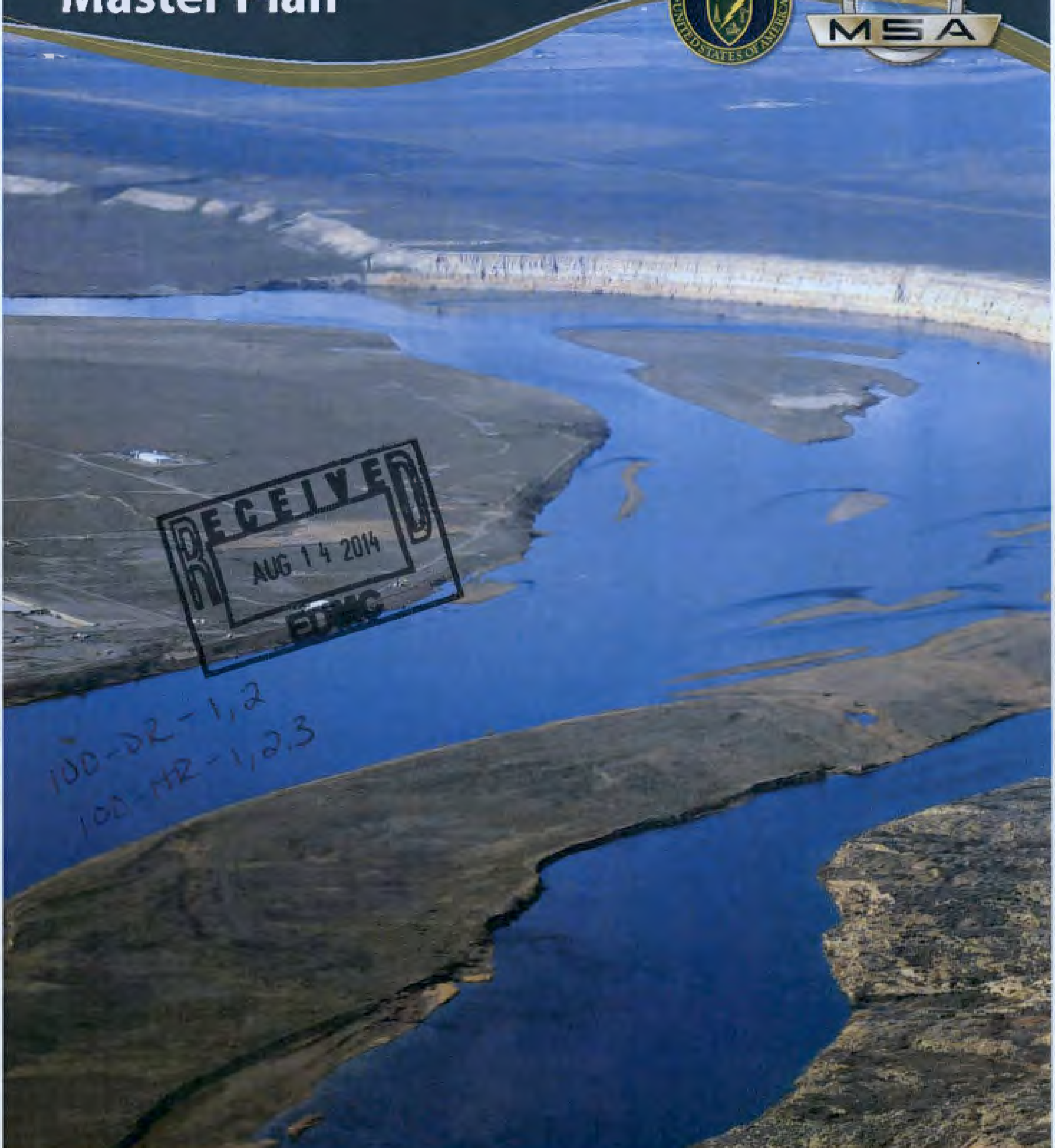
Mission Support Alliance

HNF-5828/Rev3

Hanford Site Water System
Master Plan



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Sam Camp
Manager, Water & Sewer Utilities
Site Infrastructure & Utilities
Mission Support Alliance, LLC
(509) 372-0175

Gary Stevens
Design Authority
Mission Support Alliance, LLC
(509) 373-9103

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Revision 3

Hanford Site Water System Master Plan

Document Type: RPT Program/Project: Site Infrastructure & Logistics

R. T. Bannister
Mission Support Alliance

S. L. Camp
Mission Support Alliance

G. M. Stevens
Mission Support Alliance

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P.O. Box 650
Richland, Washington 99352

APPROVED
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Release Approval Date

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The following individuals, with specific expertise and experience, participated in the preparation of this Hanford Site Water System Master Plan.

Steve Shupe	Public Works Director
Sam Camp	Water Utilities Manager
Ron Bannister	Project Manager
Kirt Bare	Civil Engineer
Tom Sackett	Director of Projects
Jim Day	Support Engineer
Catherine Huard	Site Integration
Jason Fitzgerald	Graphic Designer
Ken Bryant	Graphic Designer
Heather Maples	Graphic Designer
Kathleen Freeman	Formatting/Tech Editing
Amy Wells	Project Controls Specialist
Jessica Linton	Budget Analysis
Gary Stevens	Design Authority
Lee Wheatley	Support Engineer

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EXECUTIVE SUMMARY

The Mission Support Alliance, LLC (MSA), functions as a water service provider to the various Hanford Site contractors responsible for implementing long-term environmental cleanup goals established by the U.S. Department of Energy, Richland Operations Office (RL) and the U.S Department of Energy Office of River Protection (ORP). The MSA's primary Site customers include the Plateau Remediation Contractor (CH2M HILL Plateau Remediation Company [CHPRC]), Tank Farm Operating Contractor (Washington River Protection Solutions LLC [WRPS]), the River Corridor Closure Contractor, and the Waste Treatment Plant. Within their areas of responsibility, MSA is responsible for all aspects of the water distribution system up to and including the first off-valve or demarcation point outside each customer's facility or complex of facilities. Direct mission-related upgrade projects downstream of the first off-valve or demarcation point are the responsibility of the Site contractors requiring the upgrades (see Sections 3 and 4)

This Water System Master Plan revision presents the MSA plan for managing Hanford Site Water Systems administered under the Mission Support Contract (MSC), DE-AC06-08RL14728[1], for RL. The Master Plan documents a strategy, as outlined in the contract, for managing repairs, life extensions, replacements, and deactivation of water system facilities and equipment controlled by the MSA, over a 10-year planning horizon (see Sections 6 and 7). The Master Plan contains a detailed system inventory and documents the overall condition of the MSA-managed water system (see Sections 2, 5, and 7). MSA maintains the Master Plan in accordance with DE-AC06-08RL14728.

Mission Support Alliance (MSA) supplies water to the Hanford Site from either or both of two inlet structures on the Columbia River designated as the 100-B and 100-D Facilities. Each station has sufficient capacity to supply the normal water requirements identified to date. In general, the piped delivery and distribution systems are in functional condition and are oversized for current demands.

Peak demand flows and line pressures are controlled by operating a combination of constant-speed and variable-speed pumps to supply customers' needs or meet demand requirements. When supplying significant flows, associated with 200 East Area evaporator campaigns, Waste Treatment Plant construction, and 100 and 200 Areas construction activities, the system has experienced significant pressure transients.

The impact of high demands on the system revealed reliability and safety issues during support of 242-A Evaporator treatment campaigns. These issues would be expected to become more pronounced with Waste Treatment Plan commissioning in 2019. Therefore, this plan incorporates improvements to the water system infrastructure that are currently in the design phase. The improvements will enhance performance and reliability, as well as anticipate future

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[1]DE-AC06-09RL14728, 2009, *Mission Support Contract*, as amended, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

demands and impacts of decommissioning facilities as mission objectives are met. One of the major improvements is Project L-778, Plateau Raw Water Improvements (see Section 8). This project will commit the pumps and at least 600,000 gal from each 1.1-Mgal potable water storage tank in the 200 East and 200 West Areas to fire protection. The project will install reduced pressure backflow prevention valves to tie the potable water system with the raw water system for universal fire protection, disconnect the export water system from the 200 East and West Area raw water system at the 282EC and 282WC facilities, and deactivate the raw water booster pump arrangements. The project will also modify former fire pumps at the 200E and 200W reservoirs to serve as raw water system supply pumps. Follow-on projects will install vertical-drive turbine pumps at 181B and 181D, bypassing the 182B and 182D reservoirs and pumping directly to the 282E and 282W reservoirs. This will allow for the closure of the four facilities in the 100B and 100D Areas (reservoirs and pump houses), reducing the operations footprint, lowering operating costs, and improving water transmission efficiency.

The MSA-managed water system provides fire protection, process water, potable water, and construction water needed for ongoing environmental cleanup activities. The MSA manages portions of the water systems as a "ready-to-serve" water utility; supporting facilities in Hanford's 100, 200, and 600 Areas (see Sections 2 and 3). The Hanford Site population is projected to be reduced by approximately 37 percent over the next 10 years, with the largest reduction in the 100 Areas, followed by the 600 Area and 200 West Area. Potable water use is expected to drop by approximately 14 percent with the major reductions in 600 and 200 West Areas. Export and raw water use will increase slightly with the activation of clean-up processes (see Section 4).

This revision of the Master Plan establishes a 10-year planning period through 2022 and uses the *Ten Year Site Plan* and the *Infrastructure and Services Alignment Plan* as guidance for managing the Hanford Site Water Systems assigned to the MSA, under the MSC. In the plan recommendation are made that may not be required if already identified projects are completed. Because future budgets will drive what can and cannot be accomplished, an attempt was made to provide as many options as possible. This document presents a strategy consistent with the RL *2015 Hanford Site Cleanup Vision*. The following key recommendations discussed in the Water System Master Plan:

- Project L-778, Plateau Raw Water Improvements (see Section 8)
- Project L-679, Replacement of the 283W Gas Chlorination with Sodium Hypochlorite Chlorination.
- Project L-708, Advance Water Metering, implement strategic metering to gather data to better determine the integrity of the distribution system and more reliably determine actual demands on the system.
- 181B and 181D Vertical Turbine Pumps, improving flow to the Central Plateau and allowing the shutdown and decontamination and decommissioning (D&D) of four facilities (reservoirs and pump houses).

- Evaluate impact of cooling tower installation in Evaporator Plant 242-B on raw water and potable water
- Pursue need to continually update system data bases and customer interface requirements

Consideration has been given to system components that have deteriorated to a point where they affect the MSA's ability to deliver a reliable water supply or contribute to the spread of surface and subsurface contamination. The plan provides a baseline for budgeting so that a coordinated water system operations, maintenance, pipe restoration, and/or equipment replacement schedule can be established. Also, the plan develops a priority list of essential water system projects that will systematically repair or replace components that have failed or are near failure.

The plan includes a comprehensive water system management strategy (see Sections 6 and 7) that addresses the following areas (see Sections 5 and 6):

- Increase stabilization of the water system
- Minimize leaks and groundwater recharge resulting from water system operations
- Evaluate, repair, and/or replace deteriorated waterlines and valves
- Improve system reliability
- Downsize infrastructure footprint consistent with RL and ORP cleanup goals and projected Hanford Site water resource needs
- Comply with Washington State Department of Health water system requirements
- Decommission elements of the water system as missions are completed and the Site footprint is reduced.

The management strategy notes the need for extensive system knowledge and close coordination among contractors and DOE decision makers. The management strategy identifies a specific need for continual update and reassessment of water system data and plant capabilities. MSA will work closely with RL, ORP, and the other Hanford contractors to better define their water system needs, establish required capabilities, and support planning and decision-making that will optimize the functioning of the water system over the 40-year period estimated for completion of the cleanup mission.

Water System Interface Matrix Between Mission Support Alliance and Key Stakeholders

Stakeholder	Stakeholder Contacts	MSA Contacts	Interface Control Document
U.S. Department of Energy, Richland Operations Office	DJ Ortiz (509)376-0950 Sheila Hahn (509)376-5940	Sam Camp (509)372-0175	
U.S. Department of Energy, Office of River Protection	Garth Reed (509)376-2626	Sam Camp (509)372-0175	
WTP/BNI	Bill Clements (509)373-8542 Tony Veirup (509)373-8251 Marshall Miller (509)371-5177 Barbara D. Lau (509)371-2269 Mike Pell (509)373-4372	Sam Camp (509)372-0175 Wyatt Winters (509)376-4248	24590-WTP-ICD-MG-01-001[1] and 002[2] December 2010
Washington River Protection Solutions Tank Farm Operations	Tom Mackey (509)373-3823 Chris Woehle (509)373-2424	Sam Camp (509)372-0175 Catherine Huard (509)376-2604	HNF-4493, Rev. 1[2] September 20, 2010
CH2M HILL Plateau Remediation Company	Steve Hansen (509)376-7278 Mary Ann Green (100K/400 Area) (509)373-1463	Sam Camp (509)372-0175 Ralph Erath (509)376-0401	HNF-46148, Rev 1[3], November 02, 2010
Washington Closure Hanford	Steve Garnett (509)539-3247 Scott L. Feaster (509)372-9213	Sam Camp (509)372-0175 Manuel Chavallo (509)376-8221	Being developed

[1]24590-WTP-ICD-MG-01-001, 2010, *Interface Control Document for Raw Water*, Rev. 2, Mission Support Alliance, LLC, Richland, Washington.

[2]24590-WTP-ICD-MG-01-002, 2010, *Interface Control Document for Potable Water*, Rev. 2, Mission Support Alliance, LLC, Richland, Washington.

[3]HNF-4493, 2010, *Interface Control Document Between Washington River Protection Solutions LLC (WRPS) the Tank Operations Contractor and the Mission Support Alliance, LLC (MSA), the Water Utilities Distribution System Manager*, Rev. 1, Mission Support Alliance, LLC, Richland, Washington.

[4]HNF-46148, 2010, *Interface Control Document HNF-46148 between CH2MHILL Plateau Remediation Company and Mission Support Alliance, LLC for Water System Services,* CH2M HILL Plateau Remediation Company, Richland Washington.

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CONTENTS

FIGURES

TABLES

TERMS

AHP	analytical hierarchy process
AJHA	automated job hazard analysis
ARRA	*America Recovery and Reinvestment Act*
AWWA	American Water Works Association
BFP	backflow preventers
CAIS	Condition Assessment Information System
CAM	corrective action management
CAS	Condition Assessment Survey
CCCP	Cross-Connection Control Program
CCP	concrete cylinder pipe
CCS	cross-connection control specialist
CFR	*Code of Federal Regulations*
CHPRC	CH2M HILL Plateau Remediation Company
CMMS	Computerized Maintenance Management System
CSB	Canister Storage Building
CT	contact time
CWC	Central Waste Complex
D&D	decommissioning and demolition
DA	Design Authority
DIW	demineralized water
DOE	U.S. Department of Energy
DST	double-shell tank
Ecology	Washington State Department of Ecology
ERDF	Environmental Restoration Disposal Facility
ERW	Emergency Raw Water
ESM	energy savings measure
ETF	Effluent Treatment Facility
EW	export water
FacRep	Facility representatives
FIMS	Facilities Information Management System
FMP	facility modification process
FW	fire water
FY	fiscal year
GSA	General Services Administration
HAMMER	Volpentest HAMMER (Hazardous Materials Management and Emergency Response) Training and Education Center
HMI	human machine interface
HVAC	heating, ventilation, and air conditioning
I&C	Instrumentation and Control
ICD	Interface Control Documents
ID	identification number
IPL	
ISAP	*Infrastructure and Service Alignment Plan*
ISMS	Integrated Safety Management System
LEED	Leadership in Energy and Environmental Design

LTS	long-term stewardship
M&O	maintenance and operation
MLCSP	mortar-lined and coated steel pipe
MOV	motor operated valve
MSA	Mission Support Alliance, LLC
MSC	Mission Support Contract
NC	new construction
NFPA	National Fire Protection Association
OA	Observational Awareness
OHC	other Hanford contractor
OMB	Office of Management and Budget
OOS	out of service
ORP	U.S. Department of Energy, Office of River Protection
OTP	operational test procedure
PFP	Plutonium Finishing Plant
PLC	programmable logic controller
PM	preventive maintenance
PRC	Plateau Remediation Contract
PSW	process service water
PTA	Patrol Training Academy
PUREX	Plutonium Uranium Extraction (Plant)
PVC	polyvinyl chloride
PW	potable water
QA	Quality Assurance
RCC	River Corridor Closure
RCCC	River Corridor Closure Contract
RL	U.S. Department of Energy, Richland Operations Office
RPBA	Reduced Pressure Backflow Assembly
RPP	River Protection Project
RTS	recognition tracking system
RW	raw water
SOE	stationary operating engineer
SSP	Site Sustainability Plan
SST	single-shell tank
TA	Technical Authority
TDH	total dynamic head
TOC	Tank Farms Operations Contract
TSR	Technical Safety Requirements
TYSP	Ten Year Site Plan
VFD	variable-frequency drives
WAC	*Washington Administrative Code*
WCH	Washington Closure Hanford
WDOH	Washington State Department of Health
WESF	Waste Encapsulation and Storage Facility
WRAP	Waste Receiving and Processing Facility
WRPS	Washington River Protection Solutions
WTF	283W Water Treatment Facility

WTP	Waste Treatment Plant
WTPO	water treatment processing operator

1.0 INTRODUCTION

The Hanford Site encompasses approximately 586 mi^2 in south-central Washington State along the Columbia River (Figure 1) with Approximately 305 mi^2 of the Site comprises the Hanford Reach National Monument ,while the remaining 281 mi^2 are managed by the U.S. Department of Energy (DOE) as legacy of the World War II-era Manhattan Project efforts. Once a plutonium production complex, Hanford is now engaged in the world's largest environmental cleanup project.

Figure 1. Hanford Site Map.

1.1 MANAGEMENT OF THE HANFORD SITE

Hanford Site cleanup is managed by two DOE field offices. The U.S. Department of Energy, Richland Operations Office (RL) is responsible for nuclear waste and facility cleanup and overall management of the Hanford Site; the U.S. Department of Energy, Office of River Protection (ORP) is responsible for cleanup of Hanford Site tank waste, which includes construction and operation of the Waste Treatment Plant (WTP). The major implementing cleanup projects include the RL managed River Corridor Closure Contract (RCCC), Plateau Remediation Contract (PRC), and Mission Support Contract (MSC) and the ORP managed Tank Farms Operations Contract (TOC) and WTP.

1.2 HANFORD SITEWIDE WATER SYSTEM

The Mission Support Alliance, LLC (MSA), has contract responsibility for the Hanford Site water system except for the 300 Area; 100 N Area; 100 K, 100 B, 100 D, 100 F, 100 H Areas; and the 400 Area, which are specifically excluded from MSC contract. The 300 Area and 100 N, 100 B, 100 D, 100 F, and 100 H Areas water systems are within the scope of the RCCC. The 100K Area and 400 Area water systems are within the scope of the PRC.

The Hanford Sitewide water system provides fire protection, process water, potable water (PW), and construction water needed for ongoing environmental cleanup activities throughout the Hanford Site. The Sitewide system consists of the export water (EW), raw water (RW), and PW Systems and water systems servicing the 300 Area, 100K, 400 Area, and the 600 Area systems (See Section 2). The Sitewide water system's current mission has transitioned to support Hanford cleanup mission activities. The EW system provides a redundant water supply capability using electrically driven pumps located in the 181B and 182B buildings as the primary source, and electrically driven pumps in 181D and 182D Buildings, one diesel-driven pump in 181B and two diesel-driven pumps in the 182B Buildings as backup sources. Raw water booster pumps at the 282EC and 282WC buildings provide the primary RW supply with backup electric RW fire pumps at the 282E and 282W buildings and PW water fire pumps at the 282EC and 282WC buildings. The backup pumps are serviced by emergency diesel electric generators in their respective areas. The primary PW source is supplied from the 283 East and 283 West clearwells; the backup supply comes from 1.1-Mgal storage tanks, one in each of the 200 Areas, and pumps located at the 282EC and 282WC buildings.

1.3 MISSION SUPPORT CONTRACT

In fiscal year (FY) 2009, RL awarded the MSC contract (DE-AC06-08RL14728) to MSA, to manage portions of the Hanford Sitewide water system as a "ready-to-serve" water utility supporting the Hanford Site's 100, 200, and 600 Areas. In accordance with DE-AC06-08-RL14728, MSA maintains the Hanford Site Master Water Plan and is responsible for all aspects of the water distribution system up to and including the first off-valve or demarcation point outside each customer's facility or complex of facilities in those areas serviced by MSA.

1.4 PURPOSE OF THE DOCUMENT

This document presents the MSA strategy for managing Hanford Site Water Systems administered for RL under the MSC. This Master Plan documents a strategy for managing repairs, life extensions, replacements, and deactivation of facilities and equipment controlled by MSA over a 10-year planning horizon. The plan contains a detailed inventory of water system equipment and facilities and documents the overall condition of the Hanford Sitewide water system with recommendations.

The plan is consistent with DOE Order 430.1B, *Real Property Asset Management*, and establishes a holistic and performance-based approach to life-cycle asset management. It links planning, programming, budgeting, and evaluation to program mission projections, and performance requirements. MSA will use the process found in MSC-PRO-9679, *Control of Administrative Plans, Reports, Studies, and Description Documents*, to update the plan continually with an appropriate level of technical review. This Master Plan will be updated to take long-term stewardship (LTS), described in DOE/RL-2010-35, *Hanford Long-Term Stewardship Program Plan*, into consideration as requirements are further defined.

1.5 DOCUMENT STRUCTURE AND ORGANIZATION

The Master Plan presents the following information:

- Section 2.0 describes the MSA-managed Hanford Sitewide water systems.
- Section 3.0 provides component and system conditions as noted in the February 2012 condition assessment and the Master Plan walk-down and identifies gaps resulting from deficiencies in components and systems.
- Section 4.0 denotes and explains the Operations and Maintenance program.
- Section 5.0 projects Site water demands, current and future, and explains the requirements.
- Section 6.0 is conclusions and recommendations.
- Section 7.0 presents the overall strategy for managing the MSA portion of the Hanford Site water system to meet customer needs over the next 10 years.
- Section 8.0 identifies upgrades and refurbishments to the Hanford Sitewide water system that have been completed since the last revision of this Master Plan and identifies future projects to support MSA's 10-year objectives.
- Section 9.0 lists reference documents and provides a historical reference list of supporting documentation pertinent to the overall *Water System Master Plan*.
- Section 10.0 contains appendices that support the overall *Water System Master Plan*.

2.0 HANFORD SITE-MSA MANAGED WATER SYSTEMS – DESCRIPTIONS

The MSA-managed Hanford Site water systems consist of the EW system that draws water from the Columbia River and transports it to the RW reservoirs or booster pumps in the 200 Areas on the plateau; the RW system that supplies process water to clean-up contractor operations on the plateau and feeds the PW treatment plant in the 200 West Area; and the PW system that supplies PW to clean-up facilities and processes in the 200 East and West Areas. Each system incorporates numerous facilities, pumps, valve houses, wells, reservoirs, and distribution piping that deliver water to most areas of the Hanford Site. The RW and PW systems supply the fire protection systems servicing the subject areas. The water systems provide MSA-managed areas with fire protection water, process water, PW, and construction water for ongoing environmental cleanup activities. The following section describes the MSA-managed Hanford Site water systems.

Figure 2 illustrates the portion of the Site that encompasses the area from the Columbia River to the 200 Area Plateau. Detailed maps of the 200 Area RW and PW systems can be obtained from the Hanford Site drawing database, (Document Management and Control System). Overview depictions of the 200 East and 200 West Area RW and PW distribution systems can be found in Hanford Site drawings H-2-830460 through H-2-830463. The EW system is illustrated on drawing H-1-71269, all sheets. The subsections below describe the basic water systems and identify the key components and equipment associated with each.

Figure 2. The Hanford Site.

2.1 EXPORT WATER SYSTEM

The export water (EW) system provides water service to the 100 and 200 Areas, as well as to certain facilities in the 600 Area. At 100B and 100D, river pumping stations draw raw water from the Columbia River and feed it into reservoirs. Pump stations at the reservoirs then move water into the EW piping system, a piping network that serves the Central Plateau, the 100 Areas, and various other facilities in the outer areas of the Hanford Site.

The EW system includes the buildings, pumps, valve houses, reservoirs, and distribution piping, shown in Figure 3, that deliver water from the Columbia River to the 100N, 200 East, and 200 West Areas . The EW system also provides small amounts of service water to the 609 Central Fire Station, the MSA 622R meteorological station, and the 100B, 100D, 100K, 100H, and 100F Areas. Currently, the 100B Area is the preferred pumping station for normal operations and the 100D Area is an administratively controlled backup. During 242-A Evaporator campaigns, Water Utilities can operate a combination of 100D or 100B equipment to support customers' needs and the RW demands on the Plateau.

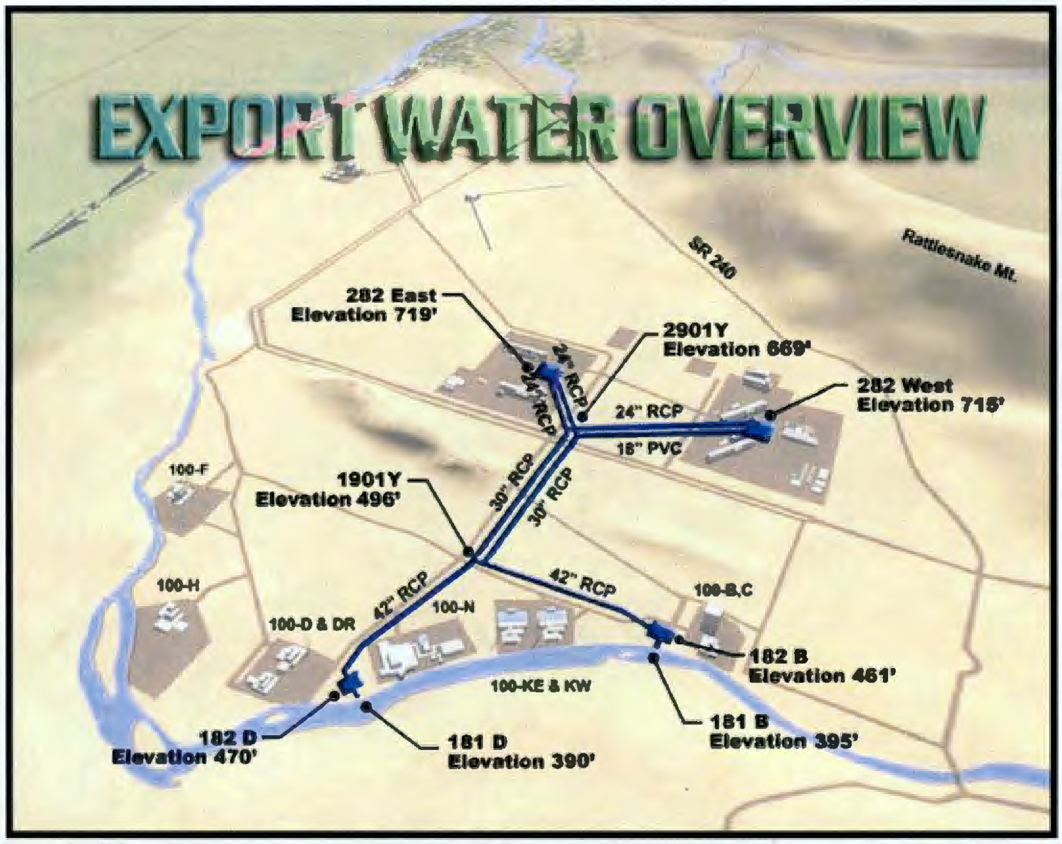

Figure 3. Export Water Distribution Piping.

River water pumped from the Columbia River is stored in 25-Mgal reservoirs, one of which is shown in Figure 4, before being pumped up onto the 200 Area Plateau. The EW pumps, located at the 182B and 182D facilities, pump water to the 200 Area Plateau RW Systems through 282EC and 282WC, and supply water to two 3-Mgal reservoirs located at 282 East and 282 West. The EW system also supplies raw river water to various 100 Area cleanup activities. The 182B pumping plant is rated at approximately 9,000 gal/min (electric) and 10,000 gal/min (diesel), while the 182D pumping plant can supply approximately 12,000 gal/min (electric). EW is pumped from the 25-Mgal reservoirs through single 42-in-diameter pipes that merge at the 1901 valve complex. From the 1901 valve stations, a dual 30-in piping system carries water to the 2901 valve complex then via dual 24-in pipes to the 200 East Area and a combination of 24-in. and 18-in pipe to the 200 West Area. Daily EW pumping averages are approximately 1.0 to 2.0 Mgal a day.

Figure 4. Aerial view of the 25-Mgal reservoir at the 182D Facility.
(A similarly sized reservoir is located in 100B Area.)

181B River Pumping Station. Two 600-hp, 1,050-gal/min @ 150-ft-vertical-drive pumps (12 and 14) are available for normal operation. A diesel-driven back up pump (6) is used. Pump P-6 is included in the Water Utilities preventive maintenance program and operates under a Washington State Department of Ecology (Ecology) Air Operating permit. The system is provided with a standby electrical battery bank. The roof is posted as "No Access" and is in need of an engineering roof inspection. The roof inspection program is Site wide and is required to be accomplished every 5 years. Access to the outside deck, which appears unsafe, may be required to perform maintenance on the diesel muffler.

182B Pump/Motors. The 182B pump house transfers 1 to 1.5 Mgal of water per day from the 25-Mgal 182B reservoir to the two 3-Mgal reservoirs located on the 282E and 282W Plateau. The 282E and 282W reservoirs are located approximately 260 ft above the 182B pump house. The 182B EW piping system is designed for 250 lb/in^2 working pressure. All the pumps, valves, and related components are designed to this pressure rating or greater. The 1,000-hp pump (P-2) develops up to 240 lb/in^2 while the P-4, P-5, and P-6 combination develop about 185 lb/in^2 pressure. Pump P-2' has a capacity of about 6,000 gal/min, while the P-4, P-5, and P-6 combination can pump approximately 8,500 gal/min.

When pump P-2 operates, pressure is controlled by cycling water back to the reservoir via a 4-in pipe and a 6-in Cla-Val™[2] relief valve. Diesel backup pumps are available; however, their hours of operation under non-emergency conditions are very limited due to environmental emission restrictions.

The EW system must provide at least 55 lb/in^2 to the suction of the RW booster pumps in the EC buildings.

Three different pump operating modes, diagrammed in Figure 5, are available at 182B: manual, automatic, and diesel backup. Each operating mode runs independently of the others.

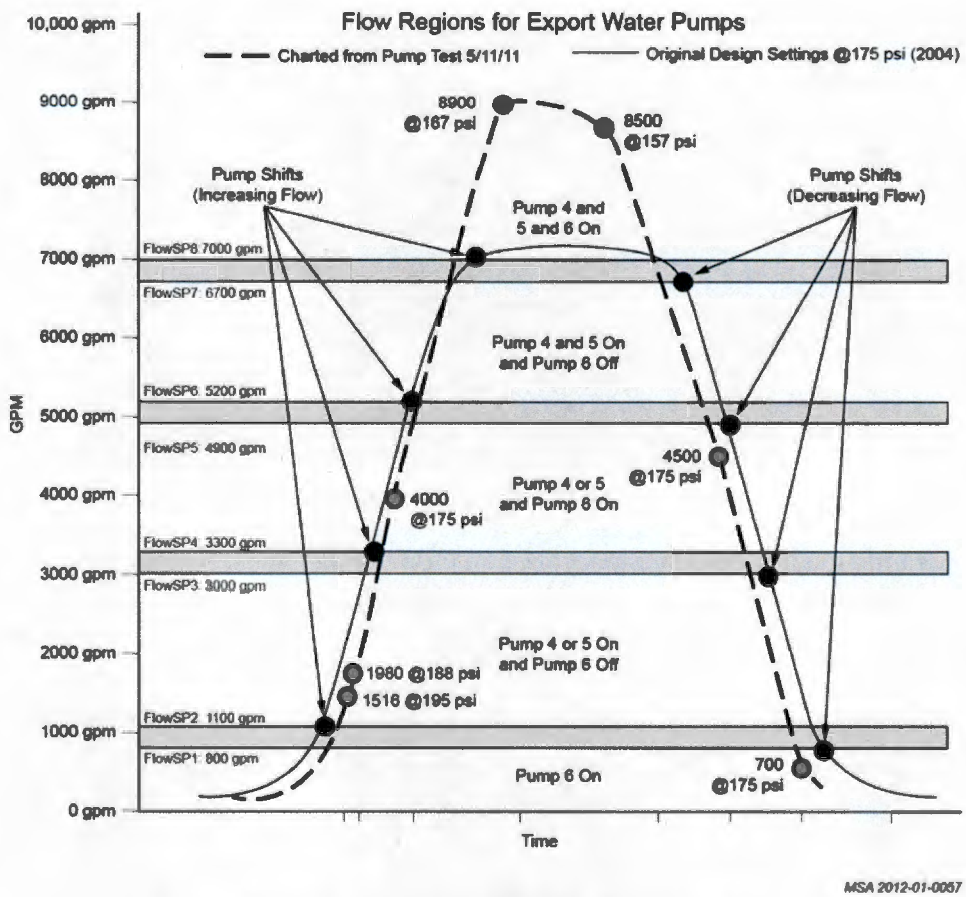

Figure 5. Flow Regions for Export Water.

The first and preferred operating mode uses pumps P-4, P-5, and P-6 automatically controlled by a programmable logic controller (PLC) to efficiently vary the flow according to water needs on the 200 Area Plateau.

The second operating mode is to use pump P-2, the 1,000-hp, constant-speed pump. Pump P-2 is used when a constant higher flow and pressure are desired on the plateau, generally when excessive flows reduce the grid pressure (e.g., heavy use of truck fill stations). Pump P-2 has a discharge pressure of about 220 lb/in^2 and is not compatible with the PLC-managed pumps.

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[2] Cla-Val is a trademark of Cla-Val Corporation, Costa Mesa, California.

Operating pump P-2 is inefficient because a substantial amount of discharge flow is recirculated back to the reservoir to manage the EW system pressure.

During 2011, pump P-2, shown in Figure 6, was removed from service because of a faulty motor. Two salvaged motors were selected and sent for inspection. Both motors were overhauled. One of the repaired motors was installed on Pump P-2, which was placed back in operation in February 2012. The second motor was stored as a spare. The process to restore pump P-2 and return it to full operating mode took over 90 days. This is an example of using available Site excess equipment parts to repair active equipment failures and the value of having 182D as a back-up supply.

Figure 6. Pump P-2 at 1,000 hp and 220 lb/in^2.

The third operating mode is the emergency backup mode. When the three-pump mode and pump P-2 are unavailable, diesel-powered pumps DP-1 and DP-2, shown in Figure 7, can be turned on to fill the 200 Area reservoirs. These pumps could also pressurize the RW grids on the plateau, but are better suited to fill the reservoirs at 282E/W.

Figure 7. 700-hp Back-Up Pump DP-2.

182B Piping and Valves. The discharge/header piping and valves are original construction, installed in 1944. The pump suction/discharge pipe size varies from 14-in- down to 12-in-diameter and the header piping ranges from 16 in to 36 in in diameter. The discharge piping is routed from the pumps to a common header for all six pumps located in the elevated pipe gallery. The header piping operates at approximately 388 to 425 fth.

101 Valve House. Isolation valves and the pressure-reducing station are being maintained by MSA Water Utilities and the general appearance within the valve house is good. Export water from the 42-in EW header passes through this combination of valves and pressure reducers to furnish the Washington Closure Hanford (WCH) maintained RW distribution system, within the 100B Area. WCH maintains all fire hydrants and the raw water distribution to B Reactor in the 100B Area.

1st Off Isolation Valve to 100K. The valve is 2 years old and in good condition. The 1st off valve is being maintained by the MSA Water Utilities Group and is considered the demarcation point between MSA Water Utilities and CH2M HILL Plateau Remediation Company (CHPRC) 100K Operations.

1821D Building/Structure. The building houses the pumps and piping header for pumping from the river to the 182D 25-Mgal reservoir. The outside platform deck, on the river side, is off limits. The roof is posted as "No Access," requiring an inspection. The roof inspection program is Site wide and is required to be accomplished every 5 years.

181D Pump/Motors. The 181D pumps pull water from the Columbia River and discharge it to the 25-Mgal 182D reservoir. The 181D and 182D pump facilities, shown in Figures 8 and 9, serve as the backup river pumping facilities for the EW System. These pumps are located downstream of the 100B Area on the Columbia River, the 181D intake pump station. When completed in 1944, the 181D River pump station housed 16 electric vertical turbine pumps, positioned in line. Of the 16 original pumps, 2 are operable and 1 is under repair. When the 100B EW pumping facilities cannot adequately deliver water or during periodic maintenance activities, the 181D and 182D pump facilities are activated to meet the system demands.

Figure 8. 181D Pump Facility.

Figure 9. 181D Pump Gallery.

Two 600-hp, 13,500 gal/min @ 150 fthd vertical drive pumps (10 and 11) available for normal operation. Pumps P-8 and P-9 were previously available; however, both currently have maintenance issues and are listed as out of service (OOS). There are no plans to return them to service.

182D River Pumping Station. The 182D facility pump station and reservoir perform the same function as the 182B facility. The 1944 facility was originally designed with six electric, horizontal, centrifugal EW pumps; only three are operable. Unlike the 182B facility, all three EW pumps have the capability to operate at the same time. A pressure control valve (Cla-Val brand valve) provides pressure control when these pumps run by cycling water back to the reservoir when pressures exceed its set point. The 182D pump house transfers water from the 25-Mgal 182D reservoir, shown in Figure 10, to the two 3-Mgal reservoirs located on the 282E and 282W Plateau. The 282E and 282W reservoirs are located approximately 250 ft above the 182D pump house. The 182D EW pumping system is designed for 250 lb/in^2 working pressure. All the pumps, valves, and related components are designed to this pressure class or greater. The working pumps operate at 475 ft total dynamic head (TDH), the same as pump P-2 at the 182B facility.

Figure 10. 182D, 25-Mgal Reservoir.

25-Mgal Reservoir and Pumping Station. Constant-speed pumps 3 and 6 are the only units available for normal operation. They are rated at 1,000 hp, 6,000 gal/in at 475 fthd. Pumps P-2, P-4, and P-5 are listed as OOS, with no repair effort identified to return them to service. Leakage in the reservoir floor has been noted in the past and the water level is administratively maintained to approximately 2 ft. The reservoir is only used as a backup during abnormal conditions. HNF-50938, *Engineering Export Water Scoping Study*, includes recommendations for improving the future configuration and operation of the 100 Area EW system and 182D in particular.

EW Distribution System Description. About 75 percent of this pipe is concrete cylinder pipe (CCP) that was manufactured on the Hanford Site in the early 1940s. CCP is a composite pipe made by wrapping a continuous steel rod around carbon steel cylinder pipe and coating the inside and outside with about 1 in. of concrete mortar. Another 20 percent of the pipe is mortar-lined and -coated steel pipe (MLCSP), which is similar to CCP, but wrapped with steel-wire mesh rather than steel rod. The MLCSP was manufactured in the 1940s by Ameron[3]. The remaining pipe is of more recent construction. Approximately 2.5 mi are of C905 polyvinyl chloride (PVC) pipe that complies with American Water Works Association (AWWA) requirements and about 0.5 mi is made of ductile iron, pressure class 350 lb/in^2 pipe.

The EW system includes a number of isolation valves that are used to divert the flow and isolate the pipelines. The valves and pressure transmitters are located near the 1901-Y and 2901-Y valve houses. Recently several valves were replaced with automatic controls allowing the valves to be operated at 283W control room via wireless (line-of-sight) telemetry.

Mile Post 7. 12-in supply to 100N from the 42-in leg from 100D. The valve is over 20 years old. Tight isolation to 100N was noted during its last operation in 2011.

609 Fire Station Potable Water Trailer. The water trailer used at this location has no apparent issues. The life cycle of the 100 Area Fire Station is not well defined. The expected utility for the 609 Fire Station is approximately 10 years.

251W EU Potable Water Trailer. A water trailer with a pump and controls is used at this location. An issue was noted with the supply pump tripping out when the water level was above

[3]Ameron is a trademark of Ameron International Corporation, Pasadena, California.

the low level set point. The supply pump is being repaired. The facility is in good general condition.

100 K Area Distribution System. The 100K Area Public Water System, identification number (ID) 00177J, is a system with 22 service connections serving approximately 302 people. The water source for this system is the Columbia River. While the 100K Area is specifically excluded from MSA's contract and is managed under the CHPRC contract, MSA does supply EW to 100K via an 8-in connection and approximately 4,000 ft of 12-in piping.

300 Area Distribution System. The 300 Area is specifically excluded from MSA's contract and is managed under the RCCC WCH contract

400 Area Water Supplies and Distribution System. The 400 Area Public Water System, ID 419470, is a system with 19 service connections, serving approximately 139 people. The 400 Area is specifically excluded from MSA's contract and is managed under the CHPRC contract.

The EW transmission valves are as follows:

- 1901-Z: 1 Remote Operated Valve (ROV) - No apparent issues noted
- 1901-U: 1 ROV - No apparent issues noted
- 1901-Y: 2 ROV - No apparent issues noted
- 2901-X: 2ROV, 1Manual valve - No apparent issues noted
- 2901-Y: 1ROV, 1 Manual valve - No apparent issues noted
- 2901-T: 1 ROV - No apparent issues noted
- 2901-U: 1 ROV - No apparent issues noted
- 2901-R: 1 ROV - No apparent issues noted
- 2901-Z: 1 ROV - No apparent issues noted
- 2901-W: 1 Manual valve - No apparent issues noted.

2.2 RAW WATER SYSTEM DESCRIPTIONS

The RW System is supplied via the booster pumping facilities at 282EC and 282WC. The water is either boosted in pressure or by-passes the booster pumps going directly into the RW grid. The booster pumps are pairs of variable-frequency drive (VFD)-controlled pumps in 200E and 200 West. Capacity in 200E is two pumps rated at 5,000 gal/min, each in the 282EC and in 200 West, two pumps rated at 3000 gal/min each in the 282WC building. The RW pumping capabilities are shown in Table 1.

Table 1. 200 Area Raw Water Pumping Capability (gal/min).

200 East	200 West
Two 5,000 Booster	Two 3,000 Booster
Three 3,500 Fire Pumps	Two 3,000 Fire Pumps
One 300 Jockey Pump	One 300 Jockey Pump

282W. The 282W reservoir and pump house is a concrete structure that houses pump/motor units below grade in a temperature controlled pump gallery. The reservoir, shown in Figure 11, is a settling basin designed to retain 3 Mgal of water dedicated to fire protection service providing the RW supply for two Fire Water (FW) pumps and one recirculation pump. The FW pumps are designed to ensure the working pressure is maintained at 110 lb/in^2 on the RW grid.

Figure 11. 282W 3-Mgal Reservoir.

282W consists of a 3-Mgal reservoir and emergency fire pumps. Life extension Project L-311, Reservoir Lining, was completed in July 2012 at the facility. The RW recirculation pump is rates as 300 gal/min at 300 fthd. Two emergency raw water (ERW) constant-speed, 350 hp, 3000 gal/min at 254 fthd pumps are located in the facility.

282WC. Booster pumps – Pumps identified as P-1 and P-2. They are 150 hp, 3000 gal/min at 145 ft. The PW fire pump is identified as 1 and the recirculation pump is identified as 2. Bases on the booster pumps are rusty. The facility is fairly new and in good general condition.

282WD. 1250kW, CAT diesel generator set is used for back-up.

283WD. There is a 1250kW CAT diesel generator set in 283WD, located near 282W, that supplies the 282E, 282EC, 282W and 282WC fire pumps, lighting panels, and computer/PLC. The recycle basin is missing facility signage.

282E. The 282E reservoir and pump house is a concrete structure that houses pump/motor units below grade in a temperature-controlled pump gallery. The reservoir is a settling basin designed to retain 3 Mgal of water and provide the suction water supply for 2 fresh-water pumps and one recirculation pump. The fire pumps are designed to ensure that the working pressure is maintained at 110 lb/in^2. The RW is used for fire protection, process, and construction water activities.

Facility includes a 3 Mgal reservoir and emergency fire pumps. Project L-317, Reservoir Lining, was completed in FY 2011. No issues have been noted with this life extension project. The jockey pump is identified as a 30-hp, 300-gal/min recirculation pump. The 3 ERW pumps are 3,500 gal/min @ 265 ft.

282EA. Reservoir head house/valve – No apparent issues noted

282EB. Reservoir head house/valve – No apparent issues noted

282EC. The 282EC pump house is a pre-engineered metal building constructed with an identical design as that of 282WC and was also constructed in 1996. This facility houses two RW booster pumps, one PW fire protection pump, and one PW recirculation pump. The 282EC pump Control Room houses a satellite Control Room similar to the 283W facility.

The RW booster pumps are designed to increase water pressure from the EW supply and boost it from 55 lb/in2 to the 110 lb/in2 grid pressure. The two variable-speed RW booster pumps, RW-5 and RW-6, are rated for 5,000 gal/min and provide pumping for normal operations (see Figure 12). This RW is used for fire protection, process, and construction water activities. One of the primary water uses is to supply RW for the PW treatment plant.

Figure 12. 282EC RW Pump.

The PW fire pump/motor unit within the pump gallery is designed to in accordance with the requirements of NFPA-20 for PW fire protection system. The fire pump is rated for 4,500 gal/min.

The PW fire pump discharges from the 282EC facility to the 200 East Area PW grid. The FW pump can pressurize either the 200W or 200E PW grid if the 283W PW pumps fail to maintain grid pressure. An example of the FW pump is shown in Figure 13. PW is drawn directly from the 283WA tank. If the grid pressure falls below 60 lb/in^2, the fire pump is designed to automatically start after time delay and pressurize the grid to 110 lb/in^2. When no longer needed it is manually shut off.

Figure 13. 282EC PW Fire Pump.

282ED. There is a 1500 kW CAT diesel generator set in 282ED – No apparent issues noted.

2.3 200 AREA WATER TREATMENT PLANT AND POTABLE WATER DISTRIBUTION SYSTEMS

The 200 East and West Area PW systems were installed in 1944 as two independent systems with one treatment plant in each area supplying PW to support domestic, chemical processing, and waste management activities. Treatment plant renovations (B-604) originally scheduled for both Areas were completed at 200 West in 1995; but the 200 East Area never received the B-604 upgrades. As a result, the 283 East Area filter plant PW production systems were placed out of service or in a dry lay-up condition in 1999. The two 200,000-gal PW clearwells, with the facilities four distribution pumps were kept in service and are maintained within the Water Utilities Maintenance Program. All PW for the Central Plateau is produced in the 200 West Areas at 283W. The 283W Water Treatment Plant is maintained in good operating condition and is expected to support Hanford mission-specific cleanup goals through 2045. Computer automation and software to provide remote monitoring capability were installed over 10 years ago and continue to operate efficiently.

The PW needed for 200 East Area is pumped from 283W through a 12-in tie line to the 200 East clearwells where chlorine levels are monitored and controlled as required. Water from the 200 West Area can be piped directly into the 200 East Area water distribution system if 283E needs to be isolated for maintenance. Both the 200 East and 200 West Areas continue to use their local PW distribution pumps (two variable speed pumps and two constant speed pumps), drawing treated PW from their clearwells and maintaining 110 lb/in^2 gauge pressure within the respective distribution grids.

The 283W Water Treatment Plants has a maximum output flow of 1,500 gal/min, based on the last Washington State Department of Health (WDOH)-required tracer study, which determines clearwell disinfection contact time (CT). This is a very important management data point. To meet some of the needs for the WTP PW demand during their operational phase, Water Utilities will need to perform another tracer study to achieve an estimated flow of greater than 1,900 gal/min from the 283W plant. Recommend accomplishing the new Tracer sometime within the FY2013 timeframe. The 200 East and 200 West Areas, each have two clearwells with storage capacity sized at 200,000 gallons each, for an approximate 400,000 gallons in each area. In addition, each area has a 1.1-million-gallon storage tank for the PW distribution system. Each tank is equipped with a 300 gal/min jockey pump that is used primarily for recirculation. The pumping capacities from the clearwells to the PW distribution grid are as shown in Table 2:

Table 2. Central Plateau Potable Water Capacity (gal/min).

200 East Area	**200 West Area**
One 4,500 Emergency Fire Pump	One 4,000 Emergency Fire Pump
Two 1,000 Variable Speed Pumps	Two 1,000 Variable Speed Pumps
Two 1,000 Constant Speed Pumps	Two 1,000 Constant Speed Pumps

Within the Central Plateau there are over 27 mi of RW and PW distribution lines, ranging from 24 in. to 4 in. in diameter. Water pipes with diameters smaller than 4 in. are defined as "Service Connections" and typically tap into main lines to provide PW to individual buildings and facilities.

In addition to other PW uses, the PW system provides backup fire protection within the 200 East and 200 West Areas. The 200 East Areas has a 1,500kVA standby generator as backup for the RW and PW Emergency Fire Pumps. A similar 1,250kVA standby generator provides backup power for the 200 West Area RW and PW emergency Fire Pumps. These generators supply power to pumps that provide fire protection water from the 3-Mgal RW reservoirs and 1.1-Mgal PW storage tanks, located in both 200 East and 200 West Areas.

283W Filter Plant. The 283W Water Treatment Facility (WTF) consists of the following: PW treatment plant, 400,000-gal clear well storage, and pump station. The 200 East and West Areas PW is supplied from the 283W WTP located in the 200 West Area. Since 1996, PW on the 200 Area Plateau has only been produced at the 283W facility. The 283E facility is out of service except for the clearwell and pumping station.

The treatment plant produces sanitary water in accordance with the W*ashington Administrative Code* (WAC) regulations by both filtration and chlorine injection. Chlorine gas cylinders are the source of chlorine for the injection system. These cylinders are housed in vessels or "ChlorTainers™," that protect from chlorine release by providing secondary containment for the chlorine vessels. The ChlorTainers are located in a covered, fenced area just outside the chlorine injection room.

™ ChlorTainer is a trademark of TGO Technologies, Inc., Santa Rosa, California

A chlorine detection and audible/visual alarm system is also in place. It provides warning should chlorine gas be detected in strategic locations in the plant. A warning and emergency level alarm is programmed based on detected concentration.

RW is supplied to the WTF from the RW grid through a series of valves, orifices, and piping. Injection of chlorine for pre-chlorination is also at this stage. Then water enters pre-treatment through a water injection, rapid-mix well that receives the alum in a water solution via a trough. The water injection, rapid-mix well is shown in Figure 14. A pressure regulator and actuated valve control the mixing pressure and time interval.

Figure 14. Rapid-Mix Well.

Pretreated water is released and circulated through three settling basins with continuous motorized paddle wheel mixing. Flocking occurs and contaminants are settled as water passes through each basin. The water is then filtered through multi-media filters containing layers of aggregate and sand. A backwash pump is used to flush the filters and keep the multi-media beds permeable. The backwash pump directs water to the hydraulic control valves, shown on the blue panel in Figure 15. The filtered water is discharged through a post-chlorine injection system into a covered clear well where it is retained for the required hold time until ready for distribution.

Figure 15. Multi-Media Bed Monitoring and Controls. Backwash Panel.

The chlorine injection system, located at 283W and shown in Figure 16, mixes gaseous chlorine with water then injects this highly chlorinated water into the piping at two possible locations: prior to entering the mixing basin and between the mixed-media bed filter and the covered clearwell.

Figure 16. Chlorine Injection System.

Treated PW is pumped from the 283W clear well and delivered 200 West Area PW grid. From the grid, PW is delivered to the 1.1 million gallon storage tank at 283WA and various facilities at the 200 West Area. The PW is also pumped across the plateau and delivered to the 283E clearwell and the 1.1-Mgal PW storage tank at 283EA.

In the early1990s, a tracer study was performed on 283E facility in order to determine the maximum capacity limit of the treatment facility. The study established the maximum PW flow to be 1,500 gal/min. This allows sufficient "hold time" for chlorination to properly disinfect the water. This flow rate cannot be exceeded without violating the state permit. Because the 283E/W facilities were identical in design and construction, it was considered acceptable that the Tracer study performed on 283E plant was adequate for the 283W plant.

PW is pumped from the 283W clear well by four 100 HP pumps, an example of which is shown in Figure 17. The 283W clear-well pump gallery contains seven pumps, five are operable. Pumps P-3 and P-6 run on electric variable-frequency drives (VFD) and pumps P-1 and P-4 run on electric constant-speed drives. These pumps are 100 hp, 1,000 gal/min, and operate at up to 115 lb/in2. Pump P-7 is used for filter back wash. The two steam-driven pumps and associated piping remain in place but are out of service.

A number of instruments take readings along the water treatment train to provide operator feedback as well as to demonstrate compliance with regulations. These instruments include turbidity, chlorine concentration, temperature, pH, pressure, and flow. Many of these instruments were installed in the 1990s or earlier

Figure 17. PW Pump.

283WA. 1.1-Mgal potable water storage tank – Tank internals were inspected in August 2007, with no internal deficiencies noted. Water Utilities should inspect again in FY2 013. AWWA recommends inspections approximately every 5 years.

283WB. Equalization Basin – #1 pump has a packing gland leak. There is a good deal of sludge around the base on the pump.

283WC. The 282WC pump house is a pre-engineered metal building that was constructed in 1996. This facility houses two RW booster pumps, one PW fire protection pump, and one PW recirculation pump. The 282WC pump house includes a satellite control room similar to that at the 283W facility.

The RW booster pumps are designed to increase water pressure from the EW supply and boost it from 55 lb/in^2 to the needed 110 lb/in^2 grid pressure. The two variable-speed RW booster pumps, RW-5 and -6 are rated for 3,000 gal/min and provide pumping for normal operations (see Figure 18). This RW is used for fire protection, process, and construction water activities. One of the primary water uses is to supply RW for the PW treatment plant.

The PW fire pump within the pump gallery is designed in accordance with the requirements of [National Fire Protection Association] NFPA-20 for the PW fire protection system. The fire pump is rated for 4,000 gal/min. The PW fire pump discharges from the 282WC facility to the PW grid. The FW pump can pressurize either the 200W or 200E PW grid if the 283W PW pumps fail to maintain grid pressure. An example of the FW pump is shown in Figure19. PW is drawn directly from the 283WA tank. If the grid pressure falls below 60 lb/in^2, the fire pump is designed to automatically start after a time delay and pressurize the grid to 110 lb/in^2. When no longer needed it is manually shut off.

Figure 18. 282WC RW Pump.

Figure 19. 282WC PW Fire Pump.

283WE. Three Sludge lagoons – Various amounts of sludge in all three lagoons.

283WF. Sampling/Monitoring – No apparent issues noted.

283E Filter Plant. The facility is no longer used to produce potable water. Valving and piping have been configured to prevent potable water contamination, per agreement with WDOH. Currently, the 400,000-gal clearwell is being used as a reservoir for 200 East PW distribution. The facility is also being used as a Chlorinator Serviceman repair shop. There is a good deal of material, including repair parts, water bottles, and chemicals, being stored in the facility. The piping around the sodium hypo chloride injection pumping unit is much deteriorated. Basement floor and base plates for #1, #2, #3, and #6 PW pumps are deteriorated and should be refurbished. Dead legs exist off #1 and #2 pumps. They are still connected to OOS #4 and #5 pumps. #4 and #5 pumps are abandoned in place.

The 283E water treatment train is no longer in operation. The clear well and PW pumping system are still active. PW is delivered to the clear well from the 283W filter plant.

A temporary chlorine injection system provides additional chlorination to the clear well as required. It consists of small storage container and an injection pump that injects diluted sodium hypochlorite into the clear well.

PW is pumped from the 283E clear well by four 100 HP pumps. The 283E clear-well pump gallery contains seven pumps, four are operable. Pumps P-3 and P-6 run on electric VFD and pumps P-1 and P-2 run on electric constant-speed drives. These pumps are 100 hp, 1,000 gal/min, and operate at 115 lb/in2. The two steam-driven pumps and pump P-7, the Backwash pump, associated piping remains in place but are out of service.

A number of instruments in the pump room take readings to provide operator feedback to the 283W Control Room as well as to demonstrate compliance with regulations. These instruments include turbidity, chlorine concentration, temperature, pH, pressure, and flow. Many of these instruments were installed in the 1990s or earlier.

283EA. 1.1-Mgal potable water storage tank – Tank internals were inspected in August 2007, with no internal deficiencies noted. Water Utilities should inspect again in FY 2013. AWWA recommends inspections approximately every 5 years.

2.4 600 AREA WATER SUPPLY AND DISTRIBUTION SYSTEMS

The 600 Area of the Hanford Site comprises all land not located within the 100, 200, 300, 400, 700, or 1100 Areas. The occupied facilities located in the 600 Area generally are served by RW systems and some have PW trailers attached for domestic use. These facilities are serviced by Water Utilities operations using water truck deliveries. The Volpentest [Hazardous Materials Management and Emergency Response] HAMMER Training and Education Center (HAMMER) is supplied by the City of Richland. The following water systems are currently in operation in the 600 Area:

HAMMER Site and the Patrol Training Academy (PTA). The City of Richland supplies water to the HAMMER Complex. There are two distribution points into Hammer through Reduced Pressure Backflow Assemblies (RPBA) located at the south fence line. These RPBA providing protection and separation between Hammer and the City of Richland water system. The PW distribution systems were constructed in the late 1990's and generally are considered to be in excellent condition. Recent upgrades have extended service to support additional building facilities west of the HAMMER site. In addition, a 12-inch main was installed from HAMMER to the east side of the PTA to provide a looped supply to the PTA. No other upgrades are currently forecasted for these systems.

251W Electrical Substation. The 251W substation receives PW from a water trailer and tank arrangement that was installed under Project L-683. The 1000-gal PW tank is filled and maintained by MSA Water Utilities and PW water is delivered on a regular schedule or as needed.

100 Area Fire Station (609 Building). The 100 Area Fire Station receives RW from a tie line to the EW system. The RW supplies non-PW services inside the facility (i.e., flushing toilets, hose bibs and fire protection). This system was installed in the mid-1940's and is generally considered in fair condition with no major upgrades currently forecasted. The facility's PW service is supplied from a trailer installed on the west side of the building that is connected to the facility's PW system. The 1,000-gal tank in the trailer is filled and maintained by MSA Water Utilities delivery crews.

2.5 700 AREA AND 1100 AREA DISTRIBUTION SYSTEMS

The 700 Area and 1100 Area receive water from the City of Richland and are not serviced by MSA

Support of OHC

In 2009, RL issued MSC DE-AC06-08RL14728 to MSA. That contract implemented a fundamental change relative to the management and operation of the Hanford Sitewide water system. In accordance with DE-AC06-08RL14728, MSA will maintain a Hanford Site water system master plan and manage portions of the Hanford Sitewide water system as a "ready-to-serve" water utility, supporting Hanford's 100, 200, and 600 Areas. Under the MSC, MSA is responsible for providing a reliable supply of fire protection water, process water, potable water, and construction water to Site customers, who are charged with meeting the ongoing environmental cleanup activities, within their specific areas of responsibility.

MSA functions as the water service provider to various Hanford Site contractors, responsible for implementing long-term environmental cleanup goals. MSA's primary Site customers include the plateau remediation contractor (CHPRC), the tank farm operating contractor (Washington River Protection Solutions [WRPS]), the River Corridor Closure Contractor (WCH), and River Protection Project (RPP) –WTP. MSA, under the MSC, is responsible for all aspects of the water distribution system up to and including the first off-valve or demarcation point outside each customer's facility of complex of facilities. Basic service functions of the "ready-to-serve" water utility are funded through the MSC, provided at no cost to Site contractors. Direct, mission related upgrade projects are paid for by the Site Contractor requiring the upgrade.

Interface Control Documents (ICD), have been developed and established, between MSA and the other major Hanford Site customers, with the exception of WCH (see 3.4). These ICDs define roles, responsibilities, service requirements, administrative responsibilities, and acceptance standards. The portion of the site-wide water system managed by MSA, as defined by DE-AC06-08RL14728 and customer interface documentation, are described below.

WRPS Tank Farm Water Supplies and Distribution. HNF-4493, *Interface Control Document between Washington River Protection Solutions, LLC (WRPS), and the Mission Support Alliance, LLC (MSA Water Utilities Distribution System,* Revision 1, and outlines contractor responsibilities. This ICD provides the requirements for interfacing MSA portion of the Hanford Water System with WRPS tank farm systems. This document identifies the portion of the MSA-managed water system that supports Hanford's tank farms, defines interface points between the MSA and WRPS managed water systems, and establishes the service requirements MSA must meet to support WRPS mission objectives. The MSA Water Purveyor and Water Utilities Design Engineer works with WRPS to establish acceptable standards and code compliance for all water systems within WRPS's area of responsibility.

The ICD covers the following subjects:

- Delivery of water to the double-shell tank (DST)/single-shell tank (SST) East Tank Farm Facilities (including 242-A Evaporator)
- Delivery of Water to the DST/SST West Tank Farm Facilities
- Delivery of Water to all other WRPS facilities serviced by MSA

Figure 20 identifies major tank farm facilities and water systems managed by MSA and the interface demarcation with WRPS. Table 5 identifies the RW and PW interface valves. All services upstream of the demarcation values are managed and operated by the MSA.

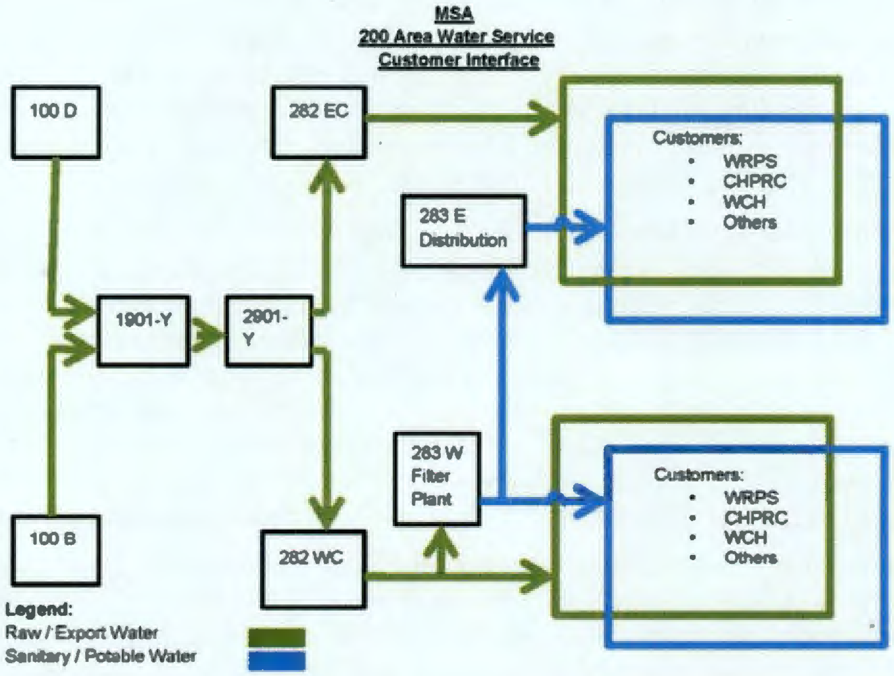


Figure 20. MSA Managed Facilities/Water Systems and Interface with WRPS.

Table 3 shows the designated demarcation valves between MSA and WRPS for reference. Valve designations are subject to change and are indicated in ICDs.

Table 3. Tank Farm Demarcation Valves between Mission Support Alliance and Washington River Protection Solutions. (2 sheets)

WRPS Facility/Building/Complex	Demarcation Valves – Raw Water	Demarcation Valves – Potable Water
2704HV	R051-2, R051-3	S523
2704 Trailer Complex	321R	TBD
272AW	n/a	199S
274AW	n/a	268S
2750	n/a	178S, 179S
2701HV	R091	n/a
MO 850	n/a	S546
242A	117R, 123R	168S
A-Complex and AN Farm	287R, 177R	434S
AW Farm	n/a	n/a
AP Farm	n/a	n/a
B/BX/BY Farms	n/a	n/a
C Farms	241-C-73-BFP	n/a

Table 3. Tank Farm Demarcation Valves between Mission Support Alliance and Washington River Protection Solutions. (2 sheets)

WRPS Facility/Building/Complex	Demarcation Valves – Raw Water	Demarcation Valves – Potable Water
T/TX/TY Farms	n/a	n/a
S/SX Farms	n/a	565S, 163S
SY Farm	n/a	backflow preventers
222-S Laboratory	55R, 57R, 58R, 60R, 95R, 98R	143S,146S, 148S,149S, 150S, 153S, 317S, 319S, 342S, 460S

WRPS = Washington River Protection Solutions.

CHPRC Central Plateau Water Supplies and Distribution. HNF-46148, *Interface Control Document HNF-46148 between CHPRC and Mission Support Alliance, LLC for Water Systems Services*, Revision 1, establishes the requirements for interfacing the MSA portions of the Hanford water system with CHPRC managed water systems on the Central Plateau. This document identifies the MSA managed portion of the Central Plateau water system, defines the interface points between the MSA and the CHPRC portions, and establishes service requirements to support CHPRC cleanup objectives. The MSA Water Purveyor and Water Utilities Design Engineer works with CHPRC to establish acceptable standards and code compliance for all water systems within CHPRC area of responsibility.

The MSA is responsible for and provides the necessary water services to the following major CHPRC facilities:

- Plutonium Finishing Plant (PFP)
- Central Waste Complex (CWC)
- T-Plant Complex (T Plant)
- Waste Receiving and Processing Facility (WRAP)
- Waste Encapsulation and Storage Facility (WESF)
- Effluent Treatment Facility (ETF)
- Canister Storage Building (CSB).

The CHPRC along with the Hanford Fire Department are responsible for systems, valves, and maintenance within CHPRC's facility boundaries. The CHPRC holds all responsibility for lines downstream of the first off-valve or demarcation point outside the CHPRC facilities or facility complex as identified in Table 4. Valve designations are subject to change and are indicated in ICDs.

Table 4. Central Plateau Demarcation Valves between Mission Support Alliance and CH2M HILL Plateau Remediation Company.

CHPRC Facility	Demarcation Valves
PFP	505Sand507S, 51 OSand51 3S

Table 4. Central Plateau Demarcation Valves between Mission Support Alliance and CH2M HILL Plateau Remediation Company.

CHPRC Facility	Demarcation Valves
CWC	1733, 258S, 4393
T Plant	5733, 5713, 20R
WRAP	2573, 2653
CSB	R311, F0101, F033
ETF (2025E)	1 94R, 1 95R, 322S
WESF (22513)	14R, 843

CHPRC = CH2M HILL Plateau Remediation Company.
CSB = Canister Storage Building.
CWC = Central Waste Complex.
ETF = Effluent Treatment Facility.
PFP = Plutonium Finishing Plant.
WESF = Waste Encapsulation and Storage Facility.
WRAP = Waste Receiving and Processing Facility.

Waste Treatment Plant Water Supply and Distribution. 24590-WTP-ICD-MG-01-001, ICD 01 - *Interface Control Document for Raw Water,* and 24590-WTP-ICD-MG-01-002, ICD 02 - *Interface Control Document for Potable Water*, establish the requirements for interfacing the MSA portions of the Hanford water system with the Bechtel National, Inc.-managed WTP water systems. These documents identify the MSA managed portion of the water system, define the interface points between the MSA and the WTP, and establish the service requirements to meet WTP construction and future operating demands. The MSA Water Purveyor and Water Utilities Design Engineer work with WTP to establish acceptable standards and code compliance for all water systems interfaces.

Raw Water Support for Waste Treatment Plant (24590-WTP-ICD-MG-01-001). The Hanford Site 200 East Area raw water system provides raw makeup water for process use and fire water for the 200 East Area. The Hanford Site raw water supply is unfiltered, untreated Columbia River water subject to seasonal changes in temperature and composition. Raw water is received at the 200 Area Plateau from water lines coming from the Columbia River. The water is then pumped through the 200 East Area and through a 12-inch raw water line loop within the River Protection Project (RPP) – Hanford Tank WTP site boundary. Raw water will be supplied during WTP construction and "operations" (startup testing, commissioning, and permanent operations). Raw water will be used to support construction activities, such as dust control and pipe flushing. Raw water will be used within the WTP for fire water makeup and may be used for cooling tower makeup, especially during seasonal peaking.

Raw water supplied from the interface will feed a manual refill of the fire water tanks and may be used for cooling tower makeup, especially during seasonal peaking. The raw water requirement during the peak cooling tower makeup period is 550 gal/min.

The fire water tanks require makeup water at 730 gal/min to fill one 350,000-gal tank in 8 hours. MSA Water Utilities has agreed that administrative controls can be implemented to increase flow rates during operations to meet the fire water storage tank fill. These administrative controls will be negotiated between the WTP Contractor and MSA Water Utilities before filling the fire water storage tanks during WTP operations. A process or procedure will be in place describing the administrative controls prior to filling the fire water storage tanks during plant operations.

Project W-519 has provided a 12-in pipeline for raw water and fire water within the WTP site boundary to the physical interface point(s). The physical interface point for the permanent connection of raw water is shown on the *Interface Control Drawing* (see WTP ICD). The *Interface Control Drawing* identifies the affected/referenced drawings for the physical interface and provides the coordinates and elevation of the physical interconnections. The physical configuration of the piping systems at the interface interconnection is shown on drawings referenced in the *Interface Control Drawing* in Table 2 (see WTP ICD).

Functional requirements for the WTP Contractor and MSA interface design for the raw water system are as stated in this ICD. MSA has committed to supply raw water at the following flow rates:

- 875 gal/min for operations
- 1200 gal/min for construction while the 242A Evaporator is operating
- 2600 gal/min for construction when the 242A Evaporator is not operating, and
- 3650 gal/min (administratively coordinated with MSA Water Utilities) for construction pipe flushing.

The MSA will supply water at nominal operating pressures between 115 and 130 lb/in^2 gauge.

Reduced Pressure Backflow Preventers (RPBA) valves are located where the raw water supply loop crosses the WTP site perimeter fence at the northwest corner of the site (Node 3T on the *Interface Control Drawing*) and where the raw water supply loop crosses the WTP site perimeter fence at the southeast corner of the site (Node 11T on the *Interface Control Drawing*). The interface points will be the 12-in. flange on the discharge side of the backflow preventers. Since the RPBAs are located inside the perimeter fence, the WTP Contractor will test the units and report completion to Water Utilities. MSA Water Utilities is responsible to insure this action is completed annually. The WTP contractor will be responsible for operating of the raw water supply loop between the two interface point locations. MSA Water Utilities will be responsible for updating the Hanford Site drawings when the corridor is returned to their control. A WTP site inner service loop will be progressively installed that will supply both temporary construction activities and permanent piping to the operating plant. This inner service loop will be supplied by temporary connections to the external service loop at Nodes 3A and 11.

Potable Water Support for Waste Treatment Plant (24590-WTP-ICD-MG-01-002). The Hanford Site 200 East Area PW system provides PW for use during construction as well as "operations" (startup testing, commissioning, and permanent operation). The PW is pumped to the RPP –WTP site from the 200 East Area PW distribution systems via PW lines to the WTP interface. The interconnection for the PW system during construction is the 4-in. line at the north WTP site boundary. The interconnection for the PW system during operations will be a line south of the WTP site boundary. This PW line is a single point failure concern. It runs along Canton and turns south down to the southwest WTP gate area. Consideration should be given to run another feed from Baltimore, providing a loop arrangement. Potable water is used as domestic water for drinking fountains, restrooms, showers, eyewash stations, and other domestic uses. Potable water is also used to supply cooling tower makeup, demineralized water (DIW) makeup, and process service water (PSW) makeup.

Project W-519 provided a 4-in. pipeline for PW at the north of the WTP site (Node 4), *Interface Control Drawing*. Water from this line will be used during the construction period. The average available flow rate during the construction period will be 200 gal/min. However, this pipeline will not be used by the WTP during operations. Instead, the WTP physical interface point for operations will be the connection to the new PW line at the south boundary of the WTP site. The physical interface locations for connection of PW are shown on the *Interface Control Drawing* (see WTP ICD). The *Interface Control Drawing* identifies the affected/referenced drawings for the physical interface and provides the coordinates and elevation of the physical interconnections, consistent with design maturity.

Functional design requirements, for the WTP Contractor and DOE PW system interface, are as stated in the Potable Water ICD. The ICD states that DOE will supply PW at a flow rate of 200 gal/min during construction and 950 gal/min (24 hour average) during operations. Nominal operating pressures during operations will be provided at the completion of a planned analysis of the 200 Area PW systems, via a formal model run report in FY2012. Currently, Water Utilities has identified to the WTP Planning Group/ICD Group, that when other area demands are taken into consideration, Water Utilities cannot furnish 950 gal/min, without exceeding their maximum filter plant output of 1,500 gal/min. Water Utilities has proposed, that they perform another tracer study, which would enable them to obtain flows out of the filter plant of approximately 1,950 gal/min. This flow rate would satisfy all current needs. This issue is being tracked to solution in the ICD issue section.

A RPBA has been installed where the 4-in PW supply line crosses the WTP site perimeter fence at the northwestern corner of the site (Node 4T on the *Interface Control Drawing*). The interface point will be the 4-inch flange on the downstream side of valve PVC 8001. The WTP Contractor will be responsible for operation of the PW supply line downstream of the preventer and for updating the Hanford Site drawings as necessary. Since the RPBA is located inside the perimeter fence, the WTP Contractor will test the units and report completion to Water Utilities. MSA Water Utilities is responsible to insure this action is completed annually. Temporary piping to support construction activities and permanent piping to supply the operating plant will be installed during the construction period and will be supplied by temporary connection to the DOE supply line at Node 4 on the Interface Control Drawing. The permanent interface to the 200 East Area PW systems will be the air gap at the cooling tower and the air gaps on WTP tanks that receive a direct PW feed from the DOE.

River Corridor Closure Supply and Distribution. An ICD does not exist between MSA and WCH. The current MSC contract, DE-AC06-08RL14728, states in the J-3 attachment, that the 300 Area and 100N Areas water systems are within the scope of the RCCC, along with the 30-in. concrete line supplying the 100F and 100H Areas, and all distribution piping connecting to the concrete main water lines supplying the 100F, 100H, 100D, 100N and 100B Areas. Currently, MSA employs the same Site standard, first off valves and demarcation points, used with the other Site Contractors to manage the water supply to WCH. It is recommended that MSA Interface Management and WCH negotiate an agreement, establishing function and responsibilities. In all cases, MSA will work with WCH, so as to not impact RCCC activities.

Demarcations Points Between MSA and WCH

- Export water to 100D, 100F and 100H, first off valve at the Pressure reducing station outside of 100D Area , the 42-inch leg south.

- Export water to 100N, first off valve from 42-inch main at mile post 7.
- Export water to 100B, first off vale in the 101B Valve House. WCH services all fire hydrants and B Reactor, within the 100B Area.

2.6 WATER SYSTEM INTERDEPENDENCIES

The Hanford Site water system plays an important role with other infrastructure systems. Table 5 shows the interdependencies of the infrastructure system with the Hanford Site water system, shown in Figure 21. The locations of the major facilities served by the Site infrastructure are shown in Figure 22.

Table 5. Interdependencies With Other Infrastructure Systems.

Infrastructure System	Relationship with Water System
Transportation System	Roadways for access to storage facilities and pump stations
Electrical - Power	Power to energize pump stations, heating and lighting facilities
Telecommunications	Communication link for water system operations, valve automation, telephones, radios, emergency response, and networking, antenna/towers for transmitting remote signals
Emergency Response	Fire and emergency response to General Purpose-Facilities
Water Supply	Domestic and Fire Protection water supplies

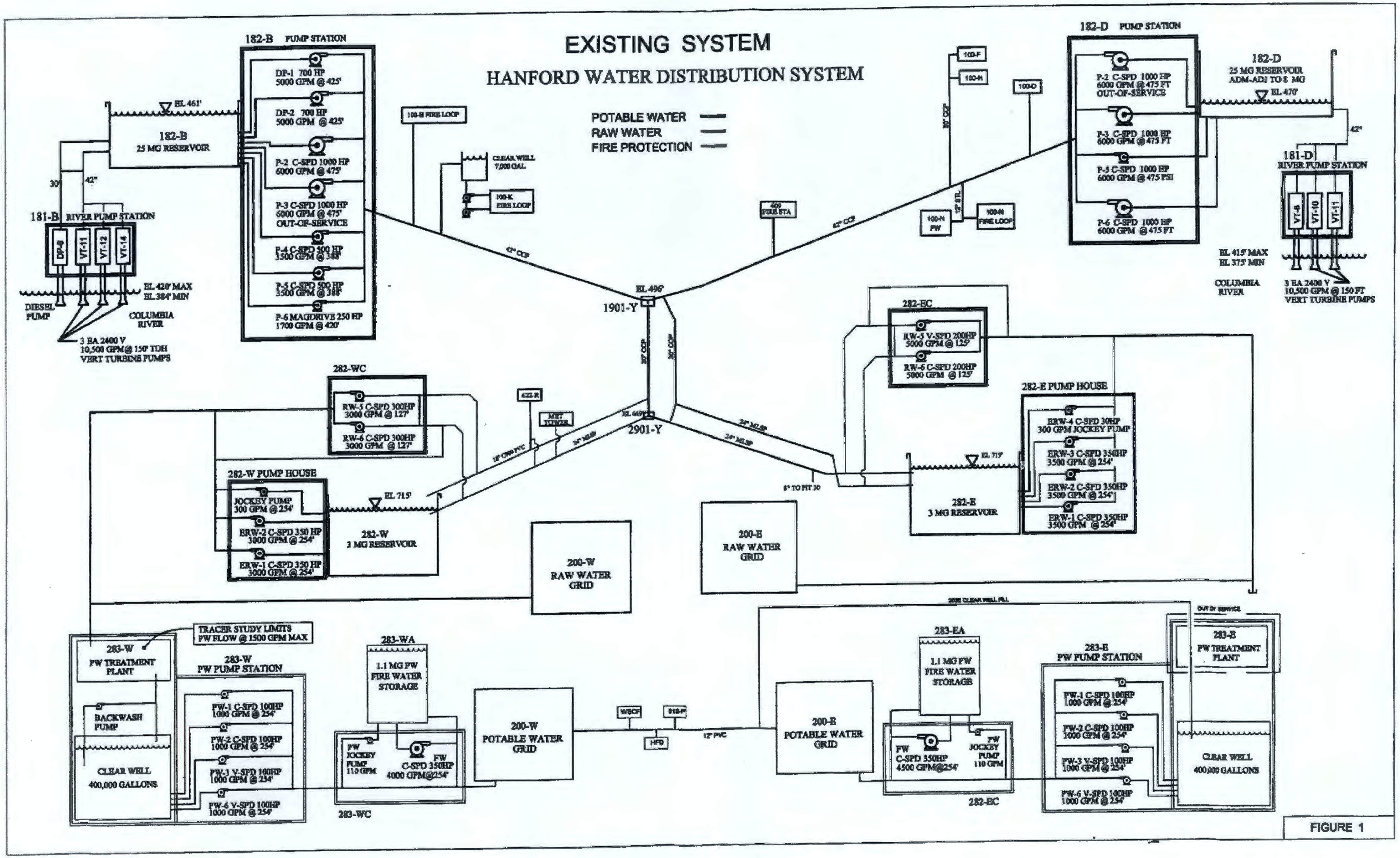


Figure 21. Existing Hanford Waster Distribution System.

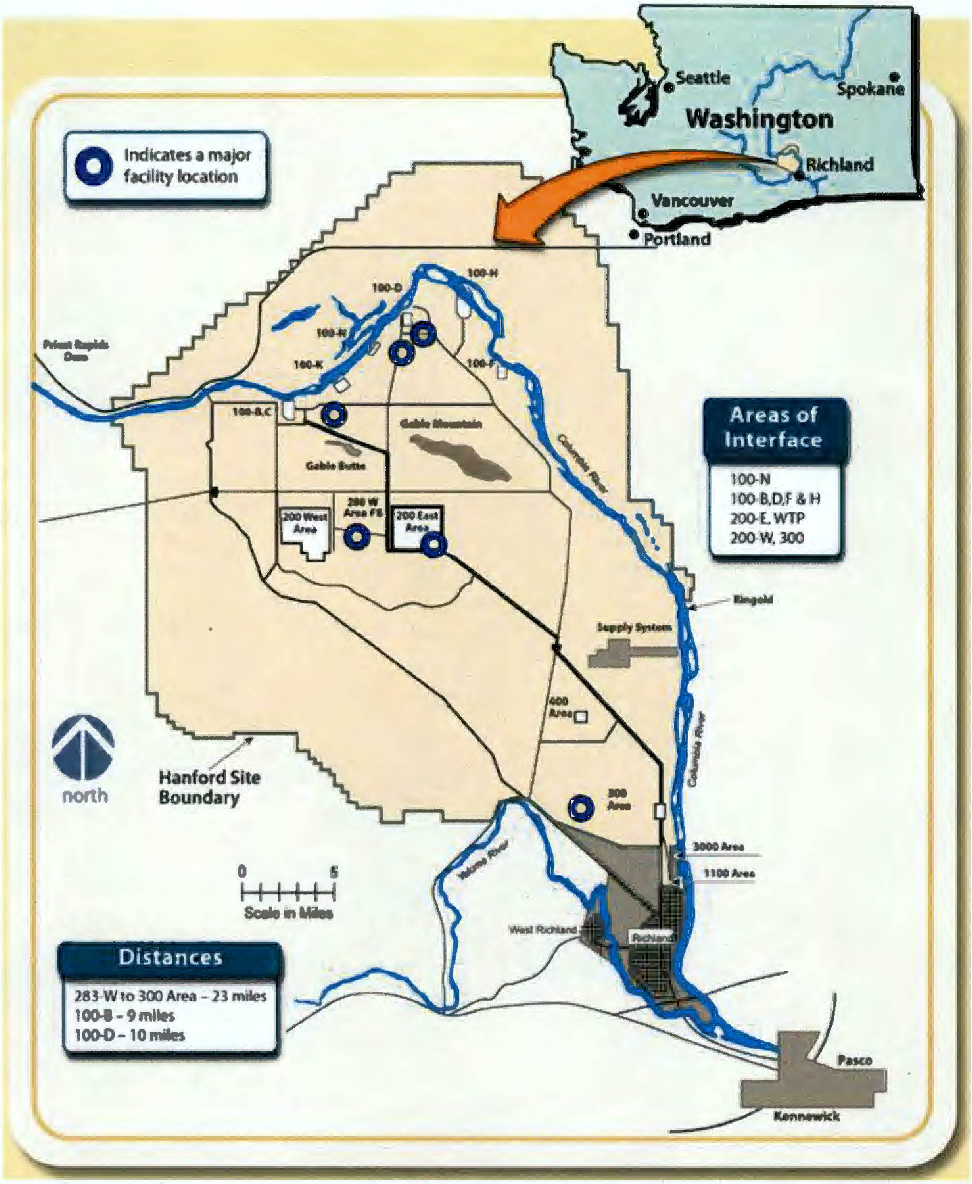


Figure 22. Major Facility Locations.

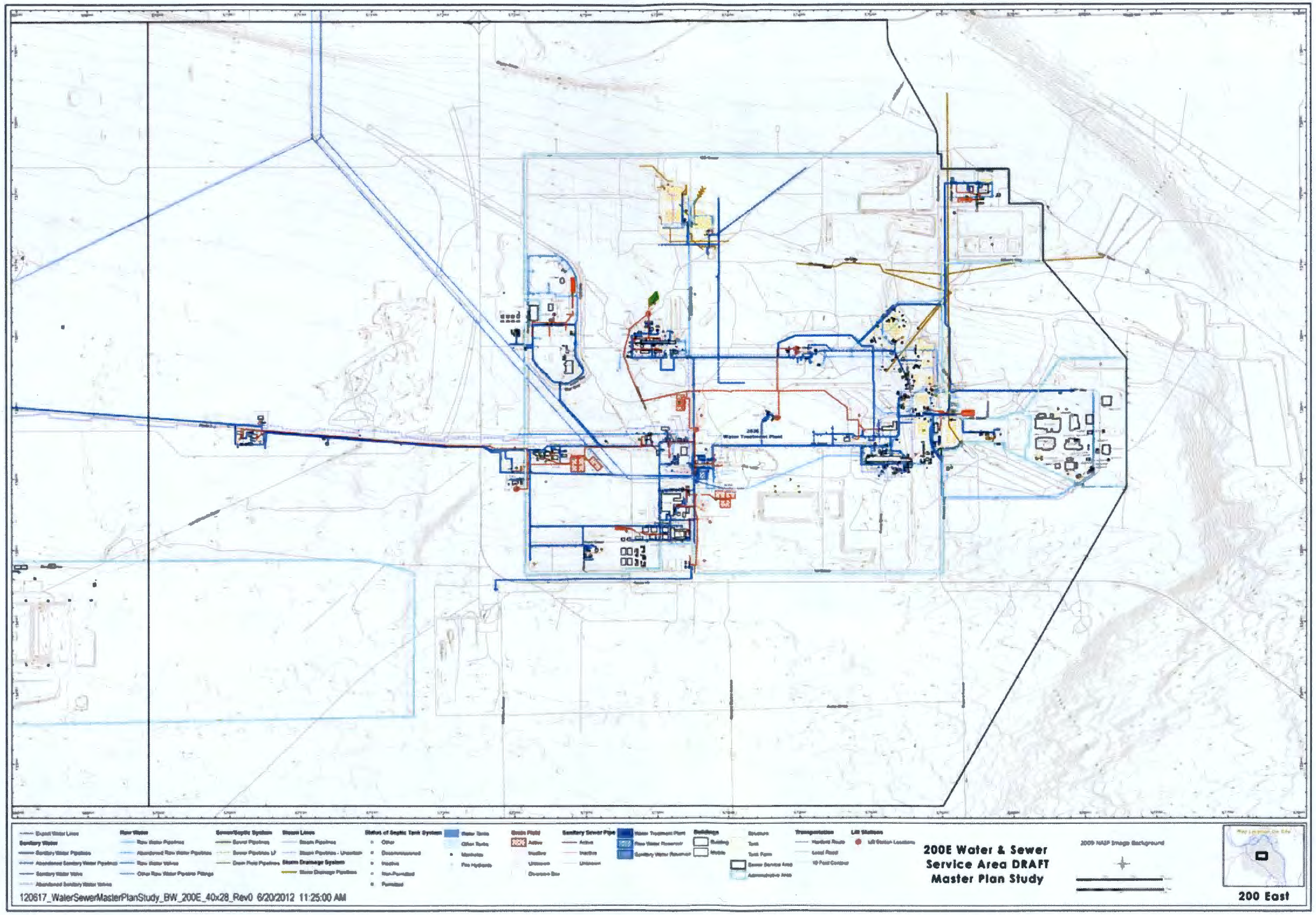


Figure 23. 200 East Area Water and Sewer Service Area..

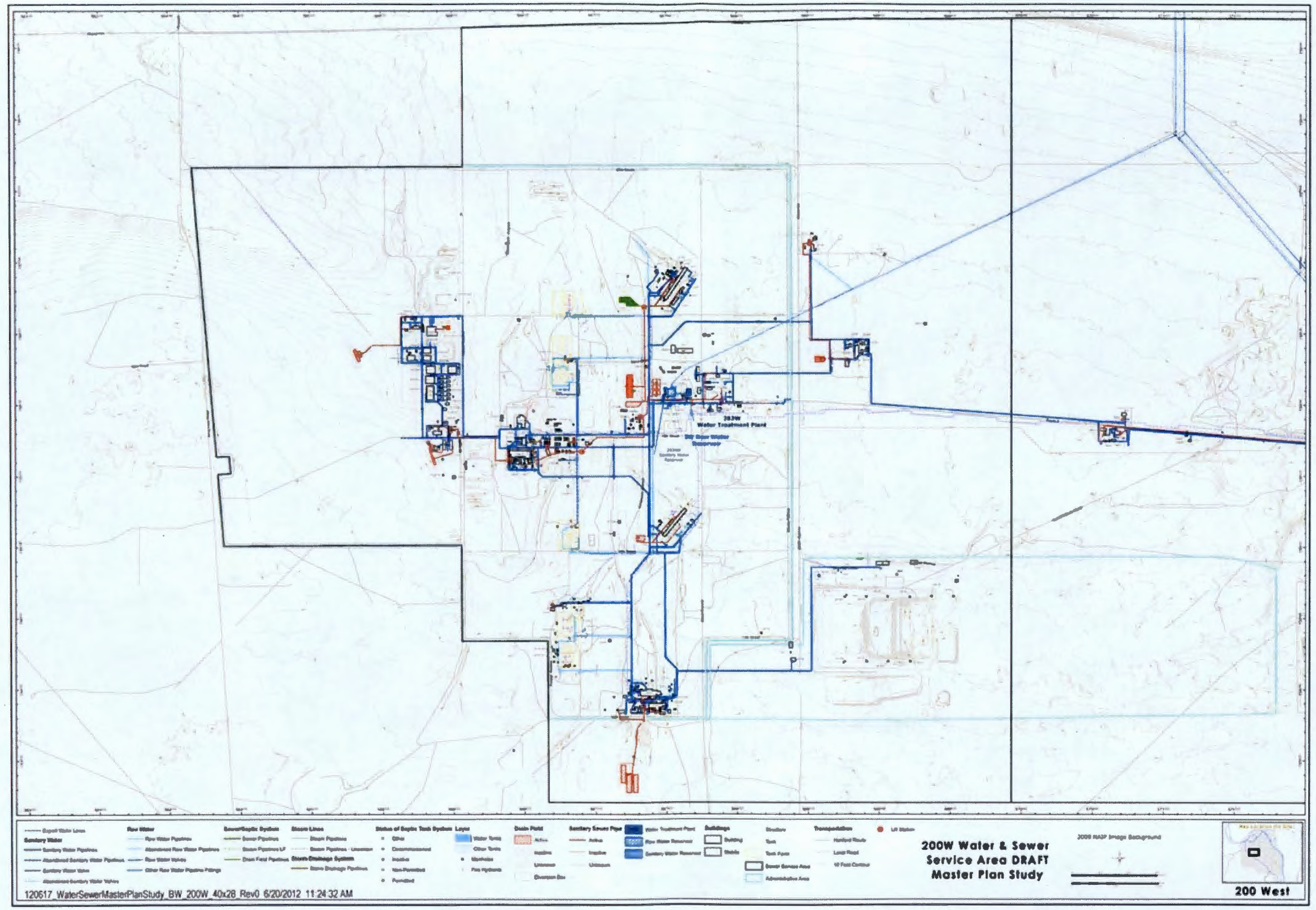


Figure 24. 200 West Area Water and Sewer Service Area.

3.0 HANFORD SITE-MSA MANAGED WATER SYSTEMS CONDITION ASSESSMENTS

MSA conducted and reported on a conditions assessment of the export, potable, and raw water systems in February, 2012 (HNF-51470, Rev 0). Then during May, 2012, a facility walk down was performed as part of the requirements for completion of the 2012 Water Master Plan. The information from both activities is consolidate in this report

The Hanford Site water system has been operated using equipment and systems over 60 years old. Until recently, preventative maintenance has been sparse as much equipment was operated on a "run to failure" basis and spare parts were often scavenged from out-of service excess equipment. This excess equipment is being exhausted and spare parts are becoming more difficult to attain, resulting in gaps or potential gaps in MSA's ability to maintain a reliable system. (see section 6.1.1)

Results of the combined assessments are presented in the following sections.

3.1 EXPORT WATER SYSTEM

181B Building/Structure. The concrete structures appear to be in good condition; they are watertight and temperature controlled. The building is functional and provides adequate protection for the operating equipment housed therein. The building is in need of painting.

181B Pumps/Motors. At the time of the assessment, two of the original 17 electric pumps and one diesel pump were operational. The two electric pumps (P-12, and -14) are the same model, age, and rated at 10,500 gal/min, shown in Figure 25. The diesel-driven pump (DP-6) was added in 2007 to serve as a backup in the event of a power outage and is shown in Figure 26. The diesel pump is rated at 5,000 gal/min and is fueled from a 12,000-gal underground diesel fuel tank.

Figure 25. 181B Pump Gallery.

Figure 26. 181B Diesel Driven Pump.

Error! Reference source not found.6 summarizes the capacity and condition of the two operable pumps. Performance tests were not conducted to confirm the present flow rate on the electric pumps. Reportedly, routine maintenance is being performed on the electric pumps. However, there are no regular preventive maintenance (PM) activity records. The diesel pump was field tested after installation and is scheduled for quarterly PM to operate the pump/motor, ensuring it is working properly.

Table 6. Operational Pump Summary.

Pump No.	Pump/Motor Manufacture, Size (gal/min)	Motor	Electric		Condition	Remarks
		HP	Volt	Amps		
DP-6	Floway/Caterpillar, (5,000)	275	NA	NA	Good	Diesel-driven emergency back-up
P-12	Pomona/Westinghouse (10,500)	900	2400	145	Fair-Untested	Flow rate not verified
P-14	Pomona/Westinghouse (10,500)	900	2400	145	Fair-Untested	Flow rate not verified

181B Piping and Valves. The buried 30- and 42-in carbon steel penstock piping and related valves were not evaluated. The piping and valves are of original construction. This portion of the delivery system has no known maintenance issues and no PM programs are currently in place for cycling and testing the valves. Operability and isolation capabilities of the existing valves from the pump discharge to the 182B reservoir are questionable. Based on the above information and a visual inspection, the existing isolation gate valves inside and outside the 181B pump house are suspect.

The underground diesel storage tank services the diesel pump. It was installed, abandoned, and then reinstated with the installation of the new diesel pump in 2006. It is functional but intrusion of runoff has been problematic into the controls at the diesel tank.

181B Power/Instrumentation and Controls. The operable electric vertical turbine pumps are powered by a single, small-capacity transformer that can only power two pumps. The transformer is fed from a single, marginally sized, 13.8kV power line, which makes it a potential electrical single point of failure for the electric pumps at 181B pumping station. The diesel driven pump does provide redundancy should electric pumps be unavailable.

All pumps are manually controlled requiring an operator to physically start and stop pumps as needed. The 182B reservoir currently does not contain float controls in order to maintain the appropriate reserve water level. The level indication instrumentation is functional.

Figure 27. 700 HP Back-Up Pump DP-2.

182B Building/Structure (Reservoir). The 182B consists of the reservoir and pump gallery. The reservoir is a cast-in-place concrete structure retaining 25 Mgal of water when full. A visual inspection was conducted in late 2011 on the reservoir and pump gallery exterior walls and the common vertical surfaces in the pump room in 2011. At that time no visual leaks were observed within the common wall of the pump gallery. Reservoir wall inspection was limited to a walk around the perimeter and resulted in no visual leakage. No attempt was made to perform any leak tests on this structure. The reservoir was in fair condition. There were signs of concrete degradation from exposure to weather. Since there are no ground water monitoring wells located in the near vicinity, it is beyond the scope of this assessment to determine if any leaks are occurring into the ground. Further inspection of the reservoir in May 2012 identified breeches in the reservoir walls, both inside the pump house and along the above-ground walls. A flow of approximately 30 gal/min was noted from the breech in the reservoir west wall. These conditions are being evaluated and repair options are being developed.

The building, while in need of painting, is weather-tight and serviceable for operating the EW pumps. Breeches resulting in leaks have been identified. Repair options are being researched. Long term, it is recommended that a liner and leak detection system be installed. Engineering studies have been done to provide a liner within the entire reservoir, or a portion of it.

182B Pumps/Motors. The 182B pump house contains a total of seven horizontal centrifugal pumps (five electric and two diesel-driven). The original 1944 design of the 182B pump gallery, shown in Figure 28, supported six horizontal centrifugal pumps and only one of these pumps (P-2) remains in service. Two of the original pumps were removed during the installation of the three-pump package that currently consists of pumps P-4, P-5, and P-6. Pumps P-4 and P-5 are 500 HP, constant-speed units, shown in Figures 30 and 31, respectively. Pump P-6, shown in Figure 29, is a 250 hp, magnetically adjusted, variable-speed-drive pump. The last original pump (P-3) remains in place, but is not operational because it is not connected to power. Adding power to pump P-3 and running it with pump P-2 would require the installation of an additional transformer and connecting it to the electrical cubical. There is no plan to provide the additional transformer or connect the motor to the electrical cubical at this time. In 2007, two new dedicated diesel-driven pumps (DP-1 and DP-2, Godwin[4] 700 hp, 5,000 gal/min) were installed and used for emergency back-up. Environmental restrictions allow only limited run times outside of emergencies for the diesel pump. Table 7 details the capacities and conditions of the operable pumps at the 182B pumping plant.

Figure 28. 182B Pump Gallery.

[4]Godwin is a trademark of Godwin Pumps of America, Inc., Bridgeport, New Jersey.

Figure 29. Pump 4 at 500 HP and 200 lb/in2.

Figure 30. Pump 5 at 500 HP and 200 lb/in2.

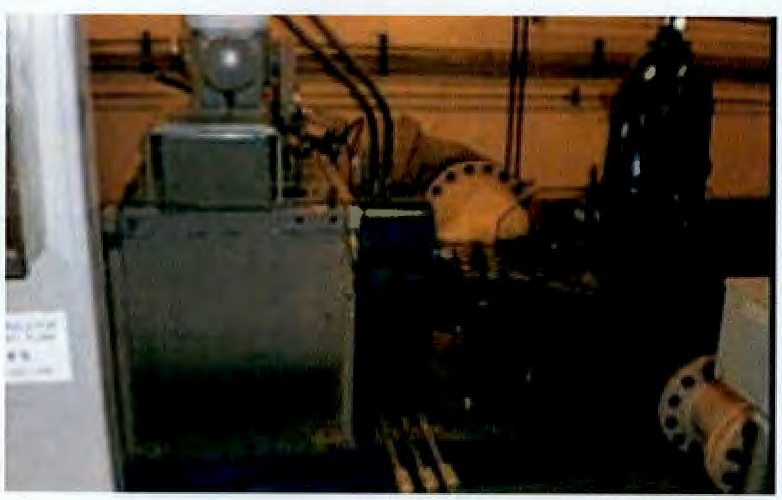


Figure 31. Pump 6 at 250 HP and 200 lb/in2

Table 7. 182B Operable Pump Capacity and Condition.

Pump No	Pump/Motor Manufacturer, Size (gal/min)	Motor (HP)	Electric (V)	Condition	Remarks
P-2	Allis Chalmers/Reliance, (6000)	1000	2400	Good	Failed motor replaced, spare motor on shelf
P-4	Peerless/US, (3750)	500	2400	Fair	PLC or manual control
P-5	Peerless/US, (3750)	500	2400	Good	PLC or manual control
P-6	Peerless/US, (1850)	250	2400	Good	PLC or manual control Magnetic drive
DP-1	Godwin/Caterpillar, (5000)	700	NA	Good	Diesel back-up
DP-2	Godwin/Caterpillar, (5000)	700	NA	Good	Diesel back-up

NA = not applicable PLC = programmable logic controller.

Demands associated with 242-A Evaporator campaigns and truck fill operations result in the 182B pump facility providing marginal flow and pressure in its current configuration. The pressure transients have caused fire protection pumps to automatically come on line as they respond to drops in the grid pressure. This problem will worsen when WTP demands are added.

Operation of RW booster pumps are not integrated with that of EW pumps to maintain a stable 200 Area grid pressure. Operating the EW pumps with 10 miles of piping and over 250 ft difference in elevation with any consistency in service pressure is an immense burden. The 182B pumps and motors are inadequate to support the added Evaporator and future WTP loads along with the existing plateau water demands.

The 182B pumps were performance tested for comparison with the data points plotted on the original pump test curves. Since being installed in 2004, performance has decreased on all the electrically driven pumps, as shown in Table 8.

The 182B pumps and motors are inadequate to support the added Evaporator and future WTP loads along with the existing plateau water demands.

A review of Table 8 indicates that the older pump (P-2) is becoming less effective in meeting the EW demands and less reliable after 67 years of service. Due to the age and difficulty finding replacement parts the reliability of this pump is significantly diminished. The 182B pumps were performance tested for comparison with the data points plotted on the original pump test curves. Since being installed in 2004, performance has decreased on all the electrically driven pumps, as shown in Table 8.

Pumps P-4, P-5, and P-6 are operable; however, Pump P-4 is running 23 percent below the design performance level, while pumps P-5 and P-6 are operating within acceptable limits. The lower than expected performance of P-4 was the result of electrical and mechanical issues that arose shortly after all three pumps were installed. This issue was complicated by an ineffective

PM program. Defective rotor assemblies were discovered in the motors on pumps P-4 and P-5. A hot bearing in P-4 triggered the investigation that led to replacing the rotors on both pumps under warranty. Since then, P-4 has never performed as well as P-5. P-4 should be inspected to determine why it is not performing as designed. Replacement of the rotating assembly (i.e., impeller and shaft) may be required. Continued maintenance issues can be expected on pump P-4. Its expected useful service life of pump P-4 is in the 5- to 10-year range. Pumps P-5 and P-6 are operating reasonably well and should continue to do so. These pumps have an expected useful service life of between 10 to 20 years.

The diesel pumps DP-1 and DP-2 are relatively new and seldom used. Each is operated occasionally to confirm their operating status and should perform satisfactorily throughout the duration of the Hanford Mission with minimal maintenance based on current use.

Table 8. Pump Test Results.

Pump No. (Year Installed)	Vendor-Certified Shop Test		Field Test May 11, 2011		Decrease in Pump Performance (%)
	Flow (gal/min)	Pressure (ft)	Flow (gal/min)	Pressure (ft)	
P-2 (1944)	6,000	475	5,400	475	>10
P-4 (2004)	3,750	388	2,900	388	23
P-5 (2004)	3,750	388	3,600	388	4
P-6 (2004)	1,850	388	1,825	388	>1
DP-1 (2007)	4,700	473	5,240	305	NA
DP-2 (2007)	4,800	496	5,880	323	NA

NA = not applicable.

182B Piping and Valves. Pump discharge and header piping, and the related valves (e.g., gate, butterfly, check, and control valves) were not thoroughly assessed in the February 2012 assessment report. The discharge/header piping and valves are original construction, installed in 1944. The pump suction/discharge pipe size varies from 14 inch down to 12 inch diameter and the header piping ranges from 16 in. to 36 in. diameter. The discharge piping is routed from the pumps to a common header for all 6 pumps located in the elevated pipe gallery. The header piping operates at approximately 230 lb/in^2 and the overall condition of the discharge and header piping is fair to poor. Based on visual observations in May 2012, there are a couple locations where pipe repairs have been made using clamps which show signs of corrosion, see Figure 32. In addition, there are several locations where paint has worn off and has not been replaced. In general, all building piping is painted or galvanized for corrosion protection of the carbon steel pipe.

Figure 32. 182B Pump Discharge Header.

The 182B pump house contains a variety of valves that include pump control valves, surge suppression valves, pressure relief, and gate valves. Some of the original valves such as the "zero valve" and pump P-2 valves are in fair condition. The original gate valves, including the "zero valve," are functional but may require multiple opening/closing cycles to seal the water flow. The "zero valve" is the primary isolation point between the pump facility and the EW line. In addition, the P-2 pump control valve is a vintage hydraulic oil actuated valve and replacement parts are not readily available. In order to support this control valve, a hydraulic oil system is required. The surge suppression valves were witnessed to be in an operable and fair condition. The 4 inch piping servicing the 6 inch pressure relief valve is undersized. Flow velocities in this system are excessive when pump P-2 is operating at low demand points. The system is also oriented so flow through this system is not measured with the installed flow meter.

New valves were installed with the five newer pump/motor units (P-4, -5, and -6 and DP-1 and -2) are in good condition.

182B Power/Instrumentation and Controls. One of the two main 4,500-KVA service transformers was removed and the second transformer was replaced with a smaller 1,500-KVA transformer. Due to the replacement of the original two 4,500 -VA transformers with a single 1,500-KVA transformer, the facility is limited to operating with only one 1,000-hp pump at a time. In rush current when starting any of the active pumps, especially P-2, results in significant transient loads to the transformer, which is detrimental to the transformer life.

The PLC was designed to evenly and efficiently increase pump capacity as flow demands increase. At the start of this condition assessment, the PLC automatic control system associated with pumps P-4, P-5, and P-6 was found inoperable. However, the pumps could be operated individually in the manual mode. After minor troubleshooting, knowledgeable MSA personnel discovered that the PLC had only a few contact and connection problems. The contacts were cleaned and reconnected, and then the PLC system was rebooted and found to be operational. Once the PLC was returned to service, a functional test was performed.

During the pump tests, several operational problems were experienced with the Cytech PLC. While performing the functional test, the assessment team interviewed several maintenance and operation (M&O) personnel and documented the following observations:

- The Cytech software that operates the pumps was installed with inadequate formal training for M&O personnel about system operation and calibration.
- The Cytech operating software was not completely integrated into the overall EW automatic control system.
- The Cytech software is an unconventional application in which several layers of hardware and software are required to transmit commands from the 182B pump house to the 282E/W reservoirs. No operations or maintenance manual is available.
- The Cytech software is not compatible with and does not communicate with the other plateau automatic control systems. It has no way to anticipate an increase or decrease in load at the plateau over 10 miles away.
- Line-of-sight communications systems are being interrupted and rendered obsolete by construction of new facilities (e.g., pump and treat facilities).

181D Building/Structure. The concrete structures appear to be in good condition; they are watertight and temperature controlled. The building is functional and provides adequate protection for the operating equipment housed therein.

181D Pumps/Motors Of the 16 electric vertical turbine pumps, only two are left in service (VT-10 and -11). These two pumps are of original construction, connected to one of two discharge manifolds extending the length of the intake bay. The abandoned 14 pump-motor units are being used for spare parts. No backup diesel pump is available at the 181D facility. The vertical turbine pumps are rated at 10,000 gal/min each. Table 9 summarizes the capacity and condition of the operable pumps.

Table 9. 181D Operable Pump Capacity and Condition.

Pump No.	Pump/Motor Manufacturer/Size (gal/min)	Motor HP	Electric		Condition	Remarks
			Volt	Amps		
VT-10	Pomona/Westinghouse (10,000)	900	2400	197	Fair-Untested	Manual control only
VT-11	Pomona/Westinghouse (10,000)	900	2400	197	Fair-Untested	Manual control only

Performance tests were not conducted to confirm the current flow rate on the pumps. Reportedly, routine maintenance has been performed on the pumps, but no regular PM activity records were found.

81D Piping and Valves. The discharge and header piping is of the same vintage as 181B and has been operational and without any known maintenance issues. The valves and other piping components are of a similar age. The header piping is 36 in. in diameter and is routed through pipe tunnels part of the way leading away from the pumps. The header piping connects to gate valves located underground in a concrete masonry valve house. The penstock piping leaving this valve house is routed through a 42-in. diameter by 3/8-in. wall thickness penstock pipe until it reaches the 182D reservoir Inlet House.

181D Power/Instrumentation and Controls. Power to drive the three remaining pumps is supplied from a single 3,750-KVA transformer located in the pump house yard. This transformer, which replaced two significantly larger units, typically runs only one or two of the three pumps at any given time. The transformer receives power from a single 13.8kV line and is marginally sized, making the transformer and distribution line a potential single-point failure for the 181D intake pumping station.

All pumps/motors are manually controlled requiring an operator to physically start and stop pumps as needed. The 182D reservoir currently does not contain float controls in order to maintain the appropriate reserve water level. The reservoir is administratively controlled to maintain a level of 4 ft (6 M – 7 Mgal) or less to prevent the possibility of leakage.

182D Building/Structure. The 182D consists of the reservoir and pump gallery. The reservoir is a cast-in-place concrete structure retaining 25 million gallons of water when full. Because of recorded leaks at the 182D reservoir, the water level is administratively controlled to approximately 25 percent of its full capacity at 6 to 7 Mgal. At this level, groundwater leakage is not detected. However, clogging and algae problems occur periodically as a result of the shallow pool operation.

Approximately 10 years ago, water was observed leaking onto the pump room floor originating from cracks in the concrete floor. This too was attributed to the 182D reservoir leakage issue. As the reservoir level was adjusted downward from the full level, the leaking stopped (see Figure 33).

Figure 33. 182D 25 Mgal Reservoir at 25 Percent Capacity.

Reservoir wall inspection was limited to a walk around the perimeter and resulted in no visual leakage. Leakage has been monitored by groundwater wells located in the near vicinity. No attempt was made to perform any leak tests on this structure. A visual inspection was conducted on the reservoir and pump gallery walls in the pump room. The outside exterior wall shows signs of concrete degradation from exposure to weathering cycles on the concrete. The overall building structure is in fair condition, however, the reservoir is considered to be in poor condition due to the reported leaks.

182D Pumps/Motors. At the time of this assessment, only pumps P-2, -3, -5, and -6 were operational. Pump P-4 was modified and replaced by a 450-hp pump/motor unit in late 1950s, but it is now out of service. No obvious mechanical issues have been reported, however, a valid assessment cannot be made until the pump/motor units can be performance tested. The 182D pump gallery is shown in Figure 34. The two pump operation at 182D can manage the flow conditions during the summer months when the 242 Evaporator campaign is on and truck fill stations are at maximum use. The Water Utilities department relies on the 182D pumping station during those high flow demands and as a secondary source for water when the 182B facility is down for repairs and/or maintenance activities (see Figure 34). No diesel-driven pumps or generators are available for emergency backup at this location. The condition of the 182D pumps is summarized in Table 10.

Figure 34. 182D Pump Gallery.

Table 10. 182D Operable Pump Capacity and Condition.

Pump No.	Pump/Motor Manufacturer/Size (gal/min)	Motor (hp)	Electric (V)	Condition	Remarks
P-3	Allis-Chalmers/Westinghouse (6,000)	1,000	2400	Operable-	Manual control
P-6	Allis-Chalmers/Westinghouse (6,000)	1,000	2400	Operable-	Manual control

182D Piping and Valves. The 182D pipe sizes, configuration, and pressure conditions are identical to that reported for 182B. Similarly, the 182D pump station consists of vintage 1944 carbon steel piping and valves (e.g., pump control, surge suppression, and gate valves). The condition of the pump discharge and header piping has no visible leaks, so it is assumed to be in fair condition.

There is no evidence regarding the condition of the valves at the 182D facility. Experience with aged water system components indicates that these valves may not properly seat to seal off water when in the closed position. The facility does not have a PM program where the valves are operated to ensure they are in good working condition.

One of the more critical valves to this pump facility is the "zero valve." The "zero valve" is assumed to be functional but may require multiple opening/closing cycles to seal the water flow. The "zero valve" is the primary isolation point between the pump facility and the EW line. In addition, the pump control valves are all Roto-Check valves, which are vintage hydraulic oil actuated. Replacement parts are not readily available for these valves. The surge suppression valves are operable and in fair condition.

The pressure control valve, associated piping and isolation valves are in good condition.

182D Power/Instrumentation and Controls. The electric pumps at the 182D reservoir are powered by two older style transformers (4,500 and 2,500 KVA). Both can step down the 13.8kV to 2,400 volts (V). According to data supplied by Site maintenance, both transformers are operable. The single 4,500-KVA transformer is capable of operating the four 1,000-hp pumps, simultaneously.

All pumps are manually controlled and there is no telemetry in place to monitor pump/motor activity at the 182D facility from the 200 Area Plateau.

EW Distribution Piping. As previously described, Table 11 shows the entire EW distribution piping system and summarizes its general condition.

Table 11. EW Pipeline and Component Summary.

Component	Description	Condition
42-in CCP pipe	100B – 11901Y, 4.3 miles long, installed 1944	Good
	100D – 1901Y 5.6 miles long, installed 1944	Good
30-in CCP pipe	3.1 miles long, installed 1944	Good
	3.1 miles long, installed 1953	Good
24-in MLCSP pipe	2901-Y – 282E, 2.3 miles long, installed 1944	Good
24-in CCP pipe	2901-Y – 282E, 2.3 miles long, installed 1967	Good
24-in MLSCP pipe	2901-Y - 282W, 2.5 miles long, installed 1944	Poor
18-in C900 PVC pipe	2901-Y – 282W, 2.5 miles long, installed 2002	Good
System isolation valves	30-in gate valves	Fair
	30-in hydraulic-actuated butterfly valves	Good
	24-in gate valves	Fair
	24 inch hydraulic-actuated butterfly valves	Good

CCP = concrete cylinder pipe. MLCSP = mortar-lined and coated steel pipe PVC = polyvinyl chloride.

Basis for the Piping Assessment

Eight different pipelines were video inspected, including the interior portions of the 42-, 30-, and 24-in. pipes. These pipelines were accessible during the installation of new isolation valves. The dry footage of pipeline observed looked very good. Each video inspection accounted for approximately 300-400 ft into each pipeline.

Of the total 27 mi of EW piping, a more in-depth assessment was targeted on 4.2 mi of 42-in pipe from the 182B to the 1901Y valve house. This segment was considered to be a representative sample of the overall distribution system. The 42-in pipe is a 250 lb/in2 pressure-rated pipe, shown in Figure 35.

Figure 35. Removed Section of 42-in Diameter Pipe from 182B to 1901Y Valve House.

An initial report was written in April 2011 (see HNF-49532, *Condition Assessment – 42-Inch EW Line*, Rev. 0). This report documented the pipe to be in excellent condition based on a strictly visual inspection. Under the heading "Uncertainties and Recommendations," the following additional information was requested to better evaluate the pipeline:

- Perform a corrosion study to look for weak points in the pipeline
- Perform a physical analysis of the existing 42-in. pipe
- Perform an analysis of the soil and water in contact with the pipe for the presence of corrosive chemicals attacking the pipeline
- Provide physical evidence at vehicle crossings over the pipeline to verify that the pipeline is protected from heavy loads.

All these analyses were performed with generally positive results describing the overall condition of the pipe. The following summaries will describe the results of the above recommended pipe line evaluations.

Corrosion Study. A surface potential study (cell to cell survey) was conducted to record the soil to soil potential energy at ground level above the buried pipeline. This field testing was used to predict corrosion cells surrounding the buried pipe. The pipeline corrosion study indicated no corrosion activity was occurring; however, it identified five areas of concern for follow up action. These locations should be investigated and repairs made as necessary (see HNF-51470, Appendix B).

Physical Analysis (Pipe, Water, and Soil) Study. A 3.5-ft sample of 42-in. pipe was shipped to Ameron's pipe analysis division for evaluation, along with soil and water samples. The results of Ameron's thorough inspections were very positive. In general the integrity of the pipe was good. The mortar showed no signs of degradation from the soil or water. The steel components were adequately protected from corrosive elements, though some superficial corrosion was noted in places. The constituents of the soil and water were neutral, with no threat of any chemical attack to the pipeline. In summary, Ameron stated, "After 65 plus years of service, the CCP was in satisfactory condition...The CCP line is expected to provide decades of additional service."

While performing the evaluation of the 42-in EW line, an opportunity developed when a section of the 24-in. pipeline broke. Subsequently, a sample of the 24-in MLCSP pipe was sent to Ameron. The sample was taken from a section of the EW pipe being repaired in the run from the 2901Y to the 282W reservoir. Coincidentally, this run of pipe has experienced three recorded line breaks in the past 15 years. No other breaks such as this one have occurred in the EW distribution system. Ameron's assessment of this pipe sample was not favorable. "After 67 years of service, the MLCSP was in a compromised condition based on the corrosion found on the exterior steel surface." Further investigation of this pipe section showed a previous patch welded to the pipe exterior, which may compromised the pipe's integrity. The earlier repair method seems suspect because of the welds and spalling mortar around it. A visual inspection of approximately 20 ft inside the pipe, beyond the open ends, showed severe mortar cracking and spalling.

Pipelines at Vehicular Crossings. The pipeline being protected at vehicle crossings proved to be a valid concern. Of the 17 crossings identified over the 42-in. pipeline, 14 were investigated using vacuum excavation techniques. Each location showed evidence of protective measures being taken to shield the pipeline from traffic loads. The original design revealed concrete or timber structures built to deflect traffic loads from bearing on the pipeline. Within the last 10 to 15 years, less protective measures have been employed at crossings. At these locations, added soil depth was used in an effort to distribute or spread the load, thus minimizing the load on the pipeline. Of the 14 crossings investigated, only six were constructed with structured encasements built so loads would not bear down on the pipeline. The remainder relied on the added depth to reduce the impact of traffic loading on the pipeline. For infrequent, light traffic loading, this may be acceptable. Unfortunately, at one such crossing, the added bury depth was not sufficient. Internal spalling of the cement lining occurred where the pipe was buried over 7 ft deep. This paved road is subject to heavy industrial traffic, including loaded dump trucks and water trucks. The repetitive loads may be having a damaging effect on the buried pipe (see Figure 35).

EW Valves/Instrumentation and Controls. The original isolation EW valves are primarily gate valves of 1944 vintage. In 2007, the EW system became automated by replacing a select number of gate valves with solar-powered, hydraulic actuated butterfly valves. At the same time, pressure transmitters were installed with wireless (line of sight) telemetry back to the 283W Control Room to monitor the transmitters and control the newly installed butterfly valves.

The automatic controls operate valves, monitor line pressure, and indicate battery charge level for the solar power unit. However, the automated control system is not being fully utilized as a result of software issues, insufficient operator training, and lack to troubleshooting skills.

The older valves are in fair condition since they are difficult to operate and require multiple open/close cycles to obtain full closure. The newer automated butterfly valves good condition, however, these valves have experienced problems with computer integration. The line of sight for the telemetry has also been compromised by construction in the vicinity of the 283W facility.

3.2 200 AREA RAW WATER SYSTEM FACILITY CONDITION ASSESSMENTS

282W Building/Structure. Based on conditions observed during the 2011 Condition Assessment, the structure housing the pumps was weather-tight and sound, but in need of some painting. The reservoir was an unlined, concrete structure showing visible signs of weather deterioration, primarily on the tops and interior surfaces of reservoir walls. Concrete erosion at the top of the overflow concrete wall had resulted in a loss of over 60,000 gal of storage capacity. There were no visible leaks in the existing wall cracks, however minor leakage of the reservoir was recorded and documented in an assessment completed in August 2011, (see reference HNF-50729, *282W Reservoir Assessment*, Rev 0). The findings from this assessment indicated that the 282W reservoir was leaking approximately 170 gall per day, which equates to just less than 250 gal/acre/day. This leakage rate can be characterized as significant. Completion of Project L-311, Refurbish and install lining in the reservoir, in July 2012 has eliminated this issue.

282W Pumps/Motors. The pump/motor units within the pump gallery are designed in accordance with the requirements of NFPA-20 for fire protection systems. Annual testing per NFPA verifies the pump curve and requires evaluation of any significant deterioration. Table 12 summarizes the condition of the pump/motor units.

Table 12. 282-W RW Fire Pump Station.

Pump No. (Yr Installed)	Pump/Motor Manufacturer Capacity, (gal/min)	Motor hp	Electrical		Condition	Remarks
			Volts	Amps		
ERW-1 (2008)	ITT/WEG (3,000)	300	460	355	Good	see Note 1
ERW-2 (1996)	ITT/WEG (3,000)	300	460	355	Good	see Note 1
Jockey Pump	XXXXX (300)	25	460	XXX	Fair	Pump installed mid 1990s, Motor replaced in last 10 years.

Note 1 - Tested monthly and annually per National Fire Protection Association.
ERW = Emergency Raw Water

282W Piping and Valves. The 282W piping and valves consists of carbon steel, standard wall pipe, and painted with a corrosion resistant coating. The piping and valves appear to be in fair condition.

The 282W piping and valves consist of carbon steel, standard wall pipe, and painted with a corrosion resistant coating. The piping and valves appear to be in fair condition.

282W Power/Instrumentation and Controls. All the fire pumps in this facility turn on automatically and are manually turned off. The pumps are designed to come on after a time delay when the grid pressure drops below 60 lb/in^2. Time delays are set so pumps turn on sequentially if pressure is not restored.

Replacements for the pressure sensors for the pump controls are no longer available. In addition, testing required per NFPA requires the control cabinet to be opened for testing exposing personnel to high voltage.

282WC Building/Structure. The structure is temperature controlled and provides a suitable environment for housing the pump/motor units. The building is in good condition and, other than the need for painting, no obvious repairs were identified.

282WC Pumps/Motors The RW booster pumps have had regular maintenance issues, primarily with packing gland leakage. One pump has had mechanical seals installed which improved leakage but they are now starting to drip excessively.

The fire protection pumps are tested monthly using a procedure that requires operating the FW pump at essentially "dead head" conditions for extended periods of time, which may have caused some premature pump/seal deterioration. A review of NFPA requirements has resulted in testing changes to minimize dead head operations during testing.

Based on the 2011 annual test, the 282WC FW pump is performing within acceptable parameters.

The PW recirculation pump is not operable and scheduled to be replaced.

Table 13 summarizes the pump conditions.

Table 13. 282-WC RW Fire Pump Station.

Pump No. (Yr Installed)	Pump/Motor Manufacturer Capacity, (gal/min)	Motor HP	Electrical		Condition	Remarks
			Volts	Amps		
RW-5 (1996)	Aurora/Marathon (3,000)	150	460	179	<Fair	Not tested - Satisfies requirements
RW-6 (1996)	Aurora/Marathon (3,000)	100	460	179	<Fair	Not tested - Satisfies requirements
PW-FW (1996)	ITT/WEG (4,000)	350	460	409	Good	see Note 1 below
PW Recirc	Aurora/US Motor (100)	20	460	23	Poor	Heavy corrosion on pump casing, leaking seal

Note 1 - Tested monthly and annually per National Fire Protection Association.

282WC Piping and Valves. The 282WC piping and valves consists of carbon steel, standard wall pipe, and painted with a corrosion resistant coating. The piping and valves appears to be in fair condition.

282WC Power/Instrumentation and Controls. The PW fire pump in this facility will turn on automatically and is manually turned off. The pump is designed to come on when the grid pressure drops below 60 lb/in^2 for approximately eight seconds. The pump/motor unit is performing as designed and is run monthly to verify its functionality. The 2011 annual test, per NFPA requirements, verified pump performance curve is within allowed parameters.

The flow meter on the sanitary fire pump test loop is providing questionable readings. Work is scheduled to remove clean, repair (or replace), and calibrate the flow meter.

Replacements for the pressure sensors for the pump controls are no longer available. Testing required per NFPA also requires the control cabinet to be opened for testing exposing personnel to high voltage.

282E Building/Structure. The structure housing the pumps is weather-tight and sound. The reservoir was lined and the concrete walls were restored in 2010. A leak detection system (i.e., perforated piping system installed beneath the liner) was installed with the liner. Since the installation has been completed there have not been any documented leaks.

282E Pumps/Motors. The pumps within the pump gallery are designed in accordance with the requirements of NFPA-20 for fire protection systems. The pumps are performing as designed and are run monthly to verify their functionality. The 2011 NFPA annual test verified the pump curves and evaluated the physical condition. Table 14 summarizes the condition of the pumps.

Table 14. 282-E RW Fire Pump Station.

Pump No. (Yr Installed)	Pump/Motor Manufacturer Capacity, (gal/min)	Motor HP	Electrical		Condition	Remarks
			Volts	Amps		
ERW-1 (1996)	ITT/WEG (3,500)	350	460	409	Fair	see Note 1
ERW-2 (1996)	ITT/WEG (3,500)	350	460	409	Fair	see Note 1
ERW-3 (1996)	ITT/WEG (3,500)	350	460	409	Fair	see Note 1
Jockey Pump	Unknown (300)	25	460	Unknown	Fair	Untested

Note 1 - Tested monthly and annually per National Fire Protection Association.
ERW = Emergency Raw Water

282E Piping and Valves. The 282E piping and valves consists of carbon steel, standard wall pipe, and painted with a corrosion resistant coating. The piping and valves appears to be in fair condition.

282E Power/Instrumentation and Controls. All the fire pumps in this facility turn on automatically and are manually turned off. The pumps are designed to come on after a time delay when the grid pressure drops below 60 lb/in^2. Time delays are set so pumps turn on sequentially if pressure is not restored. Replacements for the pressure sensors for the pump controls are no longer available. Testing required per NFPA also requires the control cabinet to be opened for testing exposing personnel to high voltage.

282EC Building/Structure. The structure is temperature controlled and provides a suitable environment for housing the pumps. Building is in need of some painting.

282EC Pumps/Motors. The RW booster pumps have had regular maintenance issues, primarily with packing gland leakage. Booster pumps are identified as #1 and #2. There is excessive packing gland leakage on #2, with hose attached directing water to the floor sump. A hose was run from the sump to the drain at 282EA. The sump pump was currently being worked.

The PW fire pump in this facility is automatically activated and must be manually deactivated. The pump is designed to come on when the grid pressure drops below 60 lb/in^2 for approximately 8 seconds. The pump/motor unit actuation is performing as designed and is tested monthly to verify its functionality. The 2011 annual test, per NFPA requirements, verified that the pump performance curve is not within allowed parameters. A review of NFPA requirements has resulted in testing changes to minimize dead head operations during testing

Table 15 summarizes the pump/motor unit conditions.

Table 15. EC RW Fire Pump Station.

Pump No. (Yr Installed)	Pump/Motor Manufacturer Capacity, (gal/min)	Motor HP	Electrical		Condition	Remarks
			Volts	Amps		
RW-5 (1996)	Aurora/Marathon (5,000)	200	460	231	<Fair	Not tested - Satisfies requirements
RW-6 (1996)	Aurora/Marathon (5,000)	200	460	231	<Fair	Not tested - Satisfies requirements
PW-FW (1996)	ITT/WEG (4500)	400	460	446	Good	see Note 1 below
PW Recirc	Aurora/US Motor (300)	20	460	23	Poor	Heavy corrosion on pump casing, leaking seal

Note 1 - Tested monthly and annually per National Fire Protection Association.

282EC Piping and Valves. The 282EC piping and valves consists of carbon steel, standard wall pipe, and painted with a corrosion resistant coating. The piping and valves appears to be in fair condition.

282EC Power/Instrumentation and Controls. The flow meter on the sanitary fire pump test loop is providing questionable readings. Work is scheduled to remove clean, repair (or replace), and calibrate it.

Replacements for the pressure sensors for the pump controls are no longer available. Testing required per NFPA also requires the control cabinet to be opened for testing exposing personnel to high voltage.

3.3 200 AREA POTABLE WATER SYSTEM FACILITY CONDITION ASSESSMENTS

283W Building/Structure. The floor in the lower level is deteriorated. The base plates on #1 and #3 PW pumps are in need of preservation. Dead legs exist off #1 and #2 pumps. They are still connected to OOS #4 and #5 pumps #4, #5, and #7 pumps were abandoned in place. The backwash pump is near failure and only a spare motor is available. Scaffolding is being used permanently to access the header isolation valve, rather than a designed platform. #3 and #4 rewash valves, in the pipe gallery, second floor, are leaking through and are very rusty. The #5 basin is drained and contains two sticks of 24- in MLSP. Truck fill shed is leaning and will need repairs soon.

The structure is temperature controlled and provides a suitable environment for housing the water treatment equipment.

The building contains a number of abandon in place items including old steam heat piping and steam driven pumps.

There is an abandon level float within the 283WA 1.1-Mgal PW storage tank. The existing level measurement instrumentation provides level indication but no alarm.

Clear well leakage has not been assessed.

283W Water Treatment Equipment/Components. The RW pretreatment rapid-mix well has a pressure gauge that is either malfunctioning or water is not injecting at sufficient pressure. Pressure at this gauge was reported at approximately 35 lb/in^2, which appears lower than expected pressure in order to be effective.

A fourth settling basin is installed but currently out of service.

The ChlorTainer system is in good condition. However, there is a potential single point failure at the chlorine injection system feed line from the ChlorTainers to the chlorine injectors.

The gaseous mixing system is antiquated and replacement parts are no longer available. Table 16 summarizes the capacity and condition of the operable pumps at the 283W WTF.

Table 16. 283-W PW Pump Station.

Pump No. (Yr Installed)	Pump/Motor Manufacturer Capacity, (gal/min)	Motor HP	Electrical		Condition	Remarks
			Volts	Amps		
PW-1 (1996)	Worthington/Baldor (1,000)	100	460	109	Fair	Not flow tested, constant speed, 9 in. impellor
PW-2 (2006)	Flowserve/Baldor (1,000)	100	460	109	Good	Not flow tested, constant speed, 8 in. impellor
PW-3 (1996)	Worthington/Baldor (1,000)	100	460	109	Fair	Not flow tested, variable speed, 9 in. impellor

PW-6 (2006)	Flowserve/Baldor (1,000)	100	460	109	Good	Not flow tested, variable speed, 8.86 in. impellor
PW-7 (Unknown)	Unknown (1,000)	100	460	109	Fair	Backwash pump, constant speed

The PW pumps listed in Table 16 draw water from the 283W treatment plant's 400,000-gal clear well (i.e. two 200,000-gal clear wells). This water is used for domestic, process, and fire protection purposes. In addition, PW from the 200W grid is transferred to the 283E clear well and 200E grid.

Pumps PW-2 and PW-6 were replaced in 2006 and the impeller sizes were adjusted for maximum flow and efficiency. However, PLC programming was not modified to address the impeller changes.

283W Piping and Valves. The hydraulic control valves to the multimedia beds are antiquated and do not function properly.

The clear well valves are in questionable condition. They have not been cycled and no PM program is in place to service the valves

283W Power/Instrumentation and Controls. Instrumentation and controls are provided by a system of computers, PLCs, and their associated programming are operational and adequate. PLC ladder logic combined with a Wonderware[5] human machine interface (HMI) provides the Control Room monitors with real-time feedback and control of the plant.

283E Building/Structure The structure is temperature controlled and provides a suitable environment for housing the water treatment equipment.

The clear well is in good condition; however, a cross-connection has been identified at the overflow of the clear well. The clear well leakage has not been assessed.

The building contains a number of abandoned items including old steam heat piping and steam driven pumps.

The entire 283E water treatment train is out of service; therefore no assessment has been made of water treatment components.

There is an abandoned level float within the 283EA 1.1 million gallon PW storage tank. The existing level measurement instrumentation provides level indication only but no alarm.

283E Pump Station Equipment/Components. Table 17 summarizes the capacities and conditions of the operable pumps at the 283E WTF.

Table 17. 283-E Potable Water Pump Station.

Pump No. (Yr Installed)	Pump/Motor Manufacturer Capacity (gal/min)	Motor HP	Electrical		Condition	Remarks
			Volts	Amps		

[5]Wonderware is a trademark of Invensys Systems, Inc., Foxboro Massachusetts.

Table 17. 283-E Potable Water Pump Station.

Pump No. (Yr Installed)	Pump/Motor Manufacturer Capacity (gal/min)	Motor HP	Electrical		Condition	Remarks
			Volts	Amps		
PW-1 (2006)	Worthington/Baldor (1,000)	100	460	109	Good	Not flow tested, constant speed, 9 in. impellor
PW-2 (2006)	Flowserve/Baldor (1,000)	100	460	109	Good	Not flow tested, constant speed, 8 in. impellor
PW-3 (2006)	Flowserve/Baldor (1,000)	100	460	109	Good	Not flow tested, variable speed, 8.88 in. impellor
PW-6 (2006)	Flowserve/Baldor (1,000)	100	460	109	Good	Not flow tested, variable speed, 8.88 in. impellor

The PW pumps described in Table 17 draw water from the 400,000-gal clear well (i.e. two 200,000-gal clear wells) at 283E. This water is used for domestic, process, and fire protection purposes. The PW from the 200W grid is transferred to the 283E clear well and 200E grid.

All the PW pumps were replaced in 2006 and impeller sizes were adjusted for maximum flow and efficiency. However, PLC programming was not modified to address the impeller changes.

283E Piping and Valves. The clear well valves are in questionable condition. They have not been cycled in many years and no PM program is in place to service the valves.

283E Power/Instrumentation and Controls. Instrumentation and controls are provided by a system of computers and PLCs. The associated controls programming is operational and adequate for the intended use. PLC ladder logic combined with a "Wonderware" HMI provides the Control Room monitors with real-time feedback and control of the plant.

4.0 OPERATIONS AND MAINTENANCE

4.1 WATER UTILITIES PROGRAM MANAGEMENT

The administration for the operations of the Sewer and Water Utilities is combined. The responsibilities are summarized below:

4.1.1 Conduct of Operations Programs

- Organization and Administration
- Shift Routines and Operating Practices
- Control Area Activities
- Communications
- On-shift Training
- Investigation of Abnormal Events, Conditions, and Trends
- Notifications
- Control of Equipment and System Status
- Lockout and Tagouts
- Independent Verification
- Logkeeping
- Turnover and Assumption of Responsibilities
- Control of Interrelated Processes
- Required Reading
- Timely Instructions/Orders
- Technical Procedures
- Operator Aids
- Component Labeling

4.1.2 Miscellaneous Employee Management

- Overtime
- Personal Time Bank Schedules
- Time Cards
- Performance Appraisals
- Supervise Water and Sewer Employees Daily Activities

4.1.3 Work Management

- Set Priorities
- Request Maintenance
- Review Work Packages
- Close Out Work Packages
- Manage Plan of the Day/Plan of the Week Schedules

4.1.4 Corrective Action Management

- Issue Identification
- Issue Evaluations
- Close Out Actions

4.1.5 Facility Safety

- Categorization of Event
- Notifications
- Event Analysis
- Final Report Submittal

4.1.6 Manage and Monitor Interfaces with Other Hanford Contractors

- CHPRC
- WRPS
- WTP
- WCH
- Pacific Northwest National Laboratory

4.1.7 IH/IS Program Implementation

- Facility safety reporting
- Review and Approve automated job hazard analyses (AJHA)
- Confined Space Program
- Chemical management
- Excavation permits.

4.1.8 Emergency Preparedness

- Building Emergency Director
- Facility Operations Supervisor
- Drill support.

4.1.9 Engineering Support

- Develop, review, and/or approve designs (drawings, engineering change requests, engineering drawing changes, sketches, calculations proposals, etc.), procedures (PROs, corrective maintenance, PMs, calibrations, etc.), site evaluations, excavation permits, AJHAs, and procurement documents (PRs, eBOMS, etc.)
- Provide technical support to Work Management (Engineering review and consultations)
- Compose and/or review statements of work
- Provide input and technical support to projects on behalf of Water Utilities (project meetings, walk downs, project development, closeout, etc.)

- Represent or assist Waster Utilities in interfaces with Engineering, Work Management, Document Control, Fire Protection, other Site contractors, RL, etc.)

4.1.10 Project Controls

- Develop an annual project schedule that incorporates corrective and preventive maintenance, drinking water sampling, cross-connection controls, work for others, periodic reports, etc.
- Incorporate unplanned maintenance activities into the schedule to capture scope, time, costs, resource utilization and schedule impacts
- Establish guidelines for updating the project schedule
- Develop and maintain instructions on P6 scheduling.

4.1.11 Control Account Management

- Integrated priority list development
- Monthly budget forecasting
- Monthly budget reporting

4.1.12 Environmental Reporting

- Quarterly chlorine reporting
- Quarterly discharge monitoring reports
- Quarterly diesel engine stack monitoring
- Semiannual diesel engine fuel consumption or emission modeling
- Annual diesel engine fuel consumption or emission modeling
- Annual diesel loss report
- Annual significant discharge log.

4.2 OPERATIONS

The operational functions performed are described below for the major facilities. Details of the operations are explained in later sections.

4.2.1 Export Facilities

The Export Water system contains the 181 and 182 facilities in both 100B and 100D Areas. The 100B Area is the main source of export/river water that is used and 100D Area is used as backup source as needed.

At this time Export Water is manned 24/7 l. The operator is based out the 182 facilities depending on the area from which water is being drawn from the river. The 181 facilities contain the large river pumps used to pump water from the river to the 25-Mgal reservoirs. The facilities are monitored hourly when pumping. This operator is also responsible for driving the export water line from the 100 Areas to the Plateau to verify no visible water on the ground which would be an indication of a water line break.

4.2.2 Filter Plant

The 283W Water Treatment Plant is responsible for producing potable water for the Plateau. The personnel are also responsible for ensuring that the raw water system is functioning properly and that the emergency fire pumps are available as needed.

At this time the Filter Plant is manned 24/7 with one operator holding a water treatment processing operator (WTPO) license from the state, each of 4 shifts worked and the operators are considered essential personnel. This position is based out the 283W filter plant. Responsibilities also include monitoring the 283E filter plant that is not active as a treatment operation, but is used as backup PW storage to ensure available water as needed.

4.2.3 NFPA Pump Testing

Five raw water pumps and two sanitary emergency fire pumps that have a diesel generator backup capacity are located on the Plateau. These pumps require weekly and monthly tests per NFPA. The Water Utilities stationary operating engineers (SOE) complete this testing as required. An annual flow test is also required for each pump to ensure the pumps are operating within NFPA standards. This test is also performed by the SOE with the assistance of millwrights and electricians from the MSA Maintenance operation.

4.2.4 Line Flushing/Valve Exercising

Water Utilities SOE's complete line flushing as required to ensure that there is adequate water movement to keep sediment at a minimum to ensure water quality.

4.3 WATER PROGRAM MONITORING

4.3.1 Cross Connection Control Program

The State-mandated Cross-Connection Control Program (CCCP) is performed by MSA professionals with cross-connection control specialist (CCS) state certification. This work includes verification of new installations to ensure it meets the WAC requirements for water quality/control; complete hazard assessment for all new facility installations; routine inspections of all facilities that utilize plumbed water to ensure continued compliance; inspection information is maintained in an approved date base to ensure compliance and history base of all facilities.

4.3.2 Backflow Prevention Program

Those with the CCS also ensure that all backflow assemblies are tested at least annually as per the WAC and monitor the test results. This test information is maintained in an approved date base to ensure compliance and history base of all units. The actual testing of the back flow assemblies is completed by a state-certified back flow assembly tester and can be either an MSA or other Hanford contractor (OHC) employee. The CCS also verifies that back flow assembly that is in place is adequate for the application needed depending upon hazard risk of the facility.

4.3.3 Water Sampling

Water Utilities has a qualified WTPO professional that develops the state mandated water sampling program for the Hanford Site. The level of sampling required is directed by the state depending upon the size and use of the systems. This program ensures the Hanford Site water system meets or excesses all drinking water standards. The actual samples are taken by a state qualified SOE to ensure correct sample management.

Water Utilities is working toward cross training at all levels to ensure the ability to maintain compliant operations at all times.

4.4 MAINTENANCE

Maintenance needs, whether Preventative or Corrective are identified by the Water Utilities staff. They are prioritized and passed along to the MSA Maintenance Services Organization for planning, which is done with the assistance of the Water Utilities staff, and execution. All maintenance staff (craft; planning) for required calibrations, preventive and corrective maintenance are obtained through the MSA Maintenance Services Organization.

Great difficulty has been experienced in budget planning related to maintenance in terms of defining , prioritizing, projecting, and costing expected baseline maintenance operations. MSA has developed and is implementing a new prioritization and costing method based on the application Analytical Hierarchy Process. That method is explained in the analytical hierarchy process (AHP) prioritization process with sample results.

4.4.1 Analytical Hierarchy Process

Water system preventative and corrective maintenance is identified by the Water Utilities group, but is performed by the MSA Maintenance group. Projecting the required budget for maintenance has historically been problematic. In an effort to characterize MSA Water Utilities projected maintenance budgets, MSA is developing and implementing an integrated maintenance prioritization system that enables it to prioritize system component maintenance and establish costs for the activities. This system provides a means for projecting the costs of maintaining prioritized system components and comparing that cost to available funding. The comparison will enable MSA to identify the maintenance that must be deferred at given budget levels so that MSA and their client may make appropriate adjustments.

The prioritization system applies a combined weighted criteria evaluation to each of the system components to produce a total that is compared to totals for all components. The list is then prioritized from highest (most important) to lowest (least important). Costs for each activity are entered and totaled. Given the budget, a line can then be set in the list. Project execution is determined by which projects fall above and which fall below the line.

Criteria for the evaluation process were developed from the DOE Contractor Requirements Document (Supplemental) Form (CRD O 430.1B, Change 1(Supplemental Rev. 0). The criteria were weighted using the AHP, which is explained in the following paragraphs. The criteria are defined as follows:

- **Regulatory**
  - Reliance on the component results from application of regulation, law, or standard.

- Reliance on the component impacts personnel safety.

- **Component Criticality**. Takes into consideration whether the component is required for serving a primary system, a redundant (secondary) system, or a non-essential system. Should also take into account such things as whether the component is a single-source point of failure for its system.
- **System Safety Impact**. Takes into account the impact on equipment or system safety (not personnel safety) in the event of a component failure.
- **Mission Support**. Takes into account the impact on mission support of the component's failure. Allows the subject matter expert to differentiate the relative importance of components to the support of mission objectives or tasks.
- **Benefit/Cost**. Takes into account the relative value of the benefit derived from avoiding the component failure compared to the cost of performing the maintenance.
- **Management Preference**. Takes into account the relative importance of non-technical concerns or preferences that are presented by MSA management.

Ranking values are determined for each component. The values entered into the prioritization spread sheet under regulatory criteria for each component are either 0 or 10, meaning that either the component fits into the regulatory category (10) or it does not (0). The AHP method is used for developing the weights to be applied to each remaining criterion in calculating the prioritization total for each component that rated a 0 for the regulatory criteria. For the balance of the prioritization totals, an AHP analysis was run. AHP involves subject matter experts performing pair wise comparisons between each of the criteria where the relative importance of the criteria being compared is assigned based on the ranges listed in Table 18 with high numbers representing a positive evaluation.

Table 18. Relative Ranking for Pairwise Comparisons.

Ranking	Value
High	7-9
Medium	4-6
Low	1-3
Non-Essential	0

The results of the comparisons are entered into the matrix shown in Table 19. To perform the evaluations, each criterion in the first column is compared to the individual criteria as they are listed in the subsequent columns. As the ranking process progresses down the first column, each row of comparisons is completed. As the comparisons are completed, only the columns where the column 1 criterion is favored should be rated. The reciprocal of that rating is later entered into the inverse matrix cell. As an example "Component Criticality" in the first column is compared to each of the other criteria in the balance of the columns:

- "Component Criticality" in Column 1 is judged equal to "Component Criticality" in Column 2, so a "1" is entered in that block.
- "Component Criticality" in Column 1 is favored over "Safety Impacts" in Column 3 by a medium rating of "6", so a "6" is entered in that block.
- "Component Criticality" in Column 1 is favored over "Benefit/Cost" in Column 4 by a medium rating of "4", so a "4" is entered in that block.
- "Component Criticality" in Column 1 is favored over "Mission Support" in Column 5 by a high rating of "7", so a "7" is entered in that block.
- "Component Criticality" in Column 1 is favored over "Management Emphasis" in Column 6 by a high rating of "8", so an "8" is entered in that block.

Comparisons in each row are completed similarly. The row that starts with "Mission Support" in Column 1 is used as an additional example:

- "Mission Support" in Column 1 is judged less favorable than "Component Criticality" in Column 2. In this case, because the criterion in Column 1 is judged less favorable, the reciprocal of Row 2, Column 5 or '1/7" (0.14) is entered into this block.
- "Mission Support" in Column 1 is judged less favorable than "Safety Impact" in Column 3. In this case, because the criterion in Column 1 is judged less favorable, the reciprocal of Row 3, Column 5 or '1/6" (0.17) is entered into this block.
- "Mission Support" in Column 1 is favored over "Benefit/Cost" in Column 4 by a low rating of "3", so a "3" is entered in that block.
- "Mission Support" in Column 1 is judged equal to "Mission Support" in Column 5, so a "1" is entered in that block.
- "Mission Support" in Column 1 is favored over "Management Emphasis" in Column 6 by a medium rating of "4", so a "4" is entered in that block.

The balance of the matrix is filled out according to this process. Table 19 shows the results.

The geometric mean is then calculated for each criterion listed in Column 1 and a normalized weighting factor for the criterion is calculated. Results indicated that the criteria were weighted for individual component evaluations according to Table 20.

Table 19. Analytical Hierarchy Process Data and Weighting Results.

	Component Criticality	Safety Impact	Benefit/Cost	Mission Support	Management emphasis	Geometric Mean	Normalized Weight
Component Criticality	1.00	6.00	4.00	7.00	8.00	4.22	0.54
Safety Impact	0.17	1.00	5.00	6.00	7.00	2.04	0.26
Benefit/Cost	0.25	0.20	1.00	0.33	0.33	0.35	0.05
Mission Support	0.14	0.17	3.00	1.00	4.00	0.78	0.10
Management emphasis	0.13	0.14	3.00	0.25	1.00	0.42	0.05

Table 20. Criteria Weighting Factors Summary.

Criterion	Weight Factor
Component Criticality	0.54
Safety Impact	0.26
Benefit/Cost	0.05
Mission Support	0.10
Management Emphasis	0.05

This means that 54 percent of the prioritization is based on Component Criticality, 26 percent is based on Safety Impact, 5 percent on Benefit/Cost, 10 percent on Mission Support, and 5 percent is based on Management Emphasis.

All components that were rated a 10 for the "Regulatory" criteria are assigned an "Evaluation Total" of 10. All others components are then evaluated with values of 1 through 9 (9 being most important) for each criteria. The "Evaluation Total" for the component is calculated by multiplying each criteria Rating by its "Weight Factor" and totaling results for that component. The components can then be prioritized for maintenance by sorting based on component "Evaluation Total" from highest to lowest.

The data sheet below is an example of a summary sheet from this evaluation on 181D components. The cost for maintenance on each component is reflected, as is the cumulative cost for all maintenance on components from top to bottom. Note that this is just a sample of the application and that ratings on the three least significant criteria have not yet been entered.

The complete results, shown in Figure 36, will offer a tool to MSA to see projected total costs for maintenance and to identify what can be accomplished for their budget.

																				Total Cost	Cumulative Cost
																				0.00	
Maintenance Prioritization Grid																				0.00	
																				0.00	
Component					Compliance Rating		Evaluation Ratings										Evaluation Total Threshold	4.8		0.00	
Component ID	Description	System	Location	Comments	Regulatory	Rating	Component Criticality	Rating	Safety Impact	Rating	Mission Support	Rating	Benefit /Cost	Rating	Management, Engineering Emphasis	Rating	Compliance Total	Evaluation Total	Maintenance Activity Cost	0.00	
RS-SCR-001	RIVER SCREEN PASSIVE RIVER SCREEN	Export	181B	check with Environment		1											1	10	0.00	0.00	0.00
RS-V-010	MAIN AIR RECEIVER RELIEF VALVE	Export	181B			1											1	10	262.08	262.08	262.08
RS-V-011	CONTROL RECEIVER RELIEF VALVE	Export	181B			1											1	10	262.08	262.08	524.16
RS-V-016	COMPRESSOR DISCHARGE RELIEF VALVE	Export	181B			1											1	10	262.08	262.08	786.24
	AIR RECEIVER TANK	Export	181B	same as line 31 (delete)		1											1	10	226.04	226.04	1,012.28
	UNDERGROUND FUEL STORAGE TANK (12000 GAL)			check with Environment		1											1	10	0.00	0.00	1,012.28
	VEEDEROOT LEAK					1											1	10	3,768.96	3,768.96	4,781.24
C6881E	1500 KVA Transformer		181B	13.8 - 2.4, Alstom		1											1	10	0.00	0.00	4,781.24
E6145P	150 KVA Transformer		181B	2.4 - 480		1											1	10	0.00	0.00	4,781.24
E6146P	150 KVA Transformer		181B	2.4 - 480		1											1	10	0.00	0.00	4,781.24
Ground System	240 VAC		181B	ITE		1											1	10	276.57	276.57	5,057.81
Bus #1	Switchgear					0	High	8	Medium	6								5.88	2,607.62	2,607.62	7,665.42
Bus #2	Switchgear					0	High	8	Medium	6								5.88	2,607.62	2,607.62	10,273.04
Battery Charger			181B			0	High	8	Medium	5							0	5.62	276.57	276.57	10,549.60
	8-100 Amp Plug Fuses		181B			0	High	8	Medium	5							0	5.62	0.00	0.00	10,549.60
Battery Charger	250AC/ 150DC		181B	Allied C&D Power Systems		0	High	8	Medium	5							0	5.62	382.17	382.17	10,931.77
	60 Battery Bank		181B			0	High	8	Medium	5							0	5.62	4,112.32	4,112.32	15,044.09
RWTR-PMP-6	Vertical Turbine Pump w/ right-	Export	181B	Floway 5000 gpm, vertical		0	High	8	Low	2							0	4.84	393.08	393.08	15,437.17

Figure 36a. Sample Maintenance Prioritization Grid.

																				Total Cost	Cumulative Cost
																				0.00	
Maintenance Prioritization Grid																				0.00	
																				0.00	
Component					**Compliance Rating**		**Evaluation Ratings**										**Evaluation Total Threshold**	**4.8**		0.00	
Component ID	**Description**	**System**	**Location**	**Comments**	**Regulatory**	**Rating**	**Component Criticality**	**Rating**	**Safety Impact**	**Rating**	**Mission Support**	**Rating**	**Benefit /Cost**	**Rating**	**Management, Engineering Emphasis**	**Rating**	**Compliance Total**	**Evaluation Total**	**Maintenance Activity Cost**	0.00	
	Right Angle Gear	Export	181B	Armadillo		0	High	8	Low	2							0	4.84	1,344.04	1,344.04	16,781.21
E2X89	2400V Station Service #1 Disconnect		181B			0	High	7	Low	2							0	4.3	0.00	0.00	16,781.21
	2400V Bus Transition		181B			0	High	7	Low	2							0	4.3	0.00	0.00	16,781.21
E2X88	Motor Contactor 2E13		181B	Process Water Pumps #11B		0	High	7	Low	2							0	4.3	631.65	631.65	17,412.86

Figure 36b. Sample Maintenance Prioritization Grid..

5.0 DEMAND FOR WATER

Site water consumption has decreased steadily over the past 10 to 12 years, primarily due to the closure of processing facilities, the closure of the 200 East and 200 West Area steam production plants and the reduction of Site personnel on the plateau. Mortar lining of major sections of potable and raw water piping has also had a positive effect on reducing water use. Pipe joints have been sealed and an overall elimination of any undetectable water leaks that may have existed.

The demand drivers for RW usage is for fire protection needs, processing activities, and domestic purposes. Figure 37 shows forecasted RW demand for the Central Plateau.

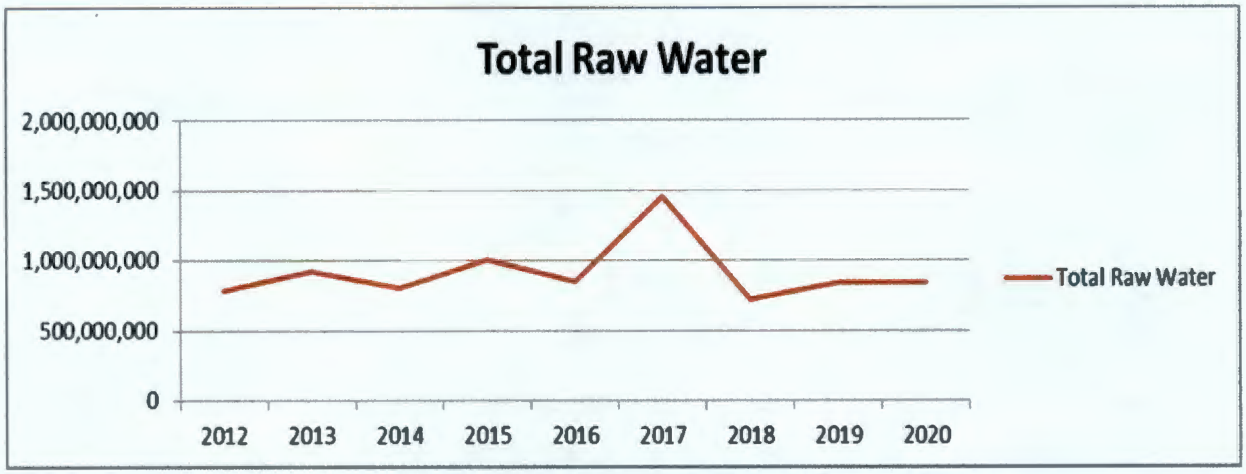


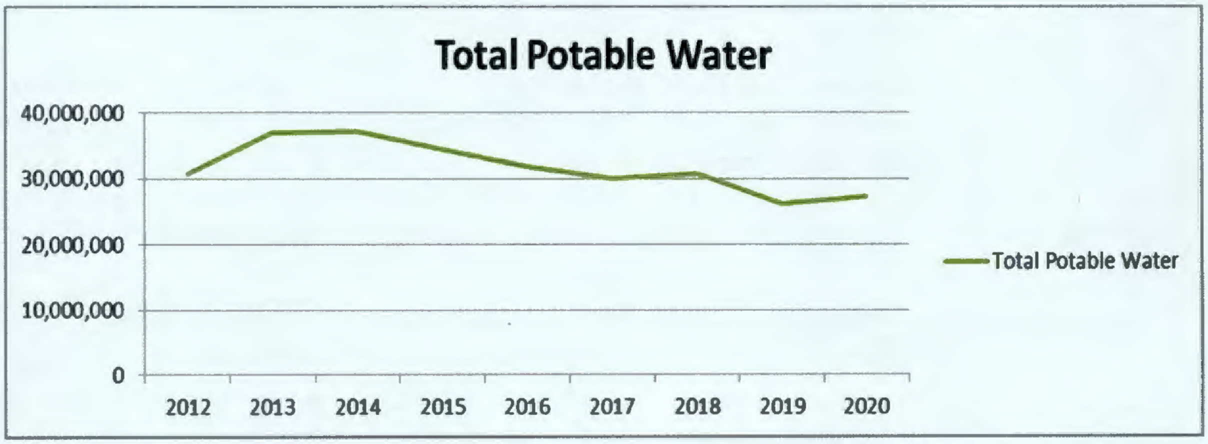
Figure 37. Quantity of RW Forecasted on the 200 Area Plateau.

A minimum of 600,000 gal of RW is continually stored to meet potential firefighting demand. The use of RW for processing results from its low production cost. Processing demand fluctuates with changing cleanup requirements. The spike indicated above during 2017 is contributed to the number of 200 East Area evaporator campaigns. Environmental regulations require that facilities using process water be designed and operated to include reuse and recycling.

The 283W Filter Plant is a customer on the 200 West Area RW grid. RW is processed at 283W, producing PW, that is used in a majority of Hanford Site facilities. Fire hydrants are supplied from both the RW and PW water systems, in the 200 East and 200 West Areas.

The demand drivers for PW production are fire protection and workforce population, or domestic use. During peak flow conditions, fire protection demand for PW exceeds that used for domestic purposes. Figure 38 shows 200 Areas projected PW production.

The standard design rate for PW consumption is 15 gal per person per day for industrial building and office employees according to the Environmental Protection Agency design manual, Onsite Wastewater Treatment and Disposal Systems. Flows per person could be as high as 30 gal/day if a facility is used by personnel taking showers. In addition to this general guideline, additional quantities of water are used for water treatment plant back flushing activities, waterline flushing activities, construction activities, dust control, and irrigation.



***Projected increase assumed to be at an additional flow of 950 gal/min/10-hour day for a full year for Waste Treatment Plant process water use. If higher 24-hr flow rates are required, PW production rates will need to be increased proportionately.**

Figure 38. Quantity of Potable Water Forecasted on the 200 Area Plateau.

5.1 FIRE PROTECTION REQUIREMENTS

The need for water for fire protection mandates the overall demand for water on the Hanford Site. Without an adequate supply for fire protection, Site facilities and processes would be forced to close. (See Appendix A, “”Bonding water Supply Requirements for Fire Protection”)

Hanford Site Fire Protection requirements are based on the following DOE Orders:

- CRD O 420.1B, *Facility Safety,* Section 4.2, Fire Protection, 12/22/05 (Ref. 7).
- SCRD O 420.1B, Revision 0, *Supplemented Contractor Requirements Document – Facility Safety,* Section B.6.b.3, 10/18/06 (Ref. 8).

Fire protection requirements establish a minimum production and storage capacity for the 200 Area water systems. A PW fire flow of 2,500 gal/min must be available for a minimum of four consecutive hours per fire-related incident. This fire flow must be provided in addition to a theoretical peak domestic flow of approximately 921 gal/min (includes WTP at 100 gal/min domestic +400 gal/min process flow). In addition to this primary source, a secondary source must be available to supply firewater if the primary source fails. An identical system providing redundancy exists with the RW system. Similar fire protection water strategies are in effect at the other areas of the Hanford Site. The fire protection systems are maintained fully operational to protect Hanford facilities as well as the surrounding environment.

The PFP fire water Technical Safety Requirements (TSR) require the sanitary water system be maintained at a minimum static 88 lb/in^2 pressure on the MSA managed PFP loop and that approximately 240,000 gal (4-hour firefighting supply including 250 gal/min hose stream demand) be available.

The CWC, T Plant, and WRAP facility fire water TSRs require that the sanitary water system minimum static pressure be 94 lb/in^2 at CWC, 94 lb/in^2 at T Plant, and 90 lb/in^2 at WRAP. The system demand is based on hydraulic calculations at the facilities' most remote fire suppression system and 200W single feed. The minimum required static pressures are based on previous two-calendar-year average standard deviations for normal water supply pressure. Minimum required static pressures will be updated annually.

The CSB, ETF, and WESF facility fire water TSRs require that the 200E RW water supply minimum static pressure be 94 lb/in^2 at WESF, 141 lb/in^2 at ETF and 85 lb/in^2 at CSB.

Table 21 identifies estimated CHPRC water system flow requirements to maintain fire protection. As illustrated in the table, ETF (2025E) is sited at very high main pressures, due to its lower elevation. Recommend developing a project to install a pressure reducing valve near ETF.

Table 21. CH2M HILL Plateau Remediation Company Projected Facility Fire Protection Requirements.

CH2M HILL Plateau Remediation Company Facility	Sprinkler System Demand and Minimum Static Pressure
Plutonium Finishing Plant	850 gal/min @ 79 lb/in^2 gauge
Central Waste Complex (2402-W Series)	651 gal/min @ 80 – 94 lb/in^2 gauge
(2403-W Series)	768 gal/min @ 73 lb/in^2 gauge
(2404-W Series)	1,700 gal/min @ 65 lb/in^2 gauge
T Plant (2706-T)	697 gal/min @ 71 – 94 lb/in^2 gauge
Waste Receiving and Processing Facility (2336W)	1103 gal/min @81 lb/in^2 gauge
Canister Storage Building (212H)	583 gal/min @ 85 lb/in^2 gauge
Effluent Treatment Facility (2025E)	527 gal/min @ 139– 141 lb/in^2 gauge
Waste Encapsulation and Storage Facility (225B)	Missing number gal/min @ 93– n 94 lb/in^2 gauge

5.2 SITE POPULATION FORECAST

Population declines and facility elimination will largely determine whether to continue water service in particular areas. A significant near-term population decline is expected along the River Corridor as the River Corridor Closure (RCC) and K Basin sludge removal missions are completed in the next five to eight years. The Site cleanup mission will then shift almost entirely to the Central Plateau.

Figure 39 shows projections for combined Hanford Site and associated in-town populations based on MSA's Land and Facilities Management 2012 update. Most anticipated population fluctuations are caused by programs[6] not currently supported by MSA.

[6] These other programs will need to fund the construction and maintenance of facilities associated with the needs of specific projects and programs.

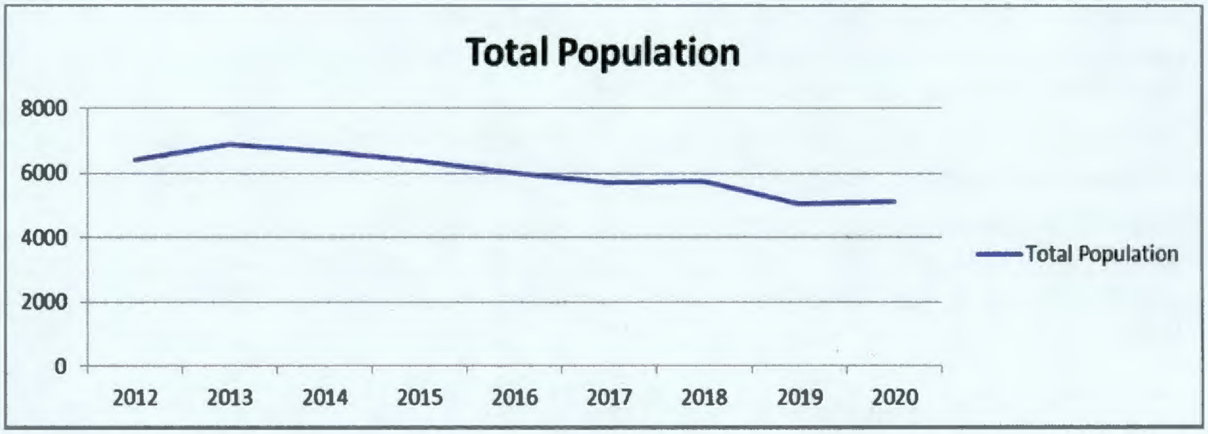


Figure 39. Combined Hanford Site Populations, Including Non-Site Personnel.

As missions complete and populations decline, a systematic program for identifying and decommissioning services within the various Hanford Site Areas is necessary. Water Utilities Management will work with MSA Land and Facility Management, MSA Interface Management, the Infrastructure and Services Alignment Plan (ISAP), TYSP, Hanford Site Sustainability Plan, and OHCs to help identify areas where services can be curtailed or eliminated. Water Utilities already works with OHCs to continually reduce or facilitate early retirement of their piped water service, reduce their dependence on bottled water, and eliminate the need to haul water to supported trailers.

The 200 Area Central Plateau and surrounding 600 Area are projected to retain the bulk of the Site population through the end of the environmental cleanup mission. The population on the plateau is expected to remain relatively constant over the next ten years. The WTP and expected support facilities planned for the 200 East Area will impact water and sewer services within the southeastern portion of the 200 East Area. Water Utilities has been working with the WTP Planning Group and using the ICD to track issues and their solutions. The population in the 200 East Area could increase by nearly 2000 employees over the next 5 to 6 years. Water Utilities is planning for the population fluctuation caused by WTP construction, cold operations, hot operations and startup, tank farm retrievals, 200 Area legacy facility remediation, and facility decommissioning.

Low populations are projected for more remote 600 Area facilities during the balance of the Site mission. No new projects are anticipated for these facilities.

In 2009, Congress passed the *America Recovery and Reinvestment Act* (ARRA), a 2-year program to set aside appropriations for a wide range of federal projects. Under the ARRA, the Hanford Site received over $1.96B to support mission-specific cleanup goals and objectives. Hanford Site contractors created approximately 2,900 prime contractor and subcontractor jobs. This increase placed an additional demand on the water system – increased demands for PW as well as RW to support accelerated cleanup projects. The capacities of the Hanford Sitewide water systems were adequate to meet the ARRA demand. Water Utilities needed to acquire four potable water haul trucks to support the comfort trailers that were installed to accommodate the population increase. No long- or short-term upgrades or modifications to the water system were necessary to address ARRA impacts. Beginning in late 2011 and early 2012, the Site Contractors begin to significantly reduce or eliminate these new positions. Water Utilities has seen a significant reduction in the amount of PW they haul and trailers they support.

5.3 DEMAND PROJECTIONS

The anticipated routine maximum demand on the EW system over the next 40 years is approximately 4,200 gal/min. At different times, demand could rise or fall from that level. Potential peak demand could exceed 14,000 gal/min for short durations. Over the next 40 years, as Hanford Site cleanup operations wind down, demand for water will diminish. The requirement for water for fire protection, process purposes, PW, and other functions will correspondingly decrease, though it will not be eliminated.

Major water users on the Central Plateau, such as the WTP, the 242-A Evaporator, Environmental Restoration Disposal Facility (ERDF), and tank farms will require substantial volumes of water on a sustained or intermittent basis for years or decades. Reliability, redundancy, and safety requirements placed on the system will remain. Tourism at B Reactor, a National Historic Site, has created a new, relatively small, but ongoing demand for water in the 100 B Area. Currently, Water Utilities supports the comfort trailer at B Reactor and works with WCH to maintain EW for the 100B Area. As noted, MSA has responsibility to deliver EW to WCH and the 100B Area via the 101 Valve House Complex. The pressure-reducing valves and isolation valves are operated and maintained by MSA.WCH has responsibility for the service within the 100B Area, which includes B Reactor.

Anticipated 200 Areas water volume projections are based on historical consumption data. PW and RW use is expected to remain nearly the same through 2020. A sharp increase in PW volume is anticipated when the WTP begins its mission for processing waste. At the end of WTP's mission, a significant decline in PW use is expected through decommissioning and demolition of the facilities.

Projected Central Plateau raw water flow requirements to support CHPRC RW and PW demands through 2022 are indicated in Table 22.

Table 22. CH2M HILL Plateau Remediation Company Sanitary Water Service Requirements.

CH2M HILL Plateau Remediation Company Facility	Nominal Flow and Pressure
Plutonium Finishing Plant	115gal/min @ 80-110 lb/in^2
Central Waste Complex	40 gal/min @ 80-110 lb/in^2
T Plant	40 gal/min @ 80-110 lb/in^2
Waste Receiving and Processing Facility	40 gal/min @ 80-110 lb/in^2
Canister Storage Building	40 gal/min @ 80-110 lb/in^2
Effluent Treatment Facility (2025E)	40 gal/min @ 80-110 lb/in^2
Waste Encapsulation and Storage Facility (225B)	40 gal/min@80-110 lb/in^2

Projected raw water flow to meet WRPS's requirements for tank farms cleanup through 2022 (including Waste Feed Delivery Phase 1 activities) are presented in Tables 23 and 24 for the 200 East Area and 200 West Area, respectively. Raw water is provided through permanent connections and via hydrants.

Table 23. 200 East Area Tank Farms Estimated Peak Raw Water Demands (2004 - 2020).

Facility	Activity	Normal Demand (gal/min)	Projected Peak Demand (gal/min)	Projected Peak Demand (Years)
A-Complex and AN Farm[1]	Flush/dilution[2] Sluicing[3] Safe Storage **Total**	0 0 40 **40**	140 700 300 **1140**	2005, 2014, 2018
AW Farm[1]	Flush/dilution[2] Safe Storage **Total**	0 20 **20**	700 100 **800**	2004
AP Farm[1]	Flush/dilution[2] Safe Storage **Total**	0 20 **20**	560 100 **660**	2011
B/BX/BY Farms[1]	Flush/dilution[2] Sluicing[3] Safe Storage (saltwell Pump) **Total**	0 0 20 **20**	420 700 0 **1120**	2014
C Farm[1]	Sluicing[3] Safe Storage **Total**	0 0 **0**	350 100 **450**	2009, 2010, 2014, 2015
242-A Evaporator	Operation Mode[4] Standby Mode **Maximum**	2700 10 **2710**	3700 500 **4200**	2004 through facility closure
Balance of 200 East	Fire Suppression (@ 20psi residual)[3] Other WRPS Facilities[6]	0 20 **20**	2500 100 **2600**	(worst case demand)

1. Consistent with current Tank Operations activities, static water pressure of 110 psig (at the pump station) is estimated to be sufficient.
2. Flush/Dilution assumes a flow rate of 140 gal/min per event.
3. Sluicing assumes a flow rate of 350 gal/min per event.
4. 242-A peak raw water flow rate during evaporator campaigns is based on SD-W049H-FDC-001, *Functional Design Criteria for the 200 Area Treated Effluent Disposal Facility, Project W-049H*, normal demand during evaporator campaigns is approximately 3000 gal/min and 130psig. During standby operation, normal demand is approximately 10 gal/min (primarily compressor coolers) with peak demand estimated for vessel fill and flush operation and wash-downs.
5. A 20 psig residual pressure is the minimum pressure required at the location of the fire for fire water flows. This minimum pressure assumes total flows from the distribution system and includes the minimum 2500 gal/min fire flow plus water flow requirements of the MSA, WRPS, and WTP at the time of the fire.
6. Peak demand for other WRPS facilities is estimated based on minor raw water usage plus peak usage during facility flushing and cleaning.

Table 24. 200 West Area Tank Farms Estimated Peak Raw Water Demands (2004 - 2020).

Facility	Activity	Normal Demand (gal/min)	Peak Demand (gal/min)	Peak Demand (Years)
T/TX/TY Farms[1,2]	Flush/Dilution[3] Sluicing[4,5] Safe Storage(saltwell pumping) **Total**	0 0 0 **0**	420 2100 0 **2520**	2011, 2014, 2018
S/SX Farms[1,2]	Flush/Dilution[3] Sluicing[4] Safe Storage(saltwell pumping) **Total**	0 0 0 **0**	0 700 0 **700**	
SY Farm[1]	WFD Flush/Dilution[3] Sluicing[4] Safe Storage **Total**	0 0 0 **0**	140 350 20 **510**	2011, 2013, 2015, 2017
222-S Laboratory	**Total[6]**	**0**	**20**	2004 through facility closure
Balance of 200 West	Fire Suppression (@20psig residual[7]) Other WRPS Facilities[8]	0 30 **30**	2500 80 **2580**	(worst case demand)

1. Consistent with current Tank Operations activities, static water pressure of 110 psig (at the pump station) is estimated to be sufficient.
2. Current discussions with Hanford Water Purveyor indicate that MSA no longer provides water service to all or part of these farms (i.e., the pipelines have been cut and capped).
3. Flush Dilution assumes a flow rate of 140 gal/min per event.
4. Sluicing assumes a flow rate of 350 gal/min per event.
5. Sluicing plans identify the potential for six simultaneous sluicing operations in the *T/TX/TY* farms.
6. The 222-S Laboratory uses minimal raw water, raw water flow rate is assumed to include some utilization potential for washdown.
7. A 20 psig residual pressure is the minimum pressure required at the location of the fire for fire water flows. This minimum pressure assumes total flows from the distribution system and includes the minimum 2500 gal/min fire flow plus water flow requirements of the MSA, WRPS, and WTP at the time of the fire.
8. Demand for other WRPS facilities are not separable in RPP-5227 (Tables 4 and 6 and Appendix A); therefore, peak demand is based on the design wash-down rate for Building 6241-A as provided in drawing H-2-822370.

Building 6241-V (Cross Site Transfer Line Vent Station) and other WRPS facilities in the 600 Area are not included in the tables. Building 6241-V has a peak demand of 80 gal/min for building wash-down (*drawing H-2-822370*). The demand is serviced from a hydrant or water truck.

5.4 WATER RIGHTS FOR THE 100, 200, AND 600 AREAS OF THE HANFORD SITE

Water supplied to the 100, 200, and 600 Areas, as well as other DOE approved activities on the Hanford Site, is pumped from the Columbia River. The water is withdrawn under the *Federal Reserved Water Rights Doctrine* (Winters' Doctrine) for land set aside as the Hanford Site by the United States government to support the conduct of activities authorized under the *Atomic Energy Act of 1954*. Federally reserved water rights associated with such land actions are not express but implied and are considered valid in support of DOE missions. Thus, the Hanford Site's water rights are the property of the United States government. The Site holds no water right documents, certificates, or deeded rights to water at this time. Therefore, as a general rule, water rights should not be considered available for transfer to entities outside the United States government without Ecology's approval.

5.5 FIRE PROTECTION FLOW AND PRESSURE REQUIREMENTS

The MSA fire protection requirements are stated in 4.1 and the ICDs. NFPA 13, *Standard for the Installation of Sprinkler Systems*, requires 90-120 min supplies for extra hazard hydraulic designs, and up to 2 hours for most high piled storage. Appendix A, Bounding Water Supply Requirements for Fire Protection, identifies the facilities and their required support.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 EXPORT WATER

181B Building/Structure. Other than required painting, There are no recommendations at this time.

181B Pumps/Motors. Predicting the life expectancy of the 181B pumps is difficult without additional pump testing. Therefore, except for the newly installed diesel-driven pump (DP-6) the existing pumps in this facility are suspect. Due to the lack of any baseline information on the operable equipment, it is recommended that the existing pumps should be performance tested within the next 12 months and determine the need for new electric vertical turbine pumps.

Recommend installing one new vertical turbine pump and continue use of the older vertical turbine pumps until failure.

Maintain the diesel pump in a serviceable condition to provide a reliable backup in the event of a power outage or to allow operations to continue while the electric pumps are being repaired.

Additionally, establish a PM program to document performance and maintain pump and motor reliability.

In the interim, because the condition of the operable vertical turbine pumps is unknown, it is recommended that an operational test procedure (OTP) be written and followed on the operating pumps at the 181B facility. The pump tests for each pump would be conducted during the daytime hours using calibrated gauges and instruments to provide accurate information without interrupting plant operations. Performance testing each pump in this manner will accomplish the following:

- Determine discharge flow and pressure
- Determine pump and motor revolutions per minute
- Determine the amperage readings at design flow conditions
- Provide vibration measurements for analysis of pump wear
- Establish a baseline for future condition assessments
- Provide a comparison to the original vendor-provided pump curves.

Because no records of recent or past PM or repair logs are available, it may be of value to inspect the inoperable vertical turbine pump-motor units to determine their condition. An assessment would benefit future operations, providing information about replacement parts and components.

An M&O manual should be written for each pump, motor, adjustable drive mechanism, and PLC instrumentation system. A routine PM schedule should be adopted, funded, and prioritized to be faithfully performed. The M&O manual should clearly define each significant piece of operating equipment identified on the PM schedule. Accurate records should be maintained to trend the performance of each piece of equipment being maintained. Specifically, acceptable operating characteristics for the variable-speed, magnetic drive on pump P-6 need to be established and documented. Operation appears to be acceptable at this time; however, this assembly had a few problems in its history.

182B Piping and Valves Recommendations. Pump discharge and header piping, and the related valves (e.g., gate, butterfly, check, and control valves) were not assessed. It is recommended that a full visual examination be performed of all piping that can be reasonably accessed. All valves should be evaluated by operating them in a manner to verify their condition. Allowances should be made to repair impaired or broken valves, or replace them with new ones. As valves are replaced, inspect the pipeline interior for excessive corrosion and document findings. Perform nondestructive tests on the existing pipe where locations warrant a closer inspection.

Failure of the 181B/182B pump header piping would be catastrophic. The header pipe is essential to successful operation of this system. It is highly recommended that the entire discharge header be evaluated with nondestructive methods such as ultrasonic thickness testing. Repairs may be difficult, expensive, and time consuming because of the header's remote and congested location.

Recommend replacing the relief valve system with one that will accommodate larger flows and located so flow through the system is measured by a flow meter installed in the system.

Recommend ultrasonic nondestructive testing to be performed on discharge and header piping to verify wall thickness is acceptable. Piping repairs to follow testing as required.

It is recommended that new isolation and control valves be purchased to replace all existing valves. In the interim, an allowance should be made to repair or replace leaking and broken isolation valves with new valves or parts. Furthermore, it is recommended that all isolation valves should be operated to determine if they are functional. The isolation valve testing, at a minimum, should first consist of operation under no-flow conditions. Then, when conditions allow, these valves should be tested to isolate flow. This test may be performed using acoustical test methods or other appropriate nondestructive techniques.

Recommend implementing engineering controls to prevent intrusion of water into the controls at the buried diesel tank. Alternatively, replace the diesel tank with an above ground unit with similar capacity and capability.

182B Power/Instrumentation and Controls. Present power requirements are adequate and no modifications are required at this time. However, recommend evaluating the feed line, transformer and associated equipment to determine if replacement is needed to enhance reliability. Establish a maintenance program to monitor the condition of these components and/or service them regularly.

In order to improve the efficiency of pump operations, it is recommended that automated controls be added to the 181B/182B facilities. A high/low float control sensor at 182B reservoir would activate the 181B pumps. Pump controls at the 181B would be added to start/stop the pumps. In addition, the 182B reservoir water level and 181B pump status should be transmitted to the 283W Control Room in the 200 West Area to fully automate operations.

Proactive measures have already been mentioned to remove one of the more significant RW users from the grid (i.e., the Gate 814 truck fill station). A new 200 East Area RW truck fill station will greatly reduce the frequency of the low-pressure hits on the 200 East Area RW grid.

Soft starts should also be installed on all these active single- speed pumps (P-2, P-4, and P-5). Pump P-3 should be activated with a soft start installed as well. This will significantly enhance the transformer reliability and longevity. Installation of a backup transformer should also be considered.

Level-control sensors should be installed on the 182B reservoir and integrated with the 181B pump station to automatically activate a river pump when needed. Sensors should be installed with telemetry that would deliver the signal back to the 283W Control Room.

As previously described in the pump/motor recommendations, regular PMs should be conducted. During scheduled PMs, equipment calibration, including establishing operational set points, should be documented and verified. MSA Instrumentation and Control (I&C) technicians should maintain and calibrate this equipment. Operations personnel will also need formal hands-on training for operating the three-pump automatic control system.

181D Building/Structure. No recommendations at this time other than painting areas in need.

181D Pump/Motors. Predicting the life expectancy of the 181D pump facility is difficult without additional pump testing. No pump performance baseline information is available. Therefore, the existing pumps in this facility are suspect. It is recommended that one new vertical electric turbine pump with new check and isolation gate valves be installed within the next 12-24 months following the improvements to the 181B/182B facilities.

A diesel-driven pump, similar to the one installed at 181B, should be installed at 181D to provide backup water supply in the event of a power outage or pump failure. This will mitigate the concern for a single point failure of the 13.8kV power supply. These additions will ensure that reliable backup pump service is available to support the EW System.

In the interim, continued use of the older vertical turbine pumps, even after a new pump unit is installed, is recommended until the vertical turbine pumps are no longer of use or if it is determined that they are not energy efficient to operate. Because the condition of the operable vertical turbine pumps is unknown, it is recommended that an operational test procedure (OTP) be written and performed on each pump to develop a baseline for operations.

Additionally, an appropriate PM program should be established to document performance and maintain pump and motor reliability. Because no records of recent-past PM or repair logs are available, it may be of value to inspect the inoperable vertical turbine pump-motor units to determine their condition. An assessment would benefit future operations, providing information about replacement parts and components.

181D Piping and Valves. It is recommended that ultrasonic nondestructive testing be performed on discharge and header piping for acceptable wall thickness determination. If the wall thickness is not acceptable, piping repairs or replacement will be required.

It is recommended that new isolation and control valves be purchased to replace all existing valves. In the interim, an allowance should be made to repair or replace dysfunctional and broken isolation valves with new valves or parts. In addition, it is recommended that all isolation valves should be operated to determine if they are functional. The isolation valve testing, at a minimum, should first consist of operation under no-flow conditions. Then, when conditions allow, these valves should be tested to isolate flow. This test may be performed using acoustical test methods or other appropriate nondestructive techniques.

181D Power/Instrumentation and Controls. The single-point failure previously identified, regarding the 13.8kV power supply, is resolved by the installation of a diesel-driven vertical turbine pump.

To improve the efficiency of pump operations, it is recommended that automated controls, with telemetry to the 283W Control Room, be added to the 181D/182D facilities, similar to the recommendation for the 181B/182B facilities. However, manual controls would appear to be an appropriate option at this facility since it is serves as a backup for the EW system.

182D Building and Structure. The 182D concrete structure appears to be in good condition and is reasonably watertight when the reservoir is at 25 percent capacity. When the reservoir exceeds this level, leaks have been observed. It has been constructed very similarly to the 182B facility, is functional, and provides adequate protection for the operating equipment housed in it. A liner in the reservoir would likely resolve the leaking issue.

182D Reservoir. The 182D reservoir appears to not be leaking and is currently being operated at approximately 25 percent capacity. No evidence is available and no test has been performed to verify that the leak has been stopped. At a minimum, the southern end of the reservoir should be lined if this facility is to be used throughout the Hanford Mission. With the sensitivity surrounding activities to mitigate groundwater plumes, this should be scheduled for construction within the next 12 months. Preliminary engineering studies have proposed methods to repair the reservoir, but have been discouraged based on available funding and the goal of reducing the 100D Area footprint.

It is recommended that the new 181D pumps in the Export Water Scoping Study be installed prior to removing the 182D Area pumping facilities. Without this action removal of 182D from service would create a single point failure condition at the 181B/182B facilities. The operation of 100D is the only means by which repairs can be made at the 100B facilities while maintaining the EW supply.

182D Pumps/Motors. The four electric pumps are operable with significantly more capacity than the pumps located in the 182B facility. Predicting the life expectancy of the pumps is difficult without additional performance testing of each pump/motor. Performance testing should follow the outline previously described and be performed as soon as possible. Even with the most optimistic performance data, a new pump unit should be installed within the next two to three years to provide a reliable installed spare. Continue using the older pumps, servicing them on a regular basis and as they break down determine if the repairs can be made economically or the pump should be replaced. Develop a quarterly PM program if the pumps are being used infrequently to keep them operational.

The 182D facility has no diesel-driven backup pumps. It is recommended that one diesel-driven EW pump be installed similar to that installed at the 182B facility. This pump should be installed prior to the improvements at182B and will serve as a back-up to the electric pumps.

182D Piping and Valves. Pump discharge and header piping and the related valves were not assessed. It is recommended that a full visual examination be performed of all piping that can be reasonably accessed. All valves should be evaluated by operating them in a manner as described in Section **Error! Reference source not found.**to verify their condition. As valves are replaced, inspect the pipeline interior for excessive corrosion and document the findings. Replace nonfunctioning valves as necessary. Perform nondestructive tests on the existing pipe where locations warrant a closer inspection.

182D Power/ Instrumentation and Controls. Transformer and switchgear capacity is fully adequate for all anticipated needs at 182D.

At the time new pumps are installed, liquid level sensors should also be installed for reservoir level control. In addition, a new flow meter and pressure sensor should be installed on the discharge header leaving the building to monitor flow and pressure when operating the plant.

Each of these devices should be monitored at the 282W control room with wired or wireless telemetry.

This pump facility is completely manually controlled, which is reasonable for its intended purpose. However, monitoring capabilities of the pump/motor operations is not appropriate and should be implemented.

A quarterly PM program to verify pump/motor controls should be scheduled to keep MSA personnel trained in operating this plant and to ensure the plant is fit for service should the need arise.

EW Piping. In general, the EW pipeline and related isolation valves are in satisfactory condition. With the exception of the 24-in.-diameter EW line routed to the 200 West Areas, the pipeline appears healthy and fit for continued service for the duration of the Hanford Mission. However, the following activities must occur to ensure that the EW line remains fit for service and properly protected from heavily loaded vehicles.

Corrosion Study. Only 4.2 miles of pipe were surveyed. At five locations there were indications of potential corrosion activity. These five sites require further exploratory excavations prior to continued surveys. It is recommended that additional cell to cell surveys be performed over the remaining EW piping to assess each section of pipeline.

Physical Analysis (Pipe, Water, and Soil) Study. No recommendations for further analysis at this time. When opportunities occur to obtain a pipe sample it would be advantageous to have the sample analyzed as was previously done.

Vehicular Crossings. Recommend completing a survey of all road/rail crossings on the remaining EW pipelines where heavily loaded dump trucks are constantly crossing over the pipeline. It is recommended that a properly designed protective encasement should be installed at all crossings (see Figure 40). In addition, administratively enforced travel routes should be established for heavy-haul trucks.

EW Valves/Instrumentation and Controls. Establish a PM program to operate all EW system valves, keeping them fit for service. The schedule should include testing and operating the valves at least annually.

Recommend troubleshooting program software to ensure it is working properly. When posted error statements occur in the software and cannot be resolved, then investigate the transmission signal at the physical connections of the field installed components. Field testing may include verify valve position, line pressure, and battery charge for the solar power unit. Apply lessons learned from the operator training to troubleshooting existing software. Incorporating these recommendations will enhance operator confidence and ensure reliable operation of the software.

Recommend simulator training of operators in the evaluation and troubleshooting issues that might occur. This training will present upset field conditions that allow the operator to assess the condition and provide the correct response. This will enable the operators to develop confidence and skill in using the software program.

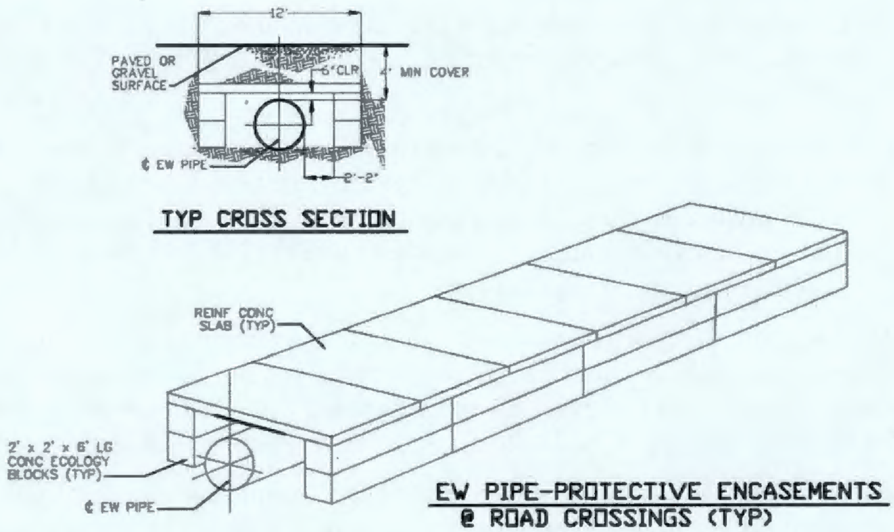


Figure 40.. Suggested Pipe Encasement at Road Crossings.

6.2 RAW WATER

282W Building/Structure. The building is in satisfactory condition except for the need for painting. The reservoir should be relined with leak detection capabilities to preserve the integrity of the exterior reinforced concrete wall and eliminate groundwater intrusion. In addition, repairs need to be performed on the top six inches of the reservoir walls including the overflow structure. A contract was awarded for L-311 to perform theses specific improvements and should be completed in July of 2012.

282W Pumps and Motors. No recommendations at this time. The RW fire pumps are maintained and run on a monthly basis and are operating at their designed levels. Per NFPA requirements, the pump curve is verified through annual testing. Predicting the useful life of these pumps is difficult since they are infrequently used. When in operation, the pumps run for a short period of time. Their useful life is expected to last for the duration of the Hanford Mission with minor repairs as necessary.

282W Piping and Valves. No recommendations at this time. No indication of malfunctioning valves or faulty pipe.

282W Power Instrumentation and Control. The control panels for the fire pumps need to be modified. The pressure sensor needs to be replaced so spares are available. Modifications should also include moving instrumentation outside the cabinet allowing calibration and NFPA required readings without opening the cabinet. Additionally, automatic shutdown allowed per NFPA should be considered.

282WC Building/Structure. No recommendations other than painting at this time.

282WC Pumps/Motors. Replace PW recirculation pump/motor units. The existing PW fire pump is adequate at this time for the present demands. Predicting its useful life is difficult since this pump is infrequently used. When it is in operation, the pump runs for a short period of time. Thus, its useful life is expected to last for the duration of the Hanford Mission with minor repairs as necessary. NFPA required annual testing will monitor pump condition based on its pump curve.

The RW pumps satisfy the operating requirements to supply the 200 West Area RW grid. Recommend establishing a PM program to document performance and maintain pump and motor reliability.

282WC Piping and Valves. No recommendations at this time.

282WC Power Instrumentation and Controls. The control panels for the fire pumps need to be modified. The pressure sensor needs to be replaced. Modifications should also include moving instrumentation outside the cabinet allowing calibration and NFPA required readings without opening the cabinet. Additionally, automatic shutdown allowed per NFPA should be considered.

Flow meter on the sanitary fire pump test loop needs to be serviced and calibrated.

282E Building/Structure. The building is in satisfactory condition except for needing painting. The reservoir is in excellent condition since it has been recently relined (Project L-317) to preserve the integrity of the exterior reinforced concrete wall.

282E Pump Motors. No recommendations at this time. The RW fire pumps are maintained and run on a monthly basis and are operating at their designed levels. Per NFPA requirements, the pump curve is verified through annual testing. Predicting the useful life of these pumps is difficult since they are infrequently used. When in operation, the pumps run for a short period of time. Their useful life is expected to last for the duration of the Hanford Mission with minor repairs as necessary.

282E Piping and Valves. No recommendations at this time. No indication of malfunctioning valves or faulty pipe.

282E Power Instrumentation and Controls. The control panels for the fire pumps need to be modified. The pressure sensor needs to be replaced. Modifications should also include moving instrumentation outside the cabinet allowing calibration and NFPA required readings without opening the cabinet. Additionally, automatic shutdown allowed per NFPA should be considered.

282EC Building and Structures. No recommendations other than painting at this time.

282EC Pumps/Motors. The existing PW fire pump is adequate at this time for the present demands. However, the NFPA requirements are not being met. The pump is operating more than 5 percent below the original pump curve. Additional evaluation is ongoing. Predicting its useful life is difficult since this pump is infrequently used. The pump is used for short periods, therefore its useful life is expected to last for the duration of the Hanford Mission with minor repairs. NFPA required annual testing will monitor pump condition based on its pump curve.

Investigate the leaking RW booster pump and perform necessary repairs. The RW pumps satisfy the operating requirements to supply the 200E RW grid. Recommend establishing a PM program to document performance and maintain pump and motor reliability.

282EC Piping and Valves. No recommendations at this time.

282EC Power/Instrumentation and Controls. The control panels for the fire pump need to be modified. The pressure sensor needs to be replaced. Modifications should also include moving instrumentation outside the cabinet allowing calibration and NFPA required readings without opening the cabinet. Additionally, automatic shutdown allowed per NFPA should be considered.

Flow meter on the sanitary fire pump test loop needs to be serviced and calibrated.

6.3 POTABLE WATER

283W Building and Structures. Recommend the following:

- Remove abandoned equipment and piping to improve accessibility and reduce clutter.
- Perform a tracer study on the 283W facility in order to increase the maximum capacity limit to satisfy demands for future use.
- Remove the abandoned level float within the 283WA 1.1-Mgal PW storage tank.
- Program the existing level measurement instrumentation to provide alarms.
- Seal cracks and openings
- Paint where appropriate.

283W Water Treatment Equipment Components. The PW pumps satisfy the operating requirements to supply the 200 West Area PW grid. Recommend the following:

- Establish a PM program to document performance and maintain pump and motor reliability.
- Replacement of antiquated equipment and components within the water treatment train is recommended. This includes but is not limited to:
  - Inlet control valves on the filter basins
  - Flocculation paddle drives
  - Upgrades to instrumentation, particularly those that provide permit regulated data.

283W Piping and Valves. Piping and valves are generally in good condition, but valve evaluation procedure needs to incorporate prioritization process that takes into account Regulatory requirements and personnel safety, component criticality, safety impacts, Mission support, benefit/cost consideration, and management preferences. The condition of highly prioritized valves should be scrutinized, and repaired or replaced to sustain the operation of this critical operation. Evaluate replacing critical control valves.

The clear well valves should be operated and an active PM program should be put in place.

283W Power/Instrumentation and Controls. Recommend upgrading the control system. The plant control system needs to be updated, since the PLCs, computers, and software are early 1990s technology. Upgrade the control valves and panels for the filter inlet flow.

283E Building/Structure. Recommend the following:

- Remove abandoned equipment and piping to improve accessibility and reduce clutter.
- Remove the abandoned level float within the 283EA 1.1-Mgal PW storage tank.
- Program the existing level measurement instrumentation to provide alarms.
- Correct the identified cross-connection at the 283EA clear well.

283E Building/Structure. Recommend the following:

- Remove abandoned equipment and piping to improve accessibility and reduce clutter.
- Remove the abandoned level float within the 283EA 1.1-Mgal PW storage tank.
- Program the existing level measurement instrumentation to provide alarms.
- Correct the identified cross-connection at the 283EA clear well.
- Paint structure.

283E Pump Station Equipment Components. The PW pumps satisfy the operating requirements to supply the 200E PW grid. Recommend establishing a PM program to document performance and maintain pump and motor reliability.

283E Piping and Valves. Piping and valves appear to be generally in good condition, but valve evaluation procedure needs to incorporate prioritization process that takes into account Regulatory requirements and personnel safety, component criticality, safety impacts, Mission support, benefit/cost consideration, and management preferences. The condition of highly prioritized valves should be scrutinized, and repaired or replaced to sustain the operation of this critical operation. The clear well valves should be operated and an active PM program should be put in place.

283E Power/Instrumentation and Controls. Recommend upgrading the control system. The plant control system needs to be updated, since the PLCs, computers, and software are early 1990s technology. Recommend updating the control programming to accommodate the revised PW pump impellers previously installed. A complete list of proposed Recommended Actions is given in Appendix C.

6.4 200 WEST/EAST POTABLE AND RAW WATER GRIDS

A prioritized list of projects has been recommended to address the immediate needs of the PW and RW distribution systems.

6.5 SYSTEM-WIDE ISSUES

6.5.1 SYSTEM REDUNDANCY AND PLATEAU OPERATIONS

6.5.1.1 Discussion

The RW, FW, and PW supply systems on the plateau depend on the Export river water intake and pumping stations at the 100B and 100D Areas. If these areas cannot supply water from the river and RW supplies from the 200A reservoirs are depleted, then all RW water supply grids on the plateau (200 East and 200 West Areas) will be incapacitated. PW production would then cease and as clear well volumes are depleted, PW supplies would go down as well. Currently the combined operations of the 100D and 100B Areas provide a redundant system. If either the 100B or the 100D EW system fails, redundancy is lost.

The recent EW scoping study recommends maintaining redundant EW capability into the foreseeable future. Based on this recommendation, a plan has been developed to install high-head pumps in 181D to bypass the 182D reservoir and pump house. This will eliminate current concerns related to reliability and reservoir leakage that may impact local contamination plumes.

In addition, MSA Water Utility operations has experienced difficulties in maintaining consistent pressure and flow on the RW grid at the plateau due to the impacts of the hydraulic connection between the EW and RW systems at the suction of the RW booster pumps combined with the differences in pressure capacities of the EW pumps at 182B and 182D. Completion of the Truck Fill Station and implementation of the EW Scoping Study recommendations will eliminate the sources of the problems and improve the operating characteristics of the systems.

6.5.1.2 Conclusions and Recommendations

The following multistep recommendation would alleviate several of these problems with fairly minimal costs compared to other alternatives. These recommendations are being implemented in FY12 and 13 in a recently approved reliability project.

The RW systems in 200E/W should be modified to make them independent from the operation of the EW pumps and reservoirs. Then, the 182B pumps could be used to simply fill the 282E/W reservoirs. This would eliminate the major communication problems between the plateau and the river areas. It also would eliminate the pressure spikes and flow problems on the RW grid. In this scenario, the booster pumps at 282EC and 282WC would be taken out of service, and the PW grid would be tied to the RW grid with backflow preventers (BFP). Fire pumps at 282EC and 282WC would supply fire water to both the RW grids through the BFPs and the PW grids. PW fire tanks at 283WA and 283EA would provide dedicated fire protection water for both the PW and RW grids. The RW pumps currently in the basements at 282E and 282W would be modified to be used as RW distribution grid pumps for continuous operation (i.e., no longer fire pumps). A variable speed drive should be added at each RW station to follow demand. These pumps are capable of fully pressurizing the RW grid taking suction from the RW reservoirs. The following are being evaluated and implemented:

- Install dual-train backflow preventer assemblies in 282EC and 282WC so the PW booster pumps can be utilized to charge the RW grid.
- Tie in piping from the PW fire pump headers to backflow preventers that tee into the booster pump discharges. This will include accommodations for the existing 10 in. by 12 in. relief valve if their continued use is needed
- Convert fire pumps located in basement of 282E to continuous use RW pumps.
  - Remove annunciator system and all fire protection alarm wiring/equipment.
  - Install operations-compatible PLC control system to turn pumps off and on from 283W.
  - Install variable speed drives (VFD or magnetic drive) and associated controllers (whichever is necessary) for one of the now RW pumps at each RW reservoir (alternately, install new variable speed pumps.)
  - Incorporate variable speed controls into the new PLC controller and update other PLC and HMI interfaces as needed for operator monitoring and control.

- Implement EW scoping study recommendations for pump installations at 181D and 181B and bypass piping around reservoirs at 182B and 182D, to feed EW directly from the river to the Plateau RW reservoirs.

6.6 AUTOMATIC COMPUTER CONTROL SYSTEM

6.6.1 Discussion

Several control issues have been identified with communications between the aging Allen Bradley SLC 500 PLC, the user interface software, and recognition tracking system (RTS) (based on line of sight). Several layers of hardware and software are required to transmit commands from the 182B pump house to the 282E and 282W reservoirs. Line of-sight communications has failed requiring a reset of the software "key." Proprietary visual basic software and Cytech protocol translation to Profibus[7] add additional failure points because of software incompatibilities. The following recommendation will alleviate some the problems associated with the computer control system.

6.6.2 Conclusions and Recommendations

Implementing the following recommendations will resolve the computer control communications issues:

- Install a PLC system in 182B that is compatible with the Plateau water systems operations to control pumps P-4, P-5, and P-6 located at building 182B (replace old Cytech system).
- Install a level controlling device at 282W and 282E to control level of reservoirs. Include communications between level control devices and 182B area and 282W control room Ethernet connection recommended.
- Install a reliable data link between the 100B/D Areas and the 283W control room.
- Install operations compatible data communication and control system for motor operated valves (MOV) at 1901Y and 2901Y (line-of-sight-system does not work).

6.6.3 Additional Recommendations

The following improvements should be considered after the previous recommendations have been implemented and if funding allows.

- Install a cooling tower for the 242A Evaporator to significantly reduce overall RW load during evaporator runs.
- Install deep wells on plateau for emergency water supply versus retaining 100D pumping capability.

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[7] Profibus is a registered trademark of Profibus Nutzeroganisation, Karlsruhe, Germany.

- Install high-head (over 150 lb/in^2) vertical turbine pumps at 181D and/or 181B to send water directly up to the plateau reservoirs bypassing the 182D and/or 182B pumping facilities.
- Improve the rapid mix system for alum.
- Improve the chlorine addition "v-notch" system.
- Provide redundant chlorine feed lines from the ChlorTainers to the injection room.

6.7 SUMMARY OF PW HYDRAULIC ANALYSIS

MSA developed a comprehensive hydraulic analysis to model the 200 Area PW System. The model included over 38 miles of water lines 4-in. diameter and larger. Some smaller lines were included, but predominantly only the larger pipelines were used as the focus for this hydraulic modeling. Over the past 10 years, Fluor/MSA Operations personnel provided the system demands and operating conditions for the PW system.

The hydraulic analysis used Bently-WaterCAD (previously Haestad Methods) computer software to perform the water balance modeling. The pipelines were shown schematically, with user-defined lengths. The physical data for each pipeline included the length between junctions, the elevation for top of pipe at each junction, and the pipe material with associated roughness coefficients. This information was captured from available as-built construction drawings, meetings with MSA utility personnel, and field observations. Pump station output, flow, and pressure were obtained from the archived certified vendor information on file or from pump curves provided by MSA. Pump curve data and recorded flow test data from fire department hydrant tests were used to simulate the operating conditions and calibrate the hydraulic model.

The resulting hydraulic model replicates the combined 200 East and 200 West Areas PW systems. The information provided by the model is now in use as a valuable tool to planners for future extensions on the PW system. Changes in system flows, simulated pipe breaks, and other flow scenarios can now be modeled easily to determine anticipated impacts to the existing operating system. The model also can be used to assist in troubleshooting problem spots and reconciling pressure differences within the system.

6.8 SUMMARY OF EXPORT WATER AND RAW WATER HYDRAULIC ANALYSIS

A comprehensive hydraulic analysis was developed by MSA to model the EW system and the 200 East Area RW system, mapping over 42 miles of water lines 4-in.-diameter and larger. This model describes how the EW system manages and delivers RW from the 182B/182D facilities to the 282E and 282W RW reservoirs, and into the 200 East Area RW grid. The EW system consists of water piping from the 182(B/D) to the 282E/EC and 282W/WC. The 200 West Area RW distribution grid has not been included in the current model. Future plans should include modeling this piping to fully simulate flows and pressures throughout the 200 West Area distribution system. MSA provided the system demands and operating conditions for the EW and RW systems.

The hydraulic analysis utilizes Bently-WaterCAD computer software to perform the water balance modeling. The pipelines were shown schematically, with user defined lengths. The physical data for each pipeline included the length between junctions, the elevation for top of pipe at each junction, and the pipe material with associated roughness coefficient. This information was captured from available as-built construction drawings, meetings with MSA utility personnel, and field observations. Pump station output (flows and pressures) was obtained from the archived certified vendor information or from pump curves provided by MSA. Pump curve data and recorded flow test data from fire department hydrant tests were used to simulate the operating conditions and calibrate the hydraulic model.

The resulting hydraulic model replicates the EW system and the 200 East Area RW distribution system. This information provided by the model is now available for use with the EW and RW systems. Changes in system flows, simulated pipe breaks, and other flow scenarios can now be easily modeled to determine the impact that subtle or significant changes will have on the operating system. The model also can be used to assist in troubleshooting problem spots and reconciling pressure differences within the model boundaries.

7.0 SYSTEM MANAGEMENT

The Water System Master Plan provides a strategy for optimizing the management of the essential water systems and components currently in operation at the Hanford Site. Water Utilities provides a coordinated maintenance and pipe replacement strategy consistent with the water system needs and budgets established by the MSC.

In general, the pipes that make up the distribution system are much larger than required by current or anticipated demands. There is considerable redundancy, system looping, and interconnection of the distribution network in the various service areas. This allows greater reliability, the ability to shut-off portions of the system with minimal disruption of services to other customers, less impact to the clean-up mission, reduced stress on the system and the ability to handle high peak demands, like firefighting, without straining the system to deliver required high flows. As part of the Site deactivation process, looping also allows for the isolation and then removal of piping, as facilities are placed into a deactivation and demolition arrangement.

Water Utilities conducts a water sampling and monitoring program, of the potable water distribution system and tracks the quality and clarity of the water. As quality declines, Water Utilities performs line flushing to improve the water quality. As the Sitewide populations declines and process flow demands lessen, the turn over times of the water in the mains will decrease and lead to a water quality degradation. Water Utilities works with Site Planning to develop and implement strategic plans that concentrate populations and eliminates water supply to abandoned sections, on the RW and PW distribution system. As portions of the water systems are taken out of service, the remaining piping network will have increased system flows and therefore maintain acceptable levels of water quality. Hanford Site planning uses the ISAP and the TYSP to evaluate system reduction and the potential impacts on the remaining water systems. Working with Hanford Site Planning helps integrate Hanford needs and permits Water Utilities to perform forward looking planning, estimate projected water usage in sparsely populated or remote areas and be able to identify the systems that can be deactivated. Water Utilities determines the amount of piping that can be removed and gets that information into the ISAP process. Proper system configuration and alignment is very important. Water system dead legs cannot be created, as a result of system deactivations.

7.1 ASSET MANAGEMENT

Water utilities and Support Service Maintenance Group use the work management process, MSC-PRO-12115, *Work Management*, for initiating, authorizing, performing and executing work within the MSC scope of services. This process is a disciplined approach to work that directs users to address Integrated Safety and Management System (ISMS) core functions while preparing work documents. It also provides the process to ensure that Water Utilities work planning, execution, and closeout meets contractual requirements. Water Utilities Management, with Technical Authority (TA) concurrence as appropriate, prioritizes all maintenance actions. Elements of this process have also been included in the contracting and procurement processes to ensure that off site and on site work or fabricated services meet contract requirements.

Maintenance management shall be applied using a graded approach as required by MSC-PRO-259, *Graded Approach*. A graded approach ensures that the level of analysis, documentation, and actions for maintenance activities are commensurate with the relative importance to safety, safeguards, and security; the magnitude of any hazard involved; the stage of the facility's life cycle; the programmatic mission of the facility; the particular characteristics of the facility; and any other relevant factors. Within MSA, there are two general categories of facilities:

- Below Hazard Category 3 nuclear facilities, (Radiological Facilities)
- Non-nuclear facilities (industrial, offices, etc.)

MSA must maintain real property assets in a manner that promotes operational safety, worker health, environmental compliance, property preservation, and cost-effectiveness while meeting the Hanford Site program missions. This requires a balanced approach that not only sustains the assets, but also provides for their recapitalization and includes the following as a minimum:

- Assessment of the real property assets, a work control system, management of deferred maintenance, a method to prioritize, and systems to budget and track maintenance expenditures.
- Identification of 5-year maintenance and repair requirements (sustainment) and funding for deferred maintenance reduction.
- Identification of 5-year recapitalization requirements to replace or modernize existing facilities.
- Condition assessments must be performed on real property assets at least once within a five-year period, and may be required more frequently for mission essential facilities, such as the pump houses, reservoirs, Fire pump housing, filter plant and other critical infrastructure items. The condition assessment program shall utilize a tailored approach based on facility status, mission and importance and the magnitude of the hazards associated with facilities and infrastructure. Inspection methodology shall be consistent with industry practice, and shall include identification of safety and health hazards. Deferred maintenance estimates will be based on nationally recognized cost estimating systems or the DOE Condition Assessment Information System (CAIS).

Water Utilities facilities are all non-nuclear facilities. MSA uses a suite of programs, processes, and tools to manage assets within their area of responsibility. Portions of three separate programs are used by Water Utilities in this endeavor. They include material storage, condition assessment survey (CAS), and MAXIMO™ software. This section describes these processes and other tools employed, that ensure compliance with CRD O 430.1B, *Real Property Asset Management*, while providing an effective, reliable water system (see Figure 41). The maintenance strategy encompasses the ISAP and TYSP to evaluate site needs over a ten year horizon. MSA will continue to evaluate system engineering practices, to better identify and integrate water facilities, structures, equipment, and systems needed to support the Hanford Site missions.

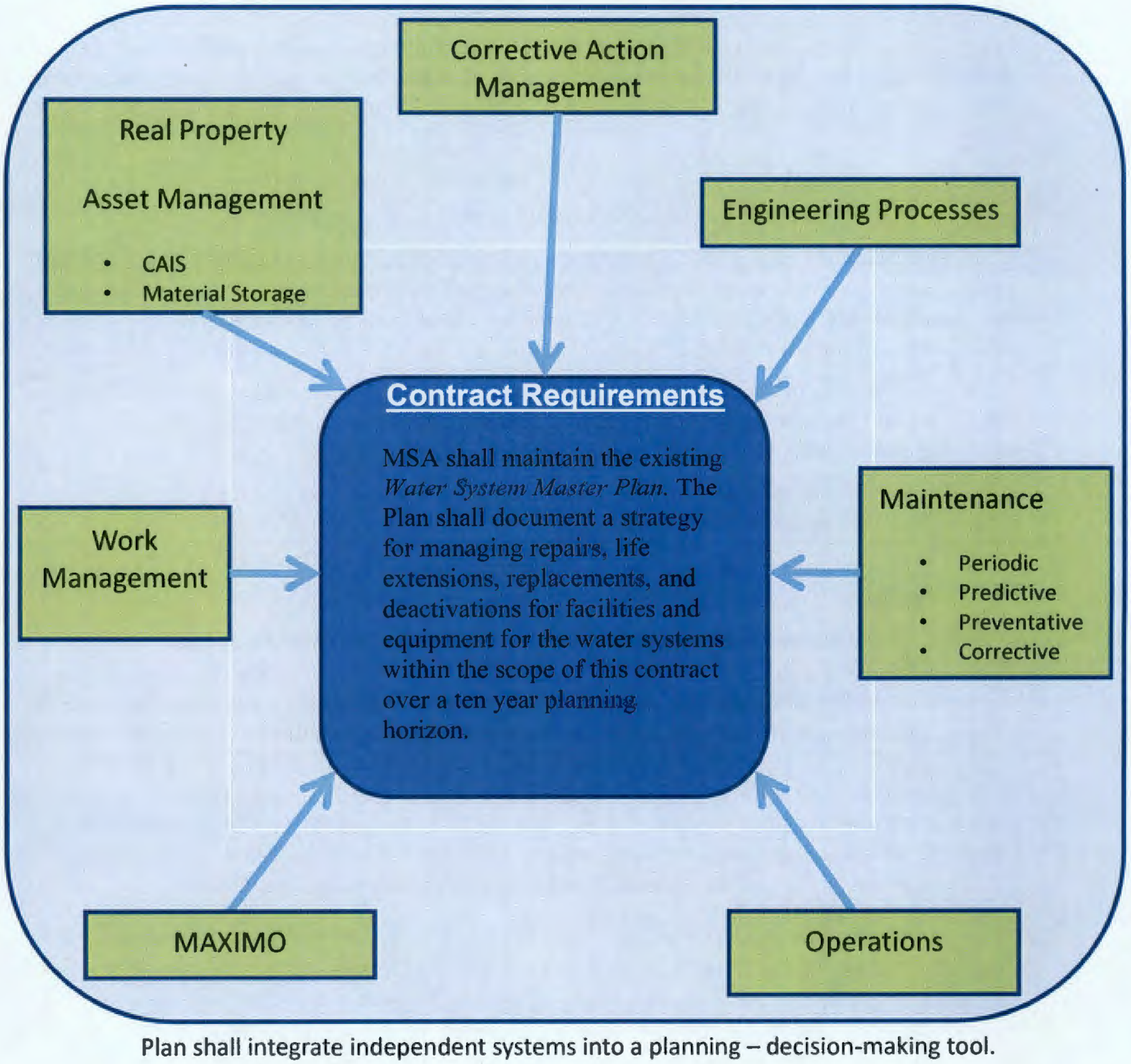

Figure 41. Integrated Systems.

7.1.1 Repair Material

MSC-PRO-140, *Utilizing General Supplies, Spare Parts*, and Convenience Storage Inventories, implements the requirements of Title 41 *Code of Federal Regulations* (CFR) Part 101, "Federal Property Management Regulations," CRD O 580.1, Chg. 1, Department of Energy Personal Property Management Program, DOE G 580.1-1, *Department of Energy Personal Property Management Guide*, and MSA business practices as they pertain to general supplies and spare parts inventories and equipment items held for future projects, commonly referred to as "Convenience Storage" items. Items stocked in the general supplies inventory are typically used by numerous organizations. Spare parts are established in inventory, as appropriate, to maintain continuity of facility operations and to reduce system and facility downtime. Convenience storage provides a controlled storage environment for retention of equipment items with a known or potential future use in planned projects.

General supplies are items of a general nature with multiple users, frequent transactions, and high volume. Spare parts are items to be held as replacement spares for equipment in current use in DOE programs. Convenience storage inventory consists of items held for a known future use or for a potential use in a planned project.

Observation: In the past, Water Utilities has taken advantage of system and component redundancy to "scavenge parts" for repairing failed components. A review of the Water Utilities inventory of spare parts and convenience storage items indicated that the Group was not using the spare parts and convenience storage system to its fullest. There was a noted disparity between how the material storage system actually worked and how it was thought to work. The initial funding for acquisition of the spare parts is by DOE based on justification of the spare parts as identified and approved.

Recommendation: Develop a listing of critical components by system that meet the requirements of MSC-PRO-140 and populate Water Utilities spare parts inventory with the needed parts. Critical items are those materials essential to a system or component that if not immediately available will create a crisis situation. Having spare parts available would reduce or eliminate the long lead time under normal shipping conditions and improve the repair process.

7.2 CONDITION ASSESSMENT SURVEYS AND MATERIAL INSPECTIONS

Water Utilities evaluates and prioritizes all inputs from the following:

- MSA facilities condition assessment surveys, as described,
- DOE facility representative surveillances/observational awareness (OA) and,
- Water Utilities-generated CASs and system walk downs. For all condition asset surveys, Water Utilities will evaluate and submit work request in the Computerized Maintenance Management System (CMMS), as appropriate.

7.2.1 Condition Assessment Surveys

The last CAS was conducted in 2009 and the next is due in 2014. The survey is to be conducted every 5 years. The Water Utilities manager interfaces with the CAS Program representative. MSC-PRO-35415, *Real Property Asset Management Maintenance,* MSC-RD-10859, *Maintenance Management* and MSC-PRO-12115, *Work Management* are used for assessing and maintaining the condition of MSC assigned Site assets. Complete and accurate information on real property holdings is critical to the Department of Energy for managing facilities and reporting to the General Services Administration (GSA), Office of Management and Budget (OMB), Congress, and the taxpayer. The CAS can be broken down into eleven discrete functions. These functions support implementation of the ISMS Core Factions into the MSC Maintenance Process of which Water Utilities is an integral part.

1. Obtain approval of list of applicable facilities from DOE.

2. Develop assessment schedule (5 -year plan).
3. Obtain/review status/history reports and /maintenance input.
4. Develop facility specific plan.
5. Contact facility Manager or point of contact.
6. Brief facility manager and perform walk down/assessment.
7. Review discoveries with facility manager and apply grading scores
8. CAS inspector inputs data into CAIS
9. Facility manager submits items graded 5 or less to Work Management
10. Enter work request per MSC-PRO-12115
11. CAS inspector obtains status reports and reconciles activities
12. CAIS data is uploaded to Facilities Information Management System (FIMS).

The CAS is a program for physical analysis of facilities through inspection and rating of the major facilities systems. Ratings of 5 or less are then input and utilized with other facility information by CAIS to determine a deferred maintenance value for each building system along with building total. This data can be used to determine asset condition, needed major repairs or replacement, and follow-on assessments to determine changes in condition. This system has been determined by DOE Headquarters to be the standard at all DOE sites for asset management.

7.2.2 DOE/RL Operations Oversight

The DOE Oversight Division performs surveillance of Water Utilities operations and material condition of all facilities. Facility representatives (FacRep) performing surveillances or observational awareness, submit OA reports to Water Utilities Management, for notification and resolution. Water Utilities employs the MSA program for corrective action management (CAM). The MSA CAM program outlines a process of requirements and responsibilities for the timely evaluation of conditions adverse to quality, safety, health, operability, and the environment. This procedure provides direction to meet quality improvement requirements through the performance of CAM activities as outlined in MSC-MP-599, *Quality Assurance Program Description,* Section 3.0, "Quality Improvement." CAM is a quality improvement process that satisfies basic fundamentals from the Quality Assurance (QA) criteria expressed in 10 CFR 830.122(c), "Quality Assurance Criteria," and ISMS. Water Utilities has an excellent interface with their RL representatives and has developed open lines of communication.

7.2.3 Water Utilities Generated Condition Asset Surveys and System Walk Down.

Water Utilities initiated and supported Water Condition Assessment, HNF-51470, *Water Utility Condition Assessment*, Rev. 0, February 27, 2012. Water Utilities endeavors to enhance the management of the utilities and support the Site ISAP, by having a condition assessment of the export, potable and raw water systems performed. Recommendations were made and Water Utilities is currently evaluating those recommendations and developing a strategy to effectively resolve noted issues. The CAM process will be used to capture significant issues and CMMS will be used to track maintenance issues.

Note: The Public Works Director and Water Utilities management are developing a database to collect noted deficiencies and cost. This will enable them to set priorities and better manage budgetary issues.

7.2.4 Evaluations Conclusions

Water Utilities evaluates and prioritizes all input from MSA Facilities CASs, as described above, DOE Facility Representative Surveillances/ OA and Water Utilities generated CASs and system walk downs. For all CASs, Water Utilities will evaluate and submit work request in CMMS, as appropriate. Before conducting a survey, the survey team will obtain/review previous CASs and other facility status reports from the Work Management System and previous inspection reports for use in determining the condition of previously identified discrepancies. This total CAS process is the basis for assessing and maintaining the condition of assets in a manner that promotes operational safety, worker health, environmental compliance, property preservation, and cost effectiveness while supporting program missions. It implemented contract requirements specific to CRD 0 430.1B.

The underground water line mains and major pieces of equipment that support the water distribution systems in the 200 East, 200 West, and 600 Areas have been evaluated based on their likelihood of failure and the potential for spreading contamination to or through the groundwater. A matrix was developed (see Tables 25 and 26) to catalog and prioritize the results of this evaluation. Water lines were scored in seven categories, each receiving a score from best to worst. A cumulative score was then obtained and a composite ranking was established. The pieces of equipment were similarly scored in five categories, each receiving a score from best to worse. A cumulative score was then reached and a composite ranking was established. The matrix prioritized each section of the underground water mains and existing equipment based on its likelihood of failure and/or the potential to contribute to the spread of contamination or non-desirable groundwater plume impacts across the Site. As a result of this ranking, based on the current condition of the RW and PW distribution systems, piping replacements and mortar lining have been and will continue to be implemented strategically to minimize future environmental impacts to the Columbia River Corridor.

Table 25. Projected Pipe Condition Assessment.[1]

Pipe Material	**Condition**										
	10	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Cement Lined DI (1965-present)										■	
Unlined Cast Iron or DI (before 1965)				■							
PVC, AWWA C900 DR-18, Class 150											■
PVC, Class 125 (Schedule 20)									■		
HDPE, AWWA C901 SDR 11.0											■
Asbestos-Cement									■		
Carbon Steel											
Tar Coated/Wrapped Schedule 10		■									
Galvanized, Schedule 40		■									
Bare, Schedule 40	■										

Table 25. Projected Pipe Condition Assessment.[1]

Pipe Material	Condition										
	10	9	8	7	6	5	4	3	2	1	0
Reinforced Concrete Pipe											
RCP-1944				■							
RCP-1953					■						
RCP-1967						■					

[1]Projected useful life of buried pipe to remain in service for next 50 years without major failures (10 being poor condition and 0 being good condition)

The following point scale was used to evaluate each water line and its potential for contributing to the spread of environmental contamination at Hanford: minimal potential for damage = 1, located 1/2 mile from nearest contamination = 2, leak may flow directly into Columbia River = 4, located over vadose zone plume = 5, located within 300 ft of known contamination = 8, water line located within a contamination area = 10.

The *Hanford Site Water System Water Distribution Pipelines–Weighted Priority Matrix* lists each existing water line within the 100 Area EW and the 200 East and 200 West Area RW and PW distribution systems. This matrix was used to prioritize each line based on the criteria established above. Based on the current condition of the raw and potable water distribution systems, strategic piping replacements will be required to minimize future environmental impacts to the Columbia River Corridor.

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Table 26. Hanford Site Water System Distribution Pipelines 2012 Weighted Priority Matrix.

Item	Description	Project Number	Location	Type of Line	Pipe Size (Inches)	Length (Meters)	Year Installed	Age	Material	Maintenance History	Value to Site Mission	Duration of Remaining Mission	Risk of Failure	Potential for Environmental Damage	Comments	Totals
Priority ranking	This column indicates the specific location of the proposed line to be installed, replaced or repaired.	Project Number	100 Area 200E 200W 600 Area	Raw or Potable	Size	Approximate length of the proposed pipeline to be installed, replaced, or repaired.	Year	0 - 10 years = 1 11 - 20 years = 3 21 - 30 years = 6 31 - 40 years = 8 41 - 50 years = 9 Over 50 yrs = 10	C900 PVC/HDPE = 1 Lined DI/CI = 2 RCCP = 3 Unlined DI/CI (RW) = 5 Asbestos Cement. = 8 Unlined DI/CI (PW) = 9 Steel (PW) = 10	No known leaks/breaks = 1 One leak repair = 3 >1 leak repair = 6 Frequent leak repairs = 8 Major line breaks = 10	Could be Abandoned = 1 Not critical to Site Mission = 3 Supports Critical Experiments = 4 Support Mission Activities = 5 Part of Fire Protection System = 6 Fire Water to RAD Facilities = 8 Possible Privatization Fines = 10	0 - 5 Years Remaining = 0 6 - 19 Years Remaining = 5 Over 20 Years Remaining = 10	See Pipe Condition Assessment Ratings	Minimal potential for damage = 1 Located .5 Mile from contamination = 2 Leak may flow directly to river = 4 Located over Vadose Zone plume = 5 Located < 300' of known contamination = 8 Located within contamination area = 10	Estimating use	This column will establish a priority ranking for future water line repair and/or replacement work at Hanford. Rating is on a scale of 1-100, with 100 as the highest priority.
1	20" South A-Farm Feed through PUREX behind 275E	L-352	200E	Raw	20	1,140	1953	10	6	6	8	10	5		20", 14" Pipe, 8" Pipe, 6" Pipe *362 M in same trench	**64.29**
2	12" PW to 222S (West S-Plant Feed)	L-357	200W	Potable	12	240	1960	9	9	6	8	10	8	8	All 8" Pipe, Break 22 years ago	**82.86**
3	10" B-Plant Feed Lines	L-398	200E	Potable	10	1,440	1952	10	9	6	5	5	8	10	60% 10",25% 8" Pipe and 15% 6" Pipe	**75.71**
4	14" 242S Supply Line	L-355	200W	Raw	14	620	1963	9	5	10	8	5	5	10	All 14" Pipe, 686K leak - Near tank farm	**74.29**
5	8" A-Farm North Feed	L-353	200E	Raw	8	1,035	1953	10	5	1	8	5	5	10	All 8" Pipe	**62.86**
6	10" 272WA Loop and Feed	L-420	200W	Potable	10	1,175	1960	9	9	1	8	10	8	8	All 10" Pipe	**75.71**
7	8" SE Side of T-Plant	L-423	200W	PW Converted to RW	8	640	1958	9	9	1	8	5	8	10	86.5% 8" Pipe, 13.5% 6" Pipe	**71.43**
8	8" 2101M Loop	L-430	200E	Potable	8	1,035	1960	9	9	6	6	10	8	2	All 8" Pipe 2 breaks	**71.43**
9	12" 20th Street Water Plant Main	L-431	200W	Potable	12	520	1950	10	9	6	6	10	8	1	20% 8" Pipe, 80% 12" Pipe, Includes Project L-414	**71.43**
10	24" Old PUREX Feed	L-342	200E	Raw	24	1,310	1952	10	10	1	8	10	5	5	All 24" Pipe	**70.00**
11	8" PFP Plant Piping	L-356	200W	Potable	8	1,724	1958	9	9	6	8	0	8	10	All 8" Pipe	**71.43**
12	8" 272AW Service Main	L-359	200E	Raw	8	175	1956	10	5	3	8	10	5	8	All 8" Pipe	**70.00**
13	4" 242S Feed	L-422	200W	Potable	4	500	1960	9	5	1	5	10	8	10	All 4" Pipe	**68.57**

Table 26. Hanford Site Water System Distribution Pipelines 2012 Weighted Priority Matrix.

Item	Description	Project Number	Location	Type of Line	Pipe Size (Inches)	Length (Meters)	Year Installed	Age	Material	Maintenance History	Value to Site Mission	Duration of Remaining Mission	Risk of Failure	Potential for Environmental Damage	Comments	Totals
Priority ranking	This column indicates the specific location of the proposed line to be installed, replaced or repaired.	Project Number	100 Area 200E 200W 600 Area	Raw or Potable	Size	Approximate length of the proposed pipeline to be installed, replaced, or repaired.	Year	0 - 10 years = 1 11 - 20 years = 3 21 - 30 years = 6 31 - 40 years = 8 41 - 50 years = 9 Over 50 yrs = 10	C900 PVC/HDPE = 1 Lined DI/CI = 2 RCCP = 3 Unlined DI/CI (RW) = 5 Asbestos Cement. = 8 Unlined DI/CI (PW) = 9 Steel (PW) = 10	No known leaks/breaks = 1 One leak repair = 3 >1 leak repair = 6 Frequent leak repairs = 8 Major line breaks = 10	Could be Abandoned = 1 Not critical to Site Mission = 3 Supports Critical Experiments = 4 Support Mission Activities = 5 Part of Fire Protection System = 6 Fire Water to RAD Facilities = 8 Possible Privatization Fines = 10	0 - 5 Years Remaining = 0 6 - 19 Years Remaining = 5 Over 20 Years Remaining = 10	See Pipe Condition Assessment Ratings	Minimal potential for damage = 1 Located .5 Mile from contamination = 2 Leak may flow directly to river = 4 Located over Vadose Zone plume = 5 Located < 300' of known contamination = 8 Located within contamination area = 10	Estimating use	This column will establish a priority ranking for future water line repair and/or replacement work at Hanford. Rating is on a scale of 1-100, with 100 as the highest priority.
14	12" South Feed to PFP	TBD	200W	Potable	12	690	1960	9	8	1	8	10	2	8	U-Plant to PFP, All 12" Pipe	65.71
15	6" 204 AR Feed	L-417	200E	Potable	6	250	1958	9	8	1	5	10	3	10	All 6" Pipe .	65.71
16	10" B-Farm Feed Line	L-398	200E	Potable	10	1,200	1953	10	9	1	5	5	8	8	All 10" Pipe	65.71
17	4" B-Farm Service Lines	L-447	200E	Potable	4	300	1953	10	9	1	5	5	8	8	60% 3", 40% 4" Pipe	65.71
18	8" South Baltimore Feed	L-448	200E	Potable	8	725	1960	9	9	3	6	10	8	1	60% 8" Pipe, 40% 4" Pipe	65.71
19	4" A-Farm Construction Feed	L-455	200E	Potable	4	250	1976	7	9	3	5	10	1	10	90% 3"; 10% 4" Pipe	64.29
20	8" 204 AR Supply	L-425	200E	Raw	8	345	1953	10	5	1	8	5	5	10	All 8" Pipe	62.86
21	4" B-Farm Supply Lines	L-358	200E	Raw	4	1,105	1960	9	5	1	8	5	5	8	All 4" Pipe	58.57
22	6" C-Farm Feed	L-426	200E	Raw	6	830	1960	9	5	1	6	5	5	10	All 6" Pipe	58.57
23	12" and 16" B-Plant Feedlines	L-433	200E	Raw	12	1,030	1944	10	5	1	6	5	5	8	35% 16', 65% 12" Pipe	57.14
24	4" U-Farm Feed	TBD	200W	Raw	4	970	1960	9	5	3	3	5	5	10	All 4" Pipe Break 9 years ago (1998)	57.14
25	8" 2750 Loop	L-459	200E	Potable	8	855	1985	6	9	6	6	10	1	1	All 8" Pipe 2 breaks	55.71
26	12" Misc S-Plant Piping	L-451	200W	Raw	12	760	1964	9	5	1	5	5	5	8	All 12" Pipe	54.29
27	8" 4th Street West of Baltimore	L-465	200E	Potable	8	1,275	1979	6	9	3	6	10	1	2	All 8" Pipe	52.86
28	6" B-Farm Main	L-432	200E	Raw	6	685	1960	9	5	1	3	5	5	8	All 6" Pipe	51.43
29	12" Gate 814 Fill Line	L-454	200E	Raw	12	1,415	1960	9	5	3	3	10	5	1	All 12" Pipe	51.43
30	8" 272AW Extension	L-456	200E	Raw	8	400	1983	6	5	1	10	5	1	8	All 8" Pipe	51.43

Table 26. Hanford Site Water System Distribution Pipelines 2012 Weighted Priority Matrix.

Item	Description	Project Number	Location	Type of Line	Pipe Size (Inches)	Length (Meters)	Year Installed	Age	Material	Maintenance History	Value to Site Mission	Duration of Remaining Mission	Risk of Failure	Potential for Environmental Damage	Comments	Totals
Priority ranking	This column indicates the specific location of the proposed line to be installed, replaced or repaired.	Project Number	100 Area 200E 200W 600 Area	Raw or Potable	Size	Approximate length of the proposed pipeline to be installed, replaced, or repaired.	Year	0 - 10 years = 1 11 - 20 years = 3 21 - 30 years = 6 31 - 40 years = 8 41 - 50 years = 9 Over 50 yrs = 10	C900 PVC/HDPE = 1 Lined DI/CI = 2 RCCP = 3 Unlined DI/CI (RW) = 5 Asbestos Cement. = 8 Unlined DI/CI (PW) = 9 Steel (PW) = 10	No known leaks/breaks = 1 One leak repair = 3 >1 leak repair = 6 Frequent leak repairs = 8 Major line breaks = 10	Could be Abandoned = 1 Not critical to Site Mission = 3 Supports Critical Experiments = 4 Support Mission Activities = 5 Part of Fire Protection System = 6 Fire Water to RAD Facilities = 8 Possible Privatization Fines = 10	0 - 5 Years Remaining = 0 6 - 19 Years Remaining = 5 Over 20 Years Remaining = 10	See Pipe Condition Assessment Ratings	Minimal potential for damage = 1 Located .5 Mile from contamination = 2 Leak may flow directly to river = 4 Located over Vadose Zone plume = 5 Located < 300' of known contamination = 8 Located within contamination area = 10	Estimating use	This column will establish a priority ranking for future water line repair and/or replacement work at Hanford. Rating is on a scale of 1-100, with 100 as the highest priority.
31	6" Raw Water to 209E	TBD	200E	Raw	6	655	1961	9	5	3	5	0	5	5	Scope Reduced due to L-386	45.71
32	12" TEDF Fire Loop	L-458	200E	Raw	12	2,517	1993	3	1	1	8	10	0	8	All 12" Pipe. Concerns over pressure class of pipe 150/200psi	44.29
33	6" 241 TX Feed	L-462	200W	Raw	6	1,620	1958	9	5	1	1	0	5	8	33% 6" Pipe, 10% 2", 56% 4" Pipe	41.43
34	12" Buffalo Street Sluice Line	L-471	200E	Raw	12	570	1995	3	2	1	8	5	0	10	All 12" Pipe	41.43
35	10" Misc T-Plant Piping	L-399 Addition	200W	Potable	10	420	1980	6	2	1	5	5	0	8	85% 10", 10% 6", 5% 2"	38.57
36	4" US Ecology Feed	L-481	200E	Potable	4	1,655	1982	6	2	1	5	10	0	2	95% 4" Pipe, 5% 2"	37.14
37	6" 275EA Backside	TBD	200E	Potable	6	270	1998	1	1	1	5	10	0	5	All 6" Pipe	32.86
38	10" U-Plant Mains	TBD	200W	Raw	10	390	1992	3	2	1	5	5	0	8	30% 10", 70% 6" Pipe	34.29

Table 26. Hanford Site Water System Distribution Pipelines 2012 Weighted Priority Matrix

Item	Description	Project Number	Location	Type of Line	Pipe Size (Inches)	Length (Meters)	Year Installed	Age	Material	Maintenance History	Value to Site Mission	Duration of Remaining Mission	Risk of Failure	Potential for Environmental Damage	Comments	Totals
Priority ranking	This column indicates the specific location of the proposed line to be installed, replaced or repaired.	Project Number	100 Area 200E 200W 600 Area	Raw or Potable	Size	Approximate length of the proposed pipeline to be installed, replaced, or repaired.	Year	0 - 10 years = 1 11 - 20 years = 3 21 - 30 years = 6 31 - 40 years = 8 41 - 50 years = 9 Over 50 yrs = 10	C900 PVC/HDPE = 1 Lined DI/CI = 2 RCCP = 3 Unlined DI/CI (RW) = 5 Asbestos Cement. = 8 Unlined DI/CI (PW) = 9 Steel (PW) = 10	No known leaks/breaks = 1 One leak repair = 3 >1 leak repair = 6 Frequent leak repairs = 8 Major line breaks = 10	Could be Abandoned = 1 Not critical to Site Mission = 3 Supports Critical Experiments = 4 Support Mission Activities = 5 Part of Fire Protection System = 6 Fire Water to RAD Facilities = 8 Possible Privatization Fines = 10	0 - 5 Years Remaining = 0 6 - 19 Years Remaining = 5 Over 20 Years Remaining = 10	See Pipe Condition Assessment Ratings	Minimal potential for damage = 1 Located .5 Mile from contamination = 2 Leak may flow directly to river = 4 Located over Vadose Zone plume = 5 Located < 300' of known contamination = 8 Located within contamination area = 10	Estimating use	This column will establish a priority ranking for future water line repair and/or replacement work at Hanford. Rating is on a scale of 1-100, with 100 as the highest priority.
39	6" T-Plant Fill Station Line	TBD	200W	Raw	6	795	1972	7	2	1	6	5	0	2	All 6",Abandons 1,310 M at 241 TX	32.86
40	8" Dry Grout Feed	TBD	200E	Potable	8	410	1987	3	2	1	1	5	0	8	15% 6", 10% 3", 75% 8" Pipe	28.57
	TOTAL:					33,941										

Proposed Out Year Funding Legend (as of 2012)	
Currently in MSA Infrastructure Projects Out-year Funding Profile	(green)
Currently not in the MSA Funding Profile	

7.2.5 Periodic Maintenance

Water Utilities employs a maintenance strategy that performs periodic maintenance activities that are intended to maintain a component or system in the as-designed condition without the need for unplanned corrective maintenance. Types of tasks that fall into this category typically include preventive maintenance (PM), which includes instrument calibrations, and surveillance testing of safety systems and equipment. Periodic maintenance is performed by the Maintenance Group in Support Services. Water Utilities maintains positive control over the maintenance activity and the integrity of the system or facility. Water Utilities is currently performing an evaluation the PM data base (see appendix B for combined listing of PM and corrective maintenance) and evaluated the frequency and need for the PM. The following are the basis for inclusion in this program:

- Failure impacts to the worker, public, and environment
- Mission impacts
- Financial impacts, budgetary cost.
- Compliance with regulatory requirements
- Manufacturer recommendations
- Performance history.

Two primary processes of the Water Utilities PM program are predictive and preventative maintenance. Collectively these two processes include the following:

Predictive Maintenance

- Lube Oil Analysis
- Thermography
- Vibration Analysis
- Visual Inspections

Preventive Maintenance

- Component Replacements
- Cleaning
- Lubrication
- Adjustments
- Inspections and Testing

7.2.6 MAXIMO®

Water Utilities and the Work Management Group use the computer software MAXIMO®, a robust off the shelf software, as an asset and maintenance management tool. The MAXIMO® program performs as the platform for managing assets, periodic maintenance, job planning, and work orders. This data platform has integrated Water Utilities assets, maintenance requirements, and configuration capabilities to optimize water system management. It also links to Work Management, which integrates the planning process for equipment replacement, maintenance and other work activities not covered by operations.

7.2.7 Corrective Maintenance

Water Utilities submits a work request for corrective maintenance to Work Management. Corrective maintenance is performed when a system or component fails to perform its intended

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function or underperforms. Corrective maintenance is a work task that performs a repair activity on a failed or malfunctioning component, system or facility, to restore the intended function or design condition (see appendix B for combined listing of PM and corrective maintenance). Corrective maintenance is performed by the Support Services Maintenance Group. All work is prioritized and evaluated for level of impact to customers, and continued operations. Water Utilities will initiate a response to an unplanned water line failure or outage, within 2 hours of notification. They will develop a recovery plan within 24 hours. The plan will include a schedule for returning the system to normal service. Water Utilities maintains positive control over the maintenance activity and the integrity of the Water System at all times. If repairs are declared emergent by Water Utilities Operations Manager, then the recovery plan will be developed within 8 hours, marked the limits of MSA's jurisdiction. MSA did not have responsibility for water systems within the 100, 300, and 400 Areas.

Downstream of the facilities demarcation points, the various cleanup contractors control the pumps, pipelines, and valves. MSA's responsibilities to the other contractors are to deliver a particular volume of water, at a specified pressures, to individual demarcation points in support of their cleanup activities. MSA maintains an excellent interface with the cleanup contractors, to include descriptions of the needs and conditions of the cleanup contractors' portions of the overall system in each contractor Interface Control Document (HNF-46148 [CHPRC]and HNF-4493 [WRPS]). These documents are managed by the Interface Control Managers and revised as appropriate. In meeting these responsibilities, MSA has adopted and has implemented a philosophy of 100 percent customer satisfaction in all its support roles. Working with the other contractors Interface Management team, all issues are discussed and resolved in a timely manner.

7.3 FACILITY MODIFICATION PROCESS

The facility modification process (FMP) process is used for facility modifications to compile design criteria, design analysis, drawings and other engineering input and output documentation related to a specific modification or project. The Water Utilities Design Authority (DA) works with Water Utilities management to complete the FMP process with in the Water Utilities organization. For the most part, the FMP process is used for formal release of project engineering documentation into the Hanford Document Control System upon turnover of systems and facilities following construction. It is the key process following construction for ensuring that controlled drawings are updated correctly and new vendor data is provided for incorporation into maintenance systems.

7.3.1 Modifications

MSA Water Utilities modifies equipment and facilities as needed to support economies of scale and system efficiency. Work tasks that change the design configuration of the physical asset being maintained by the Utilities will be performed in accordance with MSC-PRO-2001, *Facility Modification Package Process* and MSC-POL-CONFIG, *Configuration Management Policy.*

Uses of like-for-like or equivalent items or temporary changes for performing routine repairs are NOT modifications. Temporary changes include performing a tie into a secured system or troubleshooting a secured system, which will be restored to its original configuration prior to the system being placed back into normal operation. Temporary changes must have configuration steps identified in a work package directing the tie-in and return of the system to normal configuration.

The majority of modifications made are planned and executed as water system Reliability Projects. Figure 42, depicts the workflow process for Infrastructure Reliability Projects, from identification, prioritization, integration, evaluation and DOE approval.

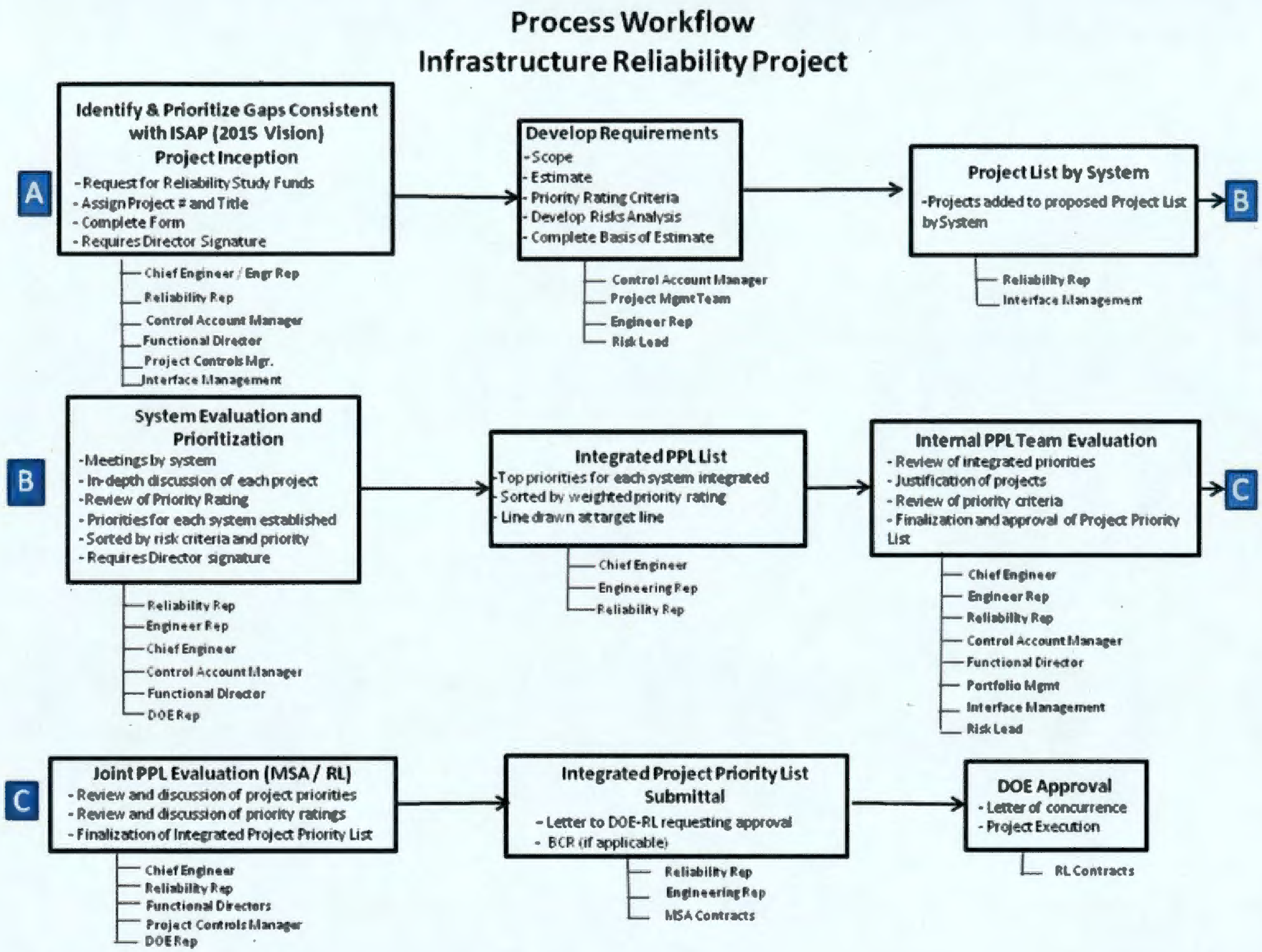

Figure 42. Reliability Projects Process Workflow

7.3.2 Corrective Action Management

MSC-PRO-052, CAM, is the MSC process used by Water Utilities to effectively manage issues identified during operation of the water systems, CASs and system/facility walk downs. This program uses a graded approach to assess, track, and manage, through completion, issues identified within the water systems.

The CAM process encourages the identification of areas for improvement, timely identification, evaluating analysis and correction of issues and conditions. CAM uses trending results for continuous monitoring of process outcomes and collective significance reviews. Cause, function, and process trend codes are identified and trended to assist in the identification of repeated events, generic issues, or other vulnerabilities to prevent or significantly reduce the probability for recurrence and/or mitigate the consequences of the issue. Ultimately, the value of this process is predicated on addressing issues and conditions that may hinder Water Utilities' performance and achievement of its Operational, Safety, Environmental, Health and Quality objectives. This process is part of the Conduct of Operations that Water Utilities has instituted.

7.3.3 Operations

MSA provides operations support for all water utilities facilities within their area of responsibility. Water Operations personnel who are either performing or supervising the performance of equipment and facility operations or inspection tours/rounds at Hanford, utilize operating procedures and in most cases have participated in a monitored qualification program.

The Water Utilities procedures provide standards for the professional conduct of operations, so that personnel performing these duties meet the expectations of DOE and Water Utilities facility management.

Operating procedures describe watch standing practices that apply to all operating personnel. These procedures describe the important aspects of routine shift activities and watch standing practices. Professional conduct and good watch standing practices will result in appropriate attention to facility existing and changing conditions. Water Utilities training and operating procedures help the personnel anticipating the results of actions taken and, if appropriate, stopping and resolving concerns prior to proceeding.

Operating procedures help ensure that Water Utilities facilities and or equipment are operated and maintained in a safe operational or shutdown mode. Operating procedures help personnel fulfill assignments as members of the Building Emergency Organization. These assignments include Building Emergency Director, Building Warden, ICP Communicator, and Facility Operations Specialist. Maintaining authority and responsibility for all facility operations shall be transferred only through formal turnover to a qualified relief. These responsibilities include all aspects of shift evolutions as related to facility operation.

Assigned Water Utilities personnel are responsible for all operations conducted in their work area on their shift, and for the status of all systems, components, and records within their defined work area. This responsibility shall be transferred only through formal turnover to a qualified relief.

It is the responsibility of Water Utilities Line Management to ensure that only trained and qualified personnel operate equipment.

Only personnel that have a validated WDOH, Certificate of Competency for Water Treatment and have successfully completed the plant specific qualifications are allowed to perform duties for mandatory water plant positions. Mandatory positions, as defined by WDOH, are those positions assigned specifically to the water plant for potable water production. Temporary operator certification may be granted by the WDOH, within the guidelines of WAC 246-292-080, "System Temporary Operator Certification," for those operators who do not possess a WDOH Certificate of Competency. Water Utilities management shall ensure that only qualified personnel conduct in-plant measurements for pH, turbidity, and residual disinfectant concentrations. Per WAC 246-290-638, "Analytical Requirements," qualified shall mean a person certified under WAC 246-292, "Water Works Operator Certification."

7.3.4 Deactivations of Facilities and Equipment

The process of deactivating a facility or component is covered in DOE G 430.1-3, *Deactivation Implementation Guide.* Basically, Water Utilities would be placing a facility or component into a stable and known condition. This would include the removal of hazardous materials to ensure adequate protection of the worker, insure public health and safety, and to protect the environment. Deactivation of facilities and components limit the long-term cost of surveillance and continued maintenance. Deactivation does not include any decontamination that may be necessary for the dismantlement and demolition phase of decommissioning (e.g., removal of contaminates such as mercury and asbestos remaining in the fixed structures and equipment after deactivation). An example of a deactivation of a facility would be the turnover of 183D in the 100D Area to the decommissioning and demolition (D&D) contractor, WCH.

MSA Water Utilities identifies system and components that can be deactivated within the Utilities Group and tracks them using the MAXIMO™ system, within Work Management. Water Utilities evaluates and plans the deactivation of equipment and systems, no longer needed for the Site mission. Water Utilities is the lead for their assigned facilities, within scope and budget. The planning for this process will include input from ISAP, TYSP, and other tools such as updated schedules from other MSA-serviced contractors to optimize system deactivations. Considerations are made to the potential for a future facility mission, existing system looping or configurations, and potential negative impacts to other Hanford Site contractors. Thus, right-sizing the system to meet contractor needs is in alignment with the 2015 Vision.

Once the decision to decommission a portion of the water system is made, the following methods are employed. Typically, for below grade piping, the line is uncovered and cut and capped as close to the main as reasonably achievable. This removes as much piping as possible and eliminates the potential for dead legs. For equipment being replaced as part of a modification, the replaced equipment will be removed as part of the project. Remaining equipment no longer in service will be documented as deactivated and will be removed as part of the D&D process.

8.0 MSA WATER SYSTEM STRATEGY

8.1 2015 VISION

RL has established a 2015 Vision (Figure 43) designed to protect the Columbia River and provide safe and effective cleanup of the Hanford Site. The 2015 Vision

- Reduces the active Site Cleanup footprint from 586 mi^2 to 75 mi^2
- Significantly reduces long-term mortgage costs
- At completion, shifts resources to full scale cleanup of the Central Plateau
- Reduces cost by "right sizing" Hanford infrastructure and services via a MSC
- Minimizes injury to natural resources.

Consistent with the 2015 Vision, the *Hanford Site Water System - Action Plan* establishes a path forward for managing the Hanford Site Water System while meeting client needs and shrinking the Site footprint. The Action Plan is presented in Figure 44; Figures 45 through 48 provide further detail.

Figure 49 conceptualizes this approach, hypothetically imposing concentric circles on the Hanford Site boundaries. The circles represent the three zones with their differing levels of service. In this hypothetical, long-term water service would be provided as needed to facilities in the green zone. Service to facilities in the yellow zone would be evaluated on an individual basis. Existing service in the tan zone would be terminated as practical, and requests for new service would ordinarily be denied.

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Figure 43. Hanford Site Water System –2015 Vision.

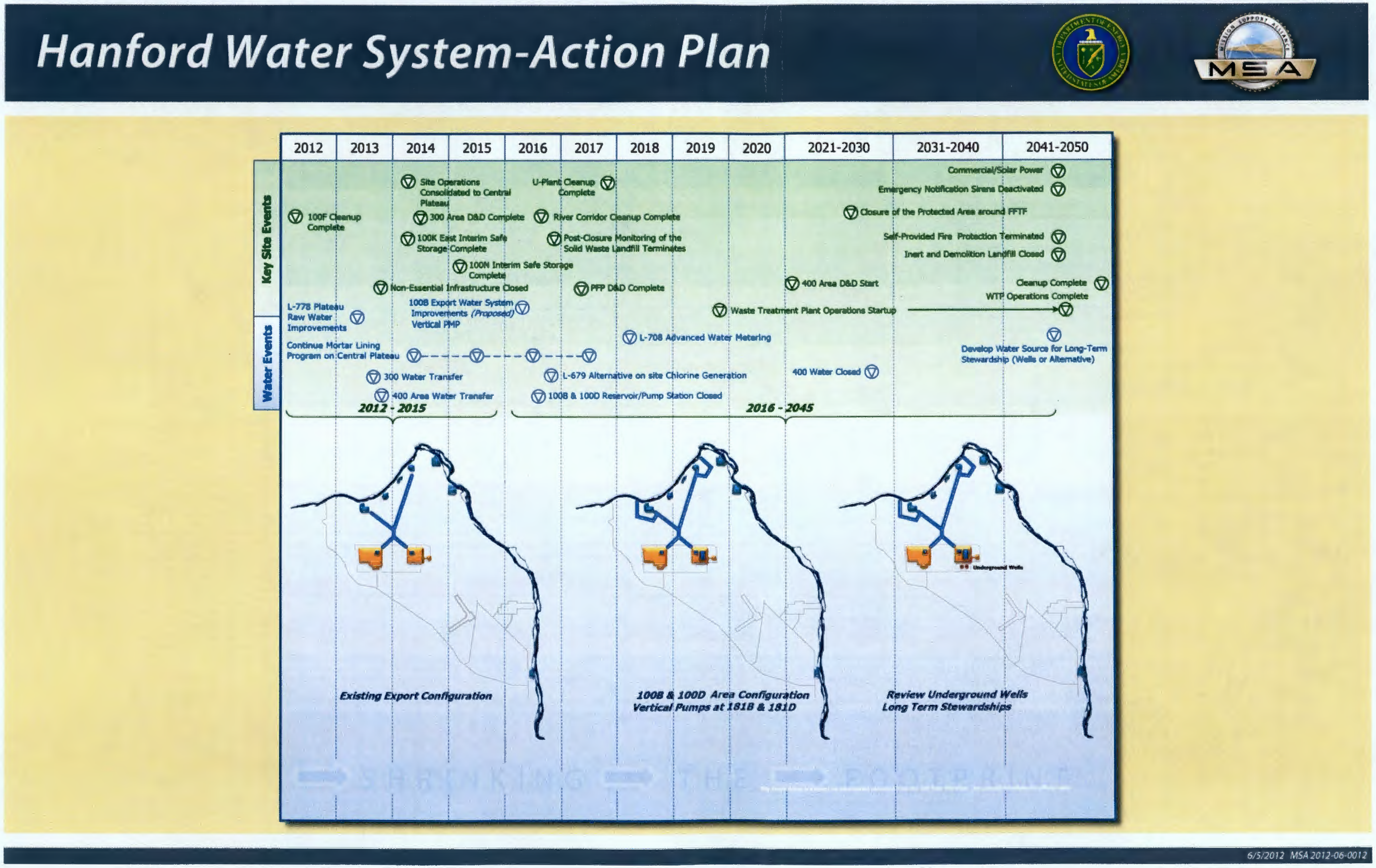

Figure 44. Hanford Water System Action Plan.

Current Configuration (2012 – 2015). The Hanford EW System comprises approximately 35 mi of large-diameter pipelines and numerous reservoirs and pump stations. This system was constructed in the early 1940's in support of large-scale nuclear operations and chemical processing activities. Although drastically oversized for its current use, this system has provided over 60 years of reliable service. The Site Mission has now changed to Cleanup and large quantities of water are only occasionally needed for daily processing activities. As the water requirements of the Hanford Site Contractors change, system modifications must be implemented to meet these new demands. Project L-778, Plateau Improvements, will improve overall performance and energy efficiency in support of the on-going Cleanup Mission at the Hanford Site. (See Figure 45)

Near-Term Goals (2016 – 2035). To meet the needs of the Hanford Cleanup Mission, fundamental water system changes are required. Significant quantities of water will be needed in the 200E and 200W Areas to support Cleanup. Project L-778, Plateau Raw Water Improvements, will commit the pumps and at least 0.6 million gallons of each 1.1-Mgal PW storage tank in 200E and 200W to fire protection. The project will install Reduce Pressure Backflow Assemblies and tie the PW system with the RW system for universal fire protection. Disconnect the EW system from the 200E and 200W RW system at the 282EC and 282WC facilities and deactivate the booster pump arrangements. The project will dedicate former fire pumps at 200E and 200W reservoirs to supply RW system. Follow on projects will install vertical drive turbine pumps at 181B and 181D, bypassing the 182B and 182D Reservoirs, pumping directly to the 282E and 282W Reservoirs. This will allow for the closure of the four facilities in the 100B and 100D Areas, reducing the foot print, lowering operating cost and improving the water transmission efficiency. (See Figure 46.)

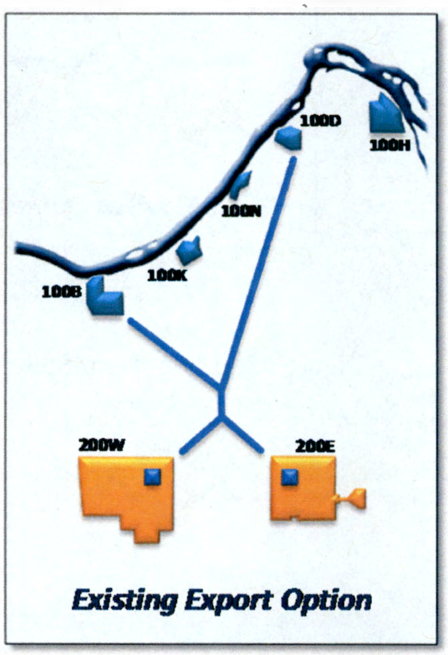

Figure 45. Current Configuration.

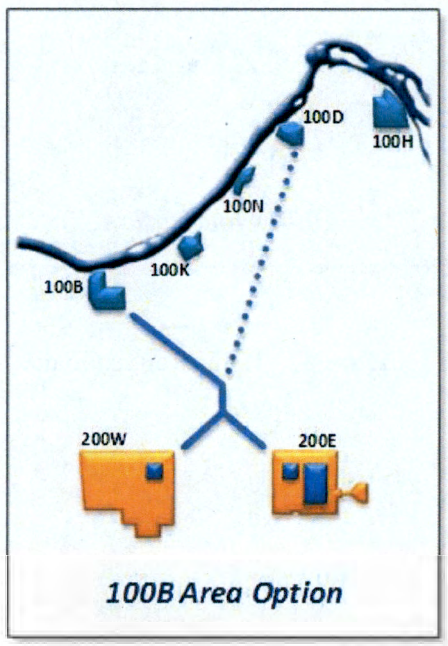

Figure 46. Near-Term Goals.

Long-Range Goals (2036-2069). As Site Cleanup progresses, the demand for water will likely be significantly reduced. Following completion of the Evaporator and Waste Treatment Plant Operations, the need to pump large quantities of water from the river may no longer be required. With the large volume of water storage available on the Plateau, it is likely that an alternate source of water could be a viable alternative. Underground wells, carefully placed and pumping at a relatively low discharge rate should be adequate to keep the reservoirs full and ready to meet the reduced Cleanup needs, as well as, fire protection. Depending on Cleanup progress, large portions of the EW piping system could be removed from service and decommissioned. (See Figure 47.)

Long-Term Stewardship Ends (2070). Following Cleanup, nearly all Hanford systems and structures will be dismantled and decommissioned in accordance with established requirements. As a result, water will no longer be required and the river pumping stations, wells, underground piping and reservoirs will be decommissioned. (See Figure 48.)

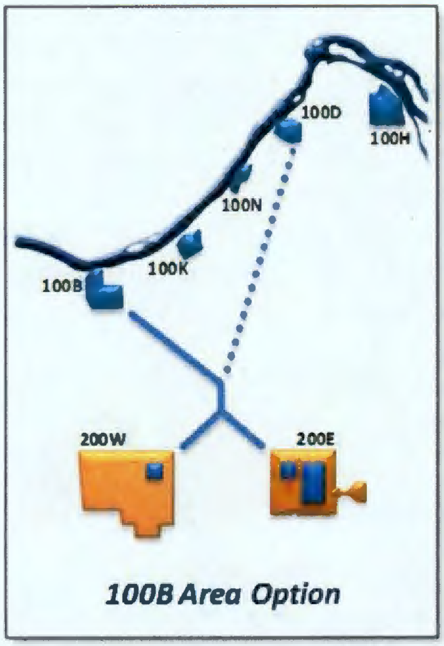

Figure 47. Long-Range Goals.

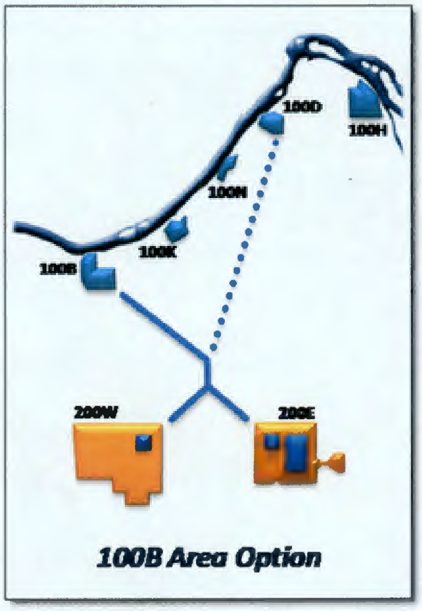

Figure 48. Long-Term Stewardship Ends.

Figure 49. Shrinking Footprint.

Shrinking the active Site footprint is RL's vision. (See Figure 49.) The 2015 Vision and the main focus of the Water Utilities Management is to effectively support the reduction of the Site Cleanup footprint from 586 mi^2 to 75 mi^2. Water Utilities is actively supporting the principals of "Right Sizing" and reducing operating cost reduction with Project L-778, Plateau Raw Water Improvement. While construction of this project will not in itself result in footprint reduction, it will set the stage for follow-on projects at 181B and 181D to replace 181D and 181B pumps with vertical turbine pumps to provide water to the plateau reservoirs. Completion of that project will result in the ability to eliminate four facilities structures: the 25Mgal reservoirs at 182B and 182D and the pump houses at 182B and 182D. Consequently L778 will pave the way for the removal of 4 facilities and the resulting reduction in operating costs with the elimination of maintenance at the 182B and 182D facilities and reductions in power consumption.

8.2 IMPROVED DATA MANAGEMENT AND CUSTOMER INTERFACE

As the infrastructure systems of the Hanford Site have matured, generations of caretakers have been involved with system development. The learned knowledge has not always been fully institutionalized for ready access to successor operator/decision-makers. Effective integration between the Hanford operating contractors is essential to each contractor's success in meeting their mission objectives (Figures 50 and 51).

In its role as the responsible party for water services, MSA must have effective System Engineering tools to assure that the water system will be able to adapt to changing demands and perform efficiently. MSA maintains an accurate and complete data base of the system components, their basic condition, performance criteria, and maintenance history; a database of ICD requirements; and a fluid system analytical tool like Bently-WaterCAD. These tools are essential components for managing the complexities of the water system and assuring that system requirements are aligned with mission objectives. MSA Water Utilities, Work Management, Engineer and Project Management, continually strive to improve and implement these tools. Keeping them current is one of the highest priorities of the MSA water system management team.

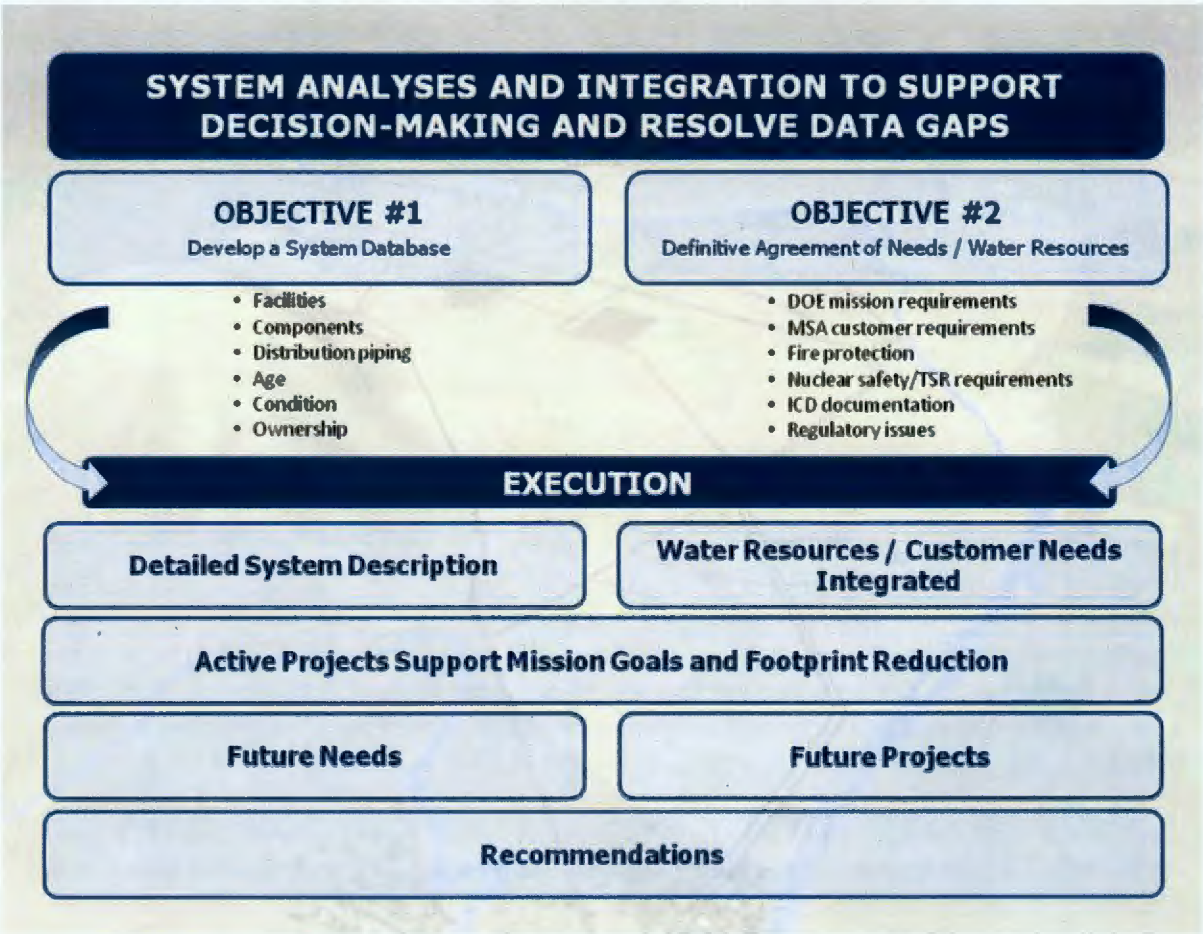

Figure 50. Water System Analyses and Integration.

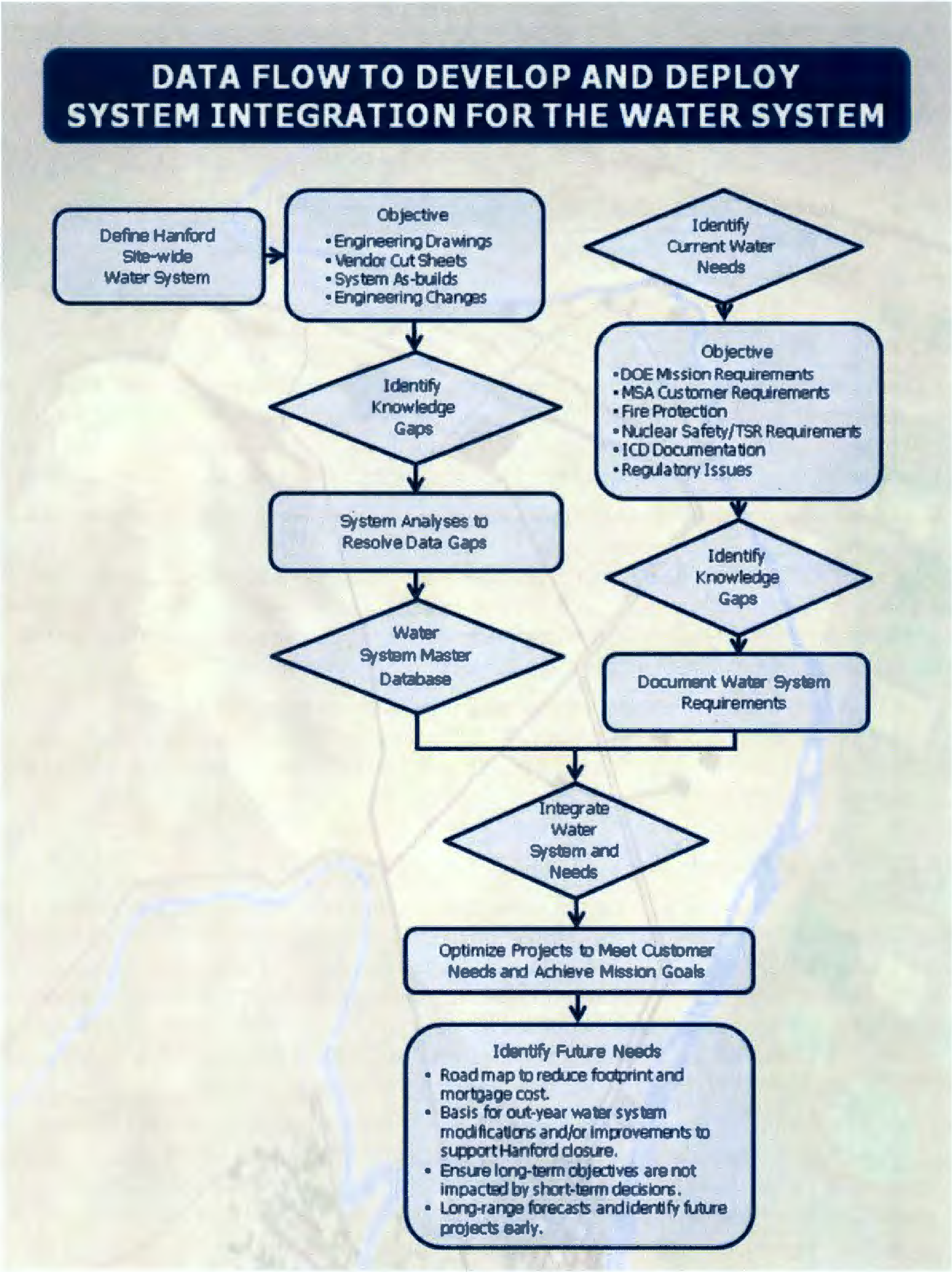

Figure 51. Water System Integration.

Over the next 10 years the MSA will focus on upgrades to facilities and system to:

- Increase system reliability to ensure MSA water customer safety requirements are maintained
- Provide an adequate supply of water to meet MSA customer demands
- Downsize infrastructure footprint consistent with RL and ORP cleanup goals and projected Hanford Site water resource needs
- "Right-size" the existing system to reduce cost associated with mortgage, operation, and maintenance
- Decommission facilities.

8.2.1 River Corridor

Cleaning up the river corridor is the primary goal of the present Hanford cleanup effort and the driving force behind the DOE-RL 2015 Vision. Cleanup goals include completing remediation of contaminated sites, D&D structures, protecting habitat and cultural resources, and reducing the footprint of active site cleanup to 75 mi^2 focused on the Central Plateau.

Within the next four years the RCC mission is expected to be completed. Water demands in the river corridor have already seen significant reductions at 100D, 100F, 100H and 100N or over 50 percent and they will be reduced even more when cleanup is completed in those areas. Water feeds supporting the 100D, 100F, and 100H remediation projects will be abandoned. Minimal water availability to support Hanford Site fire protection may be maintained, and tourism at B Reactor has created a new, relatively small, but ongoing demand for water in the 100 B Area.

An EW system options study that evaluates options for replacing the 100 B and 100 D pump stations and reservoirs was completed. Project L-778, Plateau Raw Water Improvements, and the Vertical Drive Turbine Pump modification at 181/182B and 181/182D have been funded and are moving forward (FY2013 thru 2016).

8.2.2 Central Plateau

The Central Plateau, which encompasses the 200 East and 200 West Areas, will remain a hub of activity until closure projected for completion in 2045. 200E contains WTP, the tank farm evaporators (242A) and several of the larger tank farms. There are many current offices and WRPS is planning an additional office complex near the south entrance to the WTP. There have been discussions on a possible Supplemental Treatment Plant. As major treatment facilities are commissioned to meet final disposition objectives of the Site, water demands will increase on the plateau, and ultimately decline in the final phase of the clean-up operation.

The need for water services on the Central Plateau will diminish but not disappear during the next 40 years. Major water users such as the WTP, the 242-A Evaporator, ERDF, and Tank Farms will require substantial volumes of water on a sustained or intermittent basis for years or decades to come. Interface Control Documents between the MSA, WRPS, and CHPRC have established service requirements for the next ten years and, as stated, are reviewed and updated as appropriate by the contractors. Central Plateau water demands are well below the current system capacity.
A significant amount of work has been done on the Central Plateau to upgrade and refurbish existing RW and PW distribution systems.

8.2.3 600 Area

Some changes to the 600 Area water system and distribution piping are needed to align 600 Area facilities with the 2015 Vision. The City of Richland supplies PW to the WCH 300 Area, to HAMMER training facilities, and the Patrol Training Academy (PTA). For systems serving the 600 Area, the following changes and upgrades are forecast to address the 2015 Vision:

- HAMMER and PTA – Currently additional facilities are being constructed to improve training facilities. The Hammer area has completed the installation of an additional Reduce Pressure Backflow Assemble and now has redundant water available for fire protection.
- 251W Electrical Substation – Project L-683 has been completed. 251W now receives PW from a trailer adjacent to the building.
- 100 Area Fire Station (609 Building) – This system is generally considered in fair condition with no major upgrades currently planned to address the 2015 Vision.
- Meteorological Tower (622R,) 100N, 100K, 181B, and various field hydrants at 100B, 100F, 100H, etc. are currently serviced for Fire Protection from EW.

8.2.4 Other Areas

The 300, 400, 700, and 1100 Area water systems, which are not managed by MSA, will produce PW for fire suppression and in a more limited role for domestic activities. The 300 Area water system is largely managed under the RCC contract. PW is supplied by the City of Richland. Potential upgrades and refurbishment of the 300 Area water distribution system are not addressed in this plan.

8.3 PLANNING CONTEXT and CONSISTENCY

Water Utilities fully supports the 2015 Vision. Additionally, Water Utilities supports the vision of protecting and enhancing human health and the environment while completing the cleanup mission. Through collaboration with the other Hanford Site contractors, RL and ORP, MSA is integrating sustainability into project management and the successful mission completion.

8.3.1 Strategic Planning Hierarchy at Hanford: Infrastructure and Services Alignment Plan

Hanford strategic planning in 2012 is a program approach defining attributes in two broad areas; (1) Physical Plant and (2) Services to meet Hanford's cleanup mission. The Physical Plant includes infrastructure and facilities, the largest planning driver for infrastructure. Services generally refer to those essential services that benefit all programs and property, whether DOE owned or not. The ISAP is a strategic high-level process and planning document providing infrastructure systems and services to successfully meet Hanford Site needs in the near (2015 and 2020) and long-term (2070) planning horizon years.

The ISAP (HNF-44238 Rev. 2, August, 2011) is a collaborative structured strategic planning document that includes tactical planning information summarizing current attributes for achieving the defined mission. The 2012 annual ISAP report will include content to prioritize projects to support and inform the DOE annual budget formulation process.

The ISAP report is primarily a day-to-day operational strategic tool for tactical decision making used by Hanford Contractors as well as RL and ORP staff.

The ISAP report also provides planning framework for developing the TYSP (annually updated) and area-wide plan report documents.

The ISAP report provides planning framework for developing up to nine infrastructure master plans. There are five master plans (e.g. electrical, water, sanitary sewer, information technology and analytical lab services) that are completed and/or required by contract and currently in deferred status. MSA is working on and/or considering companion master plans in four areas - transportation (to include roads, rails, commuter and transit topics), facilities (an update in 2012 for 330 buildings is in progress), land (long-term stewardship program, plus other topics including transfers, pits and integrated vegetation management) and possibly a new master plan for services. Each master plan at Hanford is on a 2-year or on a non-specific periodic update cycle. Each master plan drives respective infrastructure and utility system projects and contracts decisions, forming the base level in the planning hierarchy consistent with the ISAP report.

8.3.2 Changes in Facility Standards

According to an article in the ASHRAE Journal, approximately 86% of building construction expenditures relate to renovation of existing buildings, and it is estimated that over the next 30 years that about half of the entire existing building stock in the U.S. including the Hanford site will need to be renovated. Based on recent changes to buildings and facilities performance standards and all applicable codes and standards (American Public Works Association, AWWA, National Electric Code, International Building Code, Ecology, etc.), there is a small opportunity for making existing utility buildings more energy efficient.

8.3.3 Utility Buildings Sustainability Compliance

There are 868 existing buildings at Hanford expected to remain after the year 2020. The Site Sustainability Plan (SSP) is an annual report showing the site's overall progress towards energy savings for existing buildings. Six of 20 goals based on several laws and executive orders directly apply to existing utility buildings. The SSP report identifies a few existing buildings that already underwent energy upgrades at Hanford to meet long term goals for energy savings. The ISAP 2012 report and SSP annual report reflect that energy savings goals are cross-cutting regulations applicable to all existing facilities identified by each system manager in FY 2013 and going forward, including the facilities listed in Table 27. The SSP goal is for 20 percent reduction in energy use compared to the baseline year 2008 for energy consumption by the year 2020. The FMP report also implements parts of the SSP report while also providing compliance with several executive orders.

Table 27. DOE Approved Facilities.

Facility Reference/Size	Included in FMP 2012	Included in 2012 Baseline Energy Use Audit	Energy retrofits made in past 5 yr	Overall Condition (see Chapter 3 for Condition Assessment)	Current Age / Remaining Life (in yr) (2035 Mission)
181B River Pump House 22,811 ft^2	Yes	No	No	Good	68 / 6

Table 27. DOE Approved Facilities.

Facility Reference/Size	Included in FMP 2012	Included in 2012 Baseline Energy Use Audit	Energy retrofits made in past 5 yr	Overall Condition (see Chapter 3 for Condition Assessment)	Current Age / Remaining Life (in yr) (2035 Mission)
181B101 Valve Pit 216 ft^2	Yes	No	No	Good	68 / 6
181B102 Valve House 440 ft^2	Yes	No	No	Good	68 / 6
181B66 Fuel Tank 12,000 gal	Yes	No	No	Good	17 / 6
182B Reservoir and Pump House 249,208 ft^2	Yes	No	No	Good	68 / 6
181D River Pump House 17,343 ft^2	Yes	No	No	Good	68 / 6
181D101 Valve Pit 184 ft^2	Yes	No	No	Good	68 / 6
181D102 Valve House 484 ft^2	Yes	No	No	Good	68 / 6
182D Reservoir and Pump House 249,646 ft^2	Yes	No	No	Poor	68 / 6
1901Y Valve House 2,102 ft^2	Yes	No	No	Good	68 / 23
1901Z Valve House 624 ft^2	Yes	No	No	Good	68 / 23
282E Reservoir and Pump House	Yes	No	No	Good	68 /23
282EA Inlet House North 406 ft^2	Yes	No	No	Good	68 / 23
282EB Inlet House South 296 ft^2	Yes	No	No	Good	68 / 23
282EC Booster Pump House 3,624 ft^2	Yes	No	No	Very Good	15 / 23
282ED Stby Elec Gen 824 ft^2	Yes	No	No	Good	15 / 23
282W Reservoir and Pump House 32,247 ft^2	Yes	No	No	Good	68 /23
282WA Inlet House 406 ft^2	Yes	No	No	Good	68 / 23
282WC Booster Pump House 3,624 ft^2	Yes	No	No	Very Good	15 / 23

Table 27. DOE Approved Facilities.

Facility Reference/Size	Included in FMP 2012	Included in 2012 Baseline Energy Use Audit	Energy retrofits made in past 5 yr	Overall Condition (see Chapter 3 for Condition Assessment)	Current Age / Remaining Life (in yr) (2035 Mission)
282WD Stby Elec Gen 824 ft^2	Yes	No	No	Good	15 / 23
283E Filter Plant (Stby) 27,388 ft^2	Yes	No	No	Good	68 / 23
283EA PW Reservoir 1.1M Gal	Yes	No	No	Good	15 / 23
283W Filter Plant 29,214 ft^2	Yes	No	No	Good	68 / 23
283WA PW Reservoir 1.1M Gal	Yes	No	No	Good	68 / 23
283WB EQ Basin 1,669 ft^2	Yes	No	No	Good	15 / 23
283WC Clarifier 32,000 Gals	Yes	No	NO	Good	15 / 23
283WD Recycle Pump House 340 ft^2	Yes	No	No	Good	15 / 23
283WE Sludge Lagoons (3) 24,926 ft^2	Yes	No	No	Good	15 /23
283WF Sample Bldg. 1266 ft^2	Yes	No	NO	Good	15 / 23
287W RPBA #2 186 ft^2	Yes	No	No	Good	16 / 23
2901X Valve House 272 ft^2	Yes	No	No	Good	68 / 23
3901Y Valve House 808 ft^2	Yes	No	No	Good	68 / 23
2901Z Valve House 624 ft^2	Yes	No	No	Good	68 / 23

8.3.4 FMP 2012 Study of Existing Buildings

The FMP study in 2012 identifies 374 candidate buildings that were studied. The DOE-approved list of existing utility buildings (Table 25) was used for this report as required. However, the FMP 2012 process and scope did include any field inspections of each facility to list deficiencies with respect to the utility use and purpose. Generally, the FMP study focuses only on the broad category of facility type, comparing the normal expected lifespan for each major component (roof, heating, ventilation and air conditioning [HVAC}, electrical, etc.) and identifying basic needs and a schedule for budgeting repairs or replacements for general purpose facilities over long-term periods through the year 2060.

8.3.5 Upgrades for Existing Utility Buildings

See Chapter 3, Condition Assessment recommendations and Chapter 8 Water System Upgrades.

8.3.6 Energy Upgrades and Energy Sources for Existing Utility Buildings

Baseline energy audits in progress during 2012 for 1 million square feet of existing buildings have been noted where applicable. Baseline performance information is required to determine where energy savings retrofits can be justified. The opportunity for achieving the 20 percent reduction in energy use compared to the baseline year 2008 for energy consumption by the year 2020 will be met primarily thru electrical energy conservation. Electrical power is the primary target for energy savings. Very few utility buildings use natural gas or energy from alternative fuel sources (propane, solar, wind, biomass, fuel cell, etc.) currently. An example might be using a small propane tank or natural gas (when available) with small generator operating a small pump or telemetry structure.

For energy source type, there is an ISAP strategy to convert any remote utility buildings in the 100 Areas to alternative energy sources in order to help reduce the operational and maintenance costs of the electrical grid system and meet the overall goal of shrinking the overall Hanford infrastructure footprint. Although total energy consumption at the site will increase by the year 2020, most of the energy increase is from the new vitrification facilities planned to operate through the year 2045.

For the Table 1 list of existing utility buildings, energy savings retrofits will be considered along with the costs of other needed upgrades to extend facility life, better meet the utility purpose and provide a safe workplace. The energy savings program will start out with baseline energy use and retro-commissioning studies, followed by implementation projects based on the results of each cost-benefit analysis plus available funding. A typical energy savings measure (ESM) target for a federal building requires 30 to 35 percent annual energy savings combined with a 9- to 20-year return on the retrofit investment as the payback period to fully recover the cost to implement the ESM. The existing buildings to be demolished or to be replaced are shown on Table 28.

At Hanford, the threshold of $5 million in value is the minimum project size targeted for mandatory energy savings compliance. Below $5 million, the energy savings upgrades are still a goal but non-mandatory. All new construction will meet standards for Leadership in Energy and Environmental Design (LEED) New Construction (NC) (or Green Globes NC standards, if applicable), unless a proposed building is specifically exempt.

Table 28. Existing Facilities to Be Demolished for Export Water Utilities.

Facility Reference	Designated to be demolished in FMP 2012	Included in 2012 Baseline Energy Audit	Reason for Proposed Demolition
182D Reservoir and Pumping Station	No	No	Facility no longer needed after River Pumping Upgrade Project is completed.
182B Reservoir and Pumping Station	No	No	Facility no longer needed after River Pumping Upgrade Project is completed.

Note: There are no Proposed New Facilities for MSA Export, Raw or Potable Water Utilities.

9.0 MSA WATER SYSTEMS UPGRADE PROJECTS

MSA maintains a strategy of continually evaluating customer needs and system sustainability, along with promoting safe operation and being environmentally friendly. In the past, MSA has concentrated on upgrades and refurbishment of the pipeline distribution system. Notable progress has been made replacing or refurbishing many of Hanford's deteriorating underground distribution piping system. Approximately, 7 miles of water piping has been mortar lined over the last 10 years. By focusing on the established pipeline priorities, the most deteriorated and high risk water lines have been cut, capped, refurbished or replaced.

Due to shifting priorities, budget cuts, and other constraints, not all projects planned are able to be completed. Water Utilities continues solicit ideas from Water Utilities operators, maintenance personnel and other staff members to increase efficiency and do more work with fewer resources. For example:

- Closure of 182D. Developing a plan to maintain enough system capacity to meet customer needs and satisfy State and Federal requirements. Project L-778, Plateau Raw Water Improvements, came about from these employee discussions and initiating studies.
- Mortar Lining (Pipeline Refurbishment Strategy) has been adopted by DOE HQ as a Complex-Wide Best Management Practice. Projects L-357, L-355, L-398, L-420, L-423, L-431, and L-342 have been identified and are included in the IPL (see Table 11 and 12).
- Water Utilities is in the progress of examining all preventative maintenance (PM) and determine which are critical to operation. Those that are deemed necessary are evaluated as to their frequency. This will improve Utilities utilization of assets and resources.
- Water Utilities employs various leak detection technologies, including aerial thermal imaging and sonar to identify problem areas.
- Water Utilities has promoted the use of strategic metering. HNF-42320, Rev 0, Feasibility Study for Advance Electrical and Water Metering at Hanford, determined that metering is essential for gathering reliable data to assess system integrity and as an aid to plan for projected customer demands, as the site down sizes.
- Public Works Director is developing a deficiency tracking system that will compile all deficiencies noted during safety walk downs, DOE facilities representatives walk downs, CASs and employee-noted deficiencies. This will allow Water Utilities to direct assets and resources to correct the deficiency
- Vibration monitoring and the use of engineered fluid flow hydraulic models to analyze the distribution systems to help achieve better performance, efficiency, as well as energy savings.

The implementation of ideas such as these has allowed the MSA to substantially reduce leaks and line failures. These processes allow Water Utilities to increase the overall reliability of the water systems, and achieve an acceptable end state within the established funding targets.

9.1 ACTIVITIES AND UPGRADES TO ACHIEVE END STATE

The Export Water System Scoping Study (HNF-50938) was originally undertaken to define the impacts on Hanford water systems of deactivating and closing the 100-D EW facilities and to provide recommendations for future system configuration including system recommendations for optimizing life cycle system configuration for operation, maintenance, and reliability. As the study progressed, it evolved to encompass the EW, the RW, the PW System and Fire Protection system, which currently uses water from RW and PW systems. Assessments of the requirements and capabilities of the EW, the RW the PW and the Fire Protection systems were completed to develop essential upgrades and proposed system modifications to meet requirements for continued reliability through 2035.

Preliminary technical study options and results were derived by alternatives analyses, including the AHP process. Subsequent discussions of the analyses and results with RL produced direction from RL to allocate risks and costs of the options as they related to RL requirements versus those of ORP.

9.1.1 Analyses and Recommendations:

Two options for improvements to the 100B area were considered: (1) to "upgrade" the existing 100B system using as much of the existing equipment as possible and (2) to "reconfigure" the 100B facilities to pump straight from the Columbia River to the plateau raw water reservoirs via the existing 42-in. pipe. The pump-house and reservoir at 182 B would be decommissioned and removed in the second option. The "Reconfigure B" (pump from 181-B at the river to the plateau) option was selected as the preferred technical alternative based on AHP analysis.

Based on risk analyses, it was determined that a single source of EW is adequate to satisfy RL requirements, while two sources of EW are needed when ORP requirements are included. Three options for a secondary or back-up water supply to 100B were developed. Brief descriptions of the three alternatives follow:

- Option 1 – New 30-in. ductile iron pipe from 182-B to the 1901-Y (4.38 mi).
- Option 2 – Adapt the 181-D river intake system so that it can pump water directly from the river to the plateau reservoirs.
- Option 3 – Install deep wells on the plateau to provide water to plateau raw water reservoirs.

The AHP evaluation of the three proposed alternatives for providing a back-up export water source resulted in the technically preferred alternative of Option 3, with Option 2, the use of 181 D as the secondary source, a second choice. Option 3, the installation of deep wells on the plateau, was recommended to RL for consideration.

9.1.2 RL Input Consideration

Upon consideration of the RL input after a detailed presentation of the engineering evaluation of the considered Export Water options, MSA concurs in the following recommendations:

- Implement design and installation of plateau improvements detailed below
- Implement design and installation of 181D river pumps, controls and 182 reservoir and pump-house by-pass piping to 42-in CCP and the plateau.

- Use present configuration of 181B and 182B to pump to plateau reservoirs until funding is available to install 181B river pumps, controls, and by-pass piping to plateau
- Defer decisions on plateau deep wells and cooling tower installation till proper evaluation can be completed.

9.1.3 Summary of Recommendations

The following actions rectify long-standing problems with the raw water system operations, enhance fire safety reliability, level demands, and maintains the current level of reliability of the export water system while providing adequate Export Water supply to allow decommissioning of the 182D reservoir and pump-house:

- Install standpipes in potable water tanks 283-WA and 283-EA for fire water reserves of 600,000 gal each
- Tie potable water and raw water grid together with backflow prevention
- Reassign and reprogram fire pumps at the 282-W and 282-E Reservoirs as raw water pumps and add a variable frequency drive to one pump in each pump house
- Take booster pumps out of service
- Reconfigure 181-D River Intake Pump House with two new 7,000 gal/min vertical turbine pumps capable of pumping directly to the plateau reservoirs and a new by-pass header, to be used as back-up until wells are installed.
- Close and remove 182 D Pump House and reservoir
- Study and compare the cooling tower option to the use of Pump and Treat water for Condenser Water on 242A Evaporator
- Study use of Plateau deep wells
- Utilize 100B facilities to supply plateau reservoirs while delaying the option to reconfigure 100B to pump to plateau from 181B, similar to 181D.
- Close and demolish appropriate pump houses and reservoirs.

Project L-778, Plateau Raw Water Improvements, will commit the pumps and at least 600,000 gal of each 1.1-Mgal PW storage tanks in 200 East and 200 West Areas to fire protection. The project will install Reduce Pressure Backflow Prevention valves and tie the PW system with the RW system for universal fire protection. Disconnect the EW system from the 200 East and 200 West Area RW system at the 282EC and 282WC facilities and deactivate the booster pump arrangements. The project will dedicate former fire pumps at the 200E and 200W reservoirs to supply RW system. Follow on projects will install vertical drive turbine pumps at 181B and 181D, bypassing the 182B and 182D Reservoirs, pumping directly to the 282E and 282W Reservoirs. This will allow for the closure of the four facilities in the 100B and 100D Areas, reducing the footprint, lowering operating cost, and improving the water transmission efficiency.

9.2 PLANNED AND BUDGETED OUT-YEAR PROJECTS

Table 29 identifies projects that are currently planned and budget in MSA out-year planning. Table 30 identifies anticipated operational costs as well as capital construction costs for planned projects.

Table 29. Potential Upgrade and Replacement Projects.

Project	Immediate Need	A Reduce Footprint	B Reduce Long Term Costs	C Right-Sizing	D Minimize Environmental Impacts	E Safe/Reliable/ Compliant Services	Ranking (H,M,L) IPL Priority
L-778, Plateau Raw Water Improvements	X		X		X	X	H/6
L-357, Mortar Line 12-in. Potable Water Line to 222-S Lab			X	X	X	X	M/19
181B Vertical Turbine Pumps, Header, Instrumentation	X	X	X	X	X	X	H/88
L-352, Refurbish 20 Inch Raw Water Line Near A Tank Farm	X	X	X	X	X	X	H/75
L-336, 200 East and West Area Clear well Modifications	X		X		X	X	H/54
L-679, 200 West Area Water Treatment Process Improvements	X		X	X	X	X	H/78
L-355, 14" Raw Water Supply Line to 242 S		X	X	X	X	X	M/6 ORP
181D Vertical Turbine Pumps, Header, Instrumentation	X	X	X	X	X	X	H/5 ORP
L-420, Mortar Line 8 / 10-in. Potable Water WRAP Loop - (1960)		X	X	X	X	X	M/92
L-398, 10" B Plant Potable Water Lines		X	X		X	X	M/111
L-430, 8-in. 2101M Loop 2E Approximately 1035 m of 8"PW Ln		X	X	X	X	X	M/112
L-423, Mortar Line 8" RW Line on SE side of T-plant for Fire Protection (1958)			X		X	X	M/117
L-431, Mortar Line 8-in. Potable Water Line Along 20th Street to Water Plant Main (1950)			X		X	X	M/134

Table 29. Potential Upgrade and Replacement Projects.

Project	Immediate Need	A Reduce Footprint	B Reduce Long Term Costs	C Right-Sizing	D Minimize Environmental Impacts	E Safe/Reliable/ Compliant Services	Ranking (H,M,L) IPL Priority
L-342, Mortar Line 24-in 1310 meters (Old PUREX Feed Raw - (1952)			X		X	X	M/135
L-318, Renovate 283W Backwash System (automate and add liquid alum)			X		X	X	M/None
L-708, Advanced Water Metering			X	X		X	M/None
L-TBD, Plant Specific Water Metering (To be coordinated with Project L-708)			X	X		X	H/None

Table 30. MSA Planned and Budgeted Out-Year Projects.

Priority/Event	FY Year Complete	Cost in Millions (Escalated)	Work Duration	Potential Impact if not funded
Operations and Maintenance Function; Initial development of Engineered Platform	Fy13and14	5.3-6.3	Ongoing	Any reduction in required monitoring and mandatory operational commitment may result in loss of WDOH Operating Permit.
L-778, Plateau Raw Water Improvements. (see section 8.3)	2013	1.48	1 year	Pressure transients and fire pump cycling will continue to occur, negative impacts to 242A
L-357, Mortar Line, 778 ft. of 12" PW Line from the refurbished lines from the 283E to 222-S Lab	2014	1.53	1 Year	Continued groundwater recharge. Increased maintenance costs due to leaks. High rust content at S-Plant
181B Vertical Turbine Pumps, Header, Instrumentation (see section 8.3)	2016	5.27	2 Years	Failure to complete leaves unnecessary infrastructure in place, increased cost, less reliable operations.
L-352, Refurbish 20 Inch Raw Water Line Near A Tank Farm in 200E (1953)	2015	1.29	1 Year	Continued groundwater recharge. Increased maintenance costs due to leaks. High Groundwater Priority.
L-336, 200 East and 200 West Areas Clearwell Modifications, improve existing clearwell disinfection process.	2016	2.2	2 Years	Impending system failures/ inadequate recirculation of PW. Continued groundwater recharge.
L-679, 200 West Area Water Treatment Process Improvements , replacing chlorine gas disinfection with on-site chlorine generation	2016	1.18	1 Year	Significant safety impacts due to use of gaseous chlorine. Increased safety risks in surrounding 200W area.
L-355 14" Raw Water Supply Line to 242S. Refurbish 14" RW cast iron leaded joint line to 242A Evaporator. (ORP)	2015	.389	1 Year	Continued groundwater recharge. Increased maintenance costs due to leaks. High Groundwater Priority.
181D Vertical Turbine Pumps, Header, Instrumentation (design and procure/construct- ORP) (see section 8.3)	2016	5.27	2 Years	Failure to complete leaves unnecessary infrastructure in place, increased cost, less reliable operations.
L-398 10" B Plant Potable Water Lines. Elimination of iron deposits above limits for disposal through TEDF, leaded joints and potential leaks. Existing water line is very much	2017	.582	1 Year	Continued groundwater recharge. Increased maintenance costs due to leaks. High Groundwater Priority.

Table 30. MSA Planned and Budgeted Out-Year Projects.

Priority/Event	FY Year Complete	Cost in Millions (Escalated)	Work Duration	Potential Impact if not funded
corroded and full of tuberculation.				
L-420, Mortar Line 8 / 10-in. Potable Water WRAP Loop - (1960)	2016	1.23	1 Year	Potential water line failure 300 ft from a contamination zone. Continued groundwater recharge.
L-423, Mortar Line 8-in. Raw Water Line on SE Side of T-Plant for Fire Protection (1958)	2017	.637	1 Year	Potential of water line failure near contamination zone and additional impacts to fire protection to nuclear facility.
L-430, 8-in. 2101M Loop, replace approximately 1035 m of 8" PW in 200E.	2017	.923	1 Year	Potential of water line impacting fire protection capabilities and drinking water to 2101M.
L-431, Mortar Line 8-in. Potable Water Line Along 20th Street to Water Plant Main (1950)	2017	2.5	1 Year	Potential water line failure to water line connected to cross-site tie line, resulting in loss of PW to 200E.
L-342, Mortar 1310m of 24" RW pipe. (Old PUREX Raw Water feed - 1952)	2017	2.33	1 Year	Potential of water line failure to a loop arrangement in 200E, for Tank Farms, ETF and other facilities
L-318, Renovate 283W Backwash System (automate and add liquid alum)	2018	3.73/currently not funded	1 Year	Impending system failures/ Inadequate system for Loading Alum in Plant. Not Best Management Practice.
L-708, Advanced Water Metering	2018	2.43/ currently not funded	1 Year	Inadequate data collection capabilities. Diminished capacity to monitor for water conservation.
L-TBD, Plant Specific Water Metering (to be coordinated with project L-708)	2019	3.1/ currently not funded	1 Year	Inadequate data collection capabilities. Diminished capacity to monitor for water conservation. Unable to see customer usage and make adjustments to better support Cleanup Mission. Likely to be elevated in priority.

9.3 ADDITIONAL PROJECT DISCRIPTIONS

MSA's strategy for efficiently managing the Hanford Site's water systems through 2022, has been to integrate sustainability goals with mission and strategic planning to optimize performance and minimize over all implementation cost. With the continual development of new and innovative ideas and technologies, MSA endeavors improve the sustainability of the Hanford Site water systems and lower operating cost.

9.3.1 Evaporator Cooling Tower

The 242 A Evaporator is, when operating, the largest consumer of water on the Central Plateau. Reduction of peak consumption at the evaporator through construction and operation of a cooling tower would reduce overall water demand on the Plateau by a significant margin. While cooling water would be reduced by 340 fold (34,000 percent), implementation of a cooling tower would require PW instead of RW however the increased demand for PW would also offset the need for as much flushing as currently done. Although not necessarily a MSA project, implementation of an evaporator cooling tower would have a substantial leveling and dampening effect on the demand that MSA is required to meet but most importantly current effluent restrictions would be eliminated thus allowing the evaporators to operate three times longer that they are currently allowed while eliminating groundwater recharge resulting from the evaporator operation. This effort is still being evaluated.

9.3.2 Advanced Water Metering

Project L-708, Advanced Water Metering, used HNF-42320, Rev. 0, and discussions with subject matter experts, determined 38 m would meet the needs of Water Utilities. For measuring the Water Utility's needs, three parts needed alternatives evaluated to determine the most viable overall option. The three parts were evaluated in enough detail to determine the cost of each. The three parts examined were:

- Flow technology: Install magnetic / ultrasonic flow meters
- Data Communications: Install Ethernet / industrial / cell phone wireless communications
- Power for flow measurement stations: Power via local / solar
- Power stations / extend utility power.

In order to support general water conservation requirements (among others) flow metering of some sort needs to be installed. While the most basic metering could fulfill the requirements; the Water Utilities desires an automated flow reporting of the 38 metering locations to the central control room at the 283W building; once the data has been reported the flow information can be recorded and the needed WDOH reports generated.

Based on the overall life cycle cost, the recommended water flow measurement option will use ultrasonic transit time flow technology, communicates using wireless I/O and is powered by utility power. Currently this project is not funded.

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10.0 REFERENCES

10.1 REFERENCES

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MSC-MP-599, 2012, *Quality Assurance Program Description*, Rev. 7, Mission Support Alliance, LLC, Richland, Washington.

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MSC-PRO-052, 2012, *Corrective Action Management*, Rev. 5, Mission Support Alliance, LLC, Richland, Washington.

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10.2.1 Historical Reference List

Table 31 identifies other documents that have been prepared related to the Hanford Site Water System during the past 48 years.

Table 31. Historical Reference List.

	Number	Type	Subject	Date	Author	Summary
	E-mail	Memo	K Pool Fish Program Power Cost Estimates and Options	3/15/96	Daniel Herborn	Water requirements are provided for fish rearing at K Pools
	N/A	Memo	Export Water System to 200 Area		Larry Garreits	List of export water lines installed with size, length, and pressures. Reference drawing is H-1-71269
	N/A	Memo	200 Area ESPC Facilities	3/21/96	Unknown	Table of Buildings, contacts and water requirements for the 200 Area
	H-1-71269	Drawing	Export Water Lines	3/15/66	Douglas United Nuclear	Plan of export water mains, vents, drains, and valving
	SD-LP-PD-002	Study	Upgrade Plan, Hanford Outer Area Export System	Jun 1985	Rockwell	This upgrade plan outlines the current approach and alternatives to provide enhanced reliability, flexibility and efficiency for the existing Export Water System
	SD-SS-ES-002	Study	Final Audit Report for Evaluation of the Export Water System Hanford Nuclear Reservation	Jun 1986	Engineering & Design Associates	This audit report evaluates the operating and physical conditions of the Export Water System and delineates the deficiencies prior to the preparation of an Engineering Report
	SD-SS-ES-001	Study	Engineering Report, Evaluate Export Water System for Hanford Reservation	Jun 1986	Engineering & Design Associates	Evaluates the alternatives for the Export Water System. The study evaluates various methods for equipment upgrades, system additions, remote controls, and emergency storage
	SD-SS-ES-003	Study	Pressure Pipe Network Analysis Program, User's Manual	Jun 1986	Rockwell	User's manual and computer program to model the pressure water distribution for the Export Water System
	KEH R-83-89	Study	Preliminary Engineering Study, Remote Monitoring and Control of the Export Water System	Mar 1984	ICF KH	
	30842, R1	Letter	Budget Call Letter, In-house Energy Management Program Fiscal Year 1988 Small Retrofit Projects	8/29/86	Rockwell	Enclosure: Export Water Systems Pressure Reduction Program Description and Energy Saving Evaluation

Table 31. Historical Reference List.

	Number	Type	Subject	Date	Author	Summary
	KH-SD-LL-DSD-002	Study	Outer Area Electrical Utility Study	12/15/95	Stone & Webster	A study that characterizes the existing "outer area" electrical distribution system, and provides benchmarks for evaluation of private contractor ownership and operation proposals
	WHO-SD-L010-ES-001	Study	Water System Instrument Upgrades	Jun 1992	ICF-KH	
	E-mail		Pump History	5/31/94	Thomas L. Sweet	Pump history is given in e-mail
	E009		Export Water Delivery Study	12/31/91	K.L. Kehler	Work Plan and Preliminary Test Procedure
		Study	Portable Water System Study	1990		Provides an overview of the potable water systems presently in service at the Hanford Site; future system forecasts based on anticipated DOE activities
	DE-AC06-76RL01698	Study	Export Water System Study	Nov 1979	Vitro	Study objectives: Determine actual water flow needs and system operating characteristics. Develop a plan for more economical pumping operation
	E-mail		Shutdown 183D Water Filter Plant	9/21/90	Raymond Hill	Attachment has Energy Management Project Proposal: Shutdown 183D Water Filter Plant
	EMS-13		100-D Water Filter Plant	2/18/91	R. Reed	
	VITRO-R-627	Study	Supplement to Filter Plant Study 100-D Area Water (Domestic and Test)	Oct 1983	ICF-KH	Supplements original study by using new water flow data and cost data for fiscal years 1981, 1982, and 6 months or 1983. Purpose is to determine the most desirable alternative for filtering water in 100-D, -F, and -H Areas
	VITRO-R-627	Study	Filter Plant Study 100-D Area Water (Domestic and Test)	Sept 1980	Vitro	Examine alternatives for filtering water to be used in the 100-D, 100-F, 100-H Areas and determine the most desirable based on economy and reliability

Table 31. Historical Reference List.

	Number	Type	Subject	Date	Author	Summary
	B-604	Project	Advanced Conceptual Design Report, Water System Upgrade - Reservoir	Nov 1993	ICF KH	Water System Upgrade Project B-604 will provide an upgrade to the water systems in 200-E, 200-W to provide a second reliable, independent supply of fire protection water to meet the 4-hour supply requirement
	B-604	VE	Value Analysis Project Setup	Sep 1992		Set up notes for Value Analysis of B-604 Project
	B-604	Project	Conceptual Design Report, Water System Upgrade - Reservoir	Jun 1988	ICF KH	
	L-001	Project	Conceptual Design Report, Fire Water Storage and Distribution Upgrades, 300 Area	Mar 1988	ICF KH	
	B-604/L-001	SOW	Statement of Work for Projects B-604/L-001	6/28/89	DOE	Statement of Work used earlier version of B-604/L-001 Projects
	N-027	Memo	Propose Memorandum-To-File, 100-K Water Supply and Distribution System	Jul 1990	C. Sowa	
	N-027	Study	100-K Area Water Supply Options		WHC	Undated Draft - Purpose of study is to evaluate various options available to ensure a reliable and cost-effective supply of water for the 100-K Area for potable water, fire protection, and basin cooling and support systems
	WHC-SD-NR-ES-008	Study	100-K Area Water Supply and Distribution	2/13/90	WHC	This document is an engineering study evaluation of various options available to ensure a reliable, safe, and cost-effective supply of water for the 100-K Area for potable water, fire protection, and basin cooling systems
	WHC-SD-NR-FDC-007	Study	Functional Design Criteria, 100-K Water Supply and Distribution	4/20/90	WHC	This document is a functional design criteria for Project N027, 100-K Water Supply and Distribution. Minimum/ maximum flow requirements, cooling demands, and buildings are identified

Table 31. Historical Reference List.

	Number	Type	Subject	Date	Author	Summary
	WHC-SD-N027-001	Project	Conceptual Design Report, 100-K Area Water Supply and Distribution	May 1992	ICF KH	Draft copy
	N-027	EMS	Energy Management Project Proposal, Shutdown 100-K Water Plant Project N027	6/30/92		Preliminary copy not formalized
	9201279B R34	Letter	1994 Budget Schedule	9/25/92	WHC	Attachment has Energy Management Project Proposal, Shut Down 100-K Water Plant Project N027. Replaces the 100-K water supply system and modifies the sanitary and fire water distribution system
		Memo	Electricity Costs for Raw Water Pumping at 100-K	12/9/94	Jim Uecker	Includes data and charts
	59C01187	Drawing	K-Basins General Layout Map	11/30/94		Show filters being used for fish rearing. Photo included
	E-mail	Memo	Export Water Study at 100-K	5/15/95	Chris Lucas	Energy management-related
	E-mail	Memo	K-Area action items assigned to Michael Rung	4/28/94	Dean Medford	Drawing list for K Area and energy use information
		Memo	181KE River Pumps	6/24/92	G. Bennett	Directive to stop using 1500 hp pumps
	CRP 91-0976	Proposal	Price Program Cost Reduction Proposal, Peak Demand Reduction	Apr 1991	WHC	Use 600 hp river pump instead of 1500 hp pump. 151-KW Substation Demand Profile in file
		Memo	Verification of BPA Electricity Bills	11/30/90	Jim Uecker	Replaced data that was lost for October 1990
	CRP 92-0574	Proposal	Price Program Cost Reduction Proposal, Peak Demand Reduction	Dec 1991	WHC	Use 600 hp river pump instead of 1500 hp pump. Calculations in file. Resubmittal, original 91-0976 was rejected. Letter and memo related to proposal are in the file
	9305122B R1	Letter	Incorporation of 100-K and 100-N Water Systems under WHC Steam and Water Utilities	7/23/93	A. Greenberg	Advantages and Disadvantages of consolidation are discussed.
	7F650-94-006	Memo	K-Area Water System Repairs and Maintenance of Reliable Service	6/24/94	S. Desal	Attachment VE Study. File has meeting notes discussing fish rearing

Table 31. Historical Reference List.

Number	Type	Subject	Date	Author	Summary
H-1-24490	Drawing	Electrical Submersible Pumps Plans and Details	1/23/61		Building 181K
H01024492	Drawing	Elementary Diagram River Pump House	6/5/68		Building 181KW
H-1-25000	Drawing	River Pump House Excavation Plan and Section			Building 181K
H-1-25000	Drawing	River Pump House Excavation Plan and Section			Building 181K
H-1-25001	Drawing	River Pump House Forebay Plan and Details			Building 181K
H-1-25002	Drawing	River Pump House General Grading Plan			Building 181K
H-1-25003	Drawing	River Pump House Excavation Plan and Section			Building 181K
H-1-25004	Drawing	River Pump House Forebay Plan			Building 181K
H-1-25450	Drawing	River Pump House General Arrangement			Building 181K
H-1-25452	Drawing	River Pump House Fish Line			100-K Water Plan Facilities
H-1-72076	Drawing	Elementary Diagram River Pump House	6/24/68		Building 181KE
H-2-76739	Drawing	Drawing List/Civil Site Plan and Specs, 12-inch Sanitary Water			Building 200E
H-2-76740	Drawing	Civil 12-inch Sanitary Water Plan and Profile			Building 200E
H-2-76741	Drawing	Civil 12-inch Sanitary Water Plan, Profile and Details			Building 200E
	Drawing	Hanford (Outer Area) Water Supply System, Average Flow			Undated sketch showing meter point, raw and sanitary water flows for 200E and 200W
	Data	200 Areas Water Usage Information - Draft	9/10/92	R. Wood	
R78-1659	Letter	Export Water System	8/21/78	R. Huckfeldt	Water demand analysis for Battelle Meteorological Laboratory in 200W

Table 31. Historical Reference List.

	Number	Type	Subject	Date	Author	Summary
		Presentation	$500,000 Cost Reduction in Steam and Water Services to PUREX			Old presentation not dated
		Report	Integrated Infrastructure Planning Workshop Report, 200 East and 200 West Water Systems	12/2/92	F. Board	Attachments: 1-Background presentation; 2-Excerpts from 200 Areas Water Usage Information; 3-200 Areas Sanitary Water Needs; 4-200 Area Raw Water Needs
		Presentation	200 Areas Water Systems Needs Assessment, Workshop Summary	2/3/93	Board / Holmberg	Presentation
	WHC-S-0168	Spec	Specification for Sanitary Water Facility Pump / Motor Units	3/31/93	WHC	Procurement specification with pump curves. File has meter demand profiles and Electricity Consumption Reports
	SD-LP-ER-001	Study	200 Area Water Storage Freeze Protection Energy Reduction Study	7/30/84	Rockwell	This study evaluates the water storage freeze protection system and recommends energy-saving alternatives
	RLIP 5480.7	Procedure	Fire Protection (Implements DOE Order 5480.7)	7/30/90	DOE	File has excerpts from DOE 6430.1A
	KH-SD-LL-DSD-001	Study	Outer Area Water Utility Study	12/15/95	Stone and Webster	A study that characterizes the existing outer area (raw and sanitary) water system, and provides benchmarks for evaluation of private contractor ownership and operation proposals
	KEH-8017 Task 8 Rev2	Study	200 Areas Sanitary Water System Alternatives Analysis	Dec 1995	SAIC	Floppy of report in file. Examines the existing operation and various options that have the potential to reduce water production costs while maintaining or increasing the reliability of the water supply
	KEH-8017 Task 7 Rev2	Study	200 Area Water System Second Power Source for Project B-604 Pumps Alternatives Analysis	Oct 1995	SAIC	Summary analysis concerning diesel-generating sets and a different option, bringing a second electric transmission line to supply power from a point sufficiently independent

Table 31. Historical Reference List.

	Number	Type	Subject	Date	Author	Summary
	KH-SD-ER5057-ES-001	Study	Engineering Study 200 Area Water Metering Projects L-222/L-223	1/13/95	ICF KH	This report studies and develops the feasibility and rough order cost estimate for adding water meters to the key facilities in the 200 East and 200 West Areas of the Hanford Site
		Memo	Export Water System Line Pressure	6/21/89	R. Roehl	Discusses pressure reduction
		Memo	Reduced Pressure Operation of the Export Water System	8/27/87	G. Board	Discusses pressure reduction. File has PVC pipe data
		Memo	Meeting Minutes, Project H-786 Supplemental ECCS Supply on Export Water System	10/2/88	UNC Nuclear Industries	
		Letter	Use of Export Water System for Project H-786, Supplemental ECCS Study	1/30/87	UNC Nuclear Industries	File has data on raw water usage
		Memo	Response to Export Water System Pressure Reduction Project	1/9/87	R. Brown	
		Presentation	UNC Plan for Upgrading the N Reactor Emergency Core Cooling System	9/18/86	J. Kelly	Presentation
		Memo	Draft Report, 100N Water Systems VE Study	2/16/94	Meng Associates	
	WHC-SD-SQA-ANAL-30001	Study	Fire Protection Water Supply Analysis	8/18/95	Industrial Safety and Fire Protection	The analysis assesses the water supply systems for the 100K, 200E and 200W, 300, 400, 1100, and 3000 Areas, and provides a baseline for future hydraulic analyses
	FAX	Data	Pollution Prevention Opportunity Assessment	3/22/96	Mary Betsch	Water heating methods for Fish Rearing Project
	FAX	Specs	Fish Rearing Pumping Data	3/15/96	Dan Herborn	600 gal/min circulation pump information
	E-Mail	Data	Business Plan for Yakima Indian Nation and Partners	1/25/96	Bruce (Nick) Anderson	Fire Rearing business plan
	FAX	Drawing	Export Water System	3/29/96	Clay Gosney	Block Diagram of Export Water System
	Data	Data	Water System Descriptions	4/3/96	Lynn Kelly	100K, 100N system descriptions

Table 31. Historical Reference List.

	Number	Type	Subject	Date	Author	Summary
	FAX	Data	Gallons of Raw Water	4/15/96	Bev Bovingdon	July 1995 raw water pumped: average is 8,707,000 gallons per day
	RL-WSP-94-01	Study	Hanford Site Water Systems Plan - Site Utilities Program	3/7/94	Site Utilities	Provides an overview of the potable water systems presently in service at the Hanford Site. Future system forecasts based on anticipated DOE activities
	Data	FAX	Export Water - Dollar-Per-Gallon Calculation	4/26/96	Kathleen Milam	Cost Account 1MDA05 (Export Water System)
	Data	FAX	Filter Water Dollar-Per-Gallon Calculation	5/1/96	Kathleen Milam	Cost Account 1MDA05 (200 Area Water System)
	Data	Spreadsheet	Distribution of BPA Electricity Costs, FY 1995 Average	2/15/96	J.E. Uecker	Breakdown of average power usage per month for FY-1995

APPENDIX A
BOUNDING WATER SUPPLY REQUIREMENTS FOR FIRE PROTECTION

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Bounding Water Supply Requirements for Fire Protection										
	NFPA 13 System Demand (5)		NFPA 1 Fire Flow							
Building	Required Flow (gal/min)	Required Pressure (lb/in2)	Construction Type	Fire Flow Area (sqft)	Fire Flow at 20 lb/in2 from NFPA 1 (gal/min)	Fully Sprinklered? (75% reduction)	Adjusted Fire Flow (gal/min)	Adjusted by the AHJ, per 18.4.3	Flow Duration (Reqmnt. Source)	Total Storage Required (gallons)(2)
Potable Water										
105/109-N	NA	NA	III (200)	>138,300	8,000	N	8,000	2500 (9)	4 hour (1)	600,000
202-A (PUREX)	NA	NA	II (000)	184,990	8,000	N	8,000	2500 (9)	4 hour (1)	600,000 x 2
212-H (CSB)	583	85								
235-Z	850	79	II (000)	>138,300	8,000	Y	2,000		4 hour (1)	480,000 x 2
2402-W (CWC Series)	651	80								
2403-W (CWC Series)	768	73	II (000)	34000	2000	Y	1000		4 hour (8)	480,000
2404-W (CWC Series)	1700	65								
271T	610	88.5								
2706T	697	71								
221T			I (442)	52644	2500	N	2500		4 hour (8)	600,000
2336W (WRAP)	1103	81	II (000)	26195	3500	Y	1000		4 hour	420,000
218-A	1909	50	II (000)	10,000	2250	Y	1000		2 hour (6)	
227-S	1834	42	II (000)	6,000	1750	Y	1000		2 hour (6)	
242-A	1250	154	II (000)	13,833	2500	Partial	2500		4 hour (7)	600,000 x 2(7)
222-SA	810	85	II (000)	4725	1500	Partial only	1500		4 hour (7)	
222-S (System 3)	743	61	II (000)	129,167	7500	Partial	7500	2500 (9)	4 hour (6)	600,000 x 2(7)
2101-HV	1291	86	II (000)	15,000	2500	Y	1000		4 hour (7)	
2704-HV	1068	79	II (000)	126,842	7500	Y	1875		4 hour (6)	
2750-E (4)			II (000)	100, 339	6750	Y	1687		4 hour (6)	
Raw Water										
202-A (PUREX)	NA	NA	II (000)	>138,300	8,000	N	8,000	2500 (9)	4 hour (1)	600,000 x 2
2025-E (ETF)	527	139								
2025-EA	549	131								
222-S (System 2)	720	96	II (000)	129,167	7500	Partial	7500	2500 (9)	4 hour (6)	600,000 x 2(7)
WTP	Fire protection water for the WTP will be supplied from the two 350,000 gallon WTP fire water tanks. Tank refill requirement is 730 gal/min for 8 hours, from the 200E Area raw water loop. During construction, fire water will be supplied directly from the 200E raw water loop at a maximum demand of 2500 gal/min at 20 lb/in2. (See Interface Control Document 24590-WTP-ICD-MG-01-001, Rev. 2)									

(1) DOE SCRD 420.1B, Chg. 1, Supp. Rev. 0, and NFPA 1
(2) "x 2" indicates where two independent sources of supply are required by DOE SCRD 420.1B, Chg. 1, Suppl. Rev. 0, or ENS-ENG-IP-05.
(3) NFPA 1
(4) Pipe schedule system.
(5) For duration of flow, NFPA 13 requires 90-120 minute supplies for extra hazard hydraulic designs, and up to 2 hours for most high piled storage.
(6) ENS-ENG-IP-05, and NFPA 1.
(7) ENS-ENG-IP-05.
(8) DOE SCRD 420.1B, Chg.1, Supp. Rev. 0.
(9) E-mail concurrence from the DOE-RL and ORP Fire Protection Engineers.

APPENDIX B
HANFORD WORK ORDER NUMBERS

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wonum	description	worktype	status	wopriority	location	hanfordwonum
32157	GFCI TESTING, 100B & 100D AREAS (SAFETY)	PM	PRE-WORK REVIEW	2	100	WB-32157/P
31925	GFCI TESTING, 100B & 100D AREAS (SAFETY)	PM	RTS	2	100	WB-31925/P
32575	GFCI TESTING, 100B & 100D AREAS (SAFETY)	PM	WSCH	2	100	WB-32575/P
32099	200E - EXCAVATE & REPAIR 24" EXPORT WATER LINE LEAK		OPS ACCEPTANCE	2	600	WE-32099/C
31441	WATER UTILITIES CONFINED SPACE INSPECTION (SAFETY)	OPM	RELEASED	2	600	WW-31441/O
30898	DISCONNECT & CAP RAW WATER SUPPLY TO GABLE MOUNTAIN HYDRANT		TO-CLOSE	2	600	WB-30898/M
30417	1901Y & 2901Y - DISPOSE OF ABANDON PIPE		TO-PLAN	2	600	WB-30417/C
32183	PORTABLE EYEWASH		PRE-WORK REVIEW	2	610	WD-32183/P
31957	PORTABLE EYEWASH		RTS	2	610	WD-31957/P
31592	610 - REPAIR WATER LEAK IN FILTER/VALVE VAULT (EMERGENT)		SUSP-CONDITION	2	610	WD-31592/C
32442	PORTABLE EYEWASH		WSCH	2	610	WD-32442/P
	2607E1 - REPAIR SEWAGE LIFT STATION		TO-PLAN	2	2.61E+04	WE-30461/C
31587	2607E12 - TROUBLESHOOT & REPAIR PUMP #1		TO-PLAN	2	2.61E+15	2SS-31587/C
31812	MONTHLY CHART AND PIN CHANGES 100 AREAS	PM	OPS ACCEPTANCE	2	100B	WB-31812/P
32176	100B MONTHLY SAFETY INSPECTIONS (SAFETY)	PM	PRE-WORK REVIEW	2	100B	WB-32176/O
31949	100B MONTHLY SAFETY INSPECTIONS (SAFETY)	PM	RELEASED	2	100B	WB-31949/O
31680	100B MONTHLY SAFETY INSPECTIONS (SAFETY)	PM	RELEASED	2	100B	WB-31680/O
31815	100B MONTHLY SAFETY INSPECTIONS (SAFETY)	PM	RELEASED	2	100B	WB-31815/O
31946	MONTHLY CHART AND PIN CHANGES 100 AREAS	PM	RTS	2	100B	WB-31946/P
32046	100B WU BUILDINGS 7652 INSPECTION		RTS	2	100B	WB-32046/O
32173	MONTHLY CHART AND PIN CHANGES 100 AREAS	PM	RTS	2	100B	WB-32173/P
32411	100B WU BUILDINGS 7652 INSPECTION		WSCH	2	100B	WB-32411/O
32431	MONTHLY CHART AND PIN CHANGES 100 AREAS	PM	WSCH	2	100B	WB-32431/P
32434	100B MONTHLY SAFETY INSPECTIONS (SAFETY)	PM	WSCH	2	100B	WB-32434/O
31959	100D MONTHLY SAFETY INSPECTIONS (SAFETY)	PM	PRE-WORK REVIEW	2	100D	WD-31959/O
32185	100D MONTHLY SAFETY INSPECTIONS (SAFETY)	PM	PRE-WORK REVIEW	2	100D	WD-32185/O
32048	100D WU BUILDINGS 7652 INSPECTION		RELEASED	2	100D	WD-32048/O

31826	100D MONTHLY SAFETY INSPECTIONS (SAFETY)	PM	RELEASED	2	100D	WD-31826/O
30192	181D & 182D - MOVE BREAKERS AND CONTACTORS FROM 2101M		TO-PLAN	2	100D	WD-30192/W
32413	100D WU BUILDINGS 7652 INSPECTION		WSCH	2	100D	WD-32413/O
32461	100D MONTHLY SAFETY INSPECTIONS (SAFETY)	PM	WSCH	2	100D	WD-32461/O
31978	100N - LIFT STATION #1 INFLUENT FLOW METER CALIBRATION	PM	RELEASED	2	100NLAGOON	1SS-31978/I
31979	100N LAGOON EFFLUENT FLOW METER DATA COLLECTION	PM	RELEASED	2	100NLAGOON	1SS-31979/P
32205	100N LAGOON EFFLUENT FLOW METER DATA COLLECTION	PM	RTS	2	100NLAGOON	1SS-32205/P
31720	100N LAGOON EFFLUENT FLOW METER DATA COLLECTION	PM	TO-CLOSE	2	100NLAGOON	1SS-31720/P
30413	100N LAGOON - REPLACE MISSING PLATES IN PANEL & IMPROVE LABELING		TO-PLAN	2	100NLAGOON	1SS-30413/C
30414	100N LAGOON - INSTALL LEVEL INDICATORS IN WEIRS #1 & #2		TO-PLAN	3	100NLAGOON	1SS-30414/M
32486	100N LAGOON EFFLUENT FLOW METER DATA COLLECTION	PM	WSCH	2	100NLAGOON	1SS-32486/P
31497	101B VALVE HOUSE RELAMP		PRE-WORK REVIEW	2	101B	WB-31497/C
30253	181B EYEWASH INSPECTION (DIESEL AREA) (SAFETY)	PM	OPS ACCEPTANCE	2	181B	WB-30253/P
31933	181B AIR COMPRESSOR	PM	PRE-WORK REVIEW	2	181B	WB-31933/P
32167	181B BATTERY PM'S (M,Q,A)	PM	PRE-WORK REVIEW	2	181B	WB-32167/P
32179	181B EYEWASH INSPECTION (BATTERY ROOM) (SAFETY)	PM	PRE-WORK REVIEW	2	181B	WB-32179/P
32180	181B EYEWASH INSPECTION (DIESEL AREA) (SAFETY)	PM	PRE-WORK REVIEW	2	181B	WB-32180/P
31941	181B - SWITCH, COMPRESSOR, ON/OFF (PS-2)	PM	RELEASED	2	181B	WB-31941/J
31934	181B - FUEL TANK MONITOR MONTHLY DATA COLLECTION	PM	RELEASED	2	181B	WB-31934/P
30838	181B - REPLACE BATTERY BANK AND CHARGER		RELEASED	2	181B	WB-30838/M
31479	181B - REMOVE EXPANDING INSULATION AND RESEAL / GROUT HOLES		RELEASED	2	181B	WB-31479/C
31470	181B - REPAINT ALL EXTERIOR DOORS		RELEASED	2	181B	WB-31470/C
31513	181B - COVER NORTH WALL VENT LOUVERS		RTS	2	181B	WB-31513/C
31476	181B - REMOVE INSULATION FROM RIVER PUMP ACCESS HATCH COVERS		RTS	2	181B	WB-31476/C
31936	181B BATTERY PM'S (M,Q,A)	PM	RTS	2	181B	WB-31936/P
31953	181B EYEWASH INSPECTION (BATTERY ROOM) (SAFETY)	PM	RTS	2	181B	WB-31953/P
31954	181B EYEWASH INSPECTION (DIESEL AREA) (SAFETY)	PM	RTS	2	181B	WB-31954/P

32165	181B - FUEL TANK MONITOR MONTHLY DATA COLLECTION	PM	RTS	2	181B	WB-32165/P
30233	181B BATTERY PM'S (M,Q,A)	PM	TO-CLOSE	2	181B	WB-30233/P
32566	181B - REMOVE OVERHEAD LIGHT FIXITURE		TO-PLAN	2	181B	WB-32566/M
32332	181B - CLEAN VENTILATION DUCTS AND INSTALL NEW SCREENS		TO-PLAN	2	181B	WB-32332/C
31472	181B - FAB / INSTALL TWO ROOF VENTS AND THREE SCREENS		TO-PLAN	2	181B	WB-31472/C
31473	181B - RESEAL ROOF		TO-PLAN	2	181B	WB-31473/C
30415	181B - REPLACE UNDERGROUND CONDUIT RUN FOR FUEL TANK		TO-PLAN	2	181B	WB-30415/C
30418	181B - MODIFY DIESEL ENGINE CRANKCASE EXHAUST		TO-PLAN	3	181B	WB-30418/M
30419	181B - RELOCATE CHECK VALVE IN COMPRESSED AIR SYSTEM		TO-PLAN	3	181B	WB-30419/M
30425	181B - ROOF REPAIRS FROM 05/14/2007 ROOF INSPECTION		TO-PLAN	3	181B	WB-30425/C
30455	181B - REPAIR LEAKS ON AIR COMPRESSOR REGULATOR AND POP-OFF VALVE		TO-PLAN	3	181B	WB-30455/C
31621	181B - REPAIR ROOFING AROUND PUMP / EQUIPMENT HATCH COVERS		TO-PLAN	2	181B	WB-31621/C
31493	181B - REMOVE FOAM INSULATION FROM DOORS & INSTALL DOOR SEALS & SECURE INT. DOORS		TO-PLAN	2	181B	WB-31493/C
31494	181B - REMOVE ROOM AT NW CORNER OF FACILITY		TO-PLAN	2	181B	WB-31494/W
31512	181B - REPLACE WOODEN DECK PLANKS		TO-PLAN	2	181B	WB-31512/C
32351	181B, AIR COMPRESSOR		TO-SCREEN	2	181B	WB-32351/C
32578	181B RELAMP EXTERIOR LIGHT ON BLDG		TO-SCREEN	2	181B	WB-32578/C
32356	181B		TO-SCREEN	2	181B	WB-32356/C
32421	181B - FUEL TANK MONITOR MONTHLY DATA COLLECTION	PM	WSCH	2	181B	WB-32421/P
32423	181B BATTERY PM'S (M,Q,A)	PM	WSCH	2	181B	WB-32423/P
32430	181B - SWITCH, RECEIVER LOW PRESSURE PS-1	PM	WSCH	2	181B	WB-32430/J
32437	181B EYEWASH INSPECTION (BATTERY ROOM) (SAFETY)	PM	WSCH	2	181B	WB-32437/P
32438	181B EYEWASH INSPECTION (DIESEL AREA) (SAFETY)	PM	WSCH	2	181B	WB-32438/P
32055	181D&182D RELAMP		OPS ACCEPTANCE	2	181D	WD-32055/C
32559	181D - RELAMP AND CLEAN BROKEN BLUB IN MCC ROOM (RUSH)		OPS ACCEPTANCE	2	181D	WD-32559/C
31511	181D - REMOVE VENTILATION SCREENS / CLEAN & REINSTALL		PRE-WORK REVIEW	2	181D	WD-31511/C
32187	181D EYEWASH INSPECTION (BATTERY ROOM) (SAFETY)	PM	PRE-WORK REVIEW	2	181D	WB-32187/P

32169	181D BATTERY PM'S (M,Q,A)	PM	PRE-WORK REVIEW	2	181D	WD-32169/P
31958	181D - SWITCH, COMPRESSOR, ON/OFF (PS-2)	PM	RELEASED	2	181D	WD-31958/J
31507	181D - RESTICT ACCESS TO STAIRS LEADING TO THE ROOF PLATFORM		RELEASED	2	181D	WD-31507/C
31555	181D - REMOVE ASBESTOS INSULATION ON PIPES (SAFETY)		RELEASED	2	181D	WD-31555/C
30433	181D - REMOVE INSULATION FROM RIVER PUMP ACCESS HATCH COVERS		RELEASED	2	181D	WD-30433/C
31938	181D BATTERY PM'S (M,Q,A)	PM	RTS	2	181D	WD-31938/P
31961	181D EYEWASH INSPECTION (BATTERY ROOM) (SAFETY)	PM	RTS	2	181D	WB-31961/P
30917	181D REPLACE CONDENSATE TRAP ON AIR COMPRESSOR		TO-PLAN	2	181D	WD-30917/C
30918	181D REPLACE RELIEF VALVES ON AIR SYSTEM		TO-PLAN	2	181D	WD-30918/C
30877	181D - CORRECT LOOSE BATTERY CONNECTIONS		TO-PLAN	2	181D	WD-30877/C
30498	181D - REPLACE MISSING BOLTS IN SWITCHGEAR PANELS		TO-PLAN	2	181D	WD-30498/C
30428	181D - SUPPORT MAINTENANCE AND TESTING OF SWITCHGEAR		TO-PLAN	2	181D	WD-30428/C
30430	181D - RELOCATE CHECK VALVE IN COMPRESSED AIR SYSTEM		TO-PLAN	2	181D	WD-30430/M
31620	181D - REPAIR ROOFING AROUND PUMP / EQUIPMENT HATCH COVERS		TO-PLAN	2	181D	WD-31620/C
31509	181D - PERFORM DOOR RELATED MAINTENACE & SIGNAGE		TO-PLAN	2	181D	WD-31509/C
31510	181D - REPLACE INTERIOR CONTROL ROOM CEILING TILES		TO-PLAN	2	181D	WD-31510/C
32425	181D BATTERY PM'S (M,Q,A)	PM	WSCH	2	181D	WD-32425/P
32439	181D AIR COMPRESSOR	PM	WSCH	2	181D	WD-32439/P
32460	181D - SWITCH, RECEIVER LOW PRESSURE PS-1	PM	WSCH	2	181D	WD-32460/J
32463	181D EYEWASH INSPECTION (BATTERY ROOM) (SAFETY)	PM	WSCH	2	181D	WB-32463/P
30939	182B - REPLACE #2 EXPORT PUMP MOTOR		OPS ACCEPTANCE	2	182B	WB-30939/C
32381	182B - PERFORM VIBRATION ANALYSIS #2 EXPORT PUMP MOTOR (URGENT)		OPS ACCEPTANCE	2	182B	WB-32381/C
31521	182B SURGE SUPPRESSER LIGHTS		ORIG	2	182B	WB-31521/C
31522	182B SURGE SUPPRESSER LIGHTS		ORIG	2	182B	
30216	182B - RACKOUT SPARE BREAKER E2X101		ORIG		182B	WB-30216/C
31673	182B - NORTH SWAMP COOLER	PM	PRE-WORK REVIEW	2	182B	WB-31673/P
31674	182B - SOUTH SWAMP COOLER	PM	PRE-WORK REVIEW	2	182B	WB-31674/P

31940	182B AIR COMPRESSOR #1	PM	PRE-WORK REVIEW	2	182B	WB-31940/P
31944	182B AIR COMPRESSOR #2	PM	PRE-WORK REVIEW	2	182B	WB-31944/P
32168	182B BATTERY PM'S (M,Q,A)	PM	PRE-WORK REVIEW	2	182B	WB-32168/P
32171	182B EYEWASH/SAFETY SHOWER INSPECTION (BATTERY AREA) (SAFETY)	PM	PRE-WORK REVIEW	2	182B	WB-32171/P
32172	182B EYEWASH/SAFETY SHOWER INSPECTION (LANDING) (SAFETY)	PM	PRE-WORK REVIEW	2	182B	WB-32172/P
32175	182B STANDBY DIESEL GENERATOR MONTHLY TEST	PM	PRE-WORK REVIEW	2	182B	WB-32175/O
32177	182B EYEWASH INSPECTION (BATTERY AREA) (SAFETY)	PM	PRE-WORK REVIEW	2	182B	WB-32177/P
32178	182B EYEWASH INSPECTION (DIESEL AREA) (SAFETY)	PM	PRE-WORK REVIEW	2	182B	WB-32178/P
32353	182B - REPLACE CLA VALVE CLAMP ON DISCHARGE LINE		PRE-WORK REVIEW	2	182B	WB-32353/C
32343	EXPORT PUMP #6 INSEPCTION & SERVICE		PRE-WORK REVIEW	2	182B	WB-32343/P
31948	182B STANDBY DIESEL GENERATOR MONTHLY TEST	PM	RELEASED	2	182B	WB-31948/O
31950	182B FLOW INDICATOR CALIBRATION, EXPORT WATER	PM	RELEASED	2	182B	WB-31950/I
31942	182B FLOW INDICATOR SENSOR CLEANING, EXPORT WATER	PM	RELEASED	2	182B	WB-31942/P
31816	182B SUMP PUMP LEVEL SWITCH ADJUSTMENT	PM	RELEASED	2	182B	WB-31816/J
31545	182B, RELAY, OVERLOAD, E2X97, PUMP #2	PM	RELEASED	2	182B	WB-31545/G
31546	182B, RELAY, OVERLOAD, E2X107, PUMP #6	PM	RELEASED	2	182B	WB-31546/G
31547	182B, RELAY, UNDERVOLTAGE, BUS #2	PM	RELEASED	2	182B	WB-31547/G
31548	182B, RELAYS, OVERCURRENT, E2X102, BUS TIE BREAKER	PM	RELEASED	2	182B	WB-31548/G
31549	182B, RELAYS, OVERCURRENT, E2X103, INCOMING LINE #1	PM	RELEASED	2	182B	WB-31549/G
31550	182B, RELAY, UNDERVOLTAGE, BUS #1	PM	RELEASED	2	182B	WB-31550/G
31551	182B, RELAY, OVERLOAD, E2X105, PUMP #4	PM	RELEASED	2	182B	WB-31551/G
31552	182B, RELAY, OVERLOAD, E2X106, PUMP #5	PM	RELEASED	2	182B	WB-31552/G
30162	182B - REPLACE DOUBLE DOORS ON RIVER WATER INLET HOUSE		RELEASED	2	182B	WB-30162/C
30067	182B STANDBY DIESEL GENERATOR MONTHLY TEST	PM	RELEASED	2	182B	WB-30067/O
30866	182B - REPAIR / REPLACE BROKEN ARC SHIELDS - AIR COMPRESSOR #2		RTS	3	182B	WB-30866/C
31643	182B, CONTACTOR, AIR BREAK, 2E34	PM	RTS	2	182B	WB-31643/P
31644	182B, CONTACTOR, AIR BREAK, 2E35	PM	RTS	2	182B	WB-31644/P

31645	182B, BREAKER, 2.4 KV VACUUM, 2E28	PM	RTS	2	182B	WB-31645/P
31648	182B, BREAKER, 2.4 KV VACUUM, 2E30	PM	RTS	2	182B	WB-31648/P
31651	182B, BREAKER, 2.4 KV VACUUM, 2E32	PM	RTS	2	182B	WB-31651/P
31937	182B BATTERY PM'S (M,Q,A)	PM	RTS	2	182B	WB-31937/P
31943	182B EYEWASH/SAFETY SHOWER INSPECTION (BATTERY AREA) (SAFETY)	PM	RTS	2	182B	WB-31943/P
31945	182B EYEWASH/SAFETY SHOWER INSPECTION (LANDING) (SAFETY)	PM	RTS	2	182B	WB-31945/P
31951	182B EYEWASH INSPECTION (BATTERY AREA) (SAFETY)	PM	RTS	2	182B	WB-31951/P
31952	182B EYEWASH INSPECTION (DIESEL AREA) (SAFETY)	PM	RTS	2	182B	WB-31952/P
31554	182B, CONTACTOR, AIR BREAK, 2E33	PM	SUSP-CONDITION	2	182B	WB-31554/P
32561	182B - REPLACE ANNUNCIATOR ALARM BELL / HORN (SAFETY)		TO-PLAN	2	182B	WB-32561/C
32569	182B - UPGRADE / REPLACE LIGHT FIXTURES IN OFFICE AREA		TO-PLAN	2	182B	WB-32569/M
32328	182B - REPLACE ASPHALT ROOF ON CONCRETE DECK		TO-PLAN	2	182B	WB-32328/C
30948	182B - NORTH SWAMP COOLER REPAIRS (SAFETY)		TO-PLAN	2	182B	WB-30948/C
30891	181B / 182B - RELAMP / REPAIR INTERIOR LIGHTING		TO-PLAN	2	182B	WB-30891/C
31466	182B - REPACK #2 EXPORT PUMP		TO-PLAN	2	182B	WB-31466/C
31467	182B - CHANGE OIL IN #2 EXPORT PUMP BEARINGS		TO-PLAN	2	182B	WB-31467/C
30497	182B - REPLACE MISSING BOLTS IN SWITCHGEAR PANELS		TO-PLAN	2	182B	WB-30497/C
30837	182B REPALCE EW-V-197, EXPORT WATER RECRIC VALVE TO RESERVOIR		TO-PLAN	2	182B	WB-30837/C
30163	SAFETY 182B - REPAIR DIESEL FUEL HEADER LEAKS ON DIESEL PUMP #2		TO-PLAN	2	182B	WB-30163/C
30416	182B - INSTALL 10" CLA-VAL		TO-PLAN	3	182B	WB-30416/C
30420	182B - RESOLVE VALVE & INSTRUMENT LABELING ISSUES		TO-PLAN	2	182B	WB-30420/C
30422	182B - REPAIR / REPLACE COOLING / FILTERED WATER PRV'S		TO-PLAN	3	182B	WB-30422/C
30423	182B - ROOF REPAIRS FROM 05/14/2007 ROOF INSPECTION		TO-PLAN	3	182B	WB-30423/C
30426	181B / 182B - INSTALL FLOW METERS ON DIESEL ENGINES		TO-PLAN	2	182B	WB-30426/M
30427	182B - T/S & REPAIR HEATER #K1-8-9		TO-PLAN	3	182B	WB-30427/C
31582	182B - REMOVE OLD CHLORINE SYSTEM PIPING		TO-PLAN	2	182B	WB-31582/D
31499	182B - REPAIR CHICKEN WIRE SCREENING		TO-PLAN	2	182B	WB-31499/C

31506	182B - REPLACE ROTTED SPACER BOARD ALONG EAST SIDE ROOF DECK.		TO-PLAN	2	182B	WB-31506/C
32385	182B EXTERIOR MAIN DOOR LIGHT - REPLAMP		TO-SCREEN	2	182B	WB-32385/C
32420	HUMAN MACHINE INTERFACE (HMI)	PM	WSCH	2	182B	WB-32420/P
32424	182B BATTERY PM'S (M,Q,A)	PM	WSCH	2	182B	WB-32424/P
32427	GAUGE, OIL ACCUMULATOR, 182-B	PM	WSCH	2	182B	WB-32427/I
32428	182B EYEWASH/SAFETY SHOWER INSPECTION (BATTERY AREA) (SAFETY)	PM	WSCH	2	182B	WB-32428/P
32429	182B EYEWASH/SAFETY SHOWER INSPECTION (LANDING) (SAFETY)	PM	WSCH	2	182B	WB-32429/P
32433	182B STANDBY DIESEL GENERATOR MONTHLY TEST	PM	WSCH	2	182B	WB-32433/O
32435	182B EYEWASH INSPECTION (BATTERY AREA) (SAFETY)	PM	WSCH	2	182B	WB-32435/P
32436	182B EYEWASH INSPECTION (DIESEL AREA) (SAFETY)	PM	WSCH	2	182B	WB-32436/P
31516	182D - REMOVE STAIRS FROM RIVER WATER INLET HOUSE (SAFETY)		PRE-WORK REVIEW	2	182D	WD-31516/D
32069	182D - SOUTH SURGE SUPPRESSOR LADDER HAZARD (SAFETY)		PRE-WORK REVIEW	2	182D	WD-32069/M
32184	182D EYEWASH/SAFETY SHOWER INSPECTION (BATTERY AREA) (SAFETY)	PM	PRE-WORK REVIEW	2	182D	WD-32184/P
32186	182D EYEWASH INSPECTION (BATTERY AREA) (SAFETY)	PM	PRE-WORK REVIEW	2	182D	WB-32186/P
32170	182D BATTERY PM'S (M,Q,A)	PM	PRE-WORK REVIEW	2	182D	WD-32170/P
31955	182D NORTH RESERVOIR LEVEL INDICATOR DATA COLLECTION	PM	RELEASED	2	182D	WD-31955/P
31561	182D - ASBESTOS CLEANUP (SAFETY)		RTS	2	182D	WD-31561/C
31939	182D BATTERY PM'S (M,Q,A)	PM	RTS	2	182D	WD-31939/P
31960	182D EYEWASH INSPECTION (BATTERY AREA) (SAFETY)	PM	RTS	2	182D	WB-31960/P
32181	182D NORTH RESERVOIR LEVEL INDICATOR DATA COLLECTION	PM	RTS	2	182D	WD-32181/P
32155	182D EYEWASH/SAFETY SHOWER INSPECTION (BATTERY AREA) (SAFETY)	PM	RTS	2	182D	WD-32155/P
32568	182D - T/S & REPAIR / REPACK PUMP #3 ROTOCHECK VALVE		TO-PLAN	2	182D	WD-32568/C
30889	182D - T/S & REPAIR CWP HEATER #UH-3		TO-PLAN	2	182D	WD-30889/C
30890	182D - T/S & REPAIR CWP HEATER #UH- 6		TO-PLAN	2	182D	WD-30890/C
30489	182D - T/S AND REPAIR INTERMITTENT OPERATION OF #6 EXPORT PUMP		TO-PLAN	3	182D	WD-30489/C

30434	182D - REPAIR ROOF DEFICIENCIES		TO-PLAN	2	182D	WD-30434/C
30435	182D - TROUBLESHOOT AND REPAIR #5 EXPORT WATER PUMP		TO-PLAN	3	182D	WD-30435/C
30429	182D - PERFORM MAINTENANCE ON SWITCHGEAR		TO-PLAN	2	182D	WD-30429/C
30431	182D - INSPECT / REPAIR / REPLACE BEARINGS ON #3 EXPORT PUMP		TO-PLAN	2	182D	WD-30431/C
30432	182D - REPLACE HV INDICATING LIGHT FIXTURE ON #6 EXPORT PUMP CONTACTOR		TO-PLAN	2	182D	WD-30432/C
32426	182D BATTERY PM'S (M,Q,A)	PM	WSCH	2	182D	WD-32426/P
32440	182D NORTH RESERVOIR LEVEL INDICATOR DATA COLLECTION	PM	WSCH	2	182D	WD-32440/P
32443	182D EYEWASH/SAFETY SHOWER INSPECTION (BATTERY AREA) (SAFETY)	PM	WSCH	2	182D	WD-32443/P
32444	EXPORT HEADER PRESSURE GAUGE	PM	WSCH	2	182D	WD-32444/I
32445	GAUGE, #1 AIR COMPRESSOR RCVR PRESSURE, 182-D	PM	WSCH	2	182D	WD-32445/I
32446	SWITCH, #1 AIR COMPRESSOR PRESSURE, 182-D	PM	WSCH	2	182D	WD-32446/I
32447	GAUGE, #2 AIR COMPRESSOR RCVR PRESSURE, 182-D	PM	WSCH	2	182D	WD-32447/I
32448	SWITCH, #2 AIR COMPRESSOR PRESSURE, 182-D	PM	WSCH	2	182D	WD-32448/I
32449	GAUGE, PUMP #3, 182-D	PM	WSCH	2	182D	WD-32449/I
32450	SWITCH, PRESS. #3 PUMP ROTOCHK, 182-D	PM	WSCH	2	182D	WD-32450/I
32451	GAUGE, PUMP #5, 182-D	PM	WSCH	2	182D	WD-32451/I
32452	SWITCH, PRESS. #5 PUMP ROTOCHK, 182-D	PM	WSCH	2	182D	WD-32452/I
32453	GAUGE, PUMP #2, 182-D	PM	WSCH	2	182D	WD-32453/I
32454	SWITCH, PRESS. #2 PUMP ROTOCHK, 182-D	PM	WSCH	2	182D	WD-32454/I
32455	GAUGE, PUMP #6, 182D	PM	WSCH	2	182D	WD-32455/I
32456	SWITCH, PRESS. #6 PUMP ROTOCHK, 182-D	PM	WSCH	2	182D	WD-32456/I
32457	GAUGE, OIL ACCUMULATOR, 182-D	PM	WSCH	2	182D	WD-32457/I
32458	182D AIR COMPRESSOR #1	PM	WSCH	2	182D	WD-32458/P
32459	182D AIR COMPRESSOR #2	PM	WSCH	2	182D	WD-32459/P
32462	182D EYEWASH INSPECTION (BATTERY AREA) (SAFETY)	PM	WSCH	2	182D	WB-32462/P
30394	1901Z - REPAIR / REPLACE PRESSURE TRANSMITTER #PT-2		TO-PLAN	2	1901Z	WB-30394/C
31834	200E - HMI COMPUTER SUPPORT	PM	OPS ACCEPTANCE	2	200E	WE-31834/P
32137	200E - HYDRANT 5E DISCONNECT		PRE-WORK REVIEW	2	200E	WE-32137/M

32158	GFCI TESTING, 200E WATER UTILITIES (SAFETY)	PM	PRE-WORK REVIEW	2	200E	WE-32158/P
32190	200E WASTE WATER MONTLY SURVEILLANCE	OPM	PRE-WORK REVIEW	2	200E	WE-32190/O
32203	283E, 282E, 282EC MONTHLY SAFETY INSPECTIONS (SAFETY)	PM	PRE-WORK REVIEW	2	200E	WE-32203/O
32311	200E - INSTALL FITTINGS ON CLEANOUTS AT VARIOUS LOCATIONS		RELEASED	2	200E	WE-32311/W
31976	283E, 282E, 282EC MONTHLY SAFETY INSPECTIONS (SAFETY)	PM	RELEASED	2	200E	WE-31976/O
31962	200E WASTE WATER MONTLY SURVEILLANCE	OPM	RELEASED	2	200E	WE-31962/O
31964	200E - HMI COMPUTER SUPPORT	PM	RELEASED	2	200E	WE-31964/P
32042	200E WU BUILDINGS 7652 INSPECTION		RELEASED	2	200E	WE-32042/O
31847	283E, 282E, 282EC MONTHLY SAFETY INSPECTIONS (SAFETY)	PM	RELEASED	2	200E	WE-31847/O
31697	200E WASTE WATER MONTLY SURVEILLANCE	OPM	RELEASED	2	200E	WE-31697/O
31831	200E WASTE WATER MONTLY SURVEILLANCE	OPM	RELEASED	2	200E	WE-31831/O
31085	200E - FABRICATE AND INSTALL VARIOUS ELECTRICAL LABELS		RELEASED	2	200E	WE-31085/C
30501	2607E8A - REPLACE SEWAGE PUMP #2		RELEASED	2	200E	WE-30501/C
30443	200E - MACHINE HANDWHEEL FOR 6" GEAR OPERATED GLOBE VALVE		RELEASED	3	200E	WE-30443/F
31923	LADDER INSPECTION WATER UTILITIES 200E/200W (SAFETY)	PM	RTS	2	200E	WW-31923/P
31926	GFCI TESTING, 200E WATER UTILITIES (SAFETY)	PM	RTS	2	200E	WE-31926/P
32194	200E - HMI COMPUTER SUPPORT	PM	RTS	2	200E	WE-32194/P
32593	2607E8A - REVIEW AND RESTORE PARAMETERS IN HYDRORANGER		SCREENED	2	200E	2SS-32593/C
30883	GATE #814 TRUCK FILL STATION - INSTALL CONTROL VALVE		TO-PLAN	3	200E	WE-30883/M
30457	200E - REPLACE GROUND AND DRAIN VALVE ON GATE 814 TRUCK FILL		TO-PLAN	2	200E	WE-30457/C
32138	HYDRANT #26E - REPLACE HYDRANT		TO-PLAN	2	200E	WE-32138/C
32405	GFCI TESTING, 200E WATER UTILITIES (SAFETY)	PM	WSCH	2	200E	WE-32405/P
32407	200E WU BUILDINGS 7652 INSPECTION		WSCH	2	200E	WE-32407/O
32466	200E WASTE WATER MONTLY SURVEILLANCE	OPM	WSCH	2	200E	WE-32466/O
32469	200E - HMI COMPUTER SUPPORT	PM	WSCH	2	200E	WE-32469/P
32484	283E, 282E, 282EC MONTHLY SAFETY INSPECTIONS (SAFETY)	PM	WSCH	2	200E	WE-32484/O
31900	200W - HMI COMPUTER SUPPORT	PM	OPS ACCEPTANCE	2	200W	WW-31900/P

32315	MO273 - REPAIR POTABLE WATER LEAK NORTH OF TRAILER		OPS ACCEPTANCE	1	200W	WW-32315/C
32159	GFCI TESTING 200W WATER UTILITIES (SAFETY)	PM	PRE-WORK REVIEW	2	200W	WW-32159/P
32037	283W, 282W, 282WC MONTHLY SAFETY INSPECTIONS (SAFETY)	PM	PRE-WORK REVIEW	2	200W	WW-32037/O
32221	200W WASTE WATER MONTHLY SURVEILLANCE	OPM	PRE-WORK REVIEW	2	200W	WW-32221/O
32591	MO291 - SET UP TUBE LOCK HANDRAIL AROUND SEWAGE VAULT		PRE-WORK REVIEW	3	200W	WW-32591/W
32279	283W, 282W, 282WC MONTHLY SAFETY INSPECTIONS (SAFETY)	PM	PRE-WORK REVIEW	2	200W	WW-32279/O
32013	200W - HMI COMPUTER SUPPORT	PM	RELEASED	2	200W	WW-32013/P
32044	200W WU BUILDINGS 7652 INSPECTION		RELEASED	2	200W	WW-32044/O
31994	200W WASTE WATER MONTHLY SURVEILLANCE	OPM	RELEASED	2	200W	WW-31994/O
31740	200W WASTE WATER MONTHLY SURVEILLANCE	OPM	RELEASED	2	200W	WW-31740/O
30486	200W - EXCAVATE AND REPAIR LEAK ON 20" RAW WATER LINE		RTS	2	200W	WW-30486/C
31873	200W WASTE WATER MONTHLY SURVEILLANCE	OPM	RTS	2	200W	WW-31873/O
31927	GFCI TESTING 200W WATER UTILITIES (SAFETY)	PM	RTS	2	200W	WW-31927/P
32241	200W - HMI COMPUTER SUPPORT	PM	RTS	2	200W	WW-32241/P
32065	200W - FABRICATE AND INSTALL VARIOUS ELECTRICAL LABELS		SCREENED	2	200W	WW-32065/C
31790	283W, 282W, 282WC MONTHLY SAFETY INSPECTIONS (SAFETY)	PM	TO-CLOSE	2	200W	WW-31790/O
30487	200W - REPLACE 182S VALVE AND POST INDICATOR		TO-PLAN	2	200W	WW-30487/C
30440	INSTALL RP BACKFLOW PREVENTERS ON WATER LINES TO ERDF		TO-PLAN	2	200W	WW-30440/M
30015	REBUILD CAISSON R22		TO-PLAN	2	200W	WW-30015/C
30471	200W - MODIFY S-LABS TRUCK FILL STATION		TO-PLAN	3	200W	WW-30471/M
30476	HARD PIPE SUPPLY TO ELEVATED WATER STORAGE TANK		TO-PLAN	2	200W	WW-30476/M
30481	200W - REPLACE 278WA LIFT STATION PUMPS		TO-PLAN	2	200W	WW-30481/C
30482	MO291 - T/S & REPAIR SEWAGE LIFT STATION CONTROLS		TO-PLAN	2	200W	WW-30482/C
32406	GFCI TESTING 200W WATER UTILITIES (SAFETY)	PM	WSCH	2	200W	WW-32406/P
32409	200W WU BUILDINGS 7652 INSPECTION		WSCH	2	200W	WW-32409/O
32509	200W WASTE WATER MONTHLY SURVEILLANCE	OPM	WSCH	2	200W	WW-32509/O
32533	200W - HMI COMPUTER SUPPORT	PM	WSCH	2	200W	WW-32533/P
32551	283W, 282W, 282WC MONTHLY SAFETY INSPECTIONS (SAFETY)	PM	WSCH	2	200W	WW-32551/O
32122	2607-E1, INSTALL 3" CAMLOCK FITTING		NPR-MAT	3	2607E1A	WE-32122/C

32558	2607EO SEWAGE STATION - T/S & REPAIR CONTROL PANEL PROBLEMS		RTS	2	2607EO	2SS-32558/C
30456	2607W1 - REPAIR ALTERNATOR ALARM HORN AND ALARM LIGHT		TO-PLAN	3	2607W1	WW-30456/C
31589	2607-W6 TROUBLESHOOT & REPAIR		RELEASED	2	2607W6	2SS-31589/C
30474	S LABS - REPLACE 222SA SEWAGE PUMP WITH 220V GRINDER TYPE		TO-PLAN	2	2607W6	WW-30474/M
30478	2607-W6, TROUBLESHOOT COMPUTER CONTROL PROBLEMS		TO-PLAN	2	2607W6	WW-30478/C
32304	274AW - FABRICATE & INSTALL VALVE LABELS		RELEASED	2	274AW	WE-32304/F
31114	282E - ANNUAL FLOW TEST, RAW WATER FIRE PUMP #3 (SAFETY)		COMP-REV	2	282E	WE-31114/O
31971	282E & 282EC WEEKLY FIRE PUMP TEST (SAFETY)	PM	PRE-WORK REVIEW	2	282E	WE-31971/O
31972	282E & 282EC WEEKLY FIRE PUMP TEST (SAFETY)	PM	PRE-WORK REVIEW	2	282E	WE-31972/O
32197	282E & 282EC WEEKLY FIRE PUMP TEST (SAFETY)	PM	PRE-WORK REVIEW	2	282E	WE-32197/O
32198	282E & 282EC WEEKLY FIRE PUMP TEST (SAFETY)	PM	PRE-WORK REVIEW	2	282E	WE-32198/O
32199	282E & 282EC WEEKLY FIRE PUMP TEST (SAFETY)	PM	PRE-WORK REVIEW	2	282E	WE-32199/O
32200	282E & 282EC WEEKLY FIRE PUMP TEST (SAFETY)	PM	PRE-WORK REVIEW	2	282E	WE-32200/O
32201	282E & 282EC WEEKLY FIRE PUMP TEST (SAFETY)	PM	PRE-WORK REVIEW	2	282E	WE-32201/O
32298	282E - REPACK #1 ERW FIRE PUMP		PRE-WORK REVIEW	2	282E	WE-32298/C
31969	282E & 282EC WEEKLY FIRE PUMP TEST (SAFETY)	PM	RELEASED	2	282E	WE-31969/O
31970	282E & 282EC WEEKLY FIRE PUMP TEST (SAFETY)	PM	RELEASED	2	282E	WE-31970/O
31841	282E & 282EC WEEKLY FIRE PUMP TEST (SAFETY)	PM	RELEASED	2	282E	WE-31841/O
31186	REPACK ERW PUMP#1 DISCHARGE VALVE ERW-V-114		RTS	2	282E	WE-31186/C
32189	282E SUMP LEVEL SWITCH HI SMPS-LSH-107B	PM	RTS	2	282E	WE-32189/J
30737	FIRE PUMP INSPECTION OF 282E ERW FP #1	PM	SUSP-CONDITION	2	282E	WE-30737/P
30738	FIRE PUMP INSPECTION OF 282E ERW FP #2	PM	SUSP-CONDITION	2	282E	WE-30738/P
30739	FIRE PUMP INSPECTION OF 282E ERW FP #3	PM	SUSP-CONDITION	2	282E	WE-30739/P
31840	282E & 282EC WEEKLY FIRE PUMP TEST (SAFETY)	PM	TO-CLOSE	2	282E	WE-31840/O
32577	282E - REMOVE / INSPECT / CLEAN OR REPLACE ERW FIRE PUMPS GERAND FLOW METER		TO-PLAN	2	282E	WE-32577/C
32297	282E - REPLACE AIR RELEASE VENT ON #3 ERW FIRE PUMP		TO-PLAN	2	282E	WE-32297/C
31154	282E - #1 EMERGENCY RAW WATER FIRE PUMP REPACK		TO-PLAN	2	282E	WE-31154/C

32473	282E & 282EC WEEKLY FIRE PUMP TEST (SAFETY)	PM	WSCH	2	282E	WE-32473/O
32474	282E & 282EC WEEKLY FIRE PUMP TEST (SAFETY)	PM	WSCH	2	282E	WE-32474/O
32475	282E & 282EC WEEKLY FIRE PUMP TEST (SAFETY)	PM	WSCH	2	282E	WE-32475/O
32476	282E & 282EC WEEKLY FIRE PUMP TEST (SAFETY)	PM	WSCH	2	282E	WE-32476/O
30459	282EB - REPLACE RESERVOIR FILL VALVE		TO-PLAN	2	282EB	WE-30459/M
30410	282EC - REPLACE RAW WATER FLOW METER		COMP-REV	2	282EC	WE-30410/M
30510	282EC - REPAIR / OVERHAUL / REPLACE RECIRC PUMP		OPS ACCEPTANCE	2	282EC	WE-30510/C
30736	FIRE PUMP INSPECTION OF 282EC ESW FP #1	PM	PRE-WORK REVIEW	2	282EC	WE-30736/P
32287	282EC - REPLACE DISCHARGE PRESSURE RELIEF VALVE ON #1 ESW FIRE PUMP		PRE-WORK REVIEW	2	282EC	WE-32287/C
32193	282EC FLOW INDICATOR SENSOR CLEANING, RW DISCH HEADER	PM	PRE-WORK REVIEW	2	282EC	WE-32193/P
31966	282EC PRESS SWITCH FOR CONTROLL 282EC-EDN-FPC-001 (SAFETY)	PM	RELEASED	2	282EC	WE-31966/I
31967	282EC TIME DELAY RELAY FOR 282EC-EDN-FPC-001 (SAFETY)	FTDR	RELEASED	2	282EC	WE-31967/P
32188	282EC SUMP LEVEL SWITCH SMPS-LSH-107-A	PM	RTS	2	282EC	WE-32188/J
30946	282EC - CHANGE PANCAKE POSITION ON ESW FIRE PUMP PRESSURE CONTROL LINE (EMERGENT)		TO-PLAN	2	282EC	WE-30946/C
30951	282EC - FABRICATE ELECTRICAL LABELS		TO-PLAN	2	282EC	WE-30951/C
30437	282EC - REPLACE CASING RELIEF VALVE #1 ESW FIRE PUMP		TO-PLAN	2	282EC	WE-30437/C
30834	282EC - CALIBRATE TEMPERATURE TRANSMITTER SW-TIT/TSL-104A		TO-PLAN	2	282EC	WE-30834/C
30835	282EC - CALIBRATE TEMPERATURE TRANSMITTER SW-TI/TSL-1002		TO-PLAN	2	282EC	WE-30835/C
30836	282EC - REPLACE AND CALIBRATE TEMPERATURE TRANSMITTER SW-TI/TSL-104B		TO-PLAN	2	282EC	WE-30836/M
30165	282EC - REMOVE / INSPECT / CLEAN AND REFURBISH GERAND FLOW METER		TO-PLAN	2	282EC	WE-30165/C
30424	282EC - REPAIR RW BOOSTER PUMP DISCHARGE CHECK VALVE		TO-PLAN	2	282EC	WE-30424/C
30460	282EC - TROUBLESHOOT AND REPAIR #1 RW BOOSTER PUMP VFD		TO-PLAN	3	282EC	WE-30460/C
30463	282EC - REPAIR/REPLACE ESW FIRE PUMP #1		TO-PLAN	3	282EC	WE-30463/C
30464	282EC - CONDUCT FLOW TEST ON EMERGENCY SANITARY		TO-PLAN	3	282EC	WE-30464/C

	WATER FIRE PUMP					
30465	282EC - CALIBRATE & INSTALL PRESSURE GAUGE		TO-PLAN	2	282EC	WE-30465/M
30466	282E - REPAIR DISCONNECT POSITION INDICATOR EDS-DISC-005		TO-PLAN	2	282EC	WE-30466/C
32465	HUMAN MACHINE INTERFACE (HMI)	PM	WSCH	2	282EC	WE-32465/P
31162	282ED RELAMP GENERATOR ANN. PANEL		COMP-REV	2	282ED	WE-31162/C
32202	282ED MONTHLY GENERATOR TEST	PM	PRE-WORK REVIEW	2	282ED	WE-32202/O
31975	282ED MONTHLY GENERATOR TEST	PM	RELEASED	2	282ED	WE-31975/O
31541	282ED REPAINT WOODEN STAIRS		SUSP-MAT	2	282ED	WE-31541/C
32143	282ED - CHANGE ANNUNCIATOR MODULES TO LED TYPE		TO-PLAN	2	282ED	WE-32143/C
32479	282ED MONTHLY GENERATOR TEST	PM	WSCH	2	282ED	WE-32479/O
32024	282W & 282WC WEEKLY FIRE PUMP TEST (SAFETY)	PM	PRE-WORK REVIEW	2	282W	WW-32024/O
32025	282W & 282WC WEEKLY FIRE PUMP TEST (SAFETY)	PM	PRE-WORK REVIEW	2	282W	WW-32025/O
32299	282W - T/S & REPAIR LOOSE DISCHARGE EXPANSION JOINT ON #2 ERW FIRE PUMP		PRE-WORK REVIEW	2	282W	WW-32299/C
32301	282W - CLEAN & LUBE ERW-V-127 / #1 ERW FIRE PUMP DISCHARGE VALVE		PRE-WORK REVIEW	2	282W	WW-32301/C
32262	282W & 282WC WEEKLY FIRE PUMP TEST (SAFETY)	PM	PRE-WORK REVIEW	2	282W	WW-32262/O
32263	282W & 282WC WEEKLY FIRE PUMP TEST (SAFETY)	PM	PRE-WORK REVIEW	2	282W	WW-32263/O
32264	282W & 282WC WEEKLY FIRE PUMP TEST (SAFETY)	PM	PRE-WORK REVIEW	2	282W	WW-32264/O
32265	282W & 282WC WEEKLY FIRE PUMP TEST (SAFETY)	PM	PRE-WORK REVIEW	2	282W	WW-32265/O
32266	282W & 282WC WEEKLY FIRE PUMP TEST (SAFETY)	PM	PRE-WORK REVIEW	2	282W	WW-32266/O
32308	PROVIDE SUPPORT FOR PROJECT L-311 282W RAW WATER RESERVOIR RE-LINING		RELEASED	2	282W	WW-32308/O
32023	282W & 282WC WEEKLY FIRE PUMP TEST (SAFETY)	PM	RELEASED	2	282W	WW-32023/O
31910	282W & 282WC WEEKLY FIRE PUMP TEST (SAFETY)	PM	RELEASED	2	282W	WW-31910/O
31776	282W & 282WC WEEKLY FIRE PUMP TEST (SAFETY)	PM	RELEASED	2	282W	WW-31776/O
30516	282W - REPLACE SUMP PUMP, CONTROL PANEL AND FLOATS		RELEASED	2	282W	WW-30516/C
32022	282W & 282WC WEEKLY FIRE PUMP TEST (SAFETY)	PM	RTS	2	282W	WW-32022/O
32245	PRESS INDIC, ERW DISCH HDR (ERW-PI-103), 282W	PM	RTS	2	282W	WW-32245/I
32246	PRESS IND, #1 ERW EMER PMP SUCT(ERW-PI-108-A),282W	PM	RTS	2	282W	WW-32246/I
32247	PRES IND, #1 ERW BSTR PMP DISCH(ERW-PI-108-B),282W	PM	RTS	2	282W	WW-32247/I

32248	PRES IND, #2 ERW EMER PMP SUCT (ERW-PI-109-A),282W	PM	RTS	2	282W	WW-32248/I
32249	PRES IND, #2 RW BOOST PMP DISCH(ERW-PI-109-B),282W	PM	RTS	2	282W	WW-32249/I
32250	FLOW INDIC, ERW PUMP TEST LOOP(ERW-FI-112),282W	PM	RTS	2	282W	WW-32250/I
32251	LEVEL SWITCH, ERW STOR RESER LO (ERW-LSL-102),282	PM	RTS	2	282W	WW-32251/I
32252	LEVEL SWITCH, ERW RESERV HI (ERW-LSH-102), 282W	PM	RTS	2	282W	WW-32252/P
32253	PRESS SWITCH, ERW DISCH HDR LO (RW-PSL/H-103),282W	PM	RTS	2	282W	WW-32253/I
32254	PRESS XMTR, ERW DISCH HDR (ERW-PT-103G) 282W	PM	RTS	2	282W	WW-32254/I
32255	LEVEL XMTR, ERW STORG RESERV (ERW-LT-102),282W	PM	RTS	2	282W	WW-32255/I
32256	PRESS SWITCH, ERW DISCH HDR HI (ERW-PSH-100),282W	PM	RTS	2	282W	WW-32256/I
32259	282W LEVEL SWITCH, BLDG DRAIN SUMP HI (SMPS-LSH-107-B)	PM	RTS	2	282W	WW-32259/J
32260	282W PRESS SWITCH FOR CONTROLLER 282W-EDN-FPC-001 (SAFETY)	PM	RTS	2	282W	WW-32260/I
32261	282W TIME DELAY RELAY, 282W-EDN-FPC-001 (SAFETY)	FTDR	RTS	2	282W	WW-32261/P
31908	282W & 282WC WEEKLY FIRE PUMP TEST (SAFETY)	PM	TO-CLOSE	2	282W	WW-31908/O
32576	282W - REMOVE / INSPECT / CLEAN OR REPLACE ERW FIRE PUMPS GERAND FLOW METER		TO-PLAN	2	282W	WW-32576/C
32300	282W - REPLACE AIR RELEASE VENT ON #1 ERW FIRE PUMP		TO-PLAN	2	282W	WW-32300/C
32505	282W - ANNUAL FLOW TEST, RAW WATER FIRE PUMP #1 (SAFETY)		WSCH	2	282W	WW-32505/O
32508	FIRE PUMP INSPECTION OF 282W ERW FP #1	PM	WSCH	2	282W	WW-32508/P
32539	282W & 282WC WEEKLY FIRE PUMP TEST (SAFETY)	PM	WSCH	2	282W	WW-32539/O
32540	282W & 282WC WEEKLY FIRE PUMP TEST (SAFETY)	PM	WSCH	2	282W	WW-32540/O
32541	282W & 282WC WEEKLY FIRE PUMP TEST (SAFETY)	PM	WSCH	2	282W	WW-32541/O
32542	282W & 282WC WEEKLY FIRE PUMP TEST (SAFETY)	PM	WSCH	2	282W	WW-32542/O
30022	282WC - REPLACE ESW-V-111		NPR-MAT	2	282WC	WW-30022/C
30011	282WC - REPAIR / OVERHAUL / REPLACE JOCKEY PUMP		OPS ACCEPTANCE	2	282WC	WW-30011/C
31905	FIRE PUMP TEST LOOP FLOW INDICATOR, 282WC	PM	OPS ACCEPTANCE	2	282WC	WW-31905/I
30773	FIRE PUMP INSPECTION OF 282WC ESW FP #1	PM	PRE-WORK REVIEW	2	282WC	WW-30773/P
32258	282WC LEVEL SWITCH, PS SUMP (SMPS-LSH-107-A)	PM	RTS	2	282WC	WW-32258/J
30831	282WC - CALIBRATE TEMPERATURE TRANSMITTER SW-TIT/TSL-104A		TO-PLAN	2	282WC	WW-30831/C

30832	282WC - CALIBRATE TEMPERATURE TRANSMITTER SW-TI/TSL-1002		TO-PLAN	2	282WC	WW-30832/C
30833	282WC - REPLACE AND CALIBRATE TEMPERATURE TRANSMITTER SW-TI/TSL-104B		TO-PLAN	2	282WC	WW-30833/M
30164	282WC - REMOVE / INSPECT /CLEAN GERAND FLOW METER #1 ESW FIRE PUMP		TO-PLAN	2	282WC	WW-30164/C
30030	282WC - RECONFIGURE RECIRC PUMP DISCHARGE PIPING		TO-PLAN	2	282WC	WW-30030/M
30470	282WC - INSTALL LED LAMPS IN ANNUNCIATOR		TO-PLAN	3	282WC	WW-30470/C
30479	282WC - REPAIR / REPLACE ESW FIRE PUMP #1		TO-PLAN	2	282WC	WW-30479/C
30483	282WC - CONDUCT FLOW TEST ON EMERGENCY SANITARY WATER FIRE PUMP		TO-PLAN	3	282WC	WW-30483/C
30485	282WC REPLACE 2" FILL VALVE TO 283WA RESERVOIR		TO-PLAN	3	282WC	WW-30485/M
32503	HUMAN MACHINE INTERFACE (HMI)	PM	WSCH	2	282WC	WW-32503/P
32036	282WD MONTHLY GENERATOR TEST	PM	PRE-WORK REVIEW	2	282WD	WW-32036/O
32278	282WD MONTHLY GENERATOR TEST	PM	PRE-WORK REVIEW	2	282WD	WW-32278/O
31789	282WD MONTHLY GENERATOR TEST	PM	RELEASED	2	282WD	WW-31789/O
30473	282WD - REPLACE BATTERY CHARGER		TO-PLAN	2	282WD	WW-30473/C
32142	282WD - CHANGE ANNUNCIATOR MODULES TO LED TYPE		TO-PLAN	2	282WD	WW-32142/M
32396	282WD - CHANGE ANNUNCIATOR MODULES TO LED TYPE		TO-PLAN	2	282WD	WW-32396/M
32550	282WD MONTHLY GENERATOR TEST	PM	WSCH	2	282WD	WW-32550/O
30927	283E FABRICATE EQUIPMENT IDENTIFICATION LABELS		PRE-WORK REVIEW	2	283E	WE-30927/F
32204	283E EYEWASH INSPECTION (PIPE GALLERY- MAIN LEVEL) (SAFETY)	PM	PRE-WORK REVIEW	2	283E	WB-32204/P
31973	283E - PH PROBE LOOP CALIBRATION, 10" SW EFFLUENT	PM	RELEASED	2	283E	WE-31973/J
31974	283E - PH PROBE LOOP CALIBRATION, 8" SW EFFLUENT	PM	RELEASED	2	283E	WE-31974/J
31963	283E HACH CL17 CHLORINE ANALYZER	PM	RELEASED	2	283E	WE-31963/I
31968	283E HACH CL17 CHLORINE ANALYZER	PM	RELEASED	2	283E	WE-31968/I
31977	283E EYEWASH INSPECTION (PIPE GALLERY- MAIN LEVEL) (SAFETY)	PM	RTS	2	283E	WB-31977/P
32191	283E HACH CL17 CHLORINE ANALYZER	PM	RTS	2	283E	WE-32191/I
32192	283E SUMP LEVEL SWITCH, HIGH	PM	RTS	2	283E	WE-32192/J
32196	283E HACH CL17 CHLORINE ANALYZER	PM	RTS	2	283E	WE-32196/I

30387	283E DOOR SEALS		SUSP-CONDITION	2	283E	WE-30387/C
31227	283E CLEARWELL HATCHWAY AND VENT INSPECTION	OPM	TO-CLOSE	2	283E	WE-31227/O
32567	283E - REPLACE HOT WATER HEATER (URGENT)		TO-PLAN	2	283E	WE-32567/C
30868	283E - TERMINATE OVERFLOW FROM #2 CLEARWELL		TO-PLAN	2	283E	WE-30868/M
31119	283E - INSTALL GENERATOR FOR WATER TRUCK HEATING		TO-PLAN	2	283E	WE-31119/M
30436	283E - PAINT SOUTH SIDE ENCLOSURE		TO-PLAN	3	283E	WE-30436/C
30458	283E - REPLACE UPS IN MAIN PLC CABINET		TO-PLAN	2	283E	WE-30458/M
30462	283E - REMOVE DEAD LEG PIPING		TO-PLAN	3	283E	WE-30462/M
31540	283E - REMOVE OLD STEAM HEATERS FROM FACILITY		TO-PLAN	2	283E	WE-31540/D
32085	283E - FILTER PLANT RESTROOM - TOLIET & HOT WATER TANK LEAKING		TO-SCREEN	2	283E	WE-32085/C
32464	HUMAN MACHINE INTERFACE (HMI)	PM	WSCH	2	283E	WE-32464/P
32467	283E HACH CL17 CHLORINE ANALYZER	PM	WSCH	2	283E	WE-32467/I
32468	283E CLEARWELL HATCHWAY AND VENT INSPECTION	OPM	WSCH	2	283E	WE-32468/O
32471	283E TEMP. PROBE QUARTERLY CAL. (SW-TI-001)	PM	WSCH	2	283E	WE-32471/I
32472	283E HACH CL17 CHLORINE ANALYZER	PM	WSCH	2	283E	WE-32472/I
32477	283E - PH PROBE LOOP CALIBRATION, 10" SW EFFLUENT	PM	WSCH	2	283E	WE-32477/J
32478	283E - PH PROBE LOOP CALIBRATION, 8" SW EFFLUENT	PM	WSCH	2	283E	WE-32478/J
32480	283E SAMPLE LINE ROTAMETER CLEANING, 8" EFFLUENT	PM	WSCH	2	283E	WE-32480/P
32482	283E SAMPLE LINE ROTAMETER CLEANING, 10" EFFLUENT	PM	WSCH	2	283E	WE-32482/P
32485	283E EYEWASH INSPECTION (PIPE GALLERY- MAIN LEVEL) (SAFETY)	PM	WSCH	2	283E	WB-32485/P
31150	CALIBRATE WATER COUNTER ON TRUCK		RELEASED	2	283EA	WE-31150/C
31152	CALIBRATE WATER COUNTER ON TRUCK		RELEASED	2	283EA	WE-31152/C
30992	283W ALUM FLOOR HOIST ANNUAL (ELECTRICAL)	PM	COMP-REV	2	283W	WW-30992/P
31896	283W RAW WATER LOW PRESS SWITCH	PM	COMP-REV	2	283W	WW-31896/I
30862	EMERGENT 283W REPLACE ROBERTS VALVE #1 FILTER INFLUENT VALVE		NPR-MAT	2	283W	WW-30862/C
30187	EMERGENT 283W TROUBLESHOOT AND REPAIR #2 POTABLE WATER PUMP		NPR-MAT	2	283W	WW-30187/C
31898	283W, 8" SANITARY WATER HEADER PRESSURE GAUGE CALIBRATION	PM	OPS ACCEPTANCE	2	283W	WW-31898/I

31877	283W FILTER #1 EFFLUENT TURBIDIMETER CALIBRATION	PM	OPS ACCEPTANCE	2	283W	WW-31877/I
31878	283W FILTER #1 EFFLUENT TURBIDIMETER CALIBRATION	PM	OPS ACCEPTANCE	2	283W	WW-31878/I
31879	283W FILTER #1 EFFLUENT TURBIDIMETER CALIBRATION	PM	OPS ACCEPTANCE	2	283W	WW-31879/I
31883	283W FILTER #2 EFFLUENT TURBIDIMETER CALIBRATION	PM	OPS ACCEPTANCE	2	283W	WW-31883/I
31884	283W FILTER #2 EFFLUENT TURBIDIMETER CALIBRATION	PM	OPS ACCEPTANCE	2	283W	WW-31884/I
31888	283W FILTER #3 EFFLUENT TURBIDIMETER CALIBRATION	PM	OPS ACCEPTANCE	2	283W	WW-31888/I
31889	283W FILTER #3 EFFLUENT TURBIDIMETER CALIBRATION	PM	OPS ACCEPTANCE	2	283W	WW-31889/I
31893	283W CLEARWELL 1720C TURBIDIMETER CALIBRATION	PM	OPS ACCEPTANCE	2	283W	WW-31893/I
31894	283W CLEARWELL 1720C TURBIDIMETER CALIBRATION	PM	OPS ACCEPTANCE	2	283W	WW-31894/I
31895	283W, 10" SANITARY WATER HEADER PRESSURE GAUGE CALIBRATION	PM	OPS ACCEPTANCE	2	283W	WW-31895/I
31871	283W CHLORINE DETECTOR FUNCTIONAL TEST (SAFETY)	PM	OPS ACCEPTANCE	2	283W	WW-31871/P
31918	283W CONDUCTIVITY METER ANALYZER	PM	OPS ACCEPTANCE	2	283W	WW-31918/I
31919	CONDUCTIVITY METER ANALYZER	PM	OPS ACCEPTANCE	2	283W	WW-31919/I
31799	PORTABLE HACH SENSION1 PH ANALYZER CALIBRATION	PM	OPS ACCEPTANCE	2	283W	WW-31799/I
31800	PORTABLE HACH SENSION1 PH ANALYZER CALIBRATION	PM	OPS ACCEPTANCE	2	283W	WW-31800/I
31801	PORTABLE HACH SENSION1 PH ANALYZER CALIBRATION	PM	OPS ACCEPTANCE	2	283W	WW-31801/I
31802	PORTABLE HACH SENSION1 PH ANALYZER CALIBRATION	PM	OPS ACCEPTANCE	2	283W	WW-31802/I
31851	283W RAW WATER TURBIDIMETER CLEANING	PM	OPS ACCEPTANCE	2	283W	WW-31851/I
31854	283W FILTER #3 EFFLUENT TURBIDIMETER CLEANING	PM	OPS ACCEPTANCE	2	283W	WW-31854/I
31855	283W CLEARWELL TURBIDIMETER CLEANING	PM	OPS ACCEPTANCE	2	283W	WW-31855/I
31859	283W COMBINED FILTER EFFLUENT TURBIDIMETER CALIBRATION	PM	OPS ACCEPTANCE	2	283W	WW-31859/I
31860	283W COMBINED FILTER EFFLUENT TURBIDIMETER CALIBRATION	PM	OPS ACCEPTANCE	2	283W	WW-31860/I
31763	283W CLEARWELL HATCHWAY AND VENT INSPECTION	OPM	PRE-WORK REVIEW	2	283W	WW-31763/O
31867	283W ALUM FEEDER #1	PM	PRE-WORK REVIEW	2	283W	WW-31867/P
31868	283W ALUM FEEDER #2	PM	PRE-WORK REVIEW	2	283W	WW-31868/P
31931	PORTABLE HACH SENSION1 PH ANALYZER CALIBRATION	PM	PRE-WORK REVIEW	2	283W	WW-31931/I
32031	283W CHLORINE DETECTOR FUNC TESTS (OPERATIONS) (SAFETY)	PM	PRE-WORK REVIEW	2	283W	WW-32031/O

32032	283W CHLORINE DETECTOR FUNC TESTS (OPERATIONS) (SAFETY)	PM	PRE-WORK REVIEW	2	283W	WW-32032/O
32018	283W CHLORINATOR #1 ANNUAL PM	PM	PRE-WORK REVIEW	2	283W	WW-32018/O
32020	283W CHLORINATOR #2 ANNUAL PM	PM	PRE-WORK REVIEW	2	283W	WW-32020/O
32285	283W EYEWASH INSPECTION (ALUM FLOOR) (SAFETY)	PM	PRE-WORK REVIEW	2	283W	WB-32285/P
32271	283W CHLORINE HOIST ANNUAL (ELECTRICAL)	PM	PRE-WORK REVIEW	2	283W	WW-32271/P
32273	283W CHLORINE DETECTOR FUNC TESTS (OPERATIONS) (SAFETY)	PM	PRE-WORK REVIEW	2	283W	WW-32273/O
32274	283W CHLORINE DETECTOR FUNC TESTS (OPERATIONS) (SAFETY)	PM	PRE-WORK REVIEW	2	283W	WW-32274/O
32275	283W CHLORINE DETECTOR FUNC TESTS (OPERATIONS) (SAFETY)	PM	PRE-WORK REVIEW	2	283W	WW-32275/O
32276	283W CHLORINE DETECTOR FUNC TESTS (OPERATIONS) (SAFETY)	PM	PRE-WORK REVIEW	2	283W	WW-32276/O
32277	283W CHLORINE DETECTOR FUNC TESTS (OPERATIONS) (SAFETY)	PM	PRE-WORK REVIEW	2	283W	WW-32277/O
32572	283W - T/S & REPAIR FLOWMETER		RELEASED	2	283W	WW-32572/C
32360	283W - REPLACE DRIVE BELT #3 FLOC DRIVE (EMERGENT)		RELEASED	2	283W	WW-32360/C
32366	283W - FABRICATE "DANGER - PERMIT REQUIRED CONFINED SPACE" SIGNS		RELEASED	2	283W	WW-32366/F
32557	283W - FLOWMETER CALIBRATION, 16" CLEARWELL EFFLUENT HEADER	PM	RELEASED	2	283W	WW-32557/I
31996	283W FILTER #1 EFFLUENT TURBIDIMETER CALIBRATION	PM	RELEASED	2	283W	WW-31996/I
31997	283W FILTER #1 EFFLUENT TURBIDIMETER CALIBRATION	PM	RELEASED	2	283W	WW-31997/I
31998	283W FILTER #1 EFFLUENT TURBIDIMETER CALIBRATION	PM	RELEASED	2	283W	WW-31998/I
31999	283W FILTER #1 EFFLUENT TURBIDIMETER CALIBRATION	PM	RELEASED	2	283W	WW-31999/I
32000	283W FILTER #2 EFFLUENT TURBIDIMETER CALIBRATION	PM	RELEASED	2	283W	WW-32000/I
32001	283W FILTER #2 EFFLUENT TURBIDIMETER CALIBRATION	PM	RELEASED	2	283W	WW-32001/I
32002	283W FILTER #2 EFFLUENT TURBIDIMETER CALIBRATION	PM	RELEASED	2	283W	WW-32002/I
32003	283W FILTER #2 EFFLUENT TURBIDIMETER CALIBRATION	PM	RELEASED	2	283W	WW-32003/I
32004	283W FILTER #3 EFFLUENT TURBIDIMETER CALIBRATION	PM	RELEASED	2	283W	WW-32004/I
32005	283W FILTER #3 EFFLUENT TURBIDIMETER CALIBRATION	PM	RELEASED	2	283W	WW-32005/I
32006	283W FILTER #3 EFFLUENT TURBIDIMETER CALIBRATION	PM	RELEASED	2	283W	WW-32006/I

32007	283W FILTER #3 EFFLUENT TURBIDIMETER CALIBRATION	PM	RELEASED	2	283W	WW-32007/I
32008	283W CLEARWELL 1720C TURBIDIMETER CALIBRATION	PM	RELEASED	2	283W	WW-32008/I
32009	283W CLEARWELL 1720C TURBIDIMETER CALIBRATION	PM	RELEASED	2	283W	WW-32009/I
32010	283W CLEARWELL 1720C TURBIDIMETER CALIBRATION	PM	RELEASED	2	283W	WW-32010/I
32011	283W CLEARWELL 1720C TURBIDIMETER CALIBRATION	PM	RELEASED	2	283W	WW-32011/I
32012	283W - RAW WATER PH PROBE LOOP CALIBRATION	PM	RELEASED	2	283W	WW-32012/I
32015	200W - HMI COMPUTER SUPPORT	PM	RELEASED	2	283W	WW-32015/P
32017	283W RAW WATER TURBIDIMETER CALIBRATION	PM	RELEASED	2	283W	WW-32017/I
32026	283W - PH PROBE LOOP CALIBRATION, 10" SW EFFLUENT	PM	RELEASED	2	283W	WW-32026/I
32027	283W - PH PROBE LOOP CALIBRATION, 8" SW EFFLUENT	PM	RELEASED	2	283W	WW-32027/I
32029	283W CHLORINE DETECTOR FUNC TESTS (OPERATIONS) (SAFETY)	PM	RELEASED	2	283W	WW-32029/O
32030	283W CHLORINE DETECTOR FUNC TESTS (OPERATIONS) (SAFETY)	PM	RELEASED	2	283W	WW-32030/O
32038	283W CONDUCTIVITY METER ANALYZER	PM	RELEASED	2	283W	WW-32038/I
32039	CONDUCTIVITY METER ANALYZER	PM	RELEASED	2	283W	WW-32039/I
31981	283W RAW WATER TURBIDIMETER CLEANING	PM	RELEASED	2	283W	WW-31981/I
31982	283W FILTER #1 EFFLUENT TURBIDIMETER CLEANING	PM	RELEASED	2	283W	WW-31982/I
31983	283W FILTER #2 EFFLUENT TURBIDIMETER CLEANING	PM	RELEASED	2	283W	WW-31983/I
31984	283W FILTER #3 EFFLUENT TURBIDIMETER CLEANING	PM	RELEASED	2	283W	WW-31984/I
31985	283W CLEARWELL TURBIDIMETER CLEANING	PM	RELEASED	2	283W	WW-31985/I
31986	283W COMBINED FILTER EFFLUENT TURBIDIMETER CALIBRATION	PM	RELEASED	2	283W	WW-31986/I
31987	283W COMBINED FILTER EFFLUENT TURBIDIMETER CALIBRATION	PM	RELEASED	2	283W	WW-31987/I
31988	283W COMBINED FILTER EFFLUENT TURBIDIMETER CALIBRATION	PM	RELEASED	2	283W	WW-31988/I
31989	283W COMBINED FILTER EFFLUENT TURBIDIMETER CALIBRATION	PM	RELEASED	2	283W	WW-31989/I
31990	283W COMBINED FILTER EFFLUENT TURBIDIMETER CLEANING	PM	RELEASED	2	283W	WW-31990/I
31993	283W CHLORINE DETECTOR FUNCTIONAL TEST (SAFETY)	PM	RELEASED	2	283W	WW-31993/P
31914	283W CHLORINE DETECTOR FUNC TESTS (OPERATIONS)	PM	RELEASED	2	283W	WW-31914/O

	(SAFETY)					
31915	283W CHLORINE DETECTOR FUNC TESTS (OPERATIONS) (SAFETY)	PM	RELEASED	2	283W	WW-31915/O
31928	PORTABLE HACH SENSION1 PH ANALYZER CALIBRATION	PM	RELEASED	2	283W	WW-31928/I
31929	PORTABLE HACH SENSION1 PH ANALYZER CALIBRATION	PM	RELEASED	2	283W	WW-31929/I
31930	PORTABLE HACH SENSION1 PH ANALYZER CALIBRATION	PM	RELEASED	2	283W	WW-31930/I
31666	283W FLOWMETER CALIBRATION, 16" CLEARWELL EFFLUENT HEADER	PM	RELEASED	2	283W	WW-31666/I
31864	283W FLOCCULATOR #1	PM	RELEASED	2	283W	WW-31864/P
31865	283W FLOCCULATOR #2	PM	RELEASED	2	283W	WW-31865/P
30645	283W - REPLACE #3 FILTER HYDRAULIC LINES		RELEASED	2	283W	WW-30645/C
30136	283W CHLORINATOR #1 SEMI-ANNUAL PM (CL2-W1)	PM	RELEASED	2	283W	WW-30136/O
30138	283W CHLORINATOR #2 SEMI-ANNUAL PM (CL2-W2)	PM	RELEASED	2	283W	WW-30138/O
31995	283W HACH CL17 CHLORINE ANALYZER	PM	RTS	2	283W	WW-31995/I
32160	PORTABLE HACH SENSION1 PH ANALYZER CALIBRATION	PM	RTS	2	283W	WW-32160/I
32161	PORTABLE HACH SENSION1 PH ANALYZER CALIBRATION	PM	RTS	2	283W	WW-32161/I
32162	PORTABLE HACH SENSION1 PH ANALYZER CALIBRATION	PM	RTS	2	283W	WW-32162/I
32163	PORTABLE HACH SENSION1 PH ANALYZER CALIBRATION	PM	RTS	2	283W	WW-32163/I
32040	283W EYEWASH INSPECTION (ALUM FLOOR) (SAFETY)	PM	RTS	2	283W	WB-32040/P
32207	283W RAW WATER TURBIDIMETER CLEANING	PM	RTS	2	283W	WW-32207/I
32208	283W FILTER #1 EFFLUENT TURBIDIMETER CLEANING	PM	RTS	2	283W	WW-32208/I
32209	283W FILTER #2 EFFLUENT TURBIDIMETER CLEANING	PM	RTS	2	283W	WW-32209/I
32210	283W FILTER #3 EFFLUENT TURBIDIMETER CLEANING	PM	RTS	2	283W	WW-32210/I
32211	283W CLEARWELL TURBIDIMETER CLEANING	PM	RTS	2	283W	WW-32211/I
32212	283W COMBINED FILTER EFFLUENT TURBIDIMETER CALIBRATION -	PM	RTS	2	283W	WW-32212/I
32213	283W COMBINED FILTER EFFLUENT TURBIDIMETER CALIBRATION	PM	RTS	2	283W	WW-32213/I
32214	283W COMBINED FILTER EFFLUENT TURBIDIMETER CALIBRATION	PM	RTS	2	283W	WW-32214/I
32215	283W COMBINED FILTER EFFLUENT TURBIDIMETER CALIBRATION	PM	RTS	2	283W	WW-32215/I

32216	283W COMBINED FILTER EFFLUENT TURBIDIMETER CLEANING	PM	RTS	2	283W	WW-32216/I
32218	283W CHLORINE DETECTOR FUNCTIONAL TEST (SAFETY)	PM	RTS	2	283W	WW-32218/P
32222	283W HACH CL17 CHLORINE ANALYZER	PM	RTS	2	283W	WW-32222/I
32223	283W FILTER #1 EFFLUENT TURBIDIMETER CALIBRATION	PM	RTS	2	283W	WW-32223/I
32224	283W FILTER #1 EFFLUENT TURBIDIMETER CALIBRATION	PM	RTS	2	283W	WW-32224/I
32225	283W FILTER #1 EFFLUENT TURBIDIMETER CALIBRATION	PM	RTS	2	283W	WW-32225/I
32226	283W FILTER #1 EFFLUENT TURBIDIMETER CALIBRATION	PM	RTS	2	283W	WW-32226/I
32227	283W FILTER #2 EFFLUENT TURBIDIMETER CALIBRATION	PM	RTS	2	283W	WW-32227/I
32228	283W FILTER #2 EFFLUENT TURBIDIMETER CALIBRATION	PM	RTS	2	283W	WW-32228/I
32229	283W FILTER #2 EFFLUENT TURBIDIMETER CALIBRATION	PM	RTS	2	283W	WW-32229/I
32230	283W FILTER #2 EFFLUENT TURBIDIMETER CALIBRATION	PM	RTS	2	283W	WW-32230/I
32231	283W FILTER #3 EFFLUENT TURBIDIMETER CALIBRATION	PM	RTS	2	283W	WW-32231/I
32232	283W FILTER #3 EFFLUENT TURBIDIMETER CALIBRATION	PM	RTS	2	283W	WW-32232/I
32233	283W FILTER #3 EFFLUENT TURBIDIMETER CALIBRATION	PM	RTS	2	283W	WW-32233/I
32234	283W FILTER #3 EFFLUENT TURBIDIMETER CALIBRATION	PM	RTS	2	283W	WW-32234/I
32235	283W CLEARWELL 1720C TURBIDIMETER CALIBRATION	PM	RTS	2	283W	WW-32235/I
32236	283W CLEARWELL 1720C TURBIDIMETER CALIBRATION	PM	RTS	2	283W	WW-32236/I
32237	283W CLEARWELL 1720C TURBIDIMETER CALIBRATION	PM	RTS	2	283W	WW-32237/I
32238	283W CLEARWELL 1720C TURBIDIMETER CALIBRATION	PM	RTS	2	283W	WW-32238/I
32240	283W - RAW WATER PH PROBE LOOP CALIBRATION	PM	RTS	2	283W	WW-32240/I
32243	200W - HMI COMPUTER SUPPORT	PM	RTS	2	283W	WW-32243/P
32257	283W RAW WATER TURBIDIMETER CALIBRATION	PM	RTS	2	283W	WW-32257/I
32369	283W FLOCCULATOR #4	PM	RTS	2	283W	WW-32369/P
32283	283W CONDUCTIVITY METER ANALYZER	PM	RTS	2	283W	WW-32283/I
32284	CONDUCTIVITY METER ANALYZER	PM	RTS	2	283W	WW-32284/I
32267	283W SAMPLE LINE ROTAMETER CLEANING, 8" EFFLUENT	PM	RTS	2	283W	WW-32267/P
32269	283W SAMPLE LINE ROTAMENTER CLEANING, 10" EFFLUENT	PM	RTS	2	283W	WW-32269/P
30884	283W REPAINT CONTROL AREA FLOOR AND WALLS		SUSP-CONDITION	3	283W	WW-30884/W
31610	283W INSTALL PAPER DISPENSOR		TO-CLOSE	2	283W	WW-31610/W
30098	PROCESS SAFETY MANAGEMENT COMPLIANCE ASSESSMENT	PM	TO-CLOSE	2	283W	WW-30098/O

	(SAFETY)					
31298	FILTER #2 EFFLUENT FLOW CONTROL LOOP	PM	TO-CLOSE	2	283W	WW-31298/I
32365	283W - T/S & REPAIR #3 FLOCULATOR (EMERGENT)		TO-CLOSE	2	283W	WW-32365/C
32373	283W - REPAIR #4 FILTER PALMER SWEEP WATER SUPPLY LINE		TO-PLAN	2	283W	WW-32373/C
32374	283W - REPAIR #3 FILTER INFLUENT VALVE		TO-PLAN	2	283W	WW-32374/C
32375	283W - REPAIR #1 FILTER WASTE GATE		TO-PLAN	2	283W	WW-32375/C
32376	283W - INSTALL PRESSURE GAUGES ON FILTER ACTUATING LINES		TO-PLAN	2	283W	WW-32376/M
30937	283W - REMOVE, REWIND, AND REPLACE MOTOR IN #2 POTABLE WATER PUMP		TO-PLAN	2	283W	WW-30937/C
30897	283W - REPAIR ELECTRICAL CUBICAL DOOR #1 FLOC DRIVE		TO-PLAN	2	283W	WW-30897/C
30219	283W - MODIFY RAW WATER PRESSURE ALARM SENSING LINE		TO-PLAN	2	283W	WW-30219/M
30438	283W - REPLACE #3 SANITARY WATER PUMP ASSEMBLY		TO-PLAN	2	283W	WW-30438/C
30439	283W - REPLACE #1 SANITARY WATER PUMP ASSEMBLY		TO-PLAN	3	283W	WW-30439/C
30397	283W - T/S & REPAIR PLC (EMERGENT)		TO-PLAN	2	283W	WW-30397/C
30467	283W - REPLACE CHLORINE GAS MONITORS		TO-PLAN	2	283W	WW-30467/M
30468	283W - REPLACE #6 SW PUMP DISCHARGE CHECK & GATE VALVES		TO-PLAN	3	283W	WW-30468/M
30469	283W - REMOVE DEAD LEG PIPING		TO-PLAN	3	283W	WW-30469/M
30472	283W - REPLACE UPS IN MAIN PLC CABINET		TO-PLAN	2	283W	WW-30472/M
30475	283W - REPAIR ROOF LEAKS		TO-PLAN	2	283W	WW-30475/C
30477	283W - REMOVE UNUSED ELECTRICAL CIRCUIT FROM ALUM FEEDERS		TO-PLAN	3	283W	WW-30477/M
30484	283W - REPLACE LEAKING SEALS ON FLOCCULATOR #4 GEARBOX		TO-PLAN	2	283W	WW-30484/M
32139	283W - REPLACE CONTROL ROOM UPS		TO-PLAN	2	283W	WW-32139/C
30697	283W EVALUATE WONDERWARE OPERABILITY		TO-SCREEN	3	283W	WW-30697/C
32415	PORTABLE HACH SENSION1 PH ANALYZER CALIBRATION	PM	WSCH	2	283W	WW-32415/I
32416	PORTABLE HACH SENSION1 PH ANALYZER CALIBRATION	PM	WSCH	2	283W	WW-32416/I
32417	PORTABLE HACH SENSION1 PH ANALYZER CALIBRATION	PM	WSCH	2	283W	WW-32417/I
32418	PORTABLE HACH SENSION1 PH ANALYZER CALIBRATION	PM	WSCH	2	283W	WW-32418/I
32488	283W RAW WATER TURBIDIMETER CLEANING	PM	WSCH	2	283W	WW-32488/I

32489	283W FILTER #1 EFFLUENT TURBIDIMETER CLEANING	PM	WSCH	2	283W	WW-32489/I
32490	283W FILTER #2 EFFLUENT TURBIDIMETER CLEANING	PM	WSCH	2	283W	WW-32490/I
32491	283W FILTER #3 EFFLUENT TURBIDIMETER CLEANING	PM	WSCH	2	283W	WW-32491/I
32492	283W CLEARWELL TURBIDIMETER CLEANING	PM	WSCH	2	283W	WW-32492/I
32493	283W COMBINED FILTER EFFLUENT TURBIDIMETER CALIBRATION	PM	WSCH	2	283W	WW-32493/I
32494	283W COMBINED FILTER EFFLUENT TURBIDIMETER CALIBRATION	PM	WSCH	2	283W	WW-32494/I
32495	283W COMBINED FILTER EFFLUENT TURBIDIMETER CALIBRATION	PM	WSCH	2	283W	WW-32495/I
32496	283W COMBINED FILTER EFFLUENT TURBIDIMETER CALIBRATION	PM	WSCH	2	283W	WW-32496/I
32497	283W COMBINED FILTER EFFLUENT TURBIDIMETER CALIBRATION	PM	WSCH	2	283W	WW-32497/I
32498	283W COMBINED FILTER EFFLUENT TURBIDIMETER CLEANING	PM	WSCH	2	283W	WW-32498/I
32500	HUMAN MACHINE INTERFACE (HMI)	PM	WSCH	2	283W	WW-32500/P
32501	HUMAN MACHINE INTERFACE (HMI)	PM	WSCH	2	283W	WW-32501/P
32502	HUMAN MACHINE INTERFACE (HMI)	PM	WSCH	2	283W	WW-32502/P
32504	HUMAN MACHINE INTERFACE (HMI)	PM	WSCH	2	283W	WE-32504/P
32506	283W CHLORINE DETECTOR FUNCTIONAL TEST (SAFETY)	PM	WSCH	2	283W	WW-32506/P
32507	283W - CALIBRATION OF BEACON 410 CL2 GAS MONITOR (SAFETY)	PM	WSCH	2	283W	WW-32507/I
32510	283W HACH CL17 CHLORINE ANALYZER	PM	WSCH	2	283W	WW-32510/I
32511	283W FILTER #1 EFFLUENT TURBIDIMETER CALIBRATION	PM	WSCH	2	283W	WW-32511/I
32512	283W FILTER #1 EFFLUENT TURBIDIMETER CALIBRATION	PM	WSCH	2	283W	WW-32512/I
32513	283W FILTER #1 EFFLUENT TURBIDIMETER CALIBRATION	PM	WSCH	2	283W	WW-32513/I
32514	283W FILTER #1 EFFLUENT TURBIDIMETER CALIBRATION	PM	WSCH	2	283W	WW-32514/I
32515	283W FILTER #1 EFFLUENT TURBIDIMETER CALIBRATION	PM	WSCH	2	283W	WW-32515/I
32516	283W FILTER #2 EFFLUENT TURBIDIMETER CALIBRATION	PM	WSCH	2	283W	WW-32516/I
32517	283W FILTER #2 EFFLUENT TURBIDIMETER CALIBRATION	PM	WSCH	2	283W	WW-32517/I
32518	283W FILTER #2 EFFLUENT TURBIDIMETER CALIBRATION	PM	WSCH	2	283W	WW-32518/I
32519	283W FILTER #2 EFFLUENT TURBIDIMETER CALIBRATION	PM	WSCH	2	283W	WW-32519/I

32520	283W FILTER #2 EFFLUENT TURBIDIMETER CALIBRATION	PM	WSCH	2	283W	WW-32520/I
32521	283W FILTER #3 EFFLUENT TURBIDIMETER CALIBRATION	PM	WSCH	2	283W	WW-32521/I
32522	283W FILTER #3 EFFLUENT TURBIDIMETER CALIBRATION	PM	WSCH	2	283W	WW-32522/I
32523	283W FILTER #3 EFFLUENT TURBIDIMETER CALIBRATION	PM	WSCH	2	283W	WW-32523/I
32524	283W FILTER #3 EFFLUENT TURBIDIMETER CALIBRATION	PM	WSCH	2	283W	WW-32524/I
32525	283W FILTER #3 EFFLUENT TURBIDIMETER CALIBRATION	PM	WSCH	2	283W	WW-32525/I
32526	283W CLEARWELL 1720C TURBIDIMETER CALIBRATION	PM	WSCH	2	283W	WW-32526/I
32527	283W CLEARWELL 1720C TURBIDIMETER CALIBRATION	PM	WSCH	2	283W	WW-32527/I
32528	283W CLEARWELL 1720C TURBIDIMETER CALIBRATION	PM	WSCH	2	283W	WW-32528/I
32529	283W CLEARWELL 1720C TURBIDIMETER CALIBRATION	PM	WSCH	2	283W	WW-32529/I
32530	283W CLEARWELL 1720C TURBIDIMETER CALIBRATION	PM	WSCH	2	283W	WW-32530/I
32531	283W SUMP LEVEL SWITCH, HIGH	PM	WSCH	2	283W	WW-32531/P
32532	283W - RAW WATER PH PROBE LOOP CALIBRATION	PM	WSCH	2	283W	WW-32532/I
32535	200W - HMI COMPUTER SUPPORT	PM	WSCH	2	283W	WW-32535/P
32537	283W RAW WATER TURBIDIMETER CALIBRATION	PM	WSCH	2	283W	WW-32537/I
32538	283W TEMP. PROBE QUARTERLY CALIBRATION (SW-TI-001)	PM	WSCH	2	283W	WW-32538/I
32543	283W - PH PROBE LOOP CALIBRATION, 10" SW EFFLUENT	PM	WSCH	2	283W	WW-32543/I
32544	283W - PH PROBE LOOP CALIBRATION, 8" SW EFFLUENT	PM	WSCH	2	283W	WW-32544/I
32546	283W CHLORINE DETECTOR FUNC TESTS (OPERATIONS) (SAFETY)	PM	WSCH	2	283W	WW-32546/O
32547	283W CHLORINE DETECTOR FUNC TESTS (OPERATIONS) (SAFETY)	PM	WSCH	2	283W	WW-32547/O
32548	283W CHLORINE DETECTOR FUNC TESTS (OPERATIONS) (SAFETY)	PM	WSCH	2	283W	WW-32548/O
32549	283W CHLORINE DETECTOR FUNC TESTS (OPERATIONS) (SAFETY)	PM	WSCH	2	283W	WW-32549/O
32552	283W CONDUCTIVITY METER ANALYZER	PM	WSCH	2	283W	WW-32552/I
32553	CONDUCTIVITY METER ANALYZER	PM	WSCH	2	283W	WW-32553/I
32554	283W EYEWASH INSPECTION (ALUM FLOOR) (SAFETY)	PM	WSCH	2	283W	WB-32554/P
32326	283WA - STORAGE TANK HATCHWAY, HANDHOLE AND VENT INSPECTION		COMP-REV	2	283WA	WW-32326/C
32280	283WB - HIGH PRSSURE SWITCH SET POINT CHECK, PUMP 1	PM	RTS	2	283WB	WW-32280/J

32281	283WB - HIGH PRSSURE SWITCH SET POINT CHECK, PUMP 2	PM	RTS	2	283WB	WW-32281/J
32282	283WB - HIGH PRSSURE SWITCH SET POINT CHECK, PUMP 3	PM	RTS	2	283WB	WW-32282/J
31444	EMERGENT 283WD #1 RECYCLE PUMP TROUBLESHOOT AND REPAIR BREAKER TRIPPING		SUSP-CONDITION	2	283WD	WW-31444/C
31446	EMERGENT 283WD #2 RECYCLE PUMP TROUBLESHOOT AND REPAIR BREAKER TRIPPING		SUSP-CONDITION	2	283WD	WW-31446/C
31448	EMERGENT 283WD #3 RECYCLE PUMP TROUBLESHOOT AND REPAIR BREAKER TRIPPING		SUSP-CONDITION	2	283WD	WW-31448/C
30488	283WD - REPAIR #3 RECYCLE PUMP		TO-PLAN	3	283WD	WW-30488/C
32286	283WF EYEWASH INSPECTION (SAFETY)	PM	PRE-WORK REVIEW	2	283WF	WB-32286/P
32041	283WF EYEWASH INSPECTION (SAFETY)	PM	RTS	2	283WF	WB-32041/P
32219	283WF PH METER	PM	RTS	2	283WF	WW-32219/J
32220	283WF CONDUCTIVITY METER		RTS	2	283WF	WW-32220/J
32239	283WF SAMPLE BLDG FLUME FLOW METER	PM	RTS	2	283WF	WW-32239/J
32555	283WF EYEWASH INSPECTION (SAFETY)	PM	WSCH	2	283WF	WB-32555/P
32319	2901T - REPAIR BROKEN WELDS ON ACCESS LADDER (SAFETY)		RELEASED	2	2901T	WW-32319/C
30395	2901T - REPAIR / REPLACE PRESSURE TRANSMITTER #PT-7		TO-PLAN	2	2901T	WB-30395/C
32321	2901U - REPAIR BROKEN WELDS ON ACCESS LADDER (SAFETY)		RELEASED	2	2901U	WW-32321/C
30396	2901U - REPAIR / REPLACE PRESSURE TRANSMITTER #PT-12		TO-PLAN	2	2901U	WB-30396/C
32124	2901Y & 1901Y - PROVIDE VARIOUS SIGN PAINTER SUPPORT		RELEASED	2	2901Y	WB-32124/C
30480	6607-9, TROUBLSHOOT & REPAIR PUMP #1		TO-PLAN	2	6607-9	WW-30480/C
32394	POCKET COLORIMETER	PM	OPS ACCEPTANCE	2	GENERAL	WE-32394/I
32395	POCKET COLORIMETER	PM	OPS ACCEPTANCE	2	GENERAL	WE-32395/I
31991	POCKET COLORIMETER	PM	RELEASED	2	GENERAL	WW-31991/I
31992	POCKET COLORIMETER	PM	RELEASED	2	GENERAL	WW-31992/I
31863	POCKET COLORIMETER	PM	RELEASED	2	GENERAL	WW-31863/I
32217	POCKET COLORIMETER	PM	RTS	2	GENERAL	WW-32217/I
32499	POCKET COLORIMETER	PM	WSCH	2	GENERAL	WW-32499/I
32156	MO2209 EYEWASH INSPECTION (SAFETY)		PRE-WORK REVIEW	2	MO2209	WE-32156/P
31922	MO2209 EYEWASH INSPECTION (SAFETY)		RTS	2	MO2209	WE-31922/P
32403	MO2209 EYEWASH INSPECTION (SAFETY)		WSCH	2	MO2209	WE-32403/P

31911	TMX-410 AND TMX-412 DAILY FUNCTIONAL CHECKS (SAFETY)	PM	OPS ACCEPTANCE	2	MO256	WW-31911/P
31803	PORTABLE PH ANALYZER EC 10 CALIBRATION	PM	OPS ACCEPTANCE	2	MO256	WW-31803/I
32033	2100N TURBIDIMETER CALIBRATION	PM	RELEASED	2	MO256	WW-32033/I
32034	2100N TURBIDIMETER CALIBRATION	PM	RELEASED	2	MO256	WW-32034/I
32035	2100N TURBIDIMETER CALIBRATION	PM	RELEASED	2	MO256	WW-32035/I
32028	TMX-410 AND TMX-412 DAILY FUNCTIONAL CHECKS (SAFETY)	PM	RELEASED	2	MO256	WW-32028/P
31932	PORTABLE PH ANALYZER EC 10 CALIBRATION	PM	RELEASED	2	MO256	WW-31932/I
32164	PORTABLE PH ANALYZER EC 10 CALIBRATION	PM	RTS	2	MO256	WW-32164/I
32272	TMX-410 AND TMX-412 DAILY FUNCTIONAL CHECKS (SAFETY)	PM	RTS	2	MO256	WW-32272/P
32419	PORTABLE PH ANALYZER EC 10 CALIBRATION	PM	WSCH	2	MO256	WW-32419/I
32545	TMX-410 AND TMX-412 DAILY FUNCTIONAL CHECKS (SAFETY)	PM	WSCH	2	MO256	WW-32545/P
31481	200W - EXCAVATE AND REPAIR POTABLE WATER LINE LEAK @ VALVE 557S		RELEASED	2	MO604	WW-31481/C

APPENDIX C
RECOMMENDATIONS

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APPENDIX C
RECOMMENDATIONS

C1.0 RECOMMENDATIONS:

A primary objective of this Master Plan is to document MSA's strategy for efficiently managing the Hanford Site's water systems through 2022. The following are recommendations for projects and processes, discussed in the Master Plan, which should be considered for planning purposes over the next 10 years. Subsequent updates to the Plan will discuss status and additional recommendations, which may be required beyond 2022.

Note: Recommendations and changes to 181D/182D and 181B/182B should be evaluated based on the status of the identified project to replace the vertical-drive turbines (river pumps), Headers, and Instrumentation.

1.1 Recommend developing a project to replace the backwash pumping arrangement with an industry standard pump/motor that meets system specifications. Current pump configuration and back up unit are approximately 50 years old. The backwash pump is critical to the filter plant operation.

1.2 Conduct a Tracer Study at the 283W Filter Plant, to enable plant output to increase to approximately 1950 gal/min.

1.3 Both 1.1 m gal potable water storage tanks (283WA and 283EA) – need to have internal inspections. Both tank internals were inspected in August 2007, with no internal deficiencies noted. Water Utilities should inspect again in FY 2013. AWWA Standard M42 recommends inspections every 5 years.

1.4 Continue to monitor the reliability of the AC piping, which makes up a major portion of the distribution header to U Plant and S Labs. Currently, no issues have been noted.

1.5 Using the current data based developed for AHP, develop a listing of critical components by system that meet the requirements of MSC-PRO-140, *Utilizing General Supplies, Spare Parts, and Convenience Storage Inventories* and populate Water Utilities Spare Parts Inventory with the needed parts. Critical items are those materials essential to a system or component that if not immediately available will create a crisis situation. Having spare parts available would reduce or eliminate the long lead time under normal shipping conditions and improve the repair process.

1.6 An Interface Control Document (ICD) does not exist between MSA and WCH. The current MSC contract, DE-AC06-08RL14728, states in the J-3 attachment, that the 300 Area and 100N Areas water systems are within the scope of the RCCC, along with the 30-inch concrete line supplying the 100F and 100H Areas, and all distribution piping connecting to the concrete main water lines supplying the 100F, 100H, 100D, 100N and 100B Areas. MSA should develop an ICD, outlining responsibilities for support for the Export Water to B Reactor, and Export Water supplies for 100F, 100H, 100D, and 100N. Sewer interface could also be established.

1.7 All valves should be evaluated by operating them in a manner to verify their condition. Isolation valves, at a minimum, should first consist of operation under no-flow conditions. Then, when conditions allow, these valves should be tested to isolate flow. This test may be performed using acoustical test methods or other appropriate nondestructive technique. Allowances should be made to repair impaired or broken valves, or replace them with new ones. As valves are replaced, inspect the pipeline interior for excessive corrosion and document findings.

1.8 182B: The header pipe is essential to successful operation of this system. It is highly recommended that the entire discharge header be evaluated with nondestructive methods such as ultrasonic thickness testing. Repairs may be difficult, expensive, and time consuming because of the header's remote and congested location.

1.9 An M&O manual should be written for each pump, motor, adjustable drive mechanism, and PLC instrumentation system. A routine PM schedule should be adopted, funded, and prioritized to be faithfully performed. The M&O manual should clearly define each significant piece of operating equipment identified on the PM schedule. Accurate records should be maintained to trend the performance of each piece of equipment being maintained.

1.10 181D: A diesel driven pump, similar to the one installed at 181B, should be installed at 181D in order to provide backup water supply in the event of a power outage or pump failure. This could be accomplished during the project to install vertical drive turbine pumps. This will mitigate the concern for a single point failure of the 13.8 kV power supply. These additions will ensure that reliable backup pump service is available to support the EW System.

1.11 It is recommended that an OTP be written and performed on all critical to operation pumps, to develop a baseline for operations. Additionally, an appropriate PM program should be established to document performance and maintain pump and motor reliability.

1.12 Evaluate performing condition assessments of "critical use" distribution piping. It is recommended that cell to cell surveys, similar cell to cell survey completed on East-West pipeline from 182B to 1901-Y (see appendix B, HNF-51470) be performed. Establish a prioritized list to focus on known problem lines (e.g., the 24 in. line to the 200 West Area) and lines critical to operations.

1.13 Recommend completing a survey of all road/rail crossings on the remaining EW pipelines where heavily loaded dump trucks are constantly crossing over the pipeline. It is recommended that a properly designed protective encasement should be installed at all crossings. In addition, administratively enforced travel routes should be established for heavy-haul trucks.

1.14 Establish a PM program to operate all Export Water, Raw Water, and Potable Water system valves, keeping them fit for service. The schedule should include testing and operating the valves at least annually.

1.15 Recommend troubleshooting program software to ensure it is working properly. When posted error statements occur in the software and cannot be resolved, then investigate the transmission signal at the physical connections of the field installed components. Field testing may include: verify valve position, line pressure, and battery charge for the solar power unit. Apply lessons learned from the operator training to troubleshooting existing software. Incorporating these recommendations will enhance operator confidence and ensure reliable operation of the software.

1.16 Recommend simulator training of operators, who operate Export Water and the Filter Plant, in the evaluation and troubleshooting issues that might occur. This training will present upset field conditions that allow the operator to assess the condition and provide the correct response. This will enable the operators to develop confidence and skill in using the software program.

1.17 EW Instrumentation and Controls: Recommend troubleshooting program software to ensure it is working properly. When posted error statements occur in the software and cannot be resolved, then investigate the transmission signal at the physical connections of the field installed components. Field testing may include: verify valve position, line pressure, and battery charge for the solar power unit. Apply lessons learned from the operator training to troubleshooting existing software. Incorporating these recommendations will enhance operator confidence and ensure reliable operation of the software.

1.18 282W/282WC/282E/282EC Power/Instrumentation and Controls: The control panels for the fire pumps need to be modified. The pressure sensor needs to be replaced so spares are available. Modifications should also include moving instrumentation outside the cabinet allowing calibration and NFPA required readings without opening the cabinet. Additionally, automatic shutdown allowed per NFPA should be considered.

1.19 Replacement of antiquated equipment and components within the water treatment train is recommended. This includes but is not limited to:

Inlet control valves on the filter basins, Flocculation paddle drives, Upgrades to instrumentation, particularly those that provide permit regulated data.

1.20 Recommend establishing a PM program for the 283W and 283E PW pumps, to document performance and maintain pump and motor reliability. These pumps are critical to system operation.

1.21 283W: Recommend upgrading the control system. The plant control system needs to be updated, since the PLCs, computers, and software are early 1990s technology.

1.22 Recommend updating the control programming to accommodate the revised PW pump impellers previously installed.

1.23 Project L-778: Central Plateau Raw Water Improvements. This will make the operation of the EW pumps and reservoirs independent of 200E and 200W Raw Water systems.

1.24 Improvement project for 181B & 181D installation of vertical turbine pumps, header, instrumentation.

1.25 Continue Mortar Lining (Pipeline Refurbishment Strategy) which has been adopted by DOE HQ as a Complex-Wide Best Management Practice. Projects L-357, L-355, L-398, L-420, L-423, L-431, and L-342 have been identified and are included in the IPL.

1.26 Continue development and refinement of the Analytic Hierarchy Process in alternative selection.

1.27 Development a vibration monitoring program and the use of engineered fluid flow hydraulic models to analyze the distribution systems to help achieve better performance, efficiency, as well as energy savings, for all recently installed equipment and those units that will be install in subsequent projects.

1.28 Continue to promote the use of strategic metering. HNF-42320, rev0, Feasibility Study for Advance Electrical and Water Metering at Hanford, determined that metering is essential for gathering reliable data to assess system integrity and as an aid to plan for projected customer demands, as the site down sizes.