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Phase 2
Remedial Investigation Report
for
Naval Weapons
Industrial Reserve Plant
Bethpage, New York
Volume II

Northern Division
Naval Facilities Engineering Command

Contract Number N62472-90-D-1298

Contract Task Order 0089

October 1993

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APPENDIX A

PLANT NO. 3 INSPECTION

PLANT NO. 3 - SITE VISIT TRIP REPORT
OCTOBER 26 to 27, 1992

OBJECTIVE: Investigate the current and historic areas in and around Plant No. 3 to determine the potential for TCE to migrate into the soils and groundwater. In particular, source areas that may be associated with TCE contamination found in monitoring well HN-24I located south and west of Plant No. 3.

PRESENT:
David Brayack (HALLIBURTON NUS)
Kevin Kilmartin (HALLIBURTON NUS)
Jack Dunleavy (Navy - 10/27 only)
Tony Giouvalakis (Grumman - 10/27 only)
Donald Miller (Grumman - 10/27 only)

ACTIVITIES: On October 26, 1992, HALLIBURTON NUS conducted an inspection of the exterior of Plant No. 3 and on October 27, 1992 HALLIBURTON NUS, Navy, and Grumman conducted an inspection of the interior of Plant No. 3. This inspection was visual and non-intrusive in nature and specifically addressed each historic production line identified in the IAS as well as current operations. See attached Figure 5-1 from the IAS with markups.

EXTERIOR INSPECTION:

Overall the inspection of the exterior of the building did not indicate the presence of any potential major source areas of TCE contamination. Relevant observations are summarized as follows.

- Drums labeled as "reclaimed perchloroethylene" (PCE) were observed in the yard area (Site 1) east of Plant No. 3. Some of the drums contained residual liquids. Four additional, unlabeled and unknown drums are in the location of the former drum marshaling area.

- Above ground bulk tanks are prominent along the eastern edge of Plant No. 3. Based on labeling on the tanks, the tanks contain raw and/or waste TCE, sodium hydroxide, nitric acid, hydrofluoric acid, and Plant No. 3 process wastes. Visually, each of these tanks has competent secondary containment and there is no significant evidence of leak or spills in the areas.

- Foundations along the southern edge of Plant 3, near the eastern corner, indicate that heavy equipment was located here in the past. Grumman reports that these foundation were not tanks.

- Also along the southern edge of Plant No. 3 is a hazardous waste treatment unit, a maintenance shop, and a loading dock (cafeteria).

- The western edge of Plant No. 3 consists of office-type buildings. The western edge of the manufacturing portion is not visible.

- At the northwestern corner of Plant No. 3 there are dust collectors and transformers. A parts storage area, waste zyglo tanks, paint booth tank, empty-drums storage area, and a scrap metal storage area are located near the center of the northern edge. None of these areas appear to be major source areas of TCE, although there is the potential for them to be minor source areas.

INTERIOR INSPECTION:

Overall, the inspection of the interior of Plant No. 3 did not find any obvious major source areas of the TCE contamination found in HN-241. Specific potential areas include the TCE solvent tanks near north eastern corner of Plant No. 3 and the TCE solvent tank near the north western corner of Plant No. 3. Each of these areas as well of other areas investigated are discussed below.

<u>TCE Solvent Tanks - Northwest Corner of Plant No. 3</u> - Two large (1000 gallon plus) TCE solvent tanks were in use in this area between approximately 1984 and 1991. Both tanks have secondary containment. For the larger of the two systems, there is no reports or evidence of leaks. Additionally, based on a visual inspection, the secondary containment is competent. The

second tank is smaller. There are reports of minor leaks, particularly near the recirculation pump. The pump is also located in the secondary containment. However, near the pump, there is what appears to be an expansion joint. This joint represents a potential pathway for leaked solvents to enter the soils (and groundwater) underneath Plant No. 3.

This location is approximately 700 feet north of monitoring well cluster HN-24. Based on the distance and the approximate groundwater velocity of 70 feet per year, the location is a potential, but unlikely, source of the contamination at HN-24I. However, because of local production wells and the potential migration of TCE as a DNAPL, this location cannot be eliminated.

Conclusion: The computer modeling will be used to determine if this is a potential source of groundwater contamination. If this location is a potential upgradient area, then an intermediate depth monitoring well will be placed between HN-24 and this area.

TCE Solvent Tank - Northeast Corner of Plant No. 3 - One large (1000 gallon plus) TCE solvent tank is currently in use in the new Chem Mill area since approximately 1978. Secondary containment is present under this tank and the majority of it is in good condition. During the inspection a very slight solvent odor was noted in the sump. Also, a minor crack was observed in the secondary containment.

Conclusion: This area is close to the former drum marshaling area (Site 1). If the computer modeling indicates this to be a potential source area, then an intermediate depth monitoring well will be placed between HN-24 and this area.

General Areas in Plant No. 3 - During the inspection, 55-gallon drums of solvent were noted to be present throughout the building. There were also corresponding solvent collection drums throughout the area. Because of the concrete foundation in Plant No. 3, each of these areas would not be expected to be a potentially significant source.

Alodine/Plating/Paint/Heat Treat Areas - TCE is not believed to have been used in this area (currently as well as historically) in significant quantities. Alodine and plating operations do not normally use solvents in quantity and paint stripping and application typically use non-chlorinated solvents such as toluene. There is a sump under the plating operation that could not be inspected because of the presence of water. The former heat treat area is gone.

Printed Circuits Area - No evidence of previous activities or potential problems remain in this area.

Zyglo Inspection Area - Reportedly, no solvents are used in this process. Although based on work at another Navy facility, some zyglo solutions may be 1,1,1 TCA based.

Paint/Polyethylene Glycol Areas - No evidence of previous activities or potential problems remain in this area. The use of TCE was not identified with this process.

Honeycomb Cleaning/Paint Areas - No evidence of previous activities or potential problems remain in the Honeycomb cleaning area. Approximately 50 gallons per month of TCE was reportedly used in this process in the past. Paint Booths remain in the general area of the reported paint locations. Paint stripping and application typically use non-chlorinated solvents such as toluene.

Sulfuric Acid Anodize - This area consists of an abandoned former TCE solvent tank with secondary containment, an abandoned acid treatment system, and a reclamation unit for PCE vapors from the Flo-Coat Clean Line. The TCE tank was built in the 1980s and abandoned in 1987 as part of a corporate effort to reduce solvent use. This tank was observed to have competent secondary containment. The acid treatment system also has secondary containment, however, there is visual evidence of acid leaks from pump seals and acid attack of the secondary containment concrete. The PCE reclamation unit is relatively new. There is no evidence of potential solvent leaks from this area.

Flo-Coat Clean Line - PCE is used in this area to thin the coating material. The PCE is volatilized from the coating material first in an enclosed/ventalated room and then in a heated dryer. The fumes from this unit are transferred to the reclamation unit near the sulfuric acid anodize. Visually, the building foundation in this area is competent.

Former Chem Mill Area - There is no evidence of previous potential problem areas.

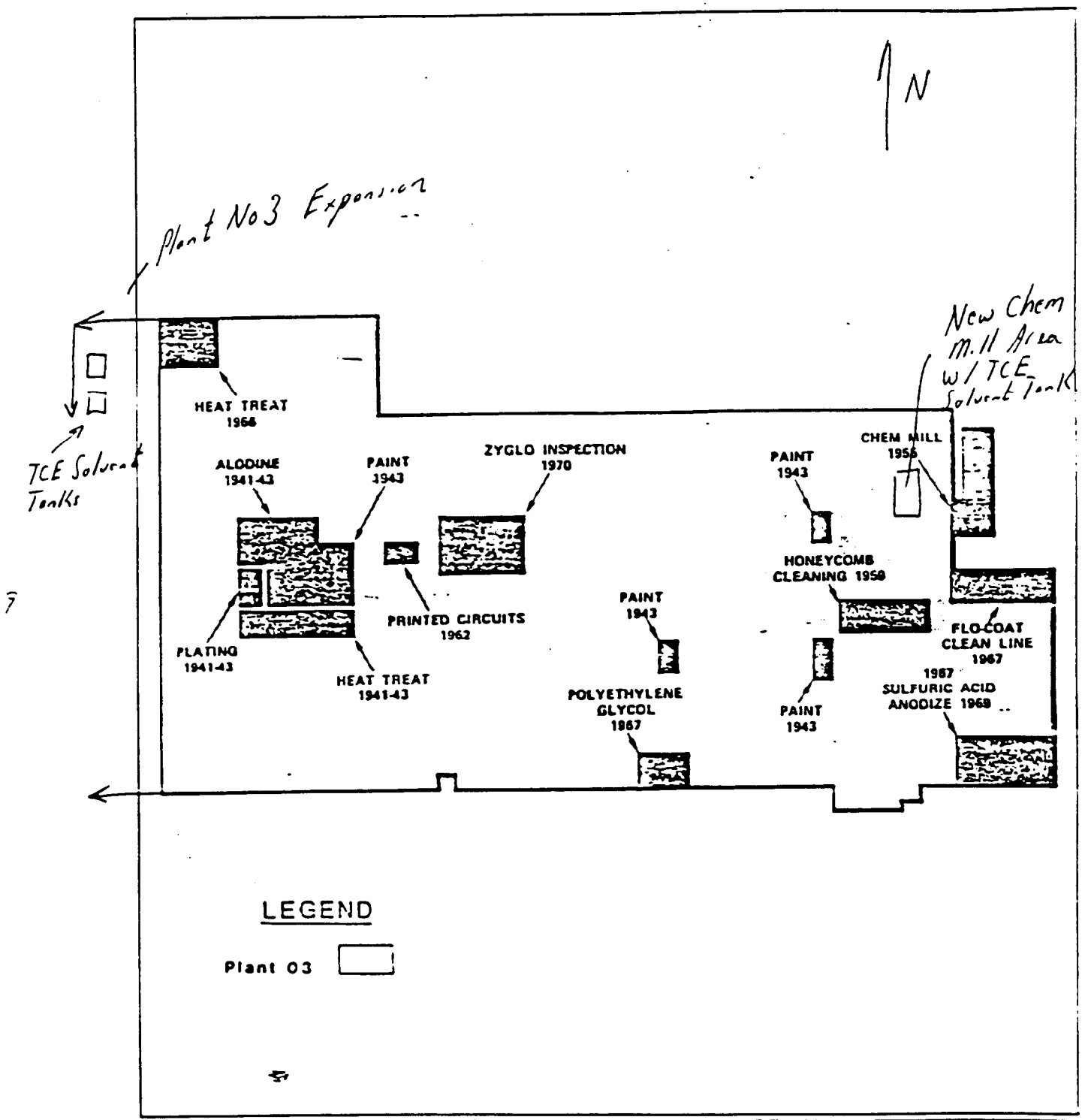


Figure 5-1

Major Production Lines, Plant 03, NWIRP Bethpage, New York Prior to 1980

Initial Assessment Study
Naval Weapons Industrial Reserve Plant
Bethpage and Calverton
Long Island, New York

APPENDIX B

SAMPLE LOG SHEETS/CHAIN-OF-CUSTODY FORMS

SAMPLE LOG SHEET

HALLIBURTON NUS
Environmental Corporation

Page 1 of 20

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other _____

Case # NA

By TR

Project Site Name BETHPAGE Project Site Number 1953

NUS Source No. BP- SS101-A Source Location In situ Drum Pile

Sample Method: S S. TROWEL	Composite Sample Data		
	Sample	Time	Color Description
Depth Sampled: 0 - 6"			
Sample Date & Time: 12-15-92 0815 Hrs.			
Sampled By: TR			
Signature(s): Tuy Ngoc		N/A	

Type of Sample
- [x] Low Concentration
- [ ] High Concentration
- [ ] Grab
- [ ] Composite
- [ ] Grab - Composite

Sample Data	
Color	Description. (Sand, Clay, Dry, Moist, Wet, etc.)
BROWN	SANDY SILT w/ pebbles

Analysis	✓ IF TAKEN	PRESERV :
VOAs		Cool to 4°C
PCBs	✓	↓
Metals		↓
As TCLP		↓
Pest	✓	"

Observations / Notes

taken in scrap area ~ [illegible]

	Organic	Inorganic
Traffic Report #		
Tag #		
AB #		
Date Shipped		
Time Shipped		
Lab		
Volume		

SAMPLE LOG SHEET

HALLIBURTON NUS
Environmental Corporation

Page 2 of 20

Case # NA

By TR

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other _____

Project Site Name BETHPAGE

Project Site Number 1953

NUS Source No. BP- SS102 - A

Source Location In situ Drum Pile

Sample Method: SS TROWEL	
Depth Sampled: 0-6"	
Sample Date & Time: 12-15-92 0835 Hrs.	
Sampled By: TR	
Signature(s): Ty Hook	
Type of Sample: [■] Low Concentration [ ] High Concentration [ ] Grab [ ] Composite [ ] Grab - Composite	

Composite Sample Data

Sample	Time	Color Description
	N/A	

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)

Analysis	✓ IF TAKEN	PRESERV:
VOAs		Cool to 4°C
PCBs	✓	↓
Metals		↓
As TCLP		↓
Cost	✓	"

Observations / Notes

Taken 6' S. of Catch Basin, in line with E side of Site 1's ~~West~~ East Bank

	Organic	Inorganic
Traffic Report #		
Tag #		
AB #		
Date Shipped		
Time Shipped		
Lab		
Volume		

SAMPLE LOG SHEET

HALLIBURTON NUS
Environmental Corporation

Page 3 of 20

- ☐ Surface Soil
- ☒ Subsurface Soil
- ☐ Sediment
- ☐ Lagoon / Pond
- ☐ Other _____

Case # NA

By TR

Project Site Name BETHPAGE Project Site Number 1953

NUS Source No. BP-SB12103-A Source Location In situ Drum Pile

Sample Method: ~~S S TROWEL~~ S S Bucket Auger	
Depth Sampled: 3.0' - 3.5'	
Sample Date & Time: 12-15-92 0940 Hrs.	
Sampled By: TR	
Signature(s): [signature]	
Type of Sample ■ Low Concentration ☐ High Concentration ☐ Grab ☐ Composite ☐ Grab - Composite	

Composite Sample Data

Sample	Time	Color Description

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
TAN	SAND W/ PEBBLES

Analysis	✓ IF TAKEN	PRESERV:
VOAs	~~X~~	Cool to 4°C
PCBs	X	↓
Metals		↓
As TCLP		↓
Pest	X	"

Observations / Notes

Located in laydown area next to W. FENCE

	Organic	Inorganic
Traffic Report #		
Tag #		
AB #		
Date Shipped		
Time Shipped		
Lab		
Volume		

SAMPLE LOG SHEET

HALLIBURTON NUS
Environmental Corporation

Page 4 of 20

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other _____

Case # NA

By TR

Project Site Name BETHPAGE

Project Site Number 1953

NUS Source No. BP-55103-A

Source Location In situ Drum Pile

Sample Method:	Composite Sample Data		
S S. TROWEL	Sample	Time	Color Description
Depth Sampled: 0-6"			
Sample Date & Time: 12-15-92 0910 Hrs.			
Sampled By: TR		N/A	
Signature(s): [signature]			

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [ ] Grab
- [ ] Composite
- [ ] Grab - Composite

Sample Data

Color | Description: (Sand, Clay, Dry, Moist, Wet, etc.)

DARK BROWN Silt w/ Fine sand & Pebbles

Possibly Fill

Analysis:	✓ IF TAKEN	PRESERV:
VOAs		Cool to 4°C
PCBs	X	↓
Metals		↓
As TCLP		↓
Pest	X	"

Observations / Notes

Taken ~~10'~~ 20' North of Boring 121 in Western laydown area

	Organic	Inorganic
Traffic Report #		
Tag #		
AB #		
Date Shipped		
Time Shipped		
Lab		
Volume		

SAMPLE LOG SHEET

HALLIBURTON NUS
Environmental Corporation

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other _____

Case # NA

By TR

Project Site Name BETHPAGE Project Site Number 1953

NUS Source No. BP- 55104-A Source Location In situ Drum Pile

Sample Method: S S. TROWEL	Composite Sample Data		
	Sample	Time	Color Description
Depth Sampled: 0-6"			
Sample Date & Time: 12-15-92 0920 Hrs.			
Sampled By: TR		N/A	
Signature(s): [signature]			

Type of Sample
- [x] Low Concentration
- [ ] High Concentration
- [ ] Grab
- [ ] Composite
- [ ] Grab - Composite

Sample Data

Color: DARK BRN Description: (Sand, Clay, Dry, Moist, Wet, etc.) FILL

Analysis	✓ IF TAKEN	PRESERV:
VOAs		Cool to 4°C
PCBs	X	↓
Metals		↓
As TCLP		↓
Pest	X	"

Observations / Notes

NE OF LARGE CONCRETE PAD

	Organic	Inorganic
Traffic Report #		
Tag #		
AB #		
Date Shipped		
Time Shipped		
Lab		
Volume		

SAMPLE LOG SHEET

HALLIBURTON NUS
Environmental Corporation

Case # NA

By TR

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other _____

Project Site Name BETHPAGE

Project Site Number 1953

NUS Source No. BP-SS105-A

Source Location In situ Drum Pile

Sample Method:	Composite Sample Data		
S S. TROWEL	Sample	Time	Color Description
Depth Sampled: 0-6"			
Sample Date & Time: 12-15-92 0930 Hrs.			
Sampled By: TR		N/A	
Signature(s): [signature]			

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [ ] Grab
- [ ] Composite
- [ ] Grab - Composite

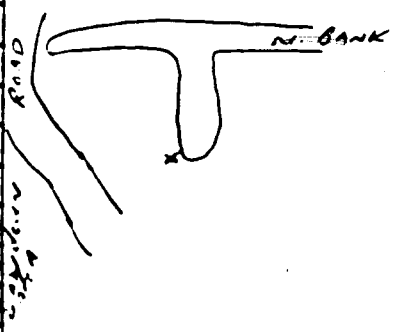
Sample Data

Color: BRN - DARK BRN

Description: (Sand, Clay, Dry, Moist, Wet, etc.) FILL

Analysis	✓ IF TAKEN	PRESERV:
VOAs		Cool to 4°C
PCBs	X	↓
Metals		
As TCLP		↓
PEST	X	"

Observations / Notes



	Organic	Inorganic
Traffic Report #		
Tag #		
AB #		
Date Shipped		
Time Shipped		
Lab		
Volume		

SAMPLE LOG SHEET

HALLIBURTON NUS
Environmental Corporation

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other _____

Case # NA

By TR

Project Site Name BETHPAGE Project Site Number 1953

NUS Source No. BP-SS106-A Source Location In situ Drum Pile

Sample Method:	Composite Sample Data		
S S TROWEL	Sample	Time	Color Description
Depth Sampled: 0-6"			
Sample Date & Time: 12-15-92 0940 Hrs.			
Sampled By: TR		N/A	
Signature(s): [signature]			

Type of Sample
- [x] Low Concentration
- [ ] High Concentration
- [ ] Grab
- [ ] Composite
- [ ] Grab - Composite

Sample Data		
Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)	
Dark Brn	Fill	Moist

Analysis	✓ IF TAKEN	PRESERV:
VOAs		Cool to 4°C
PCBs	X	↓
Metals		
As TCLP		
Pest	X	"

Observations / Notes

SE Corner of Concret BLDG Foundation

	Organic	Inorganic
Traffic Report #		
Tag #		
AB #		
Date Shipped		
Time Shipped		
Lab		
Volume		

SAMPLE LOG SHEET

HALLIBURTON NUS
Environmental Corporation

- ☐ Surface Soil
- ☒ Subsurface Soil
- ☐ Sediment
- ☐ Lagoon / Pond
- ☐ Other _____

Case # NA

By TR

Project Site Name BETHPAGE

Project Site Number 1953

NUS Source No. BP-SB21503-A

Source Location In situ Drum Pile

Sample Method:	Composite Sample Data		
S.S. TROWEL S.S. Auger	Sample	Time	Color Description
Depth Sampled: 3.0 - 3.5' (ft)			
Sample Date & Time: 12-15-92 1100 Hrs.			
Sampled By: TR		N/A	
Signature(s): [signature]			
Type of Sample			
■ Low Concentration			
☐ High Concentration			
☐ Grab			
☐ Composite			
☐ Grab - Composite			

Sample Data	
Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
TAN	W/Pebbles

Analysis	✓ IF TAKEN	PRESERV. :
VOAs	~~X~~ (TL)	Cool to 4°C
PCBs	X	↓
Metals		↓
As TCLP		↓
Pest.	X	"

Observations / Notes

Tried 8 times to ~1'
then 9th try to 3'

	Organic	Inorganic
Traffic Report #		
Tag #		
AB #		
Date Shipped		
Time Shipped		
Lab		
Volume		

SAMPLE LOG SHEET

HALLIBURTON NUS
Environmental Corporation

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other ________

Case # NA

By TR

Project Site Name BETHPAGE Project ~~Site Number~~ 1953

NUS Source No. BP- SB20603-A Source Location ~~In situ~~ Drum Pile

Sample Method:
S.S. TROWEL S.S. Auger

Depth Sampled:
3.0-3.5'

Sample Date & Time:
12-15-92 1140 Hrs.

Sampled By:
TR

Signature(s): [signature]

Type of Sample
- [x] Low Concentration
- [ ] High Concentration
- [ ] Grab
- [ ] Composite
- [ ] Grab - Composite

Composite Sample Data

Sample	Time	Color · Description
N/A		

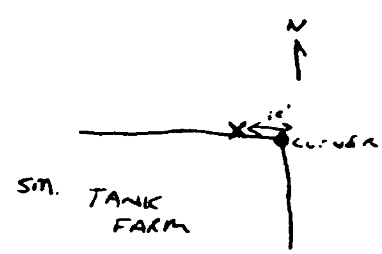
Sample Data

Color: TAN w/ Blue stain — Description: (Sand, Clay, Dry, Moist, Wet, etc.) (Sand, Moist circled) w/ Pebbles

Analysis	✓ if Taken	Preserv.
VOAs		Cool to 4°C
PCBs	X	↓
Metals		↓
As TCLP		↓
PEST	X	"

Observations / Notes

@ FENCE CORNER



	Organic	Inorganic
Traffic Report #		
Tag #		
AB #		
Date Shipped		
Time Shipped		
Lab		
Volume		

SAMPLE LOG SHEET

HALLIBURTON NUS
Environmental Corporation

Page 10 of 20

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other _____

Case # NA

By TR

Project Site Name BETHPAGE

Project Site Number 1953

NUS Source No. BP-SS322-A

Source Location In situ / Drum Pile

Sample Method:	Composite Sample Data		
S.S. TROWEL	Sample	Time	Color Description
Depth Sampled: 0-6"			
Sample Date & Time: 12-15-92 1205 Hrs.			
Sampled By: TR			
Signature(s): [signature]		N/A	

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [ ] Grab
- [ ] Composite
- [ ] Grab - Composite

Sample Data

Color | Description: (Sand, Clay, Dry, Moist, Wet, etc.)

Dark Brn - Black Fill

Analysis	✓ IF TAKEN	PRESERV:
VOAs		Cool to 4°C
PCBs	X	↓
Metals		↓
As TCLP		↓
PEST.	X	"

Observations / Notes

2' sq. original sample point inside salvage yard against the North Fence (original was taken inside Bone Yard @ Fence).

	Organic	Inorganic
Traffic Report #		
Tag #		
AB #		
Date Shipped		
Time Shipped		
Lab		
Volume		

SAMPLE LOG SHEET

HALLIBURTON NUS
Environmental Corporation

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other _____

Case # NA

By TR

Project Site Name BETHPAGE

Project Site Number 1953

NUS Source No. BP- SS207 -A

Source Location In situ Drum Pile

Sample Method: S S. TROWEL

Depth Sampled: 0-6"

Sample Date & Time: 12-15-92 1300 Hrs.

Sampled By: TR

Signature(s): [signature]

Type of Sample
- [x] Low Concentration
- [ ] High Concentration
- [ ] Grab
- [ ] Composite
- [ ] Grab - Composite

Composite Sample Data

Sample	Time	Color Description
	N/A	

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
BRN	W/Pebbles

Analysis	✓ IF TAKEN	PRESERV.
VOAs		Cool to 4°C
PCBs	X	↓
Metals		↓
As TCLP		↓
PEST.	X	"

Observations / Notes @ FENCE NEXT to Cemetary

DUP & MS/MSD

BP-SSDUP01-A

BP-SSMS/MSD-A

	Organic	Inorganic
Traffic Report #		
Tag #		
AB #		
Date Shipped		
Time Shipped		
Lab		
Volume		

SAMPLE LOG SHEET

HALLIBURTON NUS
Environmental Corporation

Page ~~13~~ 12 of 20 (TR)

Case # NA

By TR

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other _____

Project Site Name BETHPAGE

Project Site Number 1953

NUS Source No. BP-SS208-A

Source Location In situ Drum Pile

Sample Method: S.S. TROWEL

Depth Sampled: 0-6"

Sample Date & Time: 12-15-92 1315 Hrs.

Sampled By: TR

Signature(s): [signature]

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [ ] Grab
- [ ] Composite
- [ ] Grab - Composite

Composite Sample Data

Sample	Time	Color Description

Sample Data

Color	Description (Sand, Clay, Dry, Moist, Wet, etc.)
TAN → Orangish	W/Pebbles

Analysis	✓ IF TAKEN	PRESERV:
VOAs		Cool to 4°C
PCBs	X	↓
Metals		↓
As TCLP		↓
Asb	X	↓

Observations / Notes

	Organic	Inorganic
Traffic Report #		
Tag #		
AB #		
Date Shipped		
Time Shipped		
Lab		
Volume		

SAMPLE LOG SHEET

HALLIBURTON NUS
Environmental Corporation

Page 13 of 20 (TR)

Case # NA

By TR

- ☐ Surface Soil
- ☐ Subsurface Soil
- ☒ Sediment
- ☐ Lagoon / Pond
- ☐ Other _____

Project Site Name BETHPAGE

Project Site Number 1953

NUS Source No. BP- SD20B-A (TR)

Source Location In situ Drum Pile

Sample Method: S S. TROWEL	
Depth Sampled: 0-6"	
Sample Date & Time: 12- -92 1335 Hrs.	
Sampled By: TR	
Signature(s): [signature]	
Type of Sample ■ Low Concentration ☐ High Concentration ☐ Grab ☐ Composite ☐ Grab - Composite	

Composite Sample Data

Sample	Time	Color · Description
	N/A	

Sample Data

Color	Description. (Sand, Clay, Dry, Moist, Wet etc.)
Dark Brn	→ Organics & Pebbles

Analysis:	✓ IF TAKEN	PRESERV:
VOAs		Cool to 4°C
PCBs	X	↓
Metals		↓
As TCLP		↓
Cr(+)	X	X

Observations / Notes

	Organic	Inorganic
Traffic Report #		
Tag #		
AB #		
Date Shipped		
Time Shipped		
Lab		
Volume		

SAMPLE LOG SHEET

HALLIBURTON NUS
Environmental Corporation

Case # NA

By TR

- [ ] Surface Soil
- [ ] Subsurface Soil
- [x] Sediment
- [ ] Lagoon / Pond
- [ ] Other _____

Project Site Name BETHPAGE Project Site Number 1953

NUS Source No. BP- SD202-A Source Location In situ Drum Pile

Sample Method: S.S. TROWEL	
Depth Sampled: 0-6"	
Sample Date & Time: 12-15-92 1345 Hrs.	
Sampled By: TR	
Signature(s): [signature]	

Composite Sample Data

Sample	Time	Color Description
	N/A	

Type of Sample
- [x] Low Concentration
- [ ] High Concentration
- [ ] Grab
- [ ] Composite
- [ ] Grab - Composite

Sample Data

Color	Description (Sand, Clay, Dry, Moist, Wet, etc.)
TAN	& Pebbles

Analysis	✓ IF TAKEN	PRESERV:
VOAs		Cool to 4°C
PCBs	X	↓
Metals		↓
As TCLP		↓
Pest	X	"

Observations / Notes

	Organic	Inorganic
Traffic Report #		
Tag #		
AB #		
Date Shipped		
Time Shipped		
Lab		
Volume		

SAMPLE LOG SHEET

HALLIBURTON NUS
Environmental Corporation

Page 15 of 20

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other _____

Case # NA

By TR

Project Site Name BETHPAGE

Project Site Number 1953

NUS Source No. BP-SS21Z-4

Source Location In situ Drum Pile

Sample Method: S S. TROWEL

Depth Sampled: 0-6"

Sample Date & Time: 12-15-92 1400 Hrs.

Sampled By: TR

Signature(s): [signature]

Type of Sample
- [x] Low Concentration
- [ ] High Concentration
- [ ] Grab
- [ ] Composite
- [ ] Grab - Composite

Composite Sample Data

Sample	Time	Color Description
	N/A	

Sample Data

Color	Description. (Sand, Clay, Dry, Moist, Wet, etc.)
BRN	& Gravel

Analysis	✓ IF TAKEN	PRESERV :
VOAs		Cool to 4°C
PCBs	X	↓
Metals		
As TCLP		
PEST	X	

Observations / Notes

OFFSITE ~~W.~~ E (TR) Edge of Concrete Pad E. of Block Bldg & centerline of ~~R.~~ (TR) Dike Road

	Organic	Inorganic
Traffic Report #		
Tag #		
AB #		
Date Shipped		
Time Shipped		
Lab		
Volume		

SAMPLE LOG SHEET

HALLIBURTON NUS
Environmental Corporation

Case # NA

By TR

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other _____

Project Site Name BETHPAGE Project Site Number 1953

NUS Source No. BP-SS216-A Source Location In situ Drum Pile

Sample Method: S.S. TROWEL

Depth Sampled: 0-6"

Sample Date & Time: 12-15-92 1410 Hrs.

Sampled By: TR

Signature(s): [signature]

Type of Sample
- [x] Low Concentration
- [ ] High Concentration
- [ ] Grab
- [ ] Composite
- [ ] Grab - Composite

Composite Sample Data

Sample	Time	Color · Description
	N/A	

Sample Data

Color	Description (Sand, Clay, Dry, Moist, Wet, etc.)
BRN	Gravel/Pebbles Fill (Rubble)

Analysis	✓ IF TAKEN	PRESERV :
VOAs		Cool to 4°C
PCBs	X	↓
Metals		↓
As TCLP		↓
Pest	X	"

Observations / Notes

	Organic	Inorganic
Traffic Report #		
Tag #		
AB #		
Date Shipped		
Time Shipped		
Lab		
Volume		

SAMPLE LOG SHEET

HALLIBURTON NUS
Environmental Corporation

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Case # NA

By TR

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other _____

Project Site Name BETHPAGE

Project Site Number 1953

NUS Source No. BP- SS214 - A

Source Location In situ Drum Pile

Sample Method: S S. TROWEL	Composite Sample Data		
	Sample	Time	Color · Description
Depth Sampled: 0 - 6"			
Sample Date & Time: 12-15-92 1420 Hrs.			
Sampled By: TR		N/A	
Signature(s): Terry Rogal			

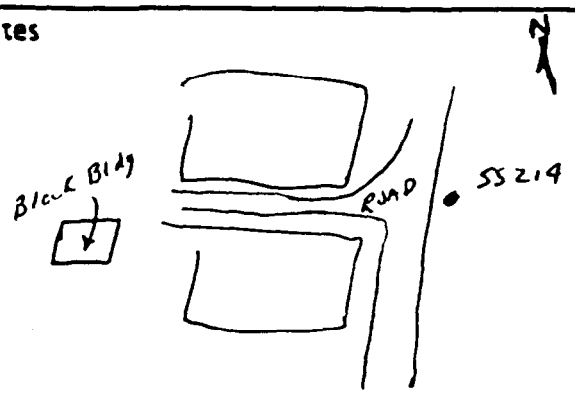
Type of Sample
- [x] Low Concentration
- [ ] High Concentration
- [ ] Grab
- [ ] Composite
- [ ] Grab - Composite

Sample Data

Color : Description. (Sand, Clay, Dry, Moist, Wet, etc.)
TAN - BRN AND GRAVEL

Analysis	✓ IF TAKEN	PRESERV :
VOAs		Cool to 4°C
PCBs	X	↓
Metals		↓
As TCLP		↓
Pest	+	"

Observations / Notes



	Organic	Inorganic
Traffic Report #		
Tag #		
AB #		
Date Shipped		
Time Shipped		
Lab		
Volume		

SAMPLE LOG SHEET

HALLIBURTON NUS
Environmental Corporation

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- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other _____

Case # NA

By TR

Project Site Name BETHPAGE

Project Site Number 1953

NUS Source No. BP- SS210-A

Source Location In situ / Drum Pile

Sample Method: S S. TROWEL

Depth Sampled: 0-6"

Sample Date & Time: 12-15-92 1430 Hrs.

Sampled By: TR

Signature(s): [signature]

Type of Sample
- [x] Low Concentration
- [ ] High Concentration
- [ ] Grab
- [ ] Composite
- [ ] Grab - Composite

Composite Sample Data

Sample	Time	Color · Description
	N/A	

Sample Data

Color	Description (Sand, Clay, Dry, Moist, Wet, etc.)
TAN	Pebbles

Analysis	✓ IF TAKEN	PRESERV :
VOAs		Cool to 4°C
PCBs	X	↓
Metals		↓
As TCLP		↓
Pest	X	"

Observations / Notes

ALSO COLLECTED:
BP- DUP02-A
BP- MS/MSD02-A
At this Location

	Organic	Inorganic
Traffic Report #		
Tag #		
AB #		
Date Shipped		
Time Shipped		
Lab		
Volume		

SAMPLE LOG SHEET

HALLIBURTON NUS
Environmental Corporation

Case # NA

By TR

- [ ] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [x] Other Rinsate Blank

Project Site Name BETHPAGE

Project Site Number 1953

NUS Source No. BP-SS210-RB

Source Location In situ Drum Pile Rinsate

Sample Method: LAB Pour H2O over S.S. TROWEL

Depth Sampled: —

Sample Date & Time: 12-15-92 1500 Hrs.

Sampled By: TR

Signature(s): [signature]

Type of Sample
- [x] Low Concentration
- [ ] High Concentration
- [ ] Grab
- [ ] Composite
- [ ] Grab - Composite

Composite Sample Data

Sample	Time	Color Description
	N/A	

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)

Analysis	✓ IF TAKEN	PRESERV:
VOAs		Cool to 4°C
PCBs	X	↓
Metals		↓
As TCLP		↓
Pest	X	↓

Observations / Notes

	Organic	Inorganic
Traffic Report #		
Tag #		
AB #		
Date Shipped		
Time Shipped		
Lab		
Volume		

SAMPLE LOG SHEET

HALLIBURTON NUS
Environmental Corporation

- ☐ Surface Soil
- ☐ Subsurface Soil
- ☐ Sediment
- ☐ Lagoon / Pond
- ☒ Other FIELD BLANK

Case # NA

By TR

Project Site Name BETHPAGE

Project Site Number 1953

NUS Source No. BP-SS210-FB

Source Location In situ Drum Pile Field Blank

Sample Method: LAB PURE H_2O ~~S.S. TROWEL~~ TR Directly into Bottle

Depth Sampled: —

Sample Date & Time: 12-15-92 1505 Hrs.

Sampled By: TR

Signature(s): [signature]

Type of Sample
- ■ Low Concentration
- ☐ High Concentration
- ☐ Grab
- ☐ Composite
- ☐ Grab - Composite

Composite Sample Data

Sample	Time	Color Description

Sample Data

Color | Description. (Sand, Clay, Dry, Moist, Wet, etc.)

Analysis	✓ IF TAKEN	PRESERV.
VOAs		Cool to 4°C
PCBs	X	↓
Metals		↓
As TCLP		↓
Pest.	X	"

Observations / Notes

	Organic	Inorganic
Traffic Report #		
Tag #		
AB #		
Date Shipped		
Time Shipped		
Lab		
Volume		

SAMPLE LOG SHEET

HALLIBURTON NUS
Environmental Corporation

Case # NA

By TR

- [ ] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [x] Other TRIP BLANK

Project Site Name BETHPAGE Project Site Number 1953

NUS Source No. BP- RS27-TB Source Location In situ Drum Pile

Sample Method: LAB Prepared ~~S.S. TROWEL~~ (TR) 12/10/92 1600 Hrs

Depth Sampled:

Sample Date & Time: 12-17-92 1735 Hrs.

Sampled By: TR

Signature(s): [signature]

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [ ] Grab
- [ ] Composite
- [ ] Grab - Composite

Composite Sample Data

Sample	Time	Color · Description

N/A

Sample Data

Color | Description: (Sand, Clay, Dry, Moist, Wet, etc.)

Analysis	✓ IF TAKEN	PRESERV.
VOAs	✓	Cool to 4°C
PCBs		↓
Metals		↓
As TCLP		↓

Observations / Notes

	Organic	Inorganic
Traffic Report #		
Tag #		
AB #		
Date Shipped		
Time Shipped		
Lab		
Volume		

SAMPLE LOG SHEET

HALLIBURTON NUS
Environmental Corporation

Case # NA

By TR

- ☐ Surface Soil
- ☐ Subsurface Soil
- ☐ Sediment
- ☐ Lagoon / Pond
- ☒ Other Rinsate Blank

Project Site Name BETHPAGE

Project Site Number 1953

NUS Source No. BP-RS27-RB

Source Location In situ Drum Pile

Sample Method: LAB H_2O OVER S S. TROWEL

Depth Sampled: —

Sample Date & Time: 12-17-92 0740 Hrs.

Sampled By: TR

Signature(s): [signature]

Type of Sample
- ■ Low Concentration
- ☐ High Concentration
- ☐ Grab
- ☐ Composite
- ☐ Grab - Composite

Composite Sample Data		
Sample	Time	Color Description
	N/A	

Sample Data	
Color	Description. (Sand, Clay, Dry, Moist, Wet, etc.)

Analysis	✓ IF TAKEN	PRESERV:
VOAs	✓	Cool to 4°C
PCBs		↓
Metals		
As TCLP		

Observations / Notes

	Organic	Inorganic
Traffic Report #		
Tag #		
AB #		
Date Shipped		
Time Shipped		
Lab		
Volume		

SAMPLE LOG SHEET

HALLIBURTON NUS
Environmental Corporation

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- ☐ Surface Soil
- ☐ Subsurface Soil
- ☐ Sediment
- ☐ Lagoon / Pond
- ☒ Other Soil / Pile

Case # NA

By TR

Project Site Name BETHPAGE

Project Site Number 1953

NUS Source No. BP-RS27

Source Location In situ Drum / Pile

Sample Method:	Composite Sample Data		
S S. TROWEL	Sample	Time	Color · Description
Depth Sampled: 3"-12"			
Sample Date & Time: 12-17-92 0840 Hrs.			
Sampled By: TR			
Signature(s): [signature]			
Type of Sample			
■ Low Concentration			
☐ High Concentration			
☐ Grab			
☐ Composite			
☐ Grab - Composite			

Sample Data

Color	Description. (Sand, Clay, Dry, Moist, Wet, etc.)
WHITE → BROWN	SILT AND SAND W/ GRAVEL

Analysis	✓ IF TAKEN	PRESERV.
VOAs	✓	Cool to 4°C
PCBs	✓	↓
Metals		↓
As TCLP		↓
PEST.	✓	↓

Observations / Notes

MW-27 Soil Pile

	Organic	Inorganic
Traffic Report #		
Tag #		
AB #		
Date Shipped		
Time Shipped		
Lab		
Volume		

SAMPLE LOG SHEET

HALLIBURTON NUS
Environmental Corporation

Case # NA

By TR

- ☐ Surface Soil
- ☐ Subsurface Soil
- ☐ Sediment
- ☐ Lagoon / Pond
- ☒ Other Soil Pile

Project Site Name BETHPAGE Project Site Number 1953

NUS Source No. BP-RS28 Source Location In situ Drum (Pile) MW28

Sample Method: S S. TROWEL	Composite Sample Data		
	Sample	Time	Color · Description
Depth Sampled: 3" – 12"			
Sample Date & Time: 12-17-92 0855 Hrs.			
Sampled By: TR		N/A	
Signature(s): [signature]			

Type of Sample
- ■ Low Concentration
- ☐ High Concentration
- ☐ Grab
- ☐ Composite
- ☐ Grab - Composite

Sample Data

Color : Description (Sand, Clay, Dry, Moist, Wet, etc.)

Gray – tan – orangish some Gravel

Analysis	✓ IF TAKEN	PRESERV.
VOAs	X	Cool to 4°C
PCBs	X	↓
Metals		↓
As TCLP		↓
Pest.	X	"

Observations / Notes

	Organic	Inorganic
Traffic Report #		
Tag #		
AB #		
Date Shipped		
Time Shipped		
Lab		
Volume		

SAMPLE LOG SHEET

HALLIBURTON NUS
Environmental Corporation

Case # NA

By TR

- [ ] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [x] Other Soil Pile

Project Site Name BETHPAGE

Project Site Number 1953

NUS Source No. BP-R529

Source Location In situ Drum Pile

Sample Method:	Composite Sample Data		
S S. TROWEL	Sample	Time	Color Description
Depth Sampled: 4" - 12"			
Sample Date & Time: 12-17-92 0910 Hrs.			
Sampled By: TR			
Signature(s): [signature]			
Type of Sample			
[x] Low Concentration			
[ ] High Concentration			
[ ] Grab			
[ ] Composite			
[ ] Grab - Composite			

Sample Data

Color Description: (Sand, Clay, Dry, Moist, Wet, etc.)

TAN - CHAMPISH - BROWN

Analysis	✓ IF TAKEN	PRESERV:
VOAs	X	Cool to 4°C
PCBs		↓
Metals		↓
As TCLP		↓

Observations / Notes

Pile under Blue Tarp

	Organic	Inorganic
Traffic Report #		
Tag #		
AB #		
Date Shipped		
Time Shipped		
Lab		
Volume		

SAMPLE LOG SHEET

HALLIBURTON NUS
Environmental Corporation

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Case # NA

By TR

- [ ] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [x] Other Soil Pile

Project Site Name BETHPAGE

Project Site Number 1953

NUS Source No. BP-25

Source Location In situ Drum (Pile)

Sample Method: S S. TROWEL

Depth Sampled: 3" - 12"

Sample Date & Time: 12-17-92 0930 Hrs.

Sampled By: TR

Signature(s): Tr[illegible]

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [ ] Grab
- [ ] Composite
- [ ] Grab - Composite

Composite Sample Data

Sample	Time	Color · Description

Sample Data

Color (Description: Sand, Clay, Dry, Moist, Wet, etc.)

WHITE - BRN W/ GRAVEL

Analysis	✓ IF TAKEN	PRESERV :
VOAs	X	Cool to 4°C
PCBs		↓
Metals	X	↓
As TCLP		↓

Observations / Notes

SEMI COVERED W/ Plastic

	Organic	Inorganic
Traffic Report #		
Tag #		
AB #		
Date Shipped		
Time Shipped		
Lab		
Volume		

SAMPLE LOG SHEET

HALLIBURTON NUS
Environmental Corporation

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Case # NA

By TR

- [ ] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [x] Other Soil Pile

Project Site Name BETHPAGE

Project Site Number 1953

NUS Source No. BP-RS24

Source Location In situ Drum Pile

Sample Method:	Composite Sample Data		
S S. TROWEL	Sample	Time	Color · Description
Depth Sampled: 3"-12"			
Sample Date & Time: 12-17-92 0945 Hrs.			
Sampled By: TR			
Signature(s): [signature]			
Type of Sample			
[x] Low Concentration			
[ ] High Concentration			
[ ] Grab			
[ ] Composite			
[ ] Grab - Composite			

Sample Data	
Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
TAN	

Analysis	✓ IF TAKEN	PRESERV.
VOAs	X	Cool to 4°C
PCBs		↓
Metals		
As TCLP		

Observations / Notes

Pile Semi Covered w/Plastic

	Organic	Inorganic
Traffic Report #		
Tag #		
AB #		
Date Shipped		
Time Shipped		
Lab		
Volume		

SAMPLE LOG SHEET

HALLIBURTON NUS
Environmental Corporation

Case # NA

By TR

- ☐ Surface Soil
- ☐ Subsurface Soil
- ☐ Sediment
- ☐ Lagoon / Pond
- ☒ Other Soil Pile

Project Site Name BETHPAGE Project Site Number 1953

NUS Source No. BP-RS30 ELABQA/QC Source Location In situ Drum (Pile)

Sample Method:	Composite Sample Data		
S S. TROWEL	Sample	Time	Color Description
Depth Sampled: 3" - 12"			
Sample Date & Time: 12-17-92 1015 Hrs.			
Sampled By: TR			
Signature(s): T Rogal			

Type of Sample
- ■ Low Concentration
- ☐ High Concentration
- ☐ Grab
- ☐ Composite
- ☐ Grab - Composite

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
ORANGISH	W/ GRAVEL

Analysis	✓ IF TAKEN	PRESERV.
VOAs	X	Cool to 4°C
PCBs	X	↓
Metals	X	↓
As TCLP		↓
Pest	X	"

Observations / Notes

Also Collected At this Location:
BP-RSDUP01 VOAS, METALS, PEST./PCBs
BP-RSMS01 VOAS ONLY
BP-RSMSD01 VOAS ONLY

	Organic	Inorganic
Traffic Report #		
Tag #		
AB #		
Date Shipped		
Time Shipped		
Lab		
Volume		

SAMPLE LOG SHEET

HALLIBURTON NUS
Environmental Corporation

- ☐ Surface Soil
- ☐ Subsurface Soil
- ☐ Sediment
- ☐ Lagoon / Pond
- ☒ Other Drumed Soil Cuttings

Case # NA

By TR

Project Site Name BETHPAGE

Project Site Number 1953

NUS Source No. BP-DR229-1

Source Location In situ / Drum / Pile

Sample Method: S S. TROWEL

Depth Sampled: 1" - 6"

Sample Date & Time: 12-17-92 1100 Hrs.

Sampled By: TR

Signature(s): Troy Asgil

Type of Sample
- ■ Low Concentration
- ☐ High Concentration
- ☐ Grab
- ☐ Composite
- ☐ Grab - Composite

Composite Sample Data

Sample	Time	Color · Description

Sample Data

Color	Description (Sand, Clay, Dry, Moist, Wet, etc.)
WHITE - TAN - ORANGISH	w/Gravel

Analysis	✓ IF TAKEN	PRESERV.
VOAs		Cool to 4°C
PCBs	X	↓
Metals		↓
As TCLP		↓
PEST.	X	"

Observations / Notes

Composite of 4 drums

	Organic	Inorganic
Traffic Report #		
Tag #		
AB #		
Date Shipped		
Time Shipped		
Lab		
Volume		

SAMPLE LOG SHEET

HALLIBURTON NUS
Environmental Corporation

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- ☐ Surface Soil
- ☐ Subsurface Soil
- ☐ Sediment
- ☐ Lagoon / Pond
- ☒ Other Drumed Soil / Cuttings

Case # NA

By TR

Project Site Name BETHPAGE

Project Site Number 1953

NUS Source No. BP- DR 229-2

Source Location In situ (Drum) Pile

Sample Method: S S. TROWEL

Depth Sampled: 1"-6"

Sample Date & Time: 12-17-92 1115 Hrs.

Sampled By: TR

Signature(s): [signature]

Type of Sample
- ■ Low Concentration
- ☐ High Concentration
- ☐ Grab
- ☐ Composite
- ☐ Grab - Composite

Composite Sample Data

Sample	Time	Color Description

Sample Data

Color Description: (Sand, Clay, Dry, Moist, Wet, etc.)

WHITE - TAN - Orangish w/ Gravel

Analysis	✓ IF TAKEN	PRESERV:
VOAs		Cool to 4°C
PCBs	X	↓
Metals		
As TCLP		↓
Pest	X	"

Observations / Notes

Composite of 4 drums

	Organic	Inorganic
Traffic Report #		
Tag #		
AB #		
Date Shipped		
Time Shipped		
Lab		
Volume		

SAMPLE LOG SHEET

HALLIBURTON NUS
Environmental Corporation

- [ ] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [x] Other Drumed Soil Cuttings

Case # NA

By TR

Project Site Name BETHPAGE

Project Site Number 1953

NUS Source No. BP- DR215

Source Location In situ Drum Pile

Sample Method: S S. TROWEL

Depth Sampled: 1"-8"

Sample Date & Time: 12-17-92 1200 Hrs.

Sampled By: TR

Signature(s): [signature]

Type of Sample
- [x] Low Concentration
- [ ] High Concentration
- [ ] Grab
- [ ] Composite
- [ ] Grab - Composite

Composite Sample Data

Sample	Time	Color Description

N/A

Sample Data

Color	Description. (Sang. Clay. Dry. Moist. Wet. etc.)
Tan → Lt Brn → Br	w/Gravel

Analysis	✓ IF TAKEN	PRESERV :
VOAs		Cool to 4°C
PCBs	X	↓
Metals		↓
As TCLP		↓
Dest	X	

Observations / Notes

(1) Drum sampled

	Organic	Inorganic
Traffic Report #		
Tag #		
AB #		
Date Shipped		
Time Shipped		
Lab		
Volume		

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

Page 1 of 1

- [x] Monitoring Well Data
- [ ] Domestic Well Data
- [x] Other Temp. Well

Case # _____

By KCK

Project Site Name Bethpage RI Project Site Number 1953

NUS Source No. BP-G-R-16 Source Location Temp. Boring No. 16

Total Well Depth:	Purge Data				
Well Casing Size & Depth: 60' Deep, 2" ϕ	Volume	pH	S.C.	Temp. (°C)	Color & Turbidit
	I	5.89	380	13.8	light Tan/very hig
Static Water Level: ~52'					
One Casing Volume:					
Start Purge (hrs.):					
End Purge (hrs.):					
Total Purge Time (min.):					
Total Amount Purged (gal.): 5 gal					
Monitor Reading: No readings above background					
Purge Method: 2" bailer					
Sample Method: "					
Depth Sampled: 50-60'					
Sample Date & Time: 12/15/92 1355	Sample Data				
	pH	S.C.	Temp. (°C)	Color & Turb	
Sampled By: Kevin C Kilmartin					
Signature(s): Kevin C. Kilmartin	Observations / Notes:				

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [ ] Grab
- [ ] Composite
- [ ] Grab - Composite

Analysis	Preservative		Organic	Inorganic
VOA's	HCL	Traffic Report #		
		Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume		

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

- [x] Monitoring Well Data
- [ ] Domestic Well Data
- [ ] Other _____

Page ____ of ____

Case # —

By TR

Project Site Name BETHPAGE Project Site Number 1953

NUS Source No. BP-G-R-11 Source Location RES TMP WELL 282 9th St.

	Purge Data				
Total Well Depth: 59.5'					
Well Casing Size & Depth: TEMP WELL 2" ø PVC	Volume	pH	S.C.	Temp. (°C)	Color & Turbidity
	I	7.30	490	8.2	TAN High
Static Water Level: 54.59					
One Casing Volume: —					
Start Purge (hrs.): 0855					
End Purge (hrs.): 0940					
Total Purge Time (min.): 45					
Total Amount Purged (gal.): 4 gal					
Monitor Reading: HNU 0.00ppm					
Purge Method: TEFLON BAILER					
Sample Method: " "					
Depth Sampled:					

Sample Date & Time:	Sample Data			
12-16-92 0945	pH	S.C.	Temp. (°C)	Color & Turbidity
Sampled By: TR	7.95	~~7.95~~ 274 TR	8.0	TAN High

Signature(s): Tr Rogal

Type of Sample
- [x] Low Concentration
- [ ] High Concentration
- [ ] Grab
- [ ] Composite
- [ ] Grab - Composite

Observations / Notes:

~~DUP & MS/MSD TAKEN HERE~~

~~BP-G-R-DUP02~~

~~BP-G-R-MS02~~

~~BP-G-R-MSD02~~

Recharge to slow (TR)

DRIED out 4 times during purge

Analysis	Preservative		Organic	Inorganic
VOAs	HCl	Traffic Report #		
		Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume		

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

- [x] Monitoring Well Data
- [ ] Domestic Well Data
- [ ] Other _____

Page ____ of ____

Case # ____

By TR

Project Site Name BETHPAGE Project Site Number 1953

NUS Source No. BP-G-R-5 Source Location @ Boring #5 / 206 Maple A E

	Purge Data				
Total Well Depth: 59.6'					
Well Casing Size & Depth: Temp Well · 2" Ø	Volume	pH	S.C.	Temp. (°C)	Color & Turbidit
	I	7.20	220	5.8	Orange Very High
Static Water Level: 53.78					
One Casing Volume: –					
Start Purge (hrs.): 1200					
End Purge (hrs.): 1220					
Total Purge Time (min.): 20					
Total Amount Purged (gal.): 5 gal					
Monitor Reading: 0.0					
Purge Method: Teflon Bailer					
Sample Method: " "					
Depth Sampled: —					

Sample Date & Time: 12/16/92 1225	Sample Data			
	pH	S.C.	Temp. (°C)	Color & Turbic
Sampled By: TR	6.65	200	5.4	Orange/sl High

Signature(s): [signature]

Type of Sample
- [x] Low Concentration
- [ ] High Concentration
- [ ] Grab
- [ ] Composite
- [ ] Grab - Composite

Observations / Notes:
Will collect DUP / MS / MSD
BP-G-R-DUP 02
BP-G-R-MS 02
BP-G-R-MSD 02

Analysis	Preservative		Organic	Inorganic
VOAs	HCl	Traffic Report #		
		Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume		

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

Page _____ of _____

- [x] Monitoring Well Data
- [ ] Domestic Well Data
- [ ] Other _____

Case # _____

By _____

PHASE II

Project Site Name BETHPAGE 1953 Project Site Number 1

NUS Source No. HNP-1 Source Location PIEZOMETER #1

Total Well Depth:	Purge Data				
Well Casing Size & Depth: 2" 61'	Volume	pH	S.C.	Temp. (°C)	Color & Turbidity
	1	7.02	310	14.1	BRN HI
Static Water Level: 53.47		0			
One Casing Volume: 1.5 gal					
Start Purge (hrs.): 1220					
End Purge (hrs.): 1310					
Total Purge Time (min.):					
Total Amount Purged (gal.): 5 gal					
Monitor Reading:					
OVA HNU					
Purge Method: S.S BAILER					
Sample Method: S.S BAILER					
Depth Sampled: N/A 53'-61'					

Sample Date & Time:	Sample Data			
12-4-92 1310	pH	S.C.	Temp. (°C)	Color & Turbidity
Sampled By: FRED & RAMSER	8.27	250	13.3	BRN HI

Signature(s): Fred McEmar

Observations / Notes:

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Analysis	Preservative		Organic	Inorganic
VOAs	HCL	Traffic Report #		
	COOL TO 4°C	Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume	2 x 40ml vial	

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

- [x] Monitoring Well Data
- [ ] Domestic Well Data
- [ ] Other _____

Page _____ of _____

Case # _____

By _____

Project Site Name BETHPAGE PHASE II 1453 Project Site Number SITE #1

NUS Source No. HNP2-1 Source Location PIEZOMETER #2

	Purge Data				
Total Well Depth: 61					
Well Casing Size & Depth: 2"Ø 61'	Volume	pH	S.C.	Temp. (°C)	Color & Turbid
Static Water Level: 53.47					
One Casing Volume: 1.5 gal					
Start Purge (hrs.): 1325					
End Purge (hrs.): 1425					
Total Purge Time (min.):					
Total Amount Purged (gal.): 5 gal					
Monitor Reading:					
Purge Method: PVC BAILER					
Sample Method: "					
Depth Sampled: 53.4'-61'					
Sample Date & Time: 1430	Sample Data				
	pH	S.C.	Temp. (°C)	Color & Tur	...y
Sampled By: FWR	7.37	200	12.6	BRN	HI

Signature(s)

Fred H Ramer

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Observations / Notes:

Analysis	Preservative		Organic	Inorganic
VOA	HCL, cool to 4°C	Traffic Report #		
		Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume		

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

Page 1 of 1

- ☐ Monitoring Well Data
- ☐ Domestic Well Data
- ☒ Other Temporary well

Case # _____

By KCK

Project Site Name BETHPAGE RI Phase 2 Project Site Number 1953

NUS Source No. BP-G-R-01 Source Location Temporary well No. 1

	Purge Data				
Total Well Depth:					
Well Casing Size & Depth: 2" ø 60' Deep	Volume	pH	S.C.	Temp. (°C)	Color & Turbidity
Static Water Level:					
One Casing Volume:					
Start Purge (hrs.) ~1040					
End Purge (hrs.): 1105					
Total Purge Time (min.): ~25					
Total Amount Purged (gal.): 5					
Monitor Reading: 0 ppm above background					
Purge Method: PVC bailer					
Sample Method: STAINLESS bailer					
Depth Sampled: ~55-60'					
Sample Date & Time: 12/7/92 1105	**Sample Data**				
	pH	S.C.	Temp. (°C)	Color & Turbidity	
Sampled By: KEVIN C. KILMARTIN	6.99	100	11.3	Brown - High	
Signature(s) Kevin C Kilmartin	Observations / Notes:				

Type of Sample

- ☐ Low Concentration
- ☐ High Concentration
- ☒ Grab
- ☐ Composite
- ☐ Grab - Composite

Analysis	Preservative		Organic	Inorganic
VOA	HCl, Cool to 4°C	Traffic Report #		
		Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume	Two 40 ml vials	

SAMPLE LOG SHEET

HALLIBURTON NUS
Environmental Corporation

- ☐ Monitoring Well Data
- ☐ Domestic Well Data
- ☒ Other TEMP. MW

Page _____ of _____

Case # _____

By FWR

Project Site Name BETHPAGE PHASE II RI Project Site Number 1953

NUS Source No. BP-G-R-02 Source Location BORING #2, RESIDENTIAL 9TH + MA

	Purge Data				
Total Well Depth: 60'					
Well Casing Size & Depth: 2"ϕ 60'	Volume	pH	S.C.	Temp. (°C)	Color & Turbidity
Static Water Level: 53'					
One Casing Volume: —					
Start Purge (hrs.): 1345					
End Purge (hrs.): 1415					
Total Purge Time (min.): 30					
Total Amount Purged (gal.): 5gal					
Monitor Reading: 0ppm					
Purge Method: PVC Bailer					
Sample Method: PVC Bailer					
Depth Sampled: ~ 55-60'					

Sample Date & Time:	Sample Data			
12-7-92 / ~~1400~~ 1415	pH	S.C.	Temp. (°C)	Color & Turbidity
Sampled By: FWR	5.04	150	13.6	YELLOW BRN HI

Signature(s): Fred W Ramsey

Type of Sample
- ☒ Low Concentration
- ☐ High Concentration
- ☒ Grab
- ☐ Composite
- ☐ Grab - Composite

Observations / Notes:

Analysis:	Preservative		Organic	Inorganic
VOA	HCL cool to 4°C	Traffic Report #		
		Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume	TWO 40ml vials	

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

Page ____ of ____

- ☐ Monitoring Well Data
- ☐ Domestic Well Data
- ☒ Other ~~TEMP WELL~~ EQUIPMENT (RINSATE) BLANK

Case # ____

By FWR

Project Site Name BETHPAGE Project Site Number 1953, RESIDENTIAL

NUS Source No. BP-G-R-RB1 Source Location RINSATE BLANK

	Purge Data				
Total Well Depth: N/A					
Well Casing Size & Depth: N/A	Volume	pH	S.C.	Temp. (°C)	Color & Turbidity
Static Water Level: N/A					
One Casing Volume: N/A					
Start Purge (hrs.): N/A					
End Purge (hrs.): N/A					
Total Purge Time (min.): N/A					
Total Amount Purged (gal.): N/A					
Monitor Reading: —					
Purge Method: —					
Sample Method: —					
Depth Sampled: —					

Sample Date & Time:	Sample Data			
12-7-92 1300	pH	S.C.	Temp. (°C)	Color & Turbidity
Sampled By: FRED LURAMSER	—	—	—	—

Signature(s)

Observations / Notes:

RINSATE BLANK OBTAINED BY POURING DI WATER THROUGH SS. Bailer.

Type of Sample

- ☒ Low Concentration
- ☐ High Concentration
- ☒ Grab
- ☐ Composite
- ☐ Grab - Composite

Analysis	Preservative		Organic	Inorganic
VOA	HCL	Traffic Report #		
	COOL TO 4°C	Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume	TWO 40ml VIALS	

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

- ☐ Monitoring Well Data
- ☐ Domestic Well Data
- ☒ Other RINSATE BLANK

Page ____ of ____

Case # ____

By FWR

Project Site Name BETHPAGE PHASE II RI Project Site Number 1953

NUS Source No. BP-6-RB2 Source Location N/A

	Purge Data				
Total Well Depth: —	Volume	pH	S.C.	Temp. (°C)	Color & Turbid
Well Casing Size & Depth: —					
Static Water Level: —					
One Casing Volume: —					
Start Purge (hrs.): —					
End Purge (hrs.): —					
Total Purge Time (min.): —					
Total Amount Purged (gal.): —					
Monitor Reading: —					
Purge Method: —					
Sample Method: —					
Depth Sampled: —					

Sample Date & Time:	Sample Data			
12/8/92 0830	pH	S.C.	Temp. (°C)	Color & Turbidity
Sampled By: FWRamser	—	—	—	—

Signature(s): Fred W Ramser

Type of Sample
- ☒ Low Concentration
- ☐ High Concentration
- ☒ Grab
- ☐ Composite
- ☐ Grab - Composite

Observations / Notes:

DI H_2O POURED THROUGH BAILER INTO TWO 40ml VIALS.

Analysis	Preservative		Organic	Inorganic
VOA's	HCL	Traffic Report #		
	COOL TO 4°C	Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume	2x 40ml	

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

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☐ Monitoring Well Data
☐ Domestic Well Data
☒ Other TEMPORARY WELL

Case # _____

By _____

Project Site Name BETHPAGE PHASE II RI Project Site Number 1953
NUS Source No. BP-G-R-03 Source Location SB-03 TEMP. WELL

	Purge Data				
Total Well Depth: 59'					
Well Casing Size & Depth: 2"Ø	Volume	pH	S.C.	Temp. (°C)	Color & Turbidity
Static Water Level: 52.5'					
One Casing Volume: —					
Start Purge (hrs.): 1015					
End Purge (hrs.): 1045					
Total Purge Time (min.): 30 min					
Total Amount Purged (gal.): 5 gal					
Monitor Reading: 0.0 ppm					
Purge Method: BAILER					
Sample Method: "					
Depth Sampled: ~ 52.5-54'					
Sample Date & Time: 12-8-92 1045	**Sample Data**				
	pH	S.C.	Temp. (°C)	Color & Turbidity	
Sampled By: FURAMSER	6.64	360	13.5	BRN HI	
Signature(s): Fred W Ramser	Observations / Notes:				

Type of Sample

☒ Low Concentration
☐ High Concentration
☒ Grab
☐ Composite
☐ Grab - Composite

Analysis	Preservative		Organic	Inorganic
VOA's	HCL	Traffic Report #		
	COOL TO 4°C	Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume	2 x 40 ml	

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

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- ☐ Monitoring Well Data
- ☐ Domestic Well Data
- ☒ Other TEMPORARY WELL

Case # ____

By FWR

Project Site Name BETHPAGE PHASE II RI Project Site Number 1953

NUS Source No. BP-G-R-04 Source Location SB04

	Purge Data				
Total Well Depth: 59'	Volume	pH	S.C.	Temp. (°C)	Color & Turbidity
Well Casing Size & Depth: 2"Ø 59'					
Static Water Level: 51.5'					
One Casing Volume: —					
Start Purge (hrs.): 1325					
End Purge (hrs.): 1355					
Total Purge Time (min.): 30 min					
Total Amount Purged (gal.): 5 gal					
Monitor Reading: 0.0 ppm					
Purge Method: BAILER					
Sample Method: BAILER					
Depth Sampled: ~ 51.5'-59'					

Sample Date & Time:	Sample Data			
12-8-92 1415	pH	S.C.	Temp. (°C)	Color & Turbidity
Sampled By: FWRamser	7.16	220	12.5°	BRN HI

Signature(s): Fred W Ramser

Type of Sample
- ☒ Low Concentration
- ☐ High Concentration
- ☒ Grab
- ☐ Composite
- ☐ Grab - Composite

Observations / Notes:
DUPLICATE; BP-G-R-D1 TAKEN AT THIS LOC.
MATRIX SPIKE; BP-G-R-MS1 TAKEN AT THIS LOC.
MATRIX SPIKE DUP; BP-G-R-MSD1 TAKEN AT THIS LOC.

Analysis	Preservative		Organic	Inorganic
VOA's	HCL	Traffic Report #		
	COOL TO 4°C	Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume	2 x 40ml.	

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

Page ____ of ____

- ☐ Monitoring Well Data
- ☐ Domestic Well Data
- ☒ Other FIELD BLANK

Case # ____

By FWR

Project Site Name BETHPAGE PHASE II RI Project Site Number 1953

NUS Source No. BP-G-R-FB1 Source Location —

	Purge Data				
Total Well Depth: —					
Well Casing Size & Depth: —	Volume	pH	S.C.	Temp. (°C)	Color & Turbidity
Static Water Level: —					
One Casing Volume: —					
Start Purge (hrs.): —					
End Purge (hrs.): —					
Total Purge Time (min.): —					
Total Amount Purged (gal.): —					
Monitor Reading: —					
Purge Method: —					
Sample Method: —					
Depth Sampled: —					

Sample Date & Time:	Sample Data			
12-9-92 0750	pH	S.C.	Temp. (°C)	Color & Turbidity
Sampled By: FWRAMSER	—	—	—	—

Signature(s): Fred W Ramser

Type of Sample
- ☐ Low Concentration
- ☐ High Concentration
- ☐ Grab
- ☐ Composite
- ☐ Grab - Composite

Observations / Notes:
DI H_2O POURED DIRECTLY INTO TWO 40ml VIALS

Analysis	Preservative		Organic	Inorganic
		Traffic Report #		
		Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume		

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

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Case # ____

By FWR

- ☐ Monitoring Well Data
- ☐ Domestic Well Data
- ☒ Other RINSATE BLANK

Project Site Name BETHPAGE PHASE II RI Project Site Number 1953

NUS Source No. BP-6-R-RB3 Source Location N/A

	Purge Data				
Total Well Depth: —	Volume	pH	S.C.	Temp. (°C)	Color & Turbid
Well Casing Size & Depth: —					
Static Water Level: —					
One Casing Volume: —					
Start Purge (hrs.): —					
End Purge (hrs.): —					
Total Purge Time (min.): —					
Total Amount Purged (gal.): —					
Monitor Reading:					
Purge Method: —					
Sample Method: —					
Depth Sampled: —					

Sample Date & Time:	Sample Data			
12/9/92 0755	pH	S.C.	Temp. (°C)	Color & Turb
Sampled By: FWRAMSER				

Signature(s): Fred W. Ramser

Type of Sample
- ☒ Low Concentration
- ☐ High Concentration
- ☒ Grab
- ☐ Composite
- ☐ Grab - Composite

Observations / Notes:

DI H_2O POURED THROUGH BAILER INTO TWO 40 ml VIALS

Analysis	Preservative		Organic	Inorganic
VOA's	HCL	Traffic Report #		
	COOL TO 4°C	Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume	2 x 40 ml	

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

Page ____ of ____

- ☐ Monitoring Well Data
- ☐ Domestic Well Data
- ☒ Other TEMPORARY WELL

Case # ____

By SMR

Project Site Name BETHPAGE PHASE II RI Project Site Number 1953

NUS Source No. BP-G-R-Ø8 Source Location RESIDENTIAL/TEMP SB-Ø8

	Purge Data				
Total Well Depth: 55'					
Well Casing Size & Depth: 2Ø 43'	Volume	pH	S.C.	Temp. (°C)	Color & Turbidity
Static Water Level: 37'					
One Casing Volume: —					
Start Purge (hrs.): 1315					
End Purge (hrs.): 1415					
Total Purge Time (min.): 60					
Total Amount Purged (gal.): 8gal					
Monitor Reading: 0.0ppm					
Purge Method: BAILER					
Sample Method: BAILER					
Depth Sampled: ~ 37-43'					

Sample Date & Time:	Sample Data			
12-9-92 1420	pH	S.C.	Temp. (°C)	Color & Turbidity
Sampled By: FLRAMSER	5.75	110.	13.1	DK BRN HI

Signature(s): Fred Ramser

Type of Sample
- ☒ Low Concentration
- ☐ High Concentration
- ☒ Grab
- ☐ Composite
- ☐ Grab - Composite

Observations / Notes:

ADDED 3 gals TO EMPLACE PVC SCREEN TO DESIRED DEPTH DUE TO RUNNING SANDS.

Analysis	Preservative		Organic	Inorganic
VOA'S	HCL	Traffic Report #		
	COOL TO 4°C	Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume	2 x 40 ml vials	

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

- ☐ Monitoring Well Data
- ☐ Domestic Well Data
- ☒ Other TEMPORARY WELL

Page ____ of ____

Case # ____

By SWR

Project Site Name BETHPAGE PHASE II RI Project Site Number 1953

NUS Source No. BP-G-R-07 Source Location SB07 RESIDENTIAL/BETHPAGE/GW

	Purge Data				
Total Well Depth: 59'	Volume	pH	S.C.	Temp. (°C)	Color & Turbidity
Well Casing Size & Depth: 2"Ø 59'					
Static Water Level: 50.5'					
One Casing Volume: —					
Start Purge (hrs.): 1000					
End Purge (hrs.): 1030					
Total Purge Time (min.): 30					
Total Amount Purged (gal.): 5gal					
Monitor Reading: 0.0 ppm					
Purge Method: Bailer					
Sample Method: "					
Depth Sampled: ~ 50-54					

Sample Date & Time:	Sample Data			
12-9-92 1030	pH	S.C.	Temp. (°C)	Color & Turbidity
Sampled By: FWRAMSER	5.18	220 µmhos/cm	12.2°C	BRN HI

Signature(s): Fred W Ramser

Observations / Notes:

Type of Sample
- ☒ Low Concentration
- ☐ High Concentration
- ☒ Grab
- ☐ Composite
- ☐ Grab - Composite

Analysis	Preservative		Organic	Inorganic
VOAs	HCL	Traffic Report #		
	COOL TO 4°C	Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume		

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

- ☐ Monitoring Well Data
- ☐ Domestic Well Data
- ☒ Other TEMPORARY WELL

Page ____ of ____

Case # ____

By FWR

Project Site Name BETHPAGE RI PHASE II Project Site Number 1953

NUS Source No. BP-G-R-12 Source Location SB12

Total Well Depth: 59	Purge Data				
Well Casing Size & Depth: 2"Ø 59	Volume	pH	S.C.	Temp. (°C)	Color & Turbidity
Static Water Level: 54.5' BGS					
One Casing Volume: —					
Start Purge (hrs.): 1005					
End Purge (hrs.): 1030					
Total Purge Time (min.): 25					
Total Amount Purged (gal.): 5gal					
Monitor Reading: 0.0ppm					
Purge Method: BAILER					
Sample Method: "					
Depth Sampled: 54.5' - 57'					
Sample Date & Time: 12-10-92 1030	Sample Data				
	pH	S.C.	Temp. (°C)	Color & Turbidity	
Sampled By: FWRAMSER	6.03	190	11.8	BRN HI	
Signature(s) Fred Wilfamser	Observations / Notes:				

Type of Sample

- ☒ Low Concentration
- ☐ High Concentration
- ☒ Grab
- ☐ Composite
- ☐ Grab - Composite

Analysis	Preservative		Organic	Inorganic
VOA	HCL	Traffic Report #		
	COOL TO 4°C	Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume	2 x 40ml	

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

- ☐ Monitoring Well Data
- ☐ Domestic Well Data
- ☐ Other RINSATE BLANK

Page ____ of ____

Case # ____

By FUR

Project Site Name BETHPAGE PHASE II RI Project Site Number 1953

NUS Source No. BP-G-R-RB4 Source Location FIELD

	Purge Data				
Total Well Depth: —	Volume	pH	S.C.	Temp. (°C)	Color & Turbid
Well Casing Size & Depth: —					
Static Water Level: —					
One Casing Volume: —					
Start Purge (hrs.): —					
End Purge (hrs.): —					
Total Purge Time (min.): —					
Total Amount Purged (gal.): —					
Monitor Reading: —					
Purge Method: —					
Sample Method: —					
Depth Sampled: —					

Sample Date & Time:	Sample Data			
12-10-92 1100	pH	S.C.	Temp. (°C)	Color & Turl
Sampled By: FURAMSER				

Signature(s): FURAMSER

Type of Sample
- ☒ Low Concentration
- ☐ High Concentration
- ☒ Grab
- ☐ Composite
- ☐ Grab - Composite

Observations / Notes:
DI H_2O POURED THROUGH BAILER INTO TWO 40ml VIALS

Analysis	Preservative		Organic	Inorganic
VOHs	HCL	Traffic Report #		
	COOL TO 4°C	Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume	2x40ml	

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

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☐ Monitoring Well Data
☐ Domestic Well Data
☒ Other TEMPORARY WELL

Case # ____

By FWR

Project Site Name BETHPAGE RI PHASE II Project Site Number 1953
NUS Source No. BP-G-R-13 Source Location SB13

	Purge Data				
Total Well Depth: 59'					
Well Casing Size & Depth: 2"Ø 59'	Volume	pH	S.C.	Temp. (°C)	Color & Turbidity
Static Water Level: 51.5					
One Casing Volume: —					
Start Purge (hrs.): ~~1200~~ 1302 HRS					
End Purge (hrs.): — 1345					
Total Purge Time (min.): 45					
Total Amount Purged (gal.): 8 gal					
Monitor Reading: 0.0 ppm					
Purge Method: BAILER					
Sample Method: "					
Depth Sampled: 52.5 - 59'					

Sample Date & Time:	Sample Data			
12-10-92 1345	pH	S.C.	Temp. (°C)	Color & Turbidity
Sampled By: FWRamser	6.66	160	11.5	

Signature(s): FWRamser

Type of Sample
- ☒ Low Concentration
- ☐ High Concentration
- ☒ Grab
- ☐ Composite
- ☐ Grab - Composite

Observations / Notes:
PURGED AN ADDITIONAL 3 GALS BECAUSE 3 GALS WERE ADDED TO WELL FOR PVC SCREEN EMPLACEMENT TO DESIRED DEPTH (59')

Analysis	Preservative		Organic	Inorganic
VOAs	HCL	Traffic Report #		
	ICE - TO 4°C	Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume	2 x 40 ml	

HALLIBURTON NUS Environmental Corporation and Subsidiaries	STANDARD CALCULATION SHEET

CLIENT: USN	FILE NO.: 1953	BY: EJR 3-23-93	PAGE 1 OF 1
SUBJECT: BETHPAGE - ROUND 2 GW SAMPLES		CHECKED BY:	DATE:

GW SAMPLING: 03-11-93 TO 03-19-93

WELLS:

HN24S
HN24I (MS/MSD)
HN24I1
HN24I2
HN27S → NOT SAMPLED = DRY
HN27I1
HN28S → NOT SAMPLED = DRY
HN28I
HN29S
HN29I (+ DUPLICATE #1)
HN29D
HN40S
HN40I (+ DUPLICATE #2)
HN41S
HN41I
HN42S
HN42I
USGS WELL

QA/QC

TRIPBLANKS:		RINSATE BLANKS:	
	3-11-93	1	ANALYZE
	3-12-93	2	HOLD
	3-16-93	3	ANALYZE
	3-17-93	4	HOLD
	3-18-93	5	ANALYZE
	3-19-93	6	HOLD

FIELD BLANK 1

DUPLICATE 1 (HN29I)
DUPLICATE 2 (HN40I)
MS/MSD (HN24I)

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

- [x] Monitoring Well Data
- [ ] Domestic Well Data
- [ ] Other _____

Page ____ of ____

Case # _____

By ER

Project Site Name BETH PAGE Project Site Number 1953

NUS Source No. BP-G-24S-Ø2 Source Location HN24S

Total Well Depth: 58.2' TPVC	Purge Data					
Well Casing Size & Depth:	Volume	pH	S.C.	Temp. (°C)	Color & Turbidity	
4" PVC 58.2'	0	7.04	220	7.0	TAN	Hi
Static Water Level: 53.43' TPVC	1	?	215	6.6	TAN	Hi
One Casing Volume: 3gal / 12 l						
Start Purge (hrs.): 1555						
End Purge (hrs.): 1623						
Total Purge Time (min.): 28 MIN						
Total Amount Purged (gal.): 22 l						
Monitor Reading: —						
Purge Method: SS BAILER						
Sample Method: SS BAILER						
Depth Sampled: 54.11' TPVC						
Sample Date & Time:	Sample Data					
03-11-93 1640	pH	S.C.	Temp. (°C)	Color & Turbidity		
Sampled By: ER	?	215	6.6 (?)	TAN	Hi	

Signature(s): E Goodman

Type of Sample
- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Observations / Notes:

CHEMICAL ODOR - STRONG

pH METER FROZE.

purged dry at 22 l

Analysis	Preservative		Organic	Inorganic
TCL VOA	4° + HCl	Traffic Report #		
		Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume		

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

Page ____ of ____

- [x] Monitoring Well Data
- [ ] Domestic Well Data
- [ ] Other ____

Case # ____

By ER

Project Site Name BETHPAGE Project Site Number 1953

NUS Source No. BP-G-24I-Ø2 Source Location HN24I

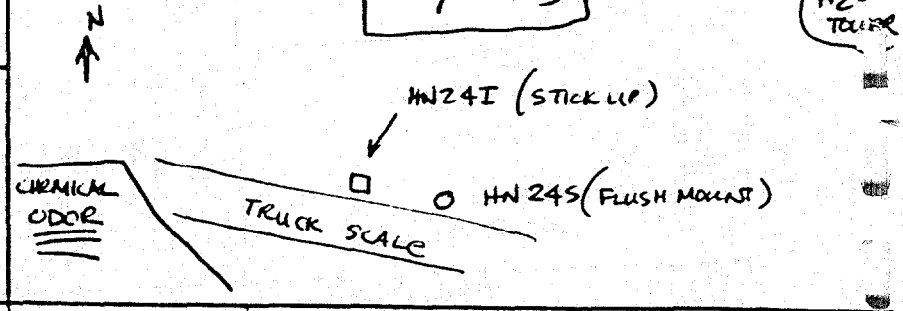
	Purge Data				
Total Well Depth: ~ 160					
Well Casing Size & Depth: 4" PVC	Volume	pH	S.C.	Temp. (°C)	Color & Turbidit
	0	11.40	1000	11.2	CLEAR LOW
Static Water Level: 57.24 TOC	1	10.61	400	11.7	TAN MED/HI
One Casing Volume: ~ 70 gal	2	8.34	275	11.0	LT TAN MED/LOW
Start Purge (hrs.): 1400	3 *	7.75	260	11.1	" LOW
End Purge (hrs.):					
Total Purge Time (min.):					
Total Amount Purged (gal.):					
Monitor Reading: —					
Purge Method: SUBMERS PUMP ~~BAILER~~					
Sample Method: SS BAILER					
Depth Sampled: 59'					

Sample Date & Time: 03-16-93 1445	Sample Data			
	pH	S.C.	Temp. (°C)	Color & Turbi
Sampled By: ER	7.75*	260	11.1	LT TAN LOW

Signature(s): Elizabeth Nolan

Type of Sample
- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Observations / Notes: MS/MSD



	Analysis	Preservative		Organic	Inorganic
1)	TCL VOA	4°C + HCl	Traffic Report #		
			Tag #		
2)	TCL VOA	4°C FOR			
		FAST	AB #		
		TURN AROUND	Date Shipped		
			Time Shipped		
			Lab		
			Volume		

* PH SUSPECT; METER NOT STABALIZING, AND TEMP FALLING — ONE MAY/IS CAUSING THE OTHER.

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

Page ____ of ____

- [x] Monitoring Well Data
- [ ] Domestic Well Data
- [ ] Other ____

Case # ____

By ER

Project Site Name BETHPAGE Project Site Number 1953

NUS Source No. BP-G-24I1-02 Source Location HN24I1

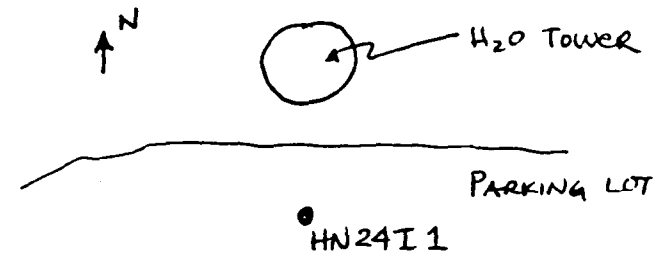
107.21'

Total Well Depth: 159' bgs	**Purge Data**				
Well Casing Size & Depth: 4" PVC 159'	Volume	pH	S.C.	Temp. (°C)	Color & Turbidity
	0	10.69	365	11.5	CLEAR LOW
Static Water Level: 51.79'	1	8.26	145	12.0	TAN MED/LOW
One Casing Volume: 70 gal	2	7.97	120	11.9	CLEAR LOW
Start Purge (hrs.): 0920	3	7.63	125	11.9	" "
End Purge (hrs.): 0938					
Total Purge Time (min.): 18					
Total Amount Purged (gal.): 210 gal					
Monitor Reading: —					
Purge Method: SUBMERS. PUMP					
Sample Method: SS BAILER					
Depth Sampled: 51.80					
Sample Date & Time: 3-16-93 1000	**Sample Data**				
	pH	S.C.	Temp. (°C)	Color & Turbidity	
Sampled By: ER	7.63	125	11.9	CLEAR LOW	

Signature(s)

Type of Sample
- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Observations / Notes:



	Analysis	Preservative		Organic	Inorganic
1)	TCL VOA	HCl + 4°C	Traffic Report #		
			Tag #		
2)	TCL VOA	4°C FAST			
		TURN	AB #		
		AROUND	Date Shipped		
			Time Shipped		
			Lab		
			Volume		

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

- [x] Monitoring Well Data
- [ ] Domestic Well Data
- [ ] Other _____

Page ____ of ____

Case # _____

By ER

Project Site Name BETH PAGE Project Site Number 1953

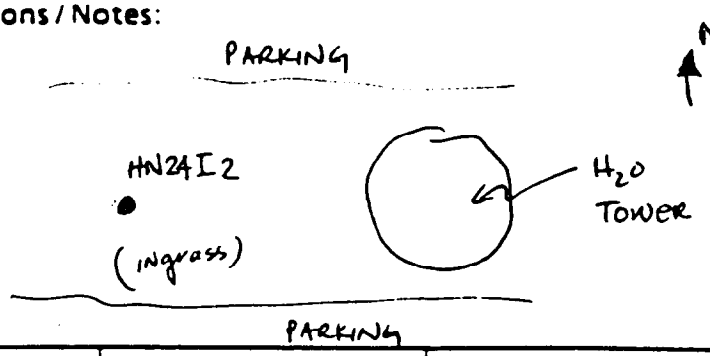
NUS Source No. BP-G-24I2-Ø2 Source Location HN 24 I 2

Total Well Depth: 160' BGS	Purge Data					
Well Casing Size & Depth: 4" PVC 160'	Volume	pH	S.C.	Temp. (°C)	Color & Turbidity	
	0	10.03	355	10.4	CLEAR	LOW
105.76 Static Water Level: 54.24	1	8.78	225	10.5	STLY CLOUDY	LOW
One Casing Volume: 69 gal	2	8.03	220	10.4	CLEAR	LOW
Start Purge (hrs.): 1135	3	7.96	220	10.4	"	"
End Purge (hrs.): 1156						
Total Purge Time (min.): 21 MIN						
Total Amount Purged (gal.): 210 gal						
Monitor Reading: —						
Purge Method: SUBM. PUMP						
Sample Method: SS BAILER						
Depth Sampled: 54.50						
Sample Date & Time: 05-16-93 1230	Sample Data					
	pH	S.C.	Temp. (°C)	Color & Turbi		
Sampled By: ER	7.96	220	10.4	CLEAR	LOW	

Signature(s): [signature]

Type of Sample
- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Observations / Notes:



Analysis	Preservative		Organic	Inorganic
1) TCL VOA	4°C + HCL	Traffic Report #		
		Tag #		
2) TCL VOA	4°C FOR			
	FAST	AB #		
	TURN AROUND	Date Shipped		
		Time Shipped		
		Lab		
		Volume		

SAMPLE LOG SHEET

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HALLIBURTON NUS
Environmental Corporation

☒ Monitoring Well Data
☐ Domestic Well Data
☐ Other _____

Case # _____

By ER

Project Site Name: Bethpage

Project Site Number: 1953

HALLIBURTON NUS Source No.: BP-G-27S-02

Source Location: HN 27S

Total Well Depth:	Purge Data				
Well Casing Size and Depth:	Volume	pH	S.C.	Temp. (°C)	Color & Turbidity
Static Water Level:					
One Casing Volume:					
Start Purge (hrs.):					
End Purge (hrs.):					
Total Purge Time (min.):					
Total Amount Purged (gal.):					
Monitor Reading:					
Purge Method:					
Sample Method:					
Depth Sampled:					

Sample Date and Time:	Sample Data			
03-11-93	pH	S.C.	Temp. (°C)	Color & Turbidity
Sampled By:				

Signature(s):

Observations/Notes:

WELL DRY!

Type of Sample
- ☐ Low Concentration
- ☐ High Concentration
- ☐ Grab
- ☐ Composite
- ☐ Grab - Composite

Analysis	Preservative		Organic	Inorganic
		Traffic Report #		
		Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume		

SAMPLE LOG SHEET

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HALLIBURTON NUS
Environmental Corporation

☒ Monitoring Well Data
☐ Domestic Well Data
☐ Other _____

Case # _____

By ER

Project Site Name: BETHPAGE

Project Site Number: 1953

HALLIBURTON NUS Source No.: BP-G-27I1-02

Source Location: HN 27 I1

55.13'

Total Well Depth: 111' TPVC	Purge Data				
Well Casing Size and Depth: 4" PVC	Volume	pH	S.C.	Temp. (°C)	Color & Turbidity
	I	9.50	165	7.0	LT TAN MED-LOW
Static Water Level: 55.87' TOC	1	9.69	150	6.9	" "
One Casing Volume: 36 gal	2	9.68	145	8.9	" "
Start Purge (hrs.): 1000	3	9.66	155	9.2	" "
End Purge (hrs.): 1114					
Total Purge Time (min.): 1hr 14 min					
Total Amount Purged (gal.): 120 gal					
Monitor Reading: —					
Purge Method: 2" sub pump					
Sample Method: SS BAILER					
Depth Sampled: 56'					

Sample Date and Time:	Sample Data			
03-19-93 1130	pH	S.C.	Temp. (°C)	Color & Turbidity
Sampled By: ER	9.66	155	9.2	LT TAN MED/LOW

Signature(s): [signature]

Type of Sample
- ☒ Low Concentration
- ☐ High Concentration
- ☒ Grab
- ☐ Composite
- ☐ Grab - Composite

Observations/Notes:
* 4" WELL OBSTRUCTED - USE 2" PUMP (BOLTS IN RISER)

Analysis	Preservative		Organic	Inorganic
TCL VOA	4° HCl	Traffic Report #		
		Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume		

SAMPLE LOG SHEET

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HALLIBURTON NUS
Environmental Corporation

☒ Monitoring Well Data
☐ Domestic Well Data
☐ Other _____

Case # _____

By ER

Project Site Name BETHPAGE

Project Site Number 1953

HALLIBURTON NUS Source No. BP-G-28S-Ø2

Source Location HN28S

Total Well Depth:	Purge Data				
Well Casing Size and Depth:	Volume	pH	S.C.	Temp. (°C)	Color & Turbidity
Static Water Level:					
One Casing Volume:					
Start Purge (hrs.):					
End Purge (hrs.):					
Total Purge Time (min.):					
Total Amount Purged (gal.):					
Monitor Reading:					
Purge Method:					
Sample Method:					
Depth Sampled:					

Sample Date and Time: 03-11-93	Sample Data			
	pH	S.C.	Temp. (°C)	Color & Turbidity
Sampled By:				

Signature(s):

Observations/Notes:

WELL DRY!

Type of Sample
- ☐ Low Concentration
- ☐ High Concentration
- ☐ Grab
- ☐ Composite
- ☐ Grab - Composite

Analysis	Preservative		Organic	Inorganic
		Traffic Report #		
		Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume		

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

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- [x] Monitoring Well Data
- [ ] Domestic Well Data
- [ ] Other ____

Case # ____

By ER

Project Site Name: BETH PAGE
Project Site Number: 1953
NUS Source No.: BP-G-28I-02
Source Location: HN28I

Total Well Depth:	141.5 TOC
Well Casing Size & Depth:	4" PVC 141.5
Static Water Level:	87.75 TOC
One Casing Volume:	57.5 gal
Start Purge (hrs.):	1040
End Purge (hrs.):	1200
Total Purge Time (min.):	1 hr 20 min
Total Amount Purged (gal.):	~135
Monitor Reading:	—
Purge Method:	SUBM. PUMP
Sample Method:	SS BAILER
Depth Sampled:	~~ER~~ 61' TOC
Sample Date & Time:	03-11-93 1225
Sampled By:	ER
Signature(s)	E Rodman

Purge Data

Volume	pH	S.C.	Temp. (°C)	Color & Turbidity	
0	11.45	580	9.7	CLEAR	LOW
1	11.28	420	10.6	STLY CLOUDY	LOW
2	10.10	210	9.9	LT. TAN	MED
3	—	—	—	—	

Sample Data

pH	S.C.	Temp. (°C)	Color & Turbidity	
9.28	200	10.6	LT TAN	MED-LOW

Observations / Notes:

purged DRY TWICE

Type of Sample
- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Analysis	Preservative		Organic	Inorganic
TCL VOA	4°C + HCl	Traffic Report #		
		Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume		

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

- [x] Monitoring Well Data
- [ ] Domestic Well Data
- [ ] Other _____

Page ____ of ____

Case # _____

By ER

Project Site Name BETHPAGE Project Site Number 1953

NUS Source No. BP-G-295-Ø2 Source Location HN 295

Total Well Depth: 50.20 TPVC	Purge Data					
Well Casing Size & Depth:	Volume	pH	S.C.	Temp. (°C)	Color & Turbidity	
4" PVC 50.20	0	7.20	540	6.8	TAN	V. HI
Static Water Level: 49.49	1	7.60	600	7.6	↓	↓
One Casing Volume: 2 ℓ	2	7.98	620	7.9	↓	↓
Start Purge (hrs.): 1135	3	7.98	640	7.7	↓	↓
End Purge (hrs.): 1155						
Total Purge Time (min.): 20 MIN						
Total Amount Purged (gal.): 6 ℓ						
Monitor Reading: —						
Purge Method: SS BAILER						
Sample Method: SS BAILER						
Depth Sampled: 50'						
Sample Date & Time:	Sample Data					
12ER 03-12-93 1205	pH	S.C.	Temp. (°C)	Color & Turbidity		
Sampled By: ER	7.98	640	7.7	TAN	V. HIGH	

Signature(s): E Rudman

Type of Sample
- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Observations / Notes:

VERY SILTY

Analysis	Preservative		Organic	Inorganic
TCL VOA	4° HCl	Traffic Report #		
		Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume		

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

Page ____ of ____

- [x] Monitoring Well Data
- [ ] Domestic Well Data
- [ ] Other ____

Case # ____

By ER

Project Site Name BETHPAGE Project Site Number 1953

NUS Source No. BP-6-29I -02 Source Location HN29I

Total Well Depth: 133 TPVC	
Well Casing Size & Depth: 4" PVC 133 TPVC	
Static Water Level: 47.49	
One Casing Volume: ~ ~~122.8~~ 56 gal	
Start Purge (hrs.): 1225	
End Purge (hrs.): 1445	
Total Purge Time (min.): 2 hrs 20 min	
Total Amount Purged (gal.): ~252 gal	
Monitor Reading: —	
Purge Method: SUBMERS PUMP	
Sample Method: SS BAILER	
Depth Sampled: 49'	
Sample Date & Time: 03-12-93 1455	
Sampled By: ER	
Signature(s) ERodman	

Purge Data

Volume	pH	S.C.	Temp. (°C)	Color & Turbidit	
0	11.70	1200	11.0	CLEAR	LOW
1	11.92	1400	9.6	LT TAN	V. LOW
2	10.70	260	8.7	CLEAR TO SLTY CLOU	
3	10.08	255	10.8		
4	10.14	220	10.6		
4.5	10.17	210	10.8		

Sample Data

pH	S.C.	Temp. (°C)	Color & Turbi
10.17	210	10.8	CLEAR TO STLY CLOUD

Observations / Notes:

NO DRAWDOWN

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Analysis	Preservative		Organic	Inorganic
TCL VOA	4° HCl	Traffic Report #		
		Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume		

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

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- [x] Monitoring Well Data
- [ ] Domestic Well Data
- [ ] Other ____

Case # ____

By ER

Project Site Name BETHPAGE Project Site Number 1953

NUS Source No. BP-G-DUP1-02 Source Location HN29I

Total Well Depth:	Purge Data				
Well Casing Size & Depth:	Volume	pH	S.C.	Temp. (°C)	Color & Turbidity
Static Water Level:					
One Casing Volume:					
Start Purge (hrs.):					
End Purge (hrs.):					
Total Purge Time (min.):					
Total Amount Purged (gal.):					
Monitor Reading:					
Purge Method:					
Sample Method:					
Depth Sampled:					

Sample Date & Time:	Sample Data			
	pH	S.C.	Temp. (°C)	Color & Turbidity
Sampled By:				

Signature(s)

Type of Sample
- [ ] Low Concentration
- [ ] High Concentration
- [ ] Grab
- [ ] Composite
- [ ] Grab - Composite

Observations / Notes:

DUPLICATE SAMPLE OF

(HN29I)

BP-G-29I-02

Analysis	Preservative		Organic	Inorganic
		Traffic Report #		
		Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume		

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

☒ Monitoring Well Data
☐ Domestic Well Data
☐ Other _____

Page ____ of ____
Case # _____
By ER

Project Site Name BETH PAGE
Project Site Number 1953
NUS Source No. BP-G-29D-Ø2
Source Location HN29D

Total Well Depth: 221' TPVC	**Purge Data**				
Well Casing Size & Depth: 4" PVC 221	Volume	pH	S.C.	Temp. (°C)	Color & Turbidity
	0	7.61	160	10.1	CLEAR LOW
Static Water Level: 47.88' TPVC	1	7.15	140	10.5	↓ ↓
One Casing Volume: 113 GAL	2	6.50	130	9.2	
Start Purge (hrs.): 0926	3	6.50	130	10.1	
End Purge (hrs.): 1124					
Total Purge Time (min.): 1 hr 58 min					
Total Amount Purged (gal.): ~340 gal					
Monitor Reading: —					
Purge Method: SUBM. PUMP					
Sample Method: SS BAILER					
Depth Sampled: ~ 48'					
Sample Date & Time: 03-12-93 1215	**Sample Data**				
	pH	S.C.	Temp. (°C)	Color & Turbid	
Sampled By: ER	6.50	130	10.1	CLEAR LOW	
Signature(s): E Rudman	Observations / Notes: NO DRAWDOWN				

Type of Sample
- ☒ Low Concentration
- ☐ High Concentration
- ☒ Grab
- ☐ Composite
- ☐ Grab - Composite

Analysis	Preservative		Organic	Inorganic
TCL VOA	4° + HCl	Traffic Report #		
		Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume		

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

- [x] Monitoring Well Data
- [ ] Domestic Well Data
- [ ] Other _____

Page ____ of ____

Case # _____

By ER

Project Site Name BETHPAGE Project Site Number 053

NUS Source No. BP-G-40S-02 Source Location HN40S

Total Well Depth: 59' TOC	Purge Data					
Well Casing Size & Depth: 4" PVC 59'	Volume	pH	S.C.	Temp. (°C)	Color & Turbidity	
	I	5.0	425	8.0	TAN	Hi
8.50' Static Water Level: 50.50'	1	5.25	385	8.2	"	"
One Casing Volume: 6 gal	2	4.93	250	8.1	"	"
Start Purge (hrs.): 1505	3	?	?	?	"	"
End Purge (hrs.): 1610						
Total Purge Time (min.): 1hr 5min						
Total Amount Purged (gal.): 18gal						
Monitor Reading: —						
Purge Method: SS bailer						
Sample Method: SS bailer						
Depth Sampled: 51'						
Sample Date & Time: 03-17-93 1620	Sample Data					
	pH	S.C.	Temp. (°C)	Color & Turbidity		
Sampled By: MM	—	—	—	—		

Signature(s)

Observations / Notes:

Meters got wet - went down. Purged 3 full volumes.

(144 7th Street)

Type of Sample
- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Analysis	Preservative		Organic	Inorganic
TCL VOA	4°C + HCl	Traffic Report #		
		Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume		

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

- [x] Monitoring Well Data
- [ ] Domestic Well Data
- [ ] Other _____

Page ____ of ____

Case # _____

By ER

Project Site Name: BETH PAGE Project Site Number: 1953

NUS Source No.: BP-G-40I-Ø2 Source Location: HN40I

Total Well Depth: 118' TOC	Purge Data					
Well Casing Size & Depth: 4" PVC 118	Volume	pH	S.C.	Temp. (°C)	Color & Turbidity	
	0	7.48	200	9.4	clear	
Static Water Level: 50.00	1	8.40	230	10.8	brn	Hi
One Casing Volume: ~~[illegible]~~ 45gal	2	8.77	140	11.3	"	"
Start Purge (hrs.): ~~[illegible]~~ 1340	3	8.40	140	11.3	grey	"
End Purge (hrs.): ~~[illegible]~~ 1455	4	8.35	140	11.3	grey	"
Total Purge Time (min.): ~~[illegible]~~ 75 min						
Total Amount Purged (gal.): ~~[illegible]~~						
Monitor Reading: ~~[illegible]~~ 180gal						
Purge Method: Submers. Pump						
Sample Method: SS bailer						
Depth Sampled: 51'						
Sample Date & Time: 03-17-93 1610	Sample Data					
	pH	S.C.	Temp. (°C)	Color & Turbi		
Sampled By: MM	8.35	140	11.3	grey	high	
Signature(s)	Observations / Notes:					

Type of Sample
- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

(144 7th st)

Analysis	Preservative		Organic	Inorganic
TCL VOA	4° HCL	Traffic Report #		
		Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume		

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

- [x] Monitoring Well Data
- [ ] Domestic Well Data
- [ ] Other _____

Page ____ of ____

Case # _____

By ER

Project Site Name BETHPAGE Project Site Number 1953

NUS Source No. BP-G-DUP2-Ø2 Source Location HN40I

	Purge Data				
Total Well Depth: 118					
Well Casing Size & Depth: 4" PVC 118	Volume	pH	S.C.	Temp. (°C)	Color & Turbidity
Static Water Level: 50.00					
One Casing Volume: 45 gal					
Start Purge (hrs.): 1340					
End Purge (hrs.): 1455					
Total Purge Time (min.): 1hr 15 min					
Total Amount Purged (gal.): 180					
Monitor Reading: —					
Purge Method: Submers Pump					
Sample Method: SS bailer					
Depth Sampled: 51'					

Sample Date & Time:	Sample Data			
03-17-93 1610	pH	S.C.	Temp. (°C)	Color & Turbidity
Sampled By: MM	8.35	140	11.3	grey high

Signature(s)

Observations / Notes:

Duplicate of BP-G-40I-Ø2

Type of Sample
- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Analysis	Preservative		Organic	Inorganic
TCL VOA	4°C HCL	Traffic Report #		
		Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume		

SAMPLE LOG SHEET

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HALLIBURTON NUS
Environmental Corporation

☒ Monitoring Well Data
☐ Domestic Well Data
☐ Other _____

Case # _____

By _____

Project Site Name: BETH PAGE

Project Site Number: 1953

HALLIBURTON NUS Source No.: BP-6-41 I-02

Source Location: HN 41 I

Total Well Depth: 55	Purge Data					
Well Casing Size and Depth: 4" - 55'	Volume	pH	S.C.	Temp. (°C)	Color & Turbidity	
	Initial	5.20	300	11.5	brown / V turbid	
Static Water Level: 41.10	1st	5.13	280	11.5	brown / V cloudy	
One Casing Volume: 10 GAL	2nd	5.09	260	11.6	brown / cloudy	
Start Purge (hrs.): 1005	3rd	5.03	260	11.4	Lt brown / cloudy	
End Purge (hrs.): 1010						
Total Purge Time (min.): 5						
Total Amount Purged (gal.): 40						
Monitor Reading: —						
Purge Method: SUB PUMP						
Sample Method: BAILER						
Depth Sampled: 50'						

Sample Date and Time: 3-12-93 1050	Sample Data			
	pH	S.C.	Temp. (°C)	Color & Turbidity
Sampled By: M. MENDEL, P. DAVIS	5.03	260	11.4	Lt brn / cloudy

Signature(s):

Observations/Notes: (72 3rd St)

Type of Sample
- ☒ Low Concentration
- ☐ High Concentration
- ☒ Grab
- ☐ Composite
- ☐ Grab - Composite

Analysis	Preservative		Organic	Inorganic
VOA	HCL 4°	Traffic Report #		
		Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume		

SAMPLE LOG SHEET

Page ____ of ____

HALLIBURTON NUS
Environmental Corporation

☒ Monitoring Well Data
☐ Domestic Well Data
☐ Other _____

Case # _____

By _____

Project Site Name: BETH PAGE

Project Site Number: 1953

HALLIBURTON NUS Source No.: BP-6-41I-02

Source Location: HN-41I

Total Well Depth: 113'	Purge Data				
Well Casing Size and Depth: 4" - 11.3'	Volume	pH	S.C.	Temp. (°C)	Color & Turbidity
	INITIAL	7.33	460	9.3	BROWN / CLOUDY
Static Water Level: 41.15	1	7.10	380	9.5	LT BROWN / CLOUDY
One Casing Volume: 47 GAL	2	6.20	300	10.8	CLEAR / LOW
Start Purge (hrs.): 0915	3	5.41	300	10.7	CLEAR / LOW
End Purge (hrs.): 0955					
Total Purge Time (min.): 35					
Total Amount Purged (gal.): 160					
Monitor Reading: —					
Purge Method: SUB PUMP					
Sample Method: BAILER					
Depth Sampled: 50					

Sample Date and Time: 3-12-93 1045	Sample Data			
	pH	S.C.	Temp. (°C)	Color & Turbidity
Sampled By: M MENDEL, P DAVIS	5.41	300	10.7	clear / low

Signature(s):

Observations/Notes: (72 3rd st)

Type of Sample
- ☒ Low Concentration
- ☐ High Concentration
- ☒ Grab
- ☐ Composite
- ☐ Grab - Composite

Analysis	Preservative		Organic	Inorganic
VOA	HCL 4°C	Traffic Report #		
		Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume		

SAMPLE LOG SHEET

Page ____ of ____

HALLIBURTON NUS
Environmental Corporation

- [x] Monitoring Well Data
- [ ] Domestic Well Data
- [ ] Other _____

Case # _____

By _____

Project Site Name: BETH PAGE

Project Site Number: 1953

HALLIBURTON NUS Source No.: BP-6-[redacted]-02 (427)

Source Location: HN 425

Total Well Depth: 60 [redacted]'	Purge Data				
Well Casing Size and Depth: 60, 4" [redacted]'	Volume	pH	S.C.	Temp. (°C)	Color & Turbidity
	INITIAL	6.81	180	8.3	BROWN / V TURBID
Static Water Level: 52.04	1	6.33	200	8.1	BROWN / V. TURBID
One Casing Volume: [redacted] 5 gal	2				
Start Purge (hrs.): 1000	3				
End Purge (hrs.): 1010	4	6.10	210	9.9	BROWN / TURBID
Total Purge Time (min.): 10	5	5.90	220	10.0	CLOUDY / SLIGHTLY TURBID
Total Amount Purged (gal.): 50					
Monitor Reading:					
Purge Method: SUB PUMP					
Sample Method: BAILER					
Depth Sampled: 55'					

Sample Date and Time:	Sample Data			
3-17-93 1030	pH	S.C.	Temp. (°C)	Color & Turbidity
Sampled By: M MENDEL, P DAVIS	5.90	220	10.0	CLOUDY SLIGHTLY TURBID

Signature(s):

Observations/Notes:

(~~[illegible]~~ OR) (Maple + 7th St)

Type of Sample
- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Analysis	Preservative		Organic	Inorganic
VOA	HCL 4°C	Traffic Report #		
		Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume		

SAMPLE LOG SHEET

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HALLIBURTON NUS
Environmental Corporation

☒ Monitoring Well Data
☐ Domestic Well Data
☐ Other _____

Case # _____

By _____

Project Site Name: BETH PAGE

Project Site Number: 1953

HALLIBURTON NUS Source No.: BP-6-[redacted]42I-02

Source Location: HN42I

Total Well Depth: [redacted] 110'	
Well Casing Size and Depth: 4" [redacted] 110'	
Static Water Level: 51.49	
One Casing Volume: 39 [redacted] GAL.	
Start Purge (hrs.): 0920	
End Purge (hrs.): 0945	
Total Purge Time (min.): 25	
Total Amount Purged (gal.): 140	
Monitor Reading: —	
Purge Method: Sub. Pump	
Sample Method: BAILER	
Depth Sampled: 60'	
Sample Date and Time: 3-17-93 1040	
Sampled By: M MENGEL, P DAVIS	
Signature(s):	

Purge Data

Volume	pH	S.C.	Temp. (°C)	Color & Turbidity
INITIAL	11.85	1000	10.1	brown / cloudy
1	11.02	360	10.1	brown / v. silty
2	9.50	180	9.9	grey / cloudy
3	8.25	170	10.0	clear

Sample Data

pH	S.C.	Temp. (°C)	Color & Turbidity
8.25	170	10.0	clear

Type of Sample
- ☒ Low Concentration
- ☐ High Concentration
- ☒ Grab
- ☐ Composite
- ☐ Grab - Composite

Observations/Notes:

(Maple + 7th st)

Analysis	Preservative		Organic	Inorganic
VOA	HCL + 4°C	Traffic Report #		
		Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume		

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

- [x] Monitoring Well Data
- [ ] Domestic Well Data
- [ ] Other _____

Page 1 of 1

Case # _____

By _____

Project Site Name: BETHPAGE Project Site Number: 1953

NUS Source No.: HN 43 I Source Location: _____

Total Well Depth: 153'	Purge Data					
Well Casing Size & Depth: 4" 153'	Volume	pH	S.C.	Temp. (°C)	Color & Turbidity	
	INITIAL	11.29	680	22.5		
Static Water Level: 58.00	1ST	9.53	160	19.0		
One Casing Volume: 61.1 GAL	2nd	8.90	120	18.5		
Start Purge (hrs.): 1300	3rd	8.60	80	18.0		
End Purge (hrs.): 1500	end	8.70	80	18.0		
Total Purge Time (min.): 120						
Total Amount Purged (gal.): 185						
Monitor Reading: HNU - NONE						
Purge Method: submersible pump						
Sample Method: SS bailer						
Depth Sampled: 70'						
Sample Date & Time: 5/26/93 1510	Sample Data					
	pH	S.C.	Temp. (°C)	Color & Turbidity		
Sampled By: Kevin Kilmartin, Mark Mengel	11.00	400	17.5	clear		
Signature(s): Mark L. Mengel	Observations / Notes:					

Type of Sample
- [x] Low Concentration
- [ ] High Concentration
- [ ] Grab
- [ ] Composite
- [ ] Grab - Composite

Analysis	Preservative		Organic	Inorganic
VOA's		Traffic Report #		
		Tag #		
		AB #		
		Date Shipped	5/26/93	
		Time Shipped		
		Lab	PACE	
		Volume		

SAMPLE LOG SHEET

Page ____ of ____

HALLIBURTON NUS
Environmental Corporation

☒ Monitoring Well Data
☐ Domestic Well Data
☐ Other ____

Case # ____

By MM

Project Site Name: BETH PAGE

Project Site Number: 1953

HALLIBURTON NUS Source No.: BP-6-USGS-02

Source Location: USGS well

Total Well Depth: 66'	
Well Casing Size and Depth: 2" 66'	
Static Water Level: 45.00	
One Casing Volume: 4	
Start Purge (hrs.): 1355	
End Purge (hrs.): 1430	
Total Purge Time (min.): 35	
Total Amount Purged (gal.): 15	
Monitor Reading: —	
Purge Method: SS BAILER	
Sample Method: SS BAILER	
Depth Sampled: 40'	

Purge Data

Volume	pH	S.C.	Temp. (°C)	Color & Turbidity
INITIAL	8.05	60	13.1	BLACK / V HIGH
1	7.33	60	4.7	BLACK / V. HIGH
2	6.75	1000	10.5	BLACK / V HIGH
3	6.60	1600	10.0	BLACK / V. HIGH

Sample Date and Time: 3-12-93 1435

Sampled By: M. MENDEL, P. DAVIS

Sample Data

pH	S.C.	Temp. (°C)	Color & Turbidity
6.60	1600	10.0	BLACK V. HIGH

Signature(s):

Type of Sample
- ☒ Low Concentration
- ☐ High Concentration
- ☒ Grab
- ☐ Composite
- ☐ Grab - Composite

Observations/Notes:

(ON 11th st)

Full of organics

TD should be ~ 73' —

well acts like a storm sewer.

Analysis	Preservative		Organic	Inorganic
VOA	HCL + 4°	Traffic Report #		
		Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume		

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

- ☐ Monitoring Well Data
- ☐ Domestic Well Data
- ☒ Other TRIP BLANK

Page ____ of ____

Case # ____

By ER

Project Site Name BETH PAGE Project Site Number 1953

NUS Source No. TRIP BLANK 03-11-93 Source Location FROM LAB

		Purge Data				
Total Well Depth: NA						
Well Casing Size & Depth:		Volume	pH	S.C.	Temp. (°C)	Color & Turbidit
Static Water Level:						
One Casing Volume:						
Start Purge (hrs.):						
End Purge (hrs.):						
Total Purge Time (min.):						
Total Amount Purged (gal.):						
Monitor Reading:						
Purge Method:						
Sample Method:						
Depth Sampled:						
Sample Date & Time: 03-11-93 FROM LAB		Sample Data				
		pH	S.C.	Temp. (°C)	Color & Turbi	
Sampled By: ER						

Signature(s): E Gladman

Observations / Notes:

TRIP BLANK

03-11-93

Type of Sample

- ☒ Low Concentration
- ☐ High Concentration
- ☒ Grab
- ☐ Composite
- ☐ Grab - Composite

Analysis	Preservative		Organic	Inorganic
TCL VOA	4°C + HCl	Traffic Report #		
		Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume		

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

- ☐ Monitoring Well Data
- ☐ Domestic Well Data
- ☒ Other TRIP BLANK

Page _____ of _____

Case # _____

By ER

Project Site Name BETH PAGE Project Site Number 1953

NUS Source No. TRIP BLANK 03-12-93 Source Location FROM LAB

		Purge Data				
Total Well Depth:	NA	Volume	pH	S.C.	Temp. (°C)	Color & Turbidity
Well Casing Size & Depth:						
Static Water Level:						
One Casing Volume:						
Start Purge (hrs.):						
End Purge (hrs.):						
Total Purge Time (min.):						
Total Amount Purged (gal.):						
Monitor Reading:						
Purge Method:						
Sample Method:						
Depth Sampled:						

Sample Date & Time:	Sample Data			
03-12-93 FROM LAB	pH	S.C.	Temp. (°C)	Color & Turbidity
Sampled By: ER				

Signature(s): E Fraser

Type of Sample
- ☒ Low Concentration
- ☐ High Concentration
- ☒ Grab
- ☐ Composite
- ☐ Grab - Composite

Observations / Notes:

TRIP BLANK

03-12-93

Analysis	Preservative		Organic	Inorganic
TCL VOA	4°C + HCl	Traffic Report #		
		Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume		

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

- ☐ Monitoring Well Data
- ☐ Domestic Well Data
- ☒ Other TRIP BLANK

Page ____ of ____

Case # ____

By ER

Project Site Name BETH PAGE Project Site Number 1953

NUS Source No. TRIP BLANK 03-16-93 Source Location FROM LAB

Total Well Depth: NA	Purge Data					
Well Casing Size & Depth:	Volume	pH	S.C.	Temp. (°C)	Color & Turbidit	
Static Water Level:						
One Casing Volume:						
Start Purge (hrs.):						
End Purge (hrs.):						
Total Purge Time (min.):						
Total Amount Purged (gal.):						
Monitor Reading:						
Purge Method:						
Sample Method:						
Depth Sampled:						
Sample Date & Time: 03-16-93 FROM LAB	Sample Data					
	pH	S.C.	Temp. (°C)	Color & Turbi		
Sampled By: ER						

Signature(s)

Type of Sample
- ☒ Low Concentration
- ☐ High Concentration
- ☐ Grab
- ☒ Composite
- ☐ Grab - Composite

Observations / Notes:

TRIP BLANK

3/16/93

Analysis	Preservative		Organic	Inorganic
TCL VOA	4° HCl	Traffic Report #		
		Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume		

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

- ☐ Monitoring Well Data
- ☐ Domestic Well Data
- ☒ Other TRIP BLANK

Page ____ of ____

Case # ____

By ER

Project Site Name BETHPAGE Project Site Number 1953

NUS Source No. TRIPBLANK 03-17-93 Source Location FROM PACE LABS

		Purge Data				
Total Well Depth: NA		Volume	pH	S.C.	Temp. (°C)	Color & Turbidity
Well Casing Size & Depth:						
Static Water Level:						
One Casing Volume:						
Start Purge (hrs.):						
End Purge (hrs.):						
Total Purge Time (min.):						
Total Amount Purged (gal.):						
Monitor Reading:						
Purge Method:						
Sample Method:						
Depth Sampled:						

Sample Date & Time:	Sample Data			
03-17-93 FROM LAB	pH	S.C.	Temp. (°C)	Color & Turbidity
Sampled By: ER				

Signature(s): E. Rodriguez

Type of Sample
- ☐ Low Concentration
- ☐ High Concentration
- ☐ Grab
- ☐ Composite
- ☐ Grab - Composite

Observations / Notes:

TRIP BLANK
03-17-93

Analysis	Preservative		Organic	Inorganic
TCL VOA	4° HCL	Traffic Report #		
		Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume		

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

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- ☐ Monitoring Well Data
- ☐ Domestic Well Data
- ☒ Other TRIP BLANK

Case # ____

By ER

Project Site Name BETH PAGE Project Site Number 1953

NUS Source No. TRIP BLANK 03-18-93 Source Location FROM PACE LABS

		Purge Data				
Total Well Depth:	NA					
Well Casing Size & Depth:		Volume	pH	S.C.	Temp. (°C)	Color & Turbidity
Static Water Level:						
One Casing Volume:						
Start Purge (hrs.):						
End Purge (hrs.):						
Total Purge Time (min.):						
Total Amount Purged (gal.):						
Monitor Reading:						
Purge Method:						
Sample Method:						
Depth Sampled:						

Sample Date & Time:	Sample Data			
03-18-93 FROM LAB	pH	S.C.	Temp. (°C)	Color & Turbi
Sampled By: ER				

Signature(s): ERodr

Type of Sample
- ☒ Low Concentration
- ☐ High Concentration
- ☒ Grab
- ☐ Composite
- ☐ Grab - Composite

Observations / Notes:

TRIPBLANK 03-18-93

Analysis	Preservative		Organic	Inorganic
TCL VOA	4° HCL	Traffic Report #		
		Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume		

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

Page ____ of ____

☐ Monitoring Well Data
☐ Domestic Well Data
☒ Other TRIP BLANK

Case # ____

By ER

Project Site Name BETHPAGE Project Site Number 1953

NUS Source No. TRIPBLANK 03-19-93 Source Location FROM PAR LABS

Total Well Depth: NA	Purge Data				
Well Casing Size & Depth:	Volume	pH	S.C.	Temp. (°C)	Color & Turbidity
Static Water Level:					
One Casing Volume:					
Start Purge (hrs.):					
End Purge (hrs.):					
Total Purge Time (min.):					
Total Amount Purged (gal.):					
Monitor Reading:					
Purge Method:					
Sample Method:					
Depth Sampled:					

Sample Date & Time: 03-19-93 FROM LAB	Sample Data			
	pH	S.C.	Temp. (°C)	Color & Turbidity
Sampled By: ER				

Signature(s) E Rodin

Type of Sample
☒ Low Concentration
☐ High Concentration
☒ Grab
☐ Composite
☐ Grab - Composite

Observations / Notes:

TRIP BLANK 03-19-93

Analysis	Preservative		Organic	Inorganic
TCL VOA	4°C HCL	Traffic Report #		
		Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume		

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

- ☐ Monitoring Well Data
- ☐ Domestic Well Data
- ☒ Other RINSATE

Page ____ of ____

Case # ____

By ER

Project Site Name BETHPAGE Project Site Number 1953

NUS Source No. BP-G-RB1-02 Source Location RINSATE

Total Well Depth: NA	
Well Casing Size & Depth:	
Static Water Level:	
One Casing Volume:	
Start Purge (hrs.):	
End Purge (hrs.):	
Total Purge Time (min.):	
Total Amount Purged (gal.):	
Monitor Reading:	
Purge Method:	
Sample Method: POUR THRU SS BAILER	
Depth Sampled: —	
Sample Date & Time: 03-11-93 1545	
Sampled By: ER	
Signature(s) EKodman	

Purge Data

Volume	pH	S.C.	Temp. (°C)	Color & Turbidity

Sample Data

pH	S.C.	Temp. (°C)	Color & Turbi

Observations / Notes:

STEAM DISTILLED THRU BAILER

RINSATE 1 — ANALYZE

Type of Sample

- ☒ Low Concentration
- ☐ High Concentration
- ☒ Grab
- ☐ Composite
- ☐ Grab - Composite

Analysis	Preservative
TCL VOA	HCl + 4°

	Organic	Inorganic
Traffic Report #		
Tag #		
AB #		
Date Shipped		
Time Shipped		
Lab		
Volume		

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

Page _____ of _____

- ☐ Monitoring Well Data
- ☐ Domestic Well Data
- ☒ Other RINSATE BLANK

Case # _____

By ER

Project Site Name BETH PAGE Project Site Number 1953

NUS Source No. BP-G-RB2-Ø2 Source Location RINSATE

		Purge Data				
Total Well Depth:	NA	Volume	pH	S.C.	Temp. (°C)	Color & Turbidity
Well Casing Size & Depth:						
Static Water Level:						
One Casing Volume:						
Start Purge (hrs.):						
End Purge (hrs.):						
Total Purge Time (min.):						
Total Amount Purged (gal.):						
Monitor Reading:						
Purge Method:						
Sample Method:	POUR THRU SS BAILER					
Depth Sampled:	NA					

Sample Date & Time:	Sample Data			
03-12-93 1130	pH	S.C.	Temp. (°C)	Color & Turbidity
Sampled By: ER				

Signature(s): E Friedman

Type of Sample
- ☒ Low Concentration
- ☐ High Concentration
- ☒ Grab
- ☐ Composite
- ☐ Grab - Composite

Observations / Notes:

STEAM DISTILLED

RINSATE #2 - HOLD

Analysis	Preservative		Organic	Inorganic
TCL VOA	4° HCl	Traffic Report #		
		Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume		

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

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☐ Monitoring Well Data
☐ Domestic Well Data
☒ Other RINSATE

Case # ____

By ER

Project Site Name BETH PAGE Project Site Number 1953

NUS Source No. BP-G-RB3-Ø2 Source Location RINSATE

	Purge Data				
Total Well Depth: —					
Well Casing Size & Depth: —	Volume	pH	S.C.	Temp. (°C)	Color & Turbidity
Static Water Level: —					
One Casing Volume: —					
Start Purge (hrs.): —					
End Purge (hrs.): —					
Total Purge Time (min.): —					
Total Amount Purged (gal.): —					
Monitor Reading: —					
Purge Method: —					
Sample Method: OVER SS BAILER					
Depth Sampled: —					

Sample Date & Time:	Sample Data			
03-16-93 1225	pH	S.C.	Temp. (°C)	Color & Turbi
Sampled By: ER				

Signature(s)

Elizabeth J Pedersen

Type of Sample

☒ Low Concentration
☐ High Concentration
☒ Grab
☐ Composite
☐ Grab - Composite

Observations / Notes:

STEAM DISTILLED H_2O OVER SS BAILER

RINSATE #3

ANALYZE

Analysis	Preservative		Organic	Inorganic
TCLVOA	4°C + HCL	Traffic Report #		
		Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume		

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

- ☐ Monitoring Well Data
- ☐ Domestic Well Data
- ☒ Other RINSATE

Page ____ of ____

Case # ____

By ER

Project Site Name BETHPAGE Project Site Number 1953

NUS Source No. BP-G-RB4-02 Source Location Rinsate

		Purge Data				
Total Well Depth:	NA	Volume	pH	S.C.	Temp. (°C)	Color & Turbidity
Well Casing Size & Depth:						
Static Water Level:						
One Casing Volume:						
Start Purge (hrs.):						
End Purge (hrs.):						
Total Purge Time (min.):						
Total Amount Purged (gal.):						
Monitor Reading:						
Purge Method:						
Sample Method: direct pour / bailer						
Depth Sampled:	NA					

Sample Date & Time:	Sample Data			
03-17-93 1600	pH	S.C.	Temp. (°C)	Color & Turbidity
Sampled By: ER				

Signature(s): E Friedman

Type of Sample
- ☒ Low Concentration
- ☐ High Concentration
- ☒ Grab
- ☐ Composite
- ☐ Grab - Composite

Observations / Notes:

Rinsate blank

steam distilled over boiler

(H_2O Analysis)

Analysis	Preservative		Organic	Inorganic
TCL VOA	4°C HCl	Traffic Report #		
		Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume		

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

Page ____ of ____

☐ Monitoring Well Data
☐ Domestic Well Data
☒ Other RINSATE

Case # ____

By ER

Project Site Name BETHPAGE Project Site Number 1953

NUS Source No. BP-G-RBS-02 Source Location Rinsate

		Purge Data				
Total Well Depth:	NA					
Well Casing Size & Depth:		Volume	pH	S.C.	Temp. (°C)	Color & Turbidity
Static Water Level:						
One Casing Volume:						
Start Purge (hrs.):						
End Purge (hrs.):						
Total Purge Time (min.):						
Total Amount Purged (gal.):						
Monitor Reading:						
Purge Method:						
Sample Method: direct pour - ss bailer						
Depth Sampled:	NA					
Sample Date & Time: 03-18-93	1230	Sample Data				
		pH	S.C.	Temp. (°C)	Color & Turbidity	
Sampled By: ER						

Signature(s)

Type of Sample
- ☒ Low Concentration
- ☐ High Concentration
- ☒ Grab
- ☐ Composite
- ☐ Grab - Composite

Observations / Notes:

steam distilled thru bailer

Rinsate

(Analyze)

Analysis	Preservative		Organic	Inorganic
TCL VOA	4°C HCl	Traffic Report #		
		Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume		

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

- ☐ Monitoring Well Data
- ☐ Domestic Well Data
- ☒ Other Rinsate

Page ____ of ____

Case # ____

By ER

Project Site Name BETH PAGE Project Site Number 1953

NUS Source No. BP-G-RB6-02 Source Location Rinsate

Total Well Depth: NA	Purge Data					
Well Casing Size & Depth:	Volume	pH	S.C.	Temp. (°C)	Color & Turbidity	
Static Water Level:						
One Casing Volume:						
Start Purge (hrs.):						
End Purge (hrs.):						
Total Purge Time (min.):						
Total Amount Purged (gal.):						
Monitor Reading:						
Purge Method:						
Sample Method: pour thru bailer						
Depth Sampled: NA						
Sample Date & Time: 03-19-93 1115	Sample Data					
	pH	S.C.	Temp. (°C)	Color & Turbidity		
Sampled By: ER						

Signature(s) E Rodman

Type of Sample
- ☒ Low Concentration
- ☐ High Concentration
- ☒ Grab
- ☐ Composite
- ☐ Grab - Composite

Observations / Notes:

Rinsate -(HAD)

Steam Distilled thru bailer

Analysis	Preservative		Organic	Inorganic
TCL VOA	4° HCl	Traffic Report #		
		Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume		

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

Page ____ of ____

- ☐ Monitoring Well Data
- ☐ Domestic Well Data
- ☒ Other FIELD BLANK

Case # ____

By ER

Project Site Name BETHPAGE Project Site Number 1953

NUS Source No. BP-G-FB1-02 Source Location FIELD BLANK

		Purge Data				
Total Well Depth:	NA					
Well Casing Size & Depth:		Volume	pH	S.C.	Temp. (°C)	Color & Turbidity
Static Water Level:						
One Casing Volume:						
Start Purge (hrs.):						
End Purge (hrs.):						
Total Purge Time (min.):						
Total Amount Purged (gal.):						
Monitor Reading:						
Purge Method:						
Sample Method: direct bottle pour						
Depth Sampled:	NA					
Sample Date & Time: 03-18-93 1130		Sample Data				
		pH	S.C.	Temp. (°C)	Color & Turbi	
Sampled By: MM						

Signature(s)

Observations / Notes:

FIELD BLANK

Steam distilled direct pour

Type of Sample

- ☒ Low Concentration
- ☐ High Concentration
- ☒ Grab
- ☐ Composite
- ☐ Grab - Composite

Analysis	Preservative		Organic	Inorganic
TCL VOA	4° HCl	Traffic Report #		
		Tag #		
		AB #		
		Date Shipped		
		Time Shipped		
		Lab		
		Volume		

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

Page 1 of 1

Case # —

By KCK

- ☐ Surface Soil
- ■ Subsurface Soil
- ☐ Sediment
- ☐ Lagoon / Pond
- ■ Other Rinsate Blank

Project Site Name BETHPAGE NWIRP Project Site Number 1953

NUS Source No. BP-SB-RB102 Source Location Pilot Borehole HN24I3

	Composite Sample Data		
Sample Method: See NOTES	Sample	Time	Color / Description
Depth Sampled: —			
Sample Date & Time: 1-14-93 1140			
Sampled By: Kevin C. Kilmartin			
Signature(s): Kevin C Kilmartin			
Type of Sample			
■ Low Concentration			
☐ High Concentration			
■ Grab			
☐ Composite			
☐ Grab - Composite			

Sample Data	
Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)

Analysis:
TCL VOLATILES

Observations / Notes
STEAM H_2O (LOT # 10791) poured over stainless steel trowel.

	Organic	Inorganic
Traffic Report #		
Tag # / Bottle No.	111473 / 111474	
AB #	FEDEX 4799386701	
Date Shipped	1-14-93	
Time Shipped	1745	
Lab	PACE	
Volume	2: 40 ml vials	

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

- ☐ Surface Soil
- ■ Subsurface Soil
- ☐ Sediment
- ☐ Lagoon / Pond
- ☐ Other _____

Page 1 of 1

Case # —

By KCK

Project Site Name BETHPAGE NWIRP Project Site Number 1953

NUS Source No. BP-SB-MS/MSD 101 Source Location PILOT Borehole HN24I1

Sample Method: SPLIT-SPOON

Depth Sampled: 150-152 FT.

Sample Date & Time: 1-14-93 1120

Sampled By: STAN J. CONTI

Signature(s): Kevin C Kilmartin for SJC

Type of Sample
- ■ Low Concentration
- ☐ High Concentration
- ■ Grab
- ☐ Composite
- ☐ Grab - Composite

Composite Sample Data

Sample	Time	Color / Description

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
YL-BROWN	FINE TO MEDIUM SAND; MOIST

Analysis: TCL VOLATILES

Observations / Notes

Matrix Spike/Matrix Spike Duplicate.
Sample depth not identified to Lab.
ID'D only as same sample as field dup.

HNU headspace of split sample = 0.4ppm

	Organic	Inorganic
Traffic Report #		
Tag # BOTTLE NO.	111829	
AB #	FED EX 4799386701	
Date Shipped	1-14-93	
Time Shipped	1745	
Lab	PACE	
Volume	125 ml	

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

Page 1 of 1

Case # —

By KCK

- ☐ Surface Soil
- ■ Subsurface Soil
- ☐ Sediment
- ☐ Lagoon / Pond
- ☐ Other _____

Project Site Name BETHPAGE NWIRP Project Site Number 1953

NUS Source No. BP-SB-FD101 Source Location PILOT Borehole HN24I1

Sample Method:	Composite Sample Data		
SPLIT-SPOON	Sample	Time	Color / Description
Depth Sampled: 150-152 FT			
Sample Date & Time: 1/14/93 1120			
Sampled By: STAN J. CONTI			
Signature(s): Kevin C Kilmartin for SJC			

Type of Sample

- ■ Low Concentration
- ☐ High Concentration
- ■ Grab
- ☐ Composite
- ☐ Grab - Composite

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
YL-BROWN	FINE TO MEDIUM SAND; MOIST

Analysis:

TCL VOLATILES

Observations / Notes

FIELD DUPLICATE, sample depth NOT identified to lab. ID'd only as same sample as MS/MSD

HNu headspace of split sample = 0.4 ppm

	Organic	Inorganic
Traffic Report #		
Tag # Bottle No.	111827	
AB #	FedEx 4799386701	
Date Shipped	1-14-93	
Time Shipped	1745	
Lab	Pace	
Volume	125 ml	

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other _____

Page 1 of 1
Case # —
By KCK

Project Site Name BETHPAGE NWIRP Project Site Number 1953
NUS Source No. BP-SB-242I150 Source Location PILOT Borehole HN24I1

Sample Method: SPLIT-SPOON

Depth Sampled: 150-152 FT.

Sample Date & Time: 1/14/93 1120

Sampled By: STAN J. CONTI

Signature(s): Kevin C Kilmartin for SJC

Type of Sample
- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Analysis: TCL VOLATILES

Composite Sample Data

Sample	Time	Color / Description

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
YL-BROWN	FINE TO MEDIUM SAND, MOIST

Observations / Notes

HNu headspace of split sample = 0.4 ppm

	Organic	Inorganic
Traffic Report #		
Tag # BOTTLE NO.	111835	
AB #	FED EX 4799386701	
Date Shipped	1-14-93	
Time Shipped	1745	
Lab	Pace	
Volume	125 ml	

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [ ] Other _____

Page 1 of 1

Case # —

By KCK

Project Site Name BETHPAGE NWIRP Project Site Number 1953

NUS Source No. BP-SB-242I160 Source Location PILOT Borehole HN24I1

Sample Method: Split - Spoon	
Depth Sampled: 160 - 161 ft	
Sample Date & Time: 1/14/93 1240	
Sampled By: STAN J. CONTI	
Signature(s): Kevin C Kilmartin for SJC	

Type of Sample

- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Composite Sample Data

Sample	Time	Color / Description

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
Pink/Brown	SILTY fine sand; MOIST

Analysis:

TCL volatiles

Observations / Notes

HNU headspace of split sample = 28ppm

	Organic	Inorganic
Traffic Report #		
Tag # Bottle No.	111831	
AB #	FedEx 4799386701	
Date Shipped	1-14-93	
Time Shipped	1745	
Lab	PACE	
Volume	125 ml	

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

- ☐ Surface Soil
- ■ Subsurface Soil
- ☐ Sediment
- ☐ Lagoon / Pond
- ☐ Other _____

Page 1 of 1

Case # —

By KCK

Project Site Name BETHPAGE NWIRP Project Site Number 1953

NUS Source No. BP-SB-242I140 Source Location Pilot Borehole HN24I1

Sample Method: SPLIT-SPOON

Depth Sampled: 140 - 141.5 FT

Sample Date & Time: 1/14/93 1015

Sampled By: STAN J. CONTI

Signature(s): Kevin C Kilmartin for SJC

Type of Sample
- ■ Low Concentration
- ☐ High Concentration
- ■ Grab
- ☐ Composite
- ☐ Grab - Composite

Composite Sample Data

Sample	Time	Color / Description

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
GY TO YI-BRN	FINE TO MEDIUM SAND, MOIST

Analysis: TCL VOLATILES

Observations / Notes

HNU headspace of split sample = 0.6 ppm

	Organic	Inorganic
Traffic Report #		
Tag # Bottle NO.	111833	
AB #	FEDEX 4799386701	
Date Shipped	1-14-93	
Time Shipped	1745	
Lab	PACE	
Volume	125 ml	

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

- ☐ Surface Soil
- ■ Subsurface Soil
- ☐ Sediment
- ☐ Lagoon / Pond
- ☐ Other _____

Page 1 of 1

Case # –

By KCK

Project Site Name BETHPAGE NWIRP Project Site Number 1953

NUS Source No. BP-SB-242I10 Source Location Pilot Borehole HN24I1

Sample Method: SPLIT-SPOON	
Depth Sampled: 10 - 12 ft	
Sample Date & Time: 1/13/93 1035	
Sampled By: KEVIN C. KILMARTIN	
Signature(s): Kevin C Kilmartin	
Type of Sample ■ Low Concentration ☐ High Concentration ■ Grab ☐ Composite ☐ Grab - Composite	
Analysis: TCL VOLATILES	Observations / Notes upper part of spoon = asphalt-like material (lag from surface?) HNU headspace of split sample ≈3.5 ppm

Composite Sample Data

Sample	Time	Color / Description

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
OR-Brown	Course sand & gravel

	Organic	Inorganic
Traffic Report #		
Tag # Bottle No.	111824	
AB #	FedEx 4799386690	
Date Shipped	1/13/93	
Time Shipped	1800	
Lab	PACE	
Volume	125 ml	

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

Page 1 of 1

Case # —

By KCK

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Lagoon / Pond
- [x] Other Rinsate Blank

Project Site Name BETHPAGE NWIRP Project Site Number 1953

NUS Source No. BP-SB-RB101 Source Location Pilot Borehole HN24I1

Sample Method: See NOTES	Composite Sample Data		
	Sample	Time	Color / Description
Depth Sampled: —			
Sample Date & Time: 1/13/93 1310			
Sampled By: Kevin C. Kilmartin			
Signature(s): Kevin C Kilmartin			

Type of Sample
- [x] Low Concentration
- [ ] High Concentration
- [x] Grab
- [ ] Composite
- [ ] Grab - Composite

Sample Data	
Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)

Analysis: TCL VOLATILES

Observations / Notes

STEAM H_2O (LOT # 10791) poured Through split-spoon samples

	Organic	Inorganic
Traffic Report #		
Tag # / Bottle No.	111475 / 111477	
AB #	FEDEX 4799386690	
Date Shipped	1/13/93	
Time Shipped	1800	
Lab	Pace	
Volume	2: 40 ml vials	

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

- ☐ Surface Soil
- ■ Subsurface Soil
- ☐ Sediment
- ☐ Lagoon / Pond
- ☐ Other _____

Page 1 of 1
Case # —
By KCK

Project Site Name BETHPAGE NWIRP Project Site Number 1953
NUS Source No. BP-SB-243I20 Source Location Pilot Borehole HN-24I2

Sample Method: SPLIT-SPOON	
Depth Sampled: 20 - 21.5 FT.	
Sample Date & Time: 1/25/93 1329	
Sampled By: KEVIN C. KILMARTIN	
Signature(s): Kevin C Kilmartin	
Type of Sample: ■ Low Concentration ☐ High Concentration ■ Grab ☐ Composite ☐ Grab - Composite	
Analysis: TCL volatiles	

Composite Sample Data

Sample	Time	Color / Description

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
BROWN	Coarse sand with common gravel; dry

Observations / Notes

HNu headspace of split sample = 0.2 ppm

	Organic	Inorganic
Traffic Report #		
Tag # Bottle #.	123876	
AB #	FEDEX 4799 3867 71	
Date Shipped	1/26/93	
Time Shipped	1555	
Lab	PACE	
Volume	125 ml	

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

- ☐ Surface Soil
- ■ Subsurface Soil
- ☐ Sediment
- ☐ Lagoon / Pond
- ☐ Other _____

Page 1 of 1
Case # —
By KCK

Project Site Name BETHPAGE NWIRP Project Site Number 1953
NUS Source No. BP-SB-243I130 Source Location Pilot borehole HN-24I2

Sample Method: Split-Spoon	
Depth Sampled: 130-132 ft.	
Sample Date & Time: 1/26/93 1115	
Sampled By: KEVIN C. KILMARTIN	
Signature(s): Kevin C Kilmartin	
Type of Sample: ■ Low Concentration ☐ High Concentration ■ Grab ☐ Composite ☐ Grab - Composite	
Analysis: TCL Volatiles	

Composite Sample Data

Sample	Time	Color / Description

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
GRAY TO RED	LITHOLOGY: SEE NOTES; WET

Observations / Notes

Thin-bedded, variegated silts, fine sands, and clay stringers.

HNu headspace of split sample = 4.4 ppm

	Organic	Inorganic
Traffic Report #		
Tag # Bottle #.	123880	
AB #	FedEx 4799386771	
Date Shipped	1/26/93	
Time Shipped	1555	
Lab	PACE	
Volume	125 ml	

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

- ☐ Surface Soil
- ■ Subsurface Soil
- ☐ Sediment
- ☐ Lagoon / Pond
- ☐ Other _____

Page 1 of 1
Case # —
By KCK

Project Site Name BETHPAGE NWIRP Project Site Number 1953
NUS Source No. BP-SB-243I140 Source Location Pilot borehole HN-24I2

Sample Method: Split-spoon	
Depth Sampled: 140 - 142 FT.	
Sample Date & Time: 1/26/93 1155	
Sampled By: KEVIN C. KILMARTIN	
Signature(s): Kevin C Kilmartin	
Type of Sample: ■ Low Concentration ☐ High Concentration ■ Grab ☐ Composite ☐ Grab - Composite	
Analysis: TCL volatiles	

Composite Sample Data

Sample	Time	Color / Description

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
Gray-black	very dense clay to silty clay; wet

Observations / Notes

HNu headspace of split sample = 92 ppm

	Organic	Inorganic
Traffic Report #		
Tag # Bottle No.	123874	
AB #	FedEx 4799386771	
Date Shipped	1/26/93	
Time Shipped	1555	
Lab	PACE	
Volume	125 ml	

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

Page 1 of 1

Case # —

By KCK

- ☐ Surface Soil
- ■ Subsurface Soil
- ☐ Sediment
- ☐ Lagoon / Pond
- ☐ Other _____

Project Site Name BETHPAGE NWIRP Project Site Number 1953

NUS Source No. BP-SB-243I150 Source Location Pilot Borehole HN-24I2

Sample Method:	Composite Sample Data		
SPLIT-SPOON	Sample	Time	Color / Description
Depth Sampled: 150 - 152 ft.			
Sample Date & Time: 1/26/93 1335			
Sampled By: KEVIN C. KILMARTIN			
Signature(s): Kevin C Kilmartin			

Type of Sample

- ■ Low Concentration
- ☐ High Concentration
- ■ Grab
- ☐ Composite
- ☐ Grab - Composite

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
See notes	See notes; WET

Analysis:

TCL VOLATILES

Observations / Notes

gray to brown to reddish-brown, variegated medium sand with silts and clay stringers.

HNu headspace of split sample = 28 ppm

	Organic	Inorganic
Traffic Report #		
Tag # Bottle #	123878	
AB #	FedEx 4799386771	
Date Shipped	1/26/93	
Time Shipped	1555	
Lab	PACE	
Volume	125 ml	

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

Page 1 of 1

Case # —

By KCK

- ☐ Surface Soil
- ■ Subsurface Soil
- ☐ Sediment
- ☐ Lagoon / Pond
- ■ Other Field Blank

Project Site Name BETHPAGE NWIRP Project Site Number 1953

NUS Source No. BP-SB-FB101 Source Location Pilot Borehole HN24I2

Sample Method: See NOTES	Composite Sample Data
Depth Sampled: —	Sample / Time / Color / Description
Sample Date & Time: 1/26/93 1235	
Sampled By: KEVIN C. KILMARTIN	
Signature(s): Kevin C Kilmartin	
Type of Sample: ■ Low Concentration ☐ High Concentration ■ Grab ☐ Composite ☐ Grab - Composite	Sample Data
	Color / Description: (Sand, Clay, Dry; Moist, Wet, etc.)
Analysis: TCL VOLATILES	Observations / Notes: Steam distilled H_2O, LOT # 10791

	Organic	Inorganic
Traffic Report #		
Tag #	123895	
Bottle No.	123894	
AB #	FedEx 4799-3867 71	
Date Shipped	1/26/93	
Time Shipped	1555	
Lab	PACE	
Volume	2; 40 ml vials	

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

Page 1 of 1

Case # —

By KCK

- ☐ Surface Soil
- ■ Subsurface Soil
- ☐ Sediment
- ☐ Lagoon / Pond
- ■ Other Rinsate Blank

Project Site Name BETHPAGE NWIRP Project Site Number 1953

NUS Source No. BP-SB-RB104 Source Location Pilot Borehole HN24I2

Sample Method: See NOTES

Depth Sampled: —

Sample Date & Time: 1/26/93 1255

Sampled By: KEVIN C. KILMARTIN

Signature(s): Kevin C Kilmartin

Type of Sample
- ■ Low Concentration
- ☐ High Concentration
- ■ Grab
- ☐ Composite
- ☐ Grab - Composite

Composite Sample Data

Sample	Time	Color / Description

Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)

Analysis: TCL VOLATILES

Observations / Notes: Steam distilled H_2O, LOT # 10791, poured through split-spoon sampler

	Organic	Inorganic
Traffic Report #		
Tag # / Bottle No.	111470 / 111471	
AB #	FEDEX 4799386771	
Date Shipped	1/26/93	
Time Shipped	1555	
Lab	PACE	
Volume	2: 40 ml vials	

HALLIBURTON NUS
Environmental Corporation

SAMPLE LOG SHEET

Page 1 of 1

Case # —

By KCK

- ☐ Surface Soil
- ■ Subsurface Soil
- ☐ Sediment
- ☐ Lagoon / Pond
- ■ Other Rinsate Blank

Project Site Name BETHPAGE NWIRP Project Site Number 1953

NUS Source No. BP-SB-RB103 Source Location Pilot Borehole HN24I2

Sample Method: See NOTES	Composite Sample Data		
	Sample	Time	Color / Description
Depth Sampled: —			
Sample Date & Time: 1/25/93 1440			
Sampled By: KEVIN C. KILMARTIN			
Signature(s): Kevin C Kilmartin			
Type of Sample			
■ Low Concentration			
☐ High Concentration			
■ Grab			
☐ Composite			
☐ Grab - Composite			

Sample Data	
Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)

Analysis:

TCL VOLATILES

Observations / Notes

STEAM distilled H_2O, LOT # 10791, poured over stainless steel trowel

	Organic	Inorganic
Traffic Report #		
Tag #	123893	
Bottle NO.	123892	
AB #	FedEx 4799386771	
Date Shipped	1/26/93	
Time Shipped	1555	
Lab	PACE	
Volume	2: 40ml vials	

HALLIBURTON NUS Environmental Corporation and Subsidiaries

CHAIN OF CUSTODY RECORD

PROJECT NO.: 1953

SITE NAME: Bethlehem NJ

SAMPLERS (SIGNATURE): Terry Rogalski

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	40 ml VOAS (HCL)	60 ml JAR	125 ml JAR	250 ml PLASTIC			REMARKS
RS27	12/17/92	0935		X	BP-RS27-TB	2	2						(LAB) → (Prepared 12/10/92 1600) NUCEOUS to ANALIZE
		0945		X	BP-RS27-RB	2	2						
		0940		X	BP-RS27	2		1	1				Soil RESIDUES
RS28		0955		X	BP-RS28	2		1	1				
RS29		0910		X	BP-RS29	1		1					
RS25		0930		X	BP RS25	2		1		1			
RS24		0945		X	BP-RS24	1		1					
RS30		1015		X	BP RS30	3		1	1	1			
DR229 1		1100		X	BP-DR229-1	1			1				
DR229 2		1115		X	BP-DR229-2	1			1				
DR215		1200		X	BP-DR215	1			1				
DUP01		—		X	BP-RSDUP01	3		1	1	1			SAME SAMPLE
MS01		—		X	BP-RS MS 01	1		1					
MSD01		—		X	BP-RS MSD 01	1		1					

RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
Terry Rogalski	1530 12/17/92	FEDERAL EXPRESS			
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE / TIME:	REMARKS: SHIPPED TO PACE INC. AB# 4799386782	

NUS 440 REVISED 0

HALLIBURTON NUS Environmental Corporation and Subsidiaries

CHAIN OF CUSTODY RECORD

PROJECT NO.: 1953

SITE NAME: BETHPAGE NWIKP

SAMPLERS (SIGNATURE): Tony Ngah

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	PESTICIDES/PCBS - 125ml Jar	PESTICIDES/PCBS - 950ml Jar					REMARKS
SS212	12/15/92	1400		X	BP-SS212-A	1	1						
SS216		1410		X	BP-SS216-A	1	1						
SS214		1420		X	BP-SS214-A	1	1						
SS210		1430		X	BP-SS210-A	1	1						
DUP		—		X	BP-DUP01-A	1	1						
MS/MSD		—		X	BP-MS/MSD01-A	1	1						
DUP		—		X	BP-DUP02-A	1	1						
MS/MSD		—		X	BP-MS/MSD02-A	1	1						
RB: SS210-RB		1500		X	BP-SS210-RB	1		1					ANALIZE BLANKS
RB: SS210-FB		1505		X	BP-SS210-FB	1		1					↓ ↓

RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
Tony Ngah	12/15/92 1700	FLORIDA EXPRESS			
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE / TIME:	REMARKS: SHIPPED TO PACE INC. FOR ANALYSIS AIR# - 7711336713	

NUS 440 REVISED 0091

HALLIBURTON NUS Environmental Corporation and Subsidiaries

CHAIN OF CUSTODY RECORD

PROJECT NO.: 1953

SITE NAME: BETHANIA NWIRP

SAMPLERS (SIGNATURE): Terry Hogan

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	PESTICIDES/PCBS-1250 ONLY							REMARKS
SS101	12/15/92	0815		X	BP-SS101-A	1	1							
SS102		0935		X	BP-SS102-A	1	1							
SB121		0930		X	BP-SB12103-A	1	1							
SS103		0910		X	BP-SS103-A	1	1							
SS104		0920		X	BP-SS104-A	1	1							
SS105		0930		X	BP-SS105-A	1	1							
SS106		0940		X	BP-SS106-A	1	1							
SB215		1100		X	BP-SB21503-A	1	1							
SB206		1140		X	BP-SB20603-A	1	1							
SS322		1205		X	BP-SS322-A	1	1							
SS207		1300		X	BP-SS207-A	1	1							
SS208		1315		X	BP-SS208-A	1	1							
SD201		1335		X	BP-SD201-A	1	1							
SD202		1345		X	BP-SD202-A	1	1							

RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
Terry Hogan	12/15/92 1700	FEDERAL EXPRESS			
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE / TIME:	REMARKS: SHIPPED TO IPACE INC FOR ANALYSIS AB# 4799386793	

NUS 440 REVISED

HALLIBURTON NUS Environmental Corporation and Subsidiaries

CHAIN OF CUSTODY RECORD

PROJECT NO.: 1452

SITE NAME:

SAMPLERS (SIGNATURE):

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS							REMARKS

RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY(SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY(SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY(SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE / TIME:	REMARKS:	

NUS 440 REVISED 0891

HALLIBURTON NUS Environmental Corporation and Subsidiaries

CHAIN OF CUSTODY RECORD

PROJECT NO.: 1953

SITE NAME: BETHPAGE NIWIRP

SAMPLERS (SIGNATURE): Kevin C Kilmartin, Mark Mengel / By KCK

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	40 ml VOA	60 ml JAR					REMARKS
43I	5/26	300P		X	BP-G-RB5-26	2	2						Rinsate blank
43I	5/26	310P		X	BP-G-43I-01	2	2						
43I	5/26	310P		X	BP-G-DUP5-26	2	2						Duplicate Sample
—	—	—		X	TRIP BLANK 5-26	2	2						Trip blank
—	—	—		X	TEMPERATURE BLANK	1		1					Temperature Blank
													# 4199386314
													FEDEX AIRBILL

RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
Kevin C Kilmartin	5 26 93				
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE / TIME:	REMARKS: FEDEX AIRBILL 4199386314	

NUS 440 REVISED 0.

HALLIBURTON NUS Environmental Corporation and Subsidiaries

CHAIN OF CUSTODY RECORD

PROJECT NO.: 1953

SITE NAME: BETHPAGE NWIRP

SAMPLERS (SIGNATURE): KC Kilmartin

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	volatiles						REMARKS
HNP1-1	12/4/92	1310		X	HNP1-1	2	2						
HNP2-1	↓	1430		X	HNP2-1	2	2						

RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
KC Kilmartin	12/4/92 1630	for MCG Artons			
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE / TIME:	REMARKS: Hand delivered to volumetric	

NUS 440 REVISED 0891

HALLIBURTON NUS Environmental Corporation and Subsidiaries

CHAIN OF CUSTODY RECORD

PROJECT NO.: 1953

SITE NAME: [illegible]

SAMPLERS (SIGNATURE): [illegible]

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	[illegible]						REMARKS
BPGR RBG	12/14/92	0720		X	BP-G-R-RBG	2	2						HOLD
BPGR 11	↓	0[illegible]		X	BP-G-R-11	2	2						
BPGR 5	↓	1225		X	BP-G-R-[illegible]	2	2						
—	—	—	—	—	—	—	—	—	—	—	—	—	TR
BPGR DUP	12/14/92	–		X	[illegible]	2	2						
BPGR MS	↓	–			[illegible]	2	2						SAME SAMPLE
BPGR MSD	↓	–			[illegible]	2	2						FOR PA/WC

RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY(SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY(SIGNATURE):
[illegible]	[illegible]				
RELINQUISHED BY (SIGNATURE):	**DATE / TIME:**	**RECEIVED BY (SIGNATURE):**	**RELINQUISHED BY (SIGNATURE):**	**DATE / TIME:**	**RECEIVED BY(SIGNATURE):**
RELINQUISHED BY (SIGNATURE):	**DATE / TIME:**	**RECEIVED FOR LABORATORY BY (SIGNATURE):**	**DATE / TIME:**	**REMARKS:**	

NUS 440 REVISED 0[illegible]

HALLIBURTON NUS Environmental Corporation and Subsidiaries

CHAIN OF CUSTODY RECORD

PROJECT NO.: [illegible]

SITE NAME: [illegible]

SAMPLERS (SIGNATURE): [illegible]

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	[illegible]						REMARKS
[illegible]	[illegible]	[illegible]		X	[illegible]	2	2						
[illegible]	[illegible]	[illegible]		X	[illegible]	2	2						[illegible]
[illegible]	[illegible]	[illegible]		X	[illegible]	2	2						[illegible]
[illegible]	[illegible]	[illegible]		X	[illegible]	2	2						
[illegible]	[illegible]	[illegible]		X	[illegible]	2	2						[illegible]
[illegible]	[illegible]	[illegible]		X	[illegible]	2	2						[illegible]

RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY(SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY(SIGNATURE):
[illegible]	[illegible]	[illegible]			
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY(SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE / TIME:	REMARKS:	

NUS 440 REVISED 0891

HALLIBURTON NUS Environmental Corporation and Subsidiaries

CHAIN OF CUSTODY RECORD

PROJECT NO.: 1953

SITE NAME: [illegible]

SAMPLERS (SIGNATURE): [illegible]

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	[illegible]						REMARKS
[illegible]-K01	[illegible]	[illegible]		x	[illegible]-K-1	2	2						
[illegible]	[illegible]	[illegible]		x	[illegible]-K-KL1	2	2						
[illegible]	[illegible]	[illegible]		x	[illegible]-K-02	2	2						

RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY(SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY(SIGNATURE):
[illegible]	[illegible]	[illegible]			
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY(SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE / TIME:	REMARKS:	

NUS 440 REVISED 0

HALLIBURTON NUS Environmental Corporation and Subsidiaries

CHAIN OF CUSTODY RECORD

PROJECT NO.: 195

SITE NAME: [illegible]

SAMPLERS (SIGNATURE): [illegible]

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	[illegible]						REMARKS
[illegible]	[illegible]	[illegible]		X	[illegible]	2	2						
[illegible]	[illegible]	[illegible]		X	[illegible]	2	2						
[illegible]	[illegible]	[illegible]		X	[illegible]	2	2						[illegible] BLANK

RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY(SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY(SIGNATURE):
[illegible]	[illegible]	[illegible]			
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY(SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE / TIME:	REMARKS:	

NUS 440 REVISED 0891

HALLIBURTON NUS Environmental Corporation and Subsidiaries

CHAIN OF CUSTODY RECORD

PROJECT NO.: 1153

SITE NAME: [illegible]

SAMPLERS (SIGNATURE): [illegible]

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	REMARKS
[illegible]	4/12	1030		X	[illegible]-G-R-07	2	2						
[illegible]	4/12	1420		X	[illegible]-G-R-[illegible]	2	2						
[illegible]	[illegible]	[illegible]		X	[illegible]-G-R-RB[illegible]	2	2						[illegible]
[illegible]	[illegible]	[illegible]		X	[illegible]-G-R-101	2	2						[illegible]

RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
[illegible]	[illegible]	[illegible]			
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE / TIME:	REMARKS:	

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HALLIBURTON NUS Environmental Corporation and Subsidiaries

CHAIN OF CUSTODY RECORD

PROJECT NO.: 1953

SITE NAME: BETHPAGE NWA

SAMPLERS (SIGNATURE): [illegible]

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	Kjeldahl Nitrogen						REMARKS
BPGR16	12/15/92	1355		X	BP-G-R-16	2	2						
BPGR RR5	↓	1410		X	BP-G-R-RR5	2	2						HOLD

RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
[illegible]	[illegible]	[illegible]			
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE / TIME:	REMARKS: HAND DELIVERED BY K. Kilmartin to VOLUMETRIC DRIVER	

NUS 440 REVISED 0891

APPENDIX C

BORING LOG SHEETS/GAMMA RAY LOGS

HN-24I1

~~HN24 2I~~ 1-14-93

SECONDS	DEPTH	COUNTS PER SECOND
15	60	6.5
22	57.5	4.5
19	55	5.5
20	52.5	5
20	50	5
23	47.5	4.5
22	45	4.5
24	42.5	4
20	40	5
24	37.5	4
14	35	7
23	32.5	4.5
18	30	5.5
16	27.5	6.5
21	25	5
22	22.5	4.5
17	20	6
16	17.5	6.5
17	15	6
16	12.5	6.5
20	10	5
21	7.5	5
14	5	7
10	2.5	10
11	1	9

BORING LOG — **HALLIBURTON NUS**

PROJECT: BETHPAGE NWIRP — BORING NO.: HN24I2
PROJECT NO.: 1953 — DATE: 1-25-93 — DRILLER:
ELEVATION: — FIELD GEOLOGIST: KEVIN C. KILMARTIN
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE / TIME	DEPTH (Ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, Ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1300	10	4 / 29 / 25 / 24	6/24				4" brown CLAY		Bottle NO 123877
							2" brown coarse sand with some SILT		
									Headspace = 0.2
							Small sample, insufficient for analytical; will use for		
							head space only		
1329	20	3 / 16 / 20 / 22	15/18			15"	Coarse brown sand		Bottle NO 123876
							with common gravel		
					*	*	Selected for analysis		Headspace = 0.2
1350	30	15 / 33 / 33 / 35					Gravel stuck in tip;		Bottle NO
							NO SAMPLE		
1405	32		24/24			24"	Coarse brown sand		123875
							with common gravel		Headspace = 0.2
1420	40	17 / 34 / 43 / 40	21/24			21"	Coarse brown TO		Bottle NO 123872
							whitish sand with		
							common gravel		Headspace = 0.2

REMARKS: Rinsate blank taken over sampling travel at 1340.
LOT NO 10791 BP-RB-103

BORING HN24I2

PAGE 1 OF 3

* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN24I
PROJECT NO.: _____ DATE: 1-26-93 DRILLER: _____
ELEVATION: _____ FIELD GEOLOGIST: _____
WATER LEVEL DATA: _____
(Date, Time & Conditions) _____

SAMPLE NO. & TYPE Time	DEPTH (Ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, Ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
0820	100	14 / 33 / 43 / 61	18/15			LT BRN	6" Coarse Sand/Gravel-LAC		Headspace · 22 ppm
						LT BRN TC	12" MEDIUM TO COARSE		
						YL TC TO BRN	Sand w/ SILTY STRINGERS		
							1 ft of heave at 110'		
0920	110	13 / 4 / 8 / 14	K 1.24			LT BRN TO BRN	8" MED. Clean sand)		Headspace: 11.2 ppm
						GY	2" very sticky dense		
							clay. Trap is clogged.		
0945	120	13 / 13 / 20 / 36	24/24		10"	LT BRN	MED SD & STICKY CLAY ICE?		Headspace. 11.0 ppm
					14"	LT GY TC	MED TC COARSE SAND		
						BLACK			
1115	130	25 / 11 / 14 / 55	22/24		14"	LT BRN	COARSE sand lay?		Bottle No 123880
					8'	GY TC	VARIEGATED SILTS, fine		Headspace: 4.4 ppm
						RED	SANDS, & CLAY STRINGERS.		(Sample)
							THIN-BEDDED		
1155	140'	23 / 8 / 9 / 13	24/24		14"	LT GY	MED TC COARSE SAND lay?		Bottle No 123874
					10"	GY TC	very DENSE and hard CLAY		Headspace. 92 ppm
						BLACK	TC SILTY CLAY		(Sample)

REMARKS ACTE Field Blank BP-98-FB101 at 1235
LOT No: 10791
Rinsate Blank of SB-FB104 at 1255 over
Split-Spoon

BORING HN24I2
PAGE 2 OF 3

* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN24I

PROJECT NO.: _____ DATE: 1-26-93 DRILLER: _____

ELEVATION: _____ FIELD GEOLOGIST: _____

WATER LEVEL DATA: _____

(Date, Time & Conditions) _____

SAMPLE NO. & TYPE TIME	DEPTH (Ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, Ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
[illegible]		14 24	24/24		12"	BLK	med. sand, with 2" clay "PLUG"		Bottle no 123878
1335	150	46 64			12"	GY to	variegated med sand		
						brn to	with silts and clay		Headspace 28 ppm
						to brn	stringers thin-bedded		
1435	160	46 78 78	24/24		16"	BLK	med sand icky?		Headspace: 1.4 ppm
					8"	GY,	variegated clayey &		
						brn,	silty, fine sand with		
						to RD-brn	some clay stringers.		
							thin-bedded.		

REMARKS _____

BORING HN24-7

PAGE 3 OF 3

* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: BethPage — BORING NO.: HN24 I1
PROJECT NO.: 1953 — DATE: 1-13-93 — DRILLER: DELTA
ELEVATION: — FIELD GEOLOGIST: KILMARTIN
WATER LEVEL DATA: —
(Date, Time & Conditions) —

SAMPLE NO. & TYPE / TIME	DEPTH (Ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, Ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1035	10	2 / 4	12/24			BLK	6" Asphalt-like		1 oz. Sample (111824 Bottle)
		15 / 14				ORG-BRN	6" coarse sand & gravel		
1110	20	11 / 11	14/24			ORG-BRN	Gravelly Sand		1 oz. Sample (111825 Bottle)
		18 / 18							
1135	30	23 / 26	12/24			orange-brn	coarse sand & gravel		1 oz Sample (111826 Bottle)
		22 / 21							
1205	40	11 / 50	8/24			orange-brn	Coarse sand & gravel		1 oz. Sample (111828 Bottle)
		100							

REMARKS —

BORING HN24I1

PAGE 1 OF 3

* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN24I1
PROJECT NO.: _____ DATE: 1-13-93 DRILLER: _____
ELEVATION: _____ FIELD GEOLOGIST: Kevin C. Kilmartin
WATER LEVEL DATA: _____
(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (Ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, Ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1420	100	5 / 11	14/24			BLK	9" Sand & Gravel - lag		
		48 / 50				red-red brn	5" Med sand		
						brn-yl-brn	4" Med sand		
1530	110	15 / 43	18/24			BLK	6" Sand - lag		
		50				red-yl-brn	12" Fine to med sand,		
							Some laminations of		
							sticky gray clay		
1615	120	6 / 26	24/24			BLK	12" Sand - lag		
		47 / 50				Brn-red brn-yl-brn	12" Silty to clayey,		
							fine to med sand		
1650		27 / 42	24/24			BLK	12" Sand - lag		
	130	50				Brn	6" fine-med sand		
						GY	6" clayey, v. fine sand		

REMARKS _____

BORING HN24I1

PAGE 2 OF 3

* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: BETHPAGE — BORING NO.: HN 24 I 1
PROJECT NO.: 1953 — DATE: 1-14-93 — DRILLER: DELTA
ELEVATION: — FIELD GEOLOGIST: CONTI
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (FT.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, Ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
S-C	140.0	44/48	1.5/1.5		V. DENSE	GRAY YELLOW	FINE TO MED SAND	SP	MOIST
1015	141.5	50/2				BRN			TOOK 1-4OZ JAR SAMPLE (111833)
									ALSO TOOK H.SP SAMPLE WAS ____ PPM
									NO CLAY IN SAMPLE
S-	150.0				V DENSE	YELLOW BRN	FINE TO MED SAND	SP	MOIST - TOOK 3-4OZ
1120		13/92	1.5/2.0						JARS 111827-111835 111829
	152.0	101/72							THIS FOR MS/MSD ALSO TOOK HSP SAMPLE ALSO
									NOTED 1/2" SEAM OF GRAY CLAY @ = 151'.
									NO CLAY IN SAMPLE
						MOTLD PINK			MOTLD W/ PINK COLORED SAND.
S-	160.0	12	1.5/1.5		V DENSE	LT BRN	SILTY FINE SAND	SP	MOIST TOOK 1-4OZ
1240	161.	62/78						SM	SAMPL CONT NO.: JHR 111831

REMARKS: FAILING RIG - 2" CPT SAMPLES

BORING HN24I1

PAGE ___ OF ___

* See Legend on Back

DELTA WELL
& PUMP CO., INC.
97 Union Avenue P.O. Box 1309
RONKONKOMA NEW YORK 11779
(516) 981-2255

GAMMA RAY LOG BY

JOHNSON-KECK GR-73 GAMMA RAY LOGGING SYSTEM

WELL ~~HN2-12I~~ HN-24I1 OWNER NAVY @ GRUMMAN

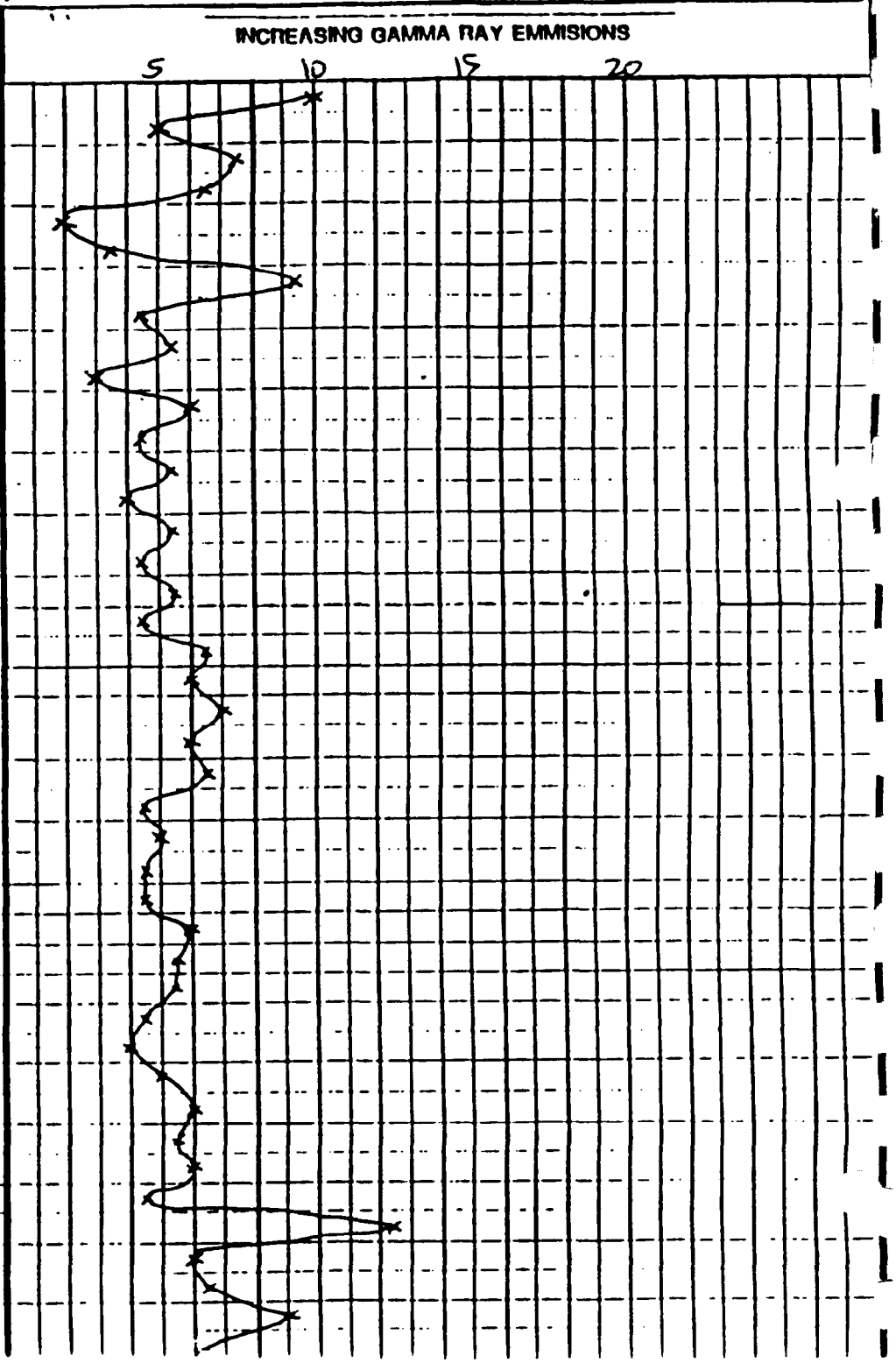
MEASURING POINT 1 feet above/below ground level DATE 1-14-93

DRILLER M. Pellegrino BOREHOLE DEPTH ____ feet, DIAMETER ____ inches

CASING DEPTH ____ feet, DIAMETER ____ inches OPERATOR C. Okon

COUNTS SETTING (GR-73) Gy/100 RANGE SETTING (GR-81) ____ TIME CONSTANT (GR-81) ____

SECONDS	DEPTH (ft)	COUNTS PER SECOND
10	165	10
20	162.5	5
13	160	7.5
15	157.5	6.5
47	155	2
29	152.5	3.5
11	150	9
23	147.5	4.5
18	145	5.5
33	142.5	3
17	140	6
23	137.5	4.5
19	135	5.5
26	132.5	4
18	130	5.5
23	127.5	4.5
18	125	5.5
22	122.5	4.5
15	120	6.5
17	117.5	6
14	115	7
17	112.5	6
16	110	6.5
22	107.5	4.5
20	105	5
22	100	4.5
23	97.5	4.5
17	95	6
19	92.5	5.5
18	90	5.5
23	87.5	4.5
24	85	4
21	82.5	5
17	80	6
19	77.5	5.5
17	75	6
23	72.5	4.5
8	70	12.5
17	67.5	6
15	65	6.5
11	62.5	9



LC36

GAMMA RAY LOG BY

DELTA WELL
& PUMP CO., INC.
97 Union Avenue P.O. Box 1309
RONKONKOMA NEW YORK 11779
(516) 981-2255

JOHNSON-KECK GR-73 GAMMA RAY LOGGING SYSTEM

WELL HN24I2 OWNER NAVY & GRUMMAN

MEASURING POINT 1 feet above/below ground level DATE 1-26-93

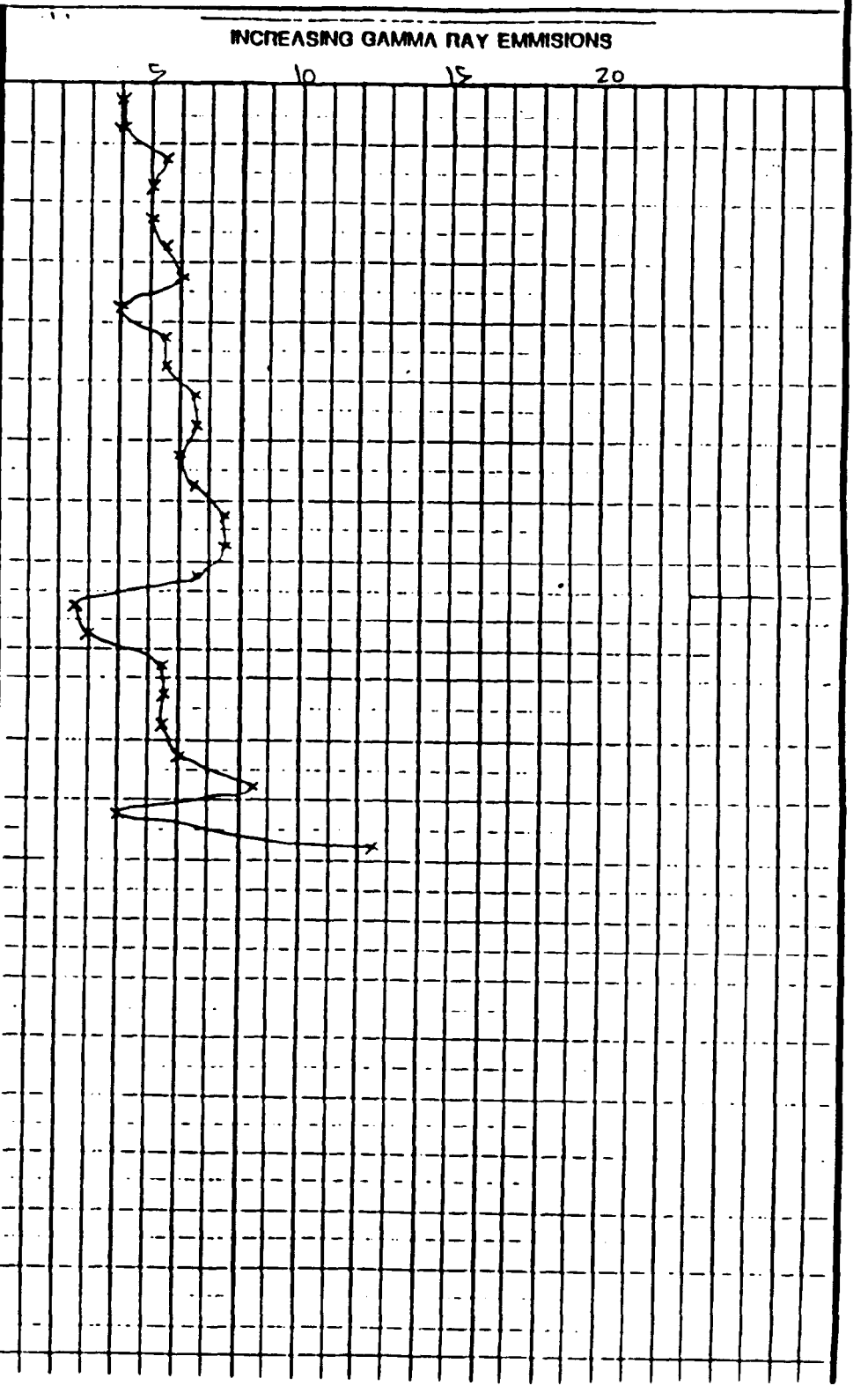
DRILLER Mike Pellegrino BOREHOLE DEPTH 165 feet, DIAMETER ____ inches

CASING DEPTH ____ feet, DIAMETER ____ inches OPERATOR Chris Okan

COUNTS SETTING (GR-73) GM/100 RANGE SETTING (GR-81) ____ TIME CONSTANT (GR-81) ____

All depths corrected to top of probe. Probe is 18" long

SECONDS	DEPTH (FT)	COUNTS PER SECOND
24	62.5	4
24	60	4
19	57.5	5.5
20	55	5
20	52.5	5
18	50	5.5
17	47.5	6
24	45	4
18	42.5	5.5
18	40	5.5
16	37.5	6.5
16	35	6.5
17	32.5	6
16	30	6.5
13	27.5	7.5
13	25	7.5
16	22.5	6.5
53	20	2.5
31	17.5	3
18	15	5.5
18	12.5	5.5
18	10	5.5
17	7.5	6
12	5	8.5
24	2.5	4
3	1	12.5



LC36

GAMMA RAY LOG BY

DELTA WELL
& PUMP CO., INC.
97 Union Avenue P.O. Box 1309
RONKONKOMA NEW YORK 11779
(516) 981-7255

JOHNSON-KECK GR-73 GAMMA RAY LOGGING SYSTEM

WELL HN24I2 OWNER NAVY@GRUMMAN

MEASURING POINT 1 feet above/below ground level DATE 1-26-93

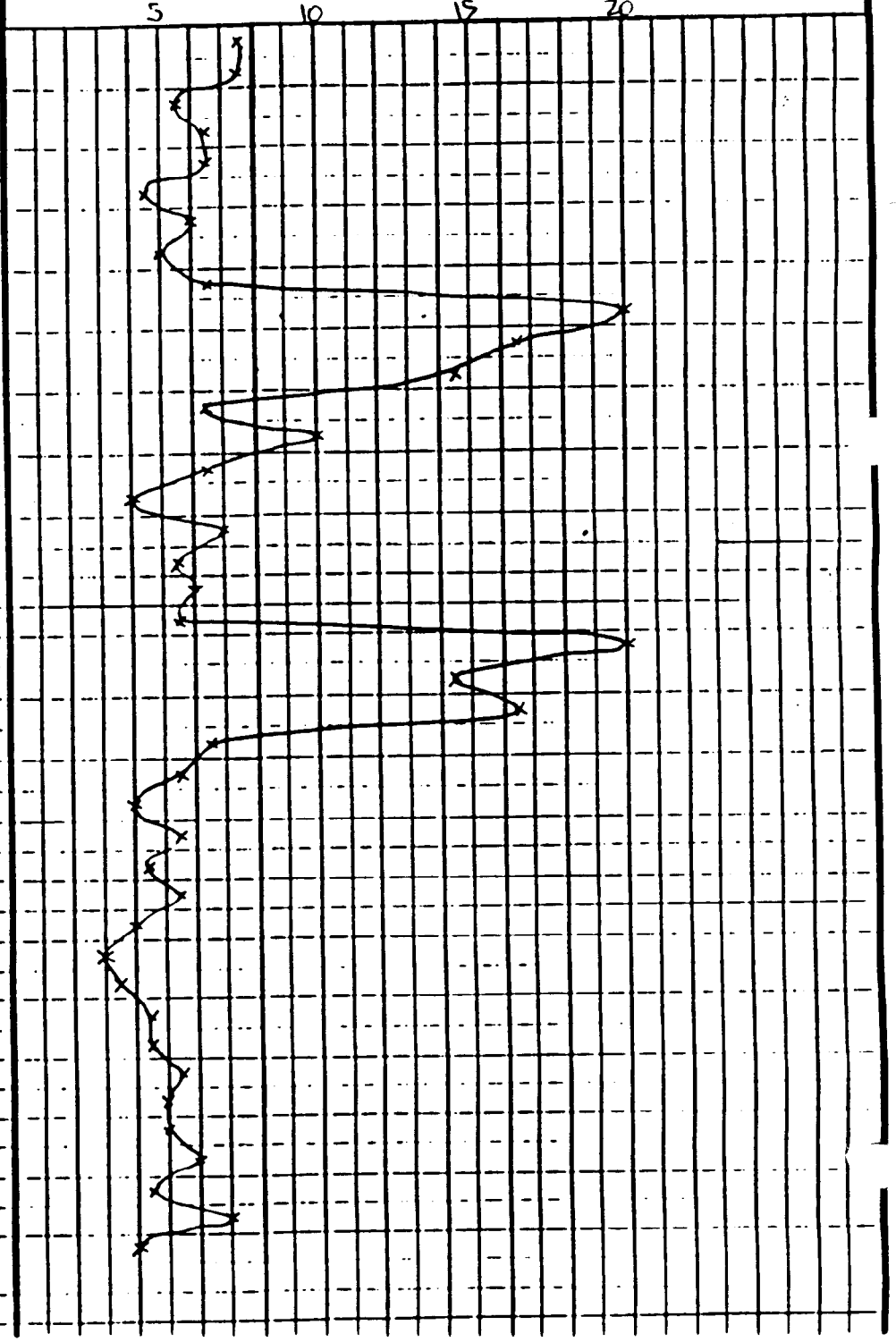
DRILLER Mike Pellegrino BOREHOLE DEPTH 165 feet, DIAMETER ____ inches

CASING DEPTH ____ feet, DIAMETER ____ inches OPERATOR Chris Okon

COUNTS SETTING (GR-73) GM/100 RANGE SETTING (GR-81) ____ TIME CONSTANT (GR-81) ____

Probe is 18" long

SECONDS	DEPTH (FT)	COUNTS PER SECOND
13	164	7.5
13	162.5	7.5
19	160	5.5
16	157.5	6.5
16	155	6.5
22	152.5	4.5
17	150	6
20	147.5	5
15	145	6.5
[illegible]	142.5	20
6	140	16.5
[illegible]	137.5	14.5
16	[illegible]	6.5
[illegible]	[illegible]	10
15	[illegible]	6.5
[illegible]	[illegible]	4
14	[illegible]	7
11	[illegible]	5.5
17	[illegible]	6
[illegible]	[illegible]	5.5
[illegible]	112	20
[illegible]	112.5	14.5
6	[illegible]	16.5
10	[illegible]	6.5
[illegible]	[illegible]	5.5
[illegible]	[illegible]	4
[illegible]	[illegible]	5.5
[illegible]	[illegible]	4.5
5	[illegible]	5.5
24	[illegible]	4
31	[illegible]	3
27	[illegible]	3.5
25	[illegible]	4.5
[illegible]	[illegible]	4.5
19	[illegible]	5.5
20	79.5	5
21	[illegible]	5
17	77.5	6
25	75	4.5
14	72.5	7
24	[illegible]	4



BORING LOG **HALLIBURTON NUS**

PROJECT: BETHPAGE RI, PHASE II JOB 1953 BORING NO: SB01 / PIEZOMETER #1
PROJECT NO.: 1953 DATE: 12-2-92 DRILLER: ADT, RICH B. DENNIS
ELEVATION: FIELD GEOLOGIST: FRED RAMSER / KEVIN KILMARTIN
WATER LEVEL DATA: 53.5' BGS 1600HRS/12-2-92
(Date, Time & Conditions) * HN27S3 *

SAMPLE NO. & TYPE OR ROD	DEPTH (ft) OR RUN NO.	BLOWS 6" OR ROD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	BOREHOLE CONDITIONS	*HNU READINGS BACKGROUND = 0.5 ppm REMARKS HS	BZ
						BLK DK. BRN			1120 HRS BEGIN TO DRILL	
	5					YELLOWISH BRN	GRAVELS + SAND w/some SILT		3.0ppm 1130*	0.0
									MOIST	
							GRAVELS ~ 1.5 ø SUBROUND TO ROUNDED			
									10.0ppm	0.5
	10									
									DRAGER TUBE CHECK - NO RESPONSE	
									9-15ppm	0.0
	15									
						DK. YEL BRN	AS ABOVE			
	20									
	25						AS ABOVE		2 ppm	5.0

* DRAGER TUBE CHECK - NO RESPONSE

REMARKS MOBILE DRILL RIG 861 NO SAMPLES TAKEN AT THIS LOCATION
OVERCAST COLD 35° A 2" PVC PIEZOMETER IS TO BE INSTALLED AT THIS LOC.
* HS: HEAD SPACE, BZ: BREATHING ZONE, BORING w/ 4" ID HSA

BORING SB#1 #1, PHASE II

PAGE 1 OF 3

WL MEASURED AT MW 27S 6.33' 1100 HRS 12-2-92 (WELL DRILLED AT THIS LOCATION TO 61 HEAD SPACE

BORING LOG **HALLIBURTON NUS**

PROJECT: BETHPAGE RI PHASE II BORING NO: SB-01/BIEZOMETER
PROJECT NO.: 1953 DATE: 12-2-92 DRILLER: ADT, RICH B. DENNI
ELEVATION: FIELD GEOLOGIST: FRED W. RAMSER
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO & TYPE OR ROD	DEPTH (ft) OR RUN NO	BLOWS 6" OR ROD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS HS	D
						AS ABOVE				
	30						SAND + GRAVEL		.5	0.0
				GRADATIONAL CHANGE GRAVEL TO SAND		ORANGE BRN.	SAND CONTENT INCREASING WITH DEPTH TO 37'			
	35								5.0	0.0
						ORANGISH BRN	SAND w/SOM GRA		GRAVELS ~1"Ø 50ppm	0.0
	40									
	45									
	50						AS ABOVE			

REMARKS 1230 HRS STOPPED BORING, DRILLERS LEAVE SITE TO GET APPS UPGRADE TO LEVEL C

BORING SB01

PAGE 2 OF 3

BORING LOG

HALLIBURTON NUS

PROJECT: BETHPAGE PHASE II BORING NO: SB-01/PIEZOMETER

PROJECT NO.: 1953 DATE: 12-2-92 DRILLER: ADT

ELEVATION: FIELD GEOLOGIST: FRED WITCHOSER

WATER LEVEL DATA:

(Date, Time & Conditions)

SAMPLE NO. & TYPE OR ROD	DEPTH (ft) OR RUN NO	BLOWS 6" OR ROD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	BOREHOLE USE CONSCESS	REMARKS
							SAND w/some GRAVEL		
	55								
	60								
							TD at 62		
							COMPLETED DRILLING		
							14 COMPS		
	65								
	6								

REMARKS

BORING SB-01

PAGE 3 OF 3

BORING LOG **HALLIBURTON NUS**

PROJECT: BETHPAGE PHASE II RI BORING NO: Piezometer #2
PROJECT NO.: 1953 DATE: 12-3-92 DRILLER: Rich B, Dennis ADT
ELEVATION: FIELD GEOLOGIST: FRED WRAMSER
WATER LEVEL DATA:
(Date, Time & Conditions) PARTLY SUNNY, WINDY COLD 35°C *HN27 52*

SAMPLE NO. & TYPE OR ROD	DEPTH (FT) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	HNU READINGS / REMARKS: HS	BL
						DK BRN	SANDY GRAVEL w/some SILT			
	5					YELLOW BRN	SILTY GRAVEL w/some SAND TR SILT		0.0ppm	0.0
	10									
	15								0.0ppm	0.0ppm
	20					DK YELLOW BRN	w/SOME SANDY GRAVEL TR SILT			
	25						AS ABOVE		0.0ppm	0.0ppm

REMARKS Major Drilling Rig HSA, No soil samples taken at this loc.

BORING Piezo #2

PAGE 1 OF 3

Page 1 of 3 Borings

BORING LOG **HALLIBURTON NUS**

PROJECT: BETHAGE PHASE II RI BORING NO: PIEZOMETER #2
PROJECT NO.: 1953 DATE: 12-3-92 DRILLER: RICH B. DENNIS ADT
ELEVATION: FIELD GEOLOGIST: FRED W. RAMSER
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO & TYPE OR ROD	DEPTH (ft) OR RUN NO	BLOWS 6" OR ROD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	MATERIAL DESCRIPTION: COLOR	MATERIAL DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK CONSISTENCY	REMARKS
	30								
	35					YELLOW BRN	SAND w/SOME GRAVEL ~20% TR SILT		
							GRAVEL CONTENT DECREASING with depth		
	40			GRADUAL CHANGE AT GRAVEL TO SAND					
						YELLOW BRN	SAND TR GRAVEL + SILT		
	45								
	50					YELLOWISH BRN	SAND + SOME SILT		

REMARKS

BORING PIEZ. #2

PAGE 2 OF 3

BORING LOG **HALLIBURTON NUS**

PROJECT: BETHPAGE PHASE II RI BORING NO: PIEZOMETER #2
PROJECT NO.: 1953 DATE: 12-3-92 DRILLER: RICH B. DENNIS
ELEVATION: FIELD GEOLOGIST: FRED W. RAMSER
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE OR RQD	DEPTH (ft) OR RUN NO	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK CLASS	HNU READING HS / REMARKS
						YELLOWISH BRN	SAND w/some SILT		MOIST TO WET
	55								0.0 0.0
	60						AS ABOVE		
							TD @ 61.5'		
							COMPLETED @ 1505		

REMARKS

BORING PIEZ #2

PAGE 3 OF 3

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HN-27I2

GAMMA RAY LOG BY

DELTA WELL
& PUMP CO., INC.
97 Union Avenue P.O. Box 1309
RONKONKOMA NEW YORK 11779
(516) 981-2255

JOHNSON-KECK GR-73 GAMMA RAY LOGGING SYSTEM

WELL PW1, SITE 1 OWNER NAVY@GRUMMAN

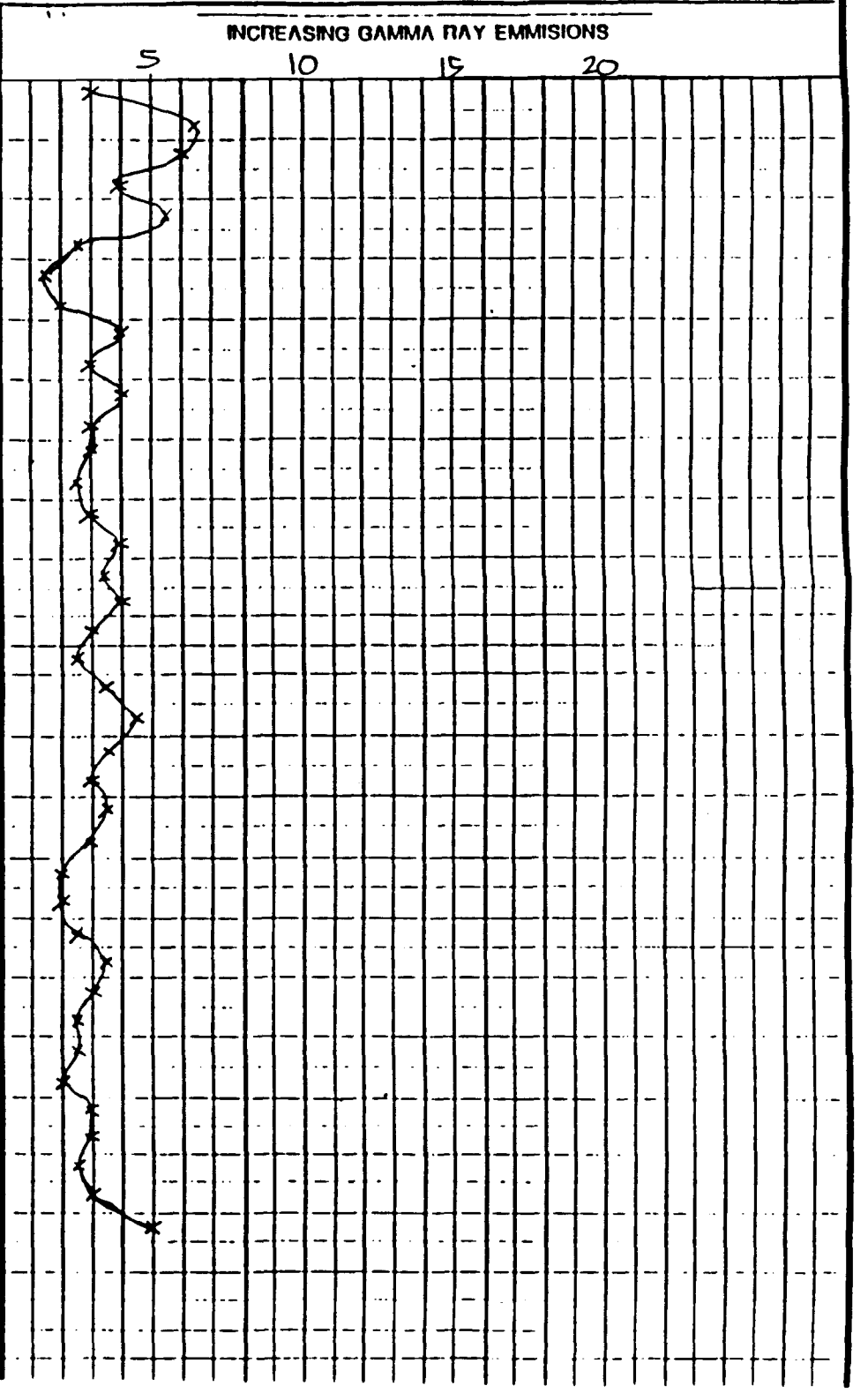
MEASURING POINT GRADE feet above/below ground level DATE 1-5-93

DRILLER R. ELMENDORF BOREHOLE DEPTH ____ feet, DIAMETER ____ inches

CASING DEPTH ____ feet, DIAMETER ____ inches OPERATOR C. OKON

COUNTS SETTING (GR-73) GM/100 RANGE SETTING (GR-81) ____ TIME CONSTANT (GR-81) ____

SECONDS	DEPTH (FT) *	COUNTS PER SECOND
36	145	3
16	142.5	6.5
17	140	6
25	137.5	4
19	135	5.5
39	132.5	2.5
69	130	1.5
48	127.5	2
25	125	4
33	122.5	3
25	120	4
36	117.5	3
36	115	3
38	112.5	2.5
33	110	3
25	107.5	4
30	105	3.5
24	102.5	4
32	100	3
37	95	2.5
29	90	3.5
23	85	4.5
29	80	3.5
32	75	3
27	70	3.5
35	65	3
53	60	2
53	55	2
40	50	2.5
30	45	3.5
36	40	3
44	35	2.5
40	30	2.5
46	25	2
32	20	3
36	15	3
42	10	2.5
36	5	3
21	0	5



* All depths measured to top of probe. Probe is 18" long.

BORING LOG — **NUS CORPORATION**

PROJECT: BETH PAGE
BORING NO: HN-43I
PROJECT NO.: 1953
DATE: 5-6-93
DRILLER: DELTA
ELEVATION:
FIELD GEOLOGIST: M. MENGEL
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO & TYPE OR ROD	DEPTH (ft) OR RUN NO	BLOWS 6" OR ROD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK CONCRETS	REMARKS
	0								
							SEE LOG FROM		
	5								
	10								
	20								
	25								

REMARKS: RIG: F10 FAILING

BORING: HN43 PILOT

PAGE 1 of 1

BORING LOG — **NUS CORPORATION**

PROJECT: BETHPAGE — BORING NO.: HN-43 I

PROJECT NO.: 1953 — DATE: 5-6-93 — DRILLER: DELTA

ELEVATION: — FIELD GEOLOGIST: M. MENGEL

WATER LEVEL DATA:

(Date, Time & Conditions)

SAMPLE NO. & TYPE OR ROD	DEPTH (ft) OR RUN NO.	BLOWS/6" OR ROD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	MATERIAL DESCRIPTION: COLOR	MATERIAL DESCRIPTION: MATERIAL CLASSIFICATION	BORE HOLE CONDITIONS	REMARKS
							SEE LOGS FROM		
	30								
	35								
	40								
	45								
	50								

REMARKS

BORING HN43 Pilot

BORING LOG — **NUS CORPORATION**

PROJECT: BETHPAGE — BORING NO.: HN-43 I
PROJECT NO.: 1953 — DATE: 5-6-93 — DRILLER: DELTA
ELEVATION: — FIELD GEOLOGIST: M MENGEL
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE OR ROD	DEPTH (ft) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	BORE USE CONSCRESS	REMARKS
S-1	50'-52'	36 42	1.1/20		DENSE	LIGHT BROWN	FINE LIGHT BROWN SAND		1015
		49 58					TRACE GRAVEL, TRACE MICA		
									HEADSPACE 1PPM
									HNU.
									S1 HNU 8PPM
							H2O @ 57'		
S-2	60-62				LOOSE	LIGHT BROWN	FINE SAND, TRACE SILT		S-2 HNU 5PPM
		11 15	1.2/20				MICA TRACE THROUGHOUT		
		16 43							
S-3	70-72	14 10	.30/20		VERY LOOSE	LIGHT BROWN	FINE TO MED SAND		HEADSPACE 1PPM
		5 3							S-3 HNU 0 PPM

REMARKS Using wire line to collect spoons
Pilot hole augers 3 1/4 ID 6 1/4 OD

BORING HN 43 Pilot

BORING LOG — **NUS CORPORATION**

PROJECT: BETHPAGE — BORING NO.: HN-43 I
PROJECT NO.: 1953 — DATE: 5-6-93 — DRILLER: DELTA
ELEVATION: — FIELD GEOLOGIST: M. MENGEL
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE OR ROD	DEPTH (ft) OR RUN NO	BLOWS 6" OR ROD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	BORE HOLE CONDITIONS	REMARKS
S-4	80-82	8 / 14 / 27 / 29	1.8/2.0		LOOSE - MED DENSE	LIGHT BROWN TO BROWN	VERY FINE SAND + SILT		1105
							TRACE CLAY @ 81'		S-4 HNU - 0 PPM
S-5	90-92	10 / 12 / 5 / -	1.2/2.0		LOOSE	LIGHT BROWN TO BROWN	SAND, CLAY, TRACE SILT		1115 HNU @ the hole 0 PPM
									S-5 HNU - 0 PPM
~~S-6~~	~~100-102~~	11 / 14 / ~~29-35~~					OVER →		

REMARKS

BORING HN43 PILOT

BORING LOG — **NUS CORPORATION**

PROJECT: BETH PAGE — BORING NO.: HN-43 I
PROJECT NO.: 1953 — DATE: 5-6-83 — DRILLER: DELTA
ELEVATION: — FIELD GEOLOGIST: M Menuec
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE OR ROD	DEPTH (ft) OR RUN NO.	BLOWS 6" OR ROD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK CONSTITUENTS	REMARKS
S-6	100-102	11 / 14	1.3/2.0		MED DENSE	LIGHT BROWN	Interbedded fine sand &		1200
		19 / 17					sandy clay mica frag		S-6 HNU 0 PPM
									1230
S-7	110-120	15 / 21	0						POOR RECOVERY d
		25 / 34							to heaving sands
									HNU @ S7 0 PPM
									1400
S-8	120-122	20 / 15	.3/2.0				light brown sand (med)		POOR RECOVERY
		25 / 20					mica frag		S-8 HNU = 0 PPM
									HAVING REAL PROBLEMS
									with RUNNING SANDS

REMARKS

BORING HN43 P1/5

PAGE 5 OF 7

BORING LOG — **NUS CORPORATION**

PROJECT: BETHPAGE — BORING NO.: HN-43I
PROJECT NO.: 1953 — DATE: 5-6-93 — DRILLER: DELTA
ELEVATION: — FIELD GEOLOGIST: M. MENGEL
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE OR ROD	DEPTH (ft) OR RUN NO.	BLOWS/6" OR ROD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	BOREHOLE CONDITIONS	REMARKS
									1425
S-9	130-132	12 / 17 / 20 / 29	.5/2.0		MD DENSE	LIGHT BROWN	FINE SAND MICA FRAG		S-9 HNU 0 PPM
									1455
S-10	135-137	17 / 13 / 21 / 25	.5/2.0		M DENSE	LIGHT BROWN	FINE SAND MICA FRAG		S-10 HNU 0 PPM
									1515
S-11	140-142	18 / 20 / 22 / 25	.5/2.0		M. DENSE	LIGHT BROWN	FINE SAND MICA FRAG TRACE SILT		S-11 HNU 1 PPM
									0745
S-12	145-147	17 / 12 / 20 / 18	.7/2.0		M DENSE	LIGHT BROWN	FINE TO MED SAND TRACE MICA		S-12 HNU 5 PPM

REMARKS

BORING HN 43 PILOT

PAGE 6 OF 7

BORING LOG — **NUS CORPORATION**

PROJECT: BETHPAGE — BORING NO.: HN-43I
PROJECT NO.: 1953 — DATE: — DRILLER: DELTA
ELEVATION: — FIELD GEOLOGIST: M. MENDEL
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE OR ROD	DEPTH (ft) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK CODE	REMARKS
									0845
S-13	150-152	10 12 20 23	.8/2.0		M DENSE	LIGHT BROWN	VERY FINE SAND TRACE SILT, MICA FRAG.		HNU S-13 5 PPM
									0915
S-14	155-157	16 14 20 17	1.0/2.0		M DENSE	LIGHT BROWN	VERY FINE SAND TRACE SILT + MICA FRAG.		HNU @ borehole C, 2.1 S-14 HNU - 1 PPM
									1000
S-15	160-162	7 8 11 16	.7/2.0		M DENSE	BROWN	VERY FINE SAND TRACE SILT + MICA		HNU S-15 - 0.1
									Augered to 165' NO SAMPLE

REMARKS

BORING HN43I

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LC36

GAMMA RAY LOG BY

DELTA WELL
& PUMP CO., INC.
97 Union Avenue P.O. Box 1309
RONKONKOMA NEW YORK 11779
(516) 981-2255

JOHNSON-KECK GR-73 GAMMA RAY LOGGING SYSTEM

WELL HN-43I OWNER NAVY@ Grumman

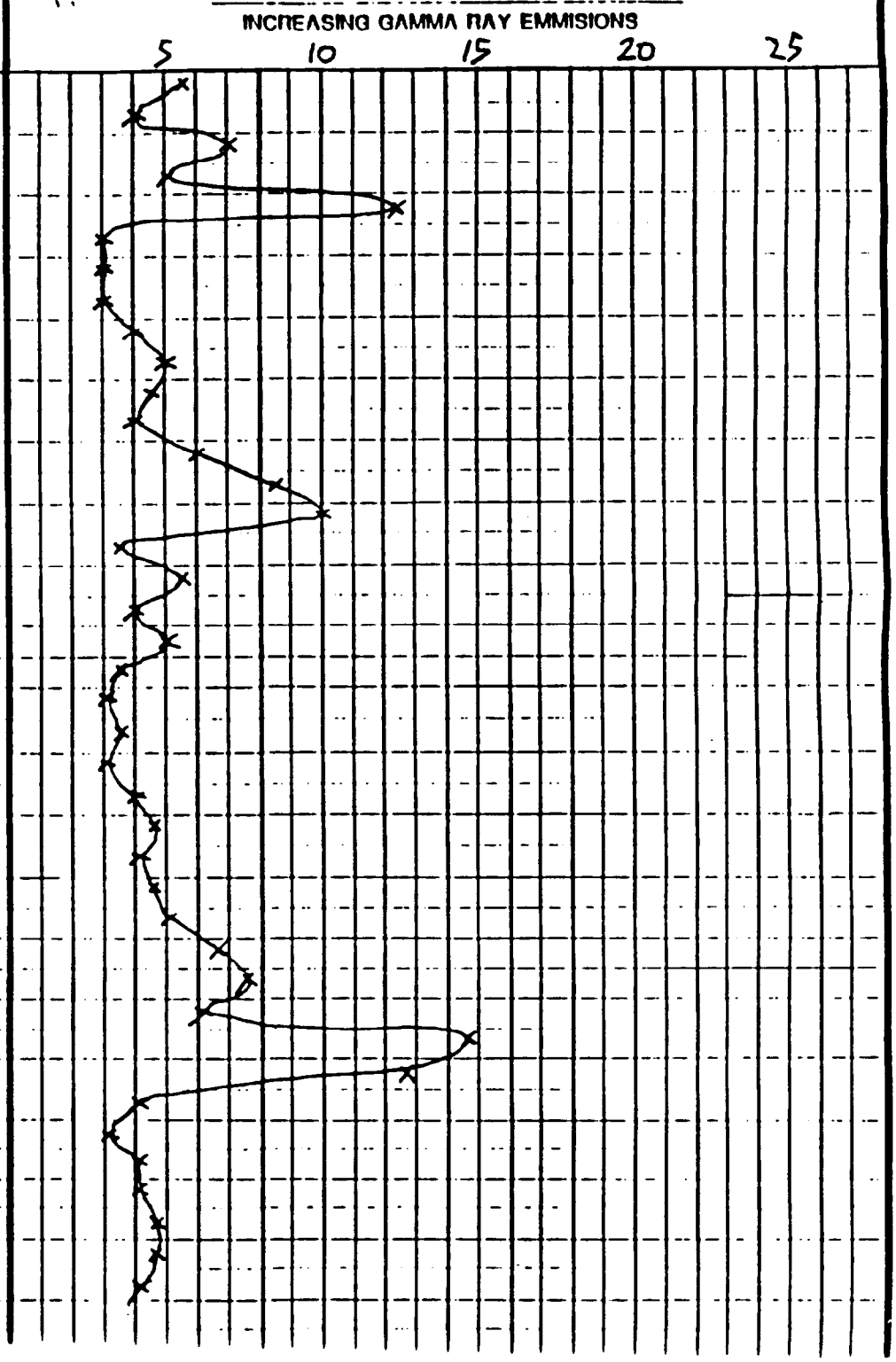
MEASURING POINT 1 feet above/below ground level DATE 5-10-93

DRILLER Joe Guggino BOREHOLE DEPTH ____ feet, DIAMETER ____ inches

CASING DEPTH ____ feet, DIAMETER ____ inches OPERATOR Chris Okon

COUNTS SETTING (GR-73) Gry/100 RANGE SETTING (GR-81) ____ TIME CONSTANT (GR-81) ____

SECONDS	DEPTH (ft) *	COUNTS PER SECOND
19	160	5.5
26	157.5	4
14	155	7
21	152.5	5
8	150	12.5
33	147.5	3
32	145	3
35	142.5	3
24	140	4
21	137.5	5
22	135	4.5
26	132.5	4
17	130	6
12	127.5	8.5
10	125	10
29	122.5	3.5
18	120	5.5
26	117.5	4
21	115	5
27	112.5	3.5
33	110	3
29	107.5	3.5
31	105	3
25	102.5	4
22	100	4.5
24	97.5	4
22	95	4.5
20	92.5	5
15	90	6.5
13	87.5	7.5
17	85	6
7	82.5	14.5
8	80	12.5
24	77.5	4
31	75	3
26	72.5	4
24	70	4
22	67.5	4.5
22	65	4.5
24	62.5	4



* All depths measured to top of probe. Probe is 18" long

LC36

GAMMA RAY LOG BY

DELTA WELL
& PUMP CO., INC.
97 Union Avenue P.O. Box 1309
RONKONKOMA NEW YORK 11779
(516) 981-2755

JOHNSON-KECK GR-73 GAMMA RAY LOGGING SYSTEM

WELL HN-43I OWNER ~~NAVY~~ @ Grumman

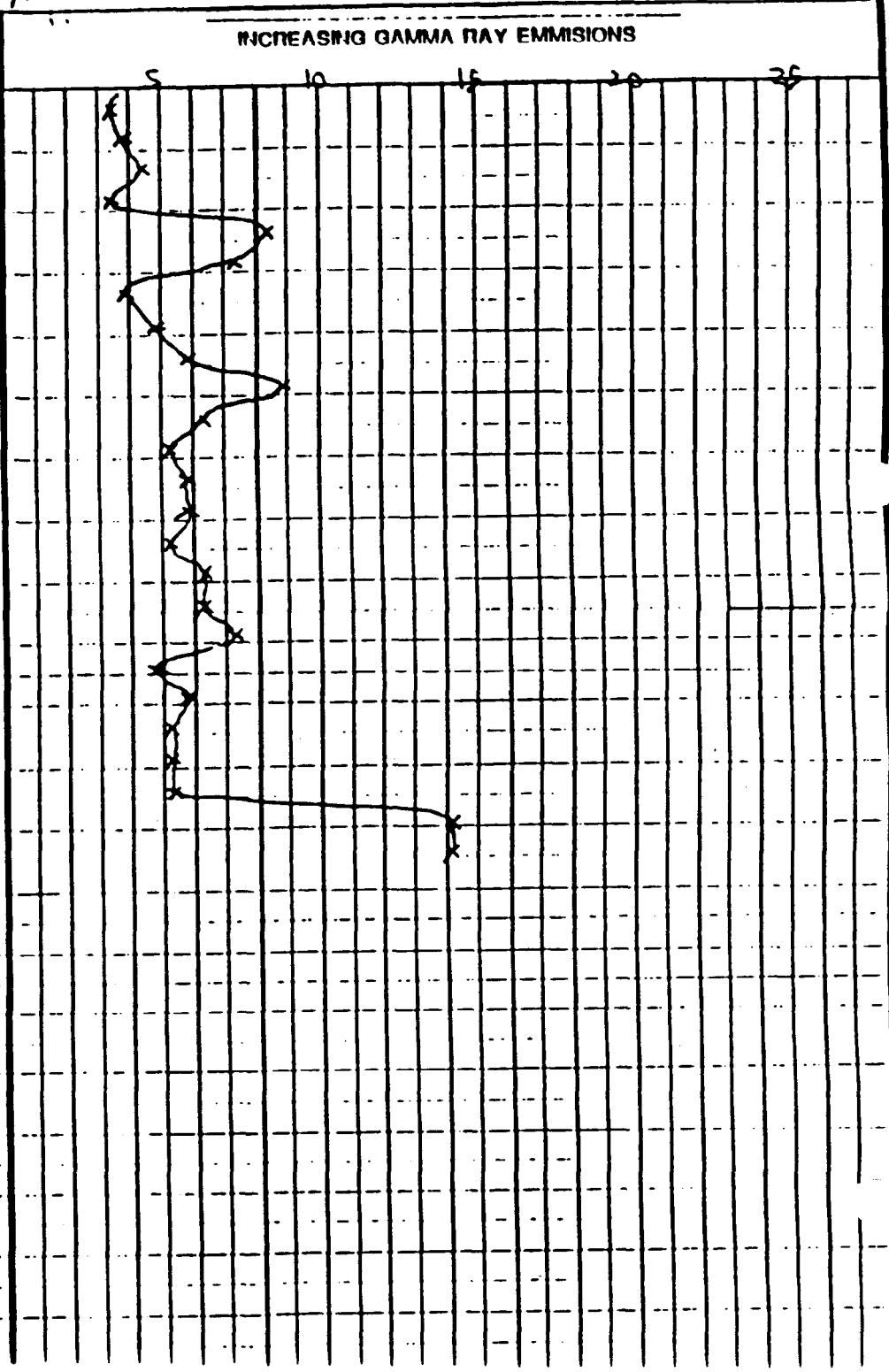
MEASURING POINT 1 feet above/below ground level DATE 5-10-93

DRILLER Joe Guggino BOREHOLE DEPTH ____ feet, DIAMETER ____ inches

CASING DEPTH ____ feet, DIAMETER ____ inches OPERATOR Chris Okon

COUNTS SETTING (GR-73) GM/100 RANGE SETTING (GR-81) ____ TIME CONSTANT (GR-81) ____

SECONDS	DEPTH (FT)	COUNTS PER SECOND
27	60	3.5
25	57.5	4
22	55	4.5
28	52.5	3.5
12	50	8.5
13	47.5	7.5
24	45	4
20	42.5	5
17	40	6
11	37.5	9
15	35	6.5
19	32.5	5.5
17	30	6
17	27.5	6
18	25	5.5
16	22.5	6.5
16	20	6.5
13	17.5	7.5
21	15	5
17	12.5	6
18	10	5.5
18	7.5	5.5
19	5	5.5
7	2.5	14.5
7	1	14.5



BORING LOG — **HALLIBURTON NUS**

PROJECT: BETHPAGE NWIRP — BORING NO.: HN-40 PILOT
PROJECT NO.: 1953 — DATE: 2-2-93 — DRILLER:
ELEVATION: — FIELD GEOLOGIST: K.C. KILMARTIN
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE / TIME	DEPTH (Ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, Ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1045	100	16/11 14/32	24/24		2"	BRN	GRAVEL - LAG		
					22"	BRN TO LT GY	MEDIUM SAND WITH a few SILTY & CLAYEY STREAKS	*	Headspace 1.5 ppm
1115	110	6/16 22/40	18/18		18"	BRN TO LT GY	MEDIUM TO MOSTLY COARSE SAND	*	Headspace 0.4 ppm
							2ft of heave at 120 ft	←	
1145	120		24/24		15"	BRN	Brown Coarse sand - lag?	*	Headspace 1.8 ppm
					6"	LT BRN TO GY	MEDIUM TO fine sand INTERBEDDED WITH STICKY, SILTY CLAY		
							6ft of heave at 130 ft	←	Heave is a fine grained, "runny" sand that packs very tightly
230	130		24/24		24"	LT BRN TO GY	COCLISE SAND (?) NOTE: Tray was clogged with a very fine-grained, tightly packed sand similar to the heave	*	Headspace 1.6 ppm 132-136' very tight according to DRILLER
							4ft of heave at 140 ft		
315	140	6/16 5/7	24/24		15"	LT BRN	COARSE sand - lag?	*	Headspace 1.8 ppm
					6"	LT BRN TO GY-BRN	SILTY & CLAYEY, very fine-grained sand		
							2ft of heave at 150 ft	←	

REMARKS: Samples obtained with a down-hole slide hammer

BORING: HN-40 PILOT

PAGE 1 OF 2

* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN-40 PILOT
PROJECT NO.: _____ DATE: 2-2-93 DRILLER: _____
ELEVATION: _____ FIELD GEOLOGIST: K.C. KILMARTIN
WATER LEVEL DATA: _____
(Date, Time & Conditions) _____

SAMPLE NO. & TYPE Time	DEPTH (Ft) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, Ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	150	4 8	24/24		12"	BN	med-coarse sand = 1gg		Headspace 0.4ppm
		8 10			12"	GY	very fine silty sand		

REMARKS Drillers drill to 155' to provide rat-hole for gamma-ray logger.

BORING HN-40 PILOT

PAGE 2 OF 2

* See Legend on Back

LC36

GAMMA RAY LOG BY

DELTA WELL
& PUMP CO., INC.
97 Union Avenue P.O. Box 1309
RONKONKOMA NEW YORK 11779
(516) 981-7255

JOHNSON-KECK GR-73 GAMMA RAY LOGGING SYSTEM

WELL HN40I OWNER NAK@GRUMMAN

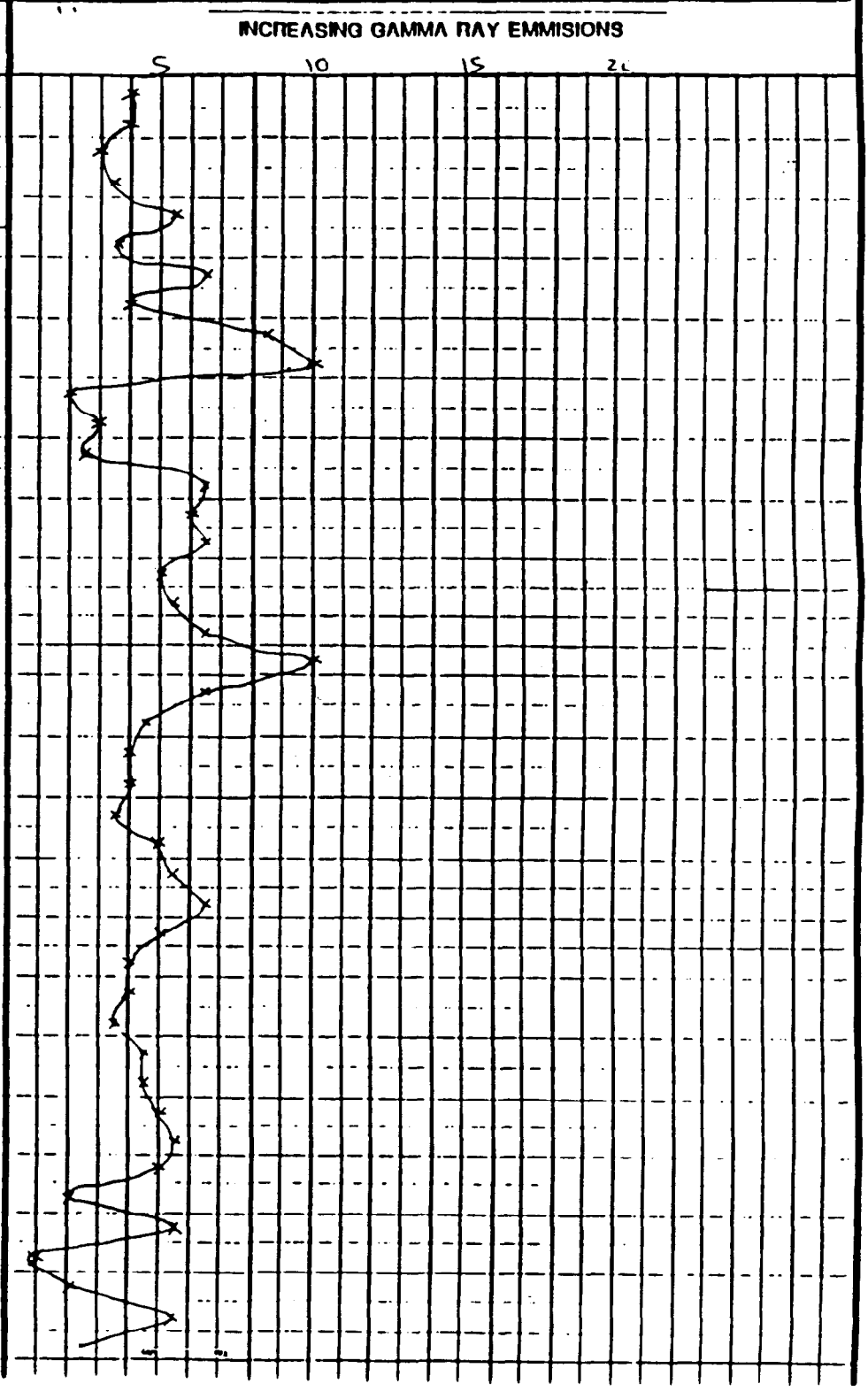
MEASURING POINT 1 feet above/below ground level DATE 2-2-93

DRILLER Mike Pellegrino BOREHOLE DEPTH ____ feet, DIAMETER ____ inches

CASING DEPTH ____ feet, DIAMETER ____ inches OPERATOR [illegible]

COUNTS SETTING (GR-73) [illegible]/100 RANGE SETTING (GR-81) ____ TIME CONSTANT (GR-81) ____

SECONDS	DEPTH (FT)	COUNTS PER SECOND
24	152.7	4
26	150	4
25	147.7	3
27	145	3.5
1	142.7	5.5
2.5	140	3.5
15	137.7	6.5
24	35	4
12	132.7	8.5
10	13	10
40	[illegible]	2
[illegible]	[illegible]	3
4	[illegible]	2.5
14	11	6.5
[illegible]	75	6
[illegible]	[illegible]	6.5
1	[illegible]	5
[illegible]	115	5.5
[illegible]	[illegible]	6.5
1	[illegible]	10
[illegible]	[illegible]	6.5
[illegible]	[illegible]	4.5
[illegible]	[illegible]	4
[illegible]	[illegible]	4
[illegible]	172	3.5
[illegible]	16	5
[illegible]	[illegible]	5.5
1	[illegible]	6.5
[illegible]	[illegible]	5
[illegible]	[illegible]	4
4	175	4
[illegible]	75	3.5
[illegible]	[illegible]	4.5
[illegible]	[illegible]	4.5
[illegible]	175	5
1	15	5.5
1	[illegible]	5
[illegible]	6	2
11	5.75	5.5
52	7	1
45	[illegible]	2
14	76	5.5



DELTA WELL
& PUMP CO., INC.
97 Union Avenue P.O. Box 1309
RONKONKOMA NEW YORK 11779
(516) 981-2255

GAMMA RAY LOG BY

JOHNSON-KECK GR-73 GAMMA RAY LOGGING SYSTEM

WELL HN40I OWNER NAVY @ GRUMMAN

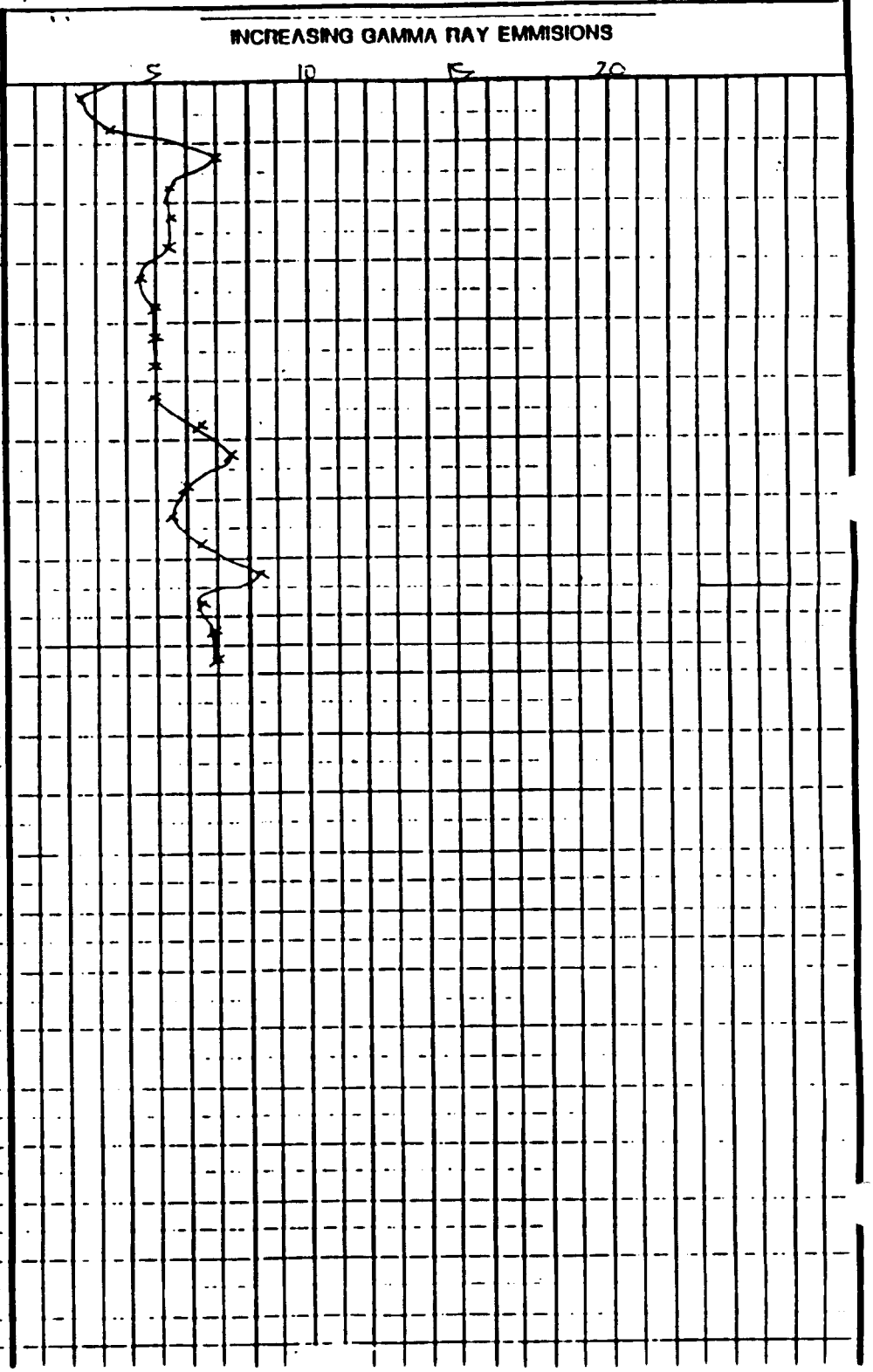
MEASURING POINT 1 feet above/below ground level DATE 2-2-93

DRILLER Mike Pellegrino BOREHOLE DEPTH ____ feet, DIAMETER ____ inches

CASING DEPTH ____ feet, DIAMETER ____ inches OPERATOR Chris Okon

COUNTS SETTING (GR-73) GM/100 RANGE SETTING (GR-81) ____ TIME CONSTANT (GR-81) ____

SECONDS	DEPTH (FT)	COUNTS PER SECOND
39	475	2.5
23	47	3.5
4	42.7	7
12	41	5.5
14	37.7	5.5
[illegible]	[illegible]	5.5
[illegible]	[illegible]	4.5
26	[illegible]	5
[illegible]	[illegible]	5
26	[illegible]	5
[illegible]	[illegible]	5
16	[illegible]	6.5
[illegible]	17.5	7.5
17	[illegible]	6
[illegible]	[illegible]	5.5
[illegible]		6.5
[illegible]		8.5
[illegible]		6.5
[illegible]		7
[illegible]	[illegible]	7



BORING LOG — **HALLIBURTON NUS**

PROJECT: BETHPAGE NWIRP — BORING NO.: HN-41 PILOT
PROJECT NO.: 1953 — DATE: 2-8-93 — DRILLER:
ELEVATION: — FIELD GEOLOGIST: KC Kilmartin
WATER LEVEL DATA (Date, Time & Conditions):

Background HNU is 0.2 ppm

SAMPLE NO. & TYPE Time	DEPTH (FT.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, FT.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
~~100~~	100	38 16	24/24		12"	BRN	Coarse sand & gravel (lag)		
1315		8 6			12"	GY	very STICKY CLAY with		Headspace: 0.4 ppm
							Minor SILT		
							2.5 ft. of heave at 110'		CLAY PLUG IN AUGER, cleaned out w/ split-spoon
1405	110	6 8 4 9 7 8 10	24/24		8"	BRN	Coarse sand (lag)		
					16"	GY	MED. sand with a few		Headspace: 0.4 ppm
							clayey-SILT beds (very		
							Thin)		
							0 ft heave at 120'		
1432	120	3 4 5 10	24/24		8"	Brn	MED-coarse sand (lag?)		
					12"	GY	CLAYEY TO SILTY, STICKY fine SAND		Head Space: 0.6 ppm
					4"	GY	STICKY CLAY TO SILTY CLAY		
							0 ft heave at 130'		
1455	130	3 4 7 9	24/24		12"	GY	very STICKY SILTY CLAY		
					6"	GY	STICKY CLAY TO SILTY CLAY		Headspace: 0.3 ppm
					4"	GY-BLK	very dense, hard CLAY		
					2"	GY	MEDIUM SAND		Heave is a silty, v fine sand with some rare
							2 ft of heave at 140'		pyritic (?) concretions
1525	140	4 4 6 14	24/24		16"	GY-BLK	very dense & hard clay		Headspace: 0.4 ppm
					8"	GY	SILTY TO clayey, fine TO		
							MEDIUM SAND		OUTSIDE of spoon coated w/ clay
							0 ft of heave at 150'		

REMARKS: Samples driven by a down-hole slide hammer

BORING: HN-41 PILOT

PAGE 1 OF 2

* See Legend on Back

BORING LOG — **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN-41 PILOT
PROJECT NO.: _____ DATE: 2-8-93 DRILLER: _____
ELEVATION: _____ FIELD GEOLOGIST: KC KILMARTIN
WATER LEVEL DATA: _____
(Date, Time & Conditions) _____

SAMPLE NO. & TYPE Time	DEPTH (Ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, Ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1555	150	2 / 2	24/24		8"	DK. GY	CLEAN MEDIUM SAND		
		6 / 11			4"	GY	SILTY and CLAYEY, STICKY fine SAND		Headspace 0.2ppm
					12"	GY TO GY-BLK	very dense & hard CLAY		

REMARKS Drillers Drilled TO 155' TO provide rathole for gamma-ray logging tool.

BORING HN-41 PIL

PAGE 2 OF 2

* See Legend on Back

LC36

GAMMA RAY LOG

DELTA WELL & PUMP Co., Inc.

JOHNSON-KECK GR-73 GAMMA RAY LOGGING SYSTEM

WELL HN41I, So. 3rd Street OWNER NAVY @ GRUMMAN

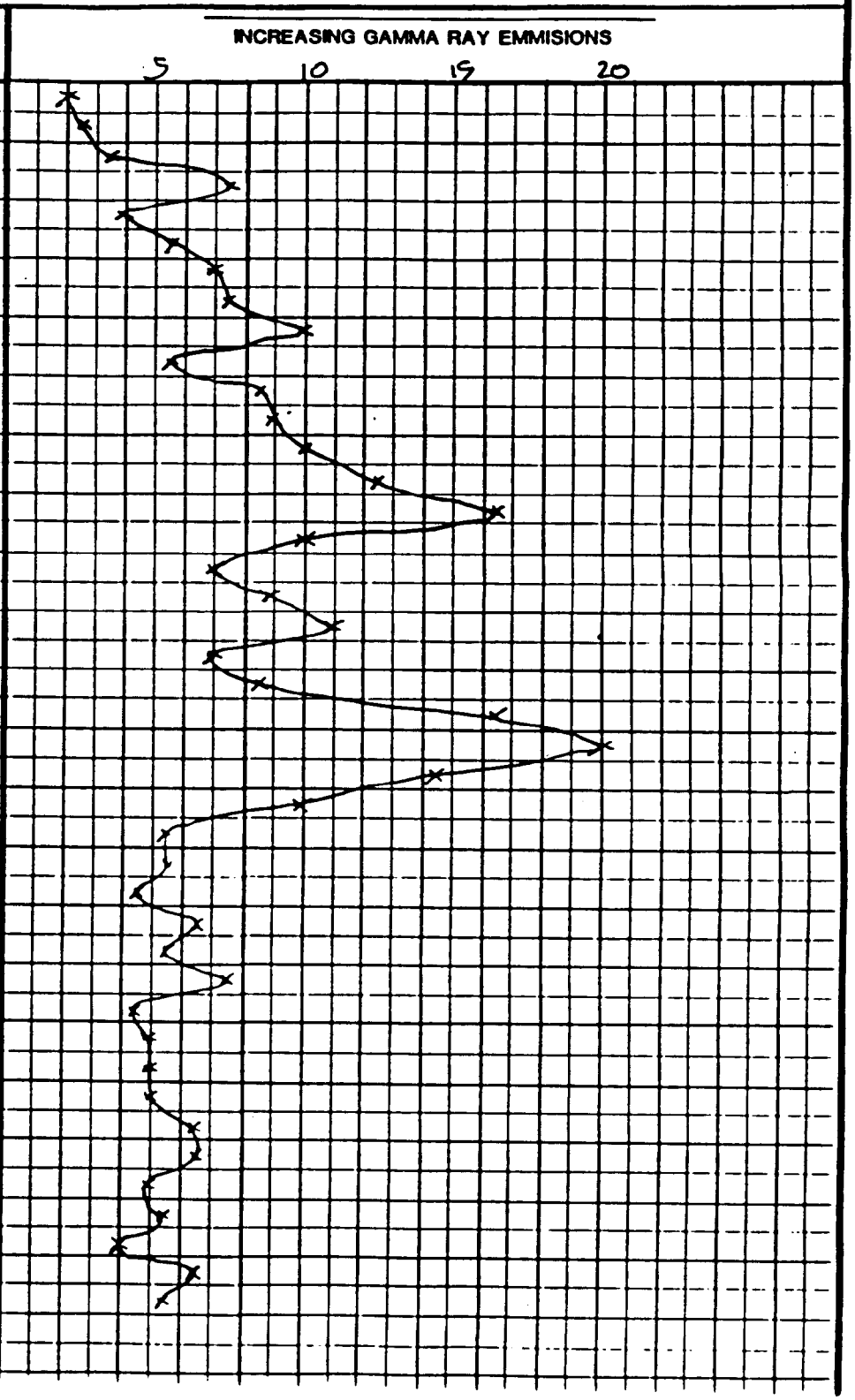
MEASURING POINT 1 feet above/below ground level DATE 2-8-93

DRILLER Mike Pellegrino BOREHOLE DEPTH ____ feet, DIAMETER ____ inches

CASING DEPTH ____ feet, DIAMETER ____ inches OPERATOR Chris Okon

COUNTS SETTING (GR-73) SR/100 RANGE SETTING (GR-81) ____ TIME CONSTANT (GR-81) ____

SECONDS	DEPTH (FT)	COUNTS PER SECOND
54	152.5	2
40	150	2.5
29	147.5	3.5
13	145	7.5
24	142.5	4
18	140	5.5
14	137.5	7
13	135	7.5
10	132.5	10
19	130	5.5
12	127.5	8.5
11	125	9
10	122.5	10
8	120	12.5
6	117.5	16.5
10	115	10
17	112.5	7
11	110	9
9	107.5	11
14	105	7
12	102.5	8.5
6	100	16.5
5	97.5	20
7	95	14.5
10	92.5	10
19	90	5.5
18	87.5	5.5
22	85	4.5
16	82.5	6.5
18	80	5.5
13	77.5	7.5
23	75	4.5
20	72.5	5
21	70	5
20	67.5	5
15	65	6.5
16	62.5	6.5
20	60	5
19	57.5	5.5
24	55	4
16	52.5	6.5
19	50	5.5



LC36

GAMMA RAY LOG

DELTA WELL & PUMP Co., Inc.

JOHNSON-KECK GR-73 GAMMA RAY LOGGING SYSTEM

WELL HN42I, So. OWNER NAVY@GRUMMAN

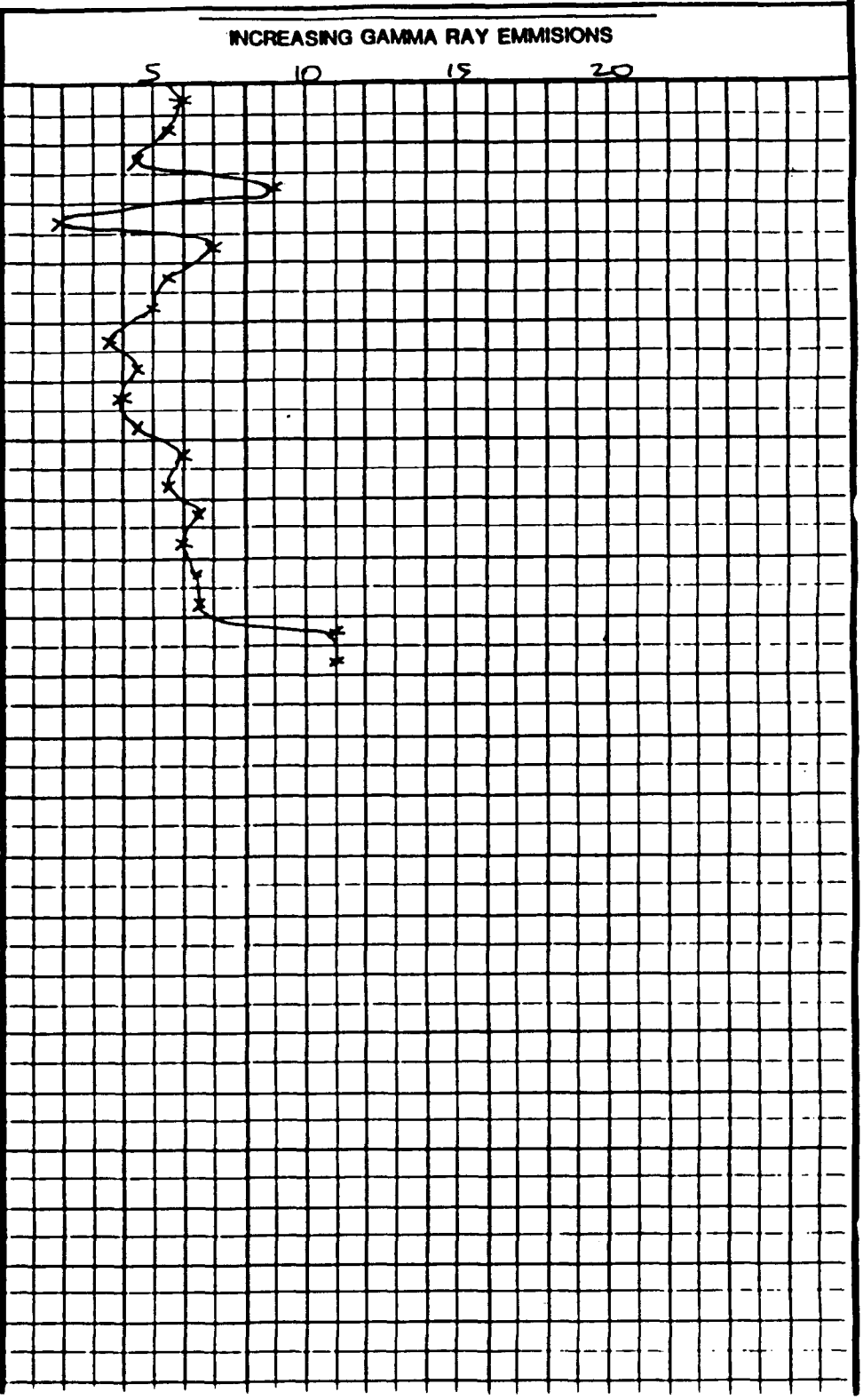
MEASURING POINT 1 feet (above) below ground level DATE 2-8-93

DRILLER Mike Pellegrino BOREHOLE DEPTH ____ feet, DIAMETER ____ inches

CASING DEPTH ____ feet, DIAMETER ____ inches OPERATOR Chris Okon

COUNTS SETTING (GR-73) GM/100 RANGE SETTING (GR-81) ____ TIME CONSTANT (GR-81) ____

SECONDS	DEPTH (FT)	COUNTS PER SECOND
17	47.5	6
18	45	5.5
22	42.5	4.5
11	40	9
54	37.5	2
14	35	7
19	32.5	5.5
20	30	5
29	27.5	3.5
23	25	4.5
24	22.5	4
22	20	4.5
17	17.5	6
18	15	5.5
16	12.5	6.5
17	10	6
15	7.5	6.5
15	5	6.5
9	2.5	11
9	1	11



BORING LOG — **HALLIBURTON NUS**

PROJECT: BETHPAGE NWIRP — BORING NO.: HN-42 PILOT
PROJECT NO.: 1953 — DATE: 2-15-93 — DRILLER: DELTA
ELEVATION: — FIELD GEOLOGIST: KC KILMARTIN
WATER LEVEL DATA: —
(Date, Time & Conditions)

SAMPLE NO. & TYPE / TIME	DEPTH (Ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	Background is 0.2 ppm REMARKS
1040	100	6 / 20 / 19 / 15	24/24		24"	BRN	Course sand with common gravel		Headspace: 0.5 ppm
							0 ft heave at 110 ft		
1105	110	7 / 10 / 16 / 19	18/18		18"	LT. GY TO BRN	uniform, medium sand		Head space: 0.7 ppm
							0 ft heave at 120 ft		
1130	120	5 / 6 / 5 / 14	24/24		24"	LT. GY	uniform, medium sand		Headspace: 0.5 ppm
							5 ft of heave at 130 ft. Heave: LT GY. medium sand		Some may be lag (shut down .5 hr = lunch)
1305	130	14 / 15 / 19 / 26	18/18		18"	LT GY TO LT BRN	uniform, medium sand. Driller reports dense "tight" zones = 132 > 140'		Headspace: 0.6 ppm
							2 ft of heave at 140 ft.		Heave is light gy med. sand
1350	140	6 / 7 / 17 / 17	24/24		24"	LT. GY TO LT BRN	Hole TO mostly med. sand. matrix appears clayey - 3" unity.		Headspace: 0.4 ppm
							3.5 ft of heave at 150 ft		
							Heave is light gray, mostly fine to medium sand.		

REMARKS: Sharp decrease in gravel & change TO uniform medium sand at ≈ 35'. Depth TO water ~ 45'. No HNU readings above background. Samples obtained with down-hole split hammer.

BORING: HN-42 PILOT

PAGE 1 OF 2

* See Legend on Back

BORING LOG **HALLIBURTON NUS**

PROJECT: _____ BORING NO.: HN-42 P, LOT
PROJECT NO.: _____ DATE: 2-15-93 DRILLER: DELTA
ELEVATION: _____ FIELD GEOLOGIST: KC KILMARTIN
WATER LEVEL DATA: _____
(Date, Time & Conditions) _____

SAMPLE NO. & TYPE Time	DEPTH (Ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, Ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1430	150	3	18/18		6"	LT. GY	SILTY TO CLAYEY fine sand		Head space: 0.4
		3							
		10			12"	LT. GY	VERY STICKY TO STIFF CLAY		

REMARKS Drillers drilled TO 155 ft TO provide 5 ft of rathole for gamma ray logger. 120-125 ft As augers pulled: Clay on Augers starts on the ~~[illegible]~~ 1' auger, grades downward from a clayey sand to a silty, sticky clay to a sticky clay to a stiff clay. Bottom 10 ft is extremely dense & "moldable", gray clay.

BORING HN 42 P1 LOT

PAGE 2 OF 2

* See Legend on Back

LC36

GAMMA RAY LOG BY

DELTA WELL
& PUMP CO., INC.
97 Union Avenue P.O. Box 1309
RONKONKOMA NEW YORK 11779
(516) 981-2255

JOHNSON-KECK GR-73 GAMMA RAY LOGGING SYSTEM

WELL HN42I, 7th Street OWNER NAVY & Grumman

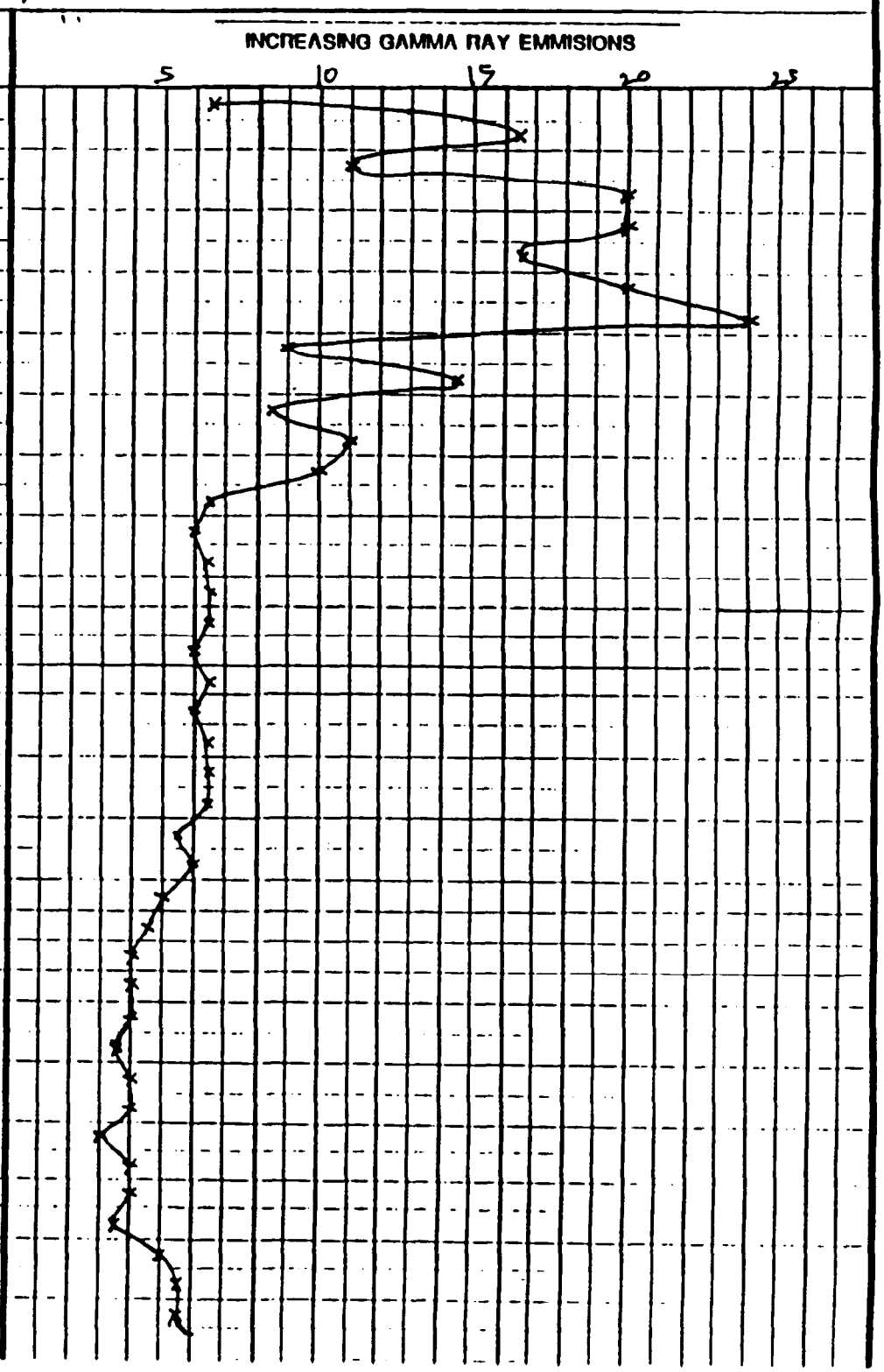
MEASURING POINT 1 feet (above) below ground level DATE 2-15-93

DRILLER Mike Pellegrino BOREHOLE DEPTH ____ feet, DIAMETER ____ inches

CASING DEPTH ____ feet, DIAMETER ____ inches OPERATOR Chris Oken

COUNTS SETTING (GR-73) GM/100 RANGE SETTING (GR-81) ____ TIME CONSTANT (GR-81) ____

SECONDS	DEPTH (FT)	COUNTS PER SECOND
16	152.5	6.5
6	150	16.5
9	147.5	11
5	145	20
5	142.5	20
6	140	16.5
5	137.5	20
4	135	25
11	132.5	9
7	130	14.5
12	127.5	8.5
9	125	11
10	122.5	10
15	120	6.5
17	117.5	6
16	115	6.5
15	112.5	6.5
16	110	6.5
17	107.5	6
16	105	6.5
17	102.5	6
16	100	6.5
16	97.5	6.5
16	95	6.5
18	92.5	5.5
17	90	6
21	87.5	5
23	85	4.5
25	82.5	4
26	80	4
24	78.5	4
30	75	3.5
25	72.5	4
26	70	4
31	67.5	3
25	65	4
25	62.5	4
28	60	3.5
21	57.5	5
18	55	5.5
19	52.5	5.5



All depths measured to top of probe. Probe is 18" long.

LC36

GAMMA RAY LOG BY

DELTA WELL
& PUMP CO., INC.
97 Union Avenue P.O. Box 1309
RONKONKOMA NEW YORK 11779
(516) 981-7255

JOHNSON-KECK GR-73 GAMMA RAY LOGGING SYSTEM

WELL HN42I, 7th Street OWNER NAVY @ Grumman

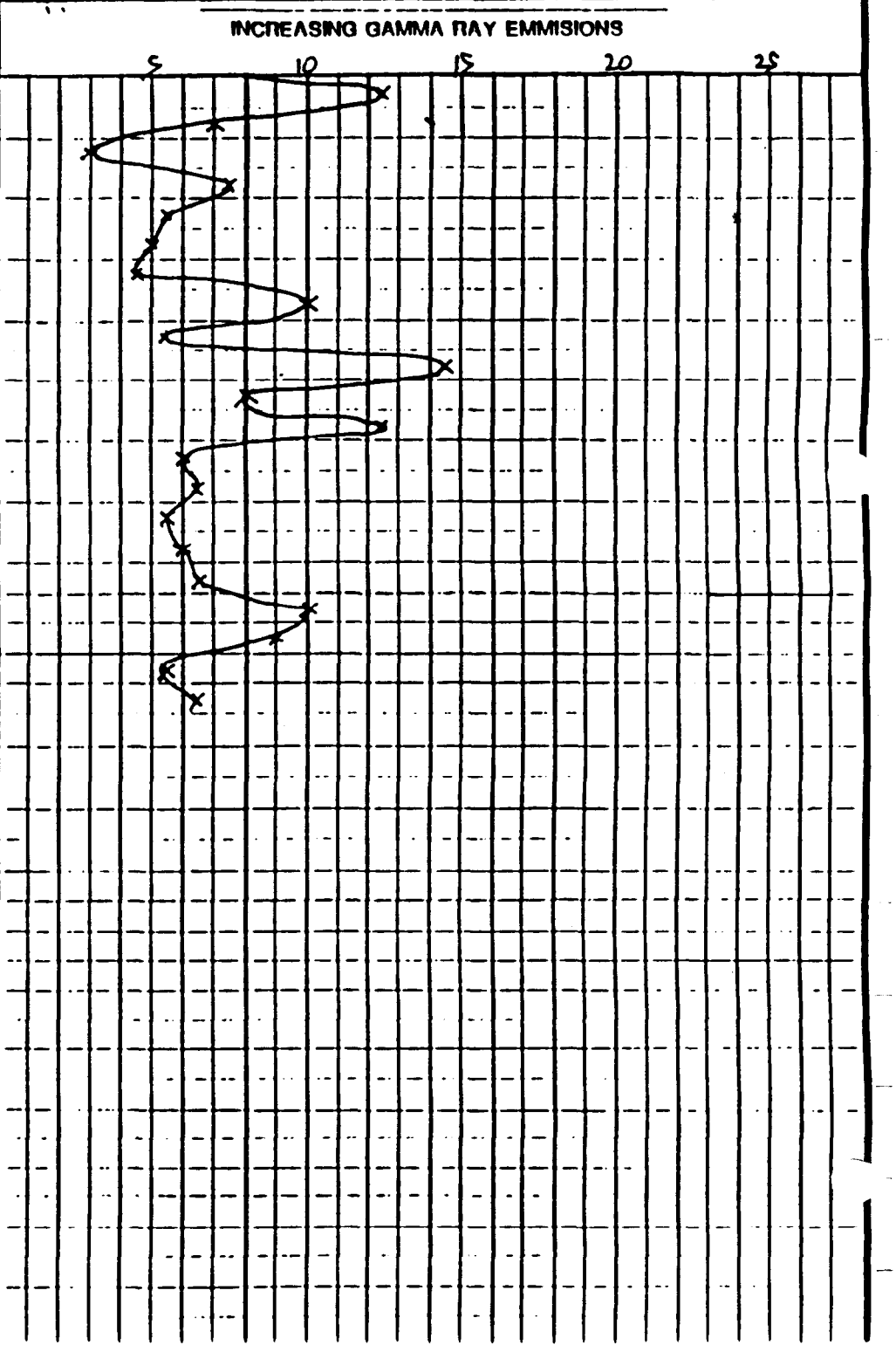
MEASURING POINT 1 feet above/below ground level DATE 2-15-93

DRILLER Mike Pellegrino BOREHOLE DEPTH ____ feet, DIAMETER ____ inches

CASING DEPTH ____ feet, DIAMETER ____ inches OPERATOR Chris Okon

COUNTS SETTING (GR-73) GM/100 RANGE SETTING (GR-81) ____ TIME CONSTANT (GR-81) ____

SECONDS	DEPTH (FT)	COUNTS PER SECOND
8	50	12.5
14	47.5	7
34	45	3
13	42.5	7.5
18	40	5.5
21	37.5	5
23	35	4.5
10	32.5	10
19	30	5.5
7	27.5	14.5
5	25	20
8	22.5	12.5
17	20	6
15	17.5	6.5
19	15	5.5
17	12.5	6
16	10	6.5
10	7.5	10
11	5	9
18	2.5	5.5
15	1	6.5



All depths measured to top of probe. Probe is 18" long

BORING LOG **HALLIBURTON NUS**

PROJECT: BETHPAGE 1953, PHASE II NW IRP BORING NO. SB-02 (9th + MAPLE)
PROJECT NO.: 1953 DATE: 12-7-92 DRILLER: RICH B, DENNIS ADT
ELEVATION: FIELD GEOLOGIST FRED LUTAMER
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO & TYPE OR ROD	DEPTH (ft) OR RUN NO.	BLOWS 6" OR ROD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS CODE	HS HNU READINGS / REMARKS
						YELLOW BRN	GRAVELS + SAND TR SILT		0.0ppm
	5								
	10								
	15								
	20								0.0ppm
	25								
	30						SILT + SAND W/SOME GRAVEL ~30%		0.0ppm
				GRAVEL CONTENT DECREASES WITH DEPTH					
	35								

REMARKS MOBILE RIG-61 HSA 3¼ ID, NO SAMPLES TAKEN AT THIS LOCATION

RESIDENTIAL
BORING SB-02
PAGE 1 OF 2

BORING LOG **HALLIBURTON NUS**

PROJECT: BETHPAGE PHASE II VWIRP BORING NO: SB-02
PROJECT NO.: 1953 DATE: 12-7-92 DRILLER: RICH B.
ELEVATION: FIELD GEOLOGIST: FRED W RAMSER
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE OR RQD	DEPTH (ft) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	HS HNU READINGS REMARKS
						YELLOW BRN	SAND W/SOME SILT		
	40								0.0ppm
	45								0.0ppm
	50								0.0ppm
	55								
	60						TD @ 60'		

REMARKS BORING BACKFILLED WITH SAND TO 5' ABOVE WATER TABLE, REMAINING HOLE FILLED WITH CEMENT + BENTONITE GROUT.

BORING SB-02

PAGE 2 OF 2

BORING LOG **HALLIBURTON NUS**

PROJECT: BETH PAGE PHASE II RI BORING NO: SB-03/TEMP WELL
PROJECT NO.: 1953 DATE: DRILLER: ADT
ELEVATION: FIELD GEOLOGIST: FRED WRAMSER
WATER LEVEL DATA: 52.5' BGS 12-8-92
(Date, Time & Conditions)

SAMPLE NO. & TYPE OR ROD	DEPTH (ft) OR RUN NO.	BLOWS 6" OR ROD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	HNU READINGS / REMARKS (45 / DZ)
						DK BRN	GRAVELLY LOAM		TOP SOIL 0-1'
						YELLOWISH BRN	SANDY GRAVEL TR/SILT		
									0.0 ppm
	10								
	20								0.0 ppm
	30								
									0.0 ppm
						YELLOWISH BRN	SAND W/SOME SILT		
	40						TR GRAVEL ~1" GRA		
									0.0 ppm
	50						AS ABOVE		

REMARKS MOBILE RIG B-57, HSA 2¼ ID, NO SPLIT SPOON SAMPLES TAKEN AT THIS LOC.

BORING SB03

PAGE 1 OF 2

BORING LOG **HALLIBURTON NUS**

PROJECT: BETHPAGE PHASE II RI BORING NO: SB03/TEMP WELL
PROJECT NO.: 1953 DATE: 12-8-92 DRILLER: ADT
ELEVATION: FIELD GEOLOGIST: FRED W. RAUSER
WATER LEVEL DATA: 52.5' 12-8-92
(Date, Time & Conditions)

SAMPLE NO & TYPE OR ROD	DEPTH (ft) OR RUN NO	BLOWS 6" OR ROD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS CONSCRS	REMARKS
							SAND w/ ~~TR~~ SOME SILT		0.0ppm
							TR/GRAVEL		GRA < 1"d
			60						
							TD @ 57'		

REMARKS

BORING SB03

PAGE 2 OF 2

BORING LOG **HALLIBURTON NUS**

PROJECT: BETHPAGE RI PHASE II BORING NO: SB04, MEADE/NINTH
PROJECT NO.: 1953 DATE: 12-8-92 DRILLER: ADT, RICHARD BENNMAN, DEAN
ELEVATION: FIELD GEOLOGIST: FRED W RAMSER
WATER LEVEL DATA: 51.5' BGS 1320 HRS 12-8-92
(Date, Time & Conditions)

SAMPLE NO & TYPE OR RQD	DEPTH (ft) OR RUN NO	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS CODES	REMARKS
						DK-BRN	0-1' DK BRN GRAVELLY LOAM		
							1'-2' DK YELLOWISH BRN SANDY GRAVEL		
						YEL-BRN	SANDY GRAVEL W/TR SILT		
	10								
	20								
	30								
						YEL-BRN	SAND W/SOME SILT TR GRA		
	40								
	50						AS ABOVE		

REMARKS MOBILE 61 3¼ Ø ID HSA, NO SPLIT SPOONS AT THIS LOC.

BORING SB04

PAGE 1 OF 2

BORING LOG **HALLIBURTON NUS**

PROJECT: BETHPAGE RI PHASE II BORING NO: SB04
PROJECT NO.: 1953 DATE: 12-8-92 DRILLER: ADT, RICHARD BEAUMAN
ELEVATION: FIELD GEOLOGIST: FRED W RAMSER
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE OR RQD	DEPTH (FT) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK CODE	REMARKS
							AS ABOVE		
							TD@ 54' 1310 HRS		
	60		60	TO 54'					

REMARKS

BORING SB0

PAGE 2 OF 2

BORING LOG **HALLIBURTON NUS**

PROJECT: BETHPAGE PHASE II RI BORING NO SB07 MEADE + TENTH
PROJECT NO.: 1953 DATE: 12-9-92 DRILLER: ADT. RICHARD BEAUMAN
ELEVATION: FIELD GEOLOGIST: FRED W RAMSER
WATER LEVEL DATA: 50.5' BGS 0955 HRS
(Date, Time & Conditions)

SAMPLE NO & TYPE OR RQD	DEPTH (ft) OR RUN NO	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK CLASS	REMARKS
						DK. BRN	LOAM W/SOME GRAVEL 0-1'		
						YEL-BRN	GRAVEL + SAND		
	10								
	20								
	30								
							AS ABOVE		
						YEL-BRN	SAND TR/GRA		
	40								
	50								

REMARKS MOBILE RIG B-57, 3¼ Ø HSA, NO SPLIT SPOONS TAKEN AT THIS LOC.
NO/ 0.0ppm READINGS ON HNU HS + BZ

BORING SB07

PAGE 1 OF 2

BORING LOG **HALLIBURTON NUS**

PROJECT: BETHPAGE PHASE II RI BORING NO: SB07
PROJECT NO.: 1953 DATE: 12-9-92 DRILLER: ADT, RICHARD BEAUMAN
ELEVATION: FIELD GEOLOGIST: FRED W RAMSER
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE OR ROD	DEPTH (ft) OR RUN NO.	BLOWS 6" OR ROD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK CODE	REMARKS
							AS ABOVE		
	60								
							TD @ 59'		

REMARKS

BORING SB07

PAGE 2 OF 2

BORING LOG **HALLIBURTON NUS**

PROJECT: BETHPAGE PHASE II RI BORING NO: SB08 / IN SUMP
PROJECT NO.: 1953 DATE: 12-9-92 DRILLER: ADT, RICHARD BEAUMAN
ELEVATION: FIELD GEOLOGIST: FRED W. RAMSER
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE OR RQD	DEPTH (ft) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS CODE	HNU READINGS: REMARKS HS	BZ
						DK-BRN	GRAVEL + SAND		0.0ppm	
						YEL-BRN	GRAVEL + SAND		0.0ppm	
	10									
						REDDISH ORANGE BRN	SAND TR GRAVEL			
	20									
						YEL BRN	SAND TR/GRAVE		GRAS .5"Ø	
	30								0.0ppm	
	40									
									0.0ppm	
	50						AS ABOVE			

REMARKS MOBILE RIG B-57 3¼ Ø HSA. NO SPLIT SPOON SAMPLES TAKEN AT THIS LOC.

BORING _____

PAGE ____ OF ____

BORING LOG **HALLIBURTON NUS**

PROJECT: BETHPAGE PHASE II RI BORING NO: SB08/INSUMP
PROJECT NO.: 1953 DATE: 12-9-92 DRILLER: ADT, RICHARD BEAUMAN
ELEVATION: FIELD GEOLOGIST: FRED W RAMSER
WATER LEVEL DATA: 37' BGS 1250 12-9-92
(Date, Time & Conditions)

SAMPLE NO. & TYPE OR RQD	DEPTH (FT) OR RUN NO	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS HS
							AS ABOVE		0.0ppm
							↓		
							TD @ 55' 1250		
	60								

REMARKS RUNNING SAND ENCOUNTERED OR PLUGGED LEAD INGER ADDED 3 GALS OF WATER TO EMPLACE PVC TO DESIRED DEPTH

BORING SB08

PAGE 2 OF 2

BORING LOG

HALLIBURTON NUS

PROJECT: BETH PAGE RI PHASE II BORING NO: SB12 MAPLE/NINTH

PROJECT NO.: 1953 DATE: 12-10-92 DRILLER: ADT, RICHARD B., DENNIS H.

ELEVATION: FIELD GEOLOGIST: FRED W. RAMSER

WATER LEVEL DATA: 54.5' BGS 12-10-92 1005 HRS

(Date, Time & Conditions)

SAMPLE NO. & TYPE OR RQD	DEPTH (ft) OR RUN NO	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS CONSISTENCY	REMARKS
						DK. BRN	0-3' GRAVELLY LOAM		
						YEL. BRN	GRAVEL + SAND		0 ppm
	10								
						YEL BRN	GRAVEL W/SOME SAND		GRA. ~ 1.5" ø ROUNDED TO SUBROUNDED
	20								
	30					YEL BRN	SAND TR/GRAVEL		GRA. ≤ .5" ø RD SUBRD
	40					YEL BRN	SAND + GRAVEL		GRA ~ 1.0" ø RD SUBRD
	50					YEL BRN	SAND TR GRAVEL		

REMARKS MOBILE RIG B-57, 3¼ ø HSA, NO SILT SAMPLES TAKEN AT THIS LOC

BORING SB12

PAGE 1 OF 2

BORING LOG **HALLIBURTON NUS**

PROJECT: BETHPAGE BORING NO: SB12
PROJECT NO.: 1953 DATE: 12-10-92 DRILLER: ADT
ELEVATION: FIELD GEOLOGIST: FRED WRAMSER
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO & TYPE OR ROD	DEPTH (ft) OR RUN NO.	BLOWS 6" OR ROD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK CODE	REMARKS
							AS ABOVE		
	6.0			TD					
							TD @ 57'		
							955 HR		

REMARKS

BORING SB12

PAGE 2 OF 2

BORING LOG **HALLIBURTON NUS**

PROJECT: BETHPAGE PHASE II RI BORING NO SB13
PROJECT NO.: 1953 DATE: 12-10-92 DRILLER: ADT, RICH BEAUMAN, DENNIS M.
ELEVATION: FIELD GEOLOGIST: FRED W RAMSER
WATER LEVEL DATA: 51.5' 1300 HR 12-10-92
(Date, Time & Conditions)

SAMPLE NO & TYPE OR ROD	DEPTH (ft) OR RUN NO	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS CODE	HS → HNU READINGS REMARKS
						DK BRN	0-1 GRAVELLY LOAM		0-1
						DK BRN	GRAVEL W/SOME SAND		0.0 ppm
							GRAVELS ≤ 3" ø RD TO SUBRD		
	10								
	20								
	30								
						YEL BRN	SAND W/SOME GRAVEL		
	40								
	50						AS ABOVE		

REMARKS MOBILE RIG B-57 3¼ ID HSA NO SPLIT SPOON SAMPLES TAKEN
TEMPORARY WELL

BORING SB13

PAGE 1 OF 2

BORING LOG **HALLIBURTON NUS**

PROJECT: BETHPAGE PHASE II RI BORING NO: SB13
PROJECT NO.: 1953 DATE: 12-10-92 DRILLER: ADT, RICH BEAUMAN, DENNIS M.
ELEVATION: FIELD GEOLOGIST: FRED W. RAMSER
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO & TYPE OR ROD	DEPTH (ft) OR RUN NO.	BLOWS 6" OR ROD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS CONVERSION	HNU READING / REMARKS
						YEL BRN	SAND + GRAVEL		
									0-99ppm
							TD @ 54' 1235 HR		
	60								

REMARKS

BORING SB13

PAGE 2 OF 2

APPENDIX D

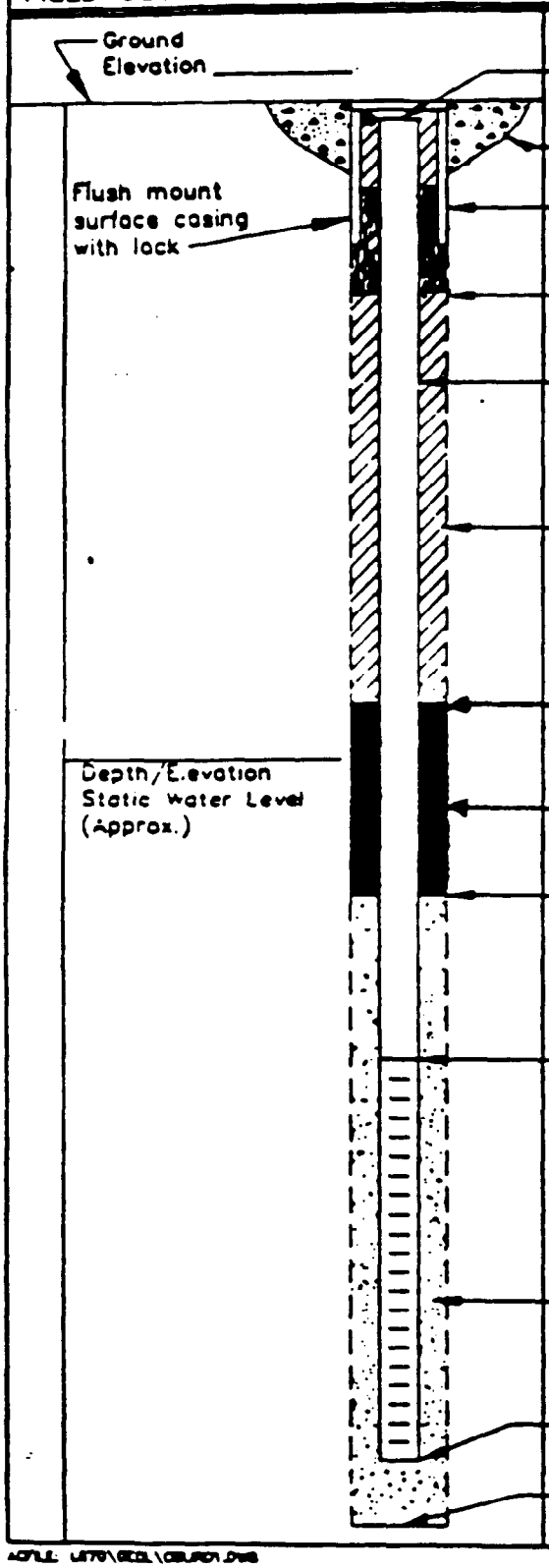
WELL CONSTRUCTION LOG SHEETS/WELL DEVELOPMENT LOG SHEETS

NUS CORPORATION

WELL NO.: HN24I1

OVERBURDEN MONITORING WELL SHEET

PROJECT: BETHPAGE NWIRP	LOCATION: BETHPAGE NY	DRILLER: DELTA
PROJECT NO.: 1953	BORING: HN24I2	DRILLING METHOD: HSA
ELEVATION:	DATE: 1-20-93	DEVELOPMENT METHOD: Air Lift
FIELD GEOLOGIST: Kevin C. Kilmartin		



ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Concrete

TYPE OF PROTECTIVE CASING: Steel Manhole

I.D. OF PROTECTIVE CASING: 9"

BOREHOLE DIAMETER: 10"

TYPE OF RISER PIPE: Sch. 40 PVC

RISER PIPE I.D.: 4"

TYPE OF BACKFILL/SEAL: Bentonite / cement Grout

DEPTH/ELEV. TOP OF SEAL ~139'

TYPE OF SEAL Bentonite

Top of Masonry Sand Seal 143' 2"

DEPTH/ELEVATION TOP OF SAND: 145'4"

DEPTH/ELEVATION TOP OF SCREEN: 149'

TYPE OF SCREEN: 4"ID, PVC, Sch. 40

SLOT SIZE x LENGTH: .010" x 10'

TYPE OF SAND PACK: #1 Morie

DEPTH/ELEVATION BOTTOM OF SCREEN: 159'

DEPTH/ELEVATION BOTTOM OF SAND: 159'

DEPTH/ELEVATION BOTTOM OF HOLE: 165'

BACKFILL MATERIAL BELOW SAND: Formation

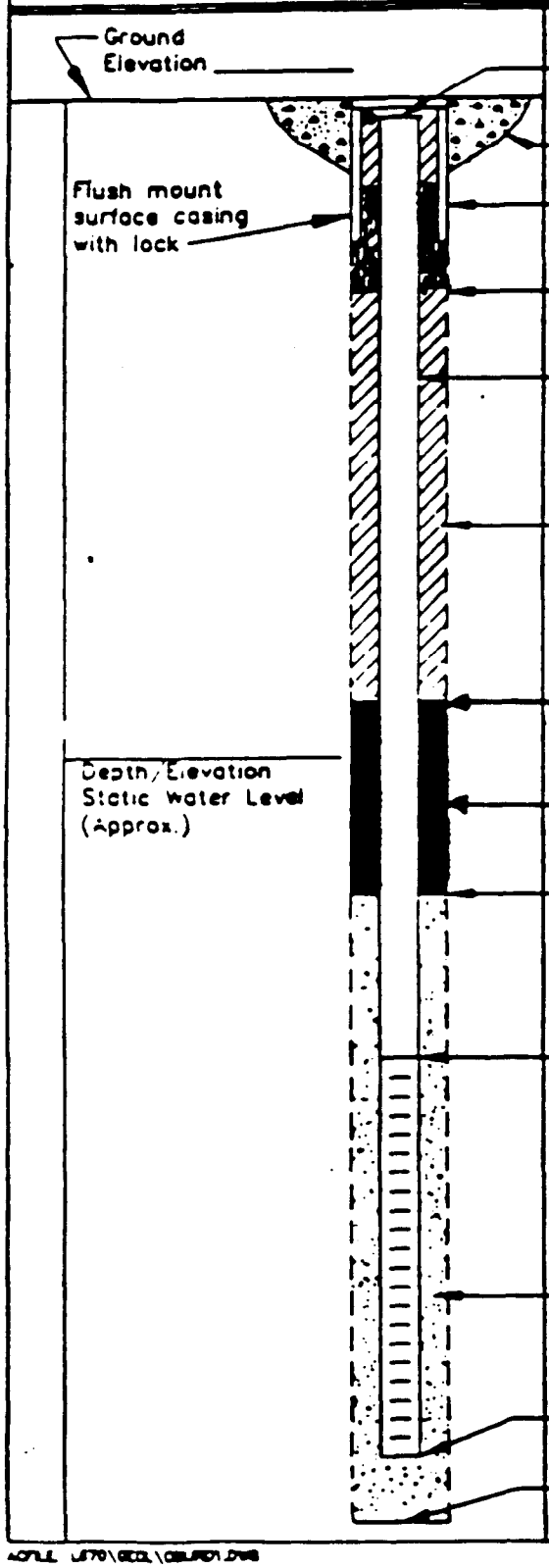
ACFILE: U:\70\GEOL\OBURDN.DWG

NUS CORPORATION

WELL NO.: HN24I2

OVERBURDEN MONITORING WELL SHEET

PROJECT: BETHPAGE NWIRP
LOCATION: BETHPAGE NY
DRILLER: DELTA
PROJECT NO.: 1953
BORING: HN24I3
DRILLING METHOD: HSA
ELEVATION:
DATE: 1-28-93
DEVELOPMENT METHOD: Air Lift
FIELD GEOLOGIST: Kevin C. Kilmartin



ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Concrete

TYPE OF PROTECTIVE CASING: Steel Manhole

I.D. OF PROTECTIVE CASING: 9"

BOREHOLE DIAMETER: 10"

TYPE OF RISER PIPE: Sch. 40 PVC

RISER PIPE I.D.: 4"

TYPE OF BACKFILL/SEAL: Bentonite/Cement Grout

DEPTH/ELEV. TOP OF SEAL ~140'

TYPE OF SEAL Bentonite

Top of Masonry SAND SEAL 144'

DEPTH/ELEVATION TOP OF SAND: 146'

DEPTH/ELEVATION TOP OF SCREEN: 150'

TYPE OF SCREEN: 4" ID, PVC, Sch. 40

SLOT SIZE x LENGTH: .010" x 10'

TYPE OF SAND PACK: #1 Morie

DEPTH/ELEVATION BOTTOM OF SCREEN: 160'

DEPTH/ELEVATION BOTTOM OF SAND: 160'

DEPTH/ELEVATION BOTTOM OF HOLE: 165'

BACKFILL MATERIAL BELOW SAND: Formation

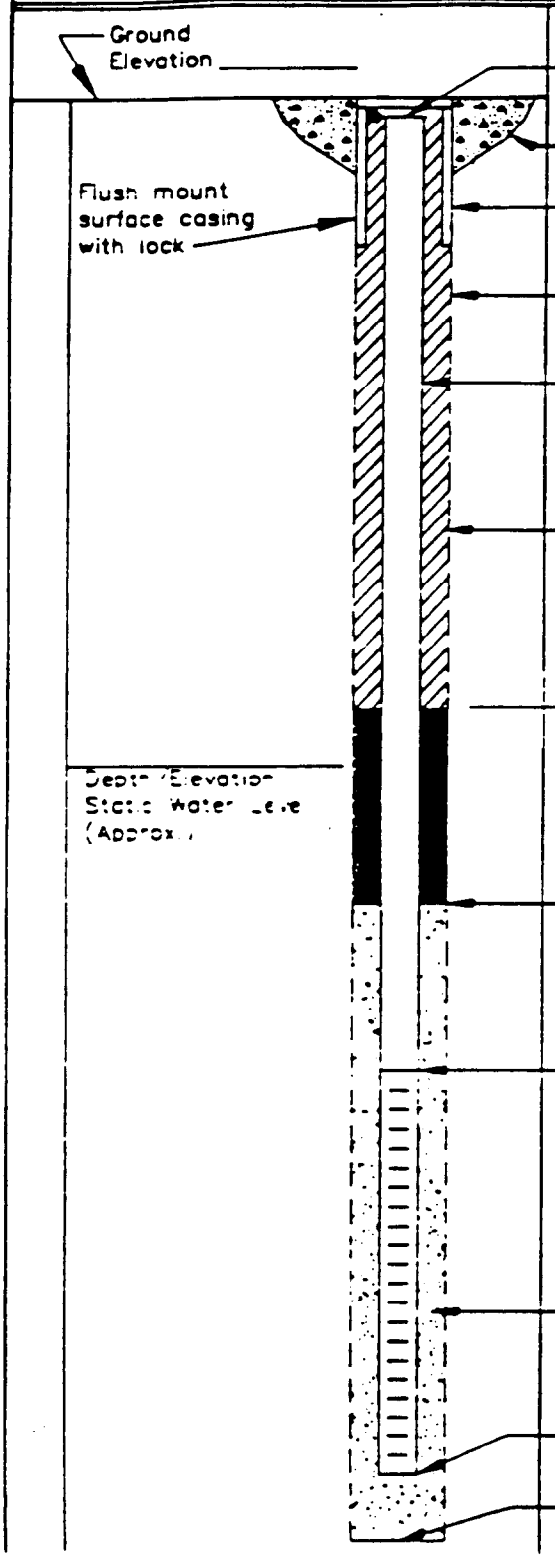
HALLIBURTON NUS
Environmental Corporation

WELL NO.: PIEZOMETER #2
HN-2752

OVERBURDEN MONITORING WELL SHEET

PROJECT: BETHPAGE RI PHASE II	LOCATION: SITE 1
PROJECT NO.: 1953	BORING: PIEZOMETER #2
ELEVATION:	DATE: 12-4-92
FIELD GEOLOGIST: FRED W RAMSER	

DRILLER: ADT, R. BEAMAN
DRILLING METHOD: HSA 4½" ID
DEVELOPMENT METHOD:



ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: CEMENT

TYPE OF PROTECTIVE CASING:

I.D. OF PROTECTIVE CASING: 6½"

BOREHOLE DIAMETER: 8¼

TYPE OF RISER PIPE: PVC SCH 40

RISER PIPE I.D.: 2" ϕ

TYPE OF BACKFILL/SEAL: BENTONITE + CEMENT SLURRY

ELEVATION / DEPTH TOP OF SEAL: 32.5
BENTONITE SLURRY

DEPTH/ELEVATION TOP OF SAND: 48'

DEPTH/ELEVATION TOP OF SCREEN: 51'

TYPE OF SCREEN: PVC SLOTTED

SLOT SIZE x LENGTH: .020" x 10'

TYPE OF SAND PACK: #2 MORIE SAND

DEPTH/ELEVATION BOTTOM OF SCREEN: 61'

DEPTH/ELEVATION BOTTOM OF SAND: 61.5'

DEPTH/ELEVATION BOTTOM OF HOLE: 61.5'

BACKFILL MATERIAL BELOW SAND: N/A

PEIZOMETER #1

BORING NO HN-27S3

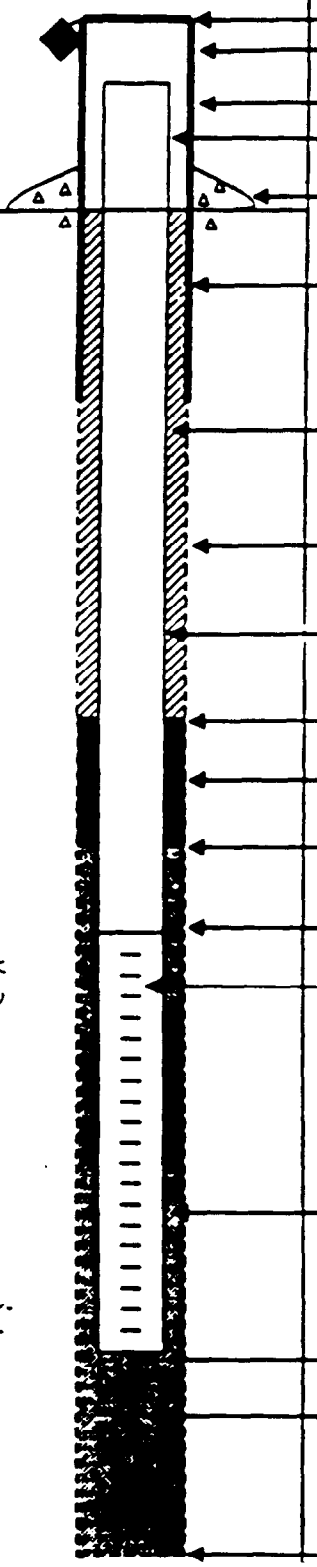
HALLIBURTON NUS
Environmental Corporation

OVERBURDEN
MONITORING WELL SHEET

PROJECT BETHPAGE RI - PHASE II
PROJECT NO. 1953
ELEVATION
FIELD GEOLOGIST FRED W RAMSER

LOCATION SITE 1
BORING PEIZOMETER #1
DATE 12-2-92

DRILLER ADT, RICH B., DENNIS
DRILLING METHOD HSA
DEVELOPMENT METHOD /



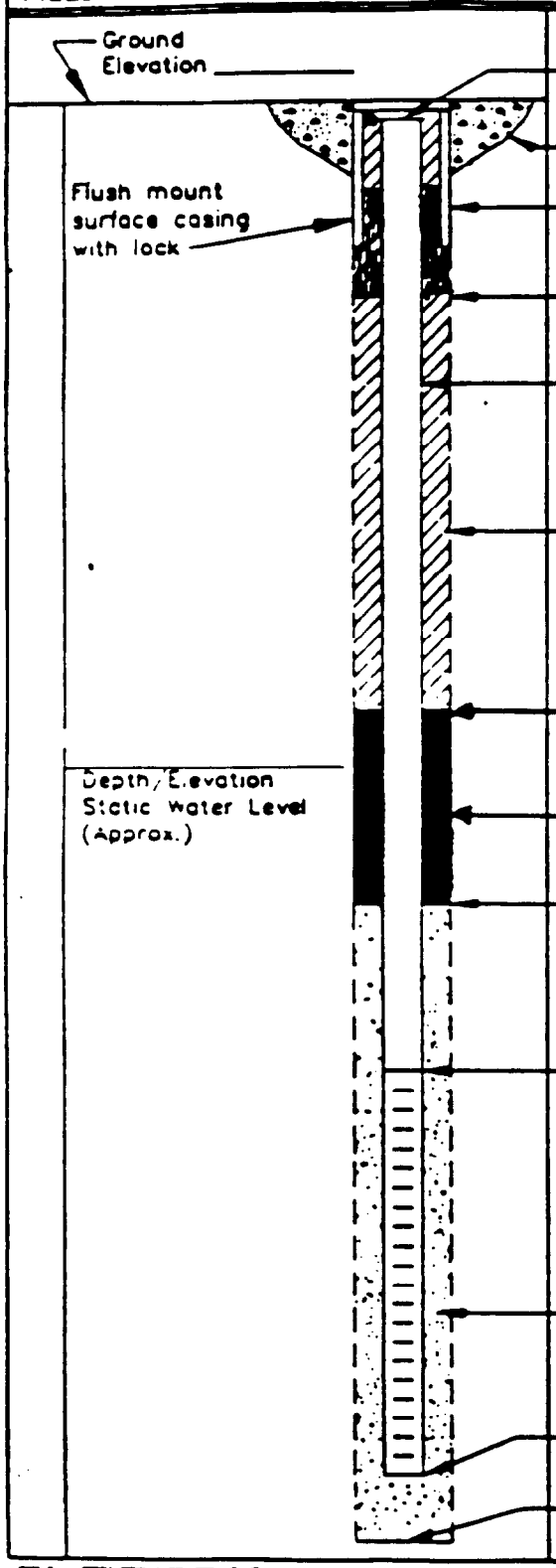
~~ELEVATION OF TOP OF SURFACE CASING~~ :
~~ELEVATION OF TOP OF RISER PIPE~~:
FLUSH MOUNT
~~STICK - UP~~ TOP OF SURFACE CASING:
STICK - UP RISER PIPE :
TYPE OF SURFACE SEAL:
I.D. OF SURFACE CASING:
TYPE OF SURFACE CASING:
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: PVC SCH 40
BOREHOLE DIAMETER: 8 1/4"
TYPE OF BACKFILL: CEMENT - BENTONITE GROUT
ELEVATION / DEPTH TOP OF SEAL: 145.5
TYPE OF SEAL: BENTONITE PELLETS
DEPTH TOP OF SAND PACK: 48
ELEVATION / DEPTH TOP OF SCREEN: 151
TYPE OF SCREEN: SLOTTED PVC
SLOT SIZE x LENGTH: 10" x .02
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: #2 MORIE SAND
ELEVATION / DEPTH BOTTOM OF SCREEN: 161'
ELEVATION / DEPTH BOTTOM OF SAND PACK: 161 ~~162~~
TYPE OF BACKFILL BELOW OBSERVATION WELL: NATURAL MATERIAL
ELEVATION / DEPTH OF HOLE: 162'

NUS CORPORATION

WELL NO.: HN-27I2

OVERBURDEN MONITORING WELL SHEET

PROJECT: BETHPAGE NWIRP
LOCATION: BETHPAGE NY
DRILLER: DELTA
PROJECT NO.: 1953
BORING: HN-27I2
DRILLING METHOD: water: Reverse Circulation
ELEVATION:
DATE:
DEVELOPMENT METHOD: Sub. Pump
FIELD GEOLOGIST: Kevin C. Kilmartin / Paul Davis



ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Concrete

TYPE OF PROTECTIVE CASING: Steel Manhole

I.D. OF PROTECTIVE CASING:

BOREHOLE DIAMETER: 18"

TYPE OF RISER PIPE: Steel

RISER PIPE I.D.: 8"

TYPE OF BACKFILL/SEAL: Bentonite / cement Grout

DEPTH/ELEV. TOP OF SEAL: ≈ 80'

TYPE OF SEAL Bentonite

Top of Masonry Sand Seal 85.6'

DEPTH/ELEVATION TOP OF SAND: 89.6'

DEPTH/ELEVATION TOP OF SCREEN: 110'

TYPE OF SCREEN: Continuous wire-wound

SLOT SIZE x LENGTH: .020" x 25'

TYPE OF SAND PACK: #2 Morie

DEPTH/ELEVATION BOTTOM OF SCREEN: 135'

DEPTH/ELEVATION BOTTOM OF SAND: 145'

DEPTH/ELEVATION BOTTOM OF HOLE: 145'

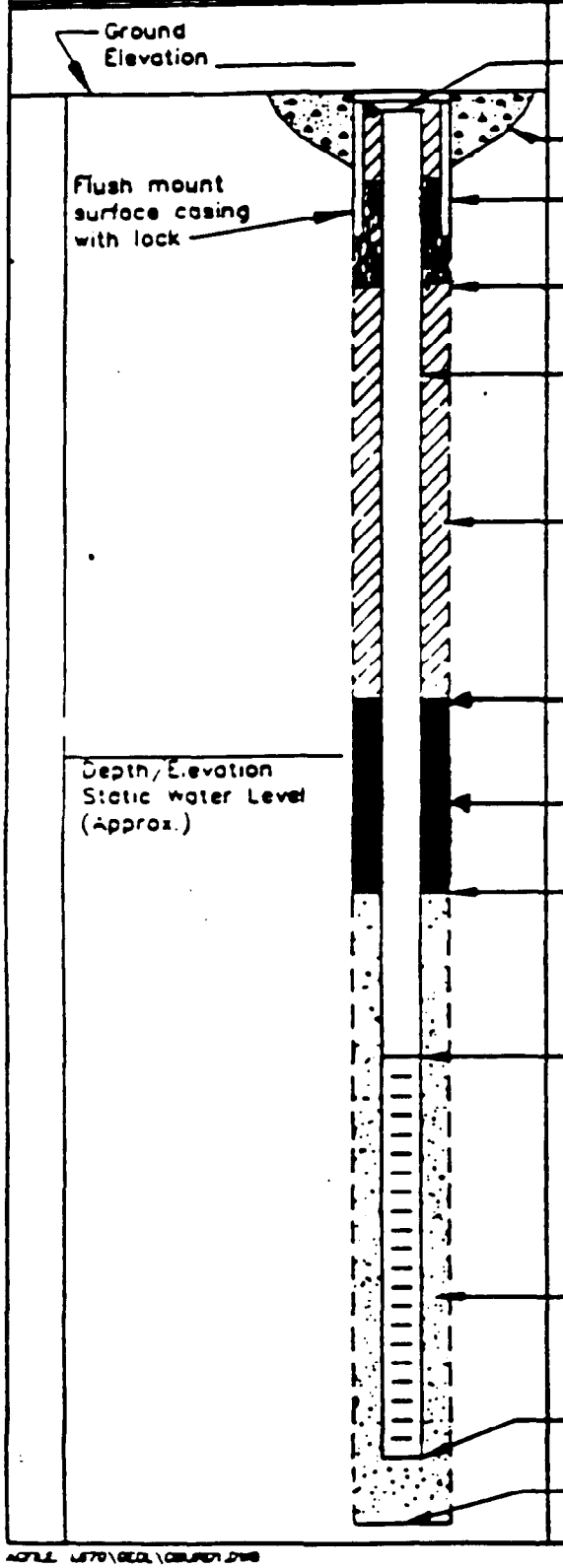
BACKFILL MATERIAL BELOW SAND: #2 Morie

NUS CORPORATION

WELL NO.: HN-40S

OVERBURDEN MONITORING WELL SHEET

PROJECT: BETHPAGE NWIRP
LOCATION: BETHPAGE NY
DRILLER: DELTA
PROJECT NO.: 1953
BORING: HN 40 S
DRILLING METHOD: HSA
ELEVATION:
DATE: 2-26-93
DEVELOPMENT METHOD: Sub. PUMP
FIELD GEOLOGIST: Kevin C. KILMARTIN



ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Concrete

TYPE OF PROTECTIVE CASING: Steel Manhole

I.D. OF PROTECTIVE CASING: 9"

BOREHOLE DIAMETER: 10"

TYPE OF RISER PIPE: Sch. 40 PVC

RISER PIPE I.D.: 4"

TYPE OF BACKFILL/SEAL: Bentonite/Cement Grout

DEPTH/ELEV. TOP OF SEAL ~39'

TYPE OF SEAL Bentonite

TOP of MASONRY SAND SEAL 42' 3"

DEPTH/ELEVATION TOP OF SAND: 45' 3"

DEPTH/ELEVATION TOP OF SCREEN: 49'

TYPE OF SCREEN: 4" ID, PVC, Sch. 40

SLOT SIZE x LENGTH: .010" X 10'

TYPE OF SAND PACK: #1 Morie

DEPTH/ELEVATION BOTTOM OF SCREEN: 59'

DEPTH/ELEVATION BOTTOM OF SAND: 59'

DEPTH/ELEVATION BOTTOM OF HOLE: 59'

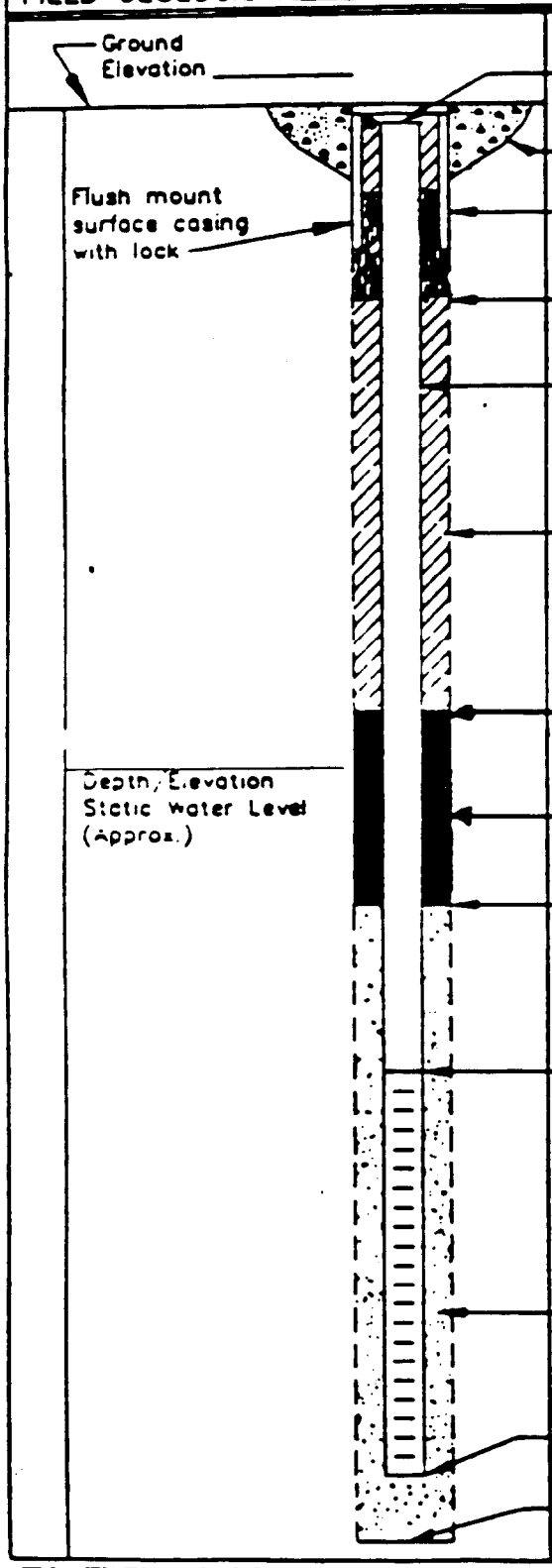
BACKFILL MATERIAL BELOW SAND: N/A

NUS CORPORATION

WELL NO.: HN40I

OVERBURDEN MONITORING WELL SHEET

PROJECT: BethPage NWIRP
LOCATION: BethPage NY
DRILLER: DELTA
PROJECT NO.: 1953
BORING: HN40I
DRILLING METHOD: HSA
ELEVATION:
DATE: 2-4-93
DEVELOPMENT METHOD: Air Lift
FIELD GEOLOGIST: Kevin C. Kilmartin



ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Concrete

TYPE OF PROTECTIVE CASING: Steel Manhole

I.D. OF PROTECTIVE CASING: 9"

BOREHOLE DIAMETER: 10"

TYPE OF RISER PIPE: Sch. 40 PVC

RISER PIPE I.D.: 4"

TYPE OF BACKFILL/SEAL: Bentonite/cement Grout

DEPTH/ELEV. TOP OF SEAL ~98'

TYPE OF SEAL Bentonite

Top of masonry sand seal 101' 6"

DEPTH/ELEVATION TOP OF SAND: 104'

DEPTH/ELEVATION TOP OF SCREEN: 108'

TYPE OF SCREEN: 4" ID, PVC, Sch. 40

SLOT SIZE x LENGTH: .010" x 10'

TYPE OF SAND PACK: #1 Morie

DEPTH/ELEVATION BOTTOM OF SCREEN: 118'

DEPTH/ELEVATION BOTTOM OF SAND: 118'

DEPTH/ELEVATION BOTTOM OF HOLE: 155'

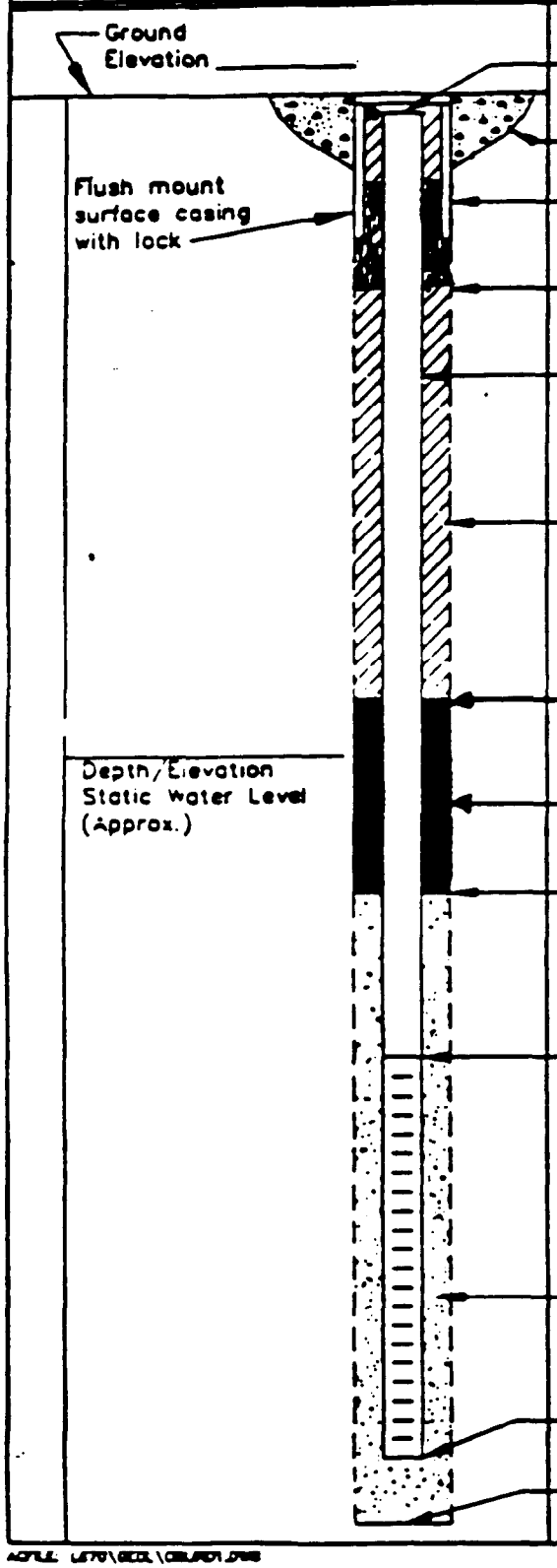
BACKFILL MATERIAL BELOW SAND: Formation

NUS CORPORATION

WELL NO.: HN-41 S

OVERBURDEN
MONITORING WELL SHEET

PROJECT: BETHPAGE NWIRP
LOCATION: BETHPAGE NY
DRILLER: DELTA
PROJECT NO.: 1953
BORING: HN 41 S
DRILLING METHOD: HSA
ELEVATION:
DATE: 2-24-93
DEVELOPMENT METHOD: Sub. PUMP
FIELD GEOLOGIST: Kevin C. KILMARTIN



ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Concrete

TYPE OF PROTECTIVE CASING: Steel Manhole

I.D. OF PROTECTIVE CASING: 9"

BOREHOLE DIAMETER: 10"

TYPE OF RISER PIPE: Sch. 40 PVC

RISER PIPE I.D.: 4"

TYPE OF BACKFILL/SEAL: Bentonite/cement Grout

DEPTH/ELEV. TOP OF SEAL: ~36'

TYPE OF SEAL Bentonite

Top of Masonry 39' 8"

SAND SEAL

DEPTH/ELEVATION TOP OF SAND: 41' 10"

DEPTH/ELEVATION TOP OF SCREEN: 45'

TYPE OF SCREEN: 4" ID, PVC, Sch. 40

SLOT SIZE x LENGTH: .010" X 10'

TYPE OF SAND PACK: #1 Morie

DEPTH/ELEVATION BOTTOM OF SCREEN: 55'

DEPTH/ELEVATION BOTTOM OF SAND: 55'

DEPTH/ELEVATION BOTTOM OF HOLE: 55'

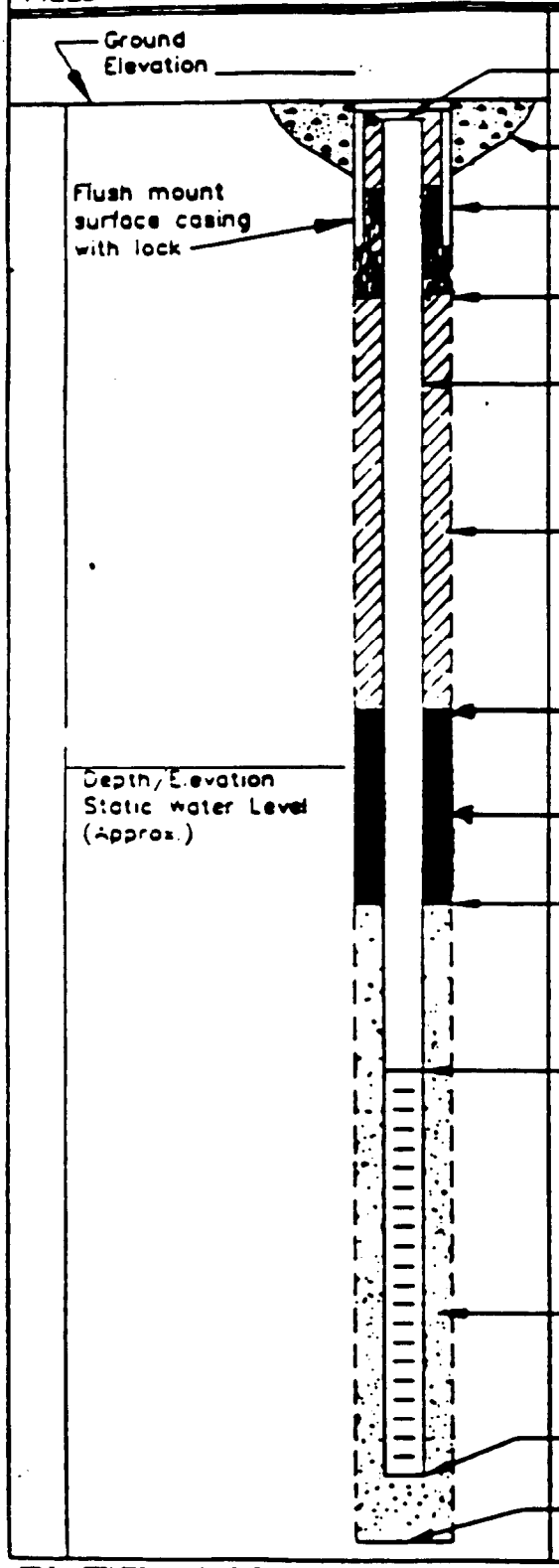
BACKFILL MATERIAL BELOW SAND: N/A

NUS CORPORATION

WELL NO.: HN-41 I

OVERBURDEN MONITORING WELL SHEET

PROJECT: BETHPAGE NWIRP
LOCATION: BETHPAGE NY
DRILLER: DELTA
PROJECT NO.: 1953
BORING: HN-41 I
DRILLING METHOD: HSA
ELEVATION:
DATE: 2-10-93
DEVELOPMENT METHOD: Air Lift
FIELD GEOLOGIST: Kevin C. Kilmartin



ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Concrete

TYPE OF PROTECTIVE CASING: Steel Manhole

I.D. OF PROTECTIVE CASING: 9"

BOREHOLE DIAMETER: 10"

TYPE OF RISER PIPE: Sch. 40 PVC

RISER PIPE I.D.: 4"

TYPE OF BACKFILL/SEAL: Bentonite/cement Grout

DEPTH/ELEV. TOP OF SEAL ~93'

TYPE OF SEAL Bentonite

Top of Masonry 96' 5"

SAND SEAL

DEPTH/ELEVATION TOP OF SAND: 99'

DEPTH/ELEVATION TOP OF SCREEN: 103'

TYPE OF SCREEN: 4" ID, PVC, Sch. 40

SLOT SIZE x LENGTH: .010" x 10'

TYPE OF SAND PACK: #1 Morie

DEPTH/ELEVATION BOTTOM OF SCREEN: 113'

DEPTH/ELEVATION BOTTOM OF SAND: 113'

DEPTH/ELEVATION BOTTOM OF HOLE: 155'

BACKFILL MATERIAL BELOW SAND: Formation

NUS CORPORATION

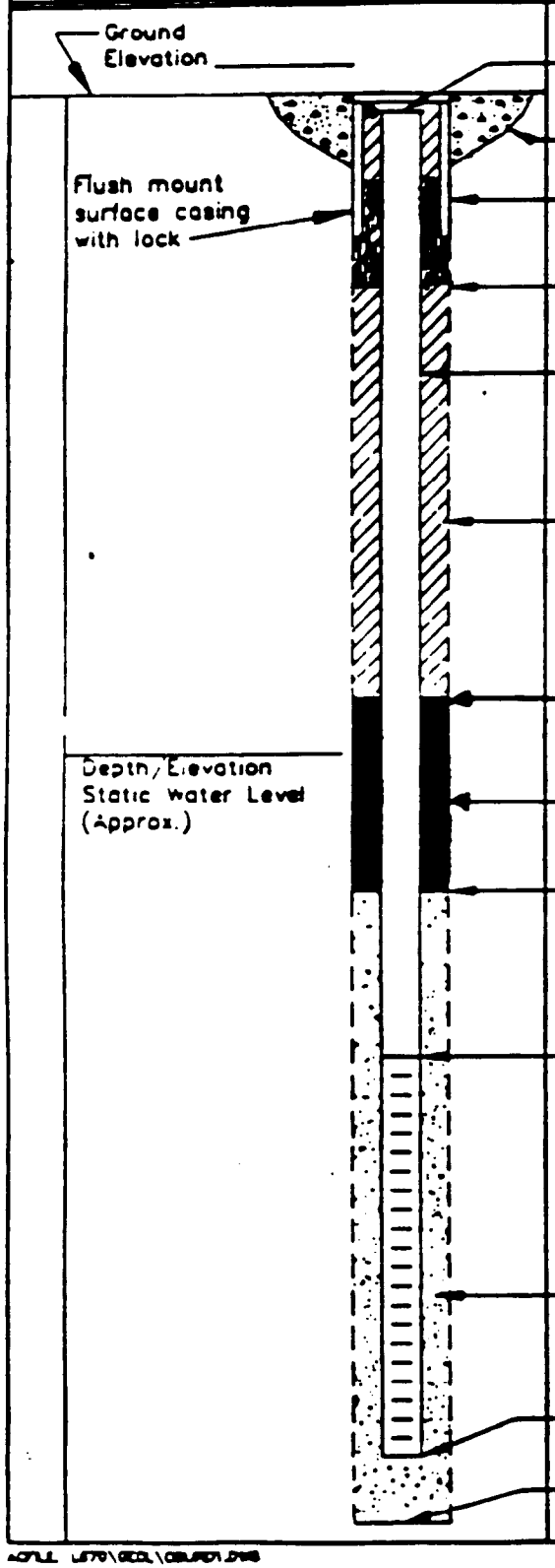
WELL NO.: HN-42S

OVERBURDEN MONITORING WELL SHEET

PROJECT: BETHPAGE NWIRP
PROJECT NO.: 1953
ELEVATION:
FIELD GEOLOGIST: Kevin C. Kilmartin

LOCATION: BETHPAGE NY
BORING: HN42S
DATE: 2-19-93

DRILLER: DELTA
DRILLING METHOD: HSA
DEVELOPMENT METHOD: Sub. Pump



ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Concrete

TYPE OF PROTECTIVE CASING: Steel Manhole

I.D. OF PROTECTIVE CASING: 9"

BOREHOLE DIAMETER: 10"

TYPE OF RISER PIPE: Sch. 40 PVC

RISER PIPE I.D.: 4"

TYPE OF BACKFILL/SEAL: Bentonite/cement Grout

DEPTH/ELEV. TOP OF SEAL: ~41'

TYPE OF SEAL: Bentonite

Top of Masonry Sand Seal: 45' 2"

DEPTH/ELEVATION TOP OF SAND: 46' 7"

DEPTH/ELEVATION TOP OF SCREEN: 50'

TYPE OF SCREEN: 4" ID, PVC, Sch. 40

SLOT SIZE x LENGTH: .010" X 10'

TYPE OF SAND PACK: #1 Morie

DEPTH/ELEVATION BOTTOM OF SCREEN: 60'

DEPTH/ELEVATION BOTTOM OF SAND: 60'

DEPTH/ELEVATION BOTTOM OF HOLE: 60'

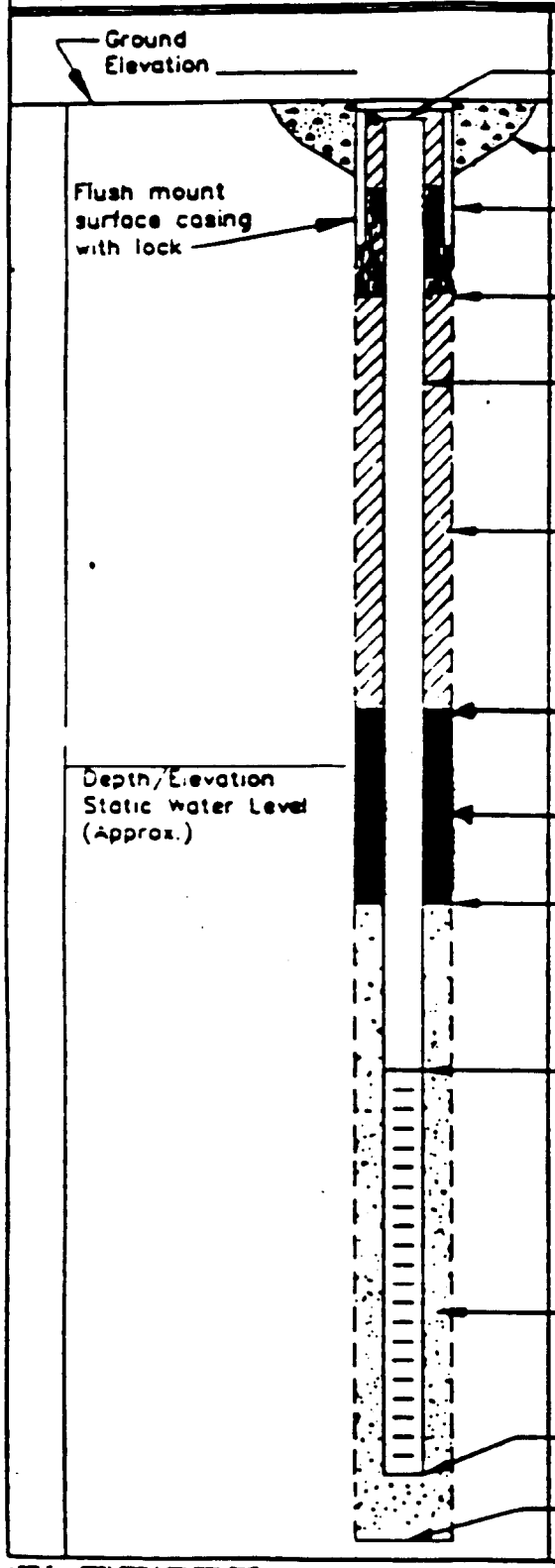
BACKFILL MATERIAL BELOW SAND: N/A

NUS CORPORATION

WELL NO.: HN-42I

OVERBURDEN MONITORING WELL SHEET

PROJECT: BETHPAGE NWIRP	LOCATION: BETHPAGE NY	DRILLER: DELTA
PROJECT NO.: 1953	BORING: HN-42I	DRILLING METHOD: HSA
ELEVATION:	DATE: 2-17-93	DEVELOPMENT METHOD: Air Lift
FIELD GEOLOGIST: Kevin C. Kilmartin		



ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL: Concrete

TYPE OF PROTECTIVE CASING: Steel Manhole

I.D. OF PROTECTIVE CASING: 9"

BOREHOLE DIAMETER: 10"

TYPE OF RISER PIPE: Sch. 40 PVC

RISER PIPE I.D.: 4"

TYPE OF BACKFILL/SEAL: Bentonite/cement Grout

DEPTH/ELEV. TOP OF SEAL ~91'

TYPE OF SEAL Bentonite

Top of Masonry SAND SEAL 94' 2"

DEPTH/ELEVATION TOP OF SAND: 96' 7"

DEPTH/ELEVATION TOP OF SCREEN: 100'

TYPE OF SCREEN: 4" ID, PVC, Sch. 40

SLOT SIZE x LENGTH: .010" X 10'

TYPE OF SAND PACK: #1 Morie

DEPTH/ELEVATION BOTTOM OF SCREEN: 110'

DEPTH/ELEVATION BOTTOM OF SAND: 110'

DEPTH/ELEVATION BOTTOM OF HOLE: 155'

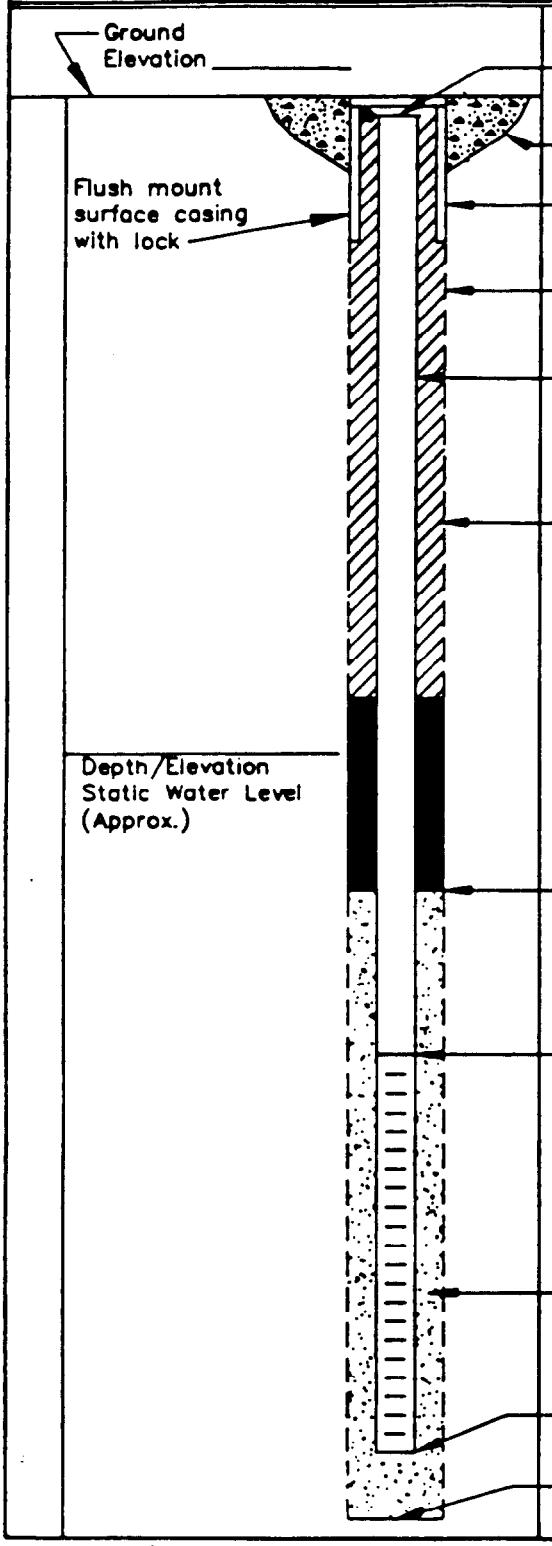
BACKFILL MATERIAL BELOW SAND: FORMATION

NUS CORPORATION

WELL NO.: HN-43I

OVERBURDEN MONITORING WELL SHEET

PROJECT: BETHPAGE	LOCATION: BETHPAGE N.Y.	DRILLER: DELTA
PROJECT NO.: 1953	BORING: HN-43I	DRILLING METHOD: HOLLOW STEM AUGER
ELEVATION:	DATE: 5-11-93	DEVELOPMENT METHOD:
FIELD GEOLOGIST: M. MENGEL		



ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL:

TYPE OF PROTECTIVE CASING:

I.D. OF PROTECTIVE CASING:

BOREHOLE DIAMETER:

TYPE OF RISER PIPE: PVC

RISER PIPE I.D.:

TYPE OF BACKFILL/SEAL: CEMENT/BENTONITE

SLURRY 132

SAND SEAL 134 /

DEPTH/ELEVATION TOP OF SAND: 138 /

DEPTH/ELEVATION TOP OF SCREEN: 141 /

TYPE OF SCREEN: PVC

SLOT SIZE x LENGTH: 10'

TYPE OF SAND PACK: MORIC

DEPTH/ELEVATION BOTTOM OF SCREEN: 151.3 /

DEPTH/ELEVATION BOTTOM OF SAND: 152.0 /

DEPTH/ELEVATION BOTTOM OF HOLE: 152.0 /

BACKFILL MATERIAL BELOW SAND:

ACFILE: L870\GEOL\OBURD1.DWG

APPENDIX E

PUMP TEST DATA AND RESULTS

APPENDIX E: PUMPING TEST DATA AND CALCULATIONS:

- DATA SUMMARY OF CALCULATIONS FOR PUMP TEST #1 AND #2

- PUMP TEST #1: SUMMARY OF GEOLOGIC CONDITIONS
  DRAWDOWN AND RECOVERY DATA
  GRAPHS OF DRAWDOWN AND RECOVERY

- PUMP TEST #2: SUMMARY OF GEOLOGIC CONDITIONS
  DRAWDOWN AND RECOVERY DATA
  GRAPHS OF DRAWDOWN AND RECOVERY

- PUMPING TEST CALCULATIONS

DATA SUMMARY OF CALCULATIONS FOR PUMP TEST #1 AND #2

BETHPAGE NWIPR
DATA SUMMARY OF CALCULATIONS FOR PUMP TEST #1 AND #2

Well	Distance From Pumping Well (ft)	Screened Interval (ft bgs)	Transmissivity (ft2/d)	Horizontal Hyd. Conductivity (ft/d)	Vertical Hyd. Conductivity (ft/d)	Kv/Kh ratio (%)	Storativity (Dimensionless)	Specific Yield (Dimensionless)	Calculation Method
PUMP TEST #1									
SHALLOW WELLS:									
HN27S2	31.5	51-61	7,002	41.19	–	–	0.054	–	Neuman (1) **
			24,511	144.0	–	–	–	–	Ferris (2)
			24487	144.0	–	–	–	–	Dupuit (3)
HN27S3	106.5	51-61	13,199	77.64	–	–	0.044	–	Neuman (1) **
INTERMEDIATE WELLS:									
HN26I	520	115.3-125.3	16,340	96.12	10.27	10.68	0.0012	–	Neuman (1)
			39,218	231.0	–	–	–	–	Ferris (2)
			38,071	224.0	–	–	–	–	Dupuit (3)
HN27I	45	100-110	6,863	40.37	5.76	14.3	0.0041	–	Neuman (1)
			5,719	33.64	–	–	0.0045	–	Neuman (1) **
			16,740	98.0	–	–	–	–	Ferris (2)
			20,126	118.0	–	–	–	–	Dupuit (3)
HN28I	425	131-141	10,559	62.11	3.96	6.4	0.0012	–	Neuman (1)
			18,549	109.0	–	–	–	–	Ferris (2)
			19,574	115.0	–	–	–	–	Dupuit (3)
OTHER:									
Recharge Basin	500	–	–	–	23.36	–	–	–	Permeability (3)
HN26I, HN27I, HN28I, HN27S2, HN27S3	–	–	17,920	105.4	–	–	0.175	–	Distance-Drawdown(5) at 1000 Minutes **
HN26I, HN27I, HN28I, HN27S2, HN27S3	–	–	17,136.6	100.8	–	–	0.33	–	Distance-Drawdown(5) at 4000 Minutes **
PUMP TEST #2									
PW-11	–	429-490	60,000	85.7	–	–	0.26	–	Distance-Drawdown(5) at 4000 Minutes
			59,723	85.3	–	–	–	–	Specific Capacity (6)

Note: All calculations based on data from Pump Test #1, except calculations for PW-11 based on data from pump test #2.
Saturated thickness for pump test #1 = 170 ft, saturated thickness for pump test #2 = 700 ft.

** Indicates analysis corrected for partial penetration effects.
(1) Method described in: Neuman, 1975
(2) Method described in: Ferris, et. al., 1962. Theory of Aquifer Test, USGS Water Supply Paper.
(3) Method described in: Dupuit, 1963.
(4) Method described in: Geotechnical Engineering, Holtz, R.D. and Korvacs, W.D., 1981, pgs. 206-207.
(5) Method described in: Fetter, C.F., Applied Hydrogeology, 1988.
(6) Method described in Logan, 1964.

PUMPING TEST # 1

SUMMARY OF GEOLOGIC CONDITIONS

BETHPAGE PUMPING TEST # 1

Pumping Well HN-2712

Pumping Rate = 448 gpm

Trend data from 0.0 to 4320.0 minutes

Drawdown data from 4320.0 to 8420.0 minutes

Recovery data from 8420.0 to 13920.0 minutes.

The conceptual geologic/hydrogeologic model for the analysis of pumping test 1 was an unconfined aquifer with a pumping well and a recharge well operating at equal pumping/recharge rates. The recharge basin was conceptualized as the recharge well, with the hypothetical recharge well location considered to be the center of the basin. A clay layer encountered in three perimeter boring at a depth of about 220 feet was assumed to be present throughout the area of the test and was used to define the bottom of the unconfined aquifer for test evaluation purposes. The water table was considered the top of the aquifer, at an approximate depth of 50 feet, resulting in an aquifer thickness of approximately 170 feet.

Since the recharge basin was in use for an extended time period prior to the start of the pumping test, the recharge rate prior to pumping test startup was considered to be a steady state condition and the water levels observed in the area were reflective of this steady-state. As a result, the added discharge to the basin and resulting added recharge to groundwater due to the pumping test could be considered as a recharge well injecting water at the same rate as the groundwater extraction rate/added discharge rate into the basin.

The background discharge rate to the aquifer from the basin could be ignored for purposes of the test evaluation, as the water table configuration at the beginning of the test was considered to be a quasi-steady state condition reflective of this background recharge to the aquifer (and cyclic pumping activities at an unknown location nearby, seen in the trend data).

Several analysis methods were applied to the drawdown data generated. The early time-drawdown data,

affected by pumping only, was matched against Neuman's type curves for an unconfined aquifer to obtain preliminary estimates of transmissivity (T) and values for vertical permeability.

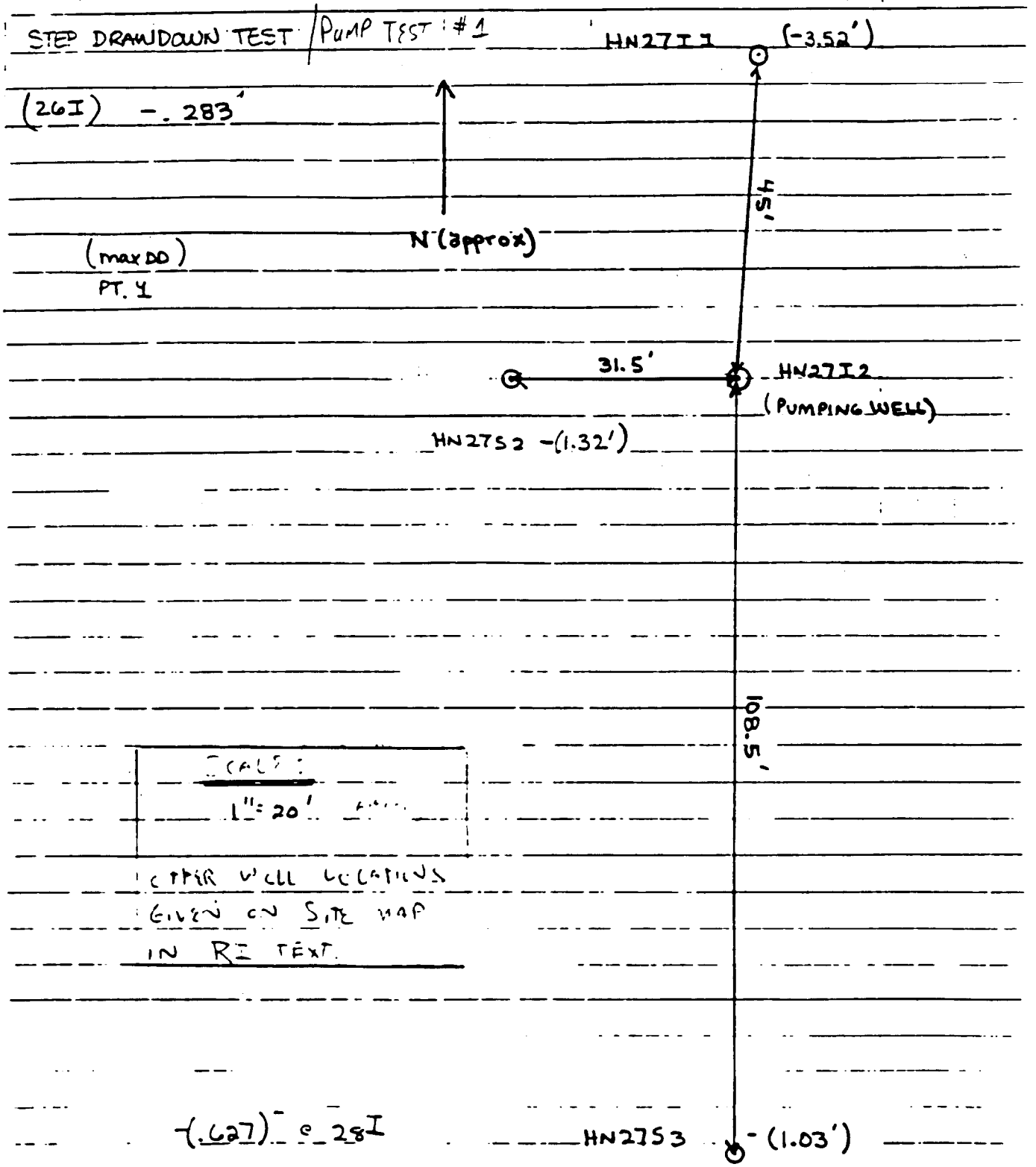
Later data, affected by both the pumping well drawdown and the recharge basin recharge, was analyzed using two methods applicable to aquifers with a pumping and a recharge well operating at equal rates. One method is a type curve matching method presented in Ferris, et.al., 1962. The other method is a steady-state drawdown analysis based on the Dupuit (1963) formula for steady state drawdown in an unconfined aquifer. For a pumping and recharge well operating at equal rates, drawdowns within the areas of influence should reach a steady-state level after the effects of both wells are established at a given observation point.

The steady-state assumption was considered a valid approximation as drawdowns appeared to be stabilizing near the end of the first 1000 minutes of pumping, prior to the manifestation of what is interpreted as additional drawdowns imposed by unknown pumping wells cycling on and off. The effects of these wells can also be seen in the trend data, which shows varying magnitudes of responses to the cyclical pumping. These differences are considered to be due to variations in the pumping rates of the wells responsible for the cyclic responses, and the cyclic drawdowns seen in the data after 1000 minutes of pumping are interpreted as cyclic pumping at higher rates than was occurring during the late portion of the trend data gathering and the early portion of the pumping test. This added extraction from the aquifer changed the quasi-equilibrium drawdown condition and resulted in further drawdowns in the observation wells.

HALLIBURTON NUS Environmental Corporation and Subsidiaries — STANDARD CALCULATION SHEET

CLIENT: NAVY	FILE NO.: 1953	BY: SJC 1-19-93	PAGE OF
SUBJECT: PUMP TEST 1 (LAYOUT)		CHECKED BY:	DATE:

STEP DRAWDOWN TEST / PUMP TEST #1



PUMPING TEST #1

DRAWDOWN AND RECOVERY DATA

BETHPAGE NWIRP
PUMPING TEST #1
PUMPING WELL: HN-27I2 PUMPING RATE: 448 GPM

	Total Time	Step Time	HN30S	HN30I	Basin	HN26I	HN28S	HN28I	HN-27I2	HN-27I1	HN27S2	HN27S3	USGS Well
TREND DATA	0.000	0.000	-0.003	0.009	0.006	0.038	-0.003	-0.019					
PUMP TEST 1	60.000	60.000	-0.012	0.037	0.044	0.038	-0.003	-0.180					
	120.000	120.000	-0.022	-0.028	0.050	-0.018	-0.003	-0.285					
	180.000	180.000	-0.041	-0.047	0.066	-0.028	0.000	-0.351					
	240.000	240.000	-0.050	-0.056	0.107	-0.047	0.000	-0.370					
	300.000	300.000	-0.065	-0.066	0.136	-0.056	-0.003	-0.437					
	360.000	360.000	-0.085	-0.085	0.170	-0.085	0.000	-0.361					
	420.000	420.000	-0.101	-0.066	0.199	-0.038	0.000	-0.038					
	480.000	480.000	-0.110	-0.009	0.189	0.028	-0.003	-0.019					
	540.000	540.000	-0.123	0.000	0.180	0.038	0.000	-0.009					
	600.000	600.000	-0.129	0.000	0.167	0.047	0.003	-0.009					
	660.000	660.000	-0.139	-0.009	0.155	0.038	0.003	-0.009					
	720.000	720.000	-0.145	0.000	0.139	0.056	0.003	0.000					
	780.000	780.000	-0.152	0.009	0.126	0.065	0.003	0.009					
	840.000	840.000	-0.161	0.009	0.120	0.065	0.003	0.009					
	900.000	900.000	-0.164	0.018	0.113	0.065	0.006	0.019					
	960.000	960.000	-0.174	0.028	0.104	0.084	0.003	0.028					
	1020.000	1020.000	-0.180	0.018	0.085	0.075	0.006	0.028					
	1080.000	1080.000	-0.183	0.018	0.072	0.084	0.003	0.028					
	1140.000	1140.000	-0.190	0.028	0.053	0.094	0.003	0.028					
	1200.000	1200.000	-0.202	0.018	0.041	0.094	0.003	0.028					
	1260.000	1260.000	-0.209	0.009	0.028	0.084	0.003	0.028					
	1320.000	1320.000	-0.218	0.009	0.015	0.084	0.003	0.028					
	1380.000	1380.000	-0.228	0.000	0.012	0.084	0.000	0.028					
	1440.000	1440.000	-0.237	-0.009	-0.003	0.084	0.003	0.028					
	1500.000	1500.000	-0.243	-0.018	-0.015	0.084	-0.003	0.028					
	1560.000	1560.000	-0.259	-0.047	-0.034	0.075	-0.003	0.028					
	1620.000	1620.000	-0.262	-0.047	-0.041	0.065	-0.003	0.028					
	1680.000	1680.000	-0.275	-0.066	-0.053	0.065	-0.003	0.019					
	1740.000	1740.000	-0.281	-0.066	-0.050	0.056	-0.003	0.009					
	1800.000	1800.000	-0.294	-0.075	-0.066	0.047	0.000	0.009					
	1860.000	1860.000	-0.304	-0.066	-0.072	0.065	0.003	0.019					
	1920.000	1920.000	-0.316	-0.066	-0.085	0.065	0.003	0.019					
	1980.000	1980.000	-0.326	-0.066	-0.088	0.084	0.003	0.028					
	2040.000	2040.000	-0.335	-0.066	-0.094	0.094	0.003	0.038					
	2100.000	2100.000	-0.342	-0.075	-0.101	0.094	0.003	0.047					
	2160.000	2160.000	-0.357	-0.066	-0.110	0.104	0.003	0.057					
	2220.000	2220.000	-0.364	-0.066	-0.113	0.104	0.003	0.057					
	2280.000	2280.000	-0.370	-0.056	-0.126	0.113	0.003	0.066					
	2340.000	2340.000	-0.380	-0.056	-0.126	0.113	0.000	0.066					
	2400.000	2400.000	-0.392	-0.056	-0.132	0.113	0.000	0.066					
	2460.000	2460.000	-0.402	-0.056	-0.136	0.104	0.000	0.066					
	2520.000	2520.000	-0.408	-0.056	-0.139	0.104	0.000	0.066					
	2580.000	2580.000	-0.421	-0.056	-0.148	0.104	0.000	0.066					
	2640.000	2640.000	-0.430	-0.066	-0.148	0.104	0.000	0.066					
	2700.000	2700.000	-0.443	-0.075	-0.151	0.094	0.000	0.057					
	2760.000	2760.000	-0.452	-0.075	-0.158	0.094	0.000	0.057					
	2820.000	2820.000	-0.465	-0.085	-0.161	0.094	0.000	0.057					
	2880.000	2880.000	-0.475	-0.094	-0.151	0.094	-0.006	0.057					
	2940.000	2940.000	-0.487	-0.113	-0.167	0.084	-0.006	0.057					
	3000.000	3000.000	-0.503	-0.123	-0.189	0.084	-0.003	0.066					
	3060.000	3060.000	-0.503	-0.142	-0.148	0.084	-0.066	0.047					
	3120.000	3120.000	-0.522	-0.142	-0.183	0.075	-0.006	0.047					
	3180.000	3180.000	-0.532	-0.151	-0.170	0.075	-0.006	0.038					
	3240.000	3240.000	-0.544	-0.170	-0.183	0.065	-0.006	0.028					
	3300.000	3300.000	-0.557	-0.170	-0.193	0.047	-0.006	0.009					
	3360.000	3360.000	-0.570	-0.100	-0.186	0.047	-0.006	0.000					
	3450.000	3450.000	-0.589	-0.189	-0.190	0.047	-0.006	-0.009					
	3480.000	3480.000	-0.595	-0.199	-0.202	0.038	-0.006	-0.019					
	3540.000	3540.000	-0.604	-0.227	-0.183	0.028	-0.006	-0.019					
	3600.000	3600.000	-0.617	-0.236	-0.196	0.028	-0.009	-0.028					
	3660.000	3660.000	-0.630	-0.236	-0.180	0.018	-0.006	-0.028					
	3720.000	3720.000	-0.639	-0.246	-0.218	0.018	-0.009	-0.038					
	3780.000	3780.000	-0.652	-0.255	-0.174	0.018	-0.003	-0.038					
	3840.000	3840.000	-0.665	-0.255	-0.208	0.009	-0.003	-0.038					
	3900.000	3900.000	-0.680	-0.265	-0.208	0.000	-0.003	-0.038					
	3960.000	3960.000	-0.690	-0.255	-0.221	0.018	-0.003	-0.038					
	4020.000	4020.000	-0.696	-0.265	-0.199	0.009	-0.003	-0.038					
	4080.000	4080.000	-0.712	-0.265	-0.212	0.018	-0.006	-0.038					
	4140.000	4140.000	-0.725	-0.265	-0.224	0.009	-0.006	-0.047					
	4200.000	4200.000	-0.737	-0.274	-0.212	0.009	-0.006	-0.047					
	4260.000	4260.000	-0.747	-0.284	-0.183	-0.009	-0.006	-0.066					
	4320.000	4320.000	-0.756	-0.303	-0.189	-0.009	-0.009	-0.076					
DRAWDOWN DATA	4320.000	0.000	-0.047	-0.018	0.025	0.018		0.018	0.000	0.000	-0.009	-0.015	-0.241
	4320.100	0.100	-0.047	-0.018	0.079	0.009		0.009	-15.927	-0.009	0.003	-0.015	-0.241
	4320.200	0.200	-0.044	-0.009	0.069	0.009		0.009	-23.046	-0.037	0.006	0.000	-0.241
	4320.300	0.300	-0.044	-0.018	0.006	0.009		0.009	-25.707	-0.085	0.003	0.000	-0.238

BETHPAGE NWIRP
PUMPING TEST #1
PUMPING WELL: HN-27I2 PUMPING RATE: 448 GPM

	Total Time	Step Time	HN30S	HN30I	Basin	HN26I	HN28S	HN28I	HN-27I2	HN-27I1	HN27S2	HN27S3	USGS Well
	4320.500	0.500	-0.044	-0.018	0.063	0.009		0.018	-27.423	-0.227	-0.019	-0.015	-0.241
	4320.750	0.750	-0.041	-0.018	0.063	0.009		0.009	-28.053	-0.407	-0.038	0.000	-0.234
	4321.000	1.000	-0.044	-0.018	0.028	0.009		0.009	-27.140	-0.540	-0.055	-0.015	-0.241
	4322.000	2.000	-0.044	-0.037	0.072	0.000		0.009	-27.093	-0.938	-0.087	-0.015	-0.244
	4323.000	3.000	-0.047	-0.056	0.069	-0.009		-0.009	-27.565	-1.252	-0.110	-0.031	-0.250
	4324.000	4.000	-0.044	-0.066	0.053	-0.019		-0.028	-27.723	-1.517	-0.119	-0.031	-0.257
	4325.000	5.000	-0.044	-0.085	0.056	-0.028		-0.047	-28.227	-1.764	-0.129	-0.031	-0.260
	4326.000	6.000	-0.047	-0.113	0.037	-0.047		-0.066	-26.510	-1.973	-0.139	-0.047	-0.257
	4328.000	8.000	-0.044	-0.142	0.025	-0.075		-0.114	-15.754	-2.181	-0.139	-0.047	-0.250
	4330.000	10.000	-0.047	-0.170	0.053	-0.085		-0.161	-18.132	-2.172	-0.126	-0.047	-0.263
	4332.000	12.000	-0.050	-0.189	0.069	-0.085		-0.180	-22.070	-2.314	-0.145	-0.063	-0.247
	4336.000	16.000	-0.050	-0.189	0.044	-0.094		-0.237	-22.180	-2.580	-0.165	-0.078	-0.273
	4340.000	20.000	-0.050	-0.189	0.072	-0.104		-0.285	-21.944	-2.751	-0.181	-0.094	-0.263
	4344.000	24.000	-0.050	-0.199	0.075	-0.104		-0.323	-21.975	-2.874	-0.191	-0.094	-0.273
	4350.000	30.000	-0.053	-0.189	0.094	-0.123		-0.361	-22.085	-2.969	-0.203	-0.094	-0.276
	4354.000	34.000	-0.053	-0.199	0.094	-0.123		-0.380	-22.196	-3.007	-0.213	-0.110	-0.292
	4360.000	40.000	-0.057	-0.189	0.098	-0.132		-0.418	-21.975	-3.045	-0.226	-0.110	-0.301
	4366.000	46.000	-0.057	-0.199	0.101	-0.132		-0.418	-22.038	-3.064	-0.229	-0.110	-0.304
	4370.000	50.000	-0.060	-0.189	0.107	-0.132		-0.418	-22.007	-3.073	-0.242	-0.110	-0.311
	4374.000	54.000	-0.060	-0.199	0.075	-0.142		-0.427	-22.227	-3.073	-0.246	-0.110	-0.311
	4380.000	60.000	-0.060	-0.189	0.110	-0.142		-0.437	-22.133	-3.083	-0.259	-0.126	-0.314
	4390.000	70.000	-0.063	-0.189	0.101	-0.142		-0.446	-22.196	-3.092	-0.268	-0.126	-0.330
	4400.000	80.000	-0.066	-0.189	0.104	-0.151		-0.446	-22.117	-3.092	-0.278	-0.142	-0.342
	4410.000	90.000	-0.069	-0.189	0.120	-0.160		-0.456	-21.959	-3.102	-0.291	-0.142	-0.355
	4420.000	100.000	-0.066	-0.199	0.145	-0.160		-0.456	-21.975	-3.102	-0.294	-0.142	-0.361
	4440.000	120.000	-0.072	-0.151	0.167	-0.151		-0.456	-22.227	-3.111	-0.310	-0.157	-0.390
	4460.000	140.000	-0.076	-0.142	0.177	-0.151		-0.465	-22.164	-3.121	-0.323	-0.173	-0.406
	4480.000	160.000	-0.082	-0.142	0.196	-0.151		-0.465	-21.928	-3.130	-0.333	-0.189	-0.422
	4500.000	180.000	-0.088	-0.151	0.196	-0.151		-0.475	-22.101	-3.130	-0.349	-0.189	-0.438
	4520.000	200.000	-0.091	-0.151	0.218	-0.151		-0.475	-21.865	-3.140	-0.365	-0.205	-0.434
	4570.000	250.000	-0.101	-0.161	0.243				-22.164	-3.159	-0.398	-0.236	
	4620.000	300.000	-0.114	-0.161	0.275	-0.151		-0.494	-22.133	-3.179	-0.433	-0.268	-0.485
	4670.000	350.000	-0.120	-0.161	0.300				-21.975	-3.187	-0.462	-0.284	
	4720.000	400.000	-0.126	-0.161	0.335	-0.142		-0.504	-22.290	-3.206	-0.492	-0.299	-0.530
	4770.000	450.000	-0.139	-0.170	0.344				-22.180	-3.206	-0.521	-0.331	
	4820.000	500.000	-0.142	-0.161	0.360	-0.151		-0.504	-22.196	-3.225	-0.547	-0.347	-0.571
	4870.000	550.000	-0.148	-0.161	0.386				-22.164	-3.234	-0.547	-0.363	
	4920.000	600.000	-0.152	-0.151	0.411	-0.142		-0.494	-22.259	-3.244	-0.592	-0.394	-0.606
	4970.000	650.000	-0.155	-0.142	0.420				-22.274	-3.253	-0.621	-0.394	
	5020.000	700.000	-0.155	-0.142	0.433	-0.142		-0.494	-22.259	-3.263	-0.647	-0.426	-0.647
	5070.000	750.000	-0.155	-0.142	0.449				-21.865	-3.272	-0.673	-0.442	
	5120.000	800.000	-0.152	-0.132	0.458	-0.132		-0.494	-22.070	-3.272	-0.689	-0.457	-0.692
	5220.000	900.000	-0.142	-0.132	0.484	-0.142		-0.494	-22.337	-3.301	-0.721	-0.489	-0.736
	5320.000	1000.000	-0.126	-0.123	0.509	-0.132		-0.504	-22.322	-3.320	-0.773	-0.520	-0.781
	5420.000	1100.000	-0.114	-0.123	0.522				-22.526	-3.339	-0.809	-0.568	
	5520.000	1200.000	-0.098	-0.151	0.550	-0.198		-0.541	-22.227	-3.367	-0.838	-0.598	-0.835
	5620.000	1300.000	-0.076	-0.151	0.601				-22.259	-3.377	-0.870	-0.615	
	5720.000	1400.000	-0.060	-0.132	0.557	-0.217		-0.541	-22.699	-3.396	-0.906	-0.647	-0.920
	5820.000	1500.000	-0.034	-0.142	0.613				-22.432	-3.415	-0.935	-0.678	
	5920.000	1600.000	-0.015	-0.123	0.626	-0.227		-0.579	-22.243	-3.424	-0.968	-0.694	-1.015
	6020.000	1700.000	0.006	-0.113	0.613				-22.699	-3.434	-0.993	-0.710	
	6120.000	1800.000	0.034	-0.113	0.617	-0.227		-0.589	-22.605	-3.443	-1.019	-0.742	-1.120
	6220.000	1900.000	0.060	-0.085	0.617				-22.463	-3.453	-1.042	-0.757	
	6320.000	2000.000	0.091	-0.066	0.613	-0.217		-0.589	-22.558	-3.453	-1.061	-0.773	-1.196
	6420.000	2100.000	0.117	-0.037	0.610				-22.715	-3.453	-1.084	-0.789	
	6520.000	2200.000	0.145	-0.028	0.601	-0.208		-0.560	-22.715	-3.453	-1.100	-0.805	-1.273
	6620.000	2300.000	0.174	-0.009	0.591				-22.495	-3.453	-1.116	-0.820	
	6720.000	2400.000	0.199	0.000	0.623	-0.198		-0.541	-22.558	-3.462	-1.139	-0.836	-1.355
	6820.000	2500.000	0.224	0.009	0.626				-22.259	-3.462	-1.155	-0.868	
	6920.000	2600.000	0.247	0.000	0.629	-0.227		-0.551	-22.448	-3.472	-1.172	-0.868	-1.435
	7020.000	2700.000	0.269	-0.009	0.607				-22.479	-3.491	-1.184	-0.899	
	7120.000	2800.000	0.294	-0.009	0.623	-0.264		-0.570	-22.699	-3.491	-1.204	-0.915	-1.511
	7220.000	2900.000	0.316	-0.009	0.613				-22.778	-3.500	-1.217	-0.915	
	7320.000	3000.000	0.338	-0.009	0.632	-0.274		-0.589	-22.542	-3.500	-1.227	-0.931	-1.584
	7420.000	3100.000	0.361	0.000	0.636				-22.416	-3.510	-1.240	-0.931	
	7520.000	3200.000	0.380	0.009	0.632	-0.283		-0.627	-22.652	-3.519	-1.252	-0.947	-1.676
	7620.000	3300.000	0.405	0.018	0.623				-22.495	-3.510	-1.262	-0.963	
	7720.000	3400.000	0.424	0.028	0.607	-0.274		-0.627	-22.747	-3.519	-1.272	-0.963	-1.746
	7820.000	3500.000	0.446	0.047	0.601				-22.605	-3.510	-1.275	-0.963	
	7920.000	3600.000	0.468	0.066	0.582	-0.264		-0.608	-22.747	-3.519	-1.288	-0.978	-1.812
	8020.000	3700.000	0.484	0.075	0.566				-22.699	-3.510	-1.291	-0.978	
	8120.000	3800.000	0.500	0.094	0.557	-0.245		-0.579	-22.589	-3.510	-1.301	-0.994	-1.882
	8220.000	3900.000	0.516	0.084	0.557				-22.605	-3.500	-1.308	-1.010	
	8320.000	4000.000	0.525	0.075	0.560	-0.264		-0.589	-22.463	-3.510	-1.314	-1.010	-1.949
	8420.000	4100.000	0.538	0.066	0.560				-22.589	-3.510	-1.320	-1.026	
RECOVERY DATA	8420.000	0.000	0.544	0.066	0.569	-0.283		-0.589	-22.478	-3.519	-1.314	-1.026	-1.987
	8420.100	0.100	0.547	0.066	0.572	-0.302		-0.598	-4.411	-3.510	-1.320	-1.010	-1.987

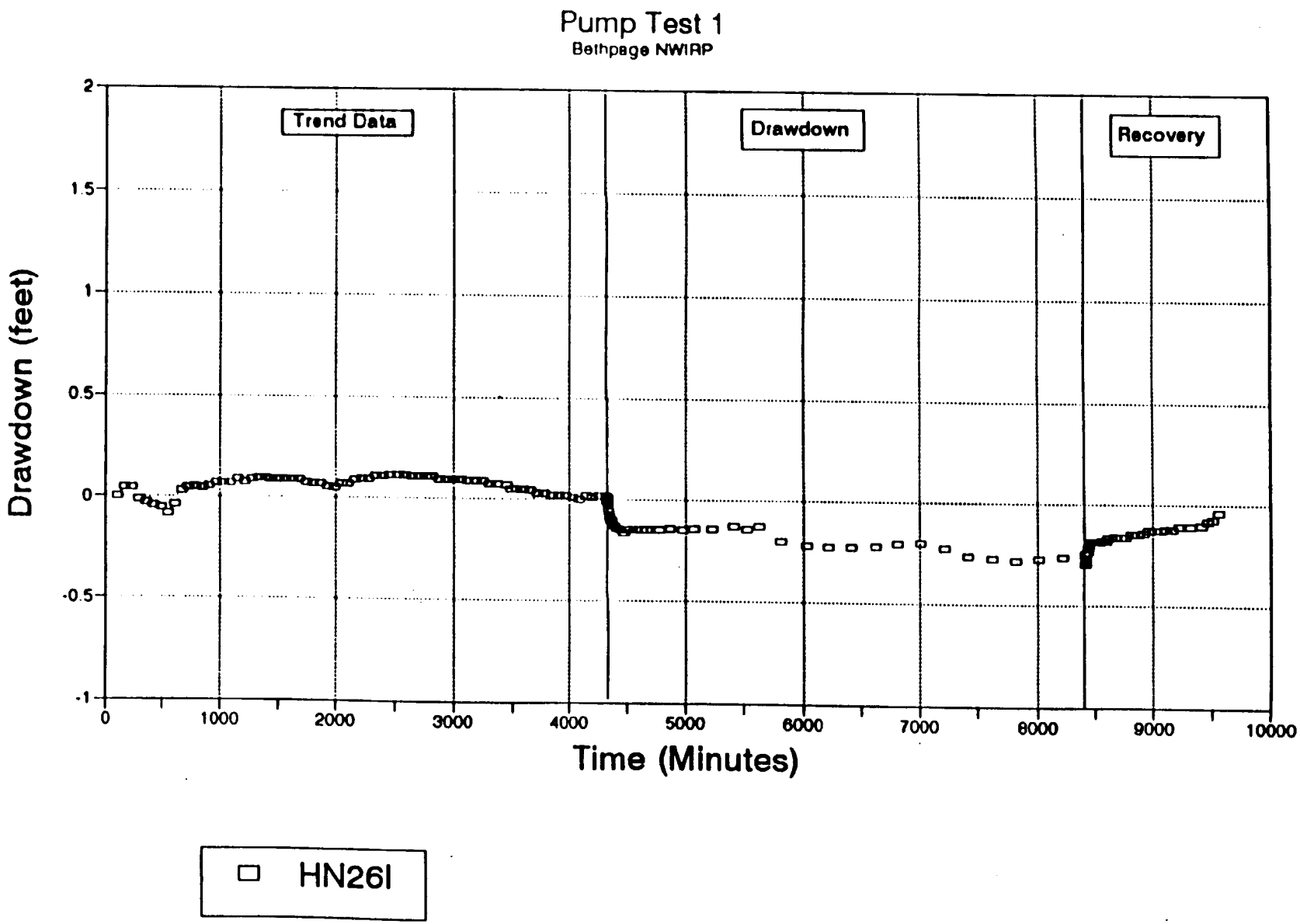
BETHPAGE NWIRP
PUMPING TEST #1
PUMPING WELL: HN-27I2 PUMPING RATE: 448 GPM

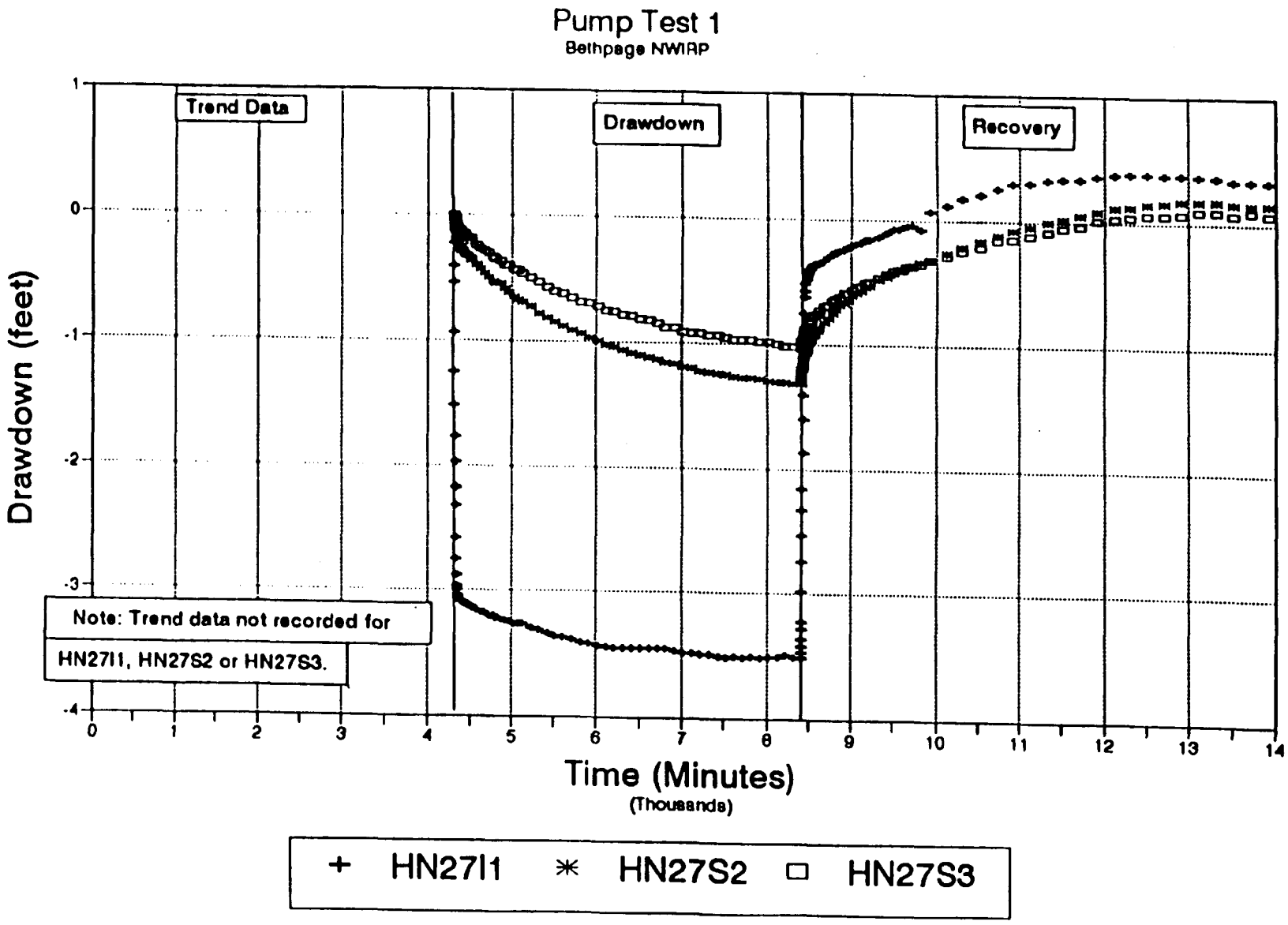
Total Time	Step Time	HN30S	HN30I	Basin	HN26I	HN28S	HN28I	HN-27I2	HN-27I1	HN27S2	HN27S3	USGS Well
8420.200	0.200	0.547	0.066	0.572	-0.302		-0.598	-0.677	-3.472	-1.320	-1.010	-1.987
8420.300	0.300	0.547	0.066	0.569	-0.302		-0.608	-1.749	-3.424	-1.317	-1.010	-1.987
8420.500	0.500	0.547	0.066	0.566	-0.302		-0.598	-1.859	-3.358	-1.304	-1.010	-1.987
8420.750	0.750	0.547	0.066	0.566	-0.302		-0.598	-1.670	-3.291	-1.291	-1.010	-1.987
8421.000	1.000	0.547	0.066	0.563	-0.302		-0.598	-1.465	-3.225	-1.285	-1.010	-1.987
8422.000	2.000	0.547	0.056	0.563	-0.293		-0.589	-0.992	-2.978	-1.259	-0.994	-1.987
8423.000	3.000	0.544	0.047	0.563	-0.283		-0.589	-0.772	-2.741	-1.240	-0.994	-1.987
8424.000	4.000	0.544	0.037	0.560	-0.274		-0.570	-0.661	-2.532	-1.223	-0.978	-1.990
8425.000	5.000	0.547	0.037	0.569	-0.274		-0.560	-0.598	-2.333	-1.217	-0.978	-1.987
8426.000	6.000	0.544	0.028	0.553	-0.264		-0.551	-0.535	-2.162	-1.204	-0.963	-1.987
8428.000	8.000	0.547	0.028	0.560	-0.245		-0.504	-0.488	-1.859	-1.188	-0.963	-1.987
8430.000	10.000	0.547	0.028	0.566	-0.236		-0.475	-0.456	-1.603	-1.175	-0.947	-1.987
8432.000	12.000	0.544	0.028	0.557	-0.217		-0.427	-0.441	-1.404	-1.165	-0.947	-1.987
8436.000	16.000	0.557	0.047	0.575	-0.208		-0.361	-0.409	-1.090	-1.142	-0.931	-1.984
8440.000	20.000	0.554	0.066	0.563	-0.198		-0.304	-0.393	-0.891	-1.133	-0.931	-1.987
8444.000	24.000	0.551	0.085	0.557	-0.189		-0.266	-0.378	-0.749	-1.116	-0.915	-1.990
8450.000	30.000	0.557	0.104	0.560	-0.189		-0.227	-0.362	-0.616	-1.097	-0.899	-1.890
8454.000	34.000	0.554	0.113	0.557	-0.189		-0.199	-0.362	-0.569	-1.087	-0.884	-1.993
8460.000	40.000	0.557	0.113	0.553	-0.189		-0.180	-0.346	-0.512	-1.074	-0.868	-1.993
8466.000	46.000	0.557	0.123	0.553	-0.189		-0.161	-0.346	-0.483	-1.065	-0.868	-1.997
8470.000	50.000	0.557	0.123	0.550	-0.189		-0.161	-0.346	-0.464	-1.055	-0.868	-1.993
8474.000	54.000	0.560	0.132	0.553	-0.189		-0.152	-0.346	-0.455	-1.048	-0.868	-1.993
8480.000	60.000	0.560	0.132	0.557	-0.189		-0.142	-0.330	-0.445	-1.039	-0.852	-2.000
8490.000	70.000	0.560	0.132	0.553	-0.189		-0.133	-0.330	-0.426	-1.026	-0.836	-2.000
8500.000	80.000	0.563	0.142	0.547	-0.189		-0.133	-0.315	-0.417	-1.010	-0.820	-2.003
8510.000	90.000	0.566	0.142	0.534	-0.179		-0.123	-0.315	-0.407	-0.993	-0.805	-2.008
8520.000	100.000	0.566	0.151	0.534	-0.179		-0.123	-0.315	-0.398	-0.980	-0.805	-2.012
8540.000	120.000	0.573	0.189	0.519	-0.179		-0.114	-0.283	-0.379	-0.955	-0.773	-2.019
8560.000	140.000	0.576	0.208	0.503	-0.170		-0.114	-0.283	-0.360	-0.929	-0.757	-2.022
8580.000	160.000	0.579	0.208	0.490	-0.160		-0.114	-0.283	-0.351	-0.906	-0.757	-2.035
8600.000	180.000	0.582	0.208	0.481	-0.160		-0.104	-0.267	-0.351	-0.887	-0.742	-2.035
8620.000	200.000	0.585	0.198	0.477	-0.160		-0.114	-0.267	-0.341	-0.864	-0.726	-2.044
8670.000	250.000	0.598	0.208	0.465	-0.151		-0.114	-0.252	-0.322	-0.822	-0.694	-2.063
8720.000	300.000	0.604	0.208	0.436	-0.151		-0.104	-0.236	-0.303	-0.783	-0.678	-2.073
8770.000	350.000	0.617	0.217	0.408	-0.142		-0.095	-0.220	-0.284	-0.744	-0.647	-2.092
8820.000	400.000	0.623	0.217	0.385	-0.132		-0.095	-0.204	-0.265	-0.715	-0.631	-2.104
8870.000	450.000	0.630	0.217	0.370	-0.132		-0.095	-0.189	-0.246	-0.686	-0.615	-2.127
8920.000	500.000	0.636	0.208	0.357	-0.132		-0.104	-0.189	-0.237	-0.657	-0.584	-2.136
8970.000	550.000	0.642	0.227	0.335	-0.123		-0.085	-0.173	-0.218	-0.637	-0.584	-2.152
9020.000	600.000	0.646	0.217	0.310	-0.123		-0.085	-0.173	-0.208	-0.611	-0.552	-2.165
9070.000	650.000	0.652	0.217	0.294	-0.113		-0.085	-0.157	-0.199	-0.586	-0.536	-2.178
9120.000	700.000	0.655	0.227	0.287	-0.113		-0.085	-0.157	-0.189	-0.563	-0.520	-2.190
9170.000	750.000	0.658	0.227	0.287	-0.104		-0.066	-0.126	-0.170	-0.540	-0.505	-2.209
9220.000	800.000	0.658	0.246	0.291	-0.085		-0.056	-0.126	-0.161	-0.521	-0.489	-2.216
9320.000	900.000	0.658	0.255	0.392	-0.075		-0.037	-0.094	-0.132	-0.485	-0.457	-2.247
9420.000	1000.000	0.655	0.265	0.452	-0.038		-0.028	-0.063	-0.104	-0.453	-0.426	4.443
9470.000	1050.000	0.677	0.284	0.753				-0.063	-0.094	-0.433	-0.426	
9520.000	1100.000	0.690	0.293	1.128				-0.047	-0.075	-0.424	-0.410	
9570.000	1150.000	0.687	0.303	1.328				-0.031	-0.066	-0.404	-0.394	
9620.000	1200.000	0.709	0.322	1.443				-0.015	-0.056	-0.388	-0.394	4.443
9670.000	1250.000	0.728	0.331	1.560				-0.015	-0.047	-0.375	-0.378	
9720.000	1300.000	0.744	0.350	1.671				0.000	-0.037	-0.362	-0.363	
9820.000	1400.000							-0.047	-0.066	-0.339	-0.347	
9920.000	1500.000								0.075	-0.314	-0.315	
10120.000	1700.000								0.123	-0.262	-0.284	
10320.000	1900.000								0.180	-0.210	-0.236	
10520.000	2100.000								0.218	-0.161	-0.205	
10720.000	2300.000								0.256	-0.116	-0.157	
10920.000	2500.000								0.294	-0.074	-0.142	
11120.000	2700.000								0.313	-0.042	-0.110	
11320.000	2900.000								0.332	0.003	-0.078	
11520.000	3100.000								0.341	0.029	-0.047	
11720.000	3300.000								0.341	0.058	-0.031	
11920.000	3500.000								0.360	0.087	0.015	
12120.000	3700.000								0.379	0.116	0.031	
12320.000	3900.000								0.398	0.135	0.047	
12520.000	4100.000								0.398	0.152	0.063	
12720.000	4300.000								0.379	0.165	0.063	
12920.000	4500.000								0.379	0.178	0.078	
13120.000	4700.000								0.369	0.178	0.094	
13320.000	4900.000								0.360	0.178	0.094	
13520.000	5100.000								0.341	0.161	0.078	
13720.000	5300.000								0.341	0.152	0.094	
13920.000	5500.000								0.332	0.155	0.078	

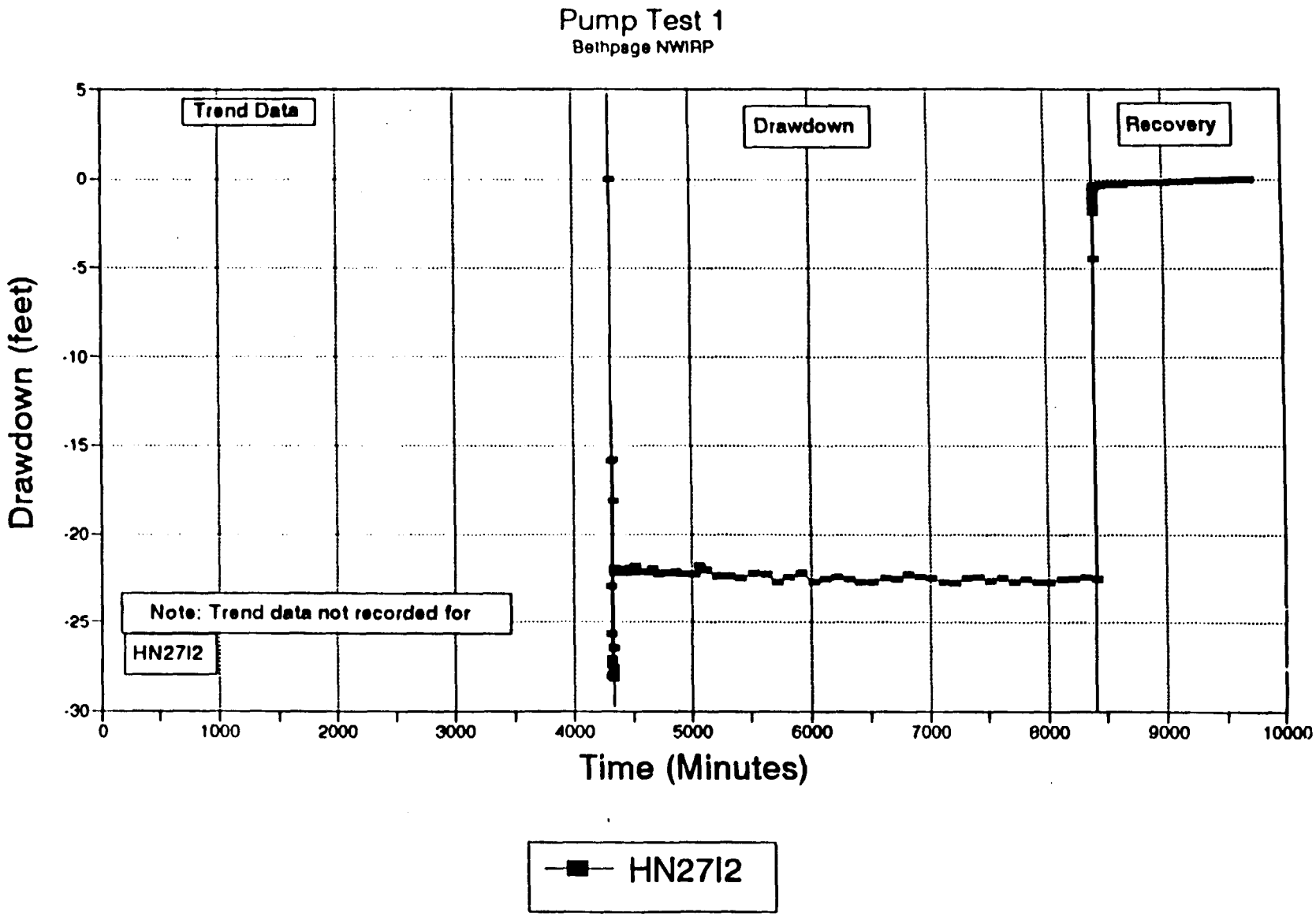
Note Shaded block indicates data not recorded for time interval

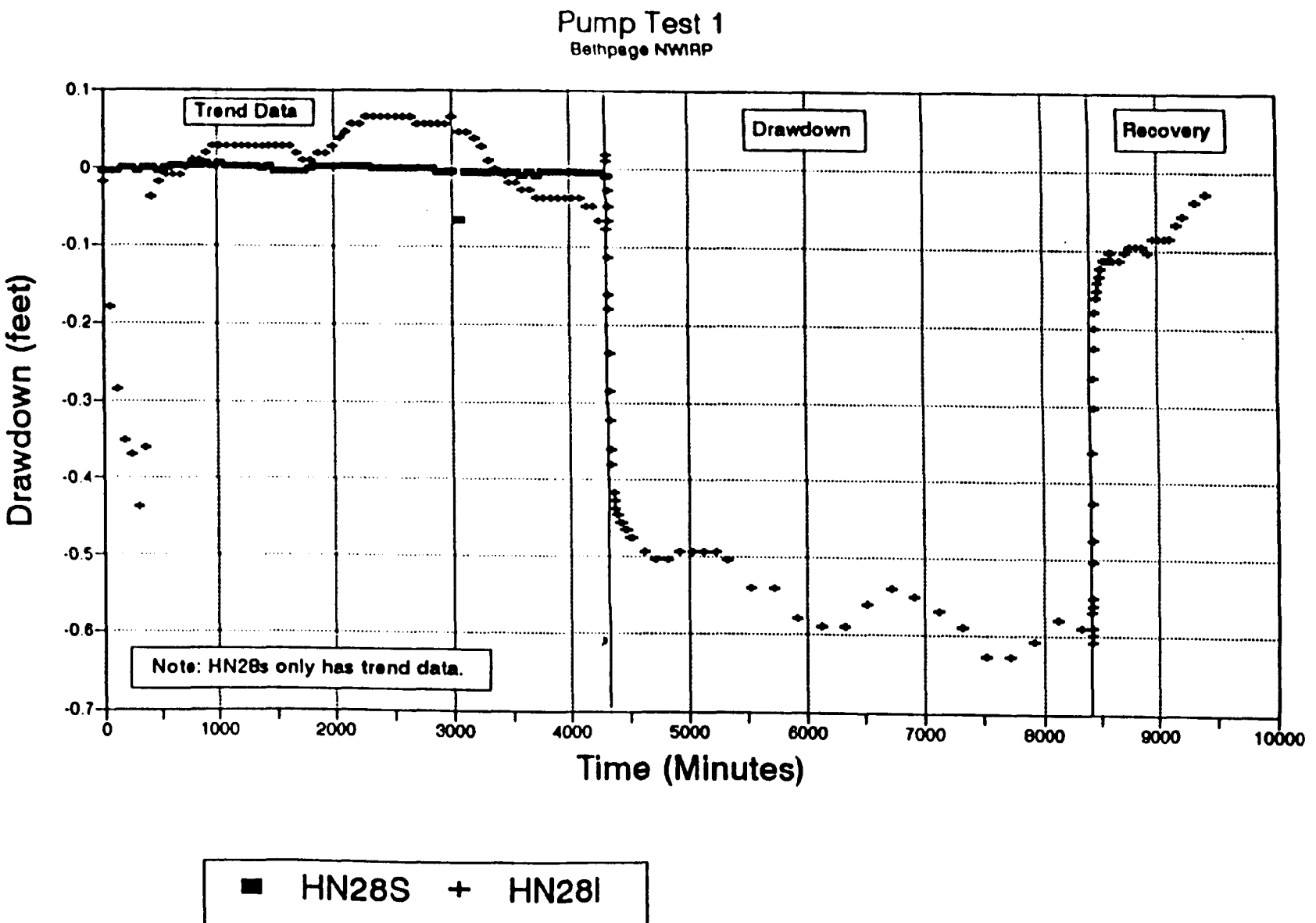
PUMPING TEST #1

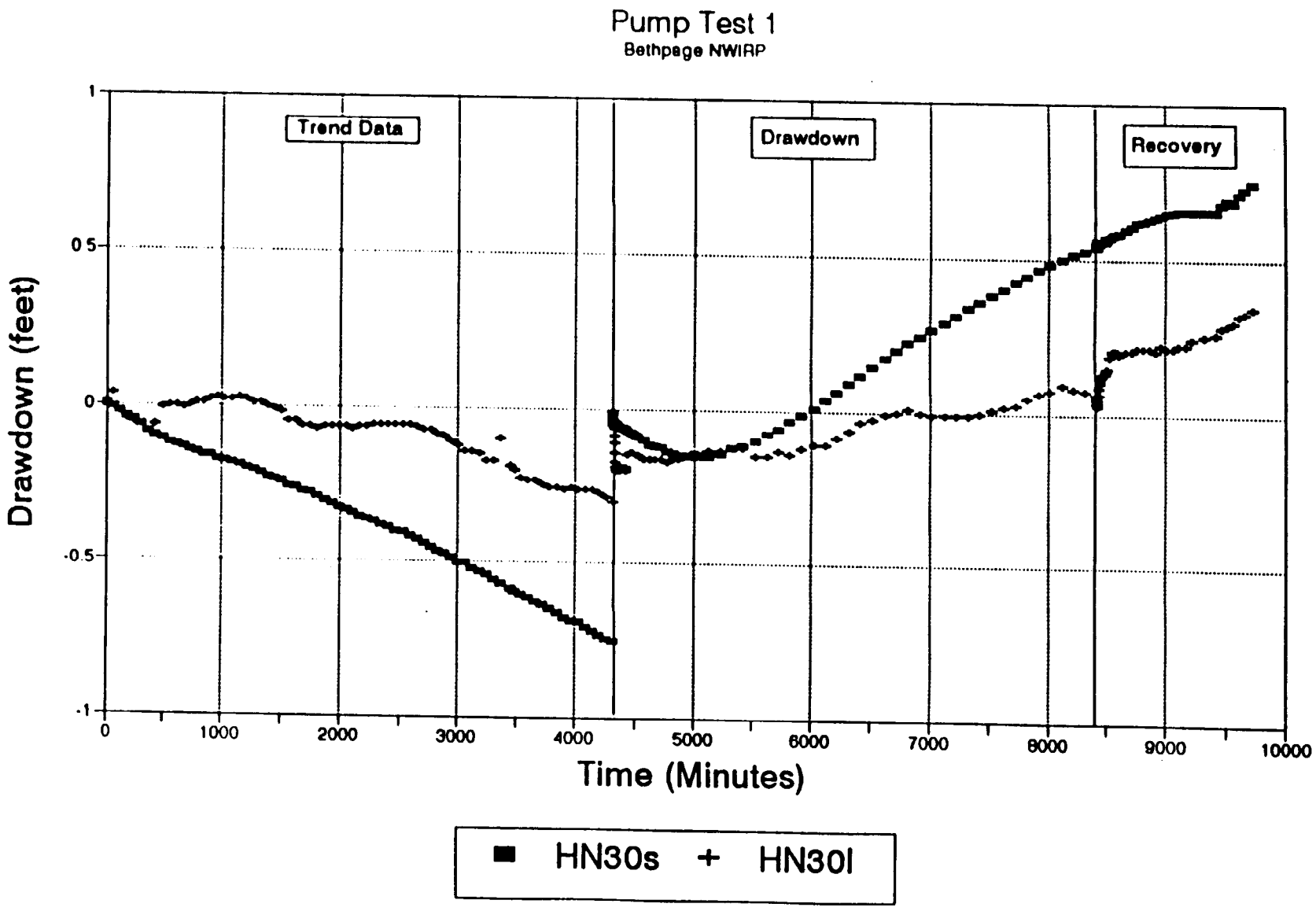
GRAPHS OF DRAWDOWN AND RECOVERY DATA

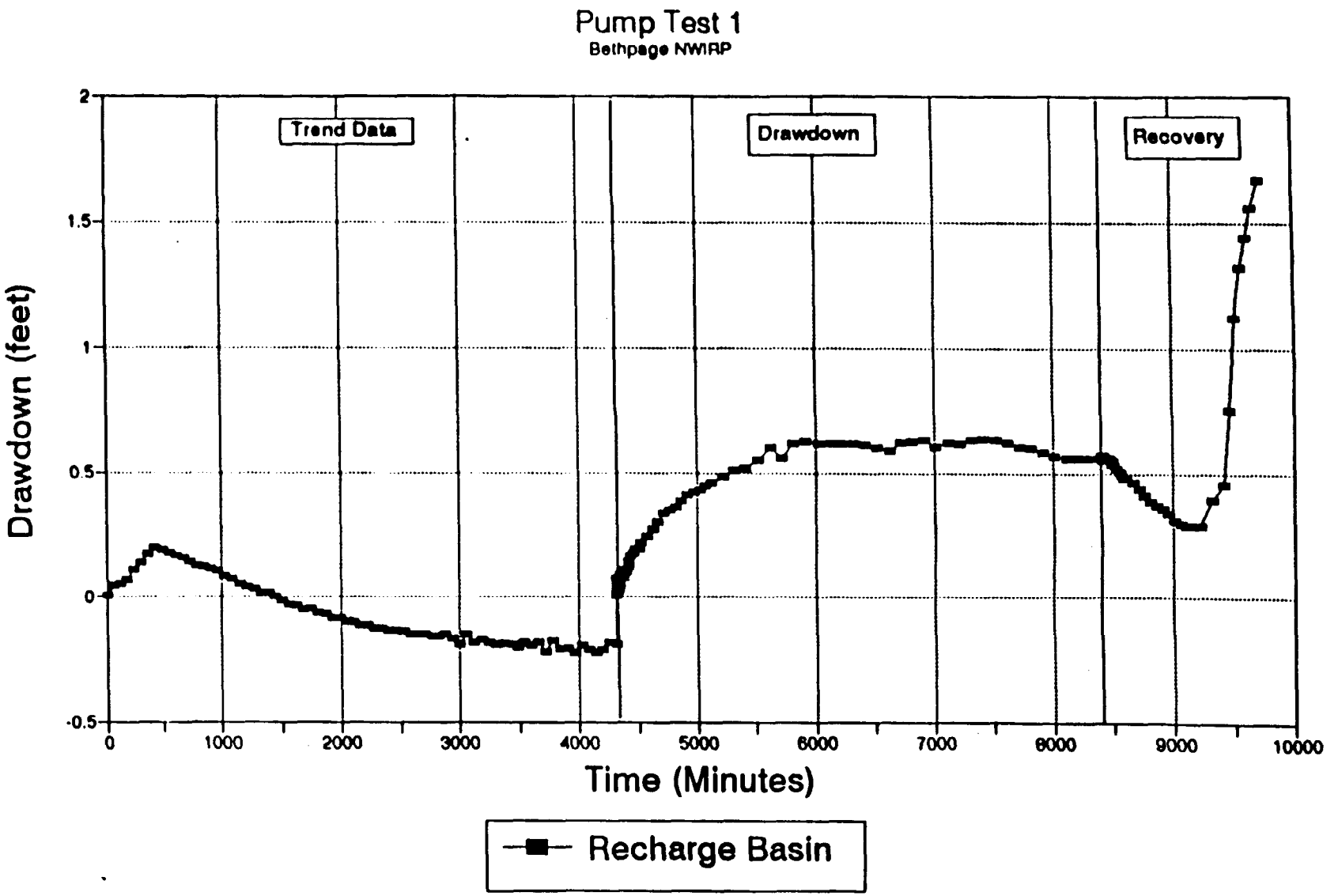

Pump Test 1
Bethpage NWIRP
Trend Data
Drawdown
Recovery
Drawdown (feet)
2
1.5
1
0.5
0
-0.5
-1
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
Time (Minutes)
HN26I

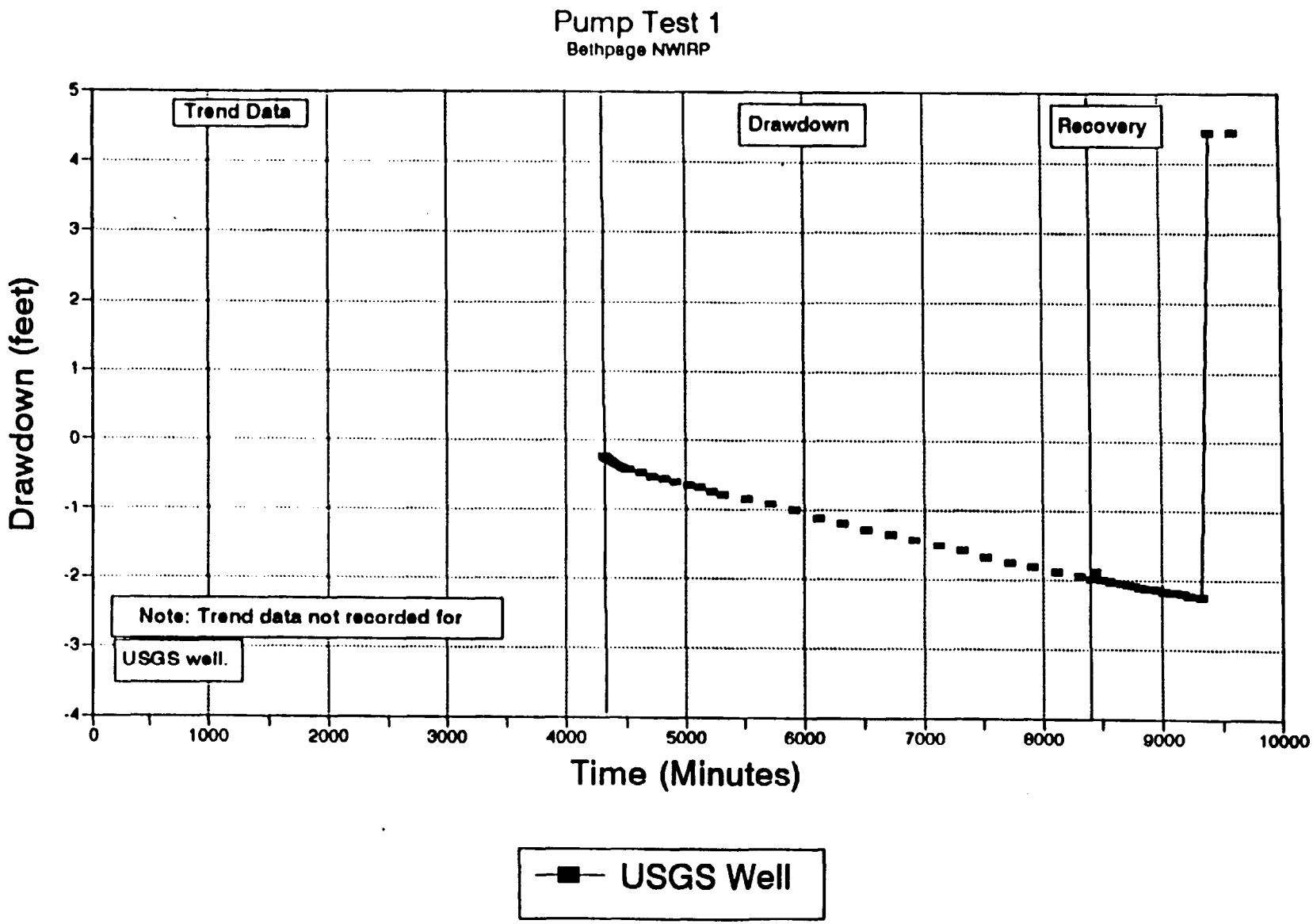

Pump Test 1
Bethpage NWIRP
Trend Data
Drawdown
Recovery
Note: Trend data not recorded for
HN27I1, HN27S2 or HN27S3.
Drawdown (feet)
1
0
-1
-2
-3
-4
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Time (Minutes)
(Thousands)
+ HN27I1
✳ HN27S2
□ HN27S3

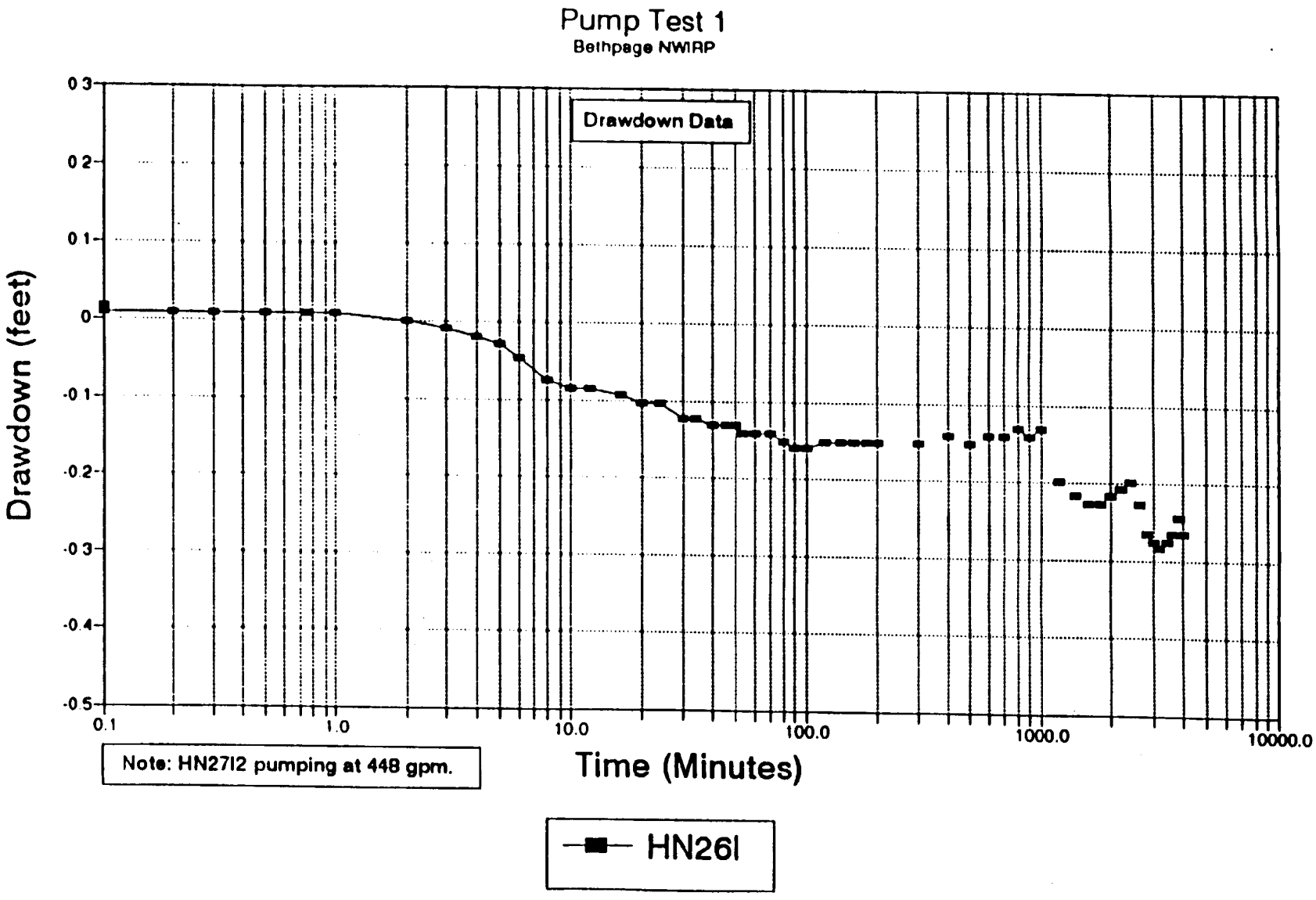

Pump Test 1
Bethpage NWIRP
Trend Data
Drawdown
Recovery
Note: Trend data not recorded for
HN27I2
Drawdown (feet)
5
0
-5
-10
-15
-20
-25
-30
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
Time (Minutes)
HN27I2

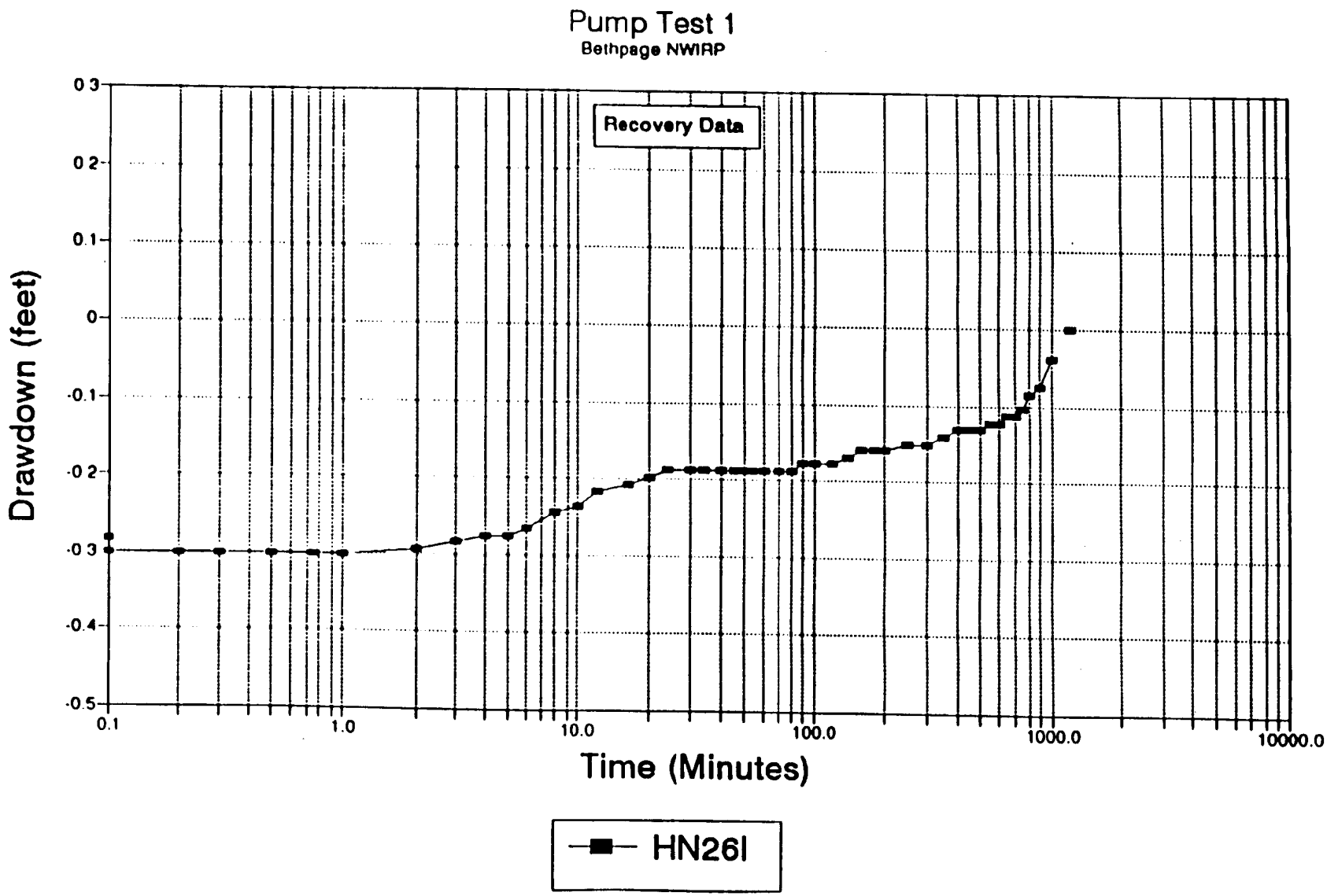

Pump Test 1
Bethpage NWIRP
Trend Data
Drawdown
Recovery
Note: HN28s only has trend data.
Drawdown (feet)
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
Time (Minutes)
HN28S + HN28I

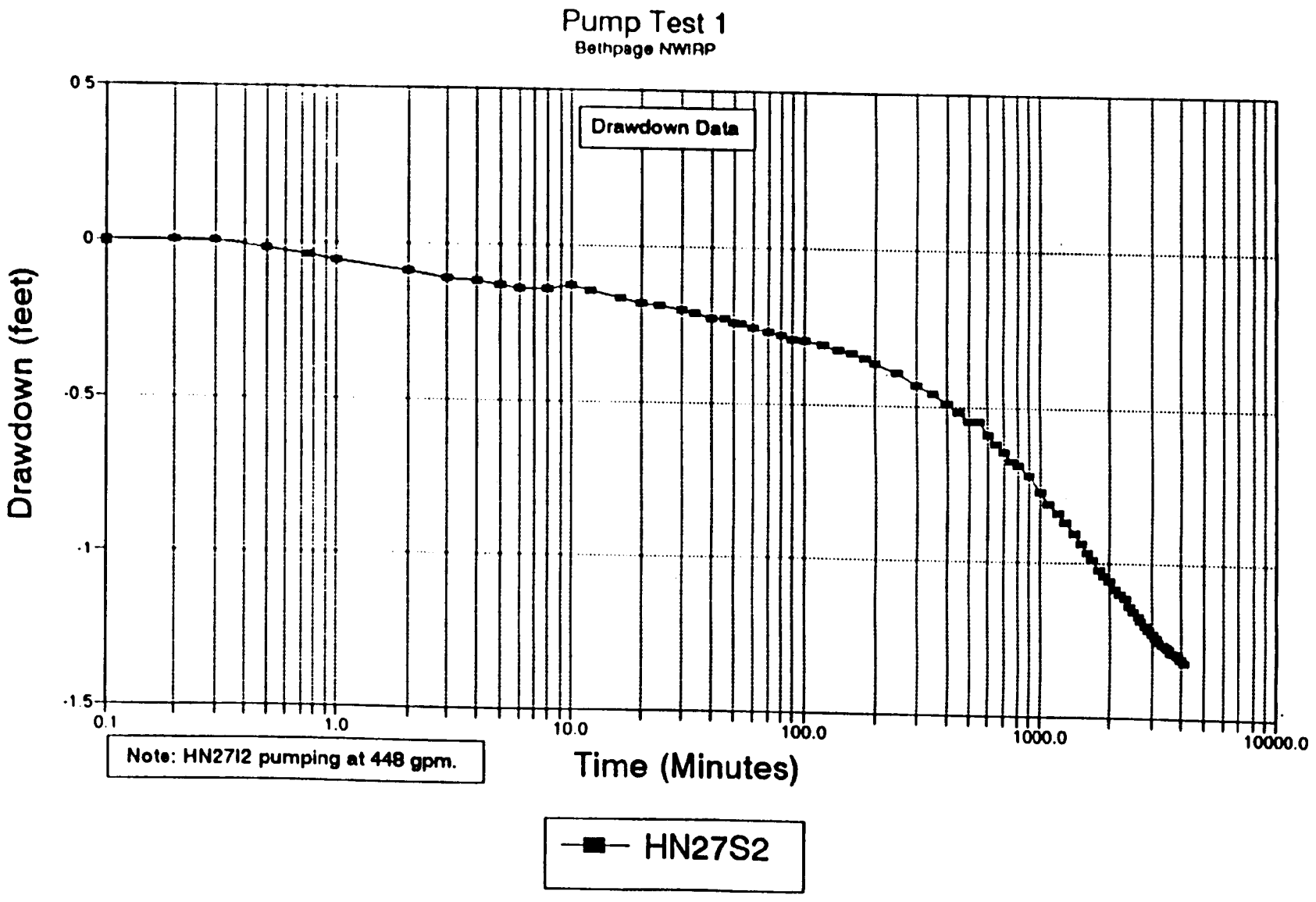

Pump Test 1
Bethpage NWIRP
Trend Data
Drawdown
Recovery
Drawdown (feet)
1
0.5
0
-0.5
-1
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
Time (Minutes)
HN30s
HN30I

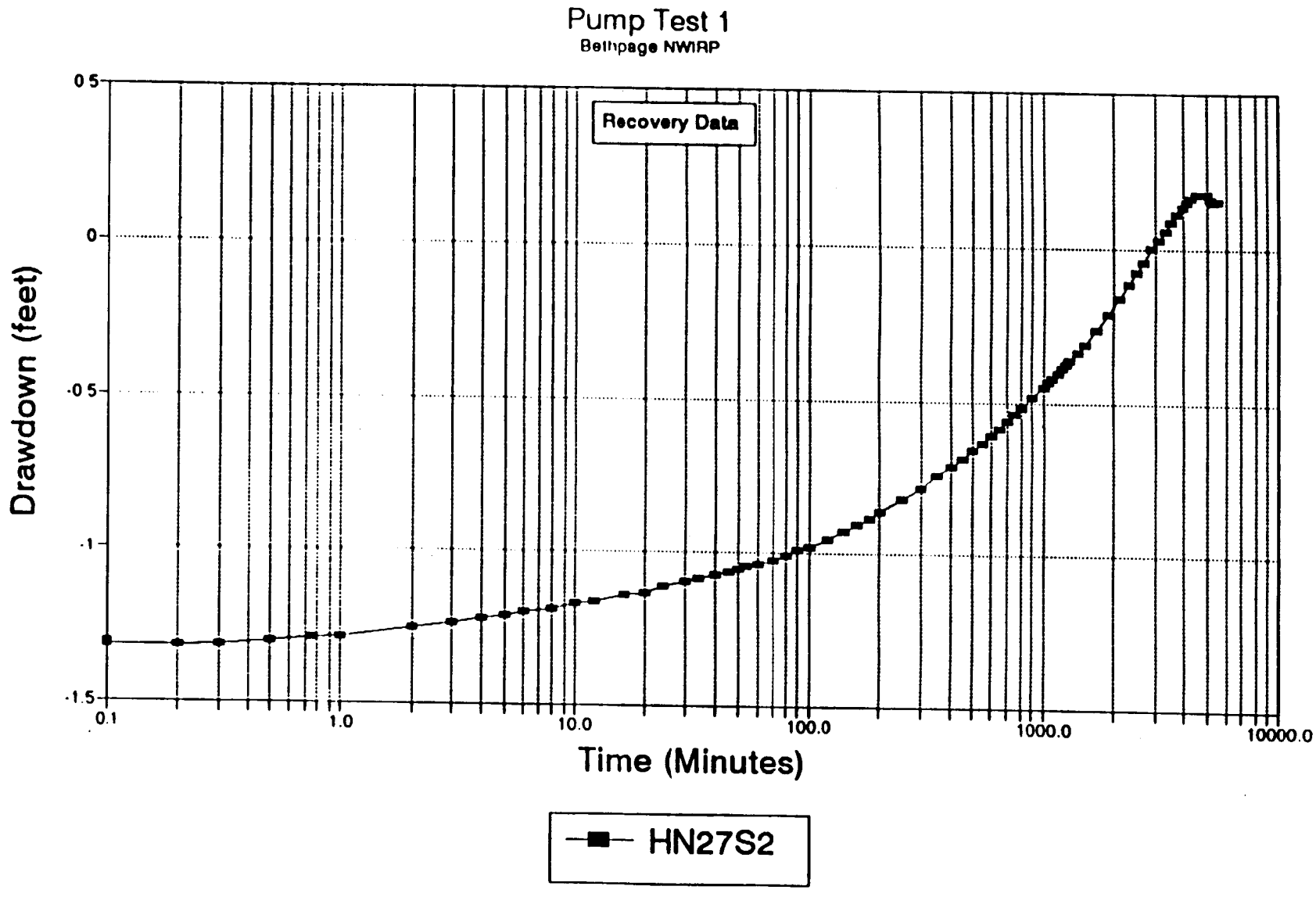

Pump Test 1
Bethpage NWIRP
Trend Data
Drawdown
Recovery
Drawdown (feet)
2
1.5
1
0.5
0
-0.5
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
Time (Minutes)
Recharge Basin

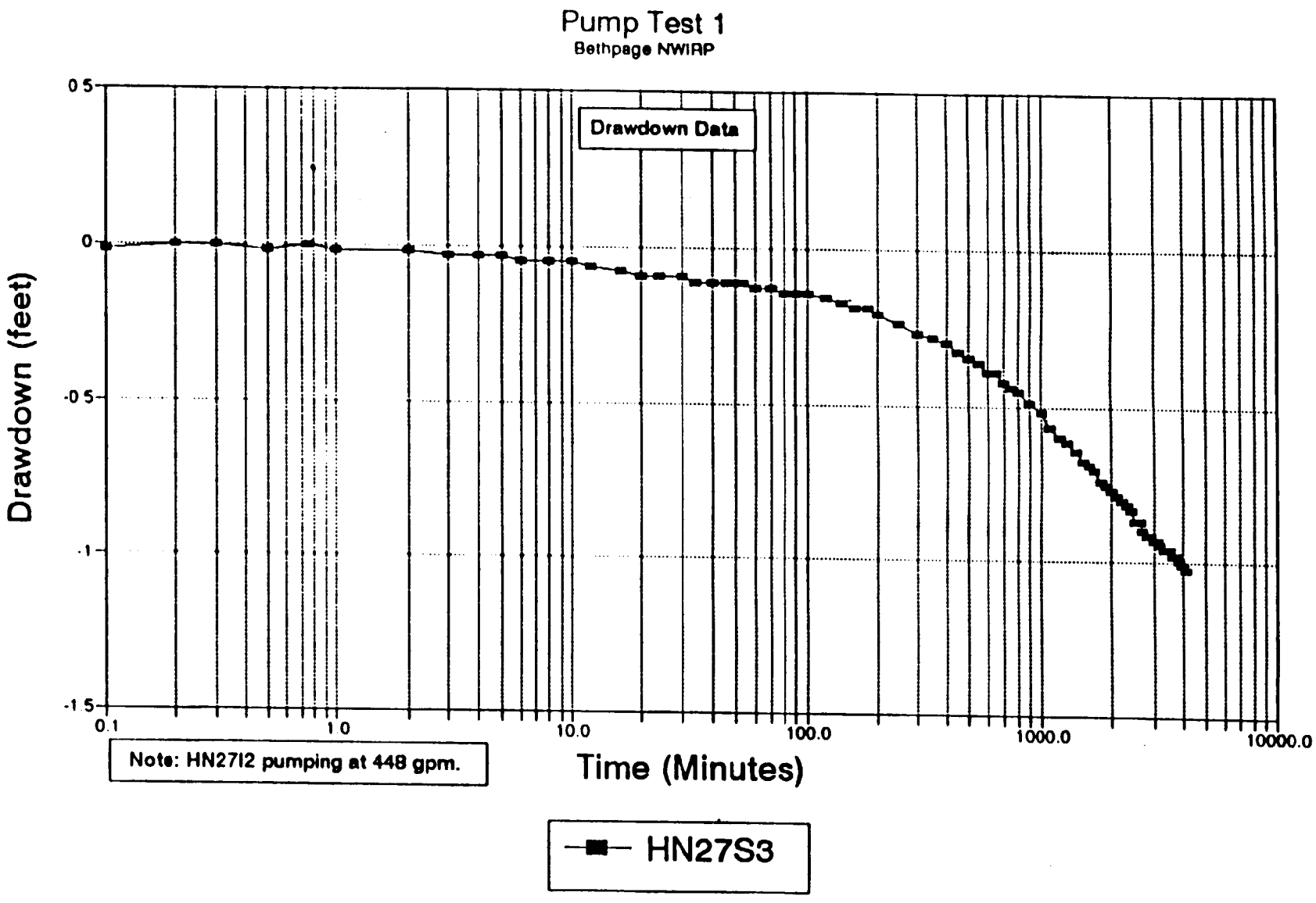

Pump Test 1
Bethpage NWIRP
Trend Data
Drawdown
Recovery
Note: Trend data not recorded for
USGS well.
Drawdown (feet)
5
4
3
2
1
0
-1
-2
-3
-4
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
Time (Minutes)
USGS Well

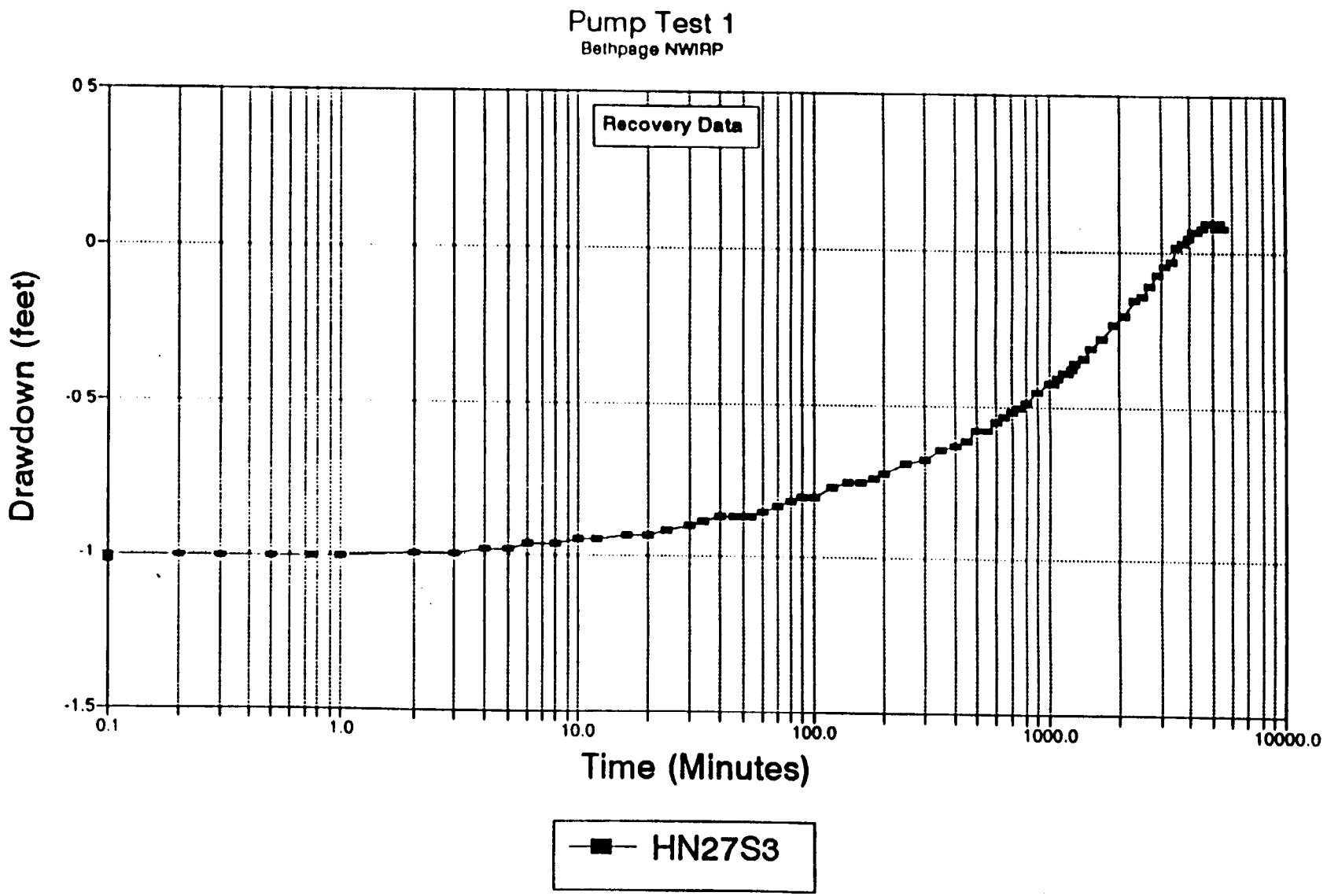

Pump Test 1
Bethpage NWIRP
Drawdown Data
Drawdown (feet)
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
0.1
1.0
10.0
100.0
1000.0
10000.0
Time (Minutes)
Note: HN27I2 pumping at 448 gpm.
HN26I

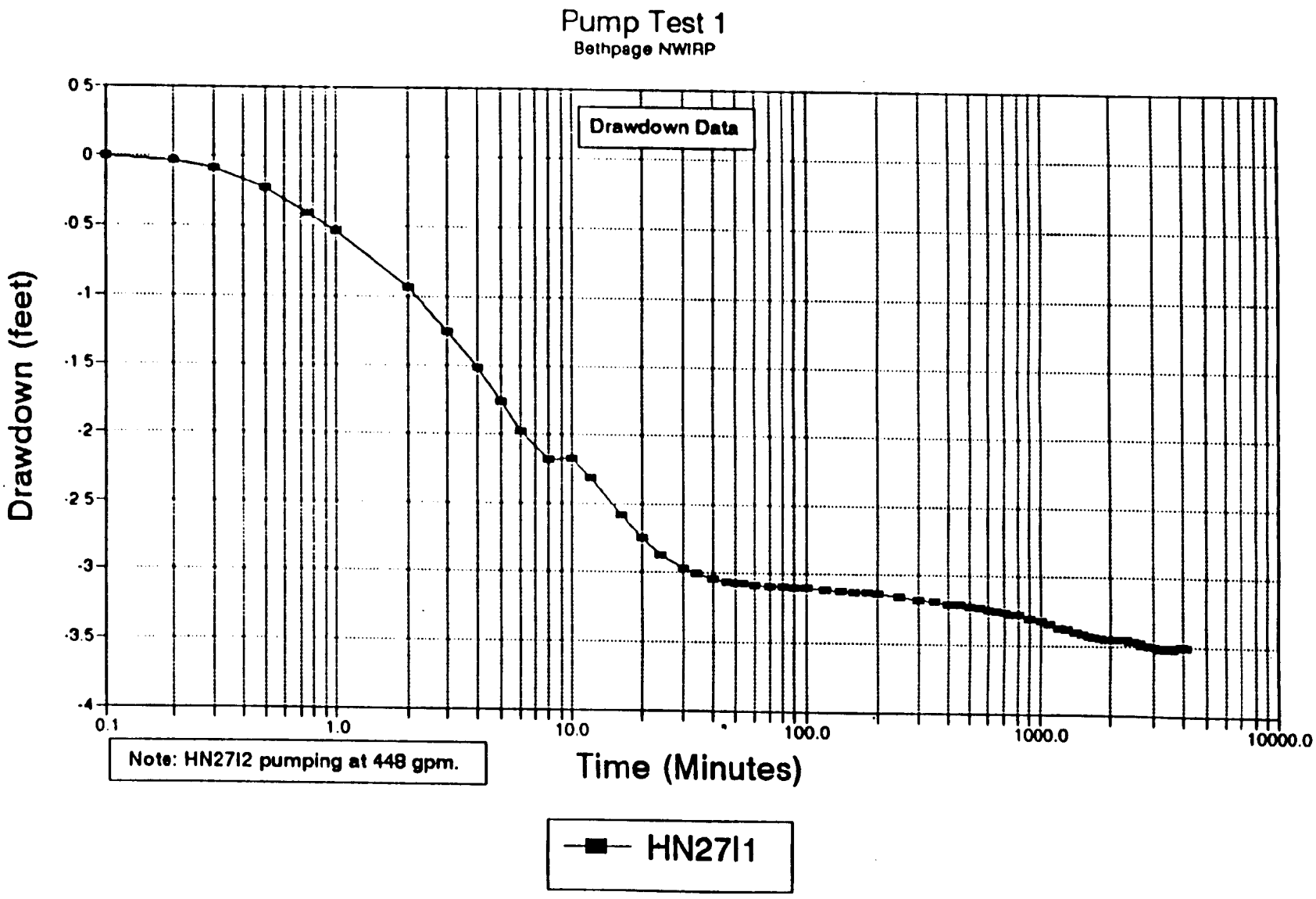

Pump Test 1
Bethpage NWIRP
Recovery Data
Drawdown (feet)
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
0.1
1.0
10.0
100.0
1000.0
10000.0
Time (Minutes)
HN26I

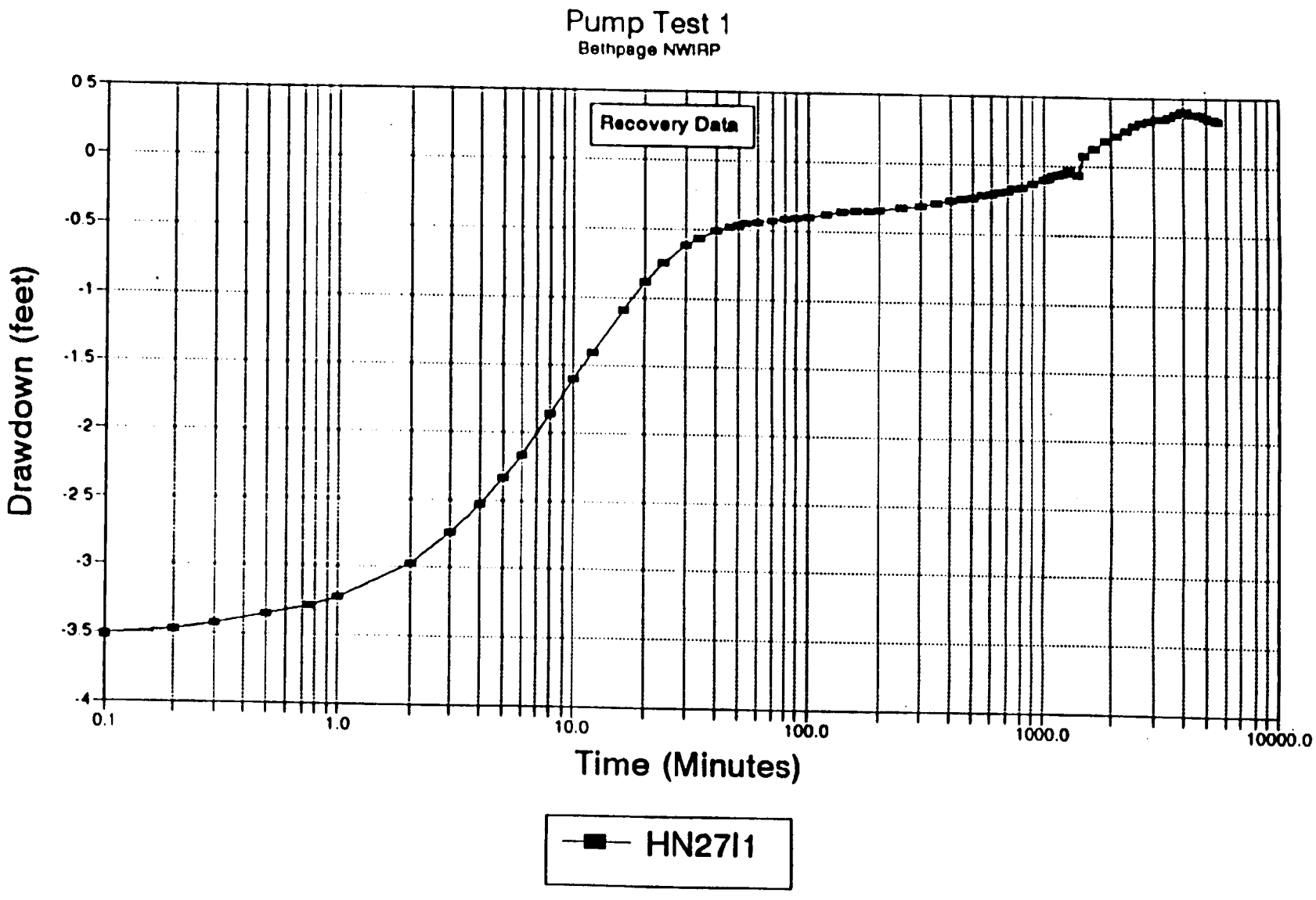

Pump Test 1
Bethpage NWIRP
Drawdown Data
Drawdown (feet)
0.5
0
-0.5
-1
-1.5
0.1
1.0
10.0
100.0
1000.0
10000.0
Time (Minutes)
Note: HN27I2 pumping at 448 gpm.
HN27S2

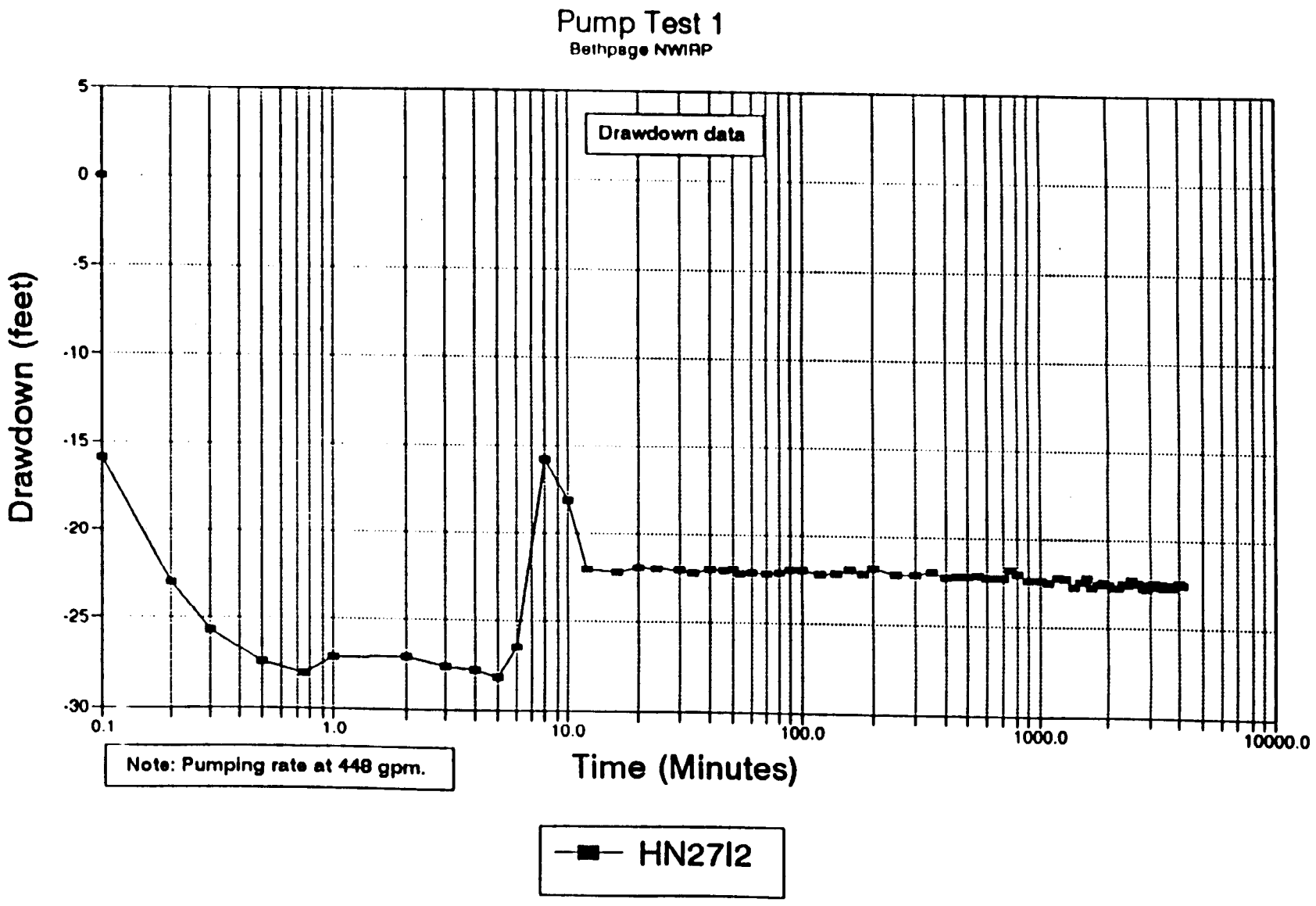

Pump Test 1
Bethpage NWIRP
Recovery Data
Drawdown (feet)
0.5
0
-0.5
-1
-1.5
0.1
1.0
10.0
100.0
1000.0
10000.0
Time (Minutes)
HN27S2

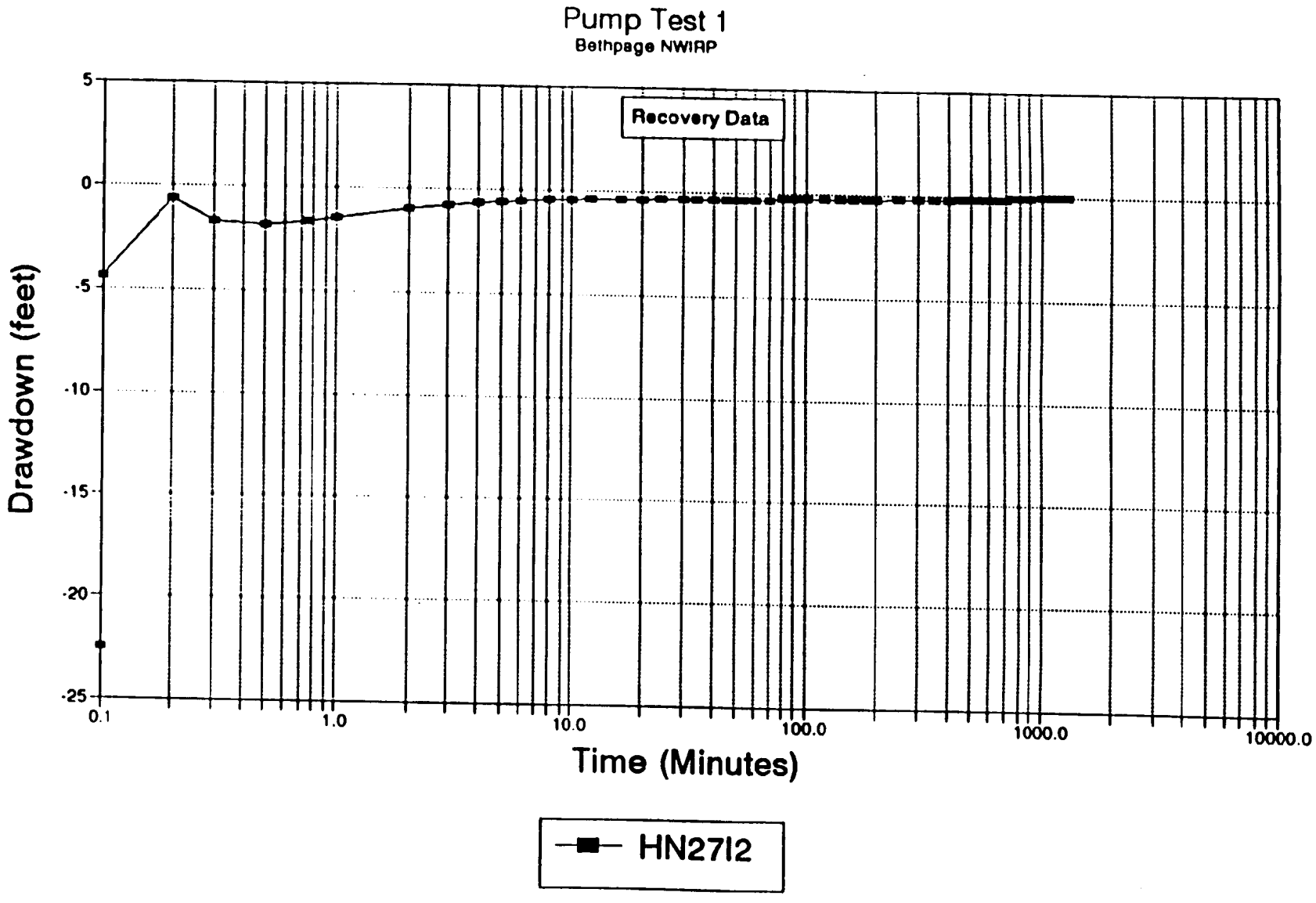

Pump Test 1
Bethpage NWIRP
Drawdown Data
Drawdown (feet)
0.5
0
-0.5
-1
-1.5
0.1
1.0
10.0
100.0
1000.0
10000.0
Time (Minutes)
Note: HN27I2 pumping at 448 gpm.
HN27S3


Pump Test 1
Bethpage NWIRP
Recovery Data
Drawdown (feet)
0.5
0
-0.5
-1
-1.5
0.1
1.0
10.0
100.0
1000.0
10000.0
Time (Minutes)
HN27S3


Pump Test 1
Bethpage NWIRP
Drawdown Data
Drawdown (feet)
0.5
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4
0.1
1.0
10.0
100.0
1000.0
10000.0
Time (Minutes)
Note: HN27I2 pumping at 448 gpm.
HN27I1


Pump Test 1
Bethpage NWIRP
Recovery Data
Drawdown (feet)
0.5
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4
0.1
1.0
10.0
100.0
1000.0
10000.0
Time (Minutes)
HN27I1


Pump Test 1
Bethpage NWIRP
Drawdown data
Drawdown (feet)
5
0
-5
-10
-15
-20
-25
-30
0.1
1.0
10.0
100.0
1000.0
10000.0
Time (Minutes)
Note: Pumping rate at 448 gpm.
HN27I2


Pump Test 1
Bethpage NWIRP
Recovery Data
Drawdown (feet)
5
0
-5
-10
-15
-20
-25
0.1
1.0
10.0
100.0
1000.0
10000.0
Time (Minutes)
HN27I2

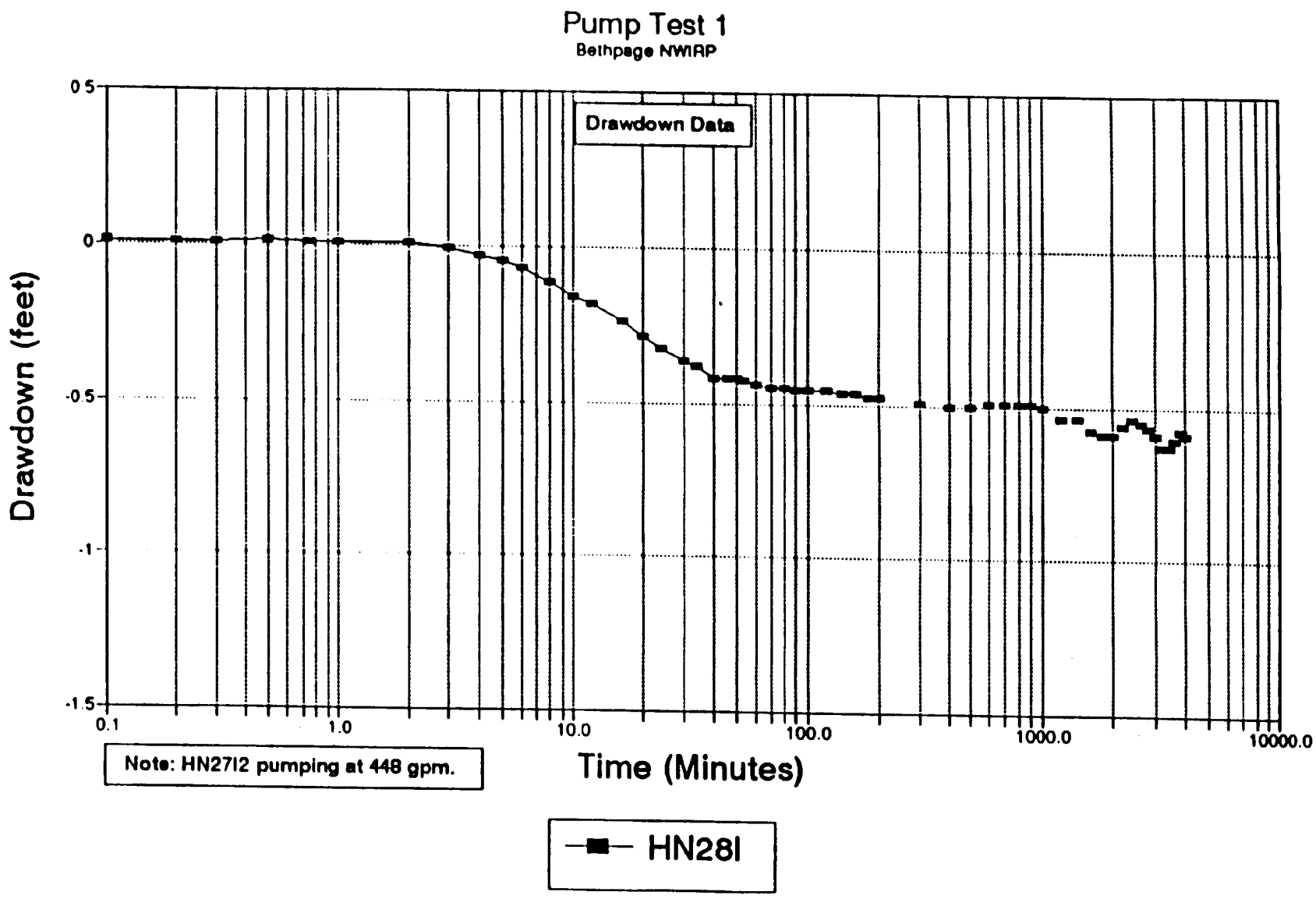
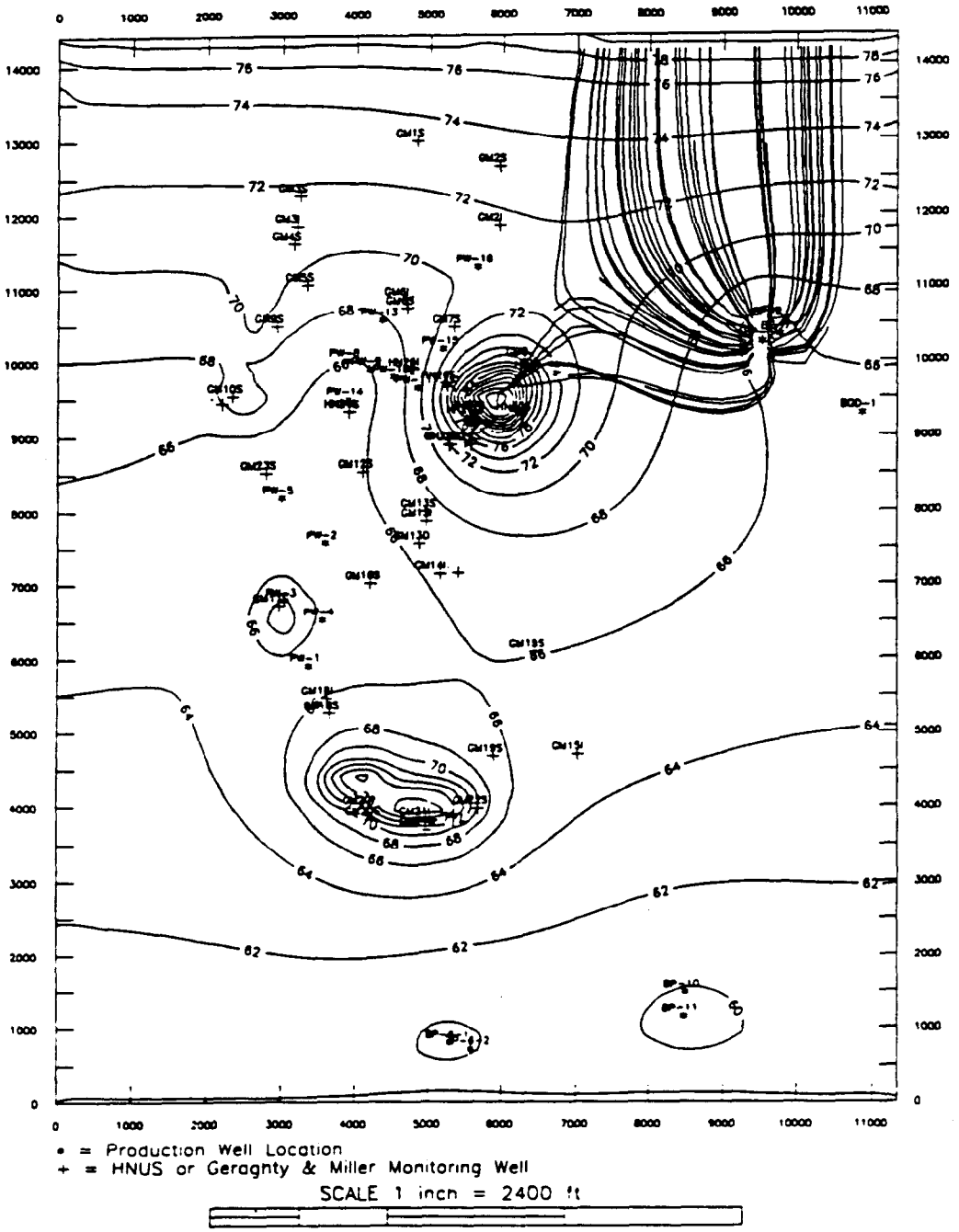

Pump Test 1
Bethpage NWIRP
Drawdown Data
Drawdown (feet)
0.5
0
-0.5
-1
-1.5
0.1
1.0
10.0
100.0
1000.0
10000.0
Time (Minutes)
Note: HN27I2 pumping at 448 gpm.
HN28I

Figure 9-15
Capture zones of BWD Wells - Sensitivity Analysis Location of North Constant Head Boundary- BWD at High Pumping Rate.



10.0 SUMMARY OF COMPUTER MODELING STUDY AND RESULTS

The following section summarizes the procedures and results of the computer modeling performed as part of the RI report for the Bethpage NWIRP.

10.1.1 Computer Modeling Objectives

The general objectives of the RI computer modeling were to provide data on the overall groundwater flow in the area of the NWIRP and to determine the potential flow directions of contaminants which may originate on the site. The specific objectives of the computer modeling at Bethpage NWIRP are listed below:

- Provide a general characterization of the subsurface conditions underlying Bethpage NWIRP.
- Develop a flow model which accurately represents groundwater flow in the area around the Grumman site, with an emphasis on the groundwater flow in and around the NWIRP.
- Model the flow directions of simulated contaminant releases under a variety of production well and NWIRP recharge basin pumping conditions.

10.1.2 Summary of Modeling Approach

The flow model was developed in several related steps, which are as follows; (1) Collect existing data and construct the conceptual model, (2) select the appropriate numerical groundwater model, (3) input initial parameters into model, (4) perform calibration on two months of steady-state data, and two sets of transient pump test data (5) perform validation on two months of steady-state data, (6) perform particle tracking simulations, (7) conduct sensitivity analysis for flow model parameters.

10.1.3 Conceptual Model

To accurately simulate the behavior of groundwater and particle movement, it is first necessary to obtain a detailed understanding of the geologic and hydrogeologic factors which control groundwater flow at a site. The conceptual model of the groundwater system was developed from information gathered on site conditions during a literature review conducted prior to construction of the model. Initial values of geologic and hydrogeologic parameters were obtained from a variety of literature sources and from two pumping test performed at the NWIRP.

Key features of the conceptual model are:

- The water table is present within the upper portion of the Magothy aquifer across most of the modeled area. The Magothy aquifer is considered to be the most significant water-bearing unit in the vicinity of the NWIRP site.

- The upper glacial and Magothy units are considered to function as a single aquifer, as no barrier exists between these units to prevent the exchange of water.

- All Grumman production wells, recharge basins and BWD wells are located in the upper glacial aquifer, or within the Magothy aquifer.

- The base of the flow system is the Raritan Clay unit, which is considered to be impermeable.

- The aquifer is considered to be unconfined.

- No natural surface water bodies are present within the modeled area which significantly effect groundwater flow in the model area.

Key features of the computer model grid are:

- The model grid covers the NWIRP, Grumman property, and BWD wells to the east and south.

- Model grid columns are oriented parallel to the normal (non-pumping) groundwater flow.

- Grid spacing is most dense in the area of the NWIRP, where the direction of groundwater flow is of primary interest. Grid spacing widens towards the edge of the grid.

- The model grid consists of five layers, which were determined based on the screened intervals of shallow intermediate and deep monitoring wells. Layer 1 contains shallow wells, layer 2 contains intermediate wells, layer 3 contains deep wells and one BWD well, layer 4 and 5 contain Grumman production wells and BWD wells.

- Constant head boundaries are present along the north and south grid boundaries, and no flow boundaries are present along the east and west grid boundaries.

10.1.4 Computer Code Selection

The modular three-dimensional finite-difference groundwater flow model (known as MODFLOW) was chosen to be used for this modeling project because it is capable of simulating the conceptual model developed for the NWIRP site. MODFLOW was developed by the U. S. Geological Survey to simulate groundwater flow in a variety of situations (Mc Donald and Harbaugh, 1988). This model can be used for two-dimensional or three-dimensional applications, and can simulate the effects of wells, recharge, drains, and rivers as well as a variety of boundary conditions. MODFLOW has been used extensively at hazardous waste sites for simulation of groundwater flow, evaluation of remedial alternatives, and can be used in conjunction with other programs for modeling of contaminant transport and particle tracking. MODFLOW uses a block-centered grid for solving the finite-difference groundwater flow equations.

MODPATH is a three-dimensional particle tracking code that was developed by the U. S. Geological Survey (Pollock, 1989). MODPATH operates separately from MODFLOW, and utilizes heads calculated

in MODFLOW to determine the direction of particle movement with time. Particle flow directions can be traced forward in time to determine where particles released from a potential contaminant source may move, or particles can be tracked in reverse to determine well capture zones.

10.1.5 Model Calibration

Model calibration refers to a demonstration that the model is capable of producing water elevations which are comparable to water elevations measured on site. Calibration included performing steady-state simulations for two separate pumping conditions at the Grumman site; low pumping conditions for Grumman production wells during February 1992, and high pumping conditions for Grumman production wells during August 1992. Calibration also included conducting transient simulations for two pumping tests which were carried out at the NWIRP site.

Model calibration was conducted to generate a best fit for both steady-state and transient conditions. Calibration was performed interactively between transient and steady-state simulations. The final calibrated model minimized the model error for both the steady-state and transient simulations.

Steady-state calibration simulated two monthly pumping scenarios. Simulated water elevation data was compared to measured data at 61 monitoring wells across the modeled area. Steady-state simulations were run until there was less than .0001 ft of change in head during one iteration of the simulation. Both steady-state and transient model calibration was performed by adjusting initial values of aquifer parameters and boundary conditions until an acceptable match of the modeled data was achieved when compared to observed measurements. To more accurately represent natural conditions, recharge was added to 3 recharge basins on Hooker-Ruco property, and to one recharge basin in the vicinity of well GM-15S during model calibration. These basins were activated to compensate for recharge which may have occurred at these basins during the months considered in the model calibration.

Transient (stressed) conditions were calibrated by simulating two pumping tests performed at the NWIRP site. These pumping tests produced drawdowns within a small portion of the model grid and transient calibration efforts were focused on this section of the model. Simulated drawdowns were compared to measured drawdowns for the transient calibration runs.

Calibration Criteria

The steady-state flow model was considered calibrated when the modeled steady-state simulations were within 2.0 ft of measured values at the monitoring wells. The calibration criteria was determined as one-half the natural water table fluctuation across the site. This calibration criteria of ± 2.0 ft was met for all of the 61 monitoring wells on site, with the exception of 8 monitoring wells. These wells which fall outside the calibration criteria are located in the immediate vicinity of active recharge basins or production wells, which may have effected the calibration results. A more rigorous calibration criteria of ± 1.0 ft was met for the modeled versus measured drawdowns for the two transient pumping test simulations. The ± 1.0 ft calibration criteria was used for the pumping test simulations because these pumping tests effected a small portion of the model grid where grid spacing is most dense, and flow in and around the NWIRP is of primary interest as potential sources of contaminants (Site 1) are known to exist in this area.

Calibration Results

For each steady-state calibration run, the difference in head between the measured and modeled heads was noted. The measured minus modeled value indicates if the measured water elevation at a well is within the calibration criteria. In addition to this value, two other quantitative calculations were preformed for the calibration runs to determine how closely the modeled data fit the measured data.

The sum of the differences of modeled data to measured data (referred to as the mean error) indicates the amount of positive or negative model error for the calibration run. A zero value of mean error indicates equal amounts of positive and negative model error, (i.e., the model predictions are not consistently high or low). Final calibration results for low pumping conditions have a mean error of -0.01 ft for low pumping conditions, and 0.02 ft for high pumping conditions. The mean error was minimized during model calibration. A small value of mean error alone does not indicate a good calibration, as both positive and negative mean errors are incorporated and may cancel out. For this reason, an additional measure of model accuracy (absolute residual value) was calculated.

The absolute residual value is the sum of the absolute values of the differences between measured and modeled data for each monitoring well. A low absolute residual value indicates a good match between

measured and modeled data, with a zero value indicating an exact match between measured and modeled data. The absolute residual value for low pumping conditions was 28.26 ft, and for high pumping conditions the absolute residual value was 36.64 ft. The absolute residual value for low pumping and high pumping conditions was minimized during calibration, and these absolute residual values were considered to be acceptable for these simulations.

The outlier wells that fall outside the calibration criteria were not included in the calculation of mean error or absolute residual error because these wells were interpreted to be influenced by active recharge basins and production wells and, therefore do not accurately reflect the modeled conditions. Pumping rates used in the model were derived from monthly averages at each production well and do not reflect daily fluctuations in recharge basin water levels or production well pumping rates. The measured water elevations represent a 'snap-shot' of water conditions, while the modeled conditions reflect steady-state conditions. Therefore, water elevations taken at monitoring wells in the immediate vicinity of active recharge basins or production wells may be influenced by pumping or recharge activities. The majority of monitoring wells are distant enough from recharge basins or pumping wells so that they are not effected by short-term fluctuation caused by pumping or recharge. The average pumping rates used in the model can accurately simulate water levels, as indicated by the close fit of modeled to measured water elevations at most of the monitoring wells during calibration.

In addition to the statistical checks made on calibration solutions noted above, the water balance of each calibration run was checked. This water balance measurement is generated by the MODFLOW model, and is an independent check on the total amount of water entering and leaving the flow system. All calibration runs fell below the ± 0.50 % water balance error criteria.

Statistical analysis on the calibration results were performed to determine how well the model data matched the measured data, and to determine if any trends were present in the distribution of model error. Linear regression data for the calibrated steady-state model indicates that a nearly direct relationship exists between the modeled and measured data. Similarly, a linear regression for the modeled and measured drawdowns for pumping test #1 shows a nearly direct relationship between measured and modeled results. The simulation of pumping test #2 was more difficult to model due to the small amounts of drawdowns produced (< 1.0 ft) in the observation wells. The regression data for this data shows more scatter and a less direct fit of the modeled data. Residual contour plots, which

show a contour plot the model error for the steady-state simulations, indicate no significant trends were present in the modeled data.

10.1.6 Model Validation

Model validation is a check on how well the model can predict a set of water elevations, utilizing the model parameters established during calibration. Model validation for the flow model consisted of entering the known pumping rates for production wells and recharge basins for two separate months, running the model to a steady-state, and comparing model output to measured data for those months. Two validation scenarios were simulated, January 1992 and July 1992.

These two data sets were not used during model calibration and represent independent data sets for model validation. The January and July data sets were chosen for validation because these months occur immediately before February and August 1992, which were used during calibration. The January and July data was considered to represent the most similar boundary conditions to those used for calibration as they occur in the same seasons as the calibration runs. Precipitation data indicates that January and July 1992 are more similar to February and August 1992 (rather than March and September, the other months considered for validation). Using months in similar seasons, with similar amounts of precipitation for calibration and validation is important because the total precipitation will effect the water elevations at the north and south constant head boundaries, which effect water elevations across the modeled area.

The January 1992 validation results show that the difference of modeled to measured water elevation falls within the ±2.0 ft criteria for 56 of 58 monitoring wells. Two wells which fall outside the ±2.0 ft criteria are monitoring wells GM-6I and GM-17S. These two wells are in the immediate vicinity of a production well and recharge basin, and are considered outlier wells and may be biased by the nearby pumping and recharge activity.

Results of the July 1992 validation show that the difference of modeled to measured water elevation falls within the ±2.0 ft criteria for the majority of the monitoring wells. A total of eight wells fall outside the calibration criteria. Five of these wells, GM-6I, GM-17S, HN-8D, HN-29D and HN-30I, are in the immediate vicinity of a production well or recharge basins, which are considered outlier wells and were

not included in calculation of mean error because they may be effected by pumping or recharge activities. Three monitoring wells, GM-7D, GM-8S and HN-28I showed a modeled to measured difference of greater than ±2.0 ft. The remaining 51 of 59 monitoring wells fall within the ±2.0 ft criteria.

10.1.7 Particle Tracking

MODPATH, a module of MODFLOW, was used to track the locations of particles after a simulated release of contaminants from suspected source areas. Particle tracking was performed to determine the possible directions and rates that contaminants will move after a release. Several particle tracking scenarios were performed, each under a different pumping condition of Grumman production wells and recharge basins, and with different BWD well pumping rates. The particle tracking program MODPATH utilizes the groundwater flow data generated by MODFLOW and simulates advective transport of particles. Other contaminant transport parameters such as diffusion, dispersion, contaminant half-life are not considered in the MODPATH simulations. All MODPATH simulations were performed using the aquifer parameters determined during model calibration, for pumping scenarios run to a steady-state.

Particle tracking analysis is used to trace out flow paths, expressed as lines, by tracking the movement of infinitely small imaginary particles placed in the flow field. This process may also be used to determine the capture zone of a well by releasing particles in a grid block, generally a well, and tracking the particles in reverse along pathlines to determine their source.

Particle Release Locations

Particle tracking analysis was performed for three separate release locations, listed below:

- Particles were released from possible contaminant sources at Site 1.
- Particles were released from possible contaminant sources at the NWIRP recharge basins.
- Particles were also released at the eastern BWD wells (BP-07, BP-08 and BP-09)

Particle tracks from the two potential source areas (Site 1 and the NWIRP recharge basins) were tracked in the forward direction to determine where particles will move after a simulated release. Particles were released from each of the three BWD wells to the east of the NWIRP. These particles were backwards tracked to determine where they originated from and to define the capture zone of each well.

Pumping Scenarios

Three pumping conditions were considered for particle tracking simulations. These pumping conditions were determined based on past, current and potential future pumping configurations at the Grumman production wells, recharge basins, and BWD wells. The emphasis of these simulations was to determine where particles will move after a release from potential contaminant sources and what effect, if any, these potential contaminant sources will have on BWD wells. The pumping scenarios are summarized in Table 10-1.

Current conditions

Current conditions were simulated in order to determine where contaminants may be moving under the pumping conditions that exist currently. Production well pumping rates for current conditions at the Grumman site were determined from 1991 and 1992 average pumping rate data. BWD wells production rate data was determined from 1991 and 1992 average pumping rate data. The BWD wells were considered to be pumping at 120% of 1991 and 1992 rates, and well BP-09 was considered to be active although it was taken off-line in 1991. These assumptions represent conservative estimates of the current conditions at the BWD wells. Three recharge basins were considered to be active on Hooker-Ruco property, recharging the aquifer at a rate of 202 gpm per basin (the rate determined during model calibration).

Figures which illustrate the particle tracking pathlines for the current pumping situation are provided in Section 8.0 of this Appendix.

TABLE 10-1

SUMMARY OF PUMPING CONDITIONS USED IN PARTICLE TRACKING SIMULATIONS
NWIRP BETHPAGE, NEW YORK

Pumping Scenario	Grumman Production Well / Recharge Basin Pumping Rate	BWD Wells Pumping Rate	Reason Considered
Current Conditions	1991, 1992 average pumping rate/recharge rate	1991, 1992 average pumping rate	Current average conditions.
High Pumping at Grumman, Scenario 1	All wells at 75% of maximum pumping rate/recharge rate	1991, 1992 average pumping rate	Likely historic conditions.
Scenario 2	All well at 75% of maximum pumping rate/recharge rate	Maximum pumping rate	Potential worst case historic conditions.
No Pumping at Grumman, Scenario 1	No pumping or recharge	1991, 1992 average pumping rate	Potential future scenario.
Scenario 2	No pumping or recharge	Maximum pumping rate	Potential future scenario.

Particle Tracking Results and Conclusions - Current Conditions:

- All particles released from Site 1 under current pumping conditions are captured by Grumman PW-01.

- Particles released from the NWIRP recharge basins show that 30% of particles released are captured by Grumman production wells PW-01, PW-09, PW-10, PW-1, PW-15 and PW-16. The remaining 70% of the particles flow to the south constant head boundary. No particles from the NWIRP recharge basins are captured by BWD wells BP-10 or BP-11.

- The capture zone for BWD wells BP-07, BP-08 and BP-09 extends into the north constant head boundary.

High Pumping Conditions

The high pumping conditions were simulated to determine where particles may have moved from contaminant sources during past pumping conditions. Before 1985 higher rates of pumping/recharge at the Grumman production wells and recharge basins may have occurred due to the increased manufacturing activity at the facility. High pumping conditions at Grumman were simulated by pumping all 14 production wells at 75% of maximum capacity. Three recharge basins were considered to be active on Hooker-Ruco property, recharging the aquifer at the rate of 202 gpm per basin (the rate determined during model calibration).

Average and high pumping scenarios at the BWD wells were considered for high pumping conditions at Grumman production wells (as shown in Table 10-1). Average BWD well pumping conditions were simulated by pumping at the rate determined from 1991 and 1992 average pumping rate data. The BWD wells were considered to be pumping at 120% of 1991 and 1992 rates, and well BP-09 was considered to be active although it was taken off-line in 1991. These assumptions represent conservative estimates of the current conditions at the BWD wells. High pumping conditions at the BWD

wells were also simulated. In this scenario all BWD wells were pumping at their actual (highest) capacity.

Particle Tracking Results and Conclusions - Grumman High Pumping Conditions, BWD Wells at Average Pumping Conditions

- All particles released from Site 1 are captured by PW-14 and PW-05.

- 73% of particles released from the NWIRP recharge basins are captured by the Grumman production wells, 24% reach the south constant head boundary, while 3% of particles reach BP-08 from the NWIRP recharge basins.

- The capture zones for BWD wells BP-07, BP-08 and BP-09 extend primarily into the north constant head boundary. Some particles originate in the vicinity of the NWIRP recharge basins. Three particles (4% of total) move from the north recharge basins to BP-08, while two particles (3% of total) move from northwest of the NWIRP recharge basins to BP-09.

Particle Tracking Results and Conclusions - Grumman High Pumping Conditions, BWD Wells at High Pumping Conditions

- All particle released from Site 1 are captured by PW-14 and PW-05.

- 65% of particles released from the NWIRP recharge basins are captured by Grumman production wells, with 2% reaching the south constant head boundary. BWD well BP-11 receives 19%, BGD-1 receives 7%, BP-08 receives 6% and BP-09 receives 1% of the total particles released.

- The capture zones for BWD wells BP-07, BP-08 and BP-09 extend primarily into the north constant head boundary, although 8% of particles move from the Grumman north recharge basins to BP-08.

No Pumping Conditions at Grumman Production wells and Recharge basins

No pumping conditions were simulated to determine how contaminants would move if Grumman production wells and recharge basins were inactive, and no pumping activity was occurring at the Grumman site. For this pumping scenario, all Grumman production wells and recharge basins were inactive. Recharge basins on Hooker-Ruco property were considered inactive. Two separate scenarios were considered for past pumpage conditions at the BWD wells during no pumping conditions at the Grumman site (as shown in Table 10-1). Average pumping conditions and high pumping conditions for the BWD wells were simulated. These two pumping conditions for the BWD wells are the same as those used for the high pumping conditions at Grumman production wells and basins.

Particle Tracking Results and Conclusions- No Pumping at Grumman, BWD Wells at Average Pumping Conditions

- Particles released from Site 1 move to the south constant head boundary.
- The capture zone for BWD wells BP-07, BP-08 and BP-09 extends into the north constant head boundary.

Particle Tracking Results and Conclusions - No Pumping at Grumman, BWD Wells at High Pumping Conditions

- 42% of the particles released from Site 1 were captured by BP-10, and 58% were captured by BP-11
- The capture zone for BWD wells BP-07, BP-08 and BP-09 extends into the north constant head boundary.

10.1.8 Sensitivity Analysis

Sensitivity analysis is the process of characterizing the effects of changes in model parameters on the behavior of the calibrated model. Sensitivity analysis for the groundwater flow model included increasing and decreasing aquifer parameters incrementally and comparing the resulting changes in modeled heads to the calibrated values of head. The magnitude of change in heads from the calibrated solution is a measure of the sensitivity of the solution to that particular parameter. Additional discussion of sensitivity analysis procedures and results are presented in Section 9.0.

Horizontal hydraulic conductivity values were increased and decreased by 25% and 50% for the sensitivity analysis. Sensitivity analysis results for hydraulic conductivity show that a decrease of 50% results in a significant increase in both mean error and absolute residual, indicating the model results are sensitive to an decrease of greater than 25% of horizontal hydraulic conductivity compared to calibrated values. The model results are not highly sensitive to an increase of up to 50% or a decrease of up to 25% for horizontal hydraulic conductivity. However, while the model results may not be highly sensitive to changes in horizontal conductivity of this magnitude, these changes do produce less favorable solutions than the calibrated model.

Vertical hydraulic conductivity values were increased and decreased by 25% and 50% for the sensitivity analysis. Sensitivity analysis results show that the model is sensitive to a decrease of greater than 25% of vertical hydraulic conductivity. The model results are not highly sensitive to an increase of up to 50% and a decrease of up to 25% for vertical hydraulic conductivity. However, while the model results may not be highly sensitive to changes in vertical hydraulic conductivity of this magnitude, these changes do produce less favorable solutions than the calibrated model.

Storage values were increased and decreased by 25% for the sensitivity analysis. Storage values are used by MODFLOW only during transient simulations, therefore the effects of the sensitivity analysis results were determined by comparing the calibrated time-drawdown curves to the sensitivity analysis curves for the pump test #1 simulation. These curves indicate that the model results are sensitive to an increase of greater than 25% of the storage value and that the model is less sensitive to a smaller increase in storage of 25% or less.

Porosity values were increased and decreased by 25% for the sensitivity analysis. Porosity values are not used in the flow model, although they are incorporated into the particle tracking module MODPATH. Changes in porosity will not effect particle flow direction but will effect the travel time of the particle. Results show that there is a direct relationship between the porosity and the travel time of a particle moving through the aquifer. A 25% increase or decrease in porosity results in the same amount of change in the total travel time of a particle through the aquifer.

Recharge values were increased and decreased by 25% and 50% for the sensitivity analysis. Changes in the recharge to the system exhibit a linear relationship to the mean error and absolute residual values, with an equal amounts of mean error increase and absolute residual error increase being incurred regardless of weather recharge is increased or decreased.

To determine the effect of more distant boundaries on the capture zone of the eastern BWD wells (BP-07, BP-08, BP-09) the northern constant head boundary conditions in the MODFLOW model were moved 1400 ft to the north, a 40% increase in the distance from the BWD wells to the north constant head boundary. The results of the sensitivity analysis show that under average or high pumping conditions at the BWD wells the capture zone of these wells is not significantly increased if the north constant head boundary is moved 1400 ft north.

10.1.9 Summary of Modeling Results

The computer modeling performed for the NWIRP site accurately simulated water levels in 56 of 61 monitoring wells in the February, 1992 pumping condition and accurately simulated water levels in 55 of 61 monitoring wells in the August, 1992 pumping condition. The wells which fell outside the calibration criteria are in the immediate vicinity of active production wells or recharge basins, which may account for these disparities. Statistical analysis (linear regression and residual contour plots) performed on the calibrated steady-state model data indicates a nearly direct correlation in modeled and measured values of head, and that no significant trends exist in the distribution of model error.

Model simulation of pumping test #1 showed very similar results to data measured during the pumping test. A comparison of measured and modeled drawdowns (in the pumping well and the observation wells) shows very close agreement of measured and modeled data. In addition, the time-drawdown

curves for modeled and measured data exhibit very similar results. The simulation of pumping test #2 was more difficult because of the small amounts of drawdown produced in the observation wells and due to the size of the model grid-blocks. Model simulations were within 1.0 ft of measured drawdowns for pumping test #2.

During model validation, the model was used to simulate water elevations for two months of data. The model accurately predicted water levels in 59 of 61 monitoring wells in the January, 1992 pumping condition and accurately simulated water levels in 54 of 61 monitoring wells in the August, 1992 pumping condition.

Sensitivity analysis was conducted for all aquifer parameters. Results indicate that the model is not highly sensitive to increases in horizontal or vertical hydraulic conductivity of up to 50% of calibrated values. The model showed significantly increased error if horizontal or vertical hydraulic conductivity were decreased more than 25% from calibrated values. Time-drawdown curves for shallow monitoring wells indicate that the model is sensitive to and increase in storage of 25%. Recharge and porosity exhibit linear (predictable) effects on model output. Sensitivity analysis indicates that moving the north constant head boundary 1400 ft to the north does not have a significant effect on the capture zones of the BWD wells BP-07, BP-08 and BP-09.

Tables 10-2 and 10-3 summarize particle tracking results from Grumman production wells and BWD wells, and when these wells are effected by particle releases. Particle tracking indicates that under current pumping conditions particles released from Site 1 will be captured by Grumman production wells, and BWD wells will not capture particles from the NWIRP recharge basins. Under high pumping (past) conditions at Grumman and average BWD rates, Site 1 particles are captured by Grumman production wells. A small number of particles may effect BWD well BP-08, and to a lesser extent, BWD well BP-09. If Grumman production wells and BWD wells pump at a high rate for sustained periods (as simulated by the steady-state model), all Site 1 particles are captured by Grumman production wells, and 19% of the particles released may move from the NWIRP recharge basins to BWD wells. These pumping conditions may have occurred for short time periods in the past, although the high pumping conditions may not have continued for extended periods of time as simulated in the steady-state model runs. Assuming no Grumman production well or recharge basin activity and average pumping conditions at the BWD wells, Site 1 particles move to the southern constant head boundary, and the capture zone

TABLE 10-2

SUMMARY OF PARTICLE TRACKING RESULTS
NWIRP BETHPAGE, NEW YORK

Grumman Pumping Conditions	BWD Pumping Conditions	Particle Release Location	Number of Particles Released	Percentage of Particles Reaching Each Location					
				Grumman PW/Basins	Min./Max. Travel Time	Constant Head	Min./Max. Travel Time	BWD Wells	Min./Max. Travel Time
Current Conditions	Current Conditions	Site 1	48	100 %	14.8 / 53.5	0%	0	0%	0
		Recharge Basins	96	30%	2.4 / 13.8	70%	20.4 / 55.5	0%	0
		BWD Wells (1)	72	0%	--	100%	1.7 / 21.6	--	--
High	Average	Site 1	48	100%	3.8 / 11.8	0%	--	0%	0
		Recharge Basins	96	73%	0.8 / 40.4	24%	20.7 / 58.2	3%	10.4 / 24.1
		BWD Wells (1)	72	7%	7.4 / 18.6	93%	1.6 / 34.9	--	--
High	High	Site 1	48	100%	4.0 / 11.6	0%	0	0%	0
		Recharge Basins	96	65%	0.8 / 30.3	2%	30.9 / 69.9	33%	7.4 / 49.5
		BWD Wells (1)	72	8%	7.11 / 15.4	92%	1.2 / 26.6	--	--
No Pumping	Average	Site 1	48	0%	0	100%	49.7 / 58.5	0%	0
		Recharge Basins (2)	0	--	--	--	--	--	--
		BWD Wells (1)	72	0%	0	100%	2.8 / 18.8	--	--
No Pumping	High	Site 1	48	0%	0	0%	0	100%	48.8 / 58.0
		Recharge Basins (2)	0	--	--	--	--	--	--
		BWD Wells (1)	72	0%	0	100%	1.7 / 30.9	--	--

(1) Capture zone analysis performed for BWD wells.
(2) Recharge basins inactive during No Pumping conditions.

TABLE 10-3
SUMMARY OF FORWARD TRACKING RESULTS
NWIRP BETHPAGE, NEW YORK

Grumman Pumping Rate	BWD Wells Pumping Rate	Particle Release Location	Wells Effected		
			Grumman Production Wells	Eastern BWD Wells (BP-7, BP-8, BP-9)	Southern BWD Wells (BP-10, P-11)
Current Conditions	Average	Site 1	Y	N	N
		NWIRP Basins	Y	N	N
High Pumping	Average	Site 1	Y	N	N
		NWIRP Basins	Y	S	N
High Pumping	High	Site 1	Y	N	N
		NWIRP Basins	Y	Y	Y
No Pumping	Average	Site 1	N	N	N
No Pumping	High	Site 1	N	N	Y

Y = Well is effected by particles from release source (well captures more than 5% of the total amount of particles released.

S= Well is slightly effected by particles from release source (well captures less than 5% of the total particles released).

N= Well is not effected by particles from release source.

of the BWD wells is not effected by NWIRP recharge basins. Under high BWD well pumping rates, particles released from Site 1 are captured by BWD wells BP-10 and BP-11.

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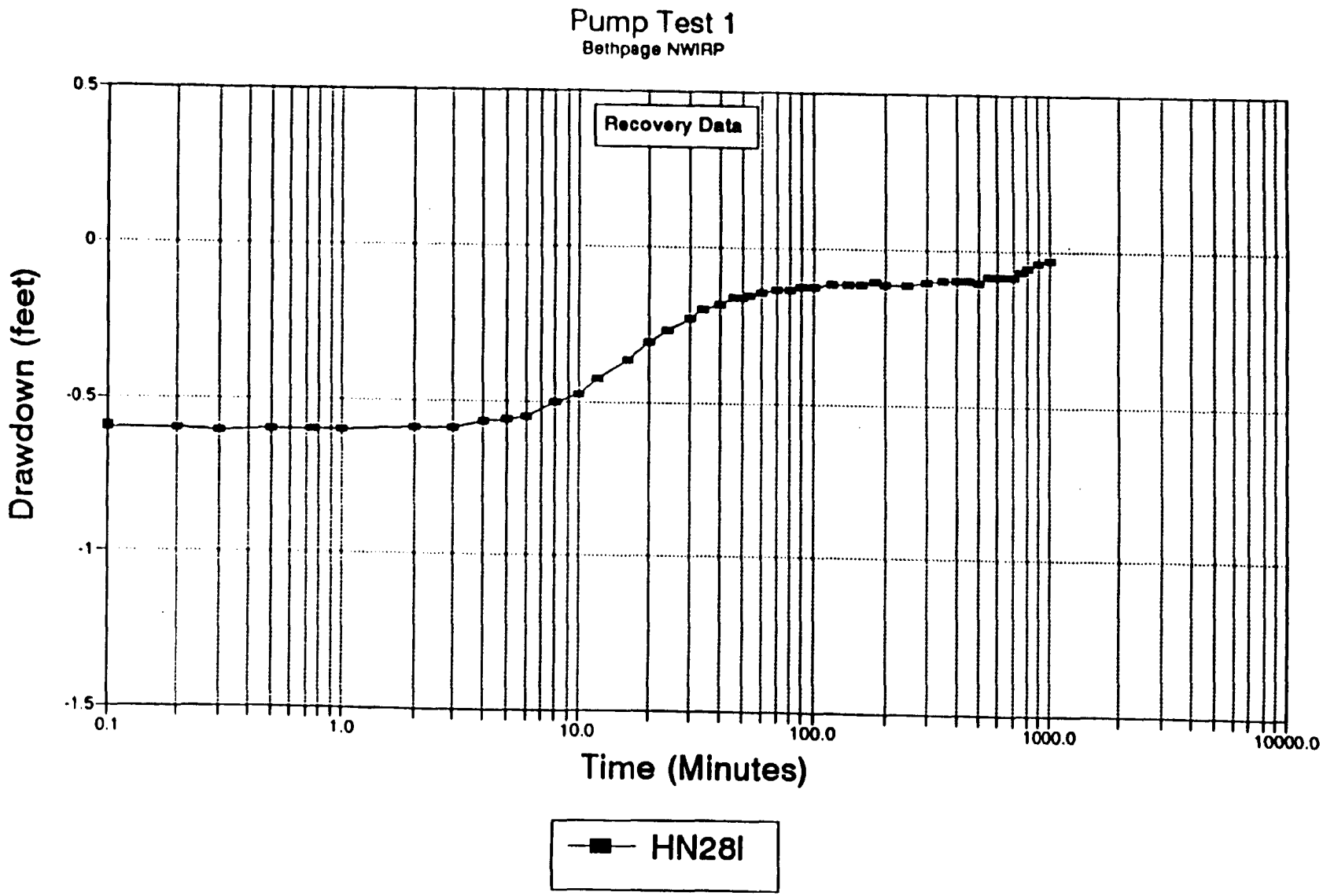

Pump Test 1
Bethpage NWIRP
Recovery Data
Drawdown (feet)
0.5
0
-0.5
-1
-1.5
0.1
1.0
10.0
100.0
1000.0
10000.0
Time (Minutes)
HN28I

PUMPING TEST # 2

SUMMARY OF GEOLOGIC CONDITIONS

BETHPAGE PUMPING TEST # 2

Pumping Well PW-11
Pumping Rate= approximately 890 gpm
Drawdown from 0.0 to 4259.0 minutes
Recovery from 4250.0 to 9700.0 minutes

The second pumping test performed at Bethpage involved pumping production well 11 at a rate of approximately 890 gpm for a period of approximately 3 days and monitoring nearby production and monitoring wells for drawdown. The data generated from the test was of questionable usefulness in general due to a combination of factors.

The drawdown data from the pumping well reflected a much greater drawdown than actually occurred in the aquifer adjacent to the well during the test, due to a combination of partial penetration and well efficiency effects.

Drawdown data from the nearby production wells used as observation wells was not of sufficient resolution to measure the small changes in drawdowns that may have occurred, as the devices used to measure drawdowns (air pressure gauges) were calibrated in two foot intervals and the actual drawdowns in the wells (if any) were significantly less than 2 feet.

Some slight drawdown effects were noted in the nearby monitoring wells (less than 0.2 feet). These wells are screened at much higher depths than PW 11 and the resulting partial penetration corrections are substantial. In addition, there are strong influences of cyclical pumping from an outside well evident in the water level data from these wells. As a result of this combination of factors, the quality of the monitoring well data is questionable for use in a detailed analysis.

The data analysis approach taken to evaluating this test is to develop an assumed real drawdown level in aquifer adjacent to the pumping well, considering partial penetration effects and the water level

response to the early stages of pumping and recovery, and using this drawdown at the well as the basis for a distance-drawdown approximation of the aquifer transmissivity. From the lack of measurable drawdown response nearby production wells, we know that the drawdown in the nearest production well was probably one foot or less. Also, the monitoring wells that exhibited slight drawdowns due to pumping confirm the minor amount of drawdown that occurred at distance from the pumping well. Using these assumptions and the Jacob semilog distance-drawdown analysis approach, an approximate overall transmissivity was obtained for the aquifer of approximately 60,000 ft^2/day.

PUMPING TEST DATA SHEET **NUS CORPORATION**

PROJECT NAME: BETHPAGE MEASURED WELL: PW-11
PROJECT NO.: 1953 DATE: 1/25/93 PUMPING WELL: PW-11
GEOLOGIST: CONTI/RODMAN/KILMARTIN CHECKED: TEST NO.: PT 2
DISTANCE FROM PUMPING WELL(ft.)(r): PUMP SETTING, FEET BELOW MONITORING POINT:
STATIC H_2O LEVEL (ft.)(s_o): MONITORING POINT:
TIME PURGE START OR STOP (t_o): ELEVATION OF MONITORING POINT (ft. above MSL):

TIME	(t) MIN. SINCE PUMP START OR STOP	WATER LEVEL MEASUREMENTS (ft.)			(s) DD Or RECOVERY (ft.)	PUMPING RATE (Q) GPM	REMARKS Page 1 USED PRESSURE GAUGE TO TAKE READINGS
		READING	CORRECTION	DTW			
1445	0	59.50	59.50		0		
1458	0	59.50	59.50		0		START PUMP
	.5	37.00			22.5		
1459	1	35.50			24.0		
1501	3	33.25			26.25		
1503	5	33.00			26.50		
1505	7	32.50			27.00		
1508	10	33.00			26.50		WATER PRESS 71
1510	12	33.00			26.50		
1514	16	32.75			26.75		900 GPM
1518	20	32.75			26.75		
1523	25	32.75			26.75		
1528	30	32.75			26.75		
1533	35	31.50			28.00		890 GPM
1538	40	31.50			28.00		
1548	50	31.00			28.50		
1558	60	31.50			28.00		
1608	70	31.75			27.75		
1618	80	31.75			27.75		
1628	90	31.75			27.75		890 GPM WATER PRESS 72
1638	100	31.50			28.00		
1658	120	31.75			27.75		
1728	150	—			—		
1758	180	32.75			26.75		
1818	200	34.00			25.50		890 GPM WATER PRESS 72
1908	250	34.00			25.50		890 GPM
2000	300	34.00			25.50		
2050	350	34.00	▽		25.50		

PUMPING TEST DATA SHEET

NUS CORPORATIO..

PROJECT NAME: BETHPAGE
MEASURED WELL: PW 11
PROJECT NO.: 1953
DATE: 1/25 - 1/26
PUMPING WELL: PW 11
GEOLOGIST: CONTI/RODMAN/KILMARTIN
CHECKED:
TEST NO.: PT
DISTANCE FROM PUMPING WELL(ft.)(r):
PUMP SETTING, FEET BELOW MONITORING POINT:
STATIC H_2O LEVEL (ft.)(s_o):
MONITORING POINT:
TIME PURGE START OR STOP (t_o):
ELEVATION OF MONITORING POINT (ft. above MSL):

Page ..

	TIME	(t) MIN. SINCE PUMP START OR STOP	WATER LEVEL MEASUREMENTS (ft.) READING	CORRECTION	DTW	(s) DD Or RECOVERY (ft.)	PUMPING RATE (Q) GPM	REMARKS
	2140	400	34.50	59.50	—	25.00		CHANGED BICYCLE PUMP THIS ONE HOLDS PRESSUR BETTER
11:20 PM	2320	500	34.50			25.00		880 GPM
1/26	0100	600	34.00			25.50		890 GPM
	0240	700	34.50			25.00		
	0420	800	34.50			25.00		890 GPM
	0600	900	34.50			25.00		
	0740	1000	34.00			25.50		885 GPM
	0920	1100	34.50			25.00		
	1100	1200	33.00			26.50		925 GPM
	1240	1300	33.00			26.50		925 GPM @ 122
	1420	1400	34.00			25.50		BETWEEN 920 & 930 GPM. 900 GPM @ 1420 HRS
	1600	1500	34.00			25.50		900 GPM @ 1600 HRS
	1740	1600	34.25			25.25		" " "
7:20	1920	1700	34.25			25.25		890 GPM WATER PRESSU
9:00	2100	1800*	34.25			25.25		880 GPM @ 72
2:40	2240	1900	34.25			25.25		885 GPM
1/27	0020	2000*	34.25			25.25		1220 AM + 100 MIN = 200 AM 890 GPM
WED	0200	2100	34.25			25.25		885 GPM @ 0200
	0340	2200*	34.25			25.25		885 GPM @ 0340
	0520	2300	34.0			25.50		890 GPM @ 0520
	0700	2400*	34.0			25.50		890 GPM @ 0700
	0840	2500	34.25			25.25		890 GPM @ 0840
	1020	2600*	34.25			25.25		885 GPM @ 1020
	1200	2700	34.50			25.00		885 GPM @ 1200
	1340	2800*	34.25			25.25		890 " " 1340
	1520	2900	34.50			25.00		900 GPM @ 1700
5:00 PM	1700	3000*	34.00			25.50		
6:40 PM	1840	3100	34.25			25.25		900 GPM @ 1840

* TAKE DDS AT OTHER PW

PUMPING TEST DATA SHEET — **NUS CORPORATION**

PROJECT NAME: BETHPAGE — MEASURED WELL: PW 11
PROJECT NO.: 1953 — DATE: 1/27/93 — PUMPING WELL: PW 11
GEOLOGIST: SJC/PN/PDI — CHECKED: — TEST NO.: PT 2
DISTANCE FROM PUMPING WELL(ft.)(r): — PUMP SETTING, FEET BELOW MONITORING POINT:
STATIC H_2O LEVEL (ft.)(s_o): — MONITORING POINT:
TIME PURGE START OR STOP (t_o): — ELEVATION OF MONITORING POINT (ft. above MSL):

	TIME	(t) MIN. SINCE PUMP START OR STOP	WATER LEVEL MEASUREMENTS (ft.) READING	CORRECTION	DTW	(s) DD Or RECOVERY (ft.)	PUMPING RATE (Q) GPM	REMARKS Page 3
3:20 pm	2020	3200*	34.25	59.50		25.25		890 GPM @ 2101 h.
1/27	2200	3300	34.50			25.00		880 GPM
11:40	2340	3400*	34.50			25.00		900 G.PM
1/28	0120	3500	34.25			25.25		885 GPM water [illegible]
Thur	0300	3600*	34.50			25.00		880 GPM
	0440	3700	34.25			25.25		890 GPM
	0620	3800*	34.25			25.25		885 GPM
	0800	3900	32.0			27.5		960 GPM water [illegible] @ 62 PSI
	0940	4000*	32.25			27.25		960 GPM " @ 62 PSI
	1120	4100	34.25			25.25		890 GPM @ 72 PSI
	1300	4200*	34.25			25.25		890 " @ 72 PSI
	1440	4300	34.25			25.25		
		PUMP	OFF		1500	1/28/93		
	1500	0	34.25			25.25		
		.5	43.00			16.50		15 SEC 42.5
		1.0	52.00			7.50		
		1.5	57.25			2.25		1:15 - 57.00
	1502	2.0	57.50			2.00		
		2.5 3.0	58.00 58.00			1.5		
		3.5 4.0	58.25 58.25			1.25		
	1505	5.0	58.25 58.50			1.25 1.00		
		7.0	58.50			1.00		
	1510	10.0	59.00			.50		
	1512	12.0	59.00			.50		
	1515	15.0	59.25			.25		
	1513	13.0	59.25					
	1520	20.0	59.25					
	1522	22.0	59.25					

* - Take rdgs at other wells

PUMPING TEST DATA SHEET **NUS CORPORATIO**

PROJECT NAME: BETHPAGE MEASURED WELL: PW11
PROJECT NO.: 1953 DATE: 1/28/93 PUMPING WELL: PW11
GEOLOGIST: CONTI/NIMMER CHECKED: TEST NO.: PT
DISTANCE FROM PUMPING WELL(ft.)(r): PUMP SETTING, FEET BELOW MONITORING POINT:
STATIC H_2O LEVEL (ft.)(s_o): MONITORING POINT:
TIME PURGE START OR STOP (t_o): ELEVATION OF MONITORING POINT (ft. above MSL):

Page 1

	TIME	(t) MIN. SINCE PUMP START OR STOP	WATER LEVEL MEASUREMENTS (ft.) READING	CORRECTION	DTW	(s) DD Or RECOVERY (ft.)	PUMPING RATE (Q) GPM	REMARKS
1/28	1525	25	59.25	59.50		.25		
TH.	1530	30	59.25			"		
	1535	35	59.25			"		
	1540	40	59.25			"		
	1550	50	59.50			0		
4:00	1600	60	59.50			0		
	1620	80	—			—		
	1640	100	—			—		
5:30	1730	150	59.50			—		
6:20	1820	200	59.50			0		
1/29	0630		59.50	59.50		0		

(PW-11 490' deep)

PUMPING TEST #2

DRAWDOWN AND RECOVERY DATA

Pumping well DATA: (PW-11)

	Step Time (min.)	Total Time (min.)	PW-11 Drawdown (ft)
Drawdown	0	0	0
	0.5	0.5	-22.5
	1	1	-24
	3	3	-26.25
	5	5	-26.5
	7	7	-27
	10	10	-26.5
	12	12	-26.5
	16	16	-26.75
	20	20	-26.75
	25	25	-26.75
	30	30	-26.75
	35	35	-28
	40	40	-28
	50	50	-26.5
	60	60	-28
	70	70	-27.75
	80	80	-27.75
	90	90	-27.75
	100	100	-28
	120	120	-27.75
	180	180	-26.75
	200	200	-25.5
	250	250	-25.5
	300	300	-25.5
	350	350	-25.5
	400	400	-25
	500	500	-25
	600	600	-25.5
	700	700	-25
	800	800	-25
	900	900	-25.5
	1000	1000	-25.5
	1100	1100	-25
	1200	1200	-26.5
	1300	1300	-26.5
	1400	1400	-25.5
	1500	1500	-25.5
	1600	1600	-25.25
	1700	1700	-25.25
	1800	1800	-25.25
	1900	1900	-25.25
	2000	2000	-25.25
	2100	2100	-25.25
	2200	2200	-25.25
	2300	2300	-25.5
	2400	2400	-25.25
	2500	2500	-25.25
	2600	2600	-25.25
	2700	2700	-25
	2800	2800	-25.25
	2900	2900	-25
	3000	3000	-25.5
	3100	3100	-25.25

	Step Time (min.)	Total Time (min.)	PW-11 Drawdown (ft)
	3200	3200	-25.25
	3300	3300	-25
	3400	3400	-25
	3500	3500	-25.25
	3600	3600	-25
	3700	3700	-25.25
	3800	3800	-25.25
	3900	3900	-27.5
	4000	4000	-27.25
	4100	4100	-25.25
	4200	4200	-25.25
	4300	4300	-25.25
Recovery	0	4300	-25.25
	0.5	4300.5	-16.25
	1	4301	-7.5
	1.5	4301.5	-2.25
	2	4302	-2
	2.5	4302.5	-1.5
	3	4303	-1.5
	3.5	4303.5	-1.25
	4	4304	-1.25
	4.5	4304.5	-1.25
	5	4305	-1
	7	4307	-1
	10	4310	-0 5
	12	4312	-0 5
	15	4315	-0.25
	18	4318	-0 25
	20	4320	-0 25
	22	4322	-0 25
	25	4325	-0 25
	30	4330	-0 25
	35	4335	-0 25
	40	4340	-0 25
	50	4350	0

BETHPAGE NWIRP
PUMPING TEST #2
PUMPING WELL: PRODUCTION WELL 11
PUMPING RATE: 890 GPM

	STEP TIME	TOTAL TIME	HN25S	HN25I	HN25D	HN29I	HN29D	HN28I	HN26I	HN27S2	HN27I2
DRAWDOWN	0.000	0.000	0.006	0.047	-0.063	-0.066	-0.063	-0.025	0.151	-0.009	0.000
	0.017	0.017	0.006	0.047	-0.063	-0.075	-0.047	-0.029	0.151	-0.009	-0.003
	0.033	0.033	0.006	0.047	-0.063	-0.075	-0.047	-0.029	0.151	-0.009	-0.003
	0.050	0.050	0.006	0.047	-0.063	-0.075	-0.047	-0.032	0.151	-0.009	0.000
	0.067	0.067	0.006	0.047	-0.063	-0.075	-0.031	-0.029	0.151	-0.009	0.000
	0.083	0.083	0.009	0.047	-0.063	-0.075	-0.031	-0.032	0.151	-0.009	-0.003
	0.100	0.100	0.006	0.047	-0.063	-0.075	-0.031	-0.032	0.151	-0.009	0.000
	0.117	0.117	0.006	0.047	-0.063	-0.075	-0.031	-0.032	0.151	-0.009	0.000
	0.133	0.133	0.009	0.056	-0.063	-0.075	-0.031	-0.032	0.151	-0.009	-0.003
	0.150	0.150	0.006	0.047	-0.063	-0.075	-0.031	-0.032	0.141	-0.009	-0.003
	0.167	0.167	0.006	0.047	-0.063	-0.075	-0.031	-0.032	0.141	-0.009	-0.003
	0.183	0.183	0.006	0.056	-0.063	-0.075	-0.031	-0.032	0.141	-0.009	-0.003
	0.200	0.200	0.006	0.047	-0.063	-0.075	-0.031	-0.035	0.141	-0.009	-0.003
	0.217	0.217	0.006	0.047	-0.047	-0.075	-0.031	-0.032	0.151	-0.006	-0.003
	0.233	0.233	0.006	0.056	-0.063	-0.075	-0.031	-0.035	0.141	-0.009	-0.003
	0.250	0.250	0.006	0.047	-0.063	-0.075	-0.031	-0.032	0.141	-0.009	-0.003
	0.267	0.267	0.006	0.047	-0.047	-0.075	-0.031	-0.032	0.141	-0.009	-0.003
	0.283	0.283	0.006	0.047	-0.047	-0.075	-0.015	-0.032	0.141	-0.006	-0.003
	0.300	0.300	0.006	0.047	-0.063	-0.085	-0.015	-0.032	0.141	-0.009	-0.003
	0.317	0.317	0.006	0.047	-0.063	-0.075	-0.015	-0.035	0.141	-0.006	-0.003
	0.333	0.333	0.006	0.047	-0.047	-0.075	-0.015	-0.032	0.141	-0.009	-0.003
	0.417	0.417	0.006	0.047	-0.063	-0.075	-0.015	-0.035	0.151	-0.009	0.000
	0.500	0.500	0.006	0.047	-0.047	-0.075	-0.031	-0.032	0.151	-0.009	0.000
	0.583	0.583	0.003	0.047	-0.047	-0.075	-0.015	-0.032	0.151	-0.009	0.000
	0.667	0.667	0.003	0.047	-0.063	-0.075	-0.015	-0.032	0.141	-0.009	0.000
	0.750	0.750	0.006	0.047	-0.063	-0.075	-0.015	-0.035	0.151	-0.006	0.000
	0.833	0.833	0.006	0.047	-0.047	-0.075	-0.031	-0.032	0.151	-0.006	0.000
	0.917	0.917	0.003	0.047	-0.047	-0.085	-0.031	-0.032	0.151	-0.006	0.003
	1.000	1.000	0.006	0.047	-0.063	-0.085	-0.031	-0.032	0.151	-0.003	0.000
	2.000	2.000	0.009	0.056	-0.063	-0.085	-0.031	-0.029	0.160	-0.006	0.009
	3.000	3.000	0.006	0.047	-0.063	-0.085	-0.031	-0.035	0.160	-0.003	0.009
	4.000	4.000	0.003	0.047	-0.063	-0.075	-0.031	-0.029	0.170	-0.006	0.012
	5.000	5.000	0.006	0.037	-0.063	-0.075	-0.031	-0.029	0.170	-0.006	0.015
	6.000	6.000	0.003	0.037	-0.078	-0.075	-0.031	-0.032	0.160	-0.009	0.012
	7.000	7.000	-0.003	0.028	-0.094	-0.075	-0.031	-0.029	0.151	-0.012	0.009
	8.000	8.000	-0.003	0.028	-0.094	-0.075	-0.031	-0.029	0.151	-0.009	0.012
	9.000	9.000	0.000	0.028	-0.110	-0.075	-0.047	-0.035	0.141	-0.006	0.012
	10.000	10.000	0.000	0.018	-0.126	-0.075	-0.063	-0.032	0.132	-0.009	0.009
	12.000	12.000	0.000	0.018	-0.141	-0.066	-0.047	-0.032	0.132	-0.009	0.006
	14.000	14.000	0.003	0.009	-0.141	-0.075	-0.078	-0.032	0.123	-0.009	0.003
	16.000	16.000	0.003	0.009	-0.157	-0.075	-0.078	-0.032	0.123	-0.006	0.003
	18.000	18.000	0.000	0.000	-0.189	-0.066	-0.094	-0.035	0.104	-0.009	0.000
	20.000	20.000	0.000	0.000	-0.189	-0.075	-0.110	-0.038	0.094	-0.006	-0.003
	22.000	22.000	-0.003	-0.009	-0.205	-0.066	-0.110	-0.038	0.094	-0.009	-0.009
	24.000	24.000	0.000	-0.009	-0.220	-0.075	-0.126	-0.045	0.085	-0.012	-0.012
	26.000	26.000	0.000	-0.018	-0.220	-0.075	-0.142	-0.051	0.085	-0.009	-0.012
	28.000	28.000	-0.003	-0.018	-0.236	-0.085	-0.142	-0.058	0.075	-0.009	-0.019
	30.000	30.000	-0.003	-0.028	-0.236	-0.085	-0.142	-0.061	0.066	-0.012	-0.025
	32.000	32.000	-0.003	-0.028	-0.252	-0.085	-0.157	-0.067	0.056	-0.015	-0.028
	34.000	34.000	-0.003	-0.028	-0.252	-0.094	-0.173	-0.067	0.056	-0.012	-0.028
	36.000	36.000	-0.003	-0.037	-0.268	-0.094	-0.173	-0.077	0.047	-0.015	-0.031
	38.000	38.000	-0.003	-0.037	-0.268	-0.104	-0.173	-0.080	0.047	-0.012	-0.031
	40.000	40.000	-0.006	-0.037	-0.268	-0.104	-0.173	-0.087	0.047	-0.015	-0.038

BETHPAGE NWIRP
PUMPING TEST #2
PUMPING WELL: PRODUCTION WELL 11
PUMPING RATE: 890 GPM

STEP TIME	TOTAL TIME	HN25S	HN25I	HN25D	HN29I	HN29D	HN28I	HN26I	HN27S2	HN27I2
42.000	42.000	-0.003	-0.037	-0.268	-0.104	-0.189	-0.090	0.038	-0.012	-0.038
44.000	44.000	-0.003	-0.037	-0.268	-0.104	-0.189	-0.093	0.038	-0.015	-0.041
46.000	46.000	-0.006	-0.037	-0.268	-0.113	-0.189	-0.100	0.038	-0.015	-0.041
48.000	48.000	-0.003	-0.037	-0.268	-0.113	-0.205	-0.103	0.038	-0.012	-0.041
50.000	50.000	0.000	-0.037	-0.268	-0.113	-0.205	-0.103	0.038	-0.012	-0.038
52.000	52.000	-0.003	-0.037	-0.268	-0.123	-0.205	-0.110	0.038	-0.015	-0.041
54.000	54.000	-0.006	-0.037	-0.252	-0.132	-0.205	-0.113	0.028	-0.019	-0.044
56.000	56.000	-0.006	-0.037	-0.268	-0.132	-0.221	-0.116	0.028	-0.015	-0.044
58.000	58.000	-0.003	-0.037	-0.252	-0.123	-0.221	-0.119	0.028	-0.015	-0.044
60.000	60.000	-0.006	-0.037	-0.252	-0.132	-0.205	-0.122	0.028	-0.019	-0.047
62.000	62.000	-0.006	-0.037	-0.252	-0.132	-0.221	-0.126	0.028	-0.022	-0.047
64.000	64.000	-0.009	-0.037	-0.252	-0.142	-0.221	-0.126	0.028	-0.019	-0.047
66.000	66.000	-0.009	-0.047	-0.252	-0.142	-0.221	-0.132	0.028	-0.022	-0.047
68.000	68.000	-0.009	-0.037	-0.252	-0.142	-0.221	-0.132	0.018	-0.022	-0.050
70.000	70.000	-0.012	-0.047	-0.252	-0.151	-0.221	-0.132	0.018	-0.022	-0.054
72.000	72.000	-0.012	-0.037	-0.252	-0.151	-0.221	-0.139	0.018	-0.022	-0.050
74.000	74.000	-0.009	-0.037	-0.236	-0.151	-0.221	-0.135	0.028	-0.019	-0.050
76.000	76.000	-0.009	-0.037	-0.236	-0.151	-0.221	-0.142	0.018	-0.022	-0.050
78.000	78.000	-0.009	-0.037	-0.236	-0.161	-0.236	-0.142	0.018	-0.019	-0.054
80.000	80.000	-0.009	-0.037	-0.236	-0.161	-0.236	-0.145	0.018	-0.019	-0.054
82.000	82.000	-0.009	-0.037	-0.236	-0.161	-0.221	-0.145	0.018	-0.019	-0.050
84.000	84.000	-0.006	-0.037	-0.236	-0.161	-0.236	-0.145	0.018	-0.019	-0.054
86.000	86.000	-0.006	-0.037	-0.220	-0.161	-0.236	-0.145	0.018	-0.015	-0.047
88.000	88.000	-0.006	-0.037	-0.220	-0.161	-0.236	-0.148	0.018	-0.019	-0.050
90.000	90.000	-0.003	-0.028	-0.220	-0.161	-0.236	-0.148	0.028	-0.019	-0.047
92.000	92.000	-0.006	-0.028	-0.220	-0.161	-0.236	-0.148	0.028	-0.022	-0.050
94.000	94.000	-0.006	-0.028	-0.220	-0.170	-0.236	-0.148	0.018	-0.022	-0.054
96.000	96.000	-0.009	-0.037	-0.220	-0.161	-0.236	-0.152	0.018	-0.022	-0.050
98.000	98.000	-0.009	-0.028	-0.205	-0.170	-0.236	-0.152	0.028	-0.022	-0.047
100.000	100.000	-0.009	-0.028	-0.205	-0.161	-0.221	-0.152	0.018	-0.022	-0.050
120.000	120.000	-0.012	-0.028	-0.173	-0.170	-0.236	-0.148	0.028	-0.025	-0.054
140.000	140.000	-0.019	-0.028	-0.157	-0.170	-0.236	-0.152	0.028	-0.034	-0.057
160.000	160.000	-0.019	-0.028	-0.157	-0.180	-0.236	-0.152	0.038	-0.031	-0.060
180.000	180.000	-0.025	-0.028	-0.141	-0.180	-0.236	-0.148	0.038	-0.041	-0.063
200.000	200.000	-0.025	-0.028	-0.141	-0.180	-0.236	-0.148	0.038	-0.044	-0.066
220.000	220.000	-0.028	-0.037	-0.141	-0.180	-0.252	-0.155	0.038	-0.044	-0.066
240.000	240.000	-0.028	-0.037	-0.126	-0.180	-0.252	-0.152	0.038	-0.047	-0.066
260.000	260.000	-0.031	-0.037	-0.110	-0.189	-0.252	-0.155	0.038	-0.047	-0.066
280.000	280.000	-0.031	-0.037	-0.110	-0.189	-0.252	-0.155	0.038	-0.050	-0.066
300.000	300.000	-0.034	-0.037	-0.110	-0.189	-0.252	-0.158	0.038	-0.053	-0.066
320.000	320.000	-0.034	-0.037	-0.110	-0.189	-0.252	-0.155	0.038	-0.053	-0.066
340.000	340.000	-0.038	-0.037	-0.110	-0.189	-0.252	-0.155	0.038	-0.060	-0.069
360.000	360.000	-0.034	-0.037	-0.094	-0.189	-0.252	-0.152	0.047	-0.050	-0.063
380.000	380.000	-0.038	-0.037	-0.094	-0.180	-0.236	-0.152	0.047	-0.060	-0.066
400.000	400.000	-0.038	-0.028	-0.094	-0.180	-0.236	-0.152	0.047	-0.057	-0.060
420.000	420.000	-0.038	-0.037	-0.078	-0.180	-0.236	-0.155	0.047	-0.057	-0.063
440.000	440.000	-0.041	-0.037	-0.078	-0.180	-0.236	-0.148	0.047	-0.063	-0.060
460.000	460.000	-0.041	-0.037	-0.078	-0.180	-0.236	-0.145	0.047	-0.063	-0.060
480.000	480.000	-0.038	-0.028	-0.078	-0.180	-0.236	-0.145	0.047	-0.066	-0.060
500.000	500.000	-0.041	-0.037	-0.078	-0.180	-0.236	-0.148	0.047	-0.066	-0.057
520.000	520.000	-0.041	-0.037	-0.078	-0.180	-0.221	-0.145	0.047	-0.066	-0.060
540.000	540.000	-0.041	-0.028	-0.078	-0.180	-0.221	-0.145	0.047	-0.063	-0.057
560.000	560.000	-0.041	-0.028	-0.078	-0.180	-0.221	-0.142	0.047	-0.063	-0.057

BETHPAGE NWIRP
PUMPING TEST #2
PUMPING WELL: PRODUCTION WELL 11
PUMPING RATE: 890 GPM

STEP TIME	TOTAL TIME	HN25S	HN25I	HN25D	HN29I	HN29D	HN28I	HN26I	HN27S2	HN27I2
580.000	580.000	-0.041	-0.028	-0.078	-0.180	-0.221	-0.145	0.047	-0.063	-0.057
600.000	600.000	-0.044	-0.028	-0.078	-0.170	-0.221	-0.142	0.047	-0.069	-0.057
620.000	620.000	-0.044	-0.037	-0.094	-0.180	-0.221	-0.145	0.047	-0.069	-0.057
640.000	640.000	-0.041	-0.037	-0.094	-0.170	-0.221	-0.145	0.047	-0.066	-0.054
660.000	660.000	-0.047	-0.037	-0.094	-0.180	-0.221	-0.142	0.047	-0.072	-0.057
680.000	680.000	-0.047	-0.037	-0.078	-0.170	-0.221	-0.142	0.047	-0.072	-0.054
700.000	700.000	-0.044	-0.028	-0.094	-0.170	-0.205	-0.135	0.056	-0.072	-0.050
720.000	720.000	-0.047	-0.028	-0.141	-0.170	-0.205	-0.139	0.056	-0.079	-0.050
740.000	740.000	-0.047	-0.028	-0.126	-0.170	-0.205	-0.135	0.056	-0.079	-0.050
760.000	760.000	-0.050	-0.028	-0.141	-0.170	-0.205	-0.132	0.056	-0.079	-0.050
780.000	780.000	-0.047	-0.028	-0.126	-0.161	-0.189	-0.126	0.056	-0.076	-0.044
800.000	800.000	-0.047	-0.028	-0.126	-0.161	-0.189	-0.126	0.066	-0.079	-0.047
820.000	820.000	-0.050	-0.028	-0.126	-0.161	-0.189	-0.126	0.066	-0.079	-0.041
840.000	840.000	-0.050	-0.028	-0.126	-0.161	-0.189	-0.122	0.066	-0.082	-0.044
860.000	860.000	-0.047	-0.028	-0.126	-0.161	-0.189	-0.119	0.066	-0.079	-0.041
880.000	880.000	-0.050	-0.028	-0.126	-0.151	-0.189	-0.119	0.066	-0.085	-0.041
900.000	900.000	-0.050	-0.018	-0.126	-0.161	-0.189	-0.119	0.066	-0.088	-0.044
920.000	920.000	-0.053	-0.028	-0.141	-0.151	-0.189	-0.119	0.066	-0.091	-0.044
940.000	940.000	-0.053	-0.028	-0.126	-0.161	-0.189	-0.119	0.056	-0.091	-0.047
960.000	960.000	-0.057	-0.028	-0.126	-0.161	-0.189	-0.122	0.056	-0.091	-0.050
980.000	980.000	-0.060	-0.037	-0.141	-0.161	-0.189	-0.126	0.056	-0.098	-0.054
1000.000	1000.000	-0.057	-0.037	-0.157	-0.161	-0.189	-0.129	0.047	-0.095	-0.054
1050.000	1050.000	-0.063	-0.047	-0.189	-0.180	-0.221	-0.139	0.038	-0.098	-0.060
1100.000	1100.000	-0.063	-0.066	-0.252	-0.199	-0.252	-0.152	0.009	-0.101	-0.069
1150.000	1150.000	-0.063	-0.066	-0.268	-0.199	-0.268	-0.158	0.009	-0.104	-0.069
1200.000	1200.000	-0.057	-0.066	-0.315	-0.208	-0.284	-0.158	0.000	-0.101	-0.066
1250.000	1250.000	-0.053	-0.066	-0.394	-0.199	-0.268	-0.161	0.009	-0.098	-0.060
1300.000	1300.000	-0.060	-0.066	-0.410	-0.199	-0.284	-0.165	0.000	-0.098	-0.063
1350.000	1350.000	-0.057	-0.066	-0.394	-0.208	-0.284	-0.165	-0.009	-0.107	-0.069
1400.000	1400.000	-0.057	-0.075	-0.410	-0.199	-0.268	-0.168	-0.009	-0.104	-0.066
1450.000	1450.000	-0.053	-0.066	-0.378	-0.199	-0.268	-0.165	-0.009	-0.104	-0.069
1500.000	1500.000	-0.053	-0.066	-0.347	-0.208	-0.268	-0.168	0.000	-0.107	-0.073
1550.000	1550.000	-0.053	-0.066	-0.299	-0.199	-0.268	-0.161	0.009	-0.110	-0.073
1600.000	1600.000	-0.063	-0.066	-0.315	-0.199	-0.268	-0.168	0.000	-0.117	-0.079
1650.000	1650.000	-0.060	-0.066	-0.283	-0.199	-0.268	-0.168	0.009	-0.114	-0.076
1700.000	1700.000	-0.057	-0.056	-0.299	-0.199	-0.268	-0.168	0.009	-0.114	-0.076
1750.000	1750.000	-0.053	-0.056	-0.283	-0.199	-0.268	-0.168	0.018	-0.110	-0.073
1800.000	1800.000	-0.053	-0.056	-0.268	-0.199	-0.268	-0.161	0.018	-0.110	-0.073
1850.000	1850.000	-0.053	-0.047	-0.268	-0.199	-0.268	-0.168	0.009	-0.117	-0.076
1900.000	1900.000	-0.044	-0.047	-0.252	-0.189	-0.268	-0.161	0.018	-0.114	-0.073
1950.000	1950.000	-0.050	-0.047	-0.236	-0.199	-0.268	-0.161	0.018	-0.117	-0.073
2000.000	2000.000	-0.047	-0.037	-0.189	-0.189	-0.252	-0.155	0.018	-0.117	-0.066
2050.000	2050.000	-0.041	-0.028	-0.141	-0.180	-0.236	-0.145	0.028	-0.114	-0.057
2100.000	2100.000	-0.038	-0.028	-0.110	-0.170	-0.221	-0.132	0.038	-0.114	-0.054
2150.000	2150.000	-0.038	-0.018	-0.094	-0.161	-0.205	-0.122	0.047	-0.114	-0.047
2200.000	2200.000	-0.028	-0.009	-0.078	-0.151	-0.189	-0.113	0.047	-0.110	-0.044
2250.000	2250.000	-0.034	-0.018	-0.063	-0.151	-0.189	-0.110	0.038	-0.117	-0.047
2300.000	2300.000	-0.028	-0.009	-0.063	-0.151	-0.189	-0.106	0.047	-0.110	-0.044
2350.000	2350.000	-0.034	-0.018	-0.047	-0.151	-0.189	-0.106	0.038	-0.117	-0.047
2400.000	2400.000	-0.025	-0.009	-0.047	-0.142	-0.173	-0.100	0.047	-0.107	-0.041
2450.000	2450.000	-0.025	-0.009	-0.063	-0.142	-0.173	-0.106	0.038	-0.110	-0.047
2500.000	2500.000	-0.028	-0.018	-0.047	-0.142	-0.189	-0.106	0.038	-0.114	-0.050
2550.000	2550.000	-0.025	-0.018	-0.094	-0.151	-0.205	-0.116	0.028	-0.114	-0.047

BETHPAGE NWIRP
PUMPING TEST #2
PUMPING WELL: PRODUCTION WELL 11
PUMPING RATE: 890 GPM

	STEP TIME	TOTAL TIME	HN25S	HN25I	HN25D	HN29I	HN29D	HN26I	HN26I	HN27S2	HN27I2
	2600.000	2600.000	-0.034	-0.037	-0.126	-0.161	-0.221	-0.126	0.009	-0.114	-0.060
	2650.000	2650.000	-0.022	-0.028	-0.205	-0.170	-0.221	-0.119	0.018	-0.104	-0.047
	2700.000	2700.000	-0.009	-0.028	-0.252	-0.151	-0.205	-0.119	0.028	-0.107	-0.047
	2750.000	2750.000	-0.015	-0.018	-0.220	-0.161	-0.221	-0.119	0.009	-0.053	-0.054
	2800.000	2800.000	-0.015	-0.028	-0.252	-0.151	-0.221	-0.126	0.009	-0.053	-0.050
	2850.000	2850.000	-0.015	-0.037	-0.299	-0.161	-0.236	-0.129	-0.009	-0.060	-0.060
	2900.000	2900.000	-0.025	-0.037	-0.283	-0.170	-0.236	-0.139	-0.019	-0.063	-0.069
	2950.000	2950.000	-0.025	-0.037	-0.220	-0.180	-0.236	-0.148	-0.019	-0.069	-0.073
	3000.000	3000.000	-0.034	-0.047	-0.189	-0.180	-0.252	-0.152	-0.019	-0.069	-0.079
	3050.000	3050.000	-0.044	-0.056	-0.173	-0.189	-0.268	-0.158	-0.028	-0.079	-0.092
	3100.000	3100.000	-0.050	-0.056	-0.157	-0.189	-0.252	-0.165	-0.028	-0.076	-0.089
	3150.000	3150.000	-0.050	-0.056	-0.126	-0.189	-0.252	-0.158	-0.019	-0.082	-0.092
	3200.000	3200.000	-0.057	-0.056	-0.126	-0.189	-0.252	-0.165	-0.028	-0.082	-0.095
	3250.000	3250.000	-0.060	-0.056	-0.110	-0.199	-0.268	-0.165	-0.019	-0.085	-0.092
	3300.000	3300.000	-0.063	-0.056	-0.110	-0.199	-0.268	-0.168	-0.019	-0.085	-0.095
	3350.000	3350.000	-0.063	-0.066	-0.110	-0.199	-0.268	-0.165	-0.028	-0.088	-0.104
	3400.000	3400.000	-0.063	-0.066	-0.110	-0.199	-0.268	-0.171	-0.028	-0.085	-0.101
	3450.000	3450.000	-0.066	-0.066	-0.094	-0.199	-0.268	-0.168	-0.019	-0.088	-0.101
	3500.000	3500.000	-0.072	-0.066	-0.094	-0.199	-0.252	-0.165	-0.019	-0.095	-0.101
	3550.000	3550.000	-0.076	-0.056	-0.094	-0.199	-0.252	-0.161	-0.019	-0.095	-0.101
	3600.000	3600.000	-0.076	-0.056	-0.094	-0.199	-0.236	-0.158	-0.009	-0.095	-0.098
	3650.000	3650.000	-0.076	-0.047	-0.078	-0.189	-0.236	-0.148	0.000	-0.098	-0.095
	3700.000	3700.000	-0.076	-0.047	-0.078	-0.189	-0.221	-0.148	0.000	-0.095	-0.098
	3750.000	3750.000	-0.082	-0.056	-0.110	-0.180	-0.221	-0.142	-0.009	-0.101	-0.101
	3800.000	3800.000	-0.085	-0.047	-0.110	-0.180	-0.221	-0.145	-0.009	-0.101	-0.098
	3850.000	3850.000	-0.088	-0.056	-0.110	-0.180	-0.221	-0.145	-0.009	-0.104	-0.101
	3900.000	3900.000	-0.095	-0.085	-0.189	-0.189	-0.252	-0.158	-0.037	-0.110	-0.117
	3950.000	3950.000	-0.091	-0.085	-0.205	-0.208	-0.252	-0.168	-0.047	-0.107	-0.120
	4000.000	4000.000	-0.085	-0.075	-0.220	-0.199	-0.236	-0.158	-0.037	-0.104	-0.114
	4050.000	4050.000	-0.088	-0.085	-0.236	-0.189	-0.236	-0.158	-0.047	-0.107	-0.117
	4100.000	4100.000	-0.079	-0.075	-0.205	-0.189	-0.236	-0.158	-0.047	-0.101	-0.114
	4150.000	4150.000	-0.076	-0.066	-0.173	-0.189	-0.236	-0.155	-0.028	-0.101	-0.111
	4200.000	4200.000	-0.076	-0.066	-0.173	-0.199	-0.252	-0.161	-0.037	-0.104	-0.114
	4250.000	4250.000	-0.076	-0.075	-0.173	-0.208	-0.268	-0.171		-0.107	-0.123
RECOVERY DATA	0.000	4250.000	-0.072	-0.085	-0.173	-0.218	-0.268	-0.178	-0.056	-0.104	-0.130
	0.017	4250.017	-0.069	-0.075	-0.173	-0.218	-0.252	-0.178	-0.066	-0.101	-0.133
	0.033	4250.033	-0.069	-0.075	-0.189	-0.218	-0.236	-0.181	-0.066	-0.104	-0.130
	0.050	4250.050	-0.069	-0.085	-0.189	-0.218	-0.236	-0.181	-0.066	-0.104	-0.130
	0.067	4250.067	-0.069	-0.075	-0.189	-0.218	-0.236	-0.178	-0.066	-0.104	-0.130
	0.083	4250.083	-0.069	-0.085	-0.189	-0.218	-0.236	-0.181	-0.066	-0.104	-0.133
	0.100	4250.100	-0.069	-0.085	-0.189	-0.218	-0.236	-0.181	-0.066	-0.104	-0.130
	0.117	4250.117	-0.069	-0.085	-0.189	-0.218	-0.236	-0.181	-0.066	-0.104	-0.130
	0.133	4250.133	-0.069	-0.085	-0.189	-0.218	-0.236	-0.181	-0.066	-0.104	-0.133
	0.150	4250.150	-0.069	-0.085	-0.189	-0.218	-0.236	-0.181	-0.066	-0.104	-0.133
	0.167	4250.167	-0.069	-0.085	-0.189	-0.218	-0.236	-0.181	-0.066	-0.104	-0.130
	0.183	4250.183	-0.069	-0.085	-0.189	-0.218	-0.236	-0.181	-0.066	-0.104	-0.133
	0.200	4250.200	-0.069	-0.085	-0.189	-0.218	-0.236	-0.181	-0.066	-0.104	-0.130
	0.217	4250.217	-0.069	-0.085	-0.189	-0.218	-0.221	-0.181	-0.066	-0.104	-0.133
	0.233	4250.233	-0.069	-0.085	-0.189	-0.218	-0.221	-0.181	-0.075	-0.104	-0.133
	0.250	4250.250	-0.069	-0.085	-0.189	-0.218	-0.221	-0.181	-0.066	-0.104	-0.133
	0.267	4250.267	-0.069	-0.085	-0.189	-0.218	-0.221	-0.181	-0.066	-0.104	-0.133
	0.283	4250.283	-0.069	-0.085	-0.189	-0.218	-0.221	-0.181	-0.075	-0.101	-0.130
	0.300	4250.300	-0.069	-0.085	-0.189	-0.218	-0.221	-0.181	-0.066	-0.104	-0.133

BETHPAGE NWIRP
PUMPING TEST #2
PUMPING WELL: PRODUCTION WELL 11
PUMPING RATE: 890 GPM

STEP TIME	TOTAL TIME	HN25S	HN25I	HN25D	HN29I	HN29D	HN28I	HN26I	HN27S2	HN27I2
0.317	4250.317	-0.069	-0.085	-0.189	-0.218	-0.221	-0.181	-0.075	-0.101	-0.133
0.333	4250.333	-0.069	-0.085	-0.189	-0.218	-0.221	-0.181	-0.075	-0.104	-0.133
0.417	4250.417	-0.069	-0.085	-0.189	-0.218	-0.221	-0.181	-0.075	-0.104	-0.130
0.500	4250.500	-0.069	-0.094	-0.189	-0.218	-0.221	-0.181	-0.075	-0.104	-0.130
0.583	4250.583	-0.069	-0.094	-0.189	-0.218	-0.221	-0.181	-0.066	-0.104	-0.130
0.667	4250.667	-0.069	-0.094	-0.189	-0.218	-0.221	-0.181	-0.075	-0.104	-0.130
0.750	4250.750	-0.069	-0.094	-0.189	-0.218	-0.221	-0.181	-0.075	-0.104	-0.130
0.833	4250.833	-0.069	-0.104	-0.205	-0.218	-0.221	-0.181	-0.075	-0.104	-0.130
0.917	4250.917	-0.069	-0.104	-0.205	-0.218	-0.221	-0.181	-0.075	-0.104	-0.130
1.000	4251.000	-0.069	-0.104	-0.205	-0.218	-0.221	-0.184	-0.075	-0.104	-0.130
2.000	4252.000	-0.069	-0.113	-0.220	-0.208	-0.221	-0.181	-0.085	-0.101	-0.130
3.000	4253.000	-0.072	-0.113	-0.220	-0.218	-0.236	-0.181	-0.094	-0.104	-0.133
4.000	4254.000	-0.072	-0.113	-0.220	-0.208	-0.236	-0.181	-0.094	-0.104	-0.139
5.000	4255.000	-0.072	-0.113	-0.220	-0.208	-0.236	-0.181	-0.104	-0.104	-0.136
6.000	4256.000	-0.072	-0.104	-0.220	-0.218	-0.236	-0.181	-0.104	-0.104	-0.139
7.000	4257.000	-0.072	-0.104	-0.220	-0.218	-0.252	-0.181	-0.104	-0.104	-0.139
8.000	4258.000	-0.076	-0.094	-0.205	-0.218	-0.252	-0.184	-0.104	-0.104	-0.139
9.000	4259.000	-0.076	-0.094	-0.189	-0.218	-0.252	-0.184	-0.104	-0.104	-0.139
10.000	4260.000	-0.076	-0.094	-0.189	-0.218	-0.252	-0.187	-0.104	-0.107	-0.143
12.000	4262.000	-0.072	-0.094	-0.173	-0.218	-0.252	-0.187	-0.085	-0.107	-0.136
14.000	4264.000	-0.072	-0.085	-0.157	-0.218	-0.236	-0.190	-0.075	-0.107	-0.136
16.000	4266.000	-0.076	-0.075	-0.141	-0.218	-0.236	-0.187	-0.066	-0.104	-0.133
18.000	4268.000	-0.076	-0.075	-0.126	-0.218	-0.221	-0.190	-0.056	-0.107	-0.130
20.000	4270.000	-0.076	-0.066	-0.110	-0.218	-0.221	-0.187	-0.056	-0.107	-0.127
22.000	4272.000	-0.076	-0.066	-0.094	-0.218	-0.205	-0.187	-0.047	-0.104	-0.120
24.000	4274.000	-0.076	-0.056	-0.078	-0.218	-0.205	-0.184	-0.037	-0.104	-0.117
26.000	4276.000	-0.076	-0.056	-0.078	-0.218	-0.189	-0.184	-0.037	-0.107	-0.114
28.000	4278.000	-0.072	-0.056	-0.063	-0.218	-0.189	-0.181	-0.028	-0.104	-0.111
30.000	4280.000	-0.072	-0.056	-0.063	-0.208	-0.173	-0.178	-0.028	-0.101	-0.104
32.000	4282.000	-0.069	-0.047	-0.047	-0.208	-0.157	-0.174	-0.019	-0.104	-0.104
34.000	4284.000	-0.072	-0.047	-0.047	-0.208	-0.157	-0.168	-0.019	-0.104	-0.101
36.000	4286.000	-0.076	-0.047	-0.047	-0.208	-0.157	-0.168	-0.019	-0.104	-0.098
38.000	4288.000	-0.072	-0.037	-0.031	-0.199	-0.142	-0.161	-0.009	-0.104	-0.098
40.000	4290.000	-0.076	-0.037	-0.031	-0.199	-0.142	-0.158	-0.009	-0.110	-0.095
42.000	4292.000	-0.079	-0.037	-0.031	-0.199	-0.126	-0.155	-0.009	-0.110	-0.095
44.000	4294.000	-0.079	-0.037	-0.031	-0.189	-0.126	-0.152	-0.009	-0.110	-0.095
46.000	4296.000	-0.076	-0.037	-0.031	-0.189	-0.126	-0.148	-0.009	-0.104	-0.092
48.000	4298.000	-0.076	-0.037	-0.031	-0.189	-0.126	-0.145	-0.009	-0.104	-0.089
50.000	4300.000	-0.072	-0.037	-0.031	-0.189	-0.126	-0.142	0.000	-0.104	-0.089
52.000	4302.000	-0.076	-0.028	-0.015	-0.180	-0.110	-0.139	0.000	-0.104	-0.085
54.000	4304.000	-0.072	-0.028	-0.031	-0.180	-0.110	-0.135	0.000	-0.104	-0.085
56.000	4306.000	-0.072	-0.028	-0.015	-0.170	-0.110	-0.132	0.000	-0.107	-0.082
58.000	4308.000	-0.072	-0.028	-0.015	-0.170	-0.110	-0.129	0.000	-0.101	-0.082
60.000	4310.000	-0.072	-0.028	-0.015	-0.170	-0.094	-0.126	0.000	-0.104	-0.079
62.000	4312.000	-0.072	-0.028	-0.015	-0.161	-0.094	-0.122	0.009	-0.101	-0.079
64.000	4314.000	-0.072	-0.028	-0.015	-0.161	-0.094	-0.119	0.009	-0.101	-0.076
66.000	4316.000	-0.072	-0.028	-0.015	-0.161	-0.078	-0.119	0.000	-0.101	-0.079
68.000	4318.000	-0.072	-0.018	-0.015	-0.161	-0.094	-0.116	0.000	-0.101	-0.076
70.000	4320.000	-0.069	-0.018	-0.015	-0.161	-0.078	-0.113	0.000	-0.101	-0.076
72.000	4322.000	-0.069	-0.018	-0.015	-0.151	-0.078	-0.113	0.000	-0.101	-0.076
74.000	4324.000	-0.069	-0.018	0.000	-0.151	-0.078	-0.110	0.009	-0.101	-0.073
76.000	4326.000	-0.066	-0.018	0.000	-0.151	-0.078	-0.110	0.009	-0.101	-0.073
78.000	4328.000	-0.069	0.009	0.000	-0.142	-0.063	-0.106	0.009	-0.101	-0.069

BETHPAGE NWIRP
PUMPING TEST #2
PUMPING WELL: PRODUCTION WELL 11
PUMPING RATE: 890 GPM

STEP TIME	TOTAL TIME	HN25S	HN25I	HN25D	HN29I	HN29D	HN28I	HN26I	HN27S2	HN27I2
80.000	4330.000	-0.066	0.009	0.000	-0.142	-0.063	-0.106	0.009	-0.101	-0.073
82.000	4332.000	-0.066	0.009	0.000	-0.142	-0.063	-0.103	0.009	-0.101	-0.073
84.000	4334.000	-0.066	0.009	0.000	-0.142	-0.078	-0.103	0.009	-0.101	-0.069
86.000	4336.000	-0.066	0.009	0.000	-0.142	-0.078	-0.100	0.009	-0.104	-0.069
88.000	4338.000	-0.066	0.018	0.000	-0.142	-0.063	-0.100	0.009	-0.101	-0.069
90.000	4340.000	-0.069	0.009	0.000	-0.132	-0.063	-0.100	0.009	-0.104	-0.073
92.000	4342.000	-0.069	0.009	0.000	-0.132	-0.063	-0.100	0.009	-0.104	-0.069
94.000	4344.000	-0.069	0.009	0.000	-0.132	-0.063	-0.097	0.009	-0.101	-0.069
96.000	4346.000	-0.069	0.009	0.000	-0.142	-0.063	-0.100	0.009	-0.098	-0.069
98.000	4348.000	-0.066	0.018	0.000	-0.132	-0.063	-0.100	0.009	-0.101	-0.073
100.000	4350.000	-0.066	0.009	0.000	-0.132	-0.063	-0.103	0.009	-0.101	-0.069
120.000	4370.000	-0.069	0.009	0.000	-0.123	-0.063	-0.087	0.018	-0.101	-0.069
140.000	4390.000	-0.066	0.018	0.015	-0.113	-0.047	-0.080	0.028	-0.098	-0.069
160.000	4410.000	-0.069	0.018	0.000	-0.113	-0.063	-0.077	0.028	-0.098	-0.069
180.000	4430.000	-0.069	0.009	0.000	-0.113	-0.063	-0.077	0.028	-0.101	-0.073
200 000	4450.000	-0.069	0.009	0.000	-0.113	-0.078	-0.077	0.028	-0.104	-0.073
220 000	4470.000	-0.063	0.018	0.015	-0.113	-0.078	-0.074	0.028	-0.098	-0.069
240 000	4490.000	-0.063	0.018	0.015	-0.113	-0.078	-0.074	0.038	-0.098	-0.073
260 000	4510.000	-0.060	0.018	0.031	-0.113	-0.078	-0.071	0.038	-0.098	-0.073
280 000	4530.000	-0.066	0.009	0.031	-0.113	-0.078	-0.074	0.038	-0.098	-0.076
300 000	4550.000	-0.063	0.009	0.031	-0.113	-0.078	-0.074	0.038	-0.098	-0.073
320 000	4570.000	-0.063	0.009	0.031	-0.123	-0.094	-0.074	0.028	-0.101	-0.076
340 000	4590.000	-0.060	0.009	0.031	-0.113	-0.094	-0.077	0.028	-0.098	-0.076
360 000	4610.000	-0.057	0.009	0.047	-0.123	-0.094	-0.077	0.038	-0.098	-0.079
380 000	4630.000	-0.060	0.009	0.047	-0.123	-0.094	-0.077	0.028	-0.098	-0.076
400 000	4650.000	-0.057	0.009	0.063	-0.113	-0.094	-0.080	0.038	-0.095	-0.085
420 000	4670.000	-0.050	0.018	0.063	-0.113	-0.094	-0.074	0.038	-0.095	-0.073
440 000	4690.000	-0.050	0.028	0.078	-0.113	-0.094	-0.077	0.047	-0.091	-0.073
460 000	4710.000	-0.047	0.018	0.078	-0.113	-0.094	-0.071	0.047	-0.091	-0.079
480 000	4730.000	-0.041	0.028	0.078	-0.113	-0.094	-0.071	0.047	-0.091	-0.063
500 000	4750.000	-0.041	0.028	0.078	-0.113	-0.078	-0.067	0.047	-0.088	-0.069
520 000	4770.000	-0.038	0.037	0.078	-0.104	-0.078	-0.067	0.056	-0.091	-0.066
540 000	4790.000	-0.038	0.037	0.078	-0.104	-0.078	-0.064	0.056	-0.091	-0.066
560 000	4810.000	-0.034	0.037	0.078	-0.104	-0.078	-0.061	0.056	-0.088	-0.063
580 000	4830.000	-0.034	0.047	0.078	-0.104	-0.078	-0.058	0.056	-0.091	-0.063
600 000	4850.000	-0.034	0.037	0.110	-0.094	-0.063	-0.055	0.066	-0.091	-0.063
620 000	4870.000	-0.034	0.047	0.110	-0.094	-0.063	-0.051	0.066	-0.088	-0.063
640 000	4890.000	-0.034	0.047	0.110	-0.094	-0.063	-0.045	0.066	-0.091	-0.060
660 000	4910.000	-0.034	0.047	0.110	-0.094	-0.047	-0.045	0.075	-0.091	-0.057
680 000	4930.000	-0.034	0.047	0.110	-0.085	-0.047	-0.045	0.075	-0.095	-0.057
700 000	4950.000	-0.034	0.047	0.110	-0.085	-0.047	-0.042	0.075	-0.091	-0.054
720 000	4970.000	-0.034	0.056	0.126	-0.085	-0.031	-0.035	0.075	-0.091	-0.054
740 000	4990.000	-0.028	0.066	0.141	-0.085	-0.031	-0.032	0.085	-0.085	-0.050
760 000	5010.000	-0.028	0.066	0.157	-0.075	-0.015	-0.025	0.094	-0.088	-0.044
780 000	5030.000	-0.028	0.066	0.157	-0.075	-0.015	-0.022	0.094	-0.091	-0.047
800 000	5050.000	-0.028	0.066	0.173	-0.075	-0.015	-0.019	0.085	-0.095	-0.044
820 000	5070.000	-0.034	0.056	0.173	-0.066	-0.015	-0.019	0.094	-0.095	-0.050
840 000	5090.000	-0.028	0.066	0.189	-0.066	-0.015	-0.019	0.094	-0.091	-0.044
860 000	5110.000	-0.025	0.066	0.189	-0.066	-0.015	-0.016	0.094	-0.088	-0.041
880 000	5130.000	-0.031	0.066	0.189	-0.066	-0.015	-0.012	0.094	-0.095	-0.047
900 000	5150.000	-0.034	0.066	0.189	-0.066	-0.015	-0.016	0.094	-0.098	-0.047
920 000	5170.000	-0.034	0.056	0.189	-0.066	-0.015	-0.016	0.085	-0.098	-0.047
940 000	5190.000	-0.034	0.056	0.189	-0.066	-0.015	-0.019	0.085	-0.101	-0.047

BETHPAGE NWIRP
PUMPING TEST #2
PUMPING WELL: PRODUCTION WELL 11
PUMPING RATE: 890 GPM

STEP TIME	TOTAL TIME	HN25S	HN25I	HN25D	HN29I	HN29D	HN28I	HN26I	HN27S2	HN27I2
960.000	5210.000	-0.034	0.056	0.189	-0.066	-0.015	-0.019	0.085	-0.098	-0.050
980.000	5230.000	-0.028	0.056	0.189	-0.075	-0.015	-0.019	0.085	-0.091	-0.047
1000.000	5250.000	-0.034	0.056	0.173	-0.075	-0.015	-0.022	0.085	-0.098	-0.054
1050.000	5300.000	-0.041	0.047	0.141	-0.075	-0.031	-0.025	0.075		
1100.000	5350.000	-0.050	0.037	0.141	-0.085	-0.047	-0.035			
1150.000	5400.000	-0.041	0.028	0.110	-0.094	-0.063	-0.048			
1200.000	5450.000	-0.041	0.028	0.015	-0.104	-0.078	-0.051			
1250.000	5500.000	-0.041	0.018	-0.015	-0.113	-0.094	-0.067			
1300.000	5550.000	-0.044	0.018	-0.031	-0.113	-0.078	-0.064			
1350.000	5600.000	-0.038	0.028	-0.015	-0.104	-0.094	-0.055			
1400.000	5650.000	-0.050	0.009	-0.031	-0.104	-0.078	-0.061			
1450.000	5700.000	-0.066	-0.009	-0.094	-0.142	-0.126	-0.129			
1500.000	5750.000	-0.066	0.000	-0.110	-0.142	-0.126	-0.132			
1550.000	5800.000	-0.069	-0.009	-0.126	-0.142	-0.126	-0.142			
1600.000	5850.000	-0.076	-0.009	-0.126	-0.151	-0.126	-0.142			
1650.000	5900.000	-0.082	-0.009	-0.110	-0.151	-0.142	-0.152			
1700.000	5950.000	-0.079	0.000	-0.141	-0.151	-0.142	-0.155			
1750.000	6000.000	-0.085	0.000	-0.126	-0.151	-0.142	-0.152			
1800.000	6050.000	-0.082	0.000	-0.126	-0.151	-0.142	-0.148			
1850.000	6100.000	-0.082	0.008	-0.489	-0.142	-0.126	-0.145			
1900.000	6150.000	-0.079	0.009	-0.489	-0.142	-0.126	-0.145			
1950.000	6200.000	-0.076	0.018	-0.489	-0.142	-0.126	-0.135			
2000.000	6250.000	-0.072	0.018	-0.473	-0.142	-0.126	-0.135			
2050.000	6300.000	-0.069	0.028	-0.457	-0.132	-0.110	-0.126			
2100.000	6350.000	-0.066	0.037	-0.441	-0.123	-0.094	-0.116			
2150.000	6400.000	-0.063	0.037	-0.425	-0.113	-0.078	-0.110			
2200.000	6450.000	-0.060	0.047	-0.410	-0.104	-0.063	-0.100			
2250.000	6500.000	-0.057	0.056	-0.394	-0.104	-0.063	-0.093			
2300.000	6550.000	-0.050	0.066	-0.378	-0.094	-0.047	-0.084			
2350.000	6600.000	-0.050	0.066	-0.362	-0.085	-0.031	-0.077			
2400.000	6650.000	-0.050	0.066	-0.347	-0.075	-0.015	-0.071			
2450.000	6700.000	-0.047	0.066	-0.331	-0.075	-0.015	-0.067			
2500.000	6750.000	-0.044	0.075	-0.299	-0.075	-0.015	-0.067			
2550.000	6800.000	-0.047	0.066	-0.220	-0.075	-0.031	-0.067			
2600.000	6850.000	-0.044	0.056	0.063	-0.094	-0.063	-0.084			
2650.000	6900.000	-0.025	0.066	0.031	-0.085	-0.047	-0.084			
2700.000	6950.000	-0.031	0.056	-0.015	-0.094	-0.078	-0.097			
2750.000	7000.000	-0.019	0.066	-0.015	-0.085	-0.063	-0.087			
2800.000	7050.000	-0.028	0.047	-0.031	-0.104	-0.078	-0.097			
2850.000	7100.000	-0.028	0.047	-0.047	-0.104	-0.078	-0.105			
2900.000	7150.000	-0.022	0.056	-0.047	-0.104	-0.078	-0.100			
2950.000	7200.000	-0.022	0.056	-0.047	-0.113	-0.078	-0.103			
3000.000	7250.000	-0.025	0.056	-0.031	-0.104	-0.078	-0.103			
3050.000	7300.000	-0.025	0.047	-0.015	-0.113	-0.078	-0.103			
3100.000	7350.000	-0.028	0.047	0.000	-0.113	-0.094	-0.106			
3150.000	7400.000	-0.022	0.056	0.015	-0.113	-0.078	-0.110			
3200.000	7450.000	-0.022	0.056	0.031	-0.113	-0.094	-0.110			
3250.000	7500.000	-0.022	0.056	0.031	-0.113	-0.094	-0.116			
3300.000	7550.000	-0.015	0.066	0.047	-0.113	-0.094	-0.116			
3350.000	7600.000	-0.012	0.066	0.063	-0.113	-0.094	-0.113			
3400.000	7650.000	-0.012	0.066	0.063	-0.113	-0.094	-0.110			
3450.000	7700.000	0.000	0.085	0.094	-0.104	-0.063	-0.097			
3500.000	7750.000	0.003	0.094	0.110	-0.094	-0.063	-0.087			

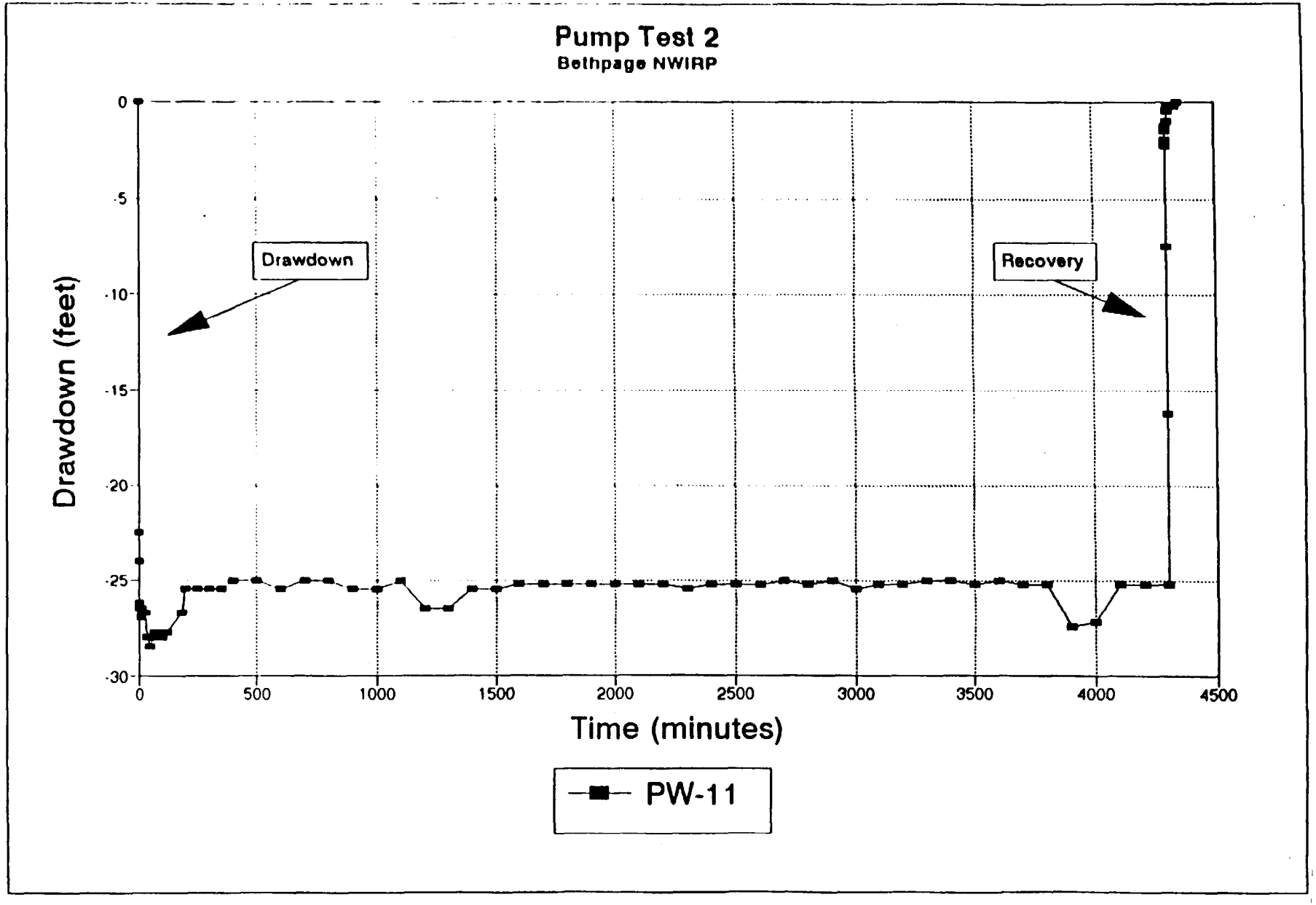
BETHPAGE NWIRP
PUMPING TEST #2
PUMPING WELL: PRODUCTION WELL 11
PUMPING RATE: 890 GPM

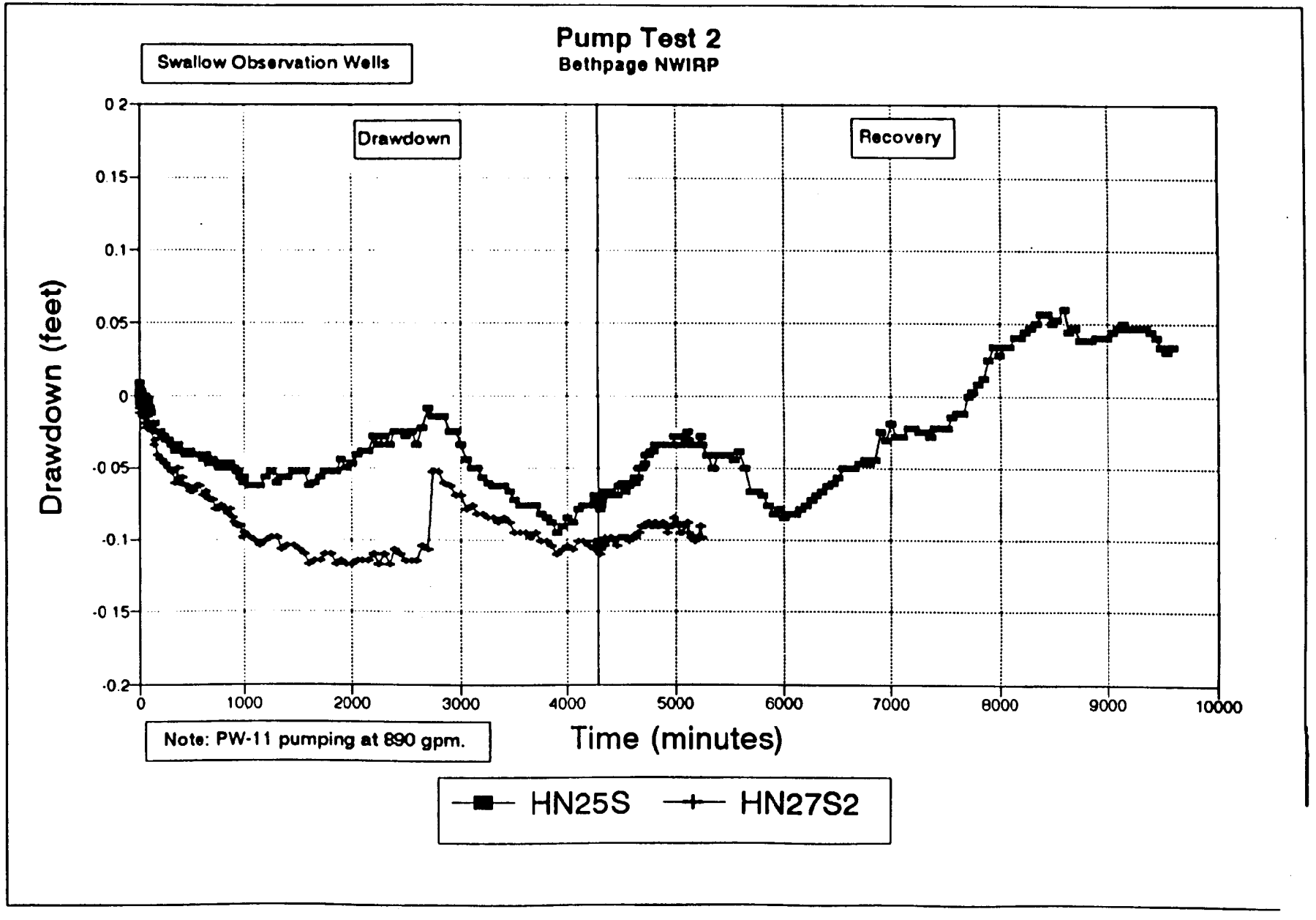
STEP TIME	TOTAL TIME	HN25S	HN25I	HN25D	HN29I	HN29D	HN28I	HN26I	HN27S2	HN27I2
3550.000	7800.000	0.008	0.094	0.126	-0.085	-0.047	-0.080			
3600.000	7850.000	0.012	0.113	0.157	-0.075	-0.031	-0.067			
3650.000	7900.000	0.025	0.123	0.189	-0.056	-0.015	-0.058			
3700.000	7950.000	0.034	0.142	0.220	-0.047	0.000	-0.042			
3750.000	8000.000	0.028	0.123	0.236	-0.047	0.000	-0.042			
3800.000	8050.000	0.034	0.132	0.268	-0.047	0.015	-0.035			
3850.000	8100.000	0.034	0.132	0.283	-0.037	0.031	-0.029			
3900.000	8150.000	0.041	0.142	0.299	-0.037	0.031	-0.029			
3950.000	8200.000	0.041	0.142	0.331	-0.037	0.031	-0.025			
4000.000	8250.000	0.044	0.151	0.362	-0.028	0.031	-0.025			
4050.000	8300.000	0.047	0.142	0.347	-0.028	0.031	-0.025			
4100.000	8350.000	0.050	0.142	0.362	-0.037	0.015	-0.035			
4150.000	8400.000	0.057	0.142	0.362	-0.037	0.015	-0.035			
4200.000	8450.000	0.057	0.142	0.331	-0.037	0.000	-0.042			
4250.000	8500.000	0.050	0.132	0.283	-0.047	0.000	-0.048			
4300.000	8550.000	0.053	0.132	0.252	-0.056	-0.015	-0.055			
4350.000	8600.000	0.060	0.123	0.236	-0.056	-0.015	-0.061			
4400.000	8650.000	0.044	0.113	0.263	-0.075	-0.047	-0.071			
4450.000	8700.000	0.047	0.113	0.236	-0.075	-0.031	-0.077			
4500.000	8750.000	0.038	0.104	0.220	-0.085	-0.047	-0.090			
4550.000	8800.000	0.038	0.104	0.220	-0.094	-0.063	-0.097			
4600.000	8850.000	0.038	0.104	0.220	-0.094	-0.078	-0.110			
4650.000	8900.000	0.041	0.104	0.220	-0.104	-0.078	-0.103			
4700.000	8950.000	0.041	0.104	0.220	-0.104	-0.078	-0.106			
4750.000	9000.000	0.041	0.104	0.220	-0.104	-0.078	-0.106			
4800.000	9050.000	0.044	0.113	0.220	-0.104	-0.078	-0.106			
4850.000	9100.000	0.047	0.113	0.220	-0.094	-0.063	-0.100			
4900.000	9150.000	0.050	0.113	0.220	-0.085	-0.063	-0.093			
4950.000	9200.000	0.047	0.113	0.220	-0.085	-0.047	-0.093			
5000.000	9250.000	0.047	0.123	0.220	-0.085	-0.047	-0.087			
5050.000	9300.000	0.047	0.123	0.236	-0.085	-0.031	-0.080			
5100.000	9350.000	0.047	0.123	0.236	-0.075	-0.031	-0.074			
5150.000	9400.000	0.044	0.123	0.236	-0.075	-0.031	-0.077			
5200.000	9450.000	0.041	0.123	0.236	-0.075	-0.015	-0.074			
5250.000	9500.000	0.034	0.113	0.205	-0.075	-0.015	-0.077			
5300.000	9550.000	0.031	0.113	0.157	-0.075	-0.015	-0.080			
5350.000	9600.000	0.034	0.113	0.094	-0.085	-0.031	-0.087			
5400.000	9650.000				-0.094	-0.047	-0.103			
5450.000	9700.000				-0.104	-0.063	-0.110			

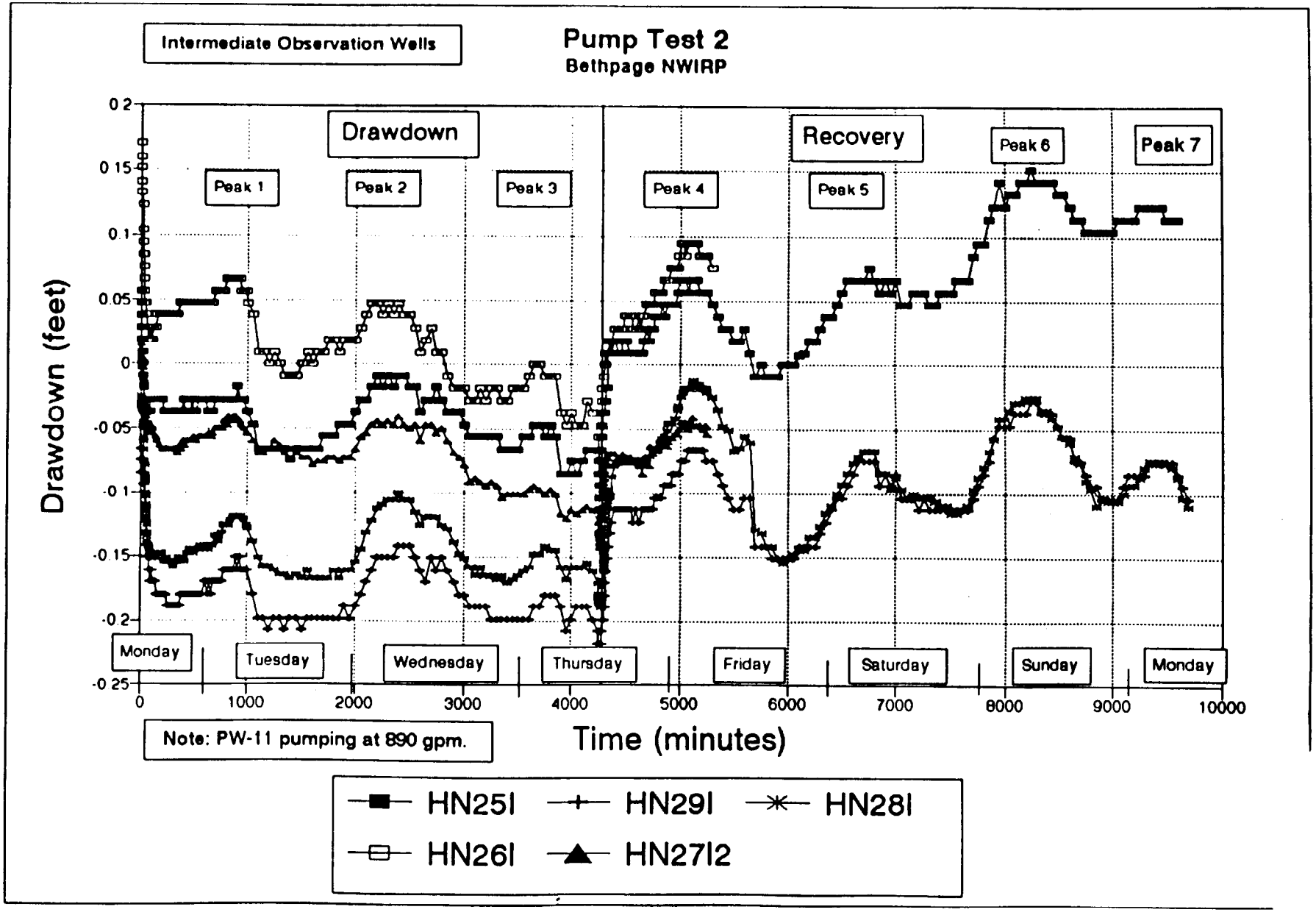
Note Shading indicates data not recorded for time interval.

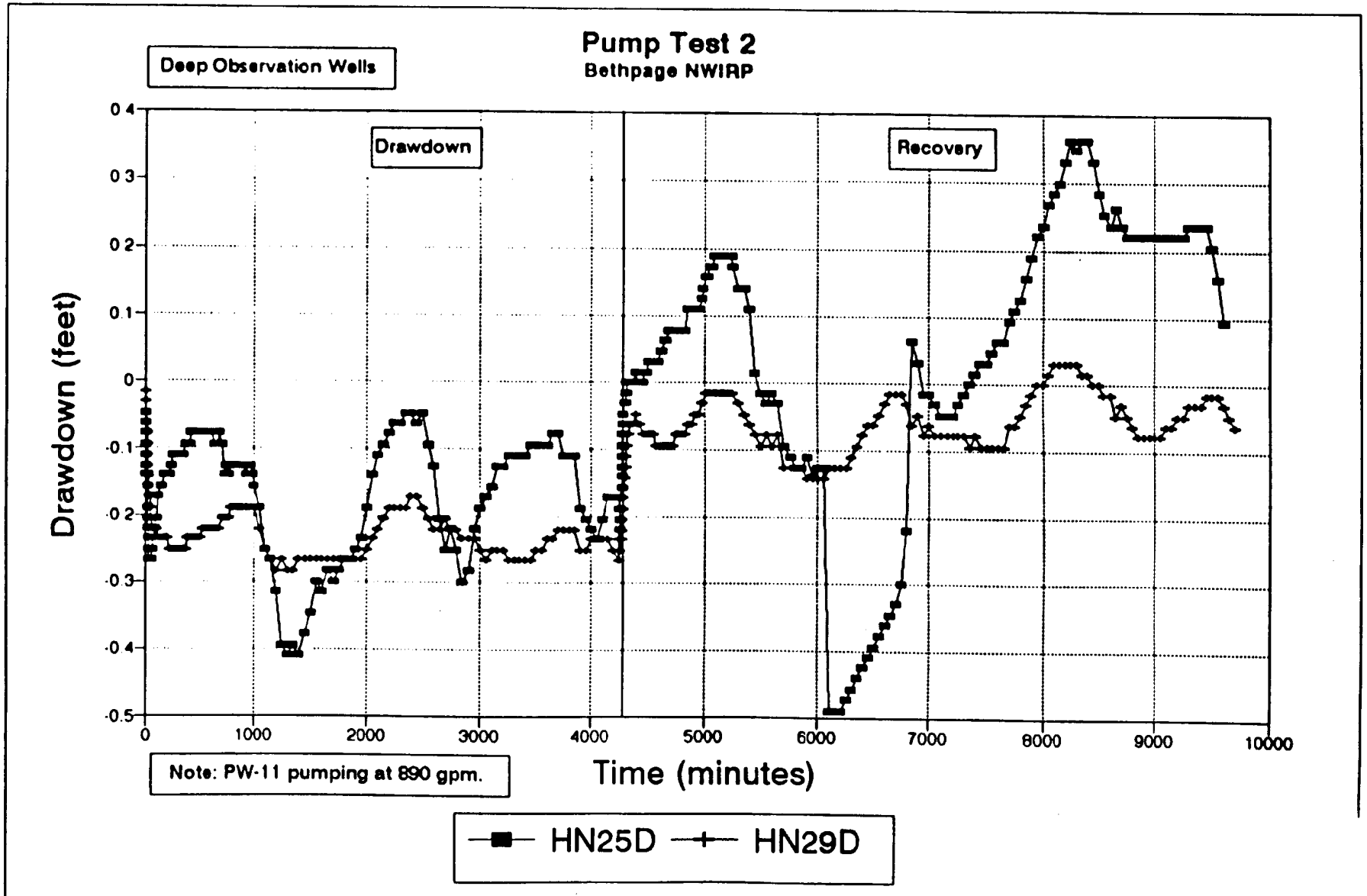
PUMPING TEST #2

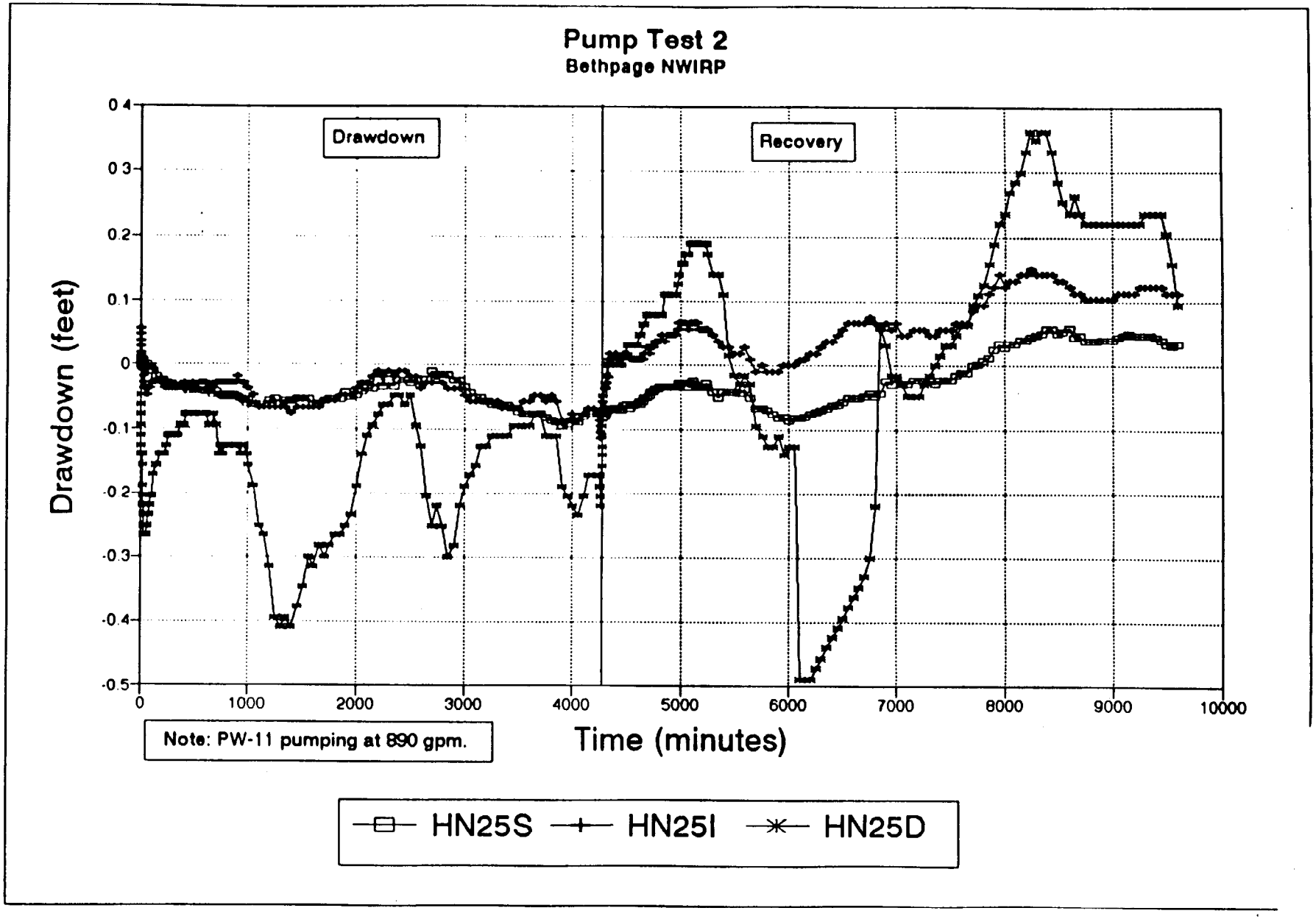
GRAPHS OF DRAWDOWN AND RECOVERY DATA

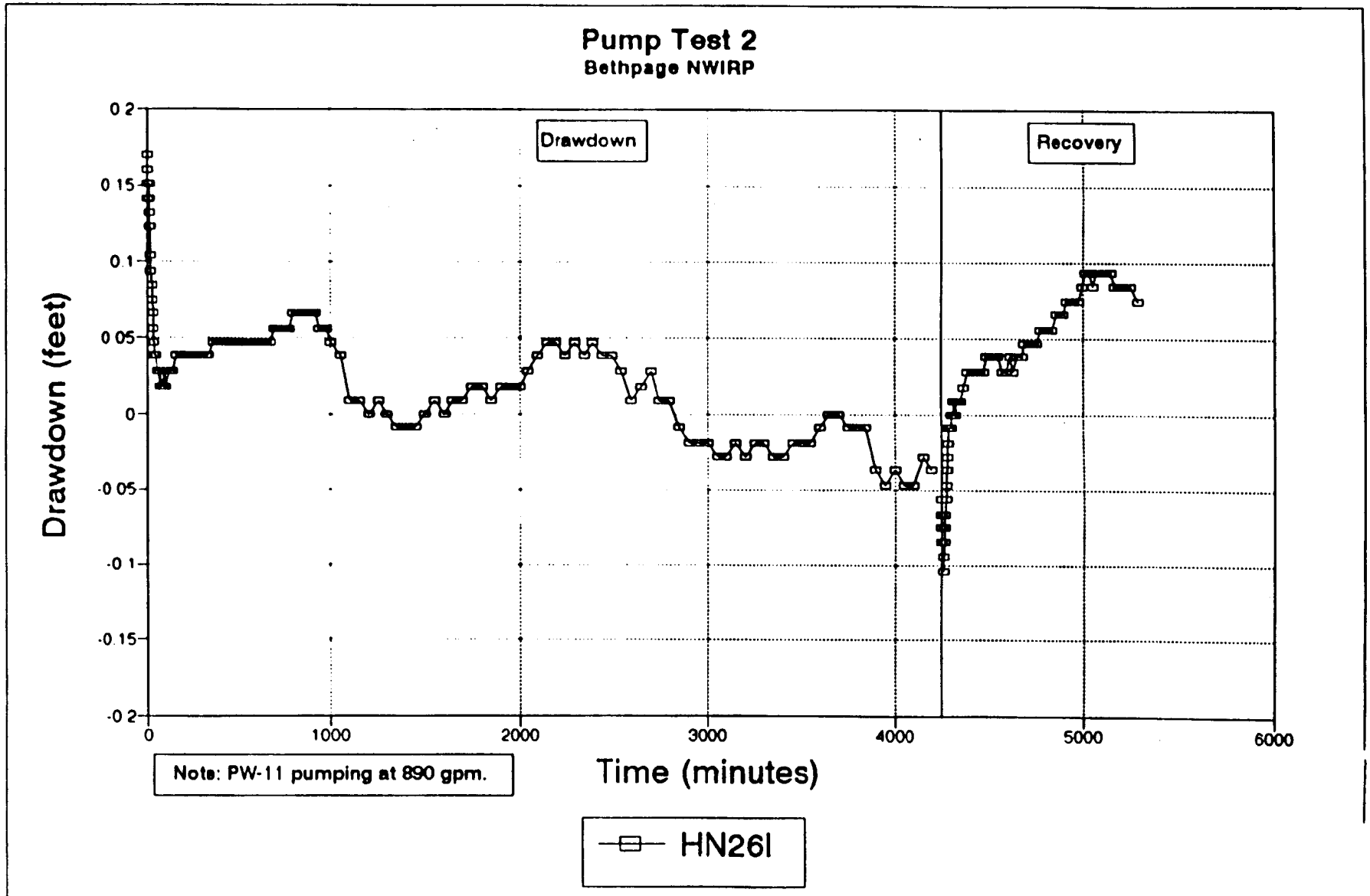

Pump Test 2
Bethpage NWIRP
Drawdown (feet)
0
-5
-10
-15
-20
-25
-30
0
500
1000
1500
2000
2500
3000
3500
4000
4500
Time (minutes)
Drawdown
Recovery
PW-11

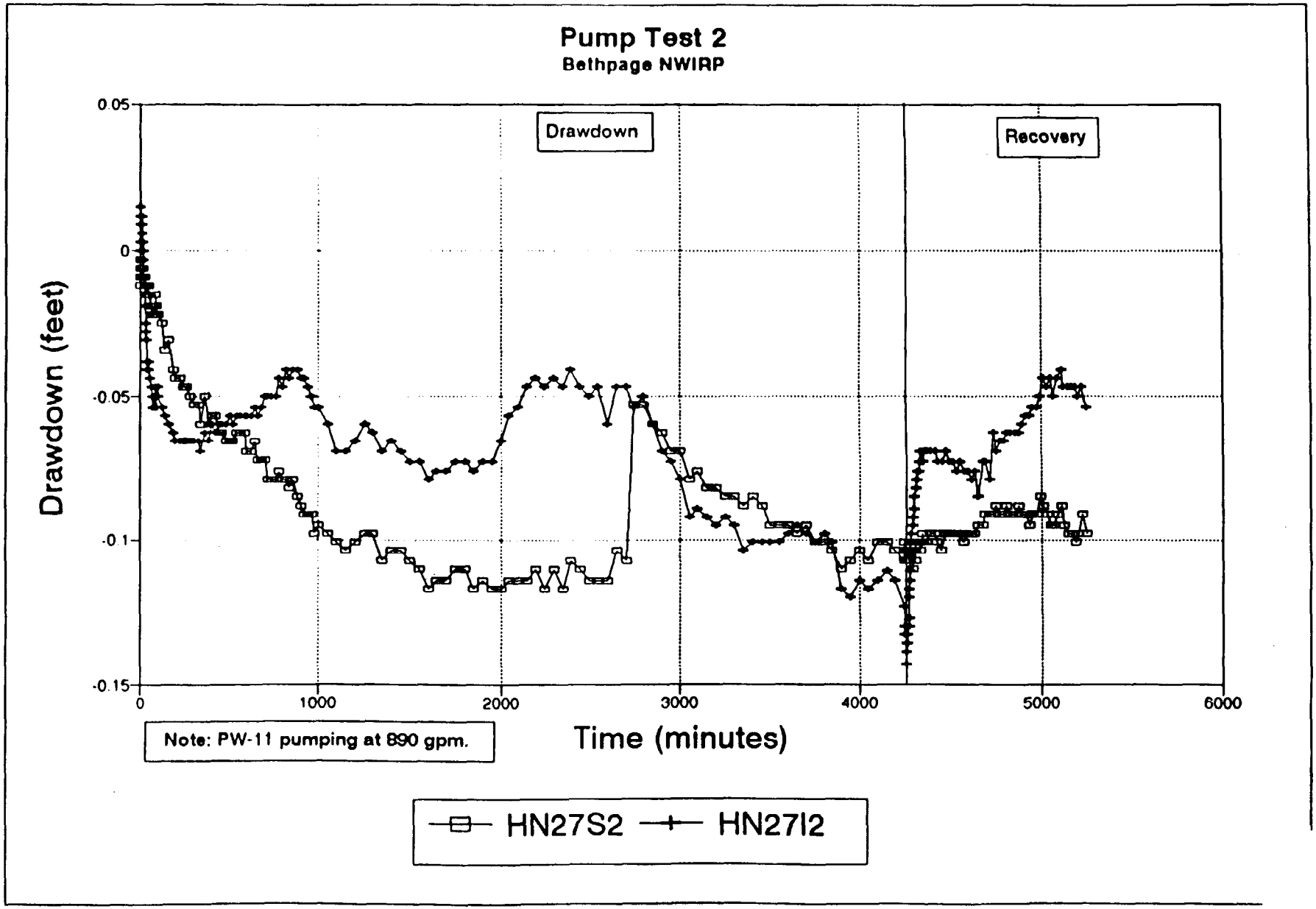

Pump Test 2
Bethpage NWIRP
Swallow Observation Wells
Drawdown
Recovery
Drawdown (feet)
0.2
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
Time (minutes)
Note: PW-11 pumping at 890 gpm.
HN25S
HN27S2

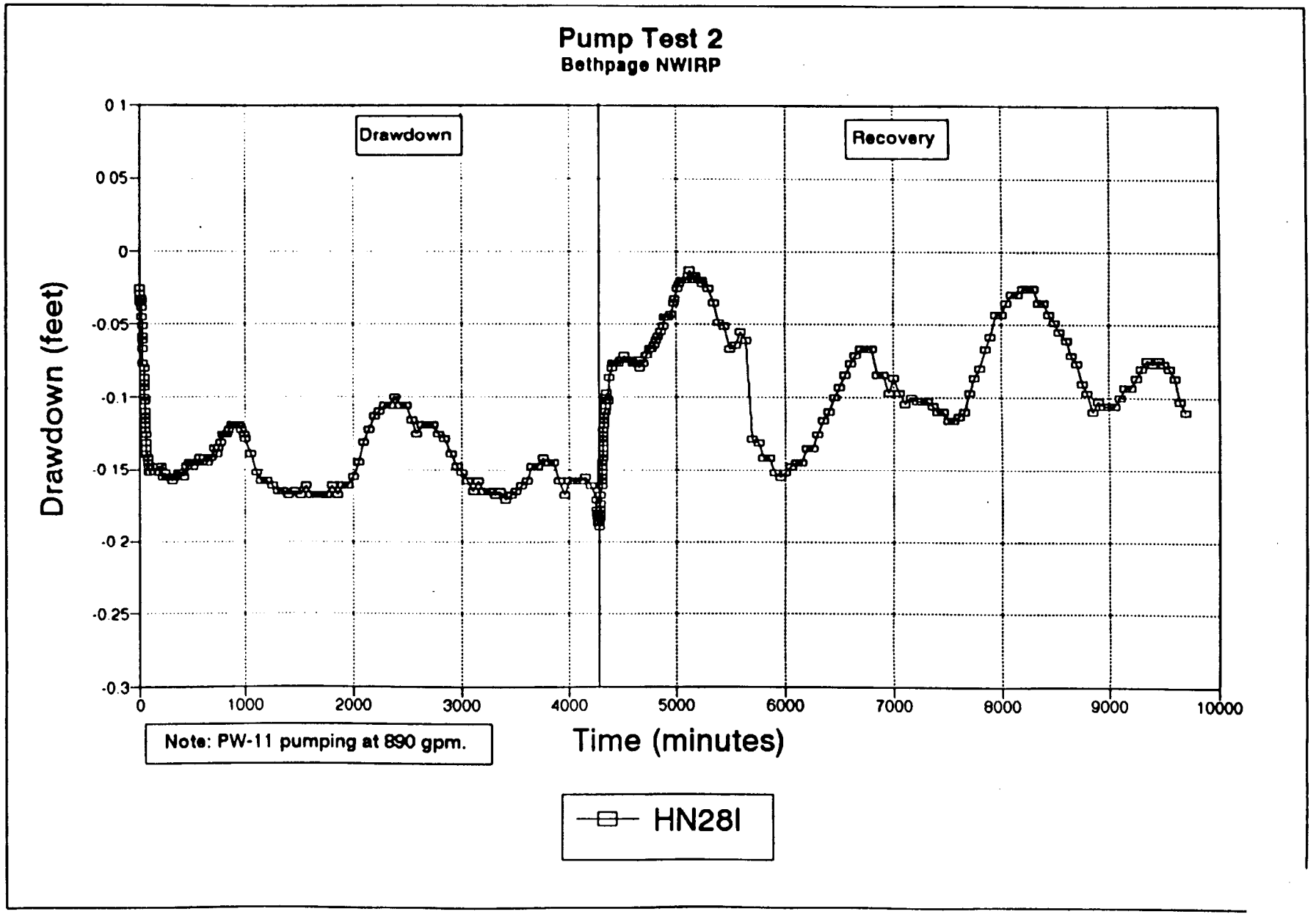

Intermediate Observation Wells
Pump Test 2
Bethpage NWIRP
Drawdown
Recovery
Peak 1
Peak 2
Peak 3
Peak 4
Peak 5
Peak 6
Peak 7
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Monday
Drawdown (feet)
0.2
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
Time (minutes)
Note: PW-11 pumping at 890 gpm.
HN25I
HN29I
HN28I
HN26I
HN27I2

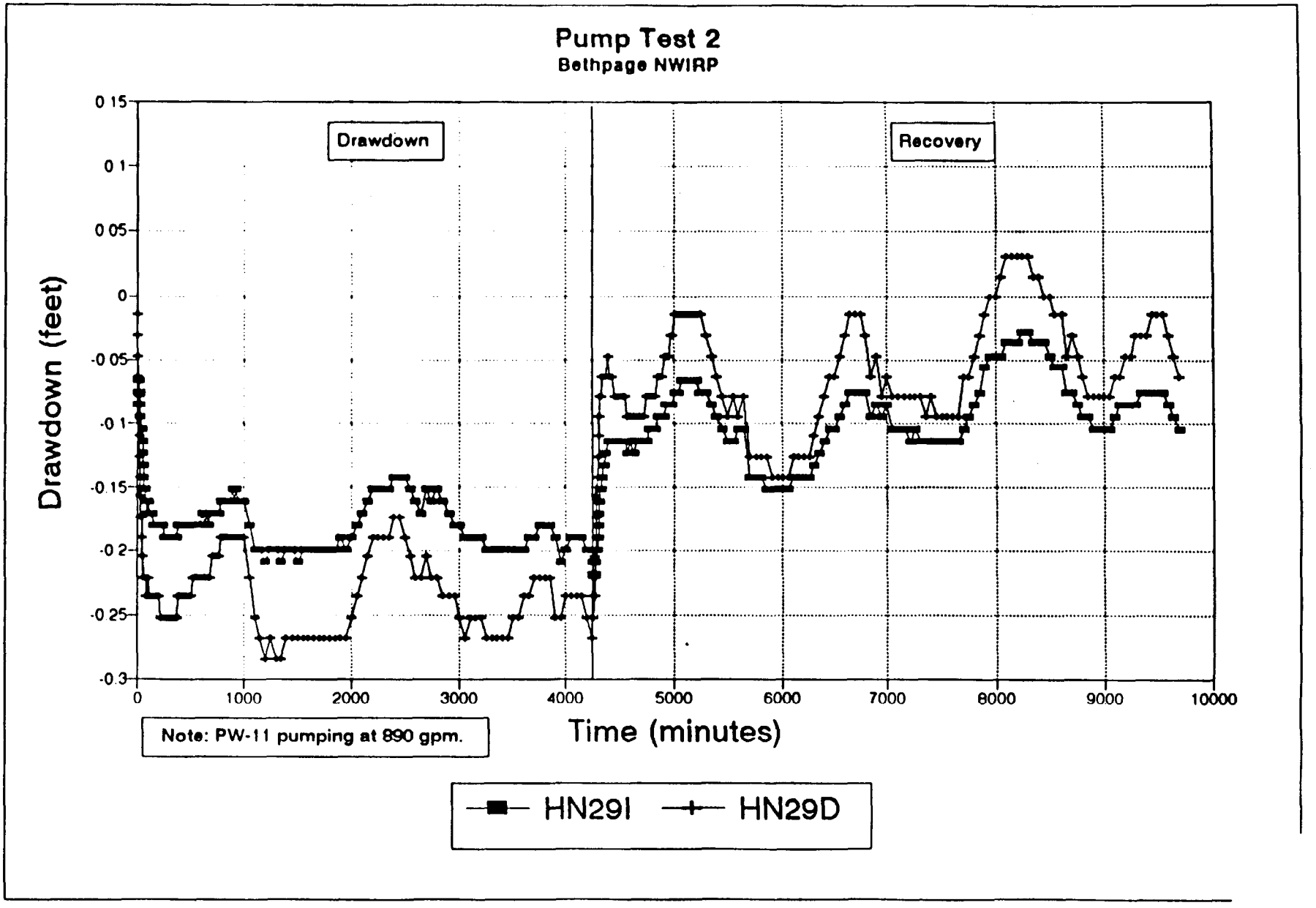

Pump Test 2
Bethpage NWIRP
Deep Observation Wells
Drawdown
Recovery
Drawdown (feet)
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
Time (minutes)
Note: PW-11 pumping at 890 gpm.
HN25D
HN29D

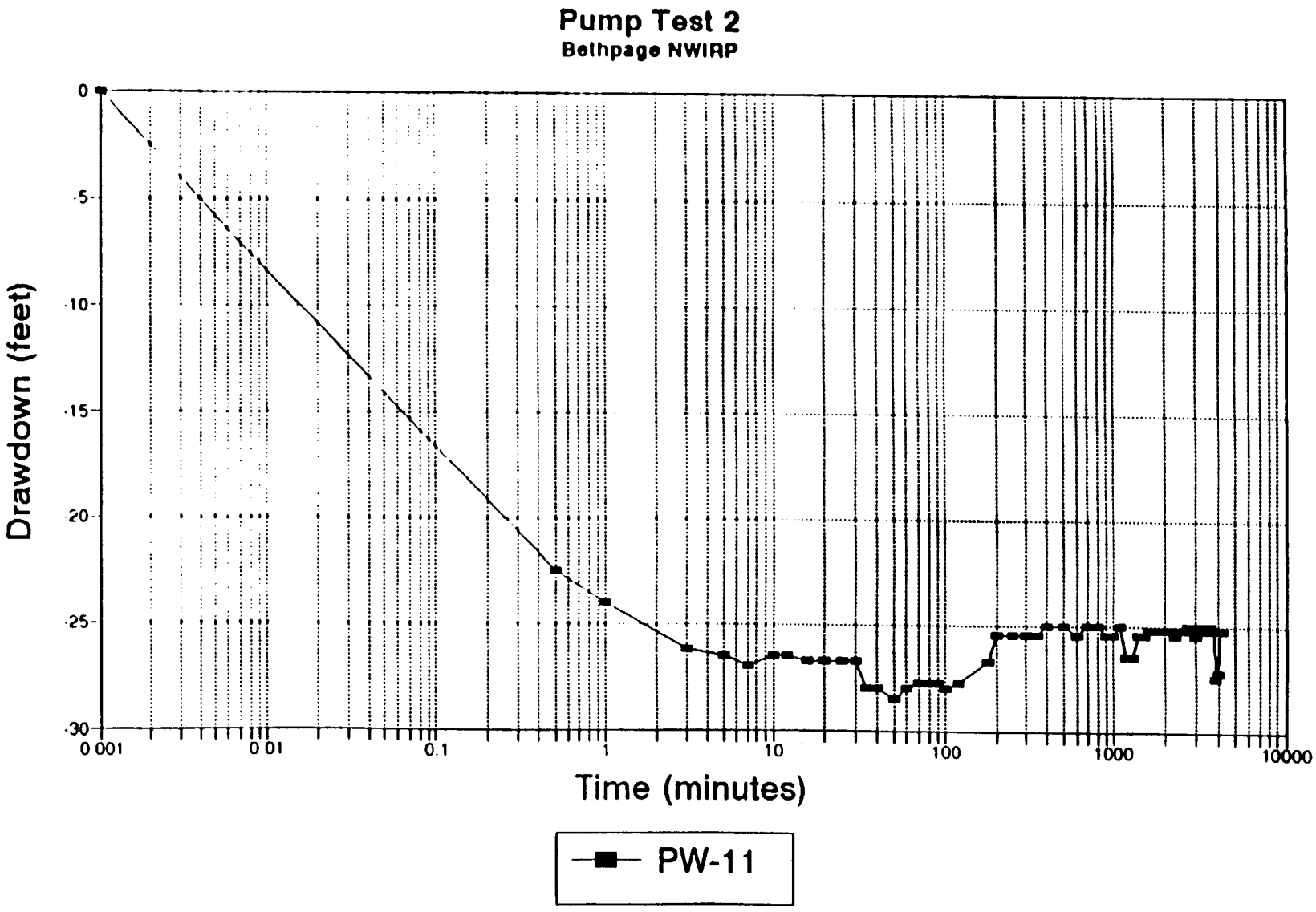

Pump Test 2
Bethpage NWIRP
Drawdown
Recovery
Drawdown (feet)
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
Time (minutes)
Note: PW-11 pumping at 890 gpm.
HN25S
HN25I
HN25D

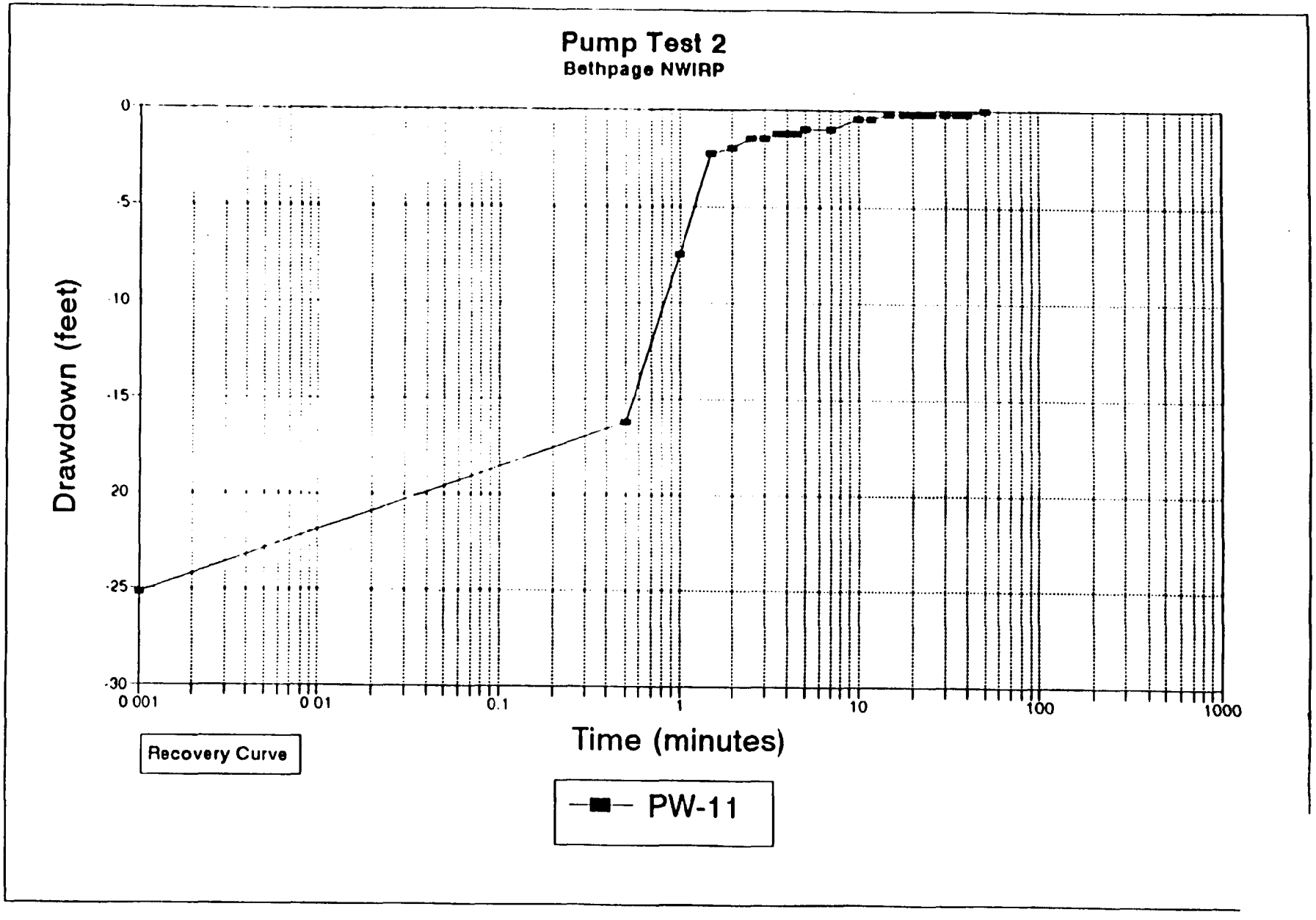

Pump Test 2
Bethpage NWIRP
Drawdown
Recovery
Drawdown (feet)
0.2
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
0
1000
2000
3000
4000
5000
6000
Time (minutes)
Note: PW-11 pumping at 890 gpm.
HN26I

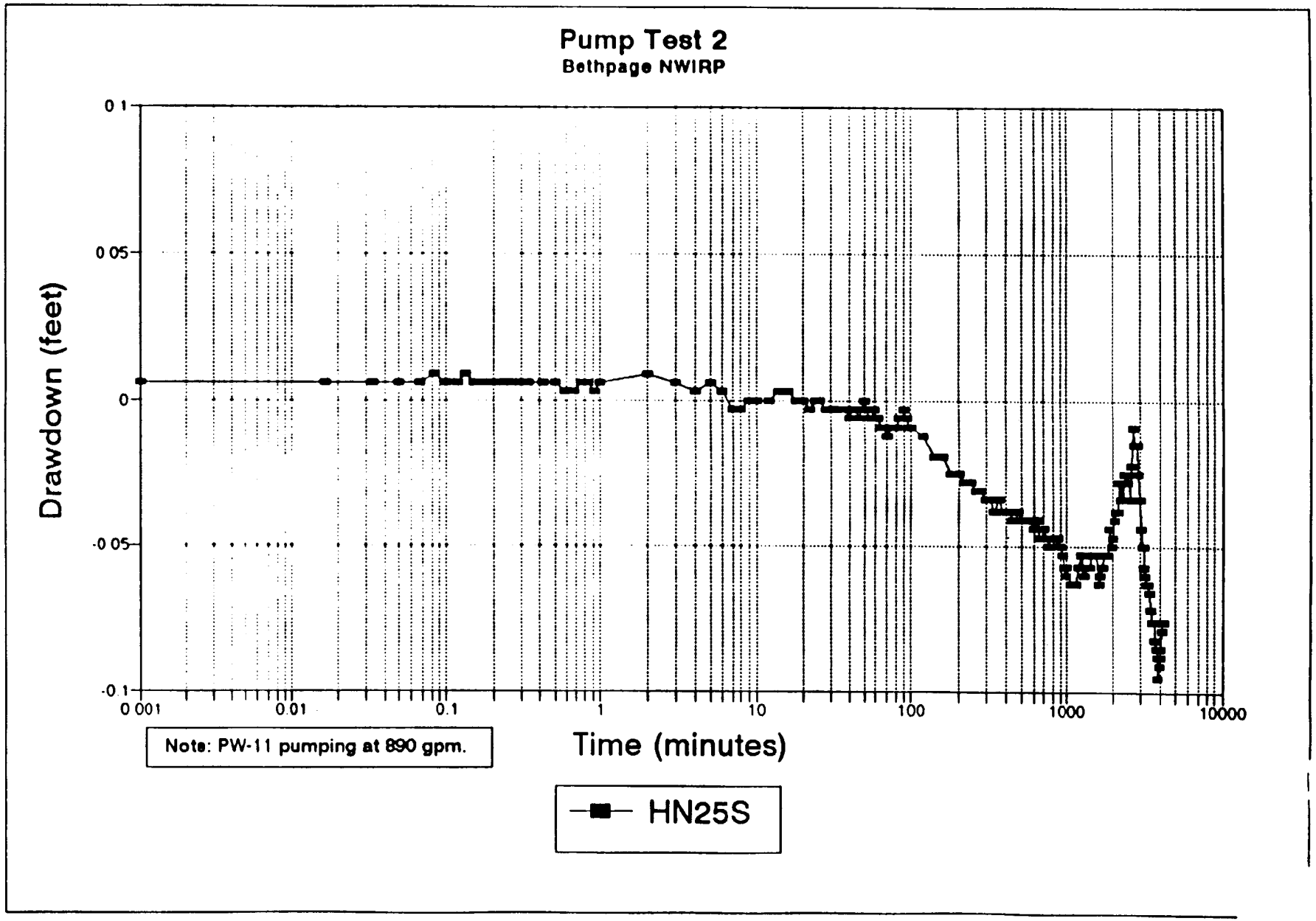

Pump Test 2
Bethpage NWIRP
Drawdown
Recovery
Drawdown (feet)
0.05
0
-0.05
-0.1
-0.15
0
1000
2000
3000
4000
5000
6000
Time (minutes)
Note: PW-11 pumping at 890 gpm.
HN27S2
HN27I2

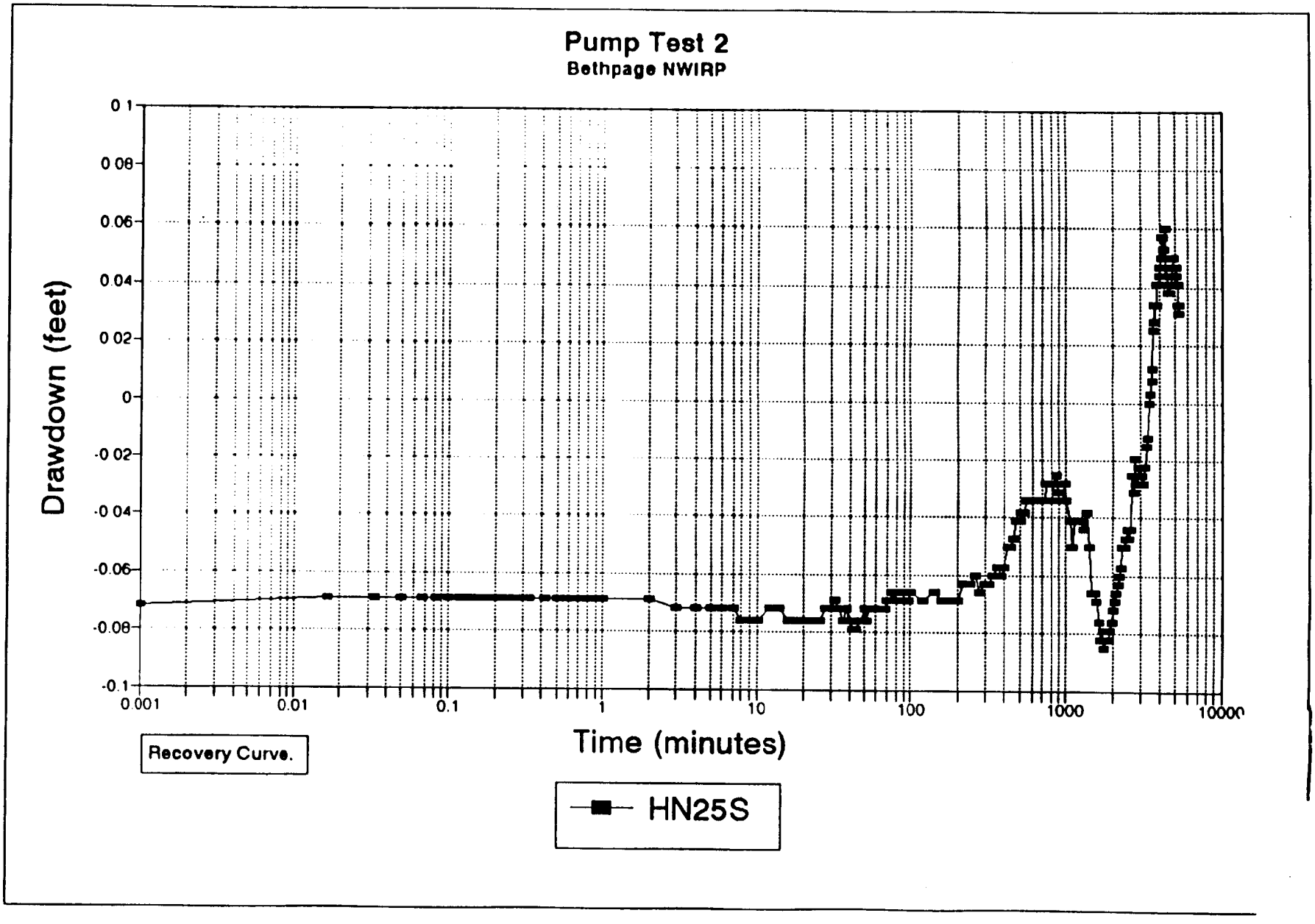

Pump Test 2
Bethpage NWIRP
Drawdown
Recovery
Drawdown (feet)
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
Time (minutes)
Note: PW-11 pumping at 890 gpm.
HN28I

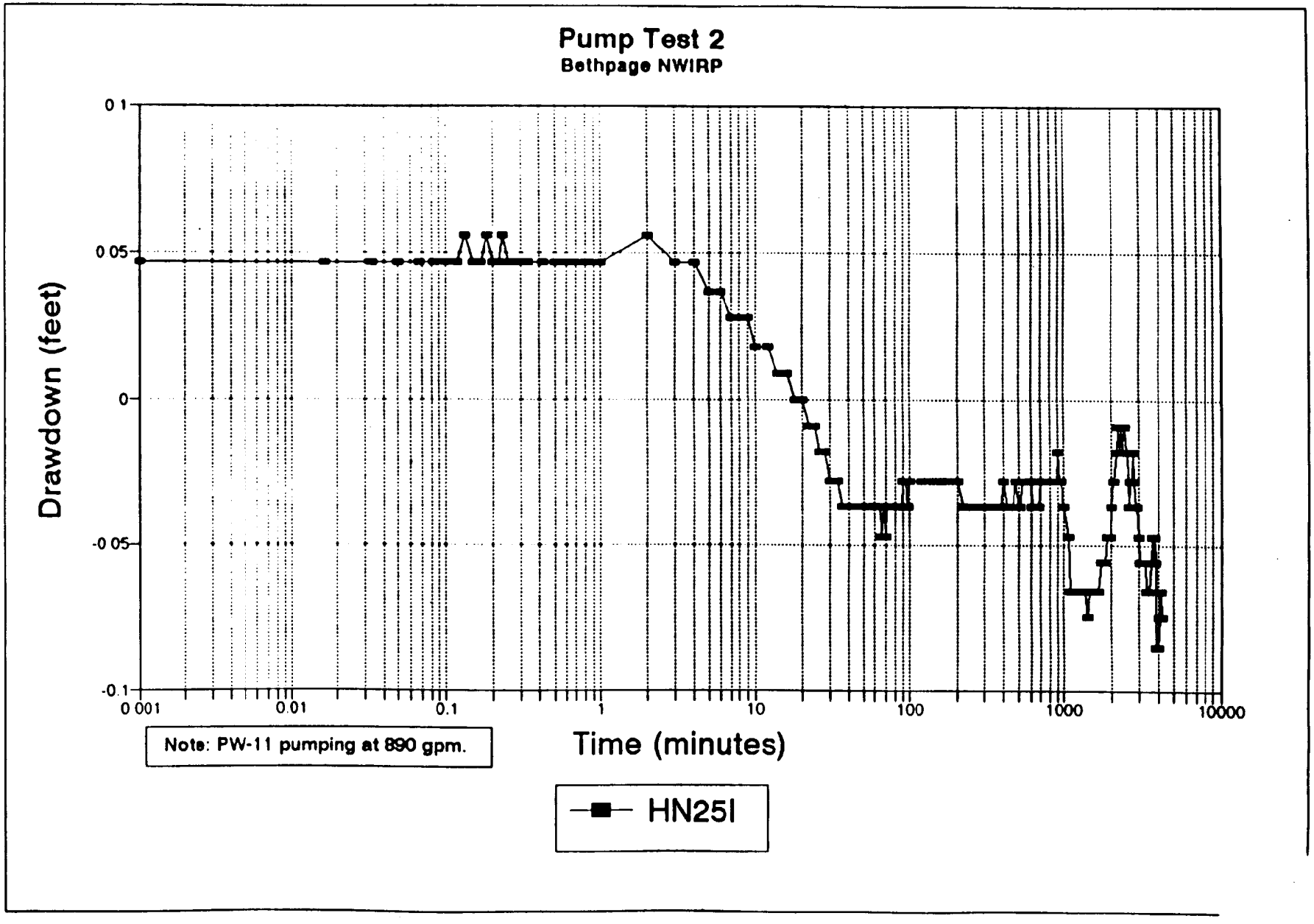

Pump Test 2
Bethpage NWIRP
Drawdown
Recovery
Drawdown (feet)
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
Time (minutes)
Note: PW-11 pumping at 890 gpm.
HN29I
HN29D

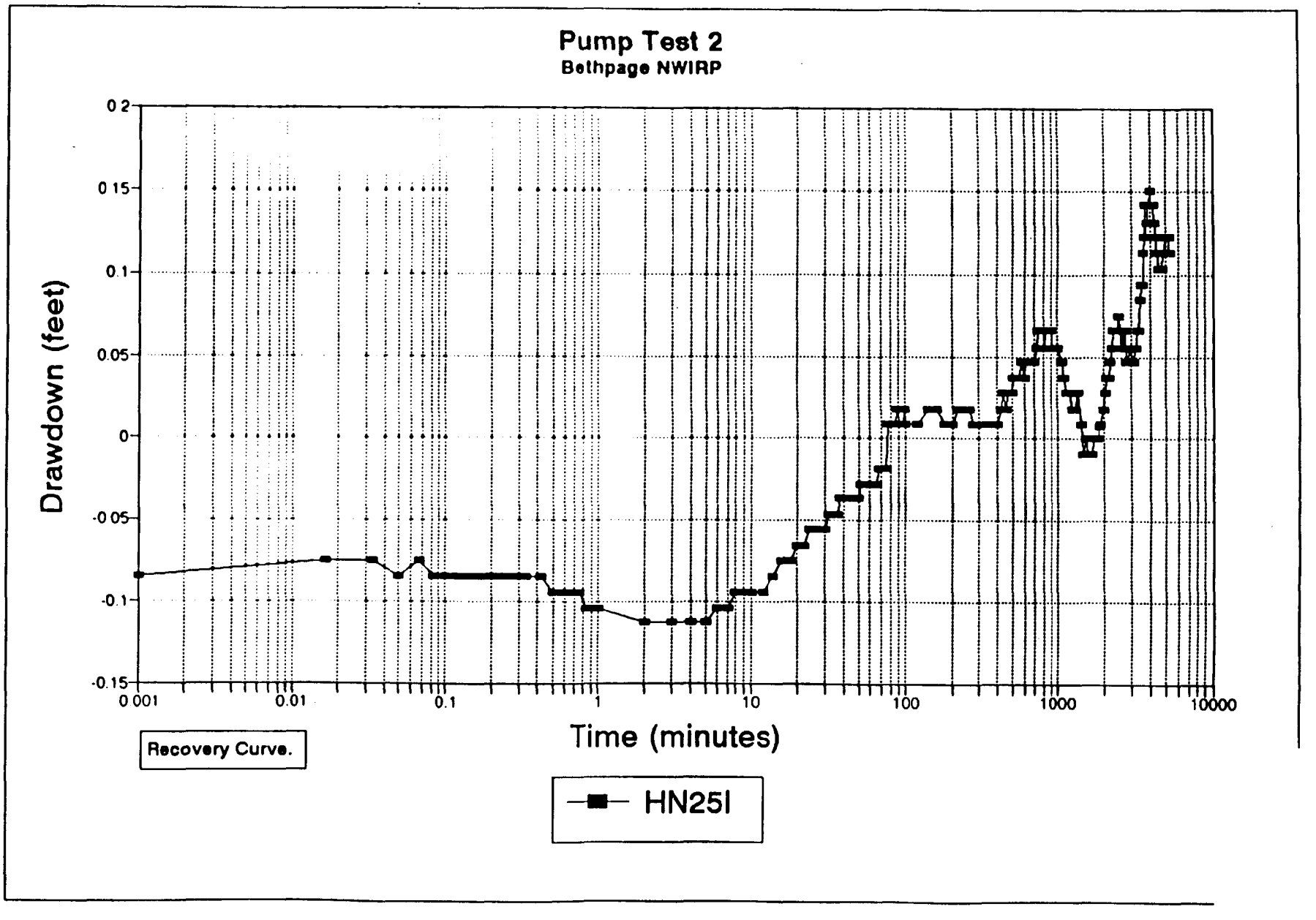

Pump Test 2
Bethpage NWIRP
Drawdown (feet)
0
-5
-10
-15
-20
-25
-30
0.001
0.01
0.1
1
10
100
1000
10000
Time (minutes)
PW-11

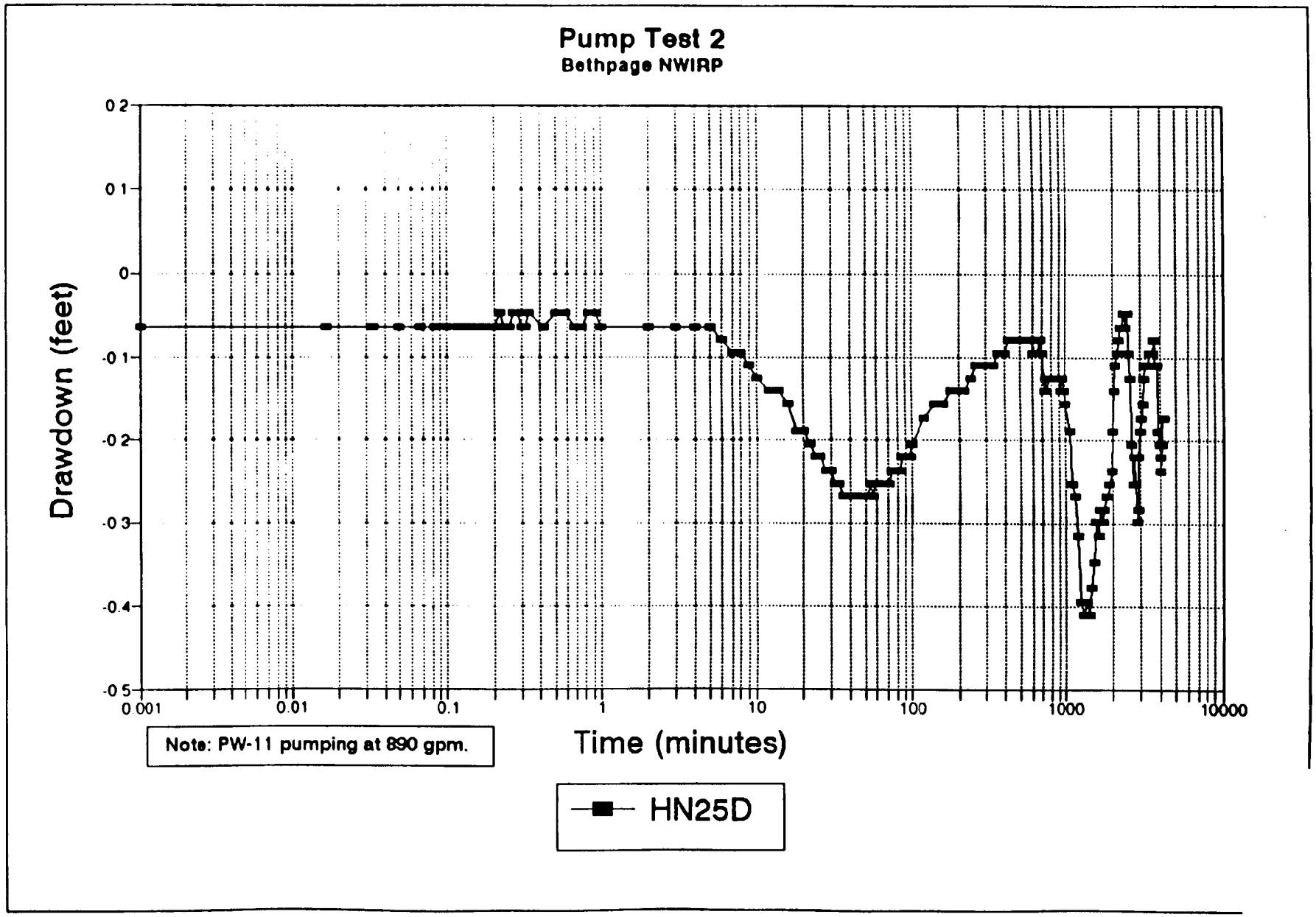

Pump Test 2
Bethpage NWIRP
Drawdown (feet)
0
-5
-10
-15
-20
-25
-30
0.001
0.01
0.1
1
10
100
1000
Time (minutes)
Recovery Curve
PW-11

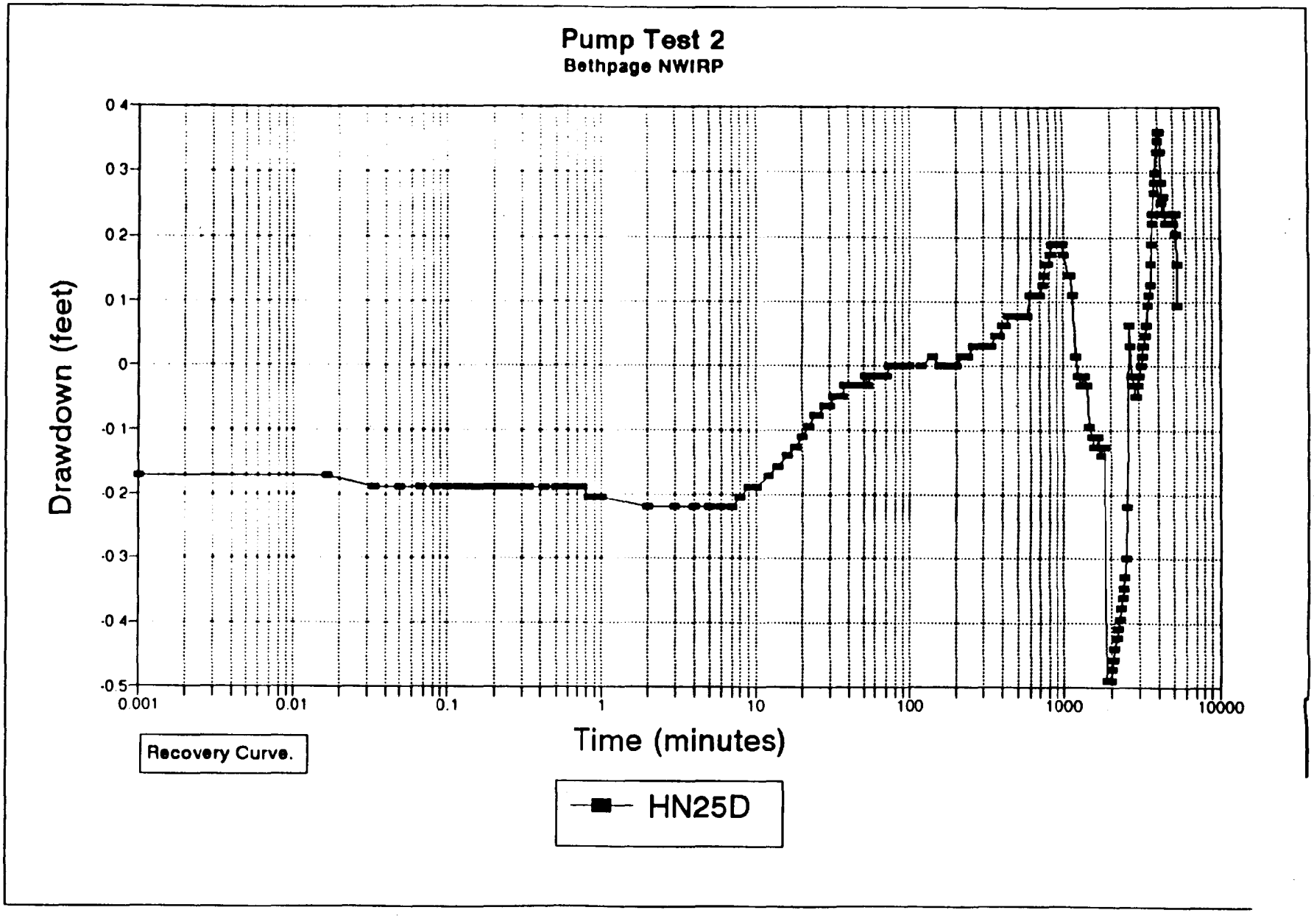

Pump Test 2
Bethpage NWIRP
Drawdown (feet)
0.1
0.05
0
-0.05
-0.1
0.001
0.01
0.1
1
10
100
1000
10000
Time (minutes)
Note: PW-11 pumping at 890 gpm.
HN25S

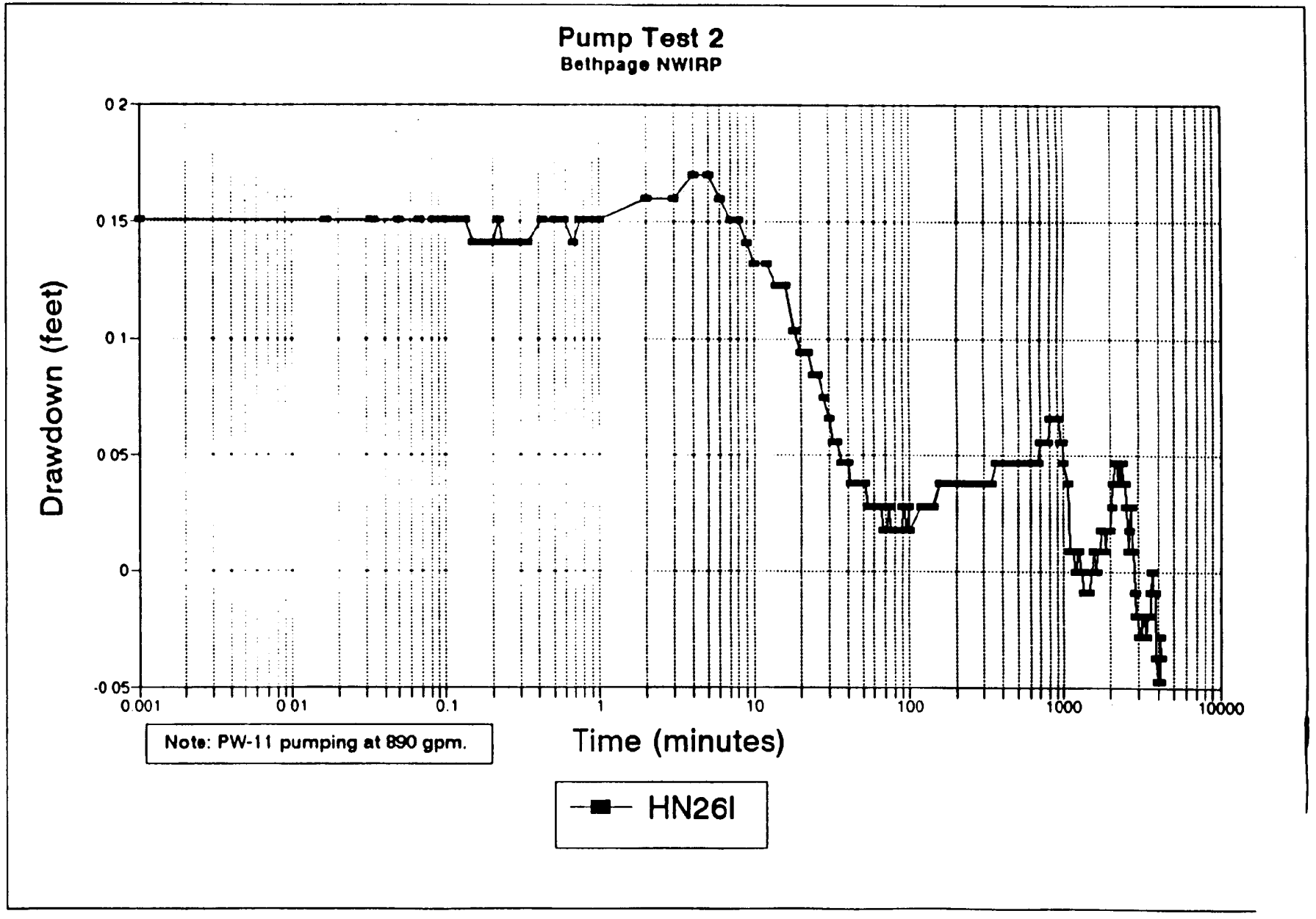

Pump Test 2
Bethpage NWIRP
Drawdown (feet)
0.1
0.08
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
-0.1
0.001
0.01
0.1
1
10
100
1000
10000
Time (minutes)
Recovery Curve.
HN25S

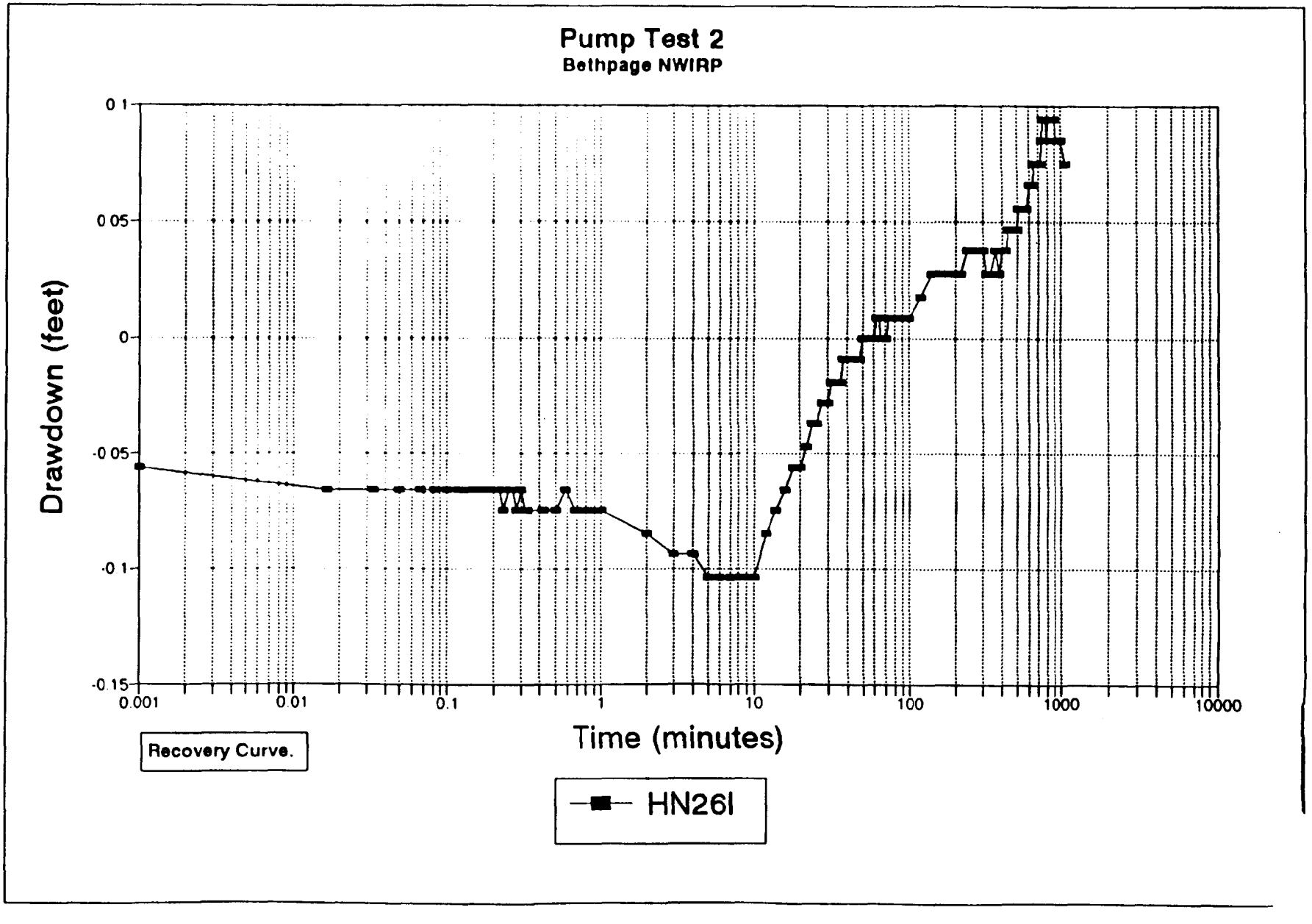

Pump Test 2
Bethpage NWIRP
Drawdown (feet)
0.1
0.05
0
-0.05
-0.1
0.001
0.01
0.1
1
10
100
1000
10000
Time (minutes)
Note: PW-11 pumping at 890 gpm.
HN25I

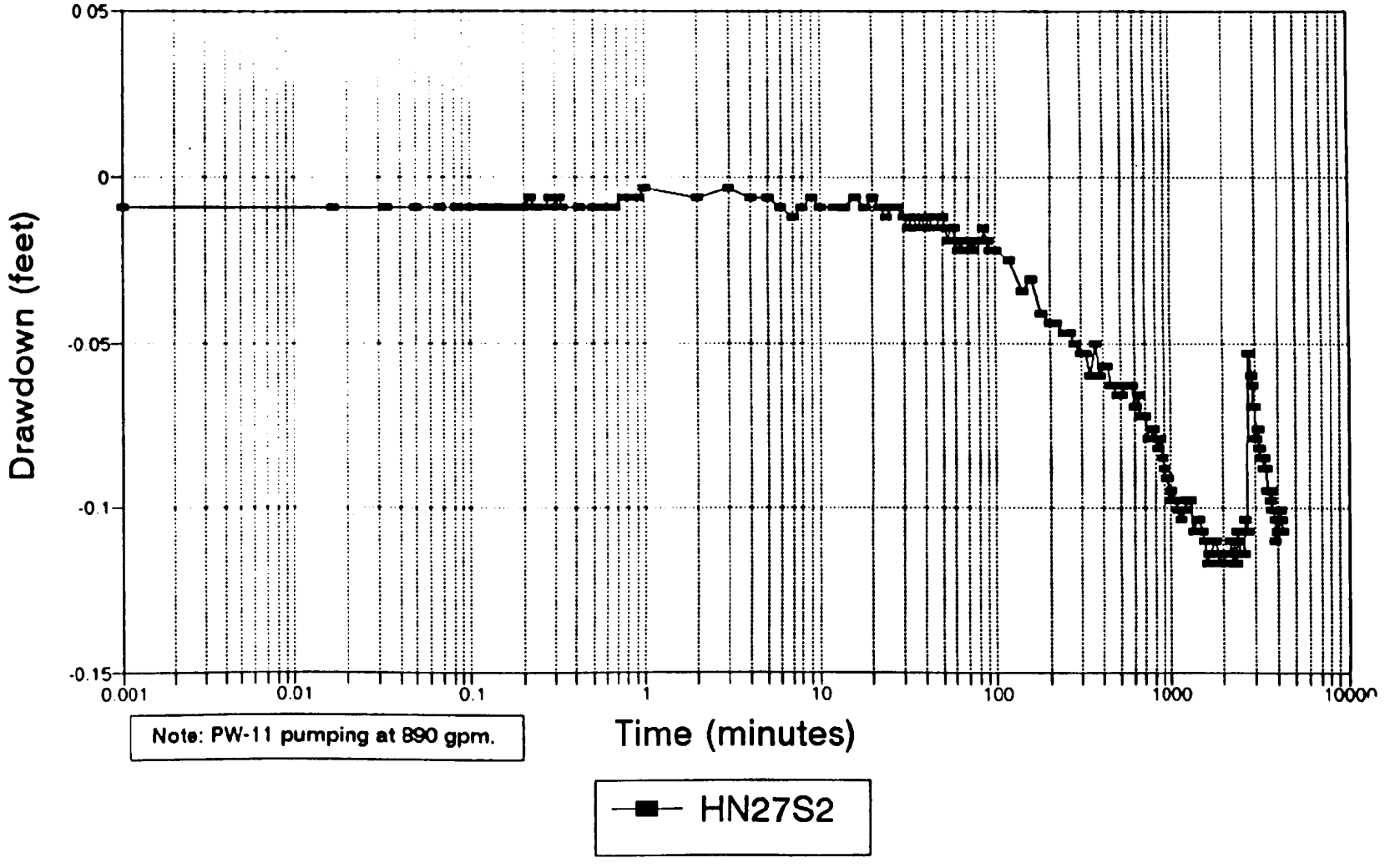

Pump Test 2
Bethpage NWIRP
Drawdown (feet)
0.2
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
0.001
0.01
0.1
1
10
100
1000
10000
Time (minutes)
Recovery Curve.
HN25I

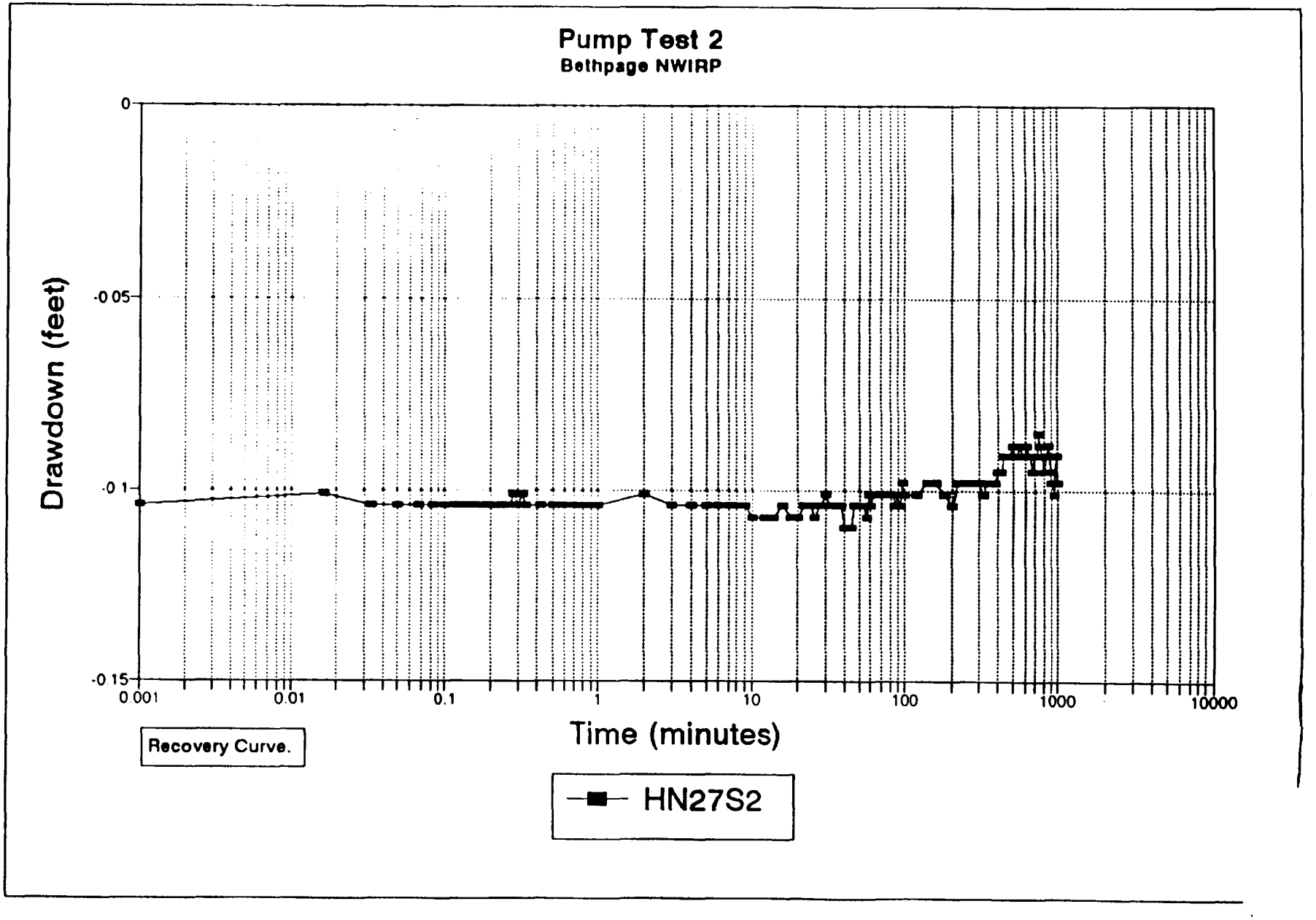

Pump Test 2
Bethpage NWIRP
Drawdown (feet)
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
0.001
0.01
0.1
1
10
100
1000
10000
Time (minutes)
Note: PW-11 pumping at 890 gpm.
HN25D

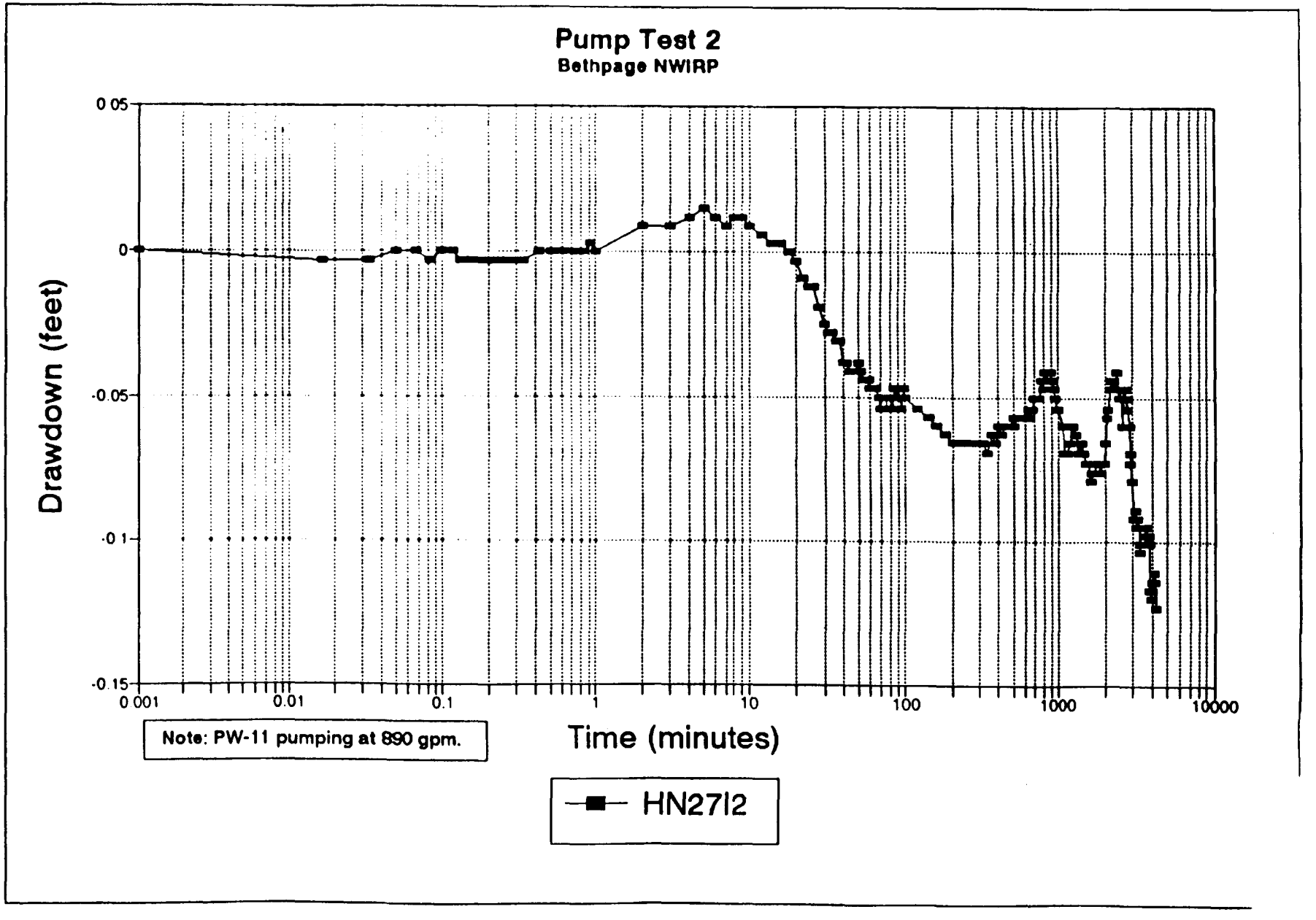

Pump Test 2
Bethpage NWIRP
Drawdown (feet)
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
0.001
0.01
0.1
1
10
100
1000
10000
Time (minutes)
Recovery Curve.
HN25D

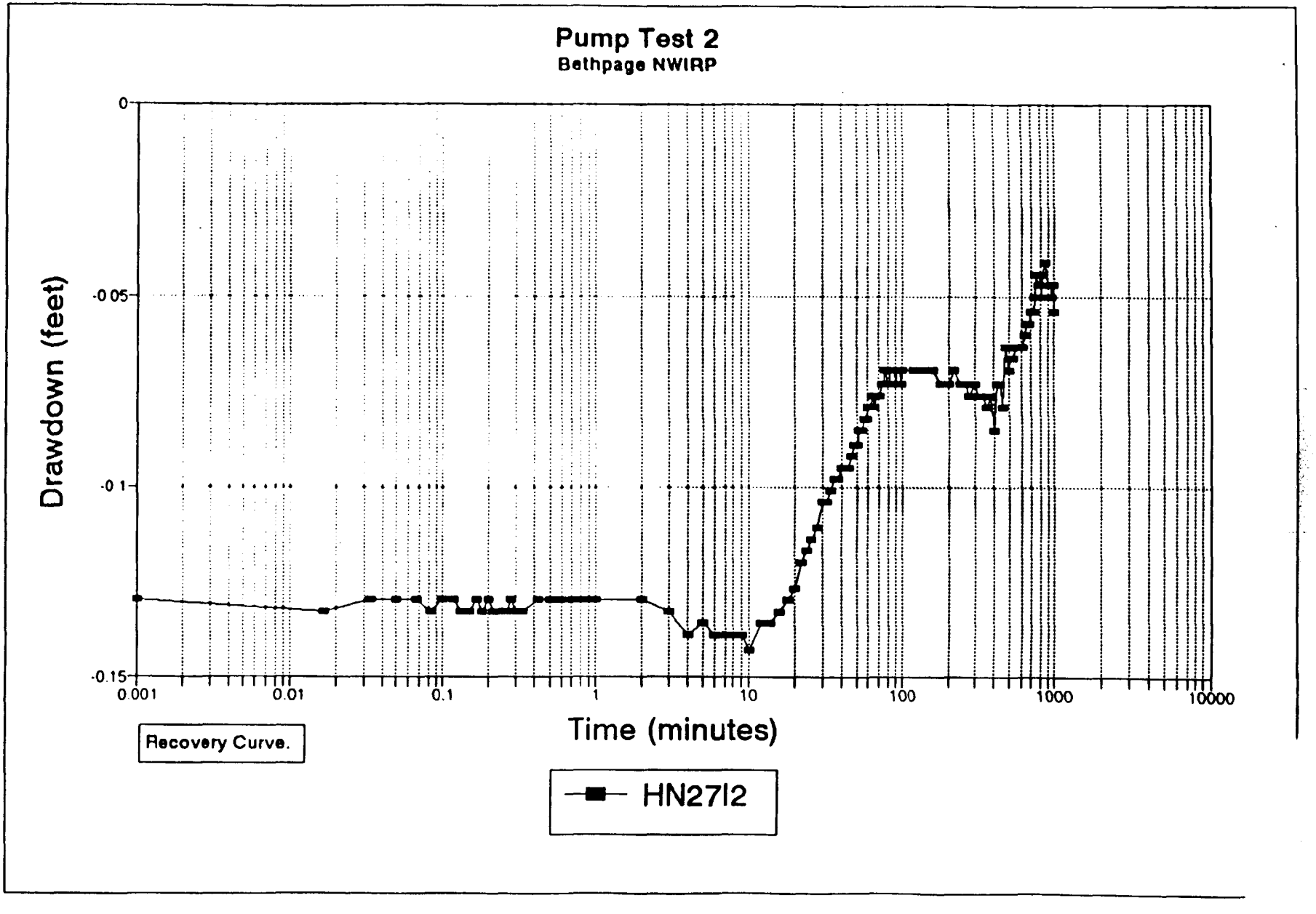

Pump Test 2
Bethpage NWIRP
Drawdown (feet)
0.2
0.15
0.1
0.05
0
-0.05
0.001
0.01
0.1
1
10
100
1000
10000
Time (minutes)
Note: PW-11 pumping at 890 gpm.
HN26I

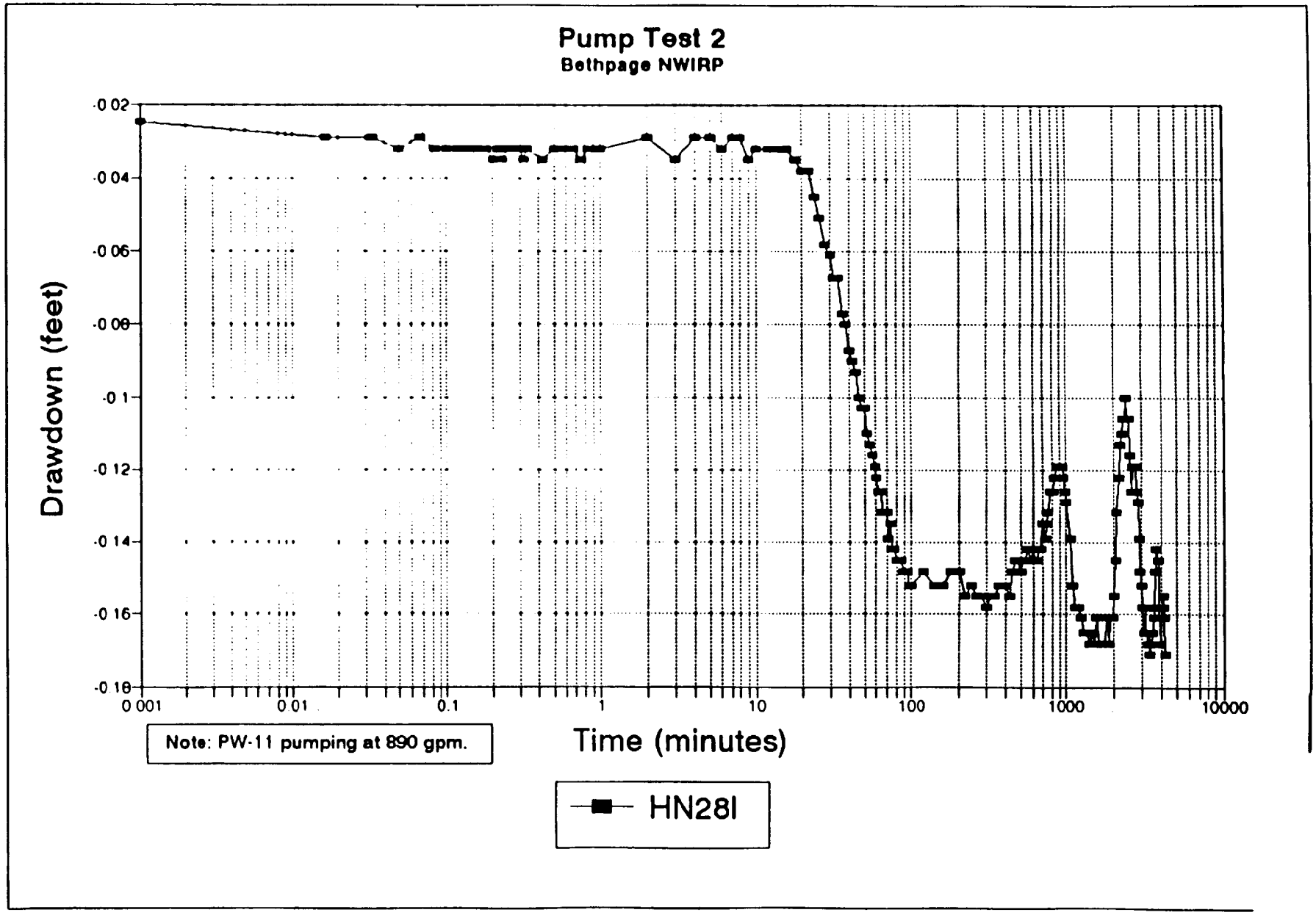

Pump Test 2
Bethpage NWIRP
Drawdown (feet)
0.1
0.05
0
-0.05
-0.1
-0.15
0.001
0.01
0.1
1
10
100
1000
10000
Time (minutes)
Recovery Curve.
HN26I

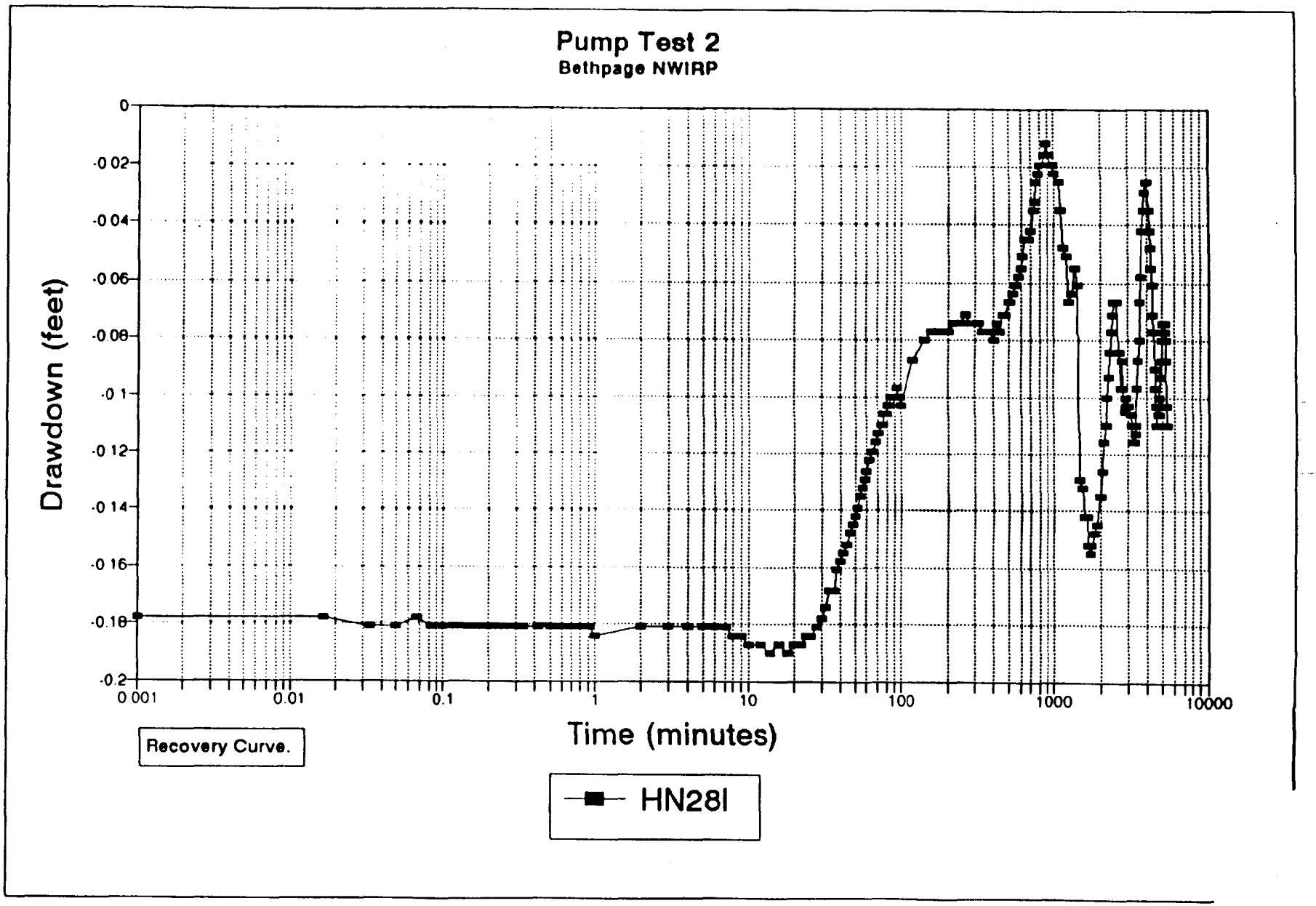

Pump Test 2
Bethpage NWIRP
Drawdown (feet)
0.05
0
-0.05
-0.1
-0.15
0.001
0.01
0.1
1
10
100
1000
10000
Time (minutes)
Note: PW-11 pumping at 890 gpm.
HN27S2

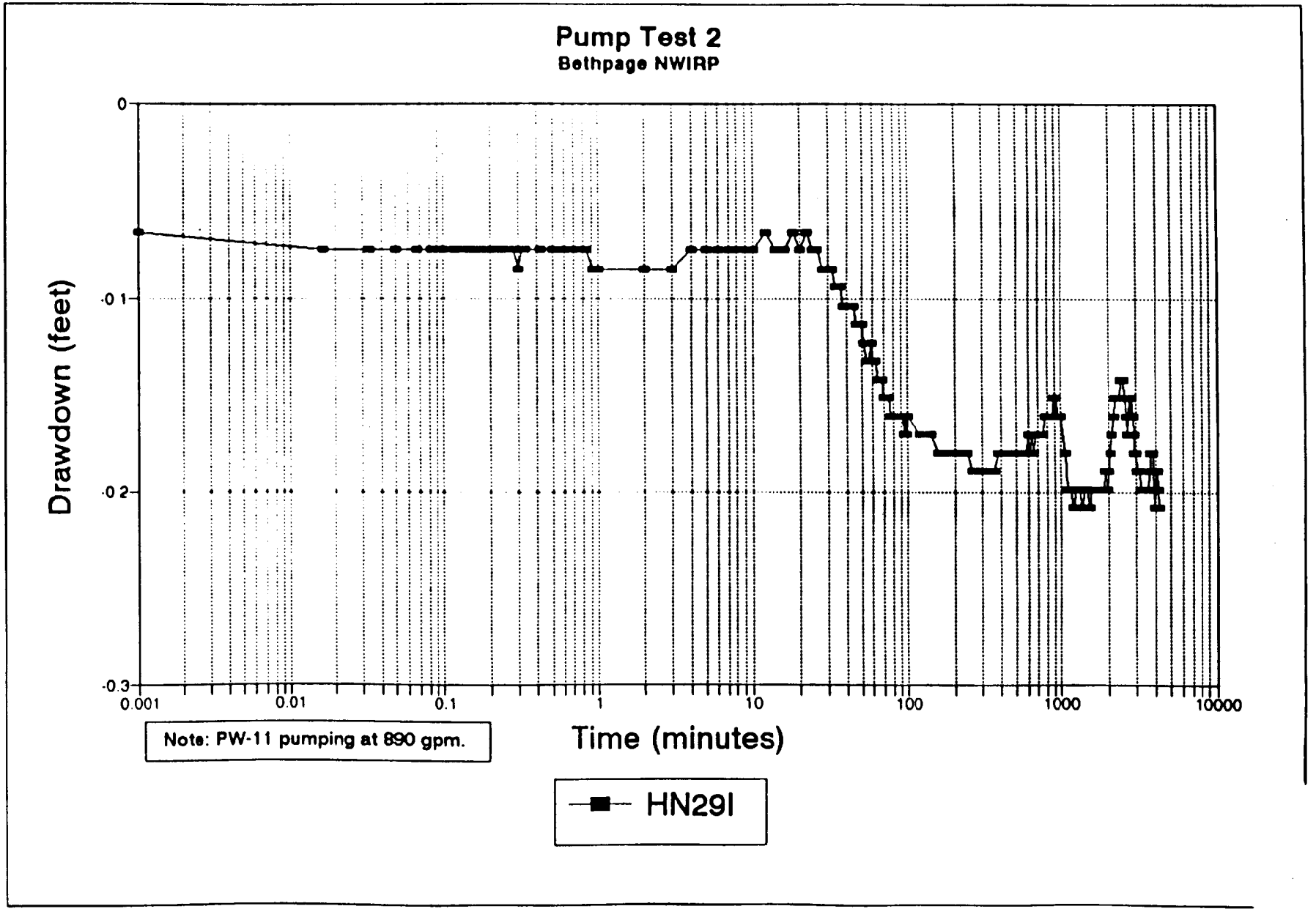

Pump Test 2
Bethpage NWIRP
Drawdown (feet)
0
-0.05
-0.1
-0.15
0.001
0.01
0.1
1
10
100
1000
10000
Time (minutes)
Recovery Curve.
HN27S2

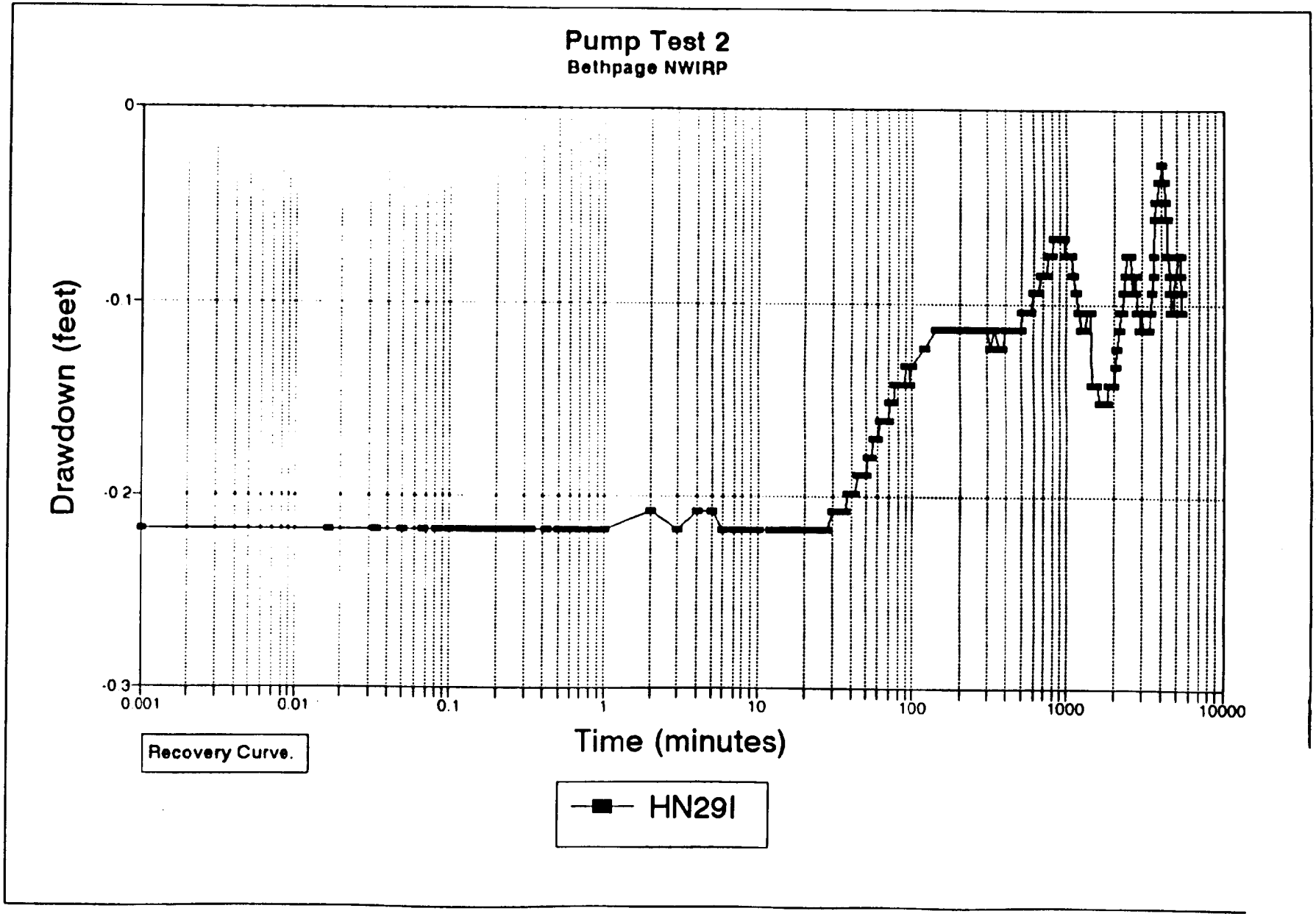

Pump Test 2
Bethpage NWIRP
Drawdown (feet)
0.05
0
-0.05
-0.1
-0.15
0.001
0.01
0.1
1
10
100
1000
10000
Time (minutes)
Note: PW-11 pumping at 890 gpm.
HN27I2

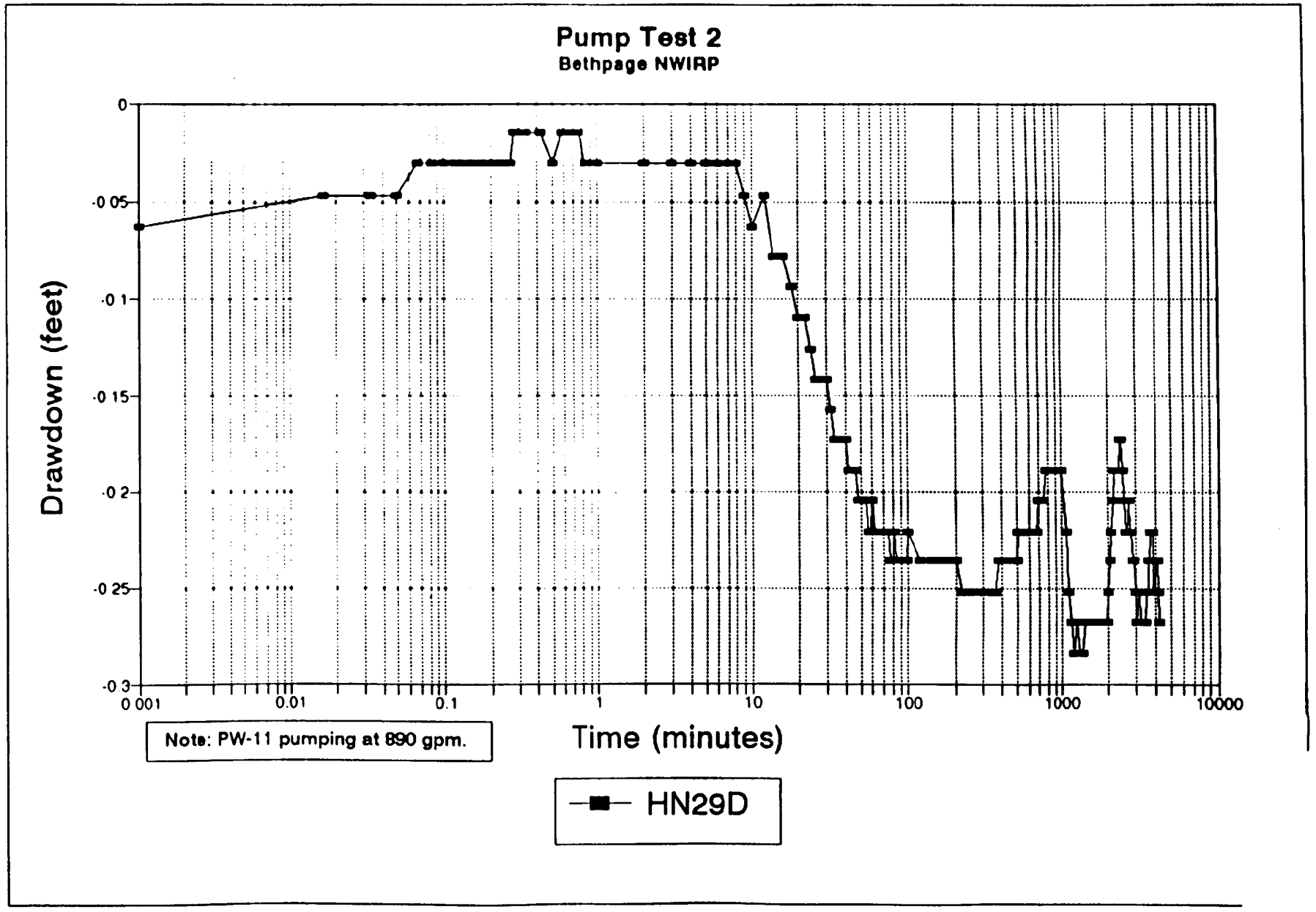

Pump Test 2
Bethpage NWIRP
Drawdown (feet)
0
-0.05
-0.1
-0.15
0.001
0.01
0.1
1
10
100
1000
10000
Time (minutes)
Recovery Curve.
HN27I2

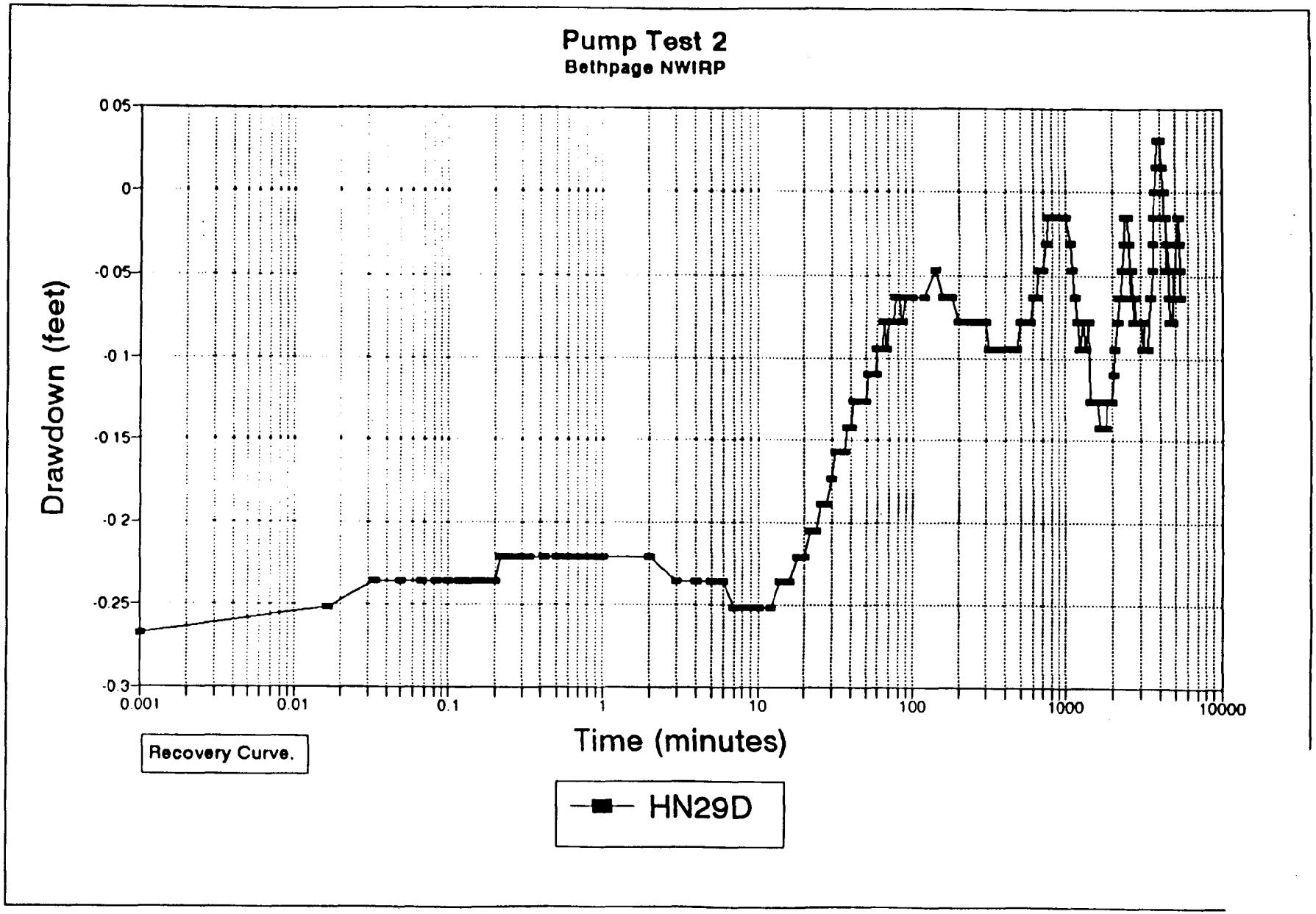

Pump Test 2
Bethpage NWIRP
Drawdown (feet)
-0.02
-0.04
-0.06
-0.08
-0.1
-0.12
-0.14
-0.16
-0.18
0.001
0.01
0.1
1
10
100
1000
10000
Time (minutes)
Note: PW-11 pumping at 890 gpm.
HN28I


Pump Test 2
Bethpage NWIRP
Drawdown (feet)
0
-0.02
-0.04
-0.06
-0.08
-0.1
-0.12
-0.14
-0.16
-0.18
-0.2
0.001
0.01
0.1
1
10
100
1000
10000
Time (minutes)
Recovery Curve.
HN28I


Pump Test 2
Bethpage NWIRP
Drawdown (feet)
0
-0.1
-0.2
-0.3
0.001
0.01
0.1
1
10
100
1000
10000
Time (minutes)
Note: PW-11 pumping at 890 gpm.
HN29I


Pump Test 2
Bethpage NWIRP
Drawdown (feet)
0
-0.1
-0.2
-0.3
0.001
0.01
0.1
1
10
100
1000
10000
Time (minutes)
Recovery Curve.
HN29I


Pump Test 2
Bethpage NWIRP
Drawdown (feet)
0
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
0.001
0.01
0.1
1
10
100
1000
10000
Time (minutes)
Note: PW-11 pumping at 890 gpm.
HN29D

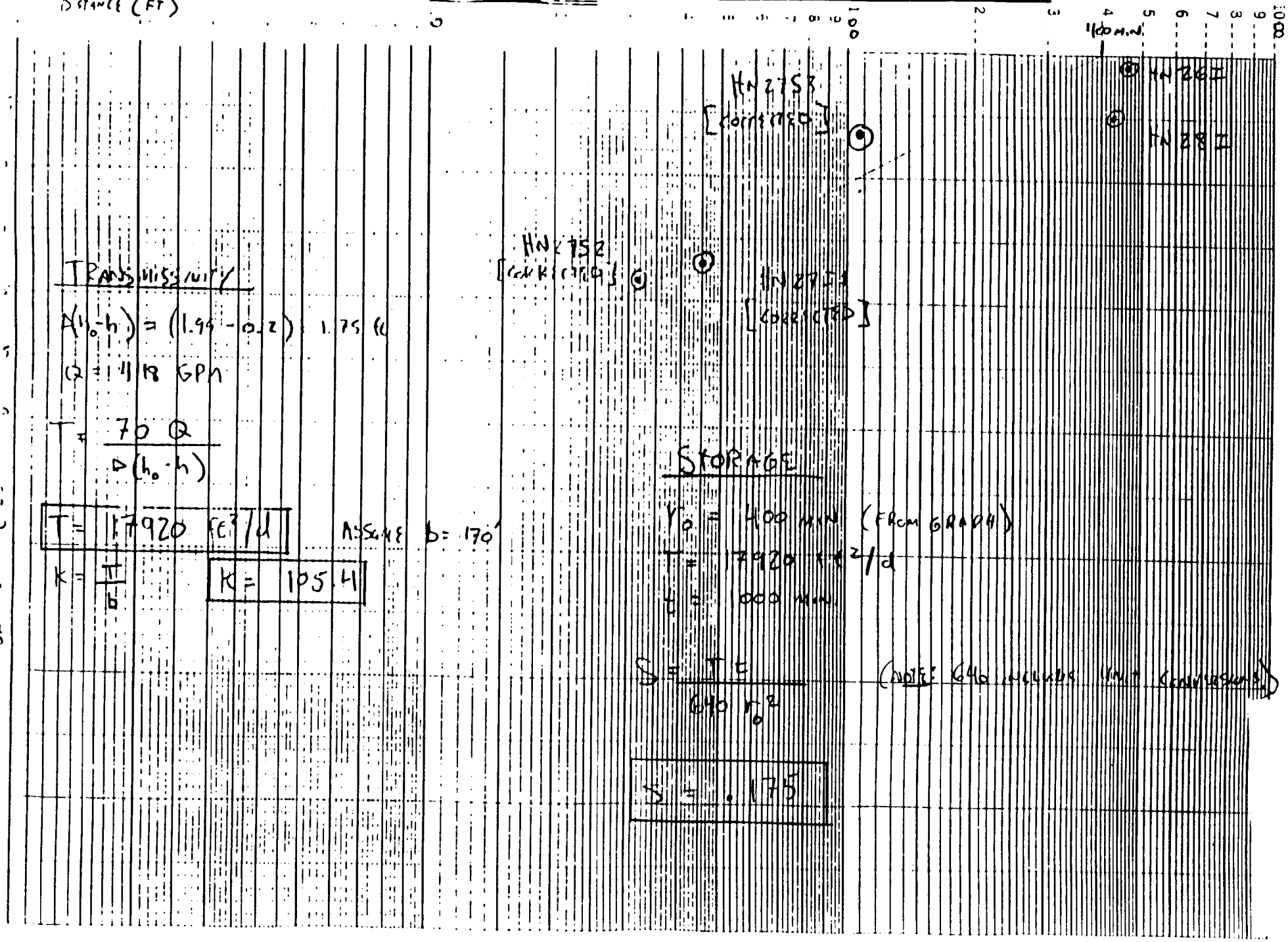

Pump Test 2
Bethpage NWIRP
Drawdown (feet)
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
0.001
0.01
0.1
1
10
100
1000
10000
Time (minutes)
Recovery Curve.
HN29D

BETHPAGE PUMPING TEST #1 AND #2:

PUMPING TEST CALCULATIONS

46 5490

DISTANCE DRAWDOWN AT 1000 MINUTES CORRECTED FOR PARTIAL PENETRATION



TRANSMISSIVITY

$A(h_o - h) = (1.94 - 0.2)\ 1.75\ ft$

$Q = 418\ GPM$

$T = \frac{70\ Q}{\Delta(h_o - h)}$

$\boxed{T = 17920\ ft^2/d}$ ASSUME $b = 170'$

$K = \frac{T}{b}$ $\boxed{K = 105.4}$

STORAGE

$r_o = 400\ MIN$ (FROM GRAPH)

$T = 17920\ ft^2/d$

$t_o = 1000\ MIN$

$S = \frac{Tt}{640\ r_o^2}$ (NOTE: 640 INCLUDES UNIT CONVERSIONS)

$\boxed{S = .175}$

CHECKED BY 2-26-93

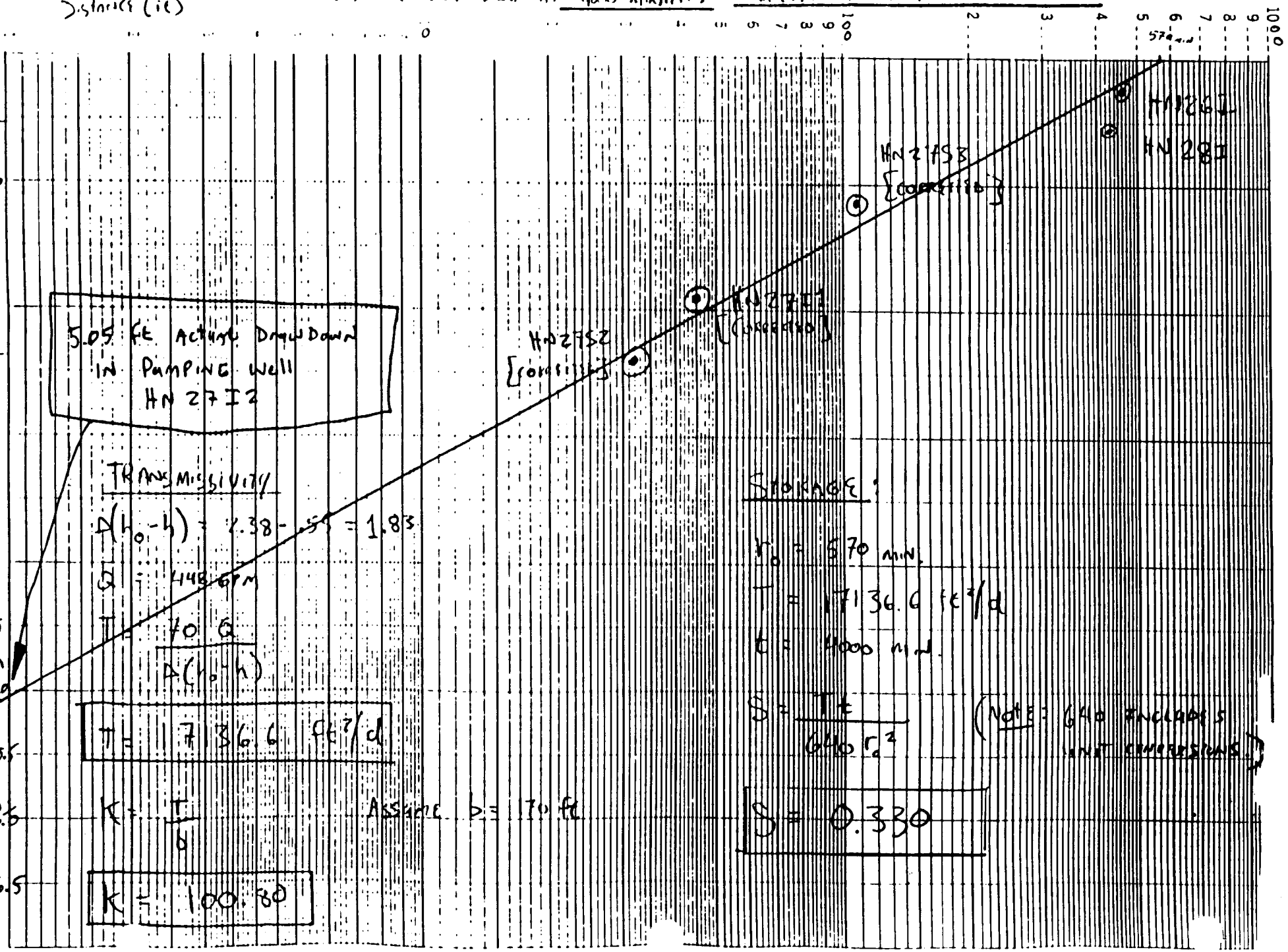
BETHAGE PUMPING TEST #1

K&E SEMI-LOGARITHMIC

46 5490

DISTANCE DRAWDOWN AT 1000 MINUTES CORRECTED FOR PARTIAL PENETRATION

Distance (ft)



5.05 ft ACTUAL DRAWDOWN IN PUMPING WELL HN 27I2

TRANSMISSIVITY

$\Delta(h_o - h) = 2.38 - .55 = 1.83$

$Q = 448$ GPM

$T = \frac{70\,Q}{\Delta(h_o - h)}$

$T = 7366$ ft²/d

$K = \frac{T}{b}$ ASSUME $b = 170$ ft

$K = 100.80$

STORAGE:

$r_o = 670$ MIN.

$T = 17136.6$ ft²/d

$t = 1000$ min.

$S = \frac{Tt}{640\,r_o^2}$ (NOTE: 640 INCLUDES UNIT CONVERSIONS)

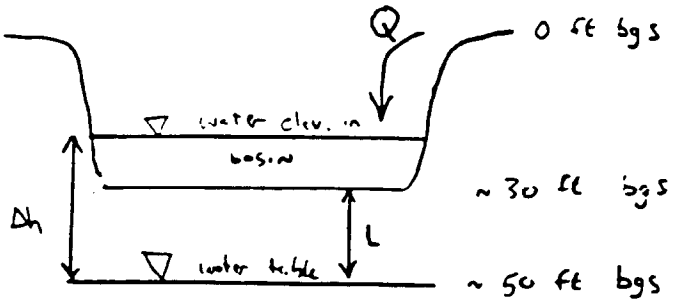
$S = 0.330$

CHECKED BY

HALLIBURTON NUS Environmental Corporation and Subsidiaries			STANDARD CALCULATION SHEET
CLIENT:	FILE NO.: 1453	BY: PLN	PAGE OF
SUBJECT: Bethpage Pumping Test #1		CHECKED BY:	DATE: 2/22/93

Estimate of Vertical Conductivity from Recharge Basin Data

Method from Holtz + Kovacs, 1981, Pg. 206-207.



$$K = \frac{\Delta Q\, L}{\Delta h\, A\, t}$$

ΔQ = Change in flow into basin = 448 gpm (From KN273₂)
= 86246 ft^3/d

L = 70 ft

Δh = 0.8 ft

A = Length × width = 370 × 320' = 92300 ft^2

t = 1 day

$$K = \frac{(86246\ ft^3/d)(70\ ft)}{(0.8\ ft)(92{,}300\ ft^2)(1\ d)} = \boxed{23.36\ ft/d}$$

HALLIBURTON NUS Environmental Corporation and Subsidiaries	STANDARD CALCULATION SHEET

CLIENT:	FILE NO.: 1953	BY: PLN	PAGE 1 OF 3
SUBJECT: BETHPAGE PUMP TEST #1		CHECKED BY: DAY	DATE: 2/18/93

NEUMAN CURVE FITTING - EARLY TIME FOR HN 27I 1

HORIZONTAL HYDRAULIC CONDUCTIVITY KRUSEMAN 1989, EQUATION 5.2

$$S = \frac{Q}{4\pi k_h D} W(u_A, \beta)$$

Q = 448 gpm = 86246.0 ft^3/d
D = 170 ft
S = 1.0 ft (FROM EARLY MATCH-POINT)
$W(u_A, \beta) = 1$ (FROM EARLY MATCH-POINT)

$$k_h = \frac{Q}{4\pi D S} W(u_A, \beta)$$

$$k_h = \frac{86246.0 \ ft^3/d}{4\pi (170 \ ft)(1.0 \ ft)} = \boxed{40.37 \ ft/d}$$

STORAGE KRUSEMAN, 1989, EQUATION 5.3

$$u_A = \frac{r^2 S_A}{4 k_h D t}$$

r = 45 ft
D = 170 ft
t = .45 min. = .0003 d (FROM early match)
u_A = 1.0 (FROM early match point)
k_h = 40.37 ft/d

$$S_A = u_A \frac{4 k_h D t}{r^2}$$

$$S_A = \frac{1.0 (4)(40.37 \ ft/d)(170 \ ft)(.0003 \ d)}{(45 \ ft)^2}$$

$$\boxed{S_A = 0.0041}$$

HALLIBURTON NUS Environmental Corporation and Subsidiaries	STANDARD CALCULATION SHEET

CLIENT:	FILE NO.: 1953	BY: PLN	PAGE 2 OF 3
SUBJECT: Bethpage Pump Test #1		CHECKED BY: DAY	DATE: 2/18/93

NEUMAN CURVE FITTING FOR HN 27 F_1

VERTICAL HYDRAULIC CONDUCTIVITY KRUSEMAN EQUATION 5.6

$$\beta = \frac{r^2 k_v}{D^2 k_h}$$

$r = 45$ ft
$D = 170$ ft
$\beta = 0.01$ (FROM CURVE MATCH)

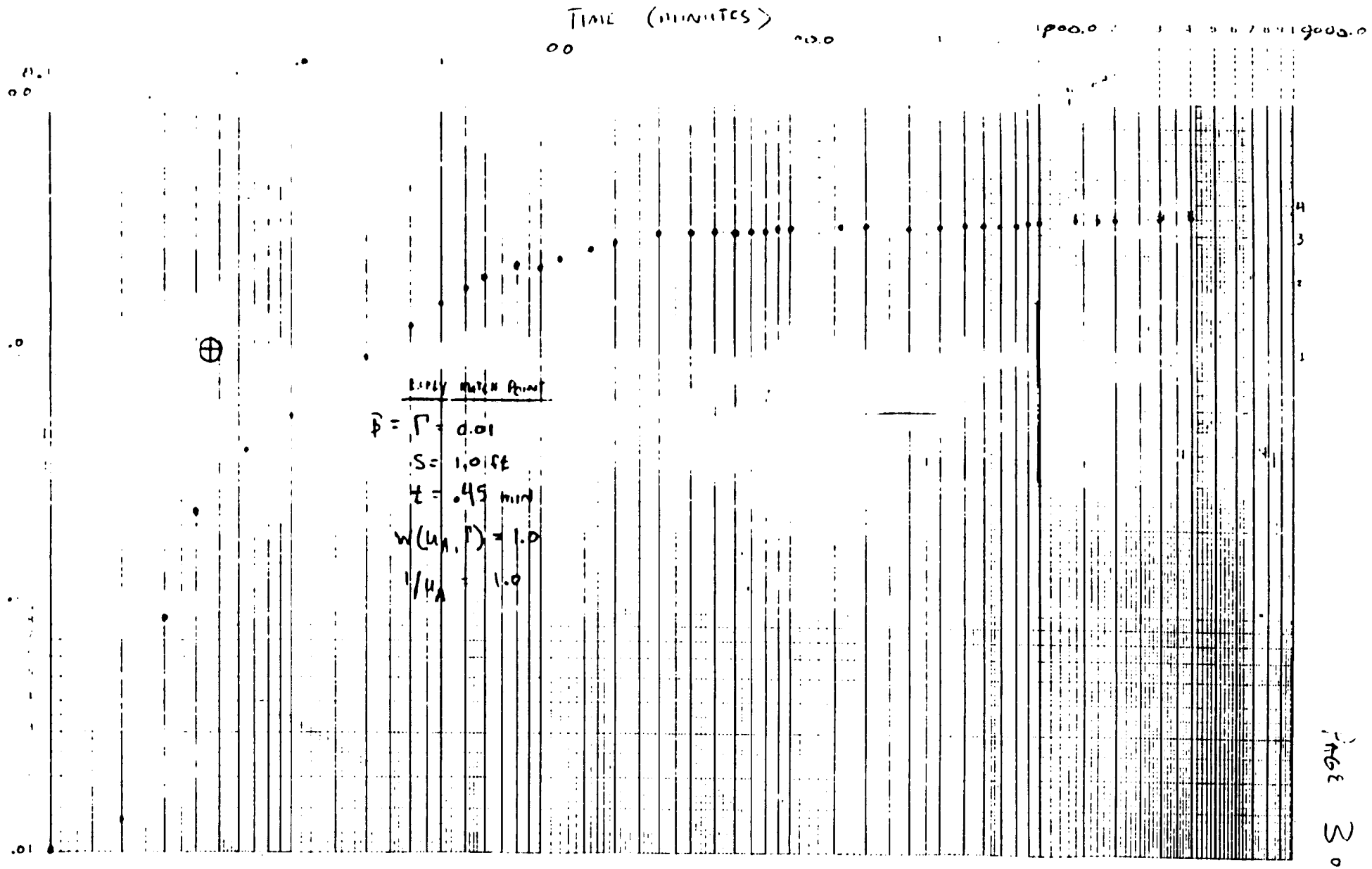
$$k_v = \frac{\beta D^2 k_h}{r^2}$$

k_h early $= 40.37$ ft/d

$$k_v \text{ early} = \frac{(0.01)(170 \text{ ft})^2 (40.37 \text{ ft/d})}{(45 \text{ ft})^2}$$

$$\boxed{k_v \text{ early} = 5.76 \text{ ft/d}}$$

HN 27 I 1 TIME - DRAWDOWN PLOT (PUMP TEST 4-5)



NOTE USING NEUMAN, 1975 TYPE CURVE FOR DELAYED GRAVITY RESPONSE.

HALLIBURTON NUS Environmental Corporation and Subsidiaries			STANDARD CALCULATION SHEET
CLIENT:	FILE NO.: 1953	BY: PLN	PAGE 1 OF 3
SUBJECT: BETHPAGE Pump Test #1		CHECKED BY: DAY	DATE: 2/25/95

NEUMAN CURVE FITTING - EARLY TIME FOR HN 2752
CORRECTED FOR PARTIAL PENETRATION.

HORIZONTAL HYDRAULIC CONDUCTIVITY : Kruseman 1989, Equation 5.2

$$S = \frac{Q}{4\pi K_h D}$$

Q = 448 GPM = 86246.0 ft^3/d
D = 170 ft
S = .98 ft (From EARLY Match Point)
$W(u_A, \beta) = 1$

$$K_h = \frac{Q}{4\pi D S}$$

$$K_h = \frac{86246.0\ ft^3/d}{4\pi\ (170\ ft)(.98\ ft)} = \boxed{41.19\ ft/d}$$

STORAGE : Kruseman, 1989 Equation 5.3

$$u_A = \frac{r^2 S_A}{4 K_h D t}$$

r = 31.5 ft
D = 170 ft
t = 2.8 min = 0.0019 days (From EARLY Match point)
u_A = 1.0 (from EARLY Match Point)
K_h = 41.19 ft/d

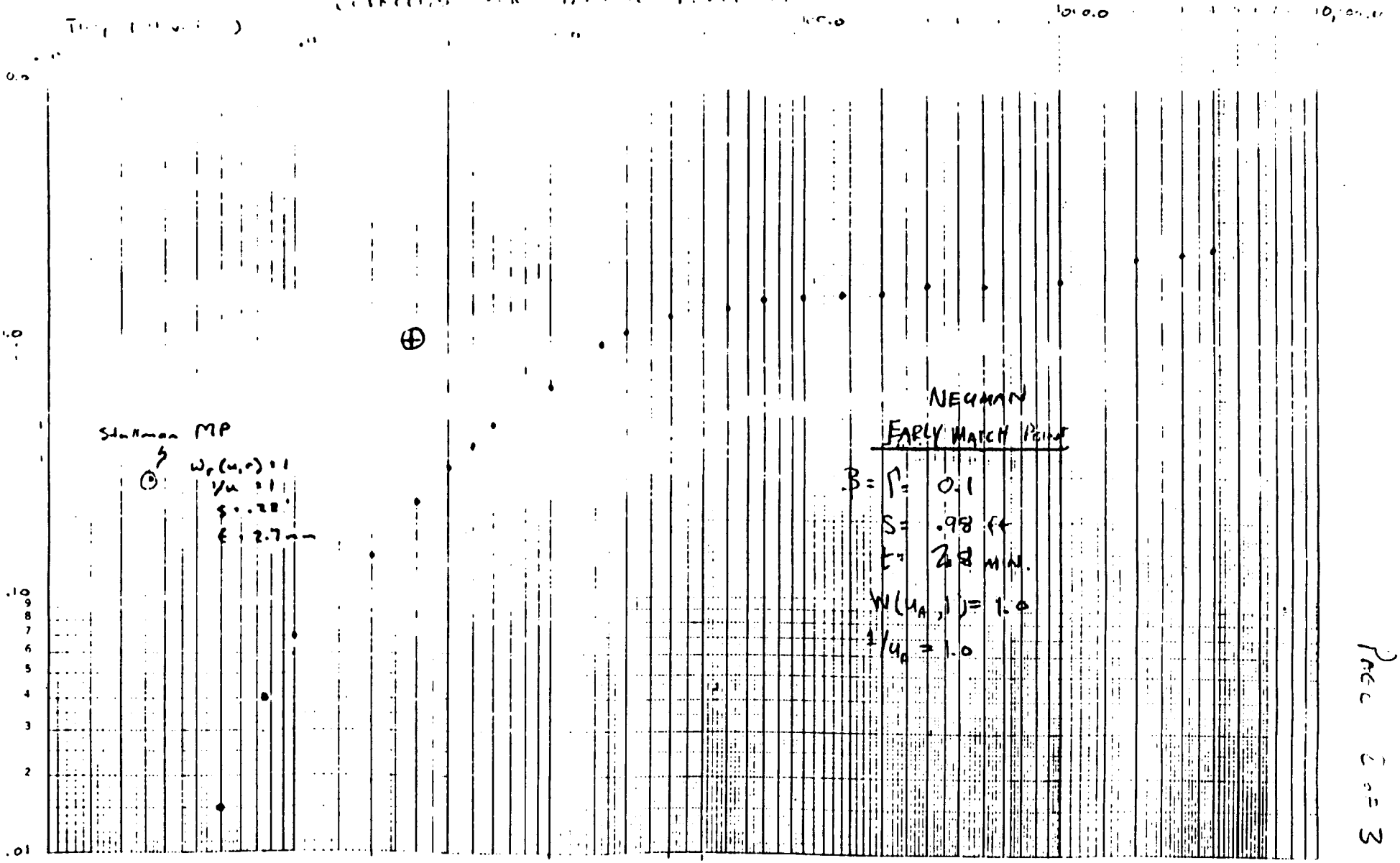
$$S_A = \frac{u_A\ 4\ K_h\ D\ t}{r^2}$$

$$S_A = \frac{(1.0)(4)(41.19\ ft/d)(170\ ft)(.0019\ d)}{(31.5\ ft)^2}$$

$$\boxed{S_A = 0.054}$$

[illegible] TIME - DRAWDOWN PLOT (PUMP TEST #1)

CORRECTED FOR WELL [illegible] EFFECTS



NOTE: NEUMAN CURVES FOR UNCONFINED AQUIFER WITH DELAYED GRAVITY RESPONSE USED FOR CURVE MATCH.

HALLIBURTON NUS Environmental Corporation and Subsidiaries — **STANDARD CALCULATION SHEET**

CLIENT:	FILE NO.: 1953	BY: PLN	PAGE 3 OF 3
SUBJECT: BETHPAGE PUMPTEST #1		CHECKED BY:	DATE: 2/23/93

TIME-DRAWDOWN DATA FOR HN2752, CORRECTED FOR PARTIAL PENETRATION EFFECTS

TIME into TEST (MIN)	MEASURED DRAWDOWN	PARTIAL PENETRATION CORRECTION	CORRECTED DRAWDOWN (ft)
0.3	0	0	
0.5	0.015	0	0.015
0.75	0.04	0	0.04
1.0	0.06	0.01	0.07
2.0	0.087	.06	.147
3.0	0.11	.13	.24
4.0	0.119	.20	.319
5.0	0.129	.26	.389
6.0	0.14	.33	.47
10.0	0.126	.54	.666
16	0.165	.81	.975
20	0.19	.91	1.09
30	0.203	1.04	1.24
50	0.24	1.15	1.39
70	0.268	1.17	1.44
100	0.29	1.20	1.49
140	0.323	1.19	1.51
200	0.37	1.16	1.53
300	0.433	1.12	1.55
400	0.55	1.09	1.64
500	0.647	.09	1.73
1000	0.77	1.08	1.85
2000	1.06	1.08	2.14
3000	1.23	1.09	2.31
4000	1.31	1.08	2.39

PT2.bas INPUTS

Production well discharge = 448 gpm
Aq. Storativity = 0.1
TIME = ___ min
DD with full Penetration = 1.0 ft
Horiz. hydraulic Conductivity = 580 gpd/ft²
VERT. hyd. Conductivity = 72 gpd/ft²
radial distance to well = 31.5 ft
Aq. Thickness = 170 ft
Dist. to bottom Prod. well = 85 ft
Distance to top Prod. well = 55 ft
Dist to bottom of obs. well = 10 ft
Dist. to top obs well = 0 ft

Note: Partial Penetration correction determined using PT2.bas Program, WALTON, 1985.

HALLIBURTON NUS Environmental Corporation and Subsidiaries			STANDARD CALCULATION SHEET
CLIENT: NAVY	FILE NO.: 1953	BY: PLN	PAGE 1 OF 3
SUBJECT: BETHPAGE Pump TEST #1		CHECKED BY: DAY	DATE: 2/24/93

NEUMAN CURVE FITTING · EARLY TIME FOR HN27S3
CORRECTED FOR PARTIAL PENETRATION EFFECTS

HORIZONTAL HYDRAULIC CONDUCTIVITY : KRUSEMAN, 1989, Equation 5.2

$$S = \frac{Q}{4\pi K_h D}$$

Q = 448 gpm = 86246.0 ft^3/d
D = 170 ft
S = 0.52 ft (From EARLY Notch point)
W (uA, β) = 1 (From EARLY Notch point)

$$K_h = \frac{Q}{4\pi D S}$$

$$K_h = \frac{86246.0\ ft^3/d}{4\pi\ (170\ ft)(0.52\ ft)} = \boxed{77.64\ ft/d}$$

STORAGE KRUSEMAN 1989 Equation 5.3

$$u_A = \frac{r^2 S_A}{4 K_h D t}$$

r = 108.5 ft
D = 170 ft
t = 14.0 min = .0097 d (From EARLY Notch point)
u_A = 1.0 (from EARLY notch point)
K_h = 77.64 ft/d

$$S_A = \frac{u_A\ 4\ K_h\ D\ t}{r^2}$$

$$S_A = \frac{(1.14)(77.64\ ft/d)(170\ ft)(.0097\ d)}{(108.5\ ft)^2}$$

$$\boxed{S_A = 0.044}$$

HALLIBURTON NUS Environmental Corporation and Subsidiaries			STANDARD CALCULATION SHEET
CLIENT: NAVY	FILE NO.: 1953	BY: PCN	PAGE 2 OF 3
SUBJECT: BETHPAGE Pump TEST #1		CHECKED BY:	DATE: 2/24/93

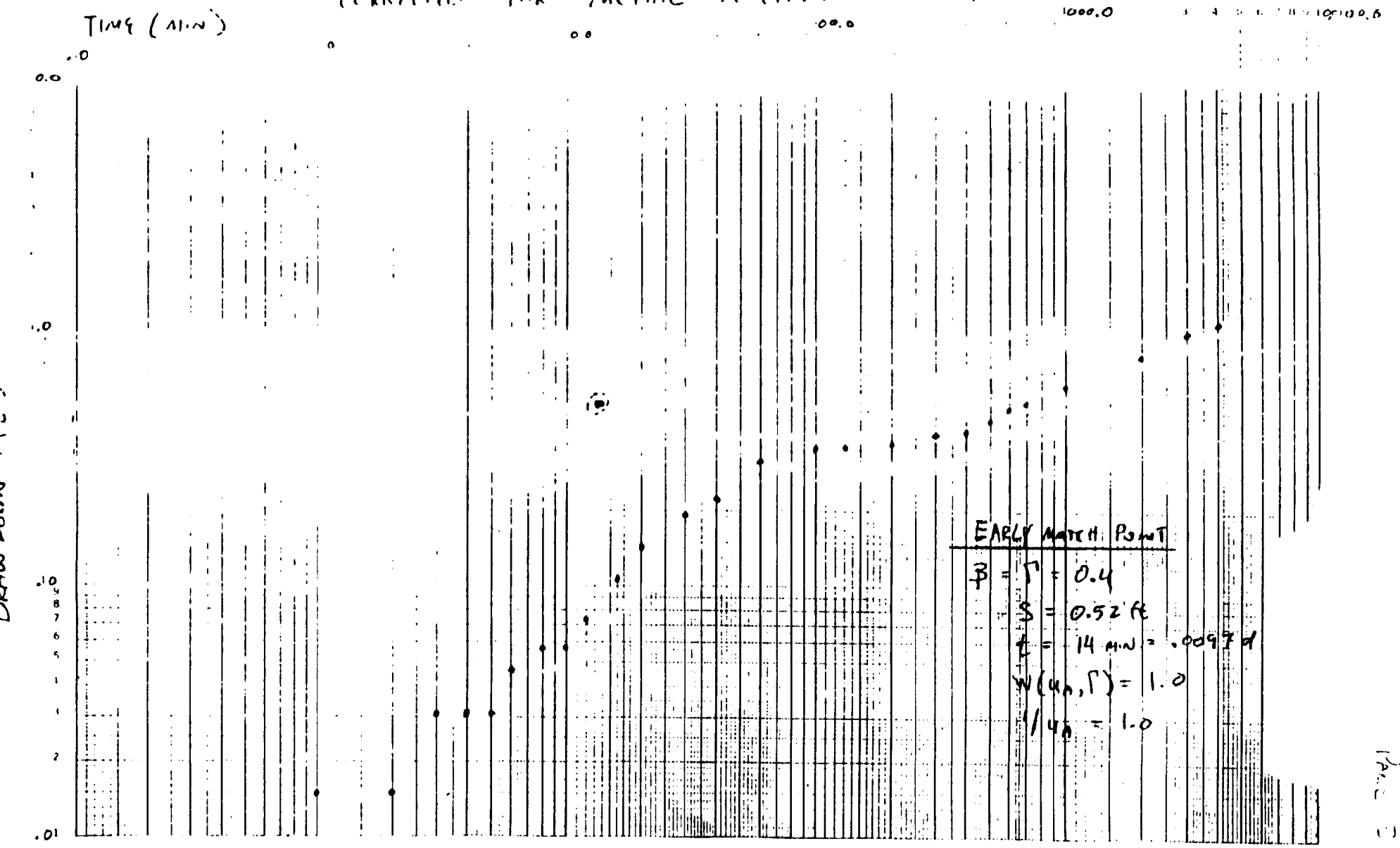
HN2753 CORRECTION FOR PARTIAL PENETRATION

TIME (MIN)	MEASURED DRAWDOWN	CORRECTION (FC)	CORRECTED DRAWDOWN
0.75	0	0	0
1.0	0.015	0	0.015
2.0	0.015	0	0.015
3.0	0.031	0	0.031
4.0	0.031	0	0.031
5.0	0.031	0	0.031
6.0	0.047	0	0.047
8.0	0.047	0.01	.057
10.0	0.047	0.01	.057
12	0.063	0.01	.073
16	0.078	0.03	.108
20	0.094	0.05	.144
30	0.094	0.10	.194
40	.11	.12	.23
60	0.126	.19	.316
100	0.142	.21	.352
140	0.173	0.19	.363
200	0.205	0.17	.375
300	0.268	0.14	.408
400	0.299	0.13	.429
500	0.347	0.12	.467
600	0.374	0.12	.514
700	0.426	0.12	.546
1000	0.520	0.12	.64
2000	0.773	0.11	.877
3000	0.931	11	1.04
4000	1.01	0.11	1.12

INPUT FOR PT2 PROGRAM

Discharge = 448 gpm
Storage = 0.1
K_h = 580 gpd/ft²
K_v = 72 gpd/ft²
distance = 108.5
aq. thickness
bot. prod well = 85
top. prod. well = 55
bot obs well = 10
Top obs well = 0

HNETSS TIME-DRAWDOWN PLOT (PUMP TEST #1)
CORRECTED FOR PARTIAL PENETRATION EFFECTS



HALLIBURTON NUS Environmental Corporation and Subsidiaries			STANDARD CALCULATION SHEET
CLIENT:	FILE NO.: 1953	BY: DLN	PAGE 1 OF 2
SUBJECT: BETHPAGE PUMP TEST #1		CHECKED BY: MJS	DATE: 2-19-93

NEUMAN CURVE FITTING – EARLY TIME FOR MW 27I1, CORRECTED FOR PARTIAL PENETRATION EFFECTS.

HORIZONTAL HYDRAULIC CONDUCTIVITY – KRUSEMAN 1989, Equation 5.2

$$S = \frac{Q}{4\pi K_h D} W(u_A, \beta)$$

$$K_h = \frac{Q}{4\pi D S} W(u_A, \beta)$$

Q = 448 gpm = 86246.0 ft³/d
D = 170 ft
S = 1.2 ft (From early match point)
W(u_A, β) = 1 (From early match point)
TYPE CURVE = 0.1 Γ

$$K_h = \frac{86246 \text{ ft}^3/\text{d}}{4\pi (170 \text{ ft})(1.2 \text{ ft})}(1) = \boxed{33.64 \text{ ft/d}}$$

STORAGE: Kruseman, 1989 Equation 5.3

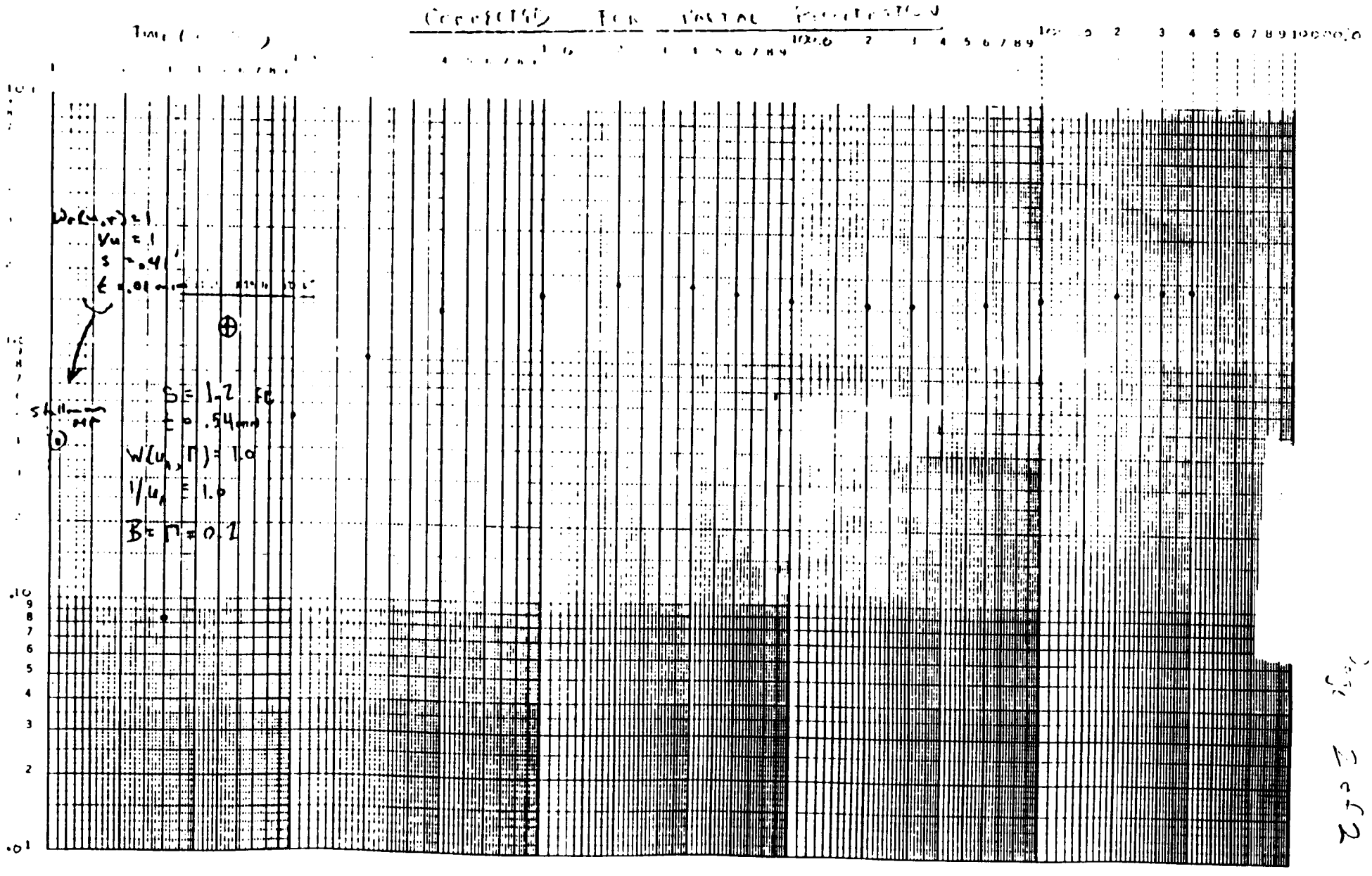
$$u_A = \frac{r^2 S_A}{4 K_h D t}$$

$$S_A = u_A \frac{4 K_h D t}{r^2}$$

r = 45 ft
D = 170 ft
t = .54 min = .0004 d (from early match)
u_A = 1.0 (from early match)
K_h = 33.64 ft/d

$$S_A = \frac{(1)(4)(33.64 \text{ ft/d})(170 \text{ ft})(.0004 \text{ d})}{(45 \text{ ft})^2}$$

$$\boxed{S_A = 0.0045}$$


Corrected for Vertical Penetration
$W_o(u,r) = 1$
$V_u = 1$
$s = .41$
$t = .01$
$S = 1.2$ ft
$t = .54$ mm
$W(u_1, \Gamma) = 1.0$
$1/u_1 = 1.0$
$B = \Gamma = 0.1$

HALLIBURTON NUS Environmental Corporation and Subsidiaries			STANDARD CALCULATION SHEET
CLIENT:	FILE NO.: 1953	BY: PLN	PAGE 1 OF 3
SUBJECT: BETHPAGE PUMP TEST #1		CHECKED BY: SJC	DATE: 2/18/03

NEUMAN CURVE - FITTING - EARLY TIME FOR HN28I

HORIZONTAL HYDRAULIC CONDUCTIVITY KRUSEMAN EQUATION 5.2

$$S = \frac{Q}{4\pi K_h D} W(u_A, \beta)$$

$$K_h = \frac{Q}{4\pi D S} W(u_A, \beta)$$

Q = 448 gpm = 86246.0 ft^3/d
D = 170 ft
S = .65 ft (From early MATCH-POINT)
$W(u_A, \beta)$ = 1 (From early MATCH-POINT)

$$K_h = \frac{86246.0\ ft^3/d}{4\pi (170\ ft)(.65\ ft)} (1.0) = \boxed{62.11\ ft/d}$$

STORAGE: KRUSEMAN EQUATION 5.3

$$u_A = \frac{r^2 S_A}{4 K_h D t}$$

r = 425 ft
D = 170 ft
t = 7.4 MIN. = 0.0051 days (MATCH-POINT)
u_A = 1.0 (From early MATCH-POINT)

$$S_A = u_A \frac{4 K_h D t}{r^2}$$

$$S_A = \frac{1.0\ 4 (62.11\ ft/d)(170\ ft)(0.0051\ d)}{(425\ ft)^2}$$

$$\boxed{S_A = 0.0012}$$

HALLIBURTON NUS Environmental Corporation and Subsidiaries			STANDARD CALCULATION SHEET
CLIENT:	FILE NO.: 1953	BY: PLN	PAGE 2 OF 3
SUBJECT: Bethpage Pump test #1		CHECKED BY: SJC	DATE: 2/18/93

Neuman Curve Fitting for HN 28I

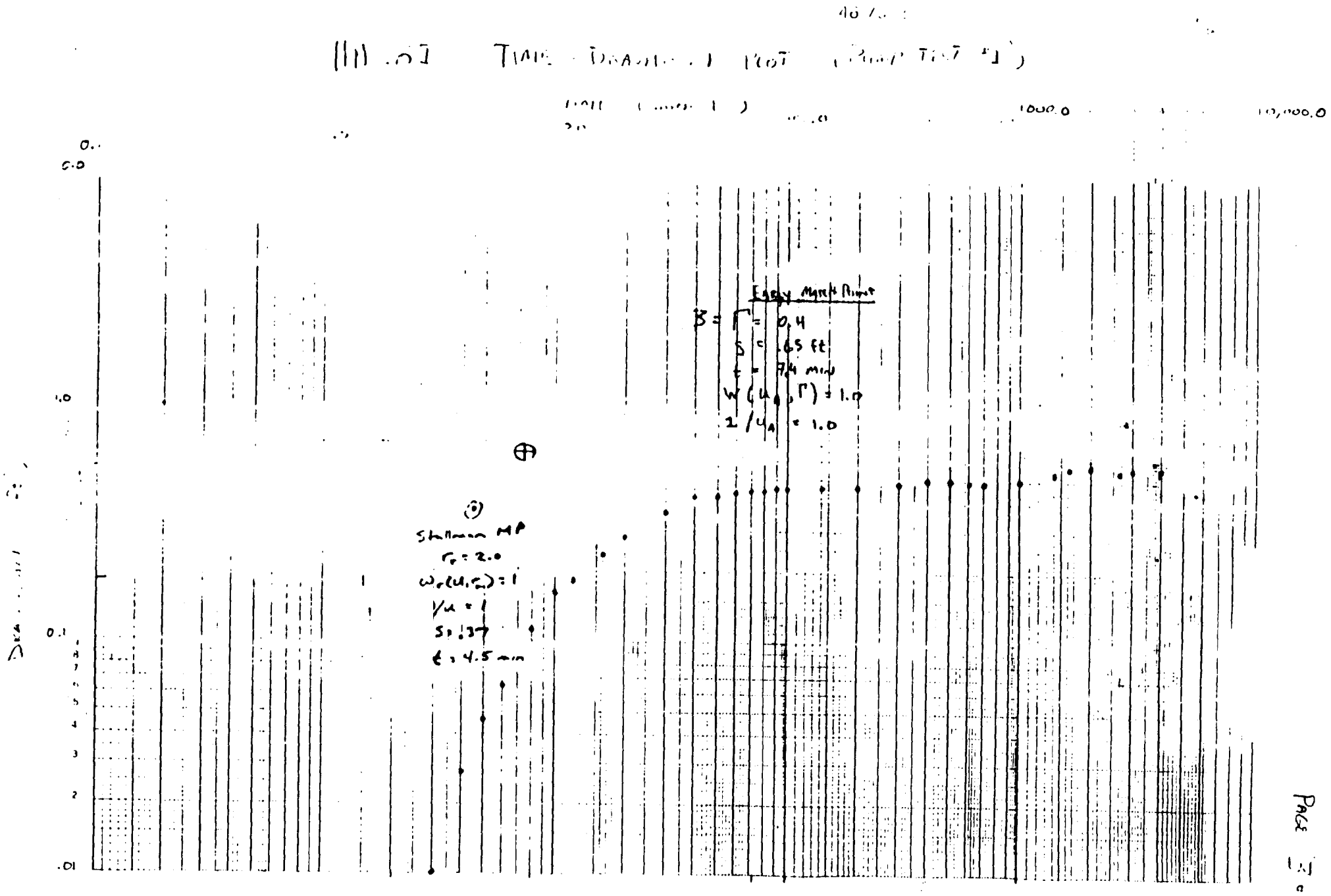
Vertical Hydraulic Conductivity · Kruseman equation 5.6

$$\beta = \frac{r^2 K_v}{D^2 K_h}$$

$r = 425$ ft
$D = 170$ ft
$\beta = 0.4$ (From Match Points)
$K_h = 62.11$ ft/d

$$K_v = \frac{\beta D^2 K_h}{r^2} = \frac{(0.4)(170\text{ ft})^2(62.11\text{ ft/d})}{(425\text{ ft})^2}$$

$$\boxed{K_v = 3.975 \text{ ft/d}}$$


1000.0
10,000.0
5.0
1.0
0.1
.01
Shallman MP
$r_0 = 2.0$
$\omega_0(u, r_0) = 1$
$1/u = 1$
$S = .37$
$t = 4.5$ min
$\beta = \Gamma = 0.4$
$S = .65$ ft
$t = 7.4$ min
$W(u, \Gamma) = 1.0$
$1/u_A = 1.0$

HALLIBURTON NUS Environmental Corporation and Subsidiaries			STANDARD CALCULATION SHEET
CLIENT:	FILE NO.: 1953	BY: PLN	PAGE 1 OF 3
SUBJECT: BETHPAGE PUMP TEST #1		CHECKED BY: SJC	DATE: 2/18/93

NEUMAN CURVE FITTING - EARLY TIME FOR HN26I

HORIZONTAL HYDRAULIC CONDUCTIVITY : KRUSEMAN 1989, EQUATION 5.2

$$S = \frac{Q}{4\pi K_h D} W(u_A, \beta)$$

$Q = 448$ gpm $= 86246.0$ ft³/d
$D = 170$ ft
$S = .42$ ft (From Early Match Point)
$W(u_A, \beta) = 1.0$ (From Early Match Point)

$$K_h = \frac{Q}{4\pi D S} W(u_A, \beta)$$

$$K_h = \frac{86246.0 \text{ ft}^3/\text{d}}{4\pi (170 \text{ ft})(.42 \text{ ft})} = \boxed{96.12 \text{ ft/d}}$$

STORAGE KRUSEMAN 1989 EQUATION 5.3

$$u_A = \frac{r^2 S_A}{4 K_h D t}$$

$r = 520$ ft
$D = 170$ ft
$t = 6.8$ min $= 0.005$ d (From Early Match)
$u_A = 1.0$ (From early match point)
$K_h = 96.12$ ft/d

$$S_A = u_A \frac{4 K_h D t}{r^2}$$

$$S_A = \frac{1.0 (4)(96.12 \text{ ft/d})(170 \text{ ft})(.005 \text{ d})}{(520 \text{ ft})^2}$$

$$\boxed{S_A = .0012}$$

HALLIBURTON NUS Environmental Corporation and Subsidiaries		STANDARD CALCULATION SHEET

CLIENT:	FILE NO.: 1953	BY: PLN	PAGE 2 OF 3
SUBJECT: Bethpage Pumptest #1		CHECKED BY: SJC	DATE: 2/18/93

NEUMAN CURVE FITTING FOR HN 26 I

VERTICAL Hydraulic Conductivity : KRUSEMAN Equation 5.6

$$\beta = \frac{r^2 \, k_v}{D^2 \, k_h}$$

$r = 420$ ft
$D = 170$ ft
$\beta = 1.0$ (From CURVE MATCH)

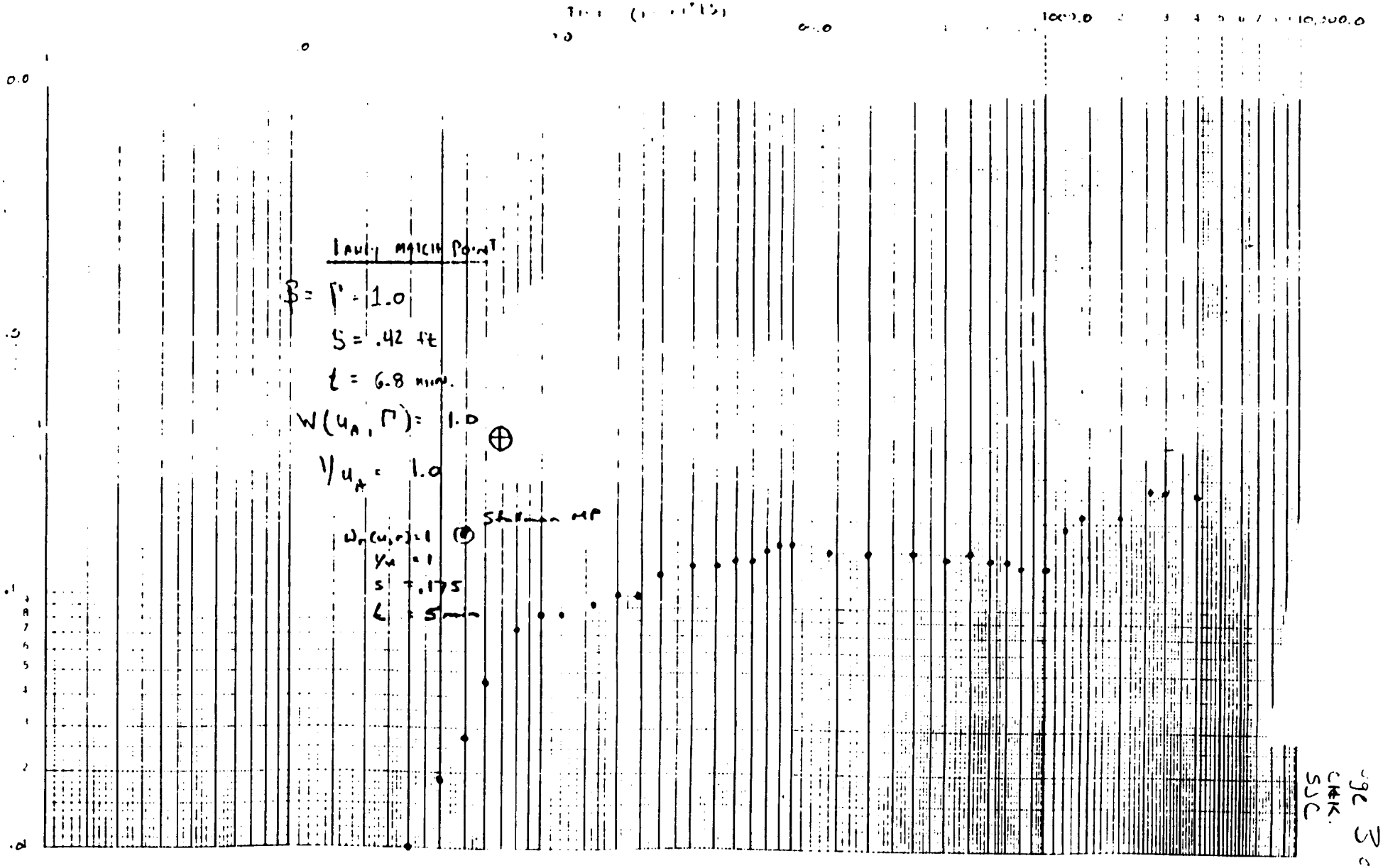
k_h early $= 96.12$ ft/d

$$k_v = \frac{\beta \, D^2 \, k_h}{r^2}$$

$$k_v \text{ early} = \frac{(1.0)(170 \text{ ft})^2 (96.12 \text{ ft/d})}{(520 \text{ ft})^2}$$

$$\boxed{k_v \text{ early} = 0.27 \text{ ft/d}}$$

11126I TIME - DRAWDOWN PLOT (PUMP TEST #1)



Page 3 of 17
CHK.
SJC

HALLIBURTON NUS Environmental Corporation and Subsidiaries — STANDARD CALCULATION SHEET

CLIENT: Navy/Bethpage	FILE NO.: 1953	BY: JPO	PAGE 1 OF 4
SUBJECT: MW 27I2 Pumping Test Analysis		CHECKED BY: PCW 2/26/93	DATE: 2/26/93

Reference: Ferris, et. al, 1962. Theory of Aquifer Tests. USGS Water Supply Paper 1536 E.

Stallman Type Curve Analysis - 1 Pumping & 1 Recharge well

$Q = 86,246\ ft^3/day$ ($Q = Q_{pumping} = Q_{recharge}$)

For Well 28 I,

$r_r = r_i/r$ $\quad r_i = 860'$

$r = 420'$

$r_r = 2.05$

@ Match Point w/ Type curve $r_r = 2.0$,

$W_r(u, r_r) = 1$

$1/u = 1$

$s = .37$

$t = 4.5\ min = .003\ days$

$$T = \frac{Q}{4\pi s}(W_r(u, r_r))$$

$= 18,549\ ft^2/day$

$K = T/b$, $\quad b = 170\ ft$

$= 109\ ft/day$

For well 26 I,

$r_r = r_i/r$, $\quad r_i = 850'$

$= 1.6$ $\quad r = 530'$

@ MP w/ Type curve $r_r = 1.6$,

$W_r(u, r_r) = 1$

$1/u = 1$

$s = .175$

$t = 5\ min = .003\ days$

Well 26I (cont.)

$T = \frac{Q}{4\pi s} W(u,r)$

$= 39,218 \text{ ft}^2/\text{day}$

$K = T/b$

$= 231 \text{ ft}^2/\text{day}$

For Well 27I2

$r_D = r_i/r$, $r_i = 470'$

$= 10.4$ $r = 45'$

@ MP w/ Type curve $r_D = 10.0$,

$W_r(u,r) = 1$

$1/u = 1$

$s = .41'$

$t = .01 \text{ min} = .0000069 \text{ days}$

$T = \frac{Q}{4\pi s} W_r(u,r)$

$= 16,740 \text{ ft}^2/\text{day}$

$K = T/b$

$= 98 \text{ ft/day}$

HALLIBURTON NUS Environmental Corporation and Subsidiaries — STANDARD CALCULATION SHEET

CLIENT:	FILE NO.:	BY:	PAGE 3 OF 4
Navy/Bethpage	1953	JPO	
SUBJECT:		**CHECKED BY:**	**DATE:**
MW 2752 Pumping Test Analysis		PCN 2/26/93	2/26/93

For Well 2752

$r_D = r_i/r = 550'/31.5' = 17.4$

2 MP w/ Type Curve $r_D = 20$;

$W_r(u,r) = 1$

$1/u = 1$

$s = .28'$

$t = 2.7$ min

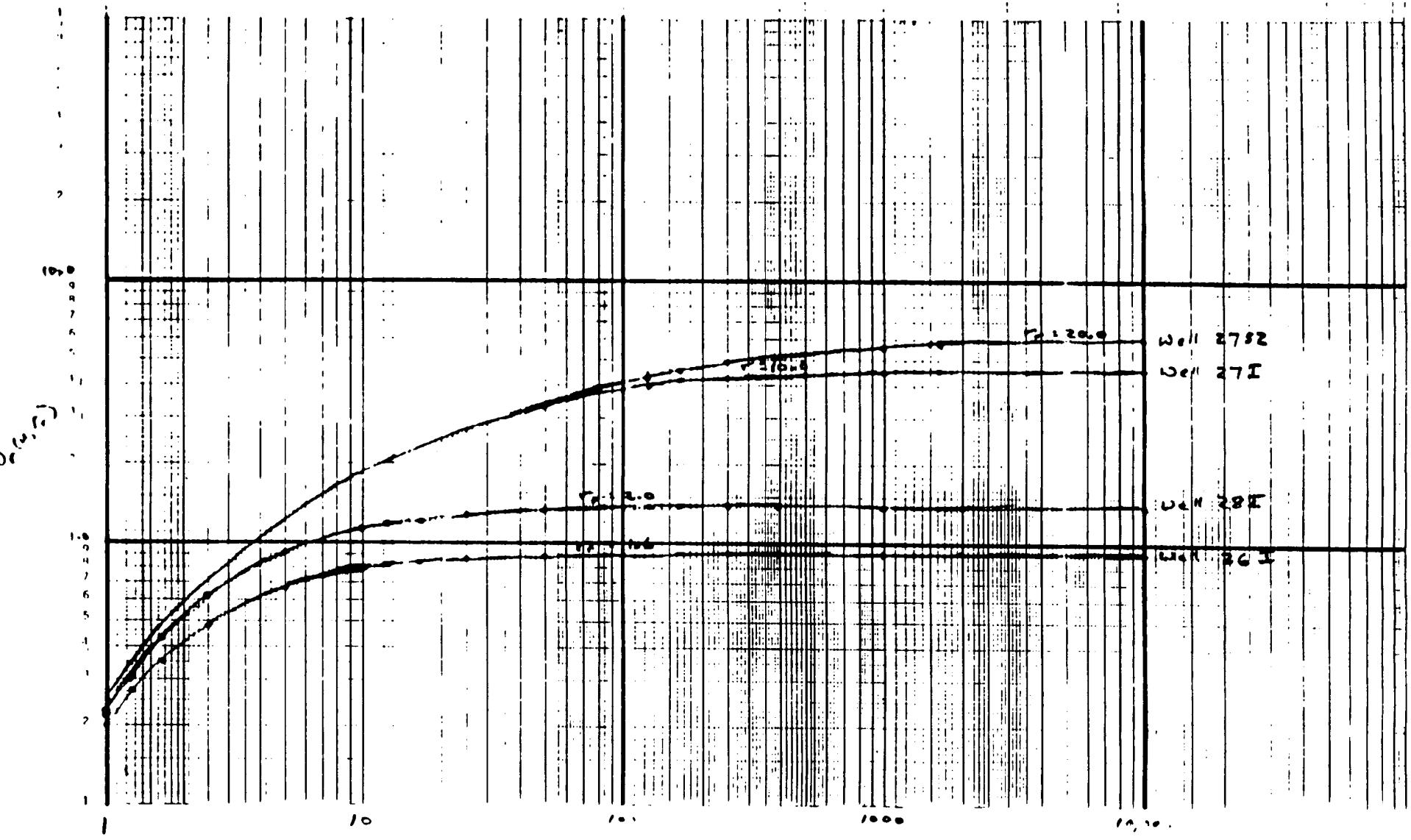
$$T = \frac{Q}{4\pi s} W_r(u,r)$$

$= 24,511 \text{ ft}^2/\text{day}$

$K = T/b$

$= 144 \text{ ft/day}$

Type Curves
Ferris, et. al, 1962



1/u

HALLIBURTON NUS Environmental Corporation and Subsidiaries | **STANDARD CALCULATION SHEET**

CLIENT: Navy/Bethpage	FILE NO.: 1953	BY: JPO	PAGE 1 OF 2
SUBJECT: MW 27I2 Pumping Test Analysis		CHECKED BY: PLW 2/26/93	DATE: 2/26/93

Method: For 1 pumping & 1 recharge well, where $Q_p = Q_R$, steady-state drawdowns will be reached in observation wells after extended periods of pumping; the steady-state drawdown will be proportional to the relative distances from the observation well to the pumping and recharge wells (Treat the system as 2 separate obs. well/pumping (recharge) well couplets, w/ Δs the change in dd per change in radial distance).

$$\Delta s = Q/4\pi T)(\ln r_2^2/r_1^2)$$

$$\Delta s = \frac{2.3Q}{4\pi T}\,2(\log r_2/r_1) = \frac{2.3Q}{2\pi T}(\log r_2/r_1)$$

For OW 26I,

$r_1 = 530'$

$r_2 = 850'$

$s = .17'$ (avg ~100-1000 min)

$$.17' = \frac{2.3Q}{4\pi T}\,2(\log 850/530)$$

$$= \frac{2.3Q}{4\pi T}\,2(.205)$$

$$= \frac{2.3Q}{4\pi T}(.41)$$

$T = 38{,}078\ ft^2/day$

Assumptions:
- Steady-state conditions approached by $t = 1000$ min - later data affected by outside pumping.
- $Q_p = Q_R = 86{,}246\ ft^3/day$
- r_1 = distance from obs. well to pumping well
- r_2 = distance from obs. well to recharge well
- Recharge well location equals center of recharge basin.
- Drawdowns negligible relative to aquifer thickness - no dewatering correction needed for drawdown data.

For OW 28I,

$r_1 = 420'$

$r_2 = 860'$

$s = 0.5'$ (avg ~100-1000 min)

$$.50' = \frac{2.3Q}{4\pi T}\,2(\log 860/420)$$

$$= \frac{2.3Q}{4\pi T}\,2(.31)$$

$$= \frac{2.3Q}{4\pi T}(.62)$$

$T = 19{,}574\ ft^2/day$

HALLIBURTON NUS Environmental Corporation and Subsidiaries — STANDARD CALCULATION SHEET

CLIENT:	FILE NO.:	BY:	PAGE 2 OF 2
Navy/Bethpage	1953	JPO	
SUBJECT:		CHECKED BY:	DATE:
MW 27I2 Pumping Test Analysis		PCW 2/26/93	2/26/93

For OW 27I1,

$r_1 = 45'$

$r_2 = 470'$

s (corrected for pp) = 1.6' (avg ~ 100-1000 min)

$$-1.6 = \frac{2.3Q}{4\pi T} 2(\log 470/45)$$

$$= \frac{2.3Q}{4\pi T} 2(1.02)$$

$$= \frac{2.3Q}{4\pi T} (2.04)$$

$T = 29,126 \ ft^2/day$

For OW 27S2,

$r_1 = 31.5'$

$r_2 = 550'$

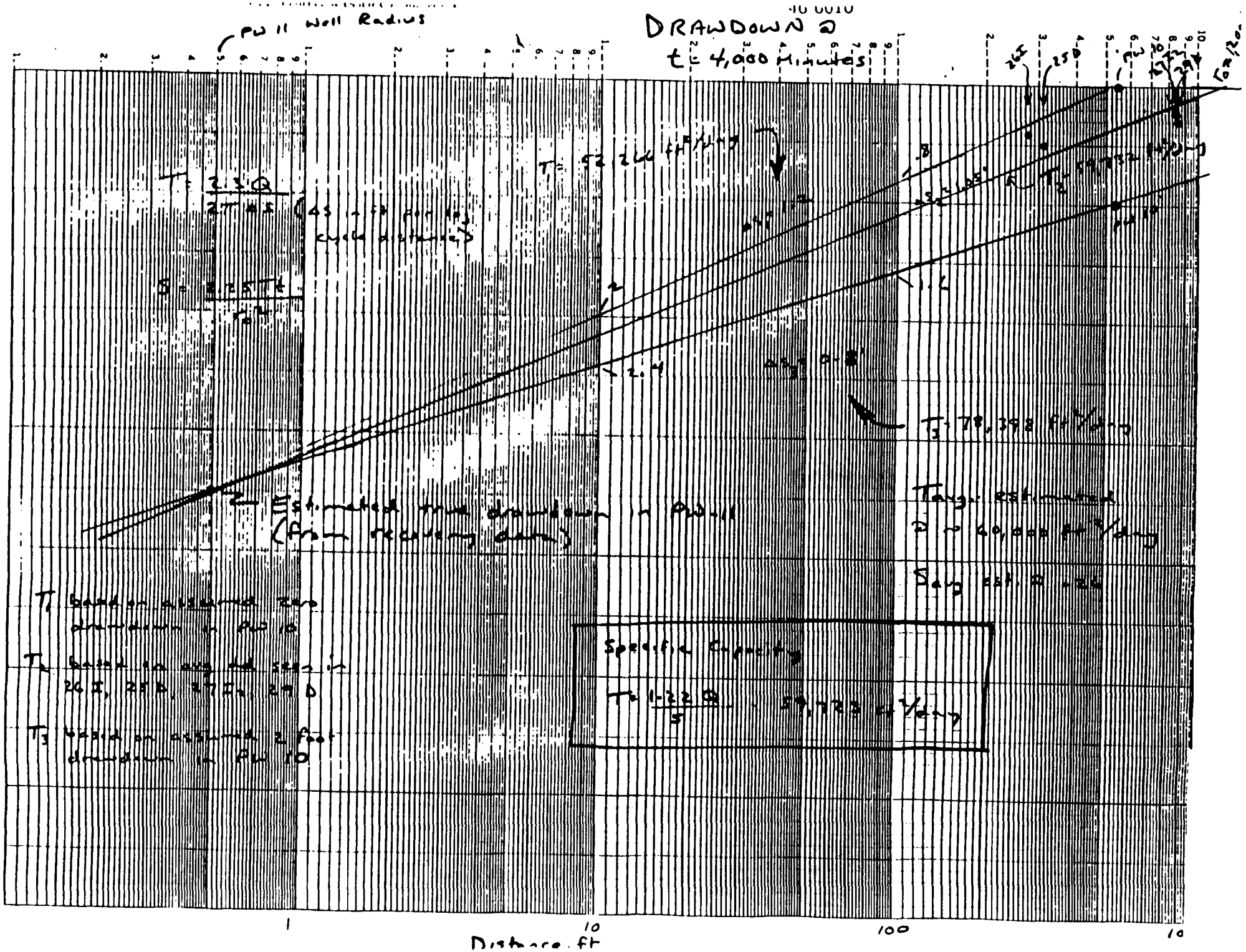
s (corrected for pp) ≅ 1.6' (avg 100-1000 min)

$$1.6 = \frac{2.3Q}{4\pi T} 2(\log 550/31.5)$$

$$= \frac{2.3Q}{4\pi T} 2(1.24)$$

$T = 24,467 \ ft^2/day$

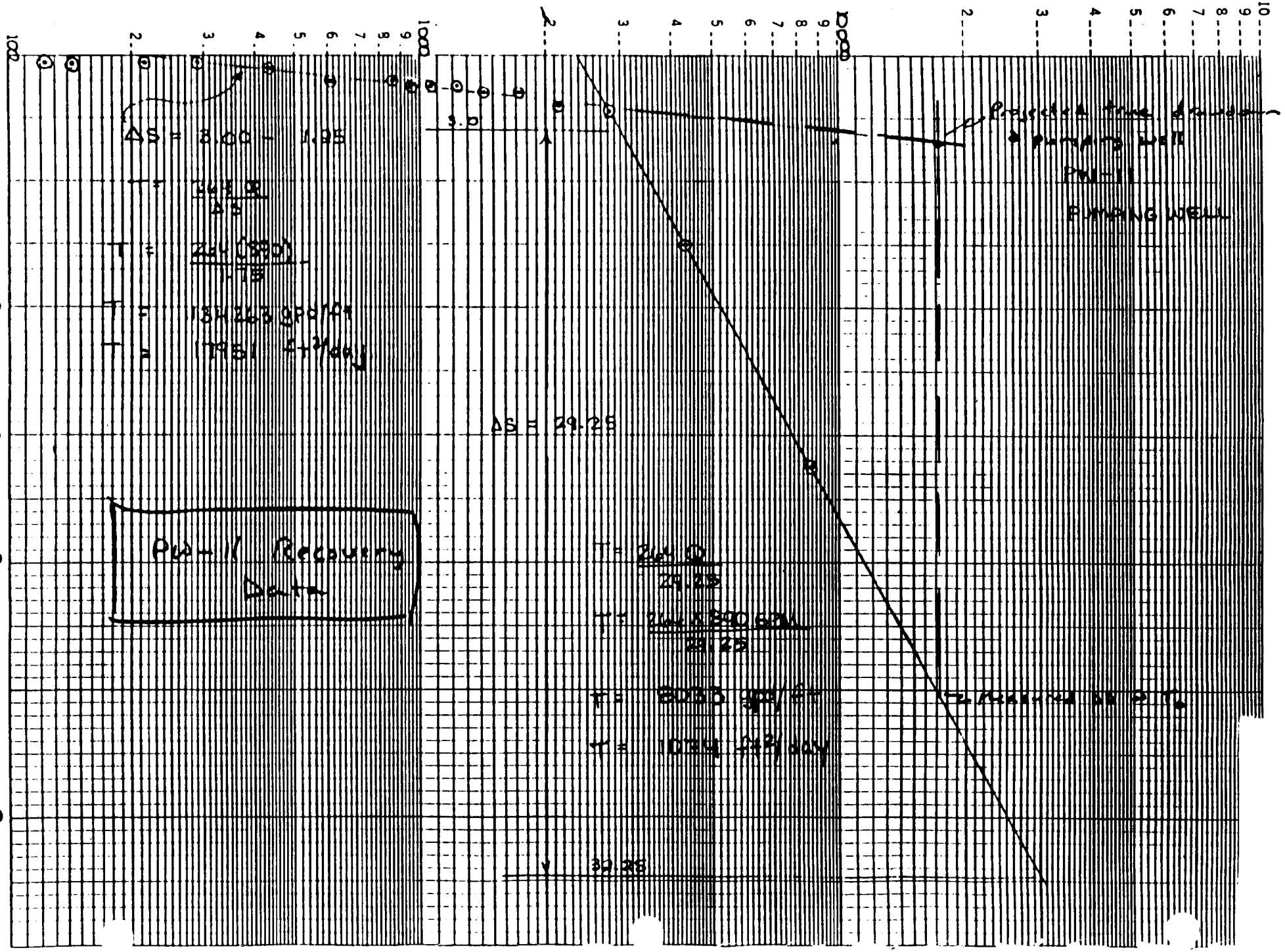
Pump Test #2


Well Radius
DRAWDOWN @
t = 4,000 Minutes
Distance, ft
1
10
100
1
2
3
4
5

PUMPING TEST #2

K·E SEMI-LOGARITHMIC • 3 CYCLES X 70 DIVISIONS KEUFFEL & ESSER CO. MADE IN U.S.A.

Ratio t/t' 46 5490



HALLIBURTON NUS Environmental Corporation and Subsidiaries

STANDARD CALCULATION SHEET

CLIENT: BETHPAGE	FILE NO.: 1953	BY: SJC 3/8/93	PAGE 1 OF
SUBJECT: PW-11 RESIDUAL DRAWDOWN PLOT		CHECKED BY:	DATE:

PUMP TEST #2

Time Since pump Started (min) (t)	Time since pump stopped (min) (t')	Ratio t/t'	Drawdown (ft)	
4300	0	—	25.25	
4300.5	0.5	8601	16.25	.64
4301	1	4301	7.50	.30
4301.5	1.5	2867.7	2.25	.09
4302	2	2151	2.0	.08
4302.5	2.5	1721	1.5	.06
4303	3	1434.3	1.5	
4303.5	3.5	1229.6	1.25	.05
4304	4	1076	1.25	
4304.5	4.5	956.6	1.25	
4305	5	861	1.0	.04
4307	7	615.3	1.0	
4310	10	431	0.5	.02
4312	12	359.3	0.5	
4315	15	287.7	0.25	
4320	20	216	0.25	
4330	30	144.3	0.25	
4335	35	123.9	0.25	

APPENDIX F

COMPUTER MODELING

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1.0 INTRODUCTION

This Appendix of the RI report presents the overall approach and the results of the Computer Modeling efforts performed at Bethpage Naval Weapons Industrial Reserve Plant (NWIRP) at Bethpage New York, which were conducted for the U. S. Navy.

Bethpage NWIRP is located on 108 acres in Nassau County of Long Island, approximately 20 miles east of New York City in a highly industrialized area. Grumman Aerospace Corp. (Grumman) leases property from the U. S. Navy as part of its Aerospace manufacturing activities. Figure 1-1 shows the location of the NWIRP site. The histories of the NWIRP and Grumman facilities are discussed in detail in the Initial Assessment Study of the NWIRP and the RI/FS Work Plan prepared by Geraghty & Miller.

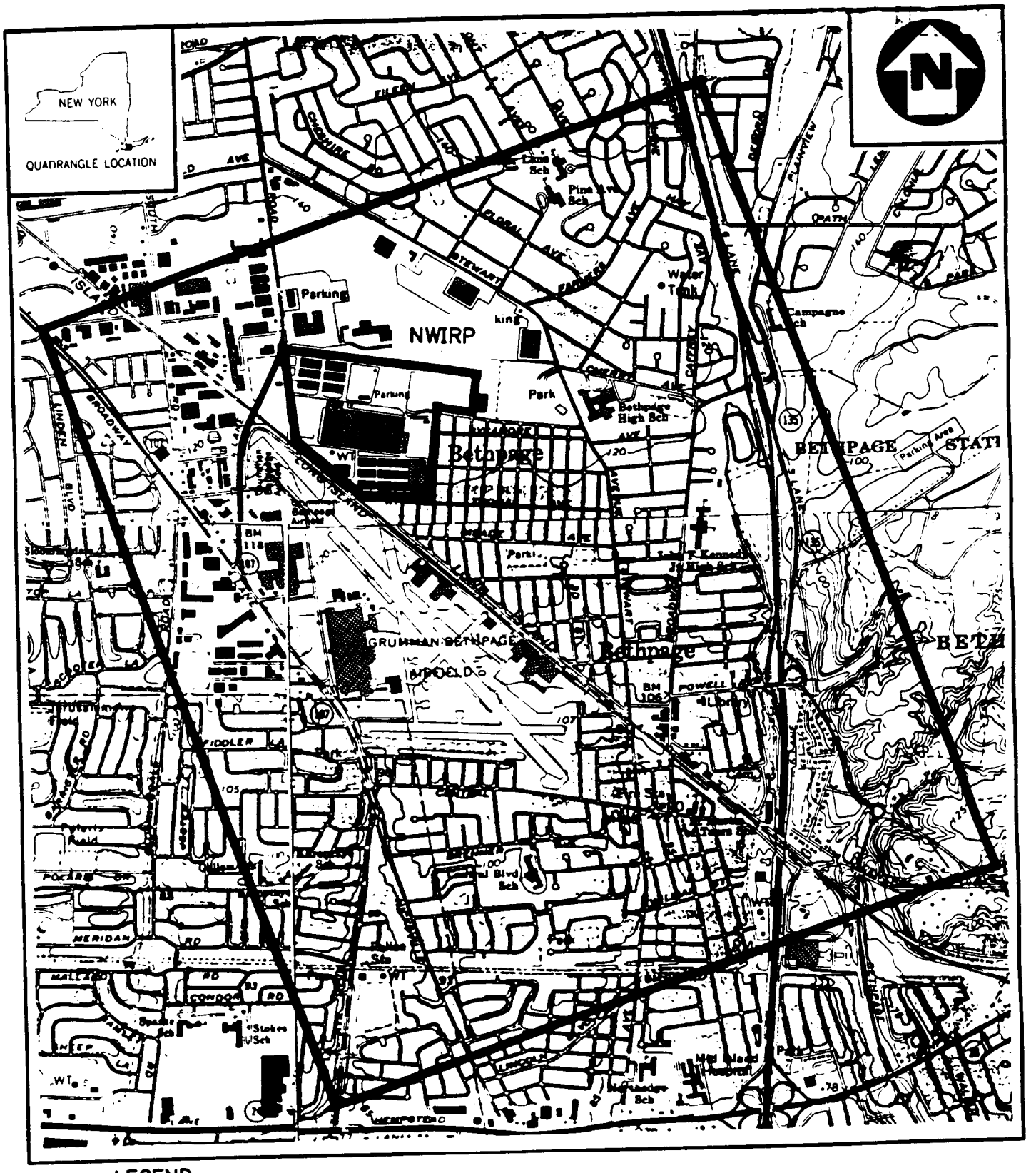
Grumman utilizes 14 high capacity production wells located on the facility for air conditioning and non-contact cooling purposes. Water pumped from these wells is returned to the aquifer via several recharge basins located across the site. The Bethpage Water District (BWD) operates water supply wells to the east and south of the Bethpage NWIRP.

1.1 OBJECTIVES OF THE COMPUTER MODELING

The modeling investigation is part of an overall RI/FS program designed to determine the locations of any potential sources of contamination on U. S. Navy property.

The general objective of the computer modeling was to provide data on groundwater flow in the area of the NWIRP and the potential flow directions of contaminants. The specific objectives of the RI computer modeling at Bethpage NWIRP are listed below:

- To provide a general characterization of the subsurface conditions underlying Bethpage NWIRP,
- To develop a localized flow model which accurately represents groundwater flow in the area around the Grumman site, with an emphasis on the groundwater flow in and around the NWIRP, and



LEGEND

EXTENT OF MODEL GRID

0 2000 4000

SCALE IN FEET

FIGURE 1-1

LOCATION OF
FINITE DIFFERENCE GRID BOUNDARY
BETHPAGE, NY

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- To model the flow directions and rate of travel for simulated contaminant releases under a variety of production well and recharge basin pumping conditions.

As part of the FS program for the NWIRP, additional computer modeling will be conducted. Objectives for the FS phase of modeling include

- Utilizing the calibrated flow model to determine potential contaminant transport directions, and
- Using particle tracking and contaminant transport simulation for evaluation of remedial alternatives for the site.

1.2 ORGANIZATION OF COMPUTER MODELING REPORT

This appendix summarizes the development of the RI computer modeling efforts and presents their results. The report is organized into nine sections. Section 1 provides an introduction to the computer modeling. Section 2 summarizes the hydrogeologic conditions of the site area. Section 3 discusses the modeling approach. Section 4 discusses the conceptual model. Section 5 summarizes computer code selection. Section 6 discusses model calibration. Section 7 discusses model validation. Section 8 discusses the particle tracking performed at the site. Section 9 summarizes the sensitivity analysis performed for the site. Section 10 provides a summary of modeling activities and a discussion of model limitations.

2.0 HYDROGEOLOGIC CONDITIONS

Bethpage NWIRP is located in west-central Long Island, which is underlain by approximately 1,100 ft of unconsolidated sand, silt, clay and gravel sediments of Late Cretaceous and Pleistocene age. These unconsolidated sediments are underlain by Precambrian crystalline bedrock, which slopes to the south-southeast. All of the geologic units dip in these directions to varying degrees (Isbister, 1966). Three aquifer systems are present within the unconfined sediments. In descending order these are, the upper glacial aquifer, the Magothy aquifer, and the Lloyd aquifer.

2.1 AQUIFER CHARACTERISTICS

2.1.1 Upper Glacial Aquifer

The upper glacial aquifer is composed of fine to coarse sand and gravel outwash deposits. In the modeled area, this unit is the upper-most hydrogeologic unit. This unit ranges in thickness beneath the site, with a total thickness of less than 75 ft. Literature sources estimate hydraulic conductivity values of approximately 270 ft/d and vertical hydraulic conductivity values at approximately one-tenth of horizontal conductivity (Smolensky and Feldman, 1990). In the majority of the area encompassed by the modeling grid, the water table lies below the bottom of the upper glacial aquifer.

2.1.2 Magothy Aquifer

The Magothy aquifer is composed of fine to medium sand, with many discontinuous clay lens present throughout the aquifer. Fine grained sediments are common in the Magothy aquifer, although no clay lenses of regional extent were encountered during the drilling program at the site. The lithologic trend observed during drilling is a decrease in the average grain size with increasing depth. The Magothy aquifer has a reported thickness of approximately 600 feet beneath the NWIRP. The basal portion of the Magothy aquifer is reported to consist of a highly permeable and productive gravel (Isbister, 1966; Geraghty & Miller, 1990).

Horizontal hydraulic conductivities for the Magothy aquifer have been estimated at approximately 50 ft/d, with decreasing vertical hydraulic conductivity with depth compared to the upper glacial aquifer. Anisotropy has been estimated at approximately 100:1 (Smolensky and Feldman, 1990). The upper portions of the aquifer are unconfined with an increasing degree of confinement with depth (Isbister, 1966). The Magothy aquifer is the principal water-supplying aquifer for the Grumman production wells and BWD wells. Water returned to the aquifer from the recharge basins at the NWIRP is believed to move through the upper glacial aquifer and recharge the Magothy aquifer, which contains the water table across much of the modeled area. The Magothy aquifer and the upper glacial aquifer are regarded as a common aquifer because they have similar lithologies, and no barrier to downward flow exists between these units.

2.1.3 Raritan Formation

The Raritan Formation underlies the Magothy Formation, and the Lloyd Sand Member of the Raritan Formation represents the third significant water bearing system in the area. The Lloyd Sand is separated from the Magothy aquifer by the Raritan Clay unit, which represents the first regionally extensive barrier to downward movement of groundwater. The Raritan Clay may range in thickness up to 175 feet thick, with vertical hydraulic conductivities of approximately 0.001 ft/d (Smolensky and Feldman, 1990; Isbister, 1966). Due to the thickness and very low conductivity of the Raritan Clay, and the fact that the Lloyd sand is not a major source of public water, the top of the Raritan Clay is considered to represent the bottom of the groundwater flow system for the area around the NWIRP.

2.2 GROUNDWATER FLOW

Most of Long Island is bisected by a east-west trending, regional groundwater divide. The NWIRP lies to the south of this divide. The groundwater beneath the NWIRP predominantly flows in a southward direction (towards the Atlantic Ocean), although the flow directions are greatly influenced by the groundwater mounding which occurs at the recharge basins associated with Grumman activities. In addition, groundwater withdrawal from Grumman production wells have a pronounced influence on groundwater flow directions. The production wells and recharge basins operate in various pumping combinations which makes their effect of local groundwater flow direction subject to change. The

NWIRP occupies an area of recharge with vertical hydraulic gradients having a downward direction (Isbister, 1966).

2.3 GRUMMAN PRODUCTION WELLS AND RECHARGE BASIN ACTIVITIES

As part of Grumman activities, fourteen production wells are operated for non-contact cooling and air conditioning purposes. Numerous recharge basins located around the site recharge water pumped from the production wells to the aquifer system. Figure 2-1 illustrates the location of Grumman production wells and recharge basins. Prior to 1984, some Plant 03 production-line rinse waters were discharged directly to the recharge basins and may have contained chemicals involved in the manufacturing process.

Interviews with Grumman personnel indicate that water pumped from production wells to recharge basins follows a consistent pattern. Production wells PW-8 through PW-16 are north of the Long Island Railroad tracks, which bisect Grumman property. Water produced from these northern production wells is recharged to northern recharge basins (outfalls 004 and 010). Water derived from southern production wells, PW-1 through PW-6, is recharged via southern recharge basins (at outfalls 005, 006 and 007). Monthly records of total pumpage from these wells has been recorded by Grumman, and this monthly pumpage data was used as part of model calibration and model validation. The majority of water pumped by Grumman production wells is returned to the aquifer by recharge basins, although a loss of water may occur due to evaporation from the recharge basins and water diverted off site to sewers and water treatment plants.

The total amount of production well pumpage and basin recharge is cyclic with an increase in summer months when demand for cooling is greatest and a decrease in the winter. Pumping data provided by Grumman indicate that production wells pump a minimum amount during February and a maximum amount during August. Production well rates may be as high as 1,200 gpm.

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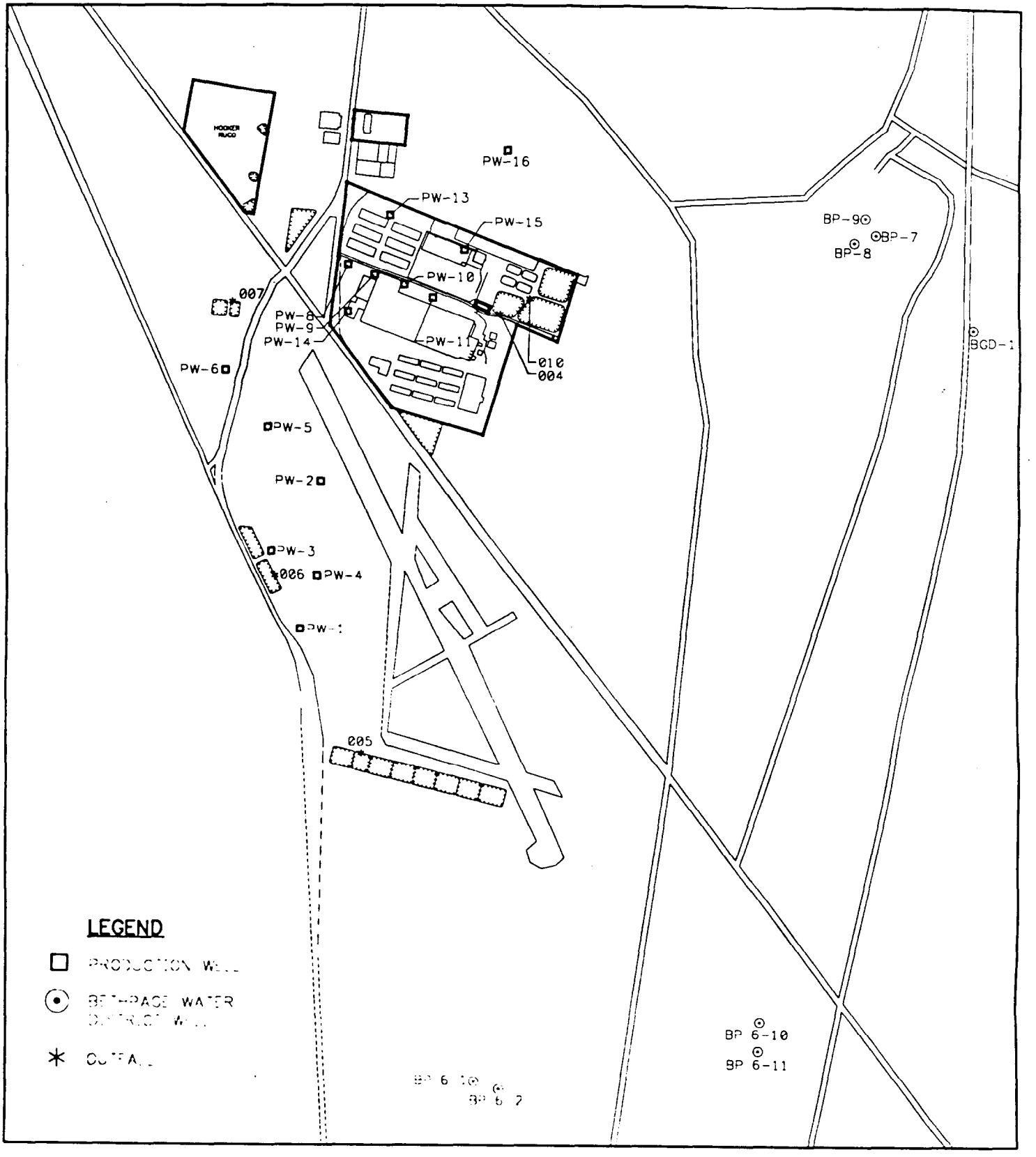

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SCALE IN FEET

LOCATION MAP OF GRUMMAN WELLS, BWD WELLS AND RECHARGE BASINS BETHPAGE, NWIRP

FIGURE 2-1

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3.0 SUMMARY OF MODELING APPROACH

3.1 DATA COLLECTION / ANALYSIS

The first portion of the modeling process is to compile the existing data. The available, relevant data regarding site hydrogeologic conditions and groundwater quality was collected and reviewed. Groundwater elevation data, meteorological conditions, pumping and recharge data, and well location data that was required for model activities was identified and obtained from Grumman, state, and Federal sources. To more fully define the aquifer parameters at the site, two pumping tests were conducted at the NWIRP. For pumping test #1, the intermediate well HN-2712 was pumped at 448 gpm, and drawdown was measured in 10 observation wells. For pumping test #2, the deep production well PW-11 was pumped at 890 gpm and drawdown was measured at 9 observation wells. A complete discussion of the results and analysis of the pumping tests is discussed in Appendix E.

3.2 CONCEPTUAL MODEL DEVELOPMENT

A conceptual model of the groundwater system was developed from information gathered after the data collection phase. The conceptual model identified and incorporated the key hydrogeologic characteristics at the site, potential contaminant source information, and locations of the BWD water supply wells in the area. In addition, the rationale for assumptions and simplifications made to the natural site conditions were reported and described in the conceptual model.

3.3 COMPUTER CODE SELECTION

A groundwater flow modeling code was selected for the modeling project. The computer code selected for the project must be able to incorporated the key aspects of the conceptual model, and must have

been well tested and verified. In addition, particle tracking and contaminant transport applications must be supported by the groundwater flow model.

3.4 FLOW MODEL CALIBRATION

The site wide flow model was developed by configuring the conceptual model into a format which is compatible for input into the flow model and entering initial values for aquifer parameters into the flow model. The model was then calibrated for two steady-state pumping conditions, and two transient pumping test simulations. The flow model was calibrated by adjusting initial values of parameters, such as, vertical and horizontal hydraulic conductivities, storage and boundary conditions. Calibration continued until the water level elevations at 61 monitoring wells (in steady-state simulations) and the modeled drawdowns (in transient pump test simulations) were adequately comparable to measured values.

3.5 FLOW MODEL VALIDATION

The calibrated model was validated using two steady-state pumping conditions and resulting water elevations which were not previously used in calibration. For each month used for validation, the pumping/recharge rates of Grumman production wells and recharge basins were input into the model, and the model results were compared against the measured water level elevations at 61 monitoring wells.

3.6 PARTICLE TRACKING

Particle tracking was performed to determine the possible directions and rates of contaminant movement following a simulated contaminate release from potential sources. Particle tracking was performed under a variety of pumping and recharge conditions, from a variety of potential sources. This approach allows for several potential release scenarios to be examined. An analysis of the rate of particle movement and the three dimensional movement of particles throughout the aquifer was also conducted.

3.7 SENSITIVITY ANALYSIS

Sensitivity analyses was performed to determine how sensitive the model output is to changes in aquifer parameters. The sensitivity analyses involved changing aquifer parameters by incremental amounts and evaluating these effects on model predictions. The results were used to quantify model accuracy and model assumptions.

3.8 SUMMARY OF MODEL LIMITATIONS

All computer modeling simulations are subject to error due to simplifications in the model, which are necessary in order to simulate complex natural systems. The impact of these sources of error can be minimized by realizing what may contribute to error in modeling results and performing sensitivity analysis on the developed model. Potential sources of model error are identified, and the steps taken to minimize error are discussed.

4.0 CONCEPTUAL MODEL

After compiling existing data available for the site, a conceptual model was constructed for the site. The conceptual model identified and incorporated the key hydrogeologic characteristics at the site, including contaminant source data, BWD well information, and other factors which control groundwater flow.

The conceptual model for the study area is summarized in the following subsections which describe

- Areal and vertical extent of the model grid,
- Model Grid dimensions,
- General hydrogeologic conditions in the model area,
- Initial estimates of the hydrogeologic parameters, and
- Boundary conditions.

4.1 AREAL AND VERTICAL EXTENT OF THE MODEL GRID

The purpose of the modeling was to define the flow of groundwater in the area encompassed by the NWIRP, Grumman property, and in the surrounding area. Figure 4-1 shows the area being modeled, and the finite-difference grid used in this study. The location of the model grid was defined in order to maximize the grid density within Navy property and encompass the BWD wells to the east of the site (BP-7, BP-8, BP-9), the Hooker-Ruco site, and the southern extent of Grumman property.

The northern boundary of the model area is located approximately 2000 feet north of the NWIRP. This location was chosen because it encompasses all Grumman production wells and lies north of the Hooker-Ruco site. The east boundary lies approximately 4800 feet east of the NWIRP and was chosen to provide full coverage of the eastern BWD wells (BP-7, BP-8, BP-9). The western grid boundary lies approximately 600 feet west of the NWIRP and encompasses the Hooker-Ruco site. To the south, the boundary lies approximately 3000 feet south of the NWIRP, and was located to encompass all Grumman property and southern recharge basins. The model grid is oriented so the east-west sides of the grid boundary are parallel to the groundwater flow direction in the area.

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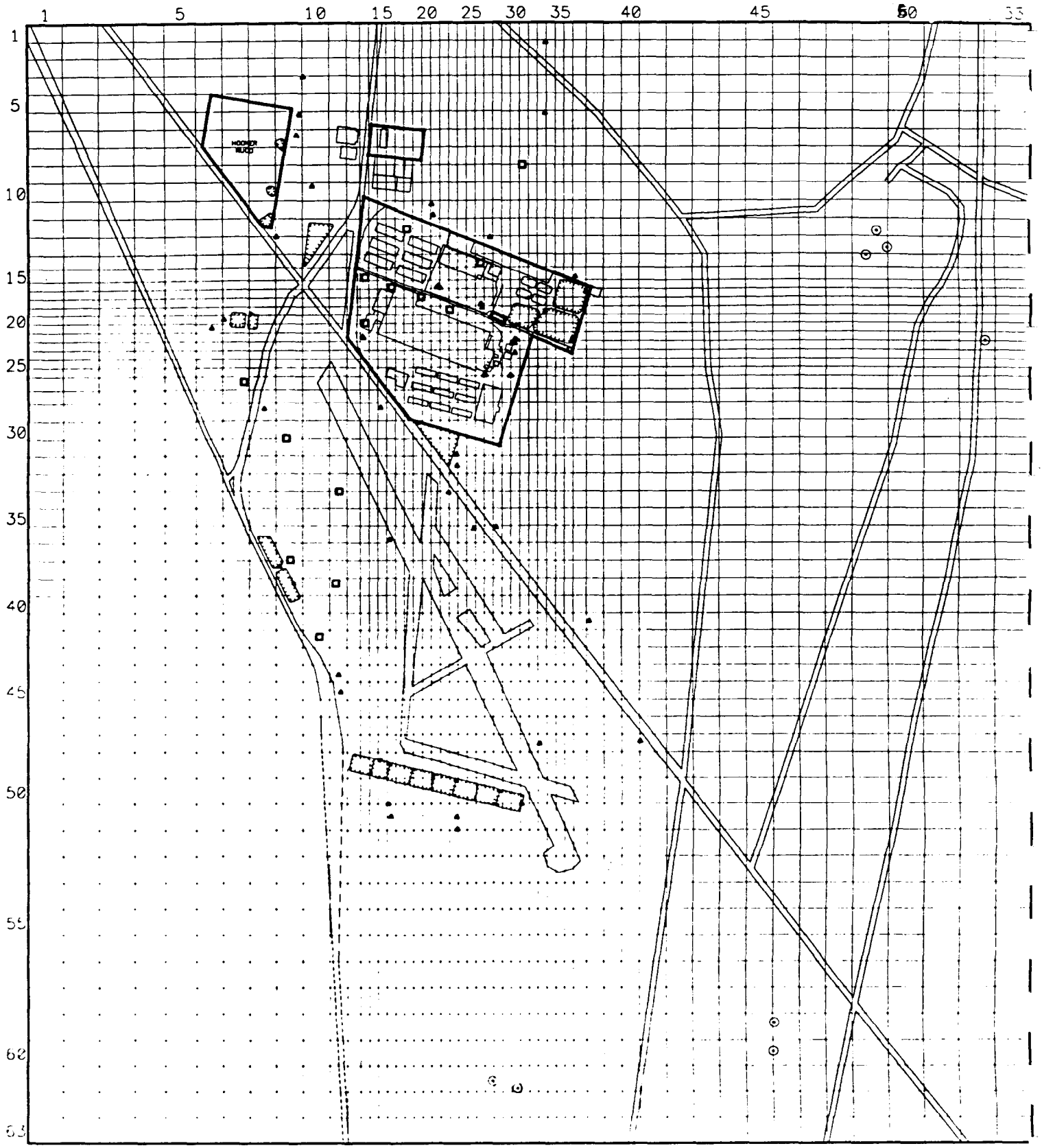

LEGEND

- ▲ MONITORING WELL
- □ PRODUCTION WELL
- ⊙ BETHPAGE WATER DISTRICT WELL
- * OUTFALL

0 1500 3000
SCALE IN FEET

FIGURE 4-1

FINITE-DIFFERENCE MODEL GRID BETHPAGE, NWIRP

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4.2 MODEL GRID DIMENSIONS

4.2.1 Horizontal Dimensions

The block-centered finite-difference grid for the site covers a 11,300 by 12,800 ft area, as shown in Figure 4-1. The grid consists of 53 columns and 63 rows and contains 5 layers. Grid line orientation was designed with columns parallel to the normal (non-pumping) groundwater flow direction in the area covered by the grid. Due to software and computer memory limitations, there are a finite number of nodes which can be effectively incorporated into a computer model. In areas of interest, nodes are more closely space to provide tighter coverage of that area, while larger node spacings are used outside the area of primary interest. Grid spacing has the highest density in the section of the grid which covers the NWIRP, where each node has a length and width of 100 ft. The consistently small size of the grid blocks allows for a detailed evaluation of potentiometric heads and groundwater flow in these areas. Node size increases towards the outer edge of the grid, where more widely spaced model generated heads were acceptable. All nodes of the grid are active (i.e., part of the aquifer).

4.2.2 Vertical Dimensions

The model grid consists of five layers, which are differentiated based on monitoring well depths in the modeling area. Layer 1 extends from the surface to approximately 100 ft below ground surface (bgs) and incorporates shallow HNUS monitoring wells. Layer 1 ranges in thickness from 77.5 to 105 ft. Layer 2 and 3 are each 100 ft thick. Layer 2 contains intermediate monitoring wells, while layer 3 contains deep HNUS monitoring wells and one BWD well. Layer 4 is 150 ft thick and contains some of the shallower Grumman production wells and one BWD well, while layer 5 ranges in thickness from 150 to 315 ft thick and contains the majority of the Grumman production wells and BWD wells.

This spacing of grid layers in relationship to well depths allows for a direct association between well depths and model layers. For example, a water table contour of the modeled heads in layer 1 would consist of shallow well heads, while a contour of layer 2 modeled heads would consist of intermediate well heads. In this way, contaminants can also be tracked throughout the aquifer. For example, if contaminants pass from layer 1 to layer 2 at a point with a shallow and intermediate well, the

intermediate well would pick up the contaminations at that point, while a shallow well would be too shallow to pick up the contamination.

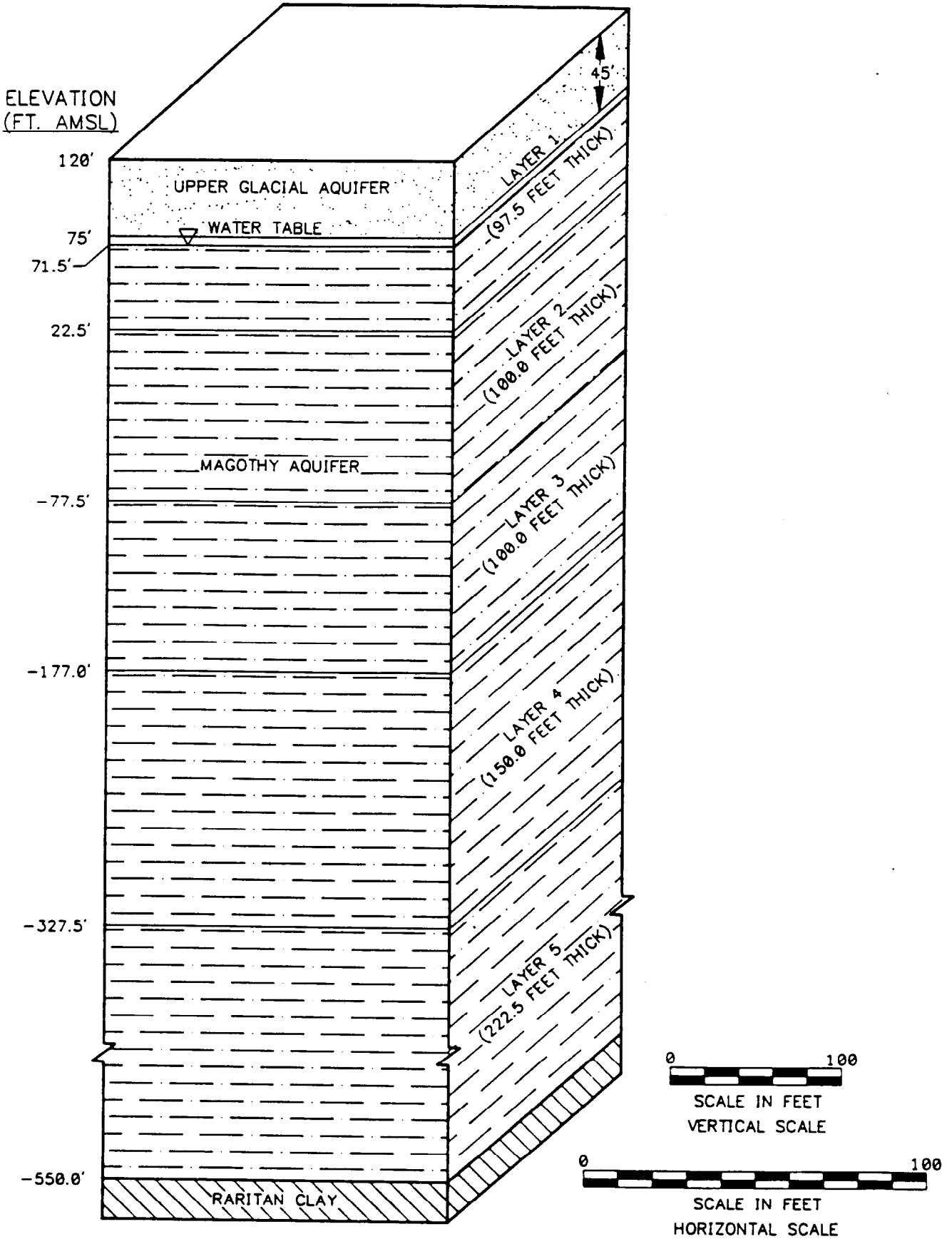
Because layers were defined based on monitoring well depths, the model layers are not directly related to lithologic units. Figure 4-2 illustrates the five model layers and their relationship to the aquifer units. Layer 1 contains the upper glacial aquifer, and the upper portion of the Magothy aquifer. Layers 2, 3, 4 and 5 are exclusively composed of the Magothy aquifer. The bottom of layer 5 is concurrent with the top of the Raritan Clay, which is a regional barrier to the downward movement of groundwater. Although some water may pass through the Raritan Clay to the underlying Lloyd aquifer, this amount of water was considered to be negligible, and the top Raritan Clay unit was assumed to be the bottom of the groundwater flow system.

Surface elevations (top of layer 1 elevation) were determined from U.S.G.S contour maps of the area. The surface contours were digitized and overlaid on to the model grid, and surface elevations for each node were approximated to the nearest 5.0 ft. Layer 1 ranges in thickness from 72.5 ft to 105 ft. Layer 2 and 3 were defined to be 100 feet thick. Layer 4 was defined to be 150 ft thick, and layer 5 was defined to be 150 feet thick. The bottom of layer 5 was determined by digitizing the elevation of the top of the Raritan clay across the area from a literature source and overlaying the model grid, and approximating the elevation to the nearest 10.0 ft (Smolensky and Feldman, 1990).

4.3 GENERAL HYDROGEOLOGIC CONDITIONS IN THE MODEL AREA

Based on monthly rounds of water-level elevations taken from monitoring wells and groundwater flow direction data from literature sources, the normal groundwater flow (under non-pumping conditions) is generally towards the south (Isbister, 1966; Smolensky and Feldman, 1990). Under pumping conditions, the activity at Grumman production wells, recharge basins and BWD wells significantly alters the local groundwater flow directions.

Groundwater is derived from precipitation and infiltration from industrial and residential recharge basins. The ultimate discharge point for water in the groundwater system is the Atlantic Ocean. Discharge form the model area will occur at the southern border of the model, which is also designated as a constant



MODFLOW LAYERS AT
GRID BLOCK: 22, 30
BETHPAGE NWIRP

FIGURE 4-2

HALLIBURTON NUS
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head boundary. Evapotranspiration and runoff are accounted for in the values used for infiltration (recharge). Additionally, during pumping conditions the water pumped from the BWD wells was considered to be removed from the system.

Based on literature sources and pumping tests conducted at the NWIRP, groundwater is considered to be unconfined (Isbister, 1966). The first laterally extensive layer which prevents the downward movement of groundwater is the Raritan Clay, which is approximately 600 feet below ground surface and is considered to be the regional flow barrier. The NWIRP occupies an area of recharge, and groundwater exhibits a downward flow direction.

4.4 INITIAL ESTIMATES OF HYDROGEOLOGIC PARAMETERS

4.4.1 Hydraulic Conductivity

Hydraulic conductivity values are specified in two directions: horizontal hydraulic conductivity (x- and y-direction) and vertical hydraulic conductivity (z-direction). Initial values for horizontal and vertical hydraulic conductivities were determined from the two pumping tests which were performed in the NWIRP area and from literature sources (Isbister, 1966; Smolensky and Feldman, 1990; Mc Clymonds and Franke, 1973). Pump test results are fully summarized in Appendix E.

In layer 1, the initial vertical hydraulic conductivity value was assumed to be one-tenth the horizontal conductivity for each node. For layers 2, 3 and 4 the ratio of vertical to horizontal conductivities decreased with depth. In layer 5 the initial vertical hydraulic conductivity values were assumed to be approximately one-fifth the horizontal conductivity values. Final values of hydraulic conductivity were determined during model calibration.

4.4.2 Storage

Initial storage values were derived from pumping test data and literature sources (Isbister, 1966). Final values were determined from model calibration. Storage values effect model solutions only during transient solutions.

4.4.3 Porosity

Initial values for porosity were determined from literature sources (Isbister, 1966; Fetter, 1988). For all nodes porosity was estimated at 0.20. Changes in the values of porosity does not effect groundwater flow directions or paths, although it does effect the rate at which groundwater moves through the aquifer.

4.4.4 Recharge

Recharge values were estimated from literature values, and from data from a climatic measuring station in Mineola, NY, approximately 10 miles from the NWIRP (Smolensky and Feldman, 1990; Feldman, Smolensky and Masterson, 1992). Average precipitation was 44.58 inches. It was assumed that 50% of precipitation was lost to runoff, evapotranspiration, or other sources while the remaining 50% recharged the groundwater system (Smolensky and Feldman, 1990). Recharge was added to the top layer only and was applied at the same rate for each node over the model grid.

4.5 BOUNDARY CONDITIONS

Boundary conditions are parameters which specify the constant head of constant flux at the boundaries and top surface of the modeled area. The types of boundary conditions used during these simulations include constant head boundaries, with specified heads during the simulation and specified flow boundaries, where the flux across a boundary is given. Water enters the model area at constant head boundaries along the north boarder of the modeling grid. Although actual water elevations at these points will fluctuate over time, it was assumed that fixed values could be assigned to these nodes for different months, due to the long-term nature of the steady-state simulations

4.5.1 Constant Head Boundaries

The boundary conditions applied to the northern and southern border of the model grid were designated as constant head boundaries. The value for constant head elevation for each node was initially determined from water-table elevation maps from literature sources (Smolensky and Feldman, 1990). Water elevations were digitized, and overlaid on to the modeling grid. Each node was assigned an

constant head elevation to the nearest 0.10 ft. The final constant head elevations assigned to all layers were determined during model calibration.

4.5.2 Specified Flux Boundaries

The value of flux across the top face of each node in layer 1 was specified to simulate the infiltration of precipitation. Flux was constant at 0.0051 ft/d, which is equal to 22.29 inches of recharge per year or one half of the total average precipitation for the area (Smolensky and Feldman, 1990).

The east and west boundaries of the modeled area were specified as no flow boundaries in all five layers (constant flux of zero). This assumption was based on potentiometric surface maps of the area, which indicate groundwater flow in the area is generally parallel to these borders, with little or no flow across the boundaries.

4.5.3 Starting Head Values

For steady-state simulations, the starting head elevations for all layers were specified for each node in the grid. When performing steady-state simulations, the values of initial head were specified to be above the top elevation of the highest cell, at 145 ft. This initial water elevation was necessary to prevent cells from starting dry, which can add additional error to the simulation runs. Regardless of the starting head value used, the same solution result was obtained. For transient simulations, starting head values were specified for each grid-block and read from input files. Each time aquifer parameters were altered during the transient calibration, a steady-state simulation was run and the resulting values of head were used as the starting head for the transient simulation. For steady-state simulations, the starting head elevations for all layers were specified for each node in the grid. When performing steady-state simulations, the values of initial head were specified to be above the top elevation of the highest cell at 145 ft. This initial water elevation was necessary to prevent cells from starting dry, which can add additional error to the simulation runs. Regardless of the starting head value used, the same solution result was obtained.

5.0 COMPUTER CODE SELECTION

5.1 COMPUTER SOFTWARE

A groundwater flow model and a related particle tracking package were utilized in the modeling effort. The following subsections describe the general capabilities of these codes. These models were chosen because they can simulate the conceptual model constructed for the site. In addition, these models have been extensively verified and documented and have been used successfully at many different kinds of hazardous waste sites. There are many modeling packages which can be added to the basic flow model for in depth analysis and presentation of modeling results.

5.1.1 MODFLOW Program

The modular three-dimensional finite-difference groundwater flow model (known as MODFLOW) was developed by the U. S. Geological Survey to simulate groundwater flow in a variety of situations (Mc Donald and Harbaugh, 1988). This model can be used for two-dimensional or three-dimensional applications and can simulate the effects of wells, recharge, drains, and rivers, as well as a variety of boundary conditions.

MODFLOW has been used extensively at hazardous waste sites for simulation of groundwater flow and evaluation of remedial alternatives. This model can also be used in conjunction with other programs for modeling of contaminant transport and particle tracking. MODFLOW uses a block-centered grid for solving the finite-difference groundwater flow equations.

Input files for MODFLOW are generated using a separate software package, known as ModelCad. This package allows the user to generate graphical input of the modeling grid and aquifer parameters, which are then converted to input files for use in MODFLOW and the particle tracking software, MODPATH. The output from the MODFLOW model consists of heads generated for each model grid block for each layer, which can then be imported into the contouring program SURFER for graphical presentation.

5.1.2 MODPATH Program

MODPATH is a three-dimensional particle tracking code that was developed by the U. S. Geological Survey (Pollock, 1989). Although it utilizes heads calculated in MODFLOW to determine the direction of particle movement with time, MODPATH operates separately from MODFLOW. Two different particle tracking approaches can be used to illustrate the flow lines of a particle. In forward tracking mode, one or more particles are released from a suspected contaminant source, and the flow paths of these particles are calculated by MODPATH. The flow lines which represent particle movement through time can then be viewed in plan view or in cross-sectional view along model rows or columns. The second particle tracking mode is reverse particle tracking, where particles are released at a one or more grid blocks (generally at well nodes) and particles are tracked towards their point of origination, which indicates the capture zone of the wells.

The output generated by MODPATH consists of a listing of particle locations and travel times in a text file, which can be converted to graphical output using the program MODPATH-PLOT. MODPATH-PLOT can generate cross-sectional particle tracks along model rows and columns.

6.0 MODEL CALIBRATION

Following the construction of the conceptual model and the input of initial values for aquifer parameters, such as horizontal and vertical hydraulic conductivities, storage, recharge and constant head elevations, calibration of the flow model was initiated. Calibration included steady-state calibration of two separate pumping conditions at the Grumman site; low pumping conditions for Grumman production wells during February, 1992, and high pumping conditions for Grumman production wells during August 1992, and performing transient simulations of two pumping tests.

Model calibration refers to a demonstrating that the model is capable of producing water elevations which are comparable to water elevations measured on site. Steady-state calibration simulated two monthly pumping scenarios. Production well pumping rates and site wide water level data was used to check the simulated water elevations across the modeled area. Transient (stressed) conditions were calibrated by simulating two pumping tests performed on site. These pumping tests produced drawdowns within a small portion of the model grid, and transient calibration efforts were focused on this section of the model. Both transient and steady-state model calibration were performed by adjusting initial values of aquifer parameters and boundary conditions until an acceptable match of the modeled data was achieved when compared to observed measurements.

The calibration process was interactive between the steady-state and transient conditions. Any changes made to aquifer parameters during steady-state calibration were incorporated into the transient calibration model. Therefore, the final values of aquifer parameters determined during calibration represent a 'best-fit' for the measured steady-state and transient data sets.

6.1 CALIBRATION CRITERIA

The calibration criteria is the acceptable difference (expressed in feet) between the measured data and the modeled data for a given pumping situation. Calibration for the flow model was carried out until the

difference between the heads predicted by the model and the measured heads were within the calibration criteria.

Generally, a groundwater flow model is to be considered calibrated when the difference between measured and modeled heads are less than one half the average fluctuation in the water table. In the area being modeled the water table had a natural fluctuation of approximately 4 ft, during 1991 and 1992, as shown in Table 6-1. Therefore, a general calibration criteria of 2.0 ft was established, and was used for the steady-state model calibration.

For the transient pump test simulations, a more rigorous calibration criteria of 1.0 ft was used for several reasons. Specifically, the pumping tests were performed in a small portion of the modeling grid, where numerous data points were present, node spacing is most dense, and precise measurements were made throughout the pumping tests. In addition, the flow of groundwater in the area around the NWIRP is of primary concern, as a potential source of contaminants (Site 1) is known to exist in these areas. For these reasons the 1.0 ft calibration criteria was used for transient simulations, and the modeled pumping tests were considered to be calibrated when model predictions of drawdowns were $\pm$ 1.0 ft when compared to measured drawdowns at each monitoring well.

As part of the MODFLOW model, a volumetric budget (or water balance) is calculated internally by the program and acts as a check on the total amount of water entering and leaving the flow system (Mc Donald and Harbaugh, 1988). This water balance provides an indication of the overall acceptability of the solution, although does not indicate how accurately the model reflects the natural system. For example, a large water budget error can indicate problems with the conceptual model or hydraulic conductivities of the model. The water budget calculates how much water enters the system from precipitation, recharge basins, and constant head boundaries and compares this to the amount of water leaving the system due to well pumpage and constant head boundaries. Results are expressed in terms of percent error with $\pm$0.50% error being considered to be the maximum allowable water balance error for all transient and steady-state calibration runs.

TABLE 6-1
MONITORING WELL WATER ELEVATIONS - 1991 AND 1992
PAGE 1 of 2

WELL	GRID LOCATION (R,C,L)	1991 OCT. 21	1991 NOV. 25	1991 DEC. 18	1992 JAN. 24	1992 FEB. 21	1992 MARCH 27	1992 APRIL 24	1992 MAY 29	1992 JUNE 26
GERAGHTY & MILLER WELLS										
GM-2S	2, 33, 1	76.30	76.45	76.24	75.75	75.16	74.47	74.04	72.90	72.74
GM-2I	6, 33, 2	75.85	75.44	75.38	74.97	74.09	73.50	73.10	71.86	71.62
GM-3S	4, 10 1	75.56	75.54	75.69	75.15	74.56	74.07	73.58	71.90	71.68
GM-3I	*6, 9, 2*	75.01	75.07	75.24	74.68	74.05	73.57	73.14	71.44	71.10
GM-4S	7, 9, 1	76.36	76.36		75.94	75.23	74.99	74.34	73.30	73.72
GM-4I	7, 9, 2	74.89	74.89		74.53	74.04	73.54	72.93	71.44	71.08
GM-5S	10, 10, 1	74.38	74.38		74.20	73.52	73.15	72.58	71.05	70.54
GM-5I	10, 10, 2	74.28	74.28		73.96	73.34	72.97	72.34	70.70	70.27
GM-6S	11, 21, 1	74.55	74.55	74.54	73.88	73.29	72.70	71.37	70.66	69.34
GM-6I	*11, 21, 2*	69.59	69.57	69.50	68.69	68.06	67.60	66.93	65.43	65.15
GM-7S	13, 27, 1	75.88	75.32	73.45	72.52	73.16	72.64	72.12	71.25	71.43
GM-7I	13, 27, 2	75.66	75.23	73.00	72.10	73.07	72.57	73.93	71.06	71.19
GM-7D	13, 27, 3	73.77	74.11	72.15	71.01	72.16	71.77	70.73	69.26	69.09
GM-8S	15, 37, 1	77.75	76.79	75.14	74.30	73.77	73.20	72.76	72.99	74.19
GM-8I	*15, 37, 2*	76.50	75.89	74.64	71.94	73.31	72.77	72.21	72.00	72.71
GM-9S	13, 9, 1	73.63	73.63		73.31	72.70	72.35	71.76	70.30	69.72
GM-9I	13, 9, 2	73.60	73.60		73.26	72.70	72.35	71.72	70.26	69.63
GM-10S	20, 7, 1	72.82	72.82	72.49	72.22	71.83	71.40	70.81	69.72	68.98
GM-10I	21, 6, 2	72.70	72.69	72.71	72.25	71.75	71.19	70.77	69.47	68.59
GM-12S	29, 15, 1	72.96	72.61	72.45	71.70	71.11	70.62	70.15	69.22	68.96
GM-12I	29, 15, 2	72.58	72.30	72.16	71.33	70.82	70.37	69.82	68.81	68.43
GM-13S	31, 23, 1	73.10	72.47	72.67	71.06	70.55	69.99	69.62	68.99	69.28
GM13I	32, 23, 2	73.21	72.52	71.90	71.47	71.10	70.39	70.04	69.13	69.54
GM-13D	34, 22, 3	71.04	70.66	68.95	68.01	69.01	68.51	67.97	67.22	67.16
GM-14S	32, 28, 1	71.25	70.51	70.09	69.32	69.20	68.71	68.21	67.82	68.03
GM-14I	36, 25, 2	71.63	70.87	70.50	69.71	69.17	68.58	68.20	67.71	68.00
GM-15S	41, 38, 1	69.11	68.34	67.91	67.29	73.85	73.34	72.87	72.39	72.72
GM-15I	48, 40, 2	67.45	66.65	67.14	66.45	66.04	65.44	65.12	64.58	64.92
GM-16S	36, 16, 1	71.41	70.67	69.97	68.53	69.79	69.05	68.85	68.45	68.58
GM-16I	36, 16, 2	71.31	70.59	69.47	69.15	69.75	69.02	68.81	68.38	68.49
GM-17S	38, 9, 1	72.97	71.76	71.00	72.49	71.22	69.46	71.29	71.49	72.89
GM-18S	45, 11, 1	69.57	68.14	68.28	67.48	66.73	65.98	65.75	65.78	66.42
GM-18I	44, 11, 2	69.86	68.49	68.74	67.92	67.74	66.94	66.71	66.83	67.47
GM-19S	48, 33, 1	68.63	67.34	67.57	66.81	66.41	65.78	65.43	65.33	66.17
GM-19I	48, 33, 2	68.53	67.29	67.64	66.98	66.46	65.84	65.50	65.35	66.12
GM-20S	51, 16, 1	69.96	67.16	67.00	66.19	65.33	64.74	64.30	65.40	67.01
GM-20I	51, 16, 2	68.92	66.62	66.61	65.98	65.54	64.83	64.50	65.28	66.42
GM-20D	51, 16, 3	67.67	65.91	65.76	64.95	64.68	61.43	63.66	63.92	64.68
GM-21S	51, 23, 1	68.35	66.11	66.01	65.31	64.42	64.38	63.46	64.76	65.95
GM-21I	51, 23, 2	67.72	65.74	65.60	64.93	64.52	63.93	63.55	64.42	65.45
GM-22S	51, 30, 1	67.90	66.77	63.02	66.35	65.88	65.31	65.10	64.86	66.13
GM-22I	51, 30, 2	67.08	65.63	66.04	67.68	64.87	64.30	64.08	64.09	65.39
GM-23S	29, 8, 1	71.84	71.54	72.00	71.38	70.32	69.82	69.42	68.61	68.01
GM-23I	29, 8, 2	71.85	71.54	72.42	71.79	70.32	69.78	69.40	68.57	67.96
HALLIBURTON NUS WELLS										
HN-8D	*17, 37, 3*					70.95	70.35	69.85	69.49	70.15
HN-24S	13, 22, 1			72.99	72.35	71.69				69.55
HN-24I	13, 22, 2			72.62	71.73	71.18	70.78	70.06	68.78	68.34
HN-25S	16, 21, 1			73.84	73.07	72.40	71.87	71.38	70.53	70.56
HN-25I	16+17, 21+22, 2			73.83	73.02	72.23	71.91	70.99	70.15	70.14
HN-25D	16, 21, 3					71.21	71.11	69.29	67.80	67.54
HN-26S	18, 26, 1			75.38	74.51	74.23	73.63	72.83	73.55	74.33
HN-26I	19, 26, 2			74.86	74.24	73.28	72.61	72.05	71.79	72.26
HN-27S	22+23, 30, 1			75.38	74.64	74.21	73.68		74.34	75.94
HN-27I	22+23, 30, 2			74.88	74.09	73.61	72.98			
HN-28S	26+27, 29+30, 1			73.58	72.65	72.10	71.55	71.16	71.12	72.08
HN-28I	26+27, 29+30, 2			72.86	71.91	71.28	70.78	70.32	69.75	70.14
HN-29S	26+27, 26+27, 1			73.76	72.76	72.15	71.62	71.22	70.97	71.63
HN-29I	26+27, 26+27, 2			72.83	71.97	71.19	70.84	70.18	69.53	69.75
HN-29D	*26+27, 26+27, 3*					69.42	69.21	68.39	67.51	67.58
HN-30S	22, 36+37, 1			74.56	74.05	73.00	72.86	72.00	73.48	76.09
HN-30I	*22, 36+37, 2*			73.97	74.81	72.50	72.10	71.59	71.79	73.07

Note: Shading indicates water elevation not taken.
Italics indicate outlier well (not included in annual difference calculation).

TABLE 6-1
MONITORING WELL WATER ELEVATIONS - 1991 AND 1992
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WELL	GRID LOCATION (R,C,L)	1992 JULY 24	AUG. 28	SEPT. 25	HIGHEST WATER LEVEL	LOWEST WATER LEVEL	ANNUAL DIFFERENCE (ft)
GERAGHTY & MILLER WELLS							
GM-2S	2, 33, 1	72.10	72.39	71.73	76.45	71.73	4.72
GM-2I	6, 33, 2	71.05	71.28	70.84	75.85	70.84	5.01
GM-3S	4, 10 1	71.46	71.55	71.50	75.69	71.50	4.19
GM-3I	*6, 9, 2*	70.49	74.96	70.31	75.24	70.31	4.93
GM-4S	7, 9, 1	73.04	74.49	72.68	76.36	72.68	3.68
GM-4I	7, 9, 2	70.42	70.84	70.29	74.89	70.29	4.60
GM-5S	10, 10, 1	70.04	70.37	69.78	74.38	69.78	4.60
GM-5I	10, 10, 2	69.68	69.57	69.56	74.28	69.56	4.72
GM-6S	11, 21, 1	69.70	69.88	69.69	74.55	69.34	5.21
GM-6I	*11, 21, 2*	64.39	64.72	64.72	69.59	64.72	4.87
GM-7S	13, 27, 1	70.56	70.73	70.38	75.88	70.38	5.50
GM-7I	13, 27, 2	70.36	70.52	70.31	75.66	70.31	5.35
GM-7D	13, 27, 3	67.84	68.41	69.25	74.11	67.84	6.27
GM-8S	15, 37, 1	74.71	74.87	73.63	77.75	72.76	4.99
GM-8I	*15, 37, 2*	73.64	72.84	72.16	76.50	72.00	4.50
GM-9S	13, 9, 1	69.17	70.62	69.04	73.63	69.04	4.59
GM-9I	13, 9, 2	69.05	69.45	69.05	73.60	69.05	4.55
GM-10S	20, 7, 1	68.62	68.75	68.48	72.82	68.48	4.34
GM-10I	21, 6, 2	68.31	67.37	68.32	72.71	67.37	5.34
GM-12S	29, 15, 1	68.60	68.78	68.47	72.96	68.47	4.49
GM-12I	29, 15, 2	68.04	68.29	68.23	72.58	68.04	4.54
GM-13S	31, 23, 1	68.88	70.61	68.84	73.10	68.84	4.26
GM13I	32, 23, 2	68.97	69.55	68.98	73.21	68.98	4.23
GM-13D	34, 22, 3	66.67	67.05	67.06	71.04	67.05	3.99
GM-14S	32, 28, 1	67.59	68.51	67.75	71.25	67.75	3.50
GM-14I	36, 25, 2	67.60	66.04	67.67	71.63	66.04	5.59
GM-15S	41, 38, 1	72.25	72.72	72.46	73.85	67.29	6.56
GM-15I	48, 40, 2	64.46	64.99	64.54	67.45	64.46	2.99
GM-16S	36, 16, 1	68.27	68.54	68.14	71.41	68.14	3.27
GM-16I	36, 16, 2	68.20	68.44	68.08	71.31	68.08	3.23
GM-17S	38, 9, 1	73.42	72.29	71.21	73.42	69.46	3.96
GM-18S	45, 11, 1	65.64	66.23	65.85	69.57	65.85	3.72
GM-18I	44, 11, 2	66.47	67.22	66.84	69.86	66.83	3.03
GM-19S	48, 33, 1	65.63	66.24	65.79	68.63	65.33	3.30
GM-19I	48, 33, 2	65.56	66.24	65.73	68.53	65.35	3.18
GM-20S	51, 16, 1	66.78	67.41	66.61	69.96	64.30	5.66
GM-20I	51, 16, 2	66.13	66.46	66.10	68.92	64.50	4.42
GM-20D	51, 16, 3	64.33	64.90	64.54	67.67	61.43	6.24
GM-21S	51, 23, 1	65.79	66.50	66.15	68.35	63.46	4.89
GM-21I	51, 23, 2	65.24	65.82	65.25	67.72	63.55	4.17
GM-22S	51, 30, 1	65.73	66.23	66.19	67.90	63.02	4.88
GM-22I	51, 30, 2	64.59	65.15	64.67	67.08	64.08	3.00
GM-23S	29, 8, 1	67.98	67.84	67.68	71.84	67.68	4.16
GM-23I	29, 8, 2	67.90	67.78	67.69	71.85	67.69	4.16
HALLIBURTON NUS WELLS							
HN-8D	*17, 37, 3*	70.88	70.55	69.96	70.95	69.49	1.46
HN-24S	13, 22, 1	69.32	69.47	69.04	72.99	69.04	3.95
HN-24I	13, 22, 2	67.80	68.10	68.34	72.62	68.10	4.52
HN-25S	16, 21, 1	69.83	69.83	69.53	73.84	69.53	4.31
HN-25I	16+17, 21+22, 2	69.26	69.41	69.51	73.83	69.26	4.57
HN-25D	16, 21, 3	66.49	66.83	68.39	71.21	68.39	2.82
HN-26S	18, 26, 1	72.91			75.38	72.83	2.55
HN-26I	19, 26, 2	71.47	71.02	70.96	74.86	70.96	3.90
HN-27S	22+23, 30, 1	77.70	75.64	74.28	77.70	74.21	3.49
HN-27I	22+23, 30, 2				74.88	72.98	1.90
HN-28S	26+27, 29+30, 1	71.97	72.41	71.47	73.58	71.16	2.42
HN-28I	26+27, 29+30, 2	69.86	70.05	69.84	72.86	69.75	3.11
HN-29S	26+27, 26+27, 1	71.13	71.50	70.69	73.76	70.69	3.07
HN-29I	26+27, 26+27, 2	69.27	69.56	69.45	72.83	69.45	3.38
HN-29D	*26+27, 26+27, 3*	66.88	67.24	67.53	69.42	67.24	2.18
HN-30S	22, 36+37, 1	80.64	79.36	77.70	80.64	72.00	8.64
HN-30I	*22, 36+37, 2*	74.84	74.36	73.45	74.84	72.10	2.74

AVERAGE ANNUAL DIFFERENCE (FT) 4.13

6.2 STEADY STATE CALIBRATION

Calibration of steady-state conditions was performed to correlate modeled water elevations with measured data for 61 observation wells located in the NWIRP and throughout the Grumman site. Steady-state calibration included performing simulations of two different pumping scenarios, which correspond to the lowest and highest yearly production rates at the Grumman production wells: low pumping conditions during February 1992, and high pumping conditions during August 1992. For these pumping scenarios monthly pumping rate data was available for each production well on the Grumman site, and water levels were taken at the end of each month.

Due to seasonal precipitation fluctuations the constant head values assigned to the boundaries changed for the two months for which model calibrations were performed.

6.2.1 Steady-State Calibration Procedures

For each steady-state simulation the average pumping rates was determined for each Grumman production well from monthly production well totals. Initially, recharge basins were assumed to receive all water pumped by the production wells. The simulation output was compared against the measured data, aquifer parameters were changed until the modeled data were within the ± 2.0 ft calibration criteria of measured results, and a best-fit was achieved across the modeled area. The final values of recharge basin recharge rates were determined during model calibration and were within 90% of the total water pumped from the production wells. Steady-state simulations were run until there was a change in head of less than .0001 ft during one iteration of the simulation.

6.2.2 Steady-State Calibration Results

Calibration results for the low pumping conditions during February 1992 are presented on Table 6-2. Calibration results for the high pumping conditions during August 1992 are presented on Table 6-3. Calibration results summarized on these tables indicate that 56 of 61 wells in low pumping simulations,

TABLE 6-2
MODEL CALIBRATION RESULTS
LOW PUMPING CONDITIONS - FEBRUARY 21, 1992

WELL	GRID LOCATION (R,C,L)	FEB. 21, 1992 WATER ELEVATION	MODELED WATER ELEVATION	MODELED - MEASURED (FT)
GM-2S	2, 33, 1	75.16	75.49	0.33
GM-2I	6, 33, 2	74.09	73.23	-0.86
GM-3S	4, 10 1	74.56	73.99	-0.57
GM-3I	6, 9, 2	74.05	73.70	-0.35
GM-4S	7, 9, 1	75.23	75.35	0.12
GM-4I	7, 9, 2	74.04	73.88	-0.16
GM-5S	10, 10, 1	73.52	72.89	-0.63
GM-5I	10, 10, 2	73.34	72.79	-0.55
GM-6S	11, 21, 1	73.29	72.29	-1.00
GM-6I (1)	*11, 21, 2*	*68.06*	*72.24*	*4.18*
GM-7S	13, 27, 1	73.16	72.59	-0.57
GM-7I	13, 27, 2	73.07	72.50	-0.57
GM-7D	13, 27, 3	72.16	72.30	0.14
GM-8S	15, 37, 1	73.77	74.71	0.94
GM-8I	15, 37, 2	73.31	74.15	0.84
GM-9S	13, 9, 1	72.70	72.55	-0.15
GM-9I	13, 9, 2	72.70	72.41	-0.29
GM-10S	20, 7, 1	71.83	71.81	-0.02
GM-10I	21, 6, 2	71.75	71.24	-0.51
GM-12S	29, 15, 1	71.11	70.68	-0.43
GM-12I	29, 15, 2	70.82	70.64	-0.18
GM-13S	31, 23, 1	70.55	70.50	-0.05
GM13I	32, 23, 2	71.10	70.18	-0.92
GM-13D	34, 22, 3	69.01	69.59	0.58
GM-14S	32, 28, 1	69.20	70.44	1.24
GM-14I	36, 25, 2	69.17	69.29	0.12
GM-15S	41, 38, 1	73.85	73.47	-0.38
GM-15I	48, 40, 2	66.04	66.57	0.53
GM-16S	36, 16, 1	69.79	69.30	-0.49
GM-16I	36, 16, 2	69.75	69.25	-0.50
GM-17S	38, 9, 1	71.22	70.46	-0.76
GM-18S	45, 11, 1	66.73	67.27	0.54
GM-18I	44, 11, 2	67.74	67.21	-0.53
GM-19S	48, 33, 1	66.41	66.69	0.28
GM-19I	48, 33, 2	66.46	66.61	0.15
GM-20S	51, 16, 1	65.33	65.70	0.37
GM-20I	51, 16, 2	65.54	65.55	0.01
GM-20D	51, 16, 3	64.68	65.36	0.68
GM-21S	51, 23, 1	64.42	65.88	1.46
GM-21I	51, 23, 2	64.52	65.67	1.15
GM-22S	51, 30, 1	65.88	65.71	-0.17
GM-22I	51, 30, 2	64.87	65.56	0.69
GM-23S	29, 8, 1	70.32	70.50	0.18
GM-23I	29, 8, 2	70.32	70.45	0.13

TABLE 6-2
MODEL CALIBRATION RESULTS
LOW PUMPING CONDITIONS - FEBRUARY 21, 1992

WELL	GRID LOCATION (R,C,L)	FEB. 21, 1992 WATER ELEVATION	MODELED WATER ELEVATION	MODELED - MEASURED (FT)
HN-8D (2)	*17, 37, 3*	*70.95*	*73.79*	*2.84*
HN-24S	13, 22, 1	71.69	72.12	0.43
HN-24I	13, 22, 2	71.18	72.05	0.87
HN-25S	16, 21, 1	72.40	71.77	-0.63
HN-25I	16+17, 21+22, 2	72.23	71.69	-0.54
HN-25D	16, 21, 3	71.21	71.43	0.22
HN-26S	18, 26, 1	74.23	72.80	-1.43
HN-26I	19, 26, 2	73.28	72.54	-0.74
HN-27S	22+23, 30, 1	74.21	74.38	0.17
HN-27I	22+23, 30, 2	73.61	73.68	0.07
HN-28S	26+27, 29+30, 1	72.10	72.38	0.28
HN-28I	26+27, 29+30, 2	71.28	72.20	0.92
HN-29S	26+27, 26+27, 1	72.15	71.84	-0.31
HN-29I	26+27, 26+27, 2	71.19	71.72	0.53
HN-29D (2)	*26+27, 26+27, 3*	*69.42*	*71.48*	*2.06*
HN-30S (2)	*22, 36+37, 1*	*73.00*	*76.80*	*3.80*
HN-30I (2)	*22, 36+37, 2*	*72.50*	*74.82*	*2.32*

NOTE: Calibration Criteria +/- 2.0 ft.
(1) Monitoring well not included in calibration due to proximity to production well.
(2) Monitoring well not included in calibration due to proximity to recharge basin.

MEAN ERROR:	-0.01
ABSOLUTE RESIDUAL VALUE:	28.26
MODFLOW WATER BALANCE ERROR:	-0.05%

TABLE 6-3
MODEL CALIBRATION RESULTS
HIGH PUMPING CONDITIONS - AUGUST 28, 1992

WELL	GRID LOCATION (R,C,L)	AUG. 28, 1992 WATER ELEVATION	MODELED WATER ELEVATION	MODELED - MEASURED (FT)
GM-2S	2, 33, 1	72.39	73.20	0.81
GM-2I	6, 33, 2	71.28	71.05	-0.23
GM-3S	4, 10 1	71.55	71.71	0.16
GM-3I (2)	*6, 9, 2*	*74.96*	*71.60*	*-3.36*
GM-4S	7, 9, 1	74.49	74.38	-0.11
GM-4I	7, 9, 2	70.84	71.92	1.08
GM-5S	10, 10, 1	70.37	70.13	-0.24
GM-5I	10, 10, 2	69.57	70.00	0.43
GM-6S	11, 21, 1	69.88	69.23	-0.65
GM-6I (1)	*11, 21, 2*	*64.72*	*69.15*	*4.43*
GM-7S	13, 27, 1	70.73	70.37	-0.36
GM-7I	13, 27, 2	70.52	70.15	-0.37
GM-7D	13, 27, 3	68.41	69.61	1.20
GM-8S	15, 37, 1	74.87	75.59	0.72
GM-8I (2)	*15, 37, 2*	*72.84*	*70.53*	*-2.31*
GM-9S	13, 9, 1	70.62	69.65	-0.97
GM-9I	13, 9, 2	69.45	69.46	0.01
GM-10S	20, 7, 1	68.75	69.30	0.55
GM-10I	21, 6, 2	67.37	68.01	0.64
GM-12S	29, 15, 1	68.78	68.00	-0.78
GM-12I	29, 15, 2	68.29	67.95	-0.34
GM-13S	31, 23, 1	70.61	68.79	-1.82
GM13I	32, 23, 2	69.55	68.34	-1.21
GM-13D	34, 22, 3	67.05	67.78	0.73
GM-14S	32, 28, 1	68.51	68.88	0.37
GM-14I	36, 25, 2	66.04	67.73	1.69
GM-15S	41, 38, 1	72.72	72.45	-0.27
GM-15I	48, 40, 2	64.99	65.77	0.78
GM-16S	36, 16, 1	68.54	67.67	-0.87
GM-16I	36, 16, 2	68.44	67.54	-0.90
GM-17S	38, 9, 1	72.29	71.70	-0.59
GM-18S	45, 11, 1	66.23	66.80	0.57
GM-18I	44, 11, 2	67.22	66.66	-0.56
GM-19S	48, 33, 1	66.24	66.43	0.19
GM-19I	48, 33, 2	66.24	66.26	0.02
GM-20S	51, 16, 1	67.41	66.65	-0.76
GM-20I	51, 16, 2	66.46	66.13	-0.33
GM-20D	51, 16, 3	64.90	65.44	0.54
GM-21S	51, 23, 1	66.50	67.48	0.98
GM-21I	51, 23, 2	65.82	66.64	0.82
GM-22S	51, 30, 1	66.23	66.46	0.23
GM-22I	51, 30, 2	65.15	65.93	0.78
GM-23S	29, 8, 1	67.84	67.01	-0.83
GM-23I	29, 8, 2	67.78	66.94	-0.84

TABLE 6-3
MODEL CALIBRATION RESULTS
HIGH PUMPING CONDITIONS - AUGUST 28, 1992

WELL	GRID LOCATION (R,C,L)	AUG. 28, 1992 WATER ELEVATION	MODELED WATER ELEVATION	MODELED - MEASURED (FT)
HN-8D (2)	*17, 37, 3*	*70.55*	*73.95*	*3.40*
HN-24S	13, 22, 1	69.47	68.98	-0.49
HN-24I	13, 22, 2	68.10	68.84	0.74
HN-25S	16, 21, 1	69.83	68.41	-1.42
HN-25I	16+17, 21+22, 2	69.41	68.30	-1.11
HN-25D	16, 21, 3	66.83	67.43	0.60
HN-26S	18, 26, 1	Dry	--	--
HN-26I	19, 26, 2	71.02	71.59	0.57
HN-27S	22+23, 30, 1	75.64	75.71	0.07
HN-27I	22+23, 30, 2	Destroyed	--	--
HN-28S	26+27, 29+30, 1	72.41	71.75	-0.66
HN-28I	26+27, 29+30, 2	70.05	71.39	1.34
HN-29S	26+27, 26+27, 1	71.50	70.47	-1.03
HN-29I	26+27, 26+27, 2	69.56	70.24	0.68
HN-29D (2)	26+27, 26+27, 3	67.24	69.77	2.53
HN-30S	22, 36+37, 1	79.36	81.03	1.67
HN-30I (2)	*22, 36+37, 2*	*74.36*	*76.71*	2.35

NOTE: Calibration Criteria +/- 2.0 ft.
(1) Monitoring well not included in calibration due to proximity to production well.
(2) Monitoring well not included due to proximity to recharge basin.

MEAN ERROR:	0.02
ABSOLUTE RESIDUAL VALUE:	36.64
MODFLOW WATER BALANCE ERROR:	-0.04%

and 55 of 61 wells in high pumping situations fall within the calibration criteria of ±2.0 ft. The wells which fall outside the calibration criteria are described below.

For both pumping conditions, wells which do not fall within the calibration criteria (referred to as outlier wells) are located in the vicinity of a production well, recharge basins, or exhibit unusual water elevations during some of the period for which water elevations were measured. Numerous production wells and recharge basins are active across the NWIRP and the Grumman site, and these activities can effect the local water-table significantly. The outlier wells are believed to be influenced by a some, near by external stress, such as a active industrial or residential recharge basin.

Wells HN-6I, GM-8I, HN-8D, HN-29D, HN-30S and HN-30I are in close proximity to active recharge basins and exhibit modeled water elevations which fall outside the calibration criteria of ± 2.0 ft. The location of these wells near production wells or recharge basins may account for the disparities in model values of water elevations. Model pumping and recharge rates for production wells and recharge basins were determined from monthly totals, and these averages may not be accurate over shorter time periods, such as one day. Water levels taken in the immediate vicinity of recharge basins represent 'snap-shot' pictures of water elevations, and will record a sudden change in water elevation in a near-by recharge basin, such as when the water level increases or decreases suddenly in the recharge basin due to a production wells turning on or off. Monthly average pumping rates used in the model cannot simulate these daily changes for wells near the recharge basins. However, for wells not immediately adjacent to a recharge basin, the monthly averages represent good approximations of steady-state conditions over a monthly interval, as evidenced by the effective calibration of the majority of the monitoring wells during low and high pumping conditions.

Well GM-6I is located in the immediate vicinity of Grumman production well 13, an active production wells during 1991 and 1992. GM-6I shows a consistently low measured value, which may indicate that pumping activity at PW-13 may be effecting the modeled vs. measured results in a similar fashion as described above for wells near recharge basins. Pumping at PW-13 may have decreased the measured values at this well, while the model inputs assumed a consistent pumping rate throughout the month.

Well HN-15S, which fell within the calibration criteria, exhibits unusual water elevations consistently through out the 1992 period during which water elevations were taken. Typically a shallow and

intermediate well in the same area will exhibit a decrease in head of approximately 1.5 ft of head or less, between the two wells. Figure 6-1 illustrates a graph of water levels at well HN-15S and HN-15I. The normal relationship is seen in the October 1991 through January 1992 data for GM-15S and GM-15I. The sudden increase in the water elevation at GM-15S during February, which does not effect GM-15I, does not conform to the typical trend of water levels at the site. This sudden increase in water level at GM-15S may be the result of a recharge basin or other external stress becoming active during the month of February 1992 and continuing at least through September 1992. To account for this, a recharge basin was assumed to be active in the vicinity of GM-15S, running at 306 gpm during low and high pumping conditions. This recharge rate for this recharge basin was determined during calibration to produce a result similar to the increase in water levels seen in the measured data at GM-15S.

Wells GM-3S, GM-3I, GM-4S. GM-4I, GM-5S, GM-5I and GM-9S, GM-9I, which are in the vicinity of the Hooker-Ruco chemical facility, generally were within the calibration criteria, although they consistently exhibited low modeled vs. measured results throughout model calibration. Three large recharge basins are present on the Hooker-Ruco site. Recharge activity at these Hooker-Ruco basins would account for the low modeled values produced at these wells during calibration simulations, as recharge may have been added to these basins during the two months used for calibration. Therefore, during the calibration simulations water was added at these basins to simulate recharge activity. Recharge rates at the Hooker-Ruco basins was determined during model calibration. During low pumping conditions, 202 gpm was added to each basin, while during high pumping conditions an average of 838 gpm was added to each basin. Table 6-4 shows the pumping and recharge rates used during the February and August, 1992 calibration scenarios.

The difference between the measured heads and the modeled heads was calculated for each well, and are listed in Tables 6-2 and 6-3. This value indicates if the measured water elevation at a well is within the calibration criteria. In addition to this value, two other quantitative calculations were preformed for the calibration runs to determine how closely the modeled data fit the measured data.

Figure 6-1
GM-15S Water Elevation 1991 and 1992

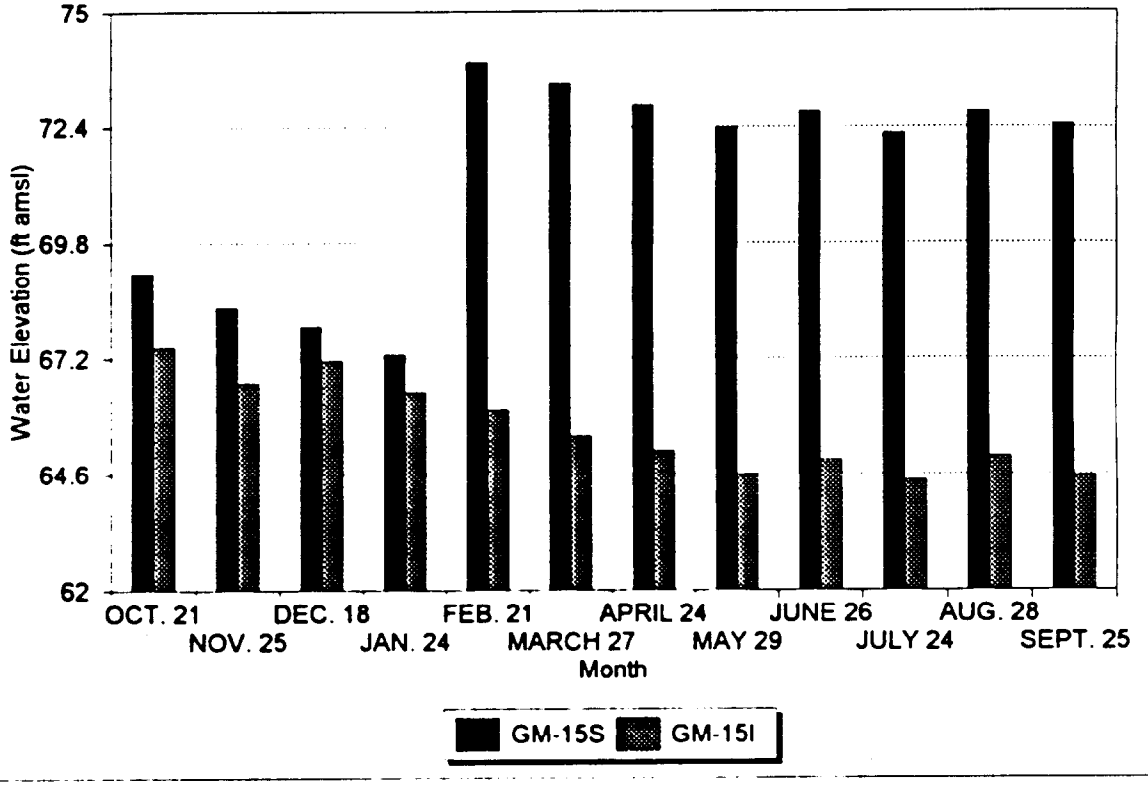


TABLE 6-4
PRODUCTION WELL PUMPING RATES FOR MODEL CALIBRATION SIMULATIONS

PRODUCTION WELL	LOCATION (ROW,COL.)	LAYER	% PUMPED FROM LAYER	FEBRUARY, 1992 (LOW PUMPING CONDITIONS)		AUGUST, 1992 (HIGH PUMPING CONDITIONS)	
				Actual Pumping rate (gpm)	Model Pumping rate (gpm)	Actual Pumping rate (gpm)	Model Pumping rate (gpm)
SOUTH PRODUCTION WELLS							
PW-1	42, 10	5	100%	378	378	1,369	1,369
PW-2	34, 11	5	100%	0	0	0	0
PW-3	38, 9	5	100%	432	432	1	1
PW-4	39, 11	4	100%	0	0	0	0
PW-5	31, 9	4	100%	0	0	0	0
PW-6	27, 7	3	11%	0	0	122	122
		4	89%	0	0	987	987
SOUTH PRODUCTION WELL TOTALS:				810	810	2,479	2,479
SOUTH RECHARGE BASINS - OUTFALLS 005, 006 AND 007							
23 GRID BLOCKS (2	--	1	100%	35	26	108	108
NORTH PRODUCTION WELLS							
PW-8	15, 13	4	16%	0	0	0	0
		5	84%	0	0	2	2
PW-9	16, 16	4	100%	305	305	1,155	1,155
PW-10	18, 19	4	100%	68	68	827	827
PW-11	19, 23	4	37%	220	220	260	260
		5	63%	375	375	443	443
PW-13	12, 18	5	100%	0	0	266	266
PW-14	21, 13	4	62%	0	0	0	0
		5	38%	0	0	0	0
PW-15	14, 26	5	100%	0	0	990	990
PW-16	9, 31	4	100%	862	862	986	986
NORTH PRODUCTION WELL TOTAL:				1,831	1,831	4,930	4,930
NORTH RECHARGE BASINS - OUTFALLS 004 AND 010							
24 GRID BLOCKS (2	--	1	100%	76	76	205	170
OTHER BASINS							
GM-15S BASIN	41, 38	1	100%	-	306	-	306
HOOKER-RUCO BASINS AVERAGE		1	100%	-	202	-	838

(1) MONTHLY PUMPING RATE FROM GRUMMAN AEROSPACE DATA.
(2) CALCULATIONS ARE TOTALS FOR EACH BASIN GRID BLOCK.

The sum of the differences of modeled data and measured data (referred to as the mean error) indicates the amount of positive or negative model error for the calibration run. The mean error is calculated by the following formula:

$$ME = \frac{1}{n} \sum_{i=1}^{n} [h_m - h_s]i$$

where ME is the mean error, hm is the measured head, hs is the simulated head, and n is the number of calibration values used. A zero value of mean error indicates equal amounts of positive and negative model error. Final calibration results for low pumping conditions have a mean error of -0.01 ft for low pumping conditions and 0.02 ft for high pumping conditions. Figures 6-2 and 6-3 graphically illustrates the amount of model error for the February and August 1992 simulations at each monitoring well. Because outlier wells may have been biased by recharge basin activity or production well activity, these wells were not included in the mean error values for these calibration scenarios. Figures 6-4 and 6-5 illustrate the amount of model error present at each monitoring well for the February and August, 1992 simulations for all wells, excluding the outlier wells. The mean error was minimized during model calibration. A small value of mean error alone does not indicate a good calibration, as both positive and negative mean errors are incorporated and may cancel out. For this reason, an additional measure of model accuracy was calculated.

The absolute residual value is the sum of the absolute values of the differences between measured and modeled data for each monitoring well, and is calculated using the formula:

$$AR = \frac{1}{n} \sum_{i=1}^{n} | [h_m - h_s]i |$$

where AR is the absolute residual value, hm is the measured head, hs is the simulated head, and n is the number of calibration values used. A low absolute residual value indicates a good match between measured and modeled data. The absolute residual value for low pumping and high pumping conditions was minimized during calibration. As noted in Tables 6-2 and 6-3, for low pumping conditions the residual value was 28.26 ft, and for high pumping conditions absolute residual value was 36.64 ft. The outlier wells that fall outside the calibration criteria were not included in the calculation of mean error or absolute residual error because these wells were interpreted to be influenced by active recharge

Figure 6-2
Model vs. Measured Values - Feb. 1992

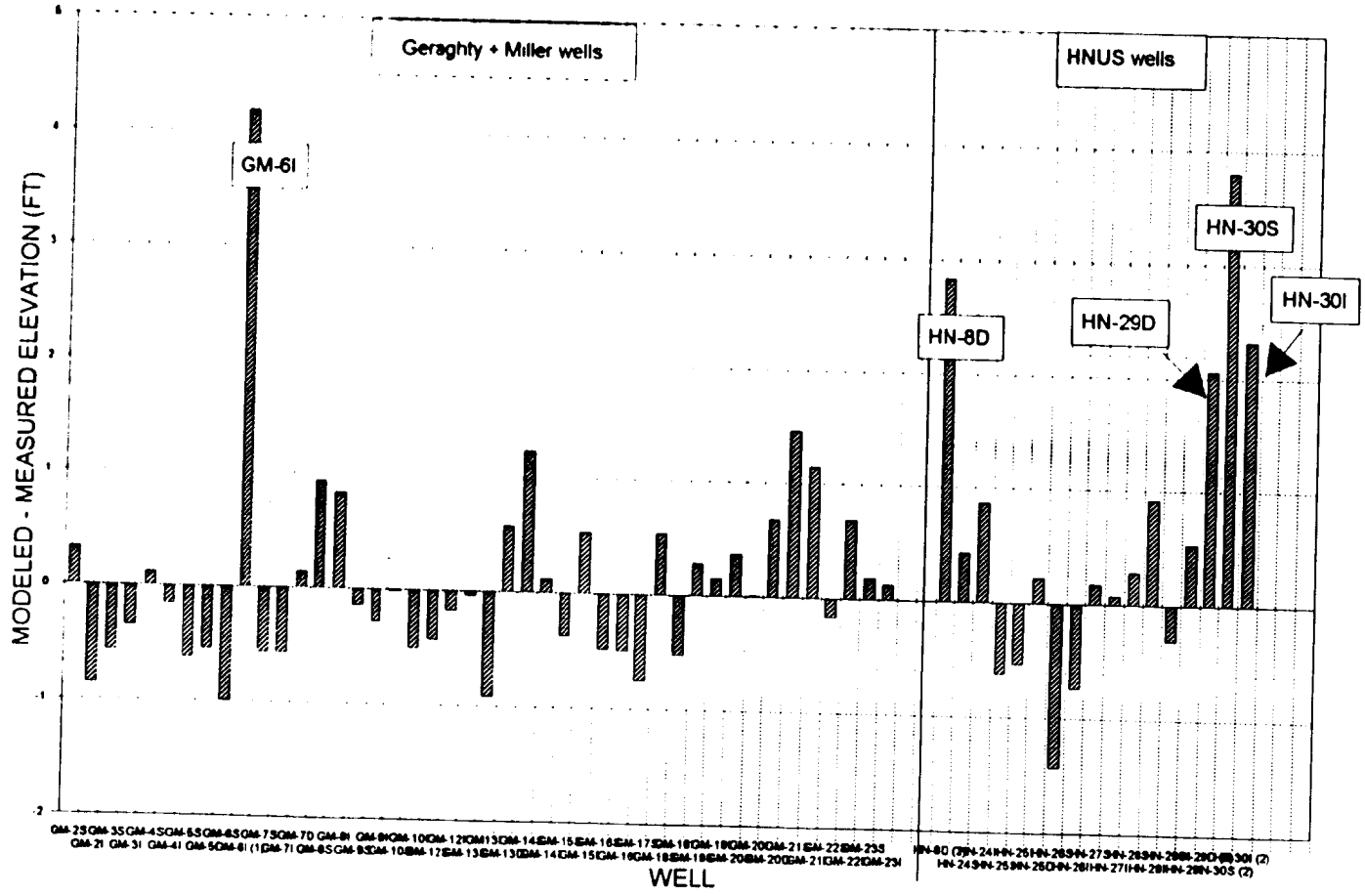


Figure 6-3
Model vs. Measured Values - Aug. 1992

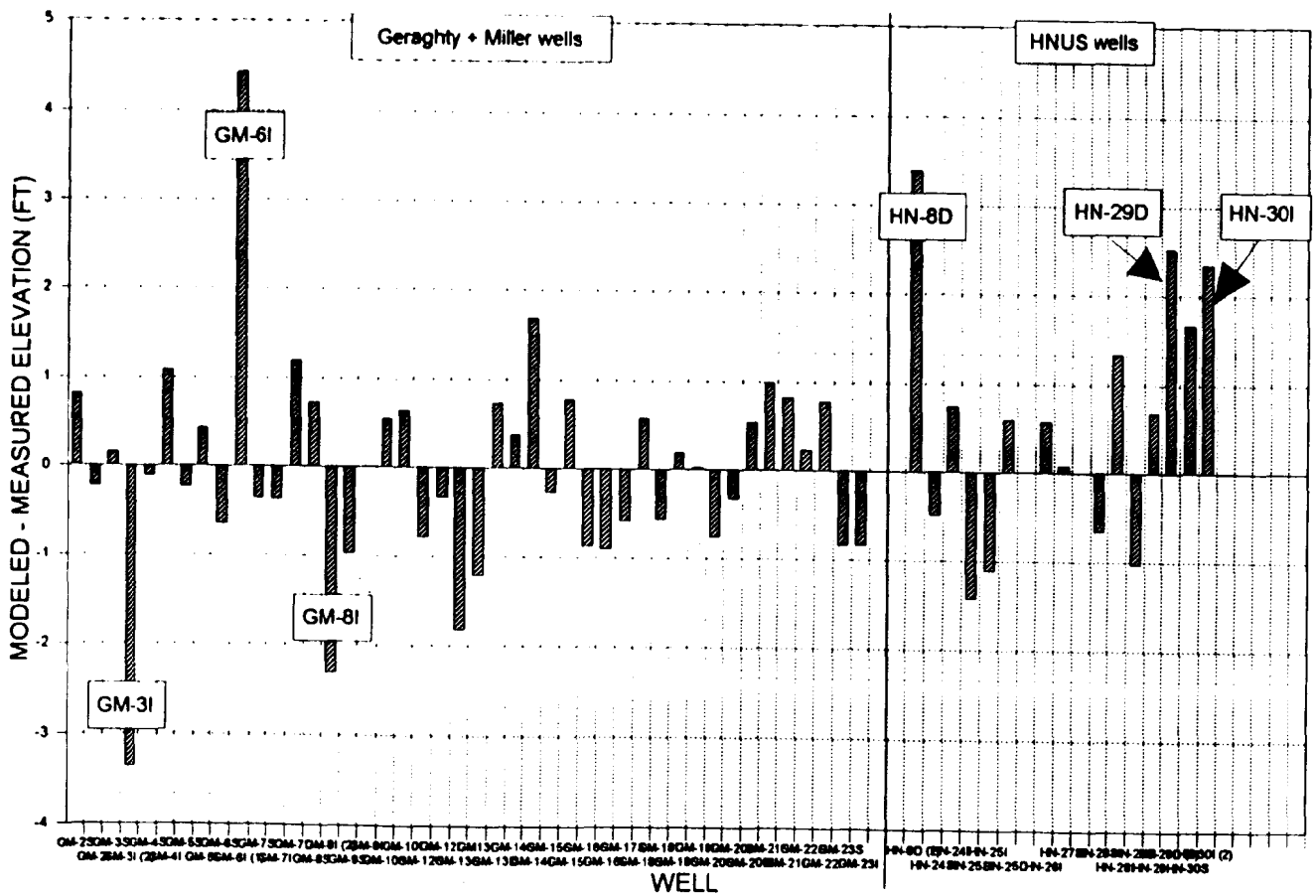
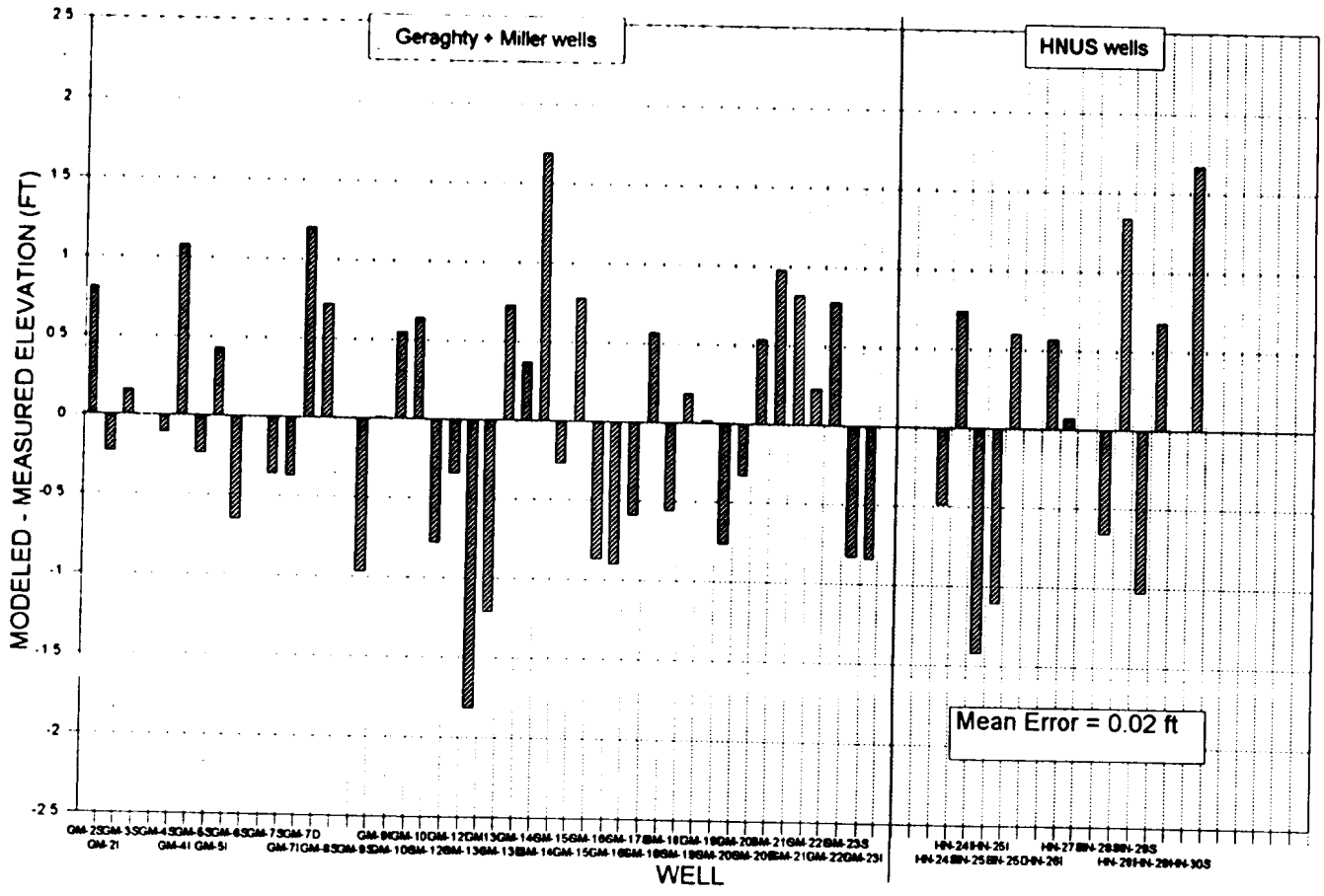


Figure 6-5
Model vs. Measured Values - Aug. 1992



basins and production wells. In addition to the statistical checks made on calibration solutions noted above, the water balance of each calibration run was checked. All calibration runs fell below the ± 0.50 % water balance error criteria.

Qualitative water elevations are presented in the water-table maps which compare measurements of modeled and measured data. Figure 6-6 compares the February 1992 measured and modeled (low pumping) water-table map. Figure 6-7 compares the August measured and modeled (high pumping) water-table map.

6.3 TRANSIENT CALIBRATION

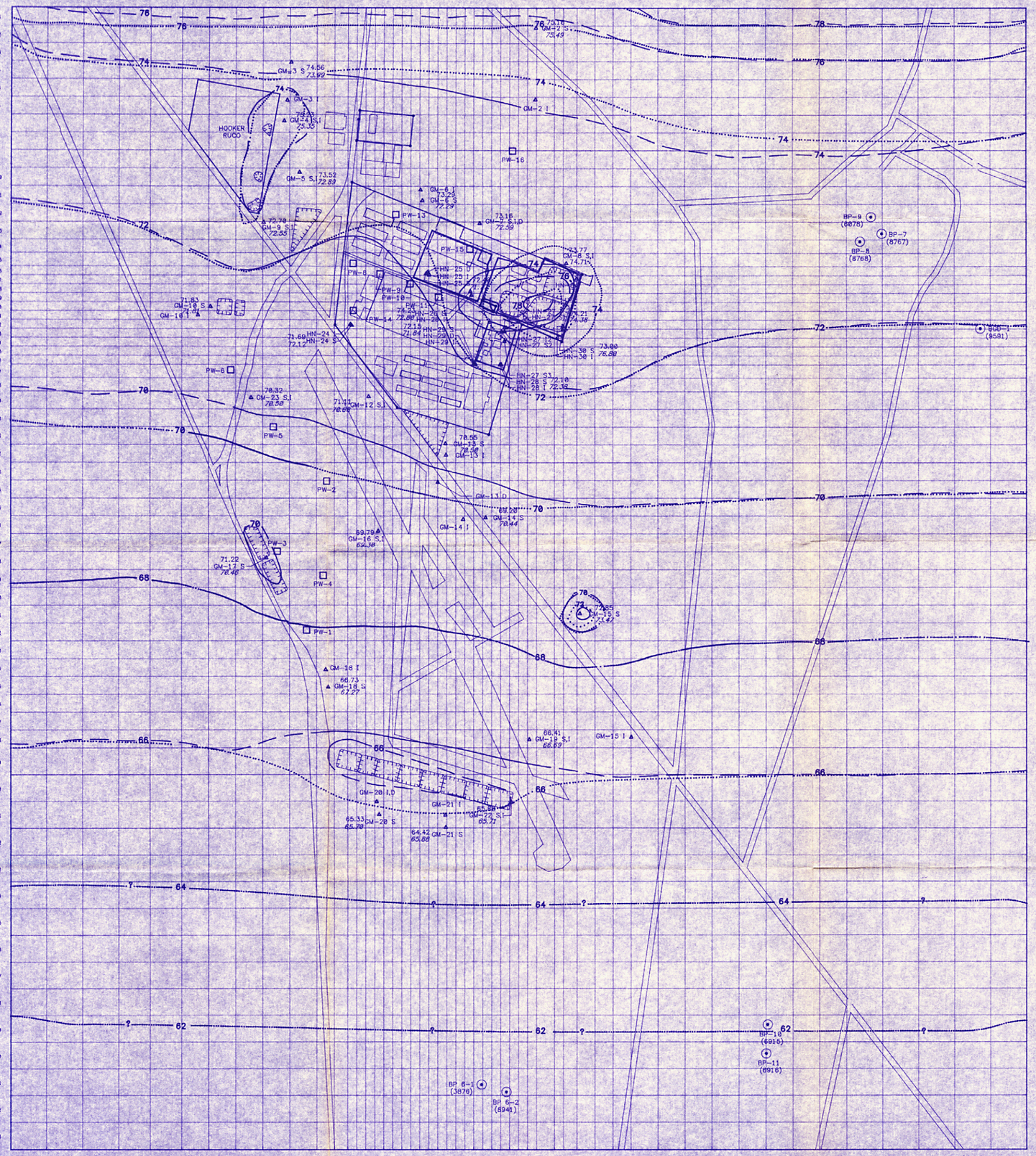
To calibrate the flow model for transient conditions, during which a stress is applied to the aquifer, two pumping tests which were conducted at the NWIRP, were simulated. The drawdowns produced in monitoring wells during the pumping tests were recorded, and this data was compared to model generated drawdowns. During pump test #1, the intermediate well HN-27I2 was pumping at a rate of 480 gpm for 2.8 days, while during pump test #2, the deep production well PW-11 was pumping at 890 gpm for 2.9 days. A complete discussion of the results for two pumping tests is provided in AppendixE.

6.3.1 Transient Calibration Procedures

Transient calibration began by performing modeling runs for the two pumping tests using the aquifer parameters determined during steady-state calibration. Subsequently, aquifer parameters, such as vertical and horizontal hydraulic conductivities, and storage were changed to achieved a best-fit between modeled and measured results for both pumping tests. For each pumping test simulation, all water pumped from the aquifer by the pumping well was assumed to be returned to the Grumman recharge basins via outfall 010, and no additional water from other site activities was contributed to the recharge basins. BWD wells were assumed to be distant enough from the pumping test activities to preclude any effect on the observed drawdowns, and therefore, the BWD wells were not active during the simulations.

6.3.2 Transient Calibration Results

Table 6-5 presents a summary of the calibration results for the two pumping test simulations. Time-drawdown graphs comparing the modeled drawdowns and recovery results for the final MODFLOW model to the measured data for pump test #1 are illustrated in Figures 6-8 through 6-19. The final



LEGEND

- □ PRODUCTION WELL
- △ MONITORING WELL
  - S = SHALLOW
  - I = INTERMEDIATE
  - D = DEEP
  - GM = GERAGHTY AND MILLER MONITORING WELL
  - HN = HALLIBURTON NUS MONITORING WELL
- ⊙ BETHPAGE WATER DISTRICT WELL
  BP-8 WELL NUMBER
  (8768) NYS DEC NUMBER
- RECHARGE BASIN
- MEASURED WATER TABLE CONTOUR LINE (DASHED WHERE INFERRED)
- MODELED WATER TABLE CONTOUR
  CONTOUR INTERVAL = 2.0 FT.
- 73.78 △ GM-15S MEASURED WATER ELEVATION FOR SHALLOW WELL MEASURED FEBRUARY 21, 1992
- 73.62 MODELED WATER ELEVATION FOR SHALLOW WELL
- ? MEASURED LINE INFERRED NO MONITORING WELL DATA

N

0 600 1200
SCALE IN FEET

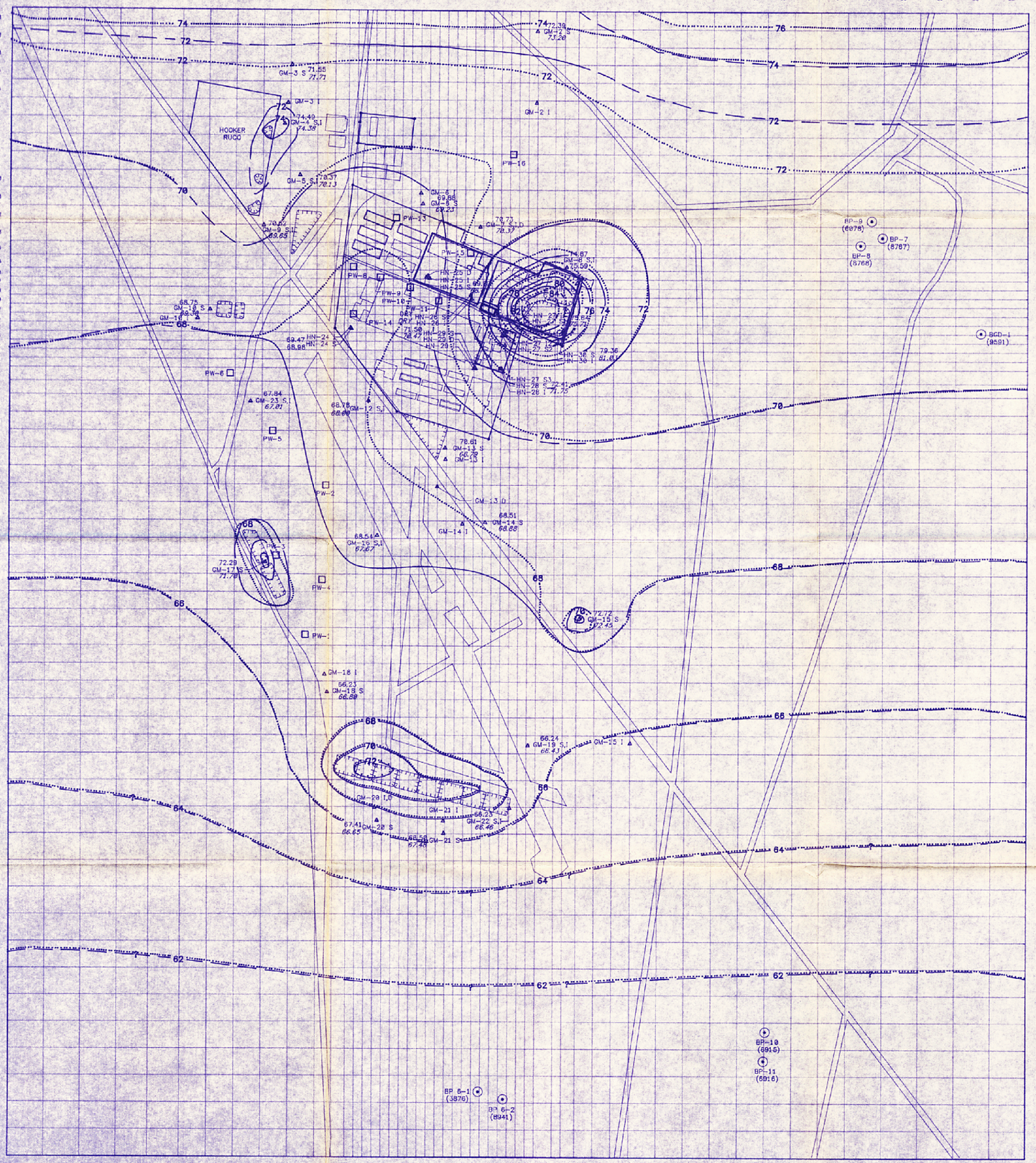
DRAWN:	M. Bates	9/8/93
CHECKED		
DESIGN ENGINEER		
PROCESS ENGINEER		
PROJECT MANAGER		
ENGINEERING MANAGER	P. C. Falvey	
CLIENT APPROVAL		

HALLIBURTON NUS
Environmental Corporation
661 ANDERSEN DRIVE
PITTSBURGH, PA 15220

COMPARISON OF MODELED AND MEASURED WATER TABLE – FEBRUARY 1992 BETHPAGE, NY

CLIENT		CONTRACT	
SCALE 1" = 600'	DATE OCTOBER 29, 1992	SHEET 1 OF 1	
DRAWING NO. FIGURE 6-6	ACFILE NAME 1953\MEASMOD.DWG	REV. 0	

DRAWING NO. FIGURE 6-6 REV. 0



LEGEND

- PRODUCTION WELL
- MONITORING WELL
  - S = SHALLOW
  - I = INTERMEDIATE
  - D = DEEP
  - GM = GERAGHTY AND MILLER MONITORING WELL
  - HN = HALLIBURTON NUS MONITORING WELL
- BETHPAGE WATER DISTRICT WELL
  BP-8 WELL NUMBER
  (8768) NYS DEC NUMBER
- RECHARGE BASIN
- MEASURED WATER TABLE CONTOUR LINE (DASHED WHERE INFERRED)
- MODELED WATER TABLE CONTOUR
- CONTOUR INTERVAL = 2.0 FT.
- 73.78 GM-15 S — MEASURED WATER ELEVATION FOR SHALLOW WELL MEASURED AUGUST 28, 1992
- 73.62 — MODELED WATER ELEVATION FOR SHALLOW WELL
- MEASURED LINE INFERRED NO MONITORING WELL DATA

N

0 600 1200
SCALE IN FEET

DRAWN	M. Bates	9/8/93
CHECKED		
DESIGN ENGINEER		
PROCESS ENGINEER		
PROJECT MANAGER		
ENGINEERING MANAGER	P. C. Falvey	
CLIENT APPROVAL		

HALLIBURTON NUS
Environmental Corporation
661 ANDERSEN DRIVE
PITTSBURGH, PA 15220

COMPARISON OF MODELED AND MEASURED WATER TABLE – AUGUST 1992
BETHPAGE, NY

CLIENT		CONTRACT	
SCALE 1" = 600'	DATE OCTOBER 29, 1992	SHEET 1 OF 1	
DRAWING NO. FIGURE 6-7		ACFILE NAME 1953\MEASMOD.DWG	REV. 0

FIGURE 6-7 0

TABLE 6-5
SUMMARY OF CALIBRATION RESULTS
PUMP TEST #1 AND PUMP TEST #2

Well	Layer	Location (Row)	Location (Column)	Measured Drawdown (ft)	Modeled Drawdown (ft)	Difference (ft) (1)
PUMP TEST #1						
HN-27S2	1	23	30	1.31	1.18	-0.13
HN-27S3		24	30	1.01	0.95	-0.06
HN-26I1		19	26	0.26	0.22	-0.04
HN-27I1	2	22	30	3.51	3.57	0.06
HN-27I2		23	30	5.05	5.13	0.08
HN-28I		26 27	29+30 29+30	0.59	0.51	-0.08
PUMP TEST #2						
HN-25S	1	21	16	0.08	0.29	0.21
HN-27S2		23	30	0.11	-0.84	-0.95
HN-25I		16 17	21+22 21+22	0.08	0.43	0.35
HN-26I1	2	19	26	0.04	0.15	0.11
HN-27I2		23	30	0.12	-0.65	-0.77
HN-28I		26 27	29+30 29+30	0.17	-0.26	-0.43
HN-29I		26 27	26+27 26+27	0.21	-0.02	-0.23
HN-25D	3	16	21	0.17	0.57	0.4
NH-29D		26 27	26+27 26+27	0.27	0.08	-0.19
PW-10	5	17 18	19+20 19+20	< 0.5	0.69	0.19
PW-11		19	23	1.03	1.86	0.83

NOTE: CALIBRATION CRITERIA FOR PUMP TEST SIMULATIONS = +/- 1.0 FT.
(1) DIFFERENCE = MODELED - MEASURED

Figure 6-8

HN-27S2 Drawdown for Pump Test #1

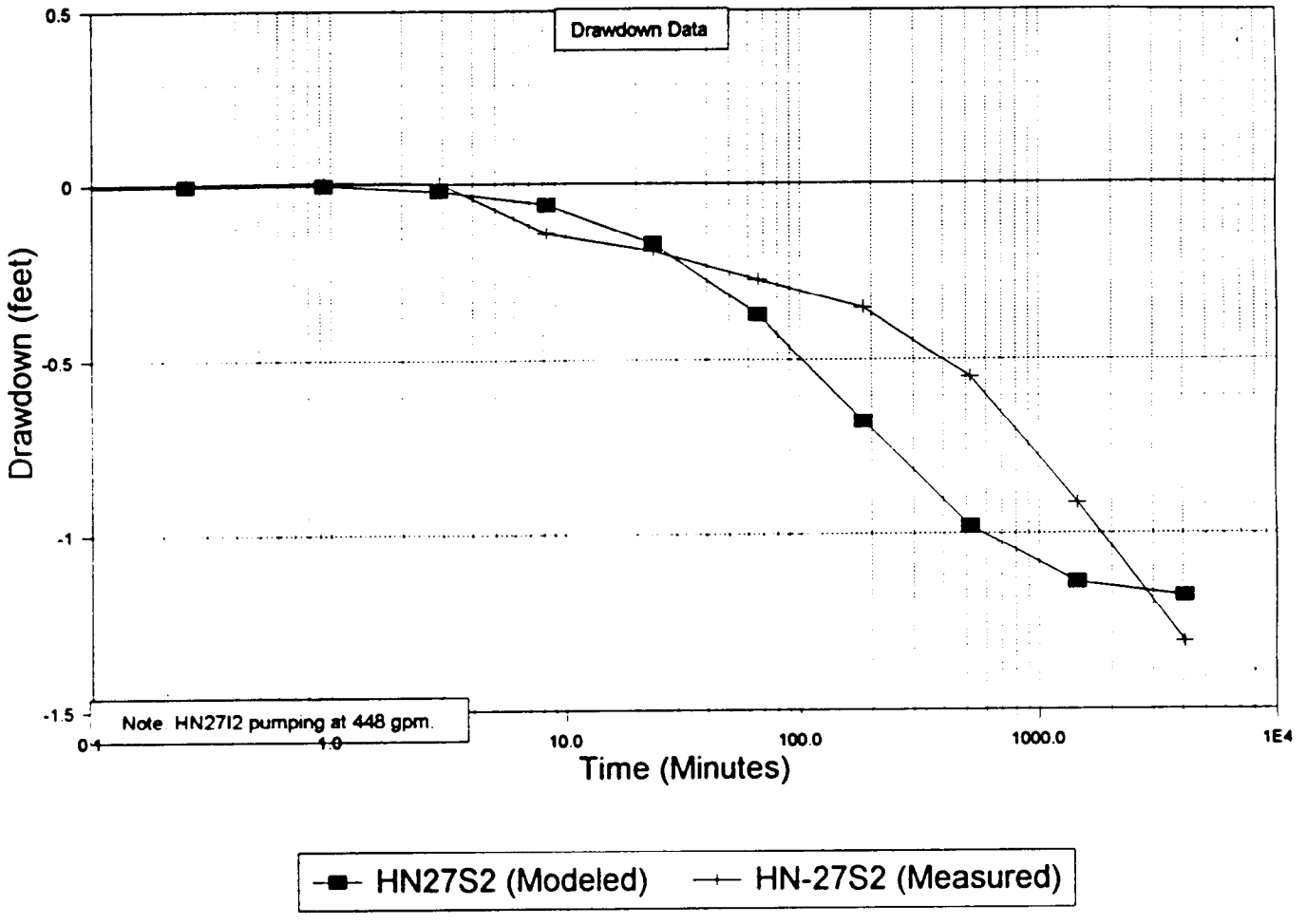


Figure 6-9

HN-27S3 Drawdown for Pump Test #1

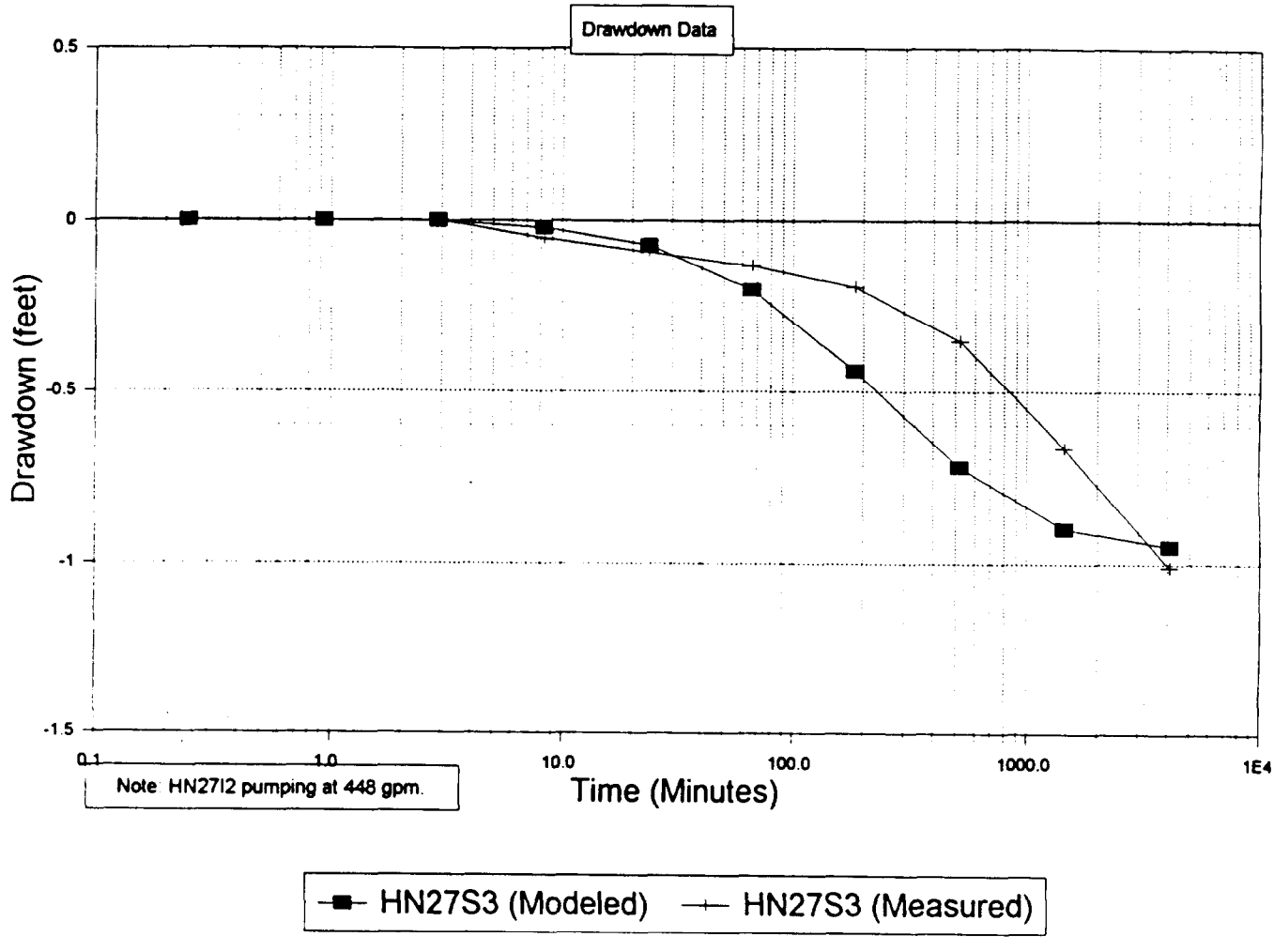


Figure 6-10
HN26I Drawdown for Pump Test #1

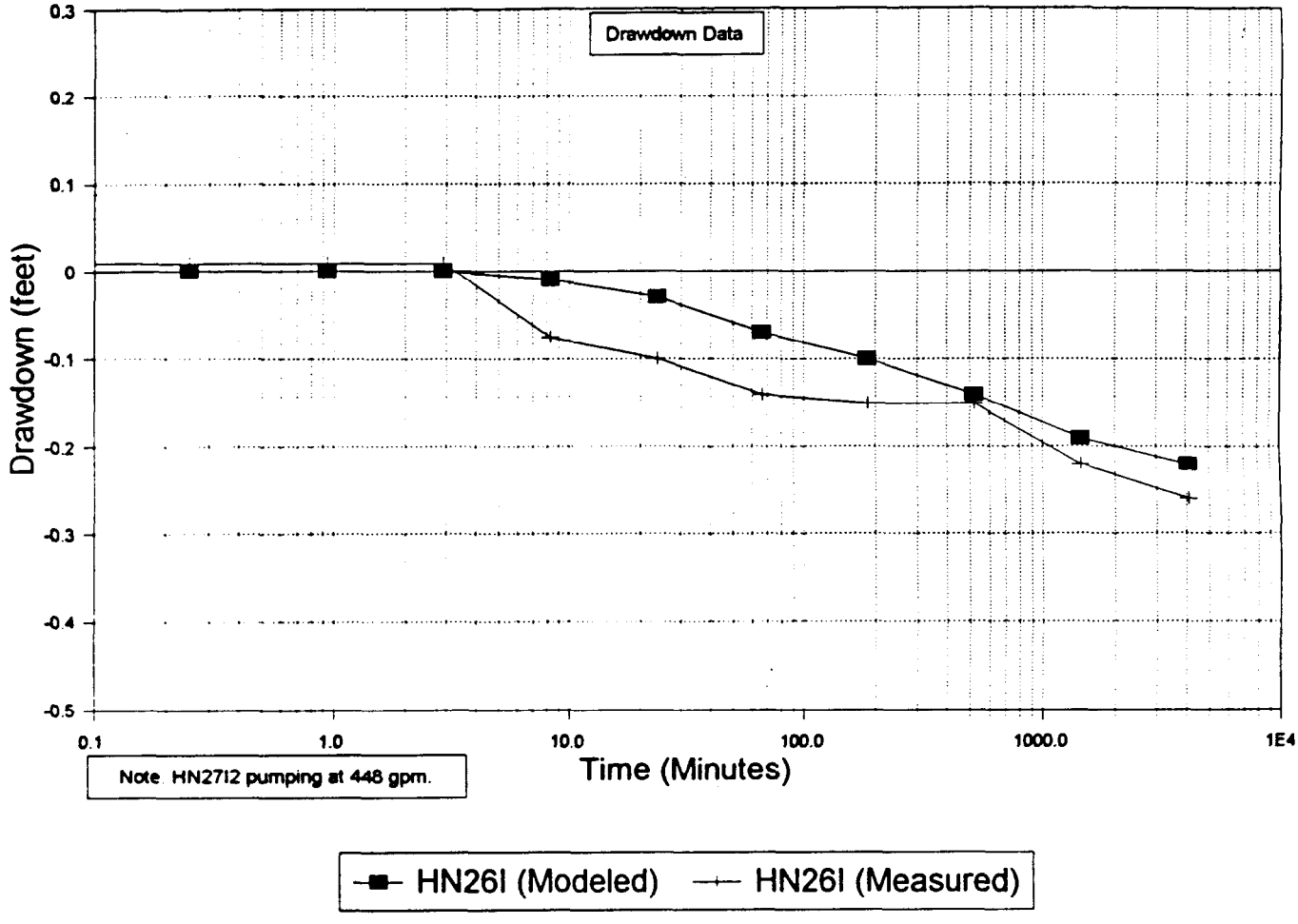


Figure 6-11
HN27I1 Drawdown for Pump Test #1

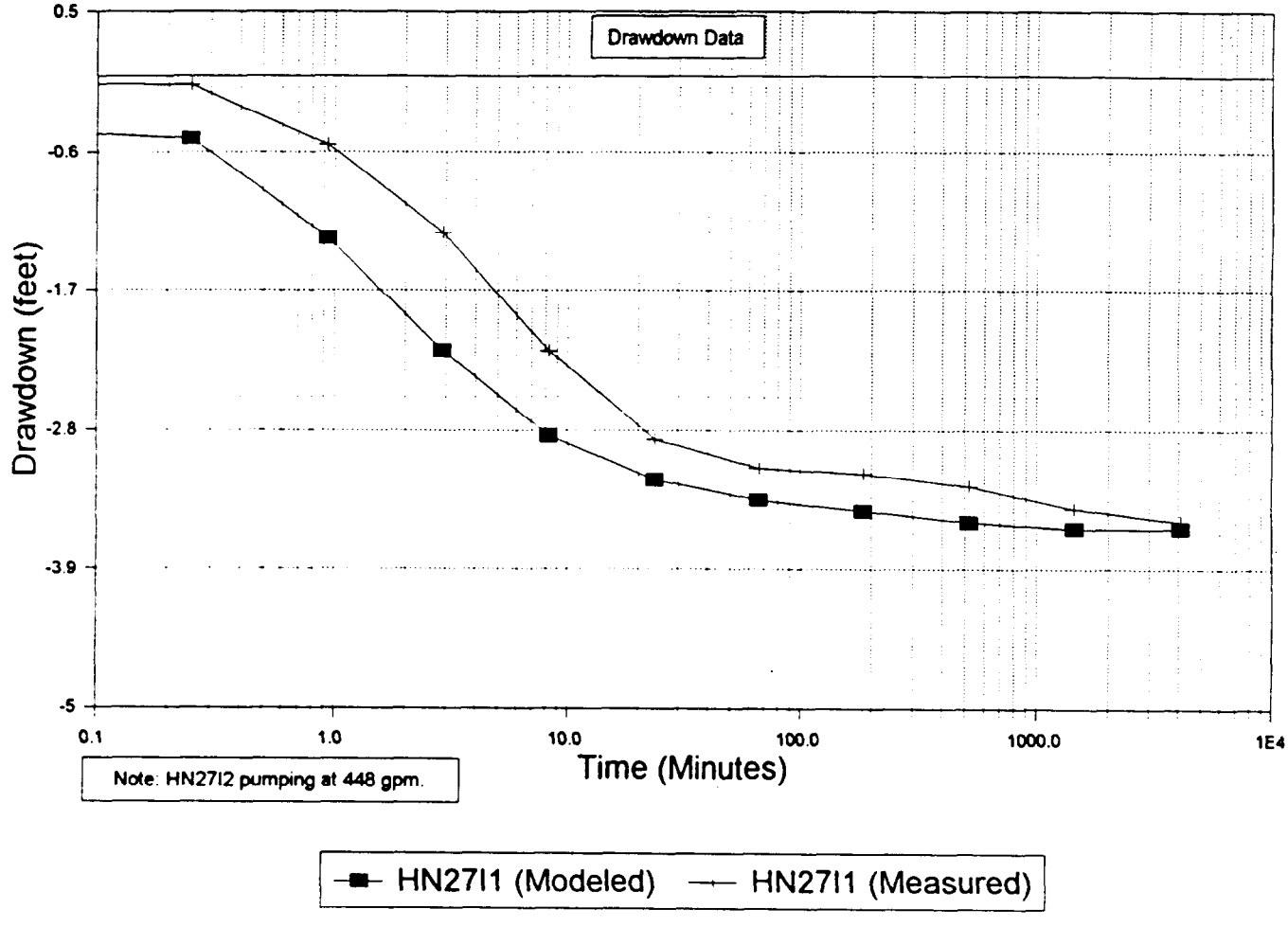


Figure 6-12
HN27I2 Drawdown for Pump Test #1

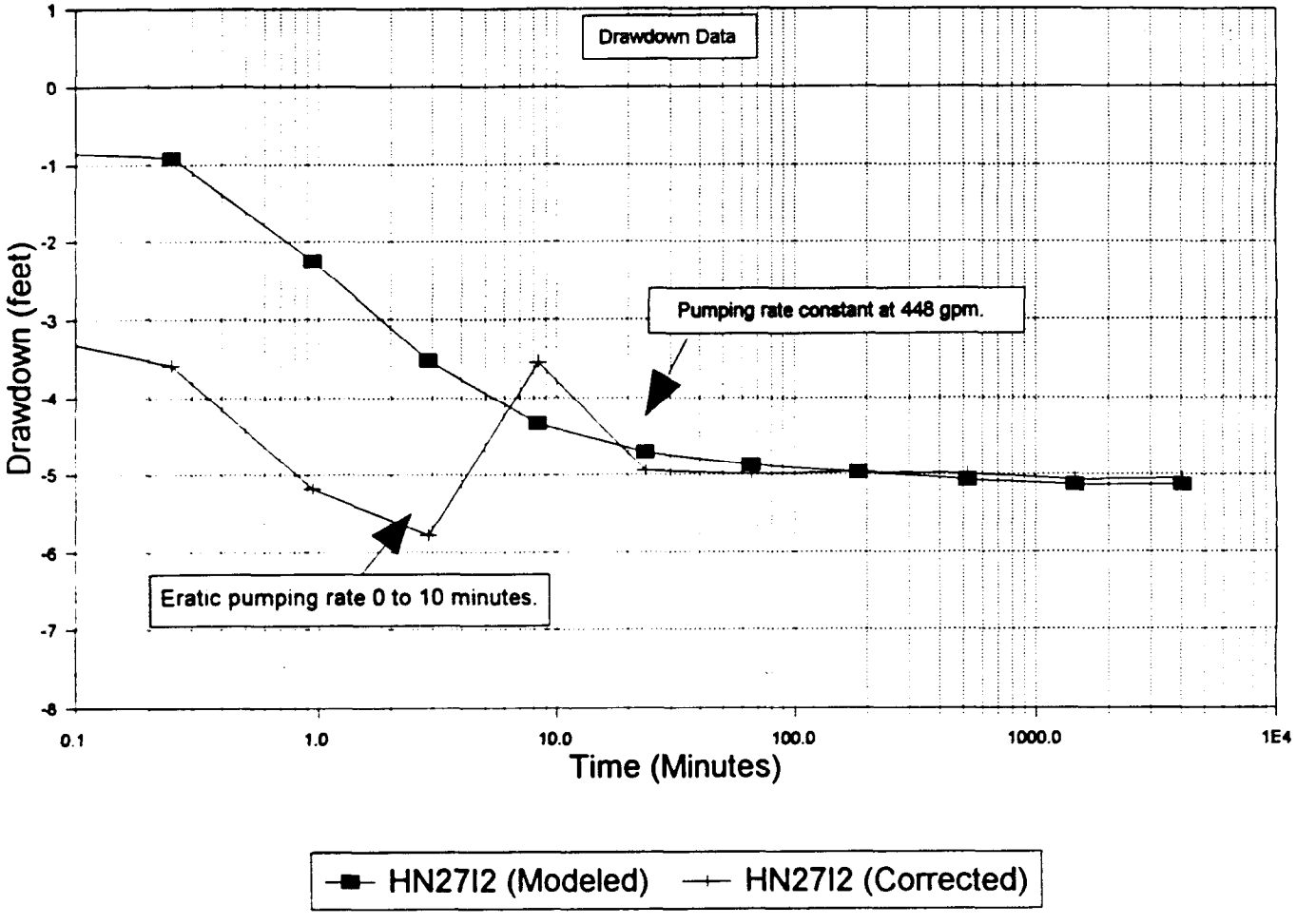


Figure 6-13
HN28I Drawdown for Pump Test #1

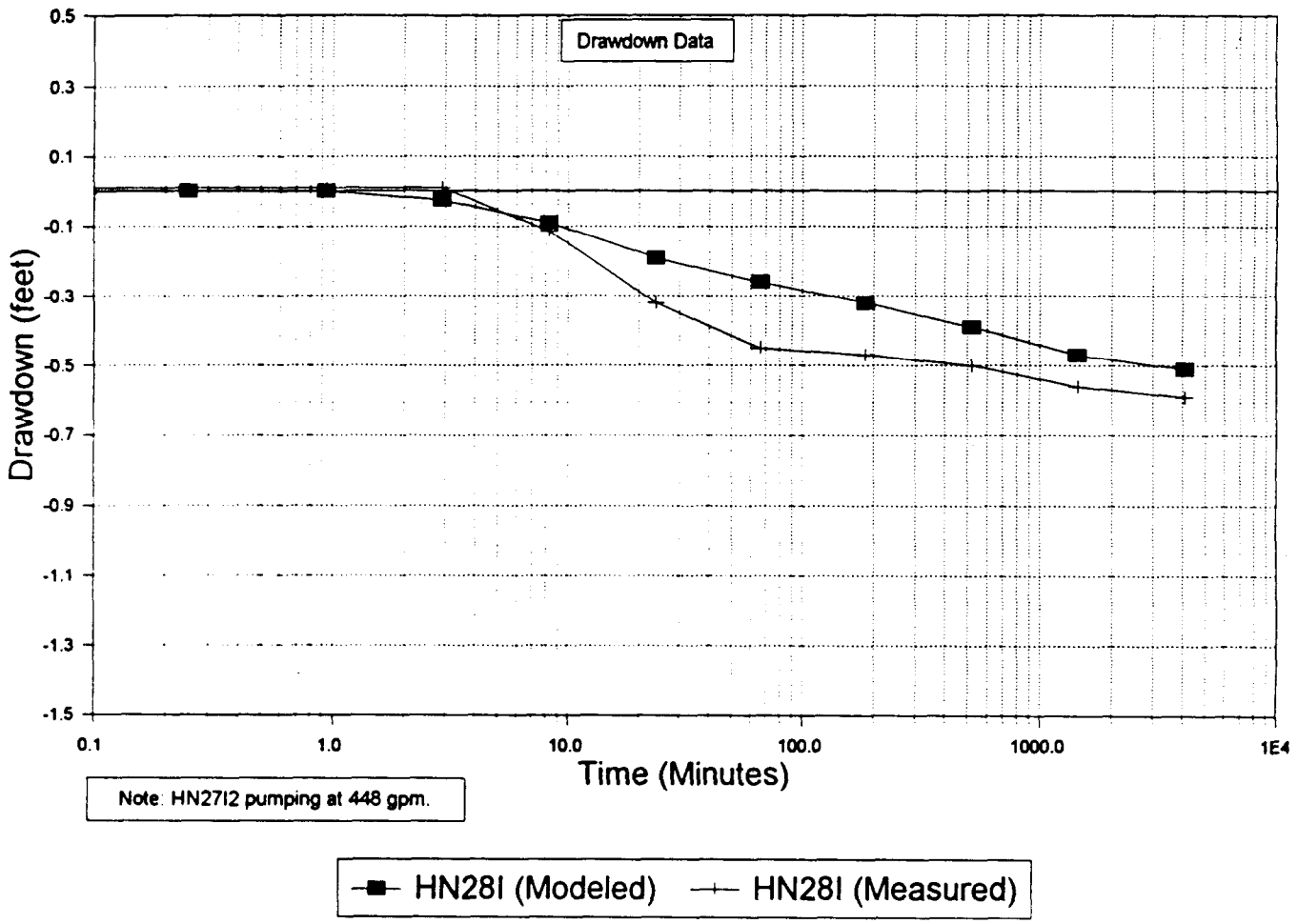


Figure 6-14

HN-27S2 Recovery for Pump Test #1

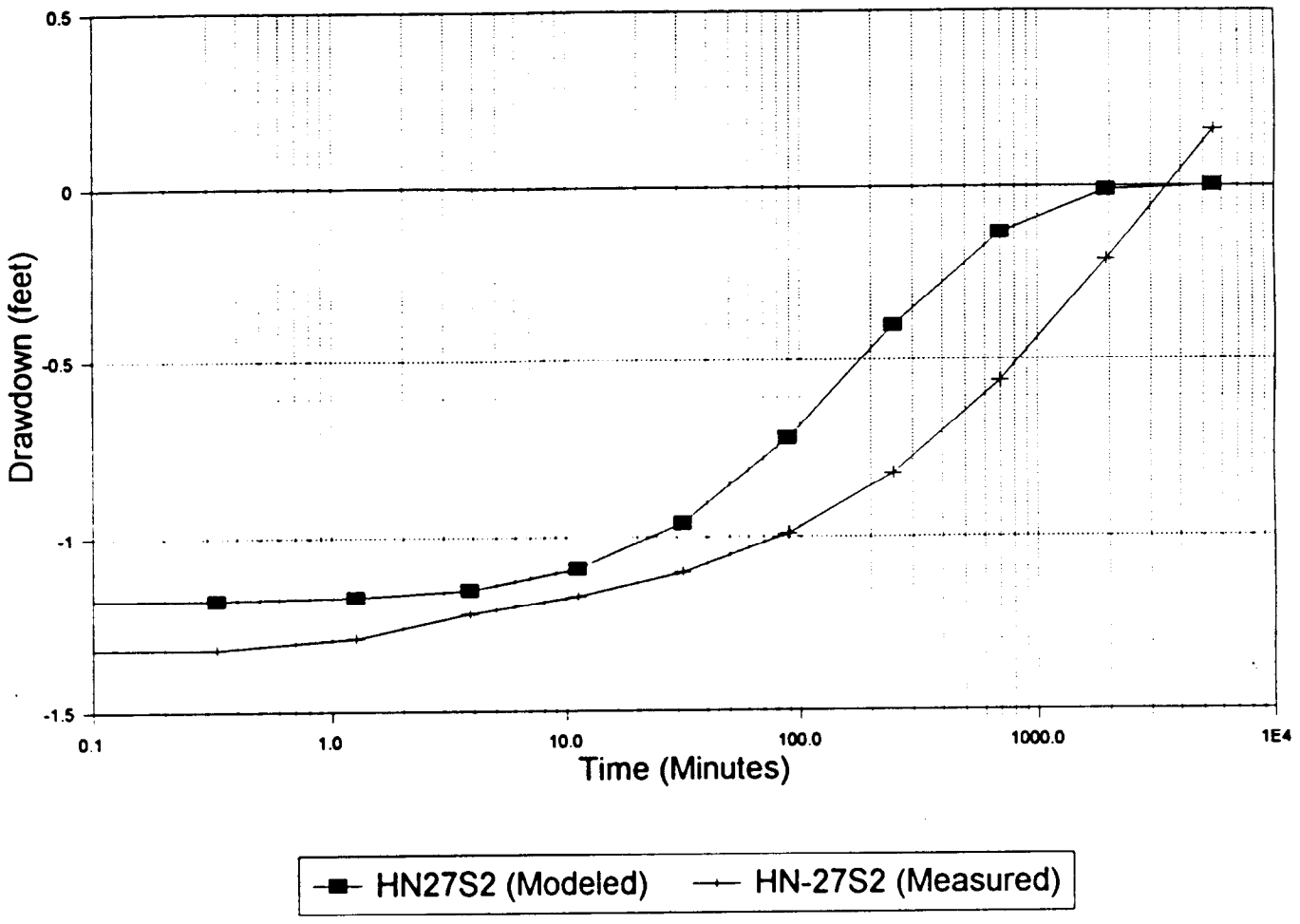


Figure 6-15
HN-27S3 Recovery for Pump Test #1

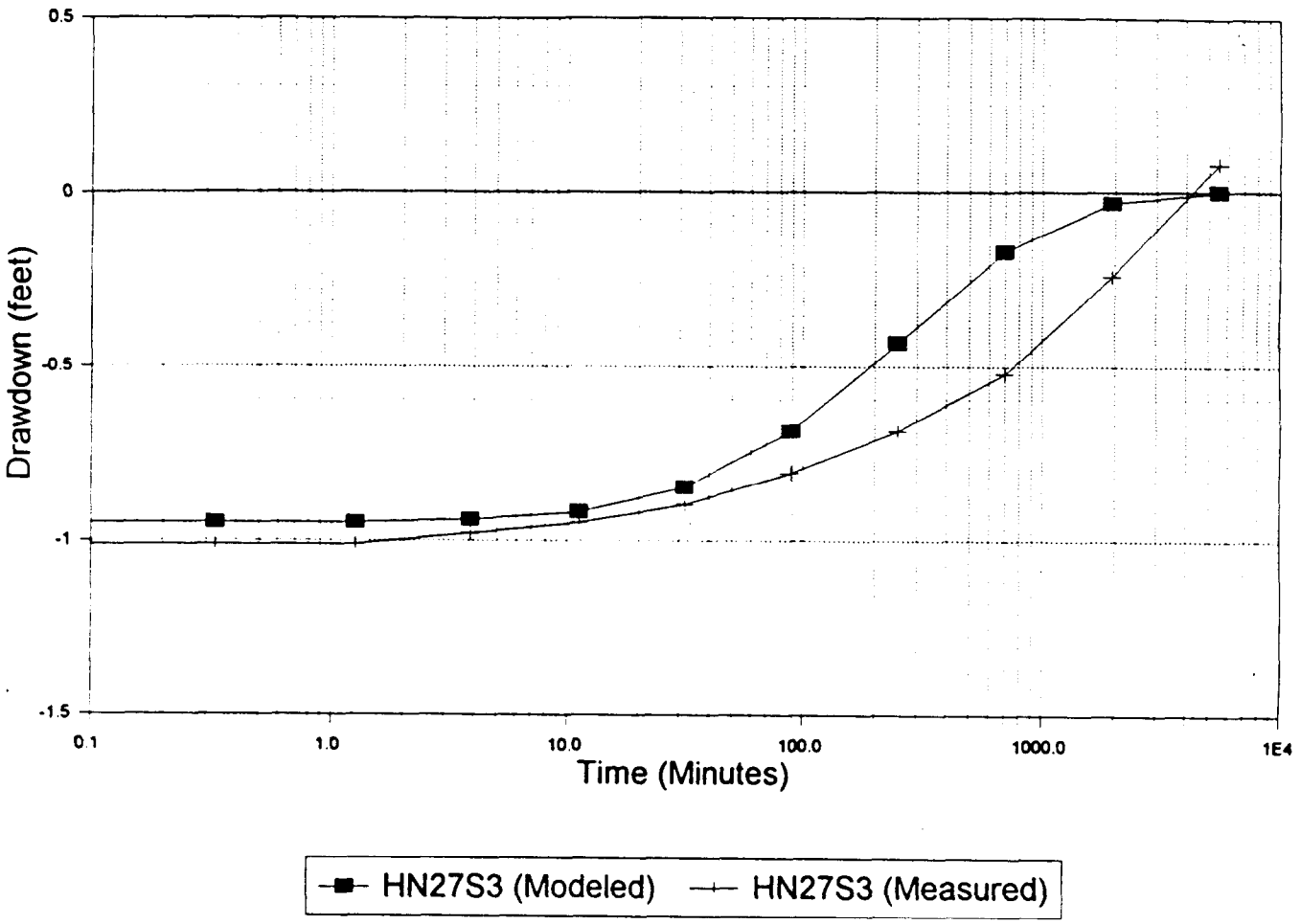


Figure 6-16
HN26I Recovery for Pump Test #1

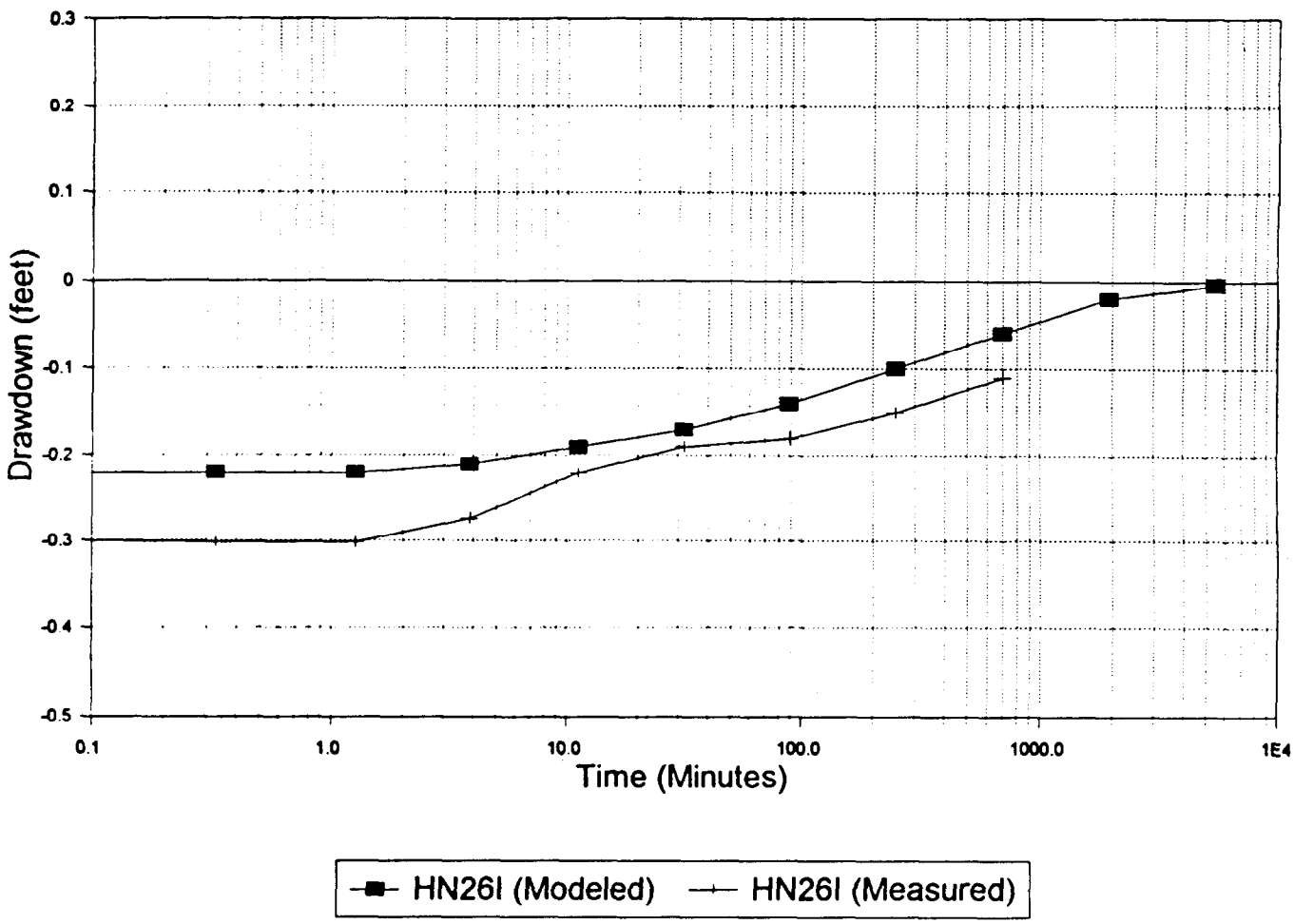


Figure 6-17

HN27I1 Recovery for Pump Test #1

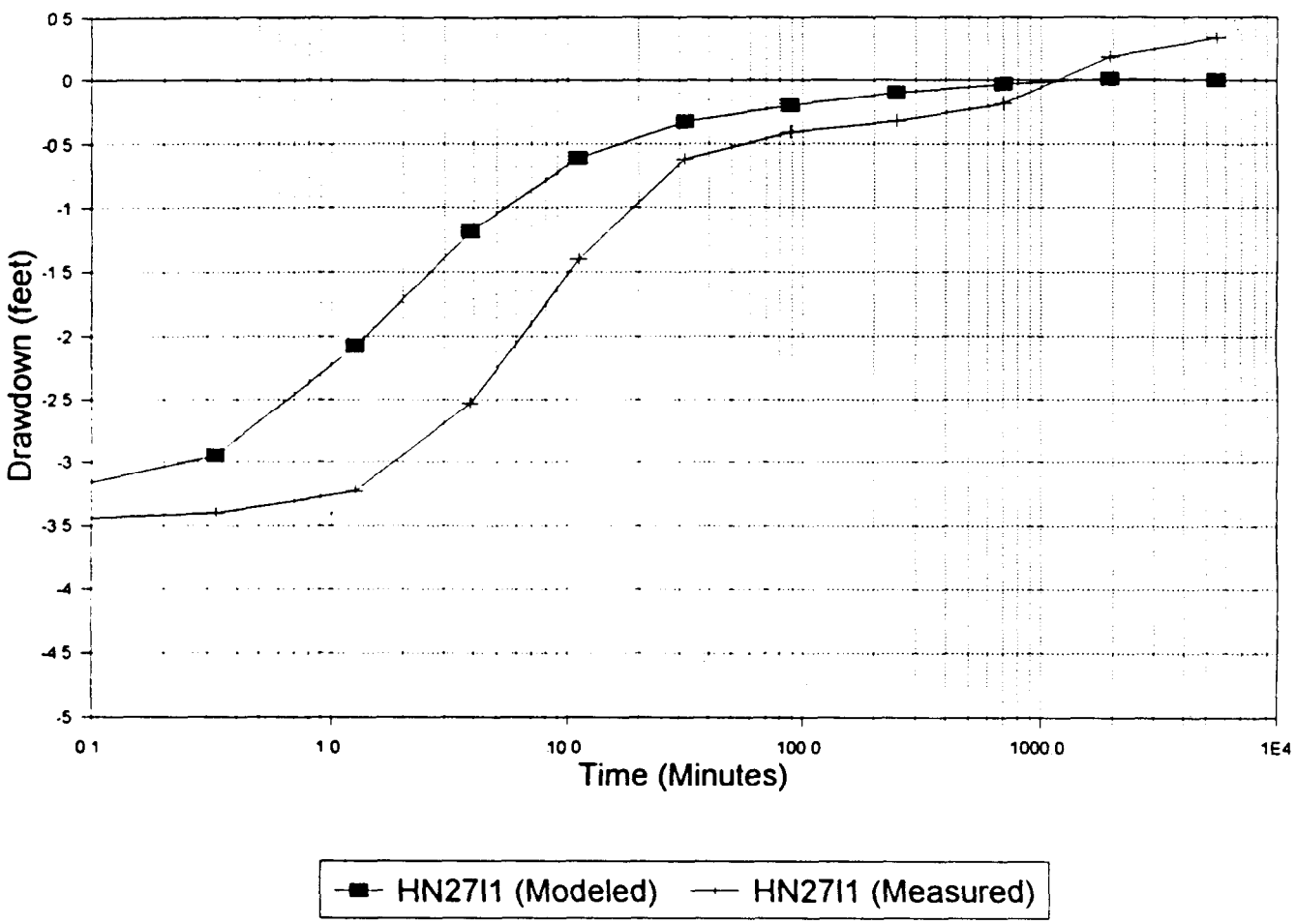


Figure 6-18
HN27I2 Recovery for Pump Test #1

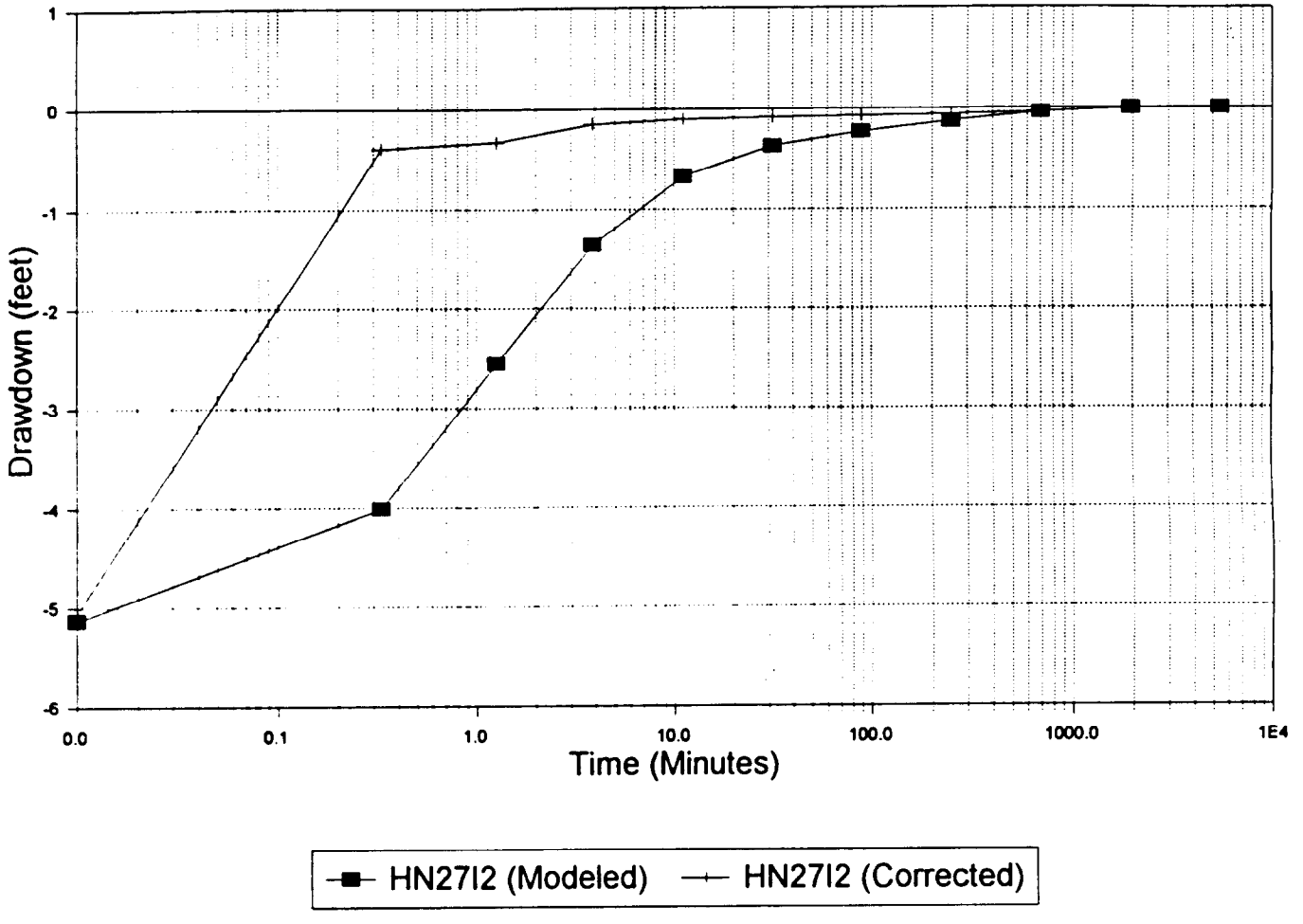
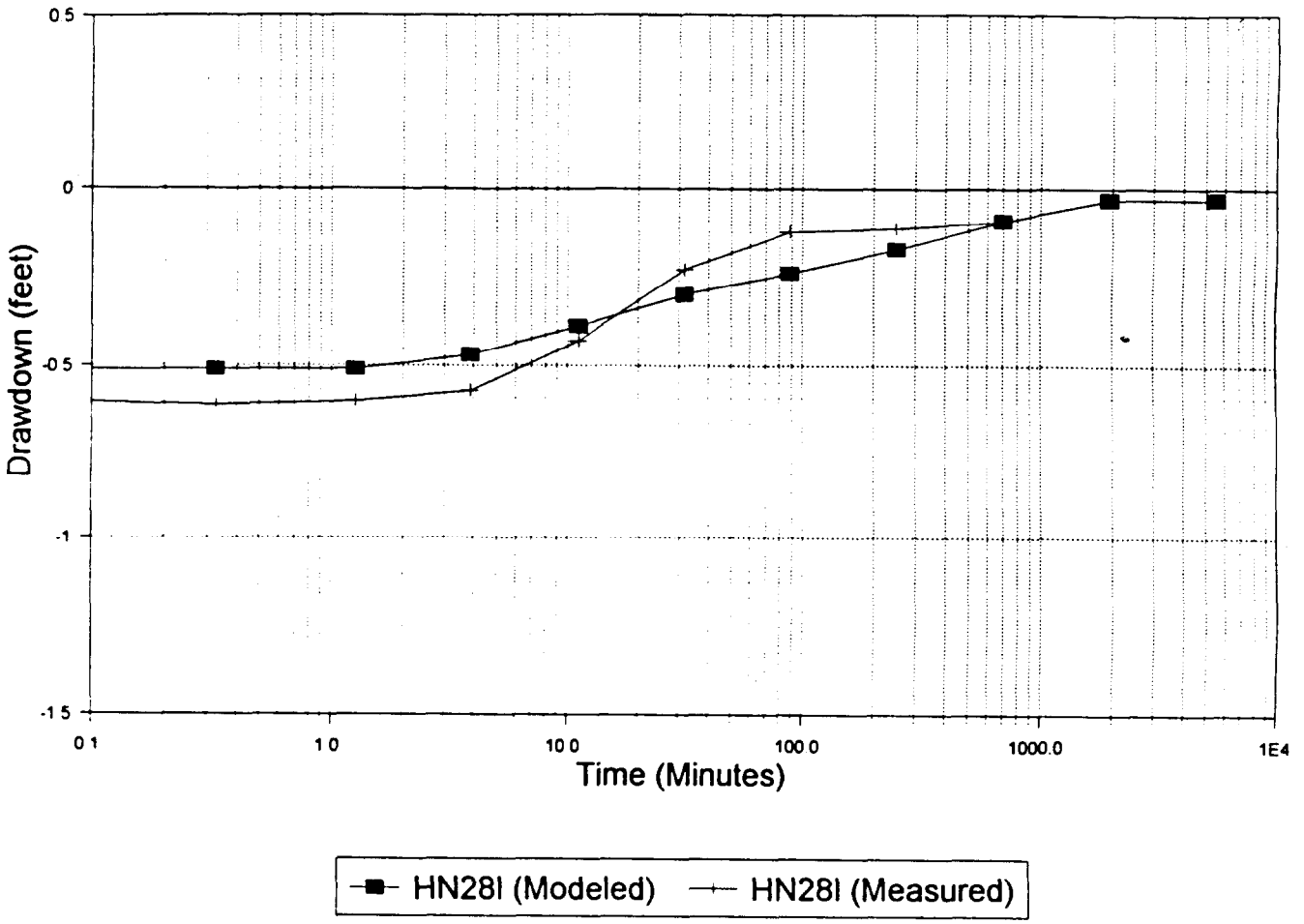


Figure 6-19
HN28I Recovery for Pump Test #1



calibration parameters for the model represent a best-fit for transient and steady-state flow conditions. Final calibrated model simulations had a MODFLOW water balance error of less than 0.15%.

Measured results for pump test #1 show significant drawdown (>1.0 ft) in 4 of the 6 observation wells. The pumping well had 5.05 ft of drawdown (corrected) occurring in the pumping well. The measured drawdown in the pumping well for both pump tests was corrected to account for the drawdown produced within the well casing, which is much higher than was actually produced in the aquifer. This correction was necessary to determine the amount of drawdown which actually occurred in the aquifer immediately outside the pumping wells which is simulated by the model, rather than the amount of drawdown inside the well casing, which was measured during the pumping test. This correction (described in Appendix E) involved determining the actual amount of drawdown which occurred at the well (determined from a distance-drawdown plot), comparing it to the measured drawdown in the pumping well, and using the ratio between actual and measured as a multiplier for the measured drawdown in the well. Use of this correction compensates for the drawdown produced in the well casing while maintaining the same shape of the time-drawdown curve for the pumping wells

As shown in Table 6-5, the modeled results for pump test #1 correspond closely to measured results at the pumping well and the five observation wells. In addition, the graphs comparing the simulated drawdowns and recovery results to the measured data for pump test #1 also show similar modeled and measured results. The total amount of drawdown and the general shape of the drawdown and recovery curves are similar between the modeled and measured results, indicating that the model can successfully reproduce the pumping test results under transient conditions.

As detailed in Appendix E, pumping test #2 did not produce significant drawdowns in observation wells. Small amounts of drawdowns were seen in the observation wells, with <0.5 ft change in head being observed during the pumping test in all of the observation wells. This small amount of drawdown is difficult for the model to simulate for several reasons. Specifically, model drawdowns produced at well nodes are composite values of drawdowns over the entire 100 ft by 100 ft grid block. Small changes in drawdown observed in the natural system may be too small to be simulated effectively, as the model assumes that the location of each observation well corresponds to the center of that grid node. This assumption, inherent in any block-centered flow model, can cause difficulty when trying to simulate small changes in head or drawdowns. In addition, the production well screen is located several hundred feet

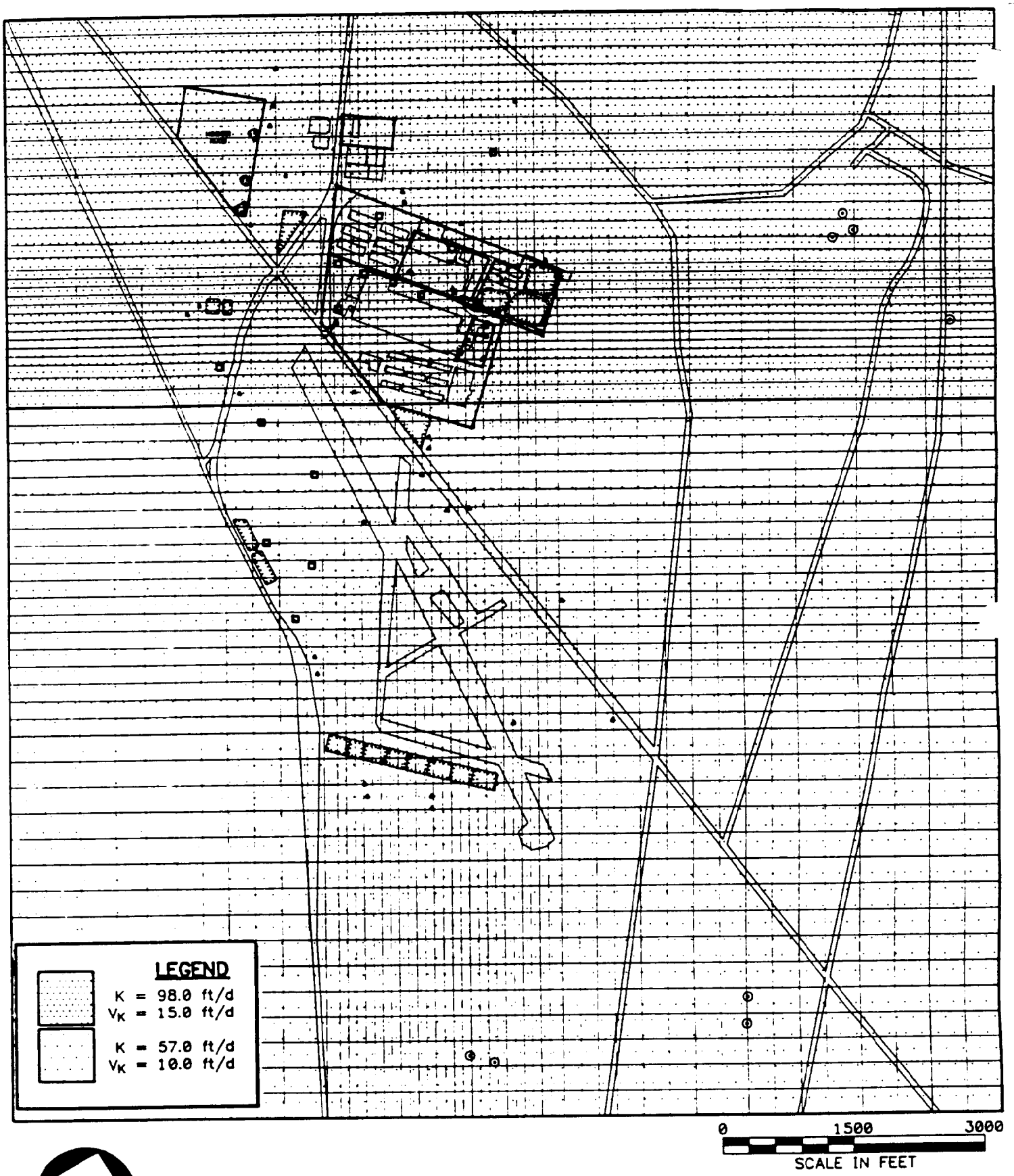
below the observation wells, which can also add error in the model predictions when attempting to simulate small-scale changes in head. An additional well with an unknown location was also cycling on and off during this pumping test, which effected total drawdowns seen in the observation wells (as described in Appendix E). Because the location and pumping rate of this well is unknown, this additional well could not be added to the model simulations. For these reasons, no comparison of modeled to measured drawdowns was made during the duration of this pumping test. Calibration of pumping test #2 was considered complete when the modeled drawdown was within the 1.0 calibration criteria. Table 6-5 summarizes calibration results of pumping test #2.

6.4 FINAL CALIBRATION VALUES OF AQUIFER PARAMETERS

The final values of horizontal hydraulic conductivity and vertical hydraulic conductivity for layers 1 through 5 are summarized in Figures 6-20 through 6-24. Storage values were constant for all grid blocks in each model layer. Layer 1 had a constant storage value of 0.05, and layers 1 through layer 5 have a constant storage value of 0.0012. A constant porosity of 0.20 was assumed for all model layers. The constant head elevations used in all model simulations are given in Table 6-6. Water elevation contour maps from the final calibrated model are presented in Figures 6-25 to 6-29 for February 1992 conditions, and Figures 6-30 to 6-34 for August 1992 conditions.

6.5 STATISTICAL ANALYSIS OF MODEL CALIBRATION RESULTS

To determine if the model data generated during calibration compares favorably to measured data, the results of the calibration were evaluated both qualitatively and quantitatively. The output of the final calibration run for the two steady-state simulations, and the two transient pumping test simulations were analyzed by plotting a linear regression of the modeled data to determine how well the modeled data set compared to the measured data set. To qualitatively determine if any systemic errors exist in the modeled water data (i.e., if consistently high or low regions are present), residual contour plots were generated for the steady-state calibration runs. For both the linear regression and residual contour analysis, the outlier wells were not included, as these wells may have been biased by localized pumping or recharge effects.



FINAL CALIBRATION VALUES
LAYER 1
HORIZONTAL/VERTICAL CONDUCTIVITY
BETHPAGE NWIRP

FIGURE 6-20

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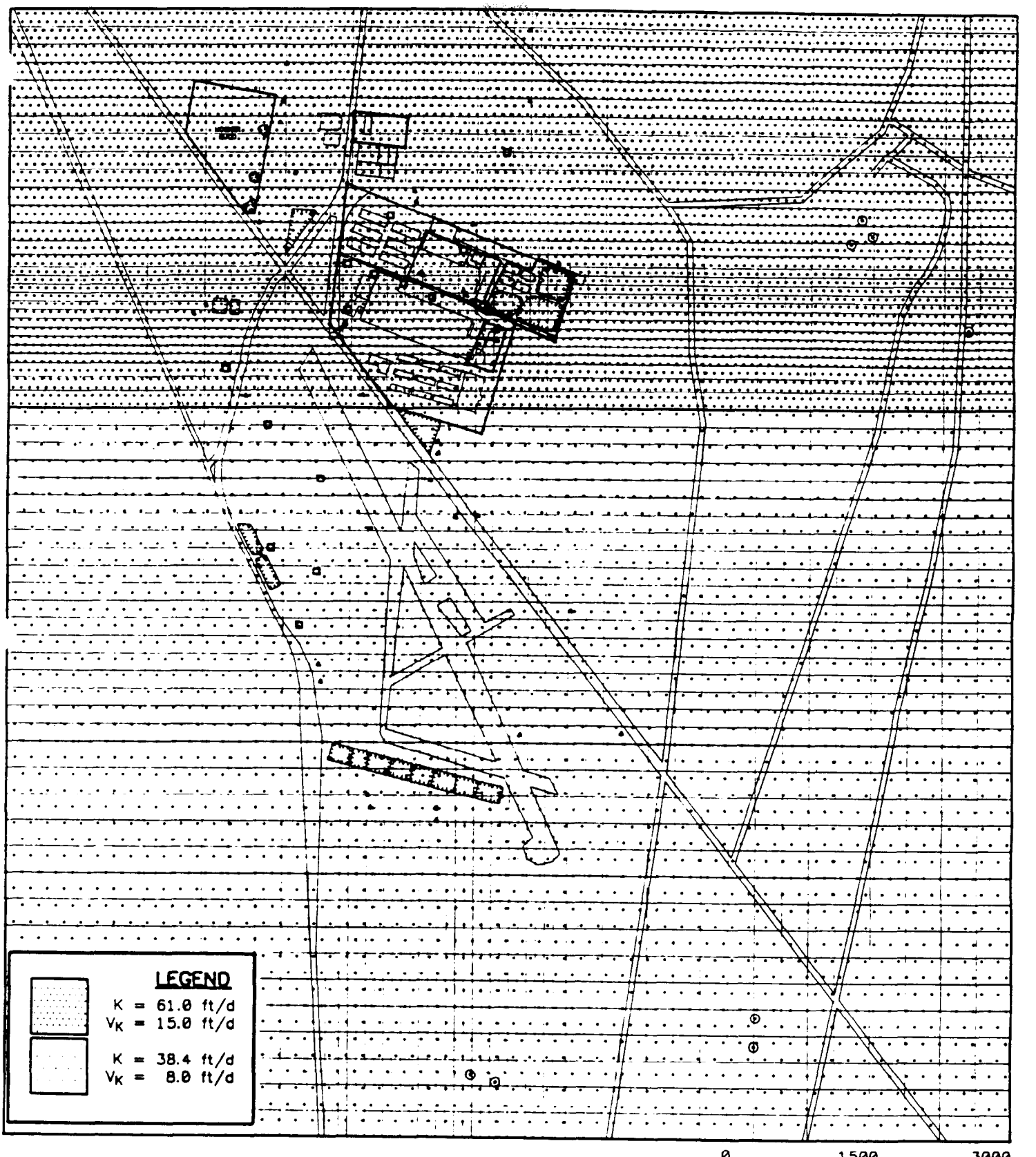

0 1500 3000
SCALE IN FEET

FINAL CALIBRATION VALUES
LAYER 2
HORIZONTAL/VERTICAL CONDUCTIVITY
BETHPAGE NWIRP

FIGURE 6-21

HALLIBURTON NUS
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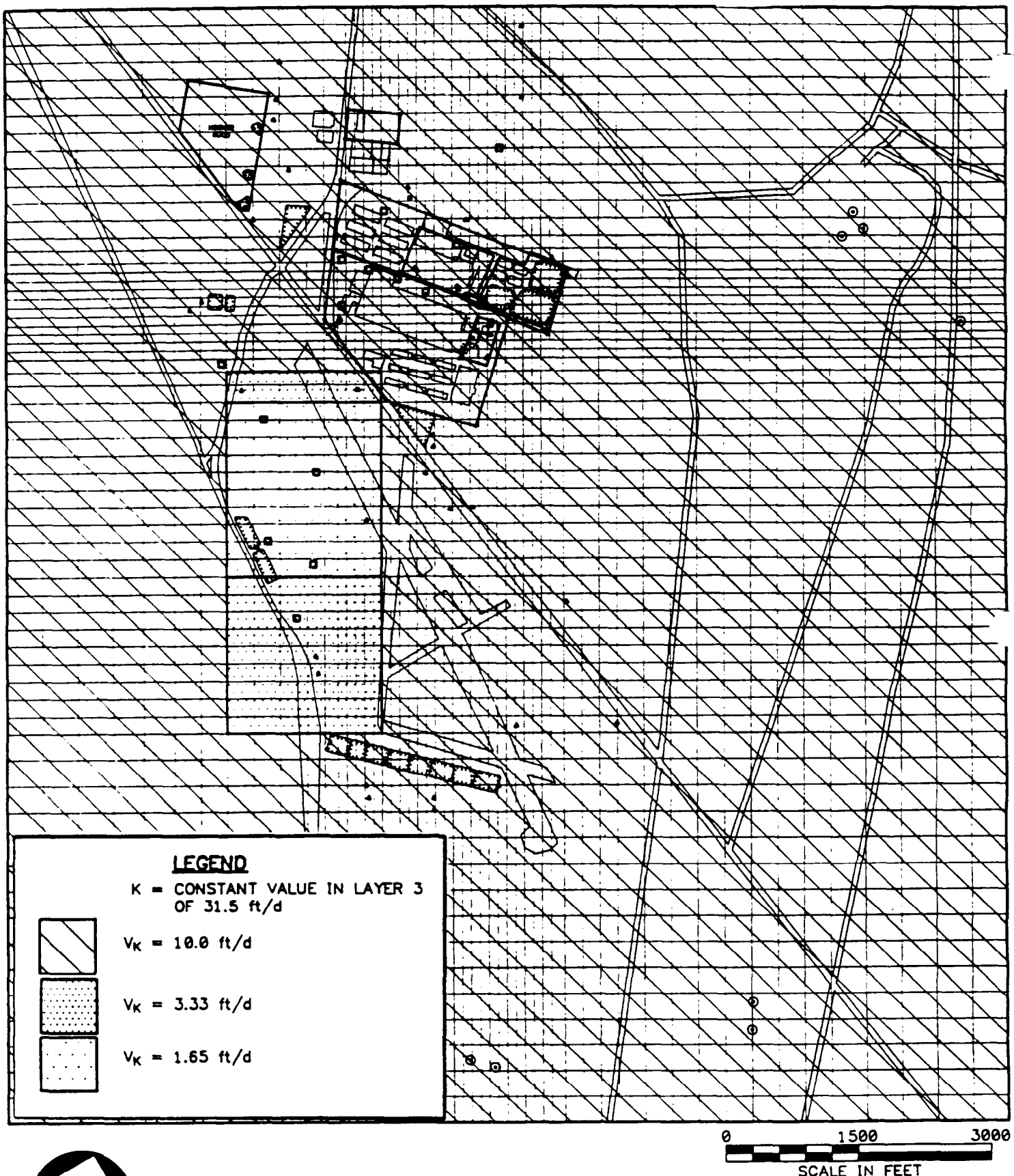
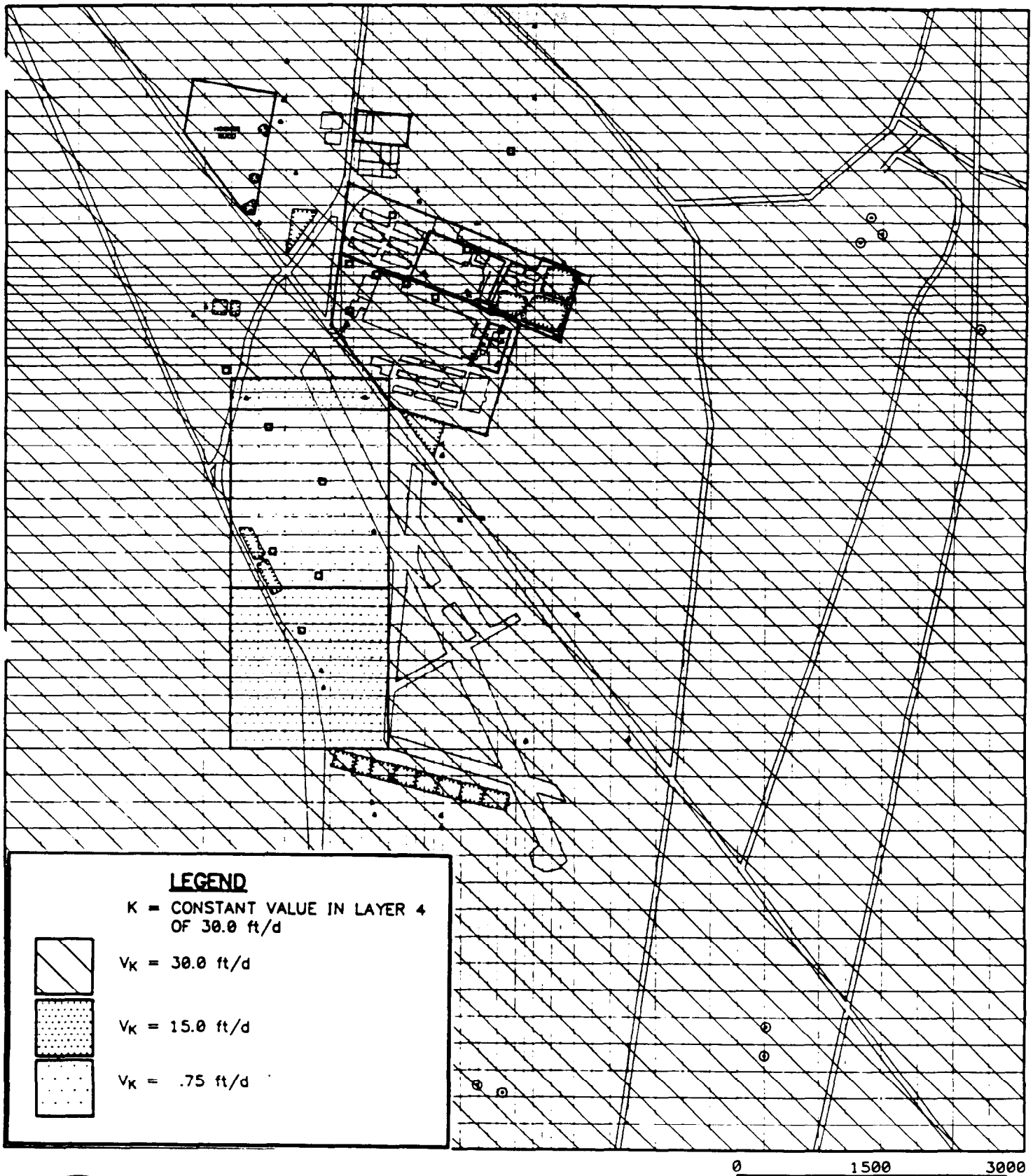


FINAL CALIBRATION VALUES
LAYER 3
HORIZONTAL/VERTICAL CONDUCTIVITY
BETHPAGE NWIRP

FIGURE 6-22

HALLIBURTON NUS
Environmental Corporation

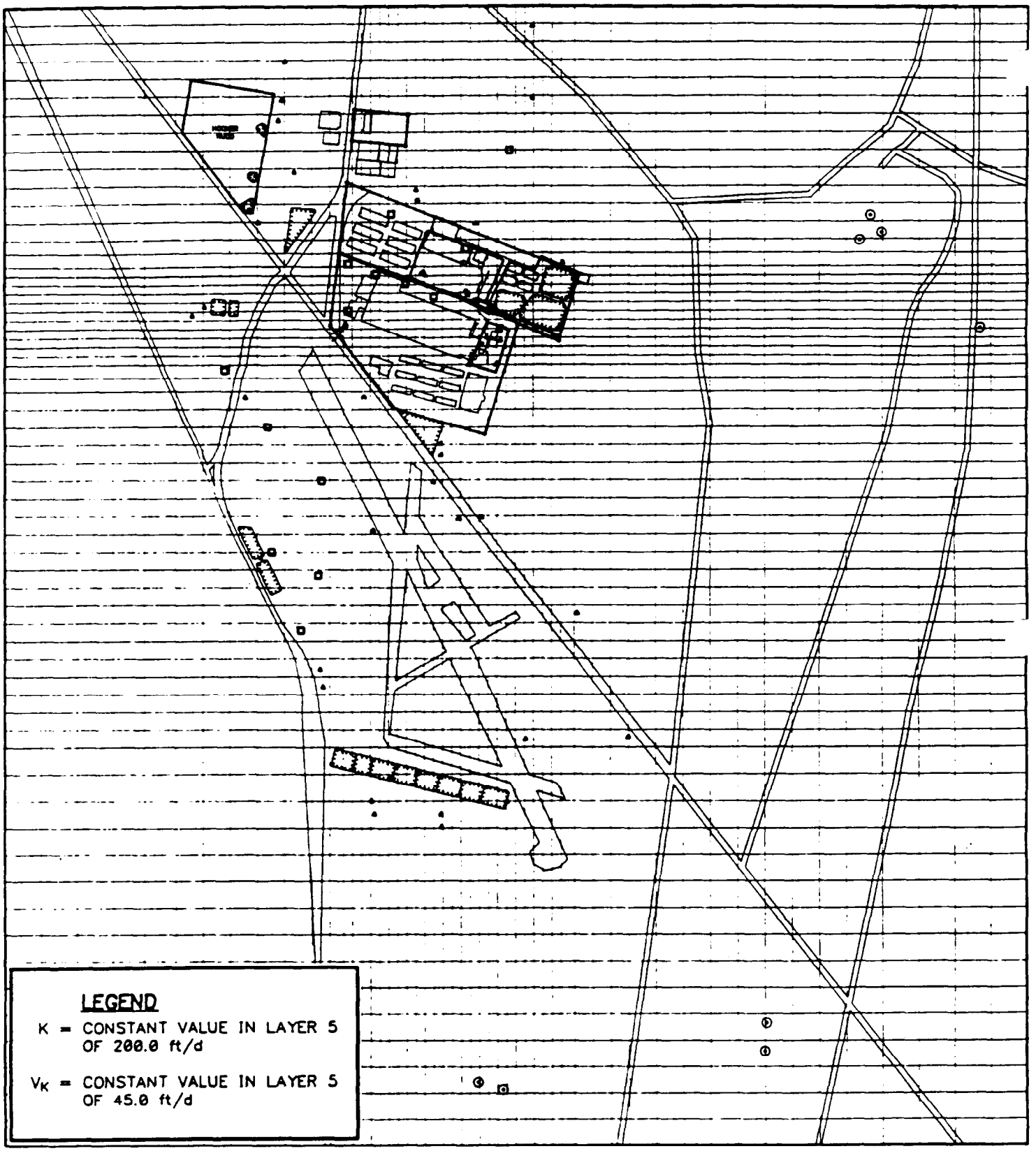


0 1500 3000
SCALE IN FEET

FINAL CALIBRATION VALUES
LAYER 4
HORIZONTAL/VERTICAL CONDUCTIVITY
BETHPAGE NWIRP

FIGURE 6-23

HALLIBURTON NUS
Environmental Corporation



FINAL CALIBRATION VALUES
LAYER 5
HORIZONTAL/VERTICAL CONDUCTIVITY
BETHPAGE NWIRP

FIGURE 6-24

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TABLE 6-6
CALIBRATION VALUES OF NORTH AND SOUTH CONSTANT HEAD BOUNDARY ELEVATIONS

LOW PUMPING CONDITIONS - FEBRUARY 1992

NORTH CONSTANT HEAD BOUNDARY ELEVATION (ft amsl)		
COLUMN #	LAYER 1	LAYER 2
1-2	76.90	76.00
3-10	77.30	76.40
11-20	77.05	76.15
21-30	77.35	76.45
31-35	76.85	75.95
36-38	77.35	76.45
39-41	77.85	76.95
42-47	79.20	78.3
48-53	79.30	78.40
SOUTH CONSTANT HEAD BOUNDARY ELEVATION (ft amsl)		
COLUMN #	LAYER 1	LAYER 2
ALL	61.70	61.60

NORTH CONSTANT HEAD BOUNDARY ELEVATION (ft amsl)			
COLUMN #	LAYER 3	LAYER 4	LAYER 5
1-2	71.95	71.85	71.75
3-10	72.35	72.25	72.15
11-22	72.60	72.50	72.4
23-34	73.15	73.05	72.95
35-40	73.85	73.75	73.65
41-53	74.35	74.15	74.05
SOUTH CONSTANT HEAD BOUNDARY ELEVATION (ft amsl)			
COLUMN #	LAYER 3	LAYER 4	LAYER 5
ALL	59.85	59.75	59.65

HIGH PUMPING CONDITIONS - AUGUST 1992

NORTH CONSTANT HEAD BOUNDARY ELEVATION (ft amsl)		
COLUMN #	LAYER 1	LAYER 2
1-2	74.55	73.55
3-10	74.95	73.95
11-20	74.70	73.70
21-30	75.00	74.00
31-35	74.50	73.50
36-38	75.00	74.00
39-41	75.5	74.5
42-47	76.85	75.85
48-53	76.95	75.95
SOUTH CONSTANT HEAD BOUNDARY ELEVATION (ft amsl)		
COLUMN #	LAYER 1	LAYER 2
ALL	60.70	60.50

NORTH CONSTANT HEAD BOUNDARY ELEVATION (ft amsl)			
COLUMN #	LAYER 3	LAYER 4	LAYER 5
1-2	70.10	70.00	69.9
3-10	70.50	70.40	70.3
11-22	70.75	70.65	70.55
23-34	71.30	71.20	71.1
35-40	72.00	71.90	71.8
41-53	72.50	72.30	72.2
SOUTH CONSTANT HEAD BOUNDARY ELEVATION (ft amsl)			
COLUMN #	LAYER 3	LAYER 4	LAYER 5
ALL	58.85	58.75	58.65

ft amsl = Feet Above Mean Sea-Level.

Figure 6-25 February 1992 model layer 1 water elevation contour map.

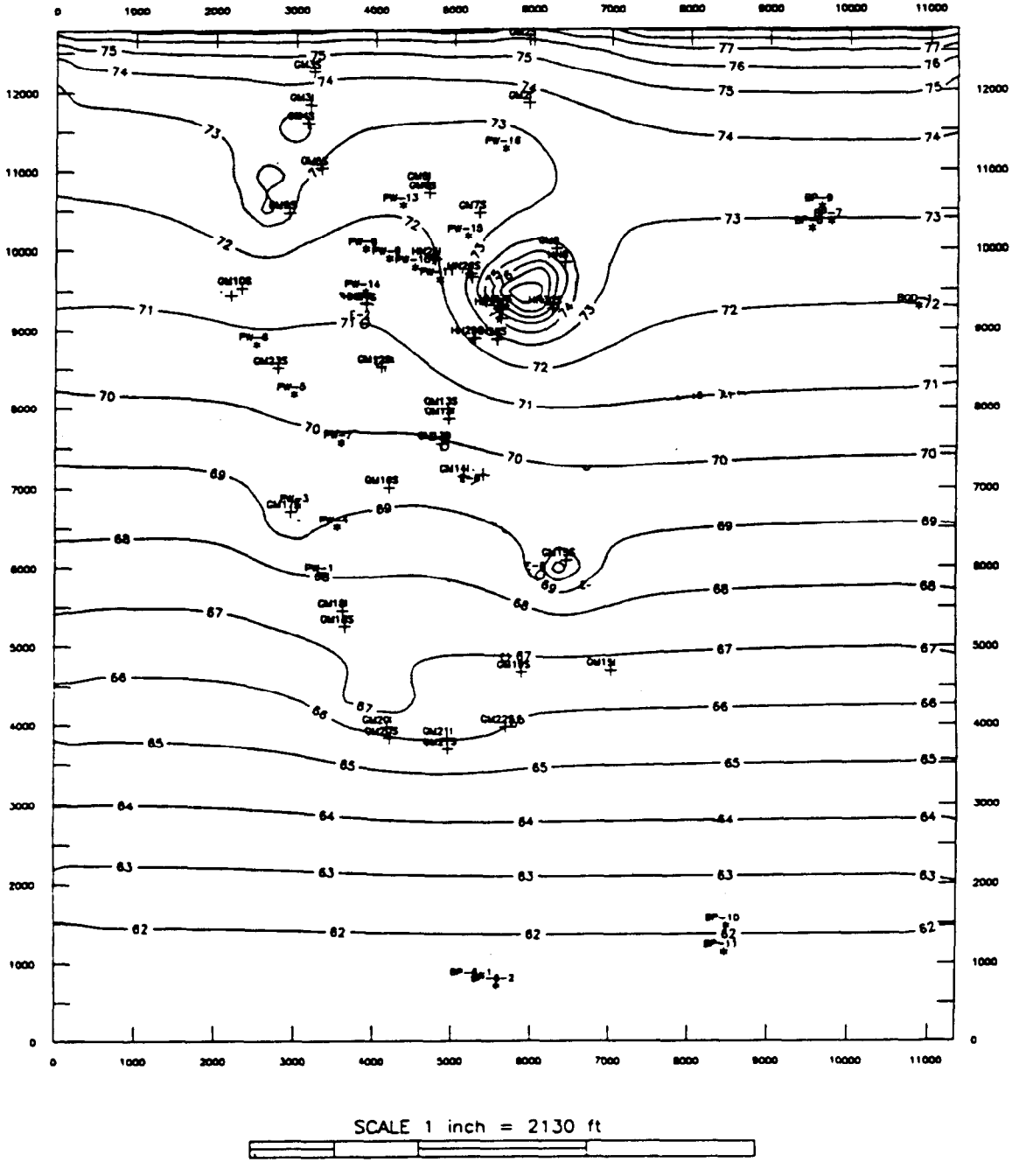
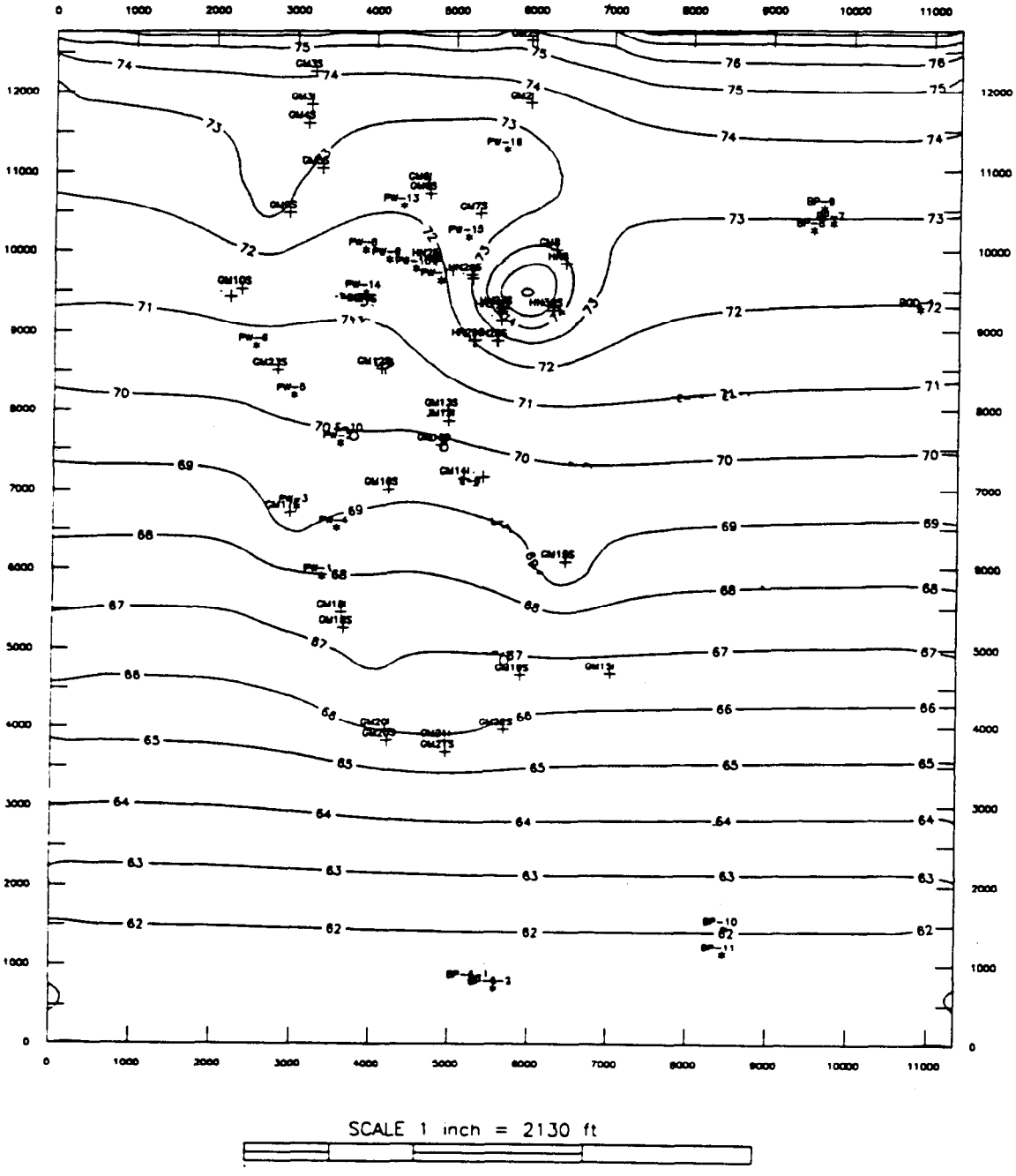
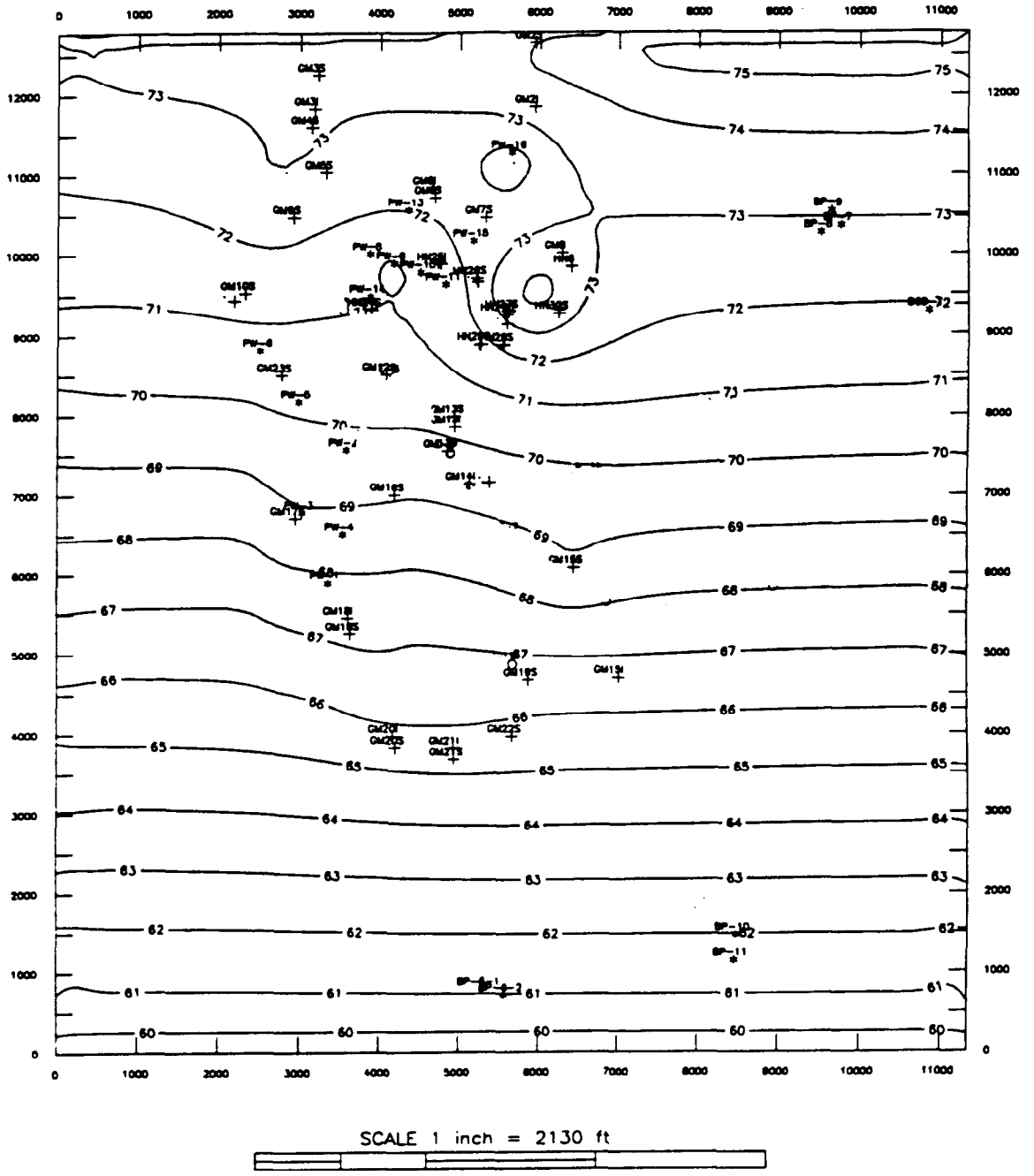


Figure 6-26 February 1992 model layer 2 water elevation contour map.



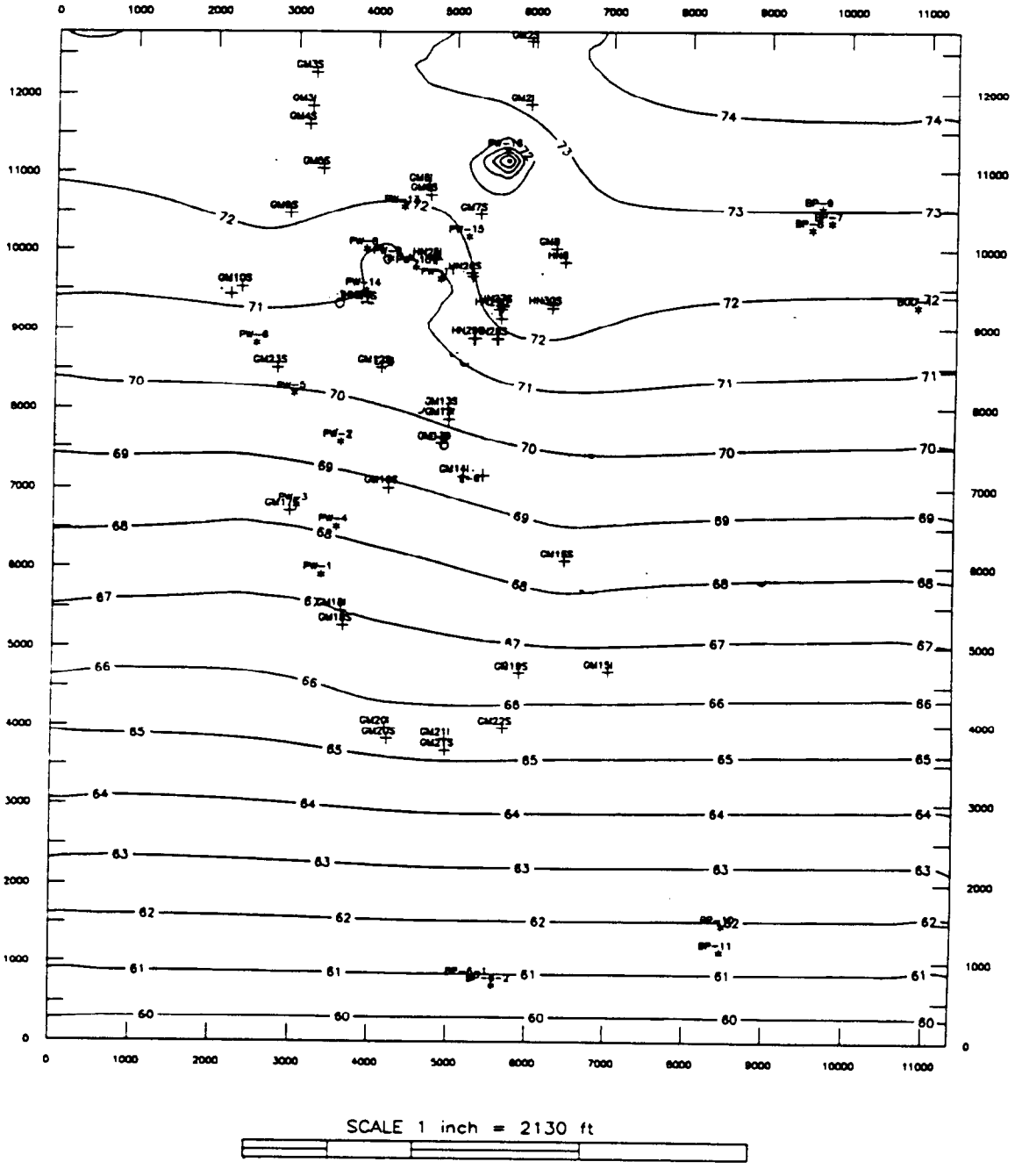
* = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well

Figure 6-27 February 1992 model layer 3 water elevation contour map.



• = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well

Figure 6-28 February 1992 model layer 4 water elevation contour map.



• = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well

Figure 6-29 February 1992 model layer 5 water elevation contour map.

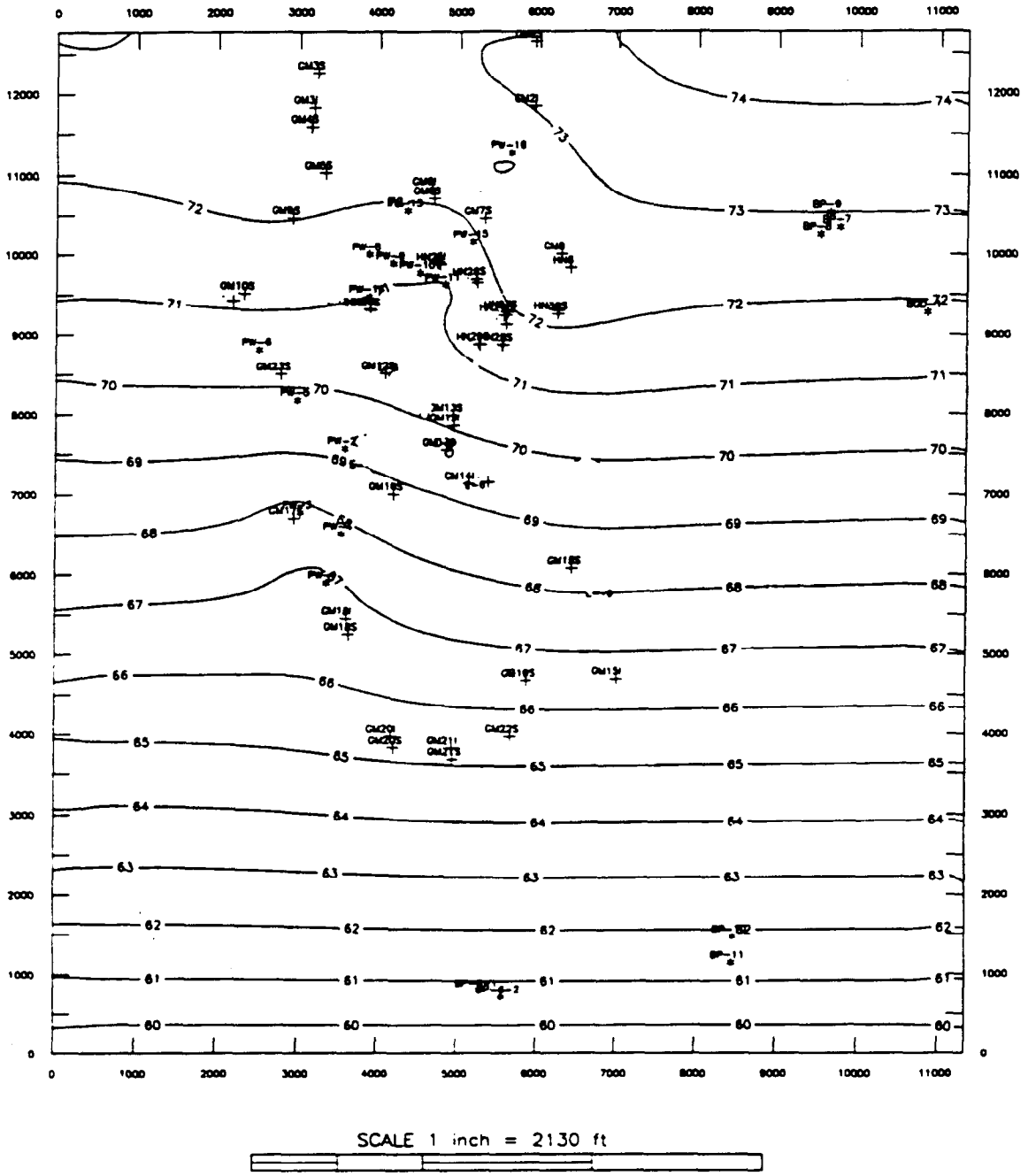
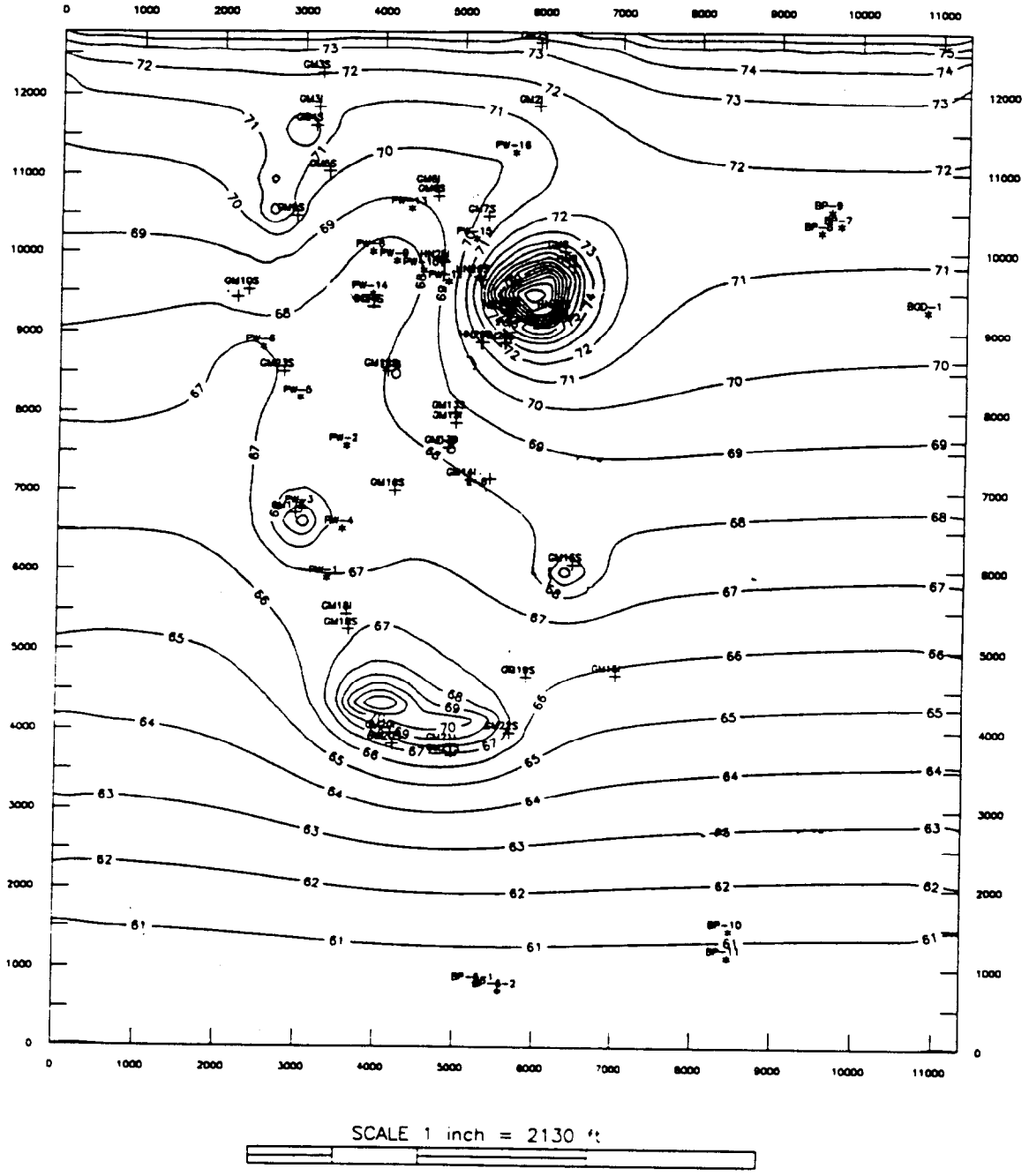


Figure 6-30 February 1992 model layer 1 water elevation contour map.



• = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well

Figure 6-31 February 1992 model layer 2 water elevation contour map.

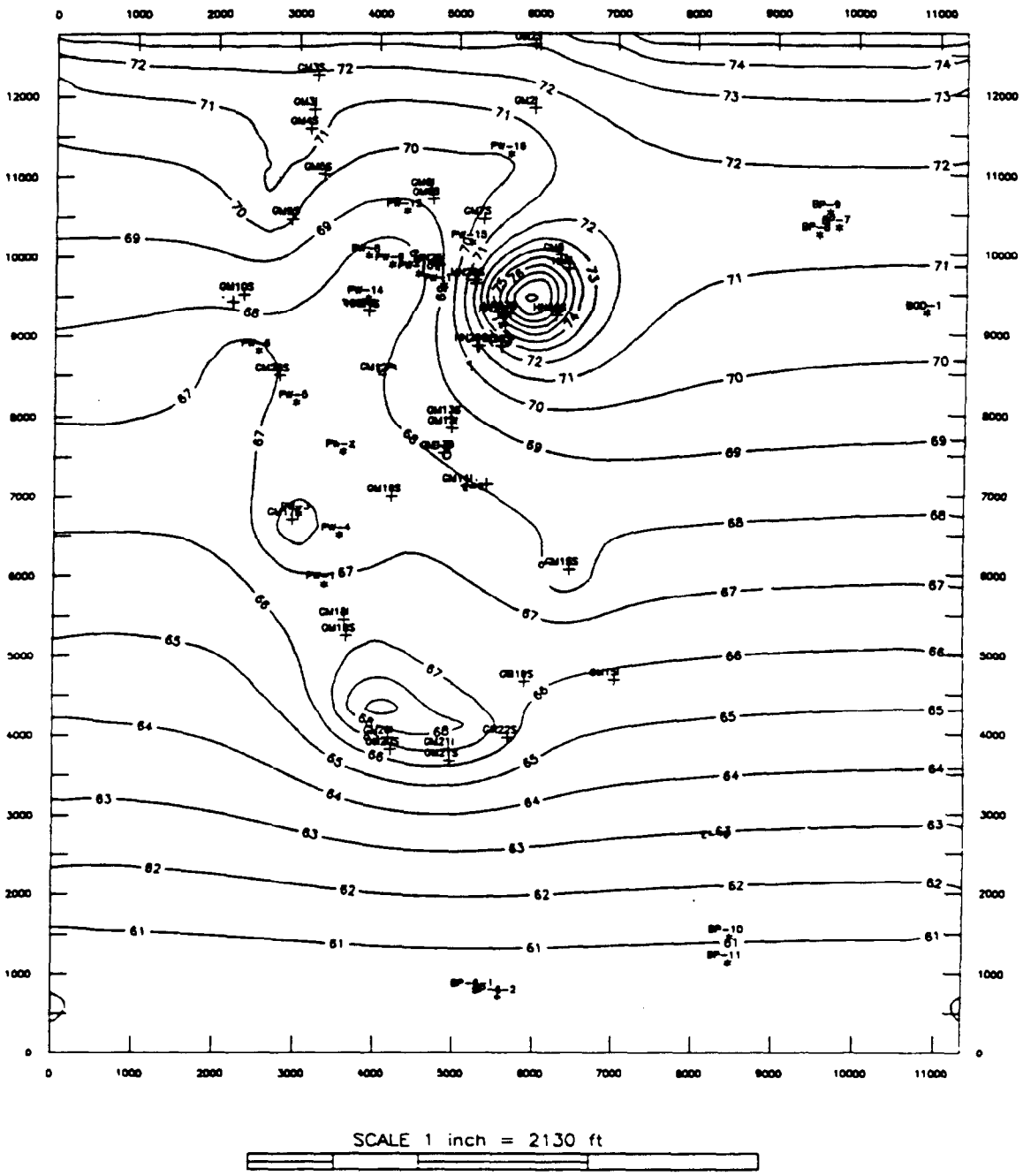


Figure 6-32 February 1992 model layer 3 water elevation contour map.

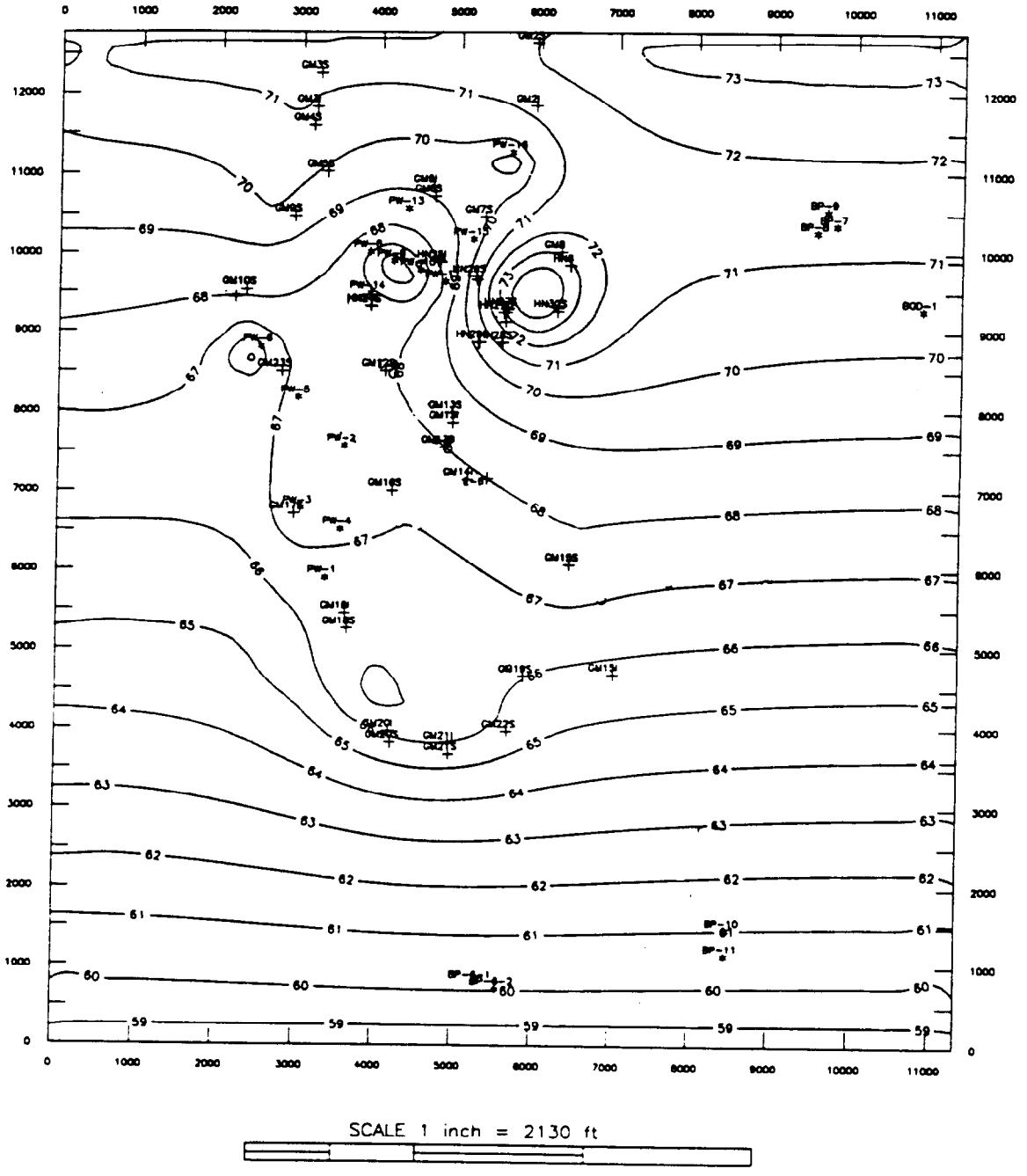
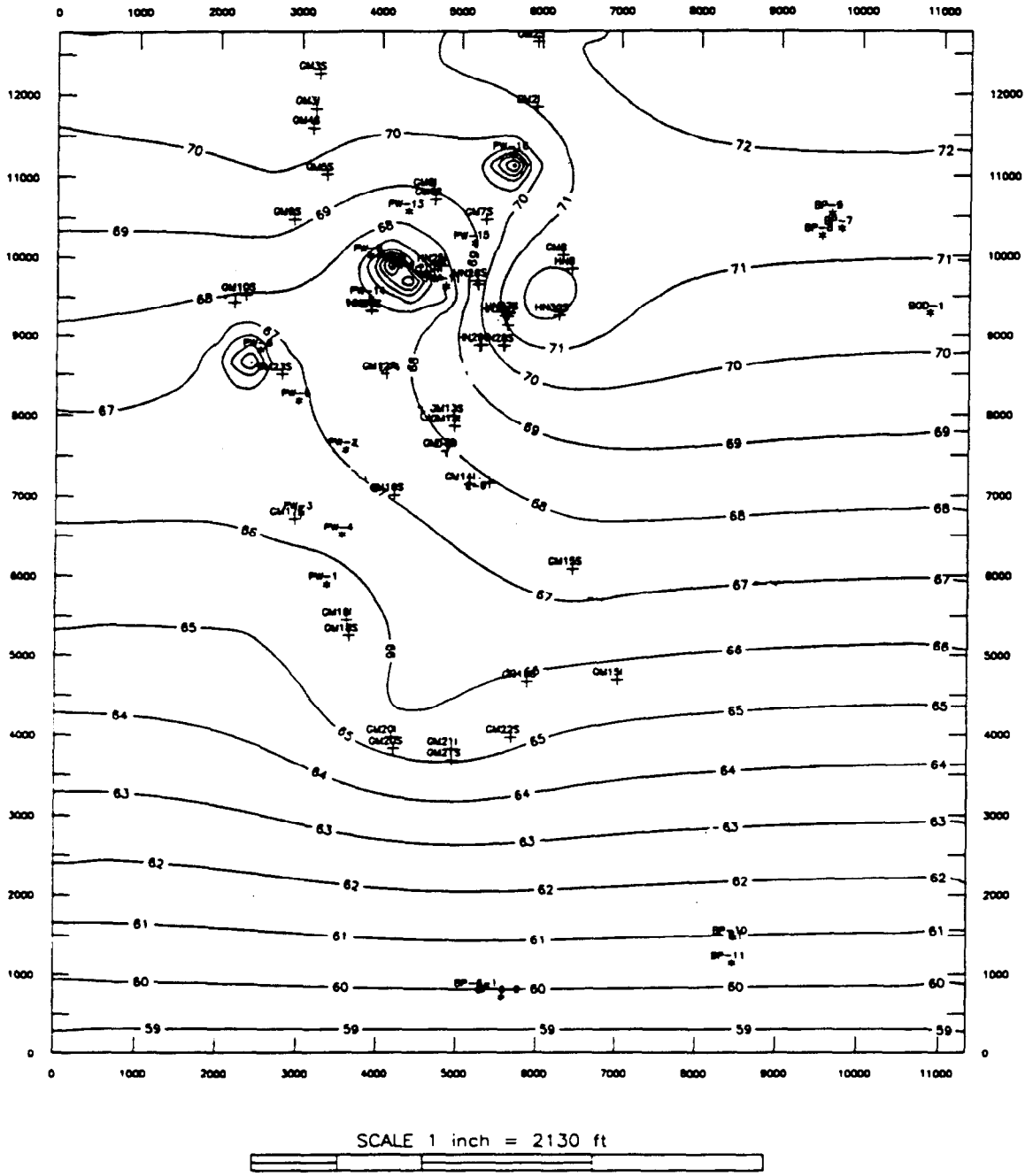
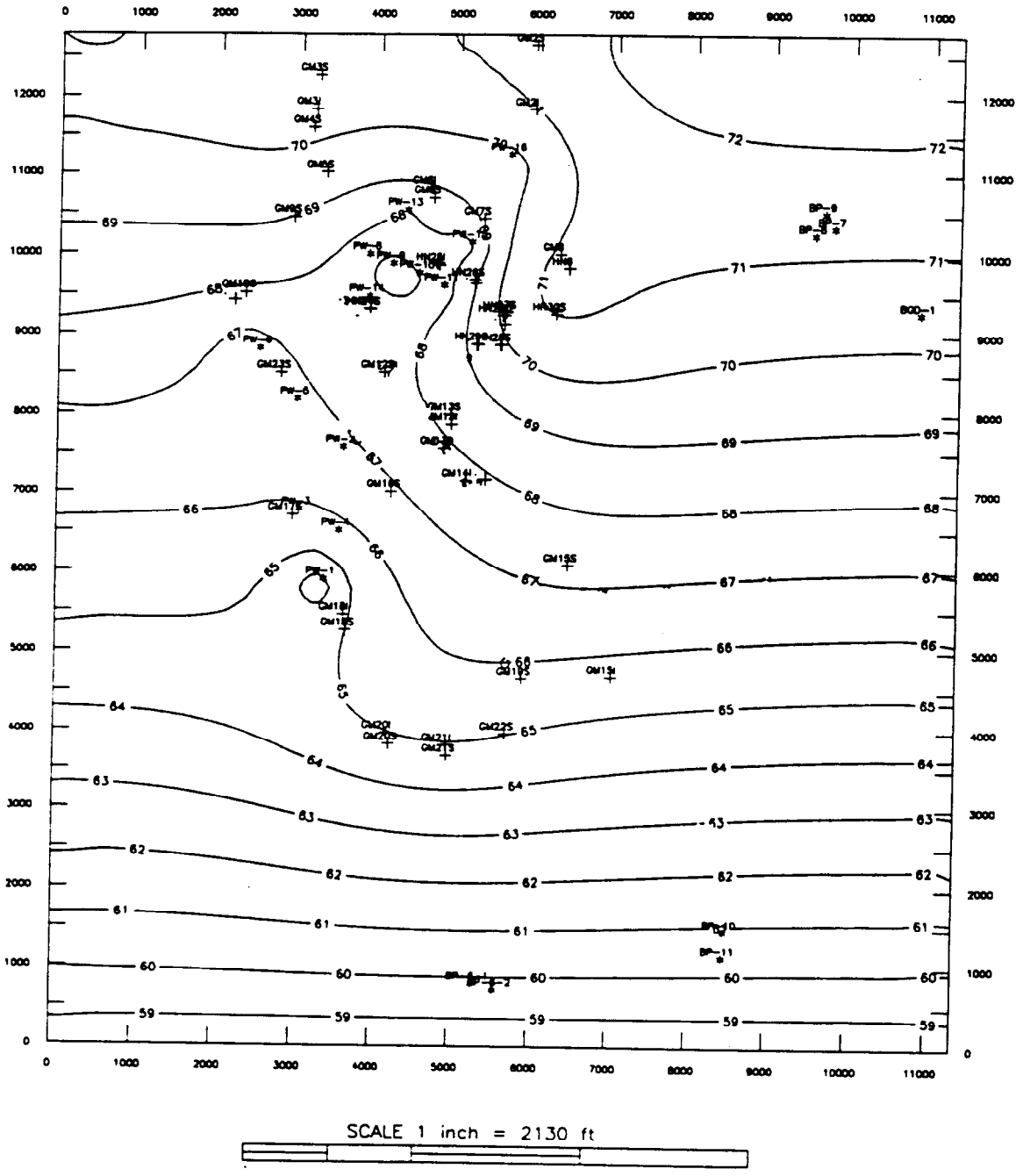


Figure 6-33 February 1992 model layer 4 water elevation contour map.



• = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well
O = Extraction Well Location

Figure 6-34 February 1992 model layer 5 water elevation contour map.



• = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well

6.5.1 Linear Regression

A linear regression was performed for the two pumping test simulations and the February and August 1992 data. Modeled water elevations were plotted against measured water elevations, and a regression line for the points was calculated using the least-squared method. Figures 6-35 and 6-36 show the linear regressions for the February and August 1992 data. The slope of the regression line indicates if a direct relationship exists between the dependant and independent variables. A slope of 1.0 indicates a direct relationship.

The slope of the regression line for the February 1992 data has a slope of 0.904, and the slope of the line for the August 1992 data has a slope of 0.981. When both data sets are combined, as illustrated in Figure 6-37, the slope of the regression line is 0.946. The regression lines for all steady-state data sets indicate a close to linear relationship for the measured and modeled data. Water elevation is a function of location within the model grid with higher elevations being present in the northern portion of the site and lower elevations towards the south. The nearly direct relationship of measured to modeled data for the entire range of water elevations indicates that model accuracy does not decrease with higher or lower values of water elevation across the site.

Figures 6-38 and 6-39 show the regressions for pump test #1 and pump test #2 drawdowns. The regression line for pumping test #1 drawdown data has a slope of 1.036 and shows a tight clustering of data around the regression line, which indicates a very close relationship between measured and modeled drawdown data. Due to the difficulty in simulating the small amount of drawdown produced in pumping test #2, the slope of this regression line for this data has a slope of 1.994 and shows scatter of data points around the regression line.

6.5.2 Residual Contours

A residual contours plot shows the distribution of model error over the model area for a given pumping scenario. Residual contour plots are useful for determining if trends are present in the distribution of model error over the grid. If trends of significantly high or low model error are seen in the residual contour plots in more than one pumping condition in a specific area, it may indicate aquifer parameters

Figure 6-35

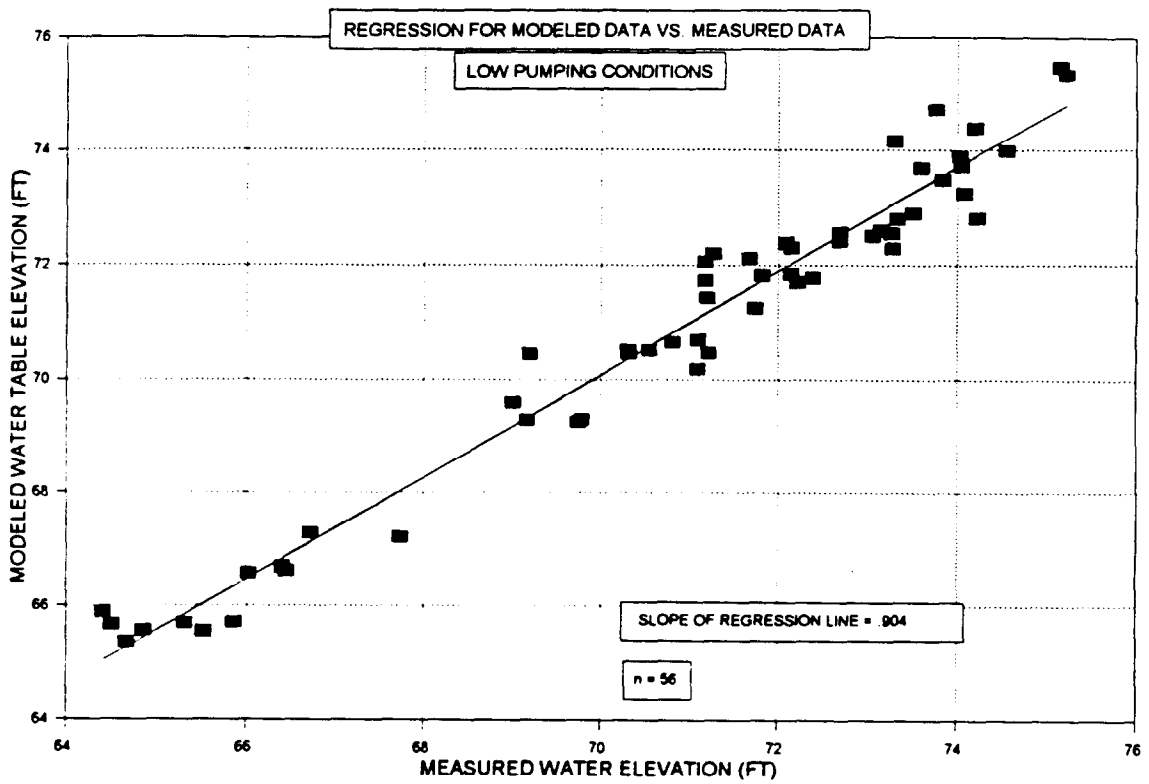

REGRESSION FOR MODELED DATA VS. MEASURED DATA
LOW PUMPING CONDITIONS
MODELED WATER TABLE ELEVATION (FT)
MEASURED WATER ELEVATION (FT)
SLOPE OF REGRESSION LINE = .904
n = 56
64
66
68
70
72
74
76

Figure 6-36

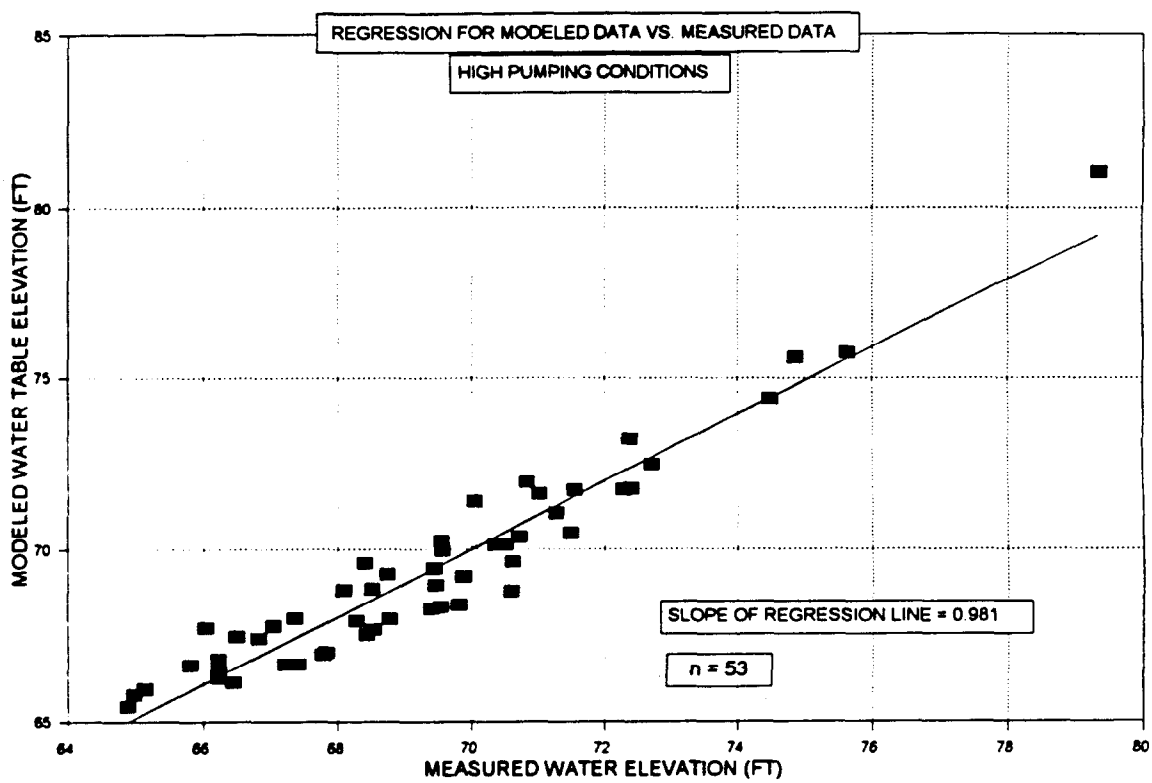

REGRESSION FOR MODELED DATA VS. MEASURED DATA
HIGH PUMPING CONDITIONS
MODELED WATER TABLE ELEVATION (FT)
85
80
75
70
65
64
66
68
70
72
74
76
78
80
MEASURED WATER ELEVATION (FT)
SLOPE OF REGRESSION LINE = 0.981
n = 53

Figure 6-37

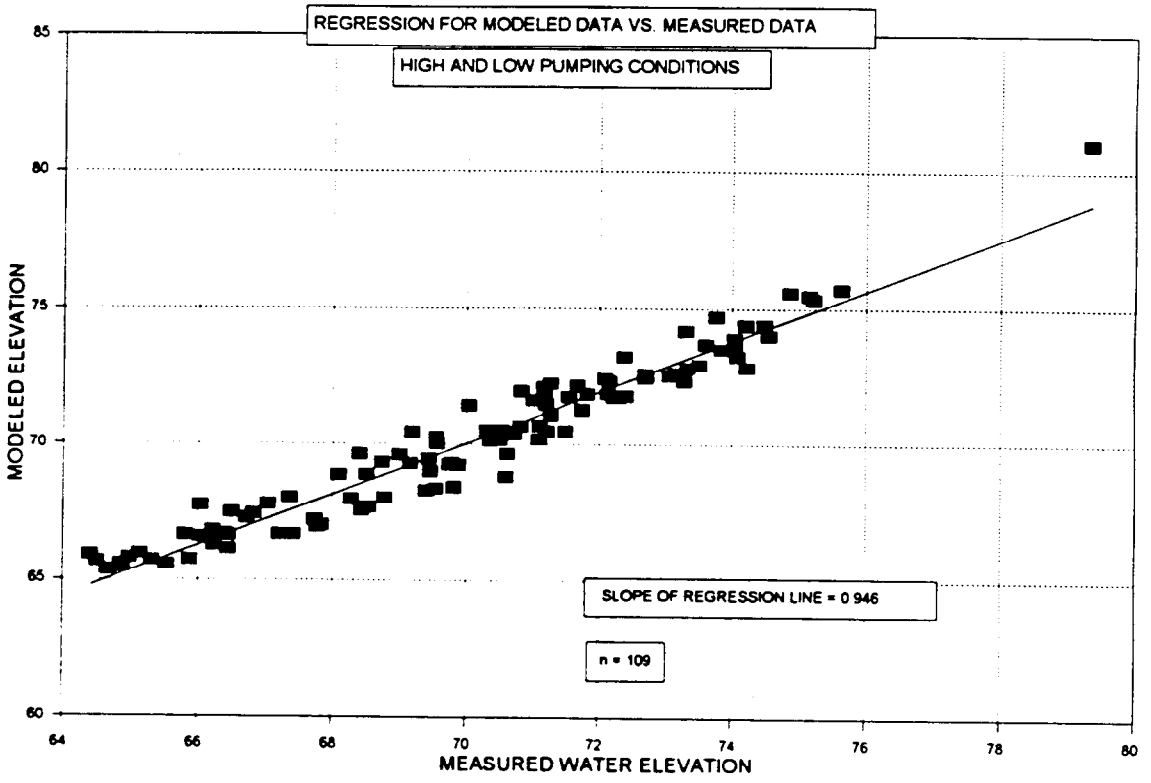

REGRESSION FOR MODELED DATA VS. MEASURED DATA
HIGH AND LOW PUMPING CONDITIONS
MODELED ELEVATION
85
80
75
70
65
60
64
66
68
70
72
74
76
78
80
MEASURED WATER ELEVATION
SLOPE OF REGRESSION LINE = 0.946
n = 109

Figure 6-38

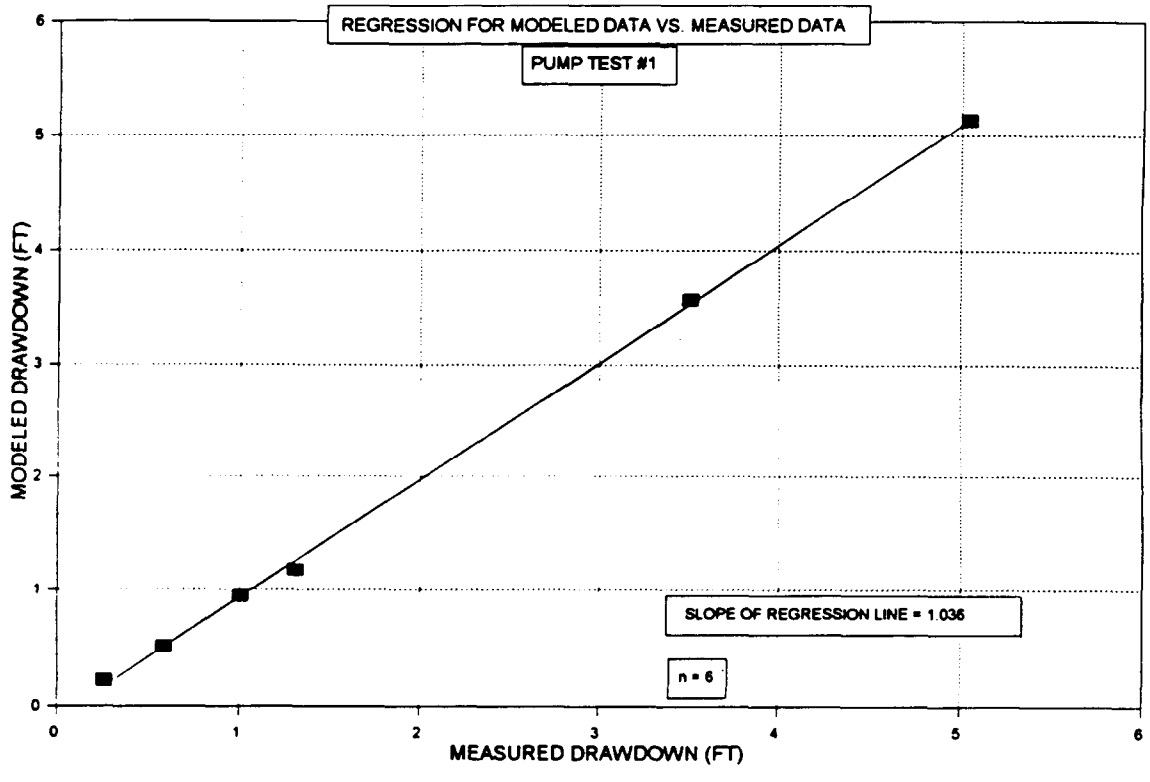
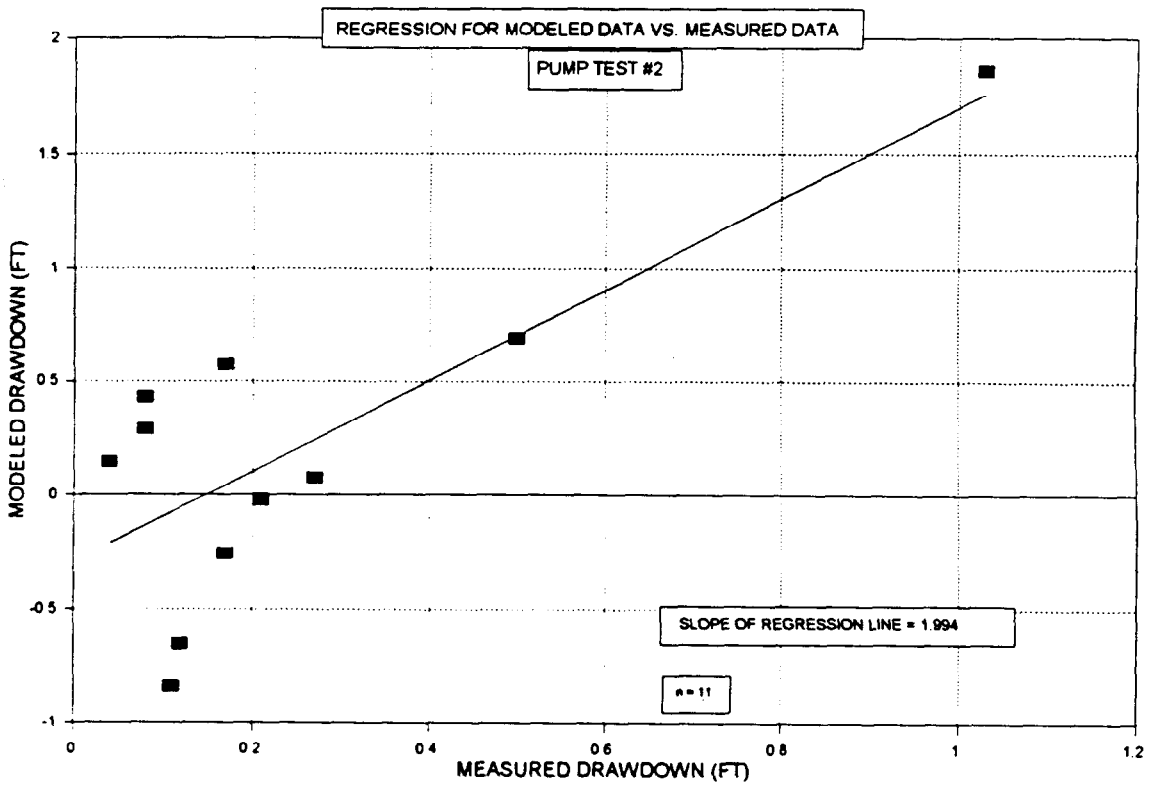

REGRESSION FOR MODELED DATA VS. MEASURED DATA
PUMP TEST #1
MODELED DRAWDOWN (FT)
MEASURED DRAWDOWN (FT)
0
1
2
3
4
5
6
SLOPE OF REGRESSION LINE = 1.036
n = 6

Figure 6-39


REGRESSION FOR MODELED DATA VS. MEASURED DATA
PUMP TEST #2
MODELED DRAWDOWN (FT)
MEASURED DRAWDOWN (FT)
SLOPE OF REGRESSION LINE = 1.994
n = 11
2
1.5
1
0.5
0
-0.5
-1
0
0.2
0.4
0.6
0.8
1
1.2

in that area need to be adjusted to eliminate these errors or adjustments need to be made to the production well or recharge rates in the area.

Residual contours were produced by entering the difference of modeled to measured values for water elevation (error expressed in feet) into the contouring package, SURFER. For both the February and August 1992 pumping conditions a separate plot was made for layer 1 and layer 2, using shallow and intermediate well error data. Insufficient numbers of deep wells exist on the site for a residual contour plot to be constructed for layer 3. Figures 6-40 and 6-41 show the residual contour plots for layer 1 and layer 2 of the calibrated February 1992 pumping conditions. Figures 6-42 and 6-43 show the residual contour plots for layer 1 and layer 2 of the calibrated August pumping conditions.

Generally, model errors across the site do not show significant trends between pumping scenarios. Areas of ± 1.0 ft model error were considered to be within acceptable levels of error as they are well below the ± 2.0 ft calibration criteria. Regions of greater than 1.0 ft positive model error are evident in the GM-21 region in the shallow and intermediate plots of the February 1992 model data. Areas of more than 1.0 ft negative model error are present in the vicinity of GM-13 and HN-25 in the shallow and intermediate plots of the August 1992 model data. These areas of slightly higher model error were not considered to be a concern, because the wells in these area were within the calibration criteria, and during model calibration attempts were made to correct these areas of model error. Also, these trends in model error are not consistent across pumping conditions and may represent increased pumpage or recharge at the production wells and recharge basins in the vicinity of these wells during the time period when water elevations were measured. The model simulations assume a constant pumping and recharge rate throughout the month, and short-term changes in pumping or recharge rates could effect the modeled vs. measured results.

Figure 6-40 February, 1992 Residual Contour Plot, Layer 1

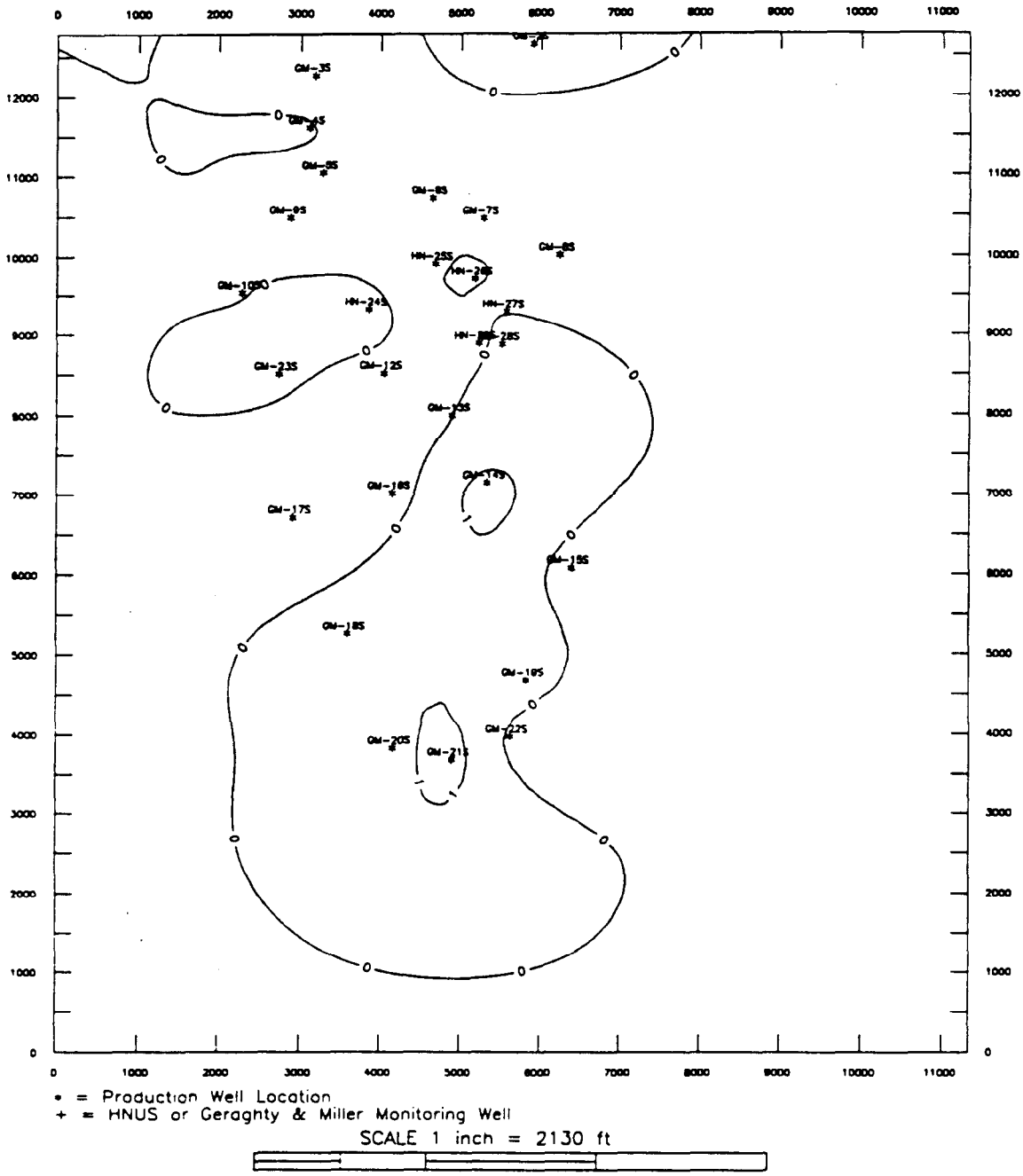


Figure 6-41 February, 1992 Residual Contour Plot, Layer 2

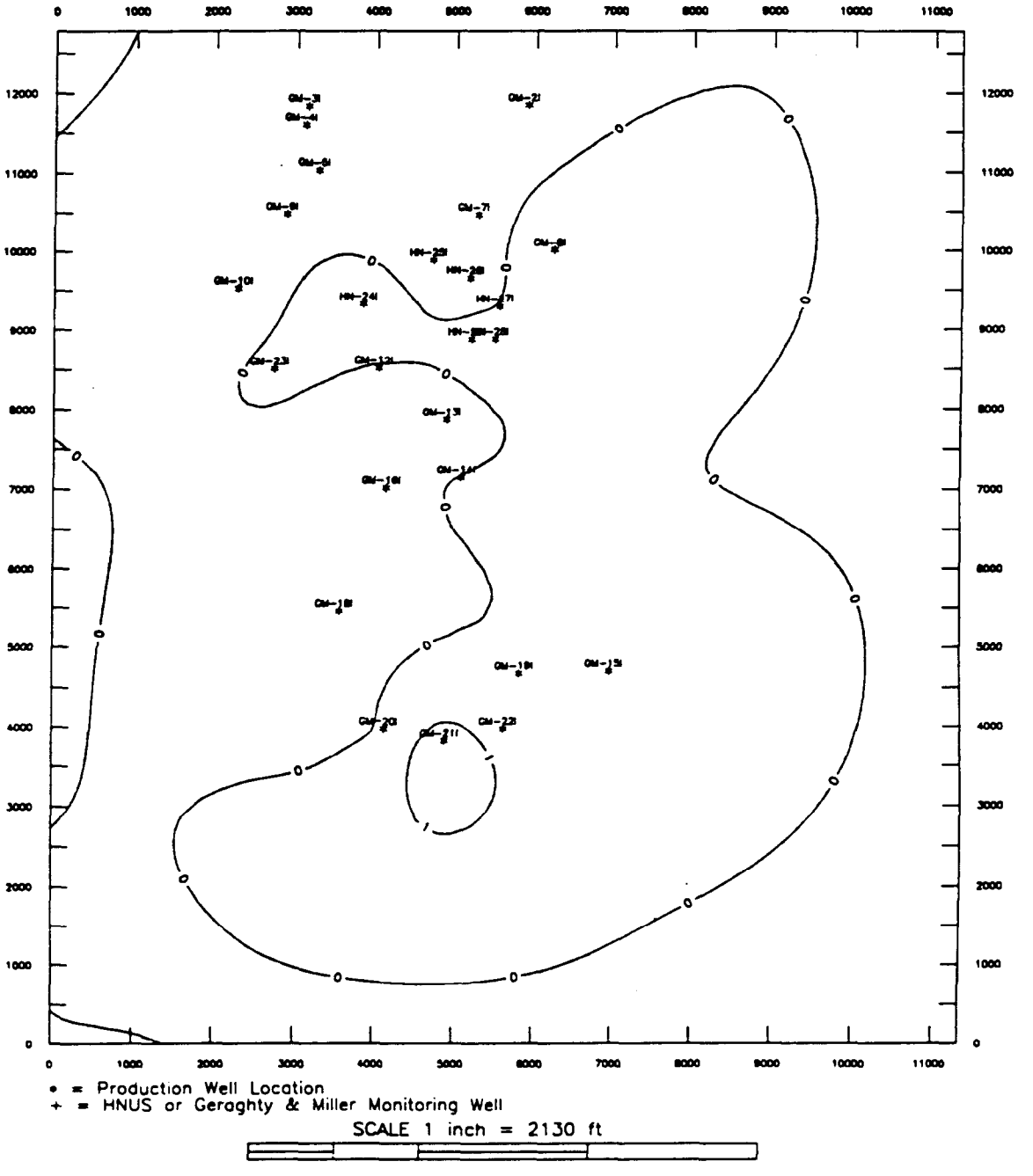


Figure 6-42 August, 1992 Residual Contour Plot, Layer 1

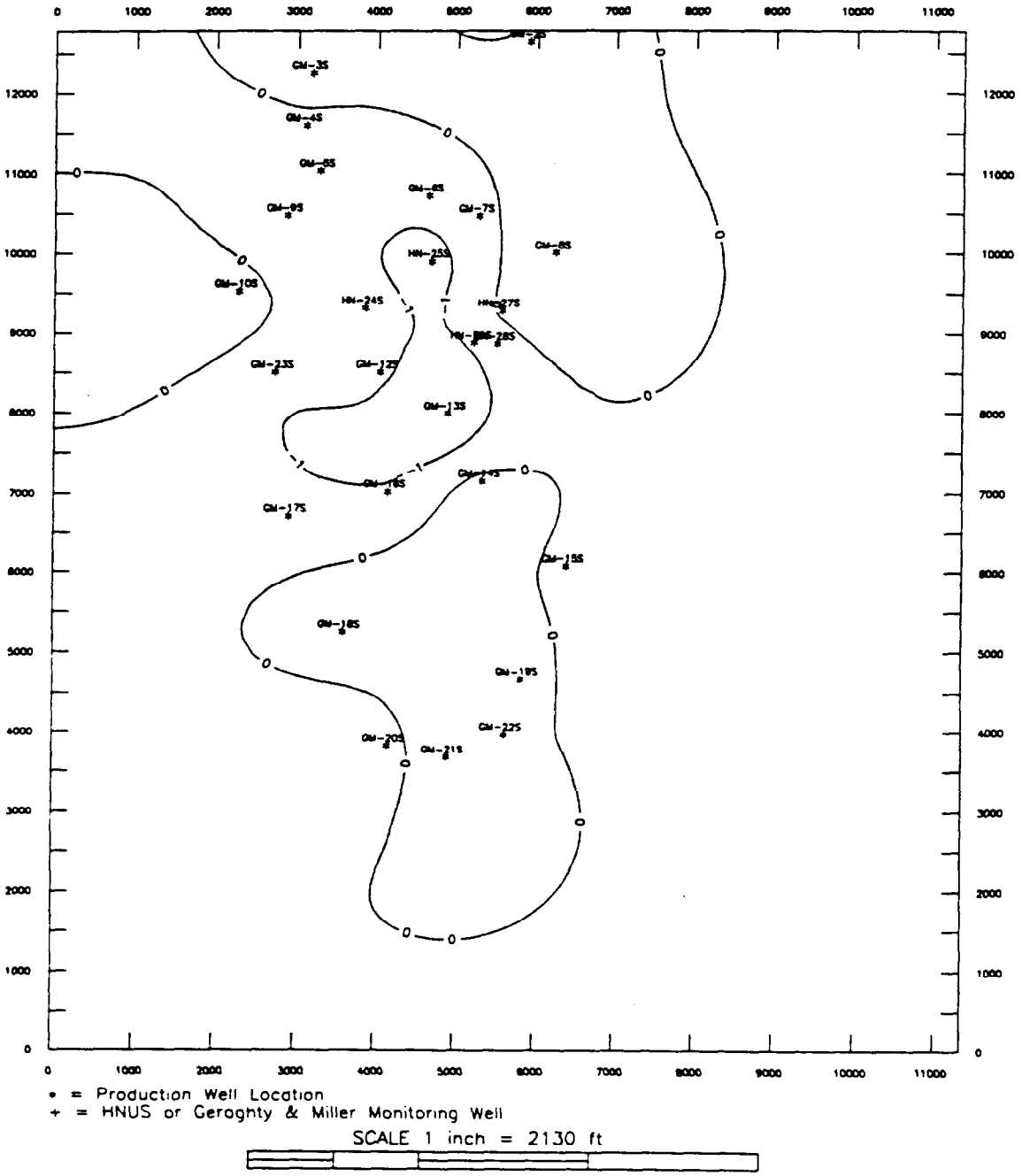
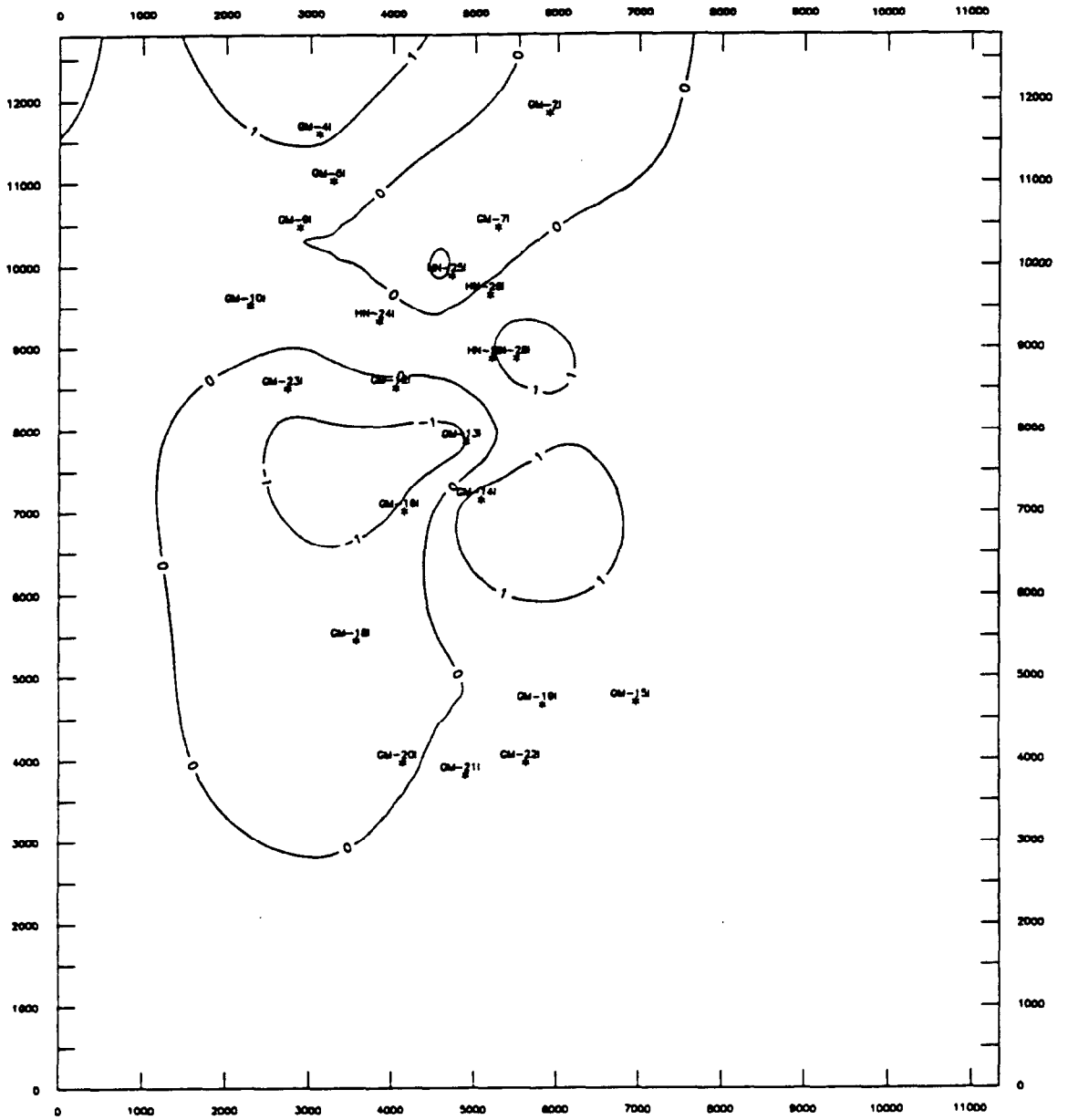


Figure 6-43 August, 1992 Residual Contour Plot, Layer 2



7.0 MODEL VALIDATION

Model validation is a check on how well the model can predict a set of water elevations, utilizing the model parameters established during model calibration. Validation helps establish confidence in the model by predicting the heads at observation points within the acceptable levels of error given a set of pumping conditions. Model validation for the MODFLOW model consisted of entering the known pumping rates for production wells and recharge basins for two separate months, running the model to a steady-state, and comparing model output to measured data for those months. Two validation scenarios for January and July 1992 were simulated, .

7.1 VALIDATION PROCEDURES

Two data sets of Grumman production well data and site wide monitoring well data were utilized (January 1992 and July 1992). These two data sets were not used during model calibration and represent independent data sets for model validation. The January 1992 and July 1992 data sets were chosen for validation because these months occur immediately before February and August, 1992, which were used during calibration. The January 1992 and July 1992 data was considered to represent the most similar boundary conditions to those used for calibration, as they occur in the same seasons as the calibration runs. Precipitation data indicates that January and July are more similar to February and August, than March and September (the other months considered for validation). Using months in similar seasons, with similar amounts of precipitation for calibration and validation is important because the total precipitation will effect the water elevations at the northern and southern constant head boundaries, which effect water elevations across the modeled area.

For each validation scenario, the Grumman production well data was input into the model, and run to a steady-state. The model output was then compared to measured results at each monitoring well. Pumping rates for Grumman production wells were determined from the monthly totals for each well. All of the water pumped from the production wells was assumed to be recharged into the Grumman recharge basins. Hooker-Ruco recharge basins were assigned the same recharge rates as those used in the February and August 1992 calibration runs. Pumping and recharge rates used for the January

and July, 1992 validation scenarios are listed in Table 7-1. The recharge basin at GM-15S was not active during the January, 1992 validation run, as water levels indicate that this activity did not begin until February 1992 (see Figure 6-1). The GM-15S basin was active in the July 1992 simulation at the recharge rate determined during the August 1992 calibration run.

All other model parameters, such as recharge, horizontal and vertical hydraulic conductivity, were identical to those used in model calibration. The January 1992 validation was performed using February 1992 boundary conditions, while the July 1992 validation was performed using the August 1992 boundary conditions.

7.2 VALIDATION RESULTS

Tables 7-2 and 7-3 present the results of model validation for January and July, 1992 scenarios. Figures 7-1 and 7-2 graphically illustrate the amount of model error for each monitoring well at the site.

The January 1992 validation run results show that the difference between the modeled and measured water elevations falls within the ±2.0 ft criteria for 56 of 58 monitoring wells. Two wells (GM-6I and GM-17S) fall outside the ±2.0 ft criteria. These wells are in the immediate vicinity of a production well and recharge basin and, as discussed in Section 6.2.2, are considered outlier wells and were not included in calculation of mean error because they may be effected by pumping or recharge activity.

Results of the July, 1992 validation run show that the difference between the modeled and measured water elevations fall within the ±2.0 ft criteria for the majority of the monitoring wells. Five wells, GM-6I, GM-17S, HN-8D, HN-29D and HN-30I, are in the immediate vicinity of a production well or recharge basins, and as discussed in Section 6.2.2, are considered outlier wells and were not included in calculation of mean error because they may be effected by pumping or recharge activity. As shown in Figure 7-2, three monitoring wells, GM-7D, GM-8S and HN-28I showed a modeled to measured difference of greater than ±2.0 ft. The remaining 51 of 59 monitoring wells fall within the ±2.0 ft criteria.

Due to the nature of the validation process, no aquifer parameters were altered between the calibration runs and the validation runs, including the constant head elevations. The seasonal variation of constant head elevations which is suspected to exist in the natural system, was not accounted for in model

TABLE 7-1
PRODUCTION WELL PUMPING RATES USED IN MODEL VALIDATION SIMULATIONS

PRODUCTION WELL	LOCATION (ROW,COL.)	LAYER	% PUMPED FROM LAYER	JANUARY, 1992 (1)		JULY, 1992 (1)	
				Actual Pumping rate (gpm)	Model Pumping rate (gpm)	Actual Pumping rate (gpm)	Model Pumping rate (gpm)
SOUTH PRODUCTION WELLS							
PW-1	42, 10	5	100%	781	781	1,093	1,093
PW-2	34, 11	5	100%	0	0	0	0
PW-3	38, 9	5	100%	0	0	0	0
PW-4	39, 11	4	100%	0	0	0	0
PW-5	31, 9	4	100%	0	0	1	1
PW-6	27, 7	3	11%	0	0	94	94
		4	89%	0	0	759	759
SOUTH PRODUCTION WELL TOTALS:				781	781	1,947	1,947
SOUTH RECHARGE BASINS - OUTFALLS 005, 006 AND 007							
23 GRID BLOCKS (2)	--	1	100%	34	34	85	85
NORTH PRODUCTION WELLS							
PW-8	15, 13	4	16%	0	0	1	1
		5	84%	0	0	6	6
PW-9	16, 16	4	100%	524	524	929	929
PW-10	18, 19	4	100%	1	1	797	797
PW-11	19, 23	4	37%	0	0	205	205
		5	63%	0	0	349	349
PW-13	12, 18	5	100%	0	0	817	817
PW-14	21, 13	4	62%	0	0	0	0
		5	38%	0	0	0	0
PW-15	14, 26	5	100%	0	0	468	468
PW-16	9, 31	4	100%	839	839	810	810
NORTH PRODUCTION WELL TOTAL:				1,364	1,364	4,382	4,382
NORTH RECHARGE BASINS - OUTFALLS 004 AND 010							
24 GRID BLOCKS (2)	--	1	100%	57	57	183	183
OTHER BASINS							
GM-15S BASIN	41, 38	1	100%	(3)	0	(3)	306
HOOKER-RUCO BASINS AVERAGE		1	100%	(3)	202	(3)	838

(1) MONTHLY PUMPING RATE FROM GRUMMAN AEROSPACE DATA.
(2) CALCULATIONS ARE TOTALS FOR EACH BASIN GRID BLOCK.
(3) RECHARGE RATE DATA NOT AVALIABLE FOR HOOKER-RUCO OR GM-15S RECHARGE BASINS.

TABLE 7-2
MODEL VALIDATION RESULTS
JANUARY 1992

WELL	GRID LOCATION (R,C,L)	JAN. 24, 1992 WATER ELEVATION	MODELED WATER ELEVATION	MODELED - MEASURED (FT)
GM-2S	2, 33, 1	75.75	75.49	-0.26
GM-2I	6, 33, 2	74.97	73.22	-1.75
GM-3S	4, 10 1	75.15	74.00	-1.15
GM-3I	6, 9, 2	74.68	73.71	-0.97
GM-4S	7, 9, 1	75.94	75.37	-0.57
GM-4I	7, 9, 2	74.53	73.90	-0.63
GM-5S	10, 10, 1	74.20	72.92	-1.28
GM-5I	10, 10, 2	73.96	72.81	-1.15
GM-6S	11, 21, 1	73.88	72.32	-1.56
GM-6I (1)	*11, 21, 2*	*68.69*	*72.27*	*3.58*
GM-7S	13, 27, 1	72.52	72.52	0.00
GM-7I	13, 27, 2	72.10	72.45	0.35
GM-7D	13, 27, 3	71.01	72.30	1.29
GM-8S	15, 37, 1	74.30	74.04	-0.26
GM-8I	15, 37, 2	71.94	73.62	1.68
GM-9S	13, 9, 1	73.31	72.59	-0.72
GM-9I	13, 9, 2	73.26	72.44	-0.82
GM-10S	20, 7, 1	72.22	71.84	-0.38
GM-10I	21, 6, 2	72.25	71.29	-0.96
GM-12S	29, 15, 1	71.70	70.73	-0.97
GM-12I	29, 15, 2	71.33	70.69	-0.64
GM-13S	31, 23, 1	71.06	70.46	-0.60
GM13I	32, 23, 2	71.47	70.13	-1.34
GM-13D	34, 22, 3	68.01	69.53	1.52
GM-14S	32, 28, 1	69.32	70.33	1.01
GM-14I	36, 25, 2	69.71	69.17	-0.54
GM-15S	41, 38, 1	67.29	68.18	0.89
GM-15I	48, 40, 2	66.45	66.41	-0.04
GM-16S	36, 16, 1	68.53	69.23	0.70
GM-16I	36, 16, 2	69.15	69.18	0.03
GM-17S (2)	*38, 9, 1*	*72.49*	*69.74*	*-2.75*
GM-18S	45, 11, 1	67.48	67.24	-0.24
GM-18I	44, 11, 2	67.92	67.36	-0.56
GM-19S	48, 33, 1	66.81	66.68	-0.13
GM-19I	48, 33, 2	66.98	66.58	-0.40
GM-20S	51, 16, 1	66.19	65.89	-0.30
GM-20I	51, 16, 2	65.98	65.69	-0.29
GM-20D	51, 16, 3	64.95	65.44	0.49
GM-21S	51, 23, 1	65.31	66.36	1.05
GM-21I	51, 23, 2	64.93	66.00	1.07
GM-22S	51, 30, 1	66.35	66.02	-0.33
GM-22I	51, 30, 2	67.68	65.78	-1.90
GM-23S	29, 8, 1	71.38	70.55	-0.83
GM-23I	29, 8, 2	71.79	70.51	-1.28

TABLE 7-2
MODEL VALIDATION RESULTS
JANUARY 1992

WELL	GRID LOCATION (R,C,L)	JAN. 24, 1992 WATER ELEVATION	MODELED WATER ELEVATION	MODELED - MEASURED (FT)
HN-8D	17, 37, 3	–	–	–
HN-24S	13, 22, 1	72.35	72.16	-0.19
HN-24I	13, 22, 2	71.73	72.10	0.37
HN-25S	16, 21, 1	73.07	71.88	-1.19
HN-25I	16+17, 21+22, 2	73.02	71.84	-1.18
HN-25D	16, 21, 3	–	–	–
HN-26S	18, 26, 1	74.51	72.67	-1.84
HN-26I	19, 26, 2	74.24	72.49	-1.75
HN-27S	22+23, 30, 1	74.64	73.71	-0.93
HN-27I	22+23, 30, 2	74.09	73.18	-0.91
HN-28S	26+27, 29+30, 1	72.65	72.10	-0.55
HN-28I	26+27, 29+30, 2	71.91	71.96	0.05
HN-29S	26+27, 26+27, 1	72.76	71.72	-1.04
HN-29I	26+27, 26+27, 2	71.97	71.63	-0.34
HN-29D	26+27, 26+27, 3	–	–	–
HN-30S	22, 36+37, 1	74.05	75.48	1.43
HN-30I	22, 36+37, 2	74.81	73.99	-0.82

NOTE: Calibration Criteria +/- 2.0 ft.
(1) Monitoring well not included in calibration due to proximity to production well.
(2) Monitoring well not included due to proximity to recharge basin.

MEAN ERROR:	-0.41
ABSOLUTE RESIDUAL VALUE:	46.02
MODFLOW WATER BALANCE ERROR:	0.10%

TABLE 7-3
MODEL VALIDATION RESULTS
JULY 24, 1992 PUMPING CONDITIONS

WELL	GRID LOCATION (R,C,L)	JULY 24, 1992 WATER ELEVATION	MODELED WATER ELEVATION	MODELED - MEASURED (FT)
GM-2S	2, 33, 1	72.10	73.27	1.17
GM-2I	6, 33, 2	71.05	71.41	0.36
GM-3S	4, 10 1	71.46	71.82	0.36
GM-3I	6, 9, 2	70.49	71.78	1.29
GM-4S	7, 9, 1	73.04	74.58	1.54
GM-4I	7, 9, 2	70.42	72.13	1.71
GM-5S	10, 10, 1	70.04	70.45	0.41
GM-5I	10, 10, 2	69.68	70.32	0.64
GM-6S	11, 21, 1	*69.70*	69.77	0.07
GM-6I (2)	*11, 21, 2*	*64.39*	*69.67*	*5.28*
GM-7S	13, 27, 1	70.56	71.25	0.69
GM-7I	13, 27, 2	70.36	71.04	0.68
GM-7D	13, 27, 3	67.84	70.55	2.71
GM-8S	15, 37, 1	*74.71*	76.83	2.12
GM-8I	15, 37, 2	73.64	75.48	1.84
GM-9S	13, 9, 1	69.17	70.09	0.92
GM-9I	13, 9, 2	69.05	69.89	0.84
GM-10S	20, 7, 1	68.62	69.70	1.08
GM-10I	21, 6, 2	68.31	68.56	0.25
GM-12S	29, 15, 1	68.60	68.65	0.05
GM-12I	29, 15, 2	68.04	68.60	0.56
GM-13S	31, 23, 1	68.88	69.42	0.54
GM13I	32, 23, 2	68.97	68.92	-0.05
GM-13D	34, 22, 3	66.67	68.29	1.62
GM-14S	32, 28, 1	67.59	69.47	1.88
GM-14I	36, 25, 2	67.60	68.17	0.57
GM-15S	41, 38, 1	72.25	72.73	0.48
GM-15I	48, 40, 2	64.46	65.94	1.48
GM-16S	36, 16, 1	68.27	67.94	-0.33
GM-16I	36, 16, 2	68.20	67.88	-0.32
GM-17S (2)	*38, 9, 1*	*73.42*	*69.90*	*-3.52*
GM-18S	45, 11, 1	65.64	66.63	0.99
GM-18I	44, 11, 2	66.47	66.60	0.13
GM-19S	48, 33, 1	65.63	66.56	0.93
GM-19I	48, 33, 2	65.56	66.39	0.83
GM-20S	51, 16, 1	66.78	66.21	-0.57
GM-20I	51, 16, 2	66.13	65.80	-0.33
GM-20D	51, 16, 3	64.33	65.26	0.93
GM-21S	51, 23, 1	65.79	67.37	1.58
GM-21I	51, 23, 2	65.24	66.56	1.32
GM-22S	51, 30, 1	65.73	66.52	0.79
GM-22I	51, 30, 2	64.59	65.98	1.39
GM-23S	29, 8, 1	67.98	67.68	-0.30
GM-23I	29, 8, 2	67.90	67.62	-0.28

TABLE 7-3
MODEL VALIDATION RESULTS
JULY 24, 1992 PUMPING CONDITIONS

WELL	GRID LOCATION (R,C,L)	JULY 24, 1992 WATER ELEVATION	MODELED WATER ELEVATION	MODELED - MEASURED (FT)
HN-8D (2)	*17, 37, 3*	*70.88*	*74.87*	*3.99*
HN-24S	13, 22, 1	69.32	69.71	0.39
HN-24I	13, 22, 2	67.80	69.57	1.77
HN-25S	16, 21, 1	69.83	69.28	-0.55
HN-25I	16+17, 21+22, 2	69.26	69.20	-0.06
HN-25D	16, 21, 3	66.49	68.34	1.85
HN-26S	18, 26, 1	72.91	72.48	-0.43
HN-26I	19, 26, 2	71.47	72.03	0.56
HN-27S	22+23, 30, 1	77.70	76.91	-0.79
HN-27I	22+23, 30, 2	Destroyed	–	–
HN-28S	26+27, 29+30, 1	71.97	72.66	0.69
HN-28I	26+27, 29+30, 2	69.86	72.26	2.40
HN-29S	26+27, 26+27, 1	71.13	71.32	0.19
HN-29I	26+27, 26+27, 2	69.27	71.08	1.81
HN-29D (2)	*26+27, 26+27, 3*	*66.88*	*70.59*	*3.71*
HN-30S	22, 36+37, 1	80.64	82.40	1.76
HN-30I (2)	*22, 36+37, 2*	*74.84*	*78.82*	*3.98*

Note: calibration criterial +/- 2.0 ft.
(1) Monitoring well not included in validation due to proximity to production well.
(2) Monitoring well not included in validation due to proximity to recharge basin.

MEAN ERROR:	0.75
ABSOLUTE RESIDUAL VALUE:	48.64
MODFLOW WATER BALANCE ERROR:	-0.04%

Figure 7-1
Model vs. Measured Values, Jan. 1992

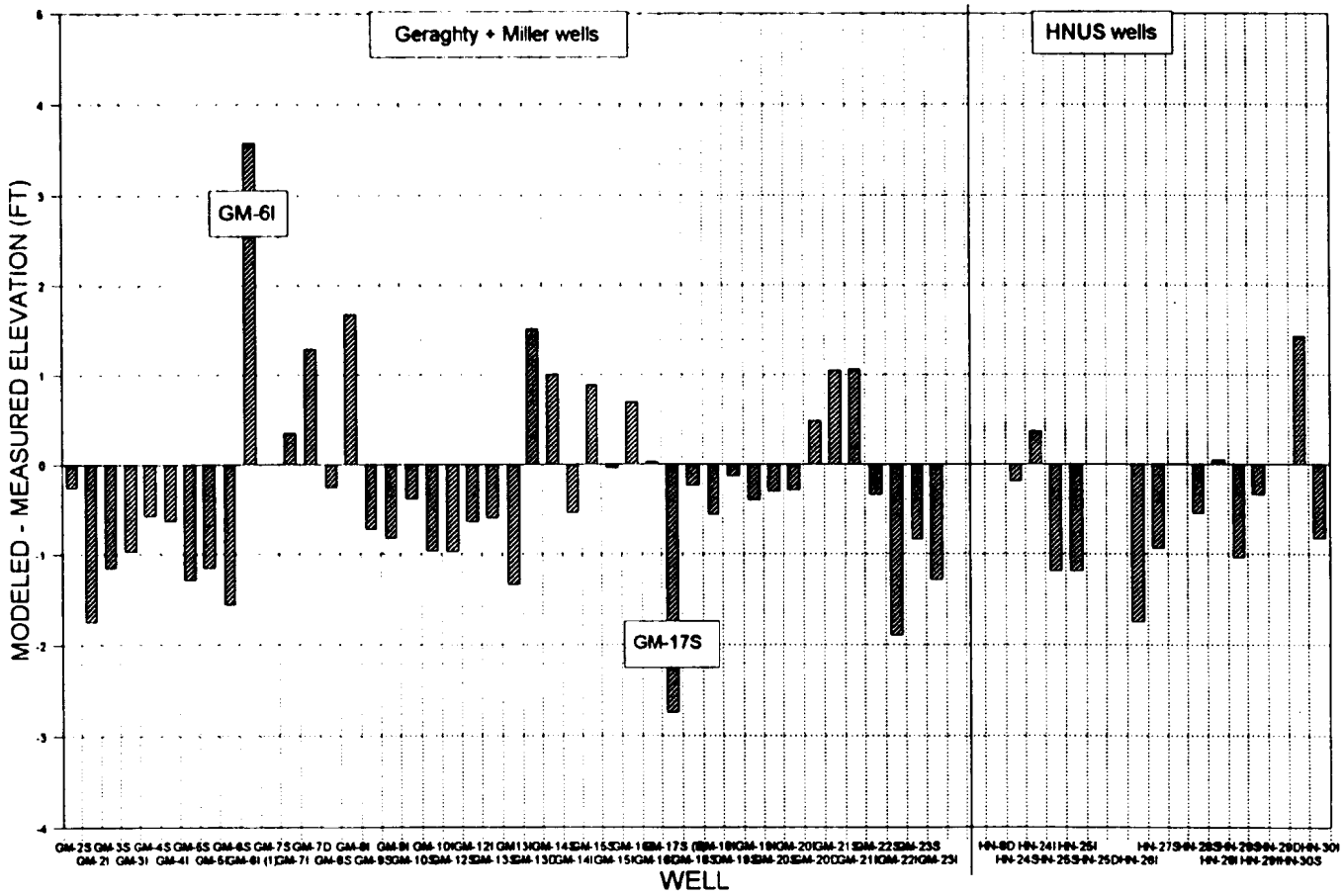
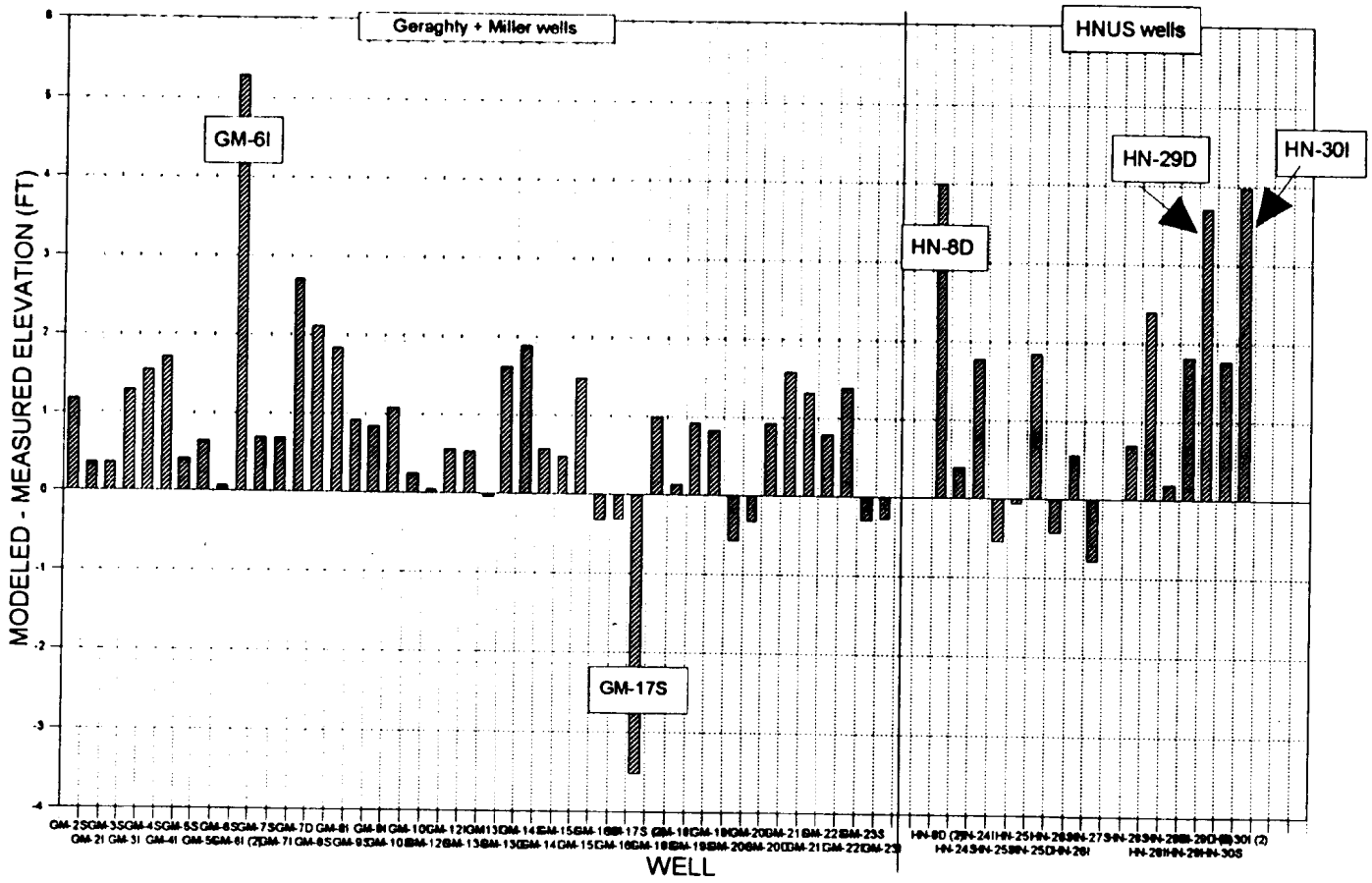


Figure 7-2
Model vs. Measured Values, July, 1992



validation, because if changes were made to the model constant head elevations the run would be considered to be a calibration run rather than a validation run. This disparity between the natural system and the modeled system may account for the generally low modeled vs. measured results in the January 1992 validation run (-0.41 ft mean error) and the generally high modeled vs. measured results in the July 1992 validation run (0.75 ft mean error). Apparently, natural boundary conditions were higher in the January 1992 run, which used February boundary conditions, while the natural boundary conditions were lower for the July validation run, which used August boundary conditions. The consistently low modeled results across the site in the January 1992 simulation and the consistently high model results across the site in the July 1992 simulation suggest that these differences may be due to constant head elevations rather than errors in the hydraulic conductivity or other model parameters. All aquifer parameters were constant at calibration values during the two validation runs. If the consistently high and low modeled values were due to errors in aquifer parameters (such as hydraulic conductivities, or recharge), the modeled to measured differences would show specific high or low modeled values in all simulations rather than the pattern seen in validation.

8.0 PARTICLE TRACKING

MODPATH, a module of MODFLOW, was used to track the locations of particles after simulated releases of contaminants from suspected source areas. Particle tracking was performed to determine the possible directions and rates that contaminants will move after a release. Several particle tracking scenarios were performed, each under a different pumping condition of Grumman production wells and recharge basins, and with different BWPD well pumping rates. MODPATH utilizes the groundwater flow data generated by MODFLOW and simulates advective transport of particles. Other contaminant transport parameters, such as diffusion, dispersion, contaminant half-life, are not considered in the MODPATH simulations. All MODPATH simulations were performed using the aquifer parameters determined during model calibration for pumping scenarios run to a steady-state.

Particle tracking analysis is used to trace flow paths, expressed as lines, by tracking the movement of infinitely small imaginary particles placed in the flow field. This process may also be used to determine the capture zone of a well by releasing particles in a grid block, generally a well, and tracking the particles in reverse along pathlines to determine their source.

8.1 PARTICLE RELEASE LOCATIONS

For each pumping configuration, particle tracking analysis was performed for three separate release locations. Particles were released from possible contaminant sources at Site 1 and the northern Grumman recharge basins. For these two sites particle tracking was performed in the forward direction to determine where particles would move with time. Particles were also released at the eastern BWD wells (BP-07, BP-08 and BP-09) and particle tracking was performed in reverse to determine the capture zones of these wells under the various pumping conditions. For all particle tracking simulations, recharge was applied to the top layer of the model; particles were not influenced by weak sinks; and, particles were not placed in constant head nodes.

8.1.1 Site 1

The particle release location of Site 1 is shown in Figure 8-1. Particles were released from four grid blocks with two particles being released from each face of each block. Twelve particles were released from each grid block with a total of 48 particles released from Site 1.

8.1.2 NWIRP Basins

The particle release locations of the NWIRP recharge basins are shown in Figure 8-1. Particles were released from 16 grid blocks with one particle being released from each face of each block. Six particles were released from each grid block with a total of 96 particles released from the north recharge basins.

8.1.3 BWD Wells

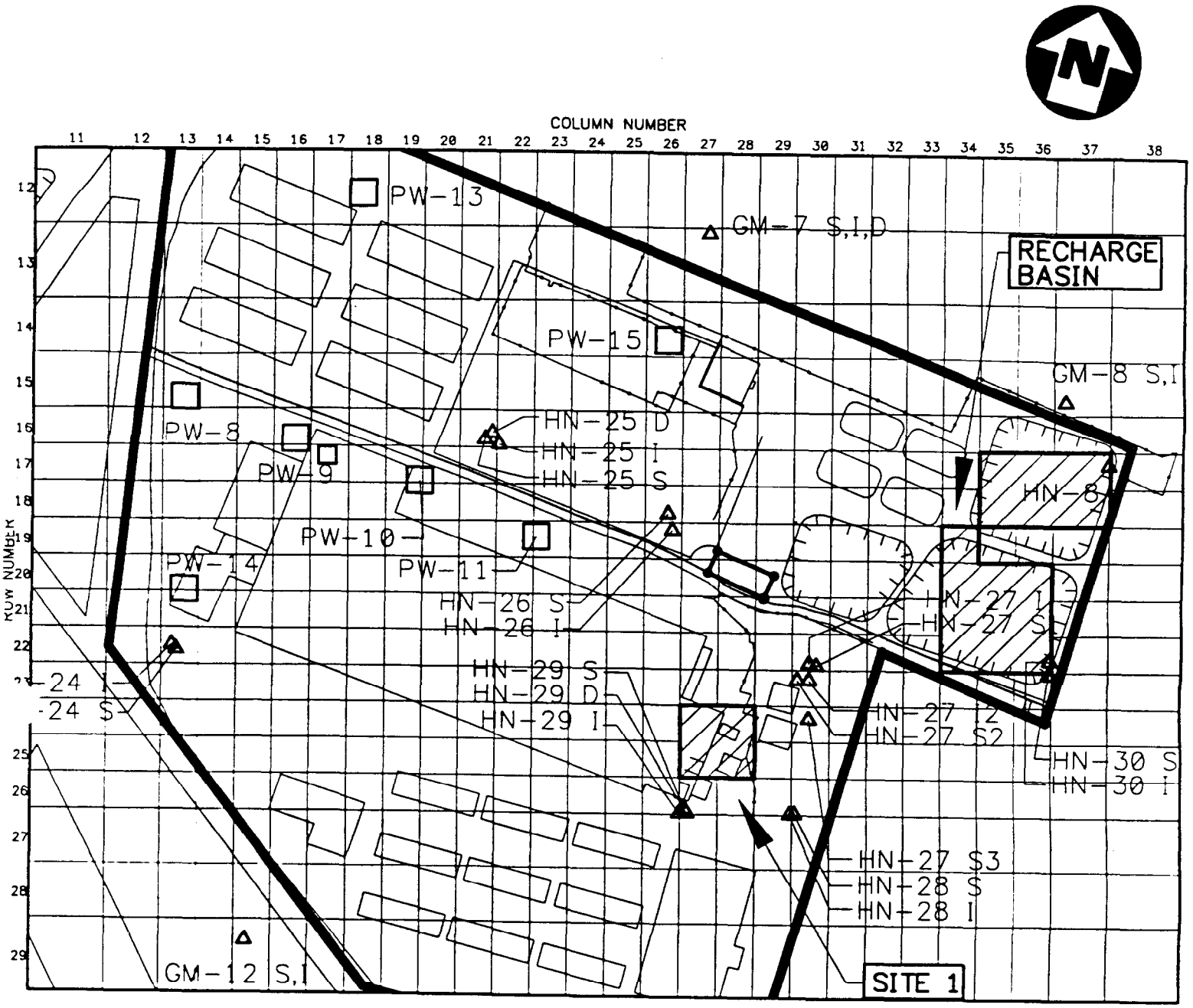
Particles were released from each of the three BWD wells to the east of the NWIRP. The location of these wells is shown in Figure 6-6. Four particles were released from each face with 24 particles released from each well. These particles were backwards tracked to determine where they originated in order to define the capture zone of each well.

8.2 PUMPING SCENARIOS

Several pumping scenarios were considered for particle tracking simulations. These pumping scenarios were based on past, current, and future potential pumping configurations at the Grumman production wells, Grumman recharge basins, and BWD wells. The emphasis of these simulations was to determine where particles will move after a release from potential contaminant sources and what effect, if any, these potential contaminant sources will have on BWD wells.

The results of the MODPATH particle tracking analysis are presented as water table maps which reflect the modeled water elevation in layer 1, with the particle tracks overlaid. Presenting both particle tracks and the water table allows for the inspection of the particle trackways, and the geometry of the water table, which is controlled by the wells and basins which are active during each pumping scenario.

ACAD: 1953\OTHER.DWG MB 6/8/93 (400plot) (400dwg)



0 400 800
SCALE IN FEET

FIGURE 8-1

PARTICLE RELEASE LOCATIONS
SITE 1 AND RECHARGE BASIN
BETHPAGE NWIRP

HALLIBURTON NUS
Environmental Corporation

8.2.1 Current Conditions

Current conditions were simulated in order to determine where contaminants may be moving under current pumping conditions. Production well pumping rates for current conditions at the Grumman site were determined from 1991 and 1992 average pumping rate data. The yearly average was determined for each Grumman production well, and pumping rates used in the scenarios for these wells are listed in Table 8-1. All water removed from the pumping wells north of the LIRR tracks was recharged to northern recharge basins, and water removed from the south Grumman production wells was recharged to the south Grumman recharge basins.

BWD wells production rate data was determined from 1991 and 1992 average pumping rate data, and pumping values used in the scenarios are shown on Table 8-2. The BWD wells were considered to be pumping at 120% of 1991 and 1992 rates, and well BP-09 was considered to be active despite it being taken off-line in 1991. These assumptions represent conservative estimates of the current conditions at the BWD wells. Three recharge basins were considered to be active on Hooker-Ruco property, pumping at 202 gpm per basin, a rate determined during model calibration. In all of the pumping conditions water pumped from the BWD well was considered to be removed from the flow system. The northern and southern constant head elevations were averages of the February and August conditions.

The particle tracking results for current pumping conditions are illustrated in Figures 8-2 through 8-4. Table 8-3 summarizes starting location and final location results of the particle tracking analysis, and the maximum and minimum travel times for all pumping conditions. Results of the particle tracking are listed below:

- All particles released from Site 1 under current pumping conditions are captured by PW-01, • Particles released from the recharge basins show that 30% of particles released are captured by Grumman production wells PW-01, PW-09, PW-10, PW-1, PW-15 and PW-16. The remaining 70% of the particles flow to the south constant head boundary. No particles from the north recharge basins are captured by BWD wells BP-10 or BP-11, and,
- The capture zone for BWD wells BP-07, BP-08 and BP-09 extends into the northern constant head boundary.

TABLE 8-1
AVERAGE GRUMMAN PRODUCTION WELL PUMPING RATES FOR AVERAGE AND HIGH PUMPING CONDITIONS.

PRODUCTION WELL	LOCATION (ROW,COL.)	LAYER	% PUMPED FROM LAYER	1991/1992 AVERAGE PUMPING RATE (1)		HIGH PUMPING CONDITIONS	
				(gal./day)	(gpm)	(gal./day)	(gpm)
SOUTH PRODUCTION WELLS							
PW-1	42, 10	5	100%	1,497,655	1,040	1,296,000	900
PW-2	34, 11	5	100%	132	0.092	1,296,000	900
PW-3	38, 9	5	100%	105,441	73	1,296,000	900
PW-4	39, 11	4	100%	211	0.147	1,296,000	900
PW-5	31, 9	4	100%	285	0.198	1,296,000	900
PW-6	27, 7	3	11%	47,760	33	142,560	99
		4	89%	386,418	268	1,153,440	801
SOUTH PRODUCTION WELL TOTALS:				2,037,902	1,415	7,776,000	5,400
SOUTH RECHARGE BASINS - OUTFALLS 005, 006 AND 007							
23 GRID BLOCKS (2)	--	1	100%	88,604	62	338,087	235
NORTH PRODUCTION WELLS							
PW-8	15, 13	4	16%	770	1	207,360	144
		5	84%	4,040	3	1,088,640	756
PW-9	16, 16	4	100%	716,967	498	1,296,000	900
PW-10	18, 19	4	100%	790,707	549	1,296,000	900
PW-11	19, 23	4	37%	149,128	104	479,520	333
		5	63%	253,921	176	816,480	567
PW-13	12, 18	5	100%	702,770	488	1,296,000	900
PW-14	21, 13	4	62%	170	0.118	803,520	558
		5	38%	104	0.072	492,480	342
PW-15	14, 26	5	100%	318,482	221	1,296,000	900
PW-16	9, 31	4	100%	1,173,992	815	1,296,000	900
NORTH PW TOTAL:				4,111,051	2,855	10,368,000	7,200
NORTH RECHARGE BASINS - OUTFALLS 004 AND 010							
24 GRID BLOCKS (2)	--	1	100%	171,294	119	432,000	300

(1) Monthly pumping rates from Grumman Aerospace data.
(2) Calculations are totals for each basin grid block.

TABLE 8-2
AVERAGE AND HIGH PUMPING RATES FOR BWD WELLS

WELL NUMBER	NYS DEC NUMBER	GRID LOCATION (R,C,L,)	TOTAL DEPTH (ft)	SCREEN INTERVAL (fbgs)	AVERAGE CONDITIONS (1)		HIGH PUMPING CONDITIONS (2)	
					(mgpd)	(gpm)	(mgpd)	(gpm)
North Wells								
7	8767	13, 49, 5	655	590 to 656	0.96	667	1.76	1,222
8	8768	14, 49, 5	682	617 to 677	1.24	861	1.66	1,153
9	6078	12, 49, 3	280	225 to 275	1.24 (3)	861 (3)	1.76	1,222
BGD-1	9591	22, 52, 5	607	542 to 602	0.05	35	1.73	1,201
South Wells								
10	6915	59, 46, 5	608	540 to 603	0.60	417	2.00	1,389
11	6916	60, 46, 5	611	556 to 606	0.32	222	1.76	1,222
5	8004	Off Grid (4)	740	675 to 735	0.32	222	1.77	1,229
6-1	3876	61, 27, 4	386	321 to 381	0.50	347	1.84	1,278
6-2	8941	61, 30, 5	775	710 to 770	0.37	257	1.70	1,181

(1) Data is 120% of 1991 average pumping rate (from1991 Bethpage Water District Annual Operations Report).
(2) Actual Capacity of Wells.
(3) Well 9 assumed to be pumping at same rate as well 8, although well was not pumping in 1991.
(4) Well BP-05 is located off of the model grid. Pumping rates are given for comparison to other BWD wells.
fbgs = feet below ground surface.
mgpd = millions of gallons per day.

Figure 8-2
Particle Tracking Results - Site 1 Release - Current Conditions.

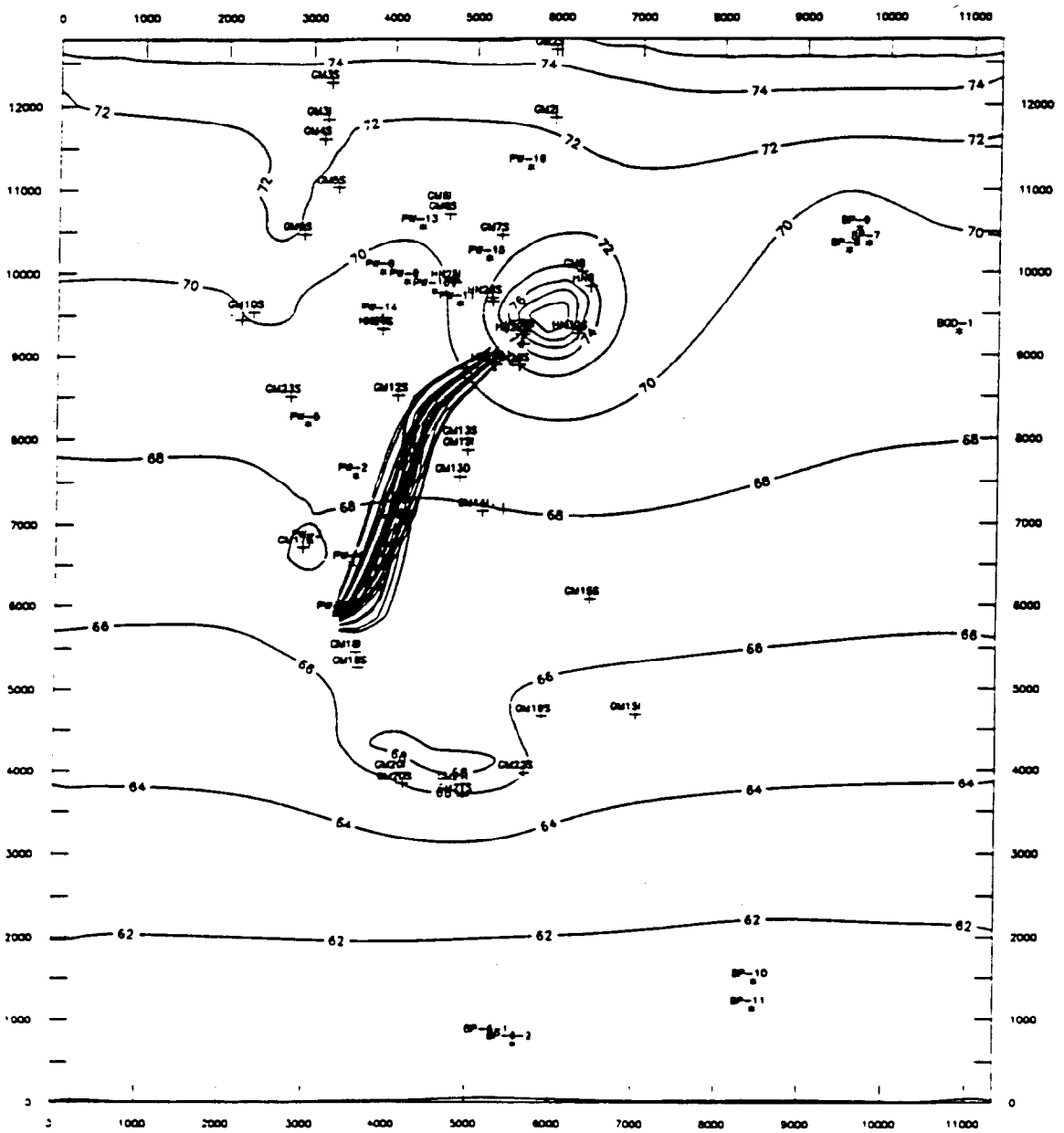


Figure 8-3
Particle Tracking Results - NWIRP Basin Release - Current Conditions.

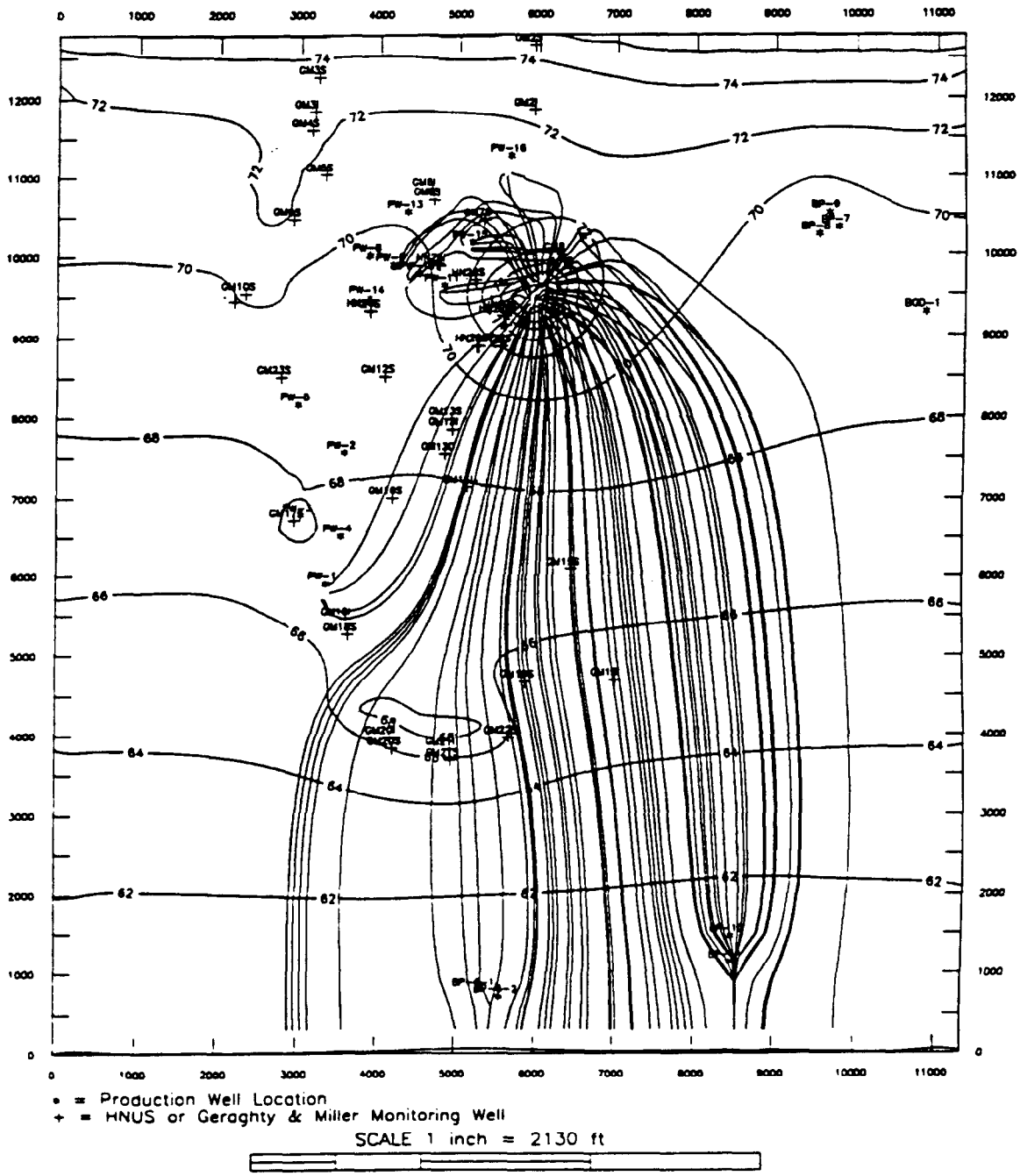


Figure 8-4
Particle Tracking Results - Capture Zones of BWD Wells - Current Conditions.

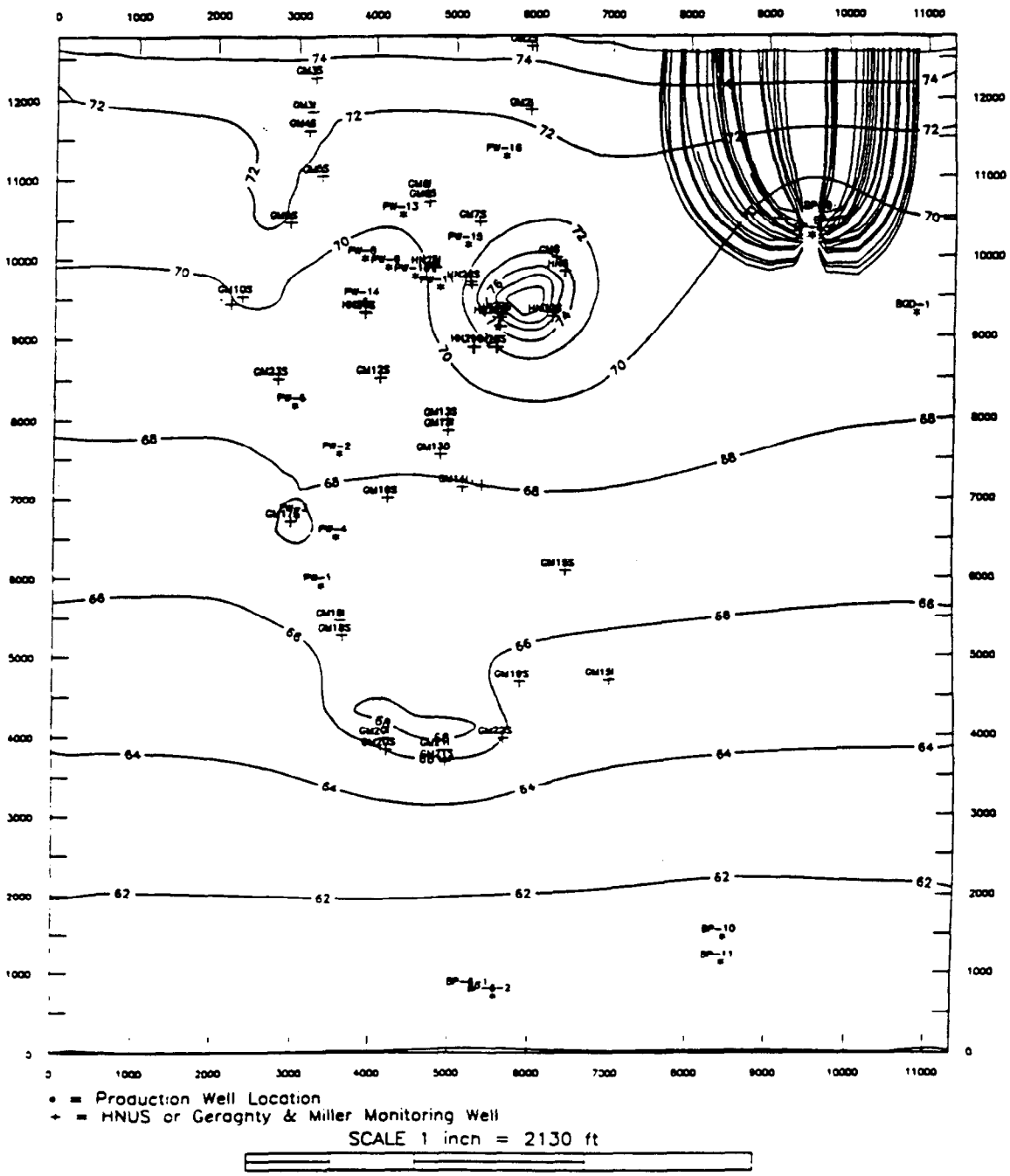


TABLE 8-3
SUMMARY OF PARTICLE TRACKING RESULTS AND TRAVEL TIMES

Grumman Pumping Conditions	BWD Pumping Conditions	Particle Release Location	Number of Particles Released	Percentage of Particles Reaching Each Location					
				Grumman PW's / Basins	Min./Max. Travel Time (yrs.)	Constant Head Boundary	Min./Max. Travel Time (yrs.)	BWD Wells	Min./Max. Travel Time (yrs.)
Current Conditions	Current Conditions	Site 1	48	100 %	14.8 / 53.5	0%	0	0%	0
		Recharge Basins	96	30%	2.4 / 13.8	70%	20.4 / 55.5	0%	0
		BWD Wells (1)	72	0%	–	100%	1.7 / 21.6	–	–
High	Average	Site 1	48	100%	3.8 / 11.8	0%	–	0%	0
		Recharge Basins	96	73%	0.8 / 40.4	24%	20.7 / 58.2	3%	10.4 / 24.1
		BWD Wells (1)	72	7%	7.4 / 18.6	93%	1.6 / 34.9	–	–
High	High	Site 1	48	100%	4.0 / 11.6	0%	0	0%	0
		Recharge Basins	96	65%	0.8 / 30.3	2%	30.9 / 69.9	33%	7.4 / 49.5
		BWD Wells (1)	72	8%	7.11 / 15.4	92%	1.2 / 26.6	–	–
No Pumping	Average	Site 1	48	0%	0	100%	49.7 / 58.5	0%	0
		Recharge Basins (2)	0	–	–	–	–	–	–
		BWD Wells (1)	72	0%	0	100%	2.8 / 18.8	–	–
No Pumping	High	Site 1	48	0%	0	0%	0	100%	48.8 / 58.0
		Recharge Basins (2)	0	–	–	–	–	–	–
		BWD Wells (1)	72	0%	0	100%	1.7 / 30.9	–	–

(1) Capture zone analysis performed for BWD wells.
(2) Recharge basins inactive during No Pumping conditions.

8.2.2 High Pumping Conditions

High pumping conditions were simulated to determine where particles may have moved from contaminant sources during past pumping conditions. Before 1985 additional pumping/recharge activity at the Grumman production wells and recharge basins may have occurred due to the increased manufacturing activity at the facility. High pumping conditions at Grumman were simulated by pumping all 14 production wells at 75% of maximum capacity, as listed in Table 8-1. All water pumped by Grumman production wells was returned to the recharge basins. Three recharge basins were considered to be active on Hooker-Ruco property, recharging at 202 gpm per basin (this rate was determined during model calibration). The northern and south constant head elevations were averages of the February and August 1992 conditions. Two separate scenarios were considered for past pumping conditions at the BWD wells, as described below.

8.2.2.1 Average BWD Well Pumping Conditions

Average BWD well pumping conditions were simulated by pumping at the rate determined from 1991 and 1992 average pumping rate data. Pumping values used in the scenarios are shown on Table 8-2. The BWD wells were considered to be pumping at 120% of 1991 and 1992 rates, and well BP-09 was considered to be active despite it being taken off-line in 1991. These assumptions represent conservative estimates of the current conditions at the BWD wells.

The particle tracks for high Grumman pumping and average BWD pumping conditions are illustrated in Figures 8-5 through 8-7. Results of the particle tracking are listed below:

- All particles released from Site 1 are captured by PW-14 and PW-05,
- 73% of particles released from the recharge basins are captured by the Grumman production wells, 24% reach the south constant head boundary, while 3% of particles reach BP-08 from the NWIRP recharge basins, and,
- The capture zones for BWD wells BP-07, BP-08 and BP-09 extend primarily into the northern constant head boundary. Some particles originate in the vicinity of the NWIRP recharge basins. Three particles (4% of total) move from the north recharge basins to BP-08, while two particles (3% of total) move from northwest of the recharge basins to BP-09.

Figure 8-5 .
Particle Tracking Results - Site 1 Release - Grumman at High Pumping Conditions, BWD at Average Pumping Conditions.

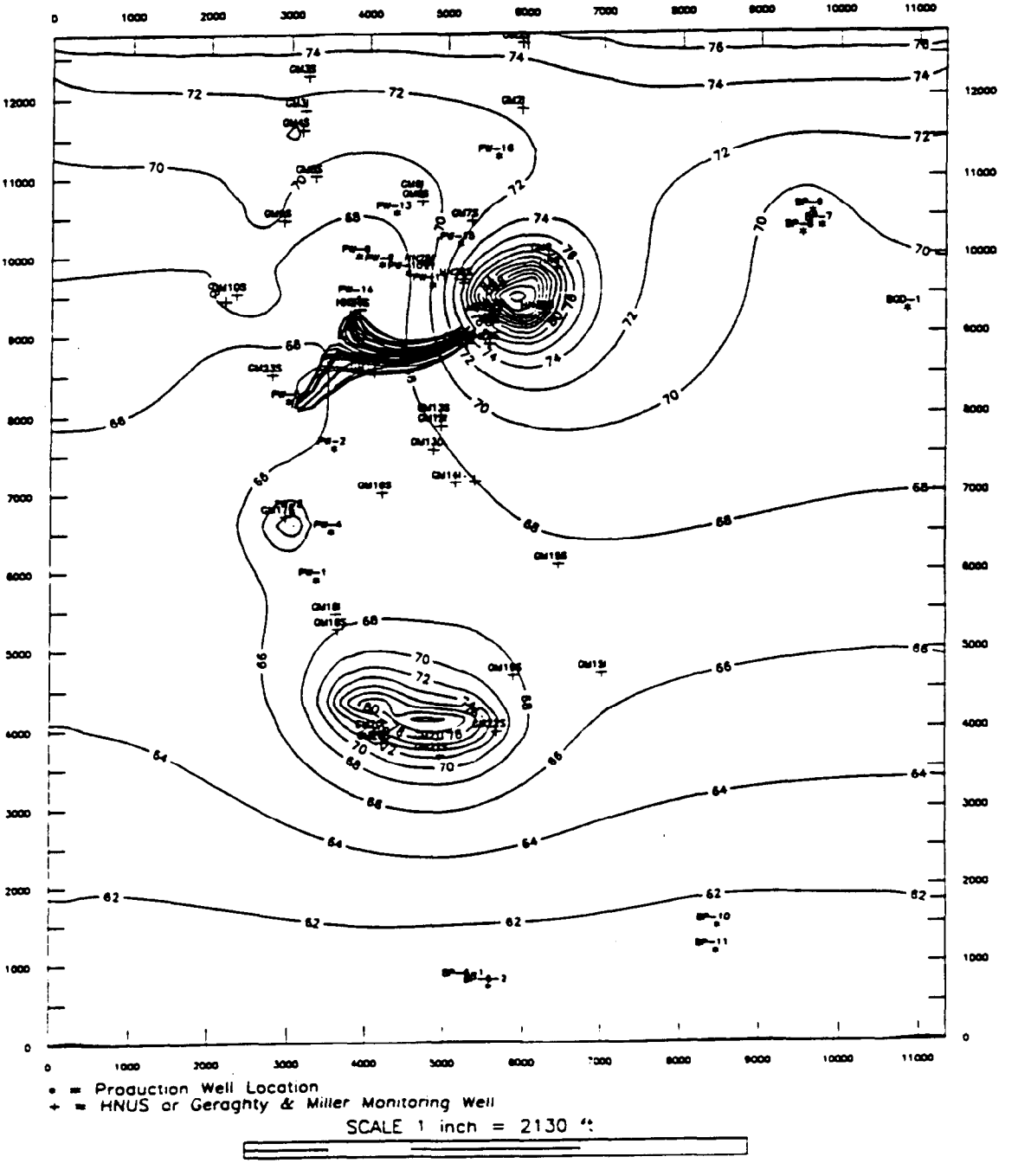


Figure 8-6
Particle Tracking Results - NWIRP Basin - Grumman at High Pumping Conditions, BWD at Average Pumping Conditions.

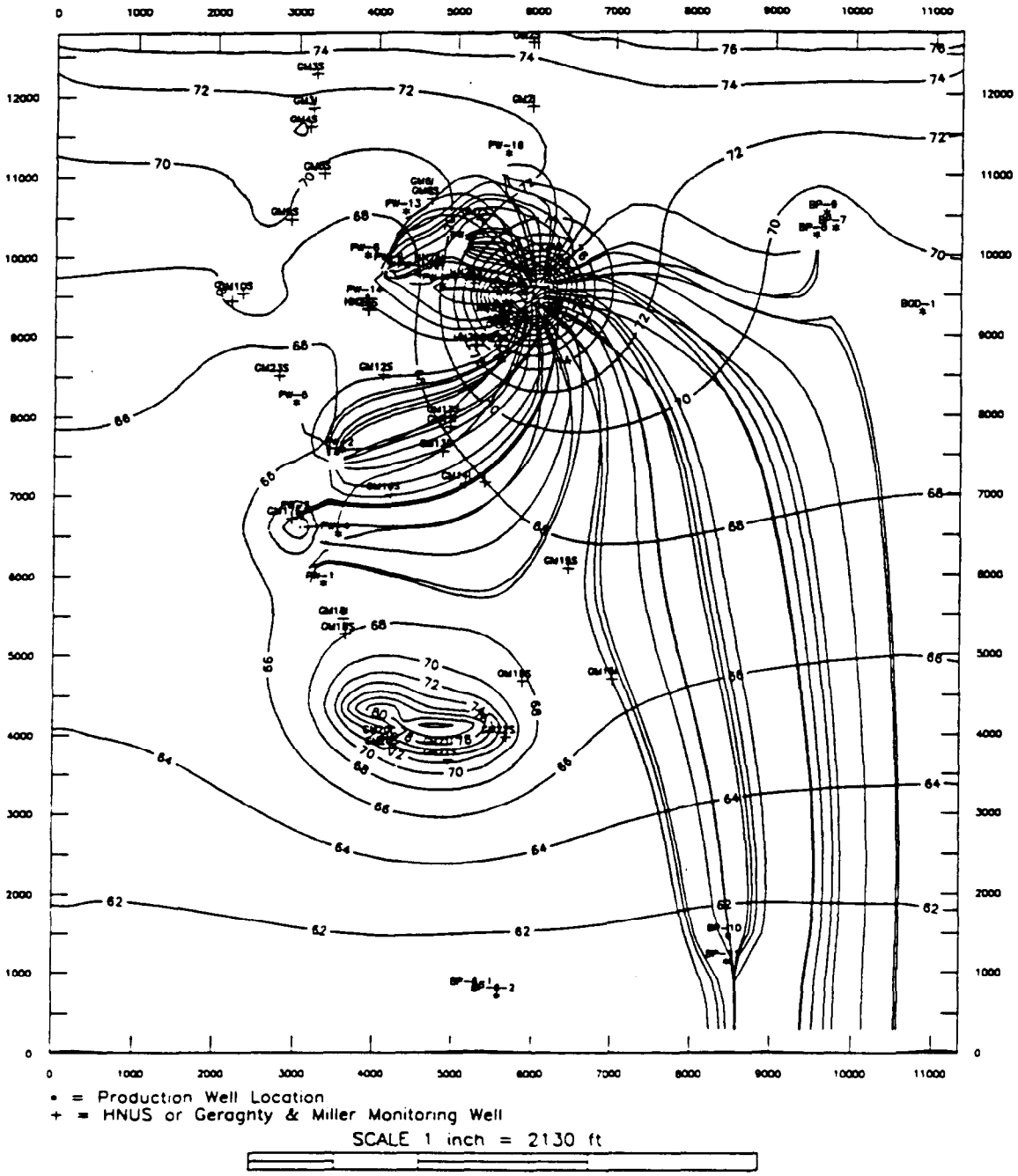
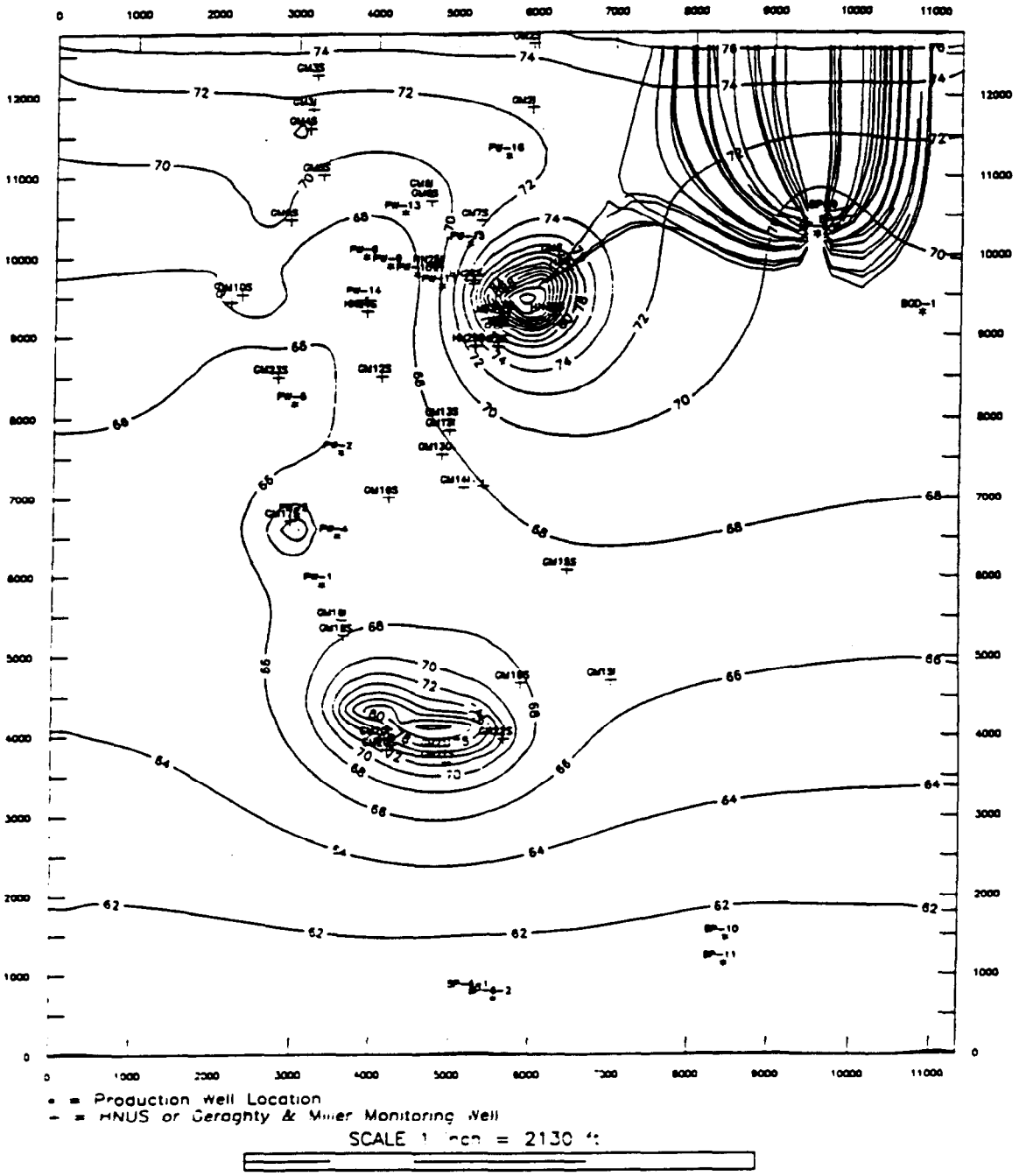


Figure 8-7
Particle Tracking Results - Capture Zones of BWD Wells - Grumman at High Pumping Conditions, BWD at Average Pumping Conditions.



8.2.2.2 High BWD Well Pumping Conditions

This pumping condition was simulated to determine were particles may have moved under past pumping conditions. These high pumping conditions may not have occurred in the past for extended periods of time, as assumed in the model run. However, these situations may represent end-member flow conditions which affected groundwater flow at the site. In this scenario all BWD wells were pumping at their actual (highest) capacity.

The particle tracks for high Grumman pumping and high BWD pumping conditions are illustrated in Figures 8-8 through 8-10. Results of the particle tracking are listed below:

- All particle released from Site 1 are captured by PW-14 and PW-05,
- 65% of particles released from the recharge basins are captured by Grumman production wells with 2% reaching the south constant head boundary. BWD well BP-11 receives 19%, BGD-1 receives 7%, BP-08 receives 6% and BP-09 receives 1% of the total particles released,
- The capture zones for BWD wells BP-07, BP-08, and BP-09 extend primarily into the northern constant head boundary, although 8% of particles move from the NWIRP recharge basins to BP-08.

8.2.3 <u>No Pumping Conditions</u>

No pumping conditions were simulated to determine how contaminants would move if Grumman production wells and recharge basins were inactive and no pumping activity was occurring at the Grumman site. These conditions may have occurred during the past, during holidays or during periods of slow production. All Grumman production wells and recharge basins were considered to be inactive. Recharge basins at Hooker-Ruco were considered inactive. As with all pumping scenarios, the northern and southern constant head elevations were averages of the February and August 1992 conditions.

Two separate scenarios were considered for past pumping conditions at the BWD wells, as described below.

Figure 8-8
Particle Tracking Results - Site 1 Release - Grumman at High Pumping Conditions, BWD at High Pumping Conditions.

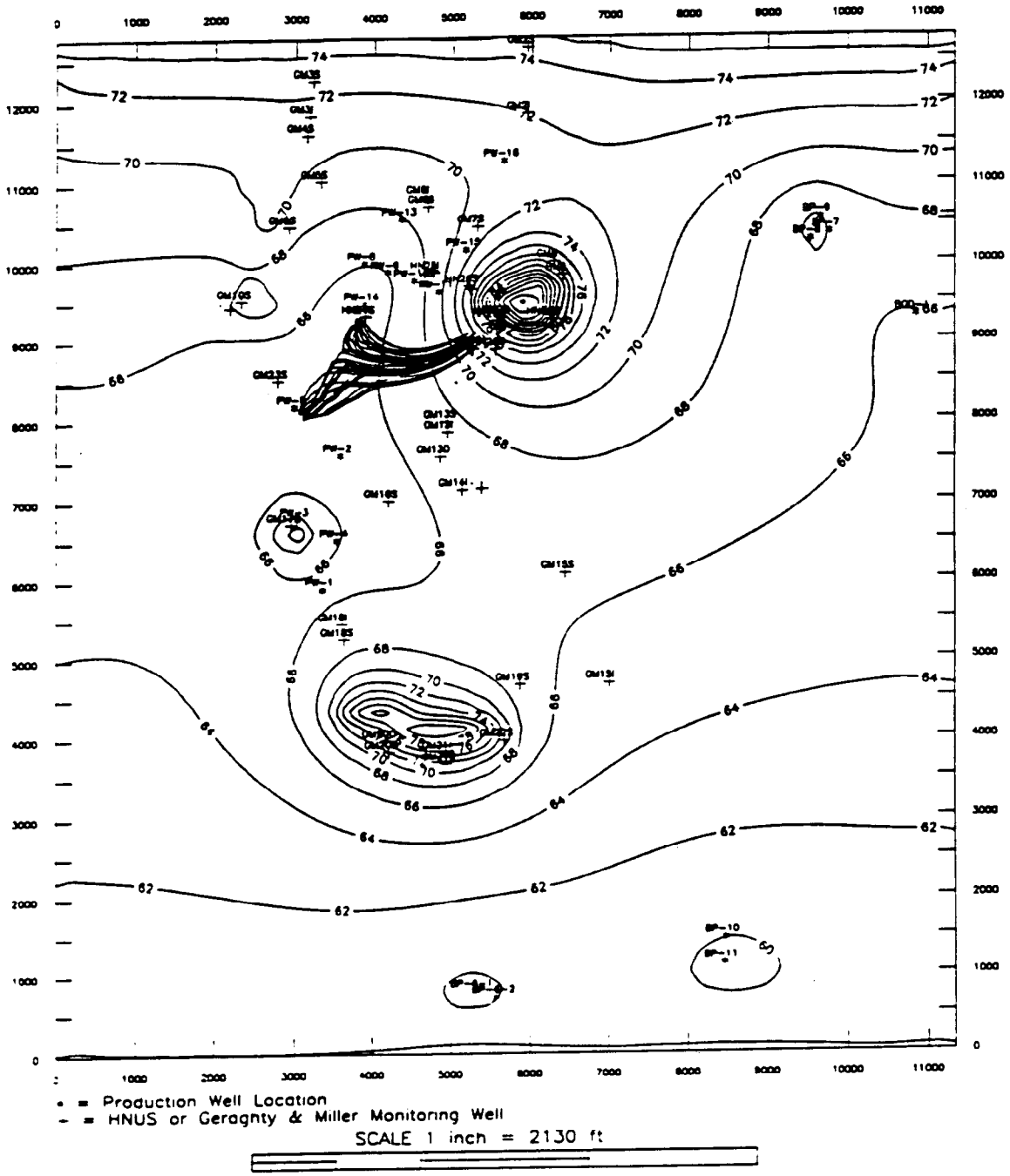


Figure 8-9
Particle Tracking Results - NWIRP Basin - Grumman at High Pumping Conditions, BWD at High Pumping Conditions.

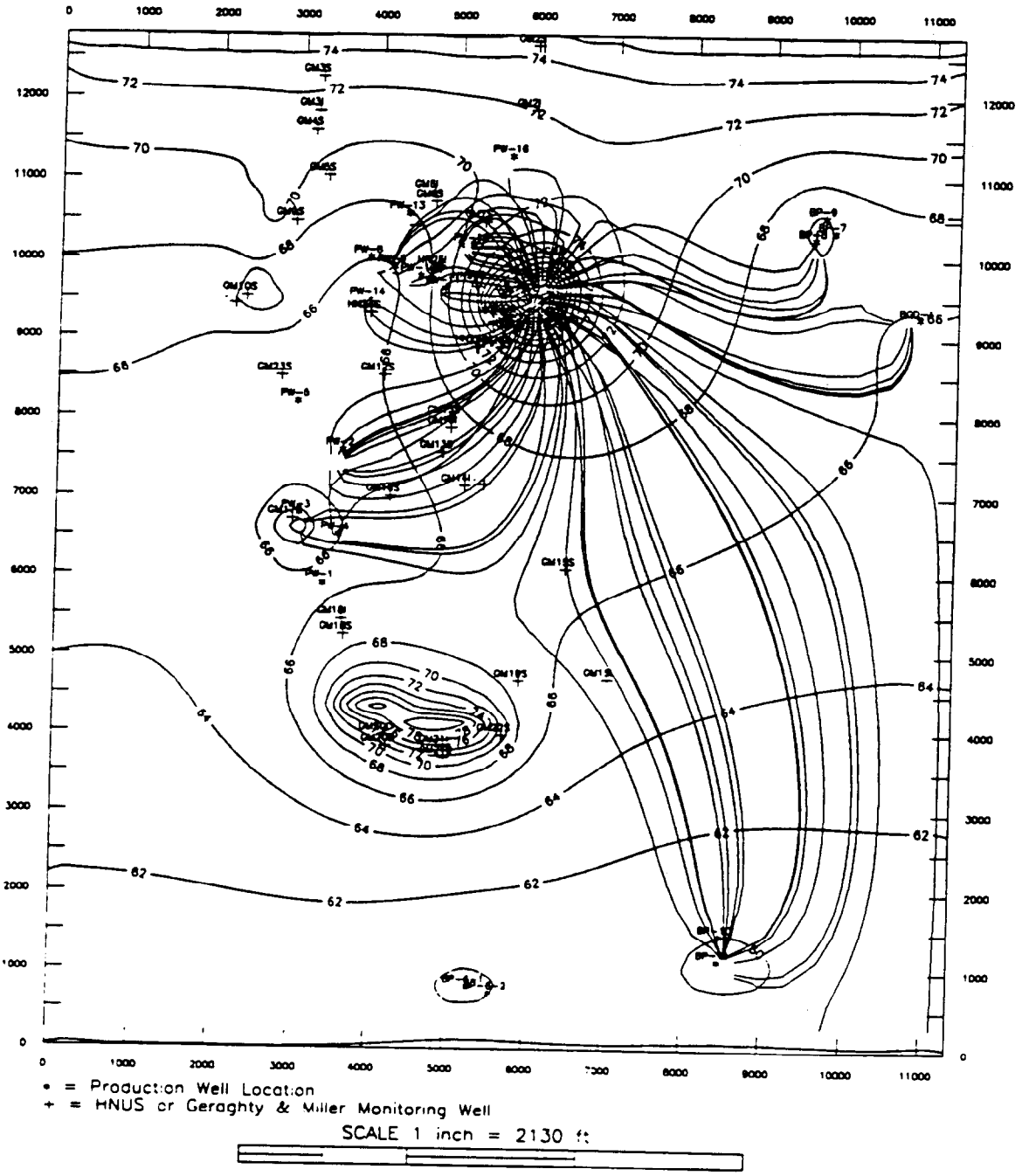
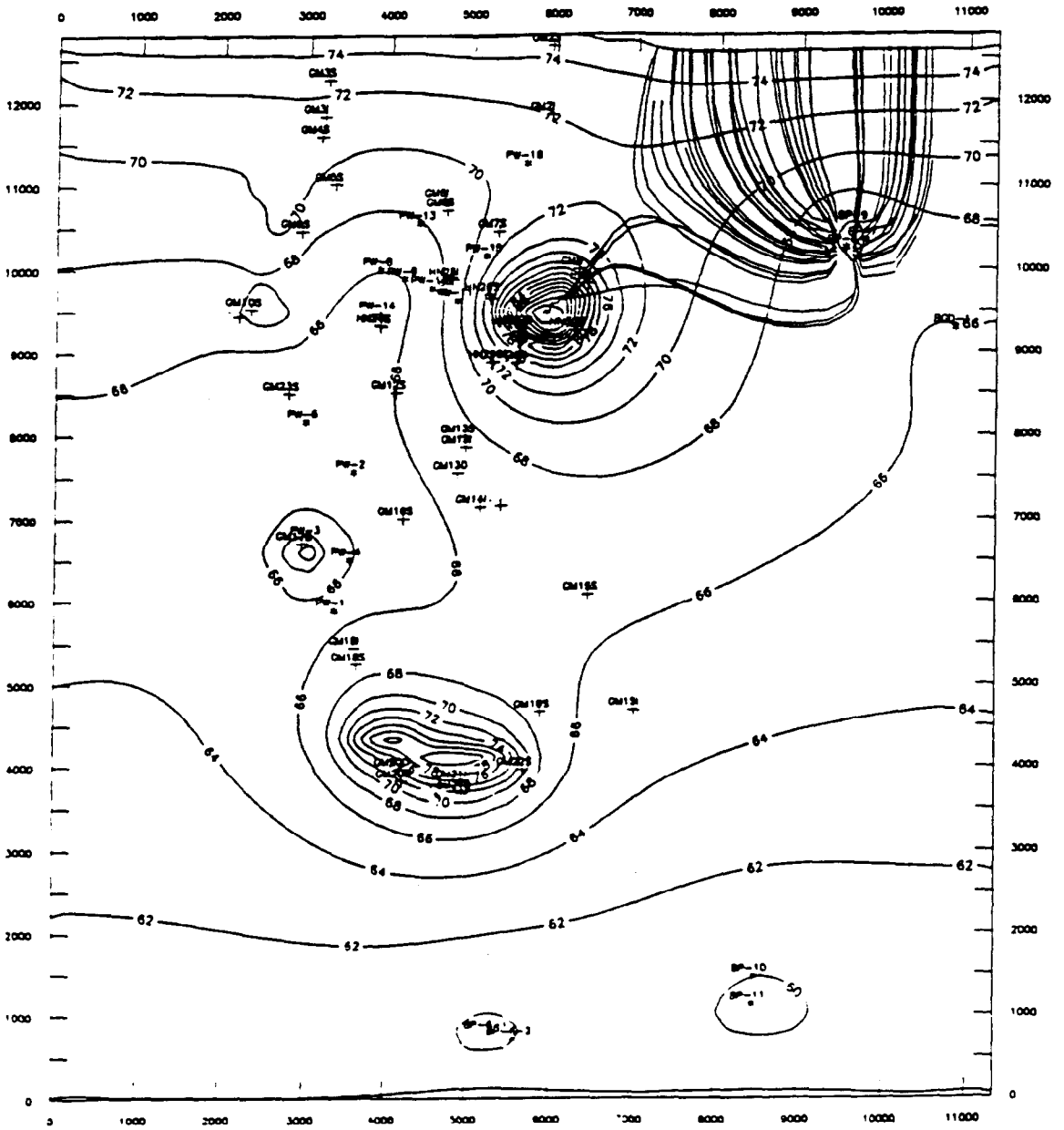


Figure 8-10
Particle Tracking Results - Capture Zones of BWD Wells - Grumman at High Pumping Conditions, BWD at High Pumping Conditions.



below.

8.2.3.1 Average BWD Well Pumping Conditions

Average BWD well pumping conditions were simulated by pumping at the rate determined from 1991 and 1992 average pumping rate data. Pumping values used in the scenarios are shown on Table 8-2. The BWD wells were considered to be pumping at 120% of 1991 and 1992 rates, and well BP-09 was considered to be active despite it being taken off-line in 1991. These assumptions represent conservative estimates of the current conditions at the BWD wells.

The particle tracks for no pumping at Grumman and average BWD pumping conditions are illustrated in Figures 8-11 and 8-12 . Results of the particle tracking are listed below:

- Particles released from Site 1 move to the south constant head boundary, and,
- The capture zone for BWD wells BP-07, BP-08 and BP-09 extends into the northern constant head boundary.

8.2.3.2 High BWD Well Pumping Conditions

This pumping condition was simulated to determine were particles may have moved under past pumping conditions. These high pumping conditions may not have occurred in the past for extended periods of time, as assumed in the model run. However, these situations may represent end-member flow conditions which affected groundwater flow at the site. In this scenario all BWD wells were pumping at their actual capacity, which, as shown on Table 8-2 is a significantly higher rate than average values. The particle tracks for no pumping at Grumman and high BWD pumping conditions are illustrated in Figures 8-13 and 8-14. Results of the particle tracking are listed below:

- 42% of the particles released from Site 1 were captured by BP-10, and 58% were captured by BP-11, and,
- The capture zone for BWD wells BP-07, BP-08 and BP-09 extends into the northern constant head boundary.

Figure 8-11
Particle Tracking Results - Site 1 Release - No Pumping at Grumman, BWD at Average Pumping Conditions.

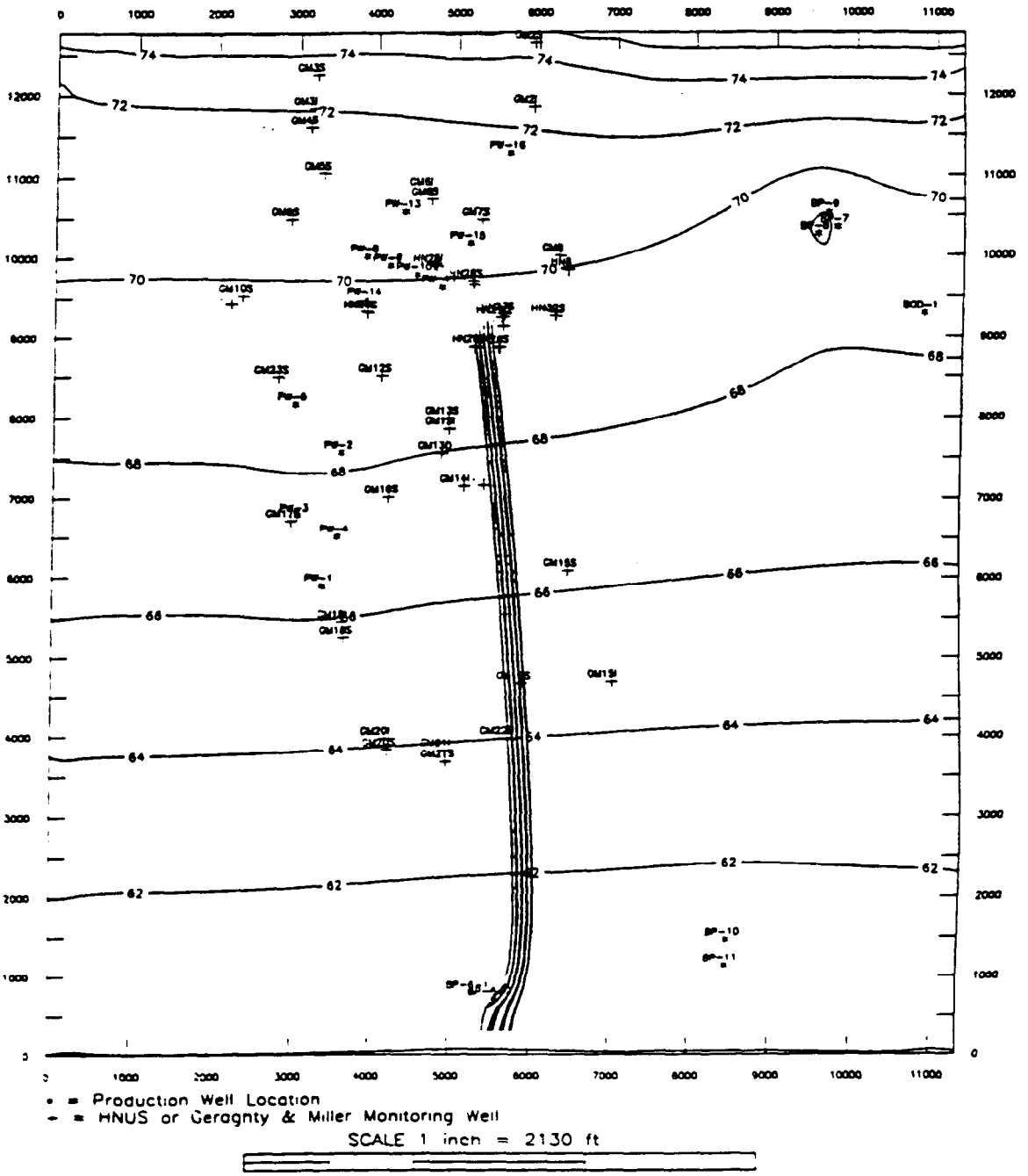


Figure 8-12
Particle Tracking Results - Capture Zones of BWD Wells - No Pumping at Grumman, BWD at Average Pumping Conditions.

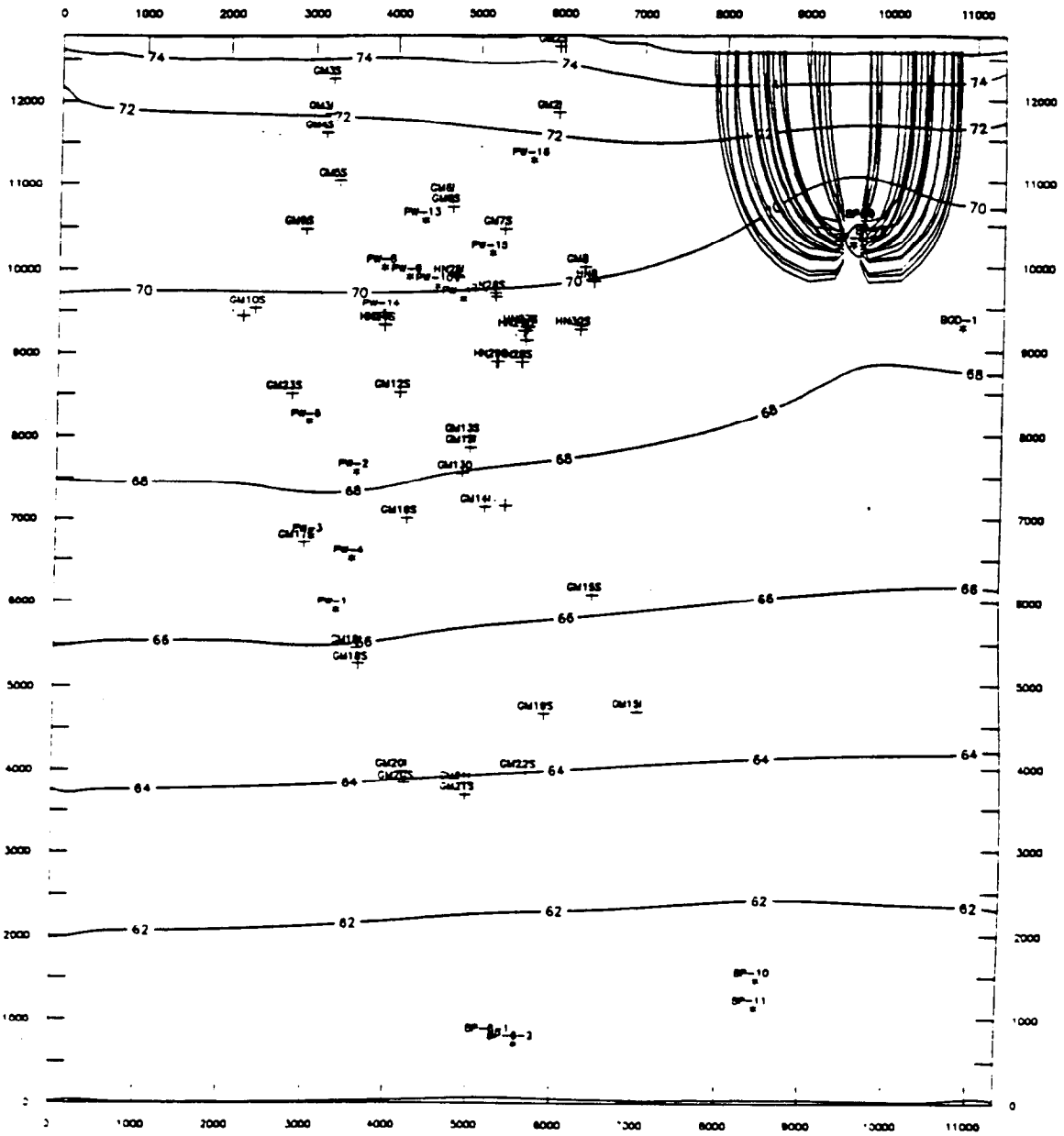


Figure 8-13
Particle Tracking Results - Site 1 Release - No Pumping at Grumman, BWD at High Pumping Conditions.

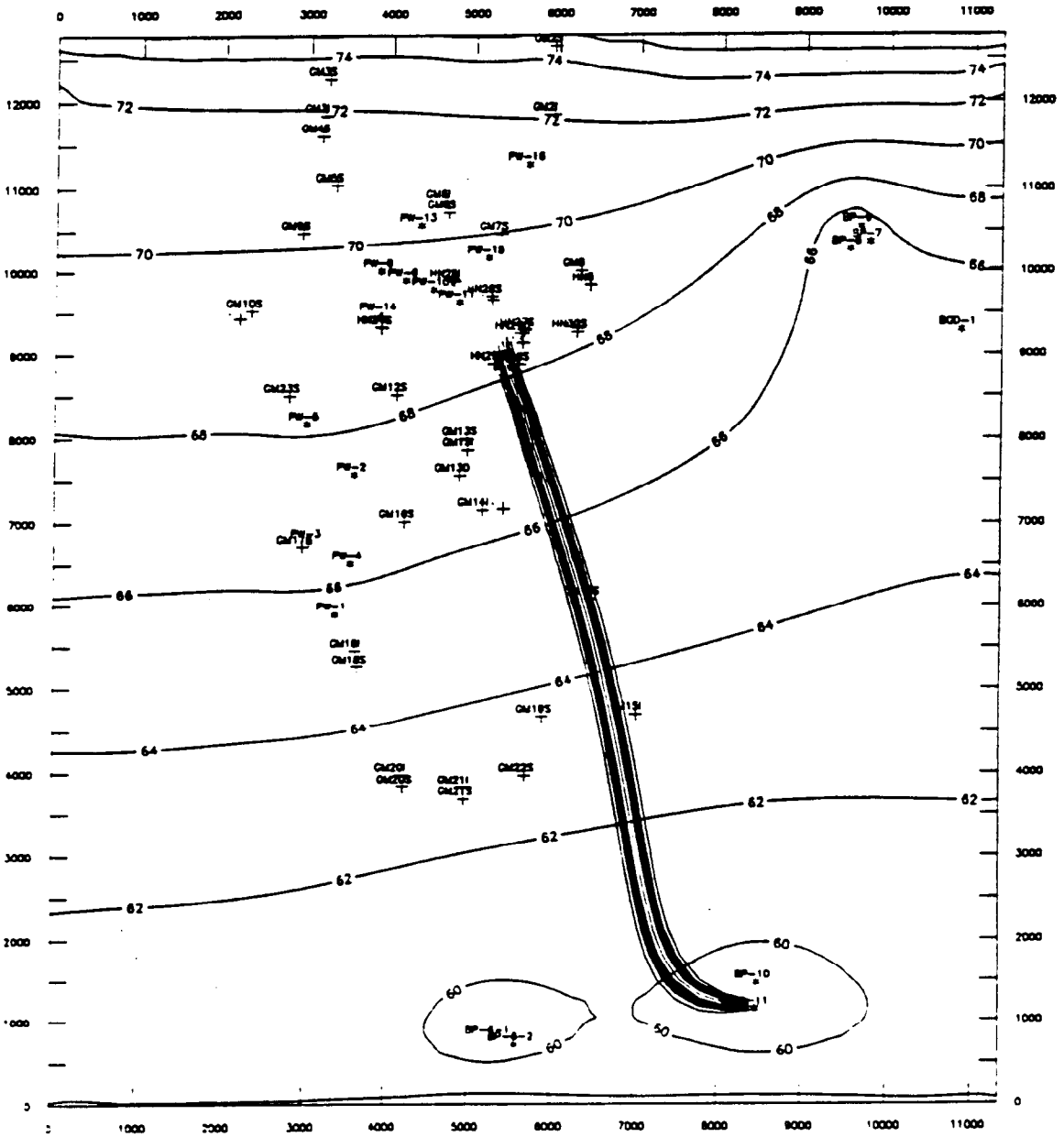
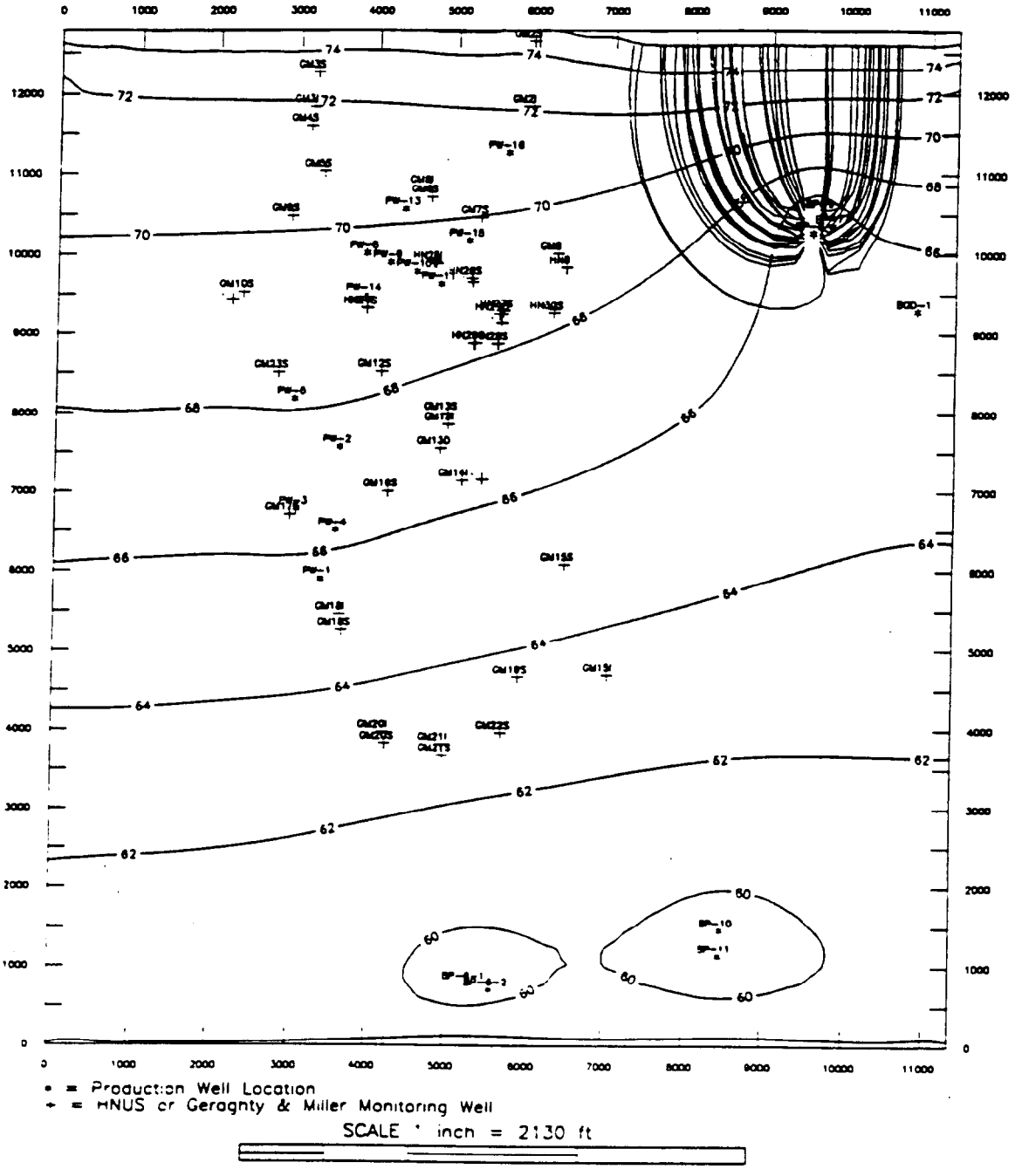


Figure 8-14
Particle Tracking Results - Capture Zones of BWD Wells - No Pumping at Grumman, BWD at High Pumping Conditions.



9.0 SENSITIVITY ANALYSIS

Sensitivity analysis is the process of characterizing the effects of changes in parameters on the behavior of the calibrated model. A sensitivity analysis helps to determine the potential for errors in model results that may be caused by a lack of accuracy in the aquifer parameters. Sensitivity analysis for this groundwater flow model included increasing and decreasing aquifer parameters incrementally and comparing the resulting changes in modeled heads to the calibrated values of head. The magnitude of change in heads from the calibrated solution is a measure of the sensitivity of the solution to that particular parameter. One model parameter was changed during each sensitivity run.

Sensitivity analysis was performed for aquifer parameters affecting both the steady-state water elevation and potential flow directions of particles within the aquifer. Parameters, such as recharge and boundary conditions, tend to affect the steady-state water elevations. Parameters, such as vertical and horizontal hydraulic conductivity and porosity, affect ground water flow direction and velocity. The storage parameter is only utilized during transient conditions and affects the shape of the time-drawdown curve of the modeled pumping tests. The results of the sensitivity analysis are reported as the effects of the parameter change on the mean error of the model solution and the absolute residual values of the model solution for steady-state solutions. Sensitivity analysis for changes in storage are reported as time-drawdown plots for simulation of pump test #1.

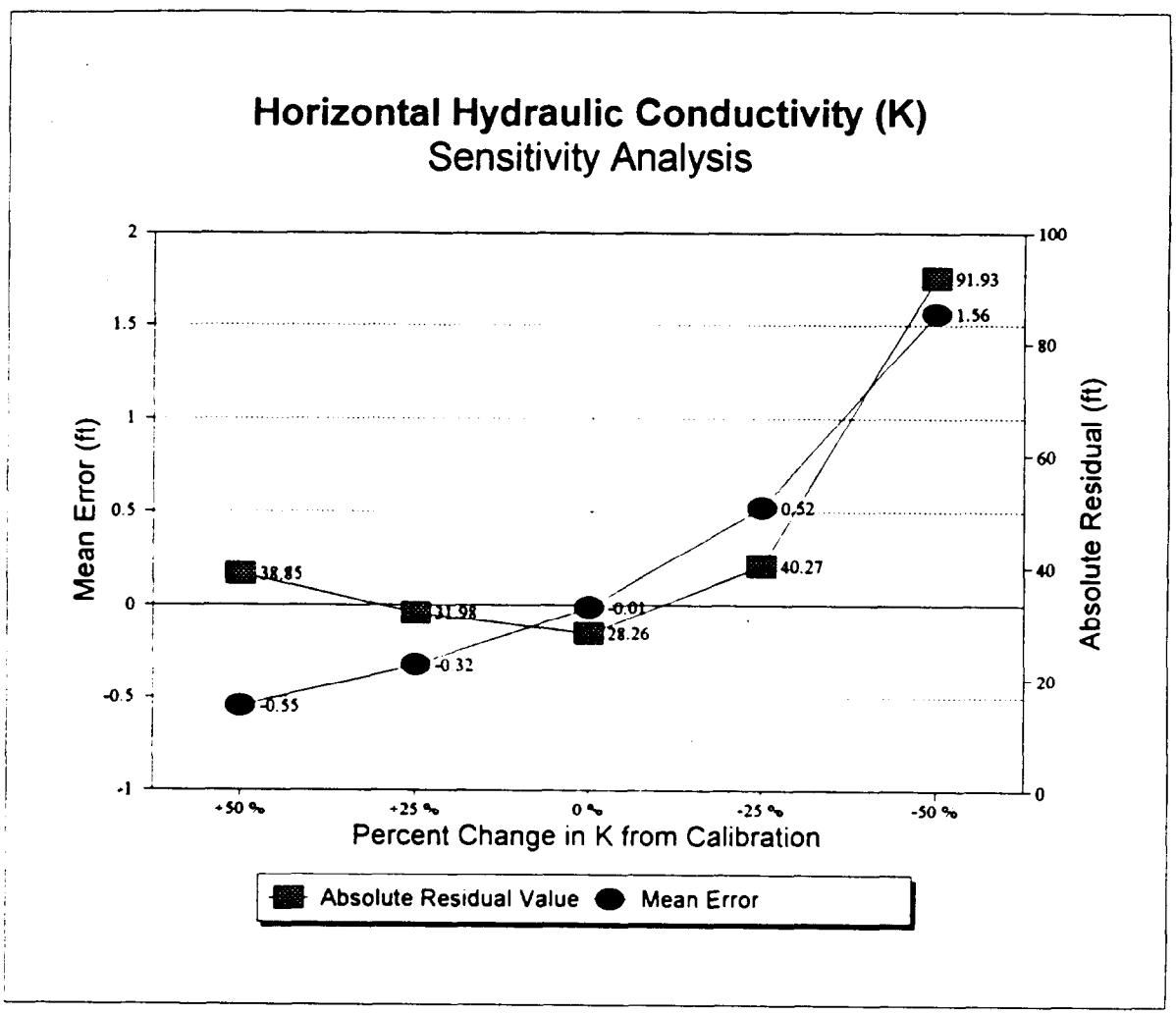
9.1 HORIZONTAL HYDRAULIC CONDUCTIVITY

Horizontal conductivity values were increased and decreased by 25% and 50% for the sensitivity analysis. For each parameter change, the model was run to a steady-state and the mean error and absolute residual values were calculated and compared to the values for the calibrated values of parameters. The results of the sensitivity analysis are illustrated on Figure 9-1.

The results indicate that an increase in horizontal hydraulic conductivity of 25% or 50% results in lower mean error values (i.e., the modeled values are too low as flow through the aquifer is increased) and

FIGURE 9-1
SENSITIVITY ANALYSIS RESULTS FOR HORIZONTAL HYDRAULIC CONDUCTIVITY (K)

Parameter	Percent Change in Parameter	Mean Error	Absolute Residual
K increased	+50 %	-0.55	38.85
K increased	+25 %	-0.32	31.98
Calibration Value	0 %	-0.01	28.26
K decreased	-25 %	0.52	40.27
K decreased	-50 %	1.56	91.93



results in a higher absolute residual value. Conversely, a decrease of 25% or 50% results in a higher mean error (i.e., modeled values are too high as the flow through the aquifer is reduced) and a higher absolute residual value. An decrease of 50% results in a significant increase in both mean error and absolute residual values, indicating the model results are sensitive to a decrease of greater than 25% of horizontal hydraulic conductivity in comparison to calibrated values. The model results are not highly sensitive to an increase of up to 50% and an decrease of up to 25% of horizontal hydraulic conductivity. However, while the model results may not be highly sensitive to changes in horizontal conductivity of this magnitude, these changes do produce less favorable solutions than the calibrated model.

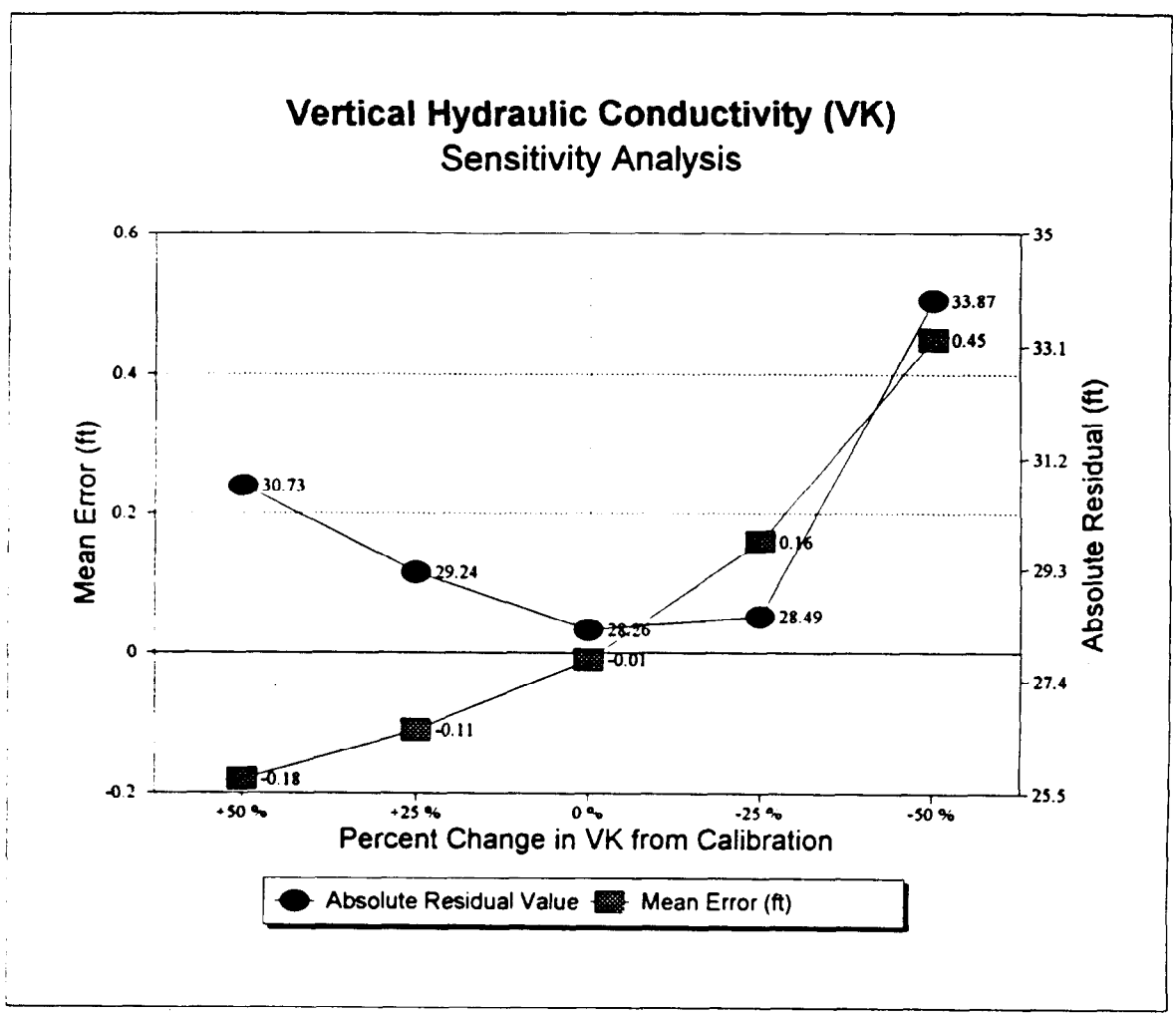
9.2 VERTICAL HYDRAULIC CONDUCTIVITY

Vertical conductivity values were increased and decreased by 25% and 50% for the sensitivity analysis. For each parameter change, the model was run to a steady-state, and the mean error and absolute residual values were calculated and compared to the values for the calibrated values of parameters. The results of the sensitivity analysis are illustrated on Figure 9-2.

The results of the sensitivity analysis indicate that an increase in vertical hydraulic conductivity of 25% or 50% results in lower mean error values (i.e., the modeled values are too low) and results in a higher absolute residual value. Conversely, a decrease of 25% or 50% results in higher mean error (i.e., modeled values are too high) and a higher absolute residual value. A decrease of 25% results in minimal change in the model output, while an decrease of 50% results in a significant increase in both mean error and absolute residual values in comparison to calibrated values. This indicates the model results are sensitive to a decrease of greater than 25% of vertical hydraulic conductivity. The model results are not highly sensitive to an increase of up to 50% and a decrease of up to 25% for vertical hydraulic conductivity. However, while the model results may not be highly sensitive to changes in vertical conductivity of this magnitude, these changes do produce less favorable solutions than the calibrated model.

FIGURE 9-2
SENSITIVITY ANALYSIS RESULTS FOR VERTICAL HYDRAULIC CONDUCTIVITY (Vk)

Parameter	Percent Change in Parameter	Mean Error	Absolute Residual
VK increased	+50 %	-0.18	30.73
VK increased	+25 %	-0.11	29.24
Calibration Value	0 %	-0.01	28.26
VK decreased	-25 %	0.16	28.49
VK decreased	-50 %	0.45	33.87



9.3 STORAGE

Storage values were increased and decreased by 25% for the sensitivity analysis. Storage values are used by MODFLOW only during transient simulations; therefore, the effects of the sensitivity analysis results were determined by comparing the calibrated time-drawdown curves to the sensitivity analysis curves for the monitoring wells for the pump test #1 simulation. The results of the sensitivity analysis are presented as time-drawdown graphs for the monitoring wells from pump test #1 (Figures 9-3 through 9-8).

The results of the sensitivity analysis indicate that an increase or decrease in storage of 25% results in time drawdown curves which are similar (for the intermediate observation wells) to those generated by the calibration value for storage. Curves for the shallow monitoring wells indicated that an increase in storage of 25% produced a significantly worse fit to the measured data for the early portion of the time-drawdown curve. These curves indicate that the model results are sensitive to an increase of greater than 25% of the storage value and the model is less sensitive to a smaller increase in storage or a decrease in storage values of 50% or less.

9.4 POROSITY

Porosity values were increased and decreased by 25% for the sensitivity analysis. Porosity values are not used in the flow model, although they are incorporated into the particle tracking module MODPATH. Changes in porosity will not effect particle flow direction but will effect the travel time of the particle. For each change in porosity during the sensitivity analysis the model was run to a steady-state, and four particles were released. The total travel time of the particles was compared to the travel time for the calibration valued of porosity. The results of the sensitivity analysis are summarized on Figure 9-9 . Figure 9-10 illustrates the particle release locations and the flow paths of the particles for the sensitivity analysis. These results show that there is a direct relationship between the porosity and the travel time of a particle moving through the aquifer. A 25% increase or decrease in porosity results in the same amount of change in the total travel time of the aquifer.

Fig.9-3 Sensitivity Analysis
HN-27S2 Drawdown for Pump Test #1

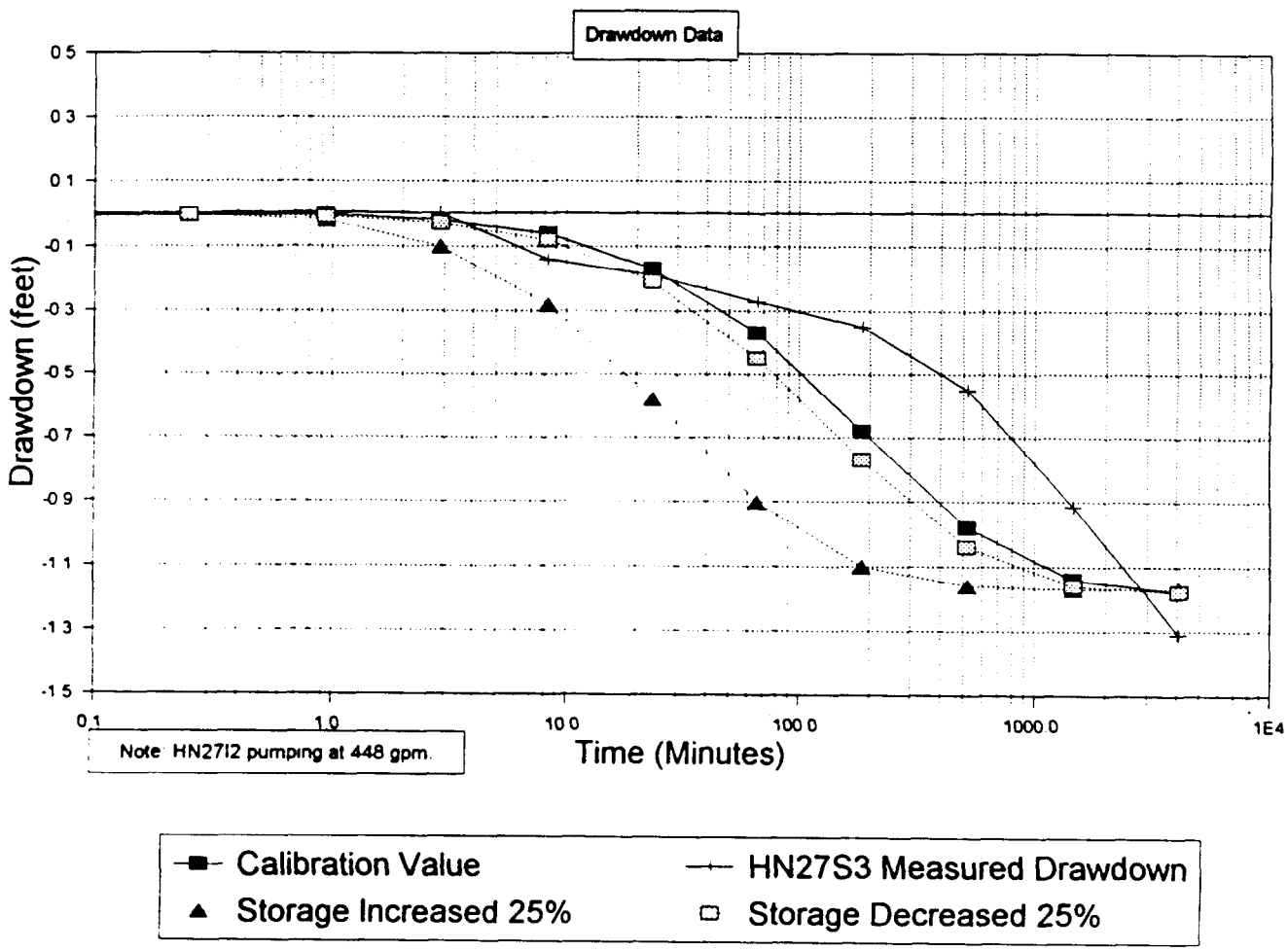


Fig.9-4 Sensitivity Analysis

HN-27S3 Drawdown for Pump Test #1

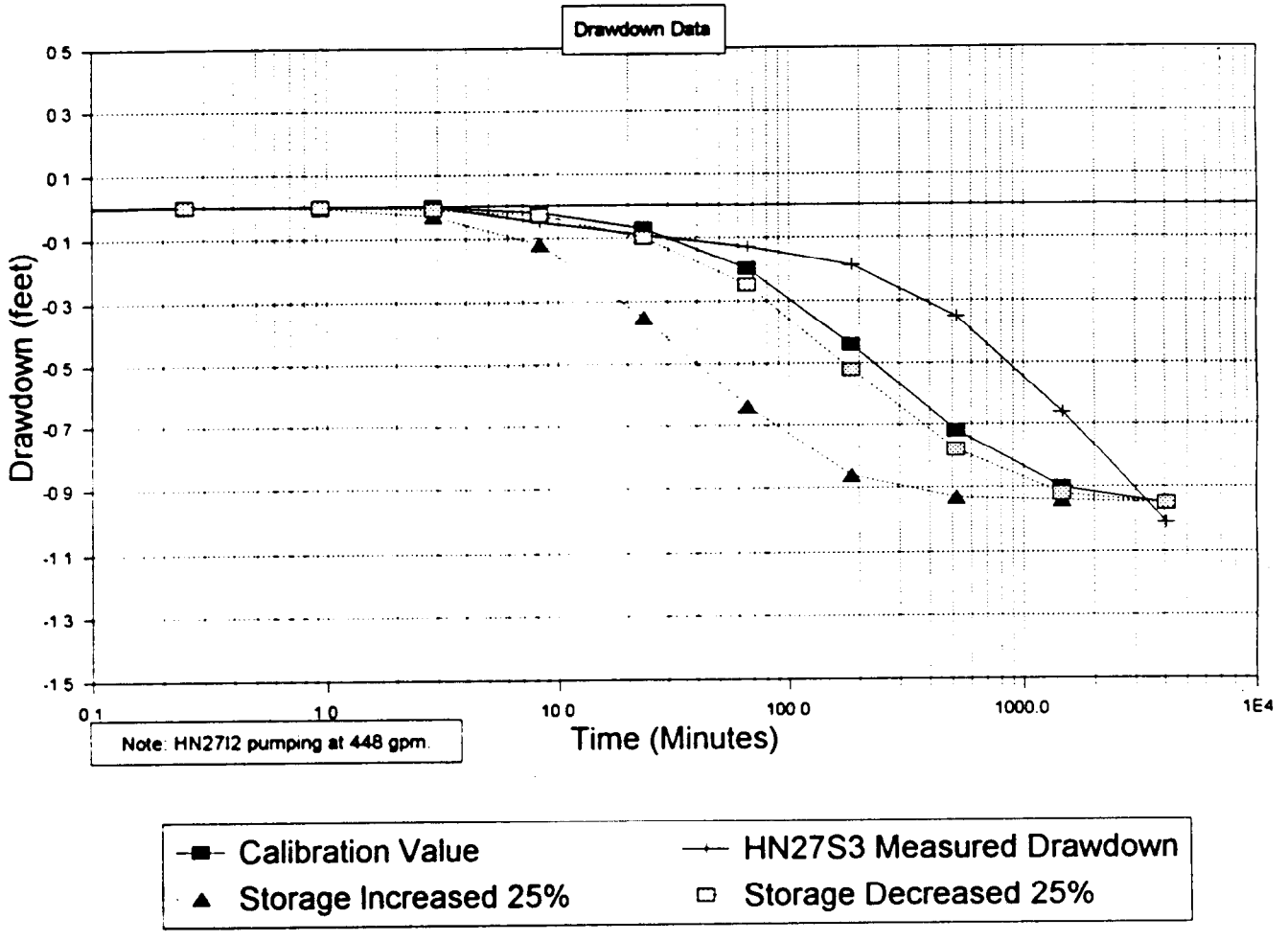


Figure 9-5 Sensitivity Analysis

HN-26I Drawdown for Pump Test #1

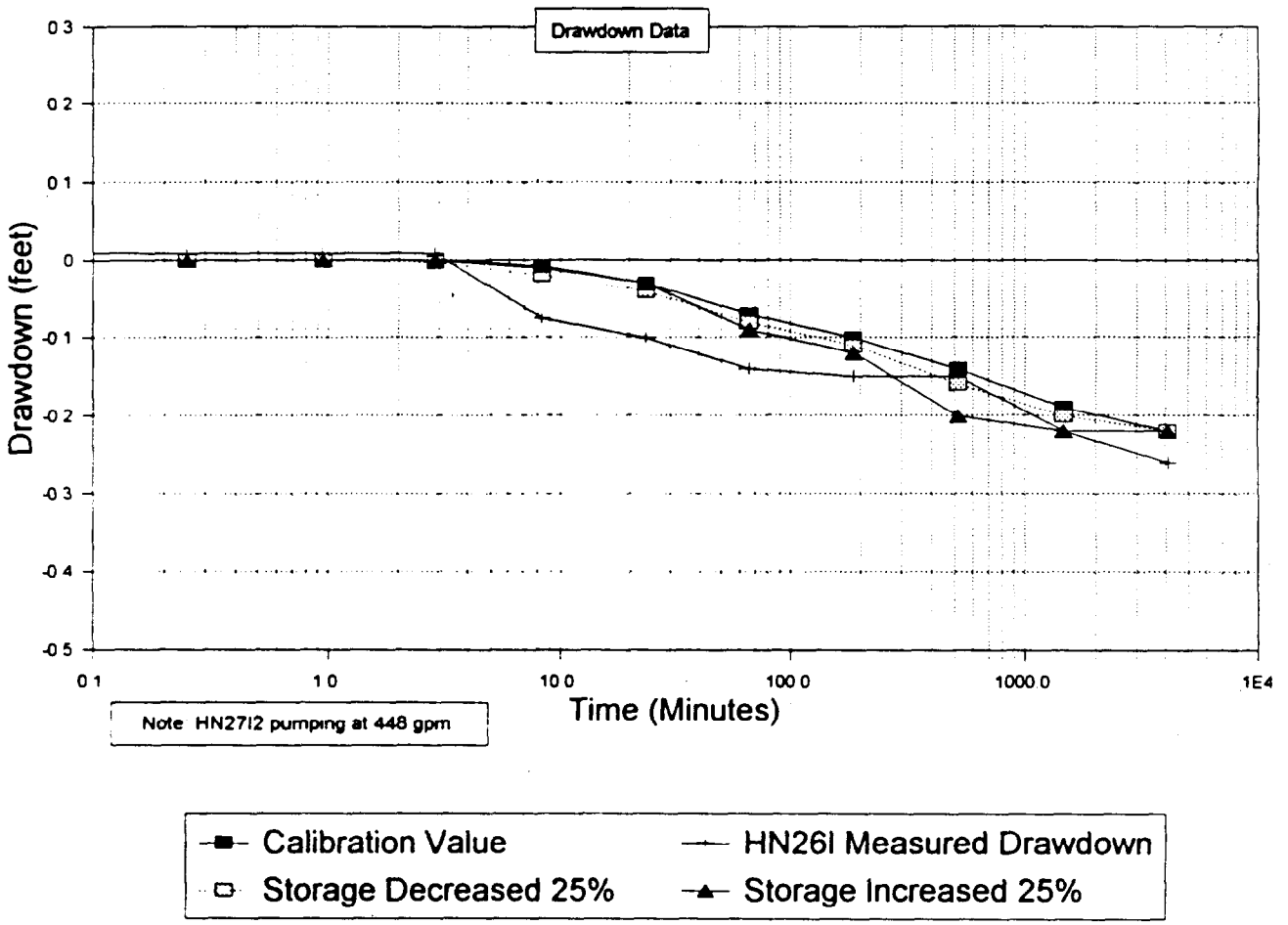


Figure 9-6 Sensitivity Analysis

HN-27I1 Drawdown for Pump Test #1

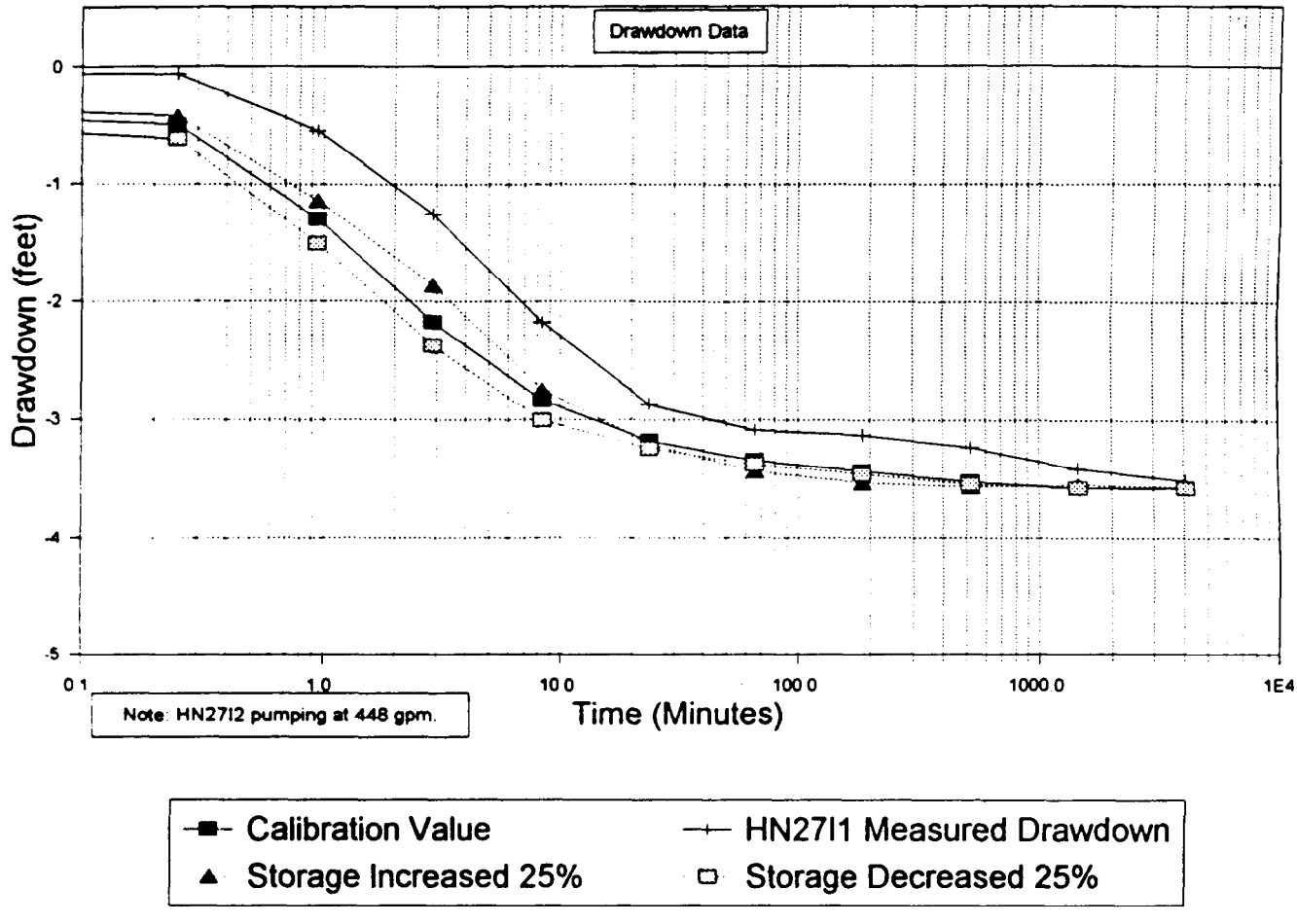


Figure 9-7 Sensitivity Analysis

HN-27I2 Drawdown for Pump Test #1

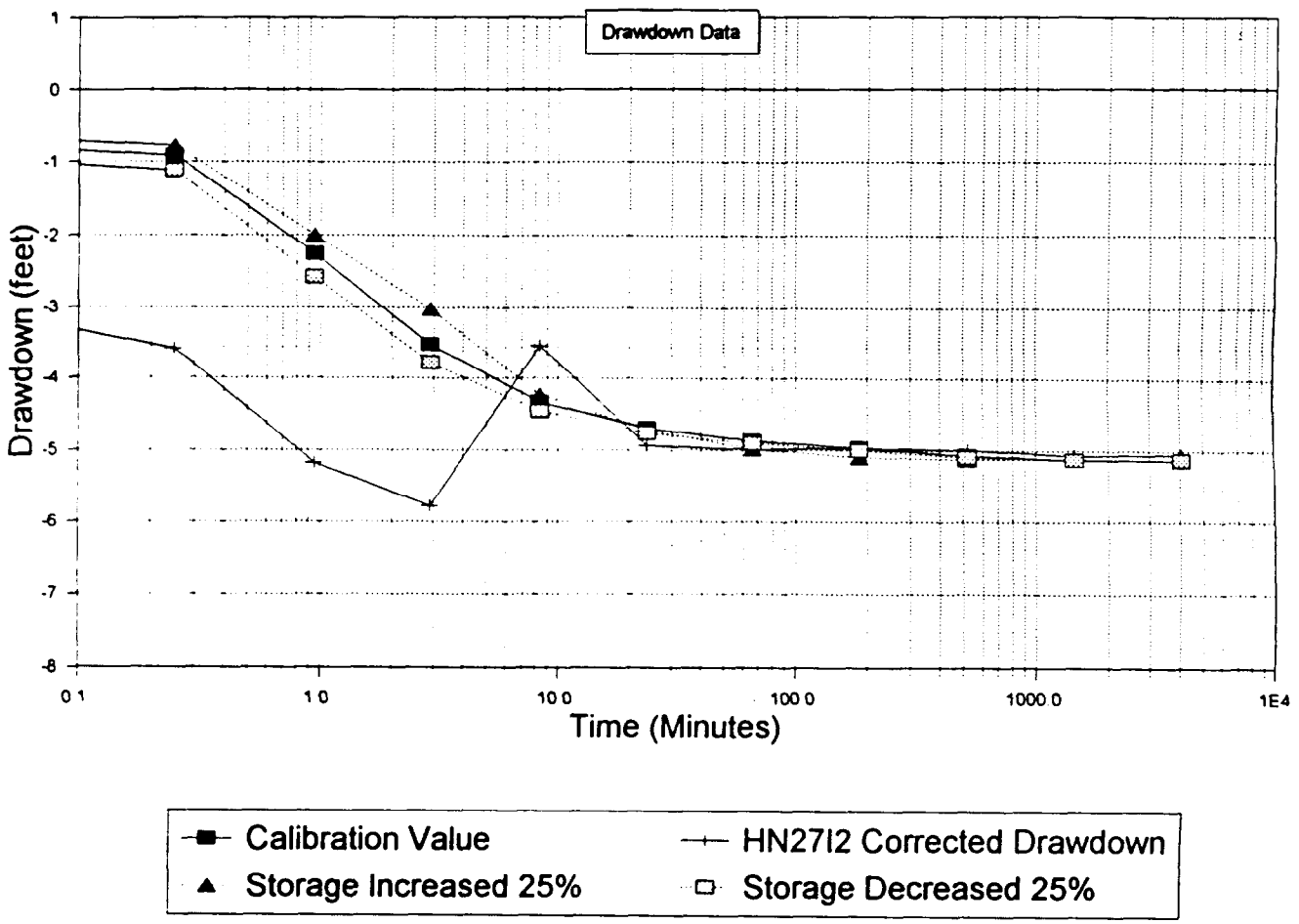


Figure 9-8 Sensitivity Analysis

HN-28I Drawdown for Pump Test #1

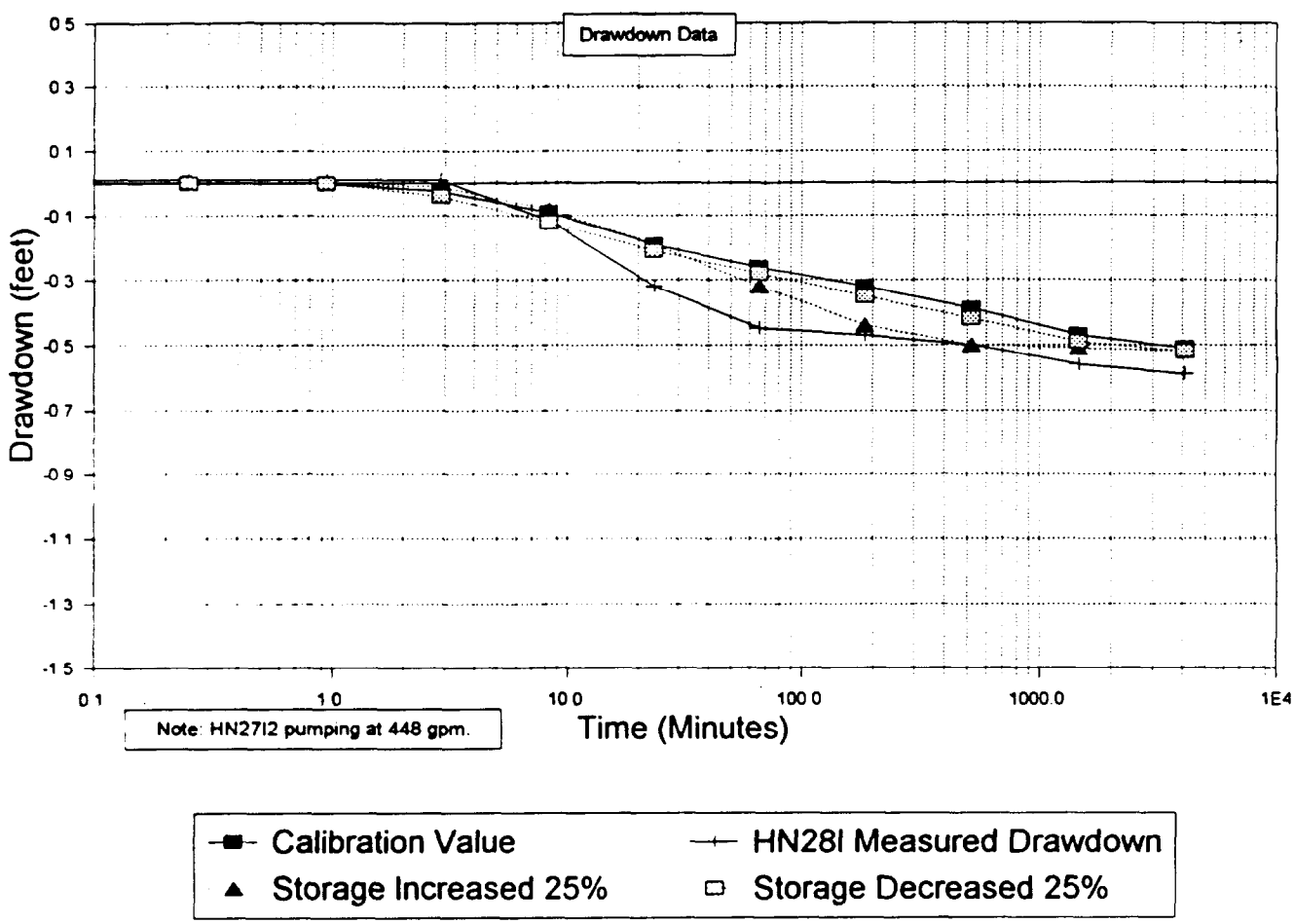


FIGURE 9-9
SENSITIVITY ANALYSIS RESULTS FOR POROSITY

PARTICLE	POROSITY DECREASED 25%		CALIBRATION VALUE	POROSITY INCREASED 25%	
NUMBER	TRAVEL TIME (DAYS)	% CHANGE	TRAVEL TIME (DAYS)	TRAVEL TIME (DAYS)	% CHANGE
1	10710	24.95	14270	17840	25.02
2	10580	25.02	14110	17640	25.02
3	13050	25.04	17410	21760	24.99
4	1105	25.03	1474	1842	24.97

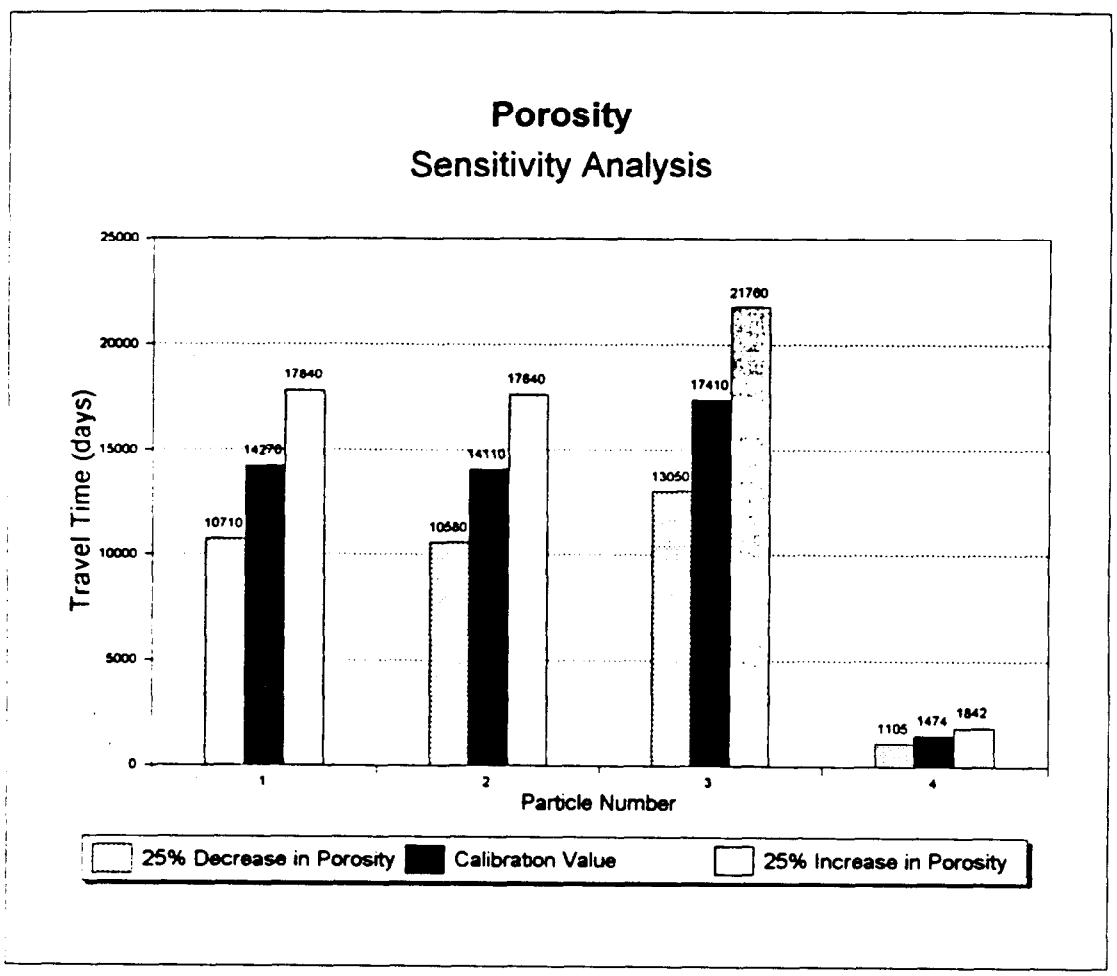
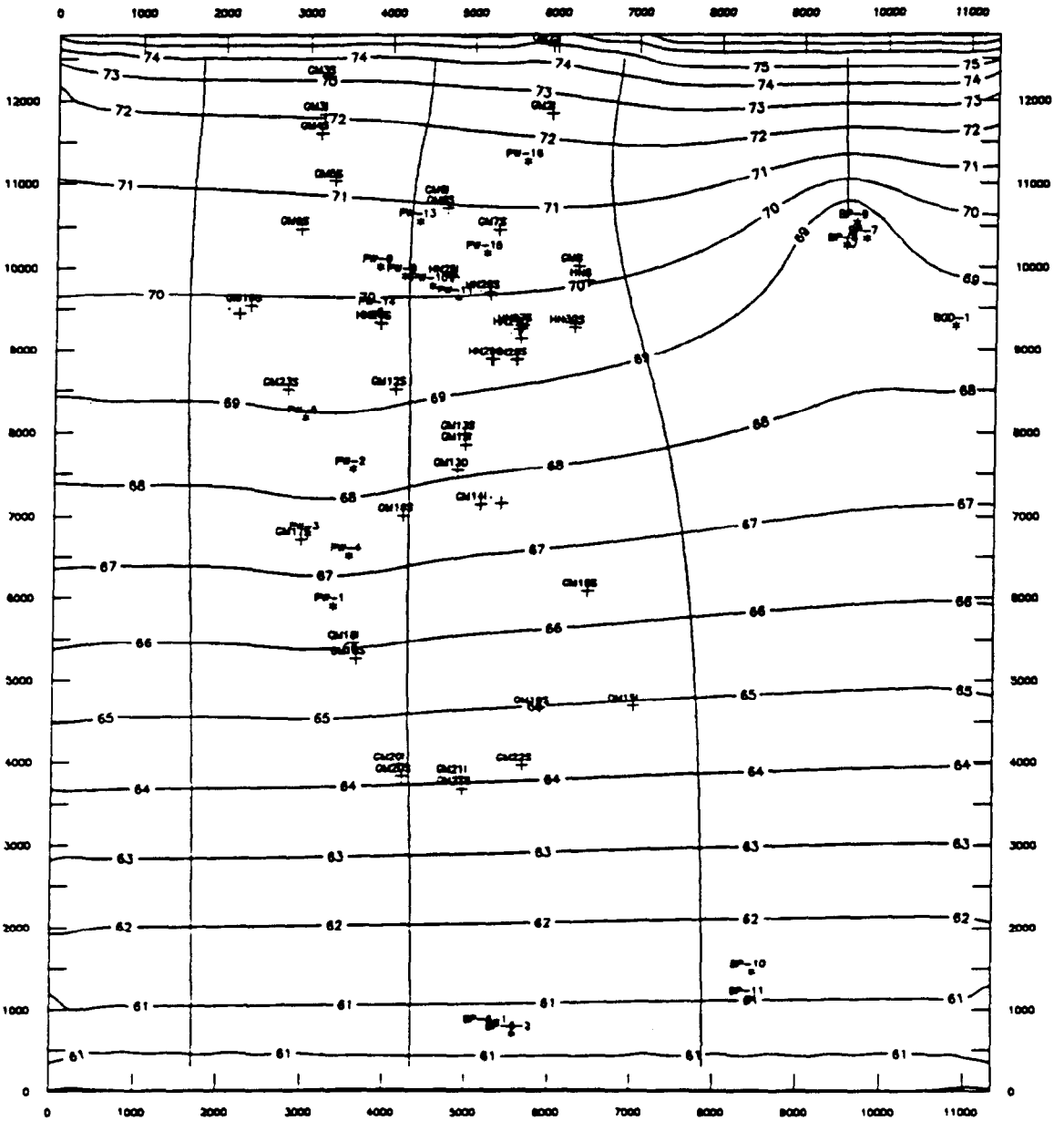


Figure 9-10
Particle Release Locations Used in Porosity Sensitivity Analysis.



• = Production Well Location
+ = HNUS or Geraghty & Miller Monitoring Well

SCALE 1 inch = 2130 ft

9.5 RECHARGE

Recharge values were increased and decreased by 25% and 50% for the sensitivity analysis. For each parameter change, the model was run to a steady-state, and the mean error and absolute residual values were calculated and compared to the values generated with the calibrated values. The results of the sensitivity analysis are illustrated on Figure 9-11.

The results of the sensitivity analysis indicate that a decrease in recharge of 25% or 50% results in lower mean error values (i.e., the modeled values are too low due to the decreased water flux into the system) and results in a higher absolute residual value. Conversely, an increase of 25% or 50% results in higher mean error (i.e., modeled values are too high due to more water entering the system) and results in a higher absolute residual value. Changes in the recharge to the system exhibit a linear (predictable) relationship to the mean error and absolute residual values, with an equal amounts of mean error increase and absolute residual error increase being incurred regardless of whether recharge is increased or decreased.

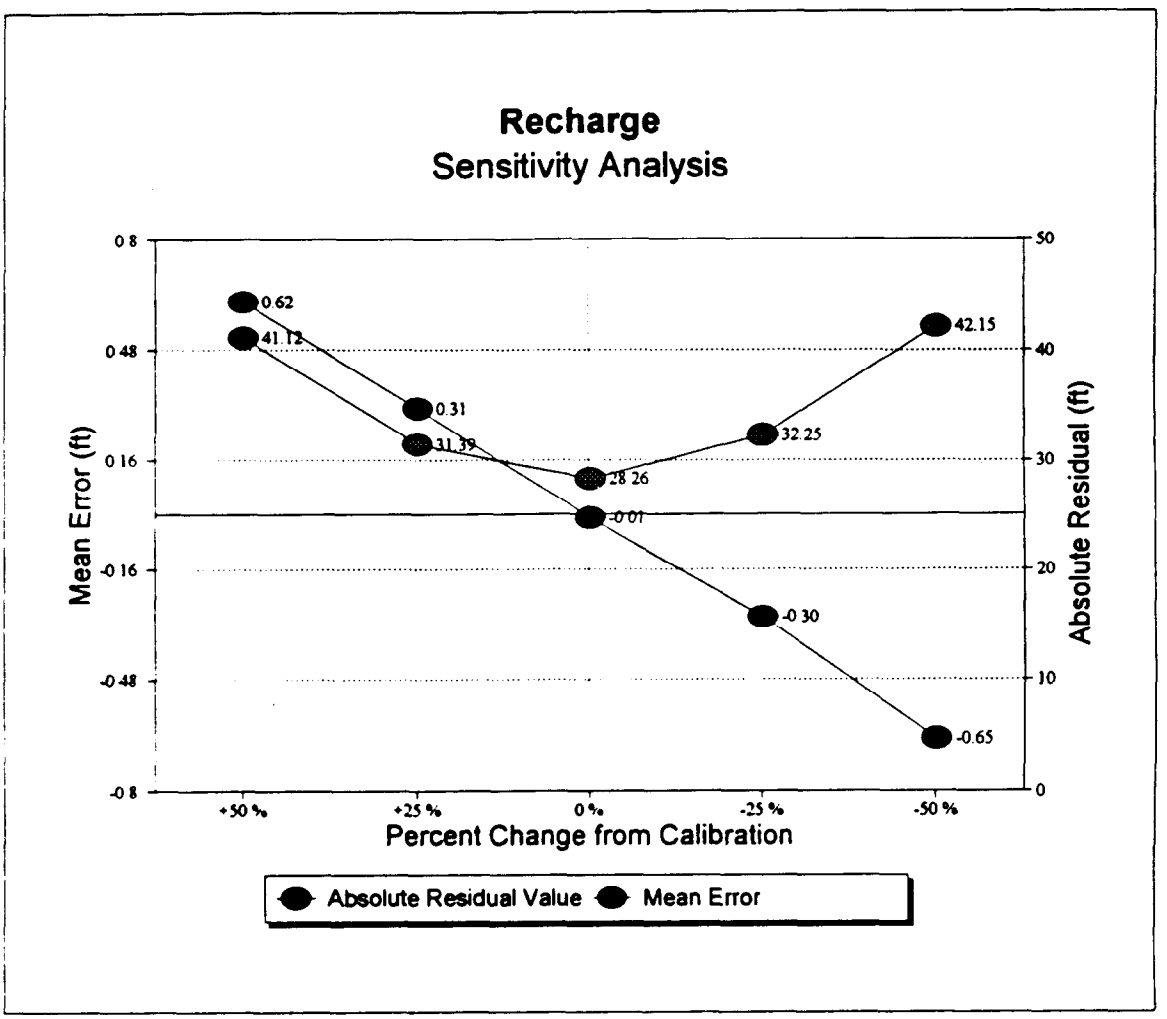
9.6 BOUNDARY CONDITIONS

To determine the effect of more distant boundaries on the capture zone of the eastern BWD wells (BP-07, BP-08, BP-09), the northern constant head boundary conditions in the MODFLOW model were moved 1400 ft to the north. This resulted in a 40% increase in the distance between the BWD wells to the northern constant head boundary. A sensitivity analysis was performed to determine whether a more distant constant head boundary would increase the size of the capture zone of the BWD wells and if additional particle movement could be expected from the NWIRP recharge basins to the BWD wells.

Two pumping scenarios were considered for the sensitivity analysis; an average pumping condition and a high pumping condition. In the average pumping condition Grumman wells were pumping at 1991/1992 average rates, and BWD wells were running at 120% of the 1991/1992 average rates. High pumping conditions had Grumman wells running at 75% of maximum capacity and BWD wells running at their actual (highest) capacity.

FIGURE 9-11
SENSITIVITY ANALYSIS RESULTS FOR RECHARGE

Parameter	Percent Change in Parameter	Mean Error	Absolute Residual
Recharge increased	+50 %	0.62	41.12
Recharge increased	+25 %	0.31	31.39
Calibration Value	0 %	-0.01	28.26
Recharge decreased	-25 %	-0.30	32.25
Recharge decreased	-50 %	-0.65	42.15



Results of each pumping condition are illustrated as the capture zone of the BWD wells under each pumping condition and constant head boundary location. Figures 9-12 and 9-13 show the capture zone of these wells under average and high pumping conditions with the northern constant head boundary in the location used during calibration. The results of the sensitivity analysis with a more distant constant head boundary are illustrated on Figures 9-14 and 9-15.

A comparison of the capture zones for the BWD wells under calibrated conditions (Figure 9-13) and the sensitivity analysis conditions for average pumping at the wells (Figure 9-14) show that these two conditions have capture zones of similar shapes. The capture zone of the BWD wells does not significantly increase if the north constant head boundary is moved 1400 ft north. Similar results are seen when comparing the capture zone of these wells under calibration conditions (Figure 9-13) with the sensitivity analysis conditions for high pumping at the wells (Figure 9-14). Under calibration conditions, 6 of 72 particles released from the BWD wells originate in the vicinity of the NWIRP recharge basins, while 8 of 72 particles released originate in the vicinity of the recharge basins. These sensitivity analyses indicate moving the north constant head boundary does not produce a significant change in the capture zones of the BWD wells.

Figure 9-12
Capture zones of BWD Wells - Calibration Location of North Constant Head Boundary - BWD at Average Pumping Rate.

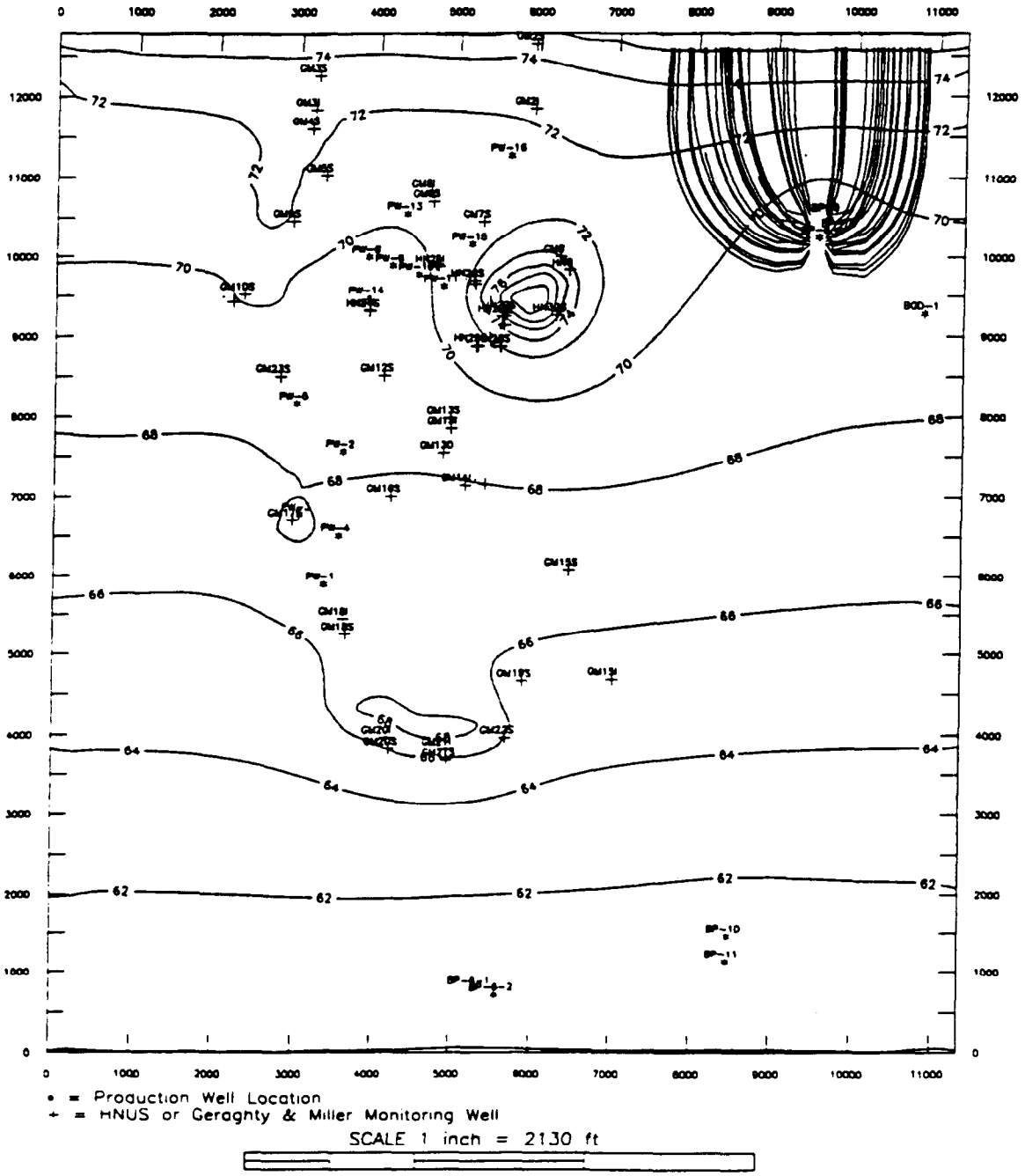


Figure 9-13
Capture zones of BWD Wells - Calibration Location of North Constant Head Boundary - BWD at High Pumping Rate.

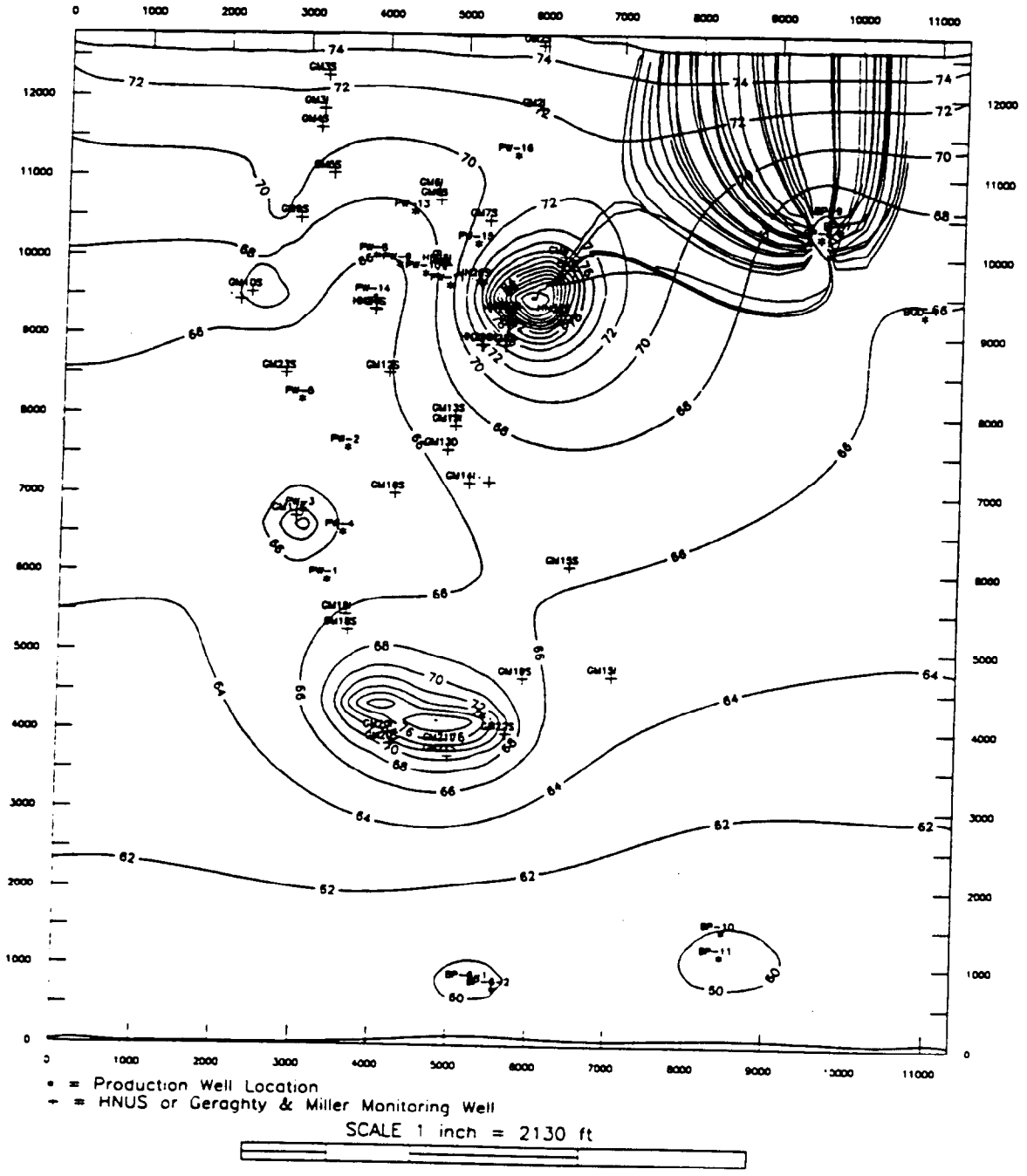
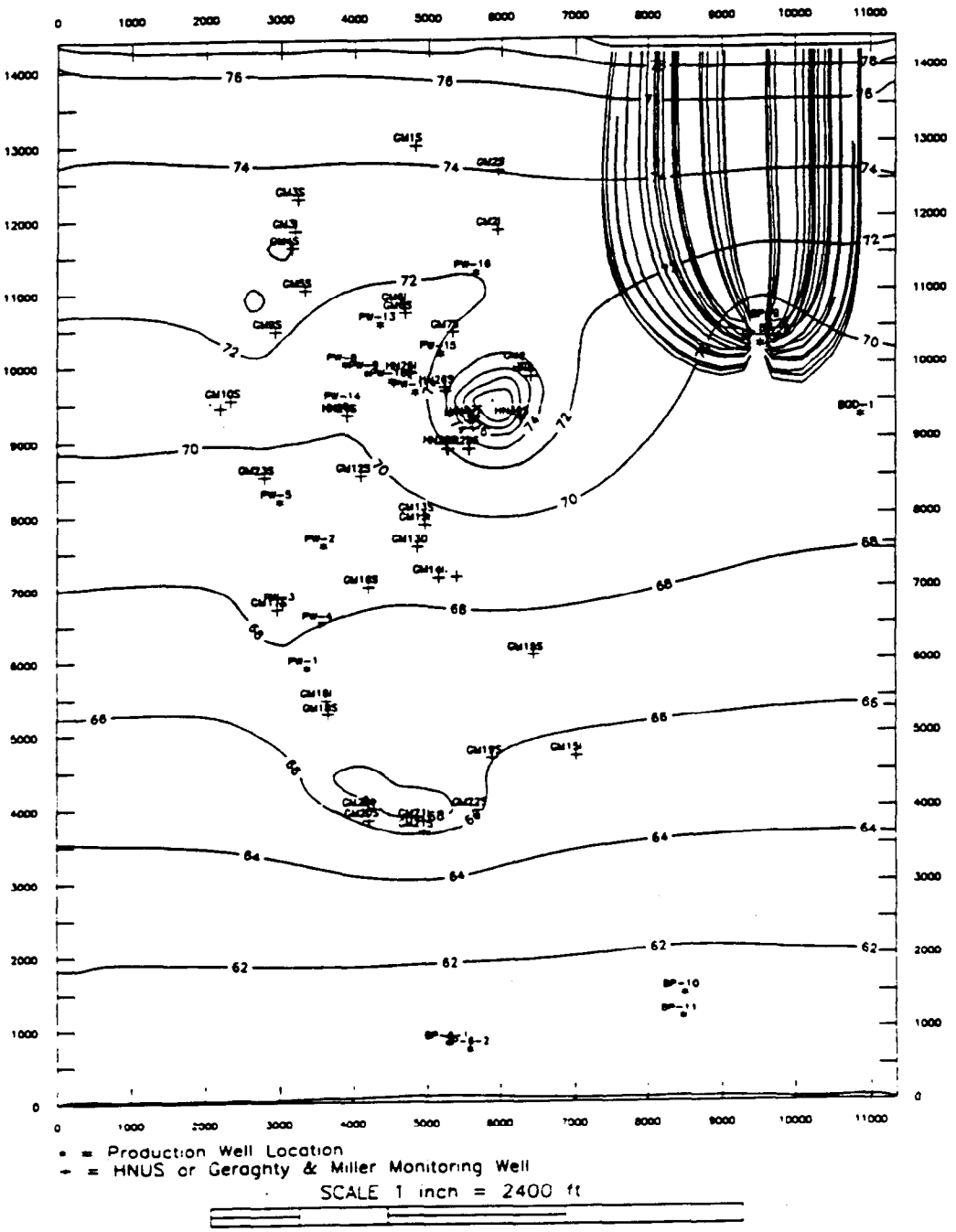


Figure 9-14
Capture zones of BWD Wells - Sensitivity Analysis Location of North Constant Head Boundary- BWD at Average Pumping Rate.



APPENDIX G

SURVEYING NOTES

GS. GROUND SURFACE
TC TOP CASING

DESCRIPTION			TOP CASING ELEV		SURFACE ELV	NORTHING	EASTING
HN 42	EAST	G.S			119.98	194699	2144055
HN 42	EAST	TC	119.61			94699	2144055

G.S. GROUND SURFACE
T.C. TOP CASING

DESCRIPTION	WELL CASING ELV	OTHER	GROUND SURFACE ELV	NORTHING	EASTING
TRAV PNT "K"		112.83	TOP PK NAIL	192613	2145222
TRAV PNT 20		112.60		192673	2145282
TRAV PNT L		109.63	TOP PK NAIL	193055	2145898
HN 41 NORTH G.S.			110.23	192967	2145984
HN 41 NORTH T.C.	109.91			192967	2145984
HN 41 SOUTH G.S.			110.29	192945	2145997
HN 41 SOUTH TC	109.90			192946	2145997
LOC. #11			123.56	194750	2143465
LOC. #12			122.12	194307	2143647
HN 42 WEST G.S.			120.59	194690	2144032
HN 42 WEST TC	120.32			194690	2144032

CONTINUED

G.S GROUND SURFACE
T.C TOP CASING

DESCRIPTION		WELL CASING ELV	OTHER	GROUND SURFACE ELV	NORTHING	EASTING
Loc #4				117.88	193452	2143910
TRAV PNT 19			115.23	TOP PK NAIL	193060	2143659
TRAV PNT H			117.41	TOP PK NAIL	193577	2144220
Loc. #13				118.08	193676	2144146
TRAV PNT I			117.22	TOP PK NAIL	193633	2144438
HN 40 North G.S				116.51	193441	2144585
HN 40 North T.C.		115.91			193441	2144585
HN 40 South G.S				116.64	193407	2144605
HN 40 South T.C.		116.35			193407	2144605
TRAV PNT J			115.70	TOP PK NAIL	192925	2144285
Loc. #16				116.20	193069	2144250

CONTINUED

DESIGNATION			INITIAL CASING ELV.	GAGE	GROUND SURFACE ELV	NORTHING	EASTING
Loc. # 1					124.39	194793	2142911
TRAV PNT "C"				122.16	TOP PK NAIL	194291	2143130
Loc. # 5					123.23	194351	2143204
Loc # 2					122.69	194482	2143521
TRAV PNT "D"				120.45	TOP PK NAIL	193795	2143305
TRAV PNT "E"				122.77	TOP PK NAIL	194461	2143557
Loc. # 3					119.91	193922	2143698
TRAV PNT "F"				116.93	TOP PK NAIL	193602	2142878
TRAV PNT "G"				115.86	TOP P.K. NAIL	193283	2143577
Loc. # 8	BOTTOM RECHARGE	BASIN			101.84	193318	2142867
Loc. # 7					116.77	193379	2143733

CONTINUED

G.S = GROUND SURFACE
TC = TOP CASING

DESCRIPTION	WELL CASING ELEV	OTHER	GROUND SURFACE ELEV	NORTHING	EASTING
HN 24 S EXISTING TOP CASING	122.73			193710	2141412
TRAV PNT 35				193958	2142249
GM 12 North		121.11		193345	2141736
HN 24 I G.S			122.69	193712	2141395
HN 24 I T.C	125.80			193712	2141395
HN 24 I 2 G.S			123.29	193795	2141467
HN 24 I 2 T.C.	122.89			193796	2141467
HN 24 I 1 G.S			121.20	193793	2141653
HN 24 I 1 TC	120.46			193793	2141653
TRAV PNT B		123.75	TOP PK NAIL	194727	2142950

CONTINUED

G.S. = Ground Surface
T.C = Top Casing

Description		Elevations: Well Casing Elev.		Elevations: Ground Surface Elev	Locations: Northing	Locations: Easting
TRAV PIT 21		—		—	195030	2142809
HN 26 I		124.84			194845	2142226
TRAV PIT A		ELEVATION 131.23		TOP CTC	194802	2142731
HN 27 I 1	G.S.			125.17	194769	2142770
HN 27 I 1	T.C.	127.28			194770	2142769
HN 27 I 2	G.S			125.53	194726	2142783
HN 27 I 2	T.C	125.06			194727	2142783
HN 27 S 2	G.S.			125.14	194711	2142756
HN 27 S 2	T.C.	124.88			194711	2142756
HN 27 S 3	G.S.			124.67	194627	2142825
HN 27 S 3	T.C.	124.39			194627	2142824

CONTINUED

APPENDIX H

HYDROGEOLOGICAL CALCULATIONS

NUS CORPORATION AND SUBSIDIARIES	STANDARD CALCULATION SHEET

CLIENT: BETHPAGE NWIRP	FILE NO.: 1953	BY: KC KILMARTIN	PAGE OF
SUBJECT:		CHECKED BY:	DATE:

GEOMETRIC MEAN OF HYDRAULIC CONDUCTIVITIES
(Fetter, 1988, p. 82)

Well No.	Kh (ft/day)	ln (Kh)
HN27S2	41.19	3.72
	144	4.97
	144	4.97
HN27S3	77.64	4.35
HN26I	96.12	4.57
	231	5.44
	224	5.41
HN27I1	40.37	3.70
	33.64	3.52
	98	4.58
	118	4.77
HN28I	62.11	4.13
	109	4.69
	115	4.74
	$\Sigma =$	63.56

$n = 14$

Mean $\ln(Kh) = 63.56/14 = 4.54$

$Kh_{(\text{Geometric mean})} = e^{4.54} = 94$

$K_h = 94$ ft/day

NUS CORPORATION AND SUBSIDIARIES			STANDARD CALCULATION SHEET
CLIENT: BETHPAGE NWIRP	FILE NO.: 1953	BY: KC KILMARTIN	PAGE 1 OF 1
SUBJECT:		CHECKED BY:	DATE:

Average Linear Velocities For April, 1993

$$V_{AL} = \frac{K}{n_e} \frac{dh}{dl}$$ (Fetter, 1988, p. 126)

$K \approx 100$ ft/day (This document, Section 3)

$n_e \approx 0.30$ (Fetter, 1988, p. 68)

(A) At water table:

dl (GM-2S to GM-14S) = 5,520 ft

dh (73.80 ft − 68.28 ft) = 5.52 ft

gradient = dh/dl = 5.52/5,520 = 0.001

$$V_{AL} = \frac{100 \text{ ft/day}}{0.30} \cdot \frac{5.52 \text{ ft}}{5{,}520 \text{ ft}} = 0.33 \text{ ft/day}$$

(B) At intermediate wells

dl (GM-2I to GM-14I) = 4,740 ft

dh (72.73 ft − 68.12 ft) = 4.61 ft

gradient = dh/dl = 4.61/4,740 ≈ 0.001

$$V_{AL} = \frac{100 \text{ ft/day}}{0.30} \cdot \frac{4.61 \text{ ft}}{4{,}740 \text{ ft}} = 0.32 \text{ ft/day}$$

APPENDIX I

ANALYTICAL RESULTS

CLEAN CTO 89
NWIRP BETHPAGE, BETHPAGE, NEW YORK
PACE, INC. - HAMPTON

TCL AQUEOUS VOLATILES (ug/L)

CLIENT ID:		BP-	TB3-12		TB3-16		TB3-17		G24I02		G24I102		G24I202	
LABORATORY ID:			35369-1		35407-2		35424-6		35407-5		35407-1		35407-4	
ANALYTE	CRQL	MDL												
CHLOROMETHANE	10	2.32	10	U	10	U	10	U	620	U	10	U	1000	U
BROMOMETHANE	10	3.95	10	U	10	U	10	U	620	U	10	U	1000	U
VINYL CHLORIDE	10	2.48	10	U	10	U	10	U	620	U	10	U	1000	U
CHLOROETHANE	10	2.41	10	U	10	U	10	U	620	U	10	U	1000	U
METHYLENE CHLORIDE	10	3.08	10	U	10	U	5	J	620	U	10	U	1000	U
ACETONE	10	2.82	10	U	10	U	10	U	620	U	10	U	1000	U
CARBON DISULFIDE	10	3.86	10	U	10	U	10	U	620	U	10	U	1000	U
1,1-DICHLOROETHENE	10	4.34	10	U	10	U	10	U	620	U	10	U	1000	U
1,1-DICHLOROETHANE	10	1.57	10	U	10	U	10	U	620	U	10	U	1000	U
1,2-DICHLOROETHENE	10	4.69	10	U	10	U	10	U	620	U	10	U	1000	U
CHLOROFORM	10	1.84	10	U	10	U	10	U	620	U	10	U	1000	U
1,2-DICHLOROETHANE	10	1.89	10	U	10	U	10	U	620	U	10	U	1000	U
2-BUTANONE	10	0.44	10	U	10	U	10	U	620	U	10	U	1000	U
1,1,1-TRICHLOROETHANE	10	2.29	10	U	10	U	10	U	620	U	10	U	1000	U
CARBON TETRACHLORIDE	10	1.58	10	U	10	U	10	U	620	U	10	U	1000	U
BROMODICHLOROMETHANE	10	1.05	10	U	10	U	10	U	620	U	10	U	1000	U
1,2-DICHLOROPROPANE	10	0.68	10	U	10	U	10	U	620	U	10	U	1000	U
Cis-1,3-DICHLOROPROPENE	10	0.85	10	U	10	U	10	U	620	U	10	U	1000	U
TRICHLOROETHENE	10	0.91	10	U	10	U	10	U	9000		91		12000	
DIBROMOCHLOROMETHANE	10	1.12	10	U	10	U	10	U	620	U	10	U	1000	U
1,1,2-TRICHLOROETHANE	10	0.93	10	U	10	U	10	U	620	U	10	U	1000	U
BENZENE	10	1	10	U	10	U	10	U	620	U	10	U	1000	U
TRANS-1,3-DICHLOROPROPENE	10	0.2	10	U	10	U	10	U	620	U	10	U	1000	U
BROMOFORM	10	1.08	10	U	10	U	10	U	620	U	10	U	1000	U
4-METHYL-2-PENTANONE	10	1.97	10	U	10	U	10	U	620	U	10	U	1000	U
2-HEXANONE	10	0.9	10	U	10	U	10	U	620	U	10	U	1000	U
TETRACHLOROETHENE	10	1	10	U	10	U	10	U	620	U	10	U	1000	U
1,1,2,2-TETRACHLOROETHANE	10	0.61	10	U	10	U	10	U	620	U	10	U	1000	U
TOLUENE	10	1.61	10	U	10	U	10	U	620	U	10	U	1000	U
CHLOROBENZENE	10	0.44	10	U	10	U	10	U	620	U	10	U	1000	U
ETHYLBENZENE	10	0.73	10	U	10	U	10	U	620	U	10	U	1000	U
STYRENE	10	0.61	10	U	10	U	10	U	620	U	10	U	1000	U
XYLENES (TOTAL)	10	0.92	10	U	10	U	10	U	620	U	10	U	1000	U
DILUTION FACTOR:			1		1		1		62.0		1.0		100.0	

CLEAN CTO 89
NWIRP BETHPAGE, BETHPAGE, NEW YORK
PACE, INC. - HAMPTON

TCL AQUEOUS VOLATILES (ug/L)

CLIENT ID:		BP-	GRB102		GRB302		TB3-11	
LABORATORY ID:			35347-3		35407-3		35347-2	
ANALYTE	CRQL	MDL						
CHLOROMETHANE	10	2.32	10	U	10	U	10	U
BROMOMETHANE	10	3.95	10	U	10	U	10	U
VINYL CHLORIDE	10	2.48	10	U	10	U	10	U
CHLOROETHANE	10	2.41	10	U	10	U	10	U
METHYLENE CHLORIDE	10	3.08	10	U	10	U	10	U
ACETONE	10	2.82	96		93		10	U
CARBON DISULFIDE	10	3.86	10	U	10	U	10	U
1,1-DICHLOROETHENE	10	4.34	10	U	10	U	10	U
1,1-DICHLOROETHANE	10	1.57	10	U	10	U	10	U
1,2-DICHLOROETHENE	10	4.89	10	U	10	U	10	U
CHLOROFORM	10	1.84	10	U	10	U	10	U
1,2-DICHLOROETHANE	10	1.89	10	U	10	U	10	U
2-BUTANONE	10	0.44	10	U	10	U	10	U
1,1,1-TRICHLOROETHANE	10	2.29	10	U	10	U	10	U
CARBON TETRACHLORIDE	10	1.58	10	U	10	U	10	U
BROMODICHLOROMETHANE	10	1.05	10	U	10	U	10	U
1,2-DICHLOROPROPANE	10	0.66	10	U	10	U	10	U
Cis-1,3-DICHLOROPROPENE	10	0.85	10	U	10	U	10	U
TRICHLOROETHENE	10	0.91	10	U	10	U	10	U
DIBROMOCHLOROMETHANE	10	1.12	10	U	10	U	10	U
1,1,2-TRICHLOROETHANE	10	0.93	10	U	10	U	10	U
BENZENE	10	1	10	U	10	U	10	U
TRANS-1,3-DICHLOROPROPENE	10	0.2	10	U	10	U	10	U
BROMOFORM	10	1.06	10	U	10	U	10	U
4-METHYL-2-PENTANONE	10	1.97	10	U	10	U	10	U
2-HEXANONE	10	0.9	10	U	10	U	10	U
TETRACHLOROETHENE	10	1	10	U	10	U	10	U
1,1,2,2-TETRACHLOROETHANE	10	0.61	10	U	10	U	10	U
TOLUENE	10	1.61	10	U	10	U	10	U
CHLOROBENZENE	10	0.44	10	U	10	U	10	U
ETHYLBENZENE	10	0.73	10	U	10	U	10	U
STYRENE	10	0.61	10	U	10	U	10	U
XYLENES (TOTAL)	10	0.92	10	U	10	U	10	U
DILUTION FACTOR:			1		1		1	

CLEAN CTO 89
NWIRP BETHPAGE, BETHPAGE, NEW YORK
PACE INC. - HAMPTON

TCL AQUEOUS VOLATILES (ug/L)

CLIENT ID:			BPSBRB101		SBFB101		SBRB103		TB3		TRIPBLK		TRIPBLK2	
LABORATORY ID:			34646-1		34625-7		34625-5		34625-6		34646-3		34660-6	
ANALYTE	CRQL	MDL												
CHLOROMETHANE	10	2.32	10	U	10	U	10	U	10	U	10	U	10	U
BROMOMETHANE	10	3.95	10	U	10	U	10	U	10	U	10	U	10	U
VINYL CHLORIDE	10	2.48	10	U	10	U	10	U	10	U	10	U	10	U
CHLOROETHANE	10	2.41	10	U	10	U	10	U	10	U	10	U	10	U
METHYLENE CHLORIDE	10	3.08	10	U(b)	10	U	10	U	10	U	10	U(b)	10	U(b)
ACETONE	10	2.82	76		100		100		10	U	20		10	U
CARBON DISULFIDE	10	3.66	10	UJ(c)	10	U	10	U	10	U	10	UJ(c)	10	UJ(c)
1,1-DICHLOROETHENE	10	4.34	10	U	10	U	10	U	10	U	10	U	10	U
1,1-DICHLOROETHANE	10	1.57	10	U	10	U	10	U	10	U	10	U	10	U
1,2-DICHLOROETHENE	10	4.69	10	U	10	U	10	U	10	U	10	U	10	U
CHLOROFORM	10	1.84	10	U	10	U	10	U	10	U	10	U	10	U
1,2-DICHLOROETHANE	10	1.89	10	U	10	U	10	U	10	U	10	U	10	U
2-BUTANONE	10	0.44	8	J	10	U	10	U	10	U	10	U	10	U
1,1,1-TRICHLOROETHANE	10	2.29	10	U	10	U	10	U	10	U	10	U	10	U
CARBON TETRACHLORIDE	10	1.58	10	U	10	U	10	U	10	U	10	U	10	U
BROMODICHLOROMETHANE	10	1.05	10	U	10	U	10	U	10	U	10	U	10	U
1,2-DICHLOROPROPANE	10	0.68	10	U	10	U	10	U	10	U	10	U	10	U
Cis-1,3-DICHLOROPROPENE	10	0.85	10	U	10	U	10	U	10	U	10	U	10	U
TRICHLOROETHENE	10	0.91	10	U	10	U	10	U	10	U	10	U	10	U
DIBROMOCHLOROMETHANE	10	1.12	10	U	10	U	10	U	10	U	10	U	10	U
1,1,2-TRICHLOROETHANE	10	0.93	10	U	10	U	10	U	10	U	10	U	10	U
BENZENE	10	1	10	U	10	U	10	U	10	U	10	U	10	U
TRANS-1,3-DICHLOROPROPENE	10	0.2	10	U	10	U	10	U	10	U	10	U	10	U
BROMOFORM	10	1.06	10	U	10	U	10	U	10	U	10	U	10	U
4-METHYL-2-PENTANONE	10	1.97	10	UJ(c)	10	UJ(c)	10	UJ(c)	10	UJ(c)	10	U	10	U
2-HEXANONE	10	0.9	10	U	10	U	10	U	10	U	10	UJ(c)	10	UJ(c)
TETRACHLOROETHENE	10	1	10	U	10	U	10	U	10	U	10	U	10	U
1,1,2,2-TETRACHLOROETHANE	10	0.61	10	U	10	U	10	U	10	U	10	U	10	U
TOLUENE	10	1.61	10	U	10	U	10	U	10	U	10	U	10	U
CHLOROBENZENE	10	0.44	10	U	10	U	10	U	10	U	10	U	10	U
ETHYLBENZENE	10	0.73	10	U	10	U	10	U	10	U	10	U	10	U
STYRENE	10	0.61	10	U	10	U	10	U	10	U	10	U	10	U
XYLENES (TOTAL)	10	0.92	10	U	10	U	10	U	10	U	10	U	10	U
DILUTION FACTOR:			1		1		1		1		1		1	

CLEAN CTO 89
NWIRP BETHPAGE, BETHPAGE, NEW YORK
PACE INC. - HAMPTON

TCL SOIL VOLATILES (mg/kg)

CLIENT ID:			BPSB24211		BPSBFD101		SB2421140		SB2421150		SB2421160		SB2431130	
LABORATORY ID:			34646-2		34660-4		34660-1		34660-3		34660-2		34625-3	
ANALYTE	CRQL	MDL												
CHLOROMETHANE	10	2.32	10	UR(c)	11	UR(c)	12	UR(c)	11	UR(c)	12	UR(c)	12	UR(c)
BROMOMETHANE	10	3.95	10	UJ(s,a)	11	U	12	U	11	U	12	U	12	U
VINYL CHLORIDE	10	2.48	10	UJ(s,a)	11	U	12	U	11	U	12	U	12	U
CHLOROETHANE	10	2.41	10	UJ(s,a)	11	U	12	U	11	U	12	U	12	U
METHYLENE CHLORIDE	10	3.08	20	U(b)	11	U(b)	12	U(b)	11	U(b)	12	U(b)	25	U(b)
ACETONE	10	2.82	27	U(b)	21	U(b)	24	U(b)	11	U	17	U	12	U
CARBON DISULFIDE	10	3.86	10	UJ(s,a)	11	J(c)	12	J(c)	11	J(c)	12	J(c)	12	U
1,1-DICHLOROETHENE	10	4.34	10	UJ(s,a)	11	U	12	U	11	U	12	U	12	U
1,1-DICHLOROETHANE	10	1.57	10	UJ(s,a)	11	U	12	U	11	U	12	U	12	U
1,2-DICHLOROETHENE	10	4.89	10	UJ(s,a)	11	U	12	U	11	U	12	U	12	U
CHLOROFORM	10	1.84	10	UJ(s,a)	11	U	12	U	11	U	12	U	12	U
1,2-DICHLOROETHANE	10	1.89	10	UJ(s,a)	11	U	12	U	11	U	12	U	12	U
2-BUTANONE	10	0.44	10	UJ(s,a)	11	U	12	U	11	U	12	U	12	U
1,1,1-TRICHLOROETHANE	10	2.29	10	UJ(s,a)	11	U	12	U	11	U	12	U	12	U
CARBON TETRACHLORIDE	10	1.58	10	UJ(s,a)	11	U	12	U	11	U	12	U	12	U
BROMODICHLOROMETHANE	10	1.05	10	UJ(s,a)	11	U	12	U	11	U	12	U	12	U
1,2-DICHLOROPROPANE	10	0.66	10	UJ(s,a)	11	U	12	U	11	U	12	U	12	U
Cis-1,3-DICHLOROPROPENE	10	0.85	10	UJ(s,a)	11	U	12	U	11	U	12	U	12	U
TRICHLOROETHENE	10	0.91	4	J(s,a)	10	J	17		8	J	3	J	12	U
DIBROMOCHLOROMETHANE	10	1.12	10	UJ(s,a)	11	U	12	U	11	U	12	U	12	U
1,1,2-TRICHLOROETHANE	10	0.93	10	UJ(s,a)	11	U	12	U	11	U	12	U	12	U
BENZENE	10	1	10	UJ(s,a)	11	U	12	U	11	U	12	U	12	U
TRANS-1,3-DICHLOROPROPENE	10	0.2	10	UJ(s,a)	11	U	12	U	11	U	12	U	12	U
BROMOFORM	10	1.06	10	UJ(s,a)	11	U	12	U	11	U	12	U	12	U
4-METHYL-2-PENTANONE	10	1.97	10	UJ(s,a)	11	U	12	U	11	U	12	U	12	U
2-HEXANONE	10	0.9	10	UJ(s,a)	11	U	12	U	11	U	12	U	12	U
TETRACHLOROETHENE	10	1	10	UJ(s,a)	11	U	12	U	11	U	12	U	12	U
1,1,2,2-TETRACHLOROETHANE	10	0.61	10	UJ(s,a)	11	U	12	U	11	U	12	U	12	U
TOLUENE	10	1.61	13	J(s,a)	16		27		12		6	J	5	J
CHLOROBENZENE	10	0.44	10	UJ(s,a)	11	U	12	U	11	U	12	U	12	U
ETHYLBENZENE	10	0.73	10	UJ(s,a)	11	U	12	U	11	U	12	U	12	U
STYRENE	10	0.61	10	UJ(s,a)	11	U	12	U	11	U	12	U	12	U
XYLENES(TOTAL)	10	0.92	10	UJ(s,a)	11	U	12	U	11	U	12	U	12	U
% SOLIDS:			97		88		83		88		84		86	
DILUTION FACTOR:			1		1		1		1		1		1	

CLEAN CTO 89
NWIRP BETHPAGE, BETHPAGE, NEW YORK
PACE, INC. - HAMPTON

TCL AQUEOUS VOLATILES (ug/L)

CLIENT ID:		BP-	G42802		G42802		GDUP102		GDUP202	
LABORATORY ID:			35424-2		35424-1		35369-6		35424-5	
ANALYTE	CRQL	MDL								
CHLOROMETHANE	10	2.32	10	U	10	U	10	U	10	U
BROMOMETHANE	10	3.95	10	U	10	U	10	U	10	U
VINYL CHLORIDE	10	2.48	10	U	10	U	10	U	10	U
CHLOROETHANE	10	2.41	10	U	10	U	10	U	10	U
METHYLENE CHLORIDE	10	3.08	5	U(b)	5	U(b)	10	U	5	U(b)
ACETONE	10	2.82	10	U	10	U	10	UJ(c)	10	U
CARBON DISULFIDE	10	3.86	10	U	10	U	10	UJ(c)	10	U
1,1-DICHLOROETHENE	10	4.34	10	U	10	U	10	U	10	U
1,1-DICHLOROETHANE	10	1.57	10	U	10	U	10	U	10	U
1,2-DICHLOROETHENE	10	4.89	10	U	10	U	10	UJ(c)	10	U
CHLOROFORM	10	1.84	10	U	10	U	10	U	10	U
1,2-DICHLOROETHANE	10	1.89	10	U	10	U	10	U	10	U
2-BUTANONE	10	0.44	10	U	10	U	10	U	10	U
1,1,1-TRICHLOROETHANE	10	2.26	10	U	10	U	10	U	10	U
CARBON TETRACHLORIDE	10	1.58	10	U	10	U	10	U	10	U
BROMODICHLOROMETHANE	10	1.05	10	U	10	U	10	U	10	U
1,2-DICHLOROPROPANE	10	0.66	10	U	10	U	10	U	10	U
Cis-1,3-DICHLOROPROPENE	10	0.85	10	U	10	U	10	U	10	U
TRICHLOROETHENE	10	0.91	6	J	10	U	17		8	J
DIBROMOCHLOROMETHANE	10	1.12	10	U	10	U	10	U	10	U
1,1,2-TRICHLOROETHANE	10	0.93	10	U	10	U	10	U	10	U
BENZENE	10	1.00	10	U	10	U	10	U	10	U
TRANS-1,3-DICHLOROPROPENE	10	0.20	10	U	10	U	10	U	10	U
BROMOFORM	10	1.06	10	U	10	U	10	U	10	U
4-METHYL-2-PENTANONE	10	1.97	10	U	10	U	10	UJ(c)	10	U
2-HEXANONE	10	0.90	10	U	10	U	10	U	10	U
TETRACHLOROETHENE	10	1.00	2	J	10	U	5	J	10	U
1,1,2,2-TETRACHLOROETHANE	10	0.61	10	U	10	U	10	U	10	U
TOLUENE	10	1.61	3	J	4	J	10	U	8	J
CHLOROBENZENE	10	0.44	10	U	10	U	10	U	10	U
ETHYLBENZENE	10	0.73	10	U	10	U	10	U	10	U
STYRENE	10	0.61	10	U	10	U	10	U	10	U
XYLENES (TOTAL)	10	0.92	10	U	10	U	10	U	10	U
DILUTION FACTOR:			1.0		1.0		1.0		1.0	

CLEAN CTO 89
NWIRP BETHPAGE, BETHPAGE, NEW YORK
PACE, INC. - HAMPTON

TCL AQUEOUS VOLATILES (ug/L)

CLIENT ID:		BP-	G24S02		G28I02		G29D02		G29I02		G29S02		G40I02		G40S02	
LABORATORY ID:			34347-4		35347-1		35369-3		35369-5		35369-4		35424-4		35424-3	
ANALYTE	CRQL	MDL														
CHLOROMETHANE	10	2.32	10	U	10	U	10	U	10	U	83	U	10	U	10	U
BROMOMETHANE	10	3.95	10	U	10	U	10	U	10	U	83	U	10	U	10	U
VINYL CHLORIDE	10	2.48	10	U	10	U	10	U	10	U	83	U	10	U	10	U
CHLOROETHANE	10	2.41	10	U	10	U	10	U	10	U	83	U	10	U	10	U
METHYLENE CHLORIDE	10	3.08	10	U	10	U	10	U	10	U	97	U(b)	4	U(b)	5	U(b)
ACETONE	10	2.92	10	UJ(c)	10	UJ(c)	10	UJ(c)	10	UJ(c)	83	UJ(c)	10	U	10	U
CARBON DISULFIDE	10	3.86	10	UJ(c)	10	UJ(c)	10	UJ(c)	10	UJ(c)	83	UJ(c)	10	U	10	U
1,1-DICHLOROETHENE	10	4.34	10	U	10	U	10	U	10	U	30	J	10	U	10	U
1,1-DICHLOROETHANE	10	1.57	10	U	10	U	10	U	10	U	120		10	U	10	U
1,2-DICHLOROETHENE	10	4.69	10	UJ(c)	10	UJ(c)	10	UJ(c)	10	UJ(c)	220	J(c)	10	U	10	U
CHLOROFORM	10	1.84	10	U	10	U	10	U	10	U	83	U	10	U	10	U
1,2-DICHLOROETHANE	10	1.89	10	U	10	U	10	U	10	U	83	U	10	U	10	U
2-BUTANONE	10	0.44	10	U	10	U	10	U	10	U	83	U	10	U	10	U
1,1,1-TRICHLOROETHANE	10	2.29	10	U	10	U	10	U	4	J	690		10	U	10	U
CARBON TETRACHLORIDE	10	1.58	10	U	10	U	10	U	10	U	83	U	10	U	10	U
BROMODICHLOROMETHANE	10	1.05	10	U	10	U	10	U	10	U	83	U	10	U	10	U
1,2-DICHLOROPROPANE	10	0.68	10	U	10	U	10	U	10	U	83	U	10	U	10	U
Cis-1,3-DICHLOROPROPENE	10	0.85	10	U	10	U	10	U	10	U	83	U	10	U	10	U
TRICHLOROETHENE	10	0.91	16		9	J	13		17		340		7	J	10	U
DIBROMOCHLOROMETHANE	10	1.12	10	U	10	U	10	U	10	U	83	U	10	U	10	U
1,1,2-TRICHLOROETHANE	10	0.93	10	U	10	U	10	U	10	U	83	U	10	U	10	U
BENZENE	10	1.00	10	U	10	U	10	U	10	U	83	U	10	U	10	U
TRANS-1,3-DICHLOROPROPENE	10	0.20	10	U	10	U	10	U	10	U	83	U	10	U	10	U
BROMOFORM	10	1.06	10	U	10	U	10	U	10	U	83	U	10	U	10	U
4-METHYL-2-PENTANONE	10	1.97	10	UJ(c)	10	UJ(c)	10	UJ(c)	10	UJ(c)	83	UJ(c)	10	U	10	U
2-HEXANONE	10	0.90	10	U	10	U	10	U	10	U	83	U	10	U	10	U
TETRACHLOROETHENE	10	1.00	7	J	10	U	26		10	U	1400		10	U	10	U
1,1,2,2-TETRACHLOROETHANE	10	0.81	10	U	10	U	10	U	10	U	83	U	10	U	10	U
TOLUENE	10	1.61	10	U	10	U	10	U	10	U	83	U	7	J	4	J
CHLOROBENZENE	10	0.44	10	U	10	U	10	U	10	U	83	U	10	U	10	U
ETHYLBENZENE	10	0.73	10	U	10	U	10	U	10	U	83	U	10	U	10	U
STYRENE	10	0.61	10	U	10	U	10	U	10	U	83	U	10	U	10	U
XYLENES (TOTAL)	10	0.92	10	U	10	U	10	U	10	U	83	U	10	U	10	U
DILUTION FACTOR:			1.0		1.0		1.0		1.0		8.3		1.0		1.0	

CLEAN CTO 89
NWIRP BETHPAGE, BETHPAGE, NEW YORK
PACE INC. - HAMPTON

TCL SOIL VOLATILES (mg/kg)

CLIENT ID:			SB243I140		SB243I150		SB243I20	
LABORATORY ID:			34825-2		34825-4		34825-1	
ANALYTE	CRQL	MDL						
CHLOROMETHANE	10	2.32	12	UR(c)	12	UR(c)	10	UR(c)
BROMOMETHANE	10	3.95	12	U	12	U	10	U
VINYL CHLORIDE	10	2.48	12	U	12	U	10	U
CHLOROETHANE	10	2.41	12	U	12	U	10	U
METHYLENE CHLORIDE	10	3.08	16	U(b)	13	U(b)	10	U(b)
ACETONE	10	2.82	12	U	12	U	10	U
CARBON DISULFIDE	10	3.86	12	U	12	U	10	U
1,1-DICHLOROETHENE	10	4.34	12	U	12	U	10	U
1,1-DICHLOROETHANE	10	1.57	12	U	12	U	10	U
1,2-DICHLOROETHENE	10	4.89	12	U	12	U	10	U
CHLOROFORM	10	1.84	12	U	12	U	10	U
1,2-DICHLOROETHANE	10	1.89	12	U	12	U	10	U
2-BUTANONE	10	0.44	12	U	12	U	10	U
1,1,1-TRICHLOROETHANE	10	2.29	12	U	12	U	10	U
CARBON TETRACHLORIDE	10	1.58	12	U	12	U	10	U
BROMODICHLOROMETHANE	10	1.05	12	U	12	U	10	U
1,2-DICHLOROPROPANE	10	0.66	12	U	12	U	10	U
Cis-1,3-DICHLOROPROPENE	10	0.85	12	U	12	U	10	U
TRICHLOROETHENE	10	0.91	36		12	U	10	U
DIBROMOCHLOROMETHANE	10	1.12	12	U	12	U	10	U
1,1,2-TRICHLOROETHANE	10	0.93	12	U	12	U	10	U
BENZENE	10	1	12	U	12	U	10	U
TRANS-1,3-DICHLOROPROPENE	10	0.2	12	U	12	U	10	U
BROMOFORM	10	1.06	12	U	12	U	10	U
4-METHYL-2-PENTANONE	10	1.97	12	U	12	U	10	U
2-HEXANONE	10	0.9	12	U	12	U	10	U
TETRACHLOROETHENE	10	1	12	U	12	U	10	U
1,1,2,2-TETRACHLOROETHANE	10	0.61	12	U	12	U	10	U
TOLUENE	10	1.61	12	U	12	U	10	U
CHLOROBENZENE	10	0.44	12	U	12	U	10	U
ETHYLBENZENE	10	0.73	12	U	12	U	10	U
STYRENE	10	0.61	12	U	12	U	10	U
XYLENES(TOTAL)	10	0.92	12	U	12	U	10	U
% SOLIDS:			83		86		95	
DILUTION FACTOR:			1		1		1	

Summary of Tentatively Identified Compounds (TICs)
Remaining After Data Qualification

Fraction	Named TIC
Volatile	Unknown(s)
	Acetic acid, ethyl ester

Data Qualifier Key

U	-	Value is a nondetect as reported by the laboratory.
U(b)	-	Value is considered to be a false positive attributable to blank contamination.
UR	-	Nondetect (quantitation limit) is considered to be unreliable.
J	-	Value is estimated because it is reported at a concentration less than the associated CRQL.
J(c)	-	Positive result is considered to be estimated based on exceedance of associated calibration criteria.
J(s)	-	Positive result is considered to be estimated because associated surrogate recovery failed to meet quality control criteria.
J(a)	-	Positive result is considered to be estimated because of poor performance of the associated internal standard.
UJ(s)	-	Nondetect is considered to be estimated based on poor surrogate recovery.
J(a)	-	Nondetect is considered to be estimated because of poor performance of the associated internal standard.

CLEAN CTO 89
NWIRP BETHPAGE, BETHPAGE, NEW YORK
PACE INC. - HAMPTON

TCL SOIL PESTICIDES (mg/kg)

CLIENT ID:			BPDUP01A		BPSB12103		BPSB20603		BPSB21503		BPSD201A		BPSD202A	
LABORATORY ID:			34366-19		34366-3		34366-9		34366-8		34366-13		34366-14	
ANALYTE	CRQL	MDL												
ALPHA-BHC	1.7	0.867	2	UJ(c)	1.8	UR(s)	32	U	1.8	U	3	UR(s)	2	UR(s)
BETA-BHC	1.7	0.67	2	U	1.8	UR(s)	32	U	1.8	U	3	UR(s)	2	UR(s)
DELTA-BHC	1.7	0.5	2	UJ(c)	1.8	UR(s)	32	U	1.8	U	3	UR(s)	2	UR(s)
GAMMA-BHC (LINDANE)	1.7	0.467	2	U	1.8	UR(s)	32	U	1.8	U	3	UR(s)	2	UR(s)
HEPTACHLOR	1.7	0.566	2	U	1.8	UR(s)	32	U	1.8	U	3	UR(s)	2	UR(s)
ALDRIN	1.7	0.367	2	U	1.8	UR(s)	32	U	1.8	U	3	UR(s)	2	UR(s)
HEPTACHLOR EPOXIDE	1.7	0.833	2	U	1.8	UR(s)	32	U	1.8	U	12	J(s)	2	UR(s)
ENDOSULFAN I	1.7	0.733	2	U	1.8	UR(s)	32	U	1.8	U	3	UR(s)	2	UR(s)
DIELDRIN	3.3	1.367	3.8	U	3.5	UR(s)	61	U	3.5	U	7.9	J(s)	3.8	UR(s)
4,4'-DDE	3.3	1.367	130	J(q)	3.5	UR(s)	61	U	3.5	U	5.8	UR(s)	3.8	UR(s)
ENDRIN	3.3	1.6	3.8	U	4.7	J(s)	61	U	3.5	U	5.8	UR(s)	3.8	UR(s)
ENDOSULFAN II	3.3	1.6	3.8	U	3.5	UR(s)	61	U	3.5	U	5.8	UR(s)	3.8	UR(s)
4,4'-DDD	3.3	1.333	8.3	J(c)	3.5	UR(s)	61	U	3.5	U	5.8	UR(s)	3.8	UR(s)
ENDOSULFAN SULFATE	3.3	3.2	3.8	U	3.5	UR(s)	61	U	3.5	U	5.8	UR(s)	3.8	UR(s)
4,4'-DDT	3.3	1.5	620	J(q)	3.5	UR(s)	61	U	3.5	U	5.8	UR(s)	3.8	UR(s)
METHOXYCHLOR	1.7	6.266	20	UJ(c)	18	UR(s)	320	U	18	U	30	UR(s)	20	UR(s)
ENDRIN KETONE	3.3	1.067	3.8	U	3.5	UR(s)	61	U	3.5	U	5.8	UR(s)	3.8	UR(s)
ENDRIN ALDEHYDE	3.3	1.866	3.8	U	3.5	UR(s)	61	U	3.5	U	5.8	UR(s)	3.8	UR(s)
ALPHA-CHLORDANE	1.7	0.7	2	U	1.8	UR(s)	32	U	1.8	U	3	UR(s)	2	UR(s)
GAMMA-CHLORDANE	1.7	0.666	2	U	1.8	UR(s)	32	U	1.8	U	3	UR(s)	2	UR(s)
TOXAPHENE	170	17.33	200	U	180	UR(s)	3200	U	180	U	300	UR(s)	200	UR(s)
AROCLOR-1016	33	6.333	38	U	35	UR(s)	610	U	35	U	58	UR(s)	38	UR(s)
AROCLOR-1221	67	8	77	U	70	UR(s)	1200	U	70	U	120	UR(s)	78	UR(s)
AROCLOR-1232	33	3.666	38	U	35	UR(s)	610	U	35	U	58	UR(s)	38	UR(s)
AROCLOR-1242	33	4	38	U	35	UR(s)	610	U	35	U	58	UR(s)	38	UR(s)
AROCLOR-1248	33	8.333	230	J(q)	1000	J(s) *	33000	J(q) *	270	J(s,q)	2600	J(s) *	48	J(s)
AROCLOR-1254	33	6.999	61	J(q)	210	J(s)	3600	J(q)	78	J(s,q)	58	UR	38	UR(s)
AROCLOR-1260	33	5	38	U	35	UR(s)	610	U	35	UJ(s)	58	UR	38	UR(s)
% SOLIDS:			86		94		80		94		58		86	
DILUTION FACTOR:			1		1/5 *		1/150 *		1		2/10 *		1	

CLEAN CTO 89
NWIRP BETHPAGE, BETHPAGE, NEW YORK
PACE INC. - HAMPTON

TCL SOIL PESTICIDES (mg/kg)

CLIENT ID:			BPSS101A		BPSS102A		BPSS103A		BPSS104A		BPSS105A		BPSS106A	
LABORATORY ID:			34366-1		34366-2		34366-4		34366-5		34366-6		34366-7	
ANALYTE	CRQL	MDL												
ALPHA-BHC	1.7	0.667	30	UJ(c)	2	UJ(c)	1900	UJ(c)	2	UJ(c)	94	UJ(c)	1.8	UJ(c)
BETA-BHC	1.7	0.67	30	U	2	U	1900	U	2	U	94	U	1.8	U
DELTA-BHC	1.7	0.5	30	UJ(c)	2	UJ(c)	1900	UJ(c)	2	UJ(c)	94	UJ(c)	1.8	UJ(c)
GAMMA-BHC (LINDANE)	1.7	0.467	30	U	2	U	1900	U	2	U	94	U	1.8	U
HEPTACHLOR	1.7	0.566	30	U	2	U	1900	U	2	U	94	U	1.8	U
ALDRIN	1.7	0.367	30	U	2	U	1900	U	2	U	94	U	1.8	U
HEPTACHLOR EPOXIDE	1.7	0.633	30	U	2	U	1900	U	2	U	94	U	1.8	U
ENDOSULFAN I	1.7	0.733	30	U	2	U	1900	U	2	U	94	U	1.8	U
DIELDRIN	3.3	1.367	57	U	3.8	U	3700	U	3.8	U	180	U	3.6	U
4,4'-DDE	3.3	1.367	57	U	27	J(c)	3700	U	3.8	U	180	U	3.6	U
ENDRIN	3.3	1.6	57	U	3.8	U	3700	U	3.8	U	180	U	3.6	U
ENDOSULFAN II	3.3	1.6	57	U	3.8	U	3700	U	3.8	U	180	U	3.6	U
4,4'-DDD	3.3	1.333	57	U	3.8	U	3700	U	3.8	U	180	U	3.6	U
ENDOSULFAN SULFATE	3.3	3.2	57	U	3.8	U	3700	U	3.8	U	180	U	3.6	U
4,4'-DDT	3.3	1.5	57	U	37		3700	U	3.8	U	180	U	3.6	U
METHOXYCHLOR	1.7	6.266	300	UJ(c)	20	UJ(q)	19000	UJ(c)	20	UJ(c)	940	UJ(c)	18	UJ(c)
ENDRIN KETONE	3.3	1.067	57	U	3.8	U	3700	U	3.8	U	180	U	3.6	U
ENDRIN ALDEHYDE	3.3	1.866	57	U	3.8	U	3700	U	3.8	U	180	U	3.6	U
ALPHA-CHLORDANE	1.7	0.7	30	U	2	U	1900	U	2	U	94	U	1.8	U
GAMMA-CHLORDANE	1.7	0.866	30	U	2	U	1900	U	2	U	94	U	1.8	U
TOXAPHENE	170	17.33	3000	U	200	U	190000	U	200	U	9400	U	180	U
AROCLOR-1016	33	6.333	570	U	38	U	37000	U	38	U	1800	U	36	U
AROCLOR-1221	67	8	1200	U	78	U	75000	U	77	U	3700	U	72	U
AROCLOR-1232	33	3.666	570	U	38	U	37000	U	38	U	1800	U	36	U
AROCLOR-1242	33	4	570	U	38	U	37000	U	38	U	25000	J(q)	36	U
AROCLOR-1248	33	8.333	25000	J(q) *	1100	J(q) *	1300000	J(q) *	2500	J(s,q) *	1800	U	1700	J(q) *
AROCLOR-1254	33	6.999	5000	J(q)	660	J(q)	170000	J(q)	530	J(s,q)	1800	U	400	J(q)
AROCLOR-1260	33	5	570	U	38	U	37000	U	38	U	1800	U	36	U
% SOLIDS:			86		86		88		86		90		92	
DILUTION FACTOR:			1 / 150 *		1 / 10 *		1120 / 10,000 *		1 / 10 *		54		1 / 10 *	

CLEAN CTO 89
NWIRP BETHPAGE, BETHPAGE, NEW YORK
PACE INC. - HAMPTON

TCL SOIL PESTICIDES (mg/kg)

CLIENT ID:			BPSS207A		BPSS208A		BPSS210A		BPSS212A		BPSS214A		BPSS216A	
LABORATORY ID:			34366-11		34366-12		34366-18		34366-15		34366-17		34366-16	
ANALYTE	CRQL	MDL												
ALPHA-BHC	1.7	0.867	3.8	UR(s)	1.7	UJ(c)	1.8	UJ(c)	1.8	UJ(c)	1.9	UJ(c)	9.1	UR(s)
BETA-BHC	1.7	0.67	3.8	UR(s)	1.7	U	1.8	U	1.8	U	1.9	U	9.1	UR(s)
DELTA-BHC	1.7	0.5	3.8	UR(s)	1.7	UJ(c)	1.8	UJ(c)	1.8	UJ(c)	1.9	UJ(c)	9.1	UR(s)
GAMMA-BHC (LINDANE)	1.7	0.467	3.8	UR(s)	1.7	U	1.8	U	1.8	U	1.9	U	9.1	UR(s)
HEPTACHLOR	1.7	0.566	3.8	UR(s)	1.7	U	1.8	U	1.8	U	1.9	U	9.1	UR(s)
ALDRIN	1.7	0.367	3.8	UR(s)	1.7	U	1.8	U	1.8	U	1.9	U	9.1	UR(s)
HEPTACHLOR EPOXIDE	1.7	0.633	3.8	UR(s)	1.7	U	1.8	U	1.8	U	1.9	U	9.1	UR(s)
ENDOSULFAN I	1.7	0.733	3.8	UR(s)	1.7	U	1.8	U	1.8	U	1.9	U	9.1	UR(s)
DIELDRIN	3.3	1.367	7.4	UR(s)	3.3	U	3.6	U	3.6	U	7.2	J(s,q)	18	UR(s)
4,4'-DDE	3.3	1.367	93	J(s)	3.3	U	3.6	U	3.6	U	3.6	U	18	UR(s)
ENDRIN	3.3	1.6	7.4	UR(s)	3.3	U	3.6	U	3.6	U	3.6	U	18	UR(s)
ENDOSULFAN II	3.3	1.6	7.4	UR(s)	3.3	U	3.6	U	3.6	U	3.6	U	18	UR(s)
4,4'-DDD	3.3	1.333	7.4	UR(s)	3.3	U	3.6	U	3.6	U	3.6	U	18	UR(s)
ENDOSULFAN SULFATE	3.3	3.2	7.4	UR(s)	3.3	U	3.6	U	3.6	U	3.6	U	18	UR(s)
4,4'-DDT	3.3	1.5	170	J(s) *	3.3	U	3.6	U	3.6	U	13	J(s,q)	18	UR(s)
METHOXYCHLOR	1.7	6.266	38	UR(s)	17	UJ(c)	18	UJ(c)	18	UJ(c)	19	UJ(c)	91	UR(s)
ENDRIN KETONE	3.3	1.067	7.4	UR(s)	3.3	U	3.6	U	3.6	U	3.6	U	18	UR(s)
ENDRIN ALDEHYDE	3.3	1.866	7.4	UR(s)	3.3	U	3.6	U	3.6	U	3.6	U	18	UR(s)
ALPHA-CHLORDANE	1.7	0.7	3.8	UR(s)	1.7	U	1.8	U	1.8	U	1.9	U	9.1	UR(s)
GAMMA-CHLORDANE	1.7	0.666	3.8	UR(s)	1.7	U	1.8	U	1.8	U	1.9	U	9.1	UR(s)
TOXAPHENE	170	17.33	380	UR(s)	170	U	180	U	180	U	190	U	910	UR(s)
AROCLOR-1016	33	6.333	74	UR(s)	33	U	36	U	36	U	36	U	180	UR(s)
AROCLOR-1221	67	8	150	UR(s)	68	U	72	U	72	U	73	U	360	UR(s)
AROCLOR-1232	33	3.666	74	UR(s)	33	U	36	U	36	U	36	U	180	UR(s)
AROCLOR-1242	33	4	74	UR(s)	33	U	36	U	36	U	36	U	180	UR(s)
AROCLOR-1248	33	8.333	74	UR(s)	73	J(s,q)	46	J(s,q)	2500	J(q)	2200	J(s,q) *	6200	J(s) *
AROCLOR-1254	33	6.999	74	UR(s)	33	U	36	U	490	J(q)	580	J(s,q)	1000	J(s)
AROCLOR-1260	33	5	74	UR(s)	33	U	36	U	36	U	36	U	180	UR(s)
% SOLIDS:			86		96		92		92		90		92	
DILUTION FACTOR:			2/20 *		1		1		1		1/10 *		5/50 *	

CLEAN CTO 89
NWIRP BETHPAGE, BETHPAGE, NEW YORK
PACE INC. - HAMPTON

TCL SOIL PESTICIDES (mg/kg)

CLIENT ID:			BPSS322A	
LABORATORY ID:			34366-10	
ANALYTE	CRQL	MDL		
ALPHA-BHC	1.7	0.667	2	UJ(c)
BETA-BHC	1.7	0.67	2	U
DELTA-BHC	1.7	0.5	2	UJ(c)
GAMMA-BHC (LINDANE)	1.7	0.467	2	U
HEPTACHLOR	1.7	0.566	17	*
ALDRIN	1.7	0.367	2	U
HEPTACHLOR EPOXIDE	1.7	0.633	2	U
ENDOSULFAN I	1.7	0.733	2	U
DIELDRIN	3.3	1.367	5	J(q)
4,4'-DDE	3.3	1.367	6.9	
ENDRIN	3.3	1.6	3.9	U
ENDOSULFAN II	3.3	1.6	3.9	U
4,4'-DDD	3.3	1.333	3.9	U
ENDOSULFAN SULFATE	3.3	3.2	3.9	U
4,4'-DDT	3.3	1.5	9.1	
METHOXYCHLOR	1.7	6.266	20	UJ(c)
ENDRIN KETONE	3.3	1.067	3.9	U
ENDRIN ALDEHYDE	3.3	1.666	3.9	U
ALPHA-CHLORDANE	1.7	0.7	48	*
GAMMA-CHLORDANE	1.7	0.666	62	*
TOXAPHENE	170	17.33	200	U
AROCLOR-1016	33	6.333	39	U
AROCLOR-1221	67	6	80	U
AROCLOR-1232	33	3.666	39	U
AROCLOR-1242	33	4	39	U
AROCLOR-1248	33	6.333	39	U
AROCLOR-1254	33	6.999	39	U
AROCLOR-1260	33	5	39	U
% SOLIDS:			83	
DILUTION FACTOR:			1/5*	

CLEAN CTO 89
NWIRP BETHPAGE, BETHPAGE, NEW YORK
PACE INC. - HAMPTON

TCL AQUEOUS PESTICIDES (ug/L)

CLIENT ID:			BPSS210RB	
LABORATORY ID:			34366-20	
ANALYTE	CRQL	MDL		
ALPHA-BHC	0.05	0.026	0.05	UJ(c)
BETA-BHC	0.05	0.021	0.05	U
DELTA-BHC	0.05	0.015	0.05	UJ(c)
GAMMA-BHC (LINDANE)	0.05	0.014	0.05	U
HEPTACHLOR	0.05	0.017	0.05	U
ALDRIN	0.05	0.011	0.05	U
HEPTACHLOR EPOXIDE	0.05	0.019	0.05	U
ENDOSULFAN I	0.05	0.022	0.05	U
DIELDRIN	0.1	0.041	0.1	U
4,4'-DDE	0.1	0.041	0.1	U
ENDRIN	0.1	0.048	0.1	U
ENDOSULFAN II	0.1	0.048	0.1	U
4,4'-DDD	0.1	0.04	0.1	U
ENDOSULFAN SULFATE	0.1	0.096	0.1	U
4,4'-DDT	0.1	0.045	0.1	U
METHOXYCHLOR	0.05	0.188	0.5	U
ENDRIN KETONE	0.1	0.032	0.1	U
ENDRIN ALDEHYDE	0.1	0.056	0.1	U
ALPHA-CHLORDANE	0.05	0.021	0.05	U
GAMMA-CHLORDANE	0.05	0.02	0.05	U
TOXAPHENE	5	0.52	5	U
AROCLOR-1016	1	0.19	1	U
AROCLOR-1221	2	0.24	2	U
AROCLOR-1232	1	0.11	1	U
AROCLOR-1242	1	0.12	1	U
AROCLOR-1248	1	0.25	1	U
AROCLOR-1254	1	0.21	1	U
AROCLOR-1260	1	0.15	1	U
DILUTION FACTOR:			1	

Data Qualifier Key

U	-	Value is a nondetect as reported by the laboratory.
J	-	Value is estimated because it is reported at a concentration less than the associated CRQL.
UR	-	Nondetect (quantitation limit) is considered to be unreliable.
U(b)	-	Value is considered to be a false positive attributable to blank contamination.
J(c)	-	Positive result is considered to be estimated based on exceedance of associated calibration criteria.
J(q)	-	Positive result is considered to be estimated due to factors which could affect quantitation, that are not associated with instrument calibration.
J(s)	-	Positive result is considered to be estimated because associated surrogate recovery failed to meet quality control criteria.
UJ(s)	-	Nondetect is considered to be estimated based on poor surrogate recovery.

CLEAN CTO 89
NWIRP BETHPAGE, BETHPAGE, NEW YORK
PACE, INC. – HAMPTON

TCL AQUEOUS VOLATILES (ug/L)

CLIENT ID:		BP-	G27102		G41102		G41S02		GUSGS02	
LABORATORY ID:			35458-2		35444-1		35444-2		35444-5	
ANALYTE	CRQL	MDL								
CHLOROMETHANE	10	2.32	10	U	10	U	10	U	10	U
BROMOMETHANE	10	3.95	10	U	10	U	10	U	10	U
VINYL CHLORIDE	10	2.48	10	U	10	U	10	U	10	U
CHLOROETHANE	10	2.41	10	U	10	U	10	U	10	U
METHYLENE CHLORIDE	10	3.08	10	U(b)	10	U(b)	10	U(b)	10	U(b)
ACETONE	10	2.82	10	U	10	U	10	U	10	U
CARBON DISULFIDE	10	3.86	10	U	10	U	10	U	10	U
1,1-DICHLOROETHENE	10	4.34	10	U	7	J	10	U	10	U
1,1-DICHLOROETHANE	10	1.57	10	U	14		10	U	4	J
1,2-DICHLOROETHENE	10	4.89	10	U	10	U	10	U	15	
CHLOROFORM	10	1.84	10	U	10	U	10	U	10	U
1,2-DICHLOROETHANE	10	1.89	10	U	10	U	10	U	10	U
2-BUTANONE	10	0.44	10	U	10	U	10	U	10	U
1,1,1-TRICHLOROETHANE	10	2.29	10	U	16		10	U	31	
CARBON TETRACHLORIDE	10	1.58	10	U	10	U	10	U	10	U
BROMODICHLOROMETHANE	10	1.05	10	U	10	U	10	U	10	U
1,2-DICHLOROPROPANE	10	0.66	10	U	10	U	10	U	10	U
Cis-1,3-DICHLOROPROPENE	10	0.85	10	U	10	U	10	U	10	U
TRICHLOROETHENE	10	0.91	4	J	10	U	10	U	100	
DIBROMOCHLOROMETHANE	10	1.12	10	U	10	U	10	U	10	U
1,1,2-TRICHLOROETHANE	10	0.93	10	U	10	U	10	U	10	U
BENZENE	10	1	10	U	10	U	10	U	10	U
TRANS-1,3-DICHLOROPROPENE	10	0.2	10	U	10	U	10	U	10	U
BROMOFORM	10	1.06	10	U	10	U	10	U	10	U
4-METHYL-2-PENTANONE	10	1.97	10	U	10	U	10	U	10	U
2-HEXANONE	10	0.9	10	U	10	U	10	U	10	U
TETRACHLOROETHENE	10	1	10	U	10	U	10	U	26	
1,1,2,2-TETRACHLOROETHANE	10	0.61	10	U	10	U	10	U	10	U
TOLUENE	10	1.61	10	U	8	J	7	J	10	U
CHLOROBENZENE	10	0.44	10	U	10	U	10	U	10	U
ETHYLBENZENE	10	0.73	10	U	10	U	10	U	10	U
STYRENE	10	0.61	10	U	10	U	10	U	10	U
XYLENES (TOTAL)	10	0.92	10	U	10	U	10	U	10	U
DILUTION FACTOR:			1		1		1		1	

CLEAN CTO 89
NWIRP BETHPAGE, BETHPAGE, NEW YORK
PACE, INC. - HAMPTON

TCL AQUEOUS VOLATILES (ug/L)

CLIENT ID:		BP-	GFB102		GRB502		TB3-18		TB3-19	
LABORATORY ID:			35444-6		35444-3		35444-4		35458-1	
ANALYTE	CRQL	MDL								
CHLOROMETHANE	10	2.32	10	U	10	U	10	U	10	U
BROMOMETHANE	10	3.95	10	U	10	U	10	U	10	U
VINYL CHLORIDE	10	2.48	10	U	10	U	10	U	10	U
CHLOROETHANE	10	2.41	10	U	10	U	10	U	10	U
METHYLENE CHLORIDE	10	3.08	10	U(b)	10	U(b)	10	U(b)	10	U(b)
ACETONE	10	2.82	91		73		10	U	10	U
CARBON DISULFIDE	10	3.86	10	U	10	U	10	U	10	U
1,1-DICHLOROETHENE	10	4.34	10	U	10	U	10	U	10	U
1,1-DICHLOROETHANE	10	1.57	10	U	10	U	10	U	10	U
1,2-DICHLOROETHENE	10	4.89	10	U	10	U	10	U	10	U
CHLOROFORM	10	1.84	10	U	10	U	10	U	10	U
1,2-DICHLOROETHANE	10	1.89	10	U	10	U	10	U	10	U
2-BUTANONE	10	0.44	10	U	10	U	10	U	10	U
1,1,1-TRICHLOROETHANE	10	2.29	10	U	10	U	10	U	10	U
CARBON TETRACHLORIDE	10	1.58	10	U	10	U	10	U	10	U
BROMODICHLOROMETHANE	10	1.05	10	U	10	U	10	U	10	U
1,2-DICHLOROPROPANE	10	0.66	10	U	10	U	10	U	10	U
Cis-1,3-DICHLOROPROPENE	10	0.85	10	U	10	U	10	U	10	U
TRICHLOROETHENE	10	0.91	10	U	10	U	10	U	10	U
DIBROMOCHLOROMETHANE	10	1.12	10	U	10	U	10	U	10	U
1,1,2-TRICHLOROETHANE	10	0.93	10	U	10	U	10	U	10	U
BENZENE	10	1	10	U	10	U	10	U	10	U
TRANS-1,3-DICHLOROPROPENE	10	0.2	10	U	10	U	10	U	10	U
BROMOFORM	10	1.06	10	U	10	U	10	U	10	U
4-METHYL-2-PENTANONE	10	1.97	10	U	10	U	10	U	10	U
2-HEXANONE	10	0.9	10	U	10	U	10	U	10	U
TETRACHLOROETHENE	10	1	10	U	10	U	10	U	10	U
1,1,2,2-TETRACHLOROETHANE	10	0.61	10	U	10	U	10	U	10	U
TOLUENE	10	1.61	10	U	10	U	10	U	10	U
CHLOROBENZENE	10	0.44	10	U	10	U	10	U	10	U
ETHYLBENZENE	10	0.73	10	U	10	U	10	U	10	U
STYRENE	10	0.61	10	U	10	U	10	U	10	U
XYLENES (TOTAL)	10	0.92	10	U	10	U	10	U	10	U
DILUTION FACTOR:			1		1		1		1	

SITE: BETHPAGE, NY NWIRP
LABORATORY: PACE INC. - HAMPTON

TCL VOLATILE AQUEOUS ANALYSES (ug/L)

CLIENT ID:			BPDRRB01		BPDRTB01		BPPW08		BPPW09		BPPW10	
LABORATORY ID:			35871-2		35871-1		35856-3		35856-4		35856-5	
PARAMETER	CRQL	MDL										
CHLOROMETHANE	10	2.32	10	U	10	U	33	U	10	U	10	U
BROMOMETHANE	10	3.95	10	U	10	U	33	U	10	U	10	U
VINYL CHLORIDE	10	2.48	10	U	10	U	33	U	10	U	10	U
CHLOROETHANE	10	2.41	10	U	10	U	33	U	10	U	10	U
METHYLENE CHLORIDE	10	3.08	10	U	10	U	33	U	10	U	10	U
ACETONE	10	2.82	10	U	10	U	33	U	10	U	10	U
CARBON DISULFIDE	10	3.86	10	UJ (c)	10	UJ (c)	33	UJ (c)	10	UJ (c)	10	UJ (c)
1,1-DICHLOROETHENE	10	4.34	10	U	10	U	250		7	J	10	U
1,1-DICHLOROETHANE	10	1.57	10	U	10	U	33	U	10	U	10	U
1,2-DICHLOROETHENE	10	4.89	10	U	10	U	33	U	10	U	10	U
CHLOROFORM	10	1.64	10	U	10	U	33	U	10	U	10	U
1,2-DICHLOROETHANE	10	1.89	10	U	10	U	33	U	10	U	10	U
2-BUTANONE	10	0.44	10	U	10	U	33	U	10	U	10	U
1,1,1-TRICHLOROETHANE	10	2.29	10	U	10	U	300		12		3	J
CARBON TETRACHLORIDE	10	1.58	10	U	10	U	33	U	10	U	10	U
BROMODICHLOROMETHANE	10	1.05	10	U	10	U	33	U	10	U	10	U
1,2-DICHLOROPROPANE	10	0.66	10	U	10	U	33	U	10	U	10	U
Cis-1,3-DICHLOROPROPENE	10	0.85	10	U	10	U	33	U	10	U	10	U
TRICHLOROETHENE	10	0.91	10	U	10	U	160		30		13	
DIBROMOCHLOROMETHANE	10	1.12	10	U	10	U	33	U	10	U	10	U
1,1,2-TRICHLOROETHANE	10	0.93	10	U	10	U	33	U	10	U	10	U
BENZENE	10	1	10	U	10	U	33	U	10	U	10	U
TRANS-1,3-DICHLOROPROPENE	10	0.2	10	U	10	U	33	U	10	U	10	U
BROMOFORM	10	1.06	10	U	10	U	33	U	10	U	10	U
4-METHYL-2-PENTANONE	10	1.97	10	U	10	U	33	U	10	U	10	U
2-HEXANONE	10	0.9	10	U	10	U	33	U	10	U	10	U
TETRACHLOROETHENE	10	1	10	U	10	U	190		9	J	3	J
1,1,2,2-TETRACHLOROETHANE	10	0.61	10	U	10	U	33	U	10	U	10	U
TOLUENE	10	1.61	10	U	10	U	33	U	10	U	10	U
CHLOROBENZENE	10	0.44	10	U	10	U	33	U	10	U	10	U
ETHYLBENZENE	10	0.73	10	U	10	U	33	U	10	U	10	U
STYRENE	10	0.61	10	U	10	U	33	U	10	U	10	U
XYLENES (TOTAL)	10	0.92	10	U	10	U	33	U	10	U	10	U
DILUTION FACTOR:			1		1		3.3		1		1	

SITE: BETHPAGE, NY NWIRP
LABORATORY: PACE INC. - HAMPTON

TCL VOLATILE AQUEOUS ANALYSES (ug/L)

CLIENT ID:			BPPW11		BPPW14		BPPWDU01		BPPWMS01		BPPWTB01	
LABORATORY ID:			35858-6		35858-2		35858-7		35858-8		35858-1	
PARAMETER	CRQL	MDL										
CHLOROMETHANE	10	2.32	10	U	100	U	20	U	100	U	10	U
BROMOMETHANE	10	3.95	10	U	100	U	20	U	100	U	10	U
VINYL CHLORIDE	10	2.48	10	U	1400		20	U	1500		10	U
CHLOROETHANE	10	2.41	10	U	100	U	20	U	100	U	10	U
METHYLENE CHLORIDE	10	3.08	10	U	100	U	20	U	100	U	10	U
ACETONE	10	2.82	10	U	100	U	20	U	100	UJ (c)	10	U
CARBON DISULFIDE	10	3.86	10	UJ (c)	100	UJ (c)	20	UJ (c)	100	UJ (c)	10	UJ (c)
1,1-DICHLOROETHENE	10	4.34	10	U	100	U	350		100	U	10	U
1,1-DICHLOROETHANE	10	1.57	10	U	100	U	12	J	100	U	10	U
1,2-DICHLOROETHENE	10	4.69	10	U	57	J	20	U	66	J	10	U
CHLOROFORM	10	1.84	10	U	100	U	5	J	100	U	10	U
1,2-DICHLOROETHANE	10	1.69	10	U	100	U	20	U	100	U	10	U
2-BUTANONE	10	0.44	10	U	100	U	20	U	100	U	10	U
1,1,1-TRICHLOROETHANE	10	2.29	3	J	100	U	420	J (q)	100	U	10	U
CARBON TETRACHLORIDE	10	1.58	10	U	100	U	20	U	100	U	10	U
BROMODICHLOROMETHANE	10	1.05	10	U	100	U	20	U	100	U	10	U
1,2-DICHLOROPROPANE	10	0.66	10	U	100	U	20	U	100	U	10	U
Cis-1,3-DICHLOROPROPENE	10	0.85	10	U	100	U	20	U	100	U	10	U
TRICHLOROETHENE	10	0.91	13		280		220		330		10	U
DIBROMOCHLOROMETHANE	10	1.12	10	U	100	U	20	U	100	U	10	U
1,1,2-TRICHLOROETHANE	10	0.93	10	U	100	U	20	U	100	U	10	U
BENZENE	10	1	10	U	100	U	20	U	100	U	10	U
TRANS-1,3-DICHLOROPROPENE	10	0.2	10	U	100	U	20	U	100	U	10	U
BROMOFORM	10	1.06	10	U	100	U	20	U	100	U	10	U
4-METHYL-2-PENTANONE	10	1.97	10	U	100	U	20	U	100	U	10	U
2-HEXANONE	10	0.9	10	U	100	U	20	U	100	U	10	U
TETRACHLOROETHENE	10	1	3	J	250		310		320		10	U
1,1,2,2-TETRACHLOROETHANE	10	0.61	10	U	100	U	20	U	100	U	10	U
TOLUENE	10	1.61	10	U	100	U	20	U	100	U	10	U
CHLOROBENZENE	10	0.44	10	U	100	U	20	U	100	U	10	U
ETHYLBENZENE	10	0.73	10	U	100	U	20	U	100	U	10	U
STYRENE	10	0.61	10	U	100	U	20	U	100	U	10	U
XYLENES (TOTAL)	10	0.92	10	U	100	U	20	U	100	U	10	U
DILUTION FACTOR:			1		10		2		10		1	

SITE: BETHPAGE, NY NWIRP
LABORATORY: PACE INC. - HAMPTON

TCL VOLATILE LOW SOIL ANALYSES (mg/Kg)

CLIENT ID:			BPDR119		BPDR27S3	
LABORATORY ID:			35871-4		35871-3	
PARAMETER	CRQL	MDL				
CHLOROMETHANE	10	2.32	10	U	10	U
BROMOMETHANE	10	3.95	10	U	10	U
VINYL CHLORIDE	10	2.48	10	U	10	U
CHLOROETHANE	10	2.41	10	U	10	U
METHYLENE CHLORIDE	10	3.08	10	U (b)	10	U (b)
ACETONE	10	2.82	16	U (b)	10	U (b)
CARBON DISULFIDE	10	3.86	10	UJ (c)	10	UJ (c)
1,1-DICHLOROETHENE	10	4.34	10	U	10	U
1,1-DICHLOROETHANE	10	1.57	10	U	10	U
1,2-DICHLOROETHENE	10	4.89	10	U	10	U
CHLOROFORM	10	1.84	10	U	10	U
1,2-DICHLOROETHANE	10	1.89	10	U	10	U
2-BUTANONE	10	0.44	10	U	10	U
1,1,1-TRICHLOROETHANE	10	2.29	10	U	10	U
CARBON TETRACHLORIDE	10	1.58	10	U	10	U
BROMODICHLOROMETHANE	10	1.05	10	U	10	U
1,2-DICHLOROPROPANE	10	0.66	10	U	10	U
Cis-1,3-DICHLOROPROPENE	10	0.85	10	U	10	U
TRICHLOROETHENE	10	0.91	10	U	10	U
DIBROMOCHLOROMETHANE	10	1.12	10	U	10	U
1,1,2-TRICHLOROETHANE	10	0.93	10	U	10	U
BENZENE	10	1	10	U	10	U
TRANS-1,3-DICHLOROPROPENE	10	0.2	10	U	10	U
BROMOFORM	10	1.06	10	U	10	U
4-METHYL-2-PENTANONE	10	1.97	10	U	10	U
2-HEXANONE	10	0.9	10	U	10	U
TETRACHLOROETHENE	10	1	10	U	10	U
1,1,2,2-TETRACHLOROETHANE	10	0.61	10	U	10	U
TOLUENE	10	1.61	2	J	10	U
CHLOROBENZENE	10	0.44	10	U	10	U
ETHYLBENZENE	10	0.73	10	U	10	U
STYRENE	10	0.61	10	U	10	U
XYLENES (TOTAL)	10	0.92	10	U	10	U
DILUTION FACTOR:			1		1	
%SOLIDS:			97		97	

SITE: BETHPAGE, NY NWIRP
LABORATORY: PACE INC. – HAMPTON

TCL PCB LOW SOIL ANALYSES (mg/Kg)

CLIENT ID:			BPDR121	
LABORATORY ID:			35871-5	
PARAMETER	CRQL	MDL		
AROCLOR-1016	33	6.33	33	U
AROCLOR-1221	67	8	67	U
AROCLOR-1232	33	3.67	33	U
AROCLOR-1242	33	4	33	U
AROCLOR-1248	33	8.33	470	J (y) *
AROCLOR-1254	33	7		R (y)
AROCLOR-1260	33	5	33	U
DILUTION FACTOR:			1	
%SOLID:			97	

* Result taken from dilution analysis.

Summary of Tentatively Identified Compounds (TICs)
Remaining After Data Qualification

Fraction	Named TIC
Volatile	Trichlorofluoromethane

Data Qualifier Key

U	-	Value is a nondetect as reported by the laboratory.
U(b)	-	Value is considered to be a false positive attributable to blank contamination.
J	-	Value is estimated because it is reported at a concentration less than the associated CRQL.
J(c)	-	Positive result is considered to be estimated based on exceedance of associated calibration criteria.
J(y)	-	Positive result is considered to be estimated based on exceedance of associated %D between the two GC columns in PCB analysis.
R(y)	-	Positive result is considered to be rejected based on exceedance of associated %D between the two GC columns in PCB analysis.

CTO 089
SITE: BETHPAGE NWIRP
LABORATORY: PACE INC. - HAMPTON

TCL VOLATILE AQUEOUS ANALYSES (ug/L)

CLIENT ID:			BP-G-43I-01		BP-G-DUP5-26		BP-G-RB5-26		TRIPBLANK 5-26	
LABORATORY ID:			36253-2		36253-3		36253-1		36253-4	
ANALYTE	CRQL	MDL								
CHLOROMETHANE	10	2.3	10	U	10	U	10	U	10	U
BROMOMETHANE	10	4	10	U	10	U	10	U	10	U
VINYL CHLORIDE	10	2.5	10	U	10	U	10	U	10	U
CHLOROETHANE	10	2.4	10	U	10	U	10	U	10	U
METHYLENE CHLORIDE	10	3.1	10	U	3	U(b)	10	U	10	U
ACETONE	10	2.8	10	U	10	U	86	J(c)	10	U
CARBON DISULFIDE	10	3.9	10	UJ(c)	10	UJ(c)	10	UJ(c)	10	UJ(c)
1,1-DICHLOROETHENE	10	4.3	10	U	10	U	10	U	10	U
1,1-DICHLOROETHANE	10	1.6	10	U	10	U	10	U	10	U
1,2-DICHLOROETHENE	10	4.9	10	U	10	U	10	U	10	U
CHLOROFORM	10	1.8	10	U	10	U	10	U	10	U
1,2-DICHLOROETHANE	10	1.9	10	U	10	U	10	U	10	U
2-BUTANONE	10	0.4	10	U	10	U	10	U	10	U
1,1,1-TRICHLOROETHANE	10	2.3	10	U	10	U	10	U	10	U
CARBON TETRACHLORIDE	10	1.6	10	U	10	U	10	U	10	U
BROMODICHLOROMETHANE	10	1.1	10	U	10	U	10	U	10	U
1,2-DICHLOROPROPANE	10	0.7	10	U	10	U	10	U	10	U
Cis-1,3-DICHLOROPROPENE	10	0.9	10	U	10	U	10	U	10	U
TRICHLOROETHENE	10	0.9	10	U	10	U	10	U	10	U
DIBROMOCHLOROMETHANE	10	1.1	10	U	10	U	10	U	10	U
1,1,2-TRICHLOROETHANE	10	0.9	10	U	10	U	10	U	10	U
BENZENE	10	1	10	U	10	U	10	U	10	U
TRANS-1,3-DICHLOROPROPENE	10	0.2	10	U	10	U	10	U	10	U
BROMOFORM	10	1.1	10	U	10	U	10	U	10	U
4-METHYL-2-PENTANONE	10	2	10	U	10	U	10	U	10	U
2-HEXANONE	10	0.9	10	UJ(c)	10	UJ(c)	10	UJ(c)	10	UJ(c)
TETRACHLOROETHENE	10	1	10	U	10	U	10	U	10	U
1,1,2,2-TETRACHLOROETHANE	10	0.6	10	U	10	U	10	U	10	U
TOLUENE	10	1.6	3	J	4	J	10	U	10	U
CHLOROBENZENE	10	0.4	10	U	10	U	10	U	10	U
ETHYLBENZENE	10	0.7	10	U	10	U	10	U	10	U
STYRENE	10	0.6	10	U	10	U	10	U	10	U
XYLENES(TOTAL)	10	0.9	10	U	10	U	10	U	10	U
DILUTION FACTOR:			1		1		1		1	

APPENDIX J

DATA VALIDATION LETTERS

Brown & Root Environmental

INTERNAL CORRESPONDENCE

C-49-4-3-279

TO: DAVE BRAYACK **DATE:** APRIL 22, 1993

FROM: KELLY A. JOHNSON **COPIES:** D. A. SCHEIB

SUBJECT: ORGANIC DATA VALIDATION - VOA
CTO 89, NWIRP BETHPAGE, BETHPAGE, NEW YORK
CASE NO. BTHPG, SDG BPG28

SAMPLES: 20/Aqueous/BP-G-

24I-02	24I-102	24I-202	24S-02	28I-02	29D-02
29I-02	29S-02	40I-02	40S-02	42I-02	42S-02
DUP1-02	DUP2-02				

RB1-02 RB3-02

TRIP BLANK-

TB3-11 TB3-12 TB3-16 TB3-17

INTRODUCTION

A validation was performed on the analytical data from the Target Compound List (TCL) volatile organic compound analysis of fourteen (14) aqueous environmental samples and six (6) aqueous field quality control blanks analyzed by PACE, Inc. - Hampton under Case No. BTHPG, SDG BPG28. These samples were collected by Brown & Root Environmental Corporation from March 11 - 17, 1993.

Included with this sample set are two rinsate blanks (designated RB-), and four trip blanks (i.e., TRIP BLANK; designated by date). Additionally, two field duplicate pairs, (BP-G-29I-02, BP-G-DUP1-02) and (BP-G-40I-02, BP-G-DUP2-02), were included in this sample set.

All analyses were conducted in accordance with Naval Energy and Environmental Support Activity (NEESA) Level D QA/QC criteria, using Contract Laboratory Program (CLP) Statement of Work (SOW) OLM01.8 analytical and reporting protocols.

The data contained in this SDG were validated with regard to the following parameters:

* • Holding times
* • GC/MS tuning and system performance
  • Initial/continuing calibrations
  • Field and laboratory method blank analysis
* • Internal standards performance
* • Surrogate spike recoveries
* • Matrix spike/matrix spike duplicate results
* • Compound identification
* • Detection limits
* • Compound quantitation
* • Data completeness

The symbol (*) indicates that all quality control criteria were met for this parameter. Documentation of compliance for these indicated parameters is provided in the attached Appendix C (Regional Worksheets).

Problems affecting data quality are discussed below; documentation supporting these findings is presented in Appendix D. Qualified Analytical Results are presented in Appendix A.

SUMMARY

Volatile Organic Compound Analysis

Two of the continuing calibrations performed displayed some noncompliances. For the continuing calibrations performed on 3/18 and 3/19/93 the Percent Differences (%Ds) between the initial and continuing calibration response factors for acetone, carbon disulfide, 1,2-dichloroethene, and 4-methyl-2-pentanone exceeded the 25% quality control criterion. Positive and nondetected results reported for these compounds in the associated samples were qualified as estimated, coded [J(c) and UJ(c)], respectively. No bias can be determined.

Methylene chloride was detected at a maximum concentration of 6 µg/L in the analysis of laboratory method blanks, and acetone was detected in a maximum concentration of 96 µg/L in the analysis of an associated rinsate blank. Action levels of 60 µg/L methylene chloride and 960 µg/L acetone were used to evaluate the data. Sample aliquot size and dilution factors were considered during

application of the action levels. Positive results reported for the blank contaminants at concentrations less than the Contract Required Quantitation Limit (CRQL) and within the action level, have been replaced by the CRQL value and are qualified as undetected, coded [U(b)]. These results are believed to be false positives. Positive results reported for the blank contaminants at concentrations above the CRQL but within the validation action level are likewise qualified as undetected, coded [U(b)]. No actions were necessary for acetone as the only positive results reported for this compound were detected in the two rinsate blanks.

ADDITIONAL COMMENTS

No other problems were noted. Positive results reported at concentrations below the associated Contract Required Quantitation Limit (CRQL), are qualified as estimated, [J]. No Tentatively Identified Compounds (TICs) were detected in the laboratory method blanks or environmental samples.

EXECUTIVE SUMMARY

Laboratory Performance Issues: Methylene chloride was detected in the laboratory method blank. The %D between initial and continuing calibration response factors for several compounds was greater than 25%.

Other Factors Affecting Data Quality: Acetone was detected in the rinsate blanks. Positive sample results reported at concentrations below the CRQL are qualified as estimates, coded [J].

The data for these analyses were reviewed with reference to the EPA Functional Guidelines for Organic Data Validation (3/90), as amended for use within EPA Region II, and the NEESA guidelines "Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program" (20.2-047B, 6/88). The text of this report has been formulated to address only those problem areas affecting data quality.

MEMO TO: DAVE BRAYACK
DATE: APRIL 22, 1993 - PAGE 4

"I attest that the data referenced herein was validated according to the agreed upon validation criteria as specified in the NEESA guidelines and the Quality Assurance Project Plan (QAPP)."

Kelly A Johnson

Brown & Root Environmental Corporation

Kelly A. Johnson
Chemist/Data Validator

Debra A. Scheib

Brown & Root Environmental Corporation

Debra A. Scheib
CLEAN Quality Assurance Manager

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as Reported by the Laboratory
3. Appendix C - Regional Worksheets
4. ApNavy Installation Restoration Program" (20.2-047B, 6/88). The text of this report has been formulated to address only those problem areas affecting data quality.

Brown & Root Environmental INTERNAL CORRESPONDENCE

C-49-3-3-175

TO: DAVE BRAYACK **DATE:** MARCH 17, 1993

FROM: KELLY A. JOHNSON **COPIES:** D. A. SCHEIB

SUBJECT: ORGANIC DATA VALIDATION
PESTICIDES/PCBs
NWIRP BETHPAGE, BETHPAGE, NEW YORK
CASE NO. BTHPG, SDG NO. SB242

SAMPLES: 10/Soil/BP-SB-

242I10	242I150	243I140
FD101	242I160	243I150
242I140	243I130	243I20

6/Aqueous/

BP-SB-RB101	BP-SB-FB101	BP-SB-RB103
TRIP BLANK-1	TRIP BLANK-2	TRIP BLANK-3

INTRODUCTION

A validation was performed on the analytical data from the Target Compound List (TCL) volatile organic compound analysis of nine (9) soil samples and six (6) aqueous field quality control blanks analyzed by PACE, Inc. - Hampton under Case No. BTHPG, SDG SB242. These samples were collected by Halliburton NUS Corporation from January 13 - 26, 1993.

Included with this sample set is one field duplicate pair (samples BP-SB242I150, BP-SBFD101), one field blank (designated -FB), two rinsate blanks (designated -RB), and three trip blanks (designated TRIP BLANK-).

All analyses were conducted in accordance with Naval Energy and Environmental Support Activity (NEESA) Level D Quality Assurance/Quality Control (QA/QC) criteria, using Contract Laboratory Program (CLP) Statement of Work (SOW) OLM01.8 analytical and reporting protocols.

The data contained in this SDG were validated with regard to the following parameters:

*	•	Holding times
*	•	C/MS tuning and system performance
	•	Initial/continuing calibrations
	•	Field and laboratory method blank results
*	•	Internal standards performance
	•	Surrogate spike recoveries
*	•	Matrix spike/matrix spike duplicate results
*	•	Field duplicate precision
*	•	Compound identification
*	•	Detection limits
*	•	Compound quantitation
*	•	Tentatively Identified Compounds (TICs)
*	•	Data completeness

The symbol (*) indicates that all quality control criteria were met for this parameter. Documentation of compliance for these indicated parameters is provided in the attached Appendix C (Regional Worksheets).

Problems affecting data quality are discussed below; documentation supporting these findings is presented in Appendix D. Qualified Analytical results are presented in Appendix A.

SUMMARY

Volatile Organic Compound Analysis

For sample BP-SB-242I10, the toluene-d8 surrogate spike percent recovery (%R) exceeded the upper quality control limit, and the bromofluorobenzene surrogate %R was below the lower quality control limit. In addition, the chlorobenzene-d5 internal standard area was below the lower quality control limit. The laboratory reanalyzed the sample, however, there were no marked improvements regarding the aforementioned quality control criteria. All positive results and nondetects are qualified as estimated, [coded J(s,a) and UJ(s,a)], respectively.

Some continuing calibration percent differences (%Ds) reported for 4-methyl-2-pentanone, 2-hexanone, and carbon disulfide exceeded the 25% quality control limit. Nondetects for these compounds are

qualified as estimated, [coded UJ(c)], in affected samples; no positive results were reported.

A continuing calibration %D for chloromethane exceeded 90%. The nondetected results reported for this compound in the associated samples are considered to be unusable and are qualified as rejected, [coded R(c)]. No associated positive results were reported.

Methylene chloride was detected at a maximum concentration of 4 µg/Kg in a laboratory method blank and 76 µg/L acetone was detected in a rinsate blank. Action levels of 40 µg/Kg and 760 µg/Kg, respectively, were used to evaluate the data. Moisture correction and dilution factors were considered during the application of the action levels. Positive results reported for methylene chloride and acetone at concentrations less than the Contract Required Quantitation Limit (CRQL) and the validation action level, have been replaced by the CRQL value and are qualified as undetected, [coded U(b)]. These results are considered to be false positives. Positive results reported for methylene chloride and acetone at concentrations above the CRQL but within the validation action level, remain as reported and are likewise qualified as undetected, [coded U(b)]. The common laboratory contaminant 2-butanone was also detected in a field quality control blank, however, no actions were warranted because no positive results were reported for this compound in any associated environmental sample.

ADDITIONAL COMMENTS

No other problems were noted. Positive results reported at concentrations below the CRQL are qualified as estimated, [J].

EXECUTIVE SUMMARY

Laboratory Performance Issues: Chloromethane nondetects in some samples are considered to be unreliable because the laboratory could not demonstrate sustained calibration for this compound. Minor calibration exceedances were noted for several other compounds. Methylene chloride was detected in laboratory method blanks.

Other Factors Affecting Data Quality: Sample BP-SB-242I10 demonstrated matrix interferences as evidenced by problems with surrogate recovery and internal standards performance. Acetone and

MEMO TO: DAVE BRAYACK
DATE: MARCH 17, 1993 - PAGE 4

2-butanone were detected in associated field quality control blanks. Positive results reported at concentrations below the CRQL are qualified as estimates.

The data for these analyses were reviewed with reference to the EPA Functional Guidelines for Organic Data Validation (3/90), as amended for use within EPA Region II, and the NEESA guidelines "Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program" (20.2-047B, 6/88). The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein was validated according to the agreed upon validation criteria as specified in the NEESA guidelines and the Quality Assurance Project Plan (QAPP)."

Kelly A Johnson

Halliburton NUS Corporation

Kelly A. Johnson
Chemist/Data Validator

Debra A. Scheib

Halliburton NUS Corporation

Debra A. Scheib
CLEAN Quality Assurance Manager

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as Reported by the Laboratory
3. Appendix C - Regional Worksheets
4. Appendix D - Support Documentation

Brown & Root Environmental

INTERNAL CORRESPONDENCE

C-49-3-3-188

TO: DAVE BRAYACK

DATE: MARCH 31, 1993

FROM: NORMAN J. STRAUB

COPIES: D. A. SCHEIB

SUBJECT: ORGANIC DATA VALIDATION
PESTICIDES/PCBs
NWIRP BETHPAGE, BETHPAGE, NEW YORK
CASE NO. BTHPG, SDG SB121

SAMPLES: 19/Soil/BP-

SD201-A	SS103-A	SS210-A
SD202-A	SS104-A	SS212-A
SB12103-A	SS105-A	SS214-A
SB20603-A	SS106-A	SS216-A
SB21503-A	SS207-A	SS322-A
SS101-A	SS208-A	DUP01-A
SS102-A		

1/Aqueous/

BP-SS210-RB

INTRODUCTION

A validation was performed on the analytical data from the organic fraction Target Compound List (TCL) pesticide and PCB analysis of nineteen (19) soil samples and one (1) aqueous field quality control blank analyzed by PACE, Inc. - Hampton under Case No. BTHPG, SDG SB121. These samples were collected by Halliburton NUS Corporation on December 15, 1992.

Included with this sample set is one field duplicate pair (samples BP-SS207-A, BPDUP01-A), and one rinsate blank (designated -RB). Additionally, sample BP-SS210-A is included in this sample set, however, its field duplicate, sample BP-DUP02, was analyzed and reported under SDG SS210.

All analyses were conducted in accordance with Naval Energy and Environmental Support Activity (NEESA) Level D QA/QC criteria, using Contract Laboratory Program (CLP) Statement of Work (SOW) OLM01.8 analytical and reporting protocols.

The data contained in this SDG were validated with regard to the following parameters:

* • Holding times
* • GC/MS tuning and system performance
  • Initial/continuing calibrations
* • Field and laboratory method blank analysis
* • Internal standards performance
  • Surrogate spike recoveries
  • Matrix spike/matrix spike duplicate results
* • Field duplicate precision
  • Compound identification
* • Detection limits
  • Compound quantitation
  • Data completeness

The symbol (*) indicates that all quality control criteria were met for this parameter. Documentation of compliance for these indicated parameters is provided in the attached Appendix C (Regional Worksheets).

Problems affecting data quality are discussed below; documentation supporting these findings is presented in Appendix D. Qualified Analytical Results are presented in Appendix A.

SUMMARY

Pesticide/PCB Compound Analysis

The initial calibration Percent Relative Standard Deviations (%RSDs) for α-BHC and Δ-BHC on the SPB-608 analytical column were less than the 20% quality control limit. Nondetects reported for these compounds are qualified as estimated, [coded UJ(c)], in all affected samples.

The Relative Percent Difference (RPD) exceeded 25% for methoxychlor for the continuing calibration INDA mixture analysis performed on the SPB-608 analytical column (01/09/93, 0845 hours). Nondetects reported for methoxychlor are qualified as estimated, [coded UJ(c)], in affected samples.

The retention time window established by the initial calibration on the SPB-608 analytical column was marginally exceeded by the

endosulfan II continuing calibration standard analyzed on 01/10/93 at 1045 hours. No action was taken because review of the affected sample chromatograms did not indicate the presence of endosulfan II in an expanded retention time window.

The percent recovery (%R) reported for the surrogate spike compound Tetrachloro-m-xylene (TCX) on one or both analytical columns was marginally below the lower advisory limit for samples BP-: SB21503-A, SS104-A, SS208-A, SS210-A and SS214-A. In accordance with EPA Region II data validation protocol, positive results in these samples are qualified as estimated, [coded J(s)]; no action is taken for associated nondetects. These results are potentially biased low.

One decachlorobiphenyl (DCB) surrogate spike compound recovery was < 10% while one or both TCX recoveries were marginally below the lower advisory limit for samples BP-: SD201-A, SD202-A, SS207-A and SS216-A. In accordance with EPA Region II data validation protocol, positive results reported in these affected samples have been qualified as estimated, [coded J(s)]; associated nondetects have been rejected, [coded R(s)].

Zero percent recoveries of both surrogates for both analytical columns were reported for sample BP-SB12103-A and its dilution analysis. It is believed that the laboratory failed to surrogate spike this sample. In accordance with EPA Region II data validation protocol, positive results reported in this sample are qualified as estimated, [coded J(s)]; nondetects are rejected, [coded R(s)].

The Matrix Spike/Matrix Spike Duplicate (MS/MSD) %Rs reported for 4,4'-DDT in the spiked sample analyses of BP-DUP01-A greatly exceeded the upper quality control limit. No action was taken in accordance with USEPA Region II data validation protocol.

Reported positive results for some samples exceeded the linear calibration range and required dilution analyses. The dilution analysis results are reported in Appendix A for the affected over range target compounds.

Positive results reported for 4,4'-DDE and 4,4'-DDT in sample BP-DUP01-A were greater than the respective upper linear calibration limits for these compounds, however, dilution analyses were not performed as required. These results are therefore, then,

qualified as estimated, [coded J(q)], due to the uncertainty associated with quantitation beyond the established calibration range.

The laboratory, in violation of CLP analytical protocol, used only a designated singular peak to quantify the multicomponent analytes. The laboratory was contacted on 03/20/93 and a request for recalculation and resubmission of incorrect data summary forms (Forms 1 and 10B) was made at that time. The corrected forms were received on 04/12/93.

Some sample results reported for aroclor-1248 and aroclor-1254 and one result reported for 4,4'-DDT in sample BP-DUP01-A were not confirmed by GC/MS as required by the analytical SOW OLM01.8. The laboratory did, however, perform GC/MS confirmation on one sample (BP-SB20603) for aroclor-1248. The laboratory stated that additional GC/MS analyses were not performed because it was felt that the confirmed analytical result was representative of all other positive results reported for aroclor-1248 in samples collected in this sampling round. No validation actions were taken, because review of the affected sample chromatograms indicated that a correct identification of the affected compound mixture was made based on retention times.

The quantitative agreement between corollary analyte values generated on both analytical columns was greater than 25% for some samples with positive results reported for aroclor-1248, aroclor-1254, 4,4'-DDT, 4,4'-DDD, 4,4'-DDE, heptachlor epoxide, and dieldrin. These positive values have been qualified as estimated, [coded J(q)].

ADDITIONAL COMMENTS

No other problems were noted. Some results were reported at concentrations below the associated Contract Required Quantitation Limit (CRQL).

EXECUTIVE SUMMARY

Laboratory Performance Issues: Initial calibration %RSDs were not met for two BHC compounds. The continuing calibration RPD for methoxychlor failed to meet quality control limits. Endosulfan II responded outside the established retention time window for a continuing calibration run. Sample BP-DUP01-A should have been run

as a dilution and was not. The laboratory incorrectly quantitated the multicomponent analytes and had to be contacted for recalculation and resubmission of the affected data. The laboratory failed to perform several confirmatory analyses. It is believed that the laboratory failed to spike one sample with surrogates.

Other Factors Affecting Data Quality: Surrogate recoveries were outside of advisory limits for several samples. MS/MSD %Rs for 4,4'-DDT exceeded quality control limits.

The data for these analyses were reviewed with reference to the EPA Functional Guidelines for Organic Data Validation (3/90), as amended for use within EPA Region II, and the NEESA guidelines "Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program" (20.2-047B, 6/88). The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein was validated according to the agreed upon validation criteria as specified in the NEESA guidelines and the Quality Assurance Project Plan (QAPP)."

Kelly A Johnson for
Halliburton NUS Corporation

Norman J. Straub
Chemist/Data Validator

Debra A. Scheib
Halliburton NUS Corporation

Debra A. Scheib
CLEAN Quality Assurance Manager

MEMO TO: DAVE BRAYACK
DATE: MARCH 31, 1993 - PAGE 6

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as Reported by the Laboratory
3. Appendix C - Regional Worksheets
4. Appendix D - Support Documentation

Brown & Root Environmental

INTERNAL CORRESPONDENCE

C-49-4-3-171

TO: DAVE BRAYACK **DATE:** APRIL 14, 1993

FROM: KELLY A. JOHNSON **COPIES:** D. A. SCHEIB

SUBJECT: ORGANIC DATA VALIDATION - VOA
CTO 89, NWIRP BETHPAGE, BETHPAGE, NEW YORK
CASE NO. BTHPG, SDG BPG41

SAMPLES: 8/Aqueous/BP-G-

41I-02 41S-02 USGS-02 27I1-02

RB5-02 FB1-02

TRIP BLANK-

3-18-93 3-19-93

INTRODUCTION

A validation was performed on the analytical data from the Target Compound List (TCL) volatile organic compound analysis of four (4) aqueous environmental samples and four (4) aqueous field quality control blanks analyzed by PACE, Inc. - Hampton under Case No. BTHPG, SDG BPG41. These samples were collected by Halliburton NUS Corporation from March 18 - 19, 1993.

Included with this sample set are one rinsate blank (designated RB-), one field blank (designated FB-), and two trip blanks (i.e., TRIP BLANK; designated by date). Additionally, sample BP-SS210-A is included in this sample set, however, its field duplicate, sample BP-DUP02, was analyzed and reported under SDG SS210.

All analyses were conducted in accordance with Naval Energy and Environmental Support Activity (NEESA) Level D QA/QC criteria, using Contract Laboratory Program (CLP) Statement of Work (SOW) OLM01.8 analytical and reporting protocols.

The data contained in this SDG were validated with regard to the following parameters:

* • Holding times
* • GC/MS tuning and system performance
* • Initial/continuing calibrations
  • Field and laboratory method blank analysis
* • Internal standards performance
* • Surrogate spike recoveries

* • Matrix spike/matrix spike duplicate results
* • Compound identification
* • Detection limits
* • Compound quantitation
* • Data completeness

The symbol (*) indicates that all quality control criteria were met for this parameter. Documentation of compliance for these indicated parameters is provided in the attached Appendix C (Regional Worksheets).

Problems affecting data quality are discussed below; documentation supporting these findings is presented in Appendix D. Qualified Analytical Results are presented in Appendix A.

SUMMARY

Volatile Organic Compound Analysis

Methylene chloride was detected at a maximum concentration of 6 µg/L in the analysis of laboratory method blanks, and acetone was detected in a maximum concentration of 91 µg/L in the analysis of an associated field blank. Action levels of 60 µg/L methylene chloride and 910 µg/L acetone were used to evaluate the data. Sample aliquot size and dilution factors were considered during application of the action levels. Positive results reported for the blank contaminants at concentrations less than the Contract Required Quantitation Limit (CRQL) and within the action level, have been replaced by the CRQL value and are qualified as undetected, coded [U(b)]. These results are believed to be false positives. Positive results reported for the blank contaminants at concentrations above the CRQL but within the validation action level are likewise qualified as undetected, coded [U(b)].

ADDITIONAL COMMENTS

No other problems were noted. Positive results reported at concentrations below the associated Contract Required Quantitation Limit (CRQL), are qualified as estimated, [J]. No Tentatively Identified Compounds (TICs) were detected in the laboratory method blanks or environmental samples.

MEMO TO: DAVE BRAYACK
DATE: APRIL 14, 1993 - PAGE 3

EXECUTIVE SUMMARY

Laboratory Performance Issues: Methylene chloride was detected in the laboratory method blank.

Other Factors Affecting Data Quality: Acetone was detected in the field and rinsate blanks. Positive sample results reported at concentrations below the CRQL are qualified as estimates.

The data for these analyses were reviewed with reference to the EPA Functional Guidelines for Organic Data Validation (3/90), as amended for use within EPA Region II, and the NEESA guidelines "Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program" (20.2-047B, 6/88). The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein was validated according to the agreed upon validation criteria as specified in the NEESA guidelines and the Quality Assurance Project Plan (QAPP)."

Halliburton NUS Corporation

Kelly A. Johnson
Chemist/Data Validator

Halliburton NUS Corporation

Debra A. Scheib
CLEAN Quality Assurance Manager

MEMO TO: DAVE BRAYACK
DATE: APRIL 14, 1993 - PAGE 4

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as Reported by the Laboratory
3. Appendix C - Regional Worksheets
4. Appendix D - Support Documentation

Brown & Root Environmental

INTERNAL CORRESPONDENCE

C-49-06-3-158

TO: DAVE BRAYACK DATE: JUNE 15, 1993

FROM: MICHELLE L. ALLEN COPIES: D. A. SCHEIB

SUBJECT: ORGANIC DATA VALIDATION
VOLATILES AND PCBs
CTO 089, NWIRP BETHPAGE, BETHPAGE, NEW YORK
CASE NO. BETHP, SDG NO. BPDR2

SAMPLES: 3/Soil/

BP-DR-27S3	BP-DR-119	BP-DR-121

10/Aqueous/

BP-PW-08	BP-PW-09	BP-PW-10
BP-PW-11	BP-PW-14	BP-PW-DU-01
BP-PW-MS-01		
BP-PW-TB-01	BP-DR-TB-01	BP-DR-RB-01

INTRODUCTION

A validation was performed on the CTO 089 NIWIRP Bethpage site analytical data from the Target Compound List (TCL) volatile organic compound analysis of three (3) soil and ten (10) aqueous samples analyzed by PACE, Inc. - Hampton under Case No. BETHP, SDG BPDR2. One soil sample, BR-DR-121, was also analyzed for polychlorinated biphenyl compounds (PCBs). These samples were collected by Brown & Root Environmental on April 22-23, 1993.

Included with this sample set is two field duplicate pairs (samples BP-PW-08 and BP-PW-DU-01, BP-PW-14 and BP-PW-MS-01), one rinsate blank (designated -RB-), and two trip blanks (designated -TB-). A Matrix Spike/Matrix Spike Duplicate (MS/MSD) was not requested for the soil samples in the volatile fraction and for the PCB sample, consequently, the data could not be validated for this parameter.

All analyses were conducted in accordance with Naval Energy and Environmental Support Activity (NEESA) Level D Quality Assurance/Quality Control (QA/QC) criteria, using Contract Laboratory Program (CLP) Statement of Work (SOW) OLM01.8 analytical and reporting protocols.

The data contained in this SDG were validated with regard to the following parameters:

*	•	Holding times
*	•	GC/MS tuning and system performance
	•	Initial/continuing calibrations
	•	Field and laboratory method blank results
*	•	Internal standards performance
	•	Surrogate spike recoveries
*	•	Matrix spike/matrix spike duplicate results
	•	Field duplicate precision
	•	Compound identification
*	•	Detection limits
	•	Compound quantitation
*	•	Tentatively Identified Compounds (TICs)
*	•	Data completeness

The symbol (*) indicates that all quality control criteria were met for this parameter. Documentation of compliance for these indicated parameters is provided in the attached Appendix C (Regional Worksheets).

Problems affecting data quality are discussed below; documentation supporting these findings is presented in Appendix D. Qualified Analytical Results are presented in Appendix A.

SUMMARY

Volatile Organic Compound Analysis

The initial calibration Percent Relative Standard Deviation (%RSD) for acetone exceeded 30%. No actions were taken as no positive results were reported for this compound in the affected samples and nondetects were not compromised. In addition, some continuing calibration Percent Differences (%Ds) reported for acetone and carbon disulfide exceeded the 25% quality control limit. Nondetects for these compounds are qualified as estimated, [coded UJ(c)], in affected samples; no positive results were reported.

Methylene chloride was detected at a maximum concentration of 4 µg/Kg, and acetone was detected at a maximum concentration of 7 µg/Kg in the laboratory method blanks. Action levels of 40 µg/Kg and 70 µg/Kg, respectively, were used to evaluate the low level soil data. Moisture correction and dilution factors were

considered during the application of the action levels. Positive results reported for methylene chloride and acetone at concentrations less than the Contract Required Quantitation Limit (CRQL) and the validation action level, have been replaced by the CRQL value and are qualified as undetected, [coded U(b)]. These results are considered to be false positives. Positive results reported for acetone at concentrations above the CRQL but within the validation action level, remain as reported and are likewise qualified as undetected, [coded U(b)]. No contamination was found in the either the aqueous laboratory method blanks or the field quality control blanks, therefore, the aqueous samples were not qualified for blank contamination.

Field duplicate imprecision was noted for the sample pair BP-PW-08 and BP-PW-DU-01. The Relative Percent Difference (RPD) for several compounds exceeded 30%, which is generally considered to be the evaluation limit used for aqueous samples. However, in accordance with EPA Region II data validation protocol, no actions were taken for the affected positive results because the exceedances were not considered to be "gross".

According to the laboratory case narrative, the compound 1,1,1-trichloroethane was flagged with an "E" qualifier on the Form I for sample BP-PW-DU-01. This compound slightly exceeded the calibration range but, theorectically, was still within the linear range of the instrument (209 > 200). No dilution analysis was performed because the laboratory contends this value is accurate. The positive result for this compound in samle BP-PW-DU-01 has been qualified as estimated, [coded J(q)], as it is the professional opinion of the data reviewer that the exact quantitation of this compound is not known despite the laboratory's contention that quantitation is accurate.

PCB Compound Analysis

The surrogate spike compound Tetrachloro-m-xylene (TCX) yielded Percent Recoveries (%Rs) that were less than the lower advisory limit yet > 10% for the environmental sample, laboratory method blank, and the laboratory control spike/laboratory control spike duplicate (LCS/LCSD). Surrogate recoveries outside of quality criteria suggest sample preparation, instrument performance, and/or sample matrix interference problems which may compromise the detection and quantitation of target contaminants present in the sample. According to EPA Region II data validation protocol, no

action was taken for affected sample since only one surrogate compound was below the quality control limit.

The initial calibration %RSD for alpha-BHC exceeded the 20% quality control limit. No action was warranted because the affected environmental sample was not analyzed for this compound.

The Relative Percent Difference (RPD) for alpha-BHC for Performance Evaluation Mixture (PEM) analysis (PEMH1) exceeded 25% on one analytical column. No action were taken because the associated environmental sample was not analyzed for this compound.

A retention time shift was observed for endrin on one GC column (SPB-1710) in the PEM analyses (PEMHG). Retention time shifts were also reported on the same column for endosulfan II, endosulfan sulfate, and endrin aldehyde in the Independent B Mixture (INDBMHE). No actions were taken in the associated environmental sample since this sample was not analyzed for these compounds and the compounds were within the retention time windows on the other GC column (SPB-608).

The Percent Difference (%D) of the positive results obtained on the two GC columns exceeded 25% for the PCB results reported in the sample, BP-DR-121. The positive result for Aroclor-1254 was > 90% between the two GC columns, and the positive result for Aroclor-1248 (taken from the sample dilution) was > 25% yet < 50%. The diluted result was chosen because the original result exceeded the instrument's linear calibration range. In addition, the aforementioned compounds were quantified from two peaks (instead of three) due to interference between the Aroclors. In accordance with EPA Region II data validation protocol, positive results for Aroclor 1254 and 1248 in the affected sample were qualified as rejected, [coded R(y)] and estimated, [coded J(y)], respectively.

ADDITIONAL COMMENTS

No other problems were noted. Positive results reported at concentrations below the associated Contract Required Quantitation Limit (CRQL), are qualified as estimated, coded [J]. A summary of Tentatively Identified Compounds (TICs) are included in Appendix A.

EXECUTIVE SUMMARY

Laboratory Performance Issues: Minor calibration exceedances were

noted for some compounds. Methylene chloride and acetone were detected in laboratory method blanks. TCX surrogate recoveries were below quality control limits for the laboratory method blank and laboratory control spike MS and MSD. Alpha-BHC RPD criteria was not met for one column for one PEM analyses. The %Ds between the two GC columns exceeded quality control criteria for positive PCB results.

Other Factors Affecting Data Quality: Field duplicate imprecision was observed for one field duplicate pair in the volatile fraction. TCX surrogate recoveries failed to meet advisory limits for the PCB sample.

The data for these analyses were reviewed with reference to the EPA Functional Guidelines for Organic Data Validation (3/90), as amended for use within EPA Region II, and the NEESA guidelines "Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program" (NEESA 20.2-047B, 6/88). The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein was validated according to the agreed upon validation criteria as specified in the NEESA guidelines and the Quality Assurance Project Plan (QAPP)."

MEMO TO: DAVE BRAYACK
DATE: JUNE 15, 1993 - PAGE 6

Michelle L. Allen

Brown & Root Environmental

Michelle L. Allen
Chemist/Data Validator

Debra A. Scheib

Brown & Root Environmental

Debra A. Scheib
CLEAN Quality Assurance Manager

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as Reported by the Laboratory
3. Appendix C - Regional Worksheets
4. Appendix D - Support Documentation

Brown & Root Environmental

INTERNAL CORRESPONDENCE

C-49-07-3-084

TO: DAVE BRAYACK DATE: JULY 12, 1993

FROM: MICHELLE L. ALLEN COPIES: D. A. SCHEIB

SUBJECT: ORGANIC DATA VALIDATION
TCL VOLATILES
CTO 089, NWIRP BETHPAGE, BETHPAGE, NEW YORK
CASE NO. BTHPG, SDG NO. 43I01

SAMPLES: 4/Aqueous/

BP-G-43I-01 BP-G-DUP5-26

BP-G-RB5-26 TRIPBLANK 5-26

INTRODUCTION

A validation was performed on the CTO 089 NIWIRP Bethpage site analytical data from the Target Compound List (TCL) volatile organic compound analysis of four (4) aqueous samples analyzed by PACE, Inc. - Hampton under Case No. BETHP, SDG 43I01. These samples were collected by Brown & Root Environmental on May 26, 1993.

Included with this sample set is one field duplicate pair (samples BP-G-43I-01 and BP-G-DU5-26), one rinsate blank (designated -RB5-), and one trip blank (designated TRIPBLANK 5-). A Matrix Spike/Matrix Spike Duplicate (MS/MSD) was not requested for these volatile aqueous samples since they are an addendum to a previous Bethpage sampling round. Hence, the data could not be validated for this parameter.

All analyses were conducted in accordance with Naval Energy and Environmental Support Activity (NEESA) Level D Quality Assurance/Quality Control (QA/QC) criteria, using Contract Laboratory Program (CLP) Statement of Work (SOW) OLM01.8 analytical and reporting protocols.

The data contained in this SDG were validated with regard to the following parameters:

* • Holding times
* • GC/MS tuning and system performance
  • Initial/continuing calibrations
  • Field and laboratory method blank results
* • Internal standards performance
* • Surrogate spike recoveries
* • Field duplicate precision
* • Compound identification
* • Detection limits
* • Compound quantitation
* • Tentatively Identified Compounds (TICs)
* • Data completeness

The symbol (*) indicates that all quality control criteria were met for this parameter. Documentation of compliance for these indicated parameters is provided in the attached Appendix C (Regional Worksheets).

Problems affecting data quality are discussed below; documentation supporting these findings is presented in Appendix D. Qualified Analytical Results are presented in Appendix A.

SUMMARY

Volatile Organic Compound Analysis

The initial calibration Percent Relative Standard Deviation (%RSD) for acetone exceeded 30% The positive result reported for this compound in sample BP-G-RB5-26 was qualified as estimated [coded J(c)]. Nondetected results in the other affected samples were not compromised. In addition, the continuing calibration Percent Differences (%Ds) reported for carbon disulfide and 2-hexanone were greater than 25%. Nondetects for these compounds are qualified as estimated, [coded UJ(c)], in affected samples; no positive results were reported.

Methylene chloride was detected at a maximum concentration of 3 µg/L in the laboratory method blank and acetone was detected at a maximum concentration of 86 µg/L in the field quality control blank, BP-G-RB5-26. Action levels of 30 µg/L and 860 µg/L, respectively, were used to evaluate the low level water data.

Aliquot size used for analysis was considered during the application of the action levels. A positive result reported for methylene chloride in sample BP-G-DU5-26 at a concentration less than the Contract Required Quantitation Limit (CRQL) and the validation action level, has been replaced by the CRQL value and is qualified as undetected, [coded U(b)]. This result is considered to be a false positive. No positive results were reported for acetone, therefore, associated environmental samples were not qualified for blank contamination for this compound.

No other problems were noted. Positive results reported at concentrations below the associated Contract Required Quantitation Limit (CRQL), are qualified as estimated, coded [J].

EXECUTIVE SUMMARY

Laboratory Performance Issues: Minor calibration exceedances were noted for some compounds. Methylene chloride was detected in laboratory method blank.

Other Factors Affecting Data Quality: Acetone was detected in the rinsate field quality control blank.

The data for these analyses were reviewed with reference to the EPA Functional Guidelines for Organic Data Validation (3/90), as amended for use within EPA Region II, and the NEESA guidelines "Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program" (NEESA 20.2-047B, 6/88). The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein was validated according to the agreed upon validation criteria as specified in the NEESA guidelines and the Quality Assurance Project Plan (QAPP)."

Michelle L. Allen

Brown & Root Environmental

Michelle L. Allen
Chemist/Data Validator

MEMO TO: DAVE BRAYACK
DATE: JULY 12, 1993 - PAGE 4

Brown & Root Environmental

Debra A. Scheib
CLEAN Quality Assurance Manager

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as Reported by the Laboratory
3. Appendix C - Regional Worksheets
4. Appendix D - Support Documentation

Data Qualifier Key

U	-	Value is a nondetect as reported by the laboratory.
U(b)	-	Value is considered to be a false positive attributable to blank contamination.
J	-	Value is estimated because it is reported at a concentration less than the associated CRQL.
J(c)	-	Positive result is considered to be estimated based on exceedance of associated calibration criteria.
UJ(c)	-	Nondetected result is considered to be estimated based on exceedance of associated calibration criteria.

APPENDIX K

RISK ASSESSMENT CALCULATIONS

UPPER 95% CONFIDENCE LIMIT ON THE ARITHMETIC MEAN

Enter Chemical: Aroclor-1242 (Site 1)
Enter Matrix: Soil

Enter number of samples: 9
Degrees of Freedom: 8

Enter sample results (use 1/2 CRDL for non-detects)

No.	Conc.	log(Conc.)	(Xi-Xbar)**2	(Xi-Xbar)**2
1	1800	7.495542	11985829	2.882395
2	1700	7.438384	12688240	2.691579
3	285	5.652489	24771082	.0211095
4	19	2.944439	27489632	8.141556
5	18500	9.825526	1.7524e8	16.22274
6	19	2.944439	27489632	8.141556
7	25000	10.12663	3.8959e8	18.73895
8	18	2.890372	27500119	8.453024
9	17.5	2.862201	27505363	8.617626
10		0	0	0
11		0	0	0
12		0	0	0
13		0	0	0
14		0	0	0
15		0	0	0
16		0	0	0
17		0	0	0
18		0	0	0
19		0	0	0
20		0	0	0
21		0	0	0
22		0	0	0
23		0	0	0
24		0	0	0
25		0	0	0
26		0	0	0
27		0	0	0
28		0	0	0
29		0	0	0
30		0	0	0
31		0	0	0
32		0	0	0
33		0	0	0
34		0	0	0
35		0	0	0
36		0	0	0
37		0	0	0
38		0	0	0
39		0	0	0
40		0	0	0
41		0	0	0
42		0	0	0
43		0	0	0
44		0	0	0
Mean:	5262.056	5.797780	9514.854	3.039542
		329.5672		

Upper 95% confidence limit on arithmetic mean: 11161.26
Upper 95% confidence limit on geometric mean: 3.7051e8

UPPER 95% CONFIDENCE LIMIT ON THE ARITHMETIC MEAN

Enter Chemical: Aroclor-1248 (Site 1)
Enter Matrix: Soil

Enter number of samples: 9
Degrees of Freedom: 8

Enter sample results (use 1/2 CRDL for non-detects)

No.	Conc.	log(Conc.)	(Xi-Xbar)**2	(Xi-Xbar)**2
1	7900	8.974618	2.012e10	.0896094
2	7500	8.922658	2.023e10	.0612011
3	25000	10.12663	1.556e10	2.106450
4	1100	7.003065	2.209e10	2.796267
5	1300000	14.07787	1.323e12	29.18814
6	2500	7.824046	2.168e10	.7245818
7	900	6.802395	2.215e10	3.507661
8	1700	7.438384	2.191e10	1.529887
9	1000	6.907755	2.212e10	3.124107
10		0	0	0
11		0	0	0
12		0	0	0
13		0	0	0
14		0	0	0
15		0	0	0
16		0	0	0
17		0	0	0
18		0	0	0
19		0	0	0
20		0	0	0
21		0	0	0
22		0	0	0
23		0	0	0
24		0	0	0
25		0	0	0
26		0	0	0
27		0	0	0
28		0	0	0
29		0	0	0
30		0	0	0
31		0	0	0
32		0	0	0
33		0	0	0
34		0	0	0
35		0	0	0
36		0	0	0
37		0	0	0
38		0	0	0
39		0	0	0
40		0	0	0
41		0	0	0
42		0	0	0
43		0	0	0
Mean:	149733.3	8.675270	431418.5	2.321850
		5856.279		

Upper 95% confidence limit on arithmetic mean: 417212.8
Upper 95% confidence limit on geometric mean: 21465442

UPPER 95% CONFIDENCE LIMIT ON THE ARITHMETIC MEAN

Enter Chemical: Aroclor-1254 (Site 1)
Enter Matrix: Soil

Enter number of samples: 9
Degrees of Freedom: 8

Enter sample results (use 1/2 CRDL for non-detects)

No.	Conc.	log(Conc.)	(Xi-Xbar)**2	(Xi-Xbar)**2
1	3600	8.188689	2.8636e8	.4313792
2	3400	8.131531	2.9317e8	.3595636
3	5000	8.517193	2.4094e8	.9708135
4	660	6.492240	3.9451e8	1.080882
5	170000	12.04355	2.234e10	20.35507
6	530	6.272877	3.9969e8	1.585125
7	900	6.802395	3.8503e8	.5321699
8	400	5.991465	4.0490e8	2.372924
9	210	5.347108	4.1259e8	4.773294
10		0	0	0
11		0	0	0
12		0	0	0
13		0	0	0
14		0	0	0
15		0	0	0
16		0	0	0
17		0	0	0
18		0	0	0
19		0	0	0
20		0	0	0
21		0	0	0
22		0	0	0
23		0	0	0
24		0	0	0
25		0	0	0
26		0	0	0
27		0	0	0
28		0	0	0
29		0	0	0
30		0	0	0
31		0	0	0
32		0	0	0
33		0	0	0
34		0	0	0
35		0	0	0
36		0	0	0
37		0	0	0
38		0	0	0
39		0	0	0
40		0	0	0
41		0	0	0
42		0	0	0
43		0	0	0
Mean:	20522.22	7.531894	56081.19	2.014362
		1866.638		

Upper 95% confidence limit on arithmetic mean: 55292.56
Upper 95% confidence limit on geometric mean: 938416.6

UPPER 95% CONFIDENCE LIMIT ON THE ARITHMETIC MEAN

Enter Chemical: Aroclor-1242 (Site 1) - Future soil (post remediation).
Enter Matrix: Soil

Enter number of samples: 8
Degrees of Freedom: 7

Enter sample results (use 1/2 CRDL for non-detects)

No.	Conc.	log(Conc.)	(Xi-Xbar)**2	(Xi-Xbar)**2
1	1800	7.495542	3266378.	4.845413
2	1700	7.438384	3637841.	4.597043
3	285	5.652489	11037760	.1282909
4	19	2.944439	12875987	5.521903
5	19	2.944439	12875987	5.521903
6	25000	10.12663	4.5765e8	23.35131
7	18	2.890372	12883164	5.778929
8	17.5	2.862201	12886754	5.915165
9		0	0	0
10		0	0	0
11		0	0	0
12		0	0	0
13		0	0	0
14		0	0	0
15		0	0	0
16		0	0	0
17		0	0	0
18		0	0	0
19		0	0	0
20		0	0	0
21		0	0	0
22		0	0	0
23		0	0	0
24		0	0	0
25		0	0	0
26		0	0	0
27		0	0	0
28		0	0	0
29		0	0	0
30		0	0	0
31		0	0	0
32		0	0	0
33		0	0	0
34		0	0	0
35		0	0	0
36		0	0	0
37		0	0	0
38		0	0	0
39		0	0	0
40		0	0	0
41		0	0	0
42		0	0	0
43		0	0	0
44		0	0	0
Mean:	3607.313	5.294312 199.2005	8677.647	2.819827

Upper 95% confidence limit on arithmetic mean: 9421.195
Upper 95% confidence limit on geometric mean: 1.1449e8

UPPER 95% CONFIDENCE LIMIT ON THE ARITHMETIC MEAN

Enter Chemical: Aroclor-1248 (Site 1) - Future soil (post remediation).
Enter Matrix: Soil

Enter number of samples: 8
Degrees of Freedom: 7

Enter sample results (use 1/2 CRDL for non-detects)

No.	Conc.	log(Conc.)	(Xi-Xbar)**2	(Xi-Xbar)**2
1	7900	8.974618	3802500	.9499894
2	7500	8.922658	2402500	.8514016
3	25000	10.12663	3.6290e8	4.522798
4	1100	7.003065	23522500	.9937669
5	2500	7.824046	11902500	.0309401
6	900	6.802395	25502500	1.434124
7	1700	7.438384	18062500	.3153502
8	1000	6.907755	24502500	1.192876
9		0	0	0
10		0	0	0
11		0	0	0
12		0	0	0
13		0	0	0
14		0	0	0
15		0	0	0
16		0	0	0
17		0	0	0
18		0	0	0
19		0	0	0
20		0	0	0
21		0	0	0
22		0	0	0
23		0	0	0
24		0	0	0
25		0	0	0
26		0	0	0
27		0	0	0
28		0	0	0
29		0	0	0
30		0	0	0
31		0	0	0
32		0	0	0
33		0	0	0
34		0	0	0
35		0	0	0
36		0	0	0
37		0	0	0
38		0	0	0
39		0	0	0
40		0	0	0
41		0	0	0
42		0	0	0
43		0	0	0
Mean:	5950	7.999944	8216.708	1.212509
		2980.791		

Upper 95% confidence limit on arithmetic mean: 11455.06
Upper 95% confidence limit on geometric mean: 38557.68

UPPER 95% CONFIDENCE LIMIT ON THE ARITHMETIC MEAN

Enter Chemical: Aroclor-1254 (Site 1) - Future soil (post remediation).
Enter Matrix: Soil

Enter number of samples: 8
Degrees of Freedom: 7

Enter sample results (use 1/2 CRDL for non-detects)

No.	Conc.	log(Conc.)	(Xi-Xbar)**2	(Xi-Xbar)**2
1	3600	8.188689	3106406.	1.490236
2	3400	8.131531	2441406.	1.353950
3	5000	8.517193	10001406	2.400194
4	660	6.492240	1386506.	.2262879
5	530	6.272877	1709556.	.4831085
6	900	6.802395	878906.3	.0274043
7	400	5.991465	2066406.	.9534986
8	210	5.347108	2648756.	2.627088
9		0	0	0
10		0	0	0
11		0	0	0
12		0	0	0
13		0	0	0
14		0	0	0
15		0	0	0
16		0	0	0
17		0	0	0
18		0	0	0
19		0	0	0
20		0	0	0
21		0	0	0
22		0	0	0
23		0	0	0
24		0	0	0
25		0	0	0
26		0	0	0
27		0	0	0
28		0	0	0
29		0	0	0
30		0	0	0
31		0	0	0
32		0	0	0
33		0	0	0
34		0	0	0
35		0	0	0
36		0	0	0
37		0	0	0
38		0	0	0
39		0	0	0
40		0	0	0
41		0	0	0
42		0	0	0
43		0	0	0
Mean:	1837.5	6.967937 1062.030	1860.850	1.168746

Upper 95% confidence limit on arithmetic mean: 3084.239
Upper 95% confidence limit on geometric mean: 11534.63

UPPER 95% CONFIDENCE LIMIT ON THE ARITHMETIC MEAN

Enter Chemical: Aroclor-1248 (Site 2)
Enter Matrix: Soil

Enter number of samples: 10
Degrees of Freedom: 9

Enter sample results (use 1/2 CRDL for non-detects)

No.	Conc.	log(Conc.)	(Xi-Xbar)**2	(Xi-Xbar)**2
1	1900	7.549609	11660176	.3072468
2	6800	8.824678	2206116.	3.346584
3	133.5	4.894101	26844833	4.415080
4	73	4.290459	27475419	7.316220
5	60.5	4.102643	27606618	8.367524
6	2500	7.824046	7922536.	.6868022
7	2200	7.696213	9701356.	.4912635
8	6200	8.732305	783756.1	3.017148
9	33000	10.40426	7.6648e8	11.62095
10	280	5.634790	25348204	1.851018
11		0	0	0
12		0	0	0
13		0	0	0
14		0	0	0
15		0	0	0
16		0	0	0
17		0	0	0
18		0	0	0
19		0	0	0
20		0	0	0
21		0	0	0
22		0	0	0
23		0	0	0
24		0	0	0
25		0	0	0
26		0	0	0
27		0	0	0
28		0	0	0
29		0	0	0
30		0	0	0
31		0	0	0
32		0	0	0
33		0	0	0
34		0	0	0
35		0	0	0
36		0	0	0
37		0	0	0
38		0	0	0
39		0	0	0
40		0	0	0
41		0	0	0
42		0	0	0
43		0	0	0
Mean:	5314.7	6.995311	10033.42	2.145275
		1091.503		

Upper 95% confidence limit on arithmetic mean: 11130.52
Upper 95% confidence limit on geometric mean: 666346.8

UPPER 95% CONFIDENCE LIMIT ON THE ARITHMETIC MEAN

Enter Chemical: Aroclor-1254 (Site 2)
Enter Matrix: Soil

Enter number of samples: 10
Degrees of Freedom: 9

Enter sample results (use 1/2 CRDL for non-detects)

No.	Conc.	log(Conc.)	(Xi-Xbar)**2	(Xi-Xbar)**2
1	1250	7.130899	27406.80	2.015914
2	3750	8.229511	7105157.	6.342546
3	49	3.891820	1072157.	3.309669
4	16.5	2.803360	1140517.	8.454775
5	18	2.890372	1137316.	7.956338
6	490	6.194405	353370.8	.2336131
7	580	6.363028	254469.8	.4250494
8	1000	6.907755	7131.803	1.432056
9	3600	8.188689	6327992.	6.138597
10	91	4.510860	986942.9	1.440505
11		0	0	0
12		0	0	0
13		0	0	0
14		0	0	0
15		0	0	0
16		0	0	0
17		0	0	0
18		0	0	0
19		0	0	0
20		0	0	0
21		0	0	0
22		0	0	0
23		0	0	0
24		0	0	0
25		0	0	0
26		0	0	0
27		0	0	0
28		0	0	0
29		0	0	0
30		0	0	0
31		0	0	0
32		0	0	0
33		0	0	0
34		0	0	0
35		0	0	0
36		0	0	0
37		0	0	0
38		0	0	0
39		0	0	0
40		0	0	0
41		0	0	0
42		0	0	0
43		0	0	0
Mean:	1084.45	5.711070	1430.325	2.048009
		302.1942		

Upper 95% confidence limit on ar:thmetic mean: 1913.531
Upper 95% confidence limit on geometric mean: 106109.0

UPPER 95% CONFIDENCE LIMIT ON THE ARITHMETIC MEAN

Enter Chemical: Aroclor-1248 (Site 3)
Enter Matrix: Soil

Enter number of samples: 6
Degrees of Freedom: 5

Enter sample results (use 1/2 CRDL for non-detects)

No.	Conc.	log(Conc.)	(Xi-Xbar)**2	(Xi-Xbar)**2
1	830	6.721426	380791.8	4.691983
2	250	5.521461	1375.174	.9334147
3	44	3.784190	28532.84	.5946529
4	19.5	2.970414	37410.01	2.511948
5	85	4.442651	16362.67	.0126958
6	49	3.891820	26868.67	.4402412
7		0	0	0
8		0	0	0
9		0	0	0
10		0	0	0
11		0	0	0
12		0	0	0
13		0	0	0
14		0	0	0
15		0	0	0
16		0	0	0
17		0	0	0
18		0	0	0
19		0	0	0
20		0	0	0
21		0	0	0
22		0	0	0
23		0	0	0
24		0	0	0
25		0	0	0
26		0	0	0
27		0	0	0
28		0	0	0
29		0	0	0
30		0	0	0
31		0	0	0
32		0	0	0
33		0	0	0
34		0	0	0
35		0	0	0
36		0	0	0
37		0	0	0
38		0	0	0
39		0	0	0
40		0	0	0
41		0	0	0
42		0	0	0
43		0	0	0
Mean:	212.9167	4.555327	313.4777	1.355355
		95.13786		

Upper 95% confidence limit on arithmetic mean: 470.7898
Upper 95% confidence limit on geometric mean: 1296.072

UPPER 95% CONFIDENCE LIMIT ON THE ARITHMETIC MEAN

Enter Chemical: Aroclor-1254 (Site 3)
Enter Matrix: Soil

Enter number of samples: 6
Degrees of Freedom: 5

Enter sample results (use 1/2 CRDL for non-detects)

No.	Conc.	log(Conc.)	(Xi-Xbar)**2	(Xi-Xbar)**2
1	1800	7.495542	1882155.	6.636888
2	530	6.272877	10387.01	1.832100
3	85	4.442651	117706.2	.2272188
4	19.5	2.970414	166940.3	3.798256
5	85	4.442651	117706.2	.2272188
6	49	3.891820	143704.2	1.055768
7		0	0	0
8		0	0	0
9		0	0	0
10		0	0	0
11		0	0	0
12		0	0	0
13		0	0	0
14		0	0	0
15		0	0	0
16		0	0	0
17		0	0	0
18		0	0	0
19		0	0	0
20		0	0	0
21		0	0	0
22		0	0	0
23		0	0	0
24		0	0	0
25		0	0	0
26		0	0	0
27		0	0	0
28		0	0	0
29		0	0	0
30		0	0	0
31		0	0	0
32		0	0	0
33		0	0	0
34		0	0	0
35		0	0	0
36		0	0	0
37		0	0	0
38		0	0	0
39		0	0	0
40		0	0	0
41		0	0	0
42		0	0	0
43		0	0	0
Mean:	428.0833	4.919326	698.3694	1.659967
		136.9103		

Upper 95% confidence limit on arithmetic mean: 1002.576
Upper 95% confidence limit on geometric mean: 4549.970

SAMPLE CALCULATIONS

CLIENT NAVY CLEAN - NWIRP BETHPAGE		JOB NUMBER 1953.	
SUBJECT CALCULATION ON REPRESENTATIVE CONCENTRATION			
BASED ON		DRAWING NUMBER	
BY NORMAN J. STRAUB NJS	CHECKED BY	APPROVED BY	DATE 05/26/93

PURPOSE: CALCULATION OF CHEMICAL-SPECIFIC REPRESENTATIVE CONCENTRATION BASED ON ONE-TAILED UPPER 95% CONFIDENCE LIMIT ON THE ARITHMETIC MEAN OF A GIVEN DATA SET.

RELEVANT EQUATIONS:

$$S = \sqrt{\frac{\sum x_i^2 - \frac{(\sum x_i)^2}{n}}{n-1}}$$

WHERE: S = STANDARD DEVIATION FOR A SMALL SAMPLE POPULATION
x_i = INDIVIDUAL SAMPLE VALUE
n = SAMPLE SET POPULATION

THE UPPER 95% CONFIDENCE LIMIT OF A DATA SET IS CALCULATED BY:

$$UCL = \bar{x} + t_{1-\alpha}\left(\frac{S}{\sqrt{n}}\right)$$

WHERE: UCL = ONE-TAILED UPPER 95% CONFIDENCE LIMIT
$\bar{x}$ = ARITHMETIC MEAN OF A DATA SET
$t_{1-\alpha}$ = ONE-TAILED t DISTRIBUTION FACTOR
S = STANDARD DEVIATION
n = DATA SET POPULATION

CLIENT NAVY CLEAN - NWIRP BETHPAGE	JOB NUMBER 1953
SUBJECT CALCULATION OF REPRESENTATIVE CONCENTRATION	
BASED ON	DRAWING NUMBER
BY MJS / CHECKED BY [illegible]	APPROVED BY / DATE 05/26/93

SAMPLE CALCULATION:

FOR NWIRP BETHPAGE, SITE 2, AROCLOR-1248 DATA:

SAMPLE	DATA VALUE (µg/kg)	x^2
1	1,900	3.61×10^6
2	6,800	4.624×10^7
3	133.5	1.782×10^4
4	73	5.329×10^3
5	60.5	3.66×10^3
6	2,500	6.25×10^6
7	2,200	4.84×10^6
8	6,200	3.844×10^7
9	33,000	1.089×10^9
10	280	7.840×10^4

$\Sigma x_i = 5.315 \times 10^4$ $\Sigma x_i^2 = 1.188 \times 10^9$

$n = 10$

$df = 9$

$\bar{X} = 5.315 \times 10^3$

$$S = \left[\frac{(1.188 \times 10^9) - \frac{(5.315 \times 10^4)^2}{10}}{9} \right]^{1/2}$$

$S = 1.003 \times 10^4$

CLIENT NAVY CLEAN - NWIRP BETHPAGE	JOB NUMBER 1953
SUBJECT CALCULATION OF REPRESENTATIVE CONCENTRATION	
BASED ON	DRAWING NUMBER

BY	CHECKED BY	APPROVED BY	DATE
MJS	[illegible]		05/26/93

FOR $df = 9$, $t_{1-\alpha} = 1.833$ (FROM GILBERT, TABLE A2)
19

$$UCL = 5.315 \times 10^3 + (1.833)\left(\frac{1.003 \times 10^4}{\sqrt{10}}\right)$$

$$\boxed{UCL = 1.11 \times 10^4 = 11{,}000 \ \mu g/kg}$$

Table A2 Quantiles of the t Distribution (Values of t Such That 100p% of the Distribution Is Less Than t_p)

Degrees of Freedom	$t_{0.60}$	$t_{0.70}$	$t_{0.80}$	$t_{0.90}$	$t_{0.95}$	$t_{0.975}$	$t_{0.990}$	$t_{0.995}$
1	.325	.727	1.376	3.078	6.314	12.706	31.821	63.657
2	.289	.617	1.061	1.886	2.920	4.303	6.965	9.925
3	.277	.584	.978	1.638	2.353	3.182	4.541	5.841
4	.271	.569	.941	1.533	2.132	2.776	3.747	4.604
5	.267	.559	.920	1.476	2.015	2.571	3.365	4.032
6	.265	.553	.906	1.440	1.943	2.447	3.143	3.707
7	.263	.549	.896	1.415	1.895	2.365	2.998	3.499
8	.262	.546	.889	1.397	1.860	2.306	2.896	3.355
9	.261	.543	.883	1.383	1.833	2.262	2.821	3.250
10	.260	.542	.879	1.372	1.812	2.228	2.764	3.169
11	.260	.540	.876	1.363	1.796	2.201	2.718	3.106
12	.259	.539	.873	1.356	1.782	2.179	2.681	3.055
13	.259	.538	.870	1.350	1.771	2.160	2.650	3.012
14	.258	.537	.868	1.345	1.761	2.145	2.624	2.977
15	.258	.536	.866	1.341	1.753	2.131	2.602	2.947
16	.258	.535	.865	1.337	1.746	2.120	2.583	2.921
17	.257	.534	.863	1.333	1.740	2.110	2.567	2.898
18	.257	.534	.862	1.330	1.734	2.101	2.552	2.878
19	.257	.533	.861	1.328	1.729	2.093	2.539	2.861
20	.257	.533	.860	1.325	1.725	2.086	2.528	2.845
21	.257	.532	.859	1.323	1.721	2.080	2.518	2.831
22	.256	.532	.858	1.321	1.717	2.074	2.508	2.819
23	.256	.532	.858	1.319	1.714	2.069	2.500	2.807
24	.256	.531	.857	1.318	1.711	2.064	2.492	2.797
25	.256	.531	.856	1.316	1.708	2.060	2.485	2.787
26	.256	.531	.856	1.315	1.706	2.056	2.479	2.779
27	.256	.531	.855	1.314	1.703	2.052	2.473	2.771
28	.256	.530	.855	1.313	1.701	2.048	2.467	2.763
29	.256	.530	.854	1.311	1.699	2.045	2.462	2.756
30	.256	.530	.854	1.310	1.697	2.042	2.457	2.750
40	.255	.529	.851	1.303	1.684	2.021	2.423	2.704
60	.254	.527	.848	1.296	1.671	2.000	2.390	2.660
120	.254	.526	.845	1.289	1.658	1.980	2.358	2.617
∞	.253	.524	.842	1.282	1.645	1.960	2.326	2.576

Source: From Fisher and Yates, 1974. Used by permission.

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CLIENT NAVY CLEAN - NWIRP BETHPAGE		JOB NUMBER 1953	
SUBJECT PCB ASSOCIATED CARCINOGENIC RISK REVISION			
BASED ON RAGS, PART A GUIDANCE		DRAWING NUMBER	
BY NORMAN J. STRAUB NJS	CHECKED BY	APPROVED BY	DATE 05/27/93

PURPOSE: CALCULATE REVISED CARCINOGENIC RISKS BASED ON RESULTS OF PREVIOUS PHASE I RI RISK ASSESSMENT and INCORPORATING PHASE II RESULTS FOR PCBs CONCENTRATIONS IN SOILS.

RELEVANT EQUATIONS:

FOR EVALUATION OF CANCER RISK INCREASE DUE TO EXPOSURE TO CARCINOGENIC CHEMICALS, THE FOLLOWING EQUATION IS USED:

$$ICR = DOSE\left(mg/kg\cdot day\right) \times CSF\left(kg\cdot day/mg\right) \qquad (1)$$

WHERE:

ICR = INCREMENTAL CANCER RISK

DOSE = TIME-WEIGHTED CHEMICAL EXPOSURE AMOUNT PER UNIT RECEPTOR BODY WEIGHT

CSF = CHEMICAL-SPECIFIC CANCER SLOPE FACTOR FOR SPECIFIED EXPOSURE ROUTE.

ESTIMATION OF DOSE (CHEMICAL UPTAKE) BY A RECEPTOR IS QUANTIFIED BY:

$$DOSE\left(mg/kg\cdot day\right) = \frac{C \times IR \times EF \times ED}{BW \times AT} \qquad (2)$$

CLIENT NAVY CLEAN-NWIRP BETHPAGE		JOB NUMBER 1953	
SUBJECT PCB ASSOCIATED CARCINOGENIC RISK REVISION			
BASED ON RAGS, PART A		DRAWING NUMBER	
BY MJS	CHECKED BY [illegible]	APPROVED BY	DATE 05/27/93

WHERE:

C = CHEMICAL CONCENTRATION IN SITE MEDIA

IR = INGESTION RATE OF SITE MEDIA

EF = EXPOSURE FREQUENCY

ED = EXPOSURE DURATION

BW = RECEPTOR BODY WEIGHT

AT = AVERAGING-TIME (i.e. PERIOD OF TIME OVER WHICH EXPOSURE IS AVERAGED)

FOR CARCINOGENS, AT IS EQUAL TO THE RECEPTOR LIFETIME.

REVISION OF THE PHASE I CANCER RISK ESTIMATES FOR NWIRP BETHPAGE IS BASED ON CALCULATION OF A NEW REPRESENTATIVE CONCENTRATION (C) FOR PCBs IN SOIL AT SITES 1, 2, and 3, and SUBSTITUTING THIS REVISED CONCENTRATION INTO THE PREVIOUSLY EMPLOYED DOSE ESTIMATION EQUATIONS. SINCE RECEPTOR IR, EF, ED, BW, and AT ARE IDENTICAL IN BOTH PHASE I and II RISK ASSESSMENTS, EQUATIONS (1) and (2) CAN BE COMBINED and REDUCED TO YIELD

CLIENT NAVY CLEAN - NWIRP BETHPAGE	JOB NUMBER 1953
SUBJECT PCB ASSOCIATED CARCINOGENIC RISK REVISION	
BASED ON RAGS, PART A	DRAWING NUMBER
BY MJS / CHECKED BY [illegible]	APPROVED BY / DATE 05/27/93

THE FOLLOWING EQUATIONS (3) and (4), RESPECTIVELY:

$$\text{REVISED RISK} = \frac{\text{DOSE (REVISED)}}{\text{DOSE (PHASE I)}} \times \text{PHASE I RISK} \qquad (3)$$

$$\boxed{\text{REVISED RISK} = \frac{\text{RC (REVISED)}}{\text{RC (PHASE I)}} \times \text{PHASE I RISK}} \qquad (4)$$

WHERE:

RC (REVISED) = REVISED REPRESENTATIVE CONCENTRATION FOR PHASE I and II PCBs IN SOIL (SITE-SPECIFIC)

RC (PHASE I) = PHASE I REPRESENTATIVE CONCENTRATION FOR PCBs IN SOIL (SITE-SPECIFIC)

SAMPLE CALCULATION:

FOR PCBs IN SOIL AT SITE 2 (OFFSITE RESIDENT EXPOSURE)

- PHASE I PCB RISK = 5.7×10^{-9}
- PHASE I TOTAL RISK = 4.5×10^{-7}
- PHASE I REP CONC = 1,900 mg/kg
- PHASE I and II REP CONC = 12,900 mg/kg (REVISED RC)

(1)

$$\text{REVISED CANCER RISK} = \left(\frac{12{,}900 \text{ mg/kg}}{1{,}900 \text{ mg/kg}}\right) \times (5.7 \times 10^{-9})$$

$$\boxed{\text{REVISED CANCER RISK} = 3.9 \times 10^{-8}}$$

CLIENT NAVY CLEAN - NWIRP BETHPAGE		JOB NUMBER 1953	
SUBJECT PCB ASSOCIATED CARCINOGENIC RISK REVISION			
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BY MS	CHECKED BY [illegible]	APPROVED BY	DATE 05/27/93

(2) REVISED TOTAL CANCER RISK = (PHASE I TOTAL CANCER RISK) − (PHASE I PCB CANCER RISK) + (PHASE I and II (REVISED) PCB CANCER RISK)

$$= (4.5 \times 10^{-7}) - (5.7 \times 10^{-9}) + (3.9 \times 10^{-8})$$

$$\boxed{\text{REVISED TOTAL CANCER RISK} = 4.8 \times 10^{-7}}$$

REFERENCES

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