Nye County Groundwater Evaluation Drilling Program

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Outline

- Groundwater Evaluation program
- Drilling program objectives
- Borehole locations
- Data collection
- Results by geographic location
- Future work
Groundwater Evaluation Program

• Funding provided by DOE for characterization of water resources in southern Nye County
  - Grant number DE-FG52-2006NA27205
  - Original award of $2,477,000 in April 2006
  - Remaining $1,511,000 transferred to NWRPO in April 2010

• Work accomplished under original grant:
  - Geophysical studies and determination of soil characteristics near Ash Meadows (BYU)
  - Established Nye County Water District
  - Construction of groundwater flow model for Pahrump Valley (DRI)

• Work elements developed for remaining funding:
  - Drilling Program (completed)
  - Evapotranspiration study (USGS)
  - Southern Amargosa eEmbedded Model (USGS)
  - Outreach and resource management
Drilling Program Objectives

• In general, the objectives were to infill data gaps in the water level measurement program, better understand geologic controls on ground water flow, and determine aquifer characteristics

• Specific objectives:
  o Pahrump Valley – infill data gaps in WLMP, especially on the Pahrump Fan
  o Amargosa Desert – determine head relationships near the Gravity Fault, collect baseline flow and chemical data
  o Oasis Valley – collect baseline flow and chemical data in areas (far) down gradient from previous nuclear tests

• Provide data to assist Nye County Water District with basic water resource characterization in southern Nye County
Hydro Resources, Inc.

14 boreholes - 4,600 feet total drilled

Two phases of drilling:
- Phase I - May 2010 to June 2010
- Phase II - November 2010 to January 2011
Drilling and Borehole Data Collection

- All data collected under NWRPO Quality Assurance Program
- Drilling
  - All boreholes located on private lands or existing EWDP sites
  - Air foam, conventional circulation
  - 10-inch surface casing set to 20 feet, 8-inch borehole drilled to total depth
  - Boreholes drilled to approximately 100 feet below water table
  - Shallowest borehole was OV-2 (119.8 feet), deepest was PV-1 (610 feet)
- Borehole data collection
  - Cuttings samples collected every 5 feet
  - Sediments logged using USCS descriptions
  - Consolidated rock logged using quantitative descriptions
  - Borehole geophysical logs
    - Open-hole (gamma, resistivity, temperature, caliper)
    - Completion (gamma, temperature, fluid resistivity, density)
Well Completion

• Monitor well completion
  o Wells completed with 4-inch Schedule 80 PVC
  o Original plan was to complete with 4.5-inch PVC, allowing use of higher capacity 4-inch pump during pump testing
  o Sandpack and grout emplaced using tremmie methods
  o Surface completion with protective steel casing, concrete pad, and locking well cap
Pump Testing and Water Sampling

- Work being conducted now
- Pump tests
  - 4-inch casing limited us to use of 3-inch pumps (low flow rates and very little aquifer stress)
  - Step testing
  - Constant discharge testing
- Water chemistry
  - Working with DRI (Reno), DRI (Las Vegas), BYU, and other independent labs to analyze water samples for the following:
    - Major anions and cations
    - Metals
    - Selected isotopes
    - Tritium
    - Strontium
    - Noble gases
Pahrump Water Table Elevation – no GWE wells
Pahrump Water Table Elevation – with GWE wells
Results – Pahrump Valley

- Infill data gaps in water level wells
  - GWE wells and WLMP wells help to refine water level contours within Pahrump Valley
- Pump testing conducted in GWE wells provides additional aquifer information that is lacking in data gap areas
- Water chemistry data will expand on existing regional data set
Amargosa Area Wells and Springs
Amargosa Water Table
Elevation – no GWE wells
Amargosa Water Table Elevation – with GWE wells
Results – Amargosa Desert

- Gravity Fault
  - Thicker sequences on the west side (hanging wall) of the fault, presumably due to accumulation of sediments in down-dropped basins
  - Thinner stratigraphic sequences on the east side
  - Water table elevation on the east side of the Gravity Fault (GF-4) is 74 feet higher than on the west side (GF-3PA)
    - Similar relationships seen in USGS wells to the south where water table elevation at GF-2A on the east side of the Gravity Fault is 87 feet higher than GF-1 located west of the fault
  - Compartmentalized stratigraphy
    - At GF-4 water production at 110 feet in coarse-grained permeable sediments was 75 gpm and at GF-4PA at same depth in less permeable clayey sediments production was 25 gpm
    - Possibly graben-like features bounded by high angle structures act as barriers between sedimentary units with contrasting permeabilities
    - At GF-4 the sediments contain 200 feet of coarse-grained gravel and sand that is absent 60 feet to the west at GF-4PA

- Caution should be taken when generalizing hydrogeologic properties along the trace of the Gravity Fault!
- Need more wells to the north along the Gravity Fault
- Water table elevation contour refinement
Results – Oasis Valley

- **Artesian conditions at OV-1**
  - OV-1 is a flowing artesian well with a head approximately 2 ft above ground surface
  - Located in Oasis Valley spring discharge area

- **Problems with OV-1 completion**
  - Artesian pressure compromised the integrity of grout seal
  - Efforts to contain leak were unsuccessful
  - Current plan is to plug back and abandon

- **OV-2 is a viable well situated within prominent discharge area within Amargosa River channel**
Future Work

- Geophysical survey (TEM, CSAMT, resistivity) transects across the Gravity Fault
- Additional wells straddling the Gravity Fault to examine head relationships
- Incorporate geologic and hydrologic data into SAMM framework as appropriate
- Examine connection between surface water infiltration and groundwater
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Questions?