NYE COUNTY NUCLEAR WASTE REPOSITORY PROJECT OFFICE

WORK PLAN

TITLE:	REVISION: 0
Groundwater Level Monitoring and Evaluation	DATE: **8/20/03**
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WORK PLAN NUMBER: **WP-10**	SUPERSEDES: **Existing Change Notice No. 1 and pages in WP-10 Rev. 0**

CHANGE NOTICE NO. 2

EFFECTIVE DATE: February 28, 2006

PURPOSE: Change time frame for data submittal by P.I. and contractors; change time frame for documentation updates by NWRPO staff.

Page 6, Section 4.1.1: Change "biannually when new data is submitted" to "annually when new data are submitted".

Page 7, Section 4.1.2: Change "biannually when new data is submitted" to "annually when new data are submitted".

Page 10, Section 4.4: Change "biannually" to "annually".

CONCURRENCE:

Dallet Hammond 3/1/06
On-Site Geotechnical Representative Date

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Principal Investigator Date

Dick Swan 3-7-06
Quality Assurance Officer Date

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NYE COUNTY NUCLEAR WASTE REPOSITORY PROJECT OFFICE

WORK PLAN

TITLE: **Groundwater Level Monitoring and Evaluation**	**Revision: 0** **Date: 8/20/03** **Page: 1 of 19**

WORK PLAN NO.: **WP-10**	**SUPERSEDES:** **New Document**
APPROVAL 9-8-03 **Project Manager** **Date**	CONCURRENCE 9/3/03 **On-Site Geotechnical Representative** **Date** 03 Sep 03 **Principal Investigator** **Date** 9/4/03 **Project Quality Assurance Officer** **Date**

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1.0 INTRODUCTION

This work plan describes strategies, methods, and schedules for groundwater level monitoring, referred to herein as water level monitoring, conducted by the Nye County Nuclear Waste Repository Project Office (NWRPO). Water level monitoring is currently conducted in Early Warning Drilling Program (EWDP) wells in the vicinity of Yucca Mountain and in privately owned wells in the Amargosa Desert, Pahrump Valley, and Stewart Valley. The EWDP is a subprogram within the Nye County Independent Scientific Investigations Program (ISIP). This Work Plan has been prepared in accordance with the provisions of the Nye County NWRPO quality administrative procedure QAP-5.2, *Preparation of Work Plans and Technical Procedures*.

2.0 PURPOSE

The purpose of this plan is to provide technically defensible strategies, methods, and schedules for the collection, storage, dissemination, and preliminary analysis of water level and related data from wells monitored by the NWRPO. This plan will help ensure that data collection and analysis are conducted in accordance with the NWRPO Quality Assurance (QA) Program, and will support other related ISIP tasks and objectives.

The data collection and analysis performed according to this work plan will be used to support a number of ISIP tasks, including the following:

- Aquifer Testing.
- Initial Groundwater Chemistry Monitoring.
- Annual Groundwater Chemistry Monitoring.
- Regional Groundwater Level Monitoring.
- Conceptual Model Revision.
- Nye County Tracer Tests.
- Regional Geologic Characterization.

QA plans and procedures applicable to the activities discussed herein, such as work plans (WPs), quality administrative procedures (QAPs), technical procedures (TPs), or test plans (TPNs), will be referenced where appropriate; the most current version of these QA documents will be used.

3.0 BACKGROUND

3.1 Justification

It is the policy of Nye County to protect the health, welfare, and economic well-being of the County and its residents. All water supplies in southern Nye County are derived from groundwater wells or groundwater discharging to the surface at springs. These water supplies must be protected to ensure that all public water supplies are in compliance with the requirements of the U.S. Safe Drinking Water Act.

Models that have been developed to assess the long-term performance of a repository at Yucca Mountain indicate that releases from the repository may occur and that groundwater contamination may result. To protect Nye County water supplies that might be impacted by releases from the repository, a network of monitoring wells is needed along the potential pathway(s) for contaminant transport downgradient of Yucca Mountain. The EWDP was designed to meet this need by drilling, constructing, testing, and monitoring a network of wells between the proposed repository site and the existing and future water supply wells located downgradient of, or in proximity to, Yucca Mountain.

According to the information presented in the Total System Performance Assessment (YMP, 2001), no water level, aquifer test, or water chemistry data are available for a large area of southern Jackass Flats, southern Crater Flat, western Rock Valley, and northern Amargosa Desert. Quantitative hydrologic data are needed to define the conditions in these areas so that the risk associated with long-term waste disposal at the Yucca Mountain repository can be identified and evaluated. The EWDP was also designed to construct monitoring wells to meet the need for additional data in these areas. The NWRPO is currently collecting water level, aquifer test, and water chemistry data from these EWDP wells. To provide supplemental data, the NWRPO also monitors water levels in private wells in southern Nye County.

This work plan describes the approach the NWRPO will take for monitoring water levels to fill data gaps in the region between Yucca Mountain and populated areas of southern Nye County, and addresses the uncertainty in water level changes and trends in the region, as well as the causes of those trends. The approach includes an initial strategy of short-term baseline water level monitoring for one year following well construction in all EWDP wells and monthly measurements for one year in private wells. The plan also describes the approach to future long-term NWRPO monitoring.

3.2 Overview of the Current Water Level Monitoring Program

Water level measurements are taken during borehole drilling and well construction; however, water level monitoring does not begin until after well construction and development activities have been completed. Water levels in EWDP wells are initially monitored on a relatively frequent basis for one year or more to provide insight into short-term water level responses related to variations in atmospheric barometric pressure and earth tides, and longer-term responses, if any, related to seasonal climatic changes and/or groundwater pumping. Semi-continuous electronic pressure and temperature measurements are made in EWDP wells containing Westbay® packer and instrument systems (i.e., Westbay® systems). These systems are currently used in seven specially-constructed multiple screen EWDP wells, referred to as Westbay® wells in this plan, to isolate discrete screened intervals and permit semi-continuous temperature and pressure monitoring. The systems also permit access to each screened interval for groundwater sampling and aquifer testing. Pressure and temperature data are used to calculate water levels, which can then be used to calculate vertical gradients at a single well or well site, and horizontal gradients between wells. The latter are in turn required to determine the direction and rate of groundwater flow.

Initial water level data are also manually collected approximately once per month from EWDP wells that do not contain Westbay® systems. These wells include piezometers and conventional

monitoring wells that have single or dual casing/screen strings open to the atmosphere and are constructed in a manner to isolate discrete intervals in subsurface formations. In cases where these wells are adjacent to each other and their well screens are at different depth intervals, the wells can provide the same data and support the same activities (i.e., water level monitoring, gradient analyses, water sampling for chemical analysis, and aquifer testing) as Westbay® wells.

At present, water levels are manually measured with well sounders in approximately 20 EWDP piezometers and monitoring wells. These wells are not designed to be instrumented with Westbay® systems, nor is there a need for them to contain such instrumentation. However, if it becomes necessary to obtain semi-continuous water level data from one or more of these wells (e.g., during an aquifer test), electronically measured pressure data can be, and in a number of cases have been, obtained using downhole transducer and data logger systems commercially available from a number of vendors.

Finally, manual water levels are also periodically measured in isolated well screens in Westbay® wells to verify the accuracy of semi-continuous electronic measurements. Manual water level methods avoid instrument drift and other accuracy problems inherent in the automated Westbay® or similar systems.

In the past, water levels in private wells have been monitored at least annually in a network of wells in the Amargosa Desert, Pahrump Valley, and Stewart Valley. Water level measurements were made in the winter of 1999/2000, spring and fall 2001, early fall 2002, and late winter 2003. Beginning in May 2003, the frequency of monitoring was increased to monthly measurements at all accessible private wells in the network. This more frequent monitoring schedule will allow the definition of the magnitude of seasonal variations in water levels in each of the basins. After at least one year of monthly measurements, measurement frequency may revert to bi-annual measurements at selected wells, with measurements taken during the seasonal high and low water level conditions.

3.3 Need for Long-Term Water Level Monitoring Plan

Some minor short-term changes in water levels in response to atmospheric barometric fluctuations and earth tides are expected in EWDP wells that are monitored on a semi-continuous basis. The initial monitoring program described in the previous section is expected to capture these short-term variations in water levels. Seasonal variations in water levels are in most cases not expected due to a number of factors, including extremely low recharge rates in the area where the wells are located, the generally thick unsaturated zone, and the lack of groundwater withdrawal (i.e., pumping) in the vicinity of EWDP wells. As a result, the initial, relatively high frequency of water level monitoring described in the preceding sections is not expected to yield data that exhibit significant seasonal trends. If such monitoring demonstrates the lack of seasonal trends, less-frequent monitoring will be more appropriate for the long term. A plan for conducting such long-term monitoring is described in this work plan.

Conversely, many of the private wells are located in areas of groundwater pumping, discharge areas with high components of natural discharge, and areas with both seasonal variations and long-term water level trends. For example, in the Amargosa Farms area, long-term water level declines have been documented that reflect the agricultural development of the area. Because of

the costs associated with instrumentation, it is not practical to monitor these wells on a semi-continuous basis. Past monitoring has indicated that water level declines in some portions of the Amargosa Desert, Pahrump Valley, and Stewart Valley are continuing. Therefore, monitoring frequency has been increased so that the seasonal variations can be defined and evaluated.

4.0 SCOPE OF WORK

This section describes an integrated plan for both initial (i.e., baseline) and long-term monitoring. The following major tasks are addressed:

- Baseline monitoring.
- Long-term monitoring.
- Data processing, analysis, and presentation.
- QA documentation requirements.
- Monitoring well locations and schedule.
- Responsibilities.
- Equipment calibration requirements.

4.1 Baseline Monitoring

During well drilling, construction, and development, water levels are measured to assist in the design of the well, to verify that seals are in place, and to measure the degree of development of the well. However, because of the effects of these activities on the water level in a given well or borehole, these initial measurements are recorded not in the baseline data-collection program but in the scientific notebook for that well.

Baseline data collection will be conducted in each new EWDP well in accordance with TP-9.2, *Procedures for Operating Westbay® Mosdax® Groundwater Monitoring Equipment in Nye County Wells* and/or TP-9.9, *Measurement of Groundwater Levels Using Electric Well Sounders* and will continue for a period of time determined by the Principle Investigator (PI). This time period will generally be a minimum of 12 months, if funding and manpower are not binding constraints. Baseline data-collection frequency and methods will vary depending on the EWDP well type, as described in the following.

4.1.1 Baseline Monitoring in Westbay® Wells

The current status of the ongoing baseline monitoring program in existing Nye County Westbay® wells is summarized in Table 1. This table will be updated annually when new data are submitted and used to track the progress of the baseline program in these wells. As each new Westbay® well is completed, the well will be incorporated into the baseline monitoring program. The major steps in this program include the following:

1. Conduct semi-continuous electronic monitoring and record temperature and pressure in each isolated well screen for at least 12 months, or as determined by the PI.

2. Convert pressure and temperature data to values of depth to water below a referenced datum.
3. Make at least two manual water level measurements, separated by a period of approximately 6 months in each isolated well screen. These measurements will be used to verify the accuracy of the semi-continuous water level data calculated from electronically measured pressure and temperature data.
4. Plot hydrographs (i.e., graphs of depth to water or elevation of water versus time) of both electronically and manually measured data.
5. Evaluate hydrographs and Westbay® pressure/temperature sensor calibration data to determine the accuracy of the semi-continuous electronic measurements. Document acceptable levels of accuracy in the metadata.
6. If electronic data do not exhibit an acceptable level of accuracy, censor the data and/or make necessary changes to increase accuracy to acceptable levels, and continue monitoring until acceptable data are collected over a period of at least 6 months. If it is determined that acceptable levels of accuracy cannot be achieved, baseline electronic monitoring may be terminated and the justification for this termination documented in the metadata.
7. Evaluate hydrographs to determine the presence of significant trends other than very short-term barometric or earth tide trends. Statistical methods may be used to filter out barometric and tidal fluctuations. In some instances, seismic effects may be present and an evaluation of seismic events may be necessary in the trend assessments.
8. If only very short-term barometric or earth tide trends are observed, terminate baseline monitoring and begin long-term monitoring, following the steps listed in Section 4.2.
9. If other significant trends are noted, continue baseline monitoring until such trends are adequately characterized and describe the criteria for that characterization in the metadata.
10. When the characterization described above is complete, terminate baseline monitoring and begin long-term monitoring.

4.1.2 Baseline Monitoring in Non-Westbay® Wells

The current status of the ongoing baseline monitoring program in EWDP wells not containing Westbay® systems (i.e., piezometers and conventional monitoring wells) is summarized in Table 2. This table will be updated annually when new data are submitted and used to track the progress of the baseline program in non-Westbay® wells. As each new well of this type is completed, the well will be incorporated into the baseline-monitoring program. The major steps of this program include the following:

1. Make monthly manual water level measurements, using a well sounder in each isolated well screen, for at least 12 months or as determined by the PI.
2. Plot hydrographs of manually measured water level data.

3. Evaluate hydrographs to determine the accuracy of water level data. Censor outliers that are judged to be in error and plot new hydrographs, if necessary. Document the justification for censoring data in the metadata.
4. If only very minor variations are observed (e.g., due to short-term barometric or earth tide fluctuations), terminate baseline monitoring and begin long-term monitoring, following the steps listed in Section 4.2.
5. If other significant trends are noted, continue baseline monitoring until such trends are adequately characterized and describe the criteria for that characterization in the metadata.
6. When the characterization described above is complete, terminate baseline monitoring and begin long-term monitoring.

In some instances, there may be a need to vary these steps. For example, EWDP wells that are located in proximity to Fortymile Wash may be well suited for investigating recharge. However, because of the infrequent flows in this drainage, it may be necessary to extend the monthly monitoring frequency beyond one year. The need for extended monitoring at a given well will be evaluated on a case-by-case basis by the PI, and monitoring frequency or baseline duration will be modified accordingly. The rationale for such extensions will be documented in the metadata.

4.1.3 Baseline Monitoring in Private Wells

Because the private wells that are being monitored are not new wells constructed under the EWDP, there is no formal baseline program implemented for them. Baseline conditions can be estimated on the basis of long-term U.S. Geological Survey (USGS) water level measurements for wells in the Pahrump Valley and Amargosa Desert.

4.2 Long-Term Monitoring Program

Water level measurements will be less frequent when baseline monitoring and regional water level evaluations have been completed. The PI or designee will determine measurement frequency and methods for each well and will document the rationale in the metadata. In general, long-term water levels will be measured in both Westbay® and non-Westbay® wells biannually, using manual well sounder methods to avoid problems with instrument drift and other accuracy problems inherent in the automated Westbay® or similar systems. Water level measurements in private wells will likely be collected on at least an annual basis as long as funding allows. Manual water level data will be collected in accordance with TP-9.9, *Measurement of Groundwater Levels Using Electric Well Sounders.*

The status of long-term monitoring in EWDP wells is summarized in Tables 1 and 2, which will be updated monthly to track the overall progress of the water level monitoring program. The major steps in this program include the following:

1. Collect of water level data at a specific frequency using methods listed in Tables 1 and 2.
2. Plot hydrographs of monitoring data annually.

3. Evaluate hydrographs annually to determine the accuracy of water level data. Censor outlier data that are judged to be in error and document the justification for censoring data in the metadata.
4. Make an annual determination of whether changes are required in monitoring frequency and methods.
5. Document the justification for program changes in the metadata, and implement those changes.

The current status of the ongoing monitoring of privately owned wells is summarized in Table 3. Table 3 will be updated annually and will be used to track the progress of the monitoring program. Long-term monitoring of private wells and the evaluation of regional water levels will continue indefinitely. The major steps in this program include the following:

1. Make monthly water level measurements at accessible private wells in the communities of Amargosa Valley, Crystal, and Pahrump; Stewart Valley; and other selected locations in southern Nye County and portions of westernmost Clark County.
2. Compare the monitoring results with those of other water level monitoring programs conducted by the USGS and the U.S. Department of Energy (DOE).
3. Enter water level data into electronic media and calculate groundwater elevations. Plot hydrographs and potentiometric, depth-to-water, and difference maps showing seasonal, annual, and cumulative changes in water levels.
4. Identify, quantify, and evaluate observed spatial and temporal variations in water levels in the Yucca Mountain region, including long-term trends, seasonal fluctuations, and responses to seismic events. These evaluations will include data from EWDP wells.
5. Evaluate qualified water level data, hydrographs, and maps to determine the adequacy of the monitoring network. Incorporate additional wells into the network to fill data gaps or reduce monitoring in areas of high well densities.
6. Continue monitoring and evaluations as appropriate and as funding permits. It is considered likely that groundwater monitoring in the Yucca Mountain region will be required in perpetuity.

4.3 Data Processing, Analysis, and Presentation

All raw data will be entered and processed electronically (e.g., in spreadsheets or a database). Data processing of manually measured water levels will be limited to converting depth of water below measuring point to depth below the ground surface (bgs), and in turn converting depth bgs to elevation above mean sea level (amsl). Data processing of semi-continuous Westbay® system pressure and temperature monitoring data will primarily involve converting these data to depth of water bgs and/or elevation amsl.

Water level data analysis for EWDP wells will primarily be accomplished through careful evaluation of hydrographs for individual well screens. Hydrographs will be examined for outlier data points that are likely in error, short-term fluctuations in data due to earth tides and

atmospheric barometric pressure changes, responses to seismic events, and longer trends reflecting changes in groundwater recharge and discharge rates. Standard statistical methods may be used to filter the tidal and barometric effects and to determine whether apparent trends in the water levels are statistically significant. Hydrographs will be compared to determine whether consistent trends are evident, trends show a preferred spatial distribution, or temporal trends can be linked to any known factors, such as seasonal pumping or seismic activity. These hydrograph analysis steps are presented in Sections 4.1 and 4.2.

Hydrographs will be plotted electronically (e.g., from spreadsheets or a database). Trends identified in these hydrographs will be described in an annual water level summary report. In addition, major modifications to the baseline and long-term monitoring programs will be described in this annual report.

For regional water level evaluations, selected EWDP semi-continuous and manual measurement data will be incorporated into data sets from the private wells. Metadata will be used to justify the selection of EWDP data included. Typically, data from EWDP wells will be selected that correspond with the monitoring period for the private wells. For example, if water levels in private wells in northern Amargosa Desert are taken on a particular date, the EWDP data for that date will be selected. These data will be augmented by data from USGS and DOE monitoring programs for the same period of time.

A master electronic file of regional water level data will be developed, containing the entire set of EWDP well, private well, and USGS and DOE water level data. The metadata accompanying this data set will identify any censored data and the reasons for its censoring. Calculations within the master data set will include changes in water levels over selected periods of time, including season changes (e.g., winter to summer), annual changes, and cumulative changes from the baseline. For the purposes of regional water level evaluations, the water level data collected between November 1999 and February 2000 have been selected as the baseline.

4.4 Quality Assurance Documentation Requirements

Copies of all data recorded will be submitted to the NWRPO Quality Assurance Records Center (QARC) annually following data collection. For water level measurements taken during drilling, data will be entered into scientific notebooks and submitted to the QARC upon well completion. All water level data will be stored in a holding file until data analysis has been completed and the metadata have been prepared. Upon completion of data analysis graphing, the graphs and associated metadata will be included with the recorded data in a single data package. After QA verification checks have been completed, these data will subsequently be entered into the QARC and provided to the public on the Nye County web site on at least a biannual basis.

4.5 Monitoring Well Locations and Schedule

EWDP well locations where water levels have previously been and/or are currently monitored are shown on Figure 1. Tables 1 and 2 summarize the monitoring schedules in each of these wells. The locations of the private wells currently monitored by the NWRPO are shown on Figure 2. Table 3 summarizes the monitoring schedules for each of the private wells.

4.6 Responsibilities

The Nye County Onsite Geotechnical Representative (OSGR) will designate a PI to direct the water level monitoring program, including monitoring temperature and pressure in Westbay® wells, manual water level monitoring in other EWDP wells, and regional water level monitoring. The PI will designate a Task Manager and work with the OSGR and Task Manager to plan and implement a monitoring program. In addition, the PI will be responsible for and/or supervise the evaluation of hydrographs, data censoring, and metadata. Finally, the PI will be responsible for integrating, analyzing, interpreting, and reporting data in technical meetings, Nye County technical reports, and peer-reviewed publications. The Task Manager will be responsible for the collection of field data from EWDP wells and the electronic recording of these data. Nye County technical staff and contractors will conduct monitoring activities in accordance with applicable QA plans and procedures.

4.7 Equipment Calibration Requirements

Westbay® system pressure/temperature probes and data loggers will be factory calibrated in accordance with QAP-12.1, *Procedures for Control of Measuring and Test Equipment*. Factory calibrations will be verified in the NWRPO office or in wells as described in TP-9.2, *Procedures for Operating Westbay® Mosdax® Groundwater Monitoring Equipment in Nye County Wells*. Finally, well sounders used in manual water level measurements will be standardized against a master well sounder at least every 6 months, as described in TP-9.9, *Measurement of Groundwater Levels Using Electric Well Sounders*. In summary, all measurement equipment will be operational and in compliance with all calibration and standardization requirements specified in QA procedures.

5.0 MANAGEMENT

The project QA Officer is responsible for the coordination of the internal review of this Work Plan and verifying compliance with the requirements of this plan. The PI is responsible for the preparation and modification of this Work Plan, ensuring the appropriate training of NWRPO personnel, and oversight of the performance of the plan. The Task Manager will supervise the collection and recording of data from EWDP Wells.

To ensure that the work involved will be quality-controlled and accomplished in accordance with the scope and objectives of the ISIP, the following training and documentation will be accomplished prior to conducting the water level monitoring activities described in this work plan. All individuals performing the activities herein will be trained in the applicable QA procedures listed below and will document that they have read and understand the procedures before conducting work.

- QAP-12.1, *Procedures for Control of Measuring and Test Equipment.*
- TP-9.2, *Procedures for Operating Westbay® Mosdax® Groundwater Monitoring Equipment in Nye County Wells.*
- TP-9.9, *Measurement of Groundwater Levels Using Electric Well Sounders.*

Finally, all activities described herein will be performed in accordance with the provisions of the EWDP Health and Safety Plan.

6.0 REFERENCES

EWDP Health and Safety Plan, Pahrump, Nevada: Nuclear Waste Repository Project Office.

QAP-5.2, *Preparation of Work Plans and Technical Procedures.* Pahrump, Nevada: Nuclear Waste Repository Project Office.

QAP-12.1, *Procedures for Control of Measuring and Test Equipment*. Pahrump, Nevada: Nuclear Waste Repository Project Office.

TP-9.2, *Procedures for Operating Westbay® Mosdax® Groundwater Monitoring Equipment in Nye County Wells.* Pahrump, Nevada: Nuclear Waste Repository Project Office.

TP-9.9, *Measurement of Groundwater Levels Using Electric Well Sounders.* Pahrump, Nevada: Nuclear Waste Repository Project Office.

U.S. Department of Energy (DOE). 2001. *Total System Performance Assessment - Analyses for Disposal of Commercial and DOE Waste Inventories at Yucca Mountain - Input to Final Environmental Impact Statement and Site Suitability Evaluation*, REV 00, ICN 02, December 2001, Las Vegas, Nevada.

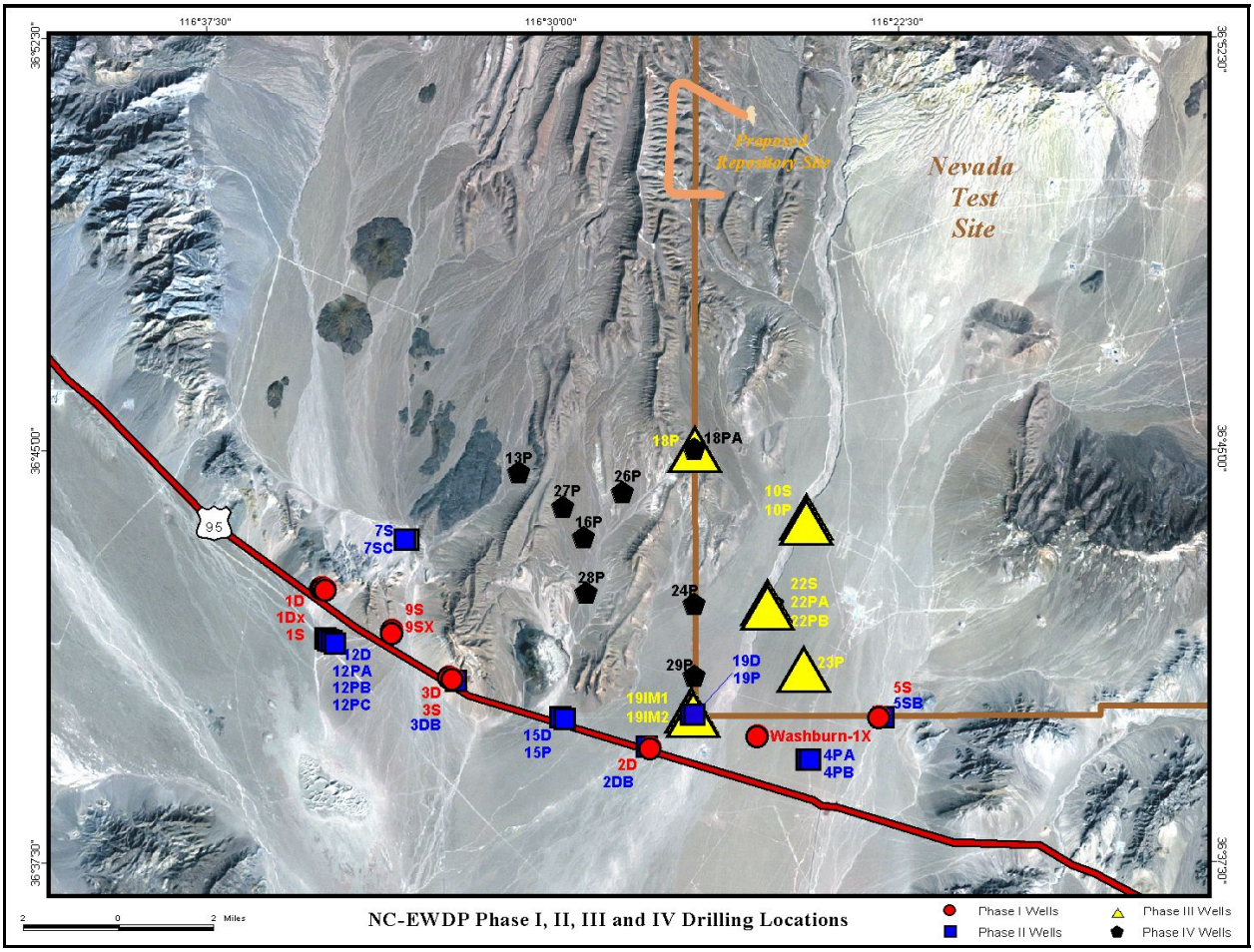
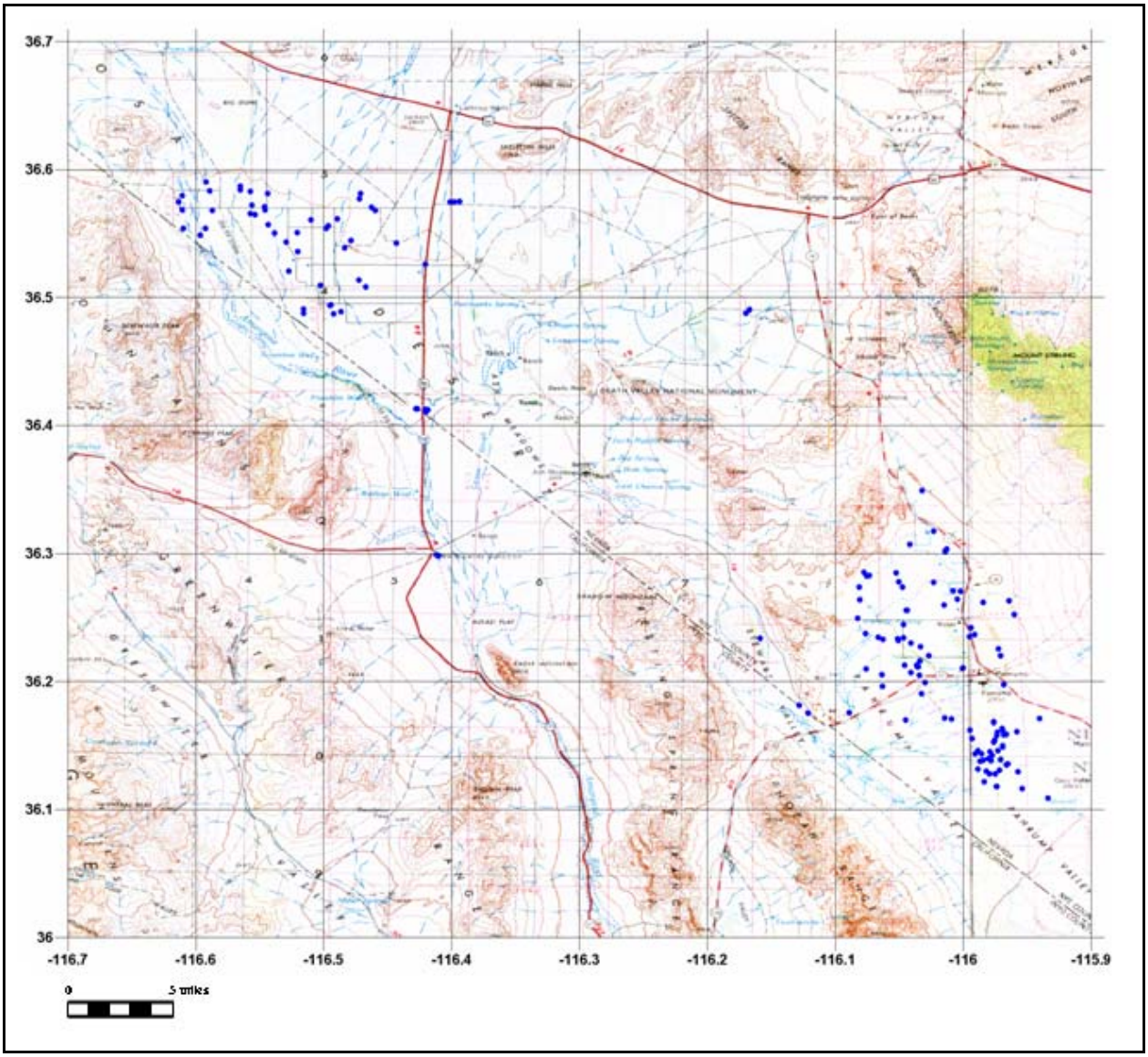


Figure 1
Location Map of Early Warning Drilling Program Monitoring Wells



Base Map: Scanned 1:250,000 USGS Death Valley and Las Vegas Sheets.

Figure 2
Locations of Private Water Wells Monitored by
the Nuclear Waste Repository Project Office

Table 1
Status of Baseline Water Level Measurement Program as of June 2003 and Future Long-Term Monitoring in Multiple-Screen Monitoring Wells

Well ID	Current Status	Number Of Screens Or Open-Hole Intervals	Baseline Water Level Monitoring Program										Long Term Monitoring Plan				
			Continuous Transducer/ Data Logger Monitoring				Manual Well Sounder Verification Monitoring			Path Forward Questions			Schedule of Monitoring		Water Level Measurement Method		
			Monitoring Schedule				Monitoring Schedule										
			Start Date	End Date	Proposed End Date (If Monitoring Is Extended)	Total Months Monitored as of 6/24/03	Dates Monitored as of 6/24/03	Proposed Additional Dates	Proposed End Date	Do Data Warrant Continued Baseline Monitoring?	Do Data Warrant Special Long-Term Monitoring?	Comments	Proposed Start Date	Measurement Frequency	Manual Well Sounder	Transducer/ Data Logger	Other
NC-EWDP-1S	Contains Westbay® packers and pressure /temperature probes	2	5/18/99	6/6/02	6/6/02	31	5/17/99 11/8/99 5/18/00	None	5/18/00	No	No		2/03	6 months	Yes	No	TBD[a]
NC-EWDP-3S	Contains Westbay® packers and pressure /temperature probes	2	5/6/99	6/6/02	TBD	28	5/21/99 11/15/99 3/10/03	TBD	TBD	TBD	TBD	Presently evaluating effects of grout contamination	TBD	TBD	TBD	TBD	TBD
NC-EWDP-7SC	Contains Westbay® packers and pressure /temperature probes	4	4/24/01	TBD	7/03	21	9/13/02 3/20/03	7/03	7/03	TBD	TBD		7/03	TBD	TBD	TBD	TBD
NC-EWDP-9SX	Contains Westbay® packers and pressure /temperature probes	4	7/16/99	5/15/03	5/15/03	32	5/19/99 11/9/99 5/19/00 12/6/01 5/15/03	None	5/15/03	No	No		5/03	6 months	Yes	No	TBD
NC-EWDP-10S	Contains Westbay® packers and pressure /temperature probes	2	12/4/02	TBD	12/03	6	7/24/02 9/11/02 6/10/03	12/03	12/03	TBD	TBD		12/03	TBD	TBD	TBD	TBD
NC-EWDP-19IM1	Contains Westbay® packers and pressure /temperature probes	5	1/24/03	4/15/03	7/04	3	11/14/01 1/23/03	7/03 1/04 7/04	7/04	TBD	TBD	Probes currently being recalibrated by Westbay® for USGS	7/04	TBD	TBD	TBD	TBD
NC-EWDP-19IM2	Open borehole	5	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	No monitoring currently planned	TBD	TBD	TBD	TBD	
NC-EWDP-22S	Contains Westbay® packers and pressure /temperature probes	4	3/24/03	TBD	12/04	3	7/25/02 9/9/02 3/25/03 4/24/03 6/17/03	3/04 9/04 12/04	12/04	TBD	TBD	Aquifer and tracer tests planned from 8/03 to 3/04	12/04	TBD	TBD	TBD	TBD

[a]TBD = To be determined.

Table 2
Status of Baseline Water Level Measurement Program through June 2003 and Future Long-Term Monitoring in Single and Multiple Completion Wells and Piezometers

Well ID	Well Type	Current Status	Number Of Screens Or Open-Hole Intervals	Baseline Water Level Monitoring Program							Long-Term Monitoring Plan				
				Monitoring Schedule					Path Forward Questions		Monitoring Schedule		Water Level Measurement Method		
				Start Date	End Date	Approximate Measure-ment Frequency	Total Months Monitored as of 6/24/03	Proposed End Date	Do Data Warrant Continued Baseline Monitoring?	Do Data Warrant Special Long-Term Monitoring?	Proposed Start Date	Approximate Measure-ment Frequency	Manual Well Sounder	Transducer/ Data Logger	Other
NC-EWDP-1DX	Dual completion piezometer	Dual strings are open	2	5/17/99	Ongoing	Monthly	49[a]	8/03	TBD[b]	TBD	8/03	TBD	TBD	TBD	TBD
NC-EWDP-2DB	Monitoring well to be completed	Open borehole from 2685 to 3075 feet	1	10/12/00	1/29/03	Monthly	28	8/03	TBD	TBD	8/03	TBD	TBD	TBD	TBD
NC-EWDP-3D	Exploratory borehole	Open borehole from 521 to 2500 feet	1	3/6/99	Ongoing	Monthly	51	8/03	TBD	TBD	8/03	TBD	TBD	TBD	TBD
NC-EWDP-4PA	Piezometer	Single string open	1	1/17/00	Ongoing	Monthly	37[c]	8/03	TBD	TBD	8/03	TBD	TBD	TBD	TBD
NC-EWDP-4PB	Piezometer	Single string open	1	2/18/00	Ongoing	Monthly	33[d]	8/03	TBD	TBD	8/03	TBD	TBD	TBD	TBD
NC-EWDP-5SB	Piezometer	Single string open	1	2/11/00	Ongoing	Monthly	40	8/03	TBD	TBD	8/03	TBD	TBD	TBD	TBD
NC-EWDP-7S	Piezometer	Single string open	1	10/24/00	Ongoing	Monthly	32	8/03	TBD	TBD	8/03	TBD	TBD	TBD	TBD
NC-EWDP-10P	Piezometer	Dual strings are open	2	1/28/02	Ongoing	Monthly	16	8/03	TBD	TBD	8/03	TBD	TBD	TBD	TBD
NC-EWDP-12PA	Piezometer	Single string open	1	3/27/00	Ongoing	Monthly	39	8/03	TBD	TBD	8/03	TBD	TBD	TBD	TBD
NC-EWDP-12PB	Piezometer	Single string open	1	4/3/00	Ongoing	Monthly	38	8/03	TBD	TBD	8/03	TBD	TBD	TBD	TBD
NC-EWDP-12PC	Piezometer	Single string open	1	4/13/00	Ongoing	Monthly	38	8/03	TBD	TBD	8/03	TBD	TBD	TBD	TBD
NC-EWDP-15P	Piezometer	Single string open	1	2/29/00	Ongoing	Monthly	30[e]	8/03	TBD	TBD	8/03	TBD	TBD	TBD	TBD
NC-EWDP-16P	Piezometer	Single string open	1	1/30/03	Ongoing	Monthly	6	2/04	TBD	TBD	2/04	TBD	TBD	TBD	TBD
NC-EWDP-18P	Piezometer	Single string open	1	11/9/01	Ongoing	Monthly	19	8/03	TBD	TBD	8/03	TBD	TBD	TBD	TBD
NC-EWDP-19P	Piezometer	Single string open	1	3/13/00	Ongoing	Monthly	39[f]	8/03	TBD	TBD	8/03	TBD	TBD	TBD	TBD
NC-EWDP-22PA	Piezometer	Dual strings are open	2	2/11/02	Ongoing	Monthly	17	8/03	TBD	TBD	8/03	TBD	TBD	TBD	TBD
NC-EWDP-22PB	Piezometer	Dual strings are open	2	3/29/02	Ongoing	Monthly	16	8/03	TBD	TBD	8/03	TBD	TBD	TBD	TBD
NC-EWDP-23P	Piezometer	Dual strings are open	2	4/3/02	Ongoing	Monthly	15	8/03	TBD	TBD	8/03	TBD	TBD	TBD	TBD
NC-EWDP-27P	Piezometer	Single string open	1	2/6/03	Ongoing	Monthly	5	2/04	TBD	TBD	2/04	TBD	TBD	TBD	TBD
NC-EWDP-28P	Piezometer	Single string open	1	1/30/03	Ongoing	Monthly	6	2/04	TBD	TBD	2/04	TBD	TBD	TBD	TBD
NC-EWDP-Washburn 1X	Piezometer	Dual strings are open, uppermost is dry	2	1/16/99	Ongoing	Monthly	42[g]	8/03	TBD	TBD	8/03	TBD	TBD	TBD	TBD

[a]Gaps in manual water level data due to monitoring with pressure transducers/data logger from 6/99 to 10/99.
[b]To be determined.
[c]Gaps in manual water level data due to monitoring with pressure transducers/data logger from 8/00 to 2/01.
[d]Gaps in manual water level data due to monitoring with pressure transducers/data logger from 8/00 to 5/01.
[e]Gaps in manual water level data due to monitoring with pressure transducers/data logger from 5/00 to 4/01.
[f]Gaps in manual water level data due to monitoring with pressure transducers/data logger from 6/00 to 11/01.
[g]Gaps in manual water level data due to monitoring with pressure transducers/data logger from 5/00 to 5/01.

Table 3
Summary of Water Level Monitoring in Private Wells

Well ID[a]	Number of Measurements					Location	Status
	1999	2000	2001	2002	2003		
1	1	1	1	1	3	Pahrump Valley	Old agricultural well; no pump
2	1			1	1	Pahrump Valley	Active domestic well
4				1	2	Pahrump Valley	Discontinue monitoring after 5/03
5	1		1	1	3	Pahrump Valley	Active domestic well
8	1	1	1	1	3	Pahrump Valley	Active domestic well
9	1	1	1	1	3	Pahrump Valley	Active domestic well
10	1	1	1	1	3	Pahrump Valley	Active domestic well
12	1	1		1	1	Pahrump Valley	Active domestic well
14	1		1			Pahrump Valley	Discontinue monitoring after 2/01
16	1					Pahrump Valley	Discontinue monitoring after 2/01
30	1	1	1			Pahrump Valley	Discontinue monitoring after 3/01
31	1	1	1			Pahrump Valley	Active domestic well
32	1	1	1	1	3	Pahrump Valley	Inactive domestic well on vacant lot
33	1	1	1	1	3	Pahrump Valley	Active domestic well
39	1		1	1	3	Pahrump Valley	Old agricultural well; inactive with pump
40	1		1	1	3	Pahrump Valley	Old agricultural well; inactive with pump
41	1		1	1	3	Pahrump Valley	Old agricultural well; inactive with pump
49	1		1			Pahrump Valley	Active domestic well
57	1		1		1	Pahrump Valley	Active commercial well
59	1	1	1	1	3	Pahrump Valley	Inactive domestic well on vacant lot
60	1	1	1			Pahrump Valley	Discontinue monitoring after 2/01
61	1		1	1	3	Pahrump Valley	Inactive domestic well on vacant lot
62	1		1	1	2	Pahrump Valley	Active commercial well
64	1			1	3	Pahrump Valley	Inactive domestic well on vacant lot
65	1		1	1	3	Pahrump Valley	Inactive domestic well on vacant lot
69	1		1	1	2	Pahrump Valley	Active commercial well
70	1		1	1	2	Pahrump Valley	Active domestic well
71	1	1	1	1	3	Pahrump Valley	Inactive domestic well on vacant lot
74	1		1	1	3	Pahrump Valley	Active domestic well on Spring Mountains alluvial fan
75	1			1	3	Pahrump Valley	Active domestic well on Spring Mountains alluvial fan
76	1			1	3	Pahrump Valley	Inactive domestic well on vacant lot; Spring Mountains alluvial fan
77				1	3	Pahrump Valley	Community well on Spring Mountains alluvial fan
79	1			1	3	Pahrump Valley	Active commercial well on Spring Mountains alluvial fan
81	1			1	3	Pahrump Valley	Inactive domestic well on vacant lot; Spring Mountains alluvial fan
83	1	1	1	1	1	Pahrump Valley	Discontinue monitoring after 9/02
88	1	1	1		3	Pahrump Valley	Active domestic well
89	1	1	1	1	1	Pahrump Valley	Discontinue monitoring after 2/03; abandoned agricultural well
92	1		1	1	2	Pahrump Valley	Inactive agricultural well on vacant lot
93	1	1	1	1	1	Pahrump Valley	Active domestic well

Table 3
Summary of Water Level Monitoring in Private Wells

Well ID[a]	Number of Measurements					Location	Status
	1999	2000	2001	2002	2003		
94	1	1	1	1	2	Pahrump Valley	Community well
100	1	1	1	1	2	Pahrump Valley	Inactive agricultural well on vacant lot
105	1					Pahrump Valley	Active commercial well at Crystal Fire Station
108			1	1	2	Pahrump Valley	Active domestic well
111			1	1	3	Pahrump Valley	Inactive domestic well
113				1	1	Pahrump Valley	Discontinue monitoring after 2/03
114			1	1	2	Pahrump Valley	Discontinue monitoring after 5/03
116				1	3	Pahrump Valley	Inactive domestic well on vacant lot
117			1	1	3	Pahrump Valley	Inactive agricultural well on vacant lot
118		1		1	3	Pahrump Valley	Inactive agricultural well on vacant lot
119		1	1	1	3	Pahrump Valley	Inactive domestic well on vacant lot
120		1	1	1	3	Pahrump Valley	Inactive agricultural well on vacant lot
122	1.00				1	Stewart Valley	Active domestic well
123	1.00				1	Stewart Valley	Active domestic well
124	1				2	Stewart Valley	Active domestic well
125				1	2	Pahrump Valley	Inactive agricultural well on vacant lot
129			1			Pahrump Valley	Active commercial well
130		1	1	1	2	Pahrump Valley	Active domestic well
133			1	1	2	Pahrump Valley	Active domestic well
135			1	1	3	Pahrump Valley	Active domestic well
136		1	1	1	3	Pahrump Valley	Active domestic well
141		1	1		2	Pahrump Valley	Active commercial well
144		1		1	2	Pahrump Valley	Active commercial well
158			1	1	2	Pahrump Valley	Active domestic well
159			1	1	2	Pahrump Valley	Active domestic well
161				1	2	Pahrump Valley	Active domestic well
219	1	1	1			Pahrump Valley	Active domestic well
220		1			2	Pahrump Valley	Inactive domestic well at abandoned Hidden Hills Ranch
229		1			2	Pahrump Valley	Active NDOT well on Tecopa Hwy
276		1	1	1	2	Pahrump Valley	Inactive domestic well
381					2	Pahrump Valley	Active domestic well
21	1			1	1	Amargosa Valley	Active domestic well
28	1		1	1	2	Amargosa Valley	Active commercial well
138	1			1	1	Amargosa Valley	Active domestic well
140	1			1	2	Amargosa Valley	Active domestic well
147	1			1	1	Amargosa Valley	Active domestic well
149	1			1	2	Amargosa Valley	Active domestic well
150	1		1	1	2	Amargosa Valley	Active domestic well
154	1		1	1	2	Amargosa Valley	Active domestic well
157	1		1	1	2	Amargosa Valley	Community Park City well

Table 3
Summary of Water Level Monitoring in Private Wells

Well ID[a]	Number of Measurements					Location	Status
	1999	2000	2001	2002	2003		
174	1			1	2	Amargosa Valley	Active domestic well
176	1		1	1	2	Amargosa Valley	Longstreet Supply well
180	1	1		1	2	Amargosa Valley	Inactive domestic on vacant lot
181	1	1	1	1	1	Amargosa Valley	Active domestic well
182	1	1		1	2	Amargosa Valley	Active domestic well
183	1	1		1	2	Amargosa Valley	Active domestic well
187	1	1		1	1	Amargosa Valley	Active agricultural well
188	1	1		1	2	Amargosa Valley	USGS Gaging station
190	1	1			2	Amargosa Valley	Active domestic well
191	1	1		1	2	Amargosa Valley	Active domestic well
194	1	1	1	1	2	Amargosa Valley	Active domestic well
195	1	1		1	2	Amargosa Valley	Active domestic well
196	1	1		1	2	Amargosa Valley	Inactive agricultural well
197	1			1	1	Amargosa Valley	Active domestic well
199	1			1	2	Amargosa Valley	Active domestic well
206	1		1	1	2	Amargosa Valley	Active domestic well
208	1		1	1	2	Amargosa Valley	Active domestic well
210	1		1	1	2	Amargosa Valley	Active domestic well
212	1		1	1	2	Amargosa Valley	Inactive agricultural well
214	1		1	1	2	Amargosa Valley	Inactive agricultural well
216	1		1	1	1	Amargosa Valley	Active domestic well
353	1		1	1	2	Amargosa Valley	Longstreet Supply well
449			1	1	2	Amargosa Valley	Inactive agricultural well

[a]Well IDs are based upon original survey index number and are not sequential because of censored data.