1. Title Page

Document Title: **GROUND-WATER QUALITY SAMPLING IN THE UINTA BASIN, UTAH:** Sampling and Analysis Plan (SAP)/ Quality Assurance Project Plan (QAPP)

Date: December 4, 2008

Organization Title: Utah Geological Survey

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Plan Coverage: This is a document describing the Utah Geological Survey's Quality Assurance Plan and Standard Operating Procedures. The plan covers all ground-water sampling done by the Utah Geological Survey for the referenced project.

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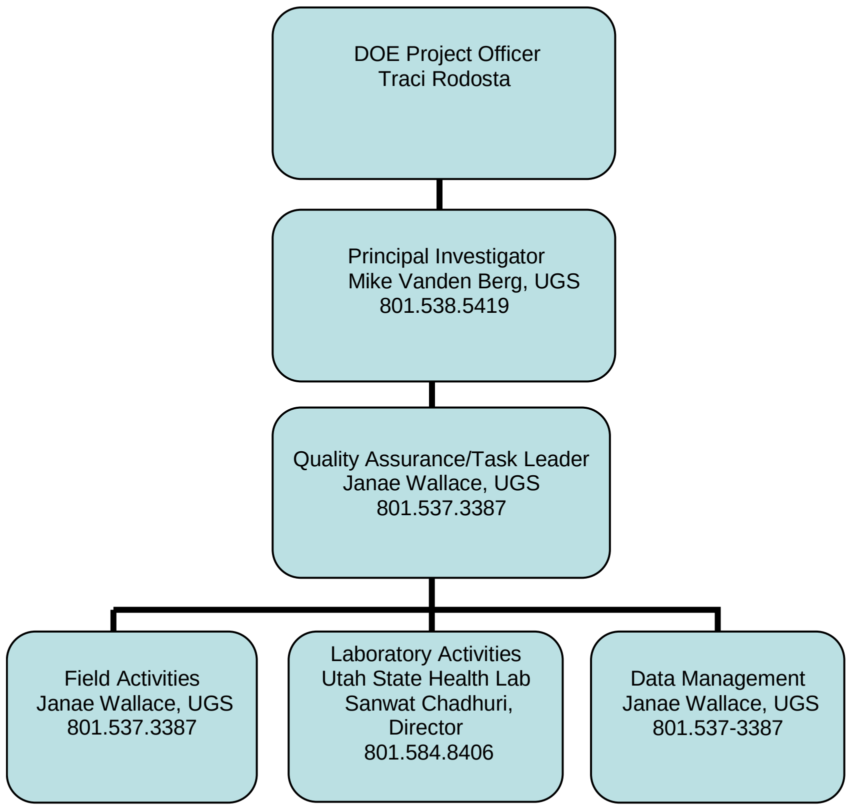
2. Project/Task Organization



3. Table of Contents

4. Problem Definition/Background

Uintah County located in eastern Utah, is a rural area with an increasing population. The southeastern part of the Uinta Basin occupies all of Uintah County. The study area occupies part of the recharge area for downgradient Green River water users. Some areas in Uintah County have had water wells with persistent high total-dissolved-solids (TDS) concentration (>1000 mg/L) obtained from samples over many sampling periods. Potential water-quality degradation, especially with respect to oil shale related activities, may result due to this increased growth from prevalent resource development activity. Water wells are a source of drinking water from the basin-fill and bedrock aquifers in Uintah County, Utah. Ground water in the aquifers may be in direct connection with surface water. Determining the impacts of energy development in rural areas is important to agricultural communities in Utah, but also for downgradient water users.

The valley-fill and bedrock aquifers are sources of drinking water for residents of the study area. Preservation of good ground-water quality is a critical issue for land-use planning and resource management in the Uinta Basin. Local government officials have expressed concern about the impact of potential contamination on ground-water resources. Local and state government officials would like to understand the relationship between geology and water quality so that they can better utilize best management practices to reduce potential contamination associated with future oil-shale development.

5. Project/Task Description

Uinta Basin is located in northeastern Utah; the unconsolidated valley-fill aquifers and bedrock aquifers are a source of drinking water in this area. The primary goals of this project are to assess the sensitivity of the alluvial and bedrock aquifers east of the Green River in Uintah County in the southeastern Uinta Basin, to contamination related to oil-shale development, to determine the major sources of any existing contamination based on characterization of chemical constituents, and to monitor baseline seasonal changes in surface- and ground-water quality in the area. This study will help local planners to preserve the quality of ground and surface water by establishing best management practices through careful land-use planning.

This study will provide baseline water-quality data, evaluate the potential impact on ground-water quality based on present energy developments and possibly agricultural activities, analyze seasonal changes in water quality, and provide a final report presenting data and providing recommendations for best management practice here and potentially for other rural/agricultural areas in Utah. We herein provide a water quality assurance project plan (QAPP), identify 50 sample sites for wells, creeks, and springs for water-quality sampling, sample the wells and surface water within the first nine months (analyses will include general chemistry [including total dissolved solids], nutrients [including nitrate-nitrogen, nitrite-nitrogen, phosphorous, and ammonia], dissolved oxygen, dissolved metals, volatile organic compounds (VOCs, including benzene), and total organic carbon (detailed list tabulated below). Annual sampling will allow us to monitor water-quality for three sampling periods to determine baseline water quality in southeastern Uinta Basin.

Proposed project schedule: The study will be completed over the three years that funding is available. Major milestones are as follows:

1) conducting a well inventory,
2) creating a current QAPP (provided herein),
3) compiling maps and previous data,
4) sampling wells, springs, and creeks (annually),
5) laboratory analysis of water samples,
6) producing chemistry compilation maps available as hardcopy and GIS (e.g., TDS, nitrate, sulfate, and iron maps for constituents having sufficient data or anomalous data),
7) analyzing various chemical constituents (GIS data to generate maps) via graphs and statistics,
8) estimating baseline water quantity, and writing a preliminary/final report

6. Data Quality Objectives and Criteria

The Data Quality Objectives for this project are the same as those listed in the Utah DWQ's QAPP for Water Monitoring Programs (see appendix, section 17).

7. Sampling Process Design

Table 1 lists all the parameters, frequency of sampling, referenced SOPs and responsible agencies for each task. Approximately 50 ground-water samples will be collected at three different times for 50 ground-water wells and springs and analyzed for chemistry type 3–dissolved calcium, dissolved sodium, bicarbonate, carbon dioxide, carbonate, chloride, total alkalinity, total hardness, specific conductance, total dissolved solids, dissolved potassium, hydroxide, sulfate, dissolved magnesium, total suspended solids, and turbidity; nutrients–nitrate, nitrite, ammonia, and phosphorous; dissolved metals type 3–dissolved arsenic, dissolved barium, dissolved cadmium, dissolved chromium, dissolved mercury, dissolved aluminum, dissolved selenium, dissolved silver, dissolved zinc, dissolved copper, dissolved iron, dissolved lead, dissolved manganese; VOCs and TOC.

TABLE 1. Sampling Design

Activity	Schedule	Responsible Agency	Methods
1. Water Quality sample and analysis. Nutrients: nitrate, nitrite, ammonia, and phosphorous Major ions and physical characteristics: chemistry type 3 and dissolved metals type 3; Total Organic Carbon and VOCs	Three sampling intervals of approximately 50 different water wells, springs, and streams.	UGS	Refer to Utah DWQ's Standard Operating Procedures (Appendix, section 17)
2. Field water quality parameters: temp., DO, conductivity, pH	Same time as sample collection occurs	UGS	Utah DWQ's SOPs (Appendix, section 17)

Water-quality samples will be collected from proposed sites, these will represent a widespread distribution of wells having different water depths and penetrating both alluvial material and bedrock, and without a biased selection based on current land use; proposed sites may change based on potential problems encountered in the field (e.g., lack of permission from well owner, well no longer operable, etc.). See attached database table and map for potential wells to be sampled.

8. Sample Methods Requirements

Sampling methods, equipment used, sample containers and preservation requirements used by Utah DWQ are listed in Utah DWQ's QAPP for Water Monitoring Programs (see appendix, section 17).

These data will be stored in EPA's standardized databases and released as a UGS contract deliverable. All data, both provisional and official, will be made available to cooperators, and other interested parties.

9. Sample Handling and Custody Requirements

All sample handling and custody requirements are contained in the Utah DWQ's QAPP for Water Monitoring Programs (see appendix, section 17).

10. Analytical Methods Requirements

Analytical methods for this project utilize standard methods as identified in the Utah Division of Laboratory Services QAPP. This QAPP is in Section 17.8 of the Utah DWQ's Monitoring Manual (see appendix).

11. Quality Control Requirements

Sample quality control requirements are contained in the Utah DWQ's QAPP for Water Quality Programs (see appendix, section 17).

12. Instrument Calibration and Frequency

Instrument calibration and frequency requirements are contained in Utah DWQ's QAPP for Water Monitoring Programs (see appendix, section 17).

13. Assessments and Response Actions

Assessments and response action requirements are contained in Utah DWQ's QAPP for Water Monitoring Programs (see appendix, section 17).

All field and laboratory procedures may be reviewed by state quality assurance officers at any time or as requested. Any identified procedural problems will be corrected based on recommendations from a QA Officer. This may include more frequent instrument calibration, additional training of field or laboratory personnel, etc.

14. Data Review, Validation and Verification Requirements

Data review, validation and verification requirements are contained in Utah DWQ's QAPP for Water Monitoring Programs (see appendix, section 17).

15. Validation and Verification Methods

Validation and verification methods requirements are contained in Utah DWQ's QAPP for Water Monitoring Programs (see appendix, section 17).

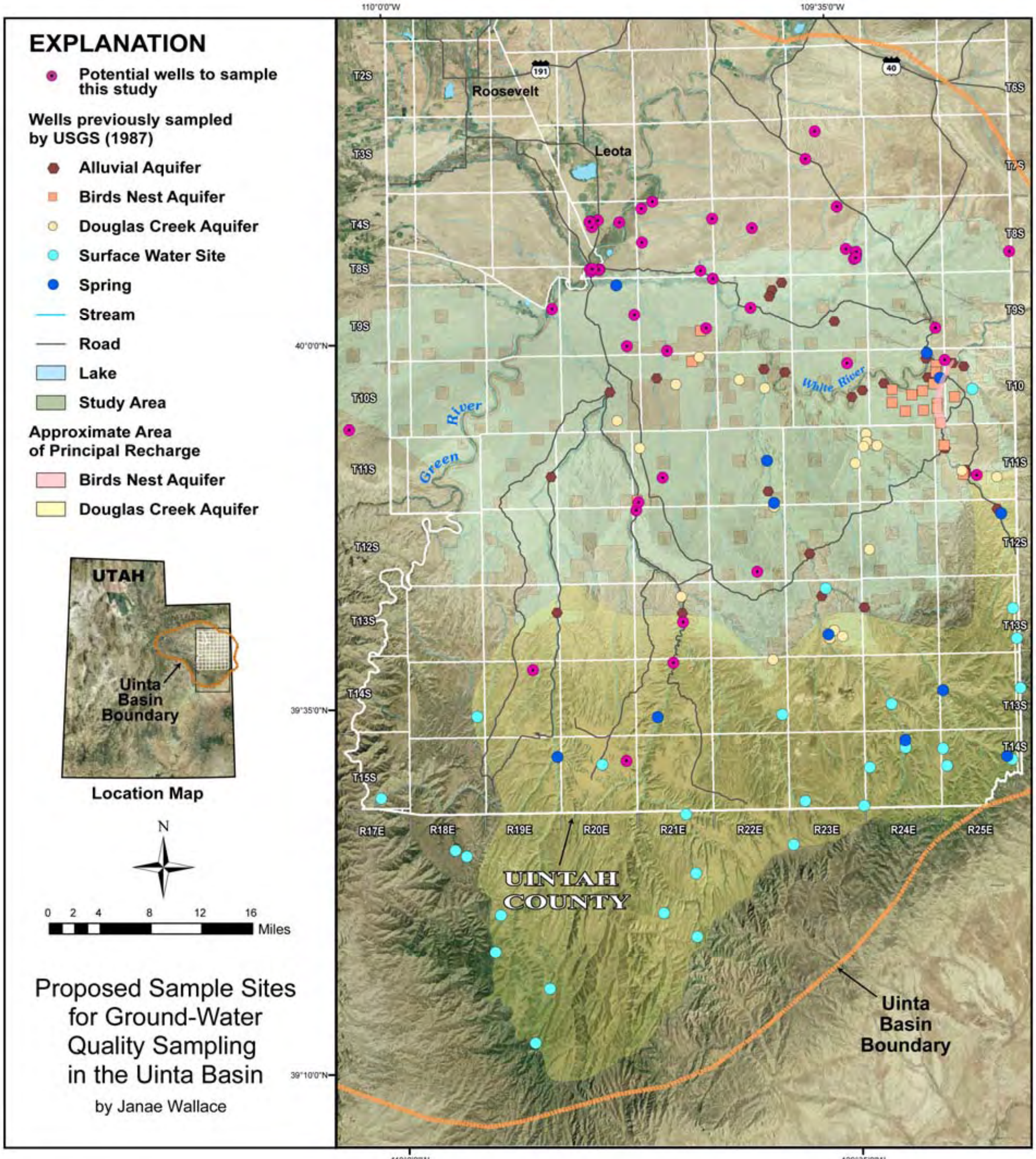
16. Reconciliation with Data Quality Objectives

Results from the monitoring activities will be routinely scrutinized against the data quality objectives established for water-quality projects. The quality assurance operator will be responsible for determining whether the objectives of the water-quality sampling efforts have been attained and whether to reestablish new data quality objectives based upon the data collected from the project.

17. Bibliography

1. **State of Utah. Division of Water Quality**. 2003. Quality Assurance Program Plan for Water Monitoring Programs.
2. **State of Utah. Division of Water Quality**. 1993. Quality Assurance Project Plan, Nonpoint Source Program. With supplemental amendments.
3. **State of Utah. Division of Water Quality**. 1993. Quality Assurance/Quality Control Manual. With amendments.
4. **US Environmental Protection Agency**. 2000. Region 8 Non-Point Source Program, Project Sponsors Project Proposal Guidance for FY 2000 and Beyond. Final Draft. July 1.
5. **US Environmental Protection Agency**. 1998. EPA QA/G-5: EPA Guidance for Quality Assurance Project Plans. EPA/600/R-98/018.
6. **US Environmental Protection Agency**. 2001. Supplemental Guidelines for the Award of Section 319 Nonpoint Source Grants to States and Territories in FY 2002 and Subsequent Years. Office of Wetlands, Oceans and Watersheds. September 5.
7. **US Environmental Protection Agency**. 1996. The Volunteer Monitor’s Guide to Quality Assurance Project Plans. Office of Wetlands, Oceans and Watersheds. EPA841-B-96-003.
8. **US Environmental Protection Agency**. 2001. EPA QA/R-5: EPA Requirements for Quality Assurance Project Plans. EPA/240/B-01/003.

18. Water Sampling Map



19. Database of Potential Wells to Sample

UGS WELL ID	DEPTH (ft)	DWRi #	X coord	Y coord	CADASTRAL	OWNER	ADDRESS	BROCK _ALLU
1	160	96-49-002-M00	657778	4426288	(D-10-25)6ccb	KN Energy	n/a	bedrock
2	120	?	617463	4375428	(D-15-20)12cca	Ute Indian Tribe	Fort Duchesne_	bedrock
3	320	49-155	623428	4387810	(D-14-21)3bbc	State of Utah Division of Wildlife Res	n/a	bedrock
4	400	0649002M00	656598	4430344	(D-9-24)25bad	Questar Gas Management	P.O.Box 390_ P	bedrock
5	40	49-2219	614071	4437725	(D-8-20)33aaa	Buggsy's Water Service	85 South 200 E	alluvial
6	212	?	591776	4386048	(D-14-18)1bbd	Ute Indian Tribe_Big Canyon Flat	Fort Duchesne_	bedrock
7	96	?	605615	4386880	(D-14-19)3dab	Ute Indian Tribe_West Squaw Canyon	Fort Duchesne_	bedrock
8	52	49-17	624652	4392995	(D-13-21)15dcd	Alameda Corp_ Pruitt Gushee_ O.S. Wyat	n/a	alluvial
9	406	49-191	618725	4407161	(D-12-21)6bba/bab	Abraham Hatch	n/a	bedrock
10	120	49-14	634046	4399374	(D-12-22)34aac	Alameda Corp_ Pruitt Gushee_ O.S. Wyat	n/a	bedrock
11	610	49-153	622055	4411315	(D-11-21)21caa	USA BLM	n/a	bedrock
12	750	49-1639	661858	4411678	(D-11-25)22cdc	OSEC Skyline Property Corp.	3601 Spring Hi	bedrock
13	485	0847001M00	582353	4417329	(D-10-17)32bcb	Matt Molder	Questar Pipeli	bedrock
14	250	49-1591	608018	4432723	(D-9-19)13baa	Alameda Corp._Gushee Pruitt_Attorney	P.O.Box 22608_	bedrock
15	300	49-357	618461	4431967	(D-9-20)13dca	Belco Development Corp.	P.O.Box 250_Bi	bedrock
16	400	9549003M00	617507	4428003	(D-9-20)35aad	Michael Loftis_The Loftis Company	Midland_TX_797	bedrock
17	400	0649001M00	628403	4436540	(D-9-21)1aab	Kerr McGee Gathering_ LLC	P.O.Box 970_ V	bedrock
18	215	0449004M00	622588	4427390	(D-9-21)33cbc	State Institutional Trust Lands Adm.	675 East 500 S	bedrock
19	50	9749001M00	627548	4430285	(D-9-21)24ccd	The Loftis Company	Midland_TX_797	bedrock
20	400	0649002M00	633168	4432880	(D-9-22)16adc	Questar Gas Management	P.O.Box_ Pinda	bedrock
21	800	a25427(49-1645)	626832	4437587	(D-8-21)35add	R.N. Industries	P.O.Box 98_ Ro	bedrock
22	0	43-8290	613839	4443926	(D-8-20)9ada	Dallis Nickell/Target Trucking Inc.	292 East 200 N	bedrock
23	53	43-10988	613846	4443921	(D-8-20)9ada	Target Trucking	1409 South 150	alluvial
24	80	49-1645	612936	4443734	(D-8-20)9bdd	R.N. Industries	P.O.Box 98_ Ro	bedrock
25	46	49-2166	612784	4443731	(D-8-20)9bdc	R.N. Industries	P.O.Box 98_ Ro	alluvial
26	50	35346	616541	4443689	(D-8-20)11acd	OURAY National Wild Life	P.O.Box 191_ V	alluvial
27	45	49-1613	613114	4437717	(D-8-20)33bad	Nebeker Trucking Company	Route 2_Box 20	bedrock
28	68	49-2235	613108	4437792	(D-8-20)33baa	Dalbo Inc.	P.O.Box 1168_	alluvial
29	75	49-2231	612825	4437747	(D-8-20)33bbd	Nile Chapman	P.O.Box 98_ Ro	alluvial
30	70	49-2238	612986	4437486	(D-8-20)33bab	Magnum Water Service Inc._ c/o Bruce A	P.O.Box 1536_	alluvial
31	48	49-2237	613951	4437651	(D-8-20)33aad	Buggsy's Water Service	85 South 200 E	alluvial
32	70	49-2229	613108	4437792	(D-8-20)33baa	Dalbo Inc.	P.O.Box 1168_	alluvial
33	53	43-10988	613059	4443089	(D-8-20)9ada	Target Trucking	2960 North 500	alluvial
34	83	49-251	619351	4445409	(D-8-21)6bdd	Gulf Oil Corp.	Box 1971 Caspe	alluvial
35	95	36125	620748	4446293	(D-7-21)32cdc?	Gulf Oil Corp.	Box 1971 Caspe	alluvial
36	150	0649002M00	628322	4444131	(D-8-21)12add	Questar Gas Management	P.O.Box 390_ P	bedrock

UGS WELL ID	DEPTH (ft)	DWRi #	X coord	Y coord	CADASTRAL	OWNER	ADDRESS	BROCK _ALLU
37	450	9549001M00	619425	4441145	(D-8-21)19baa?	Charles Richens_970-6752133	2750 County Ro	bedrock
38	120	49-256	633344	4442967	(D-8-22)15bbc	Belco Petroleum Corp.	n/a	bedrock
39	355	0449001M00	645247	4440315	(D-8-23)23bdd	Chevron Pipeline Co._ c/o Barton Jones	Rt. 3 Box 3751	bedrock
40	52	0349001P01	646548	4439672	(D-8-23)25bca	Deseret Power Electric Cooperative	12500 East 255	alluvial
41	52	0549001M00/34662	646582	4439939	(D-8-23)25bbd	Deseret Power Electric Cooperative	12500 East 255	bedrock
42	58	0549001M00/34661	646253	4439033	(D-8-23)26dad	Deseret Power Electric Cooperative	12500 East 255	bedrock
43	435	0349004P03/27768	646516	4439175	(D-8-23)25cba	Deseret Power Electric Cooperative	12500 East 255	bedrock
44	335	0049002M00	644120	4445645	(D-8-23)3dba	Deseret Gen. & Trans._Bonanza Power Pl	12500 East 255	bedrock
45	53	0349002P00	665960	4440046	(D-8-25)25bdb	Deseret Power Electric Cooperative_435	12500 East 255	alluvial
46	120	49-389	641332	4455237	(D-7-23)4cbb	Vernal District USA BLM	170 South 500	bedrock
47	400	431412	640124	4451701	(D-7-23)17cac	The Loftis Company	P.O.Box 7847_	bedrock
48	50	5049-2166/426863	612784	4443740	(D-8-20)9bdc	R.N. Industries_ Nile Chapman	P.O.Box 98_ Ro	alluvial
49	100	0649003M00/427298	645445	4425853	(D-10-23)2cdc	Marc Haes	7396 Reynolds	bedrock
50	711	49-188	619003	4408204	(D-11-21)31bdd	Golden Hatch	Vernal_UT_8407	bedrock