

**UTAH  
DEPARTMENT OF  
AGRICULTURE  
AND FOOD**

# **State Ground-Water Program 1999**



**By  
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## ACKNOWLEDGMENTS

The 1999 program has been successful because of the contributions of many people. UDA's ground-water steering committee composed of Commissioner Cary Peterson; Directors, Randy Parker, Dick Wilson, and Dr. David Clark; Section and Program Leaders, George Hopkin and Clark Burgess. This committee gave guidance, support, and direction to the program ensuring its success.

Bill Rasmussen, LaMar Wilson, and Darrell Gillman of UACD have made this year's program work. They helped select and navigated us to sample sites. Because of their efforts this year's sampling has been our most successful year to date.

Terry Monroe, Jarred Manning, and Will Atkin of Utah Division of Water Rights have also helped in selection of well sites in the Pahvant and Curlew Valleys. (Terry and Jarred are pictured on the front cover.)

The program has received excellent support from the two laboratories used in analyzing samples. The State Chemist, Dr. David Clark with his staff chemists Mohammed Sharaf and Lydia Concepcion, provided prompt analysis of the pesticide and nitrate samples collected during the year. Jan Kotuby Amazcher of the Utah State University Analytical Laboratories performed inorganic analysis. Her laboratory was very efficient in analysis and in answering questions about the reports.

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Ivan Sanderson and Virginia Sligting have been the catalyst in the final preparation of this report. Their editing has made the report much more usable and readable. Their careful proofing has insured a much more accurate document.

Final thanks go to the well owners, who, without their trust, this program would not have functioned.

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# STATE GROUND-WATER PROGRAM REPORT 1999

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The State Ground-Water Program is funded by the legislature to assist private well owners and other agencies, organizations and concerned citizens in having a better understanding of water quality. Provisions of the Clean Water Act exclude irrigation, livestock, and other private wells although these wells account for the majority of ground-water use in the State of Utah.

This report covers activities of the Utah Department of Agriculture and Food's (UDAF) State Ground-Water Program for 1999.

## **Cooperative Effort**

UDAF has a memorandum of understanding (MOU) with the Utah Division of Water Rights (WR) for collecting ground-water data from the Pahvant and Curlew valleys. Sample analyses were done for inorganic and/or organic contaminants that influence water quality. Guidance from the Utah Division of Water Rights has helped in selecting sampling areas and sharing data.

UDAF also works closely with the Department of Environmental Quality (DEQ) in providing expertise into the State Pesticide Management Plan and other ground-water programs. This relationship benefits UDAF by allowing agriculture's voice to be heard and ideas considered during the planning process. UDAF is an essential link between DEQ and farmers and ranchers of the state regarding environmental issues.

The State Ground-Water Program uses local Soil Conservation District (SCD) members to locate sample areas. Their knowledge of the area has been very beneficial in selecting wells for sampling, meeting well owners, and distributing information.

## **UDAF'S GROUND-WATER SAMPLING PROCEDURES**

UDAF meets with SCDs to educate them on ground-water issues. Districts then select wells in their area for sampling and obtain preliminary sample information by using UDAF's Pre-Sample Information Form (Fig. 1). (WR selected wells that were sampled in the Pahvant and Curlew valleys.)

The local district then escorted UDAF personnel to selected well sites. At each well, location was determined using a Global Positioning System (GPS) receiver. Water was then collected for inorganic, bacteria, and pesticide analysis at each well. Samples were packed in ice and taken to the appropriate laboratory for analysis. UDAF analyzed samples for pesticides and bacteria whereas Utah State University performed inorganic analyses. Laboratory results were sent to each well owner. GPS information was provided to UDAF's GIS administrator who provided maps of the sampled areas.

During 1999, UDAF tested all samples for Coliform and E. coli bacteria using IDEXX Colilert MUG kits. This has been a significant addition to the program.

## **AREAS SAMPLED**

During 1999, 393 samples were taken from wells, drains, and springs in five areas of the state. The areas included Hansel Valley, Blue Creek Valley, Garland, Tremonton, and Curlew Valley, all in Box Elder County; Pahvant Valley in Millard County; and the Uintah Basin in Duchesne and Uintah Counties. Each of the sampling areas is addressed, with a map showing sample location and a table of chemical analyses. Narrative reports are provided for each sampled area except Curlew and Pahvant valleys. For a description of these areas see the 1996 report.

Values that exceed drinking water, livestock, irrigation, or Clean Water Act standards are **Shaded** on each table. Sample site locations can be identified on the map by using the Map ID number from the associated table. Appendix I lists critical values for each standard.

**PRE-SAMPLE INFORMATION FORM**

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(This is a non-regulatory program. Data from sampling this well will be for your use and information)

Name: \_\_\_\_\_ Telephone #: \_\_\_\_\_  
Address: \_\_\_\_\_ Water Right #: \_\_\_\_\_  
City: \_\_\_\_\_ Depth of Well: \_\_\_\_\_  
Conservation District: \_\_\_\_\_ Depth of Water: \_\_\_\_\_

Please sketch a map showing how to locate your well (North is the top of the page.) Please give street name, and distances from major intersections or any other landmarks that may be significant. If you need more room sketch map on back of sheet.

Can we turn your pump on without you being present? \_\_\_\_\_  
Are there instructions we need to sample your well? \_\_\_\_\_

By signing this form you are giving permission for the State of Utah Department of Agriculture and Food to cross your property and sample your well.

I the undersigned am the lawful agent of the above described well and grant permission to the Utah Department of Agriculture and Food to sample said well. I also grant access permission to the well.

\_\_\_\_\_  
Sign on the above line

\_\_\_\_\_  
Date

For any further information contact: Mark Quilter, Ground Water Specialist  
UDA, 350 North Redwood Road  
Box 146500 Salt Lake City, UT 84114-6500  
(801) 538-9905 Fax: (801) 538-9436

**FIG. 1. Pre-Sample Information Form.**

## **Hansel Valley, Blue Creek, Garland, and Tremonton Area**

Twenty-four wells were sampled in the Hansel Valley, Blue Creek, Garland, and Tremonton areas on April 14. The locations of these sample sites are shown on Map #1, "Garland Area—Box Elder County, Utah." These wells are used for irrigation, culinary water supply, and livestock. This report covers three categories of water quality criteria: Irrigation, Livestock, and Culinary. Since water use may overlap among these categories for a single well, analytical results are compared to all three sets of criteria. Analyses of the samples can be found on tables 1a and 1b "Garland Area Chemistry."

### **Irrigation:**

Salinity is a measurement of the concentration of ionic salts dissolved in water. It is measured as electrical conductivity (EC), with units of micro-mhos per centimeter (umhos/cm). Higher conductivity indicates higher concentration of dissolved salts. Water that is high in salts increases osmotic pressures, making it difficult for plants to get water necessary for growth. Generally when the EC gets above 750 umhos/cm salt-sensitive plants begin to be affected. Only 5 samples have EC values less than 750 umhos/cm. They are 7, 14, 16, 17, and 20. None of the samples exceeded the severe injury level of 3,000 umhos/cm, which affects most plants. Sample 4 approaches the severe level with a value of 2,800 umhos/cm.

Sodium Adsorption Ratio (SAR) is a measure of how much sodium (Na) is in solution compared to calcium and magnesium. Excessive sodium in the soil causes soil particles to repel each other. This destroys the structure of the soil, preventing air and water movement. SAR values greater than 3 can begin to cause problems for sensitive plants and values greater than 9 cause severe problems. Samples 8-13, 19, and 24 all have elevated SAR values. Special care needs to be taken in using water from these sources for irrigation.

Bicarbonate ( $\text{HCO}_3$ ) is an ion common to water solutions. It can be hazardous to plants in excessive amounts, especially when used in sprinkler irrigation. Bicarbonate can also cause white deposits on plants and their fruits, which affect their visual appeal. Bicarbonate also increases the problems of sodium. Special attention is needed when using water with excessive bicarbonate. Minor problems appear on sensitive plants with bicarbonate levels of 1.5 and severe problems when it exceeds 8.5. All of the samples have high bicarbonates. Samples 8-13, 15, 18, 21, 23, and 24 exceed the 8.5 level.

Some specific elements can be toxic to plants. Chlorine, found in the form of Chloride (Cl), above 145 ppm can damage sensitive plants and values higher than 355 ppm can cause severe damage to almost all plants. Samples 1-4, 8, and 10-13 have elevated Cl, with samples 2 and 4 having extremely high values. Using this water in sprinkler irrigation, especially in windy conditions, increases the problem.

No other elements were above concentrations that are harmful to plants.

### **Livestock:**

Only one well fails to meet livestock quality standards. Sample 4 has elevated sulfate as sulfur (S) at 299 ppm (sulfur is generally in the form of sulfate in water). Sulfate at this level has a bitter taste to animals not used to drinking it. Animals may refuse to drink this water. At levels higher than 1,500 ppm more complex digestive problems can occur.

### **Culinary:**

Salinity for 16 wells in the area exceeds the EPA aesthetic standard of 833 umhos/cm. At this level the water may be off-flavored but it is not a health problem until the EC level reaches 3,333. Samples that exceed the aesthetic standard are: 1-4, 8-13, 15, 18, and 21-24. Sample 4 is close to the health standard of 3,333 and presents the greatest concern.

Several minerals were found to exceed the aesthetic drinking water quality standard. Sample 12 has high iron (Fe). This can cause discoloration of plumbing fixtures and promote the growth of iron bacteria, which also stains anything that it contacts. Again, this is an aesthetic issue, not a health concern.

Five samples have high manganese (Mn) levels: 4, 5, 12, 19, and 23. EPA has set an aesthetic standard of 0.05 ppm for manganese. Higher levels may cause discoloration of plumbing fixtures and have an off flavor.

Samples 2 and 4 have high sulfate as sulfur (S). EPA's standard for sulfate in drinking water is 83 ppm. This is an aesthetic standard and is not a serious health problem. Sulfate at this level may serve as a laxative to people not used to drinking the water. A rotten egg odor may also be present when this water is heated, which can be offensive.

The most serious problem with drinking water is bacterial contamination. Because disease-causing organisms are rare, common non-parasitic bacteria that are associated with parasitic bacteria are used as indicators to see if water might be contaminated. Two common indicator bacteria are Coliform and E. coli. Coliform bacteria are found in the digestive systems of mammals and in the soil. Presence of Coliform in a water sample indicates that surface contamination is taking place from soil and air, or fecal material is getting into the well. This is usually a well construction problem involving inadequate capping, leaking casing, lack of casing or improper grouting around the casing. Since E. coli is a bacterium that is found only in digestive systems of mammals, its presence in water is strong evidence that fecal material has entered into the water. Again, well construction is the primary problem. Septic systems, leaky sewer systems, or a shallow water table can also be causal factors. Both Coliform and E. coli are not harmful (some strains of E. coli such as 0157 are very infectious). Samples 2-5, 7, 8, 10-13, 15, 18, 19, 21, 22, and 24 are contaminated with Coliform. Samples 2, 8, 12, 21, and 24 are contaminated with E. coli. These wells should be inspected carefully to determine the source of contamination.

Eight samples (9-11, 13, 18, 21, 22, and 24) exceed EPA's standard for nitrate (NO<sub>3</sub><sup>-</sup>) of 10 ppm. Nitrate is toxic to infants less than one year of age. When ingested it interferes with the blood's ability to adsorb oxygen, causing "blue-baby" syndrome.

**Summary:**

The wells sampled on April 14, 1999 in northern Utah are suitable for livestock and irrigation use as long as salt-tolerant crops are grown. Many of the wells have problems meeting drinking water standards because of salinity, bacteria, nitrate, and elevated mineral levels. Culinary use of this water should be approached with caution.

**Table 1a: Garland Area Chemistry**

Map ID	pH	EC umhos/cm	CO3 meq/L	HCO3 meq/L	NO3-N mg/L	PO4-P mg/L	P mg/L	Cl	SAR mg/L	Hardness	Coliform	E. Coli	Ca mg/L	K mg/L	Mg mg/L	Na mg/L	S mg/L
1	7.3	1050	0	2.86	1.7	0.00	0.00	220.0	2.3	6.2	0	0	83.20	10.60	22.47	93.30	24.80
2	7.1	2000	0	3.21	2.5	0.00	0.00	489.0	1.8	17.2	YES	YES	223.00	10.70	70.69	123.00	93.50
3	7.2	1400	0	3.21	3.5	0.00	0.00	333.0	1.9	10.4	YES	0	133.00	7.41	44.13	97.40	35.10
4	6.7	2800	0	5.00	0.8	0.00	0.00	454.0	1.1	30.5	YES	0	400.00	11.80	122	97.90	299.00
5	7.4	770	0	4.28	0.0	0.00	0.00	127.0	1.6	5.7	YES	0	78.80	5.75	19.25	60.80	11.40
6	7.5	800	0	4.28	0.2	0.00	0.00	135.0	2.0	5.2	0	0	65.10	1.89	23.03	72.60	10.70
7	7.6	500	0	2.50	2.9	0.00	0.00	57.4	1.7	3.3	YES	0	45.50	2.77	11.3	48.10	18.20
8	7.5	1440	0	8.93	3.3	0.05	0.00	201.0	5.3	5.7	YES	YES	49.90	34.30	47.91	220.00	39.90
9	7.1	1500	0	10.40	9.9	0.05	0.00	121.0	3.5	8.5	0	0	92.30	26.20	52.8	171.00	34.70
10	7.1	1900	0	10.70	19.4	0.05	0.00	241.0	3.4	11.1	YES	0	115.00	46.00	74.65	191.00	44.50
11	7.2	1850	0	10.70	18.7	0.05	0.00	238.0	3.5	10.8	YES	0	115.00	45.60	68.96	193.00	42.40
12	7.3	1600	0	10.70	4.0	0.32	0.54	187.0	3.4	7.9	YES	YES	73.40	70.00	61.11	162.00	36.30
13	7.1	1500	0	10.20	10.0	0.05	0.00	160.0	3.6	8.5	YES	0	90.50	27.20	54.07	177.00	36.70
14	7.5	700	0	3.75	1.0	0.00	0.00	118.0	1.9	4.3	0	0	51.70	4.13	22.6	63.80	15.90
15	7.5	1400	0	10.00	3.0	0.27	0.55	132.0	1.8	10.0	YES	0	95.30	47.00	76.19	94.60	46.40
16	7.5	520	0	3.03	8.4	0.00	0.00	30.2	1.2	4.1	0	0	58.10	4.96	12.32	37.20	18.30
17	7.7	500	0	3.57	8.2	0.00	0.00	30.2	1.2	4.2	0	0	59.20	5.06	12.45	37.60	11.20
18	7.4	1280	0	9.28	10.2	0.09	0.00	108.0	2.2	8.1	YES	0	78.10	35.00	61.21	108.00	28.70
19	8.4	810	0	5.71	0.3	0.05	0.00	78.9	5.6	1.9	YES	0	14.10	34.80	19.24	137.00	23.80
20	7.6	500	0	3.93	1.6	0.00	0.00	37.6	1.1	3.7	0	0	44.00	9.07	18.42	36.00	7.29
21	7.3	1160	0	8.57	11.1	0.11	0.00	81.3	2.0	6.7	YES	YES	52.50	41.60	62.21	89.40	25.90
22	7.8	1070	0	8.21	10.0	0.12	0.00	55.7	1.7	6.8	YES	0	57.00	40.80	59.01	75.30	28.80
23	7.3	1260	0	10.40	7.9	0.07	0.00	70.1	1.9	7.9	0	0	60.20	45.00	74.34	93.90	31.90
24	8.0	1500	0	8.57	14.1	0.06	0.00	144.0	3.0	8.5	YES	YES	77.00	50.50	67.86	152.00	41.10

Detection Limits  
 Shaded values exceed drinking water, irrigation, or livestock standards.

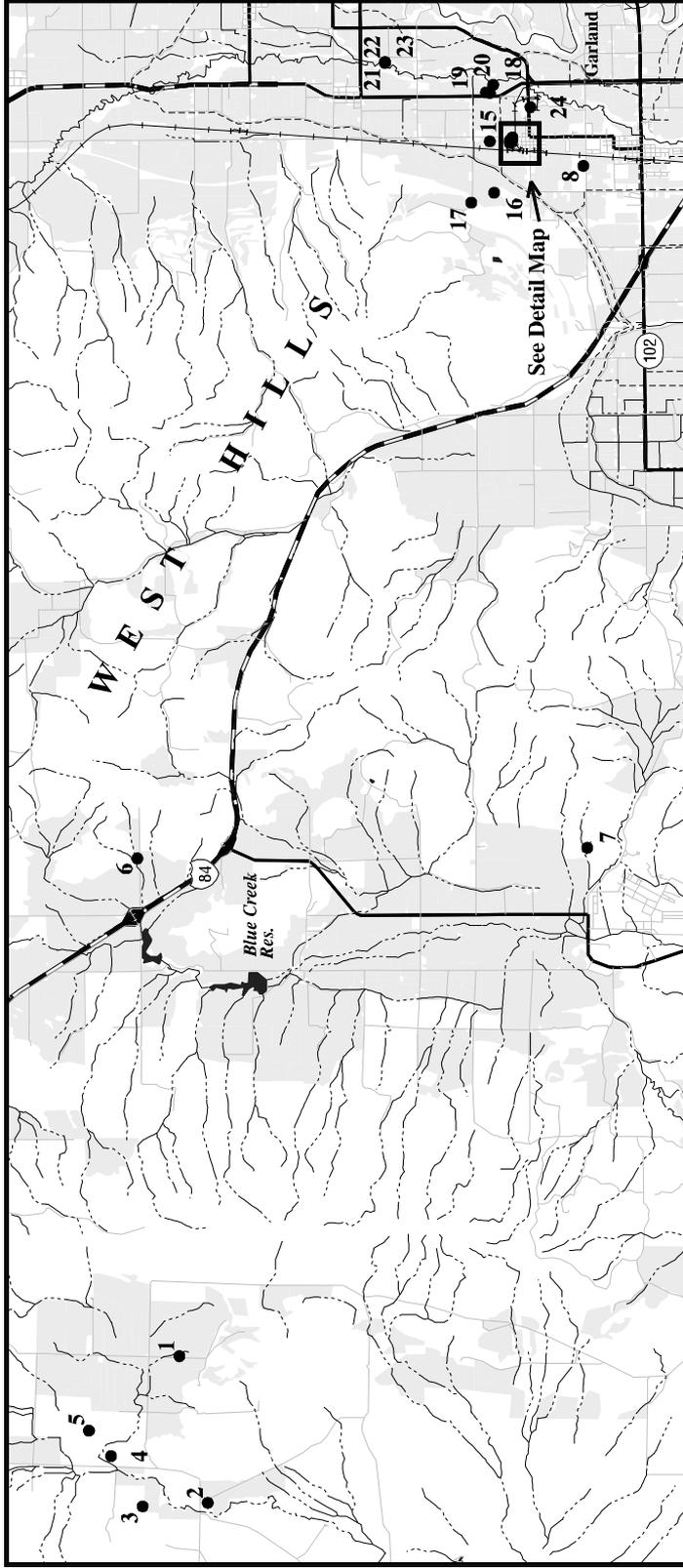
**Table 1b: Garland Area Chemistry Continued**

Map ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	Mn mg/L	Mo mg/L	Ni mg/L	Pb mg/L	Se mg/L	Si mg/L	Sr mg/L	Zn mg/L
1	0.00	0.00	0.22	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	32.40	0.54	0.00
2	0.00	0.00	0.16	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.41	0.00	0.00	0.00	24.80	1.30	0.00
3	0.00	0.00	0.12	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.20	0.67	0.08
4	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.31	0.00	0.00	0.00	12.90	1.55	0.00
5	0.00	0.00	0.13	0.13	0.00	0.00	0.00	0.00	0.00	0.49	0.30	0.00	0.00	0.00	8.93	0.38	0.00
6	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	6.68	0.71	0.25
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0.00	10.30	0.23	0.00
8	0.00	0.00	0.43	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.00	0.00	13.60	0.64	0.00
9	0.00	0.00	0.36	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.10	1.07	0.00
10	0.00	0.00	0.39	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.20	1.49	0.00
11	0.00	0.00	0.40	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.50	1.45	0.00
12	0.24	0.00	0.36	0.19	0.00	0.00	0.00	0.00	2.74	1.16	0.00	0.00	0.00	0.00	14.90	0.87	0.13
13	0.00	0.00	0.36	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.00	0.00	21.30	1.12	0.15
14	0.00	0.00	0.04	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.73	0.00	0.00	0.00	4.71	0.34	0.00
15	0.00	0.00	0.32	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.59	0.00	0.00	0.00	23.20	1.19	0.00
16	0.00	0.00	0.05	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.59	0.00	0.00	0.00	22.40	0.29	0.00
17	0.00	0.00	0.05	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.50	0.30	0.00
18	0.00	0.00	0.28	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.90	0.48	0.00
19	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.57	0.00	0.00	0.00	4.30	0.13	0.00
20	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.60	0.25	0.00
21	0.00	0.00	0.19	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.10	0.38	0.00
22	0.00	0.00	0.18	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.48	0.00	0.00	0.00	21.20	0.38	0.00
23	0.00	0.00	0.19	0.07	0.00	0.00	0.00	0.00	0.00	0.05	0.50	0.00	0.00	0.00	19.60	0.48	0.00
24	0.00	0.00	0.36	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.30	0.96	0.00

Detection Limits 0.1 mg/L 0.2 mg/L 0.1 mg/L 0.05 mg/L 0.03 mg/L 0.03 mg/L 0.03 mg/L 0.03 mg/L 0.05 mg/L 0.05 mg/L 0.02 mg/L 0.05 mg/L 0.15 mg/L 0.05 mg/L 0.5 mg/L 0.05 mg/L 0.03 mg/L 0.05 mg/L

Shaded values exceed drinking water, irrigation, or livestock standards.

# Map #1 Garland Area – Box Elder County, Utah



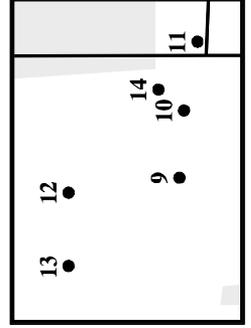
Map Scale 1:190,080  
(1 inch = 3 miles)

## Legend

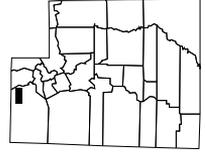
- Sample Location
- Irrigated Cropland
- Water Body
- ~ Perennial Stream
- ~ Intermittent Stream
- ~ Ditch or Canal
- ~ Interstate Highway
- ~ Secondary Route
- ~ Other Road
- ~ Railroad



## Detail Map



## Map Location



## Uintah Basin Areas

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Most sampling efforts for 1999 were focused in the Uintah Basin area. The local SCD boards advertised through the radio, newspapers, and posters in public areas that well-water testing was available. A lot of interest was generated and 187 samples were collected across the basin. For the greater part, water quality is good throughout the basin with generally low electrical conductivity. Because the area is so large and the water quality parameters so diverse, the area is divided into five sub-areas and are discussed separately. Each sub-area has a separate map and data tables. Map #2, "Uintah Basin Area" shows locations of sub-areas. Those wells that do not fit readily within a sub-area are discussed first.

## Uintah Basin

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Twenty-four wells not associated with a specific sub-area were sampled in the Uintah Basin. Map #2, "Uintah Basin Area" shows locations of these sample sites. Tables 2a and 2b contain analyses for these sites. This report covers three categories of water quality criteria: Irrigation, Livestock, and Culinary. Since water use may overlap among these categories for a single well, analytical results are compared to all three sets of criteria.

### Irrigation:

Salinity is a measurement of the concentration of ionic salts dissolved in water. It is measured as electrical conductivity (EC), with units in micro-mhos per centimeter (umhos/cm). Higher conductivity indicates higher concentration of dissolved salts. Water high in salts increases osmotic pressures, making it difficult for plants to get water necessary for growth. Generally when the EC gets above 750 umhos/cm, salt-sensitive plants begin to be affected. Eleven samples have EC values greater than 750 umhos/cm. Samples 39, 49, 73, 75, 164, 176, 218, 335, 338, and 339 all have EC values that exceed the irrigation standard. Samples 73, 75, and 164 exceed the severe-injury level of 3,000 umhos/cm with readings of 3,750, 3,780 and 3,700 umhos/cm, respectively.

Sodium Adsorption Ratio (SAR) is a measure of how much sodium (Na) is in solution compared to calcium and magnesium. Excessive sodium in the soil causes soil particles to repel each other. This destroys the structure of the soil, preventing air and water movement. SAR values greater than 3 can begin to cause problems for sensitive plants, and values greater than 9 cause severe problems. Eight samples have SAR values that exceed the standard of 3: 36, 37, 73, 75, 164, 176, 335, 338, and 339; and 5 had values above 9: 36, 37, 73, 75, and 164. Special care must be taken in using water from these sources for irrigation.

Bicarbonate ( $\text{HCO}_3$ ) is a common ion in water. It can be hazardous to plants in excessive amounts, especially when used in sprinkler irrigation. Bicarbonate can also cause white deposits on plants and their fruits, which affect their visual appeal. Bicarbonate also increases the problems of sodium. Special attention is needed when using water with excessive bicarbonate. Minor problems appear on sensitive plants with bicarbonate levels of 1.5 and severe problems occur when it exceeds 8.5. All samples analyzed for the Uintah Basin have high bicarbonate levels.

Some specific elements can be toxic to plants. Chlorine, found in the form of Chloride ( $\text{Cl}^-$ ), above 145 ppm can damage sensitive plants and values higher than 355 ppm can cause severe damage to almost all plants. Samples 73, 75, and 339 have elevated chlorine of 790, 755, and 209 ppm, respectively. Using this water in sprinkler irrigation, especially in windy conditions, increases the problem.

Samples 164 and 335 has elevated Boron (B) which is toxic to sensitive plants. Sample 331 has elevated copper (Cu) which can cause damage to plants when it exceeds 0.2 ppm.

No other elements were found in concentrations that are harmful to plants.

### **Livestock:**

One well (164) fails to meet livestock quality because it is high in Sulfate as sulfur (S), 445 ppm. Sulfate at this level can cause a bitter taste to animals not used to drinking it. Animals may refuse to drink this water. At levels higher than 1,500 ppm more complex digestive problems can occur.

### **Culinary:**

Salinity for 10 of the wells in the Uintah Basin exceeds the EPA aesthetic standard of 833 umhos/cm. At this level the water may be off flavored but it is not a health problem until the EC level reaches 3,333. Samples that exceed the aesthetic standard are: 39, 49, 73, 75, 164, 176, 218, 335, 338, and 339. Samples 73, 75, and 164 exceed the health standard of 3,333 with values of 3,750, 3,780, and 3,700, respectively, and present the greatest concern.

Two samples have high manganese (Mn) concentrations (samples 75 and 336). EPA has set an aesthetic standard of 0.05 ppm for manganese. Manganese concentrations above this level may cause an off flavor and/or discoloration of plumbing fixtures.

Samples 73, 75, 164, 176, 218, 335, 338, and 339 have high sulfate as sulfur (S). EPA's standard for sulfate in drinking water is 83 ppm. This is an aesthetic standard and is not a serious health problem. Sulfate at this level may serve as a laxative to people not used to drinking the water. A rotten egg odor may also be present when this water is heated, which can be offensive.

The most serious problem with drinking water is bacterial contamination. Because disease-causing organisms are rare, common non-parasitic bacteria that are associated with parasitic bacteria are used as indicators to see if water might be contaminated. Two common indicator bacteria are Coliform and E. coli. Coliform bacteria are found in the digestive systems of mammals and in the soil. Presence of Coliform in a water sample indicates that surface contamination is taking place from soil and air, or fecal material is getting into the well. This is usually a well construction problem involving inadequate capping, leaking casing, lack of casing, or improper grouting around the casing. Since E. coli is a bacterium that is found only in digestive systems of mammals, its presence in water is strong evidence that fecal material has entered into the water. Again, well construction is the primary problem. Septic systems, leaky sewer systems, or a shallow water table can also be causal factors. Both Coliform and E. coli are not harmful although some strains of E. coli such as 0157 are very infectious. Four samples in this area tested positive for Coliform bacteria (Samples 90, 184, 185, and 219). No samples are contaminated with E. coli. These wells should be inspected carefully to determine the source of contamination. These wells generally have at least one of the following attributes: shallow, more than 15 years old, poor construction, and/or poor siting

### **Summary:**

Wells in this area have generally suitable water quality. Water in some wells is limited for culinary uses because of bacteria contamination -17% of tested wells were positive for Coliform. The water is generally hard, with 50% of the wells rated "Moderately Hard," 38% "Hard," and 4% "Very Hard."

**Table 2a: Uintah Basin Area Chemistry**

Map ID	pH	EC umhos/cm	CO3 meq/L	HCO3 meq/L	NO3-N mg/L	PO4-P mg/L	P mg/L	Cl mg/L	SAR	Hardness	Coliform	E. Coli	Ca mg/L	K mg/L	Mg mg/L	Na mg/L	S mg/L
36	9.2	800	1.43	7.14	0.00	0.12	0.00	3.0	41.5	0.1	0	0	1.13	0.0	0.21	183.0	6.8
37	9.3	660	2.14	5.00	0.00	0.09	0.00	3.0	38.7	0.1	0	0	0.76	0.0	0.21	148.0	7.6
38	7.3	670	0.00	6.43	0.17	0.00	0.00	5.4	0.3	6.5	0	0	82.00	2.5	29.00	12.2	14.5
39	7.3	1200	0.00	7.50	1.55	0.00	0.00	34.3	1.7	8.9	0	0	109.00	1.8	44.00	82.7	67.0
49	7.3	950	0.00	5.71	0.10	0.00	0.00	9.2	0.3	9.5	0	0	118.00	1.1	44.80	15.7	76.1
73	7.5	3750	0.00	7.85	8.49	0.00	0.00	790.0	10.2	8.4	0	0	67.40	5.9	76.40	517.0	83.5
75	7.4	3780	0.00	7.85	8.99	0.00	0.00	755.0	9.6	9.3	0	0	82.40	6.1	77.40	507.0	85.2
90	7.5	610	0.00	4.36	0.00	0.00	0.00	0.0	0.1	6.3	YES	0	81.80	0.0	26.70	3.8	34.4
164	7.80	3700	0.01	7.14	0.00	0.00	0.00	84.7	11.0	10.5	0	0	109.00	2.9	70.30	601.0	445.0
171	7.94	540	0.01	4.28	0.00	0.00	0.00	3.9	0.1	5.1	0	0	61.60	0.0	25.10	3.5	13.9
176	7.56	1850	0.00	8.21	1.64	0.00	0.00	74.9	3.2	10.3	0	0	129.00	3.6	46.70	167.0	131.0
182	7.74	680	0.01	5.36	0.28	0.00	0.00	18.5	0.4	4.9	0	0	59.50	1.1	24.30	14.1	19.0
183	7.63	500	0.01	4.28	0.33	0.00	0.00	4.9	0.2	4.7	0	0	60.70	1.0	19.40	7.6	12.0
184	8.12	420	0.01	3.21	0.18	0.00	0.00	0.0	0.2	4.1	YES	0	54.50	0.0	14.90	5.3	13.3
185	7.73	680	0.00	6.07	2.44	0.00	0.00	4.1	0.1	6.1	YES	0	65.20	1.2	38.60	3.5	9.1
218	7.7	1250	0.00	5.53	0.00	0.00	0.00	35.4	0.2	15.0	0	0	191.00	4.2	66.30	13.8	156.0
219	7.7	650	0.00	4.46	0.00	0.00	0.00	59.1	0.5	6.8	YES	0	78.60	3.1	37.70	20.7	42.6
331	8.0	580	0.01	5.71	1.25	0.00	0.00	6.9	0.2	5.8	0	0	68.00	0.0	31.00	7.7	3.3
332	7.8	680	0.01	6.96	0.97	0.00	0.00	14.1	0.2	7.6	0	0	92.60	0.0	37.50	9.3	7.5
333	7.8	690	0.01	6.96	1.65	0.00	0.00	6.2	0.2	7.4	0	0	89.10	0.0	37.40	7.9	4.3
334	7.1	180	0.00	2.14	0.00	0.00	0.00	0.0	0.1	2.2	0	0	34.60	0.0	2.90	1.7	0.8
335	7.9	1900	1.07	9.46	0.00	0.00	0.00	54.3	6.0	8.4	0	0	86.10	1.8	58.20	293.0	146.0
336	7.9	620	0.14	4.86	0.00	0.00	0.00	20.7	1.4	4.2	0	0	47.00	1.3	25.40	47.7	17.0
338	7.8	1725	1.21	4.50	5.18	0.00	0.00	116.0	6.5	6.2	0	0	72.70	4.0	33.90	269.0	141.0
339	8.1	1800	1.00	3.64	8.19	0.13	0.00	209.0	7.4	5.5	0	0	66.70	9.3	26.70	283.0	109.0

Detection Limits  
 Shaded values exceed drinking water, irrigation, or livestock standards.

0.1 mg/L 0.05 mg/L 0.2 mg/L 3.0 mg/L 1 colony 100 ml 1 colony 100 ml 0.2 mg/L 0.2 mg/L 0.2 mg/L 0.2 mg/L

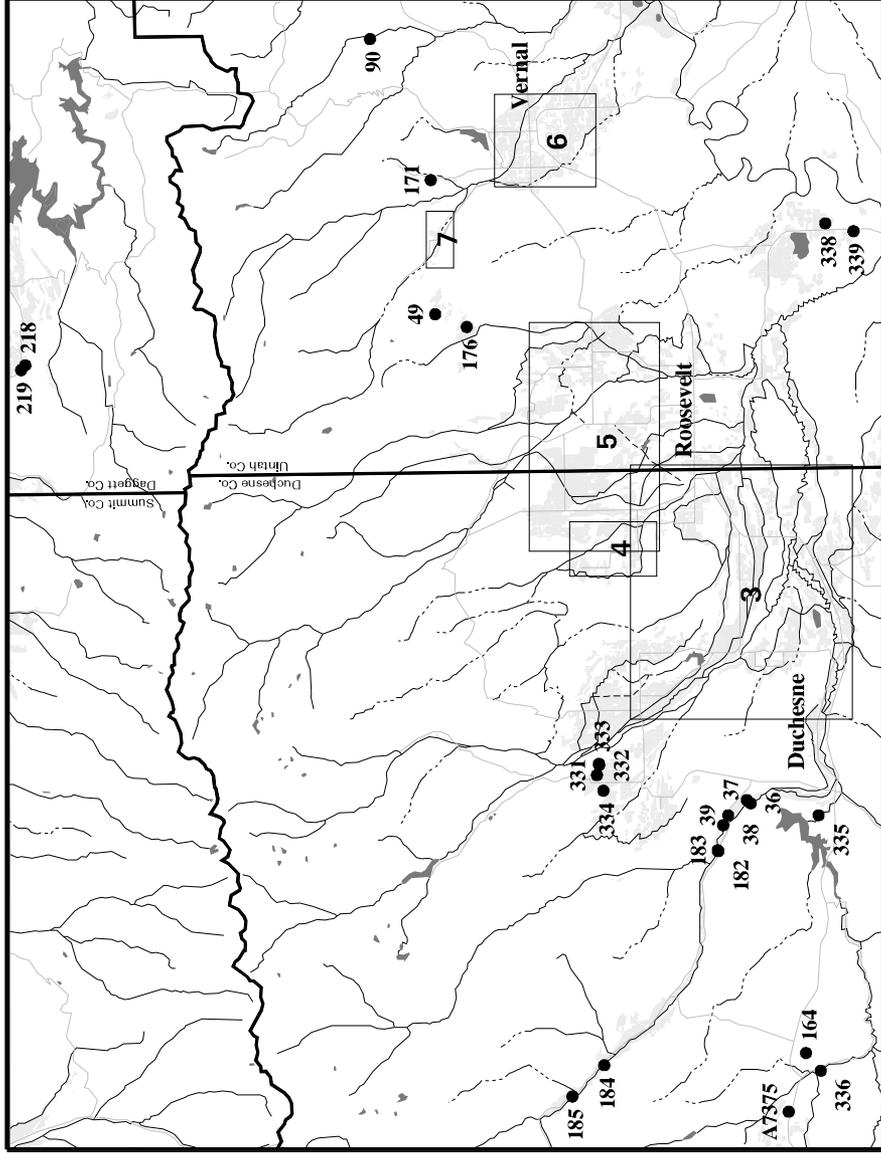
**Table 2b: Uintah Basin Area Chemistry Continued**

Map ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	Mn mg/L	Mo mg/L	Ni mg/L	Pb mg/L	Se mg/L	Si mg/L	Sr mg/L	Zn mg/L
36	0.00	0.00	0.38	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.43	0.00	0.00
37	0.00	0.00	0.26	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.71	0.00	0.00
38	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.53	0.98	0.18
39	0.00	0.00	0.19	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.11	1.11	0.00
49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.12	0.86	0.47
73	0.00	0.00	0.18	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.44	2.56	0.00
75	0.00	0.00	0.18	0.14	0.00	0.00	0.00	0.00	0.00	<b>0.05</b>	0.00	0.00	0.00	0.00	4.48	2.69	0.00
90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.20	0.38	0.08
164	0.00	0.00	<b>4.45</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.94	2.40	0.00
171	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.70	0.13	0.00
176	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.77	2.82	0.00
182	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.78	0.44	0.00
183	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.37	0.29	0.00
184	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.88	0.27	0.00
185	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.05	0.31	0.00
218	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.00	4.52	0.49	0.00
219	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.84	0.00	0.00	0.00	4.50	0.34	0.00
331	0.00	0.00	0.00	0.09	0.00	0.00	0.00	<b>0.25</b>	0.00	0.00	0.00	0.00	0.00	0.00	21.30	0.72	0.00
332	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.80	0.75	0.00
333	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.90	0.68	0.00
334	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00	3.14	0.08	0.00
335	0.00	0.00	<b>1.90</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.09	1.10	0.00
336	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	<b>0.06</b>	<b>0.05</b>	0.00	0.00	0.00	0.00	6.41	0.40	0.00
338	0.00	0.00	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.04	1.51	0.00
339	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.05	1.27	0.00

Detection Limits    0.1 mg/L    0.2 mg/L    0.1 mg/L    0.05 mg/L    0.03 mg/L    0.03 mg/L    0.03 mg/L    0.05 mg/L    0.05 mg/L    0.05 mg/L    0.05 mg/L    0.05 mg/L    0.15 mg/L    0.05 mg/L    0.5 mg/L    0.05 mg/L    0.03 mg/L    0.05 mg/L

Shaded values exceed drinking water, irrigation, or livestock standards.

# Map #2 Uintah Basin Area – Duchesne, Uintah, and Daggett Counties, Utah

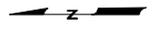


Map Scale 1:750,000  
(1 inch = 11.8 miles)

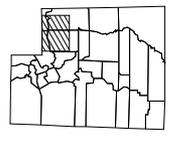
### Legend

- Sample Location
- ▭ Irrigated Cropland
- ▭ Water Body
- Intermittent Stream
- ⋯ Ditch or Canal
- Road
- Perennial Stream
- County Boundary

NOTE: Numbered areas are depicted in detail on other maps in this report.



### Map Location



## **Bluebell, Bridgeland, and Roosevelt Areas**

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Twenty-nine wells were sampled in the Bluebell, Bridgeland, and Roosevelt areas. These wells are used for irrigation, culinary purposes and livestock. Locations of these wells are identified on Map #3, "Bluebell, Bridgeland, and Roosevelt Areas." Water quality data are shown on tables 3a and 3b following this narrative discussion. This report covers three general areas of water quality: Irrigation, Livestock, and Culinary. Since water use may overlap among these categories for a single well, analytical results are compared to all three sets of criteria.

### **Irrigation:**

Salinity is a measurement of the concentration of ionic salts dissolved in water. It is measured as electrical conductivity (EC), with units of micro-mhos per centimeter (umhos/cm). Higher conductivity indicates higher concentration of dissolved salts. Water high in salts increases osmotic pressures, making it difficult for plants to get water necessary for growth. Generally when the EC gets above 750 umhos/cm salt-sensitive plants begin to be affected. Fourteen samples had EC values greater than 750 umhos/cm. They are 41, 62, 66, 180, 181, 317, 320- 322, 324, 326-328, and 337. None of the samples exceeded the severe level of 3,000 umhos/cm. The areas of high EC are from east of Big Sand Wash Reservoir to Roosevelt and around Bridgeland.

Sodium Adsorption Ratio (SAR) is a measure of how much sodium (Na) is in solution compared to calcium and magnesium. Excessive sodium in the soil causes soil particles to repel each other. This destroys the structure of the soil, preventing air and water movement. SAR values greater than 3 can begin to cause problems for sensitive plants and values greater than 9 cause severe problems. Samples 65, 66, 181, 317- 319, 321- 324, 326, and 337 all have elevated SAR values above 3 with samples 181, 319, 321, 323, 324, and 326 above the value of 9. Special care needs to be taken in using water from these sources for irrigation.

Bicarbonate ( $\text{HCO}_3$ ) is a common ion in water. It can be hazardous to plants in excessive amounts, especially when used in sprinkler irrigation. Bicarbonate can also cause white deposits on plants and their fruits, which affect their visual appeal. Bicarbonate also increases the problems of sodium. Special attention is needed when using water with excessive bicarbonate. Minor problems appear on sensitive plants with bicarbonate levels of 1.5 and severe problems occur when it exceeds 8.5. All of the samples have high bicarbonates with 41 and 327 exceeding the 8.5 level.

Samples 41 and 327 both have elevated manganese (Mn). Manganese above 0.2 ppm can injure plants and cause reduction in dry matter production. Excess manganese interferes with the plant's ability to use other nutrients such as calcium.

Boron (B) at values greater than 0.7 ppm can injure sensitive crops. Samples 324 and 337 exceed this level and may harm sensitive plants if used for irrigation. Sample 180 is close to this level with a value of 0.68 ppm.

No other elements were found in concentrations that are harmful to plants.

### **Livestock:**

One well (337) fails to meet livestock quality criteria because it is high in sulfate as sulfur (S), at 196

ppm. Sulfur is generally in the form of sulfate in water. When sulfur exceeds 167 ppm expressed as sulfate, animals may refuse the water. Sulfate at this level can cause a bitter taste to animals not used to drinking it. Animals may refuse to drink this water. At levels higher than 1,500 ppm more complex digestive problems can occur.

### **Culinary:**

Salinity for 13 of the wells in this area exceeds the EPA aesthetic standard of 833 umhos/cm. At this level the water may be off flavored but it is not a health problem until the EC level reaches 3,333. Samples that exceed the aesthetic standard are 41, 62, 66, 180, 181, 317, 320-322, 324, 326, 327, and 337

Three samples have high manganese (Mn) levels (41, 327, and 337). EPA has set an aesthetic standard of 0.05 ppm for manganese. Higher levels may cause discoloration of plumbing fixtures and have an off flavor.

Samples 180, 317, 320, and 337 have high sulfate as sulfur (S). EPA's standard for sulfate in drinking water is 83 ppm. This is an aesthetic standard and is not a serious health problem. Sulfate at this level may serve as a laxative to people not used to drinking the water. A rotten egg odor may also be present when this water is heated, which can be offensive.

The most serious problem with drinking water is bacterial contamination. Because disease-causing organisms are rare, common non-parasitic bacteria that are associated with parasitic bacteria are used as indicators to see if water might be contaminated. Two common bacteria are Coliform and E. coli. Coliform bacteria are found in the digestive systems of mammals and in the soil. Presence of Coliform in a water sample indicates that surface contamination is taking place from soil and air, or fecal material is getting into the well. This is usually a well construction problem involving inadequate capping, leaking casing, lack of casing, or improper grouting around the casing. Since E. coli is a bacterium that is found only in digestive systems of mammals, its presence in water is strong evidence that fecal material has entered into the water. Again, well construction is the primary problem. Septic systems, leaky sewer systems, or a shallow water table can also be causal factors. Both Coliform and E. coli are not harmful although some strains of E. coli such as O157 are very infectious. Ten samples in this area were positive for Coliform bacteria (Samples 40, 41, 67, 72, 181, 315, 316, 319, 322, and 327). Two samples, 67 and 327, are contaminated with E. coli. These wells should be inspected carefully to determine the source of contamination. These wells generally have at least one of the following attributes: shallow, more than 15 years old, poor construction, or poor siting.

### **Summary:**

Generally the wells in this area are suited for livestock watering which is the primary use. The water is limited for culinary use because of the high number of wells contaminated with bacteria (34% Coliform and 7% E. coli). The water is generally hard, with 24% of the wells rated "Moderately Hard," 21% "Hard," and 7% "Very Hard."

**Table 3a: Bluebell, Bridgeland, & Roosevelt Areas Chemistry**

Map ID	pH	EC umhos/cm	CO3 meq/L	HCO3 meq/L	NO3-N mg/L	PO4-P mg/L	P mg/L	Cl mg/L	SAR	Hardness	Coliform 1+=/0=-	E. Coli 1+=/0=-	Ca mg/L	K mg/L	Mg mg/L	Na mg/L	S mg/L
40	7.4	700	0.00	6.43	1.88	0.00	7.4	8.2	0.2	6.6	YES	0	78.20	5.2	35.10	7.4	9.20
41	7.8	1140	0.00	8.93	0.00	0.00	7.8	57.4	1.6	7.9	YES	0	73.50	3.8	60.80	77.0	30.90
62	7.4	1110	0.00	7.85	0.00	0.00	7.4	34.9	1.6	6.3	0	0	54.30	9.8	53.70	67.9	49.70
63	7.1	160	0.00	1.43	0.00	0.00	7.1	3.8	0.5	1.5	0	0	23.00	1.5	2.50	8.9	2.27
64	7.4	380	0.00	2.86	0.00	0.00	7.4	7.4	0.0	3.2	0	0	38.40	3.4	16.30	4.7	17.70
65	7.6	700	0.00	3.21	0.00	0.00	7.6	24.3	3.2	2.5	0	0	30.70	3.5	12.80	83.1	48.90
66	7.5	950	0.00	6.07	0.00	0.00	7.5	38.4	3.7	3.8	0	0	40.10	3.4	25.00	121.0	44.10
67	8.0	530	0.01	3.57	0.00	0.25	8	13.6	0.5	4.5	YES	YES	48.40	2.2	28.20	19.1	23.30
71	7.6	330	0.01	3.21	0.15	0.00	7.6	3.5	0.1	3.3	0	0	38.30	1.1	17.90	3.6	3.00
72	7.5	720	0.00	5.35	0.00	0.00	7.5	23.2	0.6	6.0	YES	0	70.30	1.5	32.60	23.2	26.00
180	7.8	1340	0.01	6.78	1.67	0.00	7.78	22.3	1.5	8.8	0	0	100.00	1.5	50.50	75.9	100.00
181	8.5	1230	0.01	3.57	0.00	0.04	8.54	72.2	26.2	0.4	YES	0	5.70	0.0	0.36	239.0	79.70
315	7.8	380	0.00	2.86	0.00	0.00	7.8	0.0	0.2	3.4	YES	0	39.50	3.3	19.20	5.5	14.50
316	7.4	290	0.00	2.86	0.21	0.00	7.4	3.2	0.3	2.6	YES	0	37.40	0.0	6.47	8.4	3.10
317	8.0	890	0.00	2.32	0.00	0.00	8.0	30.6	3.0	4.1	0	0	43.40	3.8	27.10	101.0	91.20
318	8.2	450	0.01	3.57	0.00	0.00	8.2	3.8	5.3	0.9	0	0	11.00	2.1	4.13	81.8	13.00
319	8.8	740	1.43	3.03	0.00	0.00	8.8	52.9	24.5	0.2	YES	0	2.10	0.0	0.71	161.0	21.2
320	7.4	1250	0.00	7.14	0.54	0.00	7.4	10.3	1.1	14.1	0	0	207.00	1.1	34.80	66.2	139.00
321	9.0	930	2.50	4.64	0.00	0.00	9.0	3.7	42.9	0.1	0	0	1.30	0.0	0.44	222.0	38.20
322	8.1	870	0.01	2.86	0.00	0.00	8.1	83.1	7.7	1.6	YES	0	20.10	1.5	6.75	157.0	54.50
323	8.7	720	0.93	4.43	0.00	0.00	8.7	8.7	20.7	0.2	0	0	2.59	1.1	1.24	162.0	21.90
324	8.8	990	2.14	7.50	0.00	0.05	8.8	0.0	55.0	0.1	0	0	1.15	0.0	0.33	260.0	14.50
325	7.6	730	0.57	5.68	0.28	0.00	7.6	32.5	0.5	6.9	0	0	82.50	1.7	35.60	23.4	10.00
326	8.7	880	2.14	4.64	0.00	0.05	8.7	10.2	32.6	0.2	0	0	2.06	0.0	0.77	216.0	30.90
327	7.5	1200	0.01	9.28	0.00	0.00	7.5	16.8	0.4	11.0	YES	YES	137.00	2.0	51.50	21.6	34.10
328	8.0	810	0.36	6.07	0.00	0.00	8.0	22.1	0.3	7.9	0	0	80.00	4.4	55.00	12.7	30.20
329	7.8	680	0.01	5.71	0.00	0.00	7.8	0.0	0.2	7.1	0	0	86.00	1.4	34.90	7.8	21.50
330	7.9	610	0.36	5.43	1.00	0.00	7.9	6.4	0.2	6.1	0	0	69.80	0.0	35.00	6.5	8.12
337	8.0	1800	0.01	3.93	0.00	0.11	8.0	97.8	8.9	4.4	0	0	37.40	1.3	37.10	321.0	196.00

Detection Limits

0.1 mg/L 0.05 mg/L 0.2 mg/L

3.0 mg/L

1 colony  
100 ml

1 colony  
100 ml

0.2 mg/L 1.0 mg/L 0.2 mg/L

0.2 mg/L 0.2 mg/L

Shaded values exceed drinking water, irrigation, or livestock standards.

**Table 3b: Bluebell, Bridgeland, & Roosevelt Areas Chemistry Continued**

Map ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	Mn mg/L	Mo mg/L	Ni mg/L	Pb mg/L	Se mg/L	Si mg/L	Sr mg/L	Zn mg/L
40	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	20.40	0.60	0.00
41	0.00	0.00	0.27	0.09	0.00	0.00	0.00	0.00	0.00	1.11	0.00	0.00	0.00	0.00	4.48	0.55	0.00
62	0.00	0.00	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.13	0.55	0.00
63	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.06	0.00
64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	4.50	0.37	0.00
65	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	4.18	0.36	0.00
66	0.00	0.00	0.23	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	4.19	0.44	0.00
67	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.56	0.43	0.00
71	0.00	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.18	0.28	0.00
72	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.83	0.65	0.00
180	0.00	0.00	0.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.20	4.85	0.00
181	0.00	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.43	0.11	0.00
315	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.03	0.43	0.00
316	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.26	0.10	0.14
317	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.28	0.00	0.00	0.00	0.00	0.00	4.20	0.56	0.00
318	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00	3.80	0.13	0.00
319	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	3.55	0.03	0.00
320	0.00	0.00	0.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.10	5.44	0.00
321	0.00	0.00	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.68	0.05	0.00
322	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.82	0.34	0.00
323	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.44	0.04	0.00
324	0.00	0.00	1.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.03	0.04	0.00
325	0.00	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.90	1.18	0.00
326	0.00	0.00	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.15	0.06	0.00
327	0.00	0.00	0.14	0.12	0.00	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.00	0.00	6.87	0.71	1.18
328	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	2.91	0.48	0.00
329	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.24	0.79	0.00
330	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.70	0.72	0.00
337	0.00	0.00	0.76	0.00	0.00	0.00	0.00	0.00	0.06	0.10	0.00	0.00	0.00	0.00	0.70	1.06	0.00

Detection Limits 0.1 mg/L 0.2 mg/L 0.1 mg/L 0.05 mg/L 0.03 mg/L 0.03 mg/L 0.03 mg/L 0.05 mg/L 0.05 mg/L 0.2 mg/L 0.05 mg/L 0.05 mg/L 0.15 mg/L 0.05 mg/L 0.5 mg/L 0.03 mg/L 0.03 mg/L 0.05 mg/L

Shaded values exceed drinking water, irrigation, or livestock standards.



## **Monarch and Cedarview Areas**

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Thirty-one wells were sampled in the Monarch and Cedarview areas. Locations of these sample sites are shown on Map #4, "Monarch and Cedarview Areas." These wells are used for irrigation, culinary water supply, and livestock. This report covers three categories of water quality criteria: Irrigation, Livestock, and Culinary. Since water use may overlap among these categories for a single well, analytical results are compared to all three sets of criteria. Analyses of the samples can be found on tables 4a and 4b.

### **Irrigation:**

Salinity is a measurement of the concentration of ionic salts dissolved in water. It is measured as electrical conductivity (EC), with units of micro-mhos per centimeter (umhos/cm). Higher conductivity indicates higher concentration of dissolved salts. Water high in salts increases osmotic pressures, making it difficult for plants to get water necessary for growth. Generally when the EC gets above 750 umhos/cm salt-sensitive plants begin to be affected. Only 6 samples have EC values less than 750 umhos/cm. They are 106 and 126-130. One of the samples, 127, exceeded the severe level of 3,000 umhos/cm which affects most plants

Sodium Adsorption Ratio (SAR) is a measure of how much sodium (Na) is in solution compared to calcium and magnesium. Excessive sodium in the soil causes soil particles to repel each other. This destroys the structure of the soil, preventing air and water movement. SAR values greater than 3 can begin to cause problems for sensitive plants and values greater than 9 cause severe problems. Sample 127 has elevated SAR at 3.9. Special care needs to be taken in using water from these sources for irrigation.

Bicarbonate ( $\text{HCO}_3$ ) is an ion common to water solutions. It can be hazardous to plants in excessive amounts, especially when used in sprinkler irrigation. Bicarbonate can also cause white deposits on plants and their fruits, which affect their visual appeal. Bicarbonate also increases the problems of sodium. Special attention is needed when using water with excessive bicarbonate. Minor problems appear on sensitive plants with bicarbonate levels of 1.5 and severe problems when it exceeds 8.5. All of the samples have high bicarbonates.

Well 127 has elevated Boron (B) at 1.47 ppm. Boron can be toxic to sensitive plants when it exceeds 0.7 ppm.

No other elements were found at concentrations that are harmful to plants.

### **Livestock:**

Only two wells fail to meet livestock quality standard for sulfate as sulfur (S), which is set at 167 ppm. Samples 127 and 128 have elevated sulfate as sulfur (S) at 486 and 227 ppm. Sulfur is generally in the form of sulfate in water. Sulfate at this level has a bitter taste to animals not used to drinking it. Animals may refuse to drink this water. At levels higher than 1,500 ppm more complex digestive problems can occur.

### **Culinary:**

Salinity for 6 wells in the area exceeds the EPA aesthetic standard of 833 umhos/cm. At this level the water may be off-flavored but it is not a health problem until the EC level reaches 3,333. Samples that exceed the aesthetic standard are: 106 and 126-130. Sample 127 is close to the health standard of 3,333

and presents the greatest concern.

Several minerals were found to exceed the aesthetic drinking water quality standard. Samples 309-314 have high iron (Fe). This can cause discoloration of plumbing fixtures and promote the growth of iron bacteria, which also stains anything that it contacts. Again, this is an aesthetic issue, not a health concern.

Two samples have high manganese (Mn) levels (310 and 312). EPA has set an aesthetic standard of 0.05 ppm for manganese. Higher levels may cause discoloration of plumbing fixtures and have an off flavor.

Samples 106 and 126-128 have high sulfate as sulfur (S). EPA's standard for sulfate in drinking water is 83 ppm. This is an aesthetic standard and is not a serious health problem. Sulfate at this level may serve as a laxative to people not used to drinking the water. A rotten egg odor may also be present when this water is heated, which can be offensive.

The most serious problem with drinking water is bacterial contamination. Because disease-causing organisms are rare, common non-parasitic bacteria that are associated with parasitic bacteria are used as indicators to see if water might be contaminated. Two common indicator bacteria are Coliform and E. coli. Coliform bacteria are found in the digestive systems of mammals and in the soil. Presence of Coliform in a water sample indicates that surface contamination is taking place from soil and air, or fecal material is getting into the well. This is usually a well construction problem involving inadequate capping, leaking casing, lack of casing, or improper grouting around the casing. Since E. coli is a bacterium that is found only in digestive systems of mammals, its presence in water is strong evidence that fecal material has entered into the water. Again, well construction is the primary problem. Septic systems, leaky sewer systems, or a shallow water table can also be causal factors. Both Coliform and E. coli are not harmful, although some strains of E. coli such as 0157 are very infectious. Samples 107, 111, 120, 127, and 130 are contaminated with Coliform. These wells should be inspected carefully to determine the source of contamination. No samples are contaminated with E. coli.

Sample 129 exceeds EPA's standard for nitrate ( $\text{NO}_3^-$ ) of 10 ppm. Nitrate is toxic to infants less than one year of age. When ingested it interferes with the blood's ability to adsorb oxygen, causing "blue-baby" syndrome.

### **Summary:**

Generally the wells in this area are suited for livestock watering which is the primary use. The water is limited for culinary use because of the elevated EC, Fe, Mn, sulfate, and nitrate levels as well as Coliform bacteria. The water is generally hard with 55% of the wells rated "Moderately Hard," 16% "Hard," and 10% "Very Hard."

**Table 4a: Monarch & Cedarview Area Chemistry**

Map ID	pH	EC umhos/cm	CO3 meq/L	HCO3 meq/L	NO3-N mg/L	PO4-P mg/L	P mg/L	Cl mg/L	SAR	Hardness	Coliform	E. Coli	Ca mg/L	K mg/L	Mg mg/L	Na mg/L	S mg/L
70	7.4	360	0.00	2.86	0.00	0.00	0.00	0.0	0.2	3.5	0	0	48.00	3.8	11.00	4.6	15.4
106	7.2	1310	0.00	5.18	0.24	0.00	0.00	10.2	0.3	14.8	0	0	195.00	3.0	58.20	17.2	166.0
107	7.6	420	0.00	3.03	0.00	0.00	0.00	8.5	0.3	4.1	YES	0	56.20	4.2	13.40	8.6	17.7
109	7.5	390	0.00	3.21	0.00	0.00	0.00	0.0	0.3	3.8	0	0	52.30	3.7	13.50	7.9	12.4
110	7.7	360	0.00	2.86	0.00	0.00	0.00	0.0	0.2	3.7	0	0	50.80	3.7	12.40	4.6	12.8
111	7.6	390	0.01	3.39	0.00	0.00	0.00	0.0	0.3	3.2	YES	0	42.50	3.6	11.70	8.7	11.7
112	7.7	350	0.00	2.86	0.00	0.00	0.00	0.0	0.1	3.4	0	0	46.20	3.8	11.60	4.4	13.0
113	7.5	400	0.00	3.39	0.29	0.00	0.00	0.0	0.3	3.8	0	0	51.00	3.5	13.60	7.8	12.0
114	7.6	390	0.00	3.39	0.00	0.00	0.00	0.0	0.3	3.8	0	0	50.80	3.8	14.00	8.1	11.4
115	7.7	390	0.00	3.39	0.40	0.00	0.00	0.0	0.3	3.6	0	0	47.60	3.5	14.00	7.8	11.2
116	7.6	410	0.00	3.75	0.00	0.00	0.00	0.0	0.3	4.0	0	0	53.20	3.5	15.90	10.3	10.4
117	7.6	360	0.00	2.86	0.00	0.00	0.00	0.0	0.2	2.8	0	0	37.60	3.4	10.80	6.3	11.6
118	7.6	410	0.00	3.57	0.00	0.00	0.00	0.0	0.3	3.6	0	0	45.50	3.5	16.00	10.4	11.2
119	7.3	340	0.00	2.50	0.00	0.00	0.00	0.0	0.1	3.5	0	0	49.30	3.4	10.10	3.7	14.9
120	7.6	365	0.00	3.21	0.00	0.00	0.00	0.0	0.2	3.7	YES	0	52.90	3.8	10.50	6.5	11.8
121	7.6	360	0.00	2.50	0.00	0.00	0.00	0.0	0.2	3.6	0	0	51.00	3.8	10.80	6.6	11.9
122	7.6	480	0.00	3.93	0.00	0.00	0.00	6.3	0.4	4.3	0	0	51.30	3.6	21.90	14.5	13.3
123	7.5	520	0.00	4.36	0.00	0.00	0.00	8.1	0.4	4.4	0	0	48.20	3.0	27.60	15.4	13.6
124	7.5	470	0.00	4.28	0.00	0.00	0.00	5.4	0.4	4.4	0	0	49.60	3.2	25.00	12.5	13.6
125	7.6	490	0.00	4.28	0.00	0.00	0.00	7.8	0.4	4.4	0	0	49.60	3.2	26.00	15.6	10.4
126	7.2	950	0.00	4.11	0.33	0.00	0.00	23.3	0.7	8.1	0	0	86.80	5.2	51.20	34.8	83.9
127	7.3	3300	0.00	7.85	3.07	0.00	0.00	88.4	3.9	22.9	YES	0	189.00	8.3	202.00	321.0	486.0
128	7.4	1920	0.00	3.21	0.00	0.00	0.00	140.0	2.5	13.4	0	0	163.00	8.6	66.60	152.0	227.0
129	7.5	1010	0.00	7.32	10.68	0.00	0.00	20.8	1.3	6.6	0	0	56.90	5.6	56.60	57.2	35.0
130	7.6	960	0.00	6.25	0.00	0.00	0.00	20.4	1.3	7.8	YES	0	90.20	3.1	43.50	58.0	55.9
309	7.6	410	0.00	3.57	0.00	0.00	0.00	0.0	0.3	3.8	0	0	46.60	3.2	18.20	9.3	10.5
310	7.7	460	0.00	4.11	0.00	0.00	0.00	5.5	0.3	4.1	0	0	46.20	3.0	24.70	11.2	9.3
311	7.6	390	0.00	3.21	0.00	0.00	0.00	0.0	0.2	3.7	0	0	52.10	3.5	11.80	7.2	11.1
312	7.7	460	0.00	4.11	0.00	0.00	0.00	3.9	0.3	4.0	0	0	47.20	3.1	21.70	11.5	10.0
313	7.8	380	0.00	2.68	0.00	0.00	0.00	0.0	0.1	3.6	0	0	45.50	4.5	16.00	3.1	20.9
314	7.8	350	0.00	2.50	0.00	0.00	0.00	0.0	0.1	3.3	0	0	45.00	3.2	12.20	3.6	12.8

Detection Limits  
 Shaded values exceed drinking water, irrigation, or livestock standards.

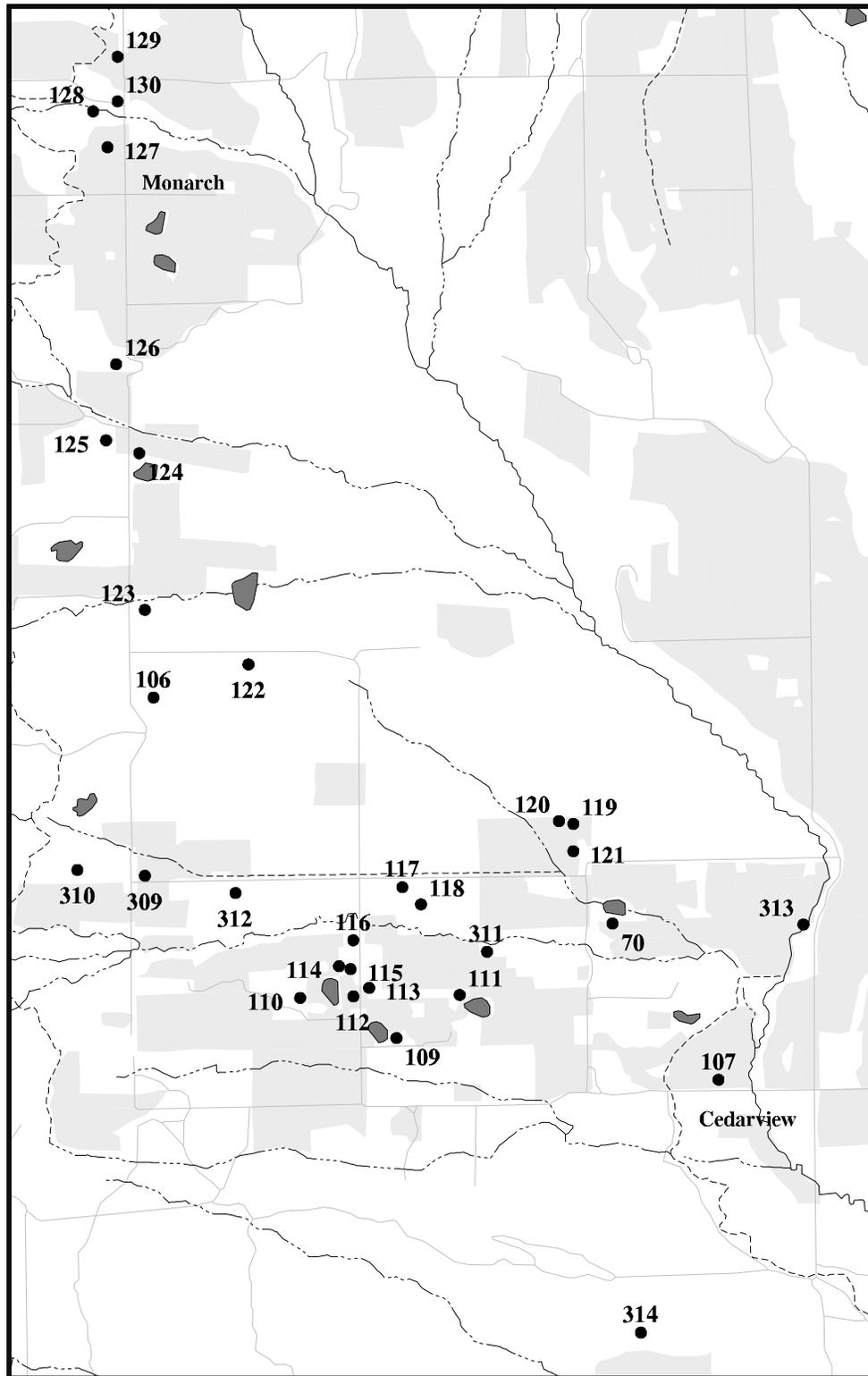
0.1 mg/L  
 0.05 mg/L  
 0.2 mg/L  
 3.0 mg/L  
 1 colony  
 100 ml  
 1 colony  
 100 ml  
 0.2 mg/L  
 1.0 mg/L  
 0.2 mg/L  
 0.2 mg/L  
 0.2 mg/L

**Table 4b: Monarch & Cedarview Area Chemistry Continued**

Map ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	Mn mg/L	Mo mg/L	Ni mg/L	Pb mg/L	Se mg/L	Si mg/L	Sr mg/L	Zn mg/L
70	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.00	3.37	0.31	0.00
106	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.56	2.10	0.00
107	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.54	0.42	0.00
109	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	3.79	0.26	0.00
110	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.79	0.28	0.00
111	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.56	0.27	0.00
112	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.80	0.27	0.00
113	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	3.75	0.26	0.00
114	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.81	0.28	0.00
115	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.79	0.27	0.00
116	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.61	0.30	0.00
117	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.58	0.21	0.00
118	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.68	0.32	0.00
119	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.00	0.00	3.78	0.27	0.00
120	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.56	0.28	0.00
121	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.57	0.29	0.00
122	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.62	0.46	0.00
123	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.58	0.52	0.00
124	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.25	0.49	0.21
125	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.58	0.55	0.00
126	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.11	0.83	0.00
127	0.00	0.00	1.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.87	4.61	0.00
128	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.69	2.58	0.00
129	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.70	1.79	0.00
130	0.00	0.00	0.16	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.20	1.89	0.00
309	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.35	0.00	0.00	0.00	0.00	0.00	3.45	0.33	0.00
310	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32	0.05	0.00	0.00	0.00	0.00	2.88	0.43	0.00
311	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.00	0.00	0.00	0.00	0.00	2.94	0.27	0.00
312	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.45	0.12	0.00	0.00	0.00	0.00	3.20	0.41	0.00
313	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.00	0.00	0.00	3.09	0.63	0.00
314	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.00	0.00	0.00	0.00	0.00	3.44	0.33	0.00

Detection Limits 0.1 mg/L 0.2 mg/L 0.1 mg/L 0.05 mg/L 0.03 mg/L 0.03 mg/L 0.03 mg/L 0.05 mg/L 0.05 mg/L 0.05 mg/L 0.2 mg/L 0.05 mg/L 0.15 mg/L 0.05 mg/L 0.5 mg/L 0.05 mg/L 0.03 mg/L 0.05 mg/L  
 Shaded values exceed drinking water, irrigation, or livestock standards.

# Map #4 Monarch and Cedarview Areas – Duchesne County, Utah



## Legend

- Sample Location
- Irrigated Cropland
- Water Body
- Perennial Stream
- - - Intermittent Stream
- - - Ditch or Canal
- Road



## Map Location



Map Scale 1:47,520  
(1 inch = .75 miles)

## **Neola, Tridell, and Lapoint Area**

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Forty-seven wells were sampled in the Neola, Tridell, and Lapoint areas. Locations of these sample sites are shown on Map #5, "Neola, Tridell, and Lapoint Areas." These wells are used for irrigation, culinary water supply, and livestock. This report covers three categories of water quality criteria: Irrigation, Livestock, and Culinary. Since water use may overlap among these categories for a single well, analytical results are compared to all three sets of criteria. Analyses of the samples can be found on tables 5a and 5b.

### **Irrigation:**

Salinity is a measurement of the concentration of ionic salts dissolved in water. It is measured as electrical conductivity (EC), with units of micro-mhos per centimeter (umhos/cm). Higher conductivity indicates higher concentration of dissolved salts. Water high in salts increases osmotic pressures, making it difficult for plants to get water necessary for growth. Generally when the EC gets above 750 umhos/cm salt-sensitive plants begin to be affected. Twelve samples have EC values greater than 750 umhos/cm. They are 57, 59-61, 177-179, 288, 289, 291, 292, and 301. One of the samples, 289, exceeded the severe injury level of 3,000 umhos/cm, which affects most plants. Sample number 289 with a value of 5,400 umhos/cm exceeds the severe level,. The areas of high EC are east and south of Neola and around Tridell and Lapoint.

Sodium Adsorption Ratio (SAR) is a measure of how much sodium (Na) is in solution compared to calcium and magnesium. Excessive sodium in the soil causes soil particles to repel each other. This destroys the structure of the soil, preventing air and water movement. SAR values greater than 3 can begin to cause problems for sensitive plants and values greater than 9 cause severe problems. Samples 178, 179, 282, 289, and 300 all have elevated SAR values. Special care needs to be taken in using water from these sources for irrigation.

Bicarbonate ( $\text{HCO}_3$ ) is an ion common to water solutions. It can be hazardous to plants in excessive amounts, especially when used in sprinkler irrigation. Bicarbonate can also cause white deposits on plants and their fruits, which affect their visual appeal. Bicarbonate also increases the problems of sodium. Special attention is needed when using water with excessive bicarbonate. Minor problems appear on sensitive plants with bicarbonate levels of 1.5 and severe problems when it exceeds 8.5. All of the samples have high bicarbonate levels. Samples 177 and 292 exceed the 8.5 level.

Some specific elements can be toxic to plants. Chlorine, found in the form of Chloride ( $\text{Cl}^-$ ), above 145 ppm can damage sensitive plants and values higher than 355 ppm can cause severe damage to almost all plants. Sample 289 has elevated Cl. Using this water in sprinkler irrigation when wind is present increases the problem.

Samples 290 and 291 both have elevated manganese (Mn). Manganese above 0.2 ppm can injure plants and cause reduction in dry matter. Excess manganese interferes with the plant's ability to use other nutrients such as calcium.

No other elements were above concentrations that are harmful to plants.

### **Livestock:**

Five wells fail to meet livestock quality criteria. Samples 59-61, 289, and 301 have elevated sulfate as

sulfur (S) above 167 ppm. Sulfur is generally in the form of sulfate in water. These wells are west of the Montes Creek Reservoir and east of Lapoint. Sulfate at this level has a bitter taste to animals not used to drinking it. Animals may refuse to drink this water. At levels higher than 1,500 ppm more complex digestive problems can occur.

### **Culinary:**

Salinity for 9 wells in the area exceeds the EPA aesthetic standard of 833 umhos/cm. At this level the water may be off-flavored but it is not a health problem until the EC level reaches 3,333. Samples that exceed the aesthetic standards are: 59-61, 177, 178, 179, 288, 289, 291, and 301. Sample 289 exceeds the health standard of 3,333 and presents the greatest concern.

Several minerals were found to exceed the aesthetic drinking water quality standard. Sample 290 has high iron (Fe). This can cause discoloration of plumbing fixtures and promote the growth of iron bacteria, which also stains anything that it contacts. Again, this is an aesthetic issue, not a health concern.

Six samples have high manganese (Mn) levels (51, 59, 61, 290, 291, and 301). EPA has set an aesthetic standard of 0.05 ppm for manganese. Higher levels may cause an off flavor and/or discoloration of plumbing fixtures.

Samples 59, 60, 61, 177, 289, and 301 have high sulfate as sulfur (S). EPA's standard for sulfate in drinking water is 83 ppm. This is an aesthetic standard and is not a serious health problem. Sulfate at this level may serve as a laxative to people not used to drinking the water. A rotten egg odor may also be present when this water is heated, which can be offensive.

The most serious problem with drinking water is bacterial contamination. Because disease-causing organisms are rare, common non-parasitic bacteria that are associated with parasitic bacteria are used as indicators to see if water might be contaminated. Two common indicator bacteria are Coliform and E. coli. Coliform bacteria are found in the digestive systems of mammals and in the soil. Presence of Coliform in a water sample indicates that surface contamination is taking place from soil and air, or fecal material is getting into the well. This is usually a well construction problem involving inadequate capping, leaking casing, lack of casing, or improper grouting around the casing. Since E. coli is a bacterium that is found only in digestive systems of mammals, its presence in water is strong evidence that fecal material has entered into the water. Again, well construction is the primary problem. Septic systems, leaky sewer systems, or a shallow water table can also be causal factors. Both Coliform and E. coli are not harmful, although some strains of E. coli such as 0157 are very infectious. Samples 50, 52, 53, 56, 58, 177-179, 278-280, 286, 287, 289-293, 297-299, 302, 305, and 306 are contaminated with Coliform. Samples 177, 286, 387, 289, 290, 298, and 302 are contaminated with E. coli. These wells should be inspected carefully to determine the source of contamination.

Sample 289 exceeds EPA's standard for nitrate ( $\text{NO}_3^-$ ) of 10 ppm. Nitrate is toxic to infants less than one year of age. When ingested it interferes with the blood's ability to adsorb oxygen, causing "blue-baby" syndrome.

### **Summary:**

Generally the wells in this area are suited for livestock watering which is the primary use. The water is of limited suitability for culinary use because of the high number of wells contaminated with bacteria (49% Coliform and 13% E. coli). The water is generally hard with 23% of the wells rated "Moderately Hard," 36% "Hard," and 11% "Very Hard."

**Table 5a: Neola, Tridell, & Lapoint Areas Chemistry**

Map ID	pH	EC umhos/cm	CO3 meq/L	HCO3 meq/L	NO3-N mg/L	PO4-P mg/L	P mg/L	Cl mg/L	SAR	Hardness	Coliform	E. Coli	Ca mg/L	K mg/L	Mg mg/L	Na mg/L	S mg/L
50	7.5	720	0.00	7.50	0.00	0.00	0.00	3.8	0.2	6.7	YES	0	77.10	0.0	37.30	9.9	4.3
51	7.3	240	0.00	2.50	0.00	0.00	0.00	3.1	0.1	2.5	0	0	38.40	0.0	5.00	2.7	2.0
52	7.4	240	0.00	2.14	0.29	0.00	0.00	0.0	0.2	2.5	YES	0	36.50	0.0	5.50	3.9	3.0
53	7.4	320	0.00	3.21	0.00	0.00	0.00	0.0	0.1	3.4	YES	0	48.30	1.3	9.50	2.0	2.2
54	7.4	320	0.00	3.21	0.00	0.00	0.00	0.0	0.0	3.3	0	0	47.60	1.3	8.90	1.2	2.7
55	7.3	680	0.00	6.07	1.53	0.00	0.00	14.6	0.2	6.8	0	0	89.80	4.4	26.80	7.8	6.6
56	7.6	740	0.00	6.78	1.80	0.00	0.00	19.1	0.2	7.3	YES	0	94.90	9.2	30.40	6.6	4.5
57	7.6	760	0.00	7.85	0.00	0.00	0.00	5.4	0.2	6.9	0	0	71.50	0.0	47.00	8.2	2.6
58	7.6	680	0.00	6.78	0.62	0.00	0.00	9.6	0.0	1.6	YES	0	70.40	1.4	40.00	8.5	4.0
59	7.5	1800	0.00	2.50	0.00	0.00	0.00	0.0	1.6	17.1	0	0	241.00	3.4	51.40	108.0	313.0
60	7.6	2200	0.00	3.21	0.31	0.00	0.00	8.0	3.0	15.4	0	0	189.00	7.3	73.70	191.0	325.0
61	7.5	2900	0.00	2.50	0.00	0.00	0.00	0.0	2.9	23.2	0	0	320.00	4.0	77.40	222.0	515.0
68	7.5	410	0.00	3.57	0.00	0.00	0.00	0.0	0.4	3.0	0	0	38.10	4.0	13.70	12.5	9.9
69	7.7	515	0.01	5.00	0.81	0.00	0.00	8.0	0.3	4.5	0	0	52.60	0.0	24.90	9.1	3.3
177	7.71	1600	0.00	8.57	1.20	0.00	0.00	16.5	1.4	12.0	YES	YES	127.00	0.0	77.60	78.7	129.0
178	8.05	1170	0.01	6.43	0.16	0.00	0.00	43.6	16.3	0.7	YES	0	8.26	2.4	4.06	229.0	38.9
179	8.18	860	0.01	4.64	0.00	0.00	0.00	24.8	11.9	0.6	YES	0	7.52	2.4	3.05	153.0	33.3
220	7.7	200	0.01	2.68	0.00	0.00	0.00	0.0	0.1	3.5	0	0	49.50	0.0	10.70	1.6	12.4
278	7.6	710	0.00	7.68	0.13	0.00	0.00	3.3	0.2	7.9	YES	0	99.10	0.0	36.50	10.2	3.9
279	7.4	435	0.00	4.64	0.31	0.00	0.00	8.7	0.1	5.1	YES	0	75.80	1.8	10.90	5.2	3.5
280	7.6	640	0.00	6.60	2.51	0.00	0.00	10.3	0.2	7.0	YES	0	88.50	2.5	31.80	8.0	3.4
281	7.8	660	0.01	7.14	0.41	0.00	0.00	0.0	0.2	7.2	0	0	80.90	1.1	42.00	8.6	3.0
282	8.5	440	0.71	2.86	0.00	0.09	0.00	5.9	11.5	0.3	0	0	3.42	1.1	0.97	93.8	14.6
283	7.7	370	0.01	2.86	0.00	0.00	0.00	0.0	0.3	3.7	0	0	50.50	4.4	12.60	8.7	16.1
284	7.8	360	0.00	3.03	0.00	0.00	0.00	0.0	0.7	3.0	0	0	41.20	3.5	10.60	18.3	14.7
285	7.7	740	0.01	7.85	0.84	0.00	0.00	13.1	0.2	7.6	0	0	84.20	3.9	46.10	10.5	2.9
286	8.3	650	1.07	6.07	0.10	0.00	0.00	0.0	0.2	7.0	YES	YES	77.30	1.4	43.10	10.8	2.1
287	8.1	650	0.36	6.78	0.00	0.00	0.00	13.3	0.3	6.1	YES	YES	53.80	5.0	60.70	13.1	2.7
288	7.5	1,050	0.00	7.85	7.10	0.00	0.00	22.8	0.6	9.9	0	0	106.00	0.0	63.70	32.6	52.6
289	7.9	5,400	0.21	3.89	30.00	0.00	0.00	995.0	19.3	9.6	YES	YES	120.00	8.1	44.30	976.0	346.0
290	7.6	350	0.01	3.57	0.00	0.00	0.00	6.7	0.3	3.4	YES	YES	45.30	1.1	12.40	9.3	0.9
291	7.4	900	0.00	7.60	0.00	0.00	0.00	73.7	0.7	8.4	YES	0	104.00	2.6	39.50	31.1	4.2
292	7.7	790	0.01	8.57	0.32	0.00	0.00	9.4	0.1	8.4	YES	0	92.00	6.0	51.70	6.0	2.7
293	7.6	670	0.01	7.14	0.23	0.00	0.00	5.7	0.1	7.1	YES	0	78.70	1.0	43.10	5.2	1.9
294	7.5	305	0.00	5.11	0.17	0.00	0.00	6.3	0.1	3.2	0	0	43.80	1.1	11.40	3.8	2.3
295	7.7	440	0.01	4.75	0.52	0.00	0.00	4.2	0.1	4.7	0	0	57.20	0.0	23.30	4.4	1.9
296	7.8	500	0.01	5.18	0.77	0.00	0.00	4.7	0.1	5.4	0	0	66.60	0.0	25.80	4.7	2.6
297	8.0	460	0.54	4.46	0.00	0.00	0.00	5.4	0.1	5.3	YES	0	74.10	1.2	16.90	3.9	1.3
298	7.4	580	0.00	6.07	0.00	0.14	0.00	7.7	0.5	5.6	YES	YES	76.90	1.6	19.70	17.9	2.5
299	7.4	680	0.00	6.96	0.56	0.07	0.00	9.6	0.2	7.2	YES	0	96.40	5.4	26.20	9.0	2.9
300	7.9	480	0.71	2.86	0.00	0.00	0.00	4.5	5.9	0.8	0	0	9.61	3.0	4.40	88.1	15.3
301	7.5	1950	0.00	2.32	0.00	0.00	0.00	0.0	1.7	17.6	0	0	236.00	6.9	64.90	116.0	324.0
302	7.6	650	0.00	7.85	0.64	0.00	0.00	0.0	0.1	7.3	YES	YES	83.50	0.0	41.90	5.6	3.7
303	7.5	230	0.00	2.14	0.45	0.00	0.00	0.0	0.1	2.0	0	0	29.30	0.0	5.64	2.0	2.1
304	7.5	610	0.00	6.96	0.11	0.00	0.00	3.1	0.1	6.4	0	0	76.30	0.0	32.60	5.6	1.8
305	7.7	550	0.00	5.71	0.22	0.00	0.00	3.2	0.1	5.3	YES	0	59.10	1.1	31.50	5.7	2.1
306	7.9	190	0.01	1.79	0.13	0.00	0.00	0.0	0.1	1.8	YES	0	26.80	0.0	4.33	1.4	1.4
307	7.6	610	0.00	6.78	1.18	0.08	0.00	5.1	0.3	5.9	0	0	72.50	0.0	28.30	13.7	3.8
308	7.8	540	0.01	5.71	0.41	0.00	0.00	3.8	0.2	5.4	0	0	68.10	2.6	25.00	9.4	3.1

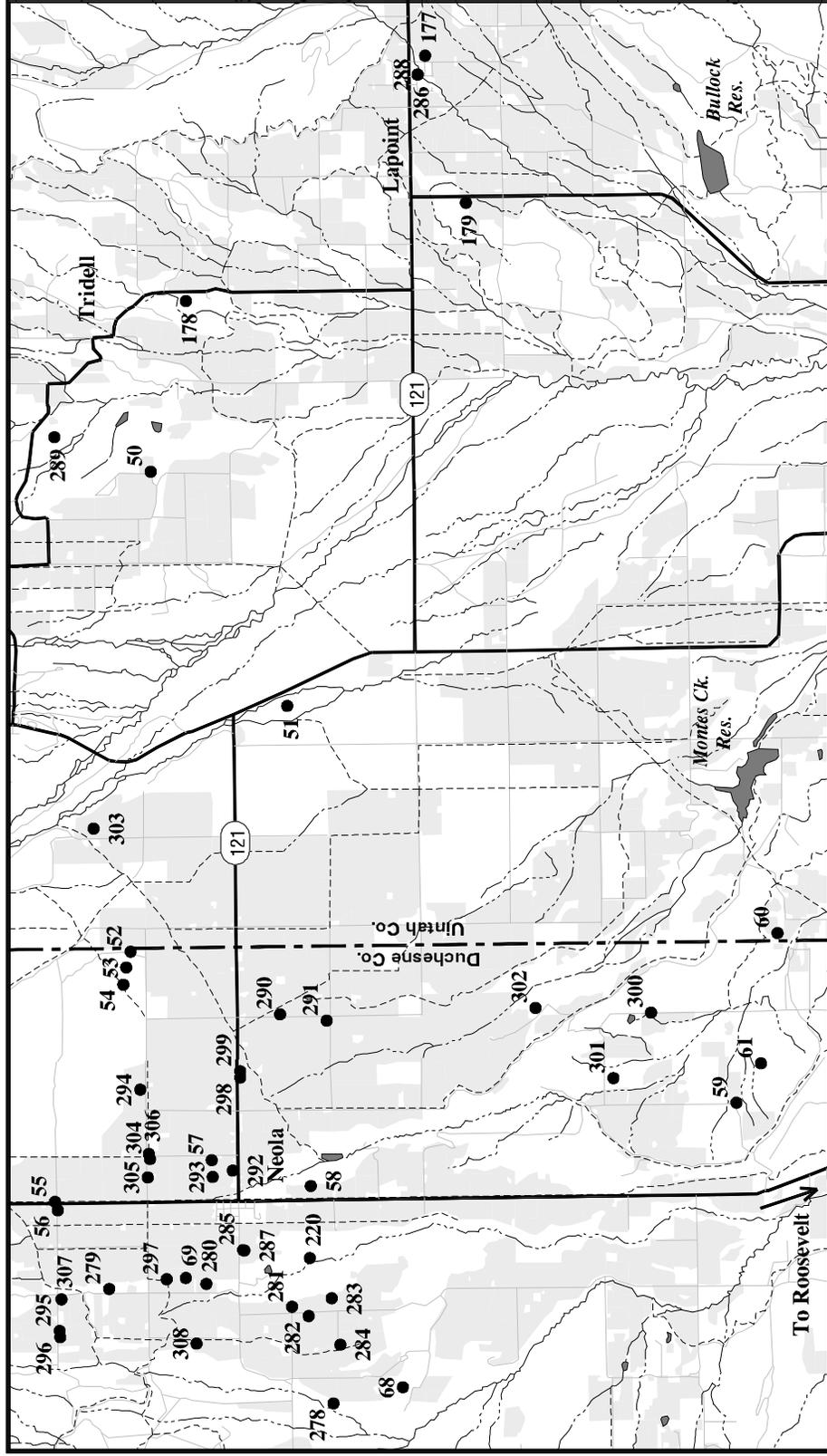
Detection Limits  
 Shaded values exceed drinking water, irrigation, or livestock standards.

**Table 5b: Neola, Tridell, & Lapoint Areas Chemistry Continued**

Map ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	Mn mg/L	Mo mg/L	Ni mg/L	Pb mg/L	Se mg/L	Si mg/L	Sr mg/L	Zn mg/L
50	0.00	0.00	0.00	0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23.70	1.36	0.00
51	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	3.21	0.11	0.09
52	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.14	0.12	0.00
53	0.00	0.00	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.46	0.16	0.30
54	0.00	0.00	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.62	0.21	0.00
55	0.00	0.00	0.00	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	23.70	0.72	0.00
56	0.00	0.00	0.00	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.80	0.78	0.00
57	0.00	0.00	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.00	1.07	0.00
58	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.80	0.86	0.00
59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	3.44	3.74	0.00
60	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.00	4.41	2.57	0.00
61	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	3.32	5.00	0.00
68	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.54	0.37	0.00
69	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.50	0.61	0.00
177	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.60	1.65	0.00
178	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.24	0.27	0.00
179	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.17	0.20	0.00
220	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.94	0.06	0.00
278	0.00	0.00	0.11	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35.20	1.02	0.00
279	0.00	0.00	0.00	0.26	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	14.70	0.35	0.00
280	0.00	0.00	0.00	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30.20	0.78	0.00
281	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.80	1.01	0.00
282	0.36	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	3.64	0.07	0.00
283	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.37	0.49	0.00
284	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.26	0.46	0.81
285	0.00	0.00	0.00	0.41	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	30.80	1.02	0.00
286	0.00	0.00	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.00	0.86	0.00
287	0.00	0.00	0.11	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.20	0.83	0.00
288	0.00	0.00	0.13	0.06	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	6.96	1.60	0.00
289	0.00	0.00	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.35	3.25	0.00
290	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.31	0.56	0.00	0.00	0.00	0.00	7.62	0.28	0.20
291	0.00	0.00	0.00	0.26	0.00	0.00	0.00	0.00	0.00	1.91	0.00	0.00	0.00	0.00	13.30	0.78	0.29
292	0.00	0.00	0.00	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	31.60	0.96	0.00
293	0.00	0.00	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23.80	0.87	0.00
294	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.95	0.21	0.00
295	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.50	0.53	0.00
296	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.10	0.59	0.00
297	0.00	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.50	0.42	0.00
298	0.00	0.00	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	6.84	0.46	0.34
299	0.00	0.00	0.00	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.91	0.50	0.00
300	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.22	0.22	0.00
301	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.15	0.11	0.00	0.00	0.00	0.00	2.93	4.32	0.00
302	0.00	0.00	0.12	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	32.50	2.29	0.00
303	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.84	0.10	0.00
304	0.00	0.00	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26.60	0.61	0.00
305	0.00	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23.50	0.62	0.00
306	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.98	0.09	0.00
307	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.80	0.80	0.00
308	0.00	0.00	0.00	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.20	0.57	0.00

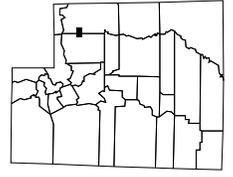
Detection Limits 0.1 mg/L 0.2 mg/L 0.05 mg/L 0.1 mg/L 0.05 mg/L 0.03 mg/L 0.03 mg/L 0.03 mg/L 0.05 mg/L 0.05 0.2 mg/L 0.2 mg/L 0.05 mg/L 0.05 mg/L 0.05 mg/L 0.05 mg/L 0.03 mg/L 0.05 mg/L 0.05 mg/L  
 Shaded values exceed drinking water, irrigation, or livestock standards.

# Map #5 Neola, Tridell, and Lapoint Areas – Duchesne and Uintah Counties, Utah



Map Scale 1:120,384  
(1 inch = 1.9 miles)

## Map Location



## Legend

- Sample Location
- Irrigated Cropland
- Water Body
- ~ Perennial Stream
- ~ Intermittent Stream
- ~ Ditch or Canal
- ~ Primary Road
- ~ Other Road
- ~ County Boundary

## **Vernal Area**

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Thirty wells were sampled in the Vernal area. Locations of these sample sites are shown on Map #6, "Vernal Area." These wells are used for irrigation, culinary water supply, and livestock. This report covers three categories of water quality criteria: Irrigation, Livestock, and Culinary. Since water use may overlap among these categories for a single well, analytical results are compared to all three sets of criteria. Analyses of the samples can be found on tables 6a and 6b labeled "Vernal Area Chemistry."

### **Irrigation:**

Salinity is a measurement of the concentration of ionic salts dissolved in water. It is measured as electrical conductivity (EC), with units of micro-mhos per centimeter (umhos/cm). Higher conductivity indicates higher concentration of dissolved salts. Water high in salts increases osmotic pressures, making it difficult for plants to get water necessary for growth. Generally when the EC gets above 750 umhos/cm, salt-sensitive plants begin to be affected. Only 1 sample has an EC value less than 750 umhos/cm (81). Sample 81 is so different from other samples that it is possible that this sample has been filtered. Sample 88 exceeds the severe injury level of 3,000 umhos/cm, which affects most plants.

Sodium Adsorption Ratio (SAR) is a measure of how much sodium (Na) is in solution compared to calcium and magnesium. Excessive sodium in the soil causes soil particles to repel each other. This destroys the structure of the soil, preventing air and water movement. SAR values greater than 3 can begin to cause problems for sensitive plants and values greater than 9 cause severe problems. Samples 44 and 217 have elevated SARs, with a value 10 and 3.2. Special care needs to be taken in using water from this source for irrigation.

Bicarbonate ( $\text{HCO}_3$ ) is an ion common to water solutions. It can be hazardous to plants in excessive amounts, especially when used in sprinkler irrigation. Bicarbonate can also cause white deposits on plants and their fruits, which affect their visual appeal. Bicarbonate also increases the problems of sodium. Special attention is needed when using water with excessive bicarbonate. Minor problems appear on sensitive plants with bicarbonate levels of 1.5 and severe problems appear when it exceeds 8.5. All of the samples have high bicarbonate levels, with 77 and 215 exceeding the 8.5 level.

Some specific elements can be toxic to plants. Chlorine, found in the form of Chloride ( $\text{Cl}^-$ ), above 145 ppm can damage sensitive plants and values higher than 355 ppm can cause severe damage to almost all plants. Samples 44 and 88 have elevated chlorine of 396 and 180 ppm respectively. Using this water in sprinkler irrigation when wind is present increases the problem.

Sample 44 has elevated Boron (B) at 0.74 ppm. Boron can be toxic to sensitive plants when it exceeds 0.7 ppm.

Samples 89 and 217 both have elevated manganese (Mn) at 1.25 and 0.49 ppm respectively. Manganese above 0.2 ppm can injure plants and cause reduction in dry matter. Excess manganese interferes with the plant's ability to use other nutrients such as calcium.

No other elements were above concentrations that are harmful to plants.

### **Livestock:**

Six wells fail to meet livestock quality criteria. Sample 44, 79, 80, 82, 88, and 217 have elevated

sulfate as sulfur (S) above 167 ppm. Sulfur is generally in the form of sulfate in water. Sulfate at this level has a bitter taste to animals not used to drinking it. Animals may refuse to drink this water. At levels higher than 1,500 ppm more complex digestive problems can occur.

### **Culinary:**

Salinity for 27 wells in the area exceeds the EPA aesthetic standard of 833 umhos/cm. At this level the water may be off-flavored but it is not a health problem until the EC level reaches 3,333. There are 3 samples that did not exceed the aesthetic standard. They are 45, 81, and 89. Sample 44 exceeds the health standard of 3,333 with a value of 4,600 and presents the greatest concern with salinity.

Two samples have high manganese (Mn) levels-89 and 217. EPA has set an aesthetic standard of 0.05 ppm for manganese. Higher levels may have an off flavor and/or cause discoloration of plumbing fixtures.

Samples 42-44, 79, 80, 82, 83, 88, and 215-217 have high sulfate as sulfur (S). EPA's standard for sulfate in drinking water is 83 ppm. This is an aesthetic standard and is not a serious health problem. Sulfate at this level may serve as a laxative to people not used to drinking the water. A rotten egg odor may also be present when this water is heated, which can be offensive.

The most serious problem with drinking water is bacterial contamination. Because disease-causing organisms are rare, common non-parasitic bacteria that are associated with parasitic bacteria are used as indicators to see if water might be contaminated. Two common indicator bacteria are Coliform and E. coli. Coliform bacteria are found in the digestive systems of mammals and in the soil. Presence of Coliform in a water sample indicates that surface contamination is taking place from soil and air, or fecal material is getting into the well. This is usually a well construction problem involving inadequate capping, leaking casing, lack of casing or improper grouting around the casing. Since E. coli is a bacterium that is found only in digestive systems of mammals, its presence in water is strong evidence that fecal material has entered into the water. Again, well construction is the primary problem. Septic systems, leaky sewer systems, or a shallow water table can also be causal factors. Both Coliform and E. coli are not harmful; however, some strains of E. coli such as 0157 are very infectious. Samples 42, 44-46, 76-78, 80, 82, 84, 86, 87, 166-170, and 214-217 are contaminated with Coliform. Samples 44, 76, and 216 are contaminated with E. coli. These wells should be inspected carefully to determine the source of contamination.

Sample 172 exceeds EPA's standard for nitrate ( $\text{NO}_3^-$ ) of 10 ppm. Nitrate is toxic to infants less than one year of age. When ingested it interferes with the blood's ability to adsorb oxygen, causing "blue-baby" syndrome.

### **Summary:**

Generally the wells in this area are suited for livestock watering. The water is limited for culinary use because of the high number of wells contaminated with bacteria (70% Coliform and 10% E. coli). The water is generally hard with 1% of the wells rated "Moderately Hard," 48% "Hard," and 41% "Very Hard."

**Table 6a: Vernal Area Chemistry**

Map ID	pH	EC umhos/cm	CO3 meq/L	HCO3 meq/L	NO3-N mg/L	PO4-P mg/L	P mg/L	Cl mg/L	SAR	Hardness	Coliform	E. Coli	Ca mg/L	K mg/L	Mg mg/L	Na mg/L	S mg/L
42	7.4	1080	0.00	6.43	2.20	0.00	0.00	7.4	0.4	10.4	YES	0	117.00	0.0	60.60	22.7	85.8
43	7.2	1020	0.00	4.64	0.88	0.00	0.00	4.9	0.3	11.2	0	0	161.00	1.1	30.70	13.4	104.0
44	8.2	4600	0.71	6.78	3.61	1.81	1.98	396.0	10.0	15.1	YES	YES	126.00	16.4	132.20	675.0	476.0
45	7.5	760	0.00	5.71	1.77	0.00	0.00	5.3	0.4	6.8	YES	0	69.60	1.0	46.00	16.1	36.7
46	7.4	905	0.00	6.07	3.09	0.00	0.00	6.5	0.6	8.1	YES	0	87.70	1.1	50.80	26.9	56.7
76	7.1	1160	0.00	7.32	5.43	0.00	0.00	24.3	0.5	10.7	YES	YES	120.00	1.1	62.40	26.0	66.0
77	7.1	1370	0.00	8.93	8.83	0.00	0.00	51.0	0.8	11.8	YES	0	131.00	2.7	70.80	45.0	67.1
78	7.2	1180	0.00	7.50	7.08	0.00	0.00	82.0	0.7	10.2	YES	0	127.00	3.8	48.20	39.0	33.5
79	7.2	1400	0.00	5.71	1.65	0.00	0.00	9.4	0.3	15.6	0	0	201.00	1.3	66.60	18.6	171.0
80	7.3	2500	0.00	5.36	5.66	0.00	0.00	33.4	0.9	26.9	YES	0	314.00	2.5	146.00	80.9	418.0
81	7.6	410	0.00	3.57	0.00	0.00	0.00	0.0	0.1	3.8	0	0	40.10	0.0	25.00	3.3	9.6
82	7.1	2010	0.00	5.71	7.40	0.00	0.00	21.7	0.4	25.8	YES	0	350.00	1.9	91.30	34.2	334.0
83	7.2	1360	0.00	6.43	5.69	0.00	0.00	23.2	0.6	14.0	0	0	184.00	1.3	55.90	38.0	136.0
84	7.3	950	0.00	6.43	2.69	0.00	0.00	6.4	0.4	8.9	YES	0	104.00	0.0	48.00	20.3	60.3
85	7.4	870	0.00	6.43	3.29	0.00	0.00	5.2	0.3	8.1	0	0	89.00	0.0	50.30	14.7	44.5
86	7.4	910	0.00	5.60	4.63	0.00	0.00	7.6	0.4	8.6	YES	0	101.00	2.9	46.50	18.5	48.5
87	7.3	860	0.00	6.73	4.38	0.00	0.00	0.0	0.3	8.3	YES	0	96.30	0.0	45.50	13.0	41.2
88	7.1	3100	0.00	8.21	4.78	0.00	0.00	180.0	1.3	32.0	0	0	413.00	6.5	134.00	117.4	397.0
89	7.2	750	0.00	7.14	0.00	0.00	0.00	7.5	0.2	7.9	0	0	106.00	1.4	29.90	8.7	15.2
165	7.7	1060	0.01	5.71	0.89	0.00	0.00	6.5	0.3	8.4	0	0	78.80	0.0	65.00	13.4	80.7
166	7.6	920	0.01	5.36	2.62	0.00	0.00	20.3	0.5	7.7	YES	0	82.10	0.0	49.80	22.9	45.9
167	7.4	980	0.01	7.85	0.77	0.00	0.00	13.4	0.4	9.4	YES	0	115.00	2.9	45.50	21.3	29.7
168	7.7	1160	0.00	7.14	3.02	0.00	0.00	18.8	0.4	9.8	YES	0	107.00	12.8	60.70	22.4	65.3
169	7.7	850	0.00	6.43	3.07	0.00	0.00	4.4	0.3	7.3	YES	0	74.10	0.0	50.10	14.8	30.8
170	7.5	860	0.00	6.78	4.76	0.00	0.00	6.1	0.3	8.1	YES	0	101.00	3.9	37.80	12.0	16.0
172	7.7	960	0.01	5.36	13.43	0.00	0.00	13.4	0.4	8.5	0	0	91.30	2.0	53.90	19.1	47.2
214	7.4	900	0.00	7.50	3.35	0.00	0.00	14.4	0.4	10.3	YES	0	115.00	0.0	61.20	23.9	61.4
215	7.3	1200	0.00	8.93	1.00	0.00	0.00	10.1	0.3	14.4	YES	0	176.00	1.8	70.00	19.6	162.0
216	7.3	1150	0.00	8.03	1.46	0.00	0.00	12.9	0.4	13.8	YES	YES	165.00	2.6	70.30	21.4	138.0
217	6.4	2500	0.00	3.03	7.74	0.00	0.00	88.8	3.2	18.5	YES	0	158.00	7.2	159.00	238.0	419.0

Detection Limits  
 Shaded values exceed drinking water, irrigation, or livestock standards.

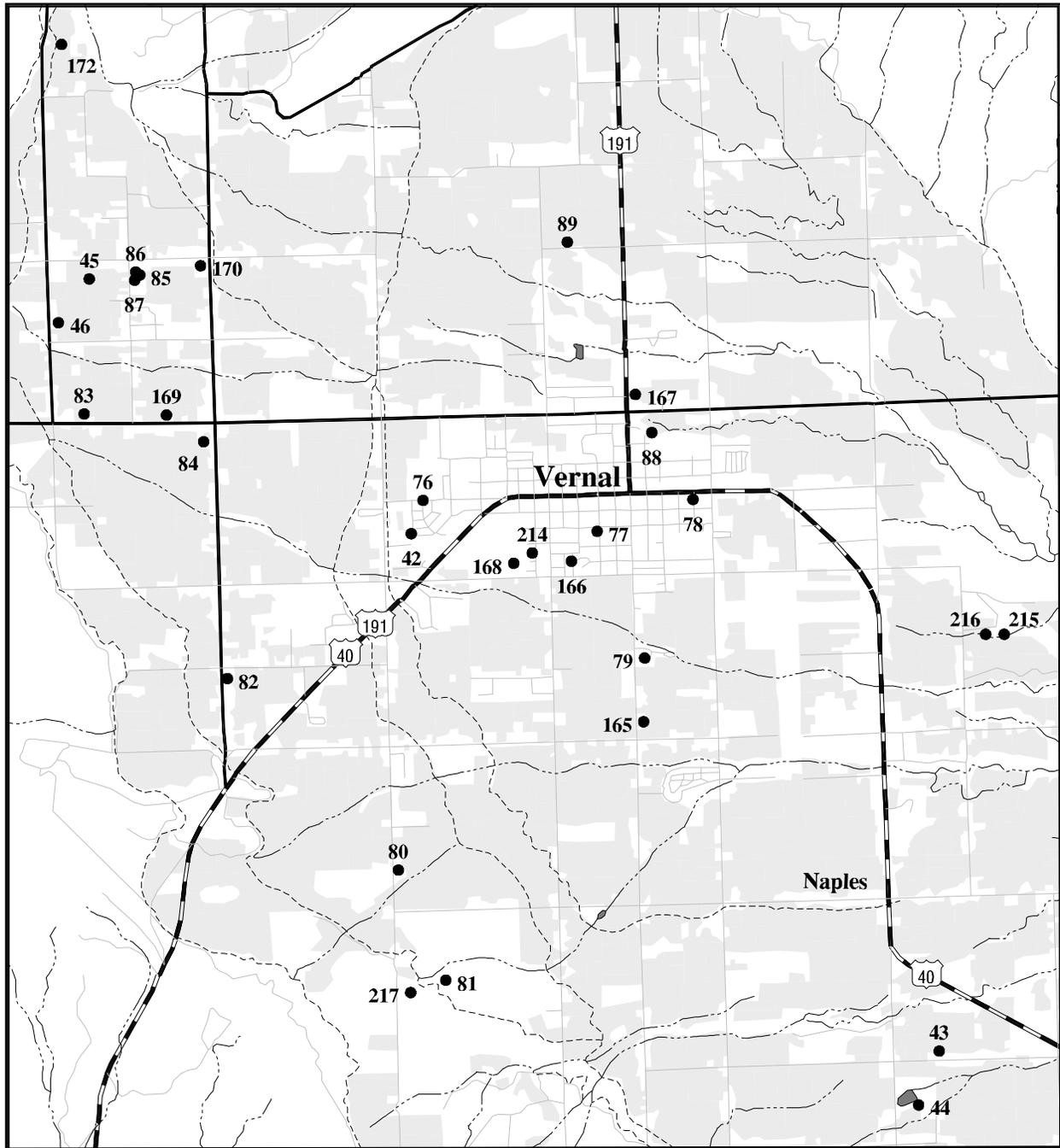
**Table 6b: Vernal Area Chemistry Continued**

Map ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	Mn mg/L	Mo mg/L	Ni mg/L	Pb mg/L	Se mg/L	Si mg/L	Sr mg/L	Zn mg/L
42	0.06	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.00	1.89	0.00
43	0.00	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.98	2.21	0.00
44	0.05	0.00	<b>0.74</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	6.44	2.18	0.00
45	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	13.00	1.55	0.08
46	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.30	1.69	0.00
76	0.00	0.00	0.22	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	12.00	1.87	0.26
77	0.00	0.00	0.34	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.20	1.94	0.00
78	0.00	0.00	0.19	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.00	1.30	0.00
79	0.00	0.00	0.18	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.07	2.41	0.00
80	0.00	0.00	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.20	2.11	0.40
81	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.85	0.49	0.00
82	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.40	4.33	0.66
83	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.81	1.93	0.00
84	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.30	1.87	0.33
85	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.80	2.10	0.00
86	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.30	1.60	0.00
87	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.90	1.74	0.00
88	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.90	7.99	0.00
89	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00	<b>1.25</b>	0.00	0.00	0.00	0.00	4.57	0.36	0.00
165	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.57	1.64	0.00
166	0.00	0.00	0.12	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.77	1.32	0.00
167	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.32	1.14	0.00
168	0.00	0.00	0.12	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.84	1.65	0.00
169	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.95	1.61	0.00
170	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.74	1.50	0.00
172	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.66	0.91	0.00
214	0.32	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	13.80	1.90	0.00
215	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.78	0.00	0.00	0.00	11.40	2.48	0.00
216	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.40	2.37	0.00
217	<b>5.72</b>	0.00	0.60	0.00	0.00	0.00	0.00	0.00	<b>0.73</b>	<b>0.49</b>	0.11	0.00	0.00	0.00	13.60	0.59	0.25

Detection Limits: 0.1 mg/L 0.2 mg/L 0.1 mg/L 0.05 mg/L 0.03 mg/L 0.03 mg/L 0.03 mg/L 0.05 mg/L 0.05 mg/L 0.05 mg/L 0.05 mg/L 0.05 mg/L 0.15 mg/L 0.05 mg/L 0.5 mg/L 0.05 mg/L 0.03 mg/L 0.05 mg/L

Shaded values exceed drinking water, irrigation, or livestock standards.

# Map #6 Vernal Area—Uintah County, Utah



Map Scale 1:63,360  
(1 inch = 1 mile)

## Legend

- |     |                     |     |                |
|-----|---------------------|-----|----------------|
| ●   | Sample Location     | — — | Ditch or Canal |
| □   | Irrigated Cropland  | — — | Primary Route  |
| ■   | Water Body          | — — | Primary Road   |
| — — | Perennial Stream    | — — | Other Road     |
| — — | Intermittent Stream |     |                |



## Map Location



## Dry Fork Area

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Twenty wells were sampled in the Dry Fork area. This is a canyon north of Vernal that is becoming a popular residential area. The area has historically been one of small animal operations; however, new homes are typical ranchettes. Locations of these sample sites are shown on Map #7, "Dry Fork Area." These wells are used for irrigation, culinary water supply, and livestock. This report covers three categories of water quality criteria: Irrigation, Livestock, and Culinary. Since water use may overlap among these categories for a single well, analytical results are compared to all three sets of criteria. Analyses of the samples are found in tables 7a and 7b.

### **Irrigation:**

Salinity is a measurement of the concentration of ionic salts dissolved in water. It is measured as electrical conductivity (EC), with units of micro-mhos per centimeter (umhos/cm). Higher conductivity indicates higher concentration of dissolved salts. Water high in salts increases osmotic pressures, making it difficult for plants to get water necessary for growth. Generally when the EC gets above 750 umhos/cm salt-sensitive plants begin to be affected. Eleven samples have EC values greater than 750 umhos/cm. They are 91-93, 95-97, 102, 103-105, and 174. None of the samples exceeded the severe injury level of 3,000 umhos/cm, which affects most plants. The highest EC values are in the northeast part of the area.

Sodium Adsorption Ratio (SAR) is a measure of how much sodium (Na) is in solution compared to calcium and magnesium. Excessive sodium in the soil causes soil particles to repel each other. This destroys the structure of the soil, preventing air and water movement. SAR values greater than 3 can begin to cause problems for sensitive plants and values greater than 9 cause severe problems. Sample 91 is the only sample that has an elevated SAR value of 3.1, slightly exceeding the standard.

Bicarbonate ( $\text{HCO}_3$ ) is an ion common to water solutions. It can be hazardous to plants in excessive amounts, especially when used in sprinkler irrigation. Bicarbonate can also cause white deposits on plants and their fruits, which affect their visual appeal. Bicarbonate also increases the problems of sodium. Special attention is needed when using water with excessive bicarbonate. Minor problems appear on sensitive plants with bicarbonate levels of 1.5 and severe problems when it exceeds 8.5. All of the samples have high bicarbonates.

No other elements were above concentrations that are harmful to plants.

### **Livestock:**

Five wells fail to meet livestock quality criteria. Samples 92, 95, 96, 102, 103, 105 and 174 have elevated sulfate as sulfur (S) at 167 ppm or above (sulfur is generally in the form of sulfate in water). Sulfate at this level has a bitter taste to animals not used to drinking it. Animals may refuse to drink this water. At levels higher than 1,500 ppm more complex digestive problems can occur.

### **Culinary:**

Salinity for 11 wells in the area exceeds the EPA aesthetic standard of 833 umhos/cm. At this level the water may be off-flavored but it is not a health problem until the EC level reaches 3,333. Samples that

exceed the aesthetic standards are: 91-93, 95-97, 102-105, and 174.

Manganese was found exceeding the aesthetic drinking water quality standard. Two samples have high manganese (Mn) levels (47 and 95). EPA has set an aesthetic standard of 0.05 ppm of manganese. Manganese above this level may cause an off flavor and/or discoloration of plumbing fixtures.

Samples 91-93, 95, 96, 102, 103-105, and 174 have high sulfate as sulfur (S). EPA's standard for sulfate in drinking water is 83 ppm. This is an aesthetic standard and is not a serious health problem. Sulfate at this level may serve as a laxative to people not used to drinking the water. A rotten egg odor may also be present when this water is heated, which can be offensive.

The most serious problem with drinking water is bacterial contamination. Because disease-causing organisms are rare common non-parasitic bacteria that are associated with parasitic bacteria are used as indicators to see if water might be contaminated. Two common indicator bacteria are Coliform and E. coli. Coliform bacteria are found in the digestive systems of mammals and in the soil. Presence of Coliform in a water sample indicates that surface contamination is taking place from soil and air, or fecal material is getting into the well. This is usually a well construction problem involving inadequate capping, leaking casing, lack of casing, or improper grouting around the casing. Since E. coli is a bacterium that is found only in digestive systems of mammals, its presence in water is strong evidence that fecal material has entered into the water. Again, well construction is the primary problem. Septic systems, leaky sewer systems, or a shallow water table can also be causal factors. Both Coliform and E. coli are not harmful, although some strains of E. coli such as 0157 are very infectious. Samples 98 and 104 are contaminated with Coliform. These wells should be inspected carefully to determine the source of contamination. Because of rapid development of housing using septic systems for waste water disposal in the area, these wells should be tested regularly for Coliform bacteria.

### **Summary:**

Generally the wells in this area are good quality. The water is generally hard with 5% of the wells rated "Moderately Hard," 50% "Hard," and 40% "Very Hard."

### Table 7a: Dry Fork Area Chemistry

Ident.	pH	EC umhos/cm	CO3 meq/L	HCO3 meq/L	NO3-N mg/L	PO4-P mg/L	P mg/L	Cl mg/L	SAR	Hardness	Coliform	E. Coli	Ca mg/L	K mg/L	Mg mg/L	Na mg/L	S mg/L
47	7.30	590	0.00	4.28	0.00	0.00	0.00	5.0	0.1	6.0	0	0	83.40	0.0	18.50	4.1	28.0
48	7.30	480	0.00	4.28	0.19	0.00	0.00	0.0	0.1	5.1	0	0	69.10	0.0	17.30	2.5	10.4
91	7.50	1,040	0.00	5.36	0.70	0.00	0.00	4.0	3.1	5.0	0	0	60.80	8.8	25.20	115.0	84.4
92	7.40	1,400	0.00	4.36	1.47	0.00	0.00	13.0	0.3	18.0	0	0	246.00	2.4	61.90	18.3	229.0
93	7.30	1,180	0.00	5.36	2.29	0.00	0.00	9.1	0.2	13.4	0	0	172.00	1.6	56.70	10.9	134.0
94	7.50	510	0.00	5.36	0.67	0.00	0.00	3.5	0.1	5.0	0	0	57.70	0.0	28.40	3.7	5.3
95	7.20	2,600	0.00	4.28	0.00	0.00	0.00	7.3	0.2	45.5	0	0	688.00	1.8	90.60	18.1	570.0
96	7.10	2,000	0.00	4.28	0.55	0.00	0.00	6.3	0.2	27.1	0	0	411.00	2.2	51.90	18.6	356.0
97	7.20	840	0.00	6.43	0.00	0.00	0.00	9.5	0.2	8.0	0	0	95.60	1.3	41.70	10.9	42.4
98	7.30	360	0.00	3.93	0.00	0.00	0.00	0.0	0.0	3.9	YES	0	57.50	0.0	9.95	1.1	1.7
99	7.50	340	0.00	3.57	0.76	0.00	0.00	0.0	0.0	3.7	0	0	53.50	0.0	9.17	1.0	2.1
100	7.60	380	0.00	3.75	0.16	0.00	0.00	0.0	0.0	4.1	0	0	57.30	0.0	12.30	1.4	4.1
101	7.40	500	0.00	4.28	0.30	0.00	0.00	0.0	0.1	5.3	0	0	73.30	0.0	16.90	3.2	20.8
102	7.10	1,400	0.00	5.36	0.38	0.00	0.00	11.1	0.3	16.5	0	0	222.00	2.5	60.70	18.0	192.0
103	7.12	1,410	0.00	5.18	0.31	0.00	0.00	11.8	0.3	16.3	0	0	213.00	3.1	65.60	17.8	194.0
104	7.40	1,200	0.00	5.71	0.00	0.00	0.00	61.7	1.1	9.6	YES	0	108.00	4.4	56.70	56.2	93.9
105	7.40	1,300	0.00	5.71	0.90	0.00	0.00	11.3	0.3	14.4	0	0	180.00	2.2	66.00	20.8	175.0
173	7.97	550	0.00	4.64	0.56	0.00	0.00	3.6	0.1	5.4	0	0	66.40	0.0	26.70	2.4	11.1
174	7.46	1,800	0.00	4.28	0.59	0.00	0.00	5.1	0.3	20.0	0	0	281.00	1.9	61.50	18.6	244.0
175	8.10	270	0.01	2.14	0.13	0.00	0.00	0.0	0.0	2.8	0	0	40.40	0.0	6.88	0.8	1.0

Detection Limits

0.1 mg/L 0.05 mg/L 0.2 mg/L

3.0 mg/L

1 colony  
100 ml

0.2 mg/L 1.0 mg/L 0.2 mg/L

0.2 mg/L

Shaded values exceed drinking water, irrigation, or livestock standards.

### Table 7b: Dry Fork Area Chemistry Continued

Map ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	Mn mg/L	Mo mg/L	Ni mg/L	Pb mg/L	Se mg/L	Si mg/L	Sr mg/L	Zn mg/L
47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	3.67	0.12	0.00
48	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.41	0.16	0.37
91	0.00	0.00	0.30	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.74	1.07	0.00
92	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.76	4.20	0.00
93	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.50	2.20	0.00
94	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.65	0.23	0.00
95	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.05	0.15	0.00	0.00	0.00	0.00	10.10	6.01	0.00
96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	5.60	3.37	0.00
97	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.31	0.28	0.00
98	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.32	0.05	0.00
99	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.47	0.10	0.00
100	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.56	0.10	0.00
101	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	2.70	0.20	0.00
102	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.40	2.94	0.00
103	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.04	2.90	0.00
104	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.34	1.08	0.00
105	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	5.26	2.13	0.25
173	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.24	0.27	0.00
174	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.98	2.79	0.00
175	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.25	0.06	0.00

Detection Limits

0.1 mg/L 0.2 mg/L 0.1 mg/L 0.05 mg/L 0.03 mg/L 0.03 mg/L 0.05 mg/L

0.05

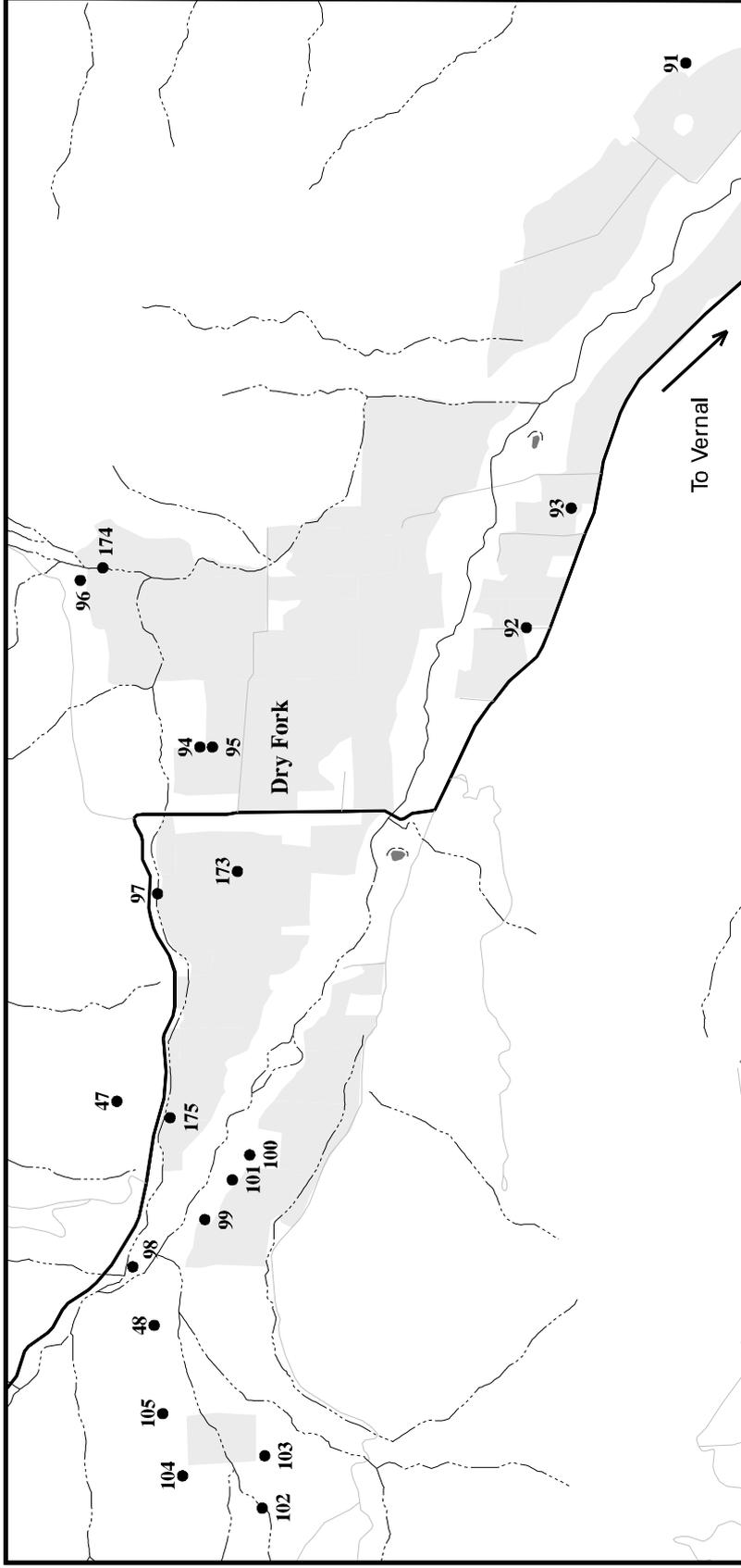
0.2 mg/L 0.05 mg/L

0.5 mg/L 0.05 mg/L 0.03 mg/L

0.05 mg/L

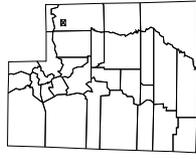
Shaded values exceed drinking water, irrigation, or livestock standards.

# Map #7 Dry Fork Area—Uintah County, Utah



Map Scale 1:25,344  
(1 inch = .4 miles)

## Map Location



## Legend

- Sample Location
- ◻ Irrigated Cropland
- ◼ Water Body
- ~ Perennial Stream
- - - Intermittent Stream
- ⌒ Dam or Weir
- ⌒ Secondary Route
- ⌒ Other Road

**Table 8a: Pahvant Area Chemistry**

Map ID	pH	EC umhos/cm	CO3 meq/L	HCO3 meq/L	NO3-N mg/L	PO4-P mg/L	P mg/L	Cl mg/L	SAR mg/L	Hardness	Coliform	E. Coli	Ca mg/L	K mg/L	Mg mg/L	Na mg/L	S mg/L
186	7.3	850	0	6.96	2.91	0.00	0.00	43.7	2.1	6.0	YES	0	67.30	1.59	35.30	85.10	14.90
187	7.4	1,350	0	5.00	8.49	0.00	0.00	191.0	1.0	11.9	0	0	154.00	3.98	50.20	56.30	50.70
188	7.3	1,400	0	5.00	5.87	0.00	0.00	166.0	0.9	13.3	YES	0	164.00	3.62	62.80	52.70	85.40
189	7.3	1,650	0	4.46	6.27	0.00	0.00	319.0	1.1	13.6	0	0	154.00	2.91	78.90	70.40	49.20
190	7.9	1,000	Trace	4.64	9.62	0.00	0.00	145.0	0.7	8.6	YES	0	98.40	1.50	48.70	34.40	9.49
191	8.0	620	Trace	3.93	2.35	0.00	0.00	104.0	0.7	5.6	0	0	57.30	3.24	38.70	26.10	3.16
192	7.8	500	Trace	3.40	1.12	0.00	0.00	98.7	1.1	4.0	YES	0	37.80	2.06	30.30	35.90	5.98
193	7.8	990	0	2.68	3.85	0.00	0.00	197.0	0.9	8.1	0	0	98.50	1.76	40.40	43.90	19.10
194	7.8	720	Trace	8.03	1.12	0.08	0.00	61.0	0.8	7.1	0	0	73.60	1.11	47.30	36.40	13.70
195	7.4	1,620	0	2.49	72.30	0.05	0.00	175.0	0.8	7.1	YES	0	83.60	1.98	37.70	36.50	17.10
196	7.4	500	Trace	4.46	1.52	0.10	0.00	63.1	0.5	5.6	YES	0	59.70	1.68	35.70	20.70	4.43
197	7.3	1,750	0	4.64	16.20	0.00	0.00	86.4	0.7	18.1	0	0	240.00	4.87	69.20	47.90	208.00
198	8.0	950	Trace	3.57	2.06	0.00	0.00	119.0	0.7	8.6	YES	YES	85.00	3.31	62.40	33.30	61.10
199	7.7	1,000	Trace	3.93	0.38	0.00	0.00	132.0	1.6	7.2	YES	YES	67.60	10.10	55.60	73.00	62.20
200	7.4	850	0	7.14	3.15	0.00	0.00	93.4	1.8	6.4	0	0	84.50	11.50	25.50	74.50	18.30
201	7.5	1,000	0	3.93	4.67	0.05	0.00	154.0	1.2	8.9	0	0	119.00	3.09	32.50	58.30	38.40
202	7.5	1,100	0	5.35	3.59	0.00	0.31	151.0	1.5	9.2	0	0	120.00	8.35	37.10	74.70	42.00
203	7.8	1,000	Trace	5.00	9.83	0.00	0.00	64.3	0.9	6.5	0	0	83.60	2.13	28.20	36.90	17.90
204	7.9	800	Trace	5.39	3.10	0.00	0.00	68.0	0.6	7.8	0	0	98.20	2.18	34.70	27.00	14.90
205	8.0	650	Trace	4.32	1.60	0.00	0.00	60.5	1.1	6.0	YES	0	70.90	1.98	30.90	42.50	22.20
206	7.4	1,100	0	6.60	24.90	0.00	0.00	68.6	0.7	8.4	YES	0	105.00	2.32	37.90	33.50	15.90
207	7.4	5,550	0	9.64	0.05	0.00	0.00	1,443.0	16.7	6.9	YES	YES	38.90	68.90	78.30	786.00	0.23
208	7.6	5,100	Trace	2.07	1.50	0.00	0.00	1,383.0	19.4	6.1	YES	YES	52.70	96.50	52.40	832.00	79.40
209	7.7	800	0	4.28	2.61	0.10	0.45	95.9	1.0	6.0	YES	0	70.70	6.43	31.40	38.90	14.60
210	7.9	5,150	Trace	4.28	1.53	0.00	0.00	1,156.0	4.8	32.7	0	0	348.00	43.10	212.00	465.00	251.00
211	7.4	10,450	0	3.75	2.08	0.00	0.00	2,674.0	9.0	57.0	YES	0	605.00	120.00	369.00	1,137.00	453.00
212	7.4	7,650	0	4.28	2.42	0.00	0.00	1,748.0	4.9	54.8	YES	0	571.00	30.90	366.00	612.00	369.00
213	7.6	800	0	5.53	0.13	0.07	0.27	107.0	2.2	4.4	YES	YES	44.10	7.25	31.00	78.80	18.00

Detection Limits  
 Shaded values exceed drinking water, irrigation, or livestock standards.

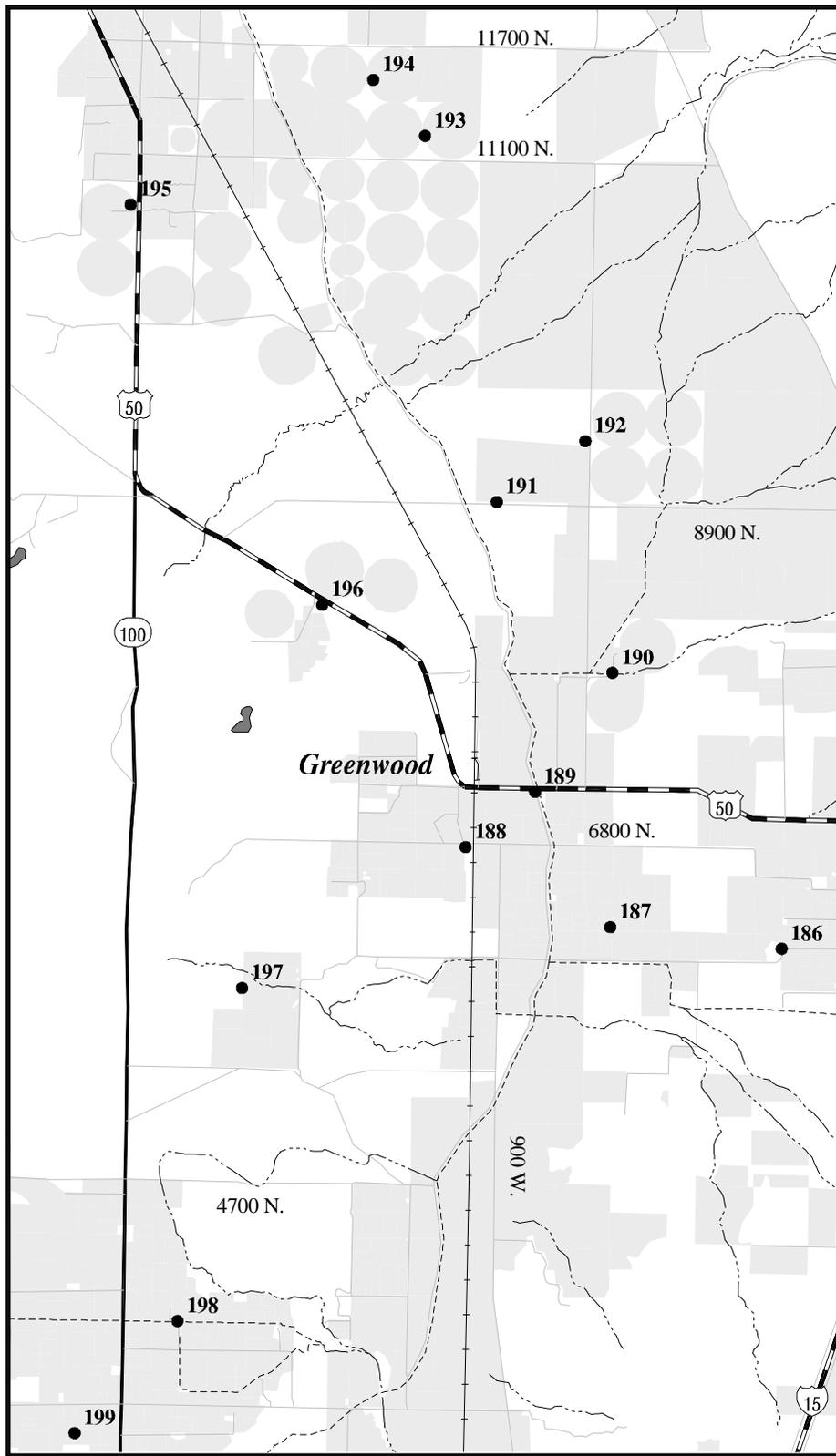
**Table 8b: Pahvant Area Chemistry**

Map ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	Mn mg/L	Mo mg/L	Ni mg/L	Pb mg/L	Se mg/L	Si mg/L	Sr mg/L	Zn mg/L
186	0.00	0.00	0.13	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.10	0.27	0.10
187	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.85	1.20	0.00
188	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.20	1.12	0.00
189	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.80	0.58	0.07
190	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.12	0.32	0.00
191	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.70	0.52	0.00
192	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.20	0.48	0.00
193	0.00	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.02	0.44	0.00
194	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.09	0.31	0.00
195	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.03	0.42	0.00
196	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.30	0.31	0.00
197	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.20	1.89	0.00
198	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.40	1.12	0.00
199	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.60	2.14	0.00
200	0.00	0.00	0.32	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.71	0.55	0.00
201	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.72	0.42	0.00
202	0.93	0.00	0.14	0.00	0.00	0.00	0.00	0.12	1.65	0.37	0.00	0.00	0.00	0.00	9.39	0.45	0.34
203	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.98	0.33	0.00
204	0.00	0.00	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.98	0.41	0.00
205	0.00	0.00	0.12	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.30	0.41	0.00
206	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.98	0.48	0.05
207	0.00	0.00	2.05	0.00	0.00	0.00	0.00	0.00	0.98	0.35	0.00	0.00	0.00	0.00	0.42	0.82	0.00
208	0.00	0.00	1.76	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.07	1.50	0.00
209	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.60	0.51	0.00
210	0.00	0.00	1.22	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.00	5.01	0.00
211	0.00	0.00	2.68	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.10	8.61	0.00
212	0.00	0.00	1.35	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.30	5.96	0.00
213	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	3.32	0.30	0.00	0.00	0.00	0.00	11.80	0.54	0.00

Detection Limits: 0.1 mg/L, 0.2 mg/L, 0.1 mg/L, 0.05 mg/L, 0.05 mg/L, 0.03 mg/L, 0.03 mg/L, 0.03 mg/L, 0.05 mg/L, 0.05 mg/L, 0.02 mg/L, 0.05 mg/L, 0.15 mg/L, 0.05 mg/L, 0.5 mg/L, 0.05 mg/L, 0.03 mg/L, 0.05 mg/L, 0.05 mg/L

Shaded values exceed drinking water, irrigation, or livestock standards.

# Map #8 North Pahvant Valley – Millard County, Utah

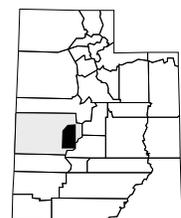


## Legend

- *Sample Location*
- *Irrigated Cropland*
- *Water Body*
- ▬ *Primary Route*
- ▬ *Primary Road*
- ▬ *Other Road*
- ▬ *Railroad*
- ▬ *Perennial Stream*
- ▬ *Ditch or Canal*
- ▬ *Intermittent Stream*

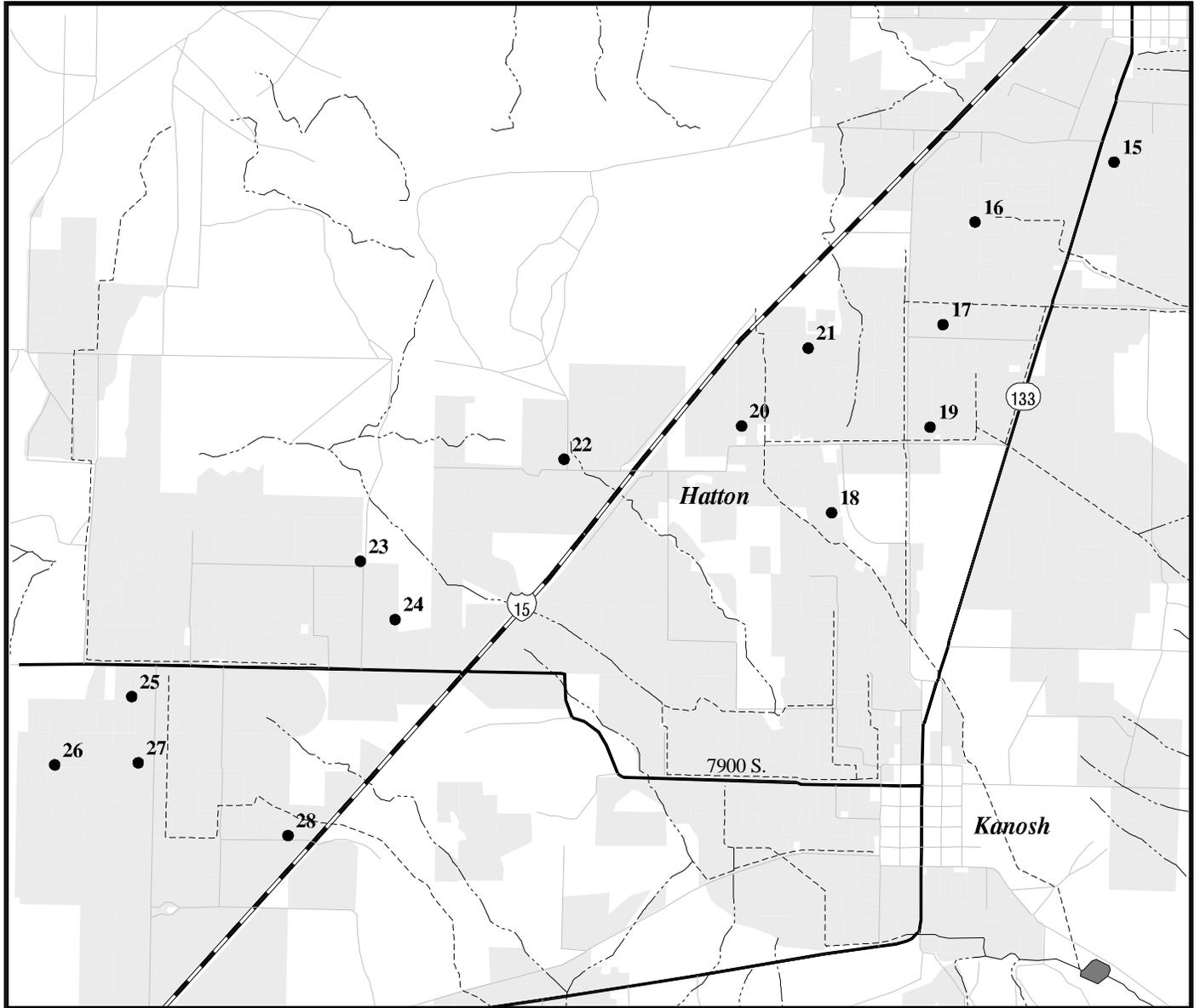


## Map Location



Map Scale 1:98,208  
(1 inch = 1.55 miles)

# Map #9 South Pahvant Valley – Millard County, Utah

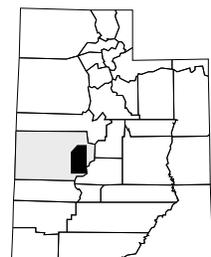


Map Scale 1:76,032  
(1 inch = 1.2 miles)

## Legend

- |       |                    |       |                     |
|-------|--------------------|-------|---------------------|
| ●     | Sample Location    | — — — | Other Road          |
| ■     | Irrigated Cropland | — — — | Railroad            |
| ■     | Water Body         | — — — | Perennial Stream    |
| — — — | Primary Route      | — — — | Ditch or Canal      |
| — — — | Primary Road       | — — — | Intermittent Stream |

## Map Location



**Table 10a: Curliew Area Chemistry**

Map ID	pH	EC umhos/cm	CO3 meq/L	HCO3 meq/L	NO3-N mg/L	PO4-P mg/L	P mg/L	Cl mg/L	SAR mg/L	Hardness	Coliform	E. Coli	Ca mg/L	K mg/L	Mg mg/L	Na mg/L	S mg/L
CV1	7.7	1600	0	4.64	0.15	0.00	0.00	337.0	4.6	6.4	0	0	76.60	8.94	32.3	191.0	26.3
CV2	8.1	1375	Trace	5.00	0.11	0.00	0.00	217.0	3.2	6.3	YES	YES	72.00	9.58	35.6	131.0	36.1
CV3	7.6	3050	Trace	5.36	1.32	0.00	0.00	718.0	5.4	15.2	YES	0	180.00	18.40	79.5	343.0	108.0
CV4	7.1	37000	0	4.82	0.00	0.00	0.00	12,990.0	73.8	37.4	YES	0	465.00	304.00	175.0	7,355.0	182.0
CV5	7.5	3900	Trace	3.21	0.39	0.00	0.00	1,207.0	9.7	12.4	YES	YES	150.00	27.30	62.1	560.0	34.8
227	7.7	1800	Trace	4.28	0.74	0.00	0.00	348.0	2.5	10.6	YES	0	104.00	12.70	77.4	140.0	80.5
CV8	7.4	3700	Trace	5.36	12.90	0.00	0.00	726.0	6.3	17.8	0	0	193.00	18.30	112.0	446.0	169.0
CV12	7.6	3250	0	3.93	0.37	0.00	0.00	835.0	11.3	7.9	0	0	101.00	24.20	33.3	512.0	37.8
230	7.5	2700	0	4.32	2.41	0.00	0.00	647.0	6.2	11.9	0	0	160.00	20.80	44.0	346.0	70.2
CV13	7.5	3200	Trace	4.82	3.41	0.00	0.00	774.0	6.6	13.4	YES	YES	178.00	25.00	50.5	385.0	89.2
232	7.2	5900	0	2.86	31.20	0.00	0.00	1,702.0	11.7	19.5	YES	YES	269.00	33.70	64.0	820.0	47.6
233	7.1	7200	0	2.14	3.71	0.00	0.00	2,368.0	6.9	37.8	YES	0	522.00	43.00	124.0	678.0	37.7
234	7.5	5550	Trace	3.03	0.20	0.00	0.00	1,644.0	23.7	6.7	YES	0	87.10	26.00	27.0	988.0	16.6
CV16	8.1	6250	Trace	1.79	0.00	0.00	0.00	1,980.0	28.8	5.1	YES	YES	53.60	16.00	33.6	1,091.0	17.0
236	7.5	1600	0	2.50	3.84	0.00	0.00	368.0	1.1	12.1	YES	YES	171.00	14.20	36.6	59.6	29.8
237	7.4	5100	0	2.32	3.32	0.00	0.00	1,579.0	4.5	30.1	0	0	421.00	28.10	93.9	389.0	14.7
CV17	7.0	9400	0	1.96	0.63	0.00	0.00	2,927.0	6.4	52.8	0	0	741.00	47.60	162.0	735.0	35.8
CV18	7.5	800	0	2.50	0.98	0.00	0.00	206.0	0.7	6.9	YES	0	98.50	10.90	20.1	29.4	42.1
240	7.4	3100	0	4.23	0.95	0.00	0.00	836.0	7.0	12.2	0	0	164.00	19.00	43.9	393.0	44.3
241	7.3	3100	0	3.75	1.26	0.00	0.00	659.0	5.4	14.3	0	0	190.00	22.70	53.9	326.0	54.8
242	7.4	2750	0	2.86	0.84	0.00	0.00	810.0	2.5	17.5	YES	0	235.00	19.80	64.3	165.0	24.2
243	7.4	2250	0	3.57	4.25	0.00	0.00	568.0	3.2	12.9	YES	0	178.00	17.20	42.9	186.0	69.4
C7	7.3	2650	0	5.00	0.28	0.00	0.00	651.0	4.8	13.2	YES	YES	165.00	16.70	60.0	284.0	57.0
245	7.7	2100	Trace	4.46	0.53	0.00	0.00	462.0	5.5	8.5	YES	YES	108.00	13.90	38.1	259.0	27.6
246	7.7	3150	Trace	3.75	1.85	0.00	0.00	846.0	12.7	5.9	0	0	72.60	8.18	28.0	502.0	16.4

Detection Limits

0.1 mg/L 0.05 mg/L 0.02 mg/L

3.0 mg/L

1 colony  
100 ml

1 colony  
100 ml

0.2 mg/L 1.0 mg/L 0.2 mg/L

0.2 mg/L 0.2 mg/L

0.2 mg/L

Shaded values exceed drinking water, irrigation, or livestock standards.

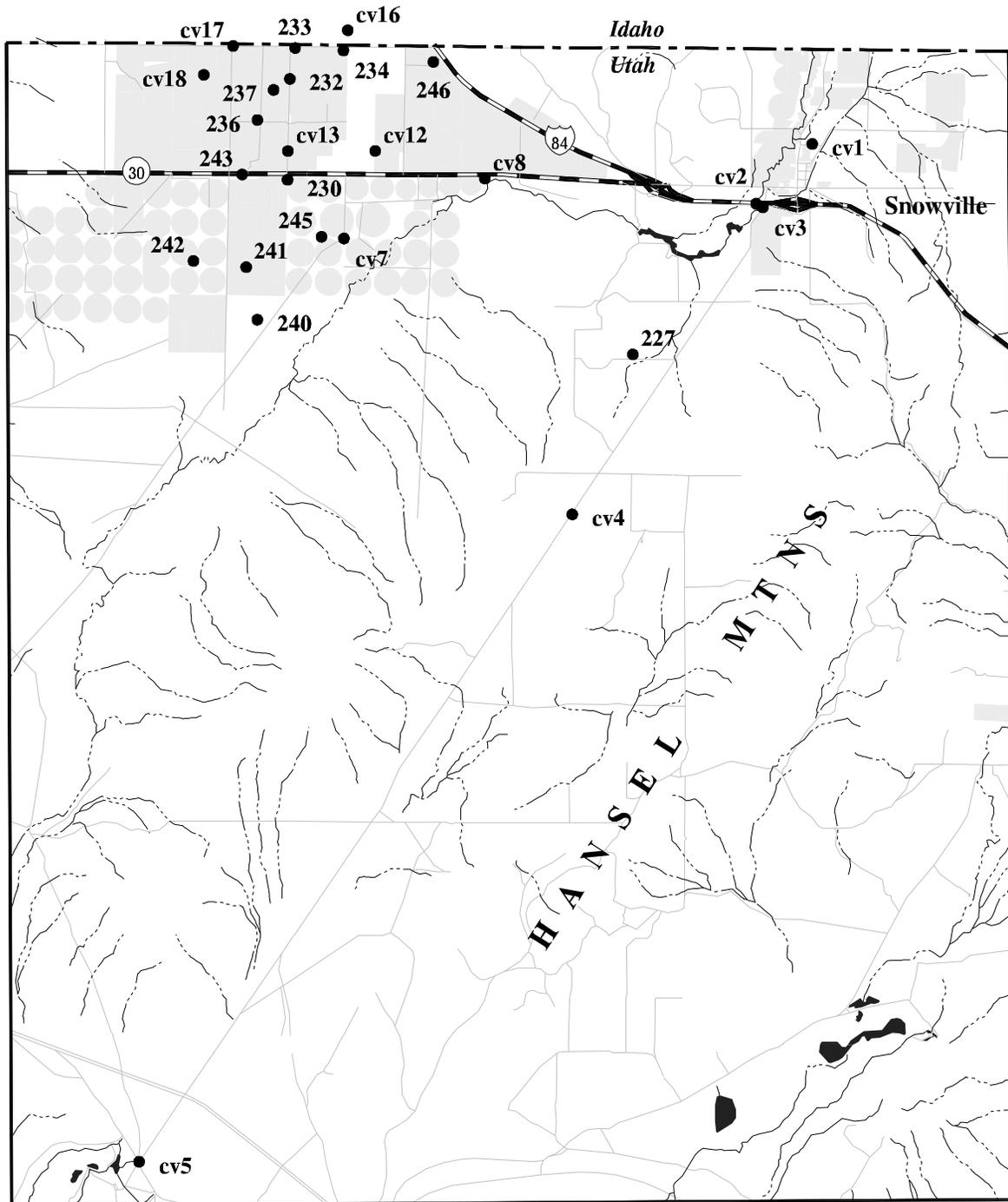
**Table 10b: Curlew Area Continued**

Map ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	Mn mg/L	Mo mg/L	Ni mg/L	Pb mg/L	Se mg/L	Si mg/L	Sr mg/L	Zn mg/L
CV1	0.00	0.00	0.12	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.58	0.00	0.00	0.00	15.10	1.23	0.00
CV2	0.18	0.00	0.13	0.08	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	7.63	0.98	0.00
CV3	0.00	0.00	0.15	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.20	2.47	0.00
CV4	0.00	0.00	1.21	0.06	0.00	0.00	0.00	0.00	0.06	0.06	0.00	0.00	0.00	0.00	7.11	8.13	0.00
CV5	1.38	0.00	0.16	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.90	2.43	0.00
227	0.34	0.00	0.11	0.05	0.00	0.00	0.00	0.00	0.07	0.00	1.05	0.00	0.00	0.00	19.70	1.24	0.93
CV8	0.00	0.00	0.21	0.05	0.00	0.00	0.00	0.00	0.06	0.00	0.85	0.00	0.00	0.00	12.40	1.93	0.07
CV12	0.00	0.00	0.10	0.22	0.00	0.00	0.00	0.00	0.00	0.07	1.57	0.00	0.00	0.00	25.90	1.47	0.00
230	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.00	0.00	27.00	1.37	0.00
CV13	0.00	0.00	0.11	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.90	1.47	0.00
232	0.00	0.00	0.13	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.00	0.00	0.00	29.80	2.34	0.00
233	0.00	0.00	0.11	0.26	0.00	0.00	0.00	0.00	0.06	0.06	0.73	0.00	0.00	0.00	30.80	4.20	0.00
234	0.00	0.00	0.14	0.14	0.00	0.00	0.00	0.00	1.71	0.00	0.00	0.00	0.00	0.00	20.70	2.65	0.00
CV16	0.00	0.00	0.15	0.06	0.00	0.00	0.00	0.00	0.12	0.17	0.71	0.00	0.00	0.00	3.19	1.78	0.00
236	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	1.22	0.00	0.00	0.00	26.60	0.89	0.00
237	0.00	0.00	0.00	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.30	2.70	0.00
CV17	0.00	0.00	0.10	0.67	0.00	0.00	0.00	0.00	0.00	0.00	1.20	0.00	0.00	0.00	29.60	5.65	0.00
CV18	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	1.47	0.10	2.48	0.00	0.00	0.00	25.70	0.49	0.00
240	0.00	0.00	0.10	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.00	1.21	0.00
241	0.37	0.00	0.11	0.15	0.00	0.00	0.00	0.00	0.18	0.07	1.55	0.00	0.00	0.00	26.60	1.49	0.00
242	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.60	1.58	0.00
243	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.05	2.78	0.00	0.00	0.00	26.30	1.00	0.00
C7	0.00	0.00	0.11	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.60	2.14	0.00
245	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.51	0.00	0.00	0.00	0.00	0.00	23.10	1.25	0.00
246	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.05	1.98	0.00

Detection Limits 0.1 mg/L 0.2 mg/L 0.1 mg/L 0.05 mg/L 0.03 mg/L 0.03 mg/L 0.03 mg/L 0.03 mg/L 0.05 mg/L 0.05 mg/L 0.02 mg/L 0.05 mg/L 0.15 mg/L 0.05 mg/L 0.5 mg/L 0.05 mg/L 0.03 mg/L 0.05 mg/L

Shaded values exceed drinking water, irrigation, or livestock standards.

# Map #10 Curlew Valley Area —Box Elder County, Utah / Oneida County, Idaho



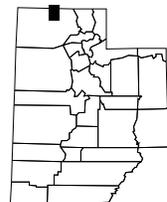
Map Scale 1:182,530  
(1 inch = 2.88 miles)

## Legend

- |   |                    |   |                     |
|---|--------------------|---|---------------------|
| ● | Sample Location    | ⋈ | Intermittent Stream |
| ■ | Irrigated Cropland | ⋈ | Ditch or Canal      |
| ■ | Water Body         | ⋈ | Primary Route       |
| ⋈ | Perennial Stream   | ⋈ | Other Road          |



## Map Location



## Appendix I: Critical Values for Tested Parameters

<b>Irrigation Parameters</b>	<b>Magnitude of Problem</b>	
	<b>Moderate</b>	<b>Severe</b>
<b><u>EC</u></b> (Electrical Conductivity) Measures total salts in solution:	> 750 umhoms/cm	> 3,000 umhoms/cm.
<b><u>SAR</u></b> (Sodium Absorption Ratio) Estimates activity of Sodium in the soil.	> 3 meq/l.	> 9 meq/l.
<b><u>Chloride.</u></b>		
For sprinkler irrigation		> 3 meq/l.
For surface irrigation	> 4 meq/l.	> 10 meq/l.
<b><u>Boron.</u></b>	> 0.7 ppm	> 10.0 ppm.
<b><u>HCO<sub>3</sub></u></b> (Bicarbonate).		
For sprinkler irrigation.	> 1.5 meq/l.	> 8.5 meq/l.
<b><u>Al</u></b> (Aluminum).	> 5.0 ppm.	
<b><u>Cu</u></b> (Copper).	> 0.2 ppm.	
<b><u>Fe</u></b> (Iron).	> 5.0 ppm.	
<b><u>Mn</u></b> (Manganese).	> 0.2 ppm.	
<b><u>Zn</u></b> (Zinc).	> 2.0 ppm.	
<b><u>Se</u></b> (Selenium).	> 0.02 ppm.	

### **Livestock**

	<b>Min. Level</b>
EC (umhoms/cm)	> 8,332
Sulfate	> 167 ppm
Nitrate	> 100 ppm
Al (Aluminum)	> 5 ppm
As (Arsenic)	> 0.2 ppm
B (Boron)	> 5.0 ppm
Cd (Cadmium)	> 0.05 ppm
Cr (Chromium)	> 1.0 ppm
Co (Cobalt)	> 1.0 ppm
Fl (Fluoride)	> 2.0 ppm
Pb (Lead)	> 0.1 ppm
Se (Selenium)	> 0.05 ppm
Zn (Zinc)	> 25.0 ppm

### **Human**

	<b>Min. Level</b>
EC (umhoms/cm)	> 3,333 (833.33*)
Nitrate	> 10 ppm
As (Arsenic)	> 0.05 ppm
Ba (Barium)	> 1.0 ppm
Cd (Cadmium)	> 0.01 ppm
Cr (Chromium)	> 0.05 ppm
Cu (Copper)	> 1.0 ppm
Fl (fluoride)	> 2.0 ppm
Fe (Iron)	> 0.3 ppm*
Pb (Lead)	> 0.05 ppm
Mn (Manganese)	> 0.05 ppm*
Se (Selenium)	> 0.01 ppm
Zn (Zinc)	> 5.0 ppm*
Sulfate	> 83 ppm*

Critical values are from: Table 1, page 8 and Table 6, page 40 of "Water Quality for Agriculture", FAO Irrigation and drainage paper 29 revision 1; and USU information sheets, "Water Quality Analysis (For Irrigation)" and "Analysis of Water Quality for Livestock" EL 280.