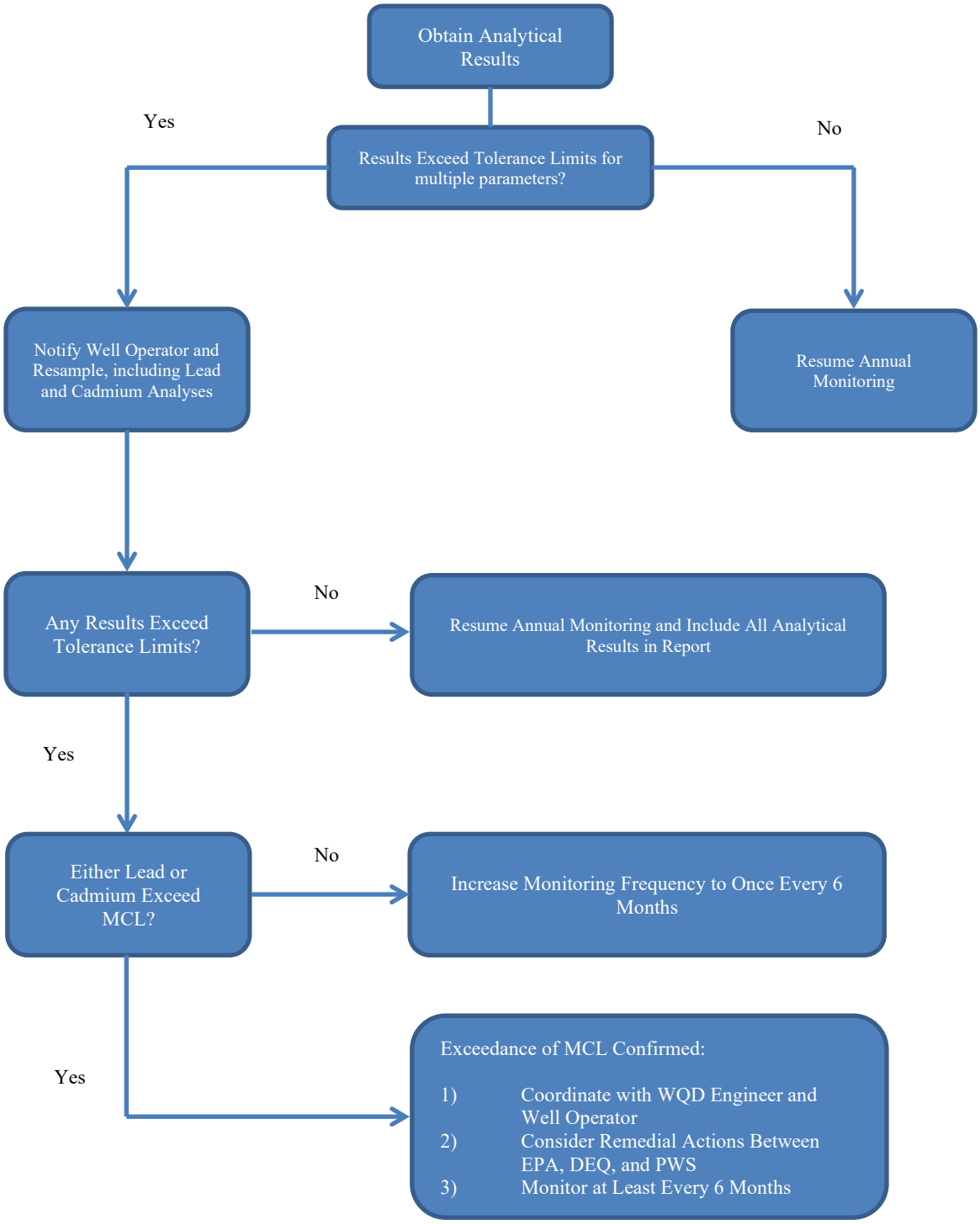


Figure 8. General response action plan



APPENDIX B:

Douthat Area Diversion Site (O-3) Inspection Form

I. SITE INFORMATION

Site name: OU1 Douthat Diversion Site	**Date of inspection:** 10/23/2024
Location and Region: Tar Creek, Ottawa County	**Weather/temperature:** Sunny, 77°F
Attachments: ■ Site map available within this report – Figure 2	

II. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
■ O&M manual ■ Readily available ■ Up to date ☐ N/A

Remarks: QAPP 10/31/22 All related O&M documents were available on-site.

2. **Site-Specific Health and Safety Plan** ■ Readily available ■ Up to date ☐ N/A
■ Contingency plan/emergency response plan ■ Readily available ■ Up to date ☐ N/A
Remarks

3. **O&M and OSHA Training Records** ■ Readily available ■ Up to date ☐ N/A
Remarks: All training is up to date for Ellen Isbell.

III. O&M COSTS

1. **O&M Maintenance Organization**
☐ Contractor for State ■ Other: Oklahoma Dept of Environmental Quality (DEQ)

Organization: _____

2. **O&M Cost Records**
■ Readily available ■ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate_____ Breakdown attached.

Total annual cost by year for review period if available

From_____	to_____	_____	☐ Breakdown attached
Date	Date	Total cost	
From_____	to_____	_____	☐ Breakdown attached
Date	Date	Total cost	
From_____	to_____	_____	☐ Breakdown attached
Date	Date	Total cost	
From_____	to_____	_____	☐ Breakdown attached
Date	Date	Total cost	
From_____	to_____	_____	☐ Breakdown attached
Date	Date	Total cost	

3. **Unanticipated or Unusually High O&M Costs During Review Period**
Describe costs and reasons: Not Applicable

IV. DIKE

1. **Road** ■ Location shown on site map ■ Road adequate
Remarks: The road wasn't too overgrown. The vegetation has been sparser since Flintrock maintained the road for use. We will continue to evaluate if the area needs maintenance, but it's manageable for inspection in its current state.

1. **Settlement** ☐ Location shown on site map ■ Settlement not evident
Areal extent_____ Depth_____
Remarks: _____

2. **Erosion** ■ Location shown on site map ☐ Erosion not evident
Areal extent_____ Depth_____
Remarks: There is an area about 20+ ft experiencing some erosion on the riparian area on either side of the "road" or path on top of the dike. This is the same area we have previously noted some wildlife activity and potential erosion with the recommendation for continued monitoring. Some reinforcements on the banks of this area are anticipated to prevent additional erosion caused by wildlife and flooding. The area has remained stable and has not had any noticeable or significant change in several years.

3. **Holes** ☐ Location shown on site map ☐ Holes not evident
Areal extent: _____ Depth:

Remarks:

4. **Bare Areas** ☐ Location shown on site map ■ N/A

Areal extent_____ Type_____
Remarks_____

6. **Excessive Vegetative Growth** Type: Grasses_____
☐ No evidence of excessive growth
■ Vegetation does not impede flow
☐ Location shown on site map Areal extent_____

Remarks: _____

7. **Slope Instability** ☐ Slides ☐ Location shown on site map ■ No evidence of slope instability
Areal extent_____
Remarks_____

V. CHANNEL

1. **Obstructions** Type: _____

■ No obstructions
□ Location shown on site map (Figure 2.)
Areal extent_____
Size_____
Remarks: There seems to be no beaver activity or dams currently in this area.
_____

2. **Erosion** □ Location shown on site map ■ Erosion not evident
Areal extent_____ Depth_____
Remarks_____
_____

VI. MINESHAFT SEAL

1. **Settlement** □ Location shown on site map ■ Settlement not evident
Areal extent_____ Depth_____
Remarks: This area remains stable. There have been no visible changes.
_____
_____

VII. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., containing contaminant plume, minimize infiltration and gas emission, etc.).

O-3 remedy was designed to reduce mine water produced via recharge of underground mines. Because the O-3 area remains a point of discharge rather than inflow for groundwater, the benefit of the diversion dike is limited to high-flow precipitation events.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. Discuss their relationship with the current and long-term protectiveness of the remedy.

Should the area south of the dike become a point of groundwater inflow, the current O&M procedures should ensure the integrity of the dike. The dike should be mowed if trees begin to grow on the dike or if vegetation growth becomes excessive and hinders inspections.

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

Bank or riparian area reinforcements to prevent further erosion.

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

N/A

INSPECTION/SAMPLE TEAM ROSTER

Ellen Isbell	DEQ	Environmental Programs Specialist
Kristen Bliss	DEQ	Environmental Programs Specialist

APPENDIX C:

Well Locations and Attributes

Groundwater Well Locations and Attributes

	Quapaw #4 (Q4)	Commerce #5 (C5)	Picher #7 (P7)	Picher #6 (P6)	Cardin #1 (CA1)
Location	NW NW NW S1-T28N-R23E (N 36°56'33.4'' W 94°47' 11.2'')	NW SE NW S6-T28N-R23E (N 36° 56' 19.4'' W 94° 52' 17.9'')	SW SE SW S20 T29N-R23E (N 36°58' 28.37" W 94°50' 38.26")	SE SE NW S21 T29N-R23E (N 36° 59' 00.7" W 94° 49' 21.1")	SW SE SE S19 T29N-R23E (N 36 58' 23.3" W 94 51' 07.2")
Type	Public Supply	Monitoring Well	Public Supply	Privately owned but moving to Public Supply	Monitoring Well
Elevation	845'	810'	814'	822'	817'
Total Depth	1,350'	1,100'	1,102'	1,100'	1,150'
Casing Depth	620'	8" at 850'	8" at 850'	850'	500'
Pump Depth	608'	795'	800'	777'	615'

APPENDIX D

Field Logbook

11/13/24 9:50AM

C5

55° F
SCATTERED RAIN
CLOUDY

WELL FLUSH START: 10:08

VSI	1	2	3
TIME:	10:23	10:35	10:40
pH:	7.68	7.94	7.96
TEMP:	19.3C	19.2	19.3
SC:	289.0	230	290.1
ORP:	-80.5	-55.5	-59.6
DO:	-.2/-.02	-.1/-0.01	-.2 -0.02

SAMPLE ID: 1948660-01,02,03

GRAB TIME: 10:42

SLIGHT SULPHUR SMELL.
WATER LOOKS CRISP + CLEAR
FLOW-METER DISABLED

C5 DUP

SAMPLE ID: 1948664-01, 02, 03

GRAB TIME: 10:44

MET KENNY KIMERER FOM CITY OF COMMERCE.

ELLEN ISBELL
NICK JOHNSON

11/13/24 11:23

Q4 59° F

CLOUDY

WELL FLUSH START: 11:35

YSI

	1	2	3
TIME:	11:50	11:55	NOON
pH:	8.11	8.11	8.11
TEMP:	18.7 C	18.7	18.8
SC:	304.1	297.5	290.1
ORP:	-61.0	-63.0	-23.0
DO:	-.2/-.02	-.2/-.02	-.2/-.02

SAMPLE ID: 1948663-01,02,03

GRAB TIME: 12:03

FLOW (GPM): 650

MET CHAZ STANLEY FROM TOWN OF QUAPAW.

TIDY, WELL KEPT.
GROUNDS LOOK GOOD.
CLEAN, CLEAR, WATER.

EI
NJ

Rite in the Rain

11/14/24

CAR 1

52°
SUNNY

FLUSH TIME START: 9:50

YSI

TIME:	10:07	10:12	10:17
pH:	7.06	7.74	7.73
TEMP:	18.2C	18.4	19.4
SC:	463	468.2	511
ORP:	87.0	33.5	-1.1
DO:	-.2/-.02	-.2/-.02	-.2/-.02

SAMPLE ID: 1948659-01,02,03

GRAB TIME: 10:20

FLOW(GPM): 90

ELLEN TSBELL
RUBY EDSELL
MET KEVIN CRAFTON

11/14/24

P7

54°
SUNNY

FLUSH TIME START: 10:33

YSI

TIME:	10:49	10:54	10:59
pH:	7.89	7.91	7.91
SC:	544	568	579
ORP:	152.0	348.0	-22.9
DO:	-.2/-.02	-.2/-.02	-.2/-.02
TEMP:	19.8	19.6	19.5

SAMPLE ID: 1948664-02,02,03

GRAB TIME: 11:02

FLOW(GPM): 180

EA
RE
KC

11/14/24

P6

FLUSH TIME START 11:14

VST

TIME	11:30	11:35	11:40
pH:	7.26	7.22	7.25
TEMP:	19.6	19.7	19.6
SC:	710	707	1346
ORP:	-216.5	-340.2	-126.1
DO:	-0.1/-.01	-.1/-0.1	-.1

SAMPLE ID: 1948606-01,02,03

GRAB TIME: 11:43

NO FLOW METER AVAILABLE.
SMALL SPIGOT PULLED.

~~EK~~
RE

KC

APPENDIX E

Lab Results

State Environmental Laboratory Services Division

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Report of Analysis

00239109.PDF

EMAIL TO
ELLEN ISBELL
ELLEN.ISBELL@DEQ.OK.GOV

PROJECT SUMMARY

Project: ISBELL-002_0015
Customer: ELLEN ISBELL
Account: ISBELL-002
Description: LPD - TAR CREEK OU1 O AND M
Program: ODEQ
Subprogram: Custom Report

AUTHORIZING SIGNATURE

George Russell - Division Director

PROJECT SAMPLE SUMMARY

Project Status: Complete

****BOLD** sample IDs are pending analysis or review and are not finalized.****

Sample ID	Sample Location	Sample Date	Sampler	Received Date	Receipt Temp. (°C)
ODEQ-1948659-01	TAR CREEK OU1 O&M CA1	11/14/24 10:20 am	EI	11/15/24 7:55 am	1.8
ODEQ-1948659-02	TAR CREEK OU1 O&M CA1	11/14/24 10:20 am	EI	11/15/24 7:55 am	1.8
ODEQ-1948659-03	TAR CREEK OU1 O&M CA1	11/14/24 10:20 am	EI	11/15/24 7:55 am	1.8
ODEQ-1948660-01	TAR CREEK OU1 O&M C5	11/14/24 10:42 am	EI	11/15/24 7:55 am	1.8
ODEQ-1948660-02	TAR CREEK OU1 O&M C5	11/14/24 10:42 am	EI	11/15/24 7:55 am	1.8
ODEQ-1948660-03	TAR CREEK OU1 O&M C5	11/14/24 10:42 am	EI	11/15/24 7:55 am	1.8
ODEQ-1948661-01	TAR CREEK OU1 O&M P6	11/14/24 10:43 am	EI	11/15/24 7:55 am	1.8
ODEQ-1948661-02	TAR CREEK OU1 O&M P6	11/14/24 10:43 am	EI	11/15/24 7:55 am	1.8
ODEQ-1948661-03	TAR CREEK OU1 O&M P6	11/14/24 10:43 am	EI	11/15/24 7:55 am	1.8
ODEQ-1948662-01	TAR CREEK OU1 O&M P7	11/14/24 11:02 am	EI	11/15/24 7:55 am	1.8
ODEQ-1948662-02	TAR CREEK OU1 O&M P7	11/14/24 11:02 am	EI	11/15/24 7:55 am	1.8
ODEQ-1948662-03	TAR CREEK OU1 O&M P7	11/14/24 11:02 am	EI	11/15/24 7:55 am	1.8
ODEQ-1948663-01	TAR CREEK OU1 O&M Q4	11/13/24 11:59 am	EI	11/15/24 7:55 am	1.8
ODEQ-1948663-02	TAR CREEK OU1 O&M Q4	11/13/24 11:59 am	EI	11/15/24 7:55 am	1.8
ODEQ-1948663-03	TAR CREEK OU1 O&M Q4	11/13/24 11:59 am	EI	11/15/24 7:55 am	1.8
ODEQ-1948664-01	TAR CREEK OU1 O&M Duplicate	11/13/24 10:44 am	EI	11/15/24 7:55 am	1.8
ODEQ-1948664-02	TAR CREEK OU1 O&M Duplicate	11/13/24 10:44 am	EI	11/15/24 7:55 am	1.8
ODEQ-1948664-03	TAR CREEK OU1 O&M Duplicate	11/13/24 10:44 am	EI	11/15/24 7:55 am	1.8

Customer satisfaction survey can be found at ***https://www.deq.ok.gov/divisions/sels/***

EPA DRINKING WATER CERTIFICATION #OK00013

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Report of Analysis

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Analytical Results

Sample ID: ODEQ-1948659-01
Sample Location: TAR CREEK OU1 O&M CA1

Analysis Method: EPA 375.4 **Analysis:** EPA375.4 Sulfate

Component	Result	Unit	Qualifiers	Analyst	Analyzed On
Sulfate	104	mg/L		JCJ	11/18/2024

Analytical Results

Sample ID: ODEQ-1948659-02
Sample Location: TAR CREEK OU1 O&M CA1

Analysis Method: EPA 200.7 **Analysis:** EPA200.7 Trace Elements

Component	Result	Unit	Qualifiers	Analyst	Analyzed On
Iron, Total	147	µg/L		VH	01/08/2025
Zinc, Total	<5.0	µg/L		VH	01/08/2025

Analysis Method: EPA 200.8 **Analysis:** EPA200.8 Trace Elements

Component	Result	Unit	Qualifiers	Analyst	Analyzed On
Cadmium, Total	<1.0	µg/L		AKA	12/02/2024
Lead, Total	<1.0	µg/L		AKA	12/02/2024

Analytical Results

Sample ID: ODEQ-1948659-03
Sample Location: TAR CREEK OU1 O&M CA1

Analysis Method: EPA 200.7 **Analysis:** EPA200.7 Trace Elements

Component	Result	Unit	Qualifiers	Analyst	Analyzed On
Iron, Dissolved	146	µg/L		VH	01/08/2025
Zinc, Dissolved	<5.0	µg/L		VH	01/08/2025

Analysis Method: EPA 200.8 **Analysis:** EPA200.8 Trace Elements

Component	Result	Unit	Qualifiers	Analyst	Analyzed On
Cadmium, Dissolved	<1.0	µg/L		AKA	12/02/2024
Lead, Dissolved	<1.0	µg/L		AKA	12/02/2024

Analytical Results

Sample ID: ODEQ-1948660-01
Sample Location: TAR CREEK OU1 O&M C5

Analysis Method: EPA 375.4 **Analysis:** EPA375.4 Sulfate

Component	Result	Unit	Qualifiers	Analyst	Analyzed On
Sulfate	15.9	mg/L		JCJ	11/18/2024

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Analytical Results

Sample ID: ODEQ-1948660-02
Sample Location: TAR CREEK OU1 O&M C5

Analysis Method: EPA 200.7 **Analysis:** EPA200.7 Trace Elements

Component	Result	Unit	Qualifiers	Analyst	Analyzed On
Iron, Total	92.2	µg/L		VH	01/08/2025
Zinc, Total	<5.0	µg/L		VH	01/08/2025

Analysis Method: EPA 200.8 **Analysis:** EPA200.8 Trace Elements

Component	Result	Unit	Qualifiers	Analyst	Analyzed On
Cadmium, Total	<1.0	µg/L		AKA	12/02/2024
Lead, Total	<1.0	µg/L		AKA	12/02/2024

Analytical Results

Sample ID: ODEQ-1948660-03
Sample Location: TAR CREEK OU1 O&M C5

Analysis Method: EPA 200.7 **Analysis:** EPA200.7 Trace Elements

Component	Result	Unit	Qualifiers	Analyst	Analyzed On
Iron, Dissolved	123	µg/L		VH	01/08/2025
Zinc, Dissolved	<5.0	µg/L		VH	01/08/2025

Analysis Method: EPA 200.8 **Analysis:** EPA200.8 Trace Elements

Component	Result	Unit	Qualifiers	Analyst	Analyzed On
Cadmium, Dissolved	<1.0	µg/L		AKA	12/02/2024
Lead, Dissolved	<1.0	µg/L		AKA	12/02/2024

Analytical Results

Sample ID: ODEQ-1948661-01
Sample Location: TAR CREEK OU1 O&M P6

Analysis Method: EPA 375.4 **Analysis:** EPA375.4 Sulfate

Component	Result	Unit	Qualifiers	Analyst	Analyzed On
Sulfate	532	mg/L		JCJ	11/18/2024

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Analytical Results

Sample ID: ODEQ-1948661-02
Sample Location: TAR CREEK OU1 O&M P6

Analysis Method: EPA 200.7 **Analysis:** EPA200.7 Trace Elements

Component	Result	Unit	Qualifiers	Analyst	Analyzed On
Iron, Total	1020	µg/L		VH	01/08/2025
Zinc, Total	20.8	µg/L		VH	01/08/2025

Analysis Method: EPA 200.8 **Analysis:** EPA200.8 Trace Elements

Component	Result	Unit	Qualifiers	Analyst	Analyzed On
Cadmium, Total	<1.0	µg/L		AKA	12/02/2024
Lead, Total	<1.0	µg/L		AKA	12/02/2024

Analytical Results

Sample ID: ODEQ-1948661-03
Sample Location: TAR CREEK OU1 O&M P6

Analysis Method: EPA 200.7 **Analysis:** EPA200.7 Trace Elements

Component	Result	Unit	Qualifiers	Analyst	Analyzed On
Iron, Dissolved	992	µg/L		VH	01/08/2025
Zinc, Dissolved	21.6	µg/L		VH	01/08/2025

Analysis Method: EPA 200.8 **Analysis:** EPA200.8 Trace Elements

Component	Result	Unit	Qualifiers	Analyst	Analyzed On
Cadmium, Dissolved	<1.0	µg/L		AKA	12/02/2024
Lead, Dissolved	<1.0	µg/L		AKA	12/02/2024

Analytical Results

Sample ID: ODEQ-1948662-01
Sample Location: TAR CREEK OU1 O&M P7

Analysis Method: EPA 375.4 **Analysis:** EPA375.4 Sulfate

Component	Result	Unit	Qualifiers	Analyst	Analyzed On
Sulfate	152	mg/L		JCJ	11/18/2024

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Analytical Results

Sample ID: ODEQ-1948662-02
Sample Location: TAR CREEK OU1 O&M P7

Analysis Method: EPA 200.7 **Analysis:** EPA200.7 Trace Elements

Component	Result	Unit	Qualifiers	Analyst	Analyzed On
Iron, Total	121	µg/L		VH	01/08/2025
Zinc, Total	<5.0	µg/L		VH	01/08/2025

Analysis Method: EPA 200.8 **Analysis:** EPA200.8 Trace Elements

Component	Result	Unit	Qualifiers	Analyst	Analyzed On
Cadmium, Total	<1.0	µg/L		AKA	12/02/2024
Lead, Total	<1.0	µg/L		AKA	12/02/2024

Analytical Results

Sample ID: ODEQ-1948662-03
Sample Location: TAR CREEK OU1 O&M P7

Analysis Method: EPA 200.7 **Analysis:** EPA200.7 Trace Elements

Component	Result	Unit	Qualifiers	Analyst	Analyzed On
Iron, Dissolved	128	µg/L		VH	01/08/2025
Zinc, Dissolved	<5.0	µg/L		VH	01/08/2025

Analysis Method: EPA 200.8 **Analysis:** EPA200.8 Trace Elements

Component	Result	Unit	Qualifiers	Analyst	Analyzed On
Cadmium, Dissolved	<1.0	µg/L		AKA	12/02/2024
Lead, Dissolved	<1.0	µg/L		AKA	12/02/2024

Analytical Results

Sample ID: ODEQ-1948663-01
Sample Location: TAR CREEK OU1 O&M Q4

Analysis Method: EPA 375.4 **Analysis:** EPA375.4 Sulfate

Component	Result	Unit	Qualifiers	Analyst	Analyzed On
Sulfate	23.5	mg/L		JCJ	11/18/2024

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Analytical Results

Sample ID: ODEQ-1948663-02
Sample Location: TAR CREEK OU1 O&M Q4

Analysis Method: EPA 200.7 **Analysis:** EPA200.7 Trace Elements

Component	Result	Unit	Qualifiers	Analyst	Analyzed On
Iron, Total	<20.0	µg/L		VH	01/08/2025
Zinc, Total	<5.0	µg/L		VH	01/08/2025

Analysis Method: EPA 200.8 **Analysis:** EPA200.8 Trace Elements

Component	Result	Unit	Qualifiers	Analyst	Analyzed On
Cadmium, Total	<1.0	µg/L		AKA	12/02/2024
Lead, Total	<1.0	µg/L		AKA	12/02/2024

Analytical Results

Sample ID: ODEQ-1948663-03
Sample Location: TAR CREEK OU1 O&M Q4

Analysis Method: EPA 200.7 **Analysis:** EPA200.7 Trace Elements

Component	Result	Unit	Qualifiers	Analyst	Analyzed On
Iron, Dissolved	<20.0	µg/L		VH	01/08/2025
Zinc, Dissolved	<5.0	µg/L		VH	01/08/2025

Analysis Method: EPA 200.8 **Analysis:** EPA200.8 Trace Elements

Component	Result	Unit	Qualifiers	Analyst	Analyzed On
Cadmium, Dissolved	<1.0	µg/L		AKA	12/02/2024
Lead, Dissolved	<1.0	µg/L		AKA	12/02/2024

Analytical Results

Sample ID: ODEQ-1948664-01
Sample Location: TAR CREEK OU1 O&M Duplicate

Analysis Method: EPA 375.4 **Analysis:** EPA375.4 Sulfate

Component	Result	Unit	Qualifiers	Analyst	Analyzed On
Sulfate	15.4	mg/L		JCJ	11/18/2024

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Analytical Results

Sample ID: ODEQ-1948664-02
Sample Location: TAR CREEK OU1 O&M Duplicate

Analysis Method: EPA 200.7 **Analysis:** EPA200.7 Trace Elements

Component	Result	Unit	Qualifiers	Analyst	Analyzed On
Iron, Total	169	µg/L		VH	01/08/2025
Zinc, Total	<5.0	µg/L		VH	01/08/2025

Analysis Method: EPA 200.8 **Analysis:** EPA200.8 Trace Elements

Component	Result	Unit	Qualifiers	Analyst	Analyzed On
Cadmium, Total	<1.0	µg/L		AKA	12/02/2024
Lead, Total	<1.0	µg/L		AKA	12/02/2024

Analytical Results

Sample ID: ODEQ-1948664-03
Sample Location: TAR CREEK OU1 O&M Duplicate

Analysis Method: EPA 200.7 **Analysis:** EPA200.7 Trace Elements

Component	Result	Unit	Qualifiers	Analyst	Analyzed On
Iron, Dissolved	72.6	µg/L		VH	01/08/2025
Zinc, Dissolved	<5.0	µg/L		VH	01/08/2025

Analysis Method: EPA 200.8 **Analysis:** EPA200.8 Trace Elements

Component	Result	Unit	Qualifiers	Analyst	Analyzed On
Cadmium, Dissolved	<1.0	µg/L		AKA	12/02/2024
Lead, Dissolved	<1.0	µg/L		AKA	12/02/2024

Customer satisfaction survey can be found at ***https://www.deq.ok.gov/divisions/sels/***

EPA DRINKING WATER CERTIFICATION #OK00013

APPENDIX F

Photos

Diversion Dike

Diversion Dike

Evidence of erosion due to wildlife activity.

Well Cap Inspection.

Commerce #5

Quapaw #4

Cardin #1

Picher #6

November 14, 2024

Picher #6

Picher #7