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JEB FORT STORY, VA
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# FORT STORY FINAL GEOTECHNICAL INFORMATION DOCUMENT VOLUME 1 OF 2 FORT STORY VA

8/1/1991

JAMES M. MONTGOMERY CONSULTING ENGINEERS

0020

# U.S. Army Corps of Engineers
# Missouri River Division,
# Omaha District

## *Fort Story Final Geotechnical Information Document*

Ft. Story, Virginia
August 1991

Volume 1 of 2

JMM James M. Montgomery

# FORT STORY
# GEOTECHNICAL INFORMATION DOCUMENT

**Attachment to**

**Site Investigation Report**
**for the**
**Fort Story Preliminary Assessment/Site Investigation**
**and**
**Fort Story NIKE Preliminary Assessment/Site Investigation**

**Fort Story**
**Virginia Beach, Virginia**

**Prepared for:**

**U.S. Army Corps of Engineers**
**Missouri River Division**
**Omaha District**
**Omaha, Nebraska**

**Prepared by:**

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**August 1991**

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# FORT STORY
# GEOTECHNICAL INFORMATION DOCUMENT

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# INTRODUCTION

JMM's Fort Story Geologic Information Document (FTSGID) is a data appendices associated with the Site Investigation Report for the Fort Story Preliminary Assessment/Site Investigation (PA/SI) and the Fort Story NIKE Preliminary Assessment/Site Investigation (NIKE PA/SI) projects. The FTSGID is a compilation of field data conducted for those projects. The FTSGID is organized by site and information category. Each site section contains soil and/or monitoring well boring lithologic logs, geotechnical grain size analyses, monitoring well construction summary sheets, monitoring well development sheets, monitoring well development sheets, photocopies of monitoring well development photographs, in situ permeability data, and groundwater sampling logs. (One set of original monitoring well development photographs is included in one of the USACE PM's FTSGID.) A master key of geologic units, titled Unified Soil Classification System, Figure A-1, for lithologic log reference follows the table of contents. A synopsis of each information category is presented below.

- Soil and monitoring well boring lithologic logs are written and graphical representations of the subsurface lithology for each boring or well location and other pertinent information as required by USACE obtained while drilling and described by the geologist on site.

- Geotechnical grain size analyses include results of grain-size distribution lab tests performed on selected soil samples collected during drilling of a well or boring.

- Monitoring well construction summary sheets are schematic drawings illustrating well installation construction and materials used.

- Monitoring well development sheets provide information regarding water level, well depth, water parameters such as pH, electrical conductivity, temperature and other field observations during well development.

- Monitoring well development photographs present visual evidence of water clarity of actual groundwater samples taken after development.

- In situ permeability data is comprised of raw slug test data and permeability results calculated using four different hydrologic evaluation methods for each well.

- Groundwater sampling logs present water parameters and field observations obtained during purging and sampling of each well for chemical analyses.

| MAJOR DIVISIONS | | | GRAPH SYMBOL | LETTER SYMBOL | LETTER DESCRIPTIONS |
|---|---|---|---|---|---|
| COARSE GRAINED SOILS | GRAVEL AND GRAVELLY SOILS | CLEAN GRAVELS (LITTLE OR NO FINES) | | GW | Well-graded gravels, gravel-sand mixtures, little or no fines |
| | | | | GP | Poorly-graded gravels, gravel-sand mixtures, little or no fines |
| | MORE THAN 60% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE | GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES) | | GM | Silty gravels, gravel-sand-silt mixtures |
| | | | | GC | Clayey gravels, gravel-sand-clay mixtures |
| MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE | SAND AND SANDY SOILS | CLEAN SAND (LITTLE OR NO FINES) | | SW | Well-graded sands, gravelly sands, little or no fines |
| | | | | SP | Poorly-graded sands, gravelly sands, little or no fines |
| | MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE | SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES) | | SM | Silty sands, sand-silt mixtures |
| | | | | SC | Clayey sands, sand-clay mixtures |
| FINE GRAINED SOILS | SILTS AND CLAYS | LIQUID LIMIT LESS THAN 50 | | ML | Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity |
| | | | | CL | Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays |
| | | | | OL | Organic silts and organic silty clays of low plasticity |
| MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE | SILTS AND CLAYS | LIQUID LIMIT GREATER THAN 50 | | MH | Inorganic silts, micaceous or diatomaceous fine sand or silty soils |
| | | | | CH | Inorganic clays of high plasticity, fat clays |
| | | | | OH | Organic clays of medium to high plasticity, organic silts |
| HIGHLY ORGANIC SOILS | | | | PT | Peat, humus, swamp soils with high organic contents |

***Note: Dual symbols are used to indicate borderline soil classifications.***

JMM

# UNIFIED SOIL CLASSIFICATION SYSTEM

**Adopted by Corps of Engineers**
**and Bureau of Reclamation, January, 1952,**
**in collaboration with A. Casagrande, PhD.**

FIGURE A-1

# Soil and Monitoring Well Boring Lithologic Logs

Site 1

BORING/WELL NUMBER *MW-101* CLIENT *U.S. ARMY CORPS OF ENGINEERS* PAGE 1 OF 1

DATE STARTED *3/27/90* COMPLETED *3/27/90* PROJECT *FT. STORY PA/SI*

SITE NUMBER *1* SITE NAME *LANDFILL 1* COORDINATES

GROUND ELEVATION *21.90 FEET, NGVD* GEOLOGIST *MARK SHUPE* *N224437, E2727239*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | GS | 0-2 | 2 2 2 2 3 | 6.0 | | SP | SAND (SP), quartz, tan, medium-fine grained, subgranular-subrounded, poor grading. | PID Instrumentation PI 101 HNu Systems 10.2 eV lamp PID Background=2.0 ppm. |
| 5 | M | 4-6 | 2 2 2 2 2 | 7.0 | | | | |
| | LITH | 8-10 | 2 3 3 3 | 6.8 | | | | |
| 10 | LITH | 10-12 | 2 1 2 2 | 7.4 | | | | |
| ▼ | SI | 12-14 | 4 5 6 4 | 2.2 | | | | |
| 15 | GEO | 14-16 | 1 2 4 3 | 5.8 | | SW | SAND (SW), quartz, medium-dark gray, coarse grained, subrounded, well graded, trace peat. | |
| 20 | LITH | 19-21 | 3 4 7 12 | 11.6 | | | SAND (SW), quartz, dark gray, medium-fine grained subrounded, well graded. | |
| | | | | | | | Total depth of boring=21 feet. | |
| 25 | | | | | | | | GS=Ground Surface<br>M=Middle of Boring<br>GEO=Geotechnical<br>SI=Soil/Groundwater Interface<br>▼=Water table during drilling |

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DRILLER *HARDIN AND HUBER, INC.* WELL COMPLETION DEPTH *21 FEET*

METHOD OF DRILLING *HOLLOW STEM AUGER* WELL DIAMETER *2 INCHES*

HOLE DIAMETER *8 1/4 INCHES* WELL MATERIAL *SCHEDULE 40 PVC*

TOTAL DEPTH *21 FEET*

BORING/WELL NUMBER *MW-102*
DATE STARTED *3/26/90* COMPLETED *3/26/90*
SITE NUMBER *1*
GROUND ELEVATION *8.69 FEET, NGVD*

CLIENT *U.S. ARMY CORPS OF ENGINEERS*
PROJECT *FT. STORY PA/SI*
SITE NAME *LANDFILL 1*
GEOLOGIST *MARK SHUPE*



COORDINATES *N224682, E2726951*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | GS<br>M | 0-2 | 2<br>2<br>1<br>1 | 6.0 | | OL | CLAY (OL), black, soft, organic, noncalc. | PID Instrumentation<br>PI 101 HNu Systems<br>10.2 eV Lamp<br>PID Background=2.0 ppm. |
| | SI | 2-4 | 2<br>5<br>4<br>5 | 4.0 | | | SAND (SW), quartz, light gray, medium-fine, subrounded, poor sorting. | |
| 5 | GEO | 4-6 | 7<br>6<br>7<br>5 | 8.5 | | SW | SAND (SW), quartz, medium gray, subrounded, medium-fine grained, poor sorting. | |
| 10 | LITH | 9-11 | 9<br>5<br>5<br>7 | 3.2 | | | SAND (SW), quartz, brown, medium-fine, subangular-subrounded, poor sorting. | |
| | | | | | | | Total depth of boring=11.5 feet. | |
| 15 | | | | | | | | |
| 20 | | | | | | | | GEO=Geotechnical<br>GS=Ground Surface<br>M=Middle of Boring<br>SI=Soil/Groundwater interface<br>LITH=Lithology<br>▼=Water table during drilling |
| 25 | | | | | | | | |

**JMM** James M. Montgomery
Consulting Engineers, Inc.

DRILLER *HARDIN AND HUBER, INC.*
METHOD OF DRILLING *HOLLOW STEM AUGER*
HOLE DIAMETER *8 1/4 INCHES*
TOTAL DEPTH *11.5 FEET*

WELL COMPLETION DEPTH *11.5 FEET*
WELL DIAMETER *2 INCHES*
WELL MATERIAL *SCHEDULE 40 PVC*

BORING/WELL NUMBER *MW-103*
DATE STARTED *3/25/90* COMPLETED *3/25/90*
SITE NUMBER *1*
GROUND ELEVATION *23.30 FEET, NGVD*

CLIENT *U.S. ARMY CORPS OF ENGINEERS*
PROJECT *FT. STORY PA/SI*
SITE NAME *LANDFILL 1*
GEOLOGIST *MARK SHUPE*



COORDINATES *N224465, E2726979*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | GS | 0-2 | 1 1 2 3 | 48.0 | | | SAND (SW), quartz, tan-buff, medium-fine grained, subangular-subrounded, poor sorting. | |
| 5 | LITH | 4-6 | 3 4 3 3 | 18.3 | | SW | | |
| 10 | M | 10-12 | 4 3 3 3 | 22.9 | | | SAND (SW), quartz, tan, medium-fine grained, subangular-subrounded, poor sorting. | |
| 15 ▼ | SI | 15-17 | 3 2 3 3 | | | | SAND (SW), quartz, tan, medium-fine, subrounded, poor sorting, water table encountered at 16.75 feet. | |
| 20 | GEO | 20-22 | 2 4 5 7 | 27 | | SM | SAND (SM), quartz, dark gray, fine, subangular-subrounded, silty, trace peat. | |
| | | | | | | | SAND (SW), quartz, light gray, fine-medium, subrounded, poor sorting. | |
| 25 | LITH | 25-27 | 3 4 7 10 | 31 | | SW | SAND (SW), quartz, light gray-medium gray, medium grained, subrounded, poor sorting. | |
| | | | | | | | Total depth of boring=27 feet. | |

GS=Ground Surface

M=Middle of Unsaturated Zone

SI=Soil/Groundwater Interface

GEO=Geotechnical

LITH=Lithology

▼=Water table during drilling

**JMM** James M. Montgomery
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DRILLER *HARDIN AND HUBER, INC.*
METHOD OF DRILLING *HOLLOW STEM AUGER*
HOLE DIAMETER *8 1/4 INCHES*
TOTAL DEPTH *27 FEET*

WELL COMPLETION DEPTH *25 FEET*
WELL DIAMETER *2 INCHES*
WELL MATERIAL *SCHEDULE 40 PVC*

BORING/WELL NUMBER *MW-104*
DATE STARTED *3/26/90* COMPLETED *3/26/90*
SITE NUMBER *1*
GROUND ELEVATION *19.50 FEET, NGVD*

CLIENT *U.S. ARMY CORPS OF ENGINEERS*
PROJECT *FT. STORY PA/SI*
SITE NAME *LANDFILL 1*
GEOLOGIST *MARK SHUPE*



COORDINATES *N224659, E2727117*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | GS | 0-2 | 1 2 3 5 | 9.0 | | SW | SAND (SW), quartz, tan, fine, subrounded-subangular, well graded. | PID Instrumentation<br>PI 101 HNu Systems<br>10.2 eV Lamp<br>PID Background=5.0 ppm. |
| 5 | M | 4-6 | 5 5 5 7 | 8.2 | | PT | PEAT (PT), black, moderately indurated, blocky fragments, dull luster. | |
| | | | | | | | SAND (SW), quartz, tan, medium-fine, subrounded-subangular, well graded. | |
| 10 ▼ | SI GEO | 10-12 | 4 3 4 4 | 7.4 | | SW | SAND (SW), quartz, tan, as above. | |
| 15 | LITH | 15-17 | 5 2 3 4 | 11.2 | | SW | SAND (SW), quartz, light gray, medium-fine, subrounded, well graded. | |
| | | | | | | PT | PEAT (PT), black, poorly indurated dull. | |
| | | | | | | | Total depth of boring=17.5 feet. | |
| 20 | | | | | | | | GS=Ground Surface<br>M=Middle of Unsaturated Zone<br>SI=Soil/Groundwater Interface<br>GEO=Geotechnical<br>LITH=Lithology<br>▼=Water table during drilling |
| 25 | | | | | | | | |

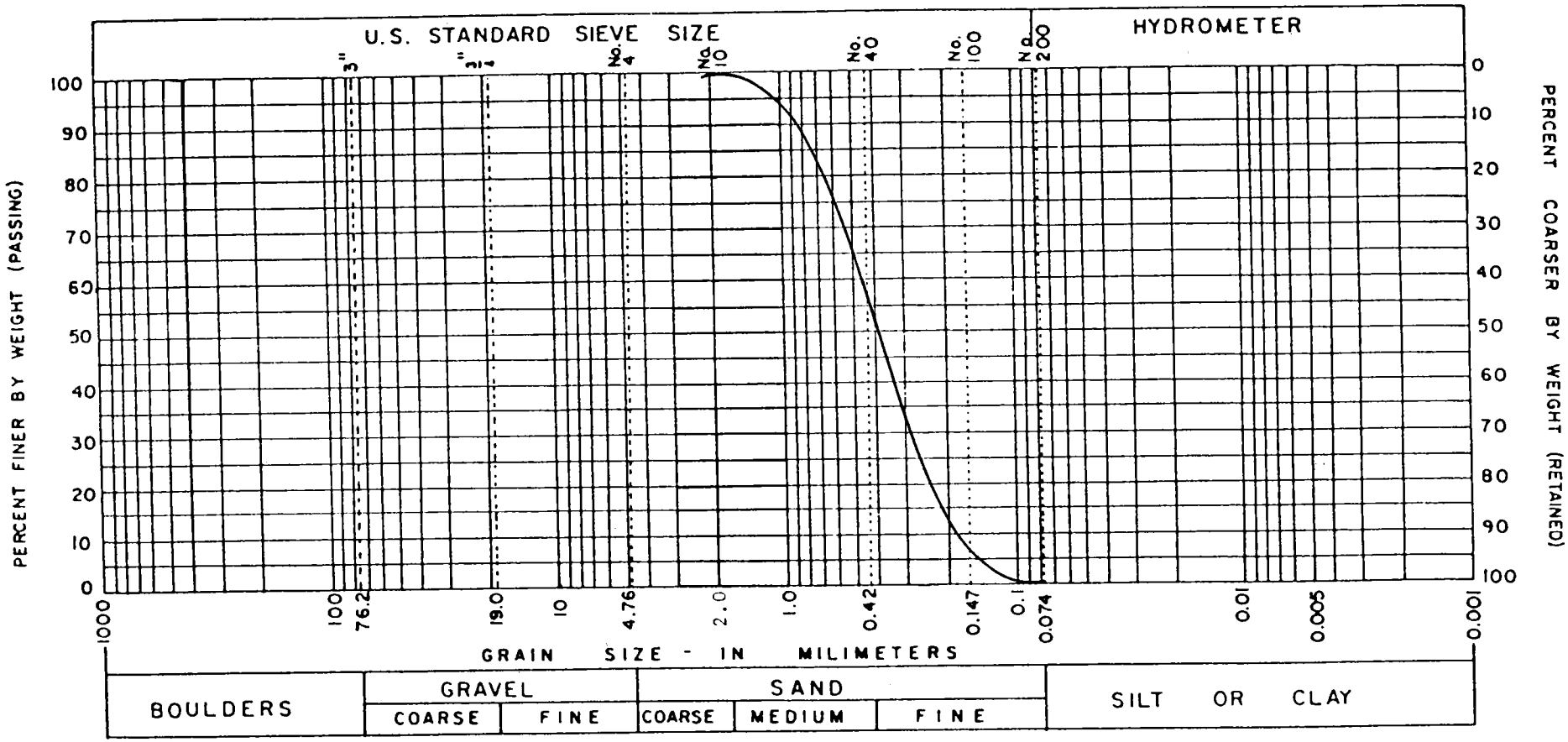
**JMM** James M. Montgomery
Consulting Engineers, Inc.

DRILLER *HARDIN AND HUBER, INC.*
METHOD OF DRILLING *HOLLOW STEM AUGER*
HOLE DIAMETER *8 1/4 INCHES*
TOTAL DEPTH *17.5 FEET*

WELL COMPLETION DEPTH *17.5 FEET*
WELL DIAMETER *2 INCHES*
WELL MATERIAL *SCHEDULE 40 PVC*

# Geotechnical Grain Size Analyses

| PROJECT: Fort Story | | LOCATION: Virginia Beach, VA | |
|---|---|---|---|
| BORING NO. Site 1 | SAMPLE NO. S1MW101 | DEPTH: 16' | CONTRACT NO. 90-075 |




| SAMPLE NO. | DEPTH | L.L. | P.I. | M.C. | Unified | Soil Description |
|---|---|---|---|---|---|---|
| S1MW101 | 16' | - | N.P. | 23.2 | SP | Tan sand |

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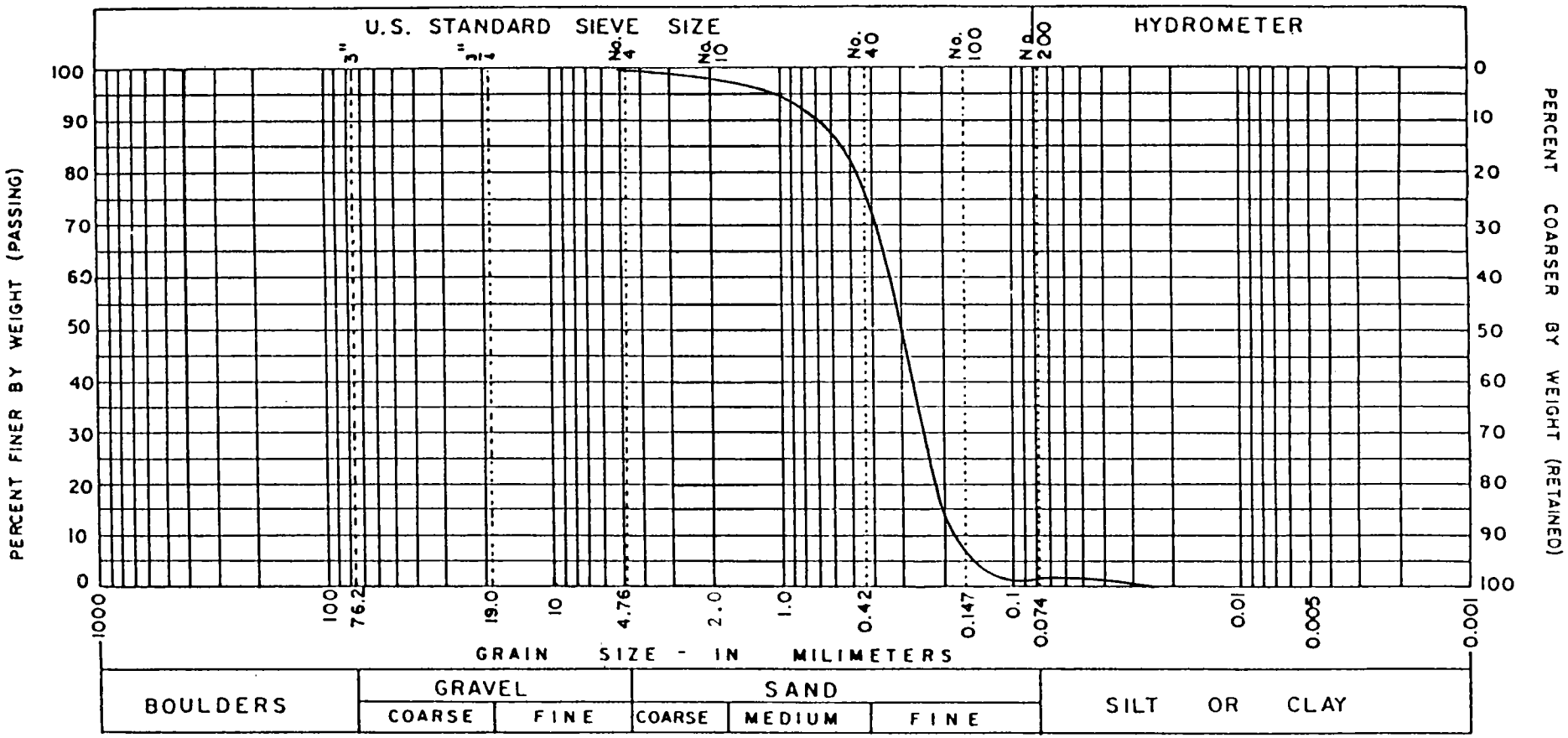
GRAIN-SIZE DISTRIBUTION

| TESTED BY: RMP | DATE: 7-12-90 |
|---|---|
| CHECKED BY: PAD | SHEET No. 1 OF 32 |

| PROJECT: Fort Story | | LOCATION: Virginia Beach, VA. | |
|---|---|---|---|
| BORING NO. Site 1 | SAMPLE NO. S1MW102 | DEPTH: 6' | CONTRACT NO. 90-075 |




| SAMPLE NO. | DEPTH | L.L. | P.I. | M.C. | Unified | Soil Description |
|---|---|---|---|---|---|---|
| S1MW102 | 6' | - | N.P. | 24.6 | SP | Tan sand |

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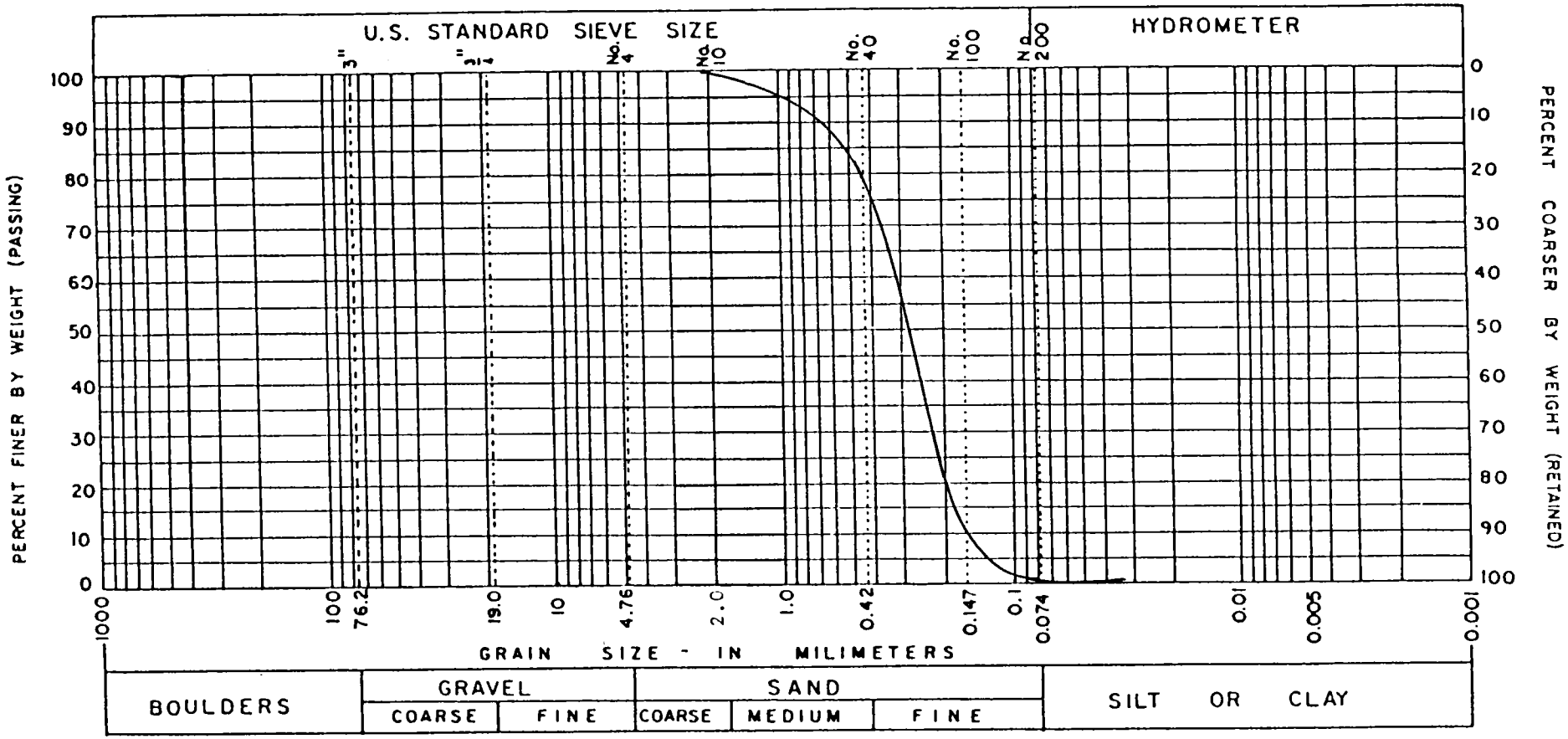
GRAIN-SIZE DISTRIBUTION

| TESTED BY: RMP | DATE: 7-12-90 |
|---|---|
| CHECKED BY: PAD | SHEET No. 2 OF 32 |

| PROJECT: Fort Story | | LOCATION: Virginia Beach, VA. | |
|---|---|---|---|
| BORING NO. Site 1 | SAMPLE NO. S1MW103 | DEPTH: 22' | CONTRACT NO. 90-075 |




| SAMPLE NO. | DEPTH | L.L. | P.I. | M.C. | Unified | Soil Description |
|---|---|---|---|---|---|---|
| S1MW103 | 22' | - | N.P. | 23.0 | SP | Tan sand |

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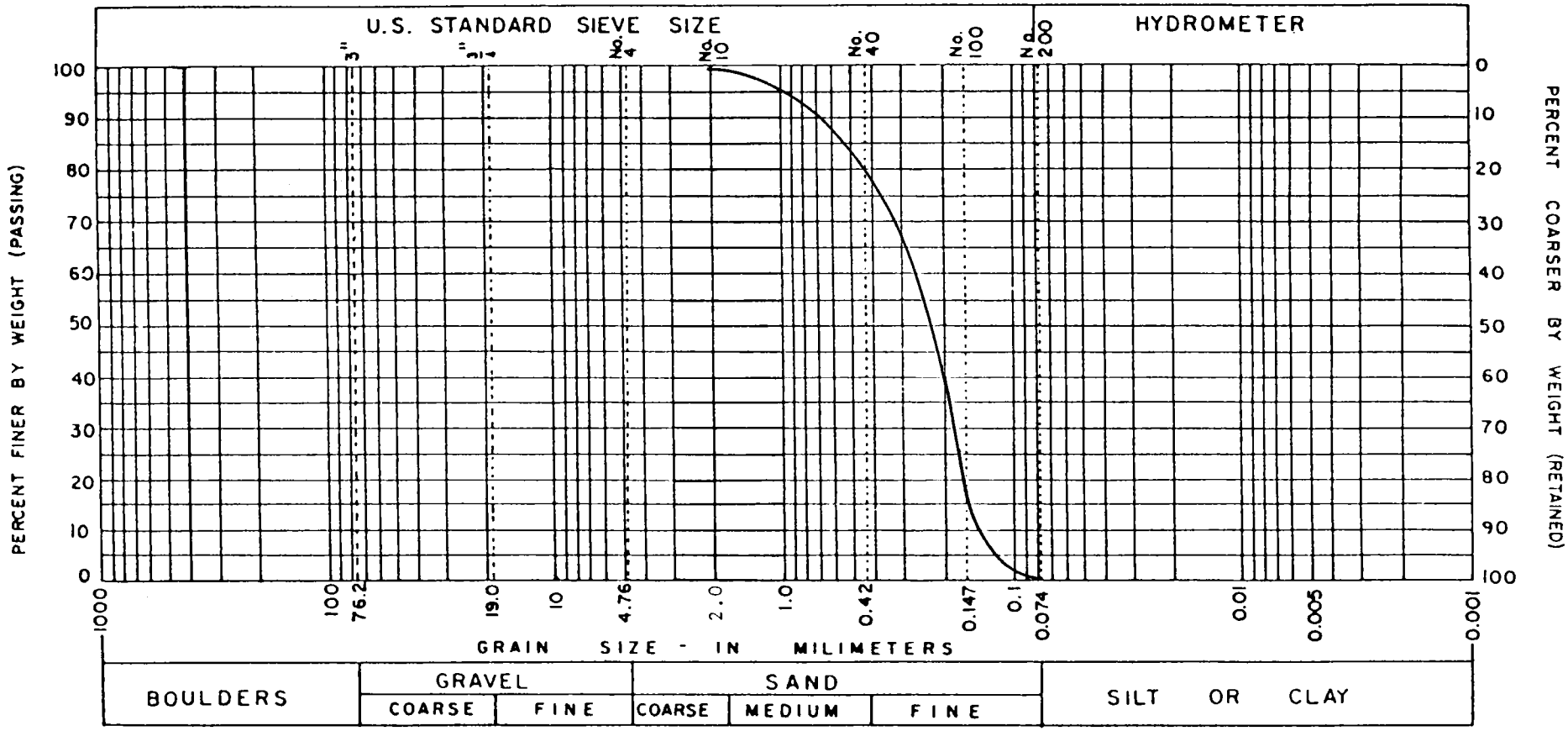
| TESTED BY: RMP | DATE: 7-12-90 |
|---|---|
| CHECKED BY: PAD | SHEET No. 3 OF 32 |

| PROJECT: Fort Story | | LOCATION: Virginia Beach, VA. | |
|---|---|---|---|
| BORING NO. Site 1 | SAMPLE NO. S1MW104 | DEPTH: 12' | CONTRACT NO. 90-075 |




| SAMPLE NO. | DEPTH | L.L. | P.I. | M.C. | Unified | Soil Description |
|---|---|---|---|---|---|---|
| S1MW104 | 12' | - | N.P. | 5.1 | SP | Tan sand |

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TESTED BY: RMP

DATE: 7-12-90

CHECKED BY: PAD

SHEET No. 4 OF 32

# Monitoring Well Construction Summary Sheets

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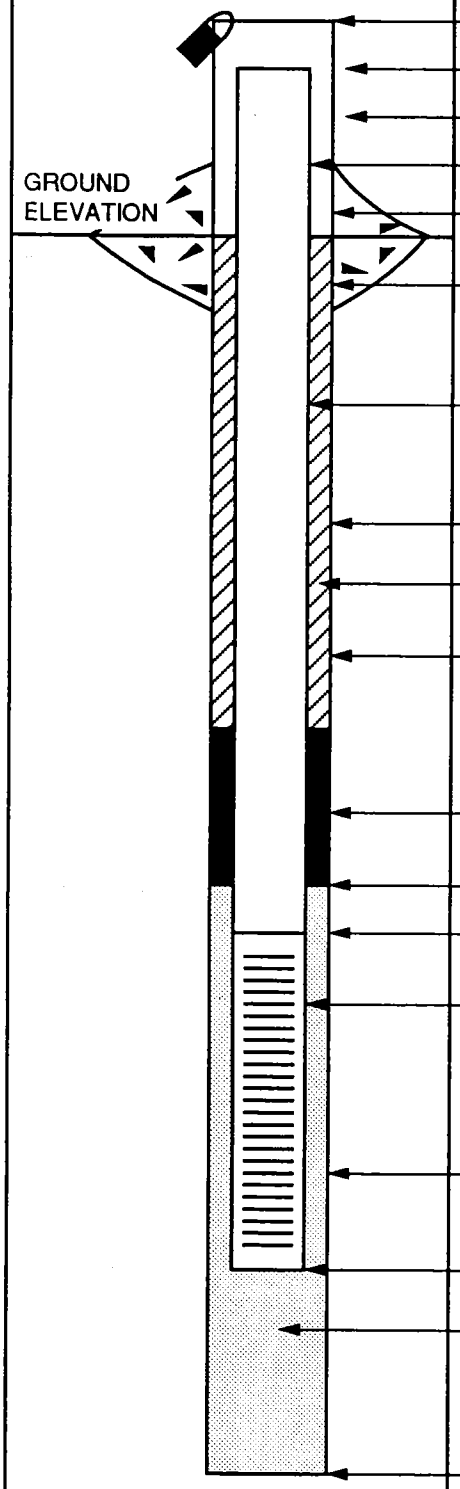
BORING NO. MW-101

# MONITORING WELL SHEET

PROJECT Fort Story PA/SI
LOCATION Site 1
PROJECT NO. 1868.0401
BORING MW-101
ELEVATION
DATE 3/27/90
FIELD GEOLOGIST Mark Shupe

DRILLER Hardin and Huber Inc.
DRILLING METHOD Hollow Stem Auger
DEVELOPMENT METHOD Air Surging/Bailing /Pumping




ELEVATION OF TOP OF SURFACE CASING: 24.61 ft.
ELEVATIONS OF TOP OF RISER PIPE: 24.44 ft.
STICK-UP TOP OF SURFACE CASING: 2.71 ft.
STICK-UP RISER PIPE: 2.54 ft.
TYPE OF SURFACE SEAL: Cement Grout
I.D. OF SURFACE CASING: 4 inch
TYPE OF SURFACE CASING: Steel
RISER PIPE I.D.: 2 inch
TYPE OF RISER PIPE: Schedule 40 PVC
BOREHOLE DIAMETER: 8 1/4 inch
TYPE OF BACKFILL: Cement Grout
ELEVATION/DEPTH OF SEAL: 7.0 ft.
TYPE OF SEAL: Granular Bentonite
DEPTH TO TOP OF SAND PACK: 9.0 ft.
ELEVATION/DEPTH TOP OF SCREEN: 11.0 ft.
TYPE OF SCREEN: Schedule 40 PVC
SLOT SIZE X LENGTH: 0.01 inch X 10 feet
I.D. OF SCREEN: 2 inch
TYPE OF SAND PACK: No. 2 Filter Sand
ELEVATION/DEPTH BOTTOM OF SCREEN: 21.0 ft.
ELEVATION/DEPTH BOTTOM OF SANDPACK: 21.0 ft.
TYPE OF BACKFILL BELOW OBSERVATION WELL: Formation
ELEVATION/DEPTH OF HOLE: 21.0 ft.

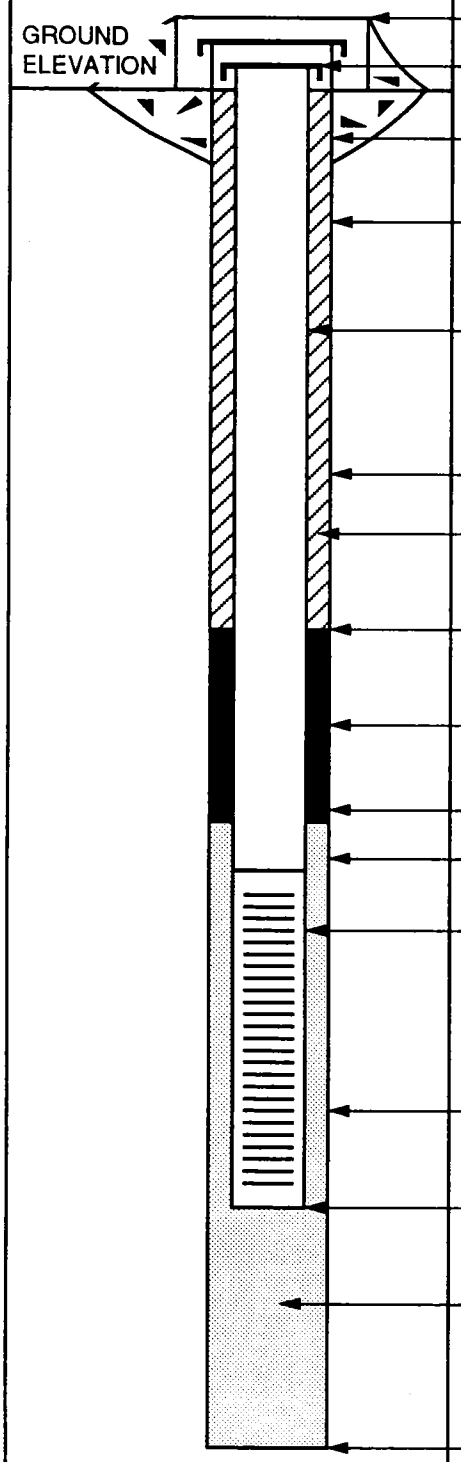
James M. Montgomery
Consulting Engineers, Inc.

BORING NO. MW-102

# MONITORING WELL SHEET

PROJECT Fort Story PA/SI
LOCATION Site 1
PROJECT NO. 1868.0401
BORING MW-102
ELEVATION
DATE 3/26/90
FIELD GEOLOGIST Mark Shupe

DRILLER Hardin and Huber Inc.
DRILLING METHOD Hollow Stem Auger
DEVELOPMENT METHOD Bailing/Pumping




ELEVATION OF TOP OF SURFACE CASING: 8.97 ft.
ELEVATIONS OF TOP OF RISER PIPE: 8.69 ft.

TYPE OF SURFACE SEAL: Cement Grout

I.D. OF SURFACE CASING: 8 inch
TYPE OF SURFACE CASING: Steel

RISER PIPE I.D.: 2 inch
TYPE OF RISER PIPE: Schedule 40 PVC

BOREHOLE DIAMETER: 8 1/4 inch
TYPE OF BACKFILL: Cement Grout

ELEVATION/DEPTH OF SEAL: 1.0 ft.

TYPE OF SEAL: Granular Bentonite

DEPTH TO TOP OF SAND PACK: 1.5 ft.
ELEVATION/DEPTH TOP OF SCREEN: 1.25 ft.

TYPE OF SCREEN: Schedule 40 PVC
SLOT SIZE X LENGTH: 0.0010 inch X 10 feet
I.D. OF SCREEN: 2 inch

TYPE OF SAND PACK: No. 2 Filter Sand

ELEVATION/DEPTH BOTTOM OF SCREEN: 11.25 ft.

ELEVATION/DEPTH BOTTOM OF SANDPACK: 11.25 ft.
TYPE OF BACKFILL BELOW OBSERVATION WELL: Formation

ELEVATION/DEPTH OF HOLE: 11.5 ft.

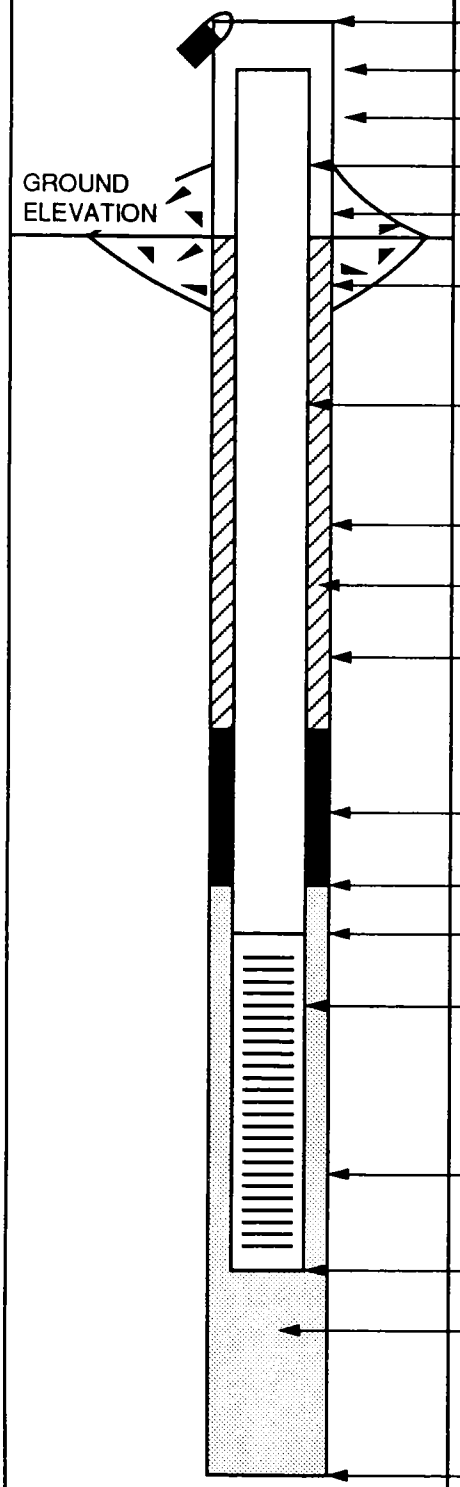
James M. Montgomery
Consulting Engineers, Inc.

BORING NO. MW-103

# MONITORING WELL SHEET

PROJECT Fort Story PA/SI
LOCATION Site 1
PROJECT NO. 1868.0401
BORING MW-103
ELEVATION
DATE 3/25/90
FIELD GEOLOGIST Mark Shupe

DRILLER Hardin and Huber Inc.
DRILLING METHOD Hollow Stem Auger
DEVELOPMENT METHOD Bailing




ELEVATION OF TOP OF SURFACE CASING: 30.20 ft.
ELEVATIONS OF TOP OF RISER PIPE: 30.53 ft.
STICK-UP TOP OF SURFACE CASING: N/A
STICK-UP RISER PIPE: N/A
TYPE OF SURFACE SEAL: Cement Grout
I.D. OF SURFACE CASING: 4 inch
TYPE OF SURFACE CASING: Steel
RISER PIPE I.D.: 2 inch
TYPE OF RISER PIPE: Schedule 40 PVC
BOREHOLE DIAMETER: 8 1/4 inch
TYPE OF BACKFILL: Cement Grout
ELEVATION/DEPTH OF SEAL: 11.0 ft.
TYPE OF SEAL: Granular Bentonite
DEPTH TO TOP OF SAND PACK: 13.0 ft.
ELEVATION/DEPTH TOP OF SCREEN: 15.0 ft.
TYPE OF SCREEN: Schedule 40 PVC
SLOT SIZE X LENGTH: 0.02 inches X 10 feet
I.D. OF SCREEN: 2 inch
TYPE OF SAND PACK: No. 2 Filter Sand
ELEVATION/DEPTH BOTTOM OF SCREEN: 25.0 ft.
ELEVATION/DEPTH BOTTOM OF SANDPACK: N/A
TYPE OF BACKFILL BELOW OBSERVATION WELL: Formation
ELEVATION/DEPTH OF HOLE: 25.0 ft.

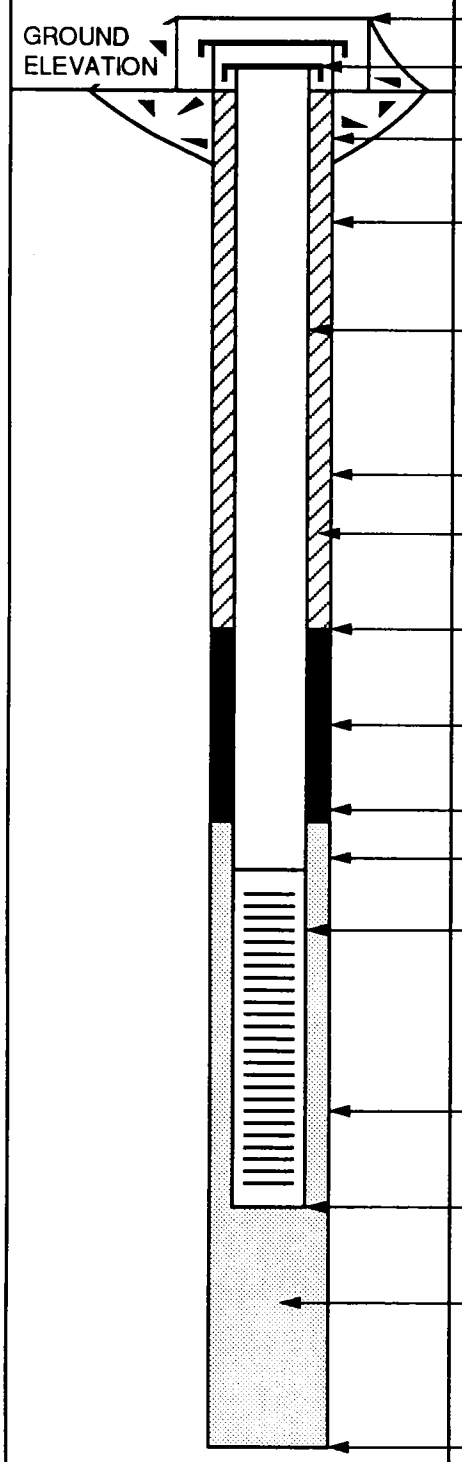
James M. Montgomery
Consulting Engineers, Inc.

BORING NO. MW-104

# MONITORING WELL SHEET

PROJECT Fort Story PA/SI
LOCATION Site 1
PROJECT NO. 1868.0401
BORING MW-104
ELEVATION
DATE 3/27/90
FIELD GEOLOGIST Mark Shupe

DRILLER Hardin and Huber Inc.
DRILLING METHOD Hollow Stem Auger
DEVELOPMENT METHOD Air Surging/Pumping




ELEVATION OF TOP OF SURFACE CASING: 22.43 ft.
ELEVATIONS OF TOP OF RISER PIPE: 22.21 ft.
TYPE OF SURFACE SEAL: Cement Grout
I.D. OF SURFACE CASING: 8 inch
TYPE OF SURFACE CASING: Steel
RISER PIPE I.D.: 2 inch
TYPE OF RISER PIPE: Schedule 40 PVC
BOREHOLE DIAMETER: 8 1/4 inch
TYPE OF BACKFILL: Cement Grout
ELEVATION/DEPTH OF SEAL: 5.5 ft.
TYPE OF SEAL: Granular Bentonite
DEPTH TO TOP OF SAND PACK: 7.5 ft.
ELEVATION/DEPTH TOP OF SCREEN: 7.5 ft.
TYPE OF SCREEN: Schedule 40 PVC
SLOT SIZE X LENGTH: 0.02 inch X 10 feet
I.D. OF SCREEN: 2 inch
TYPE OF SAND PACK: No. 2 Filter Sand
ELEVATION/DEPTH BOTTOM OF SCREEN: 17.5 ft.
ELEVATION/DEPTH BOTTOM OF SANDPACK: 17.5 ft.
TYPE OF BACKFILL BELOW OBSERVATION WELL: Formation
ELEVATION/DEPTH OF HOLE: 17.5 ft.

# Monitoring Well Development Sheets

Earth Engineering & Sciences, Inc.

## Monitoring Well Development Sheet MW 101

Project: FORT STORY IRP Location: SITE 1

Project No. 1865.0401 Dates: 4-9-90 & 3-27-90

Field Geologists: GEORGE TOWSON & DIANE ENGLAND

Barrel ID: S1 MW 101 DEV $H_2O$ No. of Barrels: 3 · 55 GAL

Initial Development Method AIR SURGING Init. Dev. Date: 3-27-90

Initial Volume Removed: 35 GAL Time Started: 815 Finished: 915

Initial Team Members: GARY ENLOE

Water Level (Initial): 11.5

Total Depth (BOH): 14.0

Designed Depth: 21.0

Depth of Sediment: 7.0

Water Level After Initial Development: 12.0

BOH After Initial Development: 18.0

---

Final Development Method: BAILING & PUMPING Fin. Dev. Date: 4-9-90

Final Volume Removed: 170 GAL Time Start: 0850 Finished: 0948

Final Team Members: GEORGE TOWSON & DIANE ENGLAND

Water Level Start: 12.2 Finished: 12.2 Ph: 6.64 EC: 170 T°C: 14

Total Depth Start: 17.73 Finished: 21

$O_2$, TOX, Lel and Organic Vapor Problems Encountered: NONE

Action: ☒ None Needed
☐ Need:

Earth Engineering & Sciences, Inc.

| Date | Time | Initial Development | Final Development | Depth to Water (ft.) | Total Depth (ft) | Design Depth (ft.) | Estimated Sediment Thickness (ft.) | Air Surging | Bailing | Pumping | Flow Rate (gal/min) | Well Volume (gal.) | Total Vol. of Develop. Water | Water Temp. (°C)* | pH | EC (μΩ)* | Turbidity (Ntu) | Team Members |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4-9-90 | 0856 | | ✓ | 12.2 | 17.73 | 21 | 3.27 | | ✓ | | .5 | 8.3 | 35 | | | | | GEORGE TOWSON DIANE ENGLAND |
| | 0915 | | ✓ | | 21.0 | 21.0 | | | ✓ | | .5 | | 48 | | | | | |
| | 0920 | | ✓ | | | | | | | ✓ | 2 | | 58 | 14 | 6.35 | 16.8 | | |
| | 0922 | | ✓ | | | | | | | ✓ | 2 | | 62 | 14 | 6.53 | 16.8 | | |
| | 0924 | | ✓ | | | | | | | ✓ | 2 | | 66 | 14 | 6.55 | 16.8 | | |
| | 0926 | | ✓ | | | | | | | ✓ | 5 | | 70 | 14 | 6.53 | 16.8 | | |
| | 0928 | | ✓ | | | | | | | ✓ | 5 | | 80 | 14 | 6.59 | 16.5 | | |
| | 0930 | | ✓ | | | | | | | ✓ | 5 | | 90 | 14 | 6.62 | 16.5 | | |
| | 0932 | | ✓ | | | | | | | ✓ | 5 | | 100 | 14 | 6.62 | 16.8 | | |
| | 0934 | | ✓ | | | | | | | ✓ | 5 | | 110 | 14 | 6.62 | 170 | | |
| | 0936 | | ✓ | | | | | | | ✓ | 5 | | 120 | 14 | 6.63 | 16.5 | | |
| | 0938 | | ✓ | | | | | | | ✓ | 5 | | 130 | 14 | 6.62 | 16.5 | | |
| | 0940 | | ✓ | | | | | | | ✓ | 5 | | 140 | 14 | 6.62 | 170 | | |
| | 0942 | | ✓ | | | | | | | ✓ | 5 | | 150 | 14 | 6.62 | 170 | | |
| | 0944 | | ✓ | | | | | | | ✓ | 5 | | 160 | 14 | 6.65 | 170 | | |
| | 0946 | | ✓ | | | | | | | ✓ | 5 | | 170 | 14 | 6.64 | 170 | 25.0** | |

Location: FORT STORY

Site #: 1

Well #: MW 101

* IN HOLE

** TURBIDITY TAKEN ON 4-10

Earth Engineering & Sciences, Inc.

## Monitoring Well Development Sheet MW-102

Project: FORT STORY IRP Location: FORT STORY

Project No. 1868.0401 Dates: 4/3/90 & 4/6/90

Field Geologists: GEORGE TOWSON & D. ENGLAND

Barrel ID: S1 MW 102 DEV $H_2O$ No. of Barrels: 2 · 55 GAL

Initial Development Method BAILING Init. Dev. Date: 4-3-90

Initial Volume Removed: 15.0 GAL Time Started: 1200 Finished: 1230

Initial Team Members: D. ENGLAND & JOE (H. & H.)

Water Level (Initial): 1.6

Total Depth (BOH): 11.25

SHEEN ON WATER DURING INITIAL BAILING

Designed Depth: 11.25

Depth of Sediment: 0

Water Level After Initial Development: 1.6

BOH After Initial Development: 11.25 Feet

---

Final Development Method: PUMPING Fin. Dev. Date: 4-6-90

Final Volume Removed: 106 GAL Time Start: 1220 Finished: 1247

Final Team Members: G. TOWSON & D. ENGLAND (EESI GEOLOGISTS

Water Level Start: 1.6 Finished: 1.6 Ph: 5.71 EC: 200 T°C: 14.4

Total Depth Start: 11.25 Finished: 11.25

$O_2$, TOX, Lel and Organic Vapor Problems Encountered: NONE

Action: ☒ None Needed
☐ Need:

Earth Engineering & Sciences, Inc.

| Date | Time | Initial Development | Final Development | Depth to Water (ft.) | Total Depth (ft) | Design Depth (ft.) | Estimated Sediment Thickness (ft.) | Air Surging | Bailing | Pumping | Flow Rate (gal/min) | Well Volume (gal.) | Total Vol. of Develop. Water | Water Temp. (°C)* | pH | EC (µΩ)* | Turbidity (Ntu) | Team Members |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4/3/90 | 1200 | ✓ | | 1.6 | 11.25 | 11.25 | 0 | | x | | .5 | 9.1 | | | | | | D ENGLAND. Joe (H&H) |
| 4-3 90 | 1230 | ✓ | | 1.6 | 11.25 | 11.25 | 0 | | x | | .5 | | 15.0 | | | 200 | | |
| 4-6-90 | 1220 | | ✓ | 1.6 | 11.25 | 11.25 | 0 | | | x | 2 | | 15.0 | 14.9 | 5.59 | 202 | | G TOWSON D ENGLAND |
| | 1225 | | ✓ | | | | | | | x | 2 | | 25 | 14.7 | 5.46 | 202 | | |
| | 1230 | | ✓ | | | | | | | x | 2 | | 35 | 14.5 | 5.51 | 202 | | |
| | 1235 | | ✓ | | | | | | | x | 5 | | 45 | 14.9 | 5.57 | 202 | | |
| | 1240 | | ✓ | | | | | | | x | 5 | | 70 | 14.5 | 5.61 | 205 | | |
| | 1245 | | ✓ | | | | | | | x | 5 | | 95 | 14.5 | 5.73 | 205 | | |
| | 1247 | | ✓ | | | | | | | x | 5 | | 105 | 14.4 | 5.71 | 200 | | |
| 4-10 | | | | 1.6 | 11.25 | 11.25 | 0 | | x | | .5 | | 106 | 14.7 | 5.69 | 200 | 4.74 | G. TOWSON D. ENGLAND |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |

Location: Fort Story Landfill #1

Site #: #1

Well #: MW-102

* in Hole

JMM JAMES M. MONTGOMERY, CONSULTING ENGINEERS, INC.

BY _____ DATE _____ CLIENT _____ SHEET _____ OF _____

CHKD. BY _____ DESCRIPTION FORT STORY JOB NO. _____

Well No. 102 Date: 4-3-90
Site No. 1

BEFORE SURGING

Depth to Water (DTW) = 1.6

Total Depth (TD) = 11.25

Design Total Depth = 11.25

Calculated depth of sediment = 0

noticed oily sheen on surface of $H_2O$ before bail

SURGING Bailing

Time begin = $12^{00}$

Time end = $12^{30}$

Development water clarity = Very brown & cloudy

Estimated volume of development water: 15 gal

Discharge rate during development = .5 gal/min

AFTER SURGING

Depth to Water: 1.6

Total Depth: 11.25

Calculated depth of sediment: 0

Earth Engineering & Sciences, Inc.

## Monitoring Well Development Sheet MW 103

Project: FORT STORY IRP Location: FORT STORY

Project No. 1868.0401 Dates: 4-3-90 & 4-6-90

Field Geologists: GEORGE TOWSON & DIANE ENGLAND

Barrel ID: S1 MW 103 DEV $H_2O$ No. of Barrels: 1.55 GAL

Initial Development Method BAILING Init. Dev. Date: 4-3-90

Initial Volume Removed: 30 GAL Time Started: 0915 Finished: 1115

Initial Team Members: DIANE ENGLAND & JOE (H&H)

Water Level (Initial): 20.4

Total Depth (BOH): 25.2

Designed Depth: 25

Depth of Sediment: 0

Water Level After Initial Development: 20.31

BOH After Initial Development: 25.4

---

Final Development Method: BAILING Fin. Dev. Date: 4-6-90

Final Volume Removed: 55 GAL Time Start: 0905 Finished: 1105

Final Team Members: G. TOWSON & D. ENGLAND

Water Level Start: 20.31 Finished: 20.30 Ph: 6.31 EC: 195 T°C: 15.5

Total Depth Start: 25.4 Finished: 25.4

$O_2$, TOX, Lel and Organic Vapor Problems Encountered: NONE

Action: ☒ None Needed
☐ Need:

Earth Engineering & Sciences, Inc.

| Date | Time | Initial Development | Final Development | Depth to Water (ft.) | Total Depth (ft) | Design Depth (ft.) | Estimated Sediment Thickness (ft.) | Air Surging | Bailing | Pumping | Flow Rate (gal/min) | Well Volume (gal.) | Total Vol. of Develop. Water | Water Temp. (°C) | pH | EC (µΩ) | Turbidity (Ntu) | Team Members |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4-3-90 | 0915 | ✓ | | 20.4 | 25.2 | 25 | 0 | | ✓ | | .5 | ~~0~~ 4.7 | 0 | | | | | D. ENGLAND<br>Joe (HARDIN & HUBER) |
| | 1115 | ✓ | | 20.4 | 25.2 | 25 | 0 | | ✓ | | .5 | ~~30~~ | 30 | | | | | |
| 4-6-90 | 0905 | | ✓ | 20.31 | 25.4 | 25 | 0 | | ✓ | | .5 | | | | | | | G-TOWSON<br>D. ENGLAND |
| | 0915 | | ✓ | | | | | | ✓ | | .5 | | | 16.0 | 6.54 | 199 | | |
| | 0925 | | ✓ | | | | | | ✓ | | .5 | | | 16.0 | 6.39 | 190 | | |
| | 0930 | | ✓ | | | | | | ✓ | | .5 | | | 15.5 | 6.43 | 190 | | |
| | 0945 | | ✓ | | | | | | ✓ | | .5 | | | 15.3 | 6.44 | 190 | | |
| | 0955 | | ✓ | | | | | | ✓ | | .5 | | | 15.5 | 6.30 | 185 | | |
| | 1005 | | ✓ | | | | | | ✓ | | .5 | | | 15.5 | 6.29 | 195 | | |
| | 1015 | | ✓ | | | | | | ✓ | | .5 | | | 15.5 | 6.34 | 185 | | |
| | 1025 | | ✓ | | | | | | ✓ | | .5 | | | 15.5 | 6.35 | 190 | | |
| | 1035 | | ✓ | | | | | | ✓ | | .5 | | | 15.5 | 6.30 | 190 | | |
| | 1045 | | ✓ | | | | | | ✓ | | .5 | ~~55~~ | ~~55~~ | 15.5 | 6.33 | 185 | | |
| ~~4-10-90~~ | 1055 | | ✓ | | | | | | ✓ | | .5 | | | 15.5 | 6.29 | 195 | | |
| | 1105 | | ✓ | | | | | | ✓ | | .5 | | 55 | 15.5 | 6.31 | 185 | | |
| 4-10-90 | | | ✓ | 20.20 | 25.4 | 0 | | | ✓ | | .5 | | 56 | 15.2 | 6.38 | 180 | | G-TOWSON<br>D. ENGLAND |

Location: FORT STORY

Site #: 1

Well #: 103

JMM JAMES M. MONTGOMERY, CONSULTING ENGINEERS, INC.

BY _____ DATE _____ CLIENT _____ SHEET _____ OF _____

CHKD. BY _____ DESCRIPTION FORT STORY JOB NO. _____

Well No. 103 Date: 4-3-90
Site No. 1

BEFORE SURGING

Depth to Water (DTW) = 20.4

Total Depth (TD) = 25.2

Design Total Depth = 25.2

Calculated depth of sediment = 0

~~SURGING~~ Bailing

Time begin = 9:15 → 10:00 → line broke; 11:00 began again

Time end = 11:15

Development water clarity = Very dark brown @ beginning, still brown, cloudy @ end

Estimated volume of development water = 30 gal

Discharge rate during development =

AFTER SURGING

Depth to Water = 20.4

Total Depth = 25.2

Calculated depth of sediment = 0

Earth Engineering & Sciences, Inc.

## Monitoring Well Development Sheet MW 104

Project: FORT STORY Location: SITE 1

Project No. 1865.0401 (SMM) Dates: 4-9-90 & 3-27-90

Field Geologists: GEORGE TOWSON

Barrel ID: S1 MW 104 No. of Barrels: 2 · 55 GAL

Initial Development Method AIR SURGING Init. Dev. Date: 3-27-90

Initial Volume Removed: 30 GAL Time Started: 1330 Finished: 1430

Initial Team Members: GARY ENLOE

Water Level (Initial): 13.5

Total Depth (BOH): 20.5

Designed Depth: 17.5 ?

Depth of Sediment: 0

Water Level After Initial Development: 14.5

BOH After Initial Development: 21.5

---

Final Development Method: PUMPING Fin. Dev. Date: 4-9-90

Final Volume Removed: 106 GAL Time Start: 1020 Finished: 1049

Final Team Members: GEORGE TOWSON & DIANE ENGLAND

Water Level Start: 14.20 Finished: 14.20 Ph: 6.45 EC: 220 T°C: 14

Total Depth Start: 21.8 Finished: 21.8

$O_2$, TOX, Lel and Organic Vapor Problems Encountered: ORGANIC SMELL (LIKE $H_2S$)
NO READINGS ON H-NUC OR CGI

Action: ☐ None Needed
☒ Need: STAYED UPWIND OF WELL, DRUMS & SAMPLE
MONITORED W/ H-NUC & CGI

Earth Engineering & Sciences, Inc.

| Date | Time | Initial Development | Final Development | Depth to Water (ft.) | Total Depth (ft) | Design Depth (ft.) | Estimated Sediment Thickness (ft.) | Air Surging | Bailing | Pumping | Flow Rate (gal/min) | Well Volume (gal.) | Total Vol. of Develop. Water | Water Temp. (°C) | pH | EC (µΩ) | Turbidity (Ntu) | Team Members |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4-9-90 | 1020 | | ✓ | 14.20 | 21.80 | 17.5? | ⊖ | | | ✓ | 2 | 7.14 | 0 | 14 | 6.37 | 221 | | |
| | 1024 | | ✓ | | | | | | | ✓ | 2 | | 8 | 14 | 6.30 | 220 | | |
| | 1026 | | ✓ | | | | | | | ✓ | 2 | | 12 | 14 | 6.33 | 220 | | |
| | 1029 | | ✓ | | | | | | | ✓ | 2 | | 18 | 14 | 6.35 | 220 | | |
| | 1033 | | ✓ | | | | | | | ✓ | 5 | | 26 | 14 | 6.44 | 220 | | |
| | 1035 | | ✓ | | | | | | | ✓ | 5 | | 36 | 14 | 6.43 | 220 | | |
| | 1037 | | ✓ | | | | | | | ✓ | 5 | | 46 | 14 | 6.52 | 220 | | |
| | 1039 | | ✓ | | | | | | | ✓ | 5 | | 56 | 14 | 6.57 | 220 | | |
| | 1041 | | ✓ | | | | | | | ✓ | 5 | | 66 | 14 | 6.56 | 220 | | |
| | 1043 | | ✓ | | | | | | | ✓ | 5 | | 76 | 14 | 6.52 | 220 | | |
| | 1045 | | ✓ | | | | | | | ✓ | 5 | | 86 | 14 | 6.45 | 220 | | |
| | 1047 | | ✓ | | | | | | | ✓ | 5 | | 96 | 14 | 6.47 | 220 | | |
| | 1049 | | ✓ | | | | | | | ✓ | 5 | | 106 | 14 | 6.45 | 220 | | |
| 4-10 | | | | | | | | | ✓ | | .5 | | 107 | 14 | 6.41 | 220 | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |

Location: FORT STORY

Site #: 1

Well #: MW 104

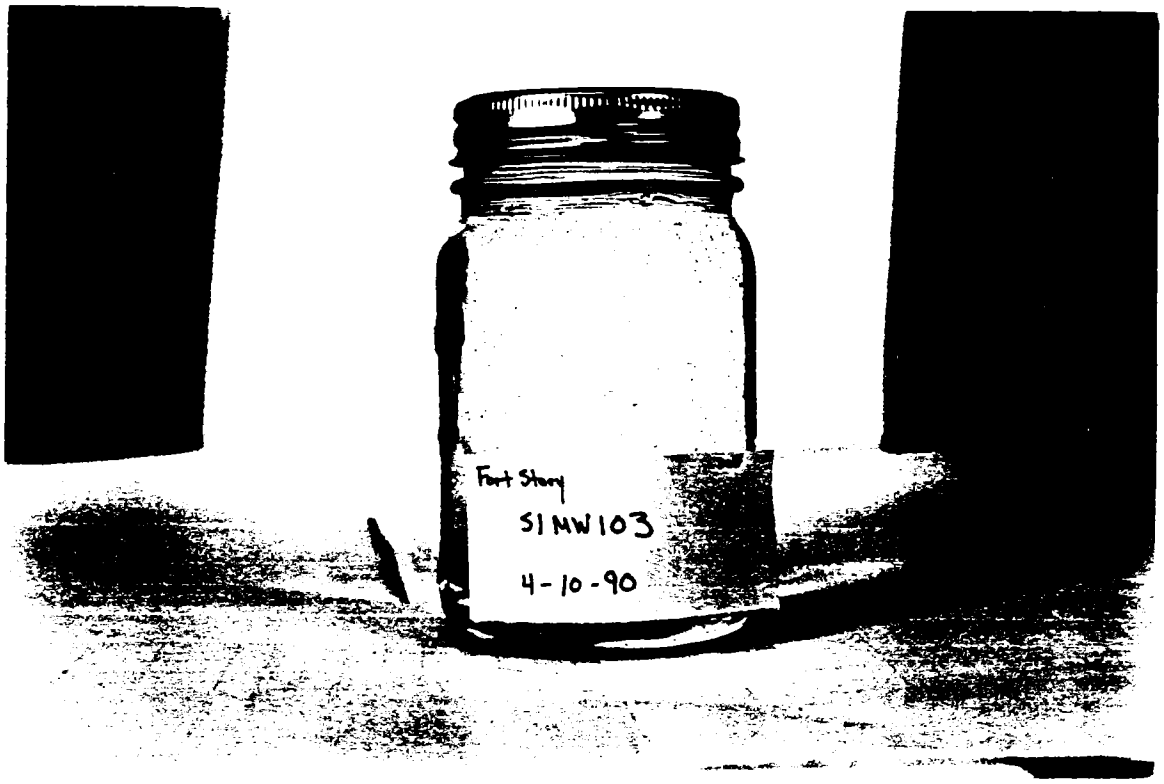
# Monitoring Well Development Photographs

Fort Story, Virginia

Site Number: 1
Well Number: MW-101

Site Number: 1
Well Number: MW-102

Fort Story, Virginia




Site Number: 1
Well Number: MW-103

Site Number: 1
Well Number: MW-104

# In Situ Permeability Data

RAW DATA

WELL # S1MW101

WELL DIAMETER= 8.25 INCHES
CASING DIAMETER= 2.00 INCHES
VOLUME OF WATER= .28 GALLONS
LENGTH OF AQUIFER TESTED= 20.00 FEET
VALUE OF HO= .29 FEET
STATIC WATER LEVEL= 16.71 FEET
LENGTH OF SCREEN= 10.00 FEET
WATER TABLE TO BOTTOM OF WELL= 7.26 FEET

SLUG TEST DATA:

| TIME | WATER LEVEL (FEET) | TIME SINCE TEST BEGAN (MINUTES) |
|---|---|---|
| 16.14. 8 | 16.86 | .14 |
| 16.14. 9 | 16.85 | .15 |
| 16.14.10 | 16.83 | .17 |
| 16.14.11 | 16.82 | .19 |
| 16.14.12 | 16.81 | .20 |
| 16.14.13 | 16.80 | .22 |
| 16.14.14 | 16.80 | .24 |
| 16.14.15 | 16.79 | .25 |
| 16.14.16 | 16.78 | .27 |
| 16.14.17 | 16.78 | .29 |
| 16.14.18 | 16.78 | .30 |
| 16.14.19 | 16.77 | .32 |
| 16.14.24 | 16.75 | .40 |
| 16.14.29 | 16.74 | .49 |
| 16.14.34 | 16.73 | .57 |

WELL # S1MW101

WELL DIAMETER= 8.25 INCHES
CASING DIAMETER= 2.00 INCHES
VOLUME OF WATER REMOVED OR ADDED TO WELL= .28 GALLONS
LENGTH OF AQUIFER TESTED= 20.00 FEET
VALUE OF H0= .29 FEET
STATIC WATER LEVEL= 16.71 FEET

SLUG TEST DATA:

| TIME SINCE TEST BEGAN (MINUTES) | WATER LEVEL (FEET) | DRAWDOWN (FEET) | HEAD RATIO | RECIPROCAL TIME (1/MINUTES) |
|---|---|---|---|---|
| .14 | 16.86 | .15 | .517 | 7.317 |
| .15 | 16.85 | .14 | .483 | 6.522 |
| .17 | 16.83 | .12 | .414 | 5.882 |
| .19 | 16.82 | .11 | .379 | 5.357 |
| .20 | 16.81 | .10 | .345 | 4.918 |
| .22 | 16.80 | .09 | .310 | 4.545 |
| .24 | 16.80 | .09 | .310 | 4.225 |
| .25 | 16.79 | .08 | .276 | 3.947 |
| .27 | 16.78 | .07 | .241 | 3.704 |
| .29 | 16.78 | .07 | .241 | 3.488 |
| .30 | 16.78 | .07 | .241 | 3.297 |
| .32 | 16.77 | .06 | .207 | 3.125 |
| .40 | 16.75 | .04 | .138 | 2.479 |
| .49 | 16.74 | .03 | .103 | 2.055 |
| .57 | 16.73 | .02 | .069 | 1.754 |

WELL # S1MW101

---

PERMEABILITY BASED ON COOPER, BREDEHOEFT, AND PAPADOPULOS METHOD

```
          PERMEABILITY=1.76E-04/ MATCH TIME (IN MINUTES)
          STORAGE COEF= 5.88E-02* ALPHA
     COMPUTER CALCULATES
          ALPHA=1.00E-05 MATCH TIME= 5.61E-02
          PERMEABILITY= 3.14E-03 CM/SEC
          STORAGE COEF=5.88E-07
          CORRELATION NUMBER=  1.00
```

---

PERMEABILITY BASED ON REGRESSION FIT OF HEAD RATIO DATA

```
          HVORSLEV PERMEABILITY=3.58E-04 / LAG TIME
          BOUWER PERMEABILTY=8.68E-04 * -SLOPE

     COMPUTER CALCULATES
          HVORSLEV PERMEABILITY=1.84E-03 CM/SEC
          BOUWER PERMEABILITY=1.71E-03 CM/SEC
               REGRESSION STATISTICS
                    X ON Y
                      INTERCEPT= -.05
                      SLOPE= -2.0
                    Y ON X
                      INTERCEPT= -.04
                      SLOPE= -2.0
                    CORRELATION COEFFICIENT=-1.00
     CALCULATIONS INDICATE THAT A VALUE OF    .37 FEET FOR HO
          OR A VALUE OF    1.762 INCHES FOR EFFECTIVE CASING DIA.
          MAY YIELD BETTER RESULTS
```

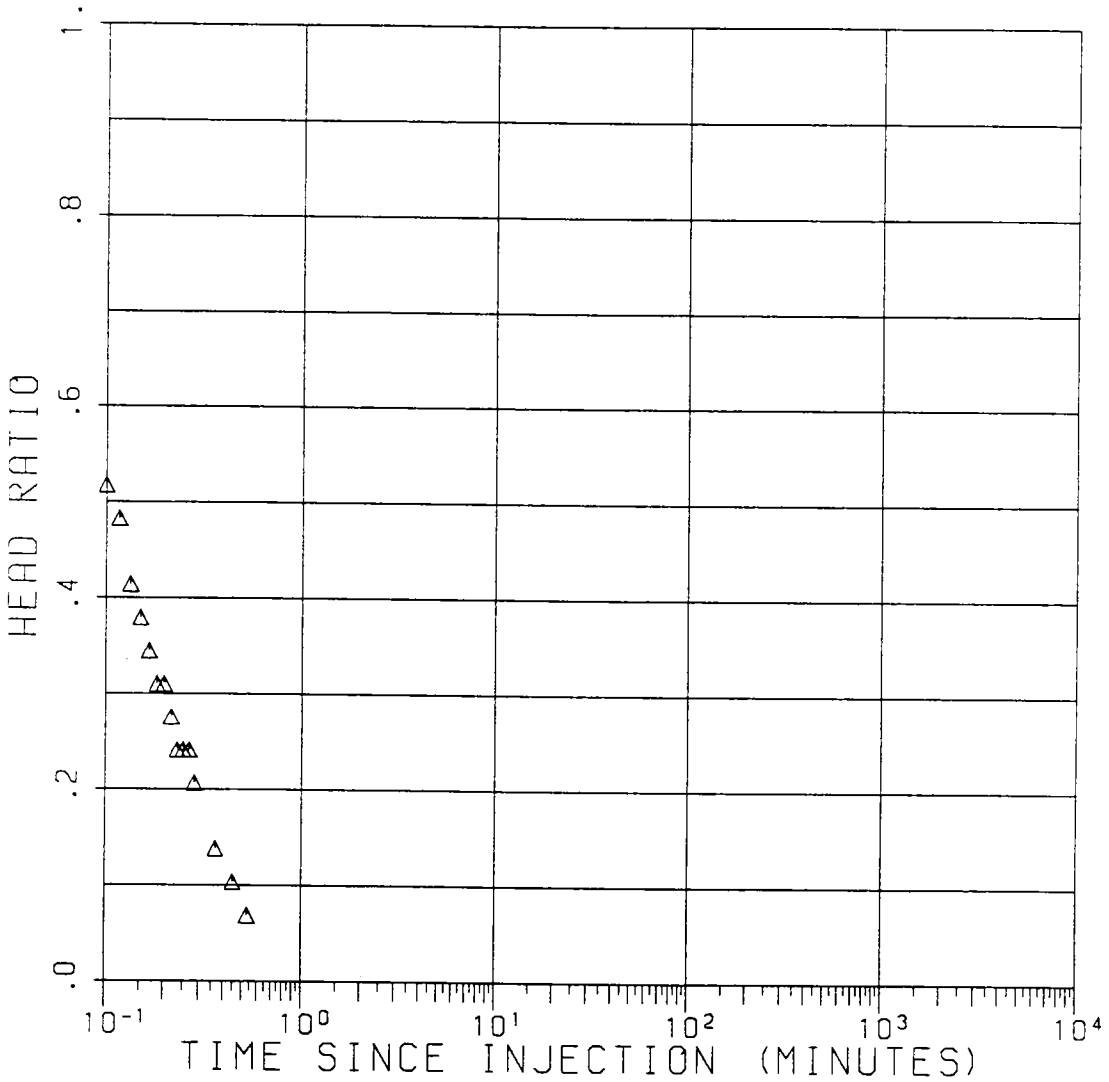
---

PERMEABILITY BASED ON REGRESSION FIT OF DATA - FERRIS & KNOWLES METHOD

```
     INSUFFICIENT DATA POINTS WITH RECIPROCAL TIMES LESS THAN .300
  NUMBER OF USABLE DATA POINTS= 0
```

| WELL # | PERMEABILITY METHOD 1 | PERMEABILITY METHOD 2 | STORAGE COEF METHOD 2 | PERMEABILITY METHOD 3 | PERMEABILITY METHOD 4 |
|---|---|---|---|---|---|
| S1MW101 | 1.84E-03 | 3.14E-03 | 5.88E-07 | .00 | 1.71E-03 |

* METHOD 1 IS HVORSLEV
METHOD 2 IS COOPER, BREDEHOEFT, AND PAPADOPULOS
METHOD 3 IS FERRIS AND KNOWLES
METHOD 4 IS BOUWER




17:29:28.67

S1MW101

FRI 05-18-1990

# SLUG TEST OF WELL S1MW101

## HEAD RATIO VS LOG TIME

RAW DATA

WELL # S1MW102

WELL DIAMETER= 8.25 INCHES
CASING DIAMETER= 2.00 INCHES
VOLUME OF WATER= .28 GALLONS
LENGTH OF AQUIFER TESTED= 20.00 FEET
VALUE OF H0= .63 FEET
STATIC WATER LEVEL= 1.59 FEET
LENGTH OF SCREEN= 10.00 FEET
WATER TABLE TO BOTTOM OF WELL= 9.64 FEET

SLUG TEST DATA:

| TIME | WATER LEVEL (FEET) | TIME SINCE TEST BEGAN (MINUTES) |
|---|---|---|
| 17.58. 7 | 1.68 | .12 |
| 17.58. 8 | 1.66 | .13 |
| 17.58. 9 | 1.64 | .15 |
| 17.58.10 | 1.63 | .17 |
| 17.58.11 | 1.62 | .18 |
| 17.58.12 | 1.62 | .20 |
| 17.58.13 | 1.61 | .22 |
| 17.58.14 | 1.61 | .23 |
| 17.58.15 | 1.60 | .25 |

WELL # S1MW102

WELL DIAMETER= 8.25 INCHES
CASING DIAMETER= 2.00 INCHES
VOLUME OF WATER REMOVED OR ADDED TO WELL= .28 GALLONS
LENGTH OF AQUIFER TESTED= 20.00 FEET
VALUE OF H0= .63 FEET
STATIC WATER LEVEL= 1.59 FEET

SLUG TEST DATA:

| TIME SINCE TEST BEGAN (MINUTES) | WATER LEVEL (FEET) | DRAWDOWN (FEET) | HEAD RATIO | RECIPROCAL TIME (1/MINUTES) |
|---|---|---|---|---|
| .12 | 1.68 | .09 | .143 | 8.571 |
| .13 | 1.66 | .07 | .111 | 7.500 |
| .15 | 1.64 | .05 | .079 | 6.667 |
| .17 | 1.63 | .04 | .063 | 6.000 |
| .18 | 1.62 | .03 | .048 | 5.455 |
| .20 | 1.62 | .03 | .048 | 5.000 |
| .22 | 1.61 | .02 | .032 | 4.615 |
| .23 | 1.61 | .02 | .032 | 4.286 |
| .25 | 1.60 | .01 | .016 | 4.000 |

WELL # S1MW102

---

PERMEABILITY BASED ON COOPER, BREDEHOEFT, AND PAPADOPULOS METHOD

PERMEABILITY=1.76E-04/ MATCH TIME (IN MINUTES)
STORAGE COEF= 5.88E-02* ALPHA
COMPUTER CALCULATES
ALPHA=1.00E-05 MATCH TIME= 1.24E-02
PERMEABILITY= 1.42E-02 CM/SEC
STORAGE COEF=5.88E-07
CORRELATION NUMBER= 1.00

---

PERMEABILITY BASED ON REGRESSION FIT OF HEAD RATIO DATA

HVORSLEV PERMEABILITY=3.58E-04 / LAG TIME
BOUWER PERMEABILTY=9.29E-04 * -SLOPE

COMPUTER CALCULATES
HVORSLEV PERMEABILITY=8.71E-03 CM/SEC
BOUWER PERMEABILITY=5.45E-03 CM/SEC
REGRESSION STATISTICS
X ON Y
INTERCEPT= -.21
SLOPE= -5.8
Y ON X
INTERCEPT= -.17
SLOPE= -6.0
CORRELATION COEFFICIENT= -.98
CALCULATIONS INDICATE THAT A VALUE OF .63 FEET FOR HO
OR A VALUE OF 1.998 INCHES FOR EFFECTIVE CASING DIA.
MAY YIELD BETTER RESULTS

---

PERMEABILITY BASED ON REGRESSION FIT OF DATA - FERRIS & KNOWLES METHOD

INSUFFICIENT DATA POINTS WITH RECIPROCAL TIMES LESS THAN .300
NUMBER OF USABLE DATA POINTS= 0

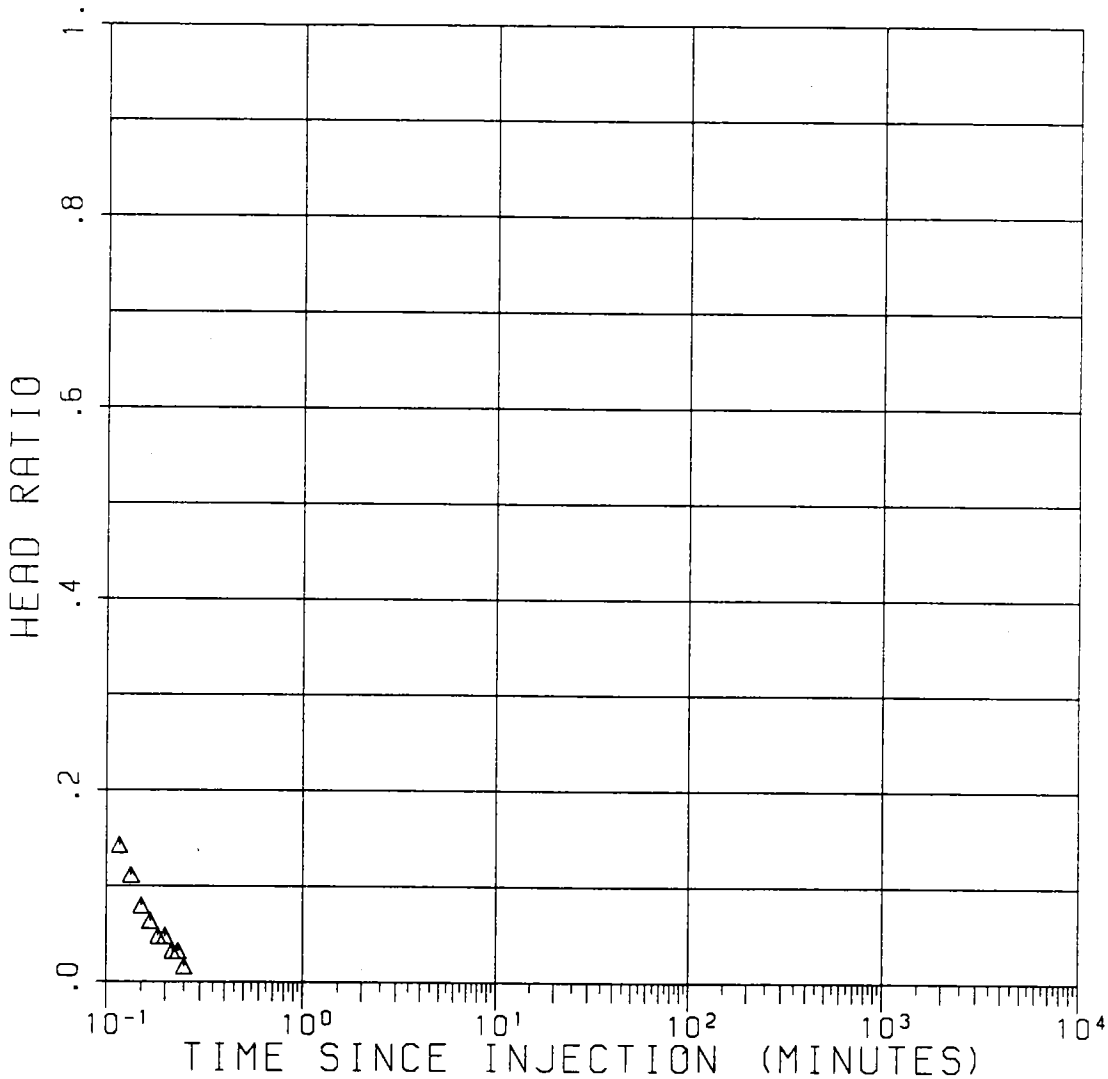
| WELL # | PERMEABILITY METHOD 1 | PERMEABILITY METHOD 2 | STORAGE COEF METHOD 2 | PERMEABILITY METHOD 3 | PERMEABILITY METHOD 4 |
|---|---|---|---|---|---|
| S1MW102 | 8.71E-03 | 1.42E-02 | 5.88E-07 | .00 | 5.45E-03 |

* METHOD 1 IS HVORSLEV
METHOD 2 IS COOPER, BREDEHOEFT, AND PAPADOPULOS
METHOD 3 IS FERRIS AND KNOWLES
METHOD 4 IS BOUWER

SITE 1. LANDFILL 1. WELL S1MW102

SUN 05-20-1990

14:01:10.59




# SLUG TEST OF WELL S1MW102

## HEAD RATIO VS LOG TIME

RAW DATA

WELL # S1MW103

WELL DIAMETER= 8.25 INCHES
CASING DIAMETER= 2.00 INCHES
VOLUME OF WATER= .28 GALLONS
LENGTH OF AQUIFER TESTED= 20.00 FEET
VALUE OF H0= .65 FEET
STATIC WATER LEVEL= 22.81 FEET
LENGTH OF SCREEN= 10.00 FEET
WATER TABLE TO BOTTOM OF WELL= 4.89 FEET

SLUG TEST DATA:

| TIME | WATER LEVEL (FEET) | TIME SINCE TEST BEGAN (MINUTES) |
|---|---|---|
| 17.15. 7 | 23.00 | .12 |
| 17.15. 8 | 22.96 | .13 |
| 17.15. 9 | 22.94 | .15 |
| 17.15.10 | 22.92 | .17 |
| 17.15.11 | 22.90 | .18 |
| 17.15.12 | 22.88 | .20 |
| 17.15.13 | 22.87 | .22 |
| 17.15.14 | 22.87 | .23 |
| 17.15.15 | 22.86 | .25 |
| 17.15.16 | 22.86 | .27 |
| 17.15.21 | 22.84 | .35 |
| 17.15.26 | 22.83 | .43 |
| 17.15.31 | 22.83 | .52 |
| 17.15.36 | 22.82 | .60 |
| 17.15.41 | 22.82 | .68 |
| 17.15.46 | 22.82 | .77 |

WELL # S1MW103

WELL DIAMETER= 8.25 INCHES
CASING DIAMETER= 2.00 INCHES
VOLUME OF WATER REMOVED OR ADDED TO WELL= .28 GALLONS
LENGTH OF AQUIFER TESTED= 20.00 FEET
VALUE OF H0= .65 FEET
STATIC WATER LEVEL= 22.81 FEET

SLUG TEST DATA:

| TIME SINCE TEST BEGAN (MINUTES) | WATER LEVEL (FEET) | DRAWDOWN (FEET) | HEAD RATIO | RECIPROCAL TIME (1/MINUTES) |
|---|---|---|---|---|
| .12 | 23.00 | .19 | .292 | 8.571 |
| .13 | 22.96 | .15 | .231 | 7.500 |
| .15 | 22.94 | .13 | .200 | 6.667 |
| .17 | 22.92 | .11 | .169 | 6.000 |
| .18 | 22.90 | .09 | .138 | 5.455 |
| .20 | 22.88 | .07 | .108 | 5.000 |
| .22 | 22.87 | .06 | .092 | 4.615 |
| .23 | 22.87 | .06 | .092 | 4.286 |
| .25 | 22.86 | .05 | .077 | 4.000 |
| .27 | 22.86 | .05 | .077 | 3.750 |
| .35 | 22.84 | .03 | .046 | 2.856 |
| .43 | 22.83 | .02 | .031 | 2.308 |
| .52 | 22.83 | .02 | .031 | 1.935 |
| .60 | 22.82 | .01 | .015 | 1.666 |
| .68 | 22.82 | .01 | .015 | 1.463 |
| .77 | 22.82 | .01 | .015 | 1.304 |

WELL # S1MW103

---

PERMEABILITY BASED ON COOPER, BREDEHOEFT, AND PAPADOPULOS METHOD

PERMEABILITY=1.76E-04/ MATCH TIME (IN MINUTES)
STORAGE COEF= 5.88E-02* ALPHA
COMPUTER CALCULATES
ALPHA=1.00E-05 MATCH TIME= 2.39E-02
PERMEABILITY= 7.39E-03 CM/SEC
STORAGE COEF=5.88E-07
CORRELATION NUMBER= 1.00

---

PERMEABILITY BASED ON REGRESSION FIT OF HEAD RATIO DATA

HVORSLEV PERMEABILITY=3.58E-04 / LAG TIME
BOUWER PERMEABILTY=7.79E-04 * -SLOPE

COMPUTER CALCULATES
PERMEABILITY VARIES MORE THAN 20% DEPENDING ON THEEQUATION USED

FOR X ON Y: HVORSLEV PERMEABILITY=2.19E-02 CM/SEC
BOUWER PERMEABILITY=1.95E-03CM/SEC
FOR Y ON X: HVORSLEV PERMEABILITY=9.76E-03 CM/SEC
BOUWER PERMEABILITY=2.13E-03 CM/SEC
AVERAGE HVORSLEV PERMEABILITY=1.35E-02 CM/SEC
AVERAGE BOUWER PERMEABILITY=2.04E-03 CM/SEC
REGRESSION STATISTICS
X ON Y
INTERCEPT= -.39
SLOPE= -2.5
Y ON X
INTERCEPT= -.33
SLOPE= -2.7
CORRELATION COEFFICIENT= -.95
CALCULATIONS INDICATE THAT A VALUE OF .65 FEET FOR HO
OR A VALUE OF 1.996 INCHES FOR EFFECTIVE CASING DIA.
MAY YIELD BETTER RESULTS

---

PERMEABILITY BASED ON REGRESSION FIT OF DATA - FERRIS & KNOWLES METHOD

INSUFFICIENT DATA POINTS WITH RECIPROCAL TIMES LESS THAN .300
NUMBER OF USABLE DATA POINTS= 0

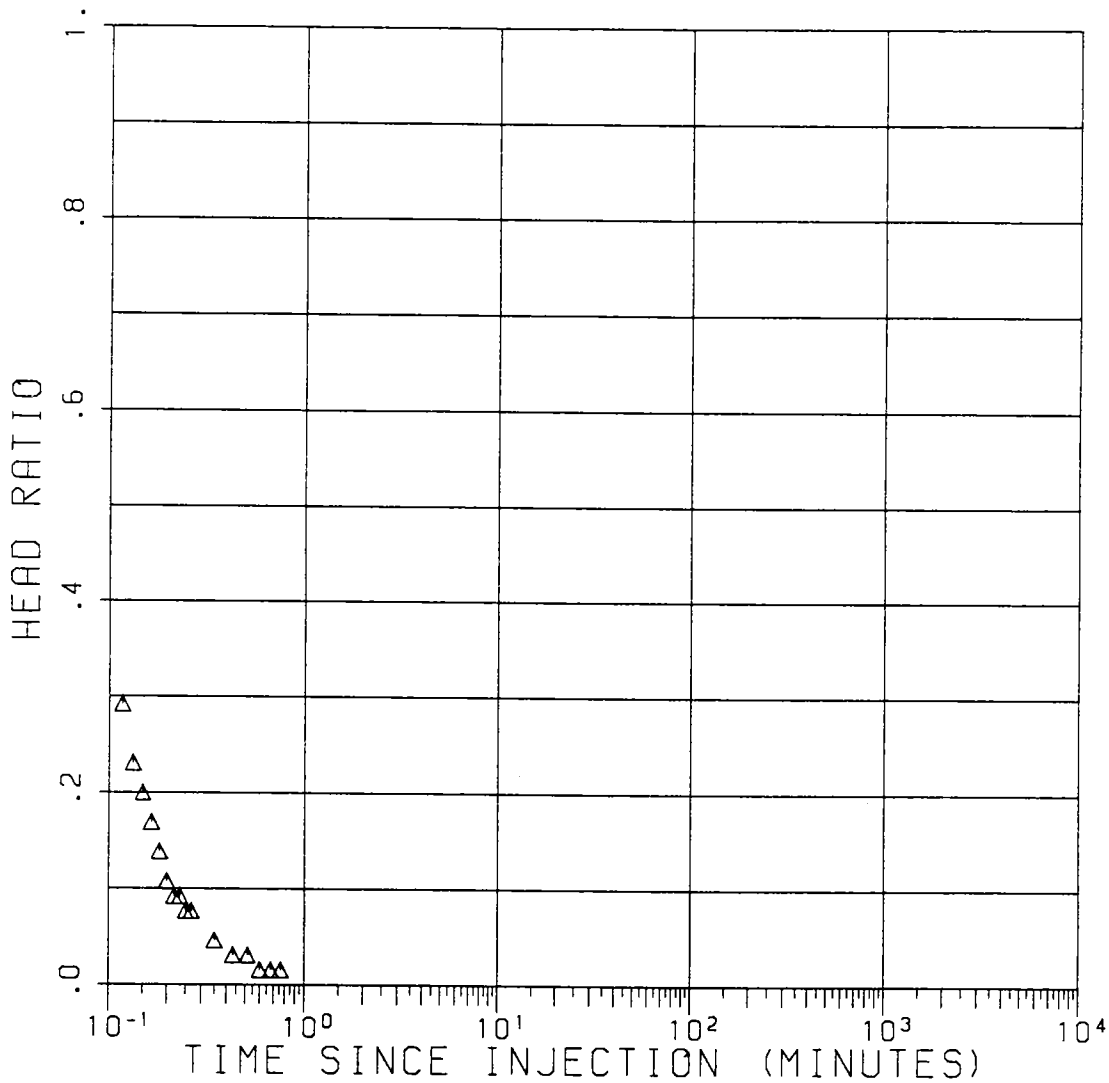
| WELL # | PERMEABILITY METHOD 1 | PERMEABILITY METHOD 2 | STORAGE COEF METHOD 2 | PERMEABILITY METHOD 3 | PERMEABILITY METHOD 4 |
|---|---|---|---|---|---|
| S1MW103 | 1.35E-02 | 7.39E-03 | 5.88E-07 | .00 | 2.04E-03 |

* METHOD 1 IS HVORSLEV
METHOD 2 IS COOPER, BREDEHOEFT, AND PAPADOPULOS
METHOD 3 IS FERRIS AND KNOWLES
METHOD 4 IS BOUWER

SITE 1. LANDFILL 1. WELL S1MW103

SUN 05-20-1990

14:06:32.73




# SLUG TEST OF WELL S1MW103

## HEAD RATIO VS LOG TIME

RAW DATA

WELL # S1MW104

WELL DIAMETER= 8.25 INCHES
CASING DIAMETER= 2.00 INCHES
VOLUME OF WATER= .28 GALLONS
LENGTH OF AQUIFER TESTED= 20.00 FEET
VALUE OF H0= 1.72 FEET
STATIC WATER LEVEL= 15.20 FEET
LENGTH OF SCREEN= 10.00 FEET
WATER TABLE TO BOTTOM OF WELL= 5.16 FEET

SLUG TEST DATA:

| TIME | WATER LEVEL (FEET) | TIME SINCE TEST BEGAN (MINUTES) |
|---|---|---|
| 16.25. 3 | 15.67 | .06 |
| 16.25. 4 | 15.53 | .08 |
| 16.25. 5 | 15.44 | .09 |
| 16.25. 6 | 15.37 | .11 |
| 16.25. 7 | 15.32 | .13 |
| 16.25. 8 | 15.29 | .14 |
| 16.25. 9 | 15.26 | .16 |
| 16.25.10 | 15.25 | .18 |
| 16.25.11 | 15.24 | .19 |
| 16.25.12 | 15.23 | .21 |
| 16.25.13 | 15.22 | .23 |
| 16.25.14 | 15.22 | .24 |
| 16.25.15 | 15.21 | .26 |
| 16.25.16 | 15.21 | .28 |
| 16.25.17 | 15.21 | .29 |
| 16.25.18 | 15.21 | .31 |
| 16.25.19 | 15.20 | .33 |
| 16.25.24 | 15.20 | .41 |
| 16.25.29 | 15.20 | .49 |
| 16.25.34 | 15.20 | .58 |
| 16.25.39 | 15.20 | .66 |
| 16.25.44 | 15.20 | .74 |
| 16.25.49 | 15.20 | .83 |
| 16.25.54 | 15.20 | .91 |
| 16.25.59 | 15.20 | .99 |

WELL # S1MW104

WELL DIAMETER= 8.25 INCHES
CASING DIAMETER= 2.00 INCHES
VOLUME OF WATER REMOVED OR ADDED TO WELL= .28 GALLONS
LENGTH OF AQUIFER TESTED= 20.00 FEET
VALUE OF H0= 1.72 FEET
STATIC WATER LEVEL= 15.20 FEET

SLUG TEST DATA:

| TIME SINCE TEST BEGAN (MINUTES) | WATER LEVEL (FEET) | DRAWDOWN (FEET) | HEAD RATIO | RECIPROCAL TIME (1/MINUTES) |
|---|---|---|---|---|
| .06 | 15.67 | .47 | .274 | 16.667 |
| .08 | 15.53 | .33 | .192 | 13.043 |
| .09 | 15.44 | .24 | .140 | 10.714 |
| .11 | 15.37 | .17 | .099 | 9.091 |
| .13 | 15.32 | .12 | .070 | 7.895 |
| .14 | 15.29 | .09 | .052 | 6.977 |
| .16 | 15.26 | .06 | .035 | 6.250 |
| .18 | 15.25 | .05 | .029 | 5.660 |
| .19 | 15.24 | .04 | .023 | 5.172 |
| .21 | 15.23 | .03 | .017 | 4.762 |
| .23 | 15.22 | .02 | .012 | 4.412 |
| .24 | 15.22 | .02 | .012 | 4.110 |
| .26 | 15.21 | .01 | .006 | 3.846 |
| .28 | 15.21 | .01 | .006 | 3.614 |
| .29 | 15.21 | .01 | .006 | 3.409 |
| .31 | 15.21 | .01 | .006 | 3.226 |
| .33 | 15.20 | .00 | .000 | 3.061 |
| .41 | 15.20 | .00 | .000 | 2.438 |
| .49 | 15.20 | .00 | .000 | 2.027 |
| .58 | 15.20 | .00 | .000 | 1.734 |
| .66 | 15.20 | .00 | .000 | 1.515 |
| .74 | 15.20 | .00 | .000 | 1.345 |
| .83 | 15.20 | .00 | .000 | 1.210 |
| .91 | 15.20 | .00 | .000 | 1.099 |
| .99 | 15.20 | .00 | .000 | 1.007 |

WELL # S1MW104

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PERMEABILITY BASED ON COOPER, BREDEHOEFT, AND PAPADOPULOS METHOD

PERMEABILITY=1.76E-04/ MATCH TIME (IN MINUTES)
STORAGE COEF= 5.88E-02* ALPHA
COMPUTER CALCULATES
ALPHA=1.00E-05 MATCH TIME= 9.90E-03
PERMEABILITY= 1.78E-02 CM/SEC
STORAGE COEF=5.88E-07
CORRELATION NUMBER= 1.00

---

PERMEABILITY BASED ON REGRESSION FIT OF HEAD RATIO DATA

HVORSLEV PERMEABILITY=3.58E-04 / LAG TIME
BOUWER PERMEABILTY=7.91E-04 * -SLOPE

COMPUTER CALCULATES
HVORSLEV PERMEABILITY=8.62E-03 CM/SEC
BOUWER PERMEABILITY=6.52E-03 CM/SEC
REGRESSION STATISTICS
X ON Y
INTERCEPT= -.09
SLOPE= -8.2
Y ON X
INTERCEPT= -.09
SLOPE= -8.3
CORRELATION COEFFICIENT=-1.00
CALCULATIONS INDICATE THAT A VALUE OF 1.57 FEET FOR HO
OR A VALUE OF 2.089 INCHES FOR EFFECTIVE CASING DIA.
MAY YIELD BETTER RESULTS

---

PERMEABILITY BASED ON REGRESSION FIT OF DATA - FERRIS & KNOWLES METHOD

INSUFFICIENT DATA POINTS WITH RECIPROCAL TIMES LESS THAN .300
NUMBER OF USABLE DATA POINTS= 0

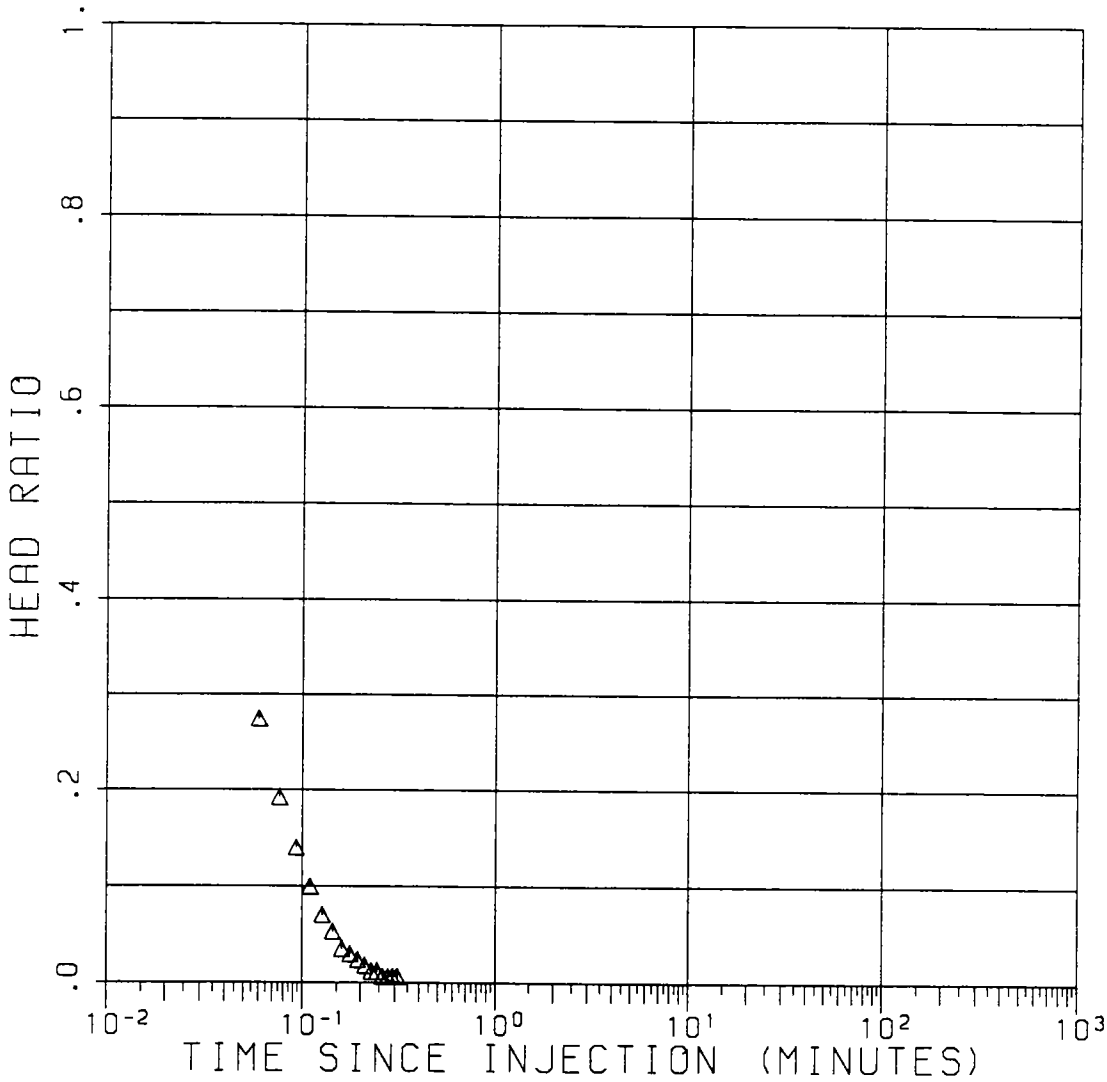
| WELL # | PERMEABILITY METHOD 1 | PERMEABILITY METHOD 2 | STORAGE COEF METHOD 2 | PERMEABILITY METHOD 3 | PERMEABILITY METHOD 4 |
|---|---|---|---|---|---|
| S1MW104 | 8.62E-03 | 1.78E-02 | 5.88E-07 | .00 | 6.52E-03 |

* METHOD 1 IS HVORSLEV
METHOD 2 IS COOPER, BREDEHOEFT, AND PAPADOPULOS
METHOD 3 IS FERRIS AND KNOWLES
METHOD 4 IS BOUWER

SITE 1, LANDFILL 1, WELL S1MW104

SUN 05-20-1990

14:12:42.49




# SLUG TEST OF WELL S1MW104

## HEAD RATIO VS LOG TIME

# Groundwater Sampling Logs

# GROUNDWATER SAMPLING LOG

## FORT STORY



CLIENT USACE
SITE 1
WELL NUMBER MW 101
JOB NUMBER 1868.0401

TOTAL WELL DEPTH 21'
WELL DIAMETER 2"
BOREHOLE DIAMETER 8 3/4"

MIN NUMBER WELL VOL TO BE PURGED 3
VOL PER VERTICAL FT CASING (GAL) .95
VOL PER FT BOREHOLE (LESS CASING)(GAL)

STATIC WATER LEVEL (FT) 17.0
STANDING WATER COLUMN (FT) 3.0

AMT ONE WELL VOL (GAL) 2.85
TOTAL GAL TO BE PURGED 8.55

PURGING SYSTEM TEFLON BAILER
SAMPLING SYSTEM TEFLON BAILER

| DATE | TIME | AMOUNT PURGED (GAL) | EC | FIELD PARAMETERS MEASURED pH | TEMP | TURBIDITY | PID | | | COMMENTS | SAMPLER |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 27 | 0620 | 0 | 220 | 6.45 | 16.1 | | | | | murky Brown 0% Sed | MDS/EJD |
| " | 0622 | 3 | 250 | 6.40 | 16.0 | | | | | murky- Brown 0% Sed | MDS/EJD |
| " | 0623 | 6 | 270 | 6.45 | 15.9 | | | | | murky- Brown 0% Sed | MDS/EJD |
| " | 0625 | 9 | | | | | | | | N/A | MDS/EJD |
| " | 0624 | 12 | | | | | | | | N/A | MDS/EJD |
| " | 0626 | 15 | 250 | 6.47 | 16.0 | | | | | murky- Brown 0% Sed | MDS/EJD |
| " | | | | | | | | | | N/A | MDS/EJD |
| " | | | | | | | | | | N/A | MDS/EJD |
| " | | | | | | | | | | | |
| " | | | | | | | | | | | |
| " | | | | | | | | | | | |
| FINAL READING | 0643 | 6* | 240 | 6.56 | 16.0 | 1326.7 | 0.4 | | | murky- Brown 0% Sed | MDS/EJD |

NOTES: Purge Rate: 2 gl/min

Well Did not purge dry

TURBIDITY: 50 x 50
108 - 9

# GROUNDWATER SAMPLING LOG

## FORT STORY



CLIENT USACE
SITE 1
WELL NUMBER MW 102
JOB NUMBER 1868.0401

TOTAL WELL DEPTH 11.25'
WELL DIAMETER 2"
BOREHOLE DIAMETER 8 3/4"

MIN NUMBER WELL VOL TO BE PURGED 3
VOL PER VERTICAL FT CASING (GAL) .95
VOL PER FT BOREHOLE (LESS CASING)(GAL)

STATIC WATER LEVEL (FT) 1.80
STANDING WATER COLUMN (FT) 9.45

AMT ONE WELL VOL (GAL) 9.0
TOTAL GAL TO BE PURGED 27.0

PURGING SYSTEM TEFLON BAILER
SAMPLING SYSTEM TEFLON BAILER

| DATE | TIME | AMOUNT PURGED (GAL) | FIELD PARAMETERS MEASURED | | | | | | | COMMENTS | SAMPLER |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | EC | pH | TEMP | TURBIDITY | PID | | | | |
| 5/27 | 0843 | 0 | 190 | 5.58 | 14.9 | | | | | BROWNISH TINT 0% SED | MDS/EJD |
| " | 0846 | 5 | 210 | 5.69 | 14.7 | | | | | BROWNISH TINT 0% SED | MDS/EJD |
| " | 0850 | 10 | 180 | 5.86 | 14.3 | | | | | BROWNISH TINT 0% SED | MDS/EJD |
| " | 0853 | 15 | 190 | 5.80 | 14.7 | | | | | BROWNISH TINT 0% SED | MDS/EJD |
| " | 0856 | 20 | | | | | | | | N/A | MDS/EJD |
| " | 0900 | 25 | | | | | | | | N/A | MDS/EJD |
| " | 0903 | 30 | 170 | 5.84 | 14.7 | | | | | BROWNISH TINT 0% SED | MDS/EJD |
| " | | | | | | | | | | N/A | MDS/EJD |
| " | | | | | | | | | | | |
| " | | | | | | | | | | | |
| " | | | | | | | | | | | |
| FINAL READING | 0943 | 6* | 160 | 5.87 | 14.7 | 149.6 | 0.0 | | | CLEAR - BROWN 0% SED | MDS/EJD |

NOTES: Purge Rate: 1.8 gl/min

TURBIDITY: 50% = 74.8

Well was not purged dry

# GROUNDWATER SAMPLING LOG

## FORT STORY



CLIENT USACE
SITE 1
WELL NUMBER MW 103
JOB NUMBER 1868.0401

TOTAL WELL DEPTH 25.0
WELL DIAMETER 2"
BOREHOLE DIAMETER 8 3/4"

MIN NUMBER WELL VOL TO BE PURGED 3
VOL PER VERTICAL FT CASING (GAL) .95
VOL PER FT BOREHOLE (LESS CASING)(GAL)

STATIC WATER LEVEL (FT) 22.6
STANDING WATER COLUMN (FT) 2.6

AMT ONE WELL VOL (GAL) 3.6
TOTAL GAL TO BE PURGED 10.8

PURGING SYSTEM TEFLON BAILER
SAMPLING SYSTEM TEFLON BAILER

| DATE | TIME | AMOUNT PURGED (GAL) | EC | FIELD PARAMETERS MEASURED pH | TEMP | TURBIDITY | PID | | | COMMENTS | SAMPLER |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5-27 | 1350 | 0 | 30 | 5.60 | 13.7 | | | | | REDDISH TINT 10% SED | mps/EJP |
| " | 1352 | 2 | 150 | 5.41 | 13.0 | | | | | REDDISH TINT 0% SED | MDS/EJD |
| " | 1354 | 3 | 150 | 5.49 | 13.4 | | | | | CLER 0% SED | MDS/EJD |
| " | 1356 | 0 | | | | | | | | N/A | MDS/EJD |
| " | 1400 | 0 | | | | | | | | N/A | MDS/EJD |
| " | 1405 | 0 | | | | | | | | N/A | MDS/EJD |
| " | 1406 | 1 | 150 | 5.41 | 13.2 | | | | | CLEAR 0% SED | MDS/EJD |
| " | | | | | | | | | | N/A | MDS/EJD |
| " | | | | | | | | | | | |
| " | | | | | | | | | | | |
| " | | | | | | | | | | | |
| FINAL READING | 1440 | 6* | 150 | 5.49 | 13.8 | 66.0 | 0.0 | | | CLEAR NO SED. | mps/EJP |

NOTES: 1 g/min = Purge Rate

Recharge Rate:

TURBIDITY:

~~Purge~~ 1'/every 6 minutes

## SUMMARY OF PURGED WELLS

NEW MW 103 is located on the WESTERN side of the site. The initial SWL was 22' 6", with a SWC of 2.6. The well volume was found to be 3.6 gallons, thus requiring a total of 10.8 gallons to be purged.

The purging began at 1350. The purge rate was calculated at 1 g gallons/minute. At 1356, the well was purged dry. The bailer was then used to ensure no water was still present in the well. A total of two bailer volumes were drawn (partial volume of 4 oz.) to verify that the well was indeed dry. At 1405 and 1406 the flexidip was used to calculate groundwater recharge. The groundwater recharge rate was determined to be 1 ft/minutes. This well was allowed to recharge for 36 minutes prior to sampling.

# GROUNDWATER SAMPLING LOG

## FORT STORY



CLIENT USACE
SITE 1
WELL NUMBER MW 104
JOB NUMBER 1868.C401

TOTAL WELL DEPTH 17.5
WELL DIAMETER 2"
BOREHOLE DIAMETER 8 3/4"

MIN NUMBER WELL VOL TO BE PURGED 3
VOL PER VERTICAL FT CASING (GAL) .95
VOL PER FT BOREHOLE (LESS CASING)(GAL)

STATIC WATER LEVEL (FT) 9'6"
STANDING WATER COLUMN (FT) 7' 11"

AMT ONE WELL VOL (GAL) 7.5
TOTAL GAL TO BE PURGED 22.5

PURGING SYSTEM TEFLON BAILER
SAMPLING SYSTEM TEFLON BAILER

| DATE | TIME | AMOUNT PURGED (GAL) | EC | FIELD PARAMETERS MEASURED pH | TEMP | TURBIDITY | PID | | | COMMENTS | SAMPLER |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5-27 | 0949 | 0 | 250 | 6.62 | 14.5 | | | | | murky - Brown 0% Sed | MDS/EJD |
| " | 0951 | 5 | 260 | 6.57 | 14.6 | | | | | murky - Brown 0% - Sed | MDS/EJD |
| " | 0954 | 7 | 240 | 6.51 | 14.2 | | | | | murky - Brown 0% - Sed | MDS/EJD |
| " | 0959 | 8 | 250 | 6.49 | 14.3 | | | | | murky - Brown 0% - Sed | MDS/EJD |
| " | 1003 | 0 | | | | | | | | N/A | MDS/EJD |
| " | 1005 | 0 * | | | | | | | | N/A | MDS/EJD |
| " | 1009 | 1 * | | | | | | | | N/A | MDS/EJD |
| " | 1009 | 1 | 250 | 6.60 | 14.3 | | | | | murky - Brown 0% Sed | MDS/EJD |
| " | | | | | | | | | | | |
| " | | | | | | | | | | | |
| " | | | | | | | | | | | |
| FINAL READING | 1101 | 6 | 250 | 6.65 | 14.7 | 80.6 | 0.8 | | | murky - Brown 0% Sed | MDS/EJD |

NOTES: 2.0 gl/min - Purge Time

TURBIDITY: 50 x 50 x 50 x 100.2

* Well Purged dry

Recovery Rate: 6"/1' 20 sec = 1'/2 1/2 minutes

**SUMMARY OF PURGED WELLS**

NEW MW 104 is located on the NORTHERN side of the site. The initial SWL was 9' 6", with a SWC of 7' 11. The well volume was found to be 7.5 gallons, thus requiring a total of 22.5 gallons to be purged.

The purging began at 0949. The purge rate was calculated at 2 gallons/minute. At 1003, the well was purged dry. The bailer was then used to ensure no water was still present in the well. A total of two bailer volumes were drawn (partial volume of 4 oz.) to verify that the well was indeed dry. At 1005 and 1007 the flexidip was used to calculate groundwater recharge. The groundwater recharge rate was determined to be 1 ft/minute. This well was allowed to recharge for 31 minutes prior to sampling.

**Soil and Monitoring Well Boring Lithologic Logs**

Site 2

BORING/WELL NUMBER *MW-105*
DATE STARTED *3/24/90* COMPLETED *3/24/90*
SITE NUMBER *2*
GROUND ELEVATION *16.89 FEET, NGVD*

CLIENT *U.S. ARMY CORPS OF ENGINEERS*
PROJECT *FORT STORY PA/SI*
SITE NAME *LANDFILL 2*
GEOLOGIST *MARK SHUPE*



COORDINATES *N223836, E2724570*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | GS | 0-2 | 2 2 4 7 | 31 | | SP | SAND (SP), quartz, tan, medium-fine, subrounded-subangular, fair sorting. | PID Instrumentation PI 101 HNu Systems 10.2 eV Lamp PID Background=0.0 ppm. |
| | LITH | 2-4 | 8 9 10 7 | 27 | | SM | SILTY SAND (SM), quartz, dark gray, fine-medium grained, subangular-subrounded, poor sorting, silty, pos oil residue on grains. | |
| 5 | LITH | 4-6 | 6 7 6 6 | 33 | | | | |
| ▼ | LITH | 6-8 | 3 3 7 4 | 31 | | SP | SAND (SP), quartz, tan, fine-medium grained, subangular, poor sorting; water table encountered at 7 feet. | |
| | SI GEO | 8-10 | 2 2 3 4 | 24.8 | | | | Poor returns in 8-10 foot sample. Drive 2 spoons for additional sample volume. Blow counts = 2,2,3,4,4,5,7,6 |
| 10 | | | | | | | | |
| 15 | LITH | 14-16 | 13 19 9 4 | 31 | | | SAND (SP), quartz, gray-tan, medium-fine, subrounded, poor sorting. | |
| | | | | | | | Total Depth of boring=16 feet. | |
| 20 | | | | | | | | |
| 25 | | | | | | | | |

GS=Ground Surface

SI=Soil/Groundwater Interface

GEO=Geotechnical

LITH=Lithology

▼ =Water table during drilling

**JMM** James M. Montgomery Consulting Engineers, Inc.

DRILLER *HARDIN AND HUBER, INC.*
METHOD OF DRILLING *HOLLOW STEM AUGER*
HOLE DIAMETER *8 1/4 INCHES*
TOTAL DEPTH *17.5 FEET*

WELL COMPLETION DEPTH *16 FEET*
WELL DIAMETER *2 INCHES*
WELL MATERIAL *SCHEDULE 40 PVC*

BORING/WELL NUMBER *MW-106*
DATE STARTED *3/25/90* COMPLETED *3/25/90*
SITE NUMBER *2*
GROUND ELEVATION *9.75 FEET, NGVD*

CLIENT *U.S. ARMY CORPS OF ENGINEERS*
PROJECT *FORT STORY PA/SI*
SITE NAME *LANDFILL 2*
GEOLOGIST *MARK SHUPE*



COORDINATES *N223740, E2724355*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | GS | 0-2 | 2 3 4 5 | 19.7 | | | SAND (SW), quartz, tan, medium grained, soubrounded, poor sorting; encountered water at 2 feet. | PID Instrumentation OVM 580B Thermo Environmental Instruments, Inc. 10.2 eV Lanp PID Background=0.0 ppm. |
| | GEO SI | 2-4 | 7 10 15 16 | 19.0 | | | | |
| 5 | LITH | 4-6 | 4 7 6 6 | 37.3 | | SW | SAND (SW), quartz, light gray, medium grained, subrounded, poor sorting. | |
| 10 | LITH | 10-12 | 7 8 9 12 | 18.8 | | | SAND (SW), quartz, tan, medium-grained, subrounded, fair sorting. | Sand running up into auger string at 10 feet; Estimate 0.5 feet of run-up. |
| | | | | | | | Total depth of boring=12 feet. | |
| 15 | | | | | | | | |
| 20 | | | | | | | | |
| 25 | | | | | | | | |

GS=Ground Surface

SI=Soil/Groundwater Interface

GEO=Geotechnical

LITH=Lithology

▼ =Water table during drilling

**JMM** James M. Montgomery Consulting Engineers, Inc.

DRILLER *HARDIN AND HUBER, INC.*
METHOD OF DRILLING *HOLLOW STEM AUGER*
HOLE DIAMETER *8 1/4 INCHES*
TOTAL DEPTH *12 FEET*

WELL COMPLETION DEPTH *11.75 FEET*
WELL DIAMETER *2 INCHES*
WELL MATERIAL *SCHEDULE 40 PVC*

BORING/WELL NUMBER *MW-107*
DATE STARTED *3/24/90* COMPLETED *3/24/90*
SITE NUMBER *2*
GROUND ELEVATION *10.84 FEET, NGVD*

CLIENT *U.S. ARMY CORPS OF ENGINEERS*
PROJECT *FORT STORY PA/SI*
SITE NAME *LANDFILL 2*
GEOLOGIST *MARK SHUPE*



COORDINATES *N223368, E2724613*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | GS | 0-2 | 4 15 12 13 | | | SM | SILT (SM), vegetation-roots, brown sandy. SAND (SP), tan fine, subrounded, poorly graded, wood and glass from 1-2 feet. | |
| | SI GEO | 2-4 | 3 5 5 4 | 1.2 | | SP | SAND (SP), buff to gray medium, subrounded, poorly graded, wood at 6 feet, water at 2 feet. | 2-4 foot interval drive 3 spoons for additional sample volume Blow counts=2,2,3,2 3,5,4,3 3,5,5,4 |
| 5 | LITH | 5-7 | 1 1 2 1 | 0.8 | | | SAND (SP), brown, medium, subrounded, poorly graded, peat seam at 6 feet. | PID Instrumentation PI 101 HNu Systems 10.2 eV Lamp PID Background=0.0 ppm. |
| 10 | LITH | 10-12 | 7 11 14 11 | 2.8 | | PT | PEAT (PT), dark brown. | |
| | | | | | | SP | SAND (SP), brown, medium, subrounded, poorly graded. Total depth of boring=13 feet. | |
| 15 | | | | | | | | |
| 20 | | | | | | | | GS=Ground Surface SI=Soil/Groundwater Interface GEO=Geotechnical LITH=Lithology ▼=Water table during drilling |
| 25 | | | | | | | | |

**JMM** James M. Montgomery
Consulting Engineers, Inc.

DRILLER *HARDIN AND HUBER, INC.*
METHOD OF DRILLING *HOLLOW STEM AUGER*
HOLE DIAMETER *8 1/4 INCHES*
TOTAL DEPTH *13 FEET*

WELL COMPLETION DEPTH *11.5 FEET*
WELL DIAMETER *2 INCHES*
WELL MATERIAL *SCHEDULE 40 PVC*

BORING/WELL NUMBER *MW-108*
DATE STARTED *3/24/90* COMPLETED *3/24/90*
SITE NUMBER *2*
GROUND ELEVATION *9.29 FEET, NGVD*

CLIENT *U.S. ARMY CORPS OF ENGINEERS*
PROJECT *FORT STORY PA/SI*
SITE NAME *LANDFILL 2*
GEOLOGIST *MARK SHUPE*



COORDINATES *N223040, E2724645*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | GS DUP SPLIT | 0-2 | 7 7 8 10 | 3.2 | | SM | SAND (SM), topsoil, dark brown, silty, fine, subrounded, very moist, brown color at 1 foot, wood, organic material, water at 2.5 feet. | 0-2 foot interval drive 3 spoons for additional sample volume Blow counts=3,3,2,3 2,4,5,6 7,7,8,10 |
| | SI GEO | | 3 5 3 3 | 2.0 | | | | |
| 5 | | | | | | | PEAT (PT), brown, wood. | PID Instrumentation PI 101 HNu Systems 10.2 eV Lamp PID Background=0.0 ppm. |
| | LITH | 5-7 | 1 1 2 3 | 0.2 | | PT | | |
| | | | | | | | SAND (SW), brown, fine, subrounded, well graded. | |
| 10 | LITH | 10-12 | 1 3 2 2 | 1.0 | | SW | | |
| | | | | | | | Total depth of boring=14 feet. | |
| 15 | | | | | | | | |
| 20 | | | | | | | | |
| 25 | | | | | | | | |

GS=Ground Surface

DUP=Duplicate Sample

SPLIT=Split Sample

GEO=Geotechnical

SI=Soil/Groundwater Interface

LITH=Lithology

▼ =Water table during drilling

**JMM** James M. Montgomery
Consulting Engineers, Inc.

DRILLER *HARDIN AND HUBER, INC.*
METHOD OF DRILLING *HOLLOW STEM AUGER*
HOLE DIAMETER *8 1/4 INCHES*
TOTAL DEPTH *14 FEET*

WELL COMPLETION DEPTH *12 FEET*
WELL DIAMETER *2 INCHES*
WELL MATERIAL *SCHEDULE 40 PVC*

BORING/WELL NUMBER *MW-109* CLIENT *U.S. ARMY CORPS OF ENGINEERS* PAGE 1 OF 1

DATE STARTED *3/25/90* COMPLETED *3/25/90* PROJECT *FORT STORY PA/SI*

SITE NUMBER *2* SITE NAME *LANDFILL 2* COORDINATES

GROUND ELEVATION *10.07 FEET, NGVD* GEOLOGIST *MARK SHUPE* *N223184, E2725537*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | GS | 0-2 | 2 2 4 4 | 22.9 | | ML | SANDY SILT (ML) roots, vegetation, brown-tan. | PID Instrumentation OVM 580B Thermo Environmental Instruments, Inc. 10.2 eV Lamp PID Background=0.0 ppm. |
| | SI GEO | 2-4 | 4 6 8 7 | 18.2 | | SM | SAND (SM), quartz, dark gray-brown, medium-fine, subangular, poor sorting, silty; encounter water table 2.5 feet. | |
| 5 | LITH | 4-6 | 4 6 7 5 | | | | SAND (SW), quartz, dark brown, fine-medium grained, subrounded-subangular, fair sorting, silty. | |
| | | | | | | SW | SAND (SW), quartz, tan, subrounded, poor sorting, subrounded. | |
| 10 | LITH | 10-12 | 3 4 5 5 | 27.3 | | | SAND (SW), quartz, light gray, subrounded, fair sorting, subrounded. | |
| | | | | | | | Total depth of boring=12 feet. | |
| 15 | | | | | | | | |
| 20 | | | | | | | | |
| 25 | | | | | | | | |

GS=Ground Surface

SI=Soil/Groundwater Interface

GEO=Geotechnical

LITH=Lithology

▼ =Water table during drilling

**JMM** James M. Montgomery Consulting Engineers, Inc.

DRILLER *HARDIN AND HUBER, INC.* WELL COMPLETION DEPTH *12 FEET*

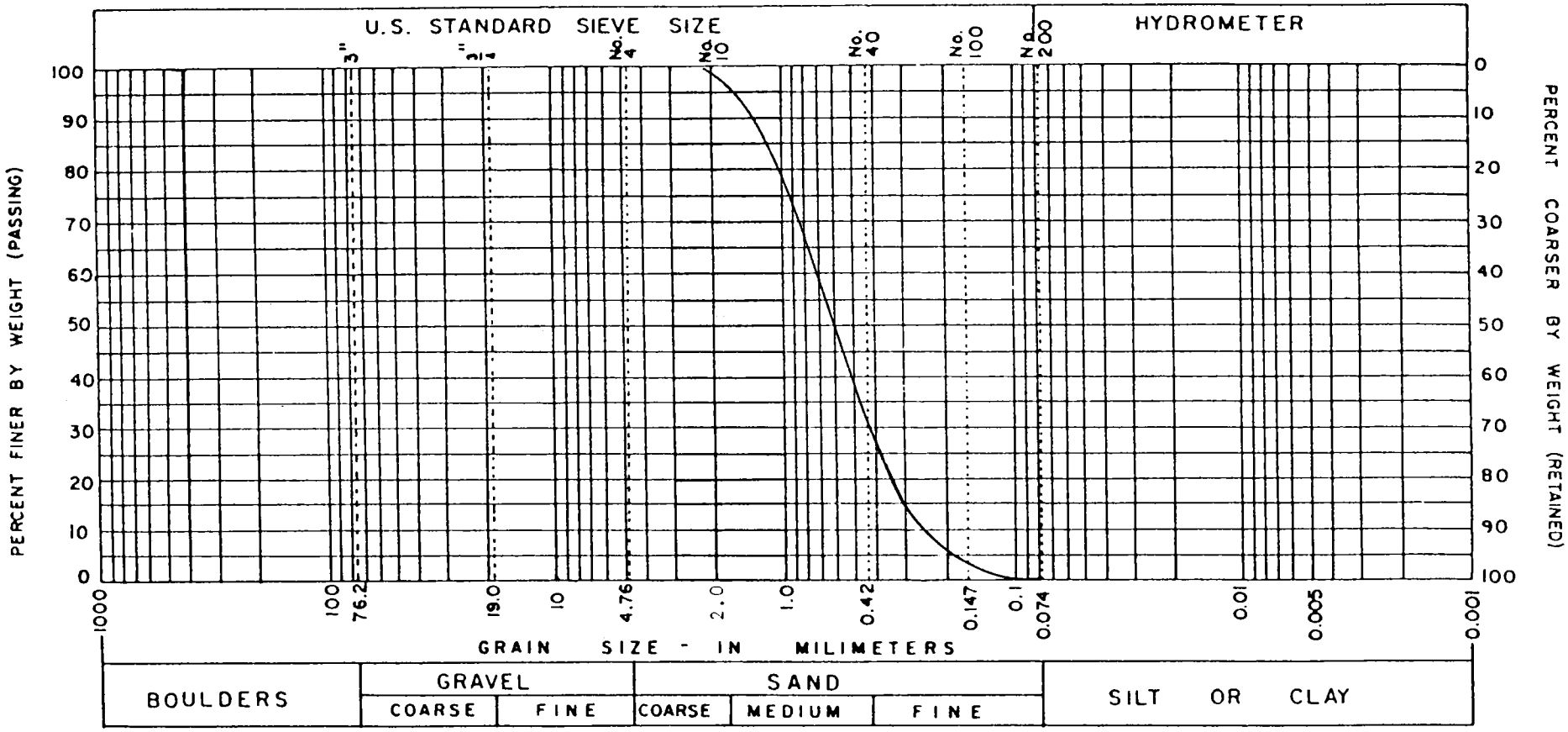
METHOD OF DRILLING *HOLLOW STEM AUGER* WELL DIAMETER *2 INCHES*

HOLE DIAMETER *8 1/4 INCHES* WELL MATERIAL *SCHEDULE 40 PVC*

TOTAL DEPTH *12 FEET*

# Geotechnical Grain Size Analyses

| PROJECT: Fort Story | | LOCATION: Virginia Beach, VA. | |
|---|---|---|---|
| BORING NO. Site 2 | SAMPLE NO. S2MW105 | DEPTH: 10' | CONTRACT NO. 90-075 |




| SAMPLE NO. | DEPTH | L.L. | P.I. | M.C. | Unified | Soil Description |
|---|---|---|---|---|---|---|
| S2MW105 | 10' | - | N.P. | 22.2 | SP | Tan sand |

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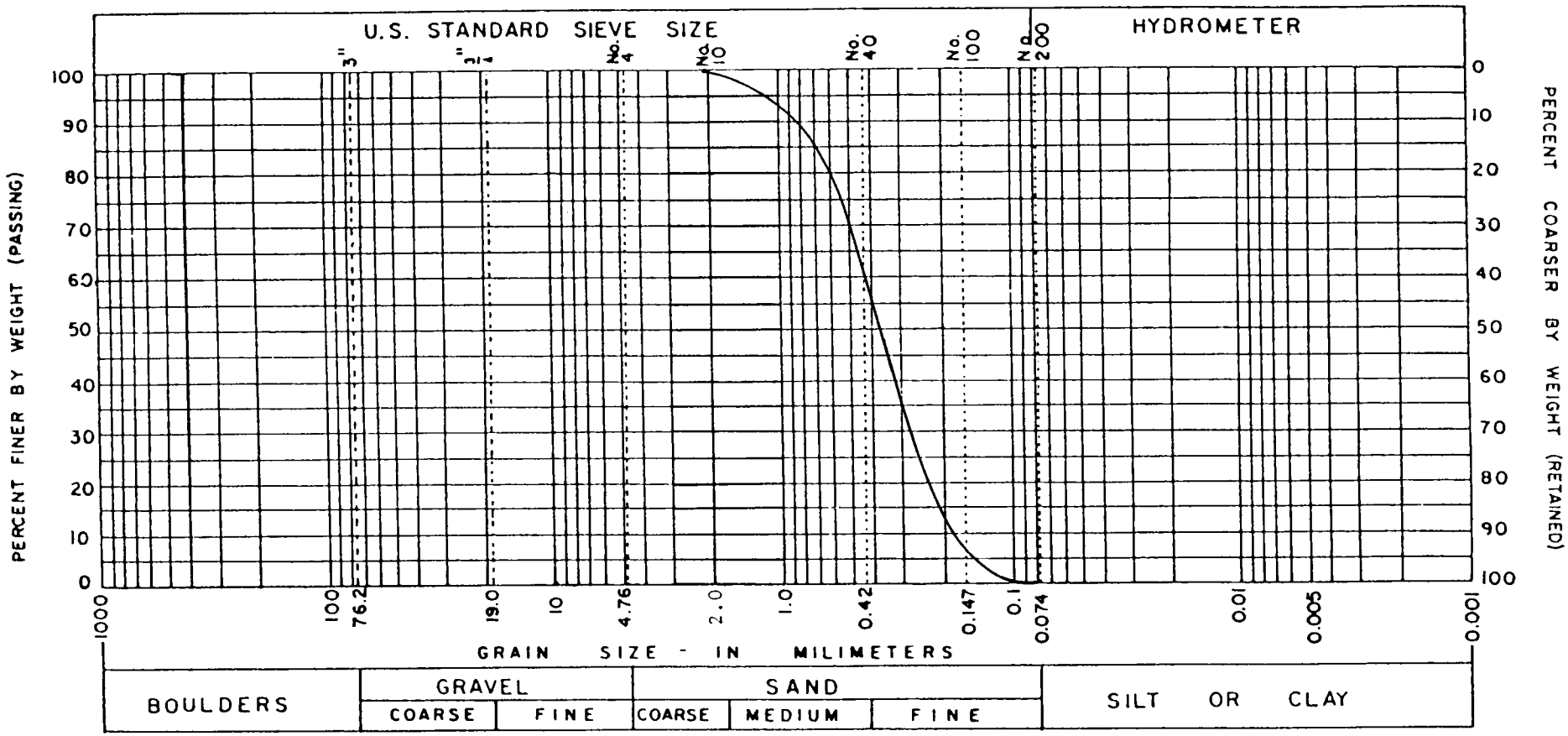
## GRAIN-SIZE DISTRIBUTION

| TESTED BY: RMP | DATE: 7-12-90 |
|---|---|
| CHECKED BY: PAD | SHEET No. 5 OF 32 |

| PROJECT: Fort Story | | LOCATION: Virginia Beach, VA. | |
|---|---|---|---|
| BORING NO. Site 2 | SAMPLE NO. S2MW106 | DEPTH: 4' | CONTRACT NO. 90-075 |




| SAMPLE NO. | DEPTH | L.L. | P.I. | M.C. | Unified | Soil Description |
|---|---|---|---|---|---|---|
| S2MW106 | 4' | - | N.P. | 22.6 | SP | Tan sand |

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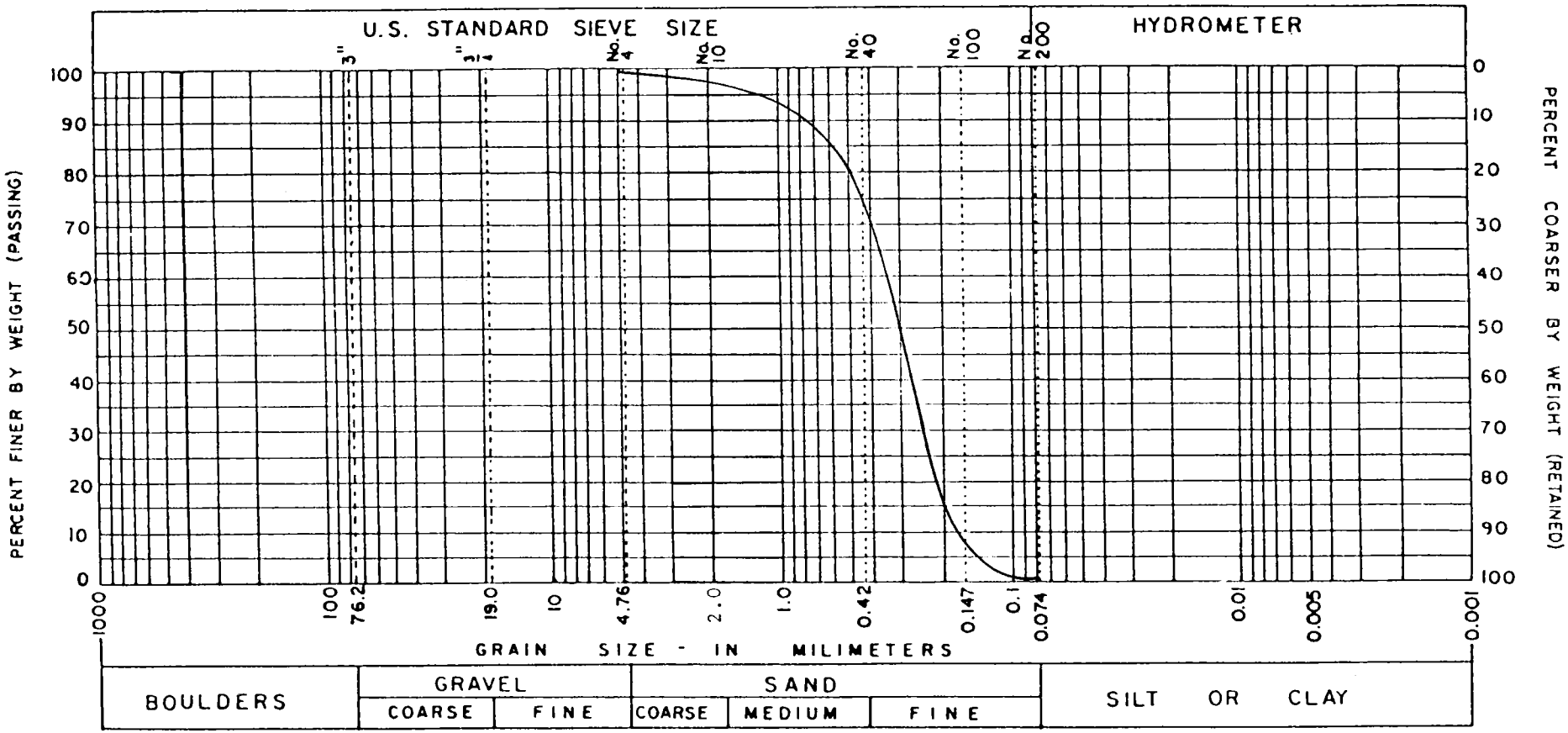
GRAIN-SIZE DISTRIBUTION

| TESTED BY: RMP | DATE: 7-12-90 |
|---|---|
| CHECKED BY: PAD | SHEET No. 6 OF 32 |

| PROJECT: Fort Story | | LOCATION: Virginia Beach, VA. | |
|---|---|---|---|
| BORING NO. Site 2 | SAMPLE NO. S2MW107 | DEPTH: 3' | CONTRACT NO. 90-075 |




| SAMPLE NO. | DEPTH | L.L. | P.I. | M.C. | Unified | Soil Description |
|---|---|---|---|---|---|---|
| S2MW107 | 3' | - | N.P. | 20.0 | SP | Tan sand |

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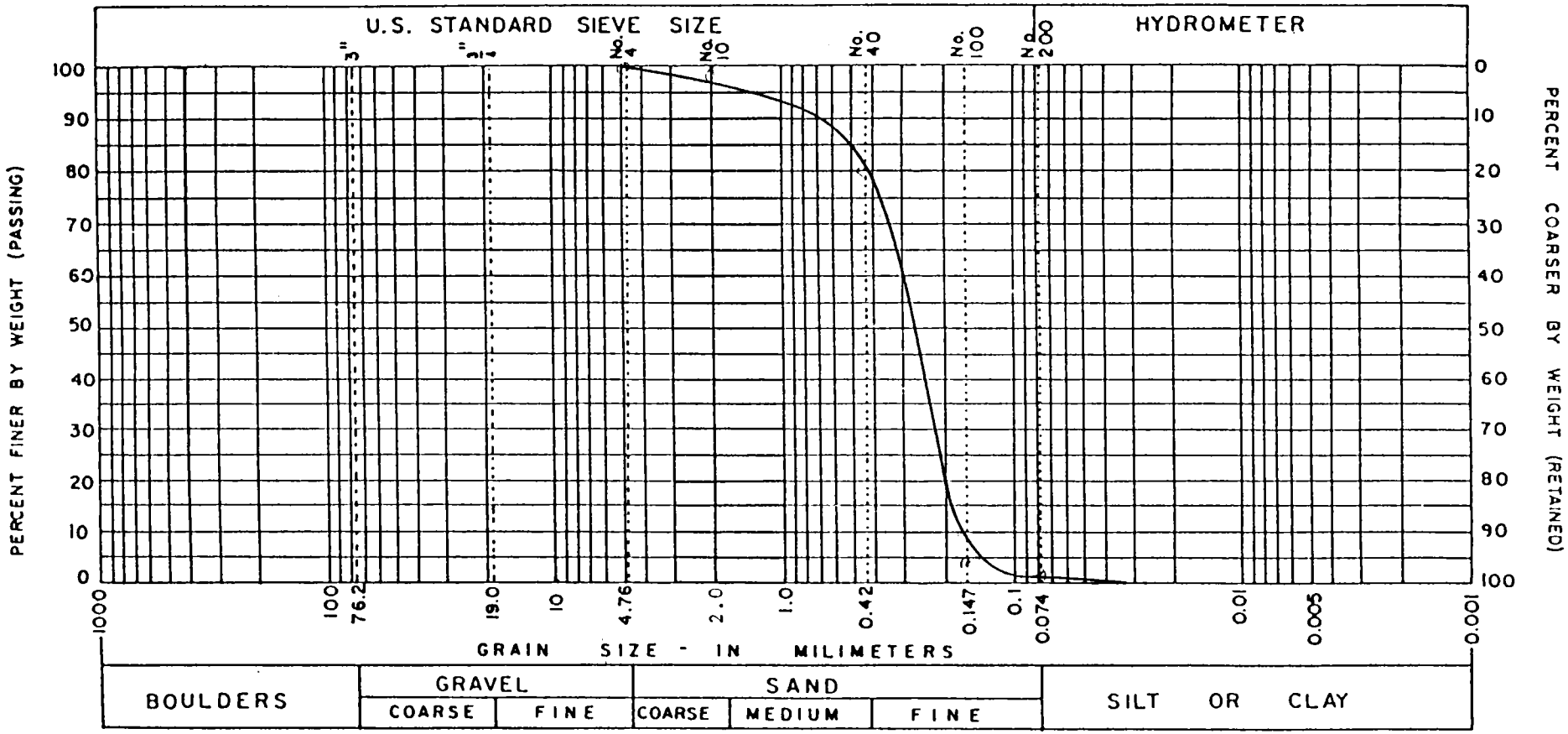
GRAIN-SIZE DISTRIBUTION

| TESTED BY: RMP | DATE: 7-12-90 |
|---|---|
| CHECKED BY: PAD | SHEET No. 7 OF 32 |

| PROJECT: Fort Story | | LOCATION: Virginia Beach, VA. | |
|---|---|---|---|
| BORING NO. Site 2 | SAMPLE NO. S2MW108 | DEPTH: 3' | CONTRACT NO. 90-075 |




| SAMPLE NO. | DEPTH | L.L. | P.I. | M.C. | Unified. | Soil Description |
|---|---|---|---|---|---|---|
| S2MW108 | 3' | - | N.P. | 15.8 | SP | Tan sand |

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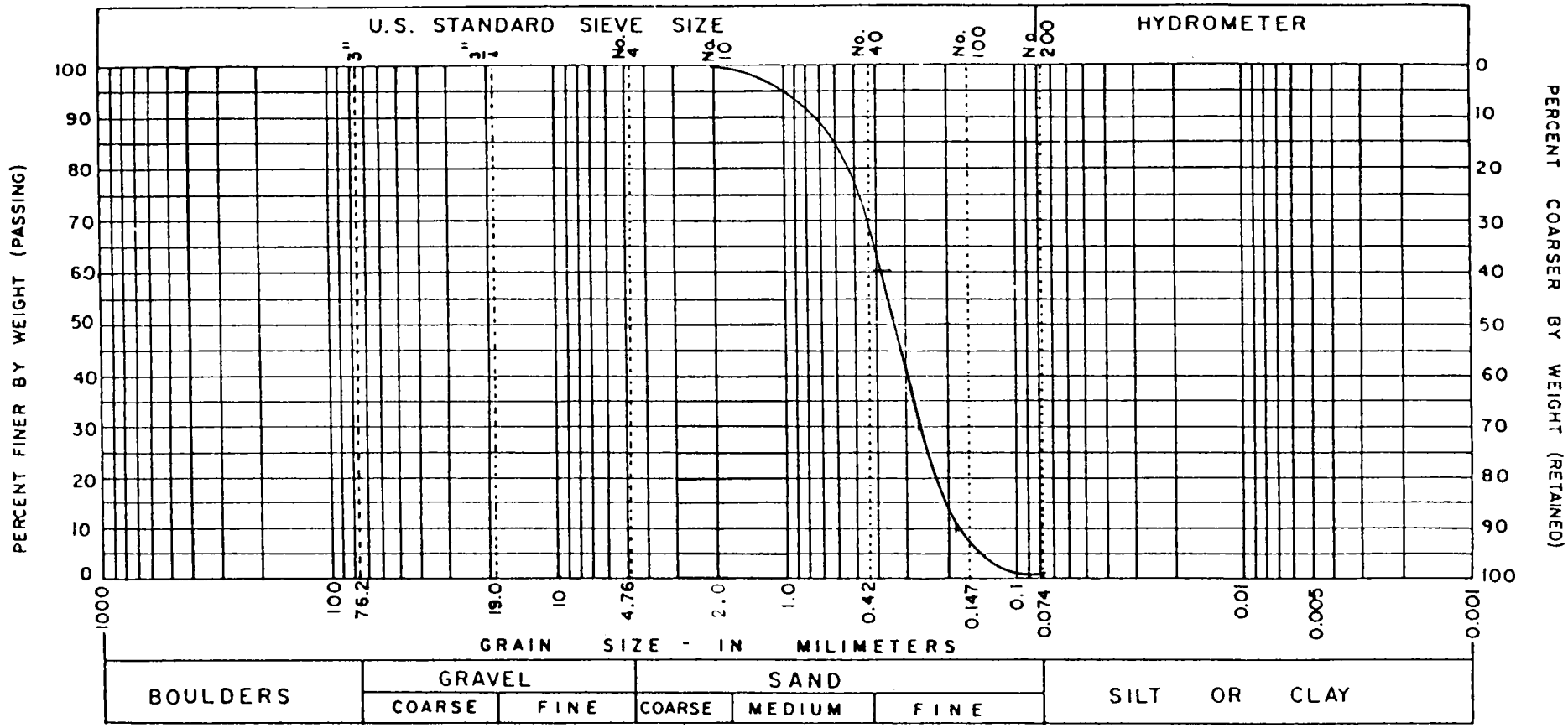
GRAIN-SIZE DISTRIBUTION

| TESTED BY: RMP | DATE: 7-12-90 |
|---|---|
| CHECKED BY: PAD | SHEET No. 8 OF 32 |

| PROJECT: Fort Story | | LOCATION: Virginia Beach, VA. | |
|---|---|---|---|
| BORING NO. Site 2 | SAMPLE NO. S2MW109 | DEPTH: 6' | CONTRACT NO. 90-075 |




| SAMPLE NO. | DEPTH | L.L. | P.I. | M.C. | Unified | Soil Description |
|---|---|---|---|---|---|---|
| S2MW109 | 6' | - | N.P. | 22.5 | SP | Tan sand |

Earth Engineering & Sciences, Inc.

GRAIN-SIZE DISTRIBUTION

TESTED BY: RMP

DATE: 7-12-90

CHECKED BY: PAD

SHEET No. 9 OF 32

# Monitoring Well Construction Summary Sheets

James M. Montgomery
Consulting Engineers, Inc.

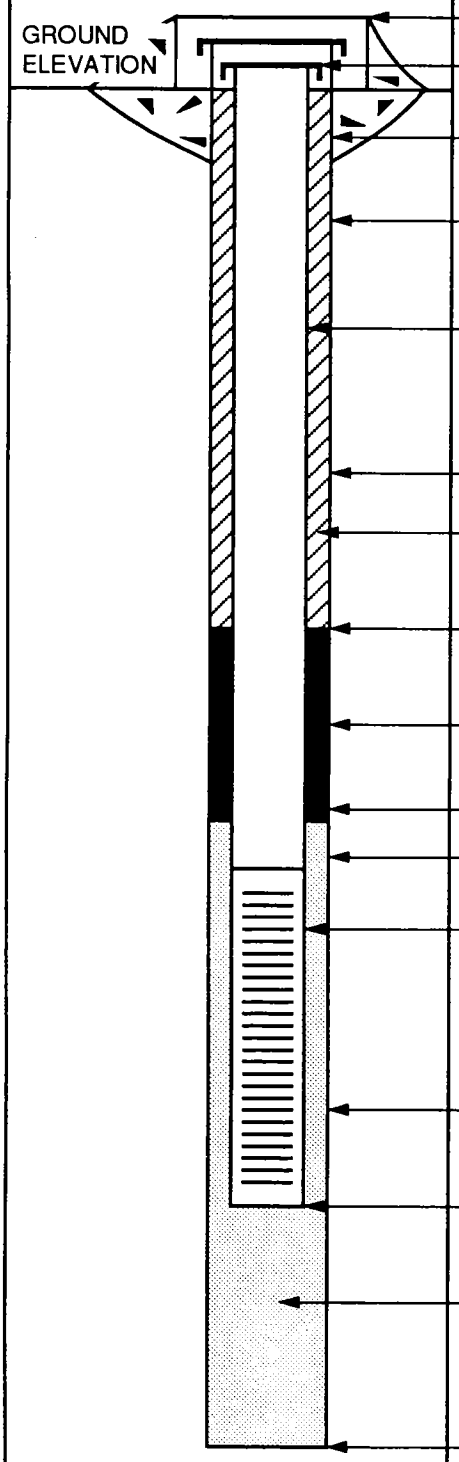
BORING NO. MW-105

# MONITORING WELL SHEET

PROJECT Fort Story PA/SI
PROJECT NO. 1868.0401
ELEVATION
FIELD GEOLOGIST Mark Shupe

LOCATION Site 2
BORING MW-105
DATE 3/24/90

DRILLER Henry Seal
DRILLING METHOD Hollow Stem Auger
DEVELOPMENT METHOD Bailing/Pumping




ELEVATION OF TOP OF SURFACE CASING: 16.89 ft.
ELEVATIONS OF TOP OF RISER PIPE: 16.56 ft.

TYPE OF SURFACE SEAL: Cement Grout

I.D. OF SURFACE CASING: 8 inch
TYPE OF SURFACE CASING: Steel

RISER PIPE I.D.: 2 inches
TYPE OF RISER PIPE: Schedule 40 PVC

BOREHOLE DIAMETER: 8 1/4 inches
TYPE OF BACKFILL: Cement Grout

ELEVATION/DEPTH OF SEAL: 2.0 ft.

TYPE OF SEAL: Granular Bentonite

DEPTH TO TOP OF SAND PACK: 3.0 ft.
ELEVATION/DEPTH TOP OF SCREEN: 5.0 ft.

TYPE OF SCREEN: Schedule 40 PVC
SLOT SIZE X LENGTH: 0.02 inch X 10 feet
I.D. OF SCREEN: 2 inches

TYPE OF SAND PACK: No. 2 Filter Sand

ELEVATION/DEPTH BOTTOM OF SCREEN: 16.0 ft.

ELEVATION/DEPTH BOTTOM OF SANDPACK: 16.0 ft.
TYPE OF BACKFILL BELOW OBSERVATION WELL:

ELEVATION/DEPTH OF HOLE: 16.0 ft.

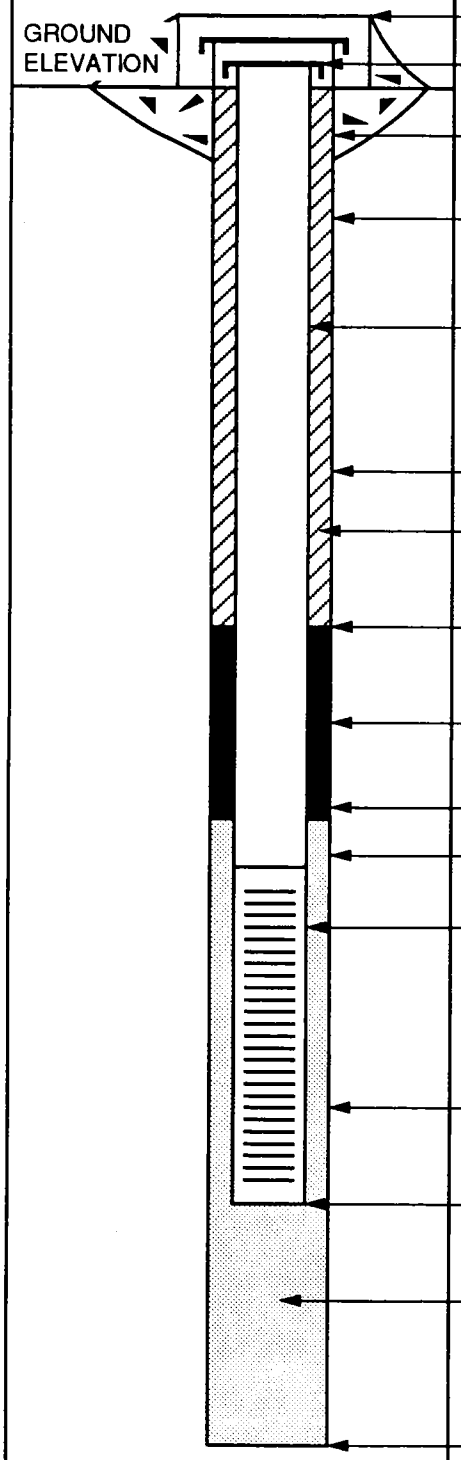
JMM James M. Montgomery
Consulting Engineers, Inc.

BORING NO. MW-106

# MONITORING WELL SHEET

PROJECT Fort Story PA/SI
LOCATION Site 2
PROJECT NO. 1868.0401
BORING MW-106
ELEVATION
DATE 3/25/90
FIELD GEOLOGIST Mark Shupe

DRILLER Hardin and Huber Inc.
DRILLING METHOD Hollow Stem Auger
DEVELOPMENT METHOD Air Surging/Pumping




ELEVATION OF TOP OF SURFACE CASING: 9.75 ft.
ELEVATIONS OF TOP OF RISER PIPE: 9.52 ft.
TYPE OF SURFACE SEAL: Cement Grout
I.D. OF SURFACE CASING: 8 inch
TYPE OF SURFACE CASING: Steel
RISER PIPE I.D.: 2 inches
TYPE OF RISER PIPE: Schedule 40 PVC
BOREHOLE DIAMETER: 8 1/4 inches
TYPE OF BACKFILL: Cement Grout
ELEVATION/DEPTH OF SEAL: 1.25 ft.
TYPE OF SEAL: Granular Bentonite
DEPTH TO TOP OF SAND PACK: 1.5 ft.
ELEVATION/DEPTH TOP OF SCREEN: 1.75 ft.
TYPE OF SCREEN: Schedule 40 PVC
SLOT SIZE X LENGTH: 0.02 inch X 10 feet
I.D. OF SCREEN: 2 inches
TYPE OF SAND PACK: No. 2 Filter Sand
ELEVATION/DEPTH BOTTOM OF SCREEN: 1.75 ft.
ELEVATION/DEPTH BOTTOM OF SANDPACK: N/A
TYPE OF BACKFILL BELOW OBSERVATION WELL:
ELEVATION/DEPTH OF HOLE: 11.75 ft.

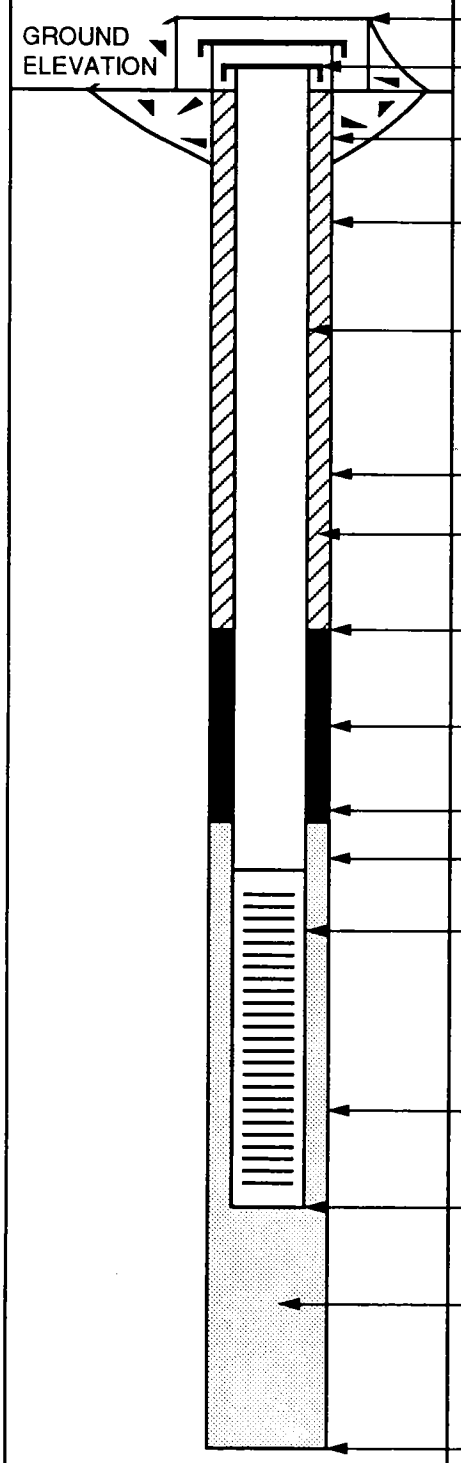
James M. Montgomery
Consulting Engineers, Inc.

BORING NO. MW-107

# MONITORING WELL SHEET

PROJECT Fort Story PA/SI
LOCATION Site 2
PROJECT NO. 1868.0401
BORING MW-107
ELEVATION
DATE 3/24/90
FIELD GEOLOGIST Gary B. Enloe

DRILLER Hardin and Huber Inc.
DRILLING METHOD Hollow Stem Auger
DEVELOPMENT METHOD Bailing/Pumping




ELEVATION OF TOP OF SURFACE CASING: 10.84 ft.
ELEVATIONS OF TOP OF RISER PIPE: 10.60 ft.
TYPE OF SURFACE SEAL: Cement Grout
I.D. OF SURFACE CASING: 8 inch
TYPE OF SURFACE CASING: Steel
RISER PIPE I.D.: 2 inches
TYPE OF RISER PIPE: Schedule 40 PVC
BOREHOLE DIAMETER: 8 1/4 inches
TYPE OF BACKFILL: Cement Grout
ELEVATION/DEPTH OF SEAL: 0.5 ft.
TYPE OF SEAL: Granular Bentonite
DEPTH TO TOP OF SAND PACK: 1.0 ft.
ELEVATION/DEPTH TOP OF SCREEN: 1.5 ft.
TYPE OF SCREEN: Schedule 40 PVC
SLOT SIZE X LENGTH: 0.02 inch X 10 feet
I.D. OF SCREEN: 2 inches
TYPE OF SAND PACK: No. 2 Filter Sand
ELEVATION/DEPTH BOTTOM OF SCREEN: 11.5 ft.
ELEVATION/DEPTH BOTTOM OF SANDPACK: 13.0 ft.
TYPE OF BACKFILL BELOW OBSERVATION WELL: No. 2 Filter Sand
ELEVATION/DEPTH OF HOLE: 13.0 ft.

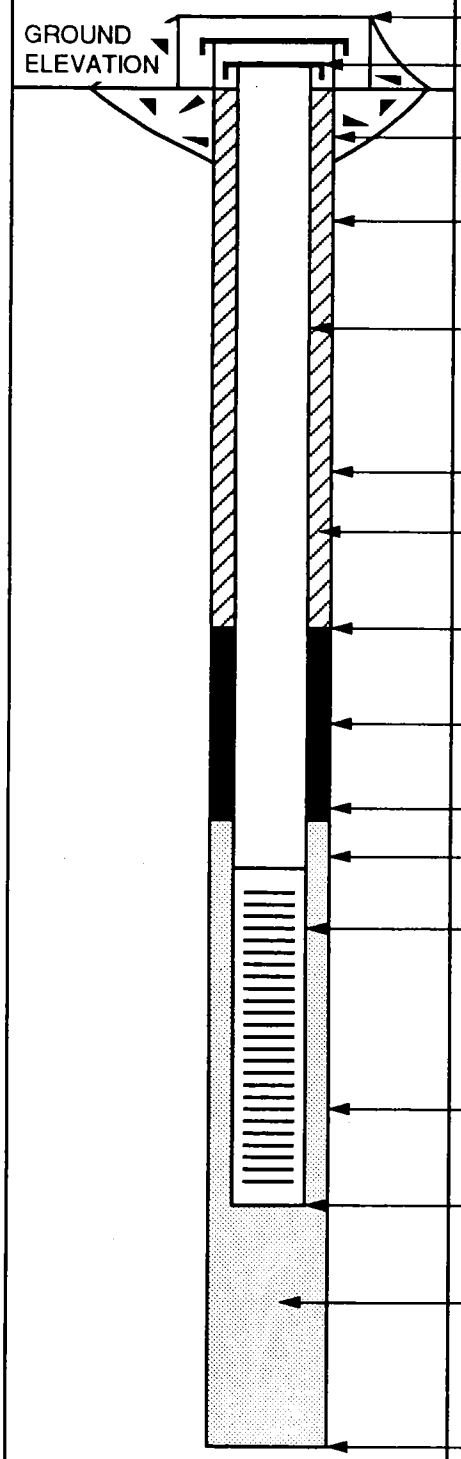
James M. Montgomery
Consulting Engineers, Inc.

BORING NO. MW-108

# MONITORING WELL SHEET

PROJECT Fort Story PA/SI
LOCATION Site 2
PROJECT NO. 1868.0401
BORING MW-108
ELEVATION
DATE 3/24/90
FIELD GEOLOGIST Gary B. Enloe

DRILLER Hardin and Huber Inc.
DRILLING METHOD Hollow Stem Auger
DEVELOPMENT METHOD Air Surging/Pumping




ELEVATION OF TOP OF SURFACE CASING: 9.29 ft.
ELEVATIONS OF TOP OF RISER PIPE: 8.98 ft.
TYPE OF SURFACE SEAL: Cement Grout
I.D. OF SURFACE CASING: 8 inch
TYPE OF SURFACE CASING: Steel
RISER PIPE I.D.: 2 inches
TYPE OF RISER PIPE: Schedule 40 PVC
BOREHOLE DIAMETER: 8 1/4 inches
TYPE OF BACKFILL: Cement Grout
ELEVATION/DEPTH OF SEAL: 1.0 ft.
TYPE OF SEAL: Granular Bentonite
DEPTH TO TOP OF SAND PACK: 1.5 ft.
ELEVATION/DEPTH TOP OF SCREEN: 2.0 ft.
TYPE OF SCREEN: Schedule 40 PVC
SLOT SIZE X LENGTH: 0.02 inch X 10 feet
I.D. OF SCREEN: 2 inches
TYPE OF SAND PACK: No. 2 Filter Sand
ELEVATION/DEPTH BOTTOM OF SCREEN: 12.0 ft.
ELEVATION/DEPTH BOTTOM OF SANDPACK: 14.0 ft.
TYPE OF BACKFILL BELOW OBSERVATION WELL: No. 2 Filter Sand
ELEVATION/DEPTH OF HOLE: 14.0 ft.

James M. Montgomery
Consulting Engineers, Inc.

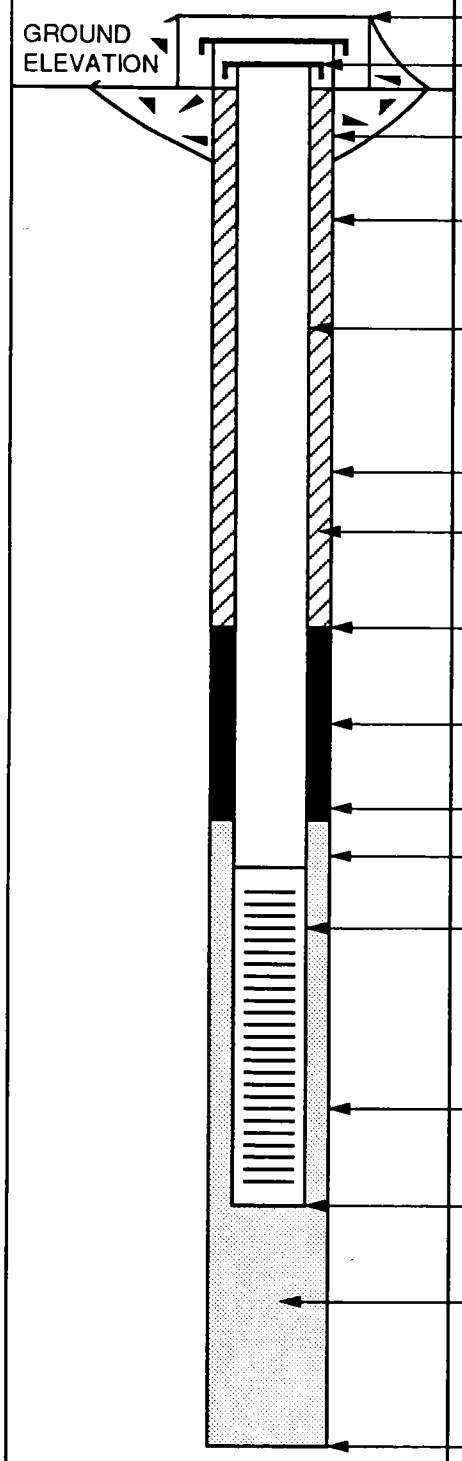
BORING NO. MW-109

# MONITORING WELL SHEET

PROJECT Fort Story PA/SI
PROJECT NO. 1868.0401
ELEVATION
FIELD GEOLOGIST Mark Shupe

LOCATION Site 2
BORING MW-109
DATE 3/25/90

DRILLER Henry Seal
DRILLING METHOD Hollow Stem Auger
DEVELOPMENT METHOD Air Surging/Pumping




ELEVATION OF TOP OF SURFACE CASING: 10.07 ft.
ELEVATIONS OF TOP OF RISER PIPE: 9.68 ft.
TYPE OF SURFACE SEAL: Cement Grout
I.D. OF SURFACE CASING: 8 inch
TYPE OF SURFACE CASING: Steel
RISER PIPE I.D.: 2 inches
TYPE OF RISER PIPE: Schedule 40 PVC
BOREHOLE DIAMETER: 8 1/4 inches
TYPE OF BACKFILL: Cement Grout
ELEVATION/DEPTH OF SEAL: 1.5 ft.
TYPE OF SEAL: Granular Bentonite
DEPTH TO TOP OF SAND PACK: 1.75 ft.
ELEVATION/DEPTH TOP OF SCREEN: 1.75 ft.
TYPE OF SCREEN: Schedule 40 PVC
SLOT SIZE X LENGTH: 0.02 inch X 10 feet
I.D. OF SCREEN: 2 inches
TYPE OF SAND PACK: No. 2 Filter Sand
ELEVATION/DEPTH BOTTOM OF SCREEN: 1.75 ft.
ELEVATION/DEPTH BOTTOM OF SANDPACK: N/A
TYPE OF BACKFILL BELOW OBSERVATION WELL: Formation
ELEVATION/DEPTH OF HOLE: 12.0 ft.

# Monitoring Well Development Sheets

Earth Engineering & Sciences, Inc.

## Monitoring Well Development Sheet MW-105

Project: FORT STORY IRP Location: LANDFILL #2 FORT STORY

Project No. 1869 Dates: 4-4-90

Field Geologists: GEORGE TOWSON & DIANE ENGLAND

Barrel ID: S2 MW105 DEV H2O No. of Barrels: 3.55 GAL

Initial Development Method BAILING Init. Dev. Date: 4-4-90

Initial Volume Removed: 20 GAL Time Started: 0900 Finished: 0940

Initial Team Members: GEORGE TOWSON, DIANE ENGLAND & JOE (H&H)

Water Level (Initial): 7.90

Total Depth (BOH): 14.72

Designed Depth: 15.0

Depth of Sediment: .18

Water Level After Initial Development: 7.9

BOH After Initial Development: 14.90

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Final Development Method: PUMPING Fin. Dev. Date: 4-4-90

Final Volume Removed: 150 GAL Time Start: 0941 Finished: 1046

Final Team Members: GEORGE TOWSON, DIANE ENGLAND & JOE (H&H)

Water Level Start: 7.90 Finished: 7.90 Ph: 6.55 EC: 200 T°C: 15.4

Total Depth Start: 14.90 Finished: 14.90

$O_2$, TOX, Lel and Organic Vapor Problems Encountered: NONE

Action: ☒ None Needed
☐ Need:

Earth Engineering & Sciences, Inc.

| Date | Time | Initial Development | Final Development | Depth to Water (ft.) | Total Depth (ft) | Design Depth (ft.) | Estimated Sediment Thickness (ft.) | Air Surging | Bailing | Pumping | Flow Rate (gal/min) | Well Volume (gal.) | Total Vol. of Develop. Water | Water Temp. (°C) | pH | EC (µΩ) | Turbidity (Ntu) | Team Members |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4-4-90 | 0900 | ✓ | | 7.90 | 14.72 | 15.0 | .29 | | ✓ | | .5 | 6.67 | 0 | | | | | GEORGE TOWSON DIANE ENGLAND |
| | 0940 | ✓ | | 7.90 | 14.9 | 14.90? | 0 | | ✓ | | .5 | | 20 | | | | | |
| 4-4-90 | 0941 | | ✓ | 7.90 | | | | | | ✓ | 2 | | 20 | | | | | |
| | 0951 | | ✓ | | | | | | | ✓ | 2 | | 40 | 15.0 | 5.60 | 170 | | |
| | 1001 | | ✓ | | | | | | | ✓ | 2 | | 60 | 16.0 | 6.76 | 200 | | |
| | 1016 | | ✓ | | | | | | | ✓ | 2 | | 90 | 19.1 | 6.51 | 225 | | |
| | 1026 | | ✓ | | | | | | | ✓ | 2 | | 110 | 18.4 | 6.43 | 210 | | |
| | 1040 | | ✓ | | | | | | | ✓ | 2 | | 140 | 14.8 | 6.33 | 199 | | |
| | 1046 | | ✓ | | | | | | | ✓ | 2 | | 150 | 15.4 | 6.55 | 200 | | |
| 4-10 | | | ✓ | 7.75 | 14.9 | | | | ✓ | | .5 | | 151 | 15.0 | 6.42 | 195 | 45.6 | G. TOWSON D. ENGLAND |
| | | | | | | | | | | | | | | | | | | |
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Location: FORT STORY

Site #: 2

Well #: MW 105

Earth Engineering & Sciences, Inc.

## Monitoring Well Development Sheet MW 106

Project: FORT STORY IRP Location: SITE 2

Project No. 1865.0401 Dates: 4-4-90

Field Geologists: G. TOWSON & D. ENGLAND

Barrel ID: S2 MW 106 DEV $H_2O$ No. of Barrels: 3.55

Initial Development Method AIR SURGED Init. Dev. Date: 4-4-90

Initial Volume Removed: 15941 Time Started: 0800 Finished: 0900

Initial Team Members: D. ENGLAND & JOE FERRERI

Water Level (Initial): .80'

Total Depth (BOH): 11.2

Designed Depth: 11.75

Depth of Sediment: .55

Water Level After Initial Development: 1.0'

BOH After Initial Development: 11.3

---

Final Development Method: PUMPING Fin. Dev. Date: 4-4-90

Final Volume Removed: 165 Time Start: 1130 Finished: 1255

Final Team Members: G. TOWSON & D. ENGLAND

Water Level Start: .81 Finished: 1.15 Ph: 5.47 EC: 30 T°C: 14.3

Total Depth Start: 11.3 Finished: 11.55

$O_2$, TOX, Lel and Organic Vapor Problems Encountered: NONE

Action: ☒ None Needed
☐ Need:

Earth Engineering & Sciences, Inc.

| Date | Time | Initial Development | Final Development | Depth to Water (ft.) | Total Depth (ft) | Design Depth (ft.) | Estimated Sediment Thickness (ft.) | Air Surging | Bailing | Pumping | Flow Rate (gal/min) | Well Volume (gal.) | Total Vol. of Develop. Water | Water Temp. (°C) | pH | EC (µΩ) | Turbidity (Ntu) | Team Members |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4-4-90 | 1130 | | | .81 | 11.3 | 11.75 | .45 | | | ✓ | 2 | 10.3 | 0 | | | | | G. Towson D. England |
| | 1150 | | | | | | | | | ✓ | 2 | | 40 | 13.0 | 5.13 | 32 | | |
| | 1200 | | | | | | | | | ✓ | 2 | | 60 | 12.5 | 4.78 | 30 | | |
| | 1210 | | | | | | | | | ✓ | 5 | | 80 | 12.7 | 4.92 | 30 | | |
| | 1215 | | | | | | | | | ✓ | 5 | | 115 | 12.6 | 5.21 | 34 | | |
| | 1220 | | | | | | | | | ✓ | 5 | | 140 | 13.5 | 5.45 | 30 | | |
| | 1225 | | | 1.15 | 11.55 | | | | | ✓ | 5 | | 165 | 14.3 | 5.47 | 30 | | |
| 4-10 | | | | | | | | | | | | | 166 | 13.9 | 5.42 | 35 | 9.3 | G. Towson D. England |
| | | | | | | | | | | | | | | | | | | |
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Location: Ft Story

Site #: 2

Well #: MW 106

Earth Engineering & Sciences, Inc.

# Monitoring Well Development Sheet MW 107

Project: Ft Story Location: Site 2

Project No. 1865 Dates: 4-4-90 & 4-5-90

Field Geologists: G. Towson & D. England

Barrel ID: S2 MW 107 Dev $H_2O$ No. of Barrels: 3.55 gal

Initial Development Method Bailing Init. Dev. Date: 4-4-90

Initial Volume Removed: 30 gal Time Started: 1030 Finished: 1145

Initial Team Members: G. Towson

Water Level (Initial): 1.37

Total Depth (BOH): 9.3

Designed Depth: 11.5

Depth of Sediment: 2.1

Water Level After Initial Development: 1.42

BOH After Initial Development: 10.95

---

Final Development Method: Pumping Fin. Dev. Date: 4-5-90

Final Volume Removed: 160 Time Start: 1045 Finished: 1130

Final Team Members: G. Towson & D. England

Water Level Start: 1.35 Finished: 1.39 Ph: 6.77 EC: 415 T°C: 15.9

Total Depth Start: 10.95 Finished: 10.95

$O_2$, TOX, Lel and Organic Vapor Problems Encountered: None

Action: ☒ None Needed
☐ Need:

Earth Engineering & Sciences, Inc.

| Date | Time | Initial Development | Final Development | Depth to Water (ft.) | Total Depth (ft) | Design Depth (ft.) | Estimated Sediment Thickness (ft.) | Air Surging | Bailing | Pumping | Flow Rate (gal/min) | Well Volume (gal.) | Total Vol. of Develop. Water | Water Temp. (°C) | pH | EC (µΩ) | Turbidity (Ntu) | Team Members |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4-4 | 1030 | ✓ | | 1.37 | 9.3 ~~10.5~~ | 11.5 | 2.1 | | ✓ | | .5 | 9.52 | | | | | | G. Towson |
| | 1145 | ✓ | | 1.42 | 11.0 | | | | ✓ | | .5 | | 30 | | | | | |
| 4-5 | 1045 | | ✓ | 1.38 | 10.95 | 11.0 | — | | | ✓ | 2.5 | | | | | | | G. Towson D. England |
| | 1100 | | ✓ | 1.38 | 10.95 | | — | | | ✓ | 5 | | 37.5 | 19.0 | 6.71 | 420 | | G. T. |
| | 1110 | | ✓ | | | | | | | ✓ | 5 | | 87.5 | 16.4 | 6.77 | 415 | | |
| | 1120 | | ✓ | | | | | | | ✓ | 5 | | 137.5 | 16.0 | 6.78 | 412 | | |
| | 1130 | | ✓ | | | | | | | ✓ | 5 | | 160 | 15.9 | 6.77 | 415 | | |
| 4-10 | | | ✓ | 1.29 | 10.95 | | | | ✓ | | .5 | | 161 | 15.7 | 6.71 | 415 | | |
| | | | | | | | | | | | | | | | | | | |
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Location: Ft Story

Site #: 2

Well #: MW107

Earth Engineering & Sciences, Inc.

## Monitoring Well Development Sheet MW 108

Project: FORT STORY Location: SITE 2

Project No. 1868 Dates: 4-5-90 & 4-4-90

Field Geologists: G. TOWSON & D. ENGLAND

Barrel ID: S2 MW 108 DEV H2O No. of Barrels: 3-55 GAL

Initial Development Method AIR SURGING Init. Dev. Date: 4-4-90

Initial Volume Removed: 25 GAL Time Started: 1005 Finished: 1100

Initial Team Members: DIANE ENGLAND & JOE FERRERI

Water Level (Initial): 1.0

Total Depth (BOH): 10.9

Designed Depth: 12.0

Depth of Sediment: 1.2'

Water Level After Initial Development: 1.9'

BOH After Initial Development: 11.7'

---

Final Development Method: PUMPING Fin. Dev. Date: 4-5-90

Final Volume Removed: 155 Time Start: 1155 Finished: 1235

Final Team Members: G. TOWSON

Water Level Start: 1.23 Finished: 1.23 Ph: 6.35 EC: 250 T°C: 13

Total Depth Start: 11.4 Finished: 11.95

$O_2$, TOX, Lel and Organic Vapor Problems Encountered: NONE

Action: ☒ None Needed
☐ Need:

Earth Engineering & Sciences, Inc.

| Date | Time | Initial Development | Final Development | Depth to Water (ft.) | Total Depth (ft) | Design Depth (ft.) | Estimated Sediment Thickness (ft.) | Air Surging | Bailing | Pumping | Flow Rate (gal/min) | Well Volume (gal.) | Total Vol. of Develop. Water | Water Temp. (°C) * | pH | EC (µΩ) * | Turbidity (Ntu) | Team Members |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4-5-92 | 1155 | | | 1.23 | 11.4 | 12 | .6 | | | ✓ | 2 | 9.56 | 0 | | | | | G-TOWSON D-ENGLAND |
| | 1205 | | | | | | | | | ✓ | 2 | | 20 | 13.0 | 6.50 | 250 | | |
| | 1210 | | | | | | | | | ✓ | 5 | | 30 | 13.0 | 6.33 | 250 | | |
| | 1215 | | | | | | | | | ✓ | 5 | | 55 | 13.0 | 6.32 | 245 | | |
| | 1220 | | | | | | | | | ✓ | 5 | | 80 | 13.0 | 6.33 | 250 | | |
| | 1225 | | | | | | | | | ✓ | 5 | | 105 | 13.0 | 6.31 | 245 | | |
| | 1230 | | | | | | | | | ✓ | 5 | | 130 | 13.0 | 6.33 | 250 | | |
| | 1235 | | | | | | | | | ✓ | 5 | | 155 | 13.0 | 6.35 | 250 | | |
| 4-10 | | | | | | | | | ✓ | | 5 | | 156 | 13.0 | 6.47 | 250 | 17.3 | G-TOWSON D-ENGLAND |
| | | | | | | | | | | | | | | | | | | |
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Location: Ft STORY

Site #: 2

Well #: MW 108

* - in Hole

Earth Engineering & Sciences, Inc.

## Monitoring Well Development Sheet MW 109

Project: FORT STORY Location: SITE 2

Project No. 1865 Dates: 4.5-90

Field Geologists: G. TOWSON, D. ENGLAND

Barrel ID: S2 MW 109 No. of Barrels: 3.55 GAL

Initial Development Method A.L SURGING Init. Dev. Date: 3/28/90

Initial Volume Removed: 15 GAL Time Started: 1005 Finished: 1100

Initial Team Members: GARY ENLOE

Water Level (Initial): 1.73

Total Depth (BOH): 10.17

Designed Depth: 11.75

Depth of Sediment: 1.58

Water Level After Initial Development: 2.15

BOH After Initial Development: 11.75

---

Final Development Method: PUMPING Fin. Dev. Date: 4-5-90

Final Volume Removed: 125 Time Start: 1530 Finished: 1555

Final Team Members: G. TOWSON

Water Level Start: 1.27 Finished: 1.27 Ph: 6.14 EC: 100 T°C: 12.8

Total Depth Start: 11.25 Finished: 11.25

$O_2$, TOX, Lel and Organic Vapor Problems Encountered: ~~NONE~~ LeL 8 in Hole
$H_2S$ smell $O_2$ 20.2
TOX 1ppm

Action: ☐ None Needed
☒ Need: MAINTAIN UPWIND & MONITOR AMBIENT DOWN WIND

Earth Engineering & Sciences, Inc.

| Date | Time | Initial Development | Final Development | Depth to Water (ft.) | Total Depth (ft) | Design Depth (ft.) | Estimated Sediment Thickness (ft.) | Air Surging | Bailing | Pumping | Flow Rate (gal/min) | Well Volume (gal.) | Total Vol. of Develop. Water | Water Temp. (°C) | pH | EC (µΩ) | Turbidity (Ntu) | Team Members |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4-5-90 | 1530 | | ✓ | 1.27 | 11.25 | 11.75 | .5 | | | ✓ | 5 | 9.38 | 0 | 13 | 6.33 | 120 | | G-TOWSON |
| | 1540 | | ✓ | | | | | | | ✓ | 5 | | 50 | 13 | 6.16 | 95 | | |
| | 1545 | | ✓ | | | | | | | ✓ | 5 | | 75 | 13 | 6.15 | 95 | | |
| | 1550 | | ✓ | | | | | | | ✓ | 5 | | 100 | 12.5 | 6.15 | 95 | | |
| | 1555 | | ✓ | | | | | | | ✓ | 5 | | 125 | 12.5 | 6.14 | 100 | | |
| 4-10 | | | ✓ | | | | | | ✓ | | 5 | | 126 | 13.0 | 6.24 | 115 | 85.3 | G-TOWSON D. ENGLAND |
| | | | | | | | | | | | | | | | | | | |
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Location: FORT STORY

Site #: 2

Well #: MW 10S

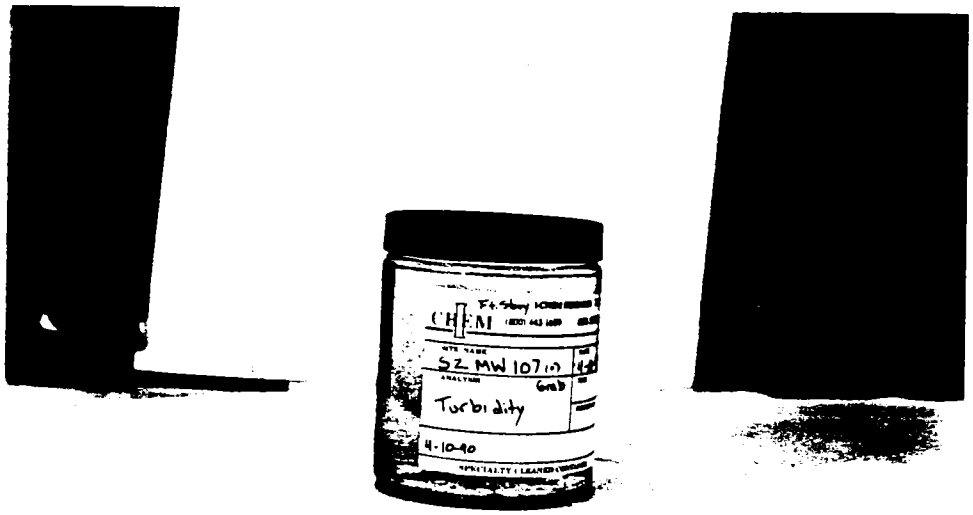
# Monitoring Well Development Photographs

Fort Story, Virginia

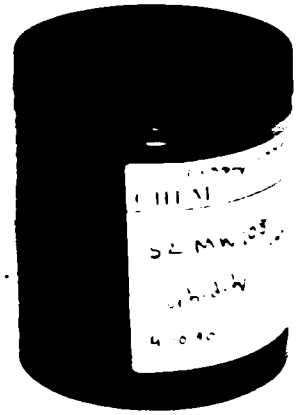
Site Number: 2
Well Number: MW-105

Site Number: 2
Well Number: MW-106

Fort Story, Virginia

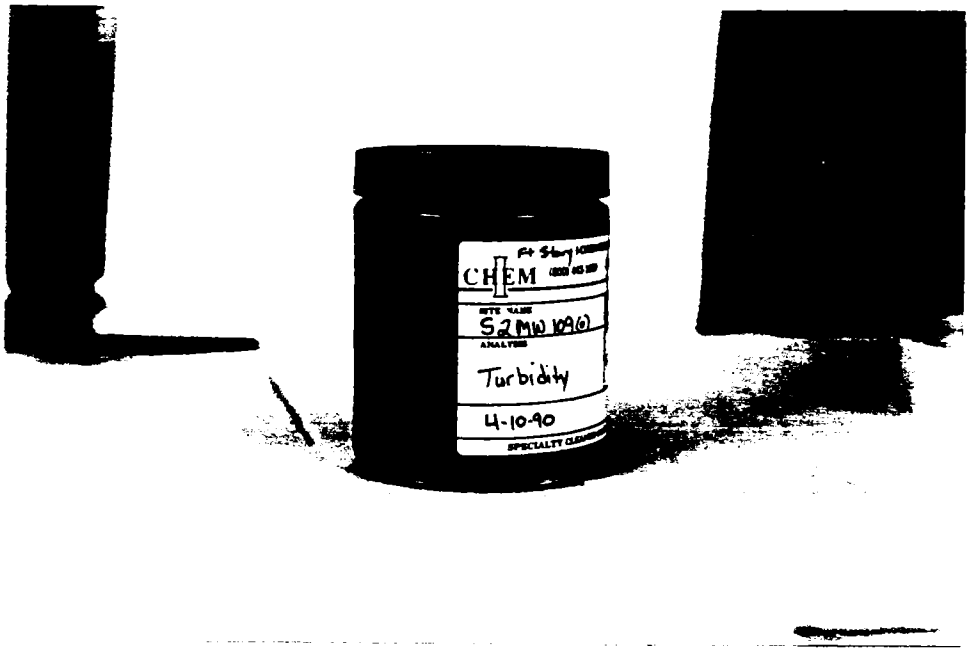



Site Number: 2
Well Number: MW-107



Site Number: 2
Well Number: MW-108

Fort Story, Virginia




Site Number: 2
Well Number: MW-109

# In Situ Permeability Data

RAW DATA

WELL # S2MW105

WELL DIAMETER= 8.25 INCHES
CASING DIAMETER= 2.00 INCHES
VOLUME OF WATER= .28 GALLONS
LENGTH OF AQUIFER TESTED= 20.00 FEET
VALUE OF HO= 1.72 FEET
STATIC WATER LEVEL= 7.84 FEET
LENGTH OF SCREEN= 10.00 FEET
WATER TABLE TO BOTTOM OF WELL= 6.86 FEET

SLUG TEST DATA:

| TIME | WATER LEVEL (FEET) | TIME SINCE TEST BEGAN (MINUTES) |
|---|---|---|
| 11.56. 6 | 8.09 | .10 |
| 11.56. 7 | 8.00 | .12 |
| 11.56. 8 | 7.95 | .13 |
| 11.56. 9 | 7.93 | .15 |
| 11.56.10 | 7.91 | .17 |
| 11.56.11 | 7.90 | .18 |
| 11.56.12 | 7.89 | .20 |
| 11.56.13 | 7.88 | .22 |
| 11.56.14 | 7.88 | .23 |
| 11.56.15 | 7.87 | .25 |
| 11.56.16 | 7.87 | .27 |
| 11.56.17 | 7.87 | .28 |

WELL # S2MW105

WELL DIAMETER= 8.25 INCHES
CASING DIAMETER= 2.00 INCHES
VOLUME OF WATER REMOVED OR ADDED TO WELL= .28 GALLONS
LENGTH OF AQUIFER TESTED= 20.00 FEET
VALUE OF H0= 1.72 FEET
STATIC WATER LEVEL= 7.84 FEET

SLUG TEST DATA:

| TIME SINCE TEST BEGAN (MINUTES) | WATER LEVEL (FEET) | DRAWDOWN (FEET) | HEAD RATIO | RECIPROCAL TIME (1/MINUTES) |
|---|---|---|---|---|
| .10 | 8.09 | .25 | .146 | 10.000 |
| .12 | 8.00 | .16 | .093 | 8.571 |
| .13 | 7.95 | .11 | .064 | 7.500 |
| .15 | 7.93 | .09 | .052 | 6.667 |
| .17 | 7.91 | .07 | .041 | 6.000 |
| .18 | 7.90 | .06 | .035 | 5.455 |
| .20 | 7.89 | .05 | .029 | 5.000 |
| .22 | 7.88 | .04 | .023 | 4.615 |
| .23 | 7.88 | .04 | .023 | 4.286 |
| .25 | 7.87 | .03 | .017 | 4.000 |
| .27 | 7.87 | .03 | .017 | 3.750 |
| .28 | 7.87 | .03 | .017 | 3.529 |

WELL # S2MW105

---

PERMEABILITY BASED ON COOPER. BREDEHOEFT. AND PAPADOPULOS METHOD

PERMEABILITY=1.76E-04/ MATCH TIME (IN MINUTES)
STORAGE COEF= 5.88E-02* ALPHA
COMPUTER CALCULATES
ALPHA=1.00E-05 MATCH TIME= 1.02E-02
PERMEABILITY= 1.73E-02 CM/SEC
STORAGE COEF=5.88E-07
CORRELATION NUMBER= 1.00

---

PERMEABILITY BASED ON REGRESSION FIT OF HEAD RATIO DATA

HVORSLEV PERMEABILITY=3.58E-04 / LAG TIME
BOUWER PERMEABILTY=8.55E-04 * -SLOPE

COMPUTER CALCULATES
PERMEABILITY VARIES MORE THAN 20% DEPENDING ON THEEQUATION USED

FOR X ON Y: HVORSLEV PERMEABILITY=2.79E-02 CM/SEC
BOUWER PERMEABILITY=5.00E-03CM/SEC
FOR Y ON X: HVORSLEV PERMEABILITY=1.78E-02 CM/SEC
BOUWER PERMEABILITY=5.26E-03 CM/SEC
AVERAGE HVORSLEV PERMEABILITY=2.17E-02 CM/SEC
AVERAGE BOUWER PERMEABILITY=5.13E-03 CM/SEC
REGRESSION STATISTICS
X ON Y
INTERCEPT= -.36
SLOPE= -5.9
Y ON X
INTERCEPT= -.31
SLOPE= -6.1
CORRELATION COEFFICIENT= -.98
CALCULATIONS INDICATE THAT A VALUE OF 1.93 FEET FOR HO
OR A VALUE OF 1.888 INCHES FOR EFFECTIVE CASING DIA.
MAY YIELD BETTER RESULTS

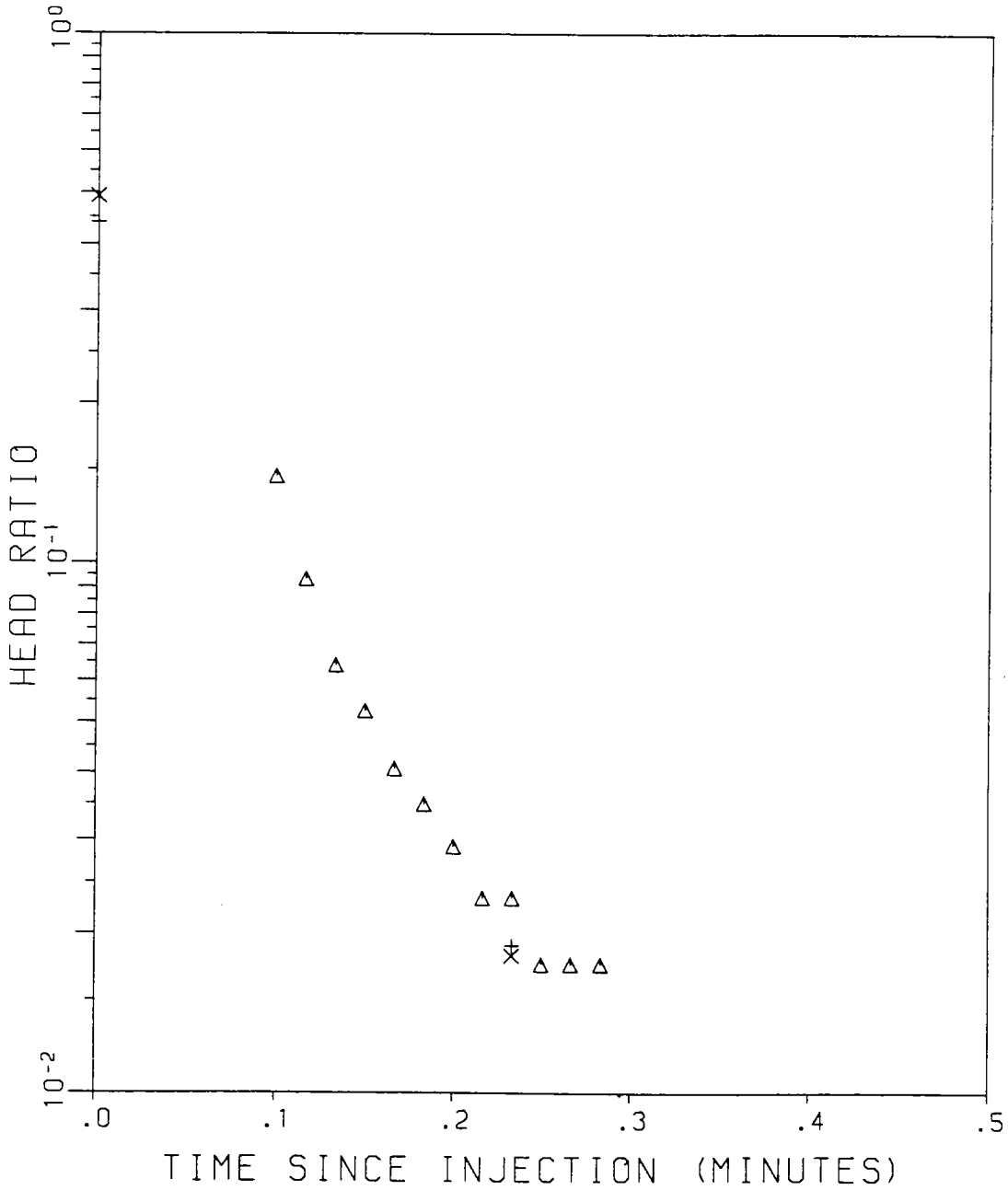
---

PERMEABILITY BASED ON REGRESSION FIT OF DATA - FERRIS & KNOWLES METHOD

INSUFFICIENT DATA POINTS WITH RECIPROCAL TIMES LESS THAN .300
NUMBER OF USABLE DATA POINTS= 0

| WELL # | PERMEABILITY METHOD 1 | PERMEABILITY METHOD 2 | STORAGE COEF METHOD 2 | PERMEABILITY METHOD 3 | PERMEABILITY METHOD 4 |
|---|---|---|---|---|---|
| S2MW105 | 2.17E-02 | 1.73E-02 | 5.88E-07 | .00 | 5.13E-03 |

* METHOD 1 IS HVORSLEV
METHOD 2 IS COOPER, BREDEHOEFT, AND PAPADOPULOS
METHOD 3 IS FERRIS AND KNOWLES
METHOD 4 IS BOUWER




SLUG TEST OF WELL S2MW105
LOG HEAD RATIO VS TIME

SITE 2. LANDFILL 2. WELL S2MW105
TUE 10-30-1990
07:33:39.81

RAW DATA

WELL # S2MW106

WELL DIAMETER= 8.25 INCHES
CASING DIAMETER= 2.00 INCHES
VOLUME OF WATER= .28 GALLONS
LENGTH OF AQUIFER TESTED= 20.00 FEET
VALUE OF HO= 1.72 FEET
STATIC WATER LEVEL= .84 FEET
LENGTH OF SCREEN= 10.00 FEET
WATER TABLE TO BOTTOM OF WELL= 11.62 FEET

SLUG TEST DATA:

| TIME | WATER LEVEL (FEET) | TIME SINCE TEST BEGAN (MINUTES) |
|---|---|---|
| 14.56. 4 | 1.46 | .07 |
| 14.56. 5 | 1.05 | .08 |
| 14.56. 6 | .94 | .10 |
| 14.56. 7 | .89 | .12 |
| 14.56. 8 | .88 | .13 |
| 14.56. 9 | .87 | .15 |
| 14.56.10 | .86 | .17 |
| 14.56.11 | .86 | .18 |
| 14.56.12 | .85 | .20 |
| 14.56.13 | .85 | .22 |

WELL # S2MW106

WELL DIAMETER= 8.25 INCHES
CASING DIAMETER= 2.00 INCHES
VOLUME OF WATER REMOVED OR ADDED TO WELL= .28 GALLONS
LENGTH OF AQUIFER TESTED= 20.00 FEET
VALUE OF H0= 1.72 FEET
STATIC WATER LEVEL= .84 FEET

SLUG TEST DATA:

| TIME SINCE TEST BEGAN (MINUTES) | WATER LEVEL (FEET) | DRAWDOWN (FEET) | HEAD RATIO | RECIPROCAL TIME (1/MINUTES) |
|---|---|---|---|---|
| .07 | 1.46 | .62 | .361 | 15.000 |
| .08 | 1.05 | .21 | .122 | 12.000 |
| .10 | .94 | .10 | .058 | 10.000 |
| .12 | .89 | .05 | .029 | 8.571 |
| .13 | .88 | .04 | .023 | 7.500 |
| .15 | .87 | .03 | .017 | 6.667 |
| .17 | .86 | .02 | .012 | 6.000 |
| .18 | .86 | .02 | .012 | 5.455 |
| .20 | .85 | .01 | .006 | 5.000 |
| .22 | .85 | .01 | .006 | 4.615 |

WELL # S2MW106

---

PERMEABILITY BASED ON COOPER, BREDEHOEFT, AND PAPADOPULOS METHOD

```
          PERMEABILITY=1.76E-04/ MATCH TIME (IN MINUTES)
          STORAGE COEF= 5.88E-02* ALPHA
     COMPUTER CALCULATES
          ALPHA=1.00E-05 MATCH TIME= 6.80E-03
          PERMEABILITY= 2.59E-02 CM/SEC
          STORAGE COEF=5.88E-07
          CORRELATION NUMBER=    .97
```

---

PERMEABILITY BASED ON REGRESSION FIT OF HEAD RATIO DATA

```
          HVORSLEV PERMEABILITY=3.58E-04 / LAG TIME
          BOUWER PERMEABILTY=9.67E-04 * -SLOPE

     COMPUTER CALCULATES
          HVORSLEV PERMEABILITY=5.88E-03 CM/SEC
          BOUWER PERMEABILITY=1.79E-02 CM/SEC
               REGRESSION STATISTICS
                    X ON Y
                      INTERCEPT=  .65
                      SLOPE= -18.
                    Y ON X
                      INTERCEPT=  .74
                      SLOPE= -19.
                    CORRELATION COEFFICIENT= -.98
     CALCULATIONS INDICATE THAT A VALUE OF  15.74 FEET FOR HO
          OR A VALUE OF     .660 INCHES FOR EFFECTIVE CASING DIA.
          MAY YIELD BETTER RESULTS
```

---

PERMEABILITY BASED ON REGRESSION FIT OF DATA - FERRIS & KNOWLES METHOD

```
     INSUFFICIENT DATA POINTS WITH RECIPROCAL TIMES LESS THAN .300
  NUMBER OF USABLE DATA POINTS= 0
```

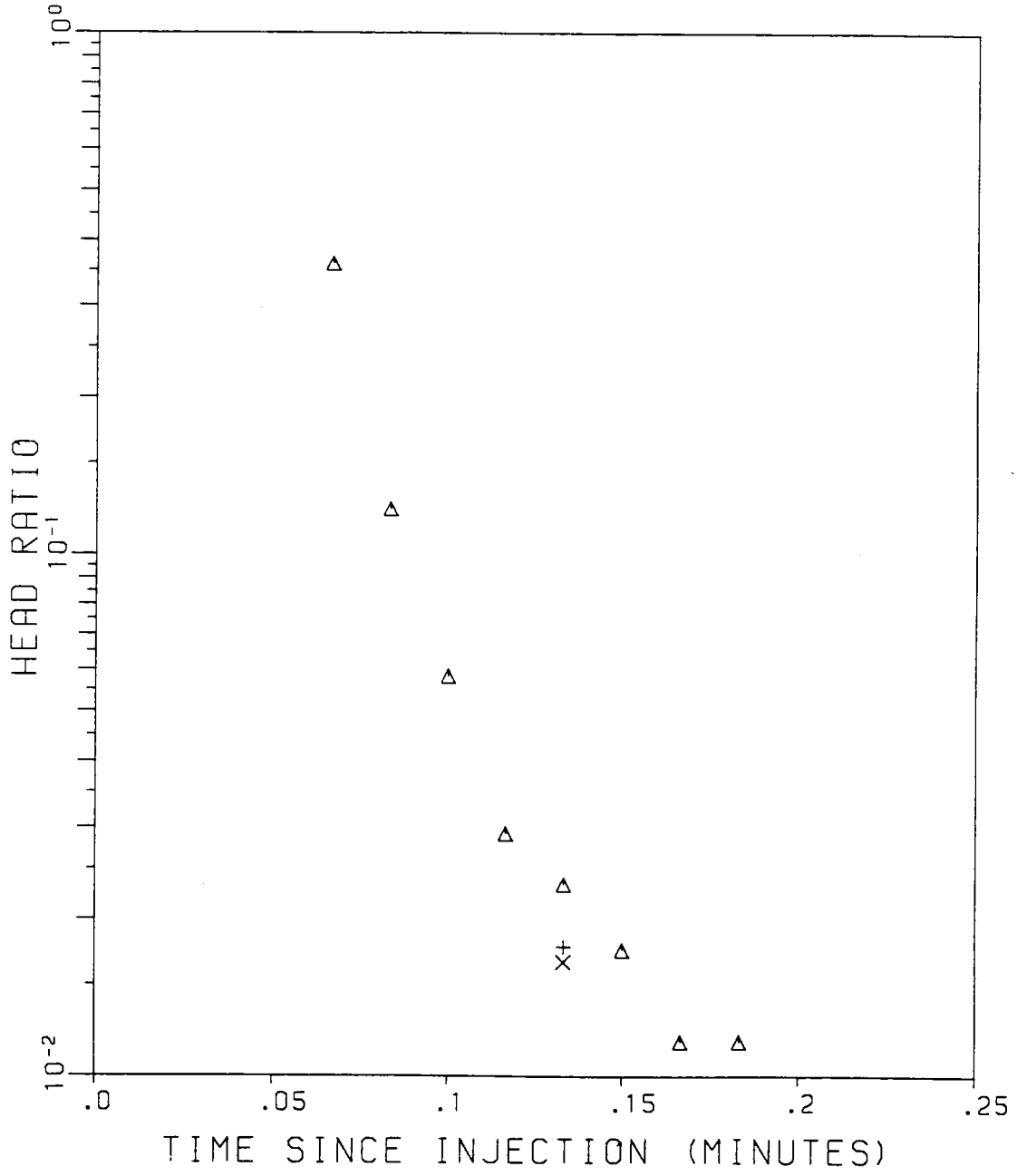
| WELL # | PERMEABILITY METHOD 1 | PERMEABILITY METHOD 2 | STORAGE COEF METHOD 2 | PERMEABILITY METHOD 3 | PERMEABILITY METHOD 4 |
|---|---|---|---|---|---|
| S2MW106 | 5.88E-03 | 2.59E-02 | 5.88E-07 | .00 | 1.79E-02 |

* METHOD 1 IS HVORSLEV
METHOD 2 IS COOPER, BREDEHOEFT, AND PAPADOPULOS
METHOD 3 IS FERRIS AND KNOWLES
METHOD 4 IS BOUWER

SITE 2, LANDFILL 2, WELL S2MW106

TUE 10-30-1990

07:38:15.97




# SLUG TEST OF WELL S2MW106

## LOG HEAD RATIO VS TIME

RAW DATA

WELL # S2MW107

WELL DIAMETER= 8.25 INCHES
CASING DIAMETER= 2.00 INCHES
VOLUME OF WATER= .28 GALLONS
LENGTH OF AQUIFER TESTED= 20.00 FEET
VALUE OF H0= .26 FEET
STATIC WATER LEVEL= 1.80 FEET
LENGTH OF SCREEN= 10.00 FEET
WATER TABLE TO BOTTOM OF WELL= 9.35 FEET

SLUG TEST DATA:

| TIME | WATER LEVEL (FEET) | TIME SINCE TEST BEGAN (MINUTES) |
|---|---|---|
| 15.14.11 | 1.97 | .18 |
| 15.14.12 | 1.96 | .20 |
| 15.14.13 | 1.96 | .22 |
| 15.14.14 | 1.95 | .23 |
| 15.14.15 | 1.95 | .25 |
| 15.14.16 | 1.95 | .27 |
| 15.14.17 | 1.95 | .28 |
| 15.14.18 | 1.94 | .30 |
| 15.14.23 | 1.94 | .38 |
| 15.14.28 | 1.93 | .47 |
| 15.14.33 | 1.93 | .55 |
| 15.14.38 | 1.92 | .63 |
| 15.14.43 | 1.92 | .72 |
| 15.14.48 | 1.91 | .80 |
| 15.14.53 | 1.91 | .88 |
| 15.14.58 | 1.91 | .97 |
| 15.15. 3 | 1.90 | 1.05 |
| 15.15. 8 | 1.90 | 1.13 |
| 15.15.13 | 1.89 | 1.22 |
| 15.15.18 | 1.89 | 1.30 |
| 15.15.23 | 1.89 | 1.38 |
| 15.15.28 | 1.89 | 1.47 |
| 15.15.33 | 1.89 | 1.55 |
| 15.15.38 | 1.89 | 1.63 |
| 15.15.43 | 1.89 | 1.72 |

WELL # S2MW107

WELL DIAMETER= 8.25 INCHES
CASING DIAMETER= 2.00 INCHES
VOLUME OF WATER REMOVED OR ADDED TO WELL= .28 GALLONS
LENGTH OF AQUIFER TESTED= 20.00 FEET
VALUE OF H0= .26 FEET
STATIC WATER LEVEL= 1.80 FEET

SLUG TEST DATA:

| TIME SINCE TEST BEGAN (MINUTES) | WATER LEVEL (FEET) | DRAWDOWN (FEET) | HEAD RATIO | RECIPROCAL TIME (1/MINUTES) |
|---|---|---|---|---|
| .18 | 1.97 | .17 | .654 | 5.455 |
| .20 | 1.96 | .16 | .615 | 5.000 |
| .22 | 1.96 | .16 | .615 | 4.615 |
| .23 | 1.95 | .15 | .577 | 4.286 |
| .25 | 1.95 | .15 | .577 | 4.000 |
| .27 | 1.95 | .15 | .577 | 3.750 |
| .28 | 1.95 | .15 | .577 | 3.529 |
| .30 | 1.94 | .14 | .538 | 3.333 |
| .38 | 1.94 | .14 | .538 | 2.609 |
| .47 | 1.93 | .13 | .500 | 2.143 |
| .55 | 1.93 | .13 | .500 | 1.818 |
| .63 | 1.92 | .12 | .462 | 1.579 |
| .72 | 1.92 | .12 | .462 | 1.395 |
| .80 | 1.91 | .11 | .423 | 1.250 |
| .88 | 1.91 | .11 | .423 | 1.132 |
| .97 | 1.91 | .11 | .423 | 1.034 |
| 1.05 | 1.90 | .10 | .385 | .952 |
| 1.13 | 1.90 | .10 | .385 | .882 |
| 1.22 | 1.89 | .09 | .346 | .822 |
| 1.30 | 1.89 | .09 | .346 | .769 |
| 1.38 | 1.89 | .09 | .346 | .723 |
| 1.47 | 1.89 | .09 | .346 | .682 |
| 1.55 | 1.89 | .09 | .346 | .645 |
| 1.63 | 1.89 | .09 | .346 | .612 |
| 1.72 | 1.89 | .09 | .346 | .583 |

WELL # S2MW107

---

PERMEABILITY BASED ON COOPER, BREDEHOEFT, AND PAPADOPULOS METHOD

```
          PERMEABILITY=1.76E-04/ MATCH TIME (IN MINUTES)
          STORAGE COEF= 5.88E-02* ALPHA
     COMPUTER CALCULATES
          ALPHA= .10     MATCH TIME=  1.3
          PERMEABILITY= 1.34E-04 CM/SEC
          STORAGE COEF=5.88E-03
          CORRELATION NUMBER=   .95
```

---

PERMEABILITY BASED ON REGRESSION FIT OF HEAD RATIO DATA

```
          HVORSLEV PERMEABILITY=3.58E-04 / LAG TIME
          BOUWER PERMEABILTY=9.22E-04 * -SLOPE

     COMPUTER CALCULATES
          HVORSLEV PERMEABILITY=2.83E-04 CM/SEC
          BOUWER PERMEABILITY=1.74E-04 CM/SEC
               REGRESSION STATISTICS
                    X ON Y
                      INTERCEPT= -.20
                      SLOPE= -.18
                    Y ON X
                      INTERCEPT= -.19
                      SLOPE= -.19
                    CORRELATION COEFFICIENT= -.97
     CALCULATIONS INDICATE THAT A VALUE OF    .26 FEET FOR HO
          OR A VALUE OF    1.991 INCHES FOR EFFECTIVE CASING DIA.
          MAY YIELD BETTER RESULTS
```

---

PERMEABILITY BASED ON REGRESSION FIT OF DATA - FERRIS & KNOWLES METHOD

```
     INSUFFICIENT DATA POINTS WITH RECIPROCAL TIMES LESS THAN .300
  NUMBER OF USABLE DATA POINTS= 0
```

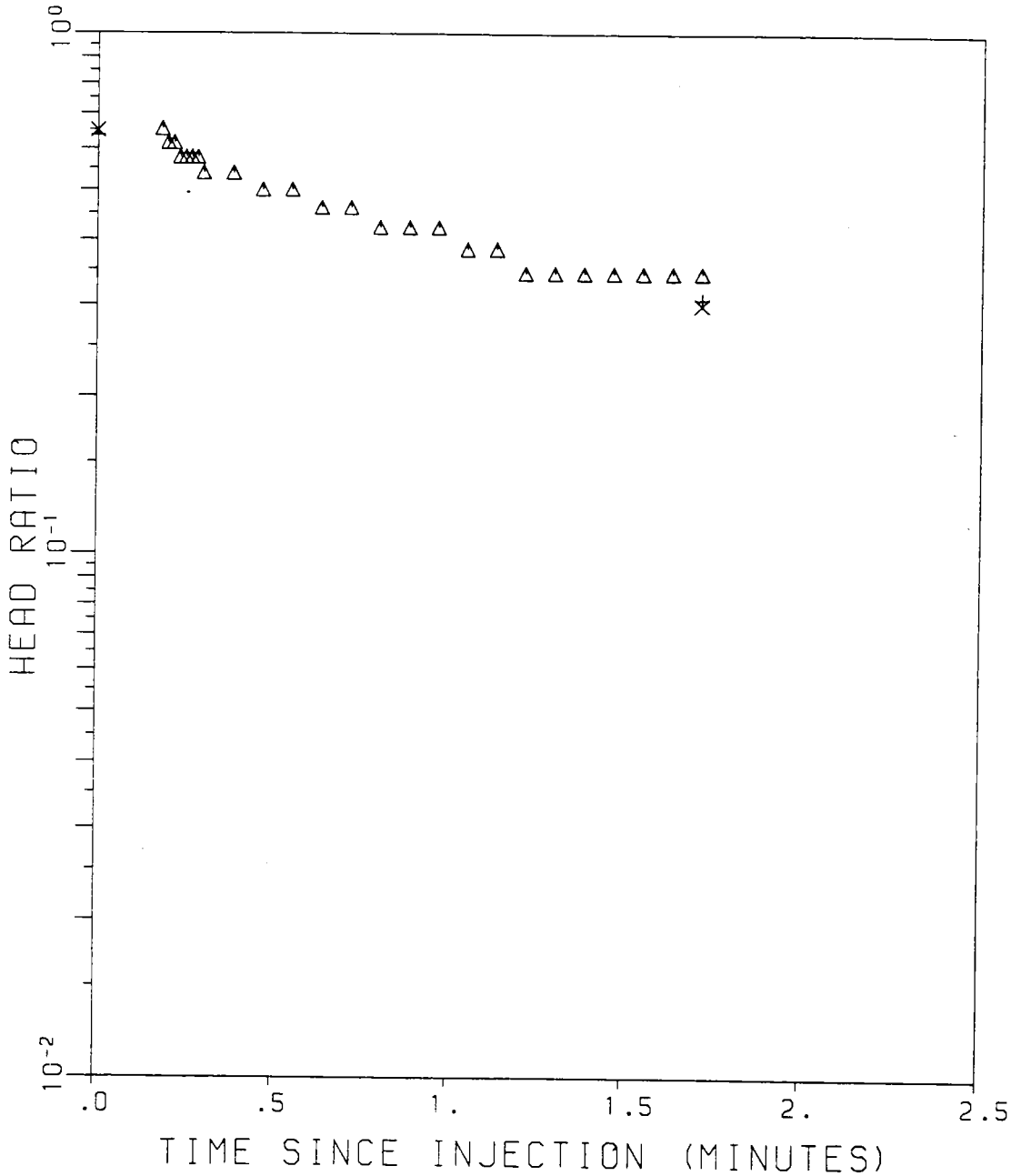
| WELL # | PERMEABILITY METHOD 1 | PERMEABILITY METHOD 2 | STORAGE COEF METHOD 2 | PERMEABILITY METHOD 3 | PERMEABILITY METHOD 4 |
|---|---|---|---|---|---|
| S2MW107 | 2.83E-04 | 1.34E-04 | 5.88E-03 | .00 | 1.74E-04 |

* METHOD 1 IS HVORSLEV
METHOD 2 IS COOPER, BREDEHOEFT, AND PAPADOPULOS
METHOD 3 IS FERRIS AND KNOWLES
METHOD 4 IS BOUWER

SITE 2. LANDFILL 2. WELL S2MW107

TUE 10-30-1990

07:42:59.06




SLUG TEST OF WELL S2MW107

LOG HEAD RATIO VS TIME

RAW DATA

WELL # S2MW108

WELL DIAMETER= 8.25 INCHES
CASING DIAMETER= 2.00 INCHES
VOLUME OF WATER= .28 GALLONS
LENGTH OF AQUIFER TESTED= 20.00 FEET
VALUE OF H0= 1.72 FEET
STATIC WATER LEVEL= .63 FEET
LENGTH OF SCREEN= 10.00 FEET
WATER TABLE TO BOTTOM OF WELL= 11.03 FEET

SLUG TEST DATA:

| TIME | WATER LEVEL (FEET) | TIME SINCE TEST BEGAN (MINUTES) |
|---|---|---|
| 17.12.13 | .94 | .22 |
| 17.12.14 | .91 | .24 |
| 17.12.15 | .87 | .26 |
| 17.12.16 | .85 | .27 |
| 17.12.17 | .83 | .29 |
| 17.12.18 | .81 | .31 |
| 17.12.23 | .74 | .39 |
| 17.12.28 | .71 | .47 |
| 17.12.33 | .69 | .56 |

WELL # S2MW108

WELL DIAMETER= 8.25 INCHES
CASING DIAMETER= 2.00 INCHES
VOLUME OF WATER REMOVED OR ADDED TO WELL= .28 GALLONS
LENGTH OF AQUIFER TESTED= 20.00 FEET
VALUE OF HO= 1.72 FEET
STATIC WATER LEVEL= .63 FEET

SLUG TEST DATA:

| TIME SINCE TEST BEGAN (MINUTES) | WATER LEVEL (FEET) | DRAWDOWN (FEET) | HEAD RATIO | RECIPROCAL TIME (1/MINUTES) |
|---|---|---|---|---|
| .22 | .94 | .31 | .181 | 4.478 |
| .24 | .91 | .28 | .163 | 4.167 |
| .26 | .87 | .24 | .140 | 3.896 |
| .27 | .85 | .22 | .128 | 3.659 |
| .29 | .83 | .20 | .117 | 3.448 |
| .31 | .81 | .18 | .105 | 3.261 |
| .39 | .74 | .11 | .064 | 2.563 |
| .47 | .71 | .08 | .047 | 2.113 |
| .56 | .69 | .06 | .035 | 1.796 |

WELL # S2MW108

---

PERMEABILITY BASED ON COOPER, BREDEHOEFT, AND PAPADOPULOS METHOD

```
          PERMEABILITY=1.76E-04/ MATCH TIME (IN MINUTES)
          STORAGE COEF= 5.88E-02* ALPHA
     COMPUTER CALCULATES
          ALPHA=1.00E-05 MATCH TIME= 3.20E-02
          PERMEABILITY= 5.52E-03 CM/SEC
          STORAGE COEF=5.88E-07
          CORRELATION NUMBER=  1.00
```

---

PERMEABILITY BASED ON REGRESSION FIT OF HEAD RATIO DATA

```
          HVORSLEV PERMEABILITY=3.58E-04 / LAG TIME
          BOUWER PERMEABILTY=9.57E-04 * -SLOPE

     COMPUTER CALCULATES
          HVORSLEV PERMEABILITY=5.52E-03 CM/SEC
          BOUWER PERMEABILITY=2.08E-03 CM/SEC
               REGRESSION STATISTICS
                    X ON Y
                      INTERCEPT= -.30
                      SLOPE= -2.2
                    Y ON X
                      INTERCEPT= -.28
                      SLOPE= -2.2
                    CORRELATION COEFFICIENT= -.99
     CALCULATIONS INDICATE THAT A VALUE OF   1.53 FEET FOR HO
          OR A VALUE OF    2.117 INCHES FOR EFFECTIVE CASING DIA.
          MAY YIELD BETTER RESULTS
```

---

PERMEABILITY BASED ON REGRESSION FIT OF DATA - FERRIS & KNOWLES METHOD

```
     INSUFFICIENT DATA POINTS WITH RECIPROCAL TIMES LESS THAN .300
  NUMBER OF USABLE DATA POINTS= 0
```

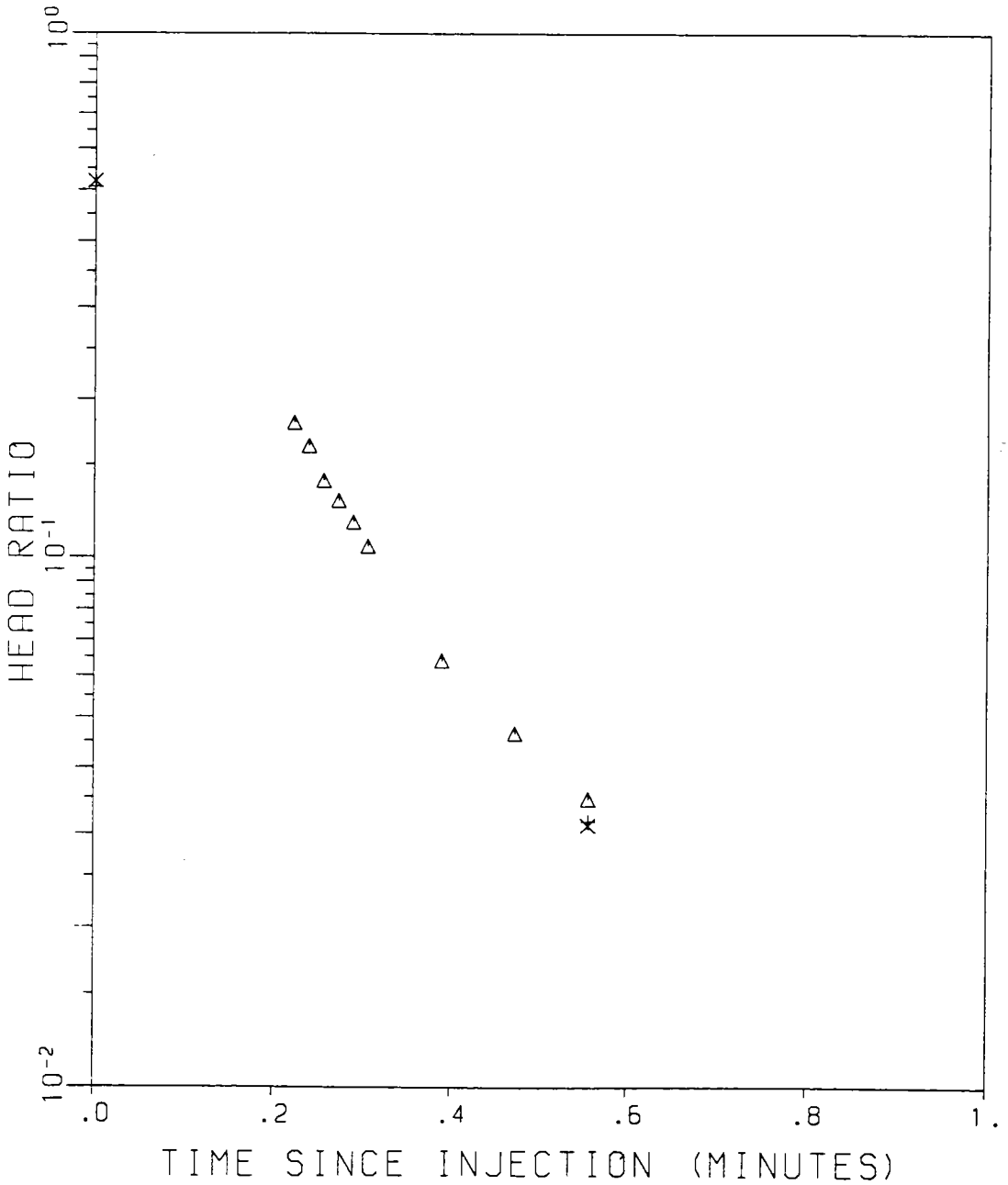
| WELL # | PERMEABILITY METHOD 1 | PERMEABILITY METHOD 2 | STORAGE COEF METHOD 2 | PERMEABILITY METHOD 3 | PERMEABILITY METHOD 4 |
|---|---|---|---|---|---|
| S2MW108 | 5.52E-03 | 5.52E-03 | 5.88E-07 | .00 | 2.08E-03 |

* METHOD 1 IS HVORSLEV
METHOD 2 IS COOPER, BREDEHOEFT, AND PAPADOPULOS
METHOD 3 IS FERRIS AND KNOWLES
METHOD 4 IS BOUWER

SITE 2. LANDFILL 2. WELL S2MW108

TUE 10-30-1990

07:47:49.45




SLUG TEST OF WELL S2MW108

LOG HEAD RATIO VS TIME

RAW DATA

WELL # S2MW109

WELL DIAMETER= 8.25 INCHES
CASING DIAMETER= 2.00 INCHES
VOLUME OF WATER= .28 GALLONS
LENGTH OF AQUIFER TESTED= 20.00 FEET
VALUE OF H0= 1.72 FEET
STATIC WATER LEVEL= 1.11 FEET
LENGTH OF SCREEN= 10.00 FEET
WATER TABLE TO BOTTOM OF WELL= 10.80 FEET

SLUG TEST DATA:

| TIME | WATER LEVEL (FEET) | TIME SINCE TEST BEGAN (MINUTES) |
|---|---|---|
| 16.29. 4 | 1.64 | .07 |
| 16.29. 5 | 1.49 | .08 |
| 16.29. 6 | 1.39 | .10 |
| 16.29. 7 | 1.33 | .12 |
| 16.29. 8 | 1.29 | .13 |
| 16.29. 9 | 1.25 | .15 |

WELL # S2MW109

WELL DIAMETER= 8.25 INCHES
CASING DIAMETER= 2.00 INCHES
VOLUME OF WATER REMOVED OR ADDED TO WELL= .28 GALLONS
LENGTH OF AQUIFER TESTED= 20.00 FEET
VALUE OF H0= 1.72 FEET
STATIC WATER LEVEL= 1.11 FEET

SLUG TEST DATA:

| TIME SINCE TEST BEGAN (MINUTES) | WATER LEVEL (FEET) | DRAWDOWN (FEET) | HEAD RATIO | RECIPROCAL TIME (1/MINUTES) |
|---|---|---|---|---|
| .07 | 1.64 | .53 | .309 | 15.000 |
| .08 | 1.49 | .38 | .221 | 12.000 |
| .10 | 1.39 | .28 | .163 | 10.000 |
| .12 | 1.33 | .22 | .128 | 8.571 |
| .13 | 1.29 | .18 | .105 | 7.500 |
| .15 | 1.25 | .14 | .082 | 6.667 |

WELL # S2MW109

---

PERMEABILITY BASED ON COOPER, BREDEHOEFT, AND PAPADOPULOS METHOD

PERMEABILITY=1.76E-04/ MATCH TIME (IN MINUTES)
STORAGE COEF= 5.88E-02* ALPHA
COMPUTER CALCULATES
ALPHA=1.00E-05 MATCH TIME= 1.45E-02
PERMEABILITY= 1.22E-02 CM/SEC
STORAGE COEF=5.88E-07
CORRELATION NUMBER= 1.00

---

PERMEABILITY BASED ON REGRESSION FIT OF HEAD RATIO DATA

HVORSLEV PERMEABILITY=3.58E-04 / LAG TIME
BOUWER PERMEABILTY=9.52E-04 * -SLOPE

COMPUTER CALCULATES
HVORSLEV PERMEABILITY=6.93E-03 CM/SEC
BOUWER PERMEABILITY=6.51E-03 CM/SEC
REGRESSION STATISTICS
X ON Y
INTERCEPT= -.08
SLOPE= -6.8
Y ON X
INTERCEPT= -.08
SLOPE= -6.9
CORRELATION COEFFICIENT=-1.00
CALCULATIONS INDICATE THAT A VALUE OF 1.69 FEET FOR HO
OR A VALUE OF 2.015 INCHES FOR EFFECTIVE CASING DIA.
MAY YIELD BETTER RESULTS

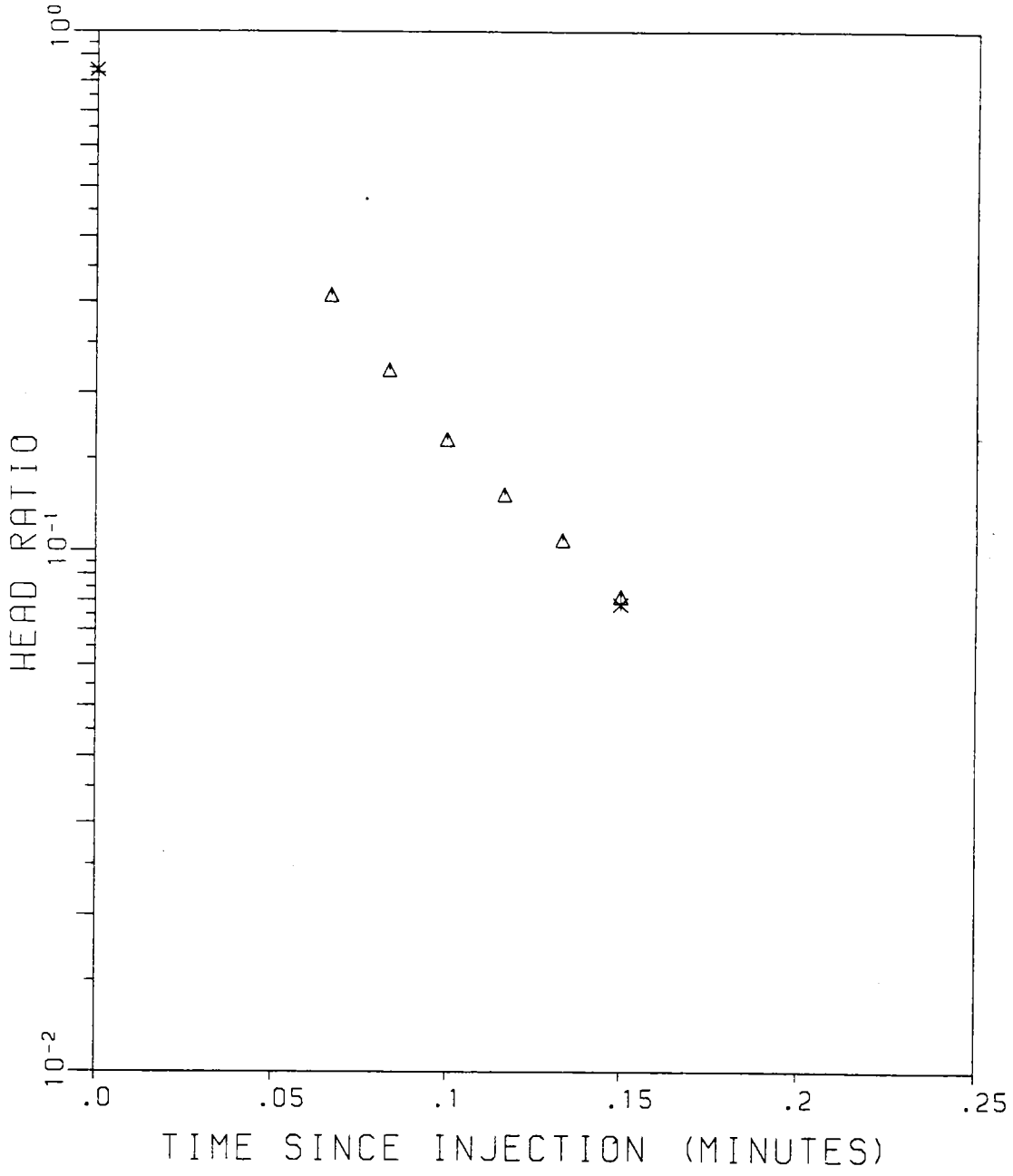
---

PERMEABILITY BASED ON REGRESSION FIT OF DATA - FERRIS & KNOWLES METHOD

INSUFFICIENT DATA POINTS WITH RECIPROCAL TIMES LESS THAN .300
NUMBER OF USABLE DATA POINTS= 0

| WELL # | PERMEABILITY METHOD 1 | PERMEABILITY METHOD 2 | STORAGE COEF METHOD 2 | PERMEABILITY METHOD 3 | PERMEABILITY METHOD 4 |
|---|---|---|---|---|---|
| S2MW109 | 6.93E-03 | 1.22E-02 | 5.88E-07 | .00 | 6.51E-03 |

* METHOD 1 IS HVORSLEV
METHOD 2 IS COOPER, BREDEHOEFT, AND PAPADOPULOS
METHOD 3 IS FERRIS AND KNOWLES
METHOD 4 IS BOUWER




SLUG TEST OF WELL S2MW109
LOG HEAD RATIO VS TIME

SITE 2, LANDFILL 2, WELL S2MW109

TUE 10-30-1990

07:54:35.90

# Groundwater Sampling Logs

# GROUNDWATER SAMPLING LOG

## FORT STORY



CLIENT USACE
SITE 2
WELL NUMBER MW 105
JOB NUMBER 1868.040

TOTAL WELL DEPTH 15.0
WELL DIAMETER 2"
BOREHOLE DIAMETER 8 3/4"

MIN NUMBER WELL VOL TO BE PURGED 3
VOL PER VERTICAL FT CASING (GAL) .95
VOL PER FT BOREHOLE (LESS CASING)(GAL)

STATIC WATER LEVEL (FT) 8' 2"
STANDING WATER COLUMN (FT) 6.8

AMT ONE WELL VOL (GAL) 6.46
TOTAL GAL TO BE PURGED 19.4

PURGING SYSTEM TEFLON BAILER
SAMPLING SYSTEM TEFLON BAILER

| DATE | TIME | AMOUNT PURGED (GAL) | EC | pH | TEMP | TURBIDITY | PID | | | COMMENTS | SAMPLER |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | FIELD PARAMETERS MEASURED | | | | | | | | |
| " | 15 | 0 | 190 | 6.71 | 13.1 | | | | | BROWNISH TINT 0% SED | MDS/EJD |
| " | 1512 | 5 | 200 | 6.60 | 13.2 | | | | | BROWNISH TINT 0% SED | MDS/EJD |
| " | 1545 | 10 | 190 | 6.67 | 13.2 | | | | | BROWN-CLEAR 0% SED | MDS/EJD |
| " | 1541 | 15 | 190 | 6.99 | 12.9 | | | | | CLEAR 0% SED | MDS/EJD |
| " | 1550 | 20 | | | | | | | | N/A | MDS/EJD |
| " | 1552 | 25 | | | | | | | | N/A | MDS/EJD |
| " | 1555 | 30 | 190 | 6.63 | 12.8 | | | | | CLEAR NO SED | MDS/EJD |
| " | 1600 | 35 | | | | | | | | N/A | MDS/EJD |
| " | | | | | | | | | | | |
| " | | | | | | | | | | | |
| " | | | | | | | | | | | |
| FINAL READING | 1603 | 6* | 200 | 6.67 | 12.8 | 58.4 | 0.0 | | | Clear NO SED | MDS/EJD |

NOTES: Low flow 2.5 l/min

TURBIDITY: 58.4 NTU Brownish

Well not purged dry.

# GROUNDWATER SAMPLING LOG

## FORT STORY



CLIENT USACE
SITE 2
WELL NUMBER MW 106
JOB NUMBER 1868.0401

TOTAL WELL DEPTH 11.75
WELL DIAMETER 2"
BOREHOLE DIAMETER 8 3/4"

MIN NUMBER WELL VOL TO BE PURGED 3
VOL PER VERTICAL FT CASING (GAL) .95
VOL PER FT BOREHOLE (LESS CASING)(GAL)

STATIC WATER LEVEL (FT) 1.2"
STANDING WATER COLUMN (FT) 10.55'

AMT ONE WELL VOL (GAL) 10.0
TOTAL GAL TO BE PURGED 30

PURGING SYSTEM TEFLON BAILER
SAMPLING SYSTEM TEFLON BAILER

| DATE | TIME | AMOUNT PURGED (GAL) | EC | pH | TEMP | TURBIDITY | PID | | | COMMENTS | SAMPLER |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | FIELD PARAMETERS MEASURED | | | | | | | | |
| 5.28 | 1435 | 0 | 50 | 5.92 | 12.6 | | | | | yellow - Clear 0% Sed | MDS/EJD |
| " | 1438 | 5 | 50 | 6.13 | 12.4 | | | | | Clear 0% Sed | MDS/EJD |
| " | 1440 | 10 | 60 | 6.16 | 12.3 | | | | | yellow - Brown 0% Clear | MDS/EJD |
| " | 1442 | 15 | | | | | | | | N/A | MDS/EJD |
| " | 1445 | 20 | | 6.11 | 12.3 | | | | | Brown Tint 0% Sed | MDS/EJD |
| " | 1447 | 25 | | | | | | | | N/A | MDS/EJD |
| " | 1450 | 30 | | | | | | | | N/A | MDS/EJD |
| " | 1452 | 35 | | 6.10 | 12.5 | | | | | murky Brown 0% Sed | MDS/EJD |
| " | | | | | | | | | | | |
| " | | | | | | | | | | | |
| " | | | | | | | | | | | |
| FINAL READING | 1515 | 6* | 40 | 6.07 | 12.3 | 200.2 | 0.0 | | | murky 0% Brown Sed | MDS/EJD |

NOTES: Pump Rate = 2.6 gpm

Well did not purge dry

TURBIDITY: .2 x 120.1

# GROUNDWATER SAMPLING LOG

## FORT STORY



CLIENT USACE
SITE 2
WELL NUMBER MW 107
JOB NUMBER 1868.0401

TOTAL WELL DEPTH 13.0
WELL DIAMETER 2"
BOREHOLE DIAMETER 8 3/4"

MIN NUMBER WELL VOL TO BE PURGED 3
VOL PER VERTICAL FT CASING (GAL) .95
VOL PER FT BOREHOLE (LESS CASING)(GAL)

STATIC WATER LEVEL (FT) 2.0
STANDING WATER COLUMN (FT) 11.0

AMT ONE WELL VOL (GAL) 10.45
TOTAL GAL TO BE PURGED 31.35

PURGING SYSTEM TEFLON BAILER
SAMPLING SYSTEM TEFLON BAILER

| DATE | TIME | AMOUNT PURGED (GAL) | FIELD PARAMETERS MEASURED | | | | | | | COMMENTS | SAMPLER |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | EC | pH | TEMP | TURBIDITY | PID | | | | |
| 5-28 | 1049 | 0 | 250 | 6.52 | 10.6 | | | | | MURKY-BROWN 0% SED | MDS/EJD |
| " | 1051 | 5 | 240 | 6.56 | 10.2 | | | | | MURKY-BROWN 0% SED | MDS/EJD |
| " | 1053 | 10 | 250 | 6.62 | 12.1 | | | | | GRAYISH-BROWN 0% SED | MDS/EJD |
| " | 1055 | 15 | 260 | 6.60 | 11.4 | | | | | GRAYISH-BROWN 0% SED | MDS/EJD |
| " | 1058 | 20 | | | | | | | | N/A | MDS/EJD |
| " | 1100 | 25 | | | | | | | | N/A | MDS/EJD |
| " | 1105 | 30 | 260 | 6.61 | 11.5 | | | | | GRAYISH-BROWN 0% SED | MDS/EJD |
| " | 1108 | 35 | | | | | | | | N/A | MDS/EJD |
| " | | | | | | | | | | | |
| " | | | | | | | | | | | |
| " | | | | | | | | | | | |
| FINAL READING | 1131 | 6+ | 260 | 6.56 | 11.8 | 144.8 | 0.0 | | | Grayish Brown 0% Sed | MDS/EJD |

NOTES: Purge Rate: 2.5 gal/min

TURBIDITY: 5 NTU x 50% = 72.4
2 x 2 x 72.4

# GROUNDWATER SAMPLING LOG

## FORT STORY



CLIENT USACE
SITE 2
WELL NUMBER MW 108
JOB NUMBER 1868.0401

TOTAL WELL DEPTH 14.0
WELL DIAMETER 2"
BOREHOLE DIAMETER 8 3/4"

MIN NUMBER WELL VOL TO BE PURGED 3
VOL PER VERTICAL FT CASING (GAL) .95
VOL PER FT BOREHOLE (LESS CASING)(GAL)

STATIC WATER LEVEL (FT) 1.0
STANDING WATER COLUMN (FT) 13.0

AMT ONE WELL VOL (GAL) 12.35
TOTAL GAL TO BE PURGED 37.1

PURGING SYSTEM TEFLON BAILER
SAMPLING SYSTEM TEFLON BAILER

| DATE | TIME | AMOUNT PURGED (GAL) | EC | pH | TEMP | TURBIDITY | PID | | | COMMENTS | SAMPLER |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | FIELD PARAMETERS MEASURED | | | | | | | | |
| 5-28 | 0911 | 0 | 290 | 6.19 | 6.10 | | | | | BROWNISH TINT 0% SED | MDS/EJD |
| " | 0913 | 4 | 300 | 6.12 | 6.11 | | | | | BROWNISH TINT 0% SED | MDS/EJD |
| " | 0915 | 8 | 220 | 5.98 | 6.19 | | | | | BROWNISH TINT 0% SED | MDS/EJD |
| " | 0917 | 16 | | | | | | | | N/A | MDS/EJD |
| " | 0920 | 20 | 240 | 6.11 | 6.14 | | | | | BROWNISH TINT 0% SED | MDS/EJD |
| " | 0923 | 24 | | | | | | | | N/A | MDS/EJD |
| " | 0926 | 28 | | | | | | | | N/A | MDS/EJD |
| " | 0927 | 32 | 225 | 6.09 | 6.42 | | | | | BROWNISH TINT 0% SED | MDS/EJD |
| " | 0930 | 36 | 235 | 6.11 | 6.41 | | | | | BROWNISH TINT 0% SED | MDS/EJD |
| " | | | | | | | | | | | |
| " | | | | | | | | | | | |
| FINAL READING | 1031 | 67 | 300 | 6.14 | 6.4 | 1207.2 | 0.0 | | | 0% SED BROWNISH TINT | MDS/EJD |

NOTES: 2 L/minute – Purge Rate
Well was not purged dry.

TURBIDITY: 50% + 50% + 50%
2 × 2 × 2 × 2 × 14.2 =

1/3 Yellow Tinge to Dissolved after 2 attempts to Filter

# GROUNDWATER SAMPLING LOG

## FORT STORY



CLIENT USACE
SITE 2
WELL NUMBER MW 109
JOB NUMBER 1868.0401

TOTAL WELL DEPTH 11.75
WELL DIAMETER 2"
BOREHOLE DIAMETER 8 3/4"

MIN NUMBER WELL VOL TO BE PURGED 3
VOL PER VERTICAL FT CASING (GAL) .95
VOL PER FT BOREHOLE (LESS CASING)(GAL)

STATIC WATER LEVEL (FT) 1.5
STANDING WATER COLUMN (FT) 10.25

AMT ONE WELL VOL (GAL) 9.4
TOTAL GAL TO BE PURGED 29

PURGING SYSTEM TEFLON BAILER
SAMPLING SYSTEM TEFLON BAILER

| DATE | TIME | AMOUNT PURGED (GAL) | EC | FIELD PARAMETERS MEASURED pH | TEMP | TURBIDITY | PID | | | COMMENTS | SAMPLER |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5-28 | 1230 | 0 | 125 | 5.91 | 9.2 | | | | | Clear-Brown c/o Sed | MDS/EJD |
| " | 1232 | 5 | 180 | 6.06 | 9.4 | | | | | murky-Brown c/o Sed | MDS/EJD |
| " | 1235 | 10 | 180 | 6.02 | 9.1 | | | | | murky-Brown c/o Sed | MDS/EJD |
| " | 1237 | 20 | | | | | | | | | MDS/EJD |
| " | 1240 | 25 | | | | | | | | | MDS/EJD |
| " | 1243 | 30 | 190 | | 7.7 | | | | | | MDS/EJD |
| " | | | | | | | | | | N/A | MDS/EJD |
| " | | | | | | | | | | N/A | MDS/EJD |
| " | | | | | | | | | | | |
| " | | | | | | | | | | | |
| " | | | | | | | | | | | |
| FINAL READING | | 6 + | 190 | 6.09 | 7.8 | 457.2 | 0.0 | | | | mds/EJD |

NOTES: Purge Rate 2.5 gal/min

TURBIDITY:

Well was not purged dry

Dissolved metals contained a yellow tinge after two seperate filtered sample was submitted.

**Soil and Monitoring Well Boring Lithologic Logs**

Site 4

BORING/WELL NUMBER *SB-101*
DATE STARTED *3/27/90* COMPLETED *3/27/90*
SITE NUMBER *4*
GROUND ELEVATION *10.25 FEET, NGVD*

CLIENT *U.S. ARMY CORPS OF ENGINEERS*
PROJECT *FT. STORY PA/SI*
SITE NAME *FIREFIGHTER TRAINING AREA*
GEOLOGIST *GARY B. ENLOE*



COORDINATES *N224370, E2720871*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | GS | 0-2 | 5<br>10<br>11<br>12 | | | | SAND (SP), brown to tan, medium w/ some fines, thin sandy silt seam at 1 foot, water at 2 feet, subrounded, poorly graded. | 0-2 foot interval drive 2 spoons for additional sample volume Blow Counts=5,15,18,26 5,10,11,12 |
| 5 | LITH | 5-7 | 1<br>8<br>10<br>11 | | | SP | SAND (SP), buff to brown, medium, subrounded, poorly graded, color difference possibly due to increasing saturation. | PID Instrumentation PI 101 HNu Systems 10.2 eV Lamp PID Background=0.0 ppm. |
| | BH | 8-10 | 12<br>7<br>12<br>6 | 2.0 | | | | 8-10 foot interval. Drive 2 spoons for additional sample volume Blow Counts=6,8,5,9 12,7,12,6 |
| 10 | | | | | | | Total depth of boring=10 feet. | Water injected into auger string during drilling to control running sands. |
| 15 | | | | | | | | |
| 20 | | | | | | | | |
| 25 | | | | | | | | GS=Ground Surface<br>LITH=Lithology<br>BH=Bottom of Hole<br>▼=Water table during drilling |

**JMM** James M. Montgomery
Consulting Engineers, Inc.

DRILLER *HARDIN AND HUBER, INC.*
METHOD OF DRILLING *HOLLOW STEM AUGER*
HOLE DIAMETER *8 1/4 INCHES*
TOTAL DEPTH *10 FEET*

WELL COMPLETION DEPTH *N/A*
WELL DIAMETER *N/A*
WELL MATERIAL *N/A*

BORING/WELL NUMBER *SB-102*
DATE STARTED *4/3/90* COMPLETED *4/3/90*
SITE NUMBER *4*
GROUND ELEVATION *10.36 FEET, NGVD*

CLIENT *U.S. ARMY CORPS OF ENGINEERS*
PROJECT *FT. STORY PA/SI*
SITE NAME *FIREFIGHTER TRAINING AREA*
GEOLOGIST *MARK SHUPE*



COORDINATES *N224142, E2720539*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | GS | 0-2 | 1 6 9 7 | 1.1 | | | SAND(SP), quartz, dark brown, medium to fine grained, subrounded, graded, trace silty. | PID Instrumentation PI 101 HNu Systems 10.2 eV Lamp PID Background=0.0 ppm. |
| 5 | LITH | 4-6 | 2 4 8 9 | 1.1 | | SP | SAND(SP), quartz, brown-tan, coarse-fine, subrounded, graded. | Begin boring on 3/27/90 shut down after augering 4 feet due to hydraulic leak; move rig 20 feet due east and construct boring on 4/3/90. |
| | BH | 8-10 | 5 12 22 15 | 1.0 | | | SAND(SP), quartz, tan, coarse-fine, subrounded, graded. | |
| 10 | | | | | | | Total depth of boring=10 feet. | |
| 15 | | | | | | | | |
| 20 | | | | | | | | |
| 25 | | | | | | | | |

GS=Ground Surface

LITH=Lithology

BH=Bottom of Hole

▼ =Water table during drilling

**JMM** James M. Montgomery
Consulting Engineers, Inc.

DRILLER *HARDIN AND HUBER, INC.*
METHOD OF DRILLING *HOLLOW STEM AUGER*
HOLE DIAMETER *8 1/4 INCHES*
TOTAL DEPTH *10 FEET*

WELL COMPLETION DEPTH *N/A*
WELL DIAMETER *N/A*
WELL MATERIAL *N/A*

BORING/WELL NUMBER *SB-103*
DATE STARTED *3/27/90* COMPLETED *3/27/90*
SITE NUMBER *4*
GROUND ELEVATION *10.25 FEET, NGVD*

CLIENT *U.S. ARMY CORPS OF ENGINEERS*
PROJECT *FT. STORY PA/SI*
SITE NAME *FIREFIGHTER TRAINING AREA*
GEOLOGIST *MARK SHUPE*



COORDINATES *N224122, E2720757*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | GS | 0-2 | 2<br>4<br>10<br>7 | 9.4 | | | SAND (SW), quartz, black, medium-coarse grained, subrounded, well graded. | PID Instrumentation<br>PI 101 HNu Systems<br>10.2 eV Lamp<br>PID Background=0.0 ppm. |
| 5 | LITH | 4-6 | 7<br>10<br>14<br>14 | 2 | | SW | SAND (SW), quartz, tan coarse subrounded-subangular, well graded. | |
| | BH | 8-10 | 86<br>74<br>62<br>59 | 2.3 | | | | |
| 10 | | | | | | | Total depth of boring=10 feet. | |
| 15 | | | | | | | | |
| 20 | | | | | | | | |
| 25 | | | | | | | | |

GS=Ground Surface

LITH=Lithology

BH=Bottom of Hole

▼ =Water table during drilling

**JMM** James M. Montgomery
Consulting Engineers, Inc.

DRILLER *HARDIN AND HUBER, INC.*
METHOD OF DRILLING *HOLLOW STEM AUGER*
HOLE DIAMETER *8 1/4 INCHES*
TOTAL DEPTH *10 FEET*

WELL COMPLETION DEPTH *N/A*
WELL DIAMETER *N/A*
WELL MATERIAL *N/A*

BORING/WELL NUMBER *SB-104*
DATE STARTED *3/27/90* COMPLETED *3/27/90*
SITE NUMBER *4*
GROUND ELEVATION *10.80 FEET, NGVD*

CLIENT *U.S. ARMY CORPS OF ENGINEERS*
PROJECT *FT. STORY PA/SI*
SITE NAME *FIREFIGHTER TRAINING AREA*
GEOLOGIST *GARY B. ENLOE*



COORDINATES *N224194, E2720945*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | GS | 0-2 | 8<br>15<br>19<br>27 | 2.0 | | SM | SAND (SM), dark brown, fine, poorly graded, subrounded. | PID Instrumentation<br>PI 101 HNu Systems<br>10.2 eV Lamp<br>PID Background=0.0 ppm. |
| | | | | | | | SAND (SP), brown, fine, moist, poorly graded, subrounded. | |
| 5 | | | | | | SP | | |
| | LITH | 5-7 | 12<br>14<br>22<br>24 | | | | SAND (SP), tan to buff, medium, poorly graded, subrounded to subangular, water at 2.5-3 feet. | |
| | BH | 8-10 | 65<br>10<br>13<br>12 | 2.0 | | | | 8-10 foot interval drive<br>2 spoons for additional sample<br>Blow counts=28,15,16,20<br>6,10,13,12 |
| 10 | | | | | | | Total depth of boring=10 feet. | |
| 15 | | | | | | | | PID Instrumentation<br>PI 101 HNu Systems<br>10.2 eV Lamp<br>PID Background=0.0 ppm. |
| 20 | | | | | | | | |
| 25 | | | | | | | | GS=Ground Surface<br>LITH=Lithology<br>BH=Bottom of Hole<br>▼=Water table during drilling |

**JMM** James M. Montgomery
Consulting Engineers, Inc.

DRILLER *HARDIN AND HUBER, INC.*
METHOD OF DRILLING *HOLLOW STEM AUGER*
HOLE DIAMETER *8 1/4 INCHES*
TOTAL DEPTH *10 FEET*

WELL COMPLETION DEPTH *N/A*
WELL DIAMETER *N/A*
WELL MATERIAL *N/A*

BORING/WELL NUMBER *SB-105*
DATE STARTED *3/27/90* COMPLETED *3/27/90*
SITE NUMBER *4*
GROUND ELEVATION *11.64 FEET, NGVD*

CLIENT *U.S. ARMY CORPS OF ENGINEERS*
PROJECT *FT. STORY PA/SI*
SITE NAME *FIREFIGHTER TRAINING AREA*
GEOLOGIST *GARY B. ENLOE*



COORDINATES *N223921, E2720525*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | GS | 0-2 | 1<br>7<br>10<br>14 | 4.2 | | SP<br>SW | SAND (SP), tan, fine, subrounded, poorly graded.<br>SAND (SW), brown, medium, well graded, subrounded, moist. | 0-2 foot interval drive 2 spoons for additional sample volume Blow counts=3,8,14,20 1,7,10,14 |
| 5 | LITH | 5-7 | 2<br>4<br>10<br>10 | | | SP | SAND (SP), brown to tan, coarse, poorly graded, subrounded, water at 5.5 feet. | PID Instrumentation PI 101 HNu Systems 10.2 eV Lamp PID Background=0.0 ppm. |
| | BH | 8-10 | 11<br>18<br>26<br>33 | 3.3 | | | | 8-10 foot interval drive 2 spoons for additional sample volume Blow counts=1,1,1,2 11,18,26,33 |
| 10 | | | | | | | Total depth of boring=10 feet. | |
| 15 | | | | | | | | Note: water injected while drilling to keep out flowing sands. |
| 20 | | | | | | | | |
| 25 | | | | | | | | GS=Ground Surface<br>BH=Bottom of Hole<br>LITH=Lithology<br>▼=Water table during drilling |

**JMM** James M. Montgomery
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DRILLER *HARDIN AND HUBER, INC.*
METHOD OF DRILLING *HOLLOW STEM AUGER*
HOLE DIAMETER *8 1/4 INCHES*
TOTAL DEPTH *10 FEET*

WELL COMPLETION DEPTH *N/A*
WELL DIAMETER *N/A*
WELL MATERIAL *N/A*

BORING/WELL NUMBER *SB-106*
DATE STARTED *3/27/90* COMPLETED *3/27/90*
SITE NUMBER *4*
GROUND ELEVATION *12.48 FEET, NGVD*

CLIENT *U.S. ARMY CORPS OF ENGINEERS*
PROJECT *FT. STORY PA/SI*
SITE NAME *FIREFIGHTER TRAINING AREA*
GEOLOGIST *MARK SHUPE*



COORDINATES *N223971, E2720938*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | GS | 0-2 | 4 7 7 6 | 5.0 | | | SAND (SP), quartz, dark gray-black, medium grained, subrounded, poor grading. | PID Instrumentation<br>PI 101 HNu Systems<br>10.2 eV Lamp<br>PID Background=0.0 ppm. |
| 5 | LITH | 5-7 | 4 6 6 6 | 5.1 | | SP | SAND (SP), quartz, tan, coarse grained, subrounded, poor grading. | |
| | BH | 8-10 | 36 29 15 21 | 8.8 | | | | |
| 10 | | | | | | | Total depth of boring=10 feet. | |
| 15 | | | | | | | | |
| 20 | | | | | | | | |
| 25 | | | | | | | | |

GS=Ground Surface

BH=Bottom of Hole

LITH=Lithology

▼ =Water table during drilling

JMM James M. Montgomery Consulting Engineers, Inc.

DRILLER *HARDIN AND HUBER, INC.*
METHOD OF DRILLING *HOLLOW STEM AUGER*
HOLE DIAMETER *8 1/4 INCHES*
TOTAL DEPTH *10 FEET*

WELL COMPLETION DEPTH *N/A*
WELL DIAMETER *N/A*
WELL MATERIAL *N/A*

BORING/WELL NUMBER *SB-107*
DATE STARTED *3/27/90* COMPLETED *3/27/90*
SITE NUMBER *4*
GROUND ELEVATION *12.48 FEET, NGVD*

CLIENT *U.S. ARMY CORPS OF ENGINEERS*
PROJECT *FT. STORY PA/SI*
SITE NAME *FIREFIGHTER TRAINING AREA*
GEOLOGIST *MARK SHUPE*



COORDINATES *N223761, E2720960*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | GS | 0-2 | 5<br>10<br>16<br>17 | 1.1 | | | SAND (SP), quartz, dark brown, medium-fine grained, graded, trace gravel, fill. | PID Instrumentation<br>PI 101 HNu Systems<br>10.2 eV Lamp<br>PID Background=0.0 ppm. |
| 5 | LITH | 4-6 | 6<br>11<br>12<br>14 | 2.9 | | SP | SAND (SP), quartz, gray-brown, coarse-fine, subrounded, graded.<br>SAND (SP), quartz, dark gray-brown, medium-fine, subrounded, trace silty. | |
| | LITH | 9-11 | 4<br>9<br>10<br>10 | 0.8 | | | | |
| 10 | | | | | | | SAND (SP), quartz, medium gray, medium-fine grained, subrounded, graded.<br>SAND (SP), quartz, tan-brown, medium-fine grained, subrounded, graded. | |
| 15 | BH<br>DUP<br>SPLIT | 13-15 | 16<br>24<br>25<br>32 | 2.2 | | SW | SAND (SW), quartz, medium-gray, coarse to fine, subrounded, well graded.<br>Total depth of boring=15 feet. | 13-15 foot interval<br>2 spoons driven for additional sample<br>Blow counts=16,24,25,32<br>8,11,12,8 |
| 20 | | | | | | | | GS=Ground Surface<br>BH=Bottom of Hole<br>LITH=Lithology<br>DUP-Duplicate Sample<br>SPLIT=Split Sample |
| 25 | | | | | | | | ▼ =Water table during drilling |

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DRILLER *HARDIN AND HUBER, INC.*
METHOD OF DRILLING *HOLLOW STEM AUGER*
HOLE DIAMETER *8 1/4 INCHES*
TOTAL DEPTH *15 FEET*

WELL COMPLETION DEPTH *N/A*
WELL DIAMETER *N/A*
WELL MATERIAL *N/A*

BORING/WELL NUMBER *SB-108*
DATE STARTED *3/27/90* COMPLETED *3/27/90*
SITE NUMBER *4*
GROUND ELEVATION *13.49 FEET, NGVD*

CLIENT *U.S. ARMY CORPS OF ENGINEERS*
PROJECT *FT. STORY PA/SI*
SITE NAME *FIREFIGHTER TRAINING AREA*
GEOLOGIST *GARY B. ENLOE*



COORDINATES *N223737, E2720598*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | GS | 0-2 | 2<br>5<br>12<br>14 | 2.0 | | SP | SAND (SP), brown, medium, poorly graded, subrounded, moist. | 0-2 foot interval drive 2 spoons for additional sample volume Blow counts=2,5,12,14 2,4,11,20 |
| 5 ▼ | LITH | 5-7 | 6<br>8<br>10<br>11 | | | | SAND (SP), brown, coarse, subrounded, poorly graded. | PID Instrumentation PI 101 HNu Systems 10.2 eV Lamp PID Background=0.0 ppm. |
| 10 | LITH | 10-12 | 4<br>6<br>10<br>12 | | | SW | SAND (SW), tan, coarse, well graded, subrounded. | |
| 15 | BH | 15-17 | 10<br>12<br>14<br>18 | 2.6 | | | Total depth of boring=17 feet. | 15-17 foot interval drive 2 spoons for additional sample volumes Blow counts=10,12,14,18 4,7,11,14 |
| 20 | | | | | | | | Approximately 10 feet of sand flowed up into auger string before last sample interval. |
| 25 | | | | | | | | GS=Ground Surface<br>BH=Bottom of Hole<br>LITH=Lithology<br>▼ =Water table during drilling |

**JMM** James M. Montgomery Consulting Engineers, Inc.

DRILLER *HARDIN AND HUBER, INC.*
METHOD OF DRILLING *HOLLOW STEM AUGER*
HOLE DIAMETER *8 1/4 INCHES*
TOTAL DEPTH *17 FEET*

WELL COMPLETION DEPTH *N/A*
WELL DIAMETER *N/A*
WELL MATERIAL *N/A*

BORING/WELL NUMBER *SB-109*
DATE STARTED *3/27/90* COMPLETED *3/27/90*
SITE NUMBER *4*
GROUND ELEVATION *13.67 FEET, NGVD*

CLIENT *U.S. ARMY CORPS OF ENGINEERS*
PROJECT *FT. STORY PA/SI*
SITE NAME *FIREFIGHTER TRAINING AREA*
GEOLOGIST *GARY B. ENLOE*



COORDINATES *N223917, E2721049*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | GS | 0-2 | 7<br>17<br>27<br>17 | 1.0 | | SM | SAND (SM), dark brown, silty, subrounded, poorly graded, fill, gravel. | 0-2 foot interval drive 2 spoons for additional sample volume Blow Counts=7,17,27,17 11,100/12" |
| ▼ | | | | | | SW | SAND (SW), tan to brown, medium, well graded, subrounded, water at 4 feet. | |
| 5 | LITH | 5-7 | 5<br>6<br>10<br>15 | | | SP | SAND (SP), brown, medium, subrounded, poorly graded. | PID Instrumentation PI 101 HNu Systems 10.2 eV Lamp PID Background=0.0 ppm. |
| 10 | LITH | 10-12 | 8<br>10<br>11<br>9 | | | | SAND (SP), tan to buff, medium, subrounded, poorly graded. | |
| | | 13-15 | 1<br>2<br>3<br>2 | | | | | 13-17 foot interval Sand is washing out of sampler, BH sample was collected from auger cuttings (from approximate depth of 15 feet). Injected water to keep out flowing sand. Blow Counts (13-15 feet) 1,2,3,2 2,3,3,3 8,8,9,5 |
| 15 | | 15-17 | 26<br>18<br>16<br>20 | 3.0 | | | Total depth of boring=15 feet. | Blow Counts (15-17 feet) 26,18,16,20 |
| 20 | | | | | | | | |
| 25 | | | | | | | | |

GS=Ground Surface

LITH=Lithology

BH=Bottom of Hole

▼ =Water table during drilling

**JMM** James M. Montgomery
Consulting Engineers, Inc.

DRILLER *HARDIN AND HUBER, INC.*
METHOD OF DRILLING *HOLLOW STEM AUGER*
HOLE DIAMETER *8 1/4 INCHES*
TOTAL DEPTH *15 FEET*

WELL COMPLETION DEPTH *N/A*
WELL DIAMETER *N/A*
WELL MATERIAL *N/A*

BORING/WELL NUMBER *MW-110* CLIENT *U.S. ARMY CORP OF ENGINEERS* PAGE *1* OF *1*

DATE STARTED *3/26/90* COMPLETED *3/26/90* PROJECT *FORT STORY IRP*

ELEVATION *13.51 FEET, MSL* GEOLOGIST *GARY B. ENLOE*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | GS | 0-2 | 6 9 4 5 | 1.4 | | | Gray fine SAND, subrounded, with gravel, fill | 0-2 foot interval drive 2 spoons for additional sample volume Blow counts=6,9,4,5 10,7,11,9 |
| | LITH | 2-4 | 10 13 12 11 | | | SP | Brown fine SAND, poorly graded, subrounded, moist | |
| 5 | SI GEO | 4-6 | 10 13 14 15 | 22.0 | | | Brown medium SAND, poorly graded, subrounded, water at 5 feet, strong hydrocarbon smell at water table | 4-6 foot interval drive 2 spoons for additional sample volume Blow counts=10,13,14,15 1,1,1,1 |
| 10 | LITH | 10-12 | 1 2 3 3 | | | SW | Brown to tan coarse SAND, well graded, subrounded | PID Instrumentation PI 101 HNu Systems 10.2 eV Lamp PID Background=0.0 ppm |
| 15 | | | | | | | Total depth of boring=13.5 feet | |
| 20 | | | | | | | | |
| 25 | | | | | | | | |

GS=Ground Surface

SI=Soil/Groundwater Interface

LITH=Lithology

GEO=Geotechnical

▼ =Water table during drilling

**JMM** James M. Montgomery Consulting Engineers, Inc.

DRILLER *HARDIN AND HUBER, INC.* WELL COMPLETION DEPTH *13 FEET*

METHOD OF DRILLING *HOLLOW STEM AUGER* WELL DIAMETER *2 INCHES*

HOLE DIAMETER *8 1/4 INCHES* WELL MATERIAL *SCHEDULE 40 PVC*

TOTAL DEPTH *13.5 FEET*

BORING/WELL NUMBER *MW-111*
DATE STARTED *3/26/90* COMPLETED *3/26/90*
SITE NUMBER *4*
GROUND ELEVATION *14.03 FEET, NGVD*

CLIENT *U.S. ARMY CORPS OF ENGINEERS*
PROJECT *FT. STORY PA/SI*
SITE NAME *FIREFIGHTER TRAINING AREA*
GEOLOGIST *GARY B. ENLOE*



COORDINATES *N223674, E2720726*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | GS | 0-2 | 4 6 9 11 | 0.6 | | SM | SAND (SM), vegetation-roots, brown, silty, fine, moist. | 0-2 foot interval drive 2 spoons for additional sample volume Blow counts=4,6,9,11 4,5,11,12 |
| | LITH | 2-4 | 5 9 9 8 | | | SP | SAND (SP), tan, medium, poorly graded, subrounded, increasing moisture with depth, water at 5 feet. | |
| 5 | SI GEO | 4-6 | 4 6 7 10 | 1.6 | | | | 4-6 foot interval drive 2 spoons for additional sample volume Blow counts=4,6,7,10 5,7,9,10 |
| | | | | | | | SAND (SW), tan, coarse, well graded, subrounded. | |
| 10 | LITH | 10-12 | 1 1 2 4 | | | SW | | PID Instrumentation PI 101 HNu Systems 10.2 eV Lamp PID Background=0.0 ppm. |
| | | | | | | | Total depth of boring=13.5 feet. | |
| 15 | | | | | | | | |
| 20 | | | | | | | | |
| 25 | | | | | | | | |

GS=Ground Surface

SI=Soil/Groundwater Interface

LITH=Lithology

GEO=Geotechnical

▼ =Water table during drilling

JMM James M. Montgomery Consulting Engineers, Inc.

DRILLER *HARDIN AND HUBER, INC.*
METHOD OF DRILLING *HOLLOW STEM AUGER*
HOLE DIAMETER *8 1/4 INCHES*
TOTAL DEPTH *13.5 FEET*

WELL COMPLETION DEPTH *13 FEET*
WELL DIAMETER *2 INCHES*
WELL MATERIAL *SCHEDULE 40 PVC*

BORING/WELL NUMBER *MW-112*
DATE STARTED *3/26/90* COMPLETED *3/26/90*
SITE NUMBER *4*
GROUND ELEVATION *14.00 FEET, NGVD*

CLIENT *U.S. ARMY CORPS OF ENGINEERS*
PROJECT *FT. STORY PA/SI*
SITE NAME *FIREFIGHTER TRAINING AREA*
GEOLOGIST *GARY B. ENLOE*



COORDINATES *N223835, E2721089*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | GS | 0-2 | 4 7 6 9 | 0.0 | | SP | SAND (SP), dark brown, fine, subrounded, poorly graded, iron staining. | 0-2 foot interval drive 2 spoons for additional sample volume Blow counts=4,7,6,9 5,7,10,12 |
| | LITH | 2-4 | 5 7 8 13 | | | | SAND (SP), brown, medium, subrounded, poorly graded, tan from 3-3.5 feet. | |
| 5 | SI GEO | 4-6 | 5 8 10 12 | 0.6 | | SW | SAND (SW), brown, coarse, well graded, subrounded. | 4-6 foot interval drive 2 spoons for additional sample volume Blow counts=5,8,10,12 3,7,10,13 |
| 10 | LITH | 10-12 | 3 4 5 4 | | | | SAND (SW), buff, coarse, well graded, subrounded. | PID Instrumentation PI 101 HNu Systems 10.2 eV Lamp PID Background=0.0 ppm. |
| | | | | | | | | Auger advanced to 20 feet to pound out flowing sand with roller bit; set well at 13 feet. |
| 15 | | | | | | | Total depth of boring=14 feet. | |
| 20 | | | | | | | | |
| 25 | | | | | | | | |

GS=Ground Surface

SI=Soil/Groundwater Interface

LITH=Lithology

GEO=Geotechnical

▼ =Water table during drilling

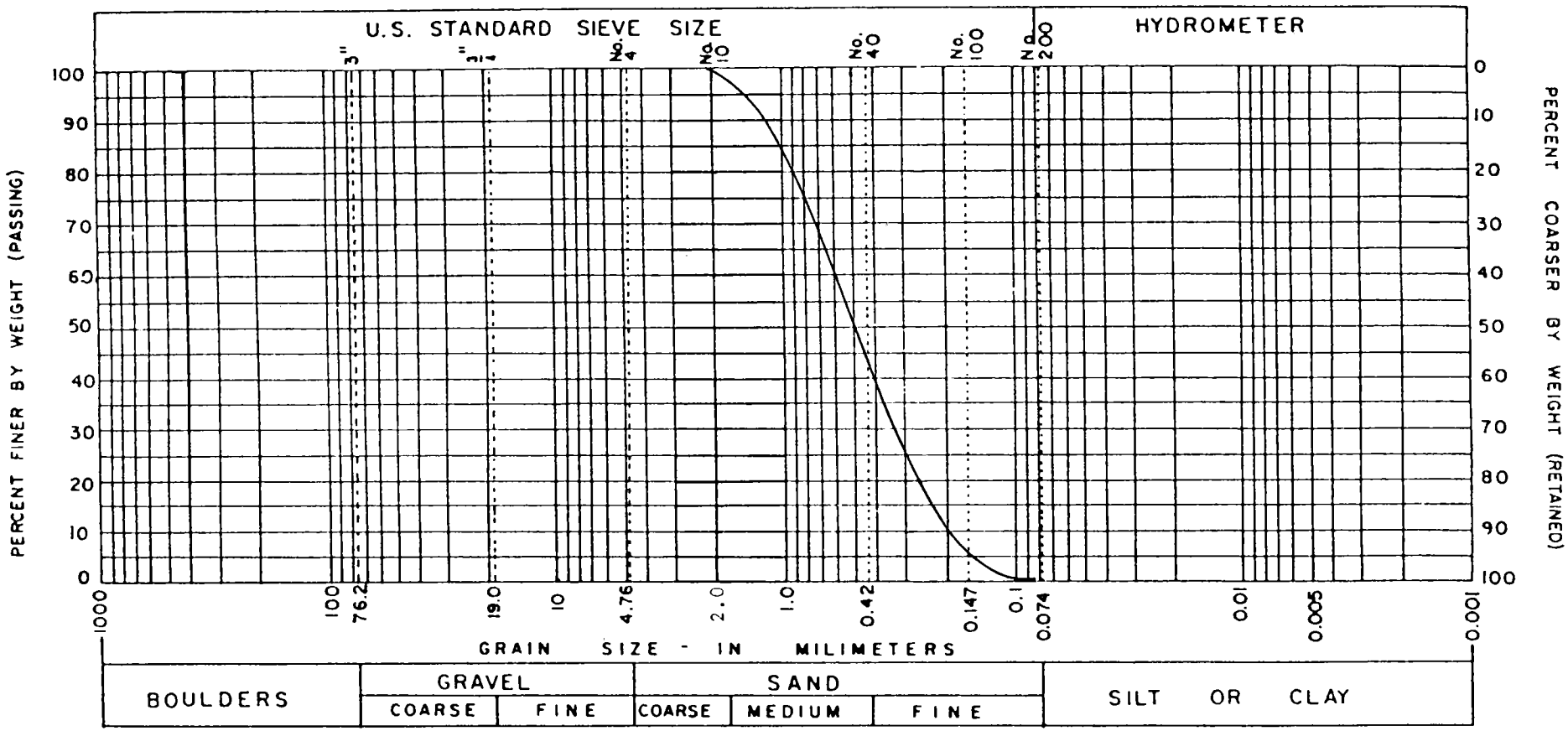
**JMM** James M. Montgomery
Consulting Engineers, Inc.

DRILLER *HARDIN AND HUBER, INC.*
METHOD OF DRILLING *HOLLOW STEM AUGER*
HOLE DIAMETER *8 1/4 INCHES*
TOTAL DEPTH *14 FEET*

WELL COMPLETION DEPTH *13 FEET*
WELL DIAMETER *2 INCHES*
WELL MATERIAL *SCHEDULE 40 PVC*

# Geotechnical Grain Size Analyses

| PROJECT: Fort Story | | LOCATION: Virginia Beach, VA. | |
|---|---|---|---|
| BORING NO. Site 4 | SAMPLE NO. S4MW110 | DEPTH: 6' | CONTRACT NO. 90-075 |



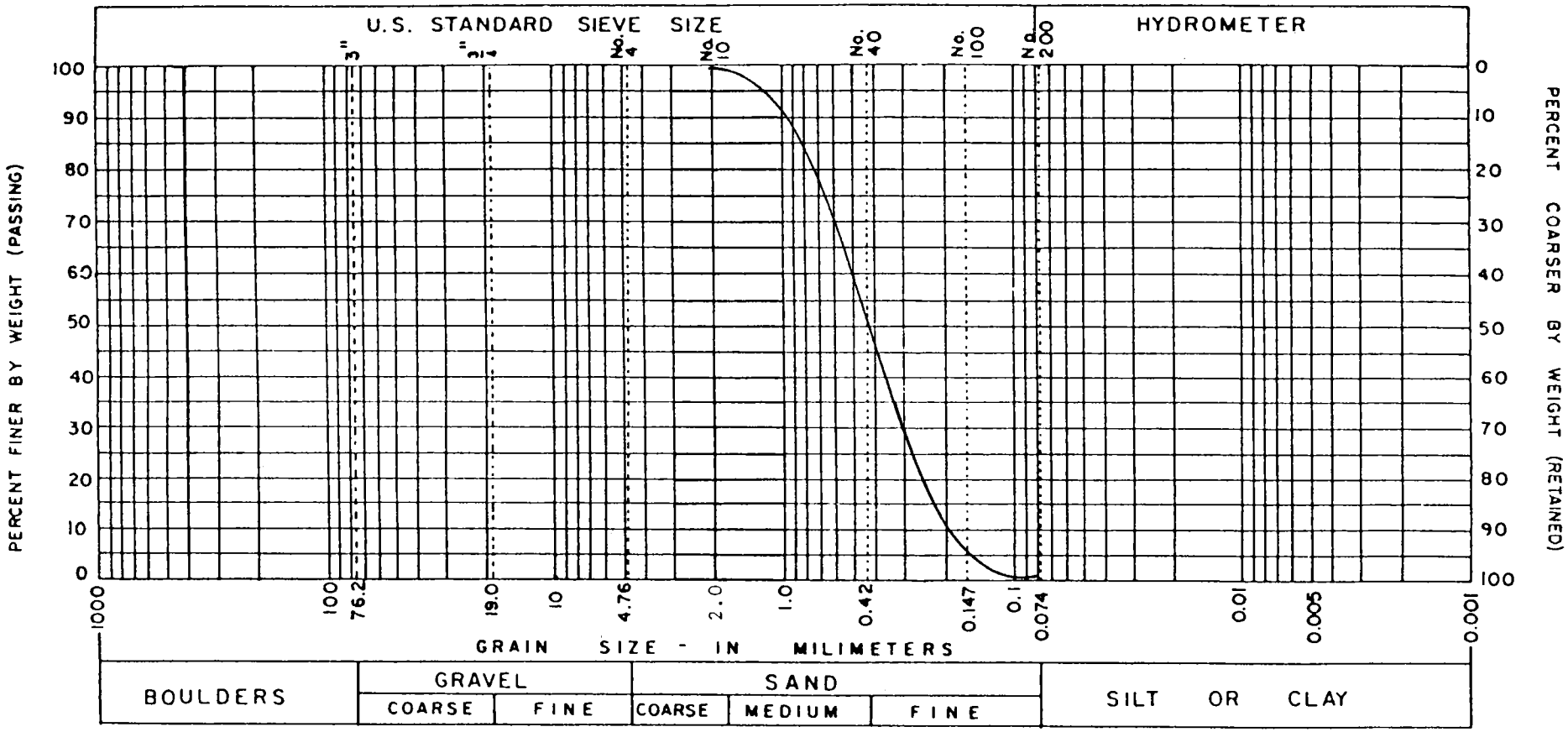

| SAMPLE NO. | DEPTH | L.L. | P.I. | M.C. | Unified | Soil Description |
|---|---|---|---|---|---|---|
| S4MW110 | 6' | - | N.P. | 16.9 | SP | Tan sand |

Earth Engineering & Sciences, Inc.

GRAIN-SIZE DISTRIBUTION

| TESTED BY: RMP | DATE: 7-12-90 |
|---|---|
| CHECKED BY: PAD | SHEET No. 12 OF 32 |

| PROJECT: Fort Story | | LOCATION: Virginia Beach, VA. | |
|---|---|---|---|
| BORING NO. Site 4 | SAMPLE NO. S4MW111 | DEPTH: 6' | CONTRACT NO. 90-075 |




| SAMPLE NO. | DEPTH | L.L. | P.I. | M.C. | Unified | Soil Description |
|---|---|---|---|---|---|---|
| S4MW111 | 6' | - | N.P. | 19.4 | SP | Tan sand |

Earth Engineering & Sciences, Inc.

## GRAIN-SIZE DISTRIBUTION

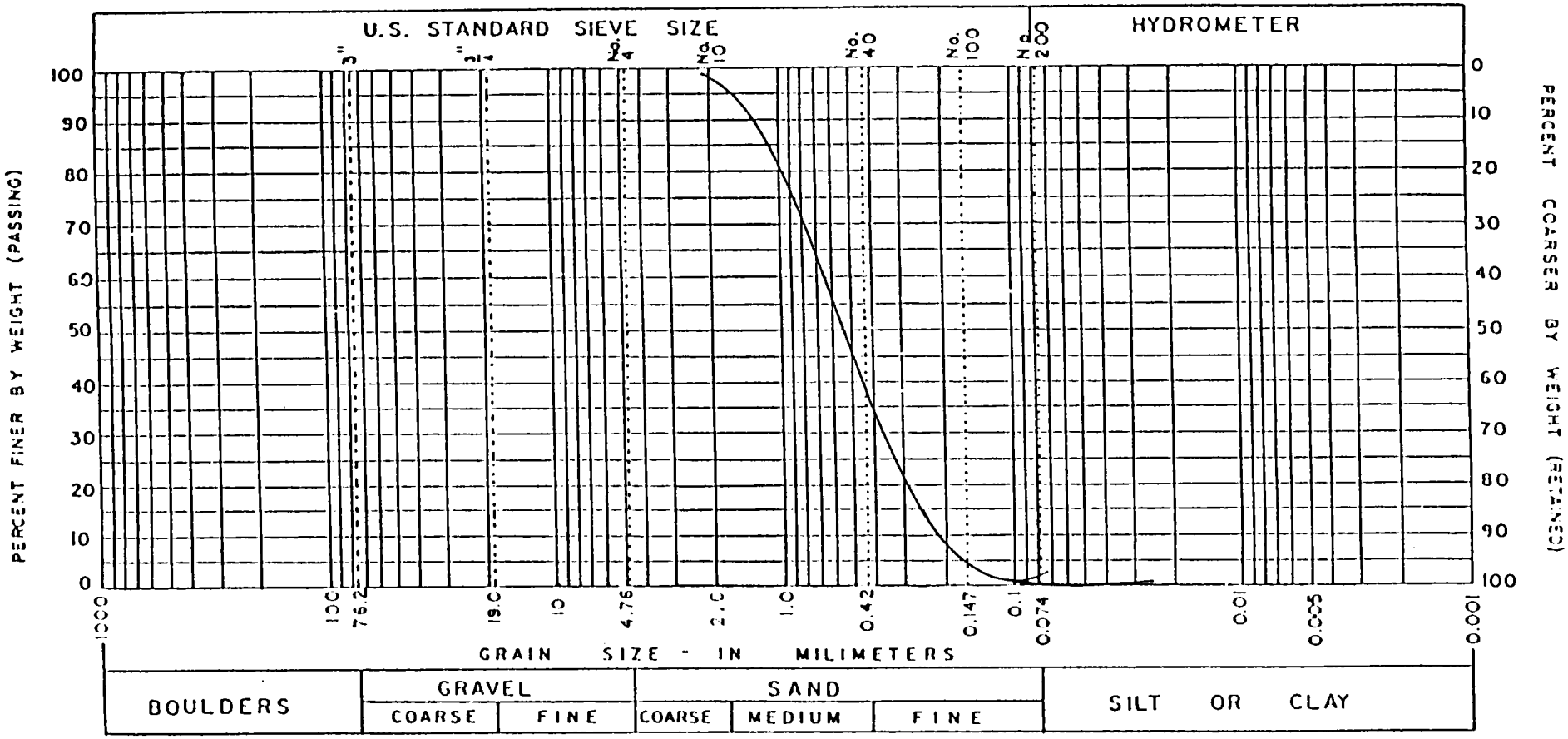
TESTED BY: RMP

DATE: 7-12-90

CHECKED BY: PAD

SHEET No. 13 OF 32

| PROJECT: Fort Story | | LOCATION: Virginia Beach, VA. | |
|---|---|---|---|
| BORING NO. Site 4 | SAMPLE NO. S4MW112 | DEPTH: 6' | CONTRACT NO. 90-075 |




| SAMPLE NO. | DEPTH | L.L. | P.I. | M.C. | Unified | Soil Description |
|---|---|---|---|---|---|---|
| S4MW112 | 6' | - | N.P. | 18.5 | SP | Tan sand |

Earth Engineering & Sciences, Inc.

GRAIN-SIZE DISTRIBUTION

TESTED BY: RMP

DATE:

CHECKED BY:

SHEET No. 14 OF 32

# Monitoring Well Construction Summary Sheets

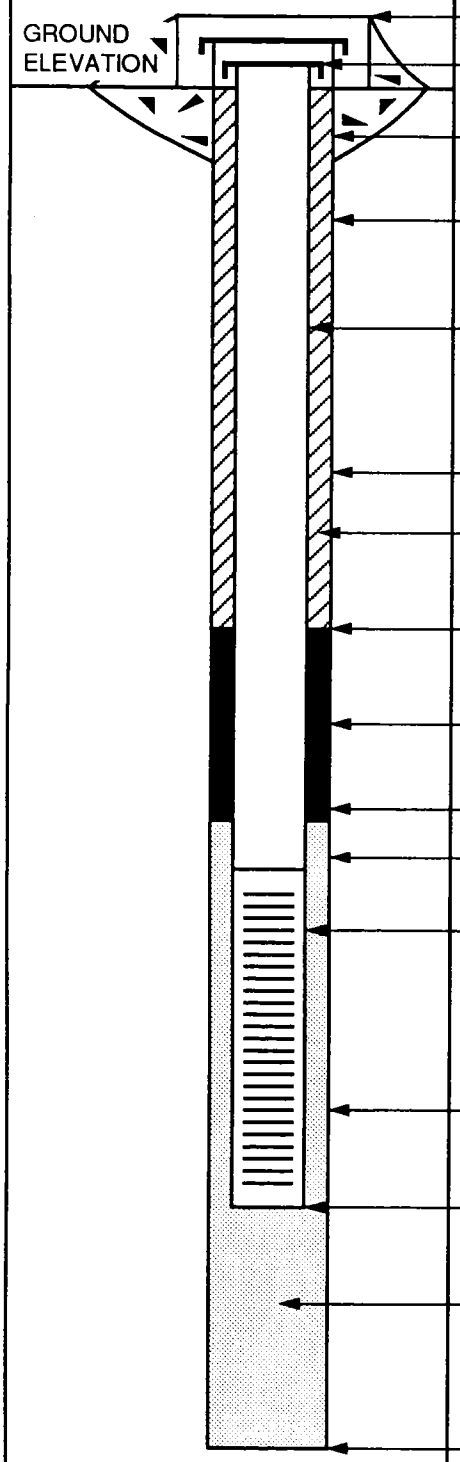
James M. Montgomery
Consulting Engineers, Inc.

BORING NO. MW-110

# MONITORING WELL SHEET

PROJECT Fort Story PA/SI
LOCATION Site 4
PROJECT NO. 1868.0401
BORING MW-110
ELEVATION
DATE 3/26/90
FIELD GEOLOGIST Gary B. Enloe

DRILLER Hardin and Huber Inc.
DRILLING METHOD Hollow Stem Auger
DEVELOPMENT METHOD Air Surging/Pumping




ELEVATION OF TOP OF SURFACE CASING: 13.79 ft.
ELEVATIONS OF TOP OF RISER PIPE: 13.51 ft.

TYPE OF SURFACE SEAL: Cement Grout

I.D. OF SURFACE CASING: 8 inch
TYPE OF SURFACE CASING: Steel

RISER PIPE I.D.: 2 inch
TYPE OF RISER PIPE: Schedule 40 PVC

BOREHOLE DIAMETER: 8 1/4 inch

TYPE OF BACKFILL: Cement Grout

ELEVATION/DEPTH OF SEAL: 1.0 ft.

TYPE OF SEAL: Granular Bentonite

DEPTH TO TOP OF SAND PACK: 2.0 ft.
ELEVATION/DEPTH TOP OF SCREEN: 3.0 ft.

TYPE OF SCREEN: Schedule 40 PVC
SLOT SIZE X LENGTH: .020 inch X 10 feet
I.D. OF SCREEN: 2 inch

TYPE OF SAND PACK: No. 2 Filter Sand

ELEVATION/DEPTH BOTTOM OF SCREEN: 13.0 ft.

ELEVATION/DEPTH BOTTOM OF SANDPACK: 13.5 ft.
TYPE OF BACKFILL BELOW OBSERVATION WELL:
No. 2 Filter Sand

ELEVATION/DEPTH OF HOLE: 13.5 ft.

James M. Montgomery
Consulting Engineers, Inc.

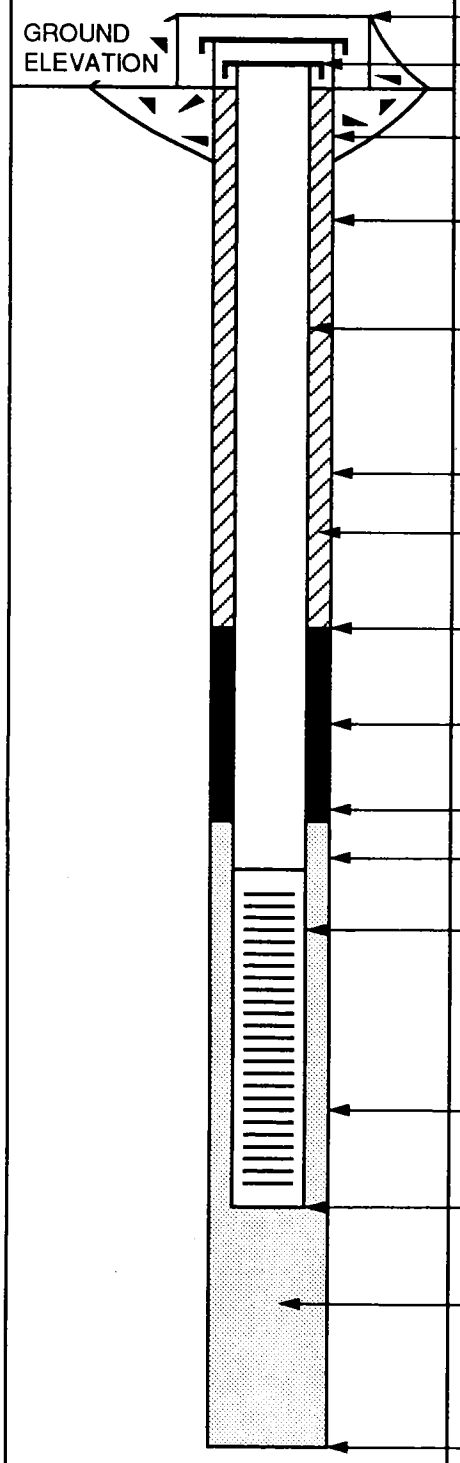
BORING NO. MW-111

# MONITORING WELL SHEET

PROJECT Fort Story PA/SI
PROJECT NO. 1868.0401
ELEVATION
FIELD GEOLOGIST Gary B. Enloe

LOCATION Site 4
BORING MW-111
DATE 3/26/90

DRILLER Hardin and Huber Inc.
DRILLING METHOD Hollow Stem Auger
DEVELOPMENT METHOD Air Surging/Bailing/Pumping




ELEVATION OF TOP OF SURFACE CASING: 14.03 ft.
ELEVATIONS OF TOP OF RISER PIPE: 13.83 ft.

TYPE OF SURFACE SEAL: Cement Grout

I.D. OF SURFACE CASING: 8 inch
TYPE OF SURFACE CASING: Steel

RISER PIPE I.D.: 2 inch
TYPE OF RISER PIPE: Schedule 40 PVC

BOREHOLE DIAMETER: 8 1/4 inch

TYPE OF BACKFILL: Cement Grout

ELEVATION/DEPTH OF SEAL: 1.0 ft.

TYPE OF SEAL: Granular Bentonite

DEPTH TO TOP OF SAND PACK: 2.0 ft.
ELEVATION/DEPTH TOP OF SCREEN: 3.0 ft.

TYPE OF SCREEN: Schedule 40 PVC
SLOT SIZE X LENGTH: .020 inch X 10 feet
I.D. OF SCREEN: 2 inch

TYPE OF SAND PACK: No. 2 Filter Sand

ELEVATION/DEPTH BOTTOM OF SCREEN: 13.0 ft.

ELEVATION/DEPTH BOTTOM OF SANDPACK: 13.5 ft.
TYPE OF BACKFILL BELOW OBSERVATION WELL:
No. 2 Filter Sand

ELEVATION/DEPTH OF HOLE: 13.5 ft.

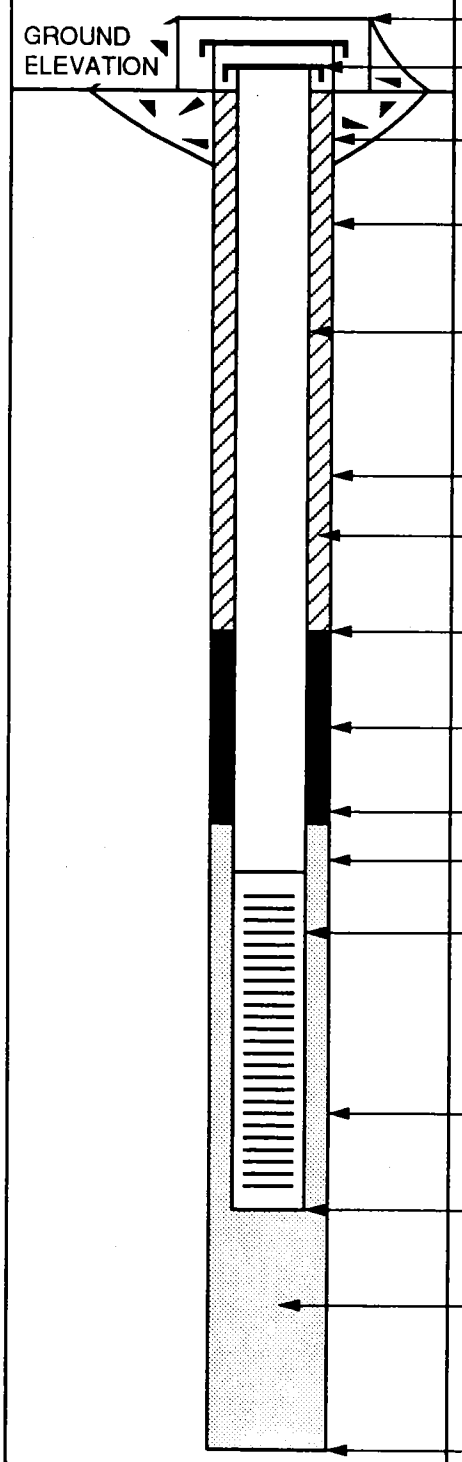
JMM James M. Montgomery
Consulting Engineers, Inc.

BORING NO. MW-112

# MONITORING WELL SHEET

PROJECT Fort Story PA/SI
LOCATION Site 4
PROJECT NO. 1868.0401
BORING MW-112
ELEVATION
DATE 3/26/90
FIELD GEOLOGIST Gary B. Enloe

DRILLER Hardin and Huber Inc.
DRILLING METHOD Hollow Stem Auger
DEVELOPMENT METHOD Air Surging/Pumping




ELEVATION OF TOP OF SURFACE CASING: 14.00 ft.
ELEVATIONS OF TOP OF RISER PIPE: 13.74 ft.

TYPE OF SURFACE SEAL: Cement Grout

I.D. OF SURFACE CASING: 8 inch
TYPE OF SURFACE CASING: Steel

RISER PIPE I.D.: 2 inch
TYPE OF RISER PIPE: Schedule 40 PVC

BOREHOLE DIAMETER: 8 1/4 inch

TYPE OF BACKFILL: Cement Grout

ELEVATION/DEPTH OF SEAL: 1.0 ft.

TYPE OF SEAL: Granular Bentonite

DEPTH TO TOP OF SAND PACK: 2.0 ft.
ELEVATION/DEPTH TOP OF SCREEN: 3.0 ft.

TYPE OF SCREEN: Schedule 40 PVC
SLOT SIZE X LENGTH: .020 inch X 10 feet
I.D. OF SCREEN: 2 inch

TYPE OF SAND PACK: No. 2 Filter Sand

ELEVATION/DEPTH BOTTOM OF SCREEN: 13.0 ft.

ELEVATION/DEPTH BOTTOM OF SANDPACK: 14.0 ft.
TYPE OF BACKFILL BELOW OBSERVATION WELL:
No. 2 Filter Sand

ELEVATION/DEPTH OF HOLE: 14.0 ft.

# Monitoring Well Development Sheets

Earth Engineering & Sciences, Inc.

## Monitoring Well Development Sheet MW - 110

Project: FORT STORY Location: SITE #4

Project No. 1868 Dates: 3-29-90 & 4-8-90

Field Geologists:

Barrel ID: S4 MW 110 DEV $H_2O$ No. of Barrels:

Initial Development Method AIR SURGED Init. Dev. Date: 3-29-90

Initial Volume Removed: 40 gal Time Started: 1020 Finished: 1115

Initial Team Members: GARY ENLOE

Water Level (Initial): 4.81

Total Depth (BOH): 12.9'

Designed Depth: 13.5'

Depth of Sediment: 0.6'

Water Level After Initial Development: 5.0

BOH After Initial Development: 13.3'

---

Final Development Method: PUMPED Fin. Dev. Date: 4-8 90

Final Volume Removed: 150 gal Time Start: 1410 Finished: 1443

Final Team Members: G. TOWSON & D. ENGLAND

Water Level Start: 4.55 Finished: 4.55 Ph: 6.44 EC: 232 T°C: 14.5

Total Depth Start: 13.3 Finished: 13.3

$O_2$, TOX, Lel and Organic Vapor Problems Encountered: NONE

Action: ☒ None Needed
☐ Need:

Earth Engineering & Sciences, Inc.

| Date | Time | Initial Development | Final Development | Depth to Water (ft.) | Total Depth (ft) | Design Depth (ft.) | Estimated Sediment Thickness (ft.) | Air Surging | Bailing | Pumping | Flow Rate (gal/min) | Well Volume (gal.) | Total Vol. of Develop. Water | Water Temp. (°C)* | pH | EC (μΩ)* | Turbidity (Ntu) | Team Members |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4/3/90 | 1410 | | ✓ | 4.55 | 13.3 | 13.5 | .20 | | ✓ | | .5 | 8.49 | 40 | 14.5 | | 478 | | NO SAND |
| | 1412 | | ✓ | | | 13.3 | 0 | | | ✓ | 2 | | 42 | 14.5 | 6.03 | 200 | | G. TOWSON D. ENGLAND |
| | 1416 | | ✓ | | | | | | | ✓ | 2 | | 50 | 14.5 | 6.04 | 200 | | |
| | 1420 | | ✓ | | | | | | | ✓ | 2 | | 58 | 14.5 | 6.15 | 200 | | |
| | 1424 | | ✓ | | | | | | | ✓ | 2 | | 66 | 14.5 | 6.28 | 210 | | |
| | 1428 | | ✓ | | | | | | | ✓ | 5 | | 74 | 14.5 | 6.37 | 230 | | |
| | 1430 | | ✓ | | | | | | | ✓ | 5 | | 84 | 14.5 | 6.40 | 232 | | |
| | 1433 | | ✓ | | | | | | | ✓ | 5 | | 109 | 14.5 | 6.43 | 233 | | |
| | 1435 | | ✓ | | | | | | | ✓ | 5 | | 119 | 14.5 | 6.43 | 233 | | |
| | 1438 | | ✓ | | | | | | | ✓ | 5 | | 134 | 14.5 | 6.45 | 232 | | |
| | 1440 | | ✓ | | | | | | | ✓ | 5 | | 139 | 14.5 | 6.45 | 232 | | |
| | 1443 | | ✓ | 4.55 | | | | | | ✓ | 5 | | 150 | 14.5 | 6.44 | 232 | | |
| 4/10/90 | | | ✓ | | | | | | ✓ | | .5 | | 151 | 14.5 | 6.31 | 340 | 24.5 | G. TOWSON D. ENGLAND |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |

Location: FORT STORY

Site #: 4

Well #: MW 110

Earth Engineering & Sciences, Inc.

## Monitoring Well Development Sheet MW ~~##~~ 111

Project: FORT STORY Location: SITE #4

Project No. 1968. Dates: 3-28-90 & 4-8-90

Field Geologists: G. TOWSON & D. ENGLAND EESI

Barrel ID: S4 MW 111 DEV $H_2O$ No. of Barrels: 3-55 GAL

Initial Development Method AIR SURGED Init. Dev. Date: 3-28--90

Initial Volume Removed: 15 GAL Time Started: 1235 Finished: 1340

Initial Team Members: GARY ENLOE

Water Level (Initial): 4.9

Total Depth (BOH): 11.8

Designed Depth: 13.5

Depth of Sediment: 1.7

Water Level After Initial Development: 5.35

BOH After Initial Development: 12.7

---

Final Development Method: BAILING & PUMPING Fin. Dev. Date: 4-8-90

Final Volume Removed: 150 GAL Time Start: 1200 Finished: 1305

Final Team Members: G. TOWSON & D. ENGLAND

Water Level Start: 4.72 Finished: 4.72 Ph: 5.46 EC: 49 T°C: 14.2

Total Depth Start: ~~4.72~~ 12.73 Finished: 13.51

$O_2$, TOX, Lel and Organic Vapor Problems Encountered: NONE

Action: ☒ None Needed
☐ Need:

Earth Engineering & Sciences, Inc.

| Date | Time | Initial Development | Final Development | Depth to Water (ft.) | Total Depth (ft) | Design Depth (ft.) | Estimated Sediment Thickness (ft.) | Air Surging | Bailing | Pumping | Flow Rate (gal/min) | Well Volume (gal.) | Total Vol. of Develop. Water | Water Temp. (°C) * | pH | EC (µΩ) * | Turbidity (Ntu) | Team Members |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4-8-90 | 1200 | | ✓ | 4.72 | 12.73 | 13.5 | .78 | | ✓ | | .5 | | 0 | | | | | G. TOWSON D. ENGLAND |
| | 1220 | | | | 13.51 | | 0 | | ✓ | | .5 | | 10 | | | | | |
| | 1222 | | | | | | | | | ✓ | 2 | | 10 | 14.2 | 5.93 | 62 | | |
| | 1226 | | | | | | | | | ✓ | 2 | | 18 | 14.1 | 5.91 | 62 | | |
| | 1230 | | | | | | | | | ✓ | 2 | | 23 | 14.2 | 5.79 | 61 | | |
| | 1234 | | | | | | | | | ✓ | 2 | | 31 | 14.0 | 5.79 | 60 | | |
| | 1238 | | | | | | | | | ✓ | 2 | | 39 | 14.0 | 5.76 | 60 | | |
| | 1242 | | | | | | | | | ✓ | 2 | | 47 | 14.1 | 5.75 | 59 | | |
| | 1246 | | | | | | | | | ✓ | 5 | | 55 | 14.1 | 5.65 | 60 | | |
| | 1249 | | | | | | | | | ✓ | 5 | | 65 | 14.2 | 5.60 | 60 | | |
| | 1251 | | | | | | | | | ✓ | 5 | | 80 | 14.2 | 5.55 | 60 | | |
| | 1254 | | | | | | | | | ✓ | 5 | | 95 | 14.0 | 5.55 | 60 | | |
| | 1257 | | | | | | | | | ✓ | 5 | | 110 | 14.0 | 5.50 | 55 | | |
| | 1300 | | | | | | | | | ✓ | 5 | | 125 | 14.1 | 5.42 | 50 | | |
| | 1302 | | | | | | | | | ✓ | 5 | | 135 | 14.2 | 5.43 | 49 | | |
| | 1305 | | | 4.72 | | | | | | ✓ | 5 | | 150 | 14.2 | 5.46 | 49 | ④ 32.7 | G. TOWSON D. ENGLAND |

Location: FORT STORY

Site #: 4

Well #: MW 111

* - in Hole

④ TAKEN 4-10

Earth Engineering & Sciences, Inc.

## Monitoring Well Development Sheet MW 112

Project: FORT STORY Location: SITE 4 FORT STORY

Project No. 1868 Dates: 3-28-90 & 4-8-90

Field Geologists: GEORGE TOWSON & DIANE ENGLAND

Barrel ID: S4 MW 112 DEV $H_2O$ No. of Barrels: 2-55 GAL

Initial Development Method AIR SURGING Init. Dev. Date: 3-28-90

Initial Volume Removed: 15 GAL Time Started: 845 Finished: 945

Initial Team Members: GARY ENLOE

Water Level (Initial): 4.51

Total Depth (BOH): 13.0

Designed Depth: 13.0

Depth of Sediment: 0

Water Level After Initial Development: 5.12

BOH After Initial Development: 13.2'

---

Final Development Method: PUMPING Fin. Dev. Date: 4-8-90

Final Volume Removed: 108 GAL Time Start: 1540 Finished: 1608

Final Team Members: GEORGE TOWSON & DIANE ENGLAND

Water Level Start: 4.65 Finished: 4.65 Ph: 6.10 EC: 150 T°C: 15.0

Total Depth Start: 13.32 Finished: 13.32

$O_2$, TOX, Lel and Organic Vapor Problems Encountered: NONE

Action: ☒ None Needed
☐ Need:

Earth Engineering & Sciences, Inc.

| Date | Time | Initial Development | Final Development | Depth to Water (ft.) | Total Depth (ft) | Design Depth (ft.) | Estimated Sediment Thickness (ft.) | Air Surging | Bailing | Pumping | Flow Rate (gal/min) | Well Volume (gal.) | Total Vol. of Develop. Water | Water Temp. (°C)* | pH | EC (µΩ)* | Turbidity (Ntu) | Team Members |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4-8-90 | 1540 | | ✓ | 4.65 | 13.32 | 13.0 | -0- | | | x | 2 | | 1 | 15.0 | 6.45 | 175 | | G. Towson D. England |
| | 1542 | | ✓ | | | | | | | | 2 | | 5 | 15.0 | 6.33 | 160 | | |
| | 1544 | | ✓ | | | | | | | | 2 | | 9 | 15.0 | 6.32 | 159 | | |
| | 1546 | | ✓ | | | | | | | | 2 | | 13 | 15.0 | 6.30 | 155 | | |
| | 1548 | | ✓ | | | | | | | | 2 | | 17 | 15.0 | 6.32 | 151 | | |
| | 1550 | | ✓ | | | | | | | | 5 | | 21 | 15.0 | 6.23 | 150 | | |
| | 1552 | | ✓ | | | | | | | | 5 | | 31 | 15.0 | 6.25 | 151 | | |
| | 1554 | | ✓ | | | | | | | | 5 | | 41 | 15.0 | 6.24 | 151 | | |
| | 1556 | | ✓ | | | | | | | | 5 | | 51 | 15.0 | 6.20 | 150 | | |
| | 1558 | | ✓ | | | | | | | | 5 | | 61 | 15.0 | 6.15 | 151 | | |
| | 1600 | | ✓ | | | | | | | | 5 | | 71 | 15.0 | 6.16 | 152 | | |
| | 1602 | | ✓ | | | | | | | | 5 | | 81 | 15.0 | 6.16 | 160 | | |
| | 1604 | | ✓ | | | | | | | | 5 | | 91 | 15.0 | 6.12 | 150 | | |
| | 1606 | | ✓ | | | | | | | | 5 | | 101 | 15.0 | 6.13 | 150 | | |
| | 1608 | | ✓ | | | | | | | | 5 | | 108 | 15.0 | 6.10 | 150 | | |
| 4-11 | | | ✓ | 4.71 | 13.32 | | | | x | | 5 | | 109 | 14.8 | 6.28 | 165 | 20.4 | G. Towson D. England |

Location: Fort Story

Site #: 4

Well #: MW 12

* - in

# Monitoring Well Development Photographs

Fort Story, Virginia

Site Number: 4
Well Number: MW-110

Site Number: 4
Well Number: MW-111

Fort Story, Virginia

Site Number: 4
Well Number: MW-112

# In Situ Permeability Data

RAW DATA

WELL # S4MW110

WELL DIAMETER= 8.25 INCHES
CASING DIAMETER= 2.00 INCHES
VOLUME OF WATER= .28 GALLONS
LENGTH OF AQUIFER TESTED= 20.00 FEET
VALUE OF HO= 1.72 FEET
STATIC WATER LEVEL= 4.52 FEET
LENGTH OF SCREEN= 10.00 FEET
WATER TABLE TO BOTTOM OF WELL= 8.46 FEET

SLUG TEST DATA:

| TIME | WATER LEVEL (FEET) | TIME SINCE TEST BEGAN (MINUTES) |
|---|---|---|
| 13. 4. 1 | 5.39 | .02 |
| 13. 4. 2 | 4.81 | .04 |
| 13. 4. 3 | 4.67 | .06 |
| 13. 4. 4 | 4.62 | .07 |
| 13. 4. 5 | 4.59 | .09 |
| 13. 4. 6 | 4.57 | .11 |
| 13. 4. 7 | 4.56 | .12 |
| 13. 4. 8 | 4.55 | .14 |
| 13. 4. 9 | 4.55 | .16 |
| 13. 4.10 | 4.54 | .17 |
| 13. 4.11 | 4.54 | .19 |
| 13. 4.12 | 4.54 | .21 |
| 13. 4.13 | 4.53 | .22 |
| 13. 4.14 | 4.53 | .24 |
| 13. 4.15 | 4.53 | .26 |
| 13. 4.16 | 4.53 | .27 |
| 13. 4.17 | 4.53 | .29 |
| 13. 4.18 | 4.53 | .31 |
| 13. 4.23 | 4.53 | .39 |
| 13. 4.28 | 4.52 | .47 |
| 13. 4.33 | 4.52 | .56 |
| 13. 4.38 | 4.52 | .64 |

WELL # S4MW110

WELL DIAMETER= 8.25 INCHES
CASING DIAMETER= 2.00 INCHES
VOLUME OF WATER REMOVED OR ADDED TO WELL= .28 GALLONS
LENGTH OF AQUIFER TESTED= 20.00 FEET
VALUE OF HO= 1.72 FEET
STATIC WATER LEVEL= 4.52 FEET

SLUG TEST DATA:

| TIME SINCE TEST BEGAN (MINUTES) | WATER LEVEL (FEET) | DRAWDOWN (FEET) | HEAD RATIO | RECIPROCAL TIME (1/MINUTES) |
|---|---|---|---|---|
| .02 | 5.39 | .87 | .507 | 42.857 |
| .04 | 4.81 | .29 | .169 | 25.000 |
| .06 | 4.67 | .15 | .087 | 17.647 |
| .07 | 4.62 | .10 | .058 | 13.636 |
| .09 | 4.59 | .07 | .041 | 11.111 |
| .11 | 4.57 | .05 | .029 | 9.375 |
| .12 | 4.56 | .04 | .023 | 8.108 |
| .14 | 4.55 | .03 | .017 | 7.143 |
| .16 | 4.55 | .03 | .017 | 6.383 |
| .17 | 4.54 | .02 | .012 | 5.769 |
| .19 | 4.54 | .02 | .012 | 5.263 |
| .21 | 4.54 | .02 | .012 | 4.839 |
| .22 | 4.53 | .01 | .006 | 4.478 |
| .24 | 4.53 | .01 | .006 | 4.167 |
| .26 | 4.53 | .01 | .006 | 3.896 |
| .27 | 4.53 | .01 | .006 | 3.659 |
| .29 | 4.53 | .01 | .006 | 3.448 |
| .31 | 4.53 | .01 | .006 | 3.261 |
| .39 | 4.53 | .01 | .006 | 2.563 |
| .47 | 4.52 | .00 | .000 | 2.113 |
| .56 | 4.52 | .00 | .000 | 1.796 |
| .64 | 4.52 | .00 | .000 | 1.562 |

WELL # S4MW110

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PERMEABILITY BASED ON COOPER, BREDEHOEFT, AND PAPADOPULOS METHOD

PERMEABILITY=1.76E-04/ MATCH TIME (IN MINUTES)
STORAGE COEF= 5.88E-02* ALPHA
COMPUTER CALCULATES
ALPHA=1.00E-05 MATCH TIME= 5.06E-03
PERMEABILITY= 3.48E-02 CM/SEC
STORAGE COEF=5.88E-07
CORRELATION NUMBER= .99

---

PERMEABILITY BASED ON REGRESSION FIT OF HEAD RATIO DATA

HVORSLEV PERMEABILITY=3.58E-04 / LAG TIME
BOUWER PERMEABILTY=9.01E-04 * -SLOPE

COMPUTER CALCULATES
PERMEABILITY VARIES MORE THAN 20% DEPENDING ON THEEQUATION USED

FOR X ON Y: HVORSLEV PERMEABILITY=2.02E-02 CM/SEC
BOUWER PERMEABILITY=1.13E-02CM/SEC
FOR Y ON X: HVORSLEV PERMEABILITY=1.65E-02 CM/SEC
BOUWER PERMEABILITY=1.22E-02 CM/SEC
AVERAGE HVORSLEV PERMEABILITY=1.82E-02 CM/SEC
AVERAGE BOUWER PERMEABILITY=1.18E-02 CM/SEC
REGRESSION STATISTICS
X ON Y
INTERCEPT= -.21
SLOPE= -13.
Y ON X
INTERCEPT= -.14
SLOPE= -14.
CORRELATION COEFFICIENT= -.96
CALCULATIONS INDICATE THAT A VALUE OF 2.07 FEET FOR HO
OR A VALUE OF 1.820 INCHES FOR EFFECTIVE CASING DIA.
MAY YIELD BETTER RESULTS

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PERMEABILITY BASED ON REGRESSION FIT OF DATA - FERRIS & KNOWLES METHOD

INSUFFICIENT DATA POINTS WITH RECIPROCAL TIMES LESS THAN .300
NUMBER OF USABLE DATA POINTS= 0

13:57:59.50 SITE 4, FIRE TRAINING AREA, WELL S4MW110 THU 05-24-1990

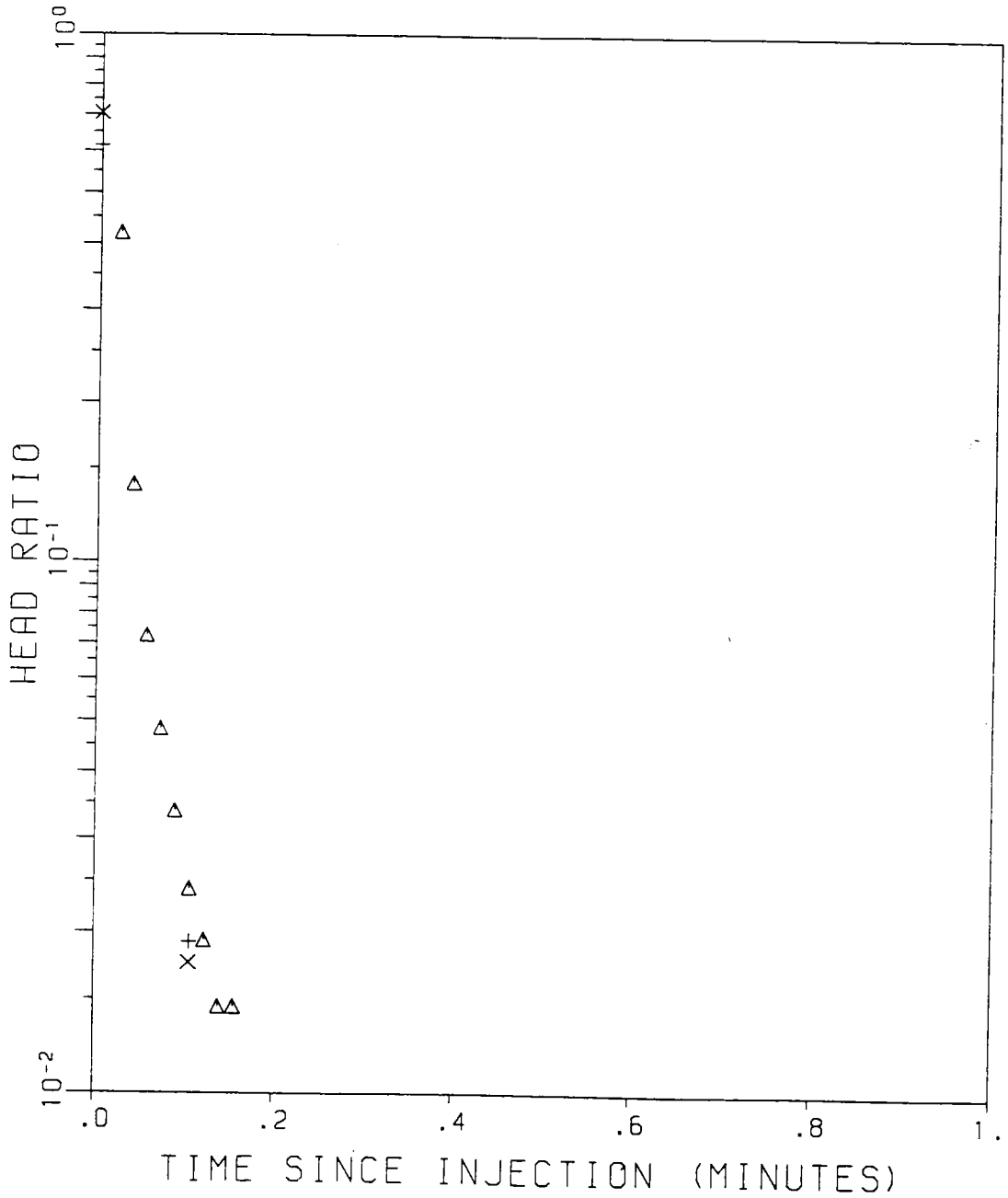
| WELL # | PERMEABILITY METHOD 1 | PERMEABILITY METHOD 2 | STORAGE COEF METHOD 2 | PERMEABILITY METHOD 3 | PERMEABILITY METHOD 4 |
|---|---|---|---|---|---|
| S4MW110 | 1.82E-02 | 3.48E-02 | 5.88E-07 | .00 | 1.18E-02 |

* METHOD 1 IS HVORSLEV
METHOD 2 IS COOPER, BREDEHOEFT, AND PAPADOPULOS
METHOD 3 IS FERRIS AND KNOWLES
METHOD 4 IS BOUWER

SITE 4. FIRE TRAINING AREA. WELL S4MW110

TUE 10-30-1990

14:08:43.84




SLUG TEST OF WELL S4MW110

LOG HEAD RATIO VS TIME

RAW DATA

WELL # S4MW111

WELL DIAMETER= 8.25 INCHES
CASING DIAMETER= 2.00 INCHES
VOLUME OF WATER= .28 GALLONS
LENGTH OF AQUIFER TESTED= 20.00 FEET
VALUE OF H0= 1.72 FEET
STATIC WATER LEVEL= 4.83 FEET
LENGTH OF SCREEN= 10.00 FEET
WATER TABLE TO BOTTOM OF WELL= 7.73 FEET

SLUG TEST DATA:

| TIME | WATER LEVEL (FEET) | TIME SINCE TEST BEGAN (MINUTES) |
|---|---|---|
| 12.16. 0 | 5.51 | .00 |
| 12.16. 0 | 5.67 | .01 |
| 12.16. 0 | 5.62 | .01 |
| 12.16. 0 | 5.50 | .01 |
| 12.16. 1 | 5.26 | .03 |
| 12.16. 2 | 4.98 | .05 |
| 12.16. 3 | 4.93 | .06 |
| 12.16. 4 | 4.91 | .08 |
| 12.16. 5 | 4.90 | .10 |

WELL # S4MW111

WELL DIAMETER= 8.25 INCHES
CASING DIAMETER= 2.00 INCHES
VOLUME OF WATER REMOVED OR ADDED TO WELL= .28 GALLONS
LENGTH OF AQUIFER TESTED= 20.00 FEET
VALUE OF H0= 1.72 FEET
STATIC WATER LEVEL= 4.83 FEET

SLUG TEST DATA:

| TIME SINCE TEST BEGAN (MINUTES) | WATER LEVEL (FEET) | DRAWDOWN (FEET) | HEAD RATIO | RECIPROCAL TIME (1/MINUTES) |
|---|---|---|---|---|
| .00 | 5.51 | .68 | .396 | 300.000 |
| .01 | 5.67 | .84 | .490 | 150.000 |
| .01 | 5.62 | .79 | .460 | 100.000 |
| .01 | 5.50 | .67 | .390 | 75.000 |
| .03 | 5.26 | .43 | .251 | 33.333 |
| .05 | 4.98 | .15 | .087 | 21.429 |
| .06 | 4.93 | .10 | .058 | 15.789 |
| .08 | 4.91 | .08 | .047 | 12.500 |
| .10 | 4.90 | .07 | .041 | 10.345 |

14:22:38.93 SITE 4, FIRE TRAINING AREA, WELL S4MW111 THU 05-24-1990

WELL # S4MW111

---

PERMEABILITY BASED ON COOPER, BREDEHOEFT, AND PAPADOPULOS METHOD

```
          PERMEABILITY=1.76E-04/ MATCH TIME (IN MINUTES)
          STORAGE COEF= 5.88E-02* ALPHA
     COMPUTER CALCULATES
          ALPHA=1.00E-02 MATCH TIME= 7.46E-03
          PERMEABILITY= 2.36E-02 CM/SEC
          STORAGE COEF=5.88E-04
          CORRELATION NUMBER=   .99
```

---

PERMEABILITY BASED ON REGRESSION FIT OF HEAD RATIO DATA

```
          HVORSLEV PERMEABILITY=3.58E-04 / LAG TIME
          BOUWER PERMEABILTY=8.82E-04 * -SLOPE

     COMPUTER CALCULATES
          HVORSLEV PERMEABILITY=2.92E-02 CM/SEC
          BOUWER PERMEABILITY=1.17E-02 CM/SEC
               REGRESSION STATISTICS
                    X ON Y
                      INTERCEPT= -.28
                      SLOPE= -13.
                    Y ON X
                      INTERCEPT= -.25
                      SLOPE= -14.
                    CORRELATION COEFFICIENT= -.97
     CALCULATIONS INDICATE THAT A VALUE OF   1.82 FEET FOR HO
          OR A VALUE OF    1.944 INCHES FOR EFFECTIVE CASING DIA.
          MAY YIELD BETTER RESULTS
```

---

PERMEABILITY BASED ON REGRESSION FIT OF DATA - FERRIS & KNOWLES METHOD

```
     INSUFFICIENT DATA POINTS WITH RECIPROCAL TIMES LESS THAN .300
  NUMBER OF USABLE DATA POINTS= 0
```

14:22:42.09 SITE 4, FIRE TRAINING AREA, WELL S4MW111 THU 05-24-1990

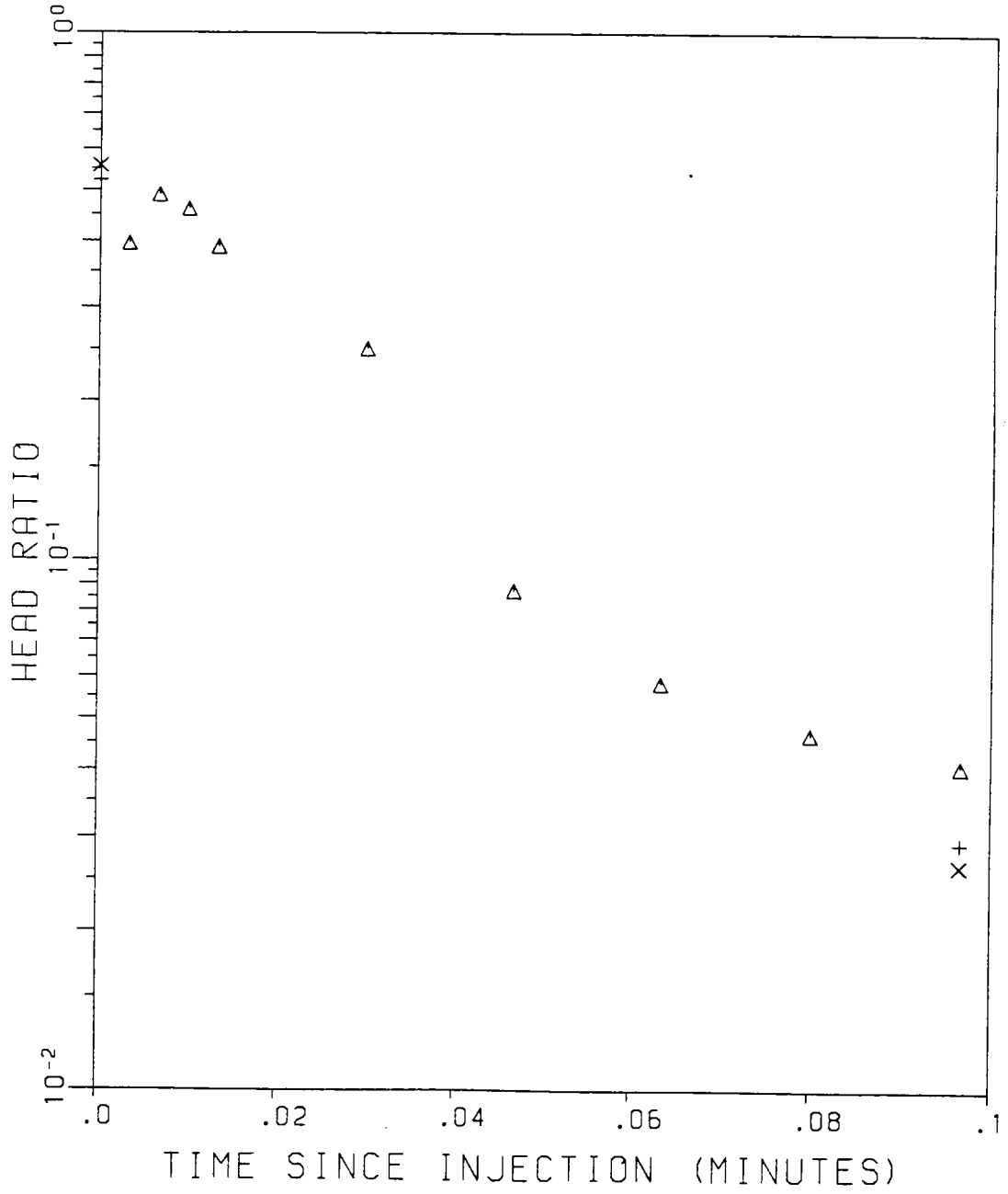
| WELL # | PERMEABILITY METHOD 1 | PERMEABILITY METHOD 2 | STORAGE COEF METHOD 2 | PERMEABILITY METHOD 3 | PERMEABILITY METHOD 4 |
|---|---|---|---|---|---|
| S4MW111 | 2.92E-02 | 2.36E-02 | 5.88E-04 | .00 | 1.17E-02 |

* METHOD 1 IS HVORSLEV
METHOD 2 IS COOPER, BREDEHOEFT, AND PAPADOPULOS
METHOD 3 IS FERRIS AND KNOWLES
METHOD 4 IS BOUWER

SITE 4. FIRE TRAINING AREA. WELL S4MW111

TUE 10-30-1990

14:12:45.45




SLUG TEST OF WELL S4MW111

LOG HEAD RATIO VS TIME

RAW DATA

WELL # S4MW112

WELL DIAMETER= 8.25 INCHES
CASING DIAMETER= 2.00 INCHES
VOLUME OF WATER= .28 GALLONS
LENGTH OF AQUIFER TESTED= 20.00 FEET
VALUE OF H0= 1.72 FEET
STATIC WATER LEVEL= 4.76 FEET
LENGTH OF SCREEN= 10.00 FEET
WATER TABLE TO BOTTOM OF WELL= 8.31 FEET

SLUG TEST DATA:

| TIME | WATER LEVEL (FEET) | TIME SINCE TEST BEGAN (MINUTES) |
|---|---|---|
| 11.14. 3 | 5.21 | .05 |
| 11.14. 4 | 4.94 | .07 |
| 11.14. 5 | 4.86 | .08 |
| 11.14. 6 | 4.83 | .10 |
| 11.14. 7 | 4.80 | .12 |
| 11.14. 8 | 4.79 | .13 |
| 11.14. 9 | 4.79 | .15 |
| 11.14.10 | 4.78 | .17 |
| 11.14.11 | 4.78 | .18 |
| 11.14.12 | 4.77 | .20 |
| 11.14.13 | 4.77 | .22 |
| 11.14.14 | 4.77 | .23 |

WELL # S4MW112

WELL DIAMETER= 8.25 INCHES
CASING DIAMETER= 2.00 INCHES
VOLUME OF WATER REMOVED OR ADDED TO WELL= .28 GALLONS
LENGTH OF AQUIFER TESTED= 20.00 FEET
VALUE OF HO= 1.72 FEET
STATIC WATER LEVEL= 4.76 FEET

SLUG TEST DATA:

| TIME SINCE TEST BEGAN (MINUTES) | WATER LEVEL (FEET) | DRAWDOWN (FEET) | HEAD RATIO | RECIPROCAL TIME (1/MINUTES) |
|---|---|---|---|---|
| .05 | 5.21 | .45 | .262 | 20.000 |
| .07 | 4.94 | .18 | .105 | 15.000 |
| .08 | 4.86 | .10 | .058 | 12.000 |
| .10 | 4.83 | .07 | .041 | 10.000 |
| .12 | 4.80 | .04 | .023 | 8.571 |
| .13 | 4.79 | .03 | .017 | 7.500 |
| .15 | 4.79 | .03 | .017 | 6.667 |
| .17 | 4.78 | .02 | .012 | 6.000 |
| .18 | 4.78 | .02 | .012 | 5.455 |
| .20 | 4.77 | .01 | .006 | 5.000 |
| .22 | 4.77 | .01 | .006 | 4.615 |
| .23 | 4.77 | .01 | .006 | 4.286 |

WELL # S4MW112

---

PERMEABILITY BASED ON COOPER, BREDEHOEFT, AND PAPADOPULOS METHOD

```
          PERMEABILITY=1.76E-04/ MATCH TIME (IN MINUTES)
          STORAGE COEF= 5.88E-02* ALPHA
     COMPUTER CALCULATES
          ALPHA=1.00E-05 MATCH TIME= 6.70E-03
          PERMEABILITY= 2.63E-02 CM/SEC
          STORAGE COEF=5.88E-07
          CORRELATION NUMBER=   .99
```

---

PERMEABILITY BASED ON REGRESSION FIT OF HEAD RATIO DATA

```
          HVORSLEV PERMEABILITY=3.58E-04 / LAG TIME
          BOUWER PERMEABILTY=8.97E-04 * -SLOPE

     COMPUTER CALCULATES
          HVORSLEV PERMEABILITY=1.01E-02 CM/SEC
          BOUWER PERMEABILITY=1.37E-02 CM/SEC
               REGRESSION STATISTICS
                    X ON Y
                      INTERCEPT=  .09
                      SLOPE= -15.
                    Y ON X
                      INTERCEPT=  .13
                      SLOPE= -15.
                    CORRELATION COEFFICIENT= -.99
     CALCULATIONS INDICATE THAT A VALUE OF   2.63 FEET FOR HO
          OR A VALUE OF    1.617 INCHES FOR EFFECTIVE CASING DIA.
          MAY YIELD BETTER RESULTS
```

---

PERMEABILITY BASED ON REGRESSION FIT OF DATA - FERRIS & KNOWLES METHOD

```
     INSUFFICIENT DATA POINTS WITH RECIPROCAL TIMES LESS THAN .300
  NUMBER OF USABLE DATA POINTS= 0
```

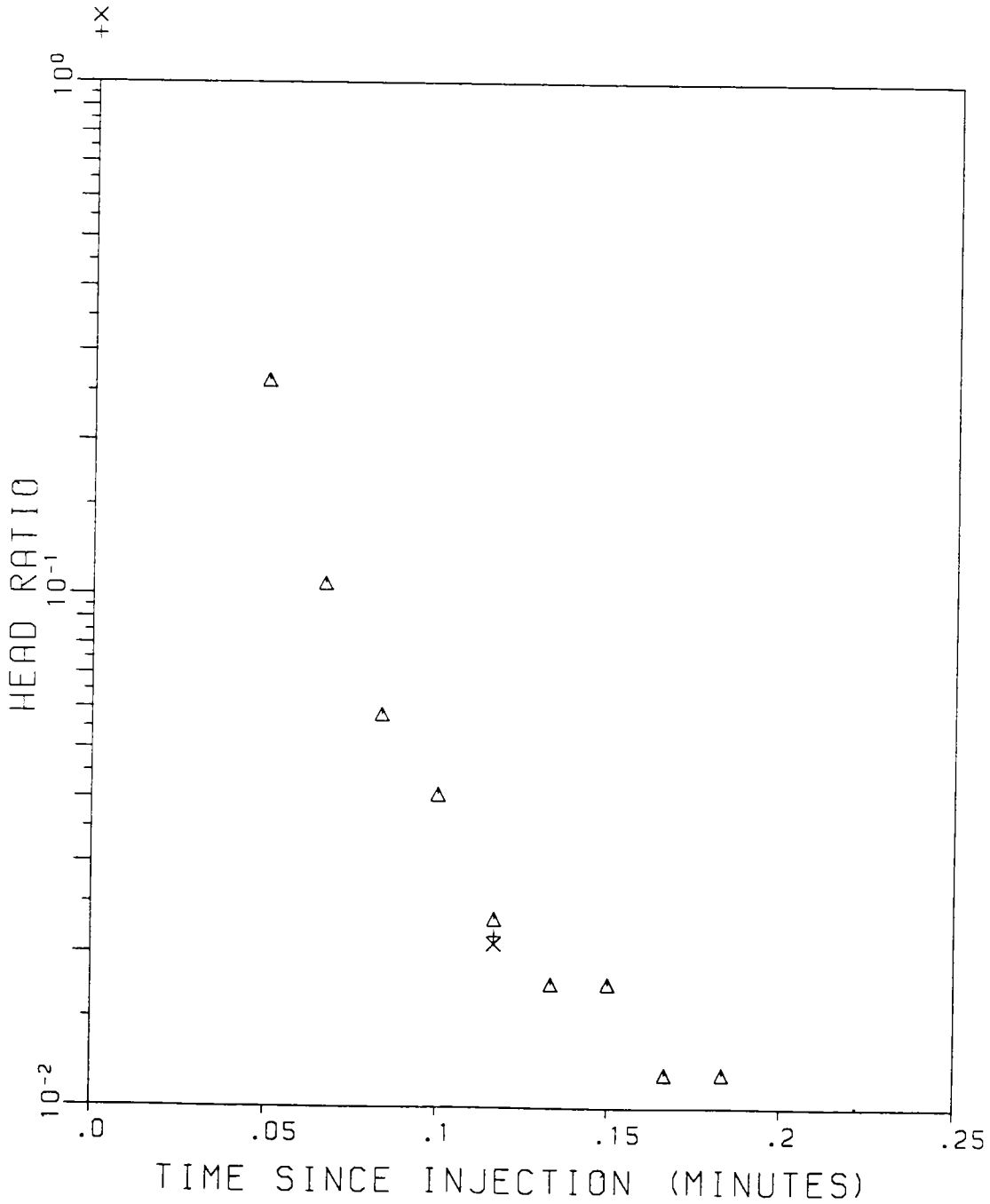
| WELL # | PERMEABILITY METHOD 1 | PERMEABILITY METHOD 2 | STORAGE COEF METHOD 2 | PERMEABILITY METHOD 3 | PERMEABILITY METHOD 4 |
|---|---|---|---|---|---|
| S4MW112 | 1.01E-02 | 2.63E-02 | 5.88E-07 | .00 | 1.37E-02 |

* METHOD 1 IS HVORSLEV
METHOD 2 IS COOPER, BREDEHOEFT, AND PAPADOPULOS
METHOD 3 IS FERRIS AND KNOWLES
METHOD 4 IS BOUWER

SITE 4. FIRE TRAINING AREA. WELL S4MW112

TUE 10-30-1990

14:24:21.47




SLUG TEST OF WELL S4MW112

LOG HEAD RATIO VS TIME

# Groundwater Sampling Logs

# GROUNDWATER SAMPLING LOG

## FORT STORY



CLIENT USACE
SITE 4
WELL NUMBER MW 110
JOB NUMBER 1868.

TOTAL WELL DEPTH 13.0
WELL DIAMETER 2"
BOREHOLE DIAMETER 8 3/4"

MIN NUMBER WELL VOL TO BE PURGED 3
VOL PER VERTICAL FT CASING (GAL) .95
VOL PER FT BOREHOLE (LESS CASING)(GAL)

STATIC WATER LEVEL (FT) 8.2
STANDING WATER COLUMN (FT) 4.8

AMT ONE WELL VOL (GAL) 4.6
TOTAL GAL TO BE PURGED 13.8

PURGING SYSTEM TEFLON BAILER
SAMPLING SYSTEM TEFLON BAILER

| DATE | TIME | AMOUNT PURGED (GAL) | EC | pH | TEMP | TURBIDITY | PID | | | COMMENTS | SAMPLER |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | FIELD PARAMETERS MEASURED | | | | | | | |
| 5-24 | 1101 | 0 | 550 | 6.53 | 25.1 | | | | | yellow-Brown HAS POL ODOR HAS HEEN | MDS/EJD EJ |
| " | 1103 | 4 | 500 | 6.61 | 26.0 | | | | | yellow-Brown POL ODOR | MDS/EJD EJ |
| " | 1105 | 8 | 500 | 6.64 | 26.2 | | | | | yellow-Brown POL ODOR | MDS/EJD |
| " | 1107 | 12 | | | | | | | | N/A | MDS/EJD |
| " | 1109 | 15 | 550 | 6.60 | 25.1 | | | | | yellow-Brown POL ODOR | MDS/EJD |
| " | | | | | | | | | | N/A | MDS/EJD |
| " | | | | | | | | | | N/A | MDS/EJD |
| " | | | | | | | | | | N/A | MDS/EJD |
| " | | | | | | | | | | | |
| " | | | | | | | | | | | |
| " | | | | | | | | | | | |
| FINAL READING | 1120 | 6* | 600 | 6.62 | 26.2 | 693.6 | 0.0 | | | Greenish Brown POL ODOR | MDS/EJD EJ |

NOTES: [illegible] Product on top of water column TURBIDITY: [illegible] 173.9

B Floating Pug oil 8.2 → 8.6 ft (.4 column of oil) OIL SIMILAR TO MOTOR OIL.

Purge Rate: 2.5 g/min

B Dissolved Solution Contains yellow tint

# GROUNDWATER SAMPLING LOG

## FORT STORY



CLIENT USACE
SITE 4
WELL NUMBER MW 111
JOB NUMBER 1868.

TOTAL WELL DEPTH 13.0
WELL DIAMETER 2"
BOREHOLE DIAMETER 8 3/4"

MIN NUMBER WELL VOL TO BE PURGED 3
VOL PER VERTICAL FT CASING (GAL) .95
VOL PER FT BOREHOLE (LESS CASING)(GAL)

STATIC WATER LEVEL (FT) 6.0
STANDING WATER COLUMN (FT) 7.0

AMT ONE WELL VOL (GAL) 6.7
TOTAL GAL TO BE PURGED 20.1

PURGING SYSTEM TEFLON BAILER
SAMPLING SYSTEM TEFLON BAILER

| DATE | TIME | AMOUNT PURGED (GAL) | EC | FIELD PARAMETERS MEASURED pH | TEMP | TURBIDITY | PID | | | COMMENTS | SAMPLER |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5-29 | 1437 | 0 | 160 | 6.83 | 22.1 | | | | | Clear * Trace Sand | MDS/EJD |
| " | 1439 | 5 | 160 | 6.79 | 22.0 | | | | | Clear Trace Sand | MDS/EJD |
| " | 1443 | 10 | 160 | 6.75 | 22.5 | | | | | Clear No Sand | MDS/EJD |
| " | 1445 | 15 | 170 | 6.79 | 22.8 | | | | | Clear No Sand | MDS/EJD |
| " | 1447 | 20 | | | | | | | | N/A | MDS/EJD |
| " | 1450 | 25 | 170 | 6.71 | 22.0 | | | | | Clear No Sand | MDS/EJD |
| " | | | | | | | | | | N/A | MDS/EJD |
| " | | | | | | | | | | N/A | MDS/EJD |
| " | | | | | | | | | | | |
| " | | | | | | | | | | | |
| " | | | | | | | | | | | |
| FINAL READING | 1530 | 6* | 190 | 6.84 | 22.0 | 118.2 | 0.0 | | | CLOUDY TRACE SED | MDS/EJD |

NOTES: Purge Rate: 2.5 gl/min

TURBIDITY: No Dilution

# GROUNDWATER SAMPLING LOG

## FORT STORY



CLIENT USACE
SITE [redacted]
WELL NUMBER MW 112
JOB NUMBER 1868.

TOTAL WELL DEPTH 13.0
WELL DIAMETER 2"
BOREHOLE DIAMETER 8 3/4"

MIN NUMBER WELL VOL TO BE PURGED 3
VOL PER VERTICAL FT CASING (GAL) .95
VOL PER FT BOREHOLE (LESS CASING)(GAL) ____

STATIC WATER LEVEL (FT) 5'0
STANDING WATER COLUMN (FT) 8'0

AMT. ONE WELL VOL (GAL) 7.6
TOTAL GAL TO BE PURGED 22.8

PURGING SYSTEM TEFLON BAILER
SAMPLING SYSTEM TEFLON BAILER

| DATE | TIME | AMOUNT PURGED (GAL) | EC | FIELD PARAMETERS MEASURED pH | TEMP | TURBIDITY | PID | | | COMMENTS | SAMPLER |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1400 | 0 | 220 | 6.39 | 23.0 | | | | | Brown - clear 1% Sed | MDS/ETD |
| " | 1403 | 5 | 210 | 6.43 | 23.5 | | | | | Brown - clear 0% Sed | MDS/EJD |
| " | 1405 | 10 | 220 | 6.34 | 22.5 | | | | | Murky Brown 5% Sed | MDS/EJD |
| " | 1407 | 15 | 200 | 6.49 | 22.0 | | | | | Brown - clear 0% Sed | MDS/EJD |
| " | 1410 | 20 | | | | | | | | N/A | MDS/EJD |
| " | 1413 | 25 | 210 | 6.38 | 23.0 | | | | | Brown - clear 0% Sed | MDS/EJD |
| " | | | | | | | | | | N/A | MDS/EJD |
| " | | | | | | | | | | N/A | MDS/EJD |
| " | | | | | | | | | | N/A | MDS/EJD |
| " | | | | | | | | | | | |
| " | | | | | | | | | | | |
| FINAL READING | 1423 | [redacted]6 | 220 | 6.31 | 22.3 | 120.4 | 0.0 | | | Brown - clear 0% Sed | MDS/EJD |

NOTES: Pump Rate 2.5 gl/min

TURBIDITY: 5% = 60.2

**Soil and Monitoring Well Boring Lithologic Logs**

Site 5

BORING/WELL NUMBER *EB-1*
DATE STARTED *4/19/90* COMPLETED *4/19/90*
SITE NUMBER *5*
GROUND ELEVATION *14.90 FEET, NGVD*

CLIENT *U.S. ARMY CORPS OF ENGINEERS*
PROJECT *FORT STORY PA/SI*
SITE NAME *UNDERGROUND FUEL STORAGE TANK FARM*
GEOLOGIST *MARK SHUPE*



COORDINATES *N223916, E2721118*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | | 0-1 | | 25.2 | | SP | SAND (SP), dark brown-dark gray quartz, fine, subrounded, graded, trace silt. | |
| | | 1-2 | | 18.1 | | | | |
| | | 3-4 | | 14.4 | | | | |
| | | 4-5 | | 21.7 | | | | |
| 5 | | | | | | | Total depth of boring=4.5 feet. | Borehole PID=78 ppm. |
| | | | | | | | Boring did not encounter water table. | Auger encountered refusal at 4.5 feet. |
| 10 | | | | | | | | PID Instrumentation OVM 580B Thermo Environmental Instruments, Inc. 10.2 eV Lamp PID Background=0.0 ppm. |
| 15 | | | | | | | | Log developed from auger cuttings. |
| 20 | | | | | | | | |
| 25 | | | | | | | | No analytical samples collected from this boring. |

**JMM** James M. Montgomery
Consulting Engineers, Inc.

DRILLER *HARDIN AND HUBER, INC.*
METHOD OF DRILLING *HOLLOW STEM AUGER*
HOLE DIAMETER *8 1/4 INCHES*
TOTAL DEPTH *4.5 FEET*

WELL COMPLETION DEPTH *N/A*
WELL DIAMETER *N/A*
WELL MATERIAL *N/A*

BORING/WELL NUMBER *EB-2*
DATE STARTED *4/19/90* COMPLETED *4/19/90*
SITE NUMBER *5*
GROUND ELEVATION *16.23 FEET, NGVD*

CLIENT *U.S. ARMY CORPS OF ENGINEERS*
PROJECT *FORT STORY PA/SI*
SITE NAME *UNDERGROUND FUEL STORAGE TANK FARM*
GEOLOGIST *MARK SHUPE*



COORDINATES *N223923 E2721117*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | | 0-1 | | | | | SAND (SP), dark brown-dark gray quartz, fine, subrounded, graded, trace silt. | PID Instrumentation OVM 580B Thermo Environmental Instruments, Inc. 10.2 eV Lamp PID Background=0.0 ppm. |
| | | 1-2 | | | | | | |
| | | 2-3 | | | | | | |
| | | 3-4 | | | | | | |
| | | 4-5 | | | | | | |
| 5 | | 5-6 | | 32.6 | | | SAND (SP), quartz, dark gray, fine grained, subangular, graded, trace silt. | |
| | | 6-7 | | 43.4 | | | | |
| | | 7-8 | | 18.8 | | | SAND (SP), as above. | |
| | | 8-9 | | 36.6 | | | | |
| | | 9-10 | | 54.0 | | | SAND (SP), quartz, dark gray-medium gray, medium-coarse grained, subrounded. | |
| 10 | | 10-11 | | 86.9 | | SP | | |
| | | 11-12 | | 32.6 | | | | |
| ▼ | | 12-13 | | 32.6 | | | | |
| | | 13-14 | | 61.5 | | | SAND (SP), quartz, light-medium gray, medium-fine, subangular, graded. | |
| | | 14-15 | | 68.6 | | | | |
| 15 | | 15-16 | | 68.8 | | | | |
| | | 16-17 | | 57.9 | | | | Borehole PID=10.8 ppm. |
| | | 17-18 | | 57.9 | | | | |
| | | 18-19 | | 53.4 | | | | |
| | | 19-20 | | 86.0 | | | SAND (SP), quartz, medium gray, medium grained, subangular-subrounded. | |
| 20 | | | | 28.9 | | | Total depth of boring=20 feet. | |
| 25 | | | | | | | | Log developed from auger cuttings. |
| | | | | | | | | ▼ =Water table during drilling |
| | | | | | | | | No analytical samples collected from this boring. |

**JMM** James M. Montgomery
Consulting Engineers, Inc.

DRILLER *HARDIN AND HUBER, INC.*
METHOD OF DRILLING *HOLLOW STEM AUGER*
HOLE DIAMETER *8 1/4 INCHES*
TOTAL DEPTH *20 FEET*

WELL COMPLETION DEPTH *N/A*
WELL DIAMETER *N/A*
WELL MATERIAL *N/A*

BORING/WELL NUMBER *EB-3*
DATE STARTED *4/19/90* COMPLETED *4/19/90*
SITE NUMBER *5*
GROUND ELEVATION *15.30 FEET, NGVD*

CLIENT *U.S. ARMY CORPS OF ENGINEERS*
PROJECT *FORT STORY PA/SI*
SITE NAME *UNDERGROUND FUEL STORAGE TANK FARM*
GEOLOGIST *MARK SHUPE*



COORDINATES *N223895, E2721125*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | | 0-2 | | 86.9 | | | SAND (SP), quartz, dark gray-dark brown, fine, subangular, poorly graded | PID Instrumentation OVM 580B Thermo Environmental Instruments, Inc. 10.2 eV Lamp PID Background=0.0 ppm. |
| | | 2-4 | | 83.3 | | | SAND (SP), quartz, black, as above. | |
| | | 4-6 | | 65.2 | | | | |
| 5 | | | | | | | | |
| | | 6-8 | | 28.9 | | | SAND (SP), quartz, medium gray, fine-medium grained, subangular-subrounded. | |
| | | 8-10 | | 39.8 | | | | PID from augers=3.6 ppm. |
| 10 ▼ | | 10-12 | | 43.4 | | SP | SAND (SP), quartz, buff-gray, medium-coarse grained, subrounded-subangular, graded. | |
| | | 12-14 | | 65.2 | | | | |
| | | 14-16 | | 50.7 | | | SAND (SP), quartz, light gray-medium gray, subrounded, graded. | PID from augers=3.6 ppm. |
| 15 | | | | | | | | |
| | | 16-18 | | 39.8 | | | | |
| | | 18-20 | | 39.8 | | | SAND (SP), quartz, medium gray, medium-coarse grained, subrounded, graded. | |
| 20 | | | | 54.3 | | | Total depth of boring=20 feet. | |
| | | | | | | | | Log developed from auger cuttings. |
| 25 | | | | | | | | |
| | | | | | | | | ▼ =Water table during drilling |
| | | | | | | | | No analytical samples collected from this boring. |

**JMM** James M. Montgomery
Consulting Engineers, Inc.

DRILLER *HARDIN AND HUBER, INC.*
METHOD OF DRILLING *HOLLOW STEM AUGER*
HOLE DIAMETER *8 1/4 INCHES*
TOTAL DEPTH *20 FEET*

WELL COMPLETION DEPTH *N/A*
WELL DIAMETER *N/A*
WELL MATERIAL *N/A*

BORING/WELL NUMBER *EB-4*
DATE STARTED *4/19/90* COMPLETED *4/19/90*
SITE NUMBER *5*
GROUND ELEVATION *17.27 FEET, NGVD*

CLIENT *U.S. ARMY CORPS OF ENGINEERS*
PROJECT *FORT STORY PA/SI*
SITE NAME *UNDERGROUND FUEL STORAGE TANK FARM*
GEOLOGIST *MARK SHUPE*



COORDINATES *N223898, E2721152*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | | 0-2 | | 25.7 | | | SAND (SP), quartz, black, medium-fine grained, subrounded, poorly graded. | |
| | | 2-4 | | 28.9 | | | SAND (SP), quartz, dark gray-black, medium-fine, subrounded. | Borehole PID=3.6 |
| | | 4-6 | | 32.6 | | | | PID Instrumentation OVM 580B Thermo Environmental Instruments, Inc. 10.2 eV Lamp PID Background=0.0 ppm. |
| 5 | | | | | | | | |
| | | 6-8 | | 28.9 | | | SAND (SP), quartz, medium gray-brown, medium grained, subangular-subrounded. | |
| | | 8-10 | | 21.7 | | | | |
| 10 | | 10-12 | | 32.6 | | SP | SAND (SP), quartz, brown-tan, medium grained, subrounded-subangular, graded. | |
| ▼ | | 12-14 | | 25.3 | | | SAND (SP), quartz, tan, medium grained, subrounded, graded. | |
| | | 14-16 | | 18.1 | | | | |
| 15 | | | | | | | | |
| | | 16-18 | | 14.4 | | | SAND (SP), quartz, tan, medium-coarse grained, rounded-subangular, graded. | |
| | | 18-20 | | 10.8 | | | | |
| 20 | | | | 14.4 | | | Total depth of boring=20 feet. | |
| 25 | | | | | | | | Log developed from auger cuttings. |
| | | | | | | | | ▼ =Water table during drilling |
| | | | | | | | | No analytical samples were collected from this boring. |

**JMM** James M. Montgomery
Consulting Engineers, Inc.

DRILLER *HARDIN AND HUBER, INC.*
METHOD OF DRILLING *HOLLOW STEM AUGER*
HOLE DIAMETER *8 1/4 INCHES*
TOTAL DEPTH *20 FEET*

WELL COMPLETION DEPTH *N/A*
WELL DIAMETER *N/A*
WELL MATERIAL *N/A*

BORING/WELL NUMBER *EB-5*
DATE STARTED *4/19/90* COMPLETED *4/19/90*
SITE NUMBER *5*
GROUND ELEVATION *17.27 FEET, NGVD*

CLIENT *U.S. ARMY CORPS OF ENGINEERS*
PROJECT *FORT STORY PA/SI*
SITE NAME *UNDERGROUND FUEL STORAGE TANK FARM*
GEOLOGIST *MARK SHUPE*



COORDINATES *N223975, E2721109*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | | 0-2 | | 18.1 | | | SAND (SP), quartz, black, fine, subangular, poorly graded. | PID Instrumentation OVM 580B Thermo Environmental Instruments, Inc. 10.2 eV Lamp PID Background=0.0 ppm. |
| | | 2-4 | | 14.4 | | | SAND (SP), quartz, buff-gray, medium-fine grained, subangular, graded. | |
| | | 4-6 | | 18.1 | | | | |
| 5 | | | | | | | | PID from augers=3.6 ppm. |
| | | 6-8 | | 21.7 | | SP | SAND (SP), quartz, black, subrounded, fine-medium grained, graded. | |
| | | 8-10 | | 28.9 | | | | |
| 10 | | 10-12 | | 25.3 | | | SAND (SP), quartz, brown-gray, medium-coarse, subrounded. | |
| ▼ | | 12-14 | | 28.9 | | | | |
| | | 14-16 | | 21.7 | | | SAND (SP), quartz, medium-dark gray, medium-coarse grained, subrounded. | |
| 15 | | | | | | | | |
| | | 16-18 | | 14.4 | | SW | SAND (SW), quartz, black-dark gray, coarse-medium, rounded-subangular, well graded. | |
| | | 18-20 | | 18.1 | | SP | | |
| 20 | | | | 25.3 | | | Total depth of boring=20 feet. | |
| 25 | | | | | | | | Log developed from auger cuttings. |

▼ =Water table during drilling

No analytical samples were collected from this boring.

**JMM** James M. Montgomery Consulting Engineers, Inc.

DRILLER *HARDIN AND HUBER, INC.*
METHOD OF DRILLING *HOLLOW STEM AUGER*
HOLE DIAMETER *8 1/4 INCHES*
TOTAL DEPTH *20 FEET*

WELL COMPLETION DEPTH *N/A*
WELL DIAMETER *N/A*
WELL MATERIAL *N/A*

BORING/WELL NUMBER *EB-6*
DATE STARTED *4/19/90* COMPLETED *4/19/90*
SITE NUMBER *5*
GROUND ELEVATION *13.65 FEET, NGVD*

CLIENT *U.S. ARMY CORPS OF ENGINEERS*
PROJECT *FORT STORY PA/SI*
SITE NAME *UNDERGROUND FUEL STORAGE TANK FARM*
GEOLOGIST *MARK SHUPE*



COORDINATES *N223893, E2721071*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | | 0-2 | | 18.1 | | | SAND (SP), quartz, browm-dark gray, fine, subangular. | PID Instrumentation OVM 580B Thermo Environmental Instruments, Inc. 10.2 eV Lamp PID Background=0.0 ppm. |
| | | 2-4 | | 14.4 | | | SAND (SP), quartz, black-dark gray, medium-fine, subangular, poorly graded. | |
| | | 4-6 | | 18.1 | | | | |
| 5 | | | | | | | | PID in augers=3.6 ppm. |
| | | 6-8 | | 21.7 | | | SAND (SP), quartz, medium-dark gray, medium, subangular-subrounded, grading coarser. | |
| ▼ | | 8-10 | | 28.9 | | | | |
| 10 | | 10-12 | | 25.3 | | SP | SAND (SP), quartz, tan-salt and pepper, medium-coarse, subrounded, graded. | PID in augers=3.6 ppm. |
| | | 12-14 | | 28.9 | | | | |
| | | 14-16 | | 21.7 | | | SAND (SP), quartz, medium gray, medium-coarse, subrounded, graded. | PID in augers=3.6 ppm. |
| 15 | | | | | | | | |
| | | 16-18 | | 14.4 | | | | |
| | | 18-20 | | 18.1 | | | SAND (SP), quartz, buff-gray, medium grained, subrounded. | |
| | | | | | | | SAND (SP), quartz, as above. | |
| 20 | | | | 25.3 | | | | |
| | | | | | | | Depth of boring=20 feet. | |
| 25 | | | | | | | | Log developed from auger cuttings. |
| | | | | | | | | ▼ =Water table during drilling |
| | | | | | | | | No analytical samples were collected from this boring. |

**JMM** James M. Montgomery
Consulting Engineers, Inc.

DRILLER *HARDIN AND HUBER, INC.*
METHOD OF DRILLING *HOLLOW STEM AUGER*
HOLE DIAMETER *8 1/4 INCHES*
TOTAL DEPTH *20 FEET*

WELL COMPLETION DEPTH *N/A*
WELL DIAMETER *N/A*
WELL MATERIAL *N/A*

BORING/WELL NUMBER *EB-7*
DATE STARTED *4/20/90* COMPLETED *4/20/90*
SITE NUMBER *5*
GROUND ELEVATION *17.63 FEET, NGVD*

CLIENT *U.S. ARMY CORPS OF ENGINEERS*
PROJECT *FORT STORY PA/SI*
SITE NAME *UNDERGROUND FUEL STORAGE TANK FARM*
GEOLOGIST *MARK SHUPE*



COORDINATES *N223991, E2721288*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | | 0-2 | | 6.3 | | | SAND (SP), quartz, brown-dark gray, fine grained, subangular, poorly graded, trace silt. | PID Instrumentation OVM 580B Thermo Environmental Instruments, Inc. 10.2 eV Lamp PID Background=0.0 ppm. |
| | | 2-4 | | 10.5 | | | SAND (SP), quartz, brown-medium gray, fine-medium grained, subrounded-subangular. | |
| | | 4-6 | | 14.7 | | | SAND (SP), quartz, tan-gold, salt and pepper, medium grained, subrounded, graded. | |
| 5 | | | | | | | | |
| | | 6-8 | | 14.7 | | | | |
| | | 8-10 | | 14.7 | | | SAND (SP), quartz, as above. | |
| 10 | | 10-12 | | 10.5 | | SP | SAND (SP), quartz, tan-medium gray, medium grained, subrounded, graded. | |
| | | 12-14 | | 10.5 | | | | |
| ▼ | | 14-16 | | 14.7 | | | | Borehole PID=0.0 ppm |
| 15 | | | | | | | | |
| | | 16-18 | | 10.5 | | | SAND (SP), quartz, brown-medium gray, medium-coarse, subangular-subrounded, graded. | |
| | | 18-20 | | 10.5 | | | | |
| | | | | | | | SAND (SP), quartz, brown, medium grained, subrounded. | |
| 20 | | | | 14.7 | | | | |
| | | | | | | | Depth of boring=20 feet. | |
| | | | | | | | | Borehole PID=0.0 ppm. |
| | | | | | | | | Log developed from auger cuttings. |
| 25 | | | | | | | | |
| | | | | | | | | ▼ =Water table during drilling |
| | | | | | | | | No analytical samples were collected from this boring. |

**JMM** James M. Montgomery
Consulting Engineers, Inc.

DRILLER *HARDIN AND HUBER, INC.*
METHOD OF DRILLING *HOLLOW STEM AUGER*
HOLE DIAMETER *8 1/4 INCHES*
TOTAL DEPTH *20 FEET*

WELL COMPLETION DEPTH *N/A*
WELL DIAMETER *N/A*
WELL MATERIAL *N/A*

BORING/WELL NUMBER *SB-110A*
DATE STARTED *4/18/90* COMPLETED *4/18/90*
SITE NUMBER *5*
GROUND ELEVATION *17.69 FEET, NGVD*

CLIENT *U.S. ARMY CORPS OF ENGINEERS*
PROJECT *FORT STORY PA/SI*
SITE NAME *UNDERGROUND FUEL STORAGE TANK FARM*
GEOLOGIST *MARK SHUPE*



COORDINATES *N223994, E2721180*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | LITH | 0-2 | 2 3 2 2 | 6.5 | | SP | SAND (SP), quartz, medium grained, subrounded, poorly graded, tan-dark brown, trace silt. | PID Instrumentation OVM 580B Thermo Environmental Instruments, Inc. 10.2 eV Lamp PID Background=0.0 ppm. |
| | LITH | 2-4 | 2 2 2 2 3 | 3.2 | | | SAND (SP), quartz, dark brown, as above. | |
| 5 | LITH | 4-6 | 2 3 5 4 | 9.8 | | SW | SAND (SW), quartz, tan-buff-dark brown, subrounded-subangular, graded. | |
| ▼ | LITH | 6-8 | 4 5 7 7 | 9.8 | | SP | SAND (SW), quartz, tan, medium-coarse, subrounded, clean, well graded. | |
| | LITH | 8-10 | 3 4 10 7 | 13.0 | | SW | SAND (SW), quartz, tan-medium gray, medium-fine grained, subangular-subrounded, graded. | |
| 10 | LITH | 10-12 | 2 4 6 7 | 16.3 | | | SAND (SW), quartz, brown-dark brown, fine-course grained, well graded. | |
| | S2 | 12-14 | 4 10 20 18 | 26.1 | | SP | SAND (SP), quartz, gray-tan, fine-course, subangular-subrounded, graded. | |
| 15 | S1 | 14-16 | 5 8 9 14 | 39.2 | | | SAND (SP), quartz, medium, gray-tan, fine-coarse, subrounded, poorly graded. | |
| | LITH | 16-18 | 18 51/4" | 19.2 | | | SAND (SP), quartz, medium, gray tan, as above. | Augers sand locked at 18 feet; spoon packed off. |
| | LITH | 18-20 | 4 9 8 9 | 13.0 | | | SAND (SP), quartz, medium, gray-tan, subangular-subrounded, medium grained, graded. | |
| 20 | | | | | | | Total depth of boring=20 feet. | |
| 25 | | | | | | | | S1=PID Screened Soil Sample 1<br>S2=PID Screened Soil Sample 2<br>LITH=Lithology<br>▼=Water table during drilling |

**JMM** James M. Montgomery
Consulting Engineers, Inc.

DRILLER *HARDIN AND HUBER, INC.*
METHOD OF DRILLING *HOLLOW STEM AUGER*
HOLE DIAMETER *8 1/4 INCHES*
TOTAL DEPTH *20 FEET*

WELL COMPLETION DEPTH *N/A*
WELL DIAMETER *N/A*
WELL MATERIAL *N/A*

BORING/WELL NUMBER *SB-110B* | CLIENT *U.S. ARMY CORPS OF ENGINEERS* | PAGE 1 OF 1

DATE STARTED *4/18/90* COMPLETED *4/18/90* | PROJECT *FORT STORY PA/SI*

SITE NUMBER *5* | SITE NAME *UNDERGROUND FUEL STORAGE TANK FARM* | COORDINATES *N223957, E2721261*

GROUND ELEVATION *17.78 FEET, NGVD* | GEOLOGIST *MARK SHUPE*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | LITH | 0-2 | 2 1 1 2 | 9.8 | | | SAND (SP), quartz, tan-buff, medium grained, subrounded, graded. | PID Instrumentation OVM 580B Thermo Environmental Instruments, Inc. 10.2 eV Lamp PID Background=0.0 ppm. |
| | S2 | 2-4 | 4 6 6 4 | 9.8 | | | SAND (SP), quartz, tan-yellow, medium grained, as above. | |
| 5 | LITH | 4-6 | 3 4 6 4 | 9.8 | | | SAND (SP), quartz,medium-dark gray, medium-fine grained, subangular-subrounded, poorly graded. | |
| ▼ | S1 | 6-8 | 6 8 10 6 | 13.0 | | | SAND (SP), quartz, dark brown, as above. | |
| | LITH | 8-10 | 5 10 12 13 | 9.8 | | | | |
| 10 | LITH | 10-12 | 3 6 10 13 | 6.5 | | SP | SAND (SP), tan, medium-coarse grained quartz, subrounded, graded. | |
| | LITH | 12-14 | 8 12 13 11 | 6.5 | | | SAND (SP), tan, medium-fine quartz, subangular-subrounded, poorly graded. | |
| 15 | LITH | 14-16 | 3 6 8 11 | 6.5 | | | SAND (SP), light gray, fine-medium grained quartz, subangular, graded. | |
| | LITH | 16-18 | 9 9 19 16 | 9.8 | | | | |
| | LITH | 18-20 | 9 12 16 18 | 6.5 | | | SAND (SP), light gray-tan, fine-medium quartz, subangular-subrounded, graded. | |
| 20 | | | | | | | Depth of boring=20 feet. | |
| 25 | | | | | | | | S1=PID Screened Soil Sample 1<br>S2=PID Screened Soil Sample 2<br>LITH=Lithology<br>▼=Water table during drilling |

**JMM** James M. Montgomery Consulting Engineers, Inc.

DRILLER *HARDIN AND HUBER, INC.* | WELL COMPLETION DEPTH *N/A*

METHOD OF DRILLING *HOLLOW STEM AUGER* | WELL DIAMETER *N/A*

HOLE DIAMETER *8 1/4 INCHES* | WELL MATERIAL *N/A*

TOTAL DEPTH *20 FEET*

BORING/WELL NUMBER *SB-110C*
DATE STARTED *4/20/90* COMPLETED *4/20/90*
SITE NUMBER *5*
GROUND ELEVATION *16.56 FEET, NGVD*

CLIENT *U.S. ARMY CORPS OF ENGINEERS*
PROJECT *FORT STORY PA/SI*
SITE NAME *UNDERGROUND FUEL STORAGE TANK FARM*
GEOLOGIST *MARK SHUPE*



COORDINATES *N223936, E2721143*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | LITH | 0-2 | 1 2 3 3 | 10.5 | | | SAND (SP), quartz, dark gray, fine-medium grained, subangular, graded. | PID Instrumentation OVM 580B Thermo Environmental Instruments, Inc. 10.2 eV Lamp PID Background=0.0 ppm. |
| | LITH | 2-4 | 15 14 11 8 | 18.9 | | | SAND (SP), quartz, black, fine-medium grained, as above. | |
| 5 | S1 | 4-6 | 2 3 2 4 | 216 | | | SAND (SP), quartz, tan-gold, fine-medium grained, subrounded, graded, grading, coarser. | PID measured in augers = 0.0. |
| | LITH | 6-8 | 5 5 7 7 | 10.5 | | | SAND (SP), quartz, white-light gray, fine, subangular, graded. | |
| ▼ | | | | | | | SAND (SP), quartz, tan-gold, medium-coarse grained, subrounded, graded. | |
| | LITH | 8-10 | 2 3 4 5 | 18.9 | | | | |
| 10 | | | | | | SP | SAND (SP), light gray-tan quartz, subrounded-rounded, medium grained, graded. | |
| | LITH | 10-12 | 2 3 4 5 | 14.7 | | | | |
| | LITH | 12-14 | 2 4 3 6 | 14.7 | | | SAND (SP), light gray quartz, medium grained, rounded-subrounded, poorly graded. | |
| 15 | LITH | 14-16 | 2 4 6 8 | 18.9 | | | | |
| | LITH | 16-18 | 25 50/3" | 21.5 | | | SAND (SP), quartz, medium grained, medium gray-tan, subrounded, graded. | |
| | S2 | 18-20 | 25 32 50/4" | 25.1 | | | SAND (SP), quartz, light-medium gray, medium grained, subangular-subrounded, graded. | |
| 20 | | | | | | | Total depth of boring=20 feet. | |
| 25 | | | | | | | | S1=PID Screened Soil Sample 1<br>S2=PID Screened Soil Sample 2<br>LITH=Lithology<br>▼=Water table during drilling |

**JMM** James M. Montgomery
Consulting Engineers, Inc.

DRILLER *HARDIN AND HUBER, INC.*
METHOD OF DRILLING *HOLLOW STEM AUGER*
HOLE DIAMETER *8 1/4 INCHES*
TOTAL DEPTH *20 FEET*

WELL COMPLETION DEPTH *N/A*
WELL DIAMETER *N/A*
WELL MATERIAL *N/A*

BORING/WELL NUMBER *SB-111A*
DATE STARTED *4/19/90* COMPLETED *4/19/90*
SITE NUMBER *5*
GROUND ELEVATION *17.55 FEET, NGVD*

CLIENT *U.S. ARMY CORPS OF ENGINEERS*
PROJECT *FORT STORY PA/SI*
SITE NAME *UNDERGROUND FUEL STORAGE TANK FARM*
GEOLOGIST *MARK SHUPE*



COORDINATES *N223936, E2721143*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | LITH | 0-2 | 2 4 2 2 | 7.2 | | | SAND (SP), quartz, dark brown-tan, medium grained, subrounded, graded, trace silt. | PID Instrumentation OVM 580B Thermo Environmental Instruments, Inc. 10.2 eV Lamp PID Background=0.0 ppm. |
| | LITH | 2-4 | 9 9 12 13 | 7.2 | | | SAND (SP), quartz, light gray-tan, as above. SAND (SP), quartz, dark gray-dark brown, medium-coarse, subrounded, graded. | |
| 5 | LITH | 4-6 | 9 13 17 18 | 7.2 | | | SAND (SP), quartz, tan-gray, medium grained, subrounded, graded, grading coarser. | |
| | LITH | 6-8 | 8 8 10 10 | 14.4 | | | SAND (SP), tan-salt and pepper, coarse-medium grained, graded, subrounded-rounded. | |
| ▼ | LITH | 8-10 | 6 7 6 8 | 10.8 | | | | |
| 10 | LITH | 10-12 | 3 4 6 10 | 7.2 | | SP | SAND (SP), quartz, medium grained, gray-tan, subrounded, graded. | Borehole PID=105 ppm. |
| | S2 | 12-14 | 4 9 4 12 | 315 | | | SAND (SP), quartz, medium gray-brown, medium-coarse, subrounded, graded, hydrocarbon odor (diesel). | |
| 15 | S1 | 14-16 | 18 17 22 26 | 698 | | | SAND (SP), quartz, medium gray, as above, strong hydrocarbon odor (diesel). | |
| | LITH | 16-18 | 50 50/4" | 347 | | | SAND (SP), quartz, medium gray, as above, very strong hydrocarbon odor (diesel). | Borehole PID=1539 ppm. |
| | LITH | 18-20 | 48 52 50/4" | 297 | | | SAND (SP), quartz, medium gray, medium-coarse grained, rounded-subrounded, graded, very strong hydocarbon odor (diesel). | 18-20 foot interval drive 2 spoons for additional sample volume Blow counts=48,52,50/4" 9,9,12,15 |
| 20 | | | | | | | Total depth of boring=20 feet. | |
| 25 | | | | | | | | S1=PID Screened Soil Sample 1<br>S2=PID Screened Soil Sample 2<br>LITH=Lithology<br>▼=Water table during drilling |

**JMM** James M. Montgomery
Consulting Engineers, Inc.

DRILLER *HARDIN AND HUBER, INC.*
METHOD OF DRILLING *HOLLOW STEM AUGER*
HOLE DIAMETER *8 1/4 INCHES*
TOTAL DEPTH *20 FEET*

WELL COMPLETION DEPTH *N/A*
WELL DIAMETER *N/A*
WELL MATERIAL *N/A*

BORING/WELL NUMBER *SB-111B*
DATE STARTED *4/18/90* COMPLETED *4/18/90*
SITE NUMBER *5*
GROUND ELEVATION *17.97 FEET, NGVD*

CLIENT *U.S. ARMY CORPS OF ENGINEERS*
PROJECT *FORT STORY PA/SI*
SITE NAME *UNDERGROUND FUEL STORAGE TANK FARM*
GEOLOGIST *MARK SHUPE*



COORDINATES *N223907, E2721211*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | S1 | 0-2 | 4 3 5 3 | 13.0 | | | SAND (SP), quartz, dark brown, medium grained, subrounded, poorly graded, trace roots. | PID Instrumentation OVM 580B Thermo Environmental Instruments, Inc. 10.2 eV Lamp PID Background=0.0 ppm. |
| | S2 | 2-4 | 7 7 6 5 | 13.0 | | | SAND (SP), quartz, tan-dark brown, as above. | |
| 5 | LITH | 4-6 | 7 14 12 8 | 9.8 | | | SAND (SP), quartz, dark brown-gray, medium grained, as above. SAND (SP), quartz, tan-yellow, medium-coarse, subrounded, graded. | |
| ▼ | LITH | 6-8 | 3 4 6 7 | 3.2 | | | SAND (SP), quartz, dark gray-light gray, medium grained, rounded-subrounded, graded. | |
| | LITH | 8-10 | 5 6 6 9 | 6.5 | | | SAND (SP), quartz, tan-yellow, medium grained, as above. | |
| 10 | | | | | | SP | SAND (SP), quartz, dark gray-dark brown, medium grained, subrounded, graded. | |
| | LITH | 10-12 | 4 2 4 4 | 6.5 | | | | |
| | LITH | 12-14 | 3 5 8 9 | 6.5 | | | SAND (SP), quartz, medium gray-buff, medium-coarse grained, subrounded, graded. | |
| 15 | LITH | 14-16 | 21 7 9 12 | 6.5 | | | SAND (SP), as above. | |
| | LITH | 16-18 | 30 51/2" | 3.2 | | | SAND (SP), quartz, tan-brown, medium grained, as above. | |
| | LITH | 18-20 | 5 6 11 13 | 6.5 | | | SAND (SP), quartz, as above. | |
| 20 | | | | | | | Total depth of boring=20 feet. | |
| 25 | | | | | | | | |

S1=PID Screened Soil Sample 1

S2=PID Screened Soil Sample 2

LITH=Lithology

▼ =Water table during drilling

JMM James M. Montgomery Consulting Engineers, Inc.

DRILLER *HARDIN AND HUBER, INC.*
METHOD OF DRILLING *HOLLOW STEM AUGER*
HOLE DIAMETER *8 1/4 INCHES*
TOTAL DEPTH *20 FEET*

WELL COMPLETION DEPTH *N/A*
WELL DIAMETER *N/A*
WELL MATERIAL *N/A*

BORING/WELL NUMBER *SB-111C*
DATE STARTED *4/21/90* COMPLETED *4/21/90*
SITE NUMBER *5*
GROUND ELEVATION *16.98 FEET, NGVD*

CLIENT *U.S. ARMY CORPS OF ENGINEERS*
PROJECT *FORT STORY PA/SI*
SITE NAME *UNDERGROUND FUEL STORAGE TANK FARM*
GEOLOGIST *MARK SHUPE*



COORDINATES *N223947, E2721126*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | S1 | 0-6" | | 4.8 | | | SAND (SP), quartz, dark gray, medium grained, subrounded, graded, silty. | 0-6 inch interval sample collected using hand scoop |
| | LITH | 2-4 | 8 9 15 17 | 4.8 | | | SAND (SP), quartz, tan, medium grained, subrounded, graded. | PID Instrumentation OVM 580B Thermo Environmental Instruments, Inc. 10.2 eV Lamp PID Background=0.0 ppm. |
| 5 | LITH | 4-6 | 3 4 9 8 | 4.8 | | | SAND (SP) (sandstone approximately 2 inches thick), light green-gray, medium grained, subrounded, calcite cementing, strong HCl reaction, possible concrete fill. | |
| ▼ | LITH | 6-8 | 6 6 7 6 | 4.8 | | | SAND (SP), quartz, tan-gold, salt and pepper, medium-coarse grained, subrounded, poorly graded. | |
| | LITH | 8-10 | 4 7 4 8 | 4.8 | | | SAND (SP), quartz, tan-gold, medium grained, subrounded, grading coarser, graded. | |
| 10 | LITH | 10-12 | 1 5 7 9 | 4.8 | | SP | | |
| | LITH | 12-14 | 8 10 9 8 | 4.8 | | | SAND (SP), quartz, light gray, medium-coarse grained, subrounded, graded. | |
| 15 | LITH | 14-16 | 9 12 9 15 | 0.0 | | | SAND (SP), quartz, light gray, medium grained, subrounded. | |
| | LITH | 16-18 | 6 8 10 12 | 0.0 | | | SAND (SP), quartz, medium gray, medium-coarse grained, subrounded-rounded, graded. | |
| 20 | S2 | 18-20 | 5 6 5 8 | 0.0 | | | SAND (SP), quartz, medium gray, medium-coarse grained, subrounded, graded. | |
| | | | | | | | Total depth of boring=20 feet. | |
| 25 | | | | | | | | |

S1=PID Screened Soil Sample 1

S2=PID Screened Soil Sample 2

LITH=Lithology

▼=Water table during drilling

**JMM** James M. Montgomery Consulting Engineers, Inc.

DRILLER *HARDIN AND HUBER, INC.*
METHOD OF DRILLING *HOLLOW STEM AUGER*
HOLE DIAMETER *8 1/4 INCHES*
TOTAL DEPTH *20 FEET*

WELL COMPLETION DEPTH *N/A*
WELL DIAMETER *N/A*
WELL MATERIAL *N/A*

BORING/WELL NUMBER *MW-113A*
DATE STARTED *4/21/90* COMPLETED *4/21/90*
SITE NUMBER *5*
GROUND ELEVATION *16.02 FEET, NGVD*

CLIENT *U.S. ARMY CORPS OF ENGINEERS*
PROJECT *FORT STORY PA/SI*
SITE NAME *UNDERGROUND FUEL STORAGE TANK FARM*
GEOLOGIST *MARK SHUPE*



COORDINATES *N223784, E2721238*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | GS | 0-6" | | 0.0 | | | SAND (SP), quartz, dark gray, fine-medium grained, subangular, poorly graded, silty. | 0-6 inch interval sample collected using hand scoop. |
| 5 | SI | 5-7 | 3 3 3 3 | 4.8 | | SP | SAND (SP), quartz, tan-gold, medium grained, subangular-subrounded, poorly graded. | PID Instrumentation OVM 580B Thermo Environmental Instruments, Inc. 10.2 eV Lamp PID Background=0.0 ppm. |
| 10 | GEO | 10-12 | 4 5 7 5 | 4.8 | | | SAND (SP), quartz, medium gray-brown, medium grained, subangular, graded. | |
| 15 | LITH | 15-17 | 9 9 9 8 | 4.8 | | | SAND (SP), quartz, medium gray-brown, medium grained, subrounded-subangular, graded. | |
| | | | | | | | Total depth of boring=17 feet. | |
| 20 | | | | | | | | |
| 25 | | | | | | | | |

GS=Ground Surface

SI=Soil/Groundwater Interface

GEO=Geotechnical

LITH=Lithology

▼ =Water table during drilling

JMM James M. Montgomery
Consulting Engineers, Inc.

DRILLER *HARDIN AND HUBER, INC.*
METHOD OF DRILLING *HOLLOW STEM AUGER*
HOLE DIAMETER *8 1/4 INCHES*
TOTAL DEPTH *17 FEET*

WELL COMPLETION DEPTH *17 FEET*
WELL DIAMETER *2 INCHES*
WELL MATERIAL *SCHEDULE 40 PVC*

BORING/WELL NUMBER *MW-113B*
DATE STARTED *4/20/90* COMPLETED *4/20/90*
SITE NUMBER *5*
GROUND ELEVATION *13.25 FEET, NGVD*

CLIENT *U.S. ARMY CORPS OF ENGINEERS*
PROJECT *FORT STORY PA/SI*
SITE NAME *UNDERGROUND FUEL STORAGE TANK FARM*
GEOLOGIST *MARK SHUPE*



COORDINATES *N223903, E2721066*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | GS | 0-6" | | 27.1 | | | SAND (SP), quartz, dark gray, medium-fine grained, subangular-subrounded, graded. | 0-6 inch inteval sample collected using hand scoop. |
| | LITH | 2-4 | 5 6 8 9 | 23.1 | | | SAND (SP), quartz, tan-gold, salt and pepper, medium-coarse grained, subrounded-subangular, graded. | PID Instrumentation OVM 580B Thermo Environmental Instruments, Inc. 10.2 eV Lamp PID Background=0.0 ppm. |
| 5 | SI GEO | 4-6 | 4 6 10 12 | 19.9 | | SP | SAND (SP), quartz,tan-gold, medium grained, subrounded, poorly graded. | Check PID in augers= o.o ppm. |
| 10 | LITH | 10-12 | 4 9 10 12 | 39.5 | | | SAND (SP), quartz, tan-medium gray, medium-coarse grained, graded. | |
| | | | | | | | Total depth of boring=12 feet. | |
| 15 | | | | | | | | |
| 20 | | | | | | | | |
| 25 | | | | | | | | |

GS=Ground Surface

SI=Soil/Groundwater Interface

GEO=Geotechnical

LITH=Lithology

▼ =Water table during drilling

**JMM** James M. Montgomery Consulting Engineers, Inc.

DRILLER *HARDIN AND HUBER, INC.*
METHOD OF DRILLING *HOLLOW STEM AUGER*
HOLE DIAMETER *8 1/4 INCHES*
TOTAL DEPTH *12.0 FEET*

WELL COMPLETION DEPTH *12.0 FEET*
WELL DIAMETER *2 INCHES*
WELL MATERIAL *SCHEDULE 20 PVC*

BORING/WELL NUMBER *MW-114A*
DATE STARTED *4/20/90* COMPLETED *4/20/90*
SITE NUMBER *5*
GROUND ELEVATION *19.50 FEET, NGVD*

CLIENT *U.S. ARMY CORPS OF ENGINEERS*
PROJECT *FORT STORY PA/SI*
SITE NAME *UNDERGROUND FUEL STORAGE TANK FARM*
GEOLOGIST *MARK SHUPE*



COORDINATES *N223838, E2721181*

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | GS | 0-6" | | 39.9 | | | SAND (SP), quartz, dark gray-black, fine grained, subangular, poorly graded. | 0-6 inch inteval sample collected using hand scoop. PID reading from auger cuttings = 56.7 ppm. |
| 5 | LITH | 4-6 | 3 2 4 1 | 35.7 | | | SAND (SP), quartz, tan-gold, salt and pepper, medium-coarse, subrounded-subangular, graded. | PID reading in augers= 103 ppm. |
| ▼ | SI | 6-8 | 4 4 4 6 | 23.8 | | SP | SAND (SP), quartz, medium gray, fine-medium, subangular-subrounded, graded. | |
| 10 | GEO | 10-12 | 9 4 4 7 | 35.7 | | | SAND (SP), quartz, tan- light gray, medium-fine grained, subangular-subrounded, graded. | PID reading from auger cutting = 48.1 ppm. PID reading in augers= 0.0 ppm. |
| 15 | LITH | 15-17 | 6 10 10 12 | 14.5 | | | SAND (SP), quartz, medium gray-buff, subangular, medium grained, graded. | PID Instrumentation OVM 580B Thermo Environmental Instruments, Inc. 10.2 eV Lamp PID Background=0.0 ppm. |
| | | | | | | | Total depth of boring=17 feet. | |
| 20 | | | | | | | | |
| 25 | | | | | | | | |

GS=Ground Surface

SI=Soil/Groundwater Interface

GEO=Geotechnical

LITH=Lithology

▼ =Water table during drilling

**JMM** James M. Montgomery Consulting Engineers, Inc.

DRILLER *HARDIN AND HUBER, INC.*
METHOD OF DRILLING *HOLLOW STEM AUGER*
HOLE DIAMETER *8 1/4 INCHES*
TOTAL DEPTH *17.0 FEET*

WELL COMPLETION DEPTH *15.0 FEET*
WELL DIAMETER *2 INCHES*
WELL MATERIAL *SCHEDULE 40 PVC*

BORING/WELL NUMBER *MW-114B*
DATE STARTED *4/21/90* COMPLETED *4/21/90*
SITE NUMBER *5*
GROUND ELEVATION *17.56 FEET, NGVD*

CLIENT *U.S. ARMY CORPS OF ENGINEERS*
PROJECT *FORT STORY IRP*
SITE NAME *UNDERGROUND FUEL STORAGE TANK FARM*
GEOLOGIST *MARK SHUPE*



COORDINATES

| DEPTH (feet) | SAMPLE | SAMPLE INTERVAL (ft) | BLOWS/ 6 IN | PID (ppm) | GRAPHIC LOG | SOIL CLASS | GEOLOGIC DESCRIPTION | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | GS | 0-6" | | 4.8 | | SM | SAND: quartz, dark gray, fine-medium grained, subrounded, graded, trace silt. | 0-6 inch interval sample collected using hand scoop. |
| 5 | LITH | 4-6 | 3 3 2 2 | 0.0 | | | SAND: quartz, buff-gold, salt and pepper, medium-coarse, subrounded-rounded, graded. | PID Instrumentation OVM 580B Thermo Environmental Instruments, Inc. 10.2 eV Lamp PID Background=0.0 ppm. |
| ▼ | LITH | 6-8 | 5 5 6 6 | 4.8 | | SP | SAND: quartz, brown-medium gray, medium-coarse, subrounded-subangular, graded. | |
| | SI | 8-10 | 2 3 5 6 | 9.6 | | | SAND: quartz, brown-dark brown, medium-coarse grained, subrounded, graded. | |
| 10 | | | | | | | | |
| 15 | GEO | 15-17 | 6 7 7 12 | 4.8 | | | SAND: quartz, light gray, medium-coarse grained, subangular-subrounded, graded. | |
| | | | | | | | Total depth of boring = 17 feet. | |
| 20 | | | | | | | | |
| 25 | | | | | | | | GS=Ground Surface<br>SI=Soil/Groundwater Interface<br>GEO=Geotechnical<br>LITH=Lithology<br>▼ =Water table during drilling |

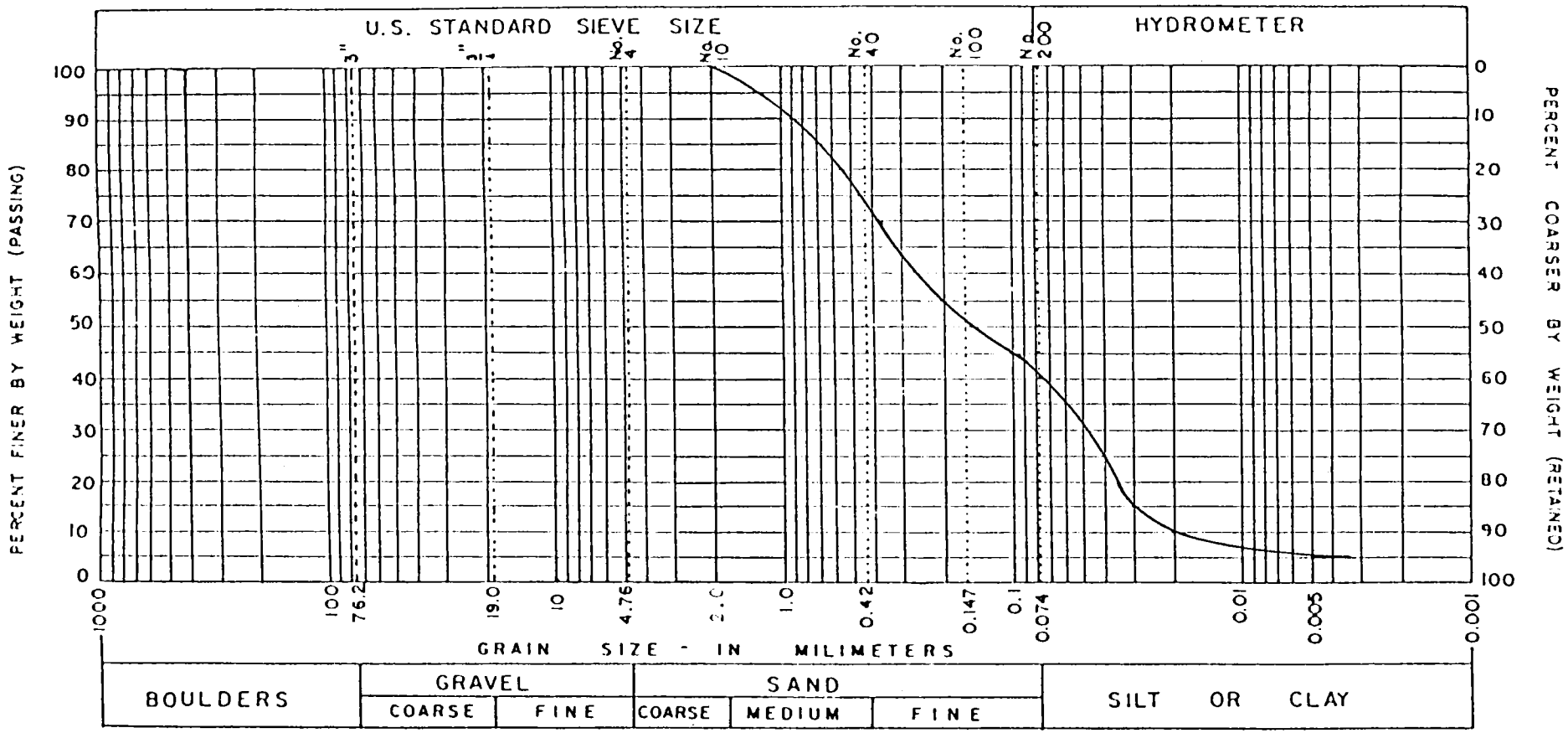
**JMM** James M. Montgomery
Consulting Engineers, Inc.

DRILLER *HARDIN AND HUBER, INC.*
METHOD OF DRILLING *HOLLOW STEM AUGER*
HOLE DIAMETER *8 1/4 INCHES*
TOTAL DEPTH *17.0 FEET*

WELL COMPLETION DEPTH *16.0 FEET*
WELL DIAMETER *2 INCHES*
WELL MATERIAL *SCHEDULE 40 PVC*

# Geotechnical Grain Size Analyses

| PROJECT: Fort Story | | LOCATION: Virginia Beach, VA. | |
|---|---|---|---|
| BORING NO. Site 5 | SAMPLE NO. S5MW113A | DEPTH: 10 | CONTRACT NO. 90-075 |



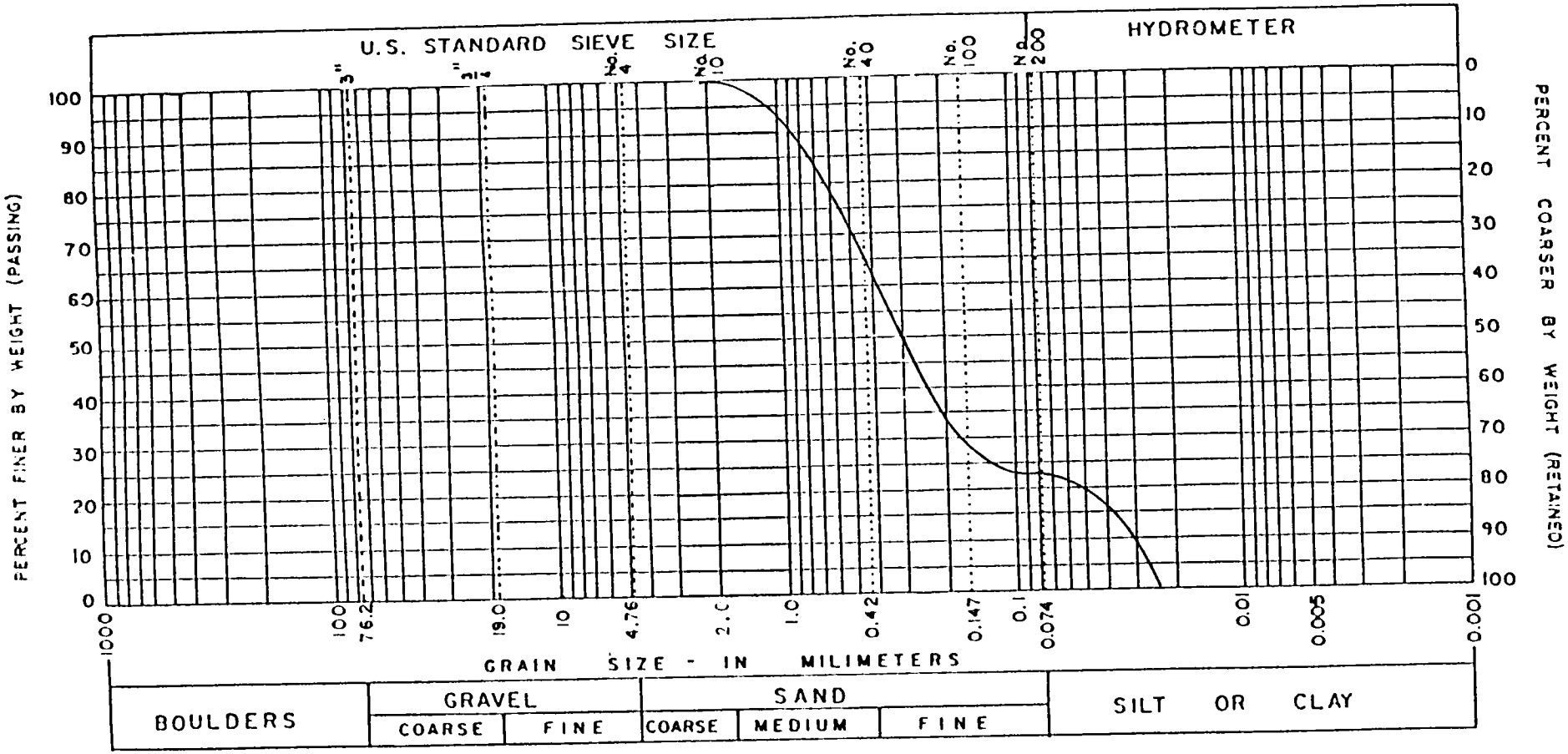

| SAMPLE NO. | DEPTH | L.L. | P.I. | M.C. | UNIFIED | Soil Description |
|---|---|---|---|---|---|---|
| S5MW113A | 10 | - | N.P. | 20.0 | SM | Brown silty sand |

Earth Engineering & Sciences, Inc.

GRAIN-SIZE DISTRIBUTION

| TESTED BY: RMP | DATE: 7 -12-90 |
|---|---|
| CHECKED BY: PAD | SHEET No. 15 OF 32 |

| PROJECT: Fort Story | | LOCATION: Virginia Beach, VA. | |
|---|---|---|---|
| BORING NO. Site 5 | SAMPLE NO. S5MW113B | DEPTH: 4' | CONTRACT NO. 90-075 |




| SAMPLE NO. | DEPTH | L.L. | P.I. | M.C. | Unified | Soil Description |
|---|---|---|---|---|---|---|
| S5MW113B | 4' | - | N.P. | 15.3 | SM | Brown silty sand |

Earth Engineering & Sciences, Inc.

GRAIN-SIZE DISTRIBUTION

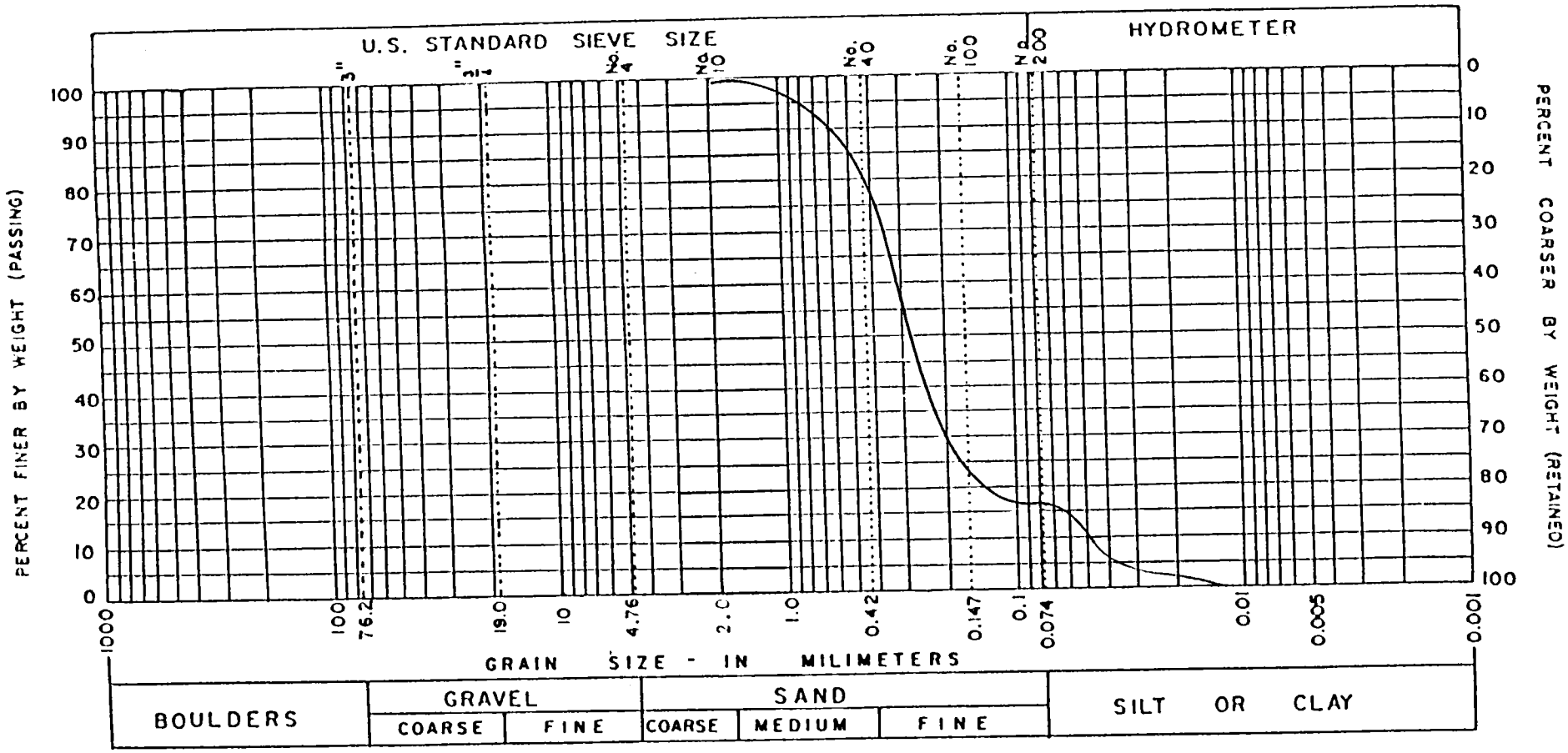
TESTED BY: RMP

DATE: 7-12-90

CHECKED BY: PAD

SHEET No. 16 OF 132

| PROJECT: Fort Story | | LOCATION: Virginia Beach, VA. | |
|---|---|---|---|
| BORING NO. Site 5 | SAMPLE NO. S5MW114A | DEPTH: 10' | CONTRACT NO. 90-075 |




| SAMPLE NO. | DEPTH | L.L. | P.I. | M.C. | Unified | Soil Description |
|---|---|---|---|---|---|---|
| S5MW114A | 10' | - | N.P. | 22.0 | SM | Brown silty sand |

Earth Engineering & Sciences, Inc.

GRAIN-SIZE DISTRIBUTION

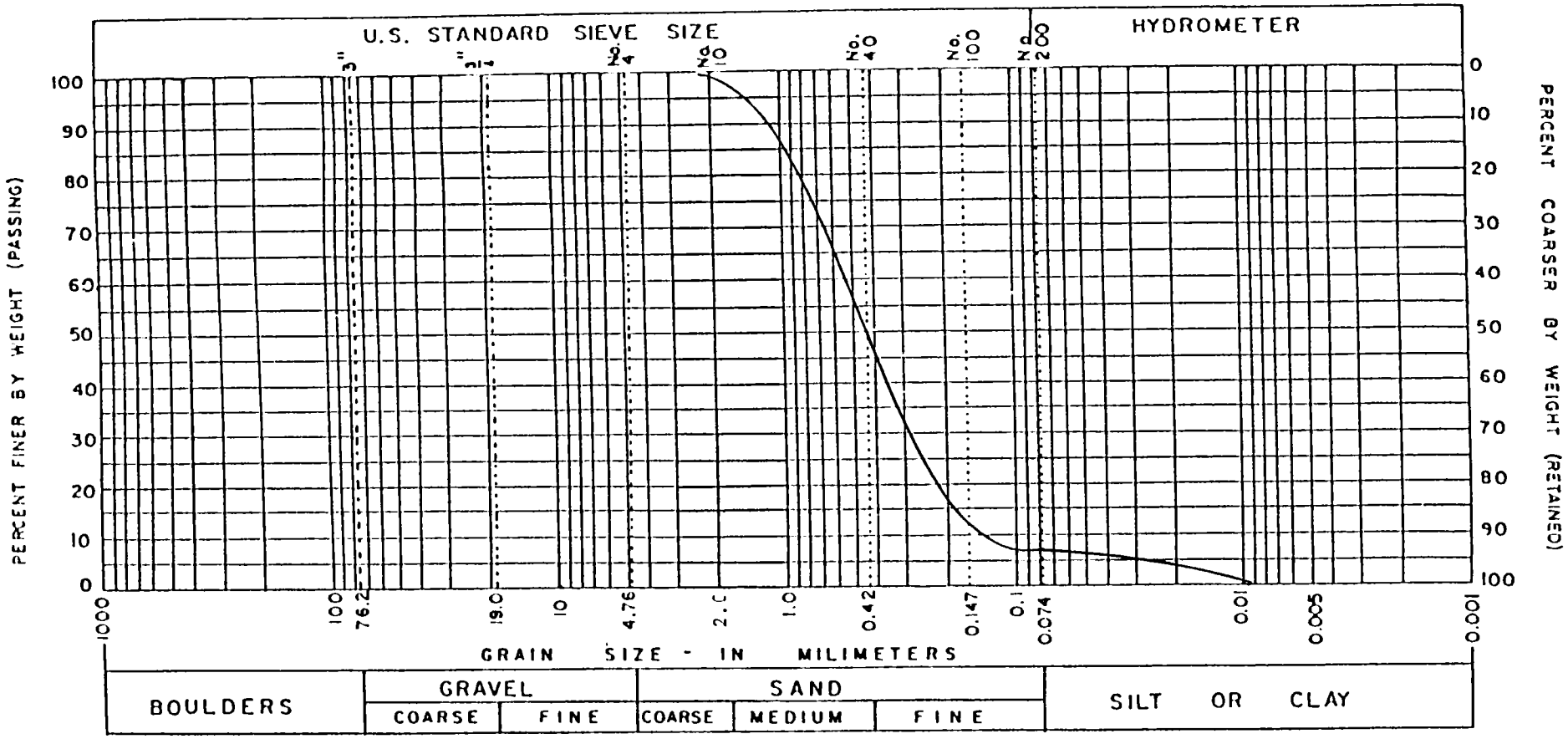
TESTED BY: RMP

DATE: 7-12-90

CHECKED BY: PAD

SHEET No. 17 OF 32

| PROJECT: Fort Story | | LOCATION: Virginia Beach, VA. | |
|---|---|---|---|
| BORING NO. Site 5 | SAMPLE NO. S5MW114B | DEPTH: 15' | CONTRACT NO. 90-075 |




| SAMPLE NO. | DEPTH | L.L. | P.I. | M.C. | Unified | Soil Description |
|---|---|---|---|---|---|---|
| S5MW114B | 15' | - | N.P. | 20.7 | SM-SP | Brown slightly silty sand |

Earth Engineering & Sciences, Inc.

GRAIN-SIZE DISTRIBUTION

TESTED BY: RMP

DATE: 7-12-90

CHECKED BY: PAD

SHEET No. 18 OF 32

# Monitoring Well Construction Summary Sheets

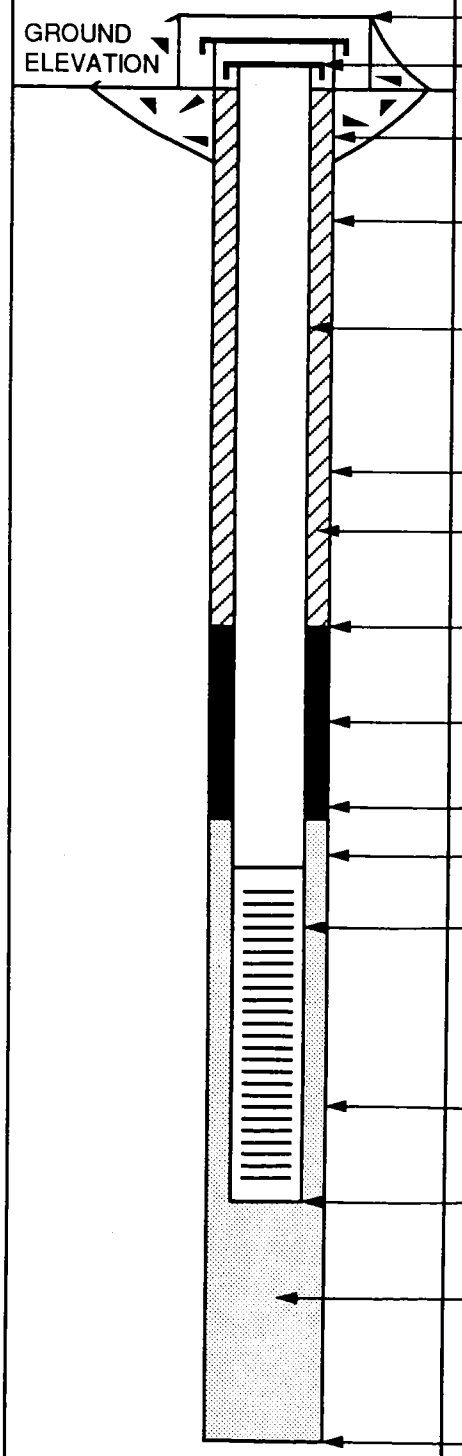
James M. Montgomery
Consulting Engineers, Inc.

BORING NO. MW-113A

# MONITORING WELL SHEET

PROJECT Fort Story PA/SI
LOCATION Site 5
PROJECT NO 1868.0401
BORING MW-113A
ELEVATION
DATE 4/21/90
FIELD GEOLOGIST Mark Shupe

DRILLER Hardin and Huber Inc.
DRILLING METHOD Hollow Stem Auger
DEVELOPMENT METHOD Air Surging/Pumping




ELEVATION OF TOP OF SURFACE CASING: 16.02 ft.
ELEVATIONS OF TOP OF RISER PIPE: 15.78 ft.

TYPE OF SURFACE SEAL: Cement Grout

I.D. OF SURFACE CASING: 8 inch
TYPE OF SURFACE CASING: Steel

RISER PIPE I.D.: 2 inch
TYPE OF RISER PIPE: Schedule 40 PVC

BOREHOLE DIAMETER: 8 1/4 inch

TYPE OF BACKFILL: Cement Grout

ELEVATION/DEPTH OF SEAL: 3.0 ft.

TYPE OF SEAL: Granular Bentonite

DEPTH TO TOP OF SAND PACK: 3.5 ft.
ELEVATION/DEPTH TOP OF SCREEN: 5.0 ft.

TYPE OF SCREEN: Schedule 40 PVC
SLOT SIZE X LENGTH: 0.01 inch X 10 feet
I.D. OF SCREEN: 2 inch

TYPE OF SAND PACK: No. 1 Filter Sand

ELEVATION/DEPTH BOTTOM OF SCREEN: 15.0 ft.

ELEVATION/DEPTH BOTTOM OF SANDPACK: 17.0 ft.
TYPE OF BACKFILL BELOW OBSERVATION WELL:
Formation

ELEVATION/DEPTH OF HOLE: 17.0 ft.

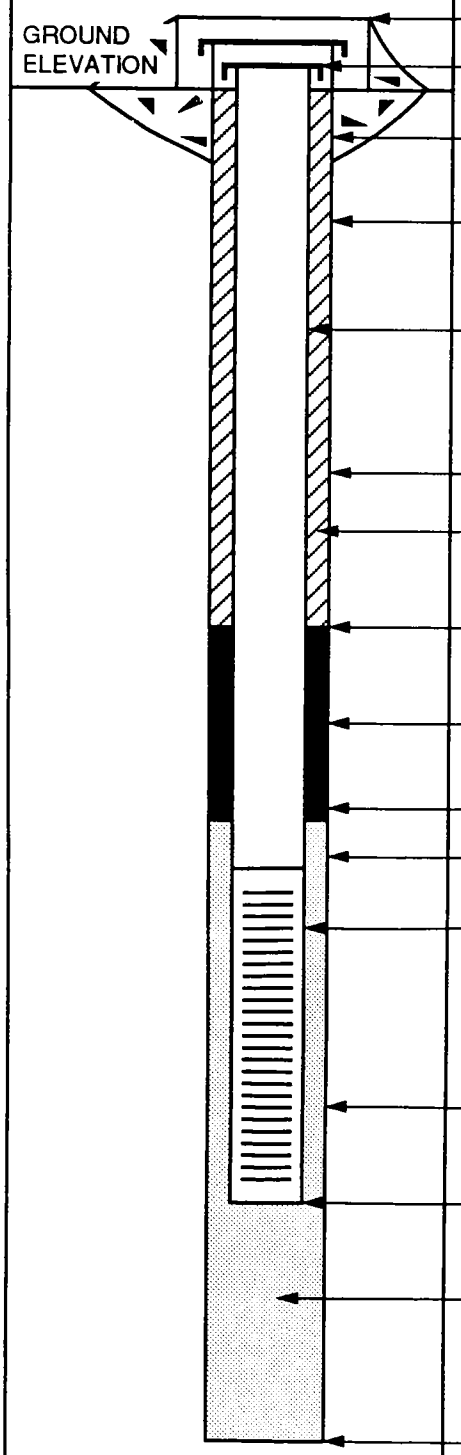
James M. Montgomery
Consulting Engineers, Inc.

BORING NO. MW-113B

# MONITORING WELL SHEET

PROJECT Fort Story PA/SI
LOCATION Site 5
PROJECT NO 1868.0401
BORING MW-113B
ELEVATION
DATE 4/20/90
FIELD GEOLOGIST Mark Shupe

DRILLER Hardin and Huber Inc.
DRILLING METHOD Hollow Stem Auger
DEVELOPMENT METHOD Air Surging/Pumping




ELEVATION OF TOP OF SURFACE CASING: 13.46 ft.
ELEVATIONS OF TOP OF RISER PIPE: 13.24 ft.

TYPE OF SURFACE SEAL: Cement Grout

I.D. OF SURFACE CASING: 8 inch
TYPE OF SURFACE CASING: Steel

RISER PIPE I.D.: 2 inch
TYPE OF RISER PIPE: Schedule 40 PVC

BOREHOLE DIAMETER: 8 1/4 inch
TYPE OF BACKFILL: No. 1 Filter Sand

ELEVATION/DEPTH OF SEAL: 1.0 ft.

TYPE OF SEAL: Granular Bentonite

DEPTH TO TOP OF SAND PACK: 1.5 ft.
ELEVATION/DEPTH TOP OF SCREEN: 2.0 ft.

TYPE OF SCREEN: Schedule 40 PVC
SLOT SIZE X LENGTH: 0.01 inch X 10 feet
I.D. OF SCREEN: 2 inch

TYPE OF SAND PACK: No. 1 Filter Sand

ELEVATION/DEPTH BOTTOM OF SCREEN: 12.0 ft.

ELEVATION/DEPTH BOTTOM OF SANDPACK: 12.0 ft.
TYPE OF BACKFILL BELOW OBSERVATION WELL: Formation

ELEVATION/DEPTH OF HOLE: 12.0 ft.

James M. Montgomery
Consulting Engineers, Inc.

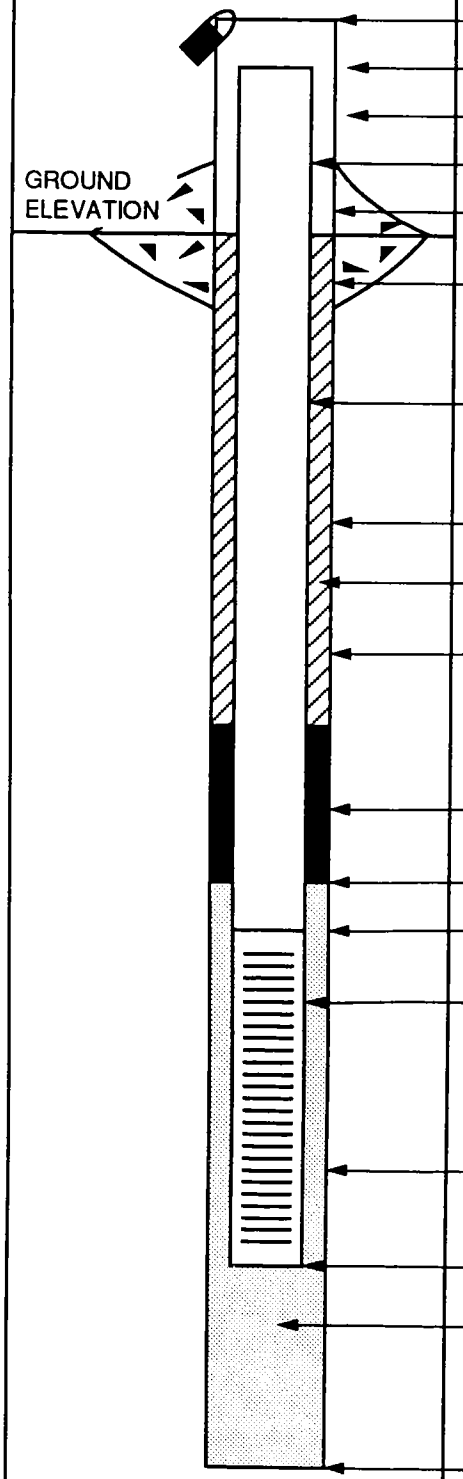
BORING NO. MW-114A

# MONITORING WELL SHEET

PROJECT Fort Story PA/SI
PROJECT NO. 1868.0401
ELEVATION
FIELD GEOLOGIST

LOCATION Site 5
BORING MW-114A
DATE 4/20/90

DRILLER Hardin and Huber Inc.
DRILLING METHOD Hollow Stem Auger
DEVELOPMENT METHOD Air Surging/Pumping




ELEVATION OF TOP OF SURFACE CASING: 19.59 ft.
ELEVATIONS OF TOP OF RISER PIPE: 19.50 ft.
STICK-UP TOP OF SURFACE CASING: 3.13 ft.
STICK-UP RISER PIPE: 3.03 ft.
TYPE OF SURFACE SEAL: Cement Grout
I.D. OF SURFACE CASING: 4 inch
TYPE OF SURFACE CASING: Steel
RISER PIPE I.D.: 2 inch
TYPE OF RISER PIPE: Schedule 40 PVC
BOREHOLE DIAMETER: 8 1/4 inch
TYPE OF BACKFILL: Cement Grout
ELEVATION/DEPTH OF SEAL: 3.0 ft.
TYPE OF SEAL: Granular Bentonite
DEPTH TO TOP OF SAND PACK: 4.0 ft.
ELEVATION/DEPTH TOP OF SCREEN: 5.0 ft.
TYPE OF SCREEN: Schedule 40 PVC
SLOT SIZE X LENGTH: 0.01 inch X 10 feet
I.D. OF SCREEN: 2 inch
TYPE OF SAND PACK: No. 1 Filter Sand
ELEVATION/DEPTH BOTTOM OF SCREEN: 15.0 ft.
ELEVATION/DEPTH BOTTOM OF SANDPACK: 15.0 ft.
TYPE OF BACKFILL BELOW OBSERVATION WELL: No. 1 Filter Sand
ELEVATION/DEPTH OF HOLE: 17.0 ft.

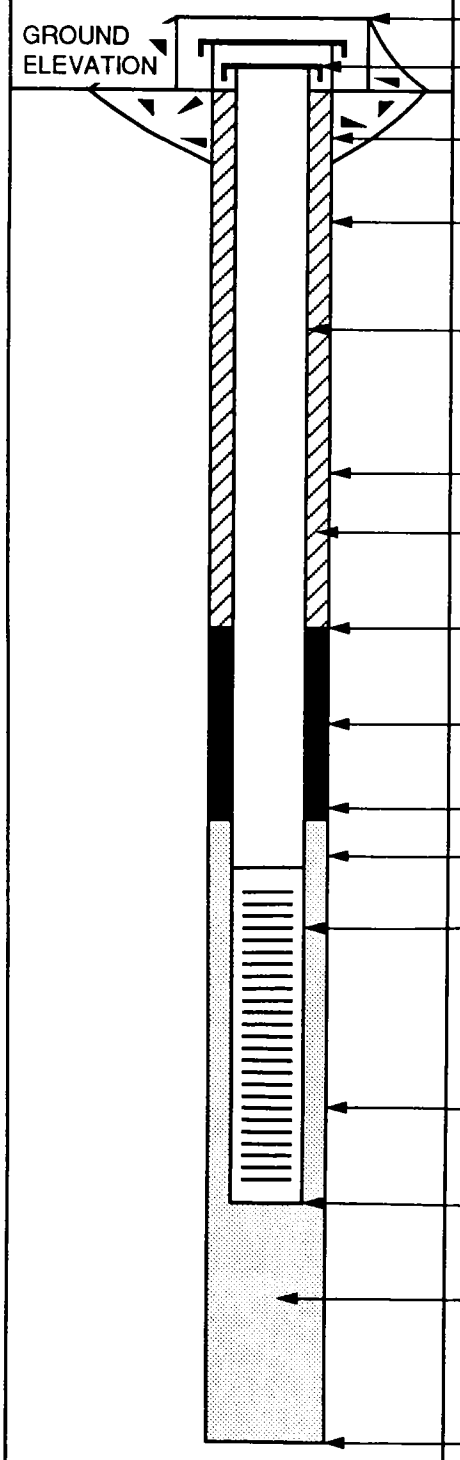
James M. Montgomery
Consulting Engineers, Inc.

BORING NO. MW-114B

# MONITORING WELL SHEET

PROJECT Fort Story PA/SI
LOCATION Site 5
PROJECT NO. 1868.0401
BORING MW-114B
ELEVATION
DATE 4/21/90
FIELD GEOLOGIST Mark Shupe

DRILLER Hardin and Huber Inc.
DRILLING METHOD Hollow Stem Auger
DEVELOPMENT METHOD Air Surging/Pumping




ELEVATION OF TOP OF SURFACE CASING: 17.83 ft.
ELEVATIONS OF TOP OF RISER PIPE: 17.56 ft.
TYPE OF SURFACE SEAL: Cement Grout
I.D. OF SURFACE CASING: 8 inch
TYPE OF SURFACE CASING: Steel
RISER PIPE I.D.: 2 inch
TYPE OF RISER PIPE: Schedule 40 PVC
BOREHOLE DIAMETER: 8 1/4 inch
TYPE OF BACKFILL: Cement Grout
ELEVATION/DEPTH OF SEAL: 3.0 ft.
TYPE OF SEAL: Granular Bentonite
DEPTH TO TOP OF SAND PACK: 4.0 ft.
ELEVATION/DEPTH TOP OF SCREEN: 6.0 ft.
TYPE OF SCREEN: Schedule 40 PVC
SLOT SIZE X LENGTH: 0.01 inch X 10 feet
I.D. OF SCREEN: 2 inch
TYPE OF SAND PACK: No. 1 Filter Sand
ELEVATION/DEPTH BOTTOM OF SCREEN: 16.0 ft.
ELEVATION/DEPTH BOTTOM OF SANDPACK: 17.0 ft.
TYPE OF BACKFILL BELOW OBSERVATION WELL: Formation
ELEVATION/DEPTH OF HOLE: 17.0 ft.

# Monitoring Well Development Sheets

Earth Engineering & Sciences, Inc.

## Monitoring Well Development Sheet MW 113A

Project: FORT STORY Location: SITE 5

Project No. _____ Dates: 4-24-90

Field Geologists: G. TOWSON & D. ENGLAND

Barrel ID: S5 MW113A No. of Barrels: 1-50 GAL

Initial Development Method AIR SURGING Init. Dev. Date: 4-24-90

Initial Volume Removed: 5 GAL Time Started: 0905 Finished: 0955

Initial Team Members: D. ENGLAND, A. Powell & D. SANTMYER

Water Level (Initial): 7.23

Total Depth (BOH): 15.12

Designed Depth: _____

Depth of Sediment: _____

Water Level After Initial Development: 7.6

BOH After Initial Development: 15.08

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Final Development Method: PUMPING Fin. Dev. Date: 4-24-90

Final Volume Removed: 50 GAL Time Start: 1535 Finished: 1550

Final Team Members: G. TOWSON & D. ENGLAND

Water Level Start: 7.31 Finished: 8.32 Ph: 5.55 EC: 150 T°C: 14.4

Total Depth Start: 15.10 Finished: 15.15

$O_2$, TOX, Lel and Organic Vapor Problems Encountered: NONE

Action: ☒ None Needed
☐ Need:

Earth Engineering & Sciences, Inc.

| Date | Time | Initial Development | Final Development | Depth to Water (ft.) | Total Depth (ft) | Design Depth (ft.) | Estimated Sediment Thickness (ft.) | Air Surging | Bailing | Pumping | Flow Rate (gal/min) | Well Volume (gal.) | Total Vol. of Develop. Water | Water Temp. (°C) | pH | EC (µΩ) | Turbidity (Ntu) | Team Members |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4-24-98 | 0905 | ✓ | | 7.23 | 15.12 | | | ✓ | | | | | | | | | | D. ENGLAND<br>A. Powell |
| | 0955 | ✓ | | 7.6 | 15.08 | | | ✓ | | | | | 5gal | | | | | D. SATTMYER |
| | 1535 | | ✓ | 7.31 | 15.10 | | | | | ✓ | ~3 | 7.32 | | 14.5 | 5.44 | 180 | | G. TOWSON<br>D. ENGLAND |
| | 1537 | | ✓ | | | | | | | ✓ | | | | 14.5 | 5.63 | 180 | | |
| | 1539 | | ✓ | | | | | | | ✓ | | | | 14.5 | 5.66 | 180 | | |
| | 1541 | | ✓ | | | | | | | ✓ | | | | 14.5 | 5.64 | 180 | | |
| | 1543 | | ✓ | | | | | | | ✓ | | | | 14.5 | 5.66 | 180 | | |
| | 1545 | | ✓ | | | | | | | ✓ | | | | 14.4 | 5.65 | 180 | | |
| | 1548 | | ✓ | | | | | | | ✓ | | | | 14.4 | 5.61 | 180 | | |
| | 1550 | | ✓ | 8.32 | 15.15 | | | | | ✓ | | | 50gal | 14.4 | 5.59 | 180 | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |

Location: FORT STORY

Site #: 5

Well #: MW 113A

Earth Engineering & Sciences, Inc.

| Date | Time | Initial Development | Final Development | Depth to Water (ft.) | Total Depth (ft) | Design Depth (ft.) | Estimated Sediment Thickness (ft.) | Air Surging | Bailing | Pumping | Flow Rate (gal/min) | Well Volume (gal.) | Total Vol. of Develop. Water | Water Temp. (°C) | pH | EC (µΩ) | Turbidity (Ntu) | Team Members |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4-24-90 | 1115 | ✓ | | 4.1 | 12.3 | | | ✓ | | | | | | | | | | D. ENGLAND<br>A. Powell |
| | 1220 | ✓ | | 4.8 | 12.3 | | | ✓ | | | | | 20gal | | | | | D. SATTMYER |
| | 1430 | | ✓ | 4.21 | 12.28 | | | | | ✓ | 1.8 | 7.58 | | 15.1 | 5.88 | 273 | | G. Towson<br>D. ENGLAND |
| | 1432 | | ✓ | | | | | | | ✓ | | | | 15.1 | 6.02 | 271 | | |
| | 1434 | | ✓ | | | | | | | ✓ | | | | 15.1 | 6.10 | 272 | | |
| | 1436 | | ✓ | | | | | | | ✓ | | | | 15.1 | 6.18 | 272 | | |
| | 1438 | | ✓ | | | | | | | ✓ | | | | 15.1 | 6.15 | 272 | | |
| | 1441 | | ✓ | | | | | | | ✓ | | | | 15.1 | 6.12 | 272 | | |
| | 1443 | | ✓ | | | | | | | ✓ | | | | 15.1 | 6.19 | 272 | | |
| | 1447 | | ✓ | 5.73 | 12.35 | | | | | ✓ | | | 50gal | 15.1 | 6.20 | 272 | | |

Location: Fort Story

Site #: 5

Well #: MW 113B

Earth Engineering & Sciences, Inc.

## Monitoring Well Development Sheet MW 113B

Project: FORT STORY Location: SITE 5

Project No. _____ Dates: 4-24-90

Field Geologists: GEORGE TOWSON & D. ENGLAND

Barrel ID: SS MW 113 B No. of Barrels: 1 · 50 gal

Initial Development Method AIR SURGING Init. Dev. Date: 4-24-90

Initial Volume Removed: 20 gal Time Started: 1115 Finished: 1220

Initial Team Members: D. ENGLAND, D. SANTMYER & A. POWELL

Water Level (Initial): 4.10

Total Depth (BOH): 12.30

Designed Depth: _____

Depth of Sediment: _____

Water Level After Initial Development: 4.8

BOH After Initial Development: 12.3

---

Final Development Method: PUMPING Fin. Dev. Date: 4-24-90

Final Volume Removed: 50 gal Time Start: 1430 Finished: 1447

Final Team Members: GEORGE TOWSON & D. ENGLAND

Water Level Start: 4.21 Finished: 5.73 Ph: 6.20 EC: 272 T°C: 15.1

Total Depth Start: 12.25 Finished: 12.35

$O_2$, TOX, Lel and Organic Vapor Problems Encountered: NONE

Action: ☒ None Needed
☐ Need:

Earth Engineering & Sciences, Inc.

## Monitoring Well Development Sheet MW 114A

Project: FORT STORY Location: 5

Project No. _____ Dates: 4-24-90

Field Geologists: G. TOWSON & D. ENGLAND

Barrel ID: SS MW 114A No. of Barrels: 1.50 GAL

Initial Development Method A.R Surging Init. Dev. Date: 4-24-90

Initial Volume Removed: 10 GAL Time Started: 0755 Finished: 0900

Initial Team Members: D. ENGLAND, A. Powell & D. SANTMYER

Water Level (Initial): 7.7

Total Depth (BOH): 14.5

Designed Depth: _____

Depth of Sediment: _____

Water Level After Initial Development: 7.9

BOH After Initial Development: 14.8

---

Final Development Method: Pumping Fin. Dev. Date: 4-24-90

Final Volume Removed: 50 GAL Time Start: 1505 Finished: 1517

Final Team Members: G. Towson & D. ENGLAND

Water Level Start: 7.74 Finished: 8.32 Ph: 4.97 EC: 229 T°C: 14.0

Total Depth Start: 14.83 Finished: 14.91

$O_2$, TOX, Lel and Organic Vapor Problems Encountered: NONE

Action: ☒ None Needed
☐ Need:

Earth Engineering & Sciences, Inc.

| Date | Time | Initial Development | Final Development | Depth to Water (ft.) | Total Depth (ft) | Design Depth (ft.) | Estimated Sediment Thickness (ft.) | Air Surging | Bailing | Pumping | Flow Rate (gal/min) | Well Volume (gal.) | Total Vol. of Develop. Water | Water Temp. (°C) | pH | EC (µΩ) | Turbidity (Ntu) | Team Members |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4-24-90 | 0755 | ✓ | | 7.7 | 14.5 | | | ✓ | | | .15 | | | | | | | D. ENGLAND<br>A. Powell |
| | 0900 | ✓ | | 7.9 | 14.8 | | | ✓ | | | | | 10 gal | | | | | D. SATTMYER |
| | 1505 | | | 7.74 | 14.93 | | | | | ✓ | 3.33 | 6.66 | | 14.0 | 4.40 | 241 | | G. Towson<br>D. ENGLAND |
| | 1507 | | | | | | | | | ✓ | | | | 14.0 | 4.85 | 235 | | |
| | 1509 | | | | | | | | | ✓ | | | | 14.0 | 4.97 | 235 | | |
| | 1511 | | | | | | | | | ✓ | | | | 14.0 | 4.97 | 232 | | |
| | 1513 | | | | | | | | | ✓ | | | | 14.0 | 4.96 | 230 | | |
| | 1515 | | | | | | | | | ✓ | | | | 14.0 | 4.97 | 230 | | |
| | 1517 | | | 8.32 | 14.91 | | | | | ✓ | | | 50 gal | 14.0 | 4.97 | 229 | | |

Location: FORT STORY

Site #: 5

Well #: MW 114A

Earth Engineering & Sciences, Inc.

## Monitoring Well Development Sheet MW 114B

Project: FORT STORY Location: SITE 5

Project No. _____ Dates: 4-24-90

Field Geologists: GEORGE TOWSON & DIANE ENGLAND

Barrel ID: SS MW 114B No. of Barrels: 1 - 50 GAL

Initial Development Method A.R SURGING Init. Dev. Date: 4-22-90

Initial Volume Removed: 20 GAL Time Started: 1015 Finished: 1110

Initial Team Members: DIANE ENGLAND, Alec Powell & DON SARTMYER

Water Level (Initial): 8.9

Total Depth (BOH): 15.7

Designed Depth: _____

Depth of Sediment: _____

Water Level After Initial Development: 9.1

BOH After Initial Development: 15.7

---

Final Development Method: PUMPING Fin. Dev. Date: 4-22-90

Final Volume Removed: 50 GAL Time Start: 1315 Finished: 1330

Final Team Members: GEORGE TOWSON & DIANE ENGLAND

Water Level Start: 8.92 Finished: 10.42 Ph: 6.20 EC: 60 T°C: 17.0

Total Depth Start: 15.7 Finished: 15.7

$O_2$, TOX, Lel and Organic Vapor Problems Encountered: NONE

Action: ☒ None Needed
☐ Need:

Earth Engineering & Sciences, Inc.

| Date | Time | Initial Development | Final Development | Depth to Water (ft.) | Total Depth (ft) | Design Depth (ft.) | Estimated Sediment Thickness (ft.) | Air Surging | Bailing | Pumping | Flow Rate (gal/min) | Well Volume (gal.) | Total Vol. of Develop. Water | Water Temp. (°C) | pH | EC (µΩ) | Turbidity (Ntu) | Team Members |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 24 90 | 1015 | ✓ | | 8.9 | 15.7 | | | ✓ | | | | | | | | | | D. ENGLAND<br>D. SAMTMYER |
| ↓ | 1110 | ✓ | | 9.1 | 15.7 | | | ✓ | | | | | 20 gal | | | | | A. POWELL |
| 4-24 90 | 1315 | | ✓ | 8.97 | 15.7 | | | | | ✓ | 2 | 6.32 | | 16.0 | 5.60 | 60 | | G. TOWNSON<br>D. ENGLAND |
| | 1317 | | ✓ | | | | | | | ✓ | | | | 17.5 | 6.00 | 70 | | |
| | 1319 | | ✓ | | | | | | | ✓ | | | | 17.0 | 6.02 | 60 | | |
| | 1321 | | ✓ | | | | | | | ✓ | | | | 17.0 | 5.95 | 60 | | |
| | 1322 | | ✓ | | | | | | | ✓ | | | | 17.0 | 6.14 | 60 | | |
| | 1324 | | ✓ | | | | | | | ✓ | | | | 17.0 | 6.25 | 60 | | |
| | 1326 | | ✓ | | | | | | | ✓ | | | | 17.0 | 6.21 | 60 | | |
| | 1328 | | ✓ | | | | | | | ✓ | | | | 17.0 | 6.19 | 60 | | |
| | 1330 | | ✓ | 10.42 | 15.7 | | | | | ✓ | | | 50 gal | 17.0 | 6.20 | 60 | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |

Location: FORT STORY

Site #: 5

Well #: MW 114B

# Monitoring Well Development Photographs

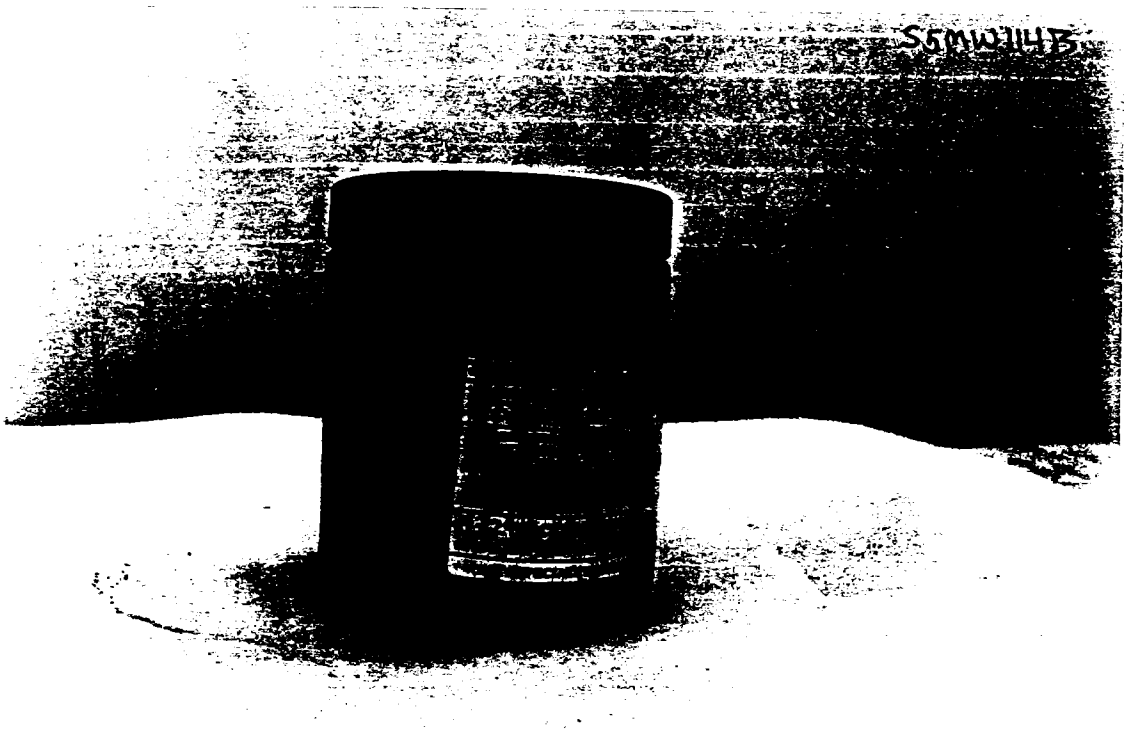
Fort Story, Virginia

Site Number: 5
Well Number: MW-113A

Site Number: 5
Well Number: MW-113B

Fort Story, Virginia

Site Number: 5
Well Number: MW-114A




Site Number: 5
Well Number: MW-114B

# In Situ Permeability Data

RAW DATA

WELL # S5MW113A

WELL DIAMETER= 8.25 INCHES
CASING DIAMETER= 2.00 INCHES
VOLUME OF WATER= .28 GALLONS
LENGTH OF AQUIFER TESTED= 20.00 FEET
VALUE OF H0= 1.72 FEET
STATIC WATER LEVEL= 7.11 FEET
LENGTH OF SCREEN= 10.00 FEET
WATER TABLE TO BOTTOM OF WELL= 7.99 FEET

SLUG TEST DATA:

| TIME | WATER LEVEL (FEET) | TIME SINCE TEST BEGAN (MINUTES) |
|---|---|---|
| 8.51. 3 | 7.76 | .05 |
| 8.51. 4 | 7.40 | .07 |
| 8.51. 5 | 7.27 | .08 |
| 8.51. 6 | 7.21 | .10 |
| 8.51. 7 | 7.18 | .12 |
| 8.51. 8 | 7.16 | .13 |
| 8.51. 9 | 7.16 | .15 |
| 8.51.10 | 7.15 | .17 |
| 8.51.11 | 7.15 | .18 |
| 8.51.12 | 7.14 | .20 |
| 8.51.13 | 7.14 | .22 |
| 8.51.14 | 7.14 | .23 |
| 8.51.15 | 7.13 | .25 |
| 8.51.16 | 7.13 | .27 |
| 8.51.17 | 7.13 | .28 |
| 8.51.22 | 7.12 | .37 |
| 8.51.27 | 7.12 | .45 |
| 8.51.32 | 7.12 | .53 |

WELL # S5MW113A

WELL DIAMETER= 8.25 INCHES
CASING DIAMETER= 2.00 INCHES
VOLUME OF WATER REMOVED OR ADDED TO WELL= .28 GALLONS
LENGTH OF AQUIFER TESTED= 20.00 FEET
VALUE OF HO= 1.72 FEET
STATIC WATER LEVEL= 7.11 FEET

SLUG TEST DATA:

| TIME SINCE TEST BEGAN (MINUTES) | WATER LEVEL (FEET) | DRAWDOWN (FEET) | HEAD RATIO | RECIPROCAL TIME (1/MINUTES) |
|---|---|---|---|---|
| .05 | 7.76 | .65 | .379 | 20.000 |
| .07 | 7.40 | .29 | .169 | 15.000 |
| .08 | 7.27 | .16 | .093 | 12.000 |
| .10 | 7.21 | .10 | .058 | 10.000 |
| .12 | 7.18 | .07 | .041 | 8.571 |
| .13 | 7.16 | .05 | .029 | 7.500 |
| .15 | 7.16 | .05 | .029 | 6.667 |
| .17 | 7.15 | .04 | .023 | 6.000 |
| .18 | 7.15 | .04 | .023 | 5.455 |
| .20 | 7.14 | .03 | .017 | 5.000 |
| .22 | 7.14 | .03 | .017 | 4.615 |
| .23 | 7.14 | .03 | .017 | 4.286 |
| .25 | 7.13 | .02 | .012 | 4.000 |
| .27 | 7.13 | .02 | .012 | 3.750 |
| .28 | 7.13 | .02 | .012 | 3.529 |
| .37 | 7.12 | .01 | .006 | 2.727 |
| .45 | 7.12 | .01 | .006 | 2.222 |
| .53 | 7.12 | .01 | .006 | 1.875 |

10:37:37.71 SITE 5, UNDERGROUND FUEL STORAGE AREA, WELL S5MW1 FRI 05-25-1990

WELL # S5MW113A

---

PERMEABILITY BASED ON COOPER, BREDEHOEFT, AND PAPADOPULOS METHOD

PERMEABILITY=1.76E-04/ MATCH TIME (IN MINUTES)
STORAGE COEF= 5.88E-02* ALPHA
COMPUTER CALCULATES
ALPHA=1.00E-05 MATCH TIME= 7.59E-03
PERMEABILITY= 2.33E-02 CM/SEC
STORAGE COEF=5.88E-07
CORRELATION NUMBER= .99

---

PERMEABILITY BASED ON REGRESSION FIT OF HEAD RATIO DATA

HVORSLEV PERMEABILITY=3.58E-04 / LAG TIME
BOUWER PERMEABILTY=8.89E-04 * -SLOPE

COMPUTER CALCULATES
PERMEABILITY VARIES MORE THAN 20% DEPENDING ON THEEQUATION USED

FOR X ON Y: HVORSLEV PERMEABILITY=1.50E-02 CM/SEC
BOUWER PERMEABILITY=7.76E-03CM/SEC
FOR Y ON X: HVORSLEV PERMEABILITY=1.04E-02 CM/SEC
BOUWER PERMEABILITY=8.78E-03 CM/SEC
AVERAGE HVORSLEV PERMEABILITY=1.23E-02 CM/SEC
AVERAGE BOUWER PERMEABILITY=8.27E-03 CM/SEC
REGRESSION STATISTICS
X ON Y
INTERCEPT= -.22
SLOPE= -8.7
Y ON X
INTERCEPT= -.09
SLOPE= -9.9
CORRELATION COEFFICIENT= -.94
CALCULATIONS INDICATE THAT A VALUE OF 3.91 FEET FOR HO
OR A VALUE OF 1.324 INCHES FOR EFFECTIVE CASING DIA.
MAY YIELD BETTER RESULTS

---

PERMEABILITY BASED ON REGRESSION FIT OF DATA - FERRIS & KNOWLES METHOD

INSUFFICIENT DATA POINTS WITH RECIPROCAL TIMES LESS THAN .300
NUMBER OF USABLE DATA POINTS= 0

10:37:46.09 SITE 5, UNDERGROUND FUEL STORAGE AREA, WELL S5MW1 FRI 05-25-1990

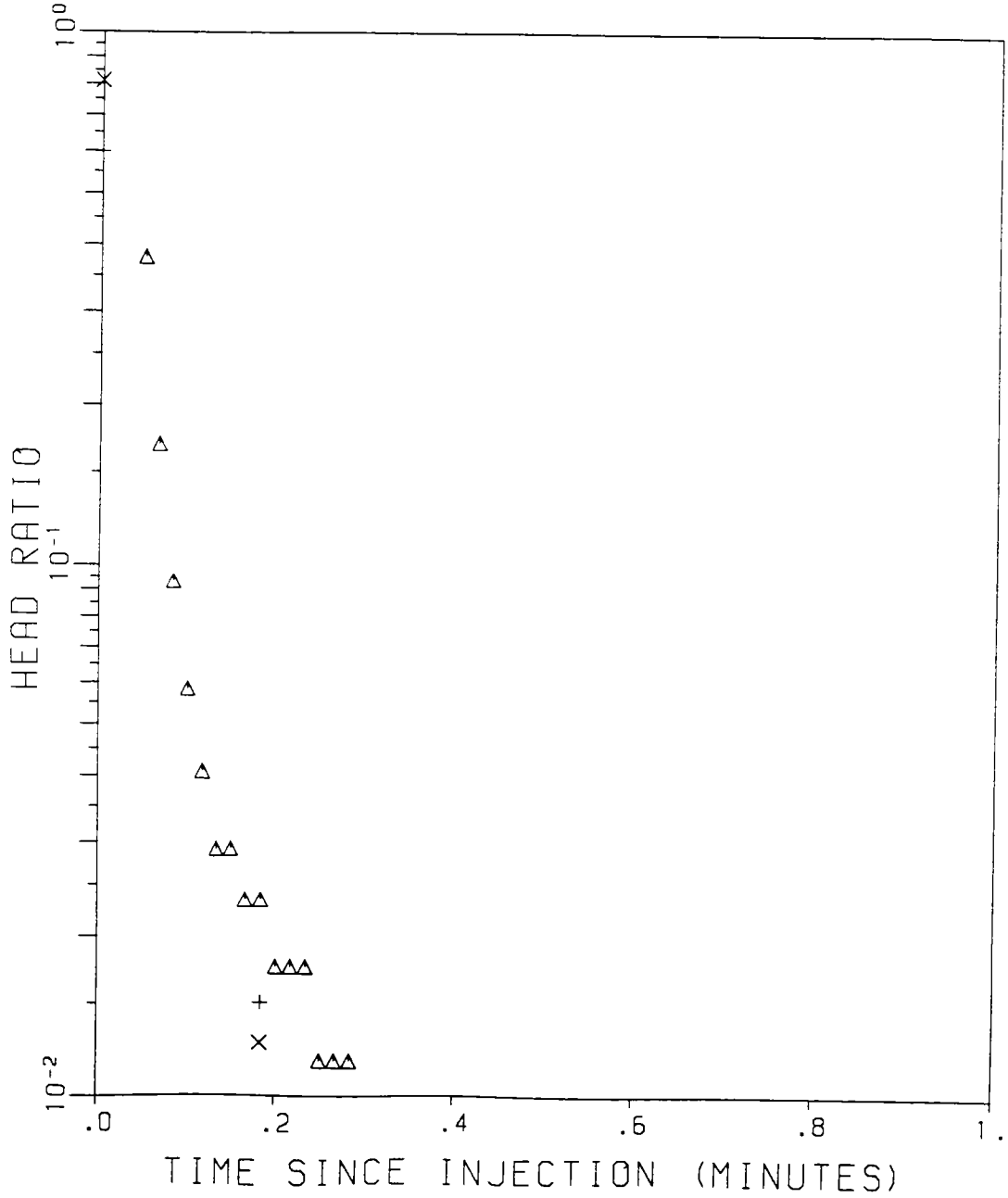
| WELL # | PERMEABILITY METHOD 1 | PERMEABILITY METHOD 2 | STORAGE COEF METHOD 2 | PERMEABILITY METHOD 3 | PERMEABILITY METHOD 4 |
|---|---|---|---|---|---|
| S5MW113A | 1.23E-02 | 2.33E-02 | 5.88E-07 | .00 | 8.27E-03 |

* METHOD 1 IS HVORSLEV
METHOD 2 IS COOPER, BREDEHOEFT, AND PAPADOPULOS
METHOD 3 IS FERRIS AND KNOWLES
METHOD 4 IS BOUWER

SITE 5. UNDERGROUND FUEL STORAGE AREA. WELL S5MW1

WED 10-31-1990

13:18:33.43




SLUG TEST OF WELL S5MW113A

LOG HEAD RATIO VS TIME

RAW DATA

WELL # S5MW113B

WELL DIAMETER= 8.25 INCHES
CASING DIAMETER= 2.00 INCHES
VOLUME OF WATER= .28 GALLONS
LENGTH OF AQUIFER TESTED= 20.00 FEET
VALUE OF HO= 1.72 FEET
STATIC WATER LEVEL= 4.44 FEET
LENGTH OF SCREEN= 10.00 FEET
WATER TABLE TO BOTTOM OF WELL= 7.65 FEET

SLUG TEST DATA:

| TIME | WATER LEVEL (FEET) | TIME SINCE TEST BEGAN (MINUTES) |
|---|---|---|
| 9.28. 2 | 4.97 | .04 |
| 9.28. 3 | 4.69 | .06 |
| 9.28. 4 | 4.57 | .07 |
| 9.28. 5 | 4.51 | .09 |
| 9.28. 6 | 4.49 | .11 |
| 9.28. 7 | 4.47 | .12 |
| 9.28. 8 | 4.47 | .14 |
| 9.28. 9 | 4.46 | .16 |
| 9.28.10 | 4.46 | .17 |
| 9.28.11 | 4.45 | .19 |
| 9.28.12 | 4.45 | .21 |
| 9.28.13 | 4.45 | .22 |
| 9.28.14 | 4.45 | .24 |
| 9.28.15 | 4.45 | .26 |
| 9.28.16 | 4.45 | .27 |
| 9.28.17 | 4.45 | .29 |
| 9.28.18 | 4.45 | .31 |
| 9.28.19 | 4.44 | .32 |
| 9.28.24 | 4.44 | .41 |
| 9.28.29 | 4.44 | .49 |
| 9.28.34 | 4.44 | .57 |

WELL # S5MW113B

WELL DIAMETER= 8.25 INCHES
CASING DIAMETER= 2.00 INCHES
VOLUME OF WATER REMOVED OR ADDED TO WELL= .28 GALLONS
LENGTH OF AQUIFER TESTED= 20.00 FEET
VALUE OF H0= 1.72 FEET
STATIC WATER LEVEL= 4.44 FEET

SLUG TEST DATA:

| TIME SINCE TEST BEGAN (MINUTES) | WATER LEVEL (FEET) | DRAWDOWN (FEET) | HEAD RATIO | RECIPROCAL TIME (1/MINUTES) |
|---|---|---|---|---|
| .04 | 4.97 | .53 | .309 | 24.896 |
| .06 | 4.69 | .25 | .146 | 17.647 |
| .07 | 4.57 | .13 | .076 | 13.636 |
| .09 | 4.51 | .07 | .041 | 11.091 |
| .11 | 4.49 | .05 | .029 | 9.375 |
| .12 | 4.47 | .03 | .017 | 8.108 |
| .14 | 4.47 | .03 | .017 | 7.134 |
| .16 | 4.46 | .02 | .012 | 6.383 |
| .17 | 4.46 | .02 | .012 | 5.769 |
| .19 | 4.45 | .01 | .006 | 5.259 |
| .21 | 4.45 | .01 | .006 | 4.839 |
| .22 | 4.45 | .01 | .006 | 4.478 |
| .24 | 4.45 | .01 | .006 | 4.164 |
| .26 | 4.45 | .01 | .006 | 3.896 |
| .27 | 4.45 | .01 | .006 | 3.659 |
| .29 | 4.45 | .01 | .006 | 3.446 |
| .31 | 4.45 | .01 | .006 | 3.261 |
| .32 | 4.44 | .00 | .000 | 3.093 |
| .41 | 4.44 | .00 | .000 | 2.458 |
| .49 | 4.44 | .00 | .000 | 2.040 |
| .57 | 4.44 | .00 | .000 | 1.744 |

10:50:10.53 SITE 5. UNDERGROUND FUEL STORAGE AREA. WELL S5MW1 FRI 05-25-1990

WELL # S5MW113B

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PERMEABILITY BASED ON COOPER. BREDEHOEFT. AND PAPADOPULOS METHOD

PERMEABILITY=1.76E-04/ MATCH TIME (IN MINUTES)
STORAGE COEF= 5.88E-02* ALPHA
COMPUTER CALCULATES
ALPHA=1.00E-05 MATCH TIME= 6.29E-03
PERMEABILITY= 2.80E-02 CM/SEC
STORAGE COEF=5.88E-07
CORRELATION NUMBER= .99

---

PERMEABILITY BASED ON REGRESSION FIT OF HEAD RATIO DATA

HVORSLEV PERMEABILITY=3.58E-04 / LAG TIME
BOUWER PERMEABILTY=8.79E-04 * -SLOPE

COMPUTER CALCULATES
HVORSLEV PERMEABILITY=1.11E-02 CM/SEC
BOUWER PERMEABILITY=1.39E-02 CM/SEC
REGRESSION STATISTICS
X ON Y
INTERCEPT= .07
SLOPE= -16.
Y ON X
INTERCEPT= .09
SLOPE= -16.
CORRELATION COEFFICIENT= -.99
CALCULATIONS INDICATE THAT A VALUE OF 2.58 FEET FOR HO
OR A VALUE OF 1.630 INCHES FOR EFFECTIVE CASING DIA.
MAY YIELD BETTER RESULTS

---

PERMEABILITY BASED ON REGRESSION FIT OF DATA - FERRIS & KNOWLES METHOD

INSUFFICIENT DATA POINTS WITH RECIPROCAL TIMES LESS THAN .300
NUMBER OF USABLE DATA POINTS= 0

10:50:13.37 SITE 5, UNDERGROUND FUEL STORAGE AREA, WELL S5MW1 FRI 05-25-1990

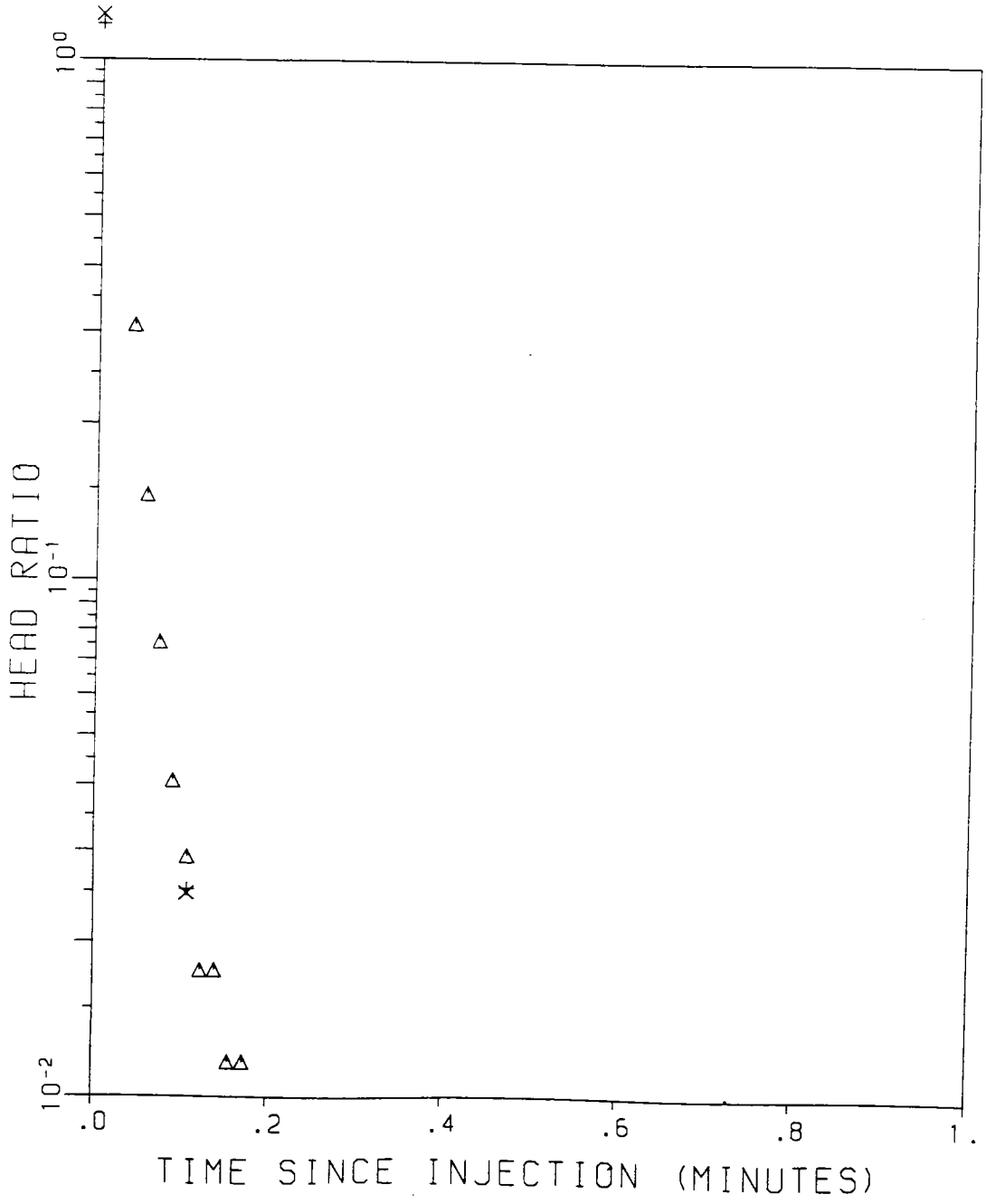
| WELL # | PERMEABILITY METHOD 1 | PERMEABILITY METHOD 2 | STORAGE COEF METHOD 2 | PERMEABILITY METHOD 3 | PERMEABILITY METHOD 4 |
|---|---|---|---|---|---|
| S5MW113B | 1.11E-02 | 2.80E-02 | 5.88E-07 | .00 | 1.39E-02 |

* METHOD 1 IS HVORSLEV
METHOD 2 IS COOPER, BREDEHOEFT, AND PAPADOPULOS
METHOD 3 IS FERRIS AND KNOWLES
METHOD 4 IS BOUWER

SITE 5. UNDERGROUND FUEL STORAGE AREA. WELL S5MW1

WED 10-31-1990

13:23:01.74




SLUG TEST OF WELL S5MW113B

LOG HEAD RATIO VS TIME

RAW DATA

WELL # S5MW114A

WELL DIAMETER= 8.25 INCHES
CASING DIAMETER= 2.00 INCHES
VOLUME OF WATER= .14 GALLONS
LENGTH OF AQUIFER TESTED= 20.00 FEET
VALUE OF H0= .22 FEET
STATIC WATER LEVEL= 10.71 FEET
LENGTH OF SCREEN= 10.00 FEET
WATER TABLE TO BOTTOM OF WELL= 6.96 FEET

SLUG TEST DATA:

| TIME | WATER LEVEL (FEET) | TIME SINCE TEST BEGAN (MINUTES) |
|---|---|---|
| 8.21. 4 | 10.78 | .07 |
| 8.21. 5 | 10.76 | .09 |
| 8.21. 6 | 10.75 | .10 |
| 8.21. 7 | 10.74 | .12 |

WELL # S5MW114A

WELL DIAMETER= 8.25 INCHES
CASING DIAMETER= 2.00 INCHES
VOLUME OF WATER REMOVED OR ADDED TO WELL= .14 GALLONS
LENGTH OF AQUIFER TESTED= 20.00 FEET
VALUE OF H0= .22 FEET
STATIC WATER LEVEL= 10.71 FEET

SLUG TEST DATA:

| TIME SINCE TEST BEGAN (MINUTES) | WATER LEVEL (FEET) | DRAWDOWN (FEET) | HEAD RATIO | RECIPROCAL TIME (1/MINUTES) |
|---|---|---|---|---|
| .07 | 10.78 | .07 | .318 | 14.286 |
| .09 | 10.76 | .05 | .227 | 11.538 |
| .10 | 10.75 | .04 | .182 | 9.677 |
| .12 | 10.74 | .03 | .136 | 8.333 |

09:23:03.93 SITE 5, UNDERGROUND FUEL STORAGE AREA. WELL S5MW1 SAT 05-26-1990

WELL # S5MW114A

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PERMEABILITY BASED ON COOPER, BREDEHOEFT, AND PAPADOPULOS METHOD

PERMEABILITY=1.76E-04/ MATCH TIME (IN MINUTES)
STORAGE COEF= 5.88E-02* ALPHA
COMPUTER CALCULATES
ALPHA=1.00E-05 MATCH TIME= 1.60E-02
PERMEABILITY= 1.10E-02 CM/SEC
STORAGE COEF=5.88E-07
CORRELATION NUMBER= 1.00

---

PERMEABILITY BASED ON REGRESSION FIT OF HEAD RATIO DATA

HVORSLEV PERMEABILITY=3.58E-04 / LAG TIME
BOUWER PERMEABILTY=8.59E-04 * -SLOPE

COMPUTER CALCULATES
HVORSLEV PERMEABILITY=6.00E-03 CM/SEC
BOUWER PERMEABILITY=6.20E-03 CM/SEC
REGRESSION STATISTICS
X ON Y
INTERCEPT= -.00
SLOPE= -7.2
Y ON X
INTERCEPT= .00
SLOPE= -7.2
CORRELATION COEFFICIENT=-1.00
CALCULATIONS INDICATE THAT A VALUE OF .22 FEET FOR HO
OR A VALUE OF 2.000 INCHES FOR EFFECTIVE CASING DIA.
MAY YIELD BETTER RESULTS

---

PERMEABILITY BASED ON REGRESSION FIT OF DATA - FERRIS & KNOWLES METHOD

INSUFFICIENT DATA POINTS WITH RECIPROCAL TIMES LESS THAN .300
NUMBER OF USABLE DATA POINTS= 0

09:23:08.87 SITE 5, UNDERGROUND FUEL STORAGE AREA, WELL S5MW1 SAT 05-26-1990

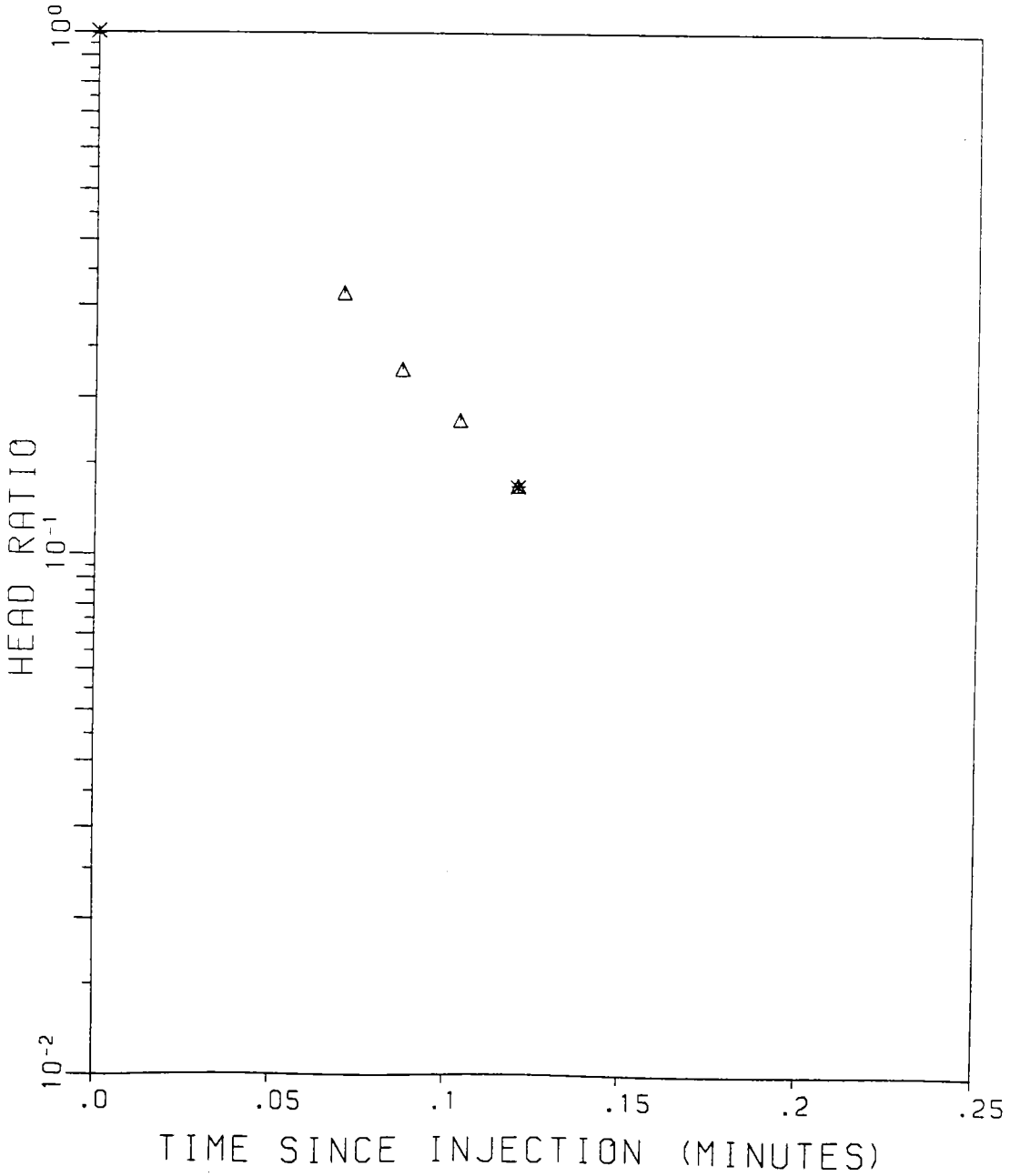
| WELL # | PERMEABILITY METHOD 1 | PERMEABILITY METHOD 2 | STORAGE COEF METHOD 2 | PERMEABILITY METHOD 3 | PERMEABILITY METHOD 4 |
|---|---|---|---|---|---|
| S5MW114A | 6.00E-03 | 1.10E-02 | 5.88E-07 | .00 | 6.20E-03 |

* METHOD 1 IS HVORSLEV
METHOD 2 IS COOPER, BREDEHOEFT, AND PAPADOPULOS
METHOD 3 IS FERRIS AND KNOWLES
METHOD 4 IS BOUWER

SITE 5. UNDERGROUND FUEL STORAGE AREA. WELL S5MW1

WED 10-31-1990

13:27:12.31




SLUG TEST OF WELL S5MW114A

LOG HEAD RATIO VS TIME

09:40:14.12 SITE 5. UNDERGROUND FUEL STORAGE AREA. WELL S5MW1 SAT 05-26-1990

RAW DATA

WELL # S5MW114B

WELL DIAMETER= 8.25 INCHES
CASING DIAMETER= 2.00 INCHES
VOLUME OF WATER= .28 GALLONS
LENGTH OF AQUIFER TESTED= 20.00 FEET
VALUE OF H0= 1.72 FEET
STATIC WATER LEVEL= 8.89 FEET
LENGTH OF SCREEN= 10.00 FEET
WATER TABLE TO BOTTOM OF WELL= 8.89 FEET

SLUG TEST DATA:

| TIME | WATER LEVEL (FEET) | TIME SINCE TEST BEGAN (MINUTES) |
|---|---|---|
| 10.11. 2 | 9.52 | .03 |
| 10.11. 3 | 9.13 | .05 |
| 10.11. 4 | 8.99 | .07 |
| 10.11. 5 | 8.94 | .08 |
| 10.11. 6 | 8.92 | .10 |
| 10.11. 7 | 8.91 | .12 |
| 10.11. 8 | 8.90 | .13 |
| 10.11. 9 | 8.90 | .15 |
| 10.11.10 | 8.89 | .17 |
| 10.11.11 | 8.89 | .18 |
| 10.11.12 | 8.89 | .20 |

09:40:14.46 SITE 5, UNDERGROUND FUEL STORAGE AREA, WELL S5MW1 SAT 05-26-1990

WELL # S5MW114B

WELL DIAMETER= 8.25 INCHES
CASING DIAMETER= 2.00 INCHES
VOLUME OF WATER REMOVED OR ADDED TO WELL= .28 GALLONS
LENGTH OF AQUIFER TESTED= 20.00 FEET
VALUE OF H0= 1.72 FEET
STATIC WATER LEVEL= 8.89 FEET

SLUG TEST DATA:

| TIME SINCE TEST BEGAN (MINUTES) | WATER LEVEL (FEET) | DRAWDOWN (FEET) | HEAD RATIO | RECIPROCAL TIME (1/MINUTES) |
|---|---|---|---|---|
| .03 | 9.52 | .63 | .367 | 30.000 |
| .05 | 9.13 | .24 | .140 | 20.000 |
| .07 | 8.99 | .10 | .058 | 15.000 |
| .08 | 8.94 | .05 | .029 | 12.000 |
| .10 | 8.92 | .03 | .017 | 10.000 |
| .12 | 8.91 | .02 | .012 | 8.571 |
| .13 | 8.90 | .01 | .006 | 7.500 |
| .15 | 8.90 | .01 | .006 | 6.667 |
| .17 | 8.89 | .00 | .000 | 6.000 |
| .18 | 8.89 | .00 | .000 | 5.455 |
| .20 | 8.89 | .00 | .000 | 5.000 |

09:40:14.71 SITE 5, UNDERGROUND FUEL STORAGE AREA, WELL S5MW1 SAT 05-26-1990

WELL # S5MW114B

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PERMEABILITY BASED ON COOPER, BREDEHOEFT, AND PAPADOPULOS METHOD

PERMEABILITY=1.76E-04/ MATCH TIME (IN MINUTES)
STORAGE COEF= 5.88E-02* ALPHA
COMPUTER CALCULATES
ALPHA=1.00E-05 MATCH TIME= 4.55E-03
PERMEABILITY= 3.88E-02 CM/SEC
STORAGE COEF=5.88E-07
CORRELATION NUMBER= .98

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PERMEABILITY BASED ON REGRESSION FIT OF HEAD RATIO DATA

HVORSLEV PERMEABILITY=3.58E-04 / LAG TIME
BOUWER PERMEABILTY=9.12E-04 * -SLOPE

COMPUTER CALCULATES
HVORSLEV PERMEABILITY=1.12E-02 CM/SEC
BOUWER PERMEABILITY=2.02E-02 CM/SEC
REGRESSION STATISTICS
X ON Y
INTERCEPT= .27
SLOPE= -22.
Y ON X
INTERCEPT= .28
SLOPE= -22.
CORRELATION COEFFICIENT=-1.00
CALCULATIONS INDICATE THAT A VALUE OF 3.25 FEET FOR H0
OR A VALUE OF 1.454 INCHES FOR EFFECTIVE CASING DIA.
MAY YIELD BETTER RESULTS

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PERMEABILITY BASED ON REGRESSION FIT OF DATA - FERRIS & KNOWLES METHOD

INSUFFICIENT DATA POINTS WITH RECIPROCAL TIMES LESS THAN .300
NUMBER OF USABLE DATA POINTS= 0

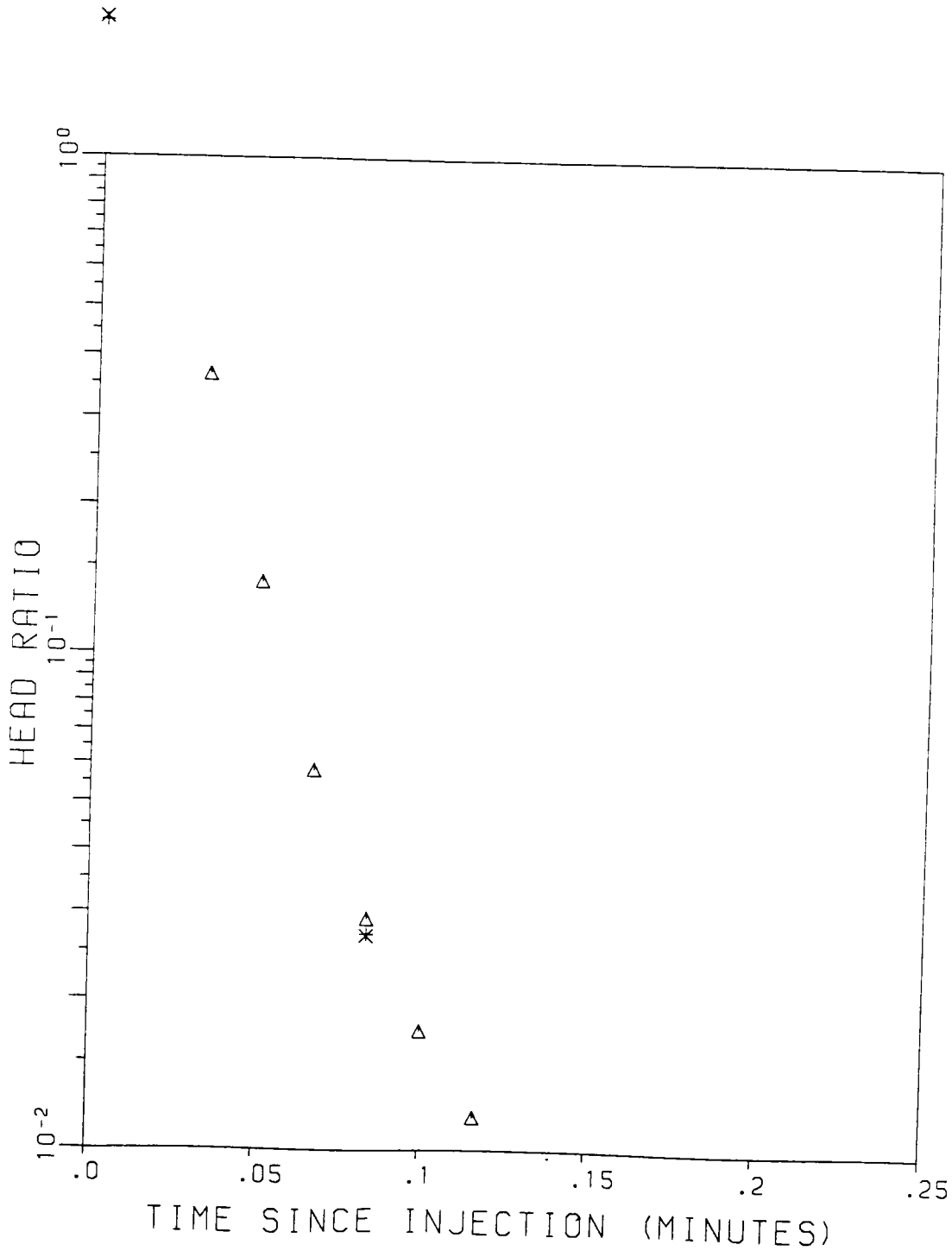
09:40:17.25 SITE 5, UNDERGROUND FUEL STORAGE AREA, WELL S5MW1 SAT 05-26-1990

| WELL # | PERMEABILITY METHOD 1 | PERMEABILITY METHOD 2 | STORAGE COEF METHOD 2 | PERMEABILITY METHOD 3 | PERMEABILITY METHOD 4 |
|---|---|---|---|---|---|
| S5MW114B | 1.12E-02 | 3.88E-02 | 5.88E-07 | .00 | 2.02E-02 |

* METHOD 1 IS HVORSLEV
METHOD 2 IS COOPER, BREDEHOEFT, AND PAPADOPULOS
METHOD 3 IS FERRIS AND KNOWLES
METHOD 4 IS BOUWER

SITE 5. UNDERGROUND FUEL STORAGE AREA. WELL S5MW1
WED 10-31-1990

13:31:18.87




SLUG TEST OF WELL S5MW114B
LOG HEAD RATIO VS TIME

# Groundwater Sampling Logs

MW 3A

# GROUNDWATER SAMPLING LOG

## FORT STORY



CLIENT USACE
SITE 5
WELL NUMBER MW 113A
JOB NUMBER 1868.0460

TOTAL WELL DEPTH 16.0
WELL DIAMETER 2"
BOREHOLE DIAMETER 8 3/4"

MIN NUMBER WELL VOL TO BE PURGED 3
VOL PER VERTICAL FT CASING (GAL) .95
VOL PER FT BOREHOLE (LESS CASING)(GAL)

STATIC WATER LEVEL (FT) 7.5
STANDING WATER COLUMN (FT) 8.5

AMT ONE WELL VOL (GAL) 8.8
TOTAL GAL TO BE PURGED 26.4

PURGING SYSTEM TEFLON BAILER
SAMPLING SYSTEM TEFLON BAILER

| DATE | TIME | AMOUNT PURGED (GAL) | EC | FIELD PARAMETERS MEASURED pH | TEMP | TURBIDITY | PID | | | COMMENTS | SAMPLER |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 6-9 | 1658 | 0 | 70 | 5.92 | 16.0 | | | | | Clear - TRACE SED | MDS/EJD |
| " | 0701 | 5 | 90 | 5.77 | 15.0 | | | | | Brown 0% SED | MDS/EJD |
| " | 0703 | 10 | 90 | 5.73 | 15.1 | | | | | Brown - 0% SED | MDS/EJD |
| " | 0706 | 15 | 90 | 5.70 | 15.6 | | | | | Brown - 0% SED | MDS/EJD |
| " | 0709 | 20 | / | / | / | | | | | N/A | MDS/EJD |
| " | 0711 | 25 | / | / | / | | | | | N/A | MDS/EJD |
| " | 0714 | 30 | 100 | 5.56 | 15.2 | | | | | Brown - 0% SED | MDS/EJD |
| " | | | / | / | / | | | | | N/A | MDS/EJD |
| " | | | | | | | | | | | |
| " | | | | | | | | | | | |
| " | | | | | | | | | | | |
| FINAL READING | 0735 | 6* | 120 | 5.48 | 15.0 | 522.8 | 0.0 | | | Brown 0% SED | MDS/EJD |

NOTES: Pump Rate 2.5 gl/min

TURBIDITY: 50x50x130.7

# GROUNDWATER SAMPLING LOG

## FORT STORY



CLIENT USACE
SITE 5
WELL NUMBER MW 113B
JOB NUMBER 1868.

TOTAL WELL DEPTH 12.5
WELL DIAMETER 2"
BOREHOLE DIAMETER 8 3/4"

MIN NUMBER WELL VOL TO BE PURGED 3
VOL PER VERTICAL FT CASING (GAL) .95
VOL PER FT BOREHOLE (LESS CASING)(GAL)

STATIC WATER LEVEL (FT) 5.0
STANDING WATER COLUMN (FT) 7.5

AMT ONE WELL VOL (GAL) 7.1
TOTAL GAL TO BE PURGED 21.3

PURGING SYSTEM TEFLON BAILER
SAMPLING SYSTEM TEFLON BAILER

| DATE | TIME | AMOUNT PURGED (GAL) | EC | FIELD PARAMETERS MEASURED pH | TEMP | TURBIDITY | PID | | | COMMENTS | SAMPLER |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 6-5 | 0806 | 0 | 280 | 6.42 | 18.1 | | | | | Clear no sed | MDS/EJD |
| " | 0808 | 5 | 200 | 6.34 | 18.0 | | | | | Brown no sed | MDS/EJD |
| " | 0811 | 10 | 240 | 6.32 | 17.5 | | | | | Brown no sed | MDS/EJD |
| " | 0814 | 15 | 250 | 6.26 | 16.0 | | | | | Brown no sed | MDS/EJD |
| " | 0817 | 20 | | | | | | | | N/A | MDS/EJD |
| " | 0820 | 25 | 160 | 6.23 | 16.1 | | | | | Brown no sed | MDS/EJD |
| " | | | | | | | | | | N/A | MDS/EJD |
| " | | | | | | | | | | N/A | MDS/EJD |
| " | | | | | | | | | | | |
| " | | | | | | | | | | | |
| FINAL READING | 0845 | 6* | 100 | 6.24 | 16.0 | 1190.4 | 0.0 | | | Brown no sed | MDS/EJD |

NOTES:

TURBIDITY: 148.8

MW 11 4

# GROUNDWATER SAMPLING LOG

## FORT STORY



CLIENT USACE
SITE 5
WELL NUMBER MW 114A
JOB NUMBER 1868.0901

TOTAL WELL DEPTH 18.0
WELL DIAMETER 2"
BOREHOLE DIAMETER 8 3/4"

MIN NUMBER WELL VOL TO BE PURGED 3
VOL PER VERTICAL FT CASING (GAL) .95
VOL PER FT BOREHOLE (LESS CASING)(GAL)

STATIC WATER LEVEL (FT) 11.2
STANDING WATER COLUMN (FT) 6.8

AMT ONE WELL VOL (GAL) 6.5
TOTAL GAL TO BE PURGED 19.5

PURGING SYSTEM TEFLON BAILER
SAMPLING SYSTEM TEFLON BAILER

| DATE | TIME | AMOUNT PURGED (GAL) | EC | pH | TEMP | TURBIDITY | PID | | | COMMENTS | SAMPLER |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | FIELD PARAMETERS MEASURED | | | | | | | | |
| 6-5 | 0900 | 0 | 180 | 5.96 | 19.6 | | | | | No Clear Sen | MDS/EJD |
| " | 0903 | 5 | 190 | 5.71 | 19.2 | | | | | Clear No Sen | MDS/EJD |
| " | 0906 | 10 | 180 | 5.62 | 18.7 | | | | | Clear - Brown No Sen | MDS/EJD |
| " | 0908 | 15 | 190 | 5.6 | 18.0 | | | | | Brown No - Sen | MDS/EJD |
| " | 0910 | 20 | 180 | 5.58 | 18.0 | | | | | Brown - No Sen | MDS/EJD |
| " | 0913 | ~~AB~~ | | | | | | | | N/A | MDS/EJD |
| " | | | | | | | | | | N/A | MDS/EJD |
| " | | | | | | | | | | N/A | MDS/EJD |
| " | | | | | | | | | | | |
| " | | | | | | | | | | | |
| " | | | | | | | | | | | |
| FINAL READING | 1000 | 6* | 185 | 5.57 | 18.0 | ~~188.8~~ | 4.0 | | | BROWN No Sen | MDS/EJD |

NOTES:

No Wood Cap

TURBIDITY: 50 x 50 x 61.1

# GROUNDWATER SAMPLING LOG
## FORT STORY



CLIENT USACE
SITE 5
WELL NUMBER MW 114B
JOB NUMBER 1868.040

TOTAL WELL DEPTH 16.0
WELL DIAMETER 2"
BOREHOLE DIAMETER 8 3/4"

MIN NUMBER WELL VOL TO BE PURGED 3
VOL PER VERTICAL FT CASING (GAL) .95
VOL PER FT BOREHOLE (LESS CASING)(GAL)

STATIC WATER LEVEL (FT) 9.3
STANDING WATER COLUMN (FT) 6.7

AMT ONE WELL VOL (GAL) 6.4
TOTAL GAL TO BE PURGED 19.1

PURGING SYSTEM TEFLON BAILER
SAMPLING SYSTEM TEFLON BAILER

| DATE | TIME | AMOUNT PURGED (GAL) | EC | pH | TEMP | TURBIDITY | PID | | | COMMENTS | SAMPLER |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | FIELD PARAMETERS MEASURED | | | | | | | |
| 6-5-90 | 0619 | 0 | 50 | 5.61 | 15.0 | | | | | Sp. Sed Brown - Clear | MDS/EJD |
| " | 0622 | 5 | 50 | 5.63 | 15.5 | | | | | Brown - No Sed | MDS/EJD |
| " | 0625 | 10 | 50 | 5.65 | 15.1 | | | | | Brown - No Sed | MDS/EJD |
| " | 0626 | 15 | 60 | 5.60 | 15.9 | | | | | Brown - No Sed | MDS/EJD |
| " | 0629 | 20 | | | | | | | | N/A | MDS/EJD |
| " | 0631 | 25 | 60 | 5.50 | 15.7 | | | | | Brown - No Sed | MDS/EJD |
| " | | | | | | | | | | N/A | MDS/EJD |
| " | | | | | | | | | | N/A | MDS/EJD |
| " | | | | | | | | | | | |
| " | | | | | | | | | | | |
| " | | | | | | | | | | | |
| FINAL READING | 0646 | 6* | 50 | 5.42 | 15.0 | 470.4 | 6.4 | | | Brown No Sed | MDS/EJD |

NOTES:

Purge Rate 2.5 g/min

12/26/25/10

TURBIDITY: 50 x 50 x 50 x 58.8