Department of Energy
Office of Legacy Management

DEC 0 8 2010

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Deputy Director
Mail Stop T8F5
Washington, DC 20555-0001

Subject: Tuba City UMTRCA Site Status

To Whom it May Concern:

The Tuba City, Arizona, Uranium Mill Tailings Radiation Control Act (UMTRCA), Title I site, has been shut down temporarily following an incident in which one of the critical unit operations was compromised and will have to be repaired before the site can resume operation. The U.S. Nuclear Regulatory Commission and the Navajo UMTRA staffs were alerted to the information herein verbally on November 23, 2010.

During a routine delivery of concentrated sulfuric acid to the site, there was a minor spill of acid when the storage tank was overfilled, which necessitated the release of a minor amount of fluid to provide headspace in the tank. Operation of the outlet valve caused a minor leak to develop behind the valve, and eventually the entire tank contents were emptied into secondary containment and thence to the evaporation pond. The employee turning the valve had a small amount of acid splash on his face behind a face shield as he turned away; he was transported to the local hospital, treated and released with a minor skin burn. This has all been reported through the U. S. Department of Energy (DOE) Occurrence Reporting and Processing System. Because the leak developed behind the shutoff valve, the safest option was to allow the tank contents to drain into the secondary containment, while diluting it with site water, which then reported to the evaporation pond. The leak was slow enough to take over a week to drain the full tank.

The amount of acid released to the pond was the full tank volume of 3000 gallons, of 98 percent sulfuric acid. Due to dilution, this acid input to the pond did not significantly change the pH of the pond. The added volume did not significantly change the current level of the pond. Because all material remained within the site operational boundaries, no report of a 'release' was made or is necessary. The DOE is currently performing an investigation into the tank overflow event. Corrective Actions will be implemented to preclude similar events in the future.

In order to put the plant back into operation the tank will need to be repaired or replaced, and a cost estimate is in development. The site will be in shutdown mode per the site operations

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manual until further notice. Meanwhile a number of non-routine and routine maintenance items will be addressed. None of the Navajo staff will be released as a result of the shutdown.

The possibility of plume movement was explored by use of a hydrologic model for the site, considering a lengthy shutdown as a conservative estimate. Under any conceivable scenario, the plume will not move more than a few feet, and this pause may indeed prove beneficial to recovery of the downgradient extraction wells, flushing more contaminants from the soil column. This modeling effort is included as an enclosure for your reference. In any event these few wells at the furthest downgradient locations could continue to extract contaminated groundwater and report it directly to the pond without treatment to prevent plume migration without impacting the pond level or content. The next semi-annual sampling event is planned for February, and if any out of the ordinary plume movement is observed, this contingency will be implemented.

As a result of this and other similar minor incidents at the site during normal operations, DOE is considering the plant configuration, operation and maintenance, and whether it remains the best option long term. Other options under consideration include reverse osmosis or ion exchange for removal of contaminants of concern. In order for another option to be seriously considered further consultation with the affected Navajo Nation and Hopi Tribe would be planned.

Please contact me if you have any questions regarding this event or interim plans. My contact information is as follows:

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Sincerely,

Richard P. Bush
Site Manager

Enclosure

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D. Gail, Stoller (e)
C. Jacobson, Stoller (e)
S. Osborn, Stoller (e)
File: TUB 30.10 (DOE)

Position Paper
Tuba City Disposal Site
November 12, 2010

Subject: temporary shutdown of the groundwater remediation system

Problem Statement
Evaluate the effects on groundwater containment from an indefinite shut down of the groundwater remediation system at the DOE LM Tuba City Disposal Site, Tuba City, Arizona.

Background Information
Groundwater remediation by DOE, using pump-and-treat technology, began in mid-2002 to remove contaminants in the Navajo Sandstone aquifer associated with historical processing of uranium ore at the site between 1956 through 1966. Ore processing required the use of large amounts of water. The shallow groundwater flow regime during ore processing was therefore much different than was present before and after ore processing. The primary contaminant of concern is uranium. Site features are shown in Figure 1 (Note: injection wells identified in Figure 1 are not used for that purpose).

Uranium isopleths shown in Figure 2 depict the recent uranium plume, as interpolated from February 2010 monitoring data. All of the information provided in this report is based on the information presented in annual groundwater reports prepared by DOE to assess the performance of the groundwater remediation system in meeting established water quality restoration objectives (see for example *Annual Groundwater Report, April 2009 through March 2010, Tuba City, Arizona, Disposal Site*, July 2010). Recipients of the annual reports include the Nuclear Regulatory Commission, Navajo UMTRA, Navajo EPA, Hopi Tribe, Navajo Department of Justice, and the Tuba City Library.

The groundwater remediation system has operated for nearly nine years under an aggressive scenario of groundwater capture in the main area of the contaminant plume. Groundwater capture is followed by treatment by mechanical distillation. Distillate is returned to the aquifer by way of an infiltration trench located at the upgradient margin of the contaminant plume. Waste byproduct (brine) is placed in a double-lined engineered evaporation pond and does not impact the groundwater setting.

Groundwater extraction has resulted in significant water table drawdown, removal of a significant volume of contaminated groundwater, removal of significant mass of contaminants, and in effectively containing the bulk of the contaminant plume. The remedial action has not resulted in a noticeable decrease in the lateral extent of the contaminant plume nor in significant reduction or downward trending in contaminant concentrations. A steady state water table has not yet been attained in the affected area of the aquifer.

The distal portion of the contaminant plume, characterized by relatively low contaminant concentrations, is known to extend beyond the capture zone of the current extraction

system. Migration of this portion of the plume has not been observed despite its location beyond the capture zone of the remediation system during full operation. Figure 3 shows the estimated groundwater capture zone under the latest pumping conditions compared to the estimated extent of uranium contamination in groundwater exceeding the remediation goal (44 µg/L).

It is expected that a shutdown of the remediation system will allow water levels in the current capture zone to equilibrate toward per-pumping conditions. In response, an increase in contaminant concentrations may be expected resulting from natural factors such as dual domain mass transfer and geochemical interaction between contaminant and aquifer matrix. These factors, inherent to contaminant fate and transport in groundwater, represent potential limitations to groundwater pump-and-treat technology in general.

Technical Issues

(1) Estimate the time for the water table to recover following cessation of groundwater withdrawal.

(2) Estimate the extent that contaminants will migrate in groundwater following cessation of groundwater withdrawal.

(3) Evaluate the effect of continued groundwater extraction at distal wells as a plume containment strategy during a general system shutdown.

Technical Analysis

(1) A groundwater flow model using MODFLOW was developed to evaluate water table recovery time from current pumping conditions. The model is a very generalized representation of site conditions. Formal documentation of the model is scheduled to be provided to DOE in March 2011. The model predicts that water table recovery will approach pre-pumping conditions within several years of system shutdown. Figures 4 and 5, respectively, illustrate the predicted water table configuration under pumping conditions before system shutdown and after three years of system shutdown.

(2) The groundwater flow model applied a particle tracking scheme (MODPATH) to estimate the travel distance of groundwater in the area of the contaminant plume that is beyond the current capture zone. The analysis represents the distance a water molecule (or a dissolved contaminant phase) will move by advective transport. Figure 6 illustrates particle tracking results at five years after system shutdown. Particles are predicted to travel a distance of approximately 50 feet in that time, at an average rate of 10 feet per year.

An analytical estimate of travel time provides a similar result (12 feet per year). This estimate is based on a calculated average linear flow velocity derived from Darcy's Law. In this estimate the average linear velocity (v) is a product of the saturated hydraulic conductivity (K) and hydraulic gradient (i), divided by the effective porosity (n). Input values for this estimate are

K=0.4/ft/d (pumping tests mean value documented in *Final Site Observational Work Plan for the UMTRA Project Site Near Tuba City, Arizona*, September 1998); i=0.017 (del head=50ft, del x=3000ft; scaled off site map using pre-pumping water table elevations at wells parallel to flow); and, n=0.2 (assumed)

(3) Continued operation of the distal groundwater extraction wells (wells 1126 – 1131, see Figures 1) while the remainder of the treatment system is shut down is feasible as a measure of plume containment. However, the measure of containment is probably small. These wells appear to have minimal impact on groundwater capture in this region of the aquifer.

The combined flow rate of these wells totals about 2 gallons per minute. The available capacity of the evaporation pond (4 million gallons) would indefinitely accommodate the inflow from these wells at this rate and assuming a conservative rate of evaporation from the pond of 5 gallons per minute.

Summary

Discontinuing active groundwater remediation will not have a significant adverse effect on containment of the groundwater contaminant plume. This assessment is based on historical information on plume development, observations that active remediation has had little impact on the extent of the plume, and on groundwater modeling.

DOE may consider using the system shutdown as an opportunity to monitor the magnitude of the water table recovery in terms of hydraulic response and contaminant concentration rebound. Such information would be useful in evaluating the potential long-term success of groundwater remediation based on potential natural limitations to the groundwater extraction technology.

Figures

Figure 1: Tuba City Site Features

Figure 2: Distribution of Uranium in Groundwater; February 2010 Monitoring Results, micrograms per Liter
- Red line signifies the location of the infiltration trench.

Figure 3: Groundwater Capture Compared to Extent of Contamination Under Pumping Conditions
- Blue line signifies the estimated extent of groundwater capture under pumping conditions; purple (outer) line signifies the approximate extent of uranium contamination in excess of 44 micrograms per Liter

Figure 4: Model-Simulated Water Table Configuration under Pumping Conditions

- Water table contour interval in 10 feet. Water table elevations are relative to an arbitrary datum and do not represent actual elevations. Water table drawdown is evident in the area of the extraction wells (blue squares); water table mounding is evident at the infiltration trench. Monitoring wells appear as small dot symbols.
- Horizontal and vertical scale units are feet.

Figure 5: Model-Simulated Water Table at Three Years Following System Shutdown

Figure 6: Model-Predicted Particle Travel Distance at Five Years Following System Shutdown

- Green dots aligned west to east in the seventh full row from the bottom of the figure are assigned particles.
- Uranium plume overlay shown in red contours (February 2010 data)
- Short red traces extending from each particle depicts the predicted travel distance for the particle in five years following system shutdown.
- Model grid cell spacing is 100 feet by 100 feet.
- Particles travel approximately 50 feet in five years following system shutdown.

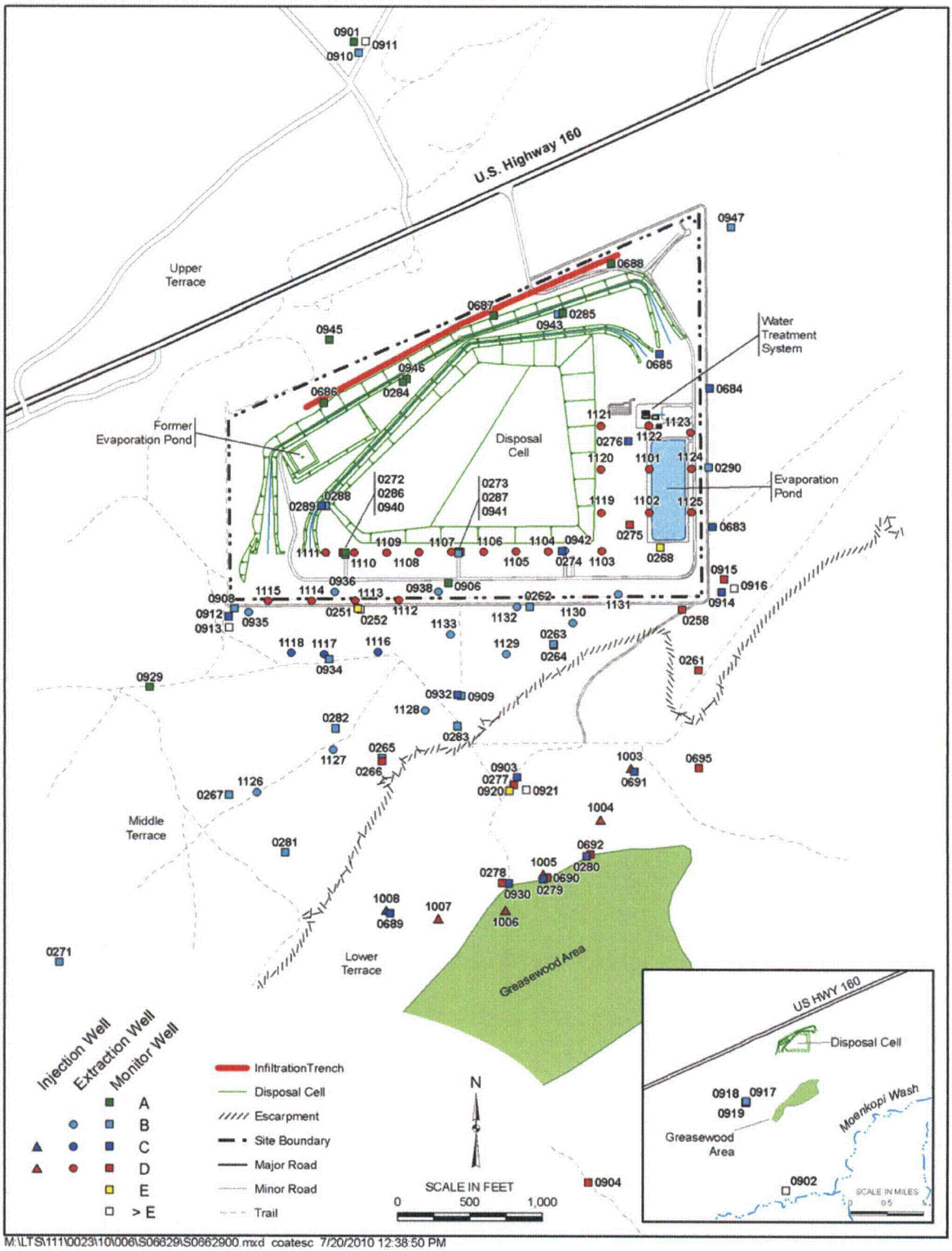

Figure 1: Tuba City Site Features

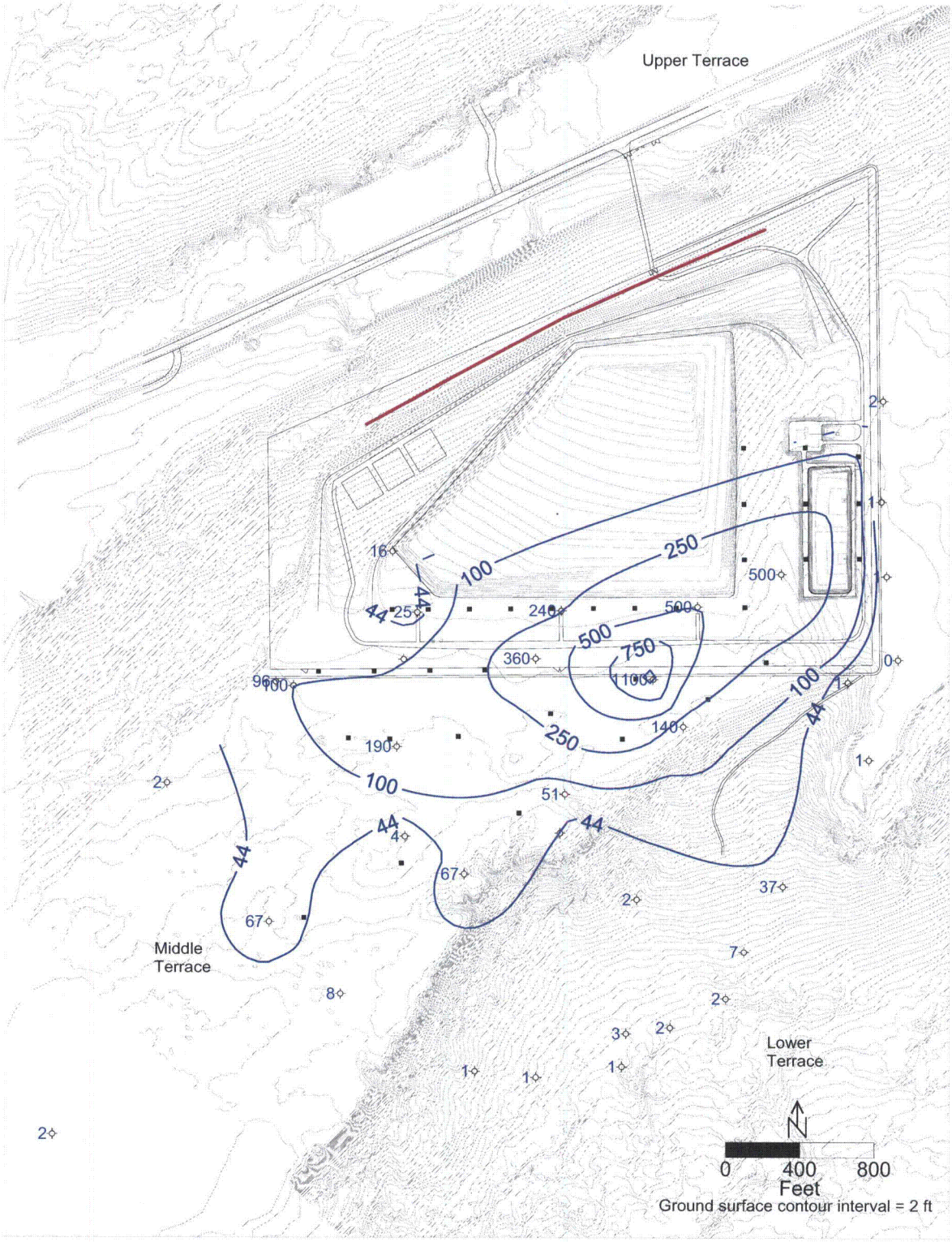

Figure 2: Distribution of Uranium in Groundwater; February 2010, micrograms per Liter

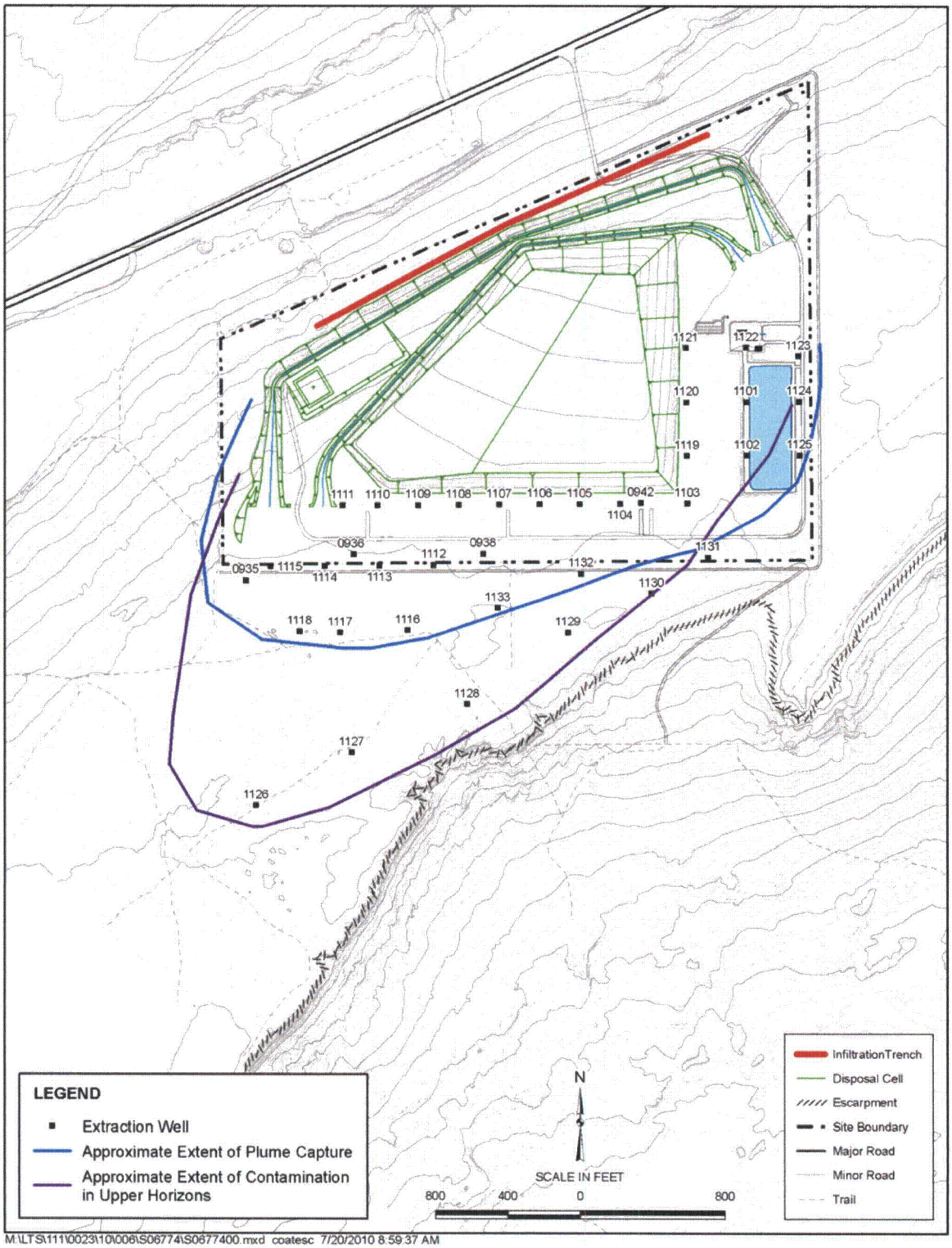

Figure 3: Groundwater Capture Compared to Extent of Contamination under Pumping Conditions

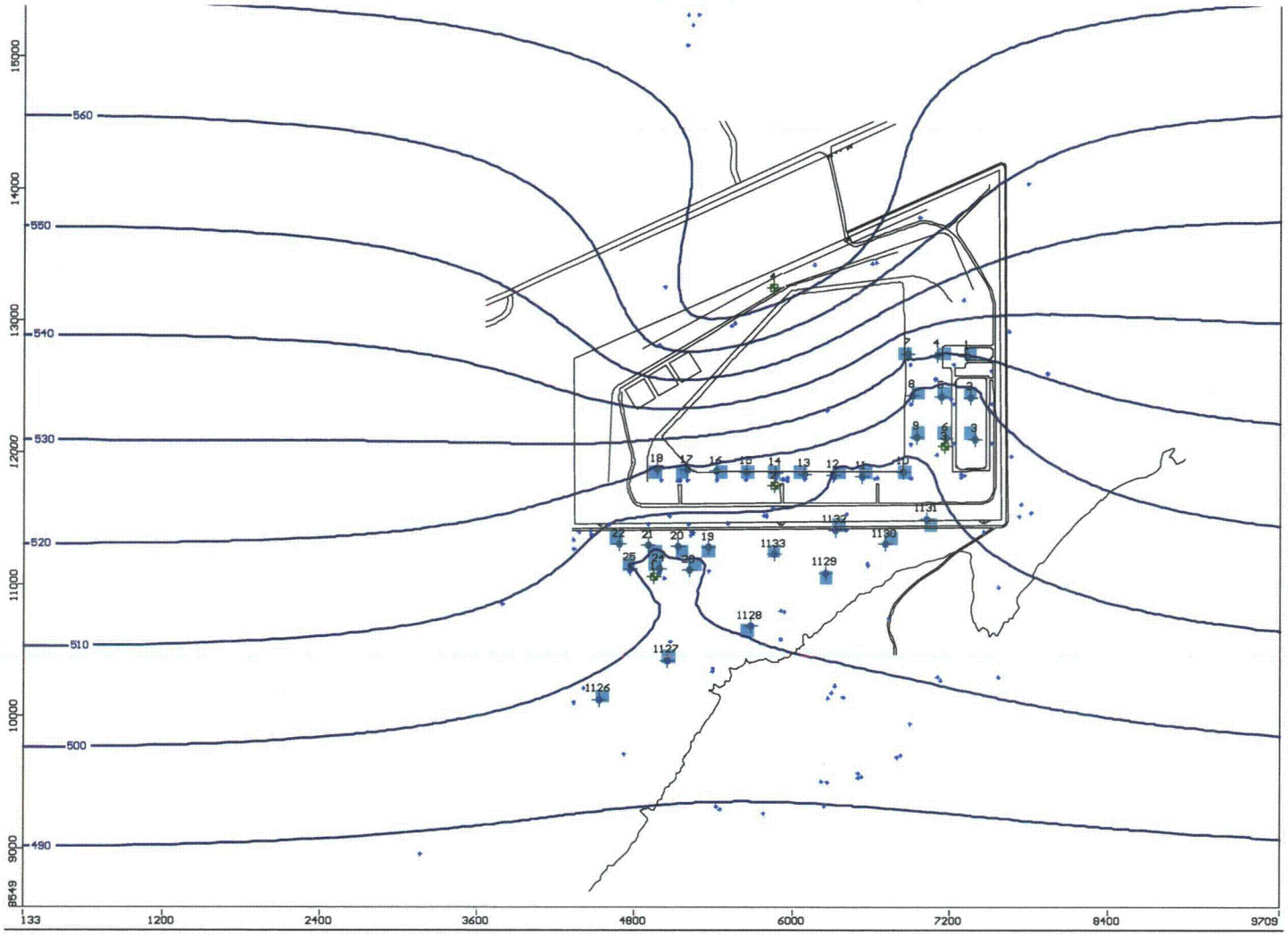

Figure 4: Model-Simulated Water Table Configuration under Pumping Conditions

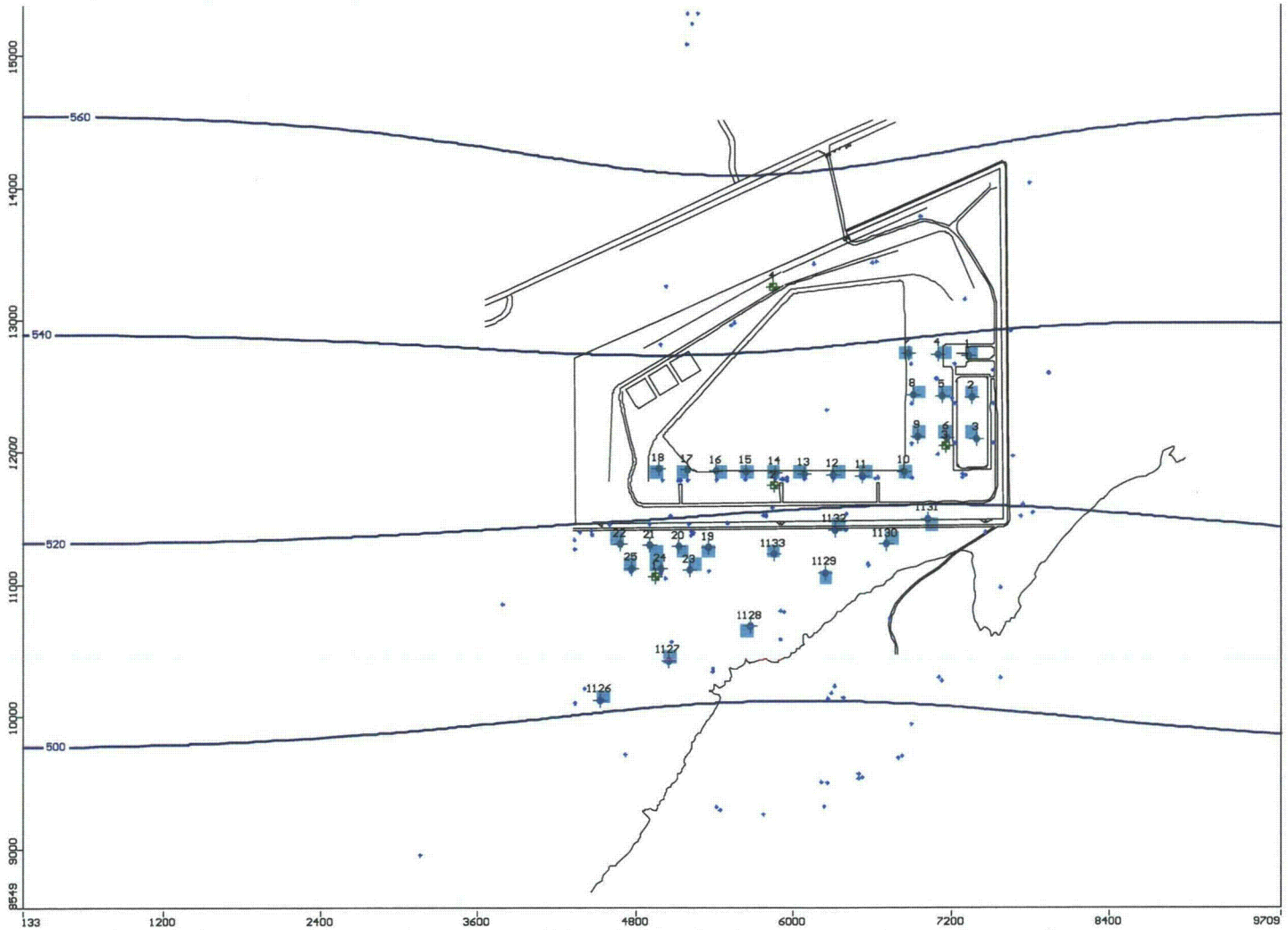

Figure 5: Model-Simulated Water Table at Three Years Following System Shutdown

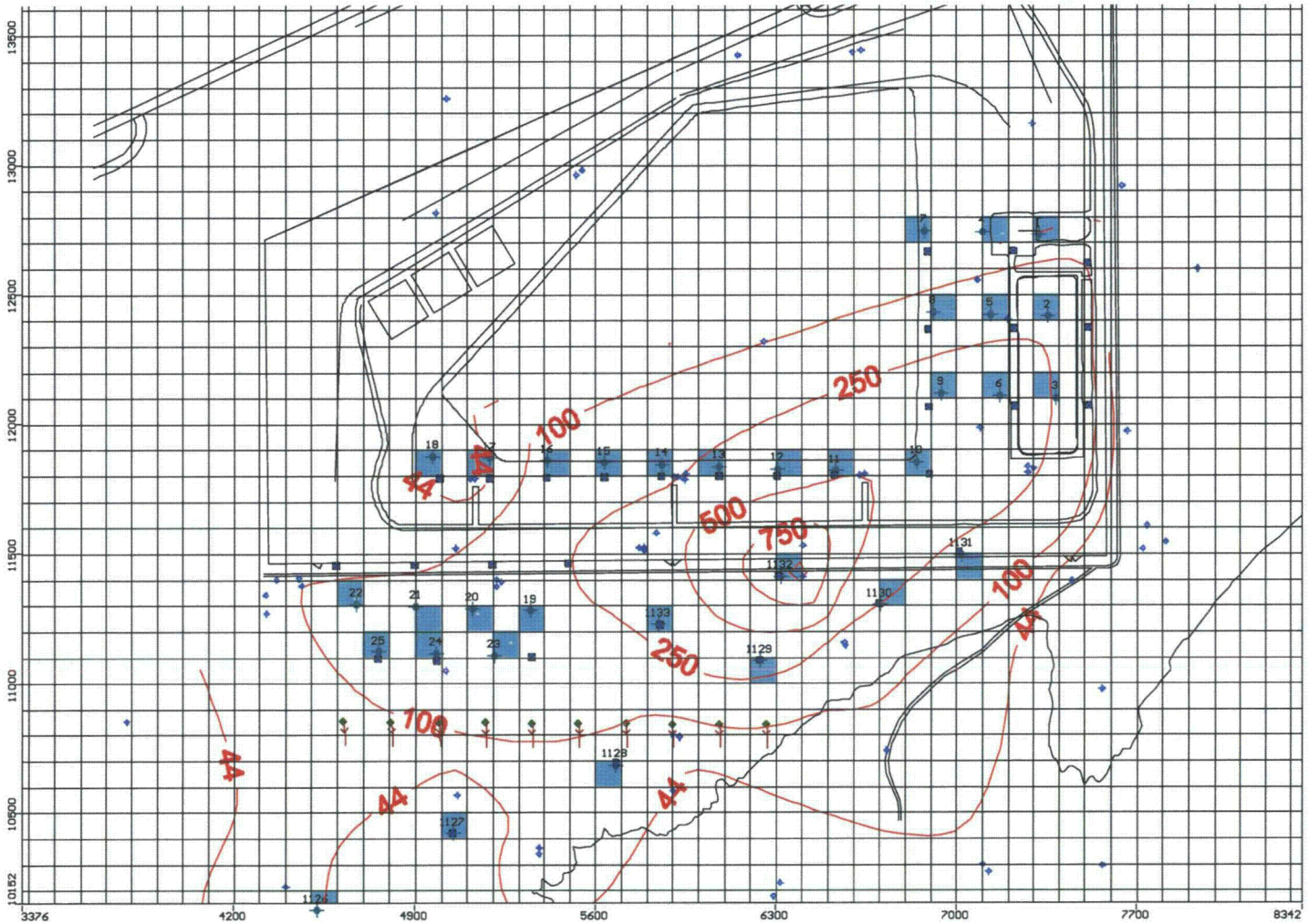

Figure 6: Model-Predicted Particle Travel Distance at Five Years Following System Shutdown