STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

2022 Summary Report: Notus Nitrate Priority Area

The Idaho Department of Environmental Quality's Groundwater Quality Rule is intended to maintain and protect the existing high quality of Idaho's groundwater. By sampling and monitoring wells throughout the state, DEQ can assess water quality to aid in land use management decisions that impact groundwater.

This monitoring project is designed to provide the data necessary for evaluating trends in groundwater nitrate concentrations in and around the Notus Nitrate Priority Area (NPA).

Background

In 2022, DEQ evaluated the water quality and sampled for various contaminants within the Notus Nitrate Priority Area (NPA) in southwestern Idaho (Figure 1 and Figure 2). The Notus NPA was previously sampled in 2012 and 2017 as part of DEQ's statewide NPA monitoring program. The NPAs in Idaho are initially identified by the presence of elevated nitrate concentrations in groundwater samples collected by the DEQ or other agencies. Elevated nitrate concentrations indicate that the groundwater has been impacted by a nitrate source, typically wastewater/sewage, fertilizer, or animal waste, and the groundwater aquifer is susceptible to other surface contaminants. Once an area of elevated nitrate concentrations has been identified, DEQ conducts a more concentrated investigation by sampling domestic and irrigation wells in the area and using the data generated by the sampling to identify boundaries to the area of nitrate impact. The NPAs throughout the state are evaluated and ranked by existing nitrate concentrations, statistical trends in the nitrate concentrations over time (if

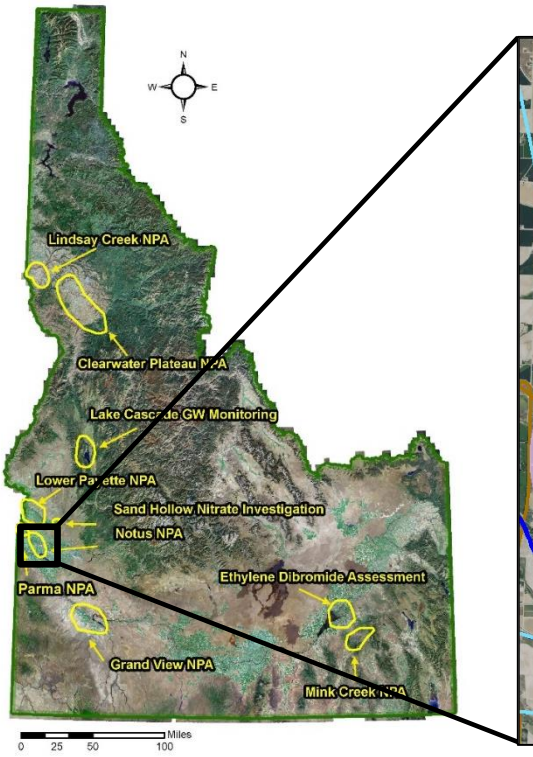

Figure 1. Location of Notus NPA in Idaho and other projects sampled in 2022.

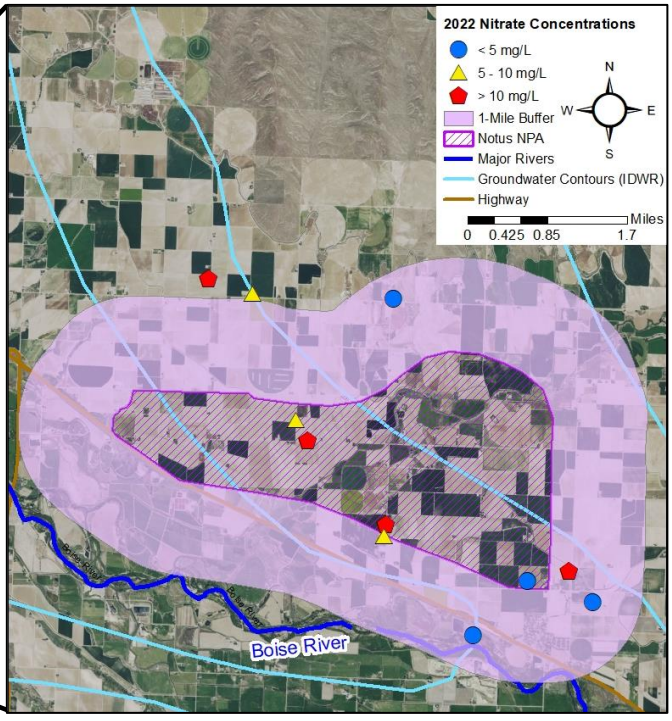

Figure 2. Locations of wells sampled in the Notus NPA and nitrate concentrations.

available), and local populations potentially affected. In 2020, the Notus NPA was ranked the 16th most impacted in the state (out of 35 NPAs), but a statistical trend in concentrations of groundwater (increasing, decreasing, or stable) was not determined (DEQ 2021).

The Notus NPA lies in the west-central region of the western Snake River Plain aquifer in southwestern Idaho between the Boise River and the north margin of the Boise Valley aquifer. Groundwater flow direction across the NPA is generally west-southwest toward the Boise River (see Figure 2—groundwater contours). Land use in the Parma NPA is generally agricultural and residential. The area is undergoing increased residential building on historical agricultural land creating a mix of rural-residential use. Residents rely on domestic wells and individual wastewater disposal (septic) systems.

Idaho Department of Water Resources (IDWR) Well Driller's Reports provided the depths of the 11 wells sampled in the Notus NPA ranging from 50 to 135 feet (average of 85 feet), with depths to groundwater of 4 to 63 feet (average of 32 feet). General lithology of the area as reported in the Well Driller's Reports was interbedded layers of gravel, sand, and clay, with groundwater sourced in sand and gravel aquifers (Graham and Campbell 1981).

Drinking Water Standards

The United States Environmental Protection Agency (EPA) sets national drinking water standards for approximately 90 contaminants. The maximum contaminant level (MCL) is an enforceable standard set by EPA that defines the maximum level of a contaminant allowed in water delivered to a public water system. DEQ adopts drinking water standards in the Groundwater Quality Rule, IDAPA 58.01.11.200. DEQ uses these standards to evaluate private well water quality.

Groundwater Monitoring Results

In 2022, DEQ collected groundwater samples from 11 domestic or irrigation wells in the Notus NPA. Samples were analyzed for nitrate, nitrite, nitrogen isotope ($\delta^{15}N$), uranium, arsenic, alkalinity, and bacteria to assess water quality in the project area. Five out of 11 wells had been previously sampled in 2017. The remaining six wells were sampled for the first time during the 2022 event. Sample results were provided to the homeowners.

Nitrate

Nitrate is a widespread groundwater contaminant in Idaho; common sources of nitrate include decaying plants and other organic matter, septic systems, byproducts from animal facilities, and nitrogen-based fertilizers. Four wells (36%) sampled in the Notus NPA had nitrate detections over the MCL (10 milligrams per liter [mg/L]). Three more had nitrate concentrations greater than half the MCL (5 mg/L). None of the 11 wells had detections for nitrite (Table 1).

The seven wells with nitrate detections of 5 mg/L or greater were also analyzed for $\delta^{15}N$. $\delta^{15}N$ is frequently used as an environmental tracer and can provide information on the origin and fate of nitrogen in a sample. Six wells (86%) had ratios in the -4‰ to +4‰ range, indicating the

nitrate source was likely commercial fertilizer. The isotope ratio for the remaining well was between 4.4‰ and 6.1‰, indicating a mix of organic sources (Seiler 1996).

Bacteria

All 11 wells were analyzed for *Escherichia coli* (*E. coli*) and total coliform (TC) bacteria. TC bacteria are common in the environment and are generally not harmful. *E. coli* is a subgroup of coliform found in greater quantities than TC in animal fecal matter. If *E. coli* is detected with TC, this indicates sewage waste is present, and disinfection is required (*Coliform Bacteria Fact Sheet*). Two wells (22%) had positive detections for TC, but no *E. coli* was detected in any sample (Table 1).

Table 1. Nutrient and bacteria concentrations.

DEQ Site ID	Well Depth	Sample Date	Nutrient Concentration			Isotopes	Bacteria Concentration[B]	
			Nitrite[A]	Nitrate[A]	Ammonia	N-15/14	E. coli	Total Coliform
			mg/L	mg/L	mg/L	‰	MPN/100 mL	MPN/100 mL
Water Quality Standard:			**1.0**	**10**	**No Stand.**	**No Stand.**	**<1**	**1.0**
1860	63	05/10/2022	<0.30	10.7	-	3.9	<1.0	<1.0
1862	60	05/10/2022	<0.30	7.40	-	3.5	<1.0	<1.0
1864	67	05/09/2022	<0.30	10.4	<0.050	3.9	<1.0	4.0
2522	98	05/09/2022	<0.30	10.3	<0.050	2.4	<1.0	11.0
2525	125	05/09/2022	<0.30	7.74	<0.050	2.7	<1.0	<1.0
3180	117	05/09/2022	<0.30	3.58	<0.050	-	<1.0	<1.0
3181	79.5	05/09/2022	<0.30	4.02	<0.050	-	<1.0	<1.0
3182	53	05/09/2022	<0.30	<0.18	0.73	-	<1.0	<1.0
3183	65	05/09/2022	<0.30	1.07	<0.050	-	<1.0	<1.0
3185	60	05/09/2022	<0.30	25.5	<0.050	3.0	<1.0	<1.0
3186	71	05/09/2022	<0.30	7.38	<0.050	5.6	<1.0	<1.0

Notes: mg/L = milligrams per liter; ‰ = permil; (-)=Not Analyzed; No Stand = No Primary or Secondary Drinking Water Regulation or Idaho Ground Water Quality Rule standard currently established; MPN/100 mL = most probable number per 100 milliliters.

[A] Contaminant with a National Primary Drinking Water Regulation standard.

[B] Total coliform and E. coli standards are from the Idaho Ground Water Quality Rule (IDAPA 58.01.11.200). An exceedance of the primary ground water quality standard for total coliform (indicated by gray shaded numbers) is not a violation of these rules. Total coliform is not a health threat in itself; it is used to indicate whether other potentially harmful bacteria may be present. Although the standards are given in cfu/100 mL, analytical results provided in MPN/100 mL are acceptable for comparison to the standard.

Arsenic

As naturally occurring element in the earth's crust, trace amounts of arsenic are found in all living matter, rocks, soil, water, and air. Water that encounters rock formations can dissolve arsenic and carry it into underground aquifers, streams, and rivers that may be used as drinking water sources. Seven of the 11 wells (64%) sampled were over the MCL for arsenic (0.01 mg/L). Data compiled by the IDWR also shows higher arsenic concentrations in southwestern Idaho.

Uranium

Uranium is a naturally occurring element in rock that can percolate into groundwater after erosion. Ten of the 11 wells (91%) sampled in the Notus NPA had uranium detections, but only one well (76 micrograms per liter [µg/L]) had a detection over the MCL (30 µ/L).

Conclusions

Four wells out of 11 sampled in 2022 in the Notus NPA were above the MCL for nitrate. No statistical trends were established because data from the same wells analyzed in previous sampling events were unavailable. Uranium and arsenic results are consistent with ambient concentrations in the area. DEQ will use the results to evaluate the NPAs and determine the extent and level of concern of groundwater degradation. Sampling will be conducted again in 2027.

All Notus NPA sampling results are available at *Ground Water Quality Monitoring and Protection*.

Contact: DEQ Boise Regional Office, (208) 373-0550

References

DEQ (Idaho Department of Environmental Quality). 2021. *2020 Nitrate Priority Area Delineation and Ranking Process*. Boise: DEQ Water Quality Division. *https://www2.deq.idaho.gov/admin/LEIA/api/document/download/14704*.

Graham, W.G. and L.J. Campbell. 1981. *Groundwater Resources of Idaho*. Boise, ID: Idaho Department of Water Resources.

IDAPA. 1997. “Ground Water Quality Rule.” Idaho Administrative Code. IDAPA 58.01.11.200.

Seiler, R.L. 1996. *Methods for Identifying Sources of Nitrogen Contamination of Ground Water in Valleys in Washoe County, Nevada*. US Geological Survey Open-File Report 96-461.

STATE OF IDAHO
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2022 Summary Report: Parma Nitrate Priority Area

The Idaho Department of Environmental Quality's Groundwater Quality Rule is intended to maintain and protect the existing high quality of Idaho's groundwater. By sampling and monitoring wells throughout the state, DEQ can assess water quality to aid in land use management decisions that impact groundwater.

This monitoring project is designed to provide the data necessary for evaluating trends in groundwater nitrate concentrations in and around the Parma Nitrate Priority Area (NPA).

Background

In 2022, DEQ evaluated water quality and sampled for various contaminants within the Parma NPA in Canyon County, Idaho (Figure 1 and Figure 2). The Parma NPA was previously sampled in 2012 and 2017 as part of DEQ's statewide NPA monitoring program. The NPAs in Idaho are initially identified by the presence of elevated nitrate concentrations in groundwater samples collected by the DEQ or other agencies. Elevated nitrate concentrations indicate that the groundwater has been impacted by a nitrate source, typically wastewater/sewage, fertilizer, or animal waste, and the groundwater aquifer is susceptible to other surface contaminants. Once an area of elevated nitrate concentrations has been identified, DEQ conducts a more concentrated investigation by sampling domestic and irrigation wells in the area and using the data generated by the sampling to identify boundaries to the area of nitrate impact. The NPAs throughout the state are evaluated and ranked by existing nitrate concentrations, statistical trends in the nitrate concentrations over time (if available), and local populations potentially affected. In 2020, the Parma NPA was ranked 25th in the state (out of 35 NPAs), but a statistical

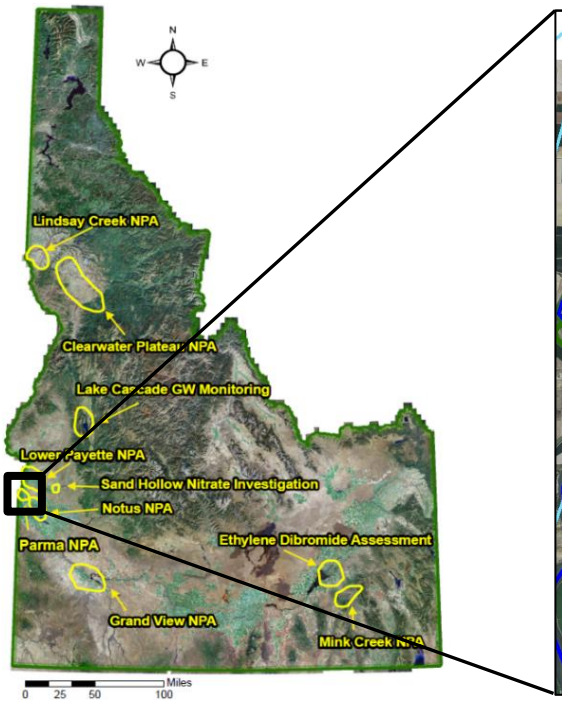

Figure 2. Location of Parma NPA in Idaho and other projects sampled in 2022.

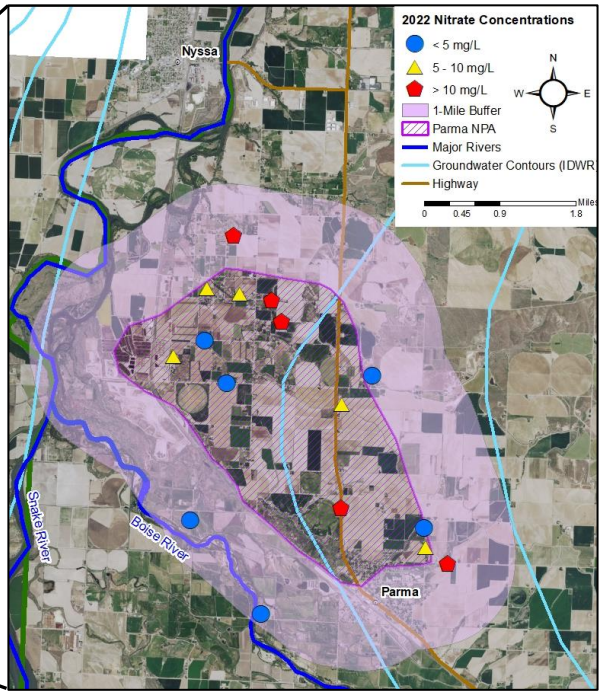

Figure 2. Locations of wells sampled in the Parma NPA and nitrate concentrations.

trend of nitrate concentrations in groundwater (increasing, decreasing, or stable) was not determined (DEQ 2021).

The Parma NPA lies between the Boise River to the south and north margin of the Boise Valley, located in the west-central region of the western Snake River Plain aquifer in southwestern Idaho. Groundwater flow direction in the Parma NPA trends west toward the Snake River on the Idaho-Oregon border (see Figure 2—groundwater contours). Land use in the Parma NPA is generally agricultural and residential. The area is undergoing increased residential building on historical agricultural land creating a mix of rural-residential use. Residents rely on domestic wells and individual wastewater disposal (septic) systems.

Idaho Department of Water Resources (IDWR) Well Driller's Reports provided the depths of the 16 wells sampled in the Parma NPA ranging from 37 to 125 feet (average of 70 feet), with depths to groundwater of 1.5 to 79 feet (average of 21 feet). General lithology of the area as reported in the Well Driller's Reports was interbedded layers of gravel, sand, and clay, with groundwater sourced in sand and gravel aquifers (Graham and Campbell 1981).

Drinking Water Standards

The United States Environmental Protection Agency (EPA) sets national drinking water standards for approximately 90 contaminants. The maximum contaminant level (MCL) is an enforceable standard set by EPA that defines the maximum level of a contaminant allowed in water delivered to a public water system. DEQ adopts drinking water standards in the Groundwater Quality Rule, IDAPA 58.01.11.200. DEQ uses these standards to evaluate private well water quality.

Groundwater Monitoring Results

In 2022, DEQ sampled groundwater from 16 domestic or irrigation wells in the Parma NPA. Samples were analyzed for nitrate, nitrite, nitrogen isotope ($\delta^{15}N$), uranium, arsenic, alkalinity, and bacteria to assess water quality in the project area. Several wells sampled in previous years were unavailable for this sampling event. DEQ sampled 8 of the 12 wells sampled in 2017 and 5 of the 7 wells sampled in 2012 and 2017. Nine new wells were added in the areas previously sampled. Sample results were provided to the homeowners.

Nitrate

Nitrate is a widespread groundwater contaminant in Idaho; common sources of nitrate include decaying plants and other organic matter, septic systems, byproducts from animal facilities, and nitrogen-based fertilizers. Five wells (31%) sampled in the Parma NPA had nitrate detections over the MCL (10 milligrams per liter [mg/L]). None of the 16 wells had detections for nitrite. Two wells were under the nitrate MCL, but ammonia was present. Currently, no MCL exists for ammonia.

Wells with nitrate detections of 5 mg/L or greater were also analyzed for $\delta^{15}N$ (10 wells). $\delta^{15}N$ is frequently used as an environmental tracer and can provide information on the origin and fate

of nitrogen in a sample. Fifty percent had ratios from -4‰ to +4‰, indicating the nitrate source was likely commercial fertilizer. The other 50% were between 4.4‰ and 6.1‰, indicating a mix of organic sources. No nitrogen isotope results were above +9.0‰, which would point to waste sources (Seiler 1996).

Bacteria

All 16 wells were analyzed for *Escherichia coli* (*E. coli*) and total coliform (TC) bacteria. TC bacteria are common in the environment and are generally not harmful. *E. coli* is a subgroup of coliform found in greater quantities than TC in animal fecal matter. If *E. coli* is detected with TC, this indicates sewage waste is present, and disinfection is required (*Coliform Bacteria Fact Sheet*). Two wells (12.5%) had positive detections for TC, but no *E. coli* was detected in any sample.

Table 1. Nutrient, isotope, and bacteria concentrations.

DEQ Site ID	Well Depth	Sample Date	Nutrient Concentration			Isotopes	Bacteria Concentration[B]	
			Nitrite[A]	Nitrate[A]	Ammonia	N-15/14	E. Coli	Total Coliform
			mg/L	mg/L	mg/L	‰	MPN/100 mL	MPN/100 mL
Water Quality Standard:			**1.0**	**10**	**No Stand.**	**No Stand.**	**<1**	**1.0**
1837	65	05/11/2022	<0.30	3.44	<0.050	-	<1.0	<1.0
1839	125	05/11/2022	<0.30	4.92	-	-	<1.0	<1.0
1842	55	05/11/2022	<0.30	9.79	-	1.8	<1.0	<1.0
1920	104	05/11/2022	<0.30	7.27	-	4.4	<1.0	<1.0
1923	58	05/10/2022	<0.30	9.74	<0.050	5.6	<1.0	<1.0
2551	84	05/11/2022	<0.30	<0.18	3.2	-	<1.0	8.0
2555	70	05/10/2022	<0.30	8.03	<0.50	6.4	<1.0	<1.0
2575	98	05/11/2022	<0.30	0.542	1.2	-	<1.0	727
3172	70	05/11/2022	<0.30	10.2	<0.050	3.9	<1.0	<1.0
3173	37	05/11/2022	<0.30	14.9	-	2.9	<1.0	<1.0
3174	61	05/11/2022	<0.30	13.5	-	4.9	<1.0	<1.0
3175	73	05/10/2022	<0.30	13.4	<0.050	3.5	<1.0	<1.0
3176	46	05/10/2022	<0.30	2.22	<0.050	-	<1.0	<1.0
3177	75	05/10/2022	<0.30	2.79	<0.050	-	<1.0	<1.0
3178	48	05/11/2022	<0.30	6.42	-	6.1	<1.0	<1.0
3179	57	05/10/2022	<0.30	19.5	<0.050	3.0	<1.0	<1.0

Notes: mg/L = milligrams per liter; ‰ = permil; (-)=Not Analyzed; No Stand = No Primary or Secondary Drinking Water Regulation or Idaho Ground Water Quality Rule standard currently established; MPN/100 mL = most probable number per 100 milliliters.

[A] Contaminant with a National Primary Drinking Water Regulation standard.

[B] Total coliform and E. coli standards are from the Idaho Ground Water Quality Rule (IDAPA

58.01.11.200). An exceedance of the primary ground water quality standard for total coliform (indicated by gray shaded numbers) is not a violation of these rules. Total coliform is not a health threat in itself; it is used to indicate whether other potentially harmful bacteria may be present. Although the standards are given in cfu/100 mL, analytical results provided in MPN/100 mL are acceptable for comparison to the standard.

Arsenic

As naturally occurring element in the earth's crust, trace amounts of arsenic are found in all living matter, rocks, soil, water, and air. Water that encounters rock formations can dissolve arsenic and carry it into underground aquifers, streams, and rivers that may be used as drinking water sources. In the Parma NPA, 87.5% of the wells sampled (14 wells) were over the MCL (0.01 mg/L) for arsenic. Data compiled by the IDWR also shows higher arsenic concentrations in southwestern Idaho.

Uranium

Uranium is a naturally occurring element in rock that can percolate into groundwater after erosion. Fifteen wells in the Parma NPA (94%) had uranium detections, but only one well (33 micrograms per liter [µg/L]) had a detection over the MCL (30 µg/L).

Conclusions

Five wells sampled for the first time in 2022 in the Parma NPA were above the MCL for nitrate. These five wells were also above the MCL for arsenic but had detections below the MCL for all other analytes. In 2022, DEQ sampled more wells than in previous Parma NPA sampling events. DEQ will use the results to evaluate the NPAs and determine the extent and level of concern of groundwater degradation. Sampling will be conducted again in 2027.

All Parma NPA sampling results are available at *Ground Water Quality Monitoring and Protection*.

Contact: DEQ Boise Regional Office, (208) 373-0550

References

DEQ (Idaho Department of Environmental Quality). 2021. *2020 Nitrate Priority Area Delineation and Ranking Process*. Boise: DEQ Water Quality Division. *https://www2.deq.idaho.gov/admin/LEIA/api/document/download/14704.*

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2022 Summary Report: Lower Payette Nitrate Priority Area

One of the missions of the Idaho Department of Environmental Quality (DEQ) is to maintain and protect the existing high quality of Idaho's groundwater. By sampling and monitoring wells throughout the state, we can assess water quality to aid in land use management decisions that impact groundwater.

This monitoring project is designed to provide the data necessary for evaluating trends in groundwater nitrate concentrations in and around the Lower Payette Nitrate Priority Area (NPA).

Background

In 2022, DEQ evaluated the water quality and sampled for various contaminants within the Lower Payette Nitrate Priority Area (NPA) in western Idaho (Figure 1 and Figure 2). This NPA was previously sampled in 2016 as part of DEQ's statewide NPA monitoring program. NPAs in Idaho are initially identified by the presence of elevated nitrate concentrations in groundwater samples collected by DEQ or other agencies. Elevated nitrate concentrations indicate that the groundwater has been impacted by a nitrate source, typically wastewater/sewage, fertilizer, or animal waste, and the groundwater aquifer is susceptible to other surface contaminants. Once an area of elevated nitrate concentrations has been identified, DEQ conducts a more

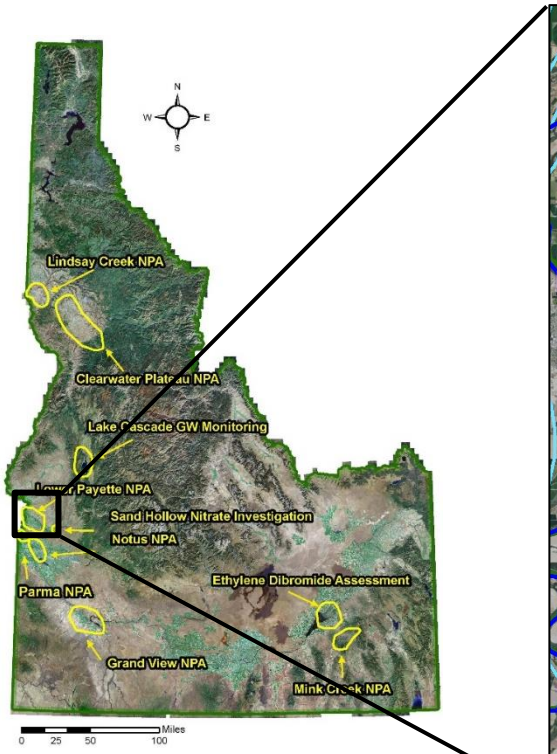

Figure 1. Location of Lower Payette NPA in Idaho and other projects sampled in 2022.

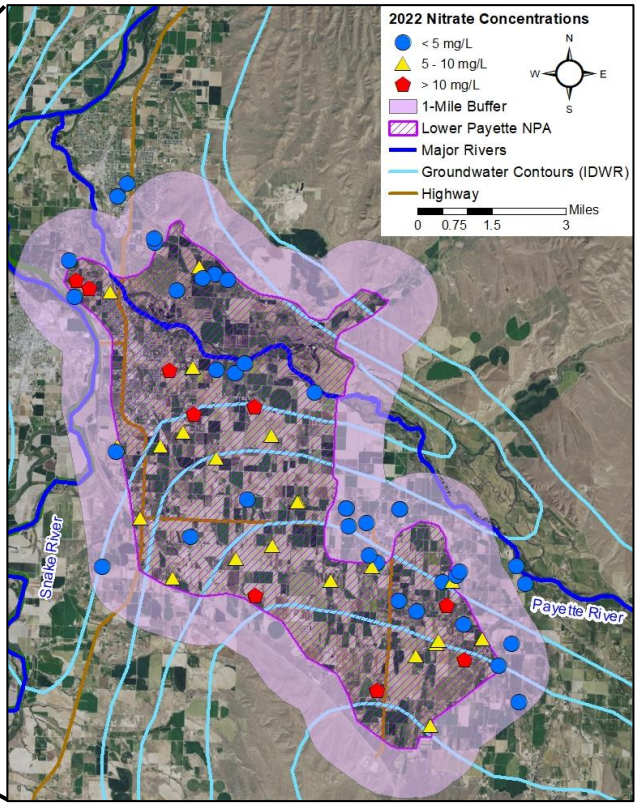

Figure 2. Locations of wells sampled in the Lower Payette NPA and nitrate concentrations.

concentrated investigation by sampling domestic and irrigation wells in the area and using the data generated by the sampling to identify boundaries to the area of nitrate impact. The NPAs throughout the state are evaluated and ranked by existing nitrate concentrations, statistical trends in the nitrate concentrations over time (if available), and local populations potentially affected. In 2020, the Lower Payette NPA was ranked 18th in the state (out of 35 NPAs), but a statistical trend of nitrate concentrations in groundwater (increasing, decreasing, or stable) was not determined (DEQ 2021).

The Lower Payette NPA lies just south of the confluence of the Payette River and the Snake River in western Idaho. It encompasses the cities of Payette, Fruitland, and New Plymouth. Groundwater flow across the NPA trends north-northwest toward the confluence of the Payette and Snake Rivers (see Figure 2 groundwater contours). Land use in the Lower Payette NPA is generally agricultural and residential. The area is undergoing increased residential building on historical agricultural land, creating a mix of rural-residential use. Residents rely on domestic wells and individual wastewater disposal (septic) systems.

Idaho Department of Water Resources (IDWR) Well Driller's Reports provided the depths of the 69 wells sampled in the Lower Payette NPA ranging from 15 to 139 feet (average of 63 feet), with depths to groundwater of 3 to 85 feet (average of 22.5 feet). General lithology of the area is interbedded layers of gravel, sand, and clay, with groundwater sourced in sand and gravel aquifers (Graham and Campbell 1981).

Drinking Water Standards

The United States Environmental Protection Agency (EPA) sets national drinking water standards for approximately 90 contaminants. The maximum contaminant level (MCL) is an enforceable standard set by EPA that defines the maximum level of a contaminant allowed in water delivered to a public water system. DEQ adopts drinking water standards in the Groundwater Quality Rule, IDAPA 58.01.11.200. DEQ uses these standards to evaluate private well water quality.

Groundwater Monitoring Results

In 2022, DEQ collected groundwater from 69 domestic or irrigation wells in the Lower Payette NPA. Samples were analyzed for nitrate, nitrite, nitrogen isotope ($\delta^{15}N$), uranium, arsenic, alkalinity, and bacteria to assess water quality in the project area. Sixty wells had previously been sampled in 2016. Two other wells had been sampled during a different monitoring project. Seven wells were sampled for the first time during the 2022 event. Sample results were provided to the homeowners.

Nitrate and Nitrite

Nitrate is a widespread groundwater contaminant in Idaho; common sources of nitrate include decaying plants and other organic matter, septic systems, byproducts from animal facilities, and nitrogen-based fertilizers. Nine wells (13%) sampled in the Lower Payette NPA had nitrate

detections over the MCL (10 milligrams per liter [mg/L]). Nitrite was detected in Well 3207, but results were below the detection limit. No other wells had positive detections for nitrite.

Wells with nitrate detections of 5 mg/L or greater were also analyzed for $\delta^{15}N$ (34 wells). $\delta^{15}N$ is frequently used as an environmental tracer and can provide information on the origin and fate of nitrogen in a sample. Four wells (8%) had ratios in the -4‰ to +4‰ range, indicating the nitrate source was likely commercial fertilizer. Sixteen wells (47%) were between 4.4‰ and 6.1‰, indicating a mix of organic sources. Four wells (11%) had $\delta^{15}N$ ratios above +9.0‰, pointing to waste sources (Seiler 1996).

Bacteria

All 69 wells were analyzed for *Escherichia coli* (*E. coli*) and total coliform (TC) bacteria. TC bacteria are common in the environment and are generally not harmful. *E. coli* is a subgroup of coliform found in greater quantities than TC in animal fecal matter. If *E. coli* is detected with TC, this indicates sewage waste is present, and disinfection is required (*Coliform Bacteria Fact Sheet*). Eleven wells (16%) had positive detections for TC, but no *E. coli* was detected in any sample.

Arsenic

As naturally occurring element in the earth's crust, trace amounts of arsenic are found in all living matter, rocks, soil, water, and air. Water that encounters rock formations can dissolve arsenic and carry it into underground aquifers, streams, and rivers that may be used as drinking water sources. In the Lower Payette NPA, 42% of the wells sampled (29 wells) were over the MCL (0.01 mg/L) for arsenic. Data compiled by the IDWR also shows higher arsenic concentrations in southwestern Idaho. Previous sampling events in this NPA also resulted in similar arsenic concentrations.

Uranium

Uranium is a naturally occurring element in rock that can percolate into groundwater after erosion. Two wells (3%) in the Lower Payette NPA had detections of uranium over the MCL (30 micrograms per liter [µg/L])—Well 2578 at 35 µg/L and Well 2023 at 37 µg/L.

Conclusions

Nine out of 69 wells sampled in the Lower Payette NPA were above the MCL for nitrate. DEQ will use the results to evaluate NPAs and determine the extent and level of concern of groundwater degradation. Sampling will be conducted again in 2027.

All Lower Payette NPA sampling results are available at *Ground Water Quality Monitoring and Protection*.

Contact: DEQ Boise Regional Office, (208) 373-0550

References

DEQ (Idaho Department of Environmental Quality). 2021. *2020 Nitrate Priority Area Delineation and Ranking Process*. Boise: DEQ Water Quality Division. *https://www2.deq.idaho.gov/admin/LEIA/api/document/download/14704.*

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2022 Summary Report: Lake Cascade Groundwater Monitoring

The Idaho Department of Environmental Quality's Groundwater Quality Rule is intended to maintain and protect the existing high quality of Idaho's groundwater. By sampling and monitoring wells throughout the state, DEQ can assess water quality to aid in land use management decisions that impact groundwater.

This monitoring project is designed to assess water quality in wells adjacent to Lake Cascade for evidence of potential septic influence on groundwater.

Background

Lake Cascade is a man-made reservoir in western Idaho, popular for fishing, boating, and other recreation (Figures 1 and 2). In 2022, DEQ collected groundwater samples from domestic wells along the perimeter of Lake Cascade and analyzed the samples for selected water quality constituents and contaminants. This sampling effort is part of a broader assessment of potential septic system impacts to groundwater and resultant degradation of water quality in Lake Cascade.

Lake Cascade lies along the margin of the Idaho Batholith in west-central Idaho. The towns of Donnelly and Cascade border the lake to the north and south, respectively. Since the late

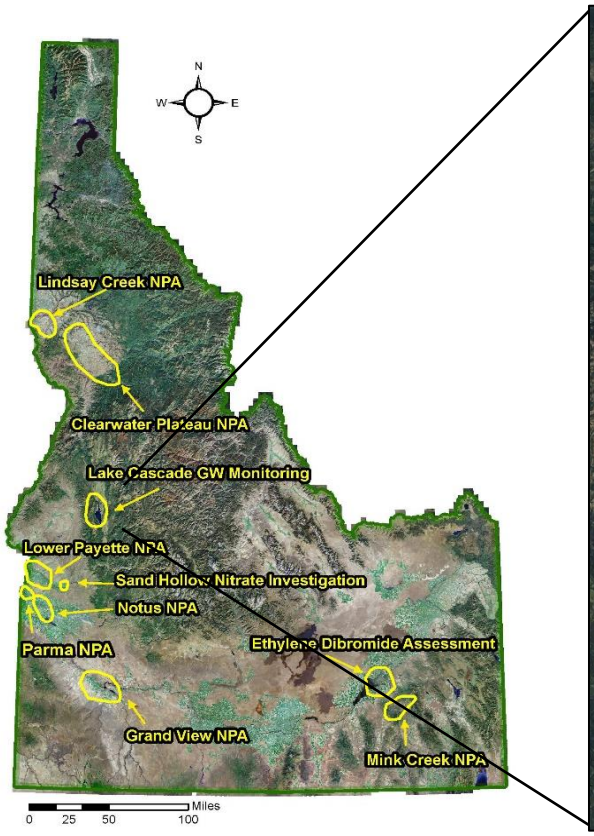

Figure 1. Location of Lake Cascade in Idaho and other projects sampled in 2022.

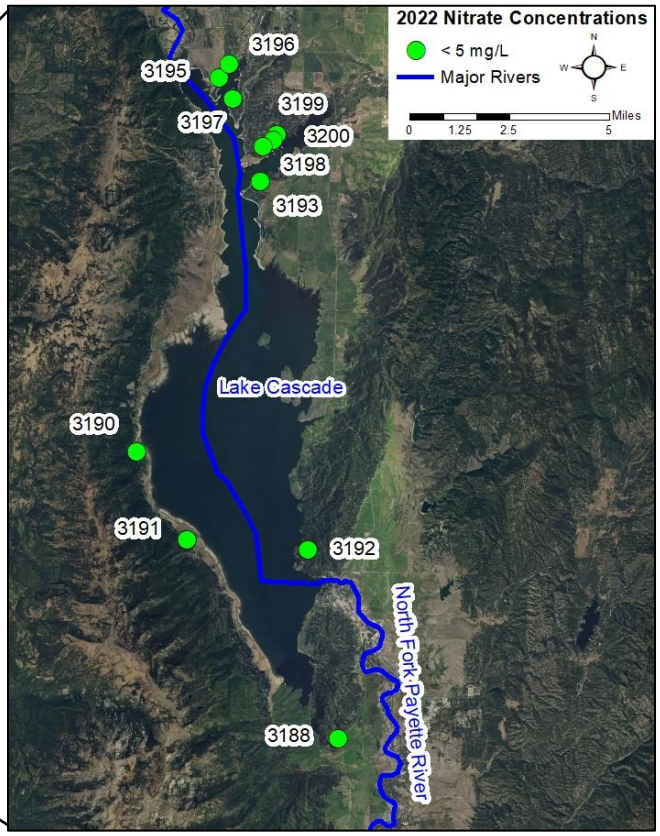

Figure 2. Location of wells sampled near Lake Cascade and nitrate concentrations.

1990s, Lake Cascade has experienced algal blooms, fish kills, and excessive growth of aquatic weeds, likely a result of elevated nutrients (nitrate and phosphorus) and sediment in the water (DEQ 1999 and DEQ 2018). In 2021, the Valley Soil and Water Conservation District (VSWCD) proposed that the effluent from poorly maintained septic systems could leach into groundwater and contribute to the nitrate and phosphorus levels in Lake Cascade.

This study assessed selected water quality parameters in groundwater at water wells located adjacent to Lake Cascade. DEQ reviewed the maps in the Idaho Department of Water Resources (IDWR) Well Driller's Reports for wells located adjacent to the lake. Eleven wells were identified for assessment with shallow groundwater and the potential for interaction with Lake Cascade. Seven of the wells are located in residential/vacation residential areas at the north end of the lake (southwest of Donnelly); one well is on the west side of the central lake area; one well is on the west side of the southern area of the lake; and two wells are on the east side of the southern area of the lake.

Depths of the 11 wells ranged from 24 to 84 feet (average of 47 feet) with groundwater reported at depths ranging from 1.5 to 44 feet below the surface (average of 20 feet). The wells were located in areas not served by public sewer systems, where residential septic systems (septic tanks and drainfields) are assumed to be used.

General subsurface lithology of nine wells, including the seven wells located at the north end of the lake, as reported in the IDWR Well Driller's Reports, was interbedded layers of sand, gravel, sandy clay, and clay. The Well Driller's Reports for the other two wells identified a subsurface of soil overlying granitic rock.

Drinking Water Standards

The United States Environmental Protection Agency (EPA) sets national drinking water standards for approximately 90 contaminants. The maximum contaminant level (MCL) is an enforceable standard set by EPA that defines the maximum level of a contaminant allowed in water delivered to a public water system. DEQ adopts drinking water standards in the Groundwater Quality Rule, IDAPA 58.01.11.200. DEQ uses these standards to evaluate private well water quality.

Groundwater Monitoring Results

The groundwater samples were analyzed for nitrate, nitrite, total phosphorus, calcium, magnesium, sodium, chloride, sulfate, alkalinity, ammonia, and bacteria. Elevated concentrations of nitrate, ammonia, phosphorous, and chloride, or the presence of bacteria, would indicate potential septic wastewater impact to groundwater.

Nitrate

Common sources of nitrate include decaying plants and other organic matter, septic systems, byproducts from animal facilities, and nitrogen-based fertilizers. The concentrations of nitrate detected in the 11 samples ranged from not detected (less than 0.18 milligrams per liter [mg/L])

to 3.19 mg/L. Only two samples (Wells 3192 and 3196) contained nitrate at a concentration greater than 1 mg/L (3.19 mg/L and 1.21 mg/L, respectively), indicating possible impact to groundwater resulting from septic wastewater, fertilizer, or surface animal waste. The EPA established the MCL for nitrate in public drinking water as 10 mg/L (Table 1).

Total Phosphorus

Concentrations of total phosphorus detected in the 11 samples ranged from 0.018 mg/L to 0.12 mg/L (Table 1). The phosphorus concentrations detected in the samples do not appear at a level indicating wastewater impact and are similar to background concentrations in the surface water tributaries to Lake Cascade. There is no MCL established for phosphorus in drinking water.

Bacteria

Samples were analyzed for total coliform (TC) bacteria and *Escherichia coli* (*E. coli*). TC bacteria are commonly found in soil and generally not harmful but can indicate potential surface contamination of groundwater or can result from poorly constructed wells that allow surface water to flow down the well casing or boring. *E. coli* is a subgroup of coliform found in animal fecal matter. If *E. coli* is detected with TC, this is a strong indication of septic wastewater and human or animal waste contamination of groundwater and disinfection is required (*Coliform Bacteria Fact Sheet*). Well 3200, located in the residential/vacation home area at the north end of the lake, had positive detections for TC and *E. coli*.; however, the sample from this well had a low nitrate concentration estimated at 0.084 mg/L (Table 1). Sample results were provided to the homeowners.

Table 1. Nutrient and Bacteria Concentrations

DEQ Site ID	Well Depth	Sample Date	Nutrient Concentration				Bacteria Concentration[B]	
			Phosphorus	Nitrite[A]	Nitrate[A]	Ammonia	E. coli	Total Coliform
			mg/L	mg/L	mg/L	mg/L	MPN/100 mL	MPN/100 mL
Water Quality Standard:			No Stand.	1.0	10	No Stand.	<1	1.0
3188	76	06/06/2022	0.12	<0.30	0.0883	<0.050	<1.0	<1.0
3190	24	06/06/2022	0.022	<0.30	<0.18	<0.050	<1.0	<1.0
3191	60	06/06/2022	0.027	<0.30	0.0818	<0.050	<1.0	<1.0
3192	84	06/06/2022	0.12	<0.30	3.19	<0.050	<1.0	<1.0
3193	48	06/06/2022	0.017	<0.30	0.131	<0.050	<1.0	<1.0
3195	48	06/06/2022	0.028	<0.30	0.990	<0.050	<1.0	<1.0
3196	30	06/06/2022	0.018	<0.30	1.21	<0.050	<1.0	<1.0
3197	49	06/06/2022	0.096	<0.30	0.247	<0.050	<1.0	<1.0
3198	30	06/06/2022	0.11	<0.30	<0.18	0.099	<1.0	<1.0
3199	27	06/06/2022	0.12	<0.30	<0.18	0.22	<1.0	<1.0
3200	38	06/06/2022	0.054	<0.30	0.0839	0.054	5.0	5.0

Notes: mg/L = milligrams per liter; No Stand = No Primary or Secondary Drinking Water Regulation or Idaho Ground Water Quality Rule standard currently established; MPN/100 mL = most probable

number per 100 milliliters

[A] Contaminant with a National Primary Drinking Water Regulation standard.
[B] Total coliform and E. coli standards are from the Idaho Ground Water Quality Rule (IDAPA 58.01.11.200). An exceedance of the primary ground water quality standard for total coliform (indicated by gray shaded numbers) is not a violation of these rules. Total coliform is not a health threat in itself; it is used to indicate whether other potentially harmful bacteria may be present. Although the standards are given in cfu/100 mL, analytical results provided in MPN/100 mL are acceptable for comparison to the standard.

Conclusions

In 2022, DEQ sampled 11 wells along the perimeter of Lake Cascade to assess whether septic wastewater impacts to groundwater could contribute to elevated nutrient levels in the lake. The 2022 assessment identified one well with bacteria contamination potentially impacted by wastewater but did not identify significantly elevated nutrient or other water quality analytes that directly indicated wastewater impacts to groundwater at the well locations.

DEQ may consider sampling additional Lake Cascade wells in the future, especially wells located in subdivisions on the southernmost end of the lake. The VCSWD obtained the names of well owners in the area who agreed to well sampling.

All Lake Cascade groundwater monitoring sampling results are available at *Ground Water Quality Monitoring and Protection*.

Contact: DEQ Boise Regional Office, (208) 373-0550

References

DEQ (Idaho Department of Environmental Quality). 1999. *1996 and 1999 Cascade Reservoir Watershed Assessment and TMDL. https://www.deq.idaho.gov/water-quality/surface-water/total-maximum-daily-loads/payette-river-north-fork-subbasin/*

DEQ (Idaho Department of Environmental Quality). 2018. *Cascade Reservoir Watershed: TMDL Five Year Review. https://www2.deq.idaho.gov/admin/LEIA/api/document/download/11978*

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STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

2022 Summary Report: Grand View Uranium Follow-Up

The Idaho Department of Environmental Quality's Groundwater Quality Rule is intended to maintain and protect the existing high quality of Idaho's groundwater. By sampling and monitoring wells throughout the state, DEQ can assess water quality to aid in land use management decisions that impact groundwater.

This monitoring project is designed to investigate elevated uranium concentrations in the Grand View Nitrate Priority Area (NPA).

Background

In 2022, DEQ evaluated the water quality and sampled for various contaminants within the Grand View Nitrate Priority Area (NPA) in Owyhee County, Idaho (Figure 1). This groundwater project was designed to further investigate elevated uranium concentrations that emerged when this NPA was previously sampled in October 2021 as part of DEQ's statewide NPA monitoring program. The NPAs in Idaho are initially identified by the presence of elevated nitrate concentrations in groundwater samples collected by the DEQ or other agencies. Elevated nitrate concentrations indicate that the groundwater has been impacted by a nitrate

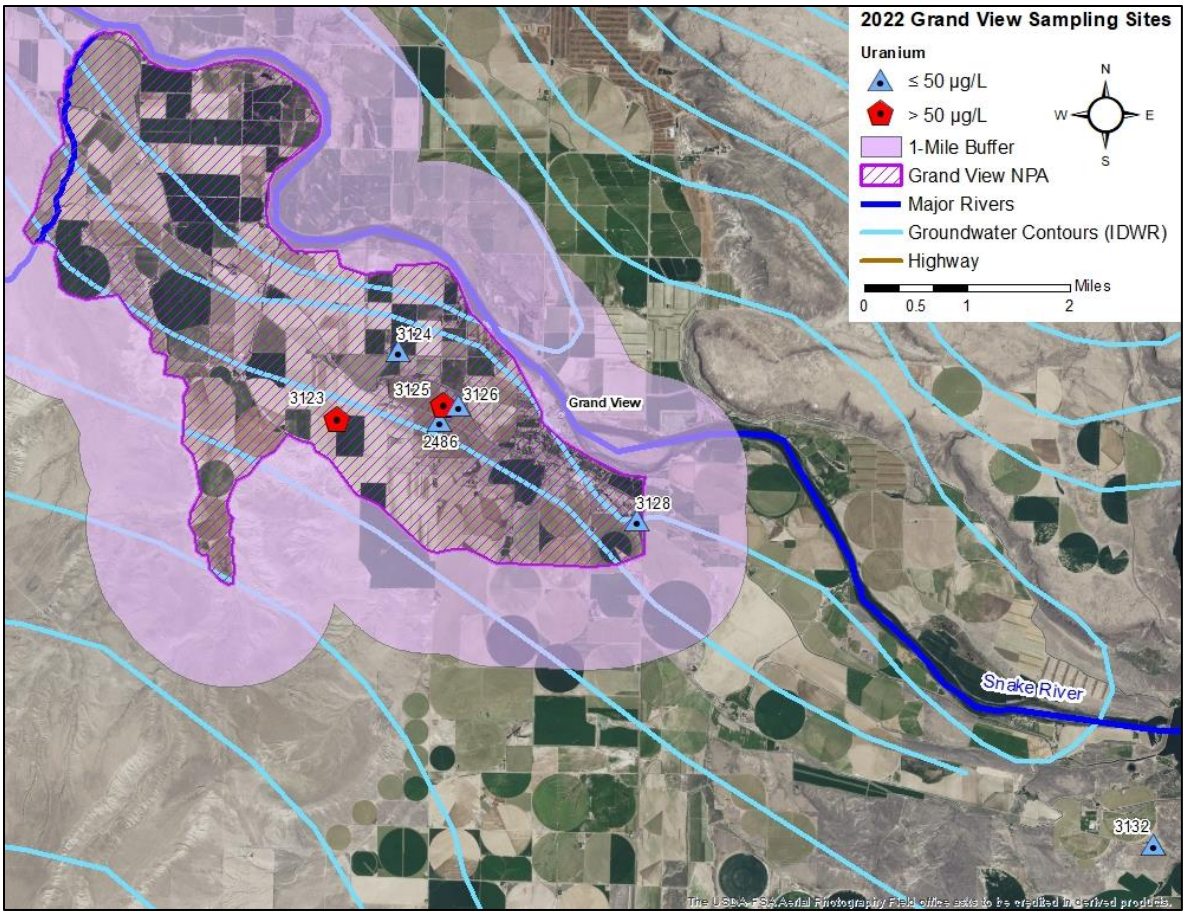

Figure 1. Grand View NPA and sites sampled for uranium in the March 2022 follow-up event.

source, typically wastewater/sewage, fertilizer, or animal waste, and the groundwater aquifer is susceptible to other surface contaminants. Once an area of elevated nitrate concentrations has been identified, DEQ conducts a more concentrated investigation by sampling domestic and irrigation wells in the area and using the data generated by the sampling to identify boundaries to the area of nitrate impact. The NPAs throughout the state are evaluated and ranked by existing nitrate concentrations, statistical trends in the nitrate concentrations over time (if available), and local populations potentially affected. In 2020, Grand View was ranked 11th in the state (out of 35 NPAs), but a statistical trend of nitrate concentrations in groundwater (increasing, decreasing, or stable) was not determined (DEQ 2021).

The Grand View NPA lies southwest of the Snake River near the southwest boundary of the western Snake River Plain in southwestern Idaho. Groundwater flow direction in the Grand View NPA trends north-northeast towards the Snake River (see Figure 1 for groundwater contours). Land use in the NPA is predominantly agriculture, and residences in the area (excluding those within the City of Grand View) are served by private wells.

Drinking Water Standards

The United States Environmental Protection Agency (EPA) sets national drinking water standards for approximately 90 contaminants. The maximum contaminant level (MCL) is an enforceable standard set by EPA that defines the maximum level of a contaminant allowed in water delivered to a public water system. DEQ adopts drinking water standards in the Groundwater Quality Rule, IDAPA 58.01.11.200. DEQ uses these standards to evaluate private well water quality.

Groundwater Monitoring Results

In January 2022, DEQ sampled groundwater from seven wells in the Grand View NPA with uranium concentrations that exceeded the MCL when sampled in October 2021. Groundwater samples from these wells were analyzed for nitrate, nitrite, nitrogen isotope ($\delta^{15}N$), uranium, arsenic, alkalinity, and bacteria.

DEQ then determined another sampling event should be conducted in March 2022 for the same seven wells after observing variable rates of change in uranium concentrations. Additional analytes (calcium, potassium, magnesium, sodium, chloride, and sulfate) often found in fertilizers were added to the original suite of analytes to determine whether the uranium in the Grand View NPA could be due to fertilizer application in the area. Results from each sampling round were provided to the homeowners.

Uranium

The seven wells sampled during the follow-up investigation were over the MCL of 30 micrograms per liter (µg/L) when sampled in October 2021. All seven continued to have uranium concentrations over the MCL in both the January 2022 and March 2022 sampling events (Table 1). The change over time in each well varied—Well 3128 saw the biggest concentration increase from 30 µg/L in October 2021 to 38 µg/L in January 2022 and 50 µg/L in

March 2022. The largest decrease in uranium concentration was in Well 3132, which fell from 45 µg/L to 39 µg/L in January and 38 µg/L in March.

Table 1. Uranium concentrations

DEQ Site ID	Well Depth	Sample Date	Uranium (µg/L)[A]
Primary or Secondary Standard:			**30**
2486	78	01/25/2022	48
2486	78	03/22/2022	46.0
3123	150	01/25/2022	71
3123	150	03/22/2022	67.0
3124	32	01/25/2022	40
3124	32	03/22/2022	42.0
3125	76	01/25/2022	55
3125	76	03/22/2022	58.0
3126	87	01/25/2022	49
3126	87	03/22/2022	49.0
3128	60	01/25/2022	38
3128	60	03/22/2022	50.0
3132	74	01/25/2022	39
3132	74	03/22/2022	38.0

Notes: µg/L = micrograms per liter;

[A] Contaminant with a National Primary Drinking Water Regulation standard.

Arsenic

As naturally occurring element in the earth's crust, trace amounts of arsenic are found in all living matter, rocks, soil, water, and air. Water that encounters rock formations can dissolve arsenic and carry it into underground aquifers, streams, and rivers that may be used as drinking water sources. Arsenic concentrations remained stable between the October 2021, January 2022, and March 2022 sampling events. Five out of seven wells (71%) were over the MCL of 0.01 milligrams per liter (mg/L) in all three events (Wells 2486, 3125, 3126, 3128, and 3123). The remaining two wells retained concentrations below the MCL. Changes in alkalinity did not seem to affect the arsenic concentrations. DEQ has not sampled the Grand View NPA for arsenic in the last 10 years, so no historical data is available for comparison.

Nitrate

Four out of the seven wells sampled (57%) had nitrate concentrations exceeding the MCL of 10 mg/L (Wells 2486, 3125, 3126, and 3132) when sampled in both January and March. The remaining three wells were below the MCL.

Nitrogen isotopes were analyzed for all samples regardless of their nitrate concentrations. $\delta^{15}N$ is frequently used as an environmental tracer and can provide information on the origin and fate of nitrogen in a sample. In both sampling events, Well 3128 had an isotope ratio in the -4‰

to +4‰ range, indicating the nitrate source was likely commercial fertilizer. The remaining wells had isotopic ratios between 4.9‰ and 7.7‰, indicating a mix of organics as the sources of nitrate (Seiler 1996).

Bacteria

All seven wells were analyzed for *Escherichia coli* (*E. coli*) and total coliform (TC) bacteria. TC bacteria are common in the environment and are generally not harmful. *E. coli* is a subgroup of coliform found in greater quantities than TC in animal fecal matter. If *E. coli* is detected with TC, this indicates sewage waste is present, and disinfection is required (*Coliform Bacteria Fact Sheet*). Wells 3123 and 3132 (29%) had positive detections for TC in October 2021. The well owners were informed and disinfected their wells, and repeated sampling did not indicate positive detections. Well 3125 had a positive TC detection in January 2022 but was negative by March 2022. No other wells tested positive for TC and there were no *E. coli* detections in any wells.

Fertilizer Analytes

The results of the analysis of calcium, potassium, magnesium, sodium, chloride, and sulfate from the March 2022 sampling event were placed into Piper diagrams to determine if a relationship existed between those analytes and uranium concentrations (Figure 2 and Figure 3).

A Piper diagram visually represents the chemical composition of water by plotting its main ions, helping to identify water types and potential sources of contamination. It combines cation and anion concentrations to show relationships between different water samples. The Piper diagram shows a correlation between increasing nitrate concentrations and an increasing Cl/SO_4 ratio combined with proportional SO_4 increases (Figure 2). Well 3132 had the highest nitrate and sulfate concentrations and the highest Cl/SO_4 ratio. Well 3123 had the lowest nitrate and sulfate concentrations and the lowest Cl/SO_4 ratio.

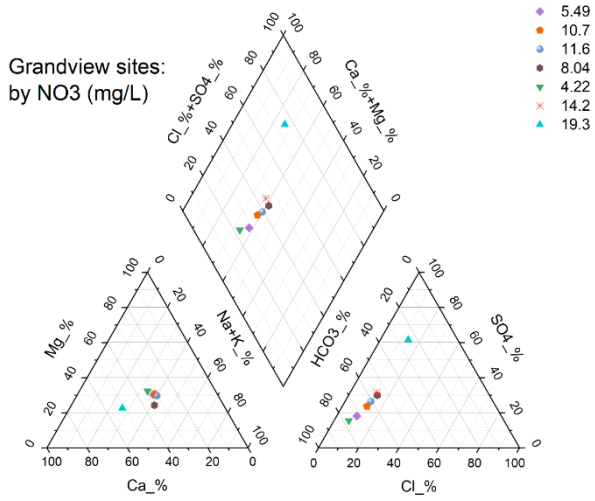

Figure 2. Piper diagram comparing relationship between nitrate and HCO_3 (alkalinity).

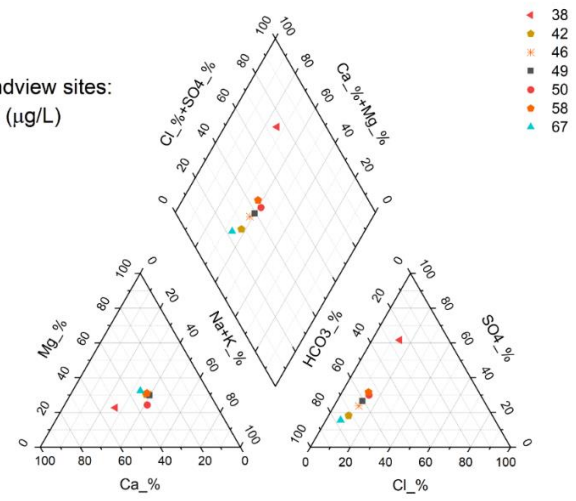

Figure 3. Piper diagram comparing relationship between uranium and HCO_3 (alkalinity).

Except for Well 3132, uranium showed a consistent trend with alkalinity in the form of HCO_3 (Figure 3).

Conclusions

Seven wells in the Grand View NPA had uranium concentrations over the MCL when sampled in October 2021 and were sampled again in January 2022 and March 2022. All wells remained above the MCL in follow-up sampling events, and changes in concentrations over time were variable. None of the factors-- well depth, alkalinity, nor nitrate concentrations provided a definitive answer on the source of uranium for all seven wells. Additional testing over multiple seasons may be required to further investigate the source of uranium.

All Grand View NPA uranium follow-up sampling results are available at *Ground Water Quality Monitoring and Protection*.

Contact: DEQ Boise Regional Office, (208) 373-0550

References

DEQ (Idaho Department of Environmental Quality). 2021. *2020 Nitrate Priority Area Delineation and Ranking Process*. Boise: DEQ Water Quality Division. *https://www2.deq.idaho.gov/admin/LEIA/api/document/download/14704.*

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STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

2022 Summary Report: Lindsay Creek Nitrate Priority Area

The Idaho Department of Environmental Quality's Groundwater Quality Rule is intended to maintain and protect the existing high quality of Idaho's groundwater. By sampling and monitoring wells throughout the state, DEQ can assess water quality to aid in land use management decisions that impact groundwater.

This monitoring project is designed to provide the data necessary for evaluating trends in groundwater nitrate concentrations in and around the Lindsay Creek Nitrate Priority Area (NPA).

Background

In 2022, DEQ evaluated the water quality and sampled nitrate and bacteria in the Lindsay Creek Nitrate Priority in Nez Perce County, Idaho (Figure 1 and Figure 2). The Lindsay Creek NPA, formerly named the Project of Tammany and Lindsay Creeks in previous reports, was designated and renamed during the 2008 NPA ranking and delineation update. The NPAs in Idaho are initially identified by the presence of elevated nitrate concentrations in groundwater

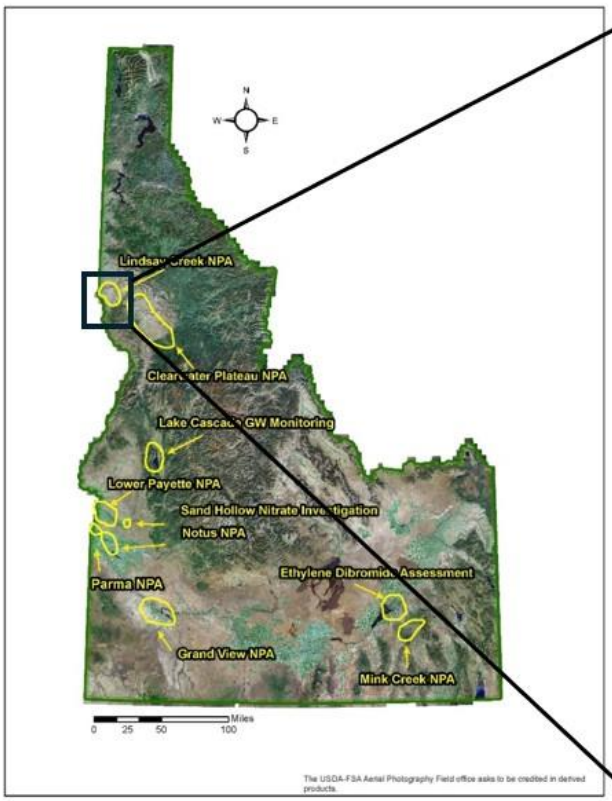

Figure 1. Location of Lindsay Creek NPA in Idaho and other projects sampled in 2022.

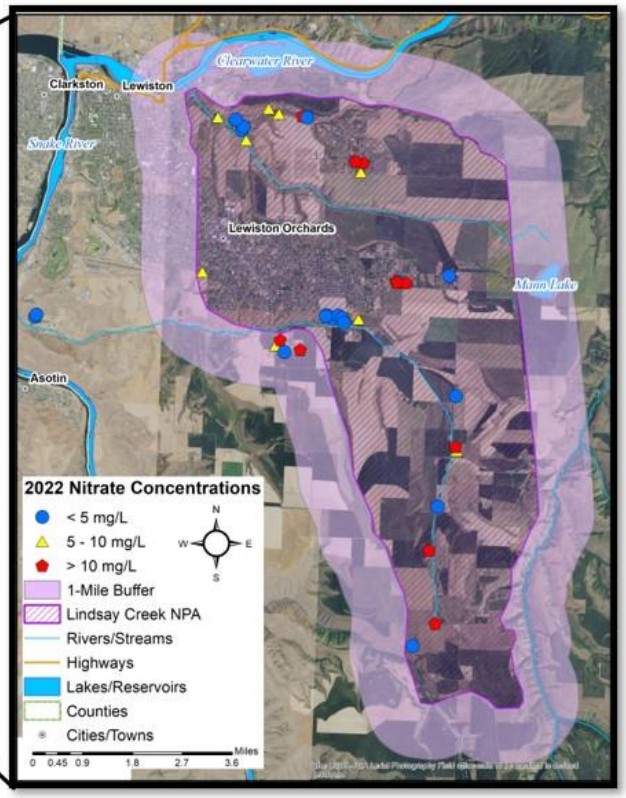

Figure 2. Location of wells sampled in the Lindsay Creek NPA and nitrate concentrations.

samples collected by DEQ or other agencies. Elevated nitrate concentrations indicate that the groundwater has been impacted by a nitrate source, typically wastewater/sewage, fertilizer, or animal waste, and the groundwater aquifer is susceptible to other surface contaminants. Once an area of elevated nitrate concentrations has been identified, DEQ conducts a more concentrated investigation by sampling domestic and irrigation wells in the area and using the data generated by the sampling to identify boundaries to the area of nitrate impact. In 2020, Lindsay Creek NPA was ranked 20th in the state (out of 35 NPAs) with no change in statistical trend for nitrate concentration (DEQ 2021). This NPA was previously sampled quarterly from 2008–2015, but with the limited seasonal variability of nitrate concentrations observed in most wells, DEQ reduced monitoring to once per year. Due to the pandemic and staffing limitations, no monitoring was completed in 2021 but resumed in 2022.

The project area is located east and southeast of Lewiston, Idaho. The land use is primarily agricultural, specifically dry-land farming. Rangeland and grazing are also common in the area. The area is underlain by the Columbia River Basalts and consists of units that formed when lava flows filled in the preexisting topography during the Miocene era (Stevens et al. 2003). A thin layer of loess forms the present-day land surface for most of the area. Groundwater in the area is mostly found in the basalt and occasionally in the alluvial valley sediments and basement rocks. Groundwater generally flows to the north and eventually discharges into the Clearwater River (Hagan 2003). Well depths from groundwater sampling locations ranged from 16 feet to 950 feet.

Drinking Water Standards

The United States Environmental Protection Agency (EPA) sets national drinking water standards for approximately 90 contaminants. The maximum contaminant level (MCL) is an enforceable standard set by EPA that defines the maximum level of a contaminant allowed in water delivered to a public water system. DEQ adopts drinking water standards in the Groundwater Quality Rule, IDAPA 58.01.11.200. DEQ uses these standards to evaluate private well water quality.

Groundwater Monitoring Results

In 2022, DEQ sampled groundwater from 37 domestic or irrigation wells and one spring in the Lindsay Creek NPA. Samples were analyzed for nitrate and nitrite as nitrogen and bacteria, to assess water quality in the project area. Ten of the wells had been previously sampled and 28 new sites were added. Sample results were provided to the homeowners.

Nitrate

Nitrate is a widespread groundwater contaminant in Idaho; common sources of nitrate include decaying plants and other organic matter, septic systems, byproducts from animal facilities, and nitrogen-based fertilizers. Twelve (35%) of the 38 sites sampled had nitrate concentrations over

the MCL (10 milligrams per liter [mg/L]). Eleven wells were under the nitrate MCL and ammonia was present which could indicate influence from human sources.

Table 1. Nutrient concentrations

DEQ Site ID	Well Depth	Sample Date	Nutrient Concentration	
			Nitrate + Nitrite[A]	Ammonia
			mg/L	mg/L
Water Quality Standard:			**10**	**No Stand.**
533	225	10/20/2022	13.4	-
1037	420	10/18/2022	<0.1	-
1038	150	10/11/2022	9.13	-
1217	264	10/13/2022	<0.1	0.0574
1225	16	10/11/2022	7.3	-
1253	56	10/13/2022	9.24	-
1315	589	10/10/2022	12.9	-
2022	950	10/20/2022	0.894	-
2654	197	10/20/2022	19.8	-
2655	203	10/20/2022	20.3	-
3239	290	10/10/2022	5.27	-
3240	303	10/10/2022	11.5	-
3241	300	10/10/2022	10.6	-
3242	310	10/10/2022	ND	0.112
3243	425	10/10/2022	4.8	-
3244	490	10/10/2022	ND	-
3245	173	10/11/2022	9.82	-
3246	229	10/11/2022	14.3	-
3247	255	10/11/2022	15	-
3248	475	10/11/2022	ND	0.0973
3249	404	10/11/2022	ND	0.0844
3250	Unk	10/11/2022	2.01	0.0812
3258	230	10/13/2022	6.32	-
3259	275	10/13/2022	6.79	-
3260	Unk	10/13/2022	12.6	-
3261	142	10/13/2022	9.72	-
3262	Unk	10/13/2022	<0.1	0.0537
3263	150	10/13/2022	20	-
3268	Unk	10/18/2022	0.682	0.0536
3269	540	10/18/2022	<0.1	0.0851

3270	275	10/18/2022	0.608	-
3271	Unk	10/18/2022	10	-
3272	Unk	10/18/2022	3.12	-
3273	220	10/18/2022	14.6	-
3278	Unk	10/20/2022	0.561	0.0539
3279	370	10/20/2022	<0.1	-
3279	370	10/20/2022	<0.1	-
3280	279	10/18/2022	1.46	0.0507
3282	175	10/10/2022	ND	0.101

Notes: mg/L = milligrams per liter; Unk=Unknown. Well log not found; (-) =Not Analyzed; No Stand = No Primary or Secondary Drinking Water Regulation or Idaho Ground Water Quality Rule standard currently established;
[A] Contaminant with a National Primary Drinking Water Regulation standard.

Bacteria

All 38 sites were analyzed for *Escherichia coli* (*E. coli*) and total coliform (TC) bacteria. TC bacteria are common in the environment and are generally not harmful.

E. coli is a subgroup of coliform found in greater quantities than TC in animal fecal matter. If *E. coli* is detected with TC, this indicates sewage waste is present, and disinfection is required (*Coliform Bacteria Fact Sheet*). Thirteen sites (34.2%) had positive detections for TC and of those positive for TC, *E. coli* was detected in one sample.

Conclusions

Eight of the new sites sampled for the first time in 2022 in the Lindsay Creek NPA were above the MCL for nitrate. Of the ten sites that had been previously sampled, five had increased nitrate results compared to previous results, three had lower nitrate results, and two had no change in nitrate. In 2022, DEQ restarted sampling in the Lindsay Creek NPA after a year hiatus and expanded the monitoring network as previous sites were no longer accessible. DEQ will use the results to evaluate the NPAs and determine the extent and level of concern of groundwater degradation. Sampling will be conducted again in 2023.

All Lindsay Creek NPA sampling results are available at *Ground Water Quality Monitoring and Protection*.

Contact: DEQ Lewiston Regional Office, (208) 799-4370

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STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

2022 Summary Report: Clearwater Plateau Nitrate Priority Area

The Idaho Department of Environmental Quality's Groundwater Quality Rule is intended to maintain and protect the existing high quality of Idaho's groundwater. By sampling and monitoring wells throughout the state, DEQ can assess water quality to aid in land use management decisions that impact groundwater.

This monitoring project is designed to provide the data necessary for evaluating trends in groundwater nitrate concentrations in and around the Clearwater Plateau Nitrate Priority Area (NPA).

Background

DEQ evaluated the water quality by sampling nitrate and bacteria in the Clearwater Plateau Nitrate Priority Area in Idaho and Lewis Counties, Idaho (Figure 1 and Figure 2). The Clearwater Plateau NPA was designated, in part, on the 1998 nitrate investigation results and has been included in every update of NPA delineation. The NPAs in Idaho are initially identified by the presence of elevated nitrate concentrations in groundwater samples collected by DEQ or other agencies. Elevated nitrate concentrations indicate that the groundwater has been impacted by

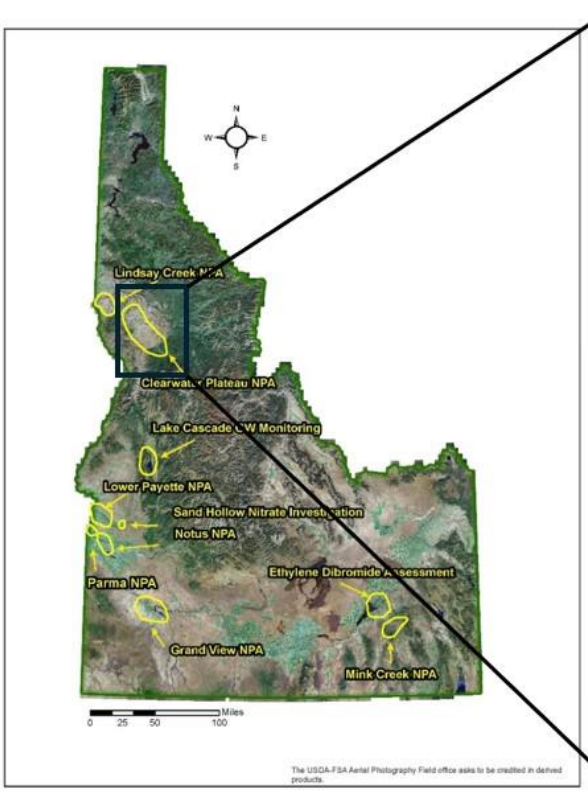

Figure 1. Location of Clearwater Plateau NPA in Idaho and other projects sampled in 2022.

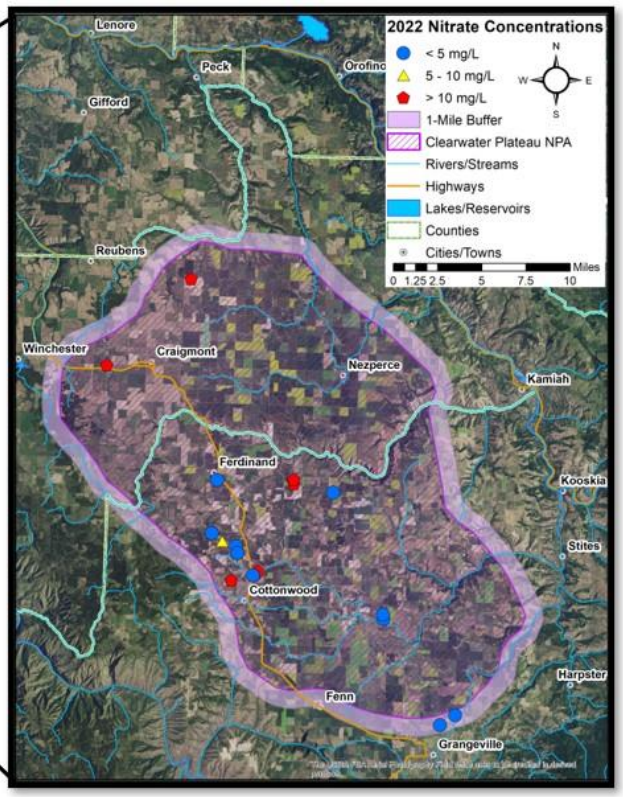

Figure 2. Location of wells sampled in the Clearwater Plateau NPA and nitrate concentrations.

a nitrate source, typically wastewater/sewage, fertilizer, or animal waste, and the groundwater aquifer is susceptible to other surface contaminants. Once an area of elevated nitrate concentrations has been identified, DEQ conducts a more concentrated investigation by sampling domestic and irrigation wells in the area and using the data generated by the sampling to identify boundaries to the area of nitrate impact. In 2020, the Clearwater Plateau NPA was ranked 15th in the state (out of 35 NPAs) with no change in statistical trend for nitrate concentration (DEQ 2021). This NPA was previously sampled quarterly from 2005–2015, but with the limited seasonal variability of nitrate concentrations observed in most wells, DEQ reduced the monitoring to once per year. Due to the pandemic and staffing limitations, no monitoring was completed in 2020 and 2021 but resumed in 2022.

The Clearwater Plateau NPA has three major rivers near its borders: the Salmon River to the south, the Snake River to the west, and the Clearwater River to the north and east. Groundwater beneath the plateau generally flows northeast through Miocene basalt layers that are overlain by loess ranging in thickness from tens to hundreds of feet and forms the present surface of the Palouse and occasionally in the alluvial valley aquifers and basement rocks (Hagan 2003). Well depths from groundwater sampling locations ranged from 70 to 480 feet below ground surface.

The project area is located immediately north of Grangeville, Idaho, straddling Lewis and Idaho Counties and encompassing the towns of Cottonwood, Ferdinand, Craigmont, and Nez Perce. The land use is primarily agricultural, specifically dry-land farming. Rangeland and grazing are also commonly found throughout the area.

Drinking Water Standards

The United States Environmental Protection Agency (EPA) sets national drinking water standards for approximately 90 contaminants. The maximum contaminant level (MCL) is an enforceable standard set by EPA that defines the maximum level of a contaminant allowed in water delivered to a public water system. DEQ adopts drinking water standards in the Groundwater Quality Rule, IDAPA 58.01.11.200. DEQ uses these standards to evaluate private well water quality.

Groundwater Monitoring Results

In 2022, DEQ sampled groundwater from 17 domestic or irrigation wells in the Clearwater Plateau NPA. Samples were analyzed for nitrate and nitrite as nitrogen and bacteria to assess water quality in the project area. Four wells had been previously sampled and 13 new wells were added. Sample results were provided to the homeowners.

Nitrate

Nitrate is a widespread groundwater contaminant in Idaho; common sources of nitrate include decaying plants and other organic matter, septic systems, byproducts from animal facilities, and nitrogen-based fertilizers. Six wells (35%) of the 17 wells sampled had nitrate detections over

the MCL (10 milligrams per liter [mg/L]). Four wells were under the nitrate MCL, but ammonia was present which could indicate influence from human sources.

Table 1. Nutrient concentrations

DEQ Site ID	Well Depth	Sample Date	Nutrient Concentration	
			Nitrate + Nitrite[A]	Ammonia
			mg/L	mg/L
Water Quality Standard:			10	No Stand.
202	400	10/12/2022	5.53	-
212	400	10/17/2022	19.7	-
417	187	10/19/2022	<0.1	0.0891
2667	380	10/19/2022	<0.1	0.0786
3251	350	10/12/2022	ND	-
3252	Unk	10/12/2022	0.713	ND
3253	200	10/12/2022	3.6	-
3254	340	10/12/2022	11.9	-
3255	400	10/12/2022	0.609	-
3264	70	10/17/2022	15.5	-
3265	175	10/17/2022	15.4	-
3266	50	10/17/2022	14.5	-
3267	480	10/17/2022	3.22	-
3274	283	10/19/2022	<0.1	0.101
3275	240	10/19/2022	<0.1	0.075
3276	360	10/19/2022	14.5	-
3277	240	10/19/2022	3.39	-

Notes: mg/L = milligrams per liter; Unk=Unknown. Well log not found; (-)=Not Analyzed; No Stand = No Primary or Secondary Drinking Water Regulation or Idaho Ground Water Quality Rule standard currently established;
[A] Contaminant with a National Primary Drinking Water Regulation standard.

Bacteria

All 17 wells were analyzed for *Escherichia coli* (*E. coli*) and total coliform (TC) bacteria. TC bacteria are common in the environment and are generally not harmful. *E. coli* is a subgroup of coliform found in greater quantities than TC in animal fecal matter. If *E. coli* is detected with TC, this indicates sewage waste is present, and disinfection is required (*Coliform Bacteria Fact Sheet*). Nine wells (52.9%) had positive detections for TC, but no *E. coli* was detected in any sample.

Conclusions

Five of the new wells sampled for the first time in 2022 in the Clearwater Plateau NPA were above the MCL for nitrate. For the four wells that were previously sampled two of them had increased nitrate results compared to their pervious nitrate results while the other two had no change. In 2022, DEQ restarted sampling in the Clearwater Plateau NPA after a multiyear hiatus and expanded the monitoring network as previous sites were no longer accessible. DEQ will use the results to evaluate NPAs and determine the extent and level of concern of groundwater degradation. Sampling will be conducted again in 2024.

All Clearwater Plateau NPA sampling results are available at *Ground Water Quality Monitoring and Protection*.

Contact: DEQ Lewiston Regional Office, (208) 799-4370

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STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

2022 Summary Report: Mink Creek Nitrate Priority Area

The Idaho Department of Environmental Quality's Groundwater Quality Rule is intended to maintain and protect the existing high quality of Idaho's groundwater. By sampling and monitoring wells throughout the state, DEQ can assess water quality to aid in land use management decisions that impact groundwater.

This monitoring project is designed to provide the data necessary for evaluating trends in groundwater nitrate concentrations in and around the Mink Creek Nitrate Priority Area (NPA).

Background

In 2022, DEQ evaluated water quality and sampled for various contaminants within the Mink Creek Nitrate Priority Area (NPA) in Bannock County, Idaho (Figure 1 and Figure 2). The Mink Creek NPA was previously sampled in 2006 and again in 2021 as part of DEQ's statewide NPA monitoring program. The NPAs in Idaho are initially identified by the presence of elevated nitrate concentrations in groundwater samples collected by the DEQ or other agencies. Elevated nitrate concentrations indicate that the groundwater has been impacted by a nitrate source, typically wastewater/sewage, fertilizer, or animal waste, and the groundwater aquifer is susceptible to other surface contaminants. Once an area of elevated nitrate concentrations has

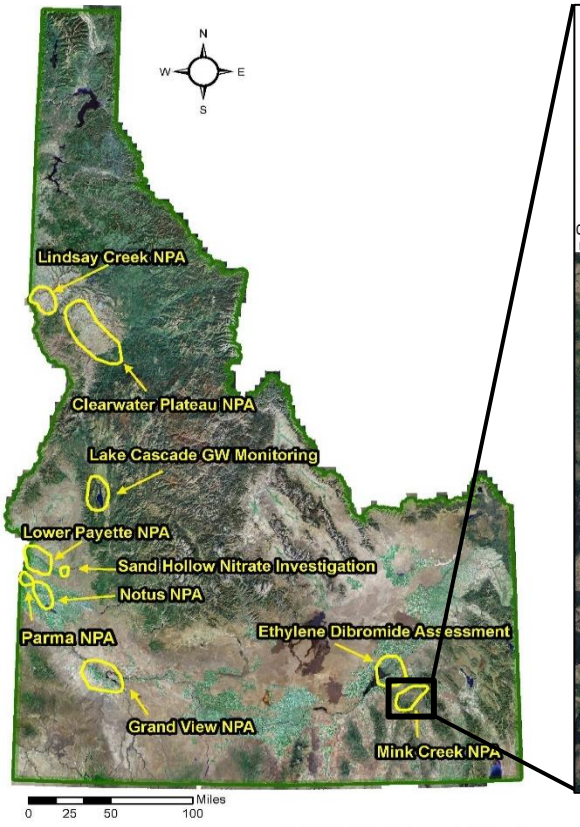

Figure 2. Location of Mink Creek NPA in Idaho and other projects sampled in 2022.

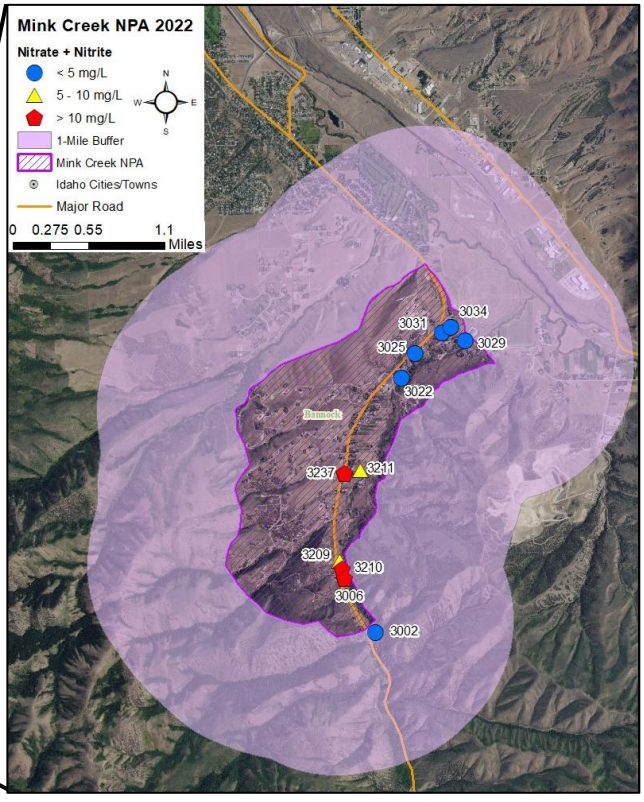

Figure 2. Locations of wells sampled in the Mink Creek NPA and total nitrogen concentrations.

been identified, DEQ conducts a more concentrated investigation by sampling domestic and irrigation wells in the area and using the data generated by the sampling to identify boundaries to the area of nitrate impact. NPAs throughout the state are evaluated and ranked by existing nitrate concentrations, statistical trends in the nitrate concentrations over time (if available), and local populations potentially affected. In 2020, the Mink Creek NPA was ranked 23rd in the state (out of 35 NPAs), but a statistical trend of nitrate concentrations in groundwater (increasing, decreasing, or stable) was not determined (DEQ 2021).

Mink Creek is a tributary to the Portneuf River flowing from the Bannock Range just south of Pocatello. The lower 3.5 miles of the canyon has been developed for semirural, residential use with individual septic systems. The upper portion of the canyon is United States Forest Service land with some livestock grazing. The valley floor consists of alluvial deposits overlying highly varied Tertiary volcanoclastic deposits and Cambrian and older, sedimentary, and metamorphic units that make up the flanks of the canyon (Rodgers and Othberg 1999). Most of the driller's logs for wells situated on the valley floor indicate total depths between 100 and 200 feet and static water levels, at the time of drilling, ranging from 18 to 120 feet. These wells appear to have been completed in the alluvial valley fill aquifer. Groundwater recharge originating as precipitation over the Bannock Range, including that occurring in the Mink Creek basin, contributes an estimated 5.4 billion gallons per year to the lower Portneuf River valley aquifer (Welhan 2006) and results in a general north-to-northeast groundwater flow direction along the axis of the developed portion of Mink Creek canyon to the confluence with the lower Portneuf River valley aquifer.

Drinking Water Standards

The United States Environmental Protection Agency (EPA) sets national drinking water standards for approximately 90 contaminants. The maximum contaminant level (MCL) is an enforceable standard set by EPA that defines the maximum level of a contaminant allowed in water delivered to a public water system. DEQ adopts drinking water standards in the Groundwater Quality Rule, IDAPA 58.01.11.200. DEQ uses these standards to evaluate private well water quality.

Groundwater Monitoring Results

In 2022, DEQ sampled groundwater from 11 domestic or irrigation wells in the Mink Creek NPA. Samples were analyzed for nitrate, ammonia, and bacteria to assess water quality in the project area. None of these wells had been sampled 2021, but 7 of the 11 had been sampled in 2006 during the initial NPA designation. Four new wells were added to the project area. Sample results were provided to the homeowners.

Nitrate and Nitrite

Nitrate is a widespread groundwater contaminant in Idaho; common sources of nitrate include decaying plants and other organic matter, septic systems, byproducts from animal facilities, and nitrogen-based fertilizers. Nitrate+nitrite concentrations ranged from 0.21 milligrams per liter

(mg/L) to 15 mg/L (Table 1). The nitrate MCL of 10 mg/L was exceeded in 3 out of 11 wells sampled (27%). Nitrate+nitrite concentrations were ≥ 5 mg/L (half the nitrate MCL) in 6 of 11 wells (55%). Ammonia concentrations ranged from 0.029 to 0.051 (Table 1); there is currently no MCL for ammonia.

Bacteria

All 11 wells were analyzed for *Escherichia coli* (*E. coli*) and total coliform (TC) bacteria. TC bacteria are common in the environment and are generally not harmful. *E. coli* is a subgroup of coliform found in greater quantities than TC in animal fecal matter. If *E. coli* is detected with TC, this indicates sewage waste is present, and disinfection is required (*Coliform Bacteria Fact Sheet*). Well 3209 had a detection of TC at a concentration of 69.7 MPN/100 mL, but no *E. coli* was detected in any sample (Table 1).

Table 1. Nutrient and bacteria concentrations.

DEQ Site ID	Well Depth	Sample Date	Nutrient Concentration		Bacteria Concentration[B]	
			Nitrate + Nitrite[A]	Ammonia	E. coli	Total Coliform
			mg/L	mg/L	MPN/100 mL	MPN/100 mL
Water Quality Standard:			**10**	**No Stand.**	**<1**	**1.0**
3002	100	09/12/2022	0.21	0.050	<1.0	<1.0
3006	Unk	09/12/2022	7.3	0.050	<1.0	<1.0
3022	Unk	09/12/2022	2.8	0.050	<1.0	<1.0
3025	Unk	09/19/2022	3.6	0.051	<1.0	<1.0
3029	Unk	09/14/2022	0.072	0.058	<1.0	<1.0
3031	Unk	09/13/2022	2.9	0.038	<1.0	<1.0
3034	267	09/13/2022	5.0	0.030	<1.0	<1.0
3209	Unk	09/14/2022	15	0.037	<1.0	69.7
3210	Unk	09/20/2022	11	0.048	<1.0	<1.0
3211	Unk	09/13/2022	9.1	0.035	<1.0	<1.0
3237	178	09/19/2022	14	0.029	<1.0	1.0

Notes: mg/L = milligrams per liter; Unk=Unknown. Well log not found; No Stand = No Primary or Secondary Drinking Water Regulation or Idaho Ground Water Quality Rule standard currently established;

[A] Contaminant with a National Primary Drinking Water Regulation standard.
[B] Total coliform and E. coli standards are from the Idaho Ground Water Quality Rule (IDAPA 58.01.11.200). An exceedance of the primary ground water quality standard for total coliform (indicated by gray shaded numbers) is not a violation of these rules. Total coliform is not a health threat in itself; it is used to indicate whether other potentially harmful bacteria may be present. Although the standards are given in cfu/100 mL, analytical results provided in MPN/100 mL are acceptable for comparison to the standard.

Conclusions

The 2022 Mink Creek NPA groundwater monitoring project evaluated nutrient and bacteria concentrations in 11 wells in the area. Three wells were above the MCL for nitrate of 10 mg/L and six exceeded 5 mg/L (one-half of the nitrate MCL). Groundwater samples from one well indicated the presence of TC bacteria. DEQ will use the results to evaluate NPAs and determine the extent and level of concern of groundwater degradation. Sampling will be conducted again in 2027.

All Mink Creek NPA sampling results are available at *Ground Water Quality Monitoring and Protection*.

Contact: DEQ Pocatello Regional Office, (208) 236-6160

References

DEQ (Idaho Department of Environmental Quality). 2021. *2020 Nitrate Priority Area Delineation and Ranking Process*. Boise: DEQ Water Quality Division. *https://www2.deq.idaho.gov/admin/LEIA/api/document/download/14704.*

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STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

2022 Summary Report: Bannock and Power County Ethylene Dibromide Assessment

The Idaho Department of Environmental Quality's Groundwater Quality Rule is intended to maintain and protect the existing high quality of Idaho's groundwater. By sampling and monitoring wells throughout the state, DEQ can assess water quality to aid in land use management decisions that impact groundwater.

This monitoring project is designed to assess the state of ethylene dibromide (EDB) contamination and inform future sampling in the area.

Background

This project is a follow-up assessment of an area of known ethylene dibromide (EDB) contamination in Bannock and Power Counties, north and west of Chubbuck, Idaho (DeJongh 1996; Safford 2005). EDB is also known as 1, 2-Dibromoethane. This sampling effort sought to assess the current state of EDB contamination and will inform future sampling. EDB is a chemical manufactured for use as a solvent, waterproofing agent, chemical intermediate in the synthesis of dyes and pharmaceuticals, and as a precursor in the synthesis of vinyl chloride. It has been used in the treatment of felled logs to control bark beetles, applied to beehives to control wax moths, and used as a pesticide and soil fumigant on golf courses. By 1984, Environmental Protection Agency (EPA) regulations eliminated most of the use of EDB as a pesticide. However, EDB is still manufactured for other purposes (HHS 2005).

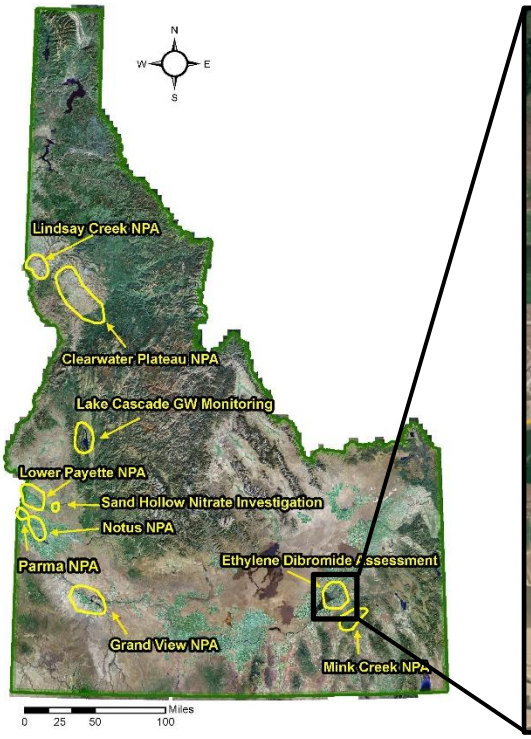

Figure 22. Location of the ethylene dibromide assessment area in Idaho and other projects sampled in 2022.

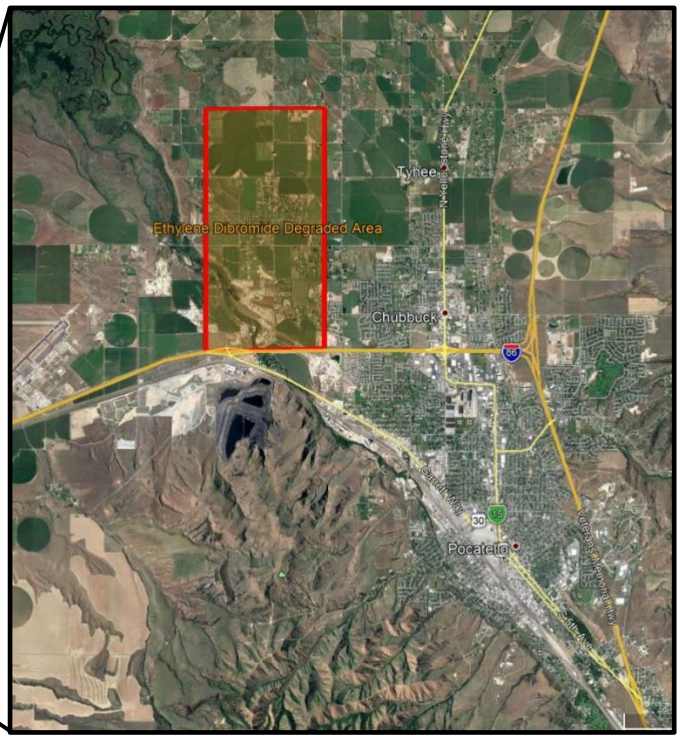

Figure 22. Ethylene dibromide degraded area in the Pocatello region.

In 1993, EDB was detected in the drinking water supply of the Fort Hall Indian Reservation at levels exceeding the United States EPA's maximum contaminant level (MCL) of 0.05 micrograms per liter (µg/L). The plume of EDB in north Bannock County is presumed to have originated on the Fort Hall Indian Reservation where EDB was applied as a pesticide in row crops. No known pesticide applications of EDB occurred outside the exterior boundaries of the reservation, but EDB contamination was found in private and public water supplies in the area south and east of the reservation boundary in northwestern Bannock County and northeastern Power County (Safford 2005).

Land use is semirural residential surrounded by agricultural activities; heavy industrial areas are located to the southwest. Two primary aquifers exist in the study area. The shallower aquifer is composed of sand and gravel (Michaud Gravel); the deeper aquifer is in the eastern Snake River Plain basalt. Mean depth to groundwater is 64.82 feet (Safford 2005). Groundwater flow in the area is generally to the southwest (Parliman and Young 1992). The previous EDB studies in the area found the presence of the compound in both the upper alluvial and lower basalt aquifers.

Drinking Water Standards

The EPA sets national drinking water standards for approximately 90 contaminants. The maximum contaminant level (MCL) is an enforceable standard set by EPA that defines the maximum level of a contaminant allowed in water delivered to a public water system. DEQ adopts drinking water standards in the Groundwater Quality Rule, IDAPA 58.01.11.200. DEQ uses these standards to evaluate private well water quality.

Groundwater Monitoring Results

In 2022, DEQ sampled six wells in the project area for 1,2-Dibromoethane (EDB), 1,2-Dibromo-3-Chloropropane (DBCP), and 1,2,3-Trichloropropane (TCP). DBCP is a soil fumigant formerly used in agriculture, and TCP is a degreasing solvent that is also associated with pesticide products. These six wells were previously sampled in August 2021, but lab results were rejected due to a temperature exceedance during shipment.

None of the sites had detections of EDB, DBCP, or TCP. All other sites sampled in 2021 also reported no detections of any of these analytes.

Conclusions

EDB, DBCP, and TCP were not detected in any of the six wells sampled in this project. Property owners were provided the results. DEQ plans to resample this area in fall 2024 to continue investigating the source and size of the EDB plume, and those results will be included in the 2024 annual report.

All ethylene dibromide assessment sampling results are available online at *Ground Water Quality Monitoring and Protection*.

Contact: DEQ Pocatello Regional Office, (208) 236-6160

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STATE OF IDAHO
DEPARTMENT OF
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2022 Summary Report: Sand Hollow Groundwater Nitrate Investigation

The Idaho Department of Environmental Quality's Groundwater Quality Rule is intended to maintain and protect the existing high quality of Idaho's groundwater. By sampling and monitoring wells throughout the state, DEQ can assess water quality to aid in land use management decisions that impact groundwater.

The purpose of this project is to collect additional samples from the domestic and monitoring wells in the project area for nitrate analysis. It is a continuation of previous sampling efforts by DEQ used to evaluate sources of nitrate and bacteria in the domestic well.

Background

In 2022, DEQ sampled one domestic and three monitoring wells in southwestern Gem County, Idaho (Figure 1) as part of an ongoing investigation into relatively higher nitrate concentrations in the project area.

In 2013, DEQ responded to a complaint of possible groundwater contamination at a domestic well for a home adjacent to a dairy farm operation. Multiple sources of nitrate with the potential to impact groundwater are present in the area, including agricultural fertilizers, dairy waste applied to fields north and east of the site, septic systems at the residence, and a dairy. The land use at the dairy included stockpiled solid waste, and a waste lagoon. Land use south and east of the site is generally agricultural, with rangeland to the west and an approximate 1,800-head dairy located adjacent to the north end of the property. Laboratory analyses of groundwater samples collected from the site's domestic well (Well 2232), detected concentrations of nitrate that increased from approximately 8 milligrams per liter (mg/L) in August 2012 to 21 mg/L in October 2015.

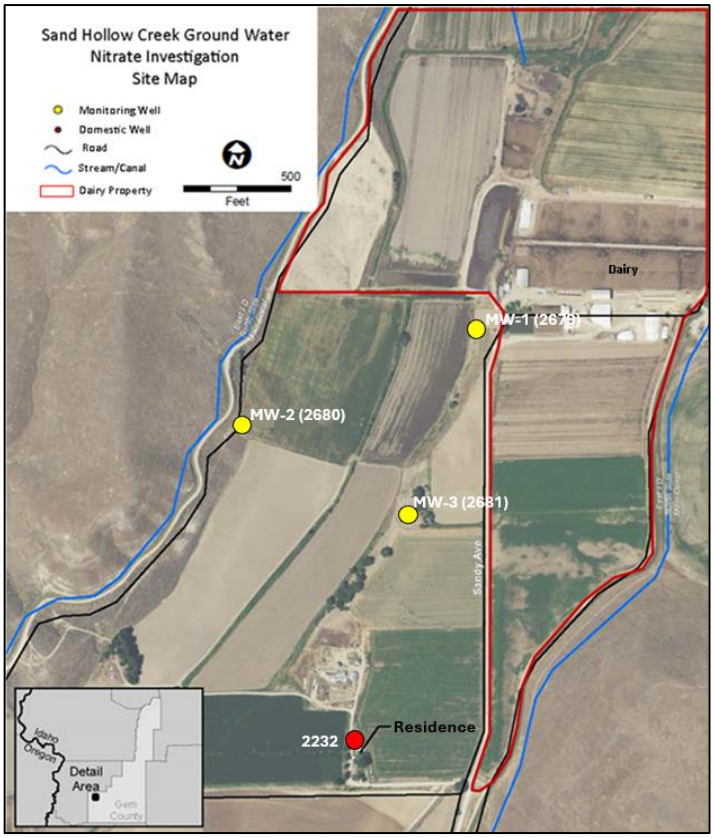

Figure 1. Project site map (modified from Tetra Tech 2019)—Sand Hollow groundwater nitrate investigation.

DEQ's assessment of the property did not identify any on-site land use changes that could account for the

significant increase in nitrate concentrations in groundwater at the well (DEQ 2019). DEQ conducted the Sand Hollow Creek's groundwater nitrate investigation to identify potential off-site nitrate sources impacting ground water at Well 2232.

In December 2016, STRATA (the initial subcontractor on the project) installed three monitoring wells (Wells 2679, 2680, and 2681) at locations estimated to be upgradient or cross gradient of Well 2232 (**Error! Reference source not found.**). The monitoring wells were installed to identify the groundwater flow direction and assess groundwater quality upgradient of Well 2232. Subsurface lithology at all wells generally consisted of poorly graded sand, silty sand, and clay.

Drinking Water Standards

The United States Environmental Protection Agency (EPA) sets national drinking water standards for approximately 90 contaminants. The maximum contaminant level (MCL) is an enforceable standard set by EPA that defines the maximum level of a contaminant allowed in water delivered to a public water system. DEQ adopts drinking water standards in the Groundwater Quality Rule, IDAPA 58.01.11.200. DEQ uses these standards to evaluate private well water quality.

Groundwater Monitoring Results

In 2022, DEQ measured depth to groundwater and sampled from the one domestic well and three monitoring wells in the project area. Samples were analyzed for a wide range of analytes: nitrate, nitrite, fluoride, chloride, phosphorus, sulfate, manganese, copper, arsenic, uranium, calcium, potassium, magnesium, sodium, alkalinity, and fertilizer chemicals. Sample results for the domestic well were provided to the homeowner.

Nutrient Results

Nutrient results (phosphorus, nitrite, and nitrate) for all wells are presented in Table 1. Groundwater collected from the domestic well had a nitrate concentration of 4.03 mg/L, less than half of the MCL of 10 mg/L. Monitoring Wells 2680 and 2681 also had low nitrate concentrations of 0.0812 mg/L and 1.982 mg/L, respectively. However, samples from the monitoring Well 2679 exceeded the MCL at 11.4 mg/L. This well is farthest upgradient from the domestic property and closest to the neighboring dairy. Previous sampling events have also shown this well to be higher in nitrate, although the concentration has decreased since it was last sampled in May 2019 (20.4 mg/L). No wells had detections for nitrite, and phosphorus concentrations ranged from 0.16 mg/L to 0.34 mg/L.

Table 1. Nutrient results for Sand Hollow Nitrate Investigation.

DEQ Site ID	Well Depth	Sample Date	Nutrient Concentration		
			Phosphorus	Nitrite[A]	Nitrate[A]
			mg/L	mg/L	mg/L
Water Quality Standard:			No Stand.	1.0	10

2232	Unk	09/28/2022	0.24	<0.30	4.03
2679	60	09/28/2022	0.34	<0.30	11.4
2680	40	09/28/2022	0.16	<0.30	0.0812
2681	45	09/28/2022	0.32	<0.30	1.92

Notes: mg/L = milligrams per liter; Unk=Unknown. Well log not found; No Stand = No Primary or Secondary Drinking Water Regulation or Idaho Ground Water Quality Rule standard currently established;

[A] Contaminant with a National Primary Drinking Water Regulation standard.

General Groundwater Chemistry Results

Water chemistry at all wells was acceptable, with no analytes exceeding set drinking water standards. Previous evaluations have shown that Well 2679 (MW-1) is high in sodium and chloride whereas Well 2232 (domestic) has elevated levels of calcium and bicarbonate. Lab results from 2022 support these findings but show that Well 2232 has a higher concentration of sodium as well—similar to Well 2679.

No wells had concentrations of any metal analytes exceeding either a Primary or Secondary Drinking Water Regulation standard.

Conclusions

The nitrate concentrations detected in groundwater samples from monitoring Well 2679 in 2022 (11.4 mg/L) exceed the MCL of 10 mg/L. However, this result shows a decrease since the last sampling effort in May 2019. The two other monitoring wells and the site's domestic well detected nitrate at concentrations less than half the MCL, showing continual reduction in nitrate over the last several years of monitoring. DEQ plans to return to the site and resample all four wells in 2023 and will reevaluate the frequency of continued monitoring at this time.

All Sand Hollow nitrate investigation sampling results are available at *Ground Water Quality Monitoring and Protection*.

Contact: DEQ State Office, (208) 373-0502

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