BHI-01043
Rev. 0

Description of Work for the Drilling within the Chromium Plume West of 100-D/DR Reactors

HANFORD

Prepare d for the U.S. Department of Energy
Office of Environmental Restoration and
Waste Management

Bechtel Hanford, Inc.
Richland, Washington

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1.0 SCOPE OF WORK

This document describes the work scope associated with installing four (4) new monitoring wells in the 100-D/DR Area (100-HR-3 Operable Unit). The new work scope is described in a Baseline Change Proposal entitled "Phase 2 Characterization of the 100-D Area Hot Spot" (BCP-97211, Rev. 0). The strategy for placement of the new wells and their design is presented in "*Assessment of the Chromium Plume West of the 100-D/DR Reactors*" (Connelly 1997). The strategy relies on estimates for flow paths that might have existed during operation of the 100-D Reactor and on experience gained during the recent installation of well 199-D4-1 (Myers et al. 1996). A Data Quality Objectives (DQO) workshop was held to evaluate data collection needs during well installation. The workshop included input from key project team members and the lead regulatory agency. Decisions concerning data resulting from the DQO process have been incorporated into this document. A summary of the DQO workshop is included as Attachment A.

2.0 BACKGROUND

In October and November of 1995, samples of pore water were collected from riverbed sediments adjacent to the 100-D/DR Area (Hope and Peterson 1996). The samples contained hexavalent chromium at unexpected concentrations, which were as high as 632 μg/L. To confirm the presence of chromium contamination in the aquifer near the pore water sampling site, plastic sampling tubes were driven into the sediments at the low-water shoreline. Tubes were emplaced at multiple depths in the aquifer. Subsequent sampling revealed hexavalent chromium concentrations as high as 869 μg/L. Chromium contamination appeared to be present throughout the vertical extent of the aquifer.

To further characterize the extent of chromium contamination inland from the river, well 199-D4-1 was installed in October 1996 (location shown in Figure 1). The well was designed to serve two purposes: groundwater monitoring and potential groundwater extraction. The initial sampling results at the well revealed chromium at a concentration of 908 μg/L. A description of the information gained from installing the new well, along with a plan for additional characterization of the chromium plume, was subsequently prepared (Connelly 1997).

Efforts to identify a source for the chromium observed along this segment of the 100-D/DR shoreline have included sampling soils adjacent to the 1907-DR process sewer outfall and estimating groundwater flow paths that might have existed during the 100-D Reactors' operating years. Although chromium-bearing effluent was known to have been discharged to the shoreline soils at the outfall, hexavalent chromium was detected in only one of 10 soil samples (Hope 1996). The single detection was at a concentration of 0.5 mg/kg, which is very close to the method detection limit and well below relevant standards. Estimates for groundwater flow paths during operations, when large mounds existed on the groundwater table, provide a reasonable explanation for moving chromium from known source sites to the segment of shoreline where contamination is detected today (Connelly 1997).

3.0 SITE HYDROGEOLOGY

The stratigraphic units associated with the unconfined aquifer in the vicinity of the four new wells includes localized Holocene surficial deposits and backfill; the informally defined Hanford formation; and the Ringold Formation (Lindsey and Jaeger 1993). The Hanford formation is dominated by gravel with sandy interbeds. Cobble-size clasts are common. Typical thickness of the Hanford formation is in the range of 40 to 50 ft in the 100-D/DR Area. In areas where it has been eroded or excavated, the formation may be only a few feet or less in thickness.

The Hanford formation overlies either Ringold Unit E or the Ringold Upper Mud Unit, depending on location, and the contact is a disconformity. In the vicinity of the new wells, the Hanford formation is in contact with the Ringold Unit E (Figure 2). The unconfined aquifer occurs in the lower portion of Ringold Unit E. The bottom of the unconfined aquifer is formed by the top of the less-transmissive Ringold Upper Mud Unit. The saturated thickness is expected to be approximately 12 ft at the new well sites. The depth to the water table is expected to be approximately 82 ft below the ground surface.

In the general area of the new wells, the Hanford/Ringold contact is expected at approximately 55 ft below the surface. The first Ringold sediments to be encountered should consist of fluvial gravels associated with Unit E, and should persist for approximately the next 43 ft of drilling. Underlying Unit E is the Upper Mud Unit, which is a silt- and clay-rich unit formed by overbank and paleosol deposits. The Upper Mud Unit contains a few sand and gravel lenses and is commonly calcareous. This unit acts as an aquitard and forms the base of the unconfined aquifer. The Upper Mud is expected at a depth of approximately 100 ft below the surface.

Several criteria are used to identify the contact between Hanford gravels and Ringold Unit E gravels (Lindsey 1995). The sand fraction of Hanford gravels typically contains 40% basalt, whereas the sand fraction of Ringold Unit E gravels typically contains 25% basalt. The color of Hanford gravels are generally salt and pepper, or grayish, while Ringold Unit E gravels are generally reddish brown to yellow-red because of oxidation. Ringold gravels are generally consolidated and locally well-cemented.

4.0 DRILLING AND CONSTRUCTION

Four new wells will be installed at locations shown in Figure 1. Well locations are staked by Environmental Restoration Contractor (ERC) personnel prior to mobilization of the drill rig. General well construction specifications, along with criteria for well drilling and construction of groundwater wells on the Hanford Site, are provided in:

- *Washington Administrative Code* (WAC), Chapter 173-160, "Minimum Standards for Construction and Maintenance of Wells"
- Bechtel Hanford, Inc. (BHI) procedures for drilling, as described in Section 9.2

This description of work (DOW) supplements those documents to include the installation of production wells and provides any special requirements necessary to meet the sampling DQOs, as described in Attachment A. A well data sheet is included as Attachment B.

4.1 DRILLING

Four wells will be installed using standard drilling methods from the surface to total drilled depth. Drilling will continue downward until the Ringold Upper Mud Unit is penetrated (e.g. approximately 5 ft into the mud unit).

Radiological contamination is not a concern at these sites. Dry cuttings generated from above the water table will be discharged to the ground after release by a Radiological Control Technician (RCT). A dust control system (e.g., cyclone), equipped to provide sampling access, will be used. Drilling spoils produced during the installation of these wells will be managed in accordance with the waste management plan for the project (DOE-RL 1997).

4.2 CONSTRUCTION

All four (4) wells will be constructed as water production/protection wells. As such, the wells are designed to maximize water recovery efficiency and to minimize the inflow of particulate material. The well design meets the minimum standards required in WAC 173-160 for construction of resource protection wells. The wells will be constructed using 6-inch stainless steel V-slot wire wrap screens, with 6-inch carbon steel riser casings extending up to the surface. This design is consistent with the design used for the 100-HR-3 and 100-KR-4 pump-and-treat system wells. Table 1 gives the approximate well depth, screen length, water level, sand pack interval, and cement seal interval for each well. A typical well construction diagram for these wells is shown in Figure 3.

Final placement of the well screen will be at the direction of the site geologist/hydrologist and will be predicated on the estimated high water level. A 20-ft screen length has been preselected, based on recent experience from installing well 199-D4-1. However, information on the saturated thickness that is acquired as the new boreholes are drilled may necessitate a change in screen length. If more than 7 ft of screen is likely to remain above the water table (i.e., the saturated thickness is less than 13 ft), a shorter screen length will be considered by the site geologist/hydrologist in the field.

Forty slot well screens with appropriate filter packs (see Figure 3) have been preselected for the four new wells, based on information gained during the installation of well 199-D4-1 and on other geologic and hydrologic information for the stratigraphic units expected to be encountered.

A cement seal will be placed immediately above the secondary filter pack. The seal will consist of portland cement mixed with water per instructions provided by the manufacturer of the cement, and not more than 5% bentonite by weight. The weight of the slurry will be verified and documented by mud balance. If excessive cement losses occur during emplacement, accelerators may be used. However, cement in contact with the well screen will not be acceptable.
Three (3) split-spoon samples will be collected during the drilling of each new well to verify that the preselected screen size and filter pack are appropriate. The first split-spoon sample will be collected 5 ft below the water table, with the second and third being collected at subsequent 5-ft deeper intervals.

4.3 WELL DEVELOPMENT

All wells will require surging and pumping for development. The project hydrologist or site geologist will determine when development is complete. The purpose of the development is to settle the filter pack; prevent uncontrolled infiltration of fines; and maximize the well's response to changes in hydraulic head and to production rates. This vigorous development will take place during well completion and prior to placement of seal materials. Final development will consist of pumping (i.e., drawdown in excess of 50% of the available screen) the wells to (1) remove silt and clay particles, (2) minimize turbidity of the extracted water (5 NTU is the goal), and (3) measure the initial response of the aquifer to pumping. During pumping, samples will be collected for analysis of turbidity, pH, and specific conductance using field instruments; samples for hexavalent chromium will be collected using a Hach kit (™Hach Company, Loveland, Colorado). Water samples for chromium will be filtered prior to analysis.

Each well will be equipped with a sampling pump. The sampling equipment will consist of the following:

- Gundfos stainless type 5S07-18 pump, single phase, 220 volt, 0.75 horsepower (4 wire)
- One-inch diameter galvanized pipe, T&C (A-53)
- Six-inch well seal for one-inch pipe and two access ports for electrical and e-tape
- Pump intake will be set one foot above the bottom of the well screen.

5.0 RADIOLOGICAL FIELD SCREENING

Radiological field screening requirements applicable to waste management are specified in the waste management plan (DOE-RL 1997). All instrumentation will be used, maintained, and calibrated in accordance with *Industrial Hygiene Work Instructions*. The field geologist will record all screening results on the borehole log per Environmental Investigations Procedure (EIP) 7.0, “Geologic Logging”.

6.0 PURGEWATER

Purgewater generated during well development activities will be handled in accordance with BHI procedure EIP 1.11, “Purgewater Management,” and with the purgewater strategy document, *Strategy for Handling and Disposing of Purgewater at the Hanford Site, Washington* (DOE-RL 1990).

7.0 QUALITY ASSURANCE

The BHI Quality Management Plan (QMP) (BHI-QA-01) defines the ERC Team management system that is in place to ensure quality. The QMP provides a quality assurance program designed to meet the requirements of the *Hanford Federal Facility Agreement and Consent Order,* U.S. Department of Energy Orders, and state/local regulations. All work performed under this Description of Work (DOW) and any work packages that accompany the DOW, will be performed in compliance with the QMP.

The QMP is implemented for this project via the following controlled manuals:

- *ERC Quality Plan* (BHI-QA-01)
- *ERC Quality Program Procedures* (BHI-QA-02)
- *Design Engineering Procedures* (BHI-DE-01)
- *Environmental Investigation Procedures* (BHI-EE-01)
- *ERC Environmental Requirements* (BHI-EE-02)
- *Waste Management Plan* (BHI-EE-10)
- *ERC Project Procedures* (BHI-MA-02)
- *ERC Procurement Procedures* (BHI-PR-01)
- *ERC Property Management Procedures* (BHI-PR-02)
- *ERC Safety and Health Procedures*, Volumes 1-4 (BHI-SH-02)
- *Hanford Site Radiological Control Manual*, Revision 2 (HSRCM 1994)

Minor modifications may be made to this DOW and/or the accompanying work packages upon the approval of the field coordinator for the project. Major modifications or deviations from this DOW or to any applicable BHI procedure will be documented in accordance with Section 3.0 of the QMP and Environmental Investigations Procedure EIP 1.4 (BHI-EE-01).

The BHI Quality Assurance Department will conduct random surveillance and assessments to verify compliance with the requirements outlined in this DOW, the project work packages, the QMP, and BHI procedures.

8.0 SCHEDULE

Drilling operations for the four new wells is scheduled to begin near the end of June 1997 and continue through the middle of August 1997.

9.0 GENERAL REQUIREMENTS

General worker health and safety training requirements, technical procedures, and technical specifications associated with this drilling project are identified below.

9.1 SAFETY AND HEALTH

All personnel working at the drilling sites under this DOW will have completed an OSHA 40-Hour Hazardous Waste Site Worker training program (29 CFR 1910.120). Work will be performed in accordance with the following BHI procedures:

- *ERC Environmental Safety and Health Program* (BHI-SH-01)
- *ERC Safety and Health Procedures*, Volumes 1-4 (BHI-SH-02)
- *ERC Industrial Hygiene Work Instructions* (BHI-SH-05)
- *ERC Environmental Requirements*, Section 2.0 ALARA (BHI-EE-02)
- Site-specific plans, as applicable:
  - Health and Safety Plans
  - Radiation Work Permits
  - Job Safety Analysis
- *Hanford Site Radiological Control Manual*, Revision 2, (HSCRM 1994).

9.2 TECHNICAL PROCEDURES/SPECIFICATIONS

This section identifies technical procedures/specifications applicable to field activities performed under this DOW. Activities associated with installing the new wells will adhere the following procedures and requirements documents:

- Technical Specification for Environmental Drilling Services (ERC 1995)
- *Environmental Investigations Procedures* (BHI-EE-01)
  - EIP 1.5 "Field Logbooks"
  - EIP 1.6 "Surveying"
  - EIP 1.8 "Well Characterization and Evaluation"
  - EIP 1.11 "Purgewater Management"
  - EIP 3.0 "Chain of Custody"
  - EIP 3.1 "Sample Packaging and Shipping"

- EIP 4.0 "Soil and Sediment Sampling"
- EIP 6.0 "Decontamination of Well Drilling and Completion Operations"
- EIP 6.2 "Field Cleaning and/or Decontamination of Drilling Equipment"
- EIP 7.0 "Geologic Logging"

• *Waste Management Plan* (BHI-EE-10).

10.0 REFERENCES

Auten, J. E. and D. A. Myers, 1996, *100-HR-3 and 100-KR-4 Pump-and-Treat Drilling Description of Work,* BHI-00770, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI-DE-01, *Design Engineering Procedures,* Bechtel Hanford, Inc., Richland, Washington.

BHI-QA-01, *ERC Quality Plan,* Bechtel Hanford, Inc., Richland, Washington.

BHI-EE-02, *Environmental* Requirements, Bechtel Hanford, Inc., Richland, Washington.

BHI-MA-02, *ERC Project Procedures,* Bechtel Hanford, Inc., Richland, Washington.

BHI-PR-01, *ERC Procurement Procedures,* Bechtel Hanford, Inc., Richland, Washington.

BHI-PR-02, *ERC Property Management Manual,* Bechtel Hanford, Inc., Richland, Washington.

BHI-SH-02, *Safety and Health Procedures,* Volumes 1-4, Bechtel Hanford, Inc., Richland, Washington.

BHI-SH-01, *Hanford ERC Environmental, Safety, and Health* Program, Bechtel Hanford, Inc., Richland, Washington.

BHI-SH-05, *Industrial Hygiene Work Instructions,* Bechtel Hanford, Inc., Richland, Washington.

BHI-QA-02, *ERC Quality Program Procedures,* Bechtel Hanford, Inc., Richland, Washington.

BHI-EE-01, *Environmental Investigations Procedures,* Bechtel Hanford, Inc., Richland, Washington.

BHI-EE-10, *Waste Management Plan,* Bechtel Hanford, Inc., Richland, Washington.

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Hope, S. J., 1996, *1907-DR Process Sewer Outfall Site Soil Characterization,* BHI-00860, Rev. 0, Bechtel Hanford Inc., Richland, Washington.

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HSRCM, 1994, *Hanford Site Radiological Control Manual*, HSRCM-1, Rev. 2, Richland, Washington.

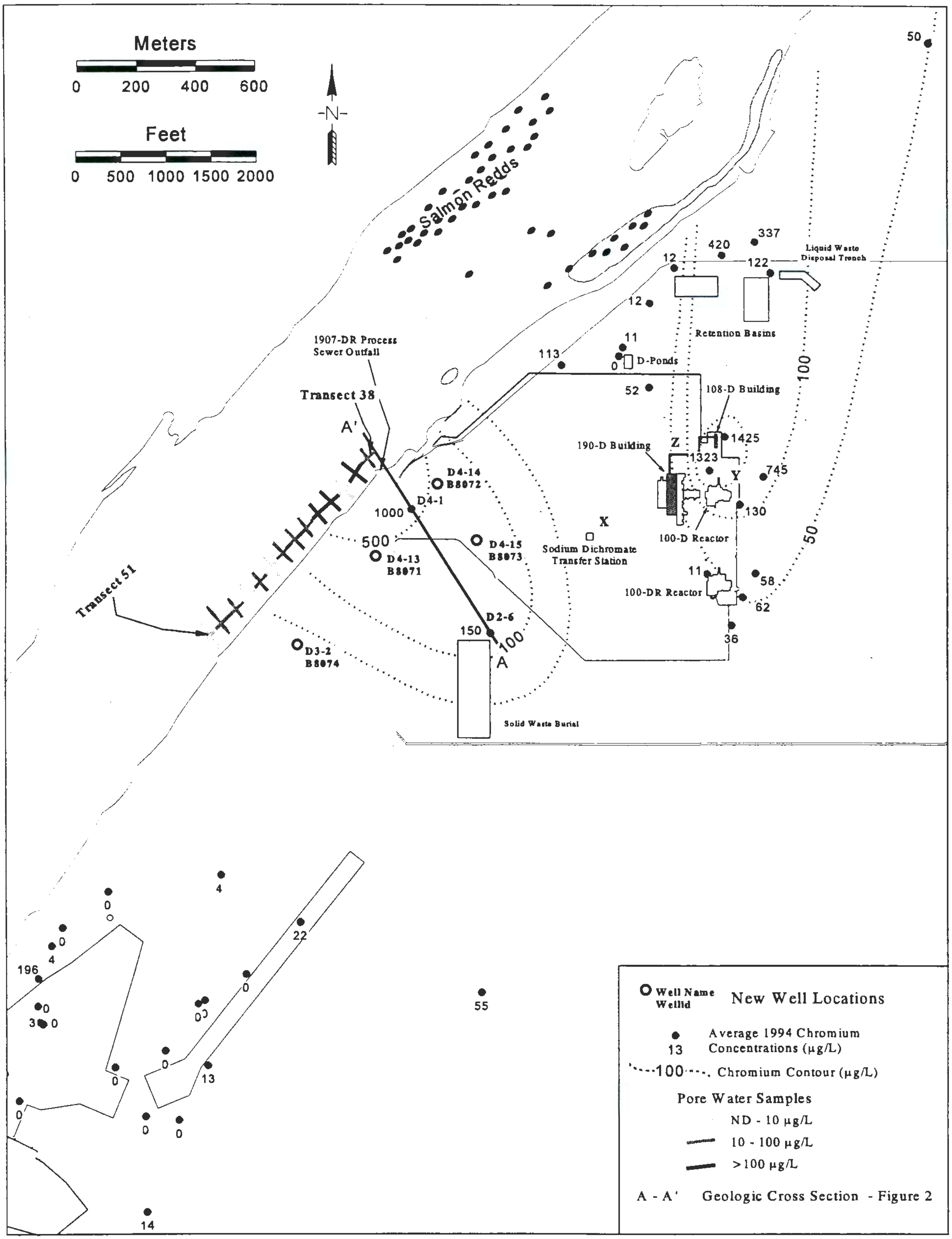
Lindsey, K. A., 1995, *Miocene- to Pliocene-Aged Suprabasalt Sediments of the Hanford Site, South-Central Washington,* BHI-00184, Rev. 00, Bechtel Hanford, Inc., Richland, Washington.

Lindsey, K. A., and G. K. Jaeger, 1993, *Geologic Setting of the 100-HR-3 Operable Unit, Hanford Site, South-Central Washington*, WHC-SD-EN-TI-132, Westinghouse Hanford Company, Richland, Washington.

Myers, D. A., V. M. Johnson, M. Melhorn, and L. D. Walker, 1996, *Well Summary Report: 100-HR-3 and 100-KR-4 Interim Remedial Action Wells,* BHI-00953, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

WAC 173-160, 1990, "Minimum Standards for Construction and Maintenance of Wells," *Washington Administrative Code*, as amended.

Figure 1. Approximate Locations for New Wells in the 100-D/DR Reactors



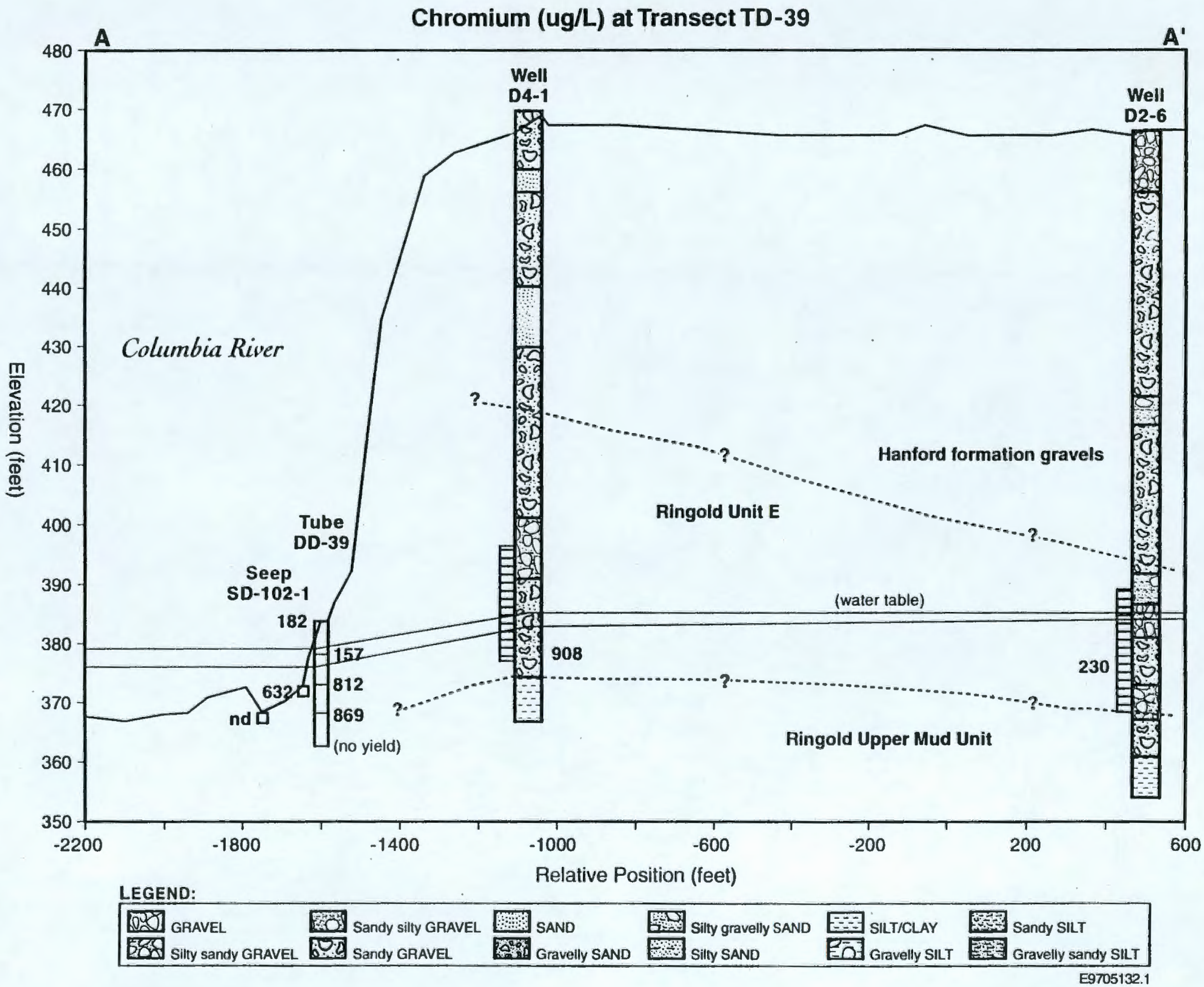


Figure 2. Hydrogeologic Cross Section in General Area of New Wells

Figure 3. Well Completion Diagram

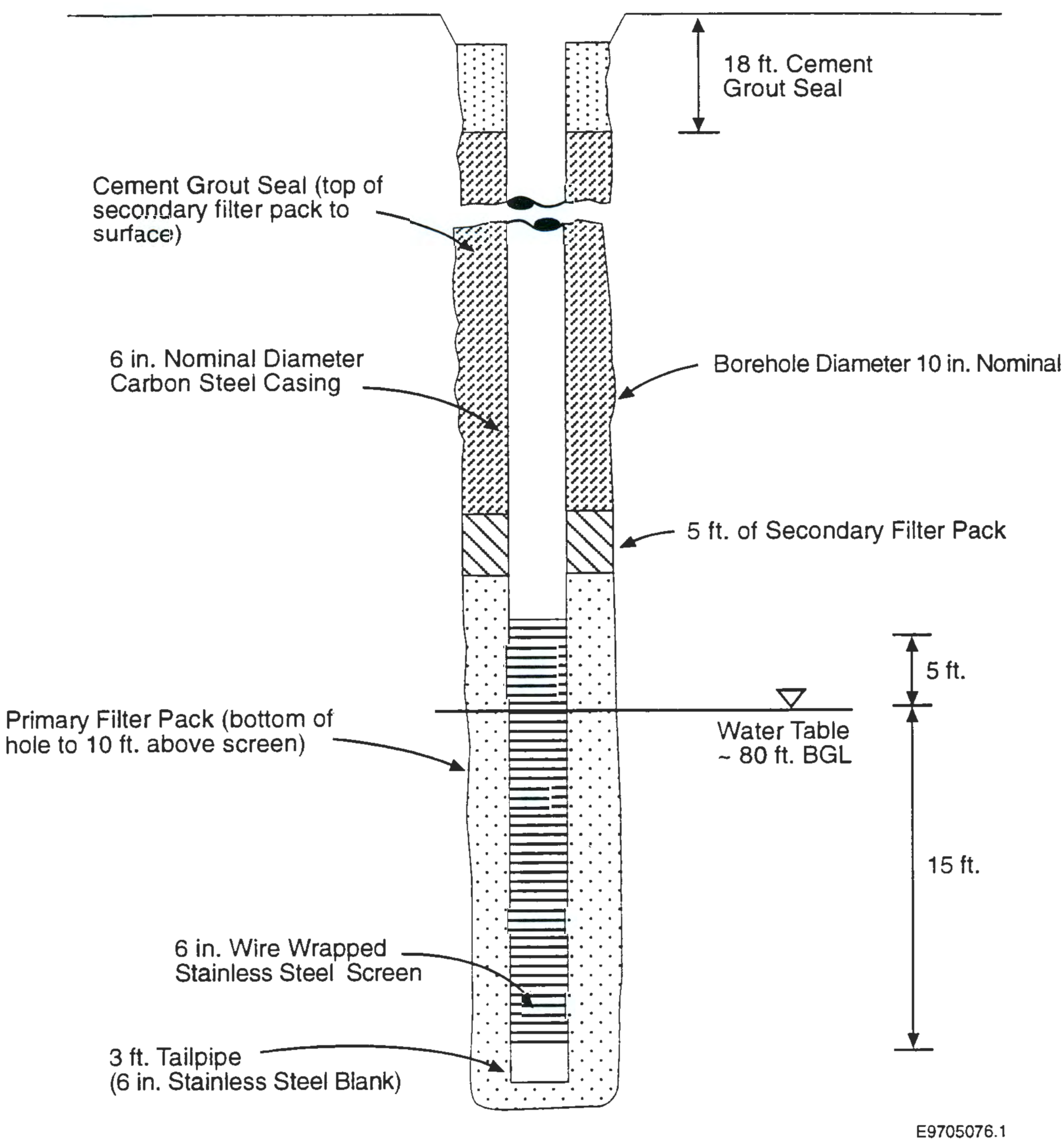


Table 1. Well Construction Parameters

Well Name (Identifier)	Estimated Depth to Top of Mud Unit	Minimum/ Average Depth-to-Water	Screen Length (Interval)	Primary Filter Pack Length (Interval)	Secondary Filter Pack Length (Interval)	Seal Interval
199-D4-13 (B8071)	98	80/82	20 (75-95)	33 (65-98)	5 (60-65)	0-60
199-D4-14 (B8072)	96	78/80	20 (73-93)	33 (63-96)	5 (58-63)	0-58
199-D4-15 (B8073)	98	80/82	20 (75-95)	33 (65-98)	5 (60-65)	0-60
199-D3-2 (B8074)	96	78/80	20 (79-93)	33 (63-96)	5 (58-63)	0-58

NOTES: Units are feet (1 meter equals 3.2808 ft). Depths are below ground level.

ATTACHMENT A

D-AREA CHROMIUM "HOTSPOT" CHARACTERIZATION DATA QUALITY OBJECTIVES PROCESS SUMMARY REPORT DRILLING WITHIN THE CHROMIUM PLUME WEST OF THE 100-D/DR REACTORS

A1.0 SCOPE AND OBJECTIVES

A1.1 PROJECT OBJECTIVES

High concentrations of chromium (~1,000 µg/L) have been identified in the groundwater west of the 100 D/DR Reactors as a result of recent sampling of the groundwater in the 100-D Area (Connelly 1997). The chromium was also found in pore water samples taken every 61 m starting at the 100-D River Pump House and extending 800 m upstream (Hope and Peterson 1996). Aquifer sampling tubes placed along the river shoreline in this same area verified the presence of chromium in the aquifer close to the river. In late 1996, well 199-D4-1 was installed about 150 m from the Columbia River, confirming the presence of chromium inland from the river.

The objective of the current project is to install four new wells. These wells will be used to (1) collect additional groundwater data to define the extent of the chromium plume, (2) quantify chromium concentrations in the aquifer, (3) support the technology deployment initiative, and (4) support future remedial action decisions.

A1.2 DATA QUALITY OBJECTIVES

The primary focus of this data quality objectives (DQO) effort is well placement (location), well design/construction options, waste management sampling during well construction/development (spoils, purgewater), and sampling during initial well development (ambient groundwater).

It is anticipated that data from these wells will be extremely useful in supporting future groundwater remediation decisions concerning the suspect chromium plume. Therefore, a secondary objective of this DQO effort is to ensure that the placement/design/construction of the new wells will allow the collection of data that can support future remediation decisions. It is expected that future remedial decisions will be based on the areal extent of the 100-D Area chromium plume, maximum hexavalent chromium (Cr^{+6}) concentrations, estimated mass of Cr^{+6} in the aquifer, and aquifer properties, such as drawdown and local flow direction.

A1.3 EXCLUSIONS

It was agreed by the decision makers that this DQO effort would addresses only well location, construction, waste management during well construction/development, and initial groundwater sampling following well development. It was further agreed that exclusions from this DQO process would include future groundwater remedial options, groundwater monitoring needs, additional well placements, and remedial action compliance issues. These issues were excluded because they are beyond the scope of the current project and would be addressed by future DQO efforts concerning the suspect 100-D Area chromium plume.

A2.0 FACILITY AND PROJECT BACKGROUND

A2.1 PHYSICAL DESCRIPTION

The area under consideration is in the 100-D/DR Area (100-HR-3 Operable Unit), west of the 100-DR Reactor building (see Figure A-1). The aquifer is about 24.4 m below the surface and groundwater is believed to generally flow northwest toward the Columbia River.

A2.2 DISCHARGES AND PROCESS KNOWLEDGE

The source of chromium in the local groundwater is suspected to be historical spills and leaks from the 190-D Building, the 1907-DR process sewer, the 100-D Area sodium dichromate transfer station (100-D-12), and various other facilities in the 100-D Area where chromium was present. For a more complete discussion of chromium discharges and 100-D Area process knowledge regarding chromium, see *Assessment of the Chromium Plume West of the 100-D/DR Reactors* (Connelly 1997).

Based on 199-D4-1 data, groundwater is the only contaminated media under consideration and Cr^{+6} is the only contaminant of concern (COC) for this DQO effort. No other contaminants of potential concern (COPC) have been identified in this area. It is anticipated that information gained from the new wells will provide valuable insight concerning the chromium sources and potential remediation decisions concerning this suspect groundwater plume.

A2.3 PLAN FOR PROJECT TASK ACTION

The plan for this project is to install four new wells in the vicinity of well 199-D4-1 to better-define the nature and extent of the groundwater chromium plume indicated by the high chromium concentrations in 199-D4-1, local Columbia River pore water, and near-river aquifer sampling tubes.

A2.4 EXISTING SOURCES OF DATA

Existing information for the project area includes 100-D Reactor facility process knowledge, analytical data from the 199-D4-1 well (construction and groundwater monitoring), Columbia River pore water data (Hope and Peterson 1996), near-river aquifer sampling tube data, and historical data concerning local aquifer "mounding". The existing data for this project has been assembled in Connelly 1997.

A3.0 PARTICIPANTS AND RESPONSIBILITIES

The names of the participants and their responsibilities regarding this DQO effort are summarized in the following table.

Participant Name and Responsibility	Planning Meeting (5/12/97)	Interview Process (5/14/97)	External DQO Meeting (5/15/97)	Off-Line Technical Input
A. C. Tortoso/RL (DOE Project Manager)		X	X	
W. W. Soper/Ecology (Regulatory Agency Lead)		X	X	
L. E. Gadbois/EPA (Regulatory Agency Support)		X		
A. J. Knepp/BHI (Environmental Lead)	X	X	X	
M. P. Connelly/CHI (Task Lead)	X		X	
R. E. Peterson/CHI (Waste Management)		X	X	
R. L. Jackson/CHI (Hydrogeologist, DOW)	X		X	
L. D. Walker/CHI (Primary DOW Author)	X		X	
R. C. Havenor/CHI (Permits, Health and Safety)				X
T. E. Marceau/BHI J. J. Sharpe/CHI (Cultural Resources)				X
K. A. Gano/BHI S. G. Weiss/CHI (Natural Resources)				X
K. A. Bergstrom/CHI (Ground Penetrating Radar)				X
R. B. Kerkow/CHI (Sampling)			X	
B. L. Vedder/BHI (Regulatory Support)				X
J. A. Lerch/CHI (Analytical Methods)				X

A4.0 PROJECT TASK SCOPING AND ISSUES SUMMARY

A4.1 SCOPING SUMMARY REPORT

The *Assessment of the Chromium Plume West of the 100-D/DR Reactors* (Connelly 1997) served as the scoping summary report for this DQO effort. This document presented background information and summarized existing project-related data. During the DQO Planning Meeting (5/12/97), the project team discussed key project scoping issues and completed the DQO Scoping Checklist (5/13/97) by aligning technical staff with the scoping topics identified. The technical staff identified to address scoping issues either attended the external DQO workshop (5/15/97) or provided scoping input to the DQO process off-line through the BHI Environmental Lead or the CHI Task Lead. Inputs from the various technical staff are included in the workshop minutes (see Section A9.0) or in the project files.

A4.2 SCOPING PROCESS ISSUES

Eight issues were identified through the scoping process. These issues included:

1. The number of wells needed for this project and their proposed locations
2. The COPC/COC analyte list (new well requirements, other plume analytes)
3. Well design/construction options (single/multi-purpose, construction sequence)
4. Data needs during drilling (soil chemistry, local geology, etc.)
5. Data needs for possible future remediation decisions (plume extent, maximum Cr+6 concentration, Cr^{+6} mass, aquifer properties)
6. Data needs for future treatment/compliance decisions (treatment options, sampling needs for compliance verification, monitoring frequency, reporting, etc.)
7. Data needs for waste management (drill cuttings, purgewater)
8. Data to resolve well site access limitations (cultural/natural resources).

A4.3 INTERVIEW PROCESS ISSUES

The interview process identified one issue to add to those identified through the scoping process. This issue involved the possible influence of PNNL's dithionite groundwater treatment wall being installed near 199-D4-1. The issue of primary importance to the Ecology and DOE-RL decision makers was the new well locations. The decision makers wanted to be sure to gain the maximum amount of future data/use possible from the wells, because future data from these wells will likely support DOE and Ecology decisions concerning local groundwater remediation.

A4.4 GLOBAL ISSUES MEETING SUMMARY

No global issues were identified with this project, so a Global Issues Meeting was not conducted. The issues identified could all be addressed by the project team and the key decision makers associated with the project. Therefore, the DQO effort proceeded directly from the interviews to an external DQO workshop.

A5.0 DQO PROCESS SUMMARY

A5.1 STEP 1: STATE THE PROBLEM

High concentrations of chromium have been identified in groundwater (well 199-D4-1), nearby Columbia River pore water samples, and local near-river aquifer sampling tube groundwater samples in the 100-D/DR Area. Additional groundwater data, collected from new wells proposed in the vicinity of the 199-D4-1 well and near-river/pore water sample sites, are needed to better-define the nature (concentration) and extent of the chromium plume indicated by the high local groundwater and river pore water chromium concentrations. The future data collected from these wells will be used to support decisions concerning the source(s) of the chromium plume and the need for local groundwater remediation.

A5.2 STEP 2: IDENTIFY THE DECISIONS

Following a discussion that addressed all the issues raised during the project scoping and interview process, it was determined that this DQO effort would address four decisions:

1. Where should the four new wells be located?

2. How should the wells be constructed?

3. What data are required during construction and initial development to support waste management activities and improve local geology/soils/chromium knowledge?

4. What groundwater data should be collected following initial well development ?

A5.3 STEP 3: IDENTIFY INPUTS TO THE DECISIONS

Decision 1: Where should the four new wells be located?

The primary inputs to this decision included existing analytical data (groundwater, aquifer sampling tube, pore water), historical local aquifer elevation information (Connelly 1997), "stagnation point analysis" results for the distance from the river sufficient to ensure minimal surface water-groundwater interaction at well 199-D4-1, and a site visit by the key decision makers. For discussion purposes during the DQO workshop, a "strawman" well placement strategy was developed by the project team using existing information. Following a discussion concerning the existing analytical data, evidence that well 199-D4-1 is of sufficient distance from the river to minimize river-groundwater interaction, and information concerning the source and travel direction of the suspect plume, the proposed locations (outlined in Connelly 1997) for wells 1 (199-D4-13), 3 (199-D4-15), and 4 (199-D3-2) were approved by the decision makers. However, it was agreed that a location about 122 m north of 199-D4-1 for well 2 (199-D4-14) would provide better aquifer/chromium plume characterization data than the originally-proposed location. See Figure A-1 for the final well locations.

Decision 2: How should the wells be constructed?

It was initially determined by the project team that the well design/construction should achieve multi-purpose use (monitoring, extraction, injection) because the existing chromium data strongly suggest that this suspect plume is a candidate for future groundwater treatment. The team proposed that the wells be constructed of stainless steel screen attached to carbon steel riser pipe. The screen will be installed through the entire thickness of the aquifer. This design would be more expensive than standard PVC monitoring wells, but would ultimately be less expensive if groundwater treatment was required because the wells proposed could also serve as extraction wells, thus avoiding the cost of installing new extraction wells near the monitoring wells. This multi-purpose design could also result in time savings for future treatment since the wells could be brought on line for plume extraction sooner. The decision-makers agreed with this proposal based on the information presented by the project team (no additional data was requested).

Two approaches can be used to install these wells. The first approach is to construct and develop the wells one-at-a-time, with the perception that information gained from each well would provide input to the location/construction/development of subsequent wells. The second approach is to use the available data to determine where all the wells should be placed before the drilling starts. The project team determined that greater cost savings could be achieved if all four wells were located before drilling starts. This savings would result by minimizing equipment and crew mobilization costs. Based on current knowledge of the project area derived from the construction and development of 199-D4-1 and the several new wells associated with the dithionite wall being installed by PNNL, it was agreed that little or no information would be gained by a one-at-a-time well construction/development approach. The decision makers agreed, based on the information presented, that all four well locations should be established before drilling starts (no additional data was requested).

The potential cost/schedule savings associated with this decision are presented in more detail in Section 7.0 (Cost and Schedule Savings).

Decision 3: What data are required during construction and initial development to support waste management and improve local geology/soils/chromium knowledge?

The project team proposed that, based on 199-D4-1 information, only standard geological well logging data and data to support waste management activities should be collected during well construction and initial development. The results of 199-D4-1 soil chemistry data collected during construction indicate that similar efforts during the construction of the four (4) new wells would not likely provide new insights to local chromium contamination or soil conditions. Similarly, groundwater data from 199-D4-1 indicate that chromium is the only contaminant present in excess of groundwater action levels.

Based on a discussion regarding existing information, it was agreed that the type and quality of data required for the waste management plan for well 199-D4-1 (DOE/RL-96-58) would be sufficient for the construction/initial development of the new wells. The new waste management plan will be a DOE/RL document that must be approved by Ecology prior to well construction.

Decision 4: What groundwater data should be collected following initial well development?

Existing data from 199-D4-1 plus other groundwater analytical data presented in Connelly 1997 were used as input to this decision. The existing data indicate that chromium is the only COC that should be analyzed following initial well development to establish initial, well-specific chromium concentrations. Specific conductance and pH were also proposed for initial analysis by the project team to evaluate potential Columbia River influence on the new wells. Decisions regarding the frequency of monitoring, analytes monitored, and the possible need for remedial action based on data from the new wells are beyond the scope of this project. These decisions will likely be addressed during the first groundwater monitoring event in FY 1998.

The quality of the initial ambient groundwater sample data was discussed to determine if laboratory analysis or field screening would be required. Based on the scope of this project and considering that future monitoring, analytes, treatment requirements, ARAR compliance, etc. are beyond the scope of this DQO, it was determined that the initial analyses for these wells could be achieved through field screening with cost/schedule savings for the project. Field instruments or sampling/analysis kits for pH, specific conductance, and chromium are readily available.

The decision makers agreed that the data collected from the wells following initial development would include only field screening analyses for chromium, pH, and specific conductance.

A5.4 STEP 4: DEFINE THE BOUNDARIES OF THE DECISIONS

The "scale" of the decisions concerning this project are the construction/development activities related to the four new wells proposed to better-characterize the suspect 100-D Area chromium plume. The"spacial" boundary for this project is the suspected extent of the chromium plume (the vicinity of the 100-D/DR Reactors and well 199-D4-1). The "temporal" boundary for the project is that all activities must be completed during FY97. The practical constraints associated with this project are the scope/budget and FY97 temporal boundary defined in the project BCP.

A5.5 STEP 5: DEVELOP DECISION RULES

The only decision rules associated with this project involve waste management decisions during well construction and initial well development. The specific criteria for drill cuttings, purgewater, and other well construction-related waste will be presented in detail in the project waste management plan. In general terms, the decision rules for the waste management plan are:

- If well spoils (drill cuttings, purgewater) contaminant concentrations do not exceed action levels, then these materials may be disposed at the well site.
- If well spoils (drill cuttings, purgewater) contaminant concentrations exceed action levels, then these materials will be treated (if necessary) and disposed at the Environmental Disposal Facility or another approved disposal facility.

No decision rules are associated with well location, well construction, or initial well sampling decisions for this project. Decision rules that might be associated with future groundwater monitoring, treatment, or ARAR compliance are beyond the scope of this project.

A5.6 STEP 6: SPECIFY ACCEPTABLE DECISION ERRORS (UNCERTAINTY)

No decision errors are associated with the well location, well construction, or initial well sampling decisions for this project. Issues associated with these decisions were resolved through existing data review, professional judgement, and cost/benefit analyses. The evaluation of decision errors that might be acceptable for future groundwater monitoring, treatment, or ARAR compliance is beyond the scope of this project.

The only decision errors (uncertainty) associated with this project involve waste management decisions during well construction and initial well development. The specific waste management criteria and allowable uncertainty for managing the disposal of drill cuttings, purgewater, and other well construction-related waste will be presented in the project waste management plan.

A5.7 STEP 7: OPTIMIZATION

The optimization of this project was achieved primarily through agreements related to well location, well design/construction strategy, and limiting data collection during well construction/development to only waste management requirements.

The initial location of well 2 (199-D4-14) was changed to optimize the aquifer characterization information provided by this project.

Wells design will be multi-purpose to optimize their future use should groundwater extraction and treatment be required for the suspect chromium plume.

Well location and construction will be determined before drilling starts to optimize (lower) the cost associated with equipment and crew mobilization.

Sampling during construction and well development has been limited to include only the data required to support waste management activities.

Ambient groundwater sampling following initial well development has been optimized (limited) to field screening for chromium and basic water quality parameters (specific conductance, pH).

A6.0 SUMMARY OF DQO OUTPUTS

The agreements made through this DQO process will support the development of a project description of work (DOW) and a waste management plan that will be implemented during well construction and initial well development activities.

A7.0 COST AND SCHEDULE SAVINGS

Cost and schedule savings attributable to this DQO effort include:

1. The initial cost of multi-purpose well construction ($20/ft) is greater than the cost of typical PVC monitoring wells. However, this higher initial cost will result in a future cost (and schedule) savings if the suspect chromium plume requires extraction/treatment because the cost of installing extraction wells, in addition to monitoring wells, will be avoided. The project team estimated that the potential cost savings associated with this decision is about $130,000.

2. Limiting sampling and analysis during well construction and initial well development to the data required to support waste management decisions will result in cost savings. The actual sampling and analysis costs (in addition to waste management support) associated with the 199-D4-1 well was $1,000. The reduction in field survey samples is estimated to save the project about $500 per well, for a total project savings of $2,000.

3. Conducting the initial ambient groundwater quality analyses with field kits/instruments (instead of standard laboratory analyses/turn-around time) will result in a cost savings of $850/well and schedule savings of about 10 days.

A8.0 LESSONS LEARNED

1. Project site visits (accompanied by the Environmental Lead or Task Lead) are very helpful in resolving logistical/geographical issues (such as well locations, project proximity to other facilities, etc.).

2. Conducting a single interview that included the decision makers, Project Engineer, Environmental Lead, and Project Task Lead is a good DQO interview "optimization" approach. Having all the decision makers and key project staff present provides considerable synergy in identifying issues, helps resolve technical issues more quickly, saves interview time for the project and the decision makers, and can preclude the need for a Global Issues Meeting.

3. Adequate background information, Task Lead "ownership", and project team preparation prior to the DQO workshop are the key elements to the successful completion of DQO planning.

A9.0 DQO MEETING MINUTES

See Figure A-2 for minutes from the the May 15, 1997, D-Area Chromium "Hot Spot" Characterization Data Quality Objectives Meeting.

A10.0 REFERENCES

Connelly, M. P., 1997, *Assessment of the Chromium Plume West of the 100-D/DR Reactors,* BHI-00967, Rev. 1, January 1997, Bechtel Hanford, Inc., Richland, Washington.

Hope, S. J. and R. E. Peterson, 1996, *Chromium in River Substrate Pore Water and Adjacent Groundwater: 100-D/DR Area, Hanford Site, Washington,* BHI-00778, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

Figure A-1. Approximate Locations for New Wells in the 100-D/DR Reactors

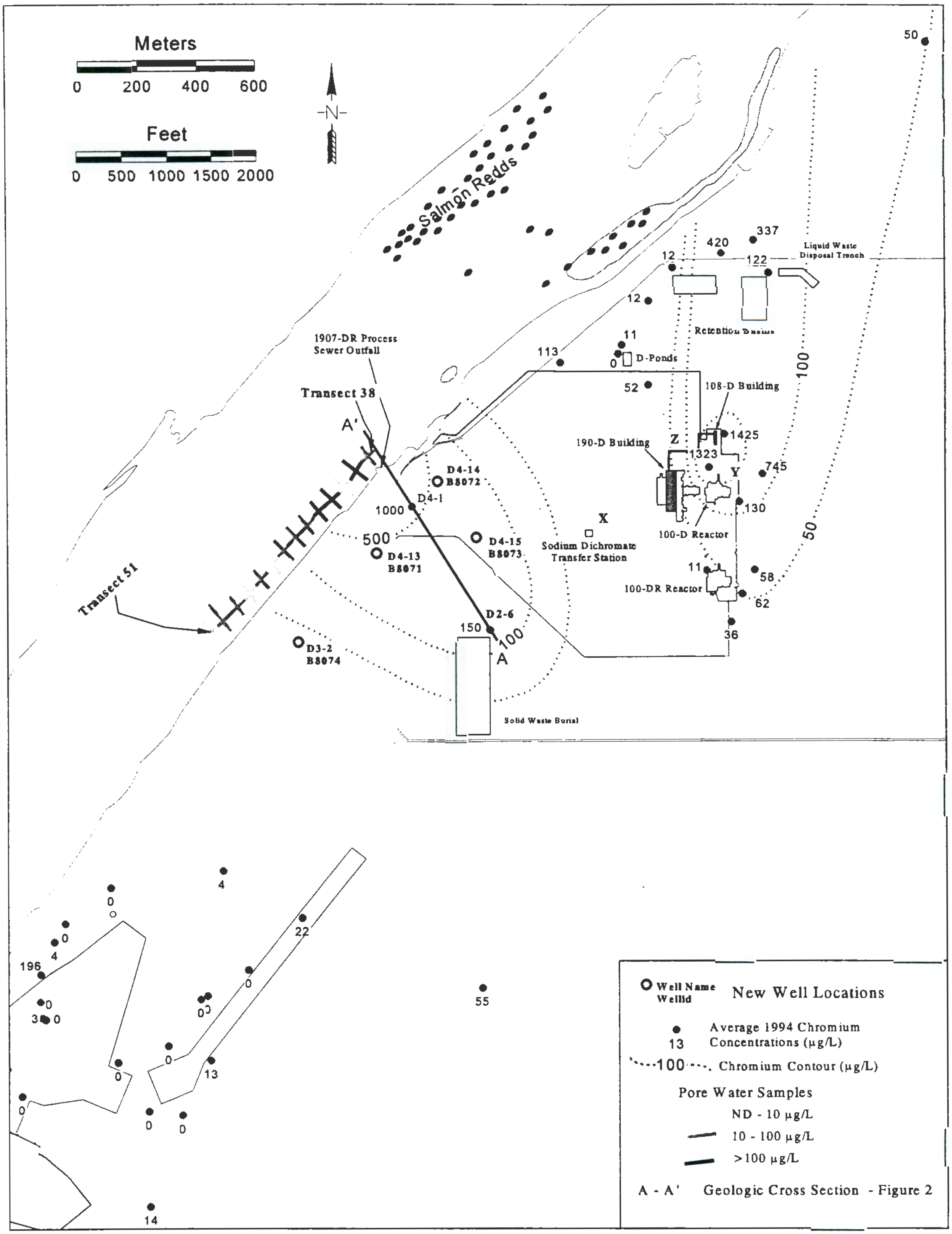


Figure A-2. Minutes from the May 15, 1997, D-Area Chromium "Hot Spot" Characterization Data Quality Objectives Meeting (Page 1 of 4)

046232

Environmental Restoration Contractor **ERC Team**

Meeting Minutes

Job No. 22192
Written Response Required? NO
Closes CCN N/A
OU: 100-HR-3
TSD: N/A
ERA: N/A
Subject Code: 4170; 8960

SUBJECT D-AREA CHROMIUM "HOT SPOT" CHARACTERIZATION DATA QUALITY OBJECTIVES MEETING

TO Distribution

FROM R. W. Ovink

DATE June 30, 1997

ATTENDEES

M. P. Connelly H9-03
R. L. Jackson H9-02
M. C. Kelly H9-01
A. J. Knepp H0-19
R. W. Ovink H9-03
R. E. Peterson H9-03
W. W. Soper B1-20
M. H. Sturges H9-01
A. C. Tortoso H0-12
L. D. Walker H9-03

DISTRIBUTION

Attendees
B. L. Vedder H0-17
Document and Information Services H0-09

A meeting on the above subject was held on May 15, 1997, at Sigma I Lobby conference room.

INTRODUCTION/PURPOSE OF WORKSHOP

The purpose for holding this DQO is to determine well placement for D-Area Chromium Hot Spot Characterization. This meeting follows a trip to the field with decision makers (5/14/97), and relies on information presented in BHI-00967, *Plan for Characterization and Remediation of Chromium Plume West of the 100-D Reactor*, Rev. 0.

An agenda and map of the 100-D Area showing proposed locations for the 4 wells was distributed to attendees (see attached).

SITE/PROJECT BACKGROUND

High concentrations of hexavalent chromium (Cr^{+6}) were detected in pore water samples taken in 1995 and drive point samples taken in fall of 1996. Documentation was reviewed to determine the source of the contamination. Historical water table information was reviewed, pointing to the 190-D building and hexavalent chromium transfer station as potential sources for contamination. In conjunction with technology deployment initiative (TDI) funding for REDOX, EM-40 funding has been secured to better characterize this plume.

Clarification was made that the purpose for drilling these wells was to characterize the plume and support TDI.

Figure A-2. Minutes from the May 15, 1997, D-Area Chromium "Hot Spot" Characterization Data Quality Objectives Meeting (Page 2 of 4)

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Page 2

Issues Discussion - Well Location/Number Logic

- This project has received $251K in funding, which allows for four wells to be drilled.
- The reasoning for the proposed locations is given in BHI-00967, *Plan For Characterization and Remediation of Chromium Plume West of the 100-D Reactor*, Rev. 0."
- The wells have been placed to provide information on estimating the size of the plume/
- The sample points provide limited information: more information is needed to properly characterize the plume and consider plume remedial activities (if needed).
- Because the possibility exists that the wells may be added to the pump and treat extraction network, stainless steel pipe is being used instead of PVC.
- A stagnation point (i.e., the furthest point downgradient from extraction wells in which capture takes place) was calculated using the analytical solution from "*Capture-Zone Type Curves: A Tool for Aquifer Cleanup*" (Javendel, I., and Chin Fu Tsang, 1986 in Ground Water Vol. 24, No. 5, pp 616-625). This stagnation point provides the basis for the ~500 ft distance between the proposed locations.

Agreement: All agreed on the proposed well design materials (6-in. stainless steel).

Agreement: Well placement. Installation of four new extraction/monitoring wells was originally proposed in BHI-00967, 1997. The purposes of these new wells at the time of proposal (in order of importance) were to (1) protect the river where the drive point and pore water sampling indicated Cr^{+6} was seeping into the river, (2) remove Cr^{+6} from the aquifer, and (3) to characterize the areal extent and levels of Cr^{+6} in the groundwater. The proposed locations for wells #1, 3, and 4 in BHI-00967 were accepted. However, since there is no knowledge about the Cr^{+6} in the groundwater to the north of well 199-D4-1 and a Technology Deployment Initiative (TDI) was initiated after the original proposal, well #2 in the original proposal was moved ~400 ft northeast to support the TDI. The TDI is a treatability test for a chemical reduction barrier which will reduce mobile Cr^{+6} to immobile Cr^{+3}. This barrier is being installed at well 199-D4-1. There will now be 1,000 to 1,100 ft between well #s 1 and 4. Cultural resource and GPR staff will need to survey this new proposed site for well #2.

ISSUES DISCUSSION

Analyte List

When the screen is being set, split-spoon sieve analysis will be performed, and field sampling for Cr^{+6}, conductivity, and pH will occur once well development is complete. Full suite sampling will occur next fiscal year during the annual sampling (scheduled for October/November 1997). These wells will be added to annual sampling in conjunction with the NPL Agreement Form which outlines the annual sampling requirements for the 100-HR-3 Operable Unit. The samples will be checked for contaminants indicative of N Area contamination (tritium, gross alpha, gross beta) in FY 1998.

Figure A-2. Minutes from the May 15, 1997, D-Area Chromium "Hot Spot" Characterization Data Quality Objectives Meeting (Page 3 of 4)

Well Construction Logic/Options

Drill/case/screen/develop one well at a time ("Learn as you go") could put this project at a cost disadvantage depending on the terms of the drilling contract. It is not likely that any information gained from the wells being drilled for REDOX would be beneficial in helping the project to choose well placement.

Data Needs

The data needs are covered in the project instructions.

Data for Future Decisions

- Verification of Cr^{+6} levels will be obtained by Hach kit after well development is completed.
- It is premature and beyond the scope of work to consider that these wells may become part of the pump and treat network
- The need for additional wells to further enhance the Cr^{-6} plume characterization is outside of the scope of this project
- The injection of dithionite (REDOX project) is not expected to affect the proposed wells (operation or groundwater quality)

Waste Disposal

Waste disposal will be addressed in the waste management plan currently being prepared by R. E. Peterson/CHI. Draft A of this document will be transmitted to RL for concurrent RL/Ecology review and comment. Ecology approval will be obtained on the Rev. 0 document. This plan will be similar in scope and format to the waste disposal plan approved by RL and Ecology for the 199-D4-1 well, which has the same general location and design as the four proposed new wells.

Access Limitations

- A cultural review request will be submitted for the newly proposed location for well #2.
- T. E. Marceau (ERC) must be informed one week prior to start of drilling.
- Cultural resource staff have requested to be present for the first 18-24 in. of drilling for wells outside of the disturbed area (wells 199-D4-13 [#1] and 199-D3-2 [#4]).
- Cultural resource staff have requested the team not plan drilling south of the well #4 location because of the significance of the area to the Tribes.

ACTIONS

1. M. C. Kelly to review records to see if BHI-00967, Rev. 0, was formally transmitted from BHI to RL. If not, a draft cover letter will be prepared to accompany 20 copies to RL.

Figure A-2. Minutes from the May 15, 1997, D-Area Chromium "Hot Spot" Characterization Data Quality Objectives Meeting (Page 4 of 4)

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2. M. P. Connelly will draft a cover letter to transmit the Cultural Resource findings from BHI to RL.

3. M. P. Connelly will request a cultural resource review of the new location for well #2.

4. M. P. Connelly will stake out new location for well #2.

5. Following internal draft review, the waste management plan will be transmitted as a Draft A to RL for concurrent RL/Ecology review. Ecology approval must be obtained.

6. M. C. Kelly will draft meeting minutes for R. W. Ovink to finalize. The meeting minutes will be distributed to attendees for review and comment via cc:Mail the week of 5/19.

7. R. W. Ovink will prepare the DQO summary report and distribute it for BHI functional review the week of 5/27. Once review is complete, the summary report will be included as an appendix to the DOW.

8. M. P. Connelly will provide an updated map of the D Area to W. W. Soper and A. C. Tortoso once the new location for well #2 has been staked out.

ATTACHMENT B

WELL DATA SHEET: 100-D/DR AREA DRILLING

WELL DATA SHEET: 100-D/DR AREA DRILLING

Four new groundwater wells are being installed in the western portion of the 100-D/DR Area in the vicinity of well 199-D4-1 (Figure B-1). The new wells will be constructed to meet specifications contained in the *Washington Administrative Code* (WAC), Chapter 173-160, "Minimum Standards for Construction and Maintenance of Wells."

Drilling is expected to progress to a depth of 100 ft below ground surface (bgs). Table 1 of the DOW summarizes the planned drilled depth. The final well depth and screen interval will be determined by the well site geologist/hydrologist.

Drilling is scheduled to begin in late June 1997 and run through the middle of August 1997.

DRILLING METHODS

The new wells will be installed from the surface to total drilled depth. If air circulating drilling method is used, the air circulation system must maintain a minimum of 5000 ft/min calculated return velocity. The ASTM recommended values for return velocities are 4200 ft/min for reverse circulation drilling (ASTM D5781-95) and 3,000-4000 ft/min for direct drilling (ASTM D5782-95) in relatively consolidated sediments. Additional return velocities have been added due to air losses which occur in sand and gravels. The formula used to calculate these velocities is given below:

1.) Reverse Circulation Drilling:

$$Return\ Velocity\ (ft/\text{min}) = \frac{Manufacturer\ Compressor\ Output\ Rating\ (ft^3/\text{min})}{Cross\ Sectional\ Area\ of\ the\ Inner\ Tube\ (Return\ Tube)\ (ft^2)} * 0.25$$

2.) Direct Circulation

$$Return\ Velocity\ (ft/\text{min}) = \frac{Manufacturer\ Compressor\ Output\ Rating\ (ft^3/\text{min})}{Annular\ Area\ (ft^2) = \frac{(Casing\ Inner\ Diameter^2 - \mathbf{Drill\ Pipe}\ Diameter^2) * 0.7854}{144}}$$

A dust control system (e.g., cyclone separator) that is equipped to provide sampling access will be used during drilling. Minimum temporary casing diameter will conform to WAC 173-160, (i.e., 10-in. inside diameter).

The depth to the bottom of the borehole, casing stickup, and depth-to-water will be obtained as drilling proceeds and recorded on the Field Activity Report. The well bore will be made available to the well site geologist/hydrologist upon request.

SAMPLING DURING DRILLING

Water samples will be collected by the well site geologist/hydrologist when the water table is first encountered during drilling. Three (3) split-spoon samples will be collected during the drilling of each new well. The first split-spoons will be taken 5 ft below the water table and the other two split-spoons at 5-ft intervals below the first.

DRILLING SPOILS CONTAINMENT

Drilling spoils from above the water table will be accumulated in piles near the point of generation until surveyed by a Radiological Control Technician (RCT). After release by the RCT, the dry spoils will be distributed over the ground. Drilling spoils produced below the water table will be placed on plastic sheeting. If release criteria are exceeded for the free moisture, the spoils will be contained. Drilling spoils that do not meet release criteria will be placed in steel 55-gal (208 L) open head drums.

DECONTAMINATION AND TRASH MANAGEMENT

Downhole tools and equipment will be wiped down to remove solid materials. Tools and equipment will be steam cleaned using potable water that does not contain additives. Containment of decontamination rinsate will not be required, providing that the downhole tools and equipment have been wiped down sufficiently to remove all drilling residues.

Miscellaneous trash items (e.g., equipment wipedown residue, disposable protective equipment) are not expected to contain radiological and/or chemical contamination and will be disposed as nonregulated trash. If field screening indicates radiological and/or chemical contamination is present in trash materials, the trash becomes regulated and will be disposed appropriately.

WELL CONSTRUCTION, COMPLETION, AND DEVELOPMENT

A well construction diagram is provided in Figure 2. The final well casing, screen, and filter pack requirements are described in detail in the DOW. Surface completion aspects (e.g., concrete pad, protective posts) will be per BHI specifications.

The cement seal placed above the secondary filter pack is detailed in the DOW. When placing the cement seal, industry standard practices (reference Haliburton Handbook) should be followed when placing the cement seal; e.g., minimizing the hydrostatic head during placement, utilizing accelerator washes (such as calcium chloride) prior to placing seals, and using an accelerator in the cement mix. A maximum of 30 percent loss of cement in the first five (5) feet of seal is acceptable. Accelerators are to be used when placing cement seals in open framework gravels.

Refer to the DOW for details describing well development. Permanent pump, tubing, etc. details are also provided in the DOW.

HEALTH AND SAFETY

Special health and/or safety concerns have not been identified for this work. Work will be performed in level "D" personal protective gear and clothing. A site-specific Health and Safety Plan provides details on all health- and safety-related issues.

**** PLEASE STAY ALERT, BE CAREFUL, AND USE COMMON SENSE! ****

REFERENCES

ASTM, 1995, *D 5781 - 95 Use of Dual-Wall Reverse-Circulation DRILLING for Geoenvironmental Exploration and the Installation of Subsurface Water-Quality Monitoring Devices*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.

ASTM, 1995, *D 5782 - 95 Use of Direct Air-Rotary Drilling for Geoenvironmental Exploration and the Installation of Subsurface Water-Quality Monitoring Devices*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.

WAC 173-160, 1990, "Minimum Standards for Construction and Maintenance of Wells" *Washington Administrative Code*, as amended.

Figure B-1. Approximate Locations for New Wells in the 100-D/DR Reactors

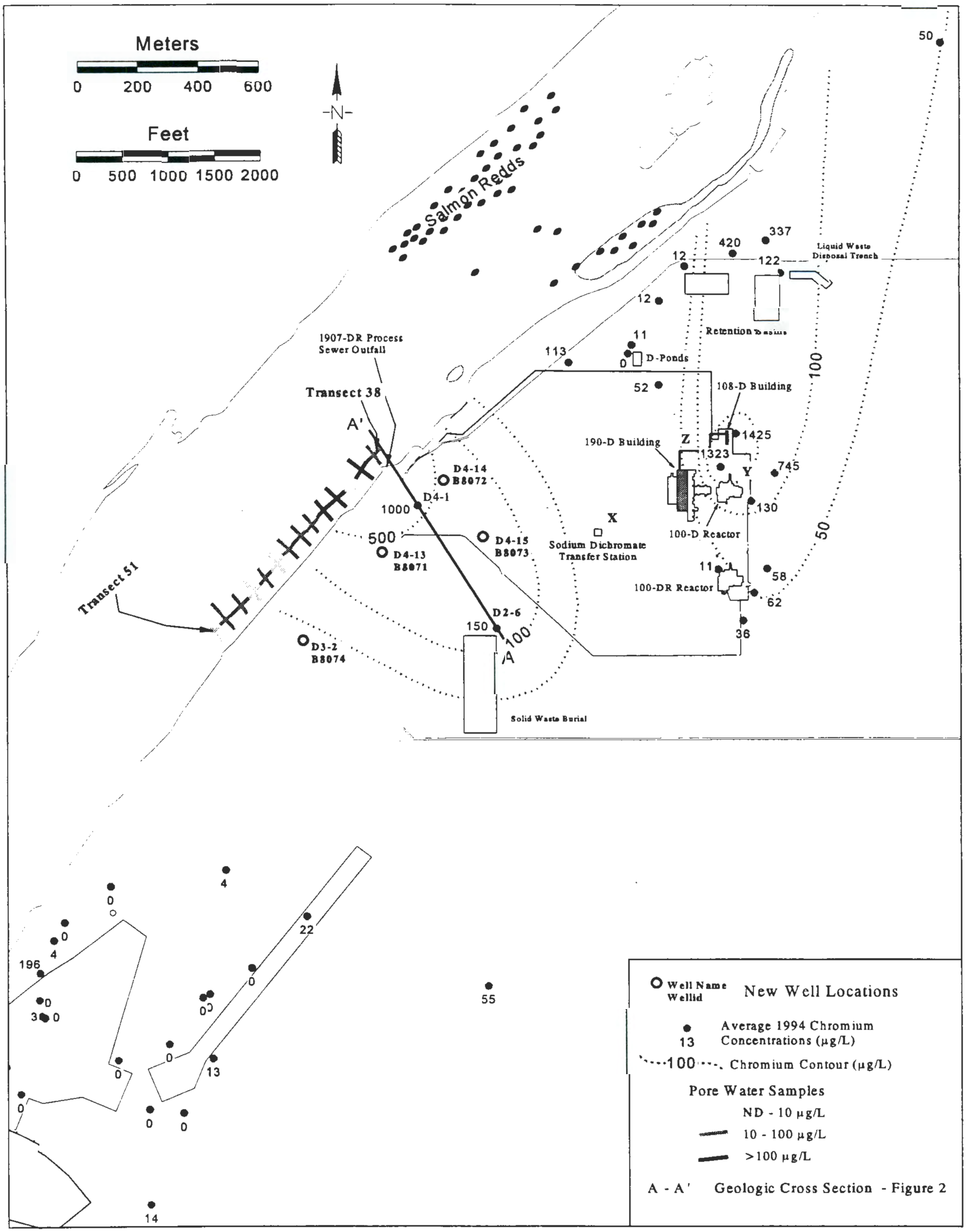
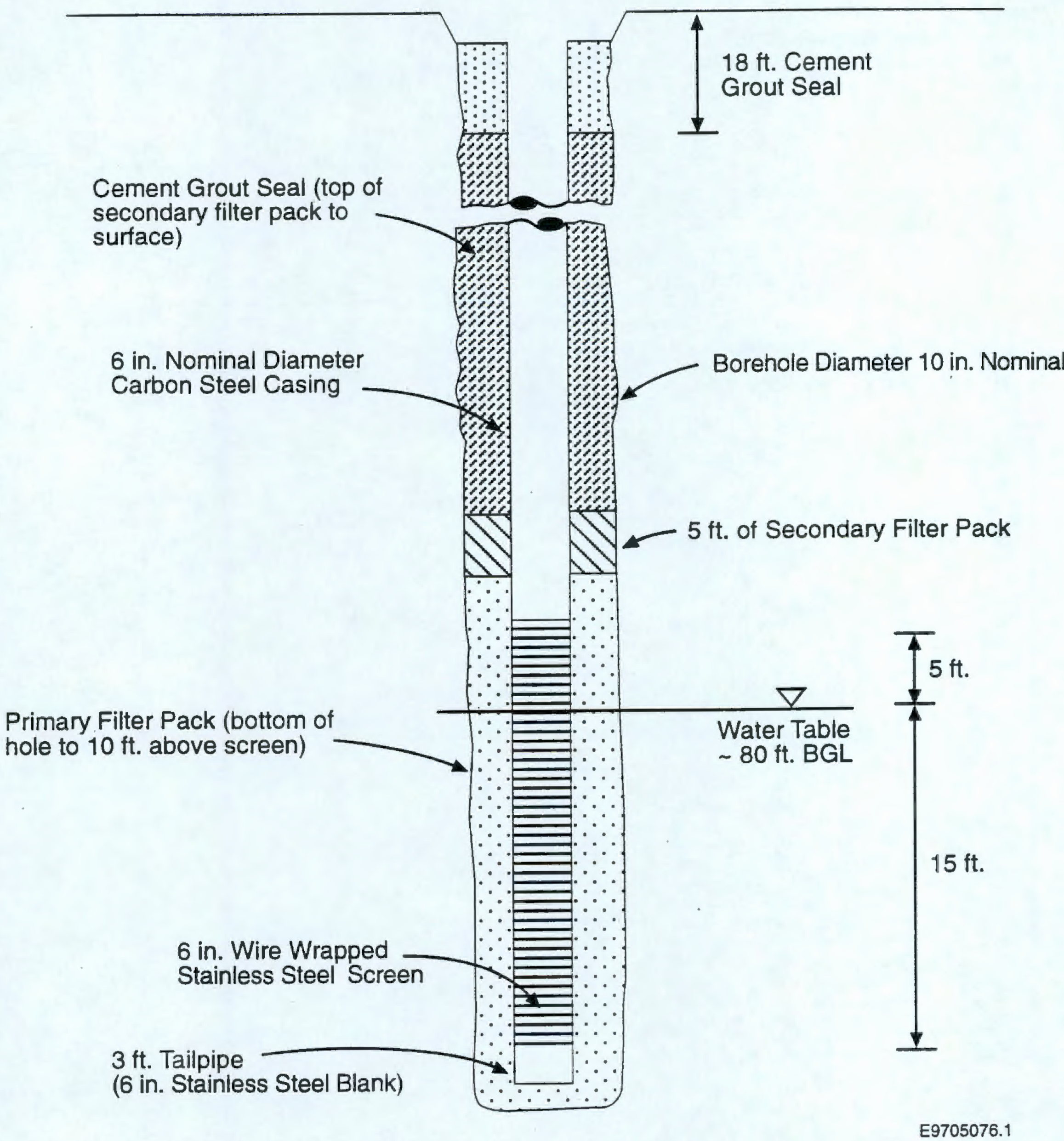


Figure B-2. Well Completion Diagram



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