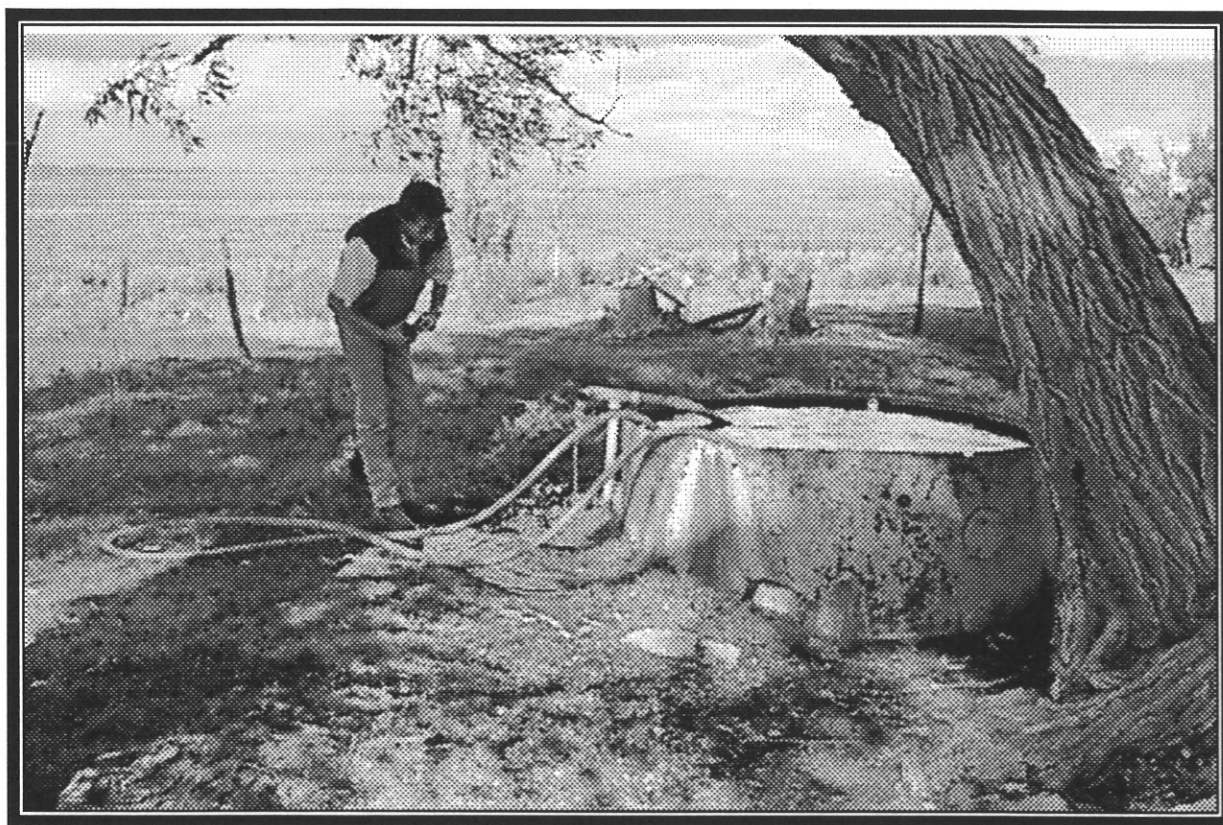


State Ground Water Program

1998 Report



Utah Department of Agriculture & Food

STATE GROUND-WATER PROGRAM REPORT 1998

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. The provisions of the Clean Water Act exclude irrigation wells, livestock wells, 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 1998.

Cooperative Effort

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

The UDAF also works closely with the Department of Environmental Quality (DEQ) in providing expertise to the State Pesticide Management Plan and other ground-water programs. This relationship benefits UDAF by allowing agriculture's voice to be heard and their ideas considered during the planning process. The UDAF is an intricate link between DEQ and the farmers and ranchers of the state in environmental issues. During 1998, UDAF continued to work with DEQ in a coalition to improve water quality on the Sevier River using a watershed approach.

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

UDAF's GROUND-WATER SAMPLING PROCEDURES

UDAF met with several UACDs groups to educate them on ground-water issues. The districts then selected wells in their area for sampling (excluding Curlew and Pahvant valleys). The districts obtained preliminary sample information by using UDAF's Pre-Sample Information Form (Fig. 1).

The local district then escorted UDAF personnel to the selected well sites. Each well location was determined using Global Positioning System (GPS). Water samples were collected at each

well for inorganic chemistry, bacteria (in cases where the water is used for culinary purposes), and pesticide analysis. The samples were packed in ice and taken to the appropriate laboratory. UDAF analyzed for pesticides and bacteria while Utah State University (USU) performed the inorganic analysis. Laboratory results were sent to each well owner. GPS location was provided to UDAF's Geographic Information System (GIS) administrator who provided maps of the sampled areas.

During 1998, UDAF again tested the use of a nitrate specific ion probe. Readings from this device did not compare with laboratory measurements. It was decided that the probe would not be used until improvements in the technology are made.

AREAS SAMPLED

During 1998, 128 wells, drains, and springs, in eleven areas of the state were sampled (10 other samples were taken as follow up and special need). The areas included East Lehi Area in Utah County; Mammoth Creek/Panguitch Lake Areas in Garfield County; Monroe/Venice Areas in Sevier County; Ibapah/ Callao Areas in Tooele County; and Pelican Lake Area in Uintah County. Wells in Curlew Valley, Box Elder County; and Pahvant Valley, Millard County were also sampled. This is part of a continuing joint effort with the Division of Water Rights. Each of the sampling areas will be addressed individually with a map showing sample location and a table of the chemical analysis data of the samples. Narrative reports are provided for each sampled area **except** the Curlew and Pahvant valleys.

The shaded laboratory data on each table shows which values exceed either drinking water, livestock, irrigation, or Clean Water Act standards. Appendix I lists the critical values for each standard.

PRE-SAMPLE INFORMATION FORM

*(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.

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 & 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 & 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.

East Lehi Area (Utah County), Utah

Twelve wells were sampled near Lehi on April 1, 1998 and one follow-up sample was taken on July 28, 1998. These wells are used for irrigation, culinary purposes and livestock. The wells were selected because of their shallow nature and the risk from pesticide and nitrate contamination. Generally this water is well suited for irrigation and no serious problems were found. The chemical analyses are listed on Tables 1a and 1b. See location map for well location.

Irrigation Quality

The water in this area is generally low in salts, with only 5 of the 12 samples having EC values exceeding 750 umhos / cm. The EC values range is from 230 umhos / cm at well Site 8 to 880 umhos / cm at well Site 3. Water in the area has a mean EC around 654 umhos / cm making it suitable for irrigation.

All wells, except for Site 8, have bicarbonate (HCO_3) above irrigation standards. Bicarbonate affects the way salts react in soil and are taken into consideration in calculating the adjusted Sodium Adsorption Ratio (R_{Na}). Bicarbonate in sprinkler irrigation water can cause white speckling on fruits which lowers the fruit's market appeal. Since other salts are so low, in this area, bicarbonate should not be much of a problem.

All R_{Na} and SAR values are acceptable for the water to be used for irrigation.

Livestock Quality

All of the wells are suitable for livestock use.

Drinking Water

Nitrate was detected in all but well Site 8. Only well Site 3 is a concern. The nitrate level in this well is 8.5 ppm— near the drinking water standard of 10.

No pesticides were detected in any of the samples for this area.

Table 1a East Lehi Area (Utah County), Utah

See location map of the area.

Irrigation and infiltration quality East Lehi Area (Utah County), Utah. Samples taken on April 1, 1998. Shaded values exceed established guidelines.

*Sample Sites	pH	EC umhos/cm	Ca ppm	Mg ppm	Na ppm	HCO ₃ meq/L	**R _{Na}	SAR
1	7.5	540	60.10	27.70	14.90	3.21	0.45	0.40
2	7.5	540	60.40	27.80	15.00	3.57	0.45	0.40
3	7.5	880	107.00	43.80	20.40	6.07	0.53	0.42
4	7.8	730	91.90	35.50	15.00	5.53	0.43	0.34
5	7.6	850	80.20	49.60	25.00	6.07	0.65	0.54
6	7.5	850	95.90	43.80	25.60	6.07	0.68	0.54
7	7.4	600	67.00	31.60	14.80	3.93	0.43	0.37
8	9.3	230	2.84	19.80	14.00	1.07	0.59	0.65
9	7.6	590	64.70	30.10	15.00	3.93	0.45	0.39
10	7.5	600	66.40	31.20	14.20	4.1	0.42	0.36
11	7.4	610	66.60	32.00	15.40	4.28	0.46	0.39
12	7.3	830	43.30	31.50	79.20	3.57	2.44	2.23

* Sample Sites: wells, drains and springs

** R_N : Adjusted SAR for HCO₃ as described in "Water Quality for Agriculture (Rev. 1)" page 63.

Table 1b - East Lehi Area (Utah County), Utah

See location map of the area.

Other elements and ions associated with water quality for irrigation, surface water, and livestock for the East Lehi Area (Utah County), Utah. Samples taken on April 1, 1998. Shaded values exceed established guidelines.

*Sample Sites	Al ppm	B ppm	Cl ppm	Fe ppm	K pp	Mn ppm	NO ₃ ppm	PO ₄ -P ppm	S ppm	Si ppm	Sr ppm	Zn ppm
1	0.00	0.00	10.8	0.00	0	0.00	2.1	0.00	20.0	5.49	0.43	0.00
2	0.00	0.00	8.8	0.00	0	0.00	2.1	0.00	20.4	5.51	0.43	0.00
3	0.00	0.00	23.8	0.00	0	0.00	8.5	0.00	27.3	11.4	0.73	0.00
4	0.00	0.00	13.5	0.00	0	0.00	4.2	0.00	19.6	10.1	0.70	0.00
5	0.00	0.00	23.4	0.00	0	0.00	5.2	0.00	23.6	12.4	0.75	0.00
6	0.00	0.00	22.7	0.00	0	0.00	5.1	0.00	23.8	11.9	0.73	0.00
7	0.00	0.00	11.3	0.06	0	0.03	2.2	0.00	19.4	5.72	0.46	0.45
8	0.00	0.00	9.2	0.00	0	0.00	0.0	0.00	8.2	0.32	0.01	0.00
9	0.00	0.00	8.7	0.00	0	0.00	2.6	0.00	18.2	6.00	0.46	0.00
10	0.00	0.00	8.6	0.00	0	0.00	2.4	0.00	19.5	6.02	0.46	0.00
11	0.00	0.00	11.5	0.07	0	0.08	2.3	0.00	19.8	5.57	0.42	0.65
12	0.00	0.00	104.0	0.00	4	0.00	5.1	0.00	23.0	13.8	0.55	0.00

* Sample Sites: wells, drains and springs








1998 UDAF Ground Water Sample Locations

Lehi Area (Utah County), Utah

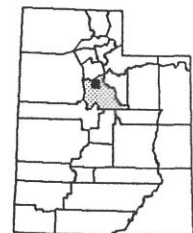


Map Scale 1:7,400 (1 inch = .12 miles)

Legend

	<i>Primary Road</i>		<i>Agricultural Land</i>
	<i>Secondary Road</i>		<i>Water Body</i>
	<i>Railroad</i>		<i>1998 Sampling Site</i>
	<i>Field Boundary</i>		

Map Location



Mammoth Creek / Panguitch Lake Area (Garfield County), Utah

Under the direction of the Sevier River Watershed Ground-Water Technical Advisory Committee, 24 wells and springs were sampled in the Mammoth Creek and Panguitch Lake Areas in Garfield County on August 18 - 19 , 1998. These wells are used for culinary and livestock purposes. Generally this water is well suited for livestock. The areas were selected for sampling because of increased development of cabins with septic systems. The chemical analyzes are listed on Table 2. See location map of the area for sample site.

Irrigation Quality

The water in this area has very low EC values not exceeding 530 umhos / cm. The EC values range is from 170 umhos / cm at well Site 12 to 530 umhos / cm at well Site 4. The average EC for the area is 332 umhos/cm.

All wells have bicarbonate (HCO_3) above the irrigation standards except for well Site 12. Bicarbonate affects the way salts react in soil and are taken into consideration in calculating the adjusted Sodium Adsorption Ratio (R_{Na}). Bicarbonate in sprinkler irrigation water can cause white speckling on fruits which lowers the fruit's market appeal. Since other salts in this area are so low, bicarbonate should not be much of a problem.

All R_{Na} and SAR values are acceptable to use the water for irrigation. This water is generally not used for irrigation and so these values have little meaning.

Livestock Quality

None of the samples exceeded any livestock standards.

Drinking Water

Nitrate levels were low for all samples and are not a concern. No pesticides were detected in any of the samples.

Sample Sites 3, 4, 9, 16, and 19 had elevated manganese (Mn) levels and sample Site 16 also had high iron (Fe). These minerals, at the levels found, could cause discoloration of plumbing fixtures as well as other aesthetics problems. This is not a health issue.

Bacteria tests for fecal Coliform were performed on each sample. Five of the 12 wells in the Mammoth Creek area were determined to be unsatisfactory for drinking. In the Panguitch Lake area only one spring was determined unsatisfactory. This spring was just across the road from the developed area in a pasture. These tests indicate that the septic systems in the Mammoth Creek area are not protecting the ground water. It is interesting to note that there are very low nitrate and phosphate levels. This is most likely due to the trees and shrubs, which have extensive root volumes and many micro flora associated with them, which use the nitrate and phosphate associated with the septic system.

Table 2 Mammoth Creek / Panguitch Lake Area (Garfield County), Utah

See location map of the area.

Water quality data from Mammoth Creek and Panguitch Lake Areas in Garfield County, UT sampled on August 18, 1998. ("nd" indicates that there was no detection of this element with the testing method used by the chemist.) Shaded values exceed established guidelines.

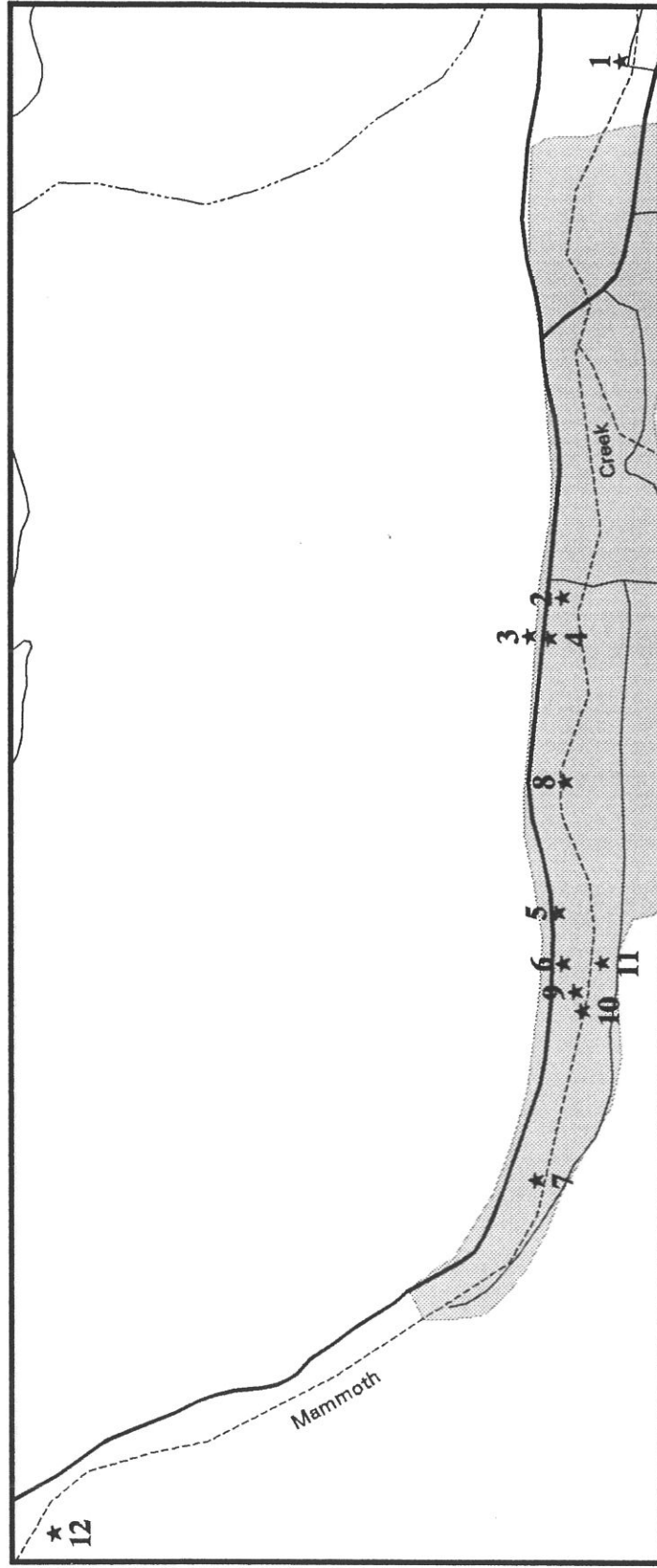
ID	pH	EC umhos/cm	HCO3 meq/L	Cl mg/L	NO3- N mg/L	PO4 P mg/L	Ca mg/L	Fe mg/L	K mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	S mg/L	Si mg/L	Sr mg/L	Zn mg/L
1	7.4	260	2.50	nd	0.22	nd	28.3	0.18	nd	15.2	nd	nd	5.08	nd	5.82	0.10	nd
2	7.6	260	2.86	nd	nd	nd	35.0	0.09	nd	13.2	0.04	nd	3.58	nd	4.22	0.11	nd
3	6.9	310	2.86	nd	0.25	nd	40.5	nd	nd	16.6	0.08	0.39	3.49	5.02	7.20	0.12	0.29
4	7.0	530	5.36	9.1	nd	nd	67.4	nd	nd	28.3	0.24	0.36	9.78	4.44	6.08	0.22	nd
5	6.8	340	3.21	3.5	nd	nd	52.7	nd	nd	11.7	0.03	0.48	6.13	6.57	9.34	0.11	1.54
6	7.1	370	4.11	nd	0.11	nd	48.1	nd	nd	23.6	nd	0.38	3.39	5.30	5.80	0.14	0.35
7	6.9	340	3.57	3.2	0.23	nd	41.5	nd	nd	20.5	0.02	0.51	4.53	7.04	6.32	0.15	0.40
8	6.9	330	2.86	7.5	0.24	nd	36.1	nd	nd	20.4	nd	0.62	8.15	8.42	8.36	0.18	0.13
9	7.0	420	4.46	4.9	0.13	nd	56.5	0.17	nd	24.6	0.21	nd	4.54	0.84	7.04	0.17	2.80
10	7.3	360	3.93	nd	0.13	nd	42.6	nd	nd	25.9	0.04	0.18	2.52	3.05	4.10	0.14	0.94
11	7.3	430	4.64	nd	nd	nd	56.4	nd	nd	29.1	nd	nd	2.77	0.95	5.21	0.17	0.34
12	7.3	170	1.43	nd	0.32	nd	23.0	nd	nd	6.35	nd	0.16	3.79	2.66	8.77	0.07	nd
13	7.0	380	3.57	4.4	0.13	nd	60.1	0.09	4	10.4	0.03	0.17	8.88	3.08	14.2	0.21	nd
14	7.1	410	3.93	5.0	nd	nd	59.6	0.07	5	13.8	nd	0.26	7.95	4.58	15.8	0.32	1.21
15	7.1	390	3.57	4.3	0.10	nd	43.4	nd	10	16.7	nd	0.47	10.4	6.77	13.0	0.62	0.20

Table 2a Mammoth Creek / Panguitch Lake Area (Garfield County), Utah

ID	pH	EC umhos/cm	HCO3 meq/L	Cl mg/L	NO3- N mg/L	PO4 P mg/L	Ca mg/L	Fe mg/L	K mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	S mg/L	Si mg/L	Sr mg/L	Zn mg/L
16	6.6	330	2.68	4.0	nd	nd	42.9	0.33	nd	10.9	1.17	0.65	7.95	8.36	14.5	0.16	0.30
17	7.3	240	2.14	4.6	0.40	0.07	33.7	0.02	nd	6.27	0.04	nd	7.83	1.07	19.1	0.13	0.08
18	6.8	260	2.14	6.5	0.43	nd	34.0	0.26	nd	6.30	nd	0.50	9.01	7.14	18.1	0.13	0.19
19	7.2	270	2.86	3.7	nd	0.11	38.6	0.28	nd	7.41	0.45	nd	6.93	nd	15.6	0.14	nd
20	7.6	270	2.68	3.7	nd	nd	27.1	nd	7	12.3	nd	nd	8.43	1.47	11.7	0.38	nd
21	7.6	310	3.21	3.6	0.34	nd	43.5	nd	nd	10.2	nd	nd	7.29	1.00	14.2	0.18	nd
22	7.9	340	3.21	4.8	nd	nd	12.2	0.19	18	6.94	nd	nd	45.1	2.00	12.6	0.23	0.45
23	7.3	300	2.50	4.0	nd	nd	13.7	0.46	16	7.69	nd	0.26	32.2	4.35	13.4	0.25	0.13
24	6.9	350	3.21	nd	0.14	0.09	53.4	0.11	nd	9.05	nd	0.35	7.10	4.67	16.0	0.20	0.08







1998 UDAF Ground Water Sample Locations

Mammoth Creek Area (Garfield County), Utah

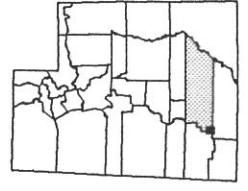


Map Scale 1:13,500 (1 inch = .21 miles)

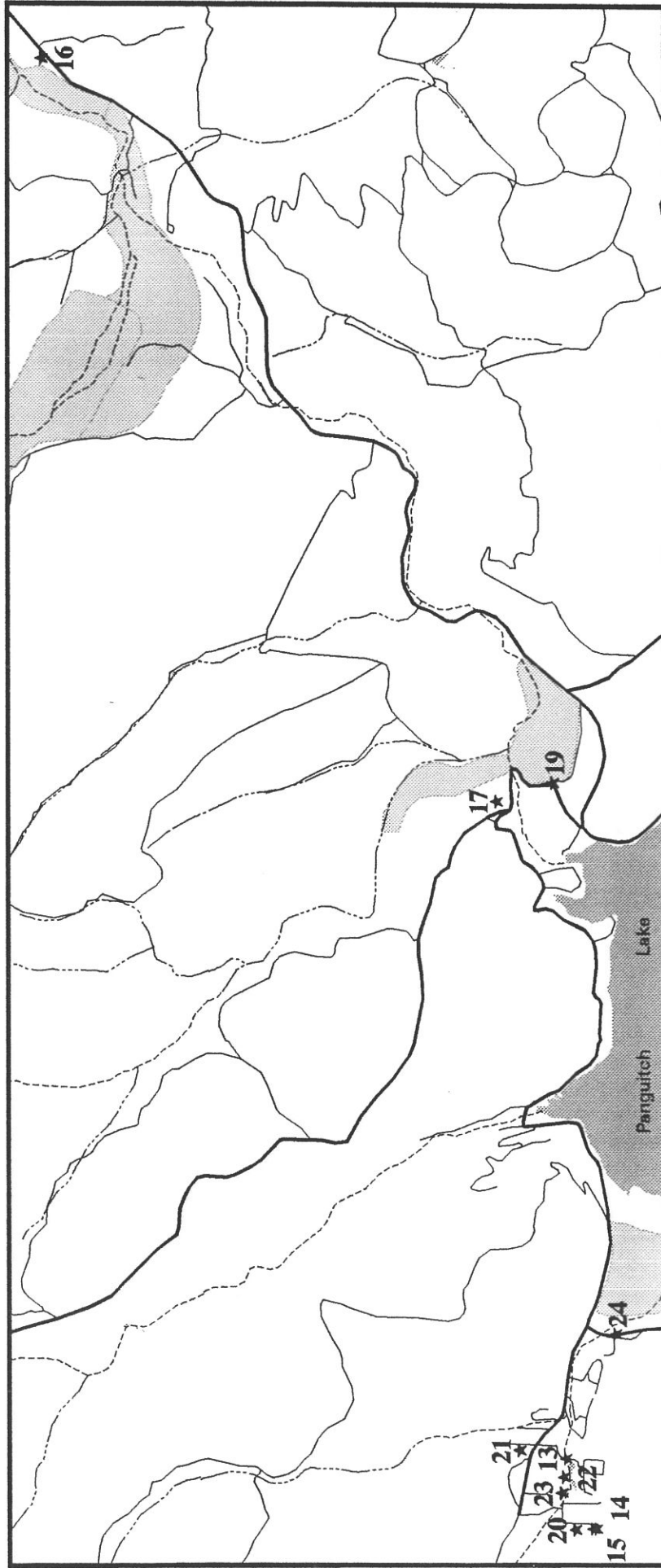
Legend

-  Improved Road
-  Unimproved Road
-  Perennial Stream
-  Intermittent Stream
-  High-Density Residential
-  1998 Sampling Site

Map Location



1998 UDAF Ground Water Sample Locations Panguitch Lake Area (Garfield County), Utah



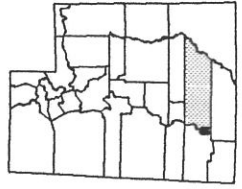
Map Scale 1:48,000 (1 inch = .75 miles)

Legend

- Perennial Stream
- Intermittent Stream
- Improved Road
- Unimproved Road
- Field Boundary
- Agricultural Land
- Water Body
- 1998 Sampling Site



Map Location



Monroe / Venice Areas (Sevier County), Utah_____

Under the direction of the Sevier River Watershed Ground Water Technical Advisory Committee, 16 wells and springs were sampled in the Monroe and Venice Areas in Sevier County on September 2, 1998. These wells are used for irrigation, culinary, and livestock purposes. The chemical analyzes are listed on Tables 3a and 3b. See location map of the area for sample site.

Irrigation Quality

The water in the Monroe area has low EC values as compared to Venice. Monroe's EC values range from 640 to 750 umhos/cm while 7 of the 8 Venice samples had EC values exceeding 750 umhos / cm. The range of the EC values in the Venice area were 670 to 2,900 umhos/cm with an average of 1,451 umhos/cm. This water requires special management for sustained irrigation of salt sensitive crops.

All wells in both areas have bicarbonate (HCO_3) above the irrigation standards. Bicarbonate affects the way salts react in soil and are taken into consideration in calculating the adjusted Sodium Adsorption Ratio (R_{na}). Bicarbonate in sprinkler irrigation water can cause white speckling on fruits which lowers the fruit's market appeal.

Only one well in both areas has high SAR and R_{na} values (Site 16). The SAR value estimates the effect of sodium on the soil. The R_{na} is a more conservative estimate of the effect of sodium on the soil and tends to exaggerate the problem. The SAR value for well Site 16 indicates that this water may create problems if used for irrigation. Soils treated with sodic water (high SAR values) tend to develop dark black organic slick spots. These spots are sometimes referred to as black alkali.

Sample Sites 10 and 16 have high chloride levels. Sprinkler irrigation with waters high in chloride (above 145 ppm Cl) can damage crops. The chloride destroys the plant cells. Values higher than 355 ppm Cl can cause damage when used for surface irrigation. The damage from sprinkling this water is compounded when the irrigation takes place with wind.

Livestock Quality

Well Site 13 had elevated sulfate (S) levels that may affect livestock that are not used to the water.

Drinking Water

Nitrate was detected in all wells. Nitrate levels are not high enough to be of concern. No pesticides were detected in any of the samples.

The EC values of sample sites Sites 9, 10, 12, 13, 14, 15, and 16 exceed the aesthetic water quality standard. This means the water in these wells may be off flavored. No sampling sites exceed the EPA health level for drinking water.

Well Sites 13 and 16 also exceeded the EPA aesthetic water quality standard for sulfate (S). Sulfate in the water can cause diarrhea in those not accustomed to drinking it. This is an aesthetic standard and is not health related.

Well Site 13 also has high manganese (Mn) which can discolor plumbing fixtures. This again is an aesthetic issue and does not affect health.

Bacteria tests also indicate that 7 of the 8 wells in Monroe were contaminated with bacteria. Three had counts so high that chemists were unable to determine whether fecal Coliform were present while none were found in the remaining samples.

In the Venice Area again 7 of the 8 wells had bacteria and 2 were found to have fecal Coliform. There is a good possibility one of the wells was contaminated by rodents in sprinkler pipe.

Table 3a - Venice / Monroe Areas (Sevier County), Utah

See location map of the area.

Irrigation and infiltration quality areas of Venice/Monroe Areas (Sevier County), Utah. Samples taken on September 2, 1998. Shaded values exceed established guidelines.

*Sample Sites	pH	EC umhos/cm	Ca ppm	Mg ppm	Na ppm	HCO ₃ meq/L	**R _{Na}	SAR
1	7.2	720	97.30	19.00	17.70	5.36	0.29	0.43
2	7.4	680	93.90	18.60	13.00	5.36	0.21	0.32
3	7.0	750	103.00	18.30	23.90	6.07	0.39	0.57
4	7.1	640	67.10	14.60	34.10	5.00	0.63	0.98
5	7.1	700	93.20	19.90	13.20	5.36	0.21	0.32
6	7.2	680	89.50	19.30	10.80	5.36	0.17	0.27
7	7.0	690	84.60	17.60	20.70	5.53	0.38	0.53
8	7.3	650	86.30	15.60	25.90	5.00	0.42	0.67
9	7.3	1060	96.70	54.20	28.00	3.75	0.41	0.57
10	7.3	1280	113.00	67.70	36.60	6.07	0.49	0.67
11	7.4	670	73.50	25.00	16.90	4.64	0.27	0.43
12	7.2	960	62.60	52.80	45.90	7.50	0.75	1.03
13	6.8	2900	174.00	241.00	107.00	9.82	1.12	1.23
14	7.2	960	89.40	40.80	38.40	6.78	0.55	0.84
15	7.1	1080	66.20	66.50	50.90	9.28	0.68	1.06
16	7.3	2700	95.50	28.30	342.00	3.57	4.66	7.90

* Sample Sites: wells, drains and springs

** R_N : Adjusted SAR for HCO₃ as described in "Water Quality for Agriculture (Rev. 1)" page 63.

Table 3b Venice / Monroe Areas (Sevier County), Utah

See location map of the area.

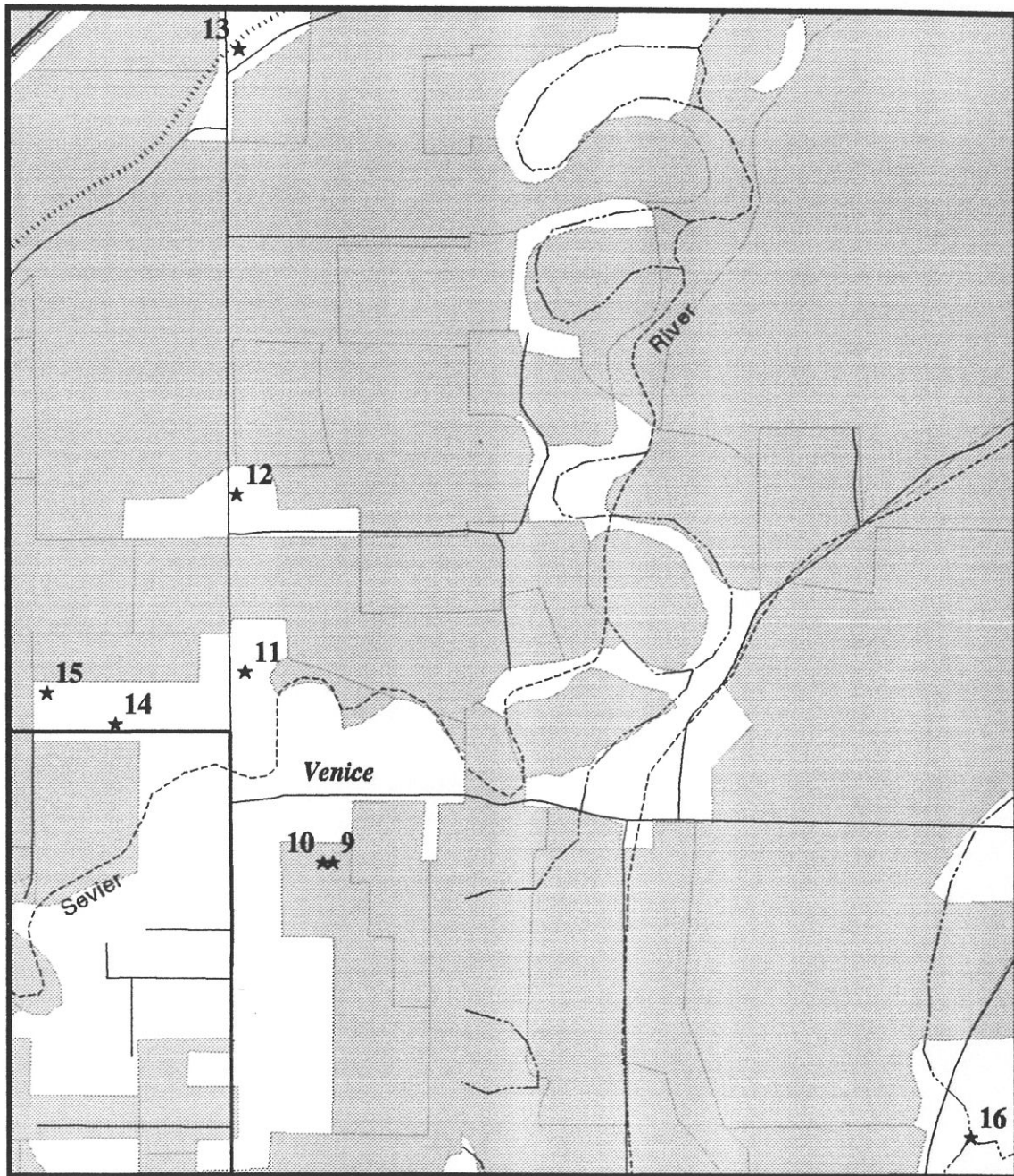
Other elements and ions associated with water quality for irrigation, surface water, and livestock for Venice/Monroe areas (Sevier County), Utah. Samples taken on September 2, 1998. **Shaded** values exceed established guidelines.

*Sample Sites	Al ppm	B ppm	Cl ppm	Fe ppm	K ppm	Mn ppm	Mo ppm	NO ₃ ppm	PO ₄ -P ppm	S ppm	Sr ppm	Zn ppm
1	0.00	0.00	48.0	0.00	0	0.00	0.00	5.4	0.06	13.4	0.67	0.14
2	0.00	0.00	14.0	0.00	0	0.00	0.00	4.9	0.00	14.3	0.62	0.00
3	0.00	0.00	23.7	0.00	0	0.00	0.00	7.0	0.08	14.5	0.82	0.00
4	0.00	0.00	14.4	0.00	0	0.00	0.00	2.1	0.00	11.6	0.41	0.00
5	0.00	0.00	14.6	0.00	0	0.00	0.00	5.2	0.00	14.0	0.61	0.00
6	0.00	0.00	14.5	0.00	0	0.00	0.00	4.2	0.00	13.8	0.45	0.00
7	0.00	0.00	13.1	0.00	0	0.00	0.00	4.1	0.06	12.9	0.51	0.00
8	0.00	0.00	14.0	0.00	0	0.00	0.00	4.1	0.00	13.7	0.57	0.00
9	0.00	0.00	106.0	0.00	4	0.00	0.00	2.5	0.00	35.1	0.84	0.00
10	0.00	0.00	149.0	0.00	4	0.00	0.00	2.3	0.00	45.1	1.05	0.00
11	0.00	0.00	24.6	0.00	0	0.00	0.00	0.7	0.00	21.0	0.53	0.00
12	0.00	0.00	26.1	0.00	4	0.00	0.00	4.2	0.00	22.1	0.43	0.00
13	0.00	0.52	92.8	0.00	4	0.14	0.00	6.6	0.00	353.0	0.92	0.00
14	0.00	0.00	50.3	0.00	5	0.00	0.00	4.2	0.00	23.8	0.86	0.00
15	0.00	0.00	27.7	0.08	4	0.00	0.00	4.9	0.00	22.4	0.44	0.00
16	0.00	0.00	529.0	0.00	6	0.00	0.00	0.9	0.00	97.1	1.44	0.00

* Sample Sites: wells, drains and springs

1998 UDAF Ground Water Sample Locations

Venice Area (Sevier County), Utah



Map Scale 1:14,000 (1 inch = .22 miles)

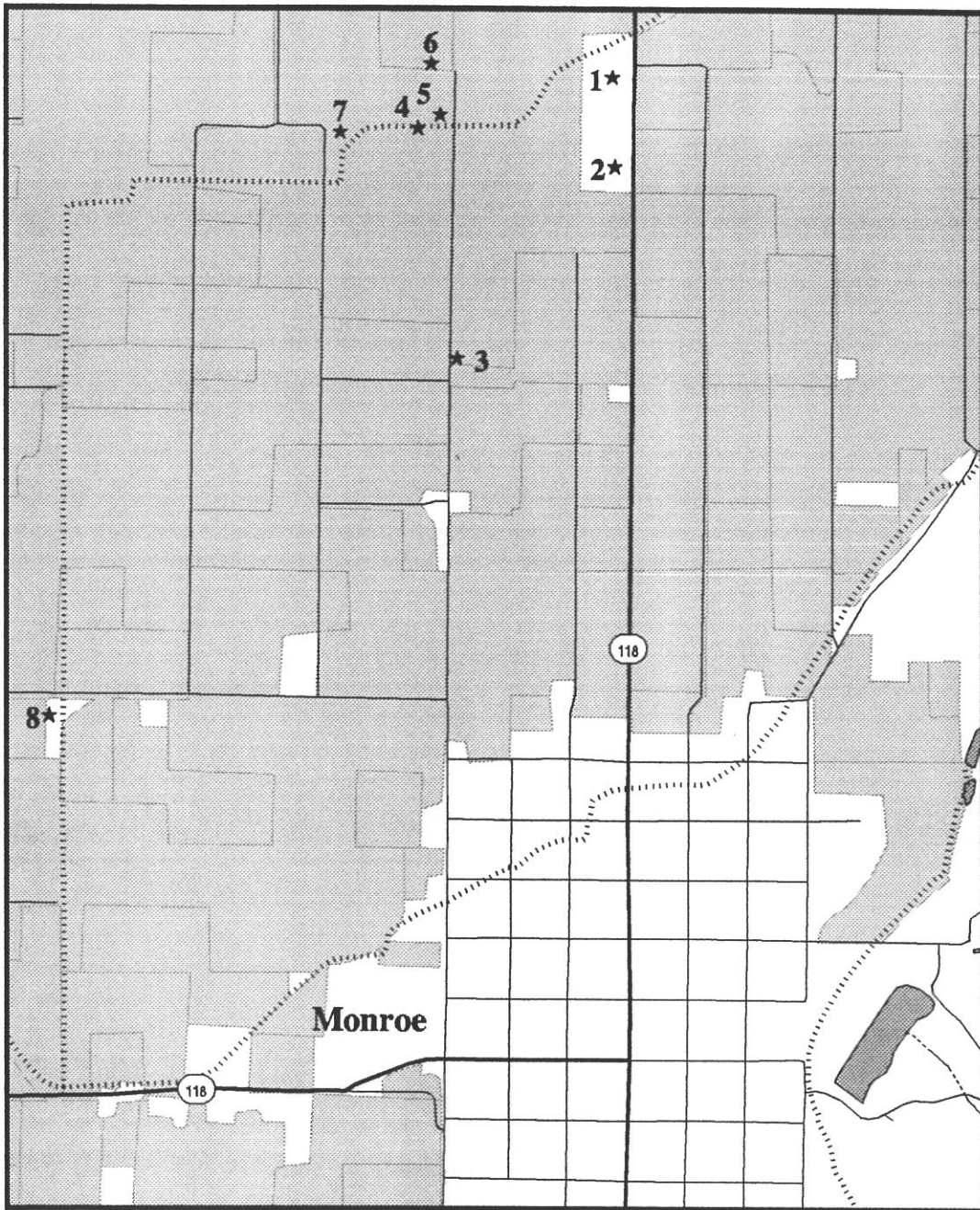
Legend

- | | | | |
|--|----------------------------|--|---------------------------|
| | <i>Perennial Stream</i> | | <i>Railroad</i> |
| | <i>Ditch or Canal</i> | | <i>Field Boundary</i> |
| | <i>Intermittent Stream</i> | | <i>Agricultural Land</i> |
| | <i>Primary Road</i> | | <i>1998 Sampling Site</i> |
| | <i>Secondary Road</i> | | |

Map Location











1998 UDAF Ground Water Sample Locations Monroe Area (Sevier County), Utah

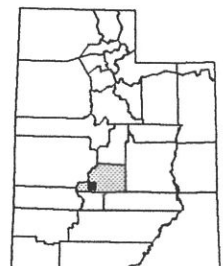


Map Scale 1:22,000 (1 inch = .35 miles)

Legend

- | | | | |
|---|----------------------------|---|---------------------------|
|  | <i>Ditch or Canal</i> |  | <i>Field Boundary</i> |
|  | <i>Intermittent Stream</i> |  | <i>Agricultural Land</i> |
|  | <i>Primary Road</i> |  | <i>Water Body</i> |
|  | <i>Secondary Road</i> |  | <i>1998 Sampling Site</i> |

Map Location



Ibapah / Callao Areas (Juab & Tooele Counties), Utah

On September 25, 1989, 14 wells were sampled in the Ibapah and Callao areas of Juab & Tooele County. These wells and springs are used for irrigation, culinary and livestock purposes. Generally this water is well suited for livestock use. The water may be used for irrigation of salt tolerant crops and all other crops when properly managed. The chemical analyzes are listed on Tables 4a and 4b. See location map of the area for sample sites.

Of interest, all but 3 wells had detectible phosphorus. This is unique in ground- water.

Irrigation Quality

The water in this area is moderately low in salts with 6 of the 14 wells sampled having EC values exceeding 750 umhos/cm. The EC values range is from 260 umhos/cm at well Site 6 to 1,400 umhos/cm at well Site 12. The average EC for the area is 711 umhos/cm, which is below the 750 umhos/cm level where irrigation problems start.

All but three sites have bicarbonate (HCO_3) above the irrigation standards. Bicarbonate affects the way salts react in soil and are taken into consideration in calculating the adjusted Sodium Adsorption Ratio (R_{Na}). Bicarbonate in sprinkler irrigation water can cause white speckling on fruits which lowers the fruit's market appeal.

The R_{Na} and SAR values for sample Sites 11, 12, and 14 could cause problems when this water is used for irrigation. The R_{Na} is a high estimate of the effect of sodium on the soil and tends to exaggerate the problem. SAR values are at acceptable levels, so with proper irrigation the water can be used without damaging soil. Soils treated with sodic water (high SAR values) tend to develop dark black organic slick spots. These spots are sometimes referred to as black alkali.

Sample Site 8 has a high chloride level. Sprinkler irrigation with waters high in chloride (above 145 ppm Cl) can damage crops. The chloride destroys the plant cells. Values higher than 355 ppm Cl can cause damage when used for surface irrigation. The damage from sprinkling this water is compounded when the irrigation takes place with wind.

Livestock Quality

There are no limits on this water for livestock use.

Drinking Water

Nitrate was detected in all well sites, except sample Sites 6 and 10. Well Site 12 has a nitrate value of 12, which exceeds EPS's drinking water standards. No pesticides were detected in these wells.

The EC values of sample Sites 2, 4, 8, 11, 12, and 13 exceed the aesthetic water quality standard. This means that these wells may be off flavored.

Well Site 10 also exceeds the EPA aesthetic water quality standard for manganese (Mn). Manganese can cause discoloration of plumbing fixtures at this level. This is an aesthetic standard and is not health related.

Eleven of the 14 wells were tested positive for bacteria. Two wells had counts so high that fecal Coliform could not be detected. One well is a new well that is not yet finished and will most likely be clean when completed.

Table 4a Ibapah/Callao Areas (Juab & Tooele County), Utah

See location map of the area.

Irrigation and infiltration quality areas of Callao / Ibapah Areas (Juab & Tooele County), Utah. Samples taken on September 25, 1998. Shaded values exceed established guidelines.

*Sample Sites	pH	EC umhos/cm	Ca ppm	Mg ppm	Na ppm	HCO ₃ meq/L	**R _{Na}	SAR
1	7.6	600	47.60	26.10	27.30	3.93	0.88	0.79
2	7.4	1180	81.10	48.80	67.10	6.07	1.74	1.45
3	7.8	270	19.30	10.90	17.60	2.14	0.77	0.79
4	7.3	840	74.40	35.50	37.10	5.35	1.07	0.89
5	7.5	500	32.10	20.90	27.40	2.50	0.94	0.92
6	7.8	260	13.30	12.60	19.20	2.14	0.86	0.91
7	7.7	310	17.90	21.70	8.14	2.50	0.30	0.31
8	7.4	1160	50.80	35.70	102.00	3.21	2.89	2.68
9	7.4	690	44.10	12.30	57.60	1.43	1.84	1.98
10	7.3	660	23.50	14.20	68.60	1.43	2.48	2.76
11	7.5	800	43.40	13.00	107.00	5.71	4.52	3.66
12	7.1	1400	113.00	32.90	122.00	7.85	3.62	2.60
13	7.2	870	91.10	24.60	48.90	5.71	1.55	1.17
14	8.5	410	8.62	2.67	69.90	1.42	4.18	5.33

* Sample Sites: wells, drains and springs

** R_N : Adjusted SAR for HCO₃ as described in "Water Quality for Agriculture (Rev. 1)" page 63.

Table 4b Ibapah/Callao Areas (Juab & Tooele County), Utah

See location map of the area.

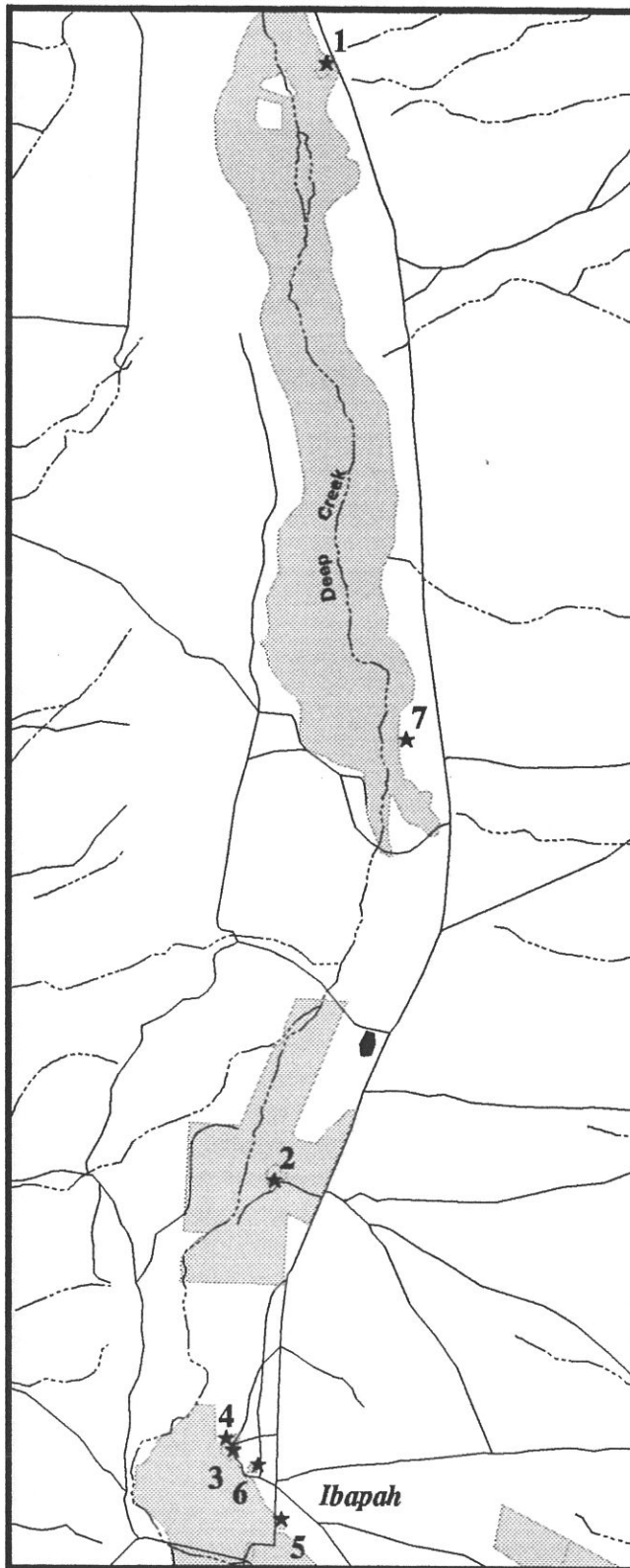
Other elements and ions associated with water quality for irrigation, surface water, and livestock for Callao / Ibapah Area (Juab & Tooele County) Utah. Samples taken on October 25, 1998. **Shaded** values exceed established guidelines.

*Sample Sites	Al ppm	B ppm	Cl ppm	Fe ppm	K ppm	Mn ppm	Mo ppm	NO ₃ ppm	PO ₄ -P ppm	S ppm	Sr ppm	Zn ppm
1	0.00	0.00	44.5	0.00	0	0.00	0.00	0.9	0.05	9.5	0.22	0.00
2	0.00	0.00	135.0	0.00	5	0.00	0.00	0.3	0.00	25.4	0.47	0.00
3	0.00	0.00	10.1	0.00	0	0.02	0.00	0.4	0.06	3.6	0.25	0.00
4	0.00	0.00	72.2	0.00	0	0.00	0.00	0.1	0.00	11.3	0.35	0.00
5	0.00	0.00	52.7	0.00	5	0.00	0.00	0.3	0.07	7.2	0.24	0.00
6	0.00	0.00	6.6	0.89	0	0.03	0.00	0.0	0.00	3.2	0.31	0.00
7	0.00	0.00	11.4	0.00	5	0.00	0.00	0.8	0.06	3.2	0.33	0.00
8	0.00	0.00	205.0	0.00	4	0.00	0.00	0.5	0.06	15.4	0.71	0.00
9	0.00	0.00	133.0	0.09	0	0.00	0.00	1.0	0.06	8.7	0.22	0.05
10	0.00	0.00	130.0	0.27	8	0.36	0.00	0.0	0.05	7.4	0.09	0.07
11	0.00	0.00	56.2	0.00	4	0.00	0.00	2.0	0.07	10.4	0.34	0.00
12	0.00	0.00	134.0	0.00	6	0.00	0.00	12.0	0.06	20.1	0.84	0.00
13	0.00	0.00	58.7	0.00	4	0.00	0.00	4.0	0.06	5.9	0.46	0.00
14	0.00	0.00	45.0	0.00	0	0.00	0.00	0.8	0.07	5.3	0.04	0.00







* Sample Sites: wells, drains and springs

1998 UDAF Ground Water Sample Locations

Ibapah Area (Tooele County), Utah



Legend

-  Intermittent Stream
-  Road
-  Field Boundary
-  Agricultural Land
-  Intermittent Water Body
-  1998 Sampling Site



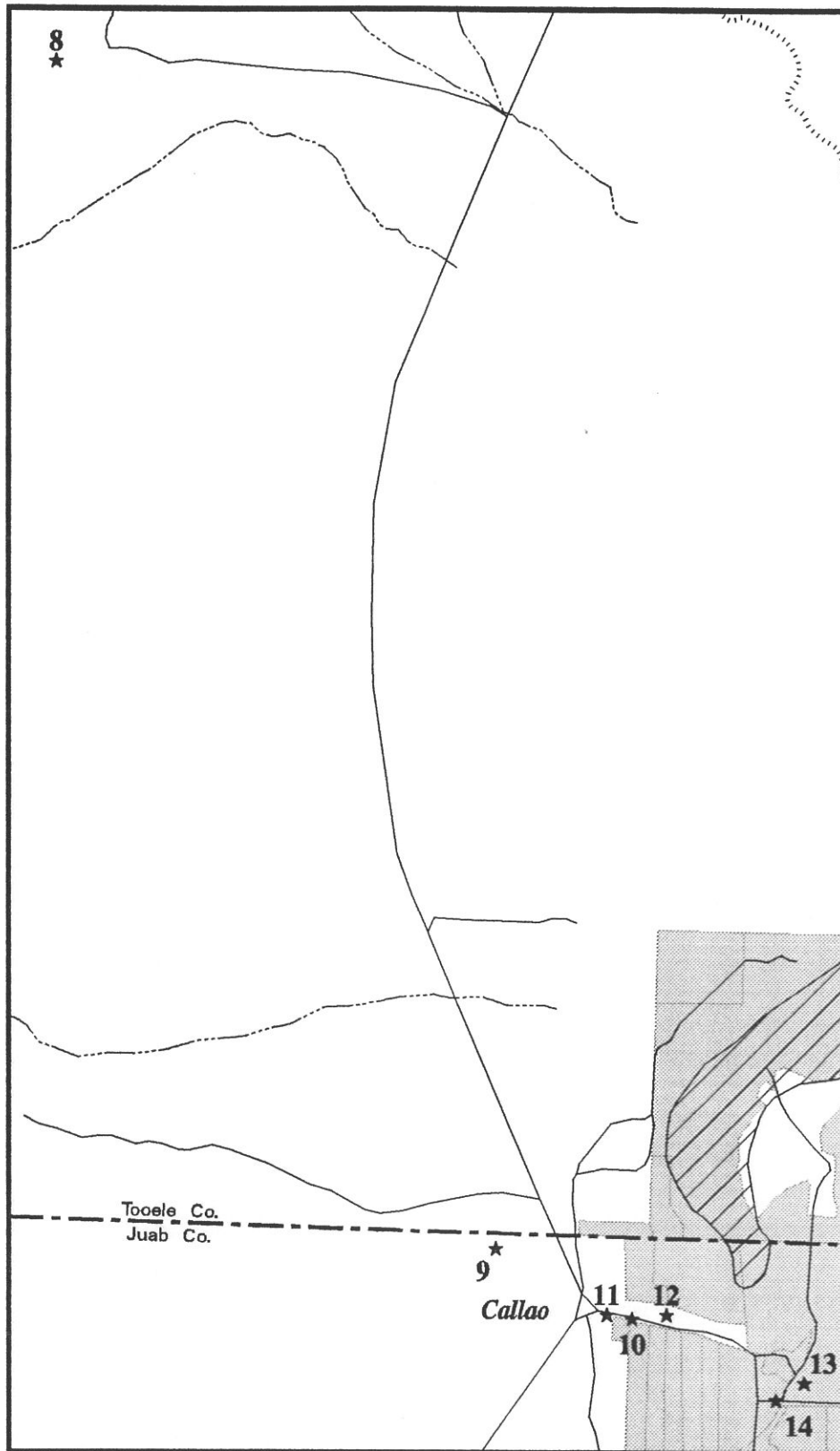
Map Location











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

1998 UDAF Ground Water Sample Locations

Callao Area (Juab & Tooele Counties), Utah



Legend

-  Wash or Ephemeral Drain
-  Intermittent Stream
-  Road
-  Field Boundary
-  County Boundary
-  Agricultural Land
-  Marsh or Wetland
-  1998 Sampling Site



Map Location



Map Scale 1:35,500 (1 inch = .56 miles)

Pelican Lake Area (Uintah County), Utah

The Uintah County SCD requested UDAF to sample irrigation, drain, and surface waters around the Pelican Lake Area of Uintah County. The SCD was particularly interested in the selenium levels of the waters, soils, and sediments of the area. On October 28, 1998, UDAF sampled 20 sites from State Road 40 south to the Uray Wildlife Refuge. The sample sites Sites 1, 2, 3, 4, 5, 12, 14, 17, and 20 included irrigation canals, Sites 11, 13, 15, 16, 18, and 19 lakes and ponds, Sites 6, 7, and 8 drains, and Sites 9 and 10 stagnant water pools.

Irrigation Quality

The salinity in these samples varies greatly as would be expected when sampling ditches, lakes, ponds, and stagnant water. Generally, the highest EC values were found in the drains, ponds below agricultural lands, and stagnant water. The EC values ranged from 210 to 8950 umhos/cm. Sample Sites 6, 7, 8, 9, 10, 13, 14, 16, and 19 exceeded the 750 umhos/cm standard for irrigation water. These sample sites are not used for irrigation and generally have very low flows. Sample Sites 1, 2, 3, 4, 5, 11, 12, 17, 18, and 20 are used for irrigation and have EC values within the acceptable range.

All sites except for Site 4 had HCO₃ (bicarbonate) levels above irrigation standards. This can result in white speckles on fruits and vegetables if the water is used for sprinkler irrigation. The drains, seepage ponds, and springs for samples 6, 7, 8, 9, 10, 13, and 14 have high SAR values. This indicates high sodium levels which if used for irrigation could destroy soil structure. Fortunately these waters are not used for irrigation. These same sites also have elevated levels or other elements such as boron and manganese which would also impact crops negatively.

Livestock Quality

Generally the water in the area is suited for livestock with the exception of the drains, and low flow seeps and ponds.

Drinking Water

These waters are not used for drinking, so it will not be discussed.

Selenium Results

The map following this narrative shows the location of the sample sites. This report will describe each sites in more detail.

Site 1 is an irrigation canal. The sample location is just past the intersection of the canal and State Road 40. Sediments from the canal as well as water were collected at this point. Selenium was not detected in the water at this site using procedures with a detection limit of 1 ppb. However, the canal sediment was found to have a selenium level of 154 ppb dry weight basis.

Site 2 is the west outflow of a small irrigation reservoir north of Pelican Lake. Again the water was free of detectable selenium, but the soil showed 812 ppb dry weight basis selenium.

- Site 3** is where the canal (Site 1) flowed into the small irrigation reservoir. At this site selenium was not detected in the soil or water.
- Site 4** is the east outflow of the reservoir. At this location only the water was sampled and selenium was detected at 1 ppb. The flow in the canal was very low as well as the water velocity.
- Site 5** is the west irrigation canal coming into the Pelican Lake area. The sample point is just north of any agricultural activity. Water and sediment samples were taken at this site. The water tested at 1 ppb and the sediment at 256 ppb dry weight basis.
- Site 6** is a seep in the ground that is thought to be from a leak in an old field drain. The drain extends north across State Road 88 to the base of a short mesa. This drain was put in many years ago to prevent shallow ground water from depositing salts in the soil from high surface evaporation. It is not clear as to the water's actual origin. At this site, water, soil, and sediments were sampled. The selenium level in the water was 13 ppb, 3,334 ppb dry weight basis for the sediments, and 536 ppb dry weight basis for the soil.
- Site 7** is the outflow of the same drain as site 6. Here the drain flows into a stagnant pond next to Pelican Lake. The selenium level of the water was 7 ppb (one half of Site 6) while the soil was 1,014 ppb dry weight basis. The soil sample was from the edge of the pond.
- Site 8** is a surface drain about one mile west of Site 7. Here the water contained 10 ppb selenium, while the sediment had 527 ppb dry weight basis, and the soil 327 ppb dry weight basis. This drain was again put in to prevent ground-water from depositing salt on the soil surface.
- Site 9** is the outflow of a shallow pond just inside the wildlife refuge's west gate. Only the water was sampled at this location. The selenium concentration of the water at this point was 94 ppb.
- Site 10** is a culvert that crosses highway 88 about one mile north of the refuge. The water in the culvert was stagnant. The wetlands on both sides of the road lacked surface water and salt deposits were evident on the soil surface indicating shallow ground water. The selenium level of the water was 11 ppb while the sediments were 988 ppb dry weight basis. The sediments appeared to be highly anaerobic with a fowl odor.
- Site 11** is the Pelican Lake pumping station. Selenium in the water at this site was at 1 ppb.
- Site 12** is the tail of the canal sampled by Site 5. Only the water was sampled at this site with 1 ppb selenium. Site 17 is the same canal, but upstream one mile and had the same selenium concentration.
- Site 13** is a pond that is formed from a seep on the east side of the Leota Bench. The selenium level at this site was 4 ppb.

Site 14 is a wetland area at the base of the bench. The sample site is a culvert under the road that heads towards the Green River. A selenium level of 5 ppb was detected at this site.

Site 15 is retention pond in a wash east of Leota. The selenium level of this site was 1 ppb.

Site 16 is a seep just off the east side of the Leota Bench. The selenium level of the water was found to be 6 ppb.

Site 17 was described with Site 12.

Site 18 is the BLM boat ramp on Pelican Lake. A selenium level of 1 ppb was detected.

Site 19 is an impoundment of water just south of the boat ramp. The selenium of this water was found to be 2 ppb.

Site 20 is the main head-gate of the canal where samples Sites 5, 17, and 12 were taken. Water at this site had a selenium level of 1 ppb. The sediments in the canal at this site had a selenium concentration of 158 ppb dry weight basis, while no selenium was detected in the saline soils of the area.

The critical value for selenium in drinking water is 10 ppb for humans and 50 ppb for animals. These samples were taken mainly for background or baseline data for the SCD. No attempt is made to relate cause and effect. It is of interest to note, however that in stagnant and anaerobic sites the selenium levels increase. In these conditions the low pH may cause higher concentrations.

Table 5a - Pelican Lake Area (Uintah County), Utah

See location map of the area.

Irrigation and infiltration qualities areas of Pelican Lake Area (Uintah County), Utah. Samples taken on October 28, 1998. **Shaded** values exceed established guidelines.

*Sample Sites	pH	EC umhos/cm	Ca ppm	Mg ppm	Na ppm	HCO ₃ meq/L	**R _{Na}	SAR
1	7.3	220	20.80	9.11	8.53	1.43	0.35	0.39
2	7.2	210	22.40	7.53	5.84	1.43	0.24	0.27
3	7.0	240	22.00	9.56	8.56	1.43	0.35	0.38
4	7.0	200	22.30	7.19	7.01	1.07	0.28	0.33
5	7.4	415	38.20	19.50	17.60	2.86	0.62	0.58
6	7.2	4800	109.00	81.50	930.00	17.9	20.41	16.41
7	7.6	1900	80.80	89.80	215.00	10.0	4.51	3.91
8	7.5	2800	79.40	129.00	374.00	11.8	6.71	6.02
9	7.8	2250	117.00	39.90	322.00	6.07	8.44	6.56
10	7.6	8950	623.00	264.00	1062.00	7.5	12.19	8.99
11	8.0	615	29.00	34.60	50.60	3.21	1.56	1.50
12	8.2	370	30.30	20.10	19.90	1.64	0.67	0.69
13	9.3	1550	21.60	76.70	233.90	3.96	5.34	5.29
14	8.6	1700	86.80	90.40	180.90	9.64	3.77	3.24
15	8.1	540	46.50	17.70	44.20	4.64	1.66	1.40
16	8.0	1080	53.10	52.40	107.00	5.00	2.76	2.49
17	8.3	420	39.10	20.40	19.80	1.96	0.64	0.64
18	8.0	580	30.20	31.10	43.90	3.21	1.39	1.34
19	7.3	755	39.50	39.50	59.50	4.28	1.73	1.60
20	7.8	460	42.70	23.00	21.20	3.03	0.70	0.65

* Sample Sites: wells, drains and springs

** R_N : Adjusted SAR for HCO₃ as described in "Water Quality for Agriculture (Rev. 1)" page 63.

Table 5b - Pelican Lake Area (Uintah County), Utah

See locatio mpa of the area

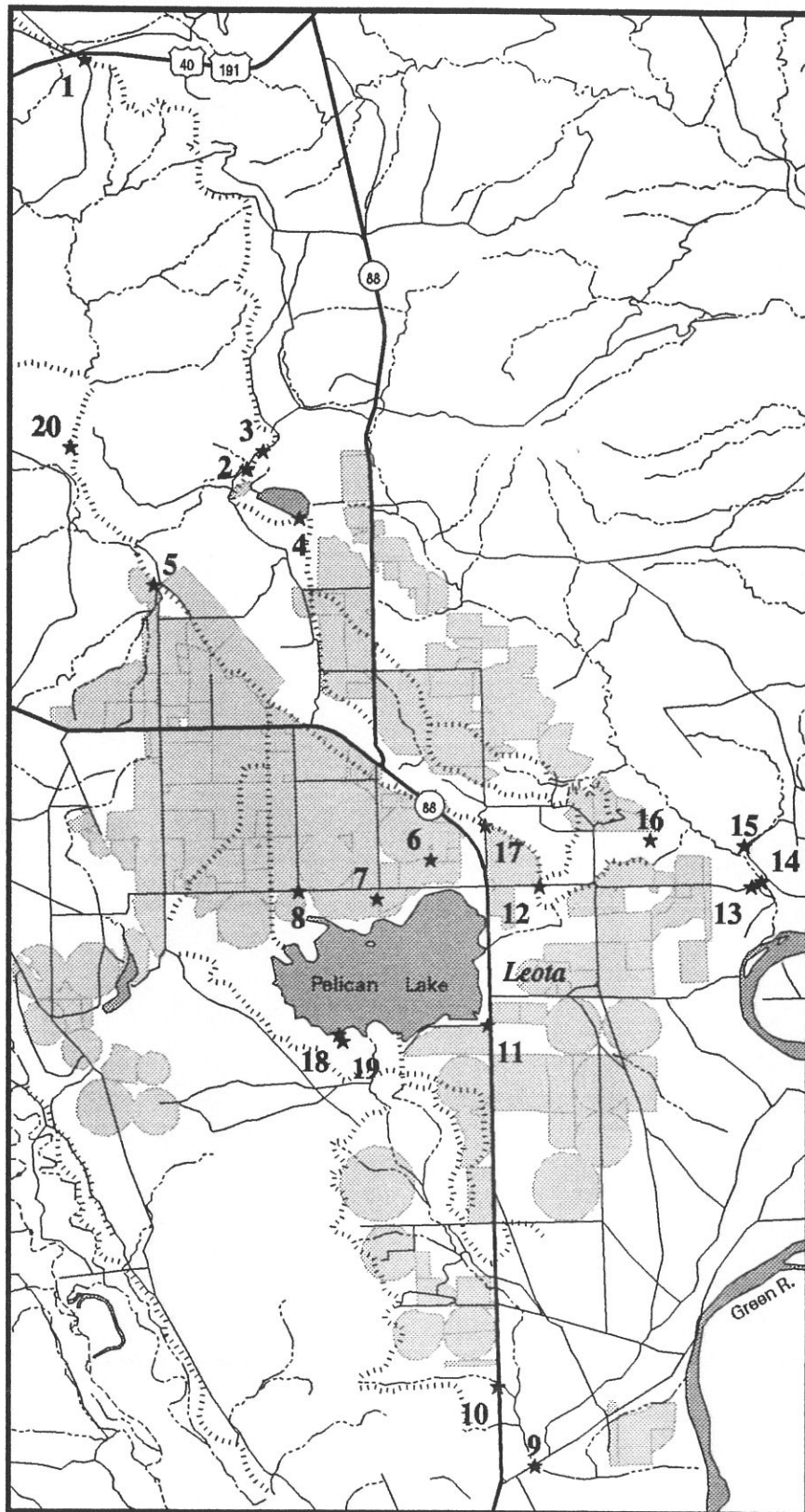
Other elements and ions associated with water quality for irrigation, surface water, and livestock for south, southwest, and western areas of Pelican Lake Area (Uintah County), Utah. Samples taken on October 28, 1998. Shaded values exceed established guidelines.

*Smple Sites	Al ppm	B ppm	Cl ppm	Fe ppm	K ppm	Mn ppm	NO ₃ ppm	PO ₄ -P ppm	S ppm	Se ppm	Sr ppm	Zn ppm
1	0.49	0.00	3.5	0.29	0	0.00	0.0	0.00	11.1	0.000	0.26	0.00
2	0.00	0.00	3.1	0.08	0	0.00	0.0	0.00	8.9	0.000	0.22	0.00
3	0.25	0.00	0.0	0.17	0	0.00	0.0	0.00	11.6	0.000	0.27	0.00
4	0.00	0.00	0.0	0.06	0	0.00	0.0	0.00	8.2	0.001	0.22	0.00
5	0.38	0.00	6.2	0.23	0	0.00	0.0	0.00	20.8	0.001	0.45	0.00
6	0.00	1.96	242.	0.00	0	0.28	0.6	0.00	426.0	0.013	3.36	0.00
7	0.00	0.66	82.6	0.09	0	0.04	3.4	0.22	133.0	0.007	2.76	0.00
8	0.00	1.21	178.	0.00	0	0.16	1.9	0.00	207.0	0.010	4.58	0.00
9	0.00	0.27	174.	0.00	0	0.00	2.5	0.00	175.0	0.094	2.05	0.00
10	0.00	1.11	1548	0.12	31	0.22	0.7	0.20	723.0	0.011	13.6	0.00
11	0.00	0.00	20.6	0.00	5	0.00	0.0	0.00	35.4	0.001	0.48	0.00
12	1.05	0.00	6.8	0.61	0	0.00	0.0	0.00	20.4	0.001	0.43	0.00
13	0.00	0.66	53.4	0.00	0	0.00	0.2	0.00	128.0	0.004	0.91	0.00
14	0.27	0.44	81.9	0.16	6	0.00	0.2	0.00	98.4	0.005	2.62	0.00
15	1.11	0.00	7.5	0.82	10	0.22	1.3	0.07	12.5	0.001	1.17	0.00
16	0.00	0.30	56.7	0.00	0	0.00	2.3	0.00	61.8	0.006	2.00	0.00
17	0.98	0.00	6.8	0.54	0	0.00	0.1	0.00	21.1	0.001	0.48	0.00
18	0.00	0.00	17.4	0.00	5	0.00	0.0	0.00	31.9	0.001	0.48	0.00
19	0.00	0.00	30.5	0.10	11	0.30	0.9	0.00	41.9	0.002	0.59	0.00
20	0.53	0.00	13.3	0.31	0	0.00	0.0	0.00	23.7	0.001	0.51	0










* Sample Sites: wells, drains and springs

1998 UDAF Ground Water Sample Locations

Pelican Lake Area (Uintah County), Utah

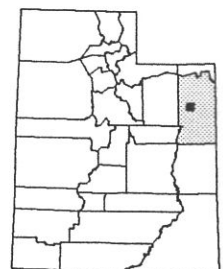


Legend

-  Perennial Stream
-  Ditch or Canal
-  Intermittent Stream
-  Primary Road
-  Secondary Road
-  Field Boundary
-  Agricultural Land
-  Water Body
-  1998 Sampling Site



Map Location



Map Scale 1:104,000 (1 inch = 1.65 miles)

Table 6a - Curlew Valley (Box Elder County), Utah

See location map of the area.

Irrigation and infiltration quality areas of Curlew Valley Area (Box Elder County), Utah. Samples taken on August 26, 1998. **Shaded** values exceed established guidelines.

*Sample Sites	pH	EC umhos/cm	Ca ppm	Mg ppm	Na ppm	HCO ₃ meq/L	**R _{Na}	SAR
1	7.2	1720	76.80	32.70	208.00	4.46	5.91	5.01
2	7.7	1380	70.50	35.40	143.00	4.64	4.09	3.47
3	7.3	3350	159.00	81.80	323.00	5	6.37	5.19
4	6.9	34000	277.00	115.00	5267.00	5	82.37	67.12
5	7.3	4120	129.00	66.30	534.00	3.21	10.75	9.52
6	7.2	2450	158.00	79.20	203.00	4.28	3.93	3.29
7	7.2	2780	153.00	62.50	302.00	4.82	6.76	5.20
8	7.2	4500	211.00	141.00	499.00	5	7.73	6.52
9	7.4	1750	112.00	55.10	149.00	3	3.25	2.88
10	7.5	1720	98.90	46.70	172.00	3.57	4.17	3.57
11	7.3	2250	101.00	38.40	283.00	4.28	7.32	6.08
12	7.4	3350	88.70	33.80	499.00	3.57	13.48	11.43
13	6.9	7900	559.00	179.00	579.00	2.5	6.82	5.45
14	6.9	10400	361.00	106.00	1437.00	3.03	20.42	17.09
15	7.1	5250	388.00	106.00	371.00	2.21	5.04	4.31
16	7.4	6600	48.30	37.60	1175.00	1.5	27.13	30.80
17	7.0	9200	661.00	181.00	718.00	1.78	7.47	6.38
18	7.5	950	94.10	23.10	39.70	2.57	1.08	0.95
19	7.2	2500	165.00	46.50	217.00	3.21	4.65	3.84

* Sample Sites: wells, drains and springs

** R_N : Adjusted SAR for HCO₃ as described in "Water Quality for Agriculture (Rev. 1)" page 63.

Table 6b - Curlew Valley (Box Elder County), Utah

See location map of the area.

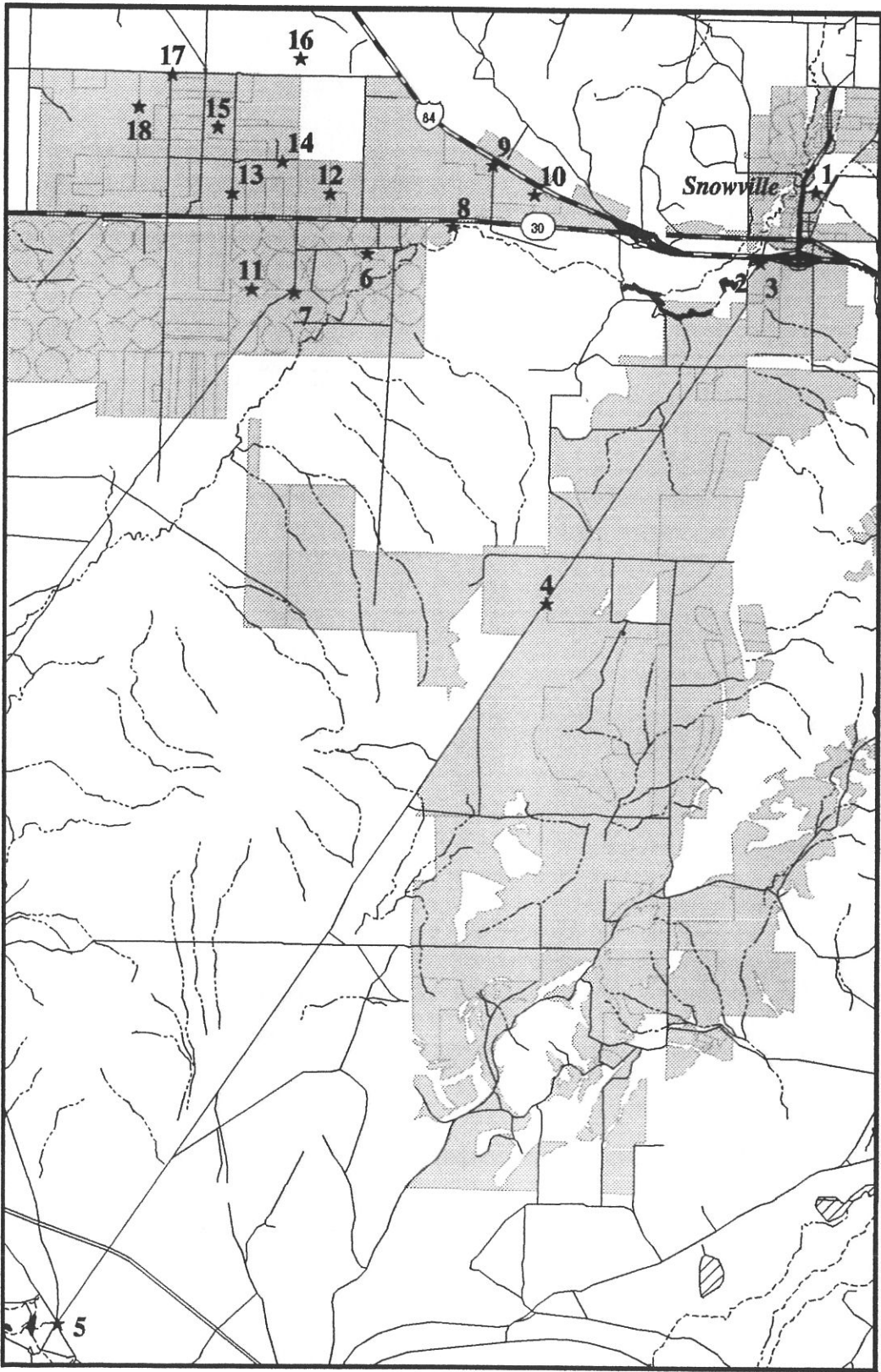
Other elements and ions associated with water quality for irrigation, surface water, and livestock for areas of Curlew Valley (Box Elder County), Utah. Samples taken on August 26, 1998. **Shaded** values exceed established guidelines.

*Sample Sites	Al ppm	B ppm	Cl ppm	Fe ppm	K ppm	Mn ppm	Mo ppm	NO ₃ ppm	PO ₄ -P ppm	S ppm	Sr ppm	Zn ppm
1	0.00	0.00	320.0	0.00	9	0.00	0.00	0.2	0.00	17.8	1.23	0.00
2	0.54	0.00	224.0	0.30	9	0.00	0.00	0.1	0.00	36.7	0.94	0.00
3	0.00	0.00	704.0	0.00	17	0.00	0.00	1.5	0.00	98.7	2.37	0.00
4	0.00	1.19	10947.0	0.13	186	0.09	0.00	0.0	0.00	132.0	7.08	0.00
5	0.00	0.20	1171.0	0.00	29	0.00	0.00	0.5	0.00	33.2	2.59	0.00
6	0.00	0.00	577.0	0.00	13	0.00	0.00	5.4	0.00	46.1	3.22	0.00
7	0.00	0.00	595.0	0.00	17	0.00	0.00	1.8	0.00	48.7	2.24	0.00
8	0.00	0.00	998.0	0.00	19	0.00	0.00	15.8	0.00	162.0	2.52	0.00
9	0.00	0.00	612.0	0.00	5	0.00	0.00	1.5	0.00	15.4	2.04	0.00
10	0.00	0.00	367.0	0.00	5	0.00	0.00	0.8	0.00	13.8	1.74	0.00
11	0.00	0.00	486.0	0.00	14	0.00	0.00	0.5	0.00	22.3	1.28	0.00
12	0.16	0.00	848.0	0.10	23	0.03	0.00	0.4	0.00	16.7	1.50	0.00
13	0.00	0.00	2256.0	0.00	41	0.00	0.00	4.0	0.00	31.8	4.20	0.00
14	0.00	0.00	3132.0	0.00	73	0.00	0.00	0.8	0.00	33.5	5.03	0.00
15	0.00	0.00	1459.0	0.00	28	0.00	0.00	3.2	0.00	13.2	2.91	0.00
16	0.00	0.00	1960.0	0.22	17	0.07	0.00	0.0	0.00	7.6	2.23	0.00
17	0.00	0.00	2879.0	0.00	51	0.00	0.00	0.8	0.00	17.1	6.99	0.00
18	0.00	0.00	187.0	0.00	13	0.00	0.00	1.2	0.00	7.7	0.58	0.00
19	0.00	0.00	624.0	0.00	19	0.00	0.00	5.3	0.00	33.4	1.07	0.00

* Sample Sites: wells, drains and springs

1998 UDAF Ground Water Sample Locations

Curlew Valley (Box Elder County), Utah



Legend

- Perennial Stream
- Ditch or Canal
- Intermittent Stream
- Primary Road
- Secondary Road
- Field Boundary
- Agricultural Land
- Water Body
- Marsh or Wetland
- 1998 Sampling Site



Map Location



Map Scale 1:160,000 (1 inch = 2.5 miles)

Table 7a Pavant Valley (Millard County), Utah -

See location map of the area.

Irrigation and infiltration qualities areas of North Pavant Valley (Millard County), Utah. Samples taken on July 29, 1998. Shaded values exceed established guidelines.

*Sample Sites	pH	EC umhos/cm	Ca ppm	Mg ppm	Na ppm	HCO ₃ meq/L	**R _{Na}	SAR
1	7.1	890	65.50	35.00	82.40	7.14	2.32	2.04
2	7.2	1420	158.00	51.90	56.60	4.64	1.26	1.00
3	6.9	1480	160.00	63.40	55.00	4.64	1.16	0.93
4	7.0	1800	155.00	82.40	71.20	4.28	1.37	1.15
5	7.2	1050	96.70	49.80	33.80	4.46	0.84	0.70
6	7.2	790	60.70	41.30	27.90	3.57	0.75	0.68
7	7.4	600	37.50	30.90	37.30	3.21	1.16	1.09
8	7.2	1060	96.30	40.50	43.40	2.86	1.06	0.94
9	7.2	830	72.90	48.30	35.00	6.07	0.93	0.78
10	7.2	710	65.80	39.50	22.40	4.28	0.61	0.54
11	6.9	1620	233.00	71.20	47.20	4.28	0.91	0.69
12	7.0	2000	172.00	129.00	70.90	3.21	1.12	1.00
13	7.2	1130	70.20	58.20	70.30	4.28	1.68	1.50
14	7.3	1300	96.30	32.80	111.00	3.93	2.99	2.49
15	7.6	640	75.00	22.40	27.40	5.00	0.92	0.71
16	7.1	1040	117.00	45.20	38.50	6.50	0.99	0.77
17	7.2	890	81.20	36.80	52.20	5.36	1.48	1.21
18	8.0	5700	35.90	87.30	853.00	6.43	18.22	17.51
19	8.6	5200	48.30	50.00	846.00	0.07	10.94	20.37
20	7.5	840	75.20	34.40	45.30	4.28	1.27	1.09
21	6.9	5500	370.00	210.00	480.00	4.28	5.94	4.94
22	7.1	11000	602.00	352.00	1091.00	3.93	10.36	8.73
23	7.1	570	97.70	38.40	35.00	6.50	0.99	0.76

* Sample Sites: wells, drains and springs

** R_N : Adjusted SAR for HCO₃ as described in "Water Quality for Agriculture (Rev. 1)" page 63.

Table 7b North Pavant Valley (Millard County), Utah

See location map of the area.

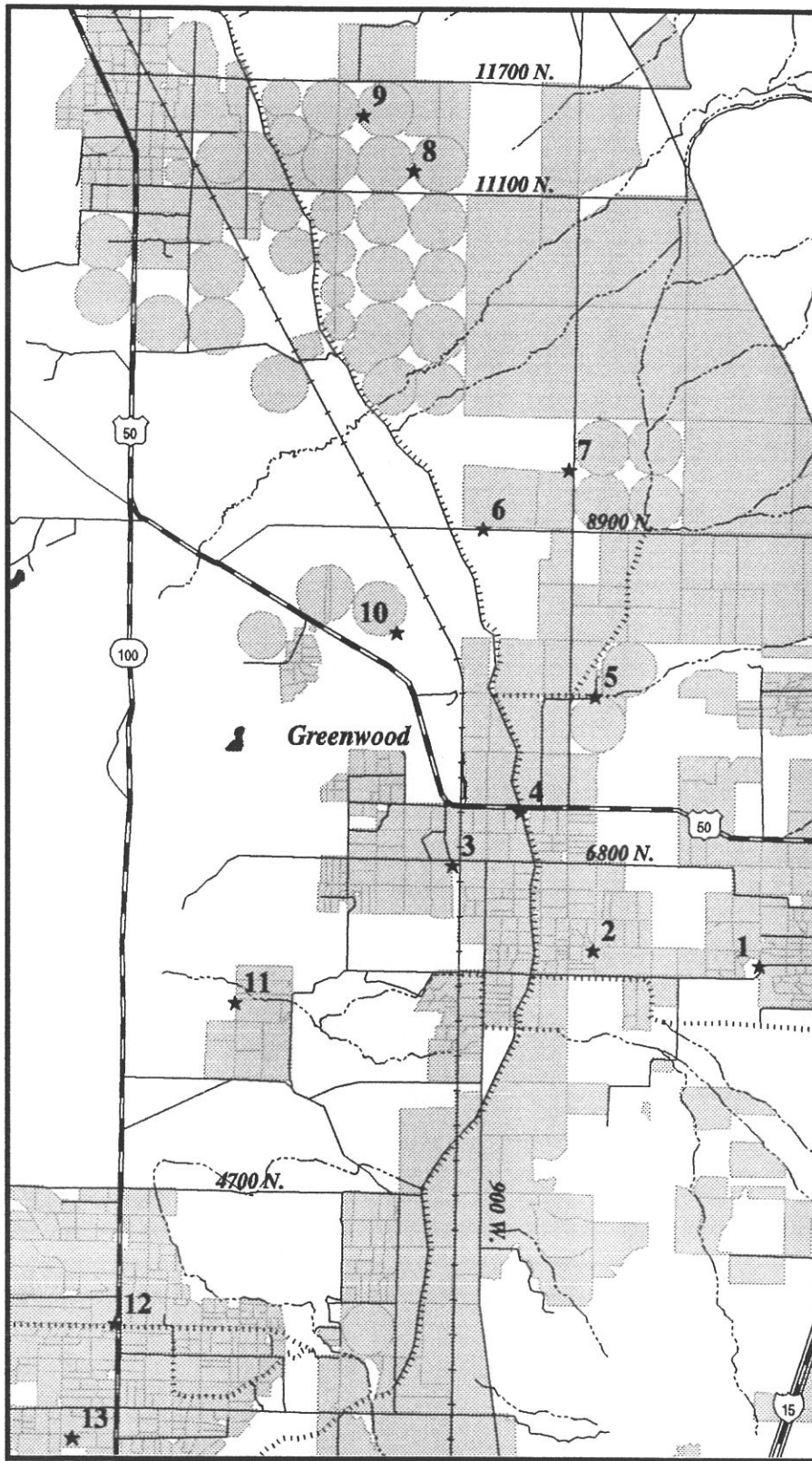
Other elements and ions associated with water quality for irrigation, surface water, and livestock for areas of North Pavant Valley (Millard County), Utah. Samples taken on July 29, 1998. **Shaded** values exceed established guidelines.

*Sample Sites	Al ppm	B ppm	Cl ppm	Fe ppm	K ppm	Mn ppm	Mo ppm	NO ₃ ppm	PO ₄ -P ppm	S ppm	Sr ppm	Zn ppm
1	0.00	0.00	56.0	0.00	0	0.00	0.00	6.0	0.00	14.5	0.27	0.00
2	0.00	0.00	202.0	0.00	0	0.00	0.00	10.2	0.00	57.5	1.28	0.00
3	0.00	0.00	185.0	0.00	0	0.00	0.00	7.5	0.00	87.1	1.14	0.00
4	0.00	0.00	338.0	0.00	0	0.00	0.00	7.6	0.00	53.7	0.61	0.00
5	0.00	0.00	155.0	0.00	0	0.00	0.00	13.2	0.00	10.0	0.34	0.00
6	0.00	0.00	118.0	0.00	0	0.00	0.00	3.0	0.00	5.2	0.56	0.00
7	0.00	0.00	78.5	0.00	0	0.00	0.00	1.4	0.00	6.1	0.50	0.00
8	0.00	0.00	200.0	0.00	0	0.00	0.00	4.8	0.00	19.4	0.44	0.00
9	0.00	0.00	68.3	0.00	0	0.00	0.00	1.2	0.00	13.8	0.32	0.00
10	0.00	0.00	81.2	0.00	0	0.00	0.00	3.5	0.00	6.6	0.35	0.00
11	0.00	0.00	93.0	0.00	5	0.00	0.00	1.1	0.00	214.0	1.95	0.00
12	0.00	0.00	233.0	0.00	5	0.00	0.22	1.8	0.00	208.0	2.02	0.00
13	0.00	0.00	132.0	0.00	10	0.00	0.24	0.5	0.00	70.1	2.18	0.00
14	0.00	0.48	231.0	0.00	14	0.00	0.00	2.2	0.00	31.7	0.62	0.00
15	0.00	0.00	34.8	0.00	0	0.00	0.00	1.7	0.00	9.2	0.30	0.00
16	0.00	0.00	102.0	0.00	0	0.00	0.00	4.5	0.00	20.3	0.59	0.00
17	0.00	0.20	120.0	0.00	0	0.00	0.00	3.4	0.00	22.5	0.47	0.00
18	0.00	2.25	1515.0	0.25	62	0.23	0.00	0.0	0.00	0.6	0.78	0.00
19	0.00	1.94	1190.0	0.09	82	0.07	0.00	0.0	0.00	95.0	1.37	0.00
20	0.00	0.14	109.0	0.00	6	0.00	0.00	3.2	0.00	16.7	0.56	0.00
21	0.00	1.18	1252.0	0.00	38	0.00	0.00	1.8	0.00	256.0	4.94	0.00
22	0.00	2.48	2744.0	0.00	96	0.00	0.00	1.6	0.00	452.0	7.98	0.00
23	0.00	0.00	32.2	0.00	4	0.00	0.00	8.3	0.00	18.6	0.71	0.00

* Sample Sites: wells, drains and springs

1998 UDAF Ground Water Sample Locations

N. Pahvant Valley (Millard County), Utah

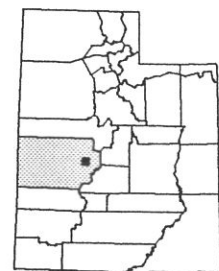


Legend

- Perennial Stream
- Ditch or Canal
- Intermittent Stream
- Primary Road
- Secondary Road
- Railroad
- Field Boundary
- Agricultural Land
- Water Body
- 1998 Sampling Site



Map Location



Map Scale 1:100,000 (1 inch = 1.6 miles)

1998 UDAF Ground Water Sample Locations

S. Pahvant Valley (Millard County), Utah

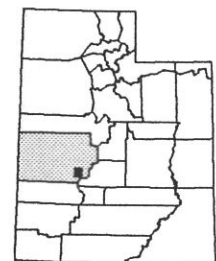


Map Scale 1:77,000 (1 inch = 1.2 miles)

Legend

	<i>Perennial Stream</i>		<i>Railroad</i>
	<i>Ditch or Canal</i>		<i>Field Boundary</i>
	<i>Intermittent Stream</i>		<i>Agricultural Land</i>
	<i>Primary Road</i>		<i>Water Body</i>
	<i>Secondary Road</i>		<i>1998 Sampling Site</i>

Map Location



Appendix I: Critical Values for Tested Parameters

Irrigation Parameters	Magnitude of Problem	
	Moderate	Severe
EC (Electrical Conductivity) Measures total salts in solution:	> 750 umhoms/cm	> 3,000 umhoms/cm.
SAR (Sodium Absorption Ratio) Estimates activity of Sodium in the soil.	> 3 meq/l.	> 9 meq/l.
Chloride.		
For sprinkler irrigation		> 3 meq/l.
For surface irrigation	> 4 meq/l.	> 10 meq/l.
Boron.	> 0.7 ppm	> 10.0 ppm.
HCO₃ (Bicarbonate).		
For sprinkler irrigation.	> 1.5 meq/l.	> 8.5 meq/l.
Al (Aluminum).	> 5.0 ppm.	
Cu (Copper).	> 0.2 ppm.	
Fe (Iron).	> 5.0 ppm.	
Mn (Manganese).	> 0.2 ppm.	
Zn (Zinc).	> 2.0 ppm.	
Se (Selenium).	> 0.02 ppm.	

Livestock

	Min. Level
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

	Min. Level
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.

*These values are for secondary Drinking Water Standards and for aesthetics water quality.