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FINAL OPERATION AND MAINTENANCE MANUAL FOR GROUNDWATER RECOVERY AND TREATMENT SYSTEM VOLUME 1 OF 2 NAS FORT WORTH TX

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NAVAL AIR STATION FORT WORTH JRB CARSWELL FIELD TEXAS

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HYDRO GeoLogic INC.

FINAL OPERATION AND MAINTENANCE MANUAL FOR THE GROUNDWATER RECOVERY AND TREATMENT SYSTEM NAS FORT WORTH JRB, TEXAS

VOLUME I OF II

Prepared for

U.S. Air Force Center for Environmental Excellence
Brooks Air Force Base, Texas

Contract Number F41624-95-D-8005

February 2000

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FINAL OPERATION AND MAINTENANCE MANUAL FOR THE GROUNDWATER RECOVERY AND TREATMENT SYSTEM NAS FORT WORTH JRB, TEXAS

Prepared for

U.S. Air Force Center for Environmental Excellence
3207 North Road
Brooks Air Force Base, Texas 78235-5363

Contract Number F41624-95-D-8005

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This document presents the Final Operation and Maintenance Manual for the groundwater recovery and treatment system at NAS Fort Worth JRB, Texas.

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PREFACE

HydroGeoLogic, Inc. (HydroGeoLogic) was contracted on September 19, 1998, to perform a Focused Feasibility Study and Interim Remedial Action for the containment of the Air Force Plant 4 (AFP 4) trichloroethylene (TCE) groundwater plume at the Naval Air Station (NAS) Fort Worth Joint Reserve Base (JRB), Texas. Work is being conducted under Contract Number F41624-95-D-8005, Delivery Order Number 0019.

Responsible key HydroGeoLogic personnel are as follows:

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The period of performance for this delivery order is from September 19, 1998, to December 30, 1999. This contract is being administered by Ms Sarah J. Byrum, U.S. Air Force, Headquarters Human Systems Center, located at 3207 North Road, Brooks AFB, TX 78235-5363. The Contracting Officer's Representative is Mr. Don Ficklen (210/536-5290) located at HQ AFCEE/ERD, 3207 North Road, Brooks AFB, Texas 78235-5363.

684 5

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS

AFB	Air Force Base
AFP 4	Air Force Plant 4
DCE	dichloroethylene
gpm	gallons per minute
IRA	Interim Remedial Action
JRB	Joint Reserve Base
MCL	Maximum Contaminant Level
mg/L	milligrams per liter
MGD	million gallons per day
NAS	Naval Air Station
O&M	Operations and Maintenance
OSHA	Occupational Safety and Health Administration
PLC	programmable logic control
psi	pounds per square inch
PVC	polyvinyl chloride
QAPP	Quality Assurance Project Plan
SWMU	solid waste management unit
TCE	trichloroethylene
TNRCC	Texas Natural Resource Conservation Commission
TOC	total organic carbon
U.S. EPA	United States Environmental Protection Agency
VOCs	volatile organic compounds

FINAL
OPERATION AND MAINTENANCE MANUAL
FOR THE
GROUNDWATER RECOVERY AND TREATMENT SYSTEM
NAS FORT WORTH JRB, TEXAS

1.0 INTRODUCTION TO THE GROUNDWATER RECOVERY AND TREATMENT SYSTEM

This manual has been prepared for the operation and maintenance (O&M) personnel operating the Air Force Groundwater Recovery and Treatment System located at the Naval Air Station Fort Worth Joint Reserve Base (NAS Fort Worth JRB). This system was installed by the U.S. Air Force in 1993 as an interim remedial action (IRA) for the cleanup of groundwater contamination originating at Air Force Plant 4 (AFP 4), located west of the former Carswell Air Force Base (AFB), since renamed NAS Fort Worth JRB. Figure 1.1 shows the location of NAS Fort Worth JRB, Figure 1.2 shows the base map, and Figure 1.3 shows the treatment system location.

The groundwater recovery and treatment system began operation in December 1993. Since the initial startup, the following additions have been made to the system:

- four recovery wells (CAR-RW9, CAR-RW10, CAR-RW11, and CAR-RW12);
- a sulfuric acid feed system;
- a flow equalization system;
- treatment skid 6 with two carbon adsorbers; and
- an effluent discharge pipe to the golf course pond.

No as-built drawings were prepared documenting these process changes. As a result, the locations of all subsurface piping and conduit are approximate.

The manual is intended to serve both as a training resource and as a guide to assist in the day-to-day O&M of the treatment facility. This manual fulfills this goal by: (1) acquainting personnel with the overall capabilities of the treatment equipment; (2) instructing personnel on the proper operation and routine maintenance of each system; (3) providing additional instructions for major maintenance, emergency operation, and shutdown; and, (4) providing records and forms to track operations and equipment maintenance. For ease of use, as-built drawings are presented in Appendix E (at the end of this volume).

The O&M manual provides descriptions of the fundamental concepts related to the treatment facility. Through frequent and routine use of the manual, plant personnel will become thoroughly familiar with the equipment and operations presented and will be able to identify problems and determine a course of action for their solution. However, no manual, regardless of how complete or well prepared it is, can replace good judgment and field experience on the part of plant personnel in ensuring the plant's successful operation.

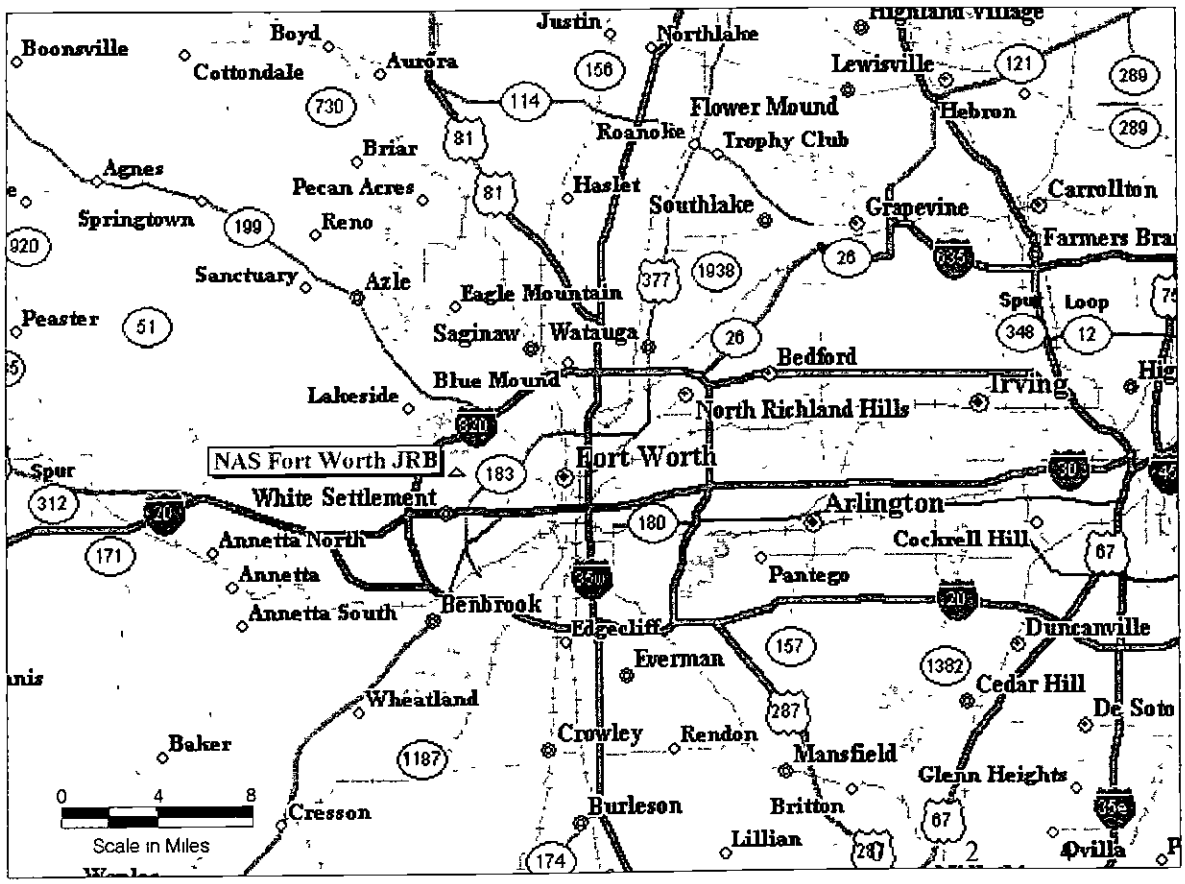

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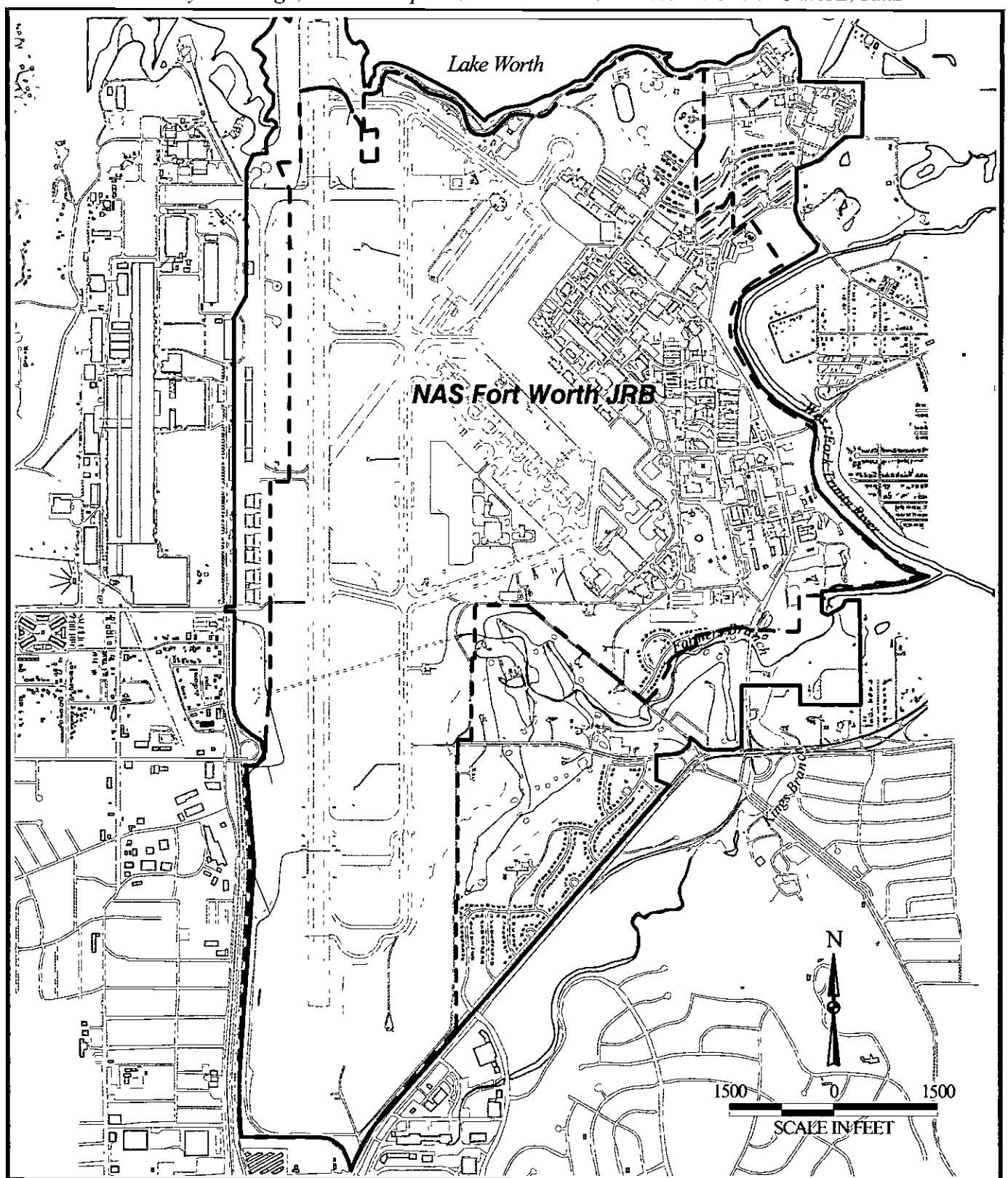
Figure 1.1
Site Location Map
NAS Fort Worth JRB, Texas



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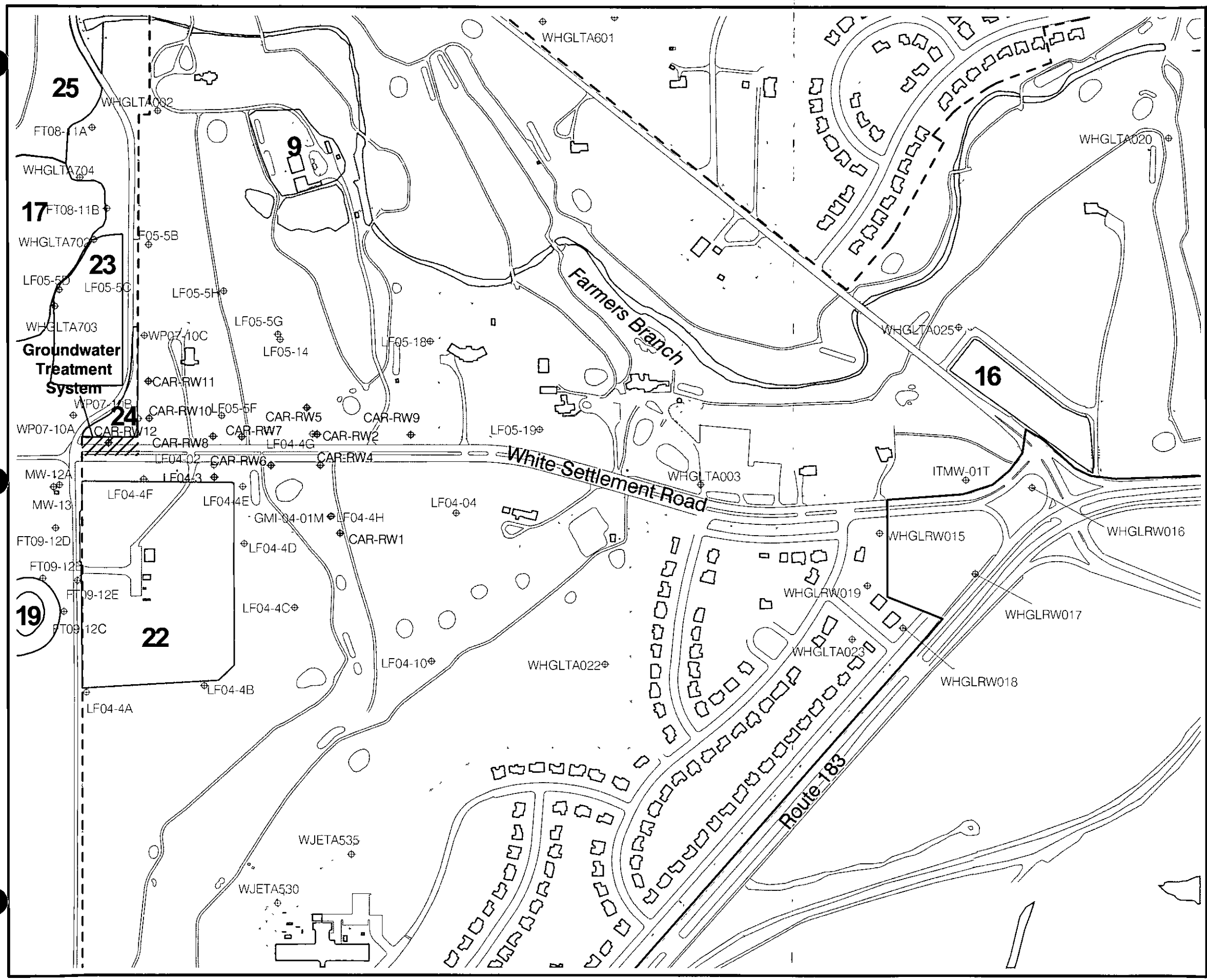
Legend

- NAS Fort Worth JRB Boundary
- Former Carswell AFB Boundary

Figure 1.2

BaseMap
NAS Fort Worth JRB, Texas



HydroGeoLogic, Inc.—Final Operation and Maintenance Manual NAS Fort Worth JRB, Texas

Figure 1.3
Groundwater Treatment System NAS Fort Worth JRB, Texas

U.S. Air Force Center for Environmental Excellence

Legend

- NAS Fort Worth JRB (Carswell Field)
- Former Carswell Air Force Base
- Recovery Wells
- Monitoring Wells
- Solid Waste Management Unit
  - SWMU 17 (Landfill No. 7)
  - SWMU 19 (Fire Training Area No. 2)
  - SWMU 22 (Landfill No 4)
  - SWMU 23 (Landfill No. 5)
  - SWMU 24 (Waste Burial Area No 7)
  - SWMU 25 (Landfill No. 8)
- Area of Concern
  - AOC 9 (Golf Course Maintenance Yard)
  - AOC 16 (Family Camp)

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Map Source HGL GIS database

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Operators should also utilize other resources available to them when making operational decisions. These include construction plans and specifications, plus vendor supplied materials. References to these materials will be made throughout the O&M manual. Manufacturers' O&M manuals have been included as Appendix F (Volume II) to this manual. A number of manufacturers' O&M manuals could not be obtained because the companies are no longer in business.

1.1 PURPOSE OF THE FACILITY

The U.S. Air Force implemented an IRA to mitigate the effects of trichloroethylene (TCE) contamination in the groundwater in the vicinity of AFP 4 and NAS Fort Worth JRB. The IRA included the operation of a groundwater recovery and treatment system located immediately downgradient of solid waste management units (SWMUs) 22 and 23 (Landfills 4 and 5) at NAS Fort Worth JRB.

In July 1996, the final Record of Decision for AFP 4 (U.S. Air Force, 1996) was issued and states that the U.S. Air Force may operate the groundwater recovery and treatment system as a corrective action if migration of contamination in the groundwater appears to be moving off site at concentrations above maximum contaminant levels (MCLs). The remedial action objective is to prevent groundwater that has contamination above MCLs from leaving Federal property boundaries.

1.2 GENERAL PROCESS DESCRIPTION

This section provides a general overview of the Groundwater Recovery and Treatment System. More detailed descriptions of the major subsystems in the treatment system are presented in Section 2.0. Drawing 1 in Appendix E shows the groundwater recovery and treatment system plan. Drawing 2 in Appendix E presents a block process flow diagram of the treatment process.

Groundwater is extracted from 11 recovery wells located at and east of the treatment system. The locations of the recovery wells were selected to provide hydraulic containment for the area of highest TCE concentration downgradient of Landfills 4 and 5. Multi-stage submersible pumps are used to pump groundwater out of the wells to an equalization tank.

Before the groundwater reaches the equalization tank, sulfuric acid is added to lower the influent pH. This pH adjustment is required to minimize the potential for calcium carbonate scaling within the treatment system. The equalization tank is designed to level out the hydraulic loads to the treatment skids. The equalization tank effluent is pumped to six treatment skids using two equalization tank transfer pumps. Two additional pumps provide backup for the transfer pumps.

The six treatment skids have a total capacity of approximately 150 gallons per minute (gpm), and are used to treat the groundwater prior to discharge to a nearby golf course pond. Each treatment skid is equipped with two low-profile air stripping units, one bag filter, and one liquid-phase carbon adsorber. Treatment skid 6 includes two liquid-phase carbon adsorbers, which can be operated in series or in parallel.

The two low-profile air stripping units are operated in series to remove volatile organic compounds (VOCs) from the groundwater. Groundwater enters the units from the top and flows across each tray, while forced air flows upward "stripping" the VOCs from the water. Air is supplied to the units from the bottom by regenerative blowers (one for each air stripper).

Treated groundwater from the air strippers flows by gravity to an air stripper sump located below the air strippers. The groundwater is pumped from the air stripper sump through a bag filter and liquid-phase carbon adsorber(s). The treated groundwater from the treatment skids is discharged to the effluent discharge piping, which is metered and discharged to a storm sewer line to the golf course pond.

2.0 MAJOR SUBSYSTEMS PROCESS DESCRIPTION AND EQUIPMENT

This section provides a detailed description of the major subsystems in the treatment facility. A list of equipment used in the groundwater recovery and treatment system is presented in Table 2.1. Pertinent O&M information on the equipment is included in Appendix F.

The major subsystems that comprise the treatment facilities are as follows:

- groundwater recovery system
- sulfuric acid feed system
- flow equalization system
- groundwater treatment system

2.1 GROUNDWATER RECOVERY SYSTEM

Submersible pumps extract groundwater from 11 recovery wells and transport the untreated groundwater to the equalization tank. The locations of the recovery wells are shown on Drawing 1 in Appendix E.

The submersible pumps are vertical multi-stage units supported by 1-inch diameter stainless steel piping. Ten of the eleven recovery wells are constructed of 6-inch diameter type 304 stainless steel. Recovery well LF04-03 is constructed of 6-inch diameter schedule 80 polyvinyl chloride (PVC). The recovery wells were installed to bedrock ranging from 25 to 40 feet below ground surface. The screened portion of the wells ranges from 10 to 20 feet above bedrock. Well completion information for the groundwater recovery wells is summarized in Table 2.2. Recovery well valve pit construction detail is presented in Figure 2.1.

Electronic or turbine flow meters are used to measure flow from each recovery well. The electronic flow meter is equipped with a flow totalizer and digital indicator for instantaneous flow. Control valves located in the recovery well valve pit regulate the flow from each well.

Groundwater from the recovery wells is transported in two 3-inch diameter PVC pipelines buried in trenches located on each side of White Settlement Road (see Drawing 1, Appendix E). The piping from each trench is joined to a header in the facility yard next to treatment skid 5. The pipe is outfitted with a basket strainer to remove large solids.

2.2 SULFURIC ACID FEED SYSTEM

Sulfuric acid is delivered in tank trucks and unloaded into 1,000-gallon sulfuric acid storage tank T-202 (see Drawing 2 in Appendix E). Currently one delivery of sulfuric acid is required every 2 months. Acid unloading is accomplished via an unloading pump mounted on the delivery truck and operated by the driver.

Table 2.1
Groundwater Recovery and Treatment System Equipment List
NAS Fort Worth JRB, Texas

Equipment	Manufacturer	Model/Part Number	Qty.
Groundwater Recovery System			
Recovery Well Vault			
Level Controller	Warrick	16MB1D0	11
Submersible Pump	Grundfos	25S	11
Flow Monitor/Totalizer	Great Lakes Instruments	675F	11
Flow Sensor	Great Lakes Instruments	F1A11A1T	8
Turbine Flow Meter	Master Meter	NA	3
Flow Control Valve	George Fisher	NA	11
Recovery Well Control Panel			
Nema 12 Enclosure	Hoffman	A161406CH	11
Sub-Panel	Hoffman	A16P14	11
Power Disconnect	Telemecanique	XF304BY	11
H-O-A Selector Switches (Switch)	Telemecanique	ZB2-BD3	11
H-O-A Selector Switches (Block)	Telemecanique	ZB2-BE101	22
H-O-A Selector Switches (Name Plate)	Telemecanique	ZB2-BY2387	11
Pilot Light (Light)	Telemecanique	ZB2-BV03	11
Pilot Light (Base)	Telemecanique	ZB2-BV6	11
Transformer	SquareD	SFA65	11
Motor Starter (Contactor)	Telemecanique	LC1-D0910	11
Motor Starter (Overload)	Telemecanique	LR2-D13	11
Sulfuric Acid Feed System			
Acid Storage Tank	Chem-Tainer Industries	69CVDC	1
Acid Feed Pump	Milton Roy LMI	C721	1
Static Mixer	unknown	NA	1
pH Controller	Milton Roy LMI	DP-5000-1B-0	1
pH Transmitter	Great Lakes Instruments	Model 692P	2
pH Sensor	Great Lakes Instruments	LCP pH Sensor, K6028P0	3
pH preAmp	Milton Roy LMI	33217A	1
pH Sensor	Milton Roy LMI	NA	1
Flow Equalization System			
Equalization Tank	Snyder-Crown Ind. Prods.	High Density Polyethylene	1
Equalization Tank Transfer Pump	Grundfos	EP1505050 U-A-BBVN	4
Level Switch	GEMS	35651	8
Overflow Sump Pump	ABS Pumps	LON0712	1

Table 2.1 (continued)
Groundwater Recovery and Treatment System Equipment List
NAS Fort Worth JRB, Texas

Equipment	Manufacturer	Model/Part Number	Qty.
Equalization Control Panel			
Enclosure	Hoffman	A302406CHNF	1
Green Light (Light)	Cutler Hammer	E22D120	4
Green Light (Lens)	Cutler Hammer	E22H3	4
Sub Panel	Hoffman	36P24	1
Red Light (Light)	Cutler Hammer	E22D120	1
Red Light (Lens)	Cutler Hammer	E22H2	1
H-O-A Selector Switch (Contact)	Cutler Hammer	E22B2	4
H-O-A Selector Switch (Switch)	Cutler Hammer	E22VBG1	4
Disconnect	Cutler Hammer	C36N40	1
Contactor	Cutler Hammer	CE15CN53	4
Thermal Overload	Cutler Hammer	C316FNA3	4
Control Relay	Omron	LY2AC120	2
Control Relay	Omron	MY4AC120	2
Transformer	Acme	TA-2-81212	1
Groundwater Treatment System			
Air Stripper	REMSYS	LP2-HF	12
Air Blower	EG&G Rotron	DR606K72M	12
Air Stripper Sump Pump	Grundfos	CR4-100, V-G-A-BV	6
Bag Filter	R-P Products	SS4-224-LP	6
Carbon Adsorber	REMSYS	CC-1000-CS	7
Level Switch	GEMS	35651	24
Solenoid Valve	unknown	85-016-00.8404	6
Treatment Skid Control Panel			
Enclosure Nema 12	Hoffman	A-30240BLP	12
Sub Panel	Hoffman	A-36P24	12
Photoholic Gauge	Dwyer	A-3080C	12
Totalizer/Flow Monitor	Great Lakes Instruments	675F	6
Flow Sensor	Great Lakes Instruments	F1A11A1	6
Control Relay	Omron	LY-2AC120	18
Control Relay	IDEC	RH3B-U-120VAC	6
Control Relay	IDEC	RH2B-U-120VAC	12
Timer Relay	IDEC	RTE-P1-1-AC120V	6
Contactor	Telemecanique	LC1-D0910	12
Overload	Telemecanique	LR2-D13	12
Contactor	MTE	MAX 020440	6
Overload	MTE	AXTO 5.4-8 0	6

Table 2.1 (continued)
Groundwater Recovery and Treatment System Equipment List
NAS Fort Worth JRB, Texas

Equipment	Manufacturer	Model/Part Number	Qty.
Fused Disconnect	Telemecanique	D115D1	6
Control Transformer	SquareD	1 Phase 480VAC/120VAC .1kVA	6
H-O-A Selector Switch (Switch)	Telemecanique	ZB2-BD3	6
H-O-A Selector Switch (Block)	Telemecanique	ZB2-BE101	12
H-O-A Selector Switch (Name Plate)	Telemecanique	ZB2-BY2387	6
Off-On Selector Switch (Switch)	Telemecanique	ZB2-BD2	12
Off-On Selector Switch (Block)	Telemecanique	ZB2-BZ101	12
Off-On Selector Switch (Name Plate)	Telemecanique	ZB2-BY2367	12
Red Pilot Light (Light)	Telemecanique	ZB2-BV04	12
Red Pilot Light (Base)	Telemecanique	ZB2-BV6	12
Green Pilot Light (Light)	Telemecanique	ZB2-BV03	18
Green Pilot Light (Base)	Telemecanique	ZB2-BV6	18
Enclosure	Hoffman	A201610LP	6
Sub Panel	Hoffman	20P16	6
Pressure Switches	Omega	PSW 100 (2 per skid)	12
Treatment Skid Drain System			
Sump Pump	Flotec	FPOSI 250X	1
Float Switch	Omega	PSW 100 Series	1
Main Control Panel			
Enclosure	Hoffman	A-36H3012SS 6LP	1
Sub Panel	Hoffman	A-36P30	1
Programmable Logic Controller (PLC)	Allen-Bradley	SLC500 #1747-L40A	1
Battery for PLC	Allen-Bradley	1747-BA	1
3 Position Selector Switch	Allen-Bradley	800T-J2A	11
Pilot Light	Allen-Bradley	800T-PT16R	11
Control Relay	IDEC	RR3PA-V2AC 120VAC	16
Control Relay	Omron	LY2AC120	7
Control Relay	Omron	MY4AC120	1
Contactor	General Electric	CC7RA-40	1
O&M Trailer and Influent/Effluent Piping			
Autodialer	RACO	Verbatim Series VSS Basic	1
Effluent Flow Monitor/Totalizer	Great Lakes Instruments	675F	1
Effluent Flow Sensor	Great Lakes Instruments	F1A11A1	1

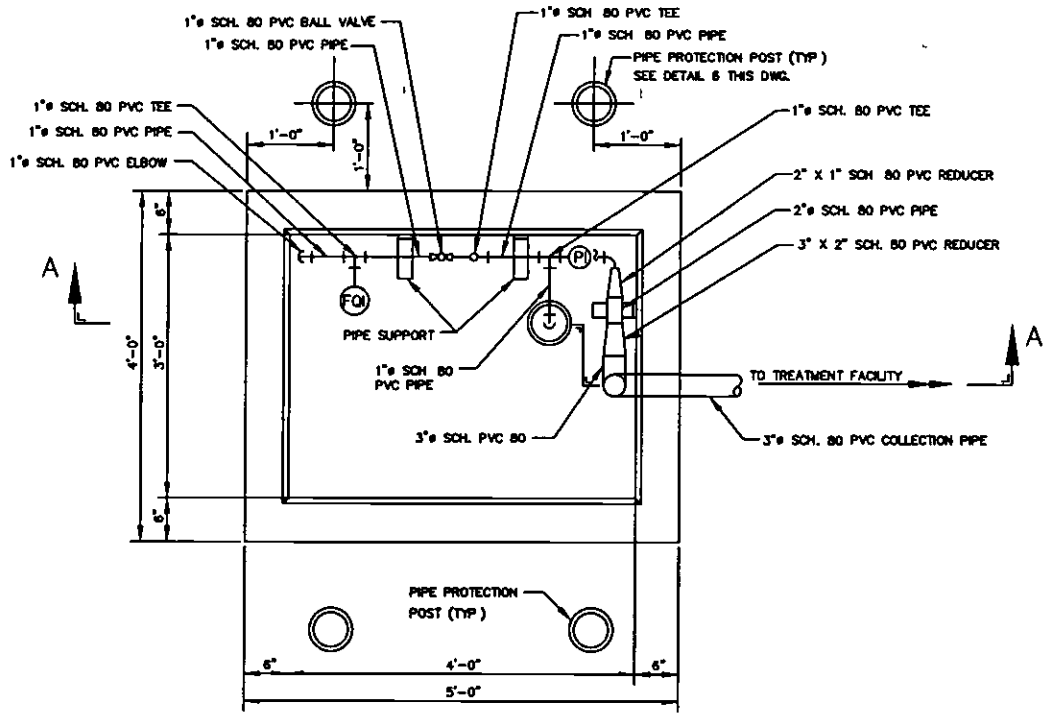
Table 2.1 (continued)
Groundwater Recovery and Treatment System Equipment List
NAS Fort Worth JRB, Texas

Equipment	Manufacturer	Model/Part Number	Qty.
Turbine Flow Meter (effluent piping)	Master Meter	NA	2
Basket Strainer (influent piping)	Mueller	883A	1

Notes:
H-O-A Hand operation, off, auto operation
NA Not available

Table 2.2
Groundwater Recovery Wells
NAS Fort Worth JRB, Texas

Well	Screen Size (inches)	Casing Diameter (inches)	Total Depth (feet below ground surface)	Screened Interval (feet below ground surface)	Screened Length (feet)
CAR-RW1	0 020	6	34.1	19 - 34	15.0
CAR-RW2	0 020	6	34.8	19 5 - 34.5	15.0
LF04-03	0.020	6	37 4	22.4 - 36.7	14.3
CAR-RW4	0.010 (10′) 0 020 (5′)	6	33.0	17 - 32	15 0
CAR-RW5	0.020	6	31.8	16.2 - 31.2	15.0
CAR-RW6	0.010	6	33.0	13 - 33	20.0
CAR-RW8	0.010	6	37 0	22 - 37	15.0
CAR-RW9	0.020	6	26.3	14.75 - 24.75	10 0
CAR-RW10	0.010	6	35.5	24.75 - 34.75	10 0
CAR-RW11	0 010	6	35.5	24.75 - 34.75	10 0
CAR-RW12	0 010	6	40.5	24 67 - 39.67	15.0



DETAIL 1
PLAN – RECOVERY WELL VALVE PIT
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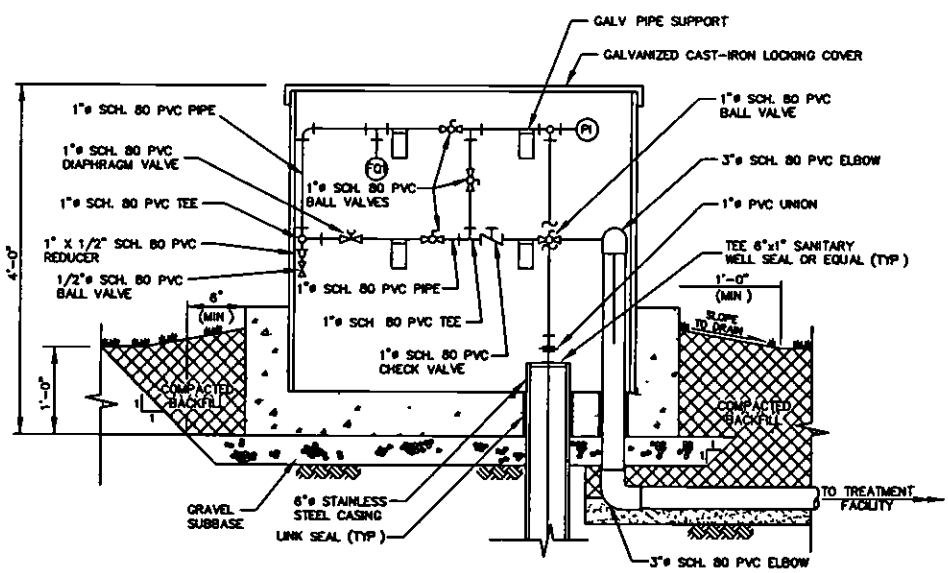

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Figure 2.1
Groundwater Recovery
Well Valve Pit Detail
NAS Fort Worth JRB, Texas

Calibration marks are provided on the sulfuric acid tank so that the level can be visibly determined. The sulfuric acid metering pump P-205, pumps 93 percent sulfuric acid from tank T-202 to the groundwater influent line. The pump is equipped with an internal (manual)/external (automatic) selector switch. In automatic mode, the pump speed is adjusted by a pH controller with a pH probe located downstream in the groundwater influent line. The pH controller, which controls the sulfuric acid feed to the influent groundwater, is located in the O&M trailer.

Another pH measurement element is located in the effluent line from the treatment system. This pH element is equipped with an indicating recorder located in the O&M trailer.

The acid storage and feed skid AS-202 provides secondary containment to prevent the release of sulfuric acid to the environment. A high-level switch in the containment skid is used to shut down all recovery well submersible pumps.

2.3 FLOW EQUALIZATION SYSTEM

The equalization tank T-201 is a 2,000-gallon high-density polyethylene tank designed to provide flow equalization between the recovery wells and the treatment skids. Water levels in the equalization tank are controlled by seven level switches. Groundwater is pumped from the equalization tank to six treatment skids by four equalization tank transfer pumps, numbered P-201 through P-204.

Rainwater and untreated groundwater from the equalization tank overflow are collected in flow equalization skid ES-201. A level-activated control system is used to operate submersible pump P-207, located within the skid. This pump discharges into equalization tank T-201. Flow equalization skid ES-201 is also equipped with a high-level switch that shuts down all recovery well pumps when activated.

2.4 GROUNDWATER TREATMENT SYSTEM

Six treatment skids are used to treat the groundwater prior to discharge to the golf course pond. Each treatment skid can treat approximately 25 gpm. The total treatment capacity of the system is approximately 150 gpm. Figure 2.2 presents a typical treatment skid layout with one carbon vessel. Each treatment skid is equipped with the following items:

- a two-stage low-profile air stripper with sump
- a transfer pump
- a bag filter
- a liquid-phase carbon adsorber
- ancillary equipment

The following sections provide details of the equipment and its operation.

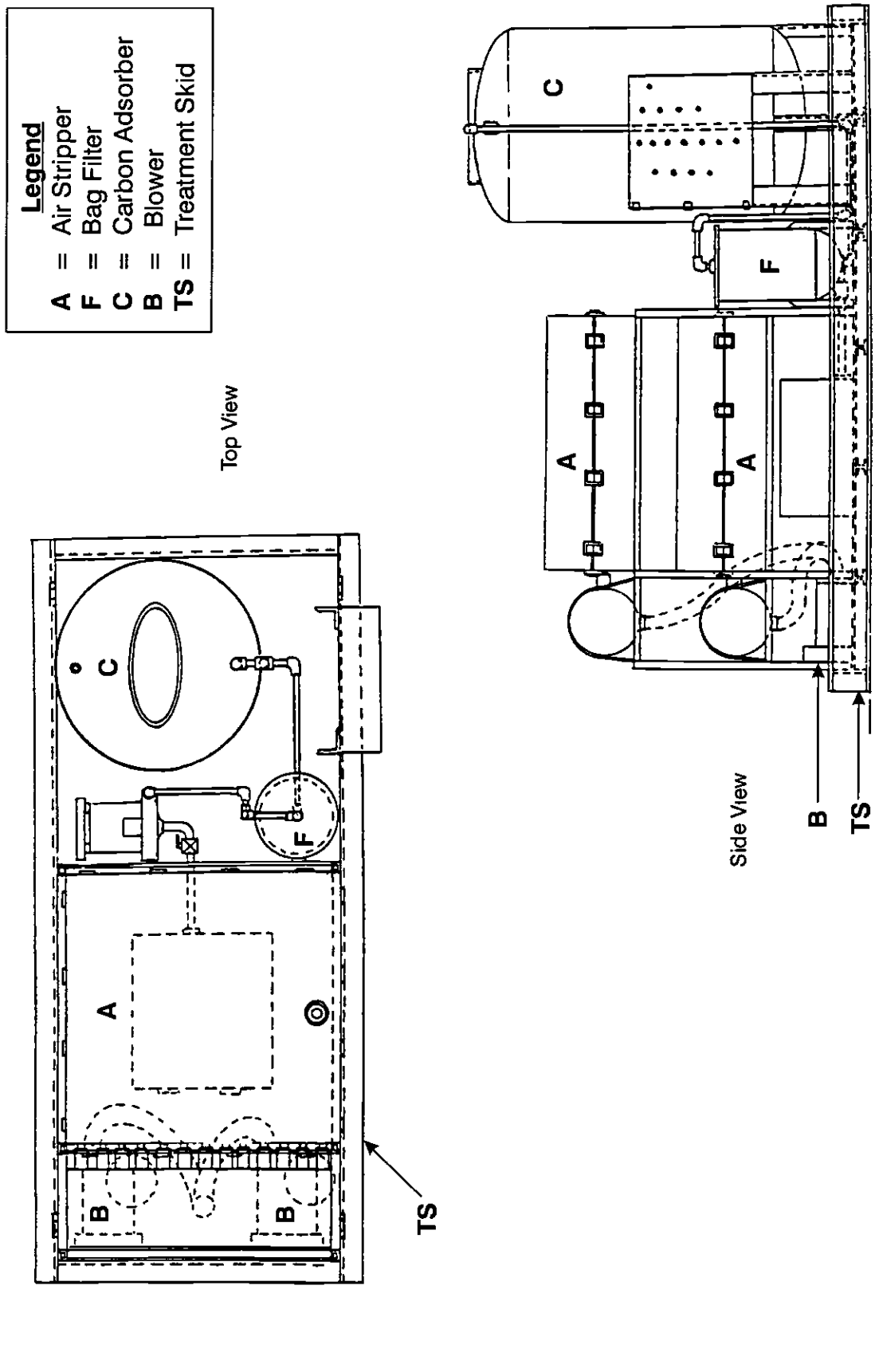

Figure 2.2
Typical Treatment Skid Layout
NAS Fort Worth JRB, Texas

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Source REMSYS Industries

2.4.1 Air Strippers

Air strippers 111A and B, 112A and B, 113A and B, 114A and B, 115A and B, and 116A and B are used to remove VOCs from the groundwater. The air stripper system consists of two low-profile air strippers connected in series. Each air stripper includes a baffled high-density polyethylene air stripping tray (5 feet by 5 feet) for groundwater treatment, with a total surface area of 25 cubic feet. Water flows by gravity from the first air stripper to the second. Air is supplied by a regenerative blower at a flow rate of 200 cubic feet per minute.

2.4.2 Transfer Pumps

Transfer pumps P-161, P-162, P-163, P-164, P-165, and P-166 are used to transport treated water from the air stripper sumps to the bag filters and carbon adsorbers.

2.4.3 Bag Filters

Bag filters F-171, F-172, F-173, F-174, F-175, and F-176 are used to protect the carbon adsorbers by removing calcium carbonate scale and other suspended solids from the groundwater. Each filter unit contains a stainless-steel basket fitted with a polypropylene filter bag. Inlet piping to the bag filters is equipped with a pressure gauge and high-pressure switch. The high-pressure switch shuts down the treatment skid when the pressure exceeds approximately 50 pounds per square inch (psi).

The filter bags are constructed of 150-micron polypropylene fabric, which can be cleaned and reused. A bag filter cleaning skid is used to contain water and solids accumulated during cleaning. Water generated from cleaning activities should be pumped manually to the adjacent treatment skid, which drains to the treatment skid drain sump and is recycled to the equalization tank. Solids generated during cleaning should be removed manually from the skid and stored in a 55-gallon drum for off-site disposal.

2.4.4 Carbon Adsorption System

After solids removal, the groundwater is pumped through a carbon adsorption system designed to remove any remaining VOCs from the groundwater. The adsorption system comprises seven carbon-steel vessels—C-181 through C-185, C-186a, and C-186b—that are approximately 3 feet in diameter and 7 feet high. Each vessel holds 1,000 pounds of granular reactivated carbon. The carbon vessels are operated as downflow fixed-bed adsorbers.

Treatment skid 6 includes two carbon adsorbers, which can be operated in series or in parallel flow paths. The flow path is determined by the position of ball valves located between the two vessels. Valving details for the different operational modes are presented in Section 3.0.

The carbon vessels are charged with reactivated liquid-phase carbon from Carbonair® Environmental Systems. The reactivated carbon conforms to the specifications presented in Table 2.3.

Table 2.3
Specifications for Reactivated Liquid-Phase Carbon
NAS Fort Worth JRB, Texas

Test	Specification
Iodine No. - Minimum	800
Moisture Content - Maximum	5
Mesh Size Nomenclature	8 x 30
Particle Size through U.S. No. 30 Mesh - % Max.	5

Inlet piping to each carbon vessel is equipped with a pressure gauge and high-pressure switch. The high-pressure switch shuts down the treatment skid when the pressure exceeds approximately 50 psi.

Manual backwash capacity is provided for the carbon vessels. Backwash operations should be initiated when the carbon inlet pressure exceeds 25 psi. Backwash water from each carbon vessel should be recycled to the equalization tank. Treatment skid valving should be aligned as specified in Section 3.0.

2.4.5 Ancillary Equipment

The following items of ancillary equipment are also part of the groundwater recovery and treatment system

2.4.5.1 Treatment Skid Drain System

Groundwater and rainwater from each treatment skid, TS-001 through TS-006, are drained by gravity to a 55-gallon sump located adjacent to the effluent discharge piping. A level-activated control system is used to operate submersible pump P-206. This pump discharges into equalization tank T-201.

2.4.5.2 Effluent Discharge Line

Treated groundwater is discharged via a 6-inch diameter PVC gravity flow line to the golf course pond. Ball valves located in the facility yard, shown in Drawing 6 of Appendix E, can be adjusted to direct the discharge to either the golf course pond, the sanitary sewer (Manhole No. 61), or equalization tank T-201.

The effluent line from the treatment skids is equipped with electronic and turbine flow meters. The electronic flow meter is equipped with a flow totalizer and a digital indicator for instantaneous flow. The indicator is located in the O&M trailer.

2.4.5.3 Autodialer

An autodialer is located in the O&M trailer and will automatically dial programmed telephone numbers when there is a change in plant operations. The plant shutdown relay is wired to the

autodialer and the operator's pager is called when any part of the plant shuts down. Details of the autodialer operations are presented in Section 5.1, Operations and Maintenance Monitoring.

2.4.5.4 Potable Water

Potable water is supplied to the treatment plant site by the City of Fort Worth. The service line is outfitted with a city water meter located inside the security fence on the south side. The service line supplies potable water to an emergency shower/eyewash station and outside hose bib.

2.4.5.5 Cold Weather Operations

The groundwater recovery and treatment system has no heat trace system to prevent freezing, but each well valve pit is equipped with a heat lamp which should be activated during freezing weather. The Fort Worth area generally experiences fewer than 10 days per year in which ambient temperatures drop to below 32 degrees Fahrenheit. When freezing weather is predicted, the groundwater recovery and treatment system must be shut down and drained. The system should be restarted only when temperatures are predicted to remain above freezing for 3 days or more.

3.0 SYSTEM OPERATING PROCEDURES

The groundwater recovery and treatment system is designed to operate automatically. The section addresses the following:

- normal operating parameters
- startup procedures
- shutdown procedures
- maintenance related procedures

The manufacturers' manuals are included in Appendix F (Volume II).

3.1 NORMAL OPERATING PARAMETERS

Process valve positions during normal operation are summarized in Table 3.1. These valve positions are identified on the Process and Instrumentation Diagrams (Drawings 3, 4, and 5 of Appendix E). Process valve positions for groundwater treatment skid 6 are detailed in Tables 3.2 and 3.3. Instrument set points, visual alarms, autodialer alarms, and system interlocks are presented in Tables 3.4, 3.5, 3.6, and 3.7, respectively.

3.2 STARTUP PROCEDURES

This section provides step-by-step instructions for an initial startup and normal startup of the system. It should be used as a guide by the mechanical operator and modified, when necessary, as the operator becomes more familiar with the equipment. Refer to the individual manufacturers' manuals (Appendix F, Volume II) for startup procedures on individual components.

3.2.1 Initial Startup

In the event that the system has been shut down for an extended period of time, all electrical equipment should be turned off, and the process vessels and pipes should be drained and isolated. If the programmable logic controller (PLC) has been disconnected from its battery, then the PLC program will have to be reloaded prior to starting the system.

The following steps are required for the initial startup.

1. Turn on the electrical power to the system using the circuit breaker panel.

2. Backwash the carbon adsorbers to remove sediments or fines that may have collected (see Section 3.5, Backwash Operations). Check the bag filters and replace if dirty or worn. Check the acid feed system for proper operation.

Table 3.1
Valve Positions During Normal Operation
Treatment System Skids 1 through 5
NAS Fort Worth JRB, Texas

Valve Number	Valve Type	Valve Location	Normal Operating Position
NL	3" Butterfly	Acid Addition Vault	Open
NL	3" Butterfly	Acid Addition Vault	Open
V-701	4" Ball	Flow Equalization Skid	Open
V-702	2" Ball	Flow Equalization Skid	Open
V-703	2" Ball	Flow Equalization Skid	Open
V-704	2" Ball	Flow Equalization Skid	Open
V-705	2" Ball	Flow Equalization Skid	Open
NL	3" Ball	Air Stripper No. 1 Outlet, Treatment System Skids (typical of 5)	Open
NL	3" Ball	Air Stripper No. 2 Outlet, Treatment System Skids (typical of 5)	Open
V-100*	1¼" Ball	Air Stripper Sump Outlet, Treatment System Skids (typical of 5)	Open
V-101*	2" Ball	Bag Filter Outlet, Treatment System Skids (typical of 5)	Open
V-102*	2" Ball	Carbon Adsorber, Treatment System Skids (typical of 5)	Open
V-103*	2" Ball	Carbon Adsorber, Treatment System Skids (typical of 5)	Open
V-104*	2" Ball	Carbon Adsorber, Treatment System Skids (typical of 5)	Closed
V-105*	2" Ball	Carbon Adsorber, Treatment System Skids (typical of 5)	Closed
V-106*	2" Ball	Carbon Adsorber, Treatment System Skids (typical of 5)	Open
V-107*	2" Ball	Carbon Adsorber, Treatment System Skids (typical of 5)	Open
V-108*	2" Ball	Skid Effluent, Treatment System Skids (typical of 5)	Open
NL	2" Ball	Skid Recycle, Treatment System Skids (typical of 5)	Closed
V-901	3" Ball	Recycle to Equalization Tank	Closed
V-902	3" Ball	Effluent Discharge Piping to Golf Course Pond (Outfall 001)	Open
V-903	3" Ball	Effluent Discharge Piping to Sanitary Sewer (Manhole 61)	Closed
V-904	2" Ball	To Hose Connection	Closed

Notes:
NL - Not Labeled
* - Treatment system skid valves are labeled using the skid number first, i.e., treatment skid 1 uses 100 series numbers, treatment skid 2 uses 200 series numbers, etc.

Table 3.2
Valve Positions During Normal Operation
Treatment System Skid 6, Parallel Configuration
NAS Fort Worth JRB, Texas

Valve Number	Valve Type	Valve Location	Normal Operating Position
NL	3" Butterfly	Acid Addition Vault	Open
NL	3" Butterfly	Acid Addition Vault	Open
V-701	4" Ball	Flow Equalization Skid	Open
V-702	2" Ball	Flow Equalization Skid	Open
V-703	2" Ball	Flow Equalization Skid	Open
V-704	2" Ball	Flow Equalization Skid	Open
V-705	2" Ball	Flow Equalization Skid	Open
NL	3" Ball	Air Stripper No. 1 Outlet, Treatment System Skids	Open
NL	3" Ball	Air Stripper No. 2 Outlet, Treatment System Skids	Open
NL	1¼" Ball	Air Stripper Sump Outlet, Treatment System Skids	Open
V-601	2" Ball	Carbon Adsorber, Treatment System Skids	Closed
V-602	2" Ball	Carbon Adsorber, Treatment System Skids	Open
V-603	2" Ball	Carbon Adsorber, Treatment System Skids	Open
V-604	2" Ball	Carbon Adsorber, Treatment System Skids	Open
V-605	2" Ball	Carbon Adsorber, Treatment System Skids	Open
V-606	2" Ball	Carbon Adsorber, Treatment System Skids	Closed
V-607	2" Ball	Carbon Adsorber, Treatment System Skids	Open
V-608	2" Ball	Carbon Adsorber, Treatment System Skids	Open
V-609	2" Ball	Carbon Adsorber, Treatment System Skids	Closed
V-610	2" Ball	Carbon Adsorber, Treatment System Skids	Open
V-611	2" Ball	Carbon Adsorber, Treatment System Skids	Open
V-612	2" Ball	Carbon Adsorber, Treatment System Skids	Open
NL	2" Ball	Skid Recycle, Treatment System Skids (typical of 6)	Closed
V-901	3" Ball	Recycle to Equalization Tank	Closed
V-902	3" Ball	Effluent Discharge Piping to Golf Course Pond (Outfall 001)	Open
V-903	3" Ball	Effluent Discharge Piping to Sanitary Sewer (Manhole 61)	Closed
V-904	2" Ball	To Hose Connection	Closed

Note:
NL - Not Labeled

Table 3.3
Valve Positions During Normal Operation
Treatment System Skid 6, Series Configuration
NAS Fort Worth JRB, Texas

Valve Number	Valve Type	Valve Location	Normal Operating Position
NL	3" Butterfly	Acid Addition Vault	Open
NL	3" Butterfly	Acid Addition Vault	Open
V-701	4" Ball	Flow Equalization Skid	Open
V-702	2" Ball	Flow Equalization Skid	Open
V-703	2" Ball	Flow Equalization Skid	Open
V-704	2" Ball	Flow Equalization Skid	Open
V-705	2" Ball	Flow Equalization Skid	Open
NL	3" Ball	Air Stripper No. 1 Outlet, Treatment System Skids	Open
NL	3" Ball	Air Stripper No. 2 Outlet, Treatment System Skids	Open
NL	1¼" Ball	Air Stripper Sump Outlet, Treatment System Skids	Open
V-601	2" Ball	Carbon Adsorber, Treatment System Skids	Closed
V-602	2" Ball	Carbon Adsorber, Treatment System Skids	Open
V-603	2" Ball	Carbon Adsorber, Treatment System Skids	Open
V-604	2" Ball	Carbon Adsorber, Treatment System Skids	Closed
V-605	2" Ball	Carbon Adsorber, Treatment System Skids	Open
V-606	2" Ball	Carbon Adsorber, Treatment System Skids	Closed
V-607	2" Ball	Carbon Adsorber, Treatment System Skids	Open
V-608	2" Ball	Carbon Adsorber, Treatment System Skids	Open
V-609	2" Ball	Carbon Adsorber, Treatment System Skids	Open
V-610	2" Ball	Carbon Adsorber, Treatment System Skids	Open
V-611	2" Ball	Carbon Adsorber, Treatment System Skids	Open
V-612	2" Ball	Carbon Adsorber, Treatment System Skids	Closed
NL	2" Ball	Skid Recycle, Treatment System Skids (typical of 6)	Closed
V-901	3" Ball	Recycle to Equalization Tank	Closed
V-902	3" Ball	Effluent Discharge Piping to Golf Course Pond (Outfall 001)	Open
V-903	3" Ball	Effluent Discharge Piping to Sanitary Sewer (Manhole 61)	Closed
V-904	2" Ball	To Hose Connection	Closed

Note:
NL - Not Labeled

Table 3.4
Instrument Set Points
NAS Fort Worth JRB, Texas

Instrument Location	Set Point
pH Controller Point 1	pH=3.5/speed=0
pH Controller Point 2	pH=6.5/speed=100
pH Controller Point 3	pH=4.0/speed=60
High-pressure bag filter inlet (typical of 6)	50 psi
High-pressure carbon vessel inlet (typical of 7)	50 psi
High-pressure differential across air stripper blower (typical of 12)	60 in W.C.
Low-pressure differential across air stripper blower (typical of 12)	10 in W.C.
High–High-level alarm air stripper sump (typical of 6)	~2'-6"
High–High-level equalization tank	~5'-6"

Table 3.5
Visual Alarms
NAS Fort Worth JRB, Texas

Visual Alarm No.	Location of Alarm
Local alarm No. 1	High-pressure bag filter (typical of 6)
Local alarm No. 2	High-pressure carbon vessel (typical of 7)
Local alarm No. 3	High-pressure differential across air stripper blower (typical of 12)
Local alarm No. 4	Low-pressure differential across air stripper blower (typical of 12)
Local alarm No. 5	High–High-level air stripper sump (typical of 6)
Local alarm No. 6	High–High-level equalization tank
Local alarm No. 7	High-level equalization tank skid containment
Local alarm No. 8	High-level acid storage and feed skid containment
Local alarm No. 9	High-level groundwater treatment skid containment

Table 3.6
Autodialer Alarms
NAS Fort Worth JRB, Texas

Telephone Alarm No.	Skid Location
Telephone alarm No. 1	Alarm at skid No. 1
Telephone alarm No. 2	Alarm at skid No. 2
Telephone alarm No. 3	Alarm at skid No. 3
Telephone alarm No. 4	Alarm at skid No. 4
Telephone alarm No. 5	Alarm at skid No. 5
Telephone alarm No. 6	Alarm at skid No. 6
Telephone alarm No. 7	Alarm at flow equalization system
Telephone alarm No. 8	Alarm at acid storage and feed system

Table 3.7
System Interlocks
NAS Fort Worth JRB, Texas

Interlock No.	Location
Interlock No. 1	Recovery well pump stoppage causes sulfuric acid feed pump P-205 to shut off. Metering pump cannot be restarted until an extraction well pump is running
Interlock No 2	High level in recovery well vault shuts down that recovery well until level drops below high-level switch.
Interlock No. 3	High level in acid storage and feed containment skid shuts off all recovery wells until level drops below high-level switch.
Interlock No. 4	High level in equalization tank stops all recovery wells until equalization tank level goes below reset switch and recovery wells restart
Interlock No. 5	High–High-level in air stripper sump shuts off treatment skid influent solenoid valve until level drops below sump low-level switch.
Interlock No. 6	High or low pressure (low pressure after time delay ≈ 10 seconds) across air photohelic gauge shuts off treatment skid influent solenoid valve until skid control power is reset.
Interlock No. 7	Carbon or bag filter high-pressure switch shuts off treatment skid influent solenoid valve until skid control power is reset.
Interlock No 8	High level in treatment skid containment shuts off treatment skid influent solenoid valve until level drops below high-level switch and sump low-level switch

3. Fill equalization tank with potable water. Start the process pumps and blowers in the "hand" position to verify operation, and then switch to "automatic" to check the controls and the PLC. Recirculate the water to bypass the effluent discharge piping (see Section 3.7, Recirculation Operations). Recirculating potable water allows the operator to verify the operations of the level controls and instruments prior to introducing contaminated water.

4. Measure and record the depth to groundwater in each of the 11 recovery wells.

5. Open all the valves in the groundwater recovery system. Prior to starting, switch the recovery pumps to the "hand" position to verify operation, and then switch to "automatic" to check controls. When starting the treatment system, only a few pumps should be brought on line at one time, as all the pumps will be running at full capacity for a brief period. Maintain flow rates in accordance with the existing Texas Natural Resource Conservation Commission (TNRCC) permit.

6. Operate the pumps in the recovery wells for a few cycles, then turn off the pumps and check the basket strainer on the influent piping. Clean the strainer if required.

3.2.2 Normal System Startup

A normal startup is performed after the system has been shut down for a short time (less than 10 days) as a result of an operational problem, freezing temperatures, or scheduled maintenance activities.

Following a shutdown, the groundwater treatment skid control panel must be reset prior to startup. The abnormal condition(s) responsible for the shutdown should be verified and corrected prior to startup. Depending on the duration of the shutdown, the recovery wells should be turned on as described in Step 5 of initial startup.

3.3 SHUTDOWN PROCEDURES

System shutdowns can occur automatically due to operating problems or manually, as described in the sections below.

3.3.1 Automatic Shutdowns Under Alarm Conditions

There are a variety of conditions (either level or pressure) that will cause a shutdown of a particular piece of equipment or the entire system. Table 3.8 lists the equipment conditions and whether the equipment will automatically restart following clearance of the condition. The operator should always check whether an operation caused the shutdown, or whether an instrument malfunctioned.

Table 3.8
Treatment System Shutdown Conditions
NAS Fort Worth, JRB, Texas

Equipment Condition	Response	Automatic Restart[1]
Recovery well vault high-level	Shut down recovery well pump	Yes
Equalization tank high-high-level	Shut down recovery well pumps	Yes
Equalization tank skid containment high-level	Shut down recovery well pumps	Yes
Air stripper sump high-high-level	Shut down treatment skid	Yes
Acid storage and feed containment high-level	Shut down recovery wells	Yes
Air stripper blower No. 1 high-pressure differential	Shut down treatment skid	No
Air stripper blower No. 2 high-pressure differential	Shut down treatment skid	No
Air stripper blower No. 1 low-pressure differential	Shut down treatment skid	No
Air stripper blower No. 2 low-pressure differential	Shut down treatment skid	No
Bag filter high-pressure	Shut down treatment skid	No
Carbon vessel high-pressure	Shut down treatment skid	No
Treatment skid containment high-level	Shut down treatment skid	Yes

Note
[1] If "Yes," the equipment will automatically restart when the condition is cleared. The operator does not need to turn the manual reset knob on the treatment skid control panel.

3.3.2 Manual Shutdown

Individual groundwater treatment skids can be shut down manually for service or repair work. Likewise, individual recovery wells can be serviced while the system continues to operate. If the recovery well submersible pump needs to be serviced, the electrical power should first be disconnected and locked out.

3.3.3 Complete Shutdown and Draining

In the event that groundwater treatment operations are to be discontinued for an extended period of time, the facilities should be completely shut down and all process vessels drained and isolated with their associated valves. The steps involved in shutdown and draining procedures are as follows:

1. Shut off the recovery well submersible pumps.

2. Pump out all groundwater from system. Turn the equalization tank transfer pumps and each air stripper sump pump to the "hand" position to drain the vessels.

3. Use a portable submersible pump to remove the remaining water.

4. Drain the bag filters and carbon adsorbers.

5. Collect and sample the remaining water for the purpose of compliance monitoring under the system's TNRCC operating permit. If analytical results verify that the water complies with TNRCC permit limitations, pump the remaining water through the effluent pipe to the golf course pond.

6. Turn off the motor starters and field disconnects. When power to the control panel is turned off, the PLC will run off a battery to maintain the PLC code in memory. When the battery loses its charge, the PLC code will be lost, and the PLC will have to be reloaded prior to the next startup. For this reason, backup copies of the PLC code should be maintained.

3.4 MAINTENANCE RELATED PROCEDURES

3.4.1 Filter Bag Changeout

The filter bags should be changed at least 2 times per week. To replace the filter bags, the operator should follow the procedures outlined below:

1. Turn the air stripper sump pump switch to the "off" position.

2. Close the associated inlet and outlet valves.

3. Open the sample port on the inlet piping to relieve pressure.

4. Remove the cover by loosening the closure bolts.

5. Remove filter bag and install a new or cleaned filter bag.
(Be sure the filter bag is properly seated inside the basket retainer plate.)

6. Install the cover and tighten the closure bolts.

7. Close the associated inlet and outlet valves and sample port.

8. Turn the air stripper sump pump switch to the "auto" position.

3.4.2 Backwash Operations

When the back pressure through a carbon adsorber rises too high, the adsorber should be backwashed to remove solids in the carbon. The steps involved in backwash operations are as follows:

1. Shut down the treatment skid.

2. Set the valve positions as shown in Table 3.9. The valve positions for groundwater treatment skid 6 are shown in Tables 3.10 and 3.11. For treatment skid 6, only one carbon adsorber can be backwashed at a time, so switch the valves to backwash the second carbon adsorber.

3 Turn the air stripper sump pump to the "hand" position.

4. Backwash for a minimum of 15 minutes, for best results.

5. Return the valves to their normal operating positions (Tables 3.1, 3.2, and 3.3).

3.4.3 Air Stripper Cleaning

If the differential pressure across the blower rises too high, the air strippers should be cleaned to remove scale from the air distribution pipes. The steps involved in cleaning the air stripper are as follows:

1. Recycle the treatment skid effluent back to the air stripper by first opening the treatment skid recycle valve, and then closing the treatment skid effluent valve.

2. Add dilute (10 percent) muriatic acid to the air stripper sump to reduce the pH to a level between 3 and 4.

3. Recycle through treatment skid for 1 to 2 days, for best results.

4. Slowly neutralize the pH between 6 and 7, and return the valves to their normal operating positions (Tables 3.1, 3.2, and 3.3).

3.4.4 Recirculation Operations

For testing purposes and when effluent cannot be discharged, recirculate treated groundwater to the equalization tank. This can be accomplished by closing effluent discharge valve V-902 and opening recirculation valve V-901.

Table 3.9
Valve Positions During Backwash Operations
Treatment System Skids 1 through 5
NAS Fort Worth JRB, Texas

Valve Number	Valve Type	Valve Location	Normal Operating Position
NL	3" Butterfly	Acid Addition Vault	Open
NL	3" Butterfly	Acid Addition Vault	Open
V-701	4" Ball	Flow Equalization Skid	Open
V-702	2" Ball	Flow Equalization Skid	Open
V-703	2" Ball	Flow Equalization Skid	Open
V-704	2" Ball	Flow Equalization Skid	Open
V-705	2" Ball	Flow Equalization Skid	Open
NL	3" Ball	Air Stripper No 1 Outlet, Treatment System Skids (typical of 5)	Open
NL	3" Ball	Air Stripper No. 2 Outlet, Treatment System Skids (typical of 5)	Open
V-100*	1¼" Ball	Air Stripper Sump Outlet, Treatment System Skids (typical of 5)	Open
V-101*	2" Ball	Bag Filter Outlet, Treatment System Skids (typical of 5)	Open
V-102*	2" Ball	Carbon Adsorber, Treatment System Skids (typical of 5)	Closed
V-103*	2" Ball	Carbon Adsorber, Treatment System Skids (typical of 5)	Open
V-104*	2" Ball	Carbon Adsorber, Treatment System Skids (typical of 5)	Open
V-105*	2" Ball	Carbon Adsorber, Treatment System Skids (typical of 5)	Open
V-106*	2" Ball	Carbon Adsorber, Treatment System Skids (typical of 5)	Open
V-107*	2" Ball	Carbon Adsorber, Treatment System Skids (typical of 5)	Closed
V-108*	2" Ball	Skid Effluent, Treatment System Skids (typical of 5)	Closed
NL	2" Ball	Skid Recycle, Treatment System Skids (typical of 5)	Closed
V-901	3" Ball	Recycle to Equalization Tank	Open
V-902	3" Ball	Effluent Discharge Piping to Golf Course Pond (Outfall 001)	Closed
V-903	3" Ball	Effluent Discharge Piping to Sanitary Sewer (Manhole 61)	Closed
V-904	2" Ball	To Hose Connection	Closed

Notes:
NL - Not Labeled
* - Treatment system skid valves are labeled using the skid number first, i e , treatment skid 1 uses 100 series numbers, treatment skid 2 uses 200 series numbers, etc.

Table 3.10
Valve Positions During Backwash Operations
Treatment System Skid 6, Adsorber 1
NAS Fort Worth JRB, Texas

Valve Number	Valve Type	Valve Location	Normal Operating Position
NL	3" Butterfly	Acid Addition Vault	Open
NL	3" Butterfly	Acid Addition Vault	Open
V-701	4" Ball	Flow Equalization Skid	Open
V-702	2" Ball	Flow Equalization Skid	Open
V-703	2" Ball	Flow Equalization Skid	Open
V-704	2" Ball	Flow Equalization Skid	Open
V-705	2" Ball	Flow Equalization Skid	Open
NL	3" Ball	Air Stripper No. 1 Outlet, Treatment System Skids	Open
NL	3" Ball	Air Stripper No 2 Outlet, Treatment System Skids	Open
NL	1¼" Ball	Air Stripper Sump Outlet, Treatment System Skids	Open
V-601	2" Ball	Carbon Adsorber, Treatment System Skids	Closed
V-602	2" Ball	Carbon Adsorber, Treatment System Skids	Open
V-603	2" Ball	Carbon Adsorber, Treatment System Skids	Closed
V-604	2" Ball	Carbon Adsorber, Treatment System Skids	Open
V-605	2" Ball	Carbon Adsorber, Treatment System Skids	Open
V-606	2" Ball	Carbon Adsorber, Treatment System Skids	Open
V-607	2" Ball	Carbon Adsorber, Treatment System Skids	Open
V-608	2" Ball	Carbon Adsorber, Treatment System Skids	Closed
V-609	2" Ball	Carbon Adsorber, Treatment System Skids	Open
V-610	2" Ball	Carbon Adsorber, Treatment System Skids	Closed
V-611	2" Ball	Carbon Adsorber, Treatment System Skids	Open
V-612	2" Ball	Carbon Adsorber, Treatment System Skids	Closed
NL	2" Ball	Skid Recycle, Treatment System Skids (typical of 6)	Closed
V-901	3" Ball	Recycle to Equalization Tank	Open
V-902	3" Ball	Effluent Discharge Piping to Golf Course Pond (Outfall 001)	Closed
V-903	3" Ball	Effluent Discharge Piping to Sanitary Sewer (Manhole 61)	Closed
V-904	2" Ball	To Hose Connection	Closed

Note:
NL - Not Labeled

Table 3.11
Valve Positions During Backwash Operations
Treatment System Skid 6, Adsorber 2
NAS Fort Worth JRB, Texas

Valve Number	Valve Type	Valve Location	Normal Operating Position
NL	3" Butterfly	Acid Addition Vault	Open
NL	3" Butterfly	Acid Addition Vault	Open
V-701	4" Ball	Flow Equalization Skid	Open
V-702	2" Ball	Flow Equalization Skid	Open
V-703	2" Ball	Flow Equalization Skid	Open
V-704	2" Ball	Flow Equalization Skid	Open
V-705	2" Ball	Flow Equalization Skid	Open
NL	3" Ball	Air Stripper No. 1 Outlet, Treatment System Skids	Open
NL	3" Ball	Air Stripper No. 2 Outlet, Treatment System Skids	Open
NL	1¼" Ball	Air Stripper Sump Outlet, Treatment System Skids	Open
V-601	2" Ball	Carbon Adsorber, Treatment System Skids	Closed
V-602	2" Ball	Carbon Adsorber, Treatment System Skids	Open
V-603	2" Ball	Carbon Adsorber, Treatment System Skids	Open
V-604	2" Ball	Carbon Adsorber, Treatment System Skids	Closed
V-605	2" Ball	Carbon Adsorber, Treatment System Skids	Closed
V-606	2" Ball	Carbon Adsorber, Treatment System Skids	Open
V-607	2" Ball	Carbon Adsorber, Treatment System Skids	Closed
V-608	2" Ball	Carbon Adsorber, Treatment System Skids	Open
V-609	2" Ball	Carbon Adsorber, Treatment System Skids	Open
V-610	2" Ball	Carbon Adsorber, Treatment System Skids	Open
V-611	2" Ball	Carbon Adsorber, Treatment System Skids	Closed
V-612	2" Ball	Carbon Adsorber, Treatment System Skids	Open
NL	2" Ball	Skid Recycle, Treatment System Skids (typical of 6)	Closed
V-901	3" Ball	Recycle to Equalization Tank	Open
V-902	3" Ball	Effluent Discharge Piping to Golf Course Pond (Outfall 001)	Closed
V-903	3" Ball	Effluent Discharge Piping to Sanitary Sewer (Manhole 61)	Closed
V-904	2" Ball	To Hose Connection	Closed

Note:
NL - Not Labeled

4.0 MAINTENANCE OF RECOVERY WELL AND PLANT EQUIPMENT

Routine and non-routine maintenance are required for the recovery wells and plant equipment. Maintenance is defined as any service or repair required to keep the process equipment fully operational.

Preventive maintenance is performed to prevent breakdown, reduce wear, and extend the life of equipment and structures. This is performed while the plant is in operation and includes routine inspections of equipment, lubrication, and minor adjustments to equipment. Corrective maintenance consists of repair and non-routine maintenance tasks, including replacement of pump packing or worn bearings, and can generally be performed with a minimum of system downtime. Major equipment repair or alterations usually require a process unit to be out of operation. This maintenance may require hiring outside contractors.

Accurate record keeping and tracking allows recurring corrective maintenance tasks to be performed with minimal disruption to facility operations.

4.1 SERVICE AND REPAIRS

Preventive maintenance, or adhering to a schedule of checks and services, is necessary to prevent the potential development of equipment failures. The operator should, from daily operational data (pressures, temperatures, flow rates) and sensory perceptions, develop a knowledge of the conditions under which each item of equipment can operate effectively. From these types of data, the operator can become aware of the signs and symptoms that indicate when equipment begins to falter, and when service of that equipment is required.

Cleaning of probes, filter bags, sumps, tanks, and air strippers is a necessary maintenance procedure required to ensure efficient system operation. Appendix F of this O&M Manual references the manufacturers' equipment manuals and details the preventive maintenance required for each item of equipment.

4.2 MAINTENANCE RECORDS

Section 5.0 of this manual describes the requirements for maintenance records, and presents data sheets for the operator to use in order to track maintenance history.

4.3 EQUIPMENT RECORDS

It is important that each item of equipment have an identification number that specifies the equipment item and location. It is recommended that an equipment record system be developed (on cards and in a computer database) that includes the following information:

- a description of each item of equipment
- the equipment item number

- the supplier with address, telephone number of local representative and manufacturer, date of purchase, and purchase cost, if available
- the size, model number, type, and serial number of the item of equipment
- associated electrical or mechanical data
- preventive maintenance required including frequency, date of performance, name of operator, and comments on the work performed
- repairs or service performed on the equipment

Items of equipment in the preventive maintenance program are presented in Table 4.1. An example of an equipment card is presented in Table 1 of Appendix A. Operators are responsible for initiating the equipment records and updating them when maintenance is performed.

4.4 MAINTENANCE PLANNING AND SCHEDULING

A daily work order should be used to track preventive and routine maintenance tasks. Seasonal and periodic tasks should be on file to be completed when time permits. A daily maintenance log is presented as Table 2 of Appendix A.

The following is an outline of the basic steps required to schedule preventive maintenance activities:

- List all equipment requiring preventive maintenance (Table 4.1).
- List preventive maintenance requirements and frequencies for each item (Table 4.1).
- Estimate the time and skills required to perform each preventive maintenance task (Table 4.1).
- On a yearly calendar, select tentative dates for performing all monthly, quarterly, semi-annual, and annual maintenance.
- Establish a preventive maintenance schedule for a typical work week. This should then be adjusted for maintenance requirements, on a monthly, quarterly, semi-annual, and annual basis.
- Adjust schedule for work priority changes and maintenance emergencies.

As excessive preventive maintenance can be wasteful, treatment system management must determine the optimum preventive maintenance schedule and replacement program.

Table 4.1
Preventive Maintenance Program
NAS Fort Worth JRB, Texas

Item of Equipment	Manufacturer	Maintenance	Frequency	Time
Groundwater Recovery System				
Level Controller	Warrick	Clean with muriatic acid	annually	30 min
Submersible Pump	Grundfos	Clean	annually	30 min
Flow Sensor	Great Lakes Instruments	Clean with muriatic acid	bimonthly	30 min
Turbine Flow Meter	Master Meter	Clean with muriatic acid	bimonthly	30 min
Sulfuric Acid Feed System				
Acid Storage Tank	Chem-Tainer Industries	Inspect	weekly	10 min
Acid Feed Pump	Milton Roy LMI	Inspect	weekly	10 min
Static Mixer	unknown	N/A	N/A	N/A
pH Sensor	Great Lakes Instruments	Calibrate	bimonthly	15 min
pH Sensor	Milton Roy LMI	Calibrate	bimonthly	15 min
Flow Equalization System				
Equalization Tank	Snyder-Crown Ind. Prods.	Inspect & clean	annually	2 hr
Equalization Tank Transfer Pump	Grundfos	Grease	quarterly	5 min
Level Switch	GEMS	Clean with muriatic acid	monthly	10 min
Overflow Sump Pump	ABS Pumps	Inspect	monthly	10 min
Groundwater Treatment System				
Air Stripper	REMSYS	Clean & inspect	annually	2 hr
Air Blower	EG&G Rotron	Clean filter	monthly	10 min
Air Stripper Sump Pump	Grundfos	Grease	quarterly	5 min
Bag Filter	R-P Products	Clean filter	2 x week	10 min
Carbon Adsorber	REMSYS	Backwash	as needed	15 min
Level Switch	GEMS	Clean with muriatic acid	monthly	10 min
Solenoid Valve	unknown	Clean	monthly	30 min
Drain System Sump	N/A	Clean	annually	30 min
Sump Pump	Flotec	Clean & inspect	monthly	10 min
Float Switch	Omega	Inspect	monthly	5 min
Effluent Flow Sensor	Great Lakes Instruments	Calibrate	annually	30 min
Turbine Flow Meter (effluent piping)	Master Meter	Clean with muriatic acid	annually	30 min
Basket Strainer (influent piping)	Mueller	Clean	monthly	15 min

Note:
N/A Not applicable

4.6 HOUSEKEEPING

Housekeeping activities are important in maintaining a clean and safe facility. The cleaning of equipment and grounds should receive the same attention as the plant operation duties. A clean and neat treatment facility will help maintain good public relations while at the same time ensuring personnel safety.

5.0 MONITORING REQUIREMENTS, RECORDS, AND REPORTS

At the time of preparing this O&M manual, the groundwater recovery and treatment system operated under TNRCC Permit No. 03973 which requires that system parameters be monitored and recorded weekly, and reported to the TNRCC on a monthly basis. Details of O&M monitoring, recovery well monitoring, compliance monitoring and biomonitoring requirements are presented below.

5.1 OPERATIONS AND MAINTENANCE MONITORING

Observation of individual components within the groundwater recovery and treatment system is performed by a mechanical operator at each site visit. Influent and totalized flow rates, discharge pump, air stripper, bag filter, and carbon adsorber pressure readings, alarm status, and existence of leaks are recorded on the "Treatment Skid Data Sheet," presented in Table 3 of Appendix A. Any unusual noises or raised temperatures, or apparent obstructions, are also to be noted on the "Treatment Skid Data Sheet."

Influent pressure readings, transfer pump discharge pressure from the equalization tank, the level of acid in the acid storage tank, the set points on the pH controller, the acid metering pump speed/stroke settings, the pre-acid addition influent pH, post-acid addition influent pH, and system effluent pH are all to be entered on the "Treatment System Data Sheet," presented in Table 4 of Appendix A.

The system is monitored by autodialer 24 hours per day. Emergency repairs and reactivation of the system must be performed immediately following a shutdown event to minimize system downtime In the event of a treatment system malfunction, the autodialer is programmed to page the mechanical operator and send a message to the operator's voicemail. The operator has 1 hour to disable the alarm, or the message will be forwarded to a second operator. If the second operator does not respond within 1 hour, the alarm is sent to a 24-hour customer service person who, in turn, contacts the mechanical operator. Each call should be handled within 2 hours. Emergency response actions are recorded on the "Treatment Skid Data Sheet" (Table 3 of Appendix A).

For recording routine maintenance tasks such as changing out and cleaning the six filter bags, cleaning the blower air filters and/or air strippers, and backwashing the carbon adsorbers, the "Treatment System Maintenance Data Sheet," (presented in Table 5 of Appendix A) should be used.

All O&M data sheets are to be collected in a folder and arranged in reverse chronological order.

5.2 RECOVERY WELL MONITORING

Recovery well operating data is recorded weekly or as needed to monitor individual well performance and, if necessary, to make adjustments to the mix of wells operating. Flow rate, gauge pressure, totalized flow, depth to groundwater, and the presence of leaks are recorded on

the "Recovery Well Data Sheet," presented in Table 6 of Appendix A. It is recommended that groundwater from each well be sampled annually and analyzed for the VOCs of concern.

5.3 COMPLIANCE MONITORING

In accordance with TNRCC Permit No. 03973, the daily average flow of effluent must not exceed 0.101 million gallons per day (MGD), and the total volume discharged during any 24-hour period must not exceed 0.20 MGD. The volume of groundwater processed must be recorded weekly, and a grab sample of effluent must be collected and analyzed weekly for *trans*-1,2-dichloroethylene (*trans*-1,2-DCE), TCE, total organic carbon (TOC), oil and grease, and mercury. The temperature and pH of the effluent sample must also be measured and recorded. All current effluent limitations and monitoring requirements required by the TNRCC permit are presented in Table 5.1. TNRCC reporting forms are to be mailed to that agency by the 20th day of the following month. These forms are presented in Appendix B. In the event that a new operating permit is issued, operating requirements for the new permit should be followed.

Although not a permit requirement, it is recommended that a sample of treatment system influent be collected and analyzed weekly for *trans*-1,2-DCE and TCE, so that weekly removal rates of these compounds may be estimated.

5.4 BIOMONITORING REQUIREMENTS

The current TNRCC permit also requires quarterly and semiannual biomonitoring tests. Two static renewal tests using the Fathead Minnow and the Water Flea (U.S. EPA, 1994), and two acute static toxicity tests using a zooplankton and the Fathead Minnow (U.S. EPA, 1993) are required. TNRCC requirements for biomonitoring and frequency of testing are presented in Table 5 2. The complete permit is presented in Appendix C.

5.5 ANALYTICAL TESTING QUALITY

All influent and effluent samples will be collected, handled, monitored, and analyzed in accordance with appropriate standards set out in the NAS Fort Worth JRB, Final Basewide Quality Assurance Project Plan (QAPP) (HydroGeoLogic, 1998), and QAPP Addendum (HydroGeoLogic, 1999).

Table 5.1
Effluent Limitations and Monitoring Requirements
TNRCC Permit No 03973
NAS Fort Worth JRB, Texas

Effluent Characteristic[1,2]	Discharge Limitations			Minimum Self-Monitoring Requirements	
	Daily Avg. (mg/L)	Daily Max. (mg/L)	Single Grab (mg/L)	Report Daily Avg. and Daily Max. Measurement Frequency	Sample Type
Flow (MGD)	0.101	0 020	N/A	1/week	Estimate
trans-1,2-Dichloroethylene	0 025	0.066	0.066	1/week	Grab
Trichloroethylene	0.052	0.164	0.164	1/week	Grab
Total Organic Carbon	N/A	55	55	1/week	Grab
Oil and Grease	N/A	15	15	1/week	Grab
Temperature (degrees F)	N/A	N/A	(95)	N/A	In-Situ
Mercury	0.00003	0.00006	0.00006	1/week	Grab
pH	N/A	9	6 to 9	1/week	Grab

Notes:
1 Effluent monitoring samples shall be taken at Outfall 001, which is the outlet of the discharge pipe prior to the golf course pond.
2 There shall be no discharge of floating solids or visible foam in other than trace amounts and no discharge of visible oil.
N/A Not applicable

Table 5.2
Biomonitoring Requirements
TNRCC Permit No 03973
NAS Fort Worth JRB, Texas

Effluent Characteristic	Single Grab	Sampling Frequency	Sample Type
Chronic Static Renewal using Fathead Minnow	≥ 0.25 mg/larva after 7 days	Semiannually	Grab
Chronic Static Renewal using Water Flea	≥ 15/female after 7 days	Quarterly	Grab
Acute Static Toxicity using *Daphnia pulex*	≥ 50% after 24 hours	Quarterly	Grab
Acute Static Toxicity using Fathead Minnow	≥ 50% after 24 hours	Quarterly	Grab

6.0 TOOLS, ON-SITE EQUIPMENT, SPARE PARTS, AND EXPENDABLE SUPPLIES

The purpose of this section is to provide plant personnel with a list of special tools, test equipment, spare parts, and expendable supplies required for successful operation.

6.1 TOOLS

The mechanical and electronic/electrical operators must acquire the sets of tools necessary to maintain all items of equipment. Because of the nature of the contaminants involved, it is not envisioned that nonsparking tools will be required at the site.

6.2 ON-SITE EQUIPMENT

Certain items of equipment are required for operation, maintenance, and sampling activities, as described in the sections below.

6.2.1 Personal Safety Equipment

Appropriate clothing should be worn at the site to protect personnel from contact with contaminants. In particular the following items should be available to wear at the site:

- hard hat
- safety glasses
- rubber gloves
- ear plugs
- steel-toed work boots
- rain gear

Health and safety responsibilities, personal protection standards, and emergency contingencies are presented in the Health and Safety Plan that comprises Appendix D.

6.2.2 Sampling Equipment

The following items are needed for sampling system influent and effluent, and recovery wells:

- appropriate number (including spares) of sample bottles
- water-level indicator
- Alconox detergent
- distilled water
- portable pH meter
- pH buffers for meter - 4.0, 7.0, and 10.0 standard
- disposable nitrile gloves
- disposable towels
- buckets (small: 5-gallon; large: 25- to 30-gallon)

6.2.3 Testing Equipment

The following equipment must be available for testing purposes at the groundwater recovery and treatment system:

- volt-ohm meter capable of reading control current (milliamps) and three-phase high voltage (480 volt) power
- photoionization detector to be used to check VOC emissions around the air strippers and in confined-spaces, prior to entry
- pH meter to be used to test pre- and post-acid influent, and system effluent
- 4 to 20 milliamp signal generator to be used for checking level control valves throughout the system

6.3 SPARE PARTS

Spare parts to be kept on-hand at the groundwater recovery and treatment system will be governed by the following considerations:

- critical need - spare parts will be kept at the site if required for successful system operation
- availability - spare parts will be kept at the site if not available locally
- cost - spare parts will be kept at the site if inexpensive or of moderate cost

Pumps most frequently require service or replacement. It is recommended that a spare pump of each model be kept at the site so that, in the event of a failure, a pump may be replaced quickly with a minimum of downtime. Local vendors should be identified for each make of pump, so that in the event of a seal or pump failure, parts may be obtained on an expedited basis. In addition to pumps and pump spare parts, the following items are recommended to be maintained in the site inventory:

- level floats for the sumps, tanks, and wells
- flow meters for each model and size in use
- ball valves for each model and size in use
- check valves for each model and size in use
- butterfly valves for each model and size in use
- blower hose for each blower
- filter bags
- control panel lights
- motor starter fuses and thermal overloads

Additional items should be added as experience is gained in O&M performance.

6.4 EXPENDABLE SUPPLIES

The following expendable supplies should be stored at the site in sufficient quantity to keep the plant operating:

- sulfuric acid (to control scaling and effluent pH)
- lithium grease (per manufacturer's specifications)
- lubricating oil (per manufacturer's specifications)
- adsorbents for spills

7.0 STAFFING

Operation, maintenance, and monitoring of the groundwater recovery and treatment system must be performed by appropriately trained and experienced personnel. It is recommended that the system be staffed by one qualified mechanical operator at the site 3 days per week during normal working hours (8:00 am to 5:00 pm), or as required. It is also recommended that an electrical and instrumentation technician perform repairs and calibrate instruments on an as needed basis.

The system is monitored by autodialer 24 hours per day. In the event of a treatment system malfunction, the autodialer is programmed to page the mechanical operator and send a message to the operator's voicemail. Details of this process are provided in Section 5.1.

For all hazardous waste operations and confined entry actions, the Occupational Safety and Health Administration requires that the "buddy system" be employed. The purpose of the "buddy system" is to provide rapid assistance to employees in the event of an emergency. Each worker must be observed by at least one other worker.

The duties of the mechanical operator include but are not limited to the following:

- monitoring all treatment processes
- performing all routine preventative maintenance tasks
- maintaining all O&M records
- performing all routine cleaning and grounds keeping activities
- collecting samples for off-site chemical analysis

It is recommended that major maintenance be performed by outside contractors on an as needed basis.

8.0 REFERENCES

HydroGeoLogic, 1999, Draft Basewide Quality Assurance Project Plan Addendum, Focused Feasibility Study and Interim Remedial Action, NAS Fort Worth JRB, Texas, Contract No. F41624-95-D-8005.

HydroGeoLogic, 1998, Final Basewide Quality Assurance Project Plan, NAS Fort Worth JRB, Texas, Contract No. F41624-95-D-8005-0007.

U.S. Air Force, 1996, Final Record of Decision, Air Force Plant 4, Tarrant County, Texas, GJPO-TP-11, prepared by Rust Geotech under DOE Contract No. DE-AC04-94AL96907.

U S. Environmental Protection Agency, 1993, Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms, 4th Edition, EPA-600-4-90-027F.

U.S. Environmental Protection Agency, 1994, Short-Term Methods for Estimating The Chronic Toxicity of Effluents and Receiving Water to Freshwater Organisms, 3rd Edition, EPA-600-4-91-002.

TAB

Appendix A

APPENDIX A
FIELD FORMS

Table 1
Preventive Maintenance Worksheet
Groundwater Recovery and Treatment System
NAS Fort Worth JRB, Texas

NAS Fort Worth JRB **Preventive Maintenance Program**	**Month:** _____ **Year:** _____

Equipment	**Electrical**
Name:	Name:
Serial No.:	Serial No.:
Make:	Make:
Size:	Type:
Model:	Voltage: Amps: RPM:
	Phase: HP:

Item No.	Work to be Done	Frequency	Time

Service Record

Date	Work Done	Date	Work	Date	Work	Date	Work

Table 2
Daily Work Order and Preventive Maintenance Log
Groundwater Recovery and Treatment System
NAS Fort Worth JRB, Texas

Equipment Item	Description of Work	Work Order Number

Date: _____ Time: _____

Signature: _____

Table 3
Treatment Skid Data Sheet
NAS Fort Worth JRB, Texas

Monitoring Point	Skid # 6	Skid # 1	Skid # 2	Skid # 3	Skid # 4	Skid # 5
Influent Flowrate (gpm)						
Totalized Flow (gal)						
Sump Pump Discharge Pressure (psi)						
Bag Filter Pressure Drop (psi)						
Carbon Adsorber(s) Pressure Drop (psi)						
Air Stripper Blower # 1 Pressure Drop (in WC)						
Air Stripper Blower # 2 Pressure Drop (in WC)						
Alarm Status						
Leaks Detected						

Notes and Comments

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Data Collectors **Date** _____

Name _____ **Signature** _____

Name _____ **Signature** _____

Table 4
Treatment System Data Sheet
NAS Fort Worth JRB, Texas

Monitoring Point	Reading	Comments
Influent Pressure (psi)		
EQ Transfer Pump Discharge Pressure (psi)		
Acid Storage Tank Level (feet)		
pH Controller Set Point 1 (pH/speed)		
pH Controller Set Point 2 (pH/speed)		
pH Controller Set Point 3 (pH/speed)		
Acid Metering Pump Speed Setting		
Acid Metering Pump Stroke Setting		
Pre-Acid Addition Influent pH		
Post-Acid Addition Influent pH (EQ Tank Influent)		
System Effluent pH		

Notes and Comments

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Data Collectors **Date** _____

Name _____ **Signature** _____

Name _____ **Signature** _____

Table 5
Treatment System Maintenance Data Sheet
NAS Fort Worth JRB, Texas

Maintenance Point	Skid # 6	Skid # 1	Skid # 2	Skid # 3	Skid # 4	Skid # 5	EQ Skid
Grease Sump/Transfer Pump							
Clean Bag Filter							X
Clean Air Filter Blower # 1							X
Clean Air Filter Blower # 2							X
Backwash Carbon Adsorber # 1							X
Backwash Carbon Adsorber # 2		X	X	X	X	X	X
Clean Air Stripper # 1							X
Clean Air Stripper # 2							X
Skid Recycle pH (Skid Off Line)							X
Leaks Detected							

Notes and Comments

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Data Collectors **Date** _____

Name _____ **Signature** _____

Name _____ **Signature** _____

Table 6
Recovery Well Data Sheet
NAS Fort Worth JRB, Texas

Recovery Well	Time	Flowrate (gpm)	Pressure (psi)	Totalized Flow (gal)	Depth to Water (ft)	Leaks Detected
CAR-RW1						
CAR-RW2						
CAR-RW4						
CAR-RW5						
CAR-RW6						
CAR-RW8						
CAR-RW9						
CAR-RW10						
CAR-RW11						
CAR-RW12						
LF04-03						
Effluent Mechanical Flowmeter						
Effluent Electronic Flowmeter						

Notes and Comments

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Data Collectors: **Date** _____

Name _____ **Signature** _____

Name _____ **Signature** _____

TAB

Appendix B

APPENDIX B
TEXAS NATURAL RESOURCE CONSERVATION COMMISSION
REPORTING FORMS

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

P O BOX 13087 • AUSTIN, TEXAS 78711-3087

MONTHLY EFFLUENT REPORT

US AIR FORCE BASE CONVERSION AGENCY
ATTN: LYNN MORGAN (FORT WORTH JRB)
SUITE 900
1155 HERNDON PKWY STE 900
HERNDON VA 20170-5534

40B	WQ0003973-000	1	9 9	1 2	12426
SYS	PERMIT NUMBER	SET	YEAR	MO.	EID

THIS REPORT TO BE USED FOR OTFL 001 TREATED GW

SEE BACK FOR INSTRUCTIONS AND DEFINITIONS.

PLEASE RETAIN A PHOTOCOPY FOR YOUR RECORDS.

TNRCC COPY

PARAMETER		EFFLUENT CONDITION VALUE	EFFLUENT CONDITION UNITS	NO EX.	FREQUENCY OF ANALYSIS		SAMPLE TYPE	
000035342 DISCHRGE	REPORTED		DAY					
DAYS MTH	PERMITTED				01	NA	01	NA
004006080 PH	REPORTED		STD UNIT					
MAXIMUM	PERMITTED	9.000			14	1/WEEK	02	GRAB
004006081 PH	REPORTED		STD UNIT					
MINIMUM	PERMITTED	6.000			14	1/WEEK	02	GRAB
005521050 OIL&GRES	REPORTED		MG/L					
DLY MAX	PERMITTED	15.000			14	1/WEEK	02	GRAB
006801050 TOC	REPORTED		MG/L					
DLY MAX	PERMITTED	55.000			14	1/WEEK	02	GRAB
321031024 TRANS12D	REPORTED		MG/L					
DLY AVG	PERMITTED	0.02500			14	1/WEEK	02	GRAB
321031050 TRANS12D	REPORTED		MG/L					
DLY MAX	PERMITTED	0.06600			14	1/WEEK	02	GRAB
344851024 TRCHETLN	REPORTED		MG/L					
DLY AVG	PERMITTED	0.05200			14	1/WEEK	02	GRAB
344851050 TRCHETLN	REPORTED		MG/L					
DLY MAX	PERMITTED	0.16400			14	1/WEEK	02	GRAB
500507124 FLOW	REPORTED		MGD					
DLY AVG	PERMITTED	0.10100			14	1/WEEK	13	ESTIMATE
500507150 FLOW	REPORTED		MGD					
DLY MAX	PERMITTED	0.20000			14	1/WEEK	13	ESTIMATE

COMMENTS AND EXPLANATIONS *(Reference all attachments here)*

I CERTIFY THAT I AM FAMILIAR WITH THE INFORMATION CONTAINED IN THIS REPORT AND THAT TO THE BEST OF MY KNOWLEDGE AND BELIEF SUCH INFORMATION IS TRUE AND COMPLETE AND ACCURATE.	NAME	SIGNATURE	DATE
TELEPHONE NUMBER	PLANT OPERATOR	PLANT OPERATOR	YEAR MO. DAY
AREA CODE NUMBER	EXECUTIVE OFFICER	EXECUTIVE OFFICER	YEAR MO. DAY

TNRCC LPS Form 0123A1 (Rev 03-20-97)

Texas Natural Resource Conservation Commission
Monthly Effluent Report Form
Completion Instructions

The Monthly Effluent Report is a self-reporting form prepared for only the specific plant or outfall printed on the front of this form. The form shows all the parameters that are to be reported as required by your permit. Extreme care should be taken to insure that this report is used for only the plant or outfall described and for the year and month printed on the top of the form. Measurements or test results must be reported in the following manner:

1. "Effluent Condition" column - Enter measurements or test results in the unshaded spaces under VALUE for the parameters using the units specified. If the UNITS specifies MGD (million gallons per day), then a measured flow of 100,000 gallons per day should be reported as .100.

2. "NO EX." column - Enter in the unshaded spaces, the exact number of times during the month that the given permitted limit was exceeded. If an effluent value reported as daily average is found to exceed the permitted daily average, enter a "1" in the box regardless of the number of single readings above the permitted limit.

3. "Frequency of Analysis" and "Sample Type" column - These columns reflect your permit requirements for the sampling of each parameter. The frequency of analysis and sample type are preprinted for each parameter along with the respective two-digit code. If your sampling technique corresponds to the printed description of frequency and sample type, simply transfer the respective two-digit codes to the unshaded spaces directly above. If your sampling techniques do not correspond to the described frequency and sample type, enter a written description of your frequency of analysis and sample type in the shaded space above.

4. If no discharge is made during the reporting month enter a "0" under VALUE for the PARAMETER (Discharge Days/Month). Leave the remainder of the form blank, except for reporting requirements under number 5 below.

5. Each form must contain two original signatures, the dates the forms were signed and the telephone number of the executive officer. In addition, domestic STP operators should write in their Number of Operator Certificate as issued by the Texas Natural Resource Conservation Commission, Class (A,B,C,D) and expiration date (YYMMDD) in the unshaded spaces under VALUE for the appropriate parameters. Send the completed form to the Data Management Team (MC 224), Enforcement Division, Texas Natural Resource Conservation Commission, PO Box 13087, Austin, Texas 78711-3087.

PLEASE RETAIN A PHOTOCOPY OF THE REPORT FOR YOUR RECORDS.

The following are definitions of terms and abbreviations used on the report:

DLY AVG	Daily Average will be the arithmetic average of all test or measurement results obtained during the reporting period.
DLY MAX.	Daily Maximum will be the largest of all the test or measurement results obtained during the reporting period.
IND.GRAB	Individual Grab will be the largest test or measurement result obtained during the reporting period from a grab sample.
DLY MIN	Daily Minimum will be the smallest test or measurement result obtained during the reporting period.
GRAB	A sample collected in less than 15 minutes.
GRAB PKLOAD	Grab sample collected at Peak Loading.
3 PRT COMP	3 part composite
6 PRT COMP	6 part composite
12 PRT COMP	12 part composite
Parameter	A physical property whose values determine the characteristics or behavior of something (e.g. temperature, BOD and pH)

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

P.O BOX 13087 • AUSTIN, TEXAS 78711-3087

MONTHLY EFFLUENT REPORT

US AIR FORCE BASE CONVERSION AGENCY
ATTN: LYNN MORGAN (FORT WORTH JRB)
SUITE 900
1155 HERNDON PKWY STE 900
HERNDON VA 20170-5534

40B	WQ0003973-000	1	9 9	1 2	12426
SYS	PERMIT NUMBER	SET	YEAR	MO.	EID

THIS REPORT TO BE USED FOR OTFL 001 TREATED GW

SEE BACK FOR INSTRUCTIONS AND DEFINITIONS.

PLEASE RETAIN A PHOTOCOPY FOR YOUR RECORDS.

TNRCC COPY

PARAMETER		EFFLUENT CONDITION VALUE	EFFLUENT CONDITION UNITS	NO. EX	FREQUENCY OF ANALYSIS		SAMPLE TYPE	
719001024 **MERCURY DLY AVG**	REPORTED		MG/L					
	PERMITTED	0.00003			14	1/WEEK	02	GRAB
719001050 **MERCURY DLY MAX**	REPORTED		MG/L					
	PERMITTED	0.00006			14	1/WEEK	02	GRAB
	REPORTED							
	PERMITTED							
	REPORTED							
	PERMITTED							
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	PERMITTED							
	REPORTED							
	PERMITTED							

COMMENTS AND EXPLANATIONS *(Reference all attachments here)*

I CERTIFY THAT I AM FAMILIAR WITH THE INFORMATION CONTAINED IN THIS REPORT AND THAT TO THE BEST OF MY KNOWLEDGE AND BELIEF SUCH INFORMATION IS TRUE AND COMPLETE AND ACCURATE.	NAME	SIGNATURE	DATE
TELEPHONE NUMBER	PLANT OPERATOR	PLANT OPERATOR	YEAR MO. DAY
AREA CODE NUMBER	EXECUTIVE OFFICER	EXECUTIVE OFFICER	YEAR MO. DAY

TNRCC LPS Form 0123A1 (Rev 03-20-97)

Texas Natural Resource Conservation Commission
Monthly Effluent Report Form
Completion Instructions

The Monthly Effluent Report is a self-reporting form prepared for only the specific plant or outfall printed on the front of this form. The form shows all the parameters that are to be reported as required by your permit. Extreme care should be taken to insure that this report is used for only the plant or outfall described and for the year and month printed on the top of the form. Measurements or test results must be reported in the following manner:

1. "Effluent Condition" column - Enter measurements or test results in the unshaded spaces under VALUE for the parameters using the units specified. If the UNITS specifies MGD (million gallons per day), then a measured flow of 100,000 gallons per day should be reported as .100.

2. "NO. EX." column - Enter in the unshaded spaces, the exact number of times during the month that the given permitted limit was exceeded. If an effluent value reported as daily average is found to exceed the permitted daily average, enter a "1" in the box regardless of the number of single readings above the permitted limit.

3. "Frequency of Analysis" and "Sample Type" column - These columns reflect your permit requirements for the sampling of each parameter. The frequency of analysis and sample type are preprinted for each parameter along with the respective two-digit code. If your sampling technique corresponds to the printed description of frequency and sample type, simply transfer the respective two-digit codes to the unshaded spaces directly above. If your sampling techniques do not correspond to the described frequency and sample type, enter a written description of your frequency of analysis and sample type in the shaded space above.

4. If no discharge is made during the reporting month enter a "0" under VALUE for the PARAMETER (Discharge Days/Month). Leave the remainder of the form blank, except for reporting requirements under number 5 below.

5. Each form must contain two original signatures, the dates the forms were signed and the telephone number of the executive officer. In addition, domestic STP operators should write in their Number of Operator Certificate as issued by the Texas Natural Resource Conservation Commission, Class (A,B,C,D) and expiration date (YYMMDD) in the unshaded spaces under VALUE for the appropriate parameters. Send the completed form to the Data Management Team (MC 224), Enforcement Division, Texas Natural Resource Conservation Commission, PO Box 13087, Austin, Texas 78711-3087.

PLEASE RETAIN A PHOTOCOPY OF THE REPORT FOR YOUR RECORDS.

The following are definitions of terms and abbreviations used on the report:

DLY. AVG.	Daily Average will be the arithmetic average of all test or measurement results obtained during the reporting period.
DLY. MAX.	Daily Maximum will be the largest of all the test or measurement results obtained during the reporting period.
IND.GRAB	Individual Grab will be the largest test or measurement result obtained during the reporting period from a grab sample
DLY MIN	Daily Minimum will be the smallest test or measurement result obtained during the reporting period.
GRAB	A sample collected in less than 15 minutes.
GRAB PKLOAD	Grab sample collected at Peak Loading.
3 PRT COMP	3 part composite
6 PRT COMP	6 part composite
12 PRT COMP	12 part composite
Parameter	A physical property whose values determine the characteristics or behavior of something (e.g. temperature, BOD and pH).

TAB

Appendix C

APPENDIX C
TEXAS NATURAL RESOURCE CONSERVATION COMMISSION
OPERATING PERMIT

PERMIT NO. 03973
(corresponds to
NPDES PERMIT NO TX0)

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION
P O. Box 13087
Austin, Texas 78711-3087

PERMIT TO DISPOSE OF WASTES
under provisions of Chapter 26
of the Texas Water Code

United States Air Force Base Conversion Agency

whose mailing address is

US AFBCA/DC Carswell
6550 White Settlement Road
Fort Worth, Texas 76114-3520

is authorized to treat and dispose of wastes from a groundwater treatment and recovery unit at the former Carswell Air Force Base (SIC 9999)

located on the west end of White Settlement Road, south of Carswell Air Force Base in the City of Fort Worth, Tarrant County, Texas

to an underground culvert; thence to a Golf Course pond; thence to Farmers Branch; thence to the West Fork Trinity River Below Lake Worth in Segment No. 0806 of the Trinity River Basin

only in accordance with effluent limitations, monitoring requirements and other conditions set forth herein, as well as the rules of the Texas Natural Resource Conservation Commission ("Commission"), the laws of the State of Texas, and other orders of the Commission. The issuance of this permit does not grant to the permittee the right to use private or public property for conveyance of wastewater along the herein described discharge route. This includes property belonging to but not limited to any individual, partnership, corporation or other entity. Neither does this permit authorize any invasion of personal rights nor any violation of federal, state, or local laws or regulations. It is the responsibility of the permittee to acquire property rights as may be necessary to use the herein described discharge route.

This permit and the authorization contained herein shall expire at midnight on December 1, 2001.

ISSUED DATE. SEP 14 1998

ATTEST: Eugenia K. Brumm

For the Commission

EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

Outfall Number 001

1. During the period beginning upon date of issuance and lasting through date of expiration, the permittee is authorized to discharge treated groundwater subject to the following effluent limitations:

   The daily average flow of effluent shall not exceed 0.101 million gallons per day (MGD) The total volume discharged during any 24-hour period shall not exceed 0 20 MGD.

Effluent Characteristic	Discharge Limitations			Minimum Self-Monitoring Requirements	
	Daily Avg mg/l	Daily Max mg/l	Single Grab mg/l	Report Daily Avg & Daily Max Measurement Frequency	Sample Type
Flow (MGD)	(Report)	(Report)	N/A	1/week	Estimate
1,2-trans-Dichloroethylene	0.025	0.066	0 066	1/week	Grab
Trichloroethylene	0.052	0 164	0 164	1/week	Grab
Total Organic Carbon	N/A	55	55	1/week	Grab
Oil and Grease	N/A	15	15	1/week	Grab
Temperature (degrees F)	N/A	N/A	(95)	N/A	In-Situ -
Mercury	0.00003	0.00006	0.00006	1/week	Grab

2. The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored once per week (*1), by grab sample.

3. There shall be no discharge of floating solids or visible foam in other than trace amounts and no discharge of visible oil

4. Effluent monitoring samples shall be taken at the following location(s): At Outfall 001, which is the outlet of the discharge pipe prior to the unnamed creek.

As required by Title 30 Texas Administrative Code (TAC) Chapter (§) 305, certain regulations appear as standard conditions in waste discharge permits. 30 TAC §§305.121 - 305.129, Subchapter F, "Permit Characteristics and Conditions" as promulgated under the Texas Water Code, §§5.103 and 5.105, and §§361.017 and 361.024(a) of the Texas Solid Waste Disposal Act establish the characteristics and standards for waste discharge permits, including sewage sludge. The following text includes these conditions and incorporates them into this permit. All definitions contained in Section 26.001 of the Texas Water Code shall apply to this permit and are incorporated herein by reference. Additional definitions of words or phrases used in this permit are as follows:

1. Flow Measurements

   a. Annual average flow - the arithmetic average of all daily flow determinations taken within a period of 12 consecutive preceding calendar months. The annual average flow determination shall consist of daily flow volume determinations made by a totalizing meter, charted on a chart recorder and limited to major domestic wastewater discharge facilities with a 1 million gallons per day or greater permitted flow.

   b. Daily average flow - the arithmetic average of all determinations of the daily discharge within a period of one calendar month. The daily average flow determination shall consist of determinations made on at least four separate days. If instantaneous measurements are used to determine the daily discharge, the determination shall be the arithmetic average of all instantaneous measurements taken during that month. Daily average flow determination for intermittent discharges shall consist of a minimum of three flow determinations on days of discharge.

   c. Instantaneous flow - the measured flow during the minimum time required to interpret the flow measuring device.

   d. 2-hour peak flow (domestic wastewater treatment plants) - the maximum flow sustained for a two-hour period during the period of daily discharge. Multiple measurements of instantaneous maximum flow within a two-hour period may be compared to the permitted 2-hour peak flow.

   e. Maximum 2-hour peak flow (domestic wastewater treatment plants) - the highest 2-hour peak flow for any 24-hour period in a calender month.

   f. Daily maximum flow - the highest total flow for any 24-hour period in a calendar month.

2. Concentration Measurements

   a Daily average concentration - the arithmetic average of all effluent samples, composite or grab as required by this permit within a period of one calendar month, consisting of at least four separate representative measurements. When four samples are not available in a calendar month, the arithmetic average of the four most recent measurements or the arithmetic average (weighted by flow) of all values taken during the month shall be utilized as the daily average concentration.

   b. 7-day average concentration - the arithmetic average of all effluent samples, composite or grab as required by this permit within a period of one calendar week, Sunday through Saturday.

   c. Daily maximum concentration - the maximum concentration measured on a single day, by composite sample, unless otherwise specified elsewhere in this permit.

   d. Fecal Coliform bacteria - the number of colonies per 100 milliliters effluent.

3. Sample Type

   a. Composite sample - a sample made up of a minimum of three effluent portions collected in a continuous 24-hour period or during the period of daily discharge if less than 24 hours, and combined in volumes proportional to flow collected no closer than two hours for domestic sewage. For industrial wastewater a composite sample is a sample made up of a minimum of three effluent portions collected in a continuous 24-hour period or during the period of daily discharge if less than 24 hours, and combined in volumes proportional to flow collected no closer than one hour.

   b. Grab sample - an individual sample collected in less than 15 minutes.

4. Treatment Facility (facility) - wastewater facilities used in the conveyance, storage, treatment, recycling, reclamation and/or disposal of domestic sewage, industrial wastes, agricultural wastes, recreational wastes, or other wastes including sludge handling or disposal facilities under the jurisdiction of the Commission.

5. The term "sewage sludge" is defined as solid, semi-solid, or liquid residue generated during the treatment of domestic sewage in 30 TAC § 312. This includes the solids separated from wastewater by unit processes which have not been classified as hazardous waste.

MONITORING AND REPORTING REQUIREMENTS

1 Self-Reporting

Monitoring results shall be provided at the intervals specified in the permit. Unless otherwise specified in this permit or otherwise ordered by the Commission, the permittee shall conduct effluent sampling and reporting in accordance with 30 TAC §§319.4 - 319.12. Unless otherwise specified, a monthly effluent report shall be submitted each month by the 20th day of the following month for each discharge which is described by this permit whether or not a discharge is made for that month.

As provided by State Law, the permittee is subject to administrative, civil and criminal penalties, as applicable, for negligently or knowingly violating the Clean Water Act, the Texas Water Code, Chapters 26, 27, and 28, and Texas Health and Safety Code, Chapter 361, including but not limited to knowingly making any false statement on any report or document, falsifying, tampering with or knowingly rendering inaccurate any monitoring device or method required by this permit or violating any other requirement imposed by state or federal regulations.

2. Test Procedures

Unless otherwise specified in this permit, test procedures for the analysis of pollutants shall comply with procedures specified in 30 TAC §§319.11 - 319.12 Measurements, tests and calculations shall be accurately accomplished in a representative manner.

3 Records of Results

a. Monitoring samples and measurements shall be taken at times and in a manner so as to be representative of the monitored activity.

b. Except for records of monitoring information required by this permit related to the permittee's sewage sludge use and disposal activities, which shall be retained for a period of at least five years (or longer as required by 40 CFR Part 503), monitoring and reporting records, including strip charts and records of calibration and maintenance, copies of all records required by this permit, and the certification required by 40 Code of Federal Regulations §264.73(b)(9) shall be retained at the facility site and/or shall be readily available for review by a TNRCC representative for a period of three years from the date of the record or sample, measurement, report or certification. This period may be extended at the request of the Executive Director.

c. Records of monitoring activities shall include the following:

i. date, time and place of sample or measurement;
ii. identity of individual who collected the sample or made the measurement.
iii. date and time of analysis;
iv identity of the individual and laboratory who performed the analysis;
v the technique or method of analysis; and
vi. the results of the analysis or measurement and quality assurance/quality control records.

The period during which records are required to be kept shall be automatically extended to and through the final disposition of any administrative or judicial enforcement action that maybe instituted against the permittee.

4. Additional Monitoring by Permittee

If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit using approved analytical methods as specified above, all results of such monitoring shall be included in the calculation and reporting of the values submitted on the required monthly effluent report. Increased frequency of sampling shall be indicated on the monthly effluent report.

5. Calibration of Instruments

All automatic flow measuring and/or recording devices and/or totalizing meters required by the permit for measuring permit limited flows shall be accurately calibrated by a trained person at plant start-up and as often thereafter as necessary to ensure accuracy, but not less often than annually unless authorized by the Executive Director for a longer period. Such person shall verify in writing that the device is operating properly and giving accurate results. Copies of the verification shall be kept at the plant site for at least three years.

6. Compliance Schedule Reports

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of the permit shall be submitted no later than 14 days following each schedule date to the appropriate Regional Office and the Manager of the Water Section (MC 149) of the Enforcement Division.

7. Noncompliance Notification

a. Unless specified otherwise, any noncompliance which may endanger human health or safety, or the environment shall be reported to the TNRCC. Report of such information shall be provided orally or by facsimile transmission (FAX) to the Regional Office within 24 hours of becoming aware of the noncompliance. A written submission of such

information shall also be provided to the Regional Office and the Manager of the Water Section (MC 149) of the Enforcement Division within five working days of becoming aware of the noncompliance. The written submission shall contain a description of the noncompliance and its cause; the potential danger to human health or safety, or the environment; the period of noncompliance, including exact dates and times; if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance, and to mitigate its adverse effects.

b. Unauthorized discharges as defined in Permit Condition 2(g) of this permit shall be reported under Part a of this noncompliance notification provision.

c. Notwithstanding any of the above, any effluent violation which deviates from the permitted effluent limitation by more than 40% shall be reported in writing to the Regional Office and the Manager of the Water Section (MC 149) of the Enforcement Division within 5 working days of becoming aware of the noncompliance.

d. Any noncompliance other than that specified in this section, or any required information not submitted or submitted incorrectly, shall be reported to the Wastewater Data Management Team (MC 148) of the Water Quality Division as promptly as possible. This requirement means to report these types of noncompliance on the monthly self-report form.

8. Signatories to Reports

All reports and other information requested by the Executive Director shall be signed by the person and in the manner required by 30 TAC §305.128 (relating to Signatories to Reports).

PERMIT CONDITIONS

1. General

a. When the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in an application or in any report to the Executive Director, it shall promptly submit such facts or information.

b. This permit is granted on the basis of the information supplied and representations made by the permittee during action on an application in accordance with 30 TAC § 50 and the application process in accordance with 30 TAC § 281, and relying upon the accuracy and completeness of that information and those representations in accordance with 30 TAC § 305. After notice in accordance with 30 TAC § 39 and opportunity for a hearing in accordance with 30 TAC § 55 (b), this permit may be modified, suspended, or revoked, in whole or in part in accordance with 30 TAC § 305 Subchapter D, during its term for cause including but not limited to, the following:

i. Violation of any terms or conditions of this permit;

ii Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts; or

iii. A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

c. The permittee shall furnish to the Executive Director, upon request and within a reasonable time, any information to determine whether cause exists for amending, revoking, suspending or terminating the permit. The permittee shall also furnish to the Executive Director, upon request, copies of records required by the permit.

2. Compliance

a. Acceptance of the permit by the person to whom it is issued constitutes acknowledgment and agreement that such person will comply with all the terms and conditions embodied in the permit, and the rules and other orders of the Commission.

b. The permittee has a duty to comply with all conditions of the permit. Failure to comply with any permit condition constitutes a violation of the permit and the Texas Water Code or the Texas Health and Safety Code, and is grounds for enforcement action, for permit amendment, revocation or suspension, or for denial of a permit renewal application or of an application for a permit for another facility.

c. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of the permit.

d. The permittee shall take all reasonable steps to minimize or prevent any discharge or sludge use or disposal or other permit violation which has a reasonable likelihood of adversely affecting human health or the environment.

e. Authorization from the Commission is required before beginning any change in the permitted facility or activity that may result in noncompliance with any permit requirements.

f. A permit may be amended, suspended and reissued, or revoked for cause. The filing of a request by the permittee for a permit amendment, suspension and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

g There shall be no unauthorized discharge of wastewater or any other waste. For the purpose of this permit, an unauthorized discharge is considered to be any discharge of wastewater into or adjacent to waters in the state at any location not permitted as an outfall or otherwise defined in the Other Requirements of this permit.

h. A temporary diversion of wastewater around a unit or units to a permitted outfall for the purposes of maintenance or repair is not a violation of this permit as long as the wastewater complies with all other standards, terms and conditions of this permit. Notice shall be provided to the Regional Office at least 24 hours in advance of any temporary diversion, where practical Where prior notice for a temporary diversion is not practical, notice shall be provided to the Regional Office as soon as possible but at least within 24 hours after beginning the temporary diversion. Not withstanding any of the above, the Commission may require that an application be submitted for formal authorization.

3 Inspections and Entry

a Inspection and entry shall be allowed as prescribed in the Texas Water Code, Chapters 26, 27, and 28, and Texas Health and Safety Code, Chapter 361.

b. The members of the Commission and employees and agents of the Commission are entitled to enter any public or private property at any reasonable time for the purpose of inspecting and investigating conditions relating to the quality of water in the state. Members, employees, or agents acting under this authority who enter private property shall observe the establishment's rules and regulations concerning safety, internal security, and fire protection, and if the property has management in residence, shall notify management or the person then in charge of his or her presence and shall exhibit proper credentials. If any member, employee, or agent is refused the right to enter in or on public or private property under this authority, the Executive Director may invoke the remedies authorized in Texas Water Code Section 26.123.

4 Permit Amendment

a. The permittee shall give notice to the Executive Director prior to physical alterations or additions to the permitted facility if such alterations or additions would require a permit amendment or result in a violation of permit requirements.

b. Prior to any facility modifications, additions and/or expansions of a permitted facility that will increase the plant capacity beyond the permitted flow, the permittee must apply for and obtain proper authorization from the Commission before commencing construction.

c. The permittee must apply for an amendment or renewal at least 180 days prior to expiration of the existing permit in order to continue a permitted activity after the expiration date of the permit. Authorization to continue such activity will terminate upon the effective denial of said application.

d Prior to accepting wastes which are not described in the permit application or which would result in a significant change in the quantity or quality of the existing discharge, the permittee must report the proposed changes to the Commission. The permittee must apply for a permit amendment reflecting any necessary changes in permit conditions, including effluent limitations for pollutants not identified and limited by this permit.

e. Texas Water Code §26.029(b) After a public hearing, notice of which shall be given to the permittee, the Commission may require the permittee, from time to time, for good cause, to conform to new or additional conditions. The Commission shall allow the permittee a reasonable time to conform to the new or additional conditions, and on application of the permittee, the Commission may grant additional time

5 Permit Transfer

a. Prior to any transfer of this permit, Commission approval must be obtained. The Commission shall be notified, in writing, of any change in control or ownership of facilities authorized by this permit. Such notification should be sent to the Wastewater Permits Application Team (MC 148) of the Water Quality Division.

b. A permit may be transferred only according to the provisions of 30 TAC §305.64 (relating to Transfer of Permits) and 30 TAC § 50.31 (relating to Action on Application for Transfer).

6. Relationship to Hazardous Waste Activities

This permit does not authorize any activity of hazardous waste storage, processing, or disposal which requires a permit or other authorization pursuant to the Texas Health and Safety Code.

7. Relationship to Water Rights

Disposal of treated effluent by any means other than discharge directly to the waters in the state must be specifically authorized in this permit and may require a permit pursuant to Chapter 11 of the Texas Water Code.

8. Property Rights

A permit does not convey any property rights of any sort, or any exclusive privilege.

The conditions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstances, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

OPERATIONAL REQUIREMENTS

1. The permittee shall at all times ensure that the facility and all its systems of collection, treatment, and disposal are properly operated. This includes the regular, periodic examination of wastewater solids within the treatment plant by the operator in order to maintain an appropriate quantity and quality of solids inventory as described in the various operator training manuals and according to accepted industry standards for process control such as the Commission's "Recommendations for Minimum Process Control Tests for Domestic Wastewater Treatment Facilities." Process control records shall be retained at the facility site and/or shall be readily available for review by a TNRCC representative for a period of three years.

2. Upon request of the Executive Director, the permittee shall take appropriate samples and provide proper analysis in order to demonstrate compliance with Commission rules. Unless otherwise specified in this permit or otherwise ordered by the Commission, the permittee shall comply with all provisions of 30 TAC §§ 312.1 - 312.13 concerning sewage sludge use and disposal and 30 TAC §§319.21 - 319.29 concerning the discharge of certain hazardous metals.

3. Domestic wastewater treatment facilities shall comply with the following provisions:

   a. The permittee shall notify the Executive Director in care of the Wastewater Permits Section (MC 148) of the Water Quality Division, in writing of any closure activity or facility expansion at least 90 days prior to conducting such activity.

   b. Closure activities include those associated with any pit, tank, pond, lagoon, or surface impoundment regulated by this permit.

   c. As part of the notification, the permittee shall submit to the Municipal Permits Team (MC 148) of the Wastewater Permits Section of the Water Quality Division, a closure plan which has been developed in accordance with the "Closure Guidance Documents Nos. 4 and 5" available through the Publications Inventory and Distribution Section (MC 195) of the Agency Communications Division.

4. The permittee is responsible for installing prior to plant start-up, and subsequently maintaining, adequate safeguards to prevent the discharge of untreated or inadequately treated wastes during electrical power failures by means of alternate power sources, standby generators, and/or retention of inadequately treated wastewater.

5 Unless otherwise specified, the permittee shall provide a readily accessible sampling point and, where applicable, an effluent flow measuring device or other acceptable means by which effluent flow may be determined.

6. The permittee shall remit an annual waste treatment fee to the Commission as required by 30 TAC § 305 (Subchapter M) and an annual water quality assessment fee to the Commission as required by 30 TAC § 320. Failure to pay either fee may result in revocation of this permit.

7. Documentation

   For all written notifications to the Commission required of the permittee by this permit, the permittee shall keep and make available a copy of each such notification, upon the same basis as self-monitoring data are required to be kept and made available.

8. Facilities which generate domestic wastewater shall comply with these provisions; domestic wastewater treatment facilities at permitted industrial sites are excluded.

   a. Whenever flow measurements for any domestic sewage treatment facility reach 75 percent of the permitted average daily flow for three consecutive months, the permittee must initiate engineering and financial planning for expansion and/or upgrading of the domestic wastewater treatment and/or collection facilities. Whenever, the average daily flow reaches 90 percent of the permitted average daily flow for three consecutive months, the permittee shall obtain necessary authorization from the Commission to commence construction of the necessary additional treatment and/or collection facilities. In the case of a domestic wastewater treatment facility which reaches 75 percent of the permitted daily average flow for three consecutive months, and the planned population to be served or the quantity of waste produced is not expected to exceed the design limitations of the treatment facility, the permittee shall submit an engineering report supporting this claim to the Executive Director of the Commission. If in the judgement of the Executive Director the population to be served will not cause permit noncompliance, then the requirement of this section may be waived. To be effective, any waiver must be in writing and signed by the Manager of the Water Section (MC 149) of the Enforcement Division of the Commission or an authorized agent, and such waiver of these requirements will be reviewed upon expiration of the existing permit; however, any such waiver shall not be interpreted as condoning or excusing any violation of any permit parameter.

   b. The plans and specifications for domestic sewage collection and treatment works associated with any domestic permit must be approved by the Commission, and failure to secure approval before commencing construction of such works or making a discharge is a violation of this permit and each day is an additional violation until approval has been secured.

c. Permits for domestic wastewater treatment plants are granted subject to the policy of the Commission to encourage the development of area-wide waste collection, treatment and disposal systems. The Commission reserves the right to amend any domestic wastewater permit in accordance with applicable procedural requirements to require the system covered by this permit to be integrated into an area-wide system, should such be developed; to require the delivery of the wastes authorized to be collected in, treated by or discharged from said system, to such area-wide system; or to amend this permit in any other particular to effectuate the Commission's policy Such amendments may be made when the changes required are advisable for water quality control purposes and are feasible on the basis of waste treatment technology, engineering, financial, and related considerations existing at the time the changes are required, exclusive of the loss of investment in or revenues from any then existing or proposed waste collection, treatment or disposal system.

9 Domestic wastewater treatment plants shall be operated and maintained by sewage plant operators holding a valid certificate of competency at the required level as defined in 30 TAC § 325.

10. Facilities which generate industrial solid waste as defined in 30 TAC §335.1 shall comply with these provisions:

a. Any solid waste generated by the permittee during the management and treatment of wastewater, as defined in 30 TAC §335.1 (including but not limited to such wastes as garbage, refuse, sludge from a waste treatment, water supply treatment plant or air pollution control facility, discarded materials, discarded materials to be recycled, whether the waste is solid, liquid, or semisolid) must be managed in accordance with all applicable provisions of 30 TAC § 335, relating to Industrial Solid Waste Management.

b. Industrial wastewater that is being collected, accumulated, stored, or processed before discharge through any final discharge outfall, specified by this permit, is considered to be industrial solid waste until the wastewater passes through the actual point source discharge and must be managed in accordance with all applicable provisions of 30 TAC § 335.

c. The permittee shall provide written notification, pursuant to the requirements of 30 TAC §335.6(g), to the Corrective Action Section (MC 127) of the Industrial and Hazardous Waste Division informing the Commission of any closure activity involving an Industrial Solid Waste Management Unit, at least 90 days prior to conducting such an activity.

d. Construction of any industrial solid waste management unit requires the prior written notification of the proposed activity to the Waste Evaluation Section (MC 129) of the Industrial and Hazardous Waste Division. No person shall dispose of industrial solid waste, including sludge or other solids from wastewater treatment processes, prior to fulfilling the deed recordation requirements of 30 TAC §335.5.

e. The term "industrial solid waste management unit" means a landfill, surface impoundment, waste-pile, industrial furnace, incinerator, cement kiln, injection well, container, drum, salt dome waste containment cavern, or any other structure vessel, appurtenance, or other improvement on land used to manage industrial solid waste.

f. The permittee shall keep management records for all sludge (or other waste) removed from any wastewater treatment process. These records shall fulfill all applicable requirements of 30 TAC § 335 and must include the following, as it pertains to wastewater treatment and discharge:

i. Volume of waste and date(s) generated from treatment process;
ii. Volume of waste disposed of on-site or shipped off-site;
iii. Date(s) of disposal;
iv. Identity of hauler or transporter;
v Location of disposal site; and
vi. Method of final disposal.

The above records shall be maintained on a monthly basis and be available at the plant site for inspection by authorized representatives of the Texas Natural Resource Conservation Commission for at least five years.

11. For facilities to which the requirements of 30 TAC § 335 do not apply, sludge and solid wastes, including tank cleaning and contaminated solids for disposal, shall be disposed of in accordance with Chapter 361 of the Health and Safety Code of Texas.

OTHER REQUIREMENTS

1 Rainfall runoff discharged from the plant area through any point source not identified in this permit by outfall shall not (a) contain floating solids, visible oil or visible foam in other than trace amounts, (b) have a pH less than 6 0 nor greater than 9 0 standard units at any time, or (c) total organic carbon of 75 mg/l nor an oil and grease concentration of 15 mg/l on a grab sample.

2 There shall be no discharge of domestic wastewater All domestic sewage shall be routed to the City Fort Worth's wastewater treatment plant (Permit No 10494-013).

3. There shall be no discharge of any wastewater related to operation of Carswell Air Force Base or utility units. Discharges from future military activity related to Air Force Base operations shall require a permit amendment.

4 There is no mixing zone established for this discharge to an intermittent stream. Acute toxic criteria apply at the point of discharge.

5 Reporting requirements pursuant to 30 TAC Sections 319.1-319.12 and any additional effluent reporting requirements contained in the permit are suspended from the effective date of the permit until plant start-up or discharge, whichever comes first, from the facility described by this permit. The permittee shall provide written notice to the Texas Natural Resource Conservation Commission, Applications Team (MC-148), Water Quality Division and Regional Office, forty-five (45) days prior to plant start-up or anticipated discharge.

6. Permit compliance/noncompliance determinations will be based on the minimum analytical level (MAL) for toxic organic and inorganic parameters. Effluent concentrations measured as less than the MAL are deemed to be compliant with the permit limitations. When an analysis of an effluent sample for the following parameters results in a measurement of less than the MAL, that parameter shall be reported as "< (MAL value)" and this shall be interpreted as a value of zero (0) for compliance purposes.

COMPOUNDS	MAL (mg/l)
Mercury	0.0002

CHRONIC BIOMONITORING REQUIREMENTS: FRESHWATER

The provisions of this Section apply to Outfall 001 for whole effluent toxicity testing (biomonitoring).

1 Scope, Frequency and Methodology

a. The permittee shall test the effluent for toxicity in accordance with the provisions below. Such testing will determine if an appropriately dilute effluent sample adversely affects the survival, reproduction, or growth of the test organism(s). Toxicity is herein defined as a statistically significant difference at the 95% confidence level between the survival, reproduction, or growth of the test organism(s) in a specified effluent dilution compared to the survival, reproduction, or growth of the test organism(s) in the control (0% effluent).

b. The permittee shall conduct the following toxicity tests utilizing the test organisms, procedures and quality assurance requirements specified in this Part of the permit and in accordance with "Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, Third Edition" (EPA-600-4-91-002), or the most recent update thereof:

1) Chronic static renewal survival and reproduction test using Ceriodaphnia dubia (Method 1002 0 or the most recent update thereof). This test should be terminated when 60% of the surviving females in the control produce three broods. This test shall be conducted once per quarter.

2) Chronic static renewal 7-day larval survival and growth test using the fathead minnow (Pimephales promelas) (Method 1000 0 or the most recent update thereof) A minimum of five (5) replicates with eight (8) organisms per replicate shall be used for this test. This test shall be conducted once per six months.

The permittee may be required to repeat an invalid test, including the control and all effluent dilutions. An invalid test is herein defined as any test failing to satisfy the test acceptability criteria, procedures, and quality assurance requirements specified in the test methods or in this permit An invalid test shall be repeated within the required reporting period.

c. The permittee shall use five effluent dilution concentrations and a control in each toxicity test. These additional effluent concentrations shall be 32%, 42%, 56%, 75%, and 100% effluent. The critical dilution, defined as 100% effluent, is the effluent concentration representative of the proportion of effluent in the receiving water during critical low flow or critical mixing conditions.

d. This permit may be amended to require a Whole Effluent Toxicity (WET) limit, chemical-specific effluent limits, a Best Management Practice (BMP), additional toxicity testing, and/or other appropriate actions to address toxicity The permittee may be required to conduct additional biomonitoring tests if biomonitoring data indicate multiple numbers of unconfirmed toxicity events.

2. Required Toxicity Testing Conditions

a. Test Acceptance - The permittee shall repeat any toxicity test, including the control and all effluent dilutions, which fails to meet any of the following criteria:

1) a mean survival equal to or greater than 80% for the control;

2) a mean number of Ceriodaphnia dubia neonates per surviving female equal to or greater than 15 in the control,

3) a minimum mean dry weight of the surviving fathead minnow larvae in the control of 0 25 mg or greater per larva at the end of the 7 days, and

4) a percent Coefficient of Variation (CV%, the standard deviation x 100/ mean) between replicates of 40% or less in the control and critical dilution in the fathead minnow survival test The CV% requirements shall not apply at the critical dilution when statistically significant lethality occurs

b. Statistical Interpretation

1) For the Ceriodaphnia dubia survival test, the statistical analyses used to determine if there is a significant difference between the control and the critical dilution shall be Fisher's Exact Test as described in the "Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, Third Edition" (EPA/600/4-91/002), or the most recent update thereof.

2) For the Ceriodaphnia dubia reproduction test and the fathead minnow larval survival and growth tests, the statistical analyses used to determine if there is a significant difference between the control and the critical dilution shall be in accordance with the methods for determining the No Observed Effect Concentration (NOEC) as described in the "Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, Third Edition" (EPA/600/4-91/002), or the most recent update thereof.

c. Dilution Water

1) Dilution water used in the toxicity tests shall be the receiving water collected at a point upstream of the discharge as close as possible to the discharge point, but unaffected by the discharge. Where the toxicity tests are conducted on effluent discharges to receiving waters that are classified as intermittent streams, or where the toxicity tests are conducted on effluent discharges where no receiving water is available due to zero flow conditions, the permittee shall; (a) substitute a synthetic dilution water that has a pH, hardness, and alkalinity similar to that of the closest downstream perennial water unaffected by the discharge, or (b) utilize the closest downstream perennial water unaffected by the discharge.

2) Where the receiving water proves unsatisfactory as a result of preexisting instream toxicity (i e fails to fulfill the test acceptance criteria of item 2.a.), the permittee may substitute synthetic dilution water for the receiving water in all subsequent tests provided the unacceptable receiving water test met the following stipulations:

a) a synthetic lab water control was performed (in addition to the receiving water control) which fulfilled the test acceptance requirements of item 2.a;

b) the test indicating receiving water toxicity was carried out to completion (i.e., 7 days);

c) the permittee submitted all test results indicating receiving water toxicity with the reports and information required in Part 3 of this Section.

The synthetic dilution water shall have a pH, hardness, and alkalinity similar to that of the receiving water or a natural water in the drainage basin that is unaffected by the discharge, provided the magnitude of these parameters will not cause toxicity in a synthetic dilution water control that has been formulated to match the pH, hardness, and alkalinity naturally found in the receiving water

Upon approval, the permittee may substitute other appropriate dilution water with chemical and physical characteristics similar to that of the receiving water.

d. Samples and Composites

1) The permittee shall collect a minimum of three flow-weighted 24-hour composite samples from Outfall 001. The second and third 24-hour composite samples will be used for the renewal of the dilution concentrations for each toxicity test. A 24-hour composite sample consists of a minimum of twelve (12) effluent portions collected at equal time intervals representative of a 24-hour operating day and combined proportionally to flow, or a sample continuously collected proportionally to flow over a 24-hour operating day.

2) The permittee shall collect the 24-hour composite samples such that the samples are representative of any periodic episode of chlorination, biocide usage, or other potentially toxic substance discharged on an intermittent basis.

3) The permittee shall initiate the toxicity tests within 36 hours after collection of the last portion of the first 24-hour composite sample. The holding time for any subsequent 24-hour composite sample shall not exceed 72 hours. Samples shall be maintained at a temperature of 4 degrees Centigrade during collection, shipping, and storage.

4) If flow from the outfall being tested ceases during the collection of effluent samples, the requirements for the minimum number of effluent samples, the minimum number of effluent portions, and the sample holding time, are waived during that sampling period. However, the permittee must have collected an effluent composite sample volume sufficient to complete the required toxicity tests with daily renewal of the effluent. When possible, the effluent samples used for the toxicity tests shall be collected on separate days if the discharge occurs over multiple days. The effluent composite sample collection duration and the static renewal protocol associated with the abbreviated sample collection must be documented in the full report required in Part 3 of this Section.

3. Reporting

All reports, tables, plans, summaries, and related correspondence required in any Part of this Section shall be submitted to the attention of the Toxicity Evaluation Team (MC 150) of the Water Quality Division.

a. The permittee shall prepare a full report of the results of all tests conducted pursuant to this permit in accordance with the Report Preparation Section of "Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, Third Edition" (EPA 600/4-91/002), or the most recent update thereof, for every valid and invalid toxicity test initiated whether carried to completion or not. All full reports shall be retained for 3 years at the plant site and shall be available for inspection by TNRCC personnel.

b. A full report must be submitted with the first valid biomonitoring test results for each test species and with the first test results any time the permittee subsequently employs a different test laboratory Full reports need not be submitted for subsequent testing unless specifically requested. The permittee shall routinely report the results of each biomonitoring test on the Table 1 forms provided with this permit All Table 1 reports must include the information specified in the Table 1 form attached to this permit

c. Where monthly biomonitoring is required, test results (Table 1 reports) are due on or before the 20th day of the month following sampling.

d. Where quarterly biomonitoring is required, test results (Table 1 reports) are due on or before April 20th, July 20th, October 20th, and January 20th, for biomonitoring conducted during the previous calendar quarter.

e. Where semiannual biomonitoring is required, test results (Table 1 reports) are due on or before July 20th and January 20th for biomonitoring conducted during the previous 6 month period.

f. Where annual biomonitoring is required, test results (Table 1 reports) are due on or before January 20th for biomonitoring conducted during the previous 12 month period.

4. Persistent Lethality

The requirements of this Part apply only when a toxicity test demonstrates significant lethal effects at the critical dilution. Significant lethal effects are defined as a statistically significant difference, at the 95% confidence level, between the survival of the test organism in a specified effluent dilution when compared to the survival of the test organism in the control.

a. The permittee shall conduct a total of two (2) additional tests (retests) for any species that demonstrates significant lethal effects at the critical dilution. The two retests shall be conducted monthly during the next two consecutive months, unless monthly testing is specified for the species demonstrating significant lethal effects. The permittee shall not substitute either of the two retests in lieu of routine toxicity testing. All reports shall be submitted within twenty (20) days of test completion. Test completion is defined as the last day of the test.

b. If one or both of the two retests specified in item 4.a. demonstrates significant lethal effects at the critical dilution, the permittee shall initiate the TRE requirements as specified in Part 5.

c. The provisions of item 4.a. are suspended upon completion of the two retests and submittal of the TRE Action Plan and Schedule defined in Part 5 of this Section.

5. Toxicity Reduction Evaluation

a. Within forty-five (45) days of the last test day of the retest that confirms significant lethal effects at the critical dilution, the permittee shall submit a General Outline for initiating a TRE. The outline shall include, but not be limited to, a description of project personnel, a schedule for obtaining consultants (if needed), a discussion of influent and/or effluent data available for review, a sampling and analytical schedule, and a proposed TRE initiation date.

b Within ninety (90) days of the last test day of the retest that confirms significant lethal effects at the critical dilution, the permittee shall submit a TRE Action Plan and Schedule for conducting a TRE The plan shall specify the approach and methodology to be used in performing the TRE. A Toxicity Reduction Evaluation is a step-wise investigation combining toxicity testing with physical and chemical analysis to determine actions necessary to eliminate or reduce effluent toxicity to a level not effecting significant lethality at the critical dilution The TRE Action Plan shall lead to the successful elimination of significant lethal effects at the critical dilution for both test species defined in item 1 c. As a minimum, the TRE Action Plan shall include the following:

1) Specific Activities - The TRE Action Plan shall specify the approach the permittee intends to utilize in conducting the TRE, including toxicity characterizations, identifications, confirmations, source evaluations, treatability studies, and/or alternative approaches. When conducting characterization analyses, the permittee shall perform multiple characterizations and follow the procedures specified in the document entitled, "Toxicity Identification Evaluation: Characterization of Chronically Toxic Effluents, Phase I" (EPA/600/6-91/005F), or alternate procedures The permittee shall perform multiple identifications and follow the methods specified in the documents entitled, "Methods for Aquatic Toxicity Identification Evaluations, Phase II Toxicity Identification Procedures for Samples Exhibiting Acute and Chronic Toxicity" (EPA/600/R-92/080) and "Methods for Aquatic Toxicity Identification Evaluations, Phase III Toxicity Confirmation Procedures for Samples Exhibiting Acute and Chronic Toxicity" (EPA/600/R-92/081). All characterization, identification, and confirmation tests shall be conducted in an orderly and logical progression;

2) Sampling Plan - The TRE Action Plan should describe sampling locations, methods, holding times, chain of custody, and preservation techniques. The effluent sample volume collected for all tests shall be adequate to perform the toxicity characterization/ identification/ confirmation procedures, and chemical-specific analyses when the toxicity tests show significant lethality

Where the permittee has identified or suspects specific pollutant(s) and/or source(s) of effluent toxicity, the permittee shall conduct, concurrent with toxicity testing, chemical-specific analyses for the identified and/or suspected pollutant(s) and/or source(s) of effluent toxicity;

3) Quality Assurance Plan - The TRE Action Plan should address record keeping and data evaluation, calibration and standardization, baseline tests, system blanks, controls, duplicates, spikes, toxicity persistence in the samples, randomization, reference toxicant control charts, as well as mechanisms to detect artifactual toxicity; and

4) Project Organization - The TRE Action Plan should describe the project staff, project manager, consulting engineering services (where applicable), consulting analytical and toxicological services, etc.

c. Within thirty (30) days of submittal of the TRE Action Plan and Schedule, the permittee shall implement the TRE with due diligence.

d. The permittee shall submit quarterly TRE Activities Reports concerning the progress of the TRE. The quarterly reports are due on or before April 20th, July 20th, October 20th, and January 20th. The report shall detail information regarding the TRE activities including:

1) results and interpretation of any chemical specific analyses for the identified and/or suspected pollutant(s) performed during the quarter,

2) results and interpretation of any characterization, identification, and confirmation tests performed during the quarter;

3) any data and/or substantiating documentation which identifies the pollutant(s) and/or source(s) of effluent toxicity,

4) results of any studies/evaluations concerning the treatability of the facility's effluent toxicity;

5) any data which identifies effluent toxicity control mechanisms that will reduce effluent toxicity to the level necessary to meet no significant lethality at the critical dilution; and

6) any changes to the initial TRE Plan and Schedule that are believed necessary as a result of the TRE findings.

Copies of the TRE Activities Report shall also be submitted to the U.S. EPA Region 6 office (6WQ-PI) and the TNRCC Region 4 office.

e. The permittee shall continue routine biomonitoring quarterly (as a minimum) during the TRE, using the most sensitive species unless, after initiating the TRE, the effluent ceases to induce lethal responses. A cessation of lethality is defined as no significant lethality at the critical dilution for a period of twelve (12) consecutive months with at least monthly sampling and testing. Such evidence shall be submitted with a statement of intent to cease the TRE. The permittee may then resume routine biomonitoring testing.

This provision does not apply as a result of corrective actions taken. Corrective actions which eliminate or reduce effluent toxicity include source reduction or elimination, housekeeping improvements, changes in chemical usage, and modifications of influent or effluent treatment.

f. The permittee shall complete the TRE and submit a Final Report on the TRE Activities no later than twenty-eight (28) months from the last test day of the retest that confirmed significant lethal effects at the critical dilution. The permittee may petition the Executive Director (in writing) for an extension of the 28-month limit. However, to warrant an extension the permittee must have demonstrated due diligence in their pursuit of the TIE/TRE and must prove that circumstances beyond their control stalled the TIE/TRE. The report shall provide information pertaining to the specific control mechanism(s) selected that will, when implemented, result in reduction of effluent toxicity to no significant lethality at the critical dilution. The report will also provide a specific corrective action schedule for implementing the selected control mechanism(s).

Copies of the Final Report on the TRE Activities shall also be submitted to the U.S EPA Region 6 office (6WQ-PI) and the TNRCC Region 4 office

g. Based upon the results of the TRE and proposed corrective actions, this permit may be amended to modify the biomonitoring requirements where necessary, to require a compliance schedule for implementation of corrective actions, to specify a WET limit, to specify a BMP, and/or to specify chemical-specific effluent limits.

24-HOUR ACUTE BIOMONITORING REQUIREMENTS: FRESHWATER

The provisions of this Section apply individually and separately to Outfall 001 for whole effluent toxicity testing (biomonitoring). No samples or portions of samples from one outfall may be composited with samples or portions of samples from another outfall The provisions of this Section are in addition to other biomonitoring requirements in this permit

1. Scope, Frequency and Methodology

a. The permittee shall test the effluent for lethality in accordance with the provisions in this Section. Such testing will determine compliance with the Surface Water Quality Standard, 30 TAC §307 6(e)(2)(B), of greater than 50% survival of the appropriate test organisms in 100% effluent for a 24-hour period.

b. The toxicity tests specified shall be conducted once per quarter. The permittee shall conduct the following toxicity tests utilizing the test organisms, procedures, and quality assurance requirements specified in this section of the permit and in accordance with "Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms, Fourth Edition" (EPA 600/4-90/027F), or the most recent update thereof:

1) Acute 24-hour static toxicity test using Daphnia pulex. A minimum of five (5) replicates with eight (8) organisms per replicate shall be used for this test.

2) Acute 24-hour static toxicity test using the fathead minnow (Pimephales promelas) A minimum of five (5) replicates with eight (8) organisms per replicate shall be used for this test.

The permittee may be required to repeat an invalid test, including the control (0% effluent). An invalid test is herein defined as any test failing to satisfy test acceptability criteria, procedures, and quality assurance requirements specified in the test methods or in this permit. An invalid test shall be repeated within the required reporting period.

c. In addition to an appropriate control, a 100% effluent concentration shall be used in the toxicity tests. Except as discussed in item 2.b., the control and/or dilution water shall consist of a standard, synthetic, moderately hard, reconstituted water.

d. This permit may be amended to require a Whole Effluent Toxicity (WET) limit, a Best Management Practice (BMP), chemical-specific effluent limits, additional toxicity testing, and/or other appropriate actions to address toxicity. The permittee may be required to conduct additional biomonitoring tests if biomonitoring data indicate multiple numbers of unconfirmed toxicity events.

e. If the biomonitoring dilution series specified elsewhere in the permit (Chronic Biomonitoring Requirements) includes a 100% effluent concentration, the results from those tests may fulfill the requirements of this 24-Hour Acute Biomonitoring section. If the Chronic or 48-Hour Acute biomonitoring testing frequency is greater than that specified in item b, any tests performed in the proper time interval may be substituted Compliance will be evaluated as specified in item a. The 50% survival in 100% effluent for a 24-hour period standard applies to all tests utilizing a 100% effluent dilution, regardless of whether the results are submitted to comply with the minimum testing frequency defined in item b

2 Required Toxicity Testing Conditions

a. Test Acceptance - The permittee shall repeat any toxicity test, including the control, if the control fails to meet a mean survival equal to or greater than 90%.

b. Dilution Water - In accordance with item 1.c., the control and/or dilution water shall normally consist of a standard, synthetic, moderately hard, reconstituted water If the permittee utilizes the results of a 48-Hour Acute test or a Chronic test to satisfy the 24-Hour Acute Biomonitoring requirements in accordance with item 1.e., the permittee may use the receiving water or dilution water that meets the requirements of item 2 a as the control and dilution water.

c Samples and Composites

1) The permittee shall collect one flow-weighted 24-hour composite sample from Outfall 001. A 24-hour composite sample consists of a minimum of twelve (12) effluent portions collected at equal time intervals representative of a 24-hour operating day and combined proportional to flow, or a sample continuously collected proportional to flow over a 24-hour operating day

2) The permittee shall collect the 24-hour composite samples such that the samples are representative of any periodic episode of chlorination, biocide usage, or other potentially toxic substance discharged on an intermittent basis.

3) The permittee shall initiate the toxicity tests within 36 hours after collection of the last portion of the 24-hour composite sample. Samples shall be maintained at a temperature of 4 degrees Centigrade during collection, shipping, and storage.

4) If the Outfall ceases discharging during the collection of the effluent composite sample, the requirements for the minimum number of effluent portions are waived. However, the permittee must have collected a composite sample volume sufficient for completion of the required test. The abbreviated sample collection, duration, and methodology must be documented in the full report required in Part 3 of this Section.

3. Reporting

All reports, tables, plans, summaries, and related correspondence required in any Part of this Section shall be submitted to the attention of the Toxicity Evaluation Team (MC 150) of the Water Quality Division

a. The permittee shall prepare a full report of the results of all tests conducted pursuant to this permit in accordance with the Report Preparation Section of "Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms, Fourth Edition" (EPA 600/4-90/027F), or the most recent update thereof, for every valid and invalid toxicity test initiated. All full reports shall be retained for three (3) years at the plant site and shall be available for inspection by TNRCC personnel.

b. A full report must be submitted with the first valid biomonitoring test results for each test species and with the first test results any time the permittee subsequently employs a different test laboratory. Full reports need not be submitted for subsequent testing unless specifically requested. The permittee shall routinely report the results of each biomonitoring test on the Table 2 forms provided with this permit All Table 2 reports must include the information specified in the Table 2 form attached to this permit

c If semi-annual biomonitoring is required, the test results (Table 2 reports) are due on the sixth (6th) month and annual anniversary dates of permit issuance The results of the initial toxicity tests are due six (6) months from the permit issue date.

d If quarterly biomonitoring is required, the test results (Table 2 reports) are due on the third (3rd), sixth (6th), and ninth (9th) month and annual anniversary dates of permit issuance. The results of the initial toxicity tests are due three (3) months from the permit issue date.

4. Persistent Mortality

The requirements of this Part apply when a toxicity test demonstrates significant lethality, here defined as a mean mortality of 50% or greater to organisms exposed to the 100% effluent concentration after 24-hours

a. The permittee shall conduct two (2) additional tests (retests) for each species that demonstrates significant lethality. The two retests shall be conducted once per week for two (2) weeks. Five effluent dilution concentrations in addition to an appropriate control shall be used in the retests. These additional effluent concentrations shall be 6%, 13%, 25%, 50% and 100% effluent. The first retest shall be conducted within 15 days of the laboratory determination of significant lethality. All test results shall be submitted within twenty (20) days of test completion of the second retest. Test completion is defined as the 24th hour.

b. If one or both of the two retests specified in item 4.a. demonstrates significant lethality, the permittee shall initiate the Toxicity Reduction Evaluation (TRE) requirements as specified in Part 5 of this Section.

5. Toxicity Reduction Evaluation

a. Within forty-five (45) days of the retest that demonstrates significant lethality, the permittee shall submit a General Outline for initiating a TRE. The outline shall include, but not be limited to, a description of project personnel, a schedule for obtaining consultants (if needed), a discussion of influent and/or effluent data available for review, a sampling and analytical schedule, and a proposed TRE initiation date.

b. Within ninety (90) days of the retest that demonstrates significant lethality, the permittee shall submit a TRE Action Plan and Schedule for conducting a TRE. The plan shall specify the approach and methodology to be used in performing the TRE. A Toxicity Reduction Evaluation is a step-wise investigation combining toxicity testing with physical and chemical analysis to determine actions necessary to eliminate or reduce effluent toxicity to a level not effecting significant lethality at the critical dilution. The TRE Action Plan shall lead to the successful elimination of significant lethality for both test species defined in item 1.b. As a minimum, the TRE Action Plan shall include the following:

1) Specific Activities - The TRE Action Plan shall specify the approach the permittee intends to utilize in conducting the TRE, including toxicity characterizations, identifications, confirmations, source evaluations, treatability studies, and/or alternative approaches. When conducting characterization analyses, the permittee shall perform multiple characterizations and follow the procedures specified in the document entitled, "Methods for Aquatic Toxicity Identification Evaluations: Phase I Toxicity Characterization Procedures" (EPA/600/6-91/003), or alternate procedures. The permittee shall perform multiple identifications and follow the methods specified in the documents entitled, "Methods for Aquatic Toxicity Identification Evaluations, Phase II Toxicity Identification Procedures for Samples Exhibiting Acute and Chronic Toxicity" (EPA/600/R-92/080) and "Methods for Aquatic Toxicity Identification Evaluations, Phase III Toxicity Confirmation Procedures for Samples Exhibiting Acute and Chronic Toxicity" (EPA/600/R-92/081). All characterization, identification, and confirmation tests shall be conducted in an orderly and logical progression;

2) Sampling Plan - The TRE Action Plan should describe sampling locations, methods, holding times, chain of custody, and preservation techniques. The effluent sample volume collected for all tests shall be adequate to perform the toxicity characterization/ identification/ confirmation procedures, and chemical-specific analyses when the toxicity tests show significant lethality

Where the permittee has identified or suspects specific pollutant(s) and/or source(s) of effluent toxicity, the permittee shall conduct, concurrent with toxicity testing, chemical-specific analyses for the identified and/or suspected pollutant(s) and/or source(s) of effluent toxicity;

3) Quality Assurance Plan - The TRE Action Plan should address record keeping and data evaluation, calibration and standardization, baseline tests, system blanks, controls, duplicates, spikes, toxicity persistence in the samples, randomization, reference toxicant control charts, as well as mechanisms to detect artifactual toxicity; and

4) Project Organization - The TRE Action Plan should describe the project staff, project manager, consulting engineering services (where applicable), consulting analytical and toxicological services, etc.

c. Within thirty (30) days of submittal of the TRE Action Plan and Schedule, the permittee shall implement the TRE with due diligence.

d The permittee shall submit quarterly TRE Activities Reports concerning the progress of the TRE. The quarterly TRE Activities Reports are due on or before April 20th, July 20th, October 20th, and January 20th The report shall detail information regarding the TRE activities including:

1) results and interpretation of any chemical-specific analyses for the identified and/or suspected pollutant(s) performed during the quarter;

2) results and interpretation of any characterization, identification, and confirmation tests performed during the quarter;

3) any data and/or substantiating documentation which identifies the pollutant(s) and/or source(s) of effluent toxicity;

4) results of any studies/evaluations concerning the treatability of the facility's effluent toxicity;

5) any data which identifies effluent toxicity control mechanisms that will reduce effluent toxicity to the level necessary to eliminate significant lethality; and

6) any changes to the initial TRE Plan and Schedule that are believed necessary as a result of the TRE findings.

Copies of the TRE Activities Report shall also be submitted to the U.S. EPA Region 6 office (6WQ-PI) and the TNRCC Region 4 office.

e. The permittee shall continue routine biomonitoring quarterly (as a minimum) during the TRE, using the most sensitive species unless, after initiating the TRE, the effluent ceases to induce significant lethality for twelve (12) consecutive weeks with at least weekly sampling and testing. Such evidence shall be submitted with a statement of intent to cease the TRE. The permittee may then resume testing as required by this Section.

This provision does not apply as a result of corrective actions taken. Corrective actions which eliminate or reduce effluent toxicity include source reduction or elimination, housekeeping improvements, changes in chemical usage, and modifications of influent or effluent treatment.

f. The permittee shall complete the TRE and submit a Final Report on the TRE Activities no later than eighteen (18) months from the last test day of the retest that demonstrates significant lethality. The permittee may petition the Executive Director (in writing) for an extension of the 18-month limit. However, to warrant an extension the permittee must have demonstrated due diligence in their pursuit of the TIE/TRE and must prove that circumstances beyond their control stalled the TIE/TRE.

The report shall specify the control mechanism(s) that will, when implemented, reduce effluent toxicity as specified in item 5.g. The report will also specify a corrective action schedule for implementing the selected control mechanism(s). The permittee shall also submit copies of the Final Report on the TRE Activities to the U.S. EPA Region 6 office (6WQ-PI) and the TNRCC Region 4 office.

g. Within three (3) years of the last day of the test confirming toxicity, the permittee shall comply with 30 TAC 307.6 (e)(2)(B), which requires greater than 50% survival of the test organism in 100% effluent at the end of 24-hours The permittee may petition the Executive Director (in writing) for an extension of the 3-year limit. However, to warrant an extension the permittee must have demonstrated due diligence in their pursuit of the TIE/TRE and must prove that circumstances beyond their control stalled the TIE/TRE

The requirement to comply with 30 TAC 307.6 (e)(2)(B) may be exempted upon proof that toxicity is caused by an excess, imbalance, or deficiency of dissolved salts. This exemption excludes instances where individually toxic components (e g. metals) form a salt compound Following the exemption, the permit may be amended to include an ion-adjustment protocol, alternate species testing, or single species testing.

h. Based upon the results of the TRE and proposed corrective actions, this permit may be amended to modify the biomonitoring requirements where necessary, to require a compliance schedule for implementation of corrective actions, to specify a WET limit, to specify a BMP, and/or to specify a chemical-specific effluent limit(s).

United States Air Force Base Conversion Agency Permit No 03973

TABLE 2 (SHEET 1 OF 2)

DAPHNIA PULEX SURVIVAL

GENERAL INFORMATION

	Time (am/pm)	Date
Composite Sample Collected		
Test Initiated		

PERCENT SURVIVAL

Time	Rep	Percent effluent (%)					
		0%	6%	13%	25%	50%	100%
24h	A						
	B						
	C						
	D						
	E						
	MEAN*						

Enter percent effluent corresponding to the LC50 below:

24 hour LC50 (Daphnia or Ceriodaphnia) = _____% effluent
(circle appropriate genus)

95% confidence limits: _____

Method of LC50 calculation:_____

*If 24-hour survivorship data from the chronic Ceriodaphnia dubia test is being used, the mean survival per dilution for all 10 replicates shall be reported on this row.

United States Air Force Base Conversion Agency : Permit No. 03973

TABLE 2 (SHEET 2 OF 2)

FATHEAD MINNOW SURVIVAL
(Pimephales promelas)

GENERAL INFORMATION

	Time (am/pm)	Date
Composite Sample Collected		
Test Initiated		

PERCENT SURVIVAL

Time	Rep	Percent effluent (%)					
		0%	6%	13%	25%	50%	100%
24h	A						
	B						
	C						
	D						
	E						
	MEAN						

Enter percent effluent corresponding to the LC50 below:

24 hour LC50 (Pimephales) = _____% effluent

95% confidence limits: _____

Method of LC50 calculation:_____

684 91

United States Air Force Base Conversion Agency Permit No 03973

TABLE 1 (SHEET 1 OF 4)

BIOMONITORING REPORTING

CERIODAPHNIA DUBIA SURVIVAL AND REPRODUCTION

			Date	Time		Date	Time
Dates and Times Composites Collected	No. 1	FROM:			TO:		
	No. 2	FROM:			TO		
	No. 3	FROM:			TO:		

Test initiated: _____ am/pm _____ date

Dilution water used _____ Receiving Water _____ Synthetic Dilution Water

NUMBER OF YOUNG PRODUCED PER FEMALE AT END OF TEST

	Percent effluent (%)					
REP	0%	32%	42%	56%	75%	100%
A						
B						
C						
D						
E						
F						
G						
H						
I						
J						
Surviv Mean						
Total Mean						
CV%*						

*coefficient of variation = standard deviation x 100/mean (calculation based on young of the surviving females)

Designate males (M), and dead females (D-x), along with number of neonates (x) released prior to death.

United States Air Force Base Conversion Agency Permit No 03973

TABLE 1 (SHEET 2 OF 4)

BIOMONITORING REPORTING

CERIODAPHNIA DUBIA SURVIVAL AND REPRODUCTION TEST

1. Dunnett's Procedure or Steel's Many-One Rank Test or Wilcoxon Rank Sum Test (with Bonferroni adjustment) or t-test (with Bonferroni adjustment) as appropriate

Is the mean number of young produced per female significantly less (p=0.05) than the number of young per female in the control for the % effluent corresponding to (significant nonlethal effects):

CRITICAL DILUTION (100%): _____ YES _____ NO

PERCENT SURVIVAL

	Percent effluent (%)					
Time of Reading	0%	32%	42%	56%	75%	100%
24h						
48h						
End of Test						

2. Fisher's Exact Test:

Is the mean survival at test end significantly less (p=0.05) than the control survival for the % effluent corresponding to (lethality):

CRITICAL DILUTION (100%): _____ YES _____ NO

3. Enter percent effluent corresponding to each NOEC (no observed effect concentration) below and circle the lowest number:

a.) NOEC survival = _____% effluent

b.) NOEC reproduction = _____% effluent

United States Air Force Base Conversion Agency Permit No 03973

TABLE 1 (SHEET 3 OF 4)

BIOMONITORING REPORTING

FATHEAD MINNOW LARVAE GROWTH AND SURVIVAL
(Pimephales promelas)

			Date Time		Date Time
Dates and Times Composites Collected	No 1	FROM:	_____	TO:	_____
	No. 2	FROM:	_____	TO:	_____
	No. 3	FROM:	_____	TO:	_____

Test initiated: _____ am/pm _____ date

Dilution water used _____ Receiving Water _____ Synthetic Dilution Water

FATHEAD MINNOW GROWTH DATA

Effluent Concentration (%)	Average Dry Weight in milligrams in replicate chambers					Mean Dry Weight	CV%*
	A	B	C	D	E		
0%							
32%							
42%							
56%							
75%							
100%							

* coefficient of variation = standard deviation x 100/mean

1. Dunnett's Procedure or Steel's Many-One Rank Test or Wilcoxon Rank Sum Test (with Bonferroni adjustment) or t-test (with Bonferroni adjustment) as appropriate:

   Is the mean dry weight (growth) at 7 days significantly less ($p=0.05$) than the control's dry weight (growth) for the % effluent corresponding to (significant nonlethal effects):

   CRITICAL DILUTION (100%): _____ YES _____ NO

United States Air Force Base Conversion Agency Permit No 03973

TABLE 1 (SHEET 4 OF 4)

BIOMONITORING REPORTING

FATHEAD MINNOW GROWTH AND SURVIVAL TEST

FATHEAD MINNOW SURVIVAL DATA

Effluent Concentration (%)	Percent Survival in replicate chambers					Mean percent survival			CV %*
	A	B	C	D	E	24h	48h	7 day	
0%									
32%									
42%									
56%									
75%									
100%									

* coefficient of variation = standard deviation x 100/mean

2. Dunnett's Procedure or Steel's Many-One Rank Test or Wilcoxon Rank Sum Test (with Bonferroni adjustment) or t-test (with Bonferroni adjustment) as appropriate:

   Is the mean survival at 7 days significantly less ($p=0.05$) than the control survival for the % effluent corresponding to:

   CRITICAL DILUTION (100%): _____ YES _____ NO

3. Enter percent effluent corresponding to each NOEC (no observed effect concentration) below and circle the lowest number:

   a.) NOEC survival = _____% effluent

   b.) NOEC growth = _____% effluent

TAB

Appendix D

APPENDIX D
HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN

FOCUSED FEASIBILITY STUDY AND INTERIM REMEDIAL ACTION NAS FORT WORTH JRB, TEXAS

Contract Number F41624-95-D-8005

Prepared for

U.S. Air Force Center for Environmental Excellence
Brooks AFB, Texas

Prepared by

HydroGeoLogic, Inc.
1155 Herndon Parkway, Suite 900
Herndon, VA 20170

January 1999

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS

AFB	Air Force Base
AFCEE	U.S Air Force Center for Environmental Excellence
ANSI	American National Standards Institute
°C	degrees Celsius
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
COR	Contracting Officer's Representative
CPC	chemical protective clothing
CPR	cardiopulmonary resuscitation
dB(A)	decibel A-weighted scale
DOT	Department of Transportation
EPA	U.S Environmental Protection Agency
FAR	Federal Acquisition Regulation
FFS	Focused Feasibility Study
FSP	Field Sampling Plan
HAZWOPER	Hazardous Waste Site Operations
HCS	Hazard Communication Standard
HEPA	high efficiency particulate air
HSO	Health and Safety Officer
HSP	Health and Safety Plan
IRA	Interim Remedial Action
JRB	Joint Reserve Base
KCl	potassium chloride
LEL	lower explosive limit
mg/m^3	milligrams per cubic meter
mil	millimeters
MSDS	material safety data sheet
NAS	Naval Air Station
NIOSH	National Institute for Occupational Safety and Health
O_2	oxygen
OSHA	Occupational Safety and Health Administration

PEL	permissible exposure limit
PID	photoionization detector
PM	Project Manager
POC	Point of Contact
PPE	personal protective equipment
ppm_v	parts per million by volume
PVC	polyvinyl chloride
QAPP	Quality Assurance Project Plan
QPP	Quality Program Plan
RCO	responsible corporate officer
SAP	Sampling and Analysis Plan
SOW	Statement of Work
SSO	Site Safety Officer
T	air temperature
T_{aj}	adjusted air temperature
TLV	threshold limit value
UEL	upper explosive limit
U.S.	United States
USCG	U. S. Coast Guard
VOC	volatile organic compound
WP	Work Plan

HEALTH AND SAFETY PLAN
FOCUSED FEASIBILITY STUDY AND INTERIM REMEDIAL ACTION
NAS FORT WORTH JRB, TEXAS

1.0 INTRODUCTION

1.1 PURPOSE

This Health and Safety Plan (HSP) is designed to assign responsibilities, establish personnel protection standards, specify mandatory operating procedures, and provide for emergency contingencies with respect to health and safety issues that may arise while HydroGeoLogic, Inc. (HydroGeoLogic) and its subcontractor personnel are engaged in field activities related to a Focused Feasibility Study (FFS) and Interim Remedial Action (IRA) at the former Carswell Air Force Base now referred to as the Naval Air Station (NAS) Fort Worth Joint Reserve Base (JRB) located in Fort Worth, Texas. The request for the preparation of a FFS and IRA was identified in the statement of work (SOW) dated July 23, 1998, under the authorization of the U.S. Air Force Center for Environmental Excellence (AFCEE) Contract Number F41624-95-D-8005, Delivery Order Number 0019. This HSP conforms to the requirements of the Occupational Safety and Health Administration (OSHA) Standard 29 CFR 1910 and 1926. Detailed OSHA requirements for hazardous waste operations are contained in OSHA Standard 29 CFR 1910 120 and OSHA Standard 29 CFR 1926 65, "Hazardous Waste Operations and Emergency Response." Additional guidance for hazardous waste operations may be found in the U.S. Environmental Protection Agency (EPA) publication, *Standard Operating Safety Guides*, November 1987, the National Institute for Occupational Safety and Health (NIOSH)/OSHA/U.S. Coast Guard (USCG)/EPA publication, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, October 1985, and the Federal Acquisition Regulation (FAR) clause 52 236-13: Accident Prevention.

This HSP is based on available background information regarding possible chemical, physical, and biological hazards that may exist at the site. If more information concerning the nature and/or concentrations of contaminants becomes available, this HSP will be amended accordingly.

1.2 APPLICABILITY

The provisions of the HSP are mandatory for all official visitors, HydroGeoLogic employees, and subcontractors while field work is being conducted at the NAS Fort Worth JRB. This field work will include: aquifer tests of two or three wells at locations in the southern TCE plume area; the installation of five monitoring wells and five extraction wells close to the southeastern boundary of the site; three bimonthly rounds of groundwater sampling of the newly installed and existing monitoring/extraction wells; renovations to the existing groundwater pumping and treatment system; operation and maintenance of the treatment system for a period of 3 months; weekly sampling of the treatment system influent and effluent for a period of 3 months; and the quarterly biomonitoring of treatment plant effluent for one quarter. Inadequate health and safety precautions on the part of visitors or subcontractors, or the belief that personnel on the site are or may be

exposed to an immediate health hazard, can be cause for HydroGeoLogic to suspend on-site activities and require all personnel to evacuate the area of concern.

1.3 PROJECT ORGANIZATION, PERSONNEL, AND RESPONSIBILITIES

This section provides HydroGeoLogic's project organization with respect to personnel, as presented in Figure 4.1 of the Field Sampling Plan (FSP), and establishes the roles and responsibilities of project personnel with respect to site health and safety. The authority and responsibilities of HydroGeoLogic personnel working on this project are presented in the following sections.

1.3.1 Responsible Corporate Officer

The Responsible Corporate Officer (RCO) for this project will be John Robertson, P.G. (Executive Vice President). The RCO has authority to direct changes to the Corporate Health and Safety Program and determines and implements personnel disciplinary actions, as required. The RCO's responsibilities for this project will include:

- Directing and monitoring implementation of the Corporate Health and Safety Program.
- Advising on health and safety matters.
- Issuing directives, advisories, and information to the Health and Safety Officer (HSO).

1.3.2 Health and Safety Officer

The HSO for this project will be Kenneth F. Rapuano. The HSO will have the authority to:

- Suspend work or otherwise limit exposure to personnel if health and safety plans appear to be unsuitable or inadequate.
- Direct personnel to change work practices if existing practices are deemed to be hazardous to their health and safety.
- Remove personnel from projects if their actions or conditions endanger their health and safety or the health and safety of co-workers.
- Approve the qualifications of employees for working at hazardous waste sites.
- Approve health and safety plans.

The HSO responsibilities for this project will include:

- Interfacing with the Project Manager (PM) in matters of health and safety.
- Keeping the RCO and PM informed on the status of the site health and safety plan.

- Developing or reviewing and approving project health and safety plans prior to submittal.
- Conducting staff training and orientation on health and safety related activities.
- Appointing or approving a Site Safety Officer (SSO).
- Monitoring compliance with health and safety plans and conducting site audits.
- Assisting in obtaining required health and safety equipment.
- Approving personnel to work on hazardous waste management projects with regard to medical examinations and health and safety training.
- Maintaining records pertaining to medical surveillance, training, fit testing, chemical exposure, and accidents/incidents.
- Providing industrial hygiene/chemical safety guidance.

1.3.3 Project Manager

The PM for this project will be Victoria M. Guvanasen, P.E. The PM has the authority to.

- Coordinate with the HSO on health and safety matters.
- Assign the HSO-approved SSO to the project and, if necessary, assign a suitably qualified replacement.
- Temporarily suspend field activities if health and safety of personnel are endangered, pending an evaluation by the HSO.
- Temporarily suspend an individual from field activities for infractions of the health and safety plan, pending an evaluation by the HSO.

The PM responsibilities for this project will include:

- Assuring that the project is performed in a manner consistent with the health and safety program.
- Assuring that the project health and safety plan is prepared, approved, and properly implemented.
- Providing the HSO with the information needed to develop health and safety plans.
- Assuring that adequate funds are allocated to fully implement project health and safety plans.

1.3.4 Site Safety Officer

The SSO will direct all on-site health and safety training and daily safety inspections. A qualified HydroGeoLogic employee who has performed these functions before will be the designated SSO. The SSO has the authority to suspend field activities temporarily if health and safety of personnel are endangered, pending further consideration by the HSO, and to temporarily suspend an individual from field activities for infractions of the health and safety plan, pending an evaluation by the HSO.

The SSO will report any problems or concerns to the HydroGeoLogic HSO and PM. The HSO will review accident reports and air monitoring data sheets; however, because these reviews will be conducted after the fact, the SSO will remain the principal person responsible for on-site safety. At the facilities, the SSO will have primary responsibility for:

- Directing health and safety activities on site.
- Assuring that appropriate personal protective equipment (PPE) is available and properly utilized by HydroGeoLogic personnel, visitors, and subcontractor personnel.
- Assuring that personnel are aware of the provisions of this plan, are instructed in the work practices necessary to ensure safety, and are aware of planned procedures for dealing with emergencies.
- Assuring that personnel are aware of the potential hazards associated with investigation activities.
- Monitoring the safety performance of all personnel to ensure that required work practices are followed.
- Monitoring the physical condition of site workers for heat and cold stress.
- Correcting any work practices or conditions that may result in injury or exposure to hazardous substances.
- Assuring the completion of the site-specific HSP forms presented in Section 14.1 (i.e., Compliance Agreement, Accident/Incident Report, Site Safety Briefing Form, etc.).
- Assuring that a copy of the HSP is maintained at the site during all field activities.
- Assuring that all air monitoring and equipment calibrations required by the HSP are preformed and recorded, and that logs/forms that include these activities are maintained (Section 14.1).
- Assuring that the subcontractor's medical monitoring program is adequate per OSHA Standard 29 CFR 1910.120 and this document.

- Verifying OSHA 40-Hour Health and Safety training before admitting official site visitors (Air Force and regulatory representatives) into the exclusion zone and verifying medical certification and fit-testing for respirator use when visitors request admittance into a Level C PPE exclusion zone (per OSHA Standard 29 CFR 1910.120).

1.3.5 Project Field Personnel

Personnel working on this project will be approved by the PM and the HSO and will meet the qualifications outlined in OSHA Standard 29 CFR 1910.120 and this HSP. Project personnel involved in field activities will be responsible for:

- Taking all reasonable precautions to prevent injury to themselves and to their fellow employees.

- Implementing the HSP and reporting any deviations from the anticipated conditions described in the plans to the SSO.

- Performing only those tasks that they believe they can do safely, and immediately reporting any accidents and/or unsafe conditions to the SSO.

1.3.6 Subcontractor Responsibilities

It will be the responsibility of each HydroGeoLogic subcontractor to ensure compliance with all applicable Federal, state, and OSHA regulations including OSHA Standard 29 CFR, Parts 1900 through 1910, Part 1926, and the contents of this HSP. Specifically contained within these OSHA regulations is OSHA Standard 29 CFR 1910.120, which includes requirements for training and medical surveillance for employees engaged in hazardous waste operations.

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2.0 SITE DESCRIPTION

Detailed descriptions of the Air Force Plant 4 (AFP 4) and NAS Fort Worth JRB sites are presented in Section 1.0 of the Work Plan. Please refer to this section for detailed site description information.

The areas of interest for this investigation are the northern and southern regional lobes of the AFP 4 groundwater plumes that have been contaminated with trichloroethylene (TCE). AFP 4 became operational in 1942. Since this time, manufacturing operations and associated processes have resulted in the generation of waste oils, waste fuels, paint residues, used solvents, and process chemicals. Now operated by Lockheed Martin Corporation, AFP 4 continues to produce fighter aircraft and associated parts, radar units, and missile components. AFP 4 is bounded on the north by Lake Worth, on the east by NAS Fort Worth JRB, and on the south and west by the City of White Settlement. In August 1990, AFP 4 was placed on the National Priorities List (NPL) because of a large TCE plume detected in groundwater under the facility. While the plume is currently being remediated, its migration path is to the east of AFP 4 and extends under NAS Fort Worth JRB.

NAS Fort Worth JRB is a parcel of the former Carswell AFB that officially closed on September 30, 1993. NAS Fort Worth JRB is bounded on the north by Lake Worth, on the east by Highway 183 and industrial acreage, on the south by Carswell AFB property that is being converted for public redevelopment, and on the west by the base runways and AFP 4. NAS Fort Worth JRB is presently composed of personnel and equipment from three naval air stations.

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3.0 FIELD ACTIVITIES

The field activities to be conducted at the NAS Fort Worth JRB will include:

- Winterization of the groundwater pumping and treatment system, including the draining of piping and sumps and ensuring that all heat lamps are operational (following the planned system upgrade, winterization will be performed as needed when weather forecasts predict temperatures of 32 °F and below);

- the installation of five 2-inch monitoring wells and five 4-inch extraction wells in the area of the southern regional lobe of the AFP 4 TCE contaminated groundwater plume.

- Three bimonthly rounds of groundwater sampling using a submersible pump at 10 new monitoring/extraction wells, one existing monitoring well (MW-IT-01T), and 11 existing extraction wells in the area of the southern regional lobe of the AFP 4 TCE plume, and 6 existing monitoring wells in the area of the northern TCE plume (WCHMHTA013, WCHMHTA014, WITCTA004, WITCTA010, WITCTA026, and USGS04T);

- Pump tests on up to three selected monitoring/extraction wells;

- Renovation of the existing groundwater pumping and treatment system to ensure that the system can be operated effectively and efficiently;

- Operation and maintenance of the groundwater pumping and treatment system for a period of 3 months;

- Weekly sampling of treatment system influent and effluent for a period of 3 months; and

- Quarterly biomonitoring of treatment system effluent for two events.

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4.0 HAZARD ASSESSMENT

This section identifies and evaluates potential site hazards which may be encountered during field activities. Control measures, to protect site personnel from these potential hazards, are incorporated throughout this HSP, but are mainly contained in the following sections:

- Section 7.0, Personal Protective Equipment
- Section 11 0, Standard Work Practices

4.1 CHEMICAL HAZARDS

Based upon the information obtained from previous site investigations (groundwater and soil), the primary chemicals of concern at AFP 4 and NAS Fort Worth JRB are listed in Table 4.1.

The primary contaminant exposure routes for workers at the site are through inhalation, ingestion, and absorption by direct skin contact. The specific contaminants, their exposure limits, and recognition qualities are presented in Table 4.1. The acute and chronic symptoms of overexposure to these chemical contaminants and first aid procedures are presented in Table 4.2. If additional contaminants are identified as being present at the NAS Fort Worth JRB, this HSP will be amended.

4.2 DECONTAMINATION SOLUTIONS AND PRESERVATIVES

Chemicals used to decontaminate sampling equipment and to preserve environmental sampling also present hazards to the project personnel who use them. The chemicals likely to be brought to the site for use in this manner include:

- Nitric Acid
- Hydrochloric Acid
- Methanol
- Hexane
- Alconox®
- Liquid Tide®

Although overexposure to these chemicals is unlikely, the acute and chronic symptoms and first aid procedures for these chemicals are also presented in Table 4.2.

Table 4.1
Exposure Limits and Recognition Qualities

Compound	Permissible Exposure Limit (PEL)[a]	IDLH Level[b]	Recognition Qualities			Odor Warning Concentration (ppm_v)	LEL[c] (%)	UEL[d] (%)	Ionization Potential (eV)
			Color	Odor	State				
Lead	0.050 mg/m^3	100 mg/m^3	gray	odorless	solid	NA	NA	NA	NA
Mercury	0.100 mg/m^3	10 mg/m^3	silver-white	odorless	liquid	NA	NA	NA	NA
Nitric Acid	2 ppm_v	25 ppm_v	colorless, red or yellow	acrid, suffocating	liquid	NA	NA	NA	11 95
Hydrochloric Acid	C 5 ppm_v	50 ppm_v	colorless to light yellow	irritating	gas	NA	NA	NA	12.74
Methanol	200 ppm_v	6000 ppm_v	colorless	pungent	liquid	100	6.0	36 0	10 84
Hexane	500 ppm_v	1100 ppm_v	colorless	gasoline-like	liquid	NA	1 1	7 5	10.18
Benzene	1.0 ppm_v[f]	500 ppm_v[e]	colorless to light yellow	aromatic	liquid	1.5 - 5 0	1 2	7 8	9 24
Toluene	200 ppm_v	500 ppm_v	colorless	aromatic	liquid	0 17 - 40	1.1	7.1	8.82
Ethylbenzene	100 ppm_v	800 ppm_v	colorless	aromatic	liquid	4.7 - 5.0	0 8	6 7	8.76
Total Xylenes	100 ppm_v	900 ppm_v	colorless	aromatic	liquid	1 0 - 1 5	1 1	7 0	8 56
Trichloroethylene	100 ppm_v[f]	1000 ppm_v[e]	colorless	chloroform-like	liquid	28.0	8 0	10.5	9.45
Tetrachloroethylene	100 ppm_v[f]	150 ppm_v[e]	colorless	chloroform-like	liquid	27 0	NA	NA	9.32
Vinyl Chloride	1 ppm_v	Unknown[e]	colorless	pleasant	liquid or gas	3,000	3 6	33	9 99
Chloroethane	1000 ppm_v	3800 ppm_v	colorless	ether-like	liquid or gas	NA	3 8	15.4	10.97
1,1-Dichloroethane	100 ppm_v	3000 ppm_v	colorless	chloroform-like	liquid	NA	5 4	11 4	11 06

Table 4.1 (continued)
Exposure Limits and Recognition Qualities

Compound	Permissible Exposure Limit (PEL)[a]	IDLH Level[b]	Recognition Qualities			Odor Warning Concentration (ppm_v)	LEL[c] (%)	UEL[d] (%)	Ionization Potential (eV)
			Color	Odor	State				
Bis(2-ethylhexyl) Phthalate	5 mg/m^3	5000 mg/m^3	colorless	slight	liquid	NA	0.3	NA	NA
1,2-Dichloroethylene	200 ppm_v	1000 ppm_v	colorless	slightly acrid, chloroform-like	liquid	17 0	5 6	12.8	9 65

a OSHA Permissible Exposure Limit (PEL) or the American Conference of Governmental Industrial Hygienists' Threshold Limit Value (both 8-hour time weighted averages)
b Immediately Dangerous to Life or Health
c Lower explosive limit
d Upper explosive limit
e To be treated as a carcinogen
f The value presented is the OSHA PEL, which is not necessarily the more conservative of the available exposure limits. The air monitoring screening levels in Table 6.1 are based upon the more conservative values

C Ceiling value, a 15-minute Time Weighted Average that shall not be exceeded at any time during the work day
NA Not Applicable

Table 4.2
Acute And Chronic Effects
Symptoms of Overexposure And First Aid Treatment

Compound	Symptoms of Overexposure	First Aid Treatment	
Lead	Weak, lassitude, insomnia; facial pallor; pal eye, anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia, gingival lead line, tremors; paralysis of wrist and ankles, encephalaopathy; nephropathy; irritation to eyes; hypotension	Eye Skin Inhalation Ingestion	Irrigate immediately Soap wash promptly Respiratory support Medical attention immediately
Mercury	Cough, chest pain, dyspnea, bronchitis pneumonitis, tremors, insomnia; irritability, indecision; headache, fatigue, weak, stomatitis, salivation, gastrointestinal disturbance, anorexia, weight loss, proteinuria, irritation of the eyes, skin	Eye· Skin· Inhalation: Ingestion	Irrigate immediately Soap wash promptly Respiratory support Medical attention immediately
Benzene	Irritation to eyes, nose, respiratory systems, giddiness; headache, nausea, staggered gait, fatigue, anorexia, lassitude; dermatitis, bone marrow depressant/depression, carcinogenic	Eye Skin: Inhalation· Ingestion·	Irrigate immediately Soap wash promptly Artificial respiration Medical attention immediately DO NOT INDUCE VOMITING
Toluene	Fatigue, weakness; confusion, euphoria, dizziness, headache, dilated pupils, lacrimation, nervousness, muscle fatigue, insomnia, paresis; dermatitis	Eye Skin Inhalation Ingestion.	Irrigate immediately Soap wash promptly Move to fresh air Medical attention immediately; DO NOT INDUCE VOMITING
Ethylbenzene	Irritation to eyes, mucous membranes; headache, dermatitis, narcosis; coma	Eye: Skin: Inhalation: Ingestion:	Irrigate immediately Soap wash promptly Artificial respiration Medical attention immediately
Xylenes	Dizziness, excitement, drowsiness, incoordination, staggering gait, irritation of eyes, nose, throat, corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis	Eye Skin Inhalation: Ingestion·	Irrigate immediately Soap wash promptly Move to fresh air Medical attention immediately; DO NOT INDUCE VOMITING

Table 4.2 (continued)
Acute and Chronic Effects
Symptoms of Overexposure and First Aid Treatment

Compound	Symptoms of Overexposure	First Aid Treatment
Trichloroethylene	Headache, vertigo, visual disturbance, tremors, somnolence, nausea, vomiting, irritation of the eyes; dermatitis; cardia arrhythmias, paresthesia; carcinogen	Eye Irrigate immediately Skin: Soap wash promptly Inhalation: Respiratory support Ingestion: Medical attention immediately
Tetrachloroethylene	Irritation of the eyes, nose, throat, nausea; flush face, neck; vertigo, dizziness, incoordination; headache, somnolence, skin erythema; liver damage, carcinogen	Eye· Irrigate immediately Skin Soap wash promptly Inhalation. Respiratory support Ingestion· Medical attention immediately
Vinyl Chloride	Weakness, abdominal pain, gastrointestinal bleeding, hepatomegaly, pallor or cyan of extremities, carcinogen	Inhalation: Respiratory support
Chloroethane	Incoordination, inebriate, abdominal cramps; cardiac arrhythmias, cardiac arrest, liver and kidney damage	Eye: Irrigate immediately Skin Water flush promptly Inhalation Respiratory support Ingestion: Medical attention immediately
1,1-Dichloroethane	Central nervous system depressant; skin irritant, liver and kidney damage	Eye Irrigate immediately Skin: Soap flush promptly Inhalation: Respiratory support Ingestion: Medical attention immediately
1,2-Dichloroethylene	Irritation of eyes and respiratory system; central nervous system depressant/depression	Eye· Irrigate immediately Skin· Soap wash promptly Inhalation: Respiratory support Ingestion: Medical attention immediately
Bis(2-ethylhexyl) Phthalate	Irritation of eyes, mucous membranes, carcinogen	Eye Irrigate immediately Skin: Not a dermal hazard Inhalation: Respiratory support Ingestion. Medical attention immediately

Table 4.2 (continued)
Acute and Chronic Effects
Symptoms of Overexposure and First Aid Treatment

Compound	Symptoms of Overexposure	First Aid Treatment
Nitric Acid	Irritation of eyes, mucous membranes, and skin; delayed pulmonary edema, pneuitis, bronchitis, dental erosion	Eye· Irrigate immediately Skin· Water flush immediately Inhalation· Respiratory support Ingestion· Medical attention immediately
Hydrochloric Acid	Inflammation of the nose, throat, laryngeal; cough, burns throat, choking; burns eyes, skin; dermatitis	Eye: Irrigate immediately Skin· Water flush immediately Inhalation Respiratory support Ingestion Medical attention immediately
Methanol	Eye irritant, headache, drowsiness, lightheadedness, nausea, vomiting; visual disturbances, blindness	Eye: Irrigate immediately Skin: Water flush immediately Inhalation: Respiratory support Ingestion: Medical attention immediately
Hexane	Light-headedness, nausea, headaches, numbness in extremities, weak muscles, eye irritation, nose irritation, dermatitis, chemical pneumonia, giddiness	Eye. Irrigate immediately Skin Soap, wash immediately Inhalation: Respiratory support Ingestion· Medical attention immediately

In order to communicate the hazards of these chemicals to site personnel, material safety data sheets (MSDSs) for each chemical will be maintained on site and presented as part of site-specific training (Section 10.2).

4.3 PHYSICAL HAZARDS

The following section titles identify physical hazards that may be encountered. They include but are not limited to:

- Hot or Cold Work Environments (Stress)
- Noise Hazards
- Materials Handling
- Utility Hazards
- Fall, Trip, and Slip Hazards (Section 11.0)
- Flammable/Explosive Atmospheres (Section 6.0)
- Heavy Equipment/Vehicular Activity (Section 11.0)

Control measures to help protect site personnel from these potential hazards are incorporated in the following subsections and throughout this HSP, specifically Section 11.0, Standard Work Practices, for safety hazards associated with drilling rigs and support vehicles.

4.3.1 Heat Stress

Heat stress can be a problem especially if site activities are required to be performed while wearing PPE in warm, humid weather conditions. The four types of heat illness in increasing order of severity include: heat rash, heat cramps, heat exhaustion, and heat stroke.

- Heat rash may result from continuous exposure to heat or humid air.

- Heat cramps are caused by heavy sweating with inadequate electrolyte replacement. Signs and symptoms include muscle spasms and pain in the hands, feet, and abdomen.

- Heat exhaustion occurs from increased stress on various body organs, including inadequate blood circulation due to cardiovascular insufficiency or dehydration. Signs and symptoms include: pale, cool, and moist skin; heavy sweating; dizziness, fainting and nausea.

- Heat stroke is the most serious form of heat stress. Temperature regulation fails, and the body temperature rises to critical levels. Immediate action must be taken to cool the body before serious injury or death occurs. When heat stroke is suspected, professional medical help must be obtained immediately. Signs and symptoms include: red, hot, and unusually dry skin; lack of or reduced perspiration; dizziness and confusion; strong, rapid pulse; and coma.

Proper training and preventive measures will help avert serious illness and loss of work productivity. Preventing heat stress is particularly important, because once someone suffers from

heat stroke or heat exhaustion, that person may be predisposed to additional injuries. To avoid heat stress, the following steps should be taken:

- Work schedules should be adjusted. The following guidelines of rest and cooling of the body will be followed to minimize the effects of heat stress:

  - If oral temperature exceeds 99.6 °F (37.6 °C), shorten the next work cycle by one-third without changing the rest period.
  - If oral temperature still exceeds 99.6 °F (37.6 °C) at the beginning of the next rest period, shorten the following work cycle by one-third.
  - Do not permit a worker to wear a semipermeable or impermeable garment when his/her oral temperature exceeds 100.6 °F (38.1 °C).

  Initially, the frequency of physiological monitoring depends on the air temperature adjusted for solar radiation and the level of physical work (See Table 4.3). The length of the work cycle will be governed by the frequency of the required physiological monitoring.

Table 4.3
Suggested Frequency of Physiological Monitoring for Fit and Acclimatized Workers

Adjusted Temperature[1]	Normal Work Ensenmble[2]	Impermeable Ensemble
90 °F or above	After each 45 minutes of work	After each 15 minutes of work
87.5 °F - 90 °F	After each 60 minutes of work	After each 30 minutes of work
82 5 °F - 87.5 °F	After each 90 minutes of work	After each 60 minutes of work
77 5 °F - 82.5 °F	After each 120 minutes of work	After each 90 minutes of work
72.5 °F - 77.5 °F	After each 150 minutes of work	After each 120 minutes of work

1 Calculate the adjusted air temperature (T_{aj}) by using the equation T_{aj} (°F) = T (°F) + (13 x % sunshine) Measure air temperature (T) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow (100 percent sunshine = no cloud cover and a sharp, distinct shadow, 0 percent sunshine = no shadows)

2 A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants

Source NIOSH/OSHA/USCG/EPA, 1985

- Shelter (air-conditioners and other cooling devices, if possible) or shaded areas should be provided to protect personnel during rest periods.

- Worker's body fluids should be maintained at normal levels to ensure that the cardiovascular system functions adequately. Daily fluid intake must approximately equal the amount of water in sweat, which will vary from day to day. The normal thirst

mechanism is not sensitive enough to ensure that water intake is sufficient to replace lost sweat. When heavy sweating occurs, the worker should be encouraged to drink more. Have workers drink fluid (preferably water or diluted drinks) before beginning work. Urge workers to drink a cup or two at each scheduled break. A total of 1 to 1.6 gallons (4 to 6 liters) of fluid per day are recommended, but will depend on actual fluid replacement needs, which will vary depending on the sweat rate.

- Drinking water temperature should be maintained at 50 °F to 60 °F (10 °C to 15.6 °C).
- Disposable cups that hold about 16 ounces should be provided.
- Encourage workers to maintain an optimal level of physical fitness. Where indicated, acclimatize workers to site work conditions.
- Train workers to recognize, identify, and treat heat stress.

When heat stress is suspected, the following steps should be taken:

- Get the victim out of the heat
- Loosen tight clothing
- Remove perspiration-soaked clothing
- Apply cool, wet cloths to the skin
- Fan the victim
- If the victim is conscious, give cool water to drink. Do not give electrolyte solutions (i.e., those containing salt) to victims of heat stress because it can cause nausea and vomiting. Only small sips of cool water should be administered to heat stress victims.
- Call for an ambulance if the victim refuses water, vomits, or starts to lose consciousness.

4.3.2 Cold Stress

If site work is to be conducted during the winter, cold stress is a concern to the health and safety of personnel. Especially with regard to the wearing of Tyvek suits because such disposable clothing does not "breathe," perspiration does not evaporate, and the suits can become wet. Wet clothes combined with cold temperatures can lead to hypothermia. If the air temperature is less than 40 °F and an employee perspires, the employee must change to dry clothes.

The following are five degrees of cold stress in increasing order of severity:

- Incipient frostbite is a mild form of cold stress characterized by sudden blanching or whitening of the skin.

- Chilblain is an inflammation of the hands and feet caused by exposure to cold moisture. It is characterized by a recurrent localized itching, swelling, and painful inflammation of the fingers, toes, or ears. Such a sequence produces severe spasms, accompanied by pain.

- Second-degree frostbite is manifested by skin with a white, waxy appearance and the skin is firm to the touch. Individuals with this condition are generally not aware of its seriousness, because the underlying nerves are frozen and unable to transmit signals to warm the body. Immediate first aid and medical treatment are required.

- Third-degree frostbite will appear as blue, blotchy skin. The tissue is cold, pale, and solid. Immediate medical attention is required.

- Hypothermia develops when body temperature falls below a critical level. In extreme cases, cardiac failure and death may occur. Immediate medical attention is warranted when the following symptoms are observed: involuntary shivering, irrational behavior, slurred speech, and sluggishness.

To care for any frostbite, handle the area gently. Never rub an affected area because rubbing causes further damage to soft tissues. Warm the affected area gently by soaking the affected part in water no warmer than 105 ° F. Keep the frostbitten part in the water until it looks red and feels warm. Loosely bandage the affected area with a dry, sterile dressing. If fingers or toes are frostbitten, place cotton or gauze between them. Do not break any blisters caused by frostbite. Obtain professional medical attention as soon as possible.

To care for hypothermia, start by caring for any life-threatening problems and call for emergency medical assistance. Remove any wet clothing and dry the victim. Warm the body gradually by wrapping the victim in blankets or putting on dry clothing and moving him or her to a warm place. If available, apply heat pads or other heat sources to the body but be sure to keep a barrier, such as a blanket, towel, or clothing, between the heat source and the victim to avoid burning the victim. If the victim is alert, give warm liquids to drink. Do not warm the victim too quickly, such as by immersing the victim in warm water, because rapid rewarming can cause dangerous heart problems. In cases of severe hypothermia when the victim may be unconscious, give rescue breathing when necessary and be prepared to administer cardiopulmonary resuscitation (CPR).

4.3.3 Noise Hazards

The SSO or designee will monitor high noise levels when equipment or machinery (e.g. backhoe, drill rig, etc.) is being used on-site. Field personnel working in areas where noise levels can be expected to reach or exceed 85 decibels on the A-weighted scale (dBA) will be issued hearing protection to reduce the level below the 85 dBA threshold. Compliance standards for occupational noise exposure are found in 20 CFR 1910.95.

4.3.4 Materials Handling

The most common type of materials handling accident is when fingers or toes of field personnel get caught between two objects. Special precautions must be implemented during the moving,

shifting, or rolling of materials and should never be attempted by a single individual. Workers are required to use proper lifting techniques for handling materials, and oversize or heavy loads require "team lift" procedures.

4.3.5 Utility Hazards

The locations of all underground utilities must be identified and marked prior to initiating any subsurface investigations. In addition, drilling within 20 feet in any direction of overhead powerlines will not be permitted.

4.4 BIOLOGICAL HAZARDS

The biological hazards that could be encountered by site personnel include, but are not limited to, the following:

- Poisonous snakes and spiders
- Stinging insects
- Ticks and chiggers
- Poisonous plants (e.g., poison sumac, poison ivy, poison oak)

Control measures to help protect site personnel from these biological hazards are incorporated in the following sections.

4.4.1 Poisonous Snakes and Spiders

Reactions from a snakebite are aggravated by acute fear and anxiety. Other factors that affect the severity of local and general reaction from a poisonous snakebite include: the amount of venom injected and the speed of absorption of venom into the victim's circulation; the size of the victim; protection from clothing, including shoes and gloves; quick anti-venom therapy; and location of the bite.

Spiders in the U.S. are generally harmless, with two notable exceptions: the Black Widow spider (Latrodectus Mactans) and the Brown Recluse or violin spider (Lox Osceles Reclusa). The symptoms of a Black Widow spider bite are: slight local reaction, severe pain produced by nerve toxin, profuse sweating, nausea, painful cramps in abdominal muscles, and difficulty in breathing and speaking. Victims recover in almost all cases, but an occasional death is reported.

Field personnel should exercise caution when lifting logs, rocks, covers to manholes, sumps, etc.

4.4.1.1 <u>First Aid Procedures (Snakebite)</u>

The objective of first aid is to reduce the circulation of blood through the bite area, to delay absorption of venom, to prevent aggravation of the local wound, and to sustain respiration. Several steps are listed to properly care for a snakebite victim. The most important step is to get the snakebite victim to the hospital quickly. Since all investigation activities will be performed

at NAS Fort Worth JRB, the base hospital will be within reasonable travel time. Meanwhile, take the following first aid measures:

- Keep the victim from moving around.
- Keep the victim as calm as possible and preferably in a lying position.
- Immobilize the bitten extremity and keep it at or below heart level. If the victim can reach a hospital within 4 to 5 hours and if no symptoms develop, no further first aid measures need to be applied.
- If mild-to-moderate symptoms develop, apply a constricting band 2 to 4 inches above the bite, but not around a joint (the elbow, knee, wrist, or ankle) and not around the head, neck, or trunk. The band should be ¾ to 1½ inches wide, not thin like a rubber band. The band should be snug but loose enough for a finger to be slipped underneath. Watch for swelling and loosen the band if it becomes too tight, but do not remove it. Periodically check the pulse in the extremity beyond the bite to insure that the blood flow has not stopped.

Several other factors must be considered in cases of snakebite:

- Shock. Keep the victim lying down and comfortable, and maintain his or her body temperature.
- Breathing and heartbeat. If breathing stops, give mouth-to-mouth resuscitation. If breathing stops and there is no pulse, perform CPR if you have been trained to do so.
- Identifying the snake. If you can kill the snake without risk or delay, bring it to the hospital for identification, but exercise extreme caution in handling the snake.
- Cleaning the bitten area. You may wash the bitten area with soap and water and blot it dry with sterile gauze. You may apply dressings and bandages, but only for a short period of time.
- Medicine to relieve pain. Do not give the victim alcohol, sedatives, aspirin, or any medicine containing aspirin. Consult a doctor or other medical personnel for specific medications that may be used.
- Snakebite kits. Keep a kit accessible for all outings in primitive areas or areas known or suspected to snake infested.

It is not recommended that cold compresses, ice, dry ice, chemical ice packs, spray refrigerants, or other methods of cold therapy be used in the first aid treatment of snakebite.

4.4.1.2 General First Aid for Poisonous Insect Bites

For minor bites and stings use cold applications and soothing lotions, such as calamine. For more severe reactions, take the following first aid measures·

- Apply a constricting band above the injection site on the victim's arm or leg (between the site and the heart). Do not apply tightly. You should be able to slip your index finger under the band when it is in place. Give artificial respiration if necessary;
- Keep the affected part below the level of the victim's heart.
- If medical care is ready available, leave the band in place; otherwise, remove it after 30 minutes.
- Apply ice contained in a towel or plastic bag, or cold cloths, to the site of the sting or bite.
- Give home medicine, such as aspirin, for pain.
- If the victim has a history of allergic reactions to insect bites or is subject to attacks of hay fever or asthma, or if he or she is not promptly relieved of symptoms, call a physician or take the victim immediately to the nearest location where medical treatment is available. In a highly sensitive person, do not wait for symptoms to appear, since delay can be fatal.
- In case of a bee sting, remove and discard the stinging apparatus and venom sac.

Workers who have had severe allergic reactions to bee/wasp stings in the past will inform the SSO when they arrive at the site for the first time.

4.4.2 Ticks and Chiggers

Field personnel should be aware of the presence of ticks (i.e , deer tick) and chiggers at the site. Common carriers of ticks and chiggers are the white-footed mouse and white-tailed deer which are prevalent in the area. The deer tick is about the size of a sesame seed, as distinguished from the dog tick, which is significantly larger. The deer tick is principally found along the Atlantic coast, living in grassy and wooded areas, and feeds on mammals such as mice, shrews, birds, raccoons, opossums, deer, and humans. Common diseases caused by ticks are presented in the following subsections.

Removal of ticks is best accomplished using small tweezers. Do not squeeze the tick's body. Grasp it where the mouth parts enter the skin and tug gently, not firmly, until it releases its hold on the skin. Save the tick in a jar labeled with the date, body location of the bite, and the place where it may have been acquired. Wipe the bite thoroughly with an antiseptic. Seek medical attention in the event tick-related disease symptoms develop.

When in an area suspected of harboring ticks (grassy, bushy, or woodland area) the following precautions can minimize the changes of being bitten by a tick:

- Wear long pants and long-sleeved shirts that fit tightly at the ankles and wrists.
- Wear light colored clothing so ticks can be easily spotted.
- Wearing tick repellents may be useful.
- Inspect clothing frequently while in tick habitat.
- Inspect your head and body thoroughly when you return from the field.
- Remove any attached ticks by tugging with tweezers where the tick's mouth parts enter the skin. Do not squeeze or crush it.

4.4.2.1 Lyme Disease

Lyme disease is an illness caused by a bacterium which may be transmitted by the bite of a tick (Ixodes Dammini), commonly referred to as the "Deer Tick". Not all ticks are infected with the bacterium, however. When an infected tick bites, the bacterium is passed into the bloodstream of the host, where it multiplies. The various stages and symptoms of the disease are well recognized and, if detected early, can be treated with antibiotics.

The illness typically occurs in the summer and is characterized by a slowly expanding red rash, which develops a few days to a few weeks after the bite of an infected tick This may be accompanied by flu-like symptoms along with headache, stiff neck, fever, muscle aches, and/or general malaise. At this stage treatment by a physician is usually effective; but, if left too long, these early symptoms may disappear and more serious problems may follow. The most common late symptom of the untreated disease is arthritis. Other problems which may occur include meningitis and neurological and cardiac abnormalities. It is important to note that some people do not get the characteristic rash but progress directly to the later manifestations. Treatment of later symptoms is more difficult than early symptoms and is not always successful.

4.4.2.2 Rocky Mountain Spotted Fever

In the eastern and southern United States this tickborne disease is transmitted by the infected Dog Tick (Dermacentor Variabilis). It is important to note that the Dog Tick is significantly larger than the Deer Tick. Nearly all cases of infection occur in the spring and summer, generally several days after exposure to infected ticks. The onset of illness is abrupt and often accompanied by high fever, headache, chills, and severe weakness. After the fourth day of fever, victims develop a spotted pink rash that usually starts on the hands and feet and gradually extends to most of the body As with Lyme disease, early detection and treatment significantly reduces the severity of illness. The disease responds to antibiotic therapy with tetracycline or chloramphenicol.

4.4.2.3 Other Diseases

Ticks transmit several other diseases, most of which are rare and occur only in specific areas. Babesiosis occurs mainly in the Cape Cod area and eastern Long Island. Colorado tick fever is similarly regional and occurs only among those who live or work at altitudes above 4,000 feet.

4.4.3 Poisonous Plants

The majority of skin reactions following contact with offending plants are allergic in nature and are characterized by general symptoms of headache and fever, itching, redness, and a rash.

Some of the most common and most severe allergic reactions result from contact with plants of the Poison Ivy group including Poison Ivy, Poison Oak and Poison Sumac The most distinctive features of Poison Ivy and Poison Oak are their leaves, which are composed of three leaflets each. Both plants also have greenish-white flowers and berries that grow in clusters. Such plants produce a severe rash characterized by redness, blisters, swelling, and intense burning and itching. The victim can also develop a high fever and become very ill. Ordinarily, the rash begins within a few hours after exposure, but it may be delayed for 24 to 48 hours.

4.4.3.1 First Aid Procedure

- Remove contaminated clothing.
- Wash all exposed areas thoroughly with soap and water, followed by rubbing alcohol.
- Apply calamine or other soothing skin lotion if the rash is mild.
- Seek medical advice if a severe reaction occurs, or if there is a known history of previous sensitivity.

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5.0 HAZARD COMMUNICATION

The HydroGeoLogic Hazard Communication Program complies with the OSHA Hazard Communication Standard (HCS) found in OSHA Standard 29 CFR 1910.120 and 1926.59, which applies to any chemical present in the workplace in such a manner that employees may be exposed to under normal conditions of use in a foreseeable emergency. Although waste materials are excluded from the OSHA requirements, decontamination chemicals for sampling equipment or protective clothing and calibration standards require MSDSs.

The principle of communicating the hazards of materials used by employees in the workplace applies to company-wide activities, from informational programs on the conduct of hazardous waste activities to the company's insistence upon adequate health and safety training. It is also important for personnel to have an awareness of client concerns for hazard communication due to Federal, state, and local regulations directly affecting certain client activities.

In order to comply with the HCS, HydroGeoLogic has determined that:

- All containers of hazardous chemicals must be appropriately labeled or tagged to identify the hazard and provide information on effects and appropriate protective measures.
- Labels, tags, or signs must be properly affixed and visible at all times while a hazard is present and removed promptly when the hazard no longer exists.
- Written information (i e., MSDSs) on hazardous chemicals in the workplace must be available to employees working with the substances.
- Appropriate MSDSs will be available to any contractor or subcontractor employee working on projects under HydroGeoLogic control.

When investigation results indicate potential imminent health risks to contracted or Federal personnel, or the public at large, the contracting officer's representative (COR) and the base point of contact (POC) will be notified as soon as practicable. Written notification and supporting documentation will be provided within three days of finding potential imminent health risks during investigation activities.

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6.0 AIR MONITORING

This section presents requirements for the use of real-time air monitoring instruments during site activities involving potential for exposure to site contaminants. It establishes the types of instruments to be used, the frequency with which they are to be used, techniques for their use, action levels for upgrading/downgrading levels of protection, and methods for instrument maintenance and calibration.

6.1 INSTRUMENTS AND USE

A Photoionization Detector (PID) equipped with an appropriate lamp will be utilized for detecting the presence of emissions from chemicals of concern. A Dräger pump and colorimetric tubes will be used to confirm any detections observed with the PID, in accordance with Table 6.1. Additionally, lower explosive limit/oxygen (LEL/O_2) and methane detectors may be used to detect the presence of flammable/explosive atmospheres. Visual observation will be used to detect the presence of airborne particulates.

The PID/Dräger pump will be used throughout the execution of these activities:

- Monitoring well installation
- Monitoring/extraction well development
- Groundwater sampling
- Sampling equipment decontamination/equipment (heavy) decontamination
- Waste characterization and disposal.

6.2 AIR MONITORING REQUIREMENTS

6.2.1 Photoionization Detector

Air monitoring with the PID will be initiated at potential sources of vapor emissions (source monitoring) at specified frequencies. The frequencies will be increased when concentrations of constituents are measured. The following potential sources are anticipated. open well heads upon initial opening; groundwater samples during sampling; and open drums containing soil cuttings.

If source monitoring indicates the presence of airborne emissions, air monitoring will be initiated in the breathing zones of workers who could be affected by the emissions. Air monitoring will also occur upon the request of site workers who notice unusual site odors or an increase in their intensity. If work is to be performed downwind of a site, air monitoring will be conducted to determine what type of PPE, if any, is required to protect workers and to determine the potential for an imminent threat to public health.

The presence of elevated readings in the worker's breathing zone, as identified in Table 6.1, would require amendments to the HSP before workers would be allowed to enter the exclusion zone. Depending on the air monitoring readings, air-purifying respirators may not be acceptable because some contaminants of concern have poor warning properties and/or will not be able to be filtered from inspired air using chemical cartridges (Table 6.1). Elevated readings will be based

on confirmation sampling using a Dräger pump and colorimetric tubes, in accordance with Table 6.1.

6.2.2 Dräger Pump and Tubes

A hand operated Drager pump with colorimetric tubes will be used to confirm the results of PID testing. If these results show concentrations greater than 0.5 ppm, above background concentrations in the breathing zone, then the colorimetric tubes will be used to identify the contaminants in the breathing zone. Colorimetric tubes to be used in the event of elevated PID readings will include: vinyl chloride, benzene, tetrachloroethylene, and/or trichloroethylene, in accordance with Table 6.1. The choice of colorimetric tubes used will vary with the potential contaminants.

6.2.3 Lower Explosive Limit/Oxygen and Methane Detectors

Air monitoring with the LEL/O_2 and methane detectors will be used during monitoring/extraction well drilling activities although soil contamination is not anticipated. In flammable/explosive atmospheres, personnel must be advised of the potential explosive atmosphere, and must initiate the use of spark proof tools in accordance with Table 6.1. LEL readings in excess of 10 percent will require cessation of field activities until readings decrease.

6.2.4 Visual Observations

If airborne particulates are observed and air monitoring results indicate the need (see Table 6.1), personnel must don air-purifying respirators equipped with organic vapor cartridges and high efficiency particulate air (HEPA) filters. If airborne particulates are observed, dust control measures must also be implemented.

6.3 MODIFICATION TO AIR MONITORING REQUIREMENTS

The action levels and protection measures presented in Table 6.1 were developed assuming that the contaminants listed in Table 4.1 were the only contaminants which would pose a significant health risk to site workers covered by this HSP. In the event that this assumption is found to be invalid through analysis of samples collected or by other means, the action levels will be modified appropriately.

6.4 INSTRUMENT MAINTENANCE AND CALIBRATION

Air and noise monitoring instruments are maintained and calibrated at HydroGeoLogic's office in Herndon, Virginia. Field maintenance will consist of daily cleaning of the instruments using a damp towel or rag to wipe off the instrument's outer casing, overnight battery recharging, and cleaning or replacing of the lamp whenever calibration cannot be attained. Procedures for ensuring instrument maintenance are presented in the PID User's Manual provided with each instrument. The User's Manual will be followed to calibrate the instruments in the field prior to each day of use under actual sampling conditions (temperature and humidity). Field equipment will also be calibrated at the end of each day to account for instrument drift and reliability.

Table 6.1
Hazard Monitoring Methods, Action Levels, and Protection Measures

Hazard	Monitoring Method	Action Level	Protective Measures	Monitoring Schedule
Toxic Vapors (as identified in Table 4 1)	PID	0 0 ppm_v < 0 5 ppm_v above background based on judgement of SSO	Level D (see Table 7 1)	-continue with regular monitoring of breathing zone
		0 5 ppm_v above background based on judgement of SSO	Level D (see Table 7.1)	-confirm/deny reading with vinyl chloride and benzene colorimetric tubes -if confirmed as vinyl chloride and/or benzene, then see vinyl chloride/benzene hazard identified below -if denied as vinyl chloride and benzene, then continue with regular monitoring of breathing zone.
		≥0.5 ppm_v < 25 ppm_v above background based on judgement of SSO (if denied as vinyl chloride and benzene)	Level D (see Table 7.1)	-confirm/deny reading with vinyl chloride and benzene colorimetric tubes -if confirmed as vinyl chloride and/or benzene, then see vinyl chloride/benzene hazard identified below. -if denied as vinyl chloride and benzene, then continue with regular monitoring of breathing zone. -confirm/deny reading with tetrachloroethylene and TCE colorimetric tubes. -if confirmed , then see hazard identified below -if denied as tetrachloroethylene or TCE, then continue with regular monitoring of breathing zone.
		≥25 ppm_v < 250 ppm_v above background based on judgement of SSO (if denied as vinyl chloride, benzene, and tetrachloroethylene)	Level C (see Table 7 1)	-continue with regular monitoring of breathing zone - contact HSO and Project Manager. - continue use of tubes, attempt to identify unknown air contaminants.
Vinyl Chloride	Colorimetric Tubes	confirmed 1 0 ppm_v < 10 ppm_v above background based on judgement of SSO.	Level C (See Table 7.1)	-continue regular monitoring of breathing zone.
Benzene	Colorimetric Tubes	confirmed 0.5 ppm_v < 5 ppm_v above background based on judgement of SSO.	Level C (See Table 7.1)	-continue regular monitoring of breathing zone.
Tetrachloroethylene	Colorimetric Tubes	confirmed 25 ppm_v < 250 ppm_v above background based on judgement of SSO.	Level C (See Table 7.1)	-continue regular monitoring of breathing zone

Table 6.1 (continued)
Hazard Monitoring Methods, Action Levels, and Protection Measures

Hazard	Monitoring Method	Action Level	Protective Measures	Monitoring Schedule
Trichloroethylene	Colorimetric Tubes	confirmed 50 ppm_v < 500 ppm_v above background based on judgement of SSO	Level C (See Table 7.1)	-continue regular monitoring of breathing zone.
Flammable/Explosive Gases and/or Vapors	LEL/O_2 and Methane Detector	0.0 < 5.0 percent LEL	-notify sampling team of readings.	-prior to and during sampling activities, monitor all areas suspected of containing flammable/explosive gases and/or vapors. -continue with regular monitoring of breathing zone.
		5.0 < 10 0 percent LEL	-use spark proof equipment/tools	-continue with regular monitoring of breathing zone. - notify HSO and Project Manager
		>10 0 percent LEL	STOP WORK, EVACUATE AREA, NOTIFY PROJECT MANAGER	-requires HSP amendments unless readings subside.
Toxic Vapors (as identified in Table 4.1 continued)	PID	≥250 ppm_v above background based on judgement of SSO (if denied as all chemicals listed above)	STOP WORK, EVACUATE AREA, NOTIFY PROJECT MANAGER	-requires identification of new chemical hazard and HSP amendments
Vinyl Chloride	Colorimetric Tubes	confirmed 10 ppm_v or greater above background based on judgement of SSO.	STOP WORK, EVACUATE AREA, NOTIFY PROJECT MANAGER	- requires HSP amendments
Benzene	Colorimetric Tubes	confirmed 5 ppm_v or greater above background based on judgement of SSO.	STOP WORK, EVACUATE AREA, NOTIFY PROJECT MANAGER	-requires HSP amendments.

Table 6.1 (continued)
Hazard Monitoring Methods, Action Levels, and Protection Measures

Hazard	Monitoring Method	Action Level	Protective Measures	Monitoring Schedule
Tetrachloroethylene	Colorimetric Tubes	confirmed 250 ppm_v or greater above background based on judgement of SSO	STOP WORK, EVACUATE AREA, NOTIFY PROJECT MANAGER	-requires HSP amendments.
Trichloroethylene	Colorimetric Tubes	confirmed 500 ppm_v or greater above background based on judgement of SSO	STOP WORK, EVACUATE AREA, NOTIFY PROJECT MANAGER	- requires HSP amendments.

6.5 RECORD KEEPING

Instrument calibrations and readings will be recorded on the air monitoring log sheet provided in Section 14.1 of this HSP. Copies of these log sheets will be maintained on site until field activities covered by this HSP have been completed, at which time the log sheets will be transmitted to the HydroGeoLogic HSO and to the project file.

LEL/O_2 and methane readings will not be recorded unless flammable/explosive or oxygen deficient/enriched atmospheres are detected. Entries will then be made in the field log book. The LEL/O_2, methane detector, and the PID will undergo daily operational checks. These checks will be recorded in the field log book and equipment calibration log (Section 14.1).

7.0 PERSONAL PROTECTIVE EQUIPMENT

This section presents requirements for the use of personal protective equipment (PPE) for each of the activities being conducted. This section includes anticipated levels of protection for each of the activities, the criteria used for selecting various levels of protection, and criteria for modifying levels of protection based on monitoring instrument readings and personal observations.

7.1 ANTICIPATED LEVELS OF PROTECTION

All work is anticipated to be performed in Level D protection, as defined in Appendix B of OSHA Standard 29 CFR 1910.120. Many activities may require the use of chemical resistant coveralls, gloves, and boot covers as presented in Table 7.1.

The items of PPE anticipated to be used for each activity are presented in Table 7.1. Where an overlap in activity occurs, the more protective equipment will apply.

Table 7.1
Protective Equipment for Field Activities

Activity	Level	Protective Equipment
Treatment System Winterization Monitoring/Extraction Well Installation Groundwater Sampling Aquifer Testing Treatment System Renovation Treatment System Operation and Maintenance	D	• Street clothes or overalls (long sleeves) • Impermeable safety boots/shoes (steel toed) • Safety glasses/goggles (if hazard to eyes exists) • Hard hat (if hazard to head exists) • Gloves (nitrile, neoprene) • Ear plugs/defenders (if hazard exists)
	D (modified)	• Rubber boots, chemically-resistant with steel toe • Gloves (nitrile, neoprene) • Tape for sealing ankle and wrist openings • Hard hat (if hazard to head exists) • Safety glasses/goggles (if hazard to eyes exists) • Uncoated Tyvek® or equivalent • Ear plugs/defenders (if hazard exists)
	C	• Coated Tyvek® or equivalent • Rubber boots; chemically-resistant with steel toe • Rubber boot covers • Latex inner gloves • Tape for sealing ankle and wrist openings • Chemical resistant outer gloves (nitrile, neoprene) • Full-face respirator (organic vapor cartridges) • Additional items may be required (site-specific) • Ear plugs/defenders (if hazard exists)

7.2 PERSONAL PROTECTIVE EQUIPMENT SELECTION CRITERIA

Respiratory protection is not anticipated for use during the initial stages of work until detectability of site contaminants with air monitoring instruments warrants the donning of respirator protection in accordance with Table 6.1. See Section 7.3 for modification criteria of respiratory protection. Basic requirements of field personnel prior to using respiratory protection include:

- All field personnel will be medically certified to wear a full face respirator and have the proper fit test documentation within the past 12 months prior to assignment.
- Only NIOSH approved respirators will be used on site. The respirators will be properly cleaned, inspected, and maintained prior to and at the conclusion of the work day.
- Cartridges to air-purifying respirators will be disposed of at the end of each work day and when load-up or breakthrough occurs.
- Field personnel will be clean shaven in areas which might prevent the seal of the respirator to the face and contact lenses will not be permitted while wearing a respirator.

Hard hats, safety glasses, and steel-toe work boots were selected to provide minimum protection in reducing the potential for injury resulting from exposure to the physical hazards associated with onsite investigations.

Boot covers, disposable nitrile gloves, and Tyvek® coveralls were selected to provide minimum protection from contamination of work clothes and from skin contact with low level contamination. Nitrile gloves of 11-millimeters thickness or greater were selected to provide protection during activities involving direct contact with high concentrations of contaminants.

PVC or Saranex® coveralls, hoods, and/or splash shields were selected to prevent saturation of work clothes during activities involving large volumes of liquids and/or saturated soils/equipment.

7.3 PERSONAL PROTECTIVE EQUIPMENT MODIFICATION CRITERIA

This section presents criteria for upgrading and downgrading chemical protective clothing (CPC) and/or respiratory protection. Where uncertainties arise, the more protective requirement will apply.

7.3.1 Chemical Protective Clothing Modification Criteria

Tyvek® coveralls and boot covers must be worn anytime there is a reasonable potential for contamination of street clothes.

Disposable nitrile gloves must be worn anytime there is a reasonable potential for contact with unsaturated soils or equipment which may contain trace contamination.

Nitrile gloves (11-mil thickness or greater) must be worn anytime there is a reasonable potential for contact with groundwater, saturated soils, and/or soils producing elevated PID readings.

Polyvinyl chloride (PVC) or Saranex® coveralls must be worn anytime there is a reasonable potential for saturation of work clothes.

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8.0 DECONTAMINATION

This section describes the steps site personnel will follow to prevent the spread of site contaminants into areas that may affect unprotected, unsuspecting site personnel or the public. It includes requirements for decontamination of personnel, sampling equipment, and drilling equipment

8.1 PERSONNEL DECONTAMINATION

The decontamination of personnel and their protective clothing will be performed within the decontamination zone. Table 8.1 presents the six stages in decontamination for Modified Level D protection.

Table 8.1
Six Stages in Decontamination for Modified Level D Protection

Stage	Procedure
Stage 1 Segregated Equipment Drop	Deposit equipment used on site on plastic drop cloths or in assigned containers with plastic liners.
Stage 2· Boot Cover and Glove Wash	Scrub outer boot covers and gloves with decontamination solution, and rinse with water.
Stage 3. Tape Removal	Remove tape around boots and gloves and deposit in container with plastic liner.
Stage 4: Remove boots, gloves, and disposable clothing	Deposit in appropriate plastic-lined container Discard disposable clothing.
Stage 5: Field wash	Wash hands and face with soap and water.
Stage 6: Dress	Put on clean clothes

Wash tubs containing an appropriate decontamination solution and soft-bristle brushes will be used to wash reusable personal protective equipment and boots. Clean water will be used for the final rinse. The choice of decontamination solution is dependent upon the type of materials which must be removed from reuseable protective equipment. Based on the current understanding of potential site contaminants, a detergent and water solution is recommended for general purpose decontamination. Acceptable detergents include laboratory-grade cleaners (e.g., Alconox™, or equivalent), or a high strength consumer detergent such as Liquid Tide™.

Alternative decontamination solutions may be called for if the contaminants encountered are different or in a more concentrated state than anticipated. Alternative solutions include:

1. Dilute acids for removal of basic (caustic) compounds, amines, and hydrazines.
2. Dilute bases (soaps and detergents) for removal of acidic compounds, phenols, thiols and some nitro and sulfonic compounds.

3. Organic solvents for removal of nonpolar compounds (organic).

Gloves and other PPE should be inspected frequently for integrity, and manufacturers' data for breakthrough times should be considered when concentrated contaminants are encountered.

The decontamination of personnel and their protective clothing will be performed in 18 stages for Level C protection, if necessary. The 18 stages are presented in Table 8.2 below.

Table 8.2
Eighteen Stages in Decontamination for Level C Protection

Stage	Procedure
Stage 1: Segregated Equipment Drop	Deposit equipment used on site on plastic drop cloths or in different containers with plastic liners Segregation at the drop reduces the probability of cross-contamination. During hot weather operations, a cool-down station may be set up within this area.
Stage 2 Boot Cover and Glove Wash	Scrub outer boot covers and gloves with a decontamination solution of detergent and water.
Stage 3: Boot Cover and Glove Rinse	Rinse off decontamination solution from Stage 2 using copious amounts of water.
Stage 4 Tape Removal	Remove tape around boots and gloves and deposit in container with plastic liner
Stage 5 Boot Cover Removal	Remove boot covers and deposit in container with plastic liner.
Stage 6 Outer Glove Removal	Remove outer gloves and deposit in container with plastic liner.
Stage 7: Suit, Glove, and Boot Wash	Wash splash suit, gloves, and safety boots. Scrub with long-handle scrub brush and decon solution.
Stage 8: Suit, Glove and Boot Rinse	Rinse off decontamination solution using water. Repeat as many times as necessary
Stage 9· Canister or Mask Change	Perform last step in the decontamination procedure (if worker is leaving exclusion zone to change canister or mask). Worker's canister is exchanged, new outer gloves and boot covers donned, and joints taped; worker returns to duty.
Stage 10: Safety Boot Removal	Remove safety boots and deposit in container with plastic liner
Stage 11 Splash Suit Removal	Remove splash suit with assistance of helper Deposit in container with plastic liner.
Stage 12 Inner Glove Wash	Wash inner gloves with decontamination solution.
Stage 13 Inner Glove Rinse	Rinse inner gloves with water.

Table 8.2 (continued)
Eighteen Stages in Decontamination for Level C Protection

Stage	Procedure
Stage 14 Face Piece Removal	Remove face piece. Deposit in container with plastic liner. Avoid touching face with fingers. Note: Certain parts of contaminated respirators, such as the harness assembly and leather or cloth components are difficult to decontaminate. If grossly contaminated, they may need to be discarded. Rubber components can be soaked in soap and water and scrubbed with a brush. Use a final rinse of water and allow to air dry before using again. Inspect the respirator for damage and wear before and after each use.
Stage 15 Inner Glove Removal	Remove inner gloves and deposit in lined container.
Stage 16. Inner Clothing Removal	Remove clothing soaked with perspiration and place in lined container. Do not wear inner clothing off site since there is a possibility that small amounts of contaminants might have been transferred when removing the disposal coveralls.
Stage 17: Field Wash	Shower if highly toxic, skin-corrosive, or skin-absorbable materials are known or suspected to be present Wash hands and face if shower is not available.
Stage 18: Redress	Put on clean clothes.

All decontamination fluids generated will be contained and disposed of as specified in the Work Plan. The decontamination area will be physically identified with rope or flagging and will be equipped to facilitate the decontamination stages listed above.

8.1.1 Closure of the Personnel Decontamination Station

All disposable clothing and plastic sheeting used during the operation will be double-bagged and contained on site prior to removal to an approved off-site disposal facility as identified in the Work Plan. Decontamination and rinse solutions will be contained on site prior to disposal. Reusable rubber clothing will be dried and prepared for future use. If contamination of non-disposable clothing has occurred, the affected items will be discarded appropriately. All wash tubs, pails, containers, etc., will be thoroughly washed, rinsed, and dried prior to removal from the site.

8.1.2 Disposal of Decontamination and Other Wastes

All PPE, polyethylene sheeting, and sampling support materials (e.g. paper towers, ziplock bags) will be collected at the end of each work day, placed in plastic trash bags and left at the site overnight. The following day, the air within the plastic trash bags will be tested using a PID. If the air within the bags does not show significant concentrations of organic vapors (greater than

10 ppm_v above background), the plastic trash bags will be double-bagged and placed in a municipal waste dumpster for disposal.

All other wastes generated during decontamination other than decontamination fluids will be placed in 55-gallon drums; the drums will be fully-opening with a top cover bung (type 17E/H) as identified in the FSP The drums will be filled or partially filled, depending upon the difficulty associated with transporting them from the work site. All containers will be numbered and clearly labeled with the well number/location and date of filling. Mixing of solid and liquid wastes shall not occur. The containers will be stored at a predesignated site for disposal after results from chemical analysis have been obtained.

8.2 EQUIPMENT DECONTAMINATION

Prior to use, between sampling locations, and at the end of sampling activities, all sampling equipment will be decontaminated to avoid cross-contamination, to decrease personal contact with contaminated materials, and to reduce the possibility of removing contamination from the site. The procedures for decontaminating equipment are presented in Section 5.9 of the FSP.

9.0 MEDICAL SURVEILLANCE

9.1 REQUIREMENTS FOR HYDROGEOLOGIC PERSONNEL

All employees involved in field activities will be active participants in HydroGeoLogic's medical surveillance program. All medical examinations and procedures will be performed annually by or under the supervision of a licensed occupational physician. Health examinations will include tests and procedures complying with the requirements of OSHA Standard 29 CFR 1910.120 (f) and the American National Standards Institute (ANSI) Z-88.2. Employees will qualify to perform hazardous waste site work using respiratory protection. Medical surveillance documents confirming workers' fitness to perform hazardous waste operations on this project, are on file at HydroGeoLogic's headquarters in Herndon, Virginia, and can be made available upon request.

9.2 REQUIREMENTS FOR SUBCONTRACTORS

Subcontractors will also be required to obtain certificates to perform hazardous waste site work and to wear respiratory protection. Subcontractors, with a company medical surveillance program meeting the requirements of OSHA Standard 29 CFR 1910.120 (f), will be required to submit a letter, on company letterhead, confirming that all workers assigned to the project will be medically qualified to perform hazardous waste related activities. In addition, medical surveillance documents for personnel assigned to the project must be made available upon request.

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10.0 TRAINING REQUIREMENTS

10.1 INITIAL TRAINING

10.1.1 Requirements for HydroGeoLogic Personnel

All personnel assigned to this project will be enrolled in HydroGeoLogic's continuous training program, in accordance with OSHA Standard 29 CFR 1910.120. Employees performing field work will have successfully completed an approved 40-hour Hazardous Waste Site Operations (HAZWOPER) Course, including 24-hours of field experience under the direction of a trained supervisor, and subsequently annual 8-hour refresher courses. In addition, the field leader will have completed an 8-hour site supervisors course. A majority of HydroGeoLogic field personnel will also be qualified in first aid/CPR training. HydroGeoLogic employee records are kept on file in HydroGeoLogic's Herndon, Virginia, office.

10.1.2 Requirements for Subcontractors

Prior to working at the site, all subcontractor personnel will have completed 40 hours of HAZWOPER training or have equivalent work experience as defined in OSHA Standard 29 CFR 1910.120(e). In addition, subcontractor personnel must also have successfully completed subsequent annual 8-hour refresher training.

HydroGeoLogic subcontractors must certify that each employee who will work at the site will have had training meeting the requirements of OSHA Standard 29 CFR 1910.120(e). This certification will be accomplished by submitting a letter to HydroGeoLogic, on company letterhead.

10.1.3 Requirements for Site Visitors

No persons will be permitted to enter the work zones (exclusion and decontamination) without having completed necessary health and safety training, as required by OSHA Standard 29 CFR 1910.120(e), and without necessary protective equipment as required by this HSP

10.2 SITE-SPECIFIC TRAINING

HydroGeoLogic will provide site-specific training to all HydroGeoLogic employees and subcontractor personnel who will perform work at the site. Daily health and safety meetings will be held prior to commencing field activities for the purpose of discussing each day's activities, potential hazards, and any new health and safety issues not previously covered. Personnel who do not participate in training will not be permitted to perform work at the site. Site-specific training will include:

- The contents of the HSP
- Names of personnel and alternates responsible for site health and safety
- Safety, health, and other hazards present on the site

- Use of personal protective equipment
- Work practices that can minimize risks from hazards
- Safe use of engineering controls and equipment on the site
- Medical surveillance requirements, including recognition of symptoms and signs that may indicate overexposure to hazards
- Decontamination procedures
- Emergency response procedures.

HydroGeoLogic and its subcontractors will be required to sign a statement indicating that site-specific training has been provided and that site hazards and control measures have been identified and discussed. This form is presented in Section 14.1.

11.0 STANDARD WORK PRACTICES

All field activities will follow the following Health and Safety Standard Work Practices.

11.1 GENERAL REQUIREMENTS/PROHIBITIONS

- A copy of this HSP will be available on site during field activities, for all field personnel, including visitors to consult.
- No running or horseplay will be permitted in the field.
- Eating, drinking, chewing of gum or tobacco, taking medication, applying cosmetics, and/or smoking will be prohibited in the exclusion and decontamination zones, and in all locations in which contact with site contaminants is possible.
- The appropriate level of PPE must be worn by all field personnel, including as a minimum, steel-toed safety boots, safety glasses, and hard hats, if necessary.
- Upon leaving an exclusion zone, hands and faces must be washed thoroughly. All protective outer clothing must be decontaminated and removed as specified in this HSP, and deposited in a designated area, prior to entering the clean area.
- Contact with potentially contaminated substances must be avoided Contact with the ground or with contaminated equipment must also be avoided. Air monitoring equipment must not be placed on potentially contaminated surfaces.
- No facial hair that interferes with a satisfactory fit of the mask-to-face seal, is permitted on personnel required to wear respiratory protective equipment.
- All personnel must satisfy medical monitoring procedures.
- No flames or open fires will be permitted on site.
- All personnel must be aware of and follow the action levels presented in this HSP for upgrading respiratory protection.
- New analytical data must be promptly conveyed by the laboratory technician or field leader via telephone to the project HSO.
- Personnel must develop hand signals with users of heavy equipment (i.e., drillers etc.). Standard hand signals to be used by personnel for nonverbal communication will include:

Stop	With arm extended to the side and palm down, hold position rigidly.
Hoist	With forearm and forefinger pointing up, move hand in small horizontal circle.

Lower	With forearm extended and forefinger pointing down, move hand in a small horizontal circle.
Travel	With palm up, fingers closed, and thumb pointing in the direction of motion, jerk hand horizontally.
Slow Move	Use one hand to give any motion signal, and place the other hand motionless in front of the hand giving the motion signal.
Emergency Stop	With arm extended to the side and palm down, move hand rapidly right and left.

Standard hand signals will be discussed during each daily health and safety meeting when heavy equipment is to be used.

- A copy of the OSHA "Job Safety and Health Protection" poster must be prominently posted at each site.

- Only equipment which has been approved by the manufacturer may be used in conjunction with site equipment.

- Medicine and alcohol can augment the effects of exposure to toxic chemicals Prescribed drugs should not be consumed by personnel on operations where the potential for absorption, inhalation, or ingestion of toxic substances exists, unless specifically approved by a qualified physician. Alcoholic beverage intake will not be allowed at anytime, including during breaks.

- No person will enter the exclusion zone alone.

- Safety devices on equipment must be activated and used as designed.

- Equipment and tools will be kept clean and in good repair and used only for their intended purposes.

- Eye protection must be worn when hammering or pounding is performed and during other activities that may produce flying particles or slivers.

- Field personnel will not be permitted to lift more than 60 pounds. Rules to remember when attempting to lift heavy objects include:

  - Size up the load before trying to lift it, test the weight and get help if needed
  - Bend the knees and look up to keep the neck and back straight
  - Do not twist or turn your body once you have made the lift
  - Make sure you can carry the load where you need to go before lifting it
  - Set the load down properly, lower slowly by bending the knees
  - Always push rather than pull the object when possible.

- Heavy lifting (more than 60 pounds per worker) must be accomplished using mechanical lifting equipment. Mechanical lifting equipment that will be available on site will include

forklifts, hoists, dollies, backhoe/trackhoe and other types of equipment that can be rented from an off-site location.

- Leather gloves must be worn when handling objects that may produce slivers (e.g., driving wood stakes, handling drill rods/augers).

- No person shall climb the drill mast without the use of ANSI approved fall protection (i.e., approved belts, lanyards, and a fall protection slide rail) or portable ladder which meets the requirements of OSHA standards.

- The SSO must make an entry into the site field logbook at least daily, to include:

  - Weather conditions
  - Site personnel
  - New arrivals and their clearance for site work
  - Air monitoring data summary
  - Monitoring instrument calibration
  - Indications of inhalation exposure
  - PPE used per task
  - Deviations from HSP
  - Inspection and cleaning of respiratory equipment
  - General health and safety problems/corrective actions.

- If personnel note any warning properties of chemicals (irritation, odors, symptoms, etc.) or even remotely suspect the occurrence of exposure, they must immediately notify the SSO for further direction.

11.2 DRILLING ACTIVITIES

Prior to the commencement of drilling activities, all locations will be surveyed and marked for underground utilities. In addition, a hand auger or probe will be used to a depth of three feet to assure the absence of underground utilities at the location of interest. If any uncertainties exist, the location will be moved to an adjacent area.

The following general drilling practices must be adhered to during investigation activities:

- All drilling equipment (i.e., rigging, derrick, hoists, augers, etc.) must be inspected by the drilling crew and SSO prior to starting work. Defective equipment will be removed from service and replaced.

- No drilling within 20 feet of overhead power lines will be permitted in any direction. The locations of all underground utilities will be identified and marked prior to initiating any subsurface activities.

- All drill rigs and other machinery with exposed moving parts must be equipped with an operational emergency stop device. Drillers and geologists must be aware of the location

of this device. This device must be tested prior to job initiation, and periodically thereafter. The driller and helper shall not simultaneously handle moving augers or flights unless there is a standby person to activate the emergency stop.

- Prior to raising the mast, the drill rig operator shall ensure that the proper stabilization measures have been taken. The drill rig shall not be moved while the mast is in the raised position.

- The driller must never leave the controls while the tools are rotating unless all personnel are clear of the rotating equipment.

- Drillers must wear hearing protection unless the employer can provide documentation that noise exposures are less than a 50 percent dose as required by OSHA Standard 29 CFR 1910.95.

- Drilling activities shall immediately cease when inclement weather (e.g., heavy rains, lightning) and high winds occur at the site. All site personnel should immediately seek shelter.

- To maintain a clean operation, drill cuttings shall be containerized as they are generated. A long-handled shovel or equivalent must be used to clear drill cuttings away from the hole and from rotating tools. Hands and/or feet are not to be used for this purpose.

- A remote sampling device must be used to sample drill cuttings when the tools are rotating. Samplers must not reach into nor near the rotating equipment. If personnel must work near tools which could rotate, the driller must shut down the rig prior to initiating such work.

- Drillers, helpers, and samplers must secure all loose clothing when in the vicinity of drilling operations.

- Only manufacturer approved equipment may be used in conjunction with other site equipment and, in particular, used to attach sections of drilling tools together. Pins that protrude from augers shall not be allowed.

A variety of additional work practices (i.e., hoisting, cat lines, pipe and auger handling, etc.) are to be adhered to by the drilling crew. If the on-site field team leader or site supervisor observes any operations or actions that are perceived as threatening to the health and safety of site personnel, drilling operations will be temporarily suspended until a mutual understanding of the actions are addressed and/or corrected.

Drilling activities may have the potential for releasing gases and vapors to the atmosphere and for exposing personnel to volatile contaminants. Gases and vapors with vapor densities of less than 1.0 (i.e., methane) are lighter-than-air and tend to migrate upward in the air to disperse. Heavier-than-air gases and vapors (i.e., hydrogen sulfide) tend to stay close to the ground and may migrate to low-lying areas. The only practical method for containment for contaminant releases to the

atmosphere is by terminating the releases at their source, i.e., by plugging the wells. Depending on the contaminants encountered, it may be necessary to evacuate personnel downwind of an area of the release. Emergency response personnel should be notified (Section 13.6) if air concentrations at the perimeter of an exclusion zone exceed threshold limit values (TLVs) or permissible exposure levels (PELs).

11.3 GOOD HOUSEKEEPING

Good housekeeping is a very important aspect of field projects and will be strongly stressed in all aspects of field work. Good housekeeping plays a key role in the protection of occupational health and in the containment of dangerous contaminants. All work areas will be kept as clean as possible at all times. All spills will be cleaned up immediately. Good housekeeping will be the responsibility of all employees.

HydroGeoLogic will implement a good housekeeping program for all field activities to minimize the spread of contamination beyond the work site. The program will include:

- Daily cleaning of the area to remove debris including paper products, cans, and other materials brought on site.
- Regular changing of wash and rinse water for hands, face, and equipment.
- Daily removal of all garbage bags and containers used to collect food products, plastic inner gloves, and contaminated disposable clothing.

11.4 WORK LIMITATIONS

All field activities will be performed during normal daylight hours.

11.5 CONFINED SPACE ENTRY

No site personnel will undertake activities that could be considered to involve confined-space entry.

11.6 SPILL CONTAINMENT

The procedures defined in this section comprise the spill containment activities in place at the site.

- All drums and containers used during cleanup will meet appropriate Department of Transportation (DOT), OSHA, and EPA regulations for each waste type.
- Drums and containers will be inspected for integrity prior to being moved. Drums or containers that cannot be inspected prior to being moved, because of storage conditions, will be positioned in an accessible location and inspected prior to further handling.
- Operations on site will be organized to minimize drum or container movement.

- Employees involved in drum or container operations will be prior warned of the hazards associated with each container.

- Where spills, leaks, or ruptures may occur, adequate quantities of spill containment equipment (absorbent, pillows, etc.) will be stationed in the immediate area. All spill containment facilities will be of sufficient size to contain and isolate the entire volume of hazardous substances being transferred.

- Drums or containers that cannot be moved without failure, will be emptied into sound containers.

- Fire extinguishing equipment meeting 29 CFR Part 1910.Subpart 1 shall be on hand and ready for use to control fires.

12.0 SITE CONTROL

12.1 WORK ZONES

Each field location will be physically barricaded with rope flagging or caution tape to control entry and exit to and from the area. These barricaded areas will be referred to as the exclusion zones. Each exclusion zone will be identified by a site supervisor and will consist of a 20-foot radius surrounding the drilling location. Each person leaving an exclusion zone will proceed directly to the decontamination zone, located adjacent to the exclusion zone and identified by physical barriers. The decontamination zone will consist of a low-lying area covered with plastic sheeting. At the completion of decontamination procedures in an area, all debris will be enclosed in the plastic sheeting and deposited into 55-gallon type 17 E/H drums for later disposal as identified in the Work Plan and Field Sampling Plan. Only personnel cleared by the HydroGeoLogic field leader and SSO will be permitted in the exclusion and/or decontamination zones. Clearance for accessing these areas will only be given to personnel who meet the training and medical surveillance requirements of OSHA Standard 29 CFR 1910.120, and who are wearing PPE appropriate for the work activities.

The support zone, where the administrative, communications, and other support services will be based, will be in a controlled area off the site or on the far end upwind of potential site contamination or areas of potential exposure. Only personnel and equipment free of contamination will be permitted in the support zone.

12.2 COMMUNICATIONS

Communications will consist of a centrally located telephone located in the designated support zone (i.e., trailer, office) and a mobile phone located in an on-site vehicle. Under emergency conditions, field personnel may also use telephones located at NAS Fort Worth JRB.

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13.0 EMERGENCY RESPONSE

This HSP has been developed to prevent the occurrence of situations that may jeopardize the health and safety of field personnel. Supplemental emergency procedures will be identified in the event that unforeseen health and safety accidents or incidents occur. HydroGeoLogic will evacuate its employees and subcontractors from the workplace if an emergency involving chemical spills, chemical fires, chemical exposure, and/or chemical emissions occurs. Emergency response planning will be in accordance with OSHA Standard 29 CFR 1910.38(a).

13.1 PREPLANNING

Upon initial arrival at the site, the HydroGeoLogic field leader and SSO will visit the Base fire department to determine the status of emergency response services. This meeting will include a determination concerning the need for further coordination with local rescue and police services.

Medical data sheets will be completed as described in Section 14.1. These sheets will be completed by all HydroGeoLogic personnel and subcontractors so that, in the event of personal injury or illness, an examining physician has background information immediately available.

13.2 EMERGENCY PROCEDURES AND ASSIGNMENTS

Upon notification of a site emergency requiring evacuation, all HydroGeoLogic personnel and subcontractors will proceed directly to the support zone (i.e., trailer, office). If personnel cannot reach the support zone without endangering their life or health, an alternative meeting place will be specified by the HydroGeoLogic SSO. Emergency egress routes and meeting places will be discussed at each daily health and safety briefing.

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

- The site supervisor will evaluate the incident, assess the need for assistance, and call appropriate contacts, if necessary.
- The site supervisor will act as the point of contact for outside emergency personnel and on site personnel.
- The site supervisor will advise emergency response and emergency room personnel concerning the types of contamination potentially contacted by injured workers receiving emergency care.
- The site supervisor will ensure that the SSO promptly notifies the HydroGeoLogic PM and HSO of the incident.

13.2.1 Chemical Inhalation

It is not anticipated that chemicals of concern will be present at the site in concentrations sufficient to cause immediate danger to life and health. Any field personnel exhibiting or complaining of

symptoms of chemical exposure, as described in Section 4.1, will be removed from the work zone and transported to a designated medical facility for examination and treatment.

13.2.2 Eye and Skin Contact

Field personnel who come into contact with contaminants while in the exclusion zone will immediately proceed to the decontamination zone, where an eyewash station will be located. Do not decontaminate prior to using the eyewash. Remove necessary PPE before performing eyewash procedures. Flush the eye with the clean water for at least 15 minutes and arrange for prompt transportation to a designated medical facility.

Unless skin contact with contaminants is severe, proceed through the decontamination zone. Field personnel should remove any contaminated PPE and wash affected areas for at least 15 minutes. If any personnel show signs of skin irritation, they will be transported to a designated medical facility.

13.3 PROCEDURES FOR PERSONNEL REMAINING ON SITE

No HydroGeoLogic or subcontractor personnel will remain on site to operate critical site emergency equipment.

13.4 PROCEDURES TO ACCOUNT FOR SITE PERSONNEL

The number of HydroGeoLogic and subcontractor personnel will be sufficiently small that each team member will be known to every other team member HydroGeoLogic's field leader and SSO will ensure that the whereabouts of each team member will be known at all times.

13.5 RESCUE AND MEDICAL DUTIES

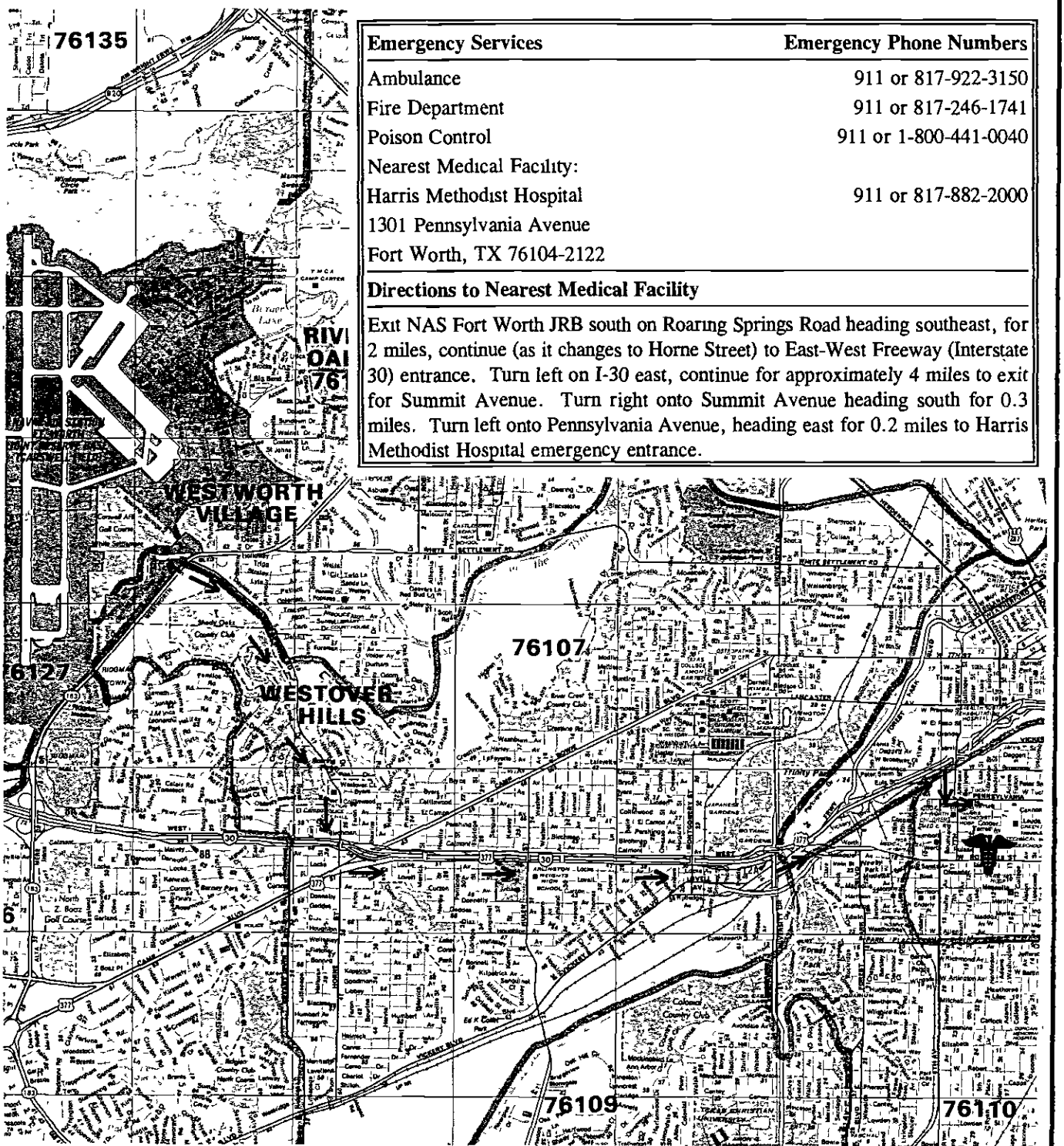
Only field personnel trained by the American Red Cross, or equivalent, will be permitted to rescue, and/or provide first aid, and/or CPR treatment. Outside emergency services and medical facilities will be the primary providers of such services. At least one person currently certified in first aid and CPR will be on-site at all times during field activities. A "physician approved" first aid kit, an ANSI approved eye wash station with 15-minutes of free-flowing freshwater, and a Class ABC fire extinguisher will be readily available on site.

HydroGeoLogic employees who shows signs or symptoms of overexposure must be immediately examined by a licensed physician. Subcontractor personnel who show signs or symptoms of overexposure will also be encouraged to visit a licensed physician. Figure 13.1 shows directions to the nearest medical facility.

Emergency Services	Emergency Phone Numbers
Ambulance	911 or 817-922-3150
Fire Department	911 or 817-246-1741
Poison Control	911 or 1-800-441-0040
Nearest Medical Facility:	
Harris Methodist Hospital	911 or 817-882-2000
1301 Pennsylvania Avenue	
Fort Worth, TX 76104-2122	

Directions to Nearest Medical Facility

Exit NAS Fort Worth JRB south on Roaring Springs Road heading southeast, for 2 miles, continue (as it changes to Horne Street) to East-West Freeway (Interstate 30) entrance. Turn left on I-30 east, continue for approximately 4 miles to exit for Summit Avenue. Turn right onto Summit Avenue heading south for 0.3 miles. Turn left onto Pennsylvania Avenue, heading east for 0.2 miles to Harris Methodist Hospital emergency entrance.



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HYDRO GeoLogic

Legend

Harris Methodist Hospital

Route to Hospital

N

Figure 13.1

Nearest Medical Facility to NAS Fort Worth JRB, Texas

13.6 EMERGENCY COMMUNICATION PROCEDURES, CONTACTS AND PHONE NUMBERS

Persons who observe an emergency situation must immediately notify the HydroGeoLogic field leader and/or SSO. The field leader or SSO will then assess the emergency, appoint someone to telephone appropriate outside emergency services, and coordinate a site evacuation Emergency telephone numbers and directions to the nearest medical facility are presented in Table 13.1 and Figure 13.1. A copy of which will be posted at the nearest telephone.

13.7 ACCIDENT/INCIDENT FOLLOW-UP AND REPORTING

Upon receiving a report of an accident or incident, the SSO shall immediately investigate the circumstances, make appropriate recommendations to prevent a recurrence, and notify the HSO by telephone. The HSO may also participate in the investigation, at his discretion.

Details of all incidents shall be documented on Accident/Incident Report forms (Section 14.1) within 24 hours of the accident/incident, and shall be distributed to the Project Manager, HSO, and COR. A copy of this report shall also be sent to the appropriate administrative contact for inclusion into an OSHA Form 101 and 200 log. Incident report forms will be available at the site support facilities.

Table 13.1
Emergency Telephone Numbers, Contacts, and Directions to Nearest Medical Facility

Key Personnel	Number
Miquette E Rochford - Project Manager Kenneth F. Rapuano - Health and Safety Officer Michael Dodyk - Base Point of Contact (HQ AFCEE/ERD) Don Ficklen - HQ AFCEE/ERD Contracting Officer's Representative	(703) 736-4511 (703) 736-4546 (817) 782-7167 (210) 536-5290
Emergency Phones Numbers	
Base Fire Department (for ambulance and fire response) On base, mobile phone On base, permanent phone Poison Control Hospital - Harris Methodist - Fort Worth 1301 Pennsylvania Avenue	 (817) 782-6330 911 911 or (800) 441-0040 911 or (817) 882-2000
Directions to Nearest Medical Facility (Figure 13.1)	
Exit NAS Fort Worth JRB south on Roaring Springs Road heading southeast for 2 miles, continue (as it changes to Horne Street) to East-West Freeway (Interstate 30) entrance. Turn left on I-30 east, continue for approximately 4 miles to exit for Summit Avenue. Turn right onto Summit Avenue heading south for 0.3 miles Turn left onto Pennsylvania Avenue, heading east for 0.2 miles to Harris Methodist Hospital emergency entrance.	

14.0 DOCUMENTATION AND EQUIPMENT

This section summarizes the documentation and equipment needs for the project as specified in the HSP. Its purpose is to provide a checklist to help ensure all necessary resources are available to carry out the requirements of the HSP.

14.1 DOCUMENTATION AND FORMS

The following documents are presented on the following pages for use during site operations:

- Site Safety Briefing Forms
- HSP Compliance Agreement Forms
- HSP Amendments Forms
- Accident/Incident Report Forms
- Personnel Medical Data Sheets
- Equipment Calibration Logs
- Air Monitoring Logs.

In addition, the following documents will be present on site during site operations:

- Approved HSP (signed copy)
- OSHA poster
- MSDSs
- Employee training and medical surveillance certificates
- Subcontractor training and medical surveillance certificates.

14.2 EMERGENCY, HEALTH AND SAFETY EQUIPMENT

- First aid kit
- Eye wash
- Inner latex or vinyl gloves
- Outer nitrile gloves (disposable and 11-mil thickness)
- Boot covers
- Hard hats and safety glasses
- Tyvek suit
- PVC and/or Saranex (with hoods)
- Ear defenders/plugs
- Decontamination kit
- Fire extinguisher
- Fall protection devices (body harness and lanyard)
- Duct tape
- LEL/O_2 meter
- Methane detector
- PID

The site supervisor and/or SSO shall be responsible for maintaining first aid kits and fire extinguishers at each site where field activities will be taking place. The locations of first aid kits and fire extinguishers will be discussed during each daily health and safety meeting.

15.0 REFERENCES

U.S. Department of Health and Human Services, National Institute for Occupational Safety and Health, 1985, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, DHHS (NIOSH) Publication No. 85-115, dated October 1985.

U.S. Department of Health and Human Services, National Institute for Occupational Safety and Health (NIOSH), 1997, *Pocket Guide to Chemical Hazards*, dated June 1997.

U.S. Environmental Protection Agency, 1992, *Standard Operating Safety Guides*, NTIS Publication No. 9285.1-03, dated June 1992.

U.S. Federal Acquisition Regulation, FAR Clause 52.236-13: Accident Prevention.

U.S. National Archives and Records Administration, 1997, *Code of Federal Regulations,* Occupational Safety and Health Administration General Industry Standards, 29 CFR 1910; Construction Industry Standards, 29 CFR 1926; 29 CFR 1910.120; 29 CFR 1926.65 " Hazardous Waste Site Operations and Emergency Response."

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SITE SAFETY BRIEFING FORM

Project _____

Date _____ Time _____ Job No. _____

Location _____

Type of Work _____

_____

_____

SAFETY TOPICS PRESENTED

Protective Clothing/Equipment _____

_____

Chemical Hazards _____

_____

Physical Hazards _____

_____

Emergency Procedures _____

_____

Hospital/Clinic _____ Phone _____

Hospital Address _____

Special Equipment _____

_____

Other _____

_____

_____

_____

ATTENDEES

Name (Printed)	Signature
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Meeting Conducted by: _____

Site Safety Officer: _____

HEALTH AND SAFETY PLAN

COMPLIANCE AGREEMENT FORM

PROJECT: RCRA Facility Investigations

CLIENT: U.S Air Force Center for Environmental Excellence

LOCATION: NAS Fort Worth JRB, Texas

PROJECT NO: AFC001-0019

I, _____, have received a copy of the Health and Safety Plan for the above-referenced project. I have read the plan, understand it, and agree to comply with all of its provisions. I understand that I can be prohibited from working on the project for violating any of the safety requirements specified in the plan.

Signed:

_____ _____

Signature Date

_____

Company

HEALTH AND SAFETY PLAN AMENDMENTS FORM

Change in field activities or hazards: _____

Proposed Amendments: _____

Proposed by: _____ Date: _____

Approved by: _____

Accented: _____ Declined: _____ Date: _____

Amendment Number: _____

Amendment Effective Date: _____

HYDROGEOLOGIC, INC.
Accident/Incident/Near Miss Investigation Form

Employee's Name:_____
Address:_____
_____ SS#_____
Job Title:_____ Supervisor's Name:_____
Office Location:_____
Location at Time of Incident:_____
Date/Time of Incident:_____

Describe clearly how the accident occurred:_____

Was incident: Physical_____ Chemical_____
Parts of body affected _____ Exposure: Dermal_____
right left Inhalation_____
Ingestion_____

Witnesses: 1)_____ 2)_____

Conditions/acts contributing to this incident_____

Managers must complete this section:
Explain specifically the corrective action you have taken to prevent a recurrence:_____

Did injured go to doctor:_____ Where:_____
_____ When:_____
Did injured go to hospital:_____ Where:_____
_____ When:_____

Signatures:

_____	_____	_____
Employee	Reporting Manager	Health & Safety Officer
_____	_____	_____
Date	Date	Date

Accidents must be reported immediately; this form must be completed and returned to the Health and Safety Officer within **24 hours.**

MEDICAL DATA SHEET

This brief Medical Data Sheet will be completed by all onsite personnel and will be kept in the command post during the conduct of site operations. This data sheet will accompany all personnel when medical assistance is needed or if transportation to hospital facilities is required.

Project _____

Name _____ Home Telephone _____

Address _____

Age _____ Height _____ Weight _____

Name of Next of Kin _____

Drug or other Allergies _____

Particular Sensitivities _____

Do You Wear Contacts? _____

Provide a Checklist of Previous Illnesses or Exposure to Hazardous Chemicals.

_____

_____

What medications are you presently using? _____

_____

_____

Do you have any medical restrictions? _____

_____

_____

Name, Address, and Phone Number of personal physician: _____

_____

_____

_____

_____

_____

I am the individual described above. I have read and understand this HSP:

_____

_____ _____

Signature Date

DAILY EQUIPMENT CALIBRATION LOG

Project Name:

Project No:

Date/Time	Initials	Instrument	Calibration Solution or Gas Concentration	Adjustments Required/ Comments

Project _____

HEALTH AND SAFETY/AIR MONITORING LOG

Date: _____ Logged by: _____

Weather: _____
Field Tasks: _____

HydroGeoLogic Personnel (or subcontractor) working on the site (name and affiliation):

HydroGeoLogic Personnel (or subcontractor) working in restricted zone:

HydroGeoLogic Site Visitors:

Air Quality Monitoring Measurements:

Time	Instrument	Parameter	Concentration	Locations

Background:

Exclusion zone:

Level of PPE: _____

Comments on other safety-related matters:

(including infractions, accidents, injuries, unusual occurrences, physical complaints)

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TAB

Appendix E

APPENDIX E
DRAWINGS

Drawing 1	**Groundwater Recovery and Treatment System Plan**
Drawing 2	**Process Flow Diagram**
Drawing 3	**Piping and Instrument Diagram, Legend**
Drawing 4	**Piping and Instrument Diagram, Recovery Wells**
Drawing 5	**Piping and Instrument Diagram, Acid Feed and Flow Equalization**
Drawing 6	**Piping and Instrument Diagram, Typical Treatment Skid**
Drawing 7	**Main Control Panel, CP-1**
Drawing 8	**Main Control Panel, Elementary Wiring Diagram Sheet 1 of 2**
Drawing 9	**Main Control Panel, Elementary Wiring Diagram Sheet 2 of 2**
Drawing 10	**Main Control Panel, Field Wiring Diagram**
Drawing 11	**Power Distribution Drawing**
Drawing 12	**Skid Control Panel, Elementary Wiring Diagram**
Drawing 13	**Skid Control Panel, Panel Layout and Bill of Materials**
Drawing 14	**Well Control Panels**

NOTES

1. LOCATION OF ALL PIPING AND ELECTRICAL CONDUITS ARE APPROXIMATE
2. THE DISCHARGE PIPE [illegible] DIA SCH 80 PVC EFF THT PIPE HAS BEEN INSTALLED WITH A 0% SLOPE FROM THE DISCHARGE BELOW GRADE AT SANITARY SEWER MANHOLE NO 61
3. TREATED EFFLUENT LINE AREAS TO GOLF COURSE POND EXIST LOCATION UNDER ROAD SIZE UNKNOWN AS AS BUILT DRAWINGS AVAILABLE

LEGEND

- RECOVERY WELLS
- [illegible]
- 2" DIA PVC ELECTRICAL CONDUIT
- 3" DIA SCH 80 PVC PIPE
- 8" DIA CAST IRON SANITARY SEWER
- 12" DIA WATER UTILITY LINE
- 6" DIA PVC TREATED EFFLUENT LINE TO GOLF COURSE POND PIPE SIZE UNKNOWN
- EXISTING STRUCTURE
- AREA OF CONCERN (AOC)
- SOLID WASTE MANAGEMENT UNITS (SWMU)

REFERENCES

1. IT CORPORATION DRAWING NO 305695-E1
2. DEPARTMENT OF THE AIR FORCE DRAWINGS TAB NO G11, SHEET 8 OF 22 AND 9 OF 22 TITLED "COMPREHENSIVE PLAN COMPOSITE UTILITY SYSTEM" DATED MAY 1995 SCALE 1"=100

N

SCALE

0 100 200 Feet

DRAWING

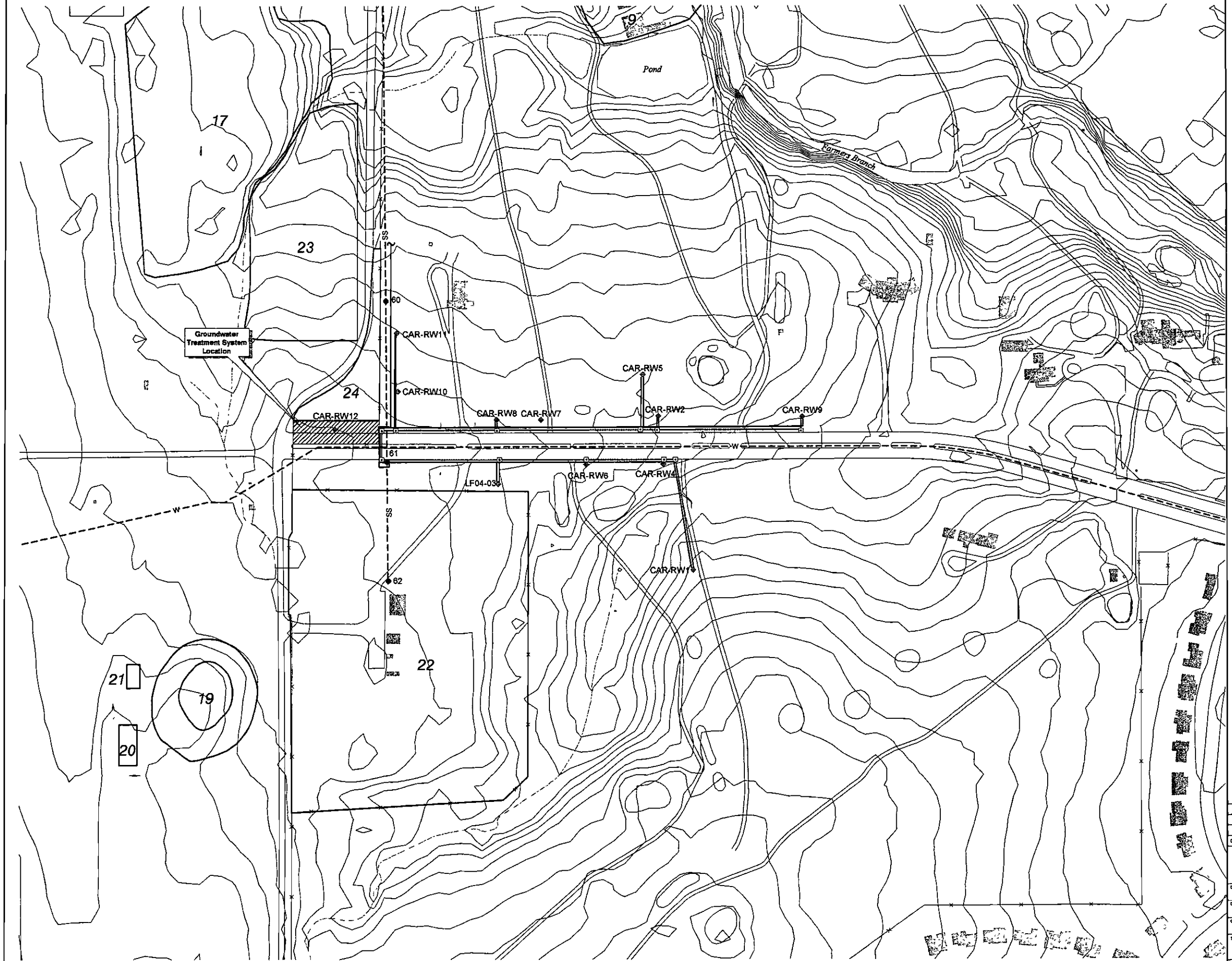
HYDRO GeoLogic

U.S. AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
WARNER ROBINS AFB

PLAN
GROUNDWATER RECOVERY SYSTEM

FORT WORTH, TEXAS

Pond
Farmers Branch
Groundwater Treatment System Location
CAR-RW11
CAR-RW10
CAR-RW12
CAR-RW8
CAR-RW7
CAR-RW5
CAR-RW2
CAR-RW9
CAR-RW6
CAR-RW4
CAR-RW1
LF04-039
SS
W
60
61
62
17
23
24
22
21
19
20



NOTES

1 LOCATION OF ALL PIPING AND ELECTRICAL CONDUITS ARE APPROXIMATE

2 THE DISCHARGE PIPE IS 4" DIA SCH 80 PVC PIPE THE PIPE HAS BEEN INSTALLED AT A 2% SLOPE THE PIPE DISCHARGES BELOW GRADE AT SANITARY SEWER MANHOLE NO 61

3 TREATED EFFLUENT DISCHARGES TO GOLF COURSE POND EXACT LOCATION OF UNDERGROUND PIPE UNKNOWN NO AS BUILT DRAWINGS AVAILABLE

LEGEND

- RECOVERY WELLS
- CONDUIT PULL BOX AND PAD
- 2" DIA. PVC ELECTRICAL CONDUIT
- 3" DIA SCH 80 PVC PIPE
- -SS- 8" DIA CAST IRON SANITARY SEWER UTILITY LINE
- -W- 12" DIA WATER UTILITY LINE
- 6" DIA PVC TREATED EFFLUENT LINE TO GOLF COURSE POND PIPE SIZE UNKNOWN
- EXISTING STRUCTURE
- AREA OF CONCERN (AOC)
  AOC 9 (GOLF COURSE MAINTENANCE YARD)
- SOLID WASTE MANAGEMENT UNIT (SWMU)
  SWMU 17 (LANDFILL NO 7)
  SWMU 19 (FIRE TRAINING AREA NO 2)
  SWMU 20
  SWMU 21
  SWMU 22 (LANDFILL NO 6)
  SWMU 23 (LANDFILL NO 5)
  SWMU 24 (WASTE BURIAL AREA NO. 7)

REFERENCES

1 IT CORPORATION DRAWING NO 305895-E1

2 DEPARTMENT OF THE AIR FORCE DRAWINGS TAB NO G11, SHEET 8 OF 22 AND 9 OF 22 TITLED " COMPRESSIVE PLAN COMPOSITE UTILITY SYSTEM," DATED MAY 1988 SCALE 1"=100'

N

File: 17A-53
D.E.

SCALE
100 0 100 200 Feet

DRAWING 1

D.O. NO.	ACTION	DATE	DESCRIPTION OF REVISION
		11/22/99	AS BUILT

HYDRO GeoLogic Inc.

U.S. AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
NAS FORT WORTH JRB

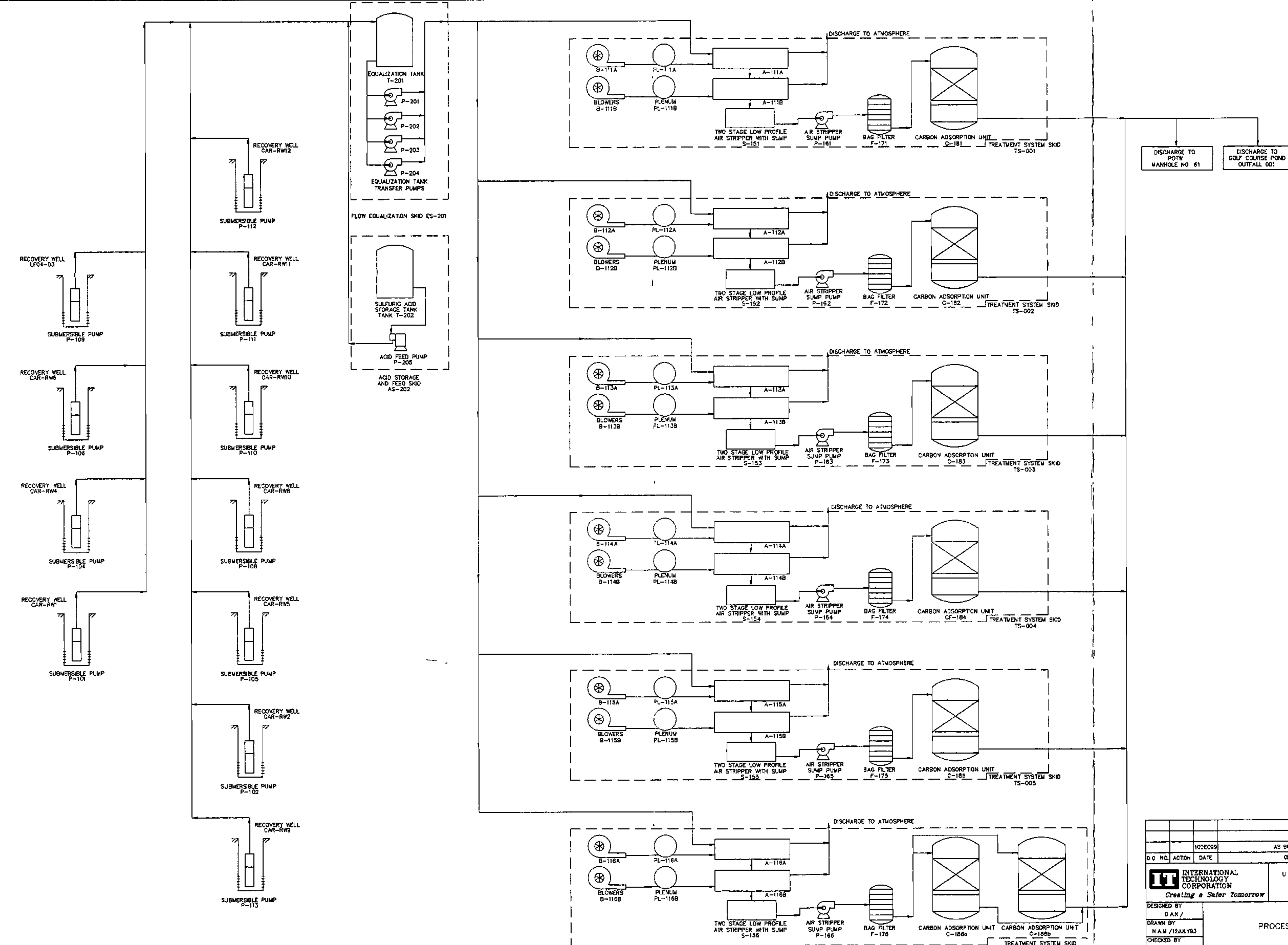
DESIGNED BY J. KENDERDINE
DRAWN BY J. BELCHER
CHECKED BY U. GUVANASEN
SUBMITTED BY

PLAN
GROUNDWATER RECOVERY SYSTEM
NAS FORT WORTH JRB TEXAS

INVITATION NO.
SPECIFICATIONS DATED
SEQUENCE NO.
DRAWING NO. 19CD-E1
SHEET NO.
FILENAME X:\AFCEE01\19CD\19CD-E1.APR

684 178

DRAWING NUMBER 305895-E4



File 174 53
D.E.

DRAWING 2

		10DEC99	AS BUILT (HYDROGEOLOGIC, INC.)
D.O. NO.	ACTION	DATE	DESCRIPTION OF REVISION

INTERNATIONAL TECHNOLOGY CORPORATION
Creating a Safer Tomorrow

U.S. ARMY ENGINEER DISTRICT, TULSA
CORPS OF ENGINEERS
TULSA, OKLAHOMA

DESIGNED BY D.A.K./
DRAWN BY N.A.M./12JULY93
CHECKED BY B.J.P.
SUBMITTED BY B. J. PAREKH
ENGINEER

PROCESS FLOW DIAGRAM

NAS Fort Worth JRB, Texas

SOC NO. DACA-92-D-0008
CONTR NO.
DRAWING NO 305895-E4
SHEET NO
SEQUENCE NO

Filename: X:\Afc001\19od\19od-E4.dwg
Revised. 12/21/99 sp

DRAWING NUMBER 305895-E4

RECOVERY WELL CAR-RW12
SUBMERSIBLE PUMP P-112
RECOVERY WELL LF04-03
SUBMERSIBLE PUMP P-109
RECOVERY WELL CAR-RW11
SUBMERSIBLE PUMP P-111
RECOVERY WELL CAR-RW6
SUBMERSIBLE PUMP P-106
RECOVERY WELL CAR-RW10
SUBMERSIBLE PUMP P-110
RECOVERY WELL CAR-RW4
SUBMERSIBLE PUMP P-104
RECOVERY WELL CAR-RW8
SUBMERSIBLE PUMP P-108
RECOVERY WELL CAR-RW1
SUBMERSIBLE PUMP P-101
RECOVERY WELL CAR-RW5
SUBMERSIBLE PUMP P-105
RECOVERY WELL CAR-RW2
SUBMERSIBLE PUMP P-102
RECOVERY WELL CAR-RW9
SUBMERSIBLE PUMP P-113

EQUALIZATION TANK T-201
P-201
P-202
P-203
P-204
EQUALIZATION TANK TRANSFER PUMPS
FLOW EQUALIZATION SKID ES-201

SULFURIC ACID STORAGE TANK T-202
ACID FEED PUMP P-205
ACID STORAGE AND FEED SKID AS-202

DISCHARGE TO ATMOSPHERE
B-111A
PL-111A
A-111A
BLOWERS B-111B
PLENUM PL-111B
A-111B
TWO STAGE LOW PROFILE AIR STRIPPER WITH SUMP S-151
AIR STRIPPER SUMP PUMP P-161
BAG FILTER F-171
CARBON ADSORPTION UNIT C-181
TREATMENT SYSTEM SKID TS-001

DISCHARGE TO POTW MANHOLE NO. 61
DISCHARGE TO GOLF COURSE POND OUTFALL 001

DISCHARGE TO ATMOSPHERE
B-112A
PL-112A
A-112A
BLOWERS B-112B
PLENUM PL-112B
A-112B
TWO STAGE LOW PROFILE AIR STRIPPER WITH SUMP S-152
AIR STRIPPER SUMP PUMP P-162
BAG FILTER F-172
CARBON ADSORPTION UNIT C-182
TREATMENT SYSTEM SKID TS-002

DISCHARGE TO ATMOSPHERE
B-113A
PL-113A
A-113A
BLOWERS B-113B
PLENUM PL-113B
A-113B
TWO STAGE LOW PROFILE AIR STRIPPER WITH SUMP S-153
AIR STRIPPER SUMP PUMP P-163
BAG FILTER F-173
CARBON ADSORPTION UNIT C-183
TREATMENT SYSTEM SKID TS-003

DISCHARGE TO ATMOSPHERE
B-114A
PL-114A
A-114A
BLOWERS B-114B
PLENUM PL-114B
A-114B
TWO STAGE LOW PROFILE AIR STRIPPER WITH SUMP S-154
AIR STRIPPER SUMP PUMP P-164
BAG FILTER F-174
CARBON ADSORPTION UNIT CF-184
TREATMENT SYSTEM SKID TS-004

DISCHARGE TO ATMOSPHERE
B-115A
PL-115A
A-115A
BLOWERS B-115B
PLENUM PL-115B
A-115B
TWO STAGE LOW PROFILE AIR STRIPPER WITH SUMP S-155
AIR STRIPPER SUMP PUMP P-165
BAG FILTER F-175
CARBON ADSORPTION UNIT C-185
TREATMENT SYSTEM SKID TS-005

DISCHARGE TO ATMOSPHERE
B-116A
PL-116A
A-116A
BLOWERS B-116B
PLENUM PL-116B
A-116B
TWO STAGE LOW PROFILE AIR STRIPPER WITH SUMP S-156
AIR STRIPPER SUMP PUMP P-166
BAG FILTER F-176
CARBON ADSORPTION UNIT C-186a
CARBON ADSORPTION UNIT C-186b
TREATMENT SYSTEM SKID TS-006

File I.D. 174-53

DRAWING 2

		10DEC99	AS BUILT (HYDROGEOLOGIC, INC.)
D O NO.	ACTION	DATE	DESCRIPTION OF REVISION

INTERNATIONAL TECHNOLOGY CORPORATION
Creating a Safer Tomorrow

U.S. ARMY ENGINEER DISTRICT, TULSA
CORPS OF ENGINEERS
TULSA, OKLAHOMA

DESIGNED BY	D.A.K./
DRAWN BY	M.A.M /12JUL'93
CHECKED BY	B.J.P
SUBMITTED BY	B. J. PAREKH
ENGINEER	

PROCESS FLOW DIAGRAM

NAS Fort Worth JRB, Texas

SOC NO. DACA-92-D-0008
CONTR. NO.
SEQUENCE NO.
DRAWING NO. 305895-E4
SHEET NO.

Filename: X:\dfs00713\cad\19cad-E4.dwg
Revised. 12/21/99 ap

DRAWING NUMBER 305895-E8

INSTRUMENT IDENTIFICATION

FIRST LETTER PROCESS VARIABLE OF ACTUATION		SECOND LETTER FUNCTION MODIFER	
A	ANALYSIS	A	ALARM
E	VOLTAGE (EMF)/ELECT	AH	ALARM HIGH
F	FLOW RATE	AL	ALARM LOW
FQ	FLOW QUANTITY	C	CONTROLLER OR CONTROL
FF	FLOW RATIO	E	ELEMENT
G	GAUGING (DIMENSIONAL)	G	GLASS OR GAUGE
H	HAND (MANUALLY)	I	INDICATOR
I	CURRENT/AMPS	IC	INDICATING CONTROLLER
L	LEVEL	P	POINT
P	PRESSURE/VACUUM	Q	TOTALIZE/INTEGRATE
X	(UNCLASSIFIED)	R	RECORDER
Y	(UNCLASSIFIED) SECOND LETTER RELAY	S	SWITCH
		SH	SWITCH HIGH
		SL	SWITCH LOW
		SLH	SWITCH LOW & HIGH (DUAL)
		SV	SAFETY VALVE
		T	TRANSMITTER
		V	VALVE
		W	WELL OR PROBE
		Y	INSTRUMENT SIGNAL RELAY

FE	FLOW ELEMENT	LV	LEVEL VALVE
FI	FLOW INDICATOR	LY	LEVEL SIGNAL RELAY (CONVERTOR)
FQ	FLOW TOTALIZER	PA	PRESSURE/VACUUM ALARM
FT	FLOW TRANSMITTER	PB	PUSH BUTTON
FY	FLOW SIGNAL RELAY (CONVERTOR)	PG	PRESSURE GAGE
HS	HAND/MANUAL SWITCH	PI	PRESSURE/VACUUM INDICATOR
II	CURRENT INDICATOR (AMMETER)		
LA	LEVEL ALARM		
LC	LEVEL CONTROL		
LE	LEVEL ELEMENT		
LI	LEVEL INDICATOR		

AIC	ANALYSIS INDICATING CONTROL	FIC	FLOW INDICATING CONTROL
AIT	ANALYSIS INDICATING TRANSMITTER	FIT	FLOW INDICATING TRANSMITTER
dPA	DIFFERENTIAL PRESSURE ALARM	FQI	FLOW INDICATING TOTALIZER
dPI	DIFFERENTIAL PRESSURE INDICATOR	LAY	LEVEL ALARM RELAY
dPIT	DIFFERENTIAL PRESSURE INDICATING TRANSMITTER	FQIA	FLOW INDICATING TOTALIER ALARM
dPS	DIFFERENTIAL PRESSURE SWITCH	LIC	LEVEL INDICATING CONTROL
dPSH	DIFFERENTIAL PRESSURE SWITCH HIGH	LIT	LEVEL INDICATING TRANSMITTER
dPSL	DIFFERENTIAL PRESSURE SWITCH LOW	PCV	PRESSURE CONTROL VALVE
		PSE	PRESSURE SAFETY ELEMENT
		PSH	PRESSURE SWITCH HIGH
		PSL	PRESSURE SWITCH LOW
		PSV	PRESSURE/VACUUM SAFETY VALVE

INSTRUMENT SYMBOLS

- L — LIGHT (L-WHITE R-RED G-GREEN A-AMBER, B-BLUE)
- LT — LOCAL MOUNTED INSTRUMENT
- LE — INSTRUMENT MOUNTED BEHIND LOCAL CONTROL BOARD
- LI — LOCAL PANEL MOUNTED INSTRUMENT
- PI — INSTRUMENT MOUNTED BEHIND BOARD (MAIN CONTROL PANEL)
- HS — PANEL MOUNTED INSTRUMENT (MAIN CONTROL PANEL)
- INTERLOCK

GENERAL EQUIPMENT

- BLOWER
- CENTRIFUGAL PUMP
- SUMP PUMP
- SUBMERSIBLE WELL PUMP
- CARBON ADSORBER
- BAG FILTER
- SUMP
- LOW PROFILE AIR STRIPPER
- AIR DISTRIBUTION PLENUM
- METERING
- STATIC MIXER
- BASKET STRAINER

MANUALLY OPERATED VALVES

- BALL VALVE
- BUTTERFLY VALVE OR DAMPER
- CHECK VALVE
- GATE VALVE
- DIAPHRAM VALVE
- GLOBE VALVE

MISCELLANEOUS

- SPRAY NOZZLES
- EXPANSION JOINT
- ATMOSPHERIC VENT
- BLIND FLANGE
- REDUCTION IN LINE SIZE
- PSV — PRESSURE RELIEF VALVE
- PSE — RUPTURE DISC
- PG — PRESSURE GAUGE
- REDUCTION EXPANSION JOINT
- LEVEL ELEMENT PROBES
- AIR BUBBLER

LINE & PIPING SYMBOLS IDENTIFICATION

- PROCESS LINE PRIMARY
- PROCESS LINE SECONDARY
- ELECTRICAL SIGNAL
- VENDOR PACKAGE
- FLANGED CONNECTION
- THREADED CONNECTION
- SOCKET WELD CONNECTION
- BUTT WELD CONNECTION

LINE SPECIFICATIONS

PVC - POLYVINYL CHLORIDE
GS - GALVANIZED STEEL

PIPE LINE IDENTIFICATION

6"-PVC
PIPING MATERIAL
LINE SIZE

ABBREVIATIONS

HOA	HAND OFF AUTOMATIC
HO	HAND OFF
OA	OFF AUTOMATIC
HH	HIGH HIGH
H	HIGH
L	LOW

File: D.E. 17A-E-53

DRAWING 3

D.O. NO	ACTION	DATE	DESCRIPTION OF REVISION
		10DEC99	AS BUILT (HYDROGEOLOGIC, INC.)

IT INTERNATIONAL TECHNOLOGY CORPORATION
Creating a Safer Tomorrow

U.S. ARMY ENGINEER DISTRICT TULSA
CORPS OF ENGINEERS
TULSA, OKLAHOMA

DESIGNED BY	D.A.K./
DRAWN BY	M.D.D./10JULY93
CHECKED BY	B.J.P.
SUBMITTED BY	B. J. PARRISH
ENGINEER	

PIPING AND INSTRUMENTATION DIAGRAM
LEGEND
SHEET 1 OF 3
NAS Fort Worth JRB, Texas

SOC NO. DACA-92-D-0008
CONTR NO
SEQUENCE NO
DRAWING NO. 305895-E8
SHEET NO

X:\AE90\199\dl99d-E8.dwg
Revised: 12/21/99 ep

DRAWING NUMBER 305895-E8

INSTRUMENT IDENTIFICATION

FIRST LETTER PROCESS VARIABLE OF ACTUATION		SECOND LETTER FUNCTION MODIFIER	
A	ANALYSIS	A	ALARM
E	VOLTAGE (EMF)/ELECT	AH	ALARM HIGH
F	FLOW RATE	AL	ALARM LOW
FQ	FLOW QUANTITY	C	CONTROLLER OR CONTROL
FF	FLOW RATIO	E	ELEMENT
G	GAUGING (DIMENSIONAL)	G	GLASS OR GAUGE
H	HAND (MANUALLY)	I	INDICATOR
I	CURRENT/AMPS	IC	INDICATING CONTROLLER
L	LEVEL	P	POINT
P	PRESSURE/VACUUM	Q	TOTALIZE/INTEGRATE
X	(UNCLASSIFIED)	R	RECORDER
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		T	TRANSMITTER
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		W	WELL OR PROBE
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FI	FLOW INDICATOR	LY	LEVEL SIGNAL RELAY (CONVERTOR)
FQ	FLOW TOTALIZER	PA	PRESSURE/VACUUM ALARM
FT	FLOW TRANSMITTER	PB	PUSH BUTTON
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HS	HAND/MANUAL SWITCH	PI	PRESSURE/VACUUM INDICATOR
II	CURRENT INDICATOR (AMMETER)		
LA	LEVEL ALARM		
LC	LEVEL CONTROL		
LE	LEVEL ELEMENT		
LI	LEVEL INDICATOR		

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AIT	ANALYSIS INDICATING TRANSMITTER	FIT	FLOW INDICATING TRANSMITTER
dPA	DIFFERENTIAL PRESSURE ALARM	FQI	FLOW INDICATING TOTALIZER
dPI	DIFFERENTIAL PRESSURE INDICATOR	LAY	LEVEL ALARM RELAY
dPIT	DIFFERENTIAL PRESSURE INDICATING TRANSMITTER	FQIA	FLOW INDICATING TOTALIER ALARM
dPS	DIFFERENTIAL PRESSURE SWITCH	LIC	LEVEL INDICATING CONTROL
dPSH	DIFFERENTIAL PRESSURE SWITCH HIGH	LIT	LEVEL INDICATING TRANSMITTER
dPSL	DIFFERENTIAL PRESSURE SWITCH LOW	PCV	PRESSURE CONTROL VALVE
		PSE	PRESSURE SAFETY ELEMENT
		PSH	PRESSURE SWITCH HIGH
		PSL	PRESSURE SWITCH LOW
		PSV	PRESSURE/VACUUM SAFETY VALVE

INSTRUMENT SYMBOLS

- LIGHT (L-WHITE, R-RED G-GREEN A-AMBER, B-BLUE)
- LOCAL MOUNTED INSTRUMENT
- INSTRUMENT MOUNTED BEHIND LOCAL CONTROL BOARD
- LOCAL PANEL MOUNTED INSTRUMENT
- INSTRUMENT MOUNTED BEHIND BOARD (MAIN CONTROL PANEL)
- PANEL MOUNTED INSTRUMENT (MAIN CONTROL PANEL)
- INTERLOCK

GENERAL EQUIPMENT

- BLOWER
- CENTRIFUGAL PUMP
- SUMP PUMP
- SUBMERSIBLE WELL PUMP
- CARBON ADSORBER
- BAG FILTER
- SUMP
- LOW PROFILE AIR STRIPPER
- AIR DISTRIBUTION PLENUM
- METERING
- STATIC MIXER
- BASKET STRAINER

MANUALLY OPERATED VALVES

- BALL VALVE
- BUTTERFLY VALVE OR DAMPER
- CHECK VALVE
- GATE VALVE
- DIAPHRAM VALVE
- GLOBE VALVE

MISCELLANEOUS

- SPRAY NOZZLES
- EXPANSION JOINT
- ATMOSPHERIC VENT
- BLIND FLANGE
- REDUCTION IN LINE SIZE
- PSV — PRESSURE RELIEF VALVE
- PSE — RUPTURE DISC
- PG — PRESSURE GAUGE
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- LEVEL ELEMENT PROBES
- AIR BUBBLER

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- VENDOR PACKAGE
- FLANGED CONNECTION
- THREADED CONNECTION
- SOCKET WELD CONNECTION
- BUTT WELD CONNECTION

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GS – GALVANIZED STEEL

PIPE LINE IDENTIFICATION

6"–PVC
PIPING MATERIAL
LINE SIZE

ABBREVIATIONS

HOA	HAND OFF AUTOMATIC
HO	HAND OFF
OA	OFF AUTOMATIC
HH	HIGH HIGH
H	HIGH
L	LOW

File D.E. 171 53

DRAWING 3

D.O. NO.	ACTION	DATE	DESCRIPTION OF REVISION
		10DEC99	AS BUILT (HYDROGEOLOGIC, INC.)

IT INTERNATIONAL TECHNOLOGY CORPORATION
Creating a Safer Tomorrow

U.S. ARMY ENGINEER DISTRICT, TULSA
CORPS OF ENGINEERS
TULSA, OKLAHOMA

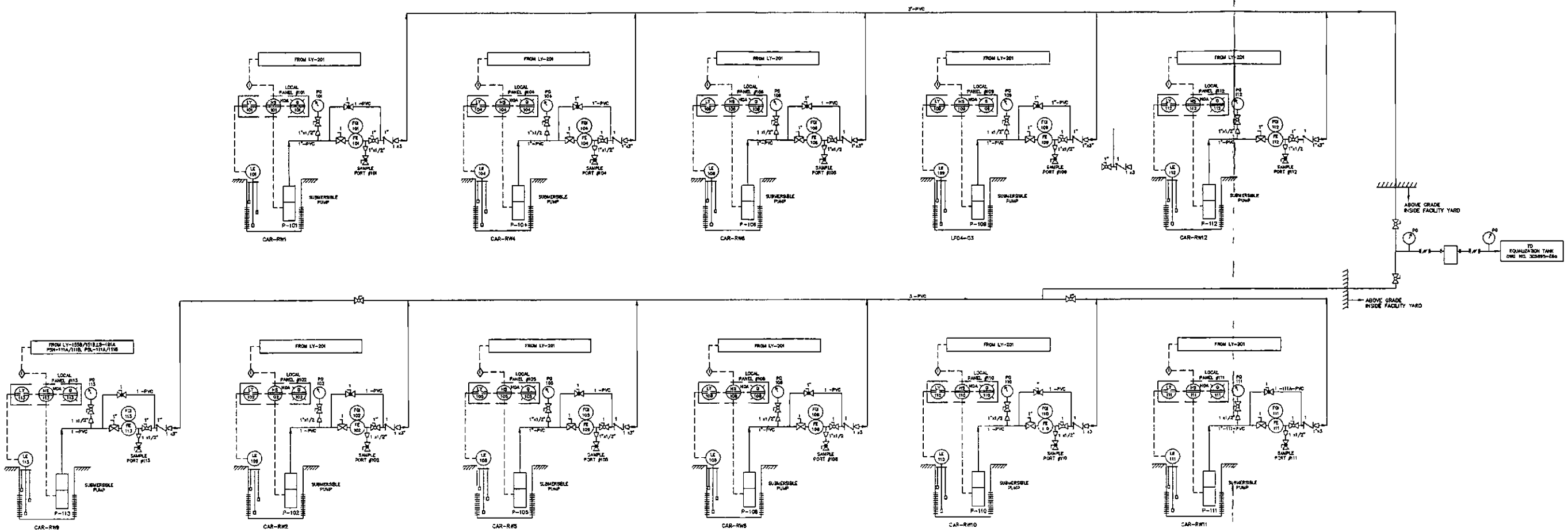
DESIGNED BY	D.N.K./
DRAWN BY	M.D.D /10JAN'93
CHECKED BY	B.J.P
SUBMITTED BY	B. J. PAREKH
ENGINEER	

PIPING AND INSTRUMENTATION DIAGRAM
LEGEND
SHEET 1 OF 3
NAS Fort Worth JRB, Texas

SOC NO.	DACA-92-D-0008
CONTR. NO.	
SEQUENCE NO	
DRAWING NO.	305895-E8
SHEET NO	

X:\4600\119\ef\19ed-E8.dwg
Revised: 12/21/99 ep

DRAWING NUMBER 305895-E6



File D.E. 174-53

DRAWING 4

D.O. NO	ACTION	DATE	DESCRIPTION OF REVISION
		10DEC99	AS BUILT (HYDROGEOLOGIC, INC.)

IT INTERNATIONAL TECHNOLOGY CORPORATION
Creating a Safer Tomorrow

U.S. ARMY ENGINEER DISTRICT TULSA
CORPS OF ENGINEERS
TULSA, OKLAHOMA

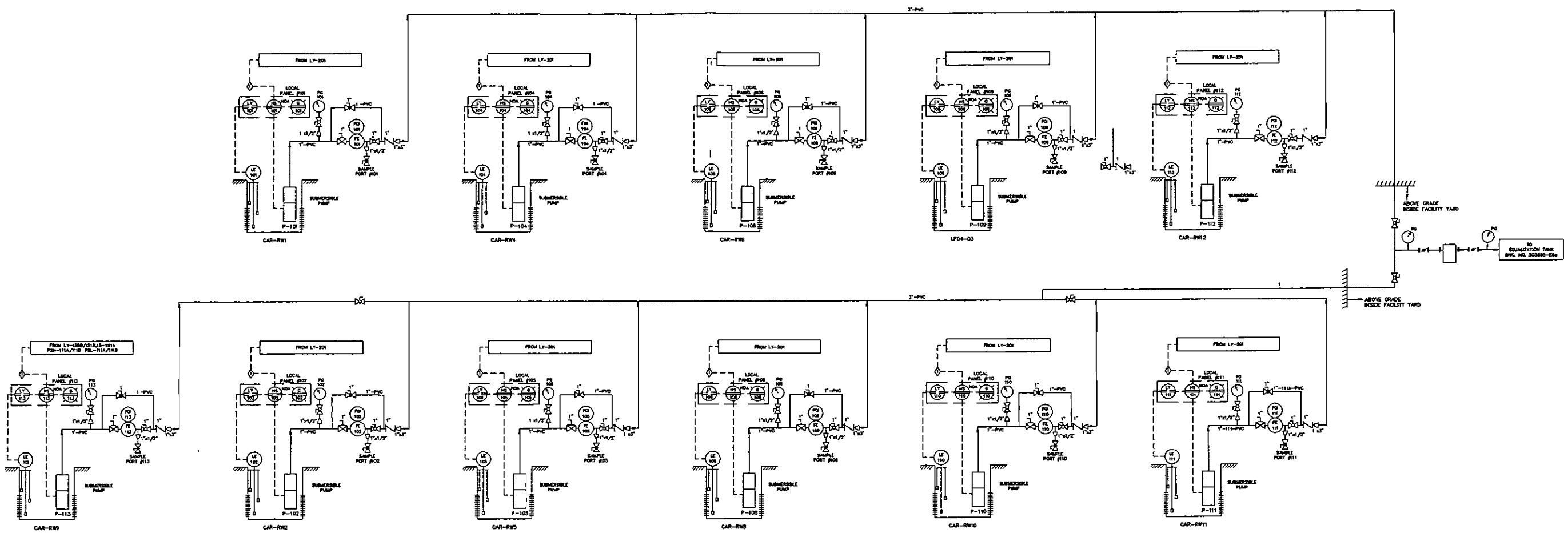
DESIGNED BY	D.A.K./
DRAWN BY	R. WEBLE/70CT99
CHECKED BY	B.J.P.
SUBMITTED BY	B. J. PAREKH
ENGINEER	

PIPING AND INSTRUMENTATION DIAGRAM
RECOVERY WELLS
SHEET 2 OF 3
NAS Fort Worth JRB, Texas

SOC NO	DACA-92-D-0008
CONTR. NO.	SEQUENCE NO.
DRAWING NO	305895-E6
SHEET NO.	

Filename: X:\AJC-001\19cd\19cd-E6.dwg
Revised: 12/20/99 cp

DRAWING NUMBER 305895-E6



File: D.R. 171-53

DRAWING 4

		10DEC99	AS BUILT (HYDROGEOLOGIC, INC.)
D.O. NO.	ACTION	DATE	DESCRIPTION OF REVISION

INTERNATIONAL TECHNOLOGY CORPORATION
Creating a Safer Tomorrow

U.S. ARMY ENGINEER DISTRICT, TULSA
CORPS OF ENGINEERS
TULSA, OKLAHOMA

DESIGNED BY	D.A.K./
DRAWN BY	R WOBLE/7OCT93
CHECKED BY	B.J.P
SUBMITTED BY	G J. PAREKH
ENGINEER	

PIPING AND INSTRUMENTATION DIAGRAM
RECOVERY WELLS
SHEET 2 OF 3
NAS Fort Worth JRB, Texas

SOC NO.	DACA-92-D-0008	
CONTR. NO.		SEQUENCE NO.
DRAWING NO. 305895-E6	SHEET NO.	

Filename: X:\AGOOT\19of19\e6-B6.dwg
Revised: 12/20/99 ap

DRAWING NUMBER 305895-E6a

From Recovery Wells Dwg No 305895-E6

3"-PVC

STATIC MIXER SM-205

1/2"

1/2"

ACID ADDITION VAULT

AE 205

3"-PVC

To Recovery Well Submersible Pumps P-101, P-102, P-104, P-105, P-106, P-108, P-109, P-110, P-111, P-112, P-113

High-High 5 Shut Down all Recovery Well Submersible Pumps

High-High 4 Shut Down P-101, P-102, P-104, P-106, P-109, P-110

High-High 3 Shut Down P-101, P-102, P-104, P-106.

High-High 2 Shut Down P-101, P-104

High-High 1 Reset all Recovery Well Submersible Pumps

2"-PVC

1"-PVC

LY 201 HH

LY 201 H

LE 201 L

LE 201

SAMPLE PORT

2"

5
4
3
2
1

EQUALIZATION TANK T-201

4"

G 201

HS 201

2"

1 1/2"

1 1/2"x3"

P-201

G 202

HS 202

2"

1 1/2"

1 1/2"x3"

P-202

G 203

HS 203

2"

1 1/2"

1 1/2"x3"

P-203

G 204

HS 204

2"

1 1/2"

1 1/2"x3"

EQUALIZATION TANK TRANSFER PUMPS P-204

PG

PSV

3"-PVC

To Treatment System Skids Dwg No 305895-E7

SECONDARY CONTAINMENT

3/8"-TUBING

AIC 205

HOA

HS 205

AIT 205

TRUCK OFFLOADING

3/8"

ACID STORAGE TANK T-202

ACID FEED PUMP P-205

2"

R 208

HH

LS 208

To Recovery Well Submersible Pumps P-101, P-102, P-104, P-105, P-106, P-108, P-109, P-110, P-111, P-112, P-113

Shut Down all Recovery Well Submersible Pumps if LS-208 indicates High-High

LS 207 H

LS 207 L

Start P-207 if LS-207 indicates High Level

Shut Down P-207 if LS-207 indicates Low Level

1"-PVC

SUBMERSIBLE PUMP P-207

FLOW EQUALIZATION SKID ES-201

2"-GS

From Treatment System Skids Dwg No 305895-E7

2"-GS

2"

LS 206 H

LS 206 L

Start P-206 if LS-206 indicates High Level

Shut down P-206 if LS-206 Indicates Low Level

SUBMERSIBLE PUMP P-206

R 209

HH

LS 209

To Recovery Well Submersible Pumps P-101, P-102, P-104, P-105, P-106, P-108, P-109, P-110, P-111, P-112, P-113

Shut Down all Recovery Well Submersible Pumps if LS-209 indicates High-High

ACID STORAGE AND FEED SKID AS-202

File DE 17A 53

DRAWING 5

D/C NO	ACTION	DATE	DESCRIPTION OF REVISION
		1DEC99	AS BUILT

HYDRO GeoLogic

U.S. Air Force Center For Environmental Excellence
NAS Fort Worth JRB Texas

DESIGNED BY J. KENDERDINE
DRAWN BY J. BELCHER
CHECKED BY V. GUVANASEN

PIPING AND INSTRUMENTATION DIAGRAM
ACID FEED AND FLOW EQUALIZATION
SHEET 2a OF 3
NAS Fort Worth JRB, Texas

SUBMITTED BY

SOC NO DACA-92-D-0008

CONTR NO

SEQUENCE NO

ENGINEER

DRAWING NO 305895-E6a

SHEET NO 305895-E6a

X:\AFCEE\TI\Pcn1\Pcn1-E6a.dwg
Revised: 12/21/99 ap

DRAWING NUMBER 305895-E6a

From Recovery Wells Dwg No 305895-E6

3"-PVC

STATIC MIXER SM-205

1/2"

1/2"

ACID ADDITION VAULT

SECONDARY CONTAINMENT

3/8"-TUBING

AE 205

AIT 205

AIC 205

HS 205

HOA

TRUCK OFFLOADING

ACID STORAGE TANK T-202

3/8"

ACID FEED PUMP P-205

2"

R 209

LS 209

HH

To Recovery Well Submersible Pumps P-101, P-102, P-104, P-105, P-106, P-108, P-109, P-110, P-111, P-112, P-113

Shut Down all Recovery Well Submersible Pumps if LS-209 indicates High-High

ACID STORAGE AND FEED SKID AS-202

3"-PVC

To Recovery Well Submersible Pumps P-101, P-102, P-104, P-105, P-106, P-108, P-109, P-110, P-111, P-112, P-113

High-High 5 Shut Down all Recovery Well Submersible Pumps

High-High 4 Shut Down P-101, P-102, P-104, P-106, P-109, P-110

High-High 3 Shut Down P-101, P-102, P-104, P-106,

High-High 2 Shut Down P-101, P-104

High-High 1 Reset all Recovery Well Submersible Pumps

To Recovery Well Submersible Pumps P-101, P-102, P-104, P-105, P-106, P-108, P-109, P-110, P-111, P-112, P-113

Shut Down all Recovery Well Submersible Pumps if LS-208 indicates High-High

R 208

LS 208

HH

LY 201 HH

LY 201 H

LY 201 L

LE 201

LE 201

5
4
3
2
1

SAMPLE PORT

2"

EQUALIZATION TANK T-201

4"

LS 207 H

LS 207 L

Start P-207 if LS-207 indicates High Level

Shut Down P-207 if LS-207 indicates Low Level

SUBMERSIBLE PUMP P-207

1"-PVC

2"-PVC

1"-PVC

G 201

HS 201

G 202

HS 202

G 203

HS 203

G 204

HS 204

2"

1 1/2"

1 1/2"x3"

P-201

P-202

P-203

EQUALIZATION TANK TRANSFER PUMPS P-204

PG

PSV

3"-PVC

To Treatment System Skids Dwg No 305895-E7

From Treatment System Skids Dwg No 305895-E7

2"-GS

LS 206 H

LS 206 L

Start P-206 if LS-206 indicates High Level

Shut down P-206 if LS-206 Indicates Low Level

SUBMERSIBLE PUMP P-206

FLOW EQUALIZATION SKID ES-201

2"-GS

File: D.E. 17A-5J

DRAWING 5

		100C099	AS BUILT
O.O. NO.	ACTION	DATE	DESCRIPTION OF REVISION

HYDRO GeoLogic Inc

U.S. Air Force Center For Environmental Excellence NAS Fort Worth JRB, Texas

DESIGNED BY J. KOMOERDINE

DRAWN BY J. BELCHER

CHECKED BY V. GUVANASEN

SUBMITTED BY

ENGINEER

PIPING AND INSTRUMENTATION DIAGRAM
ACID FEED AND FLOW EQUALIZATION
SHEET 2a OF 3
NAS Fort Worth JRB, Texas

SOC NO DACA-62-D-0006

CONTR. NO

SEQUENCE NO

DRAWING NO 305895-E6a

SHEET NO 305895-E6a

K:\AFCEE\1\Prof\1Prof-E6a.dwg
Revised: 12/21/99 ap

DRAWING NUMBER 305895-E7

FROM EQUALIZATION TANK TRANSFER PUMPS P-201 P-202 P-203, P-204 DWG NO 305895-E8a

3"-PVC

SAMPLE PORT

3"x2"

2"-PVC

TO PARALLEL TREATMENT SYSTEM SKIDS (AS THIS DRAWING)

FROM PARALLEL TREATMENT SYSTEM SKIDS (AS THIS DRAWING)

TO ATMOSPHERE

1 1/4"

SV 111

CLOSE SV-111 IF LY-151B INDICATES HIGH-HIGH LEVEL OR LS-191A INDICATES HIGH-HIGH LEVEL

SHUT DOWN B-111A, B-111B IF PSH-111A, PSH-111B INDICATES HIGH PRESSURE, PSL-111A, PSL-111B INDICATES LOW PRESSURE LY-151B INDICATES HIGH-HIGH LEVEL, LS-191A INDICATES HIGH-HIGH LEVEL

TO FEED PUMP P-161 THIS DRAWING

SHUT DOWN P-161 IF PSH-111A, PSH-111B INDICATES HIGH PRESSURE OR PSL-111A, PSL-111B INDICATES LOW PRESSURE

R 111A

R 111B

FE 111

FQI 111

G 111A

HS 111A HOA

PSH 111A

PI 111A

PSL 111A

AIR

BLOWER B-111A

2"-HOSE

PLENUM PL-111A

AIR STRIPPER A-111A

3"

3"-PVC

G 111B

HS 111B HOA

PSH 111B

PI 111B

PSL 111B

AIR

BLOWER B-111B

2 -HOSE

PLENUM PL-111B

AIR STRIPPER A-111B

3"

1"-PVC

4"-PVC

CLOSE SV-111 IF LY-151B INDICATES HIGH-HIGH LEVEL

R 151B

LY 151B HH

LE 151B

LE 151C

LY 151C H L

R 191A

LS 191A HH

TO CONTROL VALVE SV-111 THIS DRAWING

CLOSE SV-111 IF LS-191A INDICATES HIGH-HIGH LEVEL IN SECONDARY CONTAINMENT

G 161

HS 161 HOA

START P-161 IF LY-151C INDICATES HIGH LEVEL SHUT DOWN P-161 IF LY-151C INDICATES LOW LEVEL

1" OVERFLOW

SAMPLE PORT

V-100*

1 1/4"

1 1/4"-PVC

AIR STRIPPER SUMP S-151

AIR STRIPPER SUMP PUMP P-161

1" LOW POINT DRAIN

1 1/2"

TO SUMP S-206 DRW NO 305895-E6a

1 1/4"

RECYCLE

1 1/4"-PVC*

PSV

R 171

PG

PSH 171

BAG FILTER F-171

V-101*

2"-PVC

R 181

PG

PSH 181

1"

V-102* V-103*

V-104*

V-105* V-107*

V-106*

CARBON ADSORPTION UNIT C-181

2"

PSV

2"-PVC

SAMPLE PORT

V-108*

2"

2"x3"

V-904

HOSE CONNECTION

FQI 200A

FE 200A

AIT 200 pH

AE 200 pH

AI 200 pH

SAMPLE PORT

V-901

3"

TO EQUALIZATION TANK T-202 DWG NO 305895-E6a

V-903

3"

FE 200C

FQI 200C

TO POTW MANHOLE NO 61

V-902

3"

FE 200B

FQI 200B

PSV

TO GOLF COURSE POND OUTFALL 001

NOTES

1 TREATMENT SKID TS-006 HAS TWO LIQUID PHASE CARBON VESSELS.

*-TREATMENT SYSTEM SKID VALVES ARE LABELED USING THE SKID NUMBER FIRST, I.E., TREATMENT SKID 1 USES 100 SERIES NUMBERS, TREATMENT SKID 2 USES 200 SERIES NUMBERS, ETC

TREATMENT SYSTEM SKID TS-001 (1 OF 6)

File DR. 17453

DRAWING 6

D.O. NO.	ACTION	DATE	DESCRIPTION OF REVISION
		10DEC99	AS BUILT (HYDROGEOLOGIC, INC.)

INTERNATIONAL TECHNOLOGY CORPORATION
Creating a Safer Tomorrow

U.S. ARMY ENGINEER DISTRICT TULSA
CORPS OF ENGINEERS
TULSA, OKLAHOMA

DESIGNED BY DAK/
DRAWN BY WDD/3-5-93
CHECKED BY BJP
SUBMITTED BY B. J. PAREISH
ENGINEER

PIPING AND INSTRUMENTATION DIAGRAM
TYPICAL TREATMENT SYSTEM SKID
SHEET 3 OF 3
NAS Fort Worth JRB, Texas

SOC NO. DACA-92-D-0008
CONTROL NO
SEQUENCE NO.
DRAWING NO. 305895-E7
SHEET NO.

Filename: X:\AJ\001\19\all19sd-87
Revised: 12/21/99 ajp

DRAWING NUMBER 305895-E7

FROM EQUALIZATION TANK TRANSFER PUMPS P-201, P-202 P-203 P-204 DWG NO 305895-E6a

3"-PVC

SAMPLE PORT

3"x2"

2"-PVC

TO PARALLEL TREATMENT SYSTEM SKIDS (AS THIS DRAWING)

FROM PARALLEL TREATMENT SYSTEM SKIDS (AS THIS DRAWING)

TO ATMOSPHERE

1 1/4"

SV 111

CLOSE SV-111 IF LY-151B INDICATES HIGH-HIGH LEVEL OR LS-191A INDICATES HIGH-HIGH LEVEL

RECYCLE

1 1/4"-PVC"

TO FEED PUMP P-161 THIS DRAWING

SHUT DOWN P-161 IF PSH-111A, PSH-111B INDICATES HIGH PRESSURE OR PSL-111A, PSL-111B INDICATES LOW PRESSURE

SHUT DOWN B-111A, B-111B IF PSH-111A, PSH-111B INDICATES HIGH PRESSURE, PSL-111A, PSL-111B INDICATES LOW PRESSURE LY-151B INDICATES HIGH-HIGH LEVEL LS-191A INDICATES HIGH-HIGH LEVEL

R 111A, R 111B, FE 111, FQI 111

G 111A, HS 111A, HOA, PSH 111A, PI 111A, PSL 111A

AIR

BLOWER B-111A

2"-HOSE

PLENUM PL-111A

AIR STRIPPER A-111A

3"

3"-PVC

G 111B, HS 111B, HOA, PSH 111B, PI 111B, PSL 111B

BLOWER B-111B

PLENUM PL-111B

AIR STRIPPER A-111B

1"-PVC

4"-PVC

CLOSE SV-111 IF LY-151B INDICATES HIGH-HIGH LEVEL

R 151B, LY 151B HH, LE 151B, LE 151C

R 191A, LS 191A HH

TO CONTROL VALVE SV-111 THIS DRAWING

CLOSE SV-111 IF LS-191A INDICATES HIGH-HIGH LEVEL IN SECONDARY CONTAINMENT

LY 151C H L, G 161, HS 161 HOA

START P-161 IF LY-151C INDICATES HIGH LEVEL SHUT DOWN P-161 IF LY-151C INDICATES LOW LEVEL

SAMPLE PORT

1 1/4"

1" OVERFLOW

V-100*

1 1/4"-PVC

AIR STRIPPER SUMP S-151

1" LOW POINT DRAIN

AIR STRIPPER SUMP PUMP P-161

1 1/2"

TO SUMP S-206 DRW NO 305895-E6a

PSV, R 171, PG, PSH 171

BAG FILTER F-171

2"-PVC

V-101*

R 181, PG, PSH 181

V-102*, V-103*, V-104*, V-105*, V-106*, V-107*

1"

CARBON ADSORPTION UNIT C-181

2"

2"-PVC

SAMPLE PORT

V-108* 2" 2"x3"

V-904

HOSE CONNECTION

FQI 200A, FE 200A

AIT 200 pH, AE 200 pH, AJ 200 pH

SAMPLE PORT

V-901 3"

TO EQUALIZATION TANK T-202 DWG NO 305895-E6a

V-903 3"

FE 200C, FQI 200C

TO POTW MANHOLE NO 61

V-902 3"

FE 200B, FQI 200B

PSV

TO GOLF COURSE POND OUTFALL 001

File: D.P. 17A-53

NOTES

1 TREATMENT SKID TS-006 HAS TWO LIQUID PHASE CARBON VESSELS

*-TREATMENT SYSTEM SKID VALVES ARE LABELED USING THE SKID NUMBER FIRST, I.E., TREATMENT SKID 1 USES 100 SERIES NUMBERS, TREATMENT SKID 2 USES 200 SERIES NUMBERS, ETC

TREATMENT SYSTEM SKID TS-001 (1 OF 6)

DRAWING 6

D.O. NO.	ACTION	DATE	DESCRIPTION OF REVISION
		10DEC99	AS BUILT (HYDROGEOLOGIC, INC.)

IT INTERNATIONAL TECHNOLOGY CORPORATION
Creating a Safer Tomorrow

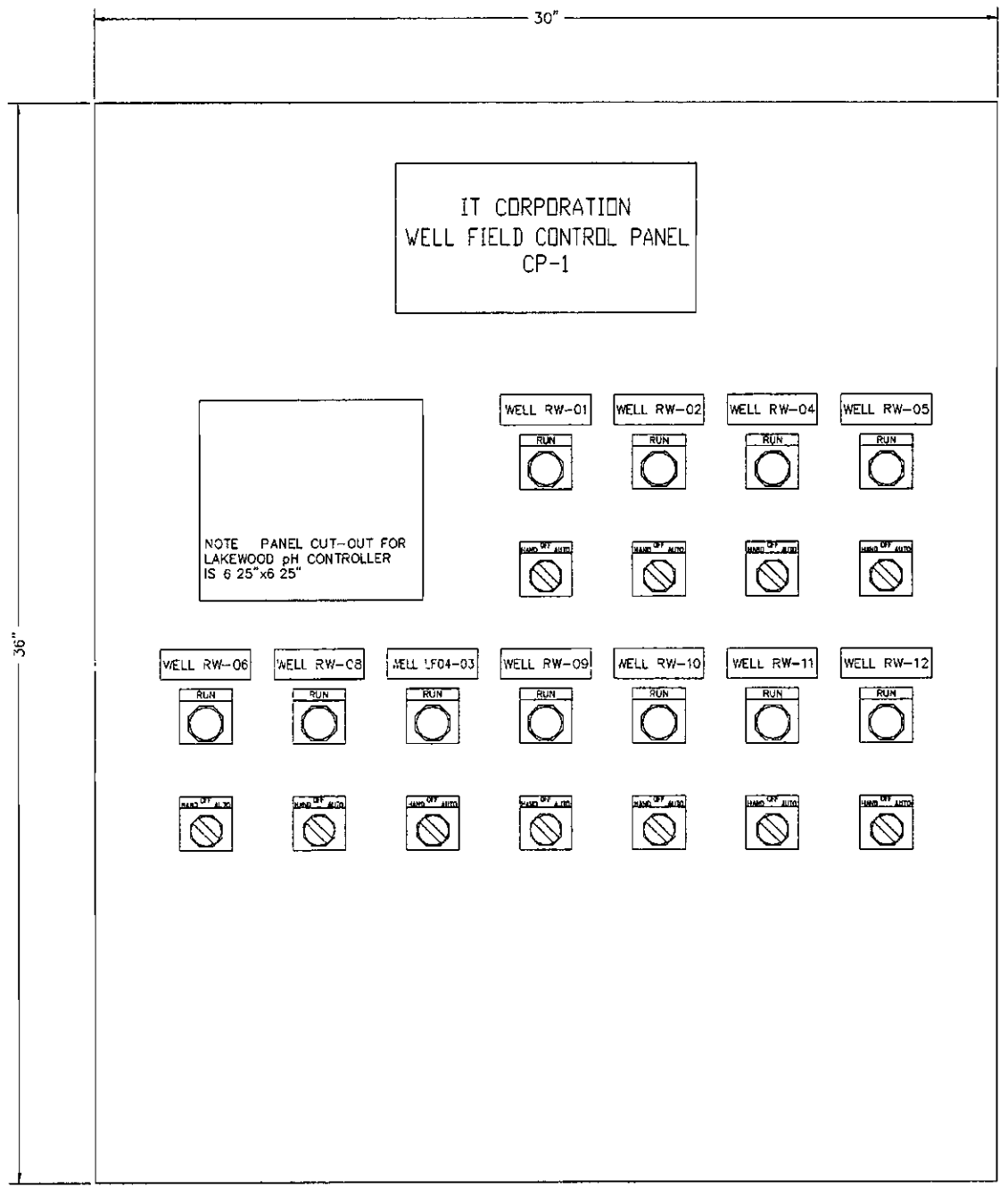
U.S. ARMY ENGINEER DISTRICT, TULSA
CORPS OF ENGINEERS
TULSA, OKLAHOMA

DESIGNED BY	D.A.K /
DRAWN BY	MDD/3-5-93
CHECKED BY	BJP
SUBMITTED BY	B. J. PAREISH
ENGINEER	

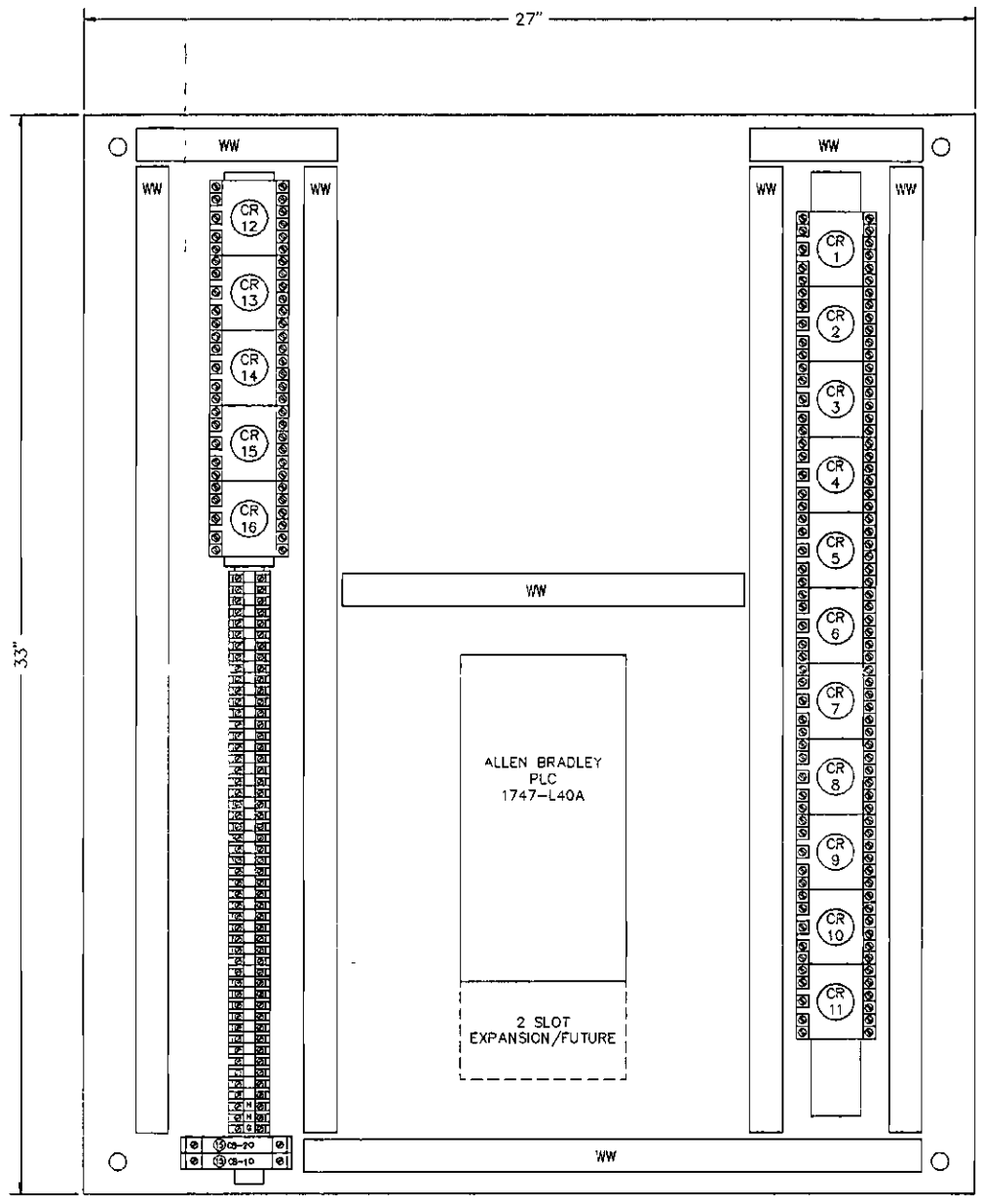
PIPING AND INSTRUMENTATION DIAGRAM
TYPICAL TREATMENT SYSTEM SKID
SHEET 3 OF 3
NAS Fort Worth JRB, Texas

SOC. NO.	DACA-92-D-0008
CONTROL NO.	
SEQUENCE NO.	
DRAWING NO.	305895-E7
SHEET NO.	

Filename: Z:\Ajc\001\19ed\19ed-E7
Revised: 12/21/99 ap



FRONT VIEW
NOT TO SCALE



INSIDE VIEW
NOT TO SCALE

BILL OF MATERIALS

ITEM	QUAN	DESCRIPTION	REMARKS
1	1	ENCLOSURE, NEMA4, HOFFMAN CAT # A-36H3012SS6LP WITH PANEL CAT # A-36P30	CP-1
2	15'	WIREWAY, 3" HIGH x 1" WIDE WITH COVER, PANDUIT OR EQUAL	WW
3	1	NAMEPLATES NP-1 THRU NP-13 ATTACHED TO PANEL FRONT WITH DOUBLE SIDED TAPE AND ST STL SCREWS	NP-1 THRU NP-13
4	11	3 POSITION SELECTOR SWITCH, MAINTAINED POSITION, STANDARD OPERATOR, 1N O-1N C CONTACTS, A-B CAT # 800T-J2A, PROVIDE "HAND-OFF-AUTO" NAMEPLATE WITH SWITCH	HOA
5	1	ALLEN BRADLEY PLC SLC500 FIXED HARDWARE STYLE, 24 INPUTS, 16 OUTPUTS, P N 1747-L40A WITH BATTERY P N 1747-BA	
6	11	PILOT LIGHT, PUSH TO TEST, TRANSFORMER TYPE 120V, RED LENS, A-B CAT # 800T-PT16R PROVIDE "RUN" NAMEPLATE WITH SWITCH	RUN
7	1	8 CHANNEL AUTO-DIALER RACO VERBATIM USB-8C	SEE NOTE 1
8	16	RELAY, 3PDT, 120VAC COIL, INDICATOR LAMP IDEC CAT # RR3PA-ULAC 120 VAC, WITH SOCKET CAT # SR3P-06 AND SOCKET MOUNTING TRACK BND1000	CR7 & CR8
9	50 1 2	TERMINAL BLOCK A-B CAT # 1492-F1 END BARRIER, A-B CAT # 1492-N18 ALLEN BRADLEY, 15A BREAKER	TB-1

NOTE

NAMEPLATES ARE WHITE PHENOLIC WITH BLACK ENGRAVED LETTERS

1 AUTO-DIALER IS IN O&M BUILDING

NOTE.

CUTOUT FOR pH CONTROLLER IS COVERED BY A BLANK 7"x7" PHENOLIC PLATE (NP-13)

File D.R. 17A-053

DRAWING 7

REVISIONS												REFERENCES	
NO	DATE	DESCRIPTION	BY	CHKD	APPD	NO	DATE	DESCRIPTION	BY	CHKD	APPD	TITLE	DRAWING NO
A	6/8/94	FOR APPROVAL	DR	JLH	GMG								
2	12/8/99	AS BUILT (LTL SERVICES/HYDROGEOLOGIC, INC.)	BH	JWK	JWK								

GMG CORPORATION
930 THIRD STREET DARMONT PA 15139
OFFICE (412) 828-2600 FAX (412) 828-2603

IT CORPORATION

PROJ LOC.				PROJ NO
DRAWN BY	DR	6/7/94	DESIGN BY	
DWG CHKD BY	JLH	6/8/94	DES. CHKD BY	
APPD BY	GMG	6/8/94	DRFT. APPRVL	

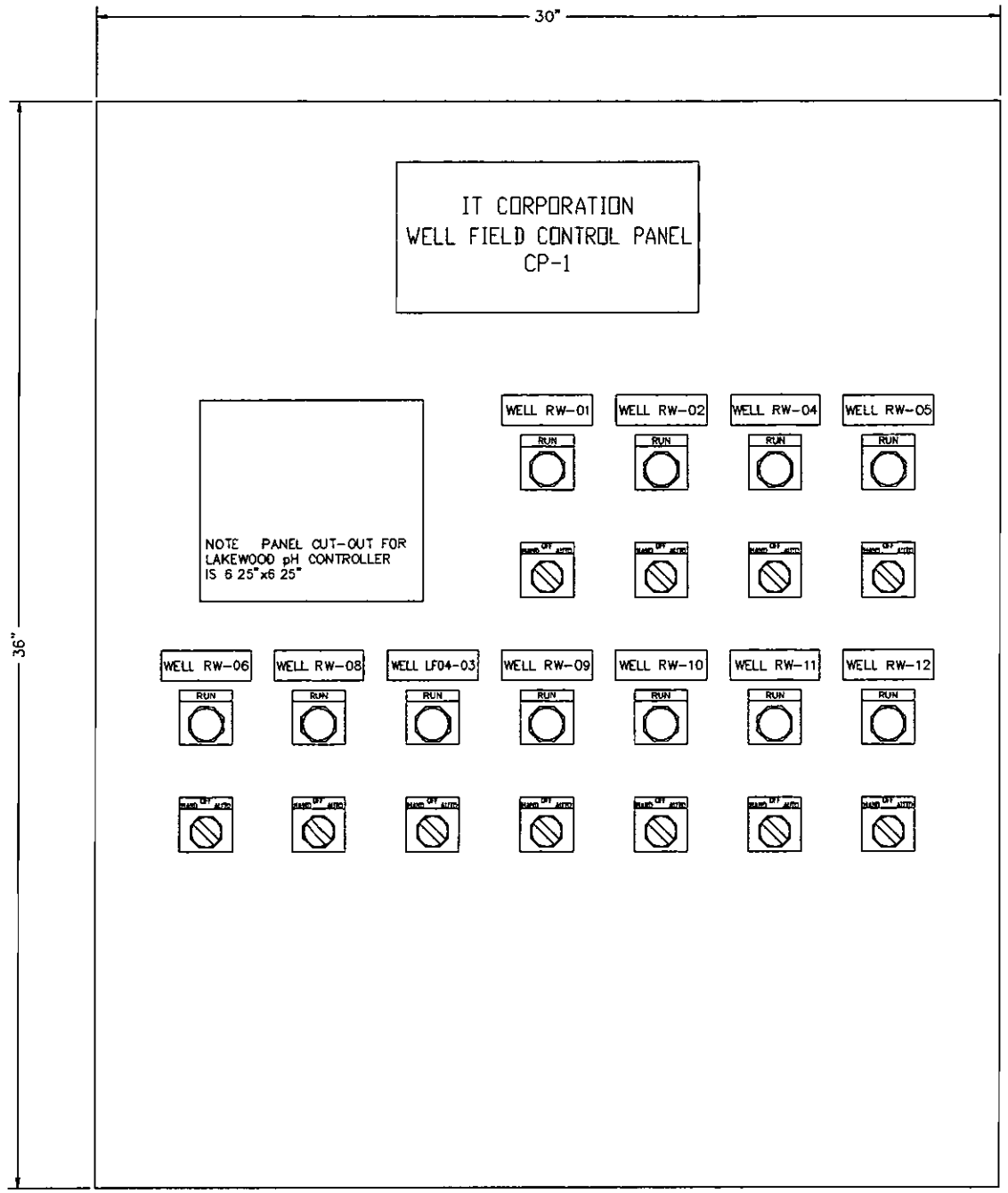
MAIN CONTROL PANEL
CARSWELL AFB GROUNDWATER TREATMENT SYSTEM
CP-1

DATE JUNE 7 1994
SCALE NONE

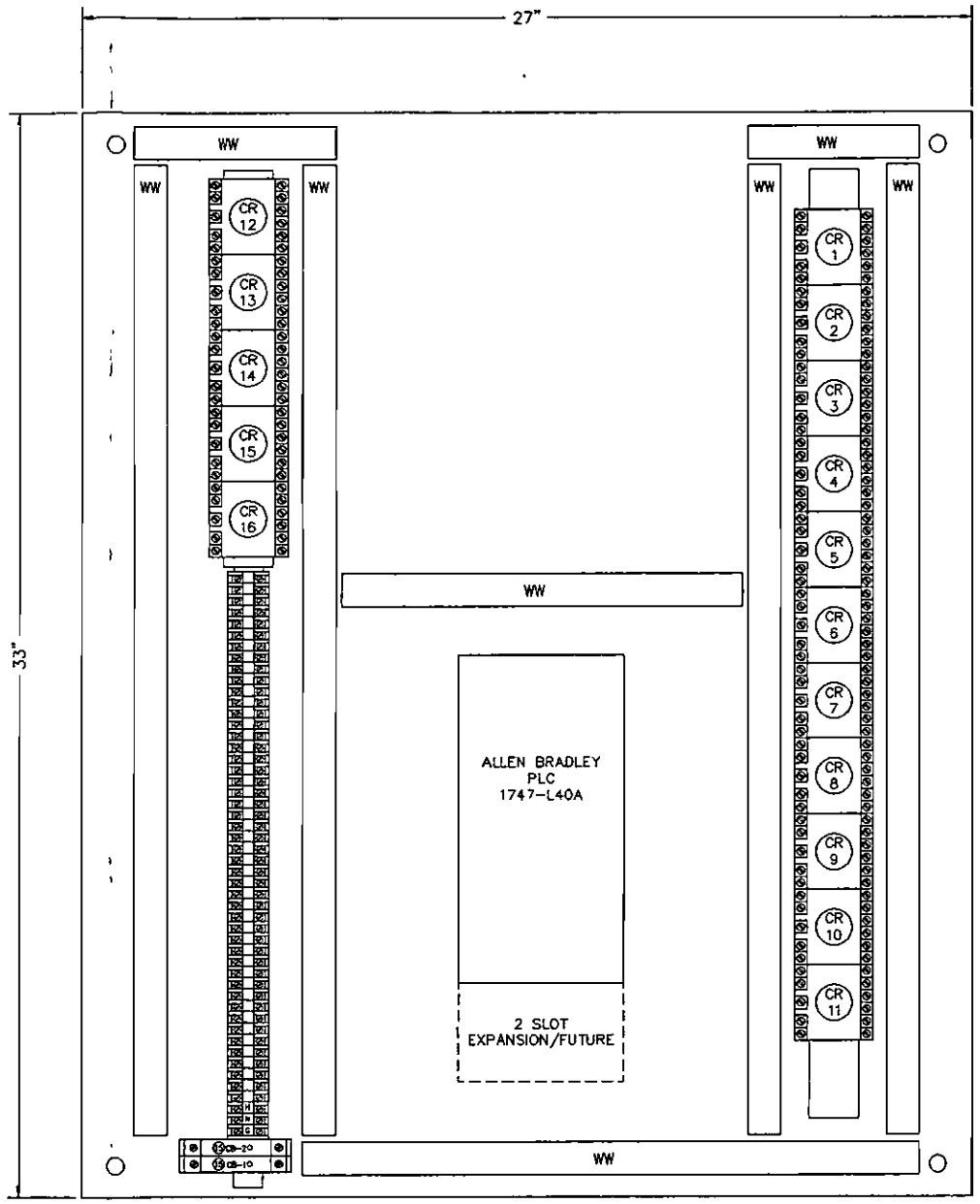
D 94-0403 600 REV (A)

X \dfs001\119cdt19cd-0403-600.dwg 12/08/99 ap

684 189



FRONT VIEW
NOT TO SCALE



INSIDE VIEW
NOT TO SCALE

BILL OF MATERIALS

ITEM	QUAN	DESCRIPTION	REMARKS
1	1	ENCLOSURE, NEMA4, HOFFMAN CAT # A-36H3012SS6LP WITH PANEL CAT # A-36P30	CP-1
2	15'	WIREWAY, 3" HIGH x 1" WIDE WITH COVER, PANDUIT OR EQUAL	WW
3	1	NAMEPLATES NP-1 THRU NP-13 ATTACHED TO PANEL FRONT WITH DOUBLE SIDED TAPE AND ST STL. SCREWS	NP-1 THRU NP-13
4	11	3 POSITION SELECTOR SWITCH, MAINTAINED POSITION, STANDARD OPERATOR, 1N O -1N C CONTACTS, A-B CAT # 800T-J2A, PROVIDE "HAND-OFF-AUTO" NAMEPLATE WITH SWITCH	HOA
5	1	ALLEN BRADLEY PLC SLC500 FIXED HARDWARE STYLE, 24 INPUTS, 16 OUTPUTS, P.N 1747-L40A WITH BATTERY P.N 1747-BA	
6	11	PILOT LIGHT, PUSH TO TEST, TRANSFORMER TYPE 120V, RED LENS, A-B CAT # 800T-PT16R PROVIDE "RUN" NAMEPLATE WITH SWITCH	RUN
7	1	8 CHANNEL AUTO-DIALER RACO VERBATIM USB-8C	SEE NOTE 1
8	16	RELAY, 3PDT, 120VAC COIL, INDICATOR LAMP IDEC CAT # RR3PA-ULAC 120 VAC, WITH SOCKET CAT # SR3P-06 AND SOCKET MOUNTING TRACK BND1000	CR7 & CR8
9	50	TERMINAL BLOCK A-B CAT # 1492-F1	TB-1
	1	END BARRIER, A-B CAT # 1492-N18	
	2	ALLEN BRADLEY, 15A BREAKER	

NOTE.

NAMEPLATES ARE WHITE PHENOLIC WITH BLACK ENGRAVED LETTERS

1 AUTO-DIALER IS IN O&M BUILDING

NOTE

CUTOUT FOR pH CONTROLLER IS COVERED BY A BLANK 7"x7" PHENOLIC PLATE (NP-13)

File: D.E. 17A-53

DRAWING 7

REVISIONS

NO	DATE	DESCRIPTION	BY	CHKD	APPD
A	5/8/94	FOR APPROVAL	DR	JLH	GMC
2	12/8/99	AS BUILT (LTL SERVICES/HYDROGEOLOGIC, INC.)	BH	JWK	JWK

REFERENCES

TITLE	DRAWING NO

GMG CORPORATION
830 THIRD STREET OAKMONT PA. 15139
OFFICE. (412) 828-2600 FAX. (412) 828-2603

IT CORPORATION

PROJ. LOC.					PROJ. NO
DRAWN BY	DR	6/7/94	DESIGN BY		
DWG. CHKD. BY	JLH	6/8/94	DES. CHKD BY		
APPD. BY	GMC	6/8/94	DRFT. APPRVL.		

MAIN CONTROL PANEL
CARSWELL AFB GROUNDWATER TREATMENT SYSTEM
CP-1

DATE JUNE 7, 1994
SCALE NONE

D 94-0403 600

REV (A)

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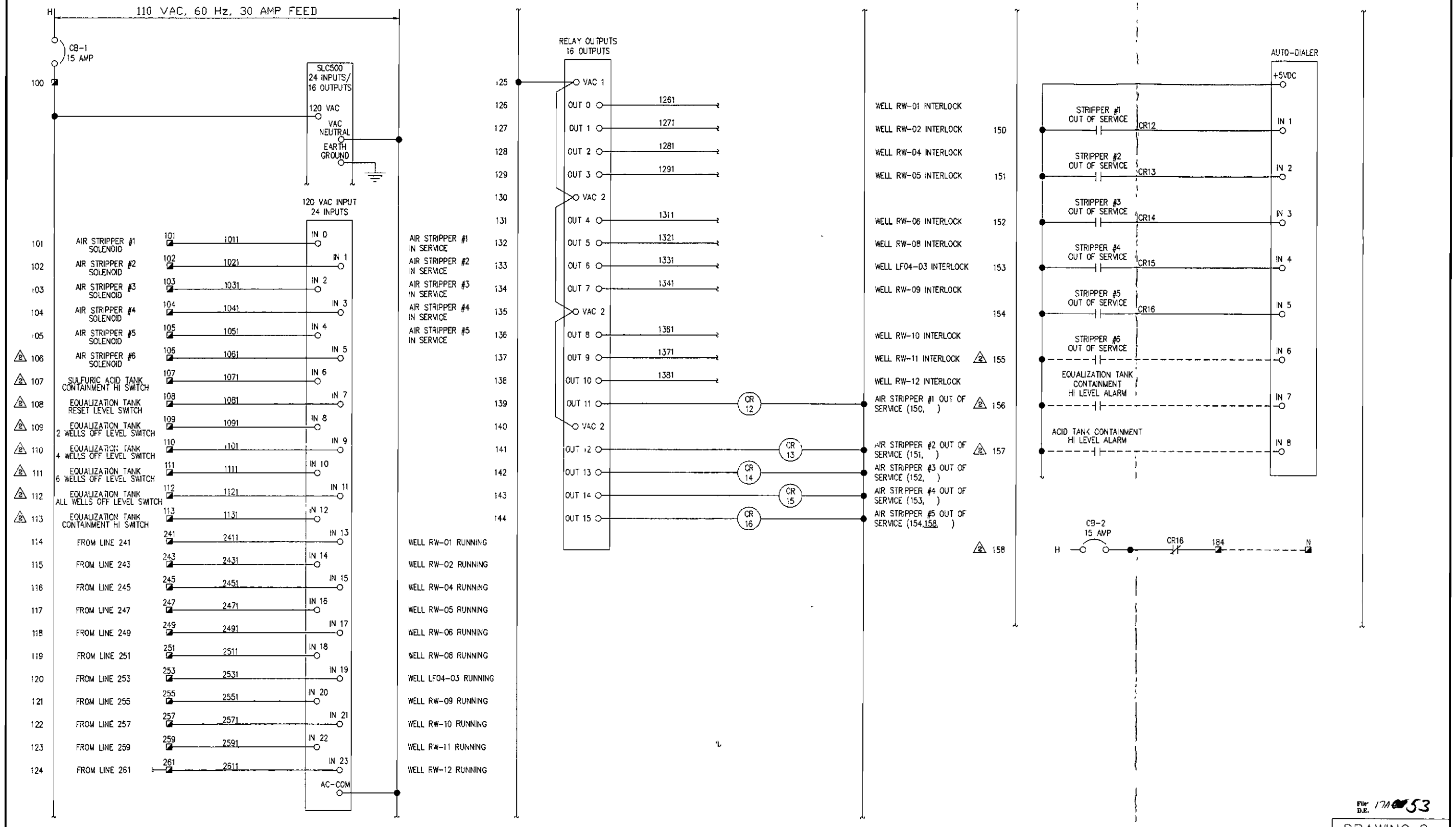

File D.E. 17A53

DRAWING 8

REVISIONS

NO	DATE	DESCRIPTION	BY	CHKD	APPD	NO	DATE	DESCRIPTION	BY	CHKD	APPD
A	5/9/94	FOR APPROVAL	DR	JLH	GMG						
2	12/9/99	AS BUILT (LTL SERVICES/HYDROGEOLOGIC, INC.)	BM	JWK	JWK						

REFERENCES

TITLE	DRAWING NO

GMG

GMG CORPORATION
930 THIRD STREET DAKMONT PA 15139
OFFICE (412) 828-2600 FAX (412) 828-2603

IT CORPORATION

PROJ LOC				PROJ NO	
DRAWN BY	DR	6/7/94	DESIGN BY		
CHG. CHKD BY	JLH	6/8/94	DES. CHKD BY		
APPD BY	GMG	6/8/94	DRFT. APPRVL		

MAIN CONTROL PANEL
CARSWELL AFB GROUNDWATER TREATMENT SYSTEM
ELEMENTARY WIRING DIAGRAM SHEET #1 OF 2

DATE JUNE 7, 1994
SCALE NONE

D 94-0403 601

REV A

X:\dfc001\19cad\19cad-0403-601.dwg 12/10/99 ap

110 VAC, 60 Hz, 30 AMP FEED

H

CB-1
15 AMP

100

SLC500
24 INPUTS/
16 OUTPUTS

120 VAC
VAC NEUTRAL
EARTH GROUND

120 VAC INPUT
24 INPUTS

101	AIR STRIPPER #1 SOLENOID	101	1011	IN 0	AIR STRIPPER #1 IN SERVICE
102	AIR STRIPPER #2 SOLENOID	102	1021	IN 1	AIR STRIPPER #2 IN SERVICE
103	AIR STRIPPER #3 SOLENOID	103	1031	IN 2	AIR STRIPPER #3 IN SERVICE
104	AIR STRIPPER #4 SOLENOID	104	1041	IN 3	AIR STRIPPER #4 IN SERVICE
105	AIR STRIPPER #5 SOLENOID	105	1051	IN 4	AIR STRIPPER #5 IN SERVICE
2 106	AIR STRIPPER #6 SOLENOID	106	1061	IN 5	
2 107	SULFURIC ACID TANK CONTAINMENT HI SWITCH	107	1071	IN 6	
2 108	EQUALIZATION TANK RESET LEVEL SWITCH	108	1081	IN 7	
2 109	EQUALIZATION TANK 2 WELLS OFF LEVEL SWITCH	109	1091	IN 8	
2 110	EQUALIZATION TANK 4 WELLS OFF LEVEL SWITCH	110	1101	IN 9	
2 111	EQUALIZATION TANK 6 WELLS OFF LEVEL SWITCH	111	1111	IN 10	
2 112	EQUALIZATION TANK ALL WELLS OFF LEVEL SWITCH	112	1121	IN 11	
2 113	EQUALIZATION TANK CONTAINMENT HI SWITCH	113	1131	IN 12	
114	FROM LINE 241	241	2411	IN 13	WELL RW-01 RUNNING
115	FROM LINE 243	243	2431	IN 14	WELL RW-02 RUNNING
116	FROM LINE 245	245	2451	IN 15	WELL RW-04 RUNNING
117	FROM LINE 247	247	2471	IN 16	WELL RW-05 RUNNING
118	FROM LINE 249	249	2491	IN 17	WELL RW-06 RUNNING
119	FROM LINE 251	251	2511	IN 18	WELL RW-08 RUNNING
120	FROM LINE 253	253	2531	IN 19	WELL LF04-03 RUNNING
121	FROM LINE 255	255	2551	IN 20	WELL RW-09 RUNNING
122	FROM LINE 257	257	2571	IN 21	WELL RW-10 RUNNING
123	FROM LINE 259	259	2591	IN 22	WELL RW-11 RUNNING
124	FROM LINE 261	261	2611	IN 23	WELL RW-12 RUNNING
				AC-COM	

RELAY OUTPUTS
16 OUTPUTS

125	VAC 1			
126	OUT 0	1261		WELL RW-01 INTERLOCK
127	OUT 1	1271		WELL RW-02 INTERLOCK
128	OUT 2	1281		WELL RW-04 INTERLOCK
129	OUT 3	1291		WELL RW-05 INTERLOCK
130	VAC 2			
131	OUT 4	1311		WELL RW-06 INTERLOCK
132	OUT 5	1321		WELL RW-08 INTERLOCK
133	OUT 6	1331		WELL LF04-03 INTERLOCK
134	OUT 7	1341		WELL RW-09 INTERLOCK
135	VAC 2			
136	OUT 8	1361		WELL RW-10 INTERLOCK
137	OUT 9	1371		WELL RW-11 INTERLOCK
138	OUT 10	1381		WELL RW-12 INTERLOCK
139	OUT 11		CR 12	AIR STRIPPER #1 OUT OF SERVICE (150,)
140	VAC 2			
141	OUT 12		CR 13	AIR STRIPPER #2 OUT OF SERVICE (151,)
142	OUT 13		CR 14	AIR STRIPPER #3 OUT OF SERVICE (152,)
143	OUT 14		CR 15	AIR STRIPPER #4 OUT OF SERVICE (153,)
144	OUT 15		CR 16	AIR STRIPPER #5 OUT OF SERVICE (154,158,)

150		
151		
152		
153		
154		
2 155		
2 156		
2 157		
2 158		

AUTO-DIALER

+5VDC		
STRIPPER #1 OUT OF SERVICE	CR12	IN 1
STRIPPER #2 OUT OF SERVICE	CR13	IN 2
STRIPPER #3 OUT OF SERVICE	CR14	IN 3
STRIPPER #4 OUT OF SERVICE	CR15	IN 4
STRIPPER #5 OUT OF SERVICE	CR16	IN 5
STRIPPER #6 OUT OF SERVICE		IN 6
EQUALIZATION TANK CONTAINMENT HI LEVEL ALARM		IN 7
ACID TANK CONTAINMENT HI LEVEL ALARM		IN 8

CB-2
15 AMP

H — CR16 — 184 — N

File D.E. 17A-53

DRAWING 8

REVISIONS

NO	DATE	DESCRIPTION	BY	CHKD	APPD	NO	DATE	DESCRIPTION	BY	CHKD	APPD
A	6/8/94	FOR APPROVAL	DR	JLH	GMG						
2	12/8/99	AS BUILT (LTL SERVICES/HYDROGEOLOGIC, INC.)	BH	JMK	JMK						

REFERENCES

TITLE	DRAWING NO

GMG

GMG CORPORATION
930 THIRD STREET CRAMONT PA 15139
OFFICE (412) 828-2600 FAX (412) 828-2603

IT CORPORATION

PROJ. LOC.				PROJ. NO
DRAWN BY	DR	5/7/94	DESIGN BY	
DWG. CHKD BY	JLH	5/8/94	DES. CHKD BY	
APPD BY	GMG	5/8/94	DRFT. APPRVL	

MAIN CONTROL PANEL
CARSWELL AFB GROUNDWATER TREATMENT SYSTEM
ELEMENTARY WIRING DIAGRAM SHEET #1 OF 2

DATE JUNE 7, 1994
SCALE NONE

D 94-0403.601

REV A

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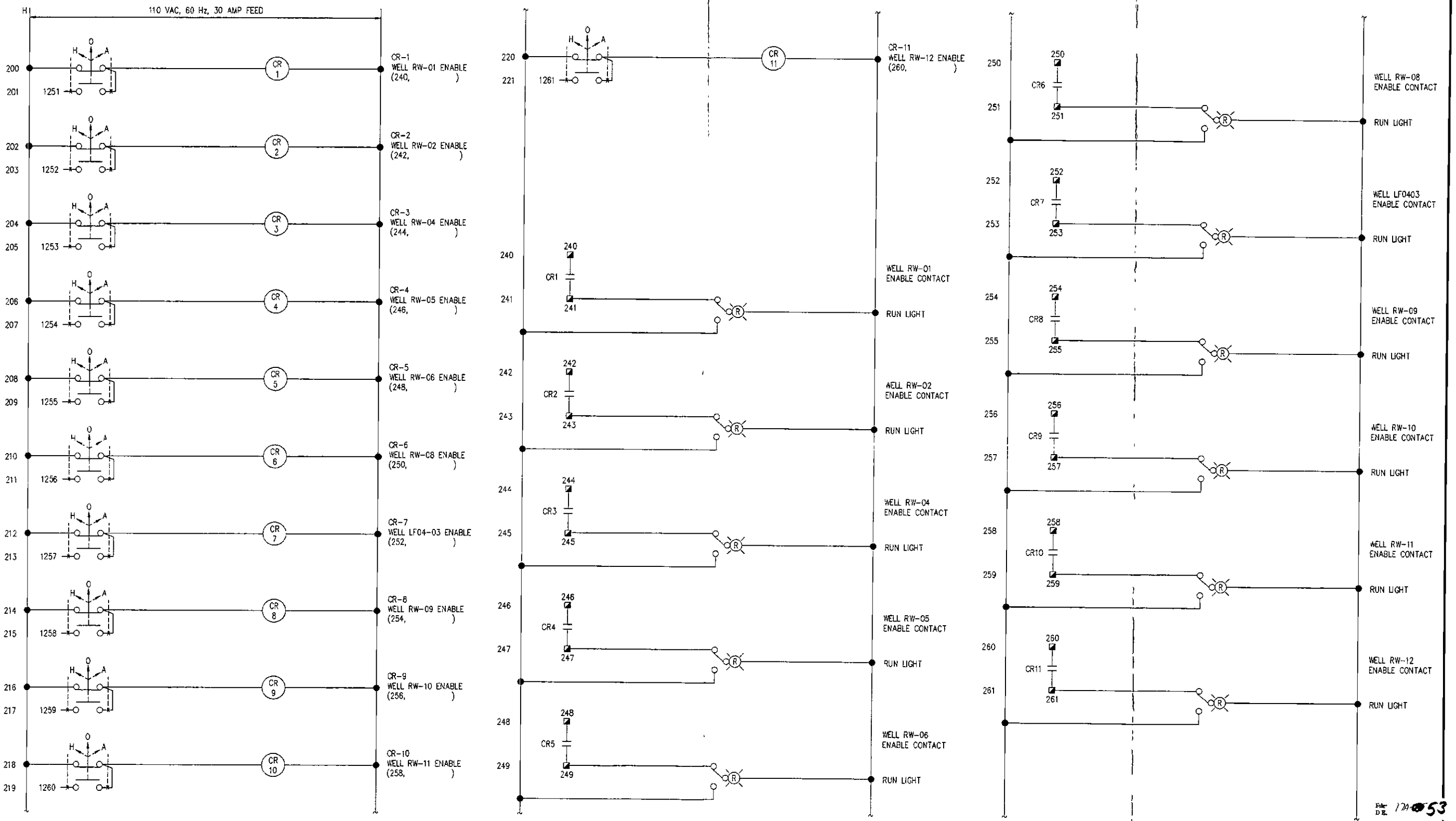

Folder 1294053

DRAWING 9

REVISIONS

NO	DATE	DESCRIPTION	BY	CHKD	APPD
A	5/8/94	FOR APPROVAL	DR	JLH	GMG
2	12/8/94	AS BUILT (LTL SERVICES/HYDROGEOLOGIC, INC.)	BH	JWK	JWK

REFERENCES

TITLE	DRAWING NO

GMG

GMG CORPORATION
930 THIRD STREET OAKMONT PA 15139
OFFICE (412) 828-2600 FAX (412) 828-2603

IT CORPORATION

PROJ. LOC					PROJ. NO.
DRAWN BY	DR	6/7/94	DESIGN BY		
DWG. CHKD BY	JLH	6/8/94	DES. CHKD BY		
APPD BY	GMG	6/8/94	CNST. APPRVL.		

MAIN CONTROL PANEL
CARSWELL AFB GROUNDWATER TREATMENT SYSTEM
ELEMENTARY WIRING DIAGRAM SHEET #2 OF 2

DATE JUNE 7, 1994
SCALE NONE

D 94-0403.602 REV A

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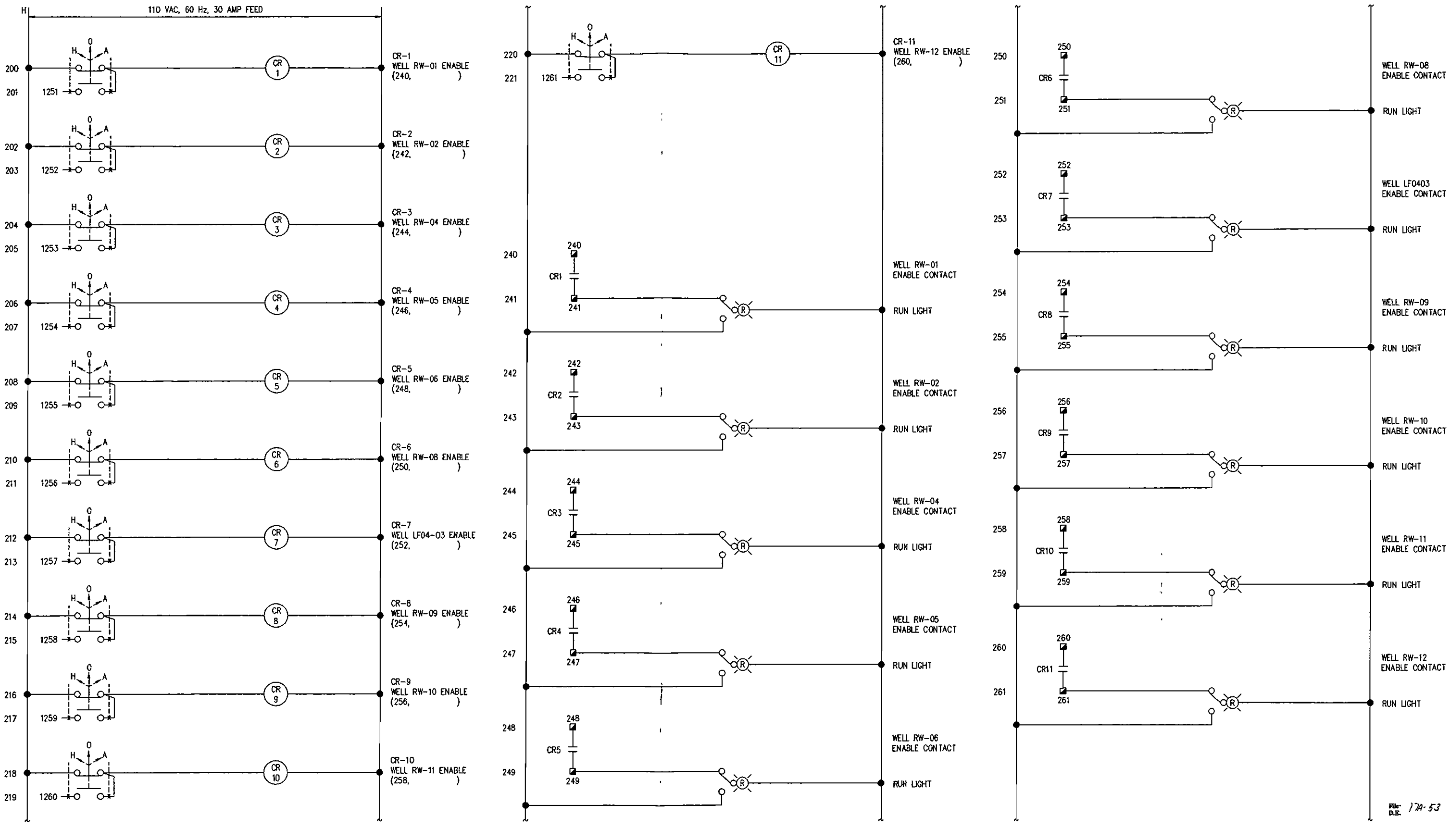

File: D.E. 174-53

DRAWING 9

REVISIONS

NO	DATE	DESCRIPTION	BY	CHKD	APPD
A	5/3/94	FOR APPROVAL	DR	JLH	GMG
2	12/8/99	AS BUILT (LTL SERVICES/HYDROGEOLOGIC, INC.)	BH	JMK	JMK

REFERENCES

TITLE	DRAWING NO

GMG

GMG CORPORATION
930 THIRD STREET, CANONSBURG PA 15139
OFFICE: (412) 828-2800 FAX: (412) 828-2603

IT CORPORATION

PROJ LOC				PROJ. NO.
DRAWN BY	DR	5/7/94	DESIGN BY	
DWG. CHKD BY	JLH	6/8/94	DES. CHKD BY	
APPD. BY	GMG	6/8/94	DRFT. APPRVL	

MAIN CONTROL PANEL
CARSWELL AFB GROUNDWATER TREATMENT SYSTEM
ELEMENTARY WIRING DIAGRAM SHEET #2 OF 2

DATE JUNE 7, 1994
SCALE NONE

D 94-0403.602

REV. A

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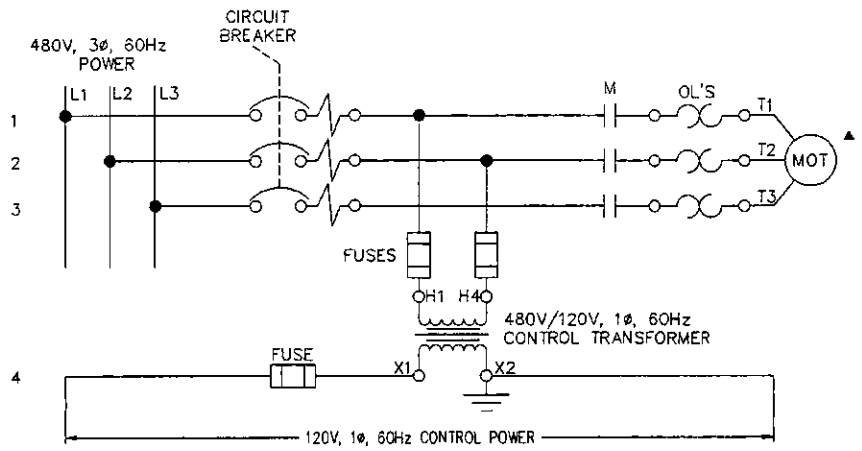
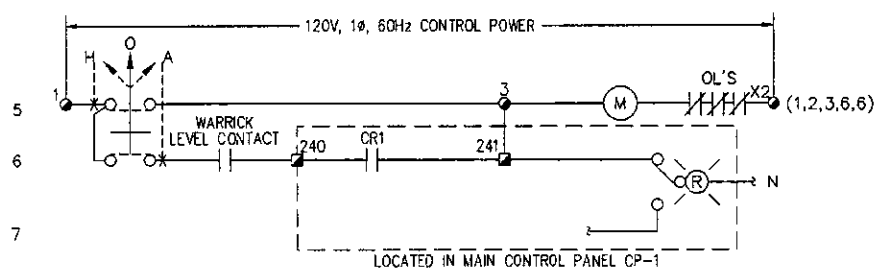
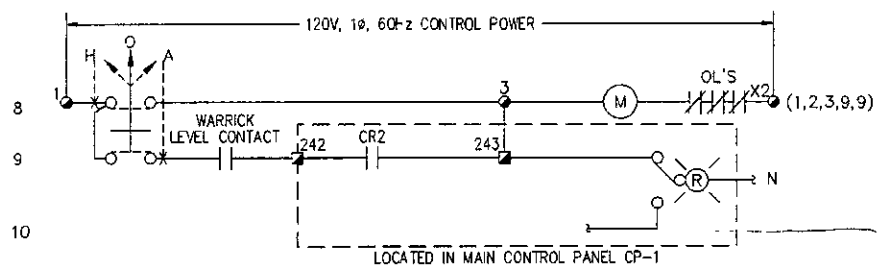


TYPICAL STARTER POWER CIRCUIT



WELL CONTROLS WELL RW-01



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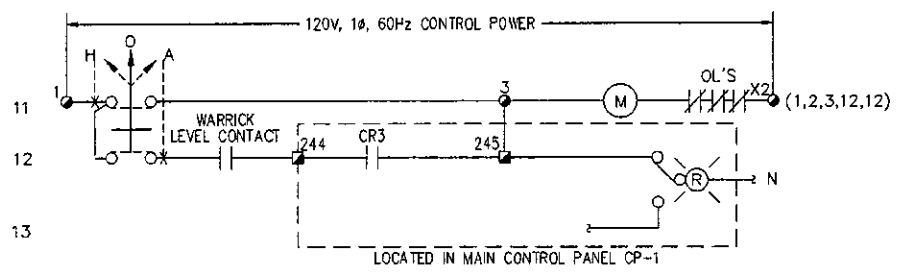
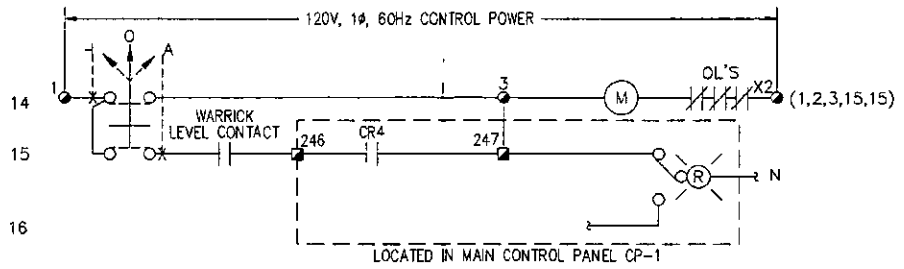


WELL CONTROLS WELL RW-04



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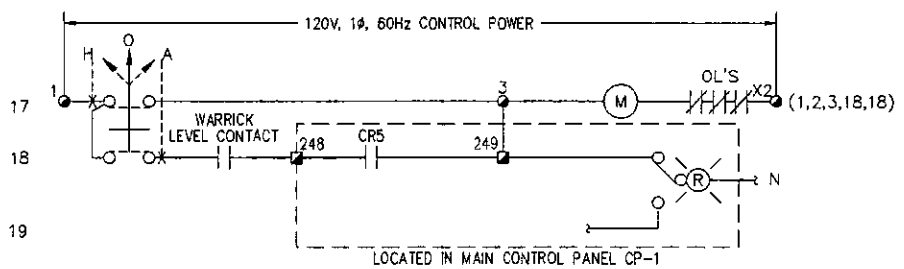
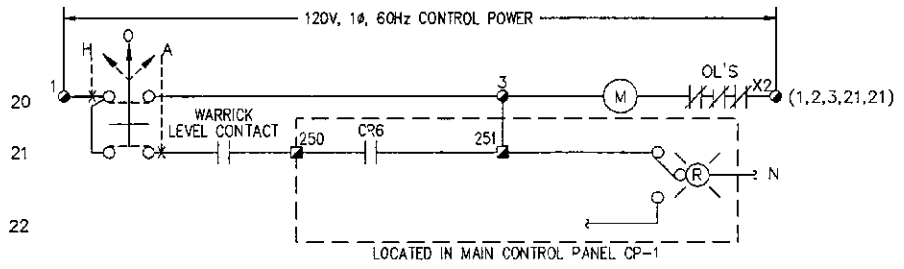
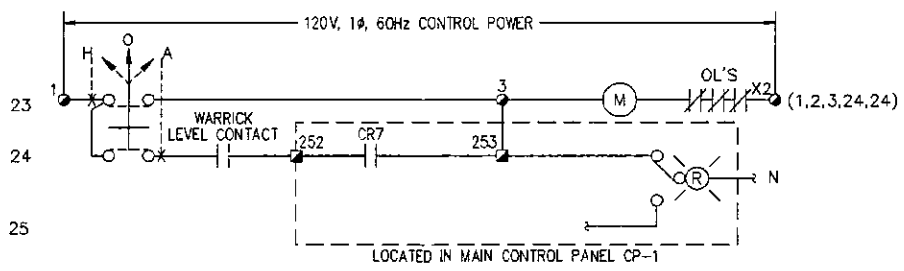


WELL CONTROLS WELL RW-06



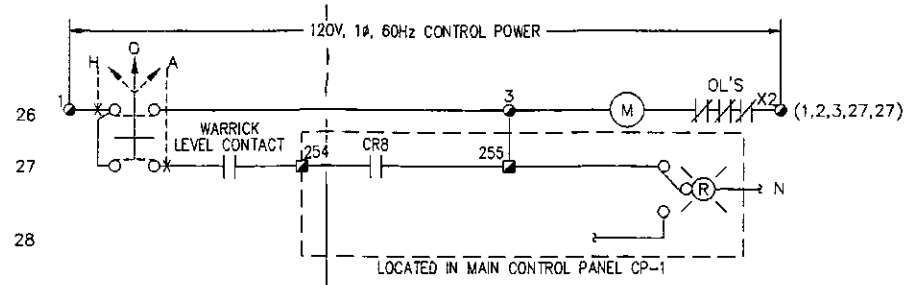
WELL CONTROLS WELL RW-08



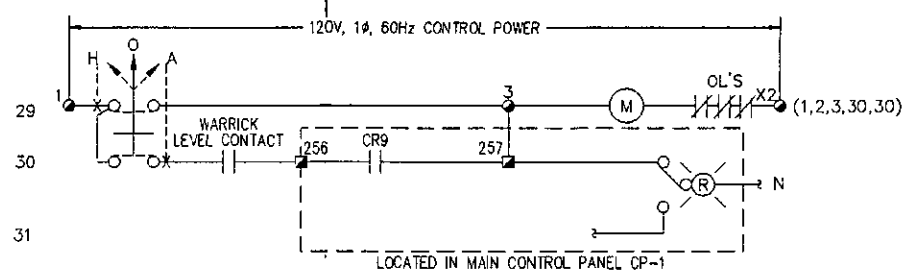
WELL CONTROLS WELL LF0403

NOTE

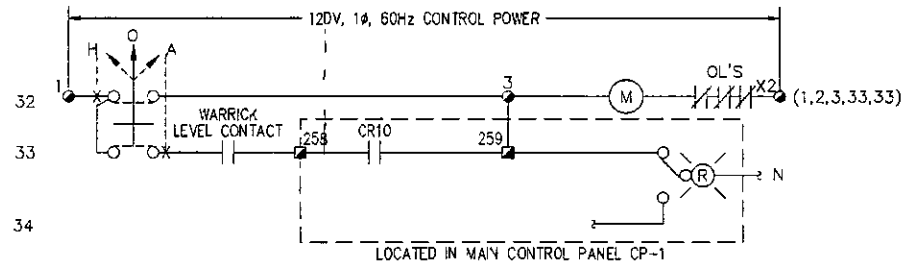
1 ALL DEVICES IN LOCAL MOTOR CONTROL PANEL UNLESS DESIGNATED OTHERWISE



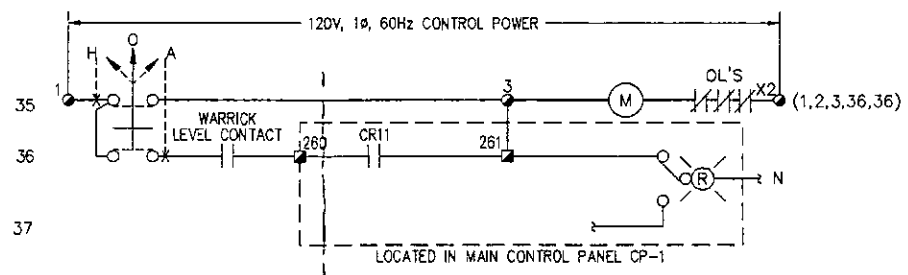
WELL CONTROLS WELL RW-09



WELL CONTROLS WELL RW-10



WELL CONTROLS WELL RW-11



WELL CONTROLS WELL RW-12

LEGEND

▲ – DENOTES DEVICE NEAR MOTOR
◕ – DENOTES TERMINAL IN LOCAL MOTOR CONTROL PANEL
◪ – DENOTES TERMINAL IN CONTROL PANEL CP-1

File D.E. 1A-053

DRAWING 10

REVISIONS

NO	DATE	DESCRIPTION	BY	CHKD	APPD	NO	DATE	DESCRIPTION	BY	CHKD	APPD
A	6/8/94	FOR APPROVAL	DR	JLH	GMG						
2	12/9/99	AS BUILT (LTL SERVICES/HYDROGEOLOGIC, INC.)	BH	JWK	JWK						

REFERENCES

TITLE	DRAWING NO

GMG

GMG CORPORATION
930 THIRD STREET, OAKMONT PA 15139
OFFICE (412) 828-2650 FAX (412) 828-2603

IT CORPORATION

PROJ LOC.				PROJ NO.	
DRAWN BY	DR	6/7/94	DESIGN BY		
GMG CHKD BY	JLH	6/8/94	DES. CHKD BY		
APPD BY	GMG	6/8/94	DEPT. APPRVL.		

MAIN CONTROL PANEL
CARSWELL AFB GROUNDWATER TREATMENT SYSTEM
FIELD WIRING DIAGRAM

DATE JUNE 7, 1994
SCALE NONE
D 94-0403.603
REV A

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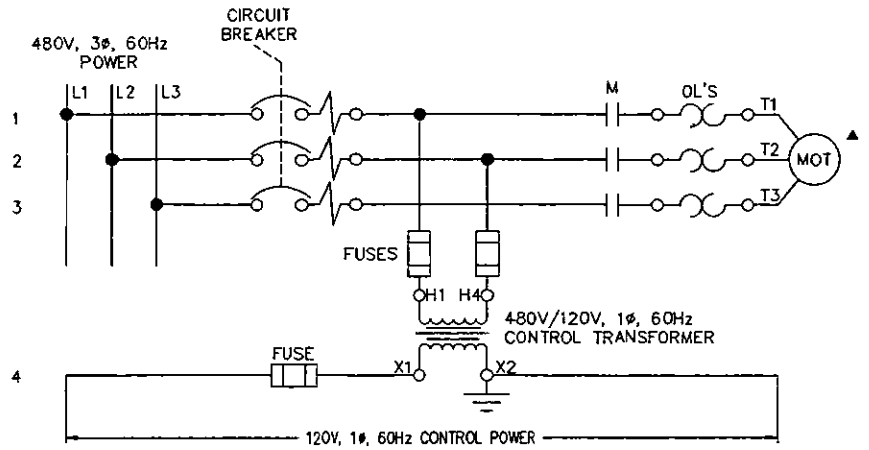
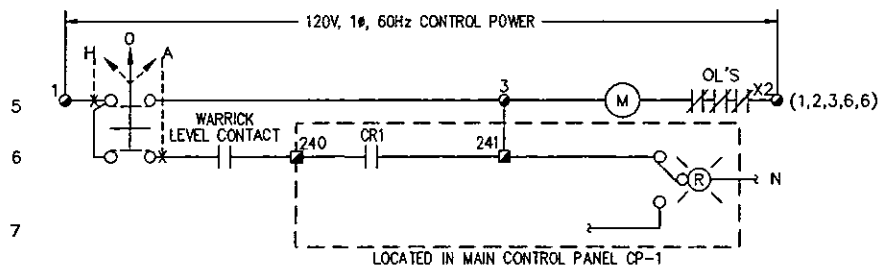
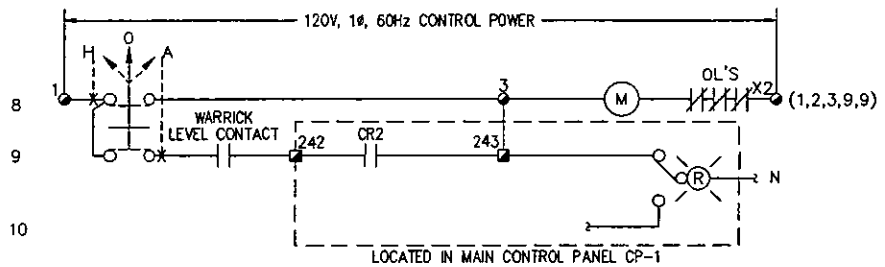


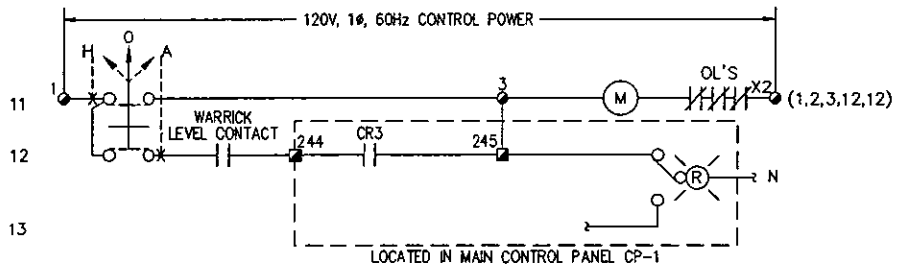
TYPICAL STARTER POWER CIRCUIT



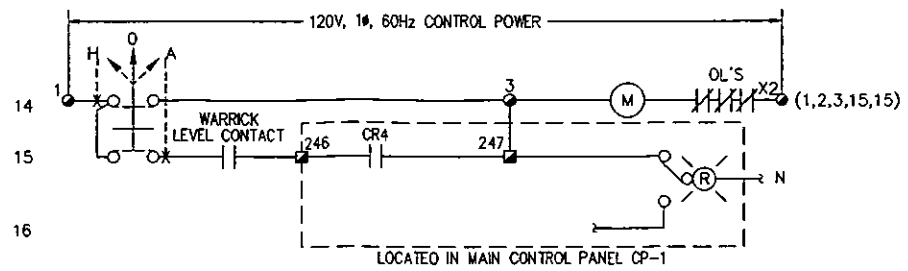
WELL CONTROLS WELL RW-01



WELL CONTROLS WELL RW-02



WELL CONTROLS WELL RW-04



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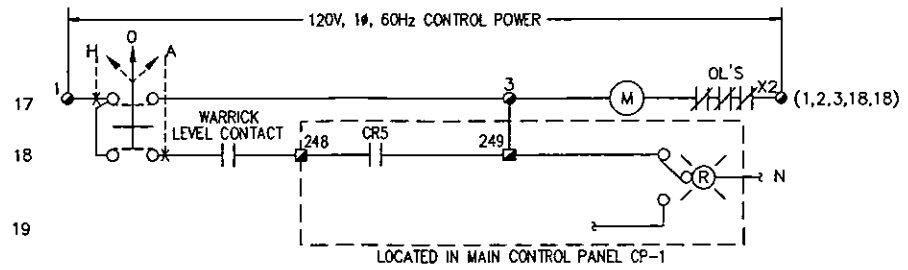
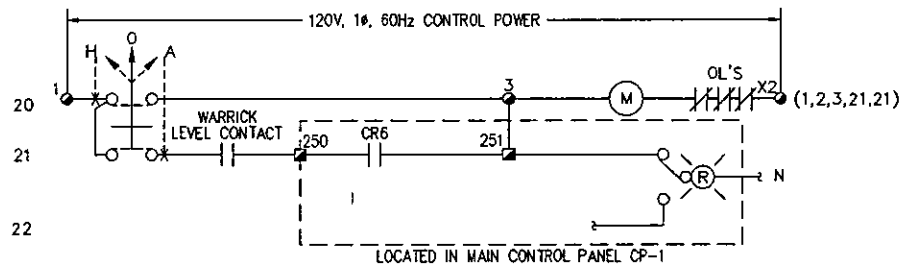
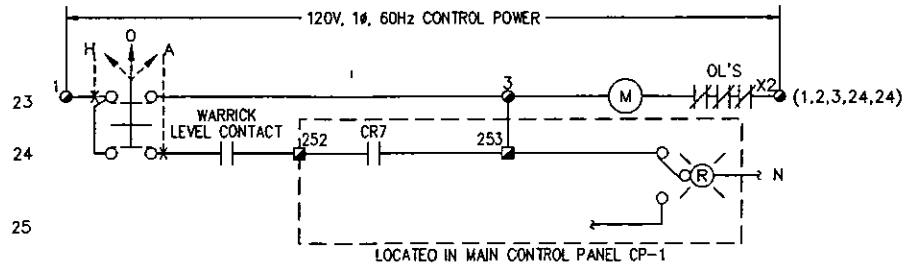


WELL CONTROLS WELL RW-06



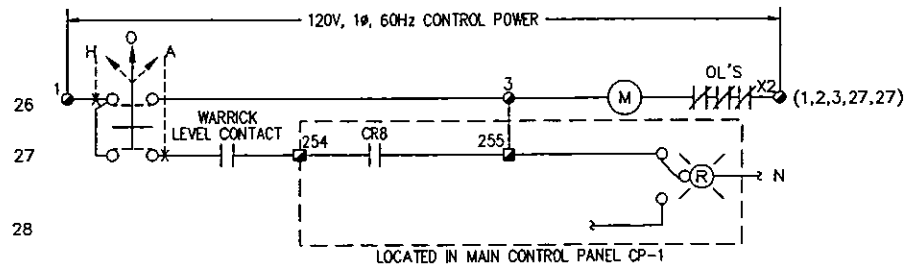
WELL CONTROLS WELL RW-08



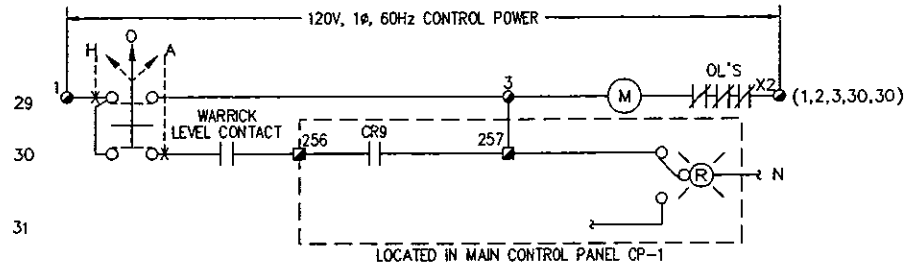
WELL CONTROLS WELL LF0403

NOTE:

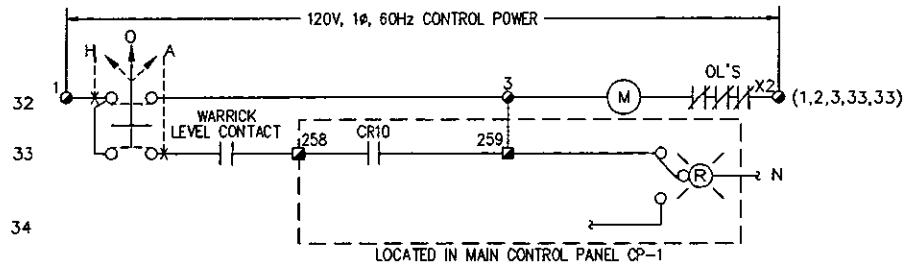
1 ALL DEVICES IN LOCAL MOTOR CONTROL PANEL UNLESS DESIGNATED OTHERWISE



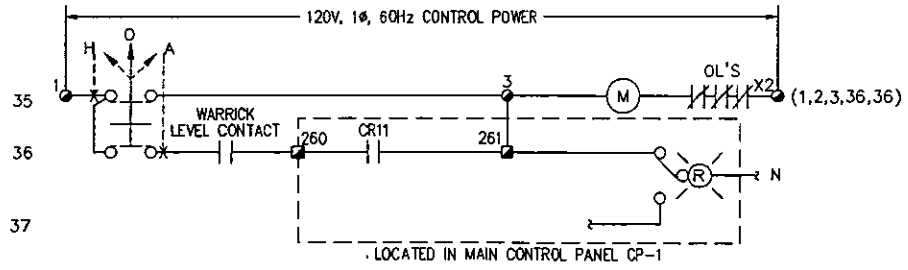
WELL CONTROLS WELL RW-09



WELL CONTROLS WELL RW-10



WELL CONTROLS WELL RW-11



WELL CONTROLS WELL RW-12

LEGEND:

▲ – DENOTES DEVICE NEAR MOTOR
◐ – DENOTES TERMINAL IN LOCAL MOTOR CONTROL PANEL
◪ – DENOTES TERMINAL IN CONTROL PANEL CP-1

File. 17A-5.3
D.E.

DRAWING 10

REVISIONS

NO	DATE	DESCRIPTION	BY	CHKD	APPD	NO	DATE	DESCRIPTION	BY	CHKD	APPD
A	5/8/94	FOR APPROVAL	DR	JLH	GMG						
2	12/8/99	AS BUILT (I.T. SERVICES/HYDROGEOLOGIC, INC.)	BH	JWK	JWK						

REFERENCES

TITLE	DRAWING NO.

GMG CORPORATION
830 THIRD STREET CORAOPOLIS, PA 15108
OFFICE: (412) 828-2600 FAX: (412) 828-2603

IT CORPORATION

PROJ. LOC				PROJ. NO
DRAWN BY	DR	5/7/94	DESIGN BY	
DWG. CHKD BY	JLH	5/8/94	DES. CHKD BY	
APPD BY	GMG	5/8/94	DEPT. APPRVL	

MAIN CONTROL PANEL
CARSWELL AFB GROUNDWATER TREATMENT SYSTEM
FIELD WIRING DIAGRAM

DATE JUNE 7 1994
SCALE NONE
D 94-0403.603
REV (A)

X:\Afc001\19cd0403-603.dwg

480VAC POWER PANEL

480VAC, 3ø, 60Hz

MAIN CIRCUIT BREAKER 400A

40A	40A	40A	40A	40A	40A	40A	15A	15A	15A	15A	15A	15A	15A	15A	15A	15A	15A	15A
SKID #1	SKID #2	EQ TANK CONTROL	SKIDS #3 & #6	SKID #4	SKID #5	SUMP PUMPS AND AUXILIARY EQUIPMENT	RW-1	RW-2	RW-4	RW-5	RW-6	RW-8	LF04-03	RW-9	RW-10	RW-11	RW-12	

480VAC, 3ø, 60Hz
TRANSFORMER 6KVA
120/240VAC 60Hz

MAIN BREAKER 60A

30A	NOT USED	30A GFI CONVENIENCE OUTLET
30A	NOT USED	30A 220V @ O&M BUILDING
20A	120V OUTLET @ PIPE	30A 220V @ O&M BUILDING
20A	ACID FEED PUMP	20A NOT USED
20A	NOT USED	20A NOT USED
20A	220V @ JP4 SKID	20A LIGHTS
20A	220V @ JP4 SKID	20A LIGHTS
20A	NOT USED	20A LIGHTS
20A	NOT USED	20A 120V @ WELLS

CONTINUED

120VAC CONTINUED

20A	EQUALIZATION TANK CONTAINMENT SUMP PUMP	20A 220V @ SKID #6
20A	GFI 120V	20A 220V @ SKID #6
20A	A-B MAIN CONTROL PANEL	20A 120V @ WELLS

File: D/E 174-0053

DRAWING 11

REVISIONS

NO	DATE	DESCRIPTION	BY	CHKD	APPD
1	3/27/95	UPDATED PART NUMBERS	DMR	JLH	JLH
2	12/8/99	AS BUILT (LTL SERVICES/HYDROGEOLOGIC, INC.)	BH	JMK	JMK

REFERENCES

TITLE	DRAWING NO.

GMG CORPORATION
630 THIRD STREET OAKMONT PA 15139
OFFICE (412) 828-2500 FAX (412) 828-2803

IT CORPORATION

PROJ. LOC				PROJ. NO. 194-0438	
DRAWN BY	DMR	10/17/94	DESIGN BY		
CHKD BY	JLH	10/19/94	DES. CHKD BY		
APPD BY	GMG	10/19/94	DRFT. APPVL		

POWER DISTRIBUTION DRAWING
CARSWELL AFB
GROUNDWATER TREATMENT SYSTEM

DATE OCT 17, 1994
SCALE NONE
D 94-0438 600
REV (1)

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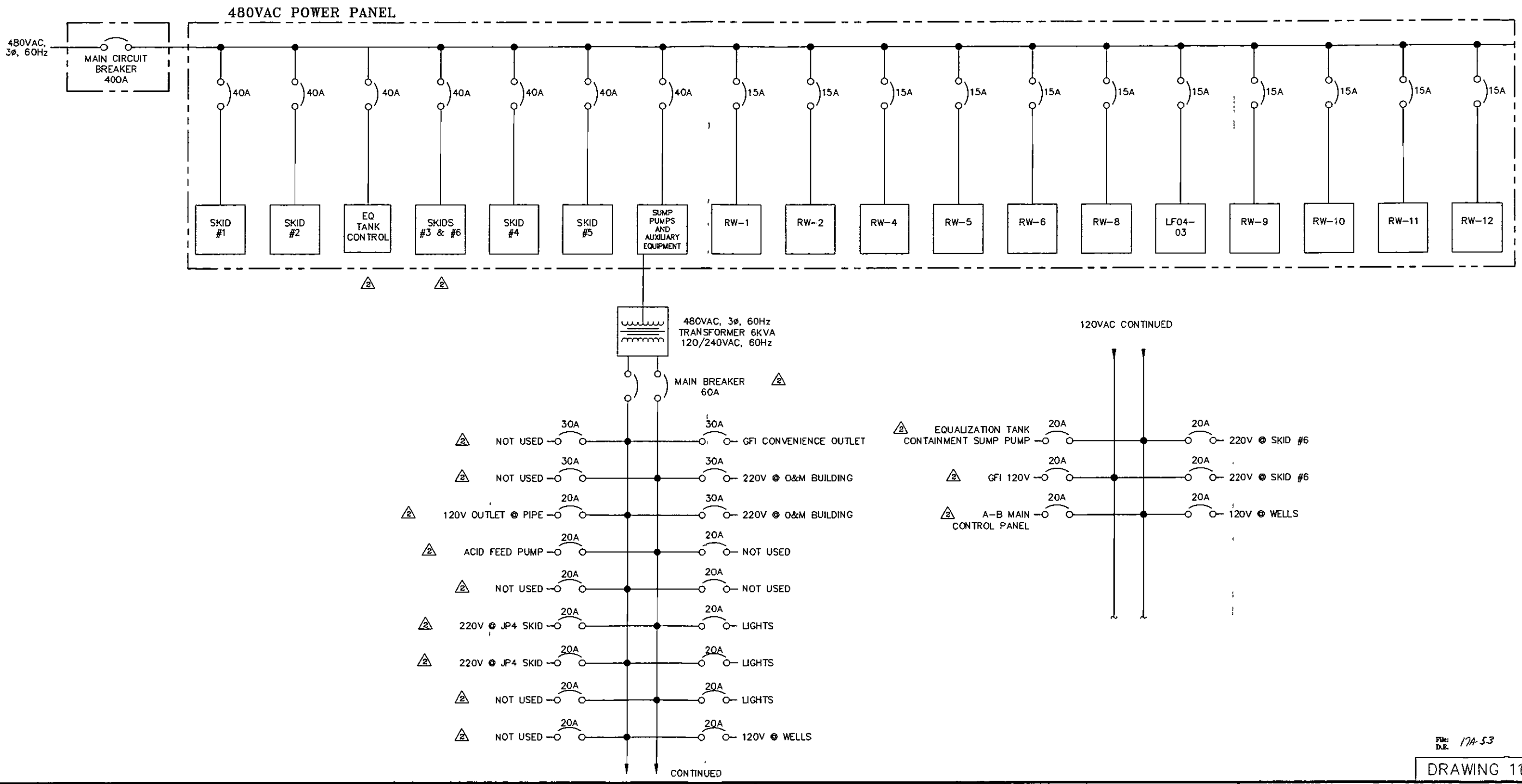

REVISIONS													REFERENCES	
NO	DATE	DESCRIPTION	BY	CHKD	APPD	NO	DATE	DESCRIPTION	BY	CHKD	APPD		TITLE	DRAWING NO.
1	3/27/95	UPDATED PART NUMBERS	DMR	JLH	JLH									
2	12/8/99	AS BUILT (LTL SERVICES/HYDROGEOLOGIC, INC.)	BH	JMK	JMK									

GMG

GMG CORPORATION
930 THIRD STREET GAMMONT PA 15139
OFFICE (412) 828-2600 FAX (412) 828-2603

IT CORPORATION

PROJ. LOC				PROJ. NO. 94-0438	
DRAWN BY	DMR	10/17/94	DESIGN BY		
DWG. CHKD BY	JLH	10/19/94	DES. CHKD BY		
APPD. BY	GMG	10/19/94	DRFT. APPRVL		

POWER DISTRIBUTION DRAWING
CARSWELL AFB
GROUNDWATER TREATMENT SYSTEM

DATE OCT 17 1994
SCALE NONE
D 94-0438.600
REV. 1

File: D.E. 17A-53

DRAWING 11

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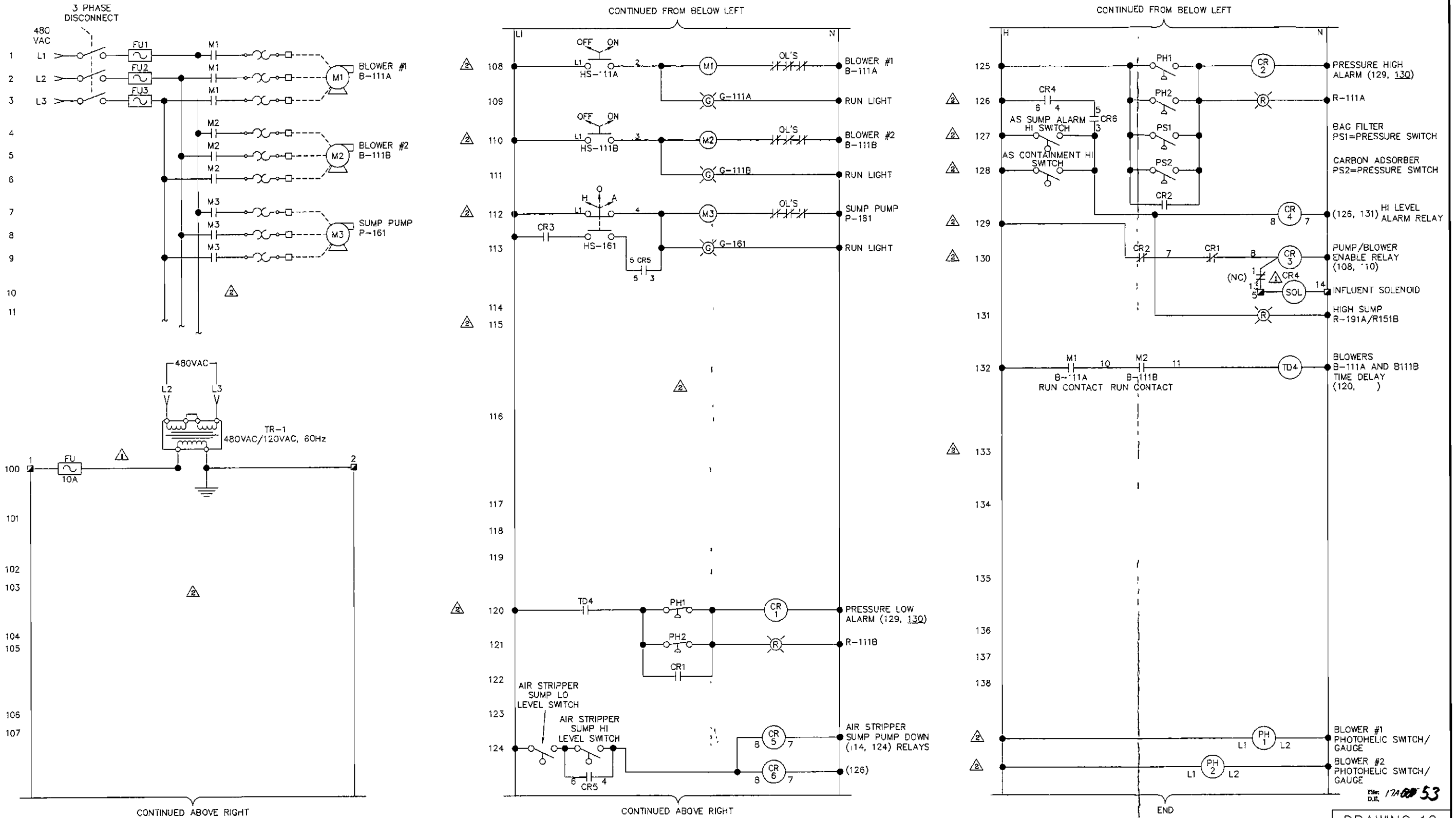

REVISIONS											REFERENCES	
NO	DATE	DESCRIPTION	BY	CHKD	APPD	NO	DATE	DESCRIPTION	BY	CHKD	APPD	TITLE	DRAWING NO
1	3/22/95	UPDATED PART NUMBERS	DMR	JLH	JLH								
2	12/8/98	AS BUILT (I.T. SERVICES/HYDROGEOLOGIC, INC.)	EH	JWK	JWK								

GMG

GMG CORPORATION
330 THIRD STREET OAKMONT PA 15139
OFFICE (412) 828-2600 FAX (412) 828-2603

IT CORPORATION

PROJ LOC.				PROJ NO	94-0438
DRAWN BY	DMR	10/18/94	DESIGN BY	1	
DWG. CHKD BY	JLH	10/19/94	DES. CHKD BY	1	
APPD BY	GMG	10/19/94	DRFT. APPRVL	1	

SKID CONTROL PANEL
ELEMENTARY WIRING DIAGRAM
CARSWELL AFB, GROUNDWATER TREATMENT SYSTEM

DATE OCT 18, 1994
SCALE NONE
D 94-0438 601
REV 1

File: I7A 53

DRAWING 12

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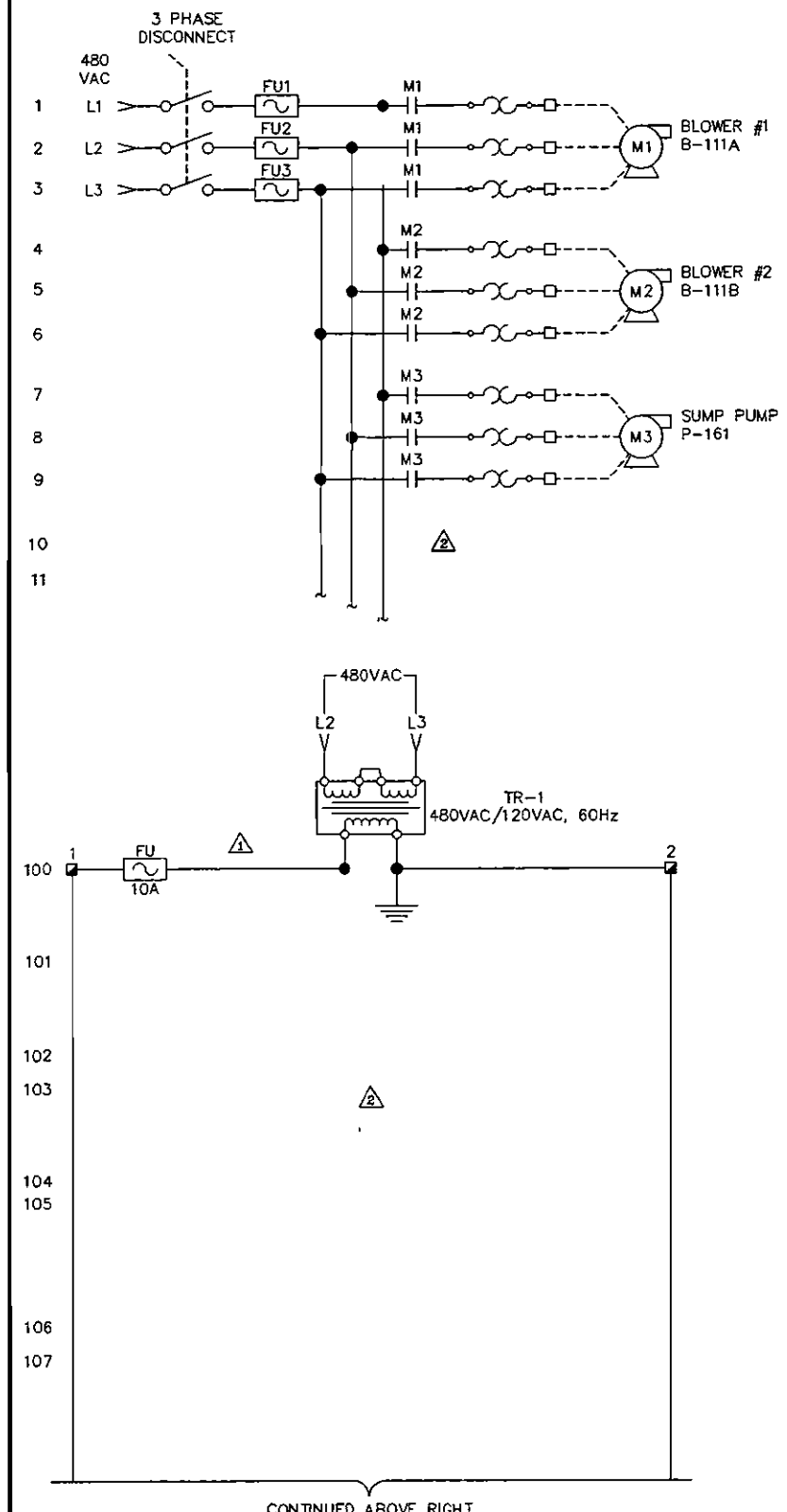

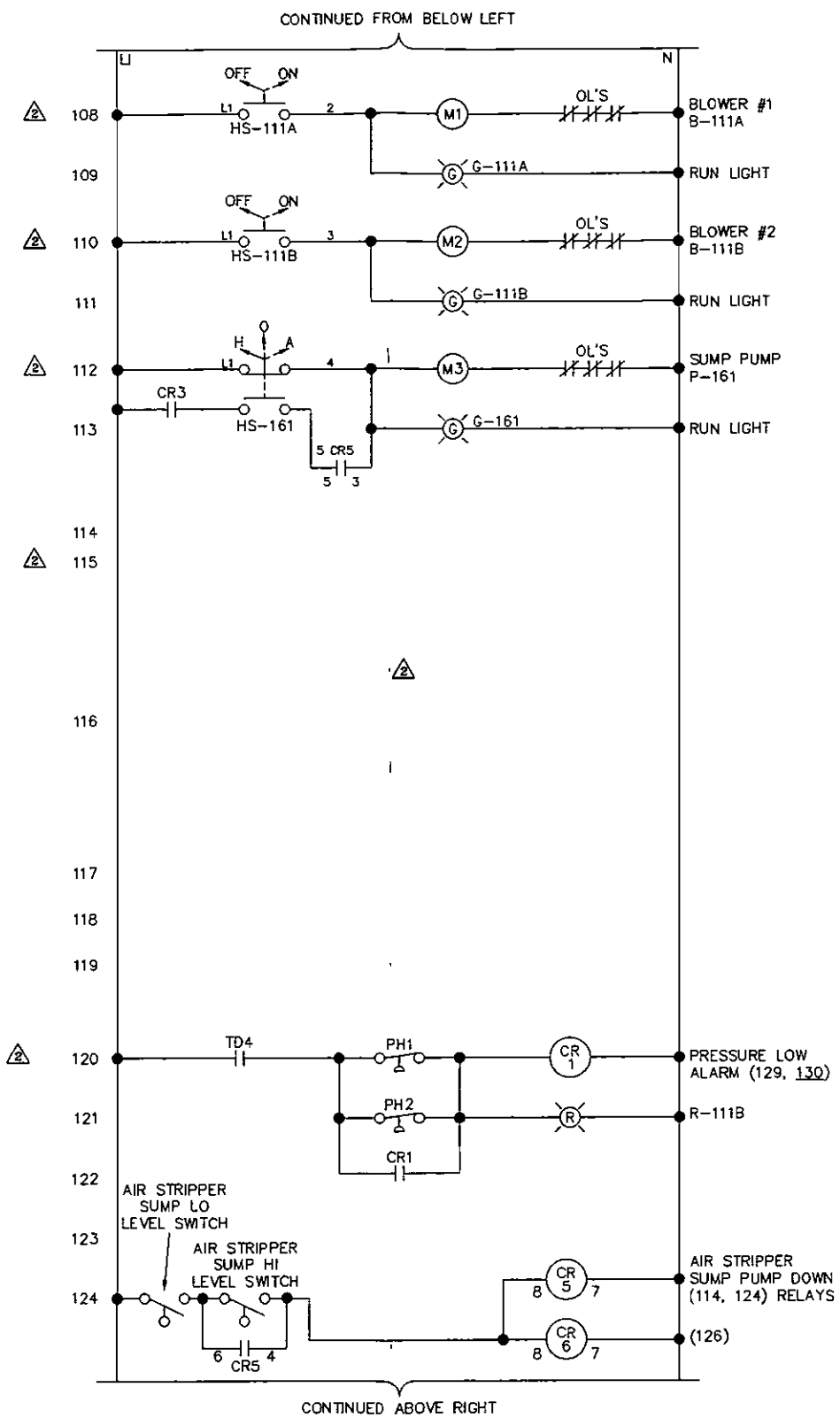

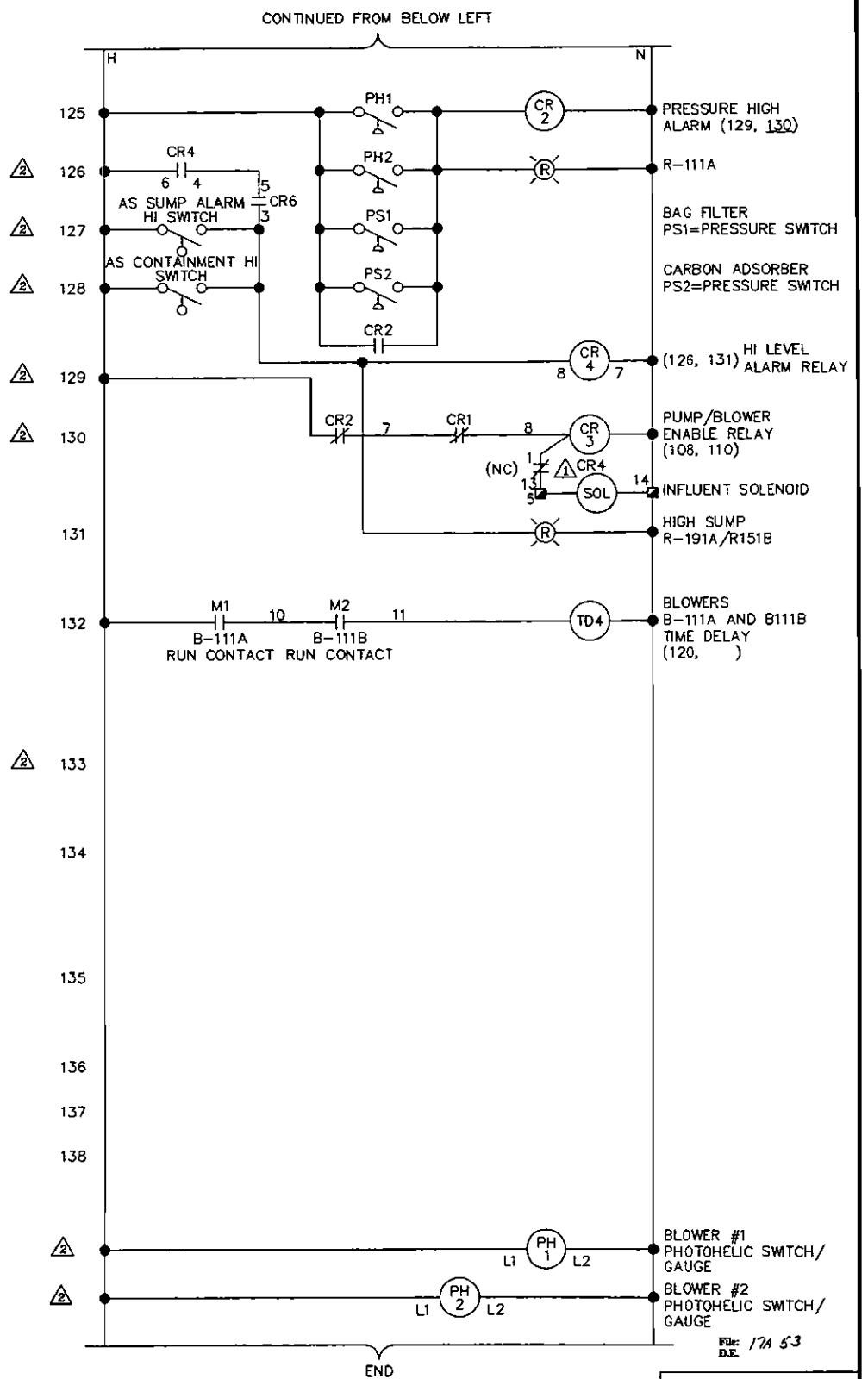

File: D.E. 17A 53

DRAWING 12

REVISIONS

NO	DATE	DESCRIPTION	BY	CHKD	APPD
1	3/27/95	UPDATED PART NUMBERS	DMR	JLH	JLH
2	12/8/99	AS BUILT (LTI, SERVICES/HYDROGEOLOGIC, INC.)	BH	JMK	JMK

REFERENCES

TITLE	DRAWING NO.

GMG CORPORATION
930 THIRD STREET DARMONT PA 15130
OFFICE (412) 828-2600 FAX (412) 828-2603

IT CORPORATION

PROJ. LOC.			PROJ NO	94-0438
DRAWN BY	DMR	10/18/94	DESIGN BY	
DWG. CHKD BY	JLH	10/19/94	DES. CHKD BY	
APPD. BY	GMG	10/19/94	DRFT APPRVL	

SKID CONTROL PANEL
ELEMENTARY WIRING DIAGRAM
CARSWELL AFB, GROUNDWATER TREATMENT SYSTEM

DATE OCT 18, 1994
SCALE NONE
D 94-0438.601
REV (1)

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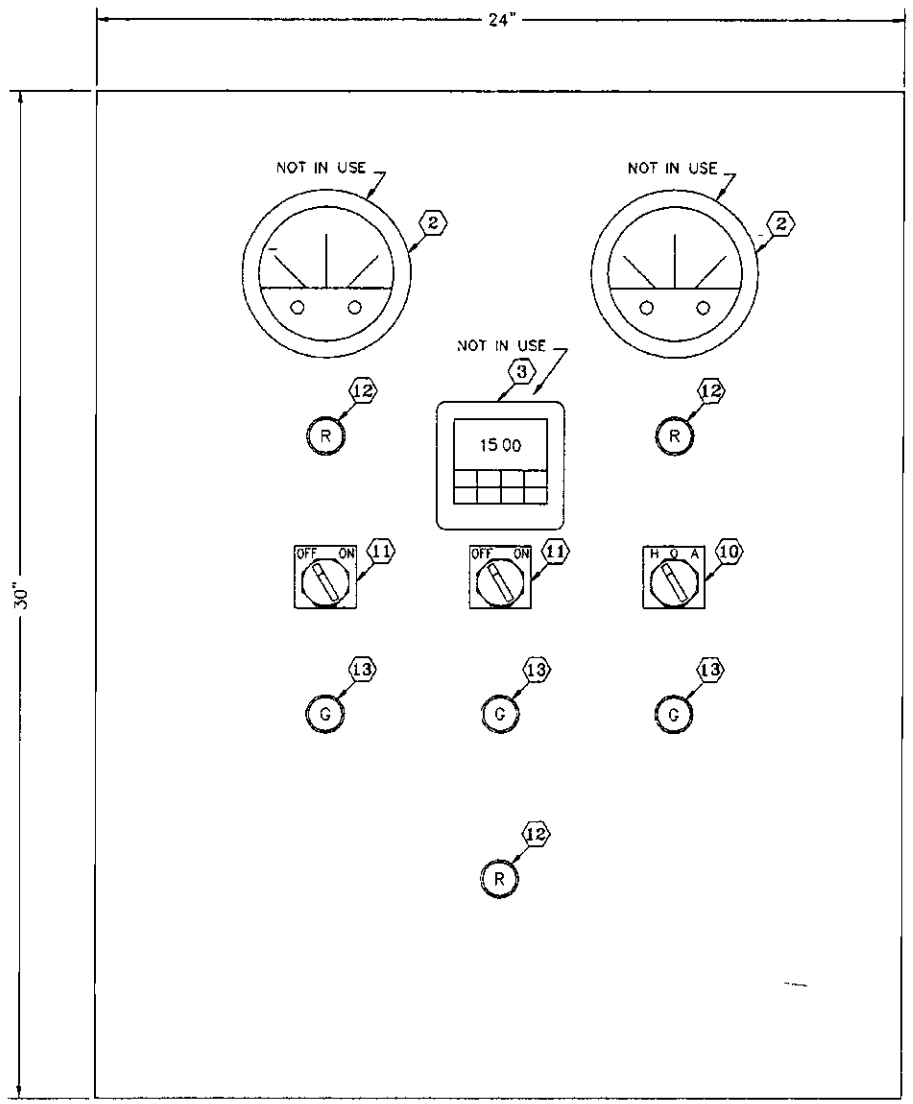
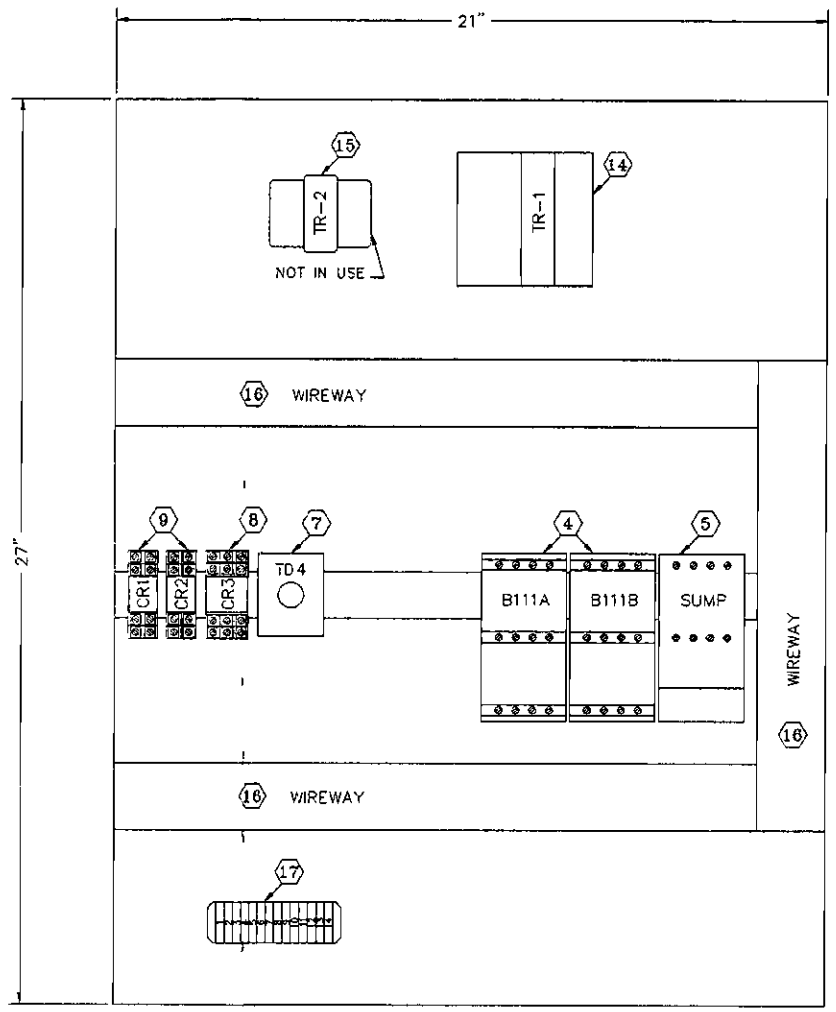


SKID PANEL LAYOUT
(TYPICAL FOR (5) PANELS)



SUB-PANEL LAYOUT
(TYPICAL FOR (5) PANELS)

BILL OF MATERIALS

ITEM	QNTY	DESCRIPTION	REMARKS
1	1	ENCLOSURE NEMA 12, 30x24x6, HOFFMAN CAT # A-302406LP WITH PANEL, 27x21 CAT # A-36P24	
2	2	DWYER PHOTOHELIC DIFFERENTIAL PRESSURE SWITCH/GAUGES, 0-80 INCHES OF WATER DWYER CAT # 3080	
3	1	HONEYWELL CONTROLLER NEMA4, BEZEL DC 300K-0-2A0-20-0000-0	
4	2	TELEMECANIQUE MOTOR STARTERS, CAT # LC1-D0910 WITH OVERLOAD CAT # LR2-D13	BLOWERS B111A, B111B
5	1	MTE MOTOR STARTERS, CAT # MAX020440 WITH OVERLOAD CAT # AXTQ 5.4-8.0	SUMP P-161
6	2	WARRICK CONTROLS, P N #16MB1D0	W-5, W-6
7	1	IDEC TIMER, CAT # RTE-P1-1-AC120V WITH SOCKET CAT # SR 2P-06	
8	1	IDEC RELAY, CAT # RH3B-U-120VAC WITH SOCKET CAT # SR 3B-05	
9	2	IDEC RELAY, CAT # RH2B-U-120VAC WITH SOCKET CAT # SR 2B-05	
10	1	TELEMECANIQUE H-O-A SELECTOR SWITCH SWITCH - PN# ZB2-BD3 BLOCK - PN# ZB2-BE101 NAMEPLATE - PN# ZB2-BY2387	HOA
11	2	TELEMECANIQUE OFF-ON SELECTOR SWITCH, 2 POSITION MAINTAINED SWITCH - PN# ZB2-BD2 BLOCK - PN# ZB2-BZ101 NAMEPLATE - PN# ZB2-BY2367	B-111A B-111B
12	3	TELEMECANIQUE PILOT LIGHT, RED LIGHT - PN# ZB2-BV04 BASE - PN# ZB2-BV6	R
13	3	TELEMECANIQUE PILOT LIGHT, GREEN LIGHT - PN# ZB2-BV03 BASE - PN# ZB2-BV6	G
14	1	CONTROL TRANSFORMER, 480VAC TO 120VAC, 1 PHASE, 60Hz, SQUARE-D 0.100KVA	
15	1	INSTRUMENT TRANSFORMER, 120VAC TO 24VAC, POWER = 10VA	
16	5 ft	WIREWAY PANDUIT 2"x2"	OR EQUAL
17	14 1 2 1	IEC TERMINAL BLOCKS, A&B CAT # 1492-U4 END BARRIER, CAT # 1492-N51 END ANCHORS (GRAY) CAT # 1492-N76GR DIN RAIL CAT # 199-DR1	OR EQUAL
18	1	TELEMECANIQUE FUSED DISCONNECT CAT # D115D1, FUSE PN# LP-CC-30	

File D.E. 17-0853

DRAWING 13

REVISIONS											REFERENCES	
NO	DATE	DESCRIPTION	BY	CHKD	APPD	NO	DATE	DESCRIPTION	BY	CHKD.	APPD	TITLE / DRAWING NO.
1	3/27/95	UPDATED PART NUMBERS	DMR	JLH	JLH							
2	12/8/95	AS BUILT (LTL SERVICES/HYDROGEOLOGIC, INC.)	BH	JMK	JMK							

GMG CORPORATION
330 THIRD STREET OAKMONT PA 15139
OFFICE (412) 828-2630 FAX (412) 828-2603

IT CORPORATION

PROJ. LOC				PROJ. NO.	94-0438
DRAWN BY	DMR	10/17/94	DESIGN BY		
DWG CHKD BY	JLH	10/19/94	DES. CHKD BY		
APPD BY	GMG	10/19/94	DRFT APPRVL		

SKID CONTROL PANEL
PANEL LAYOUT AND BILL OF MATERIALS
CARSWELL AFB GROUNDWATER TREATMENT SYSTEM

DATE OCT 17, 1994
SCALE APPROX. 1"=12"

D 94-0438 602 REV 1

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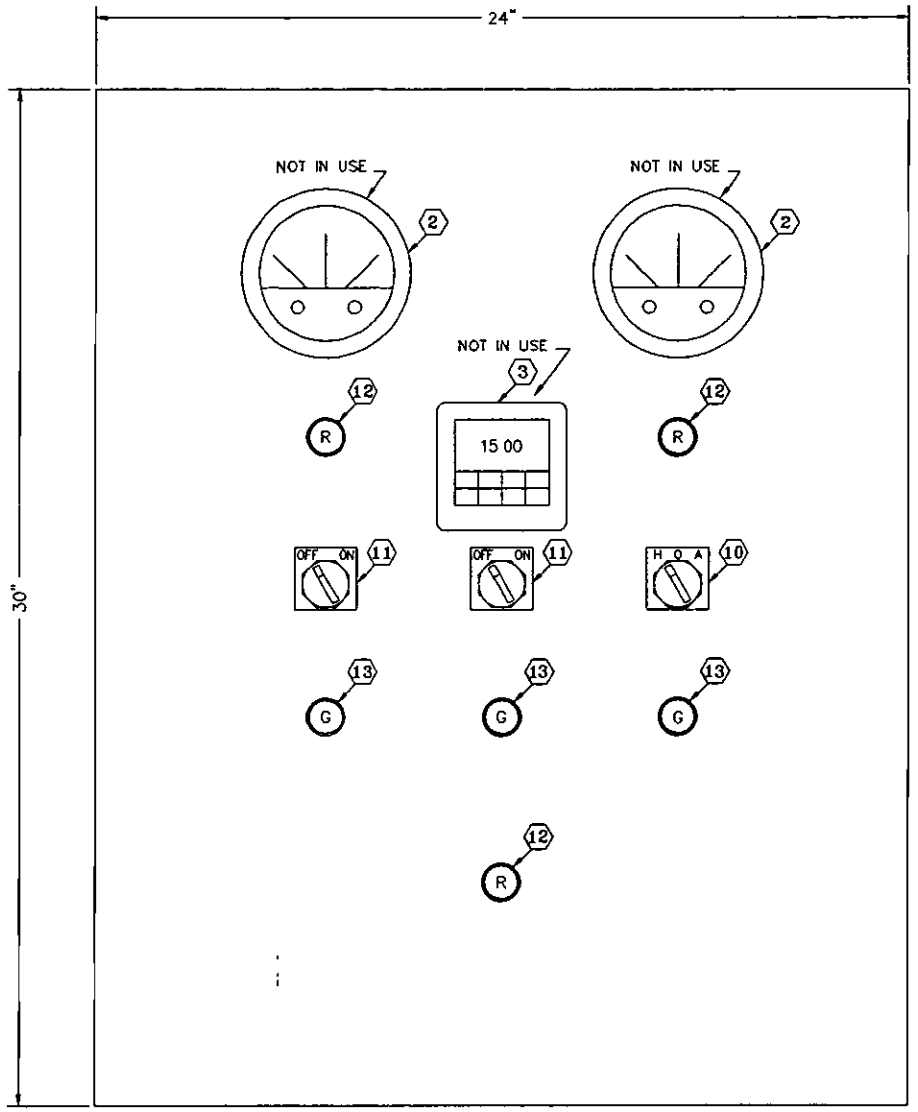
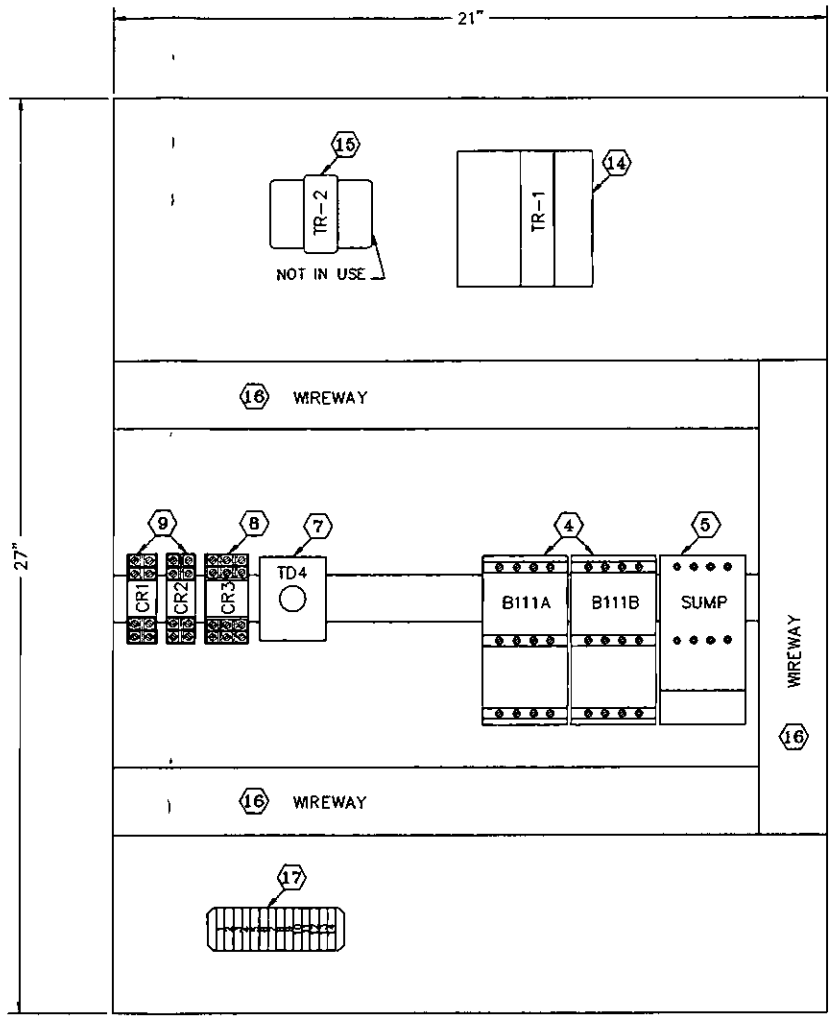


SKID PANEL LAYOUT
(TYPICAL FOR (5) PANELS)



SUB-PANEL LAYOUT
(TYPICAL FOR (5) PANELS)

BILL OF MATERIALS

ITEM	QTY.	DESCRIPTION	REMARKS
1	1	ENCLOSURE NEMA 12, 30x24x6, HOFFMAN CAT # A-302406LP WITH PANEL, 27x21 CAT # A-36P24	
2	2	DWYER PHOTOHELIC DIFFERENTIAL PRESSURE SWITCH/GAUGES, 0-80 INCHES OF WATER DWYER CAT # 3080	
3	1	HONEYWELL CONTROLLER NEMA4, BEZEL DC 300K-0-2A0-20-0000-0	
4	2	TELEMECANIQUE MOTOR STARTERS, CAT # LC1-D0910 WITH OVERLOAD CAT # LR2-D13	BLOWERS B111A, B111B
5	1	MTE MOTOR STARTERS, CAT # MAX020440 WITH OVERLOAD CAT # AXTO 5 4-8.0	SUMP P-161
6	2	WARRICK CONTROLS, P N #16MB1D0	W-5, W-6
7	1	IDEC TIMER, CAT # RTE-P1-1-AC120V WITH SOCKET CAT # SR 2P-06	
8	1	IDEC RELAY, CAT # RH3B-U-120VAC WITH SOCKET CAT # SR 3B-05	
9	2	IDEC RELAY, CAT # RH2B-U-120VAC WITH SOCKET CAT # SR 2B-05	
10	1	TELEMECANIQUE H-O-A SELECTOR SWITCH SWITCH - PN# ZB2-BD3 BLOCK - PN# ZB2-BE101 NAMEPLATE - PN# ZB2-BY2387	HOA
11	2	TELEMECANIQUE OFF-ON SELECTOR SWITCH, 2 POSITION MAINTAINED SWITCH - PN# ZB2-BD2 BLOCK - PN# ZB2-BZ101 NAMEPLATE - PN# ZB2-BY2367	B-111A B-111B
12	3	TELEMECANIQUE PILOT LIGHT, RED LIGHT - PN# ZB2-BV04 BASE - PN# ZB2-BV6	R
13	3	TELEMECANIQUE PILOT LIGHT, GREEN LIGHT - PN# ZB2-BV03 BASE - PN# ZB2-BV6	G
14	1	CONTROL TRANSFORMER, 480VAC TO 120VAC, 1 PHASE, 60Hz, SQUARE-D 0.100KVA	
15	1	INSTRUMENT TRANSFORMER, 120VAC TO 24VAC, POWER = 10VA	
16	5 ft	WIREWAY PANDUIT 2"x2"	OR EQUAL
17	14 1 2 1	IEC TERMINAL BLOCKS, A&B CAT # 1492-U4 END BARRIER, CAT # 1492-N51 END ANCHORS (GRAY) CAT # 1492-N76GR DIN RAIL CAT # 199-DR1	OR EQUAL
18	1	TELEMECANIQUE FUSED DISCONNECT CAT # D115D1, FUSE PN# LP-CC-30	

File: 17.53
D.F.

DRAWING 13

REVISIONS

NO	DATE	DESCRIPTION	BY	CHKD	APPD	NO	DATE	DESCRIPTION	BY	CHKD	APPD
1	5/27/95	UPDATED PART NUMBERS	DMR	JLH	JLH						
2	12/8/99	AS BUILT (LTL SERVICES/HYDROGEOLOGIC, INC.)	BH	JWK	JWK						

REFERENCES

TITLE	DRAWING NO

GMG CORPORATION
930 THIRD STREET GAMONT PA 15138
OFFICE (412) 828-2600 FAX (412) 828-2803

IT CORPORATION

PROJ LOC				PROJ NO.	94-0438
DRAWN BY	DMR	10/17/94	DESIGN BY		
DWG. CHKD BY	JLH	10/19/94	DES CHKD BY		
APPD BY	GMG	10/19/94	DRFT APPRVL		

SKID CONTROL PANEL
PANEL LAYOUT AND BILL OF MATERIALS
CARSWELL AFB GROUNDWATER TREATMENT SYSTEM

DATE OCT 17, 1994
SCALE APPROX. 1"=12"
D 94-0438.602
REV 1

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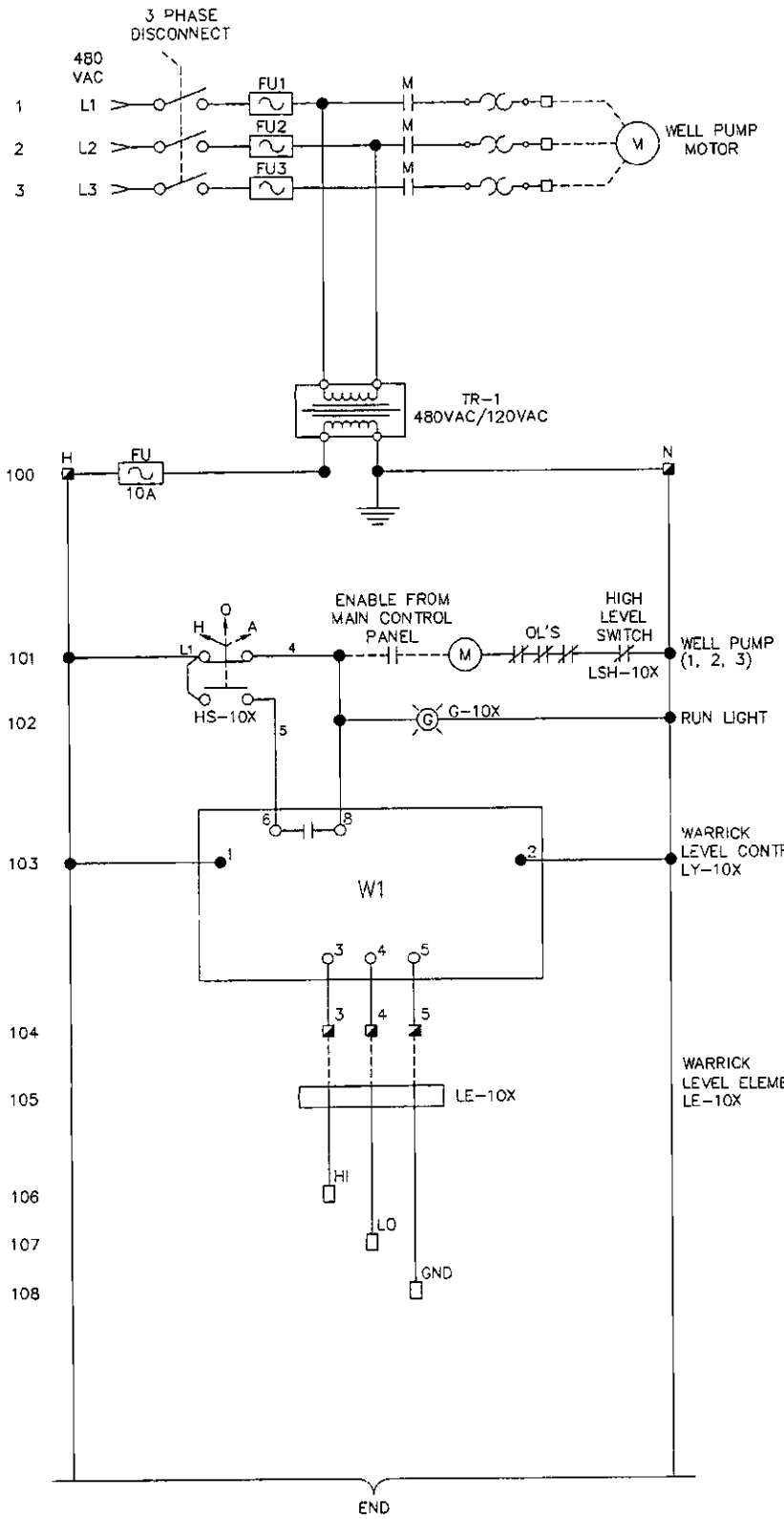
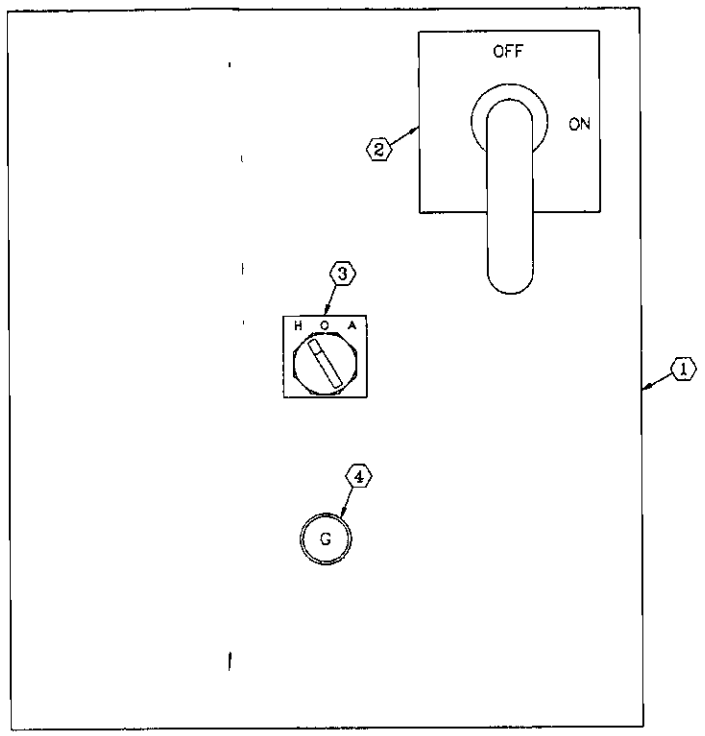
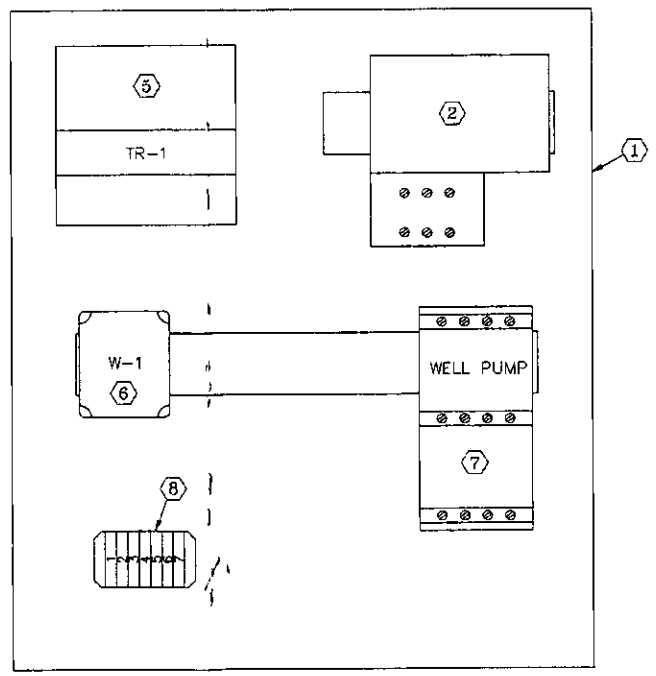




WELL CONTROL PANEL
(PANEL SIZE 16"x14"x6")



SUB-PANEL

BILL OF MATERIALS

ITEM	QNTY	DESCRIPTION	REMARKS
1	1	ENCLOSURE NEMA 12, 16x14x6, CAT # A-1614CH WITH SUB-PANEL CAT # A-16P14	OR EQUAL
2	1	DISCONNECT, FUSED, TELEMECANIQUE CAT # XF304BY	
3	1 2 1	TELEMECANIQUE H-O-A SELECTOR SWITCHES SWITCH - PN# ZB2-BD3 BLOCK - PN# ZB2-BE101 NAMEPLATE - PN# ZB2-BY2387	
4	1	TELEMECANIQUE PILOT LIGHT (GREEN) LIGHT - PN# ZB2-BVO3 BASE - PN# ZB2-BV6	OR EQUAL
5	1	TRANSFORMER 480VAC/120VAC, CLASS 9070 SQUARE-D, 0.100KVA, PN# SFA 65	TR-1
6	1	WARRICK LEVEL CONTROLLERS, PN# 16MB1DO	LY-10X
7	1	TELEMECANIQUE MOTOR STARTERS, PN# LC1-D0910 WITH OVERLOAD PN# LR2-D13	M
8	7 1 2 3	IEC TERMINAL BLOCK, CONTRACLIP RK2.5-4 END BARRIER, AP 2.5-10 END ANCHORS (GRAY) PN# ES35 DIN RAIL, PN# 199-DR1	OR EQUAL

File: DR. 17A-53

DRAWING 14

REVISIONS

NO	DATE	DESCRIPTION	BY	CHKD	APPD
1	3/27/98	UPDATED PART NUMBERS	DMR	JLH	JLH
2	11/8/98	AS BUILT (LT SERVICES/HYDROGEOLOGIC, INC.)	BH	JMK	JMK

REFERENCES

TITLE	DRAWING NO.

GMG CORPORATION
930 THIRD STREET OAKMONT PA 15139
OFFICE (412) 828-2600 FAX (412) 828-2603

IT CORPORATION

PROJ. LOC.				PROJ. NO.	94-0438
DRAWN BY	DMR	10/18/94	DESIGN BY		
DWG. CHKD BY	JLH	10/19/94	DES. CHKD BY		
APPD. BY	GMG	10/19/94	CNST. APPRVL.		

WELL CONTROL PANELS
TYPICAL OF 7
CARSWELL AFB, GROUNDWATER TREATMENT SYSTEM

DATE OCT 18, 1994
SCALE APPROX. 0"=1"
D 94-0438 603
REV. 1

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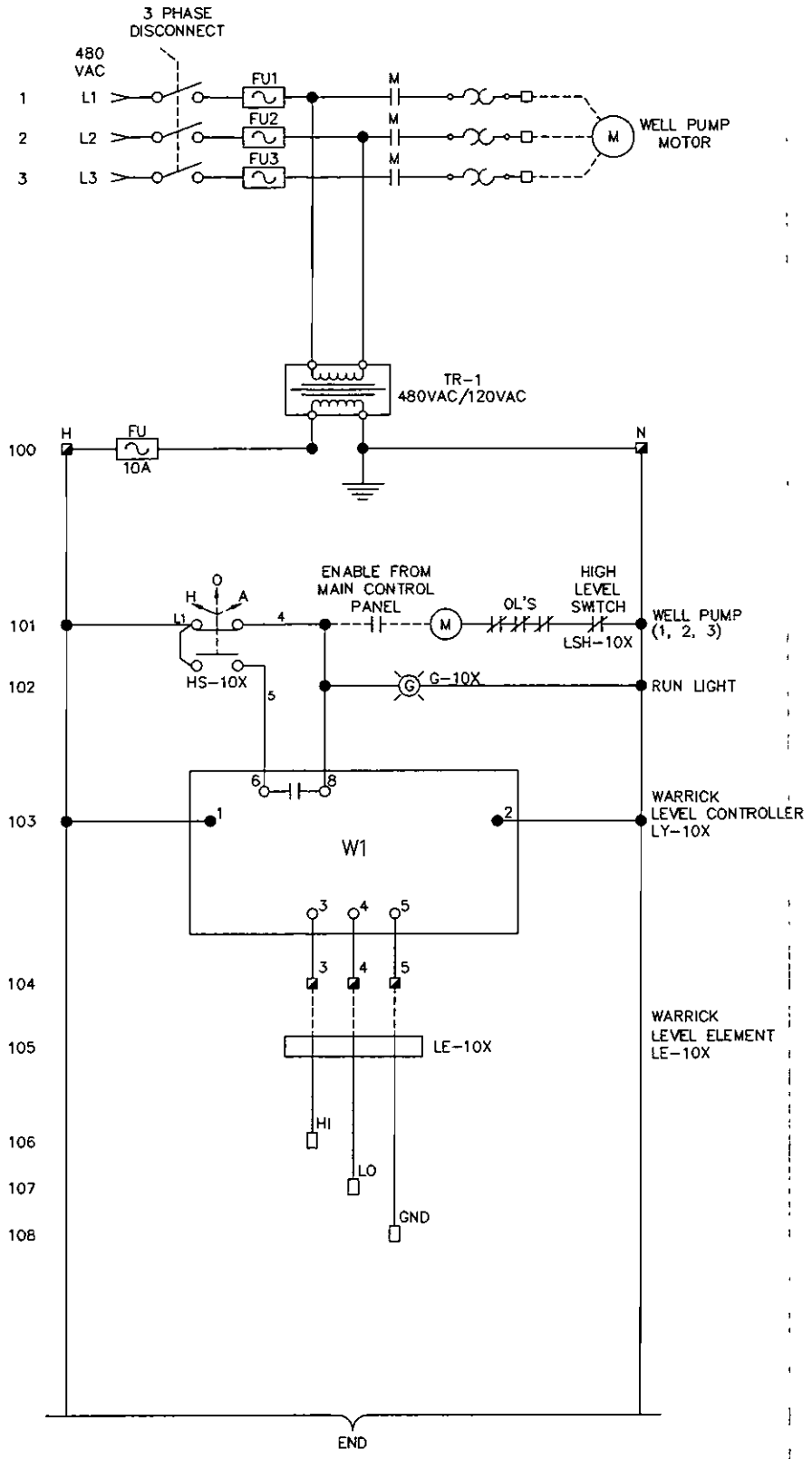
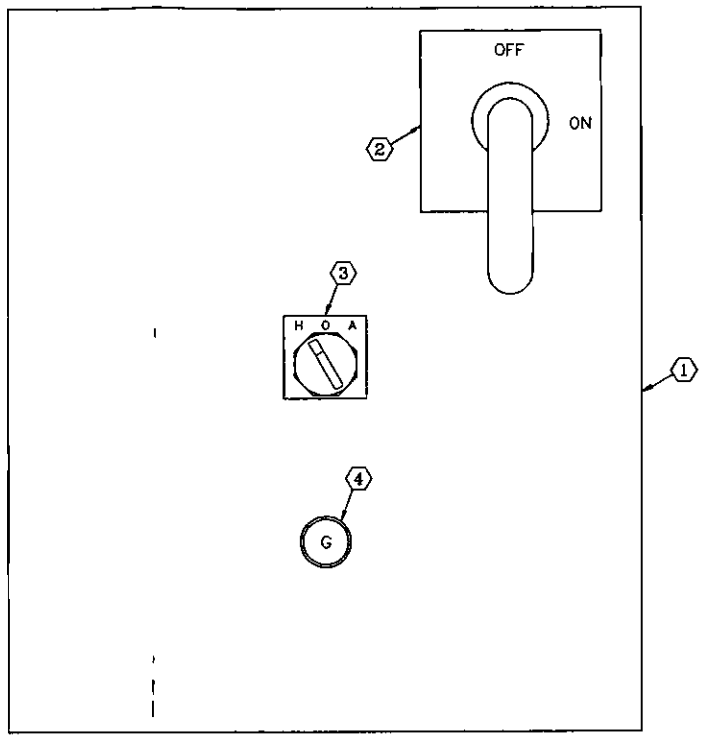
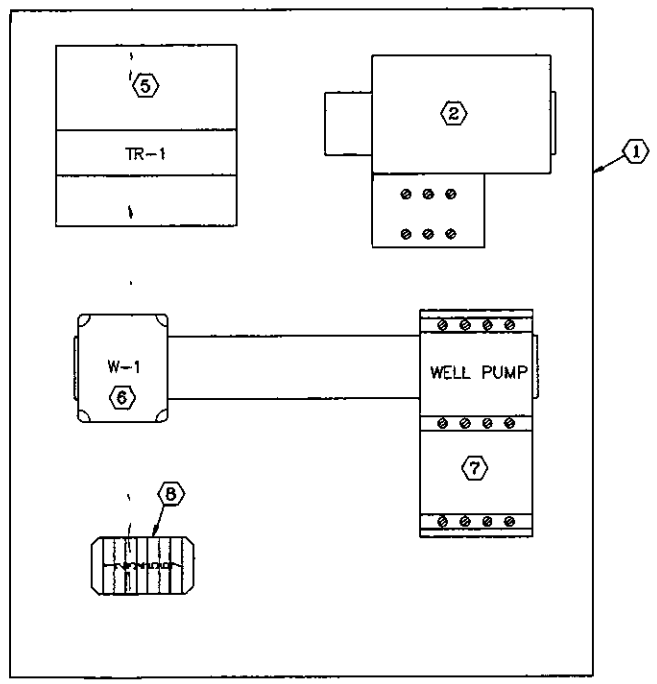




WELL CONTROL PANEL
(PANEL SIZE 16"x14"x6")



SUB-PANEL

BILL OF MATERIALS

ITEM	QNTY	DESCRIPTION	REMARKS
1	1	ENCLOSURE NEMA 12, 16x14x6, CAT # A-1614CH WITH SUB-PANEL CAT # A-16P14	OR EQUAL
2	1	DISCONNECT, FUSED, TELEMECANIQUE CAT # XF304BY	
3	1	TELEMECANIQUE H-O-A SELECTOR SWITCHES	
	1	SWITCH - PN# ZB2-BD3	
	2	BLOCK - PN# ZB2-BE101	
	1	NAMEPLATE - PN# ZB2-BY2387	
4	1	TELEMECANIQUE PILOT LIGHT (GREEN)	
	1	LIGHT - PN# ZB2-BVO3	OR EQUAL
	1	BASE - PN# ZB2-BV6	
5	1	TRANSFORMER 480VAC/120VAC, CLASS 9070 SQUARE-D, 0.100KVA, PN# SFA 65	TR-1
6	1	WARRICK LEVEL CONTROLLERS, PN# 16MB1DO	LY-10X
7	1	TELEMECANIQUE MOTOR STARTERS, PN# LC1-D0910 WITH OVERLOAD PN# LR2-D13	M
8	7	IEC TERMINAL BLOCK, CONTRACLIP RK2.5-4	OR EQUAL
	1	END BARRIER, AP 2.5-10	
	2	END ANCHORS (GRAY) PN# ES35	
	3	DIN RAIL, PN# 199-DR1	

File: D.E. 17A-53

DRAWING 14

REVISIONS

NO	DATE	DESCRIPTION	BY	CHKD	APPD
1	3/27/95	UPDATED PART NUMBERS	DMR	JLH	JLH
2	12/8/99	AS BUILT (LTL SERVICES/HYDROGEOLOGIC, INC.)	BH	JWK	JWK

REFERENCES

TITLE	DRAWING NO

GMG CORPORATION
930 THIRD STREET, DAMONT PA 15139
OFFICE (412) 828-2800 FAX (412) 828-2603

IT CORPORATION

PROJ LOC.				PROJ NO 94-0438
DRAWN BY	DMR	10/18/94	DESIGN BY	
DWG. CHKD BY	JLH	10/19/94	DES. CHKD BY	
APPD BY	GMG	10/19/94	DRFT APPRVL	

WELL CONTROL PANELS
TYPICAL OF 7
CARSWELL AFB, GROUNDWATER TREATMENT SYSTEM

DATE OCT 18, 1994
SCALE APPROX 0"=1"
D 94-0438.603
REV 1

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FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE