

## **Appendix 2: Hydrologic Monitoring**

### **1.1. Hydrologic Monitoring**

The hydrologic monitoring network shall be comprised of the monitoring sites in Table 1.1 and others to be selected by the TWG. Hydrologic data collection at these sites shall include measurements of groundwater production, depth-to-groundwater, spring discharge, stream flow, and water quality as applicable, or as otherwise agreed to and specified by the TWG.

The capital costs of establishing the hydrologic monitoring network shall be shared as stated in Sections 1.1.1 and Table 1.1. Maintenance and operation of these sites shall be performed by the Utah Geological Survey (UGS), SNWA, or a mutually agreed to third party. SNWA and UGS agree to work cooperatively to ensure data is reported in an electronic format agreed to by the TWG.

#### **1.1.1. Tier I Hydrologic Monitoring**

The objectives of the hydrologic monitoring program are to detect the potential effects of SNWA and EPU groundwater withdrawals in Snake Valley, and include collecting hydrologic data to 1) support assessments of groundwater-influenced ecosystems supporting sensitive/special-status species, 2) define the natural variation of groundwater parameters (groundwater levels, spring discharge), 3) detect declines in groundwater-levels and spring discharges attributable to groundwater development within Snake Valley, and 4) detect changes in water quality attributable to groundwater development within Snake Valley that may affect EPUs in Nevada and Utah.

The Parties recognize that some of these sites have already been established as part of existing programs, but that data collection at these sites will be incorporated as a component of this Agreement. SNWA shall fund the UGS, or a mutually agreed to third party, to perform data collection and processing at the sites for which UGS is responsible. SNWA shall perform, or fund a mutually agreed to third party to perform, data collection and processing at sites for which SNWA is responsible.

##### **1.1.1.1. SNWA Exploratory and Production Wells**

SNWA shall continuously record production data and water levels on all SNWA production wells in Snake Valley. SNWA shall measure depth-to-water in all SNWA exploratory wells in Snake Valley on a quarterly basis.

##### **1.1.1.2. Existing Monitor Wells**

Groundwater levels shall be monitored at a total of twenty-nine (29) monitor-well sites in Snake Valley, within both Nevada and Utah, including continuous monitoring at up to fourteen (14) existing UGS sites and quarterly monitoring at up to fifteen (15) other existing sites selected by the TWG. Each of the fourteen existing UGS sites scheduled for continuous monitoring includes one to three piezometers (2- or 2.5-inch-diameter PVC wells). All of these piezometers are scheduled for continuous monitoring, unless otherwise agreed to and specified by the TWG. Currently, there are thirty-three (33) piezometers installed in the fourteen (14) existing UGS well

sites, all of which have been equipped with pressure transducers to record water levels twice daily. Downloading of the data loggers attached to these transducers shall be performed quarterly or at intervals determined by the TWG. The wells scheduled for quarterly monitoring are single-completion wells and will not be equipped with transducers.

The TWG, in its review of the existing monitor wells, shall strive to optimize the network to achieve the goals and objectives of the Agreement by eliminating redundant monitoring sites and/or increasing the spatial coverage as needed.

#### **1.1.1.3. New Monitor Wells**

SNWA shall install up to three (3) new monitor wells should the TWG determine that the “existing” monitoring network outlined in section 1.1.1.2 is insufficient for meeting the goals and objectives of this Agreement. If the TWG determines that new monitor wells are needed, the location of the wells shall be restricted to the Tier I Monitoring Area, and shall be selected by the TWG. The costs of well installation and subsequent monitoring shall be borne by SNWA.

#### **1.1.1.4. Groundwater Production**

As stated in Section 1.1.1.1, SNWA shall continuously record groundwater production rates and volumes in all SNWA production wells. The State of Utah, through the Utah Division of Water Rights (UDWRI), shall record all groundwater production data on groundwater production wells in Snake Valley, Utah used for irrigation, mining, and municipal and industrial purposes. At a minimum, these records shall report monthly production totals and the duration of pumping during the reporting period.

#### **1.1.1.5. Springs and Surface Water**

Nested piezometers at selected springs and regional discharge areas within the Tier I Monitoring Area shall be installed to monitor groundwater levels with the objective of measuring the hydraulic head potential contributing to the spring and/or diffuse groundwater discharge. The Parties recognize that the measured groundwater levels in these piezometers may or may not reflect the actual hydraulic head at the spring orifice, but that the measurements may be used as a surrogate to approximate hydraulic changes due to climate variability or pumping effects. At appropriate sites, these piezometers will be coupled with surface-water gages that shall be installed to measure spring discharge.

SNWA and UGS shall work cooperatively to establish monitoring sites at the selected springs and diffuse groundwater discharge areas listed in Table 1.1. The Parties shall share in the capital costs of establishing these monitoring sites as provided for in Table 1.1.

**Table 1.1. Tier 1 Spring and Stream Monitoring Sites**

Spring / Stream Name	Piezometer Sites	Surface-Water Gages	Agency Responsible for Installation	Agency Responsible for Monitoring
Miller Spring	--	1	UGS	UGS
<b>Leland Harris Spring Complex</b>				
North Complex	1	--	UGS	UGS
<b>Gandy Salt Marsh</b>				
North Complex	1	--	UGS	UGS
<b>Bishop Springs Complex</b>				
Foote Reservoir	--	2	UGS	UGS
Twin Springs	1	2	UGS	UGS
Warm Springs at Gandy	--	1	SNWA	SNWA
Beck Springs	--	1	UGS	UGS
Knoll Spring	--	1	SNWA	SNWA
Clay Springs	--	1	UGS	UGS
Lake Creek		1	SNWA	SNWA
Big Springs Creek (at Stateline)	--	4	UGS	UGS
Big Springs	--	1	SNWA	SNWA
<b>TOTAL</b>	<b>3</b>	<b>15</b>		

The Parties agree to cooperate in the data collection and record maintenance for the surface-water sites, including providing access to the measurement sections and gages, and sharing miscellaneous discharge measurements made at each respective site. The TWG will determine the appropriate measurement section at each site and determine the specific flow-measuring device to be installed after field reconnaissance has been performed to determine the optimal arrangement. The responsible monitoring agency will develop rating curves for the gaging stations listed in Table 1.1 using the miscellaneous discharge measurements collected at each site. The TWG will review and approve the rating curves used to compute the discharge records for the respective stations.

**1.1.1.6. Precipitation Gages**

The coverage of existing precipitation stations within the Tier I Monitoring Area shall be reviewed by the TWG and, if necessary, the TWG may recommend that additional precipitation stations be established. SNWA shall fund the construction, operation, and maintenance of any such additional stations.

**1.1.1.7. Water Chemistry**

The TWG shall compile all available water-chemistry data for the Tier I and Tier II Monitoring Areas. SNWA shall develop a database accessible to the TWG for storage and retrieval of these data. The TWG shall evaluate the dataset to determine if additional groundwater samples are needed to characterize the baseline condition for the specific water-quality parameters of concern that might be affected by groundwater pumping associated with SNWA and EPU production wells. The specific water-quality parameters of concern (e.g. salinity) and associated analytical

suite shall be defined by the TWG. Sample collection shall be limited to existing pumping wells or springs within the Tier I and Tier II Monitoring Areas, and shall be performed by SNWA for sample sites located in Nevada and by UGS for sample sites located in Utah.

Routine sample collection and analysis for the water-quality parameters of concern shall be performed at up to four (4) representative existing wells identified by the TWG. The selected wells shall be existing production wells within the Tier I Monitoring Area. The routine sample collection shall be performed annually, or as otherwise mutually agreed to by the TWG. SNWA shall perform the routine sampling at the selected wells in Nevada and fund the UGS, or a mutually agreed to third party, to perform the routine sampling at the selected wells in Utah.

### **1.1.2. Tier II Hydrologic Monitoring**

The Parties agree that monitoring precipitation and groundwater levels within the undeveloped areas of the Tier II Monitoring Area is important for describing the natural variation of the underlying groundwater system(s) to discern the cause of changing groundwater levels, and whether the changes are attributable to natural variation or pumping effects.

#### **1.1.2.1. Monitor Wells**

Existing monitor wells within the Tier II Monitoring Area that are part of existing groundwater monitoring networks shall be evaluated by the TWG, and up to three (3) wells or well sites in each of the Tier II hydrographic areas will be selected for quarterly depth-to-water measurements. SNWA shall fund the USGS, or another mutually agreed to third party to perform these measurements and report the data to SNWA and the TWG.

#### **1.1.2.2. Precipitation Gages**

The coverage of existing precipitation stations within the Tier II Monitoring Area shall be reviewed by the TWG and, if necessary, the TWG may recommend that additional precipitation stations be established.