

STRATUS CONSULTING

**Hanford Site Natural Resource
Damage Assessment Data
Management Report**

Prepared for:

Hanford Natural Resource Trustees:

Confederated Tribes and Bands of the Yakama Nation,
Confederated Tribes of the Umatilla Indian Reservation,
National Oceanic and Atmospheric Administration,
Nez Perce Tribe, State of Oregon, State of Washington,
U.S. Department of Energy, U.S. Fish and Wildlife Service

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U.S. Department of Energy
U.S. Fish and Wildlife Service

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Acronyms and Abbreviations

| | |
|--------|---|
| BERA | baseline ecological risk assessment |
| CAD | computer-aided design |
| CD | compact disk |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CHPRC | CH2M HILL Plateau Remediation Company |
| CRC | Columbia River Component |
| CRITFC | Columbia River Inter-Tribal Fish Commission |
| CSM | conceptual site model |
| DDRS | Declassified Document Retrieval System |
| DOE | U.S. Department of Energy |
| EIS | environmental impact statement |
| EPA | U.S. Environmental Protection Agency |
| ETDE | Energy Technology Data Exchange |
| EVSDS | Effluent Volume to Soil Disposal Sites |
| FY | fiscal year |
| GIS | geographic information system |
| HEDR | Hanford Environmental Dose Reconstruction |
| HEIS | Hanford Environmental Information System |
| HGIS | Hanford Geographic Information System |
| HLAN | Hanford local area network |
| HWIS | Hanford Well Information System |
| HWLVN | Hanford Water Level Network Viewer |
| IDMS | integrated document management system |
| LBL | Lawrence Berkeley Laboratory |
| MIS | Management Information System |
| NOAA | National Oceanic and Atmospheric Administration |
| NRDA | natural resource damage assessment |
| NWIS | National Water Information System |

| | |
|-------|---|
| ORP | Office of River Protection |
| OSTI | Office of Science and Technical Information |
| OUO | official use only |
| PDF | Portable Document Format |
| PNNL | Pacific Northwest National Laboratory |
| POC | point of contact |
| QA/QC | quality assurance/quality control |
| RCRA | Resource Conservation and Recovery Act |
| RFQ | Request for Quotation |
| RHA | Records Holding Area |
| RI | Remedial Investigation |
| RL | Richland Operations |
| ROD | Record of Decision |
| SQL | Structured Query Language |
| TPA | Tri-Party Agreement |
| TSCA | Toxics Substance Control Act |
| TWG | technical working group |
| TWINS | Tank Waste Information Network System |
| USGS | U.S. Geological Survey |
| WCH | Washington Closure Hanford |
| WIDL | Well Information and Document Lookup |
| WIDS | Waste Information Data System |

1. Introduction

Over many years of active operations and remedial activities, a substantial quantity of environmental documentation and data has been gathered at the Hanford Site (the Site). These existing documents and data serve as important sources of information that can be used to aid in evaluating natural resource injuries. This document provides an introduction to some of these data sources, discusses procedures for a systematic data review, and presents recommendations for future data and document management.

The conceptual site model (CSM) for the Hanford natural resource damage assessment (NRDA) identifies over 200 individual documents and sources of information that are potentially useful for assessing natural resource injuries at the Site. Bibliographic references were organized into individual CSMs relevant to aspects of the NRDA process (Figure 1). This report builds upon the informational structure presented in the CSM.

Data prioritization can be an important aspect of injury assessment at large, complex waste sites. Priority data for assessing natural resource injuries generally include concentrations of hazardous substances in environmental media (e.g., soils, sediment, surface water, groundwater) and information necessary to evaluate potential adverse effects to natural resources and services. Information that may be less useful for evaluating natural resource injuries might include comprehensive inventories of hazardous substances produced or stored on-site but not released into the environment.

At Hanford, the U.S. Department of Energy (DOE) maintains multiple warehouses of historical documents, with hundreds of thousands of documents stored in each warehouse. The Hanford environmental databases contain many millions of records. Compiling all environmental data from all locations and all time periods would be a huge task at this Site. It is not likely that such an effort would increase the Trustees' understanding of natural resource injuries, and it could substantially delay the assessment process. Consequently, the data resources presented in this document focus on sources that we believe are most likely to help the Trustees evaluate natural resource injuries efficiently.

The remainder of this document is organized as follows: Section 2 presents an overview of existing sources of environmental information, documents, and data. Section 3 summarizes ongoing and future environmental studies at the Site and discusses a process by which the Trustees may obtain the new data collected for these studies. Finally, Section 4 presents recommendations for the handling of documents and data as part of the assessment of natural resource injuries at the Site. Section 4 also outlines a proposed procedure for systematic review of the environmental data.

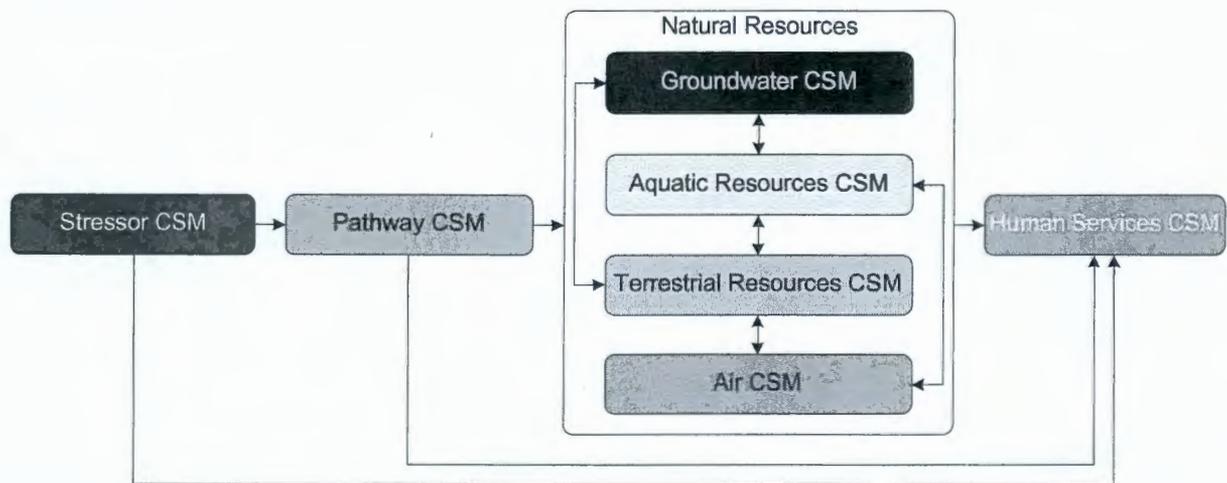


Figure 1. General organizational framework of the Hanford natural resources injury assessment CSM.

2. Existing Data Sources

This section discusses existing sources of data. Section 2.1 discusses Hanford documents and data that are publicly available. Section 2.2 then discusses DOE environmental data that have not been released to the public but may be made available to the Trustees or to designated Trustee points of contact (POCs) for the purpose of evaluating natural resource injuries.

2.1 Public Sources

For many years, DOE contractors have collected Hanford environmental data and published the results in publicly released documents. Battelle's Pacific Northwest National Laboratory (PNNL) conducted and published many of these studies. In recent years, Washington Closure Hanford (WCH) has published studies of environmental contaminants in the Columbia River and along the river corridor at the Site. Many of these documents are available in Adobe Portable Document Format (PDF) on public websites. In addition, both WCH and CH2M HILL Plateau Remediation Company (CHPRC) have published electronic databases containing large quantities of Hanford environmental data.

2.1.1 Websites containing Hanford documents

Several key websites contain documents that are potentially useful for evaluating natural resource injuries, including websites with searchable databases and websites that simply provide hyperlinks to PDF documents. The DOE Office of Science and Technical Information (OSTI) maintains or provides documents to at least three searchable databases. However, we have found that the overlap between these databases is incomplete, so one often must search all three to find a specific document.

The databases listed below allow users to search for Hanford documents by author, title, or keyword. Results are typically downloadable documents in PDF format. The databases contain many thousands of documents; determining which documents within these databases contain environmental data that will help the Trustees evaluate injury is a task for the next phase in the injury assessment process.

Searchable online databases containing Hanford documents

PNNL Library

The PNNL library contains documents published since 1998 by PNNL staff or by external researchers using PNNL facilities. This database contains many documents with environmental data that are helpful for injury assessment.

<http://www.pnl.gov/publications/>

Tri-Party Agreement (TPA) Administrative Record and Public Information Record

The TPA library contains documents produced under the TPA that are in the public information record or administrative record. This includes DOE work plans and other documents released for public review, as well as the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Resource Conservation and Recovery Act (RCRA) documents containing environmental data.

<http://www5.hanford.gov/arpir/>

DOE OSTI sites

DOE Energy Citations Database: Free access to over 2.3 million science research citations and over 209,000 electronic documents, from 1943 forward. This database contains several DOE documents summarizing environmental data collected at the Site.

<http://www.osti.gov/energycitations/>

DOE Science and Technology Information Bridge: Free public access to over 200,000 full-text documents and bibliographic citations of DOE research report literature, primarily from 1991

forward. This database also contains several DOE documents summarizing environmental data collected at the Site.

<http://www.osti.gov/bridge/>

Energy Technology Data Exchange (ETDE)¹: Internet tool for disseminating energy research and technology information collected as part of an international energy information exchange. This database appears to contain more Hanford documents than the other OSTI databases.

<http://www.etde.org/etdeweb/>

Hanford Declassified Document Retrieval System (DDRS)

The DDRS contains declassified Hanford documents and over 77,000 declassified photographs of early Hanford (1943-1960). Some documents contain historical environmental data, particularly from the 1950s.

<http://www5.hanford.gov/ddrs/index.cfm>

Websites with downloadable documents

U.S. Environmental Protection Agency (EPA) Region 10 sites

The Federal Facility RCRA/Toxics Substance Control Act (TSCA) cleanup activities website contains documents related to RCRA facilities at the Site, including in particular the tank farms on the plateau.

<http://yosemite.epa.gov/R10/OWCM.NSF/webpage/Hanford+Federal+Facility+RCRA+and+TSCA+Cleanup+Activities?OpenDocument>

The Hanford CERCLA website contains documents related to the cleanup of the 100, 200, 300, and 1100 Areas CERCLA sites, including five year reviews that summarize environmental data from the Site.

<http://yosemite.epa.gov/r10/cleanup.nsf/9f3c21896330b4898825687b007a0f33/2f133ac95a7d2684882564ff0078b367?OpenDocument>

The Mid-Columbia River website includes environmental studies conducted in the Columbia River between Grand Coulee Dam and Bonneville Dam, as well studies conducted in major tributaries to that reach of the Columbia.

<http://yosemite.epa.gov/r10/ecocomm.nsf/34090d07b77d50bd88256b79006529e8/1462d20f2774a259882571d4006ba346!OpenDocument>

1. Requires username and password. U.S. residents are allowed access free of charge, after registering and waiting for verification. We obtained a username and password less than 24 hours after submitting a request.

Hanford contractor sites

The WCH River Corridor Closure library contains the work plans and data gap analyses for the river corridor closure Remedial Investigation (RI).

http://www.washingtonclosure.com/projects/EndState/risk_library.html

The PNNL Ecological Monitoring and Compliance website contains the annual environmental reports for the Site, as well as biological management and compliance plans, and biological studies.

<http://www.pnl.gov/ecomon/documents.asp>

The Hanford Site Groundwater Remediation Project, under contract to CHPRC, contains the integrated groundwater and vadose zone management plan.

<http://www.hanford.gov/cp/gpp/index.cfm>

Other sites

The Washington Department of Ecology Nuclear Waste Program website provides summaries of Hanford history, tank waste information, groundwater and surface water programs, as well as links to other sites and documents that contain more in-depth analyses.

<http://www.ecy.wa.gov/programs/nwp/>

The Columbia River Inter-Tribal Fish Commission (CRITFC) is a joint fisheries management commission of the Yakama Nation and the Nez Perce, Umatilla, and Warm Springs tribes. The website contains links to several scientific papers related to Columbia River fisheries, as well as details of salmon restoration projects.

<http://www.critfc.org/>

The Washington Department of Health Hanford Health Information Network website, although no longer active, contains archived information on the history of Site releases of hazardous substances and a timeline of major milestones at the Site.

<http://www.doh.wa.gov/hanford/publications/index.html>

Existing compendia of Hanford documents

Ridolfi Inc. produced a Filemaker Pro database containing 1,990 documents that are potentially relevant to the Hanford injury assessment. A stand-alone executable file of this database was included in the Request for Quotations (RFQs) for the Phase I NRDA work; therefore, we assume that the Trustees already have this. Many of the documents included in the Ridolfi Inc. database are available from the online sources shown above; the bibliographic records in the database file indicate that Ridolfi Inc. has an electronic copy of many of the documents. We recommend that the Trustees build upon this existing bibliographic database (see Section 4).

Becker and Gray (1989) compiled abstracts from roughly 500 environmental reports published in the 1980s. These abstracts summarize many documents that are likely to be useful for assessing potential natural resource injuries in the 1980s.

http://www.osti.gov/bridge/product.biblio.jsp?osti_id=6039963

2.1.2 Environmental databases

WCH Columbia River Component database

WCH compiled a compendium of Columbia River studies, performed a quality assurance/quality control (QA/QC) evaluation of the studies, and produced a database containing all the data that they considered to be useful for evaluating the potential impacts of Hanford releases on the Columbia River. These data are likely to be useful for evaluating potential injuries to aquatic resources in the Columbia River (see Chapter 6 of the CSM).

While the text of the RI Work Plan for Hanford Site Releases to the Columbia River (U.S. DOE, 2008) is publicly available from the WCH River Corridor Closure library (see hyperlink in previous section), the Columbia River Component (CRC) database is on a compact disk (CD) that is only available with an original hard copy of the document. Stratus Consulting has a copy of the CRC database CD from the September 2008 final RI work plan. The CD includes the database and accompanying documentation (although the database is dated November 20, 2007). We can make these files available for the Trustees to download upon request.

We have integrated the CRC data into our Hanford geographic information system (GIS) geodatabase. The data included in this database extend from well upstream of Hanford to the Pacific Ocean (Figure 2). In total, the CRC database contains over 22,500 sample records from over 2,170 different sample locations.

CHPRC groundwater data

Hanford contractors have published annual groundwater monitoring reports for many years. These reports contain data that will be useful for investigating potential groundwater injuries at the Site (see Chapter 5 of the CSM) and are available on several of the searchable online database sites described previously. The ETDE website (see previous section) shows annual reports entitled "Hanford Site Groundwater Monitoring Report" dating back to 1996, with earlier reports entitled "Annual Report for RCRA Groundwater Monitoring" dating back to 1988. For most years, the groundwater monitoring data are summarized in PDF documents, with more recent reports including both a short summary report and a large, multiple-appendix tome.



Figure 2. Locations of environmental samples included in the WCH CRC database. Sampled media include soil, groundwater, surface water, sediment, pore water, effluent discharge, and various biota.

For fiscal year (FY) 2007 (Hartman and Webber, 2008) and FY2008 (Hartman et al., 2009), CHPRC managed the release of the annual groundwater reports and included links to download the groundwater data. The reports are now placed on dedicated websites within frames, rather than released as a single large PDF file. Within the dedicated websites for both FY2007 and FY2008 are publicly available links to ZIP files containing over 1.5 million records of current and historical groundwater data for thousands of wells at the Site:

FY2007: http://www.hanford.gov/cp/gpp/library/gwrep07/html/gw07_dta.htm

FY2008: http://www.hanford.gov/cp/gpp/library/gwrep08/html/gw08_dta.htm

Stratus Consulting recreated the groundwater database using the FY2007 files (prior to the March 30, 2009 release of the FY2008 data). The data in the ZIP files were not sufficient for evaluating groundwater injury, most notably because they did not include well locations. We subsequently obtained the well location lookup table from CHPRC (see Section 2.2). To verify that the data are likely to be useful for groundwater injury evaluation, we created example figures that show wells containing detectable concentrations of selected analytes in FY1990 (Figure 3) and FY2007 (Figure 4).

Environmental Dashboard Application (EDA)

The EDA (<http://environet.hanford.gov/eda>) is a publicly accessible query interface to Hanford groundwater and soil data. EDA requires a username and password; DOE provided Stratus Consulting with a login account within two days of submitting our online application. A user manual with screen shots is available to guide the user through the query process (CHPRC, 2009).

The EDA provides access to a complete set of groundwater data, as well as soils data from wells and borings. EDA indicates that there are 10,000 different sample IDs and over 1,500 different analytes available to query. As an example, we ran a query for every tritium sample in groundwater for all wells. EDA returned 48,211 results, with dates ranging from October 1961 to May 2009. We also requested every lead sample in soil borings, and EDA returned over 2,400 results, with dates ranging from June 1989 to May 2009. EDA includes an Export function that provides the queried data as a downloadable comma-delimited text file.

EDA provides several searchable fields, including geographical area, well status, well purpose, and well name. However, there does not appear to be an advanced query interface that would allow one to query using any field, and there is no way for the user to know specifically where a given sample was collected. The EDA may be most useful as a tool for querying and then downloading specific groundwater or soil data that can then be added to an existing database that already has lookup tables for sample IDs and corresponding sample location coordinates.

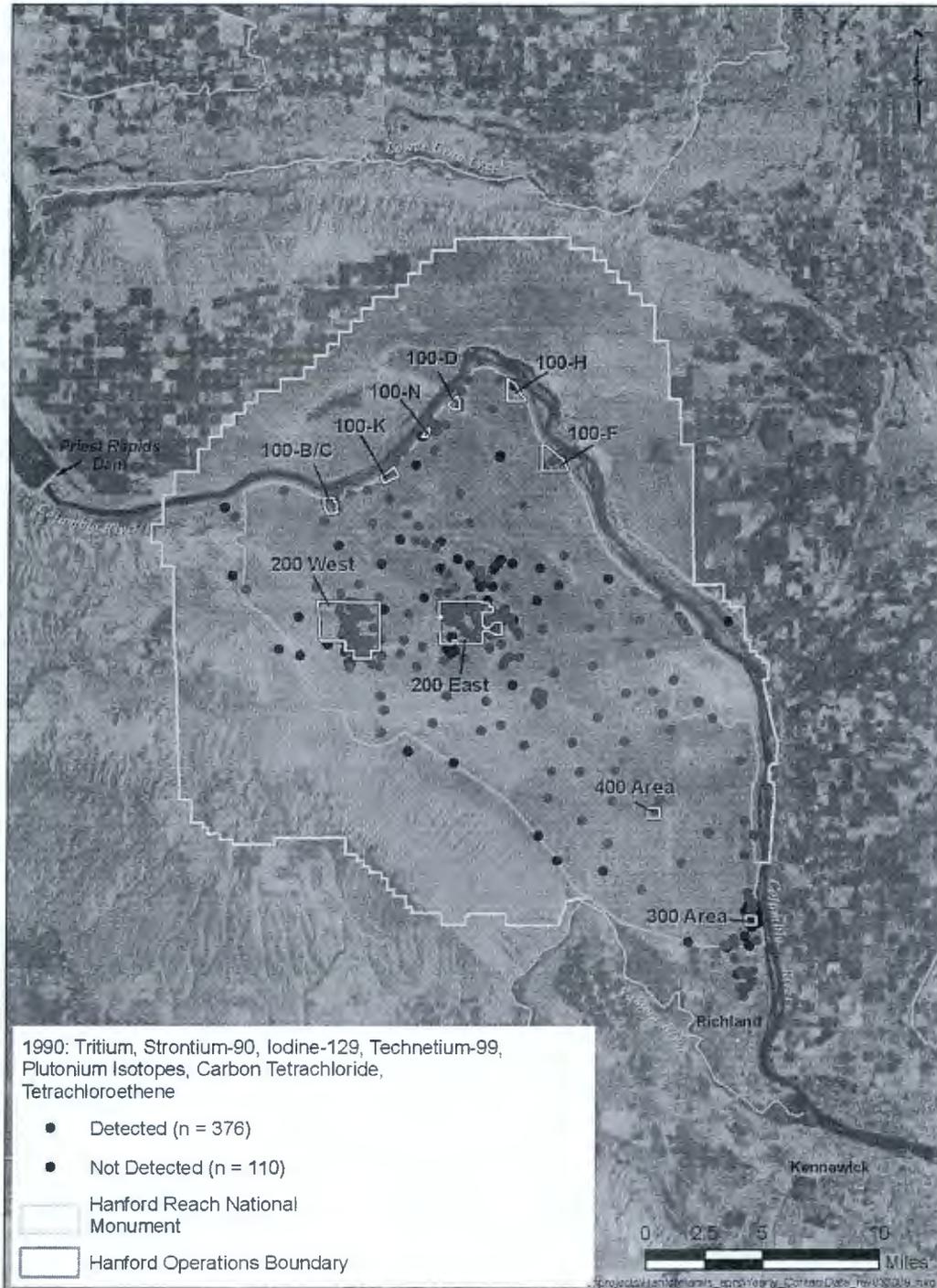


Figure 3. Wells with detectable concentrations of selected analytes in FY1990.

Data source: Rieger, 2008.

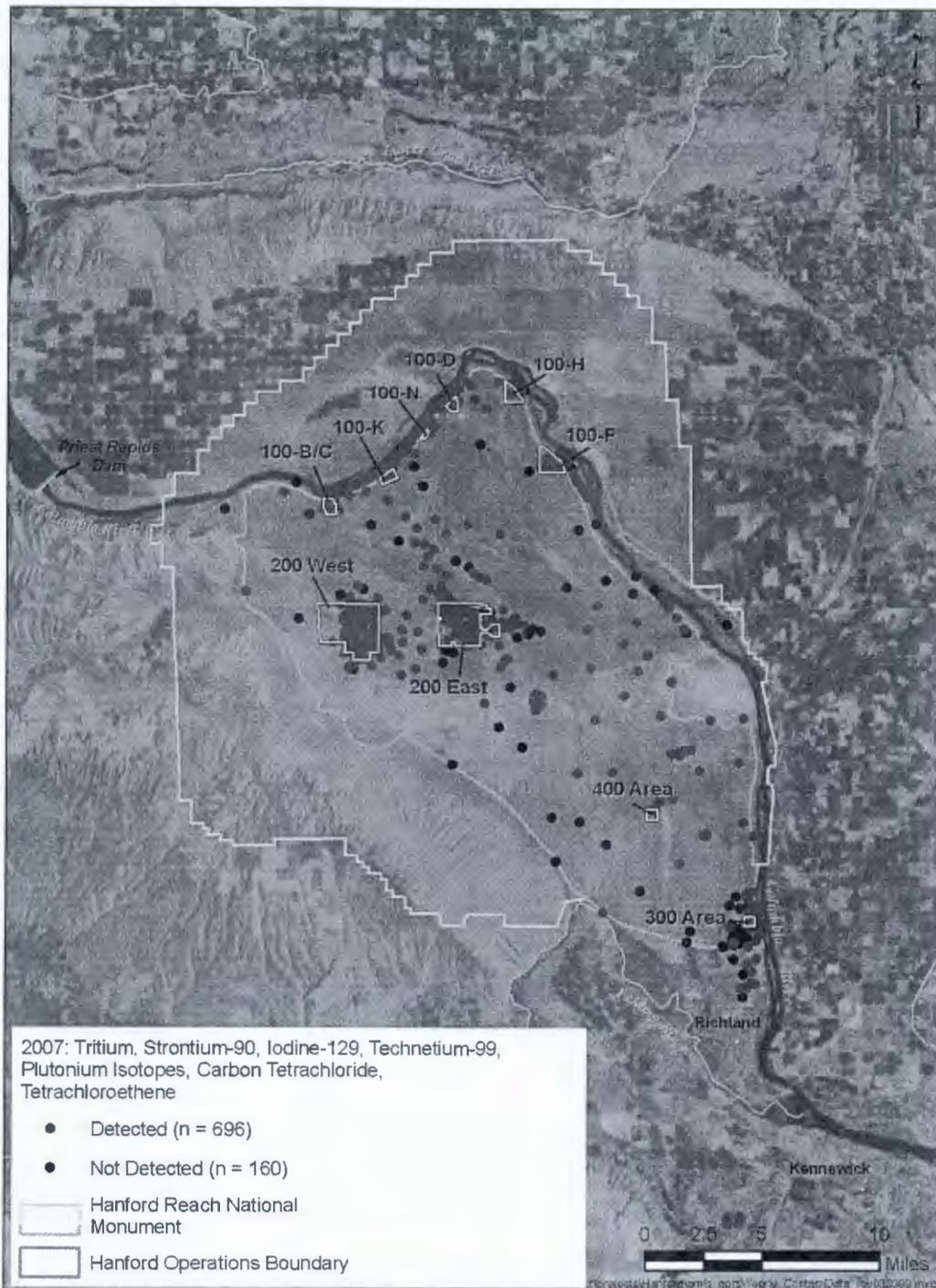


Figure 4. Wells with detectable concentrations of selected analytes in FY2007.

Data source: Rieger, 2008.

2.1.3 Other sources of relevant environmental data

The Hanford Environmental Dose Reconstruction (HEDR) included estimates of the spatial extent of iodine-131 fallout from Hanford releases (see Chapter 7 of the CSM). These estimates relied on an air dispersion model that incorporated wind data and estimates of radionuclide releases based on industrial production records. Lawrence Berkeley Laboratory (LBL) created an online map server that displays estimates of Hanford fallout between 1945 and 1951. While this model is nearly 20 years old, it provides at least one quantitative estimate of the spatial extent of Hanford fallout. As discussed in Section 2.2, LBL has provided Stratus Consulting with the GIS data files underlying the online website.

HEDR contaminant plume viewer
<http://cedrgis2.lbl.gov/Hanford/viewer.htm>

Other sources of environmental data include online databases that incorporate data from throughout the country, including environmental data from the Columbia River in the vicinity of (and downstream of) the Site:

The EPA STORET and legacy data center databases contain raw biological, chemical, and physical data on surface water and groundwater collected by federal, state, and local agencies, Tribes, volunteer groups, academics, and others.
<http://www.epa.gov/storet/dbtop.html>

The U.S. Geological Survey (USGS) National Water Information System (NWIS) data repository includes both historical and real-time hydrological information, as well as historical water quality data.
<http://waterdata.usgs.gov/nwis>

The National Oceanic and Atmospheric Administration (NOAA) Office of Response and Restoration Query Manager and MARPLOT website contains sediment chemistry, sediment toxicity, and tissue residue data for specific watershed projects, including Portland Harbor/Willamette River specifically, and the Pacific Northwest generally.
<http://response.restoration.noaa.gov/watersheddownloads>

2.1.4 Data sources for geographic information systems

Online resources for obtaining GIS files that assist with geospatial interpretation of Hanford environmental data include:

The U.S. Department of Agriculture, Natural Resources Conservation Service website, containing aerial photographs.

<http://datagateway.nrcs.usda.gov/GatewayHome.html>

The USGS website, containing digital elevation models.

<http://seamless.usgs.gov/index.php>

The USGS National Hydrography Dataset, containing surface water features.

<http://nhd.usgs.gov/data.html>

The State of Washington geospatial clearinghouse, containing a searchable database of Washington State GIS files.

<http://wa-node.gis.washington.edu/>

2.2 Official Use Only Data Sources

DOE and its Hanford contractors maintain large databases of environmental data and documents. These databases contain information relevant to most aspects of the natural resource injury assessment as discussed in the CSM, including the assessment of sources (Chapter 3 of the CSM) and pathways (Chapter 4), as well as potential injuries to groundwater and vadose soils (Chapter 5), aquatic resources (Chapter 6), terrestrial resources (Chapter 7), and air resources (Chapter 8). However, many of these documents and data are designated as official use only (OUO) and thus are only available to individuals who have a Hanford badge, an account on the Hanford local area network (HLAN), and specific permission from DOE. However, it is likely that the vast majority of these documents and data may not need to be deemed OUO. Section 4 presents data management recommendations for the Trustees, including a suggestion that DOE provide relevant environmental data to the Trustees for independent review.

We simulated the initial steps that might be taken to review existing data for an injury assessment, to evaluate the likely availability of data behind the Hanford firewall. To that end, we first completed requisite training and received a badge and an account on the HLAN (including remote access). We subsequently attempted to access data that would likely be relevant for injury assessment, and we evaluated the level of cooperation from other Hanford contractors who have access to data that were not otherwise available on the HLAN. As badged and approved contractors, we were able to successfully obtain nearly all the data and documents

that we requested (although we were not granted access to draft contractor documents prior to public release). DOE may not grant this level of access to all Trustees. As discussed in Section 4, we recommend that the Trustees establish a dialog with DOE to obtain as much of the environmental data as possible, and they should consider designating one or more specific POCs who will have access to documents and data that DOE determines to be OUO.

2.2.1 Hanford environmental data

The vast majority of Hanford environmental data are contained with the Hanford Environmental Information System (HEIS). HEIS data are likely to be the most important for assessing natural resource injuries. In this section, we review several other DOE databases in addition to HEIS, but these other databases are less likely to contain the types of environmental data that will be most relevant to the assessment of natural resource injuries.

Hanford Environmental Information System

HEIS, currently maintained by CHPRC, contains millions of records of environmental data, including both recent and historical data that been subjected to a QA/QC screening. CHPRC has developed many tools for interacting with HEIS. These tools include a simple query interface (HEIS Lite), a more advanced query interface (Virtual Library), and a map-based interface (QMAP) combining HEIS contaminant data with spatial information from the Hanford Geographic Information System (HGIS). CHPRC also maintains tools that standardize HEIS data entry, pre-process raw data prior to HEIS entry, check for errors in incoming data, and provide specialized narrowly-focused queries for specific tasks. Despite the myriad tools that have been developed, the data underlying these tools reside in HEIS.

As described previously, DOE recently added the EDA to the publicly accessible website. The EDA is also a query interface to HEIS. With both the annual groundwater report zip files (which contain data from HEIS) and the EDA (which queries HEIS in real time) available outside the Hanford firewall, it appears that DOE does not consider HEIS groundwater and soils data to be OUO.

HEIS contains groundwater, surface water, soil, biota, soil gas, and atmospheric contaminant data, as well as other miscellaneous data. HEIS currently contains over 182,000 entries for biota, 185,000 entries for surface water, and over 2.5 million entries for groundwater. Most of the existing query tools focus primarily on groundwater data or groundwater and soils. The most expansive of the query tools allows a query for biota data, but it does not return enough fields for the data to be useful (e.g., there are no fields for species or type of tissue analyzed). CHPRC (Bill Webber, personal communication, June 24, 2009) has expressed a willingness to write custom queries for the Trustee POCs and provide the data retrieved, or to connect the Trustee POCs

directly to HEIS using Access (rather than pre-existing tools) as a front end. This would allow the POCs to construct any custom queries. This advanced HEIS querying should be a priority for the next phase of the NRDA (see Section 4).

Virtual Library/QMAP

The Virtual Library and QMAP are additional tools available within HLAN that access environmental data in HEIS and spatial data in HGIS. QMAP is an GIS map server that accesses HEIS data and creates GIS maps online. A data “clearinghouse” within the Virtual Library and QMAP contains several available GIS layers, including infrastructure, boundaries, transportation corridors, and the identified waste sites in the Waste Information Data System (WIDS). We downloaded and displayed in GIS all of these layers to verify that they contain useful spatial information for evaluating natural resource injury. As with HEIS data, we recommend that DOE structure a process that will allow the Trustees to obtain the data and GIS layers in the clearinghouse.

Other Hanford GIS layers

The QMAP clearinghouse contains a small subset of computer-aided design (CAD) and GIS files that Hanford contractors have developed as part of the ongoing response and remedial activities at the Site. We attempted to obtain additional GIS files from CHPRC and WCH as well. CHPRC was particularly cooperative and responsive to our requests, providing the following GIS data layers shortly after requested:

- ▶ A lookup table containing the locations of nearly 7,900 groundwater wells in the HEIS database (shown in Figure 5)
- ▶ GIS files containing the groundwater contaminant plumes as depicted in the annual groundwater reports for both FY2007 and FY2008 (e.g., Figure 6).

The wells depicted in Figure 5 include some that were planned but never constructed and some that are not monitoring wells and therefore have no associated environmental data. In the next phase of the injury assessment, the Trustees should determine which of these wells contain environmental data that will be useful for assessing potential injuries to groundwater resources (see Chapter 5 of the CSM).



Figure 5. Wells included in the HEIS database. Some wells shown were proposed but never constructed, and some were constructed but have no associated environmental data.

Well location data source: CHPRC, provided to Stratus Consulting on 2/24/2009.

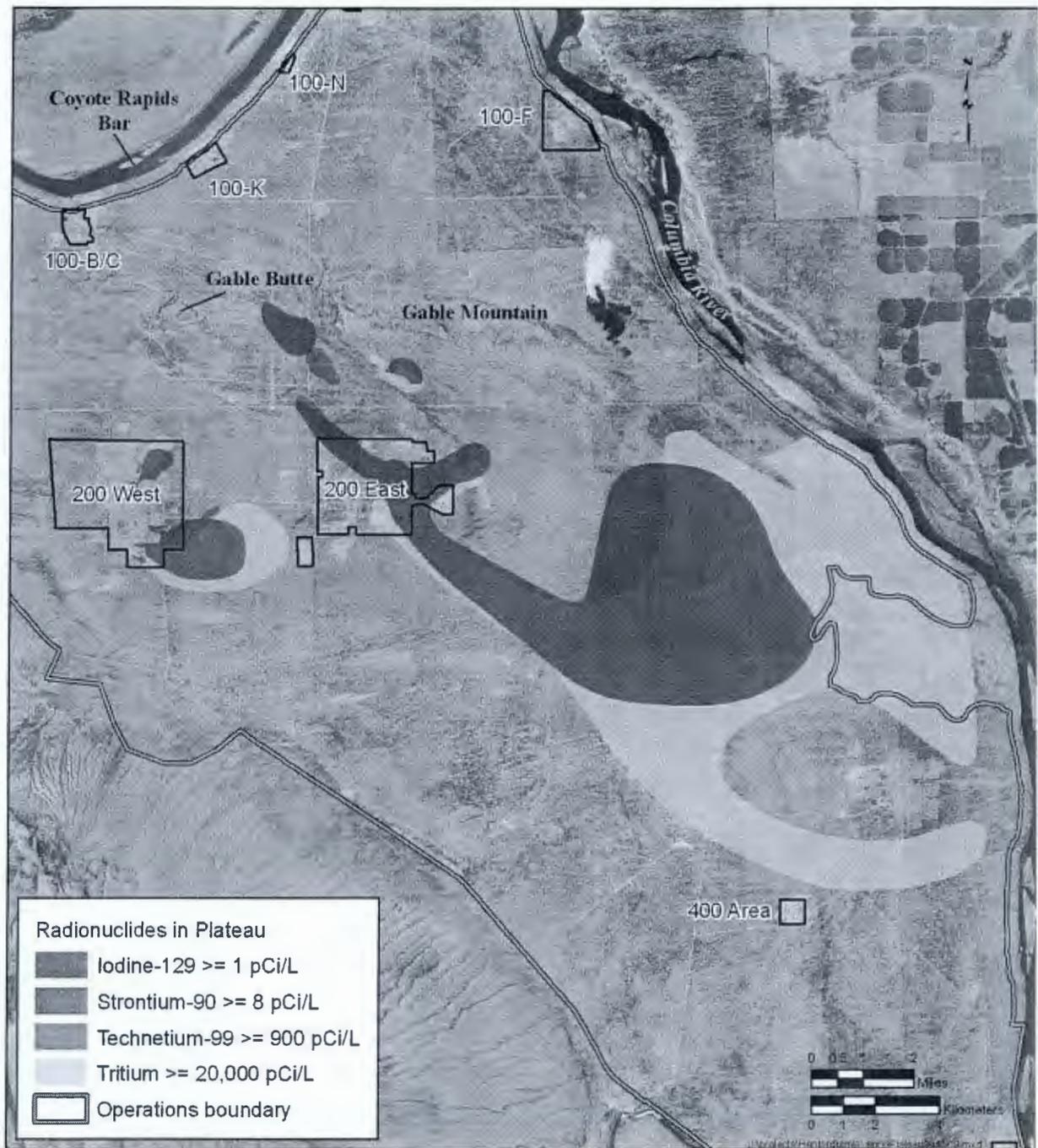


Figure 6. Estimated extent of Central Plateau radionuclide plumes in FY2007, as depicted in the FY2007 annual groundwater report.

Groundwater plume data source: CHPRC, provided to Stratus Consulting on 3/26/2009.

The groundwater plume data layers from the FY2007 annual groundwater report depict the estimated extent of groundwater plumes according to the DOE contractors who contributed to the annual report. Once we obtained these data layers, we created figures in the groundwater CSM (including the figure reproduced here as Figure 6) showing DOE's estimate of the areal extent of groundwater plumes (see Chapter 5 of the CSM).

In addition, we contacted WCH to obtain additional GIS layers that would help with the assessment of natural resource injuries in the Columbia River and the river corridor. Several weeks after our initial request, we received a geodatabase from WCH that included updated information on waste sites and response actions in the River Corridor area (see following subsection).

Finally, as mentioned previously, LBL provided us with the HEDR air plume data files that were generated from the air dispersion model in the early 1990s. Figure 7 reproduces the modeled grid of atmospheric fallout of iodine-131 from Hanford in 1945.

Waste Information Data System

The WIDS data layer from the QMAP clearinghouse includes nearly 2,200 records of areas that were identified as potential waste sites. The associated data dictionary, which we downloaded from within HLAN, is nearly 400 pages long. While it was not feasible to learn the WIDS data in detail in this initial phase, it is clear that the database contains a considerable amount of data useful for assessing operational and response action stressors (see Chapter 3 of the CSM) that may cause injury to natural resources.

Figure 8 includes an initial attempt to display potential operational stressors (waste areas) at the Site, using a query in WIDS. As noted in Chapter 3 of the CSM, the WIDS query included all of the following types of waste sites: Burial Ground, Burial Vault, Crib, Drain/Tile Field, Dumping Area, Process Pit, Radioactive Process Sewer, Retention Basin, Sanitary Landfill, Spoils Pile/Berm, Trench, and Unplanned Release. We modified the WIDS data along the River Corridor, based on updated waste site information from WCH.

Figure 8 also includes closure facilities, the construction of which may cause unavoidable injuries to natural resources (see Chapter 3 of the CSM). Most of these facilities were in WIDS or in other GIS files that we obtained from the QMAP clearinghouse.

As mentioned previously, the WIDS database does not yet have updated River Corridor information from WCH. WCH and CHPRC are finalizing a plan for transferring the updated WCH waste information to CHPRC for inclusion in WIDS in the future.

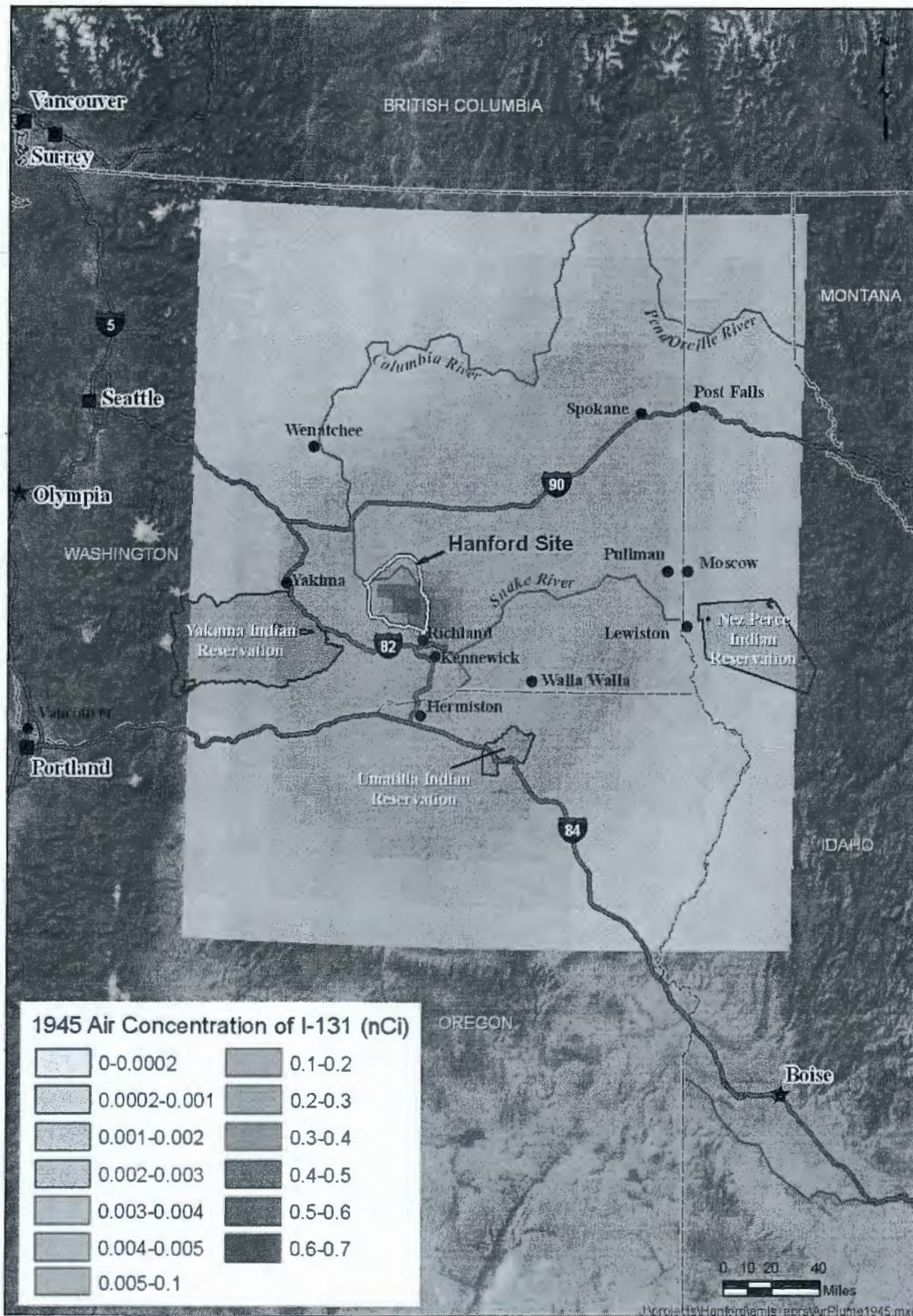


Figure 7. Modeled grid of iodine-131 aerial deposition in 1945.

Air plume data source: LBL, provided to Stratus Consulting on 4/16/2009.

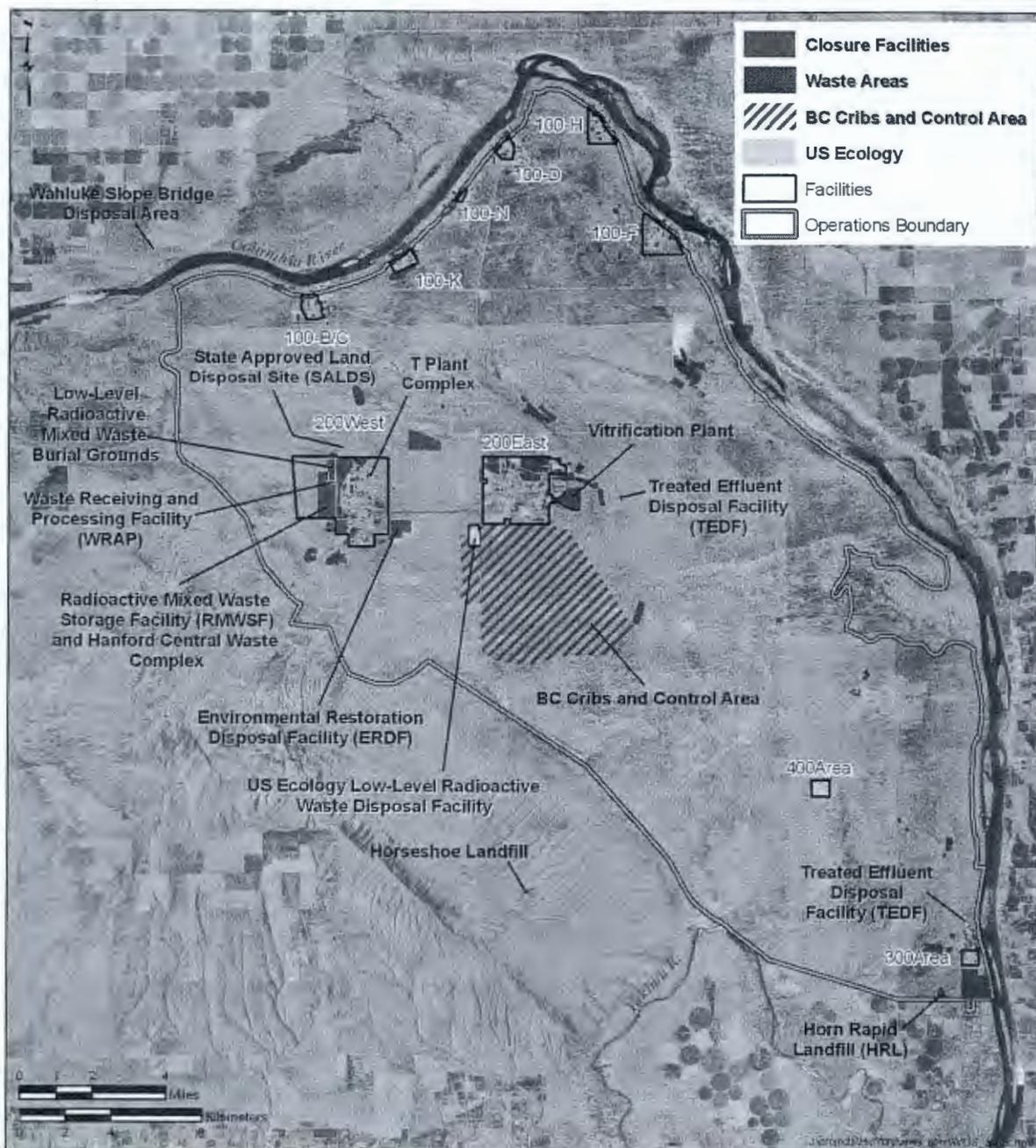


Figure 8. Hanford historical landfill sites, waste areas, and closure facilities constructed to process or store Hanford contaminants. The BC Cribs and Control Area includes some areas that require complete soil removal and other areas slated for hotspot removal only. The US Ecology facility is not a DOE facility, and it receives low level radioactive waste from sources outside of Hanford.

Data sources: DOE WIDS data layer (see text); WCH, provided to Stratus Consulting on 5/7/2009.

Well Information and Document Lookup/Hanford Well Information System

Well completion data are not available in HEIS. Some of these data are in the Well Information and Document Lookup (WIDL), which includes well completion data, status, inspection logs, and other electronic data that reside in the Hanford Well Information System (HWIS). In addition, WIDL provides links to documents (in PDF format) that have specific well information by cross-referencing the PDF through the document management system described in the following section. Well completion information, including well depth and screening intervals, are far from complete in HWIS. Extracting additional well completion data from scanned well logs and borehole logs will be laborious. In addition, both DOE and CHPRC personnel have warned that most monitoring wells are not completed to the bottom of the aquifer, because aquifer thickness information is not as relevant to remedial design as it is to NRDA. In the annual groundwater reports, groundwater contaminant data from the shallow aquifer are frequently described as concentrations at the top of the aquifer only. Without information on the saturated thickness of contaminated aquifers, it may be more difficult to estimate the likely volume of contaminated groundwater at the Site (see Chapter 5 of the CSM).

CHPRC is currently designing a new, separate database called TOPS that will contain additional relevant information, including depth of geological contacts. These data currently reside in Excel spreadsheets at PNNL. TOPS is still in a design phase; after database design, CHPRC will validate and import the spreadsheet data, then create tools that allow users to access the data.

Hanford Water Level Network Viewer

Many of the Hanford groundwater monitoring wells collect and transmit water level information on an hourly basis. This quantity of water level data is more efficiently handled in the Hanford Water Level Network Viewer (HWLNV), which is a separate, dedicated database. The temporal precision of these data may be unnecessary for evaluating potential injuries to groundwater resources at the Site. We have accessed the HWLNV and downloaded detailed water elevation data for selected monitoring wells, verifying that these data are available to Trustee POCs should they be needed.

Battelle Tank Waste Information Network System

Battelle (PNNL) maintains the Tank Waste Information Network System (TWINS). TWINS is available to users with HLAN access (such as a Trustee POC). It appears to contain both a document repository (last updated in 2003) and a data repository (updated recently). A brief scan of the contents of the TWINS suggests that the data are primarily or entirely data collected from inside the tanks. A more thorough evaluation of these data should be conducted in the next phase of the assessment. It is possible that data from other sources such as HEIS can be used to

characterize injury in the vicinity of tank farms, making detailed analysis of TWINS data a lower priority.

Effluent Volume to Soil Disposal Sites

The Effluent Volume to Soil Disposal Sites (EVSDS) database contains recorded annual volumes of waste effluent added to the 200 Area soil disposal sites during Hanford operations. These data show impressive quantities of generated liquid wastes that have the potential to be operational stressors if released into the environment (see Chapter 3 of the CSM). However, for the evaluation of potential natural resource injuries, these data are less likely to be useful than the environmental data which show that the hazardous substances from these wastes have been released and are detectable in environmental media.

2.2.2 Hanford documents

DOE and its contractors maintain multiple databases of Hanford-related documents. The home page for document searching is powered by LiveLink and is called the integrated document management system (IDMS). From this home page, users have access to predefined search templates for finding photographs, videos, declassified information, technical drawings, data from the Records Holding Area/Management Information System (RHA/MIS), and others.

The RHA includes short descriptions (“metadata”) of the contents of each of the many thousands of boxes of paper documents that are contained in four different warehouses throughout the State of Washington. Hanford documents were routinely destroyed after a six-month holding period prior to a moratorium placed on document destruction in 1992. Thus, many historical documents no longer exist.

According to CHPRC, most of the environmental data published in contractor reports has been entered into HEIS (or potentially rejected, because of insufficient QA/QC in older studies). HEIS apparently contains data from the 1940s onward. For the injury assessment, the Trustees will need to decide the appropriate level of effort for reviewing historical documents in IDMS.

IDMS is an amalgam of many different electronic document repositories. In total, the IDMS databases contain over 6 million records. The contractor reports database – the primary database for environmental reports that DOE and its contractors have generated – contains over 700,000 records. DOE controls access to the document repositories; separate permissions are required for each, including the contractor reports. Several of the other document repositories contain nuclear information (some classified, some not); access to these documents may not be a high priority as they are less likely to contain environmental data.

The result of a query in IDMS is a list of records that match the search terms, with some metadata. A link is provided to an electronic copy of the document. Some of these documents are in PDF format; others are provided in a document viewer (RIMVu) with the option of generating a PDF. Querying IDMS to find documents relevant to the natural resource injury assessment is not straightforward; DOE provides specific training courses to staff who need to become proficient at IDMS queries.

For this initial phase of the injury assessment, we queried the contractor database and found historical documents potentially helpful for injury assessment. We downloaded several of these documents, generating PDF files from RIMVu. We subsequently found that almost all of these documents were available in PDF format on publicly accessible databases such as the OSTI databases or the DDRS (see Section 2.1.1). We are hopeful that contractor reports and other relevant documents found in IDMS will either be already available on a publicly accessible website, or will be provided to the Trustees without OUO restrictions.

3. Future Data Sources

The future sources of environmental data relevant to the Hanford natural resource injury assessment that we have identified thus far are RI activities, including groundwater monitoring, the River Corridor RI, and the Central Plateau RI. After calling several points of contact, we have not learned of any upcoming environmental sampling in the middle reaches of the Columbia River from other organizations such as EPA, NOAA, CRITFC, or the Tribes. Data collection is ongoing in Lake Roosevelt upstream of the Site, and downstream in the Columbia River Estuary, associated with the Lower Columbia River Estuary Program.

Data collection and analysis is ongoing in many areas of the Site, under both RCRA and CERCLA authorities. Studies currently underway or in the final planning stages include the Hanford Releases to the Columbia River RI, the 100/300 Areas River Corridor Closure RI, site-wide groundwater monitoring, sampling in specific groundwater operable units, sampling associated with the removal of U Plant, sampling associated with tank waste retrieval, and others. DOE has briefed the Trustees on many of these work plans, and the Trustees have already provided comments on some.

Rather than attempt an exhaustive review of existing and anticipated work plans to delineate a schedule for anticipated new data, this section instead presents a brief overview of some of the most prominent studies. Because all of the environmental data from current and future studies are required to be entered into HEIS, we propose that Trustees gain access to all incoming environmental data through HEIS, with a transparent process for ensuring that all samples are in fact entered into the database (see Section 4), and that all relevant information (including biological data) are included.

3.1 Groundwater

CHPRC is the Hanford Groundwater Remediation Project contractor at the Site. Groundwater monitoring is ongoing. Annual reports containing an estimate of groundwater contaminant plumes are released approximately six months after the close of the fiscal year (i.e., in late March). CHPRC also maintains the HEIS database. Therefore, groundwater data are routinely entered into HEIS and should be available to anyone with login access to the EDA.

According to CHPRC (Bill Webber, personal communication, November 7, 2008), the groundwater plume estimates are updated annually using hand-contouring, as commercial software has historically done a poor job of modeling contaminant transport in the Hanford plumes. As discussed in the previous section, CHPRC provided us with GIS files showing the estimated groundwater plumes for both FY2007 and FY2008. We assume that CHPRC will make future data files available as well. However, the Trustees will need to independently assess whether the groundwater plumes that DOE has developed are useful for determining injury to groundwater resources (see Chapter 5 of the CSM).

In addition, as part of the tank closure and waste management environmental impact statement (EIS), the DOE Office of River Protection (ORP) has developed an independent comprehensive analysis of site-wide groundwater contamination. These models use existing groundwater data from HEIS but are entirely separate from the groundwater analyses that have been released in the DOE Richland Operations (RL) annual groundwater reports. The ORP groundwater analyses are complete; public release is expected no later than mid-summer 2009 (Woody Russell, DOE-ORP, personal communication, May 13, 2009). ORP intends to provide RL with the electronic files that include groundwater models; the Trustees should subsequently have access to these files. The completeness of the data sharing, including assumptions made, model verification, and other details are not known at this time.

3.2 Hanford Releases to the Columbia River RI

WCH is currently collecting over 1,100 samples in the Columbia River, pursuant to the RI Work Plan for Hanford Site Releases to the Columbia River (U.S. DOE, 2008). Media to be sampled include:

- ▶ Surface water
- ▶ Sediment
- ▶ Pore water
- ▶ Fish (whitefish, sucker, walleye, carp, bass, sturgeon)
- ▶ Soil on islands.

Sampling is scheduled to continue through the summer of 2009. Most of the Trustees provided comments on the proposed work plan in 2008.

According to Jamie Zeisloft (DOE- RL, personal communication, March 25, 2009), WCH is required to upload these data to the HEIS database after they have been through the QA/QC process. Thus, these data should be available in HEIS by late 2009, and with a corresponding data report in 2010. The Trustees will need to work with DOE to ensure that they have access to all data, including data excluded because of QA/QC issues (and the reason for exclusion) and all biological data.

These data are likely to be useful for the assessment of potential current and ongoing injuries to aquatic resources (Chapter 6 of the CSM). As discussed previously, DOE and the Trustees will need to determine how and when the Trustees as a whole can gain access to these data. Section 4 discusses this issue in greater detail.

3.3 River Corridor RI

DOE recently released the River Corridor RI/FS Work Plan. Data collection under this work plan is anticipated to commence in October. Stratus Consulting attempted to obtain an internal draft of the River Corridor RI Work Plan on April 1, 2009. DOE denied the request, stating that all stakeholders (and their contractors) must be granted access to the document at the same time.

The publicly available Integrated 100 Area RI/FS Work Plan, covering both the 100 Area and 300 Area, was released in early June. Specific work plans for each "decision unit" within the Integrated 100 Area are to be released in phases. The specific work plans for the 100-D and 100-H decision unit (Addendum 1) and 100-K decision unit (Addendum 2) have been released. The current release schedule for the remaining addenda and the anticipated conclusion of the studies is as follows (Jamie Zeisloft, DOE-RL, personal communication, March 25, 2009):

- ▶ September 30, 2009: Specific work plans for 100-B/C and 100-F
- ▶ December 30, 2009: Specific work plan for 100-N and 300 Area
- ▶ August 2011: Proposed remedy
- ▶ January 2012: Final Record of Decision (ROD).

The documents released in early June are now available to download from the TPA Administrative Record website (<http://www5.hanford.gov/arpir/>).

All of the new RI data for the River Corridor Closure are expected to be collected in late 2009 and in 2010. These data should be particularly useful for assessing stressors (Chapter 3 of the CSM) and natural resource injuries to both aquatic resources (Chapter 6 of the CSM) and

terrestrial resources (Chapter 7 of the CSM). Commencing preliminary data review and injury assessment activities this calendar year may give the Trustees the opportunity to estimate whether the proposed RI work is sufficient for evaluating natural resource injuries in addition to evaluating risk and determining remedial actions. The review period for these work plans is expected to be 60 days; the Trustees should plan to review these work plans from the perspective of evaluating natural resource injuries.

The data collected under the River Corridor RI are expected to follow similar procedures as the data currently being collected (see previous section), with data entered into HEIS after QA/QC. We recommend that Trustees work with DOE to ensure that they obtain all relevant data (see Section 4).

CHPRC is the contractor for groundwater site-wide, including along the River Corridor, while WCH is responsible for the River Corridor ground surface and vadose zone. CHPRC is responsible for the River Corridor work plans. As discussed in the groundwater and aquatic resources CSMs (Chapters 5 and 6 of the CSM, respectively), groundwater, vadose soils, surface water, and hyporheic water are interrelated in the River Corridor, and thus data from each of these media collected as part of the RI will be useful for assessing potential injuries to natural resources.

3.4 Central Plateau RI

RI activities on the Central Plateau are currently on a different trajectory than in the River Corridor. The River Corridor has been the primary focus of closure activities at the Site, with plans to address full closure of the Central Plateau essentially put on hold. However, with the recent infusion of stimulus money, long-term closure plans for the Central Plateau may be forthcoming.

In March 2009, DOE proposed a long-term goal of shrinking the actively managed area from 75 square miles anticipated after the River Corridor closure in 2015 to 10 square miles after completion of remedial actions in the Central Plateau. The plan for reaching this goal is conceptual only at this time; some specifics may be included in the 2015 Vision, scheduled to be released in June 2009.

Neptune & Co. has prepared a draft baseline ecological risk assessment (BERA) for the 200 Area that is currently undergoing internal review at DOE. Typically, work plans are produced after the BERA, so perhaps broader work plans for the Central Plateau will be produced within the next year.

Some RI activities on the Central Plateau are ongoing (e.g., U.S. DOE, 2007a, 2007b), and more are likely to be added as a result of the recent stimulus money. Because CHPRC is the contractor for the Central Plateau remediation, site-wide groundwater remediation, and the HEIS database, new environmental data from the Central Plateau are regularly entered into HEIS. Thus, these data should be available at least to Trustee POCs who have access to HEIS, and hopefully will be made available to all Trustees. The following section proposes a plan for providing Trustee access to the data and for ensuring that the all relevant data are in fact uploaded to HEIS.

4. Proposed Data Management Approach

This section contains a proposed approach for future data and document management for the Hanford natural resource injury assessment. It assumes that DOE will allow the Trustees to obtain environmental data necessary for performing an independent data analyses. This independent analysis of environmental data will help the Trustees identify potential data gaps and draft a plan for filling those gaps.

Because of the amount of data and the number of relevant documents that have been generated already from the Site, we recommend designating a data manager and a document manager (Figure 9), as well as the aforementioned Trustee POC(s) for DOE data access. A Trustee POC could also serve as a data manager or document manager; if not, the POC would work closely with both managers. Because DOE has recently allowed public access to groundwater and soils data in HEIS using the online EDA tool, we are optimistic that the Trustees will be able to obtain relevant environmental data from DOE and create a separate Trustee-maintained database, allowing for independent data analysis.

4.1 Trustee Point of Contact

A Trustee POC for DOE documents and data would be responsible for ensuring that the Trustees obtain environmental data and documents from DOE. Specific responsibilities would include the following:

- ▶ Develop a thorough understanding of the data and documents available within HLAN
- ▶ Become proficient at querying relevant DOE databases such as HEIS and IDMS
- ▶ Develop a working relationship with data managers at CHPRC and WCH

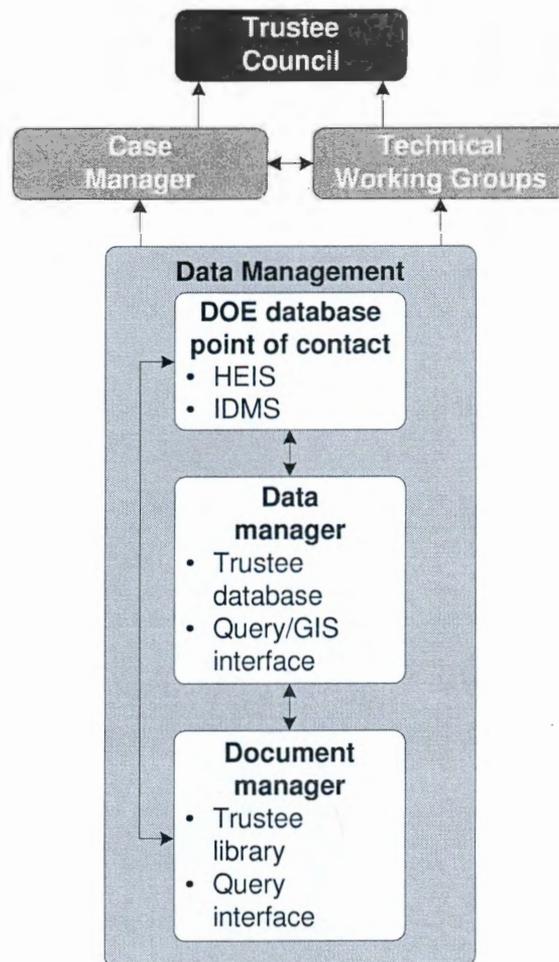


Figure 9. Proposed organization of data and document management.

- ▶ Know and communicate to the Trustees the anticipated schedule of incoming new data
- ▶ Propose and manage a process by which Trustees can review and ensure they are provided with all relevant incoming data
- ▶ Work closely with the technical case manager, data manager, and document manager to ensure that the Trustees and technical working groups (TWGs) are aware of and have access to relevant data.

The Trustee POC would have access to OUO documents and data that DOE wants to maintain as OUO. As mentioned previously, based on our investigations to date, we believe that most documents and data relevant to natural resource injury assessment will not be subject to OUO restrictions from DOE. However, if necessary, the POC would initiate discussions with DOE to ensure that relevant environmental data can be shared in an appropriate manner.

4.2 Data Manager

The data manager would work closely with a designated Trustee POC, developing a plan for obtaining environmental data from HEIS and other sources. The data manager would then develop and maintain a database of environmental data that the Trustees could use to evaluate natural resource injuries. These data should include relevant environmental data from HEIS, CRC, injury assessment studies that the Trustees conduct, and any other sources of electronic data. Specific responsibilities of the data manager would include the following:

- ▶ Create/maintain a Trustee environmental database
- ▶ Create/maintain GIS files relevant to the spatial analysis of data
- ▶ Query the database at the request of Trustees or TWGs
- ▶ Create a secure website with a map server interface, allowing all Trustees to view the data in their environmental database on demand
- ▶ Conduct spatial analysis of environmental data at the request of the Trustees or TWGs
- ▶ Obtain and integrate additional electronic data that the Trustees identify
- ▶ Integrate environmental data that the Trustees collect.

Some of the database tools that we propose above are similar to the HEIS and QMAP tools that DOE has already developed. However, it is imperative that all Trustees and TWGs have access to the data, and that the Trustees have the ability to evaluate data independently.

4.3 Document Manager

The document manager would create and maintain a repository for documents likely to be useful for natural resource injury assessment. We envision a repository available to the Trustees through a secure website with an intuitive query interface. The document manager would have the following responsibilities:

- ▶ Create a secure website that provides online access to a repository of documents that the Trustees believe will be useful for assessing natural resource injuries
- ▶ Develop or install a user-friendly query interface
- ▶ Upload new documents to the repository at the request of the Trustees
- ▶ Add keywords and abstracts to the bibliographic information on each document
- ▶ Work with the Trustee POC at DOE to obtain documents that the Trustees request that are not available outside of HLAN
- ▶ Help facilitate discussions with DOE to determine whether documents in IDMS that contain environmental data are OUO.

Other document management tasks that the document manager might oversee include scanning important documents that are only available in hard copy, ensuring that all documents in the repository are in PDF format, and using Adobe Acrobat to create single, word-searchable PDF files for each reference.

Both Ridolfi Inc. and Stratus Consulting have in-house bibliographic databases for the Site. The Ridolfi Inc. database uses Filemaker, and the Stratus Consulting version uses Reference Manager. The most efficient method of creating this proposed bibliographic database may be to build on one of these existing databases. Ridolfi Inc. created a secure website with a Filemaker interface for the Portland Harbor NRDA (Figure 10). This could serve as a template for the Hanford NRDA library.

4.4 Data Integration

Specific details of a data integration approach will depend largely on whether DOE is willing to provide the Trustees with all requested environmental data from HEIS, HWIS, and other databases. In other large NRDA cases, we have housed data in Access databases, because the software is ubiquitous, there is a user interface for writing queries, and ArcGIS software can use Access to store geospatial data files alongside the environmental data files.

RIDOLFI Inc.

Main List Docs Advanced Find

Title: Author:

General Abstract Area/Habitat Study Topics Resources COPCs/Data Injury Summary

Deck Key: Publishing Date: Sample Date: To:

Author:

Title:

PUB/DOC #: BIBLIO ID: Study Sponsor: [Add Sponsor](#)

Facility: Cited In:

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Website:

E-File Name:

Repository: Reviewer Org: Hard Copy? Yes

Reviewer: Review Date: Elec Copy? Yes

Reviewed: Yes Record Created Date: Last Modified Date:

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Log Out

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Figure 10. Example secure bibliographic database website with Filemaker interface, created by Ridolfi Inc. for the Portland Harbor NRDA.

Ultimately, the specific design of a data management system will depend on the quantity of data to be managed and the budget available to the Trustees for such management. As mentioned above, we typically house information in an Access database or multiple databases. However, the quantity of available Hanford data, particularly for groundwater, may exceed the capacity of Access. Database systems that can handle very large datasets, such as Oracle or Sybase, can be very expensive, and typically require full-time technical staff with Structured Query Language (SQL) programming experience.² Thus, we typically suggest dividing very large datasets into smaller datasets that can be accommodated in Access and thus are more readily usable by the Trustees.

Regardless of the database design that the Trustees ultimately choose, we recommend that the Trustee environmental database start by integrating data from the following sources:

- ▶ HEIS groundwater contaminant data
- ▶ HEIS surface water, sediment, and pore water data
- ▶ HEIS biota data
- ▶ HEIS soil contaminant data
- ▶ HWIS well information data
- ▶ CRC data from the WCH database
- ▶ GIS data layers from QMAP and the Virtual Library clearinghouse
- ▶ GIS base layers such as roads, hydrography, and aerial photographs
- ▶ WIDS data, including the updated information from WCH
- ▶ Lookup tables of potential injury thresholds for each of the media included in the database
- ▶ Lookup tables of sample IDs and locations.

Because DOE has expended a large effort to integrate many sources of data into HEIS and the CRC, we recommend starting with these two primary sources of data. The Trustees can then

2. CHPRC databases, including HEIS, are in Oracle. With over 2.5 million entries for groundwater alone, HEIS exceeds the capacity of Access.

review other data sources and cross-reference to ensure that the data are already in the database. The details of new data entry, including QA/QC procedures, development of a data dictionary, and dissemination of the data to all Trustees should be determined during the next phase of the NRDA. Similarly, each TWG will need to evaluate potential injury thresholds and provide the data manager with guidance regarding which thresholds to include in the lookup tables.

We recommend that culturally sensitive data not be integrated into this proposed Trustee database. Rather, the Tribes (or the Tribal TWG) should take full ownership of culturally sensitive information, with access restricted to those with whom the Tribes care to share the information. The Tribes or Tribal TWG should take responsibility for the design and implementation of a database of culturally sensitive information.

4.5 Process

The process of data and document review for the injury assessment will depend on several factors, including Trustee or TWG delegation of injury assessment responsibilities, and the level of detail that the Trustees feel is necessary to reach conclusions about injuries. This section suggests a process by which the Trustees may disseminate data to evaluate natural resource injuries.

The CSM provides an organizational structure for the injury assessment (see Figure 1). The Trustees have formed TWGs for most of the individual CSMs shown in Figure 1. We suggest that the TWGs direct the initial injury assessment for their respective resources or services, delegating tasks to individuals or the Trustee contractor. Specifically, we envision separate TWG-level document and data reviews for:

- ▶ Hazardous substance sources/releases, natural resource stressors, and pathways
- ▶ Groundwater and vadose soils
- ▶ Aquatic resources
- ▶ Terrestrial resources
- ▶ Human services.

The Trustees may add an air resources TWG in the future or delegate the evaluation of documents and data related to potential air resource injury.

4.5.1 Document review

The first step in the document review and prioritization process will be to create the document repository and a bibliographic database that includes keywords and, if available, abstracts. This will require an initial rapid review of many documents, and a high level of administrative effort.

The environmental media and/or services that are discussed or analyzed in each report should be specified either in the keywords or in specific data fields corresponding to the CSM categories. The initial rapid review of documents would include at a minimum those documents that Stratus Consulting identified in the CSM, as well as documents that Ridolfi Inc. identified in their literature reviews.

We recommend that each TWG be responsible for reviewing documents relevant to their CSM. Document review might be approached broadly, with all TWG members reviewing key documents, or it may be streamlined by delegating document review to a specific expert or contractor. The relevant documents identified in the initial rapid review will need to be reviewed in more detail to help determine potential injuries and data gaps. The specific process for document review will depend on the Trustees' preference for conducting the review. We recommend that the process include a qualitative ranking (high, medium, low) of the importance or relevance of each document, with the ranking added as a field to the online bibliography interface. Each TWG would be able to generate a bibliography of high-importance documents for evaluating their specific resources or services.

Most data published in documents from DOE contractors should be in HEIS. Documents that contain Hanford environmental data should be provided to either the Trustee POC or the data manager to verify that the data published in the report have been provided electronically to the Trustees. Many of the DOE contractor documents analyze data from the standpoint of remediation objectives, which are often different from the objectives of natural resource injury assessment. Thus, we recommend the Trustees focus on an independent analysis of the underlying data whenever possible, rather than the text and conclusions in the report.

4.5.2 Data review

Data review will be a critical step for determining injury for most resources. The specific steps that the Trustees take to evaluate data and draw conclusions about the likelihood of injury and the need for additional study will determine the plan for the next phase of the assessment process.

The first step for data review requires the data manager to compile the available environmental data into the Trustee database. Once a database is built, we again recommend that each TWG take responsibility for the initial data review. As with the document review, the data review could be approached broadly, with several Trustees and their representatives performing specific data review tasks, or it could be streamlined, with the data manager or a contractor performing the bulk of the analyses. In general, we suggest that the TWG, the data manager, and other experts whom the TWG designate should jointly evaluate the spatial and temporal coverage of the data (see, e.g., Figures 3 and 4).

Data analyses will differ depending on the resource being evaluated. Injuries based on threshold exceedences in media such as water, sediment, or soil are relatively straightforward. As discussed in the CSM, injuries to biota can be more difficult to ascertain, particularly long-term chronic effects of exposure to contaminants that have not been extensively studied. It is likely that the aquatic and terrestrial TWGs will have a specific sub-focus of data review to compile existing toxicology data for some Hanford contaminants of concern, then assess whether the data are sufficient for estimating injury, or if additional focused toxicity studies are warranted as part of the injury assessment.

4.5.3 TWG synthesis

We recommend that each TWG produce a data synthesis report as the final step in the initial document and data review process. The synthesis report would summarize the data that the TWG reviewed, including preliminary estimates of stressors, injuries, and damages. For example, a synthesis report might identify likely, possible, unlikely, and unknown injuries; the likely (and unknown) spatial and temporal extent of injuries; priority injury endpoints; and priority data needs. The synthesis report would identify hazardous substances likely to be highest priority. It would also include an initial spatial analysis of injury (with GIS figures) and a summary of the data that led to the initial estimates of injury.

Ultimately, we recommend that the TWG synthesis reports include initial recommendations for future assessment, specifying assessment tasks, data collection, and appropriate data analyses. These reports would be used to develop preliminary estimates of injuries and damages for the Assessment Plan, as well as provide guidance for initial injury assessment studies.

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