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13-AMRP-0155

APR 1 8 2013

Ms. J. A. Hedges, Program Manager
Nuclear Waste Program
State of Washington
Department of Ecology
3100 Port of Benton
Richland, Washington 99354

Dear Ms. Hedges:

216-B-3 MAIN POND CLOSURE PLAN, DOE/RL-2013-24, DRAFT A AND 216-S-10 POND AND DITCH CLOSURE PLAN, DOE/RL-2006-12, DRAFT B

The purpose of this letter is to provide the State of Washington Department of Ecology (Ecology) with the 216-B-3 Main Pond Closure Plan, DOE-RL-2013-24, Draft A and 216-S-10 Pond and Ditch Closure Plan, DOE/RL-2006-12, Draft B for review.

Tri-Party Agreement Interim Milestone M-037-03 requires submittal of both closure plans to Ecology by April 30, 2013. When finalized, these plans will support Treatment, Storage, and Disposal (TSD) unit closure for the 216-B-3 Main Pond System and the 216-S-10 Pond and Ditch.

The schedule for the closure of both TSD units will be coordinated with the Comprehensive Environmental Response, Compensation, and Liability Act remedial actions for both source and groundwater operable units in the 200 Area of the Hanford Site.

If you have any questions, please contact me or your staff may contact Briant Charboneau, of my staff, on (509) 373-6137.

Sincerely,

Jonathan A. Dowell, Assistant Manager
for the River and Plateau

AMRP:JPS

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DOE/RL-2013-24
Draft A

216-B-3 MAIN POND CLOSURE PLAN

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

U.S. DEPARTMENT OF ENERGY Richland Operations Office
P.O. Box 550
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Approved for Public Release;
Further Dissemination Unlimited

DOE/RL-2013-24
Draft A

216-B-3 MAIN POND CLOSURE PLAN

J. P. Sands
Department of Energy - Richland Operations Office

Date Published
April 2013

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

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216-B-3 MAIN POND CLOSURE PLAN

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1.0 INTRODUCTION

This closure/post-closure plan was originally included in Appendix G of DOE/RL-2002-69, Draft A, but was never finalized. This closure plan updates and supersedes the previous submittal as a stand-alone document.

The 216-B-3 Main Pond and Ditch unit will be incorporated into a future revision of the WA7890008967, *Hanford Facility Resource Conservation and Recovery Act Permit, Dangerous Waste Portion, Revision 8C, for the Treatment, Storage, and Disposal of Dangerous Waste*. When the TSD unit is incorporated, the provisions of Permit Condition II.Y.2.c will apply. Permit Condition II.Y.2.c establishes the corrective-action status of the waste site following certification of closure.

The proposed strategy for the 216-B-3 Main Pond and Ditch is clean closure. The closure of the 216-B-3 Main Pond and Ditch will be coordinated and implemented with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) remedial actions as described in the Hanford Federal Facility Agreement and Consent Order(referred to as the Tri Party Agreement) Action Plan, Section 5.5 (TSD Units and Past-Practice Units Interface). Specifically, groundwater cleanup will be coordinated with the 200-PO-5 Ground Water Operable Unit (OU) and vadose zone cleanup will be coordinated with the 200-CW-1 Source OU.

Because this closure plan is being coordinated with the activities associated with the 200-CW-1 and 200-PO-5 OUs, the closure plan is written to address only the constituents of concern relating to RCRA TSD unit operations. Any other constituents of concern relating to past-practice activities at this waste site will be addressed under past-practice authority, in accordance with Permit Condition II.Y.2. Any physical activities necessary to complete remediation of non-TSD unit constituents are outside the scope of this closure plan and will be performed in conjunction with Tri Party Agreement past-practice activities for 200-PO-5 Ground Water OU and 200-CW-1 Source OU.

The schedule to obtain a Record of Decision for the 200-CW-1 Source operable unit is dependent on completing the Remedial Investigation/Feasibility Study process which is currently subject to milestone M-15-38B. To ensure coordination, this closure plan shall be an appendix in the 200-CW-1 RI/FS report.

1.1 UNIT DESCRIPTION

This section describes the physical description of the waste sites, process information, and waste characteristics of the 216-B-3-3 Ditch and 216-B-3 Main Pond.

The 216-B-3 Pond system consisted of a main pond and 3 expansion ponds. The 3 expansion ponds (216-B-3A, 216-B-3B and 216-B-3C) were clean closed on July 31, 1995 therefore they are no longer active TSD units and thus will not be considered in this closure plan. The 216-B-3 Pond and Ditch is an inactive pond and ditch. The 216-B-3 Pond and Ditch operated open and unlined. It was stabilized with clean soil backfill and revegetated.

The 216-B-3 Main Pond TSD unit is one RCRA unit that includes the 216-B-3 Main Pond and the 216-B-3-3 Ditch. The original RCRA Part A permit application (Part A), Form 3 (Rev. 0), was submitted to the Washington State Department of Ecology (Ecology) in 1986. At that time the 216-B-3 Pond System was being operated under one Part A, Form 3. The current Part A is Rev 8 (Oct 2008).

1.1.1 Physical Description

The 216-B-3 Main Pond Closure Group is located within the secured area of the Hanford federal facility, near the Hanford Site's 200 East Area about 1,600 m (5,249 ft.) east of the perimeter fence.

216-B-3 Main Pond 216-B-3 Main Pond was located in a natural topographic depression and varied in size from about 6 to 19 ha (14 to 46 ac) (Figure 1). The 216-B-3 Main Pond operated from 1945 to 1994 and received cooling water and other 200 East Area effluents. Discharge volumes to the 216-B-3 Main Pond were at a maximum during 1988. Total discharge to the facility since 1945 is estimated to have exceeded 1.0×10^{12} liters (2.6×10^{9} gal). Most of the effluent contained low concentrations of radionuclides and chemicals. The 216-B-3 Main Pond was decommissioned in 1994 by backfilling with coarse-grained material and then covering the pond with fine-grained material. The maximum measured depth of the 216-B-3 Main Pond immediately prior to decommissioning was 3.4 m (11 ft), which is substantially shallower than the 6-m (20-ft) design depth, and suggests that sedimentation and accumulation of biomass reduced the depth during the active period of operation. This accumulation of fine-grained material may also be responsible for reducing the percolation rate beneath the pond (BHI-00802).

216-B-3 Main Pond was decommissioned by first allowing the site to de-water, then placing the backfill material along the edge of the site and working it over the bottom in 0.5- to 1.0-m (1.5- to 3-ft) lifts toward the center of the pond. Trees that grew along the edges of the pond were included in the backfill; the larger trees (up to 1 m (3 ft.) in diameter) were cut up and placed towards the center of the pond to an elevation of 172.8 m (567 ft). Woody material was not consolidated in any one location. The volume of coarse backfill placed in the pond is approximately 268,000 m^3 (350,000 yd^3). The depth of backfill ranges from 1 m (3 ft) along the edge of the pond to 2.1 m (7 ft) in the deepest portions of the pond. Approximately 0.35 m (1.2 ft) of fined-grained clean soil was placed over the coarse backfill. The surface of 216-B-3 Main Pond currently slopes toward the center of the site on a gentle grade estimated at 0.03%.

216-B-3-3 Ditch. The 216-B-3-3 Ditch was an open, unlined earthen ditch, approximately 6 m (20 ft) wide at ground level, 1.8 m (6 ft) deep, and 1,130 m (3,700 ft) long (Figure 1). The ditch operated from 1970 to 1994 and received cooling water and other effluents from 200 East Area facilities. The effluents then flowed to the 216-B-3 Main Pond. The ditch was excavated and put into service in September 1970 to replace the decommissioned 216-B-3-2 Ditch. The ditch was decommissioned and backfilled in conjunction with similar activities for 216-B-3 Main Pond in 1994.

1.1.2 Process Information

Known and suspected contamination to the 216-B-3 Main Pond system, including past-practice activities, from PUREX and B Plant is documented in the *PUREX Source Aggregate Area Management Study Report* (DOE/RL-92-04) and *B Plant Source Aggregate Area Management Study Report* (DOE/RL-92-05). The total liquid discharge to the facility since 1945 is estimated to have exceeded 1 trillion liters. Spills in the PUREX Plant were released to the 216-A-29 Ditch, which discharged to the 216-B-3-3 Ditch and ultimately to 216-B-3 Main Pond.

The largest contributing streams were the B Plant cooling water and steam condensate (nondangerous waste source), PUREX Plant cooling water (nondangerous waste source), the B Plant chemical sewer (potentially dangerous waste source), and the PUREX Plant chemical sewer (dangerous waste source).

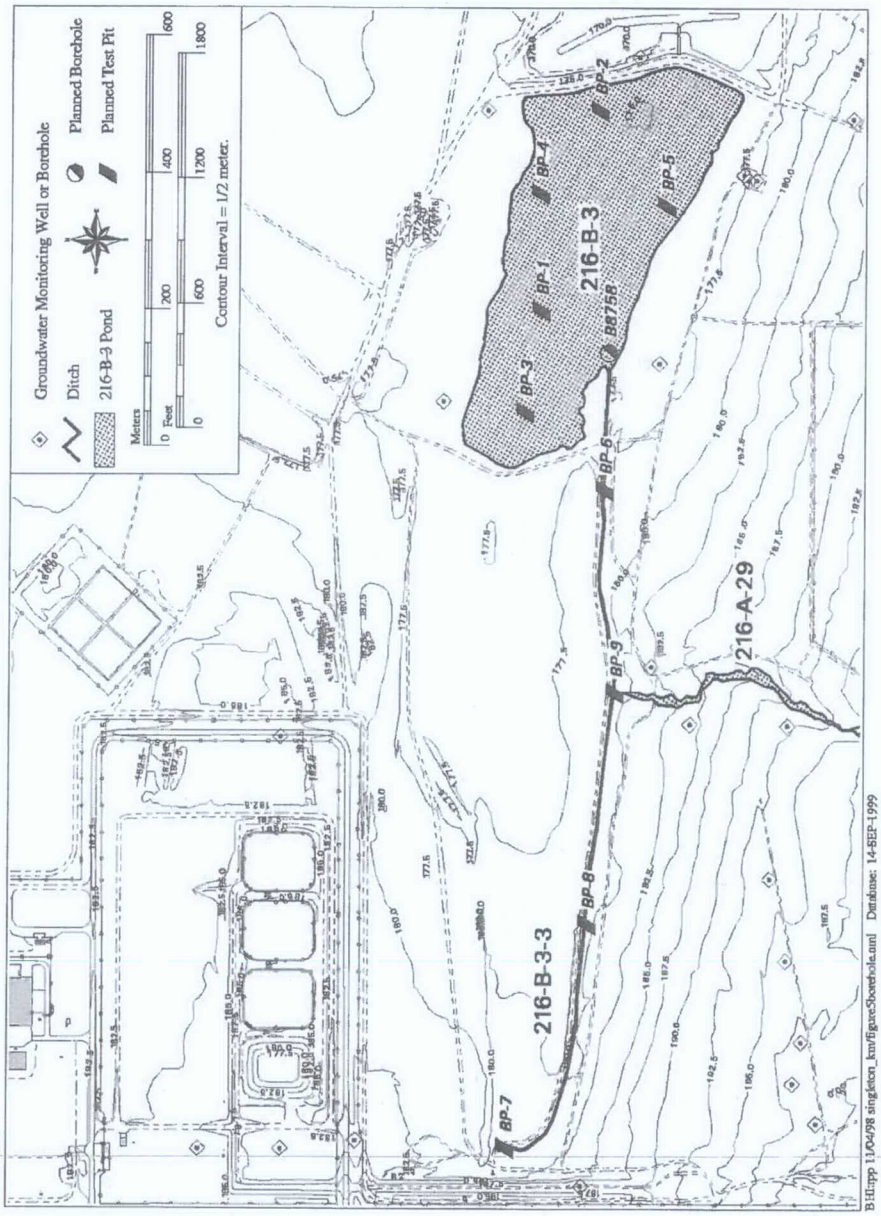
The PUREX chemical sewer was the major source of dangerous waste to the 216-B-3 Main Pond system and is the reason that 216-B-3 Main Pond is a TSD unit. Four mechanisms existed for the discharge of dangerous waste into the chemical sewer. These mechanisms were as follows.

- **Overflow of condensate from the acid fractionator** – Sporadic overflow of the acid fractionator may have resulted in an acidic waste (D002) discharge to the chemical sewer.

- **Effluent discharges from regeneration of the demineralizers** – Serial discharges of sulfuric acid and sodium hydroxide (both D002) routinely resulted in the discharge of effluent below a pH of 2 and above a pH of 12.5 to the chemical sewer. This practice continued until 1989 when a catch tank was placed in service to hold the regeneration effluents.

- **Disposal of out-of-tolerance chemical makeups** – Various chemicals, including hydrazine (U133) and state-only toxic mixtures (WT01, WT02), were discharged to the chemical sewer when adjustments to chemicals used in the PUREX Plant became out of tolerance to required plant specifications.

Figure 1 Borehole and Test Pit Locations for the 216-B-3 Main Pond



Accidental spills – Equipment failures, misvalvings, and overflowing tanks resulted in accidental spills to the chemical sewer. The most significant was unplanned release UPR-200-E-51 that occurred in May 1977 and released 15 kg of cadmium nitrate (D006) to the chemical sewer. Spills at the PUREX Plant included hydrazine (U133), cadmium nitrate (WT01/D006), and ammonium fluoride/ammonium nitrate (WT01) (DOE/RL-99-07, Appendix C). Spills in the PUREX Plant were released to the 216-A-29 Ditch, which discharged to the 216-B-3-3 Ditch and ultimately to 216-B-3 Main Pond.

One unplanned release, UPR-200-E14 occurred in 1958 when a dike on the east side of the 216-B-3 Main Pond ruptured and released contaminated water into a ravine east of the 216-B-3 Main Pond where the 216-B-3A expansion pond was located. The 216-B-3 Main Pond was also impacted by contaminants associated with two other major unplanned releases: approximately 2,500 Ci of mixed fission products from UPR-200-E-34 in 1964, and 1,000 Ci of strontium-90 from UPR-200-E-138 in 1970.

Before 1983, detailed release records were not maintained. Additional routine sources of effluent originated from the 242-A Evaporator, 242-B Evaporator, 244-AR Vault, 244-BXR Vault, 244-CR Vault, BY Tank Farm, 241-A Aging Waste Ventilation System Complex, 283-E Water Treatment Facility, and 284-E Powerhouse. None of the effluent released from these additional sources was considered to be dangerous waste. Further information is contained in DOE/RL-89-28, Rev. 0 and DOE/RL-89-28, Rev. 2, *216-B-3 Expansion Ponds Closure Plan.*

1.1.3 Waste Characteristics

This section identifies the estimate of maximum inventory and the characteristics of the waste disposed of at the RCRA TSD unit of 216-B-3 Main Pond system.

Dangerous waste discharges identified in the Part A, Form 3 included corrosive and toxic dangerous waste resulting from the regeneration of demineralizer columns at the PUREX Plant and spills of dangerous or mixed waste at the PUREX Plant. Backwash from the regeneration of the demineralizer columns frequently was corrosive (D002) and sometimes contained toxic concentrations of chemicals used in the regeneration process, including nitric acid, sulfuric acid, sodium hydroxide, and potassium hydroxide (WT02). Spills at the PUREX Plant included hydrazine (U133), cadmium nitrate (WT01/D006), and ammonium fluoride/ammonium nitrate (WT01).

200-CW-1Operable Unit Remedial Investigation Report, DOE/RL-2000-35, Rev 0 documented the characterization effort of the 216-B-3 Main Pond System. Hexavalent chromium was the only metal not detected in any samples. Varying concentrations of other metals including arsenic, barium, beryllium, cadmium, chromium, copper, nickel, lead, vanadium, and zinc were detected in most of the samples collected. The concentrations detected are generally near or below Hanford Site background for the majority of the samples. Copper and zinc concentrations were detected above background levels; however, the concentrations were less than the MTCA Method B cleanup levels for direct contact. Seven cadmium samples exceeded the state background level of 1.0 mg/kg. The maximum cadmium concentration detected was 7.3 mg/kg.

This is similar to the cadmium results from the 1989 Phase I investigation. Cadmium was found above the threshold value in 21 of the 30 Phase I samples, with a maximum concentration of 17.9 mg/kg (WHC 1991). Lead concentrations ranged from 2 to 573 mg/kg. This is consistent with the lead results from the 1989 Phase I investigation. Lead was found above the threshold value in 21 of the 30 Phase I samples, with a maximum concentration of 618 mg/kg (WHC 1991). Silver was detected in four samples at concentrations ranging from 0.29 to 9.6 mg/kg. Mercury was detected in 11 of the samples at concentrations ranging from 0.05 to 11.9 mg/kg. This is consistent with the mercury results during the 1989 Phase I investigation. Mercury was found above the threshold value in 22 of the 30 Phase I samples, with a maximum concentration of 15.6 mg/kg (WHC 1991). The RI maximum concentrations for cadmium, lead, mercury, and silver were all detected in the pond bottom sample 2.4 in to 9 ft below ground surface collected at test pit BP-1 (Figure 1).

The Contaminants of Concern (COCs) for direct exposure are documented in DOE/RL-2000-35, Rev 0. The only two COCs identified in DOE/RL-2000-35 are the radionuclides Cs-137 and Sr-90 which are both under DOE's purview per the Atomic Energy Act. No Treatment Storage and Disposal (TSD) COCs in soil are identified in DOE/RL-2000-35.

Supplemental characterization was performed per *Sampling and Analysis Plan for Supplemental Remedial Investigation Activities at Model Group 5, Large-Area Ponds, Waste Sites located Within the 200-CW-1 Operable Unit, DOE/RL-2009-57 Revision 0 REISSUE.* Additional data was needed because, contrary to normal contaminant distribution models that anticipate higher contamination levels near the waste inlet (B8758 Borehole), contamination levels were highest near the BP-l Test Pit (Figure 1), which is not near the inlet. DOE will continue evaluate this data through the CERCLA process and make a remedial decision to ensure protection of human health and the environment.

1.1.4 Contained-In Determination for Hydrazine (U133).

Hydrazine product (U133) entered the 216-B-3-3 Ditch and 216-B-3 Main Pond from the PUREX Plant aqueous makeup unit tanks. As such, all environmental media and debris generated as waste during the characterization and remediation of these TSD units would be identified as listed hydrazine dangerous waste in accordance with WAC 173-303, "Dangerous Waste Regulations," Section 173-303-081(3). This presents a problem from the context of the TSD of soils and other debris generated from remediation of these units. All substantive dangerous waste management standards will apply to generated soils and debris because they are defined as listed waste. Should environmental media only be regulated because of the hydrazine waste code, this requirement could unduly burden characterization and cleanup activities. Particularly problematic requirements are those associated with land disposal restrictions; U133 wastes must undergo treatment using one of the technologies prescribed in the 40 CFR 268, "Land Disposal Restrictions," Section 268.40 Table, "Treatment Standards for Hazardous Wastes." These technologies encompass mostly thermal or chemical destruction or extraction technologies and would be required prior to disposal of any waste, soils, and/or debris generated at 216-B-3 Main Pond and the 216-B-3-3 Ditch.

In accordance with Ecology's contained-in policy for environmental media (Tom Eaton, 1993) and the EPA's contained-in requirements for debris (40 CFR 261, Section 261.3[f]), the listed

waste code can be removed from debris and media if levels of the compound for which the waste was listed are below risk-based action levels. Hydrazine rapidly oxidizes to form nontoxic nitrogen and water in the environment. Therefore, hydrazine discharged to the 216-B-3 Main Pond system in 1991 (the year the 216-A-29 Ditch stopped operating) could not be present in the 216-B-3 Main Pond system above detection or risk-based action levels. For these reasons, a contained-in determination for U133 hydrazine in soil and debris at the 216-B-3 Main Pond and 216-B-3-3 Ditch was sought from Ecology under separate documentation (200 Area Hydrazine Contained-In Determination Request, Thompson 2000). Samples were collected from the 216-B-3-3 Ditch where it intersects with the 216-A-29 Ditch and analyzed for hydrazine to support the contained-in determination. A contained-in determination was received from Ecology on June 22, 2000 (*Approval of the Contained-In Determination Request for Hydrazine*, Hedges 2000). Appendix A of this closure plan contains this approval letter.

2.0 GROUNDWATER MONITORING

Groundwater monitoring in the 200-PO-5 groundwater area is conducted under three regulatory drivers, the Comprehensive, Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), Resource Conservation and Recovery Act of 1976 (RCRA), Revised Code of Washington (RCW) 70.105, Hazardous Waste Management, and the Atomic Energy Act of 1954 (AEA) where monitoring of radionuclides is required DOE/RL-2011-118. 200-PO-5 is below the 216-B-3 Main Pond system and numerous other sources within the 200 East Area. The current interim status groundwater monitoring plan as required by WAC 173-303-400 and 40CFR 265 Subpart F is contained in the *Groundwater Monitoring Plan for the Hanford Site 216-B-3 Pond RCRA Facility*) (DOE/RL-2008-59).

2.1 PREVIOUS GROUNDWATER MONITORING AT THE 216-B-3 MAIN POND SYSTEM.

RCRA groundwater monitoring at the 216-B-3 Main Pond system began in 1988 with an interim status indicator parameter evaluation (detection-level) program. The program was elevated to an assessment-level program in 1990 because of isolated instances of elevated total organic halogens (TOX) and total organic carbons (TOC) levels in two downgradient wells. The results of the groundwater quality assessment, which concluded in 1996, are reported in *Results of RCRA Groundwater Quality Assessment at the 216-B-3 Pond Facility* (PNNL-11604). The results indicated that no source of contamination could be correlated to the TOX/TOC occurrences, and that the source of the isolated higher concentrations may have been associated with well construction. Based on these findings, the facility was returned to contamination-indicator detection status in 1998 (PNNL-13367).

Since 1998, when the site was returned to indicator evaluation monitoring after an assessment period, there have been no confirmed exceedances of a critical mean value for any of the indicator parameters (i.e., pH, specific conductance, TOC, and TOX) in downgradient monitoring wells.

In late 2001, a new two-year trial approach to groundwater monitoring (PNNL-13367-ICN-1) was approved by Ecology; the regulators granted a statistical analysis variance for this purpose. This approach, placed into effect in December 2001, allows intrawell comparisons of successive analytical results on a semiannual basis for site-specific indicator constituents. The comparisons are based on methods prepared by the American Society for Testing and Materials , and apply a combined Shewhart-Cumulative Sum control chart method of statistical analysis. This approach allows the site-wide false-positive rate (the erroneous declaration of contamination) to be kept acceptably low in all wells for all constituents, while providing adequate statistical power to detect real contamination, should it occur.

Vadose zone characterization efforts for the main pond and the 216-B-3-3 Ditch found varying concentration of arsenic, barium, beryllium, cadmium, chromium, copper, nickel, lead, vanadium, and zinc (DOE/RL-200-35). These soil results resulted in groundwater analyses for total and dissolved concentrations of these metals over a 4-year period, from January 2002 through January 2005. No anomalous concentrations or trends of these constituents were found in groundwater; thus, sampling is no longer conducted for these constituents. Specific analyses for these metals were discontinued after the January 2005 sampling.

In 2005, the groundwater monitoring plan was updated to PNNL-15479, (*Groundwater Monitoring Plan for the Hanford Site 216-B-3 Pond RCRA Facility*) for the 216-B-3 Main Pond. The purpose of this document was to re-establish a groundwater contamination-indicator detection monitoring program for the 216-B-3 Main Pond, while Ecology evaluates the efficacy of the alternate approach.

In 2010, the groundwater monitoring plan was revised to DOE/RL-2008-59 and replaced the 2005 groundwater monitoring plan (PNNL-15479, *Groundwater Monitoring Plan for the Hanford Site 216-B-3 Pond RCRA Facility*) for the 216-B-3 Main Pond.

The 216-B-3 Main Pond facility has been monitored semiannually for specific conductance, TOC, TOX, pH. Annual sampling occurs for chloride, iron, manganese, phenols, sodium, sulfate, arsenic, nitrate cadmium, alkalinity, gross alpha, and gross beta. Additional field parameters (i.e., pH, dissolved oxygen, temperature, and turbidity) are sought as indicators of sample quality and general aquifer/well environmental conditions. Gross alpha and gross beta are monitored annually as site-specific indicators, along with specific conductance. Gross alpha and gross beta are monitored to detect whether radiogenic elements under AEA purview (especially strontium-90 and cesium-137) have impacted groundwater beneath the site. These indicator species can only provide an indication of the presence of radioactive constituents in the groundwater.

2.2 AQUIFER IDENTIFICATION.

The uppermost or unconfined aquifer beneath the 216-B-3 Pond is contained primarily within sediments of the Ringold Formation and extends from the water table to the top of the basalt or, in some areas, the Lower Mud unit of the Ringold Formation. The aquifer is more than 152 m (500 ft) thick in some areas and thins to 0 m (0 ft) along the flanks of bordering bedrock or other impermeable units (Figure 3).

The measured hydraulic properties of the suprabasalt sediments are highly variable. The range of hydraulic conductivities varies over several orders of magnitude, with the sharpest contrast between the Hanford formation and the Ringold Formation. In general, hydraulic conductivities in the Ringold Formation are several orders of magnitude lower than those in the Hanford formation. The groundwater flow throughout the 200 East Area is along a zone of very high transmissivity and is apparently a result of the water table occurring in the very permeable gravels of the Hanford formation. In the region of the 216-B-3 Main Pond System, flow appears to be southwesterly from the Ringold confined aquifer into the unconfined Hanford formation.

2.3 WELL LOCATION AND DESIGN.

The groundwater monitoring network for the 216-B-3 Pond system and the 216-B-3-3 Ditch includes four wells constructed from 1987 through 1992. The locations of the monitoring wells are shown in Figure 2.

The point of compliance (POC) is defined in WAC 173-303-645(6)(a) as a "vertical surface" located at the hydraulically downgradient limit of the waste management area that extends down into the uppermost aquifer underlying the regulated unit. For the 216-B-3 Main Pond, the POC will consist of the monitoring wells illustrated in Figure 2. Three of these wells (699-42-42B, 699-43-44, and 699-43-45) are directly downgradient of the facility, including the regulated portion of the 216-B-3-3 Ditch. WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells," was used to set the basic design requirements.

Figure 2 Groundwater Monitoring Network for 216-B-3 Main Pond

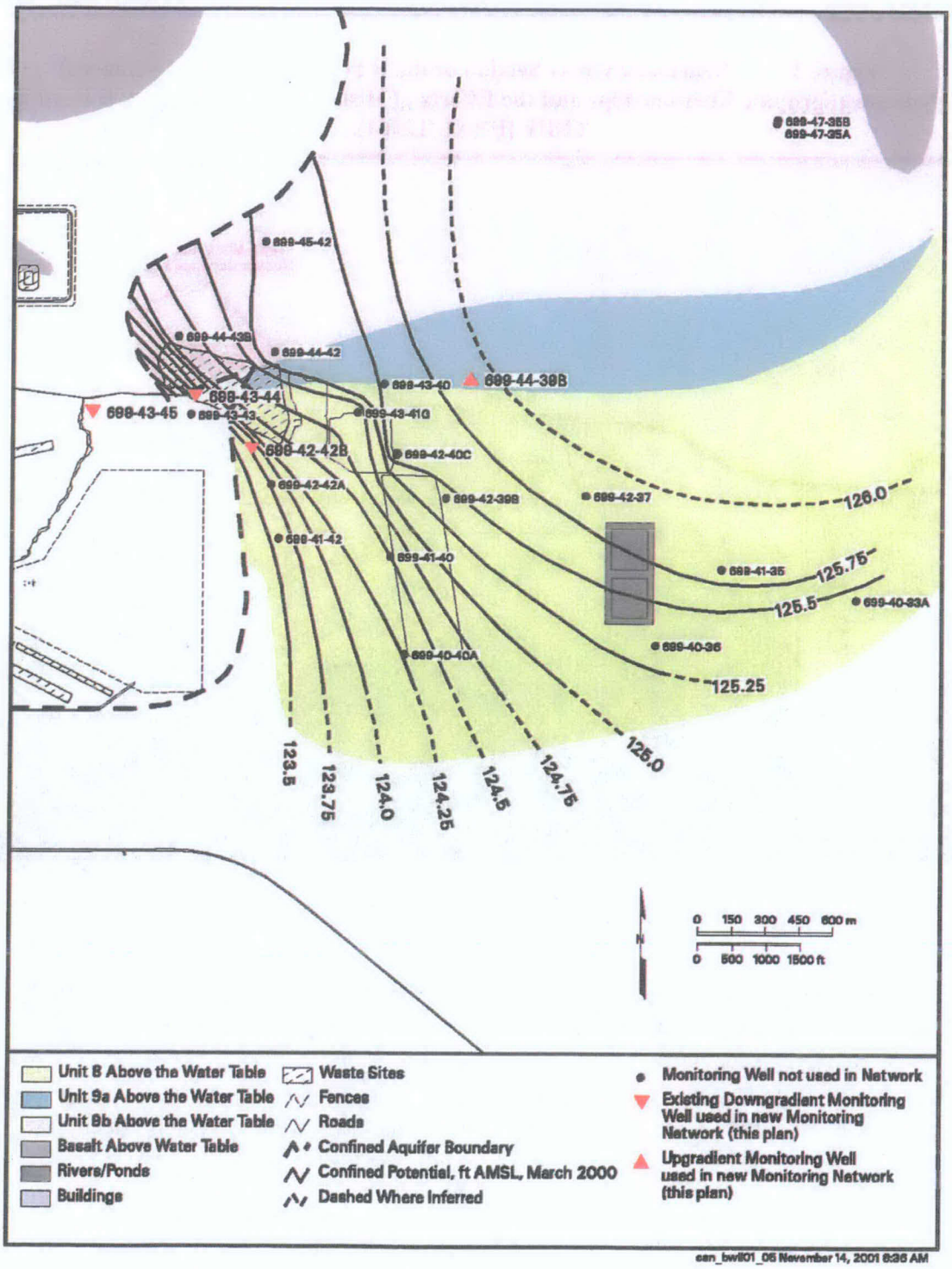
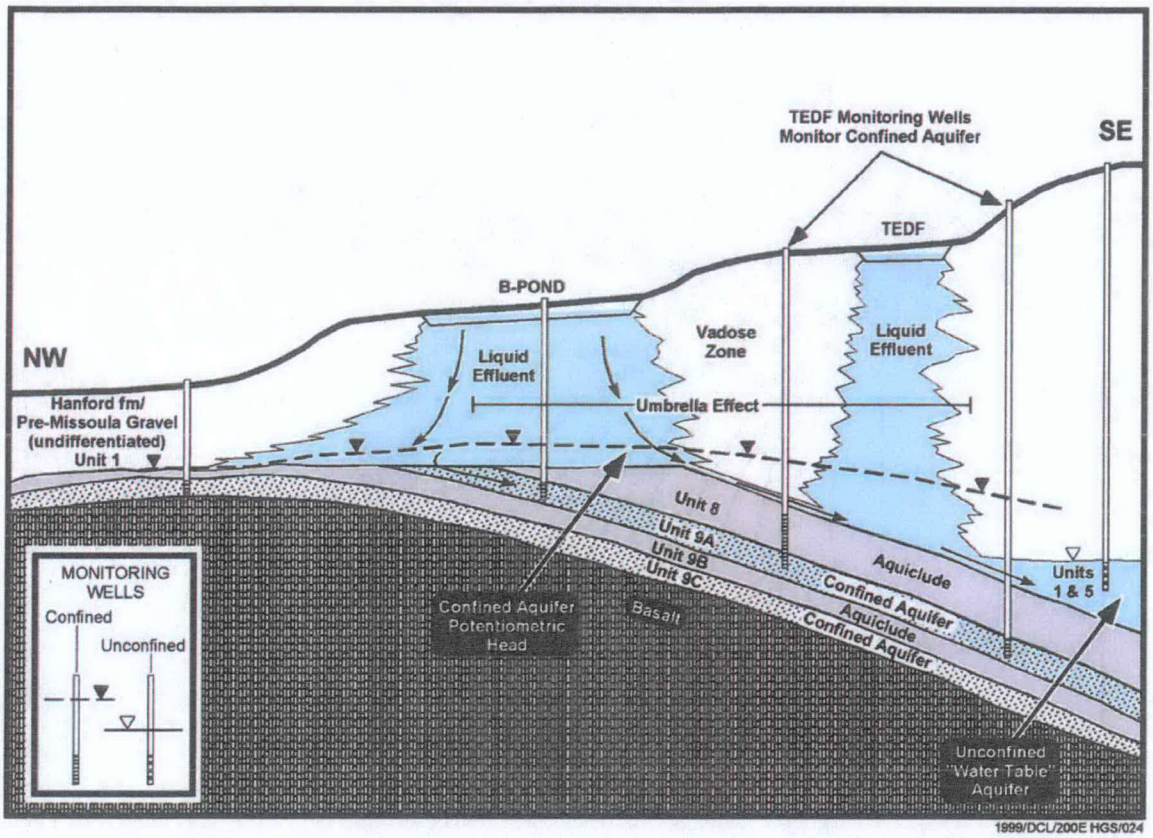


Figure 3 Schematic Cross-Section of the B Pond Area Showing General Hydrostratigraphic Relationships and the Effects of Historical Discharges by B Pond and TEDF (PNNL-12261).



3.0 CLOSURE PERFORMANCE STANDARDS

According to the closure performance standard in WAC 173-303-610(2)(a)(i – iii), the 216-B-3 Pond System will be closed in a manner that meets the following, at a minimum:

1. Minimizes the need for further maintenance;
2. Controls, minimizes, or eliminates to the extent necessary to protect human health and the environment, postclosure escape of dangerous waste, dangerous constituents, leachate, contaminated run-off, and dangerous waste decomposition products to the ground, surface water, groundwater, and air, and
3. Returns the land to the appearance and use of surrounding land areas to the degree possible given the nature of previous dangerous waste activity.

4.0 CLOSURE STRATEGY

This section presents a summary of previous closure activities and the closure strategy for 216-B-3 Main Pond System.

Closure Strategy

The first approach is to determine if clean closure of the TSD unit is achievable. Clean closure will eliminate the need for future inspections and maintenance necessitated by TSD unit constituent contamination. Clean closure also will eliminate the need for future postclosure monitoring and maintenance of the soils. Clean closure using WAC 173-340-740(3) , "Method B Soil Cleanup Levels for Unrestricted Land Use," clean-up levels will be examined first because if the data showed that the soils met these unrestricted use clean-up levels without further remediation, then the TSD unit clean closure can occur independent of the OU remediation activities.

If the TSD unit constituents cannot meet the WAC 173-340-740(3) unrestricted use cleanup levels as is, then before choosing a postclosure pathway, the operable unit remediation activities are examined to see if removal of soils is needed for past-practice contaminants. If removal of soils will be pursued for the operable unit remediation activities, then clean closure using WAC 173-340-340(3) residential values for TSD unit constituents through verification sampling and analysis can still be used. Clean closure can then be pursued for the soils, and the closure approach for groundwater must be considered (Section 5.0).

If neither of the clean-closure approaches can achieve the outcome, then the TSD unit will need to pursue some form of postclosure. The classical landfill closure option described in WAC 1 73-303-650(6)(a)(ii) would result in the construction of a barrier and long term postclosure care. Before pursuing a landfill closure option with a barrier, however, other options can be explored, with Ecology's approval, through use of the alternative closure requirement in WAC 173-303-610(1)(e), provided the conditions are met. Since the alternative requirements allow Ecology to replace all of the closure requirements except the general closure performance standards of WAC 173-303-610(2)(a), closure approaches other than landfill closure could be perused.

The Record of Decision (ROD) for the 216-B-3 Main Pond System within the 200-CW-1 operable unit shall meet the above requirements. The ROD will also identify cleanup levels to be protective of human health, the environment, and groundwater.

Soil Closure Standards

The clean-closure requirements are established in WAC 173-303-610(2)(b) and the surface impoundment standards are established in WAC 173-303-650(6)(a) to remove or decontaminate unit soils contaminated above clean-closure standards. These soil clean-closure cleanup levels are the numeric levels identified in WAC 173-340-740(3) that are either levels calculated using the most restrictive WAC 173-340-740(3) formulas for unrestricted use, or are background levels (DOE RL-92-24, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes)* when the most restrictive WAC 173-340-740(3) formulas are more stringent than

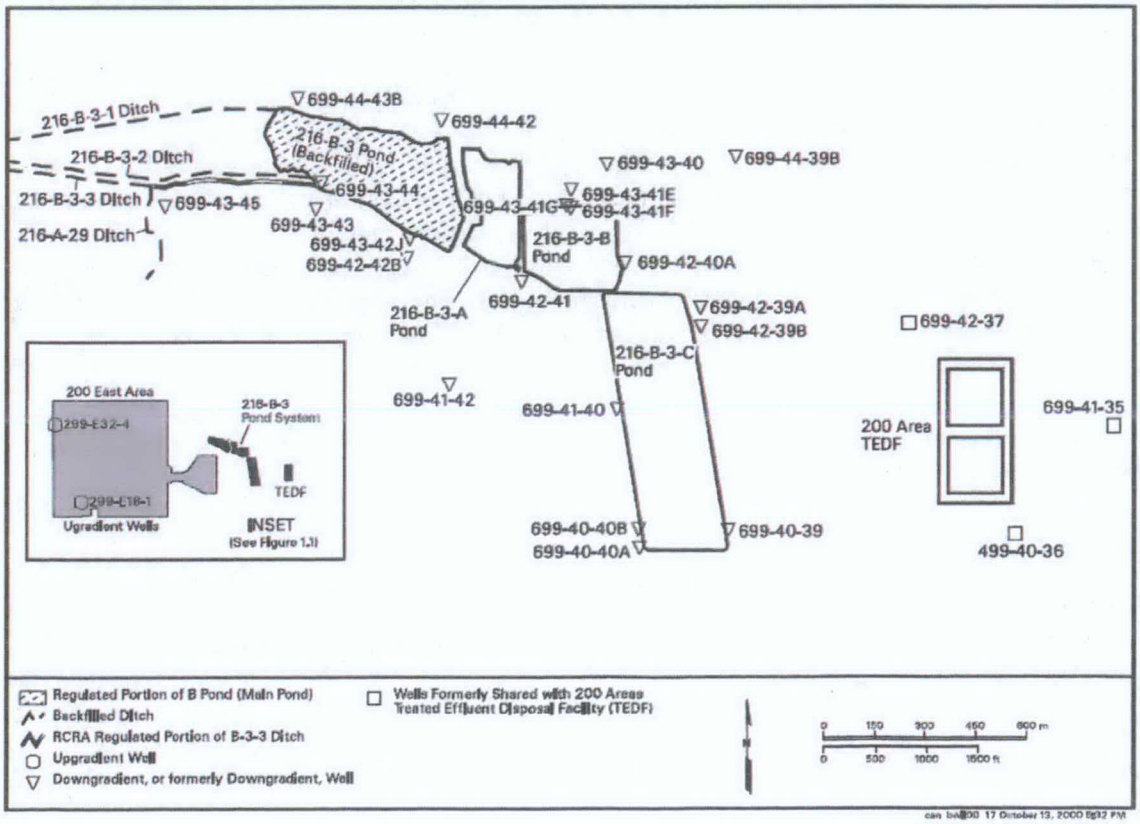
Hanford Site background concentrations. WAC 173-349-740(3) formulas for unrestricted use can include site-specific parameters.

4.1 PREVIOUS CLOSURE ACTIVITIES

Because of the history of known and potential contaminants discharged to the 216-B-3 Main Pond, a series of evaluations of soil contamination was conducted for the 216-B-3 Main Pond, 216-B-3 Expansion Ponds, and nearby portions of the B-3-3 ditch. The first phases were completed from 1989 through 1992, and involved shallow soil sampling and analysis of sediments from the 216-B-3 Main Pond, Expansion Ponds, and B-3-3 Ditch (WHC-SD-EN-AP-042), and deep vadose zone sampling in the 216-B-3 Expansion Ponds (DOE/RL-92-04).

A more recent vadose zone characterization effort was performed in 1999 in support of the 200-CW-1 OU remedial investigation, which involved only the 216-B-3 Main Pond and the B-3-3 ditch (BHI-01367). However, salient results of sampling and analysis of these ponds are included here to help substantiate inferences about contamination from past practices at 216-B-3 Main Pond as a whole.

Figure 4 Location and Configuration of the 216-B-3 Main Pond Facility and All Former Monitoring Wells Used for the Facility



Groundwater Sampling and Analysis from Soil Investigation

The 216-B-3 Main Pond historically produced an elevated water table from the large amount (over 1.0×10^{12} liters (2.6×10^{9} gal)) of water discharged to the main pond. This artificial water table has been receding since the discharges were discontinued in 1994. The groundwater beneath the TSD is currently in a detection-monitoring program for gross alpha, gross beta, arsenic, tritium, nitrate, cadmium, lead, mercury, and silver. Gross alpha and gross beta are monitored to detect whether radiogenic elements under AEA purview (especially strontium-90 and cesium-137) have impacted groundwater beneath the site. These indicator species can only provide an indication of the presence of radioactive constituents in the groundwater. For the nonradiological constituents, only nitrate has been detected; however, levels are below drinking water standards. Groundwater samples were scheduled for collection every 7.6 m (25 ft) from the water table to total depth of the borehole. The water table was encountered at approximately 54 m (177 ft) bgs. The borehole (temporary well name B5758, permanent well name 699-43-44) reached basalt, the bottom of the aquifer, at approximately 643 m (211 ft) bgs. Hence, groundwater samples were collected at only two intervals: 54 m (~177 ft) and 64 m (~210 ft), on September 22 and September 28, 1999, respectively. No perched water was encountered. Groundwater samples were collected with a portable submersible pump at the 64-m (210-ft) level and with a bailer at the 54-m (177-ft) level. Because of high turbidity, samples from the 54-m (177-ft) level were allowed to settle overnight and then decanted into sample bottles the following day using a low-flow peristaltic pump. A packer was set at 63.4 m (~208 ft) to isolate the lower 64-m (210-ft) sampling interval from groundwater above this level.

The results of the sampling efforts indicate that no constituents of concern are present in concentrations above action levels.

4.2 CLOSURE ACTIVITES FOR 216-B-3 MAIN POND AND DITCH

The proposed closure strategy for the 216-B-3 Main Pond and Ditch soils is clean closure in compliance of closure performance standards. The 216-B-3 Pond and Ditch soils currently appear to meet the clean-closure standards without remediation for the TSD constituents. Additional characterization of the 216-B-3 Main Pond and Ditch completed per DOE/RL-2006-57 Rev 0 REISSUE will be evaluated through the CERCLA process to support a remedial decision protective of human health and the environment.

The groundwater under the TSD unit is being monitored per the *Interim Status Groundwater Monitoring Plan for the 216-B-3 Main Pond*, DOE/RL-2008-59. The current status of the groundwater is under RCRA Interim Status contaminant indicator parameter monitoring. The groundwater also will be evaluated through the 200-PO-5 groundwater OU as part of a CERCLA action under alternative requirements of Dangerous Waste regulations (WAC 173-303-645(1)(e)).

5.0 CLOSURE ACTIVITIES

Overall, closure will be completed through a schedule for closure, identification of cleanup levels and standards, and sampling and analysis. For underlying soils, the closure requirements of WAC 173-303-610(2), Closure Performance Standard will be met. Where applicable, RCRA and CERCLA closure requirements will be integrated regarding protectiveness of human health and the environment as described in WAC 173-303-610(2)(a), Closure and Post-closure, and WAC 173-303-645(1)(e), Releases from Regulated Units (alternative groundwater monitoring requirements).

6.0 VERIFICATION SAMPLING AND ANALYSIS

This section discusses soil and groundwater verification sampling and analyses for meeting the closure performance standards should soil removal be required. The analytical results used to verify attainment of closure performance standards will be derived from random or statistical sampling design. Statistical sampling uses composite values and summary statistics for decision making. Clean closure will be confirmed by verification sampling integrated with the 200-CW-1 remedial actions.

7.0 CONTINGENT CLOSURE PLAN

If clean closure is not possible, a modified closure plan will be required.

8.0 SCHEDULE FOR CLOSURE

The schedule is dependent on the completion of the CERCLA process for the 200-CW-1 source OU.

Closure of the 216-B-3 Main pond and Ditch shall be coordinated and implemented with the remediation of the CW-1 source OU to ensure that all contaminants are addressed through one action. The schedule to obtain the ROD for the 200-CW-1 Source OU is dependent on completing the RI/FS process for the 200-CW-1 OU which is currently subject to milestone M-15-38B. This closure plan shall be an appendix to the RI/FS report. Any change to this milestone will directly impact the closure schedule.

9.0 CERTIFICATION OF CLOSURE

Sampling will be conducted to verify that clean closure standards are met. When sampling results have been evaluated, closure activities under this closure plan are planned to have been completed.

In accordance with WAC 173-303-610(6) "Certification of Closure," within 60 days of completion of TSD unit closure, the DOE will submit to Ecology a certification of closure. Both the DOE and the Co-Operator identified on the current Part A Permit Application for the TSD unit will sign the certification of closure, and an independent registered professional engineer will state that the unit has been closed in accordance with the approved closure plan. The certification will be submitted by registered mail or an equivalent delivery service.

Documentation supporting closure certification will be placed in the Administrative Record and will be provided to Ecology. At a minimum, typically requested documentation and information supporting closure certification includes:

1. Field notes and photographs related to closure activities.
2. Description of minor deviations from approved closure plan and their justifications.
3. Documentation of removal and final disposition of all dangerous wastes and waste residues, including contaminated media, debris, and any treated residuals.
4. Documentation that decontamination procedures were followed and decontamination standards achieved.
5. All laboratory and/or field data. This includes sampling procedures and locations, Quality Assurance/Quality Control samples, chain of custody procedures and required sample measurements.
6. Final summary report from the independent qualified registered professional engineer, itemizing all data reviewed, including analytical results used to determine a final closure status.

10.0 POSTCLOSURE PLAN

The *Hanford Site Groundwater Monitoring Report for Calendar Year 2011* (DOE/RL-2011-118) states that statistical evaluations of the indicator parameters in calendar year 2011 indicated that the 216-B-3 Main Pond TSD has not adversely affected groundwater quality. Therefore, there are no postclosure requirements specified for this RCRA TSD unit for groundwater. Groundwater monitoring will continue, however, to meet other requirements.

The closure strategy for the 216-B-3 Pond and the 216-B-3-3 Ditch is clean closure. Therefore, no postclosure plan is needed for these sites, unless clean closure cannot be achieved.

11.0 AMENDMENT OF CLOSURE PLAN

The 216-B-3 Pond and the 216-B-3-3 Ditch will be amended whenever: changes in closure activities or post-closure requirements occur; or clean closure is not met; or before certification of closure and post-closure, respectively, that would constitute a Class 1, Class 2, or Class 3 modification to the DRAFT Hanford Facility Dangerous Waste Permit (Site-Wide Permit), Revision 9, WA7890008967.

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APPENDIX A
APPROVAL OF THE CONTAINED-IN DETERMINATION REQUEST FOR HYDRAZINE

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0067433

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
1315 W. 4th Avenue • Kennewick, Washington 99336-6018 • (509) 735-7581

June 22, 2000

Mr. K. Michael Thompson
United States Department of Energy
Richland Operations Office
P.O. Box 550; MSIN A5-13
Richland, Washington 99352

RECEIVED
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EDMC

Dear Mr. Thompson:

Re: Approval of the Contained-In Determination Request for Hydrazine

The Washington State Department of Ecology (Ecology) has reviewed the contained-in determination request (i.e. letter # 00-GWVZ-050 w/att. from K.M. Thompson to E.R. Skinnarland, dated June 12, 2000) submitted by the United States Department of Energy for hydrazine contaminated soils located at the 200 CW-1 Operable Unit. Hydrazine is considered a listed (U133) hazardous constituent under the Resource Conservation and Recovery Act.

Based on the sampling results and historical information submitted, it is Ecology's opinion that hydrazine is not present in concentrations high enough to warrant management of the soil for the U133 waste code. Please note that this contained-in determination is being granted specifically for the vadose zone soils of 216-B-3 Main Pond, the 216-B-3-3 Ditch, and the drums (37 total) of Investigative Derived Waste specified in the request. Other waste streams and/or areas of the Hanford site that may be contaminated with hydrazine will require additional contained-in determination requests.

If you have questions or concerns please contact Wayne Soper, Ecology Cleanup Project Manager, at (509) 736-3049.

Sincerely,

Jane Hedges
Cleanup Section Manager
Nuclear Waste Program

JH:TW:lkd

Cc: Bryan Foley, USDOE
Moses Jarayai, BHI
Mary Todd, CHI

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DOE/RL-2006-12
Draft B

216-S-10 POND AND DITCH CLOSURE PLAN

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

U.S. DEPARTMENT OF ENERGY Richland Operations Office
P.O. Box 550
Richland, Washington 99352

Approved for Public Release;
Further Dissemination Unlimited

DOE/RL-2006-12
Draft B

216-S-10 POND AND DITCH CLOSURE PLAN

J. P. Sands
Department of Energy - Richland Operations Office

Date Published
April 2013

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

U.S. DEPARTMENT OF ENERGY | Richland Operations Office
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APPROVED
By Janis D. Aardal at 1:14 pm, Apr 09, 2013

Release Approval Date

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216-S-10 POND AND DITCH CLOSURE PLAN

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1.0 INTRODUCTION

The original closure plan for the 216-S-10 Pond and Ditch was submitted in March 2006, in accordance with Ecology et al., 1989a, *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) Milestone M-20-39, which required submittal of a closure plan for the 216-S- 10 Pond and Ditch Resource Conservation and Recovery Act of 1976 (RCRA) treatment, storage, and/or disposal (TSD) unit. This closure plan has been written to supersede the March 2006 closure plan (The abbreviated term 216-S-10 P&D will be used throughout this document.)

The 216-S-10 Pond and Ditch TSD unit will be incorporated into a future revision of the WA7890008967, *Hanford Facility Resource Conservation and Recovery Act Permit, Dangerous Waste Portion, Revision 8C, for the Treatment, Storage, and Disposal of Dangerous Waste.* When the TSD unit is incorporated, the provisions of Permit Condition II.Y.2.c will apply. Permit Condition II.Y.2.c establishes the corrective-action status of the waste site following certification of closure.

The proposed closure strategy for the 216-S-10 Pond and Ditch soils is clean closure; the groundwater will require postclosure monitoring. The 216-S-10 Pond and Ditch soils do not meet the clean-closure standards without remediation. This strategy is based on analytical data provided in DOE/RL-2005-63, Appendices A and B. The postclosure groundwater strategy is based on groundwater data contained in the *Hanford Environmental Information System* database (HEIS). Sampling of the soils will be performed to verify that contaminant removal is complete as well as to confirm waste site remedy selection was implemented to achieve clean closure standards.

The closure of the 216-S-10 P&D will be coordinated and implemented with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) remedial actions as described in the Tri Party Agreement Action Plan, Section 5.5 (TSD Units and Past-Practice Units Interface). Specifically, groundwater cleanup will be coordinated with the 200-UP-1 Groundwater Operable Unit (OU) and vadose zone cleanup will be coordinated with the 200-OA-1 Source OU. The 216-S-10 P&D was previously within the 200-CS-1 Operable Unit.

Because this closure plan is being coordinated with the activities associated with the 200-OA-1 Source OU, the closure plan is written to address only the constituents of concern relating to RCRA TSD unit operations. Any other constituents of concern are related to past-practice activities at this waste site and will be addressed under past-practice authority, in accordance with Permit Condition II.Y.2. Deferral of pre-existing contamination to other authorities that occurred prior to dangerous waste management activities is described in Ecology Publication 94-111, *Guidance for Clean Closure of Dangerous Waste Units and Facilities,* Section 2.8. Any physical activities necessary to complete remediation of non-TSD unit constituents are outside the scope of this closure plan and will be performed in conjunction with Tri-Party Agreement past-practice activities for the 200-OA-1 Source OU and the 200-UP-1 Groundwater OU.

The 200-UP-1 Groundwater Operable Unit addresses groundwater contaminant plumes beneath the southern third portion of the 200 West Area and adjacent portions of the surrounding 600

Area. (DOE/RL-2008-66, Revision 0) The *Record of Decision for Interim Remedial Action, Hanford 200 Area Superfund Site, 200-UP-1 Operable Unit* (hereafter referred to as the 200-UP-1 OU ROD) (EPA et al., 2012) was signed by EPA, DOE, and Ecology on September 27, 2012. The selected interim remedy for the 200-UP-1 OU is a combination of groundwater extraction and treatment using pump-and-treat (P&T), monitored natural attenuation (MNA), hydraulic containment of the iodine-129 plume, an iodine-129 treatment technology evaluation, remedy performance monitoring, and institutional controls (ICs). The 200-UP-1 OU ROD requires that a groundwater P&T system be designed, installed, and operated in accordance with an approved remedial design/remedial action (RD/RAWP). The schedule to obtain a Record of Decision for the 200-OA-1 Source OU is dependent on completing the Remedial Investigation/Feasibility Study process which is currently subject to milestone M-15-38B. To ensure coordination, this closure plan shall be an appendix in the 200-OA-1 RI/FS report.

1.1 Unit Description

This section includes a description of the 216-S-10 P&D, process information, and waste characteristics for the 216-S-10 P&D.

1.1.1 Physical Description

Currently, the 216-S-10 P&D is an inactive, unlined, non-operational dangerous waste surface impoundment. The 216 S-10 P&D begins approximately 445 meters (1,460 feet) southwest of the REDOX building and 4.05 meters (133 feet) south of 10th street, and ends about 1330 meters (4,364 feet) southwest of the REDOX building. The estimated sizes of the 216 S-10 P&D are described below:

- The 216-S-10 Pond covered 20,234 square meters (5 acres) and included four finger-leach trenches. The pond is approximately 2.4 meters (8 feet) deep at its deepest point. See Figures 1 and 2.
- The initial configuration of the 216-S-10 Ditch was approximately 1.2 meters (~ 4 feet) wide at its base, at least 1.8 meters (6 feet) deep and 686 meters (2250 feet) long. See Figure 3.

1.1.2 Process Information

The 216-S-10 P&D no longer receives dangerous waste. This pond and ditch was previously used to dispose of chemical sewer discharges from the Reduction-Oxidation (REDOX) facility near the Hanford Site's 200 West Area. The ditch was part of a system that included the 216-S-10 P&D and 216-S-11 Ponds.

The wastewater discharged into the 216-S-10 Ditch flowed into the 216-S-10 Pond, where it evaporated or infiltrated into the ground. The 216-S-10 Ditch began receiving wastewater from the REDOX Facility chemical sewer in August 1951. In 1954, the 216-S-10 Pond was added to the southwest end of the 216-S-10 Ditch for more disposal capacity. The 216-S-10 P&D were used to manage chemical sewer discharges from the separation and concentration processes at the Reduction Oxidation (REDOX) Facility.

The 216-S-10 Pond and Ditch were designed to percolate approximately 567,800 L (150,000 gal) of waste effluent per day. The process design capacity reflects the maximum volume of water discharged daily rather than the physical capacity of the 216-S-10 P&D. In July 1994, the effluent supply pipeline was plugged with concrete near the outfall.

216-S-10 DITCH

The 216-S-10 Ditch started receiving discharge from the REDOX Facility in 1951. After an unplanned release of uranium in May 1954, the ditch was dredged and then covered with 0.6 m (2 ft) of soil.

In September 1954, an inadvertent discharge of ammonium nitrate nonahydrate solution reduced the infiltration capacity. To improve infiltration, 0.6m (2ft) of sediment was dredged from the bottom of the ditch in 1955. The contaminated sediment was buried in excavation pits along the sides of the ditch.

Approximately 50 waste streams contributed to the 216-S-10 Ditch. The routine waste stream sources include the compressor cooling water from the 202-S Canyon and the sanitary water overflow from the water tower. The remaining sources were infrequent additions and include the 202-S Canyon floor drains, chemical sewer line manholes, and 276-S Solvent Handling Facility floor drains. The effluent to the chemical sewer was composed of approximately 60 percent REDOX Facility raw water, 20 percent sanitary water, and 20 percent steam condensate.

216-S-10 POND

The 216-S-10 Pond received discharge from the REDOX Facility. Both the 216-S-10 Ditch and Pond were designed to dispose of liquids through percolation into the soil column. The 216-S-10 Pond was dug in 1954 at the southwest end of the 216-S-10 Ditch to provide additional surface for percolation. The 216-S-10 Ditch fed the Pond. The contributors to the pond are similar to those of the 216-S-10Ditch.

The 216-S-10 P&D was used as the disposal site for the Chemical Engineering Laboratory between 1980 and 1983. The 216-S-10 P&D received one documented discharge of dangerous waste in September, 1983. It was simulated double-shell tank slurry from the Chemical Engineering Laboratory. This discharge was sent via the sewer to the pond and ditch and consisted of 450 kg (1000 lb) sodium nitrate (46 percent), sodium hydroxide (41 percent), and small quantities of sodium phosphate, sodium fluoride, sodium chloride, and potassium di-chromate.

The 216-S-10 P&D was designed to percolate approximately 567,800 liters (150,000 gallons) of waste per day. This site has not received liquid waste since October 1991.

1.1.3 Waste Characteristics

Descriptions of the dangerous waste constituents associated with the 216-S-10 P&D are included in the Draft Hanford Facility Dangerous Waste Permit (Site-Wide Permit, Revision 9, WA7890008967). During operations, the maximum volume of wastewater discharged daily to the 216-S-10 P&D was approximately 567,800 L/d (150,000 gal/d). The annual volume of effluent discharged was approximately 1.9×10^8 L (5.0×10^7 gal).The 450 kg discharge

described in the section above exhibited the dangerous waste characteristics of ignitability (D001), corrosivity (D002), chromium (D007), and toxic state-only waste (WT01, WT02).

The dangerous waste received at the 216-S-10 P&D includes sodium nitrite, sodium hydroxide, sodium phosphate, sodium fluoride, sodium chloride, and potassium di-chromate. Some of these chemicals are regulated under WAC 173-303, "Dangerous Waste Regulations," as dangerous wastes because they displayed the characteristic of corrosivity (D002) (closure parameter is pH). Potassium di-chromate is regulated because of the chromium (D007) (closure parameter is total chromium). There are no other closure parameters from D002 because disassociated anions/cations of acids, bases, and salts do not result in a dangerous waste designation and are not subject to the numerical closure performance standard comparison in WAC 173-303-610(2)(b)(i) "Closure Performance Standard," because none of them constitute a "dangerous waste, dangerous waste constituent, or residue." As part of the remediation of the unit, other hazardous substances that may be encountered will also be subject to remediation in coordination with the CERCLA Record of Decision for the 200-OA-1 source operable unit.

Table 1 TSD Constituents of Concern in soil

pH
Chromium (total)

Table 2 Added CERCLA Constituents of Potential Concern in Soil[1]

Acenaphthene	Benzo(k)fluoranthene	Copper	Mercury	Thallium
Acetone	Benzo(ghi)perylene	Cyanide	Methylene Chloride	Toluene
Anthracene	Bis-(2-ethylhexyl) phthalate	Dibenz [a,h]-Anthracene	Nitrate	Zinc
Aroclor-1254	Boron	Di-n-butylphthalate	Nitrite	
Arsenic	Butylbenzylphthalate	Lead	Phenanthrene	
Benzo(a)anthracene	Carbazole	Fluoranthene	Pyrene	
Benzo(a)pyrene	Chromium, total	Fluorene	Selenium	
Benzo(b)fluoranthene	Chrysene	Hexavalent Chromium	Silver	

1. COPCs identified in DOE/RL-2005-63, Draft B Reissue, 2007, Feasibility Study for the 200-CS-1 Chemical Sewer Group Operable Unit

2.0 GROUNDWATER MONITORING

Groundwater monitoring in the 200-UP-1 groundwater area is conducted under three regulatory drivers, the Comprehensive, Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), Resource Conservation and Recovery Act of 1976 (RCRA), Revised Code of Washington (RCW) 70.105, Hazardous Waste Management, and the Atomic Energy Act of 1954 (AEA) where monitoring of radionuclides is required (DOE/RL-2008-66, Revision 0). 200-UP-1 is below the 216-S-10 P&D and numerous other sources within the 200 West Area. 200-UP-1 has a Record of Decision for pumping and treating contaminated groundwater. Groundwater monitoring has shown an elevated level of chromium in an upgradient well, 299-W-26-7 (now dry), and a downgradient well, 299-W-26-13. The source of this contamination has not been conclusively determined. And, because chromium is a TSD unit constituent, the 216-S-10 P&D has not been currently ruled out as the source of contamination. Therefore, postclosure groundwater monitoring for chromium will be required. A description of closure strategy begins in section 4.0.

The 216-S-10 P&D closure approach is postclosure monitoring under a final-status detection monitoring program. This closure approach is based on the data gathered to date from the monitoring network *(PNNL-14070, Groundwater Monitoring Plan for the 216-S-10 P&D)* found in the Hanford Environmental Information System (HEIS) database, vadose zone characterization data, and annual groundwater monitoring results included in *Hanford Site Groundwater Monitoring for 2011* (DOE/RL-2011-118). Postclosure activities are described in Section 10.0

The current interim status groundwater monitoring plan, as required by WAC 173 303 400, Interim Status Facility Standards, and 40 CFR 265, Subpart F, Ground-Water Monitoring, is in a separate document, DOE/RL-2008-61, Interim Status Groundwater Monitoring Plan for the 216-S-10 P&D. This document contains further details regarding the geology, hydrology, and current groundwater monitoring programs for this TSD unit.

2.1 Previous Groundwater Monitoring at 216-S-10 Pond and Ditch

RCRA groundwater monitoring of the 216-S-10 P&D began in the third quarter of 1991 with an interim-status indicator parameter evaluation (detection-level) program (DOE/RL-92-03, Annual Report for RCRA Groundwater Monitoring Projects at Hanford Site Facilities for 1991). The wells were sampled quarterly for one year to establish background levels. Semiannual sampling for indicator parameters evaluation was instituted in 1992.

The RCRA indicator parameters include specific conductance, pH, total organic carbon, and total organic halides. Groundwater quality parameters include chloride, iron (filtered), manganese (filtered), phenols, sodium (filtered), and sulfate. Most of the network wells are monitored semiannually for the contamination indicator parameters total organic halides, total organic carbon, pH, and specific conductance. Major dissolved anions, metals, mercury, alkalinity, turbidity, and temperature are also sampled semiannually as indicators of sample and analytical quality, as well as general aquifer/well background conditions. Phenols, Aroclor 1254, and benzo(a)pyrene have been identified as possible contaminants for the 216-S-10 P&D and are sampled annually. In fiscal years 1996 and 1997, total organic halides were detected in upgradient well 299-W26-8 (*Hanford Site Groundwater Monitoring for Fiscal Year 1997*, PNNL-11793). Quarterly sampling of the upgradient wells occurred for one year to reestablish

critical mean for total organic halides, and then the wells were sampled semiannually. The cause of the upgradient total organic halides is likely the upgradient carbon tetrachloride plume.

Table 3 Monitoring Well Sampling for the 216-S-10 Pond and Ditch[1]

Contamination Indicator Parameters[2]	Groundwater Quality Parameters[2]	Constituents of Interest	Supporting Constituents to Support Interpretation
pH	Chloride	Chromium (Total)	Oxidation/Reduction Potential
Specific Conductance	Iron (Filtered and Unfiltered)	Hexavalent Chromium (Filtered and Unfiltered)	Temperature
Total Organic Carbon	Manganese (Filtered and Unfiltered)	Copper	Turbidity
Total Organic Halides	Phenols	Mercury	Alkalinity
	Sodium (Filtered and Unfiltered)	Zinc	Anions
	Sulfate	Aroclor 1254	Metals (Filtered and Unfiltered)
		Benzo(a)pyrene	Water Level[2]

1. Identified in Interim Status Groundwater Monitoring Plan for the 216-S-10 Pond and Ditch, DOE/RL-2008-61, Rev 0
2. RCRA Required Constituents required by 40 CFR 265.92, Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," Sample and Analysis."

Figure 4 shows the locations of groundwater monitoring wells near 216-S-10 P&D. The only exceedances of a maximum contaminant level occurred in the shallow upgradient well 299-W26-7 for hexavalent chromium, which is above the 48 micrograms per liter (µg/L) state MTCA B groundwater cleanup level (WAC173-340). An estimated 3,000 kilograms of chromium were disposed to the 216-S-10 P&D (*RPP-26744, Appendix C*). Chromium concentrations in upgradient well 299-W26-7 varied in the 10 years before it went dry, and were above the 100

µg/L federal drinking water standard (*40 CFR 141)* during most of the life of the well. The varying concentrations may have been caused by short-term releases traveling through the vadose zone. The December 2002 chromium value was 204 µg/L and was the last sample collected from the well.

Concentrations of chromium have been detected above state MTCA B groundwater cleanup levels in the downgradient wells. Chromium concentrations in well 299-W26-13 (first sampled in February 2000 and located downgradient of well 299-W26-7 were 28.4 (filtered) and 61.3 (unfiltered) µg/L in January 2008. In well 299-W26-13 at the 216-S-10 P&D, chromium averaged 86 µg/L during 2011 (hexavalent chromium and filtered total chromium results combined), and the trend has been increasing. Chromium is also elevated in well 699-32-76, located 300 meters further downgradient (*DOE/RL-2011-118*). There were no confirmed exceedances of a groundwater contamination indicator parameter at the 216-S-10 P&D during 2011.

2.2 Aquifer Identification

The uppermost or unconfined aquifer beneath the 216-S 10 P&D is approximately 61 meters (200 feet) thick and is contained within sediments of the upper unit of the Ringold Formation (Ringold Unit 5). The depth to groundwater ranges from approximately 63 meters to 70 meters (207 feet to 230 feet). The aquifer extends from the water table to the Ringold lower mud unit (Unit 8) of the Ringold Formation. The groundwater flow has been generally to the east-southeast for the last several years. The average linear velocity has remained essentially the same as in fiscal year 2006 and ranges from 0.08 meters per day to 2.25 meters per day, or 29 meters per year to 820 meters per year (DOE/RL-2008-01). The water table beneath the 216-S-10 P&D has declined significantly since the discharges to the 216-U-10 Pond system ceased in 1984.

2.3 Well Location and Design

The current monitoring well network consists of five downgradient wells (Figure 4):

- 299-W26-13
- 299-W26-14
- 699-33-75
- 699-32-76
- 299-W27-2

And, one upgradient well

- 699-33-76

Wells 299-W26-13, 699-33-75, and 699-32-76 monitor the uppermost aquifer which is downgradient of the 216-S-10 Pond. Well 299-W26-14 monitors the uppermost aquifer along the 216-S-10 Ditch. Well 299-W27-2, located at the former discharge end of the 216-S-10 Ditch, is a deep monitoring well screened just above the top of the Ringold lower mud unit.

Well 699-33-76 is an upgradient well located west of the 216-S-10 Ditch.

Wells 699-33-75, 699-32-76, and 699-33-76 were installed in 2008 to support monitoring for the 200-UP-1 Operable Unit and the 216-S-10 P&D. Wells 699-33-75, 699-32-76, and 699 33-76 were sampled quarterly until ambient conditions were statistically established.

Construction of the wells followed RCRA standard well construction specifications. The standards in WAC 173 160, Minimum Standards for Construction and Maintenance of Wells were used to establish basic design requirements. The initial six (6) interim status groundwater monitoring network wells for the 216-S-10 P&D were constructed from 1990 through 1992. Five of these wells went dry because of regional groundwater declines. Wells 299-W26-13 and 299-W26-14 were added as replacements in 2000 and 2003, respectively; and wells 699-33-75, 699-32-76, and 699-33-76 were installed in 2008. Construction summaries for the current network are provided in DOE/RL-2008-61.

3.0 CLOSURE PERFORMANCE STANDARDS

According to the closure performance standard in WAC 173-303-610(2)(a)(i – iii), the 216-S-10 P&D will be closed in a manner that meets the following, at a minimum:

1) Minimizes the need for further maintenance;
2) Controls, minimizes, or eliminates to the extent necessary to protect human health and the environment, postclosure escape of dangerous waste, dangerous constituents, leachate, contaminated run-off, and dangerous waste decomposition products to the ground, surface water, groundwater, and air, and
3) Returns the land to the appearance and use of surrounding land areas to the degree possible given the nature of previous dangerous waste activity.

4.0 CLOSURE STRATEGY

This section includes a description of the closure and postclosure strategies for closure of the 216-S-10 P&D.

Closure Strategy

The first approach is to determine if clean closure of the TSD unit is achievable. Clean closure will eliminate the need for future inspections and maintenance necessitated by TSD unit constituent contamination. Clean closure also will eliminate the need for future postclosure monitoring and maintenance of the soils. Clean closure using WAC 173-340-740(3) , "Method B Soil Cleanup Levels for Unrestricted Land Use," clean-up levels were examined first because if the data showed that the soils met these unrestricted use clean-up levels without further remediation, then the TSD unit clean closure can occur independent of the OU remediation activities.

If the TSD unit constituents cannot meet the WAC 173-340-740(3) unrestricted use cleanup levels as is, then before choosing a postclosure pathway, the operable unit remediation activities are examined to see if removal of soils is needed for past-practice contaminants. If removal of soils will be pursued for the operable unit remediation activities, then clean closure using WAC 173-340-340(3) residential values for TSD unit constituents through verification sampling and analysis can still be used. Clean closure can then be pursued for the soils, and the closure approach for groundwater must be considered (Section 5.0).

If neither of the clean-closure approaches can achieve the outcome, then the TSD unit will need to pursue some form of postclosure. The classical landfill closure option described in WAC 1 73-303-650(6)(a)(ii) would result in the construction of a barrier and long term postclosure care. Before pursuing a landfill closure option with a barrier, however, other options can be explored, with Ecology's approval, through use of the alternative closure requirement in WAC 173-303-610(1)(e), provided the conditions are met. Since the alternative requirements allow Ecology to replace all of the closure requirements except the general closure performance standards of WAC 173-303-610(2)(a), closure approaches other than landfill closure could be pursued.

The Record of Decision (ROD) for the 216-S-10 P&D within the 200-OA-1 operable unit shall meet the above requirements. The ROD will also identify cleanup levels to be protective of human health, the environment, and groundwater. Requirements for clean closure are calculated using unrestricted use exposure assumptions according to MTCA regulations Chapter 173-340. Tables 1 - 3 identify chemical constituents of potential concern (COPCs) for the 216-S-10 P&D.

Soil Closure Standards

The clean-closure requirements are established in WAC 173-303-610(2)(b) and the surface impoundment standards are established in WAC 173-303-650(6)(a) to remove or decontaminate unit soils contaminated above clean-closure standards. These soil clean-closure cleanup levels are the numeric levels identified in WAC 173-340-740(3) that are either levels calculated using the most restrictive WAC 173-340-740(3) formulas for unrestricted use, or are background levels (DOE RL-92-24, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes)* when the most restrictive WAC 173-340-740(3) formulas are more stringent than Hanford Site background concentrations. WAC 173-349-740(3) formulas for unrestricted use can include site-specific parameters.

4.1 Previous Closure Activities

The 216-S-10 Pond and the southwest end of the 216-S-10 Ditch was decommissioned, backfilled, and stabilized in October 1985. The northern portion of the 216-S-10 Ditch was not used after October 1991. In July 1994, the effluent supply pipeline near the outfall was plugged. The remainder of the 216-S-10 Ditch was decommissioned in 1991. (DOE/RL 2008-61)

Several remedial investigations were completed for the Hanford Site in 2004 (DOE/RL-2004-17, Rev. 0), 2005 (DOE/RL-2005-64, Draft A), 2006 (DOE/RL-92-76, Rev. 1), 2007 (DOE/RL-63, Draft B Reissue), and 2008 (DOE/RL-2008-61) which provided identification of sources of potential waste contamination and proposed options for remediation for numerous waste sites managed by the Department of Energy. The 216-S-10 P&D was included in these investigations.

Soils –Past remedial investigations and historical and process knowledge indicate that the 216-S-10 Pond meets clean closure standards for the contaminants of concern associated with the TSD discharge. The 216-S-10 Ditch does not meet clean closure requirements. The constituents of interest are estimated to be up to 3 feet below the bottom of the ditch.

Groundwater – The strategy for groundwater is postclosure monitoring due to elevated chromium levels at a well location associated with the 216-S-10 P&D. Strategies included integration of RCRA closure requirements with the remediation of the 200-UP-1 Groundwater OU.

The criteria for meeting the groundwater protectiveness standard is described in WAC 173-303-610(2)(a). Releases of contaminants to groundwater from 216-S-10 P&D may have occurred and comingled with plumes from other solid waste management units. The use of alternative groundwater monitoring protection requirements (WAC 173-303-645(1)(e) has also been considered for site closure.

4.2 Closure Strategy for the 216-S-10 P&D

The 216-S-10 P&D soils will be clean closed. Clean closure cannot be achieved with all soil left in place due to elevated Cr in some areas, so removal of contaminated soils will be required.

The 216–S-10 P&D will be evaluated through the CERCLA process for the 200-OA-1 source OU to choose a final remedy to achieve clean closure and ensuring protection of human health and the environment.

Groundwater cleanup will be coordinated with the 200-UP-1 Operable Unit as described in the HFFACO Action Plan, Section 5.5, and in accordance with HFFACO Milestone M-037-11.

5.0 CLOSURE ACTIVITIES

Overall, closure will be completed through a schedule for closure, identification of cleanup levels and standards, and sampling and analysis. For underlying soils, the closure requirements of WAC 173-303-610(2), Closure Performance Standard will be met. Where applicable, RCRA and CERCLA closure requirements will be integrated regarding protectiveness of human health and the environment as described in WAC 173-303-610(2)(a), Closure and Post-closure, and WAC 173-303-645(1)(e), Releases from Regulated Units (alternative groundwater monitoring requirements).

5.1 Groundwater Sampling and Analysis

The existing groundwater monitoring requirements are described in the *Interim Status Groundwater Monitoring Plan for the 216-S-10 Pond and Ditch*, DOE/RL-2008-61, Rev 0. Table 4 lists the constituents and parameters required from this plan.

Because no liner existed under the 216-S-10 Pond, groundwater monitoring would be required for a period of 3 years based on WAC 173-303-645(11) to ensure no migration of contaminants of concern were occurring. Based on WAC 173-303-645(11)(f), detection monitoring would continue for 3 years for Table 1 constituents. After soils meet closure performance standards (before the TSD unit would be certified for closure) Table 1 constituents are required to be monitored on an annual basis for a total of 3 years. These requirements will be coordinated with groundwater monitoring requirements related to 200-UP-1groundwater operable unit for Table 3 constituents.

5.2 Completed Soil Sampling and Analysis

As part of previous CERCLA remedial investigation (200-CS-1 OU for example), data were collected to characterize the nature and vertical extent of contamination and the physical conditions in the vadose zone underlying the 216-S-10 Ditch and Pond. Drilling, test pit

excavation, surface and borehole geophysical surveys, and soil sampling and analysis were conducted during the field activities.

Borehole and test pit locations are shown in Figure 4 at the end of this closure plan.

Test Pits SD-1, SD-2, and SD-3 were excavated and sampled in the 216-S-10 Ditch, and borehole B8828was drilled and sampled adjacent to the 216-S-10 Ditch. Borehole B8828 was completed as a RCRA monitoring well and renumbered as well 299-W26-14 to support the RCRA monitoring program. Test Pit SD-3 was excavated in the 216-S-10 Ditch to gather characterization data below the waste site.

Test Pits SP-1, SP-2, SP-3, and SP-4 were excavated and sampled in the 216-S-10 Pond. Borehole B8817 was drilled and sampled adjacent to the 216-S-10 Pond in fiscal year 1999, and details are provided in PNL-13198, *Borehole Data Package for the 216-S-10 Pond and Ditch.* Borehole B8817 was completed as a RCRA monitoring well and renumbered as well 299-W26-13.

The test pit locations were prepared by removing 0.3 to 0.6 m (1 to 2 ft) of topsoil from the site. The test pits were excavated to a maximum depth of 7 m (25 ft) below ground surface using a trackhoe. Samples were obtained directly from the trackhoe bucket at intervals of approximately 0.7 m (2.5 ft). Samples were analyzed for chemical and physical properties. The test pits were backfilled in the reverse order from which they were excavated using the trackhoe, and a front-end loader was used to backfill the site with topsoil and/or gravel.

Soils from the boreholes and test pits were screened in the field both for indications of contamination and to assist in determining the discrete sample locations or depths before the samples were collected. Soil samples were collected for analysis and determination of physical properties. The sampling approach generally required a greater sample frequency near the bottom of the waste site, which is the area of highest suspected contamination. Sample collection was always attempted at depths of 4.6 and 7.6 m (15 and 25 ft) below ground surface to define contamination profiles. Sample frequency generally was reduced to 6.1 to 15.2 m (20 to 50 ft) intervals below a depth of 7.6 m (25 ft) in the boreholes

Soil samples were analyzed for the constituents of concerns from DOE/RL-2004- 17, *Remedial Investigation Report for the 200-CS-1 Chemical Sewer Group Operable Unit.* Samples were analyzed selectively for field bulk density and moisture content. In addition, pond and ditch samples from the bottom of each of the test pits were analyzed for an expanded list of compounds, to satisfy waste designation requirements. Soil descriptions were recorded to better define stratigraphic relationships. The results obtained from previous characterization activities also were evaluated as part of this remedial investigation.

6.0 VERIFICATION SAMPLING AND ANALYSIS

The sampling and analysis plan for verifying that soil remaining after remediation meets the requirement of clean closure will be included in Remedial Design/Remedial Action Work Plan for 200-OA-1 OU.

6.1 Groundwater Verification Sampling and Analysis

Groundwater verification sampling for the 216-S-10 P&D will include comparing all contaminants of concern from monitoring data and comparing to cleanup levels identified in the 200-UP-1 Groundwater OU ROD.

7.0 Contingent Closure Plan

If clean closure is not possible, a modified closure plan will be required.

8.0 SCHEDULE FOR CLOSURE

Closure of the 216-S-10 P&D soils shall be coordinated and implemented with the remediation of the 200-OA-1 Source OU to ensure all contaminants are addressed one time. The schedule to obtain a Record of Decision for the 200-OA-1 Source OU is dependent on completing the Remedial Investigation/Feasibility Study process for 200-OA-1 OU which is currently subject to milestone M-15-38B. This closure plan shall be an appendix in the RI/FS report. Any change to this milestone will directly impact this closure schedule.

Groundwater monitoring is an active program that will continue in support of the 216-S-10 P&D and the 200-UP-1 Operable Unit. The groundwater monitoring program is described in section 2.0.

9.0 CERTIFICATION OF CLOSURE

Upon removal of the 216-S-10 Pond and Ditch contaminated soils, sampling will be performed to verify that contaminant removal is complete, as well as to confirm waste site remedy selection was implemented to achieve clean closure. When sampling results have been evaluated, closure activities under this closure plan are planned to have been completed.

In accordance with WAC 173-303-610(6) "Certification of Closure," within 60 days of completion of TSD unit closure, the DOE will submit to Ecology a certification of closure. Both the DOE and the Co-Operator identified on the current Part A Permit Application for the TSD unit will sign the certification of closure, and an independent registered professional engineer will state that the unit has been closed in accordance with the approved closure plan. The certification will be submitted by registered mail or an equivalent delivery service.

Documentation supporting closure certification will be placed in the Administrative Record and will be provided to Ecology. At a minimum, typically requested documentation and information supporting closure certification includes:

1. Field notes and photographs related to closure activities.
2. Description of minor deviations from approved closure plan and their justifications.
3. Documentation of removal and final disposition of all dangerous wastes and waste residues, including contaminated media, debris, and any treated residuals.
4. Documentation that decontamination procedures were followed and decontamination standards achieved.

5. All laboratory and/or field data. This includes sampling procedures and locations, Quality Assurance/Quality Control samples, chain of custody procedures and required sample measurements.
6. Final summary report from the independent qualified registered professional engineer, itemizing all data reviewed, including analytical results used to determine a final closure status.

10.0 POSTCLOSURE PLAN

The closure strategy for the 216-S-10 Pond and Ditch is clean closure with regard to TSD unit constituents for soils; therefore, no postclosure plan for the soils is required.

Clean closure of the groundwater is not possible because of chromium contamination in the groundwater. A postclosure final-status detection monitoring program is required. Postclosure groundwater monitoring will be performed as described in a postclosure groundwater monitoring plan to meet the postclosure plan requirements of WAC 173-303-610(8)(b)(i), "Post-Closure Plan; Amendment of Plan," and WAC 173-303-645, "Releases from Regulated Units," stated in WAC 173-303-61O(8)(b)(ii).

Postclosure requirements of WAC 173-303-610(8)(b)(ii) regarding planned maintenance activities and frequencies do not apply. Training requirements apply for the collection of groundwater monitoring samples.

11.0 AMENDMENT OF CLOSURE PLAN

The 216-S-10 P&D will be amended whenever: changes in closure activities or post-closure requirements occur; or clean closure is not met; or before certification of closure and post-closure, respectively, that would constitute a Class 1, Class 2, or Class 3 modification to the DRAFT Hanford Facility Dangerous Waste Permit (Site-Wide Permit), Revision 9, WA7890008967.

12.0 REFERENCES

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2) 40 Code of Federal Regulations (CFR), Part 141, National Primary Drinking Water Regulations, United States Environmental Protection Agency.
3) 40 Code of Federal Regulations (CFR) Part 300, National Oil and Hazardous Substances Pollution Contingency Plan, Environmental Protection Agency.
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5) Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 USC 9601 et. seq.
6) DOE/RL-92-03, February 1992, Annual Report for RCRA Groundwater Monitoring Projects at Hanford Site Facilities for 1991, Revision 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
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16) DOE/RL-2008-61, March 2010, Interim Status Groundwater Monitoring Plan for the 216-S-10 P&D, Revision 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
17) DOE/RL-2008-66, March 2009, Hanford Site Groundwater Monitoring for Fiscal Year 2008, Revision 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

18) DOE/RL-2011-118, August 2012, Hanford Site Groundwater Monitoring for 2011, Revision 0, U.S. Department of Energy, Richland Operations, Richland, Washington.

19) DRAFT Hanford Facility Dangerous Waste Permit (Site-Wide Permit), Revision 9, WA7890008967.

20) Ecology Publication 94-111, 2005, Guidance for Clean Closure of Dangerous Waste Units and Facilities, as amended, Washington State Department of Ecology, Olympia, Washington.

21) Hanford Environmental Information System (HEIS), Hanford Site database.

22) Ecology, EPA, and DOE, 1989a, Hanford Federal Facility Agreement and Consent Order, 2 Volumes, as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

23) Ecology, EPA, and DOE, 1989b, Hanford Federal Facility Agreement and Consent Order Action Plan, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

24) Hanford Federal Facility Agreement and Consent Order Change Control Form, Change Number M-37-12-01, Interim Milestone M-037-03, *Submit Revised Closure Plans to Support TSD Closure for two (2) TSD Units: 216-B-3 Main Pond System and 216-S-10 P&D*, due date changed to April 30, 2013.

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32) WAC 173-303, Dangerous Waste Regulations, Washington Administrative Code, as amended, Washington State Department of Ecology, Olympia, Washington.

33) WAC 173-303-610, Closure and Post-Closure, Washington Administrative Code, Washington State Department of Ecology, Olympia, Washington.

34) WAC 173-303-645, Releases from Regulated Units, Washington Administrative Code, as amended, Washington State Department of Ecology, Olympia, Washington.

35) WAC 173-303-650, Surface Impoundments, Washington Administrative Code, as amended, Washington State Department of Ecology, Olympia, Washington.

36) WAC 173-303-665, Landfills, Washington Administrative Code, as amended, Washington State Department of Ecology, Olympia, Washington.

37) WAC 173-340, Model Toxics Control Act - Cleanup, Washington Administrative Code, as amended, Washington State Department of Ecology, Olympia, Washington.

38) Waste Information Data System (WIDS), Hanford Site electronic database.

39) WCH-191, 2010, Environmental Restoration Disposal Facility Waste Acceptance Criteria, Revision 2, Washington Closure Hanford, Richland, Washington.

FIGURES

Figure 1 216-S-10 Pond

Figure 2 216-S-10 Pond and Ditch Location and Site Plan

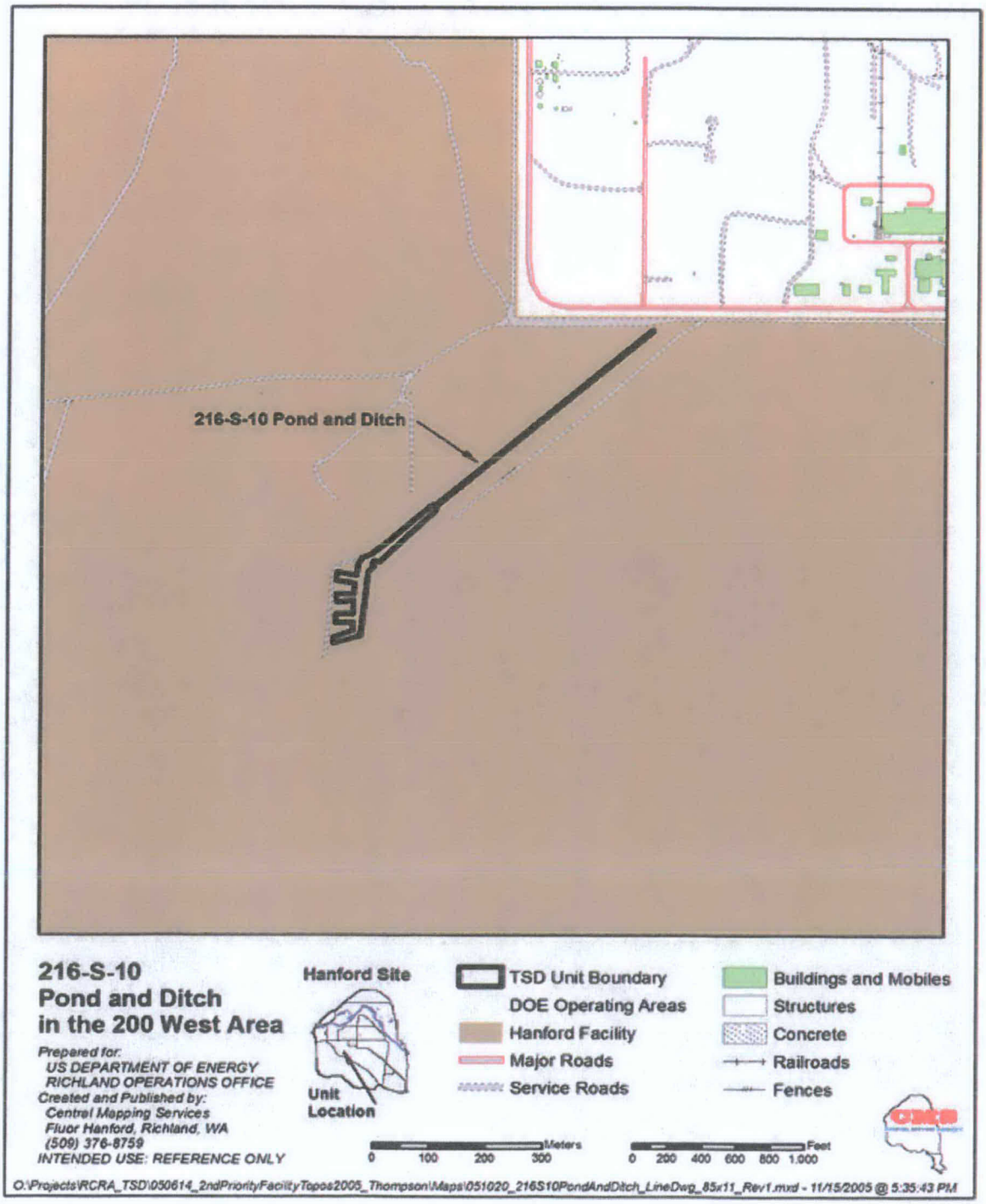


Figure 3 216-S-10 Ditch

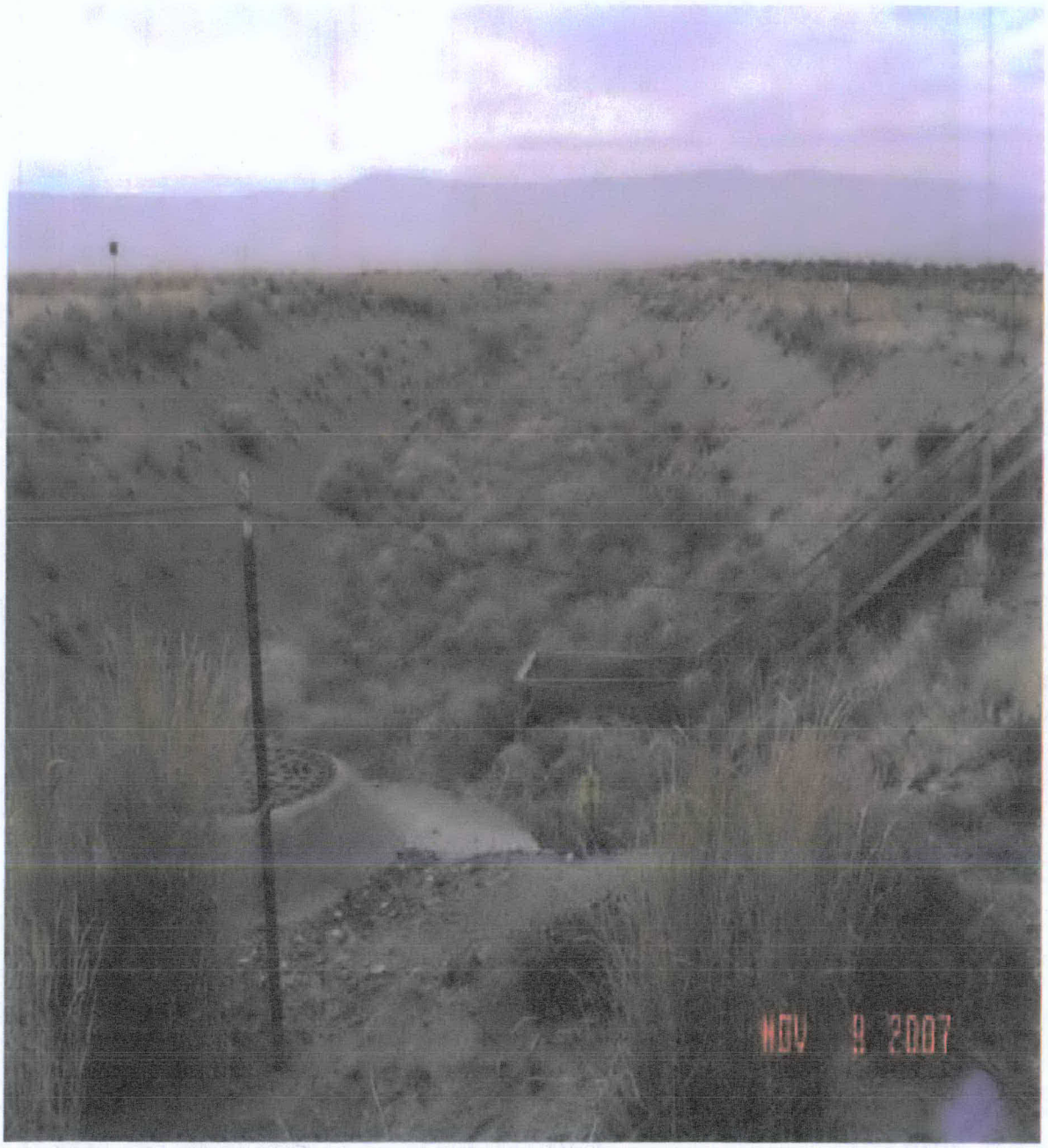
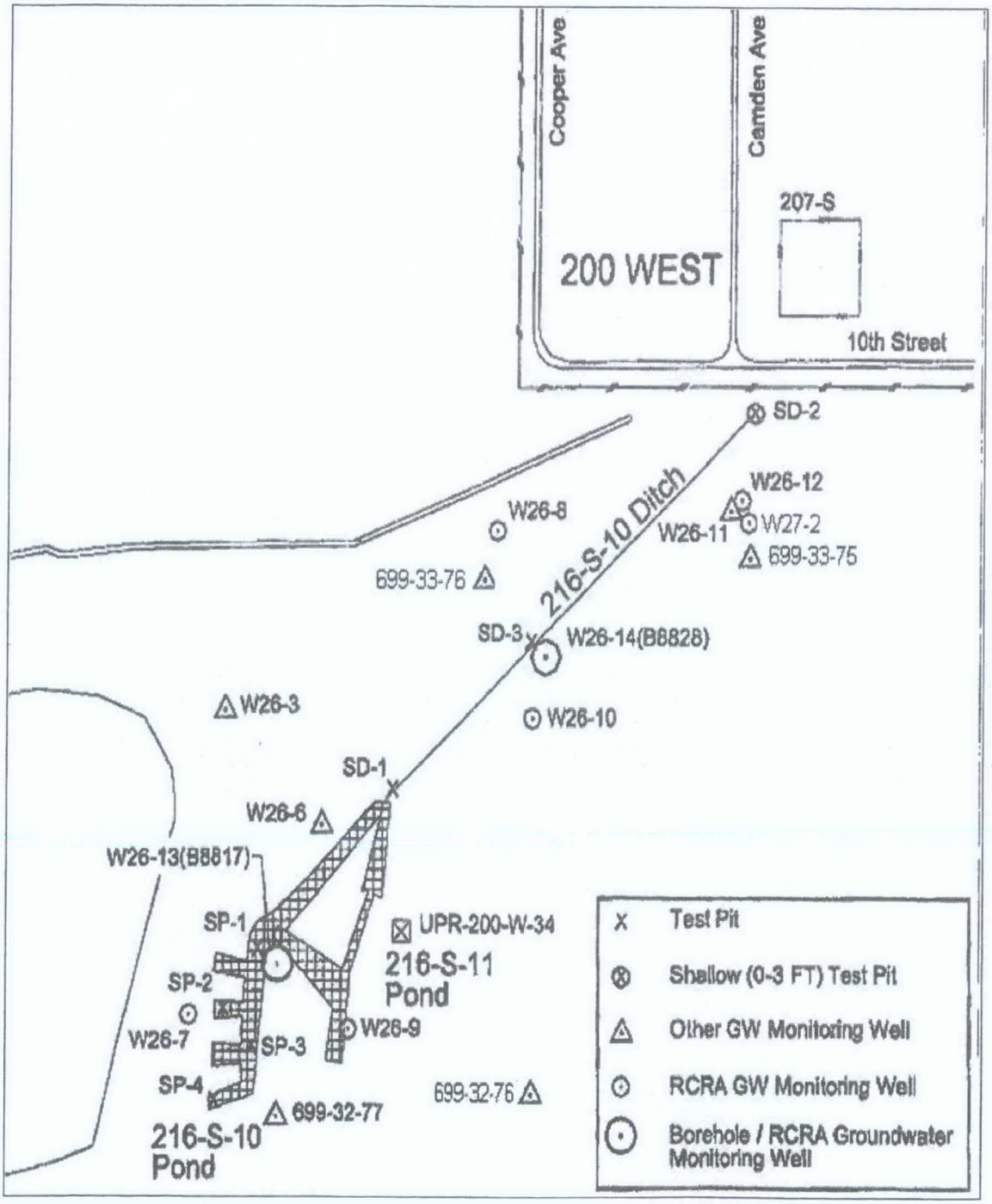


Figure 4 Borehole, Test Pit and Groundwater Well Locations



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