

ASR License No. 14  
(ASSIGNED AFTER FILING)

STATE OF OREGON  
WATER RESOURCES DEPARTMENT  
APPLICATION FOR LIMITED WATER USE LICENSE  
FOR  
AQUIFER STORAGE AND RECOVERY (ASR)

Applicant(s): Madison Farms  
Contact Person: Kent Madison  
Mailing Address: 29299 Madison Road  
Echo OR 97826 541-376-8107  
City State Zip Phone #

1. DATE(S) OF PRE-APPLICATION CONFERENCE(S): 11/15/99 (original pre-application conference)

INFORMATION REGARDING ASR TESTING UNDER A LIMITED LICENSE

2. SOURCE OF INJECTION WATER for ASR: Alluvial well located at T3N/R28E/S31/SENW a tributary of Umatilla River

3. MAXIMUM DIVERSION RATE: Up to 500 gpm (G-7612), 237 gpm (T-9701) Total 737gpm

4. MAXIMUM INJECTION RATE AT EACH WELL(S): Up to 1.64 cfs (737 gpm)

5. MAXIMUM STORAGE VOLUME: 200 mg

6. MAXIMUM STORAGE DURATION: 5 years

7. MAXIMUM WITHDRAWAL RATE AT EACH WELL(S): Up to 1.64 cfs (737 gpm)

8. LICENSE TERM OR DURATION SOUGHT (5 year maximum): 5 years

9. PROPOSED USE OR DISPOSAL OF RECOVERED WATER: Agriculture

10. IF CONTINGENCIES PRECLUDE THE USE IN ITEM 9, SPECIFY AN ALTERNATE USE OR DISPOSAL OF THE RECOVERED WATER: While highly unlikely, the contingency plan for disposal of injected water includes discharge to Butter Creek.

**INFORMATION REGARDING THE ULTIMATE ASR PROJECT**  
**AS CURRENTLY ANTICIPATED**

11. SOURCE OF INJECTION WATER for ASR: Alluvial well located at T3N/R28E/S31/SENW a  
tributary of Umatilla River
12. MAXIMUM DIVERSION RATE: Up to 500 gpm (G-7612), 237 gpm (T-9701) Total 737gpm
13. MAXIMUM INJECTION RATE AT EACH WELL(S): Up to 1.64 cfs (737 gpm)
14. MAXIMUM STORAGE VOLUME: 200 mg
15. MAXIMUM STORAGE DURATION: 5 years
16. MAXIMUM WITHDRAWAL RATE AT EACH WELL(S): Up to 1.64 cfs (737 gpm)

NOTE: The materials required by rule for an ASR limited license are extensive. The items on this sheet consist of those outlined in OAR 690-350-020(2) and (3)(a)(A-E). Please consult the rule and provide as attachments to this form the other requirements in OAR 690-350-020(3)(a).

Signature of Applicant  Date 11/1/07

Title Owner



## Technical Memorandum

**To:** Donn Miller - Oregon Water Resources Department  
Phil Richardson - Oregon Department of Environmental Quality  
Dennis Nelson - Oregon Department of Human Services

**CC:** Kent Madison - Madison Farms

**From:** Jason Melady, RG, CWRE- GSI Water Solutions, Inc.  
Eric Collins, RG - GSI Water Solutions, Inc.

**Date:** November 9, 2007

**Re:** ASR Application Workplan  
Madison Farms

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## INTRODUCTION

Madison Farms currently operates an Aquifer Storage and Recovery (ASR) system in Echo Junction, Oregon, under ASR Limited License #007 (OWRD, 2003). On behalf of Mr. Madison, GSI Water Solutions (GSI) prepared an application package for a new ASR limited license related to proposed modification to the Madison Farms ASR program. This modification consists of an increase in injection rate to 737 gallons per minute (gpm), storage volume to 200 million gallons, and recovery rate to 737 gpm. No other significant changes are proposed. This Technical Memorandum is intended to accompany the ASR limited license application to provide a scope of work for flow/volume monitoring, water level monitoring, and water quality monitoring conducted during ASR pilot testing under the new ASR limited license.

## FLOW RATE AND VOLUME MONITORING

The ASR flow meter installed at Madison Farms monitors instantaneous bi-directional flow, total injection, total recovery, and net volume. Flow meter readings will be collected on a weekly basis during ASR injection and recovery and will be used to evaluate compliance with

the flow rate and volume limits in the ASR limited license. The readings will be recorded on a form to be provided by WRD and will be submitted to WRD on an annual basis.

## **WATER LEVEL MONITORING**

Water level data will be collected at Madison Farms to assess the hydraulic response of the basalt aquifer to ASR pilot testing. Water level monitoring points include the ASR well and one observation well (See Figure 1, UMAT 1222). Table 1 summarizes the well information and the proposed monitoring frequency. Water level monitoring information, including electronic data, will be presented to OWRD at the conclusion of each ASR cycle test in the annual ASR report.

## **WATER QUALITY MONITORING**

Water quality analysis will be completed for receiving water, source water, and recovery water several time throughout future ASR cycle tests. Samples collected during ASR pilot testing will be tested for field parameters (pH, conductivity, temperature, chlorine, and oxygen-reduction potential) and analyzed by an analytical laboratory. Classes of analytes in the testing include geochemical, metals, disinfection by-products (DBPs), bacteriological, radionuclides, synthetic organic compounds (SOCs), volatile organic compounds (VOCs), selected additional site-specific pesticides, and miscellaneous chemistry parameters. A summary of the water quality testing plan is presented in Table 2. Results of water quality testing will be presented to OWRD at the conclusion of each ASR cycle test in the annual ASR report.

Prior to injection, ASR source water is chlorinated to prevent potential microorganism related issues. Sodium hypochlorite solution is dosed into the source water. The target residual chlorine level in source water at the ASR wellhead is 0.5 milligrams per liter. The chlorination system will be assessed and adjusted based on source water chlorine level monitoring performed on a routine basis during ASR injection.

Nitrate Monitoring will proceed as outlined in ASR Limited License #007. GSI has proposed modification of the ASR nitrate action level (GSI, 2007). The proposal is currently being reviewed by the agencies.

GSI developed a Quality Assurance and Quality Control (QA/QC) plan for McCarty Ranch and Madison Farms prior initiating ASR pilot testing (GSI 2002). This document is referenced in Madison Farm's current limited license and is still applicable to ASR pilot testing under the new ASR limited license. A copy of the document is included in Attachment A.

## REFERENCES

GSI. 2002. Water Sampling QA/QC Control Plan, Madison and McCarty ASR Testing Program. Prepared for Madison Farms. September 2002. Groundwater Solutions, Inc.

OWRD, 2003. Aquifer Storage and Recovery (ASR) Limited License #007.

GSI, 2007. Letter to Oregon Water Resources Department, Oregon Department of Environmental Quality, and Oregon Department of Human Services, regarding Request for Modification of ASR Nitrate Action Level, Madison Farms ASR Limited License #007 and McCarty Ranch ASR Limited License #008 - Draft. September 28, 2007. GSI Water Solutions, Inc.

## **Tables**

**Table 1**  
**ASR Project Observation Wells**  
**Madison ASR Project**

Well No.	Location	Owner	Total Depth (ft)	Diameter (in)	Pump Installed (Y/N)	Water Level Monitoring Type	Water Level Monitoring Frequency	Comments
<b>Madison ASR Observation Wells</b>								
1165	T3N, R27E, 25DA	Lowell Saylor	440	6	Y	N/A	N/A	Cascading water observed in well during field evaluation. Water level monitoring discontinued.
1222	T3N, R28E, 30DB	Gaylord Madison	629	8	Y	Airline	Prior to start of injection or recovery, and weekly during injection or recovery.	Basalt well
1166/5430	T3N, R27E, 25DD	Kent Madison	693	12 to 625' 8 to 693'	Y	Transducer	Once per hour all-year	Madison ASR Well (basalt)
N/A	T3N, R28E, 31BD	Kent Madison	24	36	Y	N/A		Madison Collector Well; 4000 feet long (horizontal) alluvial well. No water level monitoring.

See Figure 1 for well location

**Table 2**  
**ASR Water Quality Testing Schedule**  
**Madison Farms**

ASR Phase (progress point as a percentage)	Monitoring Point	Field Parameters	Geochemical	Metals	DBPs	Bacteriological	Miscellaneous	Radionuclides	SOCs	VOCs	Additional Pesticides
<b>PRE-INJECTION</b>											
	ASR Well	x	x	x	x						
	Obs Well	x	nitrate								
<b>INJECTION PERIOD</b>											
2 weeks prior to injection	Collector Well	x	x	x	x	x	x	x	x	x	x
75%	Collector Well	x	x	x	x						
<b>STORAGE PERIOD or RECOVERY PERIOD</b>											
30 days (if storage period greater than 30 days) otherwise initial startup during recovery period	Obs Well	x	nitrate								
	ASR Well	x	x	x	x	x	x	x	x	x	x
<b>RECOVERY PERIOD</b>											
initial startup (if storage period greater than 30 days) otherwise 50%	ASR Well	x	x	x	x						

Note:

Refer to Table 3 for list of constituents in each class of analyses.

Nitrate monitoring will be conducted according to the schedule authorized in Section 9 of Limited Licence #007.



**Table 3**  
**ASR Water Quality Testing**  
**Madison Farms**

	Analyte	Units	MDL	
<b>Field Parameters</b>	Temperature	Celsius	NA	
	Conductivity	mS/cm	NA	
	pH	Units	NA	
	Chlorine	mg/L	NA	
	ORP	mV	NA	
<b>Bacteriological</b>	Fecal Coliforms/E.Coli			
	Total Coliform	CFU/100 ml		
<b>Disinfection By-Products</b>				
THM	Chloroform (Trichloromethane)	mg/L	0.0005	
THM	Bromodichloromethane	mg/L	0.0005	
THM	Dibromochloromethane	mg/L	0.0005	
THM	Bromoform (Tribromomethane)	mg/L	0.0005	
	<b>Total Trihalomethanes</b>	mg/L	--	
HAA	Monochloroacetic Acid	mg/L	0.002	
HAA	Dichloroacetic Acid	mg/L	0.001	
HAA	Trichloroacetic Acid	mg/L	0.001	
HAA	Monobromoacetic Acid	mg/L	0.001	
HAA	Dibromoacetic Acid	mg/L	0.001	
	<b>Total Haloacetic Acids</b>	mg/L		
	Chlorite	mg/L		
	Bromate	mg/L		
<b>Geochemical</b>	Bicarbonate	mg/L	2	
	Calcium	mg/L	0.1	
	Carbonate	mg/L	2	
	Chloride	mg/L	1	
	Hardness (as CaCO3)	mg/L	4	
	Magnesium	mg/L	0.05	
	Nitrate as N	mg/L	0.5	
	Nitrite as N	mg/L	0.01	
	<b>Total Nitrate-Nitrite</b>	mg/L	--	
	Potassium	mg/L	0.1	
	Silica	mg/L	0.2	
	Sodium	mg/L	0.05	
	Sulfate	mg/L	5	
	<b>Total Alkalinity</b>	mg/L	2	
	<b>Total Dissolved Solid</b>	mg/L	0.7	
	<b>Total Organic Carbon</b>	mg/L	0.5	
	<b>Total Suspended Solids</b>	mg/L	2	
<b>Metals</b>	Aluminum	mg/L	0.05	
	Antimony	mg/L	0.001	
	Arsenic	mg/L	0.002	
	Barium	mg/L	0.05	
	Beryllium	mg/L	0.0005	
	Cadmium	mg/L	0.001	
	Chromium	mg/L	0.002	
	Copper	mg/L	0.005	
	Iron (Total)	mg/L	0.05	
	Iron (Dissolved)	mg/L	0.05	
	Lead	mg/L	0.001	
	Manganese (Total)	mg/L	0.002	
	Manganese (Dissolved)	mg/L	0.002	
	Mercury	mg/L	0.0004	
	Nickel	mg/L	0.004	
	Selenium	mg/L	0.002	
	Silver	mg/L	0.005	
	Thallium	mg/L	0.0006	
	Zinc	mg/L	0.01	
	<b>Miscellaneous</b>	Odor	TON	1 ton
		Color	ACU	5 color units
		Methylene Blue Active Substance	mg/L	0.05
Corrosivity (Langlier Saturation Index)		mg/L	--	
Cyanide (as free cyanide)		mg/l		
Fluoride		mg/L	0.5	
<b>Radionuclides</b>	Combined Radium 226/228	pCi/L		
	Uranium	mg/L		
	Gross Alpha	pCi/L	1.79	
	Gross Beta	pCi/L	2.83	

	Analyte	Units	MDL
<b>Synthetic Organic Compounds (SOCs)</b>			
<b>Regulated SOCs</b>			
	2,4,5-TP (Silvex)	mg/L	0.0004
	2,4-D	mg/L	0.0002
	Alachlor (Lasso)	mg/L	0.0004
	Atrazine	mg/L	0.0002
	Benzo(a)Pyrene	mg/L	0.00004
	BHC-gamma (Lindane)	mg/L	0.00002
	Carbofuran	mg/L	0.001
	Chlordane	mg/L	0.0004
	Dalapon	mg/L	0.002
	Di(2-ethylhexyl)adipate ( <i>adipates</i> )	mg/L	0.001
	Di(2-ethylhexyl)phthalate ( <i>phthalates</i> )	mg/L	0.001
	Dibromochloropropane (DBCP)	mg/L	0.00002
	Dinoseb	mg/L	0.0004
	Diquat	mg/L	0.0004
	Ethylene Dibromide (EDB)	mg/L	0.00001
	Endothall	mg/L	0.01
	Endrin	mg/L	0.00002
	Glyphosate	mg/L	0.01
	Heptachlor	mg/L	0.00004
	Heptachlor Epoxide	mg/L	0.00002
	Hexachlorobenzene (HCB)	mg/L	0.0001
	Hexachlorocyclopentadiene	mg/L	0.0002
	Methoxychlor	mg/L	0.0002
	Polychlorinated Biphenyls (PCBs)	mg/L	0.0002
	Pentachlorophenol	mg/L	0.00008
	Picloram	mg/L	0.0002
	Simazine	mg/L	0.0001
	Toxaphene	mg/L	0.001
	Vydate (Oxamyl)	mg/L	0.002
<b>Volatile Organic Compounds (VOCs)</b>			
<b>Regulated VOCs</b>			
	1,1,1-Trichloroethane	mg/L	0.0005
	1,1,2-Trichloroethane	mg/L	0.0005
	1,1-Dichloroethylene	mg/L	0.0005
	1,2,4-Trichlorobenzene	mg/L	0.0005
	1,2-Dichlorobenzene (o)	mg/L	0.0005
	1,2-Dichloroethane (EDC)	mg/L	0.0005
	1,2-Dichloropropane	mg/L	0.0005
	1,4-Dichlorobenzene (p)	mg/L	0.0005
	Benzene	mg/L	0.0005
	Carbon Tetrachloride	mg/L	0.0005
	Chlorobenzene	mg/L	0.0005
	cis-1,2-Dichloroethylene	mg/L	0.0005
	Ethylbenzene	mg/L	0.0005
	Dichloromethane (methylene chloride)	mg/L	0.0005
	Styrene	mg/L	0.0005
	Tetrachloroethylene	mg/L	0.0005
	Toluene	mg/L	0.0005
	trans-1,2-Dichloroethylene	mg/L	0.0005
	Trichloroethylene	mg/L	0.0005
	Vinyl chloride	mg/L	0.0005
	Total Xylenes	mg/L	0.0005
<b>Selected Additional Site-Specific Pesticides</b>			
	Kerb	mg/L	
	Sinbar	mg/L	
	Bromoxynil	mg/L	
	MCPA	mg/L	

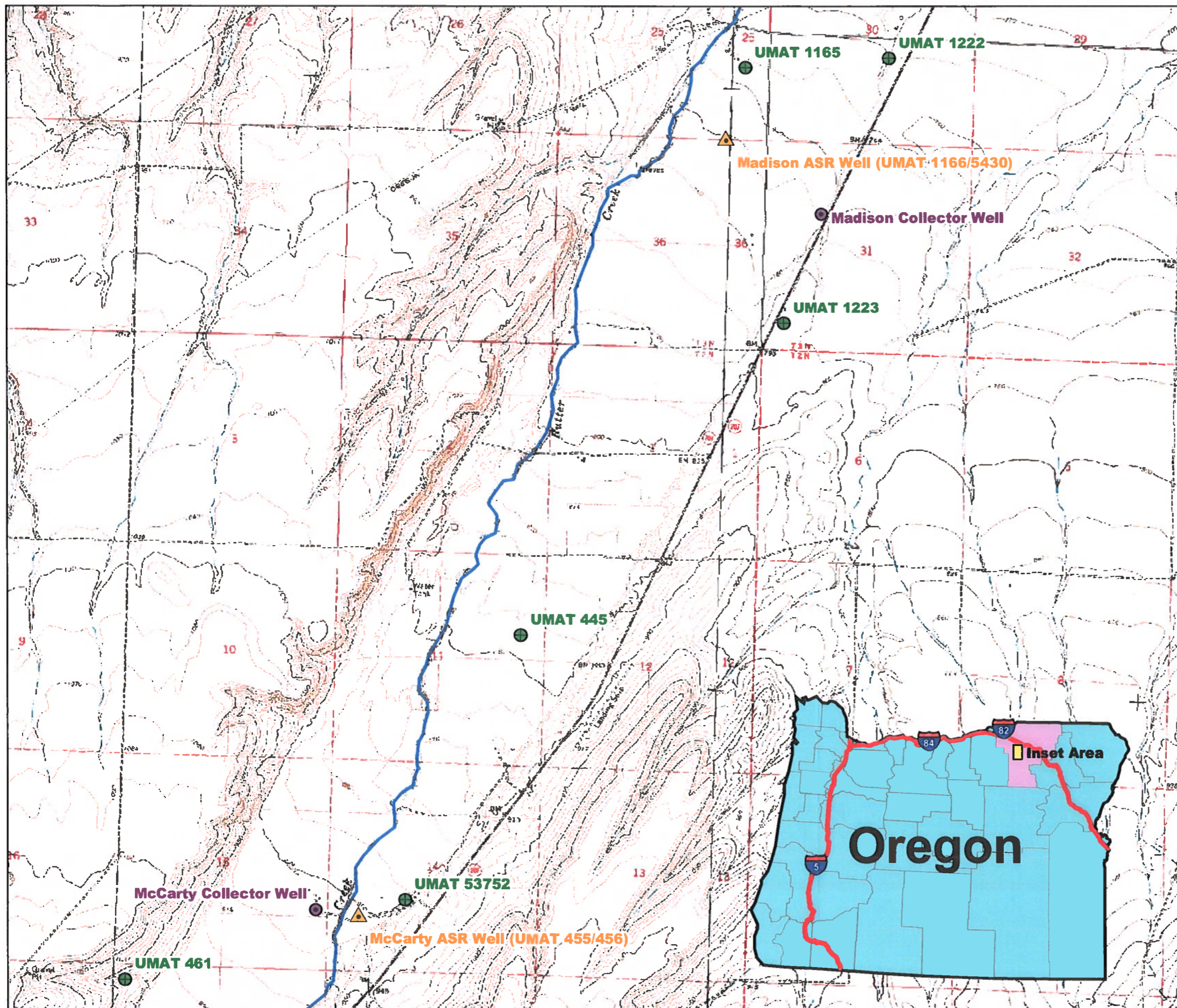
**NOTE**

MDL = Method Detection Limit




NA = Not Applicable

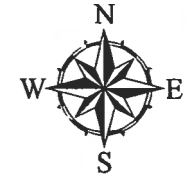
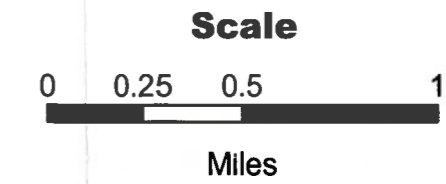
Samples are unfiltered unless noted (i.e., dissolved)

## Figures



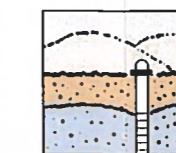
### Legend

-  ASR Well
-  Collector Well
-  Observation Well



**Figure 1**  
**ASR Project Location Map**  
**Madison and McCarty ASR Project**

P:/136 - MadisonMcCarty ASR/003 ASR Pilot Testing/Maps/  
 ASR\_location\_map.mxd



**Groundwater Solutions Inc.**

## Attachment A

# Quality Assurance and Quality Control Plan

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## Introduction

This quality assurance and quality control (QA/QC) plan describes water sampling QA/QC procedures that will be performed during Madison Farm's ASR program. The purpose of the QA/QC plan is to obtain water quality data that are valid representations of the water quality at each sampling location. Kuo Laboratory staff will collect the majority of the water quality data with guidance from GSI Water Solutions (GSI) staff. GSI will periodically check field procedures and will review field and laboratory data for completeness and compliance with this plan.

## Field QA/QC

QA/QC procedures that will be used in the field during the ASR program include field equipment calibration, field record keeping, and chain-of custody documentation. No duplicate samples will be collected in the field. If lab testing results indicate that a parameter has an unexpectedly high concentration approaching the MCL or MML, injection or pumping will be stopped and the location will be resampled as soon as possible. Each element of the Field QA/QC is described below.

### *Field Equipment Calibration*

Field meters require calibration to ensure accurate and precise measurement of field parameters. The field meters will be calibrated prior to each sampling event and subsequently operated in a manner consistent with the manufacture's recommendations.

### *Field Record Keeping*

The sampling technician will record field observations and measurements on the Water Sampling Field Form during sampling. A copy of the Water Sampling Field Form is included in Attachment B. The following information will be recorded on the form for each sampling point:

- Time of day and date
- Name of person performing the sampling
- Location of sampling point
- Field parameter values (pH, temperature, and conductivity) collected during sampling
- Appearance of sample
- Thermal and chemical preservation (if any)

If groundwater samples are collected from wells, the following additional information will be recorded on the form:

- Depth to groundwater
- Field parameter values collected during purging intervals
- Purging time and volume of water purged

## ***Sample Labels***

A sample label will be secured to each water sample container. The following information will be included on the sample labels:

- Project location
- Sample number (e.g., well ID# and date)
- Name of person collecting the sample
- Date and time of sample collection
- Type of preservative (if any)

## ***Chain-of-Custody***

A chain-of-custody form will be used to track possession of each sample and document the requested analyses. An example chain-of-custody form that will be used during the pilot testing program is included in Attachment E. The following procedure will be used regarding chain-of-custody records.

1. After collecting the samples, the sampling technician will complete the chain-of-custody form.
2. The chain-of-custody record will accompany the samples from the field to the laboratory.
3. Each individual having samples in his/her custody must ensure that the samples are not tampered with and that the chain-of-custody record is completed upon sample transfer.
4. A copy of the completed forms will be retained in the project files.

## **Laboratory Quality Assurance Program**

Samples collected during the pilot testing program will be analyzed by an analytical laboratory certified by the Drinking Water Laboratory Certification Program (DWLCP) or the Oregon Environmental Laboratory Accreditation Program (OREALAP). DWLCP is in the process of being phased out and replaced by OREALAP, which is recognized by the U.S. Environmental Protection Agency's National Environmental Laboratory Accreditation Program (NELAP) to accredit environmental testing laboratories to national standards as adopted by the National Environmental Laboratory Accreditation Conference (NELAC).

The analytical laboratory will use trip blanks, method blanks, spikes, duplicates, surrogates, and control samples in each analytical batch containing the Madison Farms samples being analyzed or at a frequency of at least one in every 20 samples, depending upon the analysis being performed. The results from these procedures will accompany the sample test results. A copy of the analytical laboratory's quality assurance manual is available upon request.

## Attachment B



