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WORK PLAN ADDENDUM FOR INTERIM REMEDIAL ACTION FOR UVB WELL UPGRADE
AT OPERABLE UNIT 4 (OU 4) NTC ORLANDO FL
9/20/2000
CH2M HILL



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September 20, 2000

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Subject: Operable Unit 4: Upgrade Work Plan
Naval Training Center, Orlando, Florida
CTO 0017, Contract No. N62467-98-D-0995

Dear Ms. Nwokike:

Enclosed please find the Work Plan for the UVB Well Upgrade at Operable Unit 4, Naval Training Center, Orlando. Copies are also being distributed to members of the Orlando Partnering Team.

If you have any questions regarding this document, please call.

Sincerely,

CH2M HILL CONSTRUCTORS, Inc.

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WORK PLAN MEMORANDUM

IRA Work Plan Addendum for the UVB Well Upgrade at Operable Unit 4, Naval Training Center, Orlando, Florida

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CONTRACT: Navy Contract # N62467-98-D-0995

CTO: CTO 0017, Naval Training Center (NTC) Orlando

DATE: September 20, 2000

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1. Introduction

This memorandum presents the Work Plan for activities related to the upgrade of UVB recirculation well system as part of the Interim Remedial Action (IRA) at Operable Unit 4 (OU-4) at Naval Training Center, Orlando. This work is being performed under Remedial Action Contract No. N62467-98-D-0995, Contract Task Order (CTO) No. 0017 at Naval Training Center (NTC) Orlando in Orlando, Florida.

During the May 2000 Orlando Partnering Team (OPT) meeting, the OPT reached consensus to upgrade the existing treatment system at the site. This document summarizes the basis of design for the upgrade of the existing groundwater recirculation well system. The primary purpose for the upgrade is to achieve the objective specified for the groundwater recirculation well system which is to mitigate migration of groundwater containing greater than 100 parts per billion (ppb) of total volatile organic compounds (VOCs) to Lake Druid.

The components of the upgrade discussed in this document include:

- Upgrade Work Plan Overview
- Extraction Well Pumping Rate Basis of Design

- Groundwater Treatment and Discharge System Basis of Design
- Process and Instrumentation Design
- Operations and Maintenance (O&M) Plan
- Permit Application Preparation
- Construction Documentation Report
- Schedule

Details of each of these components is presented below.

2. Upgrade Work Plan Overview

The existing groundwater recirculation well system will be dismantled and replaced with a standard groundwater extraction and treatment system to achieve capture of the 100 ppb total VOC plume prior to migration to Lake Druid. The existing facilities will be used to the extent practical to cost-effectively implement the retrofit.

New groundwater extraction pumps will be installed in the two existing UVB wells and will be operated to extract groundwater. The extracted groundwater will be directed to a central treatment facility, treated using a low-profile tray air stripper system, and discharged to the City of Orlando sanitary sewer system. The low-profile tray air stripper will treat the groundwater to below U.S. Environmental Protection Agency (EPA) Maximum Contaminant Levels (MCLs) prior to discharge to the sanitary sewer. Air stripper offgas will not be treated since estimates show that the emissions will be at least one order of magnitude less than the Florida Department of Environmental Protection (FDEP) limit of 13.7 pounds per day (lbs/day) of total hydrocarbons. Influent to the air stripper will be pretreated using a biocide to control biological deposits on the air stripper. Supporting details for the basis of this design are presented in the following sections.

Upon completion of construction, the new groundwater extraction system will be monitored intensely during a four day startup period during which daily monitoring of air stripper influent and effluent will be conducted to assess air stripper performance. Water levels will also be monitored using pressure transducers and manual water level measurements to assess the progress of the capture zone. Sampling of the air stripper offgas will be performed to confirm air emissions are below FDEP limits. Once startup testing is complete, the system will be set into routine, full-time operations. Weekly O&M visits will be conducted for the next three weeks after startup, then monthly O&M visits will be conducted. Autodialed alarms will be responded to on an as needed basis. O&M will consist of checking all equipment for proper operation, routine service of equipment as recommended by the manufacturer, monitoring of system flow rates, pressures, total flow throughput, and groundwater levels. Influent and effluent water samples will be collected monthly, as necessary to comply with the City of Orlando discharge permit. Groundwater will be sampled during the routine quarterly sampling program to monitor system effectiveness. The system will be operated until the remedial action (RA) is identified, at which point, its use will be reevaluated in light of its effectiveness for the site-wide remedy.

3. Extraction Well and Pumping Rate Design

An assessment was performed to evaluate the sole use of the two existing UVB wells for the proposed groundwater extraction system. Pump tests and groundwater modeling were performed to assess the condition of the existing well screens to produce water and affect the capture zone necessary for collection of the 100 ppb total VOC isoconcentration contour.

The following subsections provide the results of the pump test and modeling activities, and a description of the extraction well pumping plan that will be implemented as part of the system upgrade activities.

3.1 UVB Well Pump Tests

Pump tests were conducted on June 28 through July 1, 2000 to assess the maximum pumping capacity and capture zone of the proposed groundwater extraction system using the two existing UVB wells. Submersible pumps with a 55 gpm capacity were installed at the lower screened intervals, at approximately 43 feet below ground surface (45 feet below the top of the wellhead flange), of the two 10-inch diameter UVB wells. The pumps were operated to extract water from the upper and lower screened intervals of the wells. Three pump tests were performed:

- UVB1 step drawdown test at pumping rates of 18 gpm, 27.5 gpm, and its maximum capacity of 30 gpm. The duration of each pump step was approximately 2 hours.
- UVB2 step drawdown test at pumping rates of 14.5 gpm, 21 gpm, and its maximum capacity of 30 gpm. The duration of each pump step was approximately 2 hours.
- UVB1 was pumped at 27 gpm and UVB2 was pumped at 30 gpm simultaneously. The dual-well pumping test was performed for 24 hours.

During all tests, water levels were measured in adjacent existing monitoring and observation wells before, during, and after well pumping.

3.1.1 Pumping Rate Test

In order to evaluate the usefulness of the existing wells and pumps for the new groundwater extraction and treatment system, the maximum sustained pumping rates from the UVB wells were evaluated during step drawdown and 24-hour combined pumping tests. Two Grundfos 4-inch 40S pumps, with an operating capacity of 55 gpm, were installed and run for the pump tests. The maximum pumping rate was determined to be the rate above which the well would dewater to the level of the pump intake and not recharge. The maximum sustained pumping rates achieved in UVB1 and UVB2 during the 24-hour test were 27 and 30 gpm, respectively.

These values are considered the short-term maximum pumping rates for each well. Auditory observations made during the step drawdown pump tests indicated that the upper screen of UVB1 was dewatered during the 24-hour test. This was indicated by the absence of sound due to water cascading down to the bottom of the well from the upper screen. The upper screen in UVB2 was not dewatered; the cascade sound persisted during the entire 24-hour test. This observation shows the transient nature of the shape of the drawdown curve away from the pumping well during the test and indicates that the

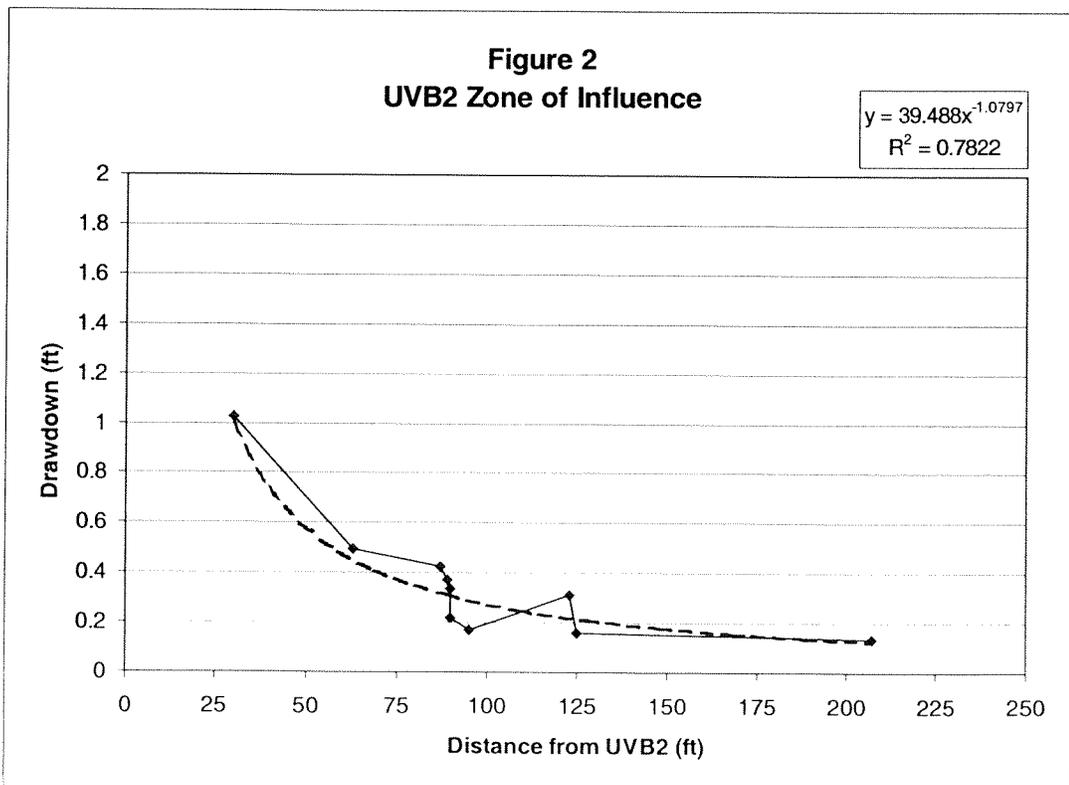
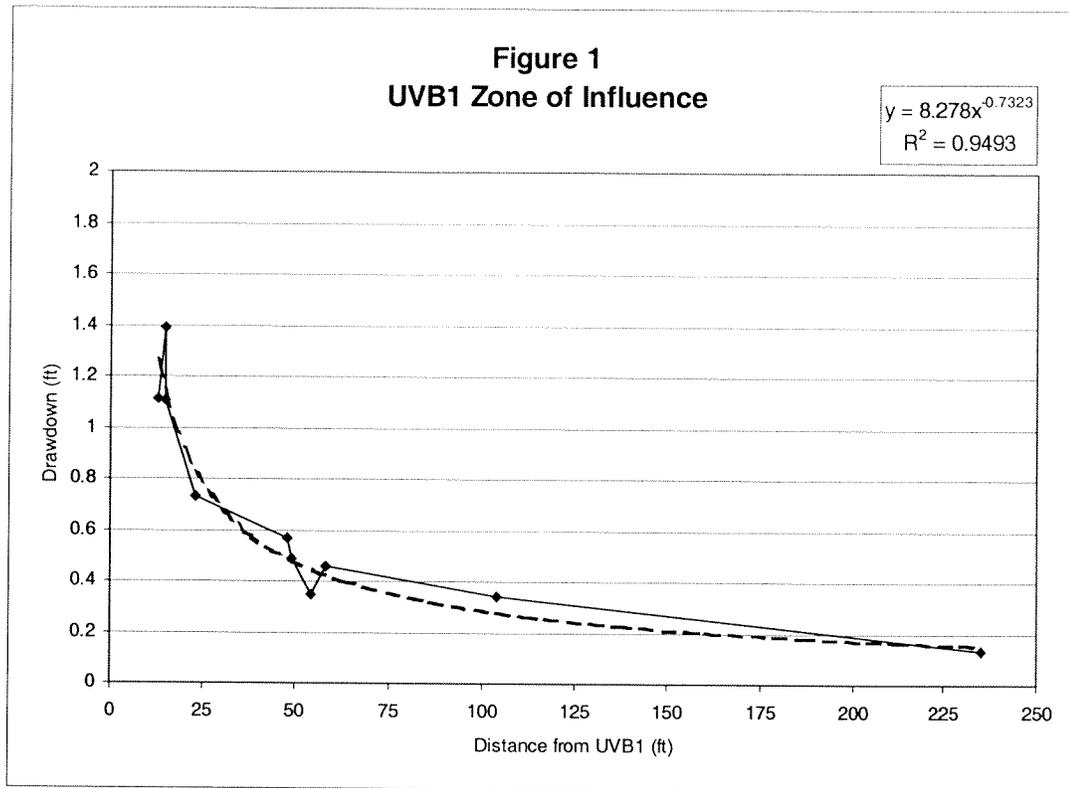
maximum pumping rates are subject to change in the long-term as the shape/slope of the drawdown curve reaches steady-state.

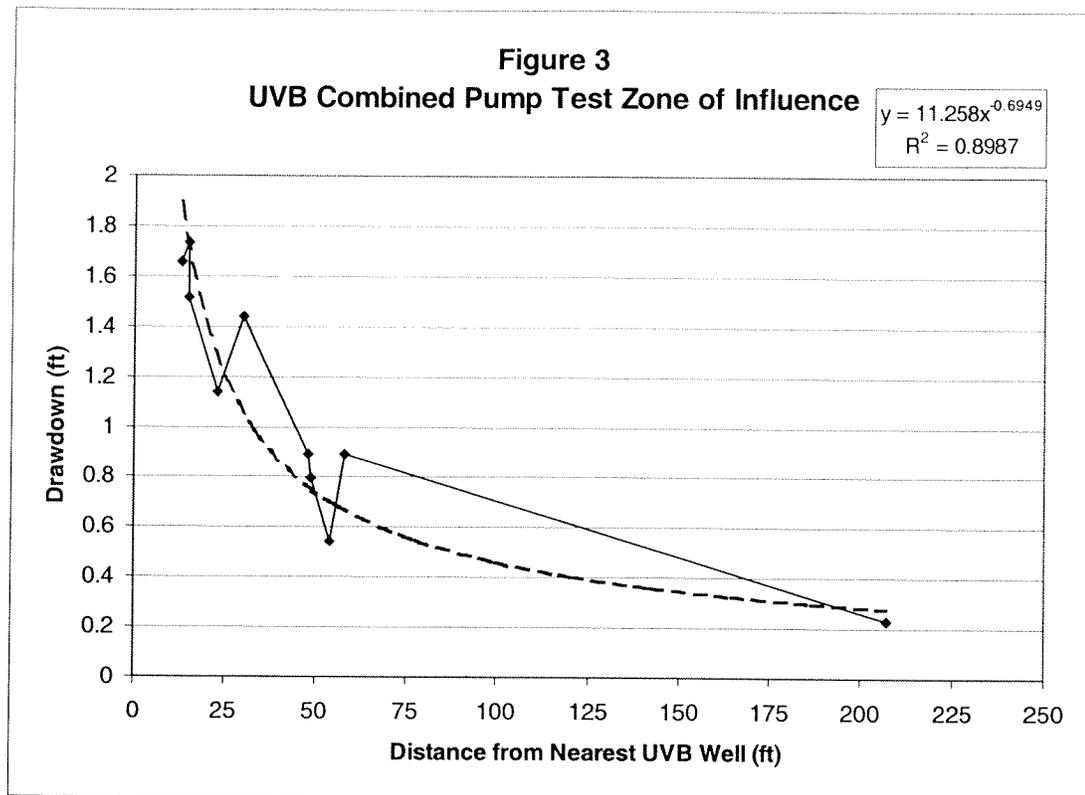
The conclusions from the step drawdown pump tests are that the existing UVB well screens produce water and that a maximum total flow rate of 57 gpm can be expected, at least initially, recognizing that it may change as the system reaches steady-state.

3.1.2 Extraction Well Capture Zone

An analysis of the monitoring well drawdown data was conducted in order to assess the short-term zone of influence of the pumping wells. Water levels measured during the pump test were subtracted from the pre-pumping water levels to determine the change in water level or drawdown. The maximum drawdown was extracted from the data set for each monitoring well to assess the zone of influence. These maximum drawdown data were plotted against the shortest distance to the pumping well.

Figures 1 through 3 present graphics of drawdown versus shortest distance to the pumping wells for each of the three pump tests. Note that the data point corresponding to the greatest distance on the curve is considered a background well, MW36A, which is located greater than 200 feet upgradient of the UVB wells. An exponential curve fit plot was included on the figures to illustrate the general data trend. The exponential equation and curve fit coefficient (R^2 value) are included in the upper right hand corner of the figures for reference purposes only; they were not used in the data analysis.



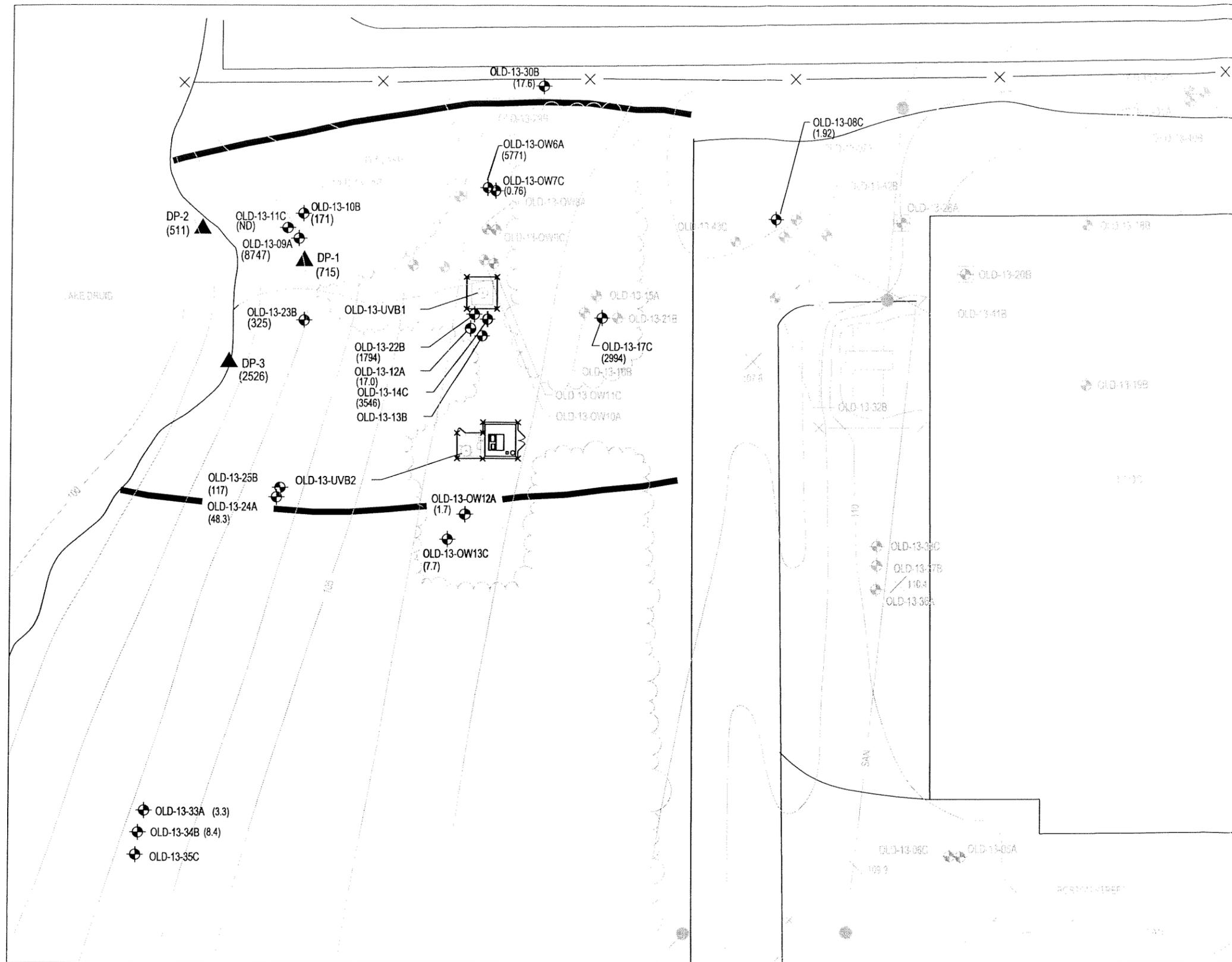


Figures 1 and 2 show that, individually, the UVB wells affected water levels in monitoring wells greater than 100 feet away. This is shown by measured drawdown greater than that in the background well MW36A. Figure 3 shows the additive effect of dual-well pumping on drawdown during the combined pumping test. At a point 100 feet away from the UVB pumping wells, the combined drawdown was greater than 0.5 feet, compared to approximately 0.3 feet during the individual UVB well pumping tests.

Figure 4 presents a site plan showing the estimated extent of the 100 ppb total VOC concentrations in groundwater over all aquifer zones plotted using groundwater sampling data from June-July 2000. It shows that the estimated extent of the 100 ppb total VOC contour along the alignment of the UVB wells, perpendicular to the groundwater flow direction, is approximately 100 feet north of UVB1 and 30 feet south of UVB2.

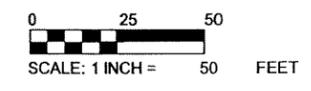
Due to the fact that the UVB well zone of influence is greater than 100 feet from the UVB wells and the estimated extent of the 100 ppb total VOC isoconcentration is within this zone, use of the two UVB wells solely for the groundwater extraction system is justified for attainment of the objective.

Attainment of the required capture zone within the 24-hour timeframe of the test indicates that the actual required long-term sustained pumping rate may be lower than 57 gpm. However, a conservative approach will be taken initially and the system will be started at the maximum sustained pumping rate of 57gpm to achieve capture of the plume immediately. Pumping rates and water levels will be observed during the initial weeks of operation. If excessive drawdown is noted at distances significantly greater than necessary,



LEGEND

- 
 OLD-13-10B (100)
 Monitoring well location and designation (July 2000 total VOC concentrations)
- 
 DP-1
 Drive Point Well Location and Designation
- 
 OLD-13-27A
 Microwell location and designation
- 
 OLD-13-UVB2
 Interim remedial action recirculation well
- 
 Estimated Extent of 100 ppb Total VOC in Groundwater Contour
- 
 Fence
- 
 Ground Surface Elevation contour (1-foot interval)
- 
 Ground elevation 114.2



SOURCE: Naval Training Center Public Works Department, Storm Sewer Map, 1978

FIGURE 4
 JULY 2000 TOTAL VOC CONCENTRATIONS
 IN GROUNDWATER

then throttling of the flow rate will be considered to reduce O&M costs (i.e., City of Orlando sanitary sewer discharge fees) and minimize impacts the surrounding water bodies and/or aquifer.

3.2 Groundwater Modeling

Water level data from the pump tests were used to model the steady-state capture zone of the proposed dual-well groundwater extraction system. The primary intent of the modeling was to estimate the steady-state extent of capture of the proposed pumping system.

Water level data from the July 2000 pump tests were evaluated using confined, semi-confined, and unconfined aquifer solutions. The best fit to the data was attained using a leaky aquifer solution. The parameters obtained using this solution were input into a MODFLOW groundwater model that essentially modeled groundwater flow at the site as one equivalent aquifer. Since the UVB wells are screened over two intervals (shallow and deep aquifer zones), and pumping was conducted from both zones, the parameters generated by evaluation of the data set were assumed to represent the combination aquifer (i.e., the resultant hydraulic conductivity value does not represent either the shallow or deep aquifer alone, but a combination of the two).

A groundwater modeling effort was completed to establish capture zones for the wells UVB1 and UVB2 pumping at their proposed rates of 27 and 30 gpm, respectively. GMS-MODFLOW was used in this effort. The aerial extent of the existing site-specific model, provided by Harding Lawson Associates and based on the U.S. Geologic Survey model, was limiting because the capture zones for the wells at the proposed pumping rates were found to be beyond the boundaries of the model. An extended model was produced partially based on the parameter conditions and boundary conditions of the existing model. The modifications included conversion to a three layer model, extension of the model domain large enough to minimize potential for boundary interference due to the pumping wells, elimination of flow conditions along the north and the south boundaries, and use of an effective recharge rate of 19 inches per year. Some of the parameters, including hydraulic conductivity, were altered in this new model to better match model output to actual drawdown measurements obtained during the pump test.

Both transient and steady state runs were made to evaluate model set up and delineate the capture zone. Drawdowns from the transient model run were qualitatively compared to the drawdown observed near the pumping wells during the June-July 2000 pumping tests. The modeled and actual drawdowns after 8 hours of pumping compared well and were estimated to be within 20 percent. The transient model was also used to qualitatively assess the time to reach steady-state conditions. The transient model runs established that steady state conditions were attained earlier than the life of the proposed pumping scheme (30 years). Hence, steady state capture zones were used for the analysis.

The results from MODFLOW were input into MODPATH for the steady-state condition (40+ years) to obtain the particle flow path lines over the long-term. MODPATH was used to simulate the particle paths which establishes an estimate of the steady-state capture zone. The MODPATH analysis used a porosity value of 0.3.

Figure 5 illustrates the steady-state capture zone of the proposed dual-well groundwater extraction system operating at pumping rates of 60, 30, and 6 gpm. The steady-state capture zone for the proposed system at 60 gpm is estimated to cover an area of approximately 1,200 feet wide by 1,200 feet long, or approximately 30 acres. This is far beyond the required capture zone; therefore, additional model runs were made to qualitatively estimate the reduction in capture zone as pumping rates are reduced. The results, including drawdown and water table elevation head plots, of all model runs are included in Attachment A. The capture zone analysis indicates that, in the long-term, a 90 percent flow turn down, to approximately 6 gpm total flow rate, may be possible to maintain a capture zone to meet the system objectives. The modeling performed to assess this turn down ratio; however, was very approximate and not checked against any actual field data from pump tests at low pumping rates. Further evaluation will be conducted after system startup to determine the ultimate long-term operational pumping rate (See Section 5).

As was previously mentioned, the model results presented here are an estimate and uncertainty related to the parameter and boundary condition variability was not addressed as part of this screening-level effort. Groundwater levels at designated monitoring locations will be monitored periodically during the operation of the pumping wells to confirm the level of capture attained by the wells.

3.3 Extraction Well Pumping Plan for System Upgrade

Two new submersible pumps will be placed at the lower screened intervals of the two UVB wells. The two existing UVB wells will be pumped initially at a combined total flow rate of 57 gallons per minute (gpm). The required capture zone will be attained relatively quickly (i.e., estimated to be within 24-hours) after which pumping rates and water levels will be observed using flow meters and pressure transducers to assess the migration of the extent of the capture zone. If excessive drawdown is noted at distances significantly greater than necessary, then throttling down the flow rate will be considered to reduce O&M costs (i.e., City of Orlando sanitary sewer discharge fees) and minimize impacts the surrounding water bodies and/or aquifer(s). Modeling suggests that it is possible that the long-term combined pumping rate may be turned down to approximately 10 gpm.

4. Groundwater Treatment and Discharge System Design

A historic data review, pump test water sampling, and an air stripper performance analysis were conducted to evaluate the scope of work necessary to implement aboveground treatment of the groundwater.

4.1 Historic Data Review

The scope of the historic data review primarily involved review of the following documents:

- Remedial Investigation (HLA, 2000 and Draft Appendices 1998)
- Focused Feasibility Study (ABB, 1997)
- Feasibility Study (HLA, 1999)
- Operation and Maintenance Manual for Recirculation Well Remediation Systems (SBP and Roy F. Weston, 1999)

Pertinent components of the Focused Feasibility Study (FFS) are summarized in detail below since they have direct bearing on the proposed system upgrade.

4.1.1 Focused Feasibility Study (ABB, 1997)

The FFS investigated three options for the IRA, pump and treat with ex-situ air stripping, in-situ air stripping, and groundwater circulation well technology. The groundwater circulation well technology was implemented and has been determined to be ineffective due to poor reinjection capacities. The proposed alternative for the upgrade is pump and treat with ex-situ air stripping, which was the most economical alternative discussed in the FFS.

The pump and treat system discussed in the FFS is very similar to the proposed upgrade described herein. The FFS pump and treat alternative assumed two extraction wells, at 30 gpm per well would capture the 100 ppb total VOC zone. However, these parameters were qualified as being subject to change during detailed design. Discharge was planned to the Orlando sanitary sewer. Pretreatment was assumed required for tetrachloroethylene (PCE), trichloroethylene (TCE), and cis-1,2 dichloroethylene (cis-1,2 DCE). Inorganics concentrations were assumed below the City of Orlando discharge limits. Air emissions testing and calculations showed that air emissions treatment would not be required.

The FFS pump and treat alternative used discharge to the POTW because pre-treatment to 100 ppb for each chemical is required, a discharge permit is in place already, and additional treatment would be required for inorganics if discharge to surface water were implemented.

4.1.2 Historic Influent Characteristics

Historic data review of the above listed references was performed to estimate the influent characteristics for the groundwater treatment system. This was performed prior to groundwater sampling during the June-July 2000 pump test to expedite preparation of the air stripper specification. The primary chemicals of concern (COCs) are PCE, TCE, and cis-1,2 DCE.

Table 1 presents historic data from wells in the vicinity of the extraction wells UVB1 and UVB2. This data represents an average of all data presented in Appendix D of the Remedial Investigation Report. VOCs, pH, calcium, iron, and manganese were considered the primary COCs for the air stripper design.

TABLE 1
Monitoring Well Data Pertaining to Air Stripper Influent Characteristics

Well ID	Depth (ft bgs)	Location ¹	DTW (ft bgs)	VOC Contaminants (µg/L)	Average Inorganics (µg/L)
13-12A	11.5	central	2.0	TCE – 8	pH – 5.67, Ca – NA, Fe – 100U, Mn – 15U
13-22B	32	central	1.8	TCE – 190J, cis-1,2 DCE - 590J	pH – 5.36, Ca – 344U, Fe – 46.9J, Mn – 12.1U
13-15A	12.5	fringe, upgradient	2.2	PCE – 26	pH – 6.46, Ca – NA, Fe – 110, Mn – 15U
13-21B	32	fringe, upgradient	2.4	TCE – 625, cis-1,2 DCE – 890	pH – 4.75, Ca – NA, Fe – 287.5, Mn – 15U

TABLE 1
Monitoring Well Data Pertaining to Air Stripper Influent Characteristics

Well ID	Depth (ft bgs)	Location ¹	DTW (ft bgs)	VOC Contaminants (µg/L)	Average Inorganics (µg/L)
13-23B	31	fringe, downgradient	1.7	TCE - 2,475, cis-1,2 DCE - 1,650	pH - 4.68, Ca - NA, Fe - 415, Mn - 15U
13-07A	18.5	far fringe, upgradient	4.7	PCE - 29,800	pH - 6.04, Ca - 25,100U, Fe - 83.34J, Mn - 12.2U
13-41B	28	far fringe, upgradient	4.7	TCE - 2,100, cis-1,2 DCE - 560, PCE - 370	pH - 4.36, Ca - 3,480U, Fe - 1,180, Mn - 22.5U
13-38C	55	far fringe, upgradient	6.1	ND for VOCs	pH - 5.97, Ca - 4,490U, Fe - 2120, Mn - 34.2U
13-36A	14	far fringe, upgradient	6.1	TCE - 3	pH - 6.42, Ca - 16,800U, Fe - 447, Mn - 2.7U
13-09A	11	far fringe, downgradient	1.5	TCE - 410, PCE - 71J, cis-1,2 DCE - 1,220	pH - 5.09, Ca - 3,350J, Fe - 51.4J, Mn - 12.1U
13-11C	62	far fringe, downgradient	0.5	Not sampled	pH - 4.57, Ca - 56,000U, Fe - 106, Mn - 2.9U
13-24A	12.7	far fringe, downgradient	2.4	TCE - 19J	pH - 5.54, Ca - NA, Fe - 190, Mn - 15U
13-25B	23.5	far fringe, downgradient	2.3	PCE - 250, TCE - 24	pH - 4.89, Ca - NA, Fe - 105, Mn - 15U

NOTES:

1 - Location refers to relative distance from extraction wells (UVB1, UVB2) as related to 100 foot capture zone.

For the purposes of designing the air stripper, TCE and cis-1,2 DCE are considered the drivers for equipment performance specification. It was assumed that the extraction wells will pull average water quality from all three zones (shallow, intermediate, and deep). A steady-state mix of 25% central, 25% fringe upgradient, 25% far fringe upgradient, 20% fringe downgradient, and 5% far fringe downgradient water was assumed to compute a weighted average influent water quality. The following lists the area-specific contaminant concentrations.

Central Conditions (25%):	TCE - 99 ppb	cis-1,2 DCE - 295 ppb
Fringe, Upgradient Conditions (25%):	TCE - 313 ppb	cis-1,2 DCE - 445 ppb
Far Fringe, Upgradient Conditions (25%):	TCE - 526 ppb	cis-1,2 DCE - 140 ppb
Fringe, Downgradient Conditions (20%):	TCE - 2,475 ppb	cis-1,2 DCE - 1,650 ppb
<u>Far Fringe, Downgradient Conditions (5%):</u>	<u>TCE - 151 ppb</u>	<u>cis-1,2 DCE - 407 ppb</u>
Average Overall Conditions:	TCE ~ 750 ppb	cis-1,2 DCE ~ 600 ppb

PCE was detected less frequently than TCE and cis-1,2 DCE. To assess its impact on the influent water quality, its weighted average was estimated using the same method as TCE and cis-1,2 DCE. The resultant average of 1,900 ppb PCE shows that the upgradient source area water, even when diluted with surrounding groundwater with much lower

concentrations of PCE, still greatly affects the quality of water extracted by the UVB wells. Therefore, PCE was also considered a driver for equipment performance in the design.

The following inorganic data was compiled from the Feasibility Study and Remedial Investigation background water quality assessment:

- Calcium – 52.9 mg/L (shallow), 7.7 mg/L (deep), 36.8 mg/L (RI Background Value), <5.0 total mg/L in 8/96 IRA Pump Test (FS, 1999)
- Iron – 0.057 mg/L (shallow), 1.4 mg/L (deep), 1.2 mg/L (RI Background Value), 0.35 to 0.49 total mg/L in 8/96 IRA Pump Test (avg. 0.4 mg/L) (FS, 1999)
- Manganese – 0.0038 mg/L (shallow), 0.0069 mg/L (deep), <0.005 mg/L in 8/96 IRA Pump Test (FS, 1999)
- Alkalinity – 5.9 to 7.7 (mean 6.6 mg/L as CaCO₃) (IRA Pump Test Data 8/96, FS, 1999)
- pH – overall weighted average pH is estimated to be 5.4

4.2 Influent Water Quality Design Conditions

Table 2 presents the design values used for the air stripper performance specification. The maximum estimated concentrations were arbitrarily assumed to be double the average concentrations for air stripper specification purposes. Note that these values were based solely on the historic groundwater data discussed in Section 3.1.

TABLE 2
Air Stripper Design Conditions

Parameter	Average	Maximum
Tetrachloroethylene (µg/L)	1,900	3,800
Trichloroethylene (µg/L)	750	1,500
cis-1,2 dichloroethylene (µg/L)	600	1,200
Temperature (°F)	72	Range of 64 - 77
pH (pH units)	5.4	Range of 4.4 - 6.5
Total Iron (mg/L)	0.4	Range of <0.005 – 2.1
Total Manganese (mg/L)	<0.005	Range of <0.003 - <0.034
Calcium (mg/L)	<5.0	Range of <0.3 - <56.0
Total Alkalinity (mg/L and CaCO ₃)	6.6	Range of 5.9 – 7.7

4.3 Pump Test Water Sampling Results

Untreated water samples were collected at three times during the June-July 2000 combined UVB well pump test to assess the specified air stripper design conditions in Table 2. Table 3 presents a summary of the sampling results.

The total VOC concentrations were significantly lower than those used for air stripper specification (See Table 2). The total VOC concentration of the effluent from the pump test ranged from 301 to 214 ppb. There was a 30 percent decrease in the concentration from approximately 12 hours into the test versus 22 hours into the test (10 hour period). The primary VOC detected was cis-1,2 DCE which comprised 75 to 80 percent of the total VOC measured. TCE comprised the remaining balance of total VOC measured. PCE was not detected, however, vinyl chloride was detected at low concentrations (less than 2 ppb). The pH of the final water sample collected 22 hours into the test was 5.81.

The results of the pump test water sampling confirm that the air stripper as designed and specified in Section 3.2 will adequately treat the water as pumped from the combined UVB well extraction system. One order of magnitude contingency exists between the air stripper

TABLE 3

JUNE 2000 PUMP TEST WATER QUALITY DATA

SA 13, OU4, Naval Training Center, Orlando, FL
152044.34.02.04.09

Sample data provided for combined UVB1 (27 gpm) and UVB2 (30 gpm) water samples collected at 3 times during pump test.

indicates above Florida MCLs.

All water sample were in compliance with the City of Orlando discharge limits.

Detected Constituents (COCs only)	FL MCL (µg/L)	Orlando (µg/L)	06/30/2000		
			8:00 W1 (µg/L)	12:30 W2 (µg/L)	17:00 W3 (µg/L)
pH	NA	5.5<pH<9.5	NA	NA	5.81
trans 1,2 dichloroethene	70	NA	2.2	1.5	1.5
Trichloroethene	3	NA	50	45	43
Vinyl chloride	1	NA	1.6	1.2	<1
cis 1,2 dichloroethene	70	NA	240	190	160
1-methylnaphthalene	NA	NA	1.6	1.7	2.0
2-methylnaphthalene	120	NA	1.2	1.1	1.9
Acenaphthene	20	NA	1.5	1.1	1.8
Fluorene	280	NA	0.84	0.96	1.2
Naphthalene	6.5	NA	1.9	2.2	2.2
Total Toxic Organics (TTO)	NA	2,130	300.8	244.8	213.6

design parameters and the actual initial groundwater quality to allow for potential future fluctuations in groundwater concentrations as the system capture zone expands with time to the source area.

4.4 Effluent Standards

The initial plan for discharge is to discharge the treated groundwater to the City of Orlando sanitary sewer system. Attachment B contains the City of Orlando discharge standards. The standard most applicable to this site is the total toxic organic (TTO) limitation of 2.13 milligrams per liter (mg/L). Although sampling during the June-July 2000 pump test indicated that TTO (i.e., total VOC) concentrations are below this limit, an air stripping treatment system will be provided and used to pretreat the groundwater prior to discharge. Provision of the air stripper will provide insurance for future potential rises in TTO levels as the groundwater extraction system taps into a source zone.

Attachment C contains performance modeling results for the 5-tray air stripper proposed for the treatment system. The proposed air stripper will treat an estimated average steady-state flow rate of 30 gpm containing the maximum estimated concentrations of TCE, PCE, and cis-1,2 DCE (See Section 3.2) to MCLs after 4 trays of processing. An extra tray was added for redundancy and added security should one of the trays be removed for cleaning. The proposed air stripper will also be able to treat an estimated maximum flow rate of 60 gpm containing the average estimated concentrations of TCE, PCE, and cis-1,2 DCE (See Section 3.2) to MCLs after 5 trays of processing.

4.5 Pretreatment

Pretreatment is typically performed to reduce the fouling potential, either inorganic scale or biological growth, on the treatment system components. The inorganic analytical data discussed in Section 3.1.2 and data from a small June 2000 groundwater sampling event of a well nearby UVB1 was used to calculate the potential for calcium carbonate scale formation on the air stripper. The Langlier Index (LI) is used to estimate the scaling potential. An LI Index of 1 indicates little or no tendency of the water to form calcium carbonate scale. The LI calculated for this water is less than -2.9 and indicates zero scaling potential. Attachment D contains all design calculations that support this basis of design.

North East Environmental Products, a major manufacturer of tray air strippers, recommends pretreatment for influent waters that contain greater than 0.5 mg/L of total iron and total manganese. Historic data shows that the concentration of iron and manganese is consistently below 0.5 mg/L. Therefore, the concentrations of iron and manganese do not cause alarm for precipitate fouling.

The former groundwater recirculation well system was previously operated using a biocide to control buildup associated with iron bacteria activity. The problem is evident as a rust/brown colored coating on the outside of the equipment that was submersed in the water when the existing pumps were pulled from the UVB wells. This same buildup was present on the inside of the piping used for the June-July 2000 pump tests. The same biocide used to control the problem previously will be used for the upgrade. The exact dosage will be determined during system startup.

4.6 Offgas Treatment

VOC emissions from the air stripper are estimated to be below the FDEP maximum allowable emission rate of 13.7 lbs/day. Support calculations are included in Attachment D. Assuming a water flow rate of 60 gpm and 100 percent treatment (i.e., 100 percent emission) of the average estimated concentrations of contaminants in the groundwater, the estimated total VOC emission rate is 2.34 lbs/day. Therefore, no offgas treatment system will be installed. Routine O&M will include periodic total VOC emission estimation and confirmation that no offgas treatment is required.

5. Process and Instrumentation Design

The design drawings for the groundwater treatment system upgrade are included in Attachment E. A low-profile tray air stripper will be installed on a new concrete pad located adjacent to the existing UVB2 compound. The two new submersible pumps will pump

water from the two UVB wells to the air stripper system. Each well discharge will be equipped with its own flow measuring and sampling devices. The groundwater from the two UVB wells will be combined and biocide added to control iron deposits. The dosed groundwater will cascade through the counter-current low-profile tray air stripper for removal of VOCs. The air stripper sump will be equipped with an effluent pump to direct treated groundwater to a nearby City of Orlando sanitary sewer manhole. A process and instrumentation diagram for the system is included in Attachment E.

The field piping will be Schedule 80 PVC pipe and installed below grade. Attachment E contains a field piping plan that shows the proposed locations of the untreated and treated water pipes.

The new pumps and air stripper will be integrated into the existing control system. The new pumps will be connected to the existing submersible pump control circuit; however, the existing variable frequency drives (VFDs) will not be utilized. Rather, a manual flow control valve will be used to manually throttle the flow rate as necessary. The air stripper system will be inserted in the control circuit where the former blower for the recirculation well system resided. The air stripper will be supplied with its own, independent control panel (mounted on the skid with the air stripper). Attachment F contains the detailed air stripper specifications. To summarize, the air stripper will be provided with the following functional controls:

- a. When the blower motor fails, send signal to extraction well control panel to alarm and shut down extraction well pumping system immediately. When an alarm shutdown occurs, the equipment is locked out and will require operator intervention to reset.
- b. When the effluent pump motor fails, send signal to extraction well control panel to alarm and shut down extraction well pumping system immediately. When an alarm shutdown occurs, the equipment is locked out and will require operator intervention to reset.
- c. When blower discharge pressure is HIGH, stop blower (blower must still have 5-minute delay) and send signal to extraction well control panel to alarm and shut down extraction well pumping system immediately. When an alarm shutdown occurs, the equipment is locked out and will require operator intervention to reset.
- d. Blower discharge low pressure alarm shall be active only when blower is on. During blower start, pressure alarm will be bypassed for the appropriate length of time to allow blower to reach operating pressure. When blower discharge pressure is LOW, shut down blower (blower must still have 5-minute delay) and send signal to extraction well control panel to alarm and shut down extraction well pumping system immediately. When an alarm shutdown occurs, the equipment is locked out and will require operator intervention to reset.
- e. Blower discharge air flow rate alarm shall be active only when blower is on. During blower start, air flow rate alarm will be bypassed for the appropriate length of time to allow blower to reach the operating air flow rate. When blower inlet air flow rate is LOW, shut down blower (blower must still have 5-minute delay) and send signal to extraction well control panel to alarm and shut down extraction well pumping

system immediately. When an alarm shutdown occurs, the equipment is locked out and will require operator intervention to reset.

- f. When air stripper sump level is HIGH-HIGH, send signal to extraction well control panel to indicate an alarm condition and to shut down extraction well pumping system immediately.

The existing autodialer will be reprogrammed to call a pager for the appropriate active operations personnel upon activation of any alarm condition.

6. Operations and Maintenance Plan

O&M of the new groundwater treatment system will be conducted according to the following general schedule:

- Daily during startup period of approximately four days
- Weekly for the next three weeks
- Monthly, thereafter

O&M will also be conducted as required by alarm conditions indicated by the autodialer. Influent and effluent samples will be collected from the air stripping system during the monthly O&M visits to comply with the City of Orlando discharge permit conditions. Groundwater sampling will be performed quarterly according to the previously scheduled monitoring events. Detail descriptions of the startup and routine O&M programs are provided below.

6.1 Startup O&M Plan

Upon completion of construction, the new groundwater extraction system will be monitored intensely during a four day startup period. The purpose of the startup period is to perform the following:

1. Conduct functional and performance testing of the air stripper to confirm compliance with the specifications and document compliance with the City of Orlando discharge permit.
2. Tune mechanical operations of the well pumps and the air stripping system to ensure no leakage and establish appropriate settings of equipment for efficient operations. This procedure will establish the appropriate operational parameters (i.e., well pump flow rates, blower air flow rate, and air stripper pressure) against which future O&M visits will be compared to determine operational status.
3. Establish baseline groundwater level conditions.
4. Monitor adjacent groundwater levels to ensure attainment of the appropriate capture zone and minimize groundwater pumping. This procedure will establish the actual feasible turndown of the groundwater pumps, postulated to be as low as 6 gpm in Section 3.2, while maintaining capture of the 100 ppb total VOC plume.
5. Optimize operations (i.e., flow rate) of the biocide metering pump to cost-effectively minimize fouling.

Day one of the startup period will begin with starting the groundwater pumps and setting the flow rates to their maximum pumping rates as established during the June-July 2000 pump test. Once the pump flow rates are set, the system will be started and checked for leaks and all fittings tightened and adjusted as necessary. The functionality of the air stripper will be checked for compliance with the specifications. The effluent pump will be checked for proper float-controlled operations. The blower air flow rate and pressure will be monitored. The system controls will be tested for proper shutdown, alarm, and autodialing operation. The functionality testing will be continued until all system equipment is set to its appropriate, efficient, operational level. These settings will be noted and maintained for performance testing and routine operations. After functionality testing is complete, the system will be shutdown and groundwater levels allowed to recover for a minimum of one overnight period.

The second day of startup will involve monitoring of air stripper performance. The intent of the testing is to ensure that the air stripper meets the performance requirements in the specification. The detailed specifications for the functional and performance tests are described in Part 3.04 of the Air Stripper Specification in Attachment F. As part of the air stripper performance testing, monitoring of air stripper influent and effluent will be conducted to assess air stripper performance. Two tests will be performed to test the treatment efficiency of the air stripper. The first test will be performed to test the air stripper at a maximum flow rate of 60 gpm and estimated average total VOC concentration (approximately 3,250 ppb). The second test will be performed to test the air stripper at an average flow of 30 gpm and estimated maximum total VOC concentration (approximately 6,500 ppb). The water for these tests will be pumped from select contaminated monitoring wells (OLD-13-17C for the average concentration water and OLD-13-09A for the maximum concentration water) and stored in storage tanks prior to testing. The water will be pumped from the storage tanks and through the air stripper at the specified flow rates during each test. The treated effluent from each test will be pumped into a separate effluent holding tank for storage prior to discharge to the sanitary sewer. Three sets of influent and effluent water samples will be collected during each test, containerized, and sent out for 24-hour turnaround laboratory analysis of VOCs using EPA Method 8260. In addition, one set of duplicate, field blank, and trip blank quality assurance and quality control (QA/QC) samples will be collected. If the laboratory test results confirm the effluent from the tests meets the performance specification, then the treated water will be discharged to the sanitary sewer. If test results indicate unacceptable treatment efficiency, then the air stripping system vendor will be contacted for repairs and retesting.

Day three of startup will involve baseline groundwater level measurement and the official startup of the groundwater extraction and treatment system upgrade. Prior to system startup, groundwater levels will be measured in adjacent monitoring and observations wells. Table 4 presents the list of wells to be monitored during O&M. In addition, the elevation of the water level in Lake Druid will be measured. A baseline ground water table elevation contour map will be prepared to establish pre-pumping conditions so that an actual zone of influence (cone of depression) can be observed and monitored during startup and routine operations. Transducers will be installed in the wells shown on Table 4. The purpose of the transducers will be to monitor drawdown in response to groundwater

TABLE 4

Well Monitoring Schedule
OU-4 Monitoring Plan, NTC Orlando

Well ID	Manual Water Levels	Transducer Monitoring	Groundwater Sampling	Zone
DP-1	X	-	-	Shallow
DP-2	X	-	-	Shallow
DP-3	X	X	X	Shallow
LAKE DRUID	X	-	-	Shallow
OLD-12-01A	X	-	-	Shallow
OLD-12-02A	X	-	-	Shallow
OLD-12-03A	X	-	-	Shallow
OLD-12-04A	X	-	-	Shallow
OLD-13-01A	X	-	-	Shallow
OLD-13-03A	X	-	-	Shallow
OLD-13-05A	X	-	-	Shallow
OLD-13-07A	X	X	X	Shallow
OLD-13-09A	X	-	X	Shallow
OLD-13-12A	X	-	X	Shallow
OLD-13-15A	X	-	X	Shallow
OLD-13-24A	X	-	X	Shallow
OLD-13-26A	X	-	-	Shallow
OLD-13-27A	X	-	-	Shallow
OLD-13-33A	X	X	-	Shallow
OLD-13-36A	X	-	-	Shallow
OLD-13-OW10A	X	-	-	Shallow
OLD-13-OW12A	X	-	X	Shallow
OLD-13-OW6A	X	X	X	Shallow
OLD-13-OW8A	X	-	-	Shallow
OLD-14-01A	X	-	-	Shallow
OLD-14-02A	X	-	-	Shallow
OLD-14-03A	X	-	-	Shallow
OLD-14-04A	X	-	-	Shallow
OLD-14-05A	X	-	-	Shallow
OLD-14-06A	X	-	-	Shallow
OLD-14-07A	X	-	-	Shallow
OLD-14-08A	X	-	-	Shallow
OLD-13-10B	X	-	X	Intermediate
OLD-13-13B	X	-	-	Intermediate
OLD-13-16B	X	-	-	Intermediate
OLD-13-18B	X	-	-	Intermediate
OLD-13-19B	X	-	-	Intermediate
OLD-13-20B	X	-	-	Intermediate
OLD-13-21B	X	-	X	Intermediate
OLD-13-22B	X	-	X	Intermediate
OLD-13-23B	X	-	X	Intermediate
OLD-13-25B	X	-	X	Intermediate
OLD-13-28B	X	-	-	Intermediate
OLD-13-29B	X	-	-	Intermediate
OLD-13-30B	X	X	X	Intermediate
OLD-13-31B	X	-	-	Intermediate
OLD-13-32B	X	-	-	Intermediate
OLD-13-34B	X	X	-	Intermediate
OLD-13-37B	X	-	-	Intermediate
OLD-13-39B	X	-	-	Intermediate
OLD-13-40B	X	-	-	Intermediate
OLD-13-41B	X	X	X	Intermediate
OLD-13-42B	X	-	-	Intermediate
OLD-13-02C	X	-	-	Deep
OLD-13-04C	X	-	-	Deep
OLD-13-06C	X	-	-	Deep
OLD-13-08C	X	-	X	Deep
OLD-13-11C	X	-	X	Deep
OLD-13-14C	X	-	X	Deep
OLD-13-17C	X	-	X	Deep
OLD-13-35C	X	X	-	Deep
OLD-13-38C	X	X	-	Deep
OLD-13-43C	X	-	-	Deep
OLD-13-OW11C	X	-	-	Deep
OLD-13-OW13C	X	-	X	Deep
OLD-13-OW7C	X	X	X	Deep
OLD-13-OW9C	X	-	-	Deep

pumping from the UVB wells during startup. Data from the transducers, augmented with manual water level data from the other wells, will be used to periodically assess the zone of influence. The change in water level in response to pumping will be assessed for each aquifer zone, shallow, intermediate, and deep.

Once baseline measurements are complete and the transducers are set and running, the complete system will be started up at the preset settings and closely monitored for approximately a two day period. The primary intent of the two day intensive monitoring program is to observe system operations, gain an understanding of system equipment, and increase comfort level in system performance. The objective is to observe and fine tune the system as necessary to decrease the future likelihood of system malfunction. The air stripping system parameters will be monitored and recorded, visual observations of the equipment will be performed, and the progress of the capture zone will be monitored closely.

Air stripping system parameters such as pumping flow rates, blower air flow rate, air stripper pressure, and total effluent quantity will be measured and recorded. One set of influent and effluent samples will be collected each day of the startup period (a total of 2 sets of samples). The samples will be containerized and sent to the laboratory for standard turnaround analysis of VOCs using EPA Method 8260. One set of duplicate, field blank, and trip blank QA/QC samples will be collected. Air stripper emissions will be monitored several times during the two day startup period using a flame ionization detector (FID). The exhaust from the air stripper will be sampled once during the last day of the startup period and sent to a laboratory for VOC analysis. The purpose of the air monitoring is to confirm that emissions are below FDEP discharge limit of 13.7 lbs/day.

The biocide metering system will be set to control iron fouling. The Manufacturer's recommended dosage rate and rate used by the previous contractor will be compared to determine an initial metering pump flow rate. The system will be set at this initial rate and observations will be made over the next several hours. If fouling is evident, then the biocide flow rate may be turned up. If the fouling is not present, then the biocide flow rate may be turned down. The intent is to set the biocide metering pump at the minimum flow rate at which no iron fouling occurs. Once the appropriate dosage rate is established, it will be calculated and recorded as a percentage of the total system flow rate so that when the system flow rate is modified in the future, the correct biocide dosage may be quickly adjusted.

Water levels will be monitored daily during the two day startup period in the wells listed in Table 4 to ascertain that the required capture zone is achieved. Manual water level measurements and transducer downloads will be performed at the end of each day. Water level elevation contour maps will be drawn using this data for each aquifer zone to illustrate the capture zones. These contour maps will be compared to the baseline contour map to estimate drawdown. Transducer data will also be used to assess drawdown in wells. The objective is to maintain a drawdown of approximately 0.1 feet in monitoring wells OLD-13-30B and OLD-13-07A and less than 0.05 feet in OLD-13-33A, OLD-13-34B, and OLD-13-35C. If excessive drawdown is noted in these wells, then the UVB well pumping rates may be turned down to reduce O&M costs (i.e., City of Orlando sanitary sewer discharge fees) and minimize impacts the surrounding water bodies and/or aquifer. Order-of-magnitude modeling suggests that the steady-state pumping rate necessary to capture the 100 ppb total

VOC plume may be lower than 57 gpm. However, a conservative approach will be taken initially and the system will be started at the maximum sustained pumping rate of 57gpm to achieve capture of the plume within a short timeframe. Based on June-July 2000 pump test data and modeling, it is expected that the flow rates of the UVB wells may be turned down by 50 percent on the second day of startup testing.

The elevation of the water in Lake Druid will be closely monitored to ascertain whether the pumping system affects it. A pressure transducer will be installed in DP-3 to monitor drawdown in the lake water. Additionally, lake water elevations will be measured twice a day during the startup period and compared to the baseline elevation. If the elevation of Lake Druid is observed to decrease directly as a result of the groundwater extraction system operations, then the system pumping rates will be lowered so that the elevation of the lake is not affected. Historic lake water elevation data, if available, may be reviewed prior to startup to assess normal patterns of fluctuation prior to determining influence due to pumping at OU4.

Once the two day startup period monitoring is complete, system operations are stable, treatment efficiency is in compliance with the specifications, and iron fouling is controlled, then the system will be set into full-time routine operations. The pressure transducers will be kept in the same wells and reprogrammed to record water level at less frequent intervals so that water level data may be obtained for the entire period between O&M visits.

6.2 Routine O&M Plan

Weekly O&M visits will be conducted for three weeks after completion of startup, then monthly O&M visits will be conducted thereafter. The primary intent is to ensure the system is functioning correctly, efficiently, and cost-effectively.

O&M shall consist of the following general activities:

- monitoring pressure transducer data for groundwater drawdown
- water level measurements
- monitoring air stripper offgas VOC concentrations using an FID
- monitoring of UVB well pumping rates
- monitoring of system effluent water flow rate
- air stripper pressure
- blower air flow rate
- total effluent flow throughput
- checking biocide drum level and iron fouling condition
- checking all equipment for proper operation
- routine service of equipment as recommended by the manufacturer

Routine O&M data will be recorded on a data sheet and kept as a permanent file for future reference.

Influent and effluent samples will be collected from the air stripping system monthly, as necessary to comply with the City of Orlando discharge permit. The City of Orlando discharge requirements require monthly influent and effluent samples to verify that treated effluent is meeting the City's pretreatment criteria. The samples will be sent to an offsite laboratory for standard turnaround VOC analysis by EPA Method 8260.

Water levels will be monitored during each O&M visit using pressure transducers and manual water level measurements to ascertain that the required capture zone is achieved. Table 4 presents the complete list of wells at the site that may be monitored. The actual wells to be routinely monitored will be evaluated once startup data is received and evaluated. It will depend upon the actual extent of the capture zone and interactions between the different aquifer zones. Water level elevation contour maps will be drawn using this data for each aquifer zone to illustrate the capture zones. These contour maps will be compared to the baseline and previous contour maps to estimate drawdown. Transducer data will also be used to assess drawdown in site wells. The objective is to maintain a drawdown of approximately 0.1 feet in monitoring wells OLD-13-30B and OLD-13-07A and approximately 0.05 feet in OLD-13-33A, OLD-13-34B, and OLD-13-35C. Pressure transducers will be installed in these wells to monitor drawdown. If excessive drawdown is noted in these wells, then the UVB well pumping rates may be turned down to reduce O&M costs (i.e., City of Orlando sanitary sewer discharge fees) and minimize impacts the surrounding water bodies and/or aquifer. Order-of-magnitude modeling suggests that the steady-state pumping rate necessary to capture the 100 ppb total VOC plume may be as low as 6 gpm.

The elevation of the water in Lake Druid will be closely monitored to ascertain whether the pumping system affects it. A pressure transducer will be installed in DP-3 to monitor drawdown in the lake water. Additionally, lake water elevations will be measured twice a day during the startup period and compared to the baseline elevation. If the elevation of Lake Druid is observed to decrease directly as a result of the groundwater extraction system operations, then the system pumping rates will be lowered so that the elevation of the lake is not affected. Historic lake water elevation data, if available, may be reviewed prior to startup to assess normal patterns of fluctuation prior to determining influence due to pumping at OU4.

Groundwater will be sampled from the wells listed in Table 4 during the routine quarterly sampling program to monitor system effectiveness. Groundwater sampling will be conducted according to the previously approved Sampling and Analysis plan. Samples will be containerized and sent to an offsite laboratory for VOC analysis by EPA Method 8260.

Routine operations and O&M will continue until the RA is identified, at which point, its use will be reevaluated in light of its effectiveness for the site-wide remedy.

7. Waste Management

As part of the field activities, a certain amount of waste material will be generated in association with personal protection, sample handling, well purging and sampling, stripper tray maintenance, and decontamination. Every effort should be made to minimize the IDW generated and to dispose of the material in the most appropriate, cost-effective manner. The majority of material generated by investigation activities will be uncontaminated or below applicable disposal limits; however, some material will come in contact with, or be composed of contaminated media, which may require pretreatment or off-site disposal.

The IDW will be segregated by medium (i.e., solids or liquids) and by location (i.e., boring, well, study area) into storage containers (generally, Department of Transportation [DOT]-

approved 55-gallon drums). Analysis Pending labels will be attached to the storage containers that describe the content of the specific container, the POI or Study Area of origin, the specific exploration location, and the date of generation. The storage containers will be segregated on pallets by POI or Study Area of origin.

After receipt of analytical results, the IDW storage containers will be labeled as "Non-Hazardous" or "Hazardous Waste", using the criteria below.

- Analytical results are less than TCLP threshold values (40 CFR §261.24) - the corresponding IDW will be labeled as "Non-Hazardous"
- Analytical results exceed TCLP threshold values - the corresponding IDW will be labeled as "Hazardous Waste"

Labels will also include the initial date of accumulation (i.e., the date the waste is first placed in a tank or drum). Wastes will be disposed of from the site within 45 days of generation.

The storage container pallets will be arranged so as to allow access between them for inspection. A logbook will be maintained with the preceding information recorded in it, as well as a sketch map of the storage areas. Daily inspections of the waste storage areas will be conducted to confirm that all requirements are being met and that the integrity of all storage containers remains uncompromised.

8. Required Permits

A Consumptive Water Use Permit Application is being submitted to the St. Johns River Water Management District concurrent with submittal of this Work Plan memorandum. A consumptive use permit is necessary for this project because the extraction wells diameter exceeds the criterion of five inches or greater. Copies of permit applications will be provided to FDEP.

NTC Orlando currently holds an Industrial Wastewater Discharge Permit with the City of Orlando for Area C (Permit No. CO83TA). This permit will need modification to accommodate larger discharge volumes associated with the treated effluent discharge. A copy of the approval letter for this Work Plan will accompany the permit application.

9. Construction Documentation Report

Upon completion of the system installation and start up activities, a construction documentation report will be prepared to describe the details of the construction and startup activities. The construction documentation report will also include record drawings sealed by a registered Florida Professional Engineer.

10. Project Schedule

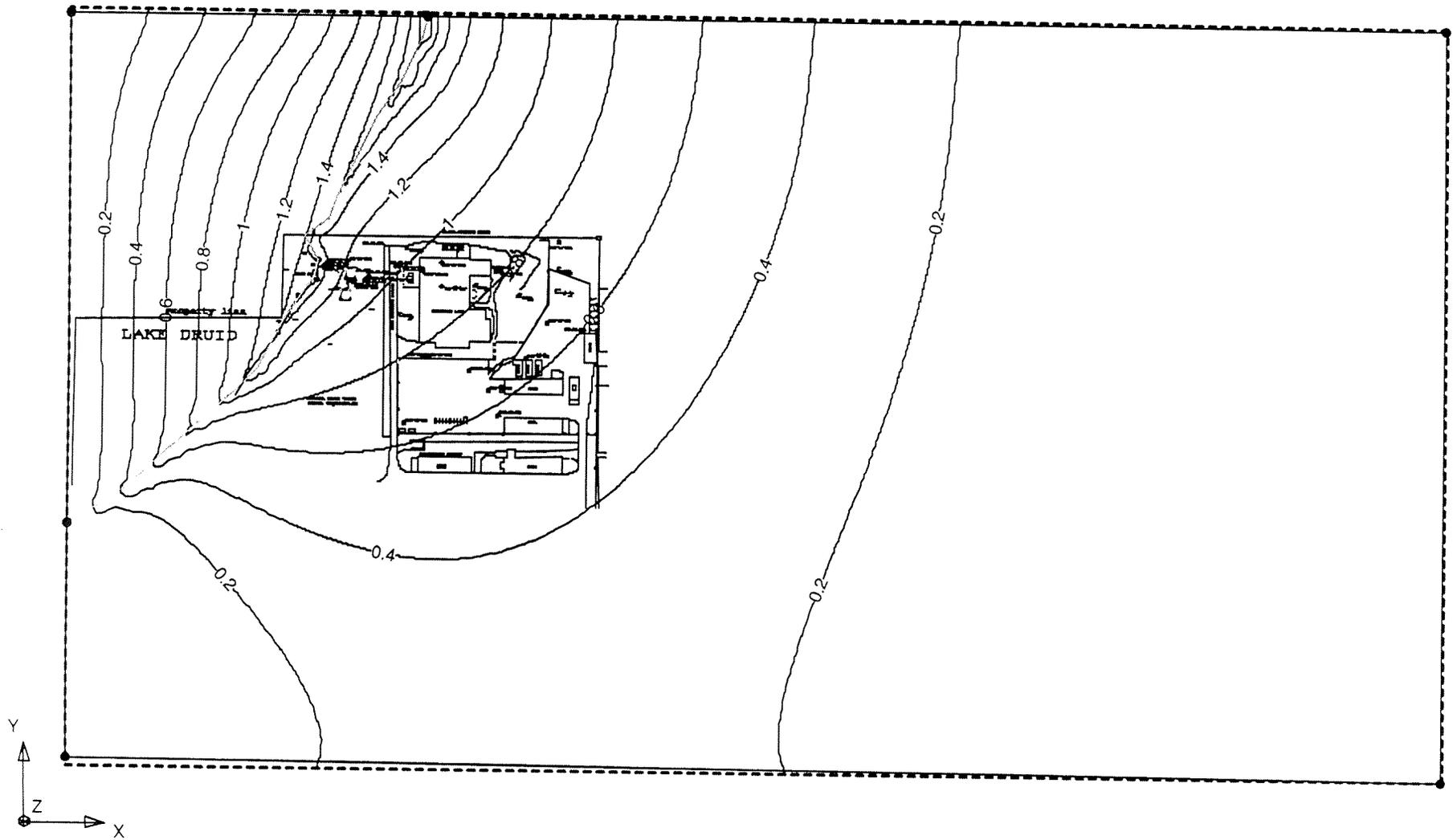
A project schedule for the upgrade activities is included in Attachment G.

ATTACHMENT A

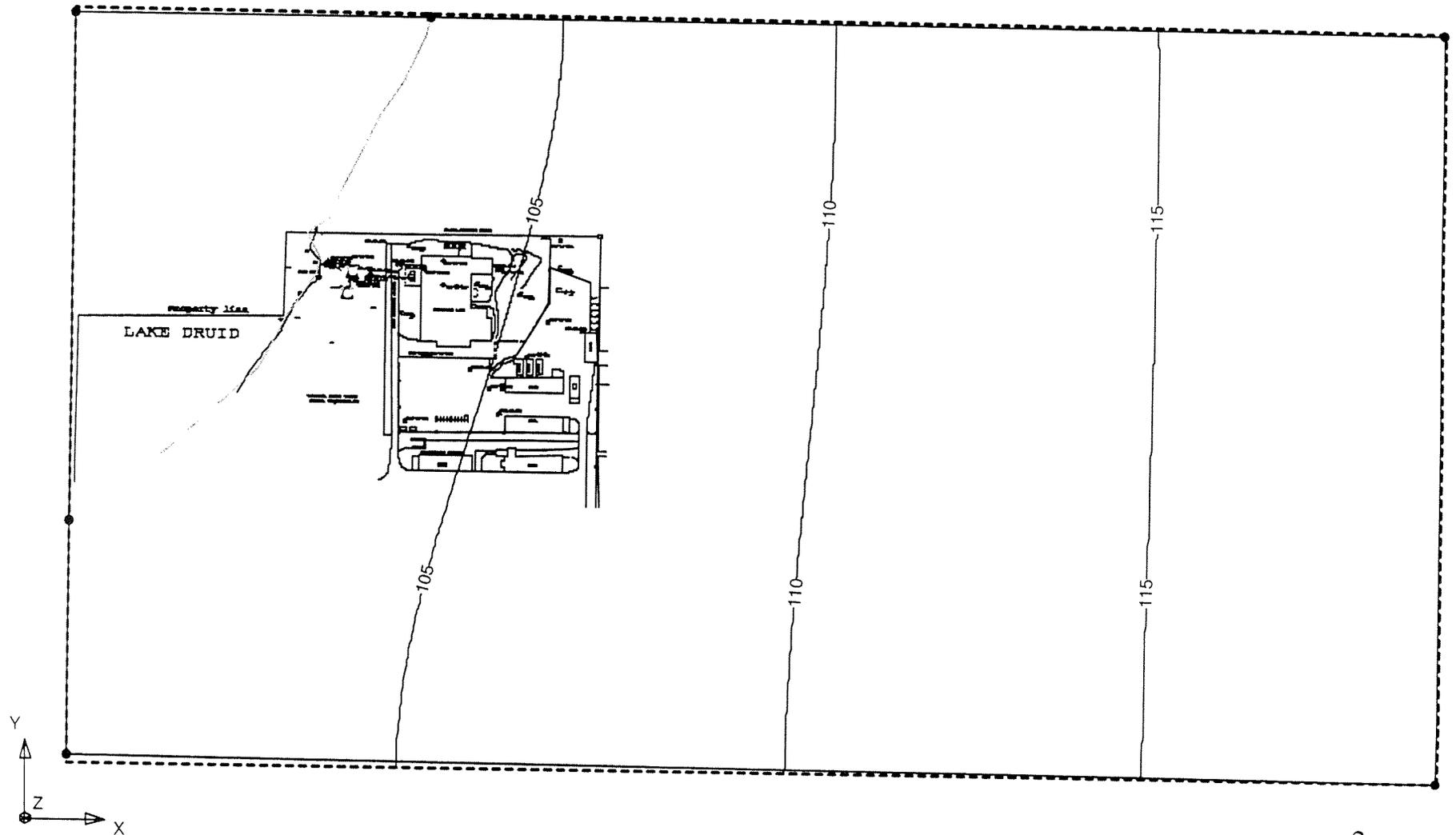
Groundwater Modeling Results

- 1 **Steady-State Drawdown under Background Conditions**
- 2 **Steady-State Water Table Elevation Head under Background Conditions**
- 3 **Steady-State Drawdown under UVB Combined Well Pumping Rate of 6 gpm**
- 4 **Steady-State Water Table Elevation Head under UVB Combined Well Pumping Rate of 6 gpm**
- 5 **Steady-State Drawdown under UVB Combined Well Pumping Rate of 30 gpm**
- 6 **Steady-State Water Table Elevation Head under UVB Combined Well Pumping Rate of 30 gpm**
- 7 **Steady-State Drawdown under UVB Combined Well Pumping Rate of 60 gpm**
- 8 **Steady-State Water Table Elevation Head under UVB Combined Well Pumping Rate of 60 gpm**

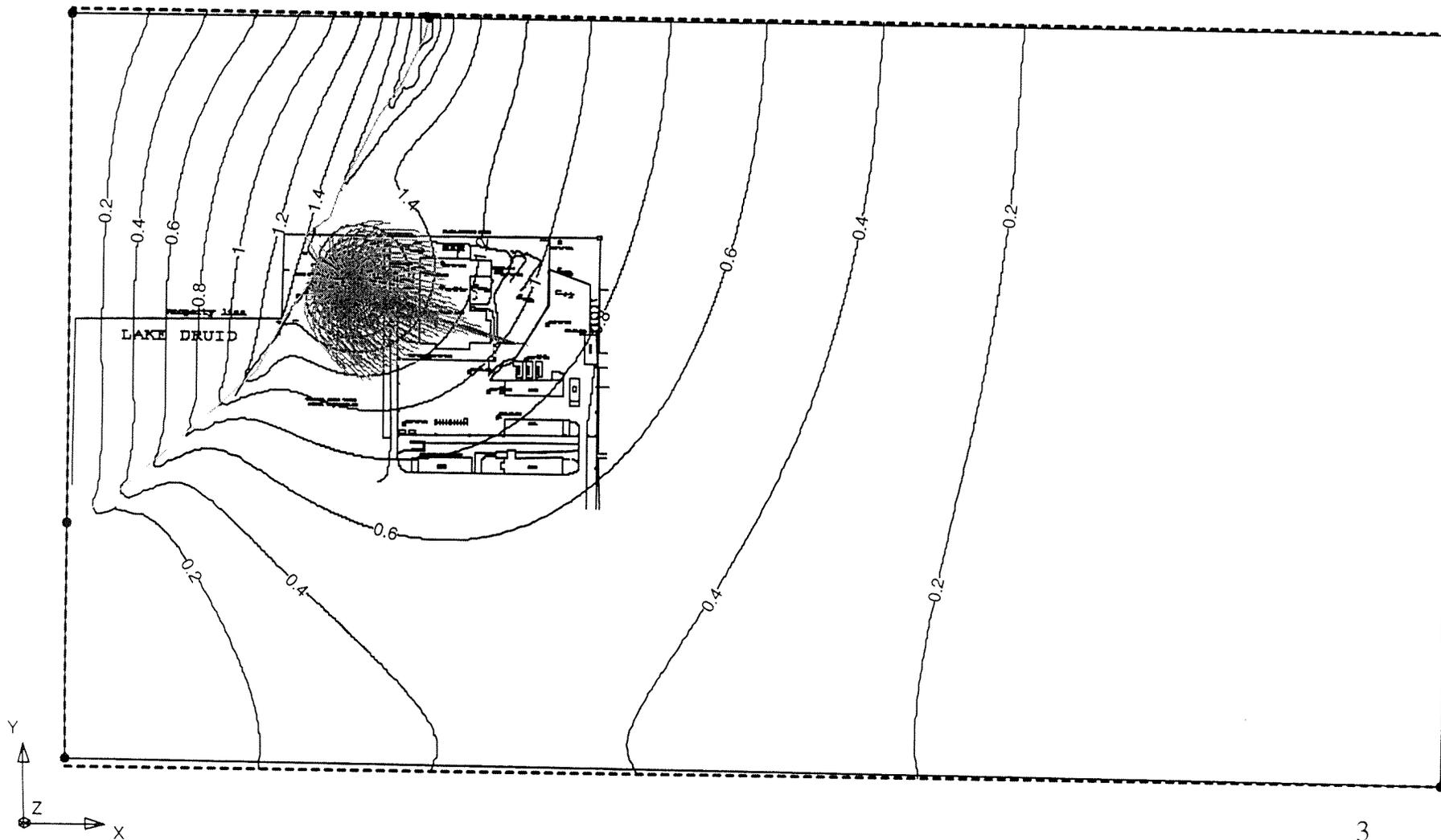
Steady-State Drawdown under Background Conditions



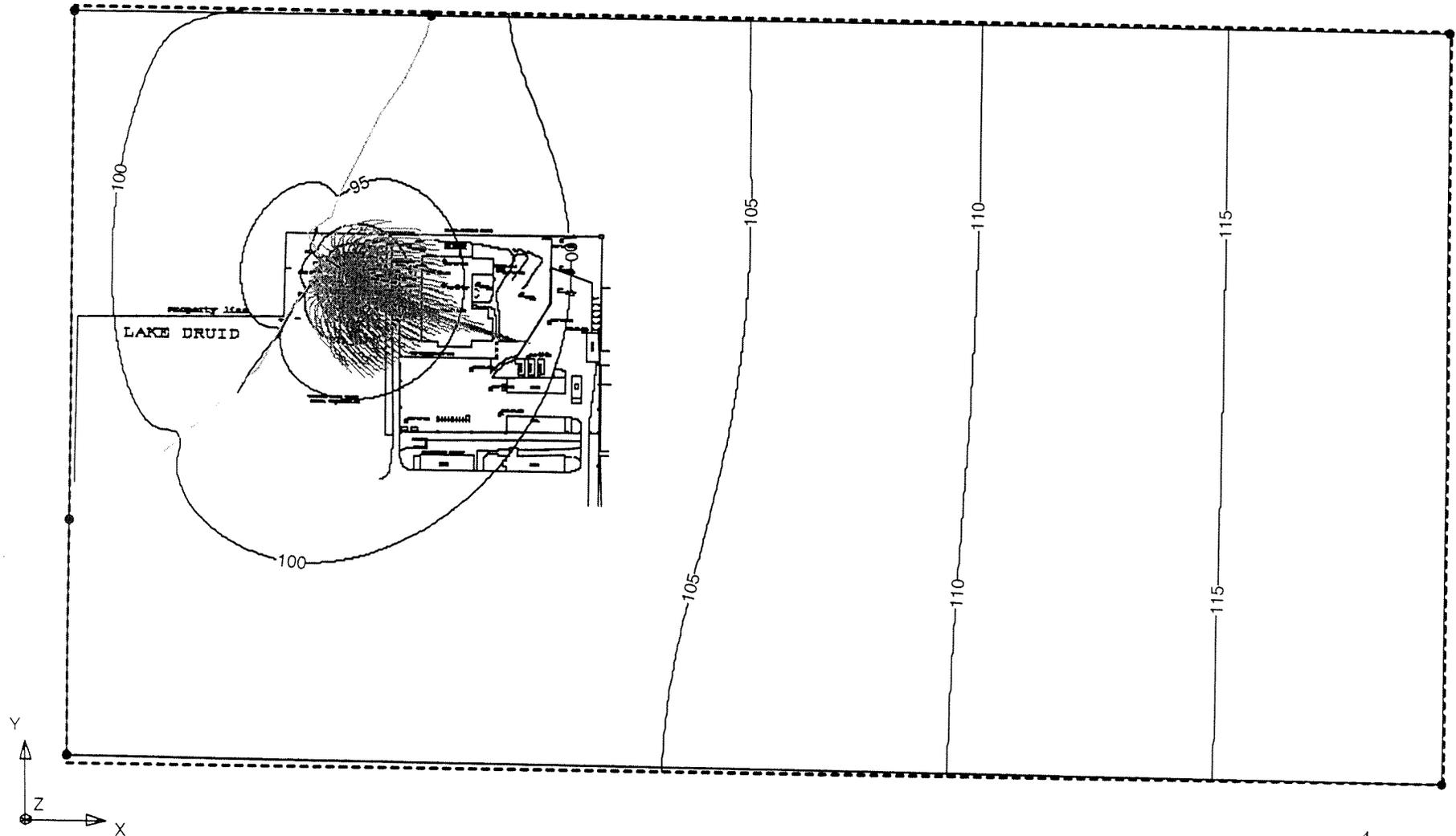
Steady-State Water Table Elevation Head under Background Conditions



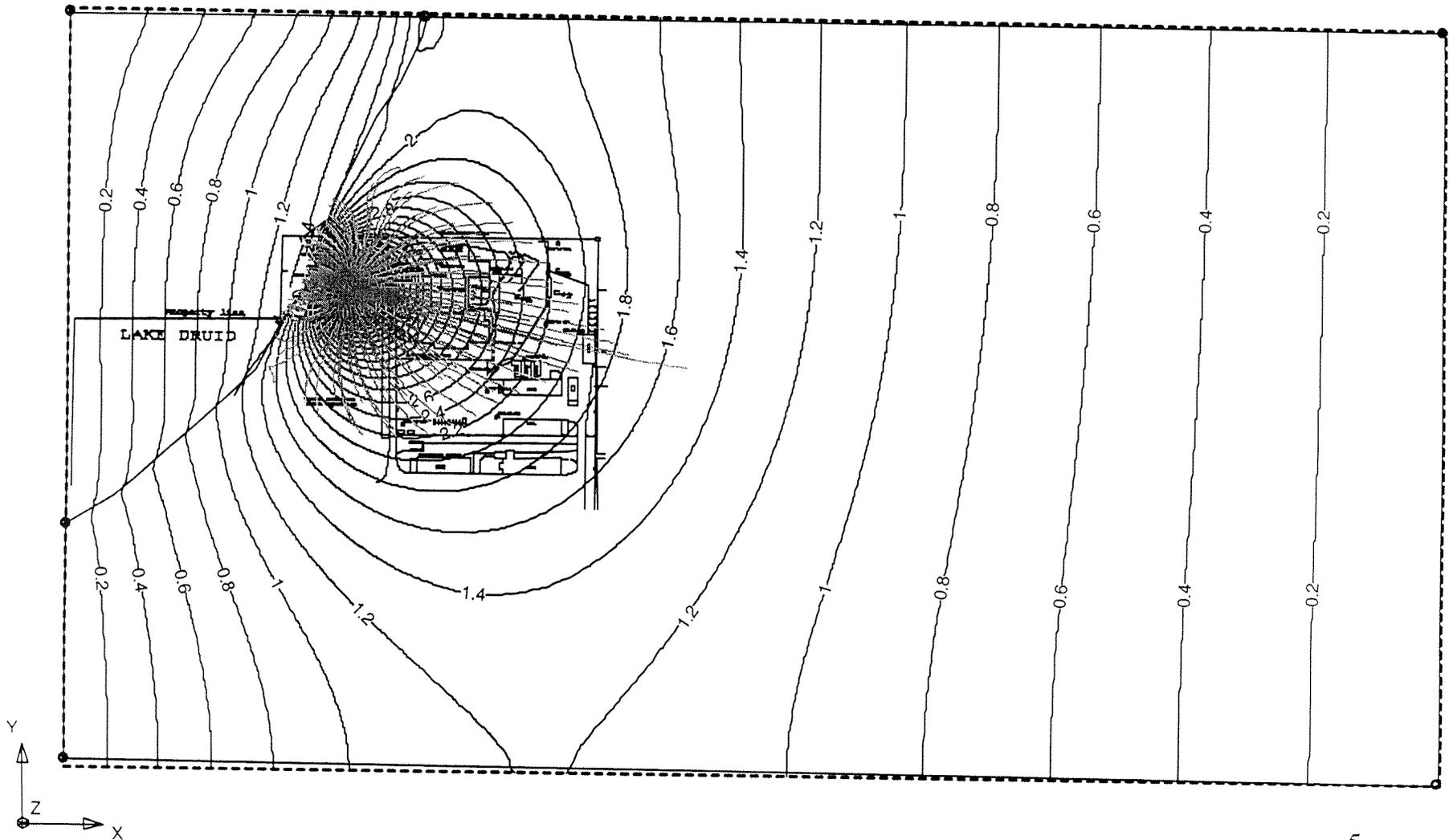
Steady-State Drawdown under UVB Combined Well Pumping Rate of 6 gpm



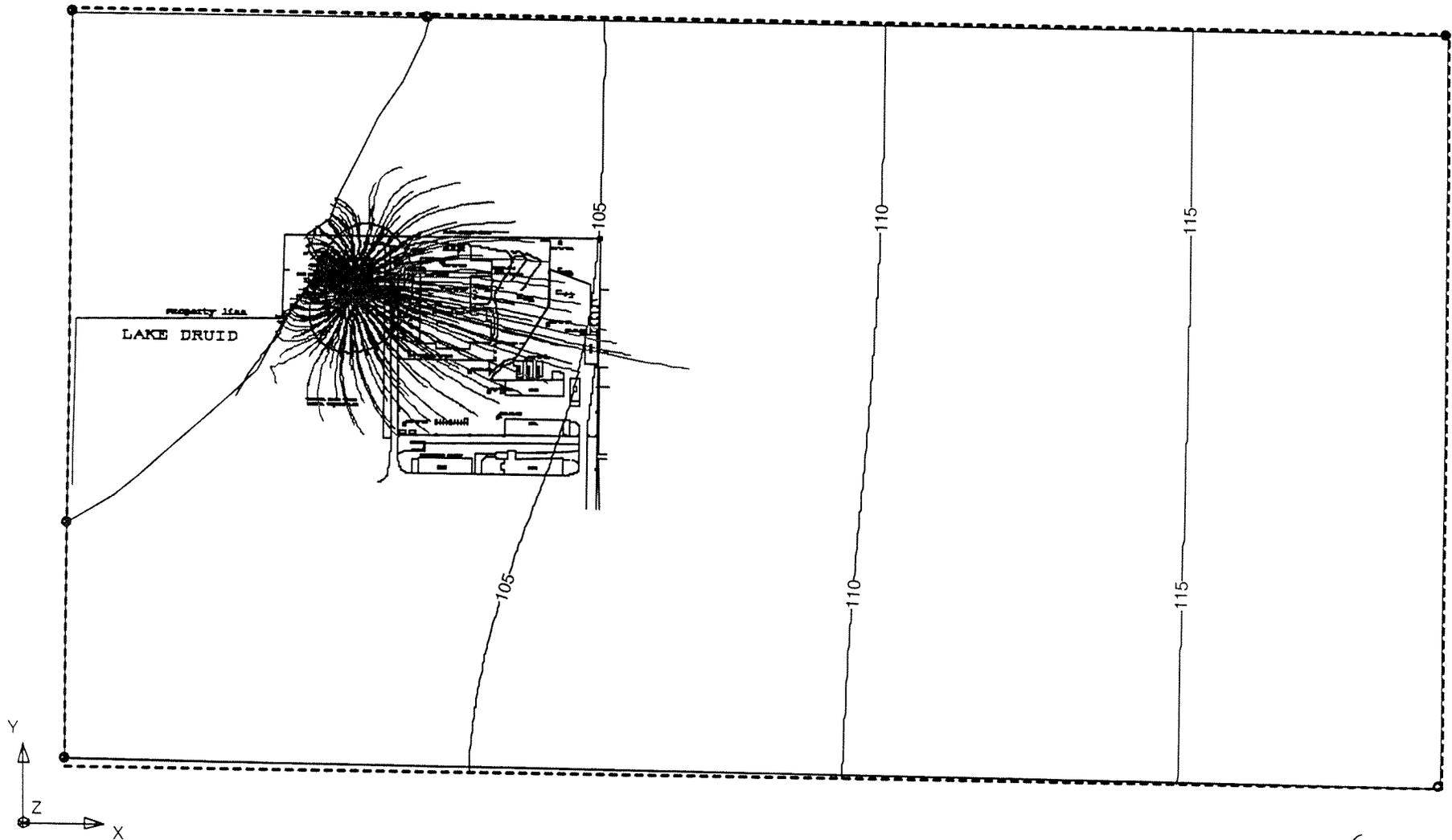
Steady-State Water Table Elevation Head under UVB Combined Well Pumping Rate of 6 gpm



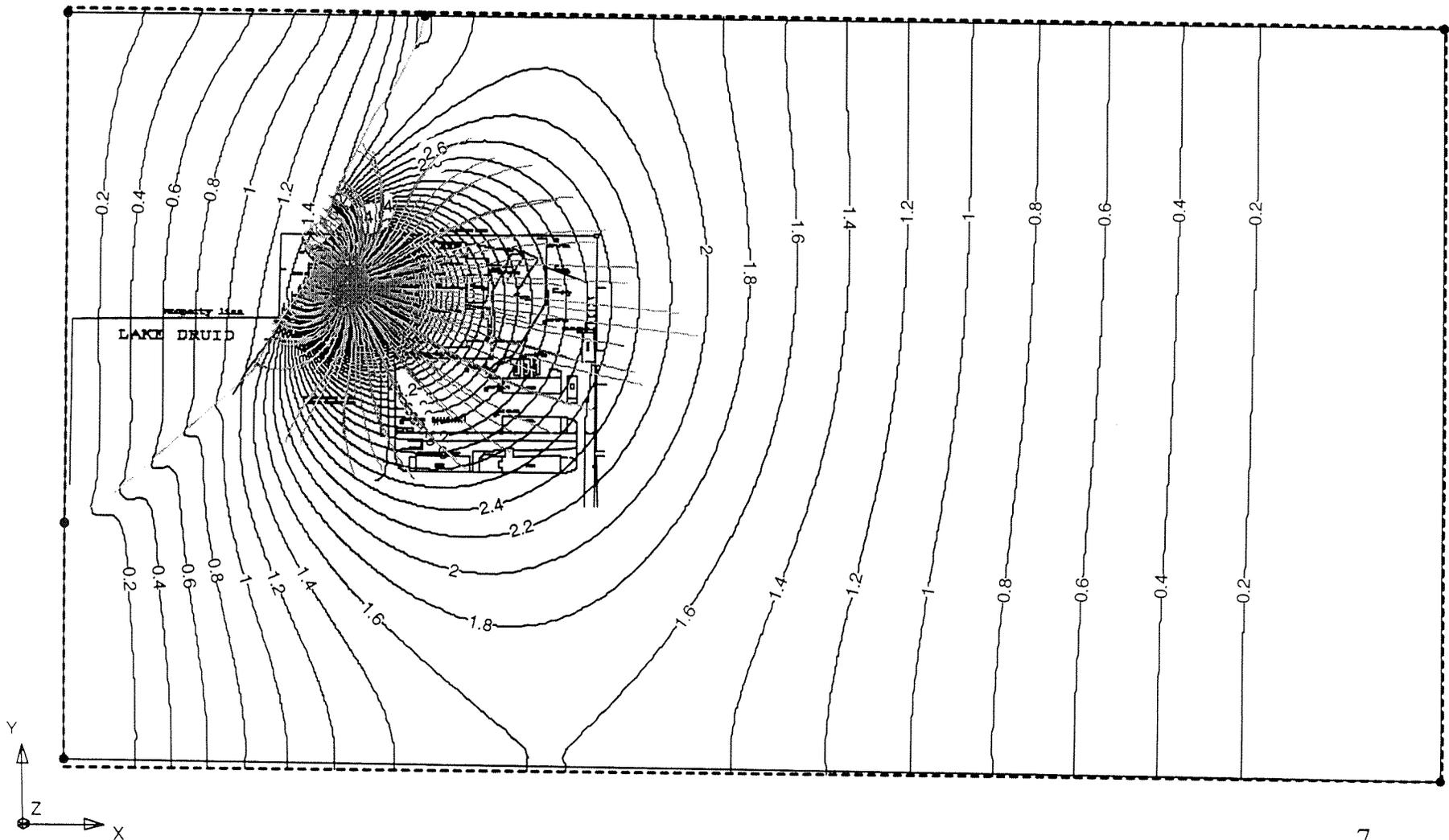
Steady-State Drawdown under UVB Combined Well Pumping Rate of 30 gpm



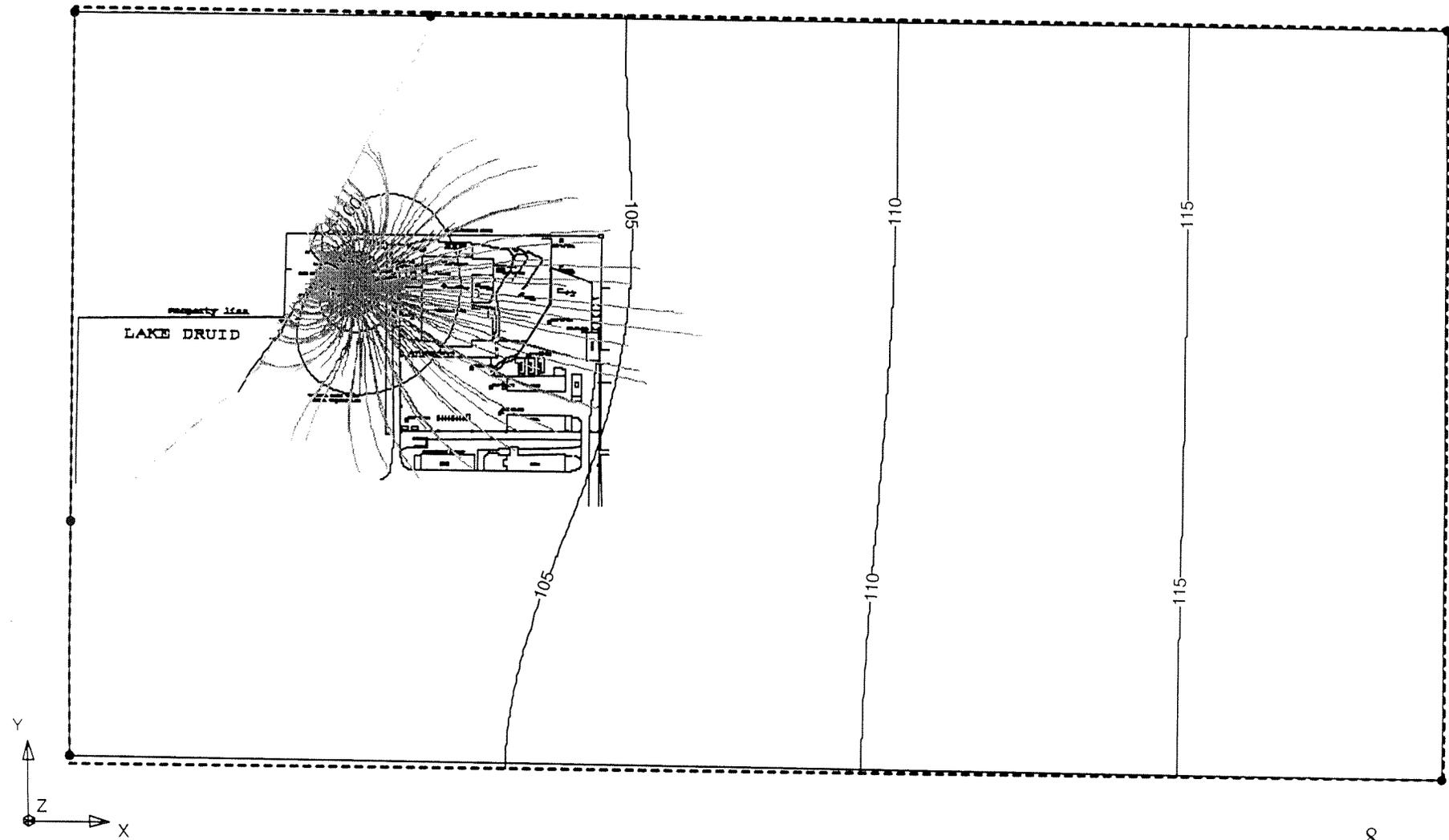
Steady-State Water Table Elevation Head under UVB Combined Well Pumping Rate of 30 gpm



Steady-State Drawdown under UVB Combined Well Pumping Rate of 60 gpm



Steady-State Water Table Elevation Head under UVB Combined Well Pumping Rate of 60 gpm



ATTACHMENT B

NO.

1 City of Orlando Discharge Limits

Permittee:	INDUSTRIAL USER DISCHARGE PERMIT	
Naval Training Center Orlando (Area C)	Number:	COB3TA
	Category:	9999
	Expiration Date:	07/01/02

2. The wastewater constituents listed below shall at no time be discharged in concentrations which exceed the limitations given:

Constituent (to be limited)	Maximum Concentrations, mg/l
Antimony	1.0
Arsenic	0.25
Barium	10.0
Beryllium	0.25
Biological Oxygen Demand (BOD)	300.0
Boron	1.0
Cadmium	0.26
Chromium (Total)	1.0
Cobalt	0.3
Copper	2.0
Cyanide	0.5
Grease	100.0
Lead	0.4
Lower Explosion Limit (LEL)	less than 5% (of LEL on the meter)
Lithium	0.03
Manganese	1.5
Mercury	0.005
Nickel	0.7
pH*	not less than 5.5 or greater than 9.5
Selenium	0.5
Silver	0.24
Sodium	300.0
Tin	5.0
Zinc	1.0
Total Metals	10.0
Total Phenols	0.5
Total Suspended Solids (TSS)	300.0
Total Toxic Organics (TTO)	2.13

* (pH excursions of 15 minutes or longer are considered pH violations)

ATTACHMENT C

NO.

1 Air Stripper Performance Modeling Results

Carbonair Environmental Systems
 2731 Nevada Avenue North
 New Hope, MN 55427-2864
 612-544-2154 800-526-4999
 Fax: 612-544-2151

08/26/00
 20:45:53

-----STAT 80-----
 VERSION 3.1
 WATER FLOW RATE: 60.0 gpm
 AIR FLOW RATE: 350.0 cfm
 WATER TEMPERATURE: 65.0 F
 AIR-TO-WATER RATIO: 44:1

Influent Conc. for TRICHLOROETHENE 750.0 ppb

NO OF TRAY	REMOVAL EFF %	EFF CONC ppb	OFF-GAS CONC ug/l	AIR EMISSION lb/d
1	69.17157	231.2132	11.7906	0.3737
2	90.19162	73.5628	15.3736	0.4872
3	96.84869	23.6348	16.5083	0.5232
4	98.98436	7.6173	16.8723	0.5348
→ 5	99.67234	2.4575	16.9896	0.5385
6	99.89426	0.7931	17.0274	0.5397

Influent Conc. for TETRACHLOROETHENE 1900.0 ppb

NO OF TRAY	REMOVAL EFF %	EFF CONC ppb	OFF-GAS CONC ug/l	AIR EMISSION lb/d
1	70.50094	560.4821	30.4436	0.9649
2	91.11435	168.8274	39.3448	1.2470
3	97.30686	51.1697	42.0189	1.3317
4	99.18221	15.5380	42.8287	1.3574
→ 5	99.75153	4.7209	43.0745	1.3652
6	99.92450	1.4346	43.1492	1.3676

Influent Conc. for 1,2-DICHLOROETHENE (CIS) 600.0 ppb

NO OF TRAY	REMOVAL EFF %	EFF CONC ppb	OFF-GAS CONC ug/l	AIR EMISSION lb/d
1	61.19022	232.8587	8.3441	0.2645
2	84.01629	95.9023	11.4568	0.3631
3	93.26336	40.4198	12.7177	0.4031
4	97.13359	17.1985	13.2455	0.4198
→ 5	98.77546	7.3473	13.4694	0.4269
6	99.47598	3.1441	13.5649	0.4299

Influent Conc. for TOTAL VOCs 3250.0 ppb

NO OF TRAY	REMOVAL EFF %	EFF CONC ppb	OFF-GAS CONC ug/l	AIR EMISSION lb/d
1	68.47526	1024.5540	50.5783	1.6030
2	89.59100	338.2925	66.1752	2.0974
3	96.45463	115.2244	71.2449	2.2580
4	98.75835	40.3538	72.9465	2.3120
→ 5	99.55306	14.5256	73.5335	2.3306
6	99.83471	5.3718	73.7416	2.3372

Carbonair Environmental Systems
 2731 Nevada Avenue North
 New Hope, MN 55427-2864
 612-544-2154 800-526-4999
 Fax: 612-544-2151

08/26/00
 20:49:22

-----STAT 80-----
 VERSION 3.1
 WATER FLOW RATE: 30.0 gpm
 AIR FLOW RATE: 350.0 cfm
 WATER TEMPERATURE: 65.0 F
 AIR-TO-WATER RATIO: 87:1

Influent Conc. for TETRACHLOROETHENE 3800.0 ppb

NO OF TRAY	REMOVAL EFF %	EFF CONC ppb	OFF-GAS CONC ug/l	AIR EMISSION lb/d
1	85.40843	554.4795	37.3048	1.1689
2	97.83806	82.1536	42.7339	1.3390
3	99.67896	12.1995	43.5379	1.3642
4	99.95231	1.8122	43.6573	1.3679
→ 5	99.99292	0.2692	43.6751	1.3685
6	99.99895	0.0400	43.6777	1.3686

Influent Conc. for TRICHLOROETHENE 1500.0 ppb

NO OF TRAY	REMOVAL EFF %	EFF CONC ppb	OFF-GAS CONC ug/l	AIR EMISSION lb/d
1	84.61287	230.8070	14.5884	0.4571
2	97.57607	36.3589	16.8235	0.5271
3	99.61676	5.7486	17.1753	0.5382
4	99.93937	0.9094	17.2309	0.5399
→ 5	99.99041	0.1439	17.2397	0.5402
6	99.99848	0.0228	17.2411	0.5402

Influent Conc. for 1,2-DICHLOROETHENE (CIS) 1200.0 ppb

NO OF TRAY	REMOVAL EFF %	EFF CONC ppb	OFF-GAS CONC ug/l	AIR EMISSION lb/d
1	78.67839	255.8593	10.8522	0.3400
2	95.22633	57.2840	13.1347	0.4116
3	98.91986	12.9617	13.6441	0.4275
4	99.75501	2.9398	13.7593	0.4311
→ 5	99.94440	0.6671	13.7854	0.4320
6	99.98738	0.1514	13.7914	0.4321

Influent Conc. for TOTAL VOCs 6500.0 ppb

NO OF TRAY	REMOVAL EFF %	EFF CONC ppb	OFF-GAS CONC ug/l	AIR EMISSION lb/d
1	83.98237	1041.1459	62.7454	1.9661
2	97.29544	175.7966	72.6920	2.2777
3	99.52446	30.9098	74.3574	2.3299
4	99.91290	5.6614	74.6476	2.3390
→ 5	99.98338	1.0802	74.7002	2.3406
6	99.99671	0.2142	74.7102	2.3410

ATTACHMENT D

NO.

1 Design Calculations

MAXIMUM FLOW AND AVERAGE CONTAMINANT CONCENTRATION CONDITION AIR STRIPPER TREATMENT SYSTEM DESIGN

NTC OU4, Orlando, FL

<u>Contamination Characterization</u>	Historic		<u>Wtd Avg*</u>	<u>Limit</u>	<u>Unit</u>	<u>Source</u>
	<u>Low</u>	<u>High</u>				
TCE concentration range	ND	2,475	750	3	ppb	FL MCL
cis-1,2 DCE concentration range	ND	1,650	600	70	ppb	FL MCL
PCE concentration range	ND	29,800	1,900	3	ppb	FL MCL

NOTE: * - See Basis of Design document for backup data to support the Wtd. Avg. values.

Air Stripper Conceptual Design Parameters

Stripper design flowrate gpm
 Governing contaminant PCE at ppb (with 2X safety factor)
 Governing contaminant is based on consideration of a combination of low Henry's Constant and high concentration versus MCL.
 Influent temperature 65 °F (Assume conservatively low temperature modeling purposes only)

Assume 100% of PCE is stripped and discharged untreated to the atmosphere.
 Assume a STAT180 using a blower airflow rate of cfm
 PCE emissions 0.057 lbs/hr or 1.37 lbs/day or 498.9 lbs/yr
 Average PCE emissions concentration is 16.9 mg/m³ or 2.5 ppm
 The OSHA TWA of PCE is ppm or 678 mg/m³

Assume 100% of TCE is stripped and discharged untreated to the atmosphere.
 Assume a STAT180 using a blower airflow rate of cfm
 TCE emissions 0.022 lbs/hr or 0.54 lbs/day or 197.0 lbs/yr
 Average TCE emissions concentration is 6.7 mg/m³ or 1.2 ppm
 The OSHA TWA of TCE is ppm or 537 mg/m³

Assume 100% of cis-1,2 DCE is stripped and discharged untreated to the atmosphere.
 Assume a STAT180 using a blower airflow rate of cfm
 cis-1,2 DCE emissions 0.018 lbs/hr or 0.43 lbs/day or 157.6 lbs/yr
 Average cis-1,2 DCE emissions concentration is 5.3 mg/m³ or 1.3 ppm
 The NIOSH REL of cis-1,2 DCE is ppm or mg/m³

Since the average potential emission concentrations are estimated to be less than the NIOSH/OSHA limits, the offgas treatment is not required for worker safety.
 The FDEP has an emissions limitation of 13.7 lbs/day total VOC.
 The estimated average potential emissions from the air stripper is 2.34 lbs/day of PCE, TCE, and cis-1,2 DCE
 Therefore, since emissions don't exceed FDEP limit and don't exceed NIOSH/OSHA worker safety standards, then **NO OFFGAS TREATMENT IS PLANNED.**

Langlier Index Calculation

NTC OU4, Orlando, FL

Average Groundwater Conditions in the Extraction Well Area
(See Basis of Design Memorandum for backup information)

Concentrations of constituents represent an average estimate for influent based on RI and pump test analytical data.

Contaminant	Value	
pH	5.4	Actual pH
[H ⁺] (M)	3.98E-06	Calculated from pH
Alkalinity (mg/l as HCO ₃ ⁻)	8.0	
[Ca ²⁺] (mg/l)	37	
Langlier Index (LI)	-3.70	

Langlier Index less than 1 indicates low potential for CaCO₃ scaling.

The Nalco Water Handbook (Kemmer, 1988) Figure 4.9 incorporates temperature.

Effluent temperature = 26.5°C (80°F)

Alkalinity as CaCO₃ = 6.6 mg/l

Calcium as CaCO₃ = 92 mg/l

pHs from Figure 4.9 = 9 (minimum value, low alkalinity off scale of figure)

LI = 7.34 - 7.3 = -3.6

The LI estimates are in close agreement and indicate a no tendency for calcium carbonate precipitation.

June 14, 2000 groundwater sampling from OLD-13-OW10A and OW11C

Contaminant	Value	
pH	5.67	Actual pH
[H ⁺] (M)	2.14E-06	Calculated from pH
Alkalinity (mg/l as HCO ₃ ⁻)	50.4	
[Ca ²⁺] (mg/l)	18.5	
Langlier Index (LI)	-2.93	

Langlier Index less than 1 indicates low potential for CaCO₃ scaling.

The Nalco Water Handbook (Kemmer, 1988) Figure 4.9 incorporates temperature.

Effluent temperature = 26.5°C (80°F)

Alkalinity as CaCO₃ = 41.3 mg/l

Calcium as CaCO₃ = 46.3 mg/l

pHs from Figure 4.9 = 8.55

LI = 7.34 - 7.3 = -2.88

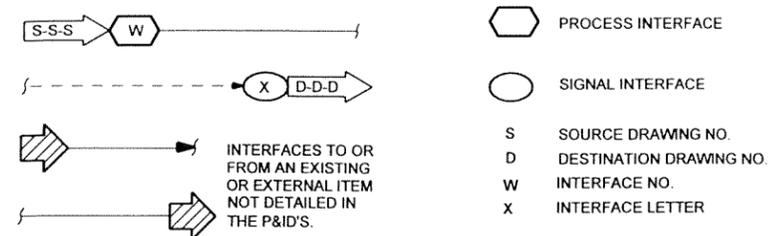
The LI estimates are in close agreement and indicate a no tendency for calcium carbonate precipitation.

ATTACHMENT E

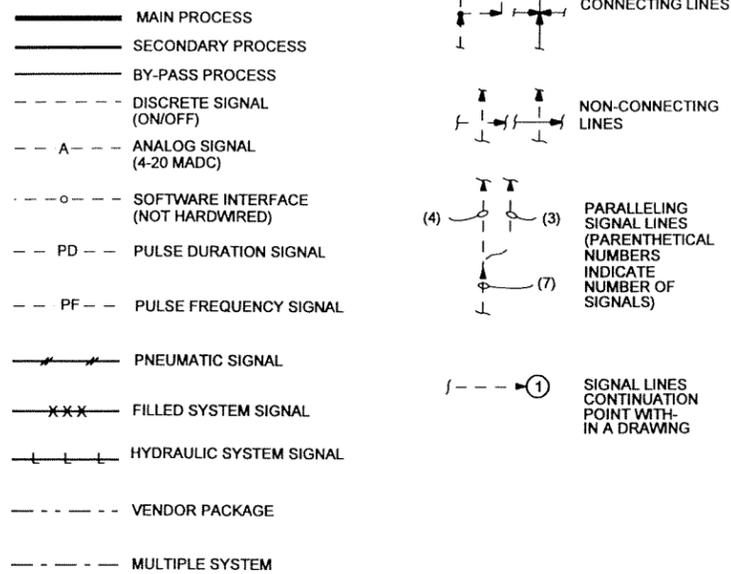
Design Drawings

- 1 Legend Sheet No. 1
- 2 Legend Sheet No. 2
- 3 Field Piping Plan
- 4 Air Stripper Treatment System Layout Plan
- 5 Process Instrumentation and Control Diagram

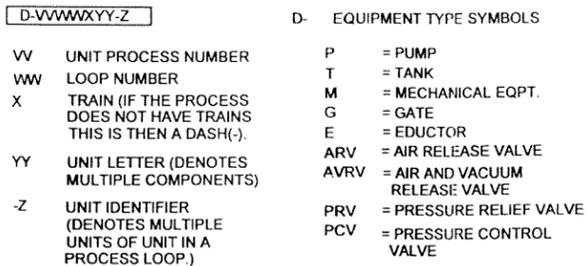
INTERFACE SYMBOLS



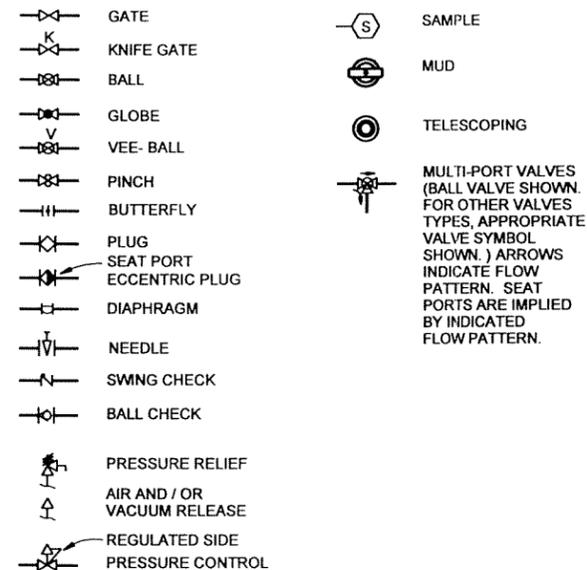
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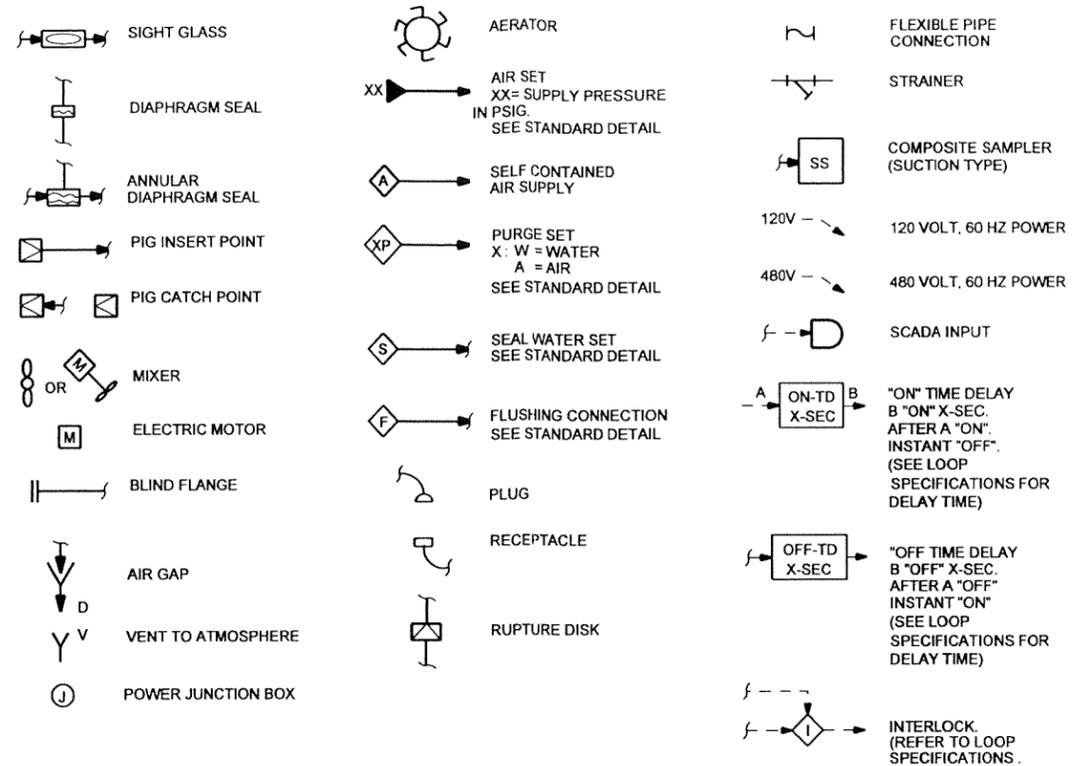
EQUIPMENT TAG NUMBERS



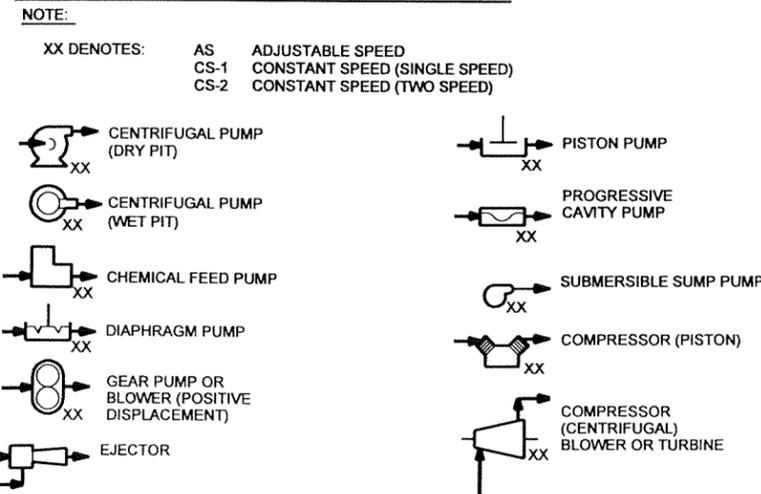
VALVE SYMBOLS



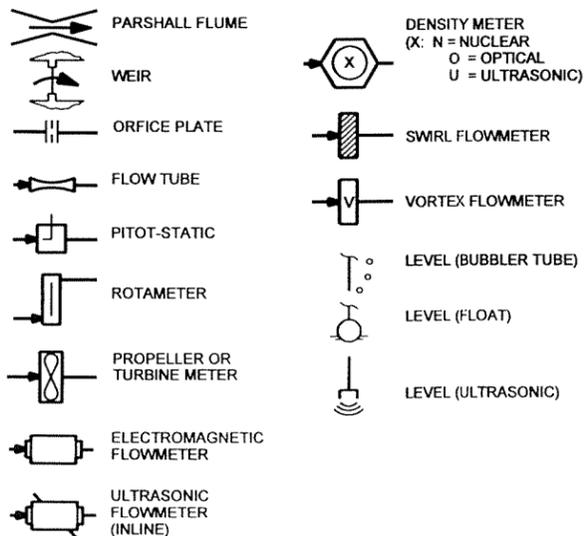
MISCELLANEOUS SYMBOLS



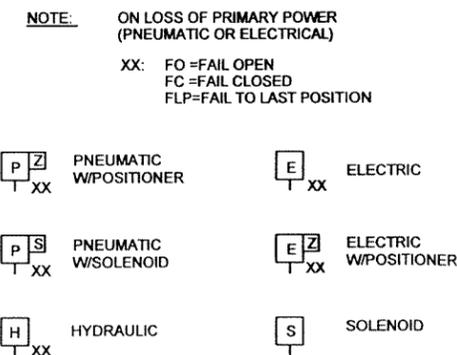
PUMP & COMPRESSOR SYMBOLS



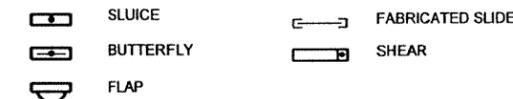
PRIMARY ELEMENT SYMBOLS



ACTUATOR SYMBOLS



GATE SYMBOLS



DSGN	T. PALAIA				
DR	E. KRISTEL				
CHK	M. OKEY				
APVD	C. HOOD	NO.	DATE	REVISION	BY

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CH2MHILL

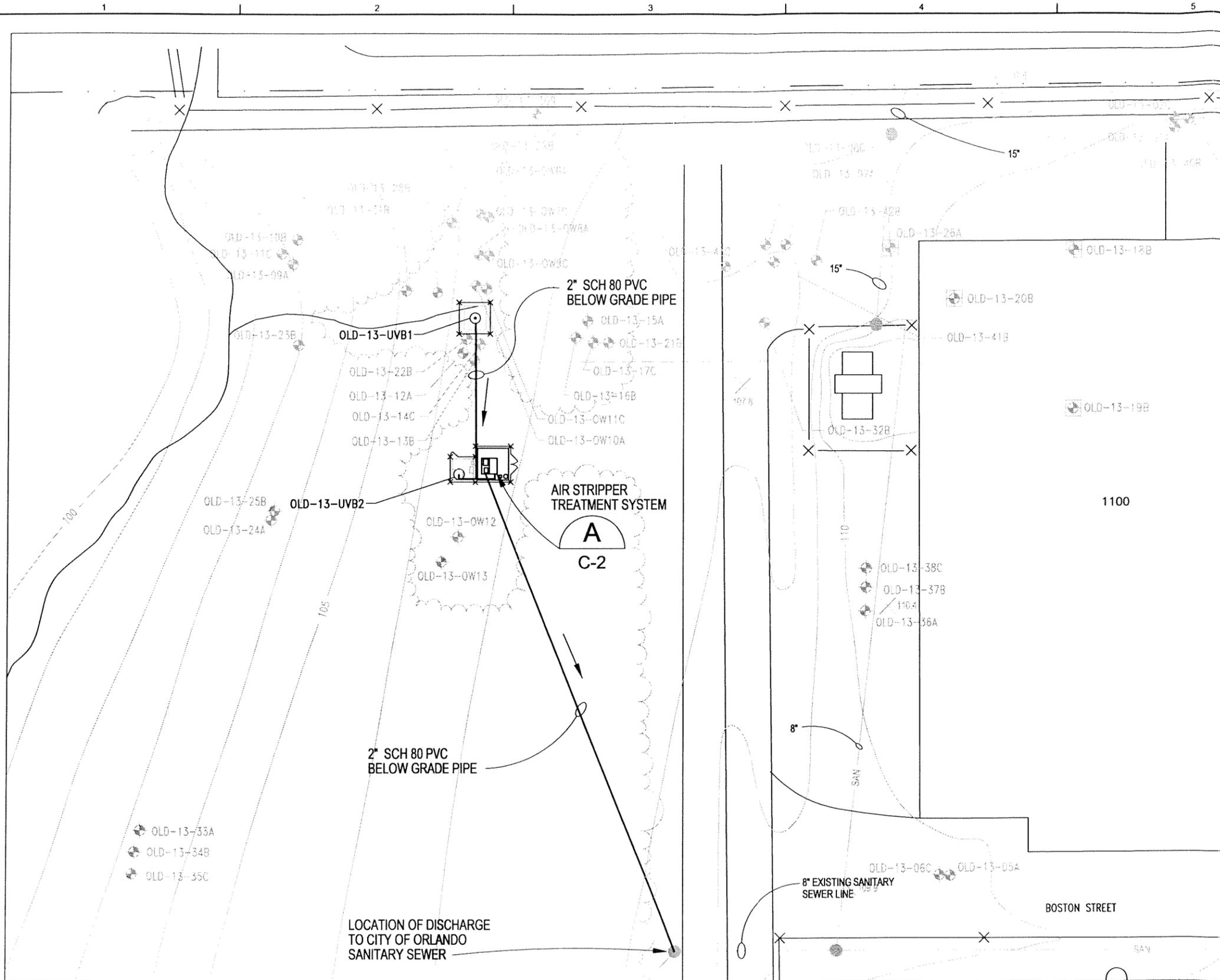
OPERABLE UNIT 4
 INTERIM REMEDIAL ACTION RETROFIT
 NAVAL TRAINING CENTER
 ORLANDO, FLORIDA

PROCESS INSTRUMENTATION AND CONTROLS

LEGEND SHEET NO. 2

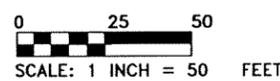
SHEET	2
DWG	G-2
DATE	AUGUST 2000
PROJ	152044.34.01.03.30

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LEGEND

- Monitoring well location and designation
- ⊗ Microwell location and designation
- ⊙ Interim remedial action recirculation well
- ×—× Fence
- ▭ Structure removed; topography no longer accurate.
- 100- Elevation contour (1-foot interval)
- × 114.2 Ground elevation



SOURCE: Naval Training Center Public Works Department, Storm Sewer Map, 1978

DSGN M. JOHNS					
DR L. WALTER					
CHK T. PALAIA					
APVD S. TSANGARIS	NO.	DATE	REVISION	BY	APVD

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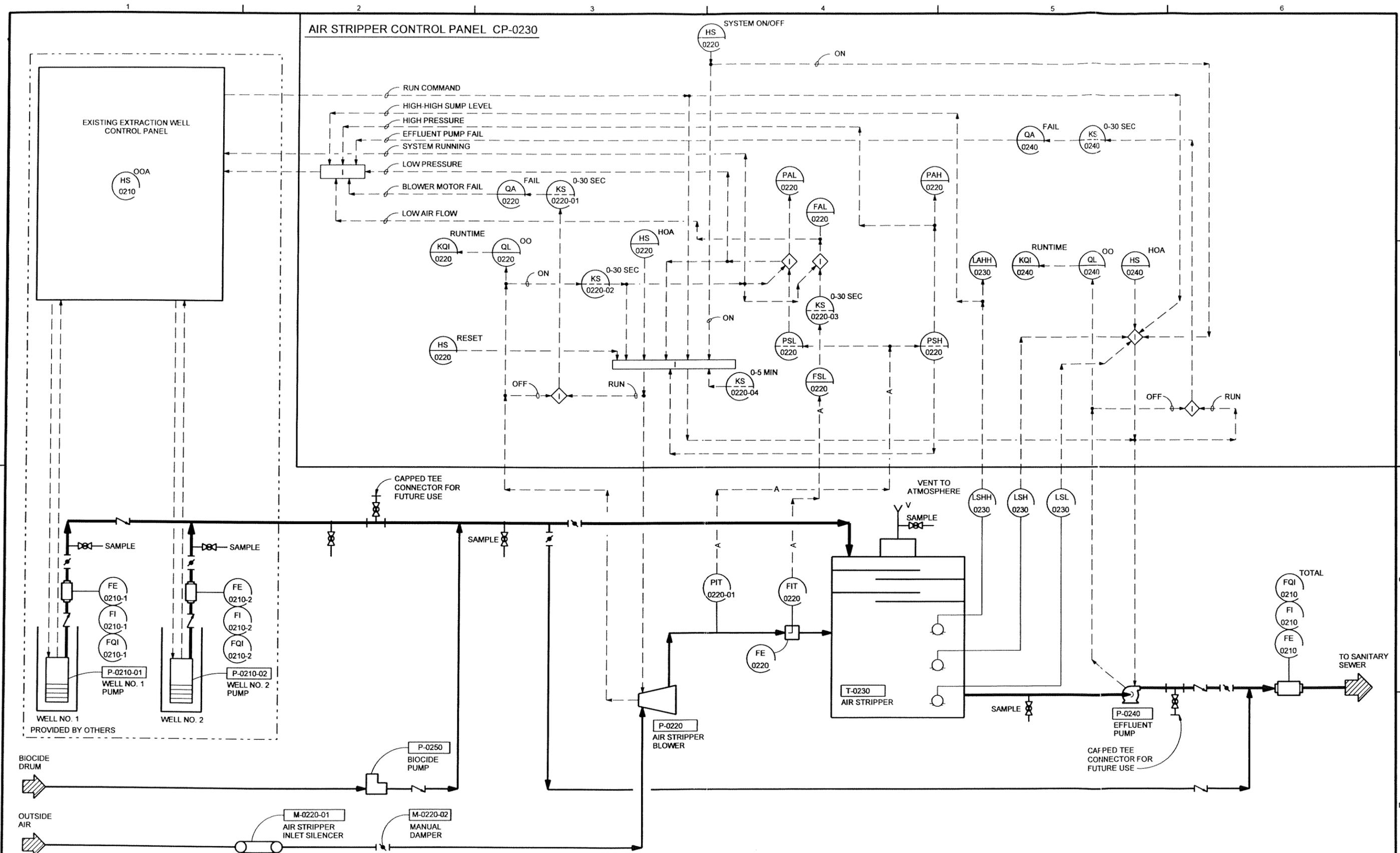


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CIVIL
 FIELD PIPING PLAN

SHEET 3
DWG C-1
DATE AUGUST 2000
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DSGN	T. PALAIA				
DR	E. KRISTEL				
CHK	M. OKEY				
APVD	C. HOOD	NO.	DATE	REVISION	BY

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OPERABLE UNIT 4
 INTERIM REMEDIAL ACTION RETROFIT
 NAVAL TRAINING CENTER
 ORLANDO, FLORIDA

PROCESS INSTRUMENTATION AND CONTROLS
 PROCESS INSTRUMENTATION
 AND CONTROL DIAGRAM

SHEET	5
DWG	I-1
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PROJ	152044.34.01.03.30

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ATTACHMENT F

NO.

1 Air Stripper System Specification

SECTION 11301 LOW-PROFILE TRAY AIR STRIPPING SYSTEM

PART 1 GENERAL

1.01 SUMMARY

- A. This specification section covers the Work necessary to furnish, test, and train operators for a low-profile, tray air stripping system.

1.02 DEFINITIONS

- A. CONTRACTOR – CH2M HILL Constructors, Inc.
- B. SUBCONTRACTOR - Offeror

1.03 REFERENCE STANDARDS

- A. Comply with the applicable provisions and recommendations of the following:
 - 1. American National Standards Institute (ANSI).
 - 2. American Society for Testing and Materials (ASTM).
 - 3. Instrument Society of America (ISA).
 - 4. National Electrical Code (NEC).
 - 5. National Electrical Manufacturers Association (NEMA).
 - 6. National Fire Protection Association (NFPA).
 - 7. Occupational Safety and Health Administration (OSHA).
 - 8. Underwriters Laboratories, Inc. (UL).

1.04 SYSTEM DESCRIPTION

- A. Provide a package low profile tray air stripping system that includes the following :
 - 1. A low-profile tray air stripper.
 - 2. An instrumentation and control system.
 - 3. All necessary piping to provide connection to the existing facilities.
 - 4. All necessary electrical components to provide a fully functional, and operational system.

1.05 SUBMITTALS

- A. CONTRACTOR may request submittals in addition to those listed when deemed necessary to adequately describe the Work covered in the respective sections.

- B. Provide submittals in complete and in sufficient detail for ready determination of compliance with the Subcontract requirements.
- C. Provide the following submittals with the Proposal:
 - 1. Submit a list of proposed equipment including manufacturer name, equipment name, model number, and design capacity (where applicable) for the following:
 - a. Low-profile tray air stripper system (include information for blower and effluent pump)
 - b. Air stripper instrumentation and control system (include information for major instruments and control system package)
 - 2. Submit complete set of catalog cut sheets for the above listed proposed equipment. At a minimum, include the following information as it pertains to the proposed equipment:
 - a. Low-Profile Tray Air Stripper: Number of trays, dimensions of trays, system hydraulic capacity, total system dimensions, description of materials of construction, description of factory finish system.
 - b. Motors: Complete motor nameplate data, as defined by NEMA MG 1, motor manufacturer, and description of motor modifications, if any.
 - c. Pump: Performance data curves showing head, capacity, horsepower demand, required net positive suction head, and pump efficiency over the entire operating range of the pump, from shutoff to maximum capacity. Indicate separately the head, capacity, horsepower demand and overall efficiency at guarantee point.
 - d. Blower: Performance data curves showing pressure, capacity, horsepower demand, and temperature rise over the entire operating range of the blower, from shutoff to maximum capacity. Indicate the minimum capacity to avoid surge (if applicable).
 - e. Control System: Installation requirements, required power supply, materials of construction, general description, and layout of components
 - f. Instrumentation: Operating range, accuracy, required power supply, pressure range, operating temperature range, calibration requirements, operating procedures, materials of construction, and description of all options selected.
 - 3. Submit a completed Compensation Schedule in accordance with the Solicitation.
- D. Provide the following submittals prior to Performance Tests:
 - 1. Submit not less than 10 working days prior to Performance Tests.

2. Submit an Air Stripper System Hydraulic and Performance Test Plan for the hydraulic and performance tests for the air stripper and control systems in sufficient detail to fully describe the specific tests to be conducted and the data to be collected to demonstrate full compliance with PERFORMANCE TESTS. At a minimum, include the schedule for testing, test plan, procedures, sampling and analysis plan, and log format.
- E. Provide the following submittals prior to Final Acceptance of the Work:
1. Submit a complete Operations and Maintenance Manual. Submit an outline of the Manual for approval by the CONTRACTOR. Submit the Manual in hardcopy and electronic formats. Submit the Manual text in Microsoft Word™ and the as-built drawings in AutoCad 14 (or lower) or MicroStation J (or lower) format. Submit the Manual in a 3-ring binder format that contains tabbed dividers between the operations and maintenance requirements for each separate piece of equipment. Provide a Table of Contents for each section of material that is provided. Provide the following detailed information in the Manual:
 - a. A 30 year life cycle analysis for all equipment.
 - b. Detailed treatment system operations safety precautions.
 - c. Detailed, easy-to-follow procedures for air stripper treatment system startup, normal operations, and shut down.
 - d. Detailed, easy-to-follow procedures for performing routine, Manufacturer recommended equipment maintenance.
 - e. Detailed, easy-to-follow procedures for trouble-shooting common treatment system malfunctions.
 - f. As-built drawings including electrical schematics.
 - g. A list of equipment with corresponding equipment manufacturer name, address, and telephone numbers for maintenance/warranty issues.
 - h. Approved catalog cut sheets for all equipment including manufacturer's installation and operation and maintenance procedures and recommendations.
 - i. List of special tools, materials, and supplies furnished with equipment for use prior to and during startup and for future maintenance.
 - j. Schedule of recommended spare parts to maintain the equipment in service for a period of 30 years. Include current price information.
 2. Submit a complete Performance Test Report as specified in PERFORMANCE TESTS.
 3. Submit a signed and dated Performance Warranty. Minimum requirements for the Performance Warranty are specified below:

- a. The Performance Warranty shall be for a period of 1 year from the date of Final Acceptance.
 - b. The Performance Warranty shall cover all air stripping system components for defects in materials and workmanship.
 - c. The Performance Warranty shall cover the air stripping system for failure to meet the PERFORMANCE REQUIREMENTS at the SERVICE CONDITIONS.
 - d. Include the Manufacturer's Warranty for appropriate equipment.
- F. Final Acceptance of the Work will be given by CONTRACTOR upon receipt and approval of all submittals as specified in FINAL ACCEPTANCE.

1.06 PROJECT CONDITIONS

- A. Location: Former Base Laundry and Dry Cleaning Facility, Naval Training Center, Orlando, Florida. The site is located approximately 200 feet west of Building 1100, at Study Area 13, Operable Unit 4, Area C, approximately 1 mile west of the Main Base off Maquire Avenue. Refer to the site location map presented on Figure 1.
- B. Ambient Air Temperature Range: minimum 20 degrees Fahrenheit, maximum 110 degrees Fahrenheit.
- C. Relative Humidity: Up to 100 percent.
- D. Site Elevation: approximately 105 feet above mean sea level.

1.07 WARRANTIES and BONDS

- A. Provide Bonds from a surety acceptable to the CONTRACTOR.
- B. Provide Performance and Payment Bonds in the amount of 100 percent of the Subcontract price as specified in the General Provision entitled Performance and Payment Bonds.
- C. Provide a Maintenance Bond in the amount of 10 percent of the Subcontract price as specified in the General Provision entitled Performance and Payment Bonds.
- D. This project shall be under warranty as set forth in the General Provision entitled Warranty and in SUBMITTALS.

1.08 HAZARDOUS WASTE HEALTH AND SAFETY REQUIREMENTS

- A. This section outlines the hazardous waste related health and safety requirements for the performance of the Work specified in the Subcontract Documents.
- B. Submittals
 - 1. Submit a Site Safety Plan.
 - 2. Submit Medical and Training Certification Letter.
- C. Safety Requirements

1. The Occupational Safety and Health Act (OSHA) Standards for Construction (Title 29, Code of Federal regulations Part 1926 and Part 1910 as revised from time to time) are applicable to this Work.
2. Any cutting, welding, brazing, or other hot work shall comply with OSHA 1910.252.

D. Subcontractor's Responsibility for Health and Safety

1. The SUBCONTRACTOR shall be solely responsible for health, safety, and protection of all its personnel and lower tier subcontractor's personnel during the performance of the Work. SUBCONTRACTOR health and safety requirements shall be in accordance with the guidelines established by OSHA in the March 6, 1989 Federal Register (29 CFR 1910.120) "Hazardous Waste Operations and Emergency Response; Final Rule."
2. The SUBCONTRACTOR shall inform the CONTRACTOR of all accidents on the site and related claims within 24 hours of their occurrence.
3. The SUBCONTRACTOR shall develop and implement a site-specific health and safety plan (Site Safety Plan) that meets the requirements of 29 CFR 1910.120(i). The Site Safety Plan shall be submitted to the CONTRACTOR for approval no less than 10 working days prior to initiation of any field construction activities. The SUBCONTRACTOR will be provided a copy of CONTRACTOR's Health and Safety Plan developed for Work at the site.
4. The SUBCONTRACTOR shall be required to submit to the CONTRACTOR prior to initiation of any field construction activities, the attached "Contractor Medical and Training Certification Letter" to certify that the SUBCONTRACTOR's personnel and lower tier subcontractor's personnel are participating in a medical surveillance program according to 29 CFR 1910.120(f) and 29 CFR 1910.134, and that SUBCONTRACTOR's personnel and lower tier subcontractor's personnel have been trained according to 29 CFR 1910.120(e). Each employee who will be performing activities with potential for exposure to hazardous waste must meet these requirements and must be listed on the certification letter by name. Addition of any employees after initiation of field construction activities shall require a resubmittal of this letter.
5. Exposure to hazardous waste is expected only during activities involving handling of water from the extraction wells (UVB1 and UVB2). The CONTRACTOR has information relating to the site that can be reviewed at the CONTRACTOR's office upon request. This information may be useful to the SUBCONTRACTOR in developing a Site Safety Plan and preparing the Proposal; however, the CONTRACTOR makes no warranty as to the completeness or adequacy of the information. The SUBCONTRACTOR shall collect added information as needed to prepare the Site Safety Plan.
6. The SUBCONTRACTOR shall provide a designated Health and Safety Officer to implement, monitor, and enforce the Site Safety Plan. The

SUBCONTRACTOR's job supervisory staff may be designated the Health and Safety Officer supplemented as necessary by additional personnel. The SUBCONTRACTOR's staff member designated as the Health and Safety Officer for the Subcontract must be a qualified engineer or technician and be able to demonstrate ability to perform correctly the duties required to the satisfaction of CONTRACTOR and must be employed full-time at the project site whenever Work is in progress. The Health and Safety Officer must have the following qualifications:

- a. Satisfactory completion of 40 hours initial training in Hazardous Waste Site Field Investigation, 3 days on-site apprenticeship, and 8 hours of specialized training.
- b. Current certification in cardiopulmonary resuscitation (CPR) and multimedia first aid.
- c. Attendance at refresher training within the past 12 months.
- d. Knowledge of emergency preparedness techniques and considerations, including:
 - i. Onsite accidents/exposure.
 - ii. Procedures for medical emergencies.
 - iii. Heat stress and cold stress prevention, symptomology, and treatment.
- e. Specific familiarity with OSHA regulations for general industry (29 CFR 1910) and the construction industry (29 CFR 1926).
- f. Experience in implementing the above-cited OSHA regulations as a designated Health and Safety Officer.
- g. Experience working on one or more hazardous waste sites.
- h. Experience with the types of activities that will be conducted at the site.
- i. Upgrade to Level A, Level B, or Level C protection is not anticipated. This information is provided for Proposal purposes only. The SUBCONTRACTOR is responsible for determining the appropriate level of protection.

E. Site Security

1. The SUBCONTRACTOR shall require all personnel and visitors having access to the site to sign-in and sign-out, and shall keep a record of all site access.
2. All visitors, SUBCONTRACTOR, and lower tier subcontractor's personnel shall read, review, and be briefed on the Site Safety Plan and sign documentation stating that they have read and understand the same.
3. All visitors to the site shall be briefed on safety and security by the SUBCONTRACTOR.

4. The CONTRACTOR will provide their own personal protection equipment during site visitation.

F. Contaminated Water Handling

1. Handling of water that may be produced during performance testing is the full responsibility of the SUBCONTRACTOR and must be in accordance with all rules and regulations for handling and disposing of contaminated water or as approved by the CONTRACTOR.
2. The SUBCONTRACTOR shall be responsible for all handling, temporary storage, and disposal of the water and for obtaining all approvals, scheduling in advance with the CONTRACTOR, and meeting all the requirements of the disposal facility. Coordinate disposal of all water with the CONTRACTOR prior to discharge.

1.09 SUBCONTRACTOR QUALITY CONTROL

- A. Establish and maintain an effective Quality Control Program.
- B. The quality of Work shall be the responsibility of the SUBCONTRACTOR. Perform sufficient inspections and tests of all Work to ensure conformance to applicable specifications and drawings with respect to the quality of materials, workmanship, construction, finish, functional performance, and identification on a continuing basis.
- C. Furnish qualified personnel, appropriate facilities, instruments and testing devices necessary to perform the quality control function. The SUBCONTRACTOR's job supervisory staff may be used for quality control supplemented as necessary by additional personnel. The SUBCONTRACTOR's staff member designated as the Quality Control Supervisory Engineer for the Subcontract must be a qualified engineer or technician and be able to demonstrate ability to perform correctly the duties required to the satisfaction of CONTRACTOR and must be employed full-time at the project site whenever Work is in progress.
- D. Maintain current daily records of quality control operations, activities, tests, and inspections including the work of suppliers and lower tier subcontractors. Keep these records on an acceptable form and indicate a description of trades working on the project, the number of personnel working, the weather conditions encountered, any delays encountered, and acknowledgement of deficiencies noted along with the corrective actions taken on current and previous deficiencies. These records shall contain factual evidence that required activities or tests have been performed, including but not limited to the following:
 1. Type, number, and results of control activities and test involved.
 2. Nature of defects and causes of rejection.
 3. Proposed remedial action.
 4. Corrective actions taken.

5. These records shall cover both conforming and defective features and shall include a statement that supplies and materials incorporated in the Work comply with the Subcontract. Furnish legible copies of these records to CONTRACTOR daily.
- E. CONTRACTOR will notify the SUBCONTRACTOR of any non-compliance with the requirements. The SUBCONTRACTOR shall, after receipt of such notice, take immediate corrective action. CONTRACTOR may issue an order to stop all or part of the Work until satisfactory corrective action has been taken. No part of the time lost due to any such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the SUBCONTRACTOR.
 - F. Completion and Final Acceptance Inspections:
 1. SUBCONTRACTOR's Quality Control Completion Inspection: Based on CONTRACTOR's concurrence that the Work is nearing substantial completion, and at least 2 working days prior to pre-final inspection, the SUBCONTRACTOR's quality control inspection personnel shall conduct a detailed inspection. Notify CONTRACTOR at least 2 working days prior to the inspection so that they may participate, if desired.
 2. Pre-Final Inspection: CONTRACTOR will conduct the pre-final inspection of the Work at the manufacturing location. The SUBCONTRACTOR shall give notice to CONTRACTOR at least 10 working days prior to the desired date of the pre-final inspection. The SUBCONTRACTOR must assure CONTRACTOR that all specific items previously identified as being unacceptable, along with all remaining Work, will be complete and acceptable by the date scheduled for the pre-final inspection. During the inspection, CONTRACTOR will produce a list of incomplete and/or unacceptable Work performed under the Subcontract and will subsequently furnish the list to the SUBCONTRACTOR. Failure of CONTRACTOR to detect and list all incomplete and/or unacceptable Work during this inspection will not relieve the SUBCONTRACTOR from acceptably performing all Work required by the Subcontract Documents.
 3. Final Acceptance Inspection. CONTRACTOR will conduct the final inspection of the Work at the Site. The SUBCONTRACTOR shall give notice to CONTRACTOR at least 5 working days prior to the desired date of the final inspection. The SUBCONTRACTOR must assure CONTRACTOR that all specific items previously identified as being unacceptable, along with all remaining Work, will be complete and acceptable by the date scheduled for the final inspection. Failure of the SUBCONTRACTOR to have all Subcontract Work acceptably complete for this inspection will be cause for CONTRACTOR to bill the SUBCONTRACTOR for additional inspection costs.

1.10 MEASUREMENT AND PAYMENT

A. Administrative Submittals:

1. Compensation Schedule: Submit schedule on CONTRACTOR's standard form.
 2. Application for Payment: In accordance with General Provisions and as specified herein.
- B. Compensation Schedule:
1. Break down Lump Sum Work as requested on the Compensation Schedule.
 - a. Provide a lump sum price for each item on the Compensation Schedule.
 - b. Since a design flow rate has not been determined at the time of Solicitation, the SUBCONTRACTOR shall provide a price for three air stripping systems of various sizes as requested on the Compensation Schedule. One system will be selected by the CONTRACTOR for purchase at the time of Award.
 - c. Solicitation Item 100 includes all cost for initial preparation and delivery of the submittals required in the Subcontract, including but not limited to the following as specified herein: Site Safety Plan, Air Stripper System Hydraulic and Performance Test Plan, Operations and Maintenance Manual, and the Performance Test Report. Also included are the incorporation of CONTRACTOR comments into the documents and the re-submittal of the revised documents until acceptable to CONTRACTOR.
 - d. Solicitation Item 200 includes all material and fabrication cost for a fully functional package air stripper treatment system with a hydraulic capacity of 50 gallons per minute (gpm) including the tray air stripper, effluent pump, control system, special tools and spare parts, and all other parts and appurtenances as specified herein. Include transportation and delivery costs for this unit in this item.
 - e. Solicitation Item 300 includes all material and fabrication cost for a fully functional package air stripper treatment system with a hydraulic capacity of 100 gpm including the tray air stripper, effluent pump, control system, special tools and spare parts, and all other parts and appurtenances as specified herein. Include transportation and delivery costs for this unit in this item.
 - f. Solicitation Item 400 includes all material and fabrication cost for a fully functional package air stripper treatment system with a hydraulic capacity of 150 gpm including the tray air stripper, effluent pump, control system, special tools and spare parts, and all other parts and appurtenances as specified herein. Include transportation and delivery costs for this unit in this item.
 - g. Solicitation Item 500 includes all cost (materials, labor, travel) to test the air stripper treatment system as specified herein. It also includes all cost for training CONTRACTOR personnel.

h. Solicitation Item 600 includes all cost to obtain all necessary bonds as specified in WARRANTIES and BONDS.

2. Include proportional amount of SUBCONTRACTOR's overhead and profit in each item.

C. Application for Payment

1. Reference General Provisions.

2. Use detailed Application for Payment Form suitable to CONTRACTOR in accordance with General Provisions.

a. Include accepted Compensation Schedule for each portion of Work.

b. Form(s) to conform to the examples furnished by CONTRACTOR for Lump Sum Work and materials on hand.

c. Submit Application for Payment, a listing of material on hand, and such supporting data as may be requested by the CONTRACTOR.

D. Payment

1. General: Payment for Work will be on a lump sum basis. Progress payments will be made in accordance with General Provisions.

2. Payment for all work shown or specified in the Subcontract Documents is included in the Subcontract Price. No measurement or payment will be made for individual items.

E. Final Application for Payment

1. Reference General Provision entitled Final Payment and as may otherwise be required in Subcontract Documents.

2. Prior to submitting final application, make acceptable delivery of required documents as specified in FINAL ACCEPTANCE.

1.11 PROPRIETARY NAMES

A. Names indicated for colors, textures, patterns, and other characteristics of materials or names identifying specific mechanical and electrical equipment are for selection only. Other manufacturers' materials and equipment are acceptable provided they closely resemble all specified salient characteristics and conform to all other requirements of those products mentioned by name.

1.12 PATENT PROTECTION

A. SUBCONTRACTOR shall, at its sole expense, defend and pay for all damages and costs awarded in any proceeding brought against CONTRACTOR, its employees and agents, and the U.S. Navy, in which it is claimed that the manufacture, sale, or use of any material and equipment or parts thereof furnished hereunder constitutes an infringement of any patent or other proprietary information right, provided SUBCONTRACTOR is promptly

notified of the commencement of any such proceeding. SUBCONTRACTOR's indemnity, as to use, applies only when infringement occurs from the normal use for which such material and equipment were designed. CONTRACTOR may, at it's option, be represented at any such proceeding.

- B. If such manufacture, sale, or use is held in any such proceeding to constitute an infringement is enjoined, SUBCONTRACTOR, at it's sole expense, shall either procure for CONTRACTOR the right to manufacture, sell, or use such material and equipment; or replace same with substantially equal but non-infringing material and equipment; or modify same to make them substantially equal but non-infringing; or remove same and refund the purchase price, transportation and installation costs, and CONTRACTOR costs associated with lost time and procurement of a replacement system.

1.13 FINAL ACCEPTANCE

- A. Approval for Final Payment will be made when the following are complete:
 1. SUBCONTRACTOR successfully passes the Final Acceptance Inspection as specified in SUBCONTRACTOR QUALITY CONTROL.
 2. All Submittals required in this section are submitted to CONTRACTOR and deemed complete and acceptable.
 3. The air stripper treatment system successfully passes the factory, functional, and performance tests specified in PERFORMANCE TESTS.
 4. The air stripper treatment system successfully completes the trouble-free continuous operations period as specified in CONTINUOUS OPERATIONS.

PART 2 PRODUCTS

2.01 GENERAL

- A. Provide a Proposal for three (3) fully functional, package, low-profile tray air stripping systems as requested on the Compensation Schedule.
- B. The following defines the Maximum and Average Flow Rates as referenced in PERFORMANCE REQUIREMENTS.

Solicitation Item No.	Average Flow Rate (gpm)	Maximum Flow Rate (gpm)
200	30	50
300	80	100
400	120	150

- C. All components shall be rated for exterior use and shall be capable of withstanding typical site weather conditions.

2.02 SERVICE CONDITIONS

Design Parameter	Units	Design Value
<u>Maximum Influent</u> Tetrachloroethylene (PCE) Concentration	µg/L	3,800
<u>Average Influent</u> PCE Concentration	µg/L	1,900
<u>Maximum Effluent</u> PCE Concentration	µg/L	3
<u>Maximum Influent</u> Trichloroethylene (TCE) Concentration	µg/L	1,500
<u>Average Influent</u> TCE Concentration	µg/L	750
<u>Maximum Effluent</u> Trichloroethylene (TCE) Concentration	µg/L	3
<u>Maximum Influent</u> cis-1,2 Dichloroethylene (DCE) Concentration	µg/L	1,200
<u>Average Influent</u> cis-1,2 DCE Concentration	µg/L	600
<u>Maximum Effluent</u> cis-1,2 DCE Concentration	µg/L	70
Liquid Temperature	°F	64 to 77 (72)
pH	pH Units	4.4 to 6.5 (5.4)
Total Iron Range (average in parenthesis)	mg/L	<0.005 to 2.1 (0.4)
Total Manganese Range (average in parenthesis)	mg/L	<0.003 to <0.034 (<0.005)
Calcium Range (average in parenthesis)	mg/L	<0.3 to <56.0 (<5.0)
Total Alkalinity (as CaCO ₃) Range (average in parenthesis)	mg/L	5.9 to 7.7 (6.6)

2.03 PERFORMANCE REQUIREMENTS

- A. The low-profile tray air stripping system shall reduce Influent Concentrations to below the Maximum Effluent Concentrations for each contaminant specified in

SERVICE CONDITIONS under the following conditions when operating without use of influent spray nozzles:

1. Maximum Flow Rate containing the average contaminant concentrations specified in SERVICE CONDITIONS.
2. Average Flow Rate containing the maximum contaminant concentrations specified in SERVICE CONDITIONS. For this condition, the air stripping system must meet the Maximum Effluent Concentrations for each contaminant with one tray removed from the system.

2.04 DESIGN REQUIREMENTS

- A. Design and construct the Air Stripper Treatment Plant to provide a minimum life expectancy of 30 years.

2.05 EQUIPMENT DESCRIPTION

- A. Tray Air Stripper (Component T-0230):

1. Materials of construction for sump, trays, and cover shall be Type 304L stainless steel.
2. Materials of construction for all piping must be chemically compatible with contaminants and concentrations listed under SERVICE CONDITIONS and provide the minimum project life as specified in DESIGN REQUIREMENTS.
3. Minimum hydraulic capacity of the tray air stripper shall be the Maximum Flow Rate.
4. Air shall be evenly distributed over the cross-sectional area of the tray air stripper.
5. Liquid shall be distributed evenly over the entire surface of the aeration trays, with no visual evidence of low flow areas or dead channels on the aeration trays.
6. The tray air stripper shall be skid mounted on a structural steel or cast iron frame. The skid shall contain provisions for lifting using the overhead lifting and transfer system to be provided by this specification and lifting by forklift.
7. The blower (Component P-0220) shall be mounted on a steel or cast iron frame. Blower discharge shall be factory connected to the air stripper sump.
8. The blower airflow and static pressure shall be adequate to achieve the performance specified in PERFORMANCE REQUIREMENTS at all operating conditions.
9. Provide inlet silencer for the blower. Silencer (Component M-0220-01) shall be capable of reducing the noise level to below 80 dB within 2 feet of the blower.
10. The tray air stripper shall contain the following equipment:
 - a. Transparent, polyurethane, vertical tube sump level sight gauge.

- b. Removable trays with chemically resistant gaskets.
 - c. Clean-out ports for each baffled channel on each tray with watertight caps with diameter large enough to access with high-pressure washer wand.
 - d. Sump inspection port with a minimum 8-inch diameter for manual access.
 - e. Sump drain valve connected to the existing sanitary sewer line.
 - f. Stainless steel mist eliminator.
 - g. Blower inlet damper (Component M-0220-02).
 - h. Stainless steel tray latches. Minimum number to prevent leakage under full hydraulic capacity.
 - i. Brass or stainless steel internal spray nozzle(s).
 - j. Sampling valves at water inlet and discharge as shown on the Drawings.
 - k. A high-pressure water washer wand in 3-foot 1/4-inch NPT threaded sections with an ON/OFF trigger, spray nozzle, and an adapter to connect the wand to the pressure washer hose end. The wand shall be capable of delivering a minimum flow of 2 gpm at a pressure of 900 psi.
 - l. The air stripper shall vent directly to the atmosphere via an offgas exhaust stack that shall extend a minimum of 10 feet from the ground surface and vent directly to the atmosphere. The vent shall be equipped with a rain guard.
 - m. Any other equipment not specifically enumerated herein needed for a complete and functional system which will produce treated water in continuous compliance with the PERFORMANCE REQUIREMENTS.
11. The trays shall be removable to allow periodic manual cleaning. Each aeration tray shall have four lifting lugs located at each corner to allow a hoist to remove it from the stack.
12. The interior of each tray of the air stripper shall be accessible via a 4-inch minimum diameter cleanout ports installed at the end of each of the aeration trays. Each channel on the aeration tray shall have a separate cleanout port. The cleanout ports shall be designed to allow insertion of a high pressure washer for cleaning of the entire length of the aeration tray.
13. The air stripper influent piping will include a capped tee connector, or like piece of equipment, to allow for the connection of an acid feed system at a later time. The connector will be located upstream of the air stripper inlet, as shown on the Drawings.
14. The air stripper effluent piping will include a capped tee connector, or like piece of equipment, to allow for the connection of an acid feed recirculation

line at a later time. The connector will be located downstream of the effluent pump as shown on the Drawings.

15. Information presented here are minimum requirements. SUBCONTRACTOR shall be fully responsible for system design.

B. Effluent Pump (Component P-0240):

1. The effluent pump shall be a frame-mounted, mechanical seal, end-suction, centrifugal pump and shall be skid mounted on a steel or cast iron frame.
2. The effluent pump shall be sized to deliver the maximum hydraulic capacity of the low-profile tray air stripper at a static head of 10 feet plus friction loss through 400 feet of 2 inch cast iron pipe with four 2-inch cast iron 90 degree elbows.
3. Maximum pump speed shall be 1,800 rpm.
4. The pump motor shall be squirrel cage induction type, TEFC, 460V, three-phase, 60-Hz, 1.15 service factor. Motors shall be designed, manufactured, and tested in accordance with NEMA MG 1.
5. The pump shall be equipped with lifting lugs if greater than 100 pounds.
6. The pump shall have the Manufacturer's standard baked enamel finish.

2.06 TREATMENT SYSTEM CONNECTIONS

A. Influent Piping:

1. The tray air stripper treatment system influent piping shall be equipped to connect to a 2-inch cast iron blind flange protruding 6-inches vertically from the ground surface, 12-inches from the edge of the air stripper skid.
2. The influent piping shall be arranged and constructed in a manner to minimize headloss through the system.

B. Effluent Piping:

1. The tray air stripper treatment system effluent piping shall be equipped to connect to a 2-inch cast iron blind flange protruding 6-inches vertically from the ground surface, 12-inches from the edge of the air stripper skid, on the opposite side of the skid that the influent piping is located.
2. The effluent piping shall be arranged and constructed in a manner to minimize headloss through the system.

C. Electrical

1. Provide 10-foot long, 3PH 480V power cord for connection to existing power panel by Others.

2.07 CONTROL SYSTEM

A. General:

1. The Process Instrumentation and Control Diagram and these Specifications depict the minimum functional requirements of the control system. Provide all instrumentation and controls necessary to provide a safe and operable system. The specific control system proposed is subject to the approval of the CONTRACTOR.
- B. Panel – Component CP-0230: NEMA 4X enclosure, stainless steel, skid mounted type, containing all operator interface and local control devices, main circuit breaker, combination motor starters, circuit breakers, control power transformer, and any other equipment necessary for a complete and operable system.
- C. Operator Controls and Indicators:
 1. System ON switch. Component HS-0220.
 2. HAND/OFF/AUTO selector switch for each motor. Components HS-0240 and HS-0220.
 3. RUN indicating light for each motor. Components QL-0240 and QL-0220.
 4. ALARM indicator lights for all alarm conditions. Components QA-0240, QA-0220, LAHH-0230, PAH-0220, PAL-0220, and FAL-0220.
 5. Elapsed time meter for each motor. Components KQI-0240 and KQI-0220.
 6. RESET pushbutton to reset alarm conditions for the air stripper blower. Component HS-0220 (Reset).
- D. External Interfaces:
 1. Accept a dry contact closure for air stripper treatment system operations start and stop control from the extraction well pumping system (Provided by Others).
 2. Provide a dry contact closure for interface with common alarm condition to the existing extraction well control panel (Provided by Others).
- E. Instruments: Provide the following instruments:
 1. Liquid filled pressure indicator and transmitter to monitor air stripper inlet pressure. Component PIT-0220-01.
 2. Provide HIGH air discharge pressure switch and alarm indication at CP-0230. Components PSH-0220 and PAH-0220.
 3. Provide LOW air discharge pressure switch and alarm indication at CP-0230. Components PSL-0220 and PAL-0220.
 4. Direct acting float switches with an enclosed mercury switch and integral cable for air stripper sump water level. Components LSL-0230, LSH-0230, and LSHH-0230.

5. Provide HIGH-HIGH air stripper sump water level switch and alarm indication at CP-0230. Components LSL-0230, LSH-0230, LSHH-0230, and LAHH-0230.
 6. Programmable logic controller to implement all logic, switch and timer functions. Component CP-0230.
 7. Effluent pump discharge water flow indicator and totalizer. Components FE-0210, FI-0210, and FQI-0210.
 8. Blower discharge air flow indicating transmitter, low flow switch, and alarm indication on CP-0230. Components FE-0220, FIT-0220, FSL-0220, and FAL-0220.
 9. Annunciator panel, analog indicators, hand switches and indicator lights as shown on the Drawings.
 10. Provide blower and pump fail alarm indication on CP-0230. Components QA-0240 and QA-0220.
- F. Functional Requirements: Complete automatic and manual operation of the air stripper system. Provide the following functions:
1. In the HAND mode, the effluent pump shall operate continuously. In the AUTO mode, with a permissive contact closure from the system ON switch and a permissive contact closure from the extraction well pumping system (Provided by Others), the effluent pump shall start when the level in the air stripper sump is HIGH and stop when the level in the air stripper sump is LOW. Without a permissive contact closure from the from the extraction well pumping system, the effluent pump shall not run in AUTO mode. In the OFF mode, the effluent pump shall not run.
 2. In the HAND mode, the air stripper blower shall operate continuously. In the AUTO mode, with a permissive contact closure from the system ON switch and a permissive contact closure from the extraction well pumping system (Provided by Others), the blower starts and stops after an adjustable time delay of 5 minutes after the feed pump stops (Component KS-0220-04). Without a permissive contact closure from the extraction well pumping system, the air stripper blower shall not run in AUTO mode. In the OFF mode, the air stripper blower shall not run.
 3. Provide time delay relay to delay alarm indication to avoid nuisance alarms at startup, 0 to 30 seconds. Components KS-0240, KS-0220-01, KS-0220-02, and KS-0220-03.
 4. Alarm Functions for All Equipment:
 - a. When the blower motor fails, send signal to extraction well control panel (Provided by Others) to alarm and shut down extraction well pumping system immediately. When an alarm shutdown occurs, the equipment is locked out and will require operator intervention to reset.

- b. When the effluent pump motor fails, send signal to extraction well control panel (Provided by Others) to alarm and shut down extraction well pumping system immediately. When an alarm shutdown occurs, the equipment is locked out and will require operator intervention to reset.
- c. When blower discharge pressure is HIGH, stop blower (blower must still have 5-minute delay) and send signal to extraction well control panel (Provided by Others) to alarm and shut down extraction well pumping system immediately. When an alarm shutdown occurs, the equipment is locked out and will require operator intervention to reset.
- d. Blower discharge low pressure alarm shall be active only when blower is on. During blower start, pressure alarm will be bypassed for the appropriate length of time to allow blower to reach operating pressure. When blower discharge pressure is LOW, shut down blower (blower must still have 5-minute delay) and send signal to extraction well control panel (Provided by Others) to alarm and shut down extraction well pumping system immediately. When an alarm shutdown occurs, the equipment is locked out and will require operator intervention to reset.
- e. Blower discharge air flow rate alarm shall be active only when blower is on. During blower start, air flow rate alarm will be bypassed for the appropriate length of time to allow blower to reach the operating air flow rate. When blower inlet air flow rate is LOW, shut down blower (blower must still have 5-minute delay) and send signal to extraction well control panel (Provided by Others) to alarm and shut down extraction well pumping system immediately. When an alarm shutdown occurs, the equipment is locked out and will require operator intervention to reset.
- f. When air stripper sump level is HIGH-HIGH, send signal to extraction well control panel to indicate an alarm condition and to shut down extraction well pumping system immediately.

G. Power Requirements: 3PH 480V AC, 60 Hz power supply.

2.08 ELECTRICAL

A. All Air Stripper Devices (Pump and Blower Motors):

1. Pre-wire to the Air Stripper Control Panel.
2. Identify all wiring with permanent labels at both ends, terminated with solderless lug, and terminated on numbered terminal blocks.
3. Wire Type: stranded copper, THHN/THWN insulation.
4. Minimum Wire Size: No. 12 AWG tin-plated copper.
5. Color-coded (provide a wire color coding legend posted in a prominent location inside control panel access).
6. Wiring shall be complete to internal terminal strips in the Control Panel.

7. Conform to all federal, state, and local electrical codes.
 8. Raceway (conduits) shall be rigid galvanized steel conduit. Washers, bolts, nuts, and other fittings shall be galvanized steel. Final connections to all motors shall be flexible, liquid tight.
- B. Provide control panel powered by a single 3PH 480V circuit for the air stripper treatment system.

2.09 SPECIAL TOOLS AND SPARE PARTS

- A. Provide all necessary special tools not readily available within 20 miles of the site required for equipment maintenance during the 30-year life expectancy.
- B. Provide one complete set of spare fuses for the main power panel and Air Stripper Control Panel.
- C. Provide two extra air stripper tray gaskets.
- D. Provide four extra clean-out port caps.
- E. Provide one extra spray nozzle.
- F. Provide one complete set of spare light bulbs for the Air Stripper Control Panel.
- G. Provide one service kit for the effluent pump.
- H. Provide one complete package of lubricants for routine service of the mechanical equipment for a period of one year from the date of Final Acceptance.

PART 3 EXECUTION

3.01 SEQUENCE OF WORK

- A. **Site Safety Plan:** Prepare a Site Safety Plan in accordance with HAZARDOUS WASTE HEALTH AND SAFETY REQUIREMENTS and all personnel assigned to work on the site shall be in full compliance with such Site Safety Plan prior to beginning field work on this Subcontract.
- B. **Fabrication of Package Air Stripping System:** Fabricate and factory test the low-profile, tray air stripping system as specified. Coordinate factory testing with the CONTRACTOR as specified.
- C. **Delivery of the Package Air Stripping System:** Transport and unload the system at the location designated by the CONTRACTOR.
- D. **Coordination of Work with the CONTRACTOR.** The CONTRACTOR must complete construction of the discharge pipeline, electrical connection, and programming of the control panel prior to treatment system startup testing.
- E. **Treatment Plant Startup Testing:** Perform functional and performance tests upon completion of construction by the CONTRACTOR. Submit test results to CONTRACTOR for review and approval.

- F. Training: Perform training of appropriate personnel after all other activities are complete.

3.02 FACTORY TEST

- A. Factory test individual components and the completed air stripper treatment system prior to delivery to the site. The test should ensure that the treatment system meets specifications stated herein and contains no leaks in the process piping. Notify the CONTRACTOR a minimum of 5 working days before factory testing so that CONTRACTOR may send a representative to observe the testing. The SUBCONTRACTOR is responsible for rectifying any problems with the system prior to delivery. SUBCONTRACTOR is responsible for all costs incurred by the SUBCONTRACTOR and CONTRACTOR as a result of failed tests including CONTRACTOR costs for oversight or retests.

3.03 DELIVERY AND INSTALLATION

- A. Provide a fully-functional, factory tested unit to the site. The unit shall be pre-wired, pre-ducted, pre-piped, and otherwise pre-assembled to be fully-functional. The unit shall be delivered as one skid. Unloading and placement of the unit is the responsibility of the SUBCONTRACTOR. The CONTRACTOR will designate the exact location of unit at the time of delivery. Foundation will be provided by others.

3.04 ON-SITE PERFORMANCE TESTS

A. General:

1. No water will be discharged to the sanitary sewer, adjacent surface water, or ground surface during on-site testing.
2. All processed water from on-site startup testing shall be diverted to a temporary storage tank capable of containing the water from the testing. Coordinate and schedule performance testing with the CONTRACTOR.
3. Furnish qualified Manufacturer's Representatives when required to assist in testing.
4. Utilize the Manufacturer's Certificate of Proper Installation form, supplemented as necessary, to document functional and performance procedures, results, problems, and conclusions.
5. Schedule and attend pretest (functional and performance) meetings related to test schedule, plan of test, materials, chemicals, and liquids required, facilities' operations interface, CONTRACTOR involvement.
6. Provide temporary valves, gauges, piping, test equipment, storage tank, and other materials and equipment required to conduct testing.

B. Cleaning and Checking: Prior to starting functional testing:

1. Calibrate testing equipment for accurate results.

2. Inspect and clean equipment, devices, connected piping, and structures so they are free of foreign material.
 3. Lubricate equipment in accordance with Manufacturer's instructions.
 4. Turn rotating equipment by hand and check motor-driven equipment for correct rotation.
 5. Open and close valves by hand and operate other devices to check for binding, interference, or improper functioning.
 6. Check power supply to electric-powered equipment for correct voltage.
 7. Adjust clearances and torques.
 8. Test piping for leaks.
 9. Obtain completion of applicable portions of Manufacturer's Certificate of Proper Installation.
- C. Ready-to-test determination will be by CONTRACTOR based on the following:
1. Notification by CONTRACTOR of equipment and system readiness for testing.
 2. Acceptable testing plan.
 3. Receipt of Manufacturer's Certificate of Proper Installation, if specified.
 4. Adequate completion of Work adjacent to, or interfacing with, equipment to be tested.
 5. Availability and acceptability of Manufacturer's Representative, when requested by CONTRACTOR, to assist in testing of respective equipment, and satisfactory fulfillment of other specified Manufacturer's responsibilities.
 6. All spare parts and special tools delivered to the CONTRACTOR.
- D. Functional Test:
1. Notify CONTRACTOR at least 5 working days prior to scheduled date of functional test.
 2. Conduct functional test until each individual component item or system has achieved 2 continuous hours of satisfactory operation. Demonstrate all operational features and controls function during this period while in the automatic modes.
 3. If, in CONTRACTOR's opinion, each system meets the functional requirements specified, such system will be accepted as conforming for purposes of advancing to performance testing phase. If, in CONTRACTOR's opinion, functional test results do not meet requirements specified, the systems will be considered non-conforming. SUBCONTRACTOR shall be responsible for any repairs, if necessary, to ensure that the treatment system meets proper specifications.

4. Performance testing shall not commence until the equipment or system meets functional tests specified.
- E. Pump Performance Test:
1. Notify CONTRACTOR at least 5 working days prior to scheduled date of performance testing.
 2. Conduct on the effluent pump.
 3. Perform under simulated operating conditions.
 4. Test for a continuous 2-hour period without malfunction.
 5. Test Log: Record the following:
 - a. Total head.
 - b. Capacity.
 - c. Horsepower requirements.
 - d. Throttle discharge valve to obtain pump data on curve at 2/3, 1/3, and shutoff conditions.
 6. Adjust, realign, or modify units and retest if necessary.
 7. Hydrostatic Tests: Pump casing(s) tested at 150 percent of shutoff head. Test pressure maintained for not less than 5 minutes.
- F. Air Stripper System Hydraulic Test:
1. Submit a proposed Hydraulic Test Plan in sufficient detail to fully describe the specific tests to be conducted and the data to be recorded to demonstrate full compliance with these specifications. The Hydraulic Test Plan is subject to review, comment, and approval by the CONTRACTOR. Minimum requirements for the Hydraulic Test are specified below.
 2. The SUBCONTRACTOR is responsible for performing the Hydraulic Test.
 3. Conduct one Hydraulic Test for the air stripper for a minimum continuous period of 1 hour.
 4. The Hydraulic Test may be performed in conjunction with the Air Stripper Performance Test using water designated for the Performance Test.
 5. Notify the CONTRACTOR a minimum of 5 working days prior to the tests.
 6. The Hydraulic Test shall include processing water through a fully installed air stripper system. The system shall include all parts as specified in EQUIPMENT DESCRIPTION.
 7. Conduct the Hydraulic Test at the hydraulic capacity of the air stripper.
 8. The Hydraulic Test results shall prove the following:

- a. Air stripper can process the hydraulic capacity.
 - b. No water or air leakage from system components.
 - c. No emission of mist from the exhaust stack.
 - d. Air is distributed evenly over the entire cross-sectional area of the tray air stripper.
 - e. Liquid is distributed evenly over the entire surface of the aeration trays, with no visual evidence of low flow areas or dead channels on the aeration trays.
 - f. The influent sprays nozzles are functioning correctly.
 9. If the above requirements are not met, the SUBCONTRACTOR shall, at their own expense, determine the problem(s) and rectify any flaws in the system prior to conducting the performance test.
- G. Air Stripper System Performance Test:
1. Submit a proposed Performance Test Plan in sufficient detail to fully describe the specific tests to be conducted and the data to be collected to demonstrate full compliance with these specifications. The Performance Test Plan is subject to review, comment, and approval by the CONTRACTOR. The Performance Test Plan shall contain at a minimum, the field sampling materials and methods, data recording and analysis plan, laboratory name and analytical methods, and quality assurance and quality control procedures. Minimum requirements for the Performance Test are specified below.
 2. The SUBCONTRACTOR is responsible for performing Performance Tests.
 3. Conduct two Performance Tests for the air stripper to show removal efficiency for the conditions specified in PERFORMANCE REQUIREMENTS. These Performance Tests shall be conducted on contaminated water of a source selected by the CONTRACTOR.
 4. Notify the CONTRACTOR 5 working days prior to the tests.
 5. The Performance Test shall include processing water for a minimum of 2 hours through the tray air stripper without the inlet spray nozzle(s).
 6. All piping and appurtenances integral to the testing will be supplied by the SUBCONTRACTOR and subject to approval by the CONTRACTOR. Following successful completion of the tests, the testing system will be disassembled and removed by the SUBCONTRACTOR.
 7. During the Performance Tests, three sets of influent and effluent water samples will be collected. These will be timed to occur during the first 15 minutes, mid-point, and final 15-minutes of the test period. In addition, one set of quality control samples will be collected during one of the sampling events. The quality control samples will include a duplicate sample, a field blank, and a trip blank. The influent and effluent samples will be collected from the sampling valves provided as part of the system.

8. The samples will be analyzed for the constituents specified in PERFORMANCE REQUIREMENTS.
9. All samples during the Performance Test will be collected and analyzed by the SUBCONTRACTOR with analytical results submitted to the CONTRACTOR for approval.
10. If discharge limits are exceeded during the Performance Test, the SUBCONTRACTOR shall, at their own expense, determine why discharge standards were not met and rectify any design flaws in the treatment system. The Performance Test shall be conducted until the tray air stripper system meets the required discharge limits.

H. Control System Performance Test

1. Test individual components for appropriate operation.
 2. Test individual signals between supplied components and the Air Stripper Control Panel.
 3. Coordinate and test individual signal interface with the existing extraction well control panel.
 4. During startup of the system the SUBCONTRACTOR shall be responsible for testing all normal functions including alarm conditions and simulated component failures of the system. SUBCONTRACTOR shall provide written test procedures to adequately test the specified operation of the system components and interface with the existing extraction well control panel.
- I. Startup Test Report: As applicable to the equipment furnished, certify in writing that:
1. Necessary hydraulic structures, piping systems, and valves have been successfully tested.
 2. Equipment systems and subsystems have been checked for proper installation, started, and successfully tested to indicate that they are operational.
 3. Systems and subsystems are capable of performing their intended functions.
 4. Facilities are ready for intended operation.
 5. Attach all results, test logs, analytical data from the laboratory, pertinent calculations, etc., to the test report.

3.05 TRAINING

- A. The SUBCONTRACTOR shall provide training for CONTRACTOR personnel on the air stripper treatment system. The instruction period shall be of sufficient length to explain the operation, maintenance, repair, and checkout procedures of the system.
- B. Coordinate the training with the CONTRACTOR at least 10 working days prior to the training date.

3.06 CONTINUOUS OPERATIONS

- A. CONTRACTOR will accept system as substantially complete and ready for continuous operation only after successful facility startup and 30 calendar days of continuous trouble-free operation is completed and documented, reports submitted, and Manufacturer's services completed for training of CONTRACTOR personnel. Trouble-free operation will be defined as:
1. Continuous attainment of the Maximum Effluent Carbon Tetrachloride Concentration in the effluent of the air stripper treatment system.
 2. No air or water leaks from equipment provided by SUBCONTRACTOR.
 3. No unscheduled system shutdown or repair due to equipment provided by SUBCONTRACTOR.

3.07 SUPPLEMENTS

- A. The supplements listed below, following the "END OF SECTION", are a part of this specification.
1. Manufacturer's Certificate of Proper Installation.
 2. Drawings.

END OF SECTION

MANUFACTURER'S CERTIFICATE OF PROPER INSTALLATION

OWNER _____ EQPT SERIAL NO: _____
EQPT TAG NO: _____ EQPT/SYSTEM: _____
PROJECT NO: _____ SPEC. SECTION: _____

I hereby certify that the above-referenced equipment/system has been:

(Check Applicable)

- Installed in accordance with Manufacturer's recommendations.
- Inspected, checked, and adjusted.
- Serviced with proper initial lubricants.
- Electrical and mechanical connections meet quality and safety standards.
- All applicable safety equipment has been properly installed.
- System has been performance tested, and meets or exceeds specified performance requirements. (When complete system of one manufacturer)

Comments: _____

I, the undersigned Manufacturer's Representative, hereby certify that I am (i) a duly authorized representative of the manufacturer, (ii) empowered by the manufacturer to inspect, approve, and operate his equipment and (iii) authorized to make recommendations required to assure that the equipment furnished by the manufacturer is complete and operational, except as may be otherwise indicated herein. I further certify that all information contained herein is true and accurate.

Date: _____, 2000

Manufacturer: _____

By Manufacturer's Authorized Representative: _____

(Authorized Signature)

Drawings

(See Design Drawings in Attachment E)

ATTACHMENT G

NO.

1 Project Schedule

Activity ID	WBS CHARGE #	Activity Description	% Comp	Orig Dur	Rem Dur	Early Start	Early Finish	2000			
								A	SEP	OCT	NOV
CTO #0017 - NTC, Orlando, FL											
Subtotal			7	568	503	24MAY00A	29AUG02				
OU-4 STRIPPER RETROFIT											
Subtotal			7	568	503	24MAY00A	29AUG02				
PHASE 3											
FUNDING AUTHORIZATION											
AQ99001		Phase 3 Award for OU4 System	100	0	0	26JUL00A					
PROJECT MANAGEMENT											
AQ98220101	98.22.01.01	Project Management	0	525*	503*	26JUL00A	29AUG02				
COST PROPOSAL PREPARATION											
AQ21010326	20.01.03.26	Develop Cost Estimate/Schedule	100	5	0	24MAY00A	05JUN00A				
AQ21010327		Submit Cost Proposal to Client for OU4	100	0	0		05JUN00A				
AQ20187		Negotiate CTO with Client	100	1	0	07JUL00A	07JUL00A				
AQ20199		Submit Final/Negotiated Estimate/Schedule	100	1	0	07JUL00A	07JUL00A				
MOBILIZATION & PREPARATORY WORK											
AQ34221208	34.22.12.08	Subcontractor's P&P Bonds	100	1	0	17JUL00A	17JUL00A				
AQ98010291	98.01.02.91	CCI Mobilization	100	2	0	18JUL00A	19JUL00A				
AQ98010290	98.01.02.90	CTO Pre-Con Meeting	100	1	0	20JUL00A	20JUL00A				
AQ99010401	99.01.04.01	Initiate Job-Site Presence	100	3	0	24JUL00A	26JUL00A				
PERMITTING											
AQ34010390	34.01.03.90	Modify Industrial Discharge Permit	0	20	20	25AUG00	22SEP00				
AIR STRIPPING											
AQ34010330	34.01.03.30	Air Stripper Design/Specifications	100	3	0	28JUL00A	01AUG00A				
AQ34031		Prepare Air Stripper Bid Package	100	3	0	28JUL00A	01AUG00A				
AQ34032		Issue RFB for Air Stripper System	100	0	0		01AUG00A				
AQ34033		Subcontractor Bids Due	100	0	0	07AUG00A					
AQ34034		Evaluate Subcontractor Bid Packages	100	3	0	07AUG00A	09AUG00A				
AQ34035		Award Subcontract for Air Stripper	100	0	0		10AUG00A				
AQ34051A		Fabrication of Air Stripper	0	55	45	11AUG00A	10OCT00				
AQ34051		Physical Treatment - Air Stripper Delivery	0	0	0		10OCT00				
AQ34130701	34.13.07.01	Physical Treatment - Air Stripper Installation	0	3	3	10OCT00	12OCT00				
ELECTRICAL SPECS(POWER SYSTEM)											
AQ34010333	34.01.03.33	Electrical Power Room System Design/Specs	100	9	0	28JUL00A	09AUG00A				

Start Date 01JUN98
Finish Date 29AUG02
Data Date 25AUG00
Run Date 12SEP00 11:44

 Early Bar
 Progress Bar
 Critical Activity

NFAC - C017 Sheet 1 of 2

**Naval Training Center, Orlando, FL
CTO COMPLETION SCHEDULE
NAVY RAC SOUTHERN DIVISION**

Activity ID	WBS CHARGE #	Activity Description	% Comp	Orig Dur	Rem Dur	Early Start	Early Finish	2000			
								A	SEP	OCT	NOV
AQ34036		Prepare Electrical System Bid Package	20	9	9	28JUL00A	07SEP00				
AQ34037		Issue RFB for Electrical System	0	0	0		08SEP00				
AQ34038		Subcontractor Bids Due	0	0	0	22SEP00					
AQ34039		Evaluate Subcontractor Bid Packages	0	2	2	22SEP00	25SEP00				
AQ34040		Award Subcontract for Electrical Power Room Sys.	0	0	0		25SEP00				
AQ34130702	34.13.07.02	Physical Treatment - Electrical Installation	0	2	2	10OCT00	11OCT00				
2" SS DISCHARGE PIPING											
AQ34010331	34.01.03.31	2" SS Discharge Piping Design/Specs.	100	9	0	28JUL00A	09AUG00A				
AQ34041		Prepare 2" SS Discharge Piping Bid Package	100	9	0	28JUL00A	09AUG00A				
AQ34042		Issue RFB for 2" SS Discharge Piping	100	0	0		10AUG00A				
AQ34043		Subcontractor Bids Due	100	0	0	24AUG00A					
AQ34044		Evaluate Subcontractor Bid Packages	50	6	6	24AUG00A	01SEP00				
AQ34045		Award Subcontract for 2" SS Discharge Piping Sys	0	0	0		01SEP00				
AQ34130703	34.13.07.03	Physical Treatment - 2" SS Disc. Pipe-Asph. Cut	0	3	3	18SEP00	20SEP00				
AQ34130704	34.13.07.04	Physical Treatment - 2" SS Discharge Piping	0	8	8	21SEP00	02OCT00				
AQ34130705	34.13.07.05	Physical Treatment - 2" SS Disc. Piping Asphalt	0	3	3	03OCT00	05OCT00				
WELL PUMP											
AQ34046		Prepare Well Pump System Bid Package	100	10	0	28JUL00A	10AUG00A				
AQ34047		Issue RFB for Well Pump System	100	0	0		11AUG00A				
AQ34010332	34.01.03.32	Well Pump System Design/Specs.	100	14	0	28JUL00A	16AUG00A				
AQ34048		Subcontractor Bids Due	100	0	0	21AUG00A					
AQ34049		Evaluate Subcontractor Bid Packages	100	2	0	21AUG00A	22AUG00A				
AQ34050		Award Subcontract for Well Pump System	0	0	0		01SEP00				
AQ34052A		Fabrication of Well Pump	0	9	9	05SEP00	15SEP00				
AQ34052		Physical Treatment - Well Pump Delivery	0	0	0		15SEP00				
AQ34020414	34.02.04.14	Well Retrofit/Pumps	0	3	3	18SEP00	20SEP00				
TESTING & ANALYSIS											
AQ34020901	34.02.09.01	System Start Up Analysis	0	3	3	13OCT00	17OCT00				
AQ34020903	34.02.09.03	System Monitoring Analysis	0	252	252	18OCT00	19OCT01				
AQ34021491	34.02.14.91	Data Evaluation & Management	0	252	252	18OCT00	19OCT01				
AQ34210690	34.21.06.90	Monthly Monitoring Report	0	252*	252*	18OCT00	19OCT01				
TRANSPORTATION AND DISPOSAL											
AQ34192291	34.19.22.91	T & D Debris	0	18*	18*	18SEP00	12OCT00				
AQ34192293	34.19.22.92	T&D Contact Water, Non-Hz	0	18*	18*	18SEP00	12OCT00				
AQ34192294	34.19.22.94	Discharge Treated Effluent.	0	18*	18*	18SEP00	12OCT00				
AS-BUILTS											
AQ34210607	34.21.06.06	As-Builts	0	3	3	18OCT00	20OCT00				
AQ34210609	34.21.06.09	O & M Manual	0	5	5	18OCT00	24OCT00				
POST CONSTRUCTION											
AQ99210590	99.21.05.90	CCI Demobilization	0	1	1	25OCT00	25OCT00				