Welcome to the Public Meeting
Request for a Class 3 Permit Modification for Solid Waste Management Unit 76, Mixed Waste Landfill

What is the purpose of the public meeting?

The US Department of Energy and Sandia Corporation have requested a Class 3 modification to the hazardous waste permit for Sandia National Laboratories.
This meeting is part of the process for a Class 3 permit modification.

Information about Solid Waste Management Unit 76, Mixed Waste Landfill is presented at the poster stations at this meeting.

How do I submit my comments?

There are <u>three ways</u> to submit your written comments on the Class 3 permit modification request.

1. ***Send to: John Kieling, Chief***
   Hazardous Waste Bureau
   New Mexico Environment Department
   2905 Rodeo Park Drive East, Building 1
   Santa Fe, New Mexico 87505

2. ***Send to: John Weckerle***
   U.S. Department of Energy, Sandia Field Office
   PO Box 5400
   Albuquerque, New Mexico 87185
   These comments will be forwarded to John Kieling.

3. ***Use the forms available at this meeting.***
   These comments will be forwarded to John Kieling.

What is the deadline for comments?

All comments must be submitted to <u>John Kieling</u> by 5:00 p.m. MT on Monday, December 29, 2014.

Where can I get more information?

Additional information is available in an an 8-volume set: *Justification for Class 3 Permit Modification for Corrective Action Complete With Controls, Solid Waste Management Unit 76, Mixed Waste Landfill.*

- ***Online at http://repository.unm.edu/***
- ***Paper at the New Mexico Environment Department Hazardous Waste Bureau***
  <u>Located at</u>: 2905 Rodeo Park Drive East, Building 1, Santa Fe, N.M.
  <u>Contact</u>: Pam Allen, 505-476-6064, 505-476-6000, pam.allen@state.nm.us for instructions.
- ***Paper at Zimmerman Library***
  <u>Located at</u>: UNM Main Campus, Albuquerque (see map)
  <u>Instructions</u>: The copy is available as a course reserve at the Reference Desk on Level 1 in the library.
- ***Paper at Centennial Library***
  <u>Located at</u>: UNM Main Campus, Albuquerque (see map)
  <u>Instructions</u>: The copy is available as a course reserve at the Reference Desk on Lower Level 1 in the library.

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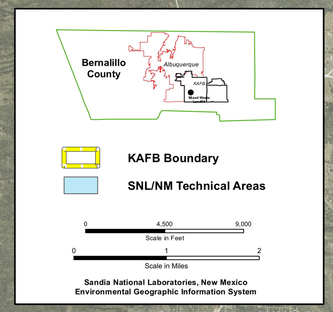
Location of Solid Waste Management Unit 76 Mixed Waste Landfill



1510000 1560000 1610000

1460000

Paseo del Norte

Albuquerque

Eubank Blvd.

Central Avenue

40

25

Albuquerue International Sunport

SNL Technical Area I

SNL Technical Area II

SNL Technical Area IV

KAFB-4

Four Hills Subdivision

Tijeras Arroyo

Sandia Mountains

N

Kirtland Air Force Base

Arroyo del Coyote

Rio Grande

SNL Technical Area V

SNL Technical Area III

SWMU 76 Mixed Waste Landfill

Isleta Amphitheatre

Mesa Del Sol

Buffer Area

KAFB Boundary

US Forest Service Withdrawn Area

Manzanita Mountains

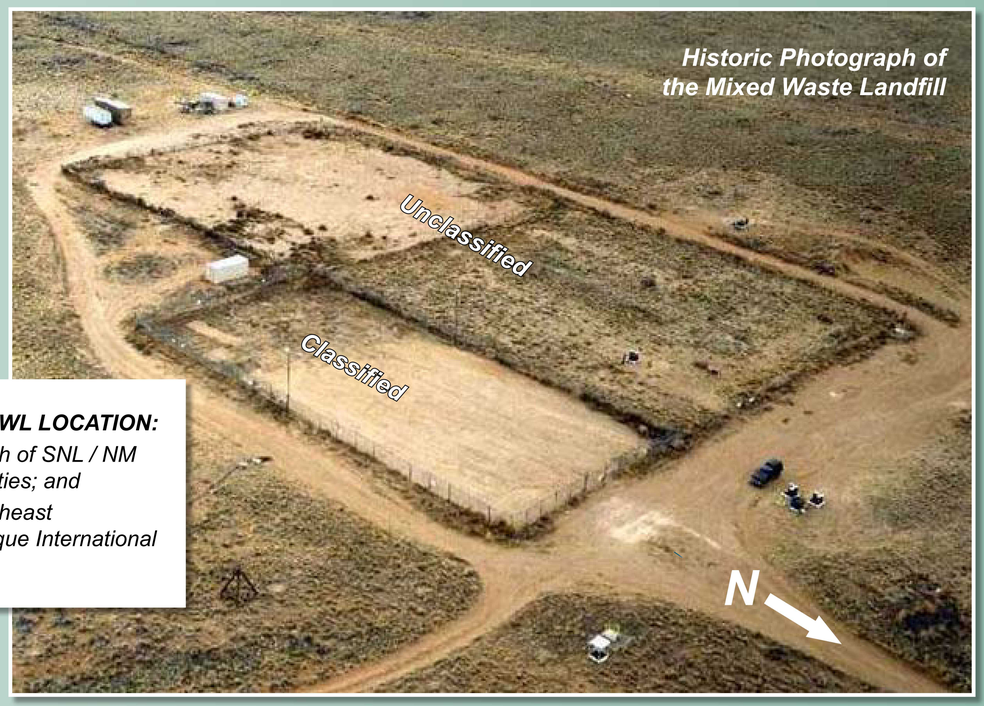
Background Information: Solid Waste Management Unit 76, Mixed Waste Landfill – Where, What, and How Deep to Groundwater?

Where is Solid Waste Management Unit 76, Mixed Waste Landfill?

Solid Waste Management Unit (SWMU) 76, Mixed Waste Landfill (MWL) is located in the north-central portion of Technical Area III at Sandia National Laboratories, New Mexico (SNL/NM), on Department of Energy owned land, within the boundaries of Kirtland Air Force Base.

SWMU 76, MWL LOCATION:

- *4 miles south of SNL / NM central facilities; and*
- *5 miles southeast of Albuquerque International Sunport*



How Deep to Groundwater?

Groundwater occurs approximately 500 feet below the ground surface in fine-grained Santa Fe Group alluvial fan sediments (silt and sand, with clay and some gravel).

The area between the ground surface and the top of the regional groundwater aquifer is approximately 500 feet thick, and is the vadose zone or unsaturated zone. This thick zone is dry (very low soil moisture) and does not contain groundwater.

What is the Mixed Waste Landfill?

The MWL is a 2.6-acre SWMU that consists of two distinct disposal areas: the classified area (occupying 0.6 acres) and the unclassified area (occupying 2.0 acres). Approximately 100,000 cubic feet of low-level radioactive and mixed waste were disposed of in the MWL from March 1959 through December 1988.

- Disposal of free liquids was not allowed, with one exception: the 1967 disposal of 204,000 gallons of reactor coolant water in the unclassified area, Trench D (i.e., ultra-pure water that contained incidental short-lived activation products).
- Wastes disposed of in the classified area include depleted, natural, and enriched uranium; thorium; barium; enriched lithium; liquid scintillation vials and beakers; neutron generator tubes and targets; plutonium-contaminated wastes and weapons test-debris.
- The total plutonium mass in the MWL is very small, estimated to be less than 1 gram.
- Wastes disposed of in the unclassified area included construction and demolition wastes, radioactively-contaminated equipment and soils, lead shielding, wood crates, steel drums, shipping casks, cardboard boxes, and personal protective equipment (e.g., gloves, coveralls, etc.).

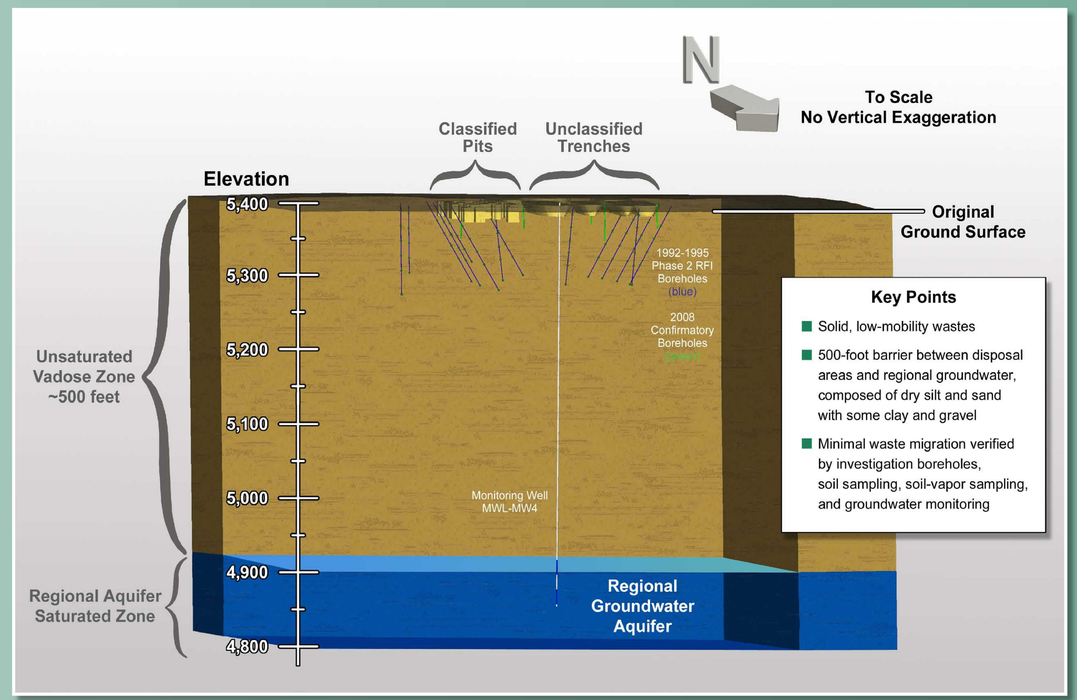
Description of Disposal Areas

CLASSIFIED AREA (0.6 acres):

Solid wastes were buried in cylindrical or square pits, ranging from 3- to 10-feet in width and 15- to 25-feet deep.

UNCLASSIFIED AREA (2.0 acres):

Solid wastes were buried in a series of parallel, north-south excavated trenches approximately 15- to 25-feet wide, 150- to 180-feet long, and 15- to 20-feet deep.



3-D Profile Showing Disposal Areas, Depth to Groundwater, and Investigation Boreholes
Final cover and monitoring networks not shown.

Corrective Action Process for Solid Waste Management Units & Final Order for Corrective Measures for the Mixed Waste Landfill

Resource Conservation and Recovery Act Corrective Action Steps

The following information defines the Resource Conservation and Recovery Act (RCRA) corrective action steps that the Department of Energy (DOE) and Sandia Corporation (Sandia) are required to complete at any Solid Waste Management Unit (SWMU) as mandated in New Mexico environmental regulations and the Compliance Order on Consent.

Construction of the SWMU 76, MWL ET cover, June 2009.

Initial Identification and Assessment

In 1987, the Mixed Waste Landfill (MWL) was identified as SWMU 76 and initial background information was collected and reported to the New Mexico Environment Department (NMED).

Investigation and Characterization of Release(s)

DOE and Sandia conducted a Phase 1 RCRA Facility Investigation (RFI) (1989-1990) and an extensive Phase 2 RFI (1992-1996) to determine the nature and extent of any releases from SWMU 76, MWL.

Evaluation of Corrective Measures Alternatives

A Corrective Measures Study (CMS) to evaluate potential remedial alternatives (i.e., corrective measures alternatives) was performed and submitted to NMED in May 2003.

Selection of Final Remedy and Public Involvement

The following public involvement on the CMS Report and remedy selection occurred in 2004:

- 60-day DOE and Sandia public comment period
- Public meeting
- 120-day NMED public comment period
- 4-day public hearing held by NMED in December 2004

NMED Final Order

On May 26, 2005 the NMED Secretary issued the Final Order, which:

- Selected a vegetative soil cover with bio-intrusion barrier (i.e., an evapotranspirative [ET] cover) as the final remedy
- Included specific requirements for the completion of corrective action

Final Order Requirements for Completing Corrective Measures

Defines the required corrective action steps to complete the corrective action process for SWMU 76, MWL

- **Corrective Measures Implementation (CMI) Plan** to include a construction plan for the ET cover (design drawings and technical specifications), a comprehensive fate and transport model, and monitoring triggers for additional actions during long-term monitoring.
- **CMI Report** documenting construction of the ET cover in accordance with the CMI Plan.
- **Long-Term Monitoring and Maintenance Plan (LTMMP)** specifying monitoring, inspection, maintenance/repair, and reporting to be implemented as part of the final remedy (i.e., long-term controls).
- **5-Year Reevaluation Reports** assessing the feasibility of excavation and analyzing the effectiveness of the final remedy. Note: first report must be submitted to NMED by January 8, 2019; 5 years after NMED approval of the LTMMP, as clarified by NMED on October 14, 2011 in the CMI Report approval letter.
- **Public participation process** to ensure continuing opportunities for public input after implementation and completion of the final remedy.

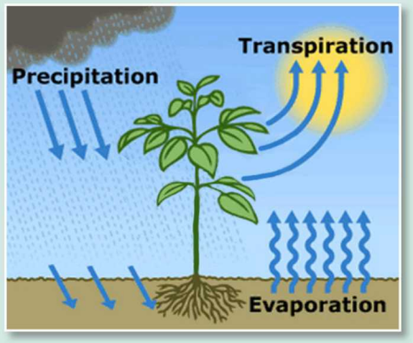
Phase 2 RFI drilling & sampling operations.

What is an evapotranspirative (ET) landfill cover and how does it protect human health and the environment?

What is an evapotranspirative landfill cover?

A vegetative soil cover based on the process of evapotranspiration.

e • vap • o • trans • pi • ra • tion
(i vap′ ō tran′ spə rā′ shən)
n. the process of transferring moisture from the earth to the atmosphere by **evaporation** of water and **transpiration** from plants.



Why was an evapotranspirative cover selected as the final remedy?

The vegetative soil cover with a biointrustion layer selected by the New Mexico Environment Department as the final remedy for Solid Waste Management Unit (SWMU) 76, Mixed Waste Landfill (MWL) is an alternative evapotranspirative (ET) cover that meets the intent of the regulations. It is effective because of the thick, dry vadose zone beneath SWMU 76, MWL (approximately 500 feet from the surface to regional groundwater) and the semi-arid climate of the area, which is characterized by:

- Low precipitation (approximately 8 inches annually in Albuquerque)
- Low relative humidity (i.e., very dry atmosphere)
- High potential evapotranspiration

In accordance with the Resource Conservation and Recovery Act (RCRA) landfill regulations, the Environmental Protection Agency (EPA) accepts alternative landfill cover designs that consider site-specific conditions, such as climate and the nature of the waste, and also meet the intent of the regulations.

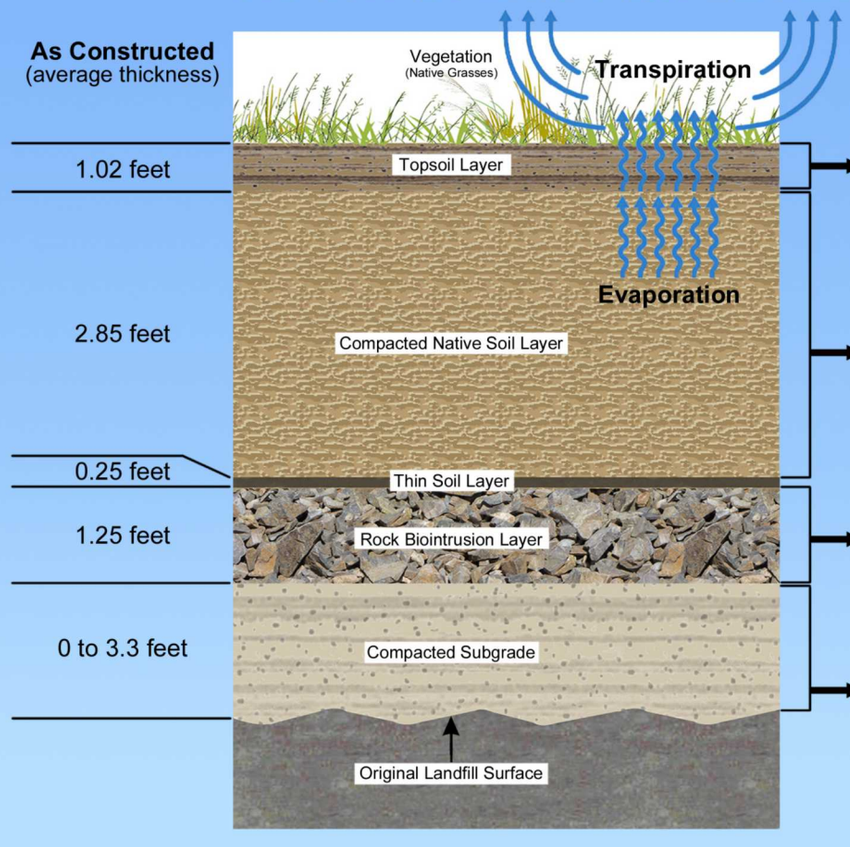
U.S. Environmental Protection Agency (EPA), 1991. "Design and Construction of RCRA/CERCLA Final Covers," EPA/625/4-91/025, U.S. Environmental Protection Agency, Washington, D.C.

What are the goals of any landfill cover according to EPA guidance?

The goals of the EPA-recommended cover design are:

- Protect human health and the environment
- Minimize the contact of waste with water
- Minimize maintenance
- Ensure that all cover componenets are stable
- Ensure that the cover performs as intended

How does the Mixed Waste Landfill ET Cover work?



The processes of evaporation and transpiration apply to both the Topsoil and the Native Soil Layers.

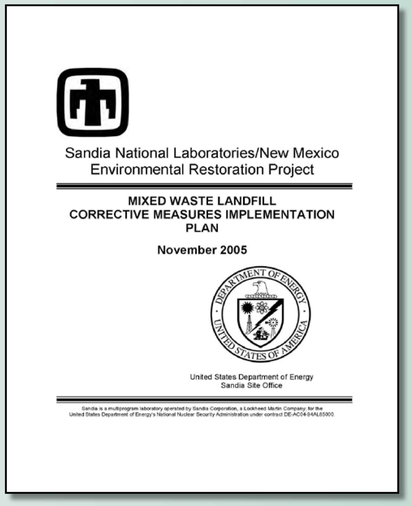
The Topsoil Layer acts as the primary sponge or reservoir that holds precipitation and supports the growth of native grasses that stabilize the surface (i.e., erosion control).

The Compacted Native Soil Layer acts as a secondary sponge or reservoir that holds precipitation that percolates downward through the topsoil layer.

The Biointrusion Layer creates a barrier for burrowing animals to prevent them from digging into the disposal areas.

The Compacted Subgrade creates a stable, level surface over the disposal areas; the foundation of the ET cover.

Corrective Measures Implementation Plan



Sandia National Laboratories/New Mexico
Environmental Restoration Project

**MIXED WASTE LANDFILL
CORRECTIVE MEASURES IMPLEMENTATION
PLAN**

November 2005

United States Department of Energy
Sandia Site Office

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Refer to the Station 3 Fact Sheet and General Information Handout for more information on the Corrective Measures Implementation Plan.

Corrective Measures Implementation Plan

The Corrective Measures Implementation (CMI) Plan details the construction process and specifications for the final remedy selected by the New Mexico Environment Department: a vegetative soil cover with biointrusion layer (herein referred to as the evapotranspirative [ET] cover).

A comprehensive fate and transport modeling report was also prepared and included as Appendix E, as required by the Final Order to address uncertainty associated with the landfill inventory characterization data.

Why is the ET Cover the appropriate final remedy?

- Protects the disposal areas by minimizing water migration downward through the cover.
- Accommodates subsidence and minimizes maintenance by using a cover comprised of native soil processed to meet design specifications and suited to the semi-arid climate.
- Minimizes cover erosion by incorporating erosion control measures in the design, including: a central crown, gentle slopes, and native vegetation.

Refer to Station 2 for more information on the ET cover.

Performance of the ET Cover

Performance of the cover is integrated with natural site conditions to ensure the ET cover performs effectively while requiring minimal maintenance. Natural site conditions that will enhance performance of the ET cover include:

- Low precipitation and high potential evapotranspiration.
- Negligible recharge to groundwater. Chloride data collected from boreholes at the MWL indicate precipitation has not percolated beyond the upper 20 feet of soil for tens of thousands of years.
- A 500-foot thick vadose zone between the disposal area and groundwater.
- Low potential for volcanic and seismic activity, with low hazard potential.

Corrective Measures Implementation Plan—Fate and Transport Model

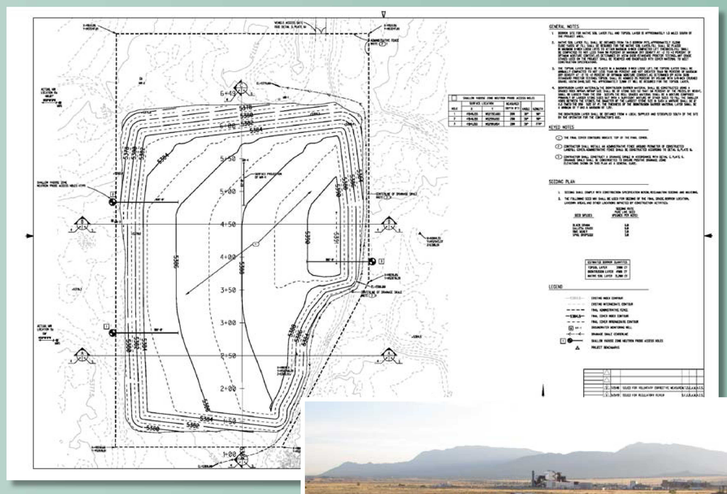
The report documents a fate and transport computer modeling process that was used to estimate and predict the potential movement of contaminants in the subsurface soils beneath Solid Waste Management Unit (SWMU) 76, Mixed Waste Landfill (MWL) under various scenarios.

- Modeling provides a technical basis for long-term monitoring requirements and trigger levels to ensure the protection of groundwater, human health, and the environment. See Station 5 for more information on the LTMMP.
- Modeling addresses public concerns and uncertainty associated with the SWMU 76, MWL inventory and characterization data.

The CMI Plan Fate and Transport Modeling Report addressed and improved upon previous modeling efforts, with the following conclusions.

- Site conditions at SWMU 76, MWL over the next 1,000 years will remain protective of groundwater, human health, and the environment.
- Based on the modeling performed, it is possible that various parameters (tritium and radon in air, and tetrachloroethene [PCE] in groundwater) could exceed regulatory standards at the site. However, the modeling demonstrates that these exceedance scenarios are very unlikely and can be prevented through long-term monitoring and corrective action, if necessary.

To address the very low potential for regulatory exceedances, long-term monitoring and trigger levels were developed and included through the long-term monitoring and maintenance plan (LTMMP) to provide early detection of changing conditions and to require the timely implementation of appropriate corrective action to ensure the protection of groundwater, human health, and the environment. <u>See Station 5 for more information</u>.



As-built engineering drawing of the ET cover.

ET cover Topsoil Layer after placement in August 2009.

Field infiltration testing – results used for ET cover performance modeling presented in the CMI Plan.

Corrective Measures Implementation Plan

Corrective Measures Implementation Plan—Soil-Vapor Investigation

In the November 2006 Notice of Disapproval on the Corrective Measure Implementation (CMI) Plan, New Mexico Environment Department (NMED) added a requirement (i.e., not included in the Final Order) for a field investigation of soil-vapor volatile organic compounds (VOCs), tritium, and radon ***to confirm earlier investigation results (1994-1997) and address public concerns about new releases.***

Soil-Vapor Field Investigation Summary of Results

The Soil-Vapor Field Investigation was completed in April and May 2008, and the results are summarized below. NMED approved the Soil-Vapor Investigation Report in September 2008.

- Radon emissions from SWMU 76, MWL and background areas had not significantly changed since 1997 and remain at background concentrations.
- In general, tritium activities were higher than those in the 1995 samples. These higher results were expected because the 2008 samples were collected in different locations than the 1995 samples, in closer proximity to waste pits and trenches.
- Overall VOC concentrations in soil vapor declined substantially since 1994.
- Results confirm the earlier results and are consistent with the conceptual model of SWMU 76, MWL.

Soil-Vapor Investigation sampling activities in April-May 2008.

Soil-vapor sampling and new monitoring well drilling (background) in May 2008.

Corrective Measures Implementation Plan—Subgrade Preparation

During the CMI Plan review and approval process, Department of Energy and Sandia Corporation began initial preparations for construction of the evapotranspirative (ET) cover.

From June through October 2006, native soil fill material was excavated and mechanically screened to less than 2-inches in the SNL/NM Technical Area III borrow pit.

The Subgrade (ground surface upon which the ET cover is constructed) was prepared by removing existing vegetation and leveling the ground surface by placement and compaction of mechanically screened and tested native soil material.

Subgrade protective measures were installed (erosion control matting) in April 2007 while waiting for final approval of the CMI Plan.

Subgrade preparation field work in October 2006 – removal of existing vegetation prior to leveling the ground surface.

Excavating and screening soils at the SNL/NM Technical Area III borrow pit area in June 2006 to be used for subgrade and ET cover construction.

Subgrade preparation in October 2006 – placement and compaction of soil to level the ground surface.

December 20, 2006 snowfall at the MWL.

Corrective Measures Implementation & Report

Deployment of the Evapotranspirative Cover

After receiving conditional approval of the Corrective Measures Implementation (CMI) Plan on December 22, 2008, from the New Mexico Environment Department (NMED), construction of the evapotranspirative (ET) cover was completed from May 20 through September 3, 2009. *The overall footprint of the ET cover is 4.1 acres including side slopes.*

ET cover consists of three main layers (biointrusion barrier, compacted native soil, and topsoil layers) installed over the compacted subgrade.

Combined average thickness of the overlying ET Cover layers (Biointrusion, Native Soil, and Topsoil Layers) is 5.37 feet – approximately 1.2 feet thicker than the minimum design thickness.

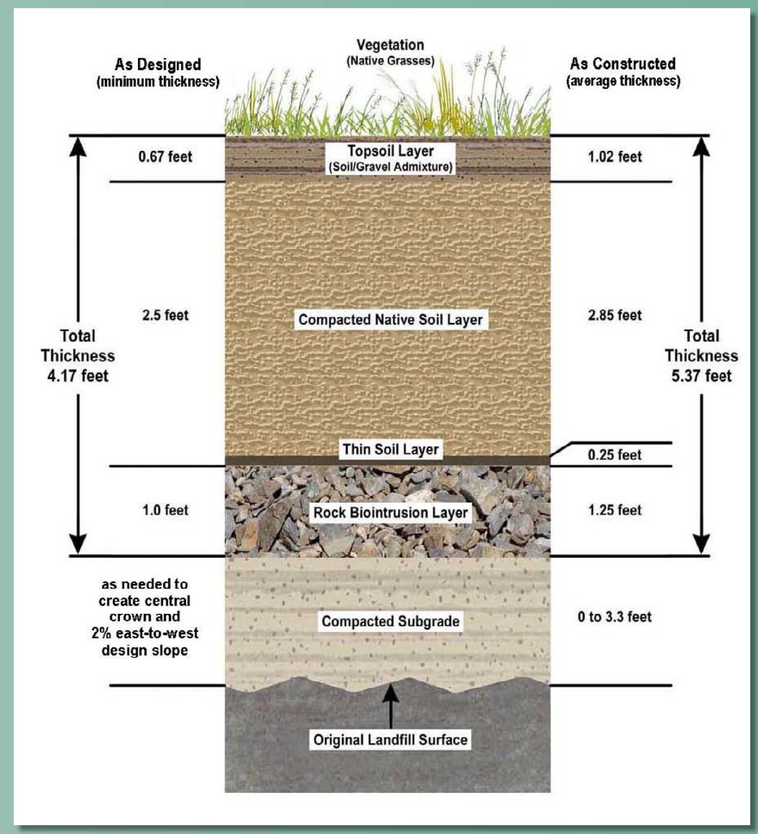
All cover layers meet CMI Plan specifications based upon:

- 113 laboratory tests (Standard Proctor, Gradation, Classification, and Saturated Hydraulic Conductivity);
- 271 field tests (in-place density and moisture); and
- Visual inspections.

Drill seeding the Topsoil Layer with native grass mixture, north side slope.

Topsoil Layer after completion but prior to seeding.

View to west of MWL ET cover with native grasses established in September 2011.



Schematic Diagram of the Mixed Waste Landfill Alternative Evapotranspirative Cover.

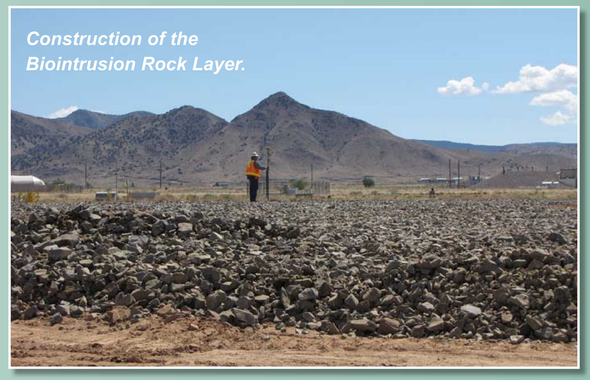
CMI Report

- CMI Report meets the requirements stipulated in the Final Order, the CMI Plan, and the December 2008 NMED conditional approval for the CMI Plan.
- The CMI Report documents that the deployment of the ET cover was performed in accordance with the requirements, specifications, and design drawings presented in the CMI Plan.
- The MWL Alternative Cover Report (Appendix A of the CMI Report) is certified by a New Mexico registered Professional Engineer and provides all required construction quality control documentation.
- With NMED approval of the CMI Report in October 2014, the Long-Term Monitoring and Maintenance Plan in January 2014, and Technical Area III Borrow Pit reclamation in June 2014, all conditions of the December 2008 CMI Plan conditional approval have been met.

ET Cover Design

- All ET cover construction activities were observed, inspected, and approved by an independent third-party Construction Quality Assurance (CQA) contractor.
- All design changes were identified, documented, and resolved in consultation between the Sandia Project Staff, the Construction Team, and the CQA Team.
- Overall, the design changes resulted in a thicker, more protective ET cover.

Placement of engineered fill to construct the Native Soil Layer.



Construction of the Biointrusion Rock Layer.

ET Cover Layer	Average Thickness of Layer	Volume of In-Place Material
Subgrade	0 to 3.3 feet	7,700 cy of native soil (compacted)
Biointrusion Layer	1.25 feet	6,800 cy of angular rock (compacted)
Biointrusion Layer void space fill and thin overlying soil layer	0.25 feet	2,600 cy (compacted)
Native Soil Layer	2.85 feet	17,300 cy (compacted)
Topsoil Layer	1.02 feet	5,400 cy (minimally compacted)
Grand Totals		**Soil Fill = 33,000 cy Rock = 6,800 cy**

cy = Cubic Yards

Long-Term Monitoring and Maintenance Plan Monitoring & Trigger Level Process, Reporting, and Future Public Participation

Long-Term Monitoring and Maintenance Plan—Monitoring and Trigger Level Process to Address Potentially Changing Conditions

The final remedy long-term controls for Solid Waste Management Unit (SWMU) 76, Mixed Waste Landfill (MWL) are defined in the Long-Term Monitoring and Maintenance Plan (LTMMP) and were implemented in January 2014 after the New Mexico Environment Department (NMED) approved the LTMMP.

- The LTMMP Multi-Media Monitoring Program defines the collection of field data necessary to determine if site conditions are changing.
- If monitoring trigger levels are exceeded, timely corrective action is required to ensure the protection of groundwater, human health, and the environment.

Reporting Requirements

Annual reports documenting all monitoring, inspection, and maintenance/ repair activities and results must be submitted to NMED by June 30 of each calendar year. The annual reporting period is defined as April 1 through March 31 of the following year.

- *First MWL Annual Long-Term Monitoring and Maintenance Report was submitted to NMED in June 2014 and was approved by NMED in August 2014.*

Every 5 years after NMED approval of the LTMMP, the Department of Energy (DOE) and Sandia Corporation (Sandia) will prepare and submit a Reevaluation Report analyzing the effectiveness of the evapotranspirative (ET) cover and reevaluating the feasibility of excavation.

- *Monitoring results will be used to update the fate and transport model and to evaluate the likelihood of contaminants reaching groundwater.*
- *First 5-Year Reevaluation Report will be submitted to NMED by January 8, 2019.*

Future Public Participation

DOE and Sandia make the Annual Long-Term Monitoring and Maintenance Reports and 5-Year Reevaluation Reports available both in hard copy and electronic (PDF) format through the Government Documents Section at Zimmerman Library on the University of New Mexico main campus in Albuquerque.

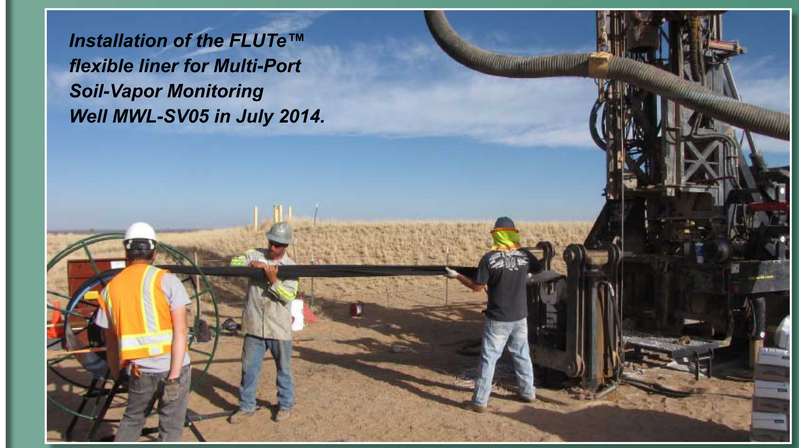
- *See Station 1 for detailed information on how to access SWMU 76, MWL documents from the Zimmerman Library.*

Reevaluation Reports will incorporate monitoring results to update the fate and transport model originally presented in the Correcting Measures Implementation Plan and to evaluate the likelihood of contaminants reaching groundwater.

- *NMED will provide a process so members of the public may comment on the reports.*
- *NMED is responsible for responding to public comments and final approval of the reports.*

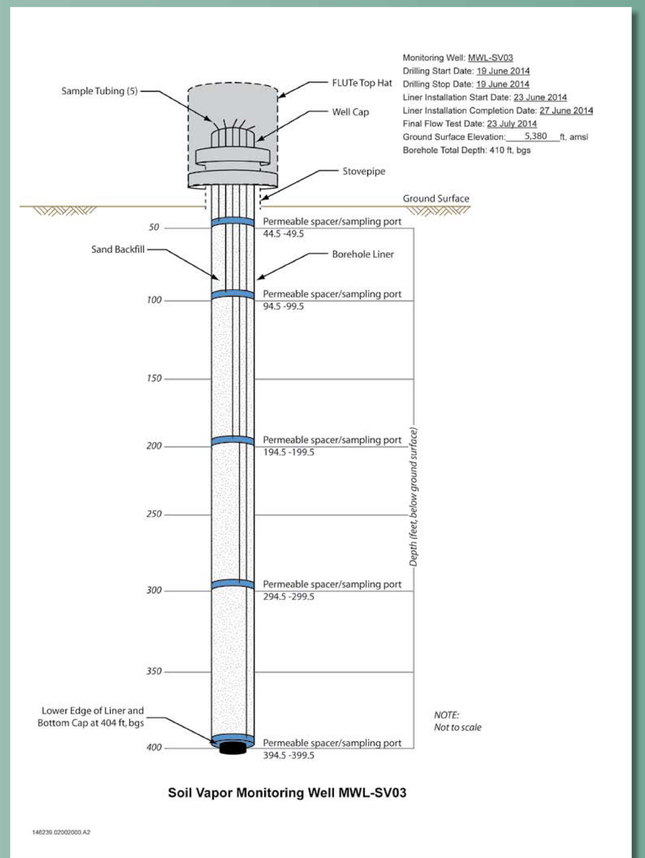
Groundwater monitoring truck with sampling pump and water level meter deployed in a monitoring well.

Drilling and FLUTe™ Soil-Vapor Monitoring Well Installation in July 2014.



Installation of the FLUTe™ flexible liner for Multi-Port Soil-Vapor Monitoring Well MWL-SV05 in July 2014.

Flow testing of FLUTe™ multi-port soil-vapor monitoring well after installation in July 2014.



Schematic Diagram of FLUTe™ Multi-Port Soil-Vapor Monitoring Well

Solid Waste Management Unit 76, Mixed Waste Landfill Groundwater Documents and Studies

Background Information

The regional groundwater aquifer beneath Solid Waste Management Unit (SWMU) 76, Mixed Waste Landfill (MWL), is located approximately 500 feet below ground surface.

- The upper surface of the aquifer occurs in the fine-grained alluvial fan sediments of the Santa Fe Group (predominantly silt and sand with some clay and gravel) approximately 500 feet below ground surface.
- Coarser-grained sediments of the Ancestral Rio Grande (ARG) are present approximately 520 to 550 feet below ground surface.

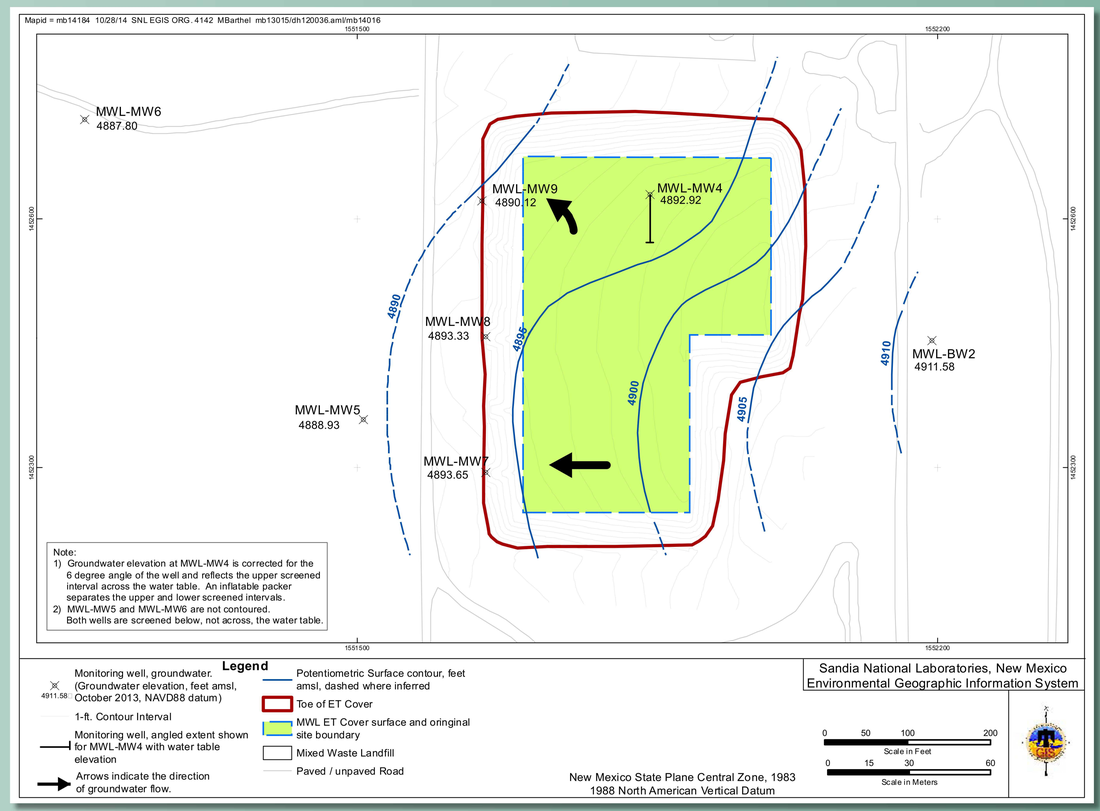
The current groundwater monitoring network at SWMU 76, MWL consists of 4 compliance wells and 3 groundwater elevation wells.

- **Long-Term Monitoring and Maintenance Plan (LTMMP) Compliance Groundwater Monitoring Wells:** MWL-BW2, MWL-MW7, MWL-MW8, MWL-MW9 were installed in 2008 with their well screens across the uppermost part of the regional aquifer in the Santa Fe Group deposits (i.e., designed to monitor the top of the regional aquifer).
- **Groundwater Elevation Monitoring Wells:** MWL-MW5 and MWL-MW6 are installed in the deeper, coarse-grained ARG deposits (well screens beneath the uppermost part of the regional aquifer) and well MWL-MW4 is installed at an angle of 6 degrees from vertical with two discrete screen intervals separated by a packer (i.e., the screens are isolated); one in the fine-grained Santa Fe Group sediments (screen across the top of the aquifer) and one in the deeper ARG sediments (screen below the top of the aquifer).
  - Used to monitor groundwater elevation only.

Since groundwater monitoring began at SWMU 76, MWL in 1990, the level (i.e., elevation) of the upper surface of the regional aquifer (i.e., water table) has declined approximately 12 feet due to large-scale groundwater withdrawals by Kirtland Air Force Base and the City of Albuquerque. From 1990 through 2002 the average rate of decline was approximately 0.8 feet per year. Since 2002, the rate of groundwater elevation decline has been lower, less than 0.4 feet per year.

- Recharge from infiltration of direct precipitation at the MWL is negligible due to high evapotranspiration, low precipitation, the depth to groundwater (approximately 500 feet).
- Groundwater recharge of the regional aquifer occurs by the infiltration of precipitation in the Manzanita Mountains located to the east.

Groundwater monitoring has been performed and reported annually since the 1990s as required by the Compliance Order on Consent. Several groundwater studies have been performed at SMWU 76, MWL and are described below. Current groundwater monitoring requirements, as of January 8, 2014, are defined in the New Mexico Environment Department (NMED)-approved LTMMP (see Station 5).



Location of SWMU 76, MWL Groundwater Monitoring Wells and the elevation of the upper surface of the regional aquifer at SWMU 76, MWL.

NMED Groundwater Data Evaluation Report

During the public comment period of the Corrective Measures Implementation Plan (December 9, 2005 through June 8, 2006), members of the public expressed the following concerns regarding bentonite drilling muds that were used in the drilling process for some of the original groundwater monitoring wells (MWL-BW1, MWL-MW2, and MWL-MW3; note these wells were decommissioned and replaced with new wells in 2008):

- Drilling muds may have removed (adsorbed) contaminants from the groundwater and also reduced the local aquifer permeability in the vicinity of the monitoring wells.
- Residual organic additives may have caused localized conditions around the well bore that chemically affected the groundwater sample results.

To address these concerns, NMED conducted a detailed study titled “Evaluation of the Representativeness and Reliability of Groundwater Monitoring Well Data, Mixed Waste Landfill.” The NMED report evaluated 16 years of groundwater monitoring results and numerous groundwater studies, and concluded the following:

- The MWL groundwater monitoring well network provides data that are reliable and representative.
- The totality of evidence indicates that the three monitoring wells that were installed with mud rotary method (MWL-BW1, MWL-MW2, and MWL-MW3), and air rotary well MW5 have yielded reliable and representative data.

The report is available on the NMED website: http://www.nmenv.state.nm.us/HWB/snlperm.html#M.

Solid Waste Management Unit 76, Mixed Waste Landfill Groundwater Documents and Studies

Groundwater Monitoring Well Network Installation in 2008

The Solid Waste Management Unit (SWMU) 76, Mixed Waste Landfill (MWL) groundwater monitoring network was modified in 2008 due to declining water levels (i.e., the wells no longer produced sufficient groundwater for a representative sample) and corrosion of the stainless steel screens (i.e., as evidenced by detection of elevated metals, including nickel and chromium, in unfiltered groundwater samples).

- Monitoring wells MWL-BW1, MWL-MW1, MWL-MW2, MWL-MW3, all constructed with stainless steel screens, were decommissioned (i.e. plugged and abandoned)
- New groundwater monitoring wells MWL-BW2, MWL-MW7, MWL-MW8, and MWL-MW9 were installed with polyvinyl chloride (PVC) well screens across the top of the regional aquifer in the fine-grained Santa Fe Group sediments.
- Installation of new wells was completed in May 2008 and approved by NMED in October 2008 and January 2009.

Lower groundwater elevations (approximately 20-foot decrease) were observed in wells MWL-MW7, MWL-MW8, and MWL-MW9 after installation along the western perimeter relative to the previous wells (MWL-MW2 and MWL-MW3). This is related to the following factors:

- Screen sections in the 2008 wells are installed deeper in the aquifer, where the movement of groundwater is faster (i.e., higher hydraulic conductivity of the sediments).
- Increasing hydraulic conductivity of the alluvial sediments with depth and the declining aquifer surface due to large-scale groundwater withdrawals by Kirtland Air Force Base and the City of Albuquerque drinking water supply wells.
- Overall effect is that groundwater moving downward, toward the more conductive (i.e., faster flowing) part of the regional aquifer where groundwater withdrawals are occurring (i.e., a draining system).

Toluene Investigation, 2009-2010

During Calendar Year 2009, toluene was detected in groundwater samples collected from all four of the new groundwater monitoring wells installed in 2008 (MWL-BW2, MWL-MW7, MWL-MW8, and MWL-MW9). Toluene concentration ranges were consistent with historical monitoring results (i.e., very low); however, the frequency of detections was higher in 2009 with no unusual indications of laboratory contamination.

- In 2009 and 2010 the Department of Energy (DOE) and Sandia Corporation (Sandia) investigated the source of the toluene.
- The New Mexico Environment Department (NMED) provided further direction in a letter dated April 30, 2010, for conducting a purging/sampling study of the groundwater along with any other studies necessary to determine the toluene source(s).
- The investigation results indicate SWMU 76, MWL is not the source of the toluene.
- NMED approved Toluene Investigation Report in January 2011.

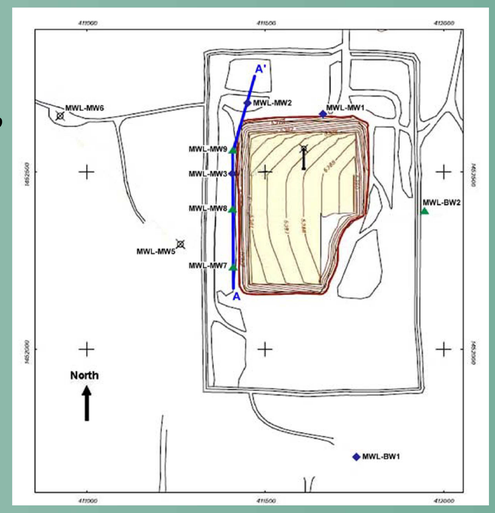
See the Station 6 Fact Sheet for more detailed information.

Monitoring Well MWL-MW4 Metals Investigation

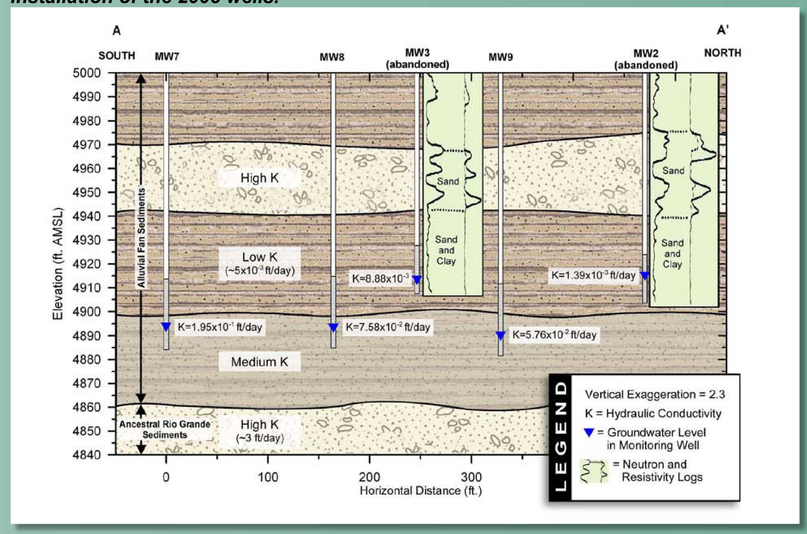
On May 20, 2014, DOE and Sandia submitted filtered and unfiltered metals results for groundwater samples collected in 2013 from monitoring well MWL-MW4. This report addressed unfiltered metals results (chromium, cobalt, copper, iron, and nickel) that showed a significant concentration increase in the 2013 samples.

- Because of the construction of MWL-MW4 (6° angle and 2 well screens separated by packer), it is the only well with a stainless steel sampling pump that is not removed between sampling events (i.e., a dedicated to the well).
- Increases in unfiltered concentrations of chromium, cobalt, copper, iron, and nickel are indicative of a source within the well and are consistent with unfiltered metals results from previous MWL monitoring wells that had corrosion issues related to stainless steel well screens (i.e., MWL-BW1, MWL-MW1 through MWL-MW3).
- Source of the 2013 elevated unfiltered metals concentrations was corrosion by-products from the dedicated stainless steel sampling pump as confirmed by purging and sampling the well over a 3-week period in September 2014 following NMED recommendations.

Profile Location Map



North – South profile showing the 20-foot difference in the groundwater elevation between the older wells (MWL-MW2 and MW3) and 2008 wells (MWL-MW7, MW8, and MW9) after installation of the 2008 wells.



Notes:
1) Profile starts at an elevation of 5000 feet above mean sea level for simplicity. Actual ground surface is 370 to 390 feet higher.
2) Green boxes adjacent to decommissioned wells MWL-MW2 and MWL-MW3 show geophysical logging information used to determine the subsurface geology when they were installed.
3) Profile shows how the 2008 monitoring well screens penetrate the deeper "Medium K" layer beneath the "Low K" layer (K = hydraulic conductivity, the measure of how easily groundwater flows through the sediments).
4) 2008 well screens installed with the top of the screen interval overlapping where groundwater level was observed in the older wells to ensure they monitor "the uppermost part of the regional aquifer" in accordance with the regulations.

Visible corrosion of the MWL-MW4 dedicated stainless steel sampling pump when replaced in May 2009.