2.7 100-FR-3 Operable Unit

M. J. Hartman

The scope of this section is the 100-FR-3 groundwater interest area, which encompasses the 100-FR-3 Operable Unit and a large section of the area north of Gable Mountain (see Figure 2.1-1). Figure 2.7-1 shows facilities, wells, and shoreline monitoring sites in this region. Nitrate is the most widely distributed groundwater contaminant. Other contaminants include strontium-90, tritium, and trichloroethene. Groundwater is monitored to track contaminant plumes and trends.

Groundwater flows primarily to the east and southeast beneath the 100-F Area (Figure 2.7-2). Movement of the nitrate plume indicates flow to the south-southeast.

Most of the former waste sites in the 100-F Area have been excavated and backfilled. There are no active disposal facilities or *Resource Conservation and Recovery Act* (RCRA) units in this area.

The remainder of this section describes contaminant plumes and concentration trends for the constituents of interest under *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) or *Atomic Energy Act of 1954* (AEA) monitoring.

A nitrate plume extends from the central 100-D Area south into the 600 Area.

2.7.1 Groundwater Contaminants

This section describes the distribution and trends of nitrate, strontium-90, tritium, trichloroethene, gross alpha, gross beta, and chromium in groundwater beneath the 100-FR-3 groundwater interest area.

2.7.1.1 Nitrate

The distribution of the nitrate plume beneath the 100-FR-3 groundwater interest area did not change significantly in fiscal year 2003. Nitrate concentrations exceed the drinking water standard (45 mg/L) in a large plume that extends from the central 100-F Area toward the south-southeast, into the 600 Area (Figure 2.1-6).

Most wells in 100-F Area have decreasing or steady trends in nitrate (e.g., well 199-F8-4; Figure 2.7-3). Nitrate concentrations in some 100-F Area wells showed peaks in around 1997 (e.g., well 199-F7-1, Figure 2.7-3), similar to what was observed in other 100 Area locations on the Hanford Site. Concentrations have subsequently declined, but the cause of the peaks is unknown.

Groundwater monitoring in the 100-FR-3 groundwater interest area includes CERCLA and AEA monitoring:

CERCLA Monitoring

- ***Selected wells and constituents are sampled quarterly.***
- ***Nine wells and three seeps are sampled annually.***
- ***Fourteen wells are sampled biennially.***
- ***Seventeen wells and two seeps were sampled as scheduled in fiscal year 2003.***
- ***Two seeps were not sampled (see Appendix A).***
- ***A new sampling and analysis plan was developed and approved in fiscal year 2003 for implementation in fiscal year 2004.***

AEA Monitoring

- ***The objectives are shared with CERCLA and monitoring is fully integrated.***

Wells in the south 100-F Area continued to detect the highest nitrate concentrations. The maximum concentration detected in fiscal year 2003 was 177 mg/L in well 199-F7-3, in the southwest 100-F Area, which shows an increasing trend (Figure 2.7-4). Well 699-71-30, ~1.5 kilometers south of 100-F Area, detected over 100 mg/L of nitrate in fiscal year 2003 (Figure 2.7-4), part of an increasing trend as the plume moves downgradient.

Nitrate concentrations in well 199-F5-43B, completed deeper in the Ringold Formation, are very low (<0.5 mg/L). There is an upward hydraulic gradient between the two wells.

The strontium-90 plume has not changed significantly in at least 10 years.

2.7.1.2 Strontium-90

Strontium-90 concentrations continued to exceed the 8 pCi/L drinking water standard beneath a portion of the 100-F Area around the 116-F-14 retention basin and nearby disposal trenches. The plume has not changed significantly in the past 10 years.

Well 199-F5-1 had the highest strontium-90 concentrations in fiscal year 2003 at 28 pCi/L (Figure 2.7-5). Concentrations in groundwater vary with water level. High water levels mobilize strontium-90 in the lower vadose zone, increasing concentrations in groundwater. Fiscal year 2003 had relatively low river stage, and correspondingly low strontium-90 concentrations. Nearby well 199-F5-3 typically has strontium-90 concentrations in the hundreds but it was not scheduled for sampling in fiscal year 2003. Well 199-F5-3 was not included in the sampling and analysis plan that was in effect in fiscal year 2003 (PNNL-13327) because there had been difficulty sampling it in the past. The well is included in the new sampling and analysis plan (DOE/RL-2003-49), and DOE will attempt to identify and repair the problems with the well.

Like other 100-F Area contaminants, strontium-90 appears to be limited to the shallow portion of the aquifer. No strontium-90 is detected in deep well 199-F5-43B, while adjacent well 199-F5-43A typically detects 2 to 4 pCi/L of strontium-90.

Plume areas (square kilometers) above the drinking water standard at the 100-FR-3 Operable Unit:

Nitrate — 12.70
Strontium-90 — 0.16
Trichloroethene — 2.37

2.7.1.3 Tritium

Tritium concentrations exceed 2,000 pCi/L beneath the south 100-F Area, but were all below the 20,000 pCi/L drinking water standard in fiscal year 2003. The plume extends southward into the 600 Area (Figure 2.1-5), but its axis strikes approximately southeast instead of south-southeast like the nitrate plume.

Concentrations of tritium are declining and ranged from undetected to 11,500 pCi/L in fiscal year 2003. The latter concentration was in well 199-F8-3, located near the 118-F-6 burial ground (Figure 2.7-6).

2.7.1.4 Trichloroethene

Trichloroethene is consistently detected in several 100-F Area wells, and a few wells in the southwest 100-F Area typically exceed the 5 µg/L drinking water standard. Of the wells sampled in fiscal year 2003, the maximum concentration was 9.8 µg/L in well 199-F7-3, which shows an increasing trend (Figure 2.7-7). The highest concentrations of trichloroethene are typically detected in well 199-F7-1 and in well 699-77-36, located in the nearby 600 Area, but those wells were not scheduled for sampling in fiscal year 2003. Concentrations in those wells are decreasing overall.

Trichloroethene exceeds the drinking water standard in southwest 100-F Area.

Farther north, concentrations in well 199-F7-2 hover around the drinking water standard. Closer to the Columbia River, wells 199-F5-45 and 199-F5-46 also detect trichloroethene. Concentrations in those two wells were below the drinking water standard in fiscal year 2003. Nearly 4 kilometers west of the 100-F Area, well 699-85-47 has consistently detected ~2 µg/L trichloroethene in recent years.

2.7.1.5 Gross Alpha and Gross Beta

Gross alpha and gross beta concentrations are measured in 100-F Area groundwater samples to screen for radionuclides.

Gross alpha activity is probably due to uranium, which has been detected in the 100-F Area but no longer is analyzed. The maximum gross alpha concentration in fiscal year 2003 was 10 pCi/L, a typical level in the 100-F Area and below the 15 pCi/L drinking water standard.

Gross beta concentrations in wells in the east 100-F Area ranged up to 51 pCi/L (well 199-F5-1) in fiscal year 2003, reflecting the presence of strontium-90, as discussed in Section 2.7.1.2. Concentrations also exceeded background levels in some wells in the south 100-F Area where there is no strontium-90. For example, well 199-F8-4 detected 24 pCi/L beta in fiscal year 2003. There are no current data on beta emitters other than strontium-90. The drinking water standard for gross beta is 50 pCi/L.

2.7.1.6 Chromium

Dissolved chromium concentrations continued to be above background in several wells in the east 100-F Area. Levels were below the 100 µg/L drinking water standard in fiscal year 2003 and are declining in most wells. Concentrations are typically highest in wells near the former retention basins and disposal trenches. For example, the maximum concentration in fiscal year 2003 was 90 µg/L in well 199-F5-46. The maximum chromium concentration in an aquifer tube was in the same region of 100-F Area, 14 µg/L in tube 63-M.

2.7.2 CERCLA Groundwater Monitoring

No groundwater remediation decisions have been made for the 100-FR-3 Operable Unit. Until such decisions are made, the groundwater project monitors contaminant plumes and trends as discussed in the preceding sections.

Until groundwater remediation decisions are made for the 100-FR-3 Operable Unit, the groundwater project will continue to monitor contaminant plumes and trends.

The sampling and analysis plan that was in effect during fiscal year 2003 (PNNL-13327) specified annual sampling of 9 wells and 3 seeps, and biennial sampling of 14 wells. Two wells are sampled quarterly for selected constituents (see Appendix A). Seventeen of the wells were scheduled for sampling in fiscal year 2003 and all were sampled successfully. Two of the three shoreline seeps were not sampled because the specific conductance of the water was the same as river water, so it did not represent discharging groundwater.

The U.S. Environmental Protection Agency approved a new sampling and analysis plan at the end of September 2003 (DOE/RL-2003-49). The new plan, which is being implemented in fiscal year 2004, revises the monitoring program slightly and calls for the addition of more aquifer sampling tubes to monitor contaminants near the Columbia River.

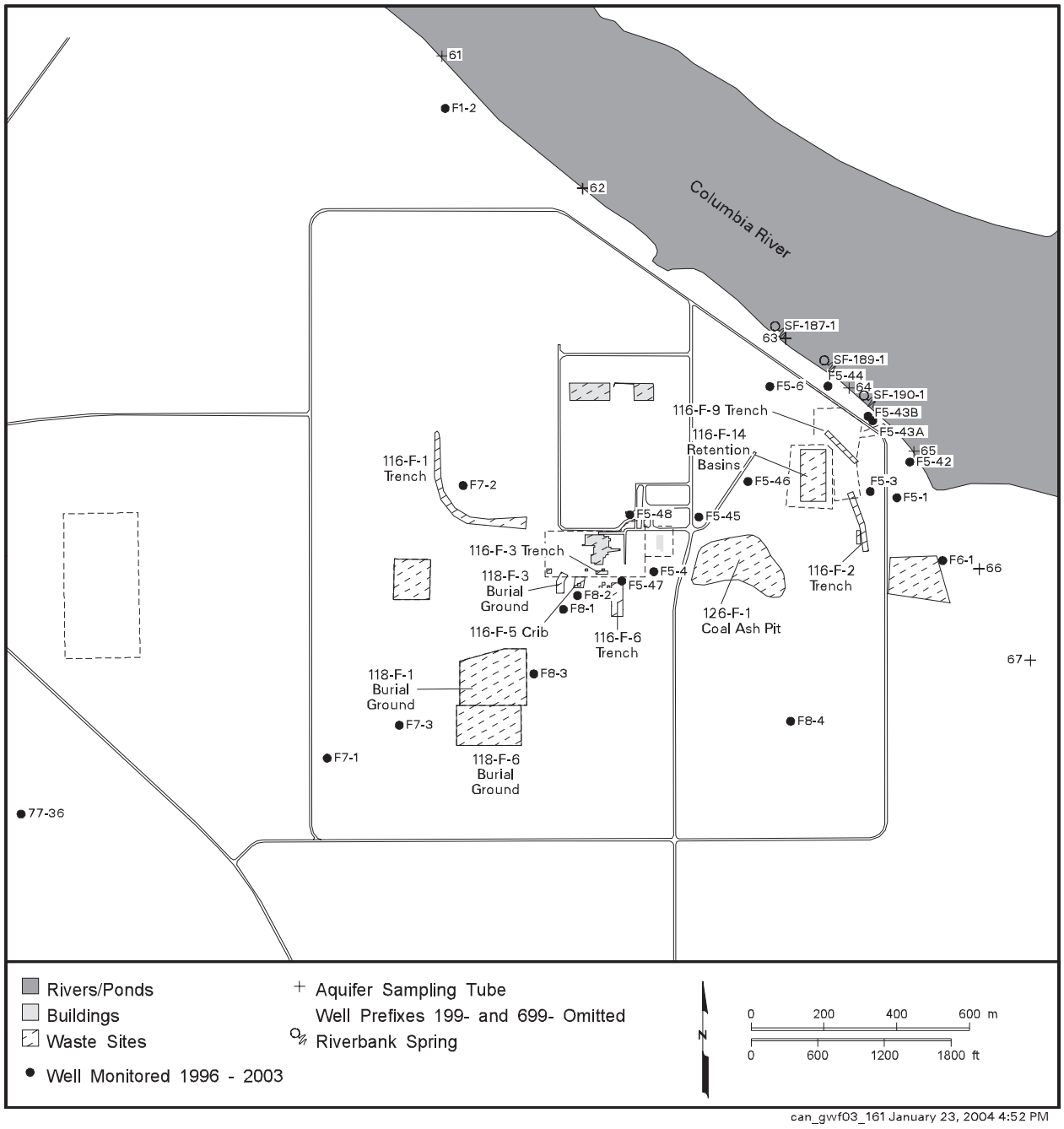

Figure 2.7-1. Groundwater Monitoring Wells in the 100-F Area

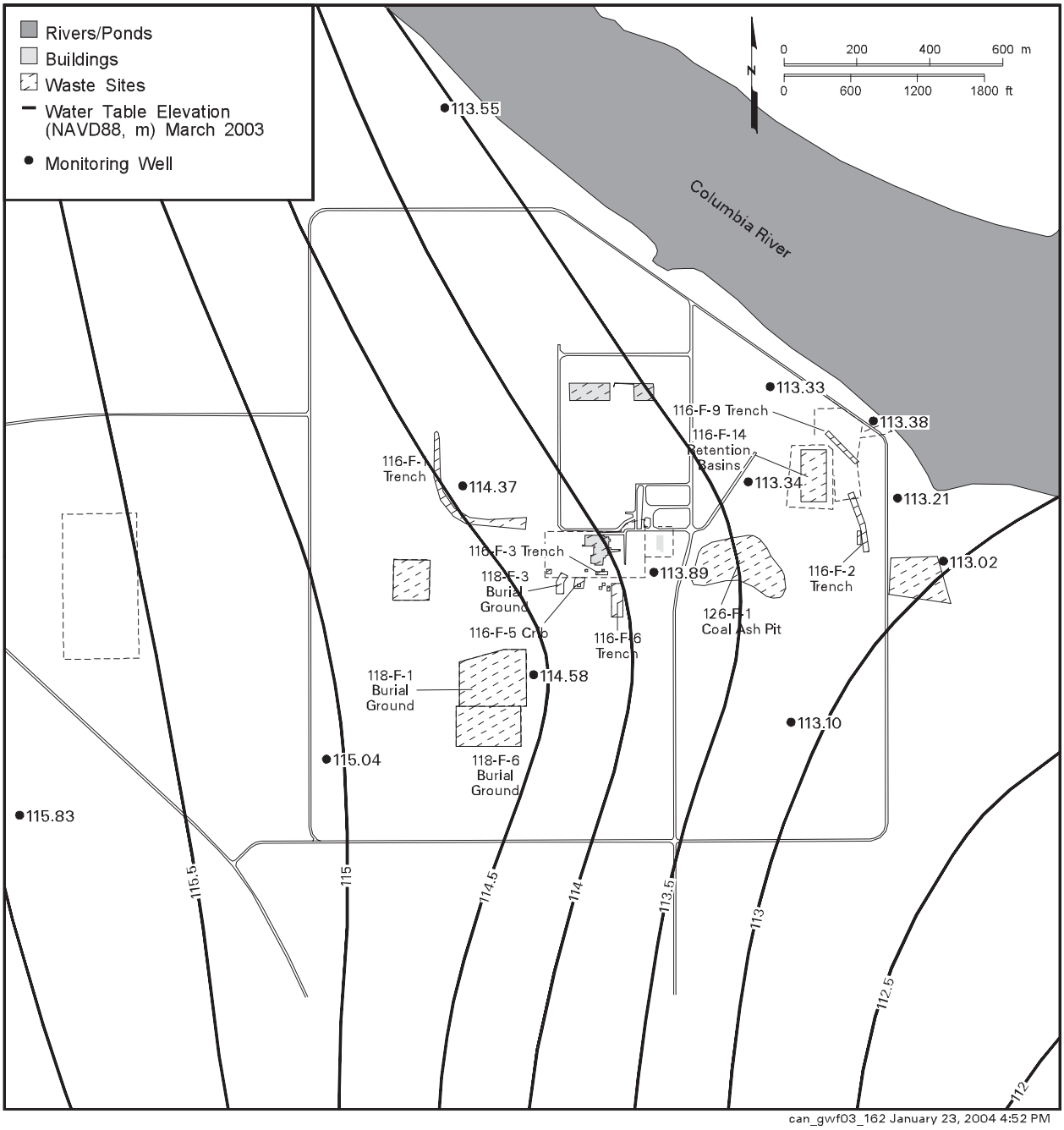

Figure 2.7-2. 100-F Area Water-Table Map, March 2003

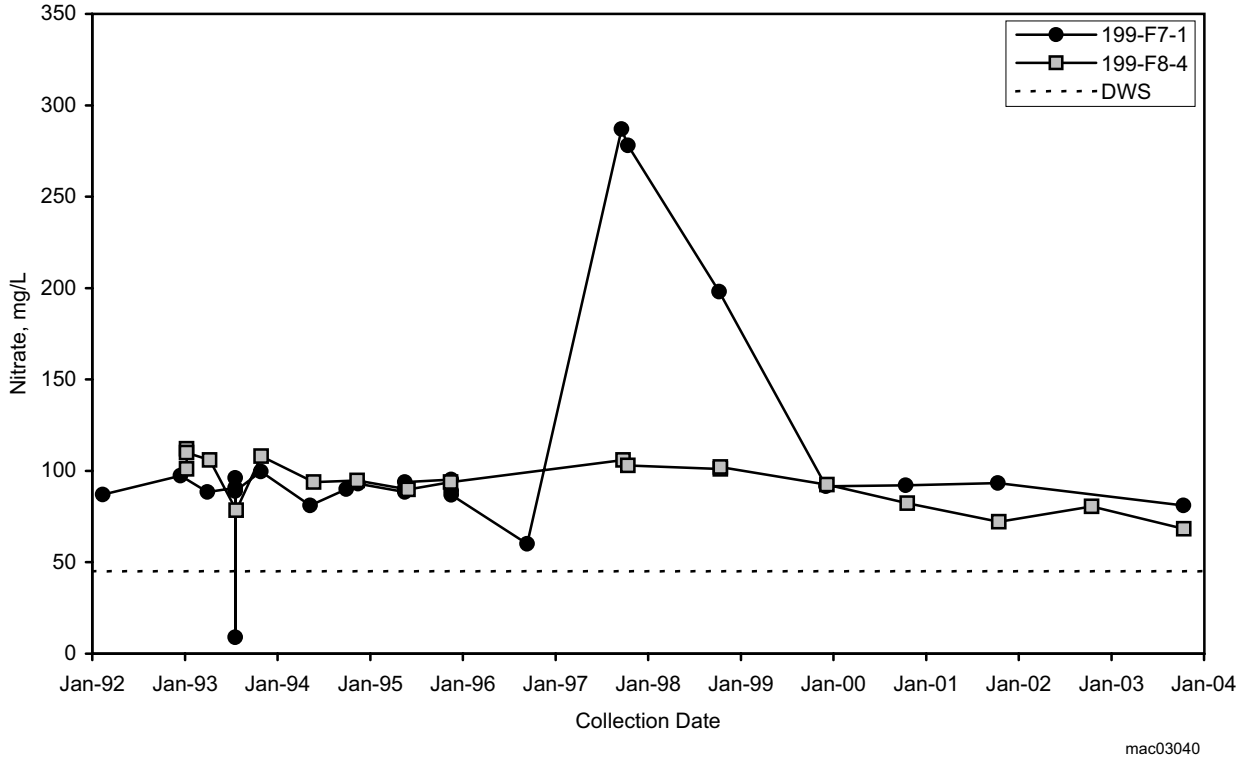

Figure 2.7-3. Nitrate Concentrations in Southeast (Well 199-F8-4) and Southwest 100-F Area (Well 199-F7-1)

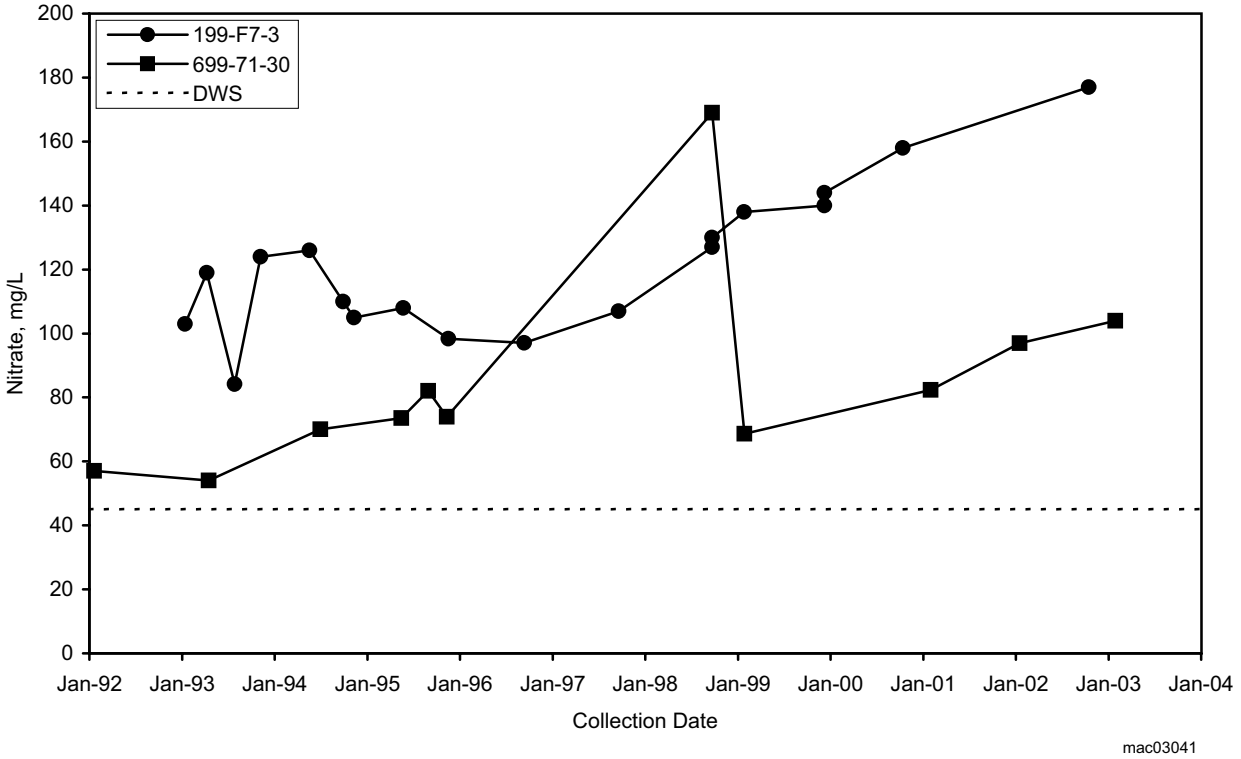

Figure 2.7-4. Nitrate Concentrations Southwest (Well 199-F7-3) and South (Well 699-71-30) of 100-F Area

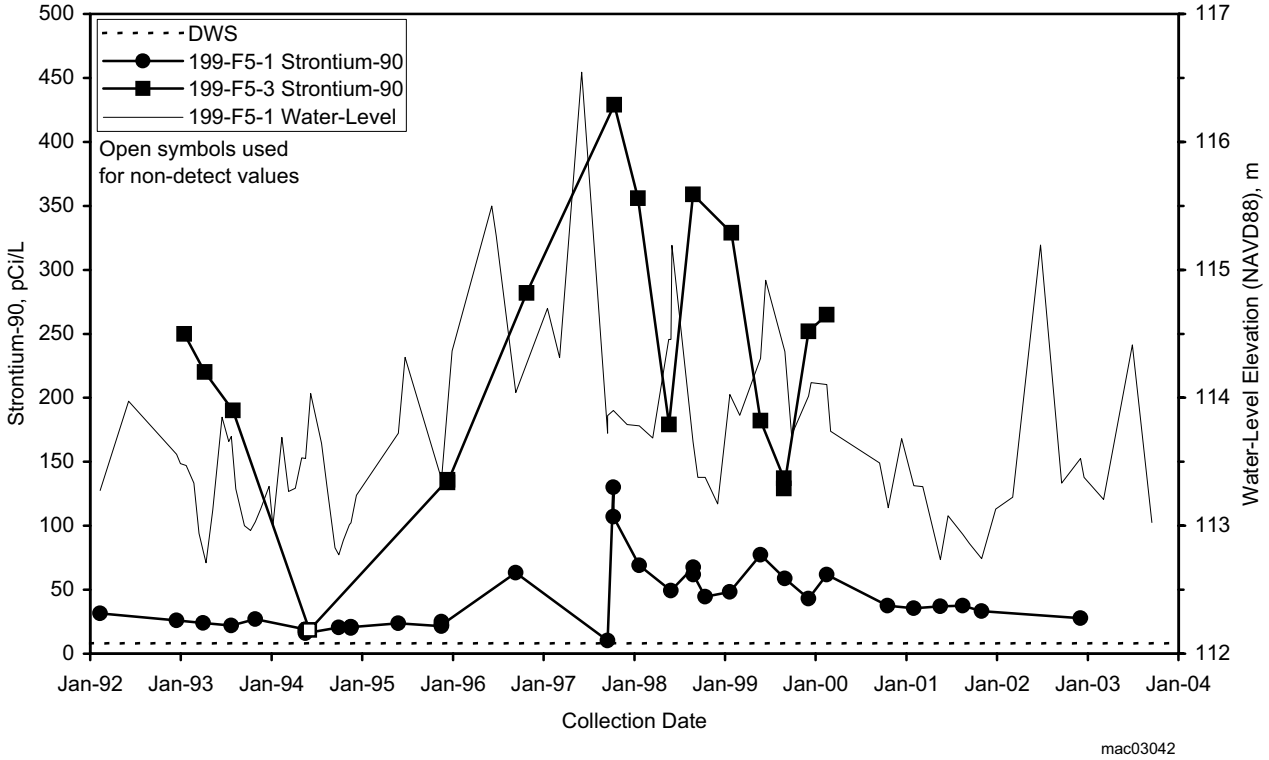

Figure 2.7-5. Strontium-90 Concentrations and Water Levels in East 100-F Area

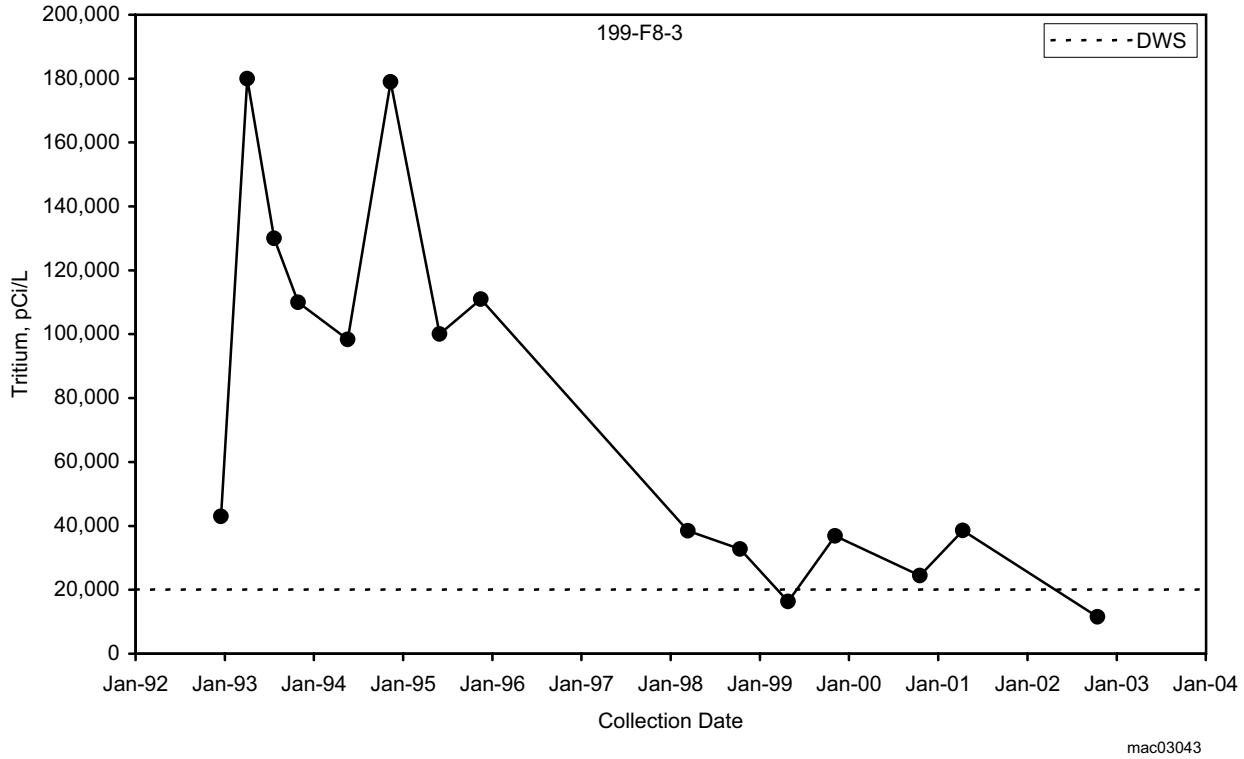

Figure 2.7-6. Tritium Concentrations Near 118-F-6 Burial Ground

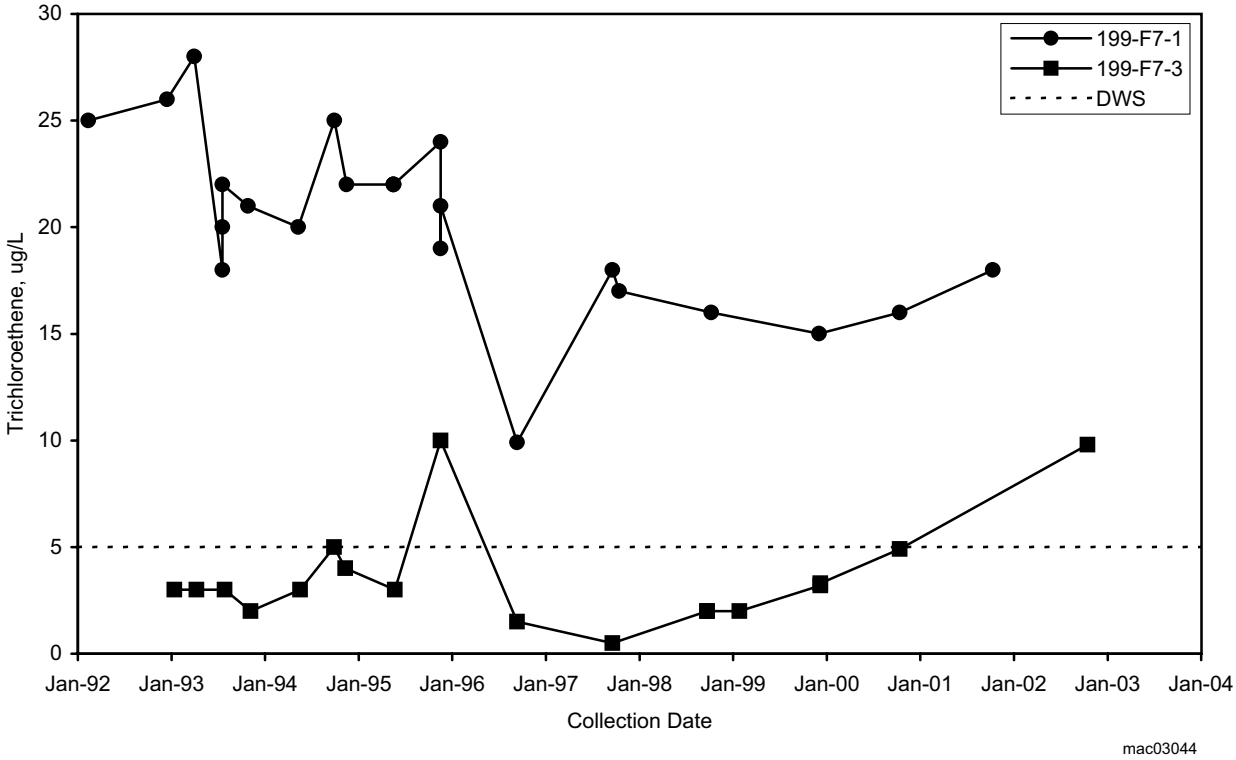

Figure 2.7-7. Trichloroethene in the Southwest 100-F Area