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CH-1153 REV. 9-80

DUPONT PLANT SITE

YE



E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
NIAGARA FALLS, N.Y. 14302

cc: Y. Erk - DEC (Buf)
M. L. Doster - DEC (Buf)
C. P. Allen - DEC
M. Hopkins - NCHD

CHEMICALS AND PIGMENTS DEPARTMENT

August 18, 1988

John S. Tygert
NYS Dept. of
Environmental Conservation
Region 9
600 Delaware Avenue
Buffalo, New York 14202-1073

Dear Mr. Tygert:

EFFECTIVENESS OF ADAMS AVE. SEWER SLURRY WALL

Attached, please find three copies of an evaluation of the effectiveness of the Adams Avenue sewer slurry wall. Recommendations contained within this report are in the process of being implemented.

Please call me at (716) 278-5344 if you have any questions.

Regards,

Richard D. Marczewski, P.E.
Area Manager
Waste Treatment

RECORDED
AUG 19 1937
COMMUNICATIONS SECTION

5120 Butler Pike
Plymouth Meeting
Pennsylvania 19462
215-825-3000
Telex 846-343

Woodward-Clyde Consultants

August 11, 1988
88C2075B-1

E. I. du Pont de Nemours and Company
26th Street and Buffalo Avenue
Niagara Falls, New York 14302

Attention: Mr. Rick Marczewski

Re: Effectiveness Evaluation
Adams Avenue Sewer Slurry Wall

Gentlemen:

In response to your request, Woodward-Clyde Consultants (WCC) is pleased to present this evaluation of the effectiveness of the Adams Avenue sewer slurry wall. The slurry wall was installed to decrease the off-plant migration of contaminants from the Du Pont Niagara Plant along the bedding of the active Adams Avenue sewer. This evaluation was performed in response to recent questions posed by the NYSDEC in regards to the slurry wall effectiveness.

If you have any questions or comments regarding this report, please do not hesitate to contact us.

Sincerely,

WOODWARD-CLYDE CONSULTANTS



for Timothy D. Glazar
Senior Staff Geologist



Lynn Rubisch Penniman, CPSS
Project Manager

TDG/LRP/kcs/WM-8K



**EFFECTIVENESS EVALUATION
ADAMS AVENUE SLURRY WALL
NIAGARA PLANT
NIAGARA FALLS, NEW YORK**

Prepared for:

**E.I. DU PONT DE NEMOURS AND COMPANY, INC.
Niagara Falls, New York**

Prepared by:

**WOODWARD-CLYDE CONSULTANTS
Plymouth Meeting, Pennsylvania**

August, 1988

EXECUTIVE SUMMARY

Manmade passageways investigations have been conducted at the Du Pont Niagara Plant to address the potential for movement of contaminants through buried utilities, such as water, sewer or electrical lines. Data from these investigations suggested that the Adams Avenue sewer may have been a pathway for contaminant transport from the site. As a result, a low permeability underground barrier (slurry wall) was constructed across the Adams Avenue sewer line.

Utility wells are located on both sides of the slurry wall and water level data before and after construction of the wall has been tabulated and evaluated. From the information, it appears that groundwater flow in the shotrock backfill has been reduced by the low permeability slurry wall resulting in mitigation of off-plant contaminant transport. Flow in the sewer line itself is considered unlikely since the line was broken and the ends were plugged. Monitoring of groundwater levels and sampling should continue in order to verify that the slurry wall is maintaining its integrity as a hydraulic and contaminant barrier.

TABLE OF CONTENTS

	<u>Page Number</u>
1.0 PREVIOUS INVESTIGATIONS AND DATA ANALYSES	1
2.0 SLURRY WALL DETAILS	2
3.0 EVALUATION OF SLURRY WALL EFFECTIVENESS	2
4.0 RECOMMENDATIONS.	3

LIST OF TABLES

	<u>Table Number</u>
SUMMARY OF DEPTH OF MATERIALS ENCOUNTERED IN TEST PITS	1
SUMMARY OF PERMEABILITY TESTS	2
WATER LEVELS IN NEARBY UTILITY WELLS	3

LIST OF FIGURES

	<u>Figure Number</u>
LOCATION OF ADAMS AVENUE SLURRY WALL.	1
EXCAVATION PROGRESS DIAGRAM	2
AS-BUILT PLAN AND SECTION OF SLURRY WALL	3
GRAIN-SIZE DISTRIBUTION CURVES OF BACKFILL SAMPLES	4

LIST OF APPENDICES

	<u>Appendix</u>
TEST PIT LOGS AND UTILITY WELL CONSTRUCTION DIAGRAMS	A

1.0 PREVIOUS INVESTIGATIONS AND DATA ANALYSES

WCC has prepared two reports: "Manmade Passageways Investigation," (dated February 17, 1984) and "Supplemental Manmade Passageways," (dated October 24, 1984) which addressed the potential for the movement of contaminants through manmade passageways. Manmade passageways are defined as those portions of the subsurface which have been excavated and refilled to accommodate the placement of buried utilities, such as water, sewer, or electrical lines. Exploratory test pits were excavated adjacent to suspect utility lines and soil samples were obtained for chemical analysis. Utility wells were installed in the test pits to permit monitoring and analysis of water flowing in the sewer trench backfill material.

Test pits TP-1 and TP-14 were excavated adjacent to the Adams Avenue sewer. A summary of depths of materials encountered in each pit is presented in Table 1. Utility well U-1 was installed in TP-1 and utility well U-14 was installed in TP-4 (Figure 1). Test pit logs and utility well construction diagrams are presented in Attachment A. The test pit logs indicate that the Adams Avenue sewer trench was cut into rock and appears to have been drilled and shot. The sewer pipe bedding was noted as a silty clay/clayey silt with coarse to fine sand and gravel size rock fragments. The pipe trench backfill was noted as predominantly shot rock and more permeable than the surrounding material. The utility wells were screened in the sewer trench backfill since the higher permeability shot rock backfill would be the preferential pathway for groundwater movement and subsequent contaminant transport.

After the test pit excavations were completed and the utility wells allowed to equilibrate, water levels and groundwater samples were obtained. The groundwater elevations observed in utility wells U-1 and U-14 were lower with respect to the nearby monitoring well 19A. This would indicate a hydraulic gradient towards the sewer trench. Groundwater concentrations of C-1 and C-2 compounds in utility wells samples were about two orders of magnitude greater than in groundwater samples from monitoring well 19A. These data suggested that the Adams Avenue sewer may be a pathway for contaminant transport from the site. As a result of the investigation, Du Pont requested that WCC prepare a report on the construction of a low permeability underground barrier (slurry wall) across the Adams Avenue sewer, west of Chemical Road (Figure 1).

2.0 SLURRY WALL DETAILS

The purpose of the slurry wall was to prevent the migration of contaminants through the sewer and sewer bedding material. Construction of the slurry wall was started on June 2, 1986, and was completed on June 13, 1986. An excavation progress diagram is presented in Figure 2. The slurry wall was constructed by excavating the unconsolidated overburden and sewer backfill and replacing with a soil bentonite backfill. An as-built plan and section of the slurry wall is presented in Figure 3. The backfill was composed of soil from a local borrow source, bentonite, and water to form a slurry. The completed slurry wall is about 35 feet long, ranges in thickness from 8 feet in the sewer trench to 3 feet on top-of-bedrock, and ranges in depth from 7 to 18 feet.

Two samples of the soil-bentonite backfill material were returned to WCC's Plymouth Meeting, Pennsylvania laboratory for permeability testing. The results of the permeability testing with water as the permeant indicated a backfill sample permeability of less than 6.5×10^{-8} cm/sec. The Summary of Permeability Tests is presented in Table 2, with the grain-size distribution of the backfill samples shown on Figure 4.

3.0 EVALUATION OF SLURRY WALL EFFECTIVENESS

Water level data before and after construction of the slurry wall is presented in Table 3. Prior to installation of the slurry wall, a relatively steep hydraulic gradient was noted between the utility wells with groundwater in the trench flowing to the west. After the slurry wall was installed, water levels in the upgradient utility well U-1 remained consistent, however, the downgradient well U-14 was dry. From this information it appears that groundwater flow in the shot rock backfill has been reduced by the low permeability slurry wall resulting in the mitigation of off-plant contaminant transport. Flow in the sewer line itself is considered unlikely since the line was broken and plugged with cinder brick, mortar, and "water plug" cement on both sides of the slurry wall.

4.0 RECOMMENDATIONS

Utility well U-1 was damaged in in the winter of 1987 and has since been inaccessible to sampling crews. WCC recommends that U-1 be repaired in order to complement U-14 in monitoring the effectiveness of the Adams Avenue slurry wall. Utility well U-14 should be checked to verify that the casing is intact and the bottom is clear of any obstructions which may cause a dry well reading. Monitoring of groundwater levels and sampling in U-1 and U-14 should continue in order to verify that the slurry wall is maintaining its integrity as a hydraulic and contaminant barrier.

WM-8K

Tables

TABLE 1

SUMMARY OF DEPTH OF MATERIALS
ENCOUNTERED IN TEST PITS
DU PONT NIAGARA PLANT
NIAGARA FALLS, NEW YORK

<u>Location</u>	<u>Surf. Elev.</u>	<u>Depth Fill (feet)</u>	<u>Depth Clay/Till (feet)</u>	<u>Depth Bedrock (feet, elevation)</u>	<u>Total Depth (feet)</u>	<u>Water Level Below G.S. (feet)</u>	<u>Water Elevation</u>	<u>Bedding Material</u>	<u>Underlying Material</u>
1	569.4	0-1.5	1.5-8.0	8.0(561.4)	14.5	8.5	560.9	Gravelly sandy silty clay under shotrock	Bedrock
14	568.9	0-2.5	2.5-6.0	6.0(562.9)	14.8	12.1	556.8	Gravelly sandy silty clay/ clayey silt under shot rock	Bedrock

TABLE 2

SUMMARY OF PERMEABILITY TEST
 ADAMS AVENUE SLURRY WALL
 DU PONT NIAGARA PLANT
 NIAGARA FALLS, NEW YORK

Test No.	Initial Moisture Content (%)	Dry Unit Weight (pcf)	Initial Degree of Saturation (%)	Confining Stress (TSF)	Final Moisture Content (%)	Final Degree of Saturation (%)	Permeability (cm/sec)
1	66.1	60.8	100.0	0.36	36.5	99.7	6.5×10^{-8}
2	43.7	74.4	92.4	0.36	31.5	100.0	5.8×10^{-8}

TABLE 3
WATER LEVELS
ADAMS AVENUE SLURRY WALL EVALUATION
DU PONT NIAGARA PLANT
NIAGARA FALLS, NEW YORK

<u>Date</u>	<u>Water Level (ft)</u> U-1	<u>Water Elevation (ft)</u> U-1	<u>Water Level (ft)</u> U-14	<u>Water Elevation (ft)</u> U-14
01/23/84	8.5	560.4	U-14 Installed 5/17/84	
05/10/84	7.8	561.1		
06/01/84	ND	ND	11.8	557.2
06/07/84	8.0	560.9	12.9	556.1
06/13/84	ND	ND	12.1	556.8
08/22/84	6.73	562.2	13.4	555.6

SLURRY WALL INSTALLED JUNE 2 THROUGH 13, 1986

06/19/86	6.8	562.1	Dry	<554.4
12/01/86	8.2	560.3	Dry	<554.4
03/27/87	*	*	Dry	<554.4
04/07/87	*	*	Dry	<554.4
05/11/87	*	*	Dry	<554.4
06/09/87	*	*	Dry	<554.4
07/01/87	*	*	Dry	<554.4
08/13/87	*	*	Dry	<554.4
09/02/87	*	*	Dry	<554.4
10/05/87	*	*	Dry	<554.4
11/16/87	*	*	Dry	<554.4
12/07/87	*	*	Dry	<554.4
01/04/88	*	*	Dry	<554.4
02/02/88	*	*	Dry	<554.4
03/03/88	*	*	Dry	<554.4

ND = No data obtained.

* = Well casing bent or buried; no data obtained.

Figures

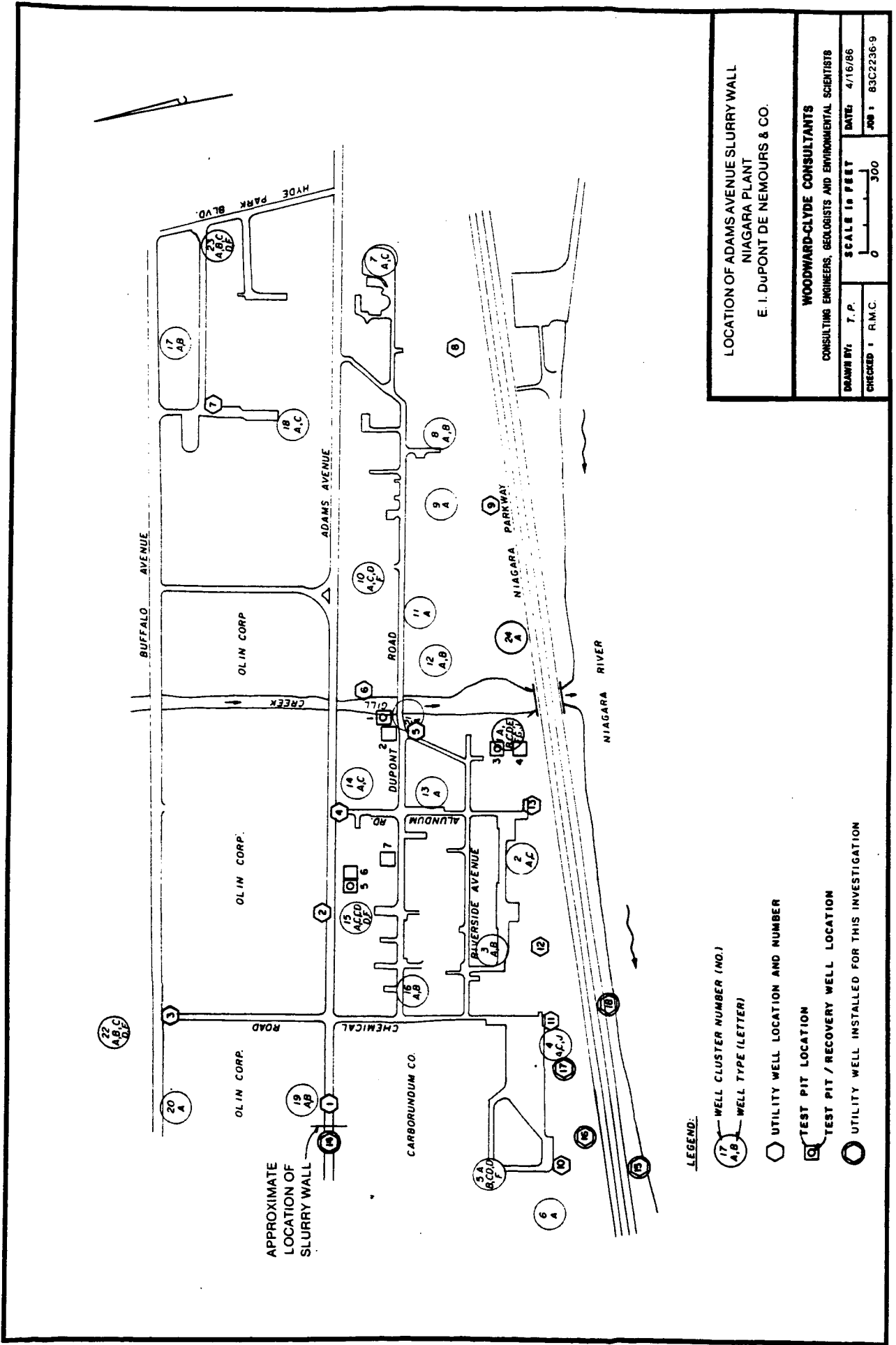
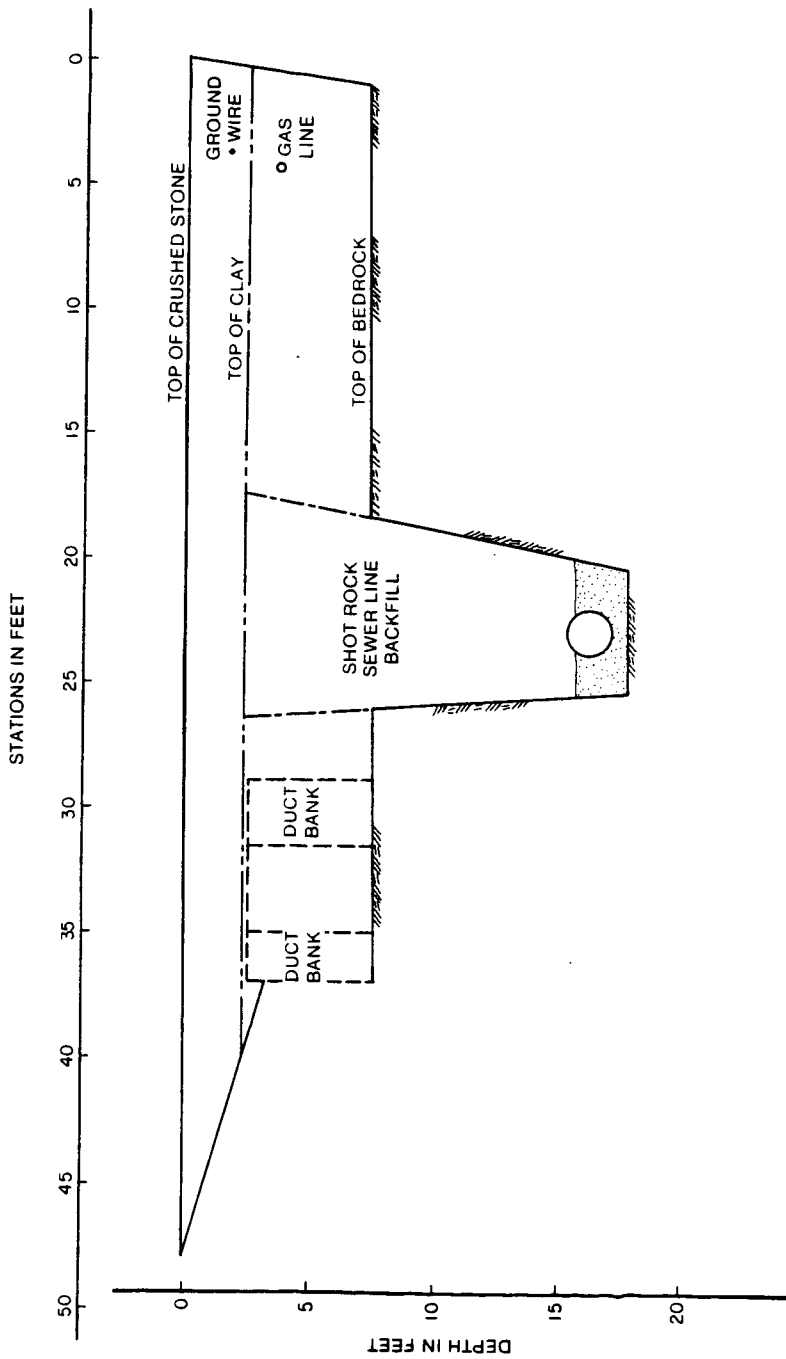


FIGURE 1



EXCAVATION PROGRESS AS OF JUNE 5, 1986
 ADAMS AVE. SEWER SLURRY WALL
 DuPONT - NIAGARA PLANT
 NIAGARA FALLS, NEW YORK

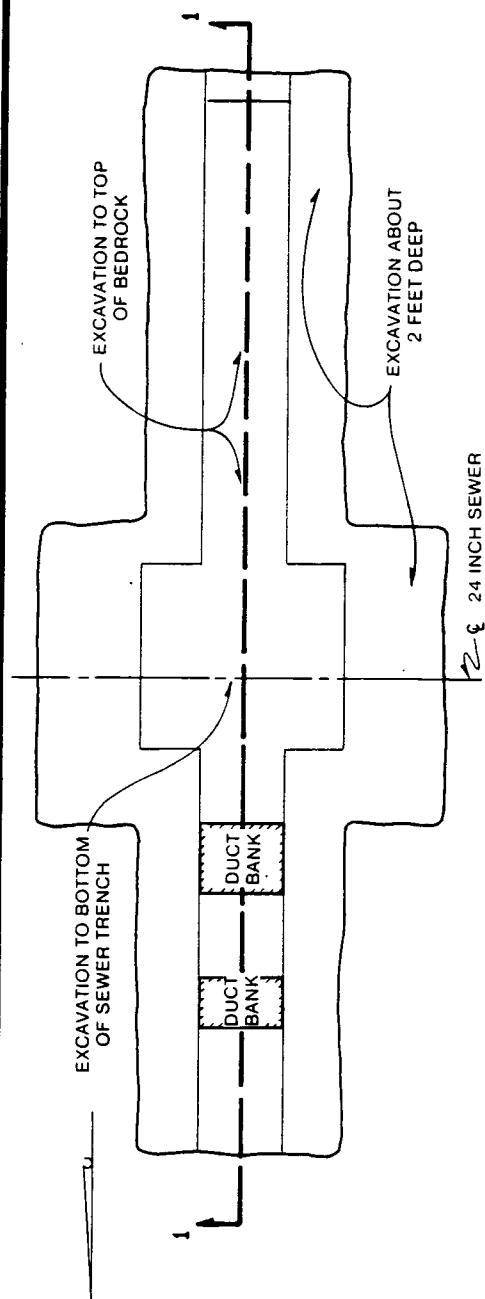
WOODWARD-CLYDE CONSULTANTS

CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

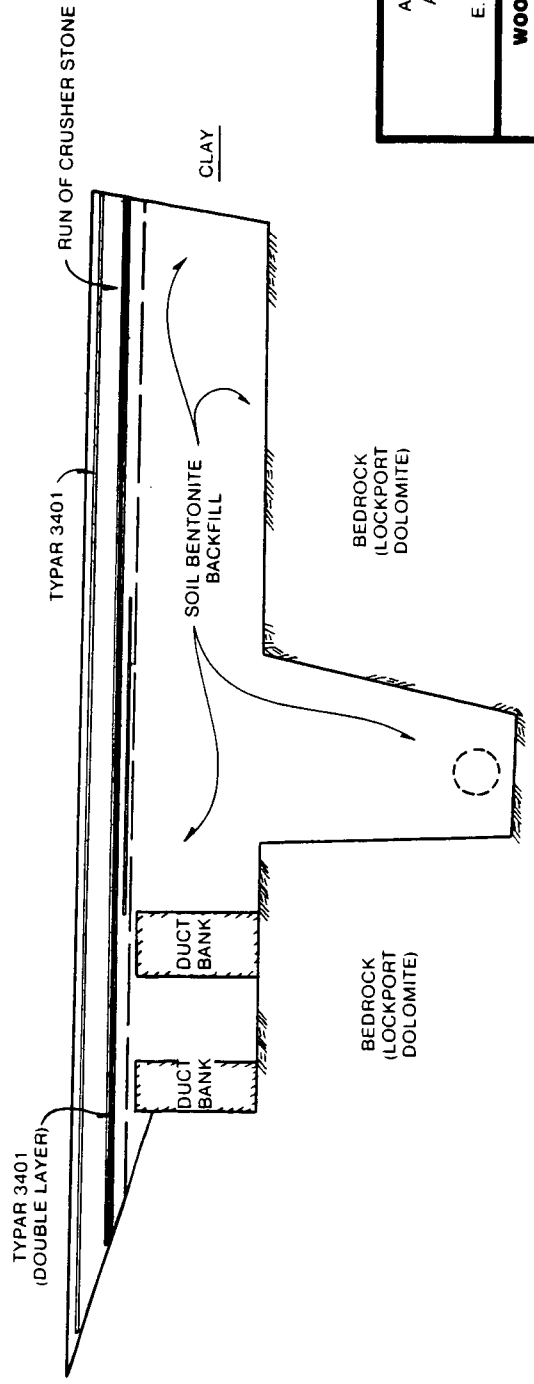
Drawn by: T. P. SCALE IN FEET Date: 7/3/86

Checked by: R. M. C. JOB: 83C2236-9

FIGURE 2



ADAMS AVENUE SLURRY WALL PLAN



SLURRY WALL SECTION (COMPLETED)

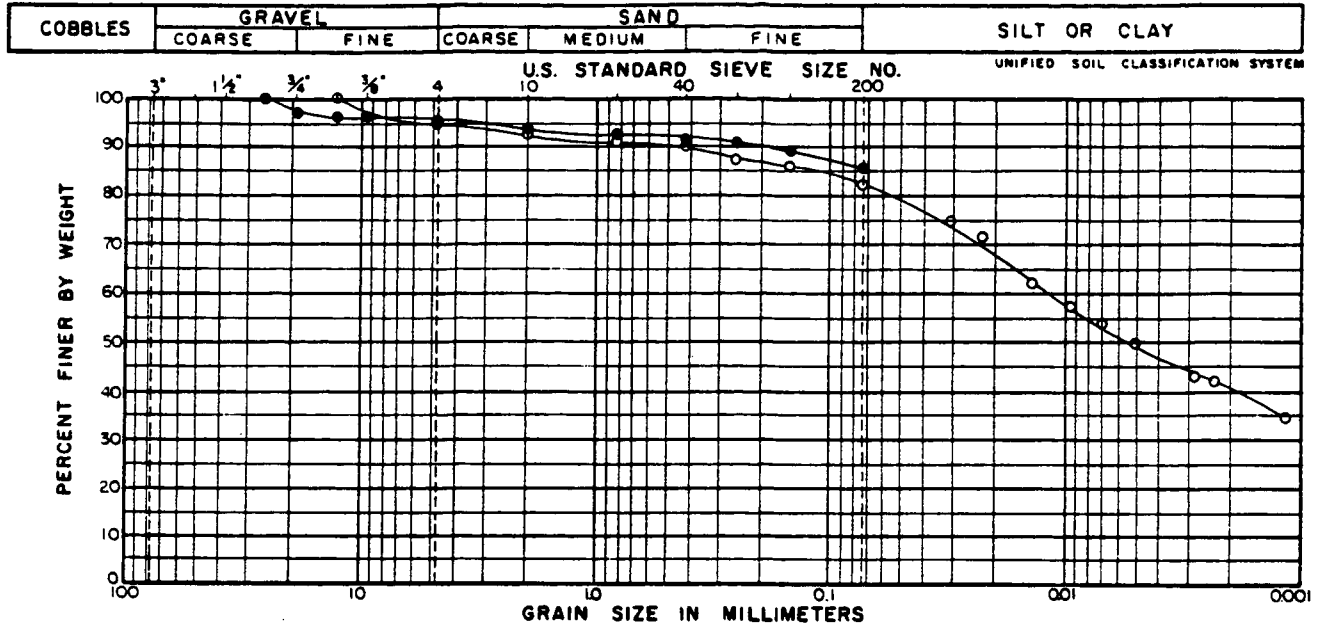
ADAMS AVENUE SLURRY WALL
 AS-BUILT PLAN AND SECTION
 NIAGARA PLANT
 E. I. DUPONT DE NEMOURS & CO.

WOODWARD-CLYDE CONSULTANTS
 CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

Drawn by: T. P.	Date: 7/29/86
Checked by: R. M. C.	Job: 83C2236-9
SCALE IN FEET	
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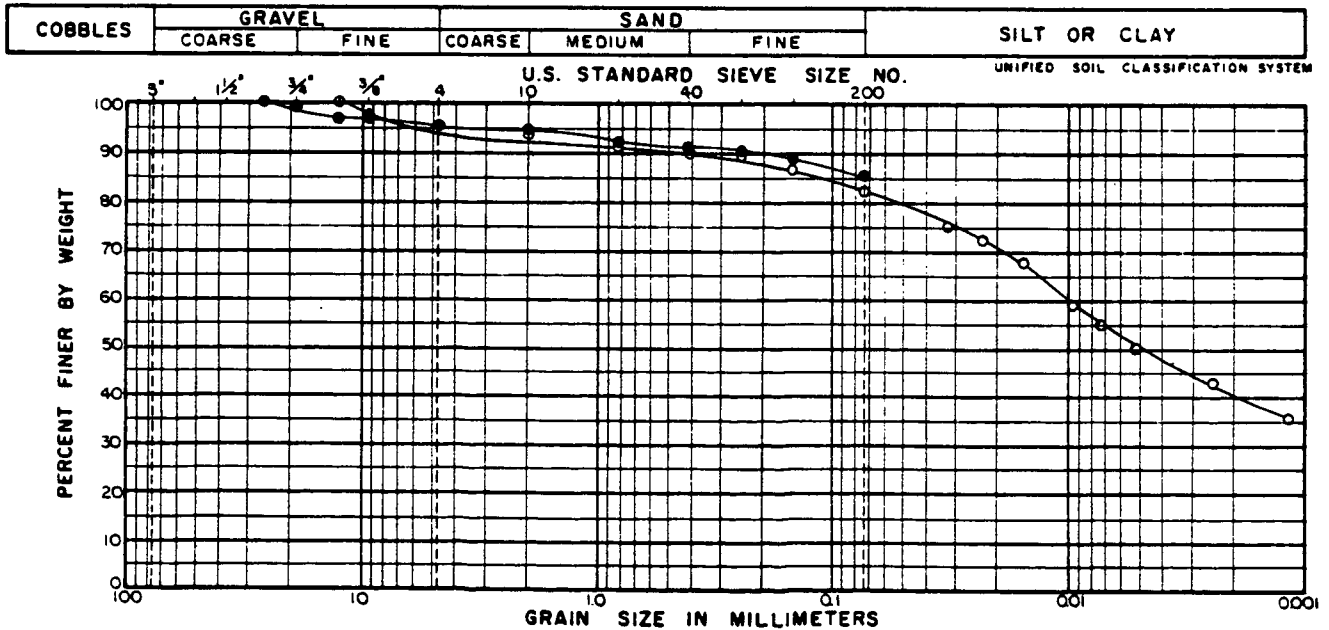
GRADATION CURVES

PROJECT NO.: 83C2236-9



BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
	L&M		●	Brown coarse to fine sandy silty clay, trace coarse to fine gravel (Borrow Source)			
	#1		○	Brown coarse to fine sandy silty clay, trace fine gravel (Backfill)			

PROJECT: DuPont, Niagara Falls, Adams Avenue Sewer



BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
	UNK		●	Brown coarse to fine sandy silty clay, trace fine gravel (Borrow Source)			
	#2		○	Brown coarse to fine sandy silty clay, trace fine gravel (Backfill)			

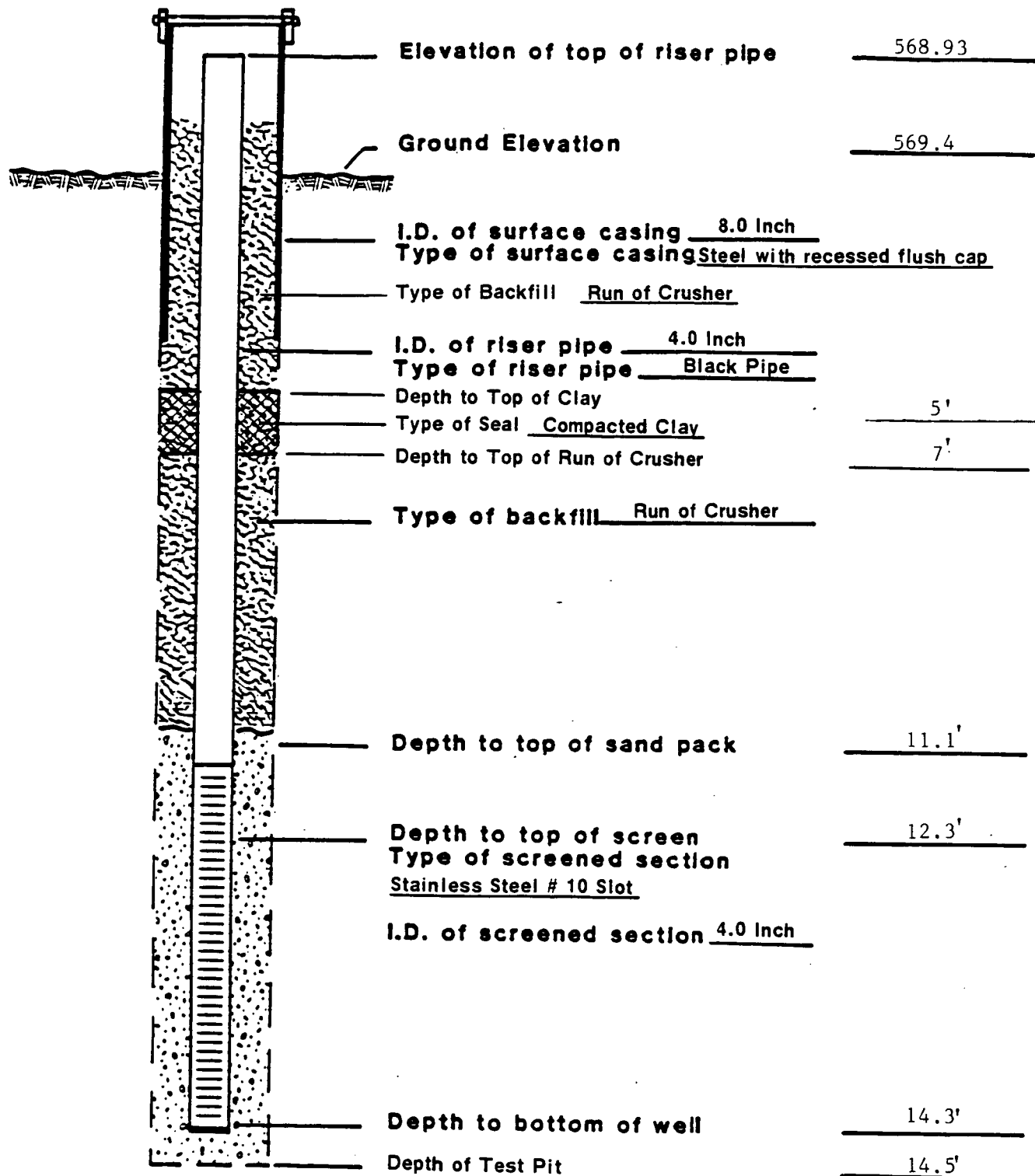
Attachments

LOG of TEST PIT No. TP-1

DATE 11/11-16/83 SURFACE ELEVATION 569.4 LOCATION See Plate 2

DEPTH, ft.	SAMPLES	POCKET PENETROM. READING (tsf)	DESCRIPTION	ELEVATION
0			Crushed STONE (1 inch max) with fines for roadway base	567.9
			Tan brown silty clayey medium to fine SAND	566.4
5			Stiff to very stiff red-brown, occasionally gray coarse to fine sandy and gravelly silty CLAY/clayey SILT (Till)	561.4
10			Grey broken DOLOMITE (sewer trench cut into rock probably drilled and shot)	554.9
15			24 inch pipe (pipe not exposed sufficiently to examine) <ul style="list-style-type: none"> • top of pipe about 14.1 feet below grade • pipe was bedded in silty CLAY/clayey SILT with coarse to fine sand and gravel size rock fragments. The pipe trench backfill is predominantly shot rock and more permeable than the surrounding material. 	

Completion Depth 14.3 Feet Water Depth 8.3 Feet Date 11/15/83
 Project Name DuPont, Man Made Passageways Investigation Project Number 83C2236-5



REPORT OF MONITORING WELL UW-1

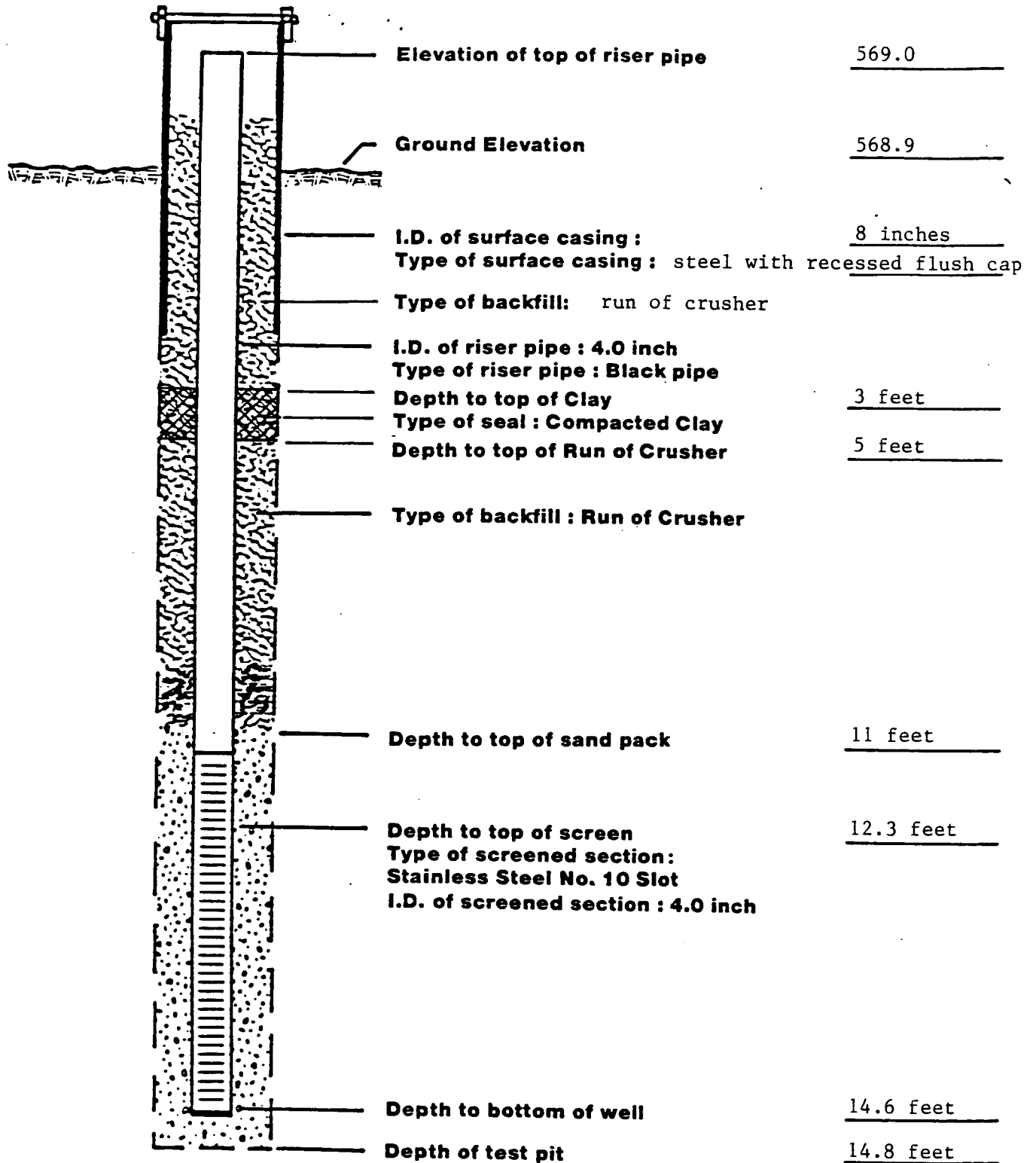
DRAWN BY: R.M.C. | CHECKED BY: R.M.C. | PROJECT NO: 83C2236-5 | DATE: 1/23/84 | FIGURE NO:

LOG of TEST PIT No. TP-14

DATE 5/2-17/84 SURFACE ELEVATION 568.9 LOCATION See Plate 2

DEPTH, ft. SAMPLES	POCKET PENETROM. READING (tsf)	DESCRIPTION	ELEVATION
0		Crushed stone with fines for roadway	567.9
		Cobble size pieces of Dolomite (road base)	567.4
		Tan to yellow-brown clayey silty fine sandy GRAVEL, with metal (FILL)	566.4
5		Red-brown gravelly fine sandy stiff silty CLAY (FILL)	562.9
10		DOLOMITE, badly fractured (sewer trench cut into rock)	554.1
15		<p>24 inch pipe</p> <p>Top of pipe approximately 14.6 feet below grade</p> <p>Pipe was bedded in a fine sandy silty CLAY to clayey SILT with gravel size rock fragments</p> <p>An angular hole was exposed in pipe and patched before backfilling</p>	

Completion Depth 14.8 Feet Water Depth Dry Feet Date 5/17/84
 Project Name Supplemental Manmade Passageways Investi. Project Number 83C2236-8



REPORT OF MONITORING WELL UW-14

DRAWN BY: LGR | CHECKED BY:

PROJECT NO.: 83C2236-8

DATE: 6/13/84

AUG 19 1968

UNITED STATES DEPARTMENT OF JUSTICE
FEDERAL BUREAU OF INVESTIGATION

BT # 68