Copy 1

TEST PIT SUMMARY REPORT
BARRIER WALL CONSTRUCTION

Gratwick-Riverside Park Site
North Tonawanda, New York

TEST PIT SUMMARY REPORT
BARRIER WALL CONSTRUCTION

Gratwick-Riverside Park Site
North Tonawanda, New York

FEBRUARY 1997
REF. NO. 7987 (9)
This report is printed on recycled paper.

CONESTOGA-ROVERS & ASSOCIATES

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1.0 INTRODUCTION

Conestoga-Rovers and Associates (CRA) on behalf of the Gratwick-Riverside Park Site (Site) Performing Parties (PPs) has prepared this Test Pit Summary Report to document the observations of the test pit investigation which was conducted at the Site in accordance with the New York State Department of Environmental Conservation (NYSDEC) approved work plan entitled "Test Pit Work Plan, Barrier Wall Construction" (TPWP), dated January 1997. The program was completed on January 22 and 23, 1997. The Site is located in North Tonawanda, New York as shown on Figure 1.1. The Order on Consent (Index #B9-0133-91-02) for the Site stipulates that a barrier wall be installed along the entire length of the Site shoreline to reduce the hydraulic connection between the Site and the Niagara River (River). The PPs implemented the TPWP in order to assist in evaluating two potential methods of construction for the barrier wall currently under consideration: a bentonite slurry wall and a high density polyethylene (HDPE) barrier wall.

The traditional method of slurry wall construction involves the use of a backhoe to excavate a trench. The trench cavity is supported by a trenching slurry which is subsequently replaced with low permeability backfill materials. A typical detail of a slurry type barrier wall is presented on Figure 1.2. An HDPE barrier wall can be constructed either by driving HDPE wall panels or by placing the liner within the groundwater collection drain trench. A typical detail of an HDPE barrier wall is presented on Figure 1.3.

The purpose of the test pit investigation was to supplement data obtained from the predesign activities to assist in the selection of the method of barrier wall construction. Section 2 summarizes the background information obtained from predesign activities. Section 3 presents the findings of the test pit investigation and Section 4 presents the conclusions.

2.0 BACKGROUND INFORMATION

The NYSDEC approved document entitled "Remedial Design Work Plan", June 1996 (RDWP) described the predesign activities to be performed to provide the additional data necessary to complete the Remedial Design for the Site. One of the predesign activities was the installation of boreholes along the approximate proposed alignment of the barrier wall. The purpose of the boreholes was to determine the depth of installation of the barrier wall by determining the depth to the underlying confining unit. A total of 23 boreholes and two prototype withdrawal wells were installed along the River shoreline. Split-spoon soil samples were examined at each location to identify the geologic stratigraphy. The borehole and withdrawal well stratigraphic logs are provided in Appendices E and F, respectively of the Remedial Design Investigation Report (RDIR) dated October 1996.

A layer of slag ranging in thickness from 3.0 to 19.0 feet was observed in all the borings. Slag is defined as a glass like mass left as a residue by the smelting of metallic ore. The slag at the Site was originally disposed of in the molten state by the Tonawanda Iron & Steel Company prior to 1960. Following disposal, the slag hardened and now exhibits characteristics similar to fractured rock. As a result of the slag presence, progress during borehole drilling was considerably slower than would be anticipated if the fill consisted of the typical mixture of refuse and soil. The blow counts on the stratigraphic logs, often in excess of 100, reflect the difficulties encountered during drilling.

3.0 TEST PIT INVESTIGATION RESULTS

3.1 PURPOSE

The purpose of the test pit program was to assist in determining the "constructability" of each type of barrier wall along the River shoreline at the Site. Figures 3.1 and 3.2 show the five test pit locations (TP-20, TP-21, TP-22, TP-23 and TP-24), the proposed barrier wall alignment, as well as the stratigraphy in cross-section through the 23 boreholes and two withdrawal wells. Specifically, the intent of the test pit program was to determine which technique or techniques are appropriate for construction of a barrier wall through areas of slag fill.

3.2 PREPARATION

The five test pits were located as close as practical to the proposed barrier wall alignment. Two of the five test pit locations (TP-21 and TP-24) were moved due to limited access to the River. At the proposed locations for these test pits, access to the River was restricted by dense vegetation and a relatively steep shoreline bank. These conditions made it difficult for the contractor to obtain the River water necessary to conduct the test pit testing. Based on the above, these locations were moved to the next closest practical location. TP-21 was relocated approximately 230 feet east of the location proposed in the TPWP. TP-24 was relocated approximately 400 feet west of the location proposed in the TPWP.

Prior to starting the excavation at each test pit location, a new 30-mil poly sheet of sufficient size to accommodate the excavated materials and to direct the groundwater dewatering from the excavated materials back into the excavation was placed adjacent to the test pit. The poly sheet was placed on the side of the test pit with the highest ground surface elevation to direct the drainage back into the test pit. The poly sheet prevented contact between excavated materials and existing Site surface soils. Excavation of each test pit was conducted with a Komatsu PC 400LC-3 excavator. Upon completion of each test pit, the excavated material was returned to the excavation in the reverse order of removal such that the bottom material was placed at the bottom of the excavation. Due to the season in which the program was conducted, the ground surface was not restored with topsoil and seed. Surface restoration consisted of filling the test pit to adjacent ground surface elevations with the excavated surface soils placed on top.

3.3 SCOPE OF WORK

The TPWP specified that the observations listed below would be made during performance of the test pit program:

- description of ease of excavation;
- description of sidewall excavation sloughing;
- description of approximate average size of materials/rocks removed;
- description and estimation of natural groundwater flow into the excavation;
- approximate volume of water pumped into the excavation including;
  - pumping rates; and
  - duration of pumping for each different rate;
- observations for groundwater - breakouts along the shoreline during the tests;
- approximate volume of water 'lost' to the sidewall materials including;
  - excavation surface area;
  - depth of water level drop; and
  - time over which drop in water level occurred.

To determine the capability of the different Site materials (i.e., fill and slag) to contain a slurry mixture (i.e., to prevent a "loss" of the slurry mixture to the formation beyond the trench walls), River water was pumped into the excavation when the base of the excavation reached two different depths below ground surface. Because the River water has a lower density and viscosity than a slurry mixture, it was concluded that if the sidewalls of the excavation were able to maintain a relatively steady volume of water within the excavation, a slurry mixture would also be able to be maintained within the trench. Determining that large volumes of slurry will not be lost through the excavation sidewalls due to the characteristics of the materials ensures that a barrier wall can be constructed using traditional slurry methods.

The TPWP indicated that the first test would be conducted once the fill materials overlying the slag had been removed to a depth of 2± feet above the top of slag. At each of the test pit locations, the top of the slag was contacted at elevations higher than anticipated. Thus, the thickness of fill overlying the slag layer was less than 2± feet. Subsequent testing of the slag layer showed that the slag had low water transmissivity. Thus, it is likely that the lack of 2± feet of fill on top of the slag did not significantly influence the fill results. Once it was determined that no additional information could be gained by observing the water in the excavation above the slag for a longer period of time, the slag and underlying soil were then excavated to the top of the confining unit. Upon completion of the excavation, the second water test was conducted. For each test, River water was pumped quickly into the excavation, until the predetermined water level (based on depth to top of excavation and top of slag) was achieved. The pump was then shut down and the change in water level with time observed. The rate of water addition to the excavation was not determined due to the relatively short time (i.e., less than 30 seconds) it typically took to fill the excavation and the fact that visually, water loss to the sidewalls for this short time frame was negligible. The depth that the water level dropped within the excavation was measured for each interval tested. This depth, along with the sidewall surface area of the excavation and the time over which the water level dropped, was used to calculate the approximate rate of water "lost" to the sidewall materials.

The observations recorded for each of the test pit locations are presented in the following subsections.

3.4 OBSERVATIONS

3.4.1 General

The following observations were recorded at all five test pit locations:

- No drums, black viscous material (BVM), or other non aqueous phase liquids were observed. Because no such materials were observed, no samples were collected for analysis of TCL organics.

- The slag appeared to become more uniformly consolidated (harder and competent) with depth.

- The ease of excavation of the test pits became increasingly more difficult as one moved from north to south across the Site, (TP-20 to TP-24). This is likely attributable to the fact that the depth of the test pits increased when moving from TP-20 (8 feet) to TP-24 (18 feet). Additionally, as discussed in the point above, the slag became more consolidated with depth. The length of time required to excavate through the slag varied. At TP-20 and TP-21 (slag thickness 4 to 6 feet, total depths less than 10 feet) the slag excavation took approximately 15 to 20 minutes. At TP's 22, 23 and 24 (slag thickness 12.5 to 16.5 feet, total depths greater than 17 feet) the slag excavation took approximately 45 to 50 minutes.

- The average size of the fill material removed during excavating was consistently on the order of one to three inches in diameter with the exception of the debris which was encountered (i.e., foundry bricks, bottles).

- The average size of slag removed from the test pits during excavating ranged from two to six inches in diameter. The average size of the excavated slag material decreased when moving from TP-20 to TP-24. This is due to the slag becoming thicker and more competent and harder when moving from the north to the south end of the Site where the slag interval is generally the thickest. At these locations excavation was accomplished by "scraping" the slag surface to break it up. As a result, the slag crumbled and was removed in small pieces. Thus, the average size of the excavated material decreased when moving from north to south at the Site.

- There was no evidence of a groundwater gradient across the test pits towards the River within the slag interval. If groundwater was present in the test pit excavations, it was relatively stagnant. Groundwater was not present within the shallow fill unit overlying the slag.

- There were no observations of groundwater breakouts along the shoreline during any of the tests.

- Water from the excavated materials placed adjacent to the test pit flowed back into the test pit. This water was a small volume and did not impact the results of the slag interval testing.

- There were no odors detected during the excavations. The HNu photoionization detector (PID) did not record any readings above background at any of the locations.

- Use of combustible gas/dust meters was deemed not required by CRA, with the concurrence of the New York State Department of Health, due to weather conditions at the time of the investigation. The monitoring equipment was on Site and available for use should there have been an incident of a reading above background on the PID.

- There was minimal sloughing of sidewall materials into the excavations. The fill material layer (two to four feet in thickness) contributed the majority of the minimal sloughing. The sidewalls within the slag interval of the excavation remained vertical, maintaining the width of the backhoe bucket throughout the excavation and testing periods. See attached photo logs in Appendix A.

- Appropriate health and safety measures were followed throughout the program as described in the TPWP.

Table 3.1 summarizes the stratigraphy encountered at each test pit. Table 3.2 summarizes the observations for each of the test pits.

3.4.2 Test Pit TP-20

Test pit TP-20 was started and completed on January 22, 1997. The fill, composed primarily of clayey topsoil mixed with old bottles, was excavated to 3.5± feet below ground surface (BGS). The top of the groundwater surface was not contacted. The excavation was 13± feet long by 2± feet wide and contained no water. One foot of River water (approximately 195 gallons) was pumped into the excavation to conduct the test of the transmissive capabilities of the fill layer. The rate of water loss was observed for 5 minutes. A total of 3.6± inches of the pumped water (12± gpm) was lost to the sidewalls in the five minute interval. This represents an approximate volume of 60 gallons or 30% of the volume of River water introduced to the excavation.

The slag was then excavated to the top of the confining unit, 7.5± feet BGS where till was contacted. The top of the groundwater surface was observed at approximately 5.5 feet BGS as the test pit was filled with water to this level. The excavation remained 13± feet long by 2± feet wide. Two feet of River water (approximately 390 gallons) was pumped into the excavation to conduct the test of the transmissive capabilities of the slag layer. The rate of water loss was observed for 10 minutes. A total of 10.5± inches was lost to the sidewalls in the 10 minute interval, 7± inches in the first 5 minutes (22± gpm) and 3.5± inches in the final 5 minutes (11± gpm). This represents an approximate volume of 170 gallons or 44% of the volume of River water introduced to the excavation. Sixty-seven percent of the total water loss was lost in the first five minutes of the test.

It was expected that the rate of water lost to the sidewalls would initially be higher and then decrease with time due to the following factors:

- the fill and slag above the groundwater level was unsaturated and the unsaturated materials near the test pit sidewalls would saturate relatively quickly, resulting in an initial high water loss rate;

- as the water level in the test pit drops with time after pumping in the water, the gradient between the water in test pit and the groundwater level would decrease, resulting in a decreased water loss rate; and

- in the slag layer, which becomes more consolidated with depth, it is expected that the hydraulic conductivity decreases with depth. Thus, as the water in the test pit drops, the hydraulic conductivity of the material which the water is in contact with and into which it can flow, is also expected to decrease, resulting in a lower water loss rate.

The results described above for the slag interval test support the expected trend in the rate of water loss with time.

3.4.3 Test Pit TP-21

Test pit TP-21 was started and completed on January 22, 1997. The fill, composed primarily of topsoil mixed with foundry brick, was excavated to 3± feet BGS. The top of the groundwater surface was not contacted. The excavation was 11± feet long by 2± feet wide and contained no water. One and a half feet of River water (approximately 250 gallons) was pumped into the excavation to conduct the test of the transmissive capabilities of the fill layer. The rate of water loss was observed for 5 minutes. A total of 7.2± inches of the pumped water (20± gpm) was lost to the sidewalls in the five minute interval. This represents an approximate volume of 100 gallons or 40% of the volume of River water introduced to the excavation.

The slag was then excavated to the top of the confining unit, 11.5± feet BGS. A layer of alluvial sand (9.0 to 11.0 feet BGS) was observed above the confining unit. The top of the groundwater surface was observed at approximately 7± feet BGS where groundwater was entering the excavation through the sidewalls. The water level was observed for 5 minutes to determine the rate of groundwater infiltration. The water level rose 0.6± feet during the interval. This equates to an infiltration of approximately 108 gallons (22± gpm). The excavation for this portion of the test was 12± feet long by 2± feet wide. Seven feet of River water (approximately 1250 gallons) was pumped into the excavation to conduct the test of the transmissive capabilities of the slag layer. The rate of water loss was observed for 10 minutes. A total of 6.0± inches was lost to the sidewalls in the 10 minute interval, 3.6 inches in the first 5 minutes (11± gpm) and 2.4 inches in the final 5 minutes (7± gpm). This represents an approximate volume of 90 gallons or 7% of the volume of River water introduced to the excavation. The rate of water loss to the sidewalls decreased with depth, similar to TP-20; 60% of the water loss was lost in the first five minutes of the test.

3.4.4 Test Pit TP-22

Test pit TP-22 was started and completed on January 23, 1997. The fill, composed primarily of sandy silt (very little debris), was excavated to 3± feet BGS. The top of the groundwater surface was not contacted. The excavation was 14± feet long by 2± feet wide and contained no water. One and a half feet of River water (approximately 315 gallons) was pumped into the excavation to conduct the test of the transmissive capabilities of the fill layer. The rate of water loss was observed for 5 minutes. A total of 4.8± inches of the pumped water was lost to the sidewalls in the five minute interval (17± gpm). This represents an approximate volume of 85 gallons or 27% of the volume of River water introduced to the excavation.

The slag was then excavated to the top of the confining unit, 16.5± feet BGS where reddish clay was contacted. The top of the groundwater surface was observed within the excavation at approximately 5± feet BGS as the test pit was filled with water to that level. The excavation for this portion of the test was 15± feet long by 2.5± feet wide. Two feet of River water (approximately 560 gallons) was pumped into the excavation to conduct the test of the transmissive capabilities of the slag layer. The rate of water loss was observed for 10 minutes. A total of 13± inches was lost to the sidewalls in the 10 minute interval at the rates shown below:

Water Level Drop (inches)	*Time (min, cumulative)*	*Rate (gpm)*
0-3	0.5	140
3-6	1.25	94
6-9	2.25	70
9-12	4.25	35
12-13	10	4

This represents an approximate volume of 305 gallons or 55% of the volume of River water introduced to the excavation. The rate of water loss to the sidewalls decreased with depth; 90% of the water loss was in the first five minutes of the test. Given the fact that groundwater was present within the test pit during excavation (indicating slag with greater conductivity) it is to be expected that the rate of water loss would be greater than at either TP-20 or TP-21. This is confirmed by the higher exfiltration rates in TP-22.

3.4.5 Test Pit TP-23

Test pit TP-23 was started and completed on January 23, 1997. The fill, composed primarily of topsoil (very little debris), was excavated to 2.5± feet BGS. The top of the groundwater surface was not contacted. The excavation was 13± feet long by 2± feet wide and contained no water. One and a half feet of River water (approximately 290 gallons) was pumped into the excavation to conduct the test of the transmissive capabilities of the fill layer. The rate of water loss was observed for 5 minutes. A total of 7.8± inches of the pumped water was lost to the sidewalls in the five minute interval, 4.8± inches in the first 2 minutes (42± gpm), 2.4± inches in the next two minutes (21± gpm) and 0.6 inches in the final minute (10± gpm). This represents an approximate volume of 135 gallons or 47 percent of the volume of River water introduced to the excavation.

The slag was then excavated to the top of the confining unit, 19± feet BGS where grey clay was contacted. Groundwater was observed entering the excavation through the sidewalls at approximately 8±± feet BGS. The rate of groundwater infiltration was small and a test to determine the infiltration rate was not performed. The excavation for this portion of the test was 13± feet long by 2± feet wide. Fifteen feet of River water (approximately 2920 gallons) was pumped into the excavation to conduct the test of the transmissive capabilities of the slag layer. The rate of water loss was observed for 10 minutes. A total of 1± inch was lost to the sidewalls in the 10 minute interval, all in the first 3 minutes of the test (3± gpm). This represents an approximate volume of 15 gallons or 0.5% of the volume of River water introduced to the excavation. The water level within the test pit remained constant for the final 7 minutes of the test. This minimal loss of water to the sidewalls is consistent with the observation that there was very little groundwater infiltrating into the open test pit during excavating, indicating a slag with a low hydraulic conductivity.

3.4.6 Test Pit TP-24

Test pit TP-24 was started and completed on January 23, 1997. The fill, composed primarily of topsoil mixed with a large quantity of old bottles, was excavated to 4± feet BGS. The top of the groundwater surface was not contacted. The excavation was 13± feet long by 2± feet wide and contained no water. Two feet of River water (approximately 390 gallons) was pumped into the excavation to conduct the test of the transmissive capabilities of the fill layer. The rate of water loss was observed for 5 minutes. A total of 9.6± inches of the pumped water was lost to the sidewalls in the five minute interval (31± gpm). This represents an approximate volume of 155 gallons or 40% of the volume of River water introduced to the excavation.

The slag was then excavated to the top of the confining unit, 18± feet BGS where grey clay was contacted. Groundwater was observed entering the excavation through the sidewalls at approximately 8.5 feet BGS. The rate of groundwater infiltration was negligible and a test to determine the infiltration rate was not performed. The excavation for this portion of the test was 13± feet long by 2± feet wide. Two and three quarters of a foot of River water (approximately 535 gallons) was pumped into the excavation to conduct the test of the transmissive capabilities of the slag layer. The rate of water loss was observed for 10 minutes. A total of 6± inches was lost to the sidewalls in the

10 minute interval, 3± inches in the first 3 minutes of the test (17 ± gpm) and 3± inches in the last 7 minutes of the test (7± gpm). This represents an approximate volume of 100 gallons or 19 percent of the volume of River water introduced to the excavation. This minimal loss of water to the sidewalls is consistent with the observation that there was very little groundwater infiltrating into the open test pit during excavating, indicating a slag with a low conductivity.

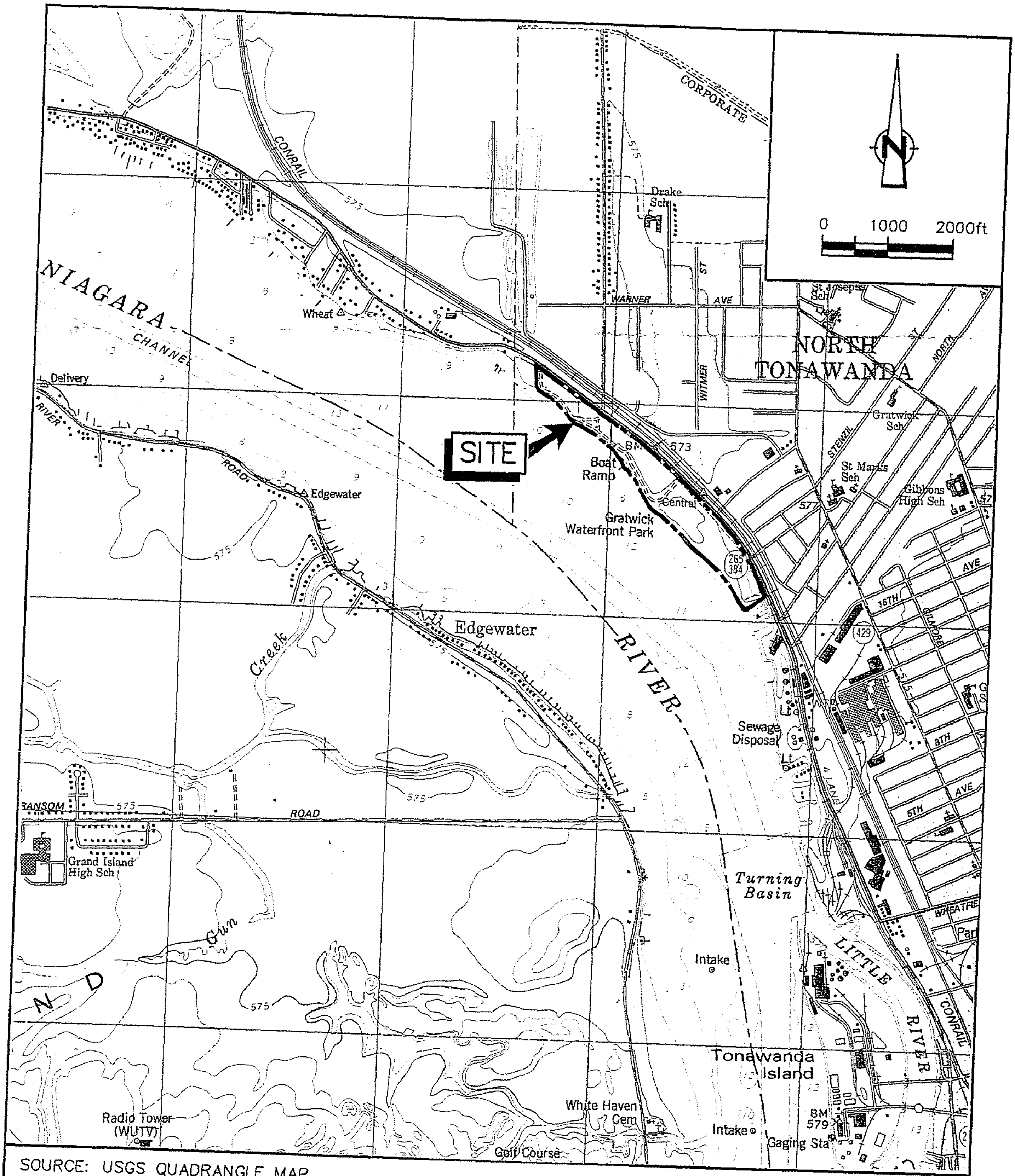
4.0 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions can be made as a result of the test pit investigation:

- Groundwater was not observed in the fill overlying the slag layer;
- A "one-pass" construction technique is not likely to be practical based on the hardness, competency and thickness of the slag layer, particularly at the southern end of the Site;
- It was possible to excavate through the slag layer down to the confining unit using a backhoe with an appropriate bucket;
- There was minimal sloughing of trench sidewalls within the fill material and vertical sidewalls were maintained when excavating through the slag layer;
- The water infiltration testing exhibited moderate water losses in the fill. It is believed that the fill is capable of maintaining a relatively constant volume of slurry within the excavation based on the higher viscosity of the slurry and the filter cake it would create along the excavation sidewalls.
- The water infiltration testing exhibited minimal water losses in the slag. Thus the slag layer is capable of maintaining a relatively constant volume of slurry within the excavation based on the higher viscosity of the slurry and the filter cake it would create along the excavation sidewalls.
- The moderate water loss in the fill and minimal water loss in the slag confirms that large volumes of slurry will not be lost through the excavation sidewalls and ensures that a barrier wall can be constructed using traditional slurry barrier wall construction methods.

It is recommended, based on the observations made during the test pit investigation, that for the current proposed barrier wall alignment, the design alternative selected for the Site barrier wall be a slurry type barrier wall using traditional construction methods if a slurry wall is selected. Should the alignment of the barrier of the barrier wall change, (e.g., from top of river bank to toe of riverbank), an alternate barrier wall construction method (e.g., "one-pass") may be appropriate depending on the hardness, competency and thickness of the slag layer underlying the revised alignment.

FIGURES



SOURCE: USGS QUADRANGLE MAP
TONAWANDA WEST, N.Y.
(1980)

figure 1.1

SITE LOCATION
TEST PIT SUMMARY REPORT
Gratwick–Riverside Park Site
Performing Parties

CRA

7987 (9) FEB 04/97(W) REV.0

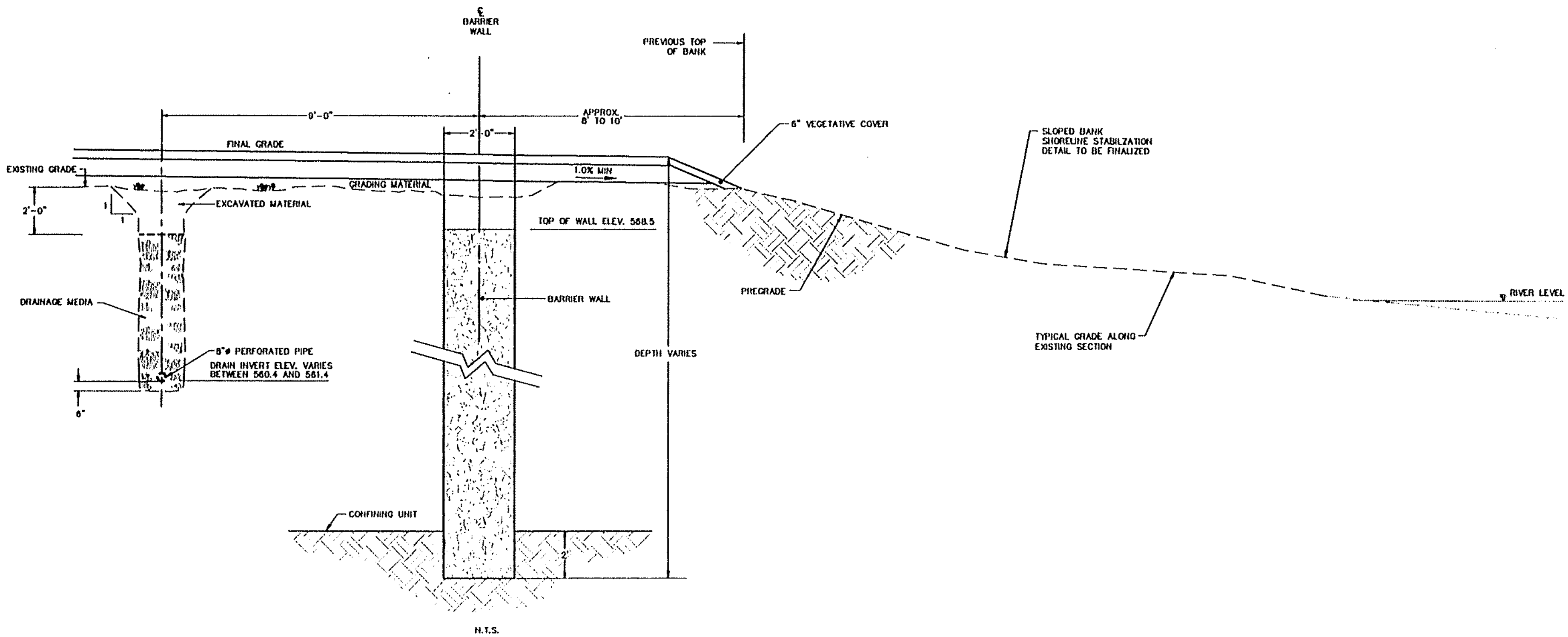


figure 1.2

TYPICAL SLURRY WALL DETAIL
TEST PIT SUMMARY REPORT
Gratwick–Riverside Park Site
Performing Parties

CRA

7987 (9) FEB 25/97(W) REV.0 (P-76)

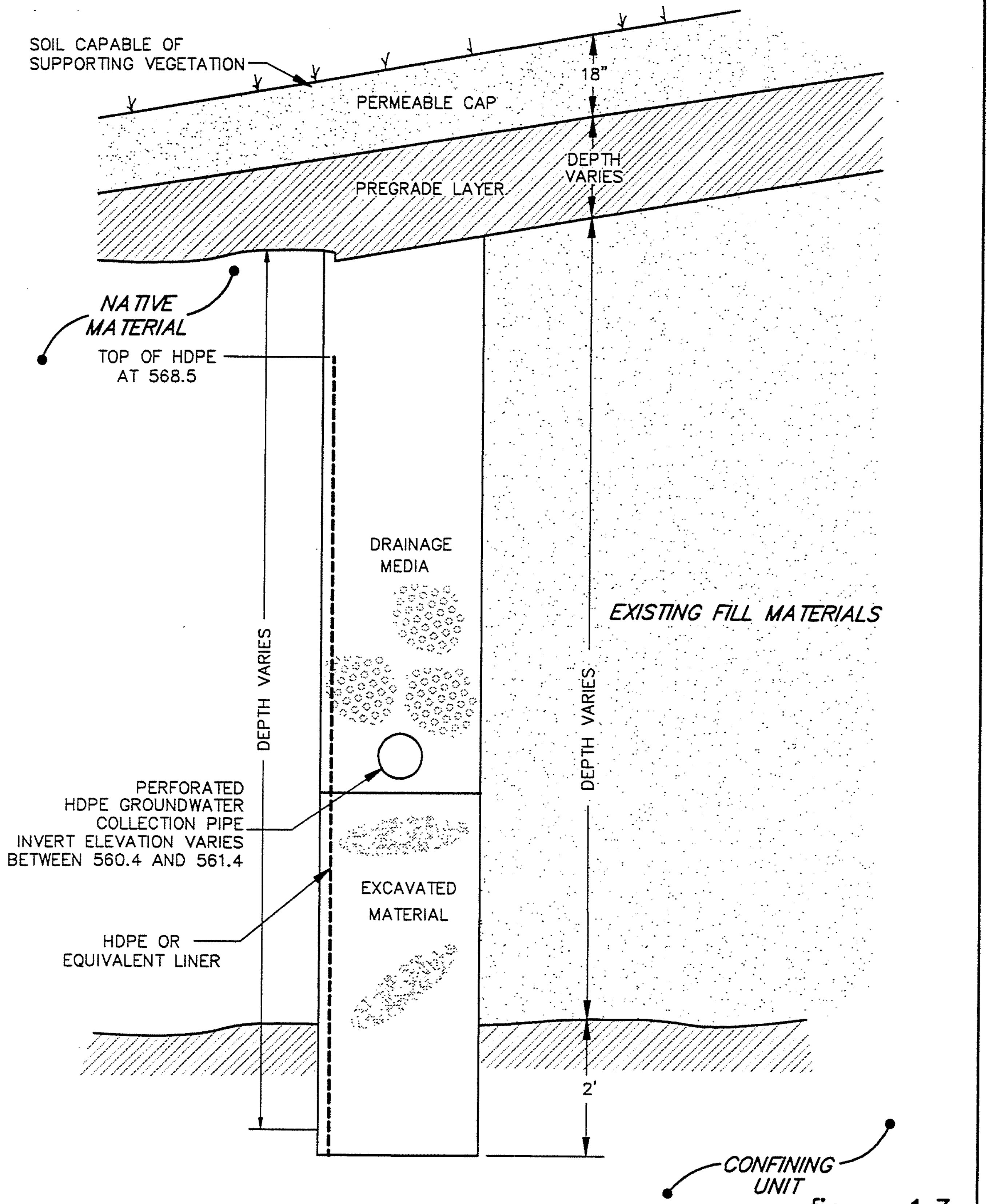
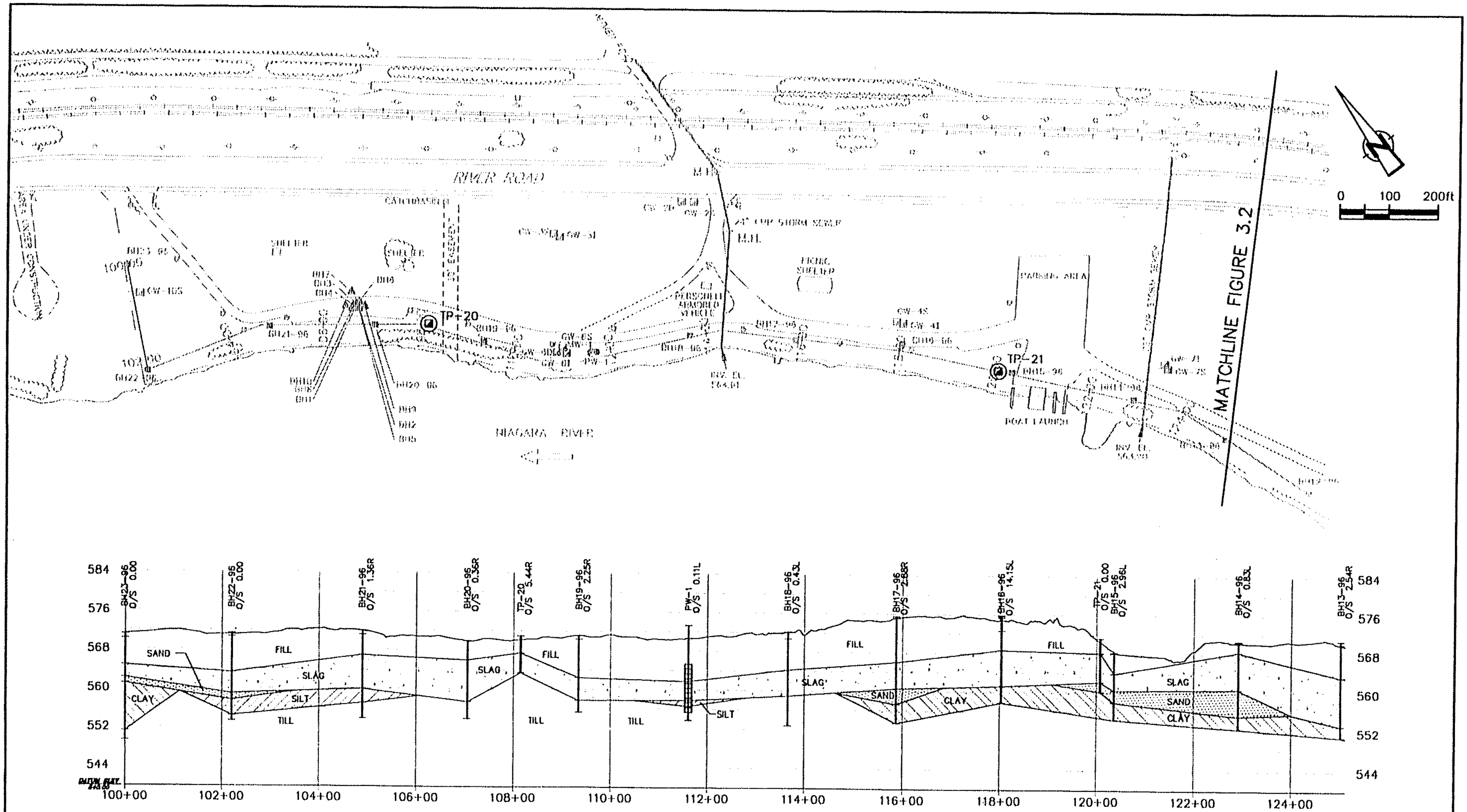


figure 1.3

TYPICAL HDPE WALL DETAIL
TEST PIT SUMMARY REPORT
Gratwick–Riverside Park Site
Performing Parties

CRA

7987 (9) FEB 25/97(W) REV.0 (D–09)



LEGEND

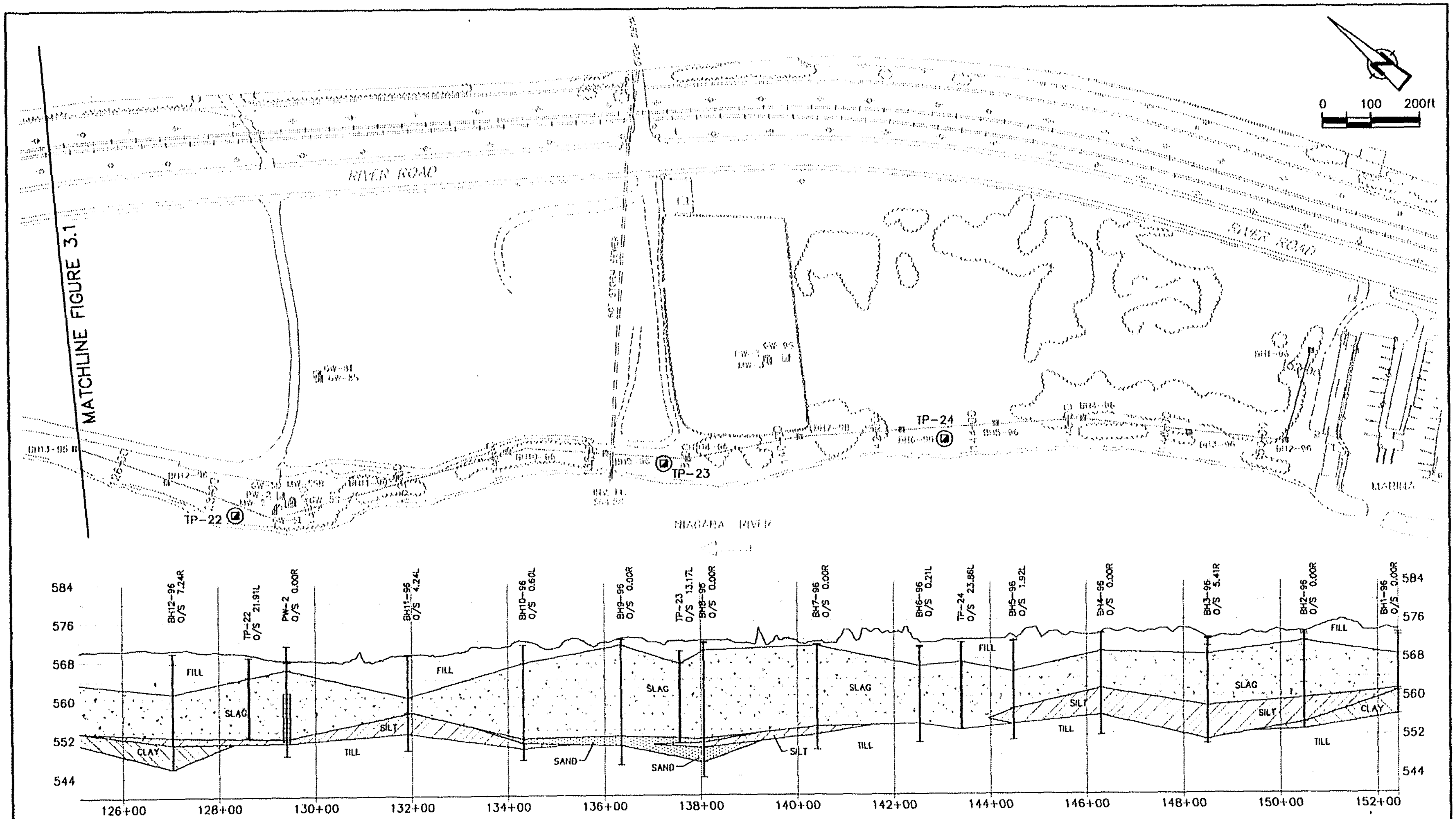
- DEC MONITORING WELL
- PREDESIGN MONITORING WELL
- PREDESIGN WITHDRAWAL WELL
- DEC POTHOLE AREA BOREHOLE
- PREDESIGN BARRIER WALL ALIGNMENT BOREHOLE
- PROPOSED BARRIER WALL ALIGNMENT
- SITE BOUNDARY
- TP-21 TEST PIT LOCATION

figure 3.1

TEST PIT LOCATIONS
TEST PIT SUMMARY REPORT
Gratwick–Riverside Park Site
Performing Parties

CRA

7987 (9) FEB 04/97(W) REV.0 (P-74)



LEGEND

- DEC MONITORING WELL
- PREDESIGN MONITORING WELL
- PREDESIGN WITHDRAWAL WELL
- PREDESIGN BARRIER WALL ALIGNMENT BOREHOLE
- PROPOSED BARRIER WALL ALIGNMENT
- SITE BOUNDARY
- TP-24 TEST PIT LOCATION

figure 3.2

TEST PIT LOCATIONS
TEST PIT SUMMARY REPORT
Gratwick–Riverside Park Site
Performing Parties

CRA

7987 (9) FEB 04/97(W) REV.0 (P-75)

TABLES

TABLE 3.1

TEST PIT STRATIGRAPHIC SUMMARY
GRATWICK-RIVERSIDE PARK SITE
NORTH TONAWANDA, NEW YORK

Test Pit I.D.	*Depth Interval (ft. bgs)*	*Soil Description*
TP-20	0 - 0.5	Clayey topsoil
	0.5 - 3.5	FILL, some bottles
	3.5 - 7.5	SLAG
	7.5 - 8.0 (*)	TILL
TP-21	0 - 3.0	FILL, Foundry brick, some topsoil
	3.0 - 9.0	SLAG
	9.0 - 11.0	Alluvial sand
	11.0 - 11.5 (*)	CLAY
TP-22	0 - 4.0	Sandy SILT, little debris
	4.0 - 16.5	SLAG
	16.5 - 17.0 (*)	Reddish Silty CLAY
TP-23	0 - 2.5	Sandy SILT, little debris
	2.5 - 19.0	SLAG
	19.0 - 19.5 (*)	Greyish Silty CLAY
TP-24	0 - 4.0	FILL, bottles and debris
	4.0 - 18.0	SLAG
	18.0 - 18.5 (*)	Greyish Silty CLAY

Note:
(*) Refers to bottom of test pit and not bottom of stratigraphic interval.

TABLE 3.2

SUMMARY OF TEST PIT OBSERVATIONS
GRATWICK-RIVERSIDE PARK SITE
NORTH TONAWANDA, NEW YORK

	Fill Interval						*Slag Interval*						*General*			
	Interval Thickness (ft)	*River Water Volume Added (gal)*	*River Water Volume Lost (gal)*	*% of Water Lost*	*Time for Loss (min)*	*Rate of Water Loss (gpm)*	*Interval Thickness (ft)*	*River Water Volume Added (gal)*	*River Water Volume Lost (gal)*	*% of Water Lost*	*Time for Loss* (min)	*Rate of Water Loss (gpm)*	*Sidewalls*	*Odors*	*PID Readings*	*Groundwater Gradient in Test Pit*
TP-20	3.5	195	60	30	5	12	4.0	390	170	44	10	17	Straight	None	0	None visible
TP-21	3.0	250	100	40	5	20	6.0	1250	90	7	10	9	Straight	None	0	None visible
TP-22	3.0	315	85	27	5	17	13.5	560	305	55	10	10.5	Straight	None	0	None visible
TP-23	2.5	290	135	47	5	27	16.5	2920	15	0.5	10	1.5	Straight	None	0	None visible
TP-24	4.0	390	155	40	5	31	14.0	535	100	19	10	10	Straight	None	0	None visible

A

APPENDIX A

TEST PIT PHOTO LOG

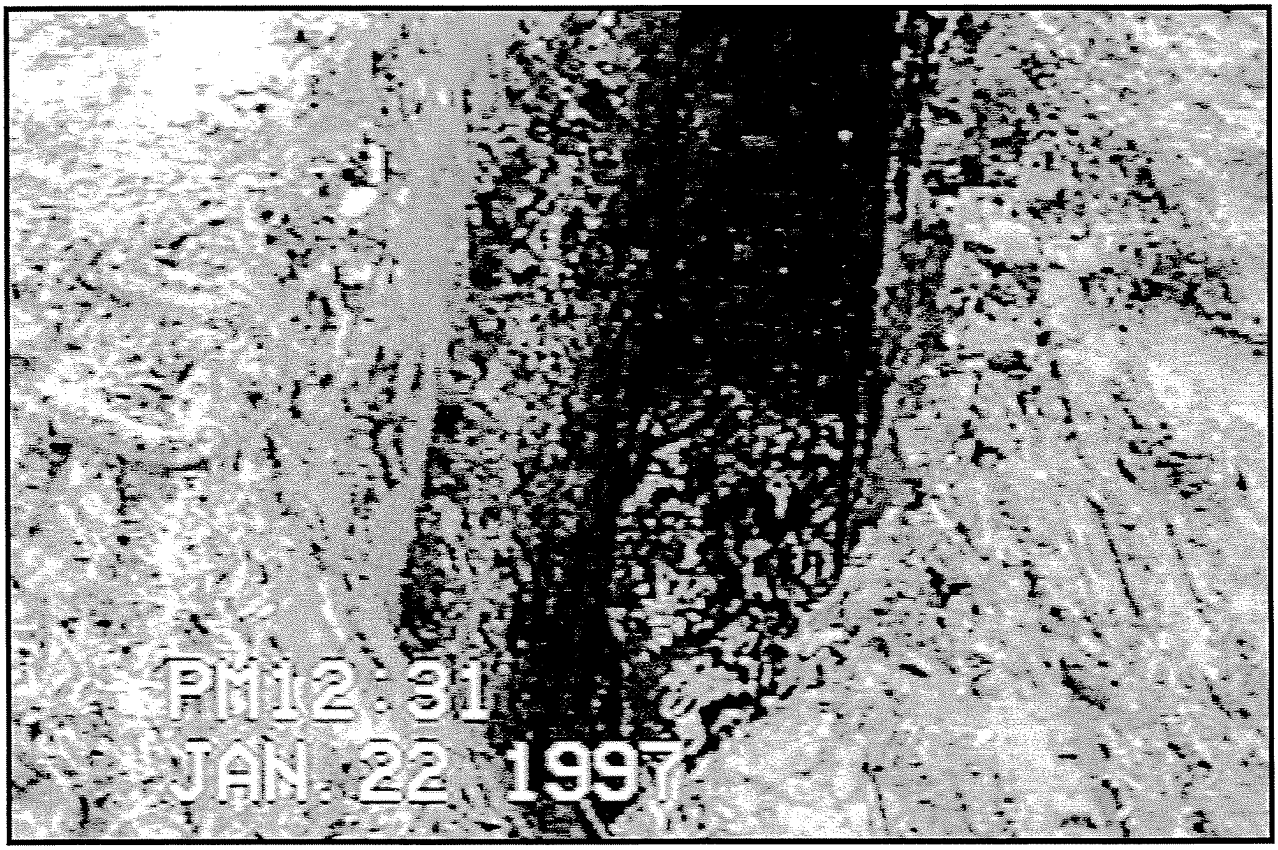
Test Pit TP-20

Test Pit TP-20

figure A.1
TEST PIT SUMMARY REPORT
GRATWICK-RIVERSIDE PARK SITE
Performing Parties

CRA

7987 (2) FEB. 13/97(P) REV.0 (layout)



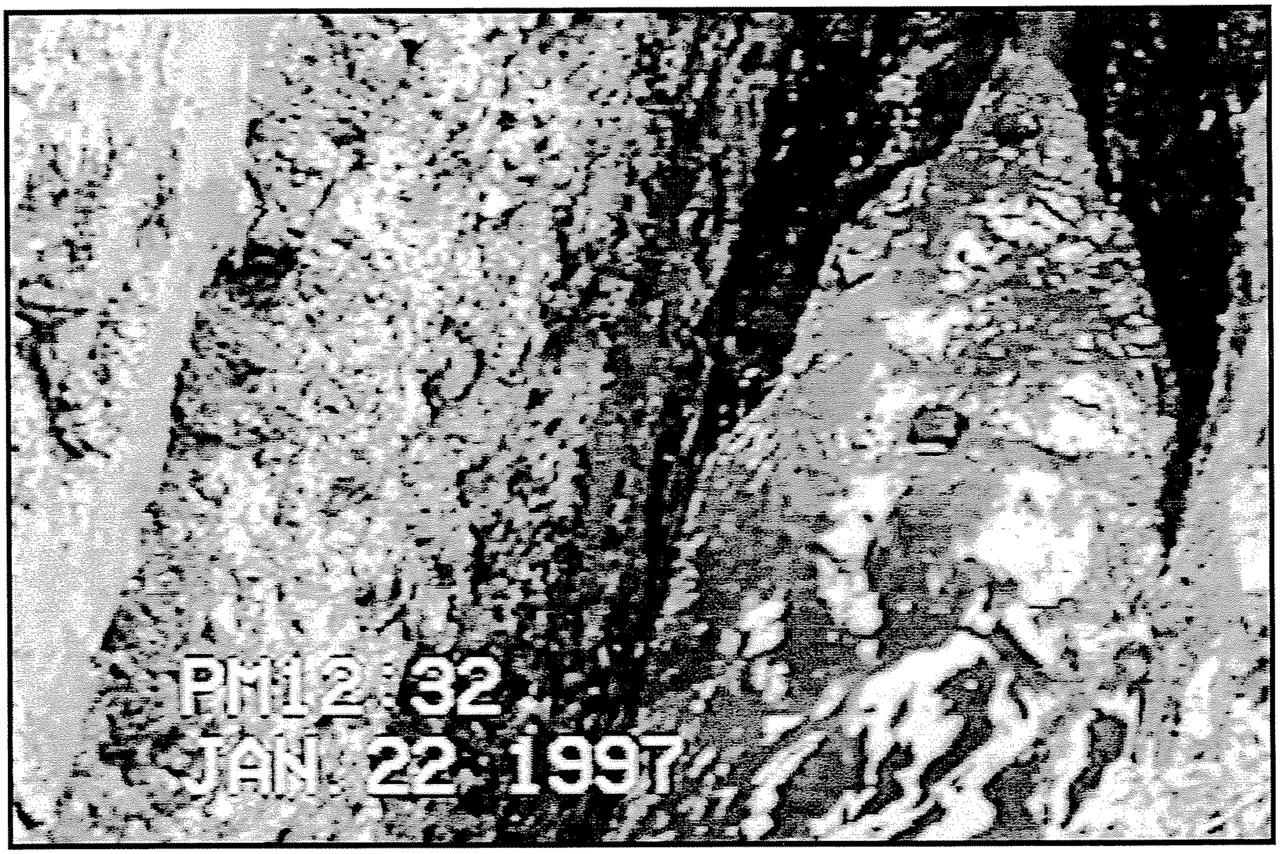
Test Pit TP-21

Test Pit TP-21

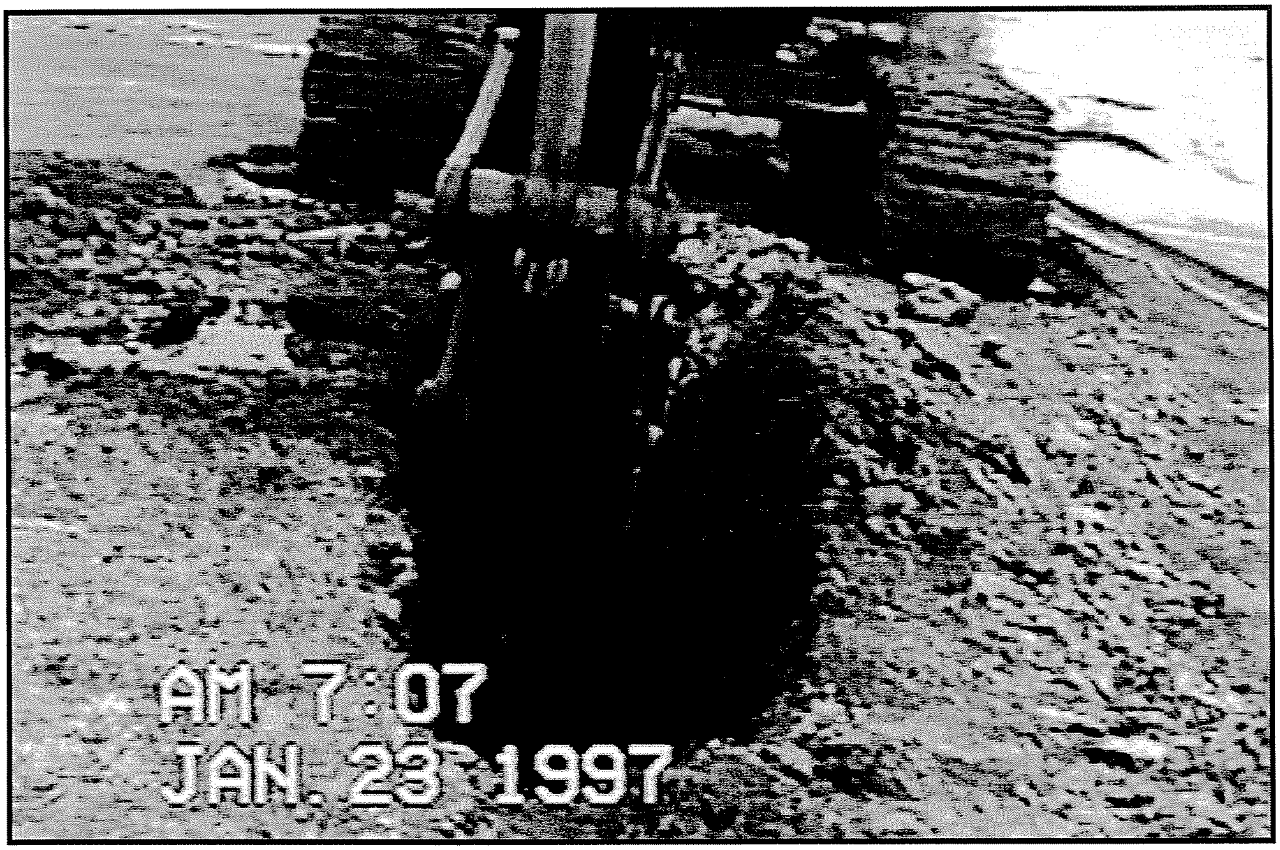
figure A.2
TEST PIT SUMMARY REPORT
GRATWICK-RIVERSIDE PARK SITE
Performing Parties

CRA

7987 (2) FEB. 13/97(P) REV.0 (layout)



Test Pit TP-21

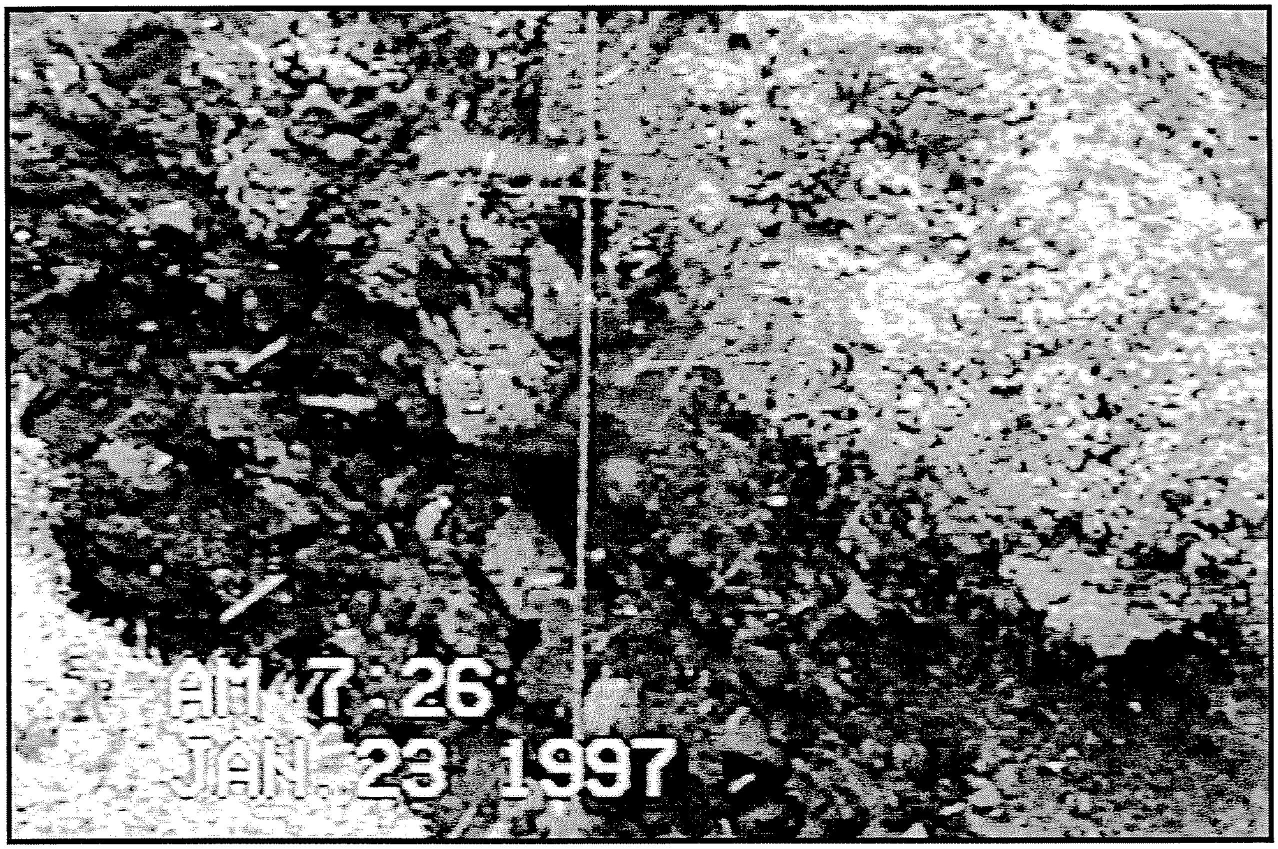


Test Pit TP-22

figure A.3
TEST PIT SUMMARY REPORT
GRATWICK-RIVERSIDE PARK SITE
Performing Parties

CRA

7987 (2) FEB. 13/97(P) REV.0 (layout)



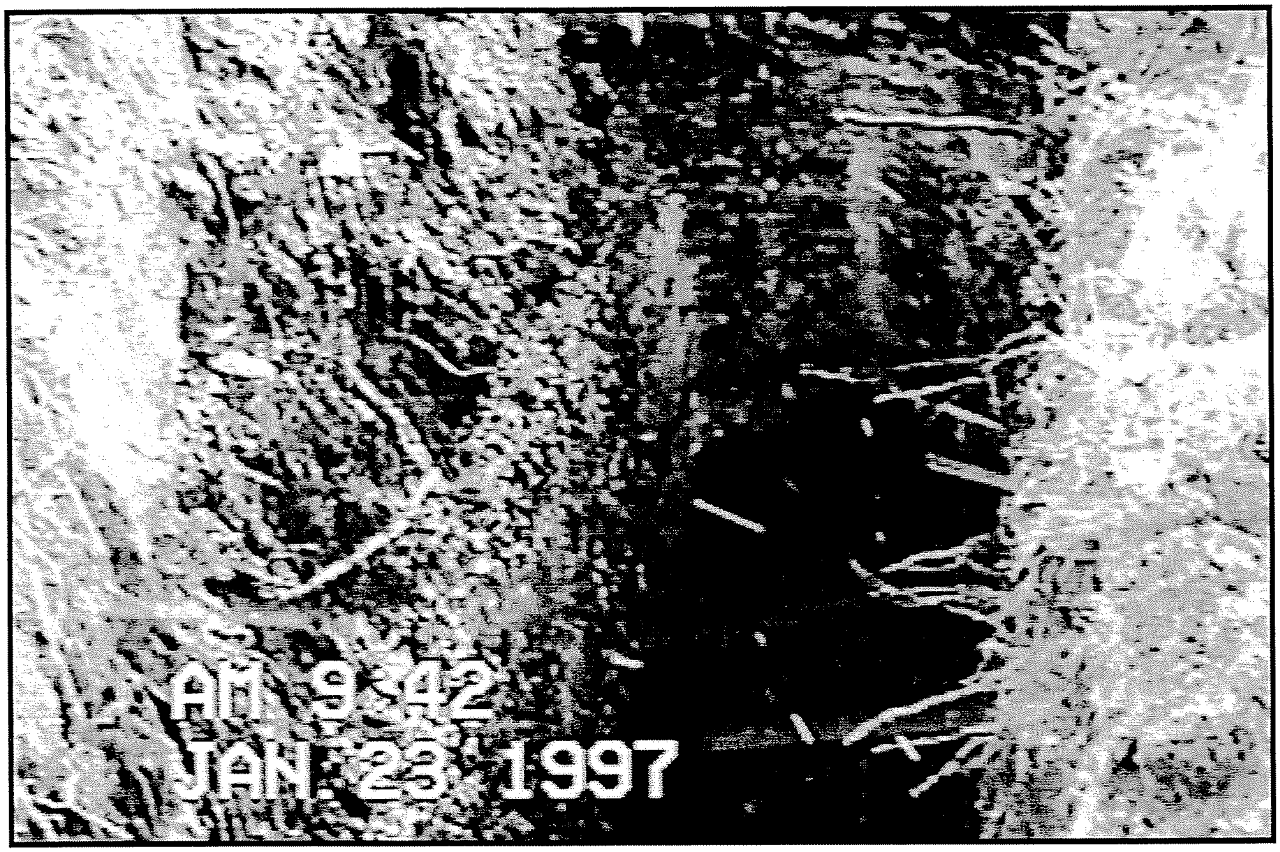
Test Pit TP-22

Test Pit TP-23

figure A.4
TEST PIT SUMMARY REPORT
GRATWICK-RIVERSIDE PARK SITE
Performing Parties

CRA

7987 (2) FEB. 13/97(P) REV.0 (layout)

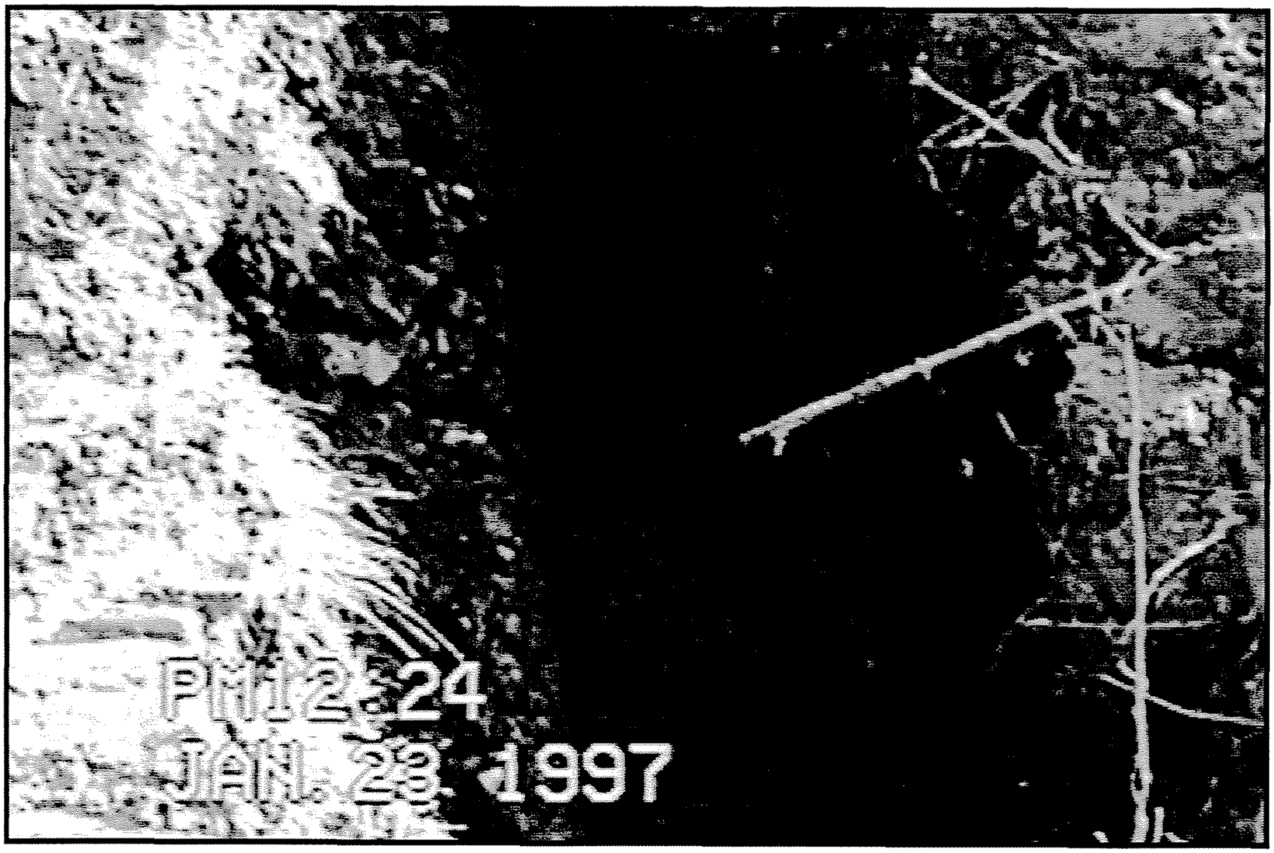


Test Pit TP-23

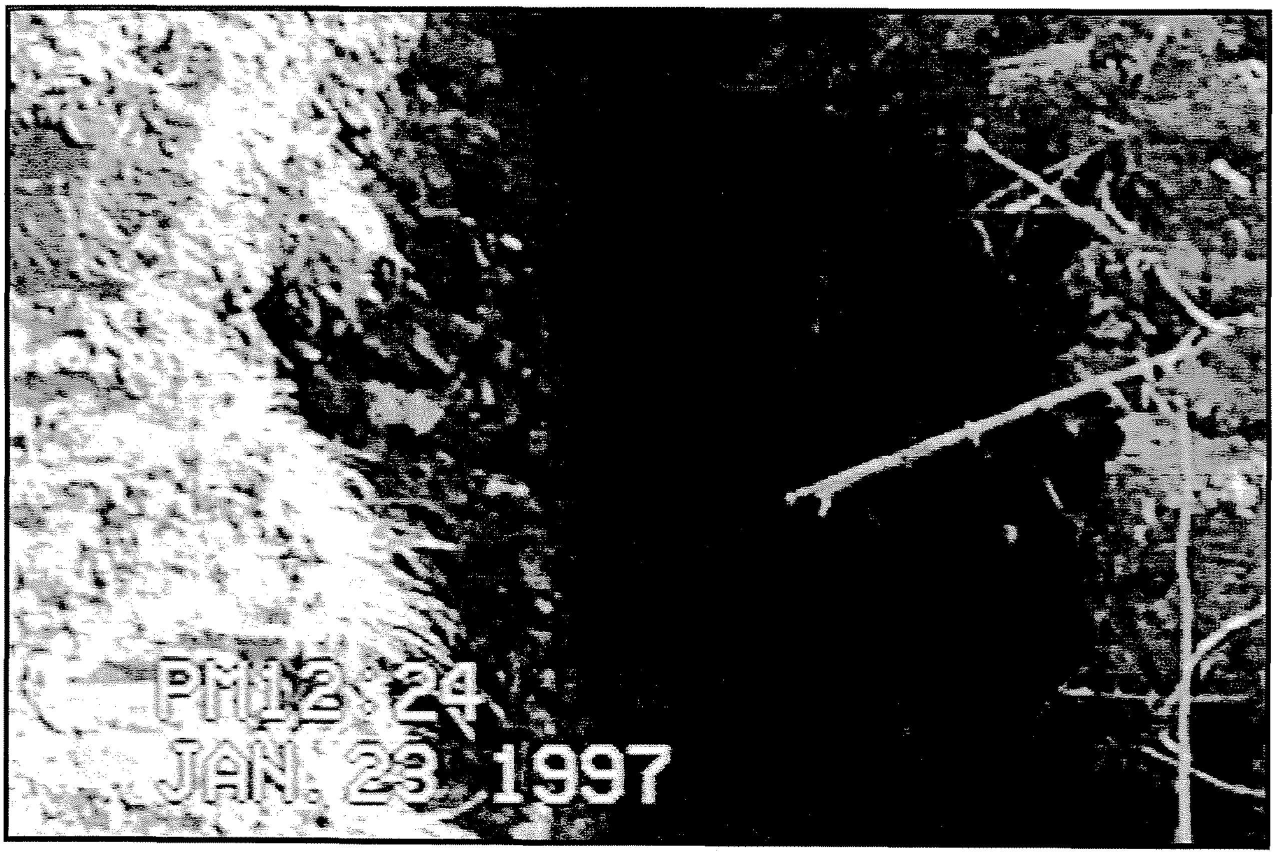
Test Pit TP-24

figure A.5
TEST PIT SUMMARY REPORT
GRATWICK-RIVERSIDE PARK SITE
Performing Parties

CRA



Test Pit TP-24



Test Pit TP-24

figure A.6
TEST PIT SUMMARY REPORT
GRATWICK-RIVERSIDE PARK SITE
Performing Parties

CRA