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Hanford 200 Area (Sanitary) Waste Water System

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HANFORD 200 AREA (SANITARY) WASTE WATER SYSTEM

INTRODUCTION AND BACKGROUND

The U.S Department of Energy (DOE) Hanford Site is located in southeastern Washington State. The Hanford Site is approximately 1,450 sq. km (560 sq. mi) of semiarid land set aside for activities of the DOE. It is located primarily west and south of the section of the Columbia River that is immediately north of the city of Richland, Washington. Activities at the Hanford Site are centralized in numerically designated areas. The reactor fuel processing and waste management facilities are located in the 200 Areas, situated on a 104 sq. km (40 sq. mi) plateau about 11 km (7 mi) from the river and roughly 40 km (25 mi) north of Richland. The plateau consists of the 200 East Area, 200 West Area, and the 600 Area (generally a buffer zone) located adjacent to and between the 200 East and West Areas. The elevation of the 200 Areas ranges approx. 200 m (660 ft) to 230 m (760 ft) above sea level. Figure 1 shows the location of the 200 Area.

The 200 Area Plateau contains active and inactive facilities for processing irradiated fuel rods from reactors located in the 100 Areas. There are over 200 occupied buildings and approximately 6,000 people on the 200 Area Plateau. (To support the cleanup and waste management activities for the next 30 years the number of people on the 200 Area Plateau is projected to peak at 12,000.) The waste generated by these facilities comprises the majority of hazardous and radioactive material stored or disposed of at the Hanford Site. Waste management activities in the 200 Areas have included the following: (1) disposal of low-level radioactive liquid effluent to the soil column, (2) burial of low-level radioactive and mixed solid waste in trenches, and (3) storage of high-level radioactive and mixed wastes in underground tanks.

The new centralized collection and treatment systems for the 200 Area Plateau of the Hanford Site are part of a relatively new overall environmental strategy at Hanford to support the Hanford Federal Facility Consent and Agreement Order (known as the Tri-Party Agreement). The Tri-Party Agreement (TPA) was signed in 1989 between the U.S. Department of Energy, the U.S. Environmental Protection Agency, and the Washington State Department of Ecology on behalf of the State of Washington. This agreement legally binds these agencies to environmental cleanup goals for the Hanford Site.

Over the last 50 years at Hanford discard of hazardous and sanitary waste water has resulted in billions of liters (gallons) of waste water discharged to the ground of the 200 Area Plateau. The general depth to water of the unconfined aquifer within the 200 Area Plateau ranges from 58 m (190 ft) to approximately 104 m (340 ft). As part of the TPA, discharges of hazardous waste water to the ground and waters of Washington State are to be eliminated in 1995. The purpose of this program is to cost-effectively protect the regional ground water quality.

Currently, sanitary waste water from the 200 Area Plateau is handled with on-site septic tank and subsurface disposal systems, many of which were constructed in the 1940s during the early days of the Hanford Site. As a result of age, neglect, and lack of regulatory control most do not meet current standards. Additional sanitary waste water collection systems are slated for the 300 and 400 Areas.

Several features of the proposed new sanitary waste water handling systems are unique to Hanford. For example, it was found to be quite cost effective to operate the treatment system as evaporative lagoons with state-of-the-art liner systems. Evaporation as a means of disposal works well at the Hanford Site due to low annual rainfall (approx. 18 cm) and a very high annual evaporation rate (approx. 150 cm), even during years with higher than average moisture. The availability of large acreages without an acquisition cost also enhances the practicality of evaporative lagoons.

Another aspect of the proposed systems unique to Hanford is routing collection lines to avoid historic contamination zones. It was a challenge first to identify these zones and secondly to design the collection system to avoid them. This challenge was met by the conceptual design team on a very tight schedule and within budget. The remainder of this presentation will focus on the challenges met in planning and designing the collection system.

FACILITY PLANNING

Collection System Technologies Alternatives Analysis considered the advantages and disadvantages of each of the following systems:

Conventional Gravity Sewers (CGS) - The advantages include easily maintained, familiar construction technology. Disadvantages include increased quantities of excavation, lift station maintenance, and that greater excavation depth increases the chances of encountering hazardous substances and unknown obstructions.

Grinder Pump (GP) - The advantages to GP systems include relatively easy connections and flexibility in siting new facilities. Disadvantages include the large number of individual grinder pumps for operation, which could be a maintenance problem and greatly impact operation of the system. Grease buildup can occur during low flows.

Septic Tank Effluent Pressure (STEP) - The advantages include utilization of existing septic tanks for pretreatment of waste prior to pumping, a long history of successful residential use, solids and grease removal prior to pumping, allowable use of small diameter pipe, inexpensive pipe, and low excavation depths. Disadvantages to a STEP system include decentralized solids removal, requiring maintenance of many sites, as well as pumps. Odor and corrosion from higher hydrogen sulfide production may become a problem.

Small Diameter Gravity Sewer (SDGS) - This system is similar to STEP, except there is no need for pumps at each septic tank, therefore cutting down on maintenance requirements while allowing the use of small diameter pipes. There are two types of SDG sewers: the minimum grade effluent sewer (MGES) and the variable grade effluent sewer (VGES) systems. The MGES system generally utilizes a minimum slope set with a minimum velocity of 0.3 mps (1 fps). The advantages of a SDGS systems are that they allow for the use of small diameter pipes. Disadvantages include long travel times and therefore an increased risk of hydrogen sulfide gas formation and the attendant odor and corrosion problems.

Combinations, GP plus STEP - The major difficulty would be the maintenance and operation of pumps at many different sites.

Vacuum Sewers (VS) - Advantages to VS include their designation as an innovative alternative by the Washington State Department of Ecology, which may result in funding advantages. Other advantages include low water use, centralized pumping, and almost no exfiltration. Disadvantages to VS include the complexity of the components, unconventional layout and associated higher engineering costs, potentially high operating costs, and the difficulty in expanding service once construction is completed without interrupting service.

The selection of central treatment and discharge influenced the selection of the collection system alternative, as well as the route to avoid contamination zones. Because of the distance to a receiving water source other than groundwater, low rainfall/high evaporation conditions, water discharge issues to the ground due to past practices, and a large expanse of land, evaporative lagoons were chosen for the treatment and disposal method. Also, the continued use of septic tanks was determined to be non-cost effective because most of the existing tanks are beyond their useful life. Thus, the existing septic tanks will require replacement and the operational and maintenance cost of over fifty septic tanks is causing an increasing burden to the Hanford Site.

The lagoons needed to be located far enough away or downwind from other operations to minimize the impacts of odors. As a result of the chosen sites for the central treatment and disposal systems, it was determined that conventional gravity collection systems are the most feasible and cost effective alternative.

Contaminated sites affected alternative selection and routing. The selected routing had to avoid contamination from:

- The old "B" Plant in the 200 East Area,
- Contaminated soils in the WTX and WTY Storage Tank areas,
- Contaminated soils in the central 200 East Area,
- Contaminated soils off the road in the Purex, 200 East Area,
- Contaminated soils due to overflow of the "U" Pond,
- Contaminated soils in the vicinity of the Plutonium Finishing Plant, 200 West Area, and
- Contaminated soils in the vicinity of abandoned trenches and solid waste burial grounds located throughout 200 East and West Areas.

CONCEPTUAL DESIGN

The majority of the existing septic systems were constructed in the 1940s. At the time, their design was in compliance with existing codes and area populations. Although the structure of personnel and buildings complexes have shifted in the last 50 years, the septic system modifications have not kept pace with these changes. Also, compliance with new regulations and past operational and maintenance practices did not keep pace with federal, state, and local requirements. This was caused by the fact that the Hanford Site was self regulating with multiple contractors operating the site during its history.

The shift in use has resulted in serious overburden and failure of many systems, and virtual abandonment of others. We have analyzed projected and current needs at the area facilities, and completed preliminary design of a system that will work once a final design is complete. The system is a complete gravity flow system with small lift station pumps placed strategically to facilitate this flow. The piping system is designed to accommodate the existing facilities' flows and the projected facilities' flows for the next 30 years of Hanford environmental cleanup and waste management activities. Each sewer system will terminate in a lined evaporative lagoon system. The proposed system will require minimal maintenance and operational cost, minimal operator training and expertise to operate, and minimal impact from environmental regulation changes because waste water discharges will be virtually eliminated along with solid waste.

Each area system will be completely independent of the other, thus not depending on the dynamics of the other area. The feasibility and alternatives engineering study showed one comprehensive system for both areas to be impractical and economically unfeasible. Although we design two separate and independent systems, principles applied to each area were virtually identical.

The design of the sewer collection system minimizes the use of small electric powered pumps to limit excavations over 3 m (10 ft) while virtually eliminating areas where contamination will be encountered. Future field survey and scanning prior to and during detailed design is expected to further economize the design of the sewer collection system.

The project was a management challenge because of three main factors: 1). short time, 2). limited budget, and 3). the use of an innovative design approach. Bovay had developed an innovative design approach which is an automated sewer design system that allowed us to input coordinates for routing the sewer line in some locations, and simply draw on the route in others to obtain a coordinate geometry record of the project. Spreadsheets have been developed for entering the coordinates, facilitating a quick design. All was not smooth with this approach, because the 200 Area sewer design was the first time this approach had been used with a non-residential project, or a project with so little initial data. Further complicating this system was the fact that much of the topographical data and drawings were in metric and had to be converted to the English Customary System. The approach was modified as the project progressed, so that Bovay and ICF Kaiser Hanford were able to complete the design on time and within the original budget. Through the innovation of the project team and the full cooperation of all involved, the project was presented to DOE for Validation in April 1994 and was successfully validated.

STATUS OF PROJECT

The Conceptual Design was completed in March 1994, validated by DOE in April 1994, and is in the Congressional Budget for Detail Design and Construction in Fiscal Year 1996 through 1999. National Environmental Protection Agency documentation in the form of an Environmental Assessment is being submitted to DOE in September, 1994. A "Finding Of No Significant Impact" is expected in early 1995. In April, 1995, an Architect/Engineer for Detailed Design will be solicited, with design to take place in 1996 and early 1997. Construction of the two sewer systems will be from mid-1997 through 1999.

We hope to address this conference at a future date with more information regarding this partnership in improving the environment of the Hanford Site and the further developments of this project.

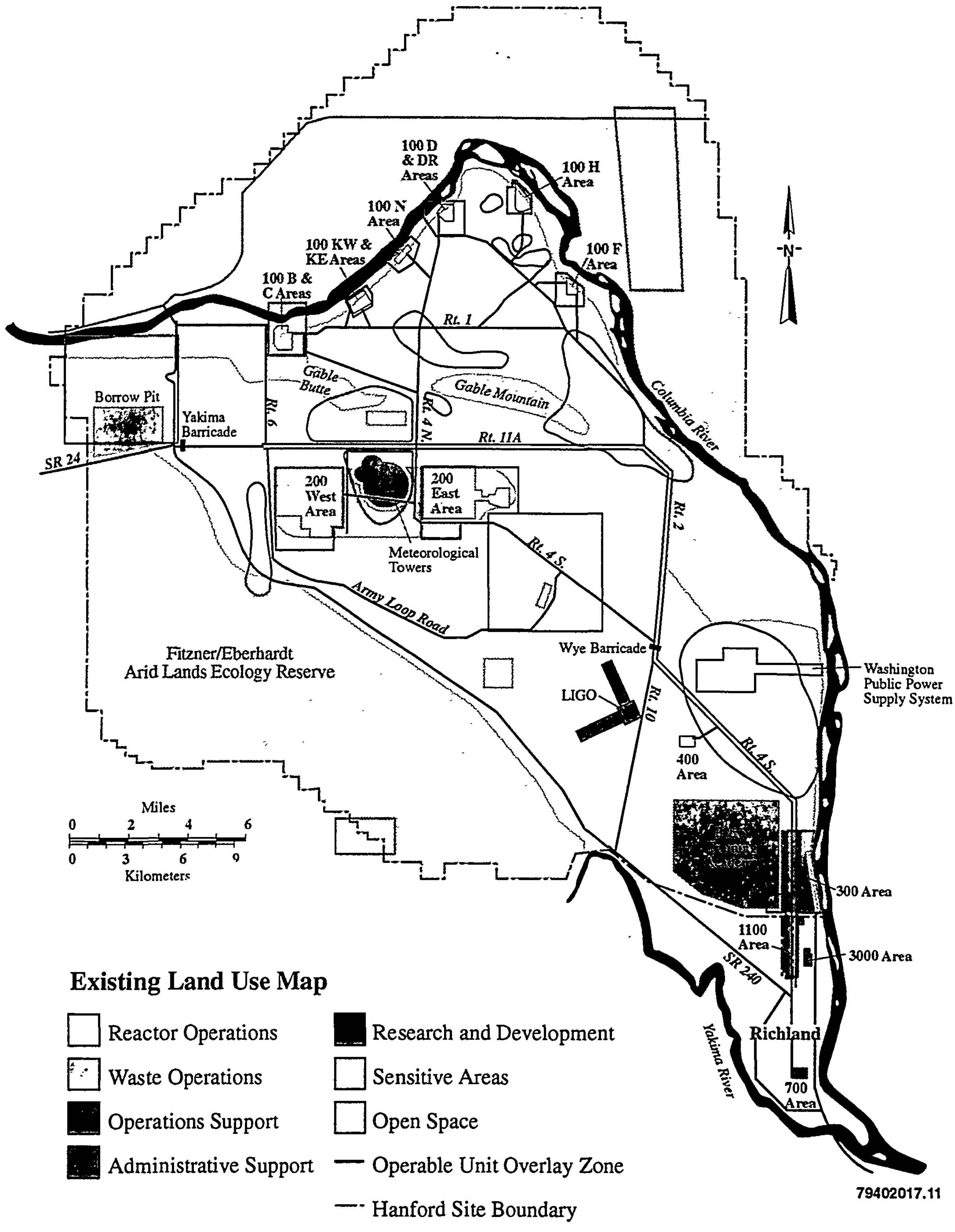

FIGURE 1 - Hanford Site Existing Land Use Map

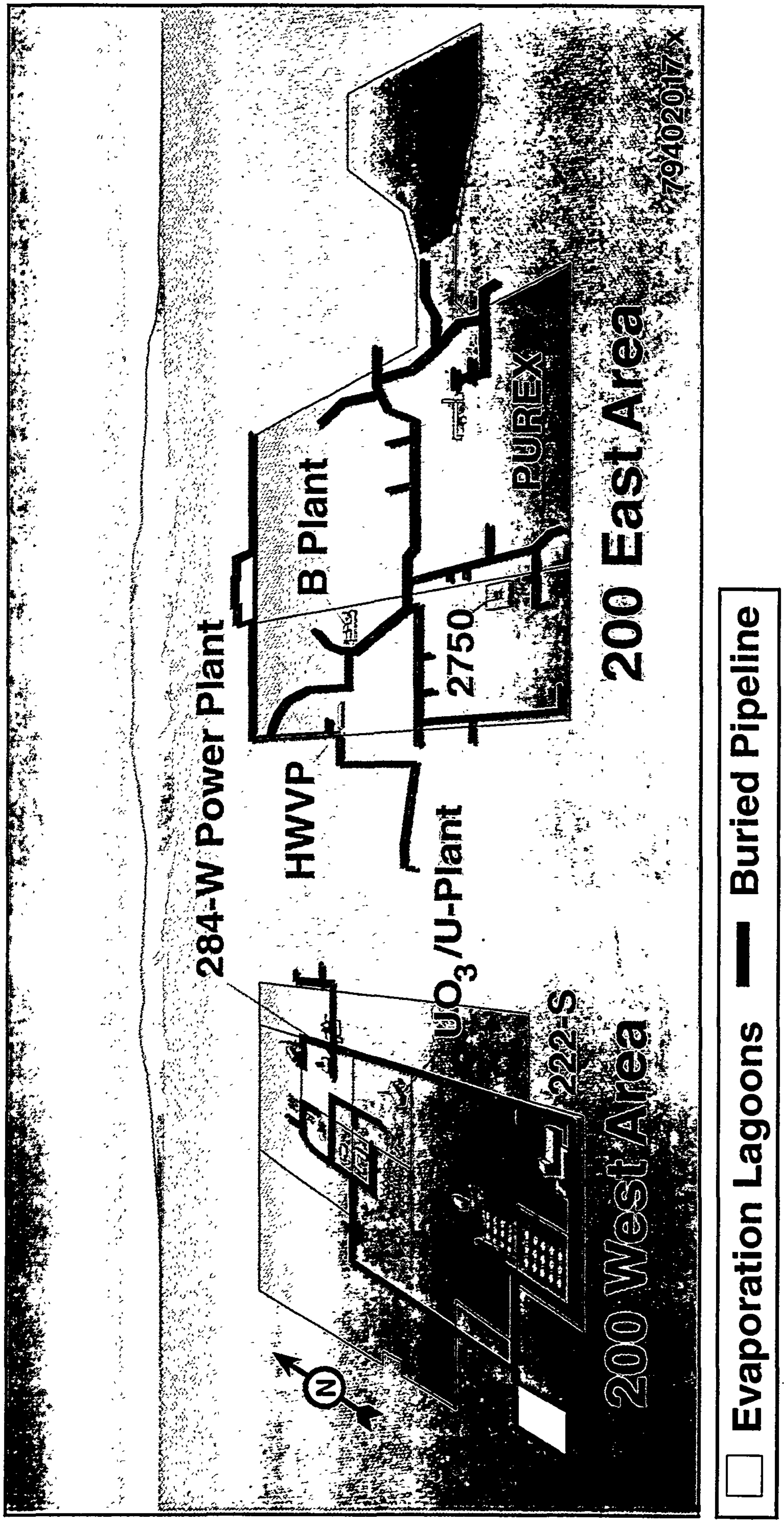

FIGURE 2 - 200 Area Sanitary Sewer Route