DRAFT FINAL
OPERATION AND MAINTENANCE MANUAL
OPERABLE UNIT 2
GROUNDWATER REMEDY
FORMER FORT ORD, CALIFORNIA

TOTAL ENVIRONMENTAL RESTORATION CONTRACT
DACW05-96-D-0011
TASK ORDER NO. 011

Submitted to:

Department of the Army
Corps of Engineers
1325 "J" Street
Sacramento, California 95814-2922

Submitted by:

IT Corporation
#4 All Pro Lane
Former Fort Ord (Marina), California 93933-1698

Revision 1
August 2002

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PREFACE

IT Corporation prepared this Draft Final Operation and Maintenance Manual (O&M Manual) under the direction of the U.S. Department of the Army (Army) for the use by the Army and the signatories of the Federal Facilities Agreement, including the U.S. Environmental Protection Agency, the Department of Toxic Substances Control, and the Regional Water Quality Control Board - Central Coast Region. Since the information and drawings presented and/or referenced in this O&M Manual were prepared for the sole use of by the Army, no other party should rely on the information without prior written consent of IT Corporation.

This O&M Manual documents the procedures and methodology to safely and efficiently operate and maintain the Operable Unit 2 groundwater remedy. Information presented in this manual was gathered from different sources and organized to provide a concise manual for use by the operator.

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List of Acronyms

1,1-DCA	1,1-dichloroethane
1,2-DCA	1,2-dichloroethane
1,2-DCP	1,2-dichloropropane
ACL(s)	aquifer cleanup level(s)
ANSI	American National Standards Institute
ARAR(s)	applicable or relevant and appropriate requirement(s)
Army	U.S. Department of the Army
AWG	American wire gauge
CCR	California Code of Regulations
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
cis-1,2 DCE	cis-1,2-dichloroethene
COC(s)	chemical(s) of concern
EW	Extraction Well
FADL	field activity daily log
FFA	Federal Facilities Agreement
GAC	granular activated carbon
gpm	gallon(s) per minute
GWTP	groundwater treatment plant
HDPE	high density polyethylene
HLA	Harding Lawson Associates, now Harding ESE
INF	Infiltration Gallery
IT	IT Corporation
IW	Injection Well
MCL	maximum contaminant level
MRWPCA	Monterey Regional Water Pollution Control Agency
MW	Monitoring Well
NEMA	National Electrical Manufacturers Association
O&M	operation and maintenance
OU2	Operable Unit 2
OU2 System Expansion	OU2 Groundwater Remedy System Expansion
PCE	perchloroethene or tetrachloroethene
PG&E	Pacific Gas and Electric
PLC	programmable logic controller
PPE	personal protective equipment
psi(g)	pounds per square inch (gauge)
PVC (xx)	polyvinyl chloride schedule (xx = 40 or 80)
RAO	remedial action objective
RWQCB	Regional Water Quality Control Board
SCADA	supervisory control and data acquisition
Sites 2/12	Sites 2 and 12

List of Acronyms continued

SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
TCE	trichloroethene
TERC II	Total Environmental Restoration Contract II
University	California State University, Monterey Bay
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
VAC	volts alternating current
VDC	volts direct current
VOC	volatile organic compound

Executive Summary

IT Corporation has prepared this *Draft Final Operation and Maintenance Manual* (O&M Manual) on behalf of the U.S. Department of the Army. This O&M Manual addresses the operation and maintenance activities to be conducted during implementation of the Operable Unit 2 (OU2) groundwater remedy at the former Fort Ord, located north of Monterey, California. The O&M Manual was prepared for the signatories of the Federal Facilities Agreement (FFA), including the Army, the U.S. Environmental Protection Agency (USEPA), the California Department of Toxic Substances Control, and the California Regional Water Quality Control Board (RWQCB) - Central Coast Region. The FFA established the schedule for performing the selected remedial action that would be executed in accordance with the *Record of Decision, Operable Unit 2, Fort Ord Landfills, Fort Ord, California*, (OU2 ROD) (Army, 1994).

The OU2 ROD (Army, 1994) presents the required remedial action objectives (RAO) and the selected remedial action alternative used to execute and accomplish the groundwater remedy for the OU2 groundwater plume. The OU2 groundwater plume consists of 11 chlorinated volatile organic compounds (VOCs) that exceed federal or state maximum contaminant levels (MCL) or risk-based values. The original groundwater remedy commenced treatment operations on October 23, 1995.

The FFA stipulated that 5-year reviews of the groundwater remedy evaluate its effectiveness in achieving the RAOs. In preparation for the first 5-year review, aquifer modeling suggested that three areas in the A-aquifer and Upper 180-foot aquifers, located further east and south of the existing extraction wells, were not adequately being captured. The OU2 System Expansion, consisting of additional extraction wells and increased treatment capacity, was deemed necessary to satisfy the required RAOs. Initial components of the OU2 System Expansion commenced treatment operations on August 11, 2000, and the expanded system was fully operational in April 2001. The original system remained operational during the installation of the expansion components.

Portions of this manual update the original *Draft Final Operation and Maintenance Manual, Operable Unit 2, Pump and Treat* (original *OU2 O&M Manual*) (IT, 1997), with amendments suggested in the *Draft Effectiveness Evaluation, Technical Memorandum, OU2 Groundwater Remedy*, (Harding Lawson Associates, 1998), and incorporates applicable guidance from the USEPA's Fact Sheet, *Operation and Maintenance in the Superfund Program* (USEPA, 2001).

This O&M Manual presents information to meet the following objectives:

- Describes the operation and maintenance features for each installed component
- Provides adequate information for the groundwater treatment plant (GWTP) Operator to be able to safely and efficiently operate, maintain, and monitor the groundwater remediation system in each mode of operation
- Details the procedures for start-up
- Details the procedures for normal plant operation and maintenance
- Provides methodology for optimizing the groundwater remediation system and evaluating its effectiveness
- Describes health and safety requirements during plant operation and maintenance
- Details the record keeping and reporting requirements
- References as-built drawings and equipment data sheets relevant to groundwater remediation system operation.

1.0 Introduction

This *Draft Operation and Maintenance Manual* (O&M Manual) was prepared by IT Corporation (IT) under contract to the U.S. Department of the Army (Army) to document the procedures used to operate and maintain the Operable Unit 2 (OU2) groundwater remedy system (OU2 System) at the former Fort Ord, California. This O&M Manual was prepared for the signatories of the Federal Facilities Agreement (FFA), including the Army, the U.S. Environmental Protection Agency (USEPA), the California Department of Toxic Substances Control, and the California Regional Water Quality Control Board (RWQCB) - Central Coast Region. The FFA establishes the schedule for performing remedial investigations, feasibility studies, and remedial actions. The selected remedial action for groundwater is being executed in accordance with the *Record of Decision, Operable Unit 2, Fort Ord Landfills, Fort Ord, California*, (OU2 ROD) (Army, 1994).

The OU2 ROD (Army, 1994) presents the required remedial action objectives (RAO) and the selected remedial action alternative used to execute and accomplish the groundwater remedy for the OU2 groundwater plume. The OU2 groundwater plume consists of 11 chlorinated volatile organic compounds (VOCs) that exceed federal or state maximum contaminant levels (MCL) or risk-based values. The original groundwater remedy commenced treatment operations on October 23, 1995.

The FFA stipulated that 5-year reviews of the groundwater remedy evaluate its effectiveness in achieving the RAOs. In preparation for the first 5-year review, aquifer modeling suggested that three areas in the A-aquifer and Upper 180-foot aquifer, located further east and south of the existing extraction wells, were not adequately being captured. The OU2 System Expansion, consisting of additional extraction wells and increased treatment capacity, was deemed necessary to satisfy the required RAOs. Initial components of the OU2 System Expansion commenced treatment operations on August 11, 2000, and the expanded system was fully operational in April 2001. The original system remained operational during the installation of the expansion components.

Construction of the OU2 System Expansion is documented in the *Draft Final Construction Completion Report* (IT, 2001a). Construction was completed in accordance with the approved *Draft Final Groundwater Remedial Action Work Plan* (IT, 1999a) and *Draft Final Contractor Quality Control Plan* (IT, 1999b).

1.1 Operations & Maintenance Manual Objectives

The objective of this O&M Manual is to provide adequate information for the groundwater treatment plant (GWTP) Operator to safely and efficiently operate, maintain, and monitor the groundwater remedy in each mode of operation. Modes of operation include batch startup, intermittent operations, and normal, automated operation. This manual also describes the procedures and the initial data requirements necessary to document that the RAOs are being met.

This O&M Manual must be periodically updated to reflect actual operating conditions. Changes in site conditions, system components, operating procedures, and experiences may also determine how the system is operated over the long term. Significant modifications will be documented in a Field Work Variance approved by the U.S. Army Corps of Engineers (USACE) and incorporated into subsequent revisions to this manual. In the future, groundwater remedy operation and maintenance may be transferred to another organization. Although the new organization may have different contractual requirements and procedures, the basic requirement to document changes will still apply.

1.2 Organization of the Operation and Maintenance Manual

This manual is organized into the following sections and appendices:

- Section 1.0 introduces the scope, intent, and organization of the O&M Manual, and describes organizational responsibilities.
- Section 2.0 presents the overview of the OU2 groundwater remedy operations, including startup, shutdown, and general operating and maintaining philosophy.
- Section 3.0 describes and details the operation and maintenance of the groundwater extraction system from each extraction well to the conveyance pipe.
- Section 4.0 describes and details the operation and maintenance of the treatment plant building and processes from the inlet manifold to the effluent tank.
- Section 5.0 describes and details the operations and maintenance of the treated water injection system from the injection pumps to each injection point.
- Section 6.0 describes and details the operations and interconnections between the electrical system and the instrumentation and control system.
- Section 7.0 covers health and safety requirements.
- Section 8.0 describes records and record-keeping requirements, long-term performance requirements, and the data collection and optimization strategy for the groundwater remedy.
- Section 9.0 lists references cited.

- Appendix A includes the construction drawing index and the field-surveyed drawing indexes for the original OU2 pipelines, the Sites 2 and 12 (Sites 2/12) pipelines, and the OU2 System Expansion pipelines. Detailed general, civil, process, mechanical, utility, electrical, and instrumentation drawings are in the *Draft Final Construction Drawings, Operable Unit 2, Groundwater Remedy System Expansion* (*Draft Final Construction Drawings)* (IT, 2002).
- Appendix B includes an index of the vendor submittals. Complete vendor documentation is included in the *Draft Vendor Submittals, Operable Unit 2, Groundwater Remedy System Expansion* (IT, 2001b).
- Appendix C includes selected from the applicable or relevant and appropriate requirement(s) (ARARs) for the remedy.
- Appendix D includes the GWTP Operator reports, checklists, and spare parts list.
- Appendix E includes the manufacturers' warranty section copied from Appendix B.

1.3 Other Related Documents

Operation and maintenance of this groundwater remedy shall comply with the referenced ARARs (Appendix C). Portions of this manual update the original *Draft Final Operation and Maintenance Manual, Operable Unit 2, Pump and Treat* (original *OU2 O&M Manual*) (IT, 1997), with amendments suggested in the *Draft Effectiveness Evaluation, Technical Memorandum, OU2 Groundwater Remedy*, (Harding Lawson Associates, 1998). The manual incorporates applicable guidance from the USEPA's Fact Sheet, *Operation and Maintenance in the Superfund Program* (USEPA, 2001).

The original OU2 extraction well and injection well completion detail is documented in the *Draft Final Well Installation and Abandonment, Operable Unit 2, Pump and Treat Report* (IT, 1996). The OU2 System Expansion extraction well and infiltration gallery boring completion detail is documented in the *Draft Final Well Installation and Abandonment Report, Operable Unit 2, Groundwater Remedy System Expansion* (IT, 2001c). Treatment plant water sampling shall follow the *Draft Sampling and Analysis Plan, Operable Unit 1, Operable Unit 2, and Sites 2 and 12, Groundwater Treatment Systems* (Harding ESE, 2001). A discussion of specific OU2 System Expansion construction components, a more detailed description of construction activities, and startup parameters for the plant commissioning are documented in the *Draft Final Construction Completion Report* (IT, 2001a). The health and safety section is intended to supplement the *Site Safety and Health Plan* (SSHP) (IT, 2000), with groundwater remedy-specific issues.

1.4 Site Location and Description

The former Fort Ord is located in northwestern Monterey County, approximately 80 miles south of San Francisco, California (Figure 1-1). The former military installation covered about 28,000 acres, is bounded by Monterey Bay to the west and the Santa Lucia Range to the south, and is surrounded by the cities of Del Rey Oaks, Marina, Sand City, and Seaside. State Highway 1 and the Southern Pacific Railroad traverse through the western portion of the former Base, separating the Monterey Bay beach front from the rest of the installation. The installation served as a training and staging facility for infantry troops from its opening in 1917 until it closed in 1993. In 1990, the former Fort Ord was placed on the USEPA National Priority List, primarily due to VOCs found in the groundwater beneath the OU2 landfills.

Operable Unit 2 formerly included six landfill cells, one cell north and five cells south of Imjin Road, covering approximately 150 acres, including the immediate surrounding area and underlying impacted groundwater. As part of the OU2 landfill remedial activity, the contents of the landfill cell north of Imjin Road were moved to the southern landfill cells. The southern landfill cells were consolidated with fill from the north OU2 landfill and other Fort Ord soil remediation sites, and have been capped and revegetated.

The two groundwater aquifers of interest within OU2 are the unconfined A-aquifer and the confined Upper 180-foot aquifer. Both aquifers consist predominantly of fine- to coarse-grained sands. The two aquifers are separated by the Fort Ord-Salinas Valley aquiclude, which consists of blue-gray plastic clay with abundant shells and occasional thin beds of fine-grained sand. Depth to groundwater in the A-aquifer is approximately 100 to 180 feet below ground surface. Groundwater in this aquifer flows generally to the north and deviates to the west and east from a north-trending groundwater divide extending from the eastern portion of the OU2 landfills to Fritzsche Army Airfield. Depth to groundwater in the Upper 180-foot aquifer is between 110 and 220 feet below ground surface. Groundwater in the Upper 180-foot aquifer generally flows east toward the Salinas Valley (HLA, 1999).

Figures 1-2 and 1-3 show the extent of the contaminated plume in the A-aquifer and Upper 180-foot aquifer, respectively, as they were recorded prior to operation of the expanded system. Updated plume contours are included in the semi-annual or annual system reports (Section 8.4.2). These figures also show the locations of remedy components including extraction wells, pipelines, treatment plant and injection system.

A separate groundwater plume exists at Sites 2/12, located to the west of the OU2 landfills. Site 2 is west of State Highway 1 between the 8th and 12th Street bridges; Site 12 is located to the east of State Highway 1. This plume is relevant to the OU2 remedy because treated water from OU2 is transferred by pipeline for discharge above the plume at Site 2.

Saltwater intrusion, defined by a total dissolved solids concentration of greater than 3,000 milligrams per liter, is migrating from Monterey Bay into both aquifers. The saltwater intrusion is due, in part, to historical groundwater pumping in the Salinas Valley to the east, and to normal saltwater/freshwater interactions found in coastal aquifers. Saltwater intrusion extends as a wedge, thinning from west to east into the Upper 180-foot aquifer beneath Site 2. The easternmost extent of saltwater intrusion into the Upper 180-foot aquifer is approximately beneath State Highway 1.

1.5 Chemicals of Concern

The OU2 groundwater plume, in the A-aquifer and Upper 180-foot aquifer, is defined by the occurrence of chlorinated VOCs present at concentrations that exceed aquifer cleanup levels (ACL) established in the OU2 ROD (Army, 1994). Table 1-1, Chemicals of Concern and Remediation Goals, lists the 11 chemicals of concern (COC), the federal and state MCLs, ACLs, and treated water discharge limits. The 11 COCs include benzene, carbon tetrachloride, chloroform, 1,1-dichloroethane (1,1-DCA), 1,2-dichloroethane (1,2-DCA), cis-1,2-dichloroethene (cis-1,2-DCE), 1,2-dichloropropane (1,2-DCP), methylene chloride, tetrachloroethene (PCE), trichloroethene (TCE), and vinyl chloride. TCE is the most common and widespread of the COCs and is used in this report to illustrate plume extent in both the A-aquifer and Upper 180-foot aquifer (Figures 1-2 and 1-3, respectively).

The Sites 2/12 groundwater plume, in the Upper 180-foot aquifer, is defined by the occurrence of eight COCs. No chlorinated VOCs have been detected above the ACLs in the Lower 180-foot aquifer. TCE is the most widespread of the eight COCs. The other seven COCs include chloroform, 1,1-dichloroethene, 1,2-DCA, cis-1,2-DCE, PCE, vinyl chloride, and total 1,3-dichloropropene.

1.6 Operable Unit 2 Groundwater Remedy Objectives

The objective of the OU2 groundwater remedy is to extract impacted groundwater from the A-aquifer and Upper 180-foot aquifer, remove the COCs from the impacted water, and to produce an effluent that meets the ACLs and ARARs (Table 1-1). During normal operations, the

groundwater remedy shall achieve and maintain an adequate capture zone while minimizing groundwater effects that effect aquifer salt water intrusion.

To meet these goals, each unit operation must be monitored to achieve its intended function while maintaining maximum operation and control. Adequate equipment sizing, alarm devices, and process control are included in the design to provide a high degree of safety, reliability, and operational flexibility.

1.7 Project Organization

The OU2 groundwater remedy was initially operated by Harding ESE under contract to IT under the Sacramento District Total Environmental Restoration Contract II (TERC II) organization and TERC II technical requirements. The operational scope of work under the TERC II contract, together with organizational roles, organizational responsibilities, and quality control requirements, are addressed in the *Work Plan, Operational Maintenance, Groundwater Treatment Systems* (HLA, 2000). Operation and maintenance of the remedy may periodically be transferred to a different organization. Although the new organization may apply different contractual requirements and procedures, the basic O&M roles and responsibilities described below will still apply.

Routine O&M of the groundwater remedy will be the responsibility of the Site Engineer and GWTP Operator, with oversight by the Site Safety and Health Officer (SSHO). Specific job descriptions and responsibilities for the Site Engineer, GWTP Operator and SSHO follow.

1.7.1 Site Engineer

The Site Engineer is responsible for technical oversight of the remedy O&M. The Site Engineer requires specific in-depth knowledge of process control, hydrogeologic interpretation, and technical report generation.

The Site Engineer will be responsible for the quarterly data summary reports and the annual or semi-annual evaluation reports, and will initiate economic and technical evaluations as needed to monitor cost-effective system operation.

Typical evaluations include:

- Extraction well (EW) flow capacity, performance, and maintenance frequency
- Treatment plant flow capacity, performance and maintenance frequency

- Injection well (IW) flow capacity, performance, and maintenance frequency
- Infiltration gallery (INF) flow capacity, performance, and maintenance frequency
- Recommendations for improving the treatment system
- Recommendations for improving the process control and reporting criteria
- Recommendations for improving hydraulic capacity and hydraulic control.

1.7.2 Groundwater Treatment Plant Operator

The GWTP Operator has day-to-day responsibility for groundwater remedy technical, operations, and maintenance issues. The groundwater remedy includes the extraction network, the GWTP, the injection network, and all ancillary components. The GWTP Operator will:

- Operate the groundwater remedy economically while meeting the referenced ARARs
- Monitor and record manual instrument interface readings and trends
- Monitor and record analog/digital signals and trends
- Monitor, record and address alarm conditions
- Monitor and record groundwater remedy and component performance
- Maintain logs, inspections and maintenance checklists
- Periodically calibrate and verify digital and analog signal inputs to the GWTP
- Perform routine sampling and sample shipment coordination
- Perform routine instrument, equipment and component maintenance
- Adjust treatment operations and components as necessary to meet objectives
- Troubleshoot operational problems and identify maintenance issues
- Schedule and supervise subcontracted repairs, service and non-routine maintenance
- Maintain inventory of spare parts and chemicals, and coordinate material replenishment
- Make recommendations for improvements
- Initiate all reports
- Coordinate and report deviations to the groundwater remedy operation.

The GWTP Operator shall have the ability and judgment to work independently, shall be familiar with continuously operating water treatment plant facility operations by formal training or by experience, and shall complement the Site Engineer on technical issues listed in this section and Section 1.7.1 above. The GWTP Operator shall have substantive knowledge of the following:

- Potable water treatment plant safety
- Pipe fittings and valves
- Well and wellhead mechanical systems
- Pumps and motors
- Pressurized air systems
- Three-phase and single-phase electrical systems
- Electronic instrumentation and control
- Instrument calibration techniques
- Data acquisition and reduction
- NT Windows computer systems

Other minimum requirements include:

- California Drivers License
- 40-hour Hazardous Waste Operations and Emergency Response Training
- Site-specific orientation
- Site-specific chemical handling training for on-site chemicals requiring a materials safety data sheet

1.7.3 Site Safety and Health Officer

The SSHO is responsible for implementation of the SSHP (IT, 2000). Future GWTP operations shall either comply with the current SSHP, as prepared by IT, or a revised SSHP as approved by the USACE. The SSHO will conduct periodic inspections to verify compliance with the SSHP, USACE contract requirements, and Occupational Safety and Health Administration regulations.

The SSHO has the authority to take immediate steps to correct unsafe or unhealthy conditions, including the termination of groundwater remedy operations. The SSHO may recommend select disciplinary actions while maintaining an open dialogue with subcontractor supervisory personnel to expedite the correction of safety deficiencies. The SSHO may communicate directly with site visitors or workers to correct hazardous conditions, assess potential unsafe conditions, and implement the requirements established in the SSHP.

The SSHO will have specialized training in personnel protective equipment (PPE), respiratory protective equipment, confined space program oversight, proper use of air monitoring

instruments, air sampling methods, and interpretation of results. In addition, the SSHO must have working knowledge of applicable federal, state, and local occupational health and safety regulations.

2.0 Overview of the Groundwater Remedy Operation

The purpose of this section is to present the process overview, and to provide general information for the GWTP Operator to safely startup and shutdown the groundwater remedy while complying with the operating guidelines. Specific equipment operation, detailed automatic control, and other operating and maintenance considerations, are described in subsequent sections.

2.1 Process Overview and History

The groundwater remedy is comprised of the groundwater extraction system, the GWTP, and the treated water injection system. Figure 2-1 depicts the water flow schematic. The process flow diagrams, *Draft Final Construction Drawings* (IT, 2002), IT File Numbers 783751-E61 and -E62, show the process in more detail. Major elements and components are listed in Table 2-1. The primary GWTP operation is VOC adsorption onto granular activated carbon (GAC). Continuous GWTP unit operations are automated through a master programmable logic controller (PLC) that is located at the GWTP. A supervisory control and data acquisition (SCADA) package is installed to monitor and control the functions of remotely installed PLCs. Secondary unit operations include process stream filtration, flow equalization, and backwash and filtration of the recycle stream. The secondary unit operations that are process stream determined are automated through the PLC.

The original groundwater remedy commenced operations on October 23, 1995 with treated water flows ranging up to 740 gallons per minute (gpm). Performance data, along with operation and maintenance issues are discussed in annual or semi-annual system reports as described in Section 8.4. Original OU2 groundwater remedy process features and OU2 System Expansion construction-specific details are discussed in the *Draft Final Construction Completion Report* (IT, 2001a).

The OU2 System Expansion commenced treatment operations on August 11, 2000. Periodic reports, including performance data, along with operation and maintenance issues, are discussed in Section 8.0, Reports to Regulatory Agencies.

The Sites 2/12 groundwater remedy treatment operation started on April 13, 1999, extracting up to 300 gpm of groundwater beneath Site 12 and recharging the aquifer beneath Site 2. A pipeline was installed between the two plants. Commencing on June 23, 1999 up to 350 gpm of excess

OU2 treated water began flowing from the existing OU2 GWTP to Site 2. The combined 650 gpm Sites 2/12 and OU2 treated water flow is conveyed west of State Highway 1 for aquifer recharge.

The treated water that is transferred from OU2 to Sites 2/12 is critical to the Sites 2/12 operation. In the event that the OU2 GWTP is shut down for an extended period (6 hours or more), the Sites 2/12 GWTP must also be shut down. At present this shutdown must be performed manually.

2.2 General Operational and Maintenance Philosophy

General O&M philosophies following startup and during normal operations are discussed below.

2.2.1 Environmental Protection

The design of the OU2 Groundwater Remedy includes features intended to protect human health and the environment in the event of failure of system components. These features include:

- The pipelines from the extraction wells to the treatment plant are double-contained. A failure in the primary, inside pipe will alarm the leak detection sensor in the secondary, outer pipe.
- The extraction well and isolation valve vaults provide containment for single-wall piping.
- Concrete vaults with leak detection are installed at the extraction wells and pipeline maintenance valve boxes where there is single-contained piping.
- The treatment areas are bermed and provide containment for the process piping and tanks. The concrete in the two containment areas is epoxy-coated to reduce environmental concrete breakdown.

2.2.2 Safety

The GWTP Operator shall follow the safety procedures referenced in Section 7.0 of this document during both operation and maintenance of the groundwater remedy.

2.2.3 System Flowrates

The design flowrates for the extraction wells and recharge points are shown in Table 2-2. System monitoring data will be evaluated to periodically adjust the individual flow rates as necessary.

Upon startup, extraction well pump networks should be energized sequentially. This will minimize the effects of water hammer while the system is gradually brought to a high flow rate.

Water hammer can cause premature and nuisance activation of pressure switches, and in extreme cases, cause pipeline failure.

2.2.4 Startup Utility Goal

The on-line goal following a major system modification will be 75 percent for the subsequent two weeks. Individual components, set points and alarm conditions may require frequent adjustment, and may result in frequent shutdowns. The moderate on-line goal will allow sufficient time to check and adjust individual pieces of equipment and to test their operating characteristics prior to placing the treatment system in a high on-line utility state.

To achieve the utility goal, the plant may need to operate 24 hours per day, seven days per week. The level of installed automation will allow the plant to run continuously without constant, 24 hour, GWTP Operator contact. After startup, or following periods of prolonged shutdown, the GWTP Operator will be in attendance as necessary during normal business hours to perform inspections and adjustments. As the treatment plant tracks to steady-state operation, the role of the GWTP Operator will decrease.

2.2.5 On-line Utility Goal

The system on-line utility goal is 95 percent. Routine O&M will be performed during normal business hours or on an as-needed basis to maintain groundwater remedy utility. It will consist of a visual inspection of process equipment and instruments, as well as scheduled maintenance procedures for all major components. The GWTP Operator will document O&M performed on standardized logs and checklists. The completed logs and checklists will be maintained in a binder located within the control room.

2.2.6 Sampling Frequency

Requirements regarding sampling frequency and other chemical data acquisition parameters can be found in the *Draft Final Sampling and Analysis Plan* (HLA, 2001). Figure 2-1 shows the locations of sampling points in the GWTP.

2.2.7 Troubleshooting Guide

A summary of common problems that may occur with the operation of the groundwater remedy and its systems can be found in the individual vendor supplied O&M Manuals found in Appendix B.

2.2.8 Spare Parts Inventory

The spare parts inventory is included as Appendix D. Inventory is kept low because the design philosophy employs 100 percent installed and operational spares for the primary process equipment. If one pump in the pair fails mechanically, electrically, or electronically, the second pump can be started immediately. The dual pumps are fully installed and operational backups, and therefore are not included in the spare parts list. If one pump fails, there should be adequate time to schedule replacement or repair of the failed component.

The spare parts list has a nominal inventory of spare pump parts. The long-term inventory should be based on the maintenance frequency, procurement lead time, and system criticality. Spare parts shall be replaced when used. No spare parts are inventoried for the submersible pumps, since pump parts are readily available. Maintenance pumps, including those pumps that are not operated continuously, do not have installed spares.

2.3 System Startup

This section describes the general groundwater remedy startup procedures and philosophy. Specific groundwater remedy system startup and shutdown procedures are described below in Section 2.4 and 2.5, respectively. Component operational procedures are discussed in later sections.

2.3.1 Startup after a Major Groundwater Remedy Modification

If a major modification or replacement is implemented on the groundwater extraction, GWTP operations, and/or treated water injection systems, the initial shakedown section in the *Draft Final Construction Completion Report* (IT, 2001a) should be followed prior to commencing normal extraction and water treatment operations. Minor modifications and replacements should generally follow Section 2.3.2 below. The number of and detail of system checks shall correspond to the level of modifications.

2.3.2 Startup after a Shutdown or Minor Groundwater Remedy Modification

If a particular component or system is replaced or modified, only that component or system and those components directly influenced by the replacement or modification need to be checked for mechanical, process, electrical, and/or instrument-control congruity, as appropriate.

After an unexpected shutdown, the GWTP Operator shall take reasonable steps to stabilize the situation, if required, and shall notify the Site Engineer. The Site Engineer will determine the appropriate inspections, as detailed below, appropriate response (short term), and appropriate

corrective action (long term). For example, after a minor earthquake, the entire system should be monitored closely for changes in operating conditions, with pipeline gauges visually checked against standard conditions. A moderate earthquake may require more extensive visual inspections, with a pipeline pressure test prior to start-up. A large earthquake will require more thorough visual and instrument inspections of both above and below ground groundwater remedy components.

After an extended shutdown, or another event that has the potential to cause system or component damage, or when damage is suspected, a mechanical, process, electrical, and/or instrumentation completeness check shall be performed to verify the correct installation and proper operation of the connected equipment.

2.3.2.1 Visual and Instrument-Assisted Inspections

During the mechanical and process completeness check, a visual inspection of the installed system against the construction drawings will be made to confirm that equipment and ancillary items are in their proper locations, are appropriately connected, that all bolts have been tightened, and that all supports have been secured to support the intended weight.

During the electrical and instrumentation completeness check, electrical equipment and wiring will be visually checked against construction drawings to ensure proper installation and connections. After connecting to the intended power supply, the end terminations at the equipment shall be checked to insure proper voltage and signal output.

2.3.2.2 Mechanical and Electrical Completeness Test

Modified or replaced components shall be pressure tested separately with potable or treated water prior to being placed in normal operation. If the components are part of a larger system that cannot be mechanically isolated, then the larger system will require pressure testing. Untreated water shall not be allowed to enter the system until the component or system has been successfully pressure tested. Pressure testing shall follow the manufacturer's guidelines for the intended use of the equipment or system. Test guidelines should consider:

- Hydrostatically test the backwash tanks, effluent tank, and all gravity flow lines. Overflow lines need not be hydrostatically tested.
- Pressure test the GAC vessels, ancillary manifold, and all pressurized lines.
- Simulate individual equipment unit operations with potable or treated water.

- Set process set points and simulate operation of PLC controls. Modifications should initially be tested in the manual mode, with the instrumentation and control package either turned off or under limited operation.

2.3.2.3 Process Completeness

After mechanical completeness is confirmed, the treatment of impacted water can begin. The objective of the process completeness test is to verify that treatment of the impacted water is occurring. This test need only be performed if there has been a material change in the treatment process. The following steps should be performed:

1. Verify that the effluent tanks have sufficient capacity.
2. Pump groundwater from operational extraction wells for at least 10 minutes.
3. Take one analytical sample each of the GAC vessel influent and GAC vessel effluent. The effluent analysis is scheduled to have a laboratory turnaround time of 24 hours.
4. If the treated water meets the discharge requirements, it can be discharged to the injection wells and/or infiltration galleries.

As soon as the analytical results obtained during batch testing confirm that the GAC is treating the water to below the effluent criteria, normal operations may begin.

2.4 System Startup Procedures

This section contains the SCADA procedures to startup the groundwater remedy.

2.4.1 Treatment Plant Startup Sequence

The groundwater remedy can be placed back in service with or without the SCADA system using the following sequence

1. Verify all valves are in their correct operating position by cross checking the GWTP Valve Positioning Checklist (Appendix D).
2. Verify all circuit breakers are in their correct operating position.
3. Press the "System Start" pushbutton. For safety purposes, pressing the "System Start" button automatically resets all equipment in "hand" to "auto" mode. Do not confuse this push button with the "virtual" pushbuttons located in the SCADA interface. SCADA activation should follow using the next two sections.
4. Verify pressure, system direction, and flowrate through each unit operation.
5. Adjust extraction wells, injection wells and infiltration galleries to the desired flow rates, as appropriate.

6. Verify the correct flow to the injection wells and infiltration galleries.

2.4.2 SCADA Cold Start

The GWTP SCADA interface is equipped with an uninterruptible power supply (UPS), which provides nominal battery backup during a utility power outage. If the power outage exceeds the battery life, then upon power restoration the personal computer running the LookoutDirect™ SCADA software will reboot. A description of the personal computer and ancillary hardware and software is detailed in Section 6.0.

After rebooting, the personal computer will prompt the operator for the user name, which gives the GWTP Operator access to all Windows NT functions, and the computer password. To launch the LookoutDirect™ software, simply double-click on the shortcut icon resembling a lighthouse. After launching, open the project file for the OU2 groundwater treatment plant, titled "OU2_GWTP," located on the C drive root directory, and backed up on the D drive. The project file is launched in the same way that a spreadsheet or word processor file is opened. Click the "Open" command from the "File" menu, or the Open dialog box.

2.4.3 Normal SCADA Startup Procedure

The virtual Hand-Off-Auto slider switches are located on the treatment plant operator screen in the personal computer's operator interface. SCADA operations are performed by clicking virtual switches or toggles with the computer's mouse. Once the LookoutDirect™ software is running the "OU2_GWTP," the treatment plant may be started as follows:

1. Clear alarms. Alarms are described in Section 6.0.
2. Place influent control valve virtual Hand-Off-Auto slider switches in "Automatic."
3. Place appropriate effluent injection pump virtual Hand-Off-Auto slider switches in "Automatic."
4. Place GWTP in the run mode by clicking the main system virtual "start" pushbutton.
5. Place appropriate extraction pump virtual Hand-Off-Auto slider switches in "Automatic."

Detailed descriptions of the control logic are included in Section 6.0.

2.5 System Shutdown

This section contains the procedures to shut down the groundwater remedy. Conditions that will cause shutdown are also briefly discussed.

2.5.1 SCADA Controlled Shutdown

A SCADA controlled shutdown of the OU2 groundwater extraction and treatment system may be initiated as follows:

1. Place each extraction well virtual Hand-Off-Auto slider switch, located on the extraction well screen of the operator interface personal computer, to "Off."
2. Click the main system virtual "stop" pushbutton of the treatment plant operator interface panel. This will stop the effluent injection pumps and close the treatment plant influent valves.
3. Follow the mechanical procedures discussed above to secure valves and equipment.

2.5.2 Routine and Emergency Manual Shutdown Procedures

Provided the groundwater remedy, at each local PLC, is being operated in the "automatic" mode, the GWTP, extraction and injection systems can be shut down without the use of the SCADA interface. To manually shutdown the groundwater remedy, perform the following procedures:

- For an orderly, routine shutdown, press the "System Stop" pushbutton at the master PLC,
- For an urgent and immediate shutdown, press the "Emergency Stop" pushbutton at the master PLC.

Either of the two actions will shut down the groundwater remedy. For safety purposes, during either of the two plant shutdown procedures listed above, the master PLC will reset process equipment in "hand" to "auto" mode. This action will remove all permissive run circuits. After a manual shutdown:

- Verify that flow to and within the system is slowing or has stopped. After water flow has stopped, close at least one butterfly valve on each parallel influent leg.
- Complete the GWTP Valve Checklist (Appendix D) for shutdown valve positions.
- If the plant is shut down for maintenance purposes, the power to the equipment associated with that system should be shut off at the local control panel or the specific trip at the motor control center. If required, the main power can be shut off at the motor control center; however, this will also de-energize power to the building lights and the instrumentation package. Lockout/tagout procedures shall be followed for maintenance work on any electrical equipment.

2.5.3 Automatic Plant Shutdown Conditions

Provided the groundwater remedy, at each local PLC, is being operated in the "automatic" mode, the GWTP, extraction and injection systems will automatically shut down in response to pre-

programmed alarm conditions such as leak detection, high pressure, or high liquid levels. The following events may sequence into a plant shutdown or reduced flow conditions:

- Loss of primary power or a tripped main circuit breaker will cause GWTP or PLC Panel shutdown. Remember that the GWTP is electrically separate from each remote PLC Panel. A loss of electricity at one or more remote PLC Panel may not shut down the GWTP; however a loss of electricity at the GWTP must lead to a termination of water flow from each extraction well pump.
- Leak detection in one or more extraction conveyance lines will shut down the extraction wells in that portion of the conveyance line, reducing flow to the GWTP.
- Excessive influent manifold pressure, which must be set below 100 psig, will shut down the extraction well pumps. The plant will eventually shutdown. Pressing the treatment plant "start" button will not restart the plant until the pressure in the influent line decreases to below the setpoint of the pressure switch.
- Excessive water in the Effluent Tank, due to a failed ultrasonic level controller or variable speed controller, will shut down the extraction pumps.
- Excessive effluent pressure, currently set at 38 psi, will shut down the local injection pump. The plant will eventually shutdown due to the level switch high (LSH) in the Effluent Tank. Pressing the treatment plant start button will not restart the plant until the pressure in the effluent line decreases to below the setpoint of the pressure switch.

The next section provides a description of the groundwater remedy's extraction system.

3.0 Groundwater Extraction System

This section presents the OU2 groundwater extraction network overview and description, including process, mechanical, civil, and instrumentation control features. Associated electrical power and the SCADA system are covered starting in Section 6.0.

3.1 Groundwater Extraction System Description

The groundwater extraction system consists of 22 extraction wells arranged in two well networks, inter-connecting conveyance piping, and other ancillary equipment. Fifteen extraction wells distributed between the Western and Eastern Networks were installed as part of the original OU2 groundwater remedy. Seven extraction wells were installed in three clusters as part of the OU2 System Expansion and are mechanically connected to the Eastern Network at the Wye Vault. Figures 1-2 and 1-3 show the extraction wells and inter-connecting conveyance pipeline. Table 2-1 lists the major elements and components.

3.2 Pipeline and Extraction Well Nomenclature

The two distinctive networks, three well clusters, and their inter-connecting conveyance pipelines are named as follows

- The Western Extraction Network is composed of seven extraction wells adjacent to the OU2 GWTP. Three A-aquifer Extraction Wells, EW-OU2-01-A to EW-OU2-03-A, lie to the north of the OU2 GWTP, while three A-aquifer Extraction Wells, EW-OU2-04-A to EW-OU2-06-A, lie to the south. The two Western Network pipelines merge with Upper 180-foot aquifer Extraction Well EW-OU2-01-180 and are conveyed to the GWTP. A mechanical isolation valve exists at the GWTP.
- The original Eastern Extraction Network, or the Abrams well cluster is composed of eight extraction wells just north of Abrams Drive. Seven A-aquifer Extraction Wells, EW-OU2-07-A to EW-OU2-13-A, and Upper 180-foot aquifer Extraction Well EW-OU2-02-180, lie between 80th Artillery Court and Wally Court. The Eastern Network pipeline conveys groundwater to the OU2 GWTP. A mechanical isolation valve exists both just upstream of the Wye connection and at the GWTP. A 1740-foot portion of this pipeline was removed and replaced in year 2002 during the Twelfth Street Realignment. The replaced section lies between Vault Numbers 31 and 35.
- The Abrams/Imjin well cluster is composed of three extraction wells. The A-aquifer Extraction Well EW-OU2-16-A, and Upper 180-foot aquifer Extraction Wells EW-OU2-05-180 and EW-OU2-06-180 are located on the southwest corner of Abrams Drive and Imjin Road. The Abrams/Imjin pipeline conveys groundwater west between the south side of Imjin Road and the north end of OU2 Landfill Cell D. A mechanical isolation valve exists near the intersection with the Area A line.

- The California State University, Monterey Bay (University) well cluster is composed of two extraction wells. The A-aquifer Extraction Wells EW-OU2-14-A and EW-OU2-15-A are located east of Abrams Drive and south of Imjin Road. The University pipeline conveys groundwater west on the north side of OU2 Landfill Cell D, where it joins the Landfill line. A mechanical isolation valve exists at a high point near OU2 Landfill Cell D.
- The Landfill well cluster is composed of two extraction wells. The Upper 180-foot aquifer Extraction Wells EW-OU2-03-180 and EW-OU2-04-180 are located southwest of OU2 Landfill Cell C. The Landfill pipeline conveys groundwater between OU2 Landfill Cells B and C toward the north end of OU2 Landfill Cell D, where it joins with the University line. A mechanical isolation valve exists near the intersection with the University line.
- The Area A line extends from the combined Abrams/Imjin, Landfill, and University lines to the Eastern Extraction Network, where it combines with the original pipeline at the Wye vault just west of Extraction Well EW-OU2-10-A. Mechanical isolation valves exist just upstream and downstream of the Wye connection.

3.3 Extraction Well Features

Original OU2 well installation information is detailed in the *Well Installation and Abandonment Report* (IT, 1996). Well locations are shown on Figures 1-2 and 1-3, as well as in the *Draft Final Construction Drawings* (IT, 2002) as IT File Number 783751-E7 and -E8.

OU2 System Expansion well installation information, including the installation of Monitoring Well MW-OU2-78-180, is detailed in the *Draft Final Well Installation and Abandonment Report* (IT, 2001c). Typical extraction well schematics are illustrated in the *Draft Final Construction Drawings* (IT, 2002) as IT File Number 783751-E37. Table 2-2 lists the estimated maximum theoretical flowrate for each extraction well.

3.3.1 Original Extraction Wells

Two wells were installed in the Upper 180-foot aquifer (Extraction Wells EW-OU2-01-180, and -02-180) and thirteen wells were installed in the A-aquifer (Extraction Wells EW-OU2-01-A, to -13-A) to depths between 129 and 174 feet below grade surface. Each extraction well was fitted with a carbon steel well casing; a stainless steel, type 304, continuous wire-wrapped slotted screen and end cap; and a 1-inch diameter, PVC schedule 40 (PVC 40) sand tube.

The six-inch diameter screens in the A-aquifer wells extend from the base of the A-aquifer to 5 feet above the water table. The ten-inch diameter screens in the Upper 180-foot aquifer wells extend from the intermediate 180-foot aquitard to the top of the aquifer. The open-ended sand

tube is placed outside the primary casing but inside the borehole, and extends into the top of the sand pack.

3.3.2 System Expansion Extraction Wells

Four extraction wells were installed in the Upper 180-foot aquifer (Extraction Wells EW-OU2-03-180, -04-180, -05-180, and -06-180) and three were installed in the A-aquifer (Extraction Wells EW-OU2-14-A, -15-A, and -16-A) to depths between 115 and 323 feet below grade surface. Each extraction well was fitted with a PVC schedule 80 (PVC 80) well casing and sump; a stainless steel, type 304, 0.045-inch, continuous wire-wrapped slotted screen; a 1-inch diameter, PVC 40 sand tube; and a 1.5-inch diameter, PVC 40 piezometer tube.

The six-inch diameter screens in the A-aquifer wells extend from the base of the A-aquifer to 5 feet above the water table. The ten-inch diameter screens in the Upper 180-foot aquifer wells extend from the intermediate 180-foot aquitard to the top of the aquifer. A 5-foot-long bottom sump with end cap is attached to the bottom of each screen to collect sand and sediment that may accumulate during operation. The piezometer and sand tube were placed outside the primary casing but inside the borehole. The piezometer includes a 0.020-inch slotted PVC screen that extends over the same depth interval as the extraction well screen. The sand tube is open ended and extends 18 inches into the top of the sand pack.

3.3.3 Extraction Well Maintenance

A loss of 25 percent or greater in specific capacity in an operational extraction well, when compared to the initial specific capacity of the well, is the metric to be used as an indicator for well rehabilitation. The initial specific capacities are listed in the *Draft Final Construction Completion Report* (IT, 2001a). Periodic checks of each well's specific capacity are not required; however, if a well's flowrate decreases substantially, there may be an operational requirement to rehabilitate the well to maintain the overall extraction system's performance.

The more common reasons for diminished specific capacity include biofouling and chemical encrustation. Biofouling events can be complex, may be caused by a variety of bacteria, and may form under the following four mechanisms: excretion of extracellular slimes, accumulation of soil particles and precipitated minerals within the slime, occlusion due to gas generation, and biological corrosion generating hydrogen sulfide or organic acids. The mechanism, appearance and odor of the biofouling must be taken into consideration before a treatment procedure is selected. Iron bacteria are suspected in some OU2 Eastern Network extraction wells, while adjacent wells are apparently not affected by iron bacteria. During wellhead pipe maintenance

performed in 1997, biofouling was noted at Extraction Wells EW-OU2-07-A and EW-OU2-11-A. Since biofouling was not noted at nearby extraction wells, a generalized approach to rehabilitating a low-flow well is not advised.

Chemical encrustation events can also be complex. Chemical interaction modeling performed for the Sites 2/12 groundwater remedy, suggests that calcite will be the dominant precipitant, with lesser amounts of ferric hydroxide, goethite, and manganese dioxide forming. Other calcium and magnesium compounds may also precipitate. Although calcite is soluble in acids, even strong acids may have little effect on ferric hydroxide, goethite and manganese dioxide. Except for the presence of brackish water, the Sites 2/12 geochemistry appears similar to OU2 geochemistry. During the OU2 Expansion pipeline and treatment plant renovations in 2000, chemical encrustation was noted on nearly all wetted surfaces.

3.4 Extraction Well Mechanical Features

A submersible pump and motor, drop pipe, wellhead piping, ancillary instrumentation, and underground concrete vaults are installed at each extraction well. Associated electrical features are covered in Section 6.0. Table 2-2 lists the recommended operational flowrates for each extraction well.

3.4.1 Extraction Well Pump and Motor

A dedicated, stainless steel submersible pump, cast iron motor, shroud, and drop pipe are installed in each extraction well. The PVC shroud helps direct water flow over the motor. Drop pipes mechanically connect the pump and pump motors to the well cap, which is located at the top of each extraction well.

At each original Western Network A-aquifer extraction well, a 24 to 55 gpm, 5-horsepower submersible pump and 2-inch diameter drop pipe is installed. The Western Network Upper 180-foot aquifer extraction well is equipped with a 75 to 225 gpm, 20-horsepower submersible pump and 3-inch diameter drop pipe. Drop pipes are completed with type 304 stainless steel to just above the water table, and continues to the well cap as carbon steel.

At each original Eastern Network A-aquifer extraction well, a 18 to 32 gpm, 3-horsepower submersible pump and 1.5-inch diameter drop pipe are installed. The Eastern Network Upper 180-foot aquifer extraction well is equipped with a 150 to 290-gpm, 25-horsepower submersible pump and 3-inch diameter drop pipe. Except for rehabilitated wells EW-OU2-07A and EW-

OU2-11A which have all stainless piping, drop pipes are completed with type 304 stainless steel to just above the water table, and continues to the well cap as carbon steel.

The System Expansion extraction wells are completed alike. A 18 to 32-gpm, 3-horsepower submersible pump and 1.5-inch diameter stainless steel drop pipe are installed in each A-aquifer extraction well. A 100 to 220-gpm, 20-horsepower submersible pump and 3-inch diameter stainless steel drop pipe are installed in each Upper 180-foot aquifer extraction well. Drop pipes are completed with type 304 stainless steel continuously from the pump to the well cap.

3.4.2 Extraction Well Vault Construction

Each extraction well is protected by an underground concrete vault, with top access at grade level through a traffic-rated lockable lid. The H-20 vault lids and frames are made of corrosion-resistant, type 6061 aluminum. The hinged lids are lockable to reduce unauthorized access, are designed with a built-in drainage channel, and are sealed to reduce seepage of water into the vaults during storm-related events. Since the well, pipe, and conduit penetrations through the concrete sides and bottom are finished with a watertight sealant, the vault and sump function as a containment area for the single-walled wellhead piping. Concrete vault locations are tabulated on Table 3-1, Extraction Well, Pipeline, and Infiltration Gallery Concrete Vault Locations.

Original OU2 A-aquifer vaults are 4-foot by 5-foot by 4-foot deep, while the original OU2 180-foot aquifer vaults are 5-foot by 6-foot by 4-foot deep. Each vault has a solid concrete bottom.

The System Expansion A-aquifer vaults are 6-foot by 6-foot by 4-foot deep by 6-inch thick, while the System Expansion 180-foot aquifer vaults are 9-foot by 6-foot by 4-foot deep by 8-inch thick. The vaults have a solid concrete bottom with an 18-inch deep sump designed to contain minor water leaks or condensation that may occur within the well vault.

3.4.3 Original Extraction Wellhead

Each original OU2 extraction wellhead contains a black iron well cap, check valve, mechanical flowmeter, and a globe valve. Secondary branches include an air release and vacuum valve, a manual reset pressure switch, a pressure gauge, and a sample port. A float switch is located near the electrical box and serves as the well vault leak detection. Two automatically-reset pressure switches, one in each network, provide redundant, high pressure shutoff. One switch is located at EW-OU2-01-180 and EW-OU2-02-180.

Each groundwater extraction pump is controlled both locally at the well vault, as well as remotely from the local PLC panel. Local electrical components are installed in a NEMA 3R enclosure located in each well vault. The hand-off-auto switch and on-off disconnect are mounted on the outside of the NEMA 3R enclosure. A manually resettable pressure switch installed on the process piping within the well vault will shut off the well pump under a high pressure condition in the automatic mode. In "hand" mode, the control instrumentation will be bypassed allowing for operational testing of the pump.

In automatic mode, the well pump is controlled at the local PLC panel based on the water level determined by sensors within the well. A discrete output signal originating from the local PLC is required to activate the submersible pump motor starter. Loss of this control signal will open the contacts on the motor starter preventing pump operation in either the manual or automatic mode. To minimize pump cycling and to obtain the necessary flowrate from the well, the globe valve within the well vault must be manually adjusted as required.

A mechanical flowmeter is installed within the well vault to measure the individual well flowrate. The flowmeter has a local display indicating instantaneous flowrate and the total recorded flow in gallons.

3.4.4 System Expansion Extraction Wellhead

Each OU2 System Expansion extraction wellhead contains a stainless steel well cap, check valve, analog output flowmeter, and an equal percentage globe valve. Secondary branches include an air release and vacuum valve, a manual reset pressure switch, a pressure gauge, and a stainless steel sample port. A float switch is located near the sump and serves as well vault leak detection. Three automatically-reset pressure switches provide redundant, high pressure shutoff. One switch for each system is located at EW-OU2-06-180, EW-OU2-15-A, and EW-OU2-04-180.

Each groundwater extraction pump is controlled both locally at the well vault, as well as remotely from the local PLC panel. Local electrical components are installed in a NEMA 4X enclosure located in each well vault. The hand-off-auto switch and on-off disconnect are mounted on the outside of the NEMA 4X enclosure. A manually resettable pressure switch installed on the process piping within the well vault will shut off the well pump under a high pressure condition in the automatic mode. In "hand" mode, the control instrumentation will be bypassed allowing for operational testing of the pump.

In automatic mode, the well pump is controlled at the local PLC panel based on the water level determined by pressure transducers within the well. A discrete output signal originating from the local PLC is required to activate the submersible pump motor starter. Loss of this control signal will open the contacts on the motor starter preventing pump operation in either the manual or automatic mode. To minimize pump cycling and to obtain the necessary flowrate from the well, the globe valve within the well vault must be manually adjusted as required.

An electronic flowmeter is installed within the well vault to measure the individual flowrate from each well. The flowmeter has a local display indicating instantaneous gpm and the total recorded flow in gallons. The flowmeter is electronically wired to send a flow-indicating 4-20 milliamp (mA) analog input signal to the local PLC for remote monitoring.

3.4.5 Extraction Well Pump Maintenance

Indications that well pump maintenance is required may include reduced water flow, low wellhead pressure readings, excessive motor noise, and/or excessive power consumption. Each individual pump can be shut down by turning its extraction well control panel switch to the off position. Close the globe valve before performing pump or wellhead maintenance. If electrical power maintenance is performed, the electrical disconnect located at the local distribution panel should also be tagged and locked out.

Pump and motor wear will occur over time. Wear of the pump impellers may be accelerated due to abrasion from formation sand particles. The wetted surfaces of both the pump and motor are composed of stainless steel. If the pump or motor fail within the first three years of operation due to chloride attack, consideration should be given to procuring a pump and motor composed of a more chlorine-resistant metal.

Vapor lock can occur at high points within the wellhead piping and extraction pipeline. In smaller diameter pipe such as in the wellhead piping, increased head resistance and false flowmeter readings are indicative of excessive entrained air. The air/vacuum break valve, located at a high point, is placed to remove the majority of the produced air. The sample port, located at another high point within the wellhead, should be opened occasionally to remove entrained air. Entrained air can be removed within the buried pipeline by periodically opening the high point vents.

3.5 Extraction Conveyance Piping

Figures 1-2 and 1-3 show the layout of the extraction network, excluding for clarity, modifications performed during the Twelfth Street Realignment. A list of the Twelfth Street Realignment construction drawings can be found on Figure 1-1 and in Appendix A, with the drawings included in the *Draft Final Construction Drawings* (IT, 2002). The conveyance pipeline ties each extraction well into a header that conveys process water back to the GWTP. Each line is double contained, with an integrated leak detection system.

3.5.1 Pipeline Materials of Construction

The original OU2 pipeline and pipe-to-pipe connections are predominantly composed of PVC80 for the carrier (inner) pipe, and PVC40 for the containment (outer) pipe. The System Expansion pipeline, and the Twelfth Street Realignment pipeline are predominantly composed of high-density polyethylene (HDPE) pipe for both the carrier and containment. Connections between the pipelines, at monitoring points, and at termination points are flanged with spool pieces predominantly of PVC80. Flanged, pipeline system connections for the System Expansion pipeline and the Twelfth Street Realignment are in accessible, locked concrete vaults with leak detection alarms.

3.5.2 Twelfth Street Realignment

About 1740 feet of 8-inch x 12-inch PVC pipe, along with the parallel single contained PVC pipeline and leak detection wiring, was removed from service between Vault No. 31 and 35 in Year 2002. A similar amount of HDPE pipe, single contained, double contained and control wire conduit, was placed north of the toe of the slope for the realigned Twelfth Street. The pipeline was procured, placed, and inspected following the previous System Expansion procedures and specifications.

3.5.3 Wye Vault

The System Expansion connects with the Eastern Network at a single-contained, fiberglass reinforced, PVC80 Wye connection, located just west of Extraction Well EW-OU2-10-A. Two manual valves, one a PVC80 butterfly valve, and one a stainless steel knife gate valve, provide network isolation capability. Access to the Wye connection is through the Wye vault. The vault is equipped with a liquid level sensor tied to the Eastern Network PLC panel.

3.5.4 Extraction System Operation and Maintenance

Evaluation over time of individual wellhead and GWTP flow and pressure measurements may reveal problems that can be isolated to a specific extraction well, wellhead piping, or extraction

pipeline, while providing initial indications of whether the problem is physical, electrical, mechanical, or process-control related.

Pipeline leaks may occur due to simple component aging (brittle gasket break), but are more likely to occur after the system has been stressed (weather/earthquake or manmade). The GWTP Operator must monitor for changes in flow or pressure trend lines, and assist the Site Engineer in establishing the root cause of all leaks.

Electrical- and process-control related manifestations usually occur suddenly, and are often associated with a step change in performance. For example, if a motor fails, there will be a step change decrease in both the individual wellhead and GWTP flowrate.

Physical- and mechanical-related manifestations are often associated with gradual changes in performance, usually occurring over days to months. Examples of physical- and mechanical-related manifestations include vapor lock, chemical encrustation, biofouling, aquifer formation plugging by fine grained particles, deterioration of the well screen, and general pump related performance issues.

3.5.5 Conveyance Pipe Leak Detection

Extraction piping within the well vaults and the GWTP is single-contained. Between the well vaults and the GWTP boundary, the extraction pipelines are double contained. Liquid level sensors installed within the low-point collection assembly monitors for leaks or breaks in the primary line.

Within the Western and original Eastern Extraction and pipeline networks, if a leak is indicated, the sensor trips an electronic circuit at the local leak detection control panel. A visual display on the leak detection control panel indicates the location of the low point nearest the suspected leak. Each leak detection control panel is wired to the local PLC. There are two leak detection sensors in the Eastern network that are tied to the GWTP. Upon detection of a leak, the local PLC will shut down the Western Network extraction pumps. To restart the local pumps, the leak detection sensor must be cleared, or bypassed. Bypassing the leak detection sensors shall only occur during maintenance and troubleshooting activities related to the leak detection system.

Within the Abrams/Imjin, Landfill, and University Extraction and pipeline networks, if a leak is indicated, the sensor trips an electronic circuit directly to the local PLC. Upon detection of a leak, the local PLC will shut down the local extraction pumps and signal the master PLC at the

GWTP. To restart the local pumps, the leak detection sensor must be cleared, or bypassed. Bypassing the leak detection sensors shall only occur during maintenance and troubleshooting activities related to the leak detection system.

3.5.6 Leak Alert System

The alarm to the leak detection system can be checked manually by pressing either the liquid or vapor button on the Leak Alert panel. Periodically test a representative leak detection probe by fully submerging in a container of water. This should alarm and shut down the corresponding networked extraction wells. As operational familiarity increases, the frequency of probe testing can decrease. Testing frequency should be reevaluated annually.

4.0 Groundwater Treatment Plant

This section presents a description of the GWTP equipment, including process, mechanical, civil, and instrumentation control features. The GWTP contains four GAC adsorption vessels, two backwash tanks, one effluent tank, ancillary pumps, and connecting piping. Associated electrical power and the SCADA system are described in Section 6.0.

4.1 Groundwater Treatment Plant Building and Containment

The GWTP is divided into the eastern, northern, and building concrete containment areas, and a concrete pad on the east side of the building. The building and containment areas were installed in 1995. Surface modifications to the eastern containment, northern containment, and wings of the truck pad areas were performed in 2000 and are documented in the *Draft Final Construction Completion Report*, (IT, 2001a).

4.1.1 Building and Containment Foundation

A 40-foot by 60-foot by 14-foot 4-inch high clear-span metal building provides weather protection for the continuously operating process equipment, electrical distribution, and ancillary control instrumentation. The building's concrete foundation is integrated with the foundations for individual equipment and with the building's containment area and sump. The containment area is designed as a spill control area encompassing the entire floor of the building. The building conforms to the 1994 Uniform Building Code, with the following design parameters: live load rating of 20 pounds per square foot; wind loading of 70 miles per hour; and a seismic zone of 4.

The building's metallic shell and internal supports shall be inspected periodically (Appendix D) for corrosion wear and other surface damage. Areas of significant damage or wear on the building's metallic shell shall be replaced as appropriate to insure structural integrity and weather tightness. Areas of minor corrosion on the building's internal supports shall be periodically hand or machine brushed to bare metal, a good zinc-based primer added, followed with an appropriate topcoat matching the original surface paint. Areas of significant corrosion shall be inspected to insure structural integrity, repaired if required, and then primed and painted. Ancillary building components shall also be periodically inspected for corrosion and repaired as appropriate.

4.1.2 Spill Control Areas

The eastern and northern containment areas, which are outside of the GWTP building, are designed as spill control areas. Each area is sloped for more effective area drainage, has raised equipment pad surfaces, and has individual sumps. Each containment area will drain into the other if water levels exceed the floor of the pipe chase that physically connects the two areas. The truck apron drains into the eastern containment, allowing the truck pad to be free of standing water during minor spill events. Concrete surfaces in the containment areas (not including the truck pad) have been prepared and coated with a sealant. The sealant is intended to provide a long term, high strength protective surface under a light industrial setting and a marine coastal environment.

4.1.3 Stormwater Containment and Management

The eastern and northern containment areas are also designed to manage stormwater. The tank and equipment pad elevations are designed to place the top of the pads above the flood level during a 24-hour, 25-year storm event. The storage capacity of each containment area is also sufficient to contain the storage volume of the largest tank during a similar storm event.

4.1.4 Containment Sump Pumps

The three containment areas drain to their respective sumps. Each sump has a dedicated sump pump, which is automatically controlled to pump to the backwash tank. The sump pump is equipped with attached level low and level high switches. Water collected in the sumps is recycled through the treatment system as described in Section 4.2.4.3.

The operation of the sump pump is tested manually by lifting the level switch to the high position. The pump should turn on. When the level switch is released and the level falls down, the pump should turn off. At the power switch the “1" is the on position and the “0" is the off position. If the pump is pumping at a reduced flowrate, the y-strainer could be filled with debris. The strainer should be removed and cleaned if necessary.

4.2 Granular Activated Carbon Treatment System

The water treatment technology used is VOC adsorption onto GAC. Four vessels holding up to 20,000 pounds of GAC each are located to the north and east of the GWTP building. Figure 2-1 is a generalized representation of the GAC treatment process.

4.2.1 Granular Activated Carbon Vessels

The eastern containment area contains two parallel vessels purchased from Calgon Carbon in 1995 and installed as part of the original OU2 groundwater remedy. The twin 10-foot diameter with 12-foot straight side vessels were manufactured by Downey Welding and Manufacturing Company of Downey, California, with tank serial numbers 5333 and 5334. Each vessel has a capacity to contain up to 20,000 pounds of GAC. Maximum design pressure is 125 pounds per square inch gauge (psig) at 150 degrees Fahrenheit. Minimum design temperature is 15 degrees Fahrenheit at 125 psig. In 2000, both vessels were internally sandblasted and relined with Plasite® 4110, and externally cleaned and epoxy coated. Two 125 psig rupture disks are installed on the adjacent PVC80 manifold. Each vessel's internal components and internal surfaces shall be periodically inspected, usually during carbon changeouts (Section 4.2.3, Item Number 6).

Each vessel's external surfaces shall be inspected periodically for corrosion wear and other surface damage. Areas of minor corrosion on the vessel's supports may be periodically hand or machine brushed to bare metal, a good zinc-based primer added, followed with an appropriate topcoat matching the original surface paint. The vessel may periodically require a complete sandblast, prime and paint. Areas of significant corrosion shall be inspected to insure structural integrity, repaired if required, and then primed and painted. Based on the corrosive effects of the marine coastal environment, consideration should be given to adding a passive or active cathodic protection system to minimize corrosive wear.

The northern containment area contains two parallel vessels purchased from Northwestern Carbon in 2000. The twin 10-foot diameter with 8-foot straight side vessels each have a capacity to contain up to 20,000 pounds of GAC. Interior tank lining is Plasite® 4110. Design pressure is 125 psig at 150 degrees Fahrenheit. Normal design temperature is 100 degrees, with a design maximum of 150 degrees. Two 125 psig rupture disks are installed on the adjacent manifold. The PVC80 pipe manifold is valved similarly to the manifold in the eastern containment.

The PVC 80 valve manifold between the two sets of vessels allows for lead-lag series service, parallel vessel service, or backwash maintenance flushes. The manifold contains four individually valved, stainless-steel sample ports, and both single point pressure gauges and differential pressure gauges.

4.2.2 Adsorption Vessel Operation

The GAC vessels shall be operated in series during normal operation. The valve assembly or manifold located between the GAC vessels allow for either bed to be valved as the lead or lag bed. Pressure indicators on the manifold are used to monitor the system's influent, midpoint, and effluent pressures. A rupture disk is provided downstream of each GAC vessel. Failure of the rupture disk redirects groundwater flow to the backwash tank, providing pressure relief of the main process line.

It is important to verify which bed is the lead bed and to verify that process water is flowing through both beds during normal operation. Improper valve operation may result in unanticipated changes in treatment efficiency producing an effluent concentration that may not meet discharge requirements. The valves shall be periodically inspected and logged to verify correct positioning, especially after each change of operation (Appendix D).

4.2.3 Granular Activated Carbon Changeouts

A GAC changeout will be scheduled when the COC concentration from the lead vessel's effluent approaches the discharge limits for treated water provided in Table 1-1. For chloroform, 1,1-DCA, and cis-1,2-DCA, the maximum discharge limits need only meet the ACLs.

When analytical testing indicates that a changeout is required, the spent GAC will be replaced with either virgin or regenerated GAC. The spent GAC will be removed off site and regenerated or disposed of by the supplier, in accordance with federal, state, and local laws and regulations. The new bed will be backwashed, and then the bed sequence will be switched. The former lag bed will become the lead bed, and the bed with the fresh, activated carbon will become the lag bed.

Because the GWTP has two parallel GAC vessels, the groundwater remedy can be operated while one set of GAC vessels is being changed out. While the groundwater remedy is operating at a reduced flow, the GWTP operator shall take advantage and perform appropriate maintenance on in-line equipment.

The procedures listed below shall be followed as part of the GAC changeout. To minimize vendor standby time and cost, the first three items should be completed before the GAC supplier arrives onsite.

1. Verify that the 25-hp air compressor is operating properly at least one day prior to the changeout.

2. Reduce the liquid level or empty both backwash tanks to allow for maximum backwash water volume. If the other set of GAC vessels will not be operating during the changeout, fill the effluent tank with treated or potable water.
3. Prepare the GWTP for the changeout by inspecting the area around the GAC vessels, noting the availability and functionality of appropriate water and air lines, vessel fill and drain lines, vessel vent lines, and associated valves.
4. Reduce the extraction well water flow to the treatment plant to correspond to the treatment flow capacity of the remaining set of GAC vessels. If the other set of GAC vessels will not be operating during the changeout, stop all extraction well water flow.
5. Prepare the GAC vessels for the changeout by closing off the manifold valves at the appropriate vessel. If the other set of GAC vessels are to continue treatment operations during the changeout, periodically verify that the water flow is continuing, and that untreated water is not flowing to the effluent tank.
6. The GAC vendor shall transfer out the spent GAC. When the vessel is empty, remove the manway flange and visually inspect the interior of the bed from the outside. No internal access of the GAC vessel shall be allowed without a confined space entry permit and the associated safety procedures. Verify that minimal residual carbon remains and all internal equipment is in place. Photographs of the vessel should be taken at least once per year for maintenance review.
7. Once the manway flange is reinstalled, fill the GAC vessel with water to the level recommended by the manufacturer, and transfer in the virgin or regenerated carbon. Ensure excess air and water is vented to the backwash tank.
8. Perform a backwash on the vessel containing the replaced GAC, as detailed in the next section. After completion of the backwash, configure the manifold valves so that the bed containing the replaced carbon is in the lag position. Verify that all closed valves are fully closed to prevent untreated water bypass.
9. Following the groundwater remedy startup procedures (Section 2.0), verify that all valves are in their correct position, verify that water is flowing in the intended path, and the system is operating normally.
10. Additional GAC vessel backwashes may be required to reduce the pressure differential between the top and bottom of the bed. Backwash water should be managed as described in the following section.

4.2.4 Granular Activated Carbon Backwashing

GAC backwashing is required after changeouts, and may be required at other times to repack the bed, remove excessive GAC fines from the vessel, reduce COC channeling or reduce bed compaction. Backwash water may be directed to either of two backwash tanks, the northern

containment's 10,000-gallon carbon steel tank, or the eastern containment's 6,000-gallon stainless steel tank. The backwash water is filtered through a bag and cartridge filter located in the eastern containment prior to being recycled into the influent stream. If recycling is not possible the backwash water may be discharged to the sewer under permit.

4.2.4.1 Backwash Tank and Pump

A backwash tank and pump is installed in each outside containment area. The tanks and pumps are piped to allow liquid exchange. Each pump is controlled through a hand-off-automatic switch in the motor control center and a local on/off switch. In automatic mode the backwash pump cycles on when the backwash tank level switch high energizes and shuts off when the backwash tank level switch low is de-energized. Activation of the backwash line high-pressure switch shuts off the respective pump. Hand operation will override the low and high level sensor control.

4.2.4.2 Backwash Flow Velocity

Prior to backwashing a just-changed GAC bed, the GWTP Operator must ascertain the elapsed time that the GAC has been wetted, or the time allowed to soak in freestanding water. An 8 by 30 mesh GAC that has been wetted for 12 hours at 80 degrees Fahrenheit will be less than 89 percent wetted. At 72 hours, the same GAC will be about 95 percent wetted. Backwashing a low-wetted bed will increase the likelihood of significant solids carry-over, resulting in the loss of product-rated sized GAC to the backwash tanks.

The recommended flow velocity is dependent on a number of factors, including GAC size, percent wetted, water temperature, and other vessel specific features. Generally, the following guidelines should be observed for newly wetted GAC:

- Vessel backwashing shall not occur if the GAC has been wetted for less than 12 hours.
- Between 12 and 24 hours, backwashing may range up to 200 gallons per minute. Start at the lowest flowrate that generates GAC fine carry-over. Hold at this flowrate until the liquid begins to clear, but not less than 15 minutes, then increase flowrate by 10 percent every 10 to 15 minutes. Do not exceed 200 gallons per minute.
- Between 24 and 48 hours, backwashing may range up to 400 gallons per minute. Start at 50 to 75 percent of the previous backwash flowrate, hold until the liquid begins to clear, then increase the flowrate by 10 to 15 percent every 5 minutes. Do not exceed 400 gallons per minute.

- Between 48 and 96 hours, backwashing may range up to 600 gallons per minute. Start at 75 percent of the previous backwash flowrate, hold for 5 to 10 minutes, then increase the flowrate by 10 to 15 percent every 5 minutes. Do not exceed 600 gallons per minute.

4.2.4.3 Backwash Procedures

Follow the generalized GAC backwash flow velocities discussed in the previous section. The general backwashing procedures are as follows:

1. Verify that the backwash tank(s) has sufficient storage capacity for an adequate backwash duration.
2. Verify that the effluent tank contains adequate water for the backwash operation, or that flow to the effluent tank will be adequate to sustain the planned backwash operation.
3. Reduce the extraction well water flow to the treatment plant to correspond to the treatment flow capacity of the remaining set of GAC vessels. If the other set of GAC vessels will not be operating during the backwash, stop all extraction well water flow.
4. Terminate untreated extraction well water flow to the specific vessel being backwashed. Configure the valves for the backwash operation following the Valve Positioning Checklist (Appendix D). For additional backwashing information see the GAC vendor information in Appendix B.
5. See the previous section for backwashing a newly wetted bed. Start the backwash at the lowest velocity that generates GAC fine carry-over or about 200 gallons per minute, whichever is less. Increase the flowrate by 50 gallons per minute every 5 to 10 minutes. Do not exceed the flow velocity that expands the bed to the point where the top of the fluidized GAC is carried to the backwash tank.
6. Allow the backwash to continue until the water level in the backwash tank reaches the high level as marked on the sight gauge. When this level is reached, turn off the injection pump by depressing the stop button located at the variable frequency drive for that pump.
7. Reconfigure the GAC vessel valves for the desired operation as detailed in the Valve Checklist (Appendix D). If a GAC changeout was performed, verify that the vessel with the replaced GAC is put into the lag position. Verify that all closed valves are fully closed to prevent untreated water bypass.
8. Before restarting the groundwater remedy, reset the injection pump to the "oper" mode located on the "Force Analog O/P" page and to the "auto" mode located on the "Remote Systems" page. Disengage the stop button at the variable frequency drive.
9. Follow the groundwater remedy startup procedures, and verify that all valves are in their correct position. Monitor the system to verify that water is flowing and the system is operating normally.

Additional GAC vessel backwashes may be required to reduce the pressure differential between the top and bottom of the bed.

4.2.4.4 Recycling of Backwash Tank Water

The first batch of backwash water that follows a changeout should be allowed to settle overnight, but may be filtered slowly and recycled if storage capacity is required. The following day, the water may be pumped through the backwash filters and recycled through the treatment plant. Subsequent backwash water batches, as necessary to remove fines, should be slowly filtered and recycled to free up storage capacity. Unloading and loading transfer water may be filtered and recycled the day of the changeout.

During normal operations, open the valves on the backwash tank line and start the backwash pump. Monitor the pressure downstream of the backwash pump and adjust the discharge valve until the desired flowrate is achieved. When the water in the backwash tank reaches the low level as marked on the sight gauge, turn off the backwash pump and close all valves on the backwash tank line. Periodically examine the filters to determine if replacement is necessary.

Monitor the pressure downstream of the backwash pump and adjust the discharge valve until the desired flowrate is achieved. When the water in the backwash tank reaches the low level as marked on the sight gauge, turn off the backwash pump and close valves on the backwash tank line. While filtering, the bag and cartridge filter pressure gauges must be periodically monitored. An increased pressure reading is indicative of a reduced water flow rate. Filter replacement may eventually be required.

4.2.4.5 Offsite Water Discharge

Backwash water discharged into the sewer requires a one time discharge permit obtained from the Monterey Regional Water Pollution Control Agency (MRWPCA). Discharged water should be minimized, and only performed when recycling is not possible or desirable. Filtered and treated water generated during GAC changeouts should be recycled. Should a sewer discharge following a GAC changeout be required, the permit should address the anticipated water volume, including typically:

- 5,000 gallons of decanted unloading water
- 4,000 gallons of filtered loading transfer water
- Two to four 10,000-gallon batches of filtered backwash water.

4.2.4.6 Bag and Cartridge Filter Changeout

Pressure gauges are a good indicator of when the bag filters and/or cartridge filters need to be changed. Excessive pressure indicates low flow and high pressure drop through the filter vessels. To change out the filter vessels, let the pressure in the backwash line down to 1 atmosphere through the bleed valve. Carefully loosen and remove cover bolts on top of the vessels. Remove the filters and replace with new ones. When you put the cover back on, be sure that the O-ring is placed in its proper position, and carefully retighten the cover bolts. Discard the filters as a hazardous waste until reclassified.

4.3 Other Groundwater Treatment Plant Equipment

The influent pipeline is a primary process pipeline and conveys untreated water from the extraction wells to the GAC systems. Two pipelines enter the GWTP, one from the Eastern Network, and one from the Western Network.

4.3.1 Influent Manifold

The influent manifold combines flow from the Western and Eastern Networks. If one of the networks is not in operation, the butterfly valve for that network should be closed to reduce reverse flow back to the well vaults. Following a brief, scheduled plant shutdown, the influent manifold butterfly valves should be closed to isolate the treatment plant. Other valves downstream of the influent manifold may be left at their set positions to minimize adjustments during the subsequent startup.

4.3.2 Flow Control Valve and Basket Strainer

After entering the GWTP, the two untreated water lines convey past parallel mounted air-to-open flow control valves and two parallel basket strainers. Upon an alarm condition, one or both valves will close, shutting water flow to the GWTP. The basket strainer filters suspended solids that may affect the operation of downstream instrumentation or mechanical devices. Buildup of particles is indicated by an increased pressure drop, measured from two pressure gauges positioned before and after the basket strainer. A pressure switch is located upstream of the strainer. A high-pressure condition will send an alarm signal and shut down the extraction well pumps.

The two lines are mixed in an in-line static mixer, and split into two parallel streams, each with a flowmeter. The two streams are directed to either the northern containment or eastern containment GAC vessels. Treated water then flows to the Effluent Tank.

4.3.3 Effluent Tank

The stainless steel effluent tank, which has a nominal holding capacity of 10,000 gallons, is used primarily as a surge tank and is intended to be half-filled during normal operations.

The effluent tank has an ultrasonic level transmitter, as well as a level switch high and level switch low sensor installed. Both the switches send discrete digital signals to the master PLC. Upon switch activation, the master PLC will shut down the extraction pumps. Upon LSL activation the master PLC will shut down the injection pumps.

The ultrasonic level transmitter sends a 4-20 mA analog input signal to the master PLC for water level monitoring. The master PLC sends a 4-20 mA signal to the injection pump's variable speed controllers. The master PLC is programmed to maintain a near constant effluent tank water level by adjusting the injection pump's flowrate based on the tank's level.

Following a scheduled, brief plant shutdown, the valves at the effluent tank and the injection pumps should be closed to isolate the treatment plant. Gate and globe valves located downstream of the GWTP building may be left at their set positions to minimize remote adjustments during the next startup.

4.3.4 Plant and Instrument Air

A 25-horsepower, 460-volt single-stage air compressor provides the requisite air flow and pressure required during carbon changeouts. A 1.5-horsepower air compressor is staged in series with the larger air compressor. A particulate filter and an oil/water coalescer are installed in series after the discharge header. Plant air is additionally available through chicago-type fittings placed near the GAC vessels.

4.3.5 Potable Water

A 2-inch water line supplies the GWTP with potable water. The potable water line directs water to each of the three containment areas at hose bibs, restroom, two eyewash stations, and one combination safety shower and eyewash station.

5.0 Treated Water Injection System

This section describes the OU2 treated water injection system, including process, mechanical, civil, and instrumentation control features. Associated electrical power and the SCADA system are covered in Section 6.0. The treated water injection system consists of six parallel injection pumps, conveyance piping to the Sites 2/12 GWTP, two injection wells and two infiltration galleries, and other ancillary equipment. Figures 1-2 and 1-3 show the layout of the treated water injection system.

5.1 Injection Pumps and Injection Points

Variable speed controllers control the flow to each injection point. Each controller operates sequentially off the Effluent Tank. As the water level rises in the tank, the variable speed controllers increase the motor speed, conveying a higher flow rate to the injection point.

5.1.1 Northwest Injection

Injection Pumps, P-910 and P-920, convey water to the northwest injection point. The northwest injection point is composed of Infiltration Gallery INF-OU2-01-180 and Injection Well IW-OU2-01-180. The single-contained PVC40 pipeline and injection well were installed in 1995. The two pumps, infiltration gallery, and the PVC80 connection between the well and gallery were installed in 2000.

5.1.2 Southwest Injection

Injection Pumps, P-510 and P-520, convey water to the southwest injection point. The southwest injection point is composed of Infiltration Gallery INF-OU2-02-180 and Injection Well IW-OU2-02-180. The two pumps, single-contained PVC40 pipeline and injection well were installed in 1995. The infiltration gallery, and the PVC80 connection between the well and gallery, were installed in 2000.

5.1.3 Eastern and Site 2 Injection

Injection Pumps, P-410 and P-420, convey water to the eastern injection point or to Site 2. These pumps are also used to recycle treated water to the backwash tank for either set of GAC vessels. The two pumps, single-contained PVC40 pipeline and Injection Well IW-OU2-03-180 were installed in 1995. The single-contained HDPE pipeline to Site 2 was installed in 1999. In

Year 2002, a 1740-foot segment of PVC40 was removed and replaced with SDR11 HDPE as part of the Twelfth Street Realignment. The replaced segment is between Vault No. 31 and 35.

5.2 Injection Wells

Injection Wells IW-OU2-01-180, IW-OU2-02-180, and IW-OU2-03-180 were installed as part of the original OU2 groundwater remedy. These three injection wells are not designed to operate continuously at the increased flowrates obtained with the additional 7 System Expansion wells. Injection well completion detail is documented in the *Draft Final Well Installation and Abandonment* Report (IT, 1996).

Well performance may be compromised by chemical encrustation, biofouling, aquifer formation plugging by fine-grained particles, deterioration of the well screen, and pump performance. A primary indicator of the need for well maintenance is a decrease in the well's specific capacity. A loss of 50 percent in specific capacity in an injection well, when compared to the specific capacity of the well determined following continuous operation, or subsequent injection well rehabilitation, will be the threshold value to be used to determine the need for well rehabilitation. A California-licensed drilling contractor will perform well maintenance.

5.3 Infiltration Galleries

Two galleries, labeled Infiltration Gallery INF-OU2-01-180 and INF-OU2-02-180, are located adjacent to Injection Wells IW-OU2-01-180 and IW-OU2-02-180, respectively. Four 16-inch diameter borings were drilled below each gallery and filled with drain rock without screens. INF-OU2-02-180 borings were 137 to 140 feet deep, while INF-OU2-01-180 borings were 97 to 99 feet deep. The infiltration gallery and injection wells are shown on Figures 1-2 and 1-3. A general profile of the infiltration galleries is shown in the *Draft Final Construction Drawings* (IT, 2002) as IT File Number 783751-E10.

Each infiltration gallery is equipped with a valve box containing a flowmeter, actuated ball valve, butterfly valve and air bleed plug. The actuated ball valve (on/off) is controlled by a high-level float switch located in the well. No electrical or control wiring exists between the OU2 GWTP and the two western injection wells. A 2-inch PVC conduit was installed between the valve vaults and the infiltration galleries. The mechanical copper linkage from the control valve uses the conduit between the valve and gallery vaults.

Gallery or piezometer performance may also be compromised by chemical encrustation, biofouling, or plugging by fine grained particles in the borings or aquifer. An indicator of the

need for gallery maintenance is a decrease in the gallery's specific capacity. A loss of 50 percent in specific capacity in a gallery, when compared to the specific capacity of the gallery determined following continuous operation, or subsequent gallery rehabilitation, is the threshold value to be used to determine the need for gallery rehabilitation. If required, the piezometer maintenance will be performed by a California-licensed drilling contractor.

5.4 Operable Unit 2 Pipeline Extension

This section summarizes the operation and maintenance associated with the pipeline extending from the OU2 GWTP to the Sites 2/12 GWTP. This pipeline conveys treated water to the Sites 2/12 GWTP where it is combined with treated water from the Sites 2/12 treatment system for discharge to infiltration galleries at Site 2.

5.4.1 Pipeline Construction

The OU2 extension pipeline was constructed of butt-fused, 8-inch, single-wall HDPE pipe. The only mechanical joints used were the termination flanges near the OU2 GWTP, Sites 2/12 GWTP, and at high and low points. The pipeline conveys treated water at flows up to 600 gpm.

5.4.2 Low and High Points

One high and one low point vault has been installed in the pipeline. A drain was installed at the low point and was placed inside a surface-completed 2-foot concrete vault. An air vent was installed at the high point and was placed inside a surface-completed 2-foot by 2-foot concrete vault.

The OU2 injection pump shall be monitored for increasing discharge pressure normalized to periodic flow adjustment. This monitoring must be performed by the OU2 GWTP Operator, since access to the OU2 building is required. If the discharge pressure begins to increase without a corresponding increase in flow, then the following shall be checked and corrected:

- appropriate pressure gauge operation
- aboveground piping at the OU2 GWTP is not partially obstructed
- air entrainment in the extension pipeline.

For air entrainment in the extension pipeline, periodically open the high point valve to allow excess air to escape. Close pipe when air has exited the pipeline.

5.4.3 Piping Near Operable Unit 2 Treatment Plant

The pipeline near OU2 splits with an 8-inch by 8-inch by 4-inch reducing Tee. The branch end is connected to OU2's eastern injection line, while the straight run side is connected to a blind flange intended for future connection. The injection water flow from the OU2 GWTP can be split between the eastern OU2 injection wells and injection at Site 2 via a 3-inch globe valve connected to the reducing Tee. A 4-inch flowmeter is installed downstream to monitor the flowrate. The pipeline remains as 4-inch PVC pipe until it connects with the 8-inch by 8-inch by 4-inch reducing Tee.

To convey treated water to the eastern injection network only, close the OU2 pipeline extension's Valve Number V-5810 located outside the OU2's building. To convey treated water to Site 2 only, close Valve Number V-440 upstream of the eastern infiltration gallery and Valve Number V-444 upstream of the eastern injection well IW-OU2-02-180.

To convey treated water to both the eastern injection network and to Site 2, open Valve Numbers V-432 and V-5810 until the desired flow split is achieved.

6.0 Electrical and Instrumentation Systems

This section provides information on the electrical service drops, PLC panel boards, and SCADA operation.

6.1 Electrical Service Drop

Electrical power is provided to the GWTP, Eastern Network, Abrams/Imjin and Landfill as 480 volts alternating current (VAC) three-phase 60-hertz, 4-wire service, while the University is provided at 240/120 VAC, three-phase 60-hertz 4-wire service. The Western Network is powered through the GWTP.

6.1.1 Abrams/Imjin Wells Electrical Service

Pacific Gas and Electric (PG&E) provides electrical service from an existing, underground 12 kilovolt line paralleling the northeast side of Abrams Road. This line is Tap 12 off Feeder 8 between Switch Numbers 6 and 8. Existing PG&E Tap 12 traverses 130 feet underground to a splice box located on the southwest side of the Abrams and Imjin intersection. About 50 feet of 4-inch conduit was installed from this splice box to the PG&E-approved transformer pad. The transformer pad was installed with two 4-inch (one spare) primary and two 3-inch (one spare) secondary termination conduits. The 3-inch conduit extends about 30 feet to the PLC panel pad. The PG&E meter is located within the PLC panel assembly. Power is supplied underground from the PLC panel through a NEMA 4X junction box to individual well pump motors. Junction boxes, which are located at each extraction well, have a door-mounted, NEMA 4X, three position, hand-off-auto power switch that provides local manual control of the extraction well pump.

6.1.2 Landfill Wells Electrical Service

PG&E provides electrical service from an existing, aboveground 12 kilovolt line off Power Pole Number 6-52. This line is Feeder Number 6, between Switch Numbers 8 and 1. About 75 feet of 4-inch conduit was installed from this pole to the PG&E-approved transformer pad. The transformer pad was installed with a 4-inch primary and a 3-inch secondary conduit. The 3-inch conduit extends about 30 feet to the service main pad. The PG&E meter is located on the service main pad. A 2-inch conduit extends about 200 feet from the service main pad to the PLC panel pad. Power is supplied underground from the PLC panel through a NEMA 4X junction box to individual well pump motors. Junction boxes, which are located at each extraction well, have a

door-mounted, NEMA 4X, three position, hand-off-auto power switch that provides local manual control of the extraction well pump.

6.1.3 University Wells Electrical Service

PG&E provides electrical service from an existing, underground 12 kilovolt line. This line is on Feeder Number 8, downstream of Switch Number 7. A splice box is between White Court and Combs Court has a line designated as Tap 2. About 100 feet of 4-inch conduit was installed from this splice box to the PG&E-approved transformer pad. The transformer pad was installed with a 4-inch primary and a 2-inch secondary conduit. The 2-inch conduit extends about 75 feet to the PLC panel pad. The PG&E meter is located on the PLC panel assembly. Power is supplied underground from the PLC panel through a NEMA 4X junction box to individual well pump motors. Junction boxes, which are located at each extraction well, have a door-mounted, NEMA 4X, three position, hand-off-auto power switch that provides local manual control of the extraction well pump.

6.1.4 Abrams (Original Eastern Network) Wells Electrical Service

PG&E provides electrical service from an existing, aboveground 12 kilovolt line off Power Pole Number 6-551. This line is Feeder Number 6, near Switch Number 7. About 250 feet of 4-inch conduit was installed from this pole to the PG&E-approved transformer pad and meter. A 225 kilovolt-amp pad mounted transformer supplies power at 480 volt, 3 phase, 60 hertz. The transformer pad was installed with a 4-inch primary and a 4-inch secondary conduit. The 4-inch conduit extends about 700 feet to the eastern distribution panel. Power is supplied underground from this distribution panel through a NEMA 3R junction box to individual well pump motors. Junction boxes, which are located at each extraction well, contain a lockable disconnect switch that provides local manual control of the extraction well pump.

6.1.5 Western Wells Electrical Service

PG&E provides electrical service from an existing, aboveground 12 kilovolt line between Power Pole Numbers 6-255 and 6-256. This line is on Feeder Number 6, between Switch Numbers 8 and 9. Primary power lines supply a 1500 kilovolt-amp pad mounted transformer located on the southeast side of the GWTP building. Secondary lines supply power at 480 volt, 3 phase, 60 hertz to the motor control center (MCC). Transformed power is available within the GWTP at 480, 208, 120, and 24 volts. Power is supplied underground from this distribution panel through a NEMA 3R junction box to individual well pump motors. Junction boxes, which are located at

each extraction well, contain a lockable disconnect switch that provides local manual control of the extraction well pump.

6.2 Programmable Logic Controller Panel Assembly

Each PLC panel assembly has a PLC panel with lockable doors mounted on a concrete foundation and protected with a perimeter security fencing. Panels located at Abrams/Imjin, Landfill, and University enclose the local power distribution panel, motor starters, low voltage transformers, PLC, relays, leak detection panel, SCADA hookups, and other ancillary items. The Eastern Network assembly has an adjacent panel the contains the power distribution panel. The western PLC, relays, leak detection panel, and SCADA hookups are placed in separate panels within the GWTP.

6.2.1 Power Distribution Panel

At the Abrams/Imjin and Landfill PLC panel, Siemens Catalog Number S2E18ML250CBS, type S2 distribution panel, with a 250 amp main lug was installed with type BQL circuit breakers. At the University PLC panel, Siemens Catalog Number S3B18ML225FBS, Type S3 distribution panel, with a 225 amp main lug, was installed with type BL circuit breakers. At the Eastern Network panel, Square D Catalog Number SB344WR, with a 400 amp main lug, was installed with type QOB circuit breakers. The Western Network power distribution panel is incorporated in the GWTP MCC.

6.2.2 Motor Starters

Allen-Bradley National Electrical Manufacturers Association (NEMA) size 0 motor starters, Catalog Number 509, were installed for each A-aquifer extraction well pump. Allen-Bradley NEMA size 1 or 2 motor starters, Catalog Number 509, were installed for each Upper 180-foot aquifer extraction well pump. Full voltage, non-reversing starters have both a melting alloy and a class 20 relay overload. Three-phase motors have a heater on each phase. Heater Type W60 was installed for EW-OU2-14-A and EW-OU2-15-A; W47 for EW-OU2-16-A; W68 for EW-OU2-03-180 and EW-OU2-04-180; and W64 for EW-OU2-05-180 and EW-OU2-06-180.

6.2.3 Low Voltage Transformers

Low voltage, 480/120 VAC transformers are installed in the Abrams/Imjin and Landfill PLC panels. The University panel is supplied with low voltage power, and does not require a separate source. The 120 VAC power is supplied to the leak detection panels, electrical plug-in outlets, Warrick Controller in EW-OU2-06-180, PLCs, and the 120/24 volts direct current (VDC) power

supply. The transformer is made by Acme Electrical Corporation, Style SR, and is rated at 240/480 VAC primary, 120/240 VAC secondary, 2 kilovolt-amp, 60 Hz, single phase.

6.3 Extraction Network Instrumentation and Control

Abrams/Imjin, Landfill, and University extraction well and wellhead instrumentation includes an analog output transducer that indicates water level, an analog output flowmeter that indicates water flowrate, and a digital output pressure switch that indicates high pressure. Well vault instrumentation include a digital output float switch which indicates high water level within the well vault. A digital output automatic reset pressure switch is located in EW-OU2-06-180, EW-OU2-15-A, and EW-OU2-04-180, and indicates a high network pipeline pressure.

A transducer was not installed in EW-OU2-06-180 because the piezometer is blocked; however, a transducer was placed in Monitoring Well MW-OU2-78-180, located near EW-OU2-06-180. EW-OU2-06-180, along with the fifteen Western and Eastern Network extraction wells, are each equipped with conductivity based water level sensors manufactured by Warrick Controls. Since the fifteen Western and Eastern Network wellhead are do not have analog input/output capability, each wellhead is equipped with a manual read flowmeter.

6.3.1 Instrumentation and Control Wiring

Digital input/output and analog output signal wire are connected back to a terminal block within each extraction vault. Pressure switches and float switches with discrete (on/off) inputs were installed with normally closed circuits to the PLC. Instrumentation wire from each extraction well is conveyed back to the network PLCs via a separate PVC conduit, separate from the electrical power lines. Analog instruments use twisted shielded pair cables consisting of Number 16 American wire gauge (AWG) tinned copper conductors, with aluminum shield. Pressure and float switches use single conductor, type THHN, Number 14 AWG.

6.3.2 Pipeline Leak Detection

The double-contained extraction pipeline has a leak detection system incorporated into the containment pipe. The leak detection system detects primary pipeline failure while reducing the potential of impacted groundwater flowing into the surrounding vadose zone. If a leak is detected, an alarm is triggered and the extraction well pumps associated with that leg of the pipeline are switched off.

A total of 87 leak detectors are installed, with 85 as part of the extraction system, including those in the well vaults: 14 in the Western Network, 15 in the original Eastern Network, 5 in the

Twelfth Street realignment, 10 in Area A line, 11 in the Imjin/Abrams line, 22 in the University line, and 8 in the Landfill line. Leak detection vault locations and numerical labeling is shown in the *Draft Final Construction Drawings* (IT, 2002) as IT File Number 837769-E001. Information is tabulated on Table 6-1, Leak Detection Location Summary by Operational Function.

6.3.3 PLC Panel Box Instrument Reset

A network header pressure switch reset pushbutton is installed in each PLC panel. The pushbutton is used to reset the PLC when a high pressure in the conveyance line occurs and then decreases below the adjustable setpoint.

6.3.4 Extraction Motor Run Relay

The run permissive to each OU2 System Expansion motor starter is a 120 VAC circuit that is energized by a 24 VDC relay from the PLC. The 24 VDC double-pole, double-throw relays, Class 8501, Type KPD12V53, Series D, DIN rail mount, socket type, from the PLC allows the pump to turn on and off. The relay is wired normally open, such that when the 24 volts from the PLC output card is off or the relay is pulled from the socket, the pump will not run.

6.3.5 Direct Current Power Supply

A 24 VDC power supply provides loop power to OU2 System Expansion flowmeter registers, pressure transducers, and to provide discrete inputs to the PLC for float and pressure switches. The 24 VDC positive was labeled as “4" with blue 14 AWG control wire. The 24 VDC negative was labeled as “9" with green 14 AWG control wire.

6.3.6 Programmable Logic Controller

Each of the five extraction well networks operates independently from an electrical power and instrument perspective. This means that each network has its own electric power source, can monitor its own events, and can independently operate based on pre-programmed scenarios. The GWTP and each network contain a discrete PLC, manufactured by AutomationDirect, installed within the local PLC panel. The five extraction-network PLCs have the capability to monitor and control the local extraction well network.

The master PLC is responsible for PLC-automated control of the GWTP. The master PLC is also programmed to monitor process variables and to make process adjustments to connected equipment.

The following conditions may initiate additional master PLC events that may lead to a plant shutdown:

- Extraction pipeline leak detection
- Influent manifold high pressure
- GAC vessel manifold high pressure
- Effluent tank level switch high high or level switch low low
- Injection pipeline high pressure
- Depressing the manual emergency shutdown push button on the master PLC.

While operating under "PLC-automated" mode, the control logic is protective of human health and the environment. If an unsafe operating condition is detected, for example a high pipeline pressure, the local PLC will shut down the upstream pumps, relieving the condition that contributed to the high pressure.

6.4 Extraction Network Control Narratives

The five installed PLCs are grouped into three basic control philosophies: the Eastern Network with one PLC; the OU2 System Expansion with three PLCs; and the GWTP with one master PLC. The master PLC at the GWTP also controls the Western Extraction Network.

6.4.1 Eastern Extraction Network Control Narrative

The Eastern Network wells do not have transmitting flowmeters or liquid level transducers. Periodic flow and water level readings must be taken manually for each extraction well. The individual wellheads are locally controlled, but can be started and stopped from the local PLC, through one of two control loops. The digital outputs in the Eastern Network will not start the extraction pump motor starter directly, but will enable the motor starter.

Each extraction well is individually hard wired into a local wellhead control loop. The wellhead loop contains the hand-off-auto switch, wellhead pressure switch, vault containment water level switch and the water level controller. The wellhead loop requires a digital output from the local PLC to operate. The controller employs Warrick™ conductance probes and a locally installed Warrick™ relay wired directly to the well pump motor starter.

The local Eastern Network PLC monitors the local pipeline pressure switch and a high liquid level switch in the Wye Vault. The PLC determines whether to enable the individual starters based on the status of the pipeline pressure switch, and the Wye vault level switch.

6.4.2 System Expansion Extraction Network Control Narrative

Analog signals from the individual extraction wells to the local PLC for the Abrams/Imjin well cluster, Landfill well cluster, and the University well cluster include transmitting flowmeters and liquid level transducers. The analog signals are not recorded at the local PLC, but are available for local PLC or downstream monitoring. The analog level signal is processed by the local PLC to provide a pre-programmed based digital output to the respective well pump.

This digital output controls an interposing relay that energizes or de-energizes the individual motor starter, providing automated high/low water level control of the associated pump. The digital output energizes the motor starter directly. The local PLC determines whether to energize the starter based on the status of the hand-off-auto in the vault, the high level switch in the vault, the pressure switch in the vault, the pressure switch on the pipeline, and the level transducer.

The one exception is Extraction well EW-OU2-06-180, where the liquid level transducer used for water level monitoring is located in adjacent monitoring well MW-OU2-78-180, approximately 10 feet to the northeast. High/low level control in this extraction well employs Warrick™ conductance probes and a locally installed Warrick™ relay.

Several other digital signals are associated with the local PLCs at the Abrams/Imjin well cluster, Landfill well cluster, and the University well cluster. These digital signals either monitor or control the well vault hand-off-auto switch, the motor starter auxiliary contacts, the vault containment high water level switch, the pressure switch for each extraction well, and the pipeline pressure switch associated with the three well clusters.

6.4.3 Western Extraction Network Control Narrative

The Western Network wells do not have transmitting flowmeters or liquid level transducers. Periodic flow and water level readings must be taken manually for each extraction well. The individual wellheads are locally controlled, but can be started and stopped from the local PLC, through one control loop. The digital output in the Western Network will not start the extraction pump motor starter directly, but will enable the motor starter.

Each extraction well is individually hard wired into a local wellhead control loop. The wellhead loop contains the hand-off-auto switch, wellhead pressure switch, vault containment water level switch and the water level controller. The wellhead loop requires a digital output from the local PLC to operate. The controller employs Warrick™ conductance probes and a locally installed Warrick™ relay wired directly to the well pump motor starter.

The GWTP PLC monitors only a single digital input associated with the Western Network pressure switch. The PLC determines whether to enable the individual starters based on the status of the pipeline pressure switch. A single common digital output with interposing relays enables or disables the western network wells.

6.5 Groundwater Treatment Plant Control Narrative

GWTP analog inputs consist of two influent flowmeters, three effluent flowmeters, and three tank level signals. Each analog signal terminates at the master PLC. Of these analog inputs, only the effluent tank level is used in the control logic. There are six analog outputs which control the six variable frequency drives which in turn control the six injection pumps.

Primary GWTP digital input and output designations are described below. All GWTP digital designations are listed in Table 6-2, Master Programmable Logic Controller Digital Inputs and Outputs.

6.5.1 Warning Conditions

A warning condition does not stop plant operation. It will energize the warning relay connected to the automatic telephone dialer (Y0) and energize the buzzer on the door of the PLC enclosure (Y15) provided the buzzer has not been disabled by the adjacent switch. The warning condition results when either the western or eastern leak detection system (X0 or X1) detects a leak for a duration of three minutes or longer, or when any of the six high pressure switches (X2, X11, X14, X15, X16, or X20) on the discharge of the six injection pumps exceeds the pressure setpoint.

6.5.2 Alarm Conditions

An alarm condition prevents the plant from entering or remaining in the “run” mode. It will also energize the alarm relay (Y1) connected to the automatic telephone dialer and energizes the buzzer on the PLC enclosure provided the buzzer has not been disabled by the adjacent switch.

The alarm condition results from any of the following conditions:

- The influent manifold high pressure switches (X3 or X12) exceeds its setpoint.
- The four effluent tank level switches (X4, X5, X6, or X7) are not in its normal state.
- The four GAC differential pressure switches (X10, X22, X23, or X27) exceeds the setpoint.
- The eastern and western leak detection systems (X0 and X1) indicate a leak for a period of three minutes or longer.
- The injection pump discharge pressure switches (X2, X11, X14, X15, X16, or X20) simultaneously exceed the setpoint.

On activation of an alarm condition that requires a plant shutdown, an alarm message will be indicated on the PLC's operator interface panel, a local alarm circuit will be energized, the master PLC will remove "permissive run" circuits from appropriate process equipment, and the GWTP Operator will be notified by the autodialer. A manual pushbutton will reset the alarm.

A telephone dial-out package (autodialer) is installed at the GWTP. During an unattended shutdown or power outage, the master PLC is programmed to direct the autodialer to dial out, alerting the GWTP Operator and the operator's backups of the alarm condition.

6.5.3 Tank Level Algorithm

To initiate normal automatic control of the effluent injection pumps, one of each motor pair must have its hand-off-auto in the automatic mode, the local/remote must be in the remote mode, and the tank's water level must exceed four feet. If the water level is below four feet, individual effluent pumps will not operate unless switched to the hand mode.

6.5.3.1 Pump P-410 and P-420 Operation

As the water level rises from four feet to seven feet, either Pump P-410 or P-420 will ramp its speed from zero percent up to the speed corresponding to the pump's potentiometer. If the potentiometer is set at 20, corresponding to 20 milliamps, the pump will operate at 100 percent of its rated speed at water levels above seven feet. If the potentiometer is set at 12, halfway between 4 and 20, the pump will operate at 50 percent of its rated speed at water levels above seven feet.

6.5.3.2 Pump P-510 and P-520 Operation

As the water level rises from seven feet to ten feet, either Pump P-510 or P-520 will ramp its speed from zero percent up to the speed corresponding to the pump's potentiometer. If the potentiometer is set at 20, the pump will operate at 100 percent of its rated speed at water levels above ten feet. If the potentiometer is set at 12, halfway between 4 and 20, the pump will operate at 50 percent of its rated speed at water levels above ten feet.

6.5.3.3 Pump P-910 and P-920 Operation

As the water level rises from eight feet to eleven feet, either Pump P-910 or P-920 will ramp its speed from zero percent up to the speed corresponding to the pump's potentiometer. If the potentiometer is set at 20, the pump will operate at 100 percent of its rated speed at water levels above eleven feet. If the potentiometer is set at 12, halfway between 4 and 20, the pump will operate at 50 percent of its rated speed at water levels above eleven feet.

6.5.4 Western Network Extraction Well Flow Shedding

The master PLC is also programmed to modulate the influent water flow based on the capacity of the injection flow. During normal automatic operation and when the water level of the effluent tank exceeds eleven feet, all three effluent injection pumps will be ramped to the maximum speed set by each respective potentiometer. If the effluent tank level continues to rise, the western network extraction wells are programmed to intermittently stop and start based on water level. When the tank level reaches approximately 11.3 feet, the Western Network extraction well pumps are de-energized. When the tank level drops below ten feet, the Western Network pumps are allowed to resume.

To maximize extraction and injection efficiency, this tank cycling should be minimized. The GWTP Operator must either decrease the influent flowrate or increase the value of the appropriate potentiometer to increase the injection flowrate. Downstream, the water levels at the discharge points must be subsequently monitored to insure that the water flow entering the injection points do not exceed the respective discharge capacities.

6.6 Supervisory Control

Overlying the five individual PLC-controlled networks is a SCADA system, connected by wireless Ethernet™ (trademark of Xerox Corporation) links. As shown on Figure 6-1, SCADA Architecture, the system is composed of four slave transceivers, one at each remote PLC panel assembly, communicating through a repeater to the master transceiver. The master transceiver is

located at the OU2 GWTP, and communicates by Ethernet™ patch with the GWTP master PLC. A SCADA operator interface is provided through a personal computer to access data and events.

6.6.1 Radio Link

The transceiver and ancillary antennae and coaxial cables, manufactured by Datalinc™, are installed at the GWTP, Abrams/Imjin, Eastern, Landfill, and University PLC panel assemblies. An Ethernet™ patch cord connects the transceiver to an Ethernet™ card placed within the PLC. The transceivers use frequency-hopping technology, transmitting data on frequencies between 902 and 928 megahertz at a power ranging up to 1 watt. The low power allows operation without a license in accordance with applicable Federal Communications Commission regulations. Except for the repeater station, the radios are PG&E powered. A solar-powered repeater station is used just north of OU2 Landfill Cell D to relay the signal back to the OU2 GWTP.

6.6.2 Supervisory Control Hardware

The personal computer is a mini-tower workstation with an 800 megahertz Pentium III processor, 256 kilobyte cache, 3Com™ Ethernet™ card, 128 megabyte internal memory, 56 kilobyte internal modem, 19-inch diagonal monitor, two 40 gigabyte hard drives, compact disk read only memory, compact disk read/write, and 3.5-inch floppy drive, using Windows NT Service Pack 5.

6.6.3 Supervisory Control Software

Software used is Lookout Direct™, an event-driven object-oriented package from National Instruments Lookout and marketed through Automation Direct (see automationdirect.com). The PC based software writes to the digital "bits" or analog memory addresses in the remote PLCs and polls the PLCs for the status of digital bits and analog memory addresses. This enables the operator to monitor and control the remote PLCs from the PC.

The Lookout Direct™ software is capable of simulating the operation of traditional real-time monitoring devices such as pilot lights and analog indicators; simulating the operation of control devices such as switches and potentiometers; and simulating traditional data logging devices such as strip chart recorders and elapsed time indicators.

6.6.4 Supervisory Control System Operation

Human machine interface (HMI) parameters are detailed in this section. SCADA GWTP startup, cold startup, and shutdown procedures are discussed in Section 2.0. Unless stated otherwise, all

input/output analog signals and all input/output digital signals used in control operation that terminate at a local or master PLC are provided as a SCADA monitored event and can be viewed on the operator interface. Most other digital signals terminating at a PLC are available for maintenance viewing on the operator interface, but may be hidden behind an operating screen.

6.6.4.1 Normal Run Mode

The run mode enables the following:

- Influent pneumatic control valves may open with their HMI hand-off-auto in "automatic."
- Extraction wells may run with local and HMI hand-off-auto in "automatic."
- Injection pumps may run with the HMI hand-off-auto in "automatic."

The run mode may be entered by either pressing the start pushbutton on the PLC enclosure (X24) or by clicking the HMI start pushbutton with the computer mouse provided there is no "alarm" condition. The run mode is disabled when an "alarm" condition occurs, by pressing the stop pushbutton on the PLC enclosure, or by clicking the HMI stop pushbutton with the computer mouse. Note that large red and green arrows on the effluent tank shown on the main treatment plant HMI screen indicate the plant is in run mode.

6.6.4.2 Hand Mode

The hand mode is the state the system is in when it is not in the run mode. The red and green circular arrows on the effluent tank symbol of the main treatment plant HMI screen is replaced by the word STOP when the system is in the hand mode.

The hand mode enables the following:

- Influent pneumatic control valves may open with their HMI hand-off-auto in "hand."
- Extraction wells may run with HMI hand-off-autos in "hand" and local hand-off auto in "hand" or "automatic."
- Injection pumps may run with the HMI hand-off-auto in "hand."

6.6.4.3 Influent Control

The four extraction-network PLCs will operate independent of each other without the SCADA overlay. With the overlay, the following additions must be considered.

6.6.4.4 System Expansion

The digital output from the master PLC energizes the motor starters directly. The local PLC determines whether to energize the starter based on the status of the hand-off-auto in the vault, the high level switch in the vault, the pressure switch in the vault, the pressure switch on the pipeline, the level transducer, the hand-off-auto on the PC operator interface, and the treatment plant run status.

6.6.4.5 Eastern and Western Networks

Individual digital outputs with interposing relays are installed at the Eastern Network PLC. This enables the operator to start these wells individually from the operator interface. A single common digital output with interposing relays enables or disables the western network wells.

The digital outputs in the eastern network and the western network do not start the extraction pump motor starter directly. They enable the motor starter. That is, the digital output from the PLC is one of several conditions that are necessary for the pumps to run. The other hardwired interlocks include the high-low level control from the Warrick™ relay, the high level switch in the vault, and the hand-off-auto hardwired to the motor starter. The PLC determines whether to enable the starter based on the pipeline high-pressure switch, the Wye vault high level switch (in the eastern network), the hand-off-auto on the PC operator interface, and the plant run status.

6.6.4.6 Groundwater Treatment Plant

On activation of an alarm condition that requires a plant shutdown, an alarm message will be indicated on the operator interface panel, a local alarm circuit will be energized, the master PLC will remove "permissive run" circuits from appropriate process equipment, and the GWTP Operator will be notified by an autodialer. A manual pushbutton will reset the alarm.

6.6.4.7 Effluent Pump Control

The six injection pumps consist of three lead-standby pairs. The operator selects which pump is the lead and which is the standby using the HMI hand-off-auto switches. Normally, the hand-off-auto for either Pump P-410 or P-420 will be in the off position, the hand-off-auto for either Pump P-510 or P-520 will be in the off position, and the hand-off-auto for either Pump P-910 or P-920 will be in the off position. The normal position for the hand-off-auto switch of the pump selected for active duty is the automatic position. Operation of the pumps in the Hand mode disables the alarm shutdown interlocks for the pump and is not recommended for unattended operation.

The HMI local/remote switches determine whether the speed the effluent pump variable speed drives is set by the HMI potentiometer or by the tank level algorithm which is described in the following section.

The HMI potentiometer for each pump can be set by typing a number between 4 and 20 after first clicking the potentiometer display with the computer mouse. When the local/remote switch is in the local position, the entry four represents a 4-milliamp signal to the variable frequency drive, which corresponds to zero percent of full speed. The entry 20 represents a 20-milliamp signal to the variable frequency drive, which corresponds to 100 percent of full speed provided the local/remote is in the local position.

When the local/remote is in the remote position, the potentiometer setting represents the maximum signal to or speed of the variable frequency drive that will be possible as the signal and speed ramp up proportional to effluent tank level.

6.6.5 Supervisory Monitoring, Control, and Expansion Capabilities

Table 6-3, SCADA Status, lists the current (December 2001) status and use of each category of digital inputs, digital outputs, analog inputs, and analog outputs. A full digital input/output listing is included as Table 6-2.

SCADA was originally set-up to provide near-real-time monitoring and control of the extraction system, GWTP operations, and injection system. Although data acquisition is accomplished with nearly all signals being transmitted to the desktop computer, as of December 2001 data recording and data trending had not yet been programmed into the desktop. Table 6-3 also includes a description of future potential uses for each category of signals.

7.0 Health and Safety

All personnel involved in the O&M of the groundwater remedy are required to be familiar with the SSHP (IT, 2000). The SSHP addresses health and safety requirements of all employees, subcontractors, and site visitors. The responsibilities of site personnel and specific procedures that are to be known and understood are presented such as emergency response, first aid, and injury prevention. General site hazards and typical chemical protection information are also presented. A copy of the SSHP shall be located at the GWTP's control room. The following information in this section is focused on specific safety procedures to follow during operation of the groundwater remedy and whenever maintenance is required.

7.1 Equipment Safety

The following practices and procedures are to be observed to protect against operating equipment hazards:

- Follow instructions in this O&M Manual and in Appendix B vendor-supplied information
- Do not perform work on equipment while it is operating or energized.
- Wear the proper PPE whenever you may come in contact with untreated water or chemicals.
- Hard hat, safety glasses and steel-toed boots are required at all locations; hard hats and safety glasses are not required in the control room.

The SSHO may require PPE as necessary to complete a specific job. Personal protective equipment will be prescribed based on the hazards that are anticipated to be present. A full description of levels of protection practiced is provided in Section 5.0 of the SSHP (IT, 2000).

7.2 Electrical Safety

The following practices and procedures are to be observed to protect against electrical hazards:

- Terminal boxes, enclosures, and covers shall be appropriately maintained to reduce accidental contact with energized circuits.
- Only authorized people are allowed to work near electrical equipment and fixtures.
- The grounding of insulated wiring, controls, equipment, and motors shall be maintained.

- Labels provided for circuit, voltage, or control identification should be legible and securely attached to the appropriate equipment.
- Follow lockout/tagout procedures for working on any electrical equipment.

7.3 Chemical Safety

The following practices and procedures are to be observed to protect against chemical hazards:

- Safety glasses are required when working in the GWTP area.
- Proper protective equipment should be worn whenever work is done on any equipment handling chemicals or extracted groundwater.
- Any chemical brought on site must be accompanied by an MSDS, which should be included in the SSHP. The hazards of the chemicals should be discussed in the tailgate safety meeting for the day the chemicals are being used.
- MSDSs for chemicals used at the GWTP shall be placed in the control room for easy access.

7.4 Emergency Response/Spill Contingency Plan

This Plan describes contingencies and emergency planning procedures to be implemented at the groundwater remedy. During the initial site indoctrination, training and site briefings will be held periodically. All employees will be trained in and reminded of emergency response/spill plan provisions, communication systems, and evacuation routes. The plan shall be reviewed and/or revised at least annually by the SSHO to ensure that it is current with prevailing site conditions. No change will be made without the consent of the SSHO.

Information on hazardous materials handled will be provided as appropriate to local police departments, fire departments, and local hospitals. Copies of the Contingency Plan will also be submitted to the organizations that may be called upon to provide emergency services.

7.4.1 Lines of Authority

The SSHO is the Emergency Coordinator and has primary responsibility for responding to and correcting emergency situations. This encompasses taking appropriate action, including activating the Contingency Plan and notifying management and the USACE of the potential need for increased involvement to ensure the safety of site personnel and the public. Possible actions may involve evacuation of personnel from the site area as well as evacuation of occupants from adjacent areas.

The GWTP Operator is responsible for ensuring that emergency and corrective measures have been implemented, appropriate authorities notified, and follow-up reports completed. The GWTP Operator has the authority to cease groundwater remedy operations if any unsafe condition requires immediate action.

It will be the responsibility of the SSHO to enforce and monitor the effectiveness of this plan. The SSHO will make regular observations of the groundwater remedy, adjacent work areas, and the surrounding site, as well as the behavior of the employees during work and non-work periods. Both the GWTP Operator and SSHO are responsible for reporting any non-standard conditions to management immediately upon discovery or as a result of routine plant inspections.

7.4.2 Safety Inspections

Safety inspections will address the following areas:

- Fire alarm systems and security for the GWTP building
- Building fire extinguisher(s)
- Electrical equipment, controls, and wiring
- Safety showers/eye wash stations
- Availability, use, and storage of PPE
- Storage and use of hazardous or combustible materials
- Housekeeping and labeling.

The SSHO will keep records of inspections and incident forms. An equipment safety and security checklist shall be prepared to document these inspections. The records will be used to document the need for improvements in procedures, equipment, or employee behavior. The SSHO has the authority to take quick corrective action and is responsible for taking immediate actions to respond to or mitigate emergency situations.

7.4.3 Potential Work Place Hazards

The groundwater remedy Operations Hazard Analysis (SSHP, 2000) contains a list of "Potential Hazards" and "Recommended Controls" for the following work place activities:

- Operation of groundwater remedy
- General/Ground maintenance and repair of groundwater remedy

- Welding and cutting
- Handling sharp objects
- Material storage
- Spent carbon replacement
- Water sampling.

Potential work place hazards are discussed below in the following three categories: hazardous materials, ignition sources, and material storage and handling.

7.4.3.1 Hazardous Materials

Work place fire hazards may exist at or near the groundwater remedy of which all personnel should be aware. Potential fire hazardous materials include

- Gasoline and/or diesel fuel (vehicles)
- Miscellaneous combustibles (such as paints and epoxies).

7.4.3.2 Ignition Sources

Potential ignition sources that require control on site include

- Faulty electrical systems
- Heat producing equipment
- Smoking
- Cutting, welding, and mechanical sparks
- Static electricity
- Compressed air.

Smoking is not permitted inside the GWTP or within 50 feet of the operations outside the building. No welding, cutting or spark generating tasks are permitted without a hot work permit authorized by the SSHO. All electrical systems must be grounded, as well as any potential sources of static electricity (e.g., steam cleaning of equipment and tanks).

7.4.3.3 Material Storage and Handling

Proper storage and handling of combustibles and flammables is necessary for fire prevention. Special storage areas on site include flammables storage cabinets, fuel storage tanks, and compressed gas storage racks. Flammable storage areas must be grounded to prevent static

discharge. Storage of flammables and combustibles shall meet all requirements of the National Fire Protection Association and the American National Standards Institute (ANSI).

7.4.4 Site Emergency Procedures

A list of emergency contact phone numbers will be posted near each site telephone and within each site vehicle. This list includes local emergency responders, medical facilities, and appropriate government officials.

Incidents may be mitigated through application of standard mitigation/control measures available to site personnel. When necessary, follow-up reporting will be made to the USACE and other appropriate authorities. If an incident on site becomes uncontrolled or is in excess of on-site capabilities, the Fire Department will be called, who will in turn notify the Federal Police and the Installation Response Team (IRT), who will oversee the emergency situation.

7.4.4.1 Spills and Leaks

In the event of a spill or leak of a hazardous substance, site personnel will immediately

- Inform the Emergency Coordinator
- Locate the source of the leak or spill and stop the flow if it can be done safely
- Notify the Fort Ord Fire Department if the spill cannot be safely contained within the designated secondary containment area(s)
- After the leak or spill has terminated, determine if the cause of the spill or leak is a damaged piece of equipment or tool. Determine if the spill or leak has caused, or will cause, damage to a piece of equipment or tool. If the answer to both questions is NO and the spill volume is less than one gallon of hazardous material, absorb with soda ash or diatomaceous earth, as appropriate.
- Describe the events leading to the spill or leak and detail the corrective measures to be taken to the Emergency Coordinator. Small spills of less than 10 gallons may be absorbed with soda ash or diatomaceous earth, as appropriate.
- Spills of greater than 10 gallons of hazardous materials will require immediate notification to management.

The location of emergency spill response equipment will be indicated on a drawing in the control room and discussed with site personnel during site indoctrination training and periodically in safety briefings.

Following an emergency, access to the affected area will be restricted. Depending upon the severity and location of the incident, physical barriers or warning tape will be used to delineate

restricted areas. For an uncontrolled occurrence, site control will be the responsibility of an outside team who will establish the new work area boundaries if necessary. For controlled occurrences, the O&M contractor will be responsible for site control.

7.4.4.2 Fire or Explosion

In the event of an uncontrolled fire or explosion, the Fire Department will be summoned immediately. This will occur concurrently with evacuation of appropriate personnel and accounting for personnel. Upon arrival of each fire unit, the GWTP Operator and SSHO will advise the fire commander of the location, nature, and identification of the hazardous materials on site. Providing it can be done safely, site personnel may

- Use fire extinguishers available on site to control or extinguish a small localized fire
- Remove or isolate flammable or other hazardous materials that may contribute to the fire
- Begin containment and recovery of the spilled materials.

The GWTP Operator and SSHO will determine in the interim whether corrective action may be attempted. Corrective action may only be attempted if personnel are adequately trained and it can be accomplished safely. Portable fire extinguishers of a sufficient number and appropriate type and size for potential fires will be kept on site and maintained according to applicable regulations and codes. At a minimum, a portable extinguisher must be placed in each area within 50 feet of any flammable liquid storage or dispensing area.

7.4.4.3 Earthquakes

The actual earth movement of an earthquake is seldom the direct cause of injury or death. Most casualties are caused by falling debris from collapsing buildings and other structures and by fires caused by broken gas mains.

During an earthquake, site personnel should:

- Remain calm and do not panic.
- If caught indoors, remain indoors. Take cover under a desk or table or against inside walls or doorways. Avoid windows and outside doors.
- Do not use or do anything that might be a source of ignition, e.g., smoking, cutting, or welding.
- If caught outdoors, move away from buildings and overhead utility lines.

- If in a moving vehicle, stop as quickly as safety permits, but stay in the vehicle. When driving after the earthquake, watch carefully for hazards created by the earthquake, e.g., undermined roads, weak bridges, or overpasses.

After an earthquake, site personnel should:

- Check for injuries. Do not move seriously injured personnel unless remaining where they would create danger of further injury.
- Check pipelines, wellheads, and utility lines for damage. Switch off power, water, and gas until a utility official has inspected the building and determined it is safe. Determine whether the plant can operate safely.
- Stay out of the building if it is severely damaged. Aftershocks are common and may cause their collapse.
- Assist emergency personnel, if requested.
- Be prepared for aftershocks, which may occur hours or days later.

7.4.4.4 Evacuation Routes and Procedures

In the event of an emergency evacuation of the GWTP, the following alarm procedures will be implemented:

- Verbal warning will be used to alert other site personnel of an evacuation emergency. Personnel will be told to exit the site and meet at a pre-designated safe meeting area that is upwind and hazardous free. The GWTP Operator will complete a head count. Further directions or response discussions will be coordinated at that point.
- The Fire Department and IRT will be notified, and they will determine if an area-wide evacuation is necessary. The proper communications will be made by radio and telephone to cue evacuation of the area.
- Normal traffic flow patterns will be in effect unless a local detour is required.

7.4.5 Emergency Equipment and Location

The following is a list of emergency equipment that will be available on site:

- Fire extinguishers (Control room, main plant area, and site vehicles)
- First Aid Kits (Control room, main plant area, and site vehicles)
- Safety shower inside building near control room
- Safety eyewash station in each outside containment area
- Spill Control Kits – as needed near the truck unloading area

The location of emergency equipment will be shown on site drawings and discussed with site personnel during site indoctrination training and periodically in safety briefings. The first-aid-kit location will be specially marked and stocked with adequate water and other supplies necessary to clean and decontaminate burns, wounds, or lesions. The inside of the GWTP building will be equipped with an approved eye wash and safety shower station in accordance with the ANSI Standard Z358.1, "Emergency Eye Wash and Shower Equipment" (ANSI, 1990).

At least one person certified in first aid techniques, which includes training in cardiopulmonary resuscitation, will be on the site whenever maintenance activities are scheduled. This individual may perform other duties, but must be immediately available to render first aid when needed.

7.4.6 Medical Emergencies

In the event of a medical emergency, the following procedures shall be implemented:

1. Call 911.
2. Identify location, request medical assistance, and provide name and telephone number.
3. Request assistance from emergency medical service and/or additional assistance.

Any person being transported to a clinic or hospital for treatment should take with them information on the chemical(s) they may have been exposed to at the site. The local hospital is

Community Hospital of Monterey Peninsula
23625 Holman Highway
Monterey, California 93942
(831) 625-4900

A list of names and numbers in the following format shall be posted within the control room.

LIST OF EMERGENCY CONTACT PHONE NUMBERS
O&M Contractor Contacts:

1. Name Work Number Home Number Cell Number

2. GWTP Operator (Alternate Emergency Coordinator)

Name	Work Number	Home Number	Cell Number
Mark Fisler	(831) 384-3735	(408) 262-3664	(831) 277-1967

If you do not personally speak with designated contact #1 or #2, call the following:

3. Project Manager

Name	Work Number	Home Number	Cell Number

Other emergency numbers include

- Fire Department 911
- Police Department 911
- Installation Response Team (831) 242-7932
- Medical Emergencies 911
- Community Hospital of Monterey Peninsula (831) 625-4900
- National Response Center (800) 424-8802
- Poison Control Center (800) 346-5922
- California Office of Emergency Services (800) 852-7550.

8.0 Recordkeeping, Performance Evaluation and Reporting

Process operation records shall be accurately kept. Records are routinely used for troubleshooting system problems, completing reports to regulatory agencies, and long-range planning.

8.1 Routine Operation and Maintenance Logs

Various O&M logs shall be completed on a routine basis (daily or weekly as appropriate). The data contained in these logs are used to generate the reports to regulatory agencies discussed later in this section. Appendix D includes copies of the following logs and reports:

- Field Activity Daily Log (FADL)
- Daily Flow Readings Log (when not automatically recorded)
- Periodic Flow Readings Log (SCADA confirmation)
- Periodic Inspection Checklist
- Periodic Maintenance Checklist.

8.1.1 Field Activity Daily Log

The FADL is the operator's diary and includes descriptions of daily activities and events, visitors on site, important telephone calls, and personnel on site. Additionally, emergency conditions, mitigating procedures or remedies, equipment failures, replacements, and repairs are noted on this form as they occur. A copy of the FADL is included in Appendix D.

8.1.2 Daily Flow Readings Log

Meter readings shall be logged each normal business day whenever the readings are not automatically recorded. Precise flow readings shall be recorded near 0800 on the day of the reading and on the Flow Reading Log (Appendix D). The average flowrate shall be calculated by the difference between the current meter reading and the previous day's meter reading divided by the minutes elapsed from the current reading to the previous reading. All meters that are currently online shall be appropriately marked. Specific information logged includes:

- name of GWTP Operator and date of inspection
- totalizer meter readings
- instantaneous flowrates in gallons per minute

- time of day readings obtained
- notation of equipment that is running or not running at time of readings.

8.1.3 Periodic Flow Readings Log

Periodic verification readings shall be logged and compared to the daily readings. The date and time of the readings and the instantaneous flowrate and total flowrate shall be recorded. The GWTP Operator will determine the period average flowrate in gallons per minute for each system logged. Other calculated items include:

- total throughput in gallons
- the operating interval in hours and minutes
- the flowrate percent difference for each system, based on the previous set of data.

The calculated values can then be compared with the SCADA flow readings to verify flow conditions and operability. Analysis of the flow conditions can be used to optimize the extraction and injection systems. The periodic report begins at 0800 of the day of the reading and ends at 0800 the following day and should include any changes to the following:

Time online	The time, in hours and minutes, that the specific piece of equipment is online in normal operation.
Time standby	The time, in hours and minutes, that the specific piece of equipment is offline but is available for immediate operation.
Time downtime	The time, in hours and minutes, that the specific piece of equipment is both offline and is not available for immediate operation.
Operating time	The amount of time, in hours and minutes, that the specific piece of equipment was in normal operation during the status report time period.
Flowrate	The current flowrate through the specific piece of equipment.
Series lead/lag	The configuration of the carbon beds during the status report time or parallel period.

Sampling events	The number, location, and analysis requested of groundwater remedy samples.
Remarks/comments	Other changes in operations.

8.1.4 Periodic Inspection Checklist

Periodic equipment inspections shall be performed. The checklist is filled out weekly, with daily changes noted as they occur. Equipment to be inspected includes the following:

Air compressor	Ensure that air compressor is operating within the manufacturer's suggested operating range. Check oil level and drain accumulated condensate from holding tank.
Air vent valves	Open air vent valves on the carbon beds to release entrapped air. Verify that the valves are not plugged.
Air vent/vacuum	Verify that all air vent/vacuum valves have seated properly and valves have no leaks.
Backwash Tank	Verify tank capacity correctly shown on SCADA system.
Pipelines and valves	Examine aboveground pipeline, valves, and associated gaskets for cracks or leaks. Check for excessive vibration or noise.
Filters, aerosol	Inspect filters for cracks and any other damage. Drain filters to remove condensed water. Periodically replace filter cartridges.
Filters, air	Inspect filters for cracks and any other damage. If the pressure drop is larger than the pressure drop specified by the manufacturer, take the filters off line and clean or replace as necessary.
Filters, bag	Check the pressure drop through the bag filters. If the pressure drop is larger than the pressure drop specified by the manufacturer, take the filters off line and clean or replace as necessary.
Filters, cartridge	Check the pressure drop through the cartridge filters. If the pressure drop is larger than the pressure drop specified by the manufacturer, take the filters off line and clean or replace as necessary.
Filters, particulate	Inspect filters for cracks and any other damage. Drain filters to remove condensed water. Periodically replace filter cartridges.

Flowmeters	Verify that flowmeters are operating properly and that a digital reading is being recorded by the PLC/SCADA system.
Corrosion	Note the level of corrosion on all items in this section. Include building and other surfaces.
Pressure gauges	Verify that the gauges are operating properly. Record pressures readings.
Pressure switches	Verify that the switches are operating properly. Record switch pressure.
Pumps	Check for abnormal vibrations, overheating, noises, and low or high pressure readings. Minimize pump cycling. Verify operability correctly shown on the SCADA system.
Sumps	Check the condition and operability of the sump pump.
Tanks	Check atmospheric tanks and pressure vessels for damage or leaks. Verify that tank water heights are at their normal operating levels.
Valve positioning	Verify that all valves are in the correct positions for the desired operation.

8.1.5 Maintenance Checklist

At a minimum, the GWTP Operator shall perform scheduled maintenance on the equipment listed on the groundwater remedy Maintenance Checklist (Appendix D). As shown on the checklist, maintenance inspections are to be performed at least monthly for some items and quarterly, semi-annually or annually for others. The GWTP Operator must refer to the manufacturer's instruction manuals in Appendix B, Vendor Submittals, for detailed instructions and maintenance procedures for these items.

8.2 Performance Monitoring

Operating data will be collected to monitor and evaluate the performance system in meeting the RAO's.

8.2.1 Discharge Standards

During routine operations, treated water injection to areas overlying the groundwater plume must meet the discharge limits per Table 1-1. For chloroform, 1,1-DCA, and cis-1,2-DCA, the maximum discharge limits need only meet the ACLs. Notification requirements that apply in the event of a discharge standard exceedance are provided in the *Work Plan* (HLA, 2000).

8.2.2 Operational Efficiency

Including routine system modification and maintenance outages, the on-line goal for the groundwater remedy is 95 percent. To achieve this utility goal, single-event maintenance-related downtimes must be minimized.

Aggregate routine maintenance shutdowns and unanticipated system interruptions, are expected to total less than 5 percent, when calculated on an annual basis. For a given calendar year, this converts to a maximum annual cumulative downtime of 18 days and 6 hours. The only major routine item requiring a plant shutdown is a GAC changeout, which should average 4 hours in duration. Mechanical equipment, such as parallel pumps, can be individually mechanically and electrically isolated, and can usually be repaired without a plant shutdown. Aggregate routine maintenance shutdowns are expected to total less than 0.6 percent or less than two days per year.

Unanticipated system interruptions fall into two categories. The first involves mechanical, electrical, or process-control repairs to the plant. A simple pipe repair may result in a plant shutdown of more than one day to allow the pipe glue to dry properly. The second involves interrupted electric power, involving one or more of the three supplied phases. An electric service power surge, or an unexpected power dip may result in a phase imbalance or inadequate voltage that leads to a treatment system shutdown. If the shutdown occurs at night, or during inclement weather, the operator may choose to inspect the plant's electrical systems more thoroughly during daylight hours, or with a qualified electrician, before placing the plant back on-line. The aggregate unanticipated system interruptions are expected to average up to 16 days per year.

8.2.3 System Optimization

Optimization of the groundwater remedy after installation and startup will be conducted to increase the overall system's effectiveness in remediating the desired constituents at a lower cost. The following subsections discuss the primary focus areas for an effective optimization program.

8.2.3.1 Optimization Approach

Prior to evaluation, raw information will be collected and formatted. Performance-data collection and evaluation are divided into two separate but dependent categories: (1) field data collection and (2) data reduction/evaluation. During the field data collection category, the GWTP Operator will collect and log the required data. During the data reduction/evaluation category, the field data are reviewed for completeness, the data are reduced to a form that can be evaluated and/or compared, and suggestions are formulated. Suggestions may include modifications to

injection and extraction flowrates, valve configurations, and equipment settings. The following subsections discuss in more detail the data collection and dissemination efforts towards optimizing the groundwater remedy.

8.2.3.2 Field Data Collection

Data will be collected and entered on standardized forms (Section 8.1). The standardized forms allow data reduction to take place in a timely and orderly fashion. These forms are to be updated as new information, including either additions or omissions about the groundwater remedy, extraction wells, and injection wells are obtained. The field data collection effort should be collected within similar time increments to allow for meaningful comparisons.

The aquifer monitoring schedule includes individual flowrates, pressures and water levels for each extraction well, injection well and infiltration gallery. Depending on the area of the aquifer being evaluated, time or access constraints, not all field measurements are required. Water levels for nearby monitoring wells may also be logged.

8.2.3.3 Office Data Reduction/Evaluation

Collected data are reduced to a reportable format using standardized spreadsheets and charts. Most of this effort shall be programmed into the SCADA system. The various charts and/or diagrams will allow the engineer to use graphical and analytical methods along with rational decisions with regard to optimizing system performance. Typical varying parameters include increasing the flowrate at a particular well while decreasing another or adjusting extraction and/or discharge rates to minimize cyclical pumping action. Carbon changeouts or other maintenance activities requiring system shutdown will be scheduled concurrently to minimize down times.

8.2.3.4 Performance of Groundwater Extraction Wells

Technical information regarding system installation is required before system optimization. Extraction well-water levels, flowmeter readings, pressure readings, and electrical consumption will be monitored on a regular basis. As data are evaluated, the pump and/or level controls will be adjusted to reduce cycle frequency, which will create a greater zone of capture. Nearby monitoring wells will also be monitored. The data could also be used to calculate individual well mass removal rates.

8.2.3.5 Performance of Granular Activated Carbon Treatment Unit

The GAC treatment unit consists primarily of two parallel sets of two 20,000-pound GAC beds and associated valving. To optimize the performance of the GAC beds, routine maintenance shall be performed as specified by the manufacturer. Where practical, routine maintenance shall be scheduled in conjunction with routine monitoring of pressure, system influent, and system effluent concentrations and flowrates through each carbon bed. These data are used to estimate carbon changeout and backwash cycles.

8.2.3.6 Performance of Injection Points

Infiltration gallery and injection well water levels, flowmeter readings and pressure readings will be monitored on a regular basis. As data are evaluated, the injection pump, injection level control, injection valves and/or nearby valves will be adjusted. Adjusting nearby valves will change the pressure dynamics of the system and will alter the amount of water flow to the injection well versus the nearby infiltration gallery. Infiltration gallery flowrates will be periodically adjusted to ensure adequate plume capture, while minimizing the effects of salt water intrusion.

8.2.3.7 Debottlenecking the Groundwater Remedy

Debottlenecking is the process of identifying, defining, and engineering a solution around a hydraulic or process bottleneck. Debottlenecking of the groundwater remedy will commence after initial shakedown and normal operation commences. A hydraulic bottleneck is a condition or situation that obstructs, restrict, or slows down water flow. A process bottleneck is a condition or situation that prevents the increase in hydraulic throughput without compromising the integrity of the effluent stream. In other words, increasing water throughput may cause the plant's effluent to exceed permitted discharge constituent concentrations.

The primary bottleneck that limits system flow capacity is the Eastern Network pipe diameter. Increasing water flow corresponds to an increase in pipeline pressure, and could result in exceeding a shutdown condition setpoint.

Secondary bottlenecks will be identified by analyzing the following:

- Extraction well construction details: top of casing, depth to water, pump intake elevation, and level sensor elevation.
- Extraction wells performance summary: flowrates, water level, drawdowns, specific capacity, capture zone, and pressure.

- GAC system performance summary: influent and effluent COC concentrations, pressure drop, and flowrates.
- Summary of groundwater remedy performance: system influent, middle, and effluent concentrations; flowrates; total energy consumption; and mass removed.
- Injection well construction details: list top of casing, depth to water, well screen elevation, and level sensor elevation.
- Infiltration gallery construction details and level sensor elevation.
- Injection well performance summary: injection flowrates, water level, well buildup, specific capacity, radii of injection influence, flow field, and pressure.
- Infiltration gallery performance summary: flowrates, depth of water, and adjacent well water levels.
- Miscellaneous performance data, including, effluent-tank cycling rates, injection-well pump cycling rates, and other gauges and readings as determined in the field.

8.3 Performance Evaluation

A groundwater monitoring program has been established for evaluating system performance. This program includes water level measurement, sample collection, and chemical analysis. The data will be used to assess the near and long-term performance of the groundwater remedy. The monitoring program addresses the following:

- Hydraulic containment: Does the groundwater remedy capture the entire impacted plume?
- Plume remediation: Are COC concentrations being reduced as expected?

Water levels are measured at the wells and piezometers at appropriate frequencies. Hydraulic containment will be evaluated by posting and contouring groundwater-level elevations on maps and interpreting the capture area. If appropriate, the Fort Ord groundwater flow model may also be re-run using the newly acquired water-level monitoring data, and evaluated to determine the extent of the capture zone. Such data can also be used to determine the appropriate flowrates of each extraction well.

The COC analytical results will be used to assess aquifer cleanup progress. Based on the data obtained, the sampling frequency from individual wells may be reduced or released from further testing. A variable sampling frequency approach will be implemented for COC sampling. The variable frequency approach allows for wells with COC concentrations that have dropped below cleanup levels to be sampled less frequently, for example once a year. This approach will not be

implemented until after 1 year of system operation in order to establish a baseline for COC concentrations.

In addition to monitoring COC concentrations over time, groundwater general chemistry parameters will also be monitored. This will allow for an ongoing evaluation of changes to inorganic aquifer water quality associated with saltwater intrusion, including salinity, TDS, and chloride concentrations.

8.4 Reports to Regulatory Agencies

Two reports are submitted to regulatory agencies on a routine basis: the Quarterly Status Report and the Annual (or semi-annual) System Report. Reports are sent to the following regulatory agencies:

- California Regional Water Quality Control Board, Central Coast Region
  81 Higuera Street, Suite 200, San Luis Obispo, California 93401
- State of California - Environmental Protection Agency
  Department of Toxic Substances Control - Region I, 10151 Croydon Way, Suite 3
  Sacramento, California 95827-2106
- U.S. Environmental Protection Agency - Region IX, 75 Hawthorne Street
  San Francisco, California 94105-3901

8.4.1 Quarterly Data Status Report

The Quarterly Data Status Report will be completed on a quarterly basis, and will be submitted 60 days after completion of each quarterly operating period. This report will summarize current operating conditions, general trends and likely solutions. A more thorough analysis of problems and solutions will be included in the Annual System Report.

The Quarterly Data Summary report will contain

- analytical data
- quarterly water-level data
- weekly and cumulative production and injection water flow rates.

8.4.2 Annual or Semi-annual System Report

During normal operations an Annual System Report will be submitted on March 31 and will include the 12-month period ending the previous December 31. This report will analyze current

operating conditions, general trends and likely solutions summarized in the previous four Quarterly Data Summary Reports.

The Annual Evaluation Reports will include the following information:

- treatment configuration with figure
- analytical summary data with tables and figures
- production and injection information with tables and figures
- calculated COC removal with tables
- COC capture effectiveness and groundwater elevation contour maps
- overall operation evaluation, including a description and summary of work performed and a discussion of work to be performed, issues/difficulties encountered, and the proposed response, including system modification
- recommendations for future action
- recommendations for changes to approved plans
- quality control and data summary report as an appendix.

The groundwater remedy operating factors to be evaluated include

- Carbon bed performance
  - Mass loading versus time (or gallons treated)
  - COC breakthrough versus time (or gallons treated).

Hydrogeologic operating factors to be evaluated include

- Well performance
  - Extraction well on-line efficiency
  - Flowrate versus change in water level or specific capacity.

- Aquifer COC distribution, with isoconcentration plots
  - COC capture effectiveness
  - Water-elevation contour maps
  - Flow model results.

After any major system modification a semi-annual System report will be submitted for the six-month period following the completion of the modification. This schedule may be modified with agency approval to bring the reporting schedule in line with the normal calendar year frequency. Following the System Expansion, a System report will be prepared for the period April 2001 through December 2001.

9.0 References

American National Standards Institute, 1990, Standard Z358.1, "Emergency Eye Wash and Shower Equipment."

Harding Lawson Associates (HLA), 1998, *Draft Effectiveness Evaluation, Technical Memorandum, OU2 Groundwater Remedy, Fort Ord, California*, Novato, California.

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IT, 2000, *Site Safety and Health Plan, Fort Ord, California,* Revision 6, Fort Ord, California.

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IT, 2001c, *Draft Final Well Installation and Abandonment Report, Operable Unit 2, Groundwater Remedy System Expansion*, Revision 0, Fort Ord, California.

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U.S. Army (Army), 1994, *Record of Decision, Operable Unit 2, Fort Ord Landfills, Fort Ord, California*, Fort Ord, California.

Army, 1997, *Installation-Wide Multispecies Habitat Management Plan for Former Fort Ord, California*, prepared by the U.S. Army Corps of Engineers, Sacramento District and Jones and Stokes Associates, Inc., Sacramento, California, April 1997.

USEPA, 2001, *Operation and Maintenance in the Superfund Program*, EPA 540-F-01-004.

TABLES

Table 1-1

Chemicals of Concern and Remediation Goals[a]
Operable Unit 2 Groundwater Remedy

Chemical of Concern	Federal MCL[b] (µg/L)[c]	State MCL (µg/L)	Aquifer Cleanup Level (µg/L)	Discharge Limits for Treated Water (µg/L)
Benzene	5.0	1.0	1.0	0.5
Carbon Tetrachloride	5.0	0.5	0.5	0.5
Chloroform	100	-	2.0[d]	0.5[e]
1,1-Dichloroethane	–	5.0	5.0	0.5[e]
1,2-Dichloroethane	5.0	0.5	0.5	0.5
cis-1,2-Dichloroethene	70	6.0	6.0	0.5[e]
1,2-Dichloropropane	5.0	–	1.0	0.5
Methylene Chloride	5.0	–	5.0	0.5
Tetrachloroethene	5.0	5.0	3.0[d]	0.5
Trichloroethene	5.0	5.0	5.0	0.5
Vinyl Chloride	2.0	0.5	0.1[d]	0.1

[a] Reference from Table 1 - U.S. Department of the Army (Army), 1994, *Record of Decision, Operable Unit 2, Fort Ord Landfills, Fort Ord, California*.

[b] maximum contaminant level.

[c] microgram per liter.

[d] Aquifer cleanup goals lower than federal or state MCL(s) are based on risk calculations in Dames & Moore, 1993, *Fort Ord Baseline Risk Assessment.* The estimated combined excess cancer risk from exposure to all chemicals at the levels listed in Table 1 is 6×10^{-5}. This cumulative risk is within the acceptable risk range and is health protective.

[e] Discharge limits for chloroform, 1,1-dichloroethane, and cis-1,2-dichloroethene to areas overlying the contaminated groundwater plume need only meet cleanup levels. Harding Lawson Associates (HLA) 1999, *Draft Final Revised Treatment System Plan, Operable Unit 2, Groundwater Remedy, Fort Ord, California;* prepared for USACE, January 29.

Table 2-1

Major Elements and Components
Operable Unit 2 Groundwater Remedy

Location	Quantity	Project[a]	Component	Specification	Model Number	Manufacturer
EW[b]-OU2-01-A	1	Original	5 horsepower pump	44 gpm[c] at 300 ft head 3450 rpm[d]	40S50-15	Grundfos
EW-OU2-02-A	1	Original	5 horsepower pump	44 gpm at 300 ft head 3450 rpm	40S50-15	Grundfos
EW-OU2-03-A	1	Original	5 horsepower pump	44 gpm at 300 ft head 3450 rpm	40S50-15	Grundfos
EW-OU2-04-A	1	Original	5 horsepower pump	44 gpm at 300 ft head 3450 rpm	40S50-15	Grundfos
EW-OU2-05-A	1	Original	5 horsepower pump	44 gpm at 300 ft head 3450 rpm	40S50-15	Grundfos
EW-OU2-06-A	1	Original	5 horsepower pump	44 gpm at 300 ft head 3450 rpm	40S50-15	Grundfos
EW-OU2-07-A	1	Original	3 horsepower pump	25 gpm at 300 ft head 3450 rpm	25S30-15	Grundfos
EW-OU2-08-A	1	Original	3 horsepower pump	25 gpm at 300 ft head 3450 rpm	25S30-15	Grundfos
EW-OU2-09-A	1	Original	3 horsepower pump	25 gpm at 300 ft head 3450 rpm	25S30-15	Grundfos
EW-OU2-10-A	1	Original	3 horsepower pump	25 gpm at 300 ft head 3450 rpm	25S30-15	Grundfos
EW-OU2-11-A	1	Original	3 horsepower pump	25 gpm at 300 ft head 3450 rpm	25S30-15	Grundfos
EW-OU2-12-A	1	Original	3 horsepower pump	25 gpm at 300 ft head 3450 rpm	25S30-15	Grundfos
EW-OU2-13-A	1	Original	3 horsepower pump	25 gpm at 300 ft head 3450 rpm	25S30-15	Grundfos
EW-OU2-14-A	1	Expansion	3 horsepower pump	18 gpm at 312 ft head 3450 rpm	25S30-15	Grundfos
EW-OU2-15-A	1	Expansion	3 horsepower pump	18 gpm at 315 ft head 3450 rpm	25S30-15	Grundfos
EW-OU2-16-A	1	Expansion	3 horsepower pump	24 gpm at 293 ft head 3450 rpm	25S30-15	Grundfos
EW-OU2-01-180	1	Original	25 horsepower pump	250 gpm at 300 ft head 3450 rpm	225S250-10	Grundfos
EW-OU2-02-180	1	Original	15 horsepower pump	150 gpm at 300 ft head 3450 rpm	135S150-9	Grundfos
EW-OU2-03-180	1	Expansion	20 horsepower pump	125 gpm at 416 ft head 3450 rpm	150S200-10	Grundfos
EW-OU2-04-180	1	Expansion	20 horsepower pump	125 gpm at 427 ft head 3450 rpm	150S200-10	Grundfos
EW-OU2-05-180	1	Expansion	20 horsepower pump	125 gpm at 416 ft head 3450 rpm	150S200-10	Grundfos
EW-OU2-06-180	1	Expansion	20 horsepower pump	125 gpm at 406 ft head 3450 rpm	150S200-10	Grundfos
INF[e]-OU2-01-180	1	Expansion	Infiltration gallery	328 gpm nominal flow 462 gpm maximum flow	Not applicable	Not applicable
INF-OU2-02-180	1	Expansion	Infiltration gallery	325 gpm nominal flow 458 gpm maximum flow	Not applicable	Not applicable
GWTP[f]	2	Expansion	New carbon adsorption vessel	20,000 pound GAC[g] treatment vessels	HP-1020S-6	US Filter / Westates

Table 2-1

Major Elements and Components
Operable Unit 2 Groundwater Remedy

Location	Quantity	Project[a]	Component	Specification	Model Number	Manufacturer
GWTP	2	Original; Expansion modified	Refurbished carbon adsorption vessel	20,000 pound GAC treatment vessels	Model 10	Calgon unit; refurbished by US Filter / Westates
GWTP	1	Expansion	New backwash Tank	Carbon steel 10,000 gal working volume 12-ft diam by 14-ft high	Dwg D10004	BH Tank Works
GWTP	1	Original; Expansion modified	Refurbished backwash tank	304 stainless steel 6,000 gal 9-ft 9-in by 11-ft 1-in high	Dwg 16998	Solarchem unit; refurbished by BH Tank Works
GWTP	1	Expansion	Effluent tank	304 stainless steel 10,000 gal working volume 11-ft diam by 16-ft high	Not applicable	BH Tank Works
GWTP	1	Expansion	Backwash pump	10 horsepower centrifugal 50 gpm 175 ft head 1800 rpm	3x1.5x13 GRP	Ingersoll-Dresser Pumps
GWTP	2	Original	Sites 2/12 & eastern injection pumps P-410 & 420	40 horsepower centrifugal ___ gpm 220 ft head 3450 rpm	4x3x6.5	ITT-AC
GWTP	2	Original; Expansion service	Southwestern injection pumps P-510 & 520	10 horsepower centrifugal 300gpm 28 ft head 1170 rpm	4x3x11	ITT-AC
GWTP	2	Expansion	Northwestern injection pumps P-910 & 920	7.5 horsepower centrifugal 300 gpm 59 ft head 3450 rpm	4x3x8F D800	Ingersoll-Dresser Pumps
GWTP	3	Expansion	Sump pump	½ horsepower submersible 20 gpm 25 ft head	1-½ inch dewater 1DW51C1EA	Goulds Pumps
GWTP	1	Expansion	Backwash cartridge filter	with CMMF02020 cartridges (20 micron by 20-in long)	FSC-1220	Filter Specialists, Inc.
GWTP	1	Original; Expansion relocation	Influent static mixer	316L stainless steel 8-in diam by 8-ft long	ID M-186	Reused Solarchem unit
GWTP	2	Original	Sites 2/12 & eastern injection pump variable frequency drives	40 horsepower 460 volt 3 phase NEMA 1 enclosure	AF 5000	Eaton
GWTP	2	Original	Southwestern injection pump variable frequency drives	10 horsepower 460 volt 3 phase NEMA 1 enclosure	AF 5000	Eaton
GWTP	2	Expansion	Northwestern injection pump variable frequency drives	10 horsepower 460 volt 3 phase NEMA 1 enclosure	VLT 5000 Aqua	Danfoss Electronic Drives
GWTP	40 feet	Expansion	2-inch building pipe	Single-contained polyvinyl chloride pipe, schedule 80	Not applicable	Various
	240 feet	Expansion	6-inch building pipe			
	20 feet	Expansion	12-inch building pipe			

Table 2-1

Major Elements and Components
Operable Unit 2 Groundwater Remedy

Location	Quantity	Project[a]	Component	Specification	Model Number	Manufacturer
Extraction pipeline	710 feet	Expansion	2-inch x 4-inch	Double-contained high-density polyethylene pipe SDR 11 inner and SDR 17 outer	Not applicable	Santa Fe Industrial Products
	5,300 feet	Expansion	3-inch x 6-inch			
	790 feet	Expansion	4-inch x 8-inch			
	1,950 feet	Expansion	6-inch x 10-inch			
	4,800 feet	Expansion	8-inch x 12-inch			
	40 feet	Expansion	4, 6, and 8-inch	Single-contained polyvinyl chloride pipe, schedule 80 installed in vault	Not applicable	Various
	1,740 feet	12th Street	8-inch x 12-inch	Double-contained high-density polyethylene pipe SDR 11 inner and SDR 17 outer	Not applicable	Santa Fe Industrial Products
	8 feet	12th Street	8-inch	Single-contained polyvinyl chloride pipe, schedule 80 installed in vault	Not applicable	Various
Injection pipeline	110 feet	Expansion	6-inch	Single-contained polyvinyl chloride pipe, schedule 80	Not applicable	Various
	1740 feet	12th Street	8-inch	Single-contained high-density polyethylene pipe SDR 11	Not applicable	Santa Fe Industrial Products
	8 feet	12th Street	8-inch	Single-contained polyvinyl chloride pipe, schedule 80	Not applicable	Various

[a] Original – installed in 1995/1996; Expansion – installed in 1999/2000; Expansion modified – originally installed in 1995/1996 but modified/replaced and reinstalled in 1999/2000; 12th Street – installed in 2002.
[b] Extraction Well
[c] gallons per minute
[d] revolutions per minute
[e] Infiltration gallery
[f] Groundwater Treatment Plant
[g] granular activated carbon

Table 2-2

Well, Pump and System Capacities
Operable Unit 2 Groundwater Remedy

Extraction Well	Well Capacity[a] (gpm)[b]	Pump Capacity[c] (gpm)	System Operating Capacity (gpm)
EW[d]-OU2-01-A	50 (09/96)	51	45
EW-OU2-02-A	50 (10/96)	51	30
EW-OU2-03-A	50 (10/96)	51	30
EW-OU2-04-A	50 (09/96)	51	35
EW-OU2-05-A	50 (10/96)	51	35
EW-OU2-06-A	50 (10/96)	51	30
EW-OU2-07-A	30 (07/01)	30	25
EW-OU2-08-A	30 (07/01)	30	25
EW-OU2-09-A	30 (07/01)	30	20
EW-OU2-10-A	30 (10/96)	30	20
EW-OU2-11-A	30 (10/96)	30	20
EW-OU2-12-A	30 (07/01)	30	25
EW-OU2-13-A	23 (08/96)	30	20
EW-OU2-01-180	225 (07/01)	280	150
EW-OU2-02-180	160 (08/01)	172	120
EW-OU2-03-180	227 (08/01)	210	125
EW-OU2-04-180	151 (05/01)	210	115
EW-OU2-05-180	178 (07/01)	210	115
EW-OU2-06-180	621 (07/01)	210	135
EW-OU2-14-A	28 (07/01)	30	20
EW-OU2-15-A	28 (07/01)	30	20
EW-OU2-16-A	27 (05/01)	30	20
Total Extraction Capacity	Not applicable	Not applicable	**1180**

Recharge Point			
IW[e]-OU2-01-180	100	Not applicable	70
IW-OU2-02-180	150	Not applicable	70
IW-OU2-03-180	80	Not applicable	60
INF[f]-OU2-01-180[g]	400	Not applicable	300
INF-OU2-02-180	280	Not applicable	270
Site 2 recharge	670, less Sites 2 and 12 extraction well rate	Not applicable	410
Total Recharge Capacity	Not applicable	Not applicable	**1180**

[a] Extraction rates by specific capacity evaluation; recharge rates by experience; (bracket) last evaluation date.

[b] gallons per minute instantaneous flow rate.

[c] Pump curve capacity at 240-foot head.

[d] Extraction Well.

[e] Injection Well.

[f] Infiltration Gallery.

[g] Five INF-OU2-XX-A wells (01, 02, 03, 04, and 05) were decommissioned in March 2000.

Table 2-2

Well, Pump and System Capacities
Operable Unit 2 Groundwater Remedy

Extraction Well	Well Capacity[a] (gpm)[b]	Pump Capacity[c] (gpm)	System Operating Capacity (gpm)
EW[d]-OU2-01-A	50 (09/96)	51	45
EW-OU2-02-A	50 (10/96)	51	30
EW-OU2-03-A	50 (10/96)	51	30
EW-OU2-04-A	50 (09/96)	51	35
EW-OU2-05-A	50 (10/96)	51	35
EW-OU2-06-A	50 (10/96)	51	30
EW-OU2-07-A	30 (07/01)	30	25
EW-OU2-08-A	30 (07/01)	30	25
EW-OU2-09-A	30 (07/01)	30	20
EW-OU2-10-A	30 (10/96)	30	20
EW-OU2-11-A	30 (10/96)	30	20
EW-OU2-12-A	30 (07/01)	30	25
EW-OU2-13-A	23 (08/96)	30	20
EW-OU2-01-180	225 (07/01)	280	150
EW-OU2-02-180	160 (08/01)	172	120
EW-OU2-03-180	227 (08/01)	210	125
EW-OU2-04-180	151 (05/01)	210	115
EW-OU2-05-180	178 (07/01)	210	115
EW-OU2-06-180	621 (07/01)	210	135
EW-OU2-14-A	28 (07/01)	30	20
EW-OU2-15-A	28 (07/01)	30	20
EW-OU2-16-A	27 (05/01)	30	20
Total Extraction Capacity	Not applicable	Not applicable	**1180**

Recharge Point			
IW[e]-OU2-01-180	100	Not applicable	70
IW-OU2-02-180	150	Not applicable	70
IW-OU2-03-180	80	Not applicable	60
INF[f]-OU2-01-180[g]	400	Not applicable	300
INF-OU2-02-180	280	Not applicable	270
Site 2 recharge	670, less Sites 2 and 12 extraction well rate	Not applicable	410
Total Recharge Capacity	Not applicable	Not applicable	**1180**

[a] Extraction rates by specific capacity evaluation; recharge rates by experience; (bracket) last evaluation date.

[b] gallons per minute instantaneous flow rate.

[c] Pump curve capacity at 240-foot head.

[d] Extraction Well.

[e] Injection Well.

[f] Infiltration Gallery.

[g] Five INF-OU2-XX-A wells (01, 02, 03, 04, and 05) were decommissioned in March 2000.

Table 3-1

Extraction Well, Injection Well, Pipeline, and Infiltration Gallery Concrete Vault Location[a]
Operable Unit 2 Groundwater Remedy

Original Remedy with Site 2 Injection and 12th Street Installation

Vault Location	Vault, 4-foot by 5-foot	Vault, 5-foot by 6-foot	Vault, 6-foot by 6-foot	High Point Vent	Low Point Drain	Leak Detection	Pullbox 11-inch by 17-inch	Total
Western Extraction	6	1	0	0	0	9	0	**16**
Abrams Extraction	7	1	0	0	0	4	0	**12**
12th Street Realignment	0	0	2	1	2	0	2	**7**
Northwestern Injection	1	0	0	2	0	0	0	**3**
Southwestern Injection	1	0	0	1	1	0	0	**3**
Eastern Injection	1	0	0	3	3	0	0	**7**
Treated Water to Site 2 Injection	0	0	0	1	1	0	0	**2**
Total	**16**	**2**	**2**	**8**	**7**	**13**	**2**	**50**

System Expansion Installation

Vault Location	Vault, 2-foot by 2-foot			Pull Box				Isolation Valve	Infiltration Gallery	Valve Box	Extraction Well		Wye Vault	Total
	Low Point	High Point	Leak Detection	2-foot Square	11-inch by 17-inch	17-inch by 30-inch	2-foot by 3-foot	4-foot Diameter	4-foot Square	4-foot by 8-foot	6-foot Square	6-foot by 9-foot	8-foot by 10-foot	
University	4	4	11	0	10	0	1	1	0	0	2	0	0	**33**
Landfill	1	0	4	0	2	2	1	1	0	0	0	2	0	**13**
Imjin/Abrams	1	1	4	1	3	2	1	1	0	0	1	2	0	**17**
Area A	2	1	7	0	4	0	0	0	0	0	0	0	1	**15**
Infiltration	0	0	0	0	0	0	0	0	2	2	0	0	0	**4**
Sub Total	**8**	**6**	**26**	**1**	**19**	**4**	**3**	**3**	**2**	**2**	**3**	**4**	**1**	**82**
Total	**40**			**27**				**3**	**2**	**2**	**3**	**4**	**1**	**82**

[a] Where concrete vault has multiple functions, the vault is accounted for in the first appropriate cell encountered.

Table 6-1

Leak Detection Location Summary by Operational Function
Operable Unit 2 Groundwater Remedy

Location	Extraction Well Vault	Pipeline High Point Vent	Pipeline Low Point Drain	Pipeline Leak Detection	Pipeline Isolation Valve	Contained Area, not otherwise listed	Subtotal
Groundwater Treatment Plant	0	0	0	0	0	2	**2**
Western Network	7	0	0	7	0	0	**14**
Eastern Network/Abrams	8	0	0	6	1	0	**15**
12th Street Realignment	0	1	1	1	0	2	**5**
University Expansion	2	4	4	11	1	0	**22**
Landfill Expansion	2	0	1	4	1	0	**8**
Imjin/Abrams Expansion	3	1	1	5	1	0	**11**
Area A Expansion	0	1	2	7	0	0	**10**
Leak Detection Locations	**22**	**7**	**9**	**41**	**4**	**4**	**87**

Table 6-1

Leak Detection Location Summary by Operational Function
Operable Unit 2 Groundwater Remedy

Location	Extraction Well Vault	Pipeline High Point Vent	Pipeline Low Point Drain	Pipeline Leak Detection	Pipeline Isolation Valve	Contained Area, not otherwise listed	Subtotal
Groundwater Treatment Plant	0	0	0	0	0	2	**2**
Western Network	7	0	0	7	0	0	**14**
Eastern Network/Abrams	8	0	0	6	1	0	**15**
12th Street Realignment	0	1	1	1	0	2	**5**
University Expansion	2	4	4	11	1	0	**22**
Landfill Expansion	2	0	1	4	1	0	**8**
Imjin/Abrams Expansion	3	1	1	5	1	0	**11**
Area A Expansion	0	1	2	7	0	0	**10**
Leak Detection Locations	**22**	**7**	**9**	**41**	**4**	**4**	**87**

Table 6-2

Master Programmable Logic Controller Digital Inputs and Outputs
Operable Unit 2 Groundwater Remedy

Input/Output	PLC Address	ISA Tag	Description
Input	X0	LSH-281	Western leak detection system.
	X1	LSH-282	Eastern leak detection system.
	X2	PSH-922	Pump P-920 high discharge pressure.
	X3	PSH-327	Eastern extraction influent high pressure.
	X4	LSLL-691	Effluent tank low-low level switch.
	X5	LSL-691	Effluent tank low-level switch.
	X6	LSH-691	Effluent tank high level switch.
	X7	LSHH-691	Effluent tank high-high level switch.
	X10	PDSH-614	East-North GAC Vessel A high pressure drop
	X11	PSH-522	Pump P-520 high discharge pressure.
	X12	PSH-307	Western extraction influent high pressure.
	X13	N/A	Not used.
	X14	PSH-412	Pump P-410 high discharge pressure.
	X15	PSH-422	Pump P-420 high discharge pressure.
	X16	PSH-512	Pump P-510 high discharge pressure.
	X17	LSH-396	Building containment sump high level.
	X20	PSH-912	Pump P-910 high discharge pressure.
	X21	N/A	Not used.
	X22	PDSH-664	North-West GAC Vessel C high pressure drop.
	X23	PDSH-665	North-East GAC Vessel D high pressure drop.
	X24	N/A	System Start button on PLC panel door.
	X25	N/A	System Stop button on PLC panel door.
	X26	N/A	Acknowledge button on PLC panel door.
	X27	PDSH-615	East-South GAC vessel B high pressure drop.
	X30	ISH-201	OU2-01-A current switch run feedback.
	X31	ISH-202	OU2-02-A current switch run feedback.
	X32	ISH-203	OU2-03-A current switch run feedback.
	X33	LSH-395	Northern containment berm high level.
	X34	ISH-204	OU2-04-A current switch run feedback.
	X35	ISH-205	OU2-05-A current switch run feedback.
	X36	ISH-206	OU2-06-A current switch run feedback.
	X37	ISH-180	OU2-04-A current switch run feedback.

Table 6-2

Master Programmable Logic Controller Digital Inputs and Outputs
Operable Unit 2 Groundwater Remedy

Input/Output	PLC Address	ISA Tag	Description
Output	Y0	N/A	Autodialer Warning
	Y1	N/A	Autodialer Alarm.
	Y2	V-324	Opens eastern network pneumatic valve.
	Y3	V-304	Opens western network pneumatic valve.
	Y4	P-510	Starts P-510 VFD.
	Y5	P-520	Starts P-520 VFD.
	Y6	P-410	Starts P-410 VFD.
	Y7	P-420	Starts P-420 VFD.
	Y10	P-920	Starts P-910 VFD.
	Y11	P-910	Starts P-920 VFD.
	Y12	P-385	Starts backwash pump P-385.
	Y13	P-345	Starts backwash pump P-345.
	Y14	N/A	Not used.
	Y15	N/A	Buzzes buzzer on door of PLC panel.
	Y16	N/A	Starts EW-OU2-01-A thru EW-OU2-06-A.
	Y17	N/A	Starts EW-OU2-01-180 well.

Table 6-3

SCADA Status (December 2001)
Operable Unit 2 Groundwater Remedy

Function[a]	Signal	HMI[b]	Digital/ Analog	Current Use	Remarks	Future Potential Use
Extraction Well Pump Operation (Number of data points)						
West (7)	Current switch	Yes	Digital	Current indication	Cannot automatically start individual wells	Elapsed time metering; trends at PC[c]
	Flow rate	No	---	Manual read only		
	Pressure switch	No	Digital	Local control	Switch activation stops local well pump	
	Vault water level switch	No	Digital	Local control	Switch activation stops local well pump	
	Well water level switch	No	Digital	Local control		
East (8)	Control switch (2)	Yes	Digital	Control activation	Cannot automatically start individual wells	
	Current switch	No	---	Not operational	Replace/rewire 8 current switches	Elapsed time metering; trends at PC
	Flow rate	No	---	Manual read only		
	Pressure switch	Yes	Digital	Local control	Switch activation stops local well pump	
	Vault water level switch	Yes	Digital	Local control	Switch activation stops local well pump	
	Well water level switch	No	Digital	Local control		
Abrams/Imjin (3)	Motor control	Yes	Digital	Starter activation	Can automatically start individual wells	Elapsed time metering; trends at PC
	Flow rate	Yes	Analog	PC data input	Verify calibration	Instantaneous, total flow, trends at PC
	Pressure switch	Yes	Digital	Local PLC control	Switch activation stops local well pump	Alarm and trends at PC
	Vault water level switch	Yes	Digital	Local PLC control	Switch activation stops local well pump	Alarm and trends at PC
	Well water transducer	Yes	Analog	PC data input	Used for local well control only. Verify calibration	Near realtime water level, trends at PC
Landfill (2)	Motor control	Yes	Digital	Starter activation	Can automatically start individual wells	Elapsed time metering; trends at PC
	Flow rate	Yes	Analog	PC data input	Verify calibration	Instantaneous, total flow, trends at PC
	Pressure switch	Yes	Digital	Local PLC control	Switch activation stops local well pump	Alarm and trends at PC
	Vault water level switch	Yes	Digital	Local PLC control	Switch activation stops local well pump	Alarm and trends at PC
	Well water transducer	Yes	Analog	PC data input	Used for local well control only. Verify calibration	Near realtime water level, trends at PC

Table 6-3

SCADA Status (December 2001)
Operable Unit 2 Groundwater Remedy

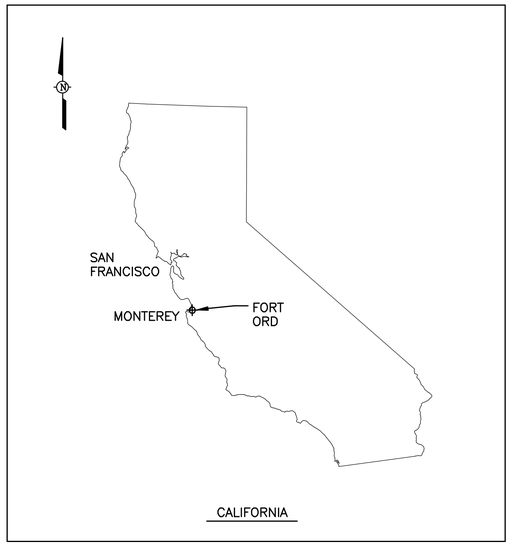
Function	Signal	HMI	Digital/ Analog	Current Use	Remarks	Future Potential Use
University (2)	Motor control	Yes	Digital	Starter activation	Can automatically start individual wells	Elapsed time metering; trends at PC
	Flow rate	Yes	Analog	PC data input	Verify calibration	Instantaneous, total flow, trends at PC
	Pressure switch	Yes	Digital	Local PLC control	Switch activation stops local well pump	Alarm and trends at PC
	Vault water level switch	Yes	Digital	Local PLC control	Switch activation stops local well pump	Alarm and trends at PC
	Well water transducer	Yes	Analog	PC data input	Used for local well control only Verify calibration	Near realtime water level, trends at PC
Pipeline Leak Detection						
West	7 zones	Yes	Digital	PC data input/alarm	Located at GWTP	
East near GWTP	2 zones	Yes	Digital	PC data input/alarm	Located at GWTP	
12th Street	5 zones	Yes	Digital	PC data input/alarm	Located at Abrams PLC panel	
Abrams	11 zones	Yes	Digital	PC data input/alarm	Located at Abrams PLC panel	
Abrams/Imjin	8 zones	Yes	Digital	PC data input/alarm	Located at Abrams/Imjin PLC panel	
Landfill	6 zones	Yes	Digital	PC data input/alarm	Located at Landfill PLC panel	
University	20 zones	Yes	Digital	PC data input/alarm	Located at University PLC panel	
Cell A	10 zones	Yes	Digital	PC data input/alarm	Located in Abrams PLC panel	
Groundwater Treatment Plant (Number of data points)						
Influent (2)	Flowmeter	Yes	Analog	PC data input	Verify calibration	Instantaneous, total flow, trends at PC
Effluent (3)	Flowmeter	Yes	Analog	PC data input		Instantaneous, total flow, trends at PC
Leak detection (2)	Containment area leak	Yes	Digital	PC data input/alarm		
Tank level (3)	Level indicator	Yes	Analog	SCADA input		Water level, trending at PC
Motor (6)	Variable speed controller	Yes	Analog	SCADA input		Elapsed time metering; trends at PC

a See Table 6-3, Master PLC Inputs/Outputs for other digital detail. This table was updated to reflect Year 2002 12th Street Realignment details only.

b Human-machine interface

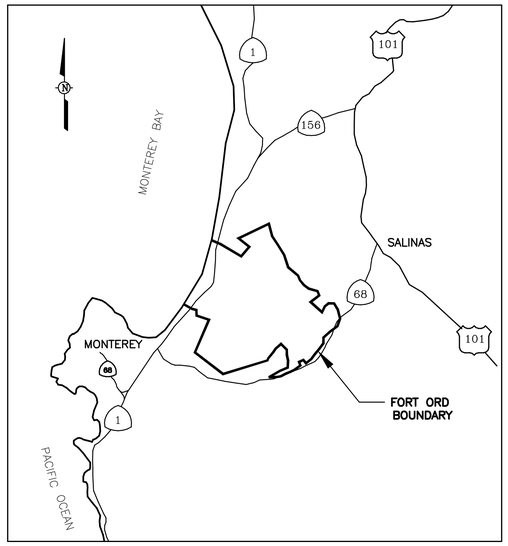
c Personal computer

FIGURES



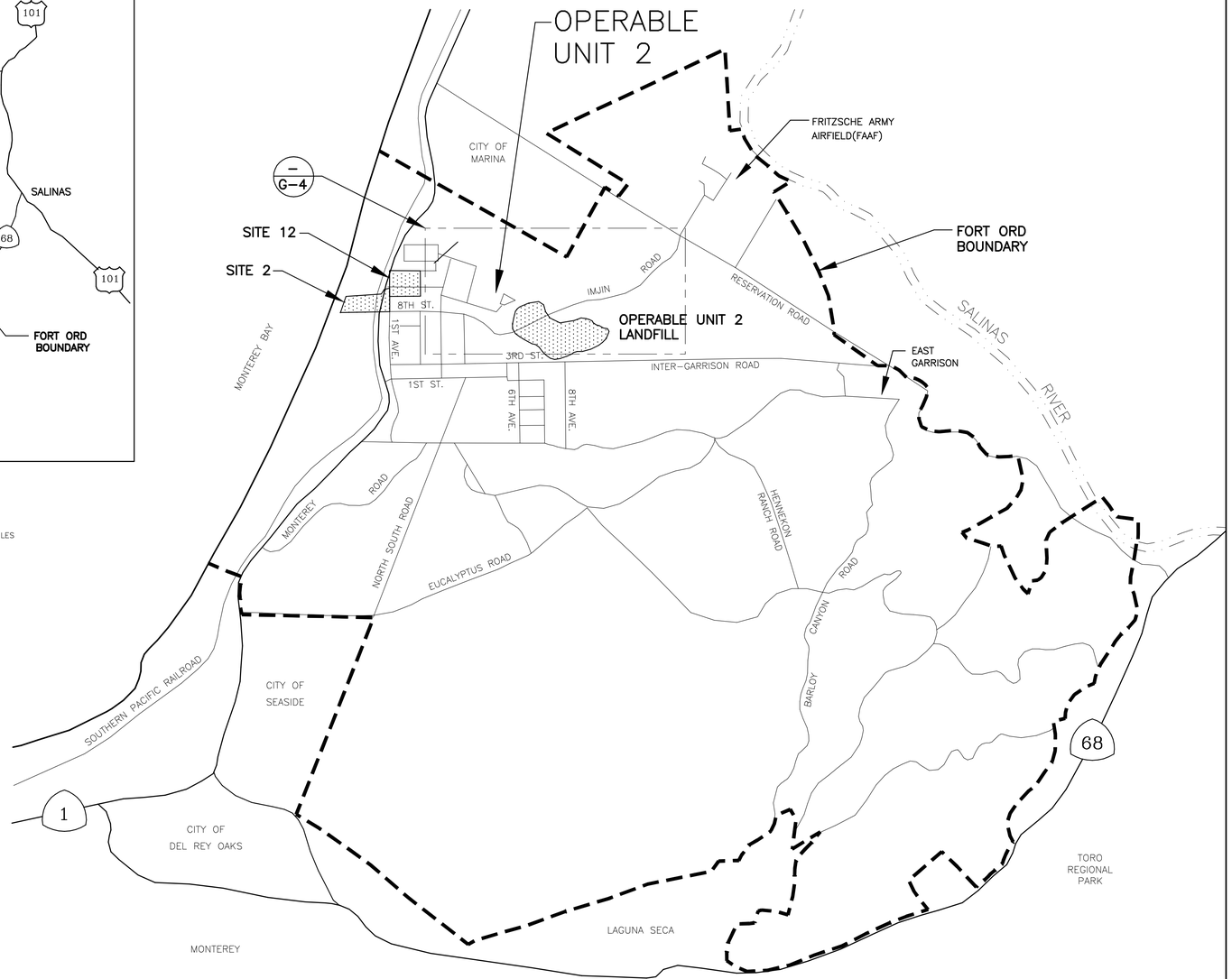
REGIONAL LOCATION

NOT TO SCALE



VICINITY MAP

SCALE
0 4 8 MILES



SITE LOCATION MAP

APPROXIMATE SCALE
0 1/2 1 MILE

SHEET NUMBER	TITLE
	GENERAL (G)
G-1	COVER SHEET
G-2	DRAWING LIST AND LOCATION MAP
G-3	STANDARD SYMBOLS AND LEGENDS
G-4	TRICHLOROETHENE PLUME, UPPER 180-FOOT AQUIFER
G-5	TRICHLOROETHENE PLUME, A AQUIFER
	CIVIL (C)
C-1	PROCESS FLOW DIAGRAM, NO. 1
C-2	PROCESS FLOW DIAGRAM, NO. 2
C-3	PIPING AND INSTRUMENTATION DIAGRAM, NO.1
C-4	PIPING AND INSTRUMENTATION DIAGRAM, NO.2
C-5	PIPING AND INSTRUMENTATION DIAGRAM, NO.3
C-6	PIPING AND INSTRUMENTATION DIAGRAM, NO.4
C-7	PIPING AND INSTRUMENTATION DIAGRAM, NO.5
C-8	PIPING AND INSTRUMENTATION DIAGRAM, NO.6
C-9	TREATMENT PLANT LOCATION AND LAYOUT
C-10	PIPE TRENCH DETAILS AND WELL VAULT DETAILS
C-11	CONCRETE FLOOR AND STAIR DETAILS
C-12	CONCRETE AND SUMP DETAILS
	UTILITY (U)
U-1	UTILITY FLOW DIAGRAM
	MECHANICAL (M)
M-1	EXTRACTION WELL DETAILS
M-2	MECHANICAL PLAN
M-3	MECHANICAL SECTIONS AND DETAILS NO. 1
M-4	MECHANICAL SECTIONS AND DETAILS NO. 2
M-5	INFILTRATION GALLERY DETAILS
	ELECTRICAL (E)
E-1	ELECTRICAL SITE PLAN AND VAULT LAYOUT
E-2	IMJIN CELL ELECTRICAL PLAN
E-3	LANDFILL CELL ELECTRICAL PLAN
E-4	UNIVERSITY CELL ELECTRICAL PLAN
E-5	TREATMENT PLANT ONE-LINE DIAGRAM
E-6	POWER AND INSTRUMENTATION PLAN
E-7	MOTOR SCHEMATICS AND DETAILS
E-8	MISCELLANEOUS ELECTRICAL DETAILS
E-9	TREATMENT PLANT PLC TERMINAL WIRING
E-10	TREATMENT PLANT PLC DIAGRAM NO. 1
E-11	TREATMENT PLANT PLC DIAGRAM NO. 2
E-12	TREATMENT PLANT PLC DIAGRAM NO. 3
E-13	ABRAMS/IMJIN CELL PLC DIAGRAM NO. 1
E-14	ABRAMS/IMJIN CELL PLC DIAGRAM NO. 2
E-15	LANDFILL CELL PLC DIAGRAM NO. 1
E-16	LANDFILL CELL PLC DIAGRAM NO. 2
E-17	UNIVERSITY CELL PLC DIAGRAM NO. 1
E-18	UNIVERSITY CELL PLC DIAGRAM NO. 2

DRAWING LIST

TWELFTH STREET REALIGNMENT MODIFICATION
(TABLE CREATED AUGUST 2002)

SHEET NUMBER	TITLE
	GENERAL (G)
G-2	DRAWING LIST AND LOCATION MAP (REVISION 1)
	CIVIL (C)
C-13	PIPELINE PLAN AND PROFILE VIEW NO. 1
C-14	PIPELINE PLAN AND PROFILE VIEW NO. 2
C-15	PIPE TRENCH AND UTILITY VAULT DETAILS NO. 1
C-16	PIPE TRENCH AND UTILITY VAULT DETAILS NO. 2
	ELECTRICAL (E)
E-1	ELECTRICAL SITE PLAN AND VAULT LAYOUT (REVISION 1)
E-19	ABRAMS POWER AND EQUIPMENT LAYOUT
E-20	ABRAMS PLC DIAGRAM NO. 1
E-21	ABRAMS PLC DIAGRAM NO. 2

REVISION	DATE	DESCRIPTION	BY	BY
1	8/08/02	JUNE 2002 TWELFTH STREET REALIGNMENT MODIFICATIONS	OC	RH
0	8/3/01	JULY 2001 AS-BUILT SUBMITTED TO AGENCIES. FILE NO. 783751-E1	OC	RH

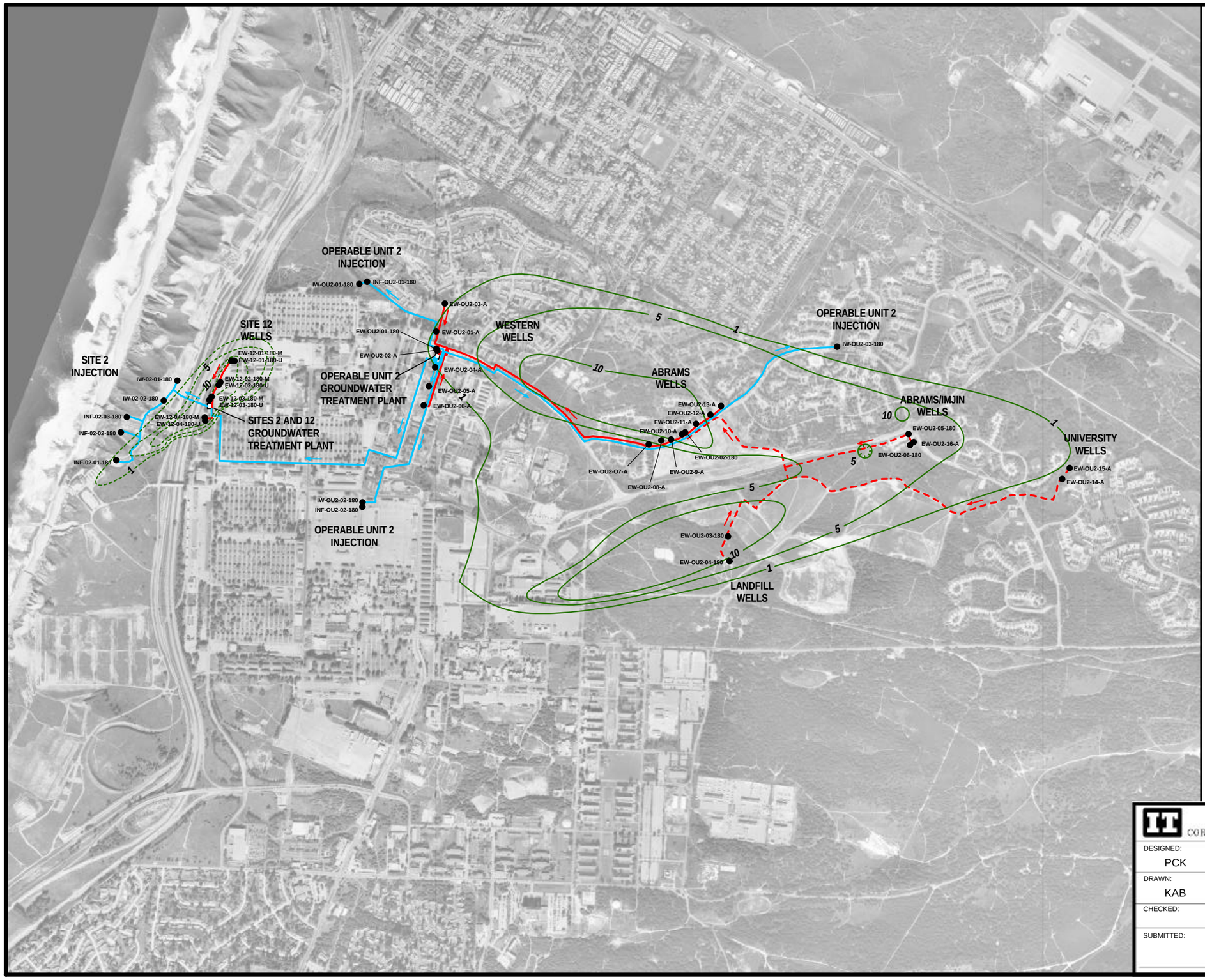
IT 4005 PORT CHICAGO HIGHWAY
CONCORD, CA. 94520
(925) 288-9898

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: JAM
DRAWN: BJ 8/25/99
CHECKED:

FORT ORD CALIFORNIA
FIGURE 1-1
OPERABLE UNIT 2
GROUNDWATER REMEDY
SYSTEM EXPANSION
DRAWING LIST AND LOCATION MAP

APPROVED: DATE APPROVED:
SCALE: AS SHOWN SPEC No.
SHEET G-2 1 OF 9
FILE No. 837769-E9



LEGEND

- EXTRACTION WELL (EW)
- INJECTION WELL (IW)
- INFILTRATION GALLERY (INF)
- EXTRACTION PIPELINE (ARROW INDICATES FLOW DIRECTION)
- INJECTION PIPELINE (ARROW INDICATES FLOW DIRECTION)
- SYSTEM EXPANSION PIPELINE (ARROW INDICATES FLOW DIRECTION)
- SITES 2 AND 12 TRICHLOROETHENE (TCE) ISOCONCENTRATION CONTOUR IN MICROGRAMS PER LITER (ug/L)
- OPERABLE UNIT 2 TRICHLOROETHENE (TCE) ISOCONCENTRATION CONTOUR IN MICROGRAMS PER LITER (ug/L)

N

FEET

0 1,000 2,000

NOTE:
TRICHLOROETHENE ISOCONCENTRATION CONTOURS ARE BASED ON SEPTEMBER 2000 ANALYTICAL DATA. THE CONTOURS GENERALLY REPRESENT CONDITIONS EXISTING PRIOR TO STEADYSTATE PUMPING OF THE OPERABLE UNIT 2 SYSTEM EXPANSION WELLS. OTHER VISUAL INTERPRETATIONS MAY BE POSSIBLE.

IT CORPORATION

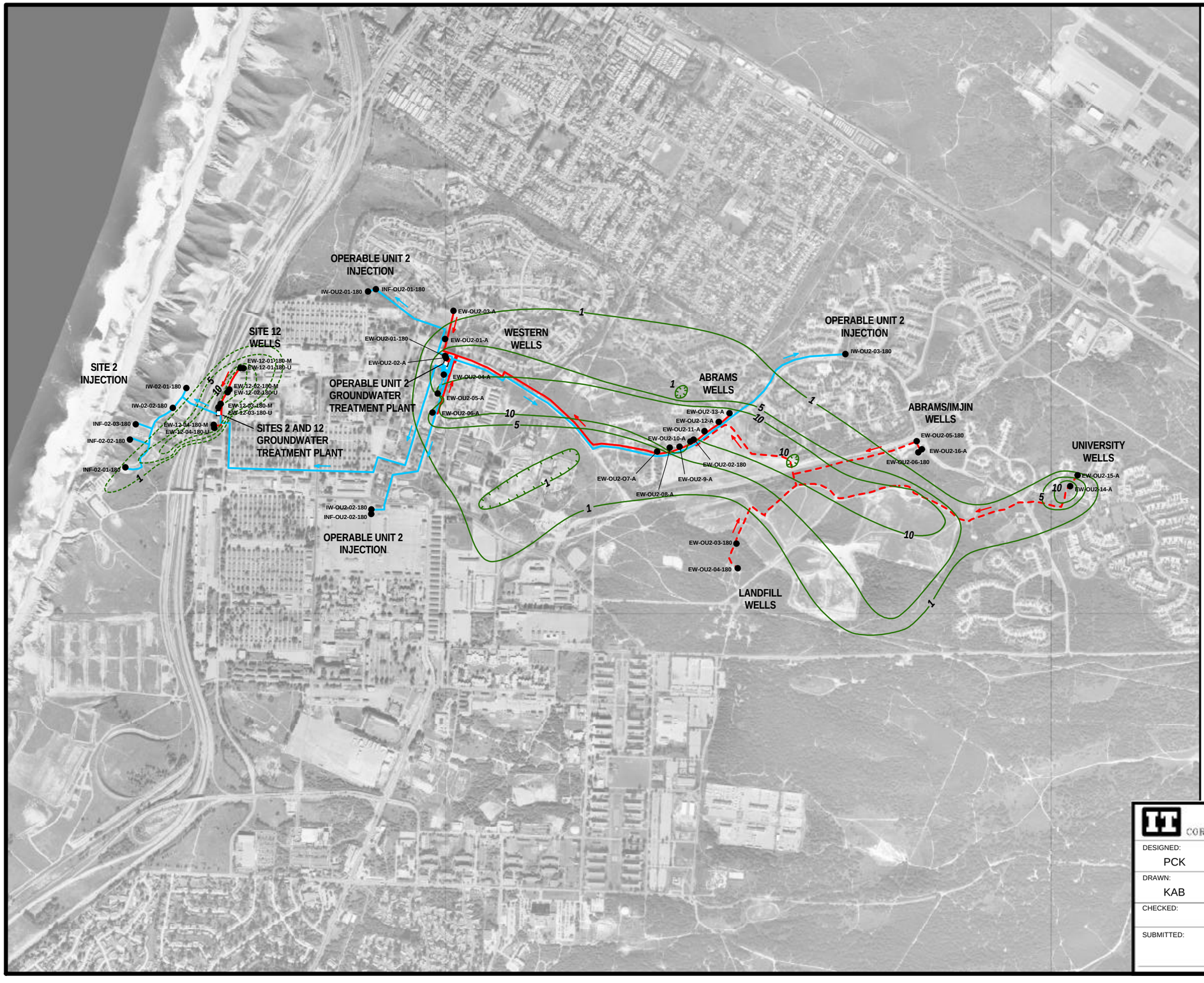
DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: PCK
DRAWN: KAB
CHECKED:

FORT ORD CALIFORNIA

FIGURE 1-3
PIPELINE ROUTING AND TRICHLOROETHENE PLUME
UPPER 180-FOOT AQUIFER
OPERABLE UNIT 2 GROUNDWATER REMEDY
FORMER FORT ORD, CALIFORNIA

SUBMITTED: DATE APPROVED:
SCALE: SPEC. No.
SHEET FILE No. N:/cad/dwg/FortOrd/Fort_Ord_GIS/TCEupper180.mxd



LEGEND

- EXTRACTION WELL (EW)
- INJECTION WELL (IW)
- INFILTRATION GALLERY (INF)
- EXTRACTION PIPELINE (ARROW INDICATES FLOW DIRECTION)
- INJECTION PIPELINE (ARROW INDICATES FLOW DIRECTION)
- SYSTEM EXPANSION PIPELINE (ARROW INDICATES FLOW DIRECTION)
- SITES 2 AND 12 TRICHLOROETHENE (TCE) ISOCONCENTRATION CONTOUR IN MICROGRAMS PER LITER (ug/L)
- OPERABLE UNIT 2 TRICHLOROETHENE (TCE) ISOCONCENTRATION CONTOUR IN MICROGRAMS PER LITER (ug/L)

N

FEET

0 1,000 2,000

NOTE:
TRICHLOROETHENE ISOCONCENTRATION CONTOURS ARE BASED ON SEPTEMBER 2000 ANALYTICAL DATA. THE CONTOURS GENERALLY REPRESENT CONDITIONS EXISTING PRIOR TO STEADYSTATE PUMPING OF THE OPERABLE UNIT 2 SYSTEM EXPANSION WELLS. OTHER VISUAL INTERPRETATIONS MAY BE POSSIBLE.

IT CORPORATION

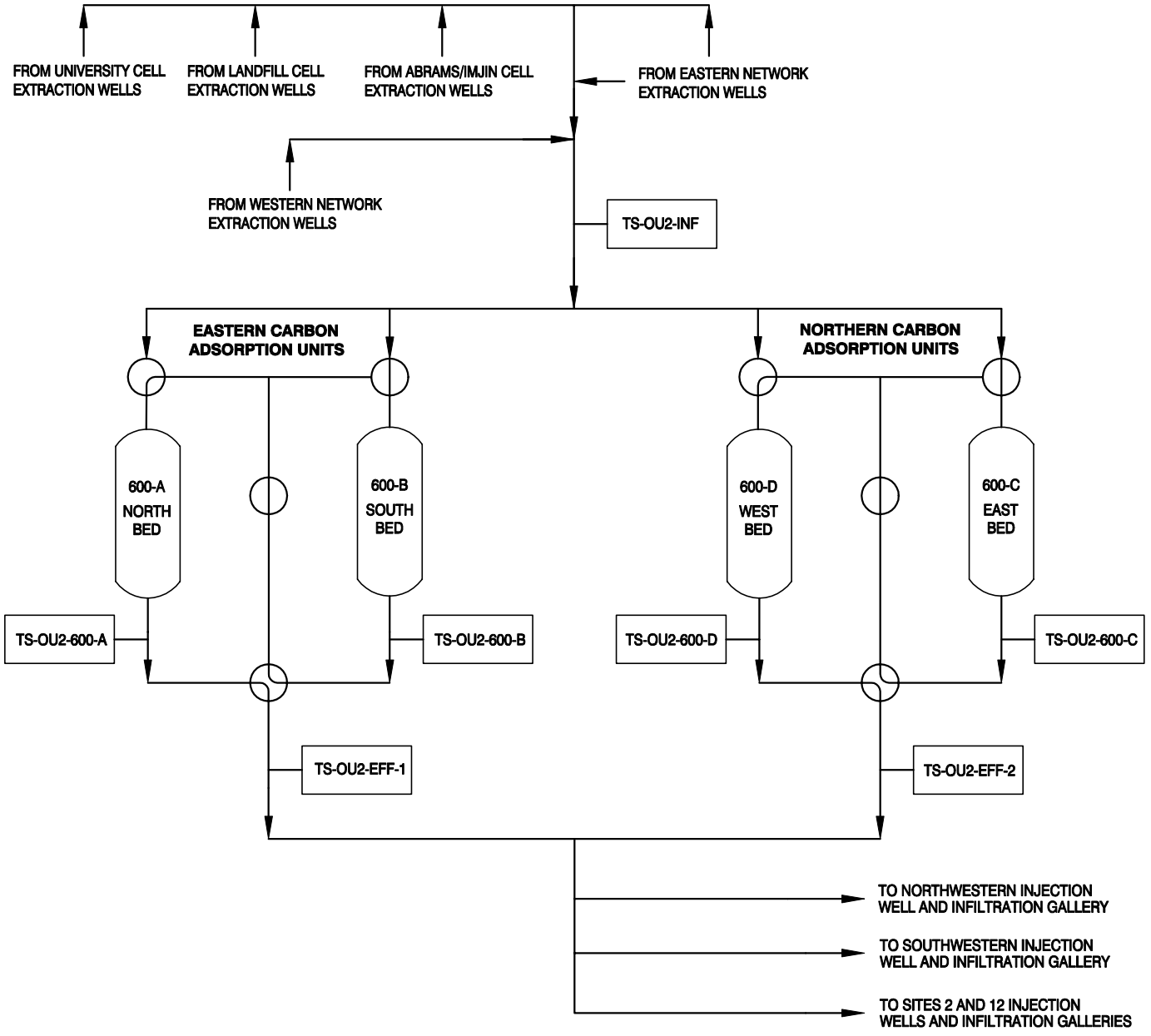
DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: PCK
DRAWN: KAB
CHECKED:

FORT ORD CALIFORNIA

FIGURE 1-2
PIPELINE ROUTING AND TRICHLOROETHENE PLUME A-AQUIFER
OPERABLE UNIT 2 GROUNDWATER REMEDY
FORMER FORT ORD, CALIFORNIA

SUBMITTED:
DATE APPROVED:
SCALE:
SPEC. No.
SHEET
FILE No. N:/cad/dwg/FortOrd/Fort_Ord_GIS/TCEa_aquifer.mxd



LEGEND

GAC — GRANULAR ACTIVATED CARBON

TS-OU2-EFF — SAMPLE LOCATION/SAMPLE IDENTIFICATION

FLOW SPLITTER

FLOW PATH

ARRANGEMENT SHOWN

- ☐ GAC PARALLEL FLOW
- ☒ GAC SERIES, SOUTH LEAD
- ☐ GAC SERIES, NORTH LEAD
- ☐ GAC SERIES, WEST LEAD
- ☒ GAC SERIES, EAST LEAD

REVISION	DATE	DESCRIPTION	BY	BY

IT CORPORATION
4005 PORT CHICAGO HIGHWAY
CONCORD, CALIFORNIA 94520
(925) 288-9898

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: R. HAYASHI
DRAWN: TRS 12/4/01
CHECKED:

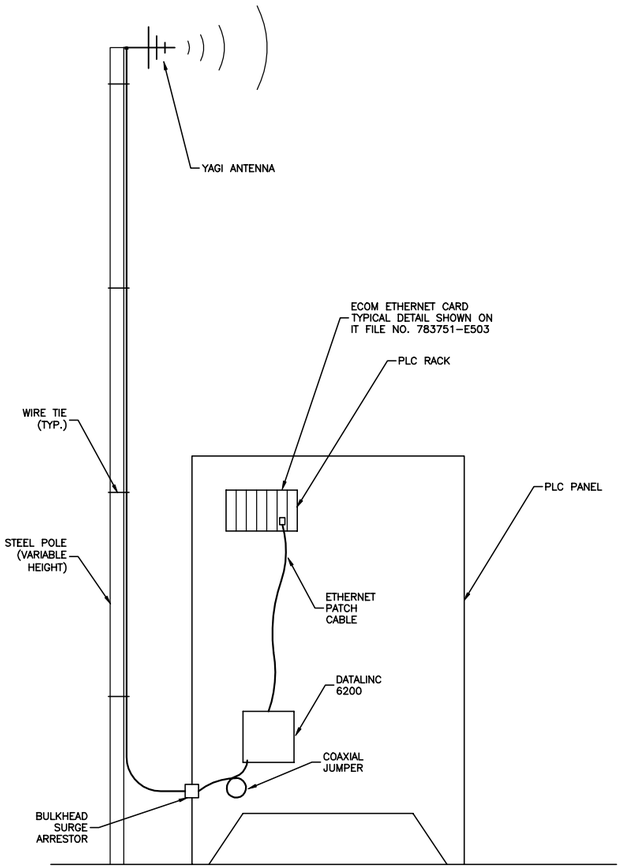
FORT ORD — CALIFORNIA

FIGURE 2-1

WATER FLOW AND TREATMENT PLANT SAMPLING SCHEMATIC
OPERABLE UNIT 2 GROUNDWATER REMEDY

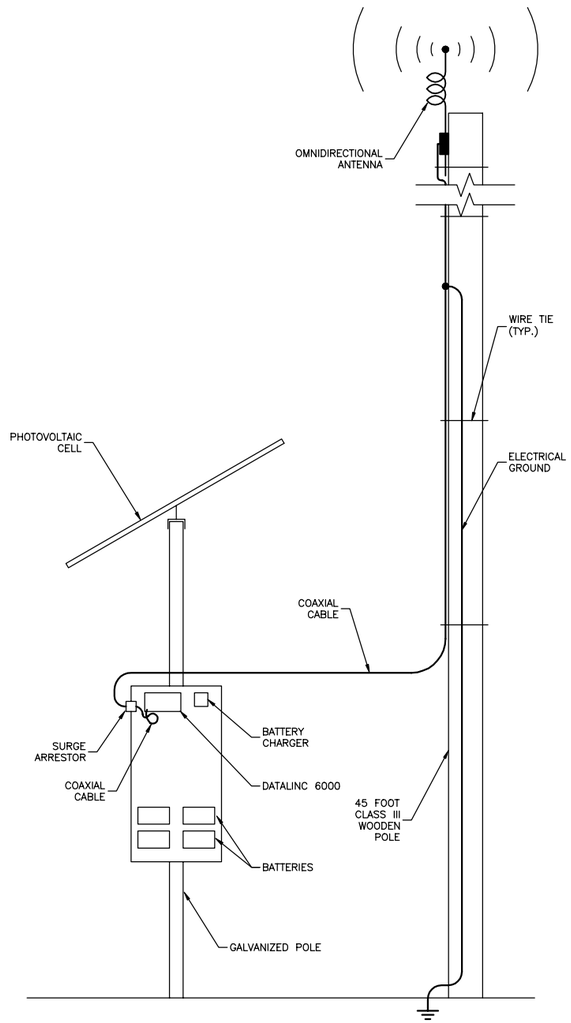
APPROVED: DATE APPROVED:

SCALE: AS NOTED SPEC No.
SHEET 1 OF 1 FILE No. 783751-A43



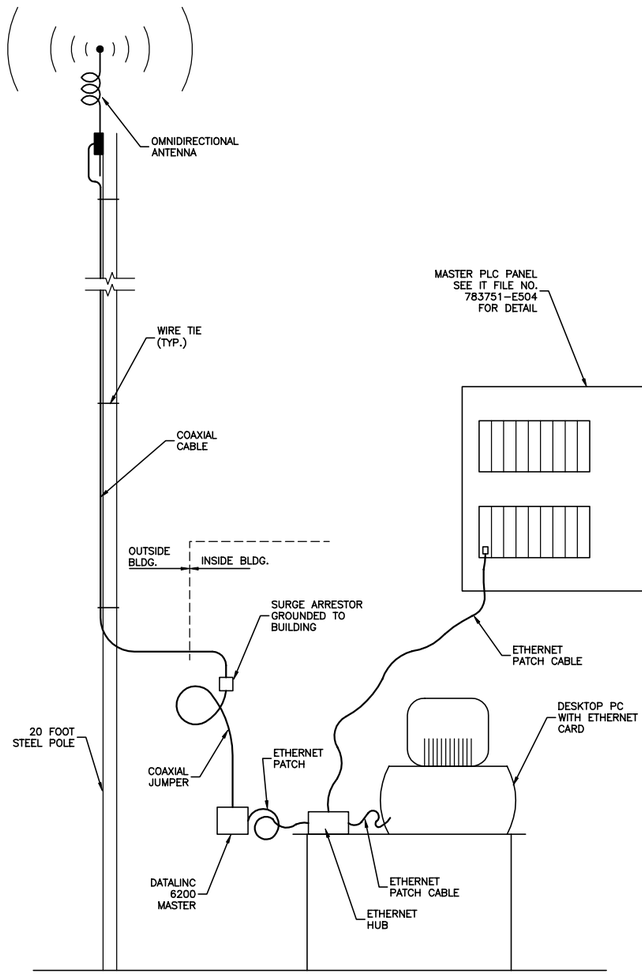
REMOTE PLC TO YAGI ANTENNA CONFIGURATION

(TYPICAL OF 4 AT ABRAMS/INJIN, EASTERN, LANDFILL AND UNIVERSITY)



REPEATER OMNI ANTENNA TO SOLAR CELL CONFIGURATION

(LOCATED NORTH OF LANDFILL CELL D)



MASTER PLC TO PC TO OMNI ANTENNA CONFIGURATION

(GROUNDWATER TREATMENT PLANT)

REVISION	DATE	DESCRIPTION	BY	BY

IT 4005 PORT CHICAGO HIGHWAY
CONCORD, CA. 94520
(925) 288-9898

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DESIGNED: R. HAYASHI
DRAWN: TRS 12/4/01
CHECKED:

FORT ORD — CALIFORNIA

FIGURE 6-1

SCADA ARCHITECTURE
OPERABLE UNIT 2 GROUNDWATER REMEDY

APPROVED: _____ DATE APPROVED: _____

SCALE: AS SHOWN | SPEC No.

SHEET _____ | FILE No. 783751-E94

APPENDIX A

As-Built Construction Drawings

Note: This Appendix includes only the list of As-built Construction Drawings. The actual drawings are included in the *Draft Final Construction Drawings, Operable Unit 2 Groundwater Remedy System Expansion, Fort Ord, California (IT, 2001b).*

A complete set of full-size drawings is maintained at the GWTP and at the USACE and IT offices.

Appendix A List of Drawings

PROJECT NUMBER	SHEET NUMBER	REVISION NUMBER	TITLE
Operable Unit 2 Expansion As-Built Construction Drawings (41)			
General (G)			
783751-E9	G-1	0	Cover Sheet
837769-E9	G-2	1	Drawing List and Location Map
783751-E23	G-3	0	Standard Symbols and Legends
783751-E7	G-4	0	Trichloroethene Plume, Upper 180-foot Aquifier
783751-E8	G-5	0	Trichloroethene Plume, A Aquifier
Process Civil (C)			
783751- E61	C-1	0	Process Flow Diagram, No. 1
783751- E62	C-2	0	Process Flow Diagram, No. 2
783751- E17	C-3	0	Piping and Instrumentation Diagram, No. 1
783751- E86	C-4	0	Piping and Instrumentation Diagram, No. 2
783751- E87	C-5	0	Piping and Instrumentation Diagram, No. 3
783751- E18	C-6	0	Piping and Instrumentation Diagram, No. 4
783751- E19	C-7	0	Piping and Instrumentation Diagram, No. 5
783751- E21	C-8	0	Piping and Instrumentation Diagram, No. 6
783751- E5	C-9	0	Treatment Plant Location and Layout
783751- E38	C-10	0	Pipe Trench Details and Well Vault Details
783751- E57	C-11	0	Concrete Floor and Stair Details
783751- E55	C-12	0	Concrete and Sump Details
837769- E002	C-13	0	Pipeline Plan and Profile View No. 1
837769- E003	C-14	0	Pipeline Plan and Profile View No. 2
837769- E004	C-15	0	Pipe Trench and Utility Vault Details No. 1
837769- E005	C-16	0	Pipe Trench and Utility Vault Details No. 2
Utility (U)			
783751-E39	U-1	0	Utility Flow Diagram
Mechanical (M)			
783751- E37	M-1	0	Extraction Well Details
783751- E6	M-2	0	Mechanical Plan
783751- E13	M-3	0	Mechanical Sections and Details No. 1
783751- E58	M-4	0	Mechanical Sections and Details No. 2
783751- E10	M-5	0	Infiltration Gallery Details
Electrical (E)			
837769- E001	E-1	1	Electrical Site Plan and Vault Layout
783751- E26	E-2	0	Main Cell Electrical Plan
783751- E27	E-3	0	Landfill Cell Electrical Plan
783751- E501	E-4	0	University Cell Electrical Plan
783751- E505	E-5	0	Treatment Plant PLC Terminal Wiring

Appendix A List of Drawings (Continued)

PROJECT NUMBER	SHEET NUMBER	REVISION NUMBER	TITLE
Electrical (E) (Continued)			
783751- E506	E-6	0	Power and Instrumentation Plan
783751- E507	E-7	0	Motor Schematics and Details
783751- E508	E-8	0	Miscellaneous Electrical Details
783751- E504	E-9	0	Treatment Plant PLC Terminal Wiring
783751- E503	E-10	0	Treatment Plant PLC Diagram No. 1
783751- E511	E-11	0	Treatment Plant PLC Diagram No. 2
783751- E512	E-12	0	Treatment Plant PLC Diagram No. 3
783751- E88	E-13	0	Abrams/Imjin Cell PLC Diagram No. 1
783751- E89	E-14	0	Abrams/Imjin Cell PLC Diagram No. 2
783751- E90	E-15	0	Landfill Cell PLC Diagram No. 1
783751- E91	E-16	0	Landfill Cell PLC Diagram No. 2
783751- E92	E-17	0	University Cell PLC Diagram No. 1
783751- E93	E-18	0	University Cell PLC Diagram No. 2
837769- E006	E-19	0	Abrams Power and Equipment Layout
837769- E007	E-20	0	Abrams PLC Diagram No. 1
837769- E008	E-21	0	Abrams PLC Diagram No. 2
Bestor Operable Unit 2 Original Remedy As-Built Survey Drawings (3)			
5562.02	1 of 3		(General Layout and Eastern Injection)
5562.02	2 of 3		(Eastern Extraction and GWTP/Northwestern Injection/Northern Part of Western Extraction)
5562.02	3 of 3		(Southwestern Injection/Southern Part of Western Extraction)
Bestor Sites 2/12 Remedy As-Built Survey Drawings (3)			
5562.04	1 of 1		Site 2 (Injection Wells and Infiltration Galleries)
5562.04	1 of 2		Site 12 (Extraction Wells and GWTP)
5562.04	2 of 2		Site 12 (Excess Water Line from OU2)
Bestor Operable Unit 2 Expansion As-Built Survey Drawings (9)			
5562.02	1 of 9		(General Layout)
5562.02	2 of 9		(Cell A Pipeline)
5562.02	3 of 9		(Imjin Crossing and Branches to Abrams/Imjin, Landfill, and University Pipelines)
5562.02	4 of 9		(Abrams/Imjin Pipeline/Extraction Wells and Western Portion of University Pipeline)
5562.02	5 of 9		(Landfill Pipeline/Extraction Wells)
5562.02	6 of 9		(Middle Portion of University Pipeline)
5562.02	7 of 9		(Eastern Portion of University Pipeline and Extraction Wells)
5562.02	8 of 9		(Northwest and Southwest Injection Wells/ Infiltration Galleries)
5562.02	9 of 9		(GWTP Property Lines and Containment Area Layouts)

APPENDIX B

Vendor Submittals (Index Only)

Note: This Appendix contains the vendor submittal index only.

The complete vendor submittal appendix is maintained at the GWTP and in the USACE and IT offices.

Appendix B
VENDOR SUBMITTAL INDEX
Operable Unit 2 Groundwater Remedy
Former Fort Ord, California

Section	Equipment	Vendor	Manufacturer/Supplier	Submittal	Subject	Remarks
Vol. 1						
1.0	Anchor Bolts (at Well Vaults and Building Piping & Equipment)	Clement Support Services	Powers Fasteners, Inc. Powers Fasteners, Inc. Powers Fasteners, Inc. Powers Fasteners, Inc. Powers Fasteners, Inc.	SD-01 SD-06 SD-06 SD-06 SD-06	MSDS Power-Fast Epoxy Injection Gel Product Description Material Properties Dispensing Guidelines Installation Guidelines	
2.0	Asphalt Paving Repair (at Road Crossings & GWTP Driveways)	Monterey Peninsula Engineering	Graniterock	SD-05	1/2 inch Asphaltic Concrete Mix Design	
3.0	Bag Filter and Bags	Filter Specialists, Inc.	Filter Specialists, Inc. Filter Specialists, Inc. Filter Specialists, Inc. Filter Specialists, Inc. Filter Specialists, Inc.	SD-01 SD-02 SD-02 SD-06 SD-19	Bag Filter Housing Data Sheet Bag Filter Catalogue Cut Reorder Bag Filter Information Installation Instructions O&M Manual	With O&M
4.0	Banding, S/S	Fastenal	Band-It	SD-01	Metals Data Sheet	316 Stainless Steel
5.0	Biological Survey (for Extraction Wells & Pipeline Route)	Harding Lawson Associates	Harding Lawson Associates Harding Lawson Associates	SD-09 SD-09	OU2 Pipeline Expansion Report Follow-up OU2 Pipeline Expansion	With 11x17 color plate 07/05/00
6.0	Cartridge Filter	Filter Specialists, Inc.	Filter Specialists, Inc. Filter Specialists, Inc. Filter Specialists, Inc. Filter Specialists, Inc. Filter Specialists, Inc.	SD-01 SD-02 SD-02 SD-06 SD-19	Multi-Cartridge Housing Data Sheet Multi-Cartridge Filter Catalogue Cut Reorder Cartridge Filter Information Installation Instructions O&M Manual	With O&M
7.0	Chemical Removal and Chemical Tank Decomtamination	Philip Industrial Services	Allwaste / Philip Allwaste / Philip Allwaste / Philip Allwaste / Philip	SD-18 SD-18 SD-18 SD-18	4,000 gallons 25% sodium hydroxide 5 poly drums 98% sulfuric acid 3 poly drums 50% hydrogen peroxide 12 poly drums 50% hydrogen peroxide	01/15/00 01/22/00 01/22/00 01/29/00
8.0	Concrete, Cast-in-Place	IT Corporation	Larsen Products Corp IT Corporation Graniterock Graniterock D&M Consulting Engineers, Inc. D&M Consulting Engineers, Inc.	SD-02 SD-04 SD-05 SD-05 SD-10 SD-12	Weld-Crete Bonding Agent Truck Pad Profile & Section Drawings 3,000 psi Concrete Design Mixes 4,000 psi Concrete Design Mixes N Housekeeping Pad Strength Results Wye Vault Floor Slump Results	With e-mail approval Stamped Three Mixes Three Mixes Exception with IT eval Exception with IT eval

Appendix B
VENDOR SUBMITTAL INDEX
Operable Unit 2 Groundwater Remedy
Former Fort Ord, California

Section	Equipment	Vendor	Manufacturer/Supplier	Submittal	Subject	Remarks
9.0	Concrete Pull Boxes, Traffic Rated	Christy Concrete Products, Inc.	Christy Concrete Products, Inc.	SD-04	B1017 Box H/20 Loading	With extension
			Christy Concrete Products, Inc.	SD-04	B1730 Box H/20 Loading	With extension
			Christy Concrete Products, Inc.	SD-04	B24" x 36" Box H/20 Loading	With extension
10.0	Concrete Pull Box Lids	Valley Fabrication	Valley Fabrication	SD-01	Procurement Requisition	Holes Drilled by Field
	Concrete Reinforcement (Rebar)			SD-04	Rebar Location	See Cast Concrete As-builts
11.0	Concrete Repair (Cast-in-Place Surfaces)	White Cap	Burke	SD-01	MSDS BurkEpoxy Mortar - A 0.3 CF	43210
			Burke	SD-01	MSDS BurkEpoxy Mortar - B	4322
			Burke	SD-01	MSDS BurkEpoxy Mortar - C	4323
			Burke	SD-01	Multi-Purpose Grout Product Info	03600
			Burke	SD-01	MSDS Multi-Purpose Grout	7030
			Lyons Manufacturing, Inc.	SD-01	Patchcrete Product Information	4/99
			Lyons Manufacturing, Inc.	SD-01	MSDS Patchcrete #1000	02/15/92
12.0	Concrete Replacement (Curbs, Gutters & Sidewalks)	Monterey Peninsula Engineering	Graniterock	SD-05	3/8 inch Concrete Pump Mix Design	
			Graniterock	SD-05	3/4 inch Concrete Mix Design	
13.0	Concrete Vaults & Lids:					
	A-Aquifer Extraction Well	Santa Rosa Cast Products	Santa Rosa Cast Products	SD-04	6'x6' Extraction Well Vault, 14,000 lbs	3 Req'd, 01/24/00
			Nystrom Building Products	SD-04	6'x6' Vault Hatches	01/23/00
	180-ft Aquifer Extraction Well	Santa Rosa Cast Products	Santa Rosa Cast Products	SD-04	6'x9' Extraction Well Vault, 22,000 lbs	4 Req'd, Rev 03/15/00
			Nystrom Building Products	SD-04	6'x9' Vault Hatches	01/23/00
			Santa Rosa Cast Products	SD-04	Extraction Well Vault Field Pour Collar	03/28/00
			Santa Rosa Cast Products	SD-04	Cover to Vault Wall Detail	Dwg X, 03/15/00
	High & Low Point / Leak Detect	Santa Rosa Cast Products	Santa Rosa Cast Products	SD-04	2'x2' HP, LP, Leak Detection Vaults	41 Req'd, Rev 02/10/00
			Nystrom Building Products	SD-04	2'x2' Vault Hatches	01/23/00
	Infiltration Gallery	Santa Rosa Cast Products	Santa Rosa Cast Products	SD-04	4'x4' Infiltration Gallery Vault	2 Req'd, Rev 03/16/00
			Nystrom Building Products	SD-04	INF Vault Hatches	03/16/00
			Xypex Chemical Corp	SD-02	Concrete Waterproofing Specs	Pgs 3, 4, 5, 8
			MA Industries	SD-02	Polypropylene Step Information	PS-1-PF
	Infiltration Valve	Santa Rosa Cast Products	Santa Rosa Cast Products	SD-04	4'x8' Valve Vault, 16,500 lbs	2 Req'd, 01/24/00
			Nystrom Building Products	SD-04	4'x8' Vault Hatches	01/23/00
	Isolation Valve	Santa Rosa Cast Products	Santa Rosa Cast Products	SD-04	4' Diam Manway Vault Assembly	3 Req'd, Sketch
	12th Street Vault No. 31 and 35	Utility Vault Company	Utility Vault Company	SD-04	6'x6' Mechanical Connection Vault	2 locations, installed in 2002
			Nystrom Building Products	SD-04	6'x6' Vault Hatches	2 locations, installed in 2002

Appendix B
VENDOR SUBMITTAL INDEX
Operable Unit 2 Groundwater Remedy
Former Fort Ord, California

Section	Equipment	Vendor	Manufacturer/Supplier	Submittal	Subject	Remarks
	General Information		Henry Company	SD-02	Ram-Nek Flexible Plastic Gaskets	For 2-Section Vaults
			Nystrom Building Products	SD-05	BGA-H20 Features & Specifications	24"x24" Hatches
			Nystrom Building Products	SD-05	FGA-H20 Features & Specifications	All Other Hatches
			Nystrom Building Products	SD-06	Installation Instructions for Hatches	
			Nystrom Building Products	SD-13	Aluminum Lid Warranty	03/16/00
			Nystrom Building Products	SD-13	5 Year Performance Standard	03/16/00
			Santa Rosa Cast Products	SD-13	Certificate of Compliance	SF-27
14.0	Concrete Vault Bolts, Tamper Proof (at Christy Boxes)	Pentagon Aerospace Group, Inc.	Pentagon Aerospace Group, Inc.	SD-02	No information	
15.0	Concrete Vault Lids:	Nystrom Building Products	Nystrom Building Products	SD-01	Performance Data	
	Wye Vault		Nystrom Building Products	SD-04	Wye Vault Layout	
			Nystrom Building Products	SD-04	Wye Vault Opening Detail	
			Nystrom Building Products	SD-04	Wye Vault Beam Support Detail	
	Original OU2 EW & IW Vaults		Nystrom Building Products	SD-04	OU2 4'x5' Opening Detail	
16.0	Conduit, Buried	Consolidated Electrical Supply	PWPipe	SD-01	Specifications & Data	Conduit & Fittings
17.0	Control Valve (Proposed Future Wye Vault Addition)	Bermad	Bermad	*SD-01*	*Description / Operation Control 710-01*	*Electric Remote Control*
			Bermad	*SD-02*	*710 Electrical Remote Control Valve*	
18.0	Drilling Site Clearance	Subdynamic Locating Services	Subdynamics	SD-04	Diagrams Where Utilities Located	2 Locations
			Subdynamics	SD-12	Field Report / Findings	7 Extraction & 2 Infiltration
19.0	Electrical & Instrumentation Cable		Futronix Systems	SD-05	16 AWG Twisted Pair Control Cable	FX1602SVNTC
		Consolidated Electrical Supply	General Cable	SD-05	Other Control, Feeder, Leak Detection & Power Cables, Type THHN	Pg 15

Appendix B
VENDOR SUBMITTAL INDEX
Operable Unit 2 Groundwater Remedy
Former Fort Ord, California

Section	Equipment	Vendor	Manufacturer/Supplier	Submittal	Subject	Remarks
20.0	Electrical Subcontract (EW PLCs and Transformer Pads)	Superior Electric	Central Wholesale Elect Distrib	SD-02	Transmittal Letter	05/10/00
			Gaylord Mfg Co	SD-02	Type 4X 2-door Floor Standing Encl	"A" -- N4XFLDDS
			PG&E	SD-02	Pad for Pad-Mounted Transformer	"B" 064309 pg 3/5, Rev 4
				SD-02	Dry-Type Distribution Transformer	"C" -- pg 9
			Circle AW	SD-02	Test Block Bypass MTBPMS15	"D" -- pg 60
			Circle AW	SD-02	Test Block Bypass MTBP Series	"E" -- pg 38
			PG&E	SD-02	Concrete Pad for 3-Phase Transformer	"F" -- 045292 pg 5/5, Rev 3
			Siemens Electrical Products	SD-02	Special Safety Switches / Non-metal	"G1" Speedfax 2000 pg 19
			Siemens Electrical Products	SD-02	Special Safety Switches / Non-metal	"G1" Speedfax 2000 pg 19
			Siemens Energy & Automation	SD-02	480/277 Volt Panel A	"H"
			Siemens Energy & Automation	SD-02	480/277 Volt Panel B	"I"
			Siemens Energy & Automation	SD-02	240/120 Volt Panel C	"K"
			Acme Transformer	SD-04	EW PLC Electric Connection Diagrams	B-111703-C
			Acme Transformer	SD-06	EW PLC Transformer Instructions	See Transformer O&M
			National Electrical Mfg Assn	SD-06	EW PLC Panelboard Instructions	See Panelboard O&M
			Acme Transformer	SD-19	Installation and O&M of Dry Type Transformers, at EW PLC	Instruction Sheet A1 Part A-701953-A
			National Electrical Mfg Assn	SD-19	EW PLC Panelboard Instructions for Installation, Operation, Maintenance	NEMA Pub PB-1.1-1996
	Epoxy Paint; for Concrete					See Paint, Epoxy
21.0	Eyewash Station	IT Corporation	PM Engineer Aug 2000	SD-05	Changes to Emergency Shower & Eyewash Stds, ANSI Z358.1-1998	Pgs 26 & 27
22.0	Fencing (at EW PLC Panels)	Peninsula Fence Company	PDS Fence Products	SD-02	Privacy Decorative Slatting	02830 / ABP, # 5044
			American Tube Company, Inc.	SD-05	Specifications for TUF-40 Tubing	Rev. 5/90
			Master Fexce Fittings, Inc.	SD-05	Material Fencing Std Specs G-82	Form: 1034
23.0	Fire Alarm System (Original at GWTP Building)	Fire-Lite Alarms, Inc.	Fire-Lite Alarms, Inc.	SD-04	DIM-485 Product Installation Dwg	#50380 Rev A
			Fire-Lite Alarms, Inc.	SD-06	Programming Instructions	With O&M Manual
			Fire-Lite Alarms, Inc.	SD-13	Limited Warranty	
			Fire-Lite Alarms, Inc.	SD-19	Program, Install, Maintenance and Operations Manual	#51003 Rev A1
24.0	Flowmeter	SantaFe Industrial Products	ABB Water Meters, Inc.	SD-02	Catalog Cuts, 1-3" & 4-8" sizes	
			ABB Water Meters, Inc.	SD-02	Catalog Cut Electronic Register (ER)	
			ABB Water Meters, Inc.	SD-06	ER Programming	See User Manual
			ABB Water Meters, Inc.	SD-19	ER User Manual	

Appendix B
VENDOR SUBMITTAL INDEX
Operable Unit 2 Groundwater Remedy
Former Fort Ord, California

Section	Equipment	Vendor	Manufacturer/Supplier	Submittal	Subject	Remarks
25.0	Gaskets, Viton	SantaFe Industrial Products	Teadit	SD-01	100 V Viton Data / Physical Properties	
			IT Corporation	SD-06	Specification Information	7/7/00 e-mail
		Down Time	Pacific Mechanical Supply	SD-13	Cert of Conformance / Compliance	
26.0	Geotextile	FML Linings, Inc.	Amoco Fabrics and Fibers Co.	SD-01	Minimum Average Property Values	
			Amoco Fabrics and Fibers Co.	SD-13	QC Certificate	
27.0	Granular Activated Carbon (GAC), Expansion Units	US Filter/Westates	US Filter/Westates	SD-01	System Specifications	
			US Filter/Westates	SD-01	Carbon Specification	
			US Filter/Westates	SD-01	MSDS Activated Carbon	
			Carboline Co.	SD-01	MSDS Carboline 893, Parts A & B	For Exterior Field Repair
			Carboline Co.	SD-01	MSDS Carbothane 134 HG, Part A	For Exterior Field Repair
			Plasite Protective Coatings, Inc.	SD-01	MSDS Plasite 4110, Parts A, B & C	Interior Coating
			Air King	SD-02	Universal Couplings	
			Apco	SD-02	Combination Air Valves	
			Apollo	SD-02	Ball Valves	
			Ashcroft	SD-02	Pressure Gages Type 1008	
			Ashcroft	SD-02	Pressure Gages Type 1009	
			Dixon/Andrews	SD-02	Couplers	
			Fluid Controls	SD-02	Ball Valves	
			Orange Research, Inc	SD-02	Differential Pressure Gage	
			Ryan Herco	SD-02	PVC Pipe & Fittings	
			Spears	SD-02	Butterfly Valves	
			Three M	SD-02	Scotchkote 206N Epoxy Coating	
			Zook	SD-02	Graphite Rupture Disks	
			US Filter/Westates	SD-04	Flow Diagram GAC Adsorber System	8-1/2 x 11
			US Filter/Westates	SD-04	HP-1020S-6 General Assembly, Rev B	11x17 & E size
			US Filter/Westates	SD-04	Vessel Anchor Detail	8-1/2 x 11, Stamped
			US Filter/Westates	SD-05	LF-1020 Pressure Drop w/ 8x30 Carbon	
			William A Teipe & Assoc, Inc	SD-05	Vessel Calculations	
			Carboline Co.	SD-06	Carbothane 134 HG	Federal Blue
			Carboline Co.	SD-06	Carboline 893	
			A & L Sandblasting and Painting	SD-08	Statement of coating completion	
			US Filter/Schmidt	SD-13	Vessel Hydrostatic Test	2 units
			US Filter/Westates	SD-13	Buy American Act Certification	
			US Filter/Westates	SD-13	Warranty Statement	1 year parts, 90 days labor
			US Filter/Westates	SD-19	O&M Manual	

Appendix B
VENDOR SUBMITTAL INDEX
Operable Unit 2 Groundwater Remedy
Former Fort Ord, California

Section	Equipment	Vendor	Manufacturer/Supplier	Submittal	Subject	Remarks
Vol. II						
28.0	Granular Activated Carbon (GAC), Refurbished Calgon Units	US Filter/Westates	Plasite Protective Coatings, Inc.	SD-01	Plasguard 4110 Product Data	Formerly Plasite 4110
			Carboline Co.	SD-01	MSDS Carboline 893, Parts A & B	Exterior Primer
			Carboline Co.	SD-01	MSDS Carbothane 134 HG, Part A	Exterior Topcoat Federal Blue
			Plasite Protective Coatings, Inc.	SD-01	MSDS Plasite 4110, Parts A, B & C	For Interior Recoating
			IT Corporation	SD-04	Modified Leg Cross Brace Detail	9/11/00 (8-1/2 x 11)
			IT Corporation	SD-05	Seismic Calcs for Supports	5 + 1 page, Stamped
			IT Corporation	SD-05	Anchor Bolt Drilling Calculation	2/23/01
			Carboline Co.	SD-06	Product Data Sheet	Carbothane 134 HG
			Plasite Protective Coatings, Inc.	SD-06	Technical Bulletin	Plasite 4110
			Plasite Protective Coatings, Inc.	SD-06	Plasite Specifications	PA-3
29.0	Grating, Trench and Sump	McNichols Company	IT Corporation	SD-01	Description	
			McNichols Company	SD-02	Safe-T-Span 1" x 1-1/2" for Trenches	STSI-6010-MISOFR
			McNichols Company	SD-02	Safe-T-Span 2" x 1" for Sumps	STST-5020-MISOFR
30.0	Grating Clips	Mercury Metals	IT Corporation	SD-01	Description	
			IT Corporation	SD-05	Design Calculations	
31.0	Grout, Non-Shrink	White Cap	Sika Corporation	SD-01	MSDS Sikaflex - 1a	09/09/99
			Sika Corporation	SD-05/06	Technical Information & Instructions	3/00
32.0	Handrails	Tubular Specialties Mfg	Tubular Specialties Mfg	SD-04	Ramp Barrier	Sheet 1 of 5
				SD-04	Pipe Chase Railing	Sheet 2 of 5
				SD-04	NE North Containment Railing	Sheet 3 of 5
				SD-04	NW North Containment Railing	Sheet 4 of 5
				SD-04	NE & SE East Containment Railing	Sheet 5 of 5
33.0	Ladders, (INF and Original OU2 EW / IW Vaults)	Ladder Man	Ladder Man	SD-02	Series 399 Fixed FRP	
			Strongwell	SD-04	Ladder Drawings #1/2/3-B-18277	11 x 17
34.0	Leak Detection System	Superior Electric	Bestor	SD-04	Leak Detection Zones	See Survey, OU2 Expan
			Universal Sensors & Devices	SD-06	Special Installation Sensor Package	LALS-2 Dual Liquid
			Universal Sensors & Devices	SD-19	Operation Instruction Manual	LA-08 System
35.0	Level Probe, EW-OU2-06-180	Water Development Corp	Warrick Controls	SD-02	Catalog Cut	
			IT Corporation	SD-06	Installation Instructions	
36.0	Level Switches	SantaFe Industrial Products	Gems Sensors	SD-02	Catalog Cut	
	12th Street Realignment	Gems Sensors	Gems Sensors	SD-02	Stainless steel float	Installed in 2002
	12th Street Realignment	Flowline, Inc.	Flowline, Inc.	SD-02	Vertical buoyancy float	Installed in 2002

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VENDOR SUBMITTAL INDEX
Operable Unit 2 Groundwater Remedy
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Section	Equipment	Vendor	Manufacturer/Supplier	Submittal	Subject	Remarks
	Level Transducers					See Pressure Transducers
37.0	Paint, Epoxy (for Concrete)	White Cap	Burke	SD-01	BurkEpoxy Coating Technical Info	09880
			Burke	SD-01	MSDS BurkEpoxy Primer A	41611
			Burke	SD-01	MSDS BurkEpoxy Primer B	61621
			Burke	SD-01	MSDS BurkEpoxy Coating Grey - A	46115
			Burke	SD-01	MSDS BurkEpoxy Coating Color - B	46125
38.0	Permeable Fill	Wm. J. Clark Trucking	Wm. J. Clark Trucking	SD-10	Materials Report (Permeable Fill)	Arroyo Seco Pit
39.0	Pipe and Fittings, HDPE (Extraction Pipeline)	SantaFe Industrial Products	CSR Poly Pipe	SD-01	HDPE Pipe Data	Figure 1, Pgs A1-A2
			New Plastic Fittings, Inc	SD-01	Guide Book for Thermoplastic Fittings	Selected HDPE Pages
			V & A Process, Inc.	SD-01	MSDS for HDPE Welding Rods	
			CSR Poly Pipe	SD-04	HDPE Pipe Dimensions	Figure 2, Pgs A3-A5
			New Plastic Fittings, Inc	SD-04	Dual Wall Fitting Dwgs & Dimensions	
			Santa Fe Industrial Products	SD-08	Dual Wall Fitting Pressure Ratings	04/12/00
			Santa Fe Industrial Products	SD-08	Single Wall HDPE Fusion	04/12/00
	12th Street Realignment	SantaFe WinWater	Quail Piping Products, Inc.	SD-01	HDPE dual wall pipe data	Installed in 2002
			Quail Piping Products, Inc.	SD-01	HDPE single wall pipe data	Installed in 2002
			Fine Stainless	SD-01	Stainless steel valves and fittings	Installed in 2002
			JM Manufaturing Co., Inc.	SD-01	Miscellaneous thermoplastic pipe fittings	Installed in 2002
40.0	Pipe and Fittings Test, HDPE	Hauser Laboratory Services	Hauser Laboratory Services	SD-10	Results of laboratory test 6"x10" tee	02/15/00
41.0	Pipe and Fittings, PVC (at GWTP and Well Vaults)	Various	IPS	SD-01	MSDS for Pipe Primer & Cement	
			Chemtrol	SD-02	PVC Pipe & Fitting to 8 inches	No 10 or 12 inch data
42.0	Pipe Supports	Clement Support Services	Clement Support Services	SD-01	Catalog Front Page	
			IT Corporation	SD-01	Index of Supplied Components	
			Tolco, Inc	SD-02	Tolstrut Catalog (Selected Pages)	T-2001
	Piping Valves	Various	Various	SD-02	Catalog Cuts Not Provided	All by Field Material Req
43.0	Pressure Gauges	SantaFe Industrial Products		SD-02	Catalog Cut	Extraction Wells
44.0	Pressure Switches	SantaFe Industrial Products	Ashcroft	SD-06/19	Installation & Maintenance	Model B400 EW Vault Manual & Auto

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Section	Equipment	Vendor	Manufacturer/Supplier	Submittal	Subject	Remarks
45.0	Pressure Transducer, Industrial	SantaFe Industrial Products	KPSI	SD-02	Series 27, 28 & 30 Industrial	
	Influent Manifold		KPSI	SD-04	Certification Drawings	See Submersible, below
	(NOT INSTALLED)		KPSI	SD-05	Series 27, 28 & 30 Specifications	
			KPSI	SD-06	Installation Instructions	See Submersible, below
			KPSI	SD-10	Calibration Reports	
			KPSI	SD-19	O&M Manual	See Submersible, below
46.0	Pressure Transducer, Submersible	SantaFe Industrial Products	KPSI	SD-02	Series 300S Small Bore Submersible	
	EW-OU2-03/04/05-180		KPSI	SD-04	Certification Drawings	Dwg #600229, 2 pages
	EW-OU2-14/15/16-A		KPSI	SD-05	Series 300S Specifications	
	MW-OU2-78-180		KPSI	SD-06	Installation Instructions	With O&M
			KPSI	SD-10	Calibration Reports	7 items
			KPSI	SD-19	O&M Manual	
47.0	Programmable Logic Controller (PLC), (at new EWs):	Superior Electric				
	Level Switch		Gems Sensors	SD-06	Instructions Single-Station	Bulletin 72947
	Motor Saver		SymCon, Inc	SD-06	Installation Instructions	Model 355
	Motor Starter		Allen-Bradley	SD-04	Magnetic Motor Controller Dwg	40050-502-1-H
			Allen-Bradley	SD-06	Heater Element Selection Table	40050-503-02(D)
			Allen-Bradley	SD-06	Heater Element Selection Table	40052-284-02(B)
	PLC Module		PLC Direct	SD-06	DL205 Installation & Safety	April 1994
	Panel		Gaylord Mfg. Co.	SD-02	Cut Sheet	
			Gaylord Mfg. Co.	SD-06	Instructions	
	Power Supply, 24 v DC		Facts Engineering Inc.	SD-02	FA-24PS, 24 volt DC	October 1999
	Power Transformer, 120 v AC		Acme Transformer	SD-04	Electrical Conneciton Diagrams	B-111703-C
			Acme Transformer	SD-19	Installation, Operation & Maintenance	A-701953-A
48.0	PLC Modifications (GWTP)	Superior Electric	PLC Direct	SD-01	DL 405 Safety Considerations	7942030-1 Jan 1994
			Square D	SD-06	Instruction Class 9001 Contact Block	30072-100-02B
			Square D	SD-06	Instruction Oil-Tight Push Button Op	30072-100-01F
			Superior Electric	SD-08	Guarantee for PLC Modifications	02/14/00
			Automation Direct	SD-13	Standard License	
			Direct Soft	SD-19	DDE Server User Manual	DA-DDE-M, cover Manual at GWTP
			Direct Soft 32	SD-19	Program Software User Manual	Cover, manual at GWTP
			Direct Soft 32	SD-19	Program Software Quick-Start Manual	Cover, manual at GWTP
			Direct Logic	SD-19	DL 405 User Manual	Cover, manual at GWTP
			Direct Logic	SD-19	DL405 Analog I/O Modules	D4-ANLG-M, cover Manual at GWTP
			Square D	SD-19	Instruction Bulletin Selector Switches	65013-002-18M, 10/97

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Section	Equipment	Vendor	Manufacturer/Supplier	Submittal	Subject	Remarks
49.0	PLC Software, (New EW PLCs)	PLC Direct	PLC Direct	SD-06	Direct Soft QuickStart Programming Manual	QS-DSOFT-M Cover and index only
50.0	Pump, Centrifugal, Backwash P - 385	SantaFe Industrial Products	US Motors	SD-01	Name Plate Information	
			Ingersoll-Dresser Pumps	SD-02	Type GRP	
			Ingersoll-Dresser Pumps	SD-02	GRP A Closer Look	
			Ingersoll-Dresser Pumps	SD-02	GRP Details	
			Ingersoll-Dresser Pumps	SD-04	General Arrangement Drawing	0572-W0000, Rev. A
			Ingersoll-Dresser Pumps	SD-05	Construction Data Sheet	
			Ingersoll-Dresser Pumps	SD-05	Hydraulic Data Sheet	
			Ingersoll-Dresser Pumps	SD-05	Typical GRP Noise Data	
			Ingersoll-Dresser Pumps	SD-06	Pump Installation Instructions	With O&M manual
			US Motors	SD-06	Motor Installation Instructions	With O&M manual
			Santa Fe Industrial Products	SD-07	Schedule	
			Ingersoll-Dresser Pumps	SD-19	Spare Parts List	
			Ingersoll-Dresser Pumps	SD-19	Pump O&M Manual	
			US Motors	SD-19	Motor O&M Manual	
51.0	Pump, Centrifugal, Injection P - 510, P - 520	SantaFe Industrial Products	US Motors	SD-01	Name Plate Information	
			Ingersoll-Dresser Pumps	SD-02	Type D-800 Centrifugal Pumps	
			Ingersoll-Dresser Pumps	SD-04	General Arrangement Drawing	2012-4 Page 11
					Base Plate, Motor Mount & Coupling	
			CJI Process Systems	SD-04	Guard	
			Ingersoll-Dresser Pumps	SD-05	Hydraulic Data Sheet	4x3x8F D-800
			Ingersoll-Dresser Pumps	SD-05	Typical D-814 Noise Data	2012-5 Page 11
			Santa Fe Industrial Products	SD-05	Motor Noise Data	Fax 5/2/00
			Santa Fe Industrial Products	SD-07	Schedule	
			Flowserve Division of I-D Pumps	SD-19	D814 Pump Installation and O&M	CPK 1123A-050100_EN
			US Motors	SD-19	Motor O&M Manual	
52.0	Pump, Submersible EW-OU2-03/04/05/06-180 EW-OU2-14/15/16-A	Pac Machine Co., Inc.	Franklin Electric	SD-01	Replacement Motor Data	EW-OU2-05 & -06-180
			Grundfos	SD-02	Pump Curves & Technical Data	25S30-15 & 150S200-10
			Reed's Manufacturing & Pump Co.	SD-04	Pump Well Sleeve Drawing	8-1/2 x 11
			Grundfos	SD-06	Installation Instructions, Pumps	With O&M manual
			Franklin Electric	SD-06	Installation Instructions, Motors	With O&M manual
			Franklin Electric	SD-06	Replacement Motor Instructions	
			Pac Machine Co., Inc.	SD-08	Pump Guarantee	
			Grundfos	SD-19	O&M Manual, S/S Pumps	
			Franklin Electric	SD-19	O&M Manual, Submersible Motors	

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Section	Equipment	Vendor	Manufacturer/Supplier	Submittal	Subject	Remarks
Vol III						
53.0	Pump, Sump (East, North, GWTP) P-375, P-395, P-495	SantaFe Industrial Products	Goulds Pumps	SD-02	Series 1DW 1-1/2" Dewatering Pump	
			SJE Rhombus	SD-02	Super Single Pump Switch	
			Goulds Pumps	SD-06	Installation Instructions	With O&M
			SJE Rhombus	SD-06	Installation Instructions	
			Santa Fe Industrial Products	SD-07	Schedule	
			SJE Rhombus	SD-13	Pump Switch Warranty	
			Lowara, A Goulds Pump Company	SD-19	O&M Manual	Installation and Usage
	Rupture Disk					See GAC, New
54.0	Static Mixer, Influent	SolarChem	(No SolarChem Info or Drawings)	SD-05	Static Mixer Modification	ID: Static Mixer M-186 in Original OU2 UV System
	Sump Design					See As-built Drawings
55.0	Sump Liners	B.H. Tank Works	IT Corporation	SD-04	Stainless Steel Sump	Sketch
56.0	Supervisory Control and Data Acquisition (SCADA):	Various				
	Ethernet Program		Automation Direct	SD-06	Information Ethernet Communications	H24-ECOM-M, Index Only
	Antenna		PolyPhaser Corporation	SD-06 &13	IS-B50 Series Impulse Suppressor Safety, Installation & Warranty	Eng-F-016 12/97
			Radiall / Larson	SD-01 & 06	YA Series Yagi Direction Antenna Specifications and Installation	12/97 5192.5000
			Maxrad, Inc.	SD-06 & 13	MBS-800 Base Station Adapter Kit Installation and Warranty	MIS-MBSADAPTER
			US Consumer Product Safety Com.	SD-06	Antenna Safety Information	1982-522-053/3905
			Data-Linc Group	SD-01 & 04	Yagi Directional Antenna Specifications and Dimensions	Model A-YB, 6 dB
			Data-Linc Group	SD-01 & 04	Omni Directional Antenna Specifications and Dimensions	Model A-OB, 3 dB
			Data-Linc Group	SD-04	Antenna / Coaxial Cable System	Antenna Coax Diagram
			Data-Linc Group	SD-06	Ethernet Radio Modem User's Guide	SRM6200E
			Data-Linc Group	SD-06	Radio Modem User's Manual	PN 161-10002-001
	Photovoltaic (PV / Solar Power)		Solar Depot, Inc.	SD-02	Catalog Component Information	Selected Pages
			Solar Depot, Inc.	SD-04	240 Wp Photovoltaic Module	TC240.cdr
			Unirac, Inc.	SD-06	Assembly Instructions	Series U-PT Panel Rack
			Morningstar Corporation	SD-19	Prostar PV Operator's Manual	R1 - April 1996

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Section	Equipment	Vendor	Manufacturer/Supplier	Submittal	Subject	Remarks
	Operator Interface		Dell	SD-05	Specifications	02/06/01
			Dell	SD-06	WorkStation Information Guide	P/N 8638P RevA01Cover Only
			Dell	SD-06	Setup & Quick Reference Guide	P/N 31GKV Rev A00 Cover Only
			Dell	SD-06	WorkStation Installation Guide	P/N 4760R Rev A03 Cover Only
			Dell	SD-06	Sony CD Documentation Update	P/N 6454R Rev A01
			Dell	SD-06	FastTrak100 User's Manual	Index
			PLC Direct	SD-06	Lookout Direct Learning Guide	PC-LKD-DEV Index Only
			Intel	SD-13	Three Year Processor Warranty	P/N 00706 A00
57.0	Survey, As-Built	Bestor	Bestor	SD-04	As-Built Drawings	All Drawings D Size
	Site 2 (West of Rt 1)		Bestor	SD-04	Site 2 West of Highway One	1 Dwg in Dwg Appendix
	Site 12 (East of Rt 1)		Bestor	SD-04	Site 12 East of Highway One	2 Dwgs in Dwg Appendix
	OU2 Origianal		Bestor	SD-04	Original OU2 Groundwater Remedy	3 Dwgs in Dwg Appendix
	OU2 Expansion		Bestor	SD-04	OU2 Groundwater System Expansion	9 Dwgs in Dwg Appendix
	New EW / PZ Coordinates		Bestor	SD-12	Extraction Wells & Piezometers	Coord & Elevations
	Site 2 INF PZ Coordinates		Bestor	SD-12	Site 2 INF Piezometers	Coord & Elevations
Vol. B4						
58.0	Tank, Backwash, New	B.H. Tank Works	Tnemec	SD-01	Rota-Pox Plus Series 140	Interior Coating
			Tnemec	SD-01	Tnemec-Zinc 90-97	Exterior Primer
			Tnemec	SD-01	Endura-Shield Series 74	Exterior Top Coat
			B.H. Tank Works	SD-04	11,400 Gallon Backwash Tank	Dwg 10004, Rev A/B
			John Schock, P.E.	SD-05	Vessel Calculations	Stamped
59.0	Tank, Backwash, Refurbished (Former UV H2O2 Tank)	B.H. Tank Works	B.H. Tank Works	SD-04	Refurbish SS Backwash Tank	Dwg 16998, 12/21/00
			Solar-Chem	SD-05	Original Vessel Calculations	Tank #3, H2O2 50%
			IT Corporation	SD-05	Refurbished Anchor Bolt Analysis	02/22/01
60.0	Tank, Effluent, Replacement	B.H. Tank Works	B.H. Tank Works	SD-04	10,000 Gallon Effluent Tank	Dwg 10102, Rev B
				SD-05	Vessel Calculations	Stamped
				SD-12	Tank Inspection Report	03/29/01
	Thrust Block					See As-built Drawings

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Section	Equipment	Vendor	Manufacturer/Supplier	Submittal	Subject	Remarks
61.0	Transformer, at Imjin/Abrams Wells	Pacific Gas and Electricity (PG&E)	Pacific Gas and Electricity (PG&E)	SD-01	General Information	
			Pacific Gas and Electricity (PG&E)	SD-02	Concrete Pad for 3-Phase Transformer	UG-1 045292 Rev.3
			Pacific Gas and Electricity (PG&E)	SD-02	Underground Conduits	UG-1 062288 Rev.1, p 4&6
			Pacific Gas and Electricity (PG&E)	SD-04	Installation Map	PM: 30124192 (16x20)
			Pacific Gas and Electricity (PG&E)	SD-04	Standard Trench Drawing	8-1/2 x 11
			Pacific Gas and Electricity (PG&E)	SD-05	Service Planning Sheet	Rev. 7/11/00
			Pacific Gas and Electricity (PG&E)	SD-08	Signed Application Documents	Transmitted 5/8/00
			USACE	SD-09	Meter Installation Inspection	07/11/00
			Pacific Gas and Electricity (PG&E)	SD-13	Agreement to Perform Work	05/09/00
62.0	Transformer, at Landfill Wells	Pacific Gas and Electricity (PG&E)	Pacific Gas and Electricity (PG&E)	SD-01	General Information	
			Pacific Gas and Electricity (PG&E)	SD-02	Concrete Pad for 3-Phase Transformer	UG-1 045292 Rev.3
			Pacific Gas and Electricity (PG&E)	SD-02	Underground Conduits	UG-1 062288 Rev.1, p 4&6
			Pacific Gas and Electricity (PG&E)	SD-04	Installation Map	PM: 30120004 (16x20)
			Pacific Gas and Electricity (PG&E)	SD-04	Standard Trench Drawing	8-1/2 x 11
			Pacific Gas and Electricity (PG&E)	SD-05	Service Planning Sheet	Rev. 7/11/00
			Pacific Gas and Electricity (PG&E)	SD-08	Signed Application Documents	Transmitted 5/8/00
			Pacific Gas and Electricity (PG&E)	SD-08	Notification of Completion	06/29/00
			USACE	SD-09	Meter Installation Inspection	07/11/00
			Pacific Gas and Electricity (PG&E)	SD-13	Agreement to Perform Work	05/09/00
63.0	Transformer, at University Wells	Pacific Gas and Electricity (PG&E)	Pacific Gas and Electricity (PG&E)	SD-01	General Information	
			Pacific Gas and Electricity (PG&E)	SD-02	Concrete Pad for 3-Phase Transformer	UG-1 064309 Rev.4
			Pacific Gas and Electricity (PG&E)	SD-02	Underground Conduits	UG-1 062288 Rev.1, p 4&6
			Pacific Gas and Electricity (PG&E)	SD-04	Installation Map	PM: 30124189 (11x17)
			Pacific Gas and Electricity (PG&E)	SD-05	Service Planning Sheet	Rev. 7/11/00
			Pacific Gas and Electricity (PG&E)	SD-08	Signed Application Documents	Transmitted 4/21/00
			Pacific Gas and Electricity (PG&E)	SD-08	Notification of Completion	06/29/00
			USACE	SD-09	Meter Installation Inspection	07/11/00
64.0	Valves, at Infiltration Galleries	SantaFe Industrial Products	Bermad	SD-02	Bi-Level Float Control Valve 750-66	general info
			Bermad	SD-06	750-60 Float Valve - Modulating	Specs, data, control diag, 10/99
			Bermad	SD-06	Model 66 Float Control - Non-modulating	Data, installation 10/99
			Bermad	SD-08	Buy American Act Compliance	06/09/00
65.0	Valves, at Isolation Vaults	Santa Fe Industrial Products	Asahi / America	SD-02	Non-Rising System Gate Valve, PVC	Rev. V-97/B
			Santa Fe & Asahi / America	SD-06	Bolt Torque Information	06/22/00
		USACE	USACE	SD-08	Waiver to Purchase Non Buy American	SPK-2-11-006, 05/06/00

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Section	Equipment	Vendor	Manufacturer/Supplier	Submittal	Subject	Remarks
66.0	Variable Frequency Drives	Avatar Engineering	Danfoss Electronic Drives	SD-01	Design Features, Specs, Op Interface	
			Danfoss Electronic Drives	SD-02	VLT 5000 Aqua Drive	
			Danfoss Electronic Drives	SD-04	Schematic Diagram Std Drive	Dwg 19-7542-00, Rev A
			Danfoss Electronic Drives	SD-04	Customer Connection Diagram	Dwg 19-7544-11, Rev D
			Danfoss Electronic Drives	SD-04	Installation Drawing, NEMA 1	Dwg 12-6786-00, Rev B
			Danfoss Electronic Drives	SD-04	NEMA 1 (IP20) Dimensions	VLT 5011 (460 VAC)
			Danfoss Electronic Drives	SD--05	Performance Information	Input, output, noise, derating, efficiency
			Danfoss Electronic Drives	SD-06	Instructions	Introduction, installation, programming, other
			Danfoss Electronic Drives	SD-06	Service	
			Danfoss Electronic Drives	SD-13	Standard Warranty	
	Video Logging:	Welenco				No Section
	EW-OU2-06-180-(Initial)		Welenco	SD-12	Videos 03/23/00 and 04/12/00 (2) Prior to compl as MW-OU2-78-180	One copy ea QC / Proj File
	EW-OU2-16-A		Welenco	SD-12	Video 02/02/01	One copy ea QC / Proj File
67.0	Well Caps	SantaFe Industrial Products	CJI Process Systems	SD-04	Well Cap Drawings	2 Dwgs & 2 Bills of Mat'l
			CJI Process Systems	SD-04	Drawing Approvals, as Noted	Letter 4/28/00
			Santa Fe Industrial Products	SD-08	Buy American Statement	Letter 6/12/00
68.0	Well Drilling	Water Development, Inc.	Water Development, Inc.	SD-06	Drilling Instructions / Bore Hole Calcs	
			Water Development, Inc.	SD-07	Original Sehedule	
			Water Development, Inc.	SD-08	Proposed Personnel	
			Colorado Silica Sand, Inc.	SD-10	Testing Sieve Guide	
			Colorado Silica Sand, Inc.	SD-10	8 - 16 Sand	
			Colorado Silica Sand, Inc.	SD-10	Oglebay Norton Ind Well-Pack Sand	
			Colorado Silica Sand, Inc.	SD-10	Chemical Analysis Results	
			Colorado Silica Sand, Inc.	SD-10	Physical Characteristics	
			Lone Star Industries, Inc.	SD-10	Typical Grading Parameters	
			SRI	SD-10	SRI Supreme #3 Sand	
			SRI	SD-10	SRI Supreme 3/4-inch Sand	
			IT Corporation	SD-12	Well Logs	See Well Installation and Abandonment Report
69.0	Well Pump Installation	THF Drilling	IT Corporation	SD-12	Well Test Report	
			IT Corporation	SD-18	Well Pump Installation Records	7 EW

APPENDIX C

Excerpts from Applicable or Relevant and Appropriate Requirements, extracted from the *Draft Final Groundwater Remedial Action Work Plan, Operable Unit 2 Groundwater Remedy System Expansion, Fort Ord, California* (IT, 1999a)

Operable Unit 2 Applicable or Relevant and Appropriate Requirements

This appendix presents applicable or relevant and appropriate requirements (ARARs) for the OU2 groundwater remedy as extracted from the *Draft Final Groundwater Remedial Action Work Plan, Operable Unit 2, Groundwater Remedy System Expansion, Fort Ord, California*, Revision 0, Fort Ord, California (IT, 1999a).

C-1.0 Remedial Action Objectives

Remedial action objectives provide the basis from which ARARs are developed and remediation goals are established. The RAOs stated in the *Record of Decision, Operable Unit 2, Fort Ord Landfills, Fort Ord, California*, (OU2 ROD) (Army, 1994) and the subsequent *Explanation of Significant Differences, Operable Unit 2, Fort Ord Landfills, Fort Ord, California*, (OU2 ESD) (Army, 1995) are to

- Reduce risks to human health and the environment
- Comply with federal and state ARARs.

C-2.0 Applicable or Relevant and Appropriate Requirements

The ARARs described below are chemical-, location-, and action-specific for the groundwater remedy. The ARARs are identical to those used during the original OU2 groundwater remedy, and are "applicable" or "relevant and appropriate." These standards are designed to be protective of human health and the environment and to be technically achievable with existing analytical and treatment technologies. Protocols and measures that will be implemented to comply with the ARARs during the remedial action are also presented below.

C-2.1 Chemical-Specific Applicable or Relevant and Appropriate Requirements

VOCs regulated by the state and federal governments are present in the groundwater beneath OU2. The following chemical-specific ARARs were identified in the OU2 ROD (Army, 1994) for COCs present

- *Central Coast Region Water Quality Control Plan* (RWQCB, 1994)

  Portions of the *Central Coast Region Water Quality Control Plan* are ARARs, and groundwater is classified according to beneficial uses. Groundwater at OU2 is considered a potential drinking water source. The *Central Coast Region Water Quality Control Plan* establishes water quality standards, including beneficial-use designations, water-quality objectives to protect these uses, and implementation programs to meet the objectives.

- "National Primary Drinking Water Standards," Title 40 *Code of Federal Regulations* (CFR), Part 141

  Two chemical-specific drinking water standards exist that contain MCLs and have been promulgated under the Safe Drinking Water Act. Maximum contaminant level goals (MCLG) were also promulgated under the Safe Drinking Water Act. The MCLGs above zero are considered chemical-specific ARARs under the National Contingency

Plan (40 CFR §300.430[e][2][I][B]). When MCLGs are equal to zero, the MCL is considered to be a chemical-specific ARAR instead of the MCLG (40 CFR §300.430[e][2] [I][C]). Table 1-1 lists national primary drinking water standards for OU2 COCs.

- "State Primary Drinking Water Standards," *Title 22 California Code of Regulations* (CCR), Chapter 15

  California primary drinking water standards establish enforceable limits for chemicals that may affect public health or the aesthetic qualities of drinking water; however, only those state requirements that are more stringent than federal standards are ARARs. The State MCLs are summarized in Table 1-1.

- "Land Disposal Restrictions, Title 22 CCR, Chapter 16

  The Land Disposal Restrictions prohibit land disposal of specified untreated hazardous wastes and provides special requirements for handling such wastes. If listed or characteristic hazardous wastes are generated as part of the treatment process, then this requirement applies.

Compliance with these chemical-specific ARARs is presented in Section C-3.1.

C-2.2 Location-Specific Applicable or Relevant and Appropriate Requirements

Environmentally sensitive locations were identified during the OU2 Expansion biological survey. Endangered plant and animal species were also identified. The following are location-specific ARARs

- Endangered Species Act (ESA), Title 16, United States Code, Section 1531 et seq., as promulgated by Title 50 CFR Part 402, Section 7

  The ESA requires that any action authorized, funded, or carried out by a federal agency must ensure that it is not likely to jeopardize the continued existence of any endangered species or result in the destruction or adverse modification of habitat of such species that is determined to be critical. Fort Ord consulted with the Fish and Wildlife Service in accordance with the ESA.

- Fish and Game Code, Chapter 15, Article 15, Section 2090

  The Code requires written finding from the State Department of Fish and Game regarding the impact of disturbances on the viability of an endangered population.

Compliance with these location-specific ARARs is discussed in Section C-3.2.

C-2.3 Action-Specific Applicable or Relevant and Appropriate Requirements

Action-specific requirements apply to implementation of remedial activities, such as groundwater treatment and discharge, and soil handling, such as for trenches for conveyance piping or foundation excavations. The following are action-specific ARARs

- Monterey Bay Unified Air Pollution Control District (MBUAPCD), Regulations II and X, and National Primary and Secondary Air Quality Standards, Title 40 CFR, Part 150

  These regulations and standards establish requirements for sources of air pollution and the appropriate level of air abatement technology to be applied for specific chemicals that may be generated as toxic air contaminants. The remedial action must meet the substantive requirements of these regulations.

- "Standards Applicable to Generators of Hazardous Waste," Title 22 CCR, Chapter 12

  These standards are applicable if hazardous waste is generated at the site. The substantive portions of this regulation will apply and be complied with.

- State Water Resources Control Board, Resolution No. 88-63

  Resolution No. 88-63 specifies that all ground and surface water is an existing or potential source of drinking water unless total dissolved solids are greater than 3,000 milligrams per liter, the well yield is less than 200 gallons per day from a single well, or the groundwater is unreasonable to treat using best management practices or best economically achievable treatment practices. Under this resolution, the Upper 180-foot aquifer at OU2 is a potential drinking source.

- State Water Resources Control Board, Resolution No. 92-49

  Resolution No. 92-49 establishes policies and procedures for the investigation, cleanup, and abatement of waste. In accordance with these requirements, cleanup levels must be set at background levels or, if background levels are not technologically or economically feasible, at the lowest levels that are achievable. The USACE completed an economic and technical feasibility analysis pursuant to Resolution No. 92-49 and determined that cleanup to the MCLs is reasonable and satisfies this requirement.

- State Water Resources Control Board, Resolution No. 68-16

  Resolution No. 68-16 establishes goals for the maintenance of existing groundwater quality. It also requires best practical control technology for discharges to high-quality water. Discharge levels were chosen by considering site-specific conditions, including the contaminants to be discharged, and the designated beneficial uses of the receiving water, available treatment technologies, and cost.

- Federal Safe Drinking Water Act, Title 40 CFR, Part 144, and California Toxic Injection Well Act, California Health and Safety Code §25159.24.

  Title 40 CFR Part 144 and the California Toxic Injection Well Act prohibit injection of contaminated water into or above a drinking water formation. Injection of treated groundwater into the source aquifer for the purpose of aquifer cleanup is exempted. For OU2, treated groundwater may be injected to the aquifer provided injected groundwater does not contain chemical concentrations above the ACLs (Table 1-1).

Compliance with action-specific ARARs is described in Section C-3.3.

C-3.0 Compliance with Applicable or Relevant and Appropriate Requirements

Implementing the OU2 groundwater remedy is protective of human health risks associated with potential exposure to groundwater and complies with the ARARs as specified in the OU2 ROD (Army, 1994) as presented in Section 2 above.

C-3.1 Chemical-Specific Applicable or Relevant and Appropriate Requirement Compliance

Implementing the RAOs will lower the 11 COCs in the A-aquifer and Upper 180-foot aquifer so that human health risks are reduced and the ARARs are satisfied. Compliance with the chemical-specific ARARs during remedial action activities are discussed below:

- *Central Coast Region Water Quality Control Plan* (RWQCB, 1994)

  The remediation system will lower concentrations of the COCs in the groundwater to drinking water quality standards or better, as shown on Table 1-1.

- "National Primary Drinking Water Standards," Title 40 CFR, Part 141

  Six of 11 COCs listed on Table 1-1 have ACLs set at the lower value of either the federal or state drinking water MCLs. These COCs are benzene, carbon tetrachloride, 1,1-DCA, 1,2-DCA, cis-1,2-DCE, and TCE.

  Chloroform, 1,2-DCP, dichloromethane, PCE, and vinyl chloride ACLs are lower than either the federal or state MCLs based on risk calculation in the *Fort Ord Baseline Risk Assessment* prepared by Dames and Moore (1993).

  The cumulative risk is within the acceptable risk range and is health protective.

- State Primary Drinking Water Standards, Title 22 CCR, Chapter 15

  Six of 11 COCs listed on Table 1-1 have ACLs set at the lower value of either the federal or state drinking water MCLs. These COCs are benzene, carbon tetrachloride, 1,1-DCA, 1,2-DCA, cis-1,2-DCE, and TCE.

  Chloroform, 1,2-DCP, dichloromethane, PCE, and vinyl chloride ACLs are lower than either the federal or state MCLs based on risk calculation in the *Fort Ord Baseline Risk Assessment* prepared by Dames and Moore (1993).

  The cumulative risk is within the acceptable risk range and is health protective.

- Land Disposal Restrictions, Title 22 CCR, Chapter 16

  The waste classification of materials generated will be determined prior to disposal. It is expected that the waste will be classified to be non-Resource Conservation Recovery Act hazardous waste. Should any waste generated on site be determined as hazardous waste, it will be manifested and disposed of appropriately.

The following discusses compliance with location-specific ARARs.

C-3.2 Location-Specific Applicable or Relevant and Appropriate Requirement Compliance

Environmentally-sensitive locations were identified in the biological survey. Endangered plant and animal species were identified. Construction and remedial activities avoided these locations and were protective of threatened and endangered species and habitats. A biologist was available to provide biological mitigation services during remediation activities on an as-needed basis. Location-specific ARARs and compliance measures are as follows:

- ESA, Title 16, United States Code, Section 1531, et seq., as promulgated by Title 50 CFR Part 402, §7

  Mitigation measures for the protection of threatened and endangered species and sensitive habitat will be in accordance with the *Installation-Wide Multispecies Habitat Management Plan for Former Fort Ord, California* (Army, 1997) and the ESA.

- Fish and Game Code, Chapter 15, Article 15, §2090

  Mitigation measures for the protection of threatened and endangered species and sensitive habitat will be in accordance with the *Installation-Wide Multispecies Habitat Management Plan for Former Fort Ord, California* (Army, 1997) and the ESA.

The following discusses compliance with action-specific ARARs.

C-3.3 Action-Specific Applicable or Relevant and Appropriate Requirement Compliance

Groundwater treatment and discharge, excavation, and soil handling associated with activities such as construction of wells or conveyance piping were completed in accordance with the following regulations and standards

- MBUAPCD, Regulations II and X, and National Primary and Secondary Air Quality Standards, Title 40 CFR Part 150

  During groundwater treatment, excavation, soil handling, and construction, appropriate measures, such as emissions abatement and dust suppression, were implemented to meet air abatement requirements.

  The design addresses fugitive air emissions of inlet COCs that can become a source of toxic air contamination. No air abatement is required.

- "Standards Applicable to Generators of Hazardous Waste," Title 22 CCR, Chapter 12

  These standards are applicable if hazardous waste is generated. Should spent carbon or any other waste generated on site be determined as hazardous waste, it will be manifested for disposal or treatment.

- State Water Resources Control Board, Resolution No. 88-63

  The water will be treated to remove COCs to below ACLs.
- State Water Resources Control Board, Resolution No. 92-49

  The USACE completed an economic and technical feasibility analysis pursuant to Resolution No. 92-49 and determined that OU2 cleanup to the MCLs is reasonable and satisfies cleanup requirements.

- State Water Resources Control Board, Resolution No. 68-16

  The COC discharge limits for OU2 treated water are below the ACL for eight COCs (benzene, chloroform, 1,1-DCA, cis-1,2-DCE, 1,2-DCP, dichloromethane, PCE, and TCE) and equal to the ACL for three COCs (carbon tetrachloride, 1,2-Dichloroethane, and vinyl chloride). These discharge levels will maintain the existing groundwater quality.

APPENDIX D

GROUNDWATER TREATMENT PLANT OPERATOR REPORTS, CHECKLISTS, AND SPARE PARTS LIST

Appendix D-1

FIELD ACTIVITY DAILY LOG

DAILY LOG	DATE			
	NO.			
	SHEET OF			

PROJECT NAME: FORT ORD, CA

PROJECT NO: 783751

FIELD ACTIVITY SUBJECT:

DESCRIPTION OF DAILY ACTIVITIES AND EVENTS

VISITORS ON SITE:

CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS:

WEATHER CONDITIONS:

IMPORTANT TELEPHONE CALLS:

IT PERSONNEL ON SITE:

SIGNATURE:

DATE:

Appendix D 2
DAILY FLOW READINGS LOG
Operable Unit 2 Groundwater Remedy
Former Fort Ord, California

Date:_____

Operator:_____

Location	Meter Number	Meter Reading	Time	Meter GPM[a]	Operator Comments[b]
Eastern Containment	FI-325				
Northern Containment	FI-679				
Recycle	FI-357				
Sites 2 and 12 Injection	FI-431				
Northwestern Injection	FI-531				
Southwestern Injection	FI-541				

ADDITIONAL REMARKS:

Notes:

[a] gallons per minute

[b] Start/Stop times, number of extraction wells on/off line, flow adjustments

Appendix D 3
FLOW READINGS LOG
Operable Unit 2 Groundwater Remedy
Former Fort Ord, California

Date:_____ Operator:_____

Location	Meter Number	Meter Reading	Time	Meter (gpm)	Water Level (ft)	Comments
Western Influent						
EW-OU2-03-A	FI-215					
EW-OU2-01-A	FI-225					
EW-OU2-02-A	FI-235					
EW-OU2-01-180	FI-245					
EW-OU2-04-A	FI-275					
EW-OU2-05-A	FI-215					
EW-OU2-06-A	FI-255					
Eastern Influent						
EW-OU2-07-A	FI-185					
EW-OU2-08-A	FI-175					
EW-OU2-09-A	FI-165					
EW-OU2-10-A	FI-155					
EW-OU2-02-180	FI-145					
EW-OU2-11-A	FI-135					
EW-OU2-12-A	FI-125					
EW-OU2-13-A	FI-115					
University Influent						
EW-OU2-15-A	FI-715					
EW-OU2-14-A	FI-725					
Abrams/Imjin Influent						
EW-OU2-06-180	FI-815					
EW-OU2-16-A	FI-735					
EW-OU2-05-180	FI-845					
Landfill Influent						
EW-OU2-04-180	FI-825					
EW-OU2-03-180	FI-835					

APPENDIX D 4
INSPECTION CHECKLIST
Operable Unit 2 Groundwater Remedy
Former Fort Ord, California

Appendix B Tab	Item	Identification	Security	Safety	Frequency*	Date	Initials	Comments
1	Anchor Bolts							
	All Anchored Equipment	Various		X	Semi-annual**			
3	Bag Filter	F-348						
	Lifting Threads			X	Semi-annual			
N/A	Building							
	Doors/locks/windows		X	X	Semi-annual			
	Inside supports		X	X	Semi-annual			
	Outside shell		X	X	Semi-annual			
6	Cartridge Filter	F-350						
	Lifting Threads			X	Semi-annual			
8	Concrete, Cast-in-Place							
	Floors			X	Semi-annual			
	Housekeeping Pads			X	Semi-annual			
	Truck Pad			X	Semi-annual			
	Vault Sumps	7 EW Vaults		X	Semi-annual			
9 &10	Concrete Pull Boxes & Aluminum Lids							
	Christy 10x17	Tbl 2-2 (19)	X	X	Semi-annual			
	Christy 17x30	Tbl 2-2 (4)	X	X	Semi-annual			
	Christy 24x36	Tbl 2-2 (3)	X	X	Semi-annual			

APPENDIX D 4
INSPECTION CHECKLIST
Operable Unit 2 Groundwater Remedy
Former Fort Ord, California

Appendix B Tab	Item	Identification	Security	Safety	Frequency*	Date	Initials	Comments
13 & 15	Concrete Vaults & Lids							
	A-Aquifer EW	Table 2-2 (3)	X	X	Semi-annual			
	180-ft Aquifer EW	Table 2-2 (4)	X	X	Semi-annual			
	High Point, Low Point, Leak Detect 24x24	Table 2-2 (40+1)	X	X	Annual			
	INF Gallery	Table 2-2 (2)	X	X	Semi-annual			
	INF Valve	Table 2-2 (2)	X	X	Semi-annual			
	Isolation	Table 2-2 (3)	X	X	Annual			
	OU2 EW/IW Replacement	15 + 3	X	X	Semi-annual			
	Wye	Table 2-2 (1)	X	X	Semi-annual			
14	Tamper Proof (Pentagon) Vault Lid Bolts							
	Christy 10x17	Tbl 2-2 (19)	X		Annual			
	Christy 17x30	Tbl 2-2 (4)	X		Annual			
	Christy 24x36	Tbl 2-2 (3)	X		Annual			
20 & 47	Electrical Panelboards							
	Abrams		X	X	Semi-annual			
	Abrams/Imjin		X	X	Semi-annual			
	Landfill		X	X	Semi-annual			
	Repeater		X	X	Semi-annual			
	University		X	X	Semi-annual			
	Wellhead (operating only)		X	X	Semi-annual			
21	Eyewash/Shower Station							
	Building Containment, Flush Supply Line			X	Quarterly			
	N & E Containment, Flush Supply Line			X	Quarterly			
	N & E Containment, Functional Checkout			X	Semi-annual			

APPENDIX D 4
INSPECTION CHECKLIST
Operable Unit 2 Groundwater Remedy
Former Fort Ord, California

Appendix B Tab	Item	Identification	Security	Safety	Frequency*	Date	Initials	Comments
22	Fencing							
	Abrams PLC		X	X	Semi-annual			
	Abrams/Imjin PLC		X	X	Semi-annual			
	Landfill PLC		X	X	Semi-annual			
	Repeater Station		X	X	Semi-annual			
	University PLC		X	X	Semi-annual			
	GWTP		X	X	Semi-annual			
23	Fire Alarm System GWTP							
	Functional Checkout		X	X	Semi-annual			
27	GAC, Northern Containment Area							
	Integrity Checkout			X	Semi-annual			
28	GAC, Eastern Containment Area							
	Integrity Checkout			X	Semi-annual			
29	Grating, Trench and Sump							
	Building			X	Semi-annual			
	East Containment			X	Semi-annual			
	North Containment			X	Semi-annual			
30	Grating Clips							
	East Containment			X	Semi-annual			
	North Containment			X	Semi-annual			

APPENDIX D 4
INSPECTION CHECKLIST
Operable Unit 2 Groundwater Remedy
Former Fort Ord, California

Appendix B Tab	Item	Identification	Security	Safety	Frequency*	Date	Initials	Comments
32	Handrails & Chains							
	East Containment			X	Semi-annual			
	North Containment			X	Semi-annual			
33	Ladders							
	Expansion EW Vaults	7		X	Semi-annual			
	Expansion INF Vaults	2		X	Semi-annual			
	Expansion Valve Vaults	2		X	Semi-annual			
	Expansion Wye Vault	1		X	Semi-annual			
	Original EW Vaults	15		X	Semi-annual			
	Original IW Vaults	3		X	Semi-annual			
42	Pipe Supports							
	GWTP			X	Semi-annual			
	Vault			X	Semi-annual			
49	PLC Software							
	Abrams PLC		X		Semi-annual			
	Abrams/Imjin PLC		X		Semi-annual			
	Landfill PLC		X		Semi-annual			
	University PLC		X		Semi-annual			
	GWTP		X		Semi-annual			
50	Pump, Centifugal, Backwash							
	Electrical/Mechanical/Guard	P-385		X	Semi-annual			

APPENDIX D 4
INSPECTION CHECKLIST
Operable Unit 2 Groundwater Remedy
Former Fort Ord, California

Appendix B Tab	Item	Identification	Security	Safety	Frequency*	Date	Initials	Comments
51	Pump, Centifugal, Injection							
	Electrical/Mechanical/Guard/VFD	P-410		X	Semi-annual			
	Electrical/Mechanical/Guard/VFD	P-420		X	Semi-annual			
	Electrical/Mechanical/Guard/VFD	P-510		X	Semi-annual			
	Electrical/Mechanical/Guard/VFD	P-520		X	Semi-annual			
	Electrical/Mechanical/Guard/VFD	P-910		X	Semi-annual			
	Electrical/Mechanical/Guard/VFD	P-920		X	Semi-annual			
53	Pump, Sump							
	Eastern Electrical/Mechanical	P-375		X	Semi-annual			
	Northern Electrical/Mechanical	P-395		X	Semi-annual			
	Inside GWTP Electrical/Mechanical	P-495		X	Semi-annual			
55	Sump Liner (Integrity)							
	Building			X	Semi-annual			
	East Containment			X	Semi-annual			
	North Containment			X	Semi-annual			

Notes: * Any descrepancy should be noted for correction when found during normal operations

** Semi-annual checks ensure the timely inspection of all items.

APPENDIX D 5
MAINTENANCE CHECKLIST
Operable Unit 2 Groundwater Remedy
Former Fort Ord, California

Appendix B Tab	Item	Identification	Task	Frequency Mo/Qtr/SA/Ann/Oth	Date	Initials	Comments
3	Bag Filter	F-348	Keep lifting threads clean and lubricated; replace when worn	Annual			
6	Cartridge Filter	F-350	Keep lifting threads clean and lubricated; replace when worn	Annual			
20 & 47	Electrical Panelboards	5 offsite PLC Panels and each wellhead electrical panel	Hot surface after 3 seconds; may indicate trouble	Periodic			
			Vacuum or wipe surfaces to remove dust accumulation	Semi-annual			
			Spray surfaces to dewater and to reduce corrosion potential	Semi-annual			
			Service of licensed electrician	After short circuit or other electrical damage			
24	Flowmeters						
	Landfill EW-OU2-03-180	FI-835	Monitor for low voltage battery warning; replace if necessary	During periodic confirmation reading			
	Landfill EW-OU2-04-180	FI-825					
	Abrams/Imjin EW-OU2-05-180	FI-845					
	Abrams/Imjin EW-OU2-06-180	FI-815					
	Abrams/Imjin EW-OU2-16-A	FI-735					
	University EW-OU2-14-A	FI-725					
	Unversity EW-OU2-15-A	FI-715					
	Eastern Calgon GAC Influent	FI-325					
	Northern USFilter GAC Influent	FI-679					
	Southwestern Injection	FI-541					
27	GAC, Northern Containment Area	TK-600C/D	Inspect for complete carbon discharge & vessel internals	Each carbon changeout			
28	GAC, Eastern Containment Area	TK-600A/B	Inspect for complete carbon discharge & vessel internals	Each carbon changeout			

APPENDIX D 5
MAINTENANCE CHECKLIST
Operable Unit 2 Groundwater Remedy
Former Fort Ord, California

Appendix B Tab	Item	Identification	Task	Frequency Mo/Qtr/SA/Ann/Oth	Date	Initials	Comments
34	Leak Detection System	Abrams PLC	Integrity check	Verify connection from each node during first year; annual checks thereafter			
		GWTP PLC					
		Imjin/Abrams PLC					
		Landfill PLC					
		University PLC					
36	Level Switches, Vault						
	Landfill EW-OU2-03-180	LSH-834	Lift level switch and check electronic response	Semi-annual			
	Landfill EW-OU2-04-180	LSH-824					
	Abrams/Imjin EW-OU2-05-180	LSH-844					
	Abrams/Imjin EW-OU2-06-180	LSH-814					
	Abrams/Imjin EW-OU2-16-A	LSH-734					
	University EW-OU2-14-A	LSH-724					
	Unversity EW-OU2-15-A	LSH-714					
	Wye Vault	LSH-192					
44	Pressure Switches, Extraction Well						
	Landfill EW-OU2-03-180	PSH-733	Throttle valves to simulate high pressure in pipeline, compare with pressure setpoint	Semi-annual			
	Landfill EW-OU2-04-180	PSH-723					
	Abrams/Imjin EW-OU2-05-180	PSH-843					
	Abrams/Imjin EW-OU2-06-180	PSH-813					
	Abrams/Imjin EW-OU2-16-A	PSH-733					
	University EW-OU2-14-A	PSH-723					
	Unversity EW-OU2-15-A	PSH-713					
44	Pressure Switches, Header						
	Landfill EW-OU2-04-180	PSH-822	Throttle valves to simulate high pressure in pipeline, compare with pressure setpoint	Semi-annual			
	Abrams/Imjin EW-OU2-06-180	PSH-812					
	University EW-OU2-15-A	PSH-712					

APPENDIX D 5
MAINTENANCE CHECKLIST
Operable Unit 2 Groundwater Remedy
Former Fort Ord, California

Appendix B Tab	Item	Identification	Task	Frequency Mo/Qtr/SA/Ann/Oth	Date	Initials	Comments
50	Pump, Centrifugal, Backwash						
	Pump	P-385	Grease bearings	4000 Run Hours or Every 3 Years			
	10 HP Motor	P-385	0.2 oz grease, ea 2 bearings	Every 3 Years			
51	Pump, Centrifugal, Injection						
	Pump	P-510 & P-520	Bearings sealed for life	NA			
	7.5 HP Motor	P-510	0.2 oz grease, ea 2 bearings	Every 3 Years			
	7.5 HP Motor	P-520					
53	Pump, Sump						
	Eastern Containment Pump	P-375	Clean suction grate and impeller	As Needed			
	Northern Containment Pump	P-395					
	Inside GWTP Building Pump	P-495					
	Eastern Containment Level Switch	LC-375	Lift level switch and check electronic response	Semi-annual			
	Northern Containment Level Switch	LC-395					
	Inside GWTP Building Level Switch	LC-495					
64	Valves, at Infiltration Galleries						
	INF-OU2-01-180	LSH-539	With confined space permit only, lift level switch and check electronic response	Semi-annual			
	INF-OU2-01-180	LSH-555					

Appendix D 6
VALVE POSITIONING
Operable Unit 2 Groundwater Remedy
Former Fort Ord, California

Valve	Description	Normal Flow	TK-340 Full	TK-380 Full	Temproary Shutdown Valve Position	Longterm Shutdown Valve Position
Influent Manifold						
V-301	West influent 6-inch butterfly valve	open			open	closed
V-302	West manifold 2-inch valve to LLNL	closed			closed	closed
V-303	West manifold 6-inch check valve	open			closed	closed
V-304	West manifold 6-inch air actuated valve	open			closed	closed
V-319	Manifold 6" butterfly bypass valve	closed			closed	closed
V-307	West manifold 2-inch PI valve	open			open	open
V-308	West manifold 6-inch butterfly valve	open			open	closed
V-321	East influent 6-inch butterfly valve	open			open	closed
V-322	East manifold 2-inch valve to LLNL	closed			closed	closed
V-323	East manifold 6-inch check valve	open			closed	closed
V-324	East manifold 6-inch air actuated valve	open			closed	closed
V-327	East manifold 2-inch PI valve	open			open	open
V-328	East manifold 6-inch butterfly valve	open			open	closed
V-315	Manifold mixer sample port valve	closed			closed	open
Sump to Backwash Tank						
V-378	East sump 2-inch check valve	open	closed	closed	closed	closed
V-376	East sump 2-inch isolation valve	open	open	open	open	closed
V-379	East sump 2-inch valve to TK-340	open	closed	open	closed	closed
V-374	East sump 2-inch valve to P-495	closed	open	open	open	open
V-496	Building sump 2-inch isolation valve	open	open	open	open	closed
V-497	Building sump 2-inch clean-out valve	closed	closed	closed	closed	open
V-498	Building sump 2-inch check valve	open	closed	closed	closed	closed
V-396	Northern sump 2-inch isolation valve	open	open	open	open	closed
V-397	Northern sump 2-inch clean-out valve	closed	closed	closed	closed	open
V-398	Northern sump 2-inch check valve	open	closed	closed	closed	closed
V-399	Northern sump 2-inch valve to TK-380	open	open	closed	closed	closed
Backwash Tank to Manifold						
V-339	TK-340 backwash influent 6-inch valve	open	closed		open	closed
V-341	TK-340 backwash effluent 4-inch valve	open	open		open	closed
V-342	East backwash 2-inch clean-out valve	closed	closed		closed	open
V-347	East 2-inch check valve	open	open		closed	closed
V-346	East air bleed valve	closed	closed		closed	open
V-344	East 2-inch valve to TK-380	closed	closed		closed	closed
V-349	Cartridge 2-inch influent valve	open	open		open	closed
V-352	Cartridge 2-inch influent drain valve	closed	closed		closed	open
V-353	Cartridge 2-inch effluent drain valve	closed	closed		closed	open
V-351	Cartridge 2-inch effluent valve	open	open		open	closed
V-352	Cartridge 2-inch influent valve	open	open		open	closed
V-354	Cartridge 2-inch influent bypass valve	closed	closed		closed	closed
V-356	Cartridge 2-inch bypass drain valve	closed	closed		closed	closed
V-355	Cartridge 2-inch effluent bypass valve	closed	closed		closed	closed
V-359	Backwash filter 2-inch valve to manifold	open	open		closed	closed

Appendix D 6
VALVE POSITIONING
Operable Unit 2 Groundwater Remedy
Former Fort Ord, California

Valve	Description	Normal Flow	TK-340 Full	TK-380 Full	Temproary Shutdown Valve Position	Longterm Shutdown Valve Position
V-389	TK-380 backwash influent 6-inch valve	open		closed	closed	closed
V-381	TK-380 backwash effluent 3-inch valve	open		open	open	closed
V-382	North backwash 2-inch clean-out valve	closed		closed	closed	open
V-387	North 2-inch check valve	open		open	closed	closed
V-385	North air bleed valve	closed		closed	closed	open
V-388	North 2-inch valve to TK-340	open		closed	closed	closed
	Effluent Manifold					
V-689	TK-690 influent 10-inch valve	open			closed	closed
V-692	TK-690 effluent 12-inch valve	open			closed	closed
V-694	TK-690 effluent drain line	closed			closed	closed
V-417	8-inch butterfly isolation valve	open			open	closed
V-923	P-920 4-inch gate valve	open			open	closed
V-924	P-920 2-inch drain valve	closed			closed	open
V-927	P-920 4-inch check valve	open			open	closed
V-928	P-920 2-inch drain valve	closed			closed	open
V-929	P-920 4-inch gate valve	open			open	closed
V-912A	P-920 pressure gauge valve	open			open	closed
V-912B	P-920 pressure switch valve	open			open	closed
V-913	P-910 4-inch gate valve	open			open	closed
V-914	P-910 2-inch drain valve	closed			closed	open
V-917	P-910 4-inch check valve	open			open	closed
V-918	P-910 2-inch drain valve	closed			closed	open
V-919	P-910 4-inch gate valve	open			open	closed
V-922	P-910 pressure gauge valve	open			open	closed
V-923	P-910 pressure switch valve	open			open	closed
V-530	P-910/920 isolation valve	open			open	closed
V-532	Northwestern air bleed valve	open			open	open
V-533	Northwestern isolation valve	open			closed	closed
V-413	P-410 4-inch gate valve	open			open	closed
V-414	P-410 2-inch drain valve	closed			closed	open
V-412A	P-410 pressure gauge valve	open			open	closed
V-412B	P-410 pressure switch valve	open			open	closed
V-417	P-410 4-inch check valve	open			open	closed
V-418	P-410 2-inch drain valve	closed			closed	open
V-419	P-410 4-inch butterfly valve	open			open	closed
V-423	P-420 4-inch gate valve	open			open	closed
V-424	P-420 2-inch drain valve	closed			closed	open
V-422A	P-420 pressure gauge valve	open			open	closed
V-422B	P-420 pressure switch valve	open			open	closed
V-427	P-420 4-inch check valve	open			open	closed
V-428	P-420 2-inch drain valve	closed			closed	open
V-429	P-420 4-inch butterfly valve	open			open	closed
V-440	Sites 2 and 12 to LLNL valve	closed			closed	closed

Appendix D 6
VALVE POSITIONING
Operable Unit 2 Groundwater Remedy
Former Fort Ord, California

Valve	Description	Normal Flow	TK-340 Full	TK-380 Full	Temproary Shutdown Valve Position	Longterm Shutdown Valve Position
V-430	P-410/420 isolation valve	open			open	closed
V-434	Sites 2 and 12 air bleed valve	open			open	open
V-433	Sites 2 and 12 isolation valve	open			open	closed
V-432	Eastern injection isolation valve	closed			closed	closed
V-513	P-510 4-inch gate valve	open			open	closed
V-514	P-510 2-inch drain valve	closed			closed	open
V-512A	P-510 pressure gauge valve	open			open	closed
V-512B	P-510 pressure switch valve	open			open	closed
V-517	P-510 4-inch check valve	open			open	closed
V-518	P-510 2-inch drain valve	closed			closed	open
V-519	P-510 4-inch butterfly valve	open			open	closed
V-523	P-520 4-inch gate valve	open			open	closed
V-524	P-520 2-inch drain valve	closed			closed	open
V-522A	P-520 pressure gauge valve	open			open	closed
V-522B	P-520 pressure switch valve	open			open	closed
V-527	P-520 4-inch check valve	open			open	closed
V-528	P-520 2-inch drain valve	closed			closed	open
V-529	P-520 4-inch butterfly valve	open			open	closed
V-540	P-510/520 isolation valve	open			open	closed
V-546	Southwestern air bleed valve	open			open	open
V-542	Southwestern isolation valve	open			open	closed

Appendix D 7
GRANULAR ACTIVATED CARBON VALVE POSITIONING
Operable Unit 2 Groundwater Remedy
Former Fort Ord, California

Valve	Description	Series Flow		Parallel Flow	TK-600A Backwash, Lowflow and Online TK-600B	TK-600A Backwash, Highflow and Offline TK-600B	Longterm Shutown Valve Position
		TK-600A lead	TK-600B lead				
V-601	Eastern GAC[a] manifold valve	open	closed	open	closed	closed	closed
V-602	Eastern GAC manifold valve	closed	open	open	open	closed	closed
V-603	Eastern GAC manifold valve	closed	closed	closed	open	open	closed
V-604	Eastern GAC manifold valve	closed	closed	closed	closed	closed	closed
V-605	Eastern GAC manifold valve	closed	open	open	closed	closed	closed
V-606	Eastern GAC manifold valve	open	closed	open	closed	closed	closed
V-607	Eastern GAC manifold valve	closed	open	closed	closed	closed	closed
V-608	Eastern GAC manifold valve	open	closed	closed	closed	closed	closed
V-609	Eastern GAC manifold valve	open	closed	closed	open	open	closed
V-610	Eastern GAC manifold valve	closed	open	closed	open	closed	closed
V-611	Eastern GAC backwash influent	closed	closed	closed	closed	open	closed
V-612	Sample port valve	closed	closed	closed	closed	closed	closed
V-613	Sample port valve	closed	closed	closed	closed	closed	closed
V-614A	Eastern pressure differential valve	open	open	open	open	closed	open
V-614B	Eastern pressure differential valve	open	open	open	open	closed	open
V-615A	Eastern pressure differential valve	open	open	open	open	closed	open
V-615B	Eastern pressure differential valve	open	open	open	open	closed	open
V-616	Eastern GAC Rupture Disc	closed	closed	closed	closed	closed	closed
V-617	Eastern GAC Rupture Disc	closed	closed	closed	closed	closed	closed
V-618	Sample port valve to LLNL	closed	closed	closed	closed	closed	closed
V-619	Sample port valve to LLNL	closed	closed	closed	closed	closed	closed
V-626A	TK-600A air/water valve	closed during normal operation					closed
V-627A	TK-600A GAC unload valve						closed
V-626B	TK-600B air/water valve						closed
V-627B	TK-600B GAC unload valve						closed
V-633A	TK-600A Sample port valve						closed
V-633B	TK600B Sample port valve						closed
V-634A	TK-600A air/water valve						closed
V-635A	TK-600A GAC unload valve						closed
V-636A	TK-600A air/water valve						open
V-634B	TK-600B air/water valve						open
V-635B	TK-600B GAC unload valve						closed
V-636B	TK-600B air/water valve						closed

Appendix D 7
GRANULAR ACTIVATED CARBON VALVE POSITIONING
Operable Unit 2 Groundwater Remedy
Former Fort Ord, California

Valve	Description	Series Flow		Parallel Flow	TK-600D Backwash, Lowflow and Online TK-600B	TK-600C Backwash, Highflow and Offline TK-600B	Longterm Shutown Valve Position
		TK-600D lead	TK-600C lead				
V-630C	Northern GAC[a] sampling valve	closed during normal operation					closed
V-631C	Northern GAC sampling valve						closed
V-632C	Northern GAC sampling valve						closed
V-630D	Northern GAC sampling valve						closed
V-631D	Northern GAC sampling valve						closed
V-632D	Northern GAC sampling valve						closed
V-634	TK-600D air bleed valve						open
V-635	TK-600D air/water valve						closed
V-636	TK-600D air/water valve						closed
V-644	TK-600C air bleed valve						open
V-645	TK-600C air/water valve						closed
V-646	TK-600C air/water valve						closed
V-651	Northern GACa manifold valve	open	closed	open	closed	closed	closed
V-652	Northern GAC manifold valve	closed	open	open	open	closed	closed
V-653	Northern GAC manifold valve	closed	closed	closed	open	open	closed
V-654	Northern GAC manifold valve	closed	closed	closed	closed	closed	closed
V-655	Northern GAC manifold valve	closed	open	open	closed	closed	closed
V-656	Northern GAC manifold valve	open	closed	open	closed	closed	closed
V-657	Northern GAC manifold valve	closed	open	closed	closed	closed	closed
V-658	Northern GAC manifold valve	open	closed	closed	closed	closed	closed
V-659	Northern GAC manifold valve	open	closed	closed	open	open	closed
V-660	Northern GAC manifold valve	closed	open	closed	open	closed	closed
V-661	Northern GAC backwash influent	closed	closed	closed	closed	open	closed
V-662	Sample port valve	closed	closed	closed	closed	closed	closed
V-663	Sample port valve	closed	closed	closed	closed	closed	closed
V-664A	Northern pressure differential valve	open	open	open	open	closed	open
V-664B	Northern pressure differential valve	open	open	open	open	closed	open
V-665A	Northern pressure differential valve	open	open	open	open	closed	open
V-665B	Northern pressure differential valve	open	open	open	open	closed	open
V-666	Northern GAC Rupture Disc	closed	closed	closed	closed	closed	closed
V-667	Northern GAC Rupture Disc	closed	closed	closed	closed	closed	closed
V-668	Sample port valve to LLNL	closed	closed	closed	closed	closed	closed
V-669	Sample port valve to LLNL	closed	closed	closed	closed	closed	closed
V-666C	TK-600C air/water valve	closed during normal operation					closed
V-667C	TK-600C GAC unload valve						closed
V-668C	TK-600C air/water valve						closed
V-666D	TK-600D air/water valve						closed
V-667D	TK-600D GAC unload valve						closed
V-668D	TK-600D air/water valve						closed
V-675C	TK-600C GAC unload valve						closed
V-676C	TK-600C air/water valve						closed
V-675D	TK-600D GAC unload valve						open
V-676D	TK-600D air/water valve						open

GAC[a] granular activated carbon

Appendix D 8
SPARE PARTS INVENTORY LIST
Operable Unit 2 Groundwater Remedy
Former Fort Ord, California

There were no identified spare parts purchased as part of the Operable Unit 2 System Expansion. Critical components, such as in-line process pumps, are provided as 100 percent spares. Non-critical components are readily available and may be taken off-line and refurbished or replaced as necessary. However, as the Groundwater Treatment Operator acquires a spare parts inventory, this appendix reserves space for the listing.

Appendix D 6
VALVE POSITIONING
Operable Unit 2 Groundwater Remedy
Former Fort Ord, California

Valve	Description	Normal Flow	TK-340 Full	TK-380 Full	Temproary Shutdown Valve Position	Longterm Shutdown Valve Position
V-389	TK-380 backwash influent 6-inch valve	open		closed	closed	closed
V-381	TK-380 backwash effluent 3-inch valve	open		open	open	closed
V-382	North backwash 2-inch clean-out valve	closed		closed	closed	open
V-387	North 2-inch check valve	open		open	closed	closed
V-385	North air bleed valve	closed		closed	closed	open
V-388	North 2-inch valve to TK-340	open		closed	closed	closed
	Effluent Manifold					
V-689	TK-690 influent 10-inch valve	open			closed	closed
V-692	TK-690 effluent 12-inch valve	open			closed	closed
V-694	TK-690 effluent drain line	closed			closed	closed
V-417	8-inch butterfly isolation valve	open			open	closed
V-923	P-920 4-inch gate valve	open			open	closed
V-924	P-920 2-inch drain valve	closed			closed	open
V-927	P-920 4-inch check valve	open			open	closed
V-928	P-920 2-inch drain valve	closed			closed	open
V-929	P-920 4-inch gate valve	open			open	closed
V-912A	P-920 pressure gauge valve	open			open	closed
V-912B	P-920 pressure switch valve	open			open	closed
V-913	P-910 4-inch gate valve	open			open	closed
V-914	P-910 2-inch drain valve	closed			closed	open
V-917	P-910 4-inch check valve	open			open	closed
V-918	P-910 2-inch drain valve	closed			closed	open
V-919	P-910 4-inch gate valve	open			open	closed
V-922	P-910 pressure gauge valve	open			open	closed
V-923	P-910 pressure switch valve	open			open	closed
V-530	P-910/920 isolation valve	open			open	closed
V-532	Northwestern air bleed valve	open			open	open
V-533	Northwestern isolation valve	open			closed	closed
V-413	P-410 4-inch gate valve	open			open	closed
V-414	P-410 2-inch drain valve	closed			closed	open
V-412A	P-410 pressure gauge valve	open			open	closed
V-412B	P-410 pressure switch valve	open			open	closed
V-417	P-410 4-inch check valve	open			open	closed
V-418	P-410 2-inch drain valve	closed			closed	open
V-419	P-410 4-inch butterfly valve	open			open	closed
V-423	P-420 4-inch gate valve	open			open	closed
V-424	P-420 2-inch drain valve	closed			closed	open
V-422A	P-420 pressure gauge valve	open			open	closed
V-422B	P-420 pressure switch valve	open			open	closed
V-427	P-420 4-inch check valve	open			open	closed
V-428	P-420 2-inch drain valve	closed			closed	open
V-429	P-420 4-inch butterfly valve	open			open	closed
V-440	Sites 2 and 12 to LLNL valve	closed			closed	closed

Appendix D 6
VALVE POSITIONING
Operable Unit 2 Groundwater Remedy
Former Fort Ord, California

Valve	Description	Normal Flow	TK-340 Full	TK-380 Full	Temproary Shutdown Valve Position	Longterm Shutdown Valve Position
V-430	P-410/420 isolation valve	open			open	closed
V-434	Sites 2 and 12 air bleed valve	open			open	open
V-433	Sites 2 and 12 isolation valve	open			open	closed
V-432	Eastern injection isolation valve	closed			closed	closed
V-513	P-510 4-inch gate valve	open			open	closed
V-514	P-510 2-inch drain valve	closed			closed	open
V-512A	P-510 pressure gauge valve	open			open	closed
V-512B	P-510 pressure switch valve	open			open	closed
V-517	P-510 4-inch check valve	open			open	closed
V-518	P-510 2-inch drain valve	closed			closed	open
V-519	P-510 4-inch butterfly valve	open			open	closed
V-523	P-520 4-inch gate valve	open			open	closed
V-524	P-520 2-inch drain valve	closed			closed	open
V-522A	P-520 pressure gauge valve	open			open	closed
V-522B	P-520 pressure switch valve	open			open	closed
V-527	P-520 4-inch check valve	open			open	closed
V-528	P-520 2-inch drain valve	closed			closed	open
V-529	P-520 4-inch butterfly valve	open			open	closed
V-540	P-510/520 isolation valve	open			open	closed
V-546	Southwestern air bleed valve	open			open	open
V-542	Southwestern isolation valve	open			open	closed

Appendix D 7
GRANULAR ACTIVATED CARBON VALVE POSITIONING
Operable Unit 2 Groundwater Remedy
Former Fort Ord, California

Valve	Description	Series Flow		Parallel Flow	TK-600A Backwash, Lowflow and Online TK-600B	TK-600A Backwash, Highflow and Offline TK-600B	Longterm Shutown Valve Position
		TK-600A lead	TK-600B lead				
V-601	Eastern GAC[a] manifold valve	open	closed	open	closed	closed	closed
V-602	Eastern GAC manifold valve	closed	open	open	open	closed	closed
V-603	Eastern GAC manifold valve	closed	closed	closed	open	open	closed
V-604	Eastern GAC manifold valve	closed	closed	closed	closed	closed	closed
V-605	Eastern GAC manifold valve	closed	open	open	closed	closed	closed
V-606	Eastern GAC manifold valve	open	closed	open	closed	closed	closed
V-607	Eastern GAC manifold valve	closed	open	closed	closed	closed	closed
V-608	Eastern GAC manifold valve	open	closed	closed	closed	closed	closed
V-609	Eastern GAC manifold valve	open	closed	closed	open	open	closed
V-610	Eastern GAC manifold valve	closed	open	closed	open	closed	closed
V-611	Eastern GAC backwash influent	closed	closed	closed	closed	open	closed
V-612	Sample port valve	closed	closed	closed	closed	closed	closed
V-613	Sample port valve	closed	closed	closed	closed	closed	closed
V-614A	Eastern pressure differential valve	open	open	open	open	closed	open
V-614B	Eastern pressure differential valve	open	open	open	open	closed	open
V-615A	Eastern pressure differential valve	open	open	open	open	closed	open
V-615B	Eastern pressure differential valve	open	open	open	open	closed	open
V-616	Eastern GAC Rupture Disc	closed	closed	closed	closed	closed	closed
V-617	Eastern GAC Rupture Disc	closed	closed	closed	closed	closed	closed
V-618	Sample port valve to LLNL	closed	closed	closed	closed	closed	closed
V-619	Sample port valve to LLNL	closed	closed	closed	closed	closed	closed
V-626A	TK-600A air/water valve	closed during normal operation					closed
V-627A	TK-600A GAC unload valve						closed
V-626B	TK-600B air/water valve						closed
V-627B	TK-600B GAC unload valve						closed
V-633A	TK-600A Sample port valve						closed
V-633B	TK600B Sample port valve						closed
V-634A	TK-600A air/water valve						closed
V-635A	TK-600A GAC unload valve						closed
V-636A	TK-600A air/water valve						open
V-634B	TK-600B air/water valve						open
V-635B	TK-600B GAC unload valve						closed
V-636B	TK-600B air/water valve						closed

Appendix D 7
GRANULAR ACTIVATED CARBON VALVE POSITIONING
Operable Unit 2 Groundwater Remedy
Former Fort Ord, California

Valve	Description	Series Flow		Parallel Flow	TK-600D Backwash, Lowflow and Online TK-600B	TK-600C Backwash, Highflow and Offline TK-600B	Longterm Shutown Valve Position
		TK-600D lead	TK-600C lead				
V-630C	Northern GAC[a] sampling valve	closed during normal operation					closed
V-631C	Northern GAC sampling valve						closed
V-632C	Northern GAC sampling valve						closed
V-630D	Northern GAC sampling valve						closed
V-631D	Northern GAC sampling valve						closed
V-632D	Northern GAC sampling valve						closed
V-634	TK-600D air bleed valve						open
V-635	TK-600D air/water valve						closed
V-636	TK-600D air/water valve						closed
V-644	TK-600C air bleed valve						open
V-645	TK-600C air/water valve						closed
V-646	TK-600C air/water valve						closed
V-651	Northern GACa manifold valve	open	closed	open	closed	closed	closed
V-652	Northern GAC manifold valve	closed	open	open	open	closed	closed
V-653	Northern GAC manifold valve	closed	closed	closed	open	open	closed
V-654	Northern GAC manifold valve	closed	closed	closed	closed	closed	closed
V-655	Northern GAC manifold valve	closed	open	open	closed	closed	closed
V-656	Northern GAC manifold valve	open	closed	open	closed	closed	closed
V-657	Northern GAC manifold valve	closed	open	closed	closed	closed	closed
V-658	Northern GAC manifold valve	open	closed	closed	closed	closed	closed
V-659	Northern GAC manifold valve	open	closed	closed	open	open	closed
V-660	Northern GAC manifold valve	closed	open	closed	open	closed	closed
V-661	Northern GAC backwash influent	closed	closed	closed	closed	open	closed
V-662	Sample port valve	closed	closed	closed	closed	closed	closed
V-663	Sample port valve	closed	closed	closed	closed	closed	closed
V-664A	Northern pressure differential valve	open	open	open	open	closed	open
V-664B	Northern pressure differential valve	open	open	open	open	closed	open
V-665A	Northern pressure differential valve	open	open	open	open	closed	open
V-665B	Northern pressure differential valve	open	open	open	open	closed	open
V-666	Northern GAC Rupture Disc	closed	closed	closed	closed	closed	closed
V-667	Northern GAC Rupture Disc	closed	closed	closed	closed	closed	closed
V-668	Sample port valve to LLNL	closed	closed	closed	closed	closed	closed
V-669	Sample port valve to LLNL	closed	closed	closed	closed	closed	closed
V-666C	TK-600C air/water valve	closed during normal operation					closed
V-667C	TK-600C GAC unload valve						closed
V-668C	TK-600C air/water valve						closed
V-666D	TK-600D air/water valve						closed
V-667D	TK-600D GAC unload valve						closed
V-668D	TK-600D air/water valve						closed
V-675C	TK-600C GAC unload valve						closed
V-676C	TK-600C air/water valve						closed
V-675D	TK-600D GAC unload valve						open
V-676D	TK-600D air/water valve						open

GAC[a] granular activated carbon

Appendix D 8
SPARE PARTS INVENTORY LIST
Operable Unit 2 Groundwater Remedy
Former Fort Ord, California

There were no identified spare parts purchased as part of the Operable Unit 2 System Expansion. Critical components, such as in-line process pumps, are provided as 100 percent spares. Non-critical components are readily available and may be taken off-line and refurbished or replaced as necessary. However, as the Groundwater Treatment Operator acquires a spare parts inventory, this appendix reserves space for the listing.

APPENDIX E

MANUFACTURERS' WARRANTIES

Appendix E
STATEMENT & WARRANTY INDEX
Operable Unit 2 Groundwater Remedy
Former Fort Ord, California

Section	Equipment	Vendor	Manufacturer/Supplier	Submittal	Subject	Remarks
13.0	Concrete Vaults & Lids:	Santa Rosa Cast Products	Nystrom Building Products	SD-13	Aluminum Lid Warranty	03/16/00
			Nystrom Building Products	SD-13	5 Year Performance Standard	03/16/00
			Santa Rosa Cast Products	SD-13	Certificate of Compliance	SF-27
23.0	Fire Alarm System	Fire-Lite Alarms, Inc.	Fire-Lite Alarms, Inc.	SD-13	Limited Warranty	
25.0	Gaskets, Viton	Down Time	Pacific Mechanical Supply	SD-13	Cert of Conformance / Compliance	
26.0	Geotextile	FML Linings, Inc.	Amoco Fabrics and Fibers Co.	SD-13	QC Certificate	
27.0	Granular Activated Carbon	US Filter/Westates	US Filter/Westates	SD-13	Buy American Act Certification	
				SD-13	Warranty Statement	1 year parts, 90 days labor
48.0	Programmable Logic Controller Modifications	Superior Electric	Superior Electric	SD-08	Guarantee for PLC Modifications	2/14/00
			Automation Direct	SD-13	Standard License	
52.0	Pump, Submersible	Pac Machine Co., Inc.	Pac Machine Co., Inc.	SD-08	Pump Guarantee	
56.0	Supervisory Control and Data Acquisition (SCADA)	Antenna	PolyPhaser Corporation	SD-06 &13	IS-B50 Series Impulse Suppressor Safety, Installation & Warranty	Eng-F-016 12/97
		Antenna	Maxrad, Inc.	SD-06 & 13	MBS-800 Base Station Adapter Kit Installation and Warranty	MIS-MBSADAPTER
		Operator Interface	Intel	SD-13	Three Year Processor Warranty	P/N 00706 A00
61.0	Transformer, at Imjin/Abrams Wells	Pacific Gas and Electricity (PG&E)	Pacific Gas and Electricity (PG&E)	SD-13	Agreement to Perform Work	5/9/00
62.0	Transformer, at Landfill Wells	Pacific Gas and Electricity (PG&E)	Pacific Gas and Electricity (PG&E)	SD-13	Agreement to Perform Work	5/9/00
64.0	Valves, at Infiltration Galleries	Santa Fe Industrial Products	Bermad	SD-08	Buy American Act Compliance	6/9/00
65.0	Valves, at Isolation Vaults	Santa Fe Industrial Products	USACE	SD-08	Waiver to Purchase Non Buy American	SPK-2-11-006, 05/06/00
66.0	Variable Frequency Drives	Avatar Engineering	Danfoss Electronic Drives	SD-13	Standard Warranty	
67.0	Well Caps	Santa Fe Industrial Products	Santa Fe Industrial Products	SD-08	Buy American Statement	Letter 6/12/00

FORT ORD

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1	Dave Eisen	Department of the Army USACE	BRAC, Bldg. #4463 Gigling Road	Monterey, CA	93944-5004	Yes
1	Edwin E. Wing	IT Corporation	4005 Port Chicago Highway	Concord, CA	94520-1120	Yes
1	Peter Kelsall	IT Corporation	9201 East Dry Creek Road	Centennial, CO	80112	Yes
1	Mike Oberwise	IT Corporation	P.O. Box 1698	Marina, CA	93933	Yes
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1	Jeff Raines	Tech Law, Inc.	90 New Montgomery Street Suite 1010	San Francisco, CA	94105	No
1	Grant Himebaugh	California Regional Water Quality Control Board	81 Higuera Street, Suite 200	San Luis Obispo, CA	93401-5414	No
1*	Ron Hayashi	IT Corporation	4005 Port Chicago Highway	Concord, CA	94520-1120	Yes
1*	Kara Romero	AHTNA	OU2 Groundwater Treatment Plant	Fort Ord, CA	93933	Yes
1	Don Smallbeck	Harding Lawson Associates	90 Digital Drive	Nevato, CA	94949	Yes
3	Tina Fischl	Administrative Records	BRAC, Bldg #4463 Gigling Road	Monterey, CA	93944-5004	No
1*	Project File	IT Corporation	PO Box 1698	Marina, CA	93933	Yes
1	Program File (Kathy Grider)	IT Corporation	4005 Port Chicago Highway	Concord, CA	94520-1120	Yes

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Approved: _____

Glen Mitchell, USACE Project Manager

TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE *(Read Instructions on the reverse side prior to initiating this form)*	DATE August 29, 2002	TRANSMITTAL NO.: 041

Section I - REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS *(This Section will be initiated by the contractor)*

TO: Doug Stanley U.S. Army Corps of Engineers 1325 "J" Street Sacramento, CA 95814-2922	FROM: Peter Kelsall IT Corporation P.O. Box 1698 Marina, CA 93933-1698	CONTRACT NO. DACW05-96-D-0011 T.O. # 011 WAD # 02	CHECK ONE: X THIS IS A NEW TRANSMITTAL THIS IS A RESUBMITTAL OF TRANSMITTAL
SPECIFICATION NO. (Cover only one section with each transmittal)	PROJECT TITLE AND LOCATION: FORMER FORT ORD, CALIFORNIA		

ITEM NO a.	DESCRIPTION OF ITEM SUBMITTED *(Type, size, model number, etc.)* b.	MFG. OR CONTR. CAT., CURVE DRAWING OR BROCHURE NO. *(See Instruction No. 8)* c.	NO. OF COPIES d.	CONTRACT REFERENCE DOCUMENT SPEC. PARA. NO. e.	 DRAWING SHEET NO. f.	FOR CONTRACTOR USE CODE g.	VARIATION *(See Instruction No. 6)* h.	FOR C E USE CODE i.
052	Draft Final, Operation and Maintenance Manual, Operable Unit 2, Groundwater Remedy Expansion, Former Fort Ord, California, Revision 1 (For Your Information Only)	N/A	19	SOP17		F		
053	DRF for the Draft Final, Operation and Maintenance Manual, Operable Unit 2, Groundwater Remedy Expansion, Former Fort Ord, California, Revision 1 (For Your Information Only)	N/A	19	SOP17		F		

REMARKS
cc:
See Distribution List

CONTRACTOR QUALITY CONTROL SYSTEMS MANAGER
IT CORPORATION

___✓___ Approved
_____ Approved with corrections as noted on submittal data and/or attached sheet(s).

SIGNATURE: _____
TITLE: CONTRACTOR QUALITY CONTROL SYSTEM MANAGER

I certify that the above submitted items have been reviewed in detail and are correct and in strict conformance with the contract drawings and specifications except as otherwise stated.

IT CORPORATION

_____ /PETER KELSALL
NAME AND SIGNATURE OF CONTRACTOR

Section II - APPROVAL ACTION

ENCLOSURES RETURNED (List by Item No.)	NAME, TITLE AND SIGNATURE OF APPROVING AUTHORITY	DATE