N00213.AR.000177
NAS KEY WEST
5090.3a

PROJECT PLAN REVISION FOR IMPLEMENTATION OF TREATMENT SYSTEM AT SOLID WASTE MANAGEMENT UNIT 9 WITH TRANSMITTAL LETTER AND SAMPLING RESULTS
NAS KEY WEST FL
11/14/1996
BECHTEL ENVIRONMENTAL INC

011469

Bechtel

Oak Ridge Corporate Center
151 Lafayette Drive
P.O. Box 350
Oak Ridge, Tennessee 37831-0350

Telephone: (423) 220-2000

NOV 14 1996

RECEIVED
NOV 22 1996
Aiken SC.

Kevin Walter
Brown and Root Environmental
900 Trail Ridge Road
Aiken, SC 29803-5297

SUBJECT: Bechtel Job No. 22567
Department of the Navy Contract No. N62467-93-D-0936
DO 0004, NAS KEY WEST, SWMU-9 PPR
Subject Code: 5320

Dear Mr. Walter:

Please find enclosed a copy of the PPR that was written to implement the treatment system at SWMU-9. Also enclosed is the sampling results to date. These were the weekly samples during start up. We do not yet have the first round of monthly sample results. These will be forwarded to you as we receive them. This information is being forwarded to you per Dudley Patrick's request.

If you have any questions or need additional information, please feel free to give me a call at (423) 220-2745 or Roy Hoekstra at (423) 220-2271.

Sincerely,

O. N. McNeil, Jr.
Project Manager

REH:dcm:LR1006
Enclosure: Enclosures and Diskettes

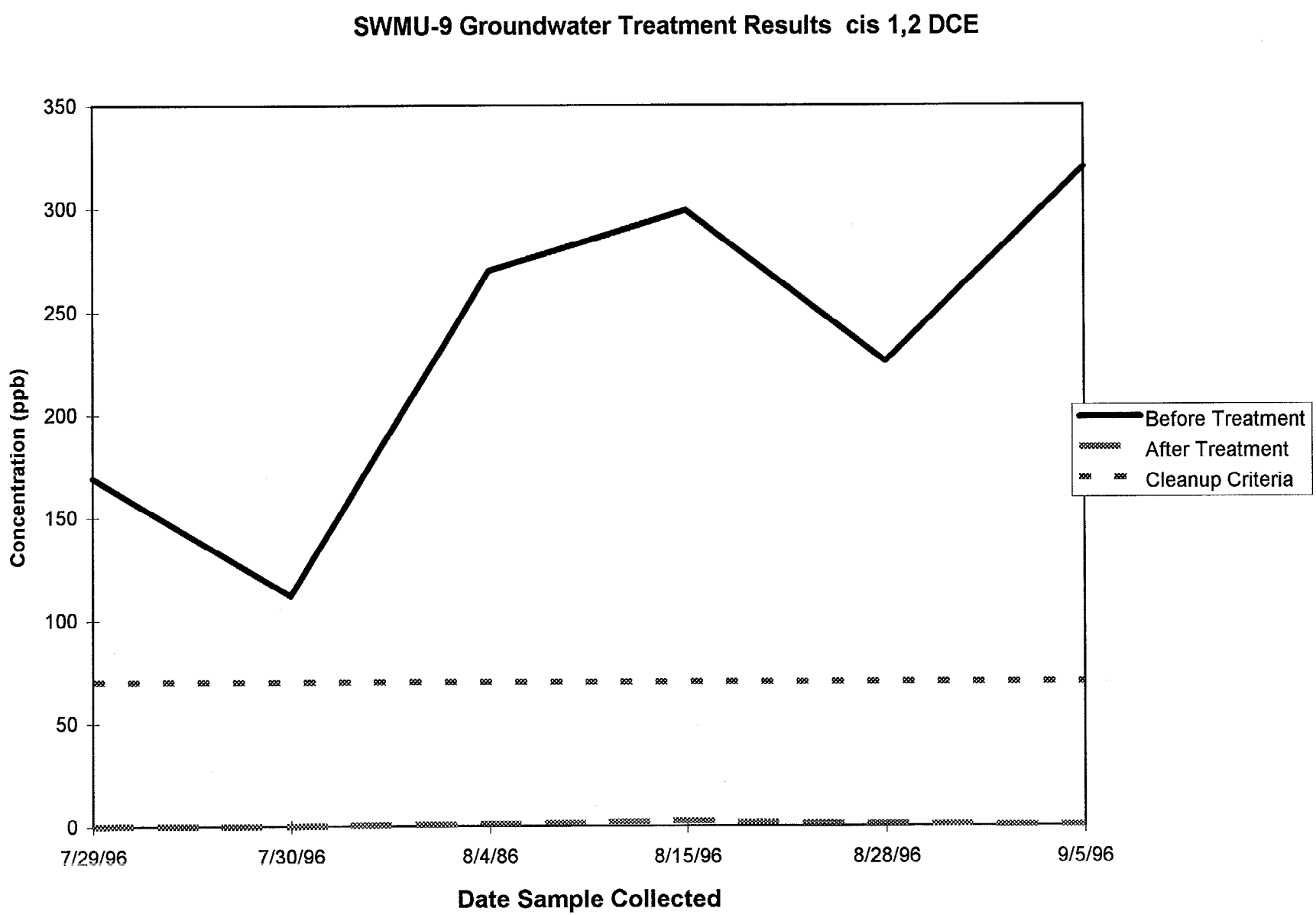
cc: D. Patrick w/o enc.
Phillip Williams w/o enc.

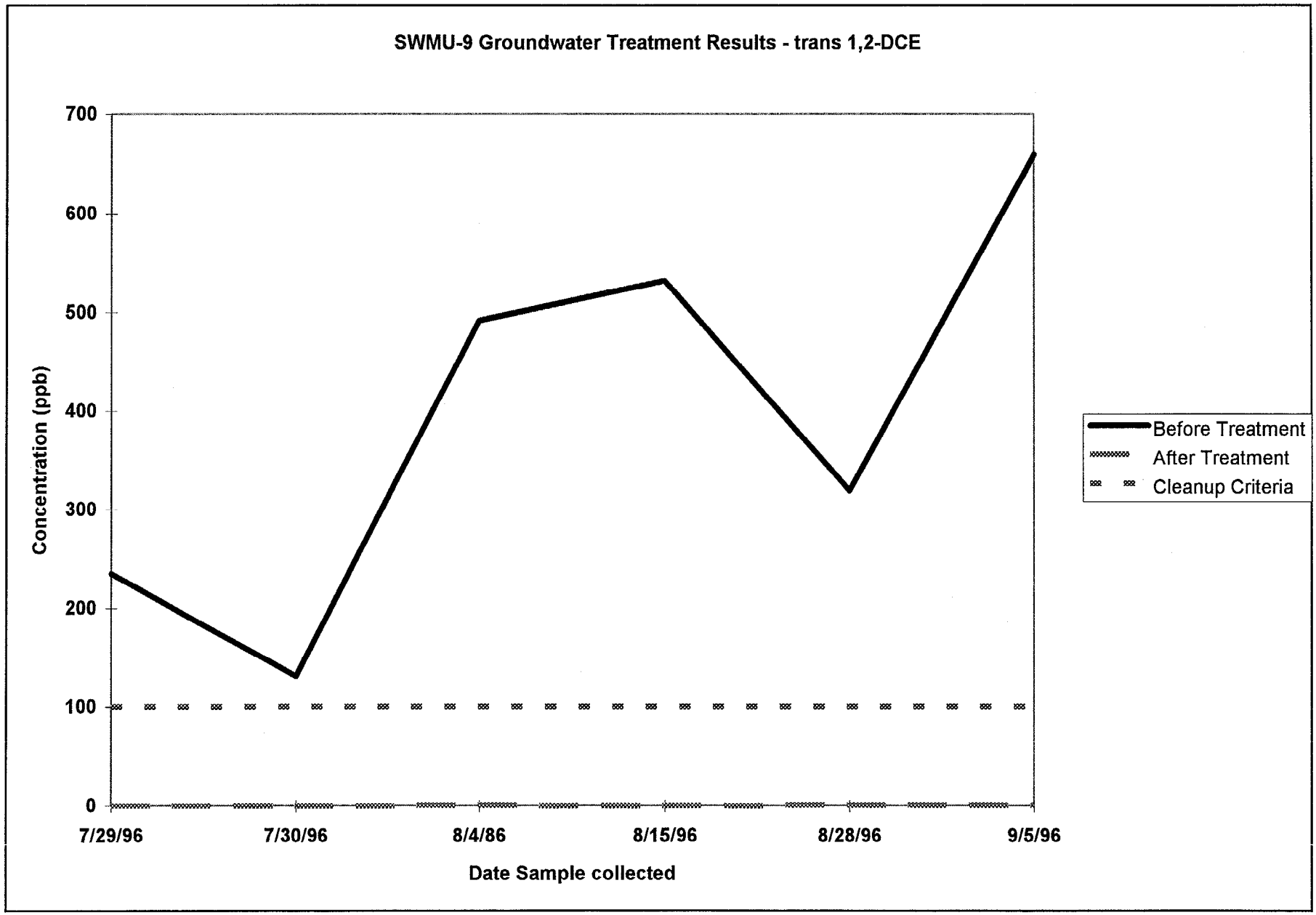
SWMU-9 Groundwater Treatment System Results

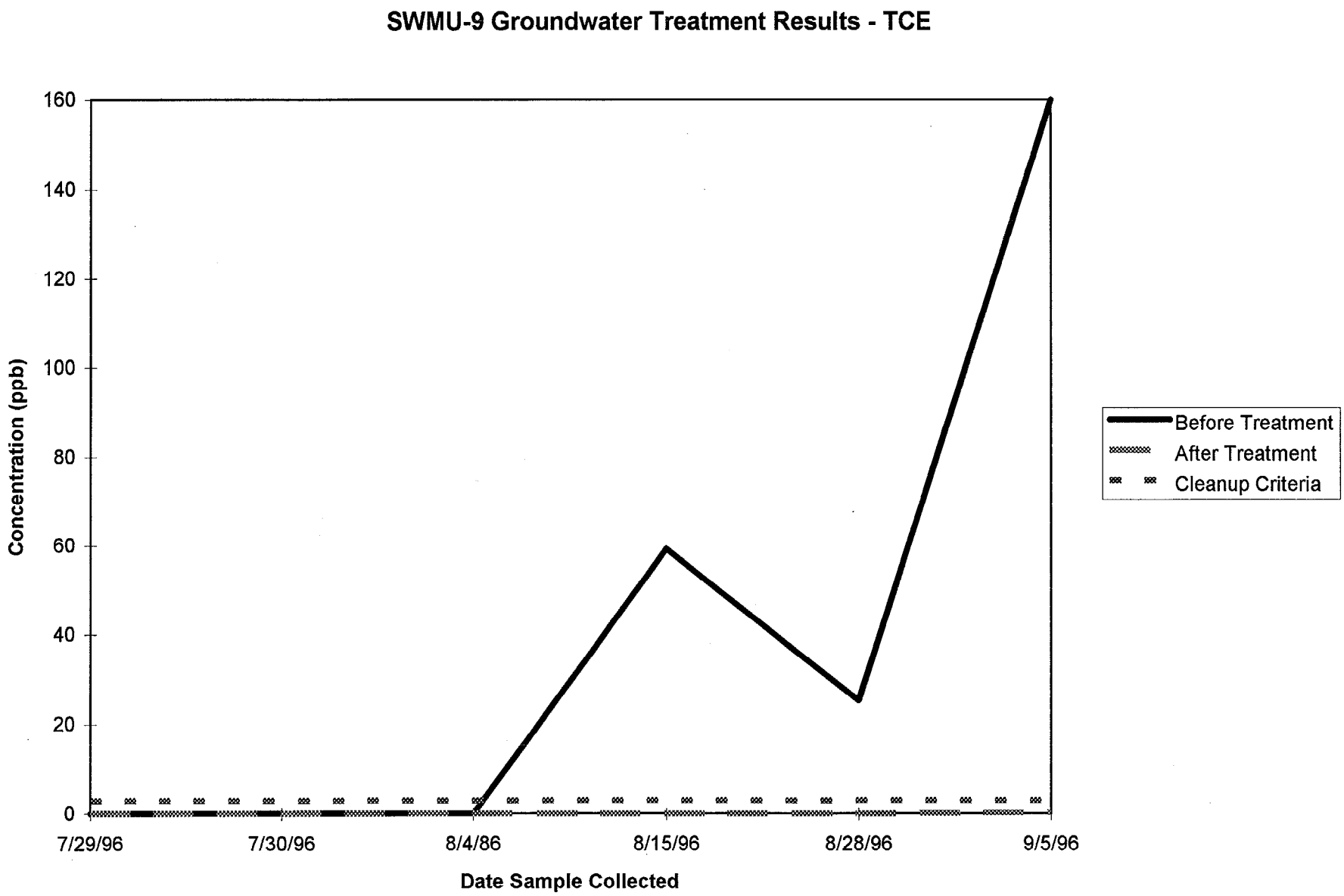
Contaminant	Standard PPB	DAY 1 (7/29/96)		DAY 2 (7/30/96)		WEEK 1 (8/4/96)	
		Before Treatment Sample ID KW02870	After Treatment Sample ID KW02871	Before Treatment Sample ID KW02872	After Treatment Sample ID KW02873	Before Treatment Sample ID KW02874	After Treatment Sample ID KW02875
Total Napthalenes	100	14.7	4.6	27.9	3.7	48.5	5.4
TRPH	5000	ND	ND	ND	ND	ND	ND
cis 1,2-DCE	70	(169)	ND	(112)	ND	(270)	1.2J
trans 1,2 DCE	100	(235)	ND	(141)	ND	(492)	0.46J
TCE	3	ND	ND	ND	ND	ND	ND
benzene	1.18	ND	ND	(4.2)	ND	(7.9)	ND

Contaminant	Standard PPB	WEEK 2 (8/15/96)		WEEK 3 (8/28/96)		WEEK 4 (9/5/96)	
		Before Treatment Sample ID KW02876	After Treatment Sample ID KW02877	Before Treatment Sample ID KW02880	After Treatment Sample ID KW02881	Before Treatment Sample ID KW02882	After Treatment Sample ID KW02883
Total Napthalenes	100	27	8.9	45.7	17.6	20	2
TRPH	5000	ND	ND	ND	ND	<430	NA
cis 1,2-DCE	70	(299)	2.6	(226)	1.3J	(320)	0.7
trans 1,2 DCE	100	(532)	ND	(319)	0.47J	(660)	0.5
TCE	3	(59.3)	ND	(25.2)	ND	(160)	0.3
benzene	1.18	(8.0)	ND	(14.6)	ND	(9)	ND

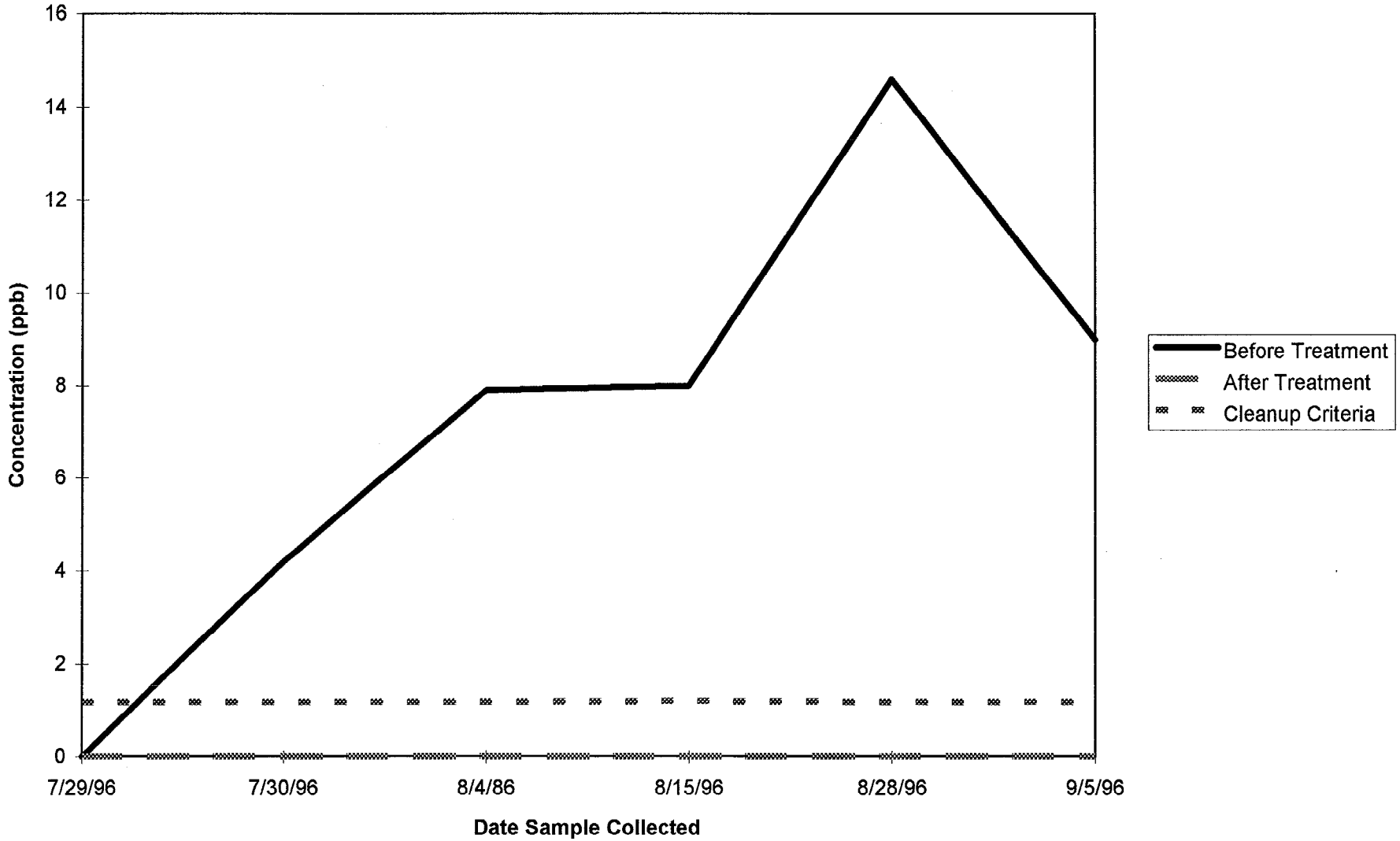
( ) indicates results above the cleanup standard


SWMU-9 Groundwater Treatment Results cis 1,2 DCE
350
300
250
200
150
100
50
0
Concentration (ppb)
7/29/96
7/30/96
8/4/86
8/15/96
8/28/96
9/5/96
Date Sample Collected
Before Treatment
After Treatment
Cleanup Criteria


SWMU-9 Groundwater Treatment Results - trans 1,2-DCE
Concentration (ppb)
700
600
500
400
300
200
100
0
7/29/96
7/30/96
8/4/86
8/15/96
8/28/96
9/5/96
Date Sample collected
Before Treatment
After Treatment
Cleanup Criteria


SWMU-9 Groundwater Treatment Results - TCE
160
140
120
100
80
60
40
20
0
Concentration (ppb)
7/29/96
7/30/96
8/4/86
8/15/96
8/28/96
9/5/96
Date Sample Collected
Before Treatment
After Treatment
Cleanup Criteria

SWMU-9 Groundwater Treatment Results - Benzene



PROJECT PLAN REVISION
(FINAL)

Document Name and No. Remediation Work Plan (Chron 3295) **Rev.** 0 **PPR #** 321-010

Site NAS - Key West **Task** _____ **Phase** 3 **DO No.** 4

Initiator: Roy Hoekstra

Description: Revised Section 4.3 SWMU-9 Jet Engine Test Cell

Date: April 10, 1996

Reason: Section 4.3 has been revised to incorporate the detailed design requirements for the product recovery and solvent plume recovery system.

IMPACT REVIEW

FUNCTIONAL REP.	NO	YES	IDENTIFY AFFECTED DOCUMENTS
PE Roy Hoekstra		✓	Remedial Work Plan
S&H Supv. Nicke Ring *	✓		
QCM Rick Summers *	✓		
Site Super. Rick Akers *	✓		
Other N/A			

* see Attached E-Mail For Field Approval of PPR-321-010

Project Manager 4/15/96 Date

Change Approved: ____ No ✓ Yes

Trend Required: ✓ No ____ Yes

Navy Concurrence Required: ____ No ✓ Yes

See attached E-Mail for Navy Approval
Navy Representative Date

Change Approved: ____ No ✓ Yes

Date: 4/12/96 5:42:57 AM
From: J Dudley Patrick
Subject: NAS KEY WEST PPR 321-010 SWMU 9
To: (REHOEKST@AM@ORN6)

Roy:
I have no further comments on the subject PPR forwarded via letter on March 15, 1996, and updated via letter dated April 10, 1996. Please incorporate/address any comments provided by the NTR and NAS Key West prior to forwarding to FDEP and EPA. Suggest request turnaround of 2 weeks for regulatory review.

Dudley

Date: 4/11/96 8:27:46 AM
From: Richard Akers
Subject: SWMU-9 PPR
Roy Hoekstra
Rick Summers

The subject PPR has been reviewed and approved by BEI field staff at Key West, including QA/QC, Safety and Health, Project Controls, and Construction.

NAS - KEY WEST

PPR 321-010

SWMU-9 JET ENGINE TEST CELL

ENGINEER'S CERTIFICATION

The engineering work described and professional opinions rendered in this document were conducted or developed using commonly accepted engineering practices and standards. The scope of engineering services described in this document was conducted under the supervision of a professional engineer registered in the State of Florida.

4-16-96

Roy E. Hoekstra, PE
Project Engineer
Florida PE Number 49690
Expires February 28, 1997

4.3 SWMU-9 JET ENGINE TEST CELL

4.3.1 Interim Remedial Action

The IRA objectives at SWMU-9 are:

- to provide hydraulic containment, recovery, and treatment of groundwater contaminated with the chlorinated solvents from cleaning and maintenance activities at the test cell;
- to provide product recovery of the floating product at the site; and
- to provide recovery and treatment of the groundwater impacted by the floating product.

Complete details of the site including hydrogeologic data and extent of contamination are included in *"Contamination Assessment Report, Jet Engine Test Cell, Building A969, Boca Chica Field, Naval Air Station, Key West, Florida", ABB Environmental Services, Inc. June 1994.* The executive summary of this report is included in Attachment 1.

To accomplish the IRA objectives, BEI's scope of work for SWMU-9 consists of the following elements:

- initial field work, including groundwater sampling using Hydropunch or similar technology to delineate the horizontal extent of solvent contamination, groundwater sampling of the existing monitoring wells at the site and aquifer testing;
- design of a groundwater pump-and-treat system including an extraction system, a treatment system and a recharge system;
- installation of the system as designed;
- installation and sampling of a deep monitoring well in the area of the solvent plume; and
- operation and maintenance (O&M) of the pump-and-treat system by BEI for one year (responsibility for O&M thereafter is to be determined).

4.3.2 Regulatory Requirements

The requirements that free product recovery efforts begin and that a system be installed to provide hydraulic control of the solvent plume were defined in the FDEP letter dated 27 November 1995. The intent of these actions is to prevent the further migration of the contaminants toward the adjacent inlet. A copy of this letter is included in Attachment 2.

Protection of Natural Resources
BEI will follow the requirements specified in the Environmental Protection Plan. SWMU-9 does not impact any wetland or endangered species habitat; however, it is located adjacent to an inlet connected to the ocean.

Permits
The following permits are required:

- A consumptive use permit is required from the South Florida Water Management District.
- An excavation permit is required to install the wells, buried piping and buried electrical conduit. This permit is obtained from the Public Works Department at NAS-Key West.

BEI will assist the Navy in obtaining these permits and will facilitate Navy interaction with the cognizant agencies in order to provide notification of proposed remedial actions and site restoration.

Water Management Requirements
At SWMU-9, extraction wells will be installed to contain the plume and pump groundwater for treatment and disposal. The groundwater will be treated with an onsite treatment system to meet FDEP standards listed in Table 1 that are protective of the receiving aquifer and the adjacent surface water. The SWMU-9 site has a variety of contaminants and not all are addressed by a single FDEP standard.

TABLE 1. SWMU-9 GROUNDWATER CLEANUP GOALS

Contaminant	Cleanup Standard	Reference
Total Napthalenes	100 ppb	Petroleum Contaminated Site Cleanup Levels for G-II Groundwater 62.770.310 FAC
TRPH	5000 ppb	Petroleum Contaminated Site Cleanup Levels for G-II Groundwater 62.770.310 FAC
cis 1,2-DCE	70 ppb	Maximum Contaminate Level - Primary Drinking Water Standard 62.550.520 FAC
trans 1,2-DCE	100 ppb	Maximum Contaminate Level - Primary Drinking Water Standard 62.550.520 FAC
TCE	3 ppb	Maximum Contaminate Level - Primary Drinking Water Standard 62.550.520 FAC

Treatment will be monitored by use of the analytical methods listed in Table 5-1. (This table is included in Revision 0 of the Remedial Work Plan.) Monitoring, testing, and reporting will meet the requirements of the FDEP and are included in Sections 4.3.6 and 4.3.7.

4.3.3 Initial Fieldwork

The *"Instruction Guide for Groundwater Evaluation at the Jet Engine Test Cell"* includes detailed requirements for groundwater sampling and the aquifer test at SWMU-9. This guide is included as Attachment 3.

Groundwater Sampling and Analysis

The groundwater samples were collected at all existing wells during June 1995 and at ten additional locations during September 1995 using the Hydropunch technology. These samples were collected to help determine the current limits of the hydrocarbon and solvent plumes. The results of this evaluation are included in the *"Technical Memorandum: Groundwater Evaluation, Jet Engine Test Cell, NAS Key West, Florida"*. This memorandum is included as Attachment 4. Table 2 summarizes the groundwater results from this and all previous sampling efforts at the site. This summary shows the variations of concentrations of the contaminates with time. Floating product was discovered in two wells, MW-4 and MW-5, during the June 1995 sampling event. This was the first time that product was discovered in any monitoring wells at the SWMU-9 site. Bail down testing was performed during December, 1995. The results of the bail down tests are also included in Attachment 4.

Table 2 - SWMU-9 SUMMARY OF GROUNDWATER ANALYTICAL RESULTS

		MW-2		MW-3		MW-4		MW-5	
		DATES		DATES		DATES		DATES	
COMPOUND	APPLIED STANDARD	OCT. 1993	JUN. 1995	OCT. 1993	JUN. 1995	OCT. 1993	JUN. 1995	FEB. 1994	JUN. 1995
Total Napthalenes	100 ppb	226	69	19	ND	198	Floating Product	340	Floating Product
TRPH	5000 ppm	1000	ND	2000	1120	8000		46000	
cis 1,2-DCE	70 ppb	ND	ND	ND	ND	ND		ND	
trans 1,2-DCE	100 ppb	ND	ND	ND	ND	ND		ND	
TCE	3 ppb	ND	ND	ND	ND	ND		ND	

		MW-14					MW-15				
		DATES					DATES				
COMPOUND	APPLIED STANDARD	OCT. 1993	DEC. 1993	JAN. 1994	FEB. 1994	JUN. 1995	OCT. 1993	DEC. 1993	JAN. 1994	FEB. 1994	JUN. 1995
Total Napthalenes	100 ppb	ND	NA	NA	NA	ND	ND	NA	NA	NA	ND
TRPH	5000 ppm	ND	NA	NA	NA	ND	ND	NA	NA	NA	ND
cis 1,2-DCE	70 ppb	11	480	54	74	18.4	9	980	160	120	196
trans 1,2-DCE	100 ppb	24	1400	76	190	56.2	17	2800	170	280	495
TCE	3 ppb	ND	ND	ND	ND	ND	ND	41	2	1.8	ND

		MW-21		MW-22		MW-23		MW-24		HY-1	HY-3
		DATES		DATES		DATES		DATES		DATE	DATE
COMPOUND	APPLIED STANDARD	FEB. 1994	JUN. 1995	FEB. 1994	JUN. 1995	FEB. 1994	JUN. 1995	FEB. 1994	JUN. 1995	JUL. 1995	JUL. 1995
Total Napthalenes	100 ppb	NA	ND	NA	ND	NA	ND	NA	ND	ND	91.1
TRPH	5000 ppm	NA	ND	NA	ND	NA	ND	NA	ND	ND	ND
cis 1,2-DCE	70 ppb	73	51.3	4.2	13	ND	13.2	770	1560	56.7	ND
trans 1,2-DCE	100 ppb	6.6	6.8	4.6	19.2	ND	ND	890	2420	4.6	ND
TCE	3 ppb	ND	ND	ND	2.4	ND	ND	2.4	ND	ND	ND

Aquifer Testing
One 4-inch diameter extraction well and four 1-inch diameter piezometers were installed for the aquifer testing. The testing was performed to determine the hydraulic characteristics of the aquifer underlying the Jet Engine Test Cell Site. The test results are reported in the calculation *"Refinement of Jet Engine Test Cell Pump Test Data"* (Attachment 5) and are summarized in the *"Technical Memorandum: Groundwater Evaluation, Jet Engine Test Cell, NAS Key West, Florida"*. A summary of the results of the aquifer test are included in Table 3. These values are mean values.

TABLE 3. Aquifer Test Results

Neuman Transmissity (ft^2/min)	Neuman Storage Coefficient	Neuman Specific Yield	Theim-Dupuit Transmissivity (ft^2/min)
0.094	1.81×10^{-4}	0.001	0.070

Using the aquifer test results, a hydraulic conductivity of 9.35×10^{-3} ft/min can be calculated. Using the groundwater gradients measured at the site and a porosity of 0.2, the linear groundwater velocity at the site would range from 42 to 66.5 feet/yr.

The results of the pump test indicate that the water levels in the aquifer underlying the SWMU-9 site react rapidly to pumping and then stabilize after a short time. The hydrogeological conditions at the site are favorable for the installation and successful operation of a pump and treat system.

4.3.4 Groundwater Pump-and-Treat System Design

The groundwater pump-and-treat system design includes extraction wells, pumps, a header system to convey extracted groundwater from the wells to the treatment unit, a groundwater treatment unit, and an infiltration gallery. The system design is based on information provided by the Contamination Assessment Report and obtained during the initial fieldwork described in Section 4.3.3. Groundwater modeling was conducted to demonstrate that the extraction wells will contain the plumes and to ensure that the flows to the infiltration gallery do not result in excessive groundwater mounding. A brief description of the system design and components is included below.

Groundwater Modeling
The groundwater model developed for the SMWU-9 site was based on existing site conditions. A model domain of 260 feet by 260 feet was used. The model used six layers with the contaminated area of groundwater assumed to be the top fifteen feet. This assumption is based on the levels of contaminates found in monitoring well MW-19D and will be confirmed with the installation of monitoring well MW-25D. Constant head boundaries were used to model the north and south boundaries of the model and noflow boundaries were used to model the

east and west boundaries. The model was calibrated to match the existing groundwater gradients.

Various pumping schemes and well locations were tried to optimize the amount of water pumped and the product recovered and to ensure that the plumes are within the capture zone. The final model placed two recovery wells in the jet fuel plume for product recovery and one well in the solvent plume. The product recovery wells will be pumped at a rate of 1.25 gallons per minute each. The solvent well will be pumped at a rate of 2.5 gallons per minute. All the wells were modeled with 15 feet of well screen. The estimated remediation time ranges from 100 days to 300 days, depending on the assumptions included in the model.

The model also included the effects of the infiltration gallery on the groundwater flow in the area of the plumes. The site does not allow the gallery to be placed directly upgradient from the plumes, but the location of the gallery is close enough to cause partial flushing and recycling of the recovered groundwater. The modeling indicated that the infiltration gallery will mound approximately 6 inches. The complete results of the groundwater modeling for the remedial system are included in Attachment 6.

Treatment System

The requirements for the treatment system are detailed in "*Technical Specification for Groundwater Treatment System, SWMU-9, Jet Engine Test Cell, NAS-Key West, Florida*" 22657-321-SP576-001 and the associated drawings 321-DD576-001 through 003. These specifications and drawings are included in Attachment 7. The treatment system will consist of the following:

- The groundwater extraction system will include three total fluid, top loading, pneumatically operated recovery pumps, air and groundwater discharge tubing, fittings, pressure filters/regulators, flow counters and accessories.
- An air compressor system will be required to provide the compressed air supply for the groundwater extraction pumps.
- An oil/water separator to remove any free product from the groundwater. Any collected product will be pumped to the product storage tank.
- A low profile air stripper to remove the volatile contaminants from the groundwater.
- A pumping system to pump the treated groundwater to the recharge gallery.

The treatment by air stripping will aerate the groundwater prior to its recharge partially upgradient of the contaminated areas. This will result in increased oxygen concentrations that will likely enhance the biodegradation of hydrocarbons derived from the JP-5 fuel spill in-situ, complementing the ex-situ treatment and facilitating the remediation of the hydrocarbons. The chlorinated VOCs will not undergo aerobic biodegradation in-situ. Treatment of these constituents will be entirely ex-situ.

Influent and Effluent Concentrations
The expected influent and effluent concentrations are included in Table 4. These values are the highest for each compound from all the monitoring wells on the site. The mixing that may reduce these concentrations was not considered.

TABLE 4. SWMU-9 Expected Influent and Effluent Concentrations

Contaminant	Maximum Expected Influent	Maximum Expected Effluent	Removal Efficiency**	Cleanup Standard
Total Napthalenes	340 ppb	15.2 ppb	0.9553	100 ppb
TRPH*	46000 ppb	2056 ppb	0.9553	5000 ppb
cis 1,2-DCE	1560 ppb	4.3 ppb	0.9972	70 ppb
trans 1,2-DCE	2800 ppb	10.08 ppb	0.9964	100 ppb
TCE	2.4 ppb	0.01 ppb	0.9974	3 ppb
Total VOC's	50702 ppb	2086 ppb	0.9554	na

* TRPH removal was calculated as Napthalenes
**These removal efficiencies were calculated using the Lopro Design Utility computer Program from QED.

Air Emissions
The maximum expected air emissions from the air stripper can be calculated by assuming that all the contaminants in the influent are stripped and emitted to the air. Using this assumption and a flow rate of 5 gpm, the total estimated maximum emissions are 3.05 lbs/day. Of this total approximately 2.79 lbs/day are from the hydrocarbon plume and 0.26 lbs/day are from the solvent plume.

Since the total emissions are below the 15 lbs/day threshold, treatment of the air emissions and air quality permitting will not be required.

Well Configuration
The locations of the recovery wells are shown on drawing 321-DD576-002. Two wells will be used for product recovery, one well will be used for the recovery of the solvent plume and an additional deep monitoring well will be added in the solvent plume. The wells will be constructed of 4 inch schedule 40 PVC pipe and screen. The details of the wells and the flush mount vaults are included on drawing 321-DD576-003. These drawings are included in Attachment 7.

Infiltration Gallery
Two options were considered for the disposal of the water generated by the remedial system: 1) using the Station's POTW and 2) using an infiltration gallery. The Station's POTW could not accept this water, so the infiltration gallery is the only available option for water disposal.

Once the groundwater has been treated it will be disposed of by recharging it back to the aquifer. The infiltration gallery will be a series of 9 trenches 50 feet long and two feet wide and spaced 50 feet apart. They will be a total of 2 feet deep with 18 inches of gravel and 6 inches of backfill on the top. The gallery will be wrapped with geotextile fabric. The treated groundwater will be pumped to the gallery through a 2" PVC pipe. Two perforated 2 inch PVC pipes will run the length of the gallery for groundwater discharge. The infiltration gallery was modeled into the groundwater model for the site. One piezometer will be installed in each corner of the gallery to monitor the water levels in the gallery. Cleanout ports will also be installed in the discharge lines.

Additional Monitoring Well
During the installation of the wells for the original site investigation two deep wells were installed. One of these wells was near the center of the site within the limits of the hydrocarbon plume and one on the far west side of the site. A deep well was not installed in the area of the solvent plume. The groundwater system design is based on the assumption that the contamination has not spread deeper than 15 feet below the water table. This assumption is valid for the hydrocarbon plume and unknown for the solvent plume.

Monitoring well MW-25D will be installed and sampled to determine any impact of the solvent contamination has had on the deeper parts of the aquifer. The results from this testing will also used to verify the assumed vertical extent of solvent contamination used in the groundwater model. This monitoring well will be installed as a recovery well with a flush mount well vault and 4 inch casing. The well will be screened from 15 feet to 25 feet below grade. MW-25D will not be used for recovery unless high levels of contaminants are detected in the groundwater samples from the well. This well will be developed and sampled per the instructions included in Attachment 3.

4.3.5 Groundwater Pump-and-Treat System Installation and Startup

Installation
The groundwater pump-and-treat system will be installed according to the specifications and drawings included in Attachment 7. The equipment vendor will be required to submit vendor/manufacturer's catalog for all remediation system equipment for approval by BEI prior to delivery. These submittals shall include equipment specifications and operating manuals for the groundwater recovery well pumps, the air compressor system, the oil/water separator system, the air stripper, piping, valves, gages and controls.

System Startup
Following installation, the groundwater treatment system shall go through a one week period of startup testing. During this period, influent groundwater and effluent from the treatment system and air emissions from the air stripper shall be sampled daily for the first two days. The samples will be submitted for analysis with required turnaround of the results of two days. This quick turnaround will be used to verify system performance. Also, startup water levels and product thickness will be measured daily in the wells adjacent to the pumping wells to determine groundwater level contour changes and any product level thickness changes under pumping conditions. If the system effluent is not meeting cleanup goals established, then the system will be adjusted or shut-down to determine the problem and to devise a remedy. If a shutdown is needed, the system will go through a one week startup period before resuming the normal operation schedule.

Once the installation and startup of the system is complete, "as-built" drawings of the system will be prepared by BEI and sealed.

4.3.6 Operations and Maintenance

BEI will provide operation and maintenance (O&M) of the treatment system for a period of one year following installation. Written O&M procedures and checklists will be provided to BEI by the equipment manufacturers. The O&M schedule will follow the sampling schedule. This will be incorporated into the Scope of Work for the O&M subcontractor to follow.

Sampling Requirements
The influent and effluent from the treatment system will be sampled weekly after the startup period for the first month and monthly thereafter. During these scheduled sampling events the following information shall be collected and reported on:

- the influent and effluent samples will be analyzed for the constituents TPRH, VOCs and Total Naphthalenes;
- flow rates from each extraction well;
- product levels in the product recovery tank;
- water levels in adjacent monitoring wells;
- product levels in adjacent monitoring wells; and
- water levels in the recharge gallery.

On a quarterly basis the following wells, MW-2, MW-3, MW-4, MW-5, MW-14, MW-15, MW-21, MW-22, MW-23, MW-24 and MW-25D, will be sampled and analyzed for the constituents: TPRH, VOCs and Total Naphthalenes. The specific sampling requirements are included in section 5.0 of the RWP.

If effluent analyses results are above discharge requirements, then the system will be shut down to determine and implement the necessary measures to attain the discharge requirements. If a shutdown is needed, the system will go through an one week startup period before resuming the normal operation schedule.

BEI's plan is based on a subcontractor performing the O&M and monitoring/sampling for one year. The Navy will determine how the O&M will be provided after the one-year period. If the Navy should desire to perform this function in-house, BEI will assist the NAS to take over the O&M of the system.

NAS Key West Public Works will be responsible for sampling and disposal of any collected product.

Reporting

BEI will prepare the first annual monitoring report for submission to the EPA and FDEP. The Navy will be responsible for any additional reports required after the first year.

Attachment 1
Executive Summary
Contamination Assessment Report
Jet Engine Test Cell
Building A969, Boca Chica Field
NAS Key West

CONTAMINATION ASSESSMENT REPORT

JET ENGINE TEST CELL, BUILDING A969
BOCA CHICA FIELD, NAVAL AIR STATION
KEY WEST, FLORIDA

Contract Task Order No. 097

Contract No. N62467-89-D-0317

Prepared by:

ABB Environmental Services, Inc.
2590 Executive Center Circle, East
Tallahassee, Florida 32301

Authors:

Roger Durham
Jay Koch

Prepared for:

Department of the Navy, Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, South Carolina 29418

Gabriel Magwood, Code 1849, Engineer-in-Charge

June 1994

FOREWORD

Subtitle I of the Hazardous and Solid Waste Amendments of 1984 to the Solid Waste Disposal Act (SWDA) of 1965 established a national regulatory program for managing underground storage tanks (USTs) containing hazardous materials, especially petroleum products. Hazardous wastes stored in USTs were already regulated under the Resource Conservation and Recovery Act (RCRA) of 1976, which was also an amendment to the SWDA. Subtitle I requires that the U.S. Environmental Protection Agency (USEPA) promulgate UST regulations. The program was designed to be administered by the individual States, who were allowed to develop more stringent standards, but not less stringent standards. Local governments were permitted to establish regulatory programs and standards that are more stringent, but not less stringent than either State or Federal regulations. The USEPA UST regulations are found in the Code of Federal Regulations, Title 40, Part 280 (40 CFR 280) (*Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks*) and Title 40 CFR 281 (*Approval of State Underground Storage Tank Programs*). Title 40 CFR 280 was revised and published on September 23, 1988, and became effective December 22, 1988.

The Navy's UST program policy is to comply with all Federal, State, and local regulations pertaining to USTs. This report was prepared to satisfy the requirements of Chapter 17-770, Florida Administrative Code (FAC) (*State Underground Petroleum Environmental Response*) regulations on petroleum contamination in Florida's environment as a result of spills or leaking tanks or piping.

Questions regarding this report should be addressed to the Commanding Officer, Naval Air Station Key West, Boca Chica Field, Key West, Florida, or to Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM), Gabriel Magwood, Code 1849, at AUTOVON 563-0658 or (803) 743-0658.

EXECUTIVE SUMMARY

The Jet Engine Test Cell site (Building A969) is used to test recently repaired jet engines. Jet engine testing activities are performed under a canopied area located in the central part of the site (see Executive Summary Figure). During testing, jet engines are fueled by a 5,000-gallon JP-5 jet fuel aboveground storage tank (AST) located within a concrete containment berm approximately 70 feet southwest of the canopy. Aboveground fuel piping extends from the northeast end of the berm to the testing area. In January 1989, a filter system leak resulted in the release of approximately 700 gallons of JP-5 jet fuel on the western side of the AST. Approximately 650 gallons of free product were recovered during initial remedial activities. During a site investigation in November 1992, stained soil was observed near the northwest corner of the canopy where lubrication oil had spilled from an overturned drum.

ABB Environmental Services, Inc. (ABB-ES), was contracted by the Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) to perform a contamination assessment (CA) and submit a Contamination Assessment Report (CAR) for the site. The CA was conducted from October 1993 through February 1994 following State guidelines for petroleum assessment and cleanup, which are outlined in Chapter 17-770, Florida Administrative Code. Forty-three soil borings were advanced into the water table and 24 monitoring wells were installed and sampled to assess the extent of soil and groundwater contamination.

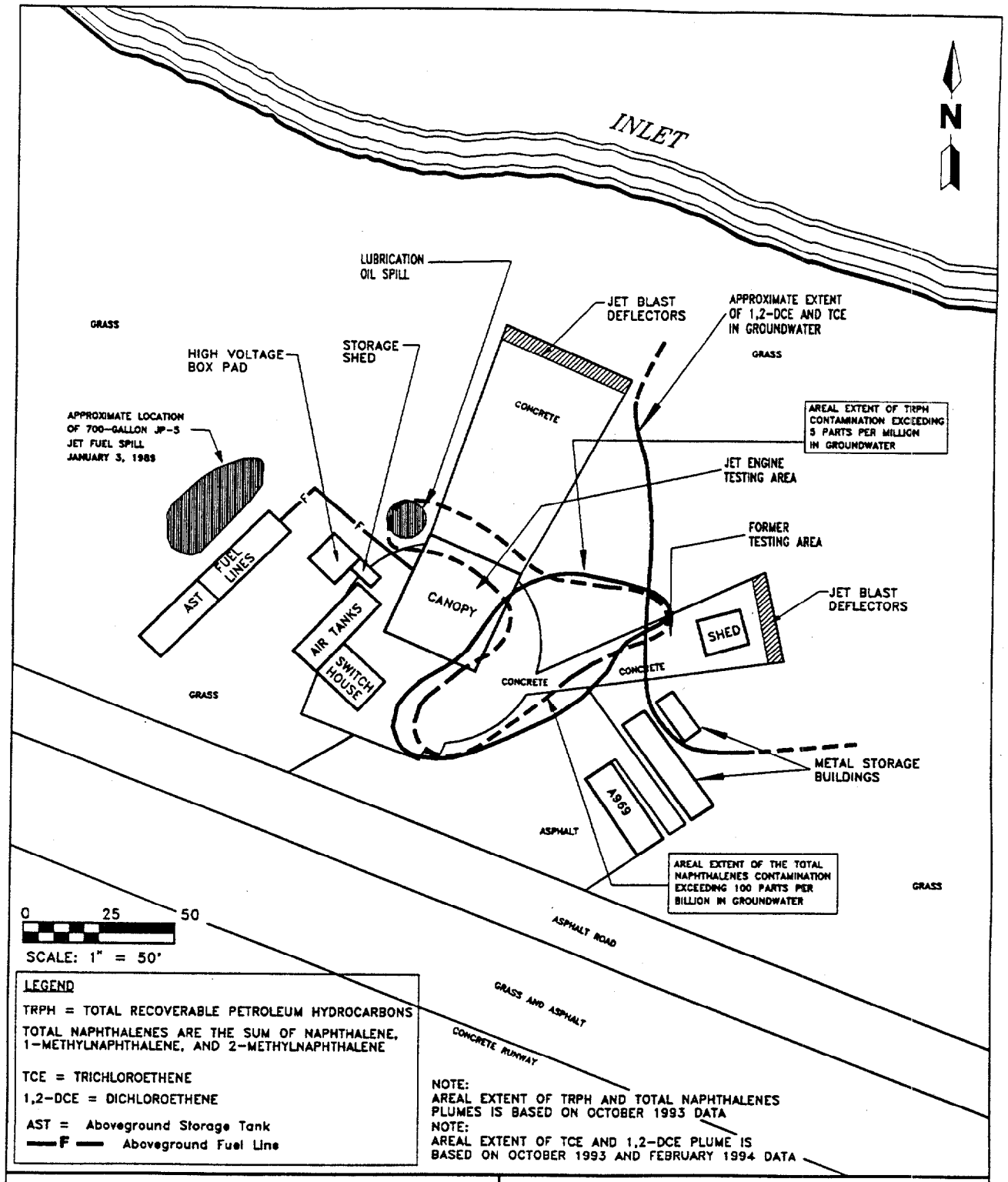
The water table was encountered at depths of 1 to 3 feet below land surface (bls). The general groundwater flow direction is toward the inlet that borders the site to the north.

Soil contamination detected at the site appears to be restricted to within 1 foot above the top of the water table, and may be an indication of residual groundwater contamination during low water table elevations.

Benzene, ethylbenzene, xylenes, naphthalenes, total recoverable petroleum hydrocarbons (TRPH), and several chlorinated compounds were identified in groundwater samples. TRPH and total naphthalenes concentrations in groundwater exceed applied State target levels in the vicinity of the jet engine testing area (see Executive Summary Figure). (Note: total naphthalenes are the sum of naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene). Concentrations of 1,2-dichloroethene (1,2-DCE) and trichloroethene (TCE) in groundwater exceeded their respective maximum contaminant levels (MCLs) in the northeast part of the site.

The areal extent of TRPH and total naphthalenes in groundwater appears to be restricted to the vicinity of the jet engine testing area. The vertical extent of TRPH and total naphthalenes in groundwater does not appear to exceed 20 feet bls.

The horizontal and vertical extent of 1,2-DCE and TCE in groundwater has not been delineated in the northeast part of the site. The presence of 1,2-DCE and TCE in groundwater does not appear to be associated with petroleum contamination. The source of 1,2-DCE and TCE in groundwater may be associated with cleaning and maintenance activities in the vicinity of the former testing area.



EXECUTIVE SUMMARY FIGURE

CONTAMINATION ASSESSMENT REPORT
JET ENGINE TEST CELL

BOCA CHICA FIELD
NAVAL AIR STATION
KEY WEST, FLORIDA

Additional site investigation is needed to assess the horizontal and vertical extent of 1,2-DCE and TCE in groundwater and the source of this contamination. Based on discussions with the Florida Department of Environmental Protection, it is the understanding of ABB-ES that additional site investigation and petroleum cleanup will be conducted as part of the Navy Installation Restoration program.

Attachment 2
Letter From Jorge Caspary, FDEP to
Dudley Patrick, SOUTHDIV

007896

Department of Environmental Protection

Lawton Chiles
Governor

Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Virginia B. Wetherell
Secretary

November 27, 1995

Mr. Dudley Patrick, Code 1858
Southern Division
Naval Facilities Engineering Command
2155 Eagle Dr., P. O. Box 10068
Charleston, South Carolina 29411-0068

RE: Technical memorandum for SWMU No. 9
Naval Air Station Key West, Florida

Dear Mr. Patrick:

I have reviewed the above referenced document dated November 2, 1995 (received November 3, 1995). Due to the presence of free product in two of the site's wells and the fact that there is migration of chlorinated compounds towards the inlet, the "natural attenuation" proposal is deemed inappropriate. The Navy should start free product recovery efforts and initiate a remedial action plan. Please provide this office a schedule and amount of the free product recovery efforts. Failure to recover free product is a violation of State Law and could result in fines being levied against the Station by the Department's South District.

If I can be of any assistance in this matter, please contact me at 904/488-3935.

Sincerely,

Jorge R. Caspary, P.G.
Remedial Project Manager

cc: Lisa Gordon, FDEP-Marathon Office
Ron Demes, NAS Key West
O. Mc Neil, Bechtel-Oak Ridge
Martha Berry, EPA-Atlanta

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BECHTEL 22567

Attachment 3
Instruction Guide for Groundwater Evaluation at the Jet Engine Test Cell

INSTRUCTION GUIDE

FOR

GROUNDWATER EVALUTION

AT

THE JET ENGINE TEST CELL

AT

NAS KEY WEST, FLORIDA

0	7/19/95	Issued for Use					
REV	DATE	REVISIONS	BY	EGS	PE	CONST	PM

ORIGIN BEI/Oak Ridge	JOB NO. 22567	
	INSTRUCTION 321-IG-001	Rev. 0
	Page 1 of 13	

INSTRUCTION GUIDE FOR GROUNDWATER EVALUATION AT THE JET ENGINE TEST CELL, NAS, KEY WEST, FLORIDA

1.0 SCOPE

Interim remedial actions are planned for a number of locations at or near Naval Air Station (NAS) Key West, Florida. Proposed remedial actions at the Jet Engine Test Cell (JETC) include the installation of a pump and treat system to remediate groundwater. Prior to installation of the system, data are needed to confirm and further define the extent of contamination and to determine optimum pumping rates for a groundwater recovery system. The objectives of this instruction guide are to address these data needs by;

- measure water and product levels in the existing wells with an oil/water interface probe,
- defining the extent of the trichloroethene (TCE) plume and confirming the presence of the naphthalene plume through the collection of groundwater samples from existing wells and from temporary groundwater sampling points installed as part of this investigation,
- if a groundwater recovery system is necessary, installing wells and piezometers and performing a pump test to determine the viability and optimum pumping rates of a pump and treat system, and
- determining tidal influences on the groundwater system.

2.0 FACILITY AREA

The JETC (Building A969) is located in the northeast section of Boca Chica Field on Boca Chica Key. A site map is shown in Figure 1. Background information, including a description of the JETC and a summary of the nature and extent of contamination, are included in BEI (1995a).

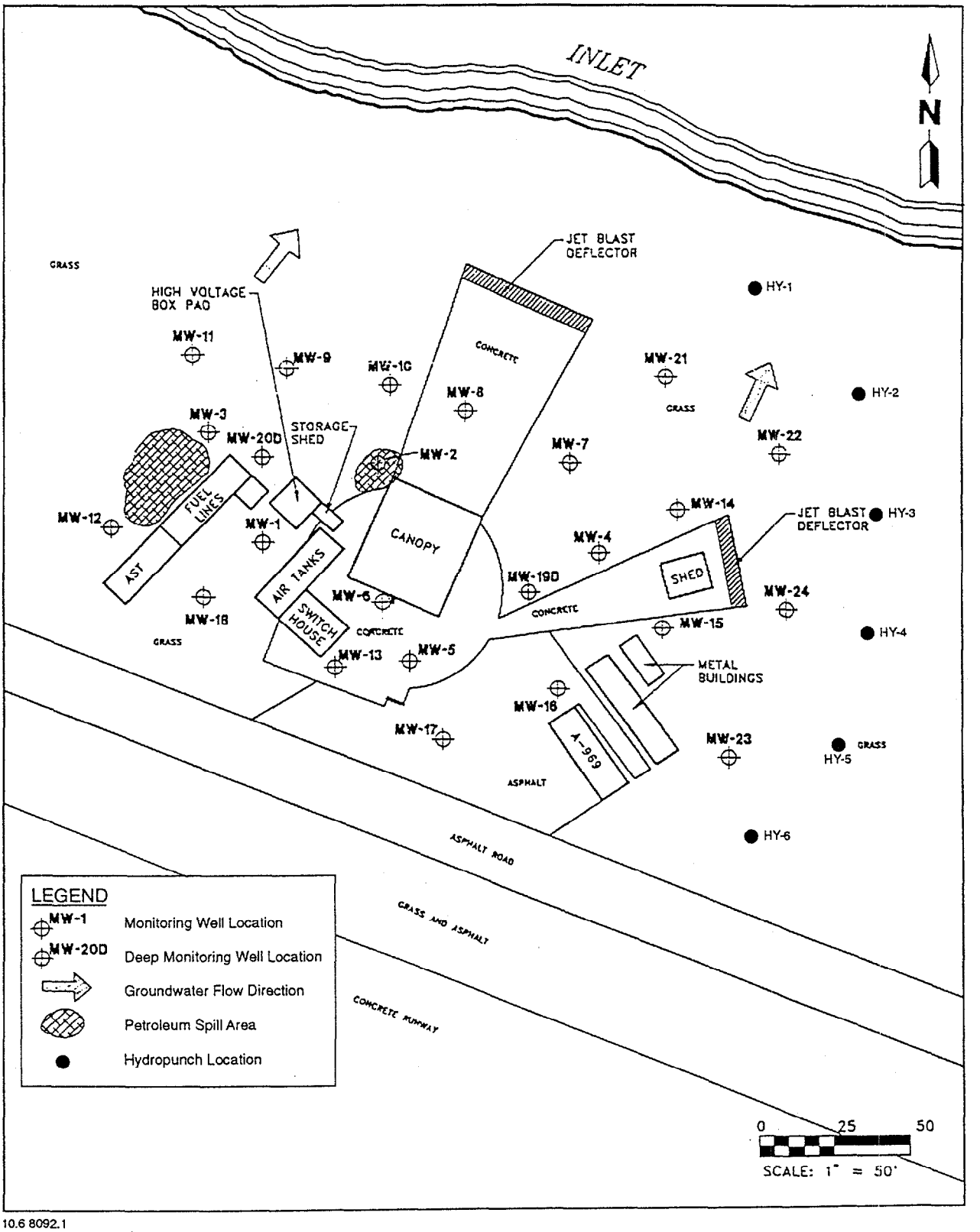
3.0 REFERENCES

ABB (1994). *Contamination Assessment Report, Jet Engine Test Cell, Building A969, Boca Chica Field, Naval Air Station Key West, Florida.*

Bechtel Environmental, Inc. (1995a). *Remedial Action Work Plan Delivery Order No. 004 at Naval Air Station, Key West, Florida.* Revision 1.

Bechtel Environmental, Inc. (1995b). *Technical Specification for Well Drilling, Installation, and Abandonment.* Navy Remedial Action Contract Project Technical Specification 22567-001-SP000-022.

Bechtel Environmental, Inc. (1995c). *Scope of Work for Drilling and Well Installation at NAS Key West.* 321-SW409-001.



10.6 8092.1

FIGURE 1
Monitoring Well and Proposed Hydropunch Locations

Bechtel Environmental, Inc. (1995d). *JETC Pump Test Design*. Navy Remedial Action Contract Project Calculation 321-G-001.

Bechtel Environmental, Inc. (1995e). *Pump Tests*. Navy Remedial Action Contract Project Procedure 22567-6027, Revision 0.

Bechtel Environmental, Inc. (1995f). *Task Specific Site Safety and Health Plan*. Draft.

Bechtel Environmental, Inc. (1994). *Groundwater Sampling*. Navy Remedial Action Contract Project Procedure 22567-6021, Revision 0.

Florida Department of Environmental Protection (1994). *Guidelines for Assessment and Remediation of Petroleum Contaminated Soil*. Division of Waste Management.

Florida Department of Environmental Regulation (1992). *Standard Operating Procedures for Laboratory Operations and Sample Collection Activities*. DER-QA-001/92.

Florida Department of Environmental Regulation (1989). *Groundwater Guidance Concentrations*. Division of Water Facilities.

U.S. Environmental Protection Agency (1993). *Suggested Operating Procedures for Aquifer Pumping Tests*. EPA/540/S-93/503.

4.0 DEFINITIONS

None

5.0 PRECAUTIONS

Safety and health protocols will be followed in accordance with the Task Specific Site Safety and Health Plan (TSSHP) (BEI, 1995f). A Site Safety and Health Representative (SSHR) will be present during all sample collection and drilling activities. Sampling and drilling activities are anticipated to be conducted using personal protective equipment (PPE) defined in the TSSHP as standard construction attire. The SSHR may modify or upgrade the level of PPE based on site conditions.

Site controls will be maintained during site operations to prevent entry by unauthorized individuals. A control zone encompassing the work area will be established using rope and/or barricade tape as necessary. Bechtel authorized visitors will be required to take site specific health and safety training prior to entering controlled zones. Visits within controlled zones by personnel who are not part of the project team (i.e. oversite personnel, etc.) will be documented in the site logbook.

6.0 PROCEDURE

6.1 MONITORING WELL MEASUREMENTS

Water levels will be collected from MW1 through MW24 with an oil/water interface probe prior to sampling the wells. Well locations are shown in Figure 1.

6.2 WELL SAMPLING AND HYDROPUNCH

Groundwater samples will be collected from all of the existing wells, and from up to sixteen hydropunch locations around JETC. Samples collected from these locations will complete definition of the extent of the 1,2-dichloroethylene (1,2-DCE) and TCE plume and confirm the location of the naphthalene plume. A map showing the well locations and the initial proposed hydropunch locations is presented in Figure 1. Locations of the hydropunch samples may change based on the analytical results and from samples collected from the monitoring wells.

Hydropunch is a technique of collecting groundwater samples that minimizes IDW by not creating drill spoils. Hydropunch also allows the collection of groundwater samples from multiple horizons within the same borehole. Groundwater samples are collected by pushing or driving a piece of small diameter stainless steel pipe with a screened sampling port to the desired depth. The sampling port has a retractable cover which is opened to collect the groundwater sample. Prior to sampling the borehole is purged with a peristaltic pump. Samples can be collected with either a peristaltic pump or a micro-bailer. If caprock is present at the site, it will be necessary to auger through it prior to using hydropunch.

Sampling of the wells and hydropunch locations will be conducted in accordance with BEI (1994). Table 1 contains a list of samples to be collected, analyses, analytical techniques, sample jars, preservatives required, and holding times for each location. Analyses to be performed are based on the results from analyses of groundwater samples reported in ABB (1994). All samples will be analyzed at an offsite laboratory. All analyses will be conducted at DQO Level III in accordance with BEI (1995). Table 2 contains a summary of all of the quality control samples.

In addition to sampling of wells and hydropunch locations proposed in this plan, downgradient hydropunch locations will be selected in the field based on the presence of contamination above action levels and the groundwater flow direction. Two day turn-around times for sample analyses will expedite determination of the downgradient sampling locations. Action levels are based on State of Florida water quality standards for a Class G-III aquifer (FDEP, 1989). Where there are no Class G-III standards available other standards have been used. A complete list of analytes of concern and action levels are presented in Table 3.

Table 1 Groundwater Sampling Requirements

Analytes	Analytical Technique	Sample Container	Preservative	Holding Time
MW1 through MW24				
TRPH	EPA 418.1	2-1 L glass bottle w/ Teflon lined cap	HCL to pH<2, Cool to 4°C	14 days
VOCs	EPA 8240	3-40 ml glass vials w/Teflon septum	HCL to pH<2, Cool to 4°C	14 days
Total Naphthalenes	EPA 8270	3-40 ml glass vials w/Teflon septum	HCL to pH<2, Cool to 4°C	14 days until extraction, 40 days until analysis
HY1 through HY16				
VOCs	EPA 8240	3-40 ml glass vials w/Teflon septum	HCL to pH<2, Cool to 4°C	14 days
Pump Test Discharge Water (2 Samples)				
VOCs	EPA 8240	3-40 ml glass vials w/Teflon septum	HCL to pH<2, Cool to 4°C	14 days
Total Naphthalenes	EPA 8270	3-40 ml glass vials w/Teflon septum	HCL to pH<2, Cool to 4°C	14 days until extraction, 40 days until analysis
Carbon Filtration Unit Discharge Water (2 Samples)				
VOCs	EPA 8240	3-40 ml glass vials w/Teflon septum	HCL to pH<2, Cool to 4°C	14 days
Total Naphthalenes	EPA 8270	3-40 ml glass vials w/Teflon septum	HCL to pH<2, Cool to 4°C	14 days until extraction, 40 days until analysis

Note: Selection of analytes based on results of sampling reported in ABB (1994).

Table 2 Quality Control Samples

Sample Type	Frequency	Analytes	Analytical Technique	Sample Container	Preservative	Holding Time
Trip Blank	1 per cooler	VOCs	EPA 8240	2-40 ml glass vials w/Teflon septum	HCL to pH<2, Cool to 4°C	14 days
Field Blank	1 every 20 samples	TRPH	EPA 418.1	1 L glass bottle w/ Teflon lined cap	HCL to pH<2, Cool to 4°C	14 days
		VOCs	EPA 8240	2-40 ml glass vials w/Teflon septum	HCL to pH<2, Cool to 4°C	14 days
		Total Naphthalenes	EPA 8270	1 L glass bottle w/ Teflon septum	HCL to pH<2, Cool to 4°C	14 days until extraction, 40 days until analysis
Rinsate Blank[1]	1 every 20 samples or 1 per week	TRPH	EPA 418.1	1 L glass bottle w/ Teflon lined cap	HCL to pH<2, Cool to 4°C	14 days
		VOCs	EPA 8240	2-40 ml glass vials w/Teflon septum	HCL to pH<2, Cool to 4°C	14 days
		Total Naphthalenes	EPA 8270	1 L glass bottle w/ Teflon septum	HCL to pH<2, Cool to 4°C	14 days until extraction, 40 days until analysis
Field Duplicate	1 every 20 samples	TRPH	EPA 418.1	1 L glass bottle w/ Teflon lined cap	HCL to pH<2, Cool to 4°C	14 days
		VOCs	EPA 8240	2-40 ml glass vials w/Teflon septum	HCL to pH<2, Cool to 4°C	14 days
		Total Naphthalenes	EPA 8270	1 L glass bottle w/ Teflon septum	HCL to pH<2, Cool to 4°C	14 days until extraction, 40 days until analysis

[1] Rinsate blanks will be collected only if sampling is performed using bailers.

Table 3 Action Levels for Contaminants of Concern

Contaminant	Criteria (ppb)	Source of Criteria
Benzene	200	State target level for Class III Groundwater
Ethylbenzene	30	Secondary maximum contaminant level
Xylenes	20	Secondary maximum contaminant level
Total VOCs	200	State target level for Class III Groundwater
Naphthalene	-	
1-Methylnaphthalene	-	
2-Methylnaphthalene	-	
Total Naphthalenes	100	State target level for Class II Groundwater
TRPH	5 mg/L	State target level for Class III Groundwater
cis-1,2-DCE	70	Primary maximum contaminant level
trans-1,2-DCE	100	Primary maximum contaminant level
TCE	3	Primary maximum contaminant level
Vinyl Chloride	1	State primary drinking water standard

Prior to collection of groundwater samples from the hydropunch locations, it may be necessary to auger through the caprock using hollow-stem augers. Once the underlying softer sands have been reached, or if augering is not necessary, samples will be collected by driving a hydropunch to the water table. After groundwater has been sampled at these locations, augered hydropunch locations will be abandoned in accordance with BEI (1995b).

6.3 WELL AND PIEZOMETER INSTALLATION

After sampling of groundwater is complete, the results of laboratory analyses will be analyzed to determine if treatment of groundwater is necessary. If the results of sample analyses indicate that contaminant concentrations are above the action levels presented in Table 3, a test recovery well and several temporary piezometers will be installed to perform a pump test. Details on the installation of the well and temporary piezometers are discussed in this section. If the results of the analyses are below action levels, it will not be necessary to perform the work discussed in this section and in Section 2.4.

One 4" recovery well and six temporary piezometers will be installed to perform a pump test (described in Section 2.4) to determine optimum pumping rates for a groundwater pump and treat system. Figure 2 shows the proposed locations of the temporary recovery well and the piezometers.

The recovery well will be drilled and constructed in accordance with all state and local regulations, the specification; *Technical Specification for Well Drilling, Installation, and Abandonment* (BEI, 1995b), and the Scope of Work for the Key West Drilling (BEI, 1995c) subcontract. Well construction drawings are shown in Figure 3.

The well will be a 4-inch PVC recovery well installed in a 10-inch diameter (minimum) borehole with a 1-inch PVC piezometer next to it. The well and piezometer will be installed at a depth of approximately 11 ft and will contain a 10 ft, 0.010-inch slotted PVC screen with a 20/30 silica sand pack to 2 ft. above the screen and a 2 ft. bentonite seal above the filter pack and grouted from the top of the filter pack to ground surface with a flush-mount protective casing. The well will be developed using a surge block or airlift technique.

Four 1-inch PVC temporary piezometers will be installed adjacent to the recovery well. The temporary piezometer locations are shown on Figure 2. The temporary piezometers will be located 5 feet from the recovery well. One additional temporary piezometer will be located adjacent to the bay (see Figure 2). The selection of temporary piezometer locations is discussed in Section 2.4. The temporary piezometers will be installed at the same depth as the recovery well and will contain a 10 ft, 0.010-inch slotted PVC screen. Casing will be placed in the hole and the formation will be allowed to collapse around the temporary piezometers and create a natural filter pack. Development of the temporary

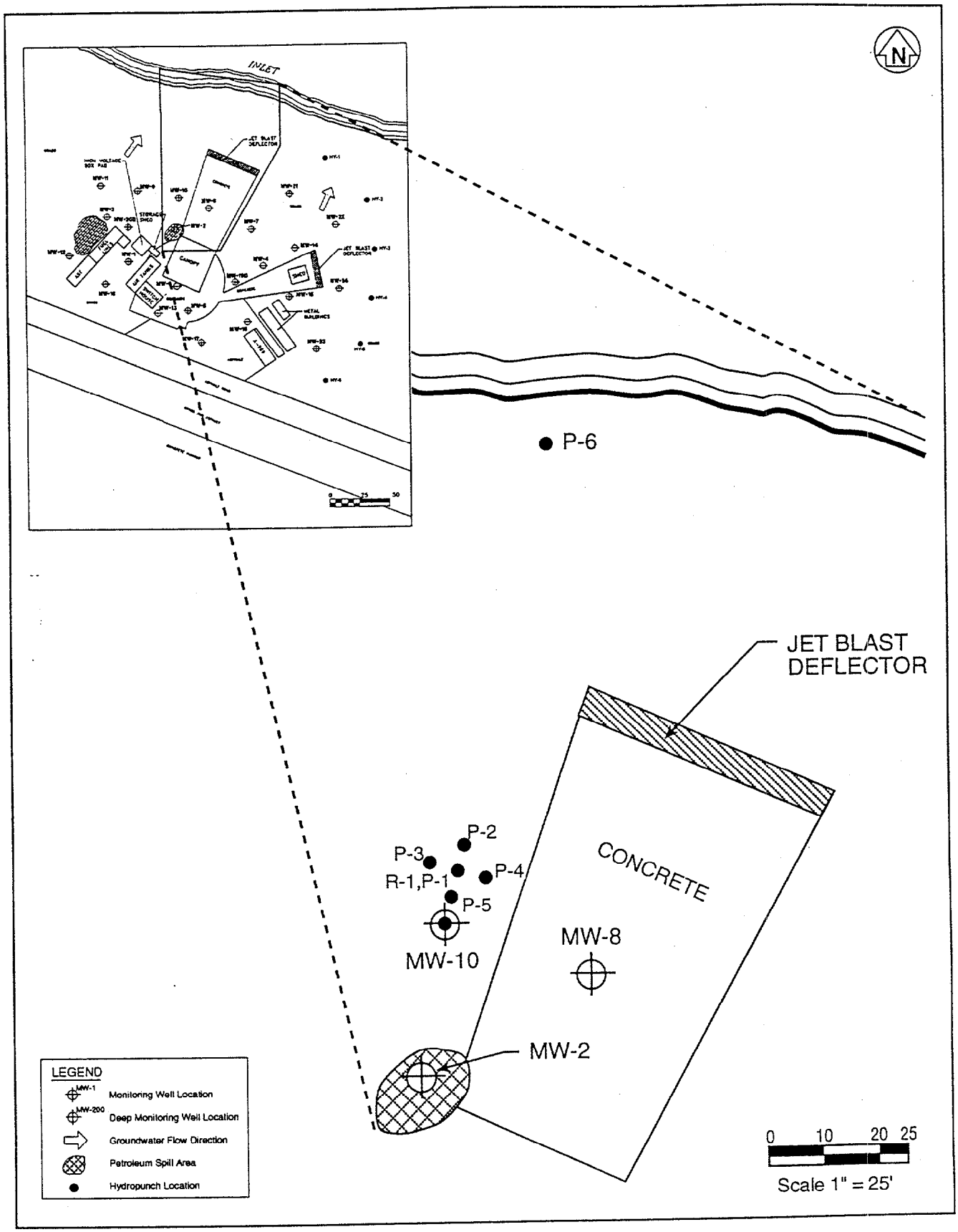


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FIGURE 2
Location of Recovery Well and Temporary Piezometer

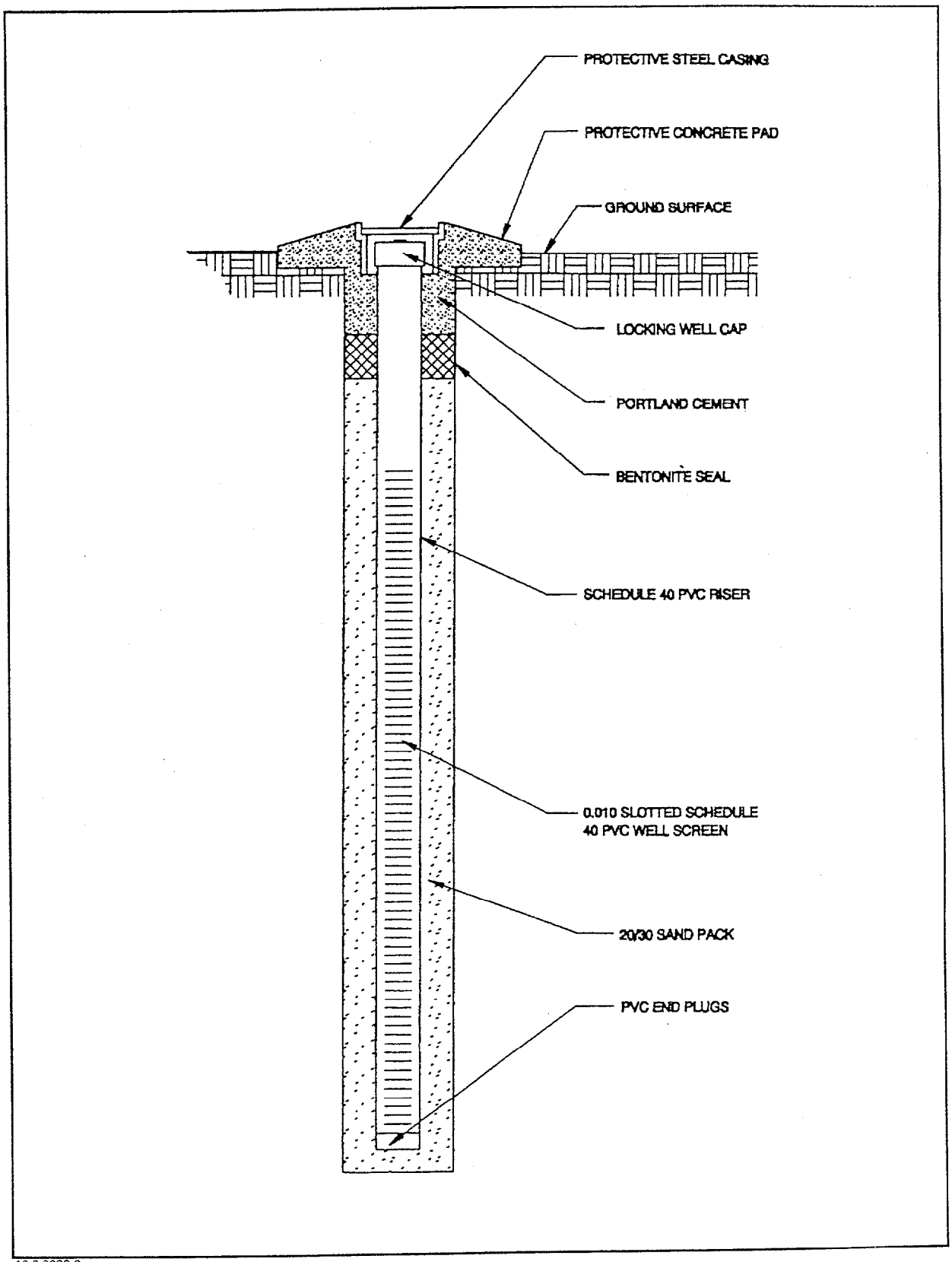

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FIGURE 3
Well Construction Details

piezometers will not be necessary, however, each piezometer will be tested to ensure that it is functioning properly. The temporary piezometers will be removed and the holes allowed to collapse back in on themselves when the remaining recovery wells are installed.

6.4 PUMP TESTING

If the results of groundwater sampling indicate that a groundwater treatment system is necessary, a 12-hr pump test will be performed on the recovery well. The test will be monitored by 4 temporary piezometers and one well (MW-10) which will observe the cone of influence generated by the pumping well. The cone of influence of the pumping well is 18.7 ft (BEI, 1995d). The temporary piezometers, will be located 5 ft from the pumping well and MW-10 will be 10 ft away. A fifth temporary piezometer will be installed next to the bay to monitor tidal influences during the test. The locations of the recovery well and the temporary piezometers are shown in Figure 2. The theoretical maximum pumping rate for the test is 0.9 gpm (BEI, 1995d). At this rate, the pumping well would be pumped dry in 24 hours. In order to provide a margin of safety, a pumping rate of 0.6 gpm has been selected. In order to verify the selected pumping rate, a step test will be performed prior to the pump test. The step test will start at a pumping rate of 0.4 gpm, and work up to 0.8 gpm in 0.1 gpm increments.

The step test will begin 48 hours after the tidal influence study is begun (see below). After the step test has been performed, the system will be allowed to recover for 24 hours and then the pump test will be performed. The pump test will run for a minimum of 12 hours and will be followed by a recovery period. The pump test will be performed in accordance with project procedure PP6027, *Pump Tests* (BEI, 1995e) and EPA Region IV SOPs (EPA, 1993).

Concurrent with the pump test, tidal influences will be monitored. The study will begin 48 hours before the step test, and will run through the entire length of the test and for 48 hours after the test to establish a baseline to modify the test results (i.e. remove tidal effects from the pumping test).

6.5 WASTE MANAGEMENT

Waste minimization will be an ongoing part of the field effort as a means to reduce or eliminate the generation of investigation derived waste (IDW) that would require handling as a hazardous waste. IDW will be managed on the principal that, to the extent possible, no contamination will be added or taken from the site.

Head space readings made by an organic vapor analyzer will be taken from soil disturbed during subsurface activities in accordance with *Guidelines for Assessment and Remediation of Petroleum Contaminated Soil* (FDEP, 1994). Soils yielding head space readings greater than 10 ppm will be containerized in DOT approved lined 55 gallon

drums. Containerized soils will be sampled and disposed of during future remediation activities at NAS Key West (i.e. remediation of the fire training area).

Disposable plastic (sheeting, gloves, PPE, well casing material from well closures, etc.) that is soiled or visually contaminated from a location within a contaminated area will be decontaminated in accordance with the *Standard Operating Procedures for Laboratory Operations and Sample Collection Activities* (FDER 1992), for decontamination of plastic equipment. After decontamination, the plastic may be reused or disposed of as garbage. Used glass containers will be similarly decontaminated in accordance with FDER SOPs and reused or disposed as garbage.

Samples from decontaminated disposable equipment will be collected from 5% of the contaminated locations and analyzed for the organics present at the site. A small quantity of soiled disposable materials which can not be decontaminated, such as paper towels is expected to be generated. This material, if soiled from a locations within a contaminated area, will be containerized (i.e. double bagged) for offsite disposal at a subtitle D landfill.

All water generated by sampling of wells MW14, MW15, MW21, MW22, and MW24 will be containerized in a 55 gallon drum which will be present on site. This water will be sampled for VOCs and then stored onsite until results indicate that the water can be either disposed of, or treated and then disposed of. Purge water from the remaining wells will be disposed of on the ground in accordance with (FDER, 1992).

All water generated by well development and the pump test will either be containerized in 10,000-gallon portable water tanks which will be present on site or will be treated by a carbon filtration unit and disposed of onsite. If a carbon filtration system is used, the system will be centrally located onsite. If the water is stored in 10,000-gallon water tanks, it will remain onsite until the groundwater pump and treat system has been installed. After installation of the pump and treat system, stored water will be treated and disposed of onsite as clean water.

Spent equipment decontamination fluids will be containerized in lined 55-gallon drums and sampled for VOCs. Contaminated water will be treated and disposed of in accordance with state and federal regulations.

6.6 FIELD PROCEDURES AND DOCUMENTATION

All activities performed as part of this task will be performed in accordance with appropriate FDER and EPA SOPs and project procedures.

Attachment 4
"Technical Memorandum: Groundwater Evaluation, Jet Engine Test Cell, NAS Key West, Florida" and Bail Down Test Results

Bechtel

Oak Ridge Corporate Center
151 Lafayette Drive
P.O. Box 350
Oak Ridge, Tennessee 37831-0350

Facsimile: (615) 220-2100

NOV 2 1995

Commanding Officer
Southern Division
Naval Facilities Engineering Command
Attention: Dudley Patrick (1858)
2155 Eagle Drive
North Charleston, SC 29406

SUBJECT: Bechtel Job No. 22567
Department of the Navy Contract No. N62467-93-D-0936
DO 0004, NAS KEY WEST, TECHNICAL MEMORANDUM, SWMU-9
JET ENGINE TEST CELL
Subject Code: 5220

Dear Mr. Patrick:

Per your request, I am forwarding copies of the Technical Memorandum TM-321-001, Groundwater Evaluation, Jet Engine Test Cell to EPA, FDEP, ABB, and Brown and Root. This memorandum reports the results of the groundwater sampling and the pump test that were recently conducted.

Based on the results of the sampling and testing activities, I would like to suggest the interim remedy for this site be revised to "natural attenuation." This would mean that a pump and treat system would not be installed and the contaminants in the groundwater would be allowed to naturally degrade. The sampling and testing results indicate that the solvent plume is smaller than previously estimated and that it is not reaching the adjacent lagoon due to the extremely flat groundwater gradient at this site and possibility due to natural degradation of the solvents. If this approach is unacceptable, a small pump and treat system could still be installed to remove the groundwater at the center of the contamination.

We will delay the start of design of the SWMU-9 pump and treat system pending of the review of natural attenuation approach by SOUTHDIV, EPA, and FDEP. If this method is used, there will be some continuing monitoring requirements and additional justification might be required.

ACTION REQ'D [ ] YES [ ] NO DUE DATE _____
RESPONSE TO CHRON NO. _____

If you have any questions or comments, please feel free to give me a call at (423) 220-2745.

Sincerely,

O. N. McNeil
Project Manager

REH:dcm:LR0433

cc: (all with TM-321-001)

Martha Berry (EPA)
Jorge Caspary (FDEP)
Ron White (ABB)
Kevin Walter (Brown and Root)

DEPARTMENT OF THE NAVY

SOUTHERN DIVISION

TECHNICAL MEMORANDUM:

GROUNDWATER EVALUATION, JET ENGINE TEST CELL, NAS KEY WEST, FLORIDA

0	10/3/95	ISSUED FOR USE	JSN	KMS	REH	BMM
REV	DATE		BY	EGS	PE	PM

ORIGIN	Groundwater Evaluation, Jet Engine Test Cell, NAS Key West, Florida	JOB NO.	
		MEMORANDUM	REV.
		TM-321-001	0
		PAGE 1 OF 1	

TECHNICAL MEMORANDUM: GROUNDWATER EVALUATION, JET ENGINE TEST CELL, NAS KEY WEST

1.0 INTRODUCTION

An assessment of groundwater at the Jet Engine Test Cell (JETC) at Naval Air Station (NAS) Key West was conducted by Bechtel Environmental, Inc. (BEI) between June 26 and September 8, 1995. The purpose of the groundwater assessment was to complete characterization of the extent of groundwater contamination and to perform aquifer tests to support evaluation of a groundwater pump and treat system. The assessment consisted of groundwater sampling and a pump test. Details on the work that was performed are presented in BEI (1995a)

2.0 RESULTS OF GROUNDWATER SAMPLING

Groundwater samples were collected from existing wells between June 27 and 29, 1995 and were analyzed for volatile organic compounds (VOCs), total naphthalenes, and total recoverable petroleum hydrocarbons (TRPHs). During this time each well was checked for floating product. Two of the wells contained product; MW-4 contained 0.18 ft and MW-5 contained 1.89 ft. Groundwater samples were not collected from MW-4 and MW-5. 10 temporary well points were installed and sampled on July 25 and 26, 1995. A groundwater sample was collected from each well point and was analyzed for VOCs and total naphthalenes. The locations of the monitoring wells and the temporary well points are shown in Figure 1. The results of sample analyses along with regulatory criteria for groundwater are presented in Table 1. Groundwater underlying JETC is classified as G-III (not suitable for drinking), however G-III criteria do not exist for most of the contaminants of concern, therefore additional criteria have been provided for comparison.

The data presented in Table 1 indicate that MW-15 and MW-24 are the only wells which contained contaminants (1,2-cis-DCE and 1,2-trans-DCE) above any criteria (primary drinling water standards). Other contaminants including TCE, naphthalene, and benzene are elevated above detection limits, but are below criteria. TRPH is also elevated in several wells. The extent of these compounds in groundwater is shown in Figures 2 through 4. Chlorinated compounds are present in groundwater on the eastern side of the site and the naphthalene and TRPH plumes are present in groundwater underlying the central and western parts of the site. ABB (1994) also identified Naphthalene, TRPH, and chlorinated hydrocarbon plumes in groundwater at JETC. ABB (1994) indicates that the product found in MW-4 and MW-5 (see above) is probably jet fuel. The estimated extent of product is shown in Figure 4.

Groundwater removed during the pump test was treated using a carbon filtration system. Samples of the water from the pump test were collected before and after treatment. The results of the analyses are summarized in Table 2. The analyses indicate that there was no contamination in groundwater at any time during the pump test.

3.0 RESULTS OF PUMP TEST

The pump test was performed with a Grundfos Readiflo 2 pump. Data was recorded on a Hermit 2000 and manual readings were taken for verification. Groundwater from the test was treated in a carbon filtration unit and then discharged on the ground. Locations of observation wells used to monitor the pump test are shown in Figure 5 and geologic logs and well construction diagrams are presented in Appendix A.

Figure 6 is a water table map at JETC showing water levels collected on September 6, 1995. The water table is essentially flat with a slight slope towards the inlet (see Figure 6). The water level in MW-18 is anomalously high and was not included in contouring of the water table map. The gradient across the site ranges from approximately 0.0017 to 0.0027 ft/ft.

Prior to the start of the pump test, a tidal study and a step test were performed. An initial tidal study was performed between July 26th through 28th with water level readings collected every hour. A second tidal study incorporating barometric data ran from July 28th through 31st. The tidal studies indicated tidal fluctuations of approximately 0.5 ft from high tide to low tide in observation well P-6. Additional data was collected from observation wells P-1 through P-5, and MW-10 after the water table had recovered from the September 6 - 7 pump test. Tidal fluctuations in these observation wells were approximately 0.2 ft.

The step test was performed on July 31st at pumping rates of 0.5 gpm, 0.6 gpm, 0.8 gpm, 1.2 gpm, and 1.5 gpm for 1 hour each. The step test indicated that the optimum pumping rate was in excess of 1.5 gpm. After the step test was completed, the groundwater system was allowed to recover for 36 hours. During the recovery period all equipment was removed from the wells at the request of the Navy.

Two pump and recovery tests were conducted between August 2 and 4, 1995 with pumping at 1.25 and 1.5 gpm. Due to a data logger malfunction, the tests were discontinued prior to completion. A third pump test was started on September 6, 1995 at a pumping rate of 2.0 gpm. The test was run for 24 hours and was followed by a 20 hour recovery test. The results of the test are presented in BEI (1995b). All of the drawdown in the pumping well and the observation wells occurred in the first 20 minutes of the test after which the water table stabilized. As a result, only the first 60 minutes of the test were needed to refine the data. This eliminated the need to correct the data for pressure and tidal influences. The results of the pump test are presented in Table 3. The storage coefficient and specific yield are also presented in Table 3, but the numbers are not representative of actual aquifer conditions. Data from the recovery test was not evaluated because the conditions required to refine the data were not met. Data from the recovery test is discussed in more detail in BEI (1995b).

BEI (1995b) calculated a hydraulic conductivity of 9.346×10^{-3} ft/min from the transmissivity listed in Table 3. Using Darcy's law, and the hydraulic gradients listed above, this yields a Darcy flow velocity of 8.4 to 13.3 ft/yr. Assuming a porosity of 0.2, this yields a linear groundwater flow velocity of 42 to 66.5 ft/yr.

4.0 CONCLUSIONS

Evaluation of the extent of contamination is complete. Two wells (MW-4, MW-5) contained product, and two wells (MW-15, MW-24) had total DCE contamination at levels above regulatory criteria. There are several other contaminants present in groundwater including TCE, tetrachlorethylene, Naphthalene, and TRPH, however levels are below regulatory guidelines. The extent of these compounds in groundwater is shown in Figures 2 through 4.

The results of the pump test indicate that water levels in the aquifer underlying JETC react rapidly to pumping and then stabilize after a short amount of time. Aquifer transmissivity values are approximately 9.4×10^{-3} ft/min and groundwater flow velocities are approximately 50 ft/yr. Groundwater flow is towards the inlet and tidal fluctuations decrease from 0.5 ft at the shore to 0.2 ft closer to the location of the pump test.

Based on this investigation, the conditions at JETC are favorable for the installation and successful operation of a pump and treat system.

Table 3 Summary of Pump Test Results

Well	Neuman			Theim-Dupuit
	Transmissivity (ft^2/min)	Storage Coefficient	Specific Yield	Transmissivity (ft^2/min)
P-2	0.06235	4.213×10^{-4}	0.001	0.088
P-3	0.08235	3.301×10^{-4}	0.001	0.072
P-4	0.1768	1×10^{-12}	0.001	0.084
P-5	0.07366	1.269×10^{-4}	0.001	0.047
MW-10	0.07305	2.442×10^{-5}	0.001	0.061
Mean	0.09364	1.805×10^{-4}	0.001	0.070

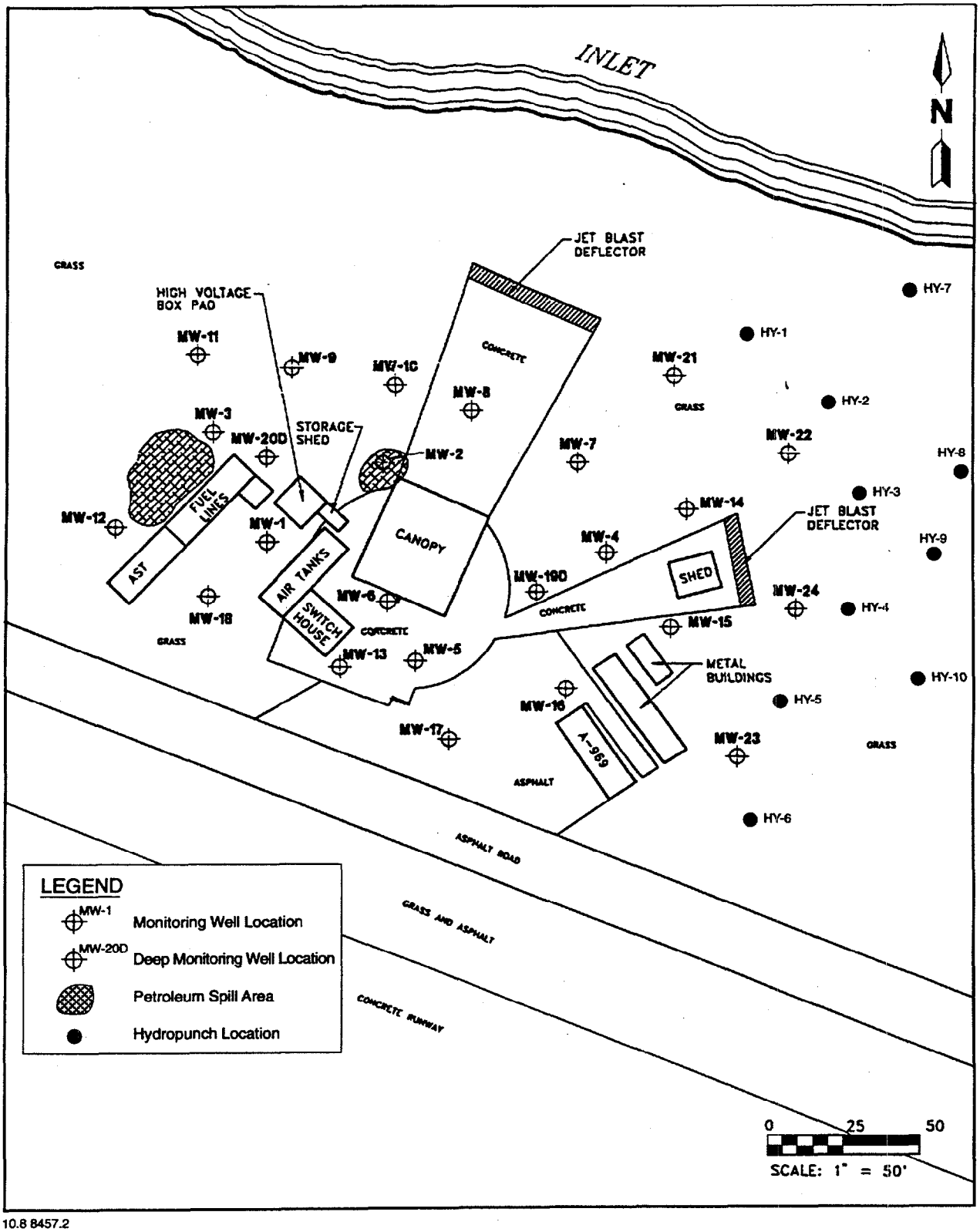

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FIGURE 1
Monitoring Well and Proposed Hydropunch Locations

Table 1. Results of Analyses of Groundwater Samples from JETC, Contaminants of Concern

Well ID	Sample ID	Results of Analysis (ug/l)								
		Solvents						BTEX		
		1,2-cis-DCE	1,2-trans-DCE	TCE	Tetrachlorethylene	Naphthalene (Total)	TRPH	Benzene	Toluene	Carbon Disulfide
Criteria	MCL-p	70	100	3	-	-	-	1	1000	-
Criteria	MCL-s	-	-	-	-	-	-	-	40	-
Criteria	G-II	-	-	-	-	100	5000	1	-	-
Criteria	G-III	-	-	-	-	-	5000	200	-	-
Criteria	WQC	-	-	80.7	-	-	-	71.28	-	-
MW1	KW02193	2.00u	2.00u	2.00u	2.00u	2.00u	1580	2.00u	2.00u	12.5
MW2	KW02180	50.0u	50.0u	50.0u	50.0u	66.1	1000u	50.0u	50.0u	250u
MW2 (dup.)	KW02181	50.0u	50.0u	50.0u	50.0u	69	1	50.0u	50.0u	250u
MW3	KW02196	2.00u	2.00u	2.00u	2.00u	2.00u	1120	2.00u	2.00u	10.0u
MW6	KW02175	2.00u	2.00u	2.00u	2.00u	NA	1000u	2.00u	2.00u	10.0u
MW7	KW02174	2.00u	2.00u	2.00u	2.00u	NA	1000u	2.00u	2.00u	10.0u
MW8	KW02179	50.0u	50.0u	50.0u	50.0u	2.00u	1000u	50.0u	50.0u	250u
MW9	KW02186	2.00u	2.00u	2.00u	2.00u	2.00u	1000u	2.00u	2.00u	10.0u
MW10	KW02183	2.00u	2.00u	2.00u	2.00u	18.8	1410	2.00u	2.00u	10.0u
MW11	KW02197	2.00u	2.00u	2.00u	2.00u	2.00u	1000u	2.00u	2.00u	10.0u
MW12	KW02195	2.00u	2.00u	2.00u	2.00u	2.00u	1000u	2.00u	2.00u	10.0u
MW13	KW02182	2.00u	2.00u	2.00u	2.00u	2.00u	1050	2.00u	2.00u	10.0u
MW14	KW02171	18.4	56.2	2.00u	2.00u	2.00u	1000u	2.00u	2.00u	10.0u
MW15	KW02169	**196**	**495**	2.00u	2.00u	2.00u	1000u	2.00u	2.00u	10.0u
MW16	KW02177	50.0u	50.0u	50.0u	50.0u	10.8	1000u	50.0u	50.0u	250u
MW17	KW02184	2.00u	2.00u	2.00u	2.00u	19.1	1920	2.00u	2.00u	10.0u
MW18	KW02191	50.0u	50.0u	50.0u	50.0u	2.00u	1000u	50.0u	50.0u	250u
MW19D	KW02190	50.0u	50.0u	50.0u	50.0u	3.42	1240	50.0u	50.0u	250u
MW20D	KW02192	2.00u	2.00u	2.00u	2.00u	2.00u	1700	2.00u	2.00u	10.0u
MW21	KW02173	51.3	6.82	2.00u	2.00u	2.00u	1000u	2.00u	2.00u	10.0u
MW22	KW02172	13	19.2	2.41	2.00u	2.00u	1000u	2.00u	2.00u	10.0u

Well ID	Sample ID	Results of Analysis (ug/l)								
		Solvents						BTEX		
		1,2-cis-DCE	1,2-trans-DCE	TCE	Tetrachlorethylene	Naphthalene (Total)	TRPH	Benzene	Toluene	Carbon Disulfide
Criteria	MCL-p	70	100	3	-	-	-	1	1000	-
Criteria	MCL-s	-	-	-	-	-	-	-	40	-
Criteria	G-II	-	-	-	-	100	5000	1	-	-
Criteria	G-III	-	-	-	-	-	5000	200	-	-
Criteria	WQC	-	-	80.7	-	-	-	71.28	-	-
MW23	KW02168	13.2	2.00u	2.00u	2.00u	NA	1000u	55.2	0.618j	10.0u
MW24	KW02170	**1560**	**2420**	2.00u	2.00u	2.00u	1000u	7	2.00 u	10.0u
HY01	KW02205	56.7	4.58	2.00u	2.00u	2.00u	NA	2.00u	2.00u	10.0u
HY02	KW02204	2.00u	2.00u	2.00u	2.00u	2.00u	NA	2.00u	2.00u	10.0u
HY03	KW02203	2.00u	2.00u	2.00u	2.00u	91.1	NA	2.00u	0.171j	10.0u
HY04(dup.)	KW02201	2.00u	2.00u	2.00u	2.00u	2.00u	NA	2.00u	0.209j	10.0u
HY04	KW02200	2.00u	2.00u	2.00u	2.00u	2.00u	NA	2.00u	0.179j	10.0u
HY05	KW02199	2.00u	2.00u	2.00u	2.00u	2.00u	NA	2.00u	2.00u	10.0u
HY06	KW02198	2.00u	2.00u	2.00u	0.0681j	2.00u	NA	2.00u	0.061j	10.0u
HY07	KW02209	5u	5u	5u	5u	0.50u	NA	5u	5u	5u
HY08	KW02208	5u	5u	5u	5u	0.50u	NA	5u	5u	5u
HY09	KW02207	5u	5u	5u	5u	0.50u	NA	5u	5u	5u
HY10	KW02206	5u	5u	5u	5u	0.50u	NA	5u	5u	5u

Notes: Values in bold are above listed criteria.
MW4 and MW5 contained product and were not sampled.
NA = Contaminant not analyzed for.
u = not detected.
j = below instrument detection limits.
HY01-HY10 were not sampled for TRPH.
1 KW02181 (MW4 - Dup.) was not analyzed for TRPH, the sample was inadvertently destroyed during shipping.
2 HY07-HY10 were analyzed by Inchscape Testing Services, remaining samples analyzed by General Engineering Laboratories.
MCL-p = primary drinking water standards (17-550.310, FAC)
MCL-s = secondary drinking water standards (17-550.320, FAC)
G-II = petroleum contaminated site cleanup levels for G-II groundwater (17-770.730, FAC)
G-III = petroleum contaminated site no further action levels for G-III groundwater (FDER, 10/90)
WQC = surface water quality criteria for G-III surface water (17-302.530, FAC)

Table 2. Results of Analysis of Samples from Pump Discharge

Location[1]	Sample ID	Date	Results of Analysis (ug/l)							
			Solvents						BTEX	
			1,2-cis-DCE	1,2-trans-DCE	TCE	Tetrachlorethylene	Naphthalene (Total)	Carbon Disulfide	Benzene	Toluene
Pretreatment	KW02211	7/31/95	5u	5u	5u	5u	0.50u	5u	5u	12
Post-treatment	KW02212	7/31/95	5u	5u	5u	5u	0.50u	6	5u	5u
Pretreatment	KW02213	8/3/95	5u	5u	5u	5u	0.50u	5u	5u	5u
Post-treatment	KW02214	8/3/95	5u	5u	5u	5u	0.50u	5u	5u	5u
Pretreatment	KW02217	8/31/95	1u	1u	1u	1u	0.9j	1u	1u	1u
Post-treatment	KW02218	8/31/95	1u	1u	1u	1u	1u	1u	1u	1u

1 Location relative to treatment plant.
u = not detected.
j = below instrument detection limits.
Wastewater samples not analyzed for TRPH.

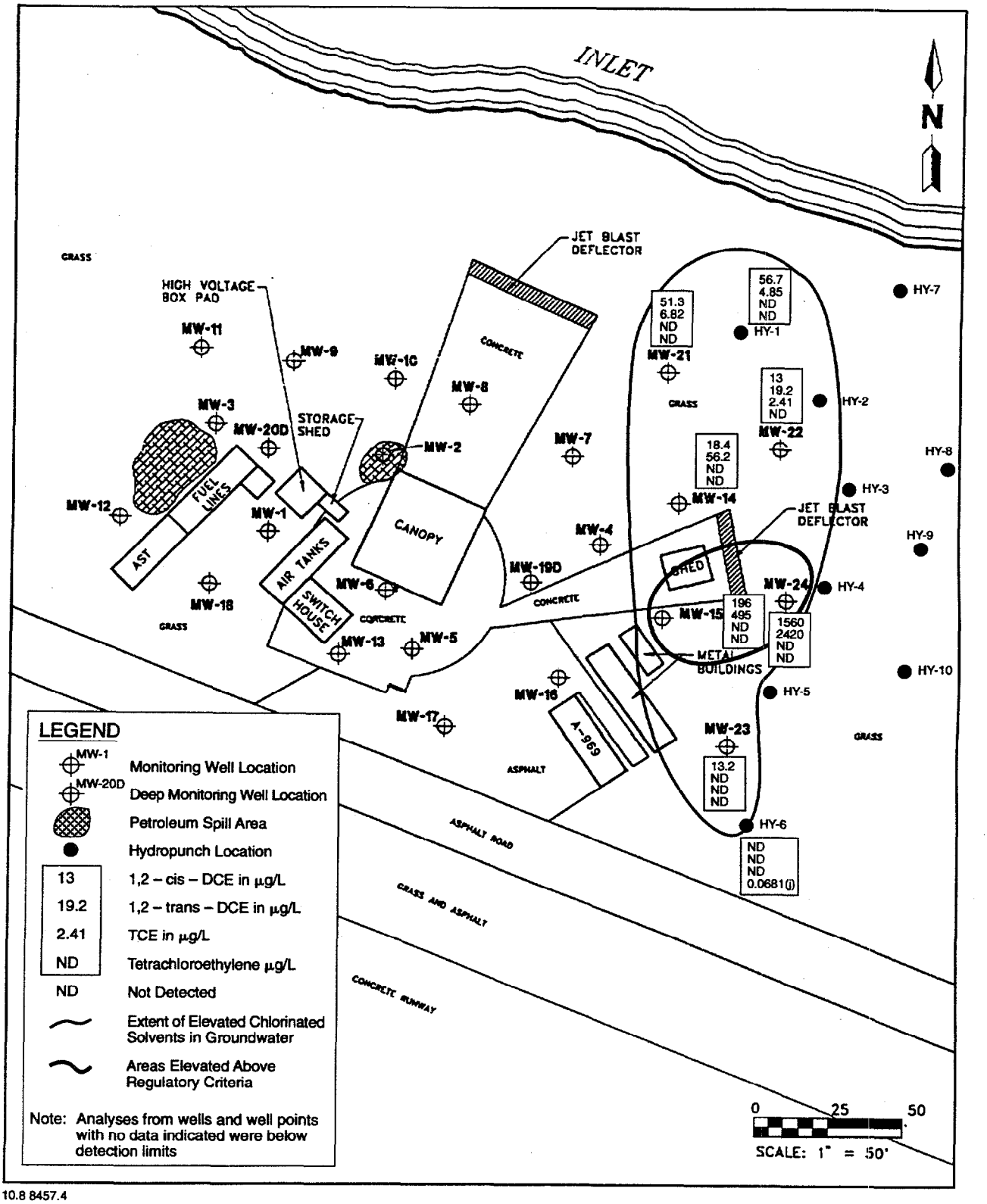

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FIGURE 2
Extent of Chlorinated Solvents in Groundwater

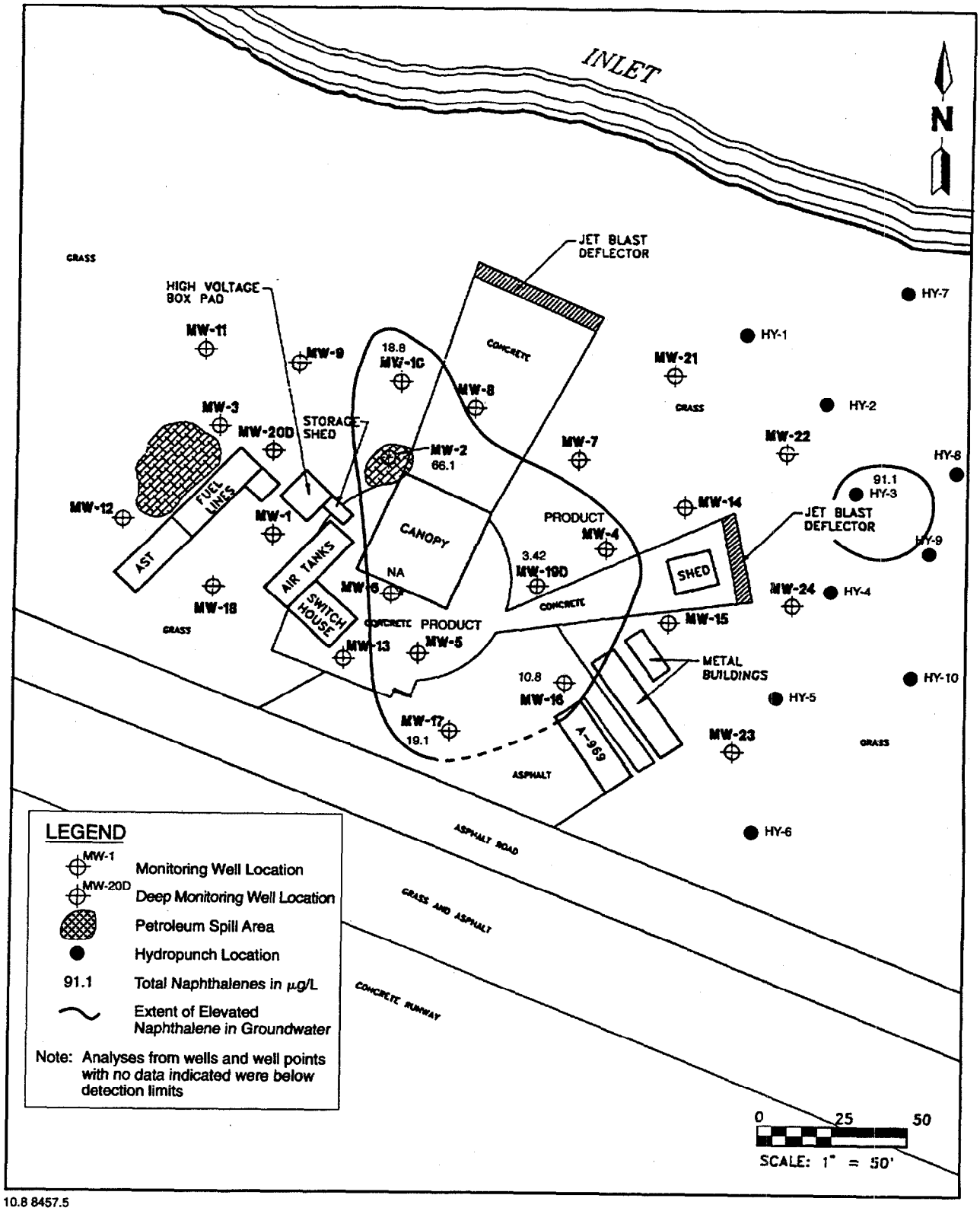

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FIGURE 3
Extent of Elevated Naphthalene in Groundwater

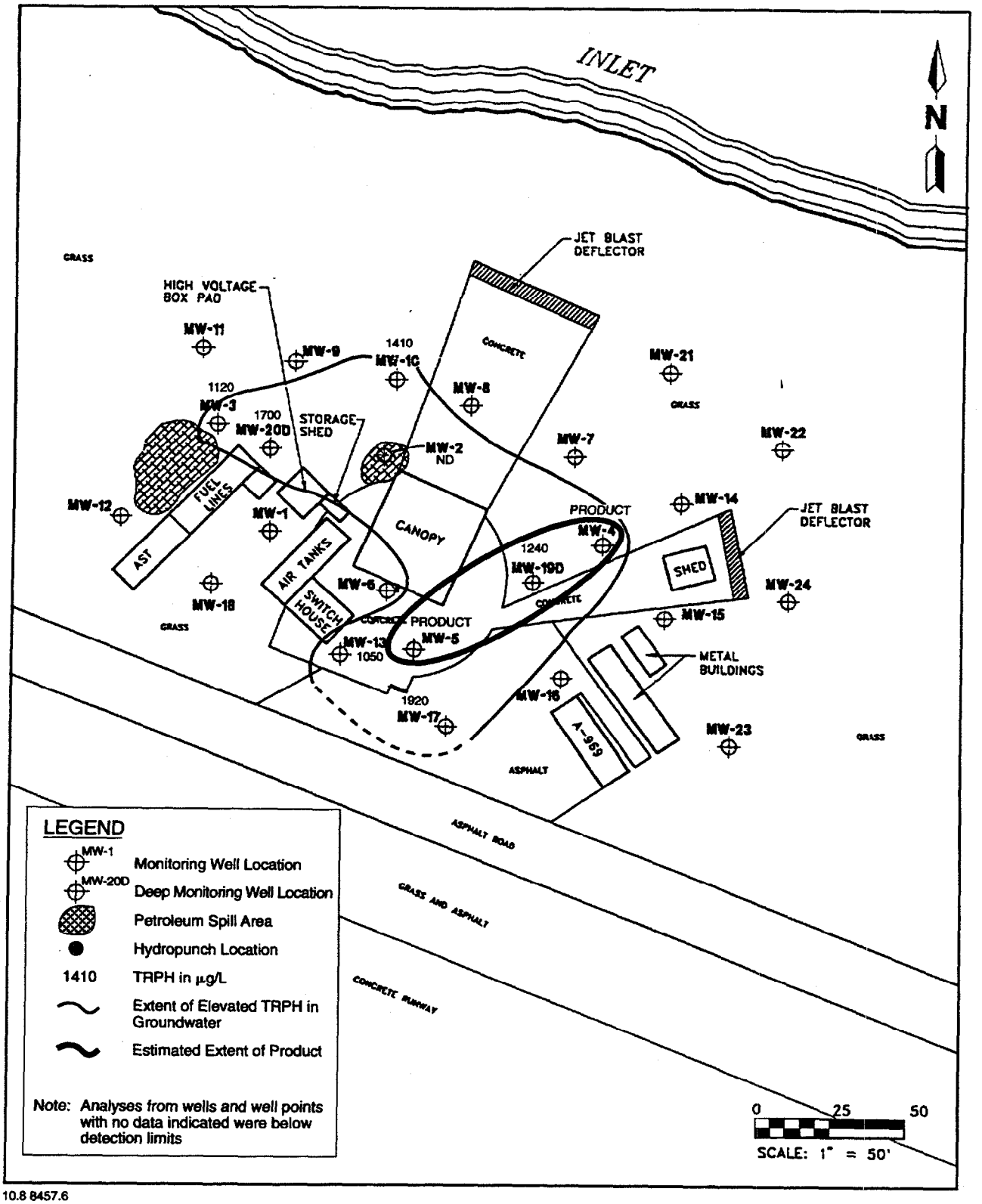

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FIGURE 4
Extent of TRPH in Groundwater

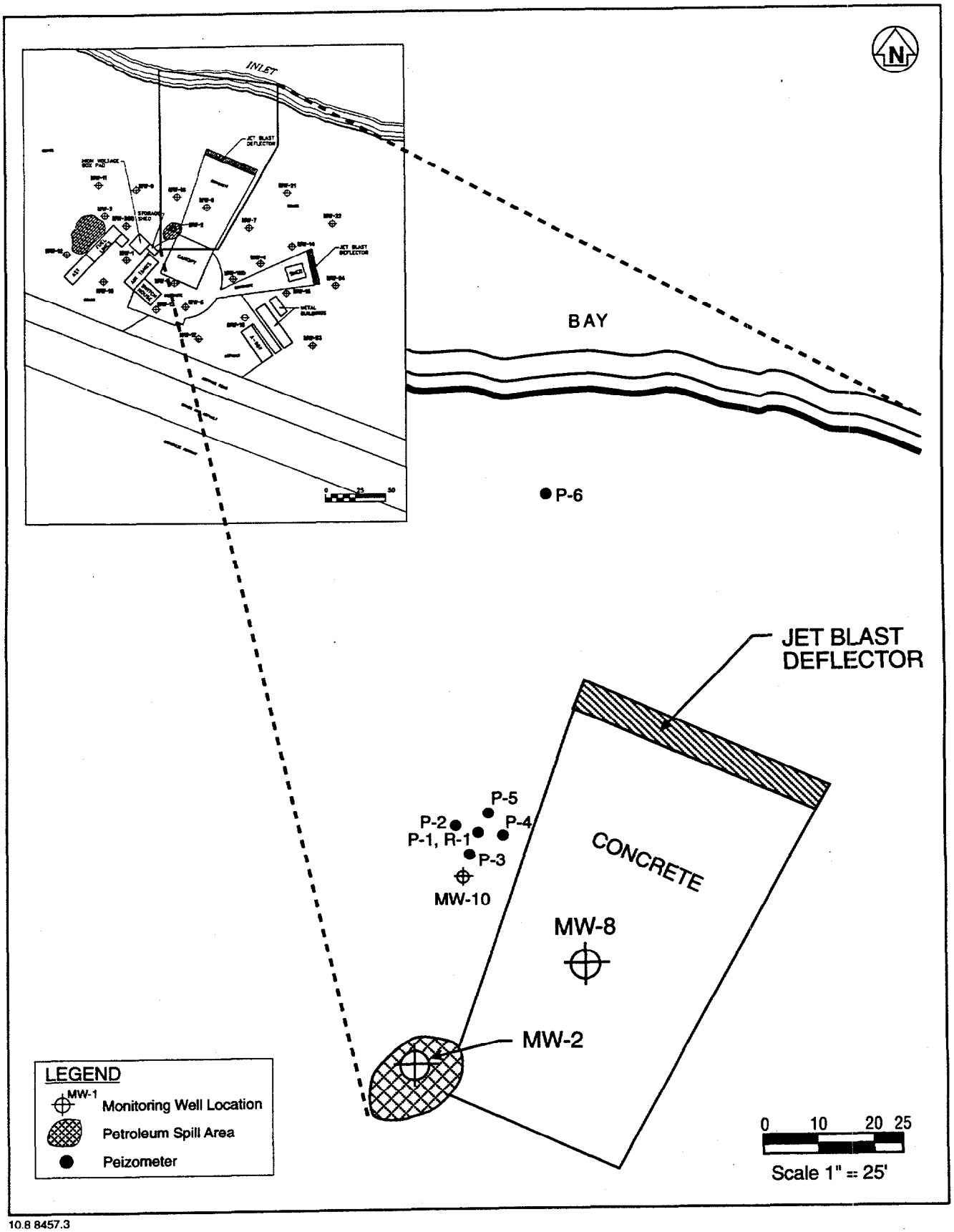

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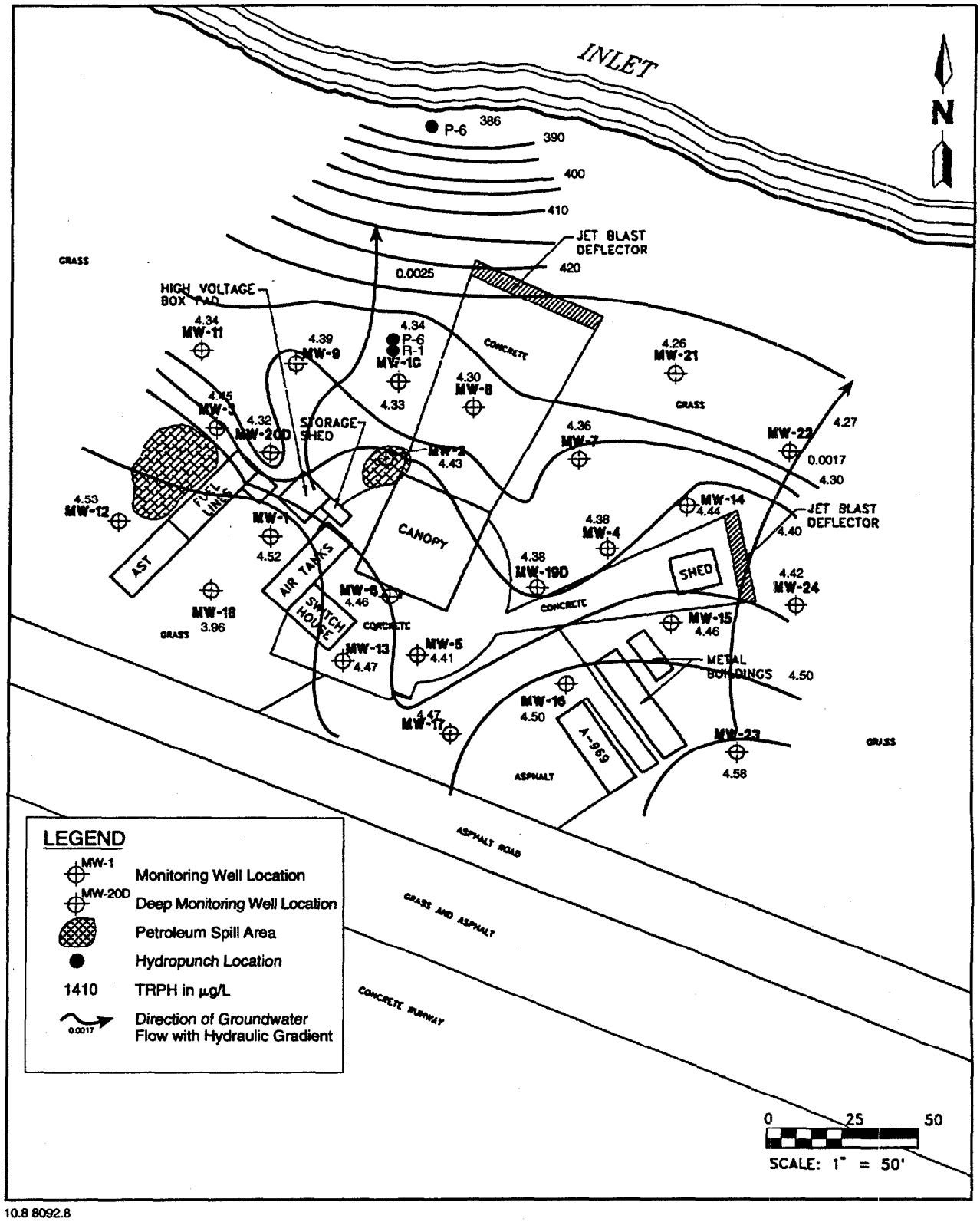
FIGURE 5
Location of Recovery Well and Temporary Piezometer



10.8 8092.8

FIGURE 6
Water Table Map, September 6, 1995

5.0 REFERENCES

5,1 ABB Environmental Services, Inc. (ABB), 1994. Contamination Assessment Report, Jet Engine Test Cell, Building A969, Naval Air Station, Key West, Florida. June.

5.1 Bechtel Environmental, Inc. (BEI), 1995a. Instruction Guide for Groundwater Evaluation at the Jet Engine Test Cell at NAS Key West, Florida. 321-IG-001 Rev. 0.

5.2 Bechtel Environmental, Inc. (BEI), 1995b. Refinement of Jet Engine Test Cell Pump Test Data. Calculation 321-G-002.

APPENDIX A

Geologic Drill Logs

and

Well Construction Diagrams

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
NAVAL AIR STATION KEY WEST	22567-321	1 OF 1	R-1

SITE	COORDINATES	ANGLE FROM HORIZ	BEARING
NAS Key West - JETC		Vertical	------

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	OVERBURDEN	ROCK (FT.)	TOTAL DEPTH
7-26-95	7-26-95	Env. Drilling Inc.	Mobile B-57	12"	10.0	1.0	11.3

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
/				4.00	2.3/1.7 2.3 /	10.00/-6.20

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
140# / 30"	11 ft 4" PVC	J.Novick

SAMP TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS / % CORE	ANALYSES PERFORMED		ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
SS 2"	2.00	1.80				4.00				0.0 - 10.0 ft. Silty Sand. Very pale orange (10YR8/2). Sand grains are fine to medium grained, subangular to subrounded limestone fragments set in a tightly packed clay and silt matrix. Contains occassional coarse grained limestone fragments up to 1" in size. Homogeneous. Moderately sorted. Hard, dry, friable.	Borehole advanced using 12" O.D. Hollow Stem Auger, combined with 2" Split Spoon Sampler.
SS 2"	2.00	2.00								@ 1.8 ft. Peat layer, dusky yellowish brown (10YR2/2). 0.2 ft thick. @ 2.0 ft. Wet.	
							5				Survey not completed yet, coordinates not available.
											Well nested with P-1.
						-5.90	10			10.0 - 11.0 ft. Oolitic Limestone. Very Pale Orange (10YR8/2). Fine to coarse oolites. Oolites are well formed and weakly bonded by calcareous cement. Oolite size increases with depth. Massive, homogeneous, moderately friable, saturated.	Bedrock described from cuttings.
						-7.00				Bottom of hole at 11 ft, 4" monitoring well installed on 7/26/95.	
											Soil description is by visual examination of split spoon samples, classification by Unified Soil Classification System (USCS) and color description from GSA Rock Color Chart.

SS = SPLIT SPOON; NQ = CORE BARREL; HX = HAND AUGER; O = OTHER

SITE: NAS Key West - JETC

HOLE NO. R-1

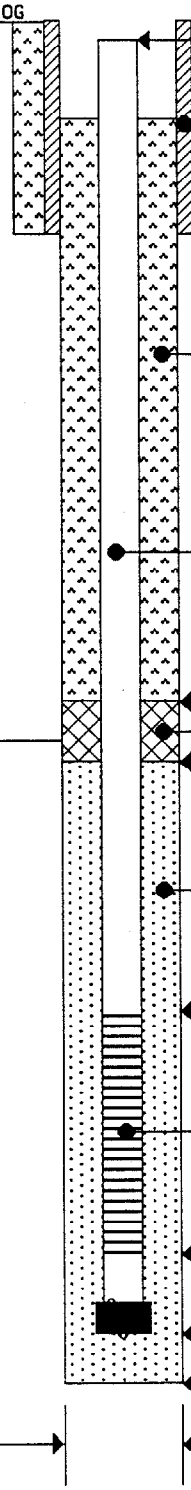
MONITORING WELL

PROJECT	WELL NO.
NAVAL AIR STATION KEY WEST	R-1

JOB NO.	SITE	COORDINATES
22567-321	NAS Key West - JETC	* Well not surveyed

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
7/26/95	7/26/95	J.Novick	Ground Surface

GENERALIZED GEOLOGIC LOG



	DEPTH (FT)	ELEV. (FTMSL)
	0.0	4.0
TOP OF RISER CASING	0.0	3.8
BOTTOM OF FLUSH MOUNT BOX	0.7	3.1
TOP OF SEAL	0.8	3.0
TOP OF FILTER PACK	1.0	2.8
TOP OF SCREEN	1.0	2.8
BOTTOM OF SCREEN	11.0	-7.2
BOTTOM OF SUMP	11.3	-7.2
BOTTOM OF HOLE	11.3	-7.3

FLUSH MOUNT BOX
DIAMETER/TYPE:
12"/Flush Mount Box

BACKFILL MATERIAL TYPE
Cement-Bentonite Grout

RISER CASING
DIAMETER/TYPE:
4"/PVC

ANNULAR SEAL TYPE
30/65 Sand

FILTER PACK TYPE
20/30 Sand

SCREEN
DIAMETER: 4"
TYPE: Machine Slotted PVC
OPENING WIDTH: 0.010

HOLE DIAMETER: 12"

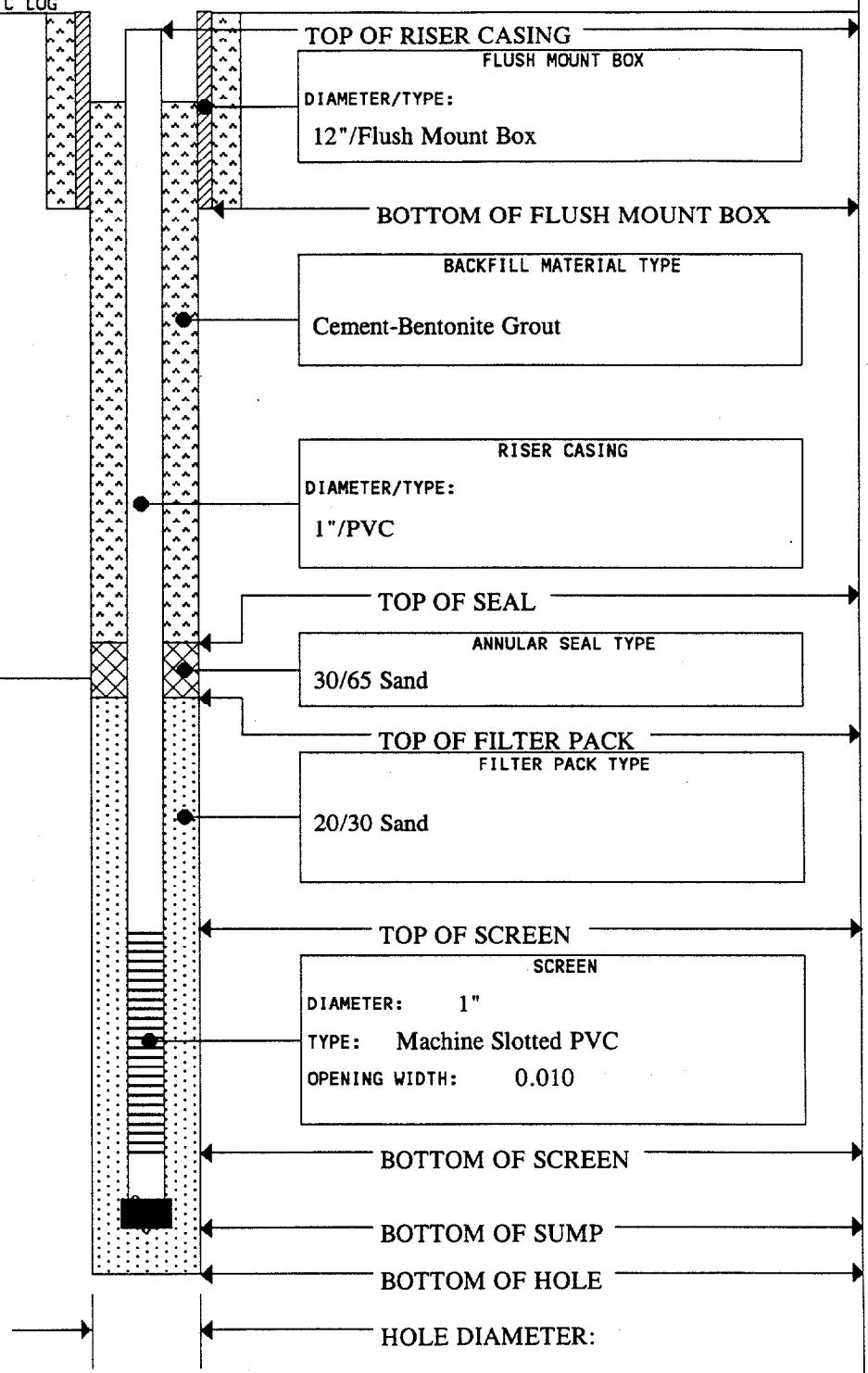
MONITORING WELL

PROJECT	WELL NO.
NAVAL AIR STATION KEY WEST	P-1

JOB NO.	SITE	COORDINATES
22567-321	NAS Key West - JETC	* Well not surveyed

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
7/26/95	7/26/95	J. Novick	Ground Surface

GENERALIZED GEOLOGIC LOG



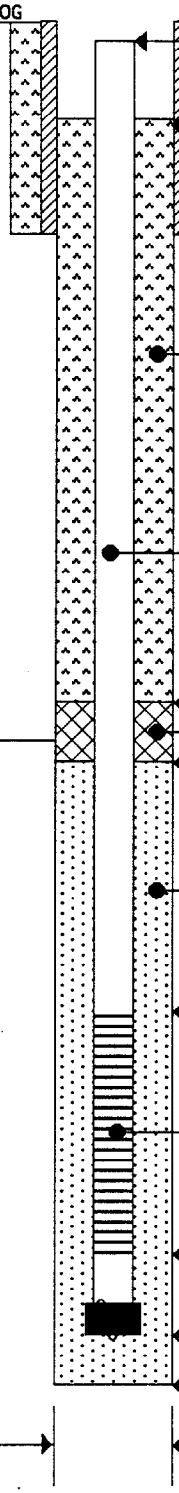
MONITORING WELL

PROJECT	WELL NO.
NAVAL AIR STATION KEY WEST	P-3

JOB NO.	SITE	COORDINATES
22567-321	NAS Key West - JETC	* Well not surveyed

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
7/26/95	7/26/95	J. Novick	Ground Suface

GENERALIZED GEOLOGIC LOG



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF RISER CASING	0.0	4.0
	0.0	4.0
BOTTOM OF FLUSH MOUNT BOX	0.7	3.3
TOP OF FILTER PACK	1.0	3.0
TOP OF SCREEN	1.0	3.0
BOTTOM OF SCREEN	11.0	-7.0
BOTTOM OF SUMP	11.0	-7.0
BOTTOM OF HOLE	11.0	-7.0

FLUSH MOUNT BOX
DIAMETER/TYPE:
8"/Fluch Mount Box

BACKFILL MATERIAL TYPE
Silica Sand

RISER CASING
DIAMETER/TYPE:
1"/PVC

TOP OF SEAL

ANNULAR SEAL TYPE
None

FILTER PACK TYPE
20/30 Silica Sand

SCREEN
DIAMETER: 1"
TYPE: Machine Slotted PVC
OPENING WIDTH: 0.010

HOLE DIAMETER:

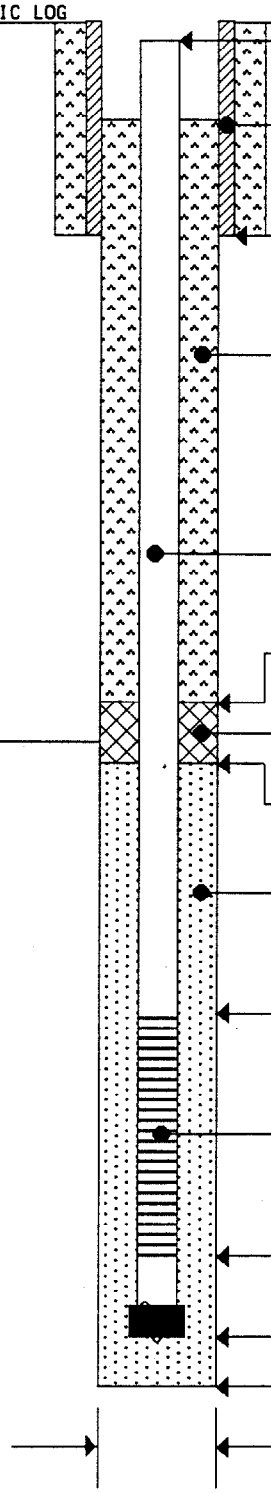
MONITORING WELL

PROJECT	WELL NO.
NAVAL AIR STATION KEY WEST	P-2

JOB NO.	SITE	COORDINATES
22567-321	NAS Key West - JETC	* Well not surveyed

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
7/26/95	7/26/95	J. Novick	Ground Surface

GENERALIZED GEOLOGIC LOG



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF RISER CASING	0.0	3.9
	0.0	3.9
BOTTOM OF FLUSH MOUNT BOX	0.7	3.2
TOP OF SEAL		
TOP OF FILTER PACK	1.0	2.9
TOP OF SCREEN	1.0	2.9
BOTTOM OF SCREEN	11.0	-7.1
BOTTOM OF SUMP	11.0	-7.1
BOTTOM OF HOLE	11.0	-7.2
HOLE DIAMETER:		

FLUSH MOUNT BOX
DIAMETER/TYPE:
8"/Flush Mount Box

BACKFILL MATERIAL TYPE
Silica Sand

RISER CASING
DIAMETER/TYPE:
1"/PVC

ANNULAR SEAL TYPE
None

FILTER PACK TYPE
20/30 Silica Sand

SCREEN
DIAMETER: 1"
TYPE: Machine Slotted PVC
OPENING WIDTH: 0.010

MONITORING WELL

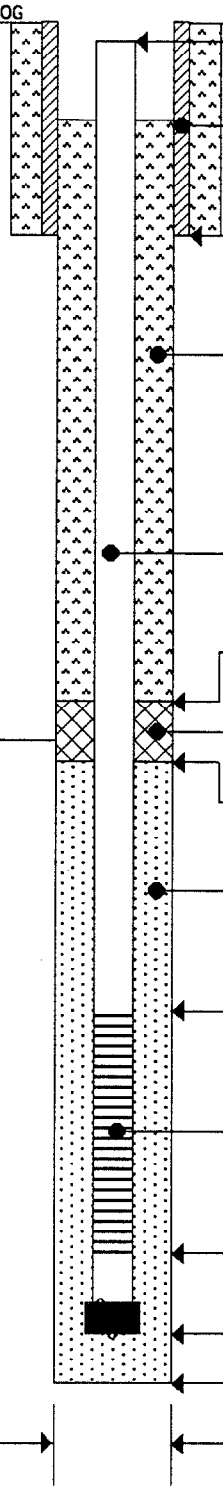
PROJECT: NAVAL AIR STATION KEY WEST

WELL NO.: P-4

JOB NO.	SITE	COORDINATES
22567-321	NAS Key West - JETC	* Well not surveyed

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
7/26/95	7/26/95	J. Novick	Ground Surface

GENERALIZED GEOLOGIC LOG



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF RISER CASING	0.0	4.0
	0.0	4.0
FLUSH MOUNT BOX — DIAMETER/TYPE: 8"/Flush Mount Box		
BOTTOM OF FLUSH MOUNT BOX	0.7	3.3
BACKFILL MATERIAL TYPE — Silica Sand		
RISER CASING — DIAMETER/TYPE: 1"/PVC		
TOP OF SEAL		
ANNULAR SEAL TYPE — None		
TOP OF FILTER PACK	1.0	3.0
FILTER PACK TYPE — 20/30 Silica Sand		
TOP OF SCREEN	1.0	3.0
SCREEN — DIAMETER: 1"; TYPE: Machine Slotted PVC; OPENING WIDTH: 0.010		
BOTTOM OF SCREEN	11.0	-7.0
BOTTOM OF SUMP	11.0	-7.0
BOTTOM OF HOLE	11.0	-7.1
HOLE DIAMETER:		

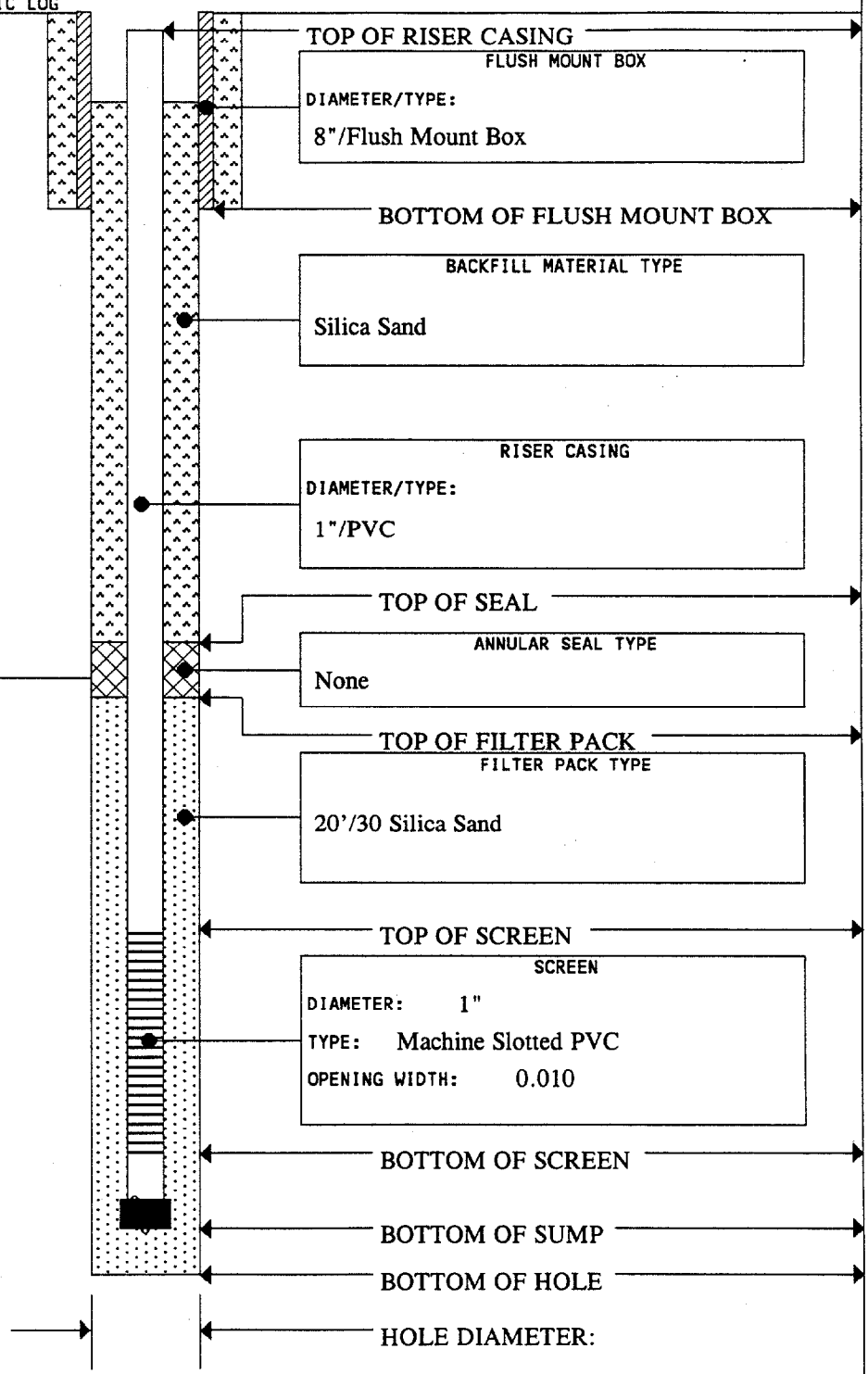
MONITORING WELL

PROJECT	WELL NO.
NAVAL AIR STATION KEY WEST	P-5

JOB NO.	SITE	COORDINATES
22567-321	NAS Key West - JETC	* Well not surveyed

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
7/25/95	7/25/95	J. Novick	Ground Surface

GENERALIZED GEOLOGIC LOG



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF RISER CASING	0.0	3.8
	0.0	3.8
BOTTOM OF FLUSH MOUNT BOX	0.7	3.1
TOP OF FILTER PACK	1.0	2.8
TOP OF SCREEN	1.0	2.8
BOTTOM OF SCREEN	11.0	-7.2
BOTTOM OF SUMP	11.0	-7.5
BOTTOM OF HOLE	11.0	-7.2

MONITORING WELL

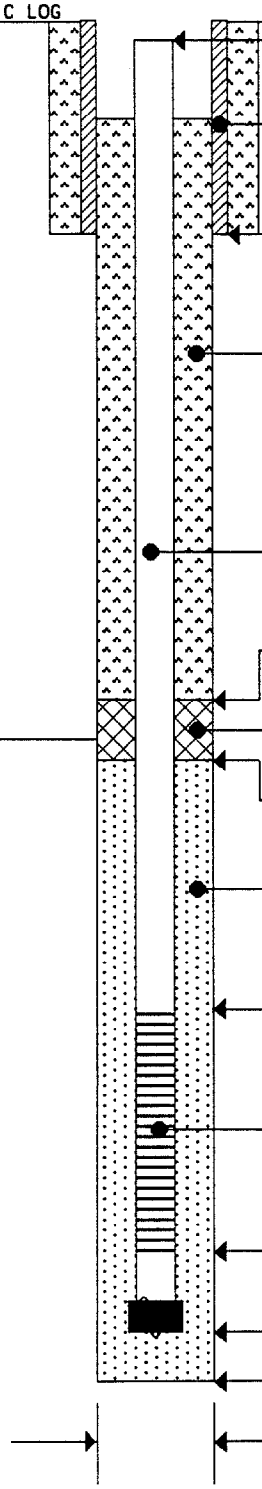
PROJECT: NAVAL AIR STATION KEY WEST

WELL NO.: P-6

JOB NO.	SITE	COORDINATES
22567-321	NAS Key West - JETC	* Well not surveyed

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
7/25/95	7/25/95	J. Novick	Ground Surface

GENERALIZED GEOLOGIC LOG



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF RISER CASING	0.0	3.1
	0.0	3.1
BOTTOM OF FLUSH MOUNT BOX	0.7	2.4
TOP OF SEAL		
TOP OF FILTER PACK	1.0	2.1
TOP OF SCREEN	1.0	2.1
BOTTOM OF SCREEN	11.0	-7.9
BOTTOM OF SUMP	11.0	-7.9
BOTTOM OF HOLE	11.0	-7.9
HOLE DIAMETER:		

FLUSH MOUNT BOX
DIAMETER/TYPE:
8"/Flush Mount Box

BACKFILL MATERIAL TYPE
Silica Sand

RISER CASING
DIAMETER/TYPE:
1"/PVC

ANNULAR SEAL TYPE
None

FILTER PACK TYPE
20/30 Silica Sand

SCREEN
DIAMETER: 1"
TYPE: Machine Slotted PVC
OPENING WIDTH: 0.010

APPENDIX B

Analytical Data

Copies of the analytical data were included in the original Technical Memorandum, but were not included in this copy. If a complete copy of the data is desired, it is available upon request.

Sample ID	Station ID
2168	MW23
2169	MW15
2170	MW24
2171	MW14
2172	MW21
2173	MW22
2174	MW7
2175	MW6
2176	Purge Water Drum
2177	MW16
2178	Equipment Rinse Blank
2179	MW8
2180	MW2
2181	MW2 (dup)
2182	MW13
2183	MW10
2184	MW17
2185	Equipment Rinse Blank
2186	MW9
2187	Trip Blank
2188	Trip Blank
2189	Trip Blank
2190	MW19D
2191	MW18
2192	MW20D
2193	MW1
2194	Trip Blank
2195	MW12
2196	MW3
2197	MW11
2198	HY06
2199	HY05
2200	HY04
2201	HY04 (dup)
2202	Equipment Rinse Blank
2203	HY03
2204	HY02
2205	HY01
2206	HY10
2207	HY9
2208	HY8
2209	HY7
2210	Trip Blank
2211	Treatment System, Pretreat, 7/31
2212	Treatment System, Post-treat, 7/31
2213	Treatment System, Pretreat, 8/3
2214	Treatment System, Post-treat, 8/3
2215	Trip Blank
2216	Trip Blank
2217	Treatment System, Pretreat, 8/31
2218	Treatment System, Post-treat, 8/31

SWMU-9

Product Thickness

Well	MW-4	MW-5
June 27-29, 1995*	0.18'	1.89'
December 17, 1995	Not Measured	0.225'
December 22, 1995	0.0' SHEEN	0.27'
December 26, 1995	0.01'	0.48'

*No bail down of the product was done.

Bail Down Tests

Bail down tests were first attempted on December 17, 1995 on MW-5. Equipment failure of oil interface probe caused the first test to be aborted after an hour of readings.

The December 17 bail down test results on MW-5:

TIME	PRODUCT THICKNESS	COMMENTS
	0.225'	Initial Measurement
0 minutes	0	
10 minutes	0.01'	
60 minutes	0.1'	Last reading before probe malfunctioned.

The December 24 bail down test results on MW-5:

TIME (minutes)	PRODUCT THICKNESS (ft)	COMMENTS
	0.27	Initial Measurement
0	0.0	
10	0.02	
20	0.01	
30	0.03	
40	0.04	
50	0.05	
60	0.06	
75	0.05	
90	0.05	
105	0.06	
120	0.07	
135	0.07	
150	0.07	
180	0.07	
210	0.07	

MW-5 was remeasured on December 26 and the thickness was 0.48'

Attachment 5
Calculation - "Refinement of Jet Engine Test Cell Pump Test Data"

CALCULATION COVER SHEET

PROJECT	JOB NO.	CALC. NO.	SHEET 1
NAVYRAC - Key West	22567-321	321-G-002	
SUBJECT: Refinement of Jet Engine Test Cell Pump Test Data	DISCIPLINE: G&HES		

CALCULATION STATUS DESIGNATION	PRELIMINARY	CONFIRMED	SUPERSEDED	VOIDED
		X		

COMPUTER PROGRAM / TYPE	SCP	MAINFRAME PC	PROGRAM NO.	VERSION / RELEASE NO.
AQTESOLV	YES NO			2.0

NO.	REASON FOR REVISION	# OF SHEETS	LAST SHEET	BY	CHECKED	APPROVAL	DATE
0	Initial Calculation	7	7	JSN	MAB	KMS.	10/3/95

RECORD OF REVISIONS

I. PURPOSE

Refine pump test data to yield transmissivities. Data was recorded by data loggers during a pump test performed at the Jet Engine Test Cell at NAS Key West from September 6 - 8, 1995.

II. SOURCES OF DATA

(1) Pump test data recorded by data loggers during slug tests (Attachment 1)

(2) Well construction diagrams and geologic drill logs (Attachment 2)

(3) Results from Aqtesolv (Attachment 3)

III. REFERENCES

ABB, Inc. (1994). Contamination Assessment Report, Jet Engine Test Cell, Building A969, Boca Chica Field, Naval Air Station, Key West, Florida. June

Bechtel Environmental, Inc. (1995). "Validation of Pumping Test Module of AQTESOLV ver. 2.0" Calculation 94733-230 (Draft).

Cooper, H.H. and C.E. Jacob (1946). "A Generalized Graphical Method for Evaluating Formation Constants and Summarizing Well Field History", American Geophysical Union Transactions, Vol.33, Pp 603-610.

Driscoll, F.G. (1986). Groundwater and Wells. Second Edition, Johnson Division, St. Paul, MN.

Geraghty & Miller, Inc. (1994). Aquifer Test Design and Analysis (AQTESOLV) Version 2.0, Modelling Group, Computer Software.

Kruseman, G.P. and N.A. De Ridder (1970). Analysis and Evaluation of Pumping Test Data. International Institute for Land Reclamation and Improvement, the Netherlands, 200 pp.

Nueman, S.P. (1975). "Analysis of Pumping Test Data from Anisotropic Unconfined Aquifers Considering Delayed Yield", Water Resources Research, Vol. 11, No. 2, Pp 329-342.

Theis, C.V. (1935). "The Relation Between Lowering of the Piezometric Surface and the Rate and Duration of Discharge of a Well Using Groundwater Storage", American Geophysical Union Transactions, Vol. 16, Pp 519-524.

IV. CALCULATIONS

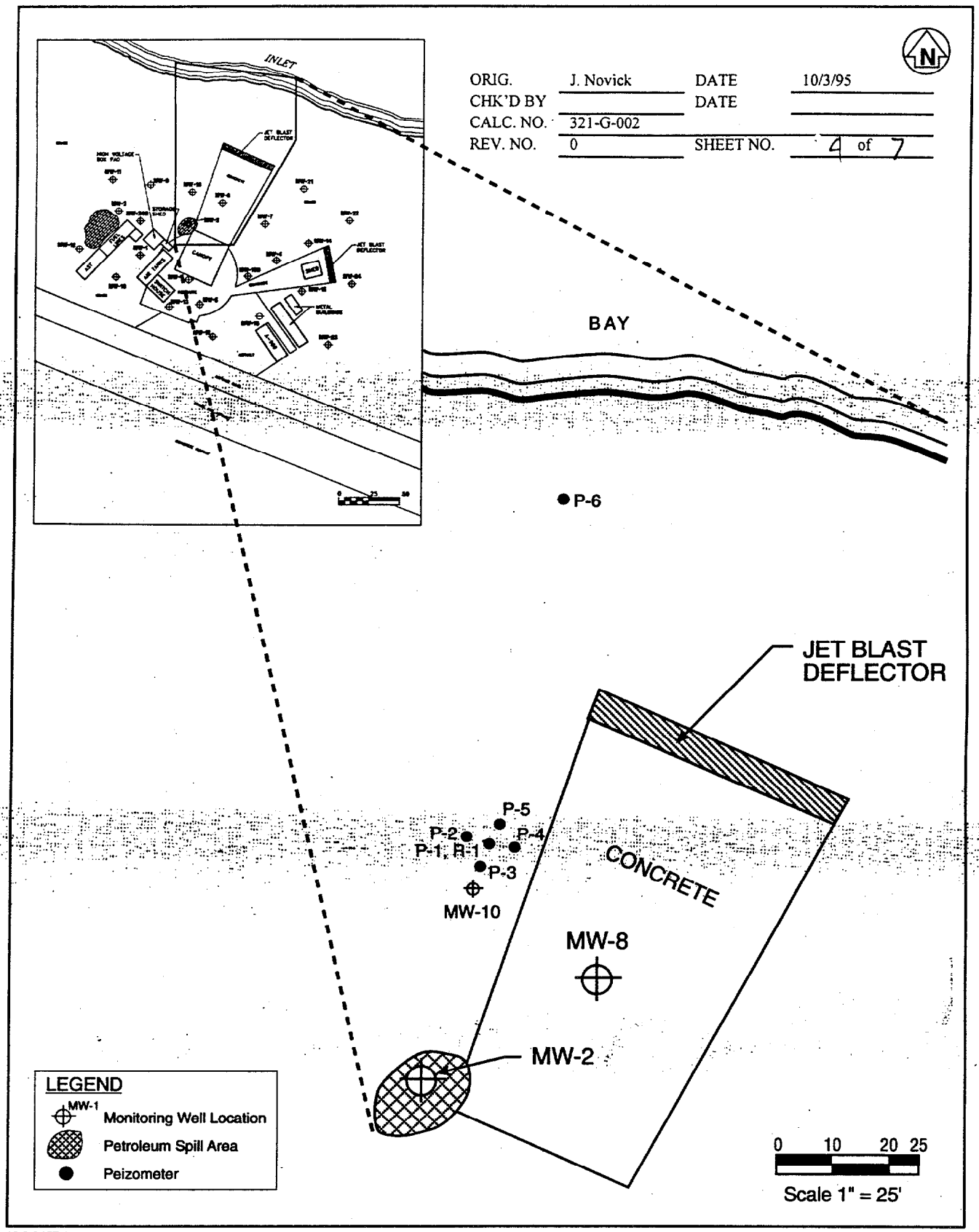
Introduction

A pump test was conducted on a 4-inch well at the Jet Engine Test Cell at NAS Key West, Key West, Florida. The tests were run in the field by Bechtel personnel. Tests were performed using a Grundfos Readiflo 2 submersible pump which pumped water from the well at a rate of 2 gpm. Data was recorded by a "Hermit" 2000 data logger was monitored at 5 observation points located 5 and 10 feet away from the pumping well. Manual readings were collected at 5 additional observation points. The locations of the pumping well and the observations wells are shown in Figure 1. R-1 was the pumping well. Water levels were recorded by a data logger in observation wells P-1, P-2, P-3, P-4, P-5 and MW-10. Manual water level readings were collected from P-6, MW-9, MW-8, MW-7, and MW-14. The test was concluded after 24 hours and a recovery test was conducted. Data was downloaded to a personal computer from the data logger. The data was analyzed using Geraghty and Miller's AQTESOLV (version 2.0). AQTESOLV takes the data downloaded from the data logger, plots the time versus water level on logarithmic scales, displays it on the computer screen, and allows the user to fit a straight line or a curve to the data using the method of Neuman (1975). Once the "best fit" is found, the program supplies a corresponding transmissivity, storage coefficient, and specific yield. Results from Neuman (1975) were checked using the Thiem-Dupuit method from Thiem (1906). Recovery data could not be analyzed for reasons which are discussed below. The equations for all of the techniques are described in Kruseman, G.P. and N.A. De Ridder (1970) and Geraghty & Miller, Inc. (1994).

Assumptions

Neuman Method

- aquifer has infinite areal extent
- aquifer is homogeneous and has uniform thickness
- aquifer potentiometric surface is initially horizontal
- pumping rate is constant
- flow is unsteady
- diameter of pumping well is very small so that storage in the well can be neglected



10.8 8457.1

FIGURE 1
Location of Recovery Well and Temporary Piezometer

Thiem-Dupuit Method

- aquifer has infinite areal extent
- aquifer is homogeneous and has uniform thickness
- aquifer potentiometric surface is initially horizontal
- pumping rate is constant
- the pumped well penetrates the entire aquifer
- flow velocity is proportional to the tangent of the hydraulic gradient
- flow is horizontal and uniform everywhere
- the aquifer is unconfined
- the flow to the well is in steady state

V. RESULTS

All of the drawdown in the pumping well and the observation wells occurred in the first 20 minutes of the test. As a result, only data from the first 60 minutes of the test were evaluated. This eliminated the need to correct the data for pressure and tidal influences. Plots of the first 60 minutes of the pump test and the full pump test and recovery test are included in Attachment 1. The plot of the full pump test shows the effects of a precipitation event that occurred approximately 2 hours into the test. Water levels in the pumping well and the observation wells started to rise about 25 minutes later suggesting that either infiltration through the sediments is rapid, or that runoff was able to effect the test by draining down the annular space of the observation wells.

AQTESOLV was used to refine the pump test data using the method of Neuman (1975). The Theim-Dupuit method uses the following formula and is solved analytically:

$$Q = \frac{2\pi KD(S_1^{'} - S_2^{'})}{\ln(r_2 / r_1)}$$

where

$$S^{'} = S - (S^2 / 2D)$$

Q = Pump discharge rate
KD = Transmissivity
S and S' = Drawdown and corrected drawdown
r = Well radius
D = Aquifer thickness

The results from the two techniques are summarized in Table 1. The storage coefficient and specific yield are calculated by the Neuman method, they are included on the graphs in Attachment 3, and in Table 1, however, the numbers are not representative of actual aquifer

conditions. Each well was 11 ft deep with a 10 ft screened interval. All of the results are consistent except for those from P-4. The transmissivity is more than twice that of the next highest value and the storage coefficient is several orders of magnitude less. The difference in the results from P-4 may be due to noise in the data which is readily apparent in the graphs in Attachment A. Data from P-1 were not analyzed because both the Neuman and Theim-Dupuit methods require analysis of data from observation wells which are at some distance from the pumping well. Input parameters for the Theim-Dupuit method are included in Attachment 4.

Table 1 Summary of Pump Test Results

Well	Neuman			Theim-Dupuit
	Transmissivity (ft^2/min)	Storage Coefficient	Specific Yield	Transmissivity (ft^2/min)
P-2	0.06235	4.213×10^{-4}	0.001	0.088
P-3	0.08235	3.301×10^{-4}	0.001	0.072
P-4	0.1768	1×10^{-12}	0.001	0.084
P-5	0.07366	1.269×10^{-4}	0.001	0.047
MW-10	0.07305	2.442×10^{-5}	0.001	0.061
Mean	0.09364	1.805×10^{-4}	0.001	0.070

The recovery test data can be analyzed using the technique described in Driscoll (1986). Transmissivity is determined by plotting residual drawdown against a ratio of the time since the test started to the time since pumping stopped. The slope of the line (Δs) is related to the aquifer transmissivity (T) by the following equation:

$$T = \frac{264Q}{\Delta s}$$

Similarly, the storage coefficient (S) can be determined by plotting the calculated recovery against the time since pumping stopped. The time at which recovery equals 0 (t'_0) is determined by extending the line to drawdown equals zero. Once t'_0 is determined from the graph, S can be determined from the following equation:

$$S = \frac{0.3Tt'_0}{r^2}$$

The plots discussed above are included in Attachment 5 along with a tabulation of the input parameters. The data in most of the plots did not fall along a straight line, therefore lines were added to the plots. The results are presented in Table 2.

Table 2 Results of Recovery Test

Well	Transmissivity (ft^2/min)	Storage Coefficient
P-1	0.039	1.40×10^{-4}
P-2	0.036	4.32×10^{-4}
P-3	0.061	1.10×10^{-4}
P-4	0.049	5.59×10^{-4}
P-5	0.098	8.23×10^{-4}
MW-10	0.075	1.58×10^{-4}
Mean	0.060	3.70×10^{-4}

The results from the recovery test agree very well with the results from the pump test.

The transmissivity values in Table 1 can be checked against published hydraulic conductivity values (ABB, 1994) for the Jet Engine Test Cell. Hydraulic conductivity values can be determined from transmissivity from the relation:

$$K = T / D$$

Where K is hydraulic conductivity. Given an aquifer thickness of 10 ft and transmissivity values from Table 1 above, the hydraulic conductivity values are 9.364×10^{-3} ft/min for the Neuman method and 7.0×10^{-3} ft/min for the Theim-Dupuit method. These values are about an order of magnitude greater than the those published in ABB (1994).

ATTACHMENT 1

Pump Test Data

1. Pump Test

SE2000
Environmental Logger
9/8/95 13:31

Unit# 681 Test 0

Setups:	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
Type	Level (F)	Level (F)	Level (F)	Level (F)	Level (F)	Level (F)	Level (F)
Mode	TOC	TOC	TOC	TOC	TOC	TOC	TOC
I.D.	P-1	Pressure	P-5	P-4	P-2	MW-10	P-3
Reference	0.28	0	0.54	0.65	0.54	0.74	0.7
PSI at Ref.	4.613	14.695	3.559	3.759	3.898	4.058	2.823
SG	1	1	1	1	1	1	1
Linearity	0	0.042	0	0	0	0	0
Scale factor	14.878	8.061	15	15.088	10.172	50.2	30.147
Offset	0.063	8.004	0.062	-0.014	-0.082	0	-0.092
Delay mSEC	50	50	50	50	50	50	50

Step 0 09/06 12:16:00

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
0	0.28	0.002	0.54	0.645	0.54	0.74	0.69
0.0083	0.294	0.002	0.54	0.645	0.54	0.755	0.462
0.0166	0.289	0.002	0.544	0.645	0.54	0.755	0.386
0.025	0.317	0.002	0.549	0.645	0.543	0.755	0.357
0.0333	0.322	0.002	0.549	0.645	0.54	0.755	0.338
0.0416	0.34	0.002	0.558	0.645	0.54	0.771	0.329
0.05	0.355	0.002	0.568	0.645	0.54	0.771	0.357
0.0583	0.383	0.002	0.568	0.645	0.54	0.771	0.357
0.0666	0.401	0.002	0.573	0.645	0.54	0.771	0.357
0.075	0.415	0.002	0.587	0.645	0.54	0.771	0.367
0.0833	0.439	0.002	0.591	0.645	0.54	0.771	0.367
0.0916	0.462	0.002	0.601	0.645	0.54	0.771	0.367
0.1	0.486	0.002	0.61	0.645	0.543	0.771	0.376
0.1083	0.509	0.002	0.62	0.645	0.54	0.771	0.386
0.1166	0.528	0.005	0.615	0.645	0.54	0.771	0.376
0.125	0.547	0.005	0.634	0.645	0.54	0.771	0.395
0.1333	0.566	0.005	0.634	0.645	0.54	0.787	0.376
0.1416	0.589	0.005	0.643	0.645	0.54	0.787	0.395
0.15	0.612	0.002	0.662	0.645	0.543	0.787	0.405
0.1583	0.626	0.005	0.667	0.645	0.54	0.787	0.405
0.1666	0.645	0.002	0.658	0.645	0.543	0.787	0.414
0.175	0.664	0.005	0.672	0.645	0.543	0.787	0.405
0.1833	0.683	0.005	0.681	0.645	0.543	0.787	0.405
0.1916	0.697	0.005	0.686	0.645	0.543	0.787	0.395
0.2	0.711	0.002	0.686	0.645	0.543	0.787	0.405
0.2083	0.725	0.005	0.695	0.645	0.543	0.803	0.433
0.2166	0.739	0.002	0.691	0.65	0.543	0.803	0.424
0.225	0.753	0.002	0.7	0.65	0.543	0.803	0.433
0.2333	0.767	0.002	0.71	0.65	0.546	0.803	0.433
0.2416	0.781	0.002	0.714	0.65	0.543	0.803	0.433
0.25	0.795	0.005	0.719	0.65	0.543	0.803	0.443
0.2583	0.814	0.002	0.719	0.65	0.546	0.803	0.443
0.2666	0.828	0.005	0.724	0.65	0.546	0.803	0.462
0.275	0.842	0.005	0.738	0.65	0.546	0.819	0.452
0.2833	0.856	0.002	0.743	0.65	0.546	0.819	0.452
0.2916	0.875	0.002	0.747	0.654	0.546	0.819	0.452
0.3	0.884	0.005	0.757	0.654	0.546	0.819	0.452

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
0.3083	0.898	0.002	0.762	0.654	0.549	0.819	0.452
0.3166	0.908	0.005	0.762	0.654	0.549	0.819	0.471
0.325	0.922	0.002	0.766	0.654	0.549	0.819	0.481
0.3333	0.936	0.005	0.776	0.654	0.549	0.819	0.5
0.35	0.959	0.002	0.781	0.654	0.549	0.834	0.566
0.3666	0.988	0.002	0.799	0.654	0.552	0.834	0.566
0.3833	1.016	0.002	0.809	0.659	0.552	0.834	0.576
0.4	1.039	0.005	0.814	0.659	0.556	0.834	0.585
0.4166	1.063	0.002	0.814	0.659	0.556	0.834	0.614
0.4333	1.086	0.002	0.833	0.664	0.556	0.85	0.604
0.45	1.109	0.002	0.828	0.664	0.556	0.85	0.595
0.4666	1.128	0.002	0.842	0.664	0.559	0.85	0.614
0.4833	1.152	0.005	0.847	0.664	0.559	0.85	0.614
0.5	1.175	0.002	0.856	0.669	0.559	0.85	0.623
0.5166	1.199	0.005	0.861	0.669	0.562	0.866	0.642
0.5333	1.217	0.005	0.861	0.673	0.562	0.866	0.633
0.55	1.236	0.002	0.875	0.673	0.565	0.866	0.652
0.5666	1.255	0.005	0.885	0.673	0.565	0.882	0.661
0.5833	1.274	0.005	0.894	0.678	0.568	0.882	0.642
0.6	1.292	0.005	0.899	0.678	0.568	0.882	0.642
0.6166	1.311	0.005	0.908	0.678	0.572	0.882	0.623
0.6333	1.33	0.005	0.908	0.683	0.575	0.898	0.652
0.65	1.349	0.005	0.918	0.683	0.575	0.898	0.652
0.6666	1.363	0.005	0.922	0.688	0.578	0.898	0.661
0.6833	1.377	0.005	0.932	0.688	0.578	0.898	0.68
0.7	1.395	0.005	0.937	0.692	0.581	0.914	0.68
0.7166	1.409	0.005	0.941	0.692	0.584	0.914	0.671
0.7333	1.428	0.005	0.941	0.697	0.584	0.914	0.652
0.75	1.447	0.005	0.96	0.697	0.588	0.914	0.69
0.7666	1.461	0.005	0.965	0.702	0.588	0.929	0.69
0.7833	1.47	0.002	0.97	0.702	0.591	0.929	0.7
0.8	1.485	0.005	0.974	0.707	0.594	0.929	0.7
0.8166	1.499	0.005	0.979	0.711	0.594	0.929	0.709
0.8333	1.513	0.005	0.979	0.711	0.594	0.929	0.7
0.85	1.522	0.005	0.979	0.716	0.597	0.945	0.728
0.8666	1.536	0.005	0.979	0.716	0.6	0.945	0.709
0.8833	1.55	0.005	0.993	0.721	0.6	0.945	0.738
0.9	1.56	0.005	0.993	0.721	0.6	0.945	0.728
0.9166	1.574	0.005	0.998	0.726	0.604	0.961	0.738
0.9333	1.583	0.005	0.998	0.726	0.607	0.961	0.776
0.95	1.592	0.005	1.003	0.73	0.607	0.961	0.776
0.9666	1.606	0.005	0.998	0.73	0.61	0.961	0.738
0.9833	1.616	0.005	1.007	0.735	0.61	0.961	0.738
1	1.625	0.005	1.012	0.735	0.613	0.977	0.766
1.2	1.714	0.005	1.041	0.764	0.809	1.009	0.852
1.4	1.761	0.007	1.074	0.792	0.886	1.056	0.88
1.6	1.794	0.007	1.093	0.811	0.928	1.088	0.909
1.8	1.841	0.007	1.111	0.835	0.957	1.151	0.842
2	1.892	0.007	1.13	0.854	0.985	1.199	0.89
2.2	1.921	0.007	1.145	0.882	1.021	1.23	0.909
2.4	1.958	0.007	1.173	0.916	1.056	1.262	0.937
2.6	1.996	0.005	1.182	0.973	1.088	1.294	0.899
2.8	2.028	0.005	1.201	1.001	1.117	1.325	0.89
3	2.057	0.005	1.215	1.011	1.143	1.341	0.928
3.2	2.085	0.007	1.244	1.016	1.165	1.357	0.956
3.4	2.113	0.007	1.282	1.025	1.184	1.373	0.966
3.6	2.141	0.007	1.296	1.03	1.207	1.389	0.985
3.8	2.16	0.007	1.315	1.044	1.223	1.404	1.023
4	2.183	0.007	1.329	1.054	1.239	1.436	1.061
4.2	2.197	0.007	1.353	1.068	1.255	1.452	1.061
4.4	2.216	0.007	1.371	1.077	1.271	1.452	1.061
4.6	2.235	0.007	1.353	1.087	1.284	1.468	1.099
4.8	2.249	0.007	1.371	1.096	1.3	1.484	1.07
5	2.268	0.007	1.376	1.101	1.313	1.499	1.08
5.2	2.282	0.007	1.376	1.106	1.322	1.499	1.118

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Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
5.4	2.291	0.007	1.39	1.115	1.335	1.515	1.118
5.6	2.305	0.007	1.409	1.12	1.342	1.515	1.175
5.8	2.319	0.007	1.405	1.125	1.354	1.531	1.175
6	2.329	0.01	1.428	1.125	1.364	1.531	1.165
6.2	2.333	0.007	1.442	1.125	1.374	1.547	1.127
6.4	2.347	0.007	1.447	1.125	1.38	1.547	1.137
6.6	2.357	0.007	1.461	1.13	1.39	1.547	1.184
6.8	2.357	0.007	1.471	1.13	1.396	1.563	1.279
7	2.371	0.007	1.471	1.12	1.402	1.563	1.251
7.2	2.375	0.007	1.48	1.111	1.409	1.563	1.27
7.4	2.38	0.007	1.49	1.111	1.415	1.579	1.26
7.6	2.389	0.007	1.494	1.101	1.422	1.579	1.289
7.8	2.394	0.007	1.494	1.068	1.428	1.579	1.318
8	2.399	0.007	1.494	1.054	1.435	1.594	1.318
8.2	2.404	0.007	1.509	1.054	1.441	1.594	1.327
8.4	2.408	0.007	1.523	1.049	1.447	1.594	1.365
8.6	2.418	0.01	1.527	1.049	1.451	1.594	1.346
8.8	2.418	0.007	1.542	1.044	1.457	1.61	1.346
9	2.422	0.007	1.551	1.044	1.46	1.61	1.365
9.2	2.427	0.007	1.556	1.044	1.467	1.61	1.422
9.4	2.432	0.01	1.565	1.044	1.47	1.61	1.413
9.6	2.436	0.01	1.57	1.044	1.473	1.626	1.394
9.8	2.436	0.007	1.565	1.044	1.483	1.626	1.365
10	2.441	0.01	1.565	1.044	1.486	1.626	1.346
11	2.45	0.007	1.603	1.049	1.515	1.642	1.432
12	2.507	0.007	1.631	1.054	1.544	1.674	1.536
13	2.525	0.007	1.636	1.058	1.569	1.674	1.565
14	2.544	0.005	1.679	1.063	1.601	1.689	1.612
15	2.558	0.007	1.683	1.068	1.627	1.705	1.555
16	2.563	0.005	1.707	1.068	1.656	1.705	1.612
17	2.572	0.005	1.717	1.068	1.682	1.721	1.622
18	2.577	0.005	1.726	1.073	1.707	1.721	1.631
19	2.582	0.005	1.74	1.073	1.73	1.721	1.641
20	2.582	0.007	1.735	1.077	1.752	1.737	1.622
21	2.596	0.007	1.759	1.082	1.771	1.737	1.669
22	2.591	0.007	1.759	1.087	1.791	1.737	1.688
23	2.591	0.007	1.759	1.096	1.81	1.737	1.65
24	2.591	0.007	1.769	1.101	1.826	1.737	1.66
25	2.591	0.007	1.773	1.111	1.842	1.753	1.726
26	2.596	0.007	1.783	1.115	1.855	1.753	1.688
27	2.596	0.007	1.783	1.125	1.868	1.753	1.726
28	2.596	0.007	1.773	1.13	1.877	1.753	1.736
29	2.596	0.007	1.787	1.135	1.89	1.753	1.717
30	2.6	0.007	1.797	1.144	1.903	1.753	1.717
31	2.629	0.007	1.811	1.149	1.913	1.769	1.736
32	2.619	0.005	1.811	1.158	1.925	1.769	1.745
33	2.619	0.007	1.816	1.168	1.935	1.769	1.755
34	2.615	0.007	1.825	1.173	1.945	1.753	1.736
35	2.619	0.005	1.821	1.187	1.957	1.769	1.774
36	2.624	0.005	1.825	1.196	1.967	1.769	1.783
37	2.624	0.005	1.825	1.206	1.977	1.784	1.783
38	2.624	0.005	1.835	1.215	1.983	1.784	1.783
39	2.629	0.005	1.844	1.225	1.993	1.784	1.717
40	2.629	0.002	1.844	1.234	1.999	1.784	1.745
41	2.661	0.005	1.858	1.249	2.009	1.784	1.812
42	2.657	0.002	1.868	1.272	2.018	1.8	1.764
43	2.657	0.002	1.863	1.306	2.025	1.8	1.726
44	2.661	0.005	1.863	1.287	2.034	1.8	1.831
45	2.666	0.005	1.873	1.291	2.041	1.8	1.802
46	2.661	0.005	1.863	1.306	2.047	1.8	1.745
47	2.666	0.002	1.887	1.315	2.054	1.8	1.793
48	2.666	0.002	1.887	1.315	2.06	1.816	1.802
49	2.666	0.002	1.877	1.32	2.07	1.816	1.831
50	2.671	0.002	1.882	1.325	2.073	1.816	1.831
51	2.685	0.002	1.901	1.329	2.083	1.816	1.821

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Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
52	2.694	0.002	1.901	1.334	2.089	1.816	1.84
53	2.699	0.002	1.906	1.339	2.092	1.832	1.84
54	2.708	0.002	1.92	1.348	2.102	1.832	1.85
55	2.708	0.002	1.915	1.353	2.105	1.832	1.84
56	2.708	0.002	1.915	1.363	2.111	1.832	1.859
57	2.713	0.002	1.92	1.368	2.118	1.848	1.802
58	2.718	0.002	1.929	1.377	2.124	1.848	1.84
59	2.718	0.002	1.943	1.382	2.131	1.848	1.812
60	2.718	0.002	1.943	1.391	2.137	1.848	1.821
61	2.732	0.002	1.948	1.396	2.14	1.848	1.84
62	2.713	0.002	1.934	1.41	2.147	1.848	1.85
63	2.708	0.002	1.925	1.415	2.15	1.848	1.84
64	2.704	0.002	1.934	1.425	2.153	1.848	1.831
65	2.704	0.002	1.929	1.434	2.16	1.848	1.859
66	2.708	0.002	1.939	1.444	2.163	1.848	1.85
67	2.708	0.005	1.943	1.448	2.166	1.848	1.859
68	2.708	0.005	1.92	1.458	2.166	1.848	1.85
69	2.708	0.007	1.929	1.463	2.169	1.848	1.793
70	2.708	0.007	1.939	1.472	2.172	1.864	1.831
71	2.708	0.007	1.953	1.482	2.176	1.864	1.774
72	2.713	0.007	1.939	1.491	2.179	1.864	1.869
73	2.713	0.007	1.948	1.505	2.182	1.864	1.831
74	2.718	0.01	1.953	1.515	2.185	1.864	1.869
75	2.718	0.01	1.958	1.529	2.185	1.864	1.869
76	2.722	0.01	1.967	1.539	2.188	1.864	1.831
77	2.722	0.01	1.958	1.548	2.192	1.864	1.898
78	2.727	0.012	1.958	1.558	2.195	1.864	1.878
79	2.732	0.012	1.977	1.567	2.195	1.879	1.907
80	2.732	0.012	1.972	1.572	2.198	1.879	1.84
81	2.732	0.012	1.972	1.577	2.201	1.879	1.85
82	2.741	0.012	1.972	1.577	2.205	1.879	1.85
83	2.741	0.012	1.967	1.581	2.208	1.879	1.888
84	2.746	0.012	1.981	1.586	2.211	1.895	1.888
85	2.75	0.012	1.986	1.591	2.214	1.895	1.907
86	2.755	0.012	1.986	1.596	2.217	1.895	1.907
87	2.76	0.012	1.991	1.6	2.217	1.911	1.917
88	2.76	0.012	1.991	1.605	2.224	1.911	1.917
89	2.769	0.012	1.991	1.615	2.224	1.911	1.898
90	2.769	0.012	2	1.62	2.227	1.911	1.926
91	2.774	0.01	1.991	1.624	2.233	1.911	1.898
92	2.774	0.012	1.986	1.629	2.233	1.911	1.907
93	2.774	0.012	1.995	1.634	2.237	1.911	1.898
94	2.774	0.012	1.995	1.634	2.24	1.911	1.888
95	2.783	0.015	1.995	1.639	2.243	1.927	1.926
96	2.783	0.015	1.991	1.643	2.243	1.927	1.936
97	2.788	0.017	1.986	1.648	2.243	1.927	1.888
98	2.793	0.02	1.995	1.653	2.243	1.927	1.869
99	2.797	0.02	1.986	1.658	2.249	1.927	1.917
100	2.797	0.017	2.005	1.662	2.249	1.927	1.907
101	2.807	0.017	2.005	1.667	2.256	1.927	1.926
102	2.807	0.017	2.005	1.672	2.259	1.943	1.917
103	2.811	0.017	2.014	1.681	2.262	1.943	1.917
104	2.816	0.02	2.01	1.681	2.262	1.943	1.85
105	2.821	0.02	2.005	1.691	2.269	1.943	1.945
106	2.826	0.017	2.01	1.696	2.272	1.959	1.888
107	2.826	0.017	2.005	1.7	2.278	1.959	1.917
108	2.83	0.015	2.005	1.71	2.282	1.959	1.964
109	2.835	0.01	2.01	1.715	2.288	1.959	1.945
110	2.835	0.012	2.005	1.724	2.291	1.959	1.974
111	2.844	0.012	2.005	1.729	2.294	1.959	1.955
112	2.844	0.012	2.005	1.729	2.298	1.974	1.898
113	2.844	0.01	2.005	1.738	2.301	1.974	1.936
114	2.844	0.007	2.014	1.743	2.304	1.974	1.974
115	2.844	0.012	2.005	1.743	2.304	1.974	1.955
116	2.844	0.012	2	1.748	2.307	1.974	1.974

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
117	2.854	0.015	1.986	1.753	2.31	1.974	1.945
118	2.858	0.015	1.958	1.757	2.314	1.974	1.917
119	2.858	0.01	1.925	1.762	2.32	1.974	1.936
120	2.863	0.01	1.925	1.767	2.323	1.974	1.926
121	2.858	0.007	1.891	1.772	2.323	1.959	1.945
122	2.858	0.005	1.844	1.776	2.33	1.959	1.898
123	2.854	0	1.816	1.781	2.333	1.943	1.85
124	2.849	0	1.797	1.786	2.333	1.943	1.831
125	2.849	0	1.773	1.781	2.336	1.927	1.764
126	2.84	0.002	1.731	1.753	2.33	1.927	1.707
127	2.826	0.005	1.702	1.643	2.317	1.895	1.679
128	2.802	0.002	1.665	1.548	2.288	1.864	1.517
129	2.802	0	1.627	1.501	2.227	1.832	1.441
130	2.769	-0.002	1.608	1.458	2.134	1.8	1.394
131	2.75	0	1.565	1.382	2.044	1.784	1.356
132	2.732	0.002	1.537	1.315	1.97	1.769	1.327
133	2.718	0.005	1.48	1.249	1.858	1.753	1.308
134	2.708	0.005	1.452	1.201	1.759	1.737	1.318
135	2.694	0.005	1.428	1.149	1.714	1.737	1.308
136	2.675	0.005	1.381	1.096	1.694	1.721	1.299
137	2.666	0.005	1.367	1.035	1.682	1.721	1.289
138	2.661	0.005	1.362	0.992	1.669	1.721	1.289
139	2.657	0.002	1.343	0.944	1.666	1.721	1.308
140	2.652	0.005	1.338	0.897	1.659	1.705	1.327
141	2.647	0.005	1.338	0.835	1.656	1.721	1.299
142	2.647	0.007	1.343	0.849	1.653	1.721	1.299
143	2.647	0.005	1.334	0.821	1.656	1.721	1.337
144	2.643	0.007	1.353	0.783	1.65	1.705	1.299
145	2.643	0.007	1.343	0.759	1.64	1.705	1.327
146	2.638	0.007	1.343	0.721	1.627	1.705	1.279
147	2.638	0.01	1.329	0.673	1.608	1.705	1.318
148	2.638	0.01	1.334	0.607	1.592	1.705	1.327
149	2.638	0.01	1.348	0.611	1.579	1.705	1.299
150	2.638	0.012	1.343	0.602	1.569	1.705	1.27
151	2.633	0.01	1.338	0.564	1.56	1.705	1.299
152	2.638	0.01	1.338	0.564	1.553	1.705	1.299
153	2.633	0.007	1.362	0.54	1.544	1.705	1.289
154	2.633	0.01	1.362	0.526	1.534	1.705	1.26
155	2.633	0.01	1.386	0.531	1.528	1.705	1.299
156	2.629	0.012	1.386	0.54	1.518	1.705	1.299
157	2.624	0.012	1.381	0.535	1.512	1.705	1.279
158	2.619	0.015	1.4	0.54	1.502	1.689	1.299
159	2.619	0.017	1.4	0.545	1.496	1.689	1.279
160	2.619	0.017	1.414	0.554	1.489	1.689	1.308
161	2.615	0.017	1.348	0.559	1.486	1.689	1.299
162	2.615	0.017	1.343	0.564	1.483	1.689	1.27
163	2.619	0.015	1.343	0.569	1.483	1.689	1.289
164	2.619	0.015	1.338	0.573	1.479	1.689	1.26
165	2.619	0.015	1.348	0.573	1.483	1.689	1.289
166	2.619	0.015	1.329	0.578	1.486	1.689	1.289
167	2.619	0.012	1.338	0.578	1.486	1.689	1.27
168	2.624	0.012	1.338	0.578	1.489	1.705	1.299
169	2.624	0.012	1.348	0.583	1.492	1.705	1.26
170	2.624	0.012	1.334	0.573	1.492	1.705	1.289
171	2.629	0.012	1.343	0.573	1.496	1.705	1.308
172	2.629	0.012	1.353	0.573	1.499	1.705	1.279
173	2.633	0.012	1.348	0.573	1.502	1.705	1.318
174	2.633	0.015	1.348	0.569	1.508	1.705	1.327
175	2.633	0.015	1.348	0.564	1.515	1.705	1.26
176	2.629	0.015	1.348	0.554	1.521	1.721	1.308
177	2.629	0.015	1.338	0.554	1.528	1.721	1.346
178	2.629	0.017	1.353	0.559	1.534	1.721	1.356
179	2.633	0.017	1.357	0.554	1.537	1.721	1.337
180	2.624	0.02	1.348	0.55	1.544	1.721	1.27
181	2.638	0.02	1.353	0.55	1.55	1.721	1.346

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Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
182	2.61	0.023	1.343	0.545	1.556	1.721	1.337
183	2.6	0.023	1.338	0.545	1.56	1.721	1.356
184	2.6	0.023	1.338	0.545	1.566	1.705	1.365
185	2.596	0.025	1.329	0.545	1.569	1.705	1.356
186	2.591	0.028	1.343	0.545	1.573	1.705	1.356
187	2.596	0.03	1.348	0.545	1.579	1.705	1.384
188	2.591	0.03	1.334	0.55	1.582	1.705	1.337
189	2.596	0.03	1.353	0.55	1.589	1.705	1.394
190	2.596	0.033	1.357	0.554	1.592	1.721	1.365
191	2.596	0.033	1.338	0.559	1.598	1.721	1.318
192	2.6	0.033	1.343	0.559	1.605	1.721	1.384
193	2.6	0.033	1.343	0.564	1.611	1.721	1.394
194	2.605	0.033	1.343	0.569	1.614	1.721	1.394
195	2.605	0.033	1.367	0.573	1.621	1.721	1.413
196	2.605	0.033	1.367	0.573	1.627	1.721	1.413
197	2.61	0.033	1.367	0.578	1.633	1.721	1.375
198	2.61	0.03	1.362	0.583	1.64	1.737	1.384
199	2.61	0.033	1.362	0.588	1.646	1.737	1.403
200	2.615	0.03	1.362	0.592	1.653	1.737	1.394
201	2.619	0.03	1.362	0.592	1.659	1.737	1.422
202	2.619	0.03	1.371	0.597	1.662	1.737	1.441
203	2.619	0.033	1.376	0.602	1.669	1.737	1.451
204	2.624	0.033	1.381	0.607	1.675	1.737	1.451
205	2.624	0.033	1.367	0.607	1.678	1.753	1.441
206	2.624	0.03	1.386	0.611	1.688	1.753	1.47
207	2.629	0.03	1.386	0.616	1.694	1.753	1.432
208	2.629	0.028	1.39	0.621	1.701	1.753	1.498
209	2.629	0.028	1.386	0.626	1.704	1.753	1.47
210	2.633	0.028	1.4	0.63	1.71	1.753	1.441
211	2.633	0.03	1.39	0.63	1.714	1.753	1.517
212	2.633	0.03	1.395	0.635	1.72	1.753	1.479
213	2.633	0.033	1.39	0.64	1.72	1.753	1.394
214	2.633	0.033	1.386	0.64	1.727	1.753	1.432
215	2.638	0.033	1.39	0.645	1.73	1.753	1.46
216	2.633	0.035	1.39	0.645	1.733	1.753	1.489
217	2.633	0.033	1.4	0.65	1.739	1.753	1.46
218	2.638	0.033	1.4	0.654	1.743	1.753	1.479
219	2.638	0.033	1.405	0.659	1.749	1.753	1.517
220	2.652	0.03	1.405	0.664	1.755	1.769	1.47
221	2.694	0.03	1.419	0.669	1.762	1.769	1.508
222	2.722	0.028	1.315	0.673	1.768	1.784	1.527
223	2.736	0.028	1.371	0.678	1.775	1.8	1.593
224	2.741	0.028	1.367	0.683	1.778	1.8	1.565
225	2.741	0.03	1.371	0.683	1.784	1.8	1.555
226	2.746	0.03	1.376	0.688	1.787	1.8	1.593
227	2.746	0.033	1.376	0.688	1.791	1.816	1.584
228	2.746	0.035	1.386	0.692	1.797	1.8	1.517
229	2.746	0.035	1.371	0.692	1.8	1.816	1.584
230	2.746	0.035	1.371	0.697	1.81	1.816	1.565
231	2.75	0.033	1.381	0.702	1.813	1.816	1.508
232	2.75	0.033	1.395	0.707	1.823	1.816	1.603
233	2.755	0.033	1.386	0.711	1.829	1.816	1.612
234	2.75	0.03	1.39	0.716	1.832	1.832	1.584
235	2.76	0.03	1.386	0.721	1.842	1.832	1.527
236	2.76	0.03	1.395	0.726	1.845	1.832	1.612
237	2.76	0.03	1.4	0.73	1.852	1.832	1.622
238	2.765	0.03	1.405	0.735	1.858	1.832	1.574
239	2.765	0.028	1.409	0.74	1.864	1.832	1.612
240	2.769	0.03	1.423	0.745	1.868	1.832	1.584
241	2.774	0.028	1.414	0.749	1.874	1.848	1.612
242	2.774	0.028	1.414	0.749	1.877	1.848	1.641
243	2.769	0.03	1.438	0.754	1.884	1.848	1.612
244	2.769	0.03	1.428	0.759	1.887	1.848	1.565
245	2.765	0.03	1.423	0.759	1.893	1.848	1.65
246	2.769	0.033	1.286	0.764	1.897	1.848	1.631

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
247	2.769	0.033	1.4	0.768	1.897	1.848	1.669
248	2.769	0.035	1.405	0.768	1.9	1.848	1.546
249	2.769	0.038	1.423	0.773	1.903	1.848	1.66
250	2.774	0.038	1.428	0.773	1.906	1.848	1.641
251	2.774	0.04	1.438	0.773	1.909	1.848	1.631
252	2.774	0.04	1.428	0.778	1.913	1.848	1.65
253	2.779	0.04	1.433	0.787	1.919	1.864	1.631
254	2.779	0.04	1.442	0.792	1.922	1.864	1.593
255	2.783	0.038	1.447	0.797	1.929	1.864	1.641
256	2.783	0.035	1.442	0.806	1.935	1.864	1.65
257	2.783	0.035	1.447	0.811	1.938	1.864	1.66
258	2.783	0.035	1.457	0.816	1.945	1.864	1.622
259	2.788	0.038	1.461	0.821	1.948	1.864	1.707
260	2.788	0.038	1.466	0.821	1.951	1.864	1.679
261	2.788	0.038	1.466	0.825	1.954	1.879	1.688
262	2.793	0.038	1.461	0.825	1.957	1.879	1.669
263	2.793	0.038	1.466	0.83	1.964	1.879	1.679
264	2.793	0.038	1.457	0.835	1.967	1.879	1.669
265	2.793	0.038	1.461	0.84	1.974	1.879	1.688
266	2.797	0.038	1.471	0.844	1.977	1.879	1.717
267	2.797	0.038	1.466	0.849	1.98	1.879	1.688
268	2.797	0.04	1.471	0.854	1.983	1.879	1.717
269	2.797	0.04	1.475	0.854	1.986	1.879	1.688
270	2.797	0.043	1.509	0.859	1.99	1.879	1.679
271	2.797	0.043	1.509	0.863	1.99	1.879	1.717
272	2.802	0.046	1.523	0.863	1.996	1.895	1.698
273	2.802	0.046	1.527	0.868	1.996	1.895	1.736
274	2.802	0.048	1.509	0.873	1.999	1.895	1.726
275	2.807	0.048	1.542	0.873	2.002	1.895	1.698
276	2.807	0.048	1.537	0.878	2.006	1.895	1.726
277	2.807	0.048	1.527	0.882	2.009	1.895	1.688
278	2.811	0.048	1.537	0.887	2.012	1.895	1.736
279	2.811	0.048	1.551	0.892	2.018	1.895	1.764
280	2.811	0.048	1.537	0.897	2.022	1.895	1.717
281	2.811	0.046	1.551	0.906	2.028	1.895	1.726
282	2.811	0.046	1.542	0.911	2.031	1.895	1.679
283	2.816	0.046	1.551	0.916	2.034	1.895	1.745
284	2.816	0.046	1.546	0.921	2.038	1.911	1.717
285	2.821	0.043	1.556	0.925	2.044	1.911	1.736
286	2.816	0.043	1.546	0.93	2.047	1.895	1.745
287	2.821	0.043	1.546	0.935	2.051	1.911	1.745
288	2.816	0.043	1.57	0.94	2.054	1.911	1.755
289	2.816	0.046	1.556	0.94	2.057	1.911	1.764
290	2.816	0.046	1.565	0.944	2.057	1.911	1.717
291	2.816	0.046	1.556	0.949	2.06	1.895	1.764
292	2.811	0.046	1.565	0.949	2.063	1.895	1.698
293	2.816	0.046	1.556	0.954	2.067	1.895	1.736
294	2.811	0.046	1.57	0.959	2.07	1.895	1.774
295	2.811	0.046	1.561	0.963	2.07	1.895	1.783
296	2.811	0.046	1.551	0.968	2.076	1.895	1.764
297	2.811	0.046	1.561	0.973	2.079	1.911	1.745
298	2.807	0.046	1.565	0.978	2.079	1.895	1.764
299	2.807	0.043	1.556	0.982	2.086	1.895	1.755
300	2.807	0.043	1.565	0.987	2.086	1.911	1.764
301	2.807	0.043	1.556	0.992	2.089	1.895	1.707
302	2.821	0.043	1.57	0.997	2.092	1.911	1.736
303	2.802	0.043	1.57	1.001	2.095	1.895	1.764
304	2.793	0.043	1.556	1.001	2.095	1.895	1.717
305	2.788	0.046	1.561	1.006	2.095	1.895	1.707
306	2.788	0.046	1.565	1.011	2.099	1.895	1.707
307	2.783	0.048	1.579	1.011	2.099	1.895	1.745
308	2.783	0.051	1.57	1.016	2.095	1.895	1.764
309	2.779	0.051	1.584	1.016	2.095	1.895	1.698
310	2.783	0.053	1.575	1.02	2.095	1.895	1.774
311	2.783	0.053	1.565	1.025	2.099	1.895	1.793

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
312	2.783	0.053	1.575	1.025	2.099	1.895	1.755
313	2.783	0.053	1.584	1.03	2.099	1.895	1.736
314	2.783	0.053	1.579	1.035	2.102	1.895	1.764
315	2.788	0.053	1.603	1.039	2.105	1.895	1.755
316	2.788	0.051	1.598	1.044	2.105	1.895	1.793
317	2.793	0.051	1.584	1.049	2.108	1.895	1.755
318	2.793	0.048	1.589	1.058	2.111	1.895	1.783
319	2.793	0.048	1.584	1.058	2.111	1.895	1.793
320	2.793	0.048	1.594	1.063	2.115	1.911	1.736
321	2.797	0.048	1.608	1.068	2.115	1.911	1.783
322	2.797	0.048	1.603	1.073	2.118	1.911	1.726
323	2.797	0.048	1.603	1.077	2.118	1.911	1.812
324	2.797	0.048	1.603	1.082	2.121	1.911	1.774
325	2.802	0.051	1.603	1.082	2.121	1.911	1.783
326	2.802	0.051	1.594	1.087	2.121	1.911	1.85
327	2.802	0.048	1.617	1.092	2.124	1.911	1.783
328	2.807	0.048	1.608	1.096	2.128	1.911	1.783
329	2.802	0.048	1.613	1.101	2.128	1.911	1.802
330	2.802	0.048	1.608	1.106	2.131	1.911	1.821
331	2.807	0.046	1.603	1.111	2.134	1.911	1.84
332	2.802	0.046	1.613	1.115	2.134	1.911	1.821
333	2.807	0.043	1.622	1.125	2.137	1.927	1.831
334	2.807	0.043	1.617	1.125	2.14	1.927	1.84
335	2.807	0.043	1.613	1.13	2.14	1.927	1.821
336	2.807	0.043	1.608	1.135	2.144	1.927	1.84
337	2.807	0.043	1.608	1.139	2.144	1.927	1.812
338	2.811	0.043	1.622	1.139	2.144	1.927	1.85
339	2.807	0.046	1.603	1.144	2.144	1.911	1.831
340	2.807	0.046	1.617	1.144	2.144	1.911	1.84
341	2.807	0.046	1.598	1.149	2.144	1.927	1.859
342	2.807	0.046	1.608	1.154	2.147	1.927	1.85
343	2.807	0.046	1.617	1.158	2.147	1.927	1.812
344	2.807	0.046	1.627	1.163	2.15	1.927	1.802
345	2.807	0.046	1.622	1.163	2.15	1.911	1.84
346	2.807	0.048	1.631	1.168	2.15	1.927	1.869
347	2.807	0.048	1.631	1.173	2.15	1.927	1.793
348	2.807	0.048	1.636	1.173	2.15	1.927	1.869
349	2.807	0.048	1.622	1.177	2.15	1.927	1.869
350	2.807	0.048	1.622	1.182	2.153	1.927	1.888
351	2.802	0.048	1.613	1.187	2.153	1.911	1.859
352	2.807	0.048	1.627	1.187	2.153	1.927	1.888
353	2.802	0.051	1.622	1.192	2.156	1.911	1.917
354	2.802	0.048	1.631	1.196	2.156	1.911	1.859
355	2.802	0.048	1.627	1.201	2.156	1.911	1.869
356	2.802	0.048	1.627	1.206	2.16	1.911	1.802
357	2.802	0.048	1.622	1.211	2.163	1.911	1.907
358	2.797	0.048	1.631	1.211	2.163	1.911	1.85
359	2.797	0.048	1.627	1.215	2.163	1.911	1.888
360	2.802	0.046	1.631	1.22	2.166	1.911	1.898
361	2.793	0.046	1.617	1.225	2.166	1.911	1.821
362	2.793	0.046	1.622	1.23	2.166	1.911	1.869
363	2.793	0.043	1.622	1.234	2.169	1.911	1.878
364	2.788	0.043	1.627	1.239	2.169	1.911	1.878
365	2.788	0.043	1.636	1.244	2.169	1.911	1.812
366	2.788	0.043	1.636	1.244	2.172	1.911	1.898
367	2.788	0.043	1.627	1.249	2.172	1.911	1.812
368	2.793	0.04	1.627	1.253	2.176	1.911	1.888
369	2.788	0.04	1.631	1.258	2.176	1.911	1.898
370	2.793	0.043	1.627	1.263	2.176	1.911	1.859
371	2.793	0.04	1.627	1.268	2.176	1.911	1.859
372	2.793	0.04	1.622	1.272	2.176	1.911	1.888
373	2.788	0.04	1.622	1.272	2.179	1.911	1.898
374	2.793	0.04	1.631	1.277	2.179	1.911	1.878
375	2.788	0.04	1.636	1.282	2.179	1.911	1.898
376	2.788	0.04	1.627	1.287	2.179	1.911	1.878

ORIG.	J. Novick	DATE	9/28/95
CHK'D BY	MLG	DATE	10/2/95
CALC. NO.	321-G-002		
REV. NO.	0	SHEET NO.	A1-9 of 52

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
377	2.788	0.04	1.617	1.287	2.179	1.911	1.888
378	2.788	0.04	1.631	1.291	2.179	1.911	1.898
379	2.788	0.04	1.641	1.296	2.179	1.911	1.898
380	2.793	0.04	1.636	1.301	2.179	1.911	1.907
381	2.788	0.04	1.646	1.306	2.182	1.911	1.869
382	2.788	0.038	1.636	1.306	2.182	1.911	1.84
383	2.788	0.04	1.646	1.31	2.182	1.911	1.888
384	2.793	0.04	1.641	1.315	2.182	1.911	1.898
385	2.793	0.04	1.631	1.315	2.182	1.911	1.945
386	2.788	0.04	1.627	1.32	2.182	1.911	1.936
387	2.788	0.038	1.641	1.325	2.182	1.911	1.926
388	2.788	0.038	1.646	1.329	2.182	1.911	1.888
389	2.788	0.04	1.641	1.334	2.182	1.911	1.907
390	2.788	0.038	1.636	1.334	2.185	1.911	1.926
391	2.788	0.038	1.636	1.339	2.185	1.911	1.936
392	2.788	0.038	1.646	1.344	2.185	1.911	1.926
393	2.788	0.038	1.636	1.348	2.185	1.911	1.917
394	2.788	0.04	1.646	1.348	2.185	1.911	1.888
395	2.788	0.038	1.627	1.353	2.185	1.911	1.926
396	2.788	0.038	1.646	1.358	2.185	1.911	1.907
397	2.788	0.04	1.641	1.358	2.185	1.911	1.898
398	2.793	0.04	1.646	1.363	2.185	1.911	1.898
399	2.793	0.04	1.646	1.368	2.185	1.927	1.888
400	2.788	0.038	1.65	1.372	2.188	1.911	1.878
401	2.793	0.038	1.66	1.377	2.188	1.927	1.917
402	2.793	0.038	1.65	1.377	2.188	1.927	1.907
403	2.793	0.038	1.655	1.382	2.188	1.927	1.964
404	2.793	0.038	1.65	1.387	2.188	1.927	1.945
405	2.797	0.038	1.646	1.391	2.192	1.927	1.945
406	2.797	0.035	1.646	1.396	2.192	1.927	1.955
407	2.793	0.038	1.655	1.396	2.192	1.927	1.85
408	2.797	0.038	1.655	1.401	2.192	1.927	1.898
409	2.797	0.035	1.655	1.406	2.192	1.927	1.936
410	2.802	0.038	1.66	1.41	2.192	1.927	1.945
411	2.802	0.038	1.641	1.41	2.192	1.927	1.936
412	2.802	0.038	1.65	1.415	2.195	1.927	1.983
413	2.802	0.035	1.665	1.42	2.195	1.927	1.945
414	2.802	0.035	1.665	1.42	2.195	1.927	1.926
415	2.807	0.035	1.646	1.425	2.195	1.927	1.964
416	2.807	0.035	1.65	1.429	2.198	1.927	1.945
417	2.802	0.038	1.66	1.429	2.198	1.911	1.964
418	2.807	0.033	1.65	1.439	2.201	1.927	1.964
419	2.807	0.033	1.646	1.439	2.201	1.927	1.955
420	2.807	0.033	1.665	1.444	2.201	1.927	1.955
421	2.807	0.033	1.66	1.448	2.201	1.927	1.974
422	2.807	0.033	1.66	1.448	2.201	1.927	2.002
423	2.802	0.03	1.66	1.453	2.205	1.927	1.983
424	2.807	0.03	1.665	1.458	2.205	1.927	1.993
425	2.807	0.03	1.665	1.463	2.205	1.927	1.955
426	2.807	0.03	1.66	1.467	2.205	1.943	1.945
427	2.807	0.033	1.66	1.467	2.205	1.943	1.974
428	2.811	0.033	1.665	1.472	2.205	1.943	1.983
429	2.807	0.033	1.655	1.472	2.205	1.943	1.964
430	2.807	0.033	1.655	1.477	2.208	1.943	1.993
431	2.811	0.033	1.679	1.482	2.208	1.943	1.964
432	2.807	0.033	1.665	1.482	2.208	1.943	2.012
433	2.811	0.033	1.66	1.486	2.208	1.943	1.926
434	2.807	0.033	1.665	1.486	2.208	1.943	1.974
435	2.807	0.033	1.665	1.491	2.208	1.943	1.888
436	2.807	0.033	1.669	1.491	2.208	1.943	1.955
437	2.811	0.033	1.665	1.496	2.208	1.943	1.936
438	2.807	0.033	1.665	1.501	2.208	1.943	1.917
439	2.807	0.033	1.683	1.505	2.211	1.943	1.945
440	2.811	0.033	1.66	1.505	2.211	1.943	1.955
441	2.807	0.033	1.679	1.51	2.211	1.943	1.917

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
442	2.811	0.033	1.674	1.515	2.211	1.943	1.917
443	2.811	0.033	1.66	1.515	2.211	1.943	1.955
444	2.811	0.033	1.665	1.52	2.211	1.943	1.878
445	2.807	0.033	1.66	1.52	2.211	1.943	1.936
446	2.807	0.035	1.669	1.524	2.211	1.943	1.907
447	2.807	0.035	1.66	1.529	2.211	1.943	1.974
448	2.807	0.035	1.665	1.529	2.211	1.943	1.964
449	2.807	0.035	1.669	1.534	2.211	1.943	1.917
450	2.807	0.035	1.679	1.534	2.211	1.927	1.926
451	2.807	0.035	1.669	1.539	2.211	1.943	1.926
452	2.802	0.035	1.665	1.539	2.214	1.943	1.917
453	2.807	0.035	1.66	1.543	2.211	1.943	1.917
454	2.802	0.035	1.669	1.548	2.214	1.927	1.917
455	2.802	0.035	1.66	1.548	2.214	1.927	1.917
456	2.807	0.035	1.65	1.553	2.214	1.943	1.926
457	2.802	0.035	1.665	1.553	2.214	1.927	1.907
458	2.802	0.035	1.679	1.558	2.214	1.927	1.926
459	2.807	0.035	1.665	1.562	2.214	1.927	1.898
460	2.807	0.035	1.669	1.562	2.214	1.927	1.926
461	2.802	0.035	1.665	1.567	2.214	1.927	1.945
462	2.802	0.035	1.669	1.567	2.214	1.927	1.945
463	2.802	0.035	1.665	1.572	2.214	1.927	1.926
464	2.802	0.035	1.665	1.577	2.214	1.943	1.945
465	2.802	0.035	1.679	1.577	2.214	1.927	1.955
466	2.802	0.035	1.669	1.581	2.214	1.927	1.955
467	2.802	0.038	1.669	1.581	2.214	1.927	1.955
468	2.807	0.038	1.674	1.586	2.214	1.927	1.945
469	2.802	0.035	1.669	1.586	2.214	1.927	1.945
470	2.802	0.038	1.66	1.591	2.217	1.927	1.945
471	2.802	0.035	1.66	1.591	2.217	1.943	1.907
472	2.802	0.038	1.669	1.596	2.214	1.943	1.955
473	2.802	0.038	1.66	1.596	2.214	1.927	1.878
474	2.807	0.038	1.665	1.6	2.214	1.927	1.955
475	2.802	0.038	1.66	1.6	2.214	1.943	1.936
476	2.802	0.038	1.669	1.605	2.214	1.927	1.869
477	2.802	0.038	1.674	1.605	2.214	1.943	1.955
478	2.802	0.038	1.674	1.61	2.217	1.927	1.936
479	2.802	0.038	1.674	1.615	2.217	1.927	1.869
480	2.797	0.038	1.674	1.615	2.214	1.927	1.955
481	2.797	0.038	1.683	1.62	2.214	1.927	1.936
482	2.807	0.04	1.674	1.62	2.214	1.943	1.898
483	2.821	0.04	1.679	1.62	2.214	1.943	1.888
484	2.826	0.04	1.688	1.624	2.214	1.943	1.955
485	2.826	0.04	1.688	1.624	2.214	1.943	1.955
486	2.826	0.04	1.679	1.629	2.214	1.943	1.898
487	2.826	0.043	1.683	1.629	2.214	1.943	1.964
488	2.826	0.043	1.693	1.634	2.214	1.943	1.945
489	2.826	0.043	1.688	1.634	2.214	1.943	1.955
490	2.826	0.043	1.14	1.639	2.217	1.943	1.964
491	2.83	0.043	1.405	1.639	2.217	1.943	1.964
492	2.83	0.043	1.405	1.643	2.217	1.943	1.974
493	2.826	0.043	1.442	1.643	2.217	1.943	1.907
494	2.83	0.043	1.48	1.648	2.217	1.943	1.898
495	2.83	0.043	1.334	1.648	2.221	1.943	1.917
496	2.826	0.043	1.305	1.653	2.221	1.943	1.983
497	2.83	0.043	1.319	1.653	2.221	1.943	1.936
498	2.83	0.043	1.324	1.658	2.221	1.943	1.983
499	2.83	0.04	1.315	1.662	2.224	1.943	1.993
500	2.835	0.04	1.324	1.662	2.224	1.943	1.974
501	2.83	0.04	1.324	1.667	2.227	1.943	1.964
502	2.83	0.038	1.296	1.672	2.227	1.943	1.964
503	2.83	0.038	1.305	1.672	2.227	1.943	1.974
504	2.83	0.038	1.348	1.677	2.23	1.943	1.907
505	2.83	0.038	1.376	1.677	2.23	1.943	1.907
506	2.826	0.038	1.371	1.681	2.23	1.943	1.936

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
507	2.83	0.038	1.348	1.686	2.233	1.943	1.974
508	2.83	0.038	1.371	1.686	2.233	1.943	1.945
509	2.826	0.035	1.367	1.691	2.233	1.943	1.945
510	2.83	0.038	1.367	1.691	2.233	1.943	1.964
511	2.83	0.038	1.39	1.691	2.233	1.943	1.936
512	2.826	0.038	1.376	1.696	2.233	1.943	1.888
513	2.826	0.038	1.371	1.696	2.233	1.943	1.859
514	2.83	0.038	1.367	1.696	2.233	1.943	1.917
515	2.826	0.038	1.367	1.7	2.233	1.943	1.898
516	2.83	0.038	1.371	1.7	2.233	1.943	1.926
517	2.826	0.04	1.376	1.705	2.233	1.943	1.945
518	2.826	0.04	1.367	1.705	2.233	1.943	1.936
519	2.826	0.038	1.367	1.71	2.233	1.943	1.84
520	2.826	0.04	1.371	1.71	2.233	1.943	1.945
521	2.826	0.038	1.367	1.715	2.233	1.943	1.917
522	2.826	0.038	1.386	1.715	2.237	1.943	1.926
523	2.826	0.038	1.381	1.719	2.237	1.943	1.964
524	2.826	0.038	1.357	1.719	2.237	1.943	1.964
525	2.826	0.035	1.371	1.719	2.237	1.943	1.888
526	2.826	0.035	1.367	1.724	2.237	1.943	1.945
527	2.826	0.035	1.371	1.729	2.24	1.943	1.983
528	2.83	0.035	1.367	1.729	2.24	1.943	1.993
529	2.83	0.035	1.362	1.729	2.24	1.943	1.926
530	2.83	0.035	1.371	1.734	2.24	1.943	1.926
531	2.83	0.035	1.376	1.734	2.24	1.943	1.983
532	2.83	0.035	1.376	1.738	2.24	1.943	1.936
533	2.83	0.035	1.371	1.738	2.24	1.943	1.926
534	2.826	0.035	1.433	1.743	2.243	1.943	1.955
535	2.83	0.033	1.371	1.743	2.24	1.943	1.898
536	2.83	0.033	1.376	1.748	2.243	1.943	1.945
537	2.83	0.033	1.362	1.748	2.243	1.943	1.945
538	2.83	0.033	1.381	1.753	2.243	1.943	1.945
539	2.83	0.033	1.381	1.753	2.246	1.943	1.964
540	2.83	0.033	1.381	1.757	2.246	1.943	1.964
541	2.835	0.03	1.381	1.757	2.246	1.959	1.955
542	2.835	0.03	1.376	1.762	2.246	1.959	1.964
543	2.835	0.03	1.376	1.762	2.246	1.959	1.974
544	2.835	0.03	1.386	1.762	2.246	1.959	2.012
545	2.835	0.03	1.386	1.767	2.249	1.959	1.945
546	2.835	0.03	1.381	1.767	2.249	1.959	1.974
547	2.835	0.03	1.367	1.767	2.249	1.959	1.964
548	2.835	0.03	1.381	1.772	2.249	1.959	1.974
549	2.835	0.03	1.39	1.772	2.249	1.959	1.964
550	2.835	0.03	1.39	1.772	2.249	1.959	1.974
551	2.84	0.03	1.39	1.772	2.249	1.959	1.964
552	2.84	0.033	1.386	1.776	2.249	1.959	1.974
553	2.835	0.035	1.376	1.772	2.246	1.943	1.945
554	2.835	0.033	1.39	1.776	2.249	1.959	1.964
555	2.84	0.033	1.376	1.781	2.249	1.959	1.974
556	2.835	0.033	1.4	1.781	2.249	1.959	1.964
557	2.835	0.033	1.4	1.786	2.249	1.959	1.955
558	2.835	0.03	1.395	1.786	2.249	1.959	1.964
559	2.835	0.03	1.395	1.786	2.249	1.959	1.936
560	2.84	0.03	1.386	1.791	2.253	1.959	1.955
561	2.84	0.03	1.39	1.791	2.253	1.959	1.898
562	2.835	0.028	1.381	1.795	2.253	1.959	1.945
563	2.84	0.028	1.395	1.795	2.256	1.959	1.945
564	2.84	0.028	1.39	1.8	2.256	1.959	1.964
565	2.844	0.028	1.4	1.8	2.256	1.959	1.964
566	2.84	0.025	1.4	1.805	2.256	1.959	1.955
567	2.84	0.025	1.405	1.805	2.259	1.959	1.917
568	2.84	0.025	1.405	1.81	2.259	1.959	1.964
569	2.844	0.023	1.4	1.81	2.262	1.974	1.974
570	2.844	0.02	1.4	1.814	2.262	1.959	1.974
571	2.844	0.02	1.395	1.819	2.265	1.959	1.964

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
572	2.849	0.02	1.4	1.819	2.265	1.974	1.964
573	2.849	0.017	1.395	1.824	2.269	1.974	1.955
574	2.849	0.017	1.405	1.829	2.269	1.974	1.955
575	2.849	0.015	1.395	1.829	2.269	1.974	1.945
576	2.849	0.015	1.4	1.833	2.269	1.974	1.955
577	2.849	0.015	1.395	1.833	2.272	1.974	1.955
578	2.849	0.015	1.405	1.838	2.272	1.974	1.964
579	2.849	0.015	1.4	1.843	2.272	1.974	1.993
580	2.849	0.012	1.4	1.843	2.272	1.974	1.964
581	2.849	0.012	1.405	1.848	2.272	1.974	2.002
582	2.849	0.012	1.39	1.853	2.272	1.974	1.945
583	2.849	0.01	1.405	1.853	2.275	1.974	1.983
584	2.849	0.01	1.39	1.857	2.275	1.974	1.974
585	2.849	0.007	1.395	1.862	2.278	1.974	1.993
586	2.849	0.005	1.405	1.867	2.278	1.974	1.993
587	2.849	0.005	1.414	1.872	2.278	1.974	2.021
588	2.854	0.005	1.405	1.872	2.282	1.974	1.964
589	2.854	0.005	1.414	1.876	2.282	1.974	2.002
590	2.854	0.005	1.409	1.876	2.282	1.974	1.993
591	2.854	0.005	1.395	1.881	2.282	1.974	1.983
592	2.854	0.005	1.405	1.881	2.278	1.974	1.983
593	2.854	0.002	1.4	1.886	2.282	1.974	1.964
594	2.854	0.002	1.409	1.886	2.278	1.974	1.917
595	2.854	0.005	1.405	1.891	2.278	1.974	1.983
596	2.849	0.005	1.409	1.891	2.278	1.974	1.955
597	2.854	0.005	1.419	1.895	2.278	1.974	1.964
598	2.849	0.005	1.405	1.895	2.278	1.974	2.012
599	2.849	0.007	1.4	1.895	2.278	1.974	2.012
600	2.849	0.007	1.405	1.895	2.275	1.974	1.964
601	2.849	0.007	1.39	1.9	2.275	1.974	2.031
602	2.849	0.01	1.405	1.9	2.275	1.974	1.964
603	2.849	0.01	1.405	1.9	2.275	1.974	1.993
604	2.849	0.007	1.4	1.905	2.275	1.974	1.993
605	2.849	0.007	1.405	1.91	2.275	1.974	1.955
606	2.849	0.005	1.405	1.91	2.275	1.974	1.983
607	2.849	0.005	1.405	1.914	2.278	1.974	1.993
608	2.849	0.005	1.4	1.914	2.278	1.974	1.983
609	2.849	0.005	1.4	1.919	2.278	1.974	1.993
610	2.849	0.005	1.405	1.919	2.278	1.974	2.012
611	2.854	0.005	1.4	1.924	2.278	1.974	2.012
612	2.849	0.005	1.405	1.924	2.278	1.974	2.05
613	2.849	0.002	1.4	1.924	2.278	1.974	2.05
614	2.849	0.002	1.4	1.929	2.282	1.974	1.974
615	2.849	0	1.409	1.933	2.282	1.974	2.05
616	2.854	0	1.409	1.933	2.282	1.974	1.955
617	2.854	0	1.405	1.938	2.285	1.974	2.012
618	2.849	0	1.409	1.938	2.285	1.974	1.993
619	2.849	0	1.419	1.938	2.285	1.974	1.993
620	2.849	0	1.409	1.938	2.282	1.974	1.974
621	2.849	0	1.414	1.943	2.282	1.974	1.983
622	2.849	0	1.414	1.943	2.282	1.974	2.002
623	2.849	0.002	1.419	1.943	2.282	1.974	2.002
624	2.854	0.002	1.409	1.943	2.278	1.974	1.983
625	2.849	0.005	1.414	1.943	2.278	1.974	1.945
626	2.854	0.005	1.4	1.943	2.278	1.974	1.926
627	2.854	0.005	1.4	1.943	2.275	1.974	1.993
628	2.854	0.005	1.395	1.943	2.275	1.974	2.021
629	2.854	0.005	1.409	1.948	2.275	1.974	1.983
630	2.854	0.005	1.414	1.948	2.278	1.974	1.993
631	2.854	0.005	1.423	1.948	2.278	1.974	2.002
632	2.854	0.005	1.414	1.952	2.275	1.974	1.983
633	2.854	0.005	1.419	1.952	2.275	1.974	1.974
634	2.854	0.007	1.409	1.952	2.275	1.974	2.012
635	2.854	0.007	1.414	1.952	2.275	1.974	2.04
636	2.854	0.007	1.423	1.952	2.275	1.974	1.993

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
637	2.854	0.005	1.423	1.957	2.278	1.974	2.021
638	2.854	0.005	1.419	1.957	2.278	1.974	1.983
639	2.858	0.002	1.414	1.962	2.278	1.974	2.021
640	2.858	0.002	1.414	1.962	2.282	1.974	2.021
641	2.854	0.002	1.414	1.967	2.282	1.974	2.012
642	2.858	0	1.433	1.967	2.282	1.974	2.012
643	2.858	0	1.419	1.967	2.282	1.974	1.993
644	2.858	0	1.433	1.967	2.282	1.974	2.04
645	2.858	0	1.433	1.971	2.282	1.974	2.031
646	2.858	0	1.419	1.971	2.282	1.974	1.983
647	2.858	0.002	1.423	1.971	2.282	1.974	2.021
648	2.858	0.002	1.428	1.971	2.282	1.974	1.983
649	2.858	0.002	1.423	1.971	2.282	1.974	2.002
650	2.858	0.002	1.423	1.971	2.282	1.974	1.983
651	2.858	0.002	1.423	1.971	2.282	1.974	1.974
652	2.863	0.002	1.419	1.971	2.282	1.974	1.983
653	2.858	0.002	1.414	1.976	2.282	1.974	2.002
654	2.858	0.002	1.423	1.976	2.282	1.974	1.983
655	2.863	0.002	1.414	1.976	2.282	1.99	2.012
656	2.858	0.002	1.423	1.976	2.282	1.99	2.04
657	2.863	0.002	1.419	1.976	2.282	1.974	1.993
658	2.863	0.002	1.438	1.981	2.282	1.974	1.993
659	2.863	0.002	1.438	1.981	2.282	1.99	1.974
660	2.863	0.002	1.442	1.981	2.282	1.99	2.021
661	2.863	0.002	1.447	1.981	2.285	1.99	1.993
662	2.863	0.002	1.442	1.986	2.285	1.99	1.983
663	2.863	0.005	1.433	1.986	2.282	1.99	2.002
664	2.868	0.005	1.428	1.981	2.282	1.99	2.021
665	2.863	0.007	1.438	1.981	2.278	1.99	2.021
666	2.868	0.007	1.433	1.981	2.278	1.99	2.04
667	2.863	0.007	1.433	1.986	2.278	1.99	1.974
668	2.863	0.007	1.447	1.986	2.282	1.99	1.964
669	2.868	0.007	1.438	1.986	2.282	1.99	2.002
670	2.868	0.007	1.428	1.986	2.282	1.99	1.964
671	2.868	0.007	1.438	1.986	2.282	1.99	2.012
672	2.868	0.007	1.442	1.986	2.282	1.99	1.993
673	2.868	0.007	1.433	1.99	2.282	1.99	1.974
674	2.868	0.007	1.423	1.99	2.282	1.99	1.983
675	2.868	0.007	1.438	1.99	2.285	1.99	1.983
676	2.868	0.005	1.438	1.995	2.285	1.99	1.974
677	2.868	0.005	1.442	1.995	2.288	1.99	1.955
678	2.868	0.002	1.438	2	2.288	1.99	2.012
679	2.868	0.002	1.433	2	2.288	1.99	1.993
680	2.868	0.002	1.442	2	2.291	1.99	1.964
681	2.872	0.002	1.447	2	2.291	1.99	1.983
682	2.872	0.002	1.433	2.005	2.291	1.99	1.993
683	2.872	0	1.428	2.005	2.291	1.99	2.021
684	2.872	0.002	1.438	2.005	2.294	1.99	2.012
685	2.872	0.002	1.442	2.005	2.291	1.99	1.974
686	2.872	0.002	1.447	2.005	2.291	1.99	1.974
687	2.872	0.005	1.447	2.005	2.291	1.99	1.993
688	2.872	0.005	1.452	2.005	2.291	1.99	2.002
689	2.872	0.005	1.442	2.005	2.291	1.99	2.012
690	2.872	0.005	1.447	2.005	2.291	1.99	1.974
691	2.872	0.007	1.447	2.009	2.291	1.99	1.926
692	2.872	0.005	1.452	2.009	2.291	1.99	1.926
693	2.872	0.005	1.452	2.009	2.291	1.99	1.955
694	2.872	0.005	1.452	2.009	2.291	1.99	1.993
695	2.872	0.005	1.438	2.009	2.291	1.99	1.983
696	2.877	0.005	1.447	2.009	2.291	1.99	1.983
697	2.877	0.005	1.452	2.014	2.294	2.006	1.993
698	2.877	0.005	1.442	2.014	2.294	2.006	2.002
699	2.877	0.005	1.457	2.014	2.294	2.006	1.945
700	2.877	0.005	1.457	2.014	2.294	2.006	1.955
701	2.877	0.005	1.452	2.014	2.294	2.006	2.002

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
702	2.882	0.007	1.475	2.014	2.294	2.006	1.993
703	2.877	0.005	1.452	2.019	2.294	2.006	1.907
704	2.877	0.007	1.452	2.019	2.294	2.006	1.945
705	2.877	0.007	1.452	2.019	2.294	2.006	1.945
706	2.882	0.007	1.466	2.019	2.298	2.006	1.974
707	2.882	0.007	1.471	2.019	2.294	2.006	1.926
708	2.882	0.007	1.457	2.019	2.294	2.006	1.955
709	2.882	0.01	1.457	2.019	2.294	2.006	1.936
710	2.882	0.007	1.452	2.024	2.294	2.006	1.974
711	2.882	0.01	1.466	2.024	2.294	2.006	1.993
712	2.882	0.01	1.457	2.024	2.294	2.006	2.05
713	2.882	0.01	1.461	2.019	2.298	2.006	1.993
714	2.882	0.012	1.466	2.024	2.298	2.006	2.002
715	2.882	0.012	1.452	2.024	2.294	2.006	2.021
716	2.882	0.012	1.457	2.024	2.294	2.006	1.974
717	2.882	0.012	1.452	2.024	2.294	2.006	2.031
718	2.882	0.015	1.457	2.024	2.294	2.006	1.945
719	2.882	0.015	1.457	2.024	2.298	2.006	2.021
720	2.882	0.015	1.457	2.024	2.298	2.006	1.983
721	2.882	0.015	1.466	2.024	2.298	2.006	1.993
722	2.882	0.015	1.466	2.024	2.298	2.006	2.021
723	2.882	0.015	1.457	2.028	2.298	2.006	2.021
724	2.886	0.015	1.457	2.028	2.298	2.006	2.031
725	2.886	0.015	1.466	2.028	2.298	2.006	1.983
726	2.882	0.015	1.461	2.028	2.301	2.006	2.021
727	2.886	0.015	1.461	2.028	2.301	2.006	1.993
728	2.886	0.015	1.457	2.033	2.301	2.006	1.993
729	2.886	0.015	1.461	2.033	2.301	2.006	2.002
730	2.882	0.015	1.475	2.033	2.301	2.006	2.021
731	2.886	0.015	1.457	2.033	2.301	2.006	2.031
732	2.886	0.015	1.471	2.033	2.301	2.006	2.031
733	2.882	0.015	1.466	2.033	2.301	2.006	2.031
734	2.882	0.017	1.452	2.038	2.301	2.006	2.002
735	2.886	0.017	1.457	2.033	2.301	2.006	1.974
736	2.882	0.017	1.48	2.033	2.301	2.006	1.983
737	2.886	0.017	1.457	2.033	2.301	2.006	2.031
738	2.896	0.017	1.461	2.038	2.301	2.006	1.993
739	2.896	0.017	1.471	2.038	2.301	2.006	2.002
740	2.901	0.017	1.475	2.038	2.304	2.006	2.021
741	2.901	0.02	1.475	2.038	2.304	2.022	2.021
742	2.901	0.02	1.442	2.038	2.304	2.022	2.012
743	2.901	0.02	1.438	2.038	2.304	2.006	1.964
744	2.901	0.023	1.466	2.038	2.301	2.006	2.031
745	2.905	0.023	1.589	2.038	2.301	2.006	2.012
746	2.901	0.025	1.636	2.033	2.301	2.006	2.031
747	2.901	0.025	1.66	2.033	2.301	2.006	2.04
748	2.901	0.028	1.679	2.033	2.301	2.006	2.021
749	2.901	0.028	1.683	2.033	2.301	2.006	1.964
750	2.901	0.028	1.707	2.033	2.301	2.022	2.012
751	2.901	0.028	1.721	2.033	2.301	2.022	2.012
752	2.901	0.028	1.75	2.038	2.301	2.006	1.993
753	2.901	0.028	1.75	2.038	2.304	2.022	2.021
754	2.901	0.028	1.754	2.038	2.304	2.022	2.012
755	2.901	0.028	1.754	2.043	2.304	2.022	2.04
756	2.901	0.028	1.754	2.043	2.307	2.022	2.012
757	2.901	0.028	1.759	2.043	2.307	2.022	2.04
758	2.901	0.028	1.769	2.043	2.307	2.022	2.012
759	2.901	0.03	1.769	2.043	2.307	2.022	2.031
760	2.901	0.03	1.778	2.043	2.307	2.022	2.002
761	2.901	0.03	1.778	2.043	2.307	2.022	2.031
762	2.901	0.03	1.773	2.043	2.307	2.022	2.031
763	2.901	0.033	1.773	2.043	2.307	2.022	2.002
764	2.901	0.033	1.764	2.047	2.307	2.022	1.983
765	2.901	0.033	1.773	2.047	2.307	2.022	2.021
766	2.901	0.033	1.787	2.047	2.307	2.022	2.021

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
767	2.896	0.033	1.792	2.047	2.307	2.022	2.002
768	2.896	0.035	1.787	2.047	2.307	2.022	1.955
769	2.896	0.038	1.778	2.047	2.307	2.022	2.012
770	2.896	0.038	1.787	2.043	2.307	2.022	1.993
771	2.896	0.04	1.783	2.043	2.304	2.022	2.002
772	2.896	0.038	1.797	2.047	2.304	2.022	1.993
773	2.896	0.04	1.792	2.047	2.307	2.022	1.974
774	2.896	0.038	1.792	2.047	2.307	2.022	1.993
775	2.896	0.038	1.797	2.047	2.31	2.022	1.983
776	2.896	0.038	1.797	2.052	2.31	2.022	2.002
777	2.896	0.038	1.792	2.052	2.31	2.022	2.04
778	2.896	0.038	1.811	2.052	2.314	2.022	2.012
779	2.896	0.035	1.825	2.057	2.314	2.022	2.031
780	2.896	0.035	1.806	2.057	2.314	2.022	2.031
781	2.896	0.035	1.802	2.057	2.317	2.022	1.974
782	2.896	0.035	1.797	2.057	2.317	2.022	2.012
783	2.896	0.035	1.806	2.062	2.317	2.022	2.002
784	2.901	0.035	1.806	2.062	2.317	2.022	2.021
785	2.896	0.035	1.806	2.062	2.317	2.022	2.05
786	2.896	0.038	1.806	2.062	2.317	2.022	2.031
787	2.896	0.038	1.802	2.062	2.317	2.022	2.04
788	2.896	0.038	1.811	2.062	2.317	2.022	2.012
789	2.891	0.04	1.811	2.062	2.314	2.022	2.002
790	2.901	0.04	1.806	2.062	2.314	2.022	2.04
791	2.896	0.043	1.806	2.057	2.314	2.022	2.031
792	2.896	0.043	1.806	2.057	2.314	2.022	2.069
793	2.891	0.043	1.806	2.062	2.314	2.022	2.04
794	2.891	0.046	1.806	2.057	2.314	2.022	2.021
795	2.891	0.046	1.792	2.057	2.314	2.022	2.031
796	2.891	0.048	1.802	2.057	2.314	2.022	2.031
797	2.891	0.048	1.802	2.057	2.314	2.022	1.945
798	2.886	0.048	1.802	2.057	2.31	2.022	2.05
799	2.891	0.048	1.802	2.057	2.31	2.022	1.983
800	2.891	0.048	1.806	2.062	2.31	2.022	2.021
801	2.891	0.051	1.811	2.062	2.31	2.022	2.059
802	2.891	0.051	1.802	2.062	2.31	2.022	2.04
803	2.891	0.053	1.792	2.062	2.31	2.022	1.945
804	2.891	0.053	1.797	2.062	2.31	2.022	1.964
805	2.891	0.056	1.787	2.057	2.31	2.022	2.059
806	2.886	0.056	1.797	2.057	2.31	2.022	2.031
807	2.891	0.056	1.797	2.057	2.31	2.022	2.069
808	2.886	0.056	1.802	2.062	2.31	2.022	2.05
809	2.886	0.056	1.806	2.062	2.31	2.022	2.04
810	2.891	0.056	1.797	2.062	2.31	2.022	2.021
811	2.891	0.056	1.797	2.062	2.314	2.022	2.031
812	2.891	0.056	1.802	2.066	2.314	2.022	2.021
813	2.891	0.056	1.811	2.066	2.314	2.022	2.059
814	2.896	0.056	1.797	2.066	2.314	2.022	2.05
815	2.891	0.056	1.816	2.066	2.314	2.022	2.04
816	2.891	0.056	1.806	2.066	2.314	2.022	2.04
817	2.891	0.056	1.792	2.066	2.317	2.022	2.05
818	2.891	0.056	1.811	2.071	2.317	2.022	2.05
819	2.891	0.056	1.802	2.071	2.317	2.022	2.031
820	2.891	0.058	1.806	2.071	2.317	2.022	2.069
821	2.891	0.058	1.816	2.071	2.317	2.022	1.983
822	2.891	0.058	1.811	2.071	2.317	2.022	2.031
823	2.886	0.058	1.806	2.071	2.317	2.022	2.021
824	2.891	0.058	1.802	2.071	2.317	2.022	1.926
825	2.891	0.058	1.811	2.071	2.317	2.022	2.078
826	2.891	0.061	1.816	2.071	2.314	2.022	2.012
827	2.886	0.061	1.821	2.071	2.317	2.022	2.04
828	2.886	0.061	1.806	2.071	2.317	2.022	2.059
829	2.891	0.061	1.825	2.071	2.317	2.022	2.05
830	2.886	0.061	1.811	2.076	2.317	2.022	2.059
831	2.891	0.064	1.802	2.076	2.317	2.022	2.059

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
832	2.891	0.064	1.816	2.076	2.317	2.022	2.04
833	2.891	0.064	1.806	2.076	2.317	2.022	2.031
834	2.891	0.064	1.816	2.076	2.317	2.038	2.069
835	2.891	0.064	1.806	2.076	2.317	2.038	2.05
836	2.886	0.064	1.797	2.076	2.32	2.038	2.021
837	2.891	0.064	1.806	2.076	2.32	2.038	2.05
838	2.891	0.064	1.821	2.081	2.32	2.038	2.021
839	2.891	0.064	1.821	2.081	2.32	2.022	2.059
840	2.886	0.064	1.821	2.081	2.32	2.022	2.04
841	2.891	0.064	1.816	2.081	2.32	2.038	2.031
842	2.891	0.064	1.816	2.081	2.32	2.022	2.059
843	2.886	0.064	1.821	2.086	2.32	2.022	2.04
844	2.886	0.064	1.821	2.086	2.323	2.022	2.002
845	2.891	0.064	1.821	2.086	2.323	2.022	2.059
846	2.886	0.064	1.821	2.086	2.323	2.022	2.012
847	2.886	0.064	1.821	2.086	2.323	2.022	2.002
848	2.886	0.064	1.825	2.086	2.326	2.038	1.974
849	2.905	0.061	1.816	2.09	2.326	2.038	2.059
850	2.901	0.061	1.825	2.09	2.326	2.038	2.05
851	2.896	0.061	1.83	2.09	2.326	2.038	2.078
852	2.891	0.061	1.835	2.09	2.33	2.038	2.059
853	2.891	0.061	1.83	2.09	2.33	2.038	2.078
854	2.891	0.061	1.821	2.095	2.33	2.038	2.031
855	2.891	0.061	1.835	2.095	2.33	2.038	2.04
856	2.891	0.061	1.83	2.095	2.33	2.038	2.021
857	2.891	0.061	1.839	2.095	2.33	2.038	2.012
858	2.891	0.064	1.839	2.095	2.33	2.038	2.059
859	2.891	0.064	1.83	2.095	2.33	2.038	2.05
860	2.891	0.064	1.825	2.095	2.33	2.038	2.012
861	2.896	0.064	1.821	2.095	2.33	2.038	2.04
862	2.891	0.064	1.825	2.095	2.33	2.038	2.05
863	2.896	0.064	1.83	2.095	2.33	2.038	2.05
864	2.891	0.066	1.835	2.095	2.33	2.038	2.059
865	2.896	0.066	1.83	2.1	2.33	2.038	2.088
866	2.896	0.066	1.844	2.1	2.33	2.038	2.069
867	2.896	0.066	1.835	2.1	2.333	2.038	2.059
868	2.891	0.066	1.83	2.1	2.33	2.038	2.04
869	2.896	0.066	1.825	2.1	2.33	2.038	2.031
870	2.896	0.066	1.844	2.1	2.33	2.038	2.04
871	2.896	0.066	1.835	2.1	2.33	2.038	2.059
872	2.896	0.066	1.83	2.1	2.333	2.038	2.069
873	2.891	0.066	1.844	2.1	2.33	2.038	2.021
874	2.891	0.066	1.835	2.105	2.333	2.038	2.05
875	2.896	0.066	1.849	2.105	2.333	2.038	2.031
876	2.891	0.069	1.839	2.105	2.333	2.038	2.05
877	2.896	0.069	1.835	2.105	2.333	2.038	2.05
878	2.896	0.069	1.844	2.105	2.333	2.038	2.031
879	2.896	0.066	1.858	2.105	2.333	2.038	2.05
880	2.896	0.066	1.839	2.105	2.333	2.038	1.993
881	2.896	0.066	1.839	2.109	2.336	2.038	2.002
882	2.896	0.066	1.835	2.109	2.336	2.038	2.05
883	2.891	0.066	1.844	2.109	2.336	2.038	2.04
884	2.891	0.066	1.849	2.109	2.336	2.038	2.069
885	2.891	0.066	1.821	2.109	2.336	2.038	2.04
886	2.896	0.066	1.835	2.109	2.336	2.038	2.04
887	2.891	0.066	1.854	2.114	2.339	2.054	2.05
888	2.891	0.066	1.839	2.114	2.336	2.038	2.05
889	2.891	0.066	1.844	2.114	2.336	2.038	2.031
890	2.891	0.069	1.835	2.109	2.336	2.038	2.04
891	2.891	0.069	1.844	2.114	2.336	2.038	2.05
892	2.891	0.069	1.83	2.109	2.336	2.038	2.069
893	2.891	0.071	1.844	2.114	2.336	2.038	2.04
894	2.891	0.071	1.835	2.109	2.336	2.054	2.04
895	2.891	0.069	1.839	2.114	2.336	2.038	2.031
896	2.891	0.071	1.844	2.114	2.336	2.038	2.031

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
897	2.891	0.071	1.835	2.114	2.336	2.038	2.031
898	2.891	0.071	1.844	2.114	2.336	2.038	2.012
899	2.891	0.071	1.839	2.114	2.336	2.038	2.04
900	2.891	0.071	1.849	2.114	2.336	2.054	2.059
901	2.891	0.071	1.858	2.114	2.336	2.054	1.993
902	2.891	0.074	1.849	2.114	2.336	2.054	2.069
903	2.886	0.071	1.844	2.114	2.336	2.038	2.069
904	2.891	0.074	1.844	2.114	2.336	2.038	1.993
905	2.886	0.074	1.849	2.114	2.336	2.038	2.031
906	2.91	0.074	1.854	2.119	2.336	2.054	2.05
907	2.901	0.074	1.844	2.119	2.336	2.054	2.05
908	2.896	0.074	1.858	2.119	2.336	2.054	2.05
909	2.891	0.074	1.854	2.119	2.336	2.054	2.021
910	2.891	0.074	1.835	2.119	2.336	2.054	2.059
911	2.886	0.076	1.849	2.119	2.336	2.038	1.974
912	2.891	0.076	1.854	2.119	2.336	2.038	2.059
913	2.886	0.076	1.844	2.119	2.336	2.038	2.04
914	2.886	0.076	1.863	2.119	2.336	2.054	2.069
915	2.886	0.076	1.849	2.119	2.336	2.038	2.021
916	2.886	0.079	1.849	2.119	2.336	2.038	2.021
917	2.886	0.076	1.844	2.119	2.336	2.054	2.021
918	2.886	0.076	1.844	2.119	2.336	2.038	2.078
919	2.886	0.076	1.844	2.119	2.336	2.038	2.05
920	2.886	0.076	1.863	2.124	2.339	2.038	2.05
921	2.886	0.076	1.839	2.124	2.339	2.038	2.069
922	2.882	0.076	1.839	2.124	2.339	2.038	2.05
923	2.882	0.079	1.849	2.124	2.336	2.038	1.974
924	2.886	0.079	1.849	2.124	2.336	2.038	2.04
925	2.882	0.079	1.844	2.124	2.336	2.038	2.04
926	2.882	0.079	1.835	2.124	2.336	2.038	2.021
927	2.882	0.079	1.835	2.124	2.336	2.038	2.04
928	2.877	0.081	1.839	2.124	2.336	2.038	2.059
929	2.877	0.081	1.839	2.124	2.336	2.038	2.05
930	2.882	0.081	1.854	2.124	2.336	2.038	2.031
931	2.882	0.081	1.854	2.124	2.336	2.038	2.04
932	2.882	0.079	1.854	2.124	2.336	2.038	2.05
933	2.877	0.079	1.849	2.124	2.339	2.038	2.021
934	2.877	0.079	1.854	2.124	2.339	2.038	2.05
935	2.882	0.079	1.854	2.124	2.339	2.038	2.002
936	2.877	0.081	1.849	2.124	2.339	2.038	2.031
937	2.877	0.081	1.844	2.124	2.336	2.038	1:974
938	2.877	0.081	1.849	2.124	2.336	2.038	2.05
939	2.877	0.081	1.844	2.124	2.336	2.038	2.021
940	2.877	0.081	1.849	2.124	2.336	2.038	2.05
941	2.877	0.081	1.849	2.128	2.336	2.038	2.021
942	2.877	0.081	1.835	2.128	2.336	2.038	2.04
943	2.872	0.081	1.839	2.124	2.336	2.038	2.012
944	2.872	0.084	1.849	2.128	2.336	2.038	1.974
945	2.877	0.084	1.844	2.128	2.336	2.038	2.031
946	2.872	0.084	1.839	2.128	2.336	2.038	1.983
947	2.872	0.084	1.839	2.128	2.336	2.038	2.04
948	2.872	0.084	1.839	2.128	2.336	2.038	2.05
949	2.872	0.081	1.839	2.128	2.336	2.038	2.05
950	2.868	0.084	1.839	2.128	2.336	2.038	2.078
951	2.868	0.084	1.844	2.128	2.336	2.038	2.069
952	2.872	0.084	1.83	2.128	2.336	2.038	2.088
953	2.868	0.084	1.844	2.128	2.336	2.038	2.04
954	2.868	0.084	1.83	2.128	2.336	2.038	1.983
955	2.868	0.084	1.835	2.128	2.336	2.038	2.05
956	2.868	0.084	1.844	2.128	2.336	2.038	1.983
957	2.868	0.084	1.844	2.128	2.336	2.038	2.031
958	2.868	0.084	1.844	2.128	2.336	2.038	2.021
959	2.868	0.084	1.844	2.128	2.336	2.038	2.012
960	2.863	0.084	1.849	2.128	2.336	2.038	2.031
961	2.863	0.084	1.835	2.128	2.336	2.038	2.04

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
962	2.863	0.084	1.849	2.128	2.333	2.038	2.04
963	2.863	0.087	1.83	2.128	2.336	2.038	2.031
964	2.863	0.087	1.844	2.128	2.333	2.038	1.993
965	2.863	0.087	1.83	2.128	2.333	2.038	1.964
966	2.863	0.087	1.83	2.128	2.333	2.038	1.974
967	2.858	0.087	1.849	2.128	2.333	2.038	2.012
968	2.858	0.087	1.844	2.128	2.333	2.038	2.05
969	2.858	0.087	1.849	2.128	2.333	2.038	1.983
970	2.858	0.084	1.849	2.128	2.333	2.038	2.021
971	2.858	0.084	1.835	2.133	2.333	2.038	2.04
972	2.858	0.084	1.844	2.133	2.333	2.038	2.021
973	2.858	0.087	1.447	2.128	2.333	2.038	1.926
974	2.858	0.087	1.457	2.128	2.333	2.038	1.955
975	2.854	0.087	1.471	2.128	2.333	2.022	2.021
976	2.896	0.087	1.49	2.128	2.33	2.038	2.04
977	2.882	0.087	1.49	2.128	2.33	2.038	2.097
978	2.938	0.087	1.509	2.128	2.333	2.054	1.983
979	2.957	0.087	1.518	2.128	2.333	2.054	2.04
980	2.971	0.087	1.523	2.133	2.336	2.069	2.04
981	2.976	0.087	1.532	2.133	2.336	2.069	2.097
982	2.98	0.087	1.532	2.133	2.339	2.069	2.088
983	2.985	0.087	1.532	2.138	2.342	2.085	2.04
984	2.985	0.087	1.542	2.138	2.342	2.069	2.04
985	2.985	0.087	1.542	2.138	2.342	2.085	2.097
986	2.985	0.089	1.532	2.138	2.342	2.085	2.059
987	2.985	0.089	1.523	2.138	2.342	2.069	2.107
988	2.98	0.089	1.532	2.143	2.346	2.069	2.078
989	2.98	0.089	1.523	2.143	2.349	2.085	2.107
990	2.976	0.089	1.532	2.143	2.349	2.069	2.031
991	2.976	0.089	1.527	2.147	2.352	2.069	2.069
992	2.976	0.089	1.527	2.147	2.352	2.069	2.078
993	2.976	0.089	1.532	2.147	2.352	2.069	2.116
994	2.971	0.089	1.532	2.147	2.355	2.069	2.012
995	2.971	0.089	1.518	2.152	2.355	2.069	2.107
996	2.966	0.089	1.527	2.152	2.359	2.069	2.116
997	2.961	0.089	1.527	2.152	2.359	2.069	2.069
998	2.961	0.089	1.527	2.157	2.359	2.069	2.04
999	2.961	0.089	1.542	2.157	2.362	2.069	2.069
1000	2.961	0.089	1.527	2.157	2.362	2.069	2.059
1001	2.957	0.089	1.537	2.162	2.365	2.069	2.078
1002	2.957	0.087	1.537	2.162	2.365	2.069	2.107
1003	2.952	0.087	1.546	2.162	2.365	2.069	2.107
1004	2.952	0.089	1.537	2.162	2.368	2.069	2.078
1005	2.947	0.089	1.527	2.166	2.368	2.054	2.05
1006	2.947	0.089	1.527	2.166	2.368	2.054	2.078
1007	2.943	0.089	1.542	2.166	2.368	2.054	2.107
1008	2.943	0.087	1.527	2.166	2.368	2.054	2.05
1009	2.943	0.087	1.537	2.166	2.371	2.054	2.069
1010	2.938	0.087	1.532	2.166	2.371	2.054	2.069
1011	2.938	0.087	1.527	2.171	2.371	2.054	2.078
1012	2.938	0.087	1.532	2.171	2.371	2.054	2.078
1013	2.938	0.087	1.542	2.171	2.371	2.054	2.05
1014	2.933	0.087	1.532	2.171	2.371	2.054	2.088
1015	2.929	0.087	1.537	2.171	2.371	2.054	2.04
1016	2.929	0.087	1.518	2.176	2.375	2.054	2.031
1017	2.929	0.087	1.523	2.176	2.371	2.038	2.04
1018	2.924	0.087	1.523	2.176	2.371	2.038	2.078
1019	2.924	0.087	1.527	2.176	2.371	2.038	2.088
1020	2.919	0.084	1.537	2.176	2.371	2.038	2.088
1021	2.924	0.087	1.527	2.176	2.371	2.038	2.002
1022	2.919	0.087	1.532	2.176	2.371	2.038	2.04
1023	2.919	0.087	1.532	2.176	2.371	2.038	2.059
1024	2.919	0.087	1.537	2.176	2.371	2.038	1.993
1025	2.915	0.087	1.537	2.176	2.368	2.038	2.021
1026	2.915	0.087	1.527	2.176	2.371	2.038	2.04

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
1027	2.915	0.089	1.532	2.171	2.368	2.038	2.069
1028	2.905	0.089	1.537	2.171	2.368	2.038	1.955
1029	2.915	0.089	1.537	2.176	2.365	2.038	2.031
1030	2.91	0.089	1.542	2.176	2.365	2.038	2.04
1031	2.905	0.089	1.537	2.171	2.365	2.022	2.04
1032	2.901	0.089	1.527	2.171	2.365	2.038	2.021
1033	2.901	0.092	1.527	2.171	2.365	2.038	2.002
1034	2.896	0.092	1.527	2.171	2.362	2.022	2.031
1035	2.896	0.092	1.518	2.171	2.362	2.022	2.012
1036	2.891	0.092	1.518	2.171	2.362	2.022	2.059
1037	2.891	0.092	1.527	2.171	2.362	2.022	2.031
1038	2.886	0.092	1.504	2.171	2.362	2.022	2.021
1039	2.886	0.092	1.504	2.171	2.359	2.022	2.012
1040	2.886	0.092	1.518	2.171	2.359	2.022	2.05
1041	2.882	0.092	1.523	2.171	2.359	2.022	2.002
1042	2.882	0.092	1.513	2.171	2.355	2.022	2.021
1043	2.882	0.092	1.523	2.171	2.355	2.022	2.031
1044	2.877	0.092	1.513	2.171	2.355	2.022	2.04
1045	2.877	0.094	1.504	2.171	2.352	2.006	2.031
1046	2.877	0.094	1.513	2.166	2.352	2.022	1.993
1047	2.872	0.094	1.504	2.166	2.352	2.006	2.021
1048	2.872	0.094	1.513	2.166	2.349	2.006	1.993
1049	2.868	0.094	1.513	2.166	2.349	2.006	1.993
1050	2.872	0.094	1.513	2.166	2.349	2.006	1.955
1051	2.868	0.097	1.504	2.166	2.346	2.006	2.031
1052	2.868	0.094	1.504	2.166	2.346	2.006	1.993
1053	2.863	0.097	1.504	2.166	2.346	2.006	2.021
1054	2.863	0.094	1.504	2.166	2.346	2.006	2.04
1055	2.863	0.094	1.504	2.166	2.346	2.006	2.002
1056	2.858	0.094	1.504	2.166	2.346	2.006	1.974
1057	2.858	0.092	1.513	2.166	2.346	2.006	1.974
1058	2.858	0.092	1.509	2.166	2.346	2.006	2.012
1059	2.858	0.092	1.513	2.166	2.346	2.006	1.983
1060	2.854	0.092	1.518	2.166	2.342	2.006	1.993
1061	2.849	0.092	1.513	2.166	2.342	2.006	2.002
1062	2.849	0.092	1.504	2.166	2.342	2.006	1.945
1063	2.849	0.094	1.509	2.166	2.339	1.99	1.955
1064	2.849	0.092	1.504	2.162	2.339	1.99	2.012
1065	2.849	0.092	1.504	2.162	2.339	1.99	1.955
1066	2.844	0.092	1.504	2.162	2.336	1.99	2.002
1067	2.84	0.092	1.494	2.162	2.336	1.99	2.012
1068	2.84	0.092	1.494	2.162	2.336	1.99	1.926
1069	2.835	0.092	1.494	2.162	2.336	1.99	2.002
1070	2.835	0.092	1.494	2.162	2.333	1.99	2.002
1071	2.835	0.092	1.504	2.162	2.333	1.99	1.945
1072	2.835	0.092	1.504	2.162	2.333	1.99	1.936
1073	2.83	0.092	1.499	2.162	2.333	1.99	1.993
1074	2.83	0.092	1.499	2.162	2.33	1.99	1.974
1075	2.83	0.092	1.499	2.162	2.33	1.99	1.964
1076	2.83	0.092	1.49	2.162	2.33	1.974	1.983
1077	2.83	0.092	1.504	2.162	2.326	1.974	1.974
1078	2.826	0.089	1.499	2.157	2.326	1.974	1.945
1079	2.821	0.089	1.494	2.157	2.326	1.974	1.993
1080	2.826	0.089	1.494	2.157	2.326	1.99	1.917
1081	2.821	0.089	1.509	2.157	2.326	1.974	2.002
1082	2.821	0.087	1.499	2.162	2.326	1.974	2.002
1083	2.821	0.087	1.494	2.157	2.326	1.974	1.964
1084	2.816	0.087	1.499	2.157	2.323	1.974	1.974
1085	2.816	0.087	1.49	2.157	2.323	1.974	1.964
1086	2.821	0.087	1.494	2.157	2.32	1.974	1.945
1087	2.83	0.087	1.49	2.157	2.32	1.974	1.983
1088	2.821	0.087	1.504	2.157	2.32	1.974	1.936
1089	2.816	0.087	1.485	2.157	2.317	1.974	1.983
1090	2.816	0.087	1.499	2.152	2.317	1.974	1.888
1091	2.811	0.087	1.499	2.152	2.317	1.974	1.936

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
1092	2.807	0.087	1.499	2.152	2.317	1.974	1.955
1093	2.807	0.084	1.494	2.152	2.317	1.959	1.955
1094	2.807	0.084	1.494	2.152	2.317	1.974	2.002
1095	2.807	0.084	1.485	2.152	2.314	1.959	1.964
1096	2.802	0.081	1.494	2.152	2.314	1.959	1.955
1097	2.802	0.081	1.494	2.152	2.314	1.959	1.964
1098	2.797	0.081	1.49	2.152	2.31	1.959	1.983
1099	2.793	0.081	1.494	2.152	2.31	1.959	1.945
1100	2.797	0.081	1.485	2.152	2.31	1.959	1.945
1101	2.793	0.079	1.485	2.152	2.307	1.959	1.945
1102	2.793	0.079	1.485	2.152	2.307	1.959	1.974
1103	2.788	0.081	1.475	2.147	2.307	1.959	1.964
1104	2.788	0.081	1.494	2.147	2.304	1.959	1.955
1105	2.783	0.081	1.48	2.147	2.304	1.943	1.917
1106	2.783	0.081	1.475	2.147	2.301	1.943	1.955
1107	2.779	0.079	1.48	2.143	2.301	1.943	1.859
1108	2.779	0.079	1.475	2.143	2.298	1.943	1.926
1109	2.779	0.081	1.48	2.143	2.298	1.943	1.907
1110	2.774	0.081	1.485	2.143	2.298	1.943	1.955
1111	2.774	0.079	1.48	2.143	2.294	1.943	1.812
1112	2.774	0.081	1.485	2.138	2.291	1.943	1.907
1113	2.769	0.079	1.475	2.138	2.291	1.943	1.936
1114	2.769	0.079	1.48	2.138	2.291	1.943	1.936
1115	2.765	0.079	1.471	2.138	2.291	1.943	1.945
1116	2.765	0.079	1.475	2.138	2.288	1.943	1.926
1117	2.765	0.079	1.48	2.138	2.288	1.943	1.907
1118	2.765	0.079	1.466	2.133	2.285	1.927	1.926
1119	2.76	0.079	1.471	2.133	2.285	1.927	1.898
1120	2.76	0.079	1.485	2.133	2.282	1.927	1.917
1121	2.755	0.079	1.49	2.133	2.282	1.927	1.917
1122	2.75	0.079	1.48	2.128	2.278	1.927	1.955
1123	2.75	0.079	1.48	2.128	2.278	1.927	1.936
1124	2.75	0.079	1.48	2.128	2.275	1.927	1.907
1125	2.746	0.079	1.466	2.128	2.275	1.927	1.917
1126	2.741	0.079	1.461	2.124	2.272	1.911	1.898
1127	2.746	0.076	1.471	2.124	2.272	1.911	1.84
1128	2.741	0.076	1.461	2.124	2.272	1.911	1.85
1129	2.741	0.076	1.466	2.124	2.269	1.911	1.878
1130	2.741	0.076	1.466	2.124	2.269	1.911	1.917
1131	2.802	0.076	1.475	2.124	2.269	1.927	1.917
1132	2.84	0.076	1.494	2.124	2.269	1.943	1.917
1133	2.858	0.076	1.49	2.119	2.269	1.959	1.878
1134	2.863	0.076	1.504	2.119	2.265	1.959	1.917
1135	2.868	0.076	1.509	2.119	2.265	1.959	1.859
1136	2.868	0.076	1.504	2.119	2.269	1.959	1.964
1137	2.863	0.076	1.509	2.119	2.269	1.959	1.964
1138	2.868	0.076	1.499	2.119	2.269	1.959	1.964
1139	2.863	0.074	1.509	2.124	2.272	1.959	1.983
1140	2.863	0.074	1.499	2.124	2.272	1.959	1.898
1141	2.849	0.074	1.504	2.124	2.272	1.959	1.983
1142	2.807	0.071	1.499	2.124	2.275	1.943	1.964
1143	2.779	0.071	1.494	2.124	2.275	1.943	1.936
1144	2.774	0.071	1.49	2.128	2.275	1.927	1.926
1145	2.765	0.069	1.48	2.128	2.275	1.927	1.907
1146	2.76	0.069	1.475	2.128	2.275	1.927	1.907
1147	2.755	0.066	1.48	2.128	2.275	1.911	1.859
1148	2.755	0.066	1.475	2.128	2.275	1.911	1.888
1149	2.75	0.064	1.471	2.128	2.275	1.911	1.917
1150	2.75	0.064	1.466	2.128	2.272	1.911	1.907
1151	2.75	0.064	1.471	2.124	2.272	1.911	1.907
1152	2.746	0.064	1.471	2.124	2.269	1.911	1.907
1153	2.746	0.064	1.466	2.124	2.269	1.911	1.907
1154	2.746	0.064	1.471	2.124	2.269	1.911	1.917
1155	2.741	0.064	1.457	2.124	2.265	1.911	1.907
1156	2.741	0.061	1.457	2.124	2.265	1.911	1.878

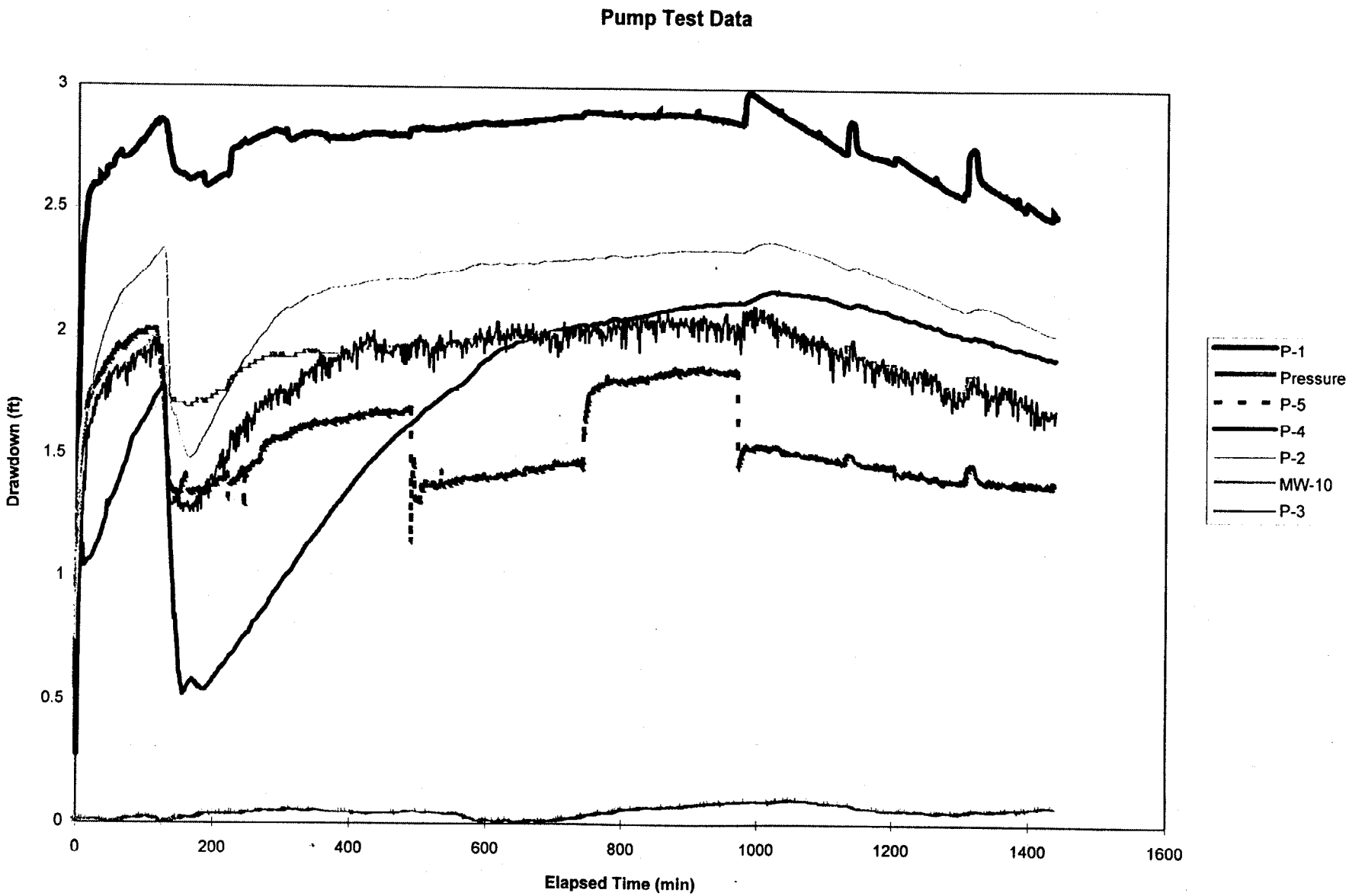
Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
1157	2.741	0.061	1.466	2.124	2.265	1.911	1.888
1158	2.741	0.061	1.461	2.119	2.262	1.911	1.812
1159	2.741	0.061	1.461	2.124	2.262	1.911	1.859
1160	2.736	0.061	1.452	2.119	2.259	1.895	1.878
1161	2.736	0.061	1.457	2.119	2.259	1.895	1.907
1162	2.736	0.061	1.461	2.114	2.256	1.895	1.888
1163	2.732	0.061	1.457	2.114	2.256	1.895	1.888
1164	2.732	0.061	1.457	2.114	2.253	1.895	1.878
1165	2.732	0.061	1.452	2.109	2.249	1.895	1.898
1166	2.732	0.061	1.466	2.109	2.249	1.895	1.869
1167	2.727	0.061	1.452	2.109	2.249	1.895	1.898
1168	2.727	0.061	1.457	2.109	2.249	1.895	1.888
1169	2.727	0.061	1.452	2.109	2.246	1.895	1.812
1170	2.727	0.058	1.457	2.105	2.246	1.895	1.869
1171	2.727	0.058	1.457	2.105	2.246	1.895	1.859
1172	2.727	0.058	1.457	2.105	2.243	1.895	1.793
1173	2.727	0.058	1.457	2.105	2.243	1.895	1.821
1174	2.727	0.058	1.447	2.105	2.243	1.895	1.878
1175	2.727	0.058	1.452	2.105	2.24	1.895	1.85
1176	2.722	0.058	1.461	2.105	2.24	1.879	1.888
1177	2.722	0.056	1.471	2.105	2.24	1.879	1.878
1178	2.722	0.056	1.471	2.1	2.237	1.879	1.859
1179	2.722	0.056	1.461	2.1	2.237	1.879	1.84
1180	2.722	0.056	1.452	2.1	2.237	1.879	1.888
1181	2.718	0.053	1.447	2.1	2.237	1.879	1.859
1182	2.718	0.053	1.452	2.1	2.237	1.879	1.878
1183	2.718	0.053	1.461	2.1	2.233	1.879	1.878
1184	2.718	0.051	1.457	2.1	2.233	1.879	1.907
1185	2.718	0.051	1.447	2.1	2.233	1.879	1.907
1186	2.718	0.051	1.461	2.1	2.233	1.879	1.85
1187	2.718	0.048	1.452	2.1	2.233	1.879	1.888
1188	2.713	0.048	1.466	2.095	2.233	1.879	1.85
1189	2.718	0.048	1.452	2.1	2.23	1.879	1.831
1190	2.713	0.048	1.461	2.095	2.23	1.879	1.821
1191	2.713	0.048	1.442	2.095	2.227	1.879	1.869
1192	2.708	0.048	1.457	2.095	2.227	1.879	1.85
1193	2.708	0.048	1.457	2.09	2.224	1.879	1.84
1194	2.708	0.051	1.447	2.09	2.224	1.864	1.812
1195	2.708	0.051	1.457	2.09	2.221	1.879	1.859
1196	2.704	0.051	1.442	2.086	2.217	1.864	1.859
1197	2.704	0.051	1.461	2.086	2.217	1.864	1.869
1198	2.708	0.051	1.447	2.086	2.214	1.864	1.859
1199	2.704	0.051	1.457	2.081	2.214	1.864	1.802
1200	2.704	0.051	1.457	2.081	2.214	1.864	1.859
1201	2.727	0.051	1.447	2.081	2.214	1.864	1.84
1202	2.727	0.051	1.457	2.081	2.211	1.879	1.84
1203	2.722	0.048	1.452	2.081	2.211	1.879	1.812
1204	2.722	0.048	1.461	2.081	2.211	1.879	1.869
1205	2.722	0.048	1.414	2.076	2.211	1.879	1.85
1206	2.722	0.048	1.433	2.076	2.208	1.864	1.85
1207	2.722	0.048	1.428	2.076	2.208	1.864	1.821
1208	2.718	0.048	1.428	2.076	2.208	1.864	1.793
1209	2.718	0.048	1.428	2.076	2.208	1.864	1.85
1210	2.713	0.048	1.428	2.076	2.205	1.864	1.85
1211	2.713	0.048	1.423	2.076	2.205	1.864	1.831
1212	2.713	0.048	1.423	2.076	2.205	1.864	1.878
1213	2.708	0.048	1.419	2.071	2.205	1.864	1.821
1214	2.708	0.051	1.414	2.071	2.201	1.864	1.831
1215	2.708	0.051	1.423	2.071	2.201	1.864	1.812
1216	2.704	0.051	1.419	2.066	2.198	1.848	1.821
1217	2.704	0.053	1.423	2.066	2.198	1.848	1.869
1218	2.699	0.053	1.423	2.066	2.195	1.848	1.802
1219	2.699	0.053	1.433	2.066	2.195	1.848	1.821
1220	2.694	0.053	1.433	2.066	2.195	1.848	1.84
1221	2.694	0.051	1.423	2.062	2.192	1.848	1.859

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
1222	2.69	0.051	1.428	2.062	2.192	1.848	1.84
1223	2.69	0.051	1.428	2.062	2.192	1.848	1.831
1224	2.685	0.051	1.419	2.062	2.192	1.848	1.802
1225	2.685	0.048	1.428	2.062	2.192	1.848	1.821
1226	2.685	0.048	1.419	2.062	2.192	1.848	1.812
1227	2.68	0.048	1.438	2.062	2.192	1.832	1.821
1228	2.68	0.046	1.414	2.062	2.192	1.848	1.764
1229	2.68	0.046	1.423	2.062	2.192	1.832	1.84
1230	2.675	0.046	1.423	2.062	2.188	1.832	1.831
1231	2.675	0.046	1.428	2.062	2.188	1.832	1.859
1232	2.675	0.046	1.428	2.062	2.185	1.832	1.831
1233	2.671	0.046	1.423	2.062	2.185	1.832	1.831
1234	2.671	0.046	1.419	2.057	2.185	1.832	1.831
1235	2.666	0.046	1.419	2.057	2.182	1.832	1.812
1236	2.666	0.046	1.409	2.057	2.182	1.832	1.812
1237	2.666	0.046	1.423	2.057	2.182	1.832	1.84
1238	2.661	0.046	1.409	2.052	2.179	1.832	1.859
1239	2.661	0.046	1.423	2.052	2.176	1.832	1.85
1240	2.657	0.048	1.419	2.052	2.176	1.832	1.859
1241	2.657	0.048	1.419	2.047	2.172	1.816	1.85
1242	2.657	0.048	1.414	2.047	2.172	1.816	1.831
1243	2.652	0.048	1.428	2.047	2.169	1.816	1.85
1244	2.652	0.048	1.433	2.047	2.169	1.816	1.774
1245	2.652	0.048	1.419	2.047	2.169	1.816	1.859
1246	2.647	0.048	1.414	2.047	2.166	1.816	1.84
1247	2.643	0.048	1.419	2.043	2.166	1.816	1.869
1248	2.643	0.046	1.419	2.043	2.166	1.816	1.802
1249	2.643	0.046	1.414	2.043	2.163	1.816	1.812
1250	2.643	0.046	1.409	2.043	2.163	1.816	1.859
1251	2.638	0.046	1.414	2.043	2.163	1.816	1.812
1252	2.638	0.046	1.414	2.043	2.16	1.816	1.802
1253	2.638	0.043	1.409	2.043	2.163	1.8	1.821
1254	2.633	0.043	1.409	2.043	2.16	1.816	1.812
1255	2.638	0.043	1.395	2.043	2.16	1.816	1.85
1256	2.629	0.043	1.405	2.038	2.156	1.8	1.821
1257	2.629	0.043	1.405	2.038	2.156	1.8	1.764
1258	2.629	0.043	1.405	2.038	2.153	1.8	1.84
1259	2.624	0.043	1.4	2.033	2.153	1.8	1.821
1260	2.629	0.04	1.4	2.033	2.153	1.8	1.84
1261	2.647	0.04	1.414	2.033	2.153	1.816	1.821
1262	2.633	0.04	1.409	2.033	2.153	1.8	1.84
1263	2.629	0.04	1.414	2.033	2.153	1.8	1.85
1264	2.619	0.038	1.4	2.033	2.15	1.8	1.812
1265	2.624	0.038	1.419	2.038	2.15	1.8	1.774
1266	2.619	0.038	1.414	2.033	2.15	1.8	1.774
1267	2.615	0.038	1.409	2.033	2.147	1.8	1.821
1268	2.615	0.038	1.409	2.033	2.147	1.8	1.821
1269	2.61	0.04	1.4	2.033	2.144	1.8	1.812
1270	2.61	0.04	1.39	2.028	2.144	1.8	1.774
1271	2.61	0.04	1.405	2.024	2.14	1.784	1.755
1272	2.605	0.043	1.395	2.024	2.137	1.784	1.736
1273	2.6	0.043	1.395	2.024	2.134	1.784	1.764
1274	2.6	0.043	1.381	2.019	2.134	1.784	1.717
1275	2.6	0.043	1.386	2.019	2.134	1.784	1.755
1276	2.596	0.046	1.405	2.019	2.131	1.784	1.783
1277	2.596	0.046	1.4	2.019	2.131	1.784	1.783
1278	2.591	0.046	1.39	2.014	2.128	1.784	1.726
1279	2.591	0.046	1.39	2.014	2.124	1.784	1.745
1280	2.591	0.046	1.39	2.014	2.124	1.784	1.745
1281	2.586	0.043	1.395	2.014	2.124	1.784	1.764
1282	2.586	0.043	1.4	2.014	2.124	1.769	1.774
1283	2.586	0.043	1.39	2.014	2.121	1.784	1.774
1284	2.582	0.043	1.4	2.014	2.121	1.769	1.745
1285	2.586	0.043	1.395	2.009	2.118	1.769	1.745
1286	2.582	0.043	1.4	2.009	2.118	1.769	1.745

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
1287	2.582	0.043	1.4	2.009	2.115	1.769	1.688
1288	2.582	0.043	1.395	2.009	2.115	1.769	1.726
1289	2.577	0.043	1.39	2.009	2.115	1.769	1.793
1290	2.577	0.04	1.39	2.009	2.115	1.769	1.717
1291	2.572	0.04	1.39	2.009	2.115	1.769	1.736
1292	2.577	0.04	1.39	2.009	2.115	1.769	1.736
1293	2.577	0.038	1.4	2.009	2.115	1.769	1.707
1294	2.572	0.038	1.395	2.009	2.111	1.769	1.736
1295	2.568	0.038	1.386	2.005	2.111	1.769	1.707
1296	2.568	0.038	1.39	2.005	2.108	1.769	1.764
1297	2.568	0.038	1.386	2.005	2.108	1.769	1.774
1298	2.568	0.04	1.395	2.005	2.105	1.769	1.736
1299	2.568	0.04	1.39	2.005	2.105	1.769	1.755
1300	2.563	0.04	1.386	2	2.102	1.769	1.736
1301	2.558	0.043	1.4	1.995	2.099	1.769	1.745
1302	2.558	0.043	1.386	1.995	2.099	1.769	1.726
1303	2.572	0.043	1.386	1.995	2.099	1.769	1.717
1304	2.582	0.043	1.386	1.995	2.095	1.769	1.774
1305	2.586	0.043	1.4	1.995	2.095	1.769	1.736
1306	2.582	0.043	1.405	1.995	2.095	1.769	1.755
1307	2.582	0.043	1.39	1.995	2.095	1.769	1.755
1308	2.586	0.043	1.395	1.995	2.095	1.769	1.745
1309	2.68	0.043	1.405	1.995	2.095	1.784	1.764
1310	2.722	0.043	1.419	1.995	2.099	1.8	1.793
1311	2.736	0.043	1.442	1.995	2.099	1.816	1.745
1312	2.75	0.043	1.442	1.99	2.099	1.832	1.793
1313	2.75	0.046	1.457	1.995	2.099	1.832	1.802
1314	2.75	0.048	1.438	1.99	2.099	1.832	1.821
1315	2.755	0.048	1.452	1.99	2.102	1.832	1.821
1316	2.76	0.048	1.452	1.99	2.102	1.832	1.764
1317	2.765	0.048	1.457	1.995	2.105	1.832	1.821
1318	2.76	0.048	1.466	1.995	2.108	1.832	1.831
1319	2.76	0.048	1.461	1.995	2.111	1.832	1.802
1320	2.76	0.051	1.457	2	2.111	1.832	1.812
1321	2.736	0.051	1.461	1.995	2.111	1.832	1.793
1322	2.708	0.053	1.447	1.995	2.115	1.832	1.802
1323	2.675	0.053	1.438	1.995	2.111	1.816	1.764
1324	2.657	0.056	1.423	1.995	2.111	1.8	1.821
1325	2.647	0.056	1.414	1.99	2.115	1.8	1.84
1326	2.643	0.056	1.414	1.99	2.115	1.784	1.764
1327	2.638	0.053	1.405	1.995	2.115	1.784	1.783
1328	2.629	0.053	1.4	1.99	2.111	1.784	1.783
1329	2.629	0.053	1.4	1.99	2.115	1.784	1.783
1330	2.629	0.053	1.405	1.99	2.115	1.784	1.783
1331	2.624	0.051	1.39	1.99	2.115	1.769	1.755
1332	2.624	0.051	1.395	1.99	2.115	1.769	1.755
1333	2.619	0.051	1.395	1.99	2.115	1.769	1.755
1334	2.619	0.051	1.395	1.986	2.111	1.769	1.774
1335	2.615	0.051	1.386	1.986	2.111	1.769	1.812
1336	2.61	0.048	1.386	1.986	2.111	1.769	1.679
1337	2.61	0.048	1.381	1.986	2.111	1.769	1.774
1338	2.61	0.048	1.39	1.986	2.111	1.769	1.783
1339	2.605	0.048	1.39	1.981	2.108	1.769	1.745
1340	2.605	0.048	1.386	1.981	2.108	1.769	1.698
1341	2.6	0.048	1.395	1.981	2.108	1.769	1.745
1342	2.6	0.046	1.4	1.981	2.108	1.769	1.717
1343	2.596	0.048	1.39	1.981	2.105	1.753	1.755
1344	2.596	0.046	1.405	1.976	2.105	1.753	1.755
1345	2.596	0.048	1.381	1.976	2.105	1.753	1.764
1346	2.596	0.046	1.395	1.981	2.105	1.753	1.745
1347	2.591	0.048	1.386	1.971	2.102	1.753	1.736
1348	2.586	0.048	1.395	1.971	2.099	1.753	1.755
1349	2.586	0.048	1.395	1.971	2.099	1.753	1.764
1350	2.586	0.051	1.4	1.971	2.099	1.753	1.764
1351	2.586	0.051	1.39	1.971	2.099	1.753	1.802

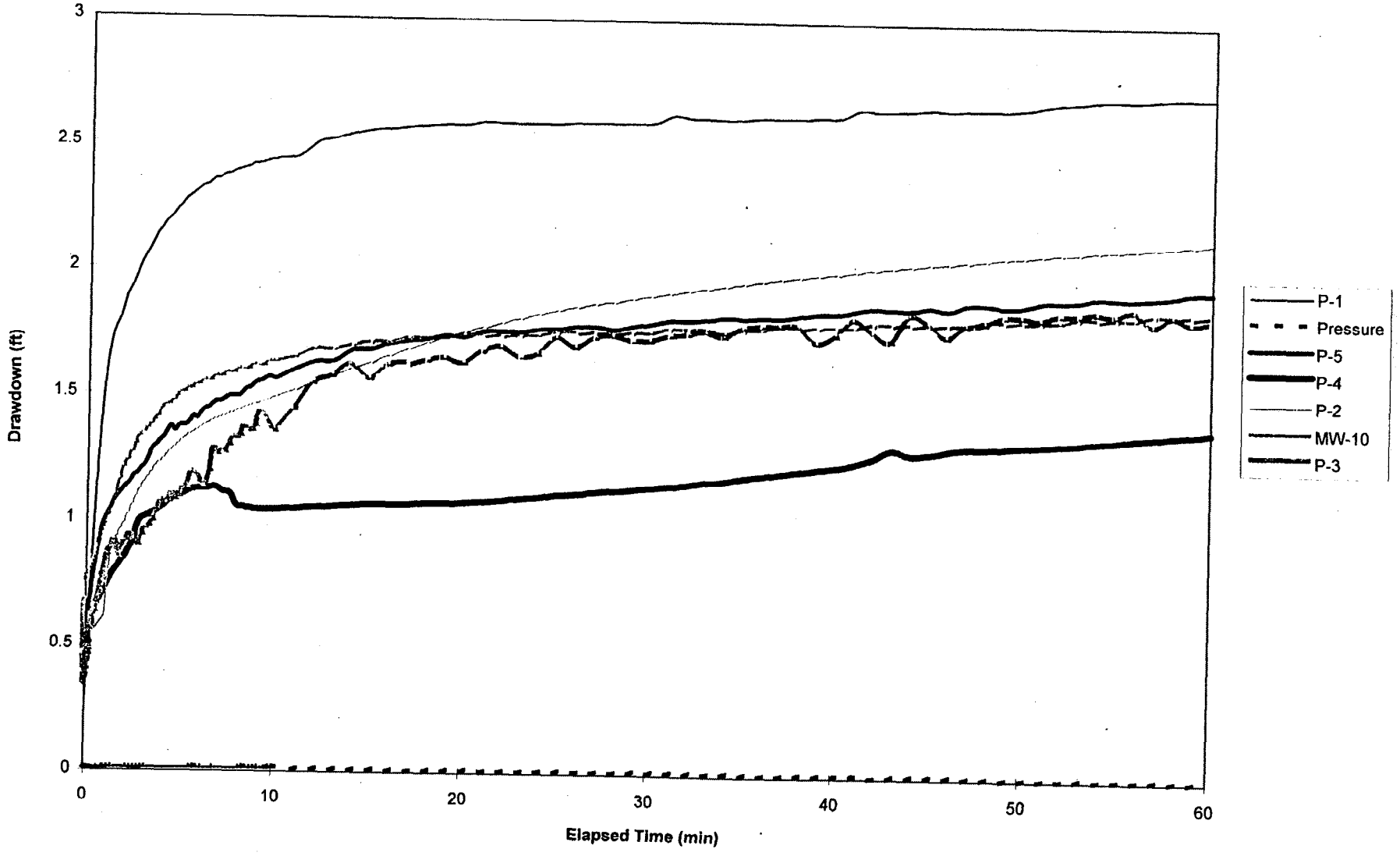
Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
1352	2.586	0.051	1.39	1.971	2.095	1.753	1.679
1353	2.582	0.051	1.39	1.967	2.095	1.753	1.745
1354	2.577	0.051	1.376	1.967	2.095	1.753	1.688
1355	2.577	0.051	1.381	1.967	2.095	1.753	1.755
1356	2.577	0.051	1.39	1.967	2.092	1.753	1.774
1357	2.572	0.051	1.395	1.967	2.092	1.753	1.726
1358	2.572	0.051	1.381	1.967	2.092	1.753	1.745
1359	2.572	0.051	1.39	1.967	2.089	1.753	1.774
1360	2.568	0.051	1.39	1.962	2.089	1.753	1.802
1361	2.572	0.051	1.386	1.962	2.089	1.753	1.774
1362	2.568	0.051	1.39	1.962	2.086	1.737	1.745
1363	2.563	0.051	1.395	1.962	2.086	1.753	1.793
1364	2.563	0.053	1.386	1.962	2.083	1.753	1.774
1365	2.563	0.051	1.386	1.962	2.083	1.737	1.783
1366	2.558	0.053	1.386	1.957	2.083	1.737	1.774
1367	2.558	0.053	1.386	1.957	2.083	1.737	1.745
1368	2.554	0.053	1.381	1.957	2.079	1.737	1.783
1369	2.554	0.053	1.386	1.957	2.076	1.737	1.783
1370	2.554	0.056	1.381	1.952	2.076	1.737	1.793
1371	2.554	0.056	1.381	1.952	2.073	1.737	1.736
1372	2.549	0.056	1.386	1.952	2.073	1.737	1.736
1373	2.544	0.058	1.386	1.948	2.07	1.737	1.793
1374	2.544	0.058	1.376	1.948	2.067	1.721	1.726
1375	2.544	0.058	1.381	1.948	2.067	1.737	1.717
1376	2.539	0.058	1.386	1.948	2.067	1.721	1.679
1377	2.539	0.058	1.371	1.948	2.063	1.721	1.745
1378	2.539	0.058	1.386	1.948	2.063	1.721	1.764
1379	2.53	0.058	1.376	1.943	2.06	1.721	1.783
1380	2.535	0.058	1.381	1.948	2.063	1.721	1.726
1381	2.558	0.058	1.395	1.943	2.063	1.737	1.736
1382	2.544	0.056	1.386	1.948	2.06	1.721	1.726
1383	2.535	0.056	1.4	1.948	2.06	1.721	1.66
1384	2.53	0.056	1.386	1.948	2.06	1.721	1.745
1385	2.53	0.056	1.371	1.948	2.063	1.721	1.736
1386	2.525	0.053	1.381	1.948	2.06	1.721	1.755
1387	2.525	0.056	1.395	1.943	2.06	1.721	1.755
1388	2.521	0.056	1.386	1.943	2.054	1.705	1.755
1389	2.521	0.056	1.381	1.943	2.057	1.721	1.717
1390	2.516	0.056	1.381	1.943	2.054	1.705	1.726
1391	2.511	0.058	1.381	1.938	2.054	1.705	1.717
1392	2.511	0.058	1.39	1.938	2.051	1.705	1.726
1393	2.507	0.058	1.367	1.938	2.051	1.705	1.707
1394	2.525	0.058	1.386	1.938	2.047	1.705	1.764
1395	2.535	0.058	1.395	1.933	2.047	1.705	1.726
1396	2.535	0.061	1.376	1.933	2.044	1.705	1.688
1397	2.525	0.061	1.386	1.933	2.041	1.705	1.726
1398	2.53	0.058	1.386	1.933	2.044	1.705	1.717
1399	2.525	0.061	1.376	1.933	2.041	1.705	1.726
1400	2.525	0.061	1.376	1.929	2.041	1.705	1.698
1401	2.525	0.061	1.39	1.933	2.041	1.705	1.726
1402	2.521	0.061	1.376	1.929	2.038	1.705	1.641
1403	2.521	0.061	1.395	1.929	2.038	1.705	1.745
1404	2.521	0.061	1.39	1.929	2.038	1.705	1.717
1405	2.516	0.061	1.381	1.929	2.034	1.705	1.698
1406	2.511	0.061	1.376	1.929	2.034	1.705	1.698
1407	2.511	0.064	1.386	1.924	2.031	1.689	1.622
1408	2.507	0.061	1.39	1.929	2.034	1.689	1.698
1409	2.507	0.061	1.371	1.924	2.031	1.689	1.641
1410	2.502	0.061	1.39	1.924	2.031	1.689	1.736
1411	2.502	0.061	1.381	1.924	2.031	1.689	1.707
1412	2.502	0.061	1.381	1.924	2.028	1.689	1.65
1413	2.502	0.064	1.39	1.924	2.028	1.689	1.641
1414	2.497	0.064	1.376	1.924	2.025	1.689	1.679
1415	2.497	0.064	1.376	1.919	2.025	1.689	1.66
1416	2.493	0.066	1.386	1.919	2.022	1.689	1.641

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
1417	2.488	0.066	1.376	1.919	2.018	1.689	1.679
1418	2.488	0.066	1.386	1.914	2.018	1.674	1.679
1419	2.488	0.066	1.371	1.914	2.015	1.689	1.698
1420	2.488	0.069	1.381	1.914	2.015	1.689	1.698
1421	2.483	0.069	1.371	1.914	2.015	1.674	1.622
1422	2.483	0.069	1.376	1.914	2.012	1.674	1.669
1423	2.479	0.069	1.371	1.91	2.012	1.674	1.698
1424	2.483	0.069	1.371	1.91	2.012	1.674	1.698
1425	2.479	0.069	1.376	1.91	2.009	1.674	1.669
1426	2.479	0.069	1.371	1.91	2.006	1.674	1.66
1427	2.479	0.071	1.381	1.905	2.009	1.674	1.679
1428	2.479	0.069	1.381	1.91	2.009	1.674	1.669
1429	2.474	0.069	1.386	1.91	2.006	1.674	1.66
1430	2.474	0.069	1.386	1.91	2.006	1.674	1.669
1431	2.474	0.069	1.381	1.91	2.006	1.674	1.679
1432	2.474	0.069	1.376	1.905	2.002	1.674	1.698
1433	2.474	0.069	1.367	1.905	2.002	1.674	1.669
1434	2.502	0.066	1.367	1.905	2.002	1.674	1.679
1435	2.493	0.066	1.371	1.905	1.999	1.674	1.679
1436	2.488	0.066	1.381	1.905	2.002	1.674	1.688
1437	2.483	0.069	1.395	1.9	2.002	1.674	1.641
1438	2.488	0.066	1.386	1.905	1.999	1.674	1.669
1439	2.483	0.066	1.386	1.905	1.999	1.674	1.698



ORIG.	J. Novick	DATE	9/28/95
CHK'D BY		DATE	
CALC. NO.	321-G-002		
REV. NO.	0	SHEET NO.	A1-27 of 52

Portion of Pump Test Used For Calculation



ORIG.	J. Novick	DATE 9/28/95
CHK'D BY	[illegible]	DATE [illegible]
CALC. NO.	321-G-002	
REV. NO.	0	SHEET NO. A1-28 of 52

2. Recovery Test

SE2000
Environmental Logger
9/8/95 12:25

Unit# 681 Test 0

Setups:	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
Type	Level (F)	Level (F)	Level (F)	Level (F)	Level (F)	Level (F)	Level (F)
Mode	TOC	TOC	TOC	TOC	TOC	TOC	TOC
I.D.	P-1	Pressure	P-5	P-4	P-2	MW-10	P-3
Reference	0.28	0	0.54	0.65	0.54	0.74	0.7
PSI at Ref.	4.613	14.695	3.559	3.759	3.898	4.058	2.823
SG	1	1	1	1	1	1	1
Linearity	0	0.042	0	0	0	0	0
Scale factor	14.878	8.061	15	15.088	10.172	50.2	30.147
Offset	0.063	8.004	0.062	-0.014	-0.082	0	-0.092
Delay mSEC	50	50	50	50	50	50	50

Step 1 09/07 12:15:53

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
0	2.479	0.069	1.386	1.9	1.996	1.658	1.679
0.0083	2.479	0.069	1.386	1.9	1.996	1.674	1.422
0.0166	2.479	0.069	1.386	1.9	1.999	1.674	1.375
0.025	2.479	0.071	1.381	1.9	1.999	1.689	1.318
0.0333	2.479	0.069	1.376	1.9	1.996	1.689	1.289
0.0416	2.479	0.069	1.381	1.9	1.996	1.689	1.299
0.05	2.483	0.071	1.376	1.9	1.999	1.689	1.308
0.0583	2.483	0.071	1.381	1.9	1.999	1.689	1.318
0.0666	2.479	0.071	1.381	1.9	1.996	1.689	1.337
0.075	2.479	0.069	1.376	1.9	1.996	1.689	1.318
0.0833	2.479	0.069	1.381	1.9	1.996	1.689	1.289
0.0916	2.483	0.069	1.386	1.9	1.996	1.689	1.299
0.1	2.479	0.071	1.39	1.9	1.999	1.689	1.289
0.1083	2.479	0.071	1.381	1.9	1.996	1.689	1.279
0.1166	2.469	0.071	1.386	1.9	1.996	1.689	1.318
0.125	2.464	0.071	1.39	1.9	1.999	1.689	1.318
0.1333	2.469	0.071	1.386	1.9	1.999	1.689	1.346
0.1416	2.436	0.069	1.386	1.9	1.999	1.689	1.327
0.15	2.422	0.071	1.386	1.9	1.999	1.689	1.318
0.1583	2.404	0.069	1.381	1.9	1.999	1.689	1.318
0.1666	2.389	0.071	1.395	1.9	1.999	1.689	1.327
0.175	2.375	0.071	1.381	1.9	1.999	1.689	1.327
0.1833	2.361	0.069	1.386	1.9	1.996	1.689	1.318
0.1916	2.347	0.071	1.39	1.9	1.999	1.689	1.337
0.2	2.333	0.071	1.39	1.9	1.999	1.689	1.337
0.2083	2.319	0.071	1.381	1.9	1.999	1.689	1.346
0.2166	2.305	0.071	1.381	1.9	1.999	1.689	1.346
0.225	2.291	0.071	1.39	1.9	1.999	1.689	1.346
0.2333	2.282	0.071	1.386	1.9	1.999	1.689	1.356
0.2416	2.268	0.071	1.386	1.9	1.999	1.689	1.346
0.25	2.253	0.071	1.381	1.9	1.999	1.674	1.318
0.2583	2.244	0.071	1.39	1.9	1.999	1.674	1.327
0.2666	2.235	0.071	1.386	1.9	1.999	1.674	1.308
0.275	2.221	0.071	1.386	1.9	1.999	1.674	1.308
0.2833	2.211	0.069	1.386	1.9	1.999	1.674	1.318
0.2916	2.202	0.069	1.376	1.9	1.999	1.674	1.318
0.3	2.197	0.071	1.381	1.9	1.999	1.674	1.308

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
0.3083	2.188	0.071	1.39	1.9	1.999	1.674	1.308
0.3166	2.178	0.071	1.386	1.9	1.999	1.674	1.308
0.325	2.169	0.069	1.381	1.9	1.996	1.674	1.337
0.3333	2.164	0.069	1.381	1.9	1.999	1.674	1.327
0.35	2.15	0.069	1.381	1.9	1.999	1.674	1.375
0.3666	2.136	0.069	1.376	1.9	1.999	1.658	1.365
0.3833	2.127	0.069	1.376	1.9	1.999	1.658	1.394
0.4	2.118	0.069	1.376	1.9	1.999	1.658	1.356
0.4166	2.103	0.071	1.371	1.9	1.999	1.658	1.356
0.4333	2.094	0.069	1.371	1.9	1.996	1.658	1.327
0.45	2.089	0.069	1.376	1.895	1.999	1.642	1.346
0.4666	2.075	0.069	1.376	1.9	1.999	1.642	1.327
0.4833	2.066	0.069	1.371	1.9	1.999	1.642	1.327
0.5	2.057	0.069	1.362	1.9	1.996	1.642	1.327
0.5166	2.047	0.069	1.367	1.895	1.999	1.642	1.318
0.5333	2.038	0.071	1.353	1.895	1.996	1.626	1.308
0.55	2.024	0.069	1.357	1.895	1.996	1.626	1.308
0.5666	2.014	0.069	1.362	1.895	1.996	1.626	1.318
0.5833	2.005	0.069	1.357	1.895	1.996	1.626	1.308
0.6	1.991	0.071	1.353	1.895	1.996	1.626	1.327
0.6166	1.982	0.069	1.353	1.895	1.996	1.626	1.365
0.6333	1.967	0.071	1.357	1.895	1.993	1.61	1.327
0.65	1.958	0.069	1.353	1.895	1.996	1.61	1.318
0.6666	1.949	0.071	1.343	1.895	1.996	1.61	1.308
0.6833	1.935	0.071	1.343	1.895	1.993	1.61	1.289
0.7	1.921	0.071	1.338	1.895	1.993	1.61	1.318
0.7166	1.911	0.069	1.338	1.895	1.996	1.61	1.299
0.7333	1.897	0.071	1.334	1.895	1.993	1.594	1.308
0.75	1.888	0.071	1.338	1.891	1.993	1.594	1.279
0.7666	1.874	0.071	1.334	1.895	1.993	1.594	1.299
0.7833	1.864	0.071	1.329	1.891	1.993	1.594	1.289
0.8	1.85	0.069	1.319	1.891	1.993	1.594	1.27
0.8166	1.841	0.071	1.324	1.891	1.993	1.594	1.27
0.8333	1.831	0.071	1.319	1.891	1.993	1.579	1.26
0.85	1.817	0.069	1.329	1.891	1.993	1.579	1.279
0.8666	1.808	0.071	1.319	1.891	1.99	1.579	1.251
0.8833	1.799	0.069	1.324	1.891	1.993	1.579	1.241
0.9	1.789	0.069	1.319	1.891	1.99	1.563	1.251
0.9166	1.775	0.069	1.31	1.891	1.99	1.563	1.279
0.9333	1.766	0.071	1.31	1.891	1.99	1.563	1.251
0.95	1.756	0.071	1.305	1.891	1.99	1.563	1.232
0.9666	1.747	0.069	1.301	1.891	1.99	1.563	1.232
0.9833	1.733	0.069	1.301	1.891	1.986	1.563	1.222
1	1.724	0.071	1.301	1.886	1.986	1.563	1.232
1.2	1.611	0.069	1.277	1.881	1.983	1.515	1.441
1.4	1.513	0.069	1.253	1.867	1.974	1.468	1.394
1.6	1.414	0.071	1.23	1.857	1.964	1.436	1.279
1.8	1.274	0.071	1.201	1.843	1.951	1.389	1.289
2	1.123	0.071	1.163	1.819	1.938	1.357	1.203
2.2	1.002	0.071	1.126	1.795	1.922	1.309	1.175
2.4	0.903	0.071	1.088	1.767	1.9	1.278	1.156
2.6	0.823	0.071	1.055	1.734	1.877	1.246	1.165
2.8	0.758	0.071	1.026	1.7	1.852	1.214	1.023
3	0.701	0.071	0.984	1.662	1.823	1.183	1.013
3.2	0.655	0.071	0.97	1.62	1.791	1.167	1.004
3.4	0.617	0.071	0.946	1.548	1.755	1.135	1.042
3.6	0.58	0.071	0.922	1.491	1.714	1.119	1.004
3.8	0.551	0.069	0.913	1.434	1.666	1.104	1.023
4	0.523	0.071	0.899	1.368	1.608	1.104	0.966
4.2	0.5	0.071	0.875	1.258	1.547	1.088	0.947
4.4	0.481	0.071	0.875	1.211	1.454	1.072	0.928
4.6	0.467	0.071	0.866	1.187	1.354	1.056	0.871
4.8	0.448	0.071	0.851	1.158	1.261	1.024	0.89
5	0.434	0.071	0.847	1.139	1.178	1.024	0.88
5.2	0.425	0.071	0.856	1.13	1.114	1.009	0.861

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
5.4	0.411	0.071	0.842	1.115	1.059	0.993	0.757
5.6	0.401	0.071	0.828	1.101	1.008	0.977	0.861
5.8	0.392	0.071	0.828	1.092	0.969	0.977	0.776
6	0.383	0.069	0.828	1.087	0.931	0.977	0.842
6.2	0.378	0.069	0.814	1.082	0.902	0.977	0.823
6.4	0.369	0.069	0.814	1.082	0.873	0.977	0.757
6.6	0.364	0.069	0.804	1.082	0.851	0.961	0.785
6.8	0.355	0.069	0.809	1.077	0.828	0.961	0.823
7	0.35	0.069	0.809	1.073	0.809	0.945	0.814
7.2	0.345	0.069	0.795	1.068	0.793	0.945	0.795
7.4	0.34	0.069	0.799	1.063	0.777	0.945	0.776
7.6	0.336	0.069	0.795	1.058	0.764	0.929	0.738
7.8	0.331	0.069	0.799	1.054	0.751	0.929	0.747
8	0.326	0.069	0.79	1.054	0.738	0.929	0.68
8.2	0.322	0.069	0.79	1.049	0.729	0.929	0.738
8.4	0.317	0.069	0.785	1.039	0.722	0.914	0.738
8.6	0.312	0.066	0.771	1.039	0.71	0.914	0.7
8.8	0.308	0.069	0.776	1.035	0.703	0.914	0.738
9	0.303	0.069	0.781	1.03	0.693	0.898	0.738
9.2	0.298	0.066	0.762	1.025	0.687	0.898	0.671
9.4	0.298	0.066	0.776	1.025	0.681	0.898	0.7
9.6	0.294	0.066	0.766	1.02	0.674	0.898	0.69
9.8	0.294	0.066	0.766	1.016	0.668	0.898	0.719
10	0.289	0.069	0.771	1.011	0.665	0.882	0.68
11	0.28	0.066	0.757	0.992	0.639	0.866	0.728
12	0.265	0.069	0.752	0.973	0.62	0.85	0.709
13	0.261	0.069	0.747	0.954	0.607	0.834	0.633
14	0.247	0.069	0.733	0.94	0.591	0.834	0.652
15	0.214	0.069	0.729	0.925	0.578	0.819	0.585
16	0.223	0.069	0.724	0.911	0.565	0.819	0.604
17	0.223	0.069	0.714	0.897	0.556	0.803	0.633
18	0.219	0.069	0.705	0.887	0.552	0.803	0.642
19	0.219	0.069	0.714	0.878	0.543	0.787	0.614
20	0.214	0.069	0.705	0.868	0.54	0.787	0.614
21	0.209	0.066	0.705	0.859	0.533	0.787	0.585
22	0.204	0.066	0.681	0.849	0.527	0.787	0.604
23	0.204	0.069	0.681	0.84	0.523	0.787	0.642
24	0.2	0.069	0.667	0.83	0.52	0.771	0.642
25	0.2	0.069	0.658	0.816	0.517	0.771	0.595
26	0.195	0.069	0.658	0.806	0.517	0.771	0.614
27	0.195	0.069	0.667	0.797	0.514	0.771	0.642
28	0.19	0.069	0.658	0.787	0.507	0.771	0.614
29	0.19	0.069	0.662	0.783	0.507	0.771	0.604
30	0.186	0.071	0.648	0.773	0.504	0.771	0.652
31	0.186	0.069	0.648	0.768	0.504	0.771	0.652
32	0.186	0.071	0.643	0.764	0.504	0.771	0.614
33	0.186	0.071	0.634	0.754	0.498	0.755	0.623
34	0.186	0.071	0.648	0.749	0.501	0.755	0.623
35	0.181	0.071	0.639	0.745	0.498	0.755	0.633
36	0.181	0.071	0.643	0.74	0.498	0.755	0.557
37	0.181	0.069	0.643	0.74	0.498	0.755	0.623
38	0.181	0.071	0.639	0.735	0.495	0.755	0.576
39	0.176	0.071	0.629	0.73	0.495	0.755	0.623
40	0.176	0.071	0.639	0.726	0.491	0.755	0.595
41	0.176	0.071	0.625	0.721	0.491	0.755	0.633
42	0.181	0.074	0.629	0.716	0.491	0.755	0.576
43	0.181	0.071	0.634	0.711	0.491	0.755	0.604
44	0.181	0.074	0.625	0.707	0.491	0.755	0.585
45	0.181	0.074	0.629	0.707	0.491	0.755	0.538
46	0.181	0.074	0.625	0.707	0.491	0.755	0.604
47	0.186	0.074	0.634	0.702	0.495	0.755	0.604
48	0.181	0.074	0.639	0.697	0.491	0.755	0.614
49	0.181	0.074	0.629	0.692	0.491	0.755	0.557
50	0.186	0.074	0.625	0.692	0.491	0.755	0.614
51	0.186	0.074	0.629	0.688	0.491	0.755	0.633

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
52	0.186	0.074	0.62	0.688	0.495	0.771	0.595
53	0.181	0.074	0.634	0.683	0.495	0.755	0.604
54	0.186	0.074	0.634	0.683	0.495	0.755	0.604
55	0.186	0.074	0.634	0.683	0.495	0.771	0.576
56	0.181	0.074	0.625	0.678	0.495	0.755	0.623
57	0.186	0.074	0.625	0.678	0.495	0.771	0.623
58	0.186	0.074	0.634	0.678	0.498	0.771	0.623
59	0.186	0.071	0.634	0.673	0.498	0.771	0.604
60	0.19	0.071	0.634	0.673	0.501	0.771	0.623
61	0.19	0.069	0.629	0.673	0.501	0.771	0.642
62	0.19	0.071	0.634	0.673	0.501	0.771	0.633
63	0.195	0.071	0.629	0.673	0.501	0.771	0.623
64	0.19	0.071	0.643	0.669	0.498	0.771	0.642
65	0.195	0.071	0.634	0.669	0.501	0.771	0.604
66	0.195	0.074	0.629	0.669	0.501	0.771	0.595
67	0.2	0.074	0.629	0.664	0.504	0.771	0.604
68	0.2	0.074	0.634	0.664	0.504	0.787	0.614
69	0.2	0.074	0.639	0.664	0.504	0.771	0.595
70	0.2	0.074	0.625	0.664	0.507	0.787	0.623
71	0.204	0.074	0.634	0.664	0.507	0.787	0.623
72	0.204	0.074	0.639	0.664	0.507	0.787	0.604
73	0.209	0.076	0.643	0.664	0.511	0.787	0.623
74	0.209	0.076	0.643	0.664	0.511	0.787	0.633
75	0.209	0.076	0.643	0.659	0.511	0.787	0.604
76	0.209	0.076	0.648	0.659	0.514	0.787	0.652
77	0.214	0.076	0.643	0.664	0.514	0.787	0.633
78	0.214	0.074	0.653	0.659	0.514	0.787	0.642
79	0.214	0.074	0.648	0.659	0.517	0.787	0.623
80	0.219	0.074	0.648	0.659	0.517	0.787	0.604
81	0.223	0.074	0.653	0.664	0.52	0.803	0.623
82	0.223	0.074	0.653	0.664	0.52	0.803	0.633
83	0.223	0.074	0.662	0.659	0.52	0.803	0.623
84	0.223	0.074	0.658	0.659	0.523	0.803	0.604
85	0.228	0.074	0.658	0.664	0.523	0.803	0.614
86	0.233	0.074	0.662	0.664	0.527	0.803	0.633
87	0.233	0.074	0.662	0.664	0.53	0.803	0.652
88	0.233	0.076	0.667	0.664	0.53	0.803	0.642
89	0.237	0.076	0.658	0.664	0.533	0.819	0.671
90	0.237	0.076	0.672	0.664	0.533	0.819	0.604
91	0.242	0.076	0.667	0.664	0.536	0.819	0.7
92	0.242	0.076	0.662	0.669	0.536	0.819	0.652
93	0.247	0.076	0.667	0.669	0.54	0.819	0.661
94	0.247	0.079	0.667	0.664	0.54	0.819	0.661
95	0.247	0.076	0.667	0.669	0.54	0.819	0.595
96	0.251	0.076	0.672	0.669	0.543	0.819	0.671
97	0.256	0.076	0.667	0.669	0.543	0.834	0.671
98	0.256	0.076	0.667	0.669	0.546	0.834	0.642
99	0.256	0.076	0.672	0.669	0.549	0.834	0.595
100	0.261	0.076	0.667	0.673	0.549	0.834	0.68
101	0.261	0.076	0.672	0.673	0.552	0.834	0.68
102	0.265	0.076	0.672	0.673	0.552	0.834	0.7
103	0.265	0.076	0.672	0.673	0.556	0.834	0.652
104	0.27	0.074	0.681	0.678	0.559	0.834	0.69
105	0.27	0.074	0.681	0.678	0.559	0.85	0.652
106	0.275	0.074	0.691	0.678	0.562	0.85	0.671
107	0.28	0.071	0.681	0.683	0.565	0.85	0.671
108	0.28	0.071	0.681	0.683	0.568	0.85	0.709
109	0.284	0.069	0.691	0.683	0.572	0.85	0.69
110	0.284	0.069	0.677	0.683	0.575	0.85	0.709
111	0.289	0.069	0.695	0.688	0.578	0.85	0.69
112	0.289	0.069	0.691	0.692	0.581	0.866	0.709
113	0.289	0.069	0.691	0.692	0.584	0.866	0.719
114	0.298	0.069	0.695	0.692	0.588	0.866	0.709
115	0.298	0.069	0.695	0.692	0.591	0.866	0.69
116	0.298	0.071	0.7	0.692	0.591	0.866	0.709

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
117	0.303	0.071	0.705	0.697	0.594	0.866	0.7
118	0.303	0.071	0.691	0.697	0.594	0.866	0.709
119	0.303	0.074	0.686	0.697	0.597	0.866	0.709
120	0.308	0.074	0.681	0.697	0.597	0.882	0.738
121	0.308	0.074	0.705	0.697	0.6	0.882	0.709
122	0.308	0.074	0.7	0.697	0.604	0.882	0.7
123	0.312	0.074	0.705	0.702	0.607	0.882	0.719
124	0.312	0.074	0.7	0.702	0.604	0.882	0.69
125	0.317	0.076	0.705	0.702	0.607	0.882	0.747
126	0.317	0.076	0.7	0.702	0.61	0.882	0.709
127	0.322	0.076	0.705	0.707	0.613	0.882	0.719
128	0.322	0.076	0.705	0.707	0.613	0.882	0.728
129	0.322	0.076	0.71	0.707	0.616	0.898	0.728
130	0.326	0.074	0.719	0.707	0.62	0.898	0.728
131	0.331	0.074	0.719	0.711	0.623	0.898	0.709
132	0.336	0.074	0.729	0.711	0.626	0.898	0.747
133	0.336	0.076	0.729	0.711	0.626	0.898	0.709
134	0.336	0.076	0.729	0.716	0.626	0.898	0.709
135	0.336	0.076	0.729	0.716	0.629	0.914	0.728
136	0.34	0.079	0.729	0.716	0.633	0.914	0.7
137	0.34	0.079	0.738	0.716	0.636	0.914	0.747
138	0.345	0.079	0.729	0.721	0.636	0.914	0.738
139	0.35	0.079	0.729	0.721	0.639	0.914	0.728
140	0.35	0.079	0.724	0.726	0.642	0.914	0.69
141	0.355	0.081	0.724	0.721	0.642	0.914	0.785
142	0.355	0.081	0.724	0.726	0.645	0.914	0.785
143	0.359	0.081	0.729	0.726	0.649	0.929	0.814
144	0.359	0.081	0.743	0.73	0.649	0.929	0.823
145	0.359	0.084	0.729	0.726	0.652	0.929	0.795
146	0.364	0.084	0.724	0.73	0.652	0.929	0.757
147	0.364	0.084	0.729	0.73	0.655	0.929	0.823
148	0.369	0.084	0.738	0.735	0.658	0.929	0.766
149	0.373	0.087	0.733	0.735	0.658	0.929	0.814
150	0.378	0.087	0.752	0.735	0.661	0.945	0.804
151	0.378	0.087	0.743	0.74	0.665	0.945	0.795
152	0.378	0.089	0.738	0.735	0.665	0.945	0.776
153	0.378	0.087	0.747	0.74	0.668	0.945	0.766
154	0.383	0.087	0.743	0.745	0.671	0.945	0.785
155	0.387	0.089	0.747	0.745	0.674	0.945	0.804
156	0.387	0.089	0.743	0.749	0.677	0.945	0.795
157	0.387	0.087	0.752	0.749	0.677	0.945	0.747
158	0.392	0.087	0.757	0.754	0.684	0.961	0.795
159	0.397	0.087	0.766	0.754	0.684	0.961	0.814
160	0.397	0.087	0.752	0.754	0.687	0.961	0.795
161	0.401	0.087	0.752	0.759	0.69	0.961	0.795
162	0.401	0.089	0.757	0.759	0.69	0.961	0.747
163	0.406	0.089	0.752	0.759	0.693	0.961	0.804
164	0.406	0.089	0.752	0.764	0.693	0.961	0.804
165	0.411	0.092	0.747	0.764	0.697	0.977	0.804
166	0.411	0.092	0.738	0.764	0.7	0.977	0.804
167	0.415	0.092	0.752	0.768	0.7	0.977	0.842
168	0.415	0.094	0.757	0.768	0.703	0.977	0.814
169	0.415	0.094	0.766	0.768	0.703	0.977	0.833
170	0.42	0.094	0.766	0.773	0.706	0.977	0.833
171	0.42	0.097	0.757	0.773	0.71	0.977	0.842
172	0.42	0.099	0.757	0.773	0.71	0.977	0.823
173	0.425	0.099	0.762	0.778	0.713	0.977	0.804
174	0.43	0.097	0.781	0.778	0.716	0.993	0.833
175	0.425	0.099	0.757	0.778	0.716	0.993	0.833
176	0.43	0.099	0.757	0.783	0.722	0.993	0.833
177	0.434	0.097	0.776	0.787	0.722	0.993	0.833
178	0.439	0.097	0.776	0.792	0.729	0.993	0.814
179	0.439	0.097	0.776	0.792	0.729	0.993	0.804
180	0.439	0.097	0.781	0.792	0.729	1.009	0.823
181	0.439	0.097	0.79	0.792	0.729	0.993	0.842

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
182	0.444	0.097	0.785	0.797	0.735	1.009	0.833
183	0.444	0.097	0.79	0.797	0.735	1.009	0.842
184	0.444	0.097	0.795	0.797	0.738	1.009	0.842
185	0.444	0.097	0.795	0.802	0.738	1.009	0.842
186	0.448	0.097	0.795	0.802	0.738	1.009	0.842
187	0.448	0.097	0.799	0.806	0.745	1.009	0.852
188	0.453	0.097	0.795	0.806	0.745	1.009	0.852
189	0.453	0.099	0.79	0.806	0.745	1.009	0.852
190	0.453	0.099	0.79	0.806	0.745	1.009	0.842
191	0.458	0.102	0.785	0.811	0.748	1.009	0.861
192	0.458	0.102	0.814	0.811	0.748	1.009	0.842
193	0.458	0.102	0.795	0.811	0.751	1.009	0.776
194	0.462	0.105	0.809	0.811	0.751	1.024	0.88
195	0.462	0.105	0.799	0.811	0.751	1.024	0.871
196	0.462	0.105	0.799	0.816	0.754	1.024	0.852
197	0.462	0.105	0.804	0.816	0.754	1.024	0.814
198	0.467	0.105	0.814	0.816	0.758	1.024	0.899
199	0.467	0.105	0.804	0.821	0.758	1.024	0.909
200	0.467	0.105	0.818	0.821	0.758	1.024	0.89
201	0.472	0.105	0.809	0.821	0.764	1.024	0.89
202	0.472	0.105	0.804	0.825	0.764	1.024	0.852
203	0.476	0.105	0.814	0.825	0.767	1.024	0.88
204	0.476	0.105	0.804	0.825	0.767	1.024	0.861
205	0.476	0.105	0.818	0.83	0.77	1.024	0.928
206	0.476	0.102	0.814	0.83	0.774	1.04	0.909
207	0.481	0.102	0.818	0.835	0.774	1.04	0.89
208	0.481	0.102	0.828	0.835	0.774	1.04	0.842
209	0.486	0.099	0.818	0.84	0.78	1.04	0.918
210	0.486	0.097	0.823	0.844	0.783	1.04	0.899
211	0.49	0.097	0.818	0.844	0.783	1.04	0.814
212	0.49	0.097	0.818	0.844	0.783	1.04	0.88
213	0.49	0.097	0.818	0.849	0.783	1.04	0.928
214	0.49	0.097	0.823	0.849	0.787	1.04	0.928
215	0.495	0.099	0.814	0.849	0.787	1.04	0.899
216	0.495	0.099	0.818	0.849	0.79	1.056	0.918
217	0.5	0.099	0.823	0.849	0.79	1.056	0.928
218	0.5	0.099	0.823	0.854	0.79	1.056	0.918
219	0.5	0.099	0.823	0.854	0.793	1.056	0.88
220	0.5	0.099	0.818	0.854	0.793	1.056	0.804
221	0.505	0.097	0.828	0.859	0.796	1.056	0.89
222	0.505	0.097	0.818	0.859	0.799	1.056	0.909
223	0.505	0.097	0.828	0.863	0.799	1.056	0.918
224	0.509	0.097	0.828	0.863	0.803	1.056	0.918
225	0.509	0.097	0.837	0.863	0.803	1.056	0.918
226	0.509	0.094	0.823	0.868	0.806	1.072	0.918
227	0.514	0.094	0.823	0.868	0.806	1.072	0.89
228	0.514	0.094	0.837	0.868	0.809	1.072	0.89
229	0.514	0.094	0.837	0.873	0.809	1.072	0.852
230	0.519	0.094	0.833	0.873	0.809	1.072	0.918
231	0.519	0.094	0.828	0.873	0.812	1.072	0.918
232	0.519	0.094	0.837	0.873	0.812	1.072	0.909
233	0.519	0.094	0.842	0.878	0.812	1.072	0.909
234	0.519	0.094	0.847	0.878	0.812	1.072	0.909
235	0.523	0.094	0.847	0.878	0.815	1.072	0.928
236	0.523	0.094	0.837	0.882	0.819	1.072	0.89
237	0.523	0.094	0.833	0.882	0.819	1.072	0.861
238	0.523	0.094	0.837	0.882	0.819	1.072	0.918
239	0.528	0.092	0.842	0.887	0.822	1.072	0.928
240	0.528	0.092	0.837	0.887	0.822	1.088	0.899
241	0.528	0.092	0.842	0.887	0.825	1.088	0.937
242	0.528	0.092	0.837	0.892	0.825	1.088	0.947
243	0.533	0.092	0.842	0.892	0.825	1.088	0.918
244	0.528	0.092	0.842	0.892	0.825	1.088	0.928
245	0.533	0.092	0.856	0.892	0.828	1.088	0.937
246	0.533	0.089	0.856	0.897	0.828	1.088	0.918

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
247	0.533	0.092	0.833	0.897	0.828	1.088	0.918
248	0.533	0.092	0.847	0.897	0.831	1.088	0.956
249	0.533	0.089	0.837	0.902	0.831	1.088	0.871
250	0.537	0.092	0.851	0.902	0.831	1.088	0.918
251	0.537	0.092	0.842	0.902	0.831	1.088	0.909
252	0.537	0.092	0.837	0.902	0.831	1.088	0.956
253	0.537	0.092	0.842	0.902	0.831	1.088	0.956
254	0.537	0.092	0.847	0.902	0.835	1.088	0.928
255	0.542	0.089	0.842	0.906	0.835	1.088	0.937
256	0.542	0.089	0.833	0.906	0.838	1.088	0.975
257	0.542	0.089	0.837	0.906	0.838	1.088	0.975
258	0.542	0.089	0.837	0.911	0.841	1.088	0.985
259	0.542	0.087	0.837	0.911	0.841	1.104	0.966
260	0.547	0.087	0.847	0.916	0.841	1.104	0.947
261	0.542	0.087	0.851	0.916	0.844	1.088	0.947
262	0.547	0.087	0.847	0.916	0.844	1.104	0.975
263	0.547	0.084	0.842	0.916	0.844	1.104	0.966
264	0.547	0.087	0.851	0.921	0.847	1.104	0.937
265	0.547	0.087	0.847	0.921	0.847	1.104	0.947
266	0.547	0.087	0.856	0.921	0.847	1.104	0.937
267	0.547	0.089	0.856	0.921	0.844	1.104	0.947
268	0.547	0.087	0.856	0.921	0.847	1.104	0.909
269	0.547	0.089	0.856	0.921	0.847	1.104	0.928
270	0.547	0.089	0.851	0.921	0.847	1.104	0.928
271	0.551	0.087	0.856	0.921	0.851	1.104	0.909
272	0.551	0.087	0.856	0.925	0.851	1.104	0.937
273	0.551	0.084	0.856	0.93	0.854	1.104	0.909
274	0.556	0.084	0.861	0.93	0.854	1.104	0.937
275	0.556	0.084	0.856	0.93	0.854	1.104	0.937
276	0.556	0.084	0.851	0.925	0.854	1.104	0.937
277	0.556	0.084	0.851	0.93	0.854	1.104	0.928
278	0.561	0.084	0.851	0.93	0.857	1.104	0.937
279	0.556	0.087	0.856	0.93	0.854	1.104	0.918
280	0.561	0.084	0.866	0.935	0.857	1.104	0.937
281	0.556	0.084	0.856	0.93	0.857	1.104	0.956
282	0.561	0.087	0.866	0.93	0.857	1.104	0.937
283	0.561	0.084	0.866	0.935	0.86	1.119	0.937
284	0.561	0.084	0.875	0.935	0.86	1.119	0.918
285	0.561	0.084	0.87	0.935	0.86	1.119	0.985
286	0.566	0.084	0.875	0.935	0.86	1.119	0.947
287	0.566	0.084	0.866	0.935	0.86	1.119	0.947
288	0.566	0.087	0.87	0.935	0.86	1.119	0.956
289	0.566	0.084	0.866	0.935	0.86	1.119	0.928
290	0.566	0.087	0.866	0.935	0.86	1.119	0.966
291	0.566	0.087	0.866	0.935	0.864	1.119	0.994
292	0.566	0.087	0.87	0.94	0.864	1.119	0.994
293	0.57	0.087	0.875	0.94	0.864	1.119	1.013
294	0.57	0.084	0.87	0.94	0.867	1.119	0.966
295	0.57	0.084	0.875	0.94	0.867	1.119	0.966
296	0.57	0.084	0.866	0.944	0.867	1.119	0.966
297	0.57	0.084	0.875	0.944	0.867	1.119	0.966
298	0.57	0.084	0.866	0.944	0.87	1.119	0.966
299	0.57	0.081	0.87	0.944	0.87	1.119	0.956
300	0.575	0.081	0.87	0.944	0.87	1.119	0.994
301	0.575	0.081	0.87	0.949	0.873	1.119	1.004
302	0.575	0.081	0.87	0.949	0.873	1.119	0.975
303	0.575	0.079	0.88	0.949	0.873	1.119	0.985
304	0.575	0.079	0.87	0.949	0.873	1.119	0.947
305	0.575	0.079	0.88	0.949	0.873	1.119	1.032
306	0.575	0.079	0.87	0.949	0.873	1.119	0.975
307	0.575	0.079	0.866	0.954	0.873	1.119	0.975
308	0.575	0.079	0.87	0.954	0.876	1.119	0.994
309	0.575	0.079	0.875	0.954	0.876	1.119	1.004
310	0.575	0.079	0.875	0.954	0.876	1.119	0.956
311	0.575	0.079	0.88	0.954	0.876	1.119	0.975

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
312	0.575	0.079	0.88	0.959	0.876	1.135	0.985
313	0.58	0.076	0.88	0.959	0.88	1.135	0.966
314	0.575	0.076	0.875	0.959	0.88	1.135	0.947
315	0.575	0.076	0.885	0.959	0.88	1.135	1.013
316	0.575	0.076	0.866	0.959	0.876	1.119	1.023
317	0.575	0.079	0.88	0.959	0.876	1.119	0.966
318	0.575	0.079	0.88	0.959	0.876	1.135	0.985
319	0.575	0.081	0.875	0.959	0.876	1.135	0.918
320	0.575	0.081	0.885	0.959	0.876	1.135	0.947
321	0.575	0.081	0.885	0.959	0.876	1.119	0.985
322	0.575	0.081	0.875	0.959	0.876	1.135	0.975
323	0.575	0.079	0.866	0.959	0.876	1.135	0.975
324	0.575	0.079	0.88	0.959	0.876	1.135	0.975
325	0.575	0.079	0.885	0.959	0.876	1.119	0.975
326	0.575	0.079	0.889	0.959	0.876	1.119	0.966
327	0.575	0.079	0.875	0.959	0.876	1.119	0.956
328	0.575	0.079	0.885	0.959	0.876	1.119	0.947
329	0.575	0.079	0.87	0.959	0.876	1.135	0.947
330	0.58	0.081	0.885	0.959	0.876	1.119	0.956
331	0.575	0.081	0.894	0.959	0.876	1.119	0.966
332	0.575	0.084	0.875	0.959	0.876	1.135	0.985
333	0.58	0.084	0.885	0.959	0.873	1.119	0.966
334	0.575	0.084	0.885	0.959	0.873	1.135	0.947
335	0.575	0.084	0.885	0.959	0.873	1.135	0.956
336	0.575	0.084	0.889	0.959	0.876	1.135	0.985
337	0.575	0.084	0.875	0.959	0.876	1.119	0.947
338	0.58	0.084	0.87	0.959	0.876	1.135	0.947
339	0.58	0.084	0.88	0.959	0.876	1.119	0.975
340	0.575	0.084	0.875	0.959	0.876	1.135	0.947
341	0.58	0.087	0.88	0.959	0.876	1.135	0.966
342	0.58	0.087	0.885	0.959	0.876	1.135	0.947
343	0.58	0.087	0.88	0.959	0.876	1.135	0.899
344	0.58	0.087	0.889	0.959	0.876	1.135	0.966
345	0.58	0.084	0.885	0.963	0.876	1.135	0.966
346	0.58	0.084	0.889	0.963	0.88	1.135	0.928
347	0.58	0.084	0.885	0.963	0.88	1.135	0.947
348	0.58	0.084	0.875	0.963	0.88	1.135	0.956
349	0.58	0.084	0.885	0.963	0.88	1.135	0.89
350	0.58	0.087	0.885	0.963	0.876	1.135	0.937
351	0.58	0.087	0.889	0.963	0.876	1.135	0.918
352	0.575	0.087	0.889	0.963	0.876	1.135	0.937
353	0.575	0.089	0.889	0.959	0.876	1.135	0.947
354	0.575	0.089	0.87	0.959	0.873	1.119	0.899
355	0.575	0.092	0.87	0.959	0.873	1.119	0.909
356	0.57	0.092	0.875	0.959	0.873	1.119	0.918
357	0.57	0.092	0.875	0.959	0.873	1.119	0.947
358	0.57	0.092	0.87	0.959	0.873	1.119	0.918
359	0.57	0.089	0.875	0.959	0.873	1.119	0.918
360	0.57	0.089	0.866	0.963	0.873	1.119	0.966
361	0.57	0.089	0.875	0.963	0.873	1.119	0.88
362	0.57	0.089	0.875	0.963	0.876	1.119	0.909
363	0.57	0.089	0.87	0.963	0.873	1.119	0.937
364	0.57	0.089	0.875	0.963	0.873	1.119	0.918
365	0.57	0.089	0.87	0.963	0.873	1.119	0.947
366	0.57	0.089	0.861	0.963	0.873	1.119	0.937
367	0.57	0.087	0.856	0.963	0.873	1.119	0.937
368	0.57	0.087	0.861	0.963	0.873	1.119	0.89
369	0.57	0.087	0.861	0.963	0.873	1.119	0.918
370	0.57	0.087	0.856	0.968	0.873	1.119	0.89
371	0.57	0.087	0.866	0.968	0.873	1.119	0.899
372	0.57	0.087	0.856	0.963	0.873	1.119	0.937
373	0.566	0.087	0.866	0.963	0.873	1.119	0.909
374	0.566	0.087	0.861	0.963	0.87	1.119	0.909
375	0.566	0.087	0.856	0.963	0.87	1.119	0.899
376	0.566	0.087	0.856	0.963	0.87	1.119	0.89

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
377	0.566	0.087	0.856	0.963	0.87	1.119	0.909
378	0.561	0.087	0.866	0.963	0.867	1.119	0.861
379	0.561	0.089	0.87	0.963	0.867	1.119	0.928
380	0.561	0.089	0.861	0.963	0.867	1.119	0.937
381	0.561	0.089	0.866	0.963	0.864	1.119	0.909
382	0.561	0.092	0.861	0.959	0.864	1.104	0.918
383	0.556	0.089	0.861	0.959	0.864	1.119	0.918
384	0.556	0.089	0.87	0.959	0.864	1.119	0.909
385	0.556	0.089	0.861	0.959	0.864	1.104	0.88
386	0.556	0.089	0.851	0.963	0.864	1.104	0.804
387	0.556	0.087	0.87	0.963	0.864	1.104	0.899
388	0.556	0.087	0.866	0.963	0.864	1.104	0.899
389	0.556	0.084	0.856	0.963	0.864	1.104	0.937
390	0.556	0.084	0.861	0.963	0.864	1.104	0.871
391	0.556	0.081	0.866	0.968	0.864	1.104	0.852
392	0.556	0.084	0.861	0.968	0.864	1.104	0.871
393	0.551	0.081	0.87	0.968	0.864	1.104	0.918
394	0.551	0.081	0.851	0.963	0.864	1.104	0.928
395	0.551	0.081	0.856	0.968	0.86	1.104	0.899
396	0.551	0.081	0.856	0.963	0.86	1.104	0.861
397	0.551	0.081	0.856	0.963	0.86	1.104	0.89
398	0.551	0.081	0.861	0.963	0.857	1.104	0.852
399	0.551	0.081	0.866	0.963	0.857	1.104	0.928
400	0.551	0.079	0.866	0.963	0.857	1.104	0.88
401	0.547	0.079	0.866	0.963	0.857	1.104	0.909
402	0.547	0.079	0.851	0.963	0.857	1.104	0.909
403	0.547	0.079	0.866	0.963	0.854	1.104	0.899
404	0.547	0.079	0.861	0.963	0.854	1.104	0.89
405	0.547	0.079	0.856	0.963	0.854	1.104	0.89
406	0.547	0.076	0.856	0.963	0.857	1.104	0.899
407	0.547	0.076	0.861	0.963	0.857	1.104	0.899
408	0.547	0.076	0.861	0.963	0.854	1.104	0.88
409	0.551	0.074	0.847	0.963	0.854	1.104	0.89
410	0.547	0.076	0.856	0.963	0.854	1.104	0.89
411	0.547	0.074	0.866	0.963	0.854	1.104	0.909
412	0.547	0.074	0.861	0.963	0.854	1.104	0.852
413	0.547	0.076	0.856	0.963	0.854	1.104	0.88
414	0.547	0.076	0.847	0.963	0.854	1.104	0.918
415	0.547	0.074	0.847	0.963	0.854	1.104	0.918
416	0.547	0.074	0.856	0.963	0.854	1.104	0.918
417	0.547	0.074	0.856	0.963	0.854	1.104	0.918
418	0.547	0.074	0.856	0.963	0.854	1.104	0.88
419	0.547	0.074	0.861	0.963	0.854	1.104	0.909
420	0.547	0.074	0.851	0.963	0.851	1.104	0.861
421	0.547	0.074	0.856	0.959	0.851	1.104	0.956
422	0.547	0.074	0.851	0.959	0.851	1.104	0.89
423	0.547	0.074	0.851	0.959	0.851	1.104	0.899
424	0.542	0.074	0.856	0.959	0.847	1.104	0.918
425	0.542	0.076	0.861	0.954	0.847	1.104	0.804
426	0.542	0.076	0.847	0.954	0.847	1.104	0.89
427	0.542	0.076	0.847	0.954	0.844	1.104	0.89
428	0.542	0.076	0.866	0.954	0.844	1.088	0.871
429	0.542	0.079	0.856	0.954	0.844	1.088	0.89
430	0.542	0.079	0.851	0.949	0.844	1.088	0.785
431	0.537	0.081	0.856	0.949	0.841	1.088	0.88
432	0.537	0.084	0.861	0.949	0.838	1.088	0.852
433	0.537	0.084	0.851	0.944	0.838	1.088	0.871
434	0.537	0.087	0.851	0.944	0.835	1.088	0.795
435	0.537	0.087	0.842	0.944	0.835	1.088	0.852
436	0.537	0.087	0.842	0.944	0.835	1.088	0.89
437	0.537	0.087	0.847	0.94	0.835	1.088	0.852
438	0.537	0.087	0.851	0.94	0.838	1.088	0.89
439	0.537	0.087	0.851	0.94	0.838	1.088	0.852
440	0.537	0.087	0.842	0.944	0.838	1.088	0.899
441	0.537	0.087	0.847	0.944	0.838	1.088	0.852

ORIG.	J. Novick	DATE	9/28/95
CHK'D BY	[illegible]	DATE	10/2/95
CALC. NO.	321-G-002		
REV. NO.	0	SHEET NO.	A1-37 of 52

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
442	0.533	0.084	0.851	0.944	0.838	1.088	0.89
443	0.533	0.084	0.847	0.944	0.838	1.088	0.89
444	0.533	0.084	0.842	0.944	0.838	1.088	0.88
445	0.533	0.084	0.847	0.944	0.838	1.088	0.89
446	0.533	0.084	0.837	0.944	0.838	1.088	0.89
447	0.528	0.081	0.837	0.944	0.835	1.088	0.899
448	0.528	0.081	0.842	0.944	0.838	1.088	0.89
449	0.528	0.081	0.833	0.944	0.838	1.088	0.89
450	0.528	0.079	0.833	0.944	0.838	1.088	0.871
451	0.523	0.079	0.842	0.944	0.838	1.088	0.899
452	0.523	0.079	0.842	0.944	0.835	1.072	0.918
453	0.523	0.079	0.842	0.944	0.835	1.072	0.852
454	0.523	0.079	0.842	0.944	0.835	1.072	0.871
455	0.519	0.076	0.833	0.944	0.831	1.072	0.861
456	0.519	0.076	0.842	0.944	0.831	1.072	0.871
457	0.519	0.076	0.833	0.944	0.831	1.072	0.909
458	0.519	0.076	0.837	0.944	0.831	1.072	0.871
459	0.514	0.076	0.828	0.944	0.828	1.072	0.861
460	0.514	0.074	0.842	0.944	0.828	1.072	0.918
461	0.514	0.074	0.828	0.944	0.828	1.072	0.88
462	0.514	0.074	0.837	0.94	0.825	1.072	0.852
463	0.509	0.074	0.842	0.94	0.825	1.072	0.918
464	0.509	0.074	0.828	0.94	0.825	1.072	0.89
465	0.509	0.074	0.828	0.94	0.822	1.072	0.88
466	0.509	0.071	0.837	0.94	0.822	1.056	0.833
467	0.509	0.074	0.833	0.94	0.822	1.072	0.861
468	0.505	0.074	0.823	0.94	0.819	1.056	0.861
469	0.505	0.074	0.828	0.935	0.815	1.056	0.833
470	0.505	0.074	0.818	0.935	0.815	1.056	0.814
471	0.505	0.074	0.842	0.935	0.815	1.056	0.871
472	0.505	0.074	0.833	0.935	0.812	1.056	0.823
473	0.505	0.074	0.823	0.935	0.812	1.056	0.833
474	0.505	0.074	0.828	0.93	0.812	1.056	0.871
475	0.505	0.074	0.823	0.93	0.812	1.056	0.833
476	0.505	0.074	0.828	0.93	0.812	1.056	0.871
477	0.505	0.071	0.818	0.93	0.812	1.056	0.88
478	0.505	0.071	0.823	0.93	0.812	1.056	0.861
479	0.505	0.071	0.833	0.93	0.812	1.056	0.871
480	0.505	0.071	0.818	0.93	0.812	1.056	0.842
481	0.505	0.069	0.818	0.93	0.812	1.056	0.899
482	0.505	0.069	0.828	0.93	0.812	1.056	0.871
483	0.505	0.069	0.823	0.93	0.812	1.056	0.852
484	0.505	0.069	0.814	0.93	0.812	1.056	0.852
485	0.505	0.069	0.814	0.93	0.812	1.056	0.833
486	0.505	0.069	0.828	0.925	0.809	1.056	0.871
487	0.505	0.069	0.828	0.925	0.809	1.056	0.842
488	0.5	0.069	0.818	0.925	0.809	1.056	0.823
489	0.5	0.069	0.828	0.925	0.806	1.056	0.861
490	0.505	0.069	0.823	0.925	0.806	1.056	0.861
491	0.5	0.069	0.818	0.925	0.806	1.056	0.899
492	0.5	0.069	0.818	0.921	0.806	1.056	0.842
493	0.5	0.069	0.823	0.921	0.806	1.056	0.814
494	0.5	0.066	0.818	0.925	0.806	1.056	0.823
495	0.5	0.066	0.823	0.921	0.806	1.056	0.88
496	0.5	0.066	0.818	0.925	0.809	1.056	0.89
497	0.505	0.064	0.818	0.925	0.809	1.056	0.842
498	0.505	0.064	0.814	0.925	0.809	1.056	0.842
499	0.505	0.064	0.814	0.925	0.809	1.056	0.861
500	0.505	0.061	0.833	0.925	0.809	1.056	0.804
501	0.505	0.064	0.828	0.925	0.809	1.056	0.814
502	0.505	0.064	0.818	0.925	0.809	1.056	0.852
503	0.5	0.064	0.828	0.921	0.806	1.056	0.795
504	0.5	0.064	0.818	0.921	0.809	1.056	0.861
505	0.5	0.061	0.814	0.921	0.809	1.056	0.861
506	0.5	0.061	0.828	0.921	0.809	1.056	0.88

ORIG.	J. Novick	DATE	9/28/95
CHK'D BY	MAB	DATE	10/2/95
CALC. NO.	321-G-002		
REV. NO.	0	SHEET NO.	A1-38 of 52

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
507	0.5	0.061	0.828	0.921	0.809	1.056	0.899
508	0.5	0.058	0.823	0.921	0.809	1.056	0.804
509	0.5	0.058	0.818	0.925	0.809	1.056	0.871
510	0.5	0.058	0.804	0.925	0.809	1.056	0.871
511	0.5	0.058	0.818	0.921	0.809	1.056	0.89
512	0.5	0.056	0.823	0.921	0.809	1.056	0.871
513	0.5	0.056	0.823	0.921	0.809	1.056	0.852
514	0.5	0.056	0.818	0.921	0.806	1.056	0.871
515	0.5	0.056	0.823	0.921	0.806	1.056	0.814
516	0.5	0.056	0.814	0.921	0.806	1.056	0.861
517	0.5	0.056	0.818	0.921	0.806	1.056	0.852
518	0.5	0.056	0.809	0.921	0.806	1.056	0.861
519	0.5	0.056	0.799	0.921	0.806	1.056	0.842
520	0.5	0.056	0.837	0.921	0.803	1.056	0.861
521	0.5	0.058	0.814	0.916	0.803	1.056	0.852
522	0.5	0.058	0.818	0.916	0.803	1.056	0.861
523	0.5	0.058	0.828	0.916	0.803	1.056	0.861
524	0.5	0.058	0.823	0.916	0.803	1.056	0.871
525	0.495	0.058	0.823	0.916	0.803	1.056	0.89
526	0.5	0.058	0.823	0.916	0.803	1.056	0.861
527	0.5	0.058	0.823	0.916	0.803	1.056	0.861
528	0.495	0.056	0.818	0.916	0.803	1.056	0.842
529	0.495	0.056	0.823	0.916	0.803	1.056	0.88
530	0.5	0.056	0.809	0.916	0.803	1.056	0.842
531	0.495	0.056	0.814	0.916	0.803	1.056	0.861
532	0.5	0.053	0.818	0.916	0.803	1.056	0.861
533	0.495	0.053	0.818	0.916	0.803	1.056	0.842
534	0.5	0.053	0.814	0.916	0.803	1.056	0.842
535	0.495	0.053	0.823	0.916	0.803	1.056	0.814
536	0.495	0.053	0.818	0.916	0.803	1.056	0.861
537	0.495	0.053	0.828	0.916	0.803	1.056	0.833
538	0.495	0.053	0.823	0.916	0.799	1.056	0.852
539	0.495	0.053	0.823	0.916	0.799	1.056	0.842
540	0.495	0.053	0.818	0.911	0.799	1.056	0.804
541	0.495	0.053	0.823	0.911	0.799	1.056	0.852
542	0.495	0.053	0.823	0.911	0.799	1.056	0.842
543	0.495	0.053	0.814	0.911	0.799	1.056	0.833
544	0.495	0.053	0.823	0.911	0.799	1.056	0.861
545	0.495	0.053	0.809	0.911	0.799	1.056	0.833
546	0.495	0.053	0.809	0.911	0.799	1.056	0.804
547	0.495	0.053	0.814	0.911	0.799	1.04	0.852
548	0.495	0.053	0.818	0.911	0.799	1.04	0.852
549	0.495	0.056	0.809	0.911	0.796	1.056	0.852
550	0.495	0.056	0.814	0.906	0.796	1.056	0.823
551	0.495	0.056	0.814	0.906	0.796	1.056	0.823
552	0.49	0.056	0.814	0.906	0.796	1.04	0.776
553	0.49	0.056	0.809	0.906	0.793	1.04	0.842
554	0.49	0.056	0.804	0.906	0.793	1.04	0.823
555	0.49	0.056	0.809	0.906	0.793	1.04	0.814
556	0.49	0.058	0.814	0.906	0.793	1.04	0.852
557	0.49	0.058	0.818	0.902	0.793	1.04	0.871
558	0.49	0.058	0.799	0.902	0.79	1.04	0.899
559	0.486	0.058	0.795	0.902	0.79	1.04	0.852
560	0.486	0.058	0.795	0.902	0.79	1.04	0.852
561	0.486	0.058	0.79	0.902	0.79	1.04	0.861
562	0.486	0.058	0.799	0.902	0.79	1.04	0.814
563	0.486	0.058	0.804	0.902	0.79	1.04	0.852
564	0.486	0.058	0.804	0.902	0.79	1.04	0.823
565	0.486	0.058	0.809	0.902	0.79	1.04	0.776
566	0.486	0.058	0.799	0.902	0.79	1.04	0.823
567	0.486	0.058	0.799	0.897	0.79	1.04	0.842
568	0.486	0.058	0.809	0.897	0.79	1.04	0.842
569	0.486	0.061	0.799	0.897	0.787	1.04	0.852
570	0.486	0.061	0.799	0.897	0.787	1.04	0.842
571	0.486	0.061	0.799	0.897	0.787	1.04	0.861

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
572	0.486	0.061	0.795	0.897	0.787	1.04	0.852
573	0.486	0.058	0.795	0.897	0.787	1.04	0.842
574	0.486	0.058	0.804	0.897	0.787	1.04	0.823
575	0.486	0.058	0.799	0.897	0.79	1.04	0.823
576	0.486	0.058	0.799	0.902	0.79	1.04	0.823
577	0.486	0.056	0.799	0.897	0.79	1.04	0.833
578	0.486	0.058	0.804	0.897	0.79	1.04	0.833
579	0.486	0.058	0.795	0.897	0.787	1.04	0.833
580	0.486	0.058	0.799	0.897	0.787	1.04	0.823
581	0.486	0.058	0.79	0.897	0.787	1.04	0.795
582	0.486	0.058	0.795	0.897	0.787	1.04	0.861
583	0.486	0.058	0.79	0.897	0.787	1.04	0.833
584	0.486	0.058	0.804	0.897	0.787	1.04	0.833
585	0.486	0.058	0.781	0.897	0.787	1.04	0.871
586	0.486	0.058	0.785	0.897	0.787	1.04	0.833
587	0.481	0.058	0.79	0.897	0.787	1.04	0.795
588	0.481	0.058	0.785	0.897	0.787	1.04	0.823
589	0.481	0.058	0.79	0.897	0.787	1.04	0.852
590	0.481	0.058	0.795	0.897	0.787	1.04	0.823
591	0.481	0.058	0.795	0.897	0.787	1.04	0.833
592	0.481	0.058	0.799	0.897	0.783	1.04	0.766
593	0.481	0.058	0.79	0.897	0.783	1.04	0.804
594	0.481	0.058	0.799	0.897	0.783	1.04	0.823
595	0.481	0.056	0.799	0.897	0.783	1.04	0.766
596	0.481	0.056	0.776	0.897	0.783	1.04	0.814
597	0.481	0.056	0.79	0.897	0.783	1.04	0.814
598	0.481	0.053	0.785	0.897	0.787	1.04	0.833
599	0.481	0.053	0.795	0.897	0.787	1.04	0.804
600	0.481	0.051	0.795	0.897	0.787	1.04	0.785
601	0.481	0.051	0.799	0.902	0.787	1.04	0.842
602	0.481	0.051	0.799	0.897	0.787	1.04	0.833
603	0.481	0.051	0.795	0.897	0.787	1.04	0.776
604	0.481	0.051	0.795	0.897	0.787	1.04	0.804
605	0.481	0.051	0.785	0.897	0.783	1.04	0.795
606	0.481	0.051	0.799	0.897	0.783	1.04	0.823
607	0.481	0.051	0.795	0.897	0.783	1.04	0.795
608	0.481	0.051	0.795	0.897	0.783	1.04	0.795
609	0.481	0.053	0.795	0.897	0.783	1.04	0.804
610	0.481	0.053	0.804	0.897	0.783	1.04	0.804
611	0.481	0.053	0.79	0.892	0.783	1.04	0.785
612	0.481	0.053	0.799	0.892	0.78	1.04	0.833
613	0.481	0.056	0.795	0.892	0.78	1.04	0.795
614	0.481	0.056	0.795	0.892	0.78	1.04	0.785
615	0.481	0.056	0.785	0.892	0.78	1.04	0.804
616	0.481	0.056	0.799	0.892	0.78	1.04	0.804
617	0.481	0.053	0.799	0.892	0.78	1.04	0.842
618	0.481	0.056	0.785	0.892	0.783	1.04	0.871
619	0.481	0.053	0.795	0.892	0.783	1.04	0.785
620	0.481	0.053	0.785	0.892	0.783	1.04	0.861
621	0.481	0.056	0.781	0.892	0.783	1.04	0.852
622	0.481	0.056	0.79	0.892	0.783	1.04	0.833
623	0.481	0.056	0.795	0.892	0.78	1.04	0.795
624	0.481	0.056	0.785	0.892	0.783	1.04	0.861
625	0.481	0.056	0.776	0.892	0.78	1.04	0.804
626	0.481	0.056	0.79	0.892	0.78	1.04	0.823
627	0.481	0.056	0.785	0.892	0.78	1.04	0.814
628	0.481	0.056	0.79	0.892	0.78	1.04	0.833
629	0.481	0.056	0.781	0.892	0.78	1.04	0.842
630	0.481	0.056	0.781	0.892	0.78	1.04	0.842
631	0.481	0.056	0.79	0.892	0.78	1.04	0.814
632	0.481	0.056	0.781	0.892	0.78	1.04	0.823
633	0.481	0.056	0.785	0.887	0.78	1.04	0.823
634	0.481	0.056	0.785	0.887	0.78	1.04	0.833
635	0.481	0.058	0.781	0.887	0.78	1.04	0.833
636	0.481	0.058	0.795	0.887	0.78	1.04	0.814

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
637	0.481	0.061	0.781	0.887	0.777	1.04	0.814
638	0.481	0.061	0.776	0.887	0.777	1.04	0.795
639	0.481	0.061	0.795	0.882	0.777	1.04	0.861
640	0.481	0.064	0.785	0.882	0.777	1.024	0.823
641	0.481	0.064	0.776	0.882	0.777	1.024	0.814
642	0.481	0.064	0.785	0.882	0.777	1.024	0.823
643	0.476	0.066	0.785	0.882	0.777	1.024	0.785
644	0.476	0.066	0.785	0.882	0.777	1.024	0.833
645	0.476	0.066	0.785	0.882	0.777	1.024	0.823
646	0.476	0.066	0.771	0.882	0.777	1.04	0.823
647	0.476	0.066	0.771	0.882	0.777	1.024	0.861
648	0.481	0.066	0.785	0.882	0.777	1.024	0.861
649	0.481	0.066	0.781	0.882	0.777	1.024	0.842
650	0.481	0.066	0.781	0.882	0.777	1.04	0.823
651	0.481	0.064	0.79	0.882	0.777	1.04	0.852
652	0.481	0.066	0.785	0.882	0.78	1.024	0.795
653	0.481	0.066	0.795	0.882	0.777	1.04	0.823
654	0.481	0.066	0.785	0.882	0.78	1.04	0.804
655	0.481	0.066	0.79	0.882	0.78	1.024	0.842
656	0.481	0.066	0.79	0.882	0.777	1.04	0.823
657	0.481	0.069	0.776	0.882	0.777	1.04	0.823
658	0.481	0.069	0.776	0.882	0.777	1.04	0.804
659	0.481	0.069	0.785	0.882	0.777	1.04	0.842
660	0.481	0.069	0.776	0.882	0.777	1.024	0.833
661	0.476	0.071	0.776	0.882	0.777	1.024	0.738
662	0.476	0.071	0.771	0.882	0.777	1.04	0.833
663	0.476	0.069	0.776	0.882	0.777	1.024	0.852
664	0.481	0.069	0.781	0.882	0.777	1.04	0.814
665	0.481	0.069	0.781	0.882	0.78	1.024	0.804
666	0.481	0.066	0.781	0.882	0.78	1.024	0.852
667	0.481	0.066	0.79	0.887	0.78	1.04	0.833
668	0.481	0.066	0.776	0.887	0.78	1.024	0.842
669	0.481	0.069	0.781	0.882	0.78	1.04	0.852
670	0.481	0.069	0.785	0.882	0.78	1.024	0.842
671	0.481	0.069	0.781	0.882	0.777	1.04	0.823
672	0.481	0.069	0.804	0.882	0.78	1.04	0.776
673	0.481	0.069	0.776	0.882	0.777	1.024	0.852
674	0.481	0.069	0.781	0.882	0.78	1.04	0.766
675	0.481	0.071	0.79	0.882	0.777	1.04	0.852
676	0.481	0.071	0.79	0.882	0.78	1.024	0.804
677	0.481	0.071	0.771	0.882	0.777	1.04	0.861
678	0.481	0.071	0.771	0.882	0.78	1.024	0.757
679	0.481	0.071	0.785	0.882	0.78	1.04	0.747
680	0.481	0.071	0.771	0.882	0.78	1.04	0.823
681	0.481	0.071	0.785	0.882	0.78	1.04	0.833
682	0.481	0.071	0.781	0.882	0.78	1.04	0.823
683	0.481	0.071	0.771	0.882	0.78	1.04	0.861
684	0.481	0.071	0.776	0.887	0.78	1.04	0.842
685	0.481	0.071	0.781	0.882	0.78	1.04	0.842
686	0.486	0.069	0.795	0.887	0.78	1.04	0.861
687	0.486	0.071	0.785	0.887	0.78	1.04	0.899
688	0.486	0.069	0.795	0.887	0.783	1.04	0.871
689	0.486	0.071	0.785	0.887	0.78	1.04	0.861
690	0.486	0.071	0.785	0.887	0.783	1.04	0.861
691	0.486	0.071	0.79	0.887	0.783	1.04	0.804
692	0.486	0.071	0.795	0.887	0.783	1.04	0.89
693	0.486	0.071	0.785	0.882	0.78	1.04	0.871
694	0.486	0.074	0.79	0.882	0.78	1.04	0.89
695	0.486	0.074	0.79	0.882	0.78	1.04	0.861
696	0.486	0.076	0.785	0.882	0.78	1.04	0.871
697	0.486	0.076	0.781	0.882	0.78	1.04	0.833
698	0.486	0.076	0.795	0.882	0.78	1.04	0.814
699	0.486	0.076	0.776	0.882	0.78	1.04	0.88
700	0.486	0.076	0.785	0.882	0.78	1.04	0.871
701	0.486	0.076	0.785	0.882	0.783	1.04	0.88

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
702	0.486	0.076	0.781	0.887	0.783	1.04	0.871
703	0.486	0.076	0.781	0.887	0.783	1.04	0.833
704	0.486	0.076	0.79	0.887	0.783	1.04	0.88
705	0.486	0.076	0.79	0.887	0.783	1.04	0.88
706	0.486	0.076	0.781	0.887	0.783	1.04	0.899
707	0.486	0.079	0.79	0.887	0.783	1.04	0.88
708	0.49	0.079	0.785	0.882	0.783	1.04	0.88
709	0.49	0.079	0.771	0.882	0.783	1.04	0.871
710	0.486	0.079	0.785	0.887	0.783	1.04	0.909
711	0.486	0.079	0.776	0.887	0.783	1.04	0.88
712	0.49	0.079	0.776	0.887	0.787	1.04	0.89
713	0.49	0.079	0.79	0.887	0.783	1.04	0.89
714	0.49	0.079	0.776	0.887	0.787	1.04	0.88
715	0.49	0.079	0.781	0.887	0.783	1.04	0.871
716	0.486	0.081	0.781	0.887	0.783	1.04	0.88
717	0.486	0.081	0.781	0.887	0.783	1.04	0.89
718	0.486	0.084	0.776	0.882	0.783	1.04	0.89
719	0.486	0.084	0.781	0.882	0.783	1.04	0.861
720	0.486	0.087	0.79	0.882	0.78	1.04	0.918
721	0.486	0.087	0.785	0.882	0.78	1.04	0.861
722	0.486	0.087	0.785	0.882	0.78	1.04	0.918
723	0.486	0.089	0.781	0.878	0.78	1.04	0.89
724	0.486	0.089	0.785	0.878	0.78	1.04	0.88
725	0.486	0.089	0.785	0.878	0.78	1.04	0.814
726	0.486	0.089	0.785	0.882	0.78	1.04	0.861
727	0.486	0.092	0.785	0.878	0.78	1.04	0.871
728	0.486	0.092	0.776	0.882	0.78	1.04	0.89
729	0.486	0.092	0.771	0.878	0.78	1.04	0.89
730	0.486	0.092	0.776	0.878	0.78	1.04	0.909
731	0.486	0.092	0.79	0.878	0.78	1.04	0.909
732	0.486	0.094	0.785	0.878	0.78	1.04	0.842
733	0.486	0.094	0.776	0.882	0.78	1.04	0.899
734	0.49	0.094	0.776	0.882	0.783	1.04	0.909
735	0.49	0.094	0.781	0.882	0.783	1.04	0.899
736	0.49	0.094	0.785	0.882	0.783	1.04	0.928
737	0.49	0.094	0.781	0.882	0.783	1.04	0.88
738	0.49	0.097	0.79	0.878	0.783	1.04	0.909
739	0.49	0.097	0.781	0.882	0.783	1.04	0.88
740	0.49	0.097	0.785	0.882	0.783	1.04	0.928
741	0.49	0.097	0.799	0.882	0.783	1.04	0.89
742	0.49	0.099	0.79	0.882	0.783	1.04	0.89
743	0.49	0.099	0.79	0.882	0.783	1.04	0.88
744	0.49	0.099	0.785	0.882	0.783	1.04	0.88
745	0.49	0.099	0.781	0.882	0.787	1.04	0.909
746	0.49	0.099	0.795	0.882	0.787	1.04	0.899
747	0.49	0.099	0.79	0.882	0.787	1.04	0.89
748	0.49	0.099	0.79	0.882	0.787	1.04	0.842
749	0.495	0.102	0.785	0.882	0.787	1.04	0.899
750	0.49	0.102	0.785	0.882	0.787	1.04	0.871
751	0.49	0.102	0.785	0.882	0.787	1.04	0.88
752	0.495	0.102	0.781	0.882	0.787	1.04	0.909
753	0.495	0.105	0.776	0.882	0.787	1.04	0.918
754	0.49	0.105	0.799	0.882	0.787	1.04	0.89
755	0.495	0.105	0.79	0.882	0.787	1.04	0.918
756	0.495	0.105	0.79	0.882	0.787	1.04	0.918
757	0.495	0.105	0.79	0.882	0.787	1.04	0.909
758	0.495	0.107	0.79	0.882	0.787	1.04	0.899
759	0.495	0.107	0.785	0.882	0.787	1.04	0.833
760	0.495	0.107	0.79	0.882	0.787	1.04	0.918
761	0.495	0.107	0.79	0.882	0.787	1.04	0.842
762	0.495	0.107	0.79	0.882	0.787	1.04	0.909
763	0.495	0.11	0.79	0.882	0.79	1.04	0.928
764	0.495	0.11	0.79	0.882	0.79	1.056	0.871
765	0.5	0.11	0.795	0.882	0.79	1.04	0.928
766	0.5	0.11	0.799	0.882	0.79	1.04	0.918

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
767	0.5	0.112	0.799	0.882	0.79	1.04	0.928
768	0.5	0.112	0.804	0.882	0.79	1.056	0.88
769	0.5	0.112	0.804	0.887	0.79	1.056	0.918
770	0.5	0.112	0.785	0.887	0.793	1.056	0.909
771	0.5	0.112	0.79	0.887	0.793	1.056	0.909
772	0.505	0.112	0.79	0.887	0.793	1.056	0.937
773	0.505	0.112	0.79	0.887	0.793	1.056	0.947
774	0.505	0.112	0.795	0.887	0.796	1.056	0.909
775	0.505	0.112	0.795	0.887	0.796	1.056	0.947
776	0.505	0.112	0.79	0.887	0.796	1.056	0.956
777	0.505	0.112	0.795	0.892	0.796	1.056	0.937
778	0.505	0.112	0.79	0.892	0.799	1.056	0.947
779	0.505	0.112	0.804	0.892	0.799	1.056	0.899
780	0.505	0.112	0.79	0.892	0.799	1.056	0.909
781	0.505	0.112	0.795	0.892	0.799	1.056	0.928
782	0.505	0.11	0.79	0.892	0.799	1.056	0.909
783	0.505	0.112	0.79	0.892	0.799	1.056	0.956
784	0.505	0.112	0.804	0.897	0.799	1.056	0.947
785	0.505	0.112	0.79	0.897	0.799	1.056	0.909
786	0.505	0.11	0.795	0.897	0.799	1.056	0.928
787	0.5	0.11	0.799	0.897	0.803	1.056	0.909
788	0.505	0.11	0.795	0.897	0.803	1.056	0.918
789	0.505	0.11	0.79	0.902	0.803	1.056	0.88
790	0.505	0.107	0.785	0.902	0.803	1.056	0.871
791	0.505	0.107	0.795	0.902	0.803	1.056	0.909
792	0.505	0.107	0.804	0.902	0.806	1.056	0.823
793	0.505	0.107	0.799	0.902	0.803	1.056	0.833
794	0.505	0.107	0.785	0.902	0.803	1.056	0.918
795	0.505	0.107	0.79	0.902	0.803	1.056	0.842
796	0.505	0.107	0.79	0.902	0.803	1.056	0.89
797	0.505	0.107	0.785	0.902	0.803	1.056	0.918
798	0.505	0.107	0.799	0.902	0.803	1.056	0.814
799	0.509	0.107	0.799	0.902	0.803	1.056	0.89
800	0.509	0.107	0.795	0.906	0.806	1.056	0.918
801	0.509	0.107	0.804	0.906	0.806	1.056	0.928
802	0.509	0.107	0.785	0.906	0.806	1.056	0.88
803	0.509	0.107	0.795	0.906	0.806	1.056	0.899
804	0.514	0.107	0.795	0.906	0.806	1.056	0.899
805	0.514	0.107	0.804	0.906	0.806	1.056	0.918
806	0.514	0.107	0.79	0.906	0.806	1.056	0.899
807	0.514	0.107	0.795	0.906	0.809	1.056	0.899
808	0.514	0.107	0.799	0.906	0.809	1.056	0.833
809	0.514	0.107	0.804	0.906	0.809	1.072	0.899
810	0.519	0.107	0.799	0.911	0.809	1.072	0.918
811	0.519	0.107	0.799	0.911	0.812	1.072	0.861
812	0.519	0.107	0.804	0.911	0.812	1.072	0.899
813	0.519	0.107	0.809	0.911	0.812	1.072	0.918
814	0.523	0.11	0.799	0.911	0.812	1.072	0.937
815	0.523	0.11	0.795	0.911	0.812	1.072	0.89
816	0.523	0.11	0.804	0.911	0.812	1.072	0.899
817	0.523	0.11	0.799	0.911	0.815	1.072	0.937
818	0.523	0.11	0.799	0.911	0.815	1.072	0.947
819	0.528	0.11	0.799	0.911	0.815	1.072	0.937
820	0.523	0.11	0.804	0.911	0.815	1.072	0.852
821	0.523	0.11	0.799	0.911	0.815	1.072	0.947
822	0.528	0.11	0.809	0.911	0.819	1.072	0.928
823	0.528	0.11	0.799	0.911	0.819	1.072	0.88
824	0.528	0.11	0.795	0.916	0.819	1.072	0.909
825	0.528	0.11	0.814	0.916	0.819	1.072	0.909
826	0.528	0.11	0.814	0.916	0.819	1.072	0.928
827	0.528	0.11	0.809	0.916	0.822	1.072	0.937
828	0.528	0.11	0.799	0.916	0.822	1.072	0.871
829	0.533	0.11	0.809	0.916	0.825	1.072	0.871
830	0.533	0.11	0.823	0.916	0.825	1.072	0.89
831	0.533	0.11	0.814	0.921	0.825	1.072	0.937

ORIG.	J. Novick	DATE	9/28/95
CHK'D BY	MHG	DATE	10/2/95
CALC. NO.	321-G-002		
REV. NO.	0	SHEET NO.	A1-43 of 52

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
832	0.533	0.11	0.804	0.921	0.825	1.072	0.947
833	0.533	0.107	0.809	0.921	0.828	1.072	0.823
834	0.537	0.107	0.799	0.921	0.828	1.088	0.899
835	0.537	0.107	0.814	0.925	0.831	1.088	0.909
836	0.537	0.105	0.818	0.925	0.831	1.088	0.928
837	0.537	0.105	0.814	0.925	0.831	1.088	0.899
838	0.537	0.105	0.818	0.925	0.831	1.088	0.918
839	0.542	0.105	0.814	0.93	0.835	1.088	0.918
840	0.542	0.105	0.823	0.93	0.835	1.088	0.947
841	0.542	0.105	0.818	0.93	0.835	1.088	0.918
842	0.542	0.105	0.818	0.93	0.835	1.088	0.928
843	0.542	0.105	0.828	0.93	0.835	1.088	0.909
844	0.542	0.105	0.823	0.93	0.838	1.088	0.956
845	0.547	0.105	0.828	0.93	0.838	1.088	0.89
846	0.547	0.105	0.818	0.93	0.838	1.088	0.937
847	0.547	0.105	0.814	0.93	0.838	1.088	0.918
848	0.547	0.107	0.814	0.93	0.838	1.088	0.928
849	0.547	0.107	0.818	0.935	0.838	1.088	0.947
850	0.547	0.107	0.818	0.935	0.838	1.088	0.956
851	0.547	0.107	0.833	0.935	0.838	1.088	0.899
852	0.547	0.107	0.818	0.935	0.841	1.088	0.947
853	0.547	0.107	0.833	0.935	0.841	1.104	0.947
854	0.547	0.107	0.828	0.935	0.841	1.104	0.956
855	0.547	0.107	0.818	0.935	0.841	1.088	0.937
856	0.551	0.107	0.814	0.935	0.841	1.088	0.918
857	0.551	0.107	0.828	0.935	0.841	1.104	0.966
858	0.551	0.107	0.837	0.935	0.844	1.104	0.956
859	0.551	0.107	0.823	0.94	0.844	1.104	0.975
860	0.551	0.107	0.823	0.94	0.844	1.104	0.956
861	0.551	0.107	0.818	0.94	0.844	1.104	0.928
862	0.551	0.107	0.823	0.94	0.844	1.104	0.966
863	0.551	0.107	0.823	0.94	0.844	1.104	0.966
864	0.556	0.107	0.833	0.94	0.847	1.104	0.947
865	0.556	0.107	0.818	0.94	0.847	1.104	0.89
866	0.556	0.107	0.828	0.944	0.847	1.104	0.928
867	0.556	0.107	0.823	0.944	0.847	1.104	0.909
868	0.556	0.107	0.823	0.944	0.847	1.104	0.956
869	0.556	0.107	0.837	0.944	0.847	1.104	0.899
870	0.561	0.107	0.837	0.944	0.847	1.104	0.947
871	0.561	0.11	0.833	0.944	0.847	1.104	0.88
872	0.561	0.11	0.833	0.944	0.851	1.104	0.871
873	0.561	0.11	0.828	0.944	0.851	1.104	0.956
874	0.561	0.11	0.837	0.944	0.851	1.104	0.956
875	0.561	0.11	0.828	0.944	0.851	1.104	0.966
876	0.561	0.112	0.828	0.944	0.851	1.104	0.975
877	0.561	0.112	0.833	0.944	0.851	1.104	0.947
878	0.566	0.112	0.833	0.944	0.854	1.104	0.966
879	0.566	0.112	0.828	0.944	0.854	1.104	0.956
880	0.566	0.112	0.828	0.944	0.854	1.104	0.89
881	0.566	0.112	0.833	0.949	0.854	1.119	0.871
882	0.566	0.112	0.818	0.949	0.857	1.104	0.928
883	0.566	0.112	0.842	0.949	0.857	1.104	0.918
884	0.57	0.112	0.833	0.949	0.857	1.104	0.918
885	0.57	0.115	0.837	0.949	0.857	1.104	0.918
886	0.57	0.115	0.837	0.949	0.857	1.119	0.909
887	0.57	0.117	0.828	0.949	0.857	1.104	0.918
888	0.57	0.117	0.818	0.949	0.857	1.119	0.823
889	0.57	0.117	0.833	0.949	0.857	1.119	0.899
890	0.57	0.12	0.842	0.949	0.857	1.119	0.928
891	0.57	0.12	0.828	0.944	0.857	1.119	0.928
892	0.57	0.122	0.837	0.949	0.857	1.119	0.937
893	0.57	0.122	0.833	0.944	0.857	1.119	0.928
894	0.57	0.122	0.842	0.949	0.857	1.119	0.956
895	0.575	0.122	0.842	0.949	0.857	1.119	0.928
896	0.575	0.122	0.837	0.949	0.86	1.119	0.899

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
897	0.575	0.125	0.842	0.949	0.86	1.119	0.909
898	0.575	0.125	0.837	0.949	0.86	1.119	0.918
899	0.575	0.125	0.847	0.949	0.864	1.119	0.842
900	0.575	0.125	0.833	0.949	0.864	1.119	0.909
901	0.575	0.125	0.842	0.949	0.864	1.119	0.966
902	0.575	0.125	0.833	0.949	0.864	1.119	0.975
903	0.575	0.128	0.833	0.954	0.864	1.119	0.956
904	0.58	0.128	0.837	0.949	0.864	1.119	0.928
905	0.58	0.128	0.837	0.949	0.864	1.119	0.985
906	0.58	0.13	0.837	0.949	0.864	1.119	0.899
907	0.58	0.13	0.842	0.949	0.867	1.119	0.956
908	0.58	0.13	0.837	0.954	0.867	1.119	0.956
909	0.58	0.13	0.833	0.954	0.867	1.119	0.975
910	0.58	0.13	0.833	0.954	0.867	1.119	0.899
911	0.584	0.133	0.851	0.954	0.87	1.119	0.918
912	0.584	0.13	0.847	0.954	0.87	1.119	0.994
913	0.584	0.13	0.851	0.959	0.873	1.119	0.956
914	0.584	0.13	0.847	0.959	0.873	1.119	0.975
915	0.589	0.13	0.856	0.959	0.873	1.119	0.899
916	0.589	0.13	0.851	0.959	0.873	1.135	0.928
917	0.589	0.133	0.851	0.959	0.876	1.135	0.937
918	0.589	0.133	0.842	0.959	0.876	1.135	0.937
919	0.589	0.133	0.847	0.963	0.876	1.135	0.966
920	0.589	0.133	0.851	0.963	0.876	1.135	0.985
921	0.589	0.133	0.847	0.963	0.876	1.135	0.985
922	0.594	0.133	0.837	0.963	0.88	1.135	0.975
923	0.594	0.133	0.847	0.963	0.88	1.135	0.956
924	0.594	0.133	0.851	0.963	0.88	1.135	0.985
925	0.594	0.135	0.851	0.963	0.883	1.135	0.975
926	0.594	0.135	0.861	0.968	0.883	1.135	0.928
927	0.594	0.133	0.851	0.968	0.883	1.135	0.994
928	0.598	0.135	0.856	0.968	0.883	1.135	1.004
929	0.598	0.135	0.851	0.968	0.883	1.135	0.928
930	0.598	0.135	0.851	0.968	0.886	1.135	0.994
931	0.598	0.135	0.851	0.968	0.886	1.135	0.966
932	0.598	0.135	0.856	0.973	0.886	1.135	0.966
933	0.598	0.135	0.856	0.973	0.886	1.135	0.985
934	0.598	0.138	0.861	0.973	0.886	1.135	0.985
935	0.598	0.138	0.847	0.973	0.886	1.135	0.937
936	0.598	0.138	0.851	0.973	0.889	1.135	0.918
937	0.598	0.138	0.861	0.973	0.889	1.135	0.985
938	0.603	0.138	0.861	0.978	0.889	1.151	0.937
939	0.603	0.138	0.851	0.978	0.892	1.135	1.013
940	0.603	0.135	0.861	0.978	0.892	1.151	0.975
941	0.603	0.135	0.866	0.978	0.892	1.151	0.947
942	0.603	0.135	0.861	0.982	0.896	1.151	0.975
943	0.603	0.135	0.866	0.982	0.896	1.151	0.994
944	0.603	0.135	0.861	0.982	0.896	1.151	0.994
945	0.603	0.135	0.861	0.982	0.896	1.151	0.994
946	0.603	0.135	0.861	0.982	0.896	1.151	0.975
947	0.603	0.135	0.856	0.987	0.899	1.151	0.985
948	0.608	0.135	0.866	0.987	0.899	1.151	0.928
949	0.603	0.135	0.861	0.987	0.899	1.151	0.975
950	0.608	0.135	0.851	0.987	0.899	1.151	0.956
951	0.608	0.135	0.856	0.987	0.899	1.151	0.937
952	0.603	0.135	0.851	0.987	0.899	1.151	0.975
953	0.603	0.138	0.856	0.987	0.896	1.151	0.966
954	0.603	0.135	0.87	0.987	0.899	1.151	0.937
955	0.603	0.135	0.847	0.987	0.899	1.151	0.937
956	0.603	0.135	0.856	0.987	0.899	1.151	0.994
957	0.608	0.135	0.875	0.992	0.899	1.151	0.985
958	0.608	0.135	0.866	0.992	0.899	1.151	0.947
959	0.608	0.135	0.866	0.992	0.899	1.151	0.994
960	0.608	0.135	0.861	0.992	0.899	1.151	0.947
961	0.608	0.138	0.866	0.992	0.899	1.151	0.975

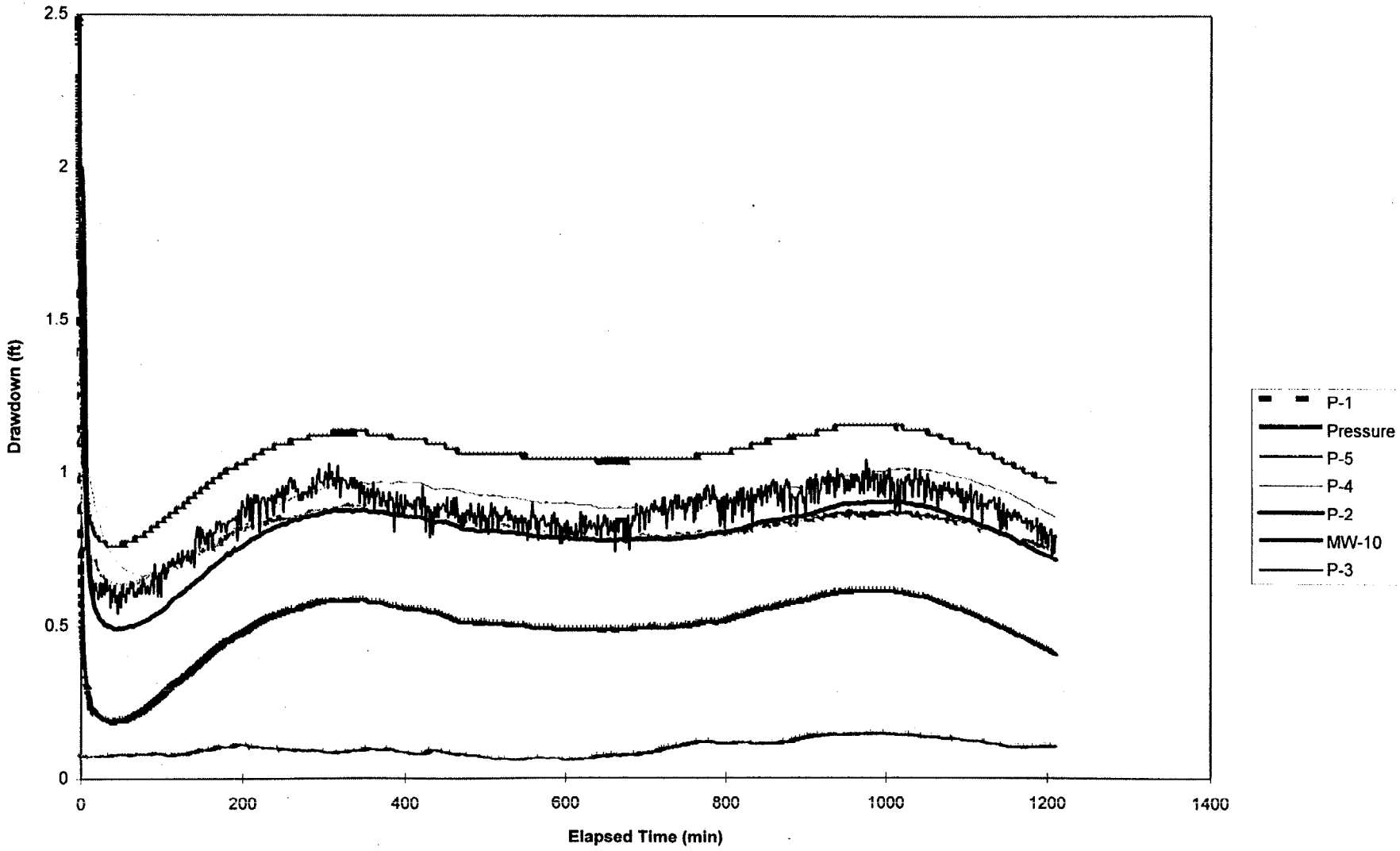
Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
962	0.608	0.135	0.866	0.992	0.899	1.151	0.985
963	0.608	0.138	0.856	0.992	0.899	1.151	0.994
964	0.608	0.135	0.861	0.992	0.899	1.151	0.966
965	0.608	0.135	0.866	0.992	0.902	1.151	0.985
966	0.608	0.138	0.851	0.992	0.899	1.151	0.985
967	0.608	0.138	0.856	0.992	0.899	1.151	0.928
968	0.608	0.138	0.861	0.992	0.899	1.151	0.966
969	0.608	0.138	0.856	0.992	0.899	1.151	0.937
970	0.608	0.138	0.851	0.992	0.899	1.151	0.975
971	0.608	0.138	0.856	0.997	0.899	1.151	1.004
972	0.608	0.138	0.866	0.997	0.902	1.151	0.928
973	0.608	0.138	0.856	0.997	0.899	1.151	1.004
974	0.608	0.138	0.842	0.997	0.899	1.151	0.975
975	0.608	0.138	0.856	0.997	0.902	1.151	1.042
976	0.608	0.138	0.861	0.997	0.902	1.151	1.004
977	0.608	0.138	0.866	0.997	0.902	1.151	0.937
978	0.608	0.138	0.861	0.997	0.902	1.151	1.013
979	0.608	0.138	0.861	0.997	0.902	1.151	1.004
980	0.608	0.14	0.856	0.997	0.902	1.151	0.947
981	0.608	0.14	0.851	0.997	0.902	1.151	0.985
982	0.608	0.14	0.866	0.997	0.902	1.151	0.966
983	0.608	0.14	0.861	0.997	0.902	1.151	0.994
984	0.608	0.14	0.87	1.001	0.902	1.151	1.004
985	0.608	0.138	0.851	1.001	0.902	1.151	0.937
986	0.608	0.138	0.861	1.001	0.902	1.151	0.994
987	0.608	0.138	0.866	1.001	0.902	1.151	0.994
988	0.608	0.138	0.856	1.001	0.902	1.151	0.975
989	0.608	0.14	0.861	1.001	0.902	1.151	0.994
990	0.608	0.14	0.851	1.001	0.902	1.151	0.918
991	0.608	0.14	0.856	1.001	0.902	1.151	0.966
992	0.608	0.14	0.866	1.001	0.902	1.151	0.928
993	0.608	0.14	0.861	1.001	0.902	1.151	0.994
994	0.608	0.14	0.866	1.001	0.902	1.151	0.937
995	0.608	0.14	0.866	1.001	0.902	1.151	0.956
996	0.608	0.14	0.866	1.001	0.902	1.151	0.928
997	0.608	0.14	0.856	1.001	0.902	1.151	1.004
998	0.608	0.14	0.861	1.001	0.902	1.151	0.918
999	0.608	0.14	0.861	1.001	0.902	1.151	0.956
1000	0.608	0.14	0.866	1.001	0.905	1.151	0.956
1001	0.608	0.138	0.861	1.001	0.905	1.151	0.994
1002	0.608	0.138	0.856	1.006	0.905	1.151	0.975
1003	0.608	0.138	0.861	1.006	0.905	1.151	0.994
1004	0.608	0.138	0.866	1.006	0.905	1.151	1.013
1005	0.608	0.138	0.856	1.006	0.902	1.151	0.909
1006	0.608	0.138	0.866	1.006	0.905	1.151	0.937
1007	0.608	0.138	0.866	1.006	0.905	1.151	0.985
1008	0.608	0.138	0.87	1.006	0.905	1.151	0.937
1009	0.608	0.138	0.87	1.006	0.905	1.151	0.966
1010	0.608	0.138	0.861	1.006	0.905	1.151	0.947
1011	0.608	0.138	0.87	1.006	0.905	1.151	0.88
1012	0.608	0.138	0.87	1.006	0.905	1.151	0.918
1013	0.608	0.138	0.866	1.006	0.905	1.151	0.89
1014	0.603	0.135	0.856	1.011	0.905	1.135	0.975
1015	0.603	0.135	0.866	1.006	0.905	1.151	0.937
1016	0.603	0.135	0.861	1.006	0.902	1.151	0.928
1017	0.603	0.135	0.861	1.006	0.902	1.151	0.871
1018	0.603	0.135	0.866	1.011	0.902	1.151	0.975
1019	0.603	0.135	0.866	1.011	0.902	1.151	0.966
1020	0.603	0.135	0.866	1.011	0.902	1.151	0.966
1021	0.603	0.135	0.866	1.011	0.902	1.151	0.966
1022	0.603	0.135	0.861	1.011	0.902	1.151	0.899
1023	0.603	0.135	0.861	1.011	0.902	1.135	0.909
1024	0.603	0.135	0.866	1.011	0.899	1.135	0.985
1025	0.598	0.135	0.861	1.006	0.899	1.135	0.966
1026	0.598	0.135	0.866	1.011	0.899	1.135	0.975

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
1027	0.598	0.135	0.861	1.006	0.899	1.135	0.985
1028	0.598	0.135	0.87	1.006	0.899	1.135	0.994
1029	0.598	0.135	0.861	1.011	0.899	1.135	0.956
1030	0.598	0.135	0.861	1.006	0.899	1.135	0.956
1031	0.598	0.135	0.866	1.006	0.899	1.135	0.975
1032	0.594	0.133	0.861	1.006	0.896	1.135	0.947
1033	0.594	0.135	0.866	1.006	0.896	1.135	0.918
1034	0.594	0.135	0.851	1.006	0.896	1.135	0.975
1035	0.594	0.133	0.856	1.006	0.896	1.135	0.966
1036	0.594	0.135	0.851	1.006	0.892	1.135	1.013
1037	0.594	0.133	0.856	1.006	0.892	1.135	0.985
1038	0.594	0.133	0.856	1.006	0.892	1.135	0.975
1039	0.589	0.133	0.856	1.006	0.892	1.135	0.975
1040	0.589	0.133	0.861	1.006	0.892	1.135	0.918
1041	0.589	0.133	0.866	1.006	0.892	1.135	0.975
1042	0.589	0.133	0.856	1.006	0.892	1.135	1.004
1043	0.589	0.13	0.851	1.006	0.892	1.135	0.956
1044	0.589	0.13	0.842	1.006	0.892	1.135	0.985
1045	0.589	0.13	0.856	1.006	0.892	1.135	0.975
1046	0.589	0.13	0.856	1.006	0.892	1.135	0.975
1047	0.589	0.128	0.856	1.006	0.889	1.135	0.966
1048	0.589	0.13	0.856	1.006	0.889	1.135	0.899
1049	0.589	0.13	0.856	1.006	0.889	1.135	0.975
1050	0.589	0.13	0.856	1.006	0.889	1.135	0.918
1051	0.584	0.13	0.847	1.006	0.886	1.135	0.994
1052	0.584	0.13	0.847	1.006	0.886	1.135	0.975
1053	0.584	0.13	0.861	1.006	0.886	1.119	0.975
1054	0.584	0.13	0.861	1.001	0.886	1.135	0.928
1055	0.584	0.128	0.856	1.006	0.886	1.119	0.947
1056	0.584	0.128	0.851	1.006	0.886	1.119	0.909
1057	0.58	0.128	0.856	1.001	0.883	1.119	0.928
1058	0.58	0.128	0.851	1.001	0.883	1.119	0.966
1059	0.58	0.128	0.856	1.001	0.883	1.119	0.966
1060	0.58	0.128	0.842	1.001	0.883	1.119	0.937
1061	0.575	0.128	0.851	1.001	0.88	1.119	0.956
1062	0.575	0.128	0.847	1.001	0.88	1.119	0.947
1063	0.575	0.128	0.851	0.997	0.876	1.119	0.928
1064	0.575	0.128	0.851	0.997	0.876	1.119	0.88
1065	0.57	0.128	0.856	0.997	0.876	1.119	0.937
1066	0.57	0.128	0.842	0.997	0.876	1.119	0.956
1067	0.57	0.125	0.842	0.997	0.876	1.119	0.956
1068	0.57	0.125	0.842	0.997	0.873	1.119	0.928
1069	0.566	0.125	0.847	0.997	0.873	1.104	0.909
1070	0.566	0.125	0.842	0.997	0.873	1.119	0.956
1071	0.566	0.125	0.847	0.997	0.873	1.104	0.937
1072	0.566	0.122	0.842	0.997	0.87	1.104	0.966
1073	0.566	0.122	0.842	0.997	0.87	1.104	0.937
1074	0.561	0.122	0.847	0.997	0.87	1.104	0.947
1075	0.561	0.122	0.842	0.997	0.867	1.104	0.947
1076	0.561	0.122	0.847	0.992	0.867	1.104	0.937
1077	0.561	0.122	0.828	0.992	0.864	1.104	0.966
1078	0.556	0.122	0.851	0.992	0.864	1.104	0.947
1079	0.556	0.122	0.842	0.987	0.864	1.104	0.928
1080	0.556	0.122	0.837	0.987	0.86	1.104	0.947
1081	0.556	0.125	0.842	0.987	0.86	1.104	0.918
1082	0.551	0.125	0.837	0.987	0.857	1.104	0.928
1083	0.551	0.125	0.842	0.987	0.857	1.088	0.947
1084	0.551	0.122	0.833	0.987	0.857	1.104	0.928
1085	0.551	0.125	0.837	0.982	0.854	1.088	0.928
1086	0.551	0.125	0.837	0.982	0.854	1.088	0.937
1087	0.551	0.122	0.823	0.982	0.854	1.088	0.928
1088	0.547	0.122	0.823	0.982	0.854	1.088	0.966
1089	0.547	0.122	0.837	0.982	0.854	1.088	0.918
1090	0.547	0.122	0.837	0.982	0.854	1.088	0.947
1091	0.547	0.122	0.837	0.982	0.851	1.088	0.937

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
1092	0.547	0.12	0.837	0.978	0.851	1.088	0.899
1093	0.547	0.12	0.833	0.978	0.851	1.088	0.918
1094	0.547	0.12	0.833	0.978	0.851	1.088	0.947
1095	0.547	0.12	0.837	0.978	0.851	1.088	0.918
1096	0.547	0.117	0.828	0.978	0.851	1.088	0.871
1097	0.542	0.117	0.833	0.978	0.847	1.088	0.918
1098	0.542	0.117	0.833	0.978	0.847	1.088	0.88
1099	0.542	0.117	0.837	0.978	0.847	1.088	0.937
1100	0.537	0.117	0.828	0.973	0.847	1.088	0.928
1101	0.537	0.117	0.833	0.973	0.844	1.088	0.899
1102	0.537	0.115	0.837	0.973	0.844	1.088	0.928
1103	0.537	0.115	0.833	0.973	0.844	1.088	0.909
1104	0.537	0.115	0.833	0.973	0.844	1.088	0.928
1105	0.533	0.115	0.837	0.973	0.841	1.072	0.956
1106	0.533	0.115	0.833	0.973	0.841	1.072	0.833
1107	0.533	0.115	0.833	0.968	0.841	1.072	0.909
1108	0.533	0.115	0.828	0.968	0.838	1.072	0.899
1109	0.528	0.115	0.818	0.968	0.838	1.072	0.928
1110	0.528	0.115	0.828	0.968	0.835	1.072	0.928
1111	0.528	0.115	0.828	0.963	0.835	1.072	0.937
1112	0.528	0.115	0.818	0.963	0.831	1.072	0.937
1113	0.523	0.115	0.818	0.963	0.831	1.072	0.88
1114	0.523	0.115	0.814	0.963	0.831	1.072	0.88
1115	0.523	0.115	0.814	0.963	0.831	1.072	0.89
1116	0.523	0.115	0.818	0.959	0.828	1.072	0.89
1117	0.519	0.115	0.799	0.959	0.828	1.072	0.918
1118	0.519	0.115	0.814	0.959	0.825	1.056	0.928
1119	0.519	0.115	0.814	0.959	0.825	1.056	0.833
1120	0.514	0.115	0.809	0.954	0.822	1.056	0.899
1121	0.514	0.112	0.809	0.954	0.822	1.056	0.899
1122	0.514	0.112	0.804	0.954	0.822	1.056	0.89
1123	0.509	0.112	0.804	0.954	0.822	1.056	0.89
1124	0.509	0.11	0.814	0.954	0.822	1.056	0.899
1125	0.509	0.11	0.818	0.954	0.819	1.056	0.88
1126	0.509	0.11	0.809	0.954	0.819	1.056	0.89
1127	0.509	0.107	0.804	0.954	0.819	1.056	0.909
1128	0.509	0.107	0.809	0.954	0.819	1.056	0.909
1129	0.509	0.107	0.814	0.954	0.815	1.056	0.909
1130	0.505	0.107	0.804	0.949	0.815	1.056	0.899
1131	0.505	0.107	0.804	0.949	0.815	1.056	0.909
1132	0.505	0.107	0.804	0.949	0.812	1.056	0.909
1133	0.5	0.107	0.809	0.949	0.812	1.056	0.909
1134	0.5	0.107	0.795	0.944	0.812	1.056	0.918
1135	0.5	0.107	0.795	0.944	0.809	1.056	0.88
1136	0.5	0.107	0.795	0.944	0.806	1.04	0.88
1137	0.495	0.107	0.804	0.944	0.806	1.04	0.899
1138	0.495	0.107	0.804	0.94	0.806	1.04	0.89
1139	0.495	0.105	0.799	0.94	0.806	1.04	0.842
1140	0.495	0.105	0.79	0.94	0.803	1.04	0.918
1141	0.49	0.105	0.804	0.94	0.799	1.04	0.833
1142	0.49	0.105	0.799	0.94	0.799	1.04	0.804
1143	0.49	0.105	0.799	0.935	0.799	1.04	0.88
1144	0.486	0.102	0.795	0.935	0.799	1.04	0.814
1145	0.486	0.102	0.795	0.935	0.796	1.04	0.899
1146	0.486	0.102	0.795	0.935	0.796	1.04	0.852
1147	0.486	0.099	0.785	0.935	0.796	1.024	0.823
1148	0.486	0.099	0.804	0.935	0.796	1.024	0.871
1149	0.486	0.099	0.785	0.935	0.796	1.024	0.814
1150	0.481	0.099	0.795	0.93	0.793	1.024	0.88
1151	0.481	0.099	0.799	0.93	0.793	1.024	0.861
1152	0.481	0.097	0.804	0.93	0.79	1.024	0.852
1153	0.476	0.097	0.795	0.93	0.79	1.024	0.871
1154	0.476	0.097	0.785	0.93	0.79	1.024	0.842
1155	0.476	0.097	0.781	0.925	0.787	1.024	0.852
1156	0.472	0.097	0.781	0.925	0.787	1.024	0.842

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6	INPUT 7
1157	0.472	0.097	0.785	0.925	0.783	1.024	0.871
1158	0.472	0.097	0.785	0.921	0.783	1.024	0.852
1159	0.472	0.097	0.771	0.921	0.78	1.024	0.88
1160	0.467	0.097	0.776	0.921	0.78	1.009	0.861
1161	0.467	0.097	0.776	0.916	0.777	1.024	0.852
1162	0.467	0.097	0.766	0.916	0.777	1.009	0.871
1163	0.462	0.097	0.762	0.916	0.774	1.009	0.842
1164	0.462	0.097	0.771	0.911	0.77	1.009	0.871
1165	0.462	0.097	0.766	0.911	0.77	1.009	0.852
1166	0.458	0.097	0.757	0.911	0.77	1.009	0.852
1167	0.458	0.097	0.766	0.911	0.77	1.009	0.861
1168	0.458	0.097	0.762	0.911	0.767	1.009	0.842
1169	0.458	0.094	0.771	0.906	0.767	1.009	0.833
1170	0.458	0.094	0.766	0.906	0.767	1.009	0.842
1171	0.453	0.094	0.766	0.906	0.764	1.009	0.833
1172	0.453	0.094	0.776	0.902	0.764	1.009	0.833
1173	0.453	0.094	0.776	0.902	0.764	0.993	0.842
1174	0.453	0.097	0.771	0.902	0.761	0.993	0.852
1175	0.448	0.097	0.771	0.902	0.758	0.993	0.814
1176	0.448	0.097	0.766	0.897	0.758	0.993	0.833
1177	0.448	0.097	0.776	0.897	0.754	0.993	0.833
1178	0.444	0.097	0.766	0.897	0.754	0.993	0.842
1179	0.444	0.097	0.771	0.897	0.754	0.993	0.842
1180	0.444	0.097	0.762	0.892	0.751	0.993	0.804
1181	0.439	0.097	0.766	0.892	0.751	0.993	0.842
1182	0.439	0.097	0.766	0.887	0.748	0.993	0.823
1183	0.439	0.097	0.766	0.887	0.748	0.993	0.814
1184	0.434	0.097	0.771	0.887	0.745	0.993	0.823
1185	0.434	0.097	0.752	0.882	0.745	0.977	0.823
1186	0.434	0.097	0.752	0.882	0.742	0.977	0.823
1187	0.43	0.097	0.757	0.882	0.742	0.993	0.852
1188	0.43	0.097	0.752	0.882	0.742	0.977	0.776
1189	0.43	0.097	0.766	0.882	0.738	0.977	0.823
1190	0.43	0.097	0.752	0.878	0.738	0.977	0.804
1191	0.43	0.097	0.752	0.878	0.738	0.977	0.833
1192	0.425	0.097	0.757	0.878	0.735	0.977	0.776
1193	0.425	0.097	0.762	0.878	0.735	0.977	0.833
1194	0.425	0.097	0.752	0.878	0.735	0.977	0.766
1195	0.42	0.097	0.757	0.873	0.732	0.977	0.804
1196	0.42	0.097	0.757	0.873	0.732	0.977	0.823
1197	0.42	0.097	0.747	0.873	0.729	0.977	0.814
1198	0.42	0.099	0.757	0.868	0.729	0.977	0.766
1199	0.415	0.097	0.752	0.868	0.729	0.977	0.804
1200	0.415	0.099	0.752	0.868	0.726	0.977	0.785
1201	0.415	0.097	0.747	0.868	0.726	0.961	0.757
1202	0.415	0.097	0.743	0.863	0.726	0.961	0.795
1203	0.415	0.097	0.757	0.863	0.726	0.961	0.795
1204	0.411	0.097	0.747	0.863	0.722	0.961	0.814
1205	0.411	0.097	0.738	0.863	0.722	0.961	0.814
1206	0.406	0.097	0.743	0.859	0.719	0.961	0.728
1207	0.406	0.097	0.747	0.859	0.719	0.961	0.795
1208	0.406	0.099	0.738	0.859	0.716	0.961	0.738
1209	0.406	0.099	0.738	0.854	0.716	0.961	0.738
1210	0.401	0.099	0.738	0.854	0.713	0.961	0.795
1211	0.401	0.099	0.724	0.854	0.713	0.961	0.785

Recovery Test Data



ORIG. J. Novick DATE 9/28/95
CHK'D BY [illegible] DATE [illegible]
CALC. NO. 321-G-002
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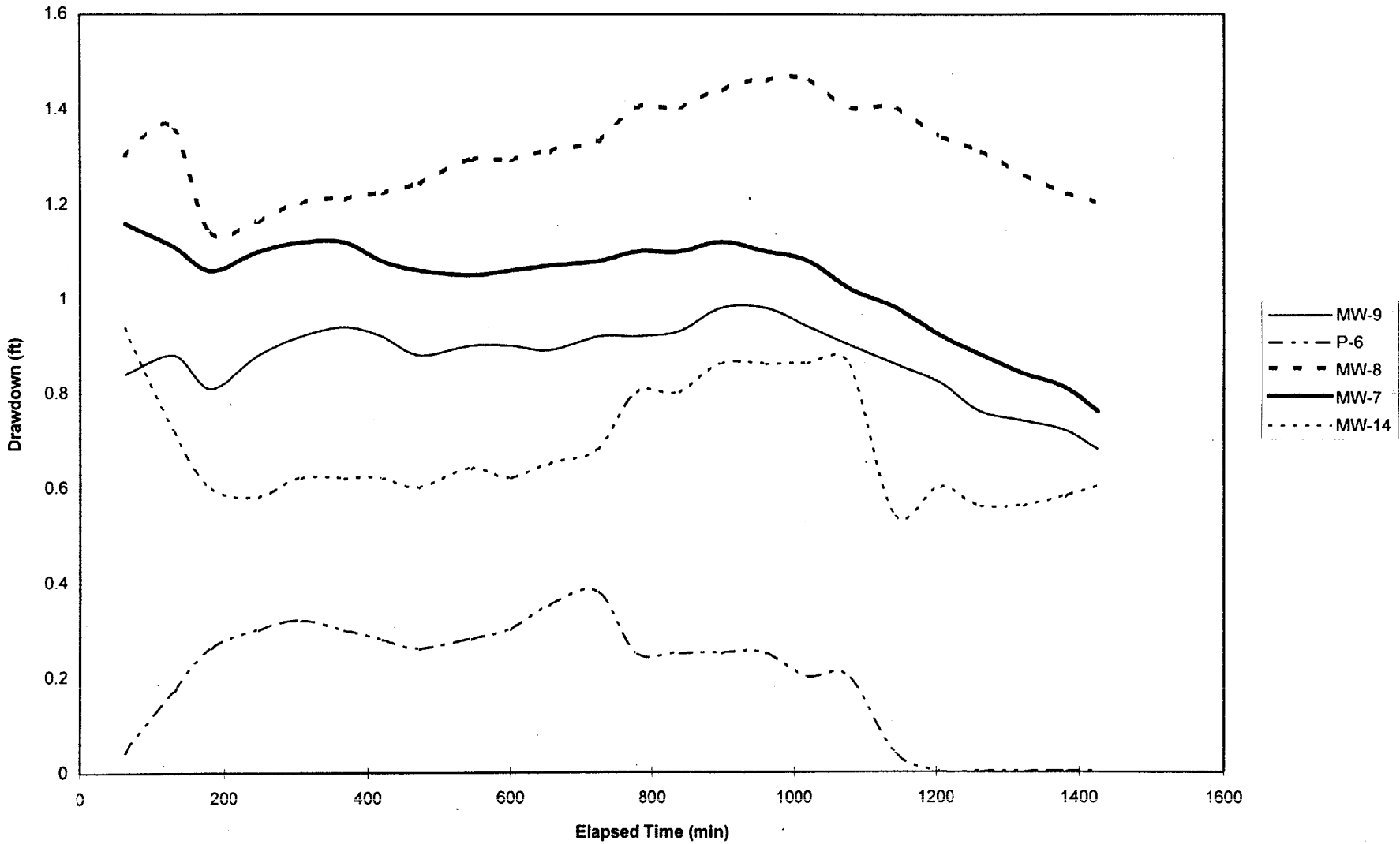
SHEET NO. A1-5 of 52

3. Manual Readings

	MW-9		P-6		MW-8		MW-7		MW-14
Elapsed Time	Depth	Elapsed Time	Depth	Elapsed Time	Depth	Elapsed Time	Depth	Elapsed Time	Depth
62	0.84	63	0.04	65	1.3	65	1.16	66	0.94
130	0.88	131	0.17	132	1.36	133	1.11	134	0.72
181	0.81	181	0.26	182	1.14	183	1.06	184	0.6
247	0.88	247	0.3	248	1.16	248	1.1	249	0.58
306	0.92	307	0.32	308	1.2	309	1.12	309	0.62
366	0.94	367	0.3	368	1.21	369	1.12	369	0.62
419	0.92	421	0.28	425	1.22	431	1.08	433	0.62
472	0.88	474	0.26	476	1.24	478	1.06	479	0.6
544	0.9	545	0.28	546	1.29	549	1.05	550	0.64
599	0.9	602	0.3	604	1.29	607	1.06	609	0.62
654	0.89	657	0.35	659	1.31	662	1.07	664	0.65
724	0.92	725	0.38	728	1.33	730	1.08	732	0.68
777	0.92	777	0.25	781	1.4	783	1.1	784	0.8
837	0.93	851	0.25	853	1.4	854	1.1	855	0.8
897	0.98	899	0.25	899	1.44	900	1.12	902	0.86
959	0.98	960	0.25	961	1.46	962	1.1	964	0.86
1019	0.94	1020	0.2	1021	1.46	1022	1.08	1024	0.86
1078	0.9	1079	0.2	1080	1.4	1081	1.02	1082	0.86
1142	0.86	1143	0.04	1144	1.4	1144	0.98	1145	0.54
1206	0.82	1207	0	1208	1.34	1208	0.92	1209	0.6
1261	0.76	1261	0	1262	1.31	1263	0.88	1263	0.56
1322	0.74	1323	0	1324	1.26	1324	0.84	1325	0.56
1381	0.72	1382	0	1383	1.22	1383	0.81	1392	0.58
1426	0.68	1427	0	1427	1.2	1428	0.76	1429	0.6
	P-1/R-1		P-2		P-3		P-4		P-5
240	2.8	243	1.62	244	1.7	245	0.58	245	0.94
1200	2.75	481	2	485	1.98	487	1.6	489	1.24
1429	2.48	734	2.11	737	2.02	738	2.02	740	1.38
		965	2.16	967	2.06	969	2.1	970	1.4
		1202	2.04	1203	1.93	1204	2.02	1204	1.4
		1430	1.85	1431	1.72	1432	1.83	1432	1.34

Note: All water level depths in feet below top of riser.

Manual Water Level Readings



ORIG. J. Novick DATE 9/28/95
CHK'D BY [illegible] DATE 10/2/95
CALC. NO. 321-G-002
REV. NO. 0 SHEET NO. A1-52 of 52

ATTACHMENT 2

Well Construction Diagrams

and

Geologic Drill Logs

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
NAVAL AIR STATION KEY WEST	22567-321	1 OF 1	R-1

SITE	COORDINATES	ANGLE FROM HORIZ	BEARING
NAS Key West - JETC		Vertical	------

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	OVERBURDEN	ROCK (FT.)	TOTAL DEPTH
7-26-95	7-26-95	Env. Drilling Inc.	Mobile B-57	12"	10.0	1.0	11.3

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
/				4.00	2.3/1.7 2.3 /	10.00/-6.20

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
140# / 30"	11 ft 4" PVC	J.Novick

SAMP TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS / % CORE	ANALYSES PERFORMED		ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
SS 2"	2.00	1.80				4.00				0.0 - 10.0 ft. Silty Sand. Very pale orange (10YR8/2). Sand grains are fine to medium grained, subangular to subrounded limestone fragments set in a tightly packed clay and silt matrix. Contains occassional coarse grained limestone fragments up to 1" in size. Homogeneous. Moderately sorted. Hard, dry, friable. @ 1.8 ft. Peat layer, dusky yellowish brown (10YR2/2). 0.2 ft thick. @ 2.0 ft. Wet.	Borehole advanced using 12" O.D. Hollow Stem Auger, combined with 2" Split Spoon Sampler.
SS 2"	2.00	2.00									
							5				Survey not completed yet, coordinates not available.
											Well nested with P-1.
						-5.90	10			10.0 - 11.0 ft. Oolitic Limestone. Very Pale Orange (10YR8/2). Fine to coarse oolites. Oolites are well formed and weakly bonded by calcareous cement. Oolite size increases with depth. Massive, homogeneous, moderately friable, saturated.	Bedrock described from cuttings.
						-7.00				Bottom of hole at 11 ft, 4" monitoring well installed on 7/26/95.	
											Soil description is by visual examination of split spoon samples, classification by Unified Soil Classification System (USCS) and color description from GSA Rock Color Chart.

SS = SPLIT SPOON; NQ = CORE BARREL;
HX = HAND AUGER; O = OTHER

SITE: NAS Key West - JETC

ORIG. J. Novick DATE 9/28/95
CHK'D BY MAE DATE 10/2/95
CALC. NO. 321-G-002
REV. NO. 0

HOLE NO. R-1

SHEET NO. A2-2 of 9

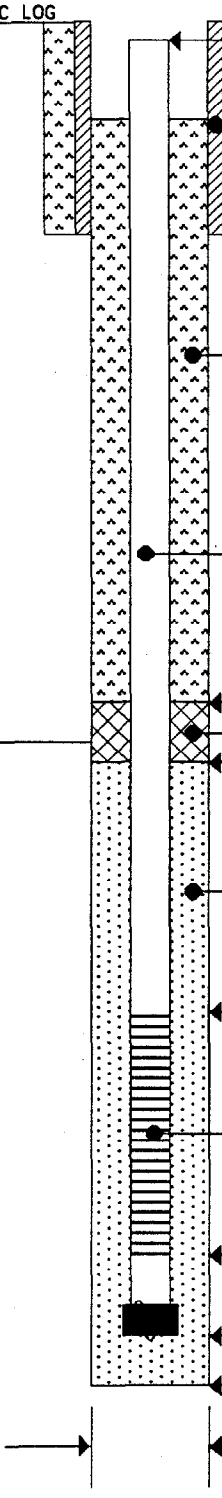
MONITORING WELL

PROJECT	WELL NO.
NAVAL AIR STATION KEY WEST	R-1

JOB NO.	SITE	COORDINATES
22567-321	NAS Key West - JETC	* Well not surveyed

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
7/26/95	7/26/95	J.Novick	Ground Surface

GENERALIZED GEOLOGIC LOG



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF RISER CASING	0.0	4.0
FLUSH MOUNT BOX DIAMETER/TYPE: 12"/Flush Mount Box	0.0	3.8
BOTTOM OF FLUSH MOUNT BOX	0.7	3.1
BACKFILL MATERIAL TYPE Cement-Bentonite Grout		
RISER CASING DIAMETER/TYPE: 4"/PVC		
TOP OF SEAL	0.8	3.0
ANNULAR SEAL TYPE 30/65 Sand		
TOP OF FILTER PACK	1.0	2.8
FILTER PACK TYPE 20/30 Sand		
TOP OF SCREEN	1.0	2.8
SCREEN DIAMETER: 4" TYPE: Machine Slotted PVC OPENING WIDTH: 0.010		
BOTTOM OF SCREEN	11.0	-7.2
BOTTOM OF SUMP	11.3	-7.2
BOTTOM OF HOLE	11.3	-7.3
HOLE DIAMETER: 12"		

ORIG.	J. Novick	DATE	9/28/95
CHK'D BY	[illegible]	DATE	10/2/95
CALC. NO.	321-G-002		
REV. NO.	0	SHEET NO.	A2-3 of 9

MONITORING WELL

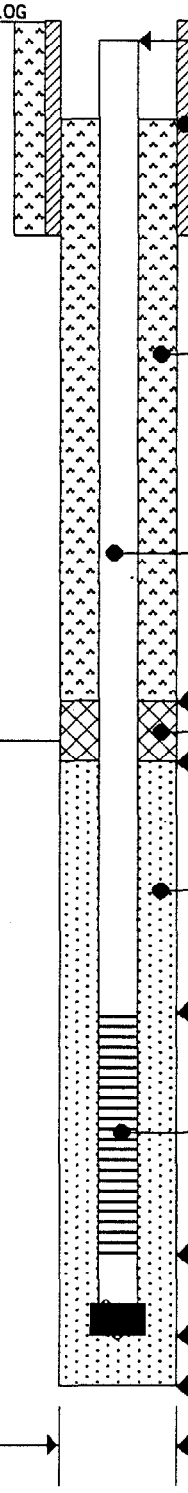
PROJECT: NAVAL AIR STATION KEY WEST

WELL NO.: P-1

JOB NO.	SITE	COORDINATES
22567-321	NAS Key West - JETC	* Well not surveyed

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
7/26/95	7/26/95	J. Novick	Ground Surface

GENERALIZED GEOLOGIC LOG



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF RISER CASING	0.0	3.8
	0.0	3.8
BOTTOM OF FLUSH MOUNT BOX	0.7	3.1
TOP OF SEAL	0.8	3.0
TOP OF FILTER PACK	1.0	2.8
TOP OF SCREEN	1.0	2.8
BOTTOM OF SCREEN	11.0	-7.2
BOTTOM OF SUMP	11.3	-7.2
BOTTOM OF HOLE	11.3	-7.5
HOLE DIAMETER:		

FLUSH MOUNT BOX
DIAMETER/TYPE: 12"/Flush Mount Box

BACKFILL MATERIAL TYPE
Cement-Bentonite Grout

RISER CASING
DIAMETER/TYPE: 1"/PVC

ANNULAR SEAL TYPE
30/65 Sand

FILTER PACK TYPE
20/30 Sand

SCREEN
DIAMETER: 1"
TYPE: Machine Slotted PVC
OPENING WIDTH: 0.010

ORIG.	J. Novick	DATE	9/28/95
CHK'D BY	MHC	DATE	10/2/95
CALC. NO.	321-G-002		
REV. NO.	0	SHEET NO.	A2-4 of 9

MONITORING WELL

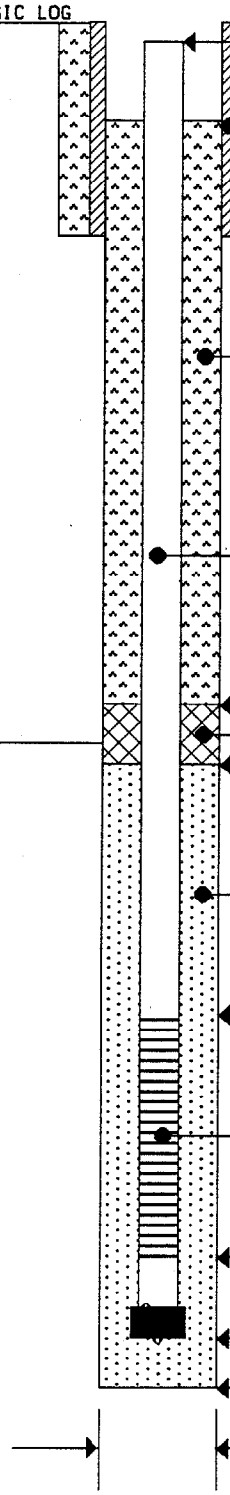
PROJECT: NAVAL AIR STATION KEY WEST

WELL NO.: P-2

JOB NO.	SITE	COORDINATES
22567-321	NAS Key West - JETC	* Well not surveyed

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
7/26/95	7/26/95	J. Novick	Ground Surface

GENERALIZED GEOLOGIC LOG



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF RISER CASING	0.0	3.9
	0.0	3.9
BOTTOM OF FLUSH MOUNT BOX	0.7	3.2
TOP OF SEAL		
TOP OF FILTER PACK	1.0	2.9
TOP OF SCREEN	1.0	2.9
BOTTOM OF SCREEN	11.0	-7.1
BOTTOM OF SUMP	11.0	-7.1
BOTTOM OF HOLE	11.0	-7.2
HOLE DIAMETER:		

FLUSH MOUNT BOX
DIAMETER/TYPE:
8"/Flush Mount Box

BACKFILL MATERIAL TYPE
Silica Sand

RISER CASING
DIAMETER/TYPE:
1"/PVC

ANNULAR SEAL TYPE
None

FILTER PACK TYPE
20/30 Silica Sand

SCREEN
DIAMETER: 1"
TYPE: Machine Slotted PVC
OPENING WIDTH: 0.010

ORIG.	J. Novick	DATE	9/28/95
CHK'D BY	MAC	DATE	10/2/95
CALC. NO.	321-G-002		
REV. NO.	0	SHEET NO.	A2-5 of 9

MONITORING WELL

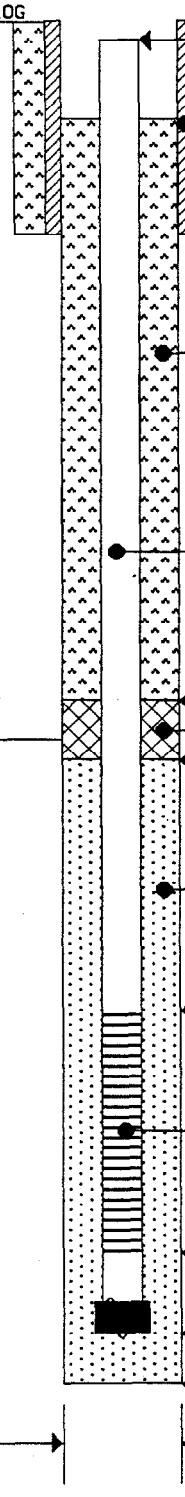
NAVAL AIR STATION KEY WEST

WELL NO. P-3

JOB NO.	SITE	COORDINATES
22567-321	NAS Key West - JETC	* Well not surveyed

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
7/26/95	7/26/95	J. Novick	Ground Suface

GENERALIZED GEOLOGIC LOG



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF RISER CASING	0.0	4.0
	0.0	4.0
BOTTOM OF FLUSH MOUNT BOX	0.7	3.3
TOP OF FILTER PACK	1.0	3.0
TOP OF SCREEN	1.0	3.0
BOTTOM OF SCREEN	11.0	-7.0
BOTTOM OF SUMP	11.0	-7.0
BOTTOM OF HOLE	11.0	-7.0
HOLE DIAMETER:		

FLUSH MOUNT BOX
DIAMETER/TYPE:
8"/Fluch Mount Box

BACKFILL MATERIAL TYPE
Silica Sand

RISER CASING
DIAMETER/TYPE:
1"/PVC

TOP OF SEAL

ANNULAR SEAL TYPE
None

FILTER PACK TYPE
20/30 Silica Sand

SCREEN
DIAMETER: 1"
TYPE: Machine Slotted PVC
OPENING WIDTH: 0.010

ORIG.	J. Novick	DATE	9/28/95
CHK'D BY	MJG	DATE	10/2/95
CALC. NO.	321-G-002		
REV. NO.	0	SHEET NO.	A2-B of 9

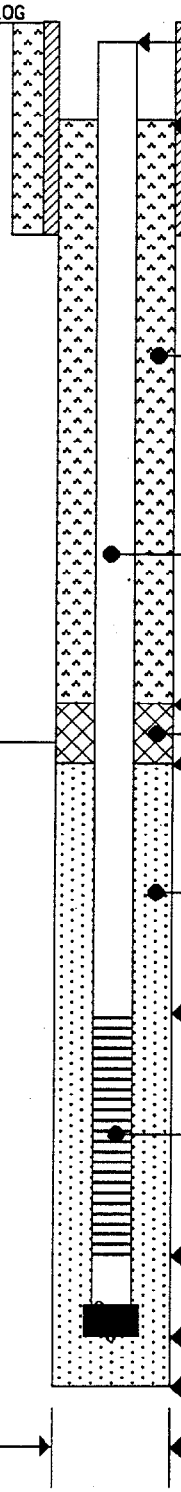
MONITORING WELL

PROJECT	WELL NO.
NAVAL AIR STATION KEY WEST	P-4

JOB NO.	SITE	COORDINATES
22567-321	NAS Key West - JETC	* Well not surveyed

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
7/26/95	7/26/95	J. Novick	Ground Surface

GENERALIZED GEOLOGIC LOG



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF RISER CASING	0.0	4.0
	0.0	4.0
BOTTOM OF FLUSH MOUNT BOX	0.7	3.3
TOP OF FILTER PACK	1.0	3.0
TOP OF SCREEN	1.0	3.0
BOTTOM OF SCREEN	11.0	-7.0
BOTTOM OF SUMP	11.0	-7.0
BOTTOM OF HOLE	11.0	-7.1
HOLE DIAMETER:		

FLUSH MOUNT BOX
DIAMETER/TYPE:
8"/Flush Mount Box

BACKFILL MATERIAL TYPE
Silica Sand

RISER CASING
DIAMETER/TYPE:
1"/PVC

ANNULAR SEAL TYPE
None

FILTER PACK TYPE
20/30 Silica Sand

SCREEN
DIAMETER: 1"
TYPE: Machine Slotted PVC
OPENING WIDTH: 0.010

ORIG.	J. Novick	DATE	9/28/95
CHK'D BY	MRE	DATE	10/2/95
CALC. NO.	321-G-002		
REV. NO.	0	SHEET NO.	A2-7 of 9

MONITORING WELL

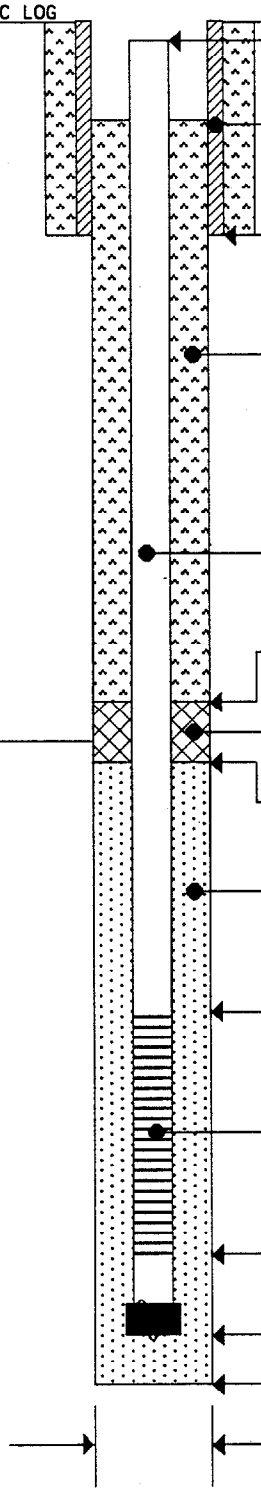
NAVAL AIR STATION KEY WEST

P-5

JOB NO.	SITE	COORDINATES
22567-321	NAS Key West - JETC	* Well not surveyed

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
7/25/95	7/25/95	J. Novick	Ground Surface

GENERALIZED GEOLOGIC LOG



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF RISER CASING	0.0	3.8
FLUSH MOUNT BOX DIAMETER/TYPE: 8"/Flush Mount Box	0.0	3.8
BOTTOM OF FLUSH MOUNT BOX	0.7	3.1
BACKFILL MATERIAL TYPE Silica Sand		
RISER CASING DIAMETER/TYPE: 1"/PVC		
TOP OF SEAL		
ANNULAR SEAL TYPE None		
TOP OF FILTER PACK	1.0	2.8
FILTER PACK TYPE 20'/30 Silica Sand		
TOP OF SCREEN	1.0	2.8
SCREEN DIAMETER: 1" TYPE: Machine Slotted PVC OPENING WIDTH: 0.010		
BOTTOM OF SCREEN	11.0	-7.2
BOTTOM OF SUMP	11.0	-7.5
BOTTOM OF HOLE	11.0	-7.2
HOLE DIAMETER:		

ORIG.	J. Novick	DATE	9/28/95
CHK'D BY	MAG	DATE	10/2/95
CALC. NO.	321-G-002		
REV. NO.	0	SHEET NO.	A2-8 of 9

MONITORING WELL

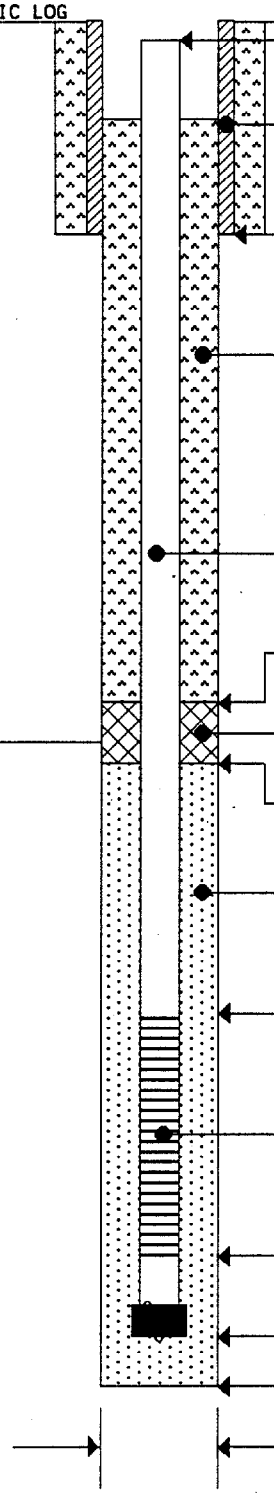
PROJECT: NAVAL AIR STATION KEY WEST

WELL NO.: P-6

JOB NO.	SITE	COORDINATES
22567-321	NAS Key West - JETC	* Well not surveyed

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
7/25/95	7/25/95	J. Novick	Ground Surface

GENERALIZED GEOLOGIC LOG



	DEPTH (FT)	ELEV. (FTMSL)
	0.0	3.1
TOP OF RISER CASING	0.0	3.1
BOTTOM OF FLUSH MOUNT BOX	0.7	2.4
TOP OF SEAL		
TOP OF FILTER PACK	1.0	2.1
TOP OF SCREEN	1.0	2.1
BOTTOM OF SCREEN	11.0	-7.9
BOTTOM OF SUMP	11.0	-7.9
BOTTOM OF HOLE	11.0	-7.9
HOLE DIAMETER:		

FLUSH MOUNT BOX
DIAMETER/TYPE: 8"/Flush Mount Box

BACKFILL MATERIAL TYPE
Silica Sand

RISER CASING
DIAMETER/TYPE: 1"/PVC

ANNULAR SEAL TYPE
None

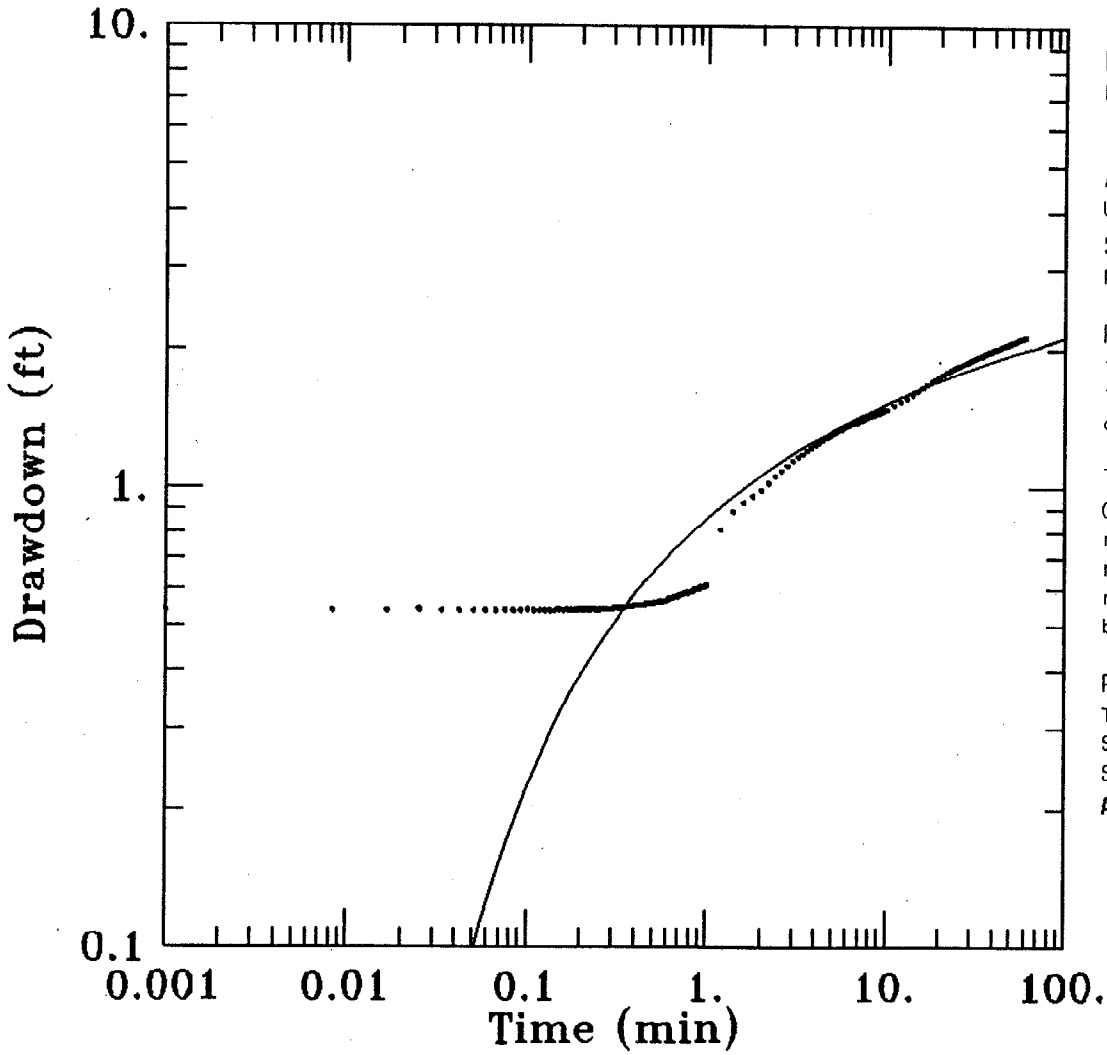
FILTER PACK TYPE
20/30 Silica Sand

SCREEN
DIAMETER: 1"
TYPE: Machine Slotted PVC
OPENING WIDTH: 0.010

ORIG.	J. Novick	DATE	9/28/95
CHK'D BY	MAG	DATE	10/2/95
CALC. NO.	321-G-002		
REV. NO.	0	SHEET NO.	A2-9 of 9

ATTACHMENT 3

Results from AQTESOLV



DATA SET:
P2PT.DAT
09/28/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Neuman

PROJECT DATA:
test date: September 6-7, 1995
test well: R-1
obs. well: P-2

TEST DATA:
Q = 2. gal/min
r = 5. ft
r_c = 0.1667 ft
r_w = 0.5 ft
b = 11. ft

PARAMETER ESTIMATES:
T = 0.06235 ft^2/min
S = 0.0004213
Sy = 0.001
β = 0.001

AQTESOLV

ORIG.	J. Novick	DATE	9/28/95
CHK'D BY	[illegible]	DATE	10/2/95
CALC. NO.	321-G-002		
REV. NO.	0	SHEET NO.	A3-2 of 30

AQTESOLV RESULTS
Version 2.0

Developed by Glenn M. Duffield
(c) 1993, 1994 Geraghty & Miller, Inc.

09/28/95 07:39:08

TEST DESCRIPTION

Data set..... P2PT.DAT
Output file..... P2PT.OUT
Data set title..... JETC Pump Test, P-2
Company..... Bechtel Environmental, Inc.
Project..... 22567-321
Client..... Navy SouthDiv
Location..... JETC (SWMU#9) - NAS Key West
Test date..... September 6-7, 1995
Test well..... R-1
Obs. well..... P-2

Units of Measurement
Length..... ft
Time..... min
Pumping rate.... gal/min

Pumping Well Data
Well No. 1
Well identification..... R-1
X location..... 0
Y location..... 0
Casing radius..... 0.1667
Wellbore radius..... 0.5
Well penetration..... Full
Number of pumping periods..... 1

Period	Pumping Rate
1	2

Observation Well/Piezometer Data
Well identification..... P-2
X location..... 5
Y location..... 0
Distance from pumping well #1.... 5
Well penetration..... Full
No. of observations..... 176

Aquifer Data
Saturated thickness..... 11

ORIG.	J. Novick	DATE	9/28/95
CHK'D BY	[illegible]	DATE	10/2/95
CALC. NO.	321-G-002		
REV. NO.	0	SHEET NO.	A3-3 of 36

ANALYTICAL METHOD

Neuman (Unconfined Aquifer)
Fully Penetrating Wells

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

	Estimate		Std. Error	
T =	6.2353E-002	+/-	1.6779E-002	ft^2/min
S =	4.2129E-004	+/-	4.9360E-005	
Sy =	1.0000E-003	+/-	1.7632E-003	
B =	1.0000E-003	+/-	6.2549E-003	

Derived Parameters
Kr = 0.005668 ft/min
Kz/Kr = 0.00484

ANALYSIS OF MODEL RESIDUALS

residual = observed - calculated
weighted residual = residual * weight

Weighted Residual Statistics:
Number of residuals..... 176
Number of estimated parameters.... 4
Degrees of freedom..... 172
Residual mean..... 0.03159
Residual standard deviation..... 0.169
Residual variance..... 0.02855

Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.001	0.54	2.1072E-008	0.54	1
0.0083	0.54	0.00034308	0.53966	1
0.0166	0.54	0.007954	0.53205	1
0.025	0.543	0.025587	0.51741	1
0.0333	0.54	0.047931	0.49207	1
0.0416	0.54	0.071937	0.46806	1
0.05	0.54	0.096332	0.44367	1
0.0583	0.54	0.11982	0.42018	1
0.0666	0.54	0.14238	0.39762	1
0.075	0.54	0.16416	0.37584	1
0.0833	0.54	0.18464	0.35536	1
0.0916	0.54	0.20412	0.33588	1
0.1	0.543	0.22286	0.32014	1
0.1083	0.54	0.24049	0.29951	1
0.1166	0.54	0.2573	0.2827	1

0.125	0.54	0.27353	0.26647	1
0.1333	0.54	0.28886	0.25114	1
0.1416	0.54	0.30354	0.23646	1
0.15	0.543	0.31777	0.22523	1
0.1583	0.54	0.33128	0.20872	1
0.1666	0.543	0.34426	0.19874	1
0.175	0.543	0.3569	0.1861	1
0.1833	0.543	0.36894	0.17406	1
0.1916	0.543	0.38056	0.16244	1
0.2	0.543	0.39191	0.15109	1
0.2083	0.543	0.40276	0.14024	1
0.2166	0.543	0.41326	0.12974	1
0.225	0.543	0.42355	0.11945	1
0.2333	0.546	0.43341	0.11259	1
0.2416	0.543	0.44299	0.10001	1
0.25	0.543	0.45239	0.090606	1
0.2583	0.546	0.46143	0.084571	1
0.2666	0.546	0.47022	0.075783	1
0.275	0.546	0.47887	0.067125	1
0.2833	0.546	0.48721	0.058793	1
0.2916	0.546	0.49533	0.050672	1
0.3	0.546	0.50334	0.042657	1
0.3083	0.549	0.51107	0.03793	1
0.3166	0.549	0.51862	0.030385	1
0.325	0.549	0.52607	0.022926	1
0.3333	0.549	0.53328	0.015723	1
0.35	0.549	0.54729	0.0017066	1
0.3666	0.552	0.56064	-0.0086393	1
0.3833	0.552	0.57352	-0.021522	1
0.4	0.556	0.5859	-0.029901	1
0.4166	0.556	0.59774	-0.041742	1
0.4333	0.556	0.60922	-0.053223	1
0.45	0.556	0.6203	-0.064299	1
0.4666	0.559	0.63094	-0.071935	1
0.4833	0.559	0.64128	-0.082283	1
0.5	0.559	0.6513	-0.0923	1
0.5166	0.562	0.66095	-0.098948	1
0.5333	0.562	0.67036	-0.10836	1
0.55	0.565	0.6795	-0.1145	1
0.5666	0.565	0.68833	-0.12333	1
0.5833	0.568	0.69696	-0.12896	1
0.6	0.568	0.70536	-0.13736	1
0.6166	0.572	0.71349	-0.14149	1
0.6333	0.575	0.72146	-0.14646	1
0.65	0.575	0.72922	-0.15422	1
0.6666	0.578	0.73676	-0.15876	1
0.6833	0.578	0.74415	-0.16615	1
0.7	0.581	0.75138	-0.17038	1
0.7166	0.584	0.75839	-0.17439	1
0.7333	0.584	0.76529	-0.18129	1
0.75	0.588	0.77204	-0.18404	1
0.7666	0.588	0.7786	-0.1906	1
0.7833	0.591	0.78507	-0.19407	1
0.8	0.594	0.7914	-0.1974	1

0.8166	0.594	0.79756	-0.20356	1
0.8333	0.594	0.80364	-0.20964	1
0.85	0.597	0.8096	-0.2126	1
0.8666	0.6	0.81541	-0.21541	1
0.8833	0.6	0.82115	-0.22115	1
0.9	0.6	0.82678	-0.22678	1
0.9166	0.604	0.83227	-0.22827	1
0.9333	0.607	0.8377	-0.2307	1
0.95	0.607	0.84304	-0.23604	1
0.9666	0.61	0.84825	-0.23825	1
0.9833	0.61	0.8534	-0.2434	1
1	0.613	0.85847	-0.24547	1
1.2	0.809	0.91333	-0.10433	1
1.4	0.886	0.95967	-0.073671	1
1.6	0.928	0.99975	-0.071746	1
1.8	0.957	1.035	-0.078017	1
2	0.985	1.0665	-0.081488	1
2.2	1.021	1.0949	-0.073882	1
2.4	1.056	1.1207	-0.064734	1
2.6	1.088	1.1445	-0.056452	1
2.8	1.117	1.1664	-0.049354	1
3	1.143	1.1867	-0.043692	1
3.2	1.165	1.2057	-0.040668	1
3.4	1.184	1.2234	-0.039449	1
3.6	1.207	1.2402	-0.033173	1
3.8	1.223	1.256	-0.032955	1
4	1.239	1.2709	-0.031893	1
4.2	1.255	1.2851	-0.030071	1
4.4	1.271	1.2986	-0.027561	1
4.6	1.284	1.3114	-0.027423	1
4.8	1.3	1.3237	-0.023713	1
5	1.313	1.3355	-0.022478	1
5.2	1.322	1.3468	-0.02476	1
5.4	1.335	1.3576	-0.022595	1
5.6	1.342	1.368	-0.026018	1
5.8	1.354	1.3781	-0.024057	1
6	1.364	1.3877	-0.023738	1
6.2	1.374	1.3971	-0.023087	1
6.4	1.38	1.4061	-0.026123	1
6.6	1.39	1.4149	-0.024868	1
6.8	1.396	1.4233	-0.027338	1
7	1.402	1.4316	-0.02955	1
7.2	1.409	1.4395	-0.030519	1
7.4	1.415	1.4473	-0.032258	1
7.6	1.422	1.4548	-0.03278	1
7.8	1.428	1.4621	-0.034096	1
8	1.435	1.4692	-0.034217	1
8.2	1.441	1.4762	-0.035153	1
8.4	1.447	1.4829	-0.035913	1
8.6	1.451	1.4895	-0.038506	1
8.8	1.457	1.4959	-0.038938	1
9	1.46	1.5022	-0.042218	1
9.2	1.467	1.5084	-0.041353	1
9.4	1.47	1.5143	-0.044349	1

9.6	1.473	1.5202	-0.047211	1
9.8	1.483	1.5259	-0.042946	1
10	1.486	1.5316	-0.045558	1
11	1.515	1.558	-0.042951	1
12	1.544	1.5819	-0.03792	1
13	1.569	1.6039	-0.034863	1
14	1.601	1.6241	-0.023088	1
15	1.627	1.6428	-0.015848	1
16	1.656	1.6603	-0.0043156	1
17	1.682	1.6767	0.0053382	1
18	1.707	1.692	0.014982	1
19	1.73	1.7065	0.023507	1
20	1.752	1.7202	0.031819	1
21	1.771	1.7332	0.03784	1
22	1.791	1.7455	0.045502	1
23	1.81	1.7573	0.052747	1
24	1.826	1.7685	0.057523	1
25	1.842	1.7792	0.062786	1
26	1.855	1.7895	0.065497	1
27	1.868	1.7994	0.068621	1
28	1.877	1.8089	0.068126	1
29	1.89	1.818	0.071986	1
30	1.903	1.8268	0.076175	1
31	1.913	1.8353	0.077671	1
32	1.925	1.8435	0.081453	1
33	1.935	1.8515	0.083504	1
34	1.945	1.8592	0.085808	1
35	1.957	1.8667	0.090347	1
36	1.967	1.8739	0.09311	1
37	1.977	1.8809	0.09608	1
38	1.983	1.8877	0.09525	1
39	1.993	1.8944	0.098612	1
40	1.999	1.9009	0.098149	1
41	2.009	1.9071	0.10185	1
42	2.018	1.9133	0.10472	1
43	2.025	1.9193	0.10574	1
44	2.034	1.9251	0.1089	1
45	2.041	1.9308	0.1102	1
46	2.047	1.9364	0.11063	1
47	2.054	1.9418	0.11218	1
48	2.06	1.9471	0.11286	1
49	2.07	1.9523	0.11765	1
50	2.073	1.9574	0.11555	1
51	2.083	1.9624	0.12056	1
52	2.089	1.9673	0.12166	1
53	2.092	1.9721	0.11987	1
54	2.102	1.9768	0.12516	1
55	2.105	1.9815	0.12355	1
56	2.111	1.986	0.12502	1
57	2.118	1.9904	0.12757	1
58	2.124	1.9948	0.1292	1
59	2.131	1.9991	0.13191	1
60	2.137	2.0033	0.1337	1

RESULTS FROM VISUAL CURVE MATCHING

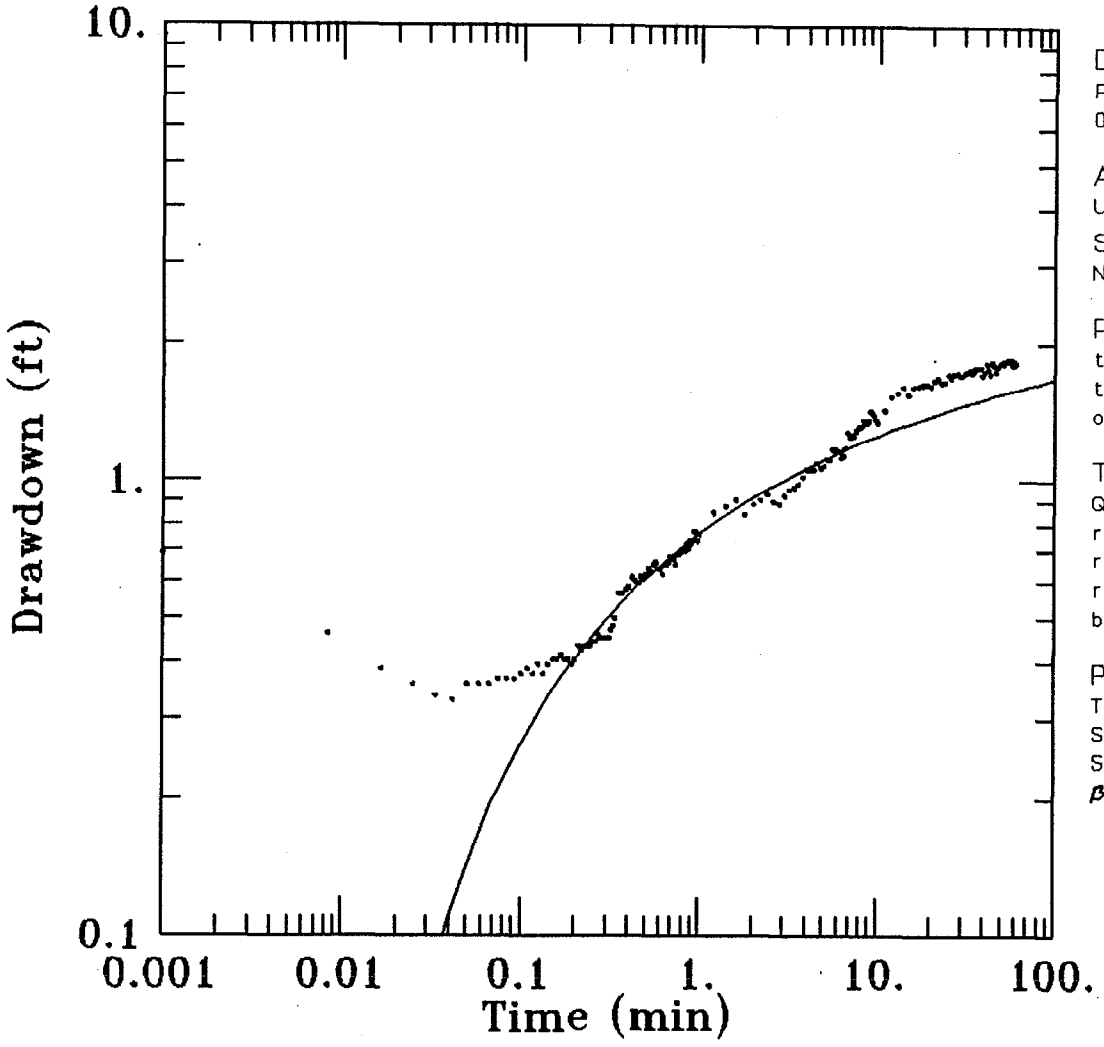
VISUAL MATCH PARAMETER ESTIMATES

Estimate

T = 6.2353E-002 ft^2/min
S = 4.2129E-004
Sy = 1.0000E-003
B = 1.0000E-003

Derived Parameters

Kr = 0.005668 ft/min
Kz/Kr = 0.00484



DATA SET:
P3PT.DAT
09/28/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Neuman

PROJECT DATA:
test date: September 6 - 7, 1995
test well: R-1
obs. well: P-3

TEST DATA:
Q = 2. gal/min
r = 5. ft
r_c = 0.167 ft
r_w = 0.5 ft
b = 11. ft

PARAMETER ESTIMATES:
T = 0.08235 ft^2/min
S = 0.0003301
Sy = 0.001
β = 0.001

AQTESOLV

ORIG.	J. Novick	DATE	9/28/95
CHK'D BY	MMS	DATE	10/2/95
CALC. NO.	321-G-002		
REV. NO.	0	SHEET NO.	A3-9 of 36

AQTESOLV RESULTS
Version 2.0

Developed by Glenn M. Duffield
(c) 1993, 1994 Geraghty & Miller, Inc.

09/28/95 09:48:00

TEST DESCRIPTION

Data set..... P3PT.DAT
Output file..... P3PT.OUT
Data set title..... JETC Pump Test, P-3
Company..... Bechtel Environmental, Inc.
Project..... 22567-321
Client..... Navy SouthDiv
Location..... JETC (SWMU#9) - NAS Key West
Test date..... September 6 - 7, 1995
Test well..... R-1
Obs. well..... P-3

Units of Measurement
Length..... ft
Time..... min
Pumping rate.... gal/min

Pumping Well Data
Well No. 1
Well identification..... R-1
X location..... 0
Y location..... 0
Casing radius..... 0.167
Wellbore radius..... 0.5
Well penetration..... Full
Number of pumping periods..... 1

Period	Pumping Rate
1	2

Observation Well/Piezometer Data
Well identification..... P-3
X location..... 5
Y location..... 0
Distance from pumping well #1.... 5
Well penetration..... Full
No. of observations..... 176

Aquifer Data
Saturated thickness..... 11

ORIG.	J. Novick	DATE	9/28/95
CHK'D BY	MAG	DATE	10/2/95
CALC. NO.	321-G-002		
REV. NO.	0	SHEET NO.	A3-10 of 36

ANALYTICAL METHOD

Neuman (Unconfined Aquifer)
Fully Penetrating Wells

==========

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

	Estimate		Std. Error	
T =	8.2354E-002	+/-	2.0380E-002	ft^2/min
S =	3.3013E-004	+/-	6.0035E-005	
Sy =	1.0000E-003	+/-	1.2772E-003	
B =	1.0000E-003	+/-	4.6355E-003	

Derived Parameters
Kr = 0.007487 ft/min
Kz/Kr = 0.00484

ANALYSIS OF MODEL RESIDUALS

residual = observed - calculated
weighted residual = residual * weight

Weighted Residual Statistics:
Number of residuals..... 176
Number of estimated parameters.... 4
Degrees of freedom..... 172
Residual mean..... 0.09847
Residual standard deviation..... 0.1664
Residual variance..... 0.0277

Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.001	0.69	-3.6268E-008	0.69	1
0.0083	0.462	0.003262	0.45874	1
0.0166	0.386	0.025181	0.36082	1
0.025	0.357	0.055651	0.30135	1
0.0333	0.338	0.086119	0.25188	1
0.0416	0.329	0.1148	0.2142	1
0.05	0.357	0.14156	0.21544	1
0.0583	0.357	0.16586	0.19114	1
0.0666	0.357	0.18821	0.16879	1
0.075	0.367	0.2091	0.1579	1
0.0833	0.367	0.22823	0.13877	1
0.0916	0.367	0.24604	0.12096	1
0.1	0.376	0.26289	0.11311	1
0.1083	0.386	0.2785	0.1075	1
0.1166	0.376	0.29319	0.082809	1

0.125	0.395	0.30723	0.087769	1
0.1333	0.376	0.32036	0.055636	1
0.1416	0.395	0.33283	0.062167	1
0.15	0.405	0.34484	0.06016	1
0.1583	0.405	0.35615	0.048848	1
0.1666	0.414	0.36696	0.047037	1
0.175	0.405	0.37744	0.027565	1
0.1833	0.405	0.38736	0.017642	1
0.1916	0.395	0.39689	-0.0018896	1
0.2	0.405	0.40617	-0.0011677	1
0.2083	0.433	0.415	0.018003	1
0.2166	0.424	0.42351	0.00048597	1
0.225	0.433	0.43184	0.0011638	1
0.2333	0.433	0.43978	-0.0067848	1
0.2416	0.433	0.44748	-0.014478	1
0.25	0.443	0.45502	-0.012018	1
0.2583	0.443	0.46224	-0.019242	1
0.2666	0.462	0.46925	-0.0072532	1
0.275	0.452	0.47614	-0.024144	1
0.2833	0.452	0.48276	-0.030762	1
0.2916	0.452	0.4892	-0.037199	1
0.3	0.452	0.49554	-0.043541	1
0.3083	0.452	0.50164	-0.049644	1
0.3166	0.471	0.50759	-0.036593	1
0.325	0.481	0.51347	-0.032465	1
0.3333	0.5	0.51913	-0.019126	1
0.35	0.566	0.53012	0.03588	1
0.3666	0.566	0.54056	0.025441	1
0.3833	0.576	0.55061	0.025389	1
0.4	0.585	0.56025	0.024752	1
0.4166	0.614	0.56945	0.044553	1
0.4333	0.604	0.57835	0.025652	1
0.45	0.595	0.58692	0.0080794	1
0.4666	0.614	0.59514	0.018862	1
0.4833	0.614	0.60312	0.01088	1
0.5	0.623	0.61083	0.012165	1
0.5166	0.642	0.61826	0.023745	1
0.5333	0.633	0.62549	0.0075135	1
0.55	0.652	0.6325	0.019504	1
0.5666	0.661	0.63926	0.021742	1
0.5833	0.642	0.64586	-0.0038644	1
0.6	0.642	0.65228	-0.010285	1
0.6166	0.623	0.65849	-0.035492	1
0.6333	0.652	0.66457	-0.012571	1
0.65	0.652	0.67049	-0.018491	1
0.6666	0.661	0.67623	-0.015226	1
0.6833	0.68	0.68185	-0.0018534	1
0.7	0.68	0.68734	-0.0073438	1
0.7166	0.671	0.69267	-0.021672	1
0.7333	0.652	0.69791	-0.045908	1
0.75	0.69	0.70303	-0.013026	1
0.7666	0.69	0.708	-0.018	1
0.7833	0.7	0.71289	-0.012895	1
0.8	0.7	0.71769	-0.017685	1

0.8166	0.709	0.72235	-0.013348	1
0.8333	0.7	0.72694	-0.026942	1
0.85	0.728	0.73144	-0.0034439	1
0.8666	0.709	0.73583	-0.026831	1
0.8833	0.738	0.74016	-0.0021582	1
0.9	0.728	0.7444	-0.016403	1
0.9166	0.738	0.74854	-0.010544	1
0.9333	0.776	0.75263	0.023366	1
0.95	0.776	0.75665	0.019351	1
0.9666	0.738	0.76057	-0.02257	1
0.9833	0.738	0.76444	-0.026445	1
1	0.766	0.76825	-0.0022533	1
1.2	0.852	0.80938	0.042622	1
1.4	0.88	0.84397	0.036031	1
1.6	0.909	0.87377	0.035225	1
1.8	0.842	0.89993	-0.057931	1
2	0.89	0.92321	-0.033211	1
2.2	0.909	0.94417	-0.03517	1
2.4	0.937	0.96322	-0.026215	1
2.6	0.899	0.98066	-0.081658	1
2.8	0.89	0.99674	-0.10674	1
3	0.928	1.0116	-0.083648	1
3.2	0.956	1.0255	-0.069541	1
3.4	0.966	1.0385	-0.072543	1
3.6	0.985	1.0508	-0.065757	1
3.8	1.023	1.0623	-0.039271	1
4	1.061	1.0732	-0.012157	1
4.2	1.061	1.0835	-0.022479	1
4.4	1.061	1.0933	-0.032291	1
4.6	1.099	1.1026	-0.0036373	1
4.8	1.07	1.1116	-0.04156	1
5	1.08	1.1201	-0.040095	1
5.2	1.118	1.1283	-0.010272	1
5.4	1.118	1.1361	-0.01812	1
5.6	1.175	1.1437	0.031337	1
5.8	1.175	1.1509	0.024078	1
6	1.165	1.1579	0.007081	1
6.2	1.127	1.1647	-0.03767	1
6.4	1.137	1.1712	-0.034192	1
6.6	1.184	1.1775	0.0065019	1
6.8	1.279	1.1836	0.095397	1
7	1.251	1.1895	0.061482	1
7.2	1.27	1.1953	0.074746	1
7.4	1.26	1.2008	0.059179	1
7.6	1.289	1.2062	0.082771	1
7.8	1.318	1.2115	0.10651	1
8	1.318	1.2166	0.1014	1
8.2	1.327	1.2216	0.10542	1
8.4	1.365	1.2264	0.13857	1
8.6	1.346	1.2312	0.11485	1
8.8	1.346	1.2358	0.11024	1
9	1.365	1.2403	0.12474	1
9.2	1.422	1.2447	0.17734	1
9.4	1.413	1.249	0.16405	1

9.6	1.394	1.2531	0.14086	1
9.8	1.365	1.2572	0.10776	1
10	1.346	1.2613	0.084748	1
11	1.432	1.2801	0.15192	1
12	1.536	1.2971	0.23886	1
13	1.565	1.3127	0.25227	1
14	1.612	1.3271	0.28494	1
15	1.555	1.3403	0.21467	1
16	1.612	1.3527	0.25933	1
17	1.622	1.3642	0.25781	1
18	1.631	1.375	0.256	1
19	1.641	1.3852	0.25582	1
20	1.622	1.3948	0.22721	1
21	1.669	1.4039	0.26511	1
22	1.688	1.4125	0.27547	1
23	1.65	1.4207	0.22925	1
24	1.66	1.4286	0.23141	1
25	1.726	1.4361	0.28991	1
26	1.688	1.4433	0.24473	1
27	1.726	1.4502	0.27584	1
28	1.736	1.4568	0.27922	1
29	1.717	1.4631	0.25385	1
30	1.717	1.4693	0.24772	1
31	1.736	1.4752	0.2608	1
32	1.745	1.4809	0.26407	1
33	1.755	1.4865	0.26854	1
34	1.736	1.4918	0.24418	1
35	1.774	1.497	0.27698	1
36	1.783	1.5021	0.28094	1
37	1.783	1.507	0.27604	1
38	1.783	1.5117	0.27128	1
39	1.717	1.5164	0.20065	1
40	1.745	1.5209	0.22414	1
41	1.812	1.5253	0.28674	1
42	1.764	1.5295	0.23445	1
43	1.726	1.5337	0.19227	1
44	1.831	1.5378	0.29318	1
45	1.802	1.5418	0.26018	1
46	1.745	1.5457	0.19928	1
47	1.793	1.5495	0.24345	1
48	1.802	1.5533	0.24871	1
49	1.831	1.557	0.27404	1
50	1.831	1.5606	0.27045	1
51	1.821	1.5641	0.25693	1
52	1.84	1.5675	0.27247	1
53	1.84	1.5709	0.26907	1
54	1.85	1.5743	0.27574	1
55	1.84	1.5775	0.26247	1
56	1.859	1.5807	0.27825	1
57	1.802	1.5839	0.21809	1
58	1.84	1.587	0.25298	1
59	1.812	1.5901	0.22191	1
60	1.821	1.5931	0.2279	1

RESULTS FROM VISUAL CURVE MATCHING

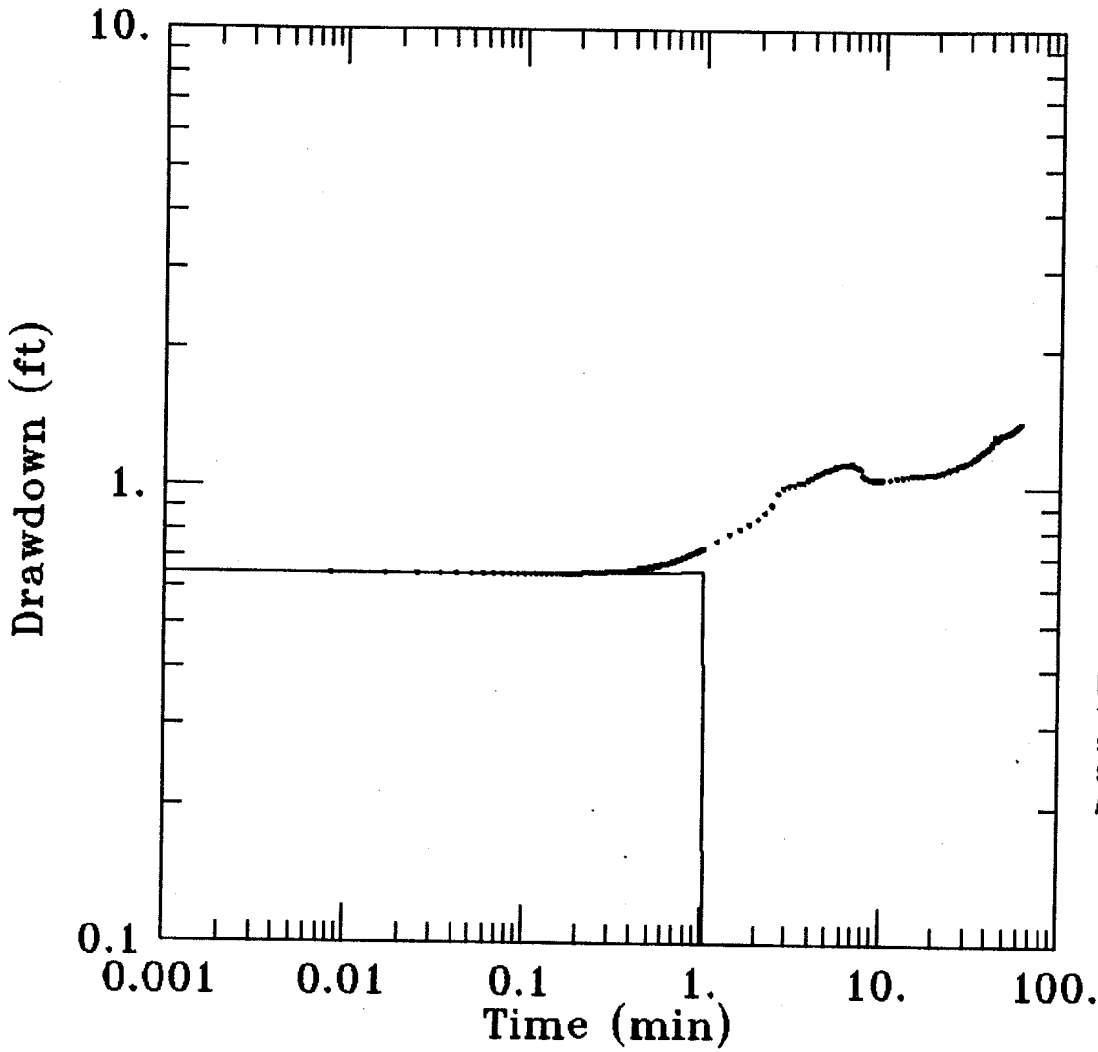
VISUAL MATCH PARAMETER ESTIMATES

Estimate

T = 8.2354E-002 ft^2/min
S = 3.3013E-004
Sy = 1.0000E-003
B = 1.0000E-003

Derived Parameters

Kr = 0.007487 ft/min
Kz/Kr = 0.00484



DATA SET:
P4PT.DAT
09/29/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Neuman

PROJECT DATA:
test date: September 6 - 7, 1995
test well: R-1
obs. well: P-4

TEST DATA:
Q = 2. gal/min
r = 5. ft
r_c = 0.167 ft
r_w = 0.5 ft
b = 11. ft

PARAMETER ESTIMATES:
T = 0.1768 ft^2/min
S = 1.E-12
Sy = 0.001
β = 0.001308

AQTESOLV

ORIG.	J. Novick	DATE 9/28/95
CHK'D BY		DATE 10/2/95
CALC. NO.	321-G-002	
REV. NO.	0	SHEET NO. A3-16 of 36

AQTESOLV RESULTS
Version 2.0

Developed by Glenn M. Duffield
(c) 1993, 1994 Geraghty & Miller, Inc.

09/29/95 07:17:08

TEST DESCRIPTION

Data set..... P4PT.DAT
Output file..... P4PT.OUT
Data set title..... JETC Pump Test, P-4
Company..... Bechtel Environmental, Inc.
Project..... 22567-321
Client..... Navy SouthDiv
Location..... JETC (SWMU#9) - NAS Key West
Test date..... September 6 - 7, 1995
Test well..... R-1
Obs. well..... P-4

Units of Measurement
Length..... ft
Time..... min
Pumping rate.... gal/min

Pumping Well Data
Well No. 1
Well identification..... R-1
X location..... 0
Y location..... 0
Casing radius..... 0.167
Wellbore radius..... 0.5
Well penetration..... Full
Number of pumping periods..... 2

Period	Pumping Rate
1	2
2	0.0083

Observation Well/Piezometer Data
Well identification..... P-4
X location..... 5
Y location..... 0
Distance from pumping well #1.... 5
Well penetration..... Full
No. of observations..... 175

Aquifer Data
Saturated thickness..... 11

ANALYTICAL METHOD

Neuman (Unconfined Aquifer)
Fully Penetrating Wells

ORIG.	J. Novick	DATE	9/28/95
CHK'D BY	MAE	DATE	10/2/95
CALC. NO.	321-G-002		
REV. NO.	0	SHEET NO.	A3-17 of 36

ANALYTICAL METHOD

Neuman (Unconfined Aquifer)
Fully Penetrating Wells

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

	Estimate	Std. Error	
T =	1.7675E-001	+/- 7.7731E+000	ft^2/min
S =	1.0000E-012	+/- 5.5514E-006	
Sy =	1.0000E-003	+/- 2.3601E-001	
B =	1.3081E-003	+/- 3.1722E-001	

Derived Parameters
Kr = 0.01607 ft/min
Kz/Kr = 0.006331

ANALYSIS OF MODEL RESIDUALS

residual = observed - calculated
weighted residual = residual * weight

Weighted Residual Statistics:
Number of residuals..... 175
Number of estimated parameters.... 4
Degrees of freedom..... 171
Residual mean..... 0.6158
Residual standard deviation..... 0.8391
Residual variance..... 0.7042

Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.0083	0.645	0.64549	-0.00048961	1
0.0166	0.645	0.64556	-0.00055692	1
0.025	0.645	0.64563	-0.000625	1
0.0333	0.645	0.64569	-0.00069223	1
0.0416	0.645	0.64576	-0.00075943	1
0.05	0.645	0.64583	-0.0008274	1
0.0583	0.645	0.64589	-0.00089452	1
0.0666	0.645	0.64596	-0.0009616	1
0.075	0.645	0.64603	-0.0010295	1
0.0833	0.645	0.6461	-0.0010965	1
0.0916	0.645	0.64616	-0.0011634	1
0.1	0.645	0.64623	-0.0012312	1
0.1083	0.645	0.6463	-0.0012981	1
0.1166	0.645	0.64636	-0.0013649	1
0.125	0.645	0.64643	-0.0014325	1
0.1333	0.645	0.6465	-0.0014993	1
0.1416	0.645	0.64657	-0.0015661	1
0.15	0.645	0.64663	-0.0016336	1

0.1583	0.645	0.6467	-0.0017003	1
0.1666	0.645	0.64677	-0.0017669	1
0.175	0.645	0.64683	-0.0018343	1
0.1833	0.645	0.6469	-0.0019008	1
0.1916	0.645	0.64697	-0.0019674	1
0.2	0.645	0.64703	-0.0020346	1
0.2083	0.645	0.6471	-0.0021011	1
0.2166	0.65	0.64717	0.0028325	1
0.225	0.65	0.64723	0.0027653	1
0.2333	0.65	0.6473	0.002699	1
0.2416	0.65	0.64737	0.0026327	1
0.25	0.65	0.64743	0.0025657	1
0.2583	0.65	0.6475	0.0024995	1
0.2666	0.65	0.64757	0.0024333	1
0.275	0.65	0.64763	0.0023663	1
0.2833	0.65	0.6477	0.0023002	1
0.2916	0.654	0.64777	0.0062342	1
0.3	0.654	0.64783	0.0061673	1
0.3083	0.654	0.6479	0.0061014	1
0.3166	0.654	0.64796	0.0060354	1
0.325	0.654	0.64803	0.0059687	1
0.3333	0.654	0.6481	0.0059028	1
0.35	0.654	0.64823	0.0057704	1
0.3666	0.654	0.64836	0.0056389	1
0.3833	0.659	0.64849	0.010507	1
0.4	0.659	0.64863	0.010375	1
0.4166	0.659	0.64876	0.010244	1
0.4333	0.664	0.64889	0.015112	1
0.45	0.664	0.64902	0.01498	1
0.4666	0.664	0.64915	0.01485	1
0.4833	0.664	0.64928	0.014719	1
0.5	0.669	0.64941	0.019588	1
0.5166	0.669	0.64954	0.019457	1
0.5333	0.673	0.64967	0.023327	1
0.55	0.673	0.6498	0.023196	1
0.5666	0.673	0.64993	0.023066	1
0.5833	0.678	0.65006	0.027936	1
0.6	0.678	0.65019	0.027806	1
0.6166	0.678	0.65032	0.027677	1
0.6333	0.683	0.65045	0.032547	1
0.65	0.683	0.65058	0.032417	1
0.6666	0.688	0.65071	0.037288	1
0.6833	0.688	0.65084	0.037159	1
0.7	0.692	0.65097	0.041029	1
0.7166	0.692	0.6511	0.040901	1
0.7333	0.697	0.65123	0.045772	1
0.75	0.697	0.65136	0.045643	1
0.7666	0.702	0.65148	0.050515	1
0.7833	0.702	0.65161	0.050387	1
0.8	0.707	0.65174	0.055258	1
0.8166	0.711	0.65187	0.059131	1
0.8333	0.711	0.652	0.059003	1
0.85	0.716	0.65213	0.063875	1
0.8666	0.716	0.65225	0.063748	1

0.8833	0.721	0.65238	0.06862	1
0.9	0.721	0.65251	0.068493	1
0.9166	0.726	0.65263	0.073366	1
0.9333	0.726	0.65276	0.073239	1
0.95	0.73	0.65289	0.077112	1
0.9666	0.73	0.65301	0.076986	1
0.9833	0.735	0.65314	0.081859	1
1	0.735	0.65327	0.081732	1
1.2	0.764	0.010423	0.75358	1
1.4	0.792	0.010323	0.78168	1
1.6	0.811	0.010225	0.80078	1
1.8	0.835	0.010127	0.82487	1
2	0.854	0.010032	0.84397	1
2.2	0.882	0.0099374	0.87206	1
2.4	0.916	0.0098451	0.90615	1
2.6	0.973	0.0097547	0.96325	1
2.8	1.001	0.0096663	0.99133	1
3	1.011	0.00958	1.0014	1
3.2	1.016	0.0094958	1.0065	1
3.4	1.025	0.0094138	1.0156	1
3.6	1.03	0.0093338	1.0207	1
3.8	1.044	0.009256	1.0347	1
4	1.054	0.0091803	1.0448	1
4.2	1.068	0.0091067	1.0589	1
4.4	1.077	0.0090351	1.068	1
4.6	1.087	0.0089655	1.078	1
4.8	1.096	0.0088979	1.0871	1
5	1.101	0.0088321	1.0922	1
5.2	1.106	0.0087681	1.0972	1
5.4	1.115	0.0087059	1.1063	1
5.6	1.12	0.0086454	1.1114	1
5.8	1.125	0.0085866	1.1164	1
6	1.125	0.0085293	1.1165	1
6.2	1.125	0.0084736	1.1165	1
6.4	1.125	0.0084193	1.1166	1
6.6	1.13	0.0083665	1.1216	1
6.8	1.13	0.0083151	1.1217	1
7	1.12	0.0082649	1.1117	1
7.2	1.111	0.0082161	1.1028	1
7.4	1.111	0.0081685	1.1028	1
7.6	1.101	0.008122	1.0929	1
7.8	1.068	0.0080767	1.0599	1
8	1.054	0.0080325	1.046	1
8.2	1.054	0.0079893	1.046	1
8.4	1.049	0.0079472	1.0411	1
8.6	1.049	0.007906	1.0411	1
8.8	1.044	0.0078658	1.0361	1
9	1.044	0.0078265	1.0362	1
9.2	1.044	0.0077881	1.0362	1
9.4	1.044	0.0077505	1.0362	1
9.6	1.044	0.0077138	1.0363	1
9.8	1.044	0.0076778	1.0363	1
10	1.044	0.0076426	1.0364	1
11	1.049	0.0074773	1.0415	1

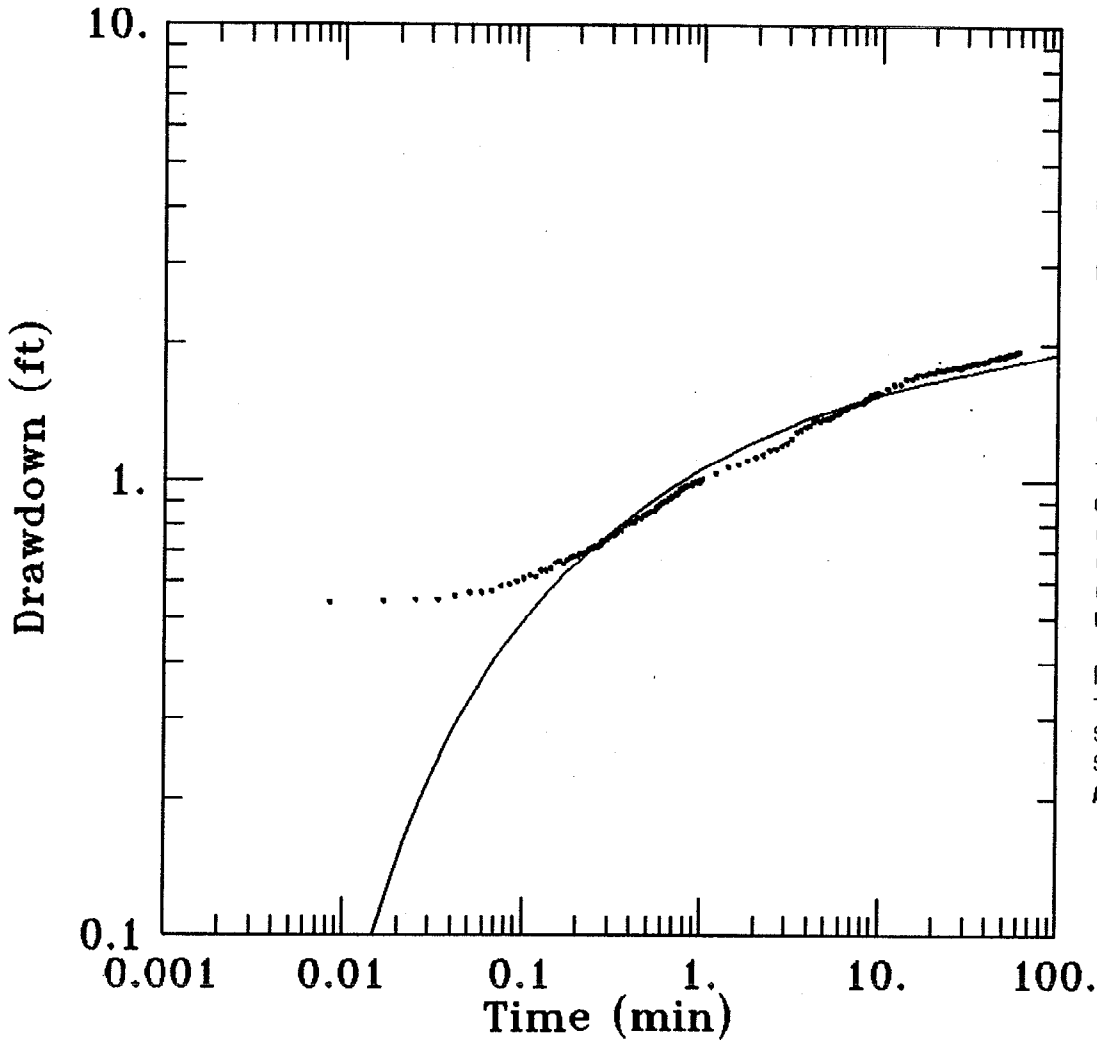
12	1.054	0.0073277	1.0467	1
13	1.058	0.0071916	1.0508	1
14	1.063	0.0070671	1.0559	1
15	1.068	0.0069527	1.061	1
16	1.068	0.0068471	1.0612	1
17	1.068	0.0067493	1.0613	1
18	1.073	0.0066584	1.0663	1
19	1.073	0.0065737	1.0664	1
20	1.077	0.0064946	1.0705	1
21	1.082	0.0064204	1.0756	1
22	1.087	0.0063507	1.0806	1
23	1.096	0.0062851	1.0897	1
24	1.101	0.0062235	1.0948	1
25	1.111	0.0061648	1.1048	1
26	1.115	0.0061095	1.1089	1
27	1.125	0.0060571	1.1189	1
28	1.13	0.0060073	1.124	1
29	1.135	0.00596	1.129	1
30	1.144	0.005915	1.1381	1
31	1.149	0.0058721	1.1431	1
32	1.158	0.0058311	1.1522	1
33	1.168	0.005792	1.1622	1
34	1.173	0.0057547	1.1672	1
35	1.187	0.0057189	1.1813	1
36	1.196	0.0056847	1.1903	1
37	1.206	0.0056518	1.2003	1
38	1.215	0.0056203	1.2094	1
39	1.225	0.0055901	1.2194	1
40	1.234	0.0055611	1.2284	1
41	1.249	0.0055332	1.2435	1
42	1.272	0.0055063	1.2665	1
43	1.306	0.0054805	1.3005	1
44	1.287	0.0054556	1.2815	1
45	1.291	0.0054316	1.2856	1
46	1.306	0.0054085	1.3006	1
47	1.315	0.0053862	1.3096	1
48	1.315	0.0053646	1.3096	1
49	1.32	0.0053438	1.3147	1
50	1.325	0.0053237	1.3197	1
51	1.329	0.0053043	1.3237	1
52	1.334	0.0052856	1.3287	1
53	1.339	0.0052674	1.3337	1
54	1.348	0.0052498	1.3428	1
55	1.353	0.0052328	1.3478	1
56	1.363	0.0052163	1.3578	1
57	1.368	0.0052004	1.3628	1
58	1.377	0.0051849	1.3718	1
59	1.382	0.0051699	1.3768	1
60	1.391	0.0051554	1.3858	1

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

Estimate
T = 1.7675E-001 ft^2/min
S = 1.0000E-012
Sy = 1.0000E-003
B = 1.3081E-003

Derived Parameters
Kr = 0.01607 ft/min
Kz/Kr = 0.006331



DATA SET:
P5PT.DAT
09/28/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Neuman

PROJECT DATA:
test date: September 6 - 7, 1995
test well: R-1
obs. well: P-5

TEST DATA:
Q = 2. gal/min
r = 5. ft
r_c = 0.167 ft
r_w = 0.5 ft
b = 11. ft

PARAMETER ESTIMATES:
T = 0.07366 ft^2/min
S = 0.0001269
Sy = 0.001
β = 0.001

AQTESOLV

ORIG.	J. Novick	DATE	9/28/95
CHK'D BY	MAG	DATE	10/12/95
CALC. NO.	321-G-002		
REV. NO.	0	SHEET NO.	A3-23 of 36

AQTESOLV RESULTS
Version 2.0

Developed by Glenn M. Duffield
(c) 1993, 1994 Geraghty & Miller, Inc.

09/28/95 14:44:38

TEST DESCRIPTION

Data set..... P5PT.DAT
Output file..... P5PT.OUT
Data set title..... JETC Pump Test, P-5
Company..... Bechtel Environmental, Inc
Project..... 22567-321
Client..... Navy SouthDiv
Location..... JETC (SWMU#9) - NAS Key West
Test date..... September 6 - 7, 1995
Test well..... R-1
Obs. well..... P-5

Units of Measurement
Length..... ft
Time..... min
Pumping rate.... gal/min

Pumping Well Data
Well No. 1
Well identification..... R-1
X location..... 0
Y location..... 0
Casing radius..... 0.167
Wellbore radius..... 0.5
Well penetration..... Full
Number of pumping periods..... 1

Period	Pumping Rate
1	2

Observation Well/Piezometer Data
Well identification..... P-5
X location..... 5
Y location..... 0
Distance from pumping well #1.... 5
Well penetration..... Full
No. of observations..... 175

Aquifer Data
Saturated thickness..... 11

ORIG.	J. Novick	DATE	9/28/95
CHK'D BY	MAG	DATE	10/2/95
CALC. NO.	321-G-002		
REV. NO.	0	SHEET NO.	A3-24 of 36

ANALYTICAL METHOD

Neuman (Unconfined Aquifer)
Fully Penetrating Wells

==========

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

	Estimate		Std. Error	
T =	7.3665E-002	+/-	5.5680E-003	ft^2/min
S =	1.2689E-004	+/-	1.4401E-005	
Sy =	1.0000E-003	+/-	3.9754E-004	
B =	1.0000E-003	+/-	8.2876E-004	

Derived Parameters
Kr = 0.006697 ft/min
Kz/Kr = 0.00484

ANALYSIS OF MODEL RESIDUALS

residual = observed - calculated
weighted residual = residual * weight

Weighted Residual Statistics:
Number of residuals..... 175
Number of estimated parameters.... 4
Degrees of freedom..... 171
Residual mean..... 0.02737
Residual standard deviation..... 0.09643
Residual variance..... 0.009299

Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.0083	0.54	0.038791	0.50121	1
0.0166	0.544	0.11715	0.42685	1
0.025	0.549	0.18504	0.36396	1
0.0333	0.549	0.24035	0.30865	1
0.0416	0.558	0.28687	0.27113	1
0.05	0.568	0.32728	0.24072	1
0.0583	0.568	0.36217	0.20583	1
0.0666	0.573	0.39313	0.17987	1
0.075	0.587	0.42125	0.16575	1
0.0833	0.591	0.44643	0.14457	1
0.0916	0.601	0.46946	0.13154	1
0.1	0.61	0.49092	0.11908	1
0.1083	0.62	0.51054	0.10946	1
0.1166	0.615	0.52882	0.086184	1

0.125	0.634	0.54611	0.087892	1
0.1333	0.634	0.56215	0.071851	1
0.1416	0.643	0.57727	0.065734	1
0.15	0.662	0.59172	0.070275	1
0.1583	0.667	0.60527	0.061734	1
0.1666	0.658	0.61814	0.039863	1
0.175	0.672	0.63054	0.041456	1
0.1833	0.681	0.64225	0.038755	1
0.1916	0.686	0.65344	0.032561	1
0.2	0.686	0.66429	0.021707	1
0.2083	0.695	0.67458	0.020415	1
0.2166	0.691	0.68448	0.0065211	1
0.225	0.7	0.69412	0.0058831	1
0.2333	0.71	0.7033	0.006705	1
0.2416	0.714	0.71215	0.0018465	1
0.25	0.719	0.72081	-0.0018144	1
0.2583	0.719	0.72909	-0.010091	1
0.2666	0.724	0.7371	-0.013104	1
0.275	0.738	0.74496	-0.0069634	1
0.2833	0.743	0.75249	-0.0094948	1
0.2916	0.747	0.75981	-0.012807	1
0.3	0.757	0.767	-0.0099959	1
0.3083	0.762	0.7739	-0.011902	1
0.3166	0.762	0.78062	-0.018622	1
0.325	0.766	0.78724	-0.021243	1
0.3333	0.776	0.79362	-0.017617	1
0.35	0.781	0.80596	-0.024965	1
0.3666	0.799	0.81766	-0.018656	1
0.3833	0.809	0.82888	-0.019884	1
0.4	0.814	0.83962	-0.02562	1
0.4166	0.814	0.84984	-0.035845	1
0.4333	0.833	0.85972	-0.026715	1
0.45	0.828	0.8692	-0.041201	1
0.4666	0.842	0.87827	-0.036275	1
0.4833	0.847	0.88707	-0.040072	1
0.5	0.856	0.89556	-0.039559	1
0.5166	0.861	0.90371	-0.042708	1
0.5333	0.861	0.91164	-0.050635	1
0.55	0.875	0.91931	-0.044307	1
0.5666	0.885	0.9267	-0.041696	1
0.5833	0.894	0.9339	-0.039904	1
0.6	0.899	0.9409	-0.041899	1
0.6166	0.908	0.94765	-0.039651	1
0.6333	0.908	0.95425	-0.046254	1
0.65	0.918	0.96068	-0.042677	1
0.6666	0.922	0.96689	-0.044892	1
0.6833	0.932	0.97298	-0.040981	1
0.7	0.937	0.97892	-0.041915	1
0.7166	0.941	0.98467	-0.043667	1
0.7333	0.941	0.99031	-0.049314	1
0.75	0.96	0.99582	-0.035825	1
0.7666	0.965	1.0012	-0.036176	1
0.7833	0.97	1.0064	-0.036436	1
0.8	0.974	1.0116	-0.037579	1

0.8166	0.979	1.0166	-0.037579	1
0.8333	0.979	1.0215	-0.0425	1
0.85	0.979	1.0263	-0.047318	1
0.8666	0.979	1.031	-0.052008	1
0.8833	0.993	1.0356	-0.04263	1
0.9	0.993	1.0402	-0.04716	1
0.9166	0.998	1.0446	-0.046574	1
0.9333	0.998	1.0489	-0.05093	1
0.95	1.003	1.0532	-0.050202	1
0.9666	0.998	1.0574	-0.05937	1
0.9833	1.007	1.0615	-0.054486	1
1	1.012	1.0655	-0.053528	1
1.2	1.041	1.1089	-0.067946	1
1.4	1.074	1.1451	-0.071139	1
1.6	1.093	1.1761	-0.083076	1
1.8	1.111	1.203	-0.092026	1
2	1.13	1.2268	-0.096849	1
2.2	1.145	1.2482	-0.10316	1
2.4	1.173	1.2674	-0.094404	1
2.6	1.182	1.2849	-0.10293	1
2.8	1.201	1.301	-0.099995	1
3	1.215	1.3158	-0.10081	1
3.2	1.244	1.3295	-0.085546	1
3.4	1.282	1.3423	-0.060334	1
3.6	1.296	1.3543	-0.058289	1
3.8	1.315	1.3655	-0.050505	1
4	1.329	1.3761	-0.047061	1
4.2	1.353	1.386	-0.033023	1
4.4	1.371	1.3955	-0.02446	1
4.6	1.353	1.4044	-0.051402	1
4.8	1.371	1.4129	-0.041902	1
5	1.376	1.421	-0.044998	1
5.2	1.376	1.4287	-0.052724	1
5.4	1.39	1.4361	-0.046108	1
5.6	1.409	1.4432	-0.034176	1
5.8	1.405	1.45	-0.044953	1
6	1.428	1.4565	-0.028459	1
6.2	1.442	1.4627	-0.020713	1
6.4	1.447	1.4687	-0.021732	1
6.6	1.461	1.4745	-0.01353	1
6.8	1.471	1.4801	-0.0091229	1
7	1.471	1.4855	-0.014522	1
7.2	1.48	1.4907	-0.01074	1
7.4	1.49	1.4958	-0.0057862	1
7.6	1.494	1.5007	-0.0066712	1
7.8	1.494	1.5054	-0.011404	1
8	1.494	1.51	-0.015992	1
8.2	1.509	1.5144	-0.0054436	1
8.4	1.523	1.5188	0.0042344	1
8.6	1.527	1.523	0.0040354	1
8.8	1.542	1.527	0.014953	1
9	1.551	1.531	0.019982	1
9.2	1.556	1.5349	0.021118	1
9.4	1.565	1.5386	0.026352	1

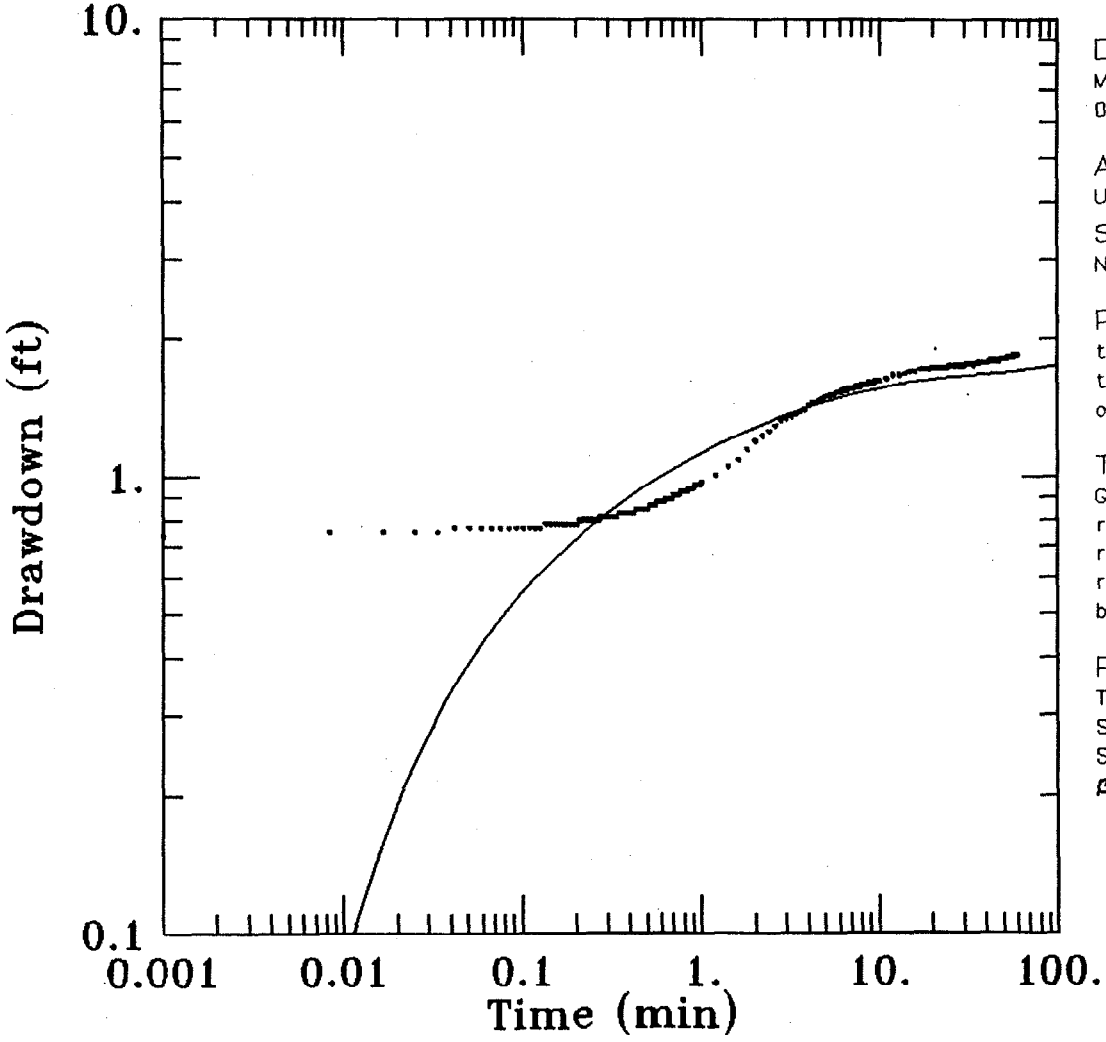
9.6	1.57	1.5423	0.027684	1
9.8	1.565	1.5459	0.019112	1
10	1.565	1.5494	0.015625	1
11	1.603	1.5656	0.037388	1
12	1.631	1.5801	0.05087	1
13	1.636	1.5932	0.04277	1
14	1.679	1.6051	0.073855	1
15	1.683	1.6161	0.066941	1
16	1.707	1.6261	0.080883	1
17	1.717	1.6354	0.081562	1
18	1.726	1.6441	0.08188	1
19	1.74	1.6522	0.087757	1
20	1.735	1.6599	0.075125	1
21	1.759	1.6671	0.091927	1
22	1.759	1.6739	0.085115	1
23	1.759	1.6804	0.078647	1
24	1.769	1.6865	0.082487	1
25	1.773	1.6924	0.080605	1
26	1.783	1.698	0.084973	1
27	1.783	1.7034	0.079567	1
28	1.773	1.7086	0.064368	1
29	1.787	1.7136	0.073358	1
30	1.797	1.7185	0.078519	1
31	1.811	1.7232	0.087837	1
32	1.811	1.7277	0.083301	1
33	1.816	1.7321	0.083898	1
34	1.825	1.7364	0.088618	1
35	1.821	1.7405	0.080453	1
36	1.825	1.7446	0.080394	1
37	1.825	1.7486	0.076434	1
38	1.835	1.7524	0.082565	1
39	1.844	1.7562	0.087783	1
40	1.844	1.7599	0.084082	1
41	1.858	1.7635	0.094456	1
42	1.868	1.7671	0.1009	1
43	1.863	1.7706	0.092412	1
44	1.863	1.774	0.088988	1
45	1.873	1.7774	0.095622	1
46	1.863	1.7807	0.082314	1
47	1.887	1.7839	0.10306	1
48	1.887	1.7871	0.099854	1
49	1.877	1.7903	0.086699	1
50	1.882	1.7934	0.088589	1
51	1.901	1.7965	0.10452	1
52	1.901	1.7995	0.1015	1
53	1.906	1.8025	0.10352	1
54	1.92	1.8054	0.11457	1
55	1.915	1.8083	0.10667	1
56	1.915	1.8112	0.10379	1
57	1.92	1.814	0.10596	1
58	1.929	1.8168	0.11215	1
59	1.943	1.8196	0.12338	1
60	1.943	1.8224	0.12064	1

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

Estimate
T = 7.3665E-002 ft^2/min
S = 1.2689E-004
Sy = 1.0000E-003
B = 1.0000E-003

Derived Parameters
Kr = 0.006697 ft/min
Kz/Kr = 0.00484



DATA SET:
MW10PT.DAT
09/28/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Neuman

PROJECT DATA:
test date: September 6 - 7, 1995
test well: R-1
obs. well: MW-10

TEST DATA:
Q = 2. gal/min
r = 10. ft
r_c = 0.1667 ft
r_w = 0.5 ft
b = 11. ft

PARAMETER ESTIMATES:
T = 0.07305 ft^2/min
S = 2.442E-05
Sy = 0.001
β = 0.001

AQTESOLV

ORIG.	J. Novick	DATE	9/28/95
CHK'D BY	[illegible]	DATE	10/2/95
CALC. NO.	321-G-002		
REV. NO.	0	SHEET NO.	A3-20 of 36

AQTESOLV RESULTS
Version 2.0

Developed by Glenn M. Duffield
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09/28/95 14:53:50

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TEST DESCRIPTION

Data set..... MW10PT.DAT
Output file..... MW10PT.OUT
Data set title..... JETC Pump Test, MW-10
Company..... Bechtel Environmental, Inc.
Project..... 22567-321
Client..... Navy SouthDiv
Location..... JETC (SWMU#9) - NAS Key West
Test date..... September 6 - 7, 1995
Test well..... R-1
Obs. well..... MW-10

Units of Measurement
Length..... ft
Time..... min
Pumping rate.... gal/min

Pumping Well Data
Well No. 1
Well identification..... R-1
X location..... 0
Y location..... 0
Casing radius..... 0.1667
Wellbore radius..... 0.5
Well penetration..... Full
Number of pumping periods..... 1

Period	Pumping Rate
1	2

Observation Well/Piezometer Data
Well identification..... MW-10
X location..... 10
Y location..... 0
Distance from pumping well #1.... 10
Well penetration..... Full
No. of observations..... 176

Aquifer Data
Saturated thickness..... 11

ORIG.	J. Novick	DATE	9/28/95
CHK'D BY	MLB	DATE	10/2/95
CALC. NO.	321-G-002		
REV. NO.	0	SHEET NO.	43-31 of 36

ANALYTICAL METHOD

Neuman (Unconfined Aquifer)
Fully Penetrating Wells

RESULTS FROM STATISTICAL CURVE MATCHING

STATISTICAL MATCH PARAMETER ESTIMATES

	Estimate		Std. Error	
T =	7.3050E-002	+/-	7.7706E-003	ft^2/min
S =	2.4424E-005	+/-	4.6779E-006	
Sy =	1.0000E-003	+/-	1.5177E-003	
B =	1.0000E-003	+/-	9.3128E-004	

Derived Parameters
Kr = 0.006641 ft/min
Kz/Kr = 0.00121

ANALYSIS OF MODEL RESIDUALS

residual = observed - calculated
weighted residual = residual * weight

Weighted Residual Statistics:
Number of residuals..... 176
Number of estimated parameters.... 4
Degrees of freedom..... 172
Residual mean..... 0.04178
Residual standard deviation..... 0.1576
Residual variance..... 0.02485

Model Residuals:

Time	Observed	Calculated	Residual	Weight
0.001	0.74	1.0353E-005	0.73999	1
0.0083	0.755	0.062227	0.69277	1
0.0166	0.755	0.15875	0.59625	1
0.025	0.755	0.23553	0.51947	1
0.0333	0.755	0.29591	0.45909	1
0.0416	0.771	0.34573	0.42527	1
0.05	0.771	0.38846	0.38254	1
0.0583	0.771	0.42503	0.34597	1
0.0666	0.771	0.45728	0.31372	1
0.075	0.771	0.48642	0.28458	1
0.0833	0.771	0.51242	0.25858	1
0.0916	0.771	0.53611	0.23489	1
0.1	0.771	0.55811	0.21289	1
0.1083	0.771	0.5782	0.1928	1
0.1166	0.771	0.59686	0.17414	1

0.125	0.771	0.61449	0.15651	1
0.1333	0.787	0.63081	0.15619	1
0.1416	0.787	0.64617	0.14083	1
0.15	0.787	0.66084	0.12616	1
0.1583	0.787	0.67457	0.11243	1
0.1666	0.787	0.6876	0.099403	1
0.175	0.787	0.70014	0.086857	1
0.1833	0.787	0.71196	0.075036	1
0.1916	0.787	0.72326	0.063738	1
0.2	0.787	0.73421	0.052793	1
0.2083	0.803	0.74458	0.058422	1
0.2166	0.803	0.75454	0.048461	1
0.225	0.803	0.76424	0.038765	1
0.2333	0.803	0.77346	0.029537	1
0.2416	0.803	0.78236	0.020638	1
0.25	0.803	0.79106	0.011942	1
0.2583	0.803	0.79936	0.0036379	1
0.2666	0.803	0.8074	-0.004398	1
0.275	0.819	0.81527	0.0037259	1
0.2833	0.819	0.82282	-0.0038177	1
0.2916	0.819	0.83014	-0.011138	1
0.3	0.819	0.83733	-0.01833	1
0.3083	0.819	0.84424	-0.025237	1
0.3166	0.819	0.85095	-0.031953	1
0.325	0.819	0.85757	-0.038568	1
0.3333	0.819	0.86393	-0.044932	1
0.35	0.834	0.87625	-0.042254	1
0.3666	0.834	0.88791	-0.05391	1
0.3833	0.834	0.89909	-0.065094	1
0.4	0.834	0.90978	-0.075779	1
0.4166	0.834	0.91995	-0.085947	1
0.4333	0.85	0.92976	-0.079755	1
0.45	0.85	0.93917	-0.089174	1
0.4666	0.85	0.94818	-0.098177	1
0.4833	0.85	0.9569	-0.1069	1
0.5	0.85	0.96531	-0.11531	1
0.5166	0.866	0.97337	-0.10737	1
0.5333	0.866	0.98122	-0.11522	1
0.55	0.866	0.9888	-0.1228	1
0.5666	0.882	0.9961	-0.1141	1
0.5833	0.882	1.0032	-0.12122	1
0.6	0.882	1.0101	-0.12812	1
0.6166	0.882	1.0168	-0.13478	1
0.6333	0.898	1.0233	-0.12529	1
0.65	0.898	1.0296	-0.13162	1
0.6666	0.898	1.0357	-0.13774	1
0.6833	0.898	1.0417	-0.14373	1
0.7	0.914	1.0476	-0.13356	1
0.7166	0.914	1.0532	-0.13921	1
0.7333	0.914	1.0588	-0.14476	1
0.75	0.914	1.0642	-0.15017	1
0.7666	0.929	1.0694	-0.14041	1
0.7833	0.929	1.0746	-0.14557	1
0.8	0.929	1.0796	-0.15061	1

0.8166	0.929	1.0845	-0.1555	1
0.8333	0.929	1.0893	-0.16032	1
0.85	0.945	1.094	-0.14903	1
0.8666	0.945	1.0986	-0.15362	1
0.8833	0.945	1.1031	-0.15813	1
0.9	0.945	1.1076	-0.16255	1
0.9166	0.961	1.1119	-0.15086	1
0.9333	0.961	1.1161	-0.15511	1
0.95	0.961	1.1203	-0.15928	1
0.9666	0.961	1.1243	-0.16334	1
0.9833	0.961	1.1283	-0.16734	1
1	0.977	1.1323	-0.15528	1
1.2	1.009	1.1744	-0.16539	1
1.4	1.056	1.2093	-0.15327	1
1.6	1.088	1.2389	-0.15091	1
1.8	1.151	1.2646	-0.11356	1
2	1.199	1.2871	-0.088103	1
2.2	1.23	1.3071	-0.077144	1
2.4	1.262	1.3251	-0.063135	1
2.6	1.294	1.3414	-0.047416	1
2.8	1.325	1.3563	-0.031253	1
3	1.341	1.3699	-0.028852	1
3.2	1.357	1.3824	-0.02538	1
3.4	1.373	1.394	-0.020984	1
3.6	1.389	1.4048	-0.015756	1
3.8	1.404	1.4148	-0.010799	1
4	1.436	1.4242	0.011807	1
4.2	1.452	1.433	0.018997	1
4.4	1.452	1.4413	0.010712	1
4.6	1.468	1.4491	0.018903	1
4.8	1.484	1.4565	0.027526	1
5	1.499	1.4635	0.035545	1
5.2	1.499	1.4701	0.028926	1
5.4	1.515	1.4764	0.038639	1
5.6	1.515	1.4823	0.03266	1
5.8	1.531	1.488	0.042964	1
6	1.531	1.4935	0.037531	1
6.2	1.547	1.4987	0.048343	1
6.4	1.547	1.5036	0.043382	1
6.6	1.547	1.5084	0.038633	1
6.8	1.563	1.5129	0.050083	1
7	1.563	1.5173	0.045718	1
7.2	1.563	1.5215	0.041527	1
7.4	1.579	1.5255	0.0535	1
7.6	1.579	1.5294	0.049631	1
7.8	1.579	1.5331	0.045905	1
8	1.594	1.5367	0.057316	1
8.2	1.594	1.5401	0.053856	1
8.4	1.594	1.5435	0.05052	1
8.6	1.594	1.5467	0.047299	1
8.8	1.61	1.5498	0.060189	1
9	1.61	1.5528	0.057183	1
9.2	1.61	1.5557	0.054277	1
9.4	1.61	1.5585	0.051466	1

9.6	1.626	1.5613	0.064744	1
9.8	1.626	1.5639	0.062108	1
10	1.626	1.5664	0.059554	1
11	1.642	1.5781	0.063887	1
12	1.674	1.5882	0.085788	1
13	1.674	1.597	0.076962	1
14	1.689	1.6048	0.084181	1
15	1.705	1.6117	0.09327	1
16	1.705	1.6179	0.087089	1
17	1.721	1.6235	0.097524	1
18	1.721	1.6285	0.092484	1
19	1.721	1.6331	0.087893	1
20	1.737	1.6373	0.09969	1
21	1.737	1.6412	0.095822	1
22	1.737	1.6448	0.092246	1
23	1.737	1.6481	0.088924	1
24	1.737	1.6512	0.085825	1
25	1.753	1.6541	0.098922	1
26	1.753	1.6568	0.096193	1
27	1.753	1.6594	0.093616	1
28	1.753	1.6618	0.091176	1
29	1.753	1.6641	0.088857	1
30	1.753	1.6664	0.086645	1
31	1.769	1.6685	0.10053	1
32	1.769	1.6705	0.098501	1
33	1.769	1.6724	0.096551	1
34	1.753	1.6743	0.07867	1
35	1.769	1.6761	0.092853	1
36	1.769	1.6779	0.091093	1
37	1.784	1.6796	0.10438	1
38	1.784	1.6813	0.10272	1
39	1.784	1.6829	0.10111	1
40	1.784	1.6845	0.099528	1
41	1.784	1.686	0.097985	1
42	1.8	1.6875	0.11248	1
43	1.8	1.689	0.111	1
44	1.8	1.6905	0.10954	1
45	1.8	1.6919	0.10812	1
46	1.8	1.6933	0.10672	1
47	1.8	1.6947	0.10533	1
48	1.816	1.696	0.11997	1
49	1.816	1.6974	0.11863	1
50	1.816	1.6987	0.11731	1
51	1.816	1.7	0.116	1
52	1.816	1.7013	0.11471	1
53	1.832	1.7026	0.12943	1
54	1.832	1.7038	0.12817	1
55	1.832	1.7051	0.12692	1
56	1.832	1.7063	0.12568	1
57	1.848	1.7075	0.14045	1
58	1.848	1.7088	0.13924	1
59	1.848	1.71	0.13803	1
60	1.848	1.7112	0.13683	1

RESULTS FROM VISUAL CURVE MATCHING

VISUAL MATCH PARAMETER ESTIMATES

Estimate
T = 7.3050E-002 ft^2/min
S = 2.4424E-005
Sy = 1.0000E-003
B = 1.0000E-003

Derived Parameters
Kr = 0.006641 ft/min
Kz/Kr = 0.00121

Attachment 4

Theim-Dupuit Input Parameters

Table 4-1 Corrected Drawdown

Observation Point	Drawdown (ft) s	Aquifer Thickness (ft) D	Corrected Drawdown (ft) s'
P-1	2.48	10	2.17
P-2	1.85	10	1.68
P-3	1.72	10	1.57
P-4	1.83	10	1.66
P-5	1.34	10	1.25
MW-10	1.60	10	1.47

Note:

$$S' = S - (S^2 / 2D)$$

Table 4-2 Transmissivity

Observation Point	Discharge Rate (ft^3/min)	Radius of Observation Point (ft) r_2	Radius of P-1 (ft) r_1	Corrected Drawdown at P-1 (ft) s'_1	Corrected Drawdown at Observation Point (ft) s'_2	Transmissivity (ft^2/min) KD
P-2	0.27	0.04	0.04	2.17	1.68	0.088
P-3	0.27	0.04	0.04	2.17	1.57	0.072
P-4	0.27	0.04	0.04	2.17	1.66	0.084
P-5	0.27	0.04	0.04	2.17	1.25	0.047
MW-10	0.27	0.04	0.04	2.17	1.47	0.061

Note:

$$Q = \frac{2\pi KD(S'_1 - S'_2)}{\ln(r_2 / r_1)}$$

Attachment 5

Recovery Test Analysis

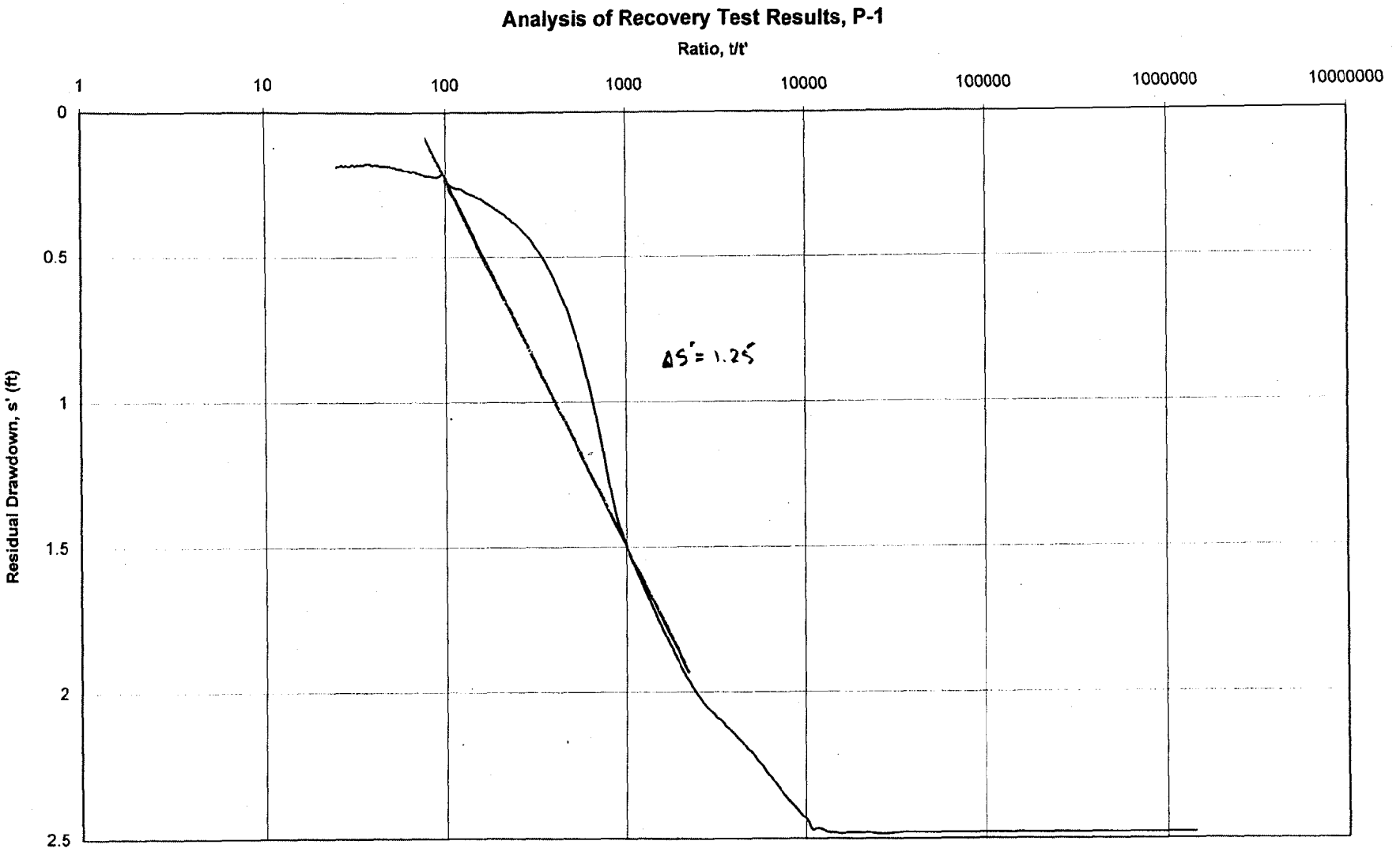
Table 5-1 Transmissivity Input Parameters

Observation Point	Pump Rate (gpm) Q	Slope of Line Δs	Transmissivity (ft^2/min) T	Time at Zero Recovery (min) t'_0	Distance to Observation Point (ft) r	Storage Coefficient S
P-1	2.0	1.25	0.039	0.3	5	1.40×10^{-4}
P-2	2.0	1.35	0.036	1.0	5	4.32×10^{-4}
P-3	2.0	0.8	0.061	0.15	5	1.10×10^{-4}
P-4	2.0	1.0	0.049	0.95	5	5.59×10^{-4}
P-5	2.0	0.5	0.098	0.70	5	8.2×10^{-4}
MW-10	2.0	0.65	0.075	0.70	10	1.58×10^{-4}

Note:

$$T = \frac{264Q}{\Delta s}$$

$$S = \frac{0.3Tt'_0}{r^2}$$



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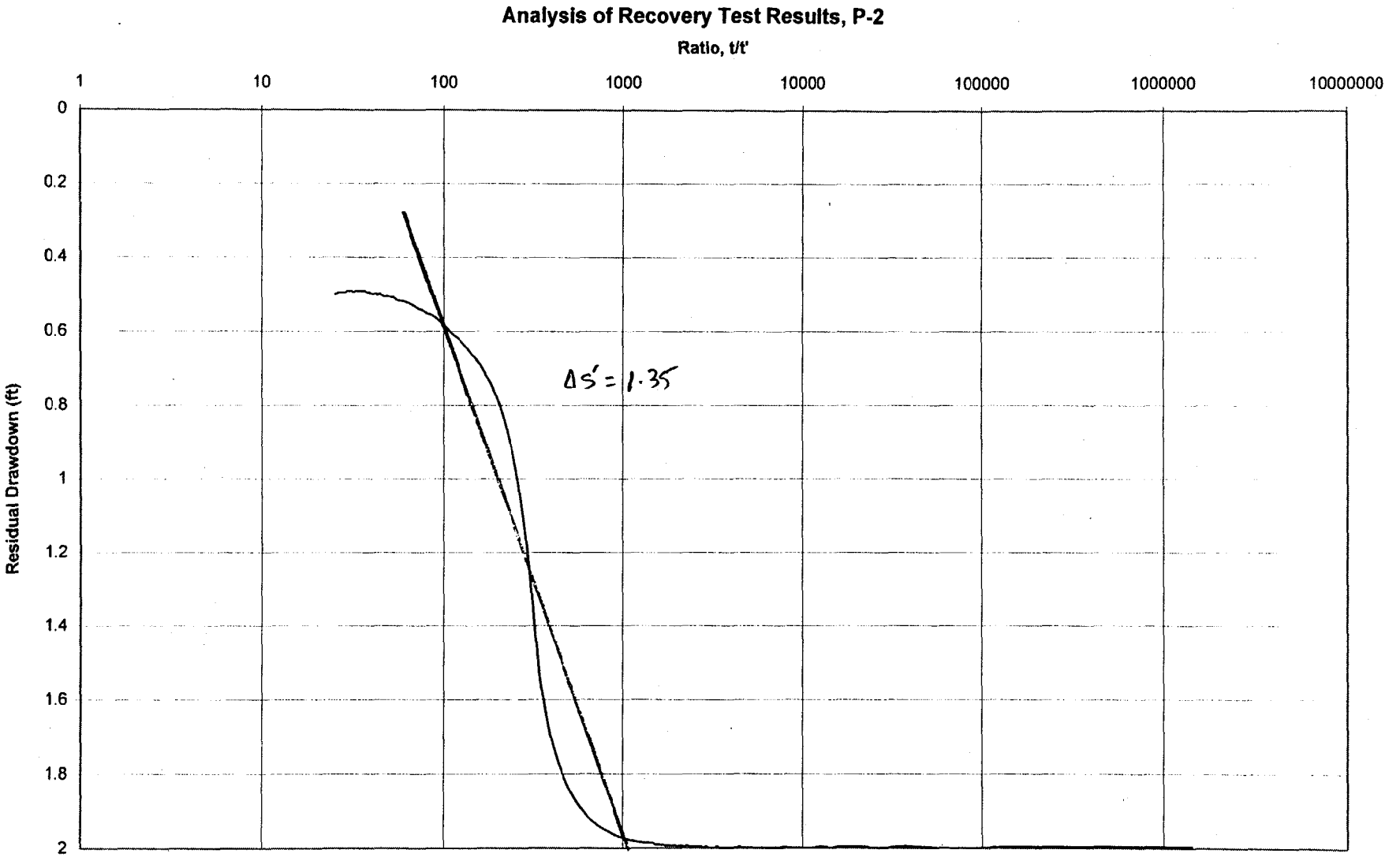
CHK'D BY		DATE	10/3/95
CALC. NO.	321-G-002		
REV. NO.	0	SHEET NO.	A5-3 of 14

P-2 Chart 3



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CALC. NO.	321-G-002		
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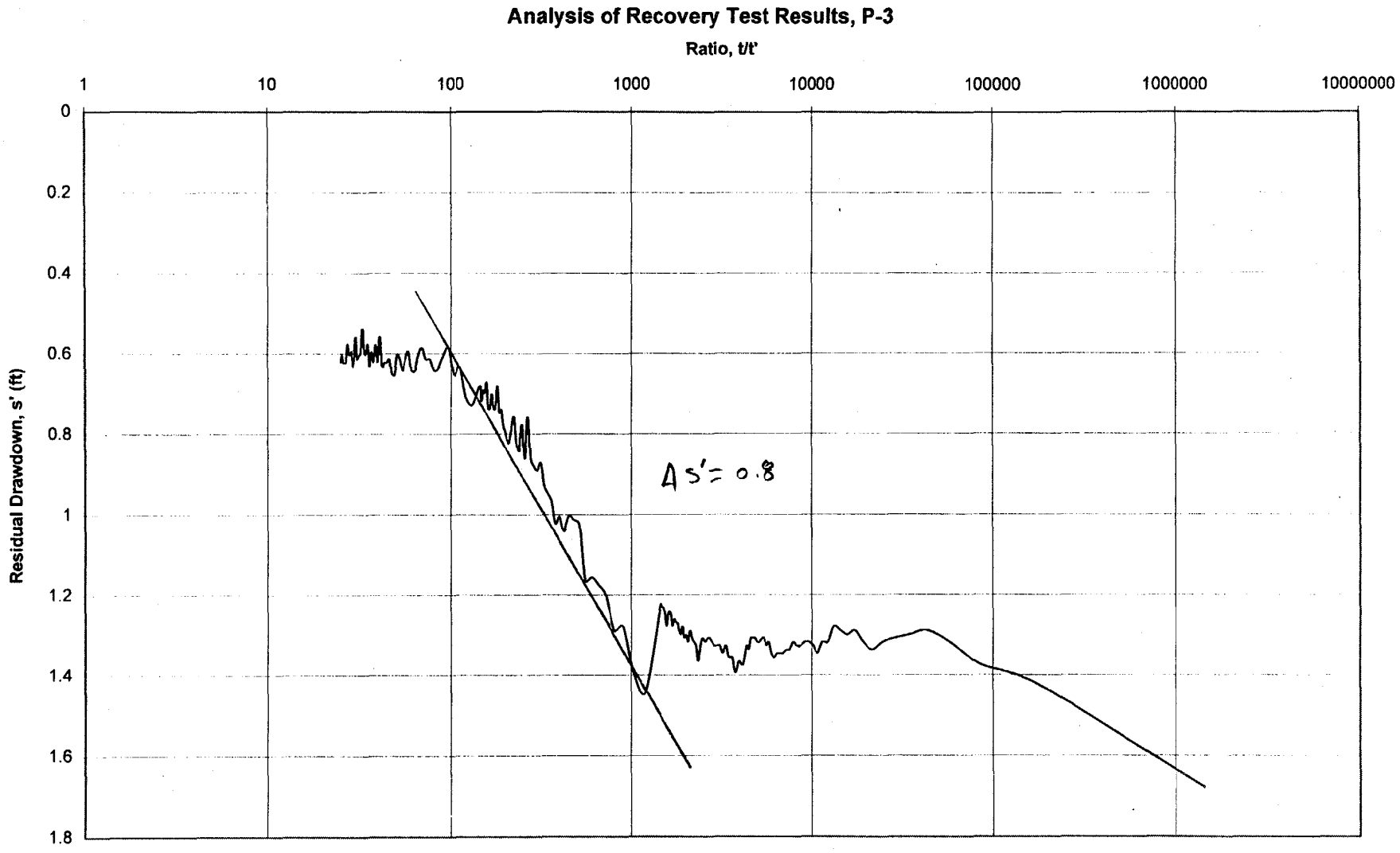

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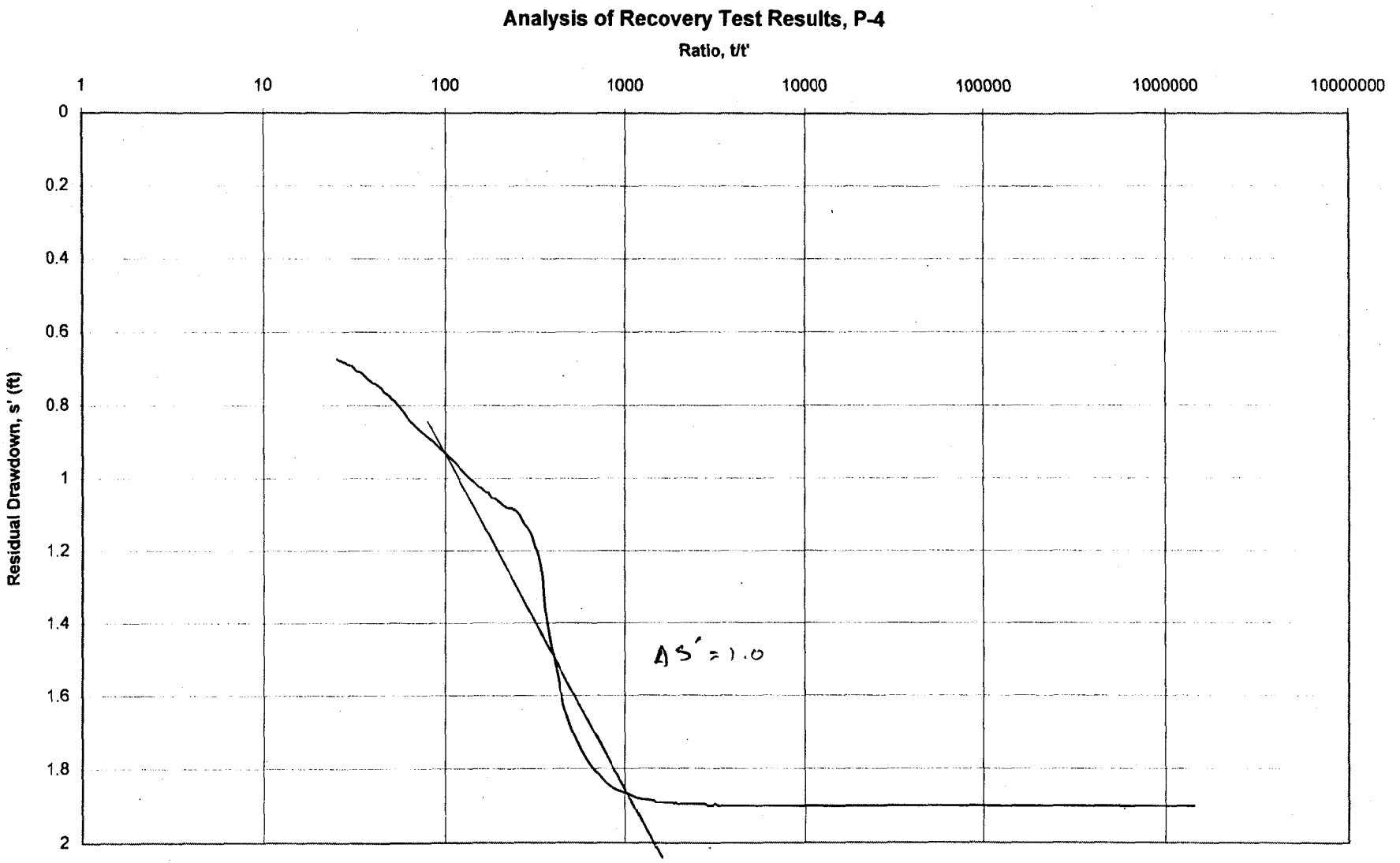
CALC. NO.	321-G-002		
REV. NO.	0	SHEET NO.	A5-5 of 14

P-4 Chart 3



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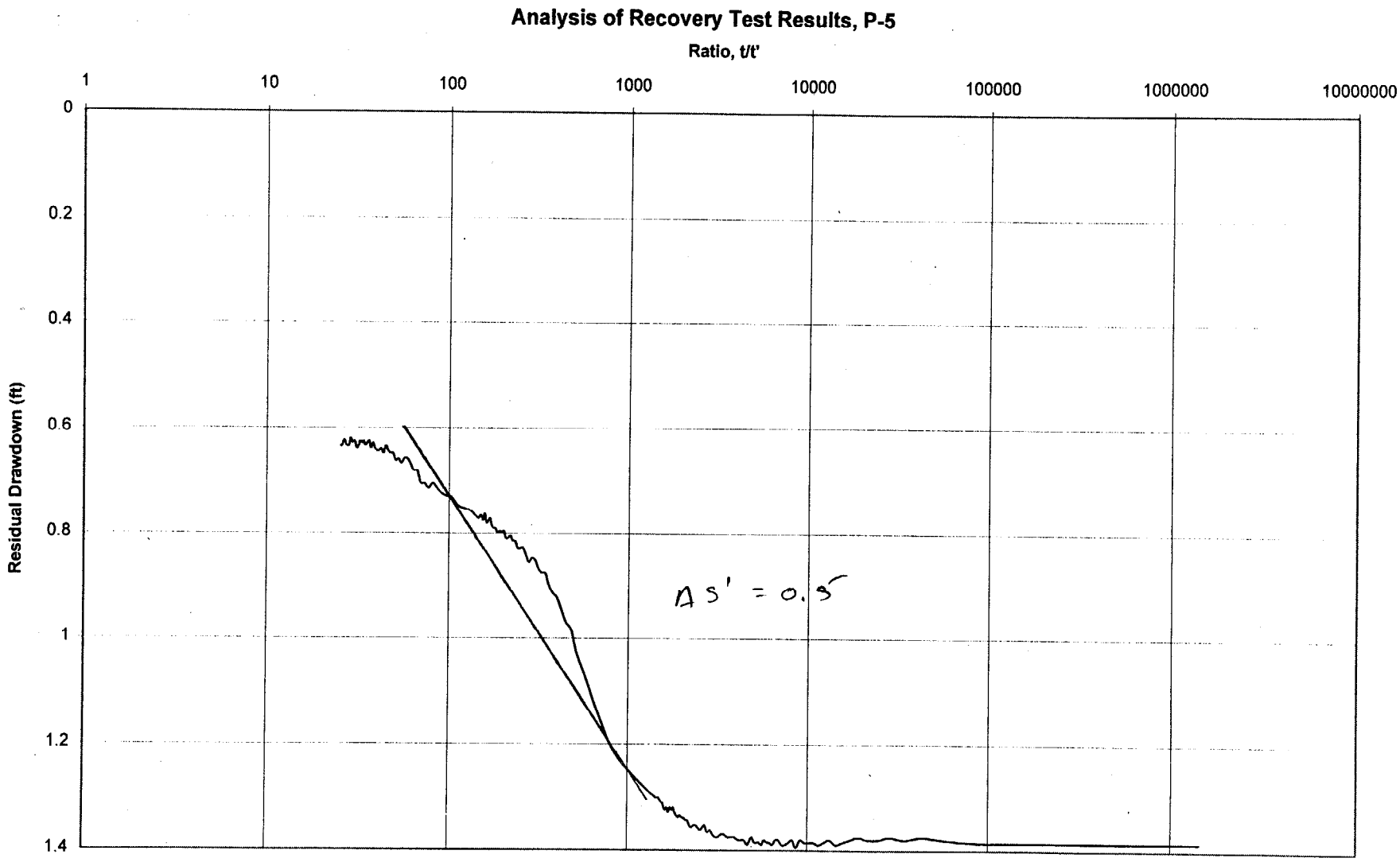

ORIG. J. Novick DATE 10/3/95
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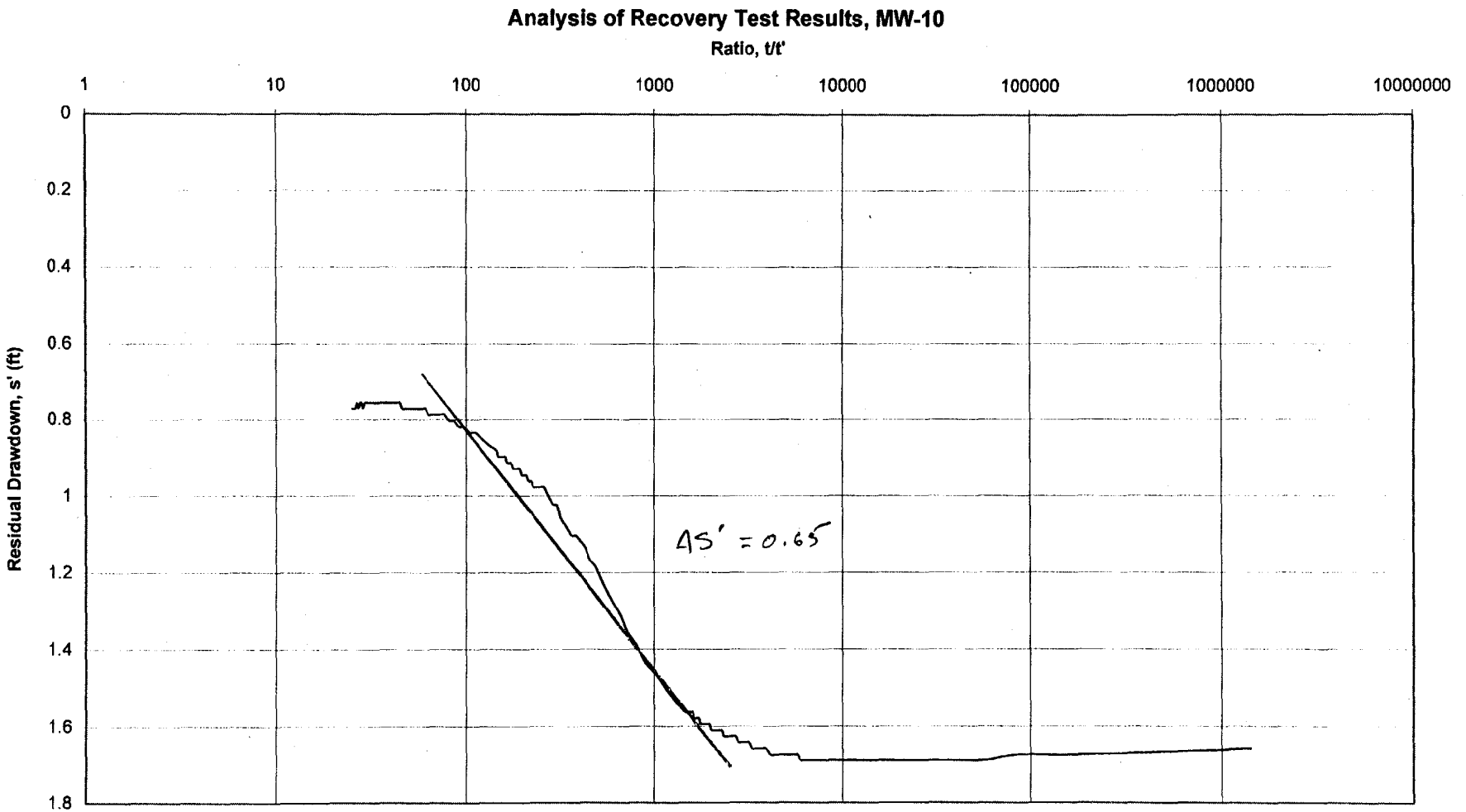
CALC. NO. 321-G-002
REV. NO. 0 SHEET NO. A5-7 of 14

MW-10 Chart 3



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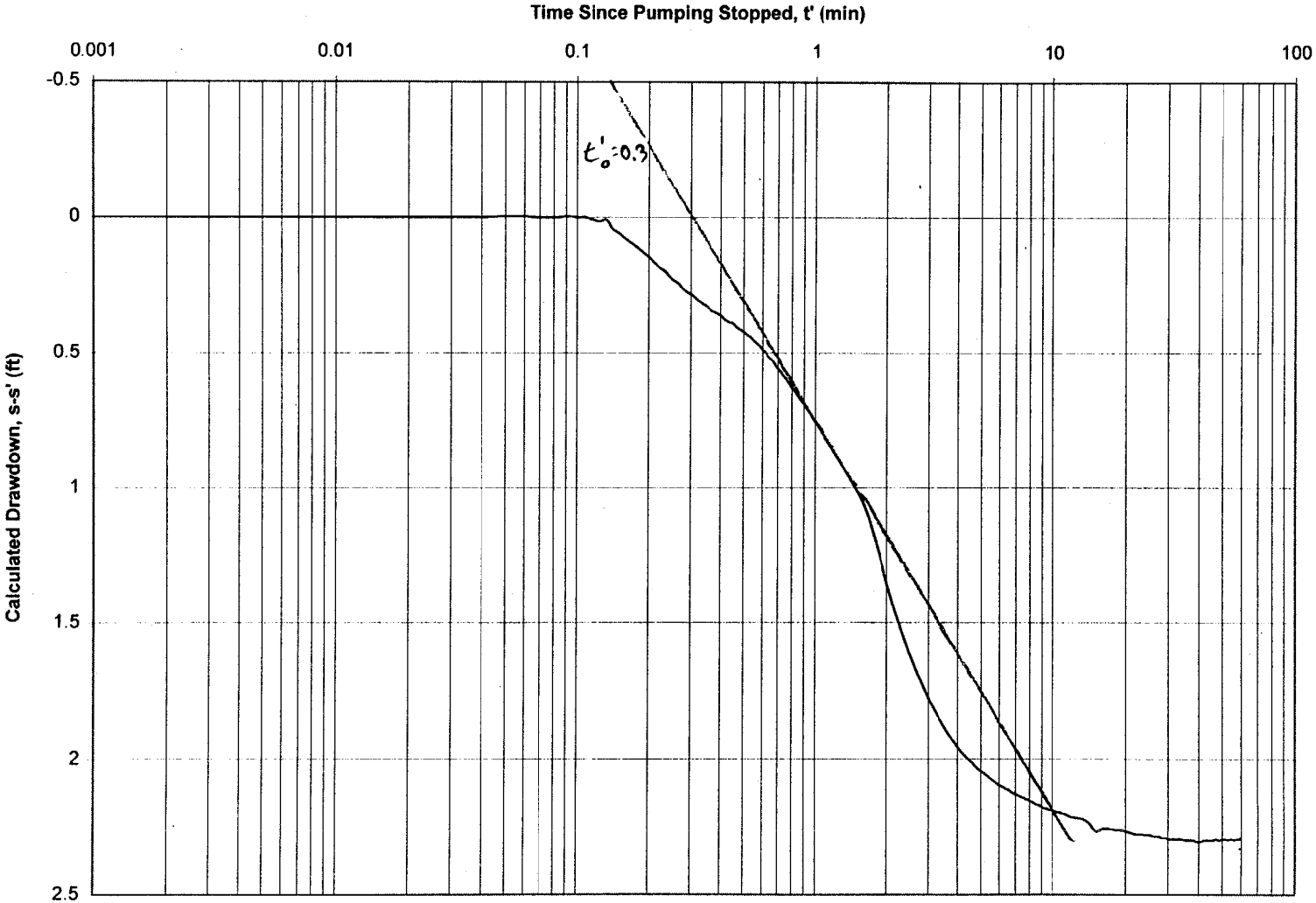
CHK'D BY		DATE	
CALC. NO.	321-G-002		
REV. NO.	0	SHEET NO.	AS-8 of 14

Analysis of Recovery Test Results, P-1



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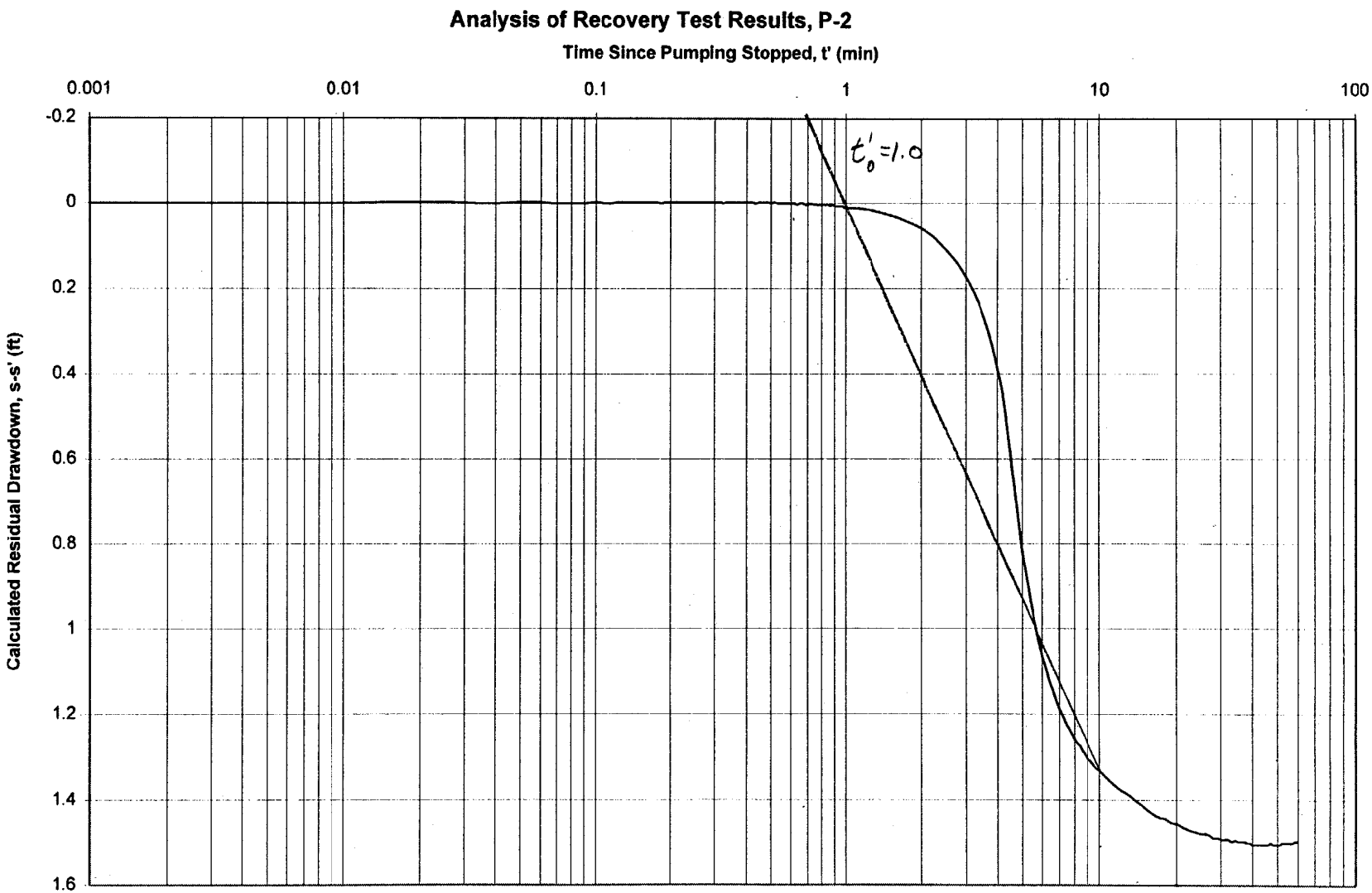
CALC. NO.	321-G-002		
REV. NO.	0	SHEET NO.	A5-9 of 14

P-2 Chart 4



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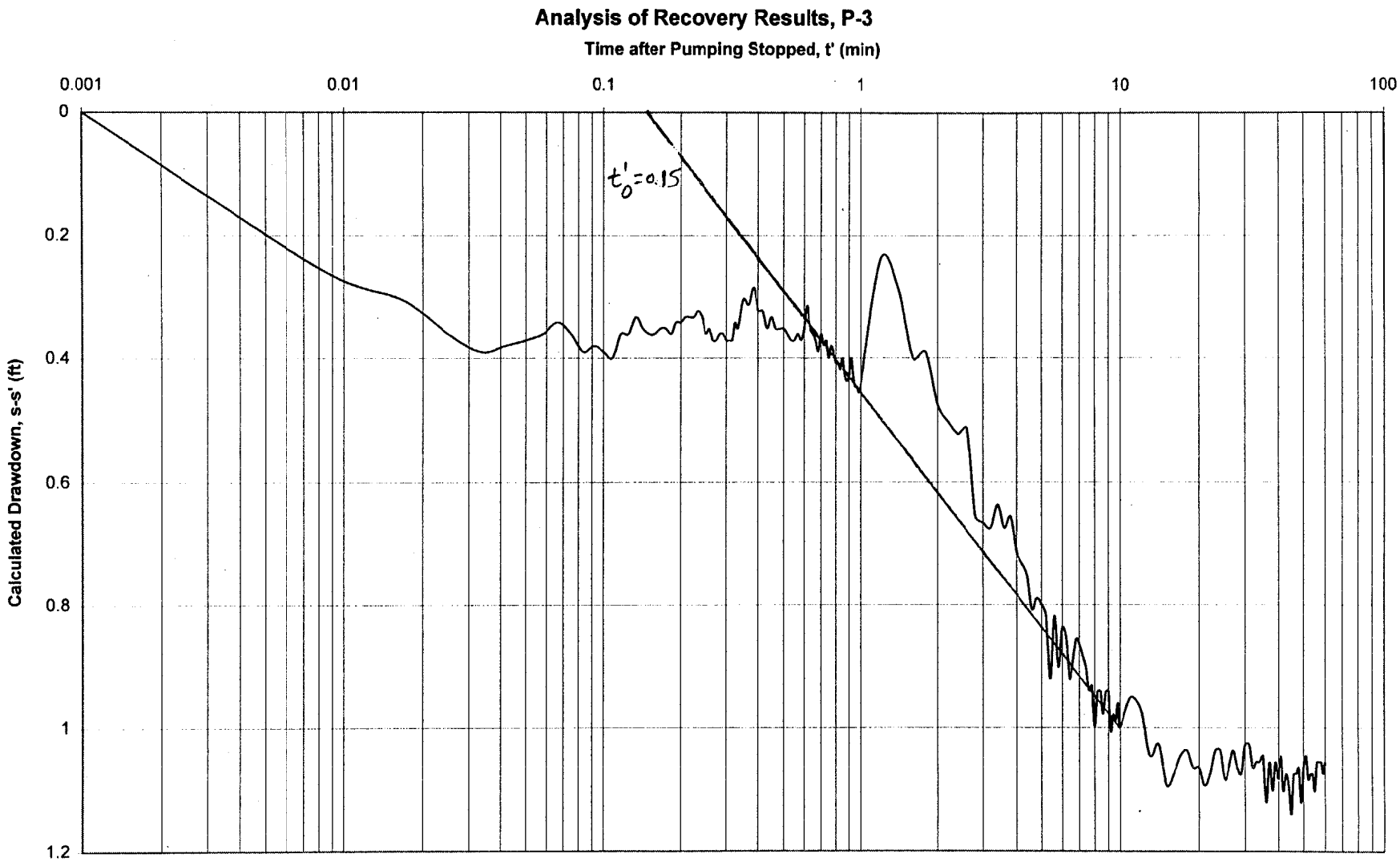
REV. NO.	0	SHEET NO.	A5-1 of 14



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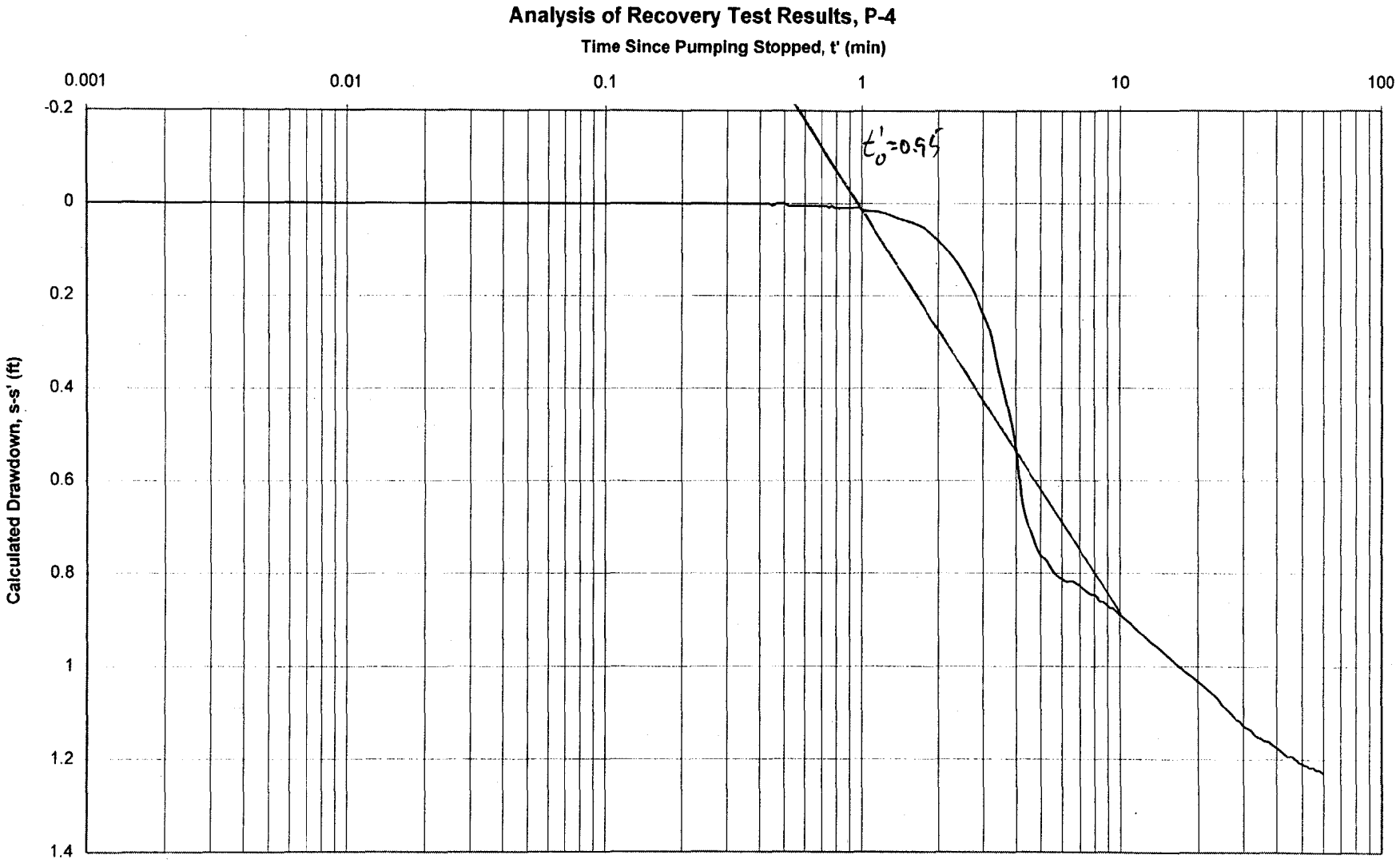

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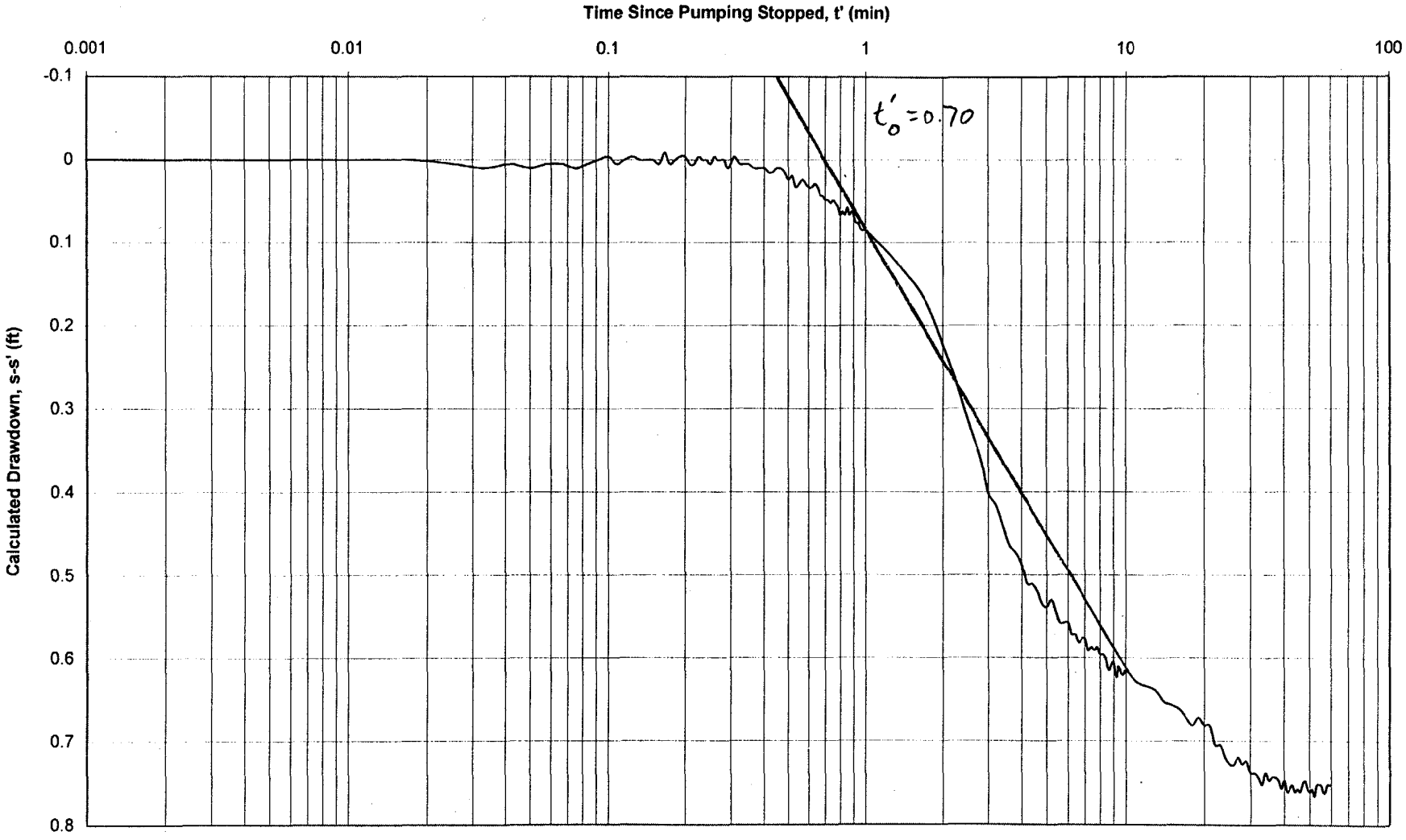
CHK'D BY	MAG	DATE	10/2/95
CALC. NO.	321-G-002		
REV. NO.	0	SHEET NO.	A5-12 of 16

Analysis of Recovery Test Results, P-5



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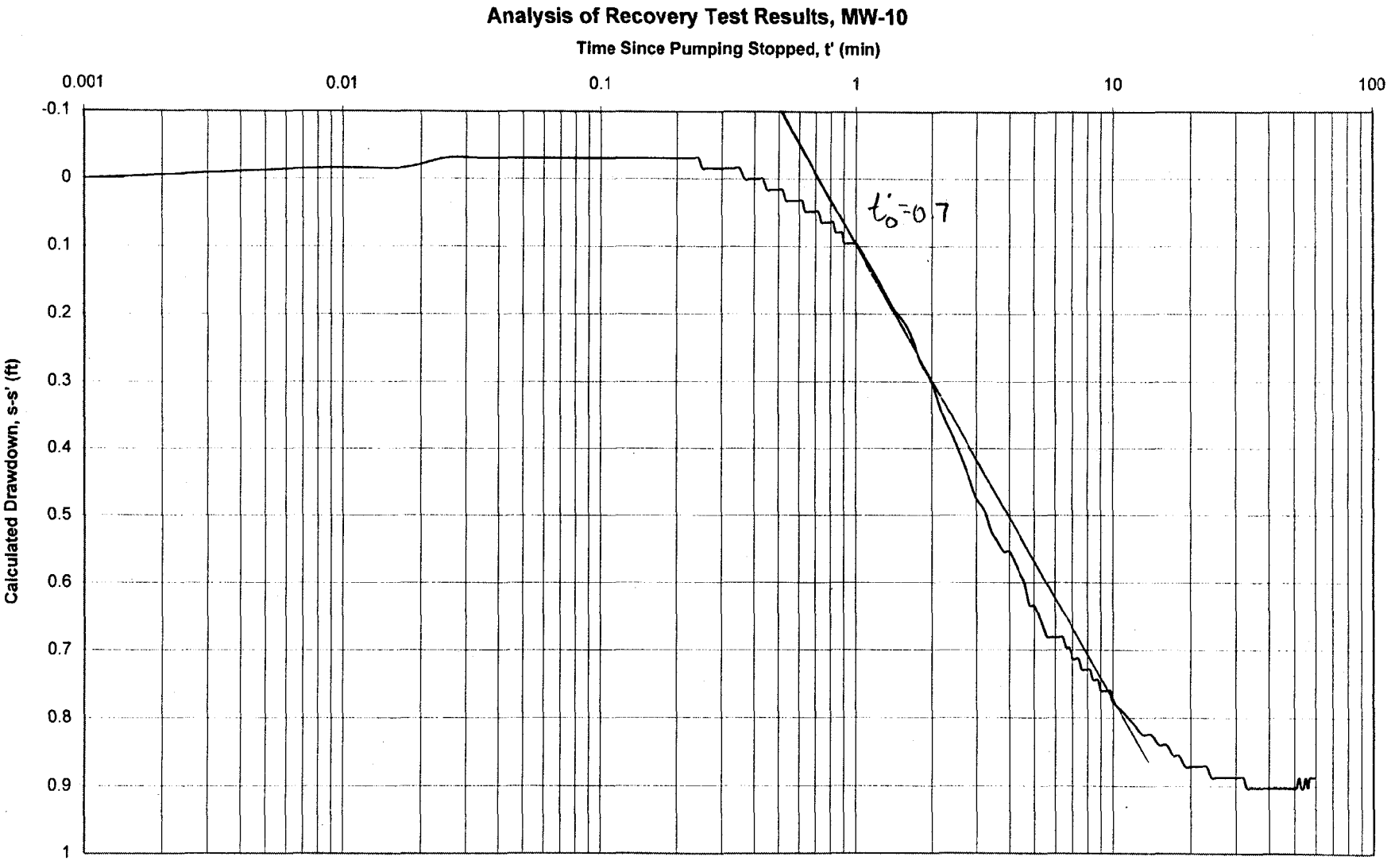
REV. NO.	0	SHEET NO.	A5-13 of 14



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CALC. NO.	321-G-002		
REV. NO.	0	SHEET NO.	A5-14 of 14

Attachment 6
Groundwater Flow and Transport Modeling

CALCULATION COVER SHEET

PROJECT NAVY-RAC	JOB NO. 22567-321-139918	CALC NO. 321-G-003	SHEET 1
SUBJECT Groundwater Flow and Transport Modeling	DISCIPLINE Hydrology/Hydraulics		

CALCULATION STATUS DESIGNATION	PRELIMINARY	CONFIRMED	SUPERSEDED	VOIDED
	X			

COMPUTER PROGRAM/TYPE	SCP	MAINFRAME	PC	PROGRAM NO.	VERSION/RELEASE NO.
	[ ] YES [X] NO	[ ]	[X]	NA	

Computer programs used:

MODFLOW: Geraghty &Miller Version 4.1
VISUAL MODFLOW: version 1.49
MT3D : version 1.8

REV. NO.	REASON FOR REVISION	TOTAL NO. OF SHEETS	LAST SHEET NO.	BY	CHECKED	APPROVED/ ACCEPTED	DATE
1	ADDED Recharge trenches	46	46	V.Y.	SCM	REH	4/8/96
0	Original	41	41	V.Y.	SCM	REH	3/4/96

RECORD OF REVISIONS

Objectives:

Groundwater flow and transport modeling are performed in the northeast section of Boca Field on Boca Chica Key to support:

I. the design of a free-product (jet fuel) recovery system

II. the design of the pump&treat system for the cleanup of the solvent plume.

Contents:

1. Problem Definition
2. Summary of Results
3. Flow Modeling for Jet Fuel Recovery System
4. Flow and Transport Modeling for Solvent Plume Removal via Pump&Treat
5. Refinement of Gallery Design
6. References
7. Attachments

1. Problem Definition:

Figure 1 of Attachment 1 shows the tentatively delineated extent of the jet fuel at the water table at the site, and the extent of the chlorinated solvents in the groundwater (Reference 1). Figure 2 of Attachment 1 shows the headspace concentrations at various soil borings, with elevated readings at SB-39 (4200 ppm) and at SB-15 (1800 ppm). For the capture of the jet fuel (free-product), a groundwater flow modeling is performed to determine the number of recovery wells and their pumping rates. The amount of groundwater removed should be kept to a minimum, and after treatment the water removed should be put back into the groundwater system via an infiltration gallery. For

the cleanup of the solvent plume, flow and transport modeling are performed to determine:

- number of wells and pumping rates to capture the solvent plume. The pumping rates will be minimized, and treated effluent will be recharged into the groundwater via an infiltration gallery;
- duration of pumping to achieve clean-up (maximum residual concentration in the groundwater will be the MCL for the particular solvent); and
- estimates of the contaminant loading with time, and estimates of total amounts of products recovered.

2. Summary of Results

Jet Fuel Recovery:

Since the extent of the jet fuel plume shown on Attachment 1 is tentative, and peak headspace concentrations have been reported at two boreholes spaced about 60 feet apart, it is postulated that instead of one contiguous free-product plume, there may exist two isolated pools of free product. Therefore, in order to account for this uncertainty and provide operational flexibility, two recovery wells located at SB-39, and SB-15, each pumping at 1.25 gpm, are recommended for the free product recovery. At each well, the well screen is 15 feet long, and the top of the screen is located 0.5 feet below the ground surface (slightly above the water table). The pumping rate of 1.25 gpm at each well is found to be sufficient to create a capture zone to contain the extent of the jet fuel on the water table, and also induce a sufficient gradient toward each well for the free-product to move into the wells. Pumping at this rate for 160-days establishes a cone of depression

around the well and a capture zone which contains the extent of the free-product. The location of the wells is shown on Figure 1. During the product recovery operation, depending on the prevailing field conditions, pumping at one of the wells can be stopped, and the other well can be pumped at a higher rate (i.e., 2.5 gpm).

If the solvent recovery operation is undertaken simultaneously with the free-product recovery operation going-on, pumping the solvent recovery well (locate about 150 feet north-east of well SB-15) at 2.5 gpm will not significantly impact the capture zone of the free-product recovery wells.

The recharge gallery will be located upgradient. Two alternate gallery designs were considered: 1) Percolation Field; 2) Trenches.

Percolation Field:

A recharge area of 10 feet by 100 feet will accommodate a recharge rate of .24 inches/hr (5.78 inches/day) ,which corresponds to a pumping rate of 2.5 gpm, without the water table under the gallery rising above the ground surface. In order to accommodate a 5 gpm recharge (both solvent recovery and free-product recovery pumps are on) and also to keep the groundwater mounding under the gallery below the ground surface, a 50 feet by 150 feet area is required. In this case the water application rate will be 1.54 inches/day (0.064 in/hr). These application rates are well within the vertical hydraulic conductivity of site soils which is 0.65 in/hr. In the sizing of the gallery, the impact of direct rainfall and evaporation on the gallery surface area is not considered. Given the prevailing rates of precipitation and evaporation at the site, the net effect would be negligable.

Trenches:

Nine trenches with 2feet by 50 feet dimensions would accomodate the total pumping rate of 5 gpm without resulting in excessive mounding. Trenches are recommended since trecnhes could be dug up as needed with the number of trenches needed tailored to the

pumping rate during the operations. See Section 5 for details; and Figure 25 for trench locations.

Solvent Plume Recovery:

Two significant contaminants of the solvent plume(shown on attachment 1) are 1,2-cis-DCE and 1,2-trans-DCE . The existing peak concentrations are: 1560 mg/l (1,2-cis-DCE), and 2420 mg/l (1,2-trans-DCE). See attachment 1 for the posted concentrations at the other wells. The target cleanup levels are set at the maximum concentration levels (MCL) of 70 mg/l for cis-DCE and 100 mg/l for trans-DCE. Fate and transport simulations are performed for a time period till the solvent concentrations in the groundwater are down to MCLs.

The estimates of cleanup times and the amount of contaminants to be removed are dependent on the values of the parameters which control the fate and transport of these contaminants (i.e., sorption and decay) ; the horizontal and the vertical extent of the plume; ~~and~~ the pumping rates, and the size and location of the well screen. The critical fate and transport parameter values are based on literature values since site-specific data were not available. Therefore model estimates have associated uncertainties. The vertical extent of the plume is not known; therefore, estimates would vary depending on the assumed depth of the plume. Likewise, to minimize cleanup times, determination of the effective screen size and where to locate it depends very much on the assumed vertical extent of the solvent plume. To address these uncertainties, a set of transport simulations were performed.

Using the most probable values of the model parameters and assuming that the depth of the plume is 15 feet from the ground surface, the best estimates of the cleanup times are 91 days for 1,2-cis-DCE and 100 days for 1,2-trans-DCE; and the total amounts

recovered are 0.51 and 0.89 pounds respectively. The recovery well is pumped at 2.5 gpm, and the well screen is 15 feet with the top of the screen set close to ground surface. A summary of the transport simulations (10 cases) is given in the table below. The values of key transport parameters are varied from case to case while other parameters are kept unchanged. Cases 9 and 10 represent the most probable conditions at the site where the plume is assumed to be 15 feet deep. The recovery well has a screen of 15 feet, and the pumping rate is 2.5 gpm as it is for all other cases. For cases 1 through 7, the depth of the plume is assumed to be 35 feet, and a 30 feet screen is used. Case 8 assumes that the screen is 15-feet long while the plume is 35 feet deep.

MT3D Simulation Number	Contaminant	Decay Rate 1/day	% Organic Carbon	K_d lbs/ft^3	Cleanup duration days	Total product removed (lbs)
1	1,2-cis-DCE	0.0001	10	8.0E-02	5074	30.3
2	1,2-cis-DCE	0.004	10	8.0E-02	584	5.0
3	1,2-cis-DCE	0.0001	0	0	211	1.0
4	1,2-cis-DCE	0.0001	1	8.0E-03	902	4.4
5	1,2-cis-DCE	0.0001	0.1	8.0E-04	292	1.3
6	1,2-trans-DCE	0.0001	1	9.61E-03	1008	8.2
7	1,2-trans-DCE	0.0001	0.1	9.61E-04	321	2.3
8	1,2-trans-DCE	0.0001	0.1	9.61E-04	4937	2.54
9	1,2-trans-DCE	0.0001	0.1	9.61E-04	100	0.89
10	1,2-cis-DCE	0.0001	0.1	8.0E-04	91	0.51

The time histories of concentrations at the pumping well, and the estimates of contaminant loadings are shown on Attachment 15 for these cases. The estimates of the cumulative

contaminant loading with time are plotted on Figures 23 and 24, and are listed in Attachment 16.

3. Flow Modeling for Jet-Fuel Recovery System

Modeling Context

The objective of flow modeling is to establish a well or well network that will create a capture zone that encompasses the entire plume. The capture zone associated with an extraction well is defined as that portion of the aquifer that contains groundwater that will eventually be captured and discharged by the well. To accomplish this, first, a flow model is developed for the site under existing conditions (natural conditions). Once this is established, the pumping wells are included in the model and model runs are made to develop drawdowns and capture zones. The conditions associated with a groundwater flow system can either change with time or remain constant. A system in which the hydraulic head remains constant in time is at steady state. In such a system, the velocity of the groundwater also remains constant with time because the velocity is directly proportional to the hydraulic gradient. If the hydraulic head changes with time, the system is transient, and the velocity vectors change with time. At steady state, the pattern of streamlines will not change with time, and each streamline will map the entire path followed by a particle of groundwater. This line is referred as a pathline and, for steady state, the pathlines will coincide with the streamlines. Numerical flow and pathline models are therefore used to examine the steady state and transient response of the groundwater system, and generate capture zones under various pumping rates.

Models Used

A 3-Dimensional numerical flow model of the site is developed using the USGS's MODFLOW finite-difference code. The pathlines are generated with USGS MODPATH code. The vendor code used in this work is the VISUAL MODFLOW from the Waterloo Hydrologic (Reference 2) which contains the flow and pathline codes mentioned above.

Model Domain

The aerial extent of the modeling domain consists of a 260 feet by 260 feet rectangular area containing the Jet Engine Test Cell (JETC) at Naval Air Station (NAS) Key West. See attachment 1 for the modeled area. The north of the model boundary is at the Inlet, and south of the model boundary includes the asphalt road south of the JETC. The surficial aquifer is represented in the model as a 15-feet thick upper system and a 20-feet thick lower system. For the flow modeling purpose, the vertical extent of the surficial aquifer is divided into six layers. The model consists of 26 rows and 26 columns which define cells of 10 feet by 10 feet within each of the six layers.

Model Parameters and Boundary Conditions

The model parameters used to define the hydrogeology of the groundwater system at site are:

Model Parameter	Value	Source
Hydraulic Conductivity	9.35E-03 ft/min (13.46 ft/day)	Reference 3
Vertical Conductivity	9.35E-04 ft/min (1.346 ft/day)	10 % of horizontal conductivity
Specific storage	0.0001 ft^{-1}	Reference 4
Porosity	0.35	Reference 4
Effective Porosity	0.25	Reference 4

The groundwater levels at the north and south of the model boundary are specified, and the east and west boundaries of the model is assumed to be no-flow boundaries. In other words, the flow across the site under natural conditions is from north to south and assumed uniform. The groundwater level or hydraulic head value at the south boundary is set at 4.61 ft, and at the north at 3.86 feet (Reference 5).

Results

The generated heads and the flow directions for the assumed "as is" conditions are shown on Figure 1. As shown in the figure, the flow is assumed uniform, the flow direction is toward the north boundary, and potentiometric surface contour lines show decline from south to north boundary. This flow picture represents the average flow condition of the site.

Recovery Wells and the Recharge Gallery

Two recovery wells (located at SB-39 and SB-15) and a solvent recovery well, and a recharge gallery were placed in the model domain, and flow and particle tracking simulations were performed. A recharge rate equivalent to the total pumping rate was applied to the gallery area as recharge. By trial and error the pumping rates, screen size and its location are determined such that the generated capture zone contains the free-product plume; the generated cone of depression on the water table at each well results in product flow into the well; and the groundwater pumped is minimal. The size of the recharge gallery is determined such that the mounding due to infiltration of the recovered groundwater in the gallery location remains below the ground surface. The free-product well locations and the initial recharge gallery are shown on the model grid in Figure 2.

Results

Initially transient simulations were performed to determine the response of the aquifer to pumping. The steady state drawdown is achieved within 10-15 days. For the remaining simulations steady state flow simulations were performed, and particle tracking was performed with steady state flow field under pumping stresses. A pumping rate of 1.25 gpm at each of the free-product recovery wells was found optimal. The screen length was 15 feet and the top of the screen was located just below the ground surface at the water table. The size of the gallery was 10 feet by 100 feet. For a total pumping rate of 2.5 gpm, the recharge rate applied at the gallery surface was 5.78 inches/day (0.24 in/hr). The steady state drawdown contours are shown in Figures 3 for the two free-product well pumping. As seen in the figure, the groundwater mounding under the gallery is at about the ground surface. Figure 4 is a vertical profile at well SB-39 showing the drawdown at

the well vicinity and the flow direction. A backward particle tracking was performed to establish the extent of the capture zone. Figure 5 shows the pathlines at 160-days. The tentative extent of the free-product plume is also shown on the figure.

The set of flow simulations were performed to determine the location and the pumping rate of the solvent recovery well, with pumping at the solvent well only. Next, pumping at all three wells (two free-product wells and one solvent well) was simulated to examine the impacts on the capture zone of each well. Figure 6 shows the drawdown of the solvent well pumping at 2.5 gpm for a screen length of 15 feet with its top located close to the ground surface. A vertile profile is shown in Figure 7 at the solvent well for steady state pumping. Figure 8 shows the results of the particle tracking under steady state conditions. As seen in the figure the capture zone generated caused a reversal of flow into the well from the north model boundary. Figures 9 and 10 show respectively drawdown and particle tracking results and the flow field for the solvent well with a screen length of 30 feet located 5 feet below the ground surface. The resulting drawdown and the capture zones are similar to those of the 15-feet screen shown in Figures 6 and 8 respectively.

The steady state drawdown due to all three wells pumping (a total of 5 gpm) is shown in Figure 11. The corresponding capture zones are shown in Figure 12. Figures 13 and 14 show drawdowns at the solvent well and well SP-39 respectively. Figure 15 shows drawdown due to the free-product recovery well and the solvent well pumping, each at 2.5 gpm (well SB-39 turned off). The corresponding capture zones are shown on Figure 16. Figure 17 is the drawdown at well SP-15 for this case.

As seen in these figures, when the total pumping rate is 5 gpm, the water table under the recharge gallery (10 feet by 100 feet) rises about 0.5 feet above the ground surface.

In order to accommodate a 5 gpm recharge (both solvent recovery and free-product recovery pumps are on) and also to keep the groundwater mounding under the gallery

below the ground surface, by trial and error it is determined that a 50 feet by 150 feet area is required (see Figure 18 for its location). Figures 19 and 20 show the drawdown and the capture zones with the 50 by 150 feet gallery. In this case, the water application rate will be 1.54 inches/day (0.064 in/hr). These application rates are well within the vertical hydraulic conductivity of site soils which is 0.65 in/hr. In the sizing of the gallery, the impact of direct rainfall and evaporation on the gallery surface area is considered. Given that the prevailing rates of precipitation and evaporation at the site are about equal, the net effect on the ability of the gallery to take the induced recharge would be none. An alternative gallery design which includes trenches were examined later (see Section 5).

The MODFLOW input files for the two-well free-product recovery case are given in Attachment 2.

4. Flow and Transport Modeling for Solvent Plume Removal via Pump&Treat

Flow Modeling

By trial and error, a solvent recovery well location and a pumping rate of 2.5 gpm were determined that would create a capture zone to contain the solvent plume. Considering that the depth of the solvent plume is unknown, two screen sizes were considered: a) assuming that the plume extents 35 feet below the ground surface, a 30-feet screen is placed about 5 feet below the ground surface; b) assuming that the plume is 15 feet deep, a 15-feet screen is placed about 0.5 feet below the ground surface. The resultant drawdown and capture zones are shown in Section 3 of this calculation package.

For transport simulations it is assumed that the solvent recovery operation will start after the free-product recovery is complete. The MODFLOW input and output files are shown in Attachment 3.

Transport Simulations: Modeling Context and Model Used

The transport simulations were performed using the MT3D code (Reference 6). The principal fate and transport processes which are simulated by MT3D (same processes which govern the effectiveness of a pump&treat system) are advection, dispersion, first order decay and sorption. Advection involves transport by bulk movement and is the primary mechanism responsible for contaminant migration. It is assumed that dissolved solutes travel in the same direction and with the same velocity as the groundwater itself. Dispersion results in the dilution of a contaminant. The degree of spreading is proportional to the size of the dispersion coefficients in mass transport models. Many abiotic and biodegradation reactions decay according to first order kinetics. Sorption (adsorption and absorption) is the partitioning of a chemical species between the solution (liquid) and sorbent (solid) phases. The practical result of the partitioning from modeling point of view is a phenomenon called retardation in which the effective velocity of the chemical is less than that of the water. The aquifer cleanup times and the amount of mass to be removed and treated are dependent on these factors. MT3D code works in conjunction with MODFLOW. The transport simulations are performed using the steady-state flow field generated from MODFLOW (heads).

Transport parameters:

Transport parameters and their values used in the simulations are mostly derived from literature since site specific values are not available. Since exact values of these parameters are uncertain, a range of values are used to bound the problem.

Transport parameters are summarized in the table below.

Parameter	1,2-cis-DCE	1,2-trans-DCE
Longitudinal dispersivity, ft	1	1
Transverse dispersivity, ft	0.333	0.333
Vertical dispersivity, ft	0.056	0.056
Molecular Diffusion, ft^2/day	1E-04	1E-04
Bulk Density(ρ_b), lb/ft^3	107.5	107.5
Porosity (θ)	0.35	0.35
K_{oc}, ml/g	49	59
f_{oc}	0.001 - 0.1	0.001- 0.1
K_d, ml/g	0.05 - 5	0.06 - 6
Retardation Coefficient (R) $R= 1+(\rho_b*K_d)/\theta$	1.24 - 25.6	1.29 - 30.5

Longitudional dispersivity of 1 foot is used base on the one-tenth of the grid spacing which is 10 feet. This one-tenth rule is recommended by EPA where no data exist

(Reference 7). Likewise, transverse dispersivity is taken as one-third of the longitudional dispersivity , and the vertical dispersivity as one-sixth of the transverse dispersivity. The bulk density and porosity are typical values for the material type at the site.

The partitioning coefficient, Kd is computed as Koc (the organic carbon partitioning coefficient for a particular hydrophobic organic) times the organic carbon fraction of soil, foc. The Koc values for 1,2-cis-DCE and 1,2-trans-DCE were obtained from literature (Reference 8). The retardation coefficients computed above range from 1.24 to 30.5. When there is no adsorption retardation coefficient is one. The duration of pumping for cleanup is directly proportional to retardation, volume of the plume, porosity, and inversely proportional to the pumping rate. Therefore a retardation of three means that cleanup duration will be three times longer. Therefore it is the controlling parameter in these simulations. It should be noted typical aquifers have very low f_{oc} values (Reference 9), and a value of 0.001 is considered to be a reasonable high value for the site.

Source concentrations:

The DCE plume in the model was represented as initial concentrations assigned to each layer of the model. Figures 21 and 22 show the kriged concentration contours for 1,2-cis-DCE and 1,2-trans-DCE respectively. The sampling well locations shown on the figures are the same ones as those shown on Attachment 1. These concentrations are conservatively assumed to be the same in depth.

Results

Ten transport simulations were performed. The MT3D input files (case 7) are given in Attachment 4, and the MT3D output for each of the ten runs are given in Attachments 5

through 14 respectively. The results are summarized in the table given in Section 2 of this calc. The time histories of concentrations at the pumping well, and the estimates of contaminant loadings are shown on attachment 15 for these cases. The estimates of the cumulative contaminant loading with time are plotted on Figures 23 and 24, and listed in Attachment 16.

5. Refinement of Gallery Design

Steady-state flow simulations were performed to examine a recharge gallery made up of a number trenches with a width of 2 feet and various lengths. To accomodate the 2-foot trench widths in the model, the model grid was refined by adding 2-foot model columns as shown in Figure 25.

By trial and error, it is determined that 9 trenches (2 feet by 50 feet) would handle a total flow of 5gpm - the maximum pumping rate for both solvent and free-product recovery operations - without causing excessive mounding. Figure 26 shows the drawdown and the mounding at the gallery trenches. The total gallery surface area is 900 ft^2 ; the recharge application rate (5 gpm) would be 12.8 inches/day or 0.53 inches/hour.

Reduced trench length (40 feet) was investigated: recharge rate increased to 0.67 in/hr. As shown in Figure 27, the water table will exceed the ground surface in the south-east end of the site.

It is concluded that a number of 2X50 feet trenches (up to nine) could be used as needed to accomodate the prevailing total clean-up pumping rate.

The MODFLOW input files are in Attachment 17.

6. References

1) Navy Rac Project, CCN: 008271, January 4, 1996

2) Waterloo Hydrogeologic Inc., Visual MODFLOW User's Manual, Waterloo, Ontario, Canada, June 1995.

3) Navy Rac Project, TM-321-001, Groundwater Evaluation, Jet Engine Test Cell, NAS Key West, Florida, October 3, 1995.

4) Allan, R. Freeze, John A. Cherry. Groundwater. Prentice Hall, 1979.

5) Contamination Assessment Report, Jet Engine Test Cell Site, Building A969, Boca Chica Field, NAS Key West, Key West Florida. June 1994.

6) Zheng, C. MT3D A Modular Three-Dimensional Transport Model for Simulation of Advection, Dispersion and Chemical Reactions of Contaminants in Groundwater Systems. Prepared for The United States Environmental Protection Agency, Robert S. Kerr Environmental Research Laboratory, Ada, Oklahoma 74820. October 17, 1990.

7) The United States Environmental Protection Agency. Water Quality Assessment: A Screening Procedure for Toxic and Conventional Pollutants in Surface and Groundwater-Part I. 1985.

8) The United States Environmental Protection Agency. Superfund Public Health Evaluation Manual. EPA/540/1-86/060. October 1986.

9) Pankow, James F. and John A. Cherry. Dense Chlorinated Solvents and Other DNAPLs in Groundwater. Waterloo Press. 1996.

7. Attachments

1) Figure 1: Site location map, Jet fuel and solvent plumes

Figure 2: Headspace Concentrations

2) MODFLOW INPUT FILES- Free-product recovery

3) MODFLOW Input&output files (solvent recovery)

4) MT3D Input files

5) MT3D output: case 1

6) MT3D output: case 2

7) MT3D output: case 3

8) MT3D output: case 4

9) MT3D output: case 5

10) MT3D output: case 6

11) MT3D output: case 7

12) MT3D output: case 8

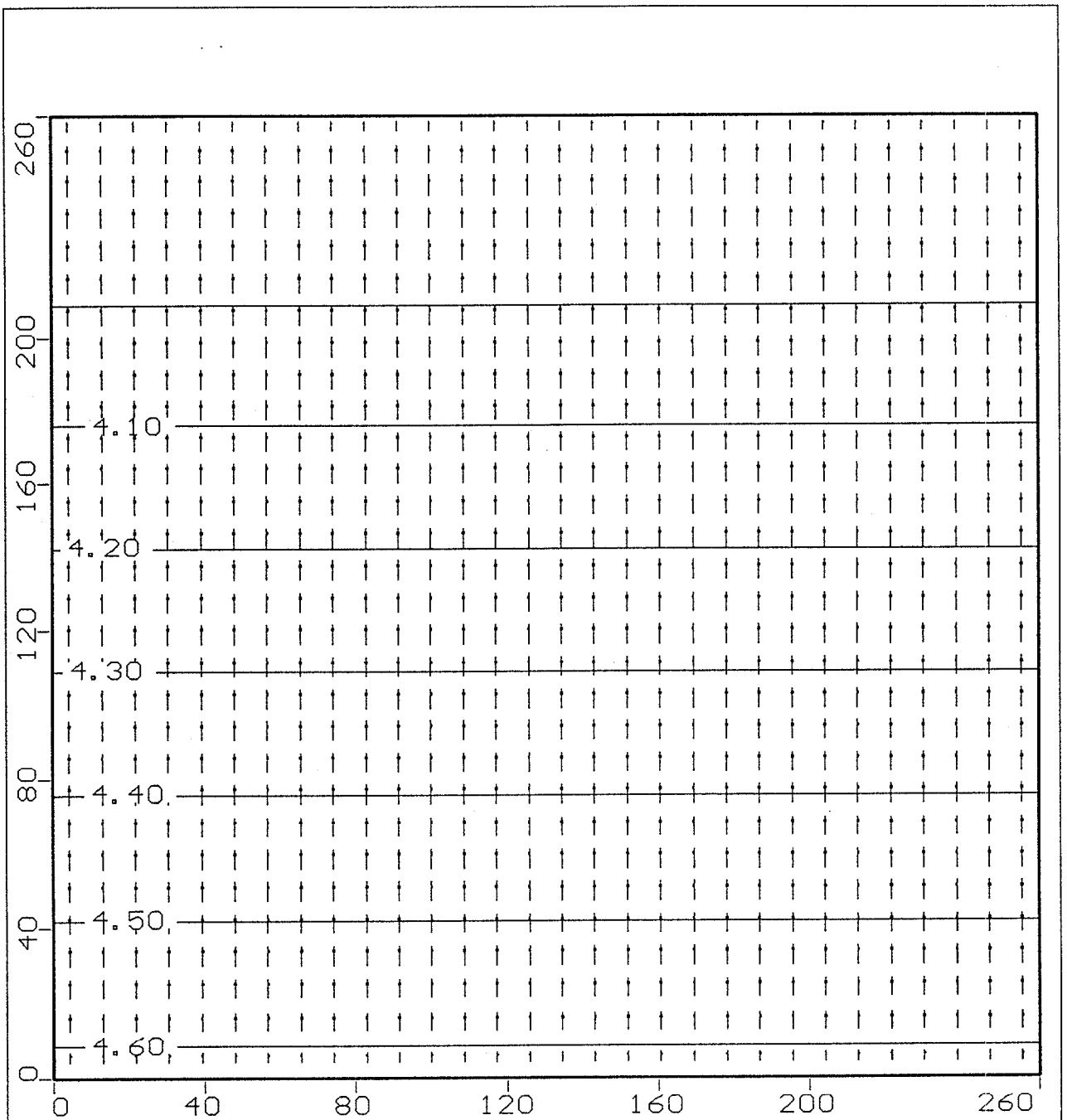
13) MT3D output: case 9

14) MT3D output: case 10

15) Time history of recovery well concentrations

16) Contaminant Loadings

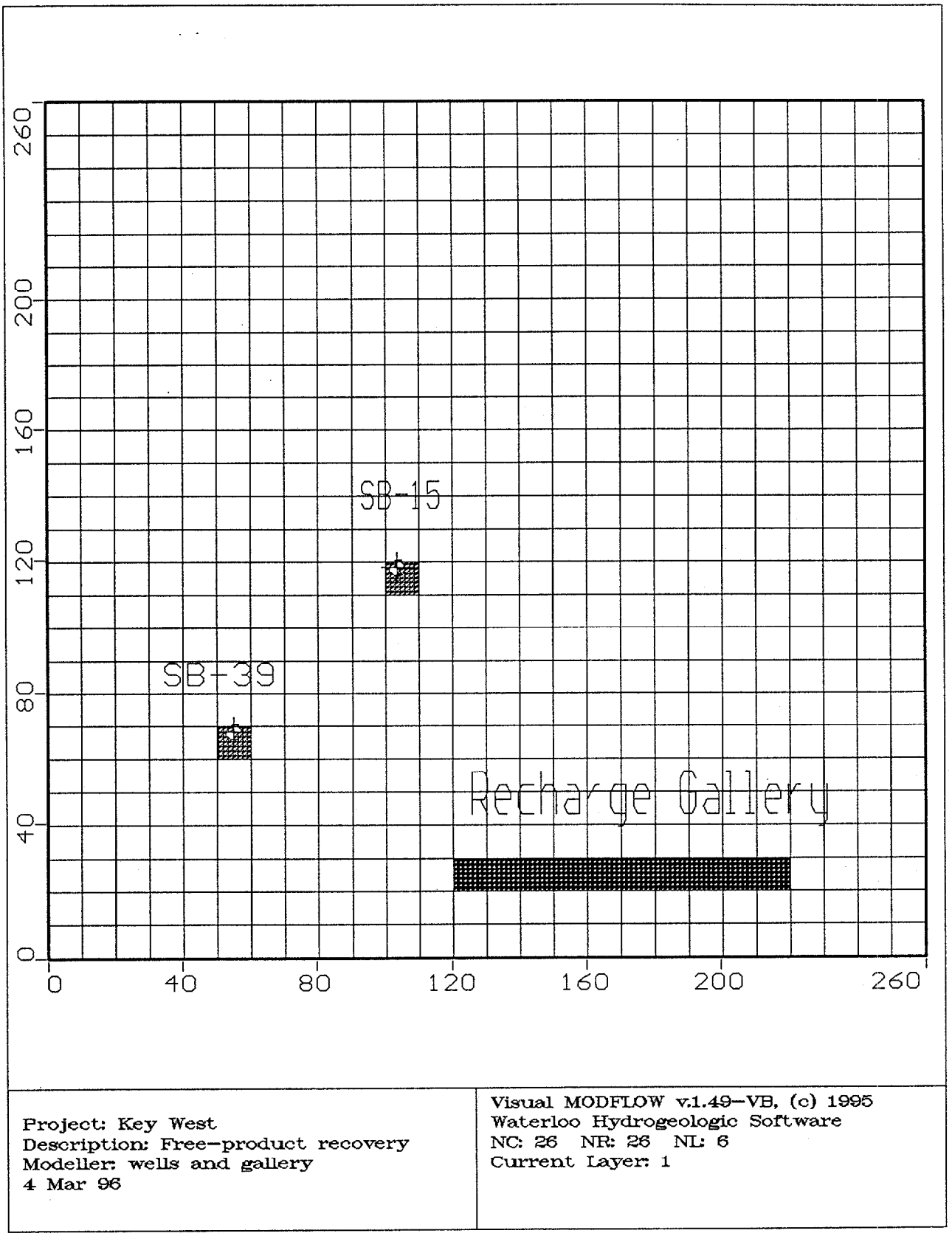
17) MODFLOW input files for Refined Gallery Design



Project: KeyWest
Description: Capture Zones for P&T
Modeller: n-flo, c-head north&south
22 Jan 96

Visual MODFLOW v.1.49-VB, (c) 1995
Waterloo Hydrogeologic Software
NC: 25 NR: 25 NL: 2
Current Layer: 1

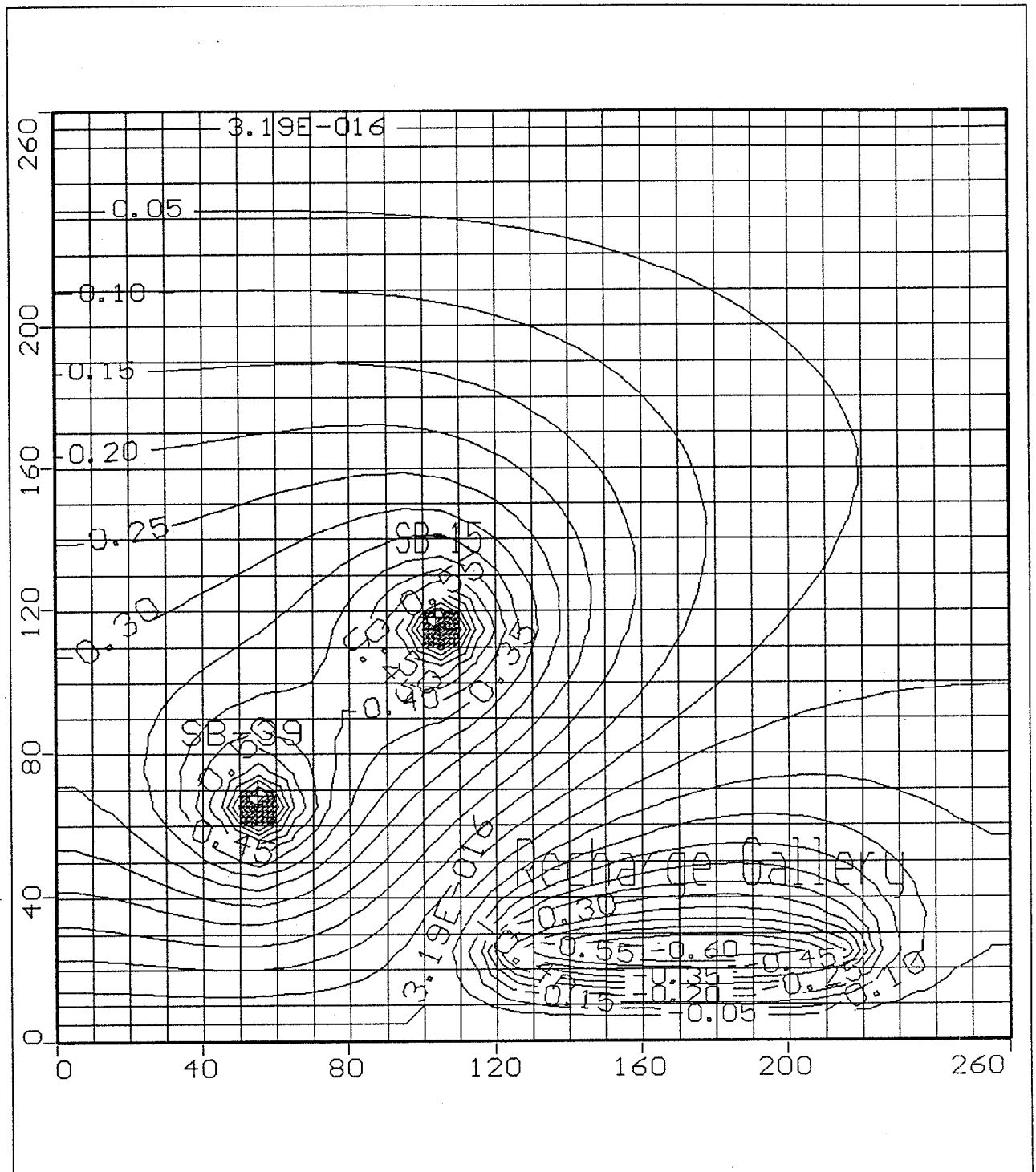
Figure 1 -



Project: Key West
Description: Free-product recovery
Modeller: wells and gallery
4 Mar 96

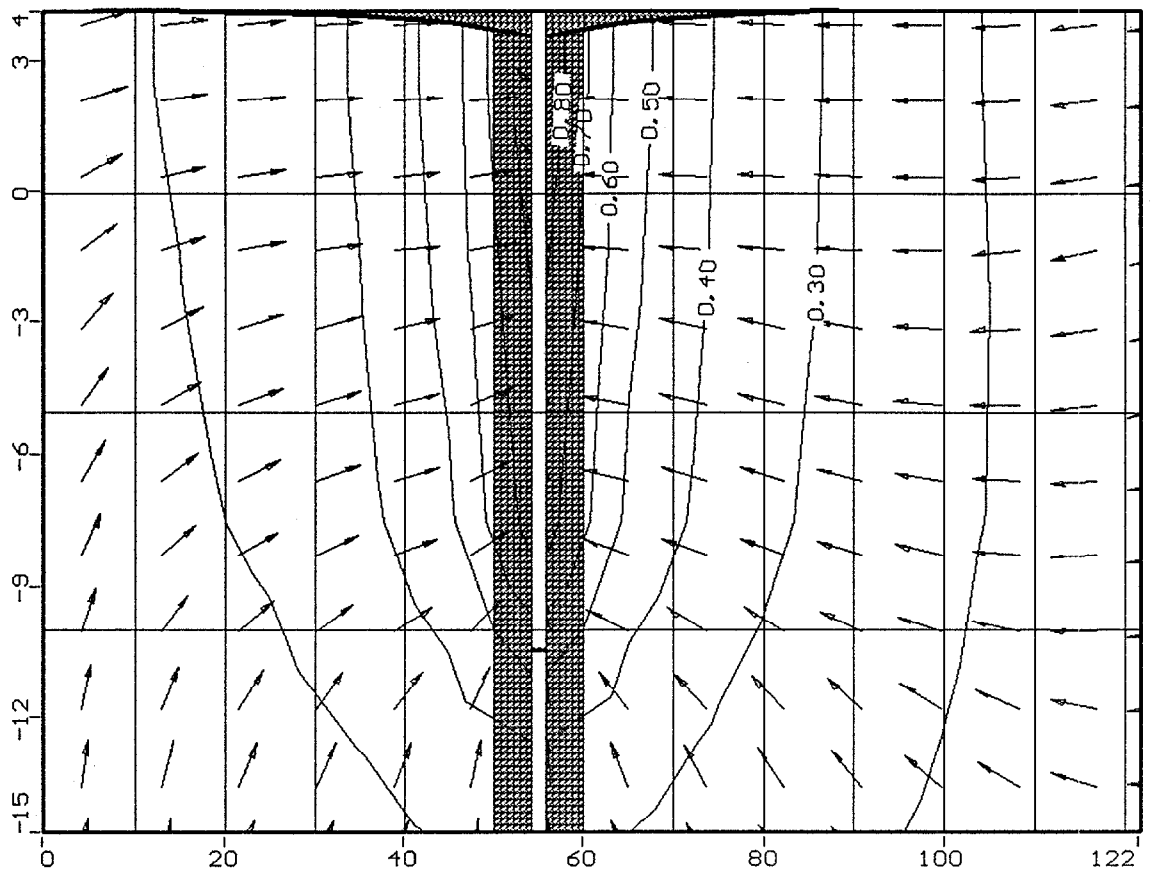
Visual MODFLOW v.1.49-VB, (c) 1995
Waterloo Hydrogeologic Software
NC: 26 NR: 26 NL: 6
Current Layer: 1

Figure 2



Project: Key West Description: SS drdwn, 15-ft scrn Modeller: 2 wells@ 1.25 gpm each 5 Mar 96	Visual MODFLOW v.1.49-VB, (c) 1995 Waterloo Hydrogeologic Software NC: 26 NR: 26 NL: 6 Current Layer: 1

Figure 3



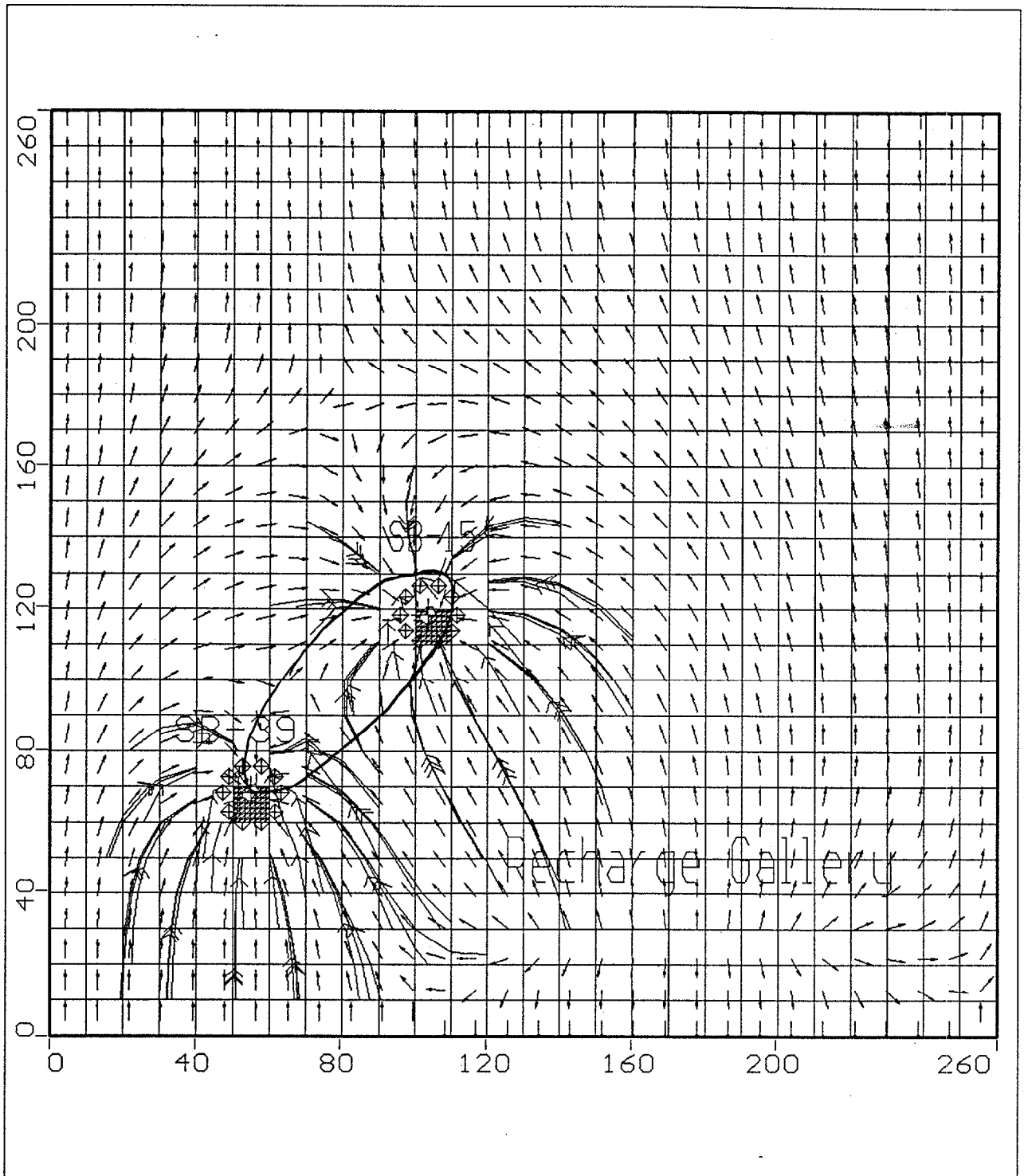
SB-39

0.20

0.10

Project: Key West Description: SS drdwn, 15-ft scrn Modeller: 2 wells@ 1.25 gpm each 5 Mar 96	Visual MODFLOW v.1.49-VB, (c) 1995 Waterloo Hydrogeologic Software NC: 26 NR: 26 NL: 6 Current Row: 20

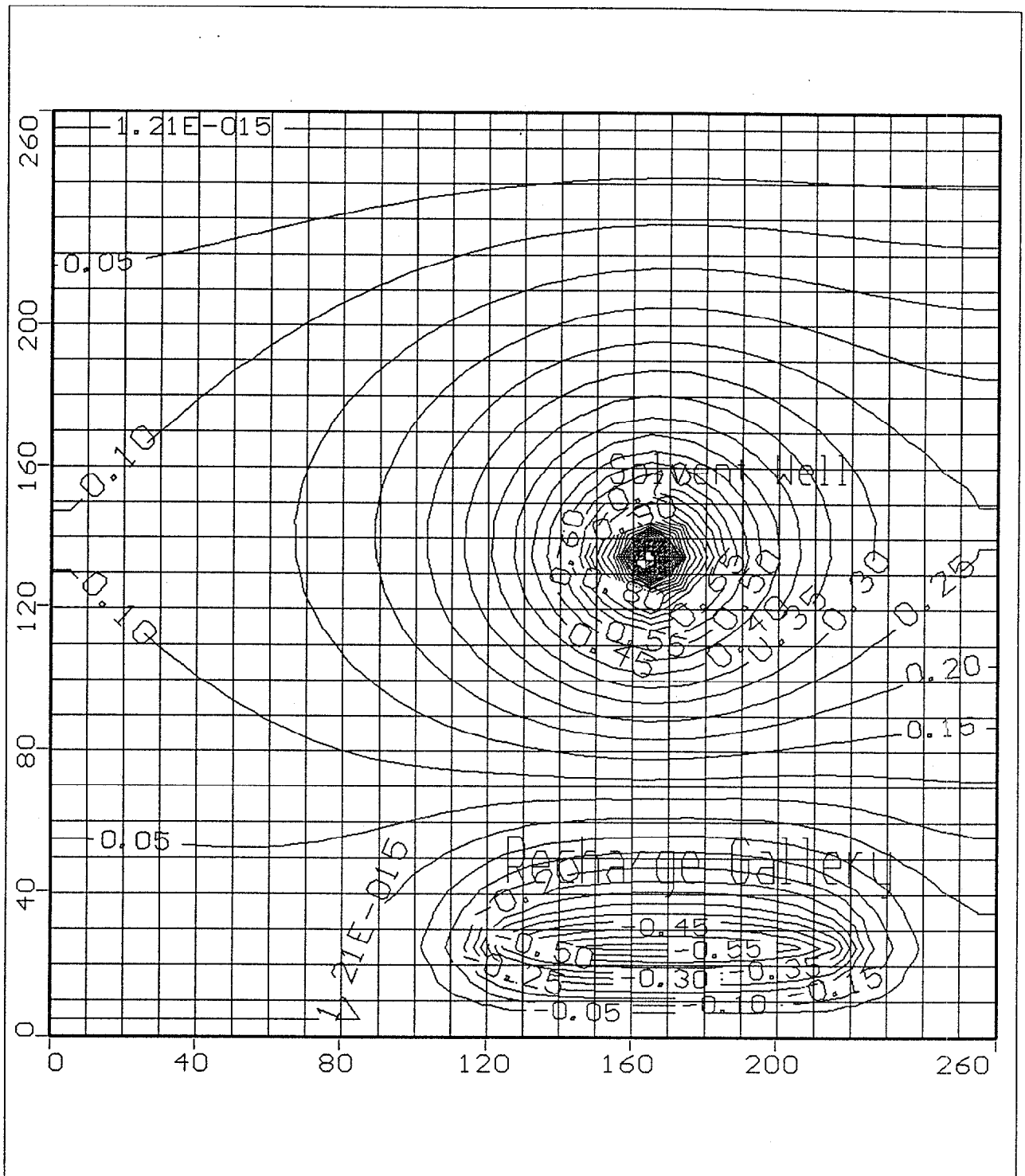
Figure 4



Project: Key West
Description: 160-d PT, 15-ft scrn
Modeller: 2 wells@ 1.25 gpm each
5 Mar 96

Visual MODFLOW v.1.49-VB, (c) 1995
Waterloo Hydrogeologic Software
NC: 26 NR: 26 NL: 6
Current Layer: 1

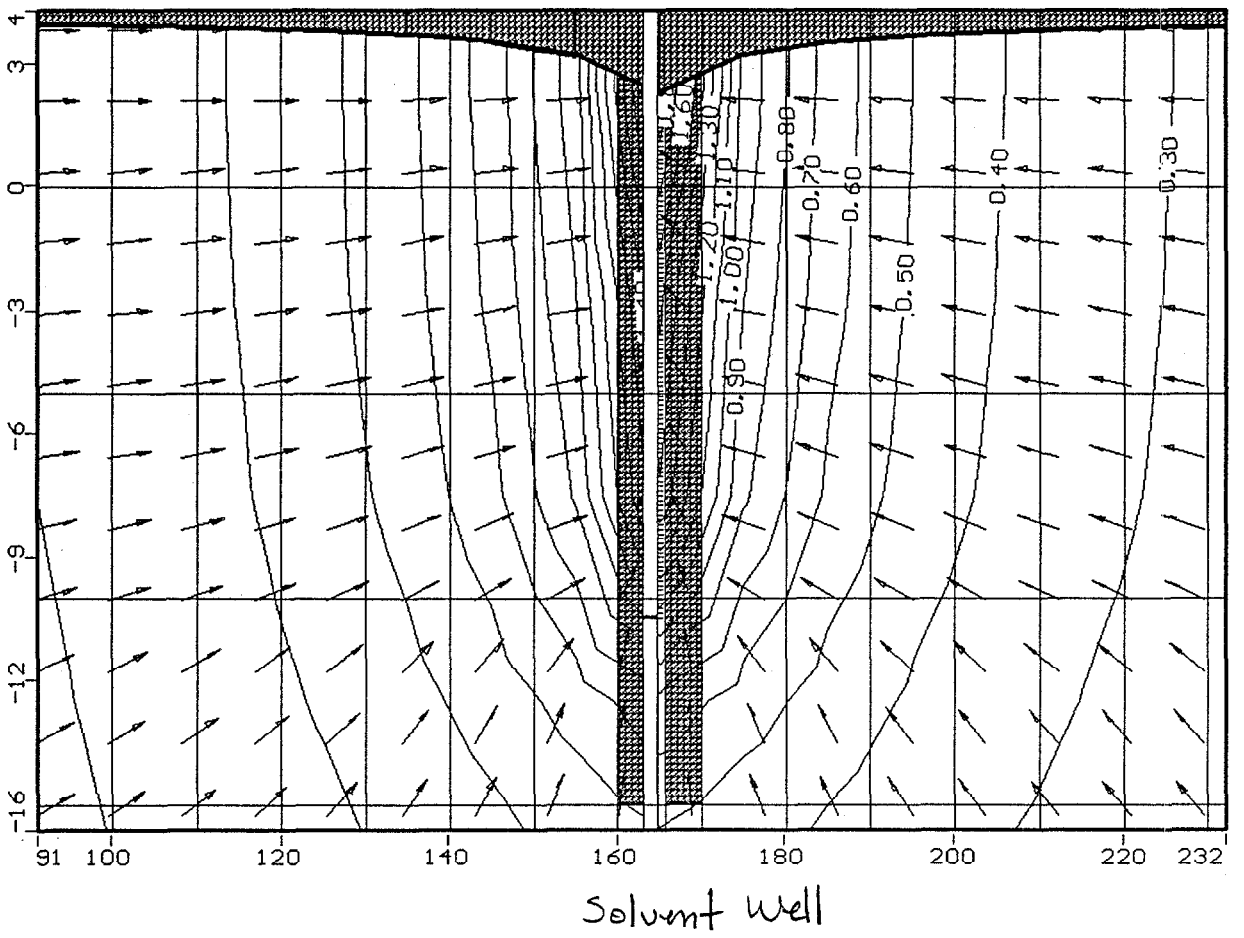
Figure 5



Project: Key West
Description: SS, drdwn, 15-ft scrn
Modeller: 2.5 gpm pumping
5 Mar 96

Visual MODFLOW v.1.49-VB, (c) 1995
Waterloo Hydrogeologic Software
NC: 26 NR: 26 NL: 6
Current Layer: 1

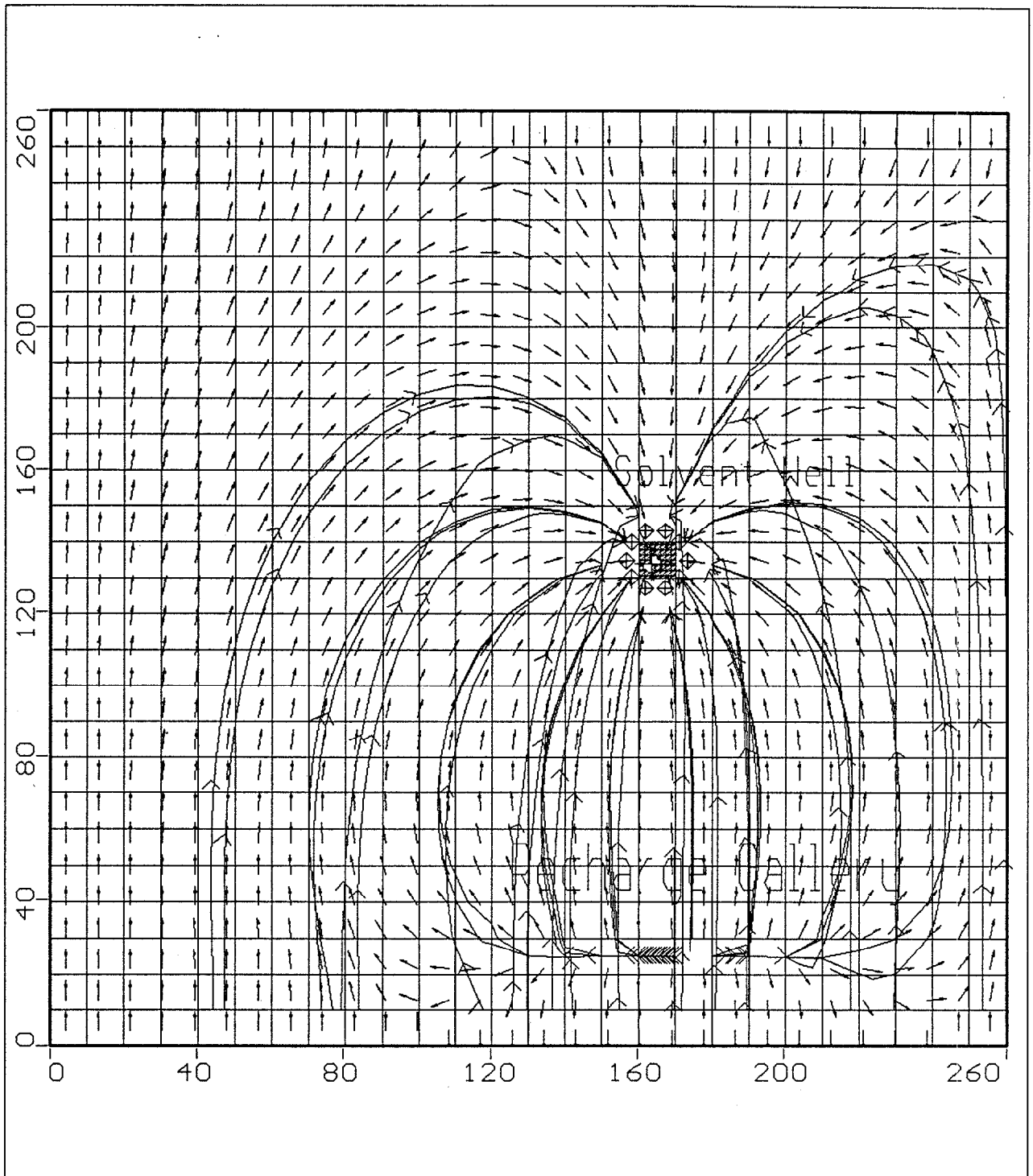
Figure 6



Project: Key West
Description: SS, Drdwn, 15-ft scrn
Modeller: 2.5 gpm pumping
5 Mar 96

Visual MODFLOW v.1.49-VB, (c) 1995
Waterloo Hydrogeologic Software
NC: 26 NR: 26 NL: 6
Current Row: 13

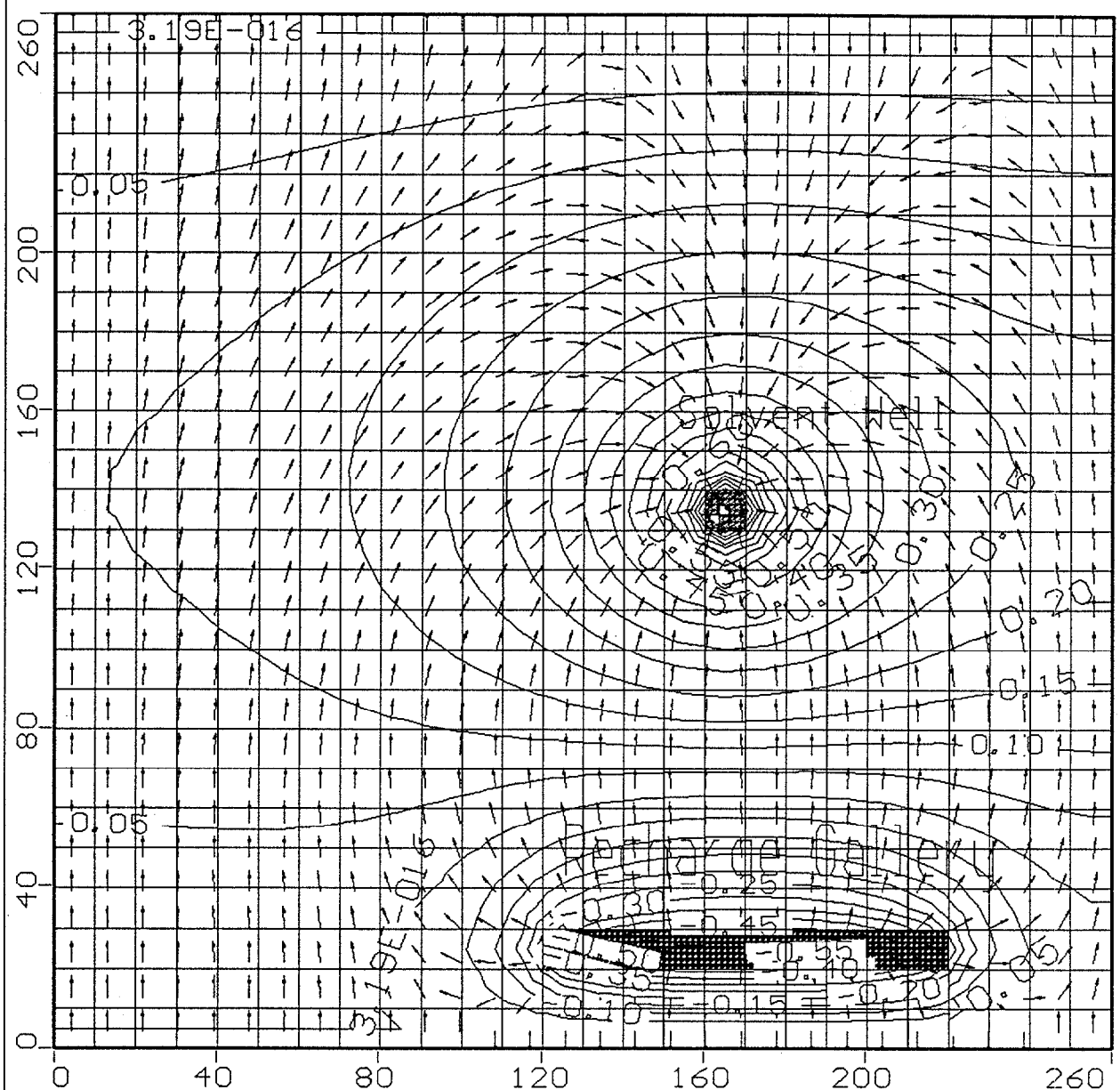
Figure 7



Project: Key West
Description: SS, PT, 15-ft scrn
Modeller: 2.5 gpm pumping
5 Mar 96

Visual MODFLOW v.1.49-VB, (c) 1995
Waterloo Hydrogeologic Software
NC: 26 NR: 26 NL: 6
Current Layer: 1

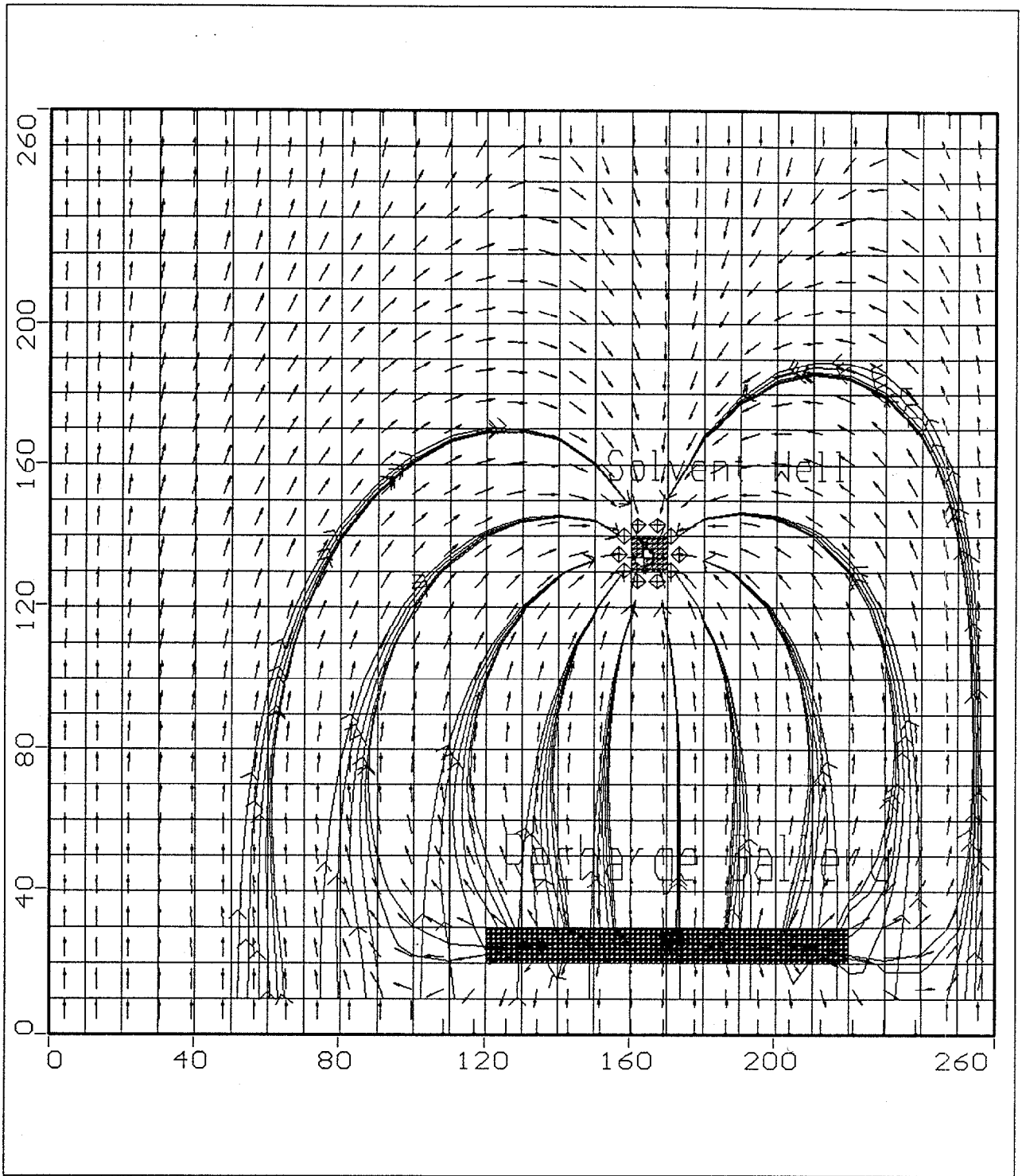
Figure 8



Project: Key West
Description: SS, drdwn, flow field
Modeller: 2.5 gpm pumping
3 Mar 96

Visual MODFLOW v.1.49-VB, (c) 1995
Waterloo Hydrogeologic Software
NC: 26 NR: 26 NL: 6
Current Layer: 1

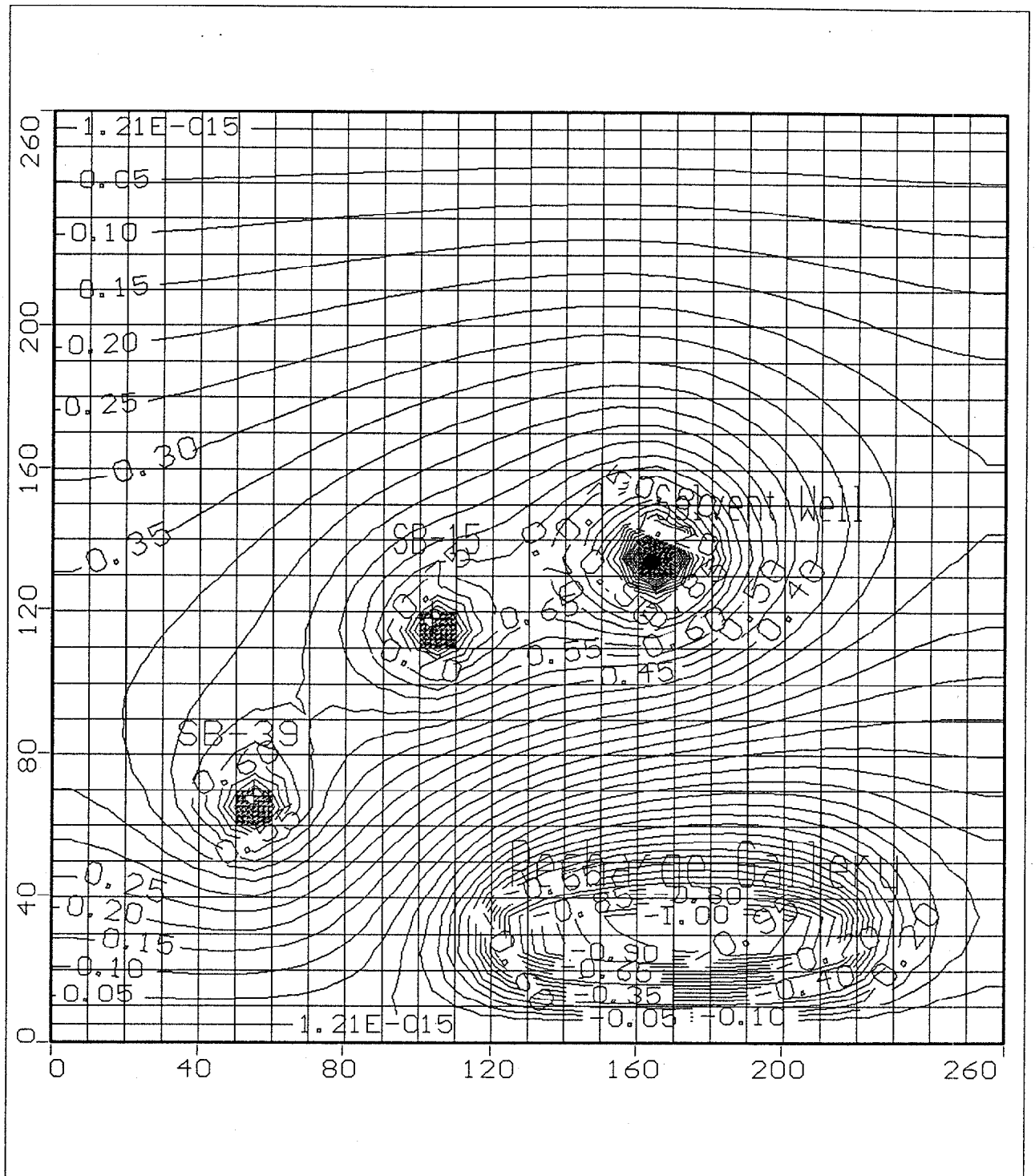
Figure 9



Project: Key West
Description: SS, Particle tracking
Modeller: 2.5 gpm pumping
3 Mar 96

Visual MODFLOW v.1.49–VB, (c) 1995
Waterloo Hydrogeologic Software
NC: 26 NR: 26 NL: 6
Current Layer: 1

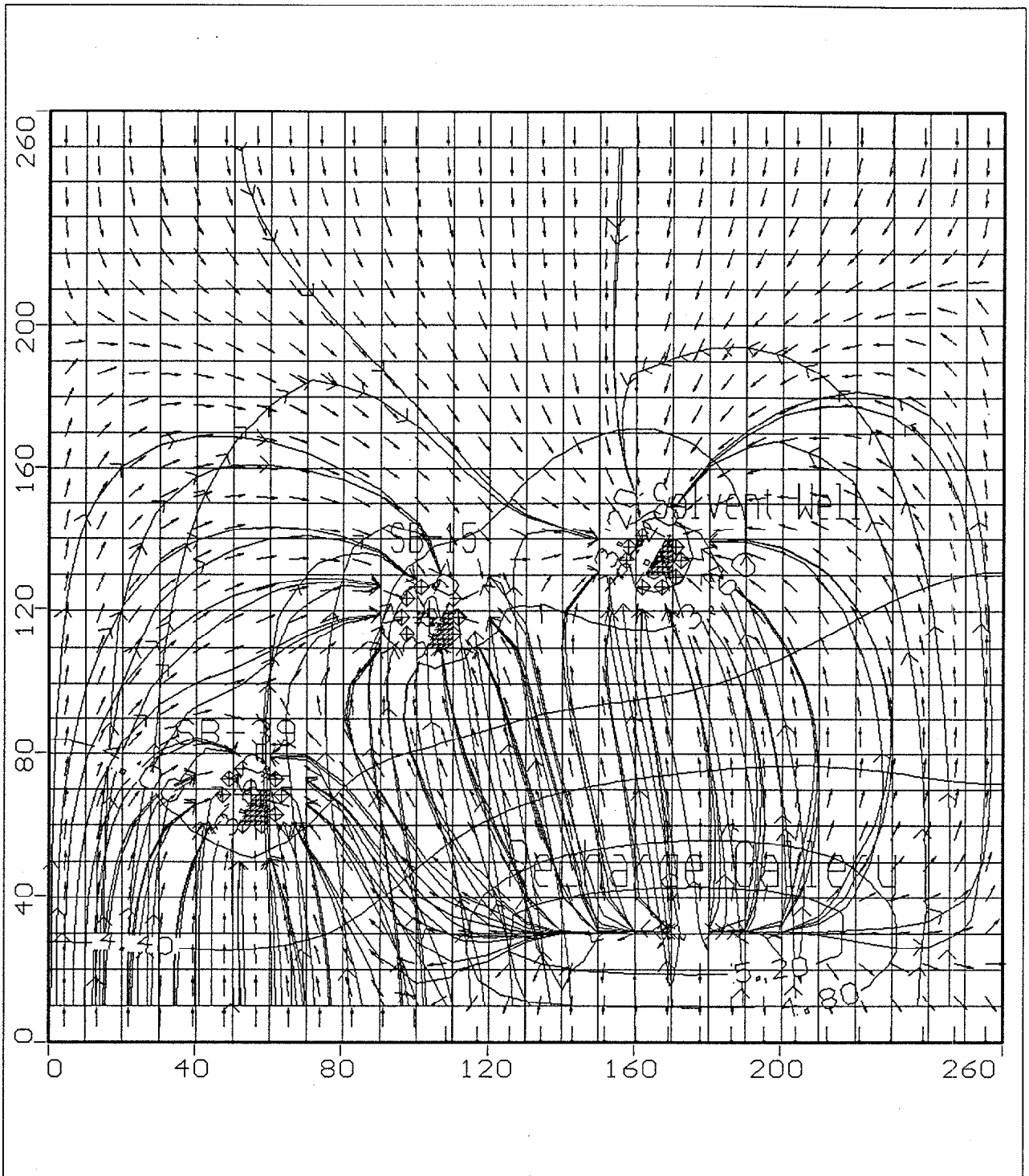
Figure 10



Project: Key West
Description: SS, 15-ft sr, SW @2.5 gpm
Modeller: 2wells@ 1.25 gpm each
9 Mar 96

Visual MODFLOW v.1.49-VB, (c) 1995
Waterloo Hydrogeologic Software
NC: 26 NR: 26 NL: 6
Current Layer: 1

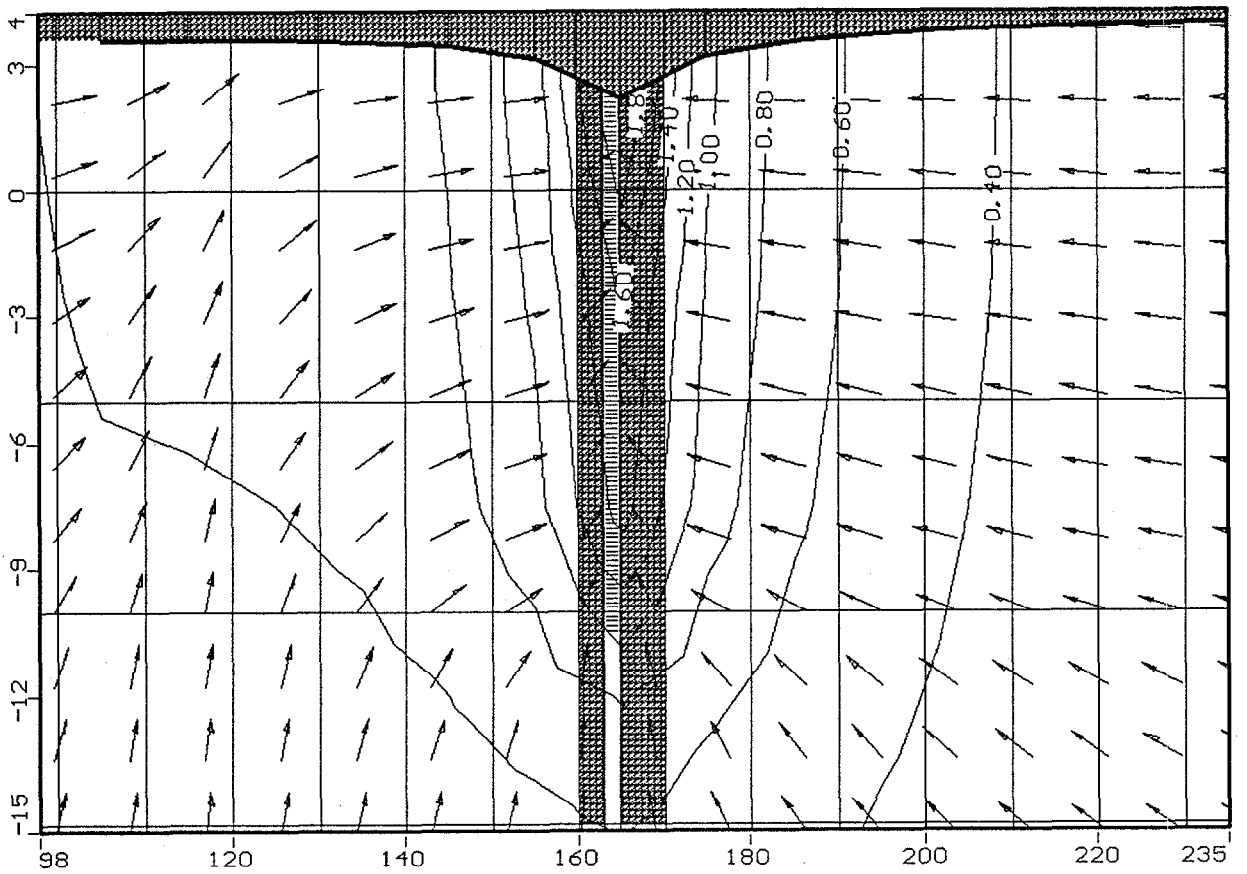
Figure 11



Project: Key West
Description: SS, 15-ft sr, SW @2.5 gpm
Modeller: 2wells@ 1.25 gpm each
9 Mar 96

Visual MODFLOW v.1.49-VB, (c) 1995
Waterloo Hydrogeologic Software
NC: 26 NR: 26 NL: 6
Current Layer: 1

Figure 12

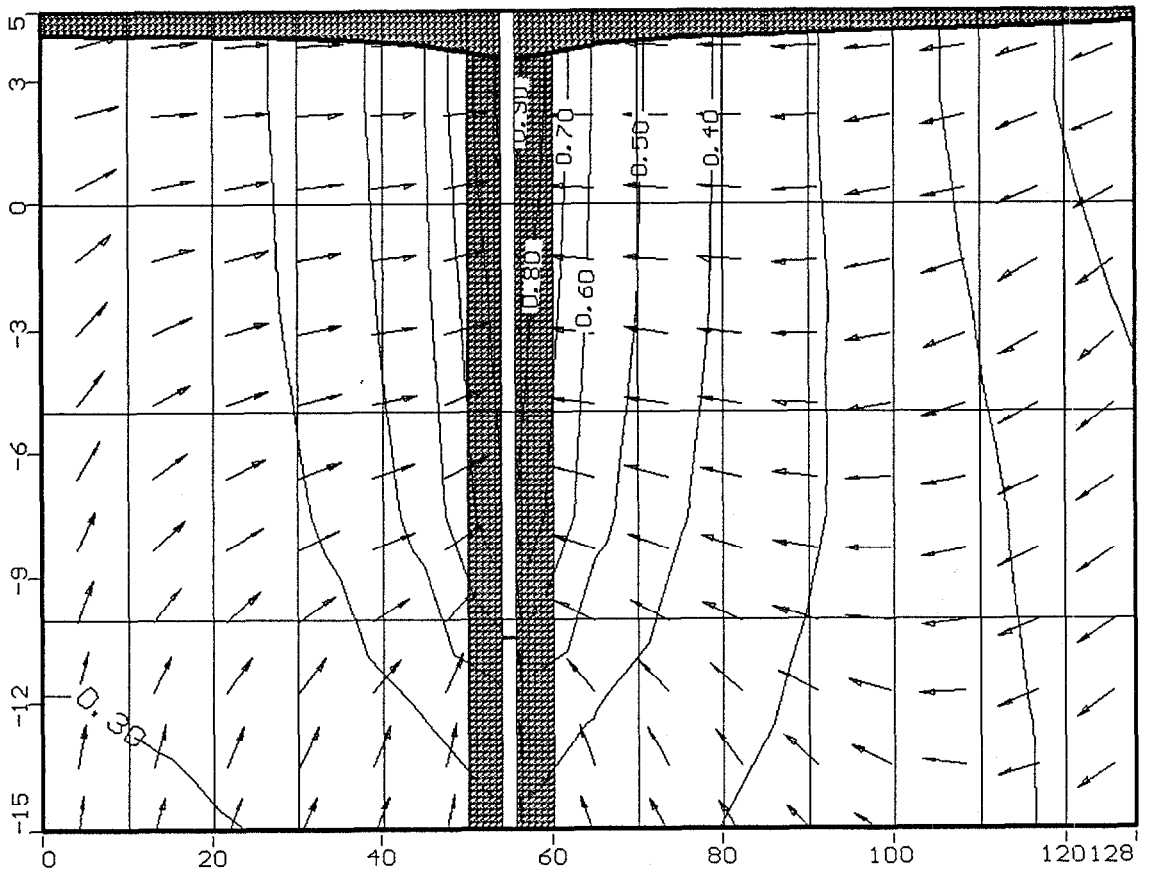


Solvent Well

Project: Key West
Description: SS, 15-ft sr, SW @2.5 gpm
Modeller: 2wells@ 1.25 gpm each
9 Mar 96

Visual MODFLOW v.1.49-VB, (c) 1995
Waterloo Hydrogeologic Software
NC: 26 NR: 26 NL: 6
Current Row: 13

Figure 13



Well SP-39

0.20

Project: Key West
Description: SS, 15-ft sr, SW @2.5 gpm
Modeller: 2wells@ 1.25 gpm each
9 Mar 96

Visual MODFLOW v.1.49-VB, (c) 1995
Waterloo Hydrogeologic Software
NC: 26 NR: 26 NL: 6
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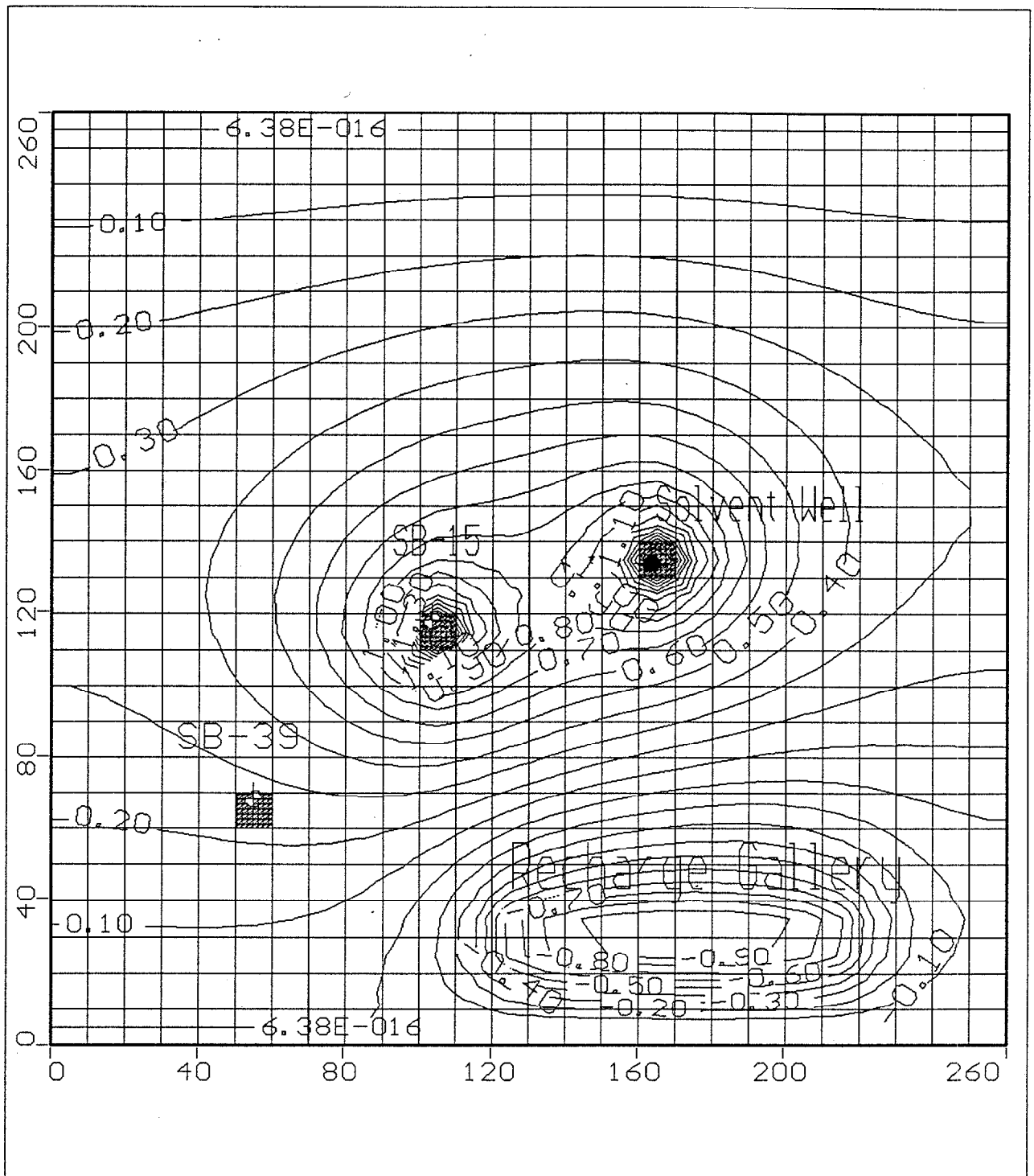
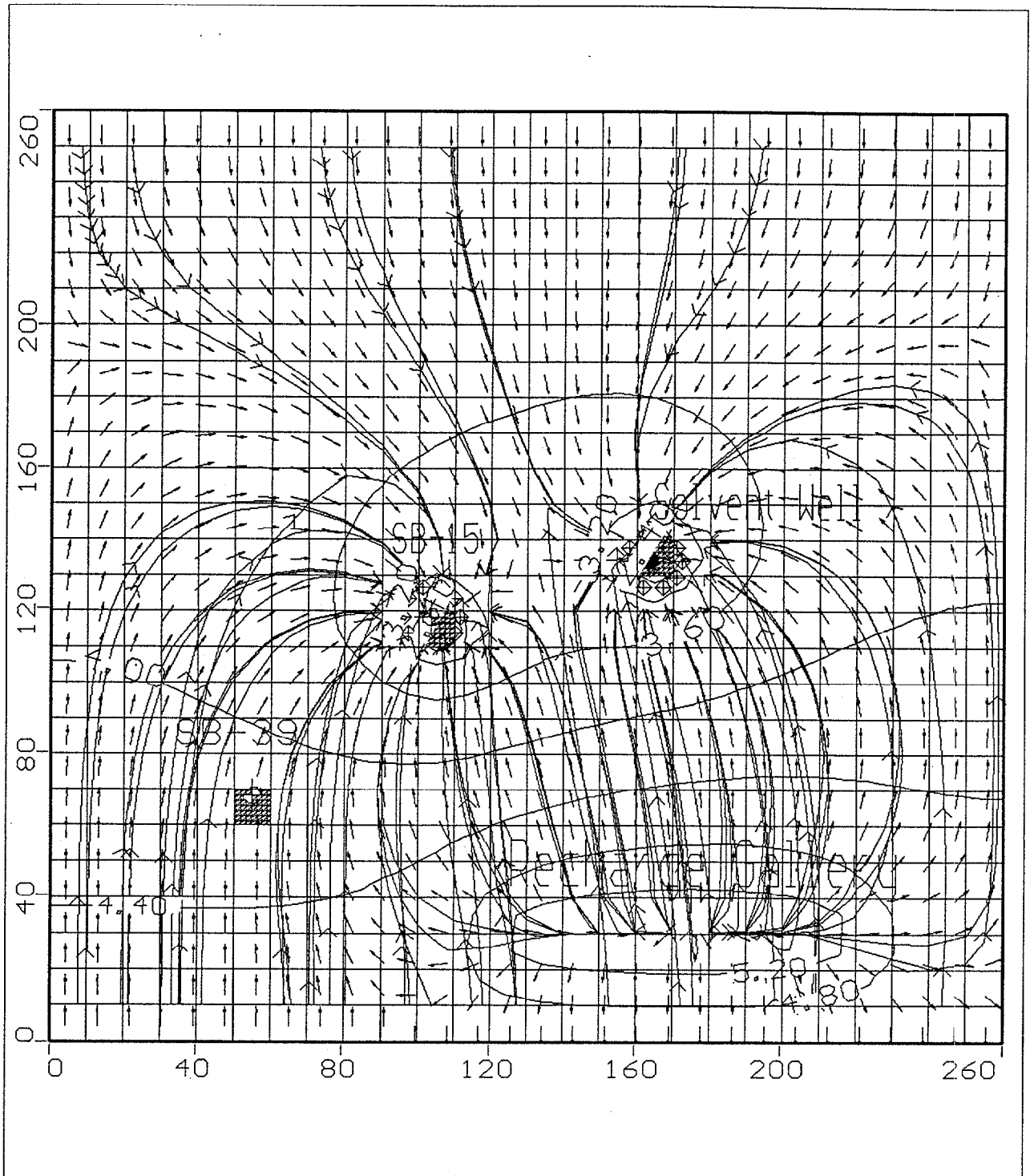
Figure 14



Project: Key West
Description: SS, 15-ft sr,DRdwn
Modeller: 2wells@ 2.5 gpm each
9 Mar 96

Visual MODFLOW v.1.49-VB, (c) 1995
Waterloo Hydrogeologic Software
NC: 26 NR: 26 NL: 6
Current Layer: 1

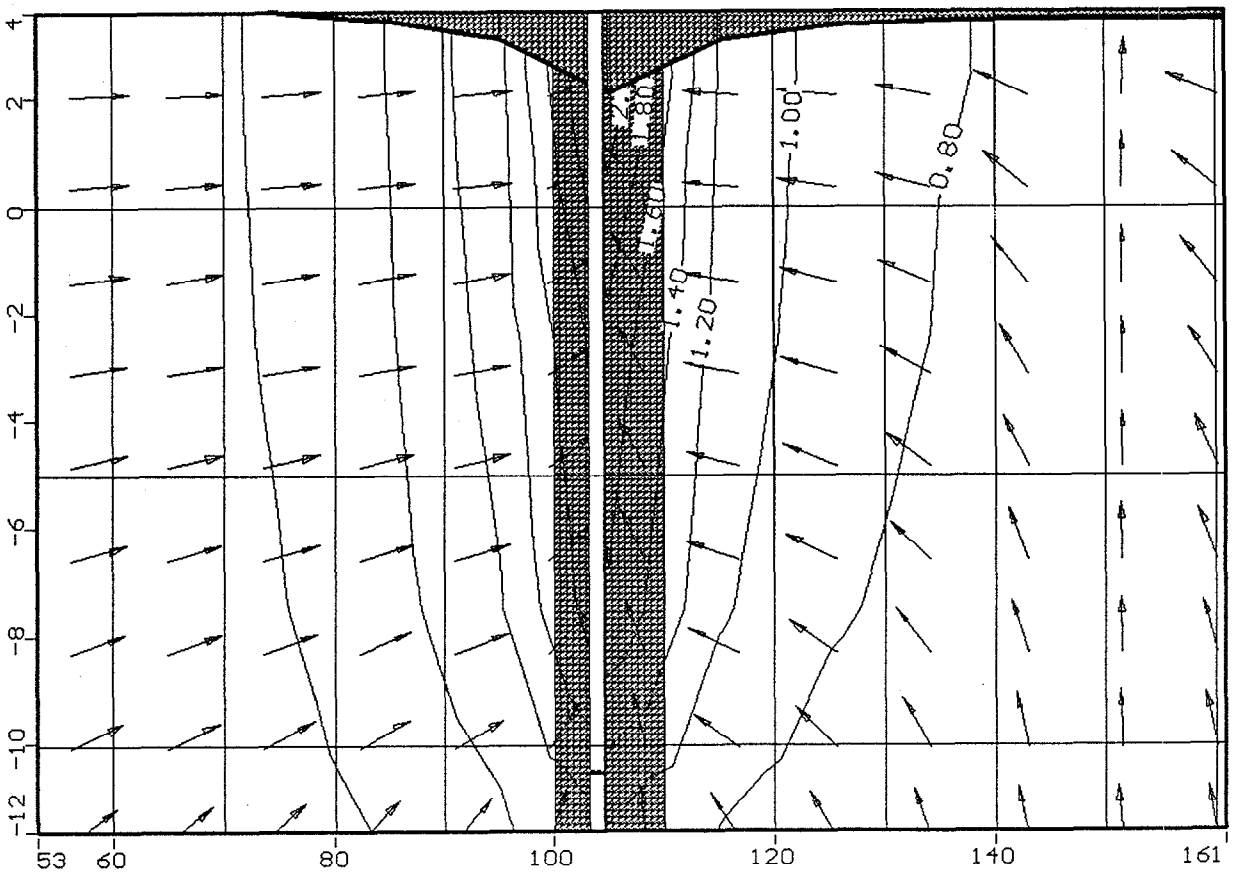
Figure 15



Project: Key West
Description: SS, 15-ft sr,DRdwn
Modeller: 2wells@ 2.5 gpm each
9 Mar 96

Visual MODFLOW v.1.49-VB, (c) 1995
Waterloo Hydrogeologic Software
NC: 26 NR: 26 NL: 6
Current Layer: 1

Figure 16

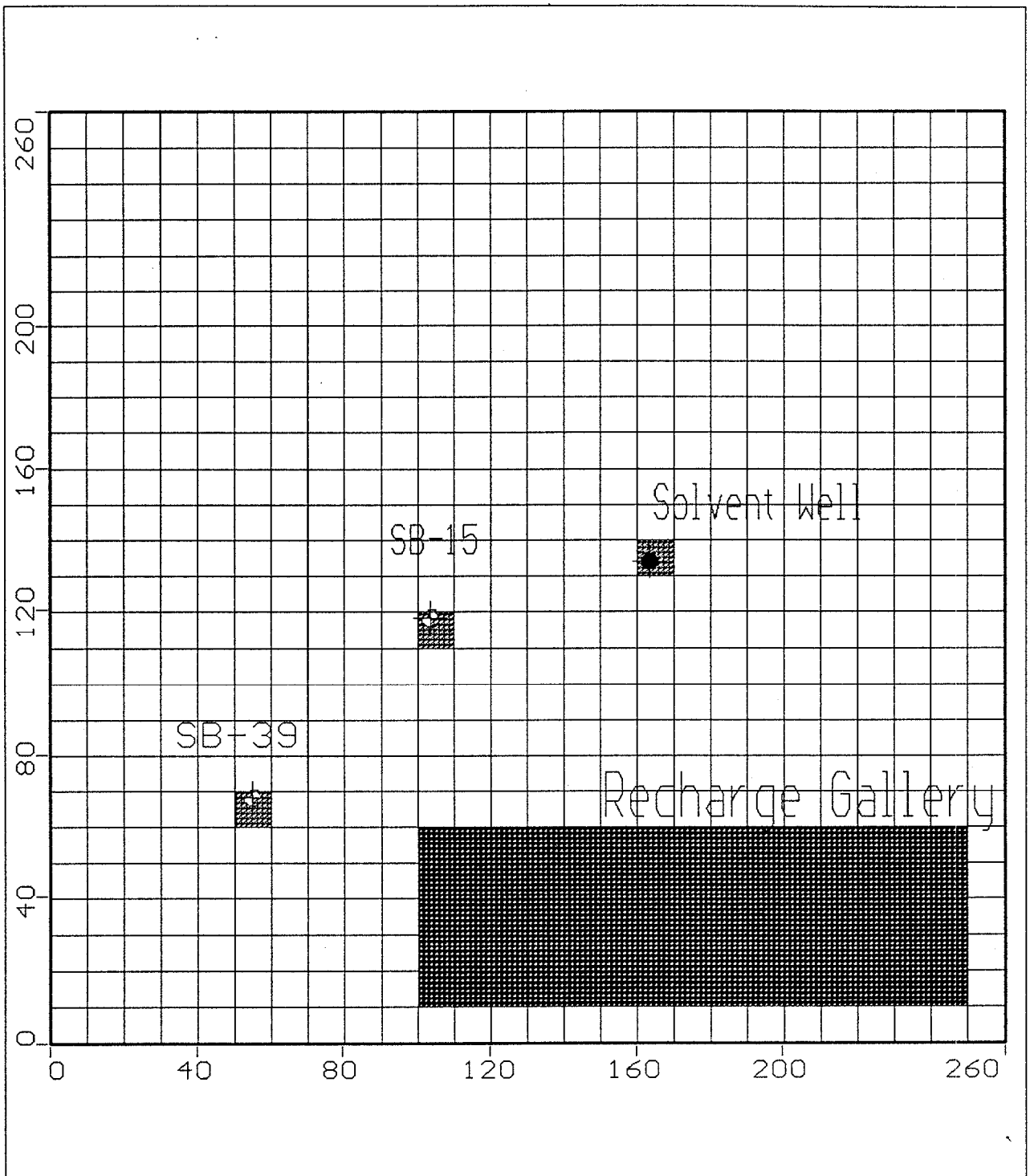


SP-15

Project: Key West
Description: SS, 15-ft sr,DRdwn
Modeller: 2wells@ 2.5 gpm each
9 Mar 96

Visual MODFLOW v.1.49-VB, (c) 1995
Waterloo Hydrogeologic Software
NC: 26 NR: 26 NL: 6
Current Row: 15

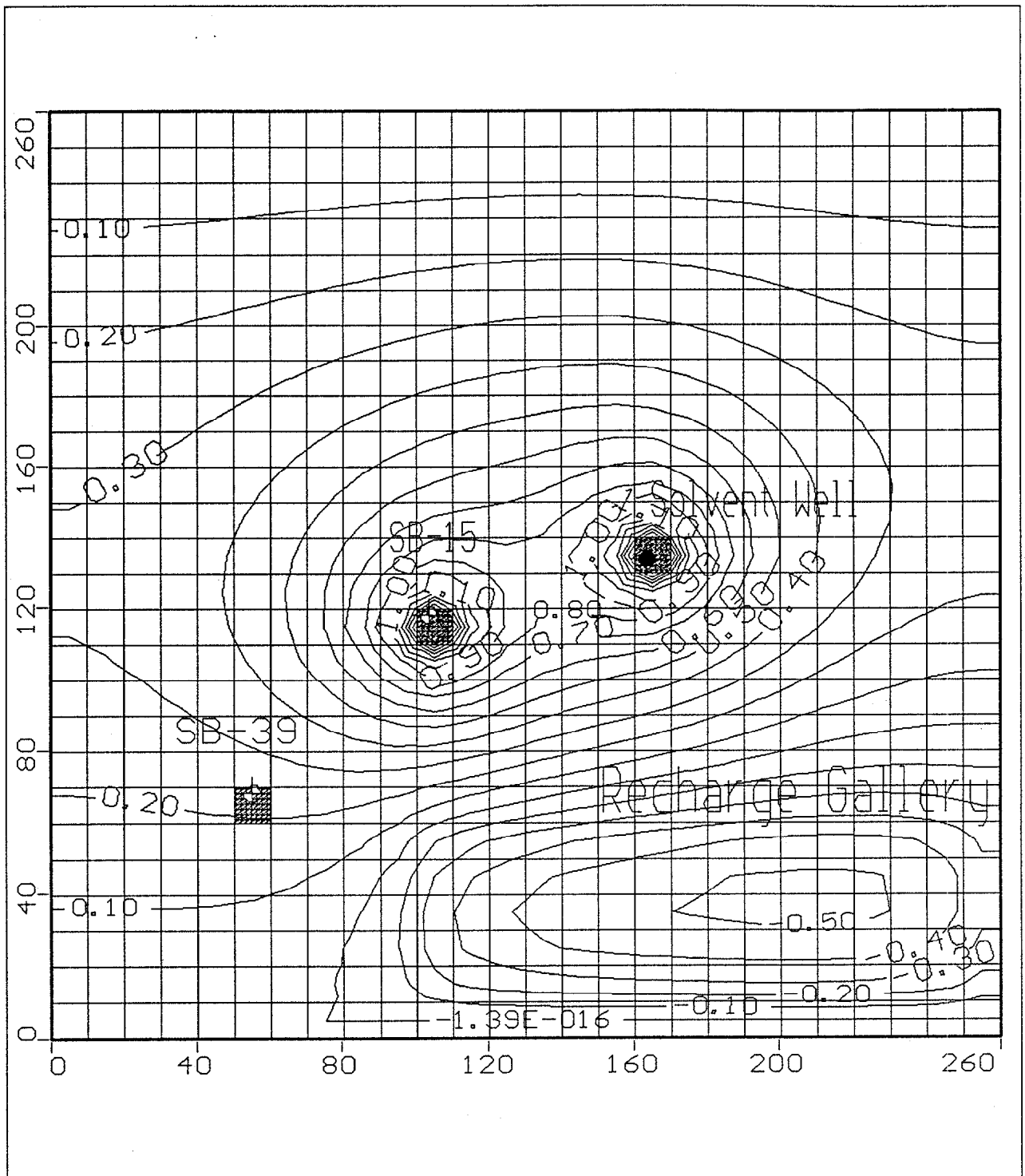
Figure 17



Project: Key West
Description: 40X150 gallery
Modeller: 2wells@ 2.5 gpm each
11 Mar 96

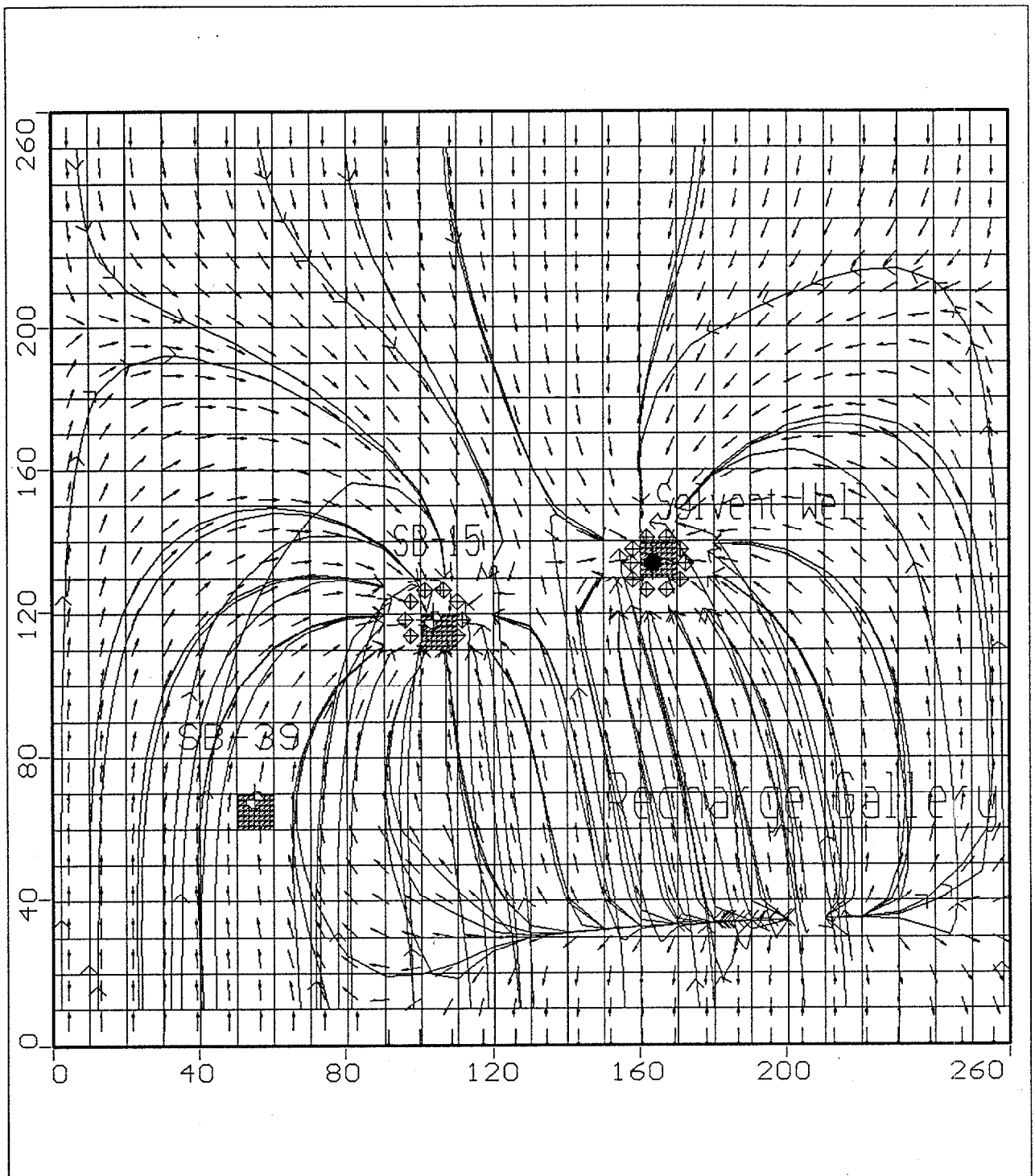
Visual MODFLOW v.1.49-VB, (c) 1995
Waterloo Hydrogeologic Software
NC: 26 NR: 26 NL: 6
Current Layer: 1

Figure 18



Project: Key West Description: SS, 15-ft sr,DRdwn Modeller: 2wells@ 2.5 gpm each 11 Mar 96	Visual MODFLOW v.1.49-VB, (c) 1995 Waterloo Hydrogeologic Software NC: 26 NR: 26 NL: 6 Current Layer: 1

Figure 19



Project: Key West
Description: SS, 15-ft sr,PT
Modeller: 2wells@ 2.5 gpm each
11 Mar 96

Visual MODFLOW v.1.49-VB, (c) 1995
Waterloo Hydrogeologic Software
NC: 26 NR: 26 NL: 6
Current Layer: 1

Figure 20

1,2-cis-DCE Distribution
(ug/l)

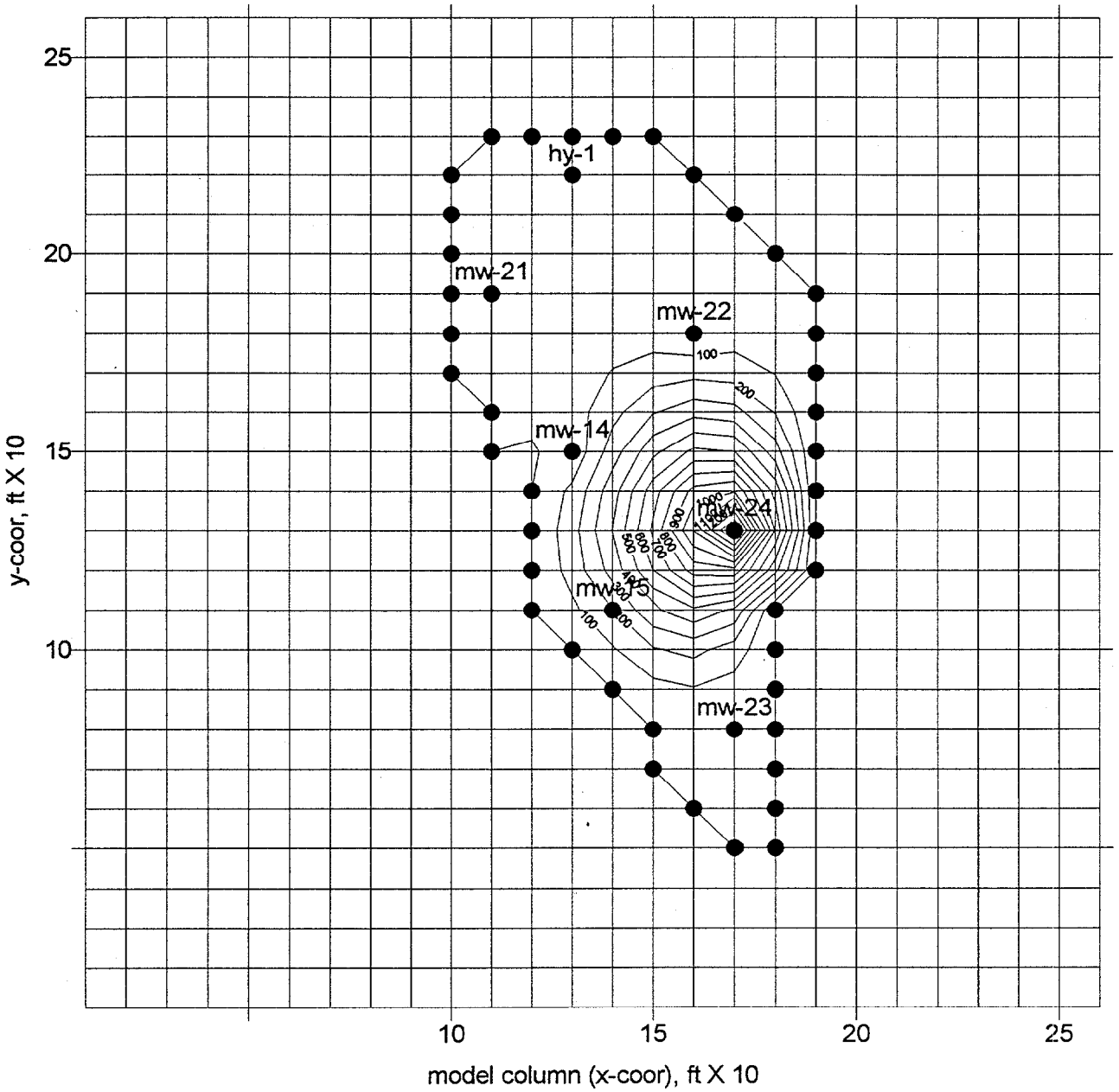


Figure 21

1,2-Trans-DCE Distribution
(ug/l)

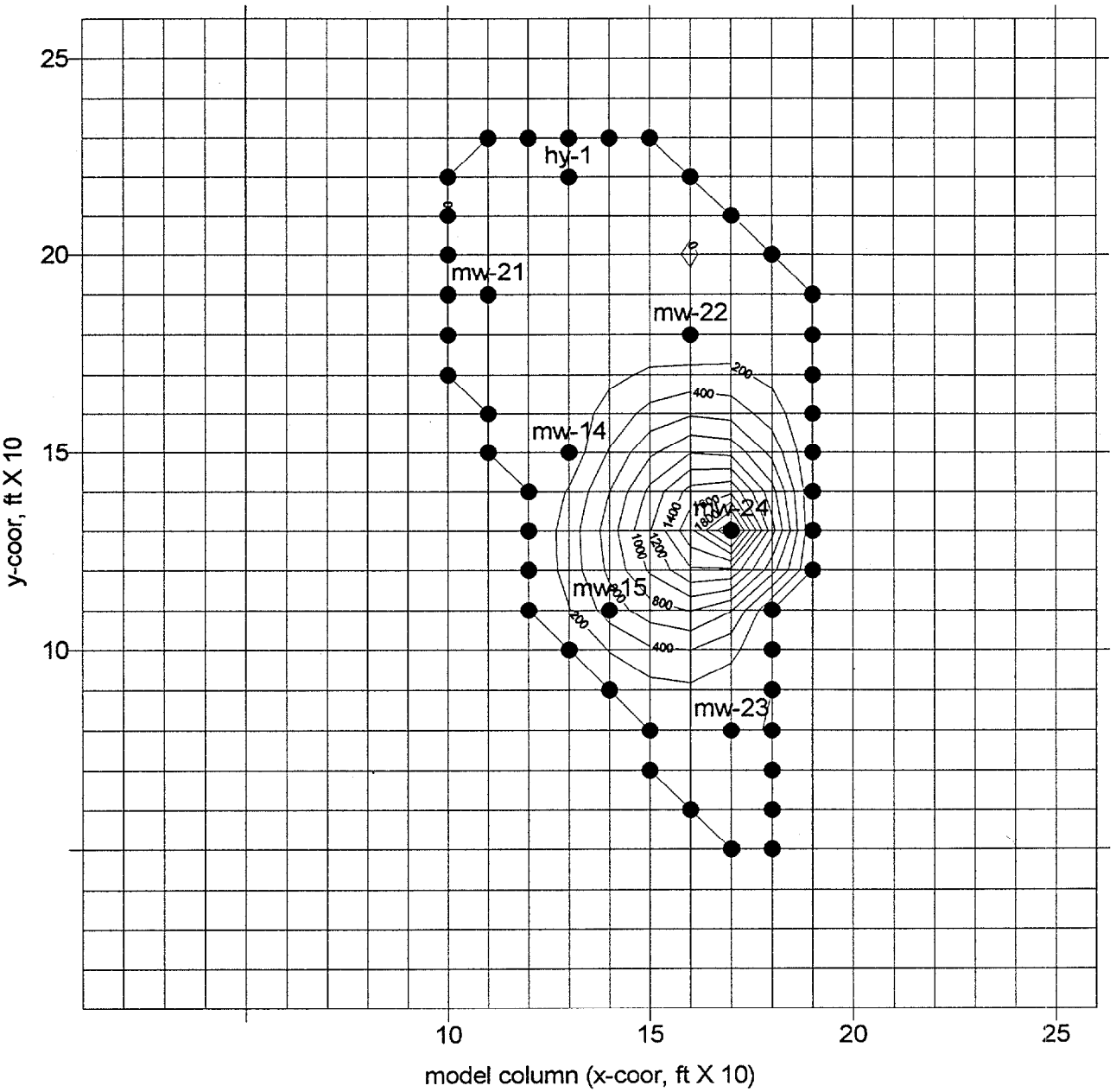
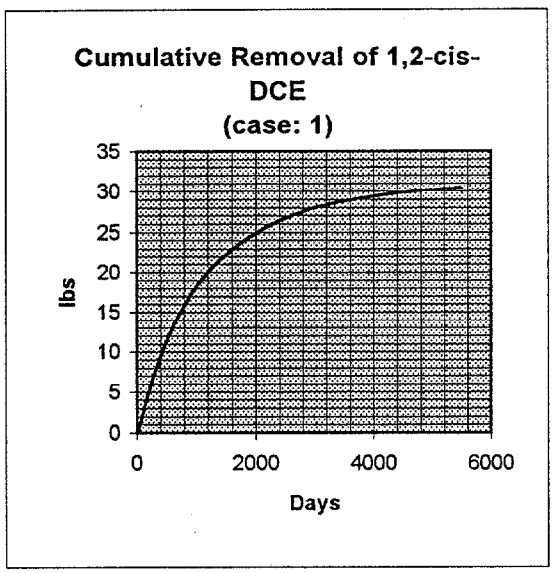
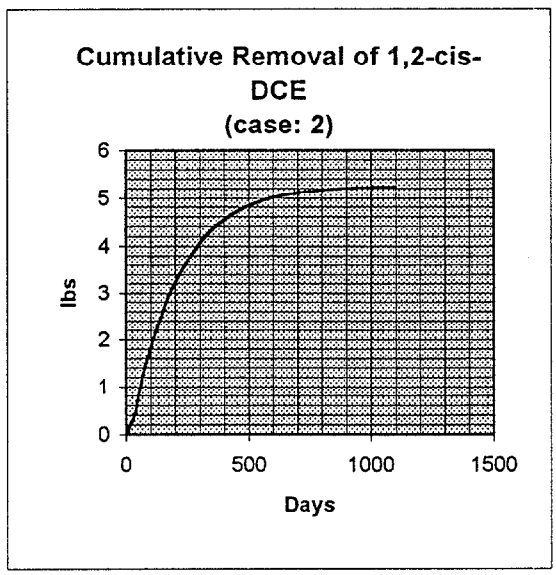
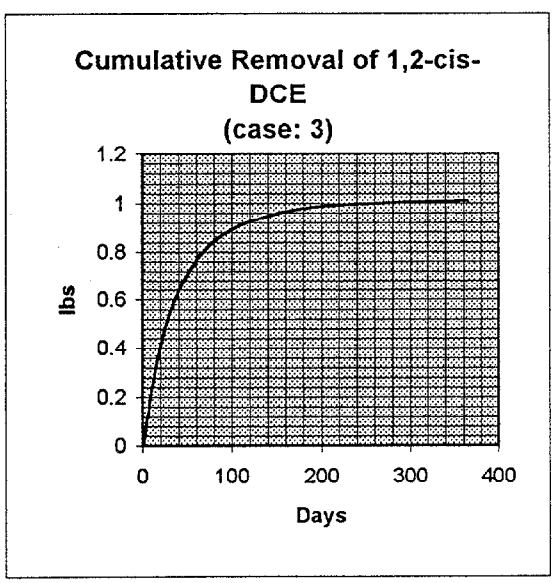


Figure 22

Figure 23


Cumulative Removal of 1,2-cis-DCE
(case: 1)
lbs
35
30
25
20
15
10
5
0
0
2000
4000
6000
Days


Cumulative Removal of 1,2-cis-DCE
(case: 2)
lbs
6
5
4
3
2
1
0
0
500
1000
1500
Days


Cumulative Removal of 1,2-cis-DCE
(case: 3)
lbs
1.2
1
0.8
0.6
0.4
0.2
0
0
100
200
300
400
Days

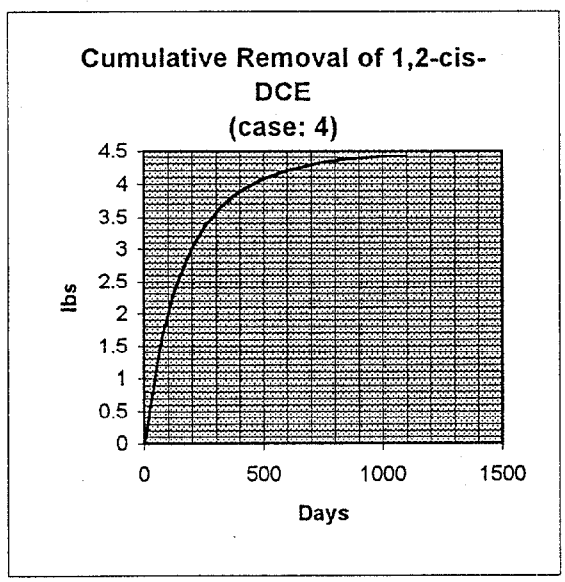
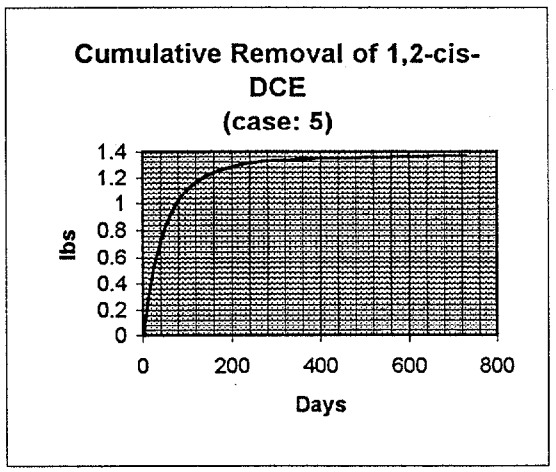
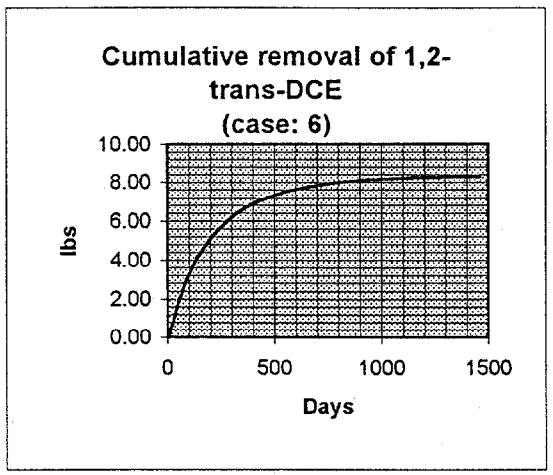
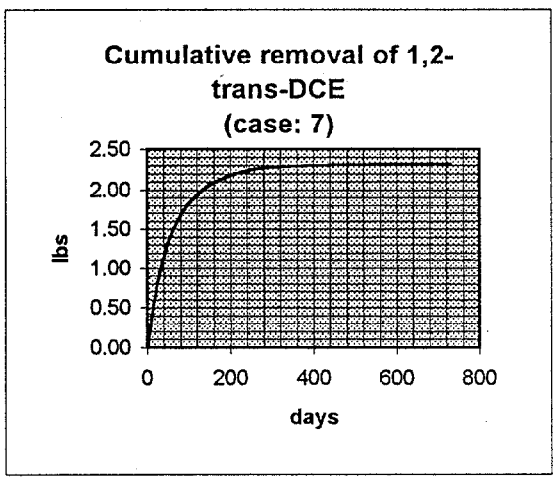
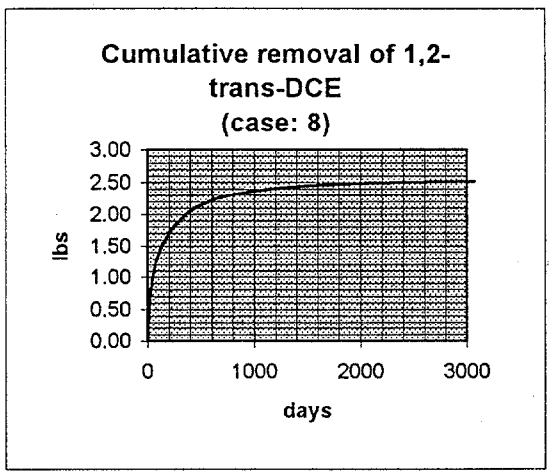

Cumulative Removal of 1,2-cis-DCE
(case: 4)
lbs
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0
500
1000
1500
Days

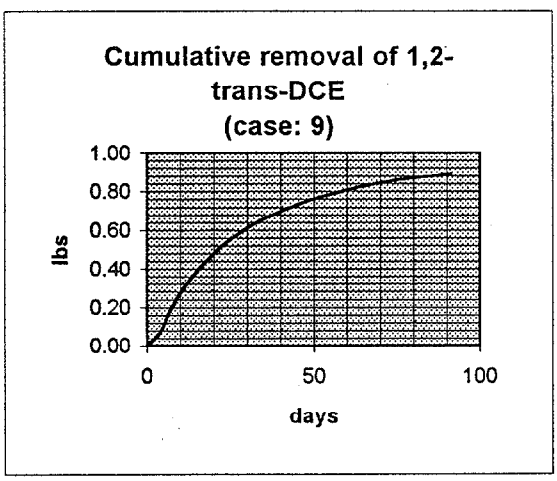
Figure 24

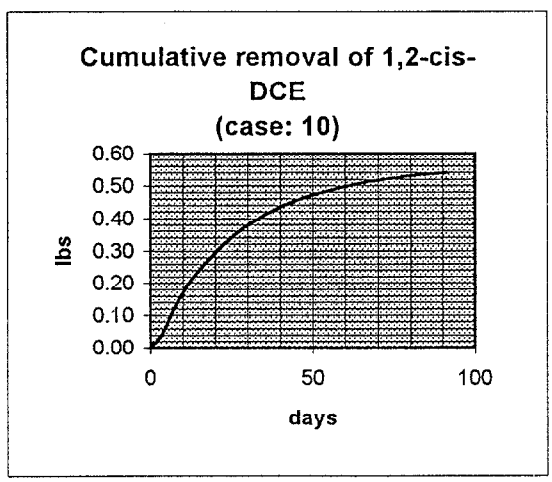

Cumulative Removal of 1,2-cis-DCE
(case: 5)
lbs
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
200
400
600
800
Days

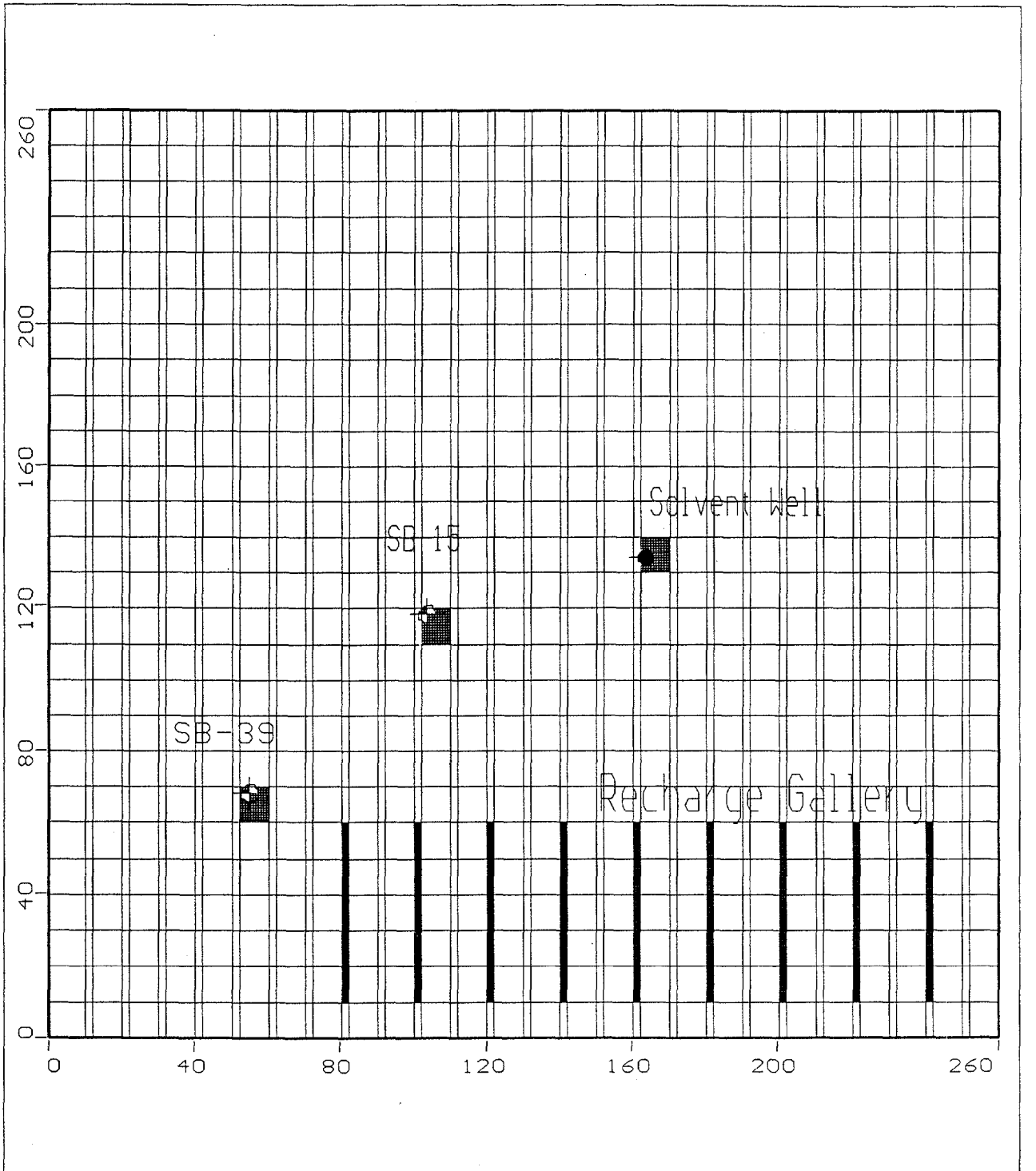

Cumulative removal of 1,2-trans-DCE
(case: 6)
lbs
10.00
8.00
6.00
4.00
2.00
0.00
0
500
1000
1500
Days


Cumulative removal of 1,2-trans-DCE
(case: 7)
lbs
2.50
2.00
1.50
1.00
0.50
0.00
0
200
400
600
800
days


Cumulative removal of 1,2-trans-DCE
(case: 8)
lbs
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0
1000
2000
3000
days

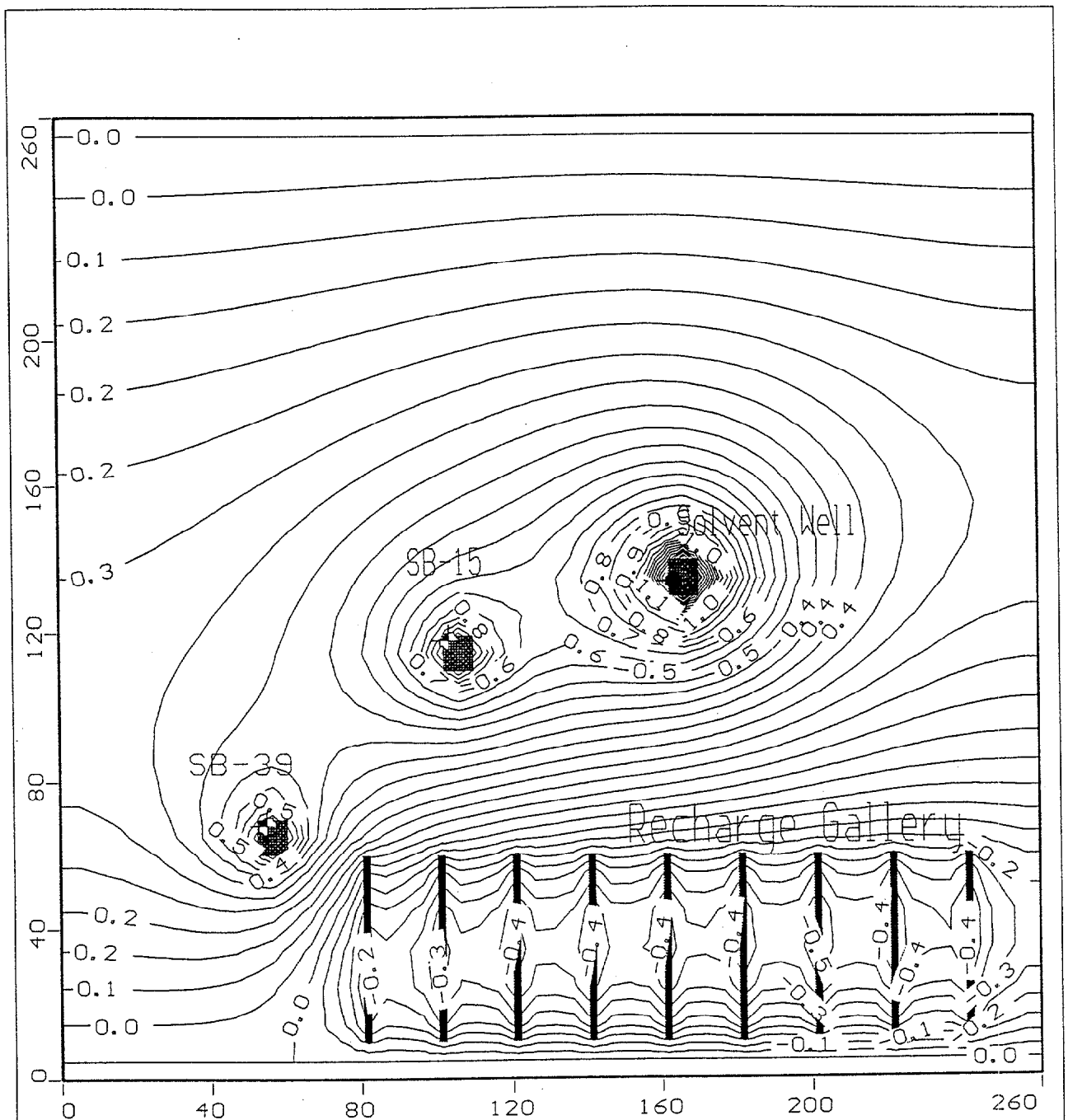

Cumulative removal of 1,2-trans-DCE
(case: 9)
lbs
1.00
0.80
0.60
0.40
0.20
0.00
0
50
100
days


Cumulative removal of 1,2-cis-DCE
(case: 10)
lbs
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0
50
100
days



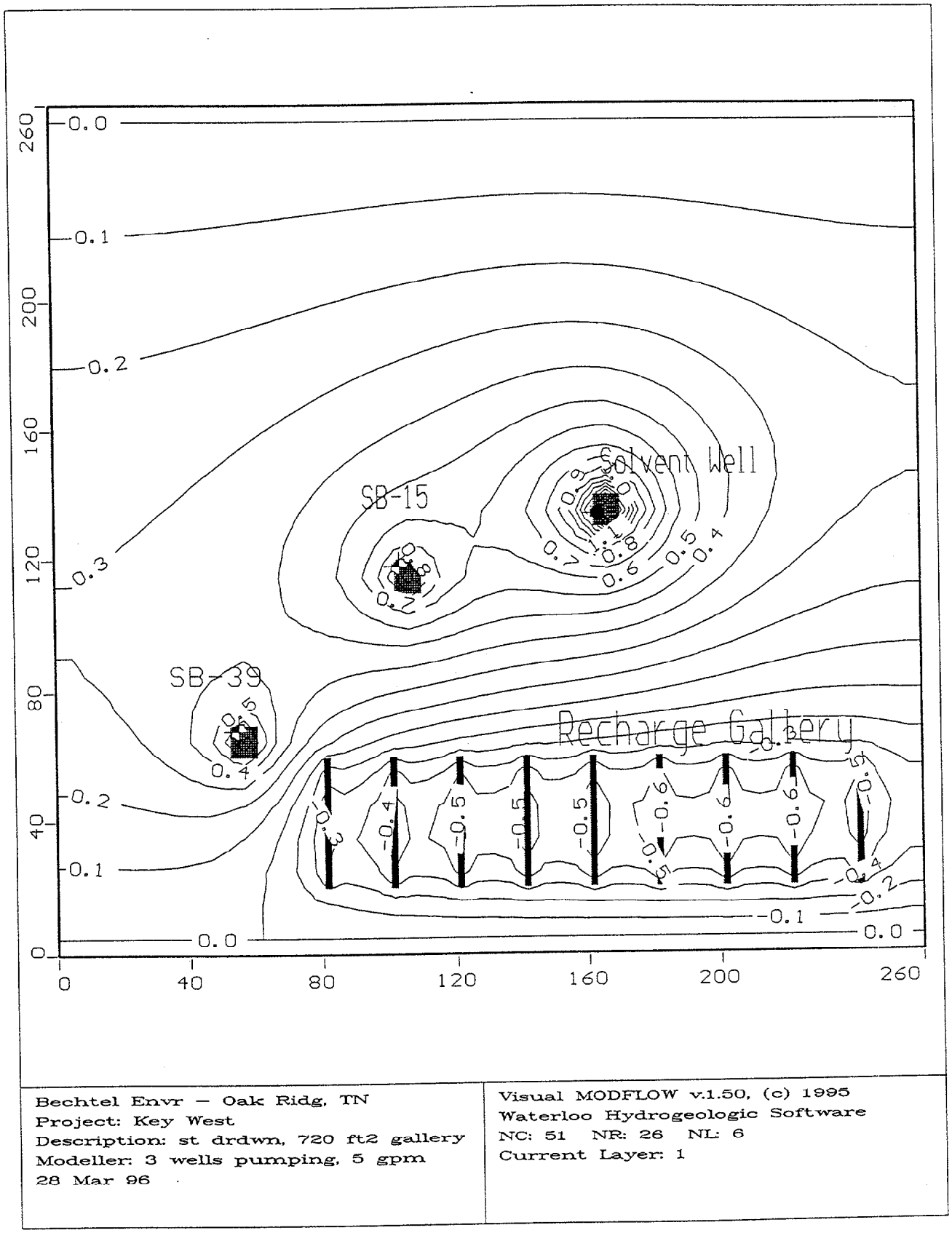
Bechtel Envr – Oak Ridg, TN Project: Key West Description: model grid with Modeller: trench–gallery 3 Apr 96	Visual MODFLOW v.1.50, (c) 1995 Waterloo Hydrogeologic Software NC: 51 NR: 26 NL: 6 Current Layer: 1

Figure 25



Bechtel Envr – Oak Ridg, TN Project: Key West Description: st drdwn, 900 ft2 gallery Modeller: 3 wells pumping, 5 gpm 28 Mar 96	Visual MODFLOW v.1.50, (c) 1995 Waterloo Hydrogeologic Software NC: 51 NR: 26 NL: 6 Current Layer: 1

Figure 26

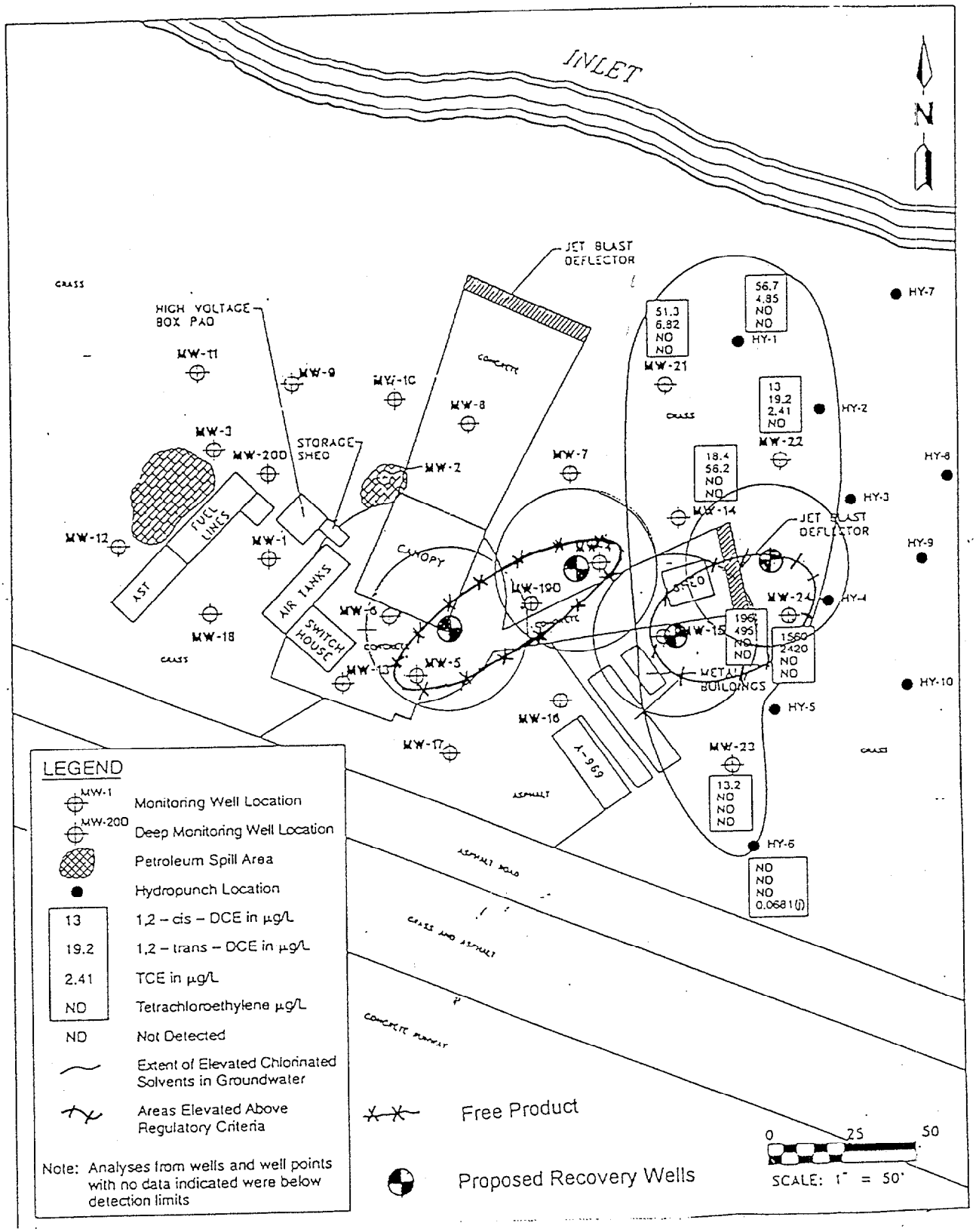


Bechtel Envr — Oak Ridg, TN
Project: Key West
Description: st drdwn, 720 ft2 gallery
Modeller: 3 wells pumping, 5 gpm
28 Mar 96

Visual MODFLOW v.1.50, (c) 1995
Waterloo Hydrogeologic Software
NC: 51 NR: 26 NL: 6
Current Layer: 1

Figure 27

Attachment 1 - Figure 1 008271



Attachment 1-
Figure 2

000809

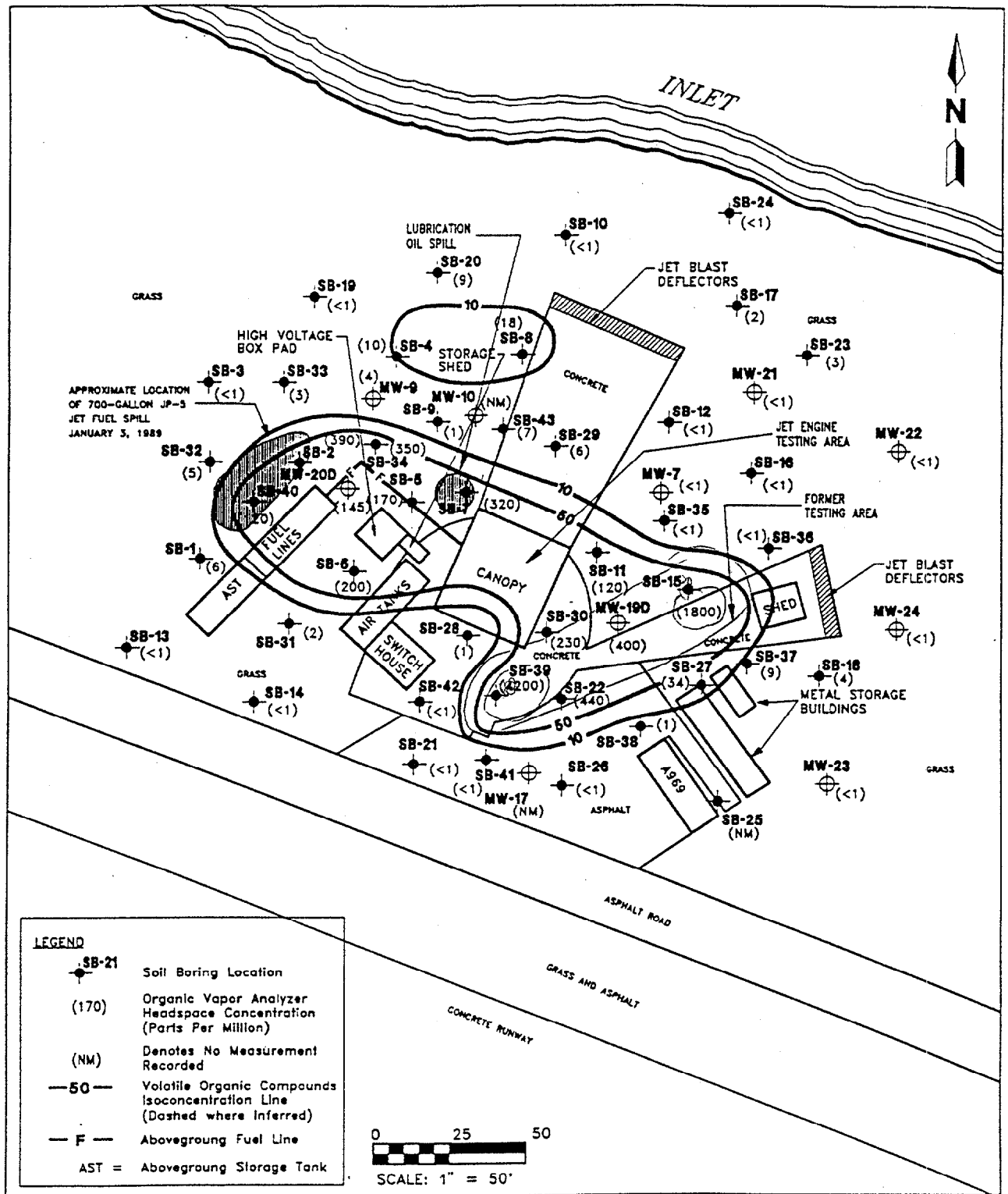


FIGURE 5-4
VOLATILE ORGANIC COMPOUNDS IN SOIL, 0 TO 2 FEET BELOW LAND SURFACE

CONTAMINATION ASSESSMENT REPORT
JET ENGINE TEST CELL

BOCA CHICA FIELD
NAVAL AIR STATION
KEY WEST, FLORIDA

JETENGTC.CAR
MVL.06.94

Attachments 2 through 16 contain the computer printouts of the various cases. These printouts were included in the original calculation, but were not included in this copy. If a complete copy of the data is desired, it is available upon request.

Attachment 7
Pump and Treat System
Technical Specifications and Drawings

DEPARTMENT OF THE NAVY

SOUTHERN DIVISION

TECHNICAL SPECIFICATION

FOR

GROUNDWATER TREATMENT SYSTEM

SWMU-9, JET ENGINE TEST CELL

NAS-KEY WEST, FLORIDA

NO.	DATE	REASON FOR REVISION	BY	CHECK	SUPV	PE
0	3/12/96	Issue for Use	ABG	WRZ	JRM	REH

ORIGIN		
BECHTEL	GROUNDWATER TREATMENT, SWMU-9 NAS-KEY WEST, FL	TECHNICAL SPECIFICATION 22567-321-SP576-001
		Sheet 1 of 16 — Rev. 0

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1.0 GENERAL

1.1 SUMMARY

1.1.1 Purpose

This specification describes the minimum requirements to procure, fabricate, assemble, and test the equipment required for the SWMU-9 Jet Engine Test Cell groundwater treatment skids for the Naval Air Station (NAS) in Key West, Florida.

1.1.2 Scope Included

This specification covers engineering, design, materials, equipment, and services required to furnish the groundwater treatment system as described in contract documents and herein.

The SUPPLIER is responsible for the required work which will include but not be limited to the following:

- Procuring all required equipment, instruments, valves, piping, and supports required for groundwater treatment skids
- Fabricating and assembling all required equipment, instruments, valves, piping, supports, and skids per this specification, and design drawings
- Testing completed unit per Section 3.2 of this specification
- Shipping completed and tested skids to NAS Key West no later than six weeks after receipt of order
- Submitting all documentation specified in Section 1.3 of this specification

1.1.3 Scope Not Included

The following work will be performed by others and is not included in the SUPPLIER's scope of work:

- Unloading the treatment skids at the site
- Installing the treatment system at the site
- Startup/acceptance testing and operation at the site

1.2 REFERENCES

All material, equipment, installation, and testing of material and equipment shall conform to this specification and to the applicable portions of the following codes and standards in effect at time of proposal. Any conflict between the specifications, codes, and standards shall be addressed to Bechtel for resolution.

<u>AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)</u>

ASTM A-53 Pipe, Steel, Black, and Hot-Dipped, Zinc-Coated Welded and Seamless

ASTM A 123	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM D-1248	Specification for Polyethylene Plastics Molding and Extrusion Materials
ASTM D-1785	Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D-2241	Polyvinyl Chloride Pressure-Rated Pipe
ASTM D-2464	Threaded Polyvinyl Chloride Plastic Pipe Fittings
ASTM D-2564	Solvent Cements for Polyvinyl Chloride Plastic Pipe and Fittings
ASTM D-2647	Crosslinkable Ethylene Plastics
ASTM D-2855	Recommended Practice for making solvent cemented joints with polyvinyl chloride pipe and fittings

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	National Electrical Code (NEC)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	Enclosures for Electrical Equipment (1,000 Volts Maximum)
NEMA AB 1	Molded Case Circuit Breakers and Molded Case Switches
NEMA LA 1	Surge Arresters
NEMA MG 1	Motors and Generators

1.3 SUBMITTALS

Drawings, data, and documents as described below are to be submitted for Bechtel review and for permission to proceed as indicated. The review will focus on interface considerations as well as on adequacy, compatibility, and conformity between SUPPLIER's submittals and this specification. Review of the SUPPLIER's submittals shall not relieve or diminish the SUPPLIER's responsibilities. All submittals shall include two reproducible copies of each item, unless otherwise noted.

The following shall be submitted:

- Equipment, instrument, and material List
- Manufacturer's catalog data
- Drawings
- Instructions
- Operation and maintenance data
- Test reports
- Certificates

1.3.1 Equipment, Instrument and Material List

A list detailing manufacturer name, model number, and price for all equipment, instruments, and material shall be submitted with proposal. The list shall include all vendor information and/or catalog cuts for all system equipment.

1.3.2 Drawings

Drawings shall include equipment drawings, illustrations, schedules, instructions, layout drawings, piping and instrumentation diagram (P&ID), manufacturers' standard installation drawings, and other information necessary to define the installation and enable Bechtel to check conformity with the requirements of the contract drawings. Drawings shall be submitted no later than one week after receipt of order. Fabrication and assembly may proceed upon notification by Bechtel.

External wiring connections shall be clearly identified. If departures from the contract drawings are deemed necessary by the SUPPLIER, complete details of such departures shall be included with the detail drawings.

1.3.3 Operation and Maintenance Manuals

The operation and maintenance manuals shall be submitted with the skid unit and each shall contain the following items:

- As-built equipment layout and P&ID (only if different from previous submittal)
- All vendor information and/or catalog cuts for all system equipment and instruments
- List of spare parts requiring maintenance or replacement within 2 years of continuous operation; list shall include part description and part model number
- Recommended maintenance frequency

1.3.4 Factory Test

Factory test reports, including tests required by Section 3.2 of this specification, shall be submitted with the skid units.

1.4 QUALITY ASSURANCE

1.4.1 Material and Equipment Qualifications

Materials and equipment shall be provided that are products of manufacturers regularly engaged in the production of such products that are of equal material, design, and workmanship. Products shall have been in use for 2 years. Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6,000 hours, exclusive of manufacturers' factory or laboratory tests, is furnished.

1.4.2 Manufacturer's Nameplates

Each major component shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a nameplate that is securely attached to the equipment in a conspicuous place; the nameplate of the distributing agent will not be acceptable. Nameplates shall be made of non-corrosive metal. As a minimum, nameplates shall be provided for air compressor, air stripper, oil/water separator, pumps/motors, and carbon canisters.

1.4.3 Labels

Laminated plastic labels for equipment, equipment enclosures, and devices shall be provided. Each label shall identify the function and device number. Labels shall be melamine plastic, 0.125-in. thick, white with black center core. Surface shall be matte finish. Corners shall be square. Lettering shall be a minimum of 0.25-in. high, normal block style.

1.4.4 Lockout Requirements

All electrical and mechanical equipment shall be provided with a lockout mechanism to prevent the unexpected startup of the equipment or release of stored energy.

1.5 SYSTEM DESCRIPTION

The treatment system consists of the equipment shown within the dashed lines designating the skid units on the P&ID (Design Drawing 22567-321-DD576-001). The skid units will be used to remediate contaminated groundwater by extracting groundwater at approximately 70°F from three extraction wells. The calculated well production is 2 gpm per well. The units shall operate 24 hours each day, 7 days a week.

The system shall include an air compressor skid; air stripper skid with discharge pump; oil/water separator system with oil storage canister, surge tank, and transfer pump; pneumatic submersible pumps; vapor-phase carbon canisters (optional); piping, valves, motor starters, controls, and instrumentation, including flow indicators, level switches, pressure indicators, and pressure switches.

Recovery well pumps will be installed under ground; all other equipment will be installed outdoors on a concrete pad under a canopy. All equipment shall be rated for outdoor use and capable of withstanding direct water spray, unless otherwise noted. The ambient temperature range will be 70 to 105°F. The complete system shall be capable of being installed on a 12-ft by 14-ft pad. The available electrical service will be 480 volt, 3-phase, 60-Hz.

The SUPPLIER shall become familiar with the details of the work and notify Bechtel of any discrepancy before ordering equipment.

2.0 PRODUCTS

2.1 GENERAL

Materials and equipment shall be standard products of the equipment manufacturer. Standard replacement parts shall be readily available.

2.2 CORROSION PROTECTION

Ferrous metal hardware shall be hot-dip galvanized in accordance with ASTM A 123. Equipment and component items not hot-dip galvanized or porcelain enamel finished shall be provided with corrosion-resistant finishes.

2.3 AIR COMPRESSOR

The selected air compressor shall be an electrical driven reciprocating type, cast iron construction, with the following features: air discharge line with pressure switch, pressure gauge, automatic condensate drain, ASME safety pressure relief valve, horizontal 80-gal air receiver tank with automatic drain valve and built to 200 psi working pressure per ASME standards, low oil safety shutoff switch, oil coalescing filter, and pressure regulator. The air compressor shall have a capacity of at least 15 scfm (14.7 psi, 36 percent RH, 60° F) at 100 psig.

The motor shall be totally enclosed, fan cooled (TEFC), and rated for the available electrical service. The unit shall have a combination motor starter with overload protection mounted in NEMA 4 enclosure and wired to the compressor motor.

Inlet filter/silencer shall provide clean air to air compressor and reduce noise level to 80 dbA maximum. Filter/silencer shall be nominally 99 percent efficient for particles 10 microns in size and larger. Filter element shall be replaceable polyester.

Suggested Air Compressor: Curtis-Teledo Model number 5HT6 or equivalent

2.4 AIR STRIPPER SKID

Air Stripper (AST-1)

The air stripper shall reduce groundwater contaminants as follows:

Contaminant	Influent Concentration (ppb)	Discharge Criteria (ppb)
CIS 1,2 Dichloroethylene	1,560	70
Naphthalene	340	100
Trans 1,2 Dichloroethylene	2,420	100
TPH (as Naphthalene)	46,000	5,000

The stripping performance for each volatile shall be guaranteed based on manufacturer's actual results demonstrated during full scale stripping of the volatile from water. Performance projections for the specific the specific operating conditions listed above shall be provided.

The low-profile air stripping system shall be furnished completely shop-assembled and skid mounted with blower, discharge pump, control panel, and related equipment as required by this specification.

The air stripper shall be equipped with level control float switch for discharge pump, discharge sample port, flow meter with totalizer, air pressure gauge, air flow meter, high sump water level switch with alarm, low air pressure switch with alarm, and viewports for sump and trays. The air stripper shall be constructed of high density polyethylene material.

The blower impeller, housing, cover, and acoustical integral manifold cavity shall be of rugged, superior castability and ductility aluminum alloy, inherently resistant to corrosion and sparking. Blower inlet and outlet flanges shall be of cast iron construction to resist stripping of threads. Soft metals such as aluminum are not acceptable. Blower shall be capable of producing the design flow rate of 150 CFM at 10 in. of water column.

Discharge Pump (P-20)

Discharge pump shall be centrifugal type with electric motor installed in-line. Pump shall be of cast iron construction. The pumping capacity shall be 4 gpm at 50 ft total dynamic head (TDH).

Control Panel

The control panel shall be equipped with programmable logic controller (PLC), combination type motor starters for blower and discharge pump, main disconnect switch, alarm interlocks, auxiliary contacts, hand-off-auto selector switches, on/off pushbuttons, panel lights, strobe alarm light, power lapse indicator, surge protection, and field terminal strips mounted in a NEMA 3R enclosure. The control panel shall be mounted on the skid.

The control panel PLC shall perform the following functions:

1) Recovery Well Pumps (P-1, P-2, P-3)

- High high air stripper water level switch (LSHH-20) de-energizes solenoid valve (SV-10) and shuts off pumps if air stripper discharge pump P-20 fails.

  High high oil/water separator water level switch (LSHH-30) de-energizes solenoid valve (SV-10) and shuts off pumps when oil/water separator O/W-30 is full.

- High high surge tank water level switch (LSHH-31) de-energizes solenoid valve (SV-10) and shuts off pumps when surge tank T-30 is full.
- High high product storage drum oil level switch (LSHH-32) de-energizes solenoid valve (SV-10) and shuts off pumps when drum T-31 is full.

- Low air stripper pressure (PSL-20) de-energizes solenoid valve (SV-10) and shuts off pumps if the air stripper blower B-1 fails.
- The solenoid valve can be manually energized or de-energized.

2) Discharge Pump (P-20)

- High sump water level switch (LSH/L-20) energizes pump when water level in AST-20 is high.
- Low sump water level switch (LSH/L-20) de-energizes pump when level in AST-20 is low.
- The pump can be manually or automatically controlled.

3) Transfer Pump (P-30)

- High surge tank water level switch (LSH/L-30) energizes solenoid valve SV-30 and starts pump when the water level in T-30 is high.
- Low surge tank water level switch (LSH/L-30) de-energizes solenoid valve SV-30 and shuts off pump when water level in T-30 is low.
- The solenoid valve can be manually energized or de-energized.

4) Indication Lights

Indication lights shall be provided to indicate the following alarm conditions:

- High oil/water separator water level
- High surge tank water level
- High product drum oil level
- High air stripper water level
- Low air stripper pressure

Any of the above alarm conditions shall energize an rotating beacon attached to the control panel.

Suggested Air Stripper: Shallow Tray® Model No. 1300 or equivalent.

2.5 OIL/WATER SEPARATOR SYSTEM

The oil/water separator shall be elevated to allow skimmed free product to gravity drain to an external product storage drum. The contaminated groundwater will gravity discharge into a surge tank from which it will be pumped to the air stripper.

Oil/Water Separator (O/W-30)

The separator shall be designed to separate oil from water as specified: influent flow rate of 5 gpm, sludge chamber capacity of 22 gal, and separation chamber capacity of 52 gal. Oil droplet removal rate shall be 10 mg/L for droplets > 30 microns. The separator shall be capable of removing both dispersed oil and

settleable solids at a maximum inlet temperature of 100° F. The oil/water separator chamber shall have cross-corrugated coalescing media. The separator will be constructed of molded fiberglass.

Suggested Oil/Water Separator: QED Environmental Systems, Inc. model DP-2 or equivalent.

Surge Tank (T-30)

The surge tank shall be self supporting, translucent, and constructed of high density cross-linked polyethylene conforming to the requirements of ASTM D 1248. A hinged cover shall be provided for the tank. The tank capacity shall be 65 gal (or appropriate size as determined by SUPPLIER) with a 1-in. outlet fitting (mounted 6-in. from the bottom of the tank) and a 1-in. ball valve to be used as a drain or sample port.

Suggested Tank: Town and Country Plastics, Inc. TC/HDPE series or equivalent.

Product Storage Drum (T-31)

The drum shall be constructed of 16 gauge steel with a 2-in. lid mounted inlet fitting and vent. The drum capacity shall be 55-gal. Accessories shall include a drain hose assembly (consisting of explosion-proof level switch, hose, and fittings) to connect the oil/water separator to the drum.

Transfer Pump (P-30)

The transfer pump shall be air-operated and double-diaphragmed. The air distribution system shall be lube-free and solenoid-operated. The pump shall be equipped with Buna-N elastomers. The pump housing shall be constructed of polypropylene. The pump shall be rated for 5 gpm at 20-ft TDH.

Suggested Pump: Wilden Model number M1 or equivalent.

2.6 GROUNDWATER EXTRACTION SYSTEM

Submersible pneumatic pumps will be a total fluids system that will extract any residual or undissolved free product that may be in the groundwater. The groundwater extraction system shall include air and groundwater discharge tubing, quick disconnect fittings, pressure filters/regulators, flow counter, well cap, and all accessories required for a complete system.

Recovery Pump (P-1, P-2, P-3)

Pump and pump fittings shall be constructed of all corrosion-resistant materials. Pump shall be submersible and capable of pumping at a design flow rate of 2 gpm against 50 ft TDH. The pump shall be a top inlet positive air displacement type, constructed of stainless steel with a 3-in. maximum outside diameter.

Suggested Pump: QED SOLO II Model number SP2000 or equivalent.

2.7 VAPOR-PHASE CARBON

Granular Activated Carbon (GAC-1, GAC-2)

The vapor-phase carbon system shall be designed to reduce contaminant concentrations in the air exiting the air stripper by 95 percent at flows up to 150 CFM. Canisters shall contain a minimum 170 pounds of type BPL 4x10 or type IVP 4x6 activated carbon. Canisters shall be 16 gauge steel, pressure rated 7 psig, have heat-cured 100 percent phenolic internal coating, high solids enamel external coating, and be rated for 150° F.

Suggested Granular Activated Carbon: Carbon Service and Equipment Co., Model Air 275 or equivalent.

2.8 INSTRUMENTATION

Flow Indicators (FI-1, 2, 3, 20)

Flow indicators shall be in-line variable area/differential pressure type. The flow meter shall have a sight glass. Size and scale shall be determined by the SUPPLIER. Flow rates shall be indicated based upon vane position on a calibrated scale. Accuracy shall be ±2 percent full scale. Flow meter shall be capable of operating at a sustained temperature of up to 150° F and shall be weather-proof, capable of withstanding a direct water spray. Range on indicator shall be appropriate for the application and installation shall be in accordance with the switch manufacturers' recommendations.

Flow Indicator (F-20)

The single probe flow sensor shall have multiple sensing points and built-in averaging capacity. The flow sensor shall be designed to be inserted into the piping through a compression fitting. It shall be furnished with instrument shut-off valves on both pressure connections.

Flow Indicator/Totalizer (FQI-1, 20)

The flow meter shall be a positive displacement type operating on the oscillating piston principle. The meter shall be rated for water use with a maximum flow rate of 15 GPM, a operating temperature up to 120°F, and a working pressure of up to 150 psi. Accuracy shall be ±2 percent full scale. The capacity register shall be permanently sealed with a tempered glass lens and be capable of measuring up to 10 million US gallons.

Level Switch (LSHH-20,30,31,32)

The liquid level switch shall be operated by a cylindrical stainless steel float by magnetic linkage and leak-proof construction to prevent process media from entering the switch housing. Switches shall be weather-proof (explosion proof for LSHH 32). Level switch shall be equipped with 5 amp SPDT, normally open contacts reversible to normally closed. Level switch high high shall be installed to monitor high oil and water levels. Level of switch heights shall be appropriate for the application and installation shall be in accordance with the switch manufacturer's recommendations.

Pressure Indicators (PI-1-6, 20)

Pressure indicators shall be dial/local indicator type, hermetically sealed, with clear plastic lens and stainless steel case. Accuracy shall be ±2 percent. Connection shall be 1/2-in. NPT male. The pressure indicator shall be weather-proof, capable of withstanding a direct water spray. Range on indicator shall be appropriate for the application and installation shall be in accordance with the switch manufacturer's recommendations.

Pressure Switch (PSL-20)

Pressure switches shall be weather-proof, capable of withstanding direct water spray. Pressure switches shall be equipped with 5 amp SPDT contacts. Pressure switch low shall be installed to monitor low blower pressure. Upon low pressure, the switch will be wired to stop air flow to the pneumatic pumps. Pressure switch setting shall be appropriate for the application and installation shall be in accordance with the switch manufacturer's recommendations.

Solenoid Values (SV-10, 30)

The 3-way solenoid valve shall be a normally closed manual reset type equipped with a continuous duty coil rated for 120 volts, 60 hertz service. The solenoid valve shall be rated for use with compressed air. The enclosure shall be rated for outdoor use.

Temperature Indicators (TI-1, 10)

The temperature indicator shall be in-stream type, with glass lens and steel case. Accuracy shall be ± 2 percent. Connection shall be 1/2-in. NPT male. Face diameter shall be 3 in., minimum. Temperature element shall be a dual copper-constant, complete with 316 SS thermowell sized to match pipe location. Range on indicator shall be appropriate for the application and installation shall be in accordance with the switch manufacturer's recommendations.

2.9 PIPING

Piping shall be Schedule 40 galvanized iron, or equivalent, and Chem-Aire™ (for above ground compressed air line) where specified. All pipe, couplings, and fittings shall be manufactured of material conforming to applicable ANSI and ASTM standards:

a) Screw Joint: Pipe to dimensional requirements of ASTM D-1785 Schedule 80, with joints meeting requirements of 10 psi working pressure, unless otherwise shown or specified. Pipe couplings must be tested as required by ASTM D-2464.

b) Solvent Joint: Pipe to dimensional requirements of ASTM D-1785 or ASTM D-2241 with joints meeting the requirements of 100 psi working pressure, unless otherwise shown or specified.

Steel pipe and fittings shall be Schedule 40 galvanized iron with dimensional requirements as given in ASTM A-53. Pipe shall be welded or seamless with screwed ends as required for assembly.

2.10 VALVES

Ball Valves

Ball valves shall be PVC, true union type, sized as indicated, with Viton seals. Connections shall be solvent weld sockets.

Suggested Ball Valve Manufacturer: Chemtrol

Sample Ports

Sample ports shall be PVC, with EPDM o-rings and ball seals.

Suggested Manufacturer: Hayward Universal Labcock

2.11 ELECTRICAL EQUIPMENT

2.11.1 Conduit

Metal conduit, including couplings, elbows, bends, and nipples shall conform to UL requirements for Rigid Galvanized Steel (RGS) and Intermediate Metal Conduit (IMC) and shall be galvanized by the hot-dip process. Fittings for metal conduit shall be suited for outdoor service.

2.11.2 Wire and Cables

Insulation on power conductors shall be rated for 600V (300V for control cables) and shall conform to the requirements of NFPA 70. Conductors in cables shall be annealed copper. Hard-drawn copper conductors shall comply with ASTM requirements as appropriate for the conductor size. Cables shall be single-conductor type No. 12 AWG minimum, unless otherwise indicated. Only use wires with "W" designation in wet or damp locations. Grounding cables shall be bare or shall have green low-voltage insulation.

2.11.3 Motor Controller

All electrical and control cable shall be terminated in local panels. Terminal blocks shall be provided and labeled in accordance with SUPPLIER's design (as-built) drawings. The local control panel shall have a 20 percent minimum spare terminal block capacity.

Motor controllers shall combination type have motor circuit protectors consisting of an adjustable instantaneous trip circuit breaker in conjunction with motor circuit overload and short circuit protection in accordance with NEMA AB 1. Each phase shall have thermal overload protection.

Control circuit shall have maximum voltage of 120 volts derived from a separate source.

Molded-Case Circuit Breakers

Circuit breakers shall be rated for calculated symmetrical of 14,000 A on a 480-V, three-phase, 60 Hz system and 10,000 A on a 240/120-volt, single-phase, 60 Hz system.

Fuses

Low-voltage, current-limiting fuses shall comply with UL standards for Class L Class R.

Surge Arresters

Surge arresters shall comply with NEMA LA 1. Arresters shall be distribution class, equipped with mounting brackets suitable for the indicated installations, and of the valve or metal-oxide varistor type.

2.11.4 MOTORS

Motors shall conform to NEMA MG 1 and shall be TEFC.

All permanently wired polyphase motors of 746 W (1 hp) or more shall meet the minimum full-load efficiencies as indicated in the following table, and as specified in this specification. Motors of 746 W (1 hp) TEFC shall be high efficiency type, unless otherwise indicated.

	Minimum Motor Efficiencies	
kW	Std. Efficiency	High Efficiency
0.746 (1 hp)	77.0	85.5
3.73 (5 hp)	82.5	88.5
7.46 (10 hp	85.5	90.0

2.12 EQUIPMENT SKID

The skids shall be built ready for operation upon arrival and connection to field piping and electrical power. The piping connections of the skid shall be flanged type, when possible. Materials of the skid shall be corrosion resistant and/or primed and painted to resist rusting. Equipment on skid shall be arranged to minimize skid dimensions and still provide adequate access for maintenance (see proposed treatment compound layout on Drawing 22567-321-DD576-003). Skid dimensions shall not exceed 6-ft in width (maximum) by 6-ft in length (maximum) by 7 ft in height (maximum). The skid shall support equipment at a minimum of 2 in. above grade, and none of the instrumentation shall be installed at an elevation exceeding 5 ft above grade. The skid shall be designed such that the assembled unit can be easily loaded and off-loaded from a flat bed tractor/trailer.

3.0 EXECUTION

3.1 INSTALLATION

3.1.1 Equipment

All appurtenances required for a complete operating system shall be provided, including such items as piping, conduit, valves, anchors, pumps, motors, skid equipment, and starter. All equipment and appurtenances shall be installed and anchored to skids in accordance with the manufacturer's written instructions.

3.1.2 Piping and Instrumentation

The pipe fittings shall include but are not limited to slip-on flanges, unions, reducing tees, 90 elbows, reducing bushings, female adapters, and hose fittings; all fittings shall be suitable for maximum operation. The assembly of piping and instrumentation shall be as shown on the attached drawing for typical assembly. All piping and fittings shall conform to applicable ASTM standards.

Piping shall be anchored to the skid at a minimum of every 2 ft and at each inlet/discharge points. Anchors shall be constructed of Unistrut™ type channel, either bolted or welded to the skid. Attachment between pipe and unistrut shall be by unistrut type pipe clamp.

3.1.3 Valves

Valves shall have the interiors cleaned of all foreign matter before installation. Stuffing boxes shall be tightened and the valve shall be fully opened and fully closed to insure that all parts are in working condition.

3.1.4 Electrical

Electrical installations shall conform to NFPA 70 and requirements specified herein. Equipment and devices shall be installed and energized in accordance with the manufacturer's published instructions.

Conduit

Only metal conduits will be permitted when conduits are required for shielding or other special purposes indicated or when required by conformance to NFPA 70. Crushed or deformed raceways shall not be installed.

Metallic conduits and tubing shall be securely and rigidly fastened in place with approved pipe straps. Conduit shall not be supported using wire or nylon ties.

Cable

Electrical cables shall undergo 250 volt megger test for 24V instrument cables and 500 volt megger for 100V and above power cables.

Grounding

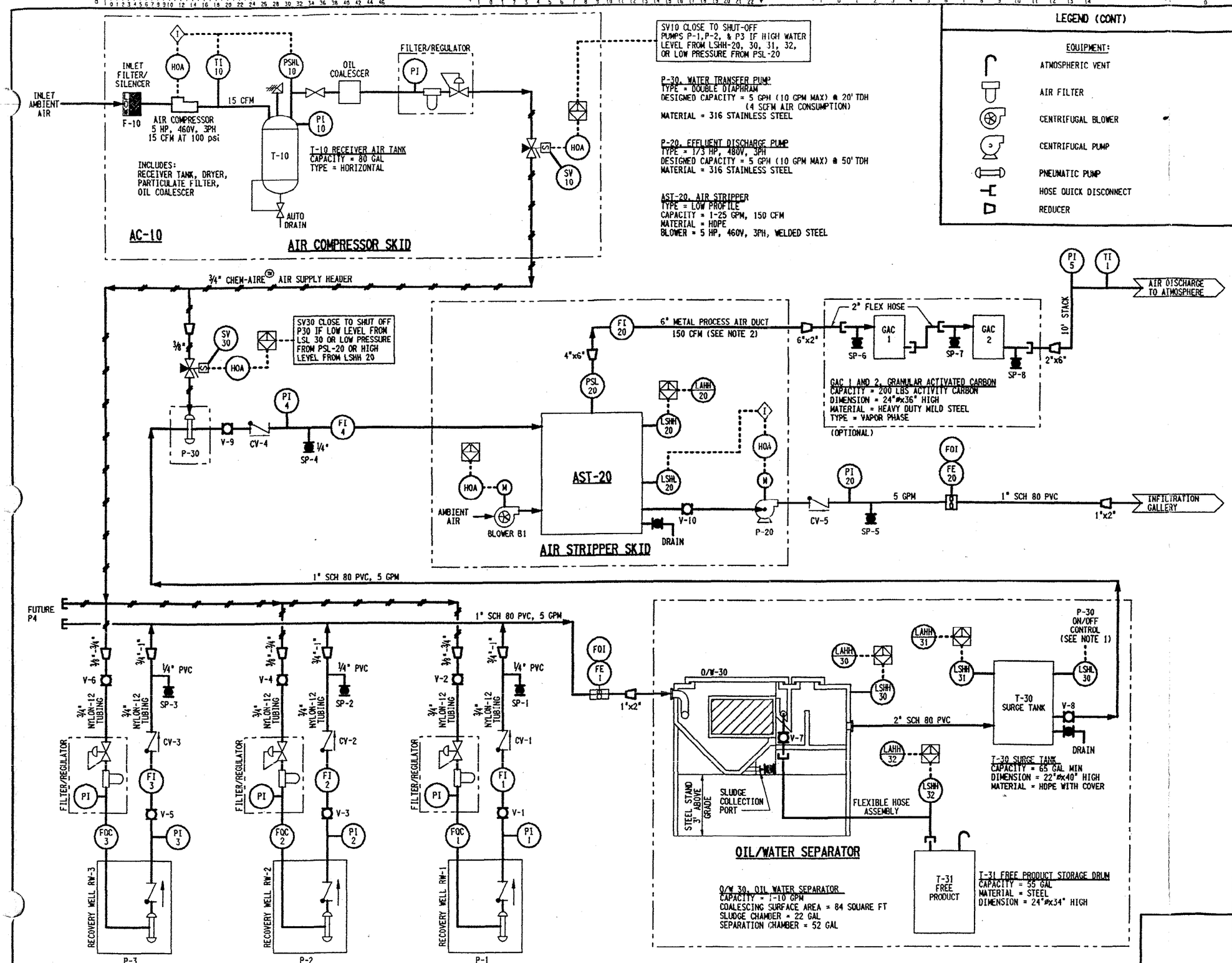
Grounding and bonding shall be in conformance with NFPA 70, Article 250, the contract drawings, and the following specifications. Terminals shall be provided for #6 AWG copper groundwire. Groundwire will be provided and installed by others

3.2 TESTING

Before shipment, an operational test of the air compressor, oil/water separator, air stripper, instrumentation, and control systems shall be performed at SUPPLIER's facility to determine if the

installed equipment meets the purpose and intent of the specifications. Tests shall demonstrate that the equipment is not electrically, mechanically, structurally, or otherwise defective; is in safe and satisfactory operating condition; and is in compliance with the specified operating characteristics. Tests shall include checks for excessive vibration, leaks in all piping and seals, correct operation of control systems and equipment, proper alignment, excessive noise levels, and power consumption. If any deficiencies are revealed during any test, such deficiencies shall be corrected and the tests shall be reconducted at no additional cost to Bechtel.

0078 HB12



LEGEND (CONT)

EQUIPMENT:

- ATMOSPHERIC VENT
- AIR FILTER
- CENTRIFUGAL BLOWER
- CENTRIFUGAL PUMP
- PNEUMATIC PUMP
- HOSE QUICK DISCONNECT
- REDUCER

LEGEND

INSTRUMENTATION:

- INSTRUMENT FOR SIGNAL MEASURED VARIABLE (LOCALLY MOUNTED)
- INSTRUMENT FOR SIGNAL MEASURED VARIABLE (PANEL MOUNTED)
- FE — FLOW ELEMENT, POSITIVE DISPLACEMENT

SIGNALS AND LINES:

- PRIMARY LIQUID PROCESS OR MECHANICAL LINK
- PNEUMATIC LINE
- ELECTRICAL SIGNAL
- VENDOR PACKAGED EQUIPMENT
- PLC ELECTRICAL INTERLOCK
- ELECTRICAL INTERLOCK

VALVES AND ACTUATORS:

- BALL VALVE, NORMALLY OPEN
- BALL VALVE, NORMALLY CLOSED
- CHECK VALVE
- PRESSURE RELIEF VALVE
- GATE VALVE
- HAND RESET, 3-WAY SOLENOID VALVE
- PRESSURE CONTROL VALVE, DIAPHRAM ACTIVATED

CV - CHECK VALVE
FI - FLOW INDICATOR
FQI - TOTALIZING FLOW METER
GAC - GRANULAR ACTIVATED CARBON
HOA - HAND/OFF/AUTO
LA - LOCAL ALARM (HIGH/LOW)
LSL - LEVEL SWITCH LOW
PI - PRESSURE INDICATOR
PSL - PRESSURE SWITCH LOW
SP - SAMPLING PORT
TI - TEMPERATURE INDICATOR
V - VALVE

NOTES

1. ALL INTERLOCKS ARE FIELD WIRED EXCEPT AIR COMPRESSOR AND AIR STRIPPER BLOWER.
2. METAL DUCT IS FIELD INSTALLED.

NO.	DATE	REVISIONS	BY	CHKR	RESEN SUPT	ENGR	PROJ ENGR	MICRO FILMD
A	3/8/96	ISSUED FOR BID	DLL	WRZ	NJA	ABJ	REH	

SCALE NOTED

BECHTEL ENVIRONMENTAL INC.
OAK RIDGE, TENNESSEE

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION NAVAL FACILITIES ENGINEERING COMMAND
CHARLESTON, SOUTH CAROLINA

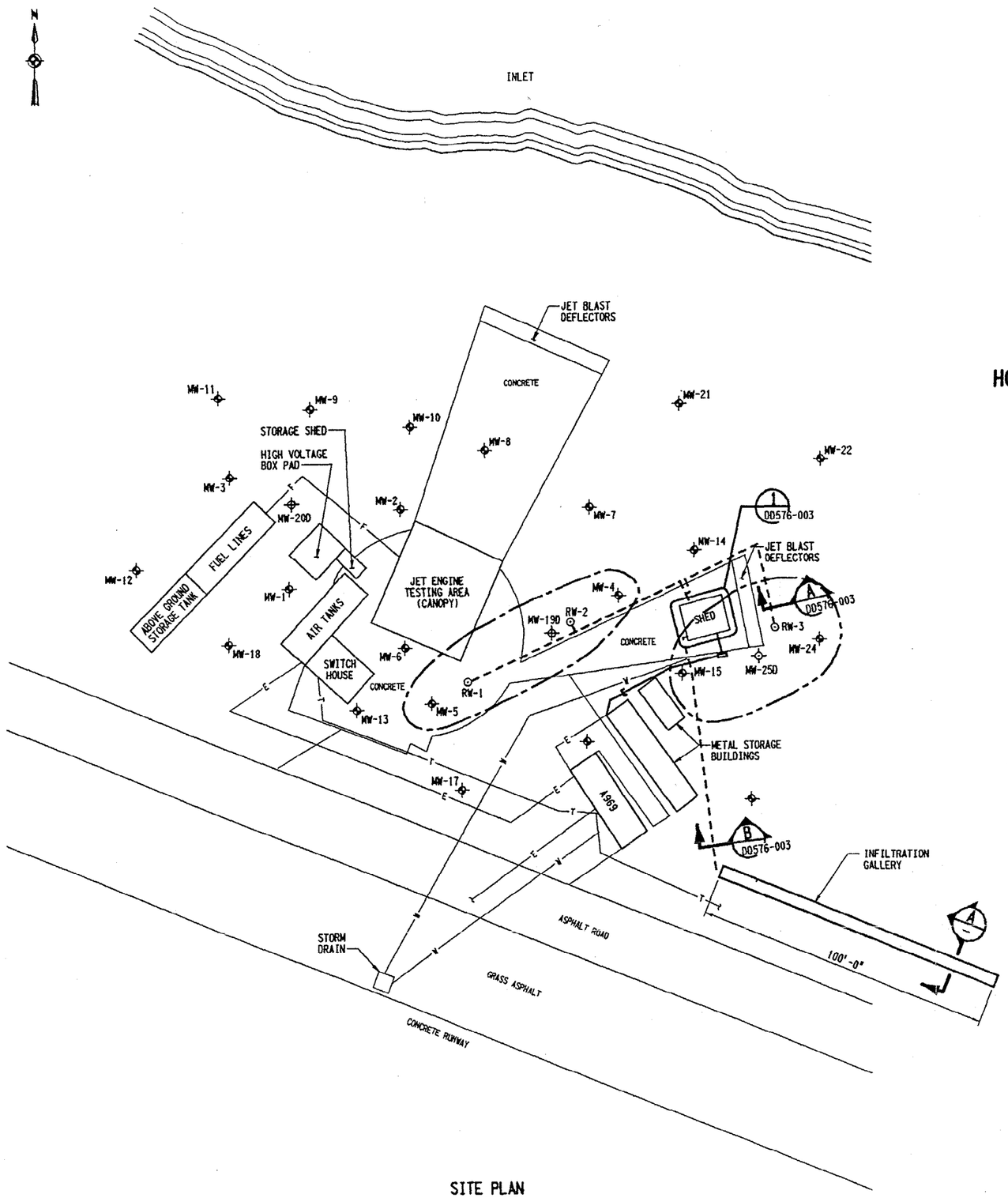
SWMU-9 GROUNDWATER TREATMENT SYSTEM
PIPING AND INSTRUMENTATION DIAGRAM

JOB NO.	DRAWING NO.	REV
22567	321-DD576-001	A

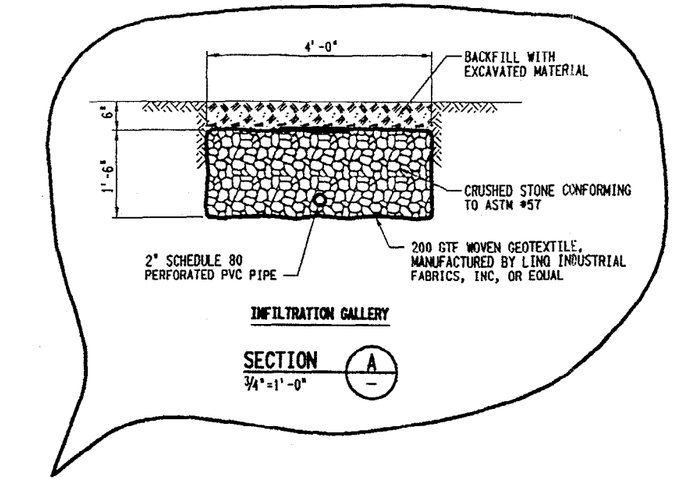
ROY E. HOEKSTRA
FLORIDA PE # 49690
EXPIRES FEBRUARY 28, 1997

SEAL

22567/321/DD576001.DGN



SITE PLAN
1"=20'



INFILTRATION GALLERY

SECTION A
3/4"=1'-0"

HOLD

NOTES

1. PHYSICAL VERIFICATION OF EXISTING UNDERGROUND UTILITIES SHALL BE DONE PRIOR TO ANY EXCAVATION.
2. LAYOUT SHOWN IS PROPOSED, ACTUAL BY FIELD.

REFERENCE DRAWINGS

SWMU-9 GROUNDWATER TREATMENT SYSTEM PIPING AND INSTRUMENTATION DIAGRAM	321-DD576-001
SWMU-9 GROUNDWATER TREATMENT SYSTEM SECTIONS AND DETAILS	321-DD576-003

LEGEND

- EXISTING MONITORING WELL
- EXISTING DEEP MONITORING WELL
- PROPOSED RECOVERY WELL
- PROPOSED DEEP MONITORING/RECOVERY WELL
- EXTENT OF ELEVATED CHLORINATED SOLVENTS IN GROUNDWATER
- EXTENT OF FREE PRODUCT
- UNDERGROUND TELEPHONE
- UNDERGROUND WATER LINE
- UNDERGROUND ELECTRIC LINE
- ABOVE GROUND FUEL LINE

0 20 40 60
1"=20'

NO.	DATE	REVISIONS	BY	CHKR	DESIGN ENG	ENGR	PROJ ENGR	MICRO FILMD
A	3/8/96	ISSUED FOR BID	DLL	WRZ	NJA	ABJ	REH	

SCALE NOTED

BECHTEL ENVIRONMENTAL INC.
OAK RIDGE, TENNESSEE

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION NAVAL FACILITIES ENGINEERING COMMAND
CHARLESTON, SOUTH CAROLINA

SWMU-9 GROUNDWATER TREATMENT SYSTEM
SITE LAYOUT PLAN

JOB NO.	DRAWING NO.	REV
22567	321-DD576-002	A

R. E. HOEKSTRA
FLORIDA PE # 49690
EXPIRES FEBRUARY 28, 1997

SEAL

22567/321/DD576002.DGN

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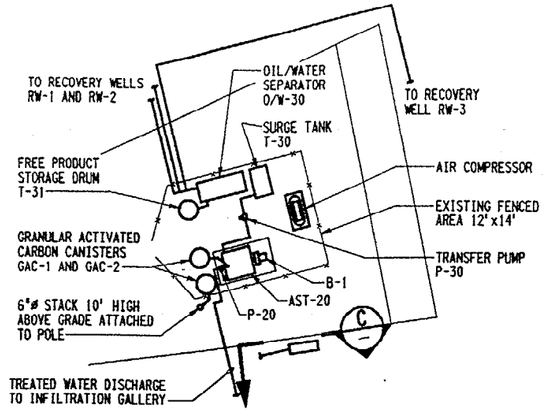
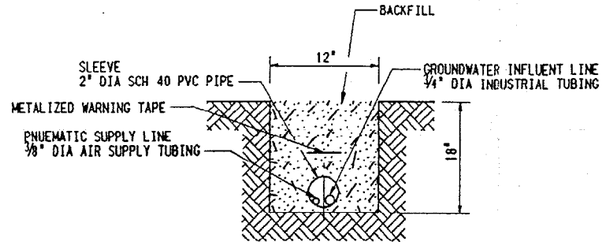
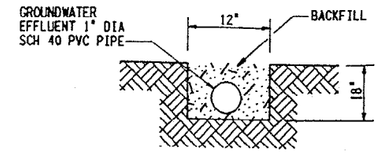


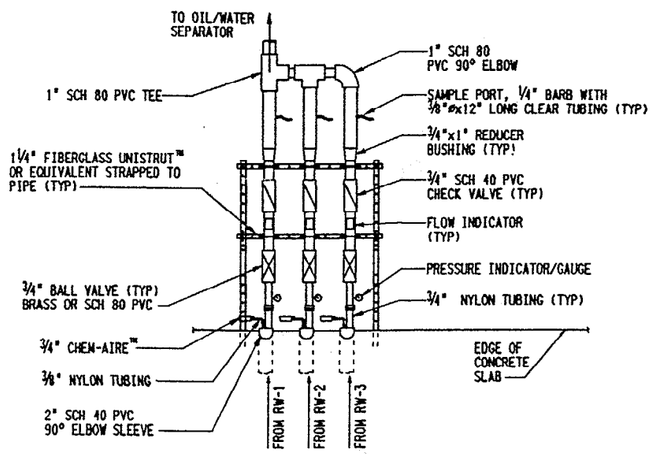
DETAIL 1 (DD576-002)
1/8"=1'-0"



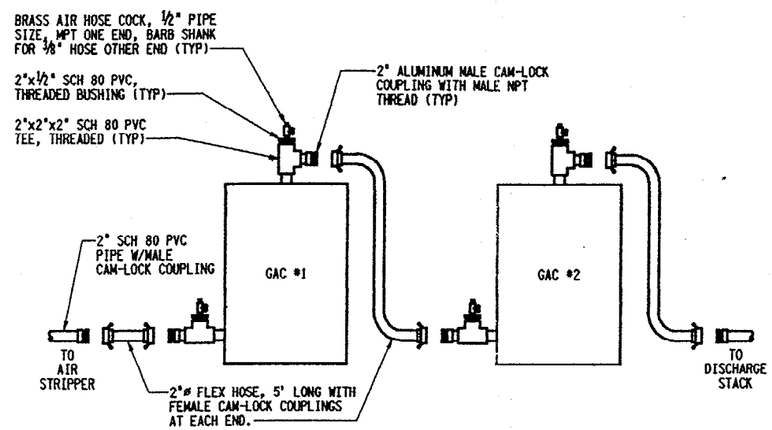
SECTION A (DD576-002)
NTS



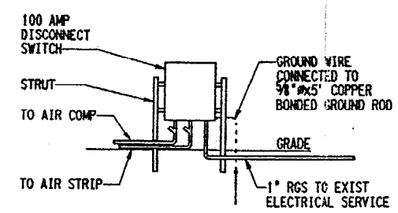
SECTION B (DD576-002)
NTS



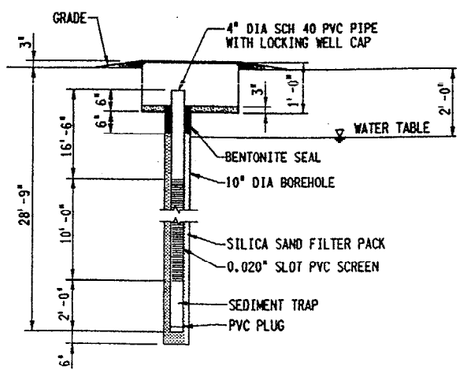
INFLUENT HEADER DETAIL
NTS



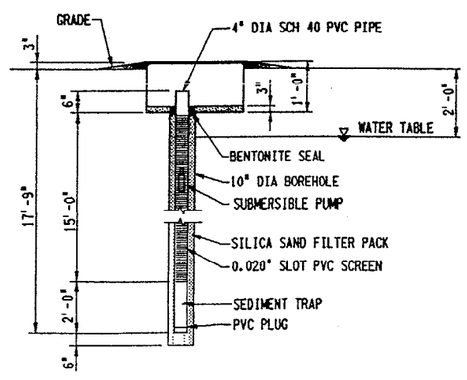
GAC QUICK CONNECT HOSE DETAILS
NTS (OPTIONAL)



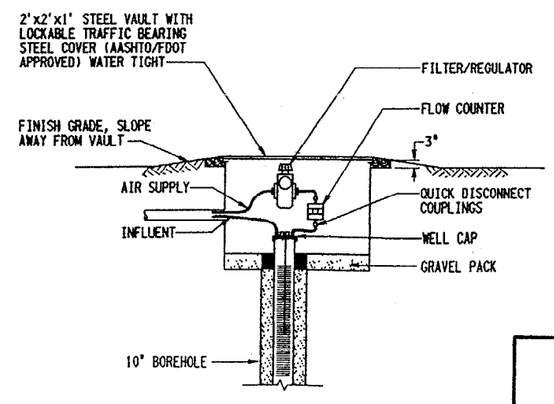
SECTION C (—)
NTS



MW-25D MONITORING WELL DETAIL
NTS



RECOVERY WELL DETAIL
NTS



RECOVERY WELL VAULT DETAIL
NTS

NOTES

1. PHYSICAL VERIFICATION OF EXISTING UNDERGROUND UTILITIES SHALL BE DONE PRIOR TO ANY EXCAVATION.
2. METALIZED POLYETHYLENE PLASTIC DETECTABLE WARNING TAPE SHALL BE INSTALLED IN TRENCHING OVER PIPING.
3. TRENCHES SHALL BE BACKFILLED WITH EXCAVATED SOIL. MATERIAL ADJACENT TO PIPING SHALL NOT HAVE ANY STONES OR OBJECTS GREATER THAN 1/2" DIAMETER.
4. LAYOUT SHOWN IS PROPOSED, ACTUAL BY FIELD.
5. ALL ELECTRICAL WORK SHALL BE IN ACCORDANCE WITH THE LATEST REVISION OF THE NATIONAL ELECTRICAL CODE.

REFERENCE DRAWINGS

SWMU-9 GROUNDWATER TREATMENT SYSTEM PIPING AND INSTRUMENTATION DIAGRAM	321-DD576-001
SWMU-9 GROUNDWATER TREATMENT SYSTEM SITE LAYOUT PLAN	321-DD576-002

LEGEND

0 20 40 60
1"=20'

NO.	DATE	REVISIONS	BY	CHKR	DESIGNER REPR	ENGR	PROJ ENGR	MICRO FLMG
A	3/8/96	ISSUED FOR BID	DLL	WRZ	NJA	ABJ	REH	

SCALE NOTED

BECHTEL ENVIRONMENTAL INC.
OAK RIDGE, TENNESSEE

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION NAVAL FACILITIES ENGINEERING COMMAND
CHARLESTON, SOUTH CAROLINA

SWMU-9 GROUNDWATER TREATMENT SYSTEM
SECTIONS AND DETAILS

JOB NO.	DRAWING NO.	REV
22567	321-DD576-003	A

SEAL

22567/321/DD576003.DGN