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FROM: M. H. Sturges MHS
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SUBJECT: **TRANSMITTAL OF AQUIFER SAMPLING TUBE COMPLETION REPORT: 100 AREA AND HANFORD TOWNSITE SHORELINES**

Attached for your use and information is the Aquifer Sampling Tube Completion Report: 100 Area and Hanford Townsite Shorelines. This report summarizes the installation and sampling activities performed in the fall of 1997. The information provided includes the depths and locations where sampling tubes were installed, the results of the sampling activities, and recommendations for data evaluation and future use.

If you have any questions, please contact Jane Borghese at 372-9585.

MCK:mck

Aquifer Sampling Tube Completion Report

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AQUIFER SAMPLING TUBE COMPLETION REPORT: 100 AREA AND HANFORD TOWNSITE SHORELINES

January 8, 1997

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ACKNOWLEDGEMENTS

The installation of aquifer sampling tubes along the Hanford Site shoreline involved significant logistical challenges, hard physical labor, and frequent extended work days. The team completed the installations under the pressure of uncertain field conditions; field constraints involving cultural/ecological resources and radiation risk; and the ever-present concern for schedule and budget. The dedicated Environmental Restoration Contractor team members from CH2M HILL Hanford, Inc. who deserve special recognition for this project are: Dave Erb, Mike Faurote, George Kelty, Bill McMahon, Bob Raidl (Field Team Lead), Jim Sharpe, Kevin Singleton, Les Walker, Dave Weekes, and Steve Weiss. Michael Baechler provided field screening support. Rich Mahood provided invaluable technical support to the field team. Michelle Kelly assisted in all office aspects of this work.

The installation team would also like to recognize the field support provided by Joe Jiminez (BHI) in helping to coordinate the field activities, and to Cliff St. John (BHI) for oversight on worker safety. Judy Nicholson (BHI) and Doug Stark (BHI) provided Teamster support, and Dan Bowman (THI) and Shawnlee Dodd (THI) were the radiological control technicians.

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1.0 INTRODUCTION

Groundwater contamination is known or suspected along the Hanford Site shoreline of the Columbia River adjacent to the retired reactor areas. Along the shoreline away from the reactor areas, where contamination is presumed to be absent, monitoring sites are frequently widely spaced or unavailable to confirm the presumption. Previous characterizations of contamination near the river have relied on data from a limited number of near-river wells, contaminant plume migration predictions, and riverbank seepage sampling to anticipate shoreline conditions.

In recent years, new methods have been developed to obtain groundwater samples from the aquifer near the groundwater/river water interface. These methods include using (1) divers to obtain samples of pore water from riverbed sediment and (2) sampling tubes that are driven into the aquifer at the shoreline. The latter method also permits sampling the aquifer at multiple depths, which helps to determine the thickness of the potentially contaminated groundwater layer that discharges into the river.

In the spring of 1997, funding was made available to install additional aquifer sampling tubes along the 100 Area and Hanford Townsite shorelines (ERC 1997a). The purpose for the installations is to establish continuous coverage of this segment of the Hanford Site shoreline by groundwater monitoring sites. Analysis of water samples collected during the installation process would provide an initial indication of water quality and these data would be used to develop subsequent monitoring schedules.

As part of the decision to proceed with the project, it was recognized that new observational data in areas previously not covered, and in areas presumed to be free of contamination, would be a significant factor in supporting future environmental restoration program decisions. In areas of well-documented contamination, the new data from locations near sensitive ecological receptors and sites of possible human exposure would also enhance the technical basis for program decisions.

This report summarizes the installation and sampling activities of the work performed in the fall of 1997. The summary includes the depths and locations where sampling tubes are installed and the results of sampling activities. Recommendations for data evaluation and future use of the tubes are also included.

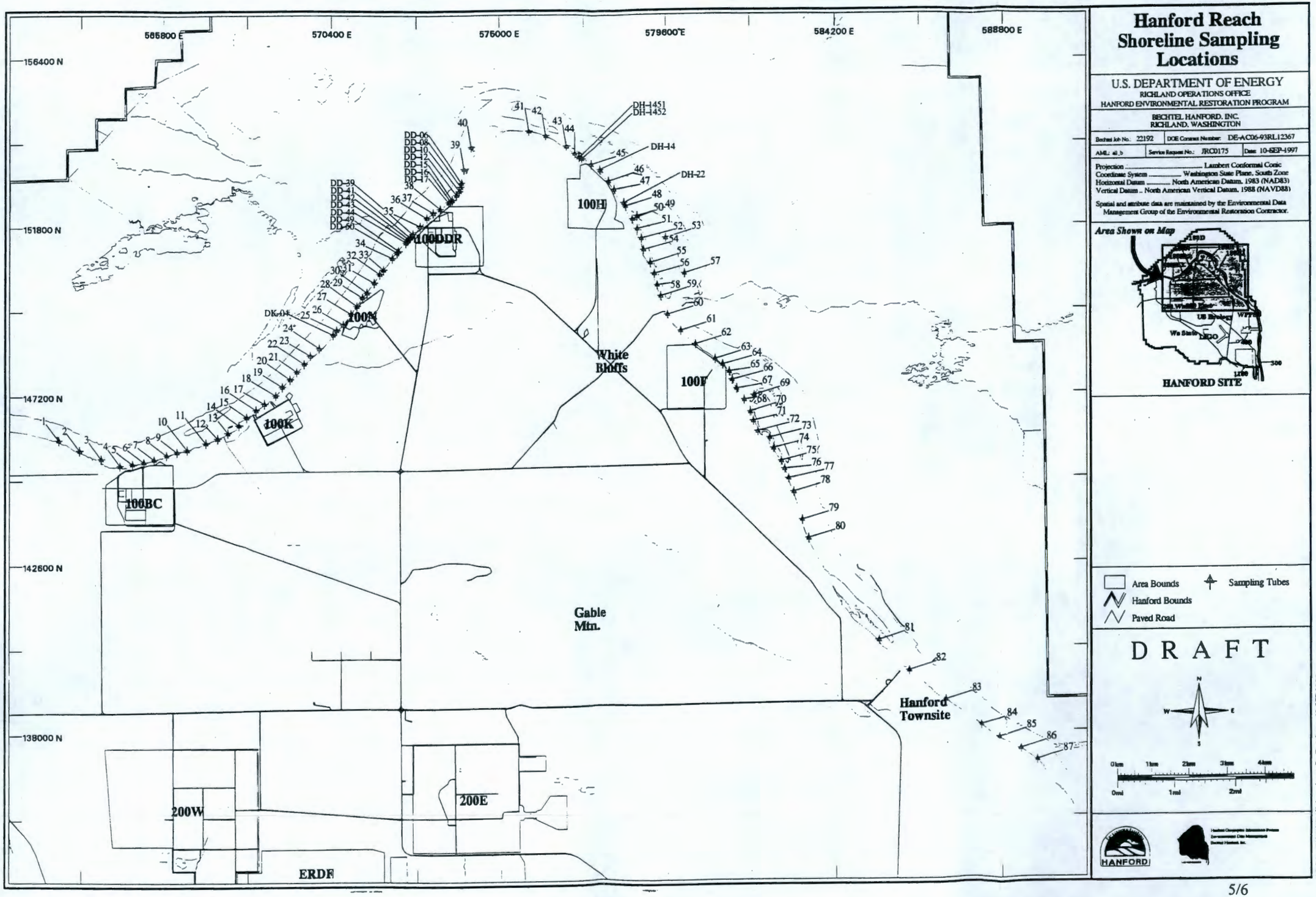
1.1 PROJECT OVERVIEW

Initial project plans were based on the installation of tubes at 87 locations, with each location having sampling ports installed at three depths. The planned locations were spaced approximately 610 m (2,000 ft) apart along the shoreline away from the reactor areas and 305 m (1,000 ft) apart along the reactor areas. Figure 1-1 shows the approximate locations initially planned along the shoreline in the northern portion of the Hanford Site.

Aquifer sampling tubes are small diameter polyethylene tubes with a screen at the lower end. The tubes are implanted in the aquifer by driving a temporary steel casing and inserting a tube into the casing. The end of each tube is fitted with a screened section that acts as the sampling port. The temporary steel casing is driven by either a hydraulic ram attached to a vehicle or by a

(i.e., highest specific conductance and greater than 200 μS/cm). Existing aquifer sampling tubes at 100-K, 100-D/DR, and 100-H Areas were resampled as part of this project.

Figure 1-1. Map of Northern Portion of Hanford Site and Planned Installation Locations.



2.0 FIELD OPERATIONS

The following sections describe the field operations used to complete this project. All field work associated under this project was conducted under Demand Work Request 1997-08-06-002 *"Install Aquifer Sample Tubes Along the Columbia River."* Included in the work package is the Site-Specific Waste Management Instruction (SSWMI). The SSWMI provides guidance for the management of low-level radioactive waste (LLW) and purgewater during the installation of sampling tubes and sampling of aquifers along the Columbia River shoreline. Also included in the Demand Work Request are the excavation permit DAN-822, Start Card Information, Activity Hazard Analysis (AHA), *National Environmental Policy Act* review, and the Davis-Bacon Work Assessment. Logbooks EL-1393 and EL-1394 were used to record all field notes.

2.1 INSTALLATION METHODOLOGY

Aquifer sampling tubes were installed following the guidelines presented in *Environmental Investigation Procedures* (EIP) 5.1, "Soil Gas Sampling" (BHI-EE-01), which was prepared for use of Geoprobe™ (Geoprobe Systems, Salinas, Kansas) equipment. At each location, up to three polyethylene sampling tubes were implanted in the aquifer. The tubes have an outside diameter of 0.63 cm (0.25 in.). Each tube has a 15-cm (6-in.) long mesh screen at the bottom end that acts as the groundwater sampling port. The screen has an 0.95 cm (0.375 in.) outside diameter and pore openings of 0.0145 cm (0.0057 in.).

Tubes are implanted using a steel probe rod as a temporary casing. The probe rod is driven into the aquifer using the Geoprobe™ vehicle or a hand-carried air hammer manufactured by Rhino Equipment Corporation. A plastic sampling tube with a screen attached is installed in the probe rod and, as the probe rod is withdrawn, the formation collapses around the tube and screen. Where the Geoprobe™ was used, three tubes are clustered within a single probe rod. Where the air hammer was used, separate probe rods are driven for each tube. Figure 2-1 illustrates the main features of the installation using the Geoprobe™ vehicle. Additional details for the installation methodologies used are presented in Appendix A.

The goal at each location was to install aquifer sampling tubes with ports near the bottom of the unconfined aquifer, at aquifer mid-depth, and within approximately 1.5 m (5 ft) of the water table. The sequence of installation using the Geoprobe™ starts with the deepest tube, which is implanted at the maximum depth of penetration possible. The probe rod is then partially backpulled and the second tube is installed at mid-depth in the aquifer. Finally, the probe rod is withdrawn further and the final tube is installed close to the water table, using the river elevation as a guide. When using the hand-carried Rhino™ air hammer, temporary casing is driven for each sampling tube.

At the planned locations along the river shoreline, the depth to the bottom of the unconfined aquifer was expected to be within the 10-m (30-ft) driving capability of the methods used. However, there are numerous areas where aquifer thickness was largely unknown, and success at implanting tubes at the planned depths was not always achieved. Also, hard, impenetrable layers or large boulders were encountered that prevented completion of the ideal three-tube arrangement.

The plastic tubes will remain essentially flush with the ground at the installation site. The sampling tubes are secured for protection from winter conditions and animal abuse using PVC conduit and local rock material. Each tube is marked to identify the location and sample port depth.

2.2 FIELD OPERATIONS CONSTRAINTS

The Columbia River shoreline environment contains resources that are culturally and ecologically sensitive. Along some portions of the shoreline, little is known about potential subsurface contamination. For the field team to work safely, efficiently, and without compromise of cultural and ecological resources, operational constraints were placed on some locations. These constraints dictated the monitoring activities and personnel that needed to be in place prior to installing tubes. The constraint categories for this project were (a) radiation control, (b) cultural sensitivity, (c) purgewater containment, and (d) ecological sensitivity.

Radiation Control. Steve DeMers (BHI Radiation Control Supervisor) reviewed each planned location to determine whether there was a potential for radiological contamination in the subsurface. The sites that could be done without radiological controls were communicated to the task manager via ERC (1997b). A supplement on controls for the Hanford Townsite Locations was communicated via ERC (1997c). The Radiation Work Permit that applied to this work is GW-104.

Culturally Sensitive Areas. A Cultural Resource Review (HCRC #97-100-21) was conducted for the installation of aquifer sampling tubes. This review encompassed a records/literature review and a field inspection. The review recommended the use of existing roads to gain access to the shoreline and that a Cultural Resource Specialist accompany the field team to monitor activities in culturally sensitive areas (ERC 1997d).

Purgewater Containment. Water was removed from the tubes during the installation process. To determine if purgewater had to be contained or could be dumped to the ground, the quality of nearby groundwater was reviewed. If nearby wells had radiological or chemical contaminant concentrations higher than that listed in the Purgewater Strategy, purgewater from nearby tubes was contained. All water purged from the potential radiological sites was also contained.

Ecologically Sensitive. An Ecological Review (97-ER-041) was conducted for installation activities (ERC 1997e). This review encompassed inspections of several representative installation locations. The review determined that no animal or plant species were identified that will be impacted by this project. However, since sampling and surveying activities continued after November 15, 1997, an amendment to the ecological review was made (97-ER-041a) (ERC 1997f). The amendment identified that locations near bald eagle roosts will be monitored prior to entry. If eagles are present where work is planned, the work will be postponed or redirected to sites outside the roost buffer zones until the eagles have voluntarily left the roost. During the final field work phase, a section of the eagle buffer zone was closed. After this closure the field crew did not access these areas.

Because the tubes are intended for future sampling activities, a location description log has been developed to aid future users in finding the tube locations. This log is attached as Appendix B.

2.3 LESSONS LEARNED

- Access to shoreline sampling sites is greatly aided by the presence of a cultural resources specialist who is familiar with the Hanford Site river shore. Close coordination with Tribal representatives is an essential element of field activities along the shoreline.

- When marking field locations, the dynamic environment caused by the daily rise and fall of the river must be considered. Fiberglass poles with flags can be placed above the high water line (several may be used to establish a line-of-sight to the shoreline location). Site identification and access constraints should be clearly labeled on each flag.

- Polyethylene sampling tubes are highly susceptible to destruction by animals. Although the specific critter has not yet been observed munching on the tubes, beaver and porcupine are suspected. Tubes are frequently chewed off at ground level. The identity of the tube can be re-established by pushing a fine, flexible wire down the tube to determine its length. Protection is required and PVC conduit appears to work well. Protection of the tube should be established at the time of installation.

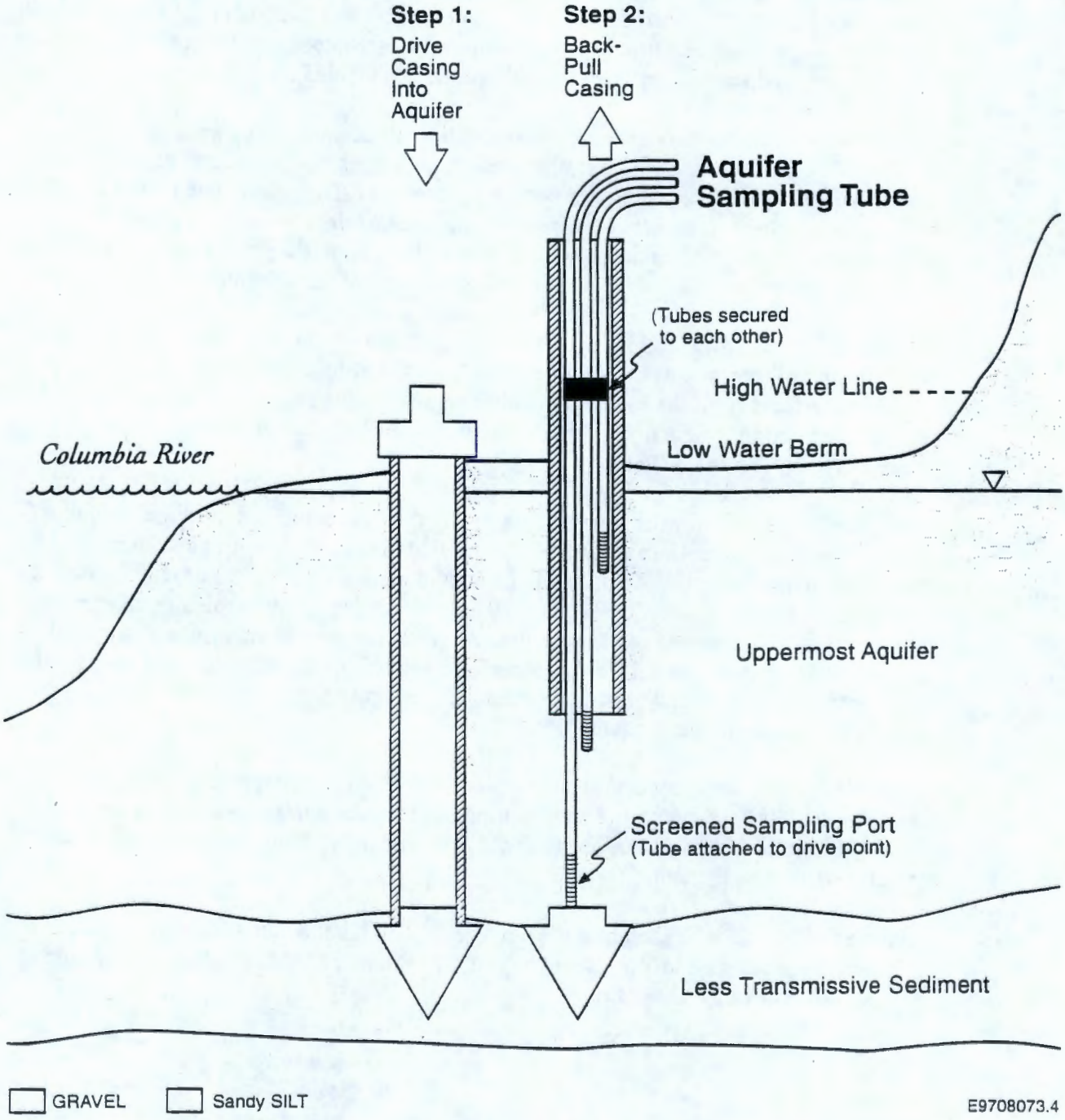
- If a small diameter drive rod is used with the Geoprobe equipment, there is danger of the rod "whipping" laterally as it is being pulled from the ground. The tension on the rod apparently results from the rod being bent (stressed) during driving as the rod bends around obstructions. Tube diameters for use with the Geoprobe equipment must be greater than 3.49 cm (1.375 in).

- Optimum time for field work near the low river stage shoreline is during the annual period of Priest Rapids Dam discharge control that is done to encourage salmon spawning in deeper water. The river stage is held constant during the daylight hours at a discharge of approximately 2×10^6 L/s (70,000 cfs) or less. Even at this discharge, the river level may rise during working hours. A call to the dam to determine changes in flow for the day is beneficial for shoreline field activities. At other times of the year, the river level may rise quickly, stranding vehicles and equipment that cannot be relocated equally quickly to higher ground.

- Rounded cobbles, slippery coatings, and steep slopes create a hazardous work environment for hand-carrying heavy equipment to and from the shoreline work site. Field teams must be extra cautious to avoid falls and injury from slips and loss of control of hand-carried equipment.

- At each field location, a sketch of the newly installed tube layout should be included in the field logbook. The layout should be oriented relative to north and to the Columbia River (show flow direction of river).

Figure 2-1. Diagram Showing Main Components of Aquifer Sampling Tube Installation.



3.0 AQUIFER SAMPLING TUBE LOCATIONS

This section describes the newly equipped locations. Descriptions for locations that were equipped during the fall 1995 project are presented in the completion report for that project (Hope and Peterson 1996b).

3.1 INSTALLATION SITES

Of the 87 planned locations, 70 locations were equipped with one to three tubes each, for a total of 178 new aquifer sampling tubes. Various problems were encountered that prevented equipping all planned locations and all planned depths. The most frequent involved impenetrable substrate, because of either dense/compact sediments or boulders. Several trial drives of temporary casing would be made at slightly offset locations, but if further progress seemed unlikely, the location would be dropped from the current project list. The strategy followed was to equip the greatest number of planned locations during the available field season window.

The newly equipped locations are shown on maps presented in Figures 3-1 through 3-6. The numbers identifying the map location include a suffix that identifies the sampling port determined to produce samples most representative of groundwater (e.g., "06-M" indicates the mid-depth port at location 6). Because some tubes had been chewed by animals just prior to the GPS, it was not possible for the surveyor to accurately determine which tube was which at some locations. A suffix of "-?" was added to the map location number. The identity of the damaged tubes will be reestablished when seasonal low river conditions return.

Also shown on the maps are existing locations of aquifer sampling tubes; riverbank seepage sites: and groundwater monitoring wells. The maps were generated by the Environmental Restoration Contractor (ERC) geographic information system and can be used as base maps for subsequent interpretive reports.

The newly installed aquifer sampling tubes are listed in Table 3-1. The table is keyed by the map location number used during the planning phase and also by the port identified as producing samples most representative of groundwater (i.e., the "map label" field in Table 3-1). The initial specific conductance measurement made on water from the tube is also shown; these results were used to determine how representative the samples were of groundwater. Well identification numbers assigned to each sampling tube are listed (e.g., B8113). The well (tube) identification number is a unique number that is used to identify all subsequent data that are associated with the tube.

A table that provides details for all successful and attempted aquifer sampling tube installations is presented in Appendix C. This table was developed for the Description of Work and has been the working table during the course of the project.

3.2 GLOBAL POSITIONING SYSTEM SURVEY RESULTS

Geographic coordinates for the newly installed aquifer sampling tubes were determined using the global positioning system (GPS) by ERC staff (Lorin Peterson) during late November/early December 1997 (Table 3-2). The horizontal coordinates are presented in Washington State Plane Coordinates, South Zone, and are expressed in meters. Elevations are presented relative to the North America Vertical Datum of 1988 (NAVD88) and the National Geodetic Vertical Datum of 1929 (NGVD29). The latter provides for easy comparison with historical data on river, water table, and topography elevations. NAVD88 elevations have been converted to NGVD29 by subtracting 1.032 m and converted to feet using a factor of 3.2808333.

Figure 3-1. Installed Locations Along 100-B/C and 100-K Area Shorelines.

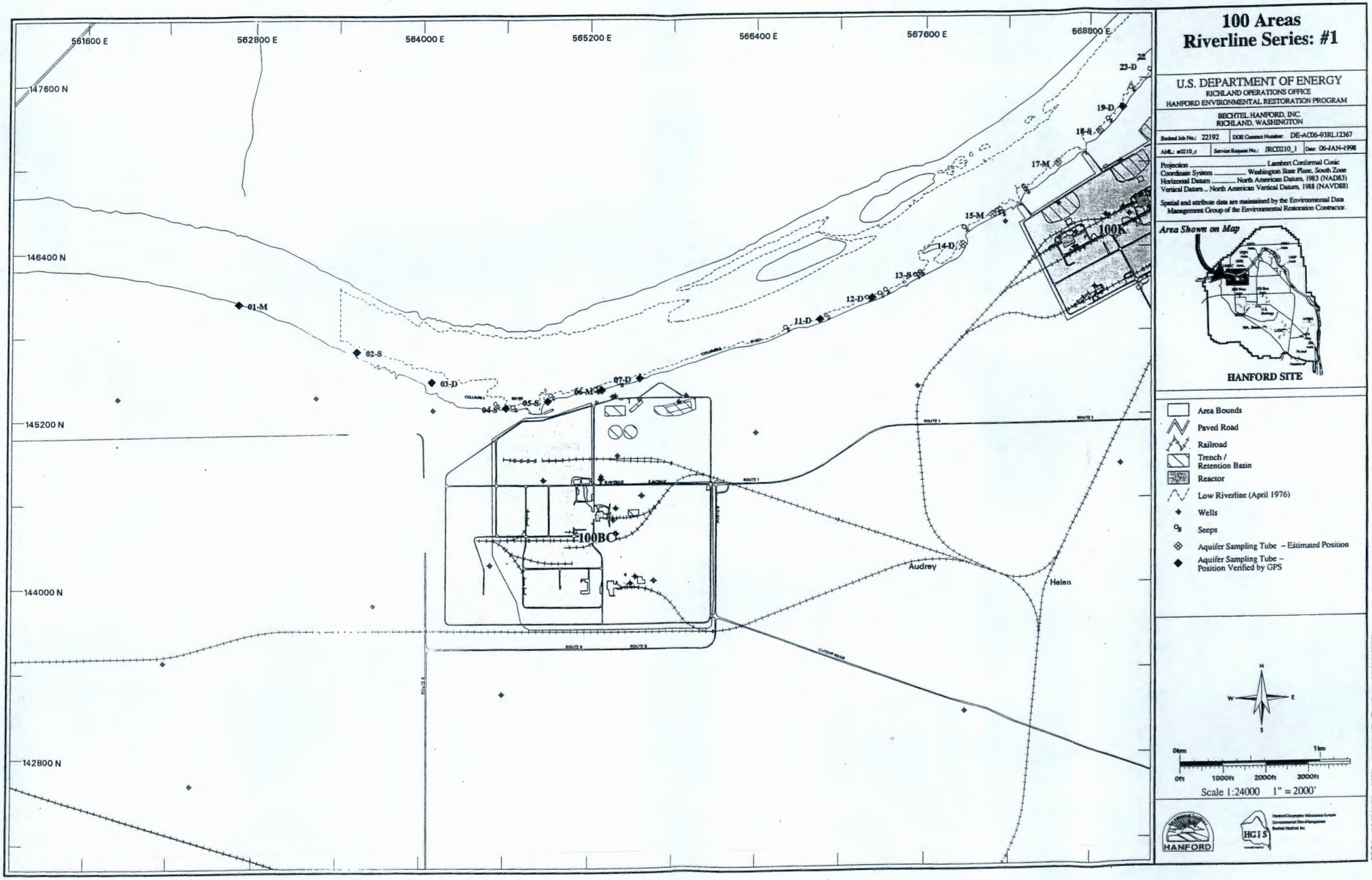


Figure 3-2. Installed Locations Along 100-N and 100-D/DR Area Shorelines.

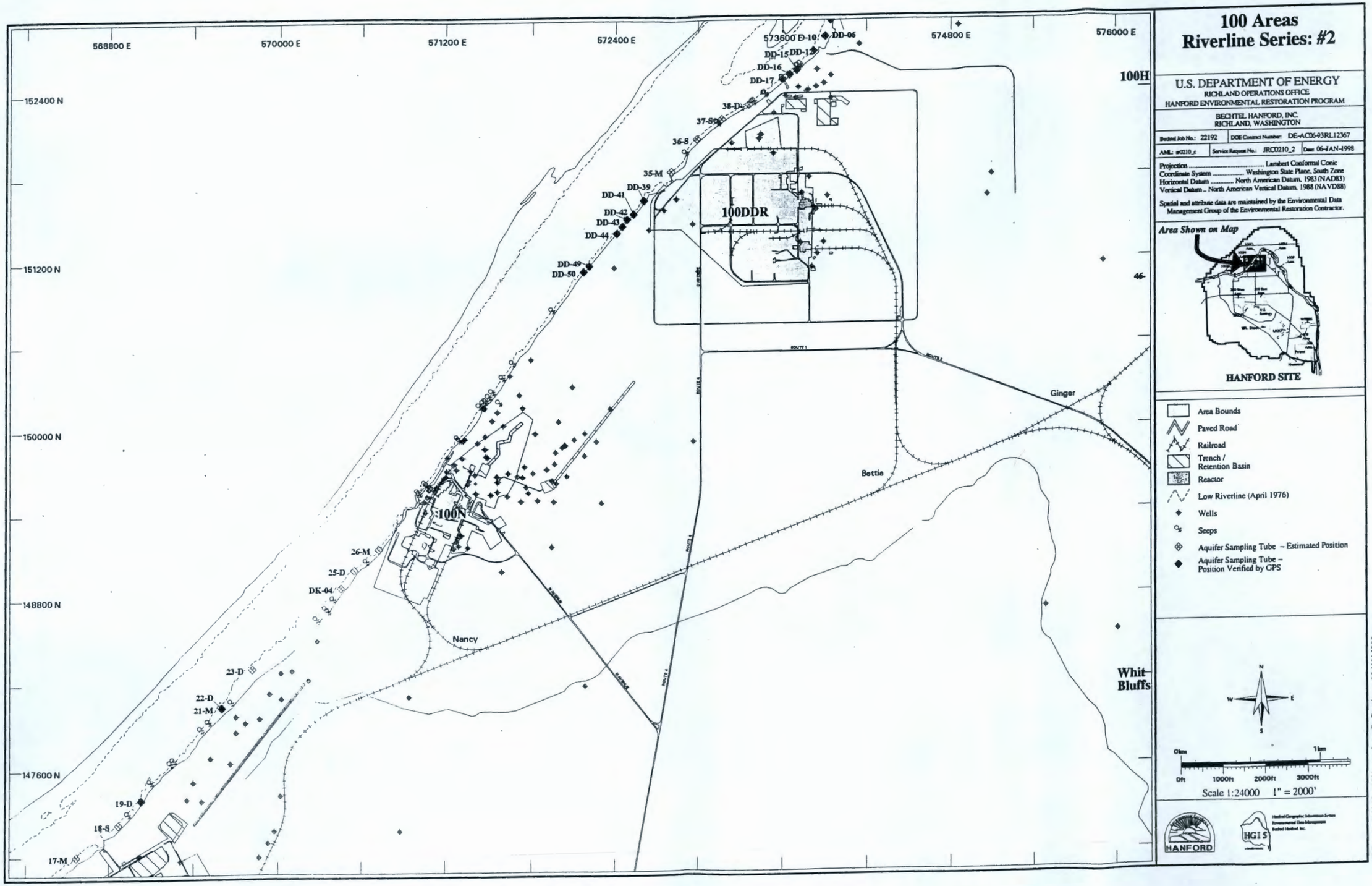


Figure 3-3. Installed Locations Along 100-D/DR and 100-H Area Shorelines.

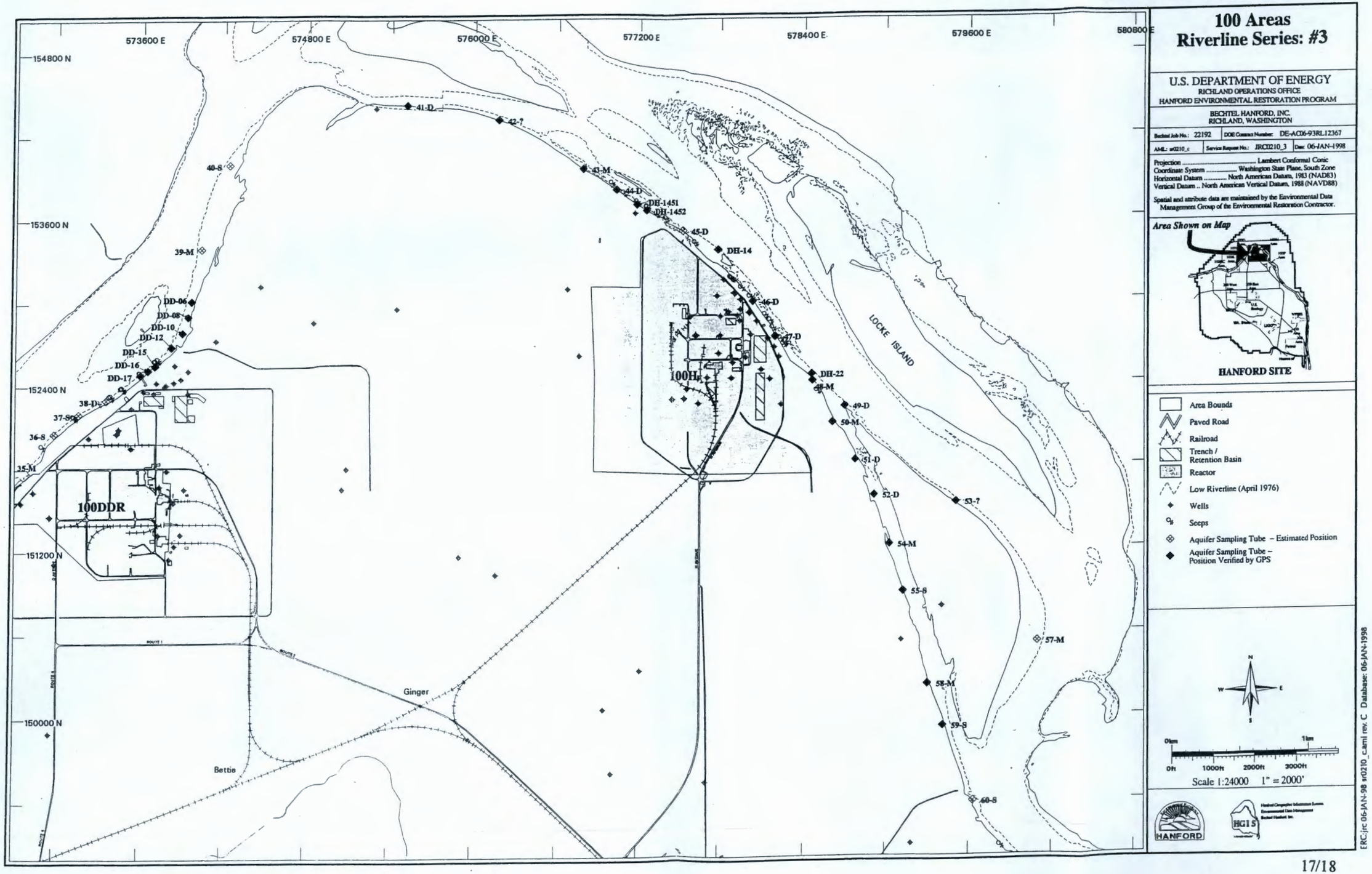


Figure 3-4. Installed Locations Along 100-F Area Shorelines.

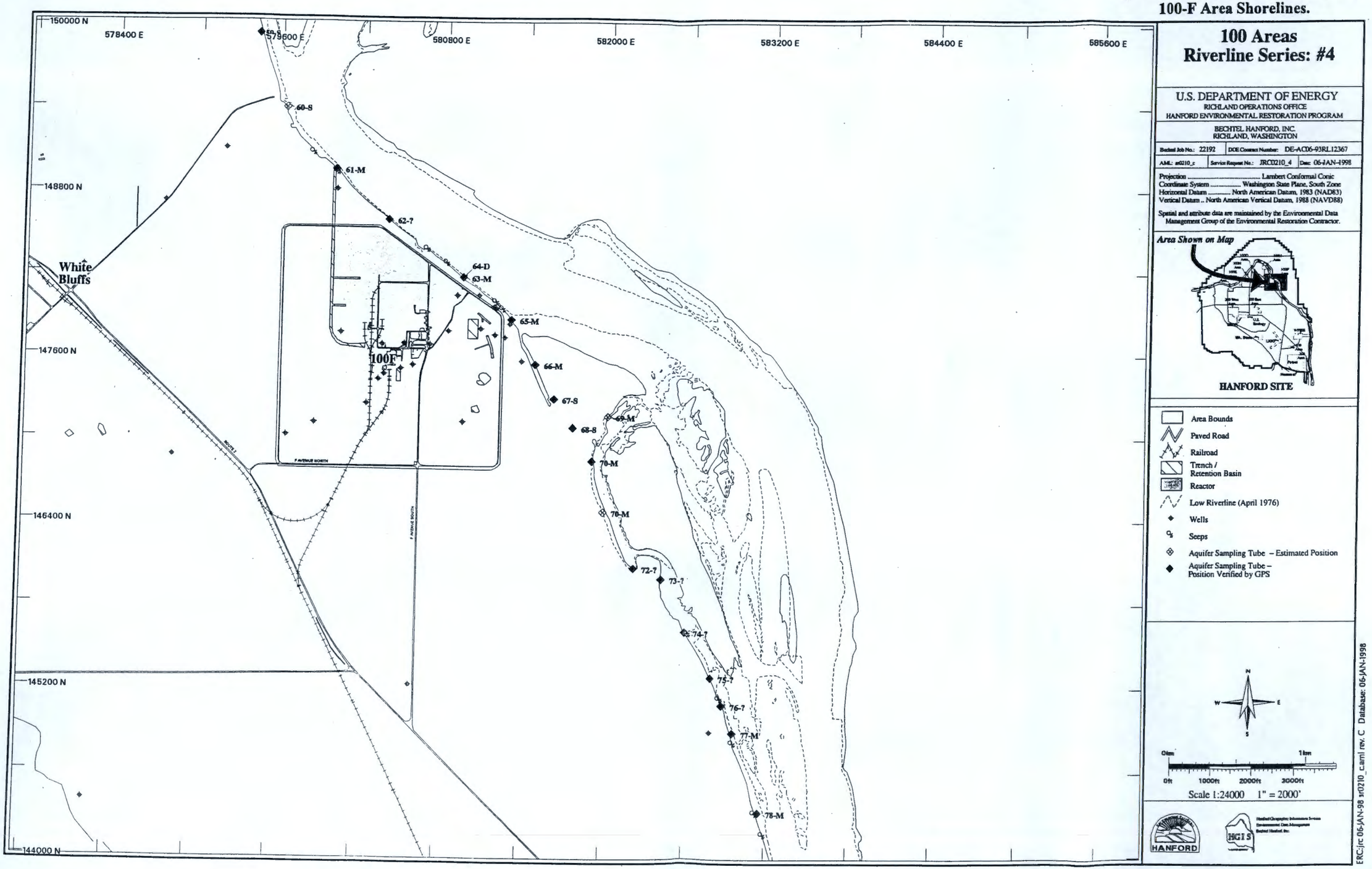


Figure 3-6. Installed Locations Along Southern Portion of Hanford Townsite Shoreline.

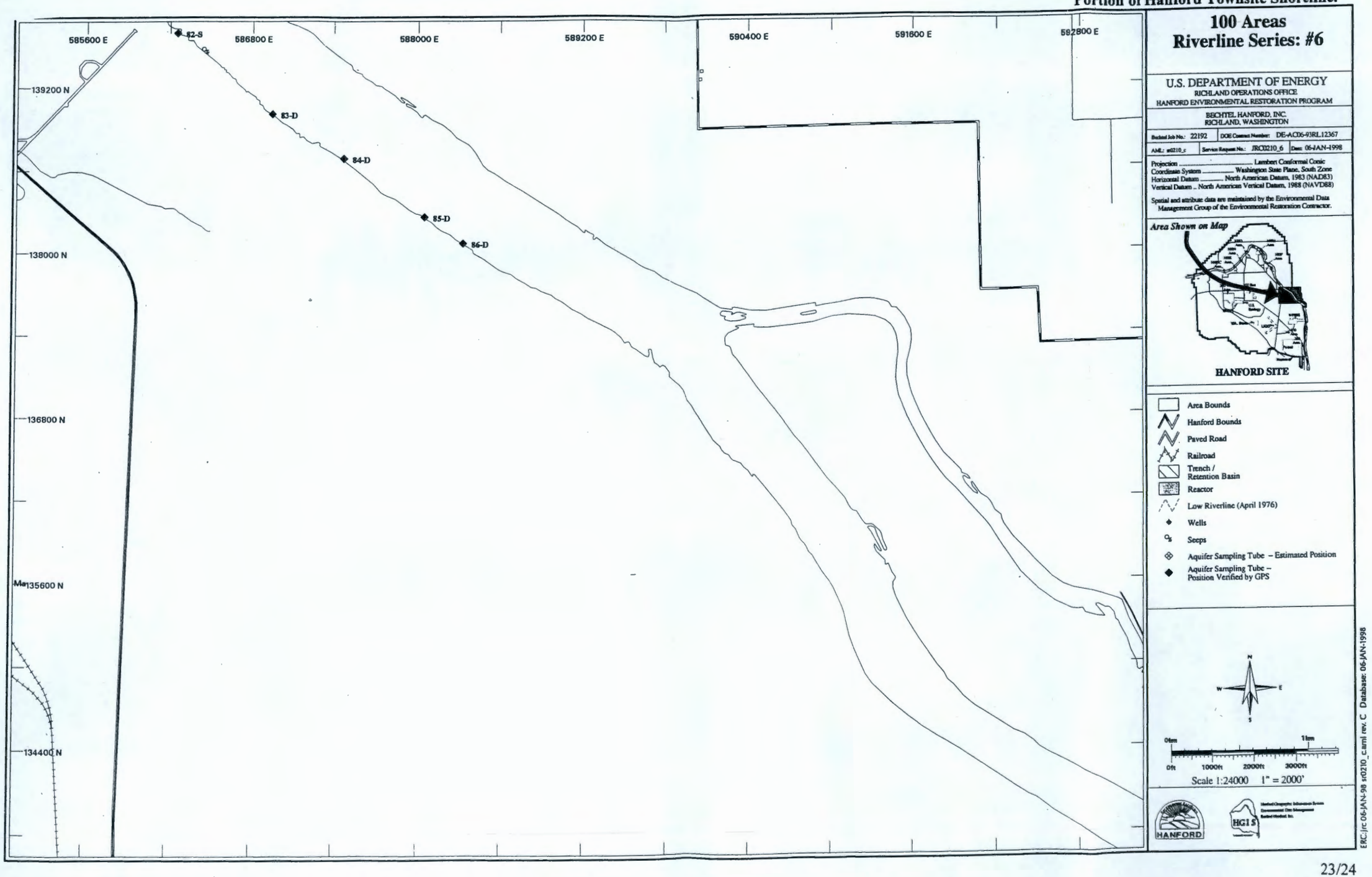


Table 3-1. Aquifer Sampling Tube Installations. (Page 1 of 5)

Map Number	Area	Installation Method	Date Installed	Port Identifier	Tube Identification Number	Depth bgs (ft)	Conductance (uS/cm)	Temperature (degrees C)	Comments
1	100-B	NA	10/02/97	01-rvr	River	0.0	130	17.5	
1	100-B	Geoprobe	10/02/97	01-S	B8115	7.0	194	17.6	
1	100-B	Geoprobe	10/02/97	01-M	B8114	16.0	242	16.6	
1	100-B	Geoprobe	10/02/97	01-D	B8113	24.0	275	19.5	
2	100-B	NA	10/03/97	02-rvr	River	0.0	137	17.6	
2	100-B	Geoprobe	10/03/97	02-S	B8118	6.0	294	18.0	
2	100-B	Geoprobe	10/03/97	02-M	B8117	14.9			Would not yield water
3	100-B	Geoprobe	11/14/97	03-M	B8120	7.0			Field meter unavailable
3	100-B	Geoprobe	11/14/97	03-D	B8119	13.0			Field meter unavailable
4	100-B	NA	10/08/97	04-rvr	River	0.0	140	14.6	
4	100-B	NA	10/09/97	04-rvr	River	0.0	134	14.7	
4	100-B	Geoprobe	10/09/97	04-S	B8124	8.3	375	19.2	
4	100-B	Geoprobe	10/08/97	04-M	B8123	13.0	368	18.0	
4	100-B	Geoprobe	10/08/97	04-D	B8122	25.0	337	18.7	
5	100-B	NA	10/09/97	05-rvr	River	0.0	125	15.4	
5	100-B	Geoprobe	10/09/97	05-S	B8127	8.5	444	17.2	
5	100-B	Geoprobe	10/09/97	05-M	B8126	17.0	315	18.5	
5	100-B	Geoprobe	10/09/97	05-D	B8125	25.5	318	18.8	
6	100-B	NA	10/10/97	06-rvr	River	0.0	127	15.4	
6	100-B	Geoprobe	10/10/97	06-S	B8130	8.8	456	18.9	
6	100-B	Geoprobe	10/10/97	06-M	B8129	15.5	425	19.4	
6	100-B	Geoprobe	10/10/97	06-D	B8128	23.0	350	19.4	
7	100-B	NA	10/20/97	07-rvr	River	0.0	140	15.7	
7	100-B	Rhino	10/20/97	07-M	B8132	8.0	392	19.2	
7	100-B	Rhino	10/20/97	07-D	B8131	20.0	366	21.9	
11	100-B	Rhino	11/03/97	11-D	B8143	10.5			Field meter inoperative
12	100-B	Rhino	11/03/97	12-D	B8146	10.0			Field meter inoperative
13	100-K	NA	10/06/97	13-rvr	River	0.0	130	16.6	
13	100-K	Geoprobe	10/06/97	13-S	B8151	8.3	318	17.4	
13	100-K	Geoprobe	10/06/97	13-D	B8149	22.9			No yield; broke off rod
14	100-K	NA	10/07/97	14-rvr	River	0.0	131	15.8	
14	100-K	Geoprobe	10/07/97	14-S	B8154	7.5	317	16.5	
14	100-K	Geoprobe	10/07/97	14-M	B8153	14.5	321	17.4	
14	100-K	Geoprobe	10/07/97	14-D	B8152	21.5	331	16.7	
15	100-K	NA	10/07/97	15-rvr	River	0.0	130	16.7	
15	100-K	Geoprobe	10/07/97	15-M	B8156	13.7	286	18.3	
17	100-K	Rhino	10/10/97	17-M	B8162	11.0			
17	100-K	Rhino	10/10/97	17-D	B8161	19.5			
18	100-K	NA	10/08/97	18-rvr	River	0.0	132	14.5	
18	100-K	Geoprobe	10/08/97	18-S	B8204	8.5	367	16.8	
19	100-K	Rhino	10/09/97	19-M	B8206	10.0			
19	100-K	Rhino	10/07/97	19-D	B8205	22.0			
21	100-K	Rhino	10/22/97	21-S	B8213	11.0			Field meter inoperative
21	100-K	Rhino	10/22/97	21-M	B8212	15.0			Field meter inoperative
22	100-K	NA	10/23/97	22-rvr	River	0.0	151	13.4	50 yds from TK-16 transect stake
22	100-K	Rhino	10/23/97	22-M	B8215	7.5	254	15.4	
22	100-K	Rhino	10/23/97	22-D	B8214	12.3	248	16.0	
23	100-K	Rhino	10/23/97	23-rvr	River	0.0	143	12.3	
23	100-K	Rhino	10/23/97	23-M	B8218	7.0	229	13.0	Poor yield; turbid
23	100-K	Rhino	10/23/97	23-D	B8217	12.0	246	13.0	
25	100-N	NA	10/27/97	25-rvr	River	0.0	143	14.3	
25	100-N	Rhino	10/27/97	25-D	B8223	7.5	260	16.9	Upslope 50 ft inland of TK-2
26	100-N	NA	10/27/97	26-rvr	River	0.0	159	14.4	

Table 3-1. Aquifer Sampling Tube Installations. (Page 2 of 5)

Map Number	Area	Installation Method	Date Installed	Port Identifier	Tube Identification Number	Depth bgs (ft)	Conductance (uS/cm)	Temperature (degrees C)	Comments
26	100-N	Rhino	10/27/97	26-S	B8228	6.0	425	13.9	
26	100-N	Rhino	10/27/97	26-M	B8227	14.0	297	13.9	
26	100-N	Rhino	10/27/97	26-D	B8226	23.0	451	13.7	
35	100-D	NA	11/06/97	35-rvr	River	0.0	130		Field meter data questionable
35	100-D	Rhino	11/06/97	35-S	B8255	8.0	120		Field meter data questionable
35	100-D	Rhino	11/06/97	35-M	B8254	14.0	185		Field meter data questionable
35	100-D	Rhino	11/06/97	35-D	B8253	21.0			Would not yield water
36	100-D	Rhino	11/05/97	36-S	B8258	8.0			Field meter inoperative
36	100-D	Rhino	11/05/97	36-M	B8257	14.0			Field meter inoperative
36	100-D	Rhino	11/05/97	36-D	B8256	21.0			Field meter inoperative
37	100-D	Rhino	11/04/97	37-S	B8261	6.5			Field meter inoperative
37	100-D	Rhino	11/04/97	37-M	B8260	13.5			Field meter inoperative; no yield
37	100-D	Rhino	11/04/97	37-D	B8259	19.5			Field meter inoperative; no yield
38	100-D	Rhino	11/04/97	38-M	B8263	10.0			Field meter inoperative
38	100-D	Rhino	11/04/97	38-D	B8262	16.5			Field meter inoperative
39	100-D	NA	9/29/97	39-rvr	River	0.0	130	21.4	
39	100-D	Geoprobe	9/29/97	39-S	B8267	8.0	340	18.1	
39	100-D	Geoprobe	9/29/97	39-M	B8266	18.0	338	15.3	
39	100-D	Geoprobe	9/29/97	39-D	B8265	28.0	250	18.9	
40	100-D	NA	9/29/97	40-rvr	River	0.0	130	25.7	
40	100-D	Geoprobe	9/29/97	40-S	B8270	8.0	272	18.2	
40	100-D	Geoprobe	9/29/97	40-M	B8269	15.5	310	17.4	
41	100-H	Rhino	9/09/97	41-S	B8273	10.0	161	18.3	
41	100-H	Rhino	9/09/97	41-M	B8272	15.0	200	16.3	
41	100-H	Rhino	9/09/97	41-D	B8271	25.0	182	14.4	
42	100-H	Rhino	9/08/97	42-S	B8276	10.0	286	17.3	
42	100-H	Rhino	9/08/97	42-M	B8275	15.0	295	16.5	
42	100-H	Rhino	9/08/97	42-D	B8274	24.0	294	16.9	
43	100-H	Rhino	9/10/97	43-M	B8278	7.5			
43	100-H	Rhino	9/10/97	43-D	B8277	9.7			
44	100-H	Rhino	9/03/97	44-M	B8281	8.5	365	13.4	
44	100-H	Rhino	9/03/97	44-D	B8280	12.7	359	14.0	
45	100-H	NA	9/05/97	45-rvr	River	0.0	145	19.5	
45	100-H	Geoprobe	9/05/97	45-S	B8285	8.0	236	16.8	
45	100-H	Geoprobe	9/05/97	45-M	B8284	15.0	218	15.3	
45	100-H	Geoprobe	9/05/97	45-D	B8283	23.0	202	19.3	
46	100-H	Rhino	9/10/97	46-D	B8286	10.5			
47	100-H	NA	10/21/97	47-rvr	River	0.0	147	16.5	
47	100-H	Rhino	10/21/97	47-M	B8290	8.0	204	15.4	
47	100-H	Rhino	10/21/97	47-D	B8289	14.5	279	16.5	
48	100-H	NA	10/10/97	48-rvr	River	0.0	126	15.7	
48	100-H	Geoprobe	10/10/97	48-S	B8294	9.0	277	16.2	
48	100-H	Geoprobe	10/10/97	48-M	B8293	17.0	290	15.0	
48	100-H	Geoprobe	10/10/97	48-D	B8292	25.0			Would not yield water
49	100-H	NA	10/01/97	49-rvr	River	0.0	131	17.6	
49	100-H	Geoprobe	10/01/97	49-S	B8297	8.5	173	17.6	
49	100-H	Geoprobe	10/01/97	49-M	B8296	17.5	264	15.1	
49	100-H	Geoprobe	10/01/97	49-D	B8295	25.5	324	14.5	
50	100-H	Geoprobe	9/25/97	50-S	B8300	8.5	314	18.9	
50	100-H	Geoprobe	9/25/97	50-M	B8299	17.5	339	16.7	
50	100-H	Geoprobe	9/25/97	50-D	B8298	26.5	320		
51	100-H	Geoprobe	9/25/97	51-S	B8303	9.5	312	16.3	
51	100-H	Geoprobe	9/25/97	51-M	B8302	17.5	335	14.5	

Table 3-1. Aquifer Sampling Tube Installations. (Page 3 of 5)

Map Number	Area	Installation Method	Date Installed	Port Identifier	Tube Identification Number	Depth bgs (ft)	Conductance (uS/cm)	Temperature (degrees C)	Comments
51	100-H	Geoprobe	9/25/97	51-D	B8301	25.5	403	14.0	
52	100-H	Geoprobe	9/24/97	52-S	B8306	7.0	227	17.7	
52	100-H	Geoprobe	9/24/97	52-M	B8305	15.0	230	15.2	
52	100-H	Geoprobe	9/24/97	52-D	B8304	24.0	318	15.7	
53	100-H	NA	9/23/97	53-rvr	River	0.0	127	21.4	
53	100-H	Geoprobe	9/23/97	53-S	B8309	8.0	200	18.5	
53	100-H	Geoprobe	9/23/97	53-M	B8308	17.0	172	16.3	
53	100-H	Geoprobe	9/23/97	53-D	B8307	26.0			
54	100-H	Geoprobe	9/24/97	54-S	B8312	7.5	210	15.7	
54	100-H	Geoprobe	9/24/97	54-M	B8311	17.0	235	13.9	
54	100-H	Geoprobe	9/24/97	54-D	B8310	26.0	223	13.4	
55	100-H	Geoprobe	9/24/97	55-S	B8315	10.0	309	14.0	
55	100-H	Geoprobe	9/24/97	55-M	B8314	18.0			
55	100-H	Geoprobe	9/24/97	55-D	B8313	26.0	276	17.9	
57	100-H	Geoprobe	9/23/97	57-S	B8321	7.0	153	18.0	
57	100-H	Geoprobe	9/23/97	57-M	B8320	18.0	155	15.6	
57	100-H	Geoprobe	9/23/97	57-D	B8319	29.0	187		
58	100-H	Rhino	10/01/97	58-S	B8324	11.0	395	16.4	
58	100-H	Rhino	10/01/97	58-M	B8323	19.5	453	16.4	
58	100-H	Rhino	10/01/97	58-D	B8322	26.5	476	17.0	
59	100-H	Rhino	10/02/97	59-S	B8327	11.0	480	15.6	
59	100-H	Rhino	10/02/97	59-M	B8326	16.5	450	15.1	
59	100-H	Rhino	10/02/97	59-D	B8325	23.0	409	15.8	Second push yielded water
60	100-H	NA	9/22/97	60-rvr	River	0.0	131	19.7	
60	100-H	Geoprobe	9/22/97	60-S	B8330	8.5	666	16.9	
60	100-H	Geoprobe	9/22/97	60-M	B8329	17.5	543	16.8	
60	100-H	Geoprobe	9/22/97	60-D	B8328	26.5			
61	100-F	NA	10/13/97	61-rvr	River	0.0	133	14.6	
61	100-F	NA	10/16/97	61-rvr	River	0.0	128	16.0	
61	100-F	NA	10/20/97	61-rvr	River	0.0	131	14.1	
61	100-F	Rhino	10/16/97	61-S	B8333	8.5	182	16.4	Replacement for 10/13 attempt
61	100-F	Geoprobe	10/13/97	61-S	B8333	9.5	220	17.9	Abandoned
61	100-F	Rhino	10/16/97	61-M	B8332	15.5	236	15.7	
61	100-F	Rhino	10/20/97	61-D	B8331	24.0	245	12.4	
62	100-F	NA	10/14/97	62-rvr	River	0.0	125	15.8	
62	100-F	Rhino	10/14/97	62-S	B8336	8.0	141	16.9	
62	100-F	Rhino	10/14/97	62-M	B8335	18.0	245	17.0	
62	100-F	Rhino	10/14/97	62-D	B8334	28.0	284	18.1	
63	100-F	NA	10/15/97	63-rvr	River	0.0	110	16.0	
63	100-F	Rhino	10/15/97	63-S	B8339	10.0	191	14.0	
63	100-F	Rhino	10/15/97	63-M	B8338	16.0	183.4	14.1	
63	100-F	Rhino	10/15/97	63-D	B8337	23.0			Would not yield water
64	100-F	NA	10/15/97	64-rvr	River	0.0	125.7	15.9	
64	100-F	Rhino	10/15/97	64-S	B8342	7.5	130.6	16.6	
64	100-F	Rhino	10/15/97	64-M	B8341	17.0	183	17.3	
64	100-F	Rhino	10/15/97	64-D	B8340	27.0	234	16.7	
65	100-F	NA	10/16/97	65-rvr	River	0.0	130		Temp. not available
65	100-F	Rhino	10/16/97	65-S	B8345	8.5	183		Temp. not available
65	100-F	Rhino	10/16/97	65-M	B8344	16.0	347		Temp. not available
65	100-F	Rhino	10/16/97	65-D	B8343	27.0			Would not yield water
66	100-F	Geoprobe	11/13/97	66-S	B8348	10.0			Field meter unavailable
66	100-F	Geoprobe	11/13/97	66-M	B8347	19.2			Field meter unavailable
66	100-F	Geoprobe	11/13/97	66-D	B8346	28.1			Field meter unavailable

Table 3-1. Aquifer Sampling Tube Installations. (Page 4 of 5)

Map Number	Area	Installation Method	Date Installed	Port Identifier	Tube Identification Number	Depth bgs (ft)	Conductance (uS/cm)	Temperature (degrees C)	Comments
67	100-F	Geoprobe	9/16/97	67-S	B8351	10.0	207		
67	100-F	Geoprobe	9/16/97	67-M	B8350	20.0	180		
67	100-F	Geoprobe	9/16/97	67-D	B8349	30.0			Would not yield water
68	100-F	Geoprobe	9/16/97	68-S	B8354	10.5	209		
68	100-F	Geoprobe	9/16/97	68-M	B8353	18.3	182		
68	100-F	Geoprobe	9/16/97	68-D	B8352	25.0	173		
69	100-F	NA	9/24/97	69-rvr	River	0.0	138.7	21.9	
69	100-F	Geoprobe	9/17/97	69-M	B8356	15.0	243	17.9	
69	100-F	Geoprobe	9/17/97	69-D	B8355	31.0			
70	100-F	NA	9/16/97	70-rvr	River	0.0	168	15.9	
70	100-F	Geoprobe	9/16/97	70-S	B8360	17.0	196	15.9	
70	100-F	Geoprobe	9/16/97	70-M	B8359	24.0	199	15.6	
70	100-F	Geoprobe	9/16/97	70-D	B8358	31.0	181	16.0	
71	100-F	NA	9/16/97	71-rvr	River	0.0	190.4	17.9	
71	100-F	Rhino	9/16/97	71-D	B8361	7.5	272	19.4	
72	100-F	NA	9/17/97	72-rvr	River	0.0	158	14.2	
72	100-F	Rhino	9/17/97	72-S	B8366	9.5	234	13.5	
72	100-F	Rhino	9/17/97	72-M	B8365	18.0	205	13.0	
72	100-F	Rhino	9/16/97	72-D	B8364	28.0	254	13.4	
73	100-F	NA	9/18/97	73-rvr	River	0.0	153	14.6	
73	100-F	Rhino	9/18/97	73-S	B8369	10.5	182	15.1	
73	100-F	Rhino	9/18/97	73-M	B8368	19.0	195	14.3	
73	100-F	Rhino	9/17/97	73-D	B8367	27.0	219	14.2	
74	100-F	NA	9/24/97	74-rvr	River	0.0	129.5	21.8	
74	100-F	Rhino	9/22/97	74-S	B8372	11.0	224	15.2	
74	100-F	Rhino	9/18/97	74-M	B8371	17.0			
74	100-F	Rhino	9/18/97	74-D	B8370	29.0			Possible screen hang up
75	100-F	NA	9/22/97	75-rvr	River	0.0	147.6	18.6	
75	100-F	Rhino	9/22/97	75-S	B8375	11.0	340	16.0	
75	100-F	Rhino	9/22/97	75-M	B8374	19.0	384	16.7	
75	100-F	Rhino	9/22/97	75-D	B8373	27.0	359	15.9	
76	100-F	NA	9/22/97	76-rvr	River	0.0	130.5	19.6	
76	100-F	Rhino	9/22/97	76-S	B8378	11.0	335	15.3	
76	100-F	Rhino	9/22/97	76-M	B8377	19.0	279	14.8	
76	100-F	Rhino	9/22/97	76-D	B8376	25.0	269	13.4	
77	100-F	Geoprobe	9/19/97	77-S	B8381	8.5	190	14.4	
77	100-F	Geoprobe	9/19/97	77-M	B8380	16.5	320	13.2	
77	100-F	Geoprobe	9/19/97	77-D	B8379	24.5	315	14.1	
78	100-F	Geoprobe	9/19/97	78-S	B8384	8.0	203	18.2	
78	100-F	Geoprobe	9/19/97	78-M	B8383	16.0	218	16.9	
78	100-F	Geoprobe	9/19/97	78-D	B8382	24.0			
80	100-F	NA	9/30/97	80-rvr	River	0.0	145.2	18.2	
80	100-F	Rhino	9/30/97	80-S	B8390	5.0	200	17.2	
80	100-F	Rhino	9/30/97	80-M	B8389	15.5	229	15.1	
80	100-F	Rhino	9/25/97	80-D	B8388	25.5	240	15.6	
81	HANF	NA	9/30/97	81-rvr	River	0.0	135	18.6	
81	HANF	Geoprobe	9/30/97	81-S	B8393	8.5	278	14.2	
81	HANF	Geoprobe	9/30/97	81-M	B8392	16.5	254	14.1	
81	HANF	Geoprobe	9/30/97	81-D	B8391	24.5			
82	HANF	NA	10/01/97	82-rvr	River	0.0	137	17.5	
82	HANF	Geoprobe	10/01/97	82-S	B8396	8.5	186	15.4	
82	HANF	Geoprobe	10/01/97	82-M	B8395	14.5			
83	HANF	Rhino	11/26/97	83-D	B8397	20.0			Would not yield water

Table 3-1. Aquifer Sampling Tube Installations. (Page 5 of 5)

Map Number	Area	Installation Method	Date Installed	Port Identifier	Tube Identification Number	Depth bgs (ft)	Conductance (uS/cm)	Temperature (degrees C)	Comments
84	HANF	NA	11/11/97	84-rvr	River	0.0	119		
84	HANF	Rhino	11/11/97	84-S	B8402	8.0	150		
84	HANF	Rhino	11/11/97	84-M	B8401	14.0			Would not yield water
84	HANF	Rhino	11/11/97	84-D	B8400	22.0			Would not yield water
85	HANF	Geoprobe	11/13/97	85-S	B8405	8.0			Field meter unavailable
85	HANF	Geoprobe	11/13/97	85-M	B8404	17.0			Field meter unavailable
85	HANF	Geoprobe	11/13/97	85-D	B8403	26.0			Field meter unavailable
86	HANF	Rhino	11/12/97	86-S	B8408	7.0	305	13.0	
86	HANF	Rhino	11/12/97	86-M	B8407	10.0			Would not yield water
86	HANF	Rhino	11/12/97	86-D	B8406	26.0	343	12.4	

NA = not applicable

Table 3-2. Global Positioning System Survey Results. (Page 1 of 5)

Map Number	Easting (m)	Northing (m)	NAVD88 Elevation (m)	NGVD29 Calc. Elev. (ft)	Map Symbol	Map Label
1	562697.662	146033.078	122.676	399.094	GPS	01-S
1	562697.662	146033.078	122.676	399.094	GPS	01-M
1	562697.662	146033.078	122.676	399.094	GPS	01-D
2	563539.581	145689.247	122.267	397.752	GPS	02-S
2	563539.581	145689.247	122.267	397.752	GPS	02-M
3	564077.431	145469.247	121.154	394.100	GPS	03-M
3	564077.431	145469.247	121.154	394.100	GPS	03-D
4	564612.459	145283.419	122.407	398.211	GPS	04-S
4	564612.066	145283.047	122.491	398.487	GPS	04-M
4	564612.184	145283.275	122.484	398.464	GPS	04-D
5	564908.310	145332.290	121.992	396.850	GPS	05-S
5	564908.310	145332.290	121.992	396.850	GPS	05-M
5	564908.310	145332.290	121.992	396.850	GPS	05-D
6	565293.927	145412.052	122.122	397.276	GPS	06-S
6	565293.927	145412.052	122.122	397.276	GPS	06-M
6.	565293.927	145412.052	122.122	397.276	GPS	06-D
7	565566.011	145495.641	120.653	392.457	GPS	07-M
7	565564.591	145493.904	120.662	392.486	GPS	07-D
11	566862.628	145903.913	108.894	353.877	GPS	11-D
12	567231.722	146055.169	105.813	343.769	GPS	12-D
13	567566.000	146219.000			est	13-S
13	567566.000	146219.000			est	13-D
14	567870.000	146429.000			est	14-S
14	567870.000	146429.000			est	14-M
14	567870.000	146429.000			est	14-D
15	568082.000	146642.000			est	15-M
17	568869.000	147226.000			est	17-M
17	568568.000	147003.000			est	17-D
19	569031.891	147394.208	82.506	267.303	GPS	19-M
19	569032.057	147394.816	82.779	268.198	GPS	19-D
21	569604.820	148035.757	124.668	405.629	GPS	21-S
21	569603.828	148039.275	125.478	408.287	GPS	21-M
22	569951.313	148359.468	126.818	412.683	GPS	22-M
22	569604.820	148035.757	124.668	405.629	GPS	22-D
23	569820.000	148308.000			est	23-M
23	569820.000	148308.000			est	23-D
DK-04	570452.000	148876.000			est	DK-04-3
DK-04	570452.000	148876.000			est	DK-04-2
25	570547.000	149001.000			est	25-D
26	570725.000	149148.000			est	26-S
26	570725.000	149148.000			est	26-M
26	570725.000	149148.000			est	26-D
DD-50	572173.030	151121.180	119.514	388.720	GPS	DD-50-4
DD-50	572172.166	151120.007	119.472	388.582	GPS	DD-50-3
DD-50	572172.633	151121.569	119.478	388.602	GPS	DD-50-2
DD-50	572172.189	151121.164	119.454	388.523	GPS	DD-50-1
DD-49	572213.696	151161.553	119.627	389.090	GPS	DD-49-1
DD-49	572213.968	151162.781	119.492	388.648	GPS	DD-49-2
DD-49	572210.802	151163.304	118.557	385.580	GPS	DD-49-3

Table 3-2. Global Positioning System Survey Results. (Page 2 of 5)

Map Number	Easting (m)	Northing (m)	NAVD88 Elevation (m)	NGVD29 Calc. Elev. (ft)	Map Symbol	Map Label
DD-49	572211.150	151163.981	118.487	385.350	GPS	DD-49-4
DD-44	572411.362	151396.947	117.645	382.588	GPS	DD-44-4
DD-44	572412.676	151394.279	118.199	384.405	GPS	DD-44-3
DD-43	572450.906	151443.222	117.536	382.230	GPS	DD-43-2
DD-43	572450.504	151443.236	117.521	382.181	GPS	DD-43-3
DD-42	572485.766	151492.564	117.919	383.487	GPS	DD-42-2
DD-42	572486.189	151492.480	117.939	383.552	GPS	DD-42-3
DD-42	572485.319	151492.503	117.973	383.664	GPS	DD-42-4
DD-41	572532.688	151530.738	117.684	382.716	GPS	DD-41-2
DD-41	572532.209	151530.033	117.646	382.591	GPS	DD-41-3
DD-41	572532.894	151530.892	117.689	382.732	GPS	DD-41-4
DD-39	572606.888	151625.527	118.012	383.792	GPS	DD-39-4
DD-39	572606.548	151626.197	117.883	383.369	GPS	DD-39-3
DD-39	572606.894	151626.189	117.940	383.556	GPS	DD-39-2
DD-39	572606.547	151625.856	117.913	383.467	GPS	DD-39-1
35	572806.000	151832.000			est	35-S
35	572806.000	151832.000			est	35-M
35	572806.000	151832.000			est	35-D
36	572992.000	152060.000			est	36-S
36	572992.000	152060.000			est	36-M
36	572992.000	152060.000			est	36-D
37	573168.000	152198.000			est	37-S
37	573168.000	152198.000			est	37-M
37	573168.000	152198.000			est	37-D
38	573361.000	152301.000			est	38-M
38	573361.000	152301.000			est	38-D
DD-17	573597.162	152483.304	117.313	381.499	GPS	DD-17-3
DD-17	573597.984	152482.772	117.390	381.751	GPS	DD-17-2
DD-17	573606.896	152482.375	116.920	380.209	GPS	DD-17-WP
DD-16	573651.165	152516.993	119.965	390.199	GPS	DD-16-4
DD-16	573650.431	152516.128	120.013	390.357	GPS	DD-16-3
DD-15	573700.609	152547.828	119.289	387.982	GPS	DD-15-4
DD-15	573700.609	152547.828	119.365	388.231	GPS	DD-15-3
DD-15	573700.609	152547.828	119.316	388.070	GPS	DD-15-2
DD-12	573820.559	152683.591	117.154	380.977	GPS	DD-12-4
DD-12	573818.681	152683.696	116.933	380.252	GPS	DD-12-3
DD-12	573819.657	152683.584	117.030	380.570	GPS	DD-12-2
DD-10	573899.056	152788.072	117.287	381.413	GPS	DD-10-4
DD-10	573899.056	152788.072	117.287	381.413	GPS	DD-10-2
DD-10	573899.056	152788.072	117.287	381.413	GPS	DD-10-3
DD-08	573940.057	152903.527			GPS	DD-08-4
DD-08	573940.057	152903.527			GPS	DD-08-3
DD-08	573940.057	152903.527			GPS	DD-08-2
DD-06	573964.576	153015.374	117.578	382.368	GPS	DD-06-3
DD-06	573964.576	153015.374	117.578	382.368	GPS	DD-06-2
39	574035.000	153393.000			est	39-S
39	574035.000	153393.000			est	39-M
39	574035.000	153393.000			est	39-D
40	574238.000	153997.000			est	40-S

Table 3-2. Global Positioning System Survey Results. (Page 3 of 5)

Map Number	Easting (m)	Northing (m)	NAVD88 Elevation (m)	NGVD29 Calc. Elev. (ft)	Map Symbol	Map Label
40	574238.000	153997.000			est	40-M
41	575515.614	154424.185	116.526	378.917	GPS	41-S
41	575511.260	154423.723	116.509	378.861	GPS	41-M
41	575512.511	154424.668	116.299	378.172	GPS	41-D
42	576165.935	154320.154	116.376	378.424	GPS	42-S
42	576166.225	154320.454	116.339	378.303	GPS	42-M
42	576167.589	154320.018	116.273	378.087	GPS	42-D
43	576782.564	153963.570	116.411	378.539	GPS	43-M
43	576779.961	153965.240	116.452	378.674	GPS	43-D
DH-1452	577255.023	153661.681	116.227	377.936	GPS	DH-1452-1
44	577033.113	153810.532	116.085	377.470	GPS	44-M
44	577031.509	153811.744	116.114	377.565	GPS	44-D
DH-1451	577182.865	153704.528	115.982	377.132	GPS	DH-1451-1
45	577529.000	153514.000			est	45-S
45	577529.000	153514.000			est	45-M
45	577529.000	153514.000			est	45-D
DH-14	577788.415	153377.955	115.031	374.012	GPS	DH-14-11
DH-14	577787.186	153374.820	115.760	376.403	GPS	DH-14-1
46	578031.495	152999.261	115.347	375.048	GPS	46-D
46	578031.463	152999.310	115.486	375.504	GPS	46-D
47	578193.919	152743.533	115.765	376.420	GPS	47-M
47	578193.982	152743.497	115.666	376.095	GPS	47-M
47	578193.394	152744.421	115.856	376.718	GPS	47-D
47	578193.447	152744.332	115.708	376.233	GPS	47-D
DH-22	578460.331	152468.304	114.224	371.364	GPS	DH-22-3
DH-22	578460.331	152468.304	114.224	371.364	GPS	DH-22-2
DH-22	578460.331	152468.304	114.224	371.364	GPS	DH-22-1
48	578465.520	152420.795	116.348	378.333	GPS	48-S
48	578465.520	152420.795	116.348	378.333	GPS	48-M
48	578465.538	152420.844	116.159	377.712	GPS	48-D
48	578465.520	152420.795	116.348	378.333	GPS	48-D
49	578699.741	152232.831	115.936	376.981	GPS	49-S
49	578699.741	152232.831	115.936	376.981	GPS	49-M
49	578699.729	152232.848	115.985	377.142	GPS	49-D
49	578699.755	152232.861	115.813	376.577	GPS	49-D
49	578699.741	152232.831	115.936	376.981	GPS	49-D
50	578611.792	152118.154	117.184	381.075	GPS	50-S
50	578611.816	152118.084	117.083	380.744	GPS	50-M
50	578611.816	152118.084	117.083	380.744	GPS	50-D
50	578611.816	152118.084	117.083	380.744	GPS	50-D
51	578779.254	151843.755	116.760	379.684	GPS	51-S
51	578779.254	151843.755	116.760	379.684	GPS	51-M
51	578779.254	151843.755	116.760	379.684	GPS	51-D
52	578919.484	151586.176	115.996	377.178	GPS	52-S
52	578919.484	151586.176	115.996	377.178	GPS	52-M
52	578919.484	151586.176	115.996	377.178	GPS	52-D
53	579510.574	151531.727	115.334	375.006	GPS	53-S
53	579510.574	151531.727	115.334	375.006	GPS	53-M
53	579510.188	151531.413	115.356	375.078	GPS	53-D

Table 3-2. Global Positioning System Survey Results. (Page 4 of 5)

Map Number	Easting (m)	Northing (m)	NAVD88 Elevation (m)	NGVD29 Calc. Elev. (ft)	Map Symbol	Map Label
54	579033.518	151231.944	116.000	377.191	GPS	54-S
54	579033.518	151231.944	116.000	377.191	GPS	54-M
54	579033.518	151231.944	116.000	377.191	GPS	54-D
55	579134.582	150891.146	115.295	374.878	GPS	55-S
55	579134.582	150891.146	115.295	374.878	GPS	55-M
55	579135.286	150891.368	115.251	374.733	GPS	55-D
57	580101.000	150525.000			est	57-S
57	580101.000	150525.000			est	57-M
57	580101.000	150525.000			est	57-D
58	579310.627	150232.255	114.929	373.677	GPS	58-S
58	579311.429	150230.317	114.880	373.516	GPS	58-M
58	579310.118	150233.170	114.858	373.444	GPS	58-D
59	579420.404	149928.523	114.857	373.441	GPS	59-S
59	579420.300	149930.907	114.860	373.451	GPS	59-M
59	579420.305	149930.079	114.963	373.789	GPS	59-D
60	579638.000	149392.000			est	60-S
60	579638.000	149392.000			est	60-M
60	579638.000	149392.000			est	60-D
61	580002.501	148949.718	115.001	373.913	GPS	61-S
61	580001.323	148949.889	115.017	373.966	GPS	61-M
61	580000.071	148950.427	115.079	374.169	GPS	61-D
62	580388.292	148585.876	115.092	374.212	GPS	62-S
62	580387.648	148586.349	115.246	374.717	GPS	62-M
62	580387.631	148586.320	115.370	375.124	GPS	62-M
62	580389.375	148585.095	115.395	375.206	GPS	62-D
62	580389.397	148585.067	115.161	374.438	GPS	62-D
63	580945.002	148174.193	115.055	374.090	GPS	63-S
63	580944.736	148174.517	115.122	374.310	GPS	63-M
63	580943.236	148175.400	115.077	374.163	GPS	63-D
64	581118.756	148037.975	115.386	375.176	GPS	64-S
64	580945.002	148174.193	115.055	374.090	GPS	64-M
64	580945.002	148174.193	115.055	374.090	GPS	64-D
66	581475.927	147541.818	114.421	372.010	GPS	66-D
65	581297.412	147864.503	115.367	375.114	GPS	65-S
65	581295.747	147866.273	115.502	375.557	GPS	65-M
65	581295.747	147866.273	115.502	375.557	GPS	65-D
66	581475.927	147541.818	114.421	372.010	GPS	66-S
66	581475.927	147541.818	114.421	372.010	GPS	66-M
67	581616.352	147291.431	114.902	373.588	GPS	67-S
67	581616.352	147291.431	114.902	373.588	GPS	67-M
67	581616.352	147291.431	114.902	373.588	GPS	67-D
68	581758.431	147085.176	115.459	375.416	GPS	68-S
68	581758.431	147085.176	115.459	375.416	GPS	68-M
68	581758.431	147085.176	115.459	375.416	GPS	68-D
69	582017.000	147168.000			est	69-M
69	582017.000	147168.000			est	69-D
70	581902.543	146843.106	116.720	379.553	GPS	70-S
70	581902.543	146843.106	116.720	379.553	GPS	70-M
70	581902.543	146843.106	116.720	379.553	GPS	70-D

Table 3-2. Global Positioning System Survey Results. (Page 5 of 5)

Map Number	Easting (m)	Northing (m)	NAVD88 Elevation (m)	NGVD29 Calc. Elev. (ft)	Map Symbol	Map Label
71	581992.000	146474.000			est	71-D
72	582224.473	146066.634	120.802	392.945	GPS	72-?
72	582224.292	146067.252	120.700	392.611	GPS	72-?
72	582223.666	146067.007	120.858	393.129	GPS	72-?
73	582424.378	145988.225	120.119	390.705	GPS	73-?
73	582424.473	145989.251	120.159	390.836	GPS	73-?
73	582424.818	145989.728	120.033	390.422	GPS	73-?
74	582600.480	145608.435	120.783	392.883	GPS	74-?
74	582599.881	145609.471	120.887	393.224	GPS	74-?
74	582599.498	145609.940	120.914	393.313	GPS	74-?
75	582793.490	145283.988	119.393	388.323	GPS	75-?
75	582792.893	145285.862	118.816	386.430	GPS	75-?
75	582790.915	145287.068	118.997	387.024	GPS	75-?
76	582878.748	145087.325	119.123	387.437	GPS	76-?
76	582878.733	145088.849	118.942	386.843	GPS	76-?
76	582877.989	145089.114	119.032	387.138	GPS	76-?
77	582957.215	144889.256	111.539	362.555	GPS	77-S
77	582957.215	144889.256	111.539	362.555	GPS	77-M
77	582957.215	144889.256	111.539	362.555	GPS	77-D
78	583152.559	144325.675	111.346	361.922	GPS	78-S
78	583152.559	144325.675	111.346	361.922	GPS	78-M
78	583152.559	144325.675	111.346	361.922	GPS	78-D
80	583510.578	143175.382	111.941	363.874	GPS	80-?
80	583509.431	143178.792	111.826	363.497	GPS	80-?
81	585375.000	140494.000			est	81-S
81	585375.000	140494.000			est	81-M
81	585375.000	140494.000			est	81-D
82	586252.470	139595.836	108.814	353.615	GPS	82-S
82	586252.470	139595.836	108.814	353.615	GPS	82-M
83	586949.357	139005.466	109.262	355.085	GPS	83-D
84	587477.148	138683.000	110.895	360.442	GPS	84-S
84	587476.025	138683.515	110.941	360.593	GPS	84-M
84	587476.487	138683.945	110.885	360.409	GPS	84-D
85	588052.700	138256.786	111.022	360.859	GPS	85-S
85	588052.700	138256.786	111.022	360.859	GPS	85-M
85	588052.700	138256.786	111.022	360.859	GPS	85-D
86	588332.623	138068.820	111.766	363.300	GPS	86-S
86	588333.214	138068.172	111.767	363.303	GPS	86-M
86	588333.555	138067.727	111.749	363.244	GPS	86-D

4.0 SAMPLING AND ANALYSIS RESULTS

Water was withdrawn from the newly installed aquifer sampling tubes to determine if the tubes would produce sufficient water for subsequent sampling and for contaminant screening analyses. The specific conductance of all samples withdrawn from the tubes was used as an indicator of the degree to which river water had influenced water quality.

If the specific conductance of the sample was less than 200 μS/cm, indicating primarily river water held in bank storage, no further field or offsite samples were collected. If the specific conductance of the sample was equal to or greater than 200 μS/cm, indicating primarily groundwater, samples were collected for field analysis. The sample with the highest specific conductance for each map location sampled was sent to an offsite laboratory for radiological analysis.

4.1 FIELD ANALYSES

Analyses for hexavalent chromium and nitrate were performed using Hach™ (Hach Company, Loveland, Colorado) spectrophotometer methods and Reflectoquant™ (Merck Company, Darmstadt, Germany) methods, respectively. The detection limit for hexavalent chromium is approximately 0.005 mg/L, and is approximately 3 mg/L for nitrate.

The maximum contaminant levels under Federal drinking water standards are 0.1 mg/L for total chromium and 45 mg/L for nitrate. The Federal ambient water quality criteria for protection of freshwater aquatic organisms is 0.011 mg/L for hexavalent chromium. The Washington State standard for chromium is 0.05 mg/L and 45 mg/L for nitrate.

4.2 OFFSITE LABORATORY ANALYSES

Analyses for gross beta activity and tritium concentrations were performed by Quanterra Environmental Services, Inc. (QES), Richland, Washington. Gross beta was determined by gas proportional counting (QES Method RICH-RC-5014), and tritium by liquid scintillation counting (QES Method RICH-RC-5007). Instrument detection limits vary with each sample, but are approximately 2.5 pCi/L for gross beta and 3.3 pCi/L for tritium.

The maximum contaminant levels under Federal drinking water standards are 50 pCi/L for gross beta activity and 20,000 pCi/L for tritium.

4.3 INITIAL SAMPLING AND ANALYSIS RESULTS

All analytical results obtained to date are listed in Table 4-1. This table, along with Table 3-1, represents all data collected as part of this project. The data are available in Excel™ software format. The data will be entered into the HEIS when all analytical results and GPS survey results become available.

The following criteria have been used to assign "undetected" qualifiers to analytical results. A detection level of 0.005 mg/L has been assumed for hexavalent chromium results determined by Hach methods. A detection level of 3 mg/L has been assumed for nitrate results determined by Reflectoquant methods. If the reported result is equal to or less than these two values, a "U" qualifier has been assigned to the result shown in Table 4-1.

For radiological analyses, a "U" qualifier has been assigned if the reported activity is a negative number or the reported activity is less than the minimum detectable activity/instrument detection limit as reported by the laboratory. This method of assigning an undetected qualifier is consistent with the method used for radiological results that are loaded into HEIS.

To date, no new areas of groundwater contamination have been identified, although infiltration of river water appears to have diluted the groundwater at many sites. Where contamination indicators are present, they appear to be consistent with previously mapped plumes.

The following generalizations and discussion are based on initial review of all data obtained for the newly installed tubes.

4.3.1 Hexavalent Chromium

The highest observed concentration of hexavalent chromium in new tubes is 0.081 mg/L in the 100-K Area along the Mile-Long Trench (map location 23-D, tube ID B8217). The sample came from 3.7 m (12 ft) below ground surface and had a specific conductance of 233 μS/cm.

Nearby groundwater from well 199-K-22 has a maximum specific conductance of approximately 450 μS/cm. This suggests that the sample is diluted by river water and that the concentration in groundwater at map location 23 could be higher when not diluted. These concentrations are consistent with concentrations observed in monitoring wells. The source of the chromium is the plume associated with the Mile-Long Trench, which is the plume targeted by the interim remedial measure pump-and-treat system.

The highest concentration of chromium observed in tubes installed in 1995 occurred in the 100-D Area hot spot, in tube DD-39-3 (tube ID B8481). The concentration in December 1997 was 0.603 mg/L, which compares favorably with concentrations observed two years earlier (Hope and Peterson 1996b).

4.3.2 Nitrate

The highest observed concentration of nitrate is 44 mg/L upstream of the 100-H Area (map location 44-D, tube ID B8220). The sample came from 4.0 m (13 ft) below ground surface and had a specific conductance of 374 μS/cm.

Nearby groundwater is expected to have a specific conductance of approximately 400 μS/cm (there are no wells nearby), suggesting that the sample is nearly undiluted by river water. The source area for the nitrate may be groundwater that has migrated from the 100-D/DR Area or, possibly, past agricultural practices.

4.3.3 Gross Beta

The highest observed gross beta concentration is 54.4 pCi/L at the 100-H Area near the 107-H Retention Basins (map location 47-D, tube ID B8289). The sample came from 4.6 m (15 ft) below ground surface and had a specific conductance of 279 μS/cm.

Nearby groundwater from well 199-H4-11 has a maximum specific conductance of approximately 450 μS/cm. This suggests that the sample is diluted by an appreciable proportion of river water and that the gross beta concentration in undiluted groundwater at map location 47 may be higher when not diluted. Gross beta in groundwater at this location likely reflects strontium-90, whose source is the nearby 107-H retention basins. The concentrations are consistent with concentrations observed in monitoring wells near the retention basins.

4.3.4 Tritium

The highest observed concentration of tritium is 47,100 pCi/L in the 100-B/C Area (map location 06-M, tube ID B8129). The sample came from 4.9 m (16 ft) below ground surface and had a specific conductance of 435 μS/cm.

Nearby groundwater from wells 199-B3-47 and 199-B2-12 has a maximum specific conductance of approximately 400 μS/cm, indicating that the sample is representative of groundwater undiluted by river water at this location. Tritium is elevated in wells 199-B3-47 and 199-B5-2, and the concentration observed in the sample from map location 06-M is consistent with concentrations in the wells. The source for the tritium is former disposal of liquid effluent on the river side of the 105-B Reactor Building.

4.3.5 Carbon-14 and Strontium-90

Two analyses for carbon-14 were performed on samples from tubes in the 100-K Area, where carbon-14 is elevated in several wells to concentrations ranging from approximately 10,000 to 25,000 pCi/L. The highest value found in tube samples is 348 pCi/L (map location 17-D, tube ID B8161).

Strontium-90 was measured at several locations along the Mile-Long Trench in the 100-K Area. The highest observed activity is 17.9 pCi/L at map location 22-M (tube ID B8215). This activity level is consistent with nearby monitoring well data.

4.3.6 General Discussion

At most locations an impenetrable layer was encountered before the 10-m (30-ft) depth capability of the driving method used was reached. The layer may represent one of the following: bottom of the unconfined aquifer, compacted sediments, or a boulder/cobble layer.

Many of the aquifer sampling tubes yield water that is more representative of river water than groundwater, as indicated by specific conductance. Whether this is an artifact of the recent two years' of unusually high river discharge conditions, or "status quo" at these locations remains to be determined by subsequent monitoring.

The 100-D/DR Area shoreline immediately downstream of the 100-D Hot Spot chromium plume (Map locations 35, 36, 37, and 38) does not appear to contain high concentrations of chromium, as initially expected. However, tubes could not be driven to significant depths in the aquifer and most of the deeper tubes failed to produce enough water for analysis. The shallow tubes that did yield water produced samples representative of river water held in bank storage.

Table 4-1. Sample Analytical Results. (Page 1 of 6)

Map Label	Sample Number	Sample Date	Specific Conductance (uS/cm)	Temperature (Deg. C)	Hexavalent Chromium (mg/L)	Nitrate (mg/L)	Gross Beta (pCi/L)	Tritium (pCi/L)	Strontium-90 (pCi/L)	Carbon-14 (pCi/L)
01-D		10/17/97	272	17.5						
01-M	B0M161	10/17/97					4.24	610		
01-M	B0M3J0	10/17/97	245	15.4	0.005 U	3 U				
01-S		10/17/97	189	16.2						
02-S	B0M160	10/17/97					2.92	1430		
02-S	B0M3H9	10/17/97	299	15.1	0.005 U	6				
02-rvr	River	10/17/97	131	15.3						
03-D	B0M2R4	11/17/97	310	12.5	0.005 U	5				
03-D	B0MBH7	11/17/97					5.32	8460		
03-M	B0M2T9	11/17/97	323	13.8	0.005 U	3 U				
03-rvr	River	11/17/97	127	10.5						
04-D	B0M7L6	10/22/97	342	17.1	0.015	11				
04-M	B0M7L5	10/22/97	355	17.9	0.011	11				
04-S	B0M6W8	10/22/97					7.52	15400		
04-S	B0M7L4	10/22/97	375	17.5	0.008	16				
04-rvr	River	10/22/97	140	12.1						
05-D	B0M7L9	10/22/97	313	18	0.005 U	8				
05-M	B0M7L8	10/22/97	322	17.8	0.012	9				
05-S	B0M6W9	10/22/97					29.7	2150		
05-S	B0M7L7	10/22/97	488	15	0.005 U	4				
05-rvr	River	10/22/97	130	14.2						
06-D	B0M9B7	10/29/97	345	19.2	0.006	16				
06-M	B0M6X0	10/29/97					41.8	47100		
06-M	B0M9B8	10/29/97	435	18.7	0.041	32				
06-S	B0M9B9	10/29/97	445	15.1	0.005 U	25				
06-rvr	River	10/29/97	133	13.2						
07-D	B0M7K6	10/29/97					20.6	18000		
07-D	B0M9C0	10/29/97	383	20.9	0.006	22				
07-M	B0M9C1	10/29/97	295	18.6	0.005 U	15				
07-rvr	River	10/29/97	141	13.7						
11-D	B0MBD9	12/1/97	311	13.4	0.005 U	7				
11-D	B0MHT3	12/1/97					23.4	1970		
12-D	B0M7K5	11/19/97					36.2	4320		
12-D	B0MBC0	11/19/97	389	16.1	0.005 U	32				
13-D		11/19/97								
13-S	B0MBB9	11/19/97	236	12.7	0.005 U	5				
13-S	B0MBJ2	11/19/97					13.2	1040		
14-D	B0MBC7	11/24/97	329	14.6	0.005 U	14				
14-D	B0MHR6	11/24/97					27	2010		
14-M	B0MBC8	11/24/97	331	15.1	0.005 U	14				
14-S	B0MBC9	11/24/97	336	14.3	0.005 U	7				
15-M	B0MBC6	11/24/97	311	13.1	0.005 U	3 U				
15-M	B0MHT1	11/24/97					4.95	576		13.1 J
15-rvr	River	11/24/97	141	9.6						
15-rvr	River	12/5/97	132	9.5						
17-D	B0MBD7	12/1/97	345	12.6	0.006	25				
17-D	B0MHT2	12/1/97					4.86	1930		348
17-M	B0MBD8	12/1/97	337	12.8	0.005	20				
18-S	B0MBD6	12/1/97	323	12.6	0.005 U	3 U				
18-S	B0MHR9	12/1/97					2.01 U	38.3 U		
18-rvr	River	12/1/97	134	9						
19-D		11/25/97	206	12.8						
19-D	B0MBF0	12/2/97	210	12.4	0.005 U	3 U				
19-D	B0MJX1	12/2/97					2.8	10.7 U		

Table 4-1. Sample Analytical Results. (Page 2 of 6)

Map Label	Sample Number	Sample Date	Specific Conductance (uS/cm)	Temperature (Deg. C)	Hexavalent Chromium (mg/L)	Nitrate (mg/L)	Gross Beta (pCi/L)	Tritium (pCi/L)	Strontium-90 (pCi/L)	Carbon-14 (pCi/L)
19-M		11/25/97	176	12.5						
19-M		12/2/97	174	12.2						
19-rvr	River	11/25/97	126	10.1						
19-rvr	River	12/2/97	132	8.2						
21-M	B0MBD0	11/24/97	246	12.8	0.041	3 U				
21-M	B0MBF1	12/2/97	248	11.7	0.043	3 U				
21-M	B0MJX2	12/2/97					5.73	244 U	1.73	
21-S		11/24/97	186	12.4						
21-S		12/2/97	183	11.1						
21-rvr	River	11/24/97	124	10.7						
22-D	B0MBF3	12/2/97	234	13.6	0.017	3 U				
22-M	B0MBF2	12/2/97	246	12.6	0.059	4				
22-M	B0MJX3	12/2/97					41.8	95.1 U	17.9	
23-D	B0MBF4	12/2/97	233	11.4	0.081	3 U				
23-D	B0MJX4	12/2/97					3.54	284 U	0.202 U	
23-M	B0MBF5	12/2/97	204	9.9	0.005 U	3 U				
DK-04-3	B0MK62	12/4/97	300	10.3	0.018	3 U				
DK-04-2	B0MJX8	12/4/97					2.76	5620		
DK-04-2	B0MK61	12/4/97	302	11.6	0.025	3 U				
25-D		11/18/97	292	11.4						
25-D	B0MBB5	11/19/97	293	10.7	0.005 U	3 U				
25-D	B0MBH8	11/19/97					3.12	2020		
25-rvr	River	11/19/97	130	9.4						
26-D	B0MBB7	11/19/97	429	12.5	0.005 U	3 U				
26-M	B0MBJ1	11/19/97					2.74	855		
26-M	B0MBB6	11/19/97	503	12.5	0.005 U	36				
26-S	B0MBB8	11/19/97	212	11.3	0.005 U	3 U				
DD-50-3		12/3/97	241	10.7						
DD-50-3	B0MK59	12/4/97	242	10.5	0.022	5				
DD-50-4		12/3/97	257	10.7						
DD-50-4	B0MK60	12/4/97	245	10.5	0.029	5				
DD-50-2		12/3/97	258	11						
DD-50-2	B0MJX7	12/4/97					2.24 U	20000		
DD-50-2	B0MK58	12/4/97	252	11	0.029	6				
DD-50-1		12/3/97	234	10.9						
DD-50-1	B0MK57	12/4/97	230	11	0.023	5				
DD-50-rvr	River	12/4/97	134	9.4						
DD-44-4	B0MBH0	12/3/97	496	11.1	0.359	34				
DD-44-4	B0MJX6	12/3/97					3.08	17000		
DD-44-3	B0MK56	12/3/97	432	9.7	0.262	25				
DD-39-3	B0MBF6	12/3/97	476	8.1	0.603	38				
DD-39-3	B0MJX5	12/3/97					3.3	292 U		
DD-39-2	B0MBF7	12/3/97	456	9.1	0.593	38				
DD-39-1		12/3/97	180	8.3						
DD-39-rvr	River	12/3/97	131	9.4						
TD-39-3	B0MBF8	12/3/97	295	7.3	0.239	17				
TD-39-2	Porewater	12/3/97	185	7.9						
TD-39-1	B0MBF9	12/3/97	277	6.9	0.184	12				
35-M	B0MB98	11/7/97	195			3 U				
35-S		11/17/97	142	12.5						
35-S	B0MB99	11/7/97	131			3 U				
35-rvr	River	11/7/97	121							
36-D	B0M2V2	11/17/97	290	13.3	0.005 U					
36-D	B0MBB0	11/7/97	217			13				

Table 4-1. Sample Analytical Results. (Page 3 of 6)

Map Label	Sample Number	Sample Date	Specific Conductance (uS/cm)	Temperature (Deg. C)	Hexavalent Chromium (mg/L)	Nitrate (mg/L)	Gross Beta (pCi/L)	Tritium (pCi/L)	Strontium-90 (pCi/L)	Carbon-14 (pCi/L)
36-M	B0M2V0	11/17/97	278	13.2	0.005 U					
36-M	B0MBB1	11/7/97	207			8				
36-S	B0M2V1	11/17/97	305	13.6	0.005 U					
36-S	B0MBB2	11/7/97	258			3 U				
36-S	B0MBH1	11/7/97					3.32	243 U		
37-S		11/18/97	143	11.1						
37-rvr		11/18/97	130	10.5						
38-D	B0M2V3	11/18/97	221	11.7	0.005 U	3 U				
38-D	B0MBH9	11/18/97					4.4	88.5 U		
38-M	B0MBB3	11/18/97	194	12	0.005 U	3 U				
DD-15-3	B0MJX9	12/5/97					5.95	1920		
DD-15-3	B0MK63	12/5/97	265	12.3	0.060	6				
DD-15-4	B0MK64	12/5/97	203	12.5	0.034	3 U				
DD-15-2		12/5/97	143	12						
TD-15-3	Porewater	12/5/97	142	7.9						
TD-15-2	Porewater	12/5/97	139	7.9						
39-D		9/29/97	249	24.3						
39-M	B0M155	9/29/97					5.66	170 U		
39-M	B0M240	9/29/97	376	17.8	0.005 U	3 U				
39-S	B0M241	9/29/97	355	21.2	0.005 U	3 U				
39-rvr	River	9/29/97	140	23.1						
40-S	B0MBB4	11/18/97	255	11.9	0.005 U	3 U				
40-S	B0MBJ0	11/18/97					2.76	133 U		
41-D		11/20/97	155	14.2						
41-M		11/20/97	146	14						
41-rvr	River	11/20/97	130	10.7						
42-M	H0LXV3	9/12/97	296	15.8	0.011	10				
42-M	H0LXV5	9/12/97					4.36	1610		
42-S	H0LXV1	9/12/97	279	16	0.007	9				
43-D	H0LWM8	9/12/97	260	15.6	0.011	9				
43-M	H0LWM7	9/12/97	360	14.1	0.012	22				
43-M	H0LWN0	9/12/97					3.55	2010		
44-D	B0LXW5	9/12/97					3.59	1370		
44-D	H0LXV6	9/12/97	374	15.3	0.025	44				
44-M	H0LXV7	9/12/97	377	12.7	0.005 U	41				
45-D	H0LXC3	9/5/97	247	20.9	0.005 U					
45-D	H0LXC7	9/5/97					6.33	122 U		
45-M	H0LXC4	9/5/97	218	15.3	0.005 U					
45-S	H0LXC5	9/5/97	236	16.8	0.005 U					
45-rvr	River	9/5/97	145	19.5						
46-D	B0LXW3	10/21/97	246	15	0.010	8				
46-D	B0M6W6	10/21/97					4.8	691		
46-rvr	River	10/21/97	131							
47-D	B0M6W7	10/21/97					54.4	391		
47-D	H0LXW1	10/21/97	279	16.5	0.005 U	25				
47-M	H0LXW2	10/21/97	204	15.4	0.007	14				
47-rvr	River	10/21/97	147	16.5						
48-M	B0M7K4	10/30/97					6.58	1240		
48-M	B0MB91	10/30/97	288	14.9	0.006	7				
48-S	B0MB92	10/30/97	278	14.9	0.003 U	7				
48-rvr	River	10/30/97	108	13						
49-D	B0M2R5	11/13/97	328	12	0.016	9				
49-D	B0MBH2	11/13/97					4.59	2830		
49-M	B0M2R6	11/13/97	295	12.8	0.011	6				

Table 4-1. Sample Analytical Results. (Page 4 of 6)

Map Label	Sample Number	Sample Date	Specific Conductance (uS/cm)	Temperature (Deg. C)	Hexavalent Chromium (mg/L)	Nitrate (mg/L)	Gross Beta (pCi/L)	Tritium (pCi/L)	Strontium-90 (pCi/L)	Carbon-14 (pCi/L)
49-S		11/13/97	124	12.5						
49-rvr	River	11/13/97	126	11.1						
50-M	B0M2R7	11/13/97	299	14.4	0.013	9				
50-M	B0MBH3	11/13/97					4.71	2480		
50-S	B0M2R8	11/13/97	301	14.6	0.011	10				
51-D	B0M2R9	11/13/97	386	12.1	0.029	19				
51-D	B0MBH4	11/13/97					3.53	3060		
51-M	B0M2T0	11/13/97	371	12.8	0.021	20				
51-S	B0M2T1	11/13/97	327	13	0.015	13				
52-D	B0M2T2	11/13/97	292	13.4	0.005 U	3 U				
52-D	B0M7K3	11/13/97					4.7	398		
52-M	B0M2T3	11/13/97	249	13.6	0.005 U	3 U				
52-S	B0M2T4	11/13/97	242	13.2	0.005 U	3 U				
53-M		11/13/97	163	14.3						
53-S		11/13/97	125	13.3						
53-rvr	River	11/13/97	127	12.2						
54-D	B0M2T5	11/14/97	233	9.9	0.005 U	3 U				
54-D	B0MBH5	11/14/97					4.56	563		
54-M	B0M2T6	11/14/97	254	10.8	0.005 U	7				
54-S	B0M2T7	11/14/97	218	10.4	0.005 U	7				
55-S	B0M2T8	11/14/97	305	10.2	0.009	9				
55-S	B0MBH6	11/14/97					3.4	1790		
57-M		11/14/97	134	9.6						
57-S		11/14/97	117	9.1						
57-rvr	River	11/14/97	120	8.9						
58-D	B0M3H7	10/8/97	404	13	0.005 U	11				
58-M	B0M159	10/8/97					8.13	121 U		
58-M	B0M3H6	10/8/97	426	12.8	0.005 U	11				
58-S	B0M3H8	10/8/97	374	12.9	0.005 U	11				
59-D	B0M3H4	10/8/97	391	11.4	0.005 U	12.7				
59-M	B0M3H5	10/8/97	416	11.8	0.005 U	12.11				
59-S	B0M158	10/8/97					7.6	-13.8 U		
59-S	B0M3H3	10/8/97	450	11.6	0.005 U	14.7				
59-rvr	River	10/8/97	146	13.2						
60-M	B0M1Y8	9/29/97	464	18.9	0.005 U	3 U				
60-S	B0M152	9/29/97					12.3	87.5 U		
60-S	B0M1Y7	9/29/97	746	17.3	0.005 U	3 U				
60-rvr	River	9/29/97	140.3	18.6						
61-D	B0MBC1	11/21/97	252	10.1	0.005 U	3 U				
61-D	B0MHR4	11/21/97					3.96	125 U		
61-M		11/21/97	186	13.2						
61-S		11/21/97	144	11.2						
61-rvr	River	11/21/97	132	9.9						
62-M	B0MBC2	11/21/97	404	12.5	0.005 U	16				
62-M	B0MHR5	11/21/97					3.96	143 U		
62-S		11/21/97	181	10.9						
63-M	B0MB96	10/30/97	190	13.4	0.005 U	3 U				
63-S	B0MB97	10/30/97	169	13.8	0.005 U	3 U				
63-rvr	River	10/30/97	128	13.6						
64-D	B0M7K7	10/30/97					7.7	208 U		
64-D	B0MB93	10/30/97	282	13.7	0.005 U	11				
64-M	B0MB94	10/30/97	224	13.6	0.005 U	7				
64-S	B0MB95	10/30/97	145	13.6	0.005 U	3 U				
64-rvr	River	10/30/97	131	13.9						

Table 4-1. Sample Analytical Results. (Page 5 of 6)

Map Label	Sample Number	Sample Date	Specific Conductance (uS/cm)	Temperature (Deg. C)	Hexavalent Chromium (mg/L)	Nitrate (mg/L)	Gross Beta (pCi/L)	Tritium (pCi/L)	Strontium-90 (pCi/L)	Carbon-14 (pCi/L)
65-M		11/21/97	164	12.3						
65-S		11/21/97	143	11.2						
66-D	B0MBC4	11/21/97	207	14.2	0.005 U	3 U				
66-M	B0MBC3	11/21/97	275	14.1	0.005 U	3 U				
66-M	B0MHT0	11/21/97					4.08	96.8 U		
66-S	B0MBC5	11/21/97	230	14	0.005 U	3 U				
67-M		9/24/97	185.4	16.4						
67-S	B0M147	9/24/97					5.31	30.2 U		
67-S	B0M182	9/24/97	215							
67-S	B0M1B2	9/24/97		16.4	0.006	3 U				
68-D		9/24/97	174.3	14.4						
68-M		9/24/97	181	14.8						
68-S	B0M146	9/24/97					2.39 U	-48.6 U		
68-S	B0M1B1	9/24/97	207	17.5	0.006	3 U				
69-M	B0M148	9/24/97					2.98	-23 U		
69-M	B0M1B3	9/24/97	244	21.5	0.005 U	4				
69-rvr	River	9/24/97	138.7	21.9						
70-D		9/24/97	185	16.6						
70-M	B0M145	9/24/97					2.25 U	140 U		
70-M	B0M199	9/24/97	207	16.3	0.009	13				
70-S	B0M1B0	9/24/97	207	16.6	0.012	14				
70-rvr	River	9/24/97	139	19.2						
71-D	B0M142	9/19/97					5.81	961		
71-D	B0M192	9/19/97	322	16.6	0.014	19				
72-D	B0M143	9/19/97					4.07	406		
72-D	B0M193	9/19/97	238	13.8	0.006	9				
72-M	B0M194	9/19/97	235	16.2	0.005 U	12				
72-S	B0M195	9/19/97	239	14	0.005 U	13				
72-rvr	River	9/19/97	157.4	18.9						
73-D	B0M144	9/19/97					2.51 U	51.8 U		
73-D	B0M196	9/19/97	208	17.6	0.005 U	3 U				
73-M	B0M198	9/19/97	202	15.6	0.005 U	3 U				
73-S	B0M197	9/19/97	185	15.7	0.005 U	3 U				
73-rvr	River	9/19/97	167.2	17.2						
74-D	B0M149	9/24/97					4.18	434		
74-D	B0M1B4	9/24/97	273	17.9	0.009	6				
74-M	B0M1B6	9/24/97	264	18.3	0.013	9				
74-S	B0M1B5	9/24/97	262	16.5	0.008	8				
74-rvr	River	9/24/97	129.5	21.8						
75-D	B0M151	9/26/97					4.65	1040		
75-D	B0M1C0	9/26/97	417	15.3	0.015	30				
75-M	B0M1C1	9/26/97	447	15.7	0.015	30				
75-S	B0M1Y6	9/26/97	397	14.9	0.010	26				
76-D	B0M1B9	9/26/97	329	12.6	0.005 U	10				
76-M	B0M1B8	9/26/97	305	12.9	0.005 U	12				
76-S	B0M150	9/26/97					2.85	801		
76-S	B0M1B7	9/26/97	417	14.7	0.005 U	22				
77-D	B0M237	9/29/97	315	18.8	0.005 U	20				
77-M	B0M153	9/29/97					3.07	720		
77-M	B0M1Y9	9/29/97	346	15.9	0.005 U	24				
77-S	B0M200	9/29/97	199	16.4	0.005 U	24				
77-rvr	River	9/29/97	134.2	20.3						
78-M	B0M154	9/29/97					1.68 U	-81.4 U		
78-M	B0M238	9/29/97	244	15.6	0.005 U	24				

Table 4-1. Sample Analytical Results. (Page 6 of 6)

Map Label	Sample Number	Sample Date	Specific Conductance (uS/cm)	Temperature (Deg. C)	Hexavalent Chromium (mg/L)	Nitrate (mg/L)	Gross Beta (pCi/L)	Tritium (pCi/L)	Strontium-90 (pCi/L)	Carbon-14 (pCi/L)
78-S	B0M239	9/29/97	201	19.9	0.005 U	5				
78-rvr	River	9/29/97	135	20.1						
80-D		11/11/97	222							
80-D	B0MBD5	11/26/97	244	12	0.005 U	4				
80-D	B0MHR7	11/26/97					3.59	140 U		
80-M		11/11/97	210							
80-M		11/26/97	171	11.2						
81-M	B0M245	10/3/97	279	15.1	0.005 U	4				
81-S	B0M156	10/3/97					4.61	43.7 U		
81-S	B0M3H1	10/3/97	301	14.2	0.005 U	4				
81-rvr	River	10/3/97	145.3	16.8						
82-S	B0M157	10/3/97					2.35 U	-34.4 U		
82-S	B0M3H2	10/3/97	208	18.9	0.005 U	6				
82-rvr	River	10/3/97	143.8	17.7						
84-D		11/26/97	215	8						
84-S		11/26/97	141	10.5						
84-rvr	River	11/26/97	139	9.3						
85-D		11/26/97	139	9.9						
85-M		11/26/97	136	9.7						
85-S		11/26/97	134	9.5						
86-D	B0MBD2	11/26/97	329	13.5	0.005 U	8				
86-D	B0MHR8	11/26/97					7.05	1260		
86-M	B0MBD3	11/26/97	316	12.6	0.005 U	7				
86-S	B0MBD4	11/26/97	303	11.8	0.005 U	7				

Qualifiers: "U" indicates undetected at indicated method detection limit; "J" indicates detected but quantity estimated.

5.0 RECOMMENDATIONS

The following recommendations have evolved from several sources. First, during the planning stage for the project, numerous parties were presented with the Environmental Restoration Program's objectives for installing new aquifer sampling tubes and were given the opportunity to suggest additional objectives. Second, experience gained with the installations during 1995 at the 100-D/DR and 100-H Areas indicated the value of more continuous coverage of the Hanford Site shoreline. Finally, the demonstrated ability of aquifer sampling tubes to provide a low cost, semi-permanent sampling site at locations optimal for collecting data for risk assessments encouraged future use of this methodology.

The recommendations have been grouped into two categories: (1) evaluating the data generated during this project, and (2) future use of the installed tubes.

5.1 EVALUATION OF DATA FROM NEWLY INSTALLED TUBES

- Incorporate aquifer sampling tube data on future contaminant distribution maps. Prepare cross sections that are oriented perpendicular to the river for contaminants of concern within each groundwater operable unit. Cross sections will contain results from aquifer sampling tubes, and also from near-river wells and riverbank seepage.

- Develop estimates for the potential maximum concentrations for contaminants near the river based on the relative proportions of river water and groundwater in the sample, as determined from specific conductance measurements.

- Estimate the surface area of riverbed that is potentially exposed to contaminated groundwater from the Hanford Site. This can be accomplished using cross sections that describe contaminant distribution, hydrogeologic units, and river channel topography.

- Estimate the rate at which contaminants are entering the river channel via groundwater discharge. These estimates would be based on the dimensions of the contaminated layer, concentrations of contaminants, and groundwater flow rate.

- Prepare documentation that describes the results of the data evaluation process.

5.2 FUTURE USE OF AQUIFER SAMPLING TUBES

- Conduct a workshop to develop an effective and efficient monitoring schedule for future use of the tubes, using the U.S. Environmental Protection Agency Data Quality Objectives process. Restrict problem statement to producing new environmental data for Environmental Restoration Program decisions.

Key issues to address during DQO workshop include:

1. Constituent list for analyses.
2. Sample characteristics for analyzing samples (e.g., river influence).
3. Tubes to be sampled and co-sampling of riverbank seepage and near-river wells.
4. Monitoring frequency.
5. Data evaluation and reporting.
6. Coordination with other monitoring programs.

- Periodically monitor the integrity of the aquifer sampling tubes to verify their availability for future sampling. Include tests that would evaluate the ability to withdraw water and measure specific conductance. Coordinate the field work with other existing work to minimize expense (e.g., monthly visits to wells equipped with data loggers).

6.0 REFERENCES

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APPENDIX A

INSTALLATION METHODOLOGY DETAILS

APPENDIX A. INSTALLATION METHODOLOGY DETAILS

The following detailed descriptions of the two methods of aquifer sampling tube emplacement are from the *Description of Work for Installing Aquifer Sampling Tubes Along the 100 Area and Hanford Townsite Shorelines* (Peterson et al. 1997).

A1.0 GEOPROBE INSTALLATIONS

Where vehicle access is possible, sampling tubes have been installed using a Geoprobe™ Model 5400 hydraulic probe driver (a trademark of Geoprobe™ Systems) and Geoprobe™ probe rod. The vehicle is parked over the desired location and leveled. The Geoprobe™ 5400 hydraulic driver is extended from the rear of the truck and a probe rod set in place.

The probe rod is driven into the ground to the maximum extent possible, which is approximately 10 m (30 ft). After the rod driving is completed, a polyethylene tube with screened sampling port attached is inserted into the probe rod and threaded onto the expendable probe rod tip. The rod is then backpulled to the next screen depth, allowing the sediments to collapse around the sampling tube. This procedure is repeated at an intermediate depth, and again at approximately 1.5 m (5 ft) below the water table. (Note: At some locations where the uppermost aquifer is fairly thin, i.e., less than approximately 3 m [10 ft], or refusal was observed, only two sampling ports were installed.) In the event that a rod cannot be driven to the target depth because of refusal, the sample location is moved laterally to avoid the object or zone of refusal. Occasionally, the rod may become stuck or break during the backpulling operation. When this happens the rod is left below ground.

A2.0 RHINO AIR HAMMER INSTALLATIONS

At locations where vehicle access is not possible, aquifer sampling tubes are installed using a PD-65 pneumatic post-pounder (a trademark of the Rhino Tool Company) to drive the probe rod to the desired target depth. Compressed air is used to power the post pounder; airlines are run from a vehicle, where the air compressor is located, to the desired installation site. Portable hydraulic jacks are used to backpull the drive rod.

The PD-65 tube installations are similar to those completed by the Geoprobe™ vehicle, except that 2.53 cm (1.0 in.)-outside diameter probe rod is used, thus requiring separate probe drives for each sampling tube.

A3.0 TUBE PROTECTION

The sampling tubes are susceptible to damage caused by the weather, river flow, and animals. In order to protect the tubes from this damage, protective polyvinyl chloride (PVC) pipe is installed around the tubes. The sampling tubes are threaded through a series of slip-fitted PVC pipe. The series of PVC pipe consists of about 0.30 m (1 ft) of 2.54 cm (1 in.) installed into the ground, slip-fitted to a 90° elbow and the elbow slip-fitted to a pipe of 0.3 to 1 m (1 to 3 ft) in length with a cap on the end. The long of the protective PVC pipe is oriented to be parallel with river flow in a downstream direction. Local cobbles are placed on top of the PVC to limit movement of the tube. The tube's identification number is printed on the outside of the PVC.

A4.0 REFERENCES

Peterson, R. E., K. L. Singleton, J. V. Borghese, 1997, *Description of Work for Installing Aquifer Sampling Tubes Along the 100 Area and Hanford Townsite Shorelines,* BHI-01090, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

APPENDIX B

AQUIFER SAMPLING TUBE LOCATION DESCRIPTIONS

Compiled by D. B. Erb
November/December 1997

APPENDIX B. AQUIFER SAMPLING TUBE LOCATION DESCRIPTIONS

This text presents directions on how to get to all installed aquifer sampling tube locations. Most sites were accessed with a 2-wheel drive pickup truck in dry weather, but conditions may change since last visited and during inclement weather. Mileage is presented from major paved road intersections or from locations where dirt/gravel side roads intersect paved main roads. In some cases, no vehicle path existed prior to the aquifer tube program, and poor- to well-defined vehicle tracks were created. Deep sand or flooding conditions may be found at some locations or approaches.

Originally, 87 sites were planned for the aquifer tube program but not all were installed (e.g., sites 8, 9, 10, 16, 20, 24, 27-34, 56, 79, and 87). Sites were generally 1,000 to 4,000 ft apart, with the closer spacings around reactor sites. Small orange pennants on 5-ft tall white rods, which either mark access approaches or approximate locations, generally designate site locations. These pennants were typically placed on higher ground at the crest of the river banks so that approximate locations could be determined from a distance. Orange wooden stakes or pennants are provided for locations at or near to the exact tube locations. Depending on river level, the tubes may or may not be accessible due to high water. Most sites were installed during lower flow periods of the late summer and fall. (Note: the Columbia River is a controlled river. Water levels have been observed to vary 5-7 ft or more on a daily basis and have been noted to vary on a seasonal basis, by up to 15-18 ft. The Priest Rapids Dam dispatcher can be contacted for daily river level information at [509] 754-5001.) All tubes appear to be accessible at flows of ~60,000 cfs or less.

To solve a problem with animals "gnawing" on the ¼-in. tubing, white or gray, 1-in. internal diameter polyvinyl chloride (PVC) pipe has been fitted to protect each tube or tubes. At "Geoprobe" sites, two or three tubes may be clustered into a single PVC pipe. At "Rhino" locations, one PVC pipe covers a single tube installation. Each PVC pipe installation consists of a tube segment installed vertically into the ground, a 90° elbow, a 3- to 8-in. long pipe segment lying flat on the ground, and an end cap. All PVC installations are labeled. Typically each PVC pipe has been covered with cobbles and boulders to anchor it against seasonally high water or strong river currents. As a result, some tube locations may be difficult to find, especially in areas with steep rocky banks. Visitors are cautioned to expect spiders at these sites. Winterization activities were not completed at sites 42-47, 60, 71-73, 77-78, and 81-82.

Hanford roads contradict the national numbering convention, in that Hanford's North-South roads bear even numbers and E-W roads bear odd numbers. The 100 Areas Fire Station sits at the intersection of Routes 1 and 4, which is the division point for all N-S and E-W road numbers. Access to sites 35-87 is best obtained by going out past the Hanford townsite and turning on Route 2. The other sites are more quickly accessed from Route 4, which passes by the 200 East Area.

Access and Site Limitations

Access to sites is limited by cultural and ecological constraints and by active field remediation projects. In particular, access to sites 14-15, 41-45, 59, 61, 71-78, and 81-86 is limited by road signs indicating "Eagle Roosting Zone." These postings are placed at least 800 yds from known overnight roosting trees used by eagles wintering along the Columbia River on the Hanford Site. This posting is in effect between November 15 and March 15, and requires an in-the-field determination by Environmental Restoration Contractor (ERC) Wildlife Biologists (Ken Gano, BHI, 372-9316 or Steve Weiss, CHI, 372-9576) that eagles are not roosting in trees at selected locations along the river. Access to these sites is limited to the hours of 10 a.m. to 2 p.m. and requires the continual presence of a wildlife biologist or their designee. If an eagle is present, access is not permitted. If an eagle arrives after work has started, work may continue.

Access routes passing through ERC field remediation projects, as at the 100-B/C, 100-D Reactor areas, and at pump-and-treat locations (e.g., 100-K) around reactors require signing in and out as visitors enter and leave the area. Alternate access routes may be available in some instances.

Cultural resources are present at many sites as the Columbia River was key to human survival in pre-Hanford Nuclear Reservation time. All sites were cleared for crew and/or vehicle entry prior to tube installation. Access to sites 21-23 have been flagged to avoid intruding on culturally sensitive areas. Cultural artifacts must not be collected at any site. The locations of potential artifacts should be identified to the ERC Cultural Resources personnel (Tom Marceau, BHI, 372-9289 or Jim Sharpe, CHI, 372-9369).

There are no radiological restrictions on access to sites with installed tubes. Radiological Control Technician (RCT) presence is not needed for site access. Some sites required RCT support during tube installation to ensure that subsurface contamination was not reaching the ground surface when drive rods were removed. Some sites require purgewater collection during sampling due to radiological considerations, and RCT survey of sample bottles is required prior to release. Note that purgewater collection may also be required for nonradiological contaminants.

Site No.	Reactor Area	Access Description
1	100-B/C	Proceed ~3.9 mi west from the 100 Area firehouse along Route 1 to the stop sign at the 100-B/C access road. Continue straight (west) along the access road for ~0.5 mi to the BHI construction trailer and sign in. Return to access road and continue west, passing the 100-B/C Area west fenceline. Turn right (north) at intersection with 100-B/C area outer perimeter road, ~0.65 from the construction trailer and proceed north for ~0.2 mi. The paved road turns left (west), while a dirt road to **Sites 2, 3,** and **4** continues straight into a gravel pit area. Follow the paved road west for 1 mi and turn right (N), onto a dirt track just before a thin, orange stake. Follow dirt road north for 0.4 mi toward the river, avoiding barbed wire on ground. Cross old railroad grade and locate Juniper tree grove 0.1 mi ahead. Turn right (east/down-river) at the grove and proceed along an ill-defined vehicle path, staying up from the coarse cobbles/boulders flanking the river, for 0.15 mi. The three tubes at **Site 1** are located close to the river near the east edge of the Juniper grove. Due to the numerous large boulders along the path, driver with caution.

Site No.	Reactor Area	Access Description
2	100-B/C	Follow directions as in **Site 1** above, to the 100-B/C west side outer perimeter road and proceed north, but enter gravel pit area. (Immediately past an elevated berm/old railroad grade, at entrance to gravel pit, a vehicle path exits to the right and to **Site 4**.) Exit pit haul road at a dirt road, which winds toward river, passing a groundwater well on right, and which continues to the river-side of gravel pit. The dirt road gradually turns to left (west, upriver) following an old levee/berm and encounters a dirt road, at ~0.5 mi from paved road. Turn right and proceed through cut in berm/levee toward the river for 0.1 mi to bare river gravel. (Large holes and low points in the road may fill up with water and limit vehicle access to the riverbed.) The two tubes at **Site 2** are located about 400 ft upstream in a single probe hole, which is accessible by driving along gravel/cobbles at low water.
3	100-B/C	Follow directions to **Site 2**, as above, to where dirt road encounters bare river gravel. Turn east (downriver) and drive ~0.4 mi along gravel, looking for flagging in willows along river, marking the two tubes at **Site 3**. Caution: this approach is slippery and muddy. Access will be controlled by river level. A four-wheel drive vehicle is highly recommended when the rocks are damp or wet.
4	100-B/C	Follow directions as in **Site 2** above into gravel pit. Turn right after passing a large berm/old railroad grade and follow dirt road east ~0.15 mi along base of berm to east edge of pit. Bear north, then east toward river and 100-B/C intake structure, following vehicle trail for a total of ~ 0.3 mi. **Site 3** is in a clearing along the river shore and three tubes are installed in a single probe hole.
5	100-B/C	Follow directions for **Site 1** to BHI construction trailer and sign in. Upon leaving the trailer, drive 100 ft east on access road, passing reactor area fenceline. Turn left (north) on paved road and proceed along fenceline for ~ 0.3 mi. Paved road then turns right while a dirt trail proceeds west along 100-B/C reactor fenceline. (At this location, **Site 6** is visible at river's edge, 400 ft to the northeast.) Follow fenceline toward 100-B/C Water Intake Pumphouse for 0.15 mi. Dirt track bears to right and winds downhill (NW) toward base of intake structure. The three tubes at **Site 5** are in one installation hole near the river's edge, downstream of the intake embayment.
6	100-B/C	Same approach as for **Site 5**. At base of slope near **Site 5**, turn right (east) and wind through ~1,000 ft of cobbles, boulders, and debris to a point just downstream of the C Reactor cooling water outfall structure. The three tubes at **Site 6** are located near river's edge in an opening between two large trees.
7	100-B/C	Proceed to turnout along paved road described for **Sites 5 & 6**, above. Turn right and follow paved road east for ~ 0.2 mi. A large white site alerting boaters for Hanford warning siren system, is on the left ~200 ft north of the road. Proceed to base of sign and turn left, down a construction access road, to base of slope. The two tubes at **Site 7** are located on gravel riverbed. This site may be flooded in higher water.
8	100-B/C	Not installed. Posted for cave-in potential.
9		Not installed.
10		Not installed. In 8 attempts, could not penetrate past 4 ft deep.

Site No.	Reactor Area	Access Description
11 & 12		Starting from the intersection of Routes 4N and 1, proceed west on Route 1 for 3.15 mi, crossing two sets of railroad tracks. Beyond the second grade crossing, two dirt roads exit to the right, as it curves to the left. One road is tangent to the bend; the other takes off to the right (north) at right angles. Turn onto and follow the latter. At 0.35 mi, a well-established dirt road bears off to the right (east/downriver) and is the access to **Site 15**. Continue straight for another 0.15 mi where road crests a 50-ft high bluff overlooking the river. **Sites 13** and **14** are reached by following the road to the right, as it descends the riverbank and passe the old Hanford Irrigation Project Pump station. An ill-defined vehicle path turns left from the road here and bears west (upstream) to **Site 11**. Orange pennant for **Site 12** is at the crest of the slope and the single tube at this site is at the river's edge, ~250 ft distant. **Site 11** is another 0.4 mi to the west, about ~200 ft east of the 5 Mile Hanford River sign, and is downhill about 200 ft from the top of bluff. A single tube was installed at this site and is under water at higher flows. **Site 10** is another 2,000 ft upstream.
13		Use directions for access to **Site 11** and **12**, to get to top of bluff overlooking river, then proceed ~750 ft east (down river) toward the Hanford Irrigation Project intake/pumphouse, visible to the right (downstream). Continue another 250 ft beyond the pumphouse, where road widens into a turnaround area, which extends to the river. Two tubes in two holes at **Site 13** are above most river levels. Coyote Rapids is located northeast at the upstream tip of an "intermittent" island (dependent on water elevation).
14		**Site 14** is located on a grassy gravel/cobble berm connecting the "intermittent" island by Coyote Rapids to the river shore. This site is accessed by an ill-defined vehicle path from the turn-around area at **Site 13** and is indicated by orange flagging through high grasses and vegetation. Start at the turnaround area and proceed east (downriver) along the base of the bank for about 500 ft. The track bears left as it approaches a cluster of trees. **Site 14** is located another 300 ft along the vehicle path, between several debris-filled trees approximately 800 ft from **Site 13**. Three tubes are installed here in one probe hole. This path is passable but very rocky due to the large cobbles present on the river bank. Be careful of large rocks when turning around. **Site 14** is within an Eagle roosting area centered at **Site 15** but no postings are yet present along this access road.
15	K-Area	This site is approximately 700 ft upstream from the K-West Intake structure. The site is reached by exiting the 100-B/C Reactor approach road as described for **Sites 11 & 12**. At 0.35 mi, take the dirt road bearing off to the right (east). (At 0.6 mi, a dirt road branches off to the left and leads in ~ 0.15 mi to the Hanford Irrigation Project Co. pumphouse and Sites 13 & 14.) Continue east for almost 1.0 mi, passing an asbestos contamination area, and turn left at the fenceline road along the west side of K-Area. (This road dead-ends at the river, at the base of the intake structure.) Approaching the river, descend a steep grade and turn left at the base of a gravel pile. Proceed west (upriver) for 0.1 mi, passing through an old homestead fence line. Continue west for another 100 ft and note an indistinct track extending 300 ft to the river. A single tube is located just upstream from a small tree, within the grasses, above bare river gravels.

Site No.	Reactor Area	Access Description
17 & 18	K-Area	**Sites 17** and **18** are accessible by the same general road directions. It is necessary to get a key from Joe Jimenez (373-9210) or Dorman Blankenship (373-5456) for entry to these sites. The visitor must exit the west fenceline near the K-East Intake Pumphouse structure through a locked gate using the key. Turn right (north) on the paved K-Areas access road located 1.5 mi west of the Routes 4 and 1 intersection and proceed north toward the reactor facilities. A railroad crossing and graded dirt road (to **Sites 19 & 21-23**) are found 0.55 mi north along this road. Continue north entering the 100-K fenceline in 0.2 mi and turn right at the stop sign. Proceed east along the inner perimeter road for 0.35 mi and continue following it as it first turns north and then west. At 1.1 mi from the stop sign, a paved road and the fenceline jut north toward the K-East Intake Pumphouse along a built-up embankment. Approaching the pumphouse area, a locked gate is seen on the west fenceline. Unlock gate and proceed along the dirt trail into the vegetated, unfenced area between the two intake structures. (The vehicle trail continues west for about 0.3 mi.) Approximately 150 ft from the fenceline, a dirt trail leads down through a cut in the riverbank and bears right, back to the K-East Pumphouse Intake. The single tube at **Site 18** is located about 100 ft downstream (toward the intake structure) from the cut in the bank. The two tubes at **Site 17** are accessible, at times of low water, by turning off the dirt road and driving through the grasses adjacent to the river shore, upstream ~1,000 ft. An orange pennant at the top of the bank marks the approximate location, and **Site 17** can be approached from the vehicle path at the top of the bank. Caution is needed to descend a rubble slope leading down to the river. Lock gate when exiting. Note: large cobbles and boulders are present beneath the grasses, but vehicle access is possible if taken slowly and by following the pre-existing vehicle path.
19	K-Area	This site is located ~1,000 ft downstream of the K-East Pumphouse Intake structure. A key is necessary to unlock the chain gate across road. Observe signs for staying on road in general area of 100-K pump and treat facility and east of the K Reactor Area. The site is approached by roads following, but outside of, the K-Area fence line. At the railroad crossing on the K-Area Access Road, turn right onto the graded gravel road and proceed parallel to the tracks, toward the SE corner of the fenceline, 0.4 mi. The road turns north and then east around a gravel pit at 0.7 mi. At 0.8 mi, a dirt road intersects from the left. (The 100-K pump and treat offices are located 0.6 mi along the graded gravel road. 100-N Area is ~1.0 mi beyond the pump and treat offices.) Turn on the dirt road and proceed north to a gate at 1.0 mi and unlock. Road winds to north and east, along the 116-K-1 emergency crib. An open gate at ~1.1 mi is entered as road turns north along east fenceline of crib. Beyond the barbed wire on right is a culturally sensitive area, which must not be entered. A gravel-paved road bears right into this area, but continue straight ahead, following a little-used dirt path that gradually turns to the west. Turn right, toward river, where a gravel/cobble fill crosses the vehicle path, and drive ~300 ft to a barbed wire fence. Two tubes are installed at **Site 19** which lies ~200 ft beyond fenceline.
20	K-Area	Not drilled.

Site No.	Reactor Area	Access Description
21 – 23	K Area	100-K pump and treat facility controls access to these sites with locked chain gates. A large quantity of pipe and conduit connect the extraction and injection wells to the pump and treat unit. The area is also very culturally sensitive. Drive only on the roads and drill pads is required. Also, when traversing across open land between drill pads and tube sites, stay on footpaths delineated by red flagging. This area has been cleared by cultural resources inspection. As above, a key is required to get past the several gates controlling which can be obtained from either Joe Jimenez or Dorman Blankenship. **Sites 21** and **22** are accessible either by roads inside the 100-K area or from the graded gravel road connecting K and N-reactor areas. **Site 23** is accessible only from the N/K Reactor road. A courtesy call to Russ Fabre' (531-0730) is recommended, prior to entering this area.
21		Starting at the intersection of the paved K-Area access road and the railroad grade crossing, turn right (east) onto the graded gravel road and proceed for 1.4 mi, before turning left onto a graded gravel road leading east to the 100-K pump and treat building and office trailer. Proceed to the chain gate, unlock and continue following road around subsurface contamination zones for 0.3 mi Turn left (west – a right turn leads to **Site 22**) onto a maintained gravel road, then turn right (north) after another 0.1 mi onto an access road to well 199-K-117A. Park along the north edge of the drill pad. **Site 21** consists of three tubes. Two tubes are located ~275 ft north, toward the river and are installed near the transition of grassy vegetation and bare river rocks. The third tube is located another 125 ft north in the bare gravel/cobbles that are flooded during high water.
22		Following instructions for **Site 21** above, pass through locked gate and follow road to wellfield access road. Turn right at this gravel road, and pass a drum storage area on north side of road within ~250 ft. At 0.25 mi further along the road, turn left (north) onto an access road to well 199-K-114A. Park at north edge of drill pad and walk north 260 ft, along the flagged path, to the two-tube cluster at **Site 22**. Note that access to this site can also be obtained from the 0.3 mi-distant, K/N Reactor road, by entering the K pump and treat area through a locked gate near the metal-sided out-building.
23		Starting at the 100-K pump and treat facility, proceed east on the maintained gravel road connecting the K and N Reactor Areas. The access route and locked gate to **Site 22** is located at 0.45 mi. Continue for another 0.2 mi and turn left (north) onto a dirt road to **Site 23** and well 199-K-114. Open gate and drive 0.1 mi to north edge of the 199-K-114 drill pad. Walk north along flagged path for ~220 ft to the two tubes installed at **Site 23**.
24		Not installed.

Site No.	Reactor Area	Access Description
25 & 26	N-Area	These two sites are accessed by a vehicle path that parallels the west fenceline of the WPPSS Hanford Generating Plant (HGP), which lies due west of the 100-N Reactor. This road starts at a road leading from the 100-K pump and treat facility, ~1.0 mi away, but access is described from the 100-N access road off Route 4N. At the intersection of Routes 4 and 1, proceed north on Route 4, for 1.7 mi, to turnoff for 100 N Reactor area. Proceed left at turnoff and continue north for 1.0 mi. A paved road, signed for the WPPSS HGP, bears off to the left past an equipment/laydown yard on the left. Follow the paved road for 0.3 mi and look for a gravel dirt road on the left, which leads to the 100-K pump and treat and the K Area in general. Turn left on this road and follow for 0.25 mi, crossing two railroad spurs. Just past the second crossing, take an unimproved dirt road to the right (north), along the west fenceline of the HGP. At the crest of a small rise the terrain falls off to the river and an orange pennant for **Site 25** should be visible at the grass line on the river bank directly ahead. Proceed to the bottom of the hill, 0.25 mi from the railroad crossing. Turn right (east/downstream) toward the HGP intake structures and look for a worn vehicle path through the high grasses toward the river. One tube was installed at **Site 25,** which is about 300 ft. along this path. Beware of large cobbles in the grasses off the vehicle path when turning around. **Site 26** has the same initial access as **Site 25**, but at base of the hill, continue east for another 250 to 300 ft under the first set of power lines. Look for a vehicle path worn into vegetation, which requires a sharp left turn. This path loses about 10 ft and then bears to the right almost immediately on entering flatter land. Proceed along the path for ~500 ft towards the pennant and a large tree in the distance, at base of a gravel slope. The site is about 50 ft downslope from the road, towards the river. There are three individual tubes in a bare area in the grasses.
27		Not installed.
28		Not installed.
29 – 31		Not installed. N-Springs surface contamination area.
32		Not installed.
33		Not installed.
34		Not installed.

Site No.	Reactor Area	Access Description
35 – 38	D-Area	**Sites 35-38** are most easily accessed from the main entrance to the 100-D Reactor area. All are at the base of a steep, 100+ ft high slope, across a flat gravel bar, to the river's edge, upwards of 350-400 ft distant from the pennant locations. Proceed with caution down the slope as it is steep and often slippery due to rounded cobbles and loose ground underfoot. Existing footpaths may be less stable than untrammeled ground. Proceed north on Route 4N. Enter the D Reactor fenced area and proceed north ~0.3 mi, until the road turns to the right (east). After ~0.5 mi, the BHI construction office will be on the left (north) side of the road. Sign in on the visitor's logbook in the trailer. Return to the road and continue east for another ~100 ft. Turn left (north) just outside the fenceline and proceed along the perimeter road for ~0.4 mi, passing the subcontractor's trailer. The road turns left again, and after another ~0.2 mi, intersects the outer perimeter road. A pennant for **Site 37** (3 tubes) is near the base of the siren tower in the near distance. **Sites 35** and **36** are accessed by turning left (west) onto the outer perimeter road. As the road approaches the 100-D fenceline, a pennant for **Site 36** (3 tubes) will be visible to the north, at the crest of the slope. The site is approximately 400 ft to the north along the river's edge. For access to **Site 35**, drive up to the fenceline and turn to the right along an unmaintained dirt road that parallels the fenceline. Follow this path west for ~0.2 mi to where an orange pennant for **Site 35** (3 tubes) can be seen at the crest of the hill. **Site 38** (2 tubes) is accessed by turning sharply right, onto the outer perimeter road, and then almost immediately turning off the road, toward the slope, following vehicle ruts down a cobble-strewn slope toward the fenceline surrounding a concrete outfall structure. The tubes are between the river and the trees, downstream of the pennant.
39		Proceed north on Route 2N passing the 100-H Reactor Access Road. Route 2N curves gradually to left (west). At ~1.5 mi beyond the 100-H road, an old paved road intersects from the right (north) just before a series of power lines. This road bears signs indicating access to the EPA Sodium Dichromate pit site. Turn right onto this road and continue north, for 2.0 mi, and turn left (west) onto another old, paved road. (Turning east on this road for 0.5 mi, then left onto a dirt road will take the visitor into an eagle roosting area and to **Sites 41-44.**) After ~0.5 mi to the west, this road turns sharply to the left (south), returning back toward the 100-D Reactor area. At this turn, a vehicle path bears through the high grasses toward the river, 0.2 mi distant. The pennant for **Site 39** is readily visible at the end of the path and the three tubes (in two holes) are directly in front of the pennant.
40		Turn right (downstream) at the **Site 39** pennant and proceed downstream along the rock beach. At 0.1 mi, near a "No Trespassing" sign, a vehicle path is visible entering higher ground and thick grasses on the right. Enter onto high ground in grasses and follow path for another ~0.1 mi, at which point the high ground and grasses are exited and the path returns to the rocky riverbed. The tube for **Site 40** single tube is near the base of the pennant, approximately 0.1 mi distant. Caution: Portions of this approach may be flooded during higher water. Proceed slowly - deep holes in grassy higher ground.

Site No.	Reactor Area	Access Description
41 – 44		Access to these sites is best accomplished by an unmaintained dirt road exiting from the northern-most point of the 100-H Outer Perimeter road. (Note access description to **Sites 45-55** below.) Access is limited by postings of the area as an eagle roosting area. Turn right off of Route 2 onto paved access road to 100-H area. Continue along this road for 2.7 mi, passing the H-Reactor building on left. Continue 0.2 mi to intersection with outer perimeter road and bear north (upstream) along river. Pass **Sites 46** and **45** (see below). At 0.5 mi, perimeter road turns sharply to left and an unmaintained dirt road continues northwest along river. **Site 44** is located near northern end of the first stand of trees, about 0.2 mi from start of dirt road. A pennant marks the location and two tubes are located at the base of a ~65-ft high embankment, in river gravels. During routine higher water, the tubes may be submerged. Continue northwest for 0.2 mi to **site 43** which is located about 200 ft downstream of the **Hanford Site 14 mile** river milepost.. An orange pennant is at the top of a 50 ft bank and the two tubes are at the base of bank. Continue north and west, as road bends around the "horn." A second grove of trees along river is entered at ~0.35 mi, as the road turns sharply, first to the right, then to the left before dropping out of grove and into bare dirt and grasses at 0.40 mi from **Site 43**. At 0.5 mi from **Site 43**, a large overturned stump is encountered on the right side of the road. Turn right here and proceed to the northeast ~0.1 mi, toward a "no trespassing" sign. Three tubes for **Site 42** are located 40-50 ft river-ward from signpost. Return to stump and proceed west on road (upriver). At ~250 ft past tree stump, the road turns to the left (south). An old signpost, with a small sign, labeled (699-) 101-45, is present at the turn. An unmaintained dirt road trends west at this point toward well. The pennant for **Site 41** may be visible in the distance at a break in a low dune line. Continue straight on the trail for ~0.3 mi. A vehicle path bears north to the river and toward the orange pennant. Follow this path for about 0.15 mi as it passes through a break in the low bank. The pennant is fastened to a No Trespassing sign. The three tubes are under mounds of large cobbles located at river's edge, north of the sign.
45 – 55		Directions to **Sites 45-55** are presented with respect to the main access road to the 100-H area. The junction with the 100-H Reactor Area access road is ~7.6 mi north of the junction of Site Routes 2S and 11E. Turn right (north) onto the access road and follow it for 2.7 mi to the reactor building. Continue north for ~0.15 mi to the road's junction with the 100-H outer perimeter road, which comes up on the right, sharply from behind. Turn left onto the outer perimeter road and proceed southeast for ~150 ft. An orange pennant for **Site 46** is visible at the crest of the 30-40 ft high riverbank. A single tube is located just downstream of the pennant and is set several feet closer to shore than an orange stake driven into the river gravel. This site is commonly under water.

Site No.	Reactor Area	Access Description
45 – 55 (cont'd)		Continue on the outer perimeter road and proceed northwest for ~0.2 mi, noting signs designating the area as an Eagle Roosting Area. An old paved road accessing the 100-H Reactor support area intersects diagonally from the left. Directly across the road is a graveled ramp leading down to the river and to several river-gauging installations. At very low water flows, three of the **Site 45** tubes are visible on a gravel bar ~100 ft from a well casing adjacent to the ramp. The three tubes are installed in one probe hole and were fitted with 30-40 ft tube extensions. This site is usually underwater. (Continuing upriver from **Site 45**, the road turns sharply to the left [west] where a dirt road continues northwest along the river's edge and provides access to Sites 41-44.) Return to the intersection of the 100-H Access Road with the outer perimeter road. Continue south on the outer perimeter road passing a number of groundwater wells. Pass by the fenced, stabilized 116-H-7 retention basin, 0.2 mi southeast, and look for an orange pennant adjacent to well 199-H4-63, ~250 ft away by the riverbank. A ramp descends the 40-ft slope nearby, starting 75-ft southeast of the well, and accesses the 100-H Reactor cooling water outfall structure. Two tubes for **Site 47** are located ~50 ft downstream of base of ramp at or below river level. The orange pennants for **Sites 48-50** are visible in the distance on the gravel bar to the southeast. From the pennant at **Site 47**, follow a well-established, gravel road for 0.3 mi, staying along crest of riverbank. Note that Eagle Roosting Area signs have been placed to prevent seasonal access to **Sites 48-59**. A poorly defined vehicle path, bearing off to the left, descends the embankment and aims for a cut in an old levee/berm to the southeast. Turn left here and pass slowly through rough road in berm, at 0.15 mi. Vague vehicle paths run straight ahead before turning right to **Sites 51, 52, 54,** and **55**; or to the left toward **Sites 48, 49** and **50**. Turn left and follow the poorly defined vehicle path toward the orange pennant at **Site 50**. Near this pennant, a vague vehicle track bears to the left and runs north, diagonally for 0.25 mi, from the berm cut to the river's edge. **Site 48**'s three tubes are installed in one probe hole, which is located about 30 ft north of an uprooted, overturned tree, and about 130 ft downriver of a "No Trespassing" sign Return to **Site 50,** which is on one side of a low, gravelly swale, which occasionally floods during high water. **Site 49** is straight ahead, to the northeast, about 350 ft, and is on a gravel bank at the river's edge. Three tubes are installed in one probe hole. (Access to **Site 53** may be possible along the cobble beach extending downstream from **Site 49** but has not been attempted.) Return to the berm cut and intersect the poorly-defined vehicle path leading southeast to **Sites 51, 52, 54,** and **55**. Orange pennants line the crest of the riverbank to the right (west) as approximations of tube locations. The vehicle path parallels the riverbank for ~1.0 mi. The ground is generally sandy with no cobbles or boulders hidden in the grasses. The potential for local flooding locally exists. Due to poor visibility, drive slowly through this area. Starting at the road cut in the berm, the vehicle path intersects a thick grass and reed vegetation cover 0.1 mi to the southeast and **Site 51**'s orange pennant and stake at 0.15 mi to the left (east). The three tubes are located in one probe hole. Continue south along the vehicle path for 0.2 mi, locating **Site 52**'s orange pennant on left near the edge of the marsh. The three tubes are located in one probe hole. A Hanford Warning Siren installation is visible to the right (west).

Site No.	Reactor Area	Access Description
45 – 55 (cont'd)		Continue south 0.25 mi locating **Site 54**'s orange stake on left near marshy area. Three tubes installed in one probe hole at this site. Continue south 0.2 mi, locating **Site 55**'s orange stake on left at marsh edge. Three tubes installed here in one probe hole. Ahead 250 ft is junction with the access road to gravel pits 19 & 20 (to the right), and well 699-90-43 (to the left). Bear left here to access **Sites 53** and **57**, if water level permits. Bear right toward riverbank to leave area by **Sites 58** and **59** and the White Bluffs Landing road, ~0.8 mi to the south.
53 & 57		**Sites 53** and **57** are on the edge of the Columbia River and are considerably east of the other tube sites in the area between the 100-H and 100-F Reactors. The river circles, first to the southeast and then to the southwest, around a river bar. Low backwater channels in this area may flood and make access to **Sites 53** and **57** difficult. Access is easiest from the White Bluffs Landing road, and is described for **Sites 57-59** below.
56		Not installed.

Site No.	Reactor Area	Access Description
57		**Sites 53** and **57-59** are best approached from the White Bluffs Landing road. The White Bluffs road is 6.5 mi north of the junction of Route 2S and Route 11. Turn right onto White Bluffs Landing road and proceed ~1.35 mi to the boat launch. Turn left along a well-defined dirt road heading north (upstream) past the corrugated metal buildings on the left side of the paved road. Note that the dirt road is posted as an Eagle Roosting Area north of the White Bluffs landing. **Site 59** is located 0.3 mi north of the turnout from the White Bluffs road. Trees paralleling the right side (riverside) of the road close in on the road at a point where an indistinct vehicle path leads off to the right and descends into a shaded opening in the grove of trees. The three tubes at **Site 59** are located down the embankment from the pennant in three separate, closely spaced locations. Return to the main dirt road and proceed north ~0.2+ mi to an orange pennant at the right side of the road, set in amongst the ryegrass. Descend the riverbank adjacent to the nearby large tree and proceed ~120 ft from the road to the edge of a marshy area. Three tubes at **Site 58** are located in a strip marked by two stakes in the high grasses. PVC piping here is not covered with cobbles/boulders. Continue to **Sites 53** and **57** by continuing north along the well-defined dirt road. Turn left onto a gravel-paved road which intersects dirt road, ~0.2 mi north of the **Site 58** pennant. Follow this road for 0.1 mi, which leads to the Pit 19 & 20 area. Look for a small sign & post on the right side of the road, labeled for well (699-) 90-34, and turn right onto a poorly-defined vehicle path leading diagonally toward several dead trees that lie at the crest of the riverbank overlooking the marsh, 0.1 mi. At the crest of the riverbank, the road descends toward the marsh. Flags for **Sites 54** and **55** can be seen in the distance to the north along a vehicle trail, bearing off to the left through high grass, 0.05 mi from the crest of the riverbank. Ford a low, wet spot in the road if water level makes road passable. Drive toward the tree line across from marsh and pass old well (699-90-34) at 0.2 mi from riverbank crest. Road continues approximately straight (east) for 0.15 mi before bearing first to the northeast and then to the southeast to avoid a steep-banked sandy dune ridge. Follow road toward river which should become visible ~0.4 mi from wellhead. A No Trespassing sign and a dead tree lie directly ahead. Continue toward the river reaching unvegetated gravel. Turn left and encounter **Site 53**, 0.5 mi upstream, which consists of three tubes installed in two holes. Note PNNL installation with metal conduit entering river nearby. Access to this site from Site 49 has not been attempted but is presumed to be possible, if slow, due to cobble-boulder ground cover. Turn right at No Trespassing sign and continue downriver, ~0.35 mi. At the third No Trespassing sign, attached orange flagging indicates **Site 57** which lies ~ 250 ft toward the river. Three tubes were installed in one probe hole. A stake and flagging mark the site, but access may be difficult during high water.
60		Proceed north from the 100-F Reactor Access road on Route 2S for 2.5 mi, turning right (northeast) onto the White Bluffs Landing Road. Proceed to the boat launch at the end of the road, ~1.35 mi, and turn right (south) into a parking area near the concrete ramp. (At the metal buildings, note Eagle Roosting Area sign on dirt road entering from left. These postings affect **Sites 48-59**.) Proceed toward a low ridge extending past a large white sign, which alerts boaters to the Hanford Siren Warning System. **Site 60** is located on this part of the riverbank and is usually flooded during high water levels. Three tubes are installed in one probe hole at a location designated by an orange stake. No pennant is in place near site.

Site No.	Reactor Area	Access Description
61 – 65		**Sites 61-65** can be accessed from either the White Bluffs road or the 100-F Reactor area. This report describes an approach from the 100-F Access Road for simplicity. However, access from the White Bluffs boat launch parking area is along a well-used dirt road exiting the parking area and winding toward the 100-F Reactor. Proceed south along this road for 0.65 mi and turn left (east) when it intersects the crumbling, paved outer perimeter road around the 100-F Area. Access to Site 61 is along a dirt road leading to a groundwater monitoring well, ~0.15 mi east from intersection. Mileage between **Sites 61** and **65** runs in reverse order of that provided below. Turn right off Route 2S, at the 100-F Area access road, located 5.0 mi north of the Route 2S/Route 11 junction. Proceed north along the access road for ~1.2 mi and turn right (east, toward river) at the intersection with the outer perimeter road. Continue along this road as it turns 90°, to the north, passing dirt roads leading to **Sites 71-80** and **66-70**, respectively. Continue north for 0.6 mi, and turn right at entrance road to well 199-F5-42, located 250 ft south, off the road. Park near river and walk ~100 ft to river. Three tubes are installed at **Site 65**. At turnoff to **Site 65**, continue north as outer perimeter road turns 45°, to the northwest, and parallels the river. Pass the Hanford 19 Mile river sign at 0.1 mi. **Site 64** is located ~0.05 mi along outer perimeter road upstream of the 19 Mile sign and is just upstream of the 100-F Cooling Water Outfall structure. **Site 64** consists of three tubes located along a low bench just above the river level. An orange pennant is visible off the road ~75 ft from both the crest of riverbank and the road. Continue northwest along outer perimeter road for 0.15 mi. An orange pennant is located at the crest of the riverbank, ~225 ft from road. Vehicular access to **Site 63** is obtainable by continuing up the perimeter road another ~200 ft and turning right, toward river, where a graded ramp leads to the river edge. Three tubes along a narrow bench comprise **Site 63**. **Site 62** is located 0.4 mi northwest of **Site 63** and is reached by a vehicle track exiting right from the perimeter road where it turns 45° to the west. The riverbank is ~300 ft from the road. A steep, slippery path leads down a gravel bank to the river's edge where three tubes are installed along a narrow ledge. **Site 61** is located 0.2 mi west of the **Site 62** access road. A dirt road extends ~1,200 ft to the right (north) from the paved perimeter road toward groundwater monitoring well. Access to **Site 61** continues another 700 ft due north past the well pad over very rough, boulder-strewn ground, to the water's edge. A low canal on the left (west) of the well access road reaches the river at a point very close to **Site 61**. Several low trees are located to the west of the three-tube site.

Site No.	Reactor Area	Access Description
66 – 70		**Sites 66-70** are accessed from the outer perimeter road surrounding the 100-F Reactor area. Turn onto the 100-F Access road from Route 2 and proceed ~0.5 mi north to an intersection with the outer perimeter road. Turn right on the perimeter road and proceed east toward the river. The road bears north after 0.3 mi, toward **Sites 61-65**. Two dirt roads intersect the perimeter road near the corner. One road takes off to the south for **Sites 71-80**, just prior to the turn. The second road intersects the perimeter from the right (east) just north of the turn, and accesses **Sites 66-70**. Turn right onto this path and continue to the river for ~0.2 mi. The road approaches the crest of the riverbank at a grove of trees, and turns to the right, down the bank slope and onto a low gravel bar adjacent to a slough. At this point, indistinct vehicle paths bear to the right and left. **Site 70** is accessed by bearing to the right (south/downriver) and proceeding ~0.15 mi to a point where the high riverbank intersects a backwater in the slough. Three tubes comprise the site, which is marked with a pennant and stake. **Sites 66-68** are along a low, intermittently flooded, unvegetated gravel bed to the left (north) and are marked with orange pennants. A vague path leads off to the left (north) from the base of the slope, winding through grasses. **Site 68** is on the right, 0.1 mi north of the entrance road and over coarse gravel and is marked with a pennant. Continue past **Site 68** on the vehicle path, which splits after ~300 ft. Bearing to the left leads to **Sites 66** and **67** while the other path continues to **Site 69**. Follow the former for ~0.1 mi to **Site 67**. Continue along the path noting an increase in the rise to high ground on the right (east), as the intermittent slough channel becomes more defined. After another 0.4 mi, **Site 66** is found near the base of the slough bank. **Site 69** is accessed by, first returning to the intersection of the two indistinct paths, and then continuing straight, rather than turning left to parallel the channel bank. Follow this path around for ~0.5 mi as it first climbs to higher ground and then gradually loops to the east, around a vegetated sand bar and old homesite, before bearing to the southeast and through a depression at the base of the sand dune. The vehicle path ends at a slough. An orange pennant at the top of the sand bar marks the approximate location of the tubes and a stake marks the location of two tubes.

Site No.	Reactor Area	Access Description
71 – 75		Access to **Sites 71-80** is possible through two side roads, which are connected by several dirt roads. This description will describe access both from the south, near the Hanford townsite, and from the 100-F Reactor Area outer perimeter road, as noted above. However, one road can be used to access all sites in this area. Note that no tubes were installed at **Site 79**. After proceeding east ~0.3 mi from the 100-F Access road, along the 100-F Outer Perimeter Road, turn right (south/downriver) onto an unmaintained dirt road just before the perimeter road turns north. Note the Eagle Roosting Area signs and obey site access limitations. Follow this road south for 0.5 mi and, after passing around a dune ridge, note vehicle tracks and orange pennant on left. Turn left here and proceed for ~0.1 mi through occasional deep sand to a point at edge of 25-30' high riverbank, overlooking a backwater. A single tube at **Site 71** is located at the bottom of the bank. Access is difficult due to the soft bank and steep step-down near the top of the footpath. Four-wheel drive vehicle recommended here. Return to the dirt road and proceed south for 0.35 mi. Road descends a low hill into an area of tall Ryegrass, and approaches a continuation of the backwater, on left. A grove of larger, old trees is on the right with several small trees on the left (east). An indistinct vehicle track bears off through the grass to left, descends a15-20 ft slope through a crude path cut into the hillside and onto a gravel bar. Partway down this path, a "No Trespassing" sign is visible on the left near the end of the backwater. This sign is marked with a red flag and flagging tape. Three tubes comprising **Site 72** are on the left near water's edge, just south of the flagged sign, and ~150 ft off the dirt road. Continue down the slope and across the gravel bar along the vehicle path to another backwater, ~0.15 mi to the southeast. Two tubes are present at **Site 73**. Return to the dirt road to continue to other sites. **Site 74** is reached by continuing south from **Site 72** for 0.35 mi along the dirt road. An orange pennant at Site 74 is along the road and another is set 150 ft east, at the crest of the riverbank overlooking the slough. Vehicle tracks extend to crest of bank. The three tubes of **Site 74** are in mud at base of riverbank. Footpath to **Site 74** is steep and awkward to traverse, with sharp drop-off at top of bank. **Site 75** is another 0.2 mi south along dirt road. Again, an orange pennant along the road marks the vehicle turnout and another orange pennant at the crest of the riverbank. Descend steep slope in loose sand to access three tubes in river mud at **Site 75**.

Site No.	Reactor Area	Access Description
76 - 80		**Sites 76-80** are most easily accessed from a route off Rte 2 S, north of the Hanford townsite. At the intersection of Route 2S and 11E, near the Hanford townsite, turn right and proceed north on Route 2S for 2.95 mi. A gravel-paved road intersects 2S from the right at this point, near a clump of trees. Bear right on this road, noting the sign for Curlew nesting. Proceed along this road for 0.25 mi and turn right (east) onto a dirt road posted with signs for wells 699-65-22 and 699-65-23, just across a remnant of an irrigation ditch. (From this intersection, a Hanford warning siren installation is visible in the distance along the dirt road. Following this dirt road provides a more direct access to **Sites 74-77**.) Continue east toward the river for 0.45 mi passing the wells. Beyond 699-65-22, next to a large tree on the left, the path becomes indistinct as it approaches the river and the **23 Mile** signpost for the Columbia River along the Hanford site. The path intersects another indistinct vehicle path, which parallels the river. Turning left accesses **Sites 77-79**. Bears to the right (south/downriver) and within 0.1 mi note the orange pennant for **Site 80**. The site is located ~100 ft to the east, at the river's edge and consists of two tubes spaced ~12 ft apart. Return to the intersection near 699-65-22 and continue north along the vehicle path paralleling the river, toward large tree in the distance. **Site 79** (not installed) is located 0.2 mi from the paths' intersection. Continue north (upstream) for another 0.5 mi. Note the sign indicating an Eagle Roosting Area about 0.2 mi from **Site 78**. Stop at a large, overturned stump on right and walk ~200 ft to the river. Two orange pennants mark **Site 78** where three tubes are present, usually underwater. Continue north along river path for another 0.35 mi, to where vehicle path reaches a row of trees paralleling the river. The vehicle path turns left, away from river, and toward another large tree. Stop here at orange pennant for **Site 77** and proceed along footpath through tumbleweeds (beware of holes in ground, camouflaged by tumbleweeds) toward river. The three tubes were installed in one borehole and are commonly found underwater. Follow the vehicle path as it turns away from the river at **Site 77**. The vehicle path intersects the gravel-paved road in another 0.15 mi, in an area with considerable soft sand (4-wheel drive recommended). Turn right (north) onto the gravel-paved road toward Hanford Site siren installation for ~150 ft, before turning right (east) again onto a dirt road that leads back to the river. After ~0.1 mi, the road bears to the left (north) and proceeds upriver another 0.05 mi to the orange pennant for **Site 76**. The three tubes comprising **Site 76** are ~200 ft east of the road and lie at the base of a steep, soft, 15-20 ft high bank, near a blue stake. Continue up the dirt road for another ~0.2 mi to reach **Site 75** (See above for tube location description.)
81		**Site 81** is most easily reached by the paved access road on the north side of the Hanford townsite. This road intersects Route 2S, at a point 1.4 mi north of the intersection of Routes 2S and 11E. Make a sharp right turn (south) and proceed toward the old Hanford High School building shell approximately 0.4 mi south. Note that the townsite is posted as an Eagle Roosting Area. As the school building is approached, a concrete powerhouse is visible to the southeast, at river's edge, along with a black, partially vegetated ashpit, ~700 ft north of the building. A dirt road bears left from the paved road and crosses toward the river between the ashpit and the powerhouse. As the road passes the ashpit, turn left (north/upstream) and drive ~0.2 mi through the ashpit. At the north edge of the pit, note a twisting vehicle path to the northeast, winding toward several larger trees on the riverbank. At 0.15 mi past the edge of the ashpit, the vehicle path enters a cut in the river, which provides access to the river's edge. **Site 81** is located in the grass near the river's edge.

Site No.	Reactor Area	Access Description
82		**Site 82** may be accessed in a manner similar to that for **Site 81** or from Route 2S as it curves to the north and west before its intersection with Route 11E. In all cases, the entrances to the Hanford townsite are posted as an Eagle Roosting Area. Continuing south along the north access route into the Hanford townsite, ~0.5 mi past the turnoff to site 81, a large white sign presenting the history of the Hanford townsite is observed on the right (west) side of the road. Turn left (east) onto a partially paved road which, after ~250 ft, bears to the right (south) parallel to the river. After ~0.1 mi, a gravel-paved dirt road bears off to the left (southeast) and extends down the bank as a boat ramp. **Site 82** is just south of the boat ramp, near river's edge in the lee of the fill dirt.
83		**Site 83** is most accessible from the Hanford townsite, but can be reached on backroads accessible from Route 2S. **Sites 83-86** are south of the Eagle Roosting Area at the Hanford townsite but since access is usually through the Township, these sites are considered to be sensitive and of limited access. Starting from the white historical sign near the turnoff to **Site 82** above, continue south along the main N-S road (parallel to the river) for ~0.75 mi to a point where the road goes from paved to poorly paved. Flagging in the brush on left side of the road marks the access road into **Site 83**. An orange pennant is visible ~ 300 ft to the east, at the riverbank's crest. A single tube was installed at river's edge ~100 ft from crest of bank, in a small bare spot at river's edge.
84		**Site 84** is ~2,000 ft southeast of **Site 83**. It is accessed from the same main N-S road as Sites 81-83. It lies beyond a grove of trees, which are accessed by turning onto a dirt path from the main gravel-paved road. Just prior to reaching a spot even with the trees, a dirt path takes off to the left (east) and winds to a point near the trees. An indistinct vehicle path again bears left toward the trees and terminates in the grove. The three tubes comprising **Site 84** are near rivers edge about 150 ft from the crest of the bank and tree grove.
85		**Site 85** is located ~2,000 ft downriver of **Site 84**. The site is reached by continuing along the main river road for about 1,800 ft Here, a dirt road bears off the main road and trends in a southeasterly direction. After another 200 ft, flagging in roadside bushes marks a turnout to **Site 85**. Turn left at the flagging and continue east for ~750 ft along the vehicle path leading to the river's edge. Three tubes installed in one hole are located in the thick, high grass near the river.
86		**Site 86** is located another 2,000 ft downriver of **Site 85**, and is accessed from the same dirt road as was used for Site 85. Continue along it for ~1,000 ft, where flagging in the vegetation indicates an indistinct vehicle path. This road bears straight for about 1,000 ft, where it turns to the left (east). After another 300 ft, the path again turns left (north) and ends by several trees in the lee of the riverbank. The three tubes at **Site 86** are located behind the northernmost trees.
87		Not installed.

APPENDIX C

INSTALLATION WORKING TABLE

Map Number or Surrogate Site	Operable Unit	Hanford River Mile	Installed/Sampled	Deep Port Tube Indent.	Installed/Sampled	Mid-Depth Port Tube Ident.	Installed/Sampled	Shallow Port Tube Id	Winterized	GPS Coordinates	Planned/Actual Equipment	Cultural Resource Constraints	Ecological Constraints	Radiological Constraints	Purgewater Containment	Reason for Containment	Analysis: Tube Most Representative of Groundwater	Installation comments	Field Reconnaissance Notes	Logistics Rank	Information Need Rank	Nearby Sampling Site	Potential Contaminants	Schedule Priority
1	BC5	2.62	Xny	B8113	Xsc	B8114	X	B8115	yes	yes	GP						Beta, H3		Flat	Easy	Low			9
2	BC5	2.98	o	B8116	Xny	B8117	Xsc	B8118	yes	yes	GP						Beta, H3		Flat	Easy	Low			9
3	BC5	3.40	Xsc	B8119	Xsc	B8120	o	B8121	yes	yes	GP						Beta, H3		Flat	Easy	Low	199-B2-13	Cr	9
4	BC5	3.75	Xsc	B8122	Xsc	B8123	Xsc	B8124	yes	yes	GP			RCT			Beta, H3		Road to shore, bank steep	Easy	Med	SB-038-3	Cr	4
5	BC5	3.95	Xsc	B8125	Xsc	B8126	Xsc	B8127	yes	yes	GP			RCT			Beta, H3		Road to shore, bank steep	Easy	Med	SB-039-2	Cr, Sr	4
6	BC5	4.15	Xsc	B8128	Xsc	B8129	Xsc	B8130	yes	yes	GP			RCT	Yes	Cr, Sr	Beta, H3		Drive on shore, bank steep	Easy	Med	199-B3-47	Cr, Sr	4
7	BC5	4.35	Xsc	B8131	Xsc	B8132	o	B8133		yes	HC			RCT	Yes	Cr, Sr	Beta, H3		Bank steep	Mod	Med	199-B3-1	Cr, Sr	4
8	BC5	4.52	o	B8134	o	B8135	o	B8136			Rhino			RCT	Yes	Cr, Sr	Beta, H3	Inaccessible; cave-in potential	Bank steep	Mod	Med	199-B3-46	Cr, Sr	4
9	BC5	4.70	o	B8137	o	B8138	o	B8139			Rhino						Beta, H3		Bank steep	Mod	Med		Cr, Sr	4
10	BC5	4.88	o	B8140	o	B8141	o	B8142			HC						Beta, H3	Eight refusals on 10/28/97; abandoned site	Bank steep	Easy	Low			4
11	BC5	5.26	Xsc	B8143	o	B8144	o	B8145	yes	yes	HC						Beta, H3		Drive upriver from HIP	Easy	Low			9
12	BC5	5.45	Xsc	B8146	o	B8147	o	B8148	yes	yes	HC						Beta, H3			Easy	Low			9
13	KR4	5.70	Xny	B8149	o	B8150	Xsc	B8151	yes		GP	CRS					Beta, H3			Easy	Low			9
14	KR4	5.98	Xsc	B8152	Xsc	B8153	Xsc	B8154			GP	CRS	Eagle				Beta, H3		~~Drive on shore~~	Diff	Low			9
15	KR4	6.10	o	B8155	Xsc	B8156	o	B8157			GP	CRS	Eagle	RCT			Beta, H3; C14		~~Drive on shore~~	Diff	Med	199-K-31	Cr, NO3, H3, C14	9
16	KR4	6.30	o	B8158	o	B8159	o	B8160			Rhino	CRS	Eagle	RCT	Yes	C14	Beta, H3; C14	Inaccessible; cultural resources	Access through fence, rad zone	Diff	Med	199-K-33	Cr, NO3, H3, C14	9
17	KR4	6.50	Xsc	B8161	Xsc	B8162	o	B8201	yes		HC	CRS		RCT	Yes	C14	Beta, H3; C14		Access through fence, rad zone	Diff	Med		Cr, NO3, H3, C14	9
18	KR4	6.70	o	B8202	o	B8203	Xsc	B8204	yes		GP	CRS		RCT	Yes	Cr	Beta, H3		~~Drive on shore if <100,000 cfs~~	Diff	Med	199-K-32A	Cr, NO3, H3	9
19	KR4	6.86	Xsc	B8205	Xsa	B8206	o	B8207		yes	HC	CRS			Yes	Cr	Beta, H3		~~Drive on shore if <100,000 cfs~~	Diff	High		Cr, NO3, H3	3
20	KR4	7.05	o	B8208	o	B8209	o	B8210			Rhino	CRS			Yes	Cr	Beta, H3	Inaccessible; cultural resources	~~Drive on shore if <100,000 cfs~~	Diff	High	199-K-18	Cr, NO3, H3, Sr	3
21	KR4	7.25	o	B8211	Xsc	B8212	Xsa	B8213		yes	HC	CRS			Yes	Cr	Beta, H3; Sr		~~Drive on shore if <100,000 cfs~~	Diff	High	199-K-20	Cr. NO3, H3, Sr	3
22	KR4	7.48	Xsc	B8214	Xsc	B8215	o	B8216	yes	yes	HC	CRS			Yes	Cr	Beta, H3; Sr			Diff	High	SK-077-1	Cr, Sr	3
23	KR4	7.67	Xsc	B8217	Xsc	B8218	o	B8219		yes	HC	CRS			Yes	Cr	Beta, H3; Sr			Diff	High	199-K-22	Cr, Sr	3
24	KR4	7.90	o	B8220	o	B8221	o	B8222		yes	Rhino	CRS			Yes	Cr	Beta, H3	Inaccessible; cultural resources		Diff	High	199-K-37	Cr	3
25	NR2	8.30	Xsc	B8223	o	B8224	o	B8225	yes	yes	HC				Yes	Cr	Beta, H3			Easy	Low	SK-082-1		9
26	NR2	8.48	Xsc	B8226	Xsc	B8227	Xsc	B8228	yes	yes	HC	CRS		RCT			Beta, H3			Easy	Low			9
27	NR2	8.67	o	B8229	o	B8230	o	B8231			Rhino			RCT			Beta, H3		From N water intake area	Mod	Low	199-N-26		10
28	NR2	8.85	o	B8232	o	B8233	o	B8234			Geoprobe			RCT	Yes	Sr	Beta, H3; Sr	surface contamination area	From top of bluff/sheet pile road	Easy	High	SN-090-1	NO3, SO4, H3, Sr	10
29	NR2	9.00	o	B8235	o	B8236	o	B8237			Geoprobe			RCT	Yes	Sr	Beta, H3; Sr	surface contamination area	From top of bluff/sheet pile road	Easy	High		NO3, SO4, H3, Sr	10
30	NR2	9.12	o	B8238	o	B8239	o	B8240			Geoprobe			RCT	Yes	Sr	Beta, H3; Sr	surface contamination area	From top of bluff/sheet pile road	Easy	High		NO3, SO4, H3, Sr	10
31	NR2	9.29	o	B8241	o	B8242	o	B8243			Geoprobe			RCT	Yes	Sr	Beta, H3; Sr	surface contamination area	Access from sheet pile road??	Easy	High		H3, Sr	10
32	NR2	9.46	o	B8244	o	B8245	o	B8246			Rhino			RCT	Yes	Sr	Beta, H3			Diff	High	199-N-51	H3, Sr	10
33	NR2	9.53	o	B8247	o	B8248	o	B8249			Rhino			RCT	Yes	Sr	Beta, H3			Diff	High	SN-094-1	H3, Sr	10
34	NR2	9.68	o	B8250	o	B8251	o	B8252			Rhino			RCT	Yes	Cr	Beta, H3			Diff	High		Cr, H3, Sr	10
35	HR3D	10.45	Xny	B8253	Xny	B8254	Xsa	B8255	yes		HC			RCT	Yes	Cr	Beta, H3		From TD-38	Mod	High		Cr, NO3	2
36	HR3D	10.60	Xsc	B8256	Xsc	B8257	Xsc	B8258	yes		HC			RCT	Yes	Cr	Beta, H3			Mod	High		Cr, NO3	2
37	HR3D	10.78	Xny	B8259	Xny	B8260	Xsa	B8261	yes		HC			RCT	Yes	Cr	Beta, H3			Mod	High	199-D5-20	Cr, NO3	2
38	HR3D	10.93	Xsc	B8262	Xsc	B8263	o	B8264	yes		HC			RCT	Yes	Cr	Beta, H3		From TD-17	Mod	High	199-D4-5	Cr, NO3	2
39	HR3D	11.65	Xny	B8265	Xsc	B8266	Xsc	B8267	yes		GP						Beta, H3		<100,000 cfs	Easy	High	699-97-51A	Cr, NO3	2
40	HR3D	12.00	o	B8268	X	B8269	Xsc	B8270	yes		GP						Beta, H3		<100,000 cfs	Easy	Low			2
41	HR3H	13.26	Xsa	B8271	Xsa	B8272	Xny	B8273	yes	yes	HC		Eagle				Beta, H3			Easy	Low			1
42	HR3H	13.69	Xny	B8274	Xsc	B8275	Xsc	B8276		yes	HC	CRS	Eagle				Beta, H3			Easy	Low			1
43	HR3H	14.10	Xsc	B8277	Xsc	B8278	o	B8279		yes	HC		Eagle				Beta, H3		Steep bank	Mod	Med	SH-144-1	Cr	1
44	HR3H	14.30	Xsc	B8280	Xsc	B8281	o	B8282		yes	HC		Eagle				Beta, H3		Steep bank	Mod	Med	SH-145-1	Cr	1
45	HR3H	14.75	Xsc	B8283	Xsc	B8284	Xsc	B8285			GP						Beta, H3			Easy	Med		Cr	1
46	HR3H	15.12	Xsc	B8286	o	B8287	o	B8288		yes	HC			RCT	Yes	Cr, Tc	Beta, H3		Drive on beach	Easy	High	SH-150-1	Cr, NO3	1
47	HR3H	15.27	Xsc	B8289	Xsc	B8290	o	B8291		yes	HC			RCT	Yes	Cr, Tc	Beta, H3			Easy	High	SH-152-1	Cr, NO3, Sr	1
48	HR3H	15.60	Xny	B8292	Xsc	B8293	Xsc	B8294	yes	yes	GP	CRS		RCT	Yes	Cr, Sr	Beta, H3		Inside channel	Easy	Med		Cr, NO3, Sr	1
49	HR3H	15.78	Xsc	B8295	Xsc	B8296	X	B8297	yes	yes	GP						Beta, H3			Easy	High		Cr, NO3, Sr	1

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Map Number or Surrogate Site	Operable Unit	Hanford River Mile	Installed/Sampled	Deep Port Tube Indent.	Installed/Sampled	Mid-Depth Port Tube Ident.	Installed/Sampled	Shallow Port Tube Id	Winterized	GPS Coordinates	Planned/Actual Equipment	Cultural Resource Constraints	Ecological Constraints	Radiological Constraints	Purgewater Containment	Reason for Containment	Analysis: Tube Most Representative of Groundwater	Installation comments	Field Reconnaissance Notes	Logistics Rank	Information Need Rank	Nearby Sampling Site	Potential Contaminants	Schedule Priority
50	HR3H	15.79	Xny	B8298	Xsc	B8299	Xsc	B8300	yes	yes	GP						Beta, H3		Inside channel	Easy	Med		Cr, Sr	1
51	HR3H	15.93	Xsc	B8301	Xsc	B8302	Xsc	B8303	yes	yes	GP						Beta, H3		Inside channel	Easy	Med		Cr, Sr	6
52	HR3H	16.20	Xsc	B8304	Xsc	B8305	Xsc	B8306	yes	yes	GP		Eagle				Beta, H3		Inside channel	Easy	Med		Cr, Sr	6
53	HR3H	16.36	X	B8307	X	B8308	X	B8309	yes	yes	GP		Eagle				Beta, H3		Flow <150,000 cfs	Easy	Low		Cr, Sr	6
54	HR3H	16.40	Xsc	B8310	Xsc	B8311	Xsc	B8312	yes	yes	GP		Eagle				Beta, H3		Inside channel	Easy	Med		Cr, Sr	6
55	HR3H	16.67	Xny	B8313	Xny	B8314	Xsc	B8315	yes	yes	GP		Eagle				Beta, H3		Inside channel	Easy	Low		Cr, Sr	6
56	HR3H	16.83	o	B8316	o	B8317	o	B8318			Geoprobe		Eagle				Beta, H3		Inside channel	Easy	Low			6
57	HR3H	17.02	X	B8319	X	B8320	X	B8321	yes		GP		Eagle				Beta, H3		Flow <150,000 cfs	Easy	Low			6
58	HR3H	17.22	Xsc	B8322	Xsc	B8323	Xsc	B8324	yes	yes	HC		Eagle				Beta, H3		Inside channel; steep bank	Mod	Low			6
59	HR3H	17.34	Xsc	B8325	Xsc	B8326	Xsc	B8327	yes	yes	HC		Eagle				Beta, H3		Steep bank, inside channel	Mod	Low			6
60	HR3H	17.71	Xny	B8328	Xsc	B8329	Xsc	B8330			GP		Eagle				Beta, H3		White Bluffs ferry/marina	Easy	Low			6
61	FR3	18.10	Xsc	B8331	Xsa	B8332	Xsa	B8333	yes	yes	HC		Eagle	RCT			Beta, H3	Initial B8333 on 10/13 by Geoprobe abandoned		Easy	Low			6
62	FR3	18.43	Xny	B8334	Xsc	B8335	Xsa	B8336	yes	yes	HC			RCT			Beta, H3			Mod	Low		NO3	6
63	FR3	18.78	Xny	B8337	Xsc	B8338	Xsc	B8339	yes		HC			RCT			Beta, H3		Steep	Mod	Med	SF-187-1	NO3	5
64	FR3	18.95	Xsc	B8340	Xsc	B8341	Xsc	B8342	yes		HC			RCT			Beta, H3		Steep	Mod	Med	199-F5-44	NO3, Sr	5
65	FR3	19.10	Xny	B8343	Xsa	B8344	Xsa	B8345	yes		HC			RCT	Yes	Sr	Beta, H3		Steep	Mod	Med	SF-190-4	NO3, Sr	5
66	FR3	19.30	Xsc	B8346	Xsc	B8347	Xsc	B8348	yes		GP				Yes	Sr	Beta, H3		Inside channel	Easy	Med	199-F6-1	NO3, H3, Sr	5
67	FR3	19.60	Xny	B8349	X	B8350	Xsc	B8351	yes		GP						Beta, H3		Inside channel	Easy	Med		NO3, H3, Sr	5
68	FR3	19.70	X	B8352	X	B8353	Xsc	B8354	yes		GP						Beta, H3		Inside channel	Easy	Med		NO3, H3, Sr	5
69	FR3	19.75	Xny	B8355	Xsc	B8356	o	B8357	yes		GP						Beta, H3		Flow <150,000 cfs	Easy	Med		NO3, H3, Sr	5
70	FR3	19.96	X	B8358	Xsc	B8359	Xsc	B8360	yes		GP						Beta, H3		Inside channel	Easy	Med		NO3, H3, Sr	5
71	FR3	20.13	Xsc	B8361	o	B8362	o	B8363			HC						Beta, H3		Sand dunes, inside channel	Mod	Med		NO3, H3, Sr	5
72	FR3	20.40	Xsc	B8364	Xsc	B8365	Xsc	B8366	yes?	yes	HC		Eagle				Beta, H3		Inside channel;steep bank	Mod	Med		NO3, H3, Sr	5
73	FR3	20.57	Xsc	B8367	Xsc	B8368	Xsc	B8369		yes	HC		Eagle				Beta, H3		Inside channel	Mod	Med		NO3, H3, Sr	7
74	FR3	20.82	Xsc	B8370	Xsc	B8371	Xsc	B8372	yes	yes	HC		Eagle				Beta, H3		Inside channel; steep bank	Mod	Med		NO3, H3, Sr	7
75	FR3	20.98	Xsc	B8373	Xsc	B8374	Xsc	B8375	yes	yes	HC		Eagle				Beta, H3		Steep; inside channel	Mod	Med	SF-207-1	NO3, H3, Sr	7
76	FR3	21.50	Xsc	B8376	Xsc	B8377	Xsc	B8378	yes	yes	HC		Eagle				Beta, H3		Drive on beach	Easy	Med	SF-211-1	NO3, H3, Sr	7
77	FR3	21.80	Xsc	B8379	Xsc	B8380	Xsc	B8381		yes	GP		Eagle				Beta, H3			Easy	Med		NO3	7
78	FR3	22.30	Xny	B8382	Xsc	B8383	Xsc	B8384		yes	GP	CRS	Eagle				Beta, H3			Easy	Med	SF-213-1	NO3	7
79	FR3	22.70	o	B8385	o	B8386	o	B8387			HC						Beta, H3	Seven refusals on 9/23/97; abandoned site		Easy	Med	SF-216-1	NO3	7
80	FR3	23.08	Xsc	B8388	Xsa	B8389	Xo	B8390	yes	yes	HC						Beta, H3	80-S pulled out by animal	<150,000 cfs	Easy	Med		NO3	7
81	HAN	25.20	Xny	B8391	Xsc	B8392	Xsc	B8393	yes		GP						Beta, H3		Drive on beach	Easy	Med	HAN-241-1	NO3	8
82	HAN	25.85	o	B8394	Xny	B8395	Xsc	B8396	yes	yes	GP		Eagle				Beta, H3		Old ferry road	Easy	Med		NO3, H3	8
83	HAN	26.66	Xny	B8397	o	B8398	o	B8399	yes	yes	HC		Eagle				Beta, H3			Easy	Med		NO3, H3	8
84	HAN	27.40	Xsa	B8400	Xsa	B8401	Xsa	B8402	yes		HC	CRS					Beta, H3			Easy	Med		NO3, H3	8
85	HAN	27.79	Xsa	B8403	Xsa	B8404	Xsa	B8405			GP						Beta, H3			Easy	Med		NO3, H3	8
86	HAN	28.14	Xsc	B8406	Xsc	B8407	Xsc	B8408	yes		HC	CRS					Beta, H3			Easy	Med		NO3, H3	8
87	HAN	28.60	o	B8409	o	B8410	o	B8411			Geoprobe						Beta, H3			Easy	Med		NO3, H3	8
199-N-92A	NR2	9.38				A9878					Pump				Yes	Sr	Beta, H3; Sr				High		H3, Sr	10.1
199-N-94A	NR2	9.20				A9880					Pump				Yes	Sr	Beta, H3; Sr				High		NO3, SO4, H3, Sr	10.1
199-N-96A	NR2	8.95				A9882					Pump				Yes	Sr	Beta, H3; Sr				High		NO3, SO4, H3, Sr	10.1
DD-06-#	HR3D	11.51		B8465(-3)		B8464(-2)					Pump						Beta, H3				High		Cr, NO3	2.1
DD-10-#	HR3D	11.30		B8468(-4)							Pump						Beta, H3				High		Cr, NO3	2.1
DD-15-#	HR3D	11.15		B8474(-4)		B8473(-3)		B8472(-2)			Pump				Yes	Cr	Beta, H3				High		Cr, NO3	2.1
DD-39-#	HR3D	10.19	Xny	B8482(-4)	Xsc	B8481(-3)	Xsc	B8480(-2)			Pump				Yes	Cr	Beta, H3				High		Cr, NO3	2.1
DD-39-1	HR3D	10.19					Xsc	B8479(-1)			Pump				Yes	Cr	Beta, H3							
DD-44-#	HR3D	10.00	Xsc	B8510(-4)	Xsc	B8509(-3)					Pump				Yes	Cr	Beta, H3				High		Cr, NO3	2.1
DD-50-#	HR3D	9.83	Xsa	B8518(-4)	Xsa	B8517(-3)	Xsa	B8516(-2)			Pump				Yes	Cr	Beta, H3				High		Cr, NO3	2.1
DD-50-1	HR3D	9.83					Xsa	B8515(-1)			Pump				Yes	Cr	Beta, H3				High		Cr, NO3	2.1

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DH-14-1	HR3H	14.93						B8519(-1)			Pump						Beta, H3				Med		Cr, NO3	1.1
DH-14-11	HR3H	14.93						B8520(-11)			Pump						Beta, H3				Med		Cr, NO3	1.1
DH-1451-1	HR3H	14.52						B8521(-1)			Pump		Eagle				Beta, H3		Steep bank		Med		Cr	1.1
DH-1452-1	HR3H	14.52						B8522(-1)			Pump		Eagle				Beta, H3		Steep bank		Med		Cr	1.1
DH-22-#	HR3H	15.45		B8525(-3)		B8524(-2)		B8523(-1)			Pump				Yes	Cr, Sr	Beta, H3				High		Cr, NO3, Sr	1.1
DK-04-#	KR4	8.10				B8527(-3)		B8526(-2)			Pump				Yes	Cr	Beta, H3				High		Cr	9.1

Installation codes: X = installed; Xsa = initial sampling attempted, cond. <200; Xsc = initial sampling complete; Xny = insufficient yield to sample; o = removed from project (see "Installation comment")

Contaminant abbreviations: Cr = hexavalent chromium; Sr = radioactive strontium; Tc = technetium-99; C14 = carbon-14; H3 = tritium

Note: Hexavalent chromium, nitrate, specific conductance, pH, and temperature are measured for all samples collected

CRS = Cultural Resources Specialist required

GPS = global positioning survey

RCT. = Radiological Control Technician required