FINAL REMEDIAL DESIGN REPORT

BUFFALO COLOR CORPORATION AREA "D" SITE

Buffalo, New York **Site No. 9 -15-012**

SUBMITTED TO

NEW YORK STATE DEPARTMENT
OF ENVIRONMENTAL CONSERVATION
DIVISION OF HAZARDOUS
WASTE REMEDIATION

SUBMITTED BY

AlliedSignal

PREPARED BY

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PARSONS

FEBRUARY 1996
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PARSONS ENGINEERING SCIENCE, INC.

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RD-ES-L-034
March 1, 1996

Mr. Shive R. Mittal, P.E.
Environmental Engineer
New York State Department of Environmental Conservation
Bureau of Western Remediation
Division of Hazardous Waste Remediation
50 Wolf Road
Albany, New York 12233

Re: Buffalo Color Area "D" Site
Erie County, New York
Site No.: 9-15-012

Dear Mr. Mittal:

Parsons Engineering Science and AlliedSignal are pleased to submit five (5) copies of the Final (100%) Design Report (including stamped plans and specifications) for approval by the NYSDEC for the referenced site. In accordance with the letter issued by the NYSDEC on December 22, 1995, we have addressed your comments on the November, 1995 Pre-Final Remedial Design. The responses are attached to this letter.

The attached Table 1 lists our final design drawings and revision status prior to the final NYSDEC review.

Please call me at (716) 633-7074 if you have any questions on the submittal or responses.

Very truly yours,

PARSONS ENGINEERING SCIENCE, INC.

James H. Kyles /JPM

James H. Kyles
Project Manager

cc: D. Paley, AlliedSignal
E. Walerko, AlliedSignal
J. P. McAuliffe, Parsons ES/Syracuse
G. Sutton, NYSDEC (1 copy)
C. O'Connor, NYSDOH (1 copy)
A. Wakeman, NYSDOH (1 copy)

RESPONSES TO NYSDEC COMMENTS ON 90% DESIGN DATED JANUARY 21, 1996

GENERAL

__Comment 1:__

The final plan sheets must be stamped by NYS P.E. and include "No alterations ...." clause required by Education Department. Also, the restriction notice should be removed as final design will be placed in public repositories.

Response:

Agreed. The final plan sheets have been stamped and we have made the revisons as requested.

__Comment 2:__

The contract documents should specify that the remediation is being done under the terms of the order on consent and the selected contractors/subcontractors should be provided with a copy of the consent order.

Response:

Section 01010 - Summary of the Work has been revised to state that the Contract Documents for the remediation have been prepared under terms of the order on consent. The order will be provided to the selected Contractor.

REMEDIAL DESIGN REPORT

__Comment 3:__

The correct site no. is 9-15-012. Please correct the cover page.

Response:

Agreed. The cover page has been corrected.

__Comment 4:__

Section 3.3.4, Federal Permits: Placement of erosion control material along the Niagara River appears to be in error. It should be Buffalo River.

Response:

Agreed. The text has been revised.

Comment 5:

Section 3.4, Engineering Design Criteria, Page 3-7, First bullet: It appears that the 50% slope beyond the anchor tench refers to the bank slope. The bank slopes will be set at 3H to 1V (see drawings). Please clarify.

Response:

Agreed. Design report text has been revised to read as, "Generally, river bank and cap slopes will not exceed 33%".

Comment 6:

Section 4.3.4, Page 2-9, Backfill Mix Design: The source of the soil for the backfill mix should be specified. The excavated material from the tench can only be used for the mix if not contaminated. Specify the permeability requirements of the backfill mix (paragraph 3). All contaminated soil from the trench excavation should be placed within containment.

Response:

Parsons ES cannot specify the source of the backfill mix because no specific source has been secured for the project. Rather, three potential sources were evaluated by REMCOR to define the backfill mix design. Parsons ES has revised the backfill specification to address the required gradation of the soils needed to achieve the necessary permeability. Our cutoff wall specification does not allow excavated soil to be used for backfill.

Comment 7:

Section 4.5.3, Page 4-2, Erosion Protection. The erosion protection will extend from Elevation 560 feet to 580 feet. Specify these elevations on plans (Drawings C-9 and C-10). Method of placing the riprap (and need of silt curtain) should be specified.

Response:

Drawings C-9 and C-10 have been modified as requested. The specification for riprap has been modified to discuss placement method. The silt curtain requirement is addressed under the Erosion Control Plan.

Comment 8:

Section 4.5.3, Erosion Protection. Placement of riprap on geotextile seems to be inconsistent with Appendix C, Figure 2.

Response:

Appendix C has been revised to be consistent with this section.

Comment 9:

Section 4.5.5, Wetland and Habitat Development, page 14. The description of fish pod construction in this section does not agree with the description given in Appendix C, Figure 5. A combination of large boulders with adjacent gravel and cobble is preferred.

Response:

The text of Section 4.5.5 and Appendix C have been revised for consistency.

COMMENTS ON APPENDIX C

Comment 10:

General. Organization and overall presentation of information in Appendix C could be improved by adding a table of contents, developing a hierarchy of text headings, and number all pages, including figures.

Response:

Agreed. Appendix C has been revised as requested.

Comment 11:

Page 1. A knowledge of the hydrology of the site is crucial to designing a wetland which functions effectively. The site's hydrology is influenced by Lake Erie levels which cycle annually, generally showing peak levels during June. Since River levels during the growing season (May to August) are probably important design criteria, these trends are important to consider.

Response:

Parsons ES has lowered the excavated "trough" by an additional foot to help ensure plant establishment. Additionally, the RFI Work Plan for Buffalo Color Areas A, B, C, and E requires a hydraulic connectivity study be conducted to assess the influence of the Buffalo River on site groundwater. This data will be reviewed, along with survey shots during 1996 of field-observed high/lows, prior to construction of the wetland in 1997. Any revisions needed to the design will be provided as field changes to the Contractor.

Comment 12:

Page 2. It is not always clear whether the discussion of Area D, beginning on page 2, pertains to all shoreline at the side or is restricted to the steeply-sloping section of shoreline at the upstream portion of the site.

Response:

The text has been revised for clarity.

Comment 13:

Page 2. The description of soil characteristics is not entirely clear as to whether this depth/type of soil will be placed in the engineered wetland.

Response:

The text has been revised for clarity.

Comment 14:

Page 3. Does the discussion of bank zones pertain to both the engineered wetland and to the banks at the upstream portion of the site?

Response:

The text has been revised for clarity.

Comment 15:

Page 3. There does not appear to be a reference to Figure 1 (plan view of the project) in Appendix C. The cross-section views in Figures 2-5 are based on Figure 1, so a reference to Figure 1 is needed.

Response:

Agreed. The reference has been provided as requested.

Comment 16:

Page 3. The text states the toe zone is "often inundated for over 6 months of the year." This seems like an unusual way to describe a zone which we assume is typically inundated most of the time. If the zone is dry for up to 6 month of the year, some wetland plants, particularly submerged vegetation will not likely fare well.

Response:

The text has been revised for clarity.

Comment 17:

Page 4. We suggest arrowwood be omitted from the list of candidate shrub plantings. This species may establish on the capped area if planted in close proximity. We suggest that shrubs such as buttonbush, dogwoods, willows, and speckled alder, which develop branches extending out over the water, be planted in Zones 1 - 3.

Response:

Agreed. The text of Appendix C has been revised accordingly, and the plans and specifications have been modified for consistency with the revised Appendix C.

Comment 18:

The description of Zone 1 hydrology sounds very similar to that provided for the toe zone. Isn't this zone hydrologically different from the toe zone? Please explain.

Response:

The text has been revised for clarity.

Comment 19:

Page 4. We suggest removing cottonwood and arrowwood from the list of candidate species. Cottonwood seeds are wind-borne and may be dispersed to the landfill cap where woody growth is undesirable.

Response:

Agreed. See response to Comment 17.

Comment 20:

*Page 5. **Planting Dates** - We suggest that planting be done in the spring. This will allow use of the appropriate planting stock (dormant cuttings, etc.) and provide for more favorable growing conditions than a summer planting. In order to accomplish a spring planting, we would agree to the delay of woody plantings until the spring of 1997.*

Response:

Agreed. Planting will be delayed until the spring of 1997.

Comment 21:

*Page 6. **Site Planting** - We suggest that the diameter of the tubes mentioned here range from 8 to 12 inches. The placement of tubes within riprap will allow planting to be done at a later time. The tubes may be left in place to protect planting stock from shifting stone. It may be desirable, however, to remove the tubes from larger tree species to prevent future girdling.*

Response:

Perforated 8-inch PVC tubes will be used for the purpose described.

Comment 22:

Page 6. We suggest establishing a short-term (1-2 years) plan for controlling noxious weeds such as mugwort, Japanese knotweed, and purple loosestrife. This measure should help establish desirable vegetative species to give them a competitive advantage over the weeds. A program like this could conceivably be performed using volunteer assistance.

Response:

Agreed. Parsons ES has revised the O&M Plan to reflect a two-year control program.

Comment 23:

*Page 6. Division of Fish and Wildlife Staff should be notified as to **amounts** of available planting stock required. State nursery stock is delivered in the spring. The contractor may be required to store or remove State planting stock from a storage site for planting. DEC may be able to store materials at Tillman Road WMA.*

Response:

Parsons ES advised Mr. K. Roblee of Division of Fish and Wildlife of the quantity of plants needed for the habitat restoration during our meeting of December 15, 1995.

<u>Comment 24:</u>

Page 6. We suggest the Erie County Soil and Water conservation District, 50 Commerce Way, East Aurora, New York as an additional source of planting. Americorps staff may be available for plantings and other labor-intensive tasks.

Response:

Agreed. Parsons ES will discuss this option with Mr. John Wittney of Erie County and AlliedSignal.

<u>Comment 25:</u>

*Page 7. **Maintenance and Care** - Because of the expected continued presence of beaver on the site, we suggest that all willow posts and planted tree species be protected by a cylinder of wire mesh extending 3 feet above the riprap surface. Without this protection, beavers will cut and fill planting stock. It will not be necessary to protect shrub and smaller willow species, since these should be able to sustain occasional cutting by beavers.*

Response:

Agreed. Parsons ES has revised the specifications to require the Contractor wrap the posts with chicken wire to protect plants from herbivores. Additionally, the O&M Plan has been revised to require maintenance of the wire wrap for up to two years from planting.

<u>Comment 26:</u>

*Page 8. **Special Concern Areas** - We suggest that those areas below the perimeter underdrain outlets be included as special concern areas. Our recommendation is that only willow and/or buttonbush be planted below the outlets.*

Response:

Agreed. The planting plan has been revised accordingly.

<u>Comment 27:</u>

Page 8. Will black willow posts be placed along shoreline at membrane seams as per REMCOR plans?

Response:

No. Black Willow posts will be placed only in the wetland area.

Comment 28:

Page 8. We suggest removing cottonwood from the list and substituting sycamore.

Response:

Agreed. The text of Appendix C and corresponding plans and specifications have been revised accordingly.

Comment 29:

Page 9. Since it seems the willow posts will expand in diameter as they grow, we wonder if the posts can expand freely if surrounded by 24 - 30 inches of riprap? Will the posts become girdled?

Response:

Although the maximum riprap size is 24 inches, the average riprap size is only 12 inches. We believe these riprap sizes will not girdle the willow posts.

Comment 30:

Page 9. Is shoreline in the area of high scour (at the point) sufficiently different from the other areas to warrant a separate cross-section view?

Response:

No. An additional cross-section is needed, however, in Appendix C.

Comment 31:

Page 11. In Table 1, we suggest deleting cottonwood and arrowwood. We suggest including sycamore, shadbush, and buttonwood. It would be desirable for wildlife-attracting purposes to plant staghorn sumac on the remediated site, perhaps along railway embankments, or at the downstream portion of the site.

Response:

Agreed.

Comment 32:

Page 12. We suggest that broad-leaved cattail (Typha latifolia) be included within the emergent planting zone. It may be beneficial to restrict planting of this species to the downstream portion of the wetland. This will allow the other emergent plants listed an opportunity to establish without severe competition *from the cattail. This species of cattail has been observed in upstream wetlands of the Buffalo River.*

Response:

Agreed.

Comment 33:

In the open-water portion of the engineered wetland (Table 2), we suggest plantings (low density) of Vallisneria (wild celery). Appendix G contains technical specifications related to Vallisneria plantings (Page 02910A-7).

Response:

Vallisneria will be planted within the wetland. Appendix C text has been revised for consistency with Appendix G.

Comment 34:

Page 13. For Table 3, it is not clear how the wetland hummock seed mix related to the project. What types of procedures and materials are necessary for mulching wetland seedings/plantings.

Response:

The text of Appendix C has been revised to describe how the hummock seed mix has been used in the wetland. Appendix G has also been revised for consistency.

Comment 35:

Figure 1.. Wetland end sections are depicted differently in Figure 1 from Drawing C-7. Which version is the definitive plan?

Response:

Drawing C-7 is correct.

Comment 36:

Figure 1. Topographic contours for engineered wetland are depicted differently in Figure 1 from Drawings C-7 and C-8. Which version is the definitive plan?

Response:

Drawings C-7 and C-8 are correct.

Comment 37:

Figure 1. We suggest Allied consider placing a break (or two) in the approximately 700 foot long offshore breakwater. The break(s) would enhance water circulation within the wetland, increase nutrient transfer, create additional "edge" and facilitate access into and out of the wetland lagoon for aquatic organisms. Large boulders could be placed in break(s) to protect against flotsam.

Response:

Two breaks have been added as requested.

Comment 38:

Figure 2. Mean (Average) water levels are identified differently in Figure 2 from cross-section views associated with Drawing C-9. Explain these differences.

Response:

See response to Comment 11.

Comment 39:

Figure 2. How were the mean water levels in Figure 2 derived? How were on-site levels tied into elevations? Were Coast Guard Station gauging data consulted to help verify on-site water level determinations?

Response:

See response to Comment 11. The Coast Guard Station is too far from the site to be useful.

Comment 40:

Figure 3. Code(s) for substrate type(s) in Figure 3 are not clear. Can we assume that contaminated soils at wetland site has been excavated and replaced with 1 foot of clean soil?

Response:

Agreed. One foot of clean substrate soil has been placed within the wetland.

APPENDIX "E"

Comment 41:

Appendix E, Section 3.2, Post Closure Conditions, Page 3-1: It may be necessary to monitor the exterior wells for chemical analysis if gradient reverses.

Response:

Agreed. Section 3.2 has been revised to reflect this contingency.

Comment 42:

Appendix E, Section 4.3, Groundwater Sampling and Analysis, Page 4-1: Due to the large fluctuation in the water level in the Buffalo River, the groundwater level measurements should be taken monthly for the first year. The frequency can be changed to quarterly in the subsequent year with the approval of the Department.

Response:

Agreed. Groundwater measurements has been taken monthly for the first year, quarterly thereafter (dependent on Department approval).

Comment 43:

Appendix E, Section 4.3.9, Data Evaluation and Reporting, Page 4-5 last paragraph and Section 6.1, Page 6-1, first paragraph: After completion of remedy, all reports generated during O&M period should be submitted as follows:

i. *One copy to the Director, Division of Hazardous Waste Remediation NYSDEC, 50 Wolf Road, Albany, New York 12233-7010;*

ii. *One copy to the Director, Bureau of Environmental Exposure Investigation, NYS Department of Health, 2 University Place, Albany, New York 12203; and*

iii. *One copy to the Regional Director, NYSDEC Region 9, 270 Michigan Avenue, Buffalo, New York 14203.*

Response:

Agreed. Distribution list has been noted in Appendix E.

TECHNICAL SPECIFICATIONS (APPENDIX G)

Comment 44:

Section 01050, Field Engineering, delete references to engineering as State Education Law requires that task to be performed by design engineer (Parsons Engineering Services). "Engineer" should be replaced with "Site Superintendent" or "licensed land surveyor" as appropriate.

Response:

Agreed. Specification has been revised as requested.

Comment 45:

Section 01300, Submittals: This section, referred to at a number of places, is missing. One copy of all the submittals should be submitted to NYSDEC for review and/or information.

Response:

Agreed. This specification was accidentally omitted from final production. Submittals has been provided to NYSDEC for review and/or information.

Comment 46:

Section 01510, Temporary Construction Facilities: Office space and facilities for NYSDEC personnel should be included.

Response:

Agreed. NYSDEC personnel will be housed in Parsons ES/AlliedSignal trailer.

Comment 47:

Section 01564, Erosion Control: This specification provides reference to October 1995 (an older version) Storm Water Management and Erosion Control Plan. Add the words "or the latest revisions" where appropriate while referencing a document in this design report. Provide a copy of the EPA memorandum 78-1.

Response:

Agreed. The specification has been revised as requested. Because this is a State regulated project, and compliance with the State's general stormwater permit for construction is required, reference to federal guidance is inappropriate.

<u>**Comment 48:**</u>

Section 01630, Substitutions: Any substitutions must be reviewed and approved by the Department.

Response:

Agreed. Substitutions will be submitted to the NYSDEC for review and approval.

<u>**Comment 49:**</u>

Section 01720, Record Documents: Documents should be made available at all times for inspection by the Department. Set of final documents should be provided to the Department.

Response:

Agreed.

<u>**Comment 50:**</u>

Section 02050, Demolition, Table 020250: Complete all the items in the table. The suggested Decommissioning Method for Wells RP-7, RP-8 and PW-2 will depend upon the depth of these wells.

Response:

Agreed. Table 020250 has been revised.

<u>**Comment 51:**</u>

Section 02081, Sediment Removal; Details of the handling and disposal of sediments and the water is not included. Delete the words "as a non-hazardous waste" in Part 3.02-A of this section. The emergency response system (page 02081-3, first paragraph) should include deployment of silt curtain along with absorbent booms, if necessary.

Response:

Agreed. Additional details have been added to the specification, including reference to the Erosion Control Plan for deployment of silt curtain and absorbent booms.

<u>Comment 52:</u>

Section 02200, Earth Work: Page 2200-7, Paragraph 3.09-C; What is the frequency of the in-place density testing to be performed by the Engineer.

Response:

The specification does not require modification, however, the CQA Plan has been revised to define the frequency of in-place density testing. It should be noted that in-place density testing is <u>not</u> required for cover soils under 6 NYCRR Part 360.

<u>Comment 53:</u>

Section 02296, Soil Bentonite Slurry Trench Cut-off Wall: Paragraph 1.01-6A; Backfill design mix should be incorporated in this design directly. This document is the pre-final remedial design report (dated October 1995), which creates confusion with the final design report referenced.

Delivered bentonite should be field tested to ensure quality, since it is critical to the quality of the slurry. Field testing should include physical and chemical purity, pH, gel strength and fines (% passing 200 sieve).

Paragraph 3.03-A and 3.04-A, Page 02296-8 & 9: The soil excavated from the trench can only be used for mix design if certified clean.

Sieve analysis (i.e., amount of fines) of backfill is directly related to the permeability of the finished cutoff walls and its ability to withstand chemical attack. During construction (page 02296-13), frequent grain size distributions and less frequent permeability testing should be performed on the backfill material to ensure that the design permeability requirements has been met by completed slurry wall. Grain size distributions can be performed in a field laboratory.

Response:

The date of the referenced Remedial Design Report has been revised to February 1996, or current. The suggested testing has been added. The specification has been revised to preclude use of onsite soil for the backfill mix. The specification has also been revised to require gradation tests be performed twice daily.

REMEDIAL ACTION WORK PLAN (APPENDIX H):

Comment 54:

Page 3-2, Paragraph 3.3.2 Clearing and Grubbing: The referenced specification 02110 is missing. Revise the thickness of the FML from 40 mil to 60 mil on page 3-3 paragraph 3.3.2.

Response:

Agreed. FML thickness has been revised to 60 mil.

Comment 55:

Section 3.3.4 Capping System - A turf grass mixture is mentioned here. Allied previously agreed to use a seed mixture containing tall grasses and a mowing frequency of once per year to establish habitat for field-nesting birds. "Once per year, after July 15th" was proposed on a REMCOR document provided to Regional Fish & Wildlife Staff by Mr. Dave Paley of AlliedSignal. Mr. Paley also provided us with a proposed seed mixture which contained orchard grass.

Response:

Agreed. The capping system will reflect a seed mixture of tall grasses. Section 3.3.4 has been revised accordingly.

Comment 56:

Page 3-4, Paragraph 3.3.5, River Bank Stabilization: Revise the thickness of Rip rap to average of 30 inches and elevation to 560 feet.

Response:

Agreed.

Comment 57:

Section 3.3.6 Engineered Wetland and Habitat Enhancement. Seedling planting technique does not agree with those described in Bank Restoration - Sit Planting in Appendix C. Which technique has been used? Both tèchniques have some merit.

Response:

The text of this section is correct. Appendix C has been revised for consistency.

<u>Comment 58:</u>

Page 4-4, Paragraph 4.7, Operations and Maintenance: The O&M manual may need revisions to include the as built conditions. Therefore, the O&M manual should be finalized at the time of completion of the remedy.

Response:

Agreed.

<u>Comment 59:</u>

Attachment 2, Construction Quality Assurance Plan: Page 5-1, Paragraph 5.3; The cap construction QA Program must comply with the applicable regulations of 6 NYCRR Part 360-2.13.

Page 5-9, Paragraph 5.4.3, Geonet Drainage Layer: The minimum coefficient of permeability must be $1x10^{-2}$ cm/sec (see 6 NYCRR Part 360-2.13).

Page 5-13, Paragraph 5.5.2 Cover soil layer: The 6 inches of the soil layer immediately below HDPE or immediately above geonet must be reasonably free of stones. Gradation indicates 45% of soil passing No. 200 sieve. Clogging of the geonet is of concern.

Response:

A sentence has been added to the CQA Plan noting compliance with 6 NYCRR Part 360-2.13.

The equivalent permeability of the proposed geonet is significantly higher than $1x10^{-2}$ cm/see referenced. The text has been revised to clarify the transmissivity of the geonet.

The HDPE is cushioned from stones by the use of the cushion geotextile both above and below. The specification for the gradation has been revised to address the clogging concern.

<u>Comment 60:</u>

Page 5-14, Section 5.5.3, Top Soil: The gradation of the top soil (20-80% passing no. 200 sieve) is not in confirmation with paragraph 2.01, of Specification 02990. Please clarify.

Response:

The text of Section 5-5.3 has been revised to conform to the Specification.

Comment 61:

Page 5-19, Table 5-1: The testing frequencies are not in accordance with 6 NYCRR Part 360-2.13(s). Please revise the table.

Response:

The testing frequencies referenced are for low permeability soils (i.e. clay). The testing frequencies for the cover soils specified are in compliance with 6 NYCRR Part 360.

DESIGN DRAWINGS (APPENDIX F)

Comment 62:

Drawing No C-1, Demolition Plan: In note no. 6, add slurry wall. The buried utilities should be cut a minimum of two feet from the face of slurry wall location.

Response:

Agreed. Drawing C-1 has been revised.

Comment 63:

Drawing No. C-2, Cutoff Wall Location Plan and detail, Note 3, Sequence of construction: Excavation outside cutoff wall will involve excavation under water in bench area at some locations. Will this under water bench area be backfilled before the river soil from the bank where bench area is under water. Please clarify the sequence.

Response:

Note 3 of Drawing C-2 has been revised to clarify construction sequence.

Comment 64:

Drawing No. C-8 shows an "access road" adjacent to engineered wetland. Does this road continue along remainder of shoreline?

Response:

This note was left from a previous draft. There is no perimeter "access road." The note has been deleted.

<u>Comment 65:</u>

Drawing No. C-8, please include a note on the drawing requesting preservation of wooden pilings at the downstream end of the site. Please include a note on the drawing requesting preservations of the beaver lodge at the downstream end of the site.

Response:

Agreed.

<u>Comment 66:</u>

Drawing C-9, note 9 and C-10, notes 9 and 11, it is not possible to meet any compaction criteria for backfill placed beneath water. LNAPL contaminated soils cannot be excavated on a visual basis in the presence of water. Both situations will require the contractor to delay the work until water levels recede or actively dewater the excavation. Add typical top elevation of the rip rap on one cross section.

Response:

This has been clarified in the specification Section 02200. For backfill beneath water, granular fill has been used. The weight of the granular fill will provide adequate compaction. It is not practical to wait for river water to retreat as the water level stays around EL.573 most of the time. Elevation at top of riprap has been added to the cross sections.

<u>Comment 67:</u>

Drawings C-12, Capping System Detail: The 6 inches of the soil layer in subgrade and cover soil immediately below and above the HDPE should be reasonably free of stones.

Response:

As noted in the response to Comment 59, the HDPE liner is protected from puncture through the use of a geotextile below, and the geonet and geotextile above the liner. The maximum particles size for the cover soil is 3 inches.

<u>Comment 68:</u>

Drawings C-13, Groundwater collection System: The 40 mil HDPE in section A/C-13 should be changed to 60 mil (two places).

Response:

Agreed.

<u>Comment 69:</u>

Drawing C-15, Typical Well Details: Please specify the distance between the exterior well and the slurry wall. The exterior well should be located as close to the slurry wall as possible.

Response:

Agreed.

<u>Comment 70:</u>

Drawing C-16, Decon Pad and Gas Vent Detail: Please indicate if both the geomembrane boot detail and the geotextile boot detail will apply at all pipe penetrations (extraction wells, interior monitoring wells, gas vent pipes etc). If so, provide combined boot detail (using single or double bend).

Response:

The details will apply to all pipe penetrations Parsons ES has left these as separate details to provide better specificity to the Contractor.

TABLE 1
INDEX OF FINAL DESIGN DRAWINGS

Date	Revision	AlliedSignal Drawing No.	Parsons ES Drawing No.	Drawing Title
2/29/96	D	431963	G-1	Title Sheet
2/2/96	C	431971	G-2	Existing Site Plan
2/28/96	D	431978	G-3	Site Utility Plan
2/2/96	C	431966	C-1	Demolition Plan
2/2/96	C	431949	C-2	Cutoff Wall Location Plan and Detail
2/2/96	C	431955	C-3	Cutoff Wall Profile Sta. 0+00 to STA. 7+50
2/2/96	C	431976	C-4	Cutoff Wall Profile STA. 7+50 to STA. 22+50
2/2/96	C	431977	C-5	Cutoff Wall Profile STA. 22+50 to STA. 36+84
2/2/96	C	431948	C-6	Capping System Subgrade Plan
2/29/96	D	431964	C-7	Final Grading Plan
2/2/96	C	431984	C-8	Habitat Features Plan
2/2/96	C	431950	C-9	Cross Sections A-A and B-B
2/2/96	C	431956	C-10	Cross Sections C-C and D-D
2/2/96	C	431951	C-11	Cross Sections E-E, F-F, G-G and H-H
2/2/96	C	435785	C-11A	Cross Sections I-I and J-J
2/29/96	D	431960	C-12	Capping System Details
2/2/96	C	431970	C-13	Ground Water Collection System Details
2/2/96	C	435761	C-14	Ground Water Collection System Details
2/2/96	C	431968	C-15	Typical Extraction Well and Observation Well Details
2/2/96	C	435762	C-16	Decon Pad and Gas Vent Details

TABLE 1
INDEX OF FINAL DESIGN DRAWINGS (CONT'D)

Date	Revision	AlliedSignal Drawing No.	Parsons ES Drawing No.	Drawing Title
2/2/96	C	435763	C-17	Habitat Details
2/2/96	C	435764	C-18	Yard Piping Details
2/2/96	C	435765	A-1	Architectural Plan
2/2/96	C	435766	A-2	Architectural Elevations -North & West
2/2/96	C	435767	A-3	Architectural Elevations -South & East
2/2/96	C	435768	A-4	Architectural Sections & Details
2/29/96	C	435786	A-5	Architectural Details
2/2/96	C	435769	S-1	Foundation Plan
2/2/96	C	435770	S-2	Foundation Details
2/2/96	C	435771	S-3	Foundation Details
2/29/96	D	435772	M-1	Equipment Layout
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FINAL REMEDIAL DESIGN REPORT

BUFFALO COLOR CORPORATION AREA "D" SITE

Buffalo, New York **Site No. 9 -15-012**

SUBMITTED TO

NEW YORK STATE DEPARTMENT
OF ENVIRONMENTAL CONSERVATION
DIVISION OF HAZARDOUS
WASTE REMEDIATION

SUBMITTED BY

AlliedSignal

PREPARED BY

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Buffalo, New York

PARSONS

FEBRUARY 1996

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REMEDIAL DESIGN REPORT
FINAL DESIGN SUBMITTAL
VOLUME 1

BUFFALO COLOR CORPORATION
AREA "D" SITE
100 LEE STREET
BUFFALO, NEW YORK
NYSDEC SITE NO. 9-15-012

Submitted to:

THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF HAZARDOUS WASTE REMEDIATION

Submitted by:

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101 Columbia Road
Morristown, NJ 07962

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FEBRUARY 1996

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James H. Kyles	**(Date)**
Parsons Engineering Science, Inc., Project Manager	

(coverrem/W:c)

REMEDIAL DESIGN REPORT

BUFFALO COLOR CORPORATION, AREA "D" SITE 100 LEE STREET BUFFALO, ERIE COUNTY, NEW YORK (NYSDEC SITE NO. 9-15-012)

CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who managed the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

John P. McAuliffe 3/1/96

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LIST OF ABBREVIATIONS AND ACRONYMS

ACRONYM	DESCRIPTION
AlliedSignal	AlliedSignal Inc.
API	American Petroleum Institute
ARARs	applicable or relevant and appropriate requirements
ASTM	American Society for Testing and Materials
BCC	Buffalo Color Corporation
BRIC	Buffalo River Improvement Corporation
BSA	Buffalo Sewer Authority
CFR	Code of Federal Regulations
cm/sec	centimeters per second
°F	degrees Fahrenheit
DNAPL	dense non-aqueous phase liquids
ECP	Electrical Control Panel
EPA	U.S. Environmental Protection Agency
FML	flexible membrane liner
ft^3	cubic feet
ft^3/sec	cubic feet per second
ft-msl	feet above mean sea level
GAC	granular activated carbon
GCL	geosynthetic clay liner
gpm	gallons per minute
gpm/ft^2	gallons per minute per square feet
HDPE	high-density polyethylene
H-O-A	Hand/Off/Auto
lb/ft^3	pounds per cubic feet
lbs/acre	pounds per acre
LNAPL	light non-aqueous phase liquid

LIST OF ABBREVIATIONS AND ACRONYMS

(Continued)

ACRONYM	DESCRIPTION
$\mu g/kg$	micrograms per kilogram
mg/l	milligrams per liter
MSL	Mean Sea Level
NAPL	non-aqueous phase liquid
NWWA	National Water Well Association
NYCRR	New York Codes, Rules, and Regulations
NYSDEC	New York State Department of Environmental Conservation
P&ID	process and instrumentation diagram
PAHs	polynuclear aromatic hydrocarbons
PIWP	Predesign Investigation Work Plan
POTW	publicly owned treatment works
ppm	parts per million
QAPP	Quality Assurance Project Plan
RAP	Remedial Action Plan
RCRA	Resource Conservation and Recovery Act
RD/RA	Remedial Design/Remedial Action
RFI	RCRA Facility Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SAP	Sampling and Analyses Plan
SCGs	Standards, Criteria, and Guidelines
SPDES	State Pollutant Discharge Elimination System
SVOCs	semivolatile organic compounds
TAGM	Technical and Administrative Guidance Memorandum
TBCs	To Be Considered
TDS	total dissolved solids
TOGS	Technical and Operations Guidance Series
TSS	total suspended solids
USACE	U.S. Army Corps of Engineers
VOCs	volatile organic compounds

SECTION 1

INTRODUCTION

1.1 PROJECT DESCRIPTION

On June 28, 1993, AlliedSignal Inc. (AlliedSignal) signed an Order on Consent[1] with the New York State Department of Environmental Conservation (NYSDEC) following a result of a NYSDEC Record of Decision[2] (ROD) signed on November 22, 1991. The Order on Consent requires the implementation of a Remedial Action (RA) at the Buffalo Color Corporation (BCC) Area "D" Site located in Buffalo, New York (Figure 1). The Order on Consent requirements include the preparation and submittal of this Remedial Design Report to the NYSDEC.

This Remedial Design Report has been prepared in accordance with the approved RD/RA Work Plan. The report: (1) summarizes the results of predesign activities; (2) includes pre-final design plans and specifications describing remedial actions to be conducted at the site; (3) outlines the necessary regulatory approval; and (4) contains a Remedial Action Work Plan describing the construction activities, health and safety program, and construction quality assurance procedures to be implemented during remedial construction.

The ROD presented the following RA objectives established by the NYSDEC:

- Prevent direct exposure to onsite soils so that the potential risk to human health through exposure is at an acceptable level.
- Prevent erosion of contaminated onsite surficial and shoreline soils and waste into the Buffalo River, thereby eliminating contaminant loading to the Buffalo River through mechanical erosion, and eliminating a potential source of contaminants to the sediments.
- Limit the migration of contaminated groundwater and non-aqueous phase liquids (NAPL) constituents from the site into the Buffalo River, thereby limiting contaminant loading to the Buffalo River via subsurface groundwater.
- Limit the migration of contaminants to the groundwater.

In accordance with the preferred alternative established in the ROD, the remedy for the Area "D" Site consists of the following components:

- Installation of a cutoff wall around the site to contain and extract contaminated groundwater.
- Installation of a flexible membrane liner (FML) covered with soil and vegetated to minimize precipitation infiltration and prevent exposure to the site waste.
- Collection of shallow groundwater and non-aqueous phase liquid from the Area "D" Site.
- Stabilization of the shoreline with geotextile fabric and riprap.

- Treatment of groundwater to the established New York State discharge limit (see Section 3.3.2).
- Excavation of existing fill outside the cutoff wall limits and replacement with clean fill.
- Access restrictions and limitation of future site use with deed restrictions.
- Monitoring to ensure the selected remedy is effective in satisfying the project objectives.

In accordance with the Order on Consent, a Remedial Design/Remedial Action (RD/RA) Work Plan[3] and a Predesign Investigation Work Plan[4] (PIWP) were submitted to the NYSDEC. After approval of these Work Plans, a Predesign Investigation was performed by REMCOR, Inc. in the summer of 1994. The findings of the Predesign Investigation have been compiled in Technical Memoranda which are described in Section 2 of this report.

1.2 SITE DESCRIPTION

The Area "D" Site is located on BCC property at 100 Lee Street, off South Park Avenue, in the City of Buffalo, Erie County, New York. The site consists of an approximately 19-acre peninsula surrounded by the Buffalo River (east, south, and southwest), by a CONRAIL et al., Railroad yard (north), and to the northeast by an abandoned railroad right-of-way and the BCC dye manufacturing facility.

Three waste management units were previously operated at the Area "D" Site: (1) iron oxide sludge lagoons; (2) a metal sludge weathering area; and (3) an incinerator area. Two of the areas, the iron oxide sludge lagoon area (NYS Site No. 9-15-012A) and the metal sludge weathering area (NYS Site No. 9-15-012B) are currently listed as Class 2 sites in the Registry of Inactive Hazardous Waste Disposal Sites by the NYSDEC.

The portions of the Area "D" Site that were identified as being of primary concern include:

- The weathering area located at the tip of the peninsula, which was used for the storage of metal oxide sludges prior to shipment to metal recyclers.
- The iron oxide sludge lagoons that were used for storage of iron oxide sludge, from the manufacture of dyes and intermediates.
- Tank farm areas used for the bulk storage of petroleum products and process chemicals.
- The area on the eastern side of the peninsula formerly occupied by open burning pits (1922 to 1954) and later by an incinerator (1954 to 1972) that was used for burning of organic wastes generated during dye manufacturing processes.

The Area "D" Site and immediate surrounding area are zoned for heavy industry. The nearest residential area is approximately 1,200 feet northwest of the site. The topography of the Area "D" Site (Elevations 568 to 587 feet above mean sea level [ft-msl]) and the surrounding area are relatively flat. Currently, surface runoff at the site is entirely to the Buffalo River. The riverbank is relatively steep, dropping from the site to the river (mean water level 568 ft-msl), at slopes approaching 1 horizontal to 1 vertical (1H:1V).

1.3 SITE HISTORY

Prior to being developed, the Area "D" Site was reportedly low-lying and swampy. During development, the area was filled to raise the surface above the Buffalo River. The Area "D" Site was used from 1905 to 1974 for manufacturing. From 1905 to 1920, acids, chemicals, and dye intermediates were produced by the Contact Process Company and by the National Aniline Chemical Company. Phosgene gas was produced between 1917 and 1918 by National Aniline and Edgewood Arsenal at the site. In 1920, these companies merged along with certain other companies into the Allied Chemical and Dye Corporation. Allied Chemical and Dye Corporation manufactured petroleum-based detergents, dye intermediates, picric acid, and other chemicals at the Area "D" Site between 1920 and 1974. During this period, the majority of onsite structures, railroad tracks, and tank parks were built.

Chemical manufacturing operations ceased in 1974 and waste management activities ceased in 1976. In 1977, the property was sold to BCC and has remained idle since that time. All tanks were removed and structures on the site were demolished to grade by BCC in 1984.

1.4 DOCUMENT ORGANIZATION

This document is organized into the following seven chapters:

- Section 1 - Introduction
- Section 2 - Investigation Results
- Section 3 - Regulations and Permit Requirements
- Section 4 - Remedial Design
- Section 5 - Construction Phase Work Plan
- Section 6 - Long-Term Operation and Maintenance
- Section 7 - References

Sections 1 through 3 summarize available information pertaining to the Area "D" Site and present design constraints. Section 4 details the design of the major remedy components. Section 5 includes the proposed construction schedule and construction QA/QC procedures. Section 6 discusses the procedures to monitor the remedy components to ensure that the long-term goal of the RA is achieved. Section 7 identifies the supporting documents used during the design phase. Technical Memoranda which were prepared by REMCOR are referenced in Section 7, however, they have not been resubmitted with this design report.

This document is supported by the following appendices:

- Appendix A - Geotechnical Investigation Results
- Appendix B - Wetlands Delineation and Habitat Assessment

- Appendix C - Habitat Survey and Restoration
- Appendix D - Storm Water Management and Erosion Control Plan
- Appendix E - Post-Remedial Construction Operations and Maintenance
- Appendix F - Design Drawings
- Appendix G - Technical Specifications
- Appendix H - Remedial Action Work Plan

Due to their size, the design drawings associated with this document (Appendix F) have been bound separately.

FIGURE 1

BUFFALO COLOR AREA "D"

AlliedSignal

SITE LOCATION MAP

BUFFALO SE, N. Y.
SE/4 BUFFALO 15' QUADRANGLE
N4245—W7845/7.5

1965

QUADRANGLE LOCATION

1000 0 1000 2000 3000 4000 FEET

PARSONS ENGINEERING SCIENCE, INC.
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SECTION 2

INVESTIGATION RESULTS

2.1 INTRODUCTION

This chapter summarizes the results of predesign investigations conducted at the Area "D" Site. Where applicable, this section references documents that contain detailed information regarding the collection and analysis of samples, and study results.

2.2 INITIAL INVESTIGATIONS

In March of 1982, an Order on Consent[5] was signed between BCC and NYSDEC to undertake field investigations of both the iron sludge lagoons and the metal sludge weathering area. Various field investigations were completed between 1985 and 1987. The results of these field investigations indicated that additional investigations were required to determine if the site posed unacceptable risk(s).

On December 14, 1987, AlliedSignal and BCC jointly signed an Order on Consent[6] with NYSDEC, agreeing to conduct a Remedial Investigation/Feasibility Study (RI/FS) of the Area "D" Site in accordance with an approved Work Plan. The RI involved the following tasks:

- A geophysical survey;
- Drilling and sampling of 7 deep test borings;
- Installation of 4 piezometers and 13 monitoring wells within shallow and deep water-bearing zones;
- Determination of geological and hydrogeological features of the region and area;
- Measurement of groundwater and river water elevations; and
- Sampling of groundwater, surface water, river sediments, and surficial soil.

The generalized RI[7] results are presented in the following sections.

2.2.1 Geologic and Hydrogeologic Investigation

The Area "D" Site is underlain by five stratigraphic units (fill, alluvium, glacio-lacustrine deposits, glacial till, and bedrock). Fill consists of mixtures of gravel, sand, silt, clay, demolition debris, and other foreign materials, and the fill layer averages nine feet thick. Alluvium underlies fill and generally consists of black to gray silty sand with traces of clay and averages 18 feet thick. Glaciolacustrine deposits underlie the alluvium, consisting of gray and brown-gray clayey silt and silty clay, and average 28 feet thick. Glacial till is the lowest surficial.deposit and consists of gray and brown sandy silt, with small percentages of clay and gravel and averages 12 feet thick.

Three water-bearing zones were defined at the Area "D" Site. The shallowest water-bearing zone is located in the fill/alluvium deposits and has an average hydraulic conductivity of 2.2×10^{-3} centimeters per second (cm/sec) and an estimated average seepage velocity of 1.4×10^{-5} cm/sec. The groundwater flow in this zone is primarily from the north and flows directly to the Buffalo River. The intermediate water-bearing zone within the glaciolacustrine deposits (overburden aquitard) has a hydraulic conductivity of only 1.2×10^{-9} cm/sec. Hydraulic conductivity in the bedrock water-bearing zone has been estimated to be 1.4×10^{-2} cm/sec.

2.2.2 Contaminant Characterization

The areas of concern at the Area "D" site are depicted in Figure 2.1. Contamination at the Area "D" Site is considered by NYSDEC to be both widespread and variable with respect to its character and concentration. Contaminants known to be present onsite are summarized in Table 2.1. Contamination was found in the fill and/or shallow groundwater at every location of the site investigated during the RI[8]. Polynuclear aromatic hydrocarbons (PAHs), metals, arsenic, and chlorinated benzene were detected in samples from the fill layer. Samples of sediments adjacent to the site had detectable concentrations of PAHs, arsenic, and several metals. Contamination of the shallow groundwater was found to include volatile organics, chlorinated benzene, iron, and other metals. In addition, an oily sheen was observed in the soils at a number of locations and a light non-aqueous phase liquid (LNAPL) was found on the groundwater in the area of former Tank Park 910 and the former incineration area.

The analytical results of the subsurface soil samples indicate that no organic contaminants were found more than 30 feet below ground surface. The groundwater data indicate that only the uppermost saturated zone is contributing contaminants to the Buffalo River. Therefore, it is apparent that the underlying clay/till layer is effective in providing a barrier for downward contaminant migration.

2.3 PREDESIGN INVESTIGATIONS

A series of Predesign Investigations (PIs) were conducted at the Area "D" Site to define site constraints; fill data gaps that existed after the RI; define site characteristics for the RD; and allow sampling for permeability, strength, treatability, and compatibility testing. The scope of the PIs encompassed: fill and soil sampling from borings, test pits, and the river bottom; monitoring well installations; groundwater and NAPL sampling; treatability testing; geotechnical testing; and surveying. The majority of the PIs were implemented by REMCOR, Inc. and were incorporated or presented in the 30 Percent Design Report. The results of the PIs were compiled into a series of Technical Memoranda that were previously provided to the NYSDEC. Several additional studies were conducted by Parsons Engineering Science. Inc. (Parsons ES) in order to gather additional information to finalize the remedial design. The key-results of the Predesign Investigations are presented in the following sections.

2.3.1 Cutoff Wall

The investigation for the cutoff wall was conducted by REMCOR and involved defining the vertical and horizontal locations of the barrier; and evaluating the compatibility of the soils, groundwater, and NAPL with the bentonite to be used as a component of the cutoff wall. There were three general activities conducted to achieve these goals:

- Borings were advanced to locate the low-permeability layer and evaluate the wall alignments;
- Test pits were installed to characterize the site soils, and verify the cutoff wall location; and
- Bench-scale testing was provided to develop appropriate slurry mix for the cutoff wall and to confirm the compatibility between cutoff wall and NAPL.

The borings were used to visually classify the soil strata at each location; to identify the presence of NAPL in the soil samples; to identify any obstructions encountered at the boring locations; to determine the depth to the low-permeability layer; and to allow soil sampling for permeability and strength testing. The test pits allowed for "bulk" observations of stratigraphy, visual classification of the materials against which the cutoff wall will be placed, and an enhanced ability to evaluate obstructions over that possible with a drill rig.

Areas of particular interest were the former iron oxide sludge lagoon area, the incineration area, and the 54-inch water line owned by the Buffalo River Improvement Corporation (BRIC). The BRIC water line is discussed further in Section 2.3.6.

The relationship of the former sludge lagoons to the cutoff wall required careful evaluation to determine the potential for contact between the cutoff wall and residuals from the surface impoundments, and with the NAPL in the incineration area. Bench-scale testing was conducted to determine the formulation of the soil/bentonite slurry mix, and the compatibility of the slurry mix with the groundwater and NAPL at the site. The results of this PI task were presented in the REMCOR Technical Memorandum - "Site Cap, Cutoff Wall, and Shoreline Stabilization Systems" [8]. It was determined through the compatibility testing program that a slurry trench cutoff wall using bentonite (sodium montmorillonite) would not be adversely affected by the NAPL and other contaminants at the site, and could be formulated such that the permeability of the cutoff wall will not exceed 1×10^{-7} cm/sec.

Compatibility testing was completed to determine the long-term effects of compounds contained in site groundwater on the materials used in the construction of the soil/bentonite cutoff wall. The compatibility testing focused on determining the long-term effects of the groundwater on the backfill mix. The program consisted of selecting one backfill mix based on the results of the short-term permeability testing for further standard soil permeability testing. The mix selected is composed of, by weight: one percent bentonite in slurry, 30 percent clay (20 percent minus No. 200 sieve), and 69 percent granular material. By comparing the permeability of a soil/bentonite mix when it is permeated with groundwater to that obtained when it is permeated with plant service water, a determination was made of the groundwater's potential effect on the permeability of the cutoff wall. No adverse impacts or incompatibilities were observed during the test.

2.3.2 Capping System

The PI, conducted by REMCOR, included consolidation testing of soils around the remaining building foundations and testing of remolded soils to be placed as subgrade for the capping system. The capping system investigation included:

- Test pits to determine properties of materials to be placed under the cap;
- Air monitoring to determine if there would be a potential for gas generation beneath the capping system;
- Sampling of existing site materials for testing to ensure capping system could be supported without causing slope failures;
- Survey to enable design of the storm water management controls; and
- Compatibility testing of liner components with onsite conditions.

The stability of the cap outslopes and the potential for differential settlement due to various past uses of the Site or soil types was a key element in the capping system design. The former weathering area was of highest concern for both issues. This area has the potential for slope movements and significant differential settlements along the southern end of the large foundation exist in the middle of the site. To estimate the settlement of the cover due to consolidation of the alluvium, consolidation testing of selected soil samples was conducted. Calculations based on the geotechnical testing showed that negligible consolidation will occur due to the increase in stress associated with placement of the capping system and dewatering of the alluvium. The calculated settlements varied from 3.2 to 8.5 inches. The resulting differential settlement, after placement of the FML cap, is expected to be less than 1 inch.

Compatibility testing of the liner material was conducted by Geotechnics. Samples selected for use in the site capping system were exposed to samples of groundwater from the Area "D" Site in accordance with "Method 9090 Compatibility Test for Wastes and Membrane Liners" (EPA/600/2-88/052)[9]. The results indicate that site groundwater would not have a detrimental effect on the proposed liner material.

2.3.3 Shoreline Stabilization

The evaluation of the shoreline stability included:

- Survey soundings to determine topography of the Buffalo River bottom adjacent to the site;
- Locating USACE Buffalo River channel dredge line;
- Sampling of the river soils/sediments to assist the stabilization design; and
- Excavating of test pits to identify areas of concern, as shown on Figure 2.1 (i.e. weathering area, tar seeps, slope movement areas).

The shoreline stabilization evaluation included defining the soils that can be considered permanent for the purpose of the stability evaluation. The soils that can be considered permanent are stable soils beneath loose river bottom materials, soils outside the limits of the USACE dredging limits, soils to be left in place following the RA, and soil to be placed as part of the RA. The former weathering area and the shoreline along the western bank were of particular interest because there have been historical references to slope movements within this area (eastern bank); and near the Conrail bridge.

The sounding survey of the Buffalo River adjacent to the site was conducted by MacIntosh and MacIntosh, Surveyors P.C. Soundings were performed along the entire shoreline, on fifty foot intervals. The limits of the sounding survey extended 100 feet from the shores of the site. The results of the sounding survey were used to create digital contours of the submerged embankments and river bottom. The contours were incorporated into the design drawings. Parsons ES obtained the USACE Buffalo River dredging limit information on a drawing in August 1995[10]. This information has been incorporated into design drawing C-6.

2.3.4 NAPL and Groundwater Treatment

The non-aqueous phase liquids (NAPL) and groundwater investigations conducted by REMCOR included characterization of the NAPL that had been identified onsite, and of the groundwater expected to be received into the wastewater treatment plant equalization tank. The PI investigations also identified the quantity of water to be collected during site development (period between initiation of the groundwater RA and the establishment of steady-state conditions) and under steady-state conditions. The various investigations related to NAPL and groundwater treatment included the following:

- Installation of test pits and borings to delineate areas of NAPL occurrence;
- Performance of a pump test to accurately estimate the hydraulic conductivity and specific yield of the alluvium aquifer;
- Conducting a pump test to gather transmissivity and storativity data of the shallow aquifer; and
- Conducting a treatability test on collected groundwater necessary for treatment plant design.

Two former seeps were identified along the river bank, as shown on Drawing G-2. The NAPL, tentatively identified as kerosene, was located near the Former Tank Park 910. The groundwater data from all of the borings and test pits was evaluated. The evaluations determined the occurrence of groundwater around the site, the variability of the top of the aquiclude, and the controls that will be required to maintain the groundwater within the limits of the cutoff wall. The characterization of the NAPL identified onsite is discussed in the document - "Revision 1, Technical Memorandum, Non-Aqueous Phase Liquids (REMCOR, Inc. December 1994)" [11]. The NAPL was found to have a density less than water and was further characterized as a light non-aqueous phase liquid (LNAPL) which generally floats on the water table.

Seven borings (NB-1 through NB-7) were advanced to specifically assess the LNAPL proximate to existing monitoring wells W-8 and MW-4-88, where LNAPL was observed during previous remedial investigations. Four of these borings were completed as piezometers RP-3 through RP-6 (NB-1/RP-4, NB-2/RP-3, NB-3/RP-5, and NB-4/RP-6). Test pits and borings advanced near the former Iron Oxide Lagoons Area, and from the west shore and Former Pit Area, also yielded information pertinent to the LNAPL assessment.

The investigation revealed LNAPL in several existing monitoring wells, including: W-15 (Former Iron Oxide Lagoons Area); MW-3-88 (West Shore and Former Pit Area); and W-8. Up to seven feet of LNAPL was identified in the existing monitoring wells. The oily substances were visually evident on the surface of groundwater samples collected from both W-14 and W-15. Well W-15 contained the largest quantity of LNAPL substances which was both free-floating and dispersed throughout the sample.

The presence of organic material, which may manifest itself as LNAPL in groundwater, was observed in subsurface soil samples collected at various locations along the west shore, in the Former Pit Area, and in the Former Iron Oxide Lagoons Area. During the collection of sediment samples from the river, an oil sheen was observed on the water surface at transects RS-6 through RS-10, along the western shoreline.

Each of the locations in which LNAPL was observed in the water or in which organic material was encountered in the soil are shown in Figure 2.1. The observations made regarding the presence of LNAPL and organic materials in the monitoring wells, piezometers, borings, and test pits are presented in detail in the Technical Memorandum [11].

Aquifer performance testing conducted at the Area "D" Site provided additional information with respect to hydrogeologic conditions occurring at the Site which was used for the design of the groundwater extraction/collection system. Pump test data was reduced and plotted on time-drawdown graphs.

The calculated values of transmissivity and storativity at each observation well are:

Observation Well	Transmissivity (gpd/ft)	Storage Coefficient Storativity
OB-1	5,225	9.41×10^{-4}
OB-2	6,117	4.76×10^{-4}
OB-3	1,197	5.96×10^{-4}
OB-4	3,771	6.35×10^{-4}

The calculated storage coefficients are less than those expected in an unconfined aquifer, where the expected range of storativity is approximately 0.3 to 0.01. The likely explanation for these observations is that the silt and clay alluvium overlying the sand and gravel may act as a leaky confining unit. Therefore, the results of the pumping test may be more indicative of the hydrologic conditions in the coarser sediments in the lower five feet of the saturated zone.

To address the presence of the LNAPL, the groundwater collection system proposed for the remedial action will require phase separation for groundwater collected from several of the recovery wells. Further discussion regarding the selection of wells with separate pumping collection and treatment is discussed in Section 4.6. The Treatability Study for the Area "D" Site groundwater was conducted by Zenon Environmental Inc. Treatability testing confirmed that ferric sulfate addition followed by lime addition (35 milliliters [mL] of a one percent lime solution per liter of samples) to a pH of 8.5, effectively removed the metals from the samples of groundwater from the Area "D" site. Preliminary estimates indicate 16 tons of lime will be required annually to carry out the chemical precipitation based on an estimated 20 gallons per minute (gpm) flow rate. This will produce 9,300 cubic feet (ft^3) of sludge that is 14 percent solids (40 tons dry basis). Organics were effectively removed by 100 milligrams (mg) of activated carbon per 100 mL of sample. Treatment of the organics is estimated to require 5,000 pounds of carbon annually.

2.3.5 Long-Term Monitoring

The long-term monitoring program requirements were evaluated in conjunction with the remedial design criteria. Elements of for the long-term monitoring program evaluation included:

- Determining locations for monitoring well placement;
- Obtaining the requirements for treated groundwater discharge; and
- Reviewing existing data to develop criteria for evaluating the RA effectiveness.

The Long-Term Monitoring Plan (LTMP), which incorporates the results of these studies, is included in Section 6 of this report.

2.3.6 54-Inch B.R.I.C. Water Line

The Buffalo River Improvement Corporation (BRIC) owns and operates a 54-inch water line which is located on the northwest corner of the Area "D" site. The water line supplies process water to several industries in the vicinity of the site. Buffalo Color Corporation is the primary user of the water main. The water line was mapped on the site drawings based upon drawings provided by AlliedSignal (dated September 1993). The design concepts for the Area "D" site were developed with consideration for not interrupting service through the BRIC water line.

2.4 FOUNDATION DESIGN INVESTIGATION

A foundation design investigation was conducted by Parsons ES to obtain necessary geotechnical information for the design of the foundation for the water treatment building. The investigation involved advancing two borings in the general proximity of the proposed water treatment plant, sampling and classifying soils, and collecting soil samples for physical analysis in a laboratory. The field data consisted of Standard Penetration Tests (SPT) values and visual soil classification. The laboratory analysis consisted of one-dimensional consolidation tests, moisture content and Atterberg Limits for cohesive soils (clay), and grain size analysis for cohesionless soils (sandy, gravelly soils). The collected data was then used to evaluate the bearing capacity of the soils and determine the amount of anticipated settlement. Foundation engineering analyses were performed for two potentially applicable building footings: a shallow spread footing of 6 foot by 6 foot and a deep steel H-pile footing. Both the bearing capacity and settlement of the proposed foundations were analyzed. The results indicate that the spread footing would settle six to nine inches due to consolidation of the soft foundation soils. Varying the depth and/or size of the proposed shallow spread footing was considered but was not adequate to significantly reduce the settlement to within acceptable limits. The analysis show that the pile foundation will have sufficient load bearing capacity. Little settlement is expected from the pile footing due to end bearing in bedrock and well distributed skin friction in the soil. Based on the analysis and structural requirements (i.e. 12 load carrying columns), a standard steel H-pile of eight inch size to bedrock is recommended to carry each column for the proposed wastewater treatment plant. Site soil testing borings show that the bedrock is located at a depth of approximately 65 feet bellow grade. Detailed information regarding the foundation design investigation is presented in Appendix A.

Utilizing the existing foundations was considered as a potentially economic solution for supporting the proposed wastewater treatment plant. The existing foundations were used to support previous buildings that have been demolished. However, no complete drawings of existing foundation design were available for the proposed area.

2.5 WETLANDS DELINEATION

A wetlands assessment was conducted to delineate wetlands and to determine the potential effect of the project on regulated wetlands located within or near the site. The wetlands assessment was conducted in accordance with the 1987 U.S. Army Corps of Engineers Wetland Delineation Manual. Following the completion of the wetland delineation, field markers denoting wetland boundaries were surveyed and tied into the site survey control. The field survey results were incorporated into the site topographic map and a detailed report is presented in Appendix B.

The majority of the site was characterized by an upland community and evidence of wetland parameters were absent. The Slope Failure Area met the parameters for a jurisdictional wetland and comprised an area of 0.44 acres. The lack of a shrub layer suggests that, of the woody species present, only the fast growing willows and cottonwoods can survive the debris deposition and ice scour naturally occurring in the Buffalo River. In contrast, the annual jewelweed flourishes in the shifting substrate.

Given the small area of the wetland, its downstream location and the large volume of water passing the site, the wetland functions performed by this wetland are quite limited. The amount of floodflow retention and sediment trapping it performs is very minor in this high flow section of the Buffalo River. The primary value of this wetland appears to be its wildlife habitat, not specifically as a typical wetland environment, but more as one of the more limited types of riparian shoreline present in this part of the Buffalo River.

2.6 HABITAT SURVEY

A survey of tree species and beach conditions along the Buffalo River shoreline was conducted in September 1995 by Beak Consultants. The main purpose of the inventory was to assess the feasibility of saving shoreline vegetation during remedial clean-up activities at the site. A secondary purpose of the survey is to provide an inventory of trees and beach conditions along the shoreline prior to remediation. The results of the survey are presented in Appendix D of this report. A summary table identifying the existing habitat type and quantity at the site is presented in Table 2.2.

TABLE 2.1

BUFFALO COLOR CORPORATION AREA "D" SITE SUMMARY OF ONSITE CONTAMINANTS

Type of Analysis	Analyte	Range
a. Organics/Surface Soils (0-2') mg/kg	Nitrobenzene	0.21 - 580
	Benzoic Acid	2.8
	Naphthalene	470
	2-Chloronaphthalene	66
	Phenanthrene	4.6 - 270
	Fluoranthene	4.8 - 330
	Pyrene	3.9 - 310
	Benzo(a)Anthracene	1.9 - 180
	Chrysene	2.1 - 180
	Benzo(b)Fluoranthene	3.1 - 150
	Benzo(k)Fluoranthene	140
	Benzo(a)Pyrene	1.7 - 140
	Indenol(1,2,3-cd)Pyrene	0.76 - 77
	Benzo(g,h,i)Perylene	0.78 - 63
	EOX(mg/kg)	11 - 2,780
b. Inorganics/Surface Soils (0-2') mg/kg	Arsenic	4.5 - 77.2
	Cadmium	0.82 - 24.8
	Chromium	44.2 - 1,990
	Copper	36.2 - 3,580
	Iron	15,200 - 537,000
	Lead	8.9 - 27,300
	Mercury	0.07 - 6.2
c. Organics/Subsurface Soils mg/kg	1,4-Dichlorobenzene	1.7 - 13
	1,2-Dichlorobenzene	0.91 - 110
	Nitrobenzene	0.21 - 1,100
	1,2,4-Trichlorobenzene	1.2 - 150
	Naphthalene	1.9 - 8.2
	2-Chloronaphthalene	0.55 - 140
	Fluoranthene	0.19 - 14
	Pyrene	0.14 - 13
	Benzo(a)Anthracene	1.1 - 6.7
	Chrysene	0.35 - 8.2
	Benzo(b)Fluoranthene	1.6 - 9.7
	Benzo(a)Pyrene	11 - 360
	EOX (mg/kg)	11 - 360

d. Inorganics/Subsurface Soils

mg/kg	Arsenic	4 - 2,860
	Cadmium	0.7 - 7
	Chromium	5.7 - 440
	Copper	6 - 14,500
	Iron	1,750 - 360,000
	Lead	8.4 - 83,200
	Mercury	0.19 - 14

e. Organics/Groundwater

ug/l	2-Chlorophenol	0.8 - 1,800
	1,4-Dichlorobenzene	1 - 4,900
	1,2-Dichlorbenzene	2 - 21,000
	1,2,4-Trichlorbenzene	8 - 1,200
	Naphthalene	0.3 - 4,900
	4-Chloroaniline	8 - 11,000
	2,4-Dinitrotoluene	2,000
	2,6-Dinotrotoluene	1,500 - 1,700
	Benzidine	90 - 360
	1-Naphthylamine	6 - 42,000
	Aniline	5 - 660
	Benzene	0.1 - 28,000
	Toluene	0.09 - 4,700
	Chlorobenzene	0.6 - 48,000
	Ethylbenzene	0.2 - 43,000
	Xylene (Total)	1 - 1,700

f. Inorganics/Groundwater

ug/l	Arsenic	5.7 - 1,820
	Cadmium	5 - 127
	Chromium	13 - 2,140
	Copper	15 - 78,700
	Iron	3940 - 405,000
	Lead	5 - 3,030
	Mercury	0.29 - 50

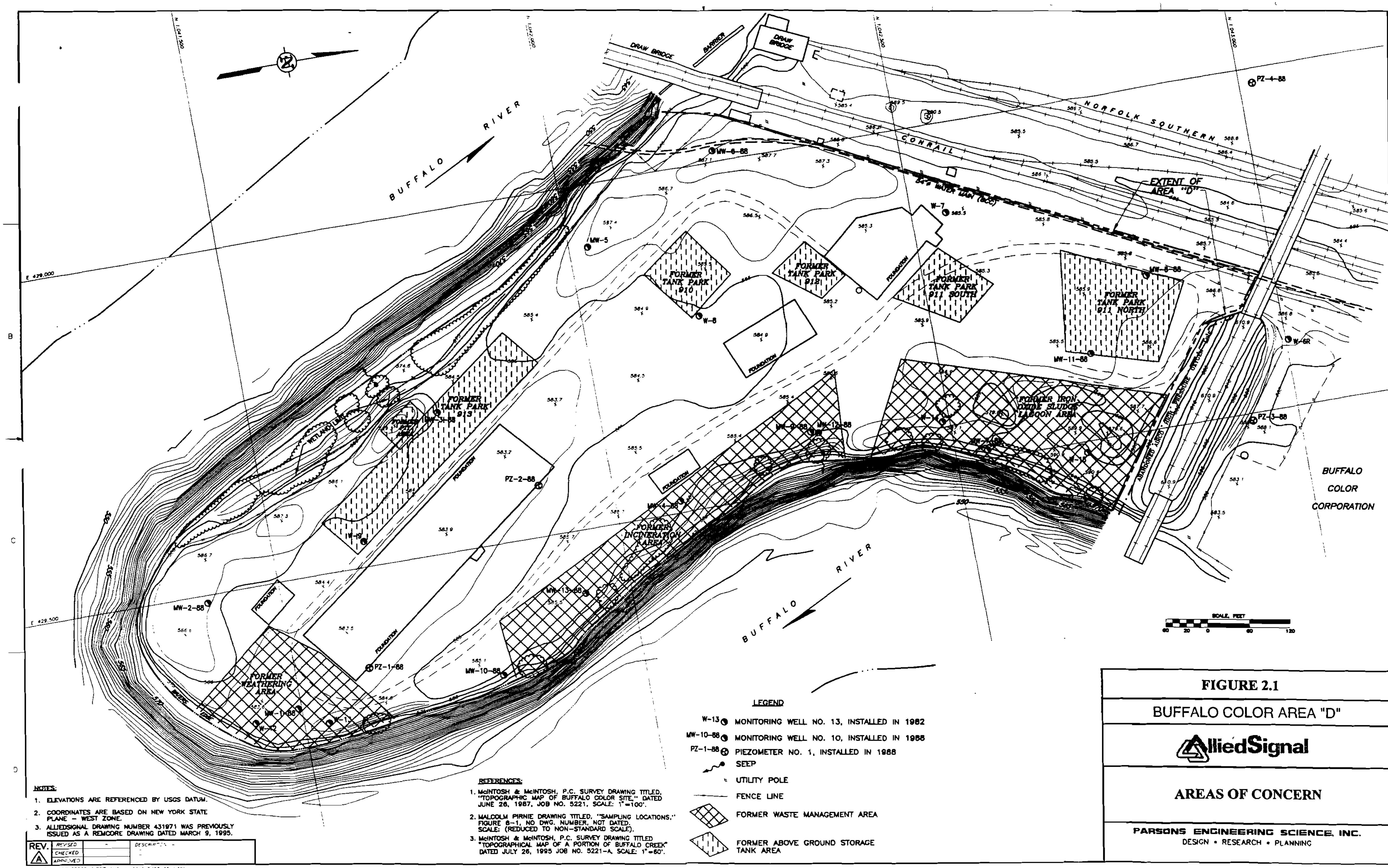
TABLE 2.2 ALLIED SIGNAL AREA "D" SITE VEGETATIVE COMMUNITIES SPECIES LIST

URBAN VACANT LOT

Common Name	Scientific Name	Abundance
Mugwort	*Artemisia Vulgaris*	very abundant
Japanese knotweed	*Polygonum cuspidatum*	abundant
Sweet white clover	*Melilotus alba*	abundant
Canada goldenrod	*Solidago canadensis*	common
White snakeroot	*Ageratina altissima*	common
Burdock	*Artium minus*	occasional
Curly dock	*Rumex crispus*	occasional
Queen Ann's lace	*Daucus carota*	common
Chicory	*Chichorium intybus*	common
Bittersweet nightshade	*Solanum dulcamara*	occasional
Hedge bindweed	*Calystegia sepium*	occasional
Evening primrose	*Oenothera biennis*	occasional
Shepard's purse	*Capsella bursa-pastoris*	few
St. John's wort	*Hypercium perforatum*	few
Spotted knapweed	*Centaurea maculosa*	few
Staghorn sumac	*Rhus typhina*	common
Eastern cottonwood	*Populus deltoides*	abundant
Green ash	*Fraximus pennsylvanica*	few
Crack willow	*Salix fragillis*	abundant
Tree of heaven	*Ailanthus altissima*	common
Sycamore	*Platanus occidentalis*	one individual
American elm	*Ulmus americana*	few

Cobble Shore Wet Meadow

Common Name	Scientific Name	Abundance
Jewelweed	*Impatiens capensis*	abundant
Enchanter's nightshade	*Circaea luteliana*	common
Hedge bindweed	*Calystegia sepium*	common
White snakeroot	*Ageratina altissima*	common
Canada goldenrod	*Solidago canadensis*	common
Tall meadow rue	*Thalictrum polygamum*	occasional
Thin leaved sunflower	*Helianthus decapetalus*	occasional
Stinging nettle	*Urtical dioica*	occasional
Wood sage	*Teucrium canadense*	occasional
Narrow-leaved cattail	*Typha augustifolia*	occasional
Purple loosestrife	*Lythrum salicaria*	occasional
Crack Willow	*Salix fragilis*	abundant
Staghorn sumac	*Rhus typhia*	occasional
American elm	*Ulmus americana*	few


BUFFALO RIVER
DRAW BRIDGE
BARRIER
DRAW BRIDGE
NORFOLK SOUTHERN
CONRAIL
EXTENT OF AREA "D"
FORMER TANK PARK 910
FORMER TANK PARK 912
FORMER TANK PARK 911 SOUTH
FORMER TANK PARK 911 NORTH
FORMER TANK PARK 913
FORMER IRON OXIDE SLUDGE LAGOON AREA
FORMER INCINERATION AREA
FORMER WEATHERING AREA
FOUNDATION
WETLAND LIMIT
BUFFALO COLOR CORPORATION
PZ-4-88
PZ-3-88
PZ-2-88
PZ-1-88
MW-6-88
MW-5
MW-8
MW-7
MW-11-88
MW-9-88
MW-12-88
MW-4-88
MW-13-88
MW-2-88
MW-10-88
MW-3-88
MW-1-88
W-19
W-6R
SCALE, FEET
LEGEND
W-13 MONITORING WELL NO. 13, INSTALLED IN 1982
MW-10-88 MONITORING WELL NO. 10, INSTALLED IN 1988
PZ-1-88 PIEZOMETER NO. 1, INSTALLED IN 1988
SEEP
UTILITY POLE
FENCE LINE
FORMER WASTE MANAGEMENT AREA
FORMER ABOVE GROUND STORAGE TANK AREA
NOTES:
1. ELEVATIONS ARE REFERENCED BY USGS DATUM.
2. COORDINATES ARE BASED ON NEW YORK STATE PLANE – WEST ZONE.
3. ALLIEDSIGNAL DRAWING NUMBER 431971 WAS PREVIOUSLY ISSUED AS A REMCORE DRAWING DATED MARCH 9, 1995.
REFERENCES:
1. McINTOSH & McINTOSH, P.C. SURVEY DRAWING TITLED, "TOPOGRAPHIC MAP OF BUFFALO COLOR SITE," DATED JUNE 26, 1987, JOB NO. 5221, SCALE: 1"=100'.
2. MALCOLM PIRNIE DRAWING TITLED, "SAMPLING LOCATIONS," FIGURE 6-1, NO DWG. NUMBER, NOT DATED. SCALE: (REDUCED TO NON-STANDARD SCALE).
3. McINTOSH & McINTOSH, P.C. SURVEY DRAWING TITLED "TOPOGRAPHICAL MAP OF A PORTION OF BUFFALO CREEK" DATED JULY 26, 1995 JOB NO. 5221-A, SCALE: 1"=60'.
REV. A
REVISED
CHECKED
APPROVED
DESCRIPTION
FIGURE 2.1
BUFFALO COLOR AREA "D"
AlliedSignal
AREAS OF CONCERN
PARSONS ENGINEERING SCIENCE, INC.
DESIGN • RESEARCH • PLANNING

SECTION 3

DESIGN CRITERIA AND PERMIT REQUIREMENTS

3.1 INTRODUCTION

The RD has been developed to satisfy the ROD and meet applicable or relevant and appropriate requirements (ARARs); and Standards, Criteria, and Guidelines (SCGs). The RD also incorporates, to the extent practical and reasonable, guidance and documents reviewed as "To-Be-Considered" (TBC). TBCs are not promulgated standards and are, therefore, only considered in the design as needed to assist in the development of engineering design criteria. Permit requirements have been incorporated into the remedial design.

3.2 COMPLIANCE WITH ARARS

This section reviews the ARARs used in establishing the RD and for measuring the effectiveness of the RA. The ROD for the Area "D" Site has documented a set of ARARs that address site groundwater and a set of ARARs that address site soils.

3.2.1 Groundwater ARARs

Groundwater beneath the Area "D" Site flows to the Buffalo River. The site groundwater is not used as a potable or other water source. Regionally, groundwater is not suitable for potable water use because of high total dissolved solids (TDS) and is classified as a Class GA saline groundwater (New York State Codes, Rules and Regulations [NYCRR], Title 6, Chapter X, 701.16). Therefore, there is no opportunity for direct exposure to groundwater and no human receptors. However, river biota may bioconcentrate groundwater contaminants that may be released into the Buffalo River through groundwater to surface water migration. This may result in environmental impacts on the river's ecosystem and potential human health risks associated with consumption of fish from the river.

The following regulatory requirements (or their latest revisions) have been identified as being ARARs for the remediation of the groundwater at the Area "D" Site:

- 6 NYCRR 703.5(a)(3), "Groundwater Standards for Class GA Waters"
- 10 NYCRR Subpart 5-1, "Standards for Drinking Water Supplies"
- 40 Code of Federal Regulations (CFR) 141.11, "Standards for Public Drinking Water Systems"
- 6 NYCRR 701.19, "Fresh Surface Water Standards (Class C)"
- NYSDEC Technical and Operations Guidance Series (TOGS) 1.1.1 (9-25-90), "Ambient Water Quality Standard"

- Clean Water Act 303-304, "Water Quality Criteria (Aquatic Life)"
- Clean Water Act 303-304, "Water Quality Criteria (Fish Consumption)."

Where two regulations have different standards for one of the chemicals of concern, the more stringent value given in the latest revision was applied. For example, 6 NYCRR Parts 700-705 were revised on September 1, 1991 to incorporate the more stringent standards of 10 NYCRR Part 5-1 and the Safe Drinking Water Act. These revised standards become part of the Order on Consent under the requirement to use the latest revisions.

Design and construction of the selected remedy will satisfy the requirements of the ARARs for groundwater. The cutoff wall, combined with groundwater pumping and pretreatment will reduce the migration of existing site groundwater to the Buffalo River. The cutoff wall and FML cap will limit offsite groundwater (i.e., groundwater from BCC or influent river water) and precipitation from migrating into the Area "D" Site and creating a means for potentially transporting site contaminants to the Buffalo River.

3.2.2 Discharge ARARs

The discharge standards for the treatment facility were based upon direct effluent discharge to the Buffalo River. Therefore, ARARs for direct discharge under a State Pollutant Discharge Elimination System (SPDES) permit were followed; namely, 6NYCRR Part 701.9 "Fresh Surface Water Standards (Class C)".

3.2.3 Soil ARARs

The Area "D" Site is surrounded on three sides by the Buffalo River and by fenced, patrolled private properties in the fourth direction. However, because the site is theoretically accessible from the Buffalo River, there is potential for exposure to the soils and waste materials onsite. The following guidelines have been identified as ARARs to the remediation of the Area "D" Site soils eroding to the Buffalo River:

- U.S. Environmental Protection Agency (EPA) Sediment Classification Guidelines (Region V: April 1977);
- NYSDEC Site-Specific Guidelines for Area "D" Soils, based on the EPA Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Guidance Report - Interim Final, May 1989; Protection of Groundwater; or Background Values;
- NYSDEC, Title 6 NYCRR Part 608 - Use and Protection of Waters; and
- NYSDEC, Technical and Administrative Guidance Memorandum (TAGM) HWR-92-4046 - Soil Cleanup Objectives and Levels.

Based on these guidelines, the chemical-specific ARARs for the soils at the Area "D" Site are as follows:

- Arsenic - 7,500 μg/kg
- Cadmium - 1,000 μg/kg
- Chromium - 10,000 μg/kg
- 1,2-Dichlorobenzene - 425 μg/kg
- 1,4-Dichlorobenzene - 425 μg/kg
- Iron - 550,000 μg/kg
- Lead - 32,500 μg/kg
- Mercury - 100 μg/kg
- Phenanthrene - 35,000 μg/kg

Design and construction of the selected remedy will satisfy the requirements of the ARARs for soil. The FML cap will eliminate fugitive dust emissions and direct exposure routes. Excavation of the fill outside the cutoff wall limits and construction of the shoreline stabilization will prohibit soil or waste from entering the Buffalo River and direct dermal contact exposure.

3.3 PERMIT REQUIREMENTS

The RA complies with the substantive requirements of all state permit programs. The permit applications filed for the RA at the site include:

- Erosion and Sediment Control Plan (Erie County Soil Conservation District) which includes the permit to discharge storm water during construction.
- State Pollutant Discharge Elimination System (SPDES) Permit. The NYSDEC has issued a letter granting a five year discharge program because the action is being conducted as a result of a Consent Order, and, therefore, does not require a permit.
- Building Permit for the Treatment Facility (City of Buffalo).
- A Joint Application for Permit under Sections 10 and 404 of the Clean Water Act (USACE and NYSDEC) for the soil removal from the river, regrading of the outslopes, and construction of the shoreline stabilization and wetland improvement.
- Coastal Zone Consistency Evaluation (New York State Department of State).

3.3.1 Storm Water Discharge Permit

Parsons ES has prepared a Storm Water Management and Erosion Control Plan (SWM & ECP) consistent with applicable New York State guidance, the *Erie and Niagara Counties Regional Planning Board Storm Drainage Design Manual*, and NPDES regulations governing storm water discharges from industrial facilities. A Notice of Intent was included as an attachment to the plan requesting coverage for storm water discharges associated with industrial activity under New York State's SPDES General Permit. The Plan is provided herein as Appendix D.

3.3.2 Discharge Permit

Approval for the discharge of treated groundwater has been issued by the NYSDEC. Table 3.1 lists the effluent discharge criteria. The detailed discharge permit including general conditions is included in Volume III of the Operations and Maintenance Manual (Appendix E). The discharge criteria, effective September 1, 1995 to September 1, 2000 include periodic monitoring/sampling of over seventy chemical or physical parameters, along with associated reporting requirements.

3.3.3 Building Permit

Under the requirements of the Contract Documents, the RA Contractor will be required to secure a building permit from the City of Buffalo for construction of the wastewater treatment plant. The design of the treatment plant conforms to all applicable City codes and requirements.

3.3.4 Federal Permits

For this project, a *Joint Application for Permit* will be submitted to the United States Army Corps of Engineers (USACE), Buffalo District (the lead agency) and NYSDEC (coordinated review) covering (1) the placement of erosion control materials (i.e. riprap) along the Buffalo River (Section 10 permit); and (2) remedial actions necessary within federal regulated wetlands. Parsons ES anticipates application for permit coverage under Nationwide Permit 38, covering hazardous waste remediation programs.

The completed permit application, along with supporting documentation and design details, will be submitted to the USACE concurrently with submittal of this report to NYSDEC and the Coastal Assessment Form/Federal Consistency Form, to the Department of State (see Section 3.2.2). As lead agency, the USACE will coordinate review of the application with the NYSDEC and Department of State.

3.3.5 Coastal Zone Consistency Evaluation

The New York State Coastal Management Program is established pursuant to the federal Coastal Zone Management Act of 1972 and the State Waterfront Revitalization and Coastal Resources Act of 1981 (WRCRA). These acts call for the coordinated, comprehensive, and full exercise of governmental authority over land and water uses in the coastal zone for the purpose of preserving and using coastal resources in a manner that balances natural resource protection and the need to accommodate economic development. To accomplish this, the acts provide that ll state and federal actions in the coastal zone shall comply with the State of New York Coastal Management Program (CMP) and Final Environmental Impact Statement. In general these policies either:

- Promote the beneficial use of coastal resources, by encouraging water dependent uses, expansion of ports and small harbors, revitalization of waterfronts, and expansion of access and recreation opportunities;

- Prevent the impairment of certain coastal resources, including fish and wildlife habitats, dunes, beaches, islands, and other natural protective features, wetlands, scenic areas, historic resources, and agricultural lands; or
- Provide for the management of activities which may impact coastal resources, including dredging, ice Management, energy facility development, waste disposal, construction of erosion structures, and mineral resource exploration.

Department of State implements the CMP through three program components - Local Waterfront Revitalization Programs (LWRPs), review of federal and state government actions for consistency with policies, and the advocacy of projects and activities which implement specific coastal policies.

Local Waterfront Revitalization Programs (LWRP)

The Local Waterfront Revitalization Program was established to enable the State's CMP to address the problems of coastal development in full partnership with local government. Management of coastal development, whether the concern is protecting critical resources or revitalizing deteriorated waterfronts, must, of necessity, include regulation of land use decision. The LWRP refines and supplements the state CMP by incorporating local needs and objectives. As authorized by Section 915 of the WRCRA, a LWRP is a locally prepared, detailed land use plan that sets forth design, location, and environmental standards for all development along the municipality's waterfront. Federal and state law provide that all government agencies in their direct funding, and permit actions adhere to any LWRP approved by the Secretary of State.

Consistency

The federal Coastal Zone Management Act stipulates that federal agency activities affecting land and water uses within the coastal zone must be consistent with approved state coastal management programs. This requirement means that no federal direct action can take place, no license or permit can be issued, and no federal financial assistance to state or local governments can be provided; unless the direct action permit, or grant, is in accord with the state's coastal program. New York State thus has control over the actions of federal agencies that affect its coastal area.

In recognition of both the beneficial and potentially adverse effects that state agency activities may have upon waterfront areas, the Waterfront Revitalization and Coastal Resources Act required that "action directly undertaken by state agencies within the coastal area shall be consistent with the coastal area policies of this Article". Actions which are not consistent with applicable policies cannot be undertaken or, where applicable, are to be modified to an extent that they will be consistent.

Advocacy

The consistency provision of the Coastal Management Program and the existence of Local Waterfront Revitalization Programs assure that many coastal policies are implemented. However, policies must also be advanced by the direct involvement in a variety of coastal programs, projects, and activities. Hence, advocacy of policies is a third major focus of the program. Included within this focus are efforts to promote the State's commercial fishing industry; provide suitable space for traditional maritime activities; preserve coastal historic, scenic, and cultural resources; promote public access to coastal lands and waters; minimize development in coastal flooding and erosion hazard areas; protect significant coastal fish and wildlife habitats; and seek solutions to the problems that constrain port and harbor dredging.

To ensure compliance with 19 NYCRR Part 600, the "Coastal Assessment Form/Federal Consistency Assessment Form" has been completed. The form requires a description of the potential impact of the proposed project on coastal areas including scenic qualities and impacts to fish and wildlife habitat. This form, and supporting documents, will be submitted to the Department of State concurrent to the submittal of the Joint Application for Permit to the United States Army Corps of Engineers.

3.4 ENGINEERING DESIGN CRITERIA

The relevant engineering design criteria are presented in detail in the following sections which provide a detailed description of the various remedial design components. The basic engineering design criteria that were used for the Area "D" Site are:

- Erosion control - A maximum soil loss of 2 tons per acre per year as defined by the Revised Universal Soil Loss Equation [12]. Full vegetative cover will be maintained over the site.
- The design precipitation event for surface drainage and storm water collection is a 50-year, 24-hour storm. A 100-year, 24-hour storm event was used for slope stability.
- Eroded soils will be removed from the shoreline. The vertical limits of the soils removal will extend from the bottom of the outslope of the site to the limits of the fill excavation at the top of the slope.
- Surface soils will be consolidated from the perimeter of the site (along CONRAIL tracks, near the 54-inch-diameter water line, and shoreline areas outside of the cutoff wall) where constituents exceed the site-specific cleanup standards.
- Soil will be placed onsite with sufficient strength to support the cap within the limits of the subgrade.
- Groundwater will be collected from beneath the capped area to eliminate the potential for discharge to the Buffalo River.
- Treated water meeting SPDES standards will be discharged.
- Hydraulic site control will be effected through the use of surface water controls and a groundwater collection system and cutoff wall.
- Capping system slopes will be 5 percent (20H:1V) on the plateau and 33 percent (3H:1V) at the outslopes.
- Generally, river bank and cap slopes will not exceed 33 percent. Slope stability analyses was conducted for all slopes exceeding 10 percent. A minimum factor of safety of 1.5 was assumed.

- Stabilized outslopes that will prevent erosion of the bank primarily from ice scour and from high water, peak flow velocity anticipated for the design precipitation event.
- Revegetation of the site using primarily non-woody species that will provide a persistent cover in western New York, and will also allow inspection of the surface performance. In addition, habitat restoration along the entire shoreline will be provided.
- A 6-foot-high chain-link fence will be installed around the Treatment Facility.
- Warning signs will be placed along the riverbank every 200 feet warning against unauthorized access.

Table 3.1 Effluent Discharge Criteria

During the period beginning September 1, 1995

and lasting until September 1, 2000

the discharges from the treatment facility to the Buffalo River shall be limited and monitored by the operator as specified below:

Outfall Number & Effluent Parameter	Discharge Limitations Daily Avg.	Discharge Limitations Daily Max.	Units	Minimum Monitoring Requirements Measurement Frequency	Minimum Monitoring Requirements Sample Type
Outfall 001 - Treated Groundwater:					
Trichloroethylene	Monitor	0.0072	lbs/d	Weekly[6]	Grab
Vinyl Chloride	Monitor	0.0072	lbs/d	Weekly[6]	Grab
2,4-Dimethylphenol	Monitor	0.0072	lbs/d	Weekly[6]	Grab
Acenaphthene	Monitor	0.0072	lbs/d	Weekly[6]	Grab
Anthracene	Monitor	0.0072	lbs/d	Weekly[6]	Grab
Benzo(a)anthracene	Monitor	0.0072	lbs/d	Weekly[6]	Grab
Chrysene	Monitor	0.0024	lbs/d	Weekly[6]	Grab
1,3-Dichlorobenzene	Monitor	0.0024	lbs/d	Weekly[6]	Grab
Fluoranthene	Monitor	0.0024	lbs/d	Weekly[6]	Grab
Fluorene	Monitor	0.0024	lbs/d	Weekly[6]	Grab
Phenanthrene	Monitor	0.0024	lbs/d	Weekly[6]	Grab
Pyrene	Monitor	0.0024	lbs/d	Weekly[6]	Grab
Chlordane	Monitor	0.00024	lbs/d	Weekly[6]	Grab
4,4'-DDT	Monitor	0.00024	lbs/d	Weekly[6]	Grab
4,4'-DDE	Monitor	0.00024	lbs/d	Weekly[6]	Grab
4,4'-DDD	Monitor	0.00024	lbs/d	Weekly[6]	Grab
Dieldrin	Monitor	0.00024	lbs/d	Weekly[6]	Grab
Aniline	Monitor	30	lbs/d	Weekly[6]	Grab
Carbon Disulfide	Monitor	0.0024	lbs/d	Weekly[6]	Grab
Xylenes, Total	Monitor	0.0024	lbs/d	Weekly[6]	Grab
Antimony, Total	Monitor	0.09	lbs/d	Quarterly	Grab
Beryllium, Total	Monitor	0.006	lbs/d	Quarterly	Grab
Selenium, Total	Monitor	0.006	lbs/d	Quarterly	Grab
Silver, Total	Monitor	0.009	lbs/d	Quarterly	Grab
Thallium, Total	Monitor	0.066	lbs/d	Quarterly	Grab
Cyanide, Total	Monitor	0.04	lbs/d	Quarterly	Grab
2,4-Dichlorophenol	Monitor	0.003	lbs/d	Quarterly	Grab
Pentachlorophenol	Monitor	0.003	lbs/d	Quarterly	Grab
Benzidine	Monitor	0.3	lbs/d	Quarterly	Grab
Benzo(k)fluoranthene	Monitor	0.0003	lbs/d	Quarterly	Grab
Bis(2-chloroethoxy)methanes	Monitor	0.015	lbs/d	Quarterly	Grab
Bis(2-ethylhexyl)phthalate	Monitor	0.036	lbs/d	Quarterly	Grab
Dibenzo(a,h)Anthracene	Monitor	0.003	lbs/d	Quarterly	Grab
Diethyl Phthalate	Monitor	0.003	lbs/d	Quarterly	Grab
Di-N-Butylphthalate	Monitor	0.0006	lbs/d	Quarterly	Grab
Nitrobenzene	Monitor	0.012	lbs/d	Quarterly	Grab
N-Nitrosodimethylamine	Monitor	0.08	lbs/d	Quarterly	Grab
N-Nitroso-N-Propylamine	Monitor	0.02	lbs/d	Quarterly	Grab
Methoxychlor	Monitor	0.00008	lbs/d	Quarterly	Grab

SECTION 4

REMEDIAL DESIGN

4.1 INTRODUCTION

The remedial design described in the following sections was developed to incorporate results of the predesign investigations, compliance with ARARs, and the engineering design criteria described in Section 3. Detailed design drawings and technical specifications have been developed for the project and are included herein as Appendices F and G, respectively.

4.2 MATERIALS CONSOLIDATION

4.2.1 River Soils Removal

Removal of fill material between the river and the cutoff wall and capping system limits will be required in order to provide a uniform, stable outslope. This will be accomplished using normal earth moving and excavation techniques involving track-mounted and rubber-tired equipment. Removal of soil from the river will be accomplished using excavators from the shoreline in conjunction with mechanical dredging techniques for materials that are further from shore. Special erosion and sediment control measures will be implemented during dredging and slope stability work as described in the Surface Water Management and Erosion Control Plan (Appendix D). These measures include the installation of a silt curtain along the limits of river soil removal activities. In accordance with guidance provided by the NYSDEC, work associated with the removal of river soils may be subject to seasonal limitations governing work performed within the Buffalo River. In accordance with the NYSDEC requirements, work in the Buffalo River may not be conducted during the period of June 1st to July 15th, due to the spawning season of species native to this area. This, in combination with other RA components, would require that the RA be implemented over a two-year period.

The shoreline stabilization design includes removal of low-strength soil, up to a depth of two feet. Removal operations are to extend from the cutoff wall bench to the limits of the riprap slope as shown on Drawing No. C-6. Portions of the soil covering the bank below the perimeter fill may have eroded from the Area "D" Site surface. The removal of the two-foot-thick layer will result in an additional benefit of capturing this material, thus eliminating the need for confirmatory sampling.

In accordance with the DEC's request for additional sediment removal beyond the riprap toe, a nominal 24-inch of sediments will be removed from the riprap toe to five feet from the "Observed COE Dredging Limit", where a silt curtain will be installed. It was understood that this sediment removal in combination with the regular COE dredging would remove all potentially contaminated sediments originated from the site. Due to the sediments' natural angle of repose, any loose sediments located between the COE's dredging limit and our proposed sediment removal limit will slide downslope into the COE's dredging channel during the COE's dredging.

To minimize unnecessary over-excavation of native soil or under-excavation of loose sediments, the removal thickness will be adjusted in the field based on visual observation of excavated sediments and/or resistance on the excavation bucket. To confirm the extent of sediment excavation, barometric sounding surveys will be conducted immediately before and after sediment removal.

4.2.2 River Soil Stabilization

Based on bench-scale testing of river soil samples, physical stabilization of the river soils will be required to facilitate consolidation of the soils into the area to be capped. Soils dredged from the river will be drained of excess water directly from the backhoe bucket into the Buffalo River immediately after they are excavated. As much free water as practicable will be allowed to drain back to the river from the dredged soils. Excavated sediments will be placed near the center of the site within the proposed slurry wall limits, allowing natural dewatering of the soils. The areas will be partitioned, as necessary, with silk curtains, earthen berms, or hay bails to prevent the migration of fine sediment. Dredged material will be allowed to gravity drain until the cap is placed in 1997. The total volume of sediment and fill material to be removed/dredged is estimated to be 20,000 cubic yards.

Prior to cap placement, the previously dredged materials will be evaluated to determine if and solidification is needed. If necessary, physical stabilization of the dredged materials will be conducted through the addition of cement kiln dust or other similar agent. Cement kiln dust will be applied, as necessary, and thoroughly mixed into the soil. The percentage of soil amendment required will be dependent on the moisture content of the soil. The solidified sediments will remain in place as subgrade material prior to cap installation.

4.2.3 Conrail Area

Additional soil consolidation under the proposed cap will involve the excavation of up to three feet of soil between the cutoff wall and the Conrail property bordering the western perimeter of the site. The 54-inch BRIC water line is also located in this area. The purpose of excavating this material is to limit dermal contact with potentially contaminated soil outside the limit of the cap, which was necessary to accommodate the design constraints associated with the BRIC water line. Refer to Section 4.4.9 for additional discussion of this issue.

4.3 CUTOFF WALL DESIGN

The design of the cutoff wall meets the requirements set forth in the ROD. A detailed evaluation was performed on the use of an HDPE vertical barrier wall as compared to a soil/bentonite slurry wall to meet the requirements set forth in the ROD. Based on concerns related to long-term monitoring, a soil/bentonite slurry wall has been selected to be installed at the Area "D" site.

4.3.1 System Requirements

The specific objective of the cutoff wall is to limit the migration of shallow groundwater and NAPL to the Buffalo River as well as to prevent inflow from the Buffalo River from entering the groundwater collection system. The cutoff wall will surround the entire site and will be keyed into the clay stratum that lies beneath the fill and alluvium.

4.3.2 Soil/Bentonite Slurry Wall Evaluation

The slurry wall will be created by simultaneously excavating and backfilling a trench with a bentonite slurry. Following excavation of a section, the slurry will be displaced with a soil/bentonite backfill mix to provide the permanent barrier. For this application, a combination of granular soil (fine gravel), cohesive soil (silty clay), bentonite, and water will comprise the trench backfill mix. The slurry wall will effectively contain the groundwater at the site because the wall forms a continuous uniform barrier and the slurry mix will be self-healing in the event of minor displacement. The performance of the slurry wall materials will be evaluated prior to installation in the laboratory with respect to site conditions and chemical compatibility.

The slurry wall installation generally involves specialized construction techniques, multifaceted construction, and complicated scheduling. The following factors will be considered during the slurry wall construction:

- The slurry wall requires the coordination and management of multiple construction tasks during installation including trenching, stabilization of excavated materials and placement under the cap, slurry mixing and handling, and backfill mixing, placement and quality control.
- The slurry wall requires importing approximately 10,000 cubic yards of backfill material.
- Construction of the slurry wall requires a wide bench (20 feet wide minimum) to be constructed on top of the shoreline embankment to facilitate execution of the installation. This impacts the final outslope configuration such that additional material must be excavated and placed under the cap. However, the use of this material is necessary to regrade the site to promote positive drainage of precipitation.

4.3.3 Slurry Mix

The primary functions of the bentonite slurry include:

- Maintaining stability of the open trench during construction;
- Containing site groundwater;
- Depositing a layer on the walls of the trench to contribute to the low permeability of the completed cutoff wall; and
- Utilization as a component of the bentonite/soil backfill of the trench.

The slurry will consist of a mixture of city water and the specified bentonite powder. Characteristics of the water with the potential to affect the performance of the slurry mix include hardness, dissolved solids, oil and grease, organic content, and pH. City water will be used for mixing the slurry in the field. City water obtained from the BCC plant was used for the laboratory trials. Characteristics of potable water supplies are commonly within the recommended limits for each quality parameter for use as mix water.

A laboratory testing program was implemented for design of the slurry mix for construction of the cutoff wall at the Area "D" Site. Testing focused on selecting a specific bentonite clay and determining the required concentration to produce a suitable slurry that is compatible with the site groundwater. Selected borrow soil was mixed with one percent bentonite to form the trial backfill mix. No adverse impacts were observed during the compatability testing with LNAPL and contaminated groundwater. Details of the slurry wall construction materials are provided in the technical specifications.

4.3.4 Backfill Mix Design

After excavation, the slurry in the trench is displaced by a mixture of fresh slurry and soil. Performance of the cutoff wall is dependent on the permeability of the backfill mix. Soil for the backfill will likely be from an offsite borrow source and consist primarily of a locally available sand and fine gravel and clayey soil. Although the cost to import clay borrow is significantly greater than the coarse-grained soils, the addition of fine-grained clayey soil is important to minimize the addition of dry bentonite powder necessary to produce a backfill of the required permeability.

A laboratory testing program implemented for design of the backfill mix for construction of the cutoff wall focused on determining the required mix proportions to produce a backfill of the required permeability that is compatible with the site groundwater. The program consisted of the following steps:

1. Geotechnical Classification and Material Selection - Several soil borrow sources were evaluated leading to selection of a mixture of granular soil and clay to be used for design of the backfill mix. The gradation of the soil is presented in the technical specifications.

2. Backfill Mix Design - The soil borrow material selected from the geotechnical tests was used to prepare and evaluate different backfill mixes with varying percentages of bentonite. The backfill mix has a slump (American Society for Testing and Materials [ASTM] C 143-90A) of between 3 and 6 inches. The unit weight of the backfill was maintained at 80 lbs/ft^3, so as to remain at least 15 lbs/ft^3 greater than the slurry. Three potential sources of backfill mix were evaluated. Technical specification 02200 (Appendix G) requires specified gradation of the soils to achieve the necessary permeability. A submittal will also be required, along with periodic QA/QC of incoming backfill to ensure compliance with this gradation.

3. Permeability Testing - Each backfill mix sample was tested for short-term permeability to determine appropriate backfill mix specifications meeting the design requirements. The maximum backfill permeability is specified to be $5x10^{-8}$ cm/sec.

4.3.5 Trench Stability

The primary reason for utilizing slurry wall construction is to ensure the stability of the excavated trench during construction. The granular soil and elevated groundwater levels at the site present difficult conditions to maintain the stability of the slurry trench.

During excavation, trench stability will be maintained by keeping the trench full of slurry with a positive head above the surrounding groundwater level. The level of slurry will be maintained three to five feet above the groundwater level. This is especially important in the granular soils adjacent to the river at the Area "D" Site. The construction bench design incorporates provisions to maintain the slurry above the river and groundwater level. Soil conditions and the slurry level will maintain a positive head in the trench and promote trench stability.

4.3.6 Cutoff Wall Alignment

Several factors were considered during the selection of the cutoff wall alignment (Drawing C-2). The overall cutoff wall alignment is intended to encompass as much potentially contaminated fill material as possible; in so doing, the cutoff wall has been placed as close to the final shoreline as possible. The design provides for a 20-foot-wide level bench, constructed to an initial elevation of 583.0 feet. From this bench, the cutoff wall will be constructed. After cutoff wall construction, the level of the bench will be lowered to an elevation of 580.0 feet. This is necessary to recontour the site for a balanced cut and fill. Along the western shore where a slope failure occurred in the 1930s, the cutoff wall will be located farther from the shoreline, and the bench along the river will be considerably wider than other areas of the site. Along the northern side of the site, the cutoff wall parallels the 54-inch diameter water line (BRIC line). A minimum distance of 30 feet from the BRIC line will be maintained to prevent damage to the water line and provide access for future maintenance of this pipe.

The cutoff wall profile is shown on Drawings C-3, C-4, and C-5. This profile shows the anticipated depth of the cutoff wall and the locations of the borings along the alignment. The boring logs provided in the Technical Memorandum - "Site Cap, Cutoff Wall, and Shoreline Stabilization Systems" [9] may be consulted for specific information on the soils along the cutoff wall.

4.4 CAPPING SYSTEM DESIGN

The preliminary design of the capping system has been prepared to meet the requirements set forth in the ROD. The capping system consists of (from bottom to top):

- 6 ounces (oz.) nonwoven geotextile;
- 60-mil high density polyethylene (HDPE) smooth flexible membrane liner (FML) on the plateau portion only;
- 60-mil HDPE textured FML (3H:1V slopes only);
- Drainage net with geotextile on both sides (3H:1V slopes only);
- Drainage net with geotextile on one side (plateau portion only);
- 24 inches of unclassified fill; and
- 6 inches of soil capable of supporting vegetation.

The limits of the capping system will extend to the perimeter of the cutoff wall.

4.4.1 Subgrade Plan

The capping system subgrade plan (Drawing No. C-6) has been designed to provide adequate room for placing excavated materials associated with shoreline stabilization, surface soil removal, cutoff wall construction, and river soil removal. Excavated material from outside the limits of the capping system and cutoff wall will be stabilized as necessary and placed on the plateau portion of the site to provide the 5 percent slope for the cap subgrade. The 5 percent slope allows the use of smooth HDPE while the 33 percent slopes require that textured HDPE be used (Drawing Nos. C-6, C-7).

Demolition of numerous existing foundations, railroad tracks, and underground pipelines is required for the construction of the cutoff wall, slope stabilization, and capping system. Design Drawing C-2 contains the approximate location of many of the known foundations, railroad tracks, and pipes based on historical site plans; however, other obstructions requiring demolition may be encountered during construction activities.

All demolition debris will be placed within the limits of the cutoff wall and capping system. No debris will be placed within two feet of the cutoff wall or FML. All debris will be placed in a manner that will not result in subsequent settlement of the cap.

Material balance calculations were performed using plan views of existing contours and proposed subgrade contours. Estimated quantities associated with removal of existing till outside the cutoff wall, and cutoff wall construction were also estimated. Table 4.1 presents a summary of the material balance.

4.4.2 Synthetic Liner Membrane

A 60-mil High Density Polyethylene (HDPE) Flexible Membrane Liner (FML) will be placed over the site after the site has been graded and the slurry wall has been installed. The FML will be terminated in a trench located immediately outside of the cutoff wall. Lateral limits extending to the west of the site are restricted because of the location of the 54-inch water line. The edge of the cap is at least 20 feet from the water line.

The HDPE FML cap was selected because the material is:

- Very durable;
- Compatible with onsite soils and groundwater;
- Uniform in consistency; and
- Cost-effective.

HDPE FML with both smooth and textured surfaces will be used at the Area "D" site. Smooth HDPE will be used for covering flat slopes (i.e., 10 percent or less) and textured HDPE will be used for steep slopes (i.e., the 3H:1V outslopes at the site). The textured liner offers a greater factor of safety against sliding of cover materials placed above the liner; however, the textured liner is more costly than the smooth liner.

Therefore, the textured liner will only be used at the 3H:1V sloped areas of the cap where it is technically required.

4.4.3 Drainage Layer

REMCOR, Inc. evaluated two alternative materials for the drainage layer component: a geosynthetic drainage net and permeable "clean" sand.

The geotextile drainage net was selected for this application because the material:

- Is less difficult to construct;
- Takes less time to construct;
- Has relatively high transmissivity;
- Is cost-effective; and
- Is relatively easy to transport to the site.

The capping system drainage layer has been designed using the Hydrologic Evaluation of Landfill Performance (HELP) Model [13]. The drainage net consists of two overlapping polyethylene strands that transmit water in the plane of the net. The drainage net is available with geotextile bonded to one or both sides, forming a composite drainage system. The thickness of the net is approximately 1/4-inch. The plateau portion of the drainage layer will consist of a drainage net composite with geotextile on one side. The 3H:1V portion of the drainage layer will consist of a drainage net composite with geotextile on both sides for stability purposes. As shown by laboratory testing, the drainage net composites offer the following transmissivities:

- Gundnet XL-14 with 6 oz. geotextile on one side, smooth FML with 5 percent slope, transmissivity = 0.038 square feet per second (ft^2/sec) (5.47 square inches per second [in^2/sec]); and
- Gundnet XL-14 with 6 oz. geotextile on both sides, textured FML with 3H:1V slope, transmissivity = 0.0099 ft^2/sec (1.43 in^2/sec).

These transmissivities were used to calculate flow capacities of each drainage net composite arrangement. The flow capacities were compared to the estimated infiltration rate calculated using the HELP Model to verify proper function of the drainage layer. A properly functioning drainage layer will not reach capacity under the maximum anticipated flow. The minimum flow capacity of the two drainage net arrangements is 3.2 cubic feet per second (ft^3/sec) whereas the actual peak daily infiltration rate into the drainage layer is only 0.3 ft^3/sec.

The drainage layer will discharge to a perimeter collection trench. The infiltration will be collected by a 6-inch HDPE corrugated perforated pipe and transferred to 6-inch HDPE corrugated solid pipe for ultimate conveyance to the Buffalo River. The pipes were sized to accommodate the peak daily infiltration rate into the drainage layer.

A layout and details of the perimeter collection and conveyance piping network is shown on Drawings C-6 and C-12. Design calculations were submitted to the NYSDEC as part of the 30 percent design report.

4.4.4 Cover Soil

A 24-inch layer of cover soil will be placed immediately over the drainage layer. Details of the cover soil placement are provided on Drawing No. C-12. The cover soil will consist of clean soil material from an offsite source as specified in Section Numbers 02200 of Appendix G. The soil will be placed in uniformly compacted lifts as described in Section 02200 of Appendix G. Erosion control measures will be implemented at all times during installation of the soil cover system as described in Appendix D.

4.4.5 Topsoil and Seed

As described in Section No. 02990 of the technical specifications, the 6-inch topsoil layer of the cap will be seeded immediately after installation. All disturbed areas will be vegetated in accordance with guidance provided by the State of New York (Urban Soil Erosion And Sediment Control Committee, October 1991) [14].

The detailed plan for seeding of the topsoil layer is described in Appendix C - Habitat Restoration. Plantings will vary according to defined bank zones. Bank zones were determined based on field observations of scour marks; drift lines; and water staining on piers, rocks, and bridge abutments near the site. The Planting Plan in Appendix C includes the following information:

- definition/elevations of planting zones;
- detailed description of types of vegetation (wildflowers, trees, shrubs, etc.) to be planted in each zone;
- planting instructions;
- planting dates;
- maintenance and care of plantings;
- an overall Planting Plan; and
- discussion of special areas of concern (high scour areas and created wetland area).

4.4.6 Soil Loss Evaluation

A soil loss evaluation was performed for the site to verify an acceptable soil loss rate after complete vegetation has been established. As described in the Storm Water Management and Erosion Control Plan (Appendix D), temporary controls will be constructed to minimize erosion loss during construction. The soil loss was estimated by utilizing the Revised Universal Soil Loss Equation (RUSLE) software provided by the Soil and Water Conservation Society [12]. The following factors were evaluated using the RUSLE equation:

- Climate;
- Erodibility of site-specific soil;
- Drainage slope length;
- Drainage slope steepness;

- Type of cover; and
- Earthwork/grading support practices (i.e., benching, strip cropping, etc.).

Results of RUSLE program for the Area "D" Site show that minimal erosion loss should occur after vegetation has been fully established. The calculated soil loss is 0.5 ton/acre/year as compared to the 2 tons/acre/year design criteria.

4.4.7 Gas Venting System

Because groundwater will be pumped from the site, vents are needed to ensure that a negative pressure does not develop within the containment. Therefore, three gas vents will be installed along the crown (high points) of the regraded area. Based on visual observation during the Predesign Investigation and knowledge of historical operations at the site, gas treatment is not required.

4.4.8 Outslope Stability

The design of the perimeter outslope stabilization system will protect the capping system by increasing the factor of safety against sliding. The design includes cutting the existing slope to a maximum grade of 33 percent or three horizontal to one vertical (3H:1V) as depicted on Drawings C-7.

The slope stability analyses were conducted using a computerized version of the modified Bishop Method. The resulting analysis demonstrates that the selected design provides for a minimum factor of safety of 1.5 against deep slope movements under static conditions.

The cover stability analyses were conducted using infinite slope analyses using internal friction angles selected from manufacturers' literature and/or EPA guidance documents. The resulting analysis demonstrates that the cover materials have a minimum factor of safety of 1.5 against cover movements under static conditions.

4.4.9 54-Inch BRIC Water Line Stability

In order to allow access to the existing 54-inch diameter Buffalo River Improvement Corporation (BRIC) water line for repair and maintenance, the limits of the site capping system will provide 30 feet between the cap system anchor trench and the BRIC line. Existing fill material encountered over and around (within 30 feet) the BRIC line will be excavated to a maximum depth of three feet below ground surface and replaced with clean fill. The BRIC line must remain in operation during construction, and a representative of the Buffalo River Improvement Corporation must be informed of any construction activities involving work within the BRIC line right-of-way.

4.5 SHORELINE STABILIZATION SYSTEM

The topography of the Area "D" Site consists of a relatively flat peninsula with steep banks dropping approximately 10 to 15 feet from the site to the river. The banks typically have slopes approaching 1 horizontal to 1 vertical (1H:1V) and are comprised mainly of construction debris and fill material underlain by alluvium. Along the western shore of the site, the bank has a much gentler slope, apparently the result of a slope failure that occurred circa 1937. In order to maintain long-term integrity, the shoreline requires protection against erosion and the steep banks require stabilization. This section provides a summary of the design pertaining to the shoreline stabilization and removal of soil from the river.

4.5.1 System Requirements

The shoreline stabilization is designed to satisfy the following requirements:

- Stabilization of the shoreline to provide a minimum factor of safety of 1.5 against slope failure for static conditions, (i.e. high water, low water, and normal water level conditions) and a minimum factor of safety of 1.3 for short term conditions (i.e. rapid drawdown from high water to low water conditions).
- Removal of existing fill material not contained within the cutoff wall and capping system limits.
- Removal of loose, eroded material as necessary for the installation of the riprap (see Drawing No. C-6).
- Consolidation of excavated till and soil under the proposed cap.
- Limit erosion that may be detrimental to the cutoff wall and capping system.

The shoreline stabilization system is comprised of several interactive components, including the erosion protection lining, outslope grading, and removal of low strength river soil. The shoreline stabilization is not required to act as a barrier for containing site contaminants; this is accomplished by the barrier wall and groundwater extraction system described elsewhere in this section.

4.5.2 Slope Configuration

The shoreline (along the western shore) will be stabilized by excavating the riverbank to a final slope of 3H:1V or less. All fill located outside the limits of the cutoff wall and capping system will be removed to form a temporary bench (elevation 583.0 feet) for the construction of the cutoff wall. Upon completion of the cutoff wall, the temporary bench will be lowered to elevation 580.0 feet and regraded for the capping system subgrade. Additional benefits associated with isolation and replacement of the fill immediately below the liner include: removal of all foundations and utilities that could puncture the liner; and placement and compaction of a uniform layer of fill immediately below the liner.

4.5.3 Erosion Protection

The outslopes will be stabilized to prevent erosion of the bank primarily from ice flows during the winter months, from the high water, from peak flow velocity, and from the destructive forces of wave action. Stabilization of the outslope is required to protect the cutoff wall encircling the site and the capping system.

The selected design involves stabilization by grading of the outslope and installation of an erosion-resistant lining. The erosion protection will be installed along the entire length of the shoreline within the limits of the site. The erosion protection will extend from Elevation 560 feet, seven feet below the minimum daily mean water level, to Elevation 580 feet, which provides 3 feet of freeboard above the maximum daily mean water level. Specification 02275 (Appendix G) addresses the placement method for the riprap.

A silt curtain will also be required at various times during construction to provide temporary erosion control. Silt curtains will be employed during activities by the Remedial Contractor along the shoreline. The silt curtain may not be used while the U.S. Army Corps of Engineers is dredging in the vicinity of the site to avoid damage to the silt curtain. Remedial activities along the shore will not proceed during this time. Additional temporary erosion control requirements are addressed in the Storm Water Management and Erosion Control Plan (Appendix D).

Several types of erosion protection lining for the shoreline were considered, including rock riprap, concrete pavement, bituminous pavement, precast concrete units, soil/cement, and steel sheet piling.

The materials were evaluated based on the following criteria:

- Quality of erosion protection;
- Ability to provide a natural habitat;
- Aesthetic value;
- Outslope stability protection;
- Failure rate;
- Resistance to heavy ice;
- Maintenance requirements;
- Constructability;
- Availability of materials;
- Minimization of construction traffic through the site;
- Facilitate drainage of the slope;
- Requirement of a toe anchor;
- Minimizing wave run-up;
- Resistance to damage from settlement; and
- Cost.

All of the systems considered provide excellent resistance to erosion and would have relatively low incidence of failure. The primary factors to differentiate the systems include the natural habitat provided, support of the slope, the resistance to damage from heavy ice, and cost of installation and maintenance. By comparison, the performance of the riprap and precast concrete units are similar. Rubble riprap was selected over the precast units for the shoreline erosion protection primarily based on cost, and the riprap requires less specialized construction equipment.

Variations of the Buffalo River stage are common. During periods of high flow levels, the soil along the outslopes may become saturated. A rapid drop of the river flow level, following a prolonged period of high flow, may result in a loss of strength of the soils potentially leading to localized failures along the slope if the slope is not well drained and water is trapped in the soil. Adequate drainage of the soil slope is required to allow the soils to drain freely and minimize potential damage resulting from rapid drawdown conditions. The use of a relatively thick layer of a relatively uniformly graded rock riprap on the outslope will allow the soil slopes to drain freely through the riprap.

Erosive forces in drainageways are primarily due to wave action and the force of the water current to dislodge rock pieces, generally under high flow conditions. The rocks must be heavy enough to resist displacement by wave action and current velocity against the stones. Factors influencing the selection of stone size include: wind velocity and direction; channel configuration; slope grade; and current velocity. The weight or size of the rocks required to resist displacement by wave action and current can be determined theoretically. Flow velocities in the lower reach of the Buffalo River are low due in part to the relatively mild channel slope of less than 1 foot per mile, the large channel cross-sectional flow area due to maintenance of a dredged channel, and the backwater effects of the lake.

The selection of the required rock size is based on recommendations by the U.S. Bureau of Reclamation to protection the upstream face of an earthen dam with slope of similar grade. The recommended rock gradation ranges from a minimum of 6 inches to a maximum of 30 inches, with an average size of about 12 inches. Sand and rock dust will be limited to less than 5 percent of the total riprap by weight. A minimum riprap thickness of 24 inches (average of 30 inches) will be used.

The riprap will be placed over a woven geotextile filter to prevent erosion of soil through the stones, as well as minimize piping of material from the slope. As described in Specification Section 02275, geotextile will be a high strength woven polypropylene to resist damage during placement of the riprap, prevent piping of soils and allow free drainage of the slopes. Geotextile will be used below all riprap areas.

The toe of the riprap will be keyed into the river soils. The toe of the riprap slope will consist of a minimum 4-foot-high by 4-foot-wide key of riprap. This key will provide a buttress of material to support the erosion protection surface and a clear delineation for the USACE dredging contractor.

Quarried stone is selected for the angular properties of the rock to resist displacement and provide a greater material strength to increase the buttressing effect of the riprap lining. Angular fragments tend to interlock and resist displacement better than round boulders or cobbles. Rock for the riprap will be hard, dense, and durable and able to resist long exposure to weather and ice on the river. A limestone or dolomite indigenous to the Buffalo area is recommended, as described in Specification Section 02275.

Typical details of the final slope configurations are provided on Drawing Nos. C-9, C-10, and C-11. The final slopes are flatter than the existing slopes. This is important for two reasons: (1) the remedial action will not alter the flow of the Buffalo River, and (2) the river will, in general, deposit material onto the riprap rather than attempt to erode the bank.

4.5.4 Slope Stability

The stability of the proposed shoreline slopes was analyzed using a computerized version of the Modified Bishop Method of Slices. It is a limiting equilibrium approach to the calculation of the factor of safety of a sliding mass along a circular surface. The computer program STABL2 [15], developed at Purdue University, was used to perform the computation. In analyzing the stability of the shoreline, the governing conditions included the slope geometry, groundwater levels, river water levels, and geotechnical properties of the various soil layers.

The values for geotechnical parameters used in the stability analysis were selected based on laboratory strength testing and test boring information. The strength parameters for the alluvium and clay layers were based on the results of consolidated-undrained triaxial tests. The strength parameters for the existing fill material were based on the standard penetration tests conducted during test boring activities. Strength parameters for the remaining materials, including the sand and gravel layer, clean fill, capping system liners, and riprap, were based on experience with similar materials. Details of the evaluation are presented in a Technical Memorandum prepared by REMCOR, Inc. [9].

The strength parameters used in the stability analysis for the various materials are as follow:

	Unit Weight (lb/ft3)		Angle of Internal Friction
	Wet	Saturated	(degrees [°])
Existing fill	100.0	120.0	29
Alluvium	120.0	130.0	33/19.8(1)
Sand and gravel	112.0	130.0	32/19.2(1)
Clay	120.0	130.0	32/28.5(2)
Cap liner	110.0	125.0	24
Cutoff wall slurry	110.0	115.0	28
Clean fill	115.0	125.0	34
Riprap	105.0	125.0	45

(1) For simulation of the existing failure surface in areas along the west shore, the angle of internal friction of this material was reduced by 40 percent.

(2) Stability calculations use 32° angle of internal friction for the clay liner in all areas except the west shore slope failure area where 28.5° is used.

The unit weight values were determined using laboratory test results and experience with similar materials. Values for the cohesion intercept were not included in any analysis as this value is not a reliable representation of soil strength. The piezometric levels were varied to simulate different river conditions, including high water, low water, and rapid river drawdown from high to low water levels. The calculated static factor of safety was 1.5 or greater, and the calculated pseudostatic factor of safety for rapid drawdown conditions was 1.3 or greater.

4.5.5 Wetlands and Habitat Development

Engineered wetlands are proposed to be developed along the southwest portion of the shoreline. The area will be widened to a maximum width of 40 feet at Elevation

573.0. The surface of the bench will be covered with soils capable of supporting vegetation. Initially, the surface will be stabilized by placing geogrid within the soils. This will reduce the potential for scour prior to the establishment of vegetation. Three general zones have been identified within the wetland area: wet meadow, emergent, and open water. Plant species will be arranged, spaced, and located within these areas at their best suitable location based on field determination. Willow poles will be planted along the edge of the area to redirect floating debris away from the area. Additionally, a number of 3- to 4-foot boulders will be placed in the channel to prevent intrusion of large debris and logs into the inner wetland area. Several species of vegetation will be planted to stimulate plant growth.

As depicted in Drawing C-8, and described in Appendix C, the riprap along the shoreline will be vegetated to a limited degree. Shallow rooted shrubs and grasses native to the Buffalo River will be planted in topsoil placed above the riprap. Additionally, willow poles will be planted at the waters edge, away from the slurry wall, to provide additional habitat enhancements along the shoreline.

Fish habitat structures (pods) will be constructed at the outside edge of the entrance to the wetlands. The fish pods have been located in areas that will be shallow in low river situations, and should be free of recreational boat traffic. Each fish pod will be constructed by placing boulders (one to three foot diameter) over the riprap.

There are three proposed sites for planting stands of trees and/or wildflowers. These locations, along the abandoned railroad embankment, northwest of the BRIC 54-inch water main, and along the edge of the bench in the western slope area, are all more than 30 feet from the cutoff wall and cap in areas that do not require annual cutting.

Two areas of the site may act as sediment traps due to widening of the river channel. If possible, the abandoned pilings near the railroad bridges at the northwest corner of the site will be left in place. The pilings may move when the river soils in this area are excavated. Warning signs will be posted around the site perimeter.

Drawing C-8 presents the habitat features that have been incorporated into the design. Details of the wetland plantings and habitat construction are provided in Appendices B and C.

4.6 GROUNDWATER COLLECTION AND CONVEYANCE SYSTEM

The groundwater collection and conveyance system design described herein was developed to meet the pertinent remedial action objective set forth in the ROD, specifically: "Limit the migration of contaminated groundwater and Non-Aqueous Phase Liquid (NAPL) constituents from the site into the Buffalo River; thereby limiting contaminant loading to the Buffalo River via subsurface groundwater."

4.6.1 System Requirements

The ROD states that the groundwater collection system shall serve two fundamental purposes:

- Collection of impacted groundwater for treatment; and

- Hydraulic control to reduce its migration to the Buffalo River.

Three separate groundwater collection systems are briefly described and evaluated in the ROD: (1) well point dewatering, (2) pumping wells, and (3) perimeter drains. The well point dewatering method of groundwater collection was discarded due to suction head limitations, while the pumping wells and perimeter drains options were deemed potentially suitable for implementation at the Area "D" Site. Perimeter drains and extraction wells were evaluated relative to six criteria:

- Overall protection of human health and the environment
- Compliance with ARARs;
- Long-term effectiveness and performance;
- Reduction of toxicity, mobility, and volume;
- Short-term effectiveness; and
- Implementability.

Both perimeter drains and extraction wells would essentially eliminate further migration of contaminated groundwater from the Area "D" Site into the Buffalo River by reversing the flow gradient through associated pumping. Both systems would be effective at achieving compliance with ARARs; would provide an effective means for reducing mobility of contaminated groundwater; and are proven, commercially available, and reliable technologies.

Extraction wells were selected for the groundwater collection and conveyance system. The extraction wells provide easier access for maintenance tasks, such as screen/collection pipe cleaning and gravel pack/collection stone redevelopment. In addition, should a failure in the collection system occur, the construction of a replacement extraction well would be less costly and less disruptive to the overall remedy (i.e. FML) than replacement of even a portion of a perimeter drain.

Potential worker exposure to site contaminants will be significantly lower during extraction well construction than during perimeter drain construction (i.e. perimeter drain construction would involve a significantly greater earthmoving effort). Potential erosion impacts to the Buffalo River during construction will be minimized by utilizing extraction wells.

4.6.2 Extraction Well/Pump Design

A hydrogeologic analysis was conducted in determining the minimum number of extraction wells necessary to achieve hydraulic control of groundwater. A minimum of four recovery wells will be required to maintain the inward hydraulic gradient.

The four extraction wells, EW-1 through EW-4, are shown on plan on Drawing No. C-7. The pump, casing, and valve and meter vault details are shown on Drawing Nos. C-13 and C-14.

Extraction wells were located based on the following criteria:

- Spacing with respect to the cutoff wall(s) and other extraction wells.

- An anticipated elevation low in the clay layer as defined by borehole investigations at the site. The top of the clay topography is a natural depression which should act as a sump. By locating EW-3 in this area, the maximum saturated thickness will be intersected, thereby permitting the greatest possible drawdown.
- Locations where the cap slope is relatively flat.
- The zone of depression able to be maintained by each well.

Extraction wells will be constructed of 6-inch-diameter, flush-threaded stainless steel risers and screens. Screens will be the V-notched, wire-wound type. Stainless steel construction was selected during the preliminary design due to its long-term durability and chemical resistance. Well screens will be set in 12-inch-diameter boreholes and surrounded with a high silica content, washed, rounded sand pack. Two gradations of sand will be used in the sand pack to enhance groundwater flow from the surrounding native soils. The sand pack of each extraction well will be fitted with a 1-inch diameter screened standpipe to facilitate groundwater level measurement. The bottom of each extraction well screen will be installed to coincide with the top of the underlying clay formation (approximate Elevation 560.0 feet). Five-foot-long stainless steel sumps with welded stainless steel bottom plates will be placed beneath each extraction well screen to facilitate the maximum possible drawdown within the overburden soils above the clay (i.e., the pumps can be set below elevation of the screen bottom, Drawing No. C-15). The maximum possible drawdown will induce the maximum possible (inward) hydraulic control at the Area "D" Site. Boreholes will be advanced using temporary casings. Extraction well specifications will employ National Water Well Association (NWWA) standards, where applicable. Extraction wells will be developed in accordance with NWWA standards (pumping, surging, jetting, or air development). Extraction wells will be designed in accordance with "Fundamental Concepts of Well Design" [16].

An existing six-inch-diameter stainless steel well (PW-2), is situated near the proposed location of Extraction Well EW-3. The LNAPL collection system will be decommissioned prior to the installation of the proposed groundwater collection system. The four-well groundwater collection system, in conjunction with the cutoff wall, is designed to maintain an inward gradient.

The extraction wells will extract groundwater and NAPL from the Area "D" Site for treatment. The reference for the submersible well pump associated with each extraction well is provided on Drawings No. C-13 and C-14. The submersible well Pumps P-1 through P-4 have a capacity of 5 gpm each.

Each extraction well will be protected at the surface by a concrete vault. This vault will also house associated valves and flow meter. A flow meter/totalizer will be installed at each well to facilitate adjusting pump flow rates. This meter will also be used to monitor the operation of each extraction well. The information that the flow meter provides will be helpful in determining if the extraction wells are maintaining desired water levels under the capping system and indicate any sources of groundwater inflow.

4.6.3 Groundwater Collection Rates

The pump discharge rate will decrease to approximately 5 gpm for the first year. This total (first year) pumping rate of 20 gpm is designed to have approximately two times the groundwater handling capacity as the maximum anticipated (induced) groundwater flow to the Area "D" Site. Under actual operating conditions, the four extraction wells will have a combined discharge of 9 gpm for the first 30 days. Once the actual (steady-state/induced) groundwater flow to the site is determined in the field, extraction well pumping rates can either be adjusted downward by throttling the discharge or resetting conductivity water-level probes in each extraction well. The extraction pumps were designed based on the total dynamic head (static head plus friction loss) of the extraction system.

The extraction well system is designed to induce inward groundwater flow to the Area "D" Site. This will be accomplished by maintaining a lower head inside the cutoff wall system than the naturally occurring piezometric head outside of the cutoff wall. Because of the limited thickness of the groundwater layer above the clay unit and moderately low permeability of the groundwater stratum, the piezometric surface within the cutoff wall area will be nearly flat during steady-state pumping conditions. The extraction well system will be configured to maintain the groundwater level within each well at approximate Elevation 565.0 (5 feet above the surface of the underlying clay formation).

Three induced flow sources are anticipated to produce groundwater within the cutoff wall area:

- Vertical upflow through the underlying clay formation (Q_V); and
- Horizontal leakage through cutoff wall discontinuities (Q_H).

Little surface water infiltration/precipitation is anticipated due to the overlying (impermeable) FML cover system. Q_V was evaluated using Darcy's law of groundwater flow and is anticipated to be 2.2 gpm based on an anticipated drawdown of 7 feet within the cutoff wall and a clay formation hydraulic conductivity of 1.2×10^{-6} cm/sec. Q_H is anticipated to be less than 0.2 gpm based on the same anticipated drawdown. Based on these evaluations, Q_T is anticipated to be 2.4 gpm, which is less than the 20 gpm capacity of the four extraction well pumps and the capacity of the Treatment Facility. Thus, should one or two extraction wells be out of service for maintenance, the remaining extraction wells would be able to maintain a lowered piezometric head within the cutoff wall area.

4.6.4 Piping/Conveyance System

The groundwater conveyance system was designed to transport extracted groundwater to the treatment plant and treated effluent to discharge. A double-wall piping system will be used to prevent contamination of the soils in the event of a leak in the piping system. Materials of construction for the conveyance piping will consist of high density polyethylene (HDPE), and pipes will be installed as described in the technical specifications. HDPE was selected for its superior corrosion resistance, compatibility with contaminants of concern, integrity of connections, and ease of installation. The plan and details for the groundwater conveyance system are shown in Drawing Nos. C-6 and C-14.

4.7 GROUNDWATER TREATMENT SYSTEM

4.7.1 System Requirements

The objectives of the treatment system are to provide treatment of the impacted groundwater at the site as follows:

- Impacted groundwater will be extracted from four wells within the capped area and conveyed to an onsite groundwater treatment system.
- The treatment process will consist of an oil/water separation process followed by flow and chemical equalization, metals precipitation, flocculation, sedimentation, filtration, carbon adsorption, final pH adjustment, sludge handling, and dewatering.
- As discussed in Section 3, the final discharge of the treated effluent will be to the Buffalo River.
- Dewatered sludge will be sent offsite for disposal.
- The treatment system will maintain compliance with ARARS as described in Section 3.

The existing groundwater quality has been characterized during the Site Remedial Investigation (Malcolm Pirnie, 1989). Section 2.3 of this report summarizes the groundwater contamination characterization. A treatability study was conducted to evaluate the processes capable of removing arsenic, iron, other metals, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and pesticides (found at trace levels or not detected) from the groundwater. Also, the treatability study was used to develop engineering design parameters, including the selection and sizing of process units and to estimate chemical and carbon usage. The results of the treatability testing are summarized in Section 2 of this report.

4.7.2 Location of Treatment Facility

The treatment facility will be situated in an area north of the site on property owned by BCC (as depicted in Drawing C-7). This location was selected to: (1) simplify cap construction, (2) reduce the amount of equipment and number of simultaneous activities in Area "D", (3) simplify utility construction, (4) ease access for operation and maintenance, and (5) provide for location of the effluent discharge piping to the Buffalo River. The treatment facility will be enclosed by a pre-engineered building with the nominal floor dimensions of 50 by 75 feet, with a concrete foundation and installed heating.

4.7.3 Sources of Groundwater

The groundwater will be extracted from four extraction wells, EW-1 through EW-4. The locations of these wells are shown in Drawing Nos. C-7 and C-13. The initial groundwater flow rate from each well was estimated to be 5 gpm or less, resulting in a total design flow of 20 gpm. Groundwater from the wells will be pumped via submersible extraction well Pumps P-1, P-2, P-3, and P-4 to the groundwater conveyance system consisting of an underground and aboveground double-wall pipe line. This pipeline will transfer the water through a central header pipe to the treatment facility.

The treatment facility is designed to treat flows up to a design maximum of 20 gpm. Based on groundwater pump tests and modelling, this is a maximum flow rate expected during the first years of operation, including a factor of safety of 2.0. After initial suppression of the groundwater table, it is anticipated that the flow rate to the treatment facility will drop to approximately 2 gpm. Figure 4.1 illustrates the anticipated drawdown of the groundwater for the site.

The groundwater characteristics used as the basis of design for the groundwater treatment plant were initially derived from the results of the remedial investigation (1988) and were later refined based on the results of the treatability study (1995). Certain individual sample results showing high dissolved organic contaminants as reported in the RI were not considered to be representative and were discounted in favor of the results presented in the treatability study.

4.7.4 Groundwater Treatment Process Design

The treatment process is depicted in Drawings I-3 through I-5. Section Number 13415, Sequence of Operation, of the technical specifications provides a detailed process description.

The main process control for the extraction well pumps and the treatment facility process pumps will be from the Motor Control Center (MCC) located in the groundwater treatment facility. Hand/Off/Auto (H-O-A) selector switches will be mounted in the MCC and will be used to select the mode of operation of the various pumps. Pump operation will be initiated by liquid level controls mounted in the process tanks.

The treatment facility is designed to operate continuously with minimum operator attention. Periodic shutdown/startup and non-routine and/or temporary operations may be required for routine maintenance, power loss, and/or automatic equipment shutdown. The principal methods of controlling the process will be through the use of mercury-type liquid level control switches. These switches will control the operation of process pumps in the system. The Treatment Facility Process and Instrumentation Diagrams (P&IDs) detail the operation and control of the system and are included as Drawing Nos. I-3, I-4, and I-5.

Oil/Water Separator S-10

The oil/water separator is designed to remove free, non-dissolved oil and grease that may be present in the groundwater. The predesign investigation indicated that LNAPL and DNAPL are present in the groundwater at the site. However, the treatment plant design assumes that bulk NAPL and DNAPL deposits will be extracted prior to the startup of the treatment facility. As a precautionary step to prevent LNAPL or DNAPL from reaching downstream process units and causing an upset condition, the oil/water separator will be installed as the first unit process. The oil/water separator is designed to capture oil and grease droplets that are 20 cm and larger, under normal operating conditions.

The separated LNAPL will be transferred to 55-gallon steel drums for storage prior to disposal/reclamation as required by applicable regulators. The drums will have bungs, removable tops, and will be lined with polyethylene. Drums will be grounded in accordance with OSHA requirements. A flexible tube feed line will be provided to transfer product from the oil skimming weir to the drum. Any solids or DNAPL collected in the oil/water separator will be transferred to the Sludge Thickener Tank T-90 using OWS Sludge Pump P-110.

Equalization Tank T-10

The flow equalization tank is designed to provide flow and concentration dampening of the wastewater pumped from the extraction wells and process water recycled from various process units in the Treatment Facility. The tank will have 3,000 gallons of nominal capacity. Only 1,900 gallons are planned for use in the current design, thereby providing 3 feet of freeboard which may be utilized if the operation of the treatment plant changes in the future. The design will provide approximately 30 minutes hydraulic retention time (HRT) at the maximum flow rate of 20 gpm and the lowest water level allowed by the pump controls. The tank will be vertical and cylindrical, 8-foot-diameter by 8-foot straight shell. The tank will be flat bottomed, open-topped with cross bracing to support possible future installation of a tank agitator. Most of the tank capacity will be used to provide a pumping well for Process Pumps P-10/P-11. The water surface level in the tank will always be under a maximum level, as shown in the drawings, to allow gravity flow from other processes into Tank T-10. The pumps will be of steel or high-density polyethylene main construction, with stainless steel and solvent-resistant plastic internal components, per the specification in Appendix G.

Process Pumps P-10 and P-11

Pumps P-10 and P-11 are horizontal centrifugal pumps. These pumps will transfer water from Tank T-10 to Clarifier CL-20. Each pump will have a maximum design flow of 10 gpm (providing a maximum duplex design flow rate of 20 gpm) at the anticipated TDH of 45 feet. The pumps will operate in a lead-lag mode initiated by the liquid level sensors in T-10. The pumps will be constructed of steel or solvent-resistant plastic, with epoxy-coated steel, stainless steel, or solvent-resistant plastic internal components.

Clarifier System

The Clarifier System will include an inclined-plate clarifier (CL-20) and floc mixer (M-20) as a package. Clarifier CL-20 receives water from Pumps P-10 and/or P-11. CL-20 is designed to remove the settleable fraction of the total suspended solids (TSS) present in the water such as calcium carbonates and metal hydroxides. The clarifier unit is an inclined plate, "lamella" type, with a settling area overflow rate of less than 500 gpd per square foot (gpd/ft^2). The maximum settling area will be about 60 ft^2. The clarifier is designed to remove the TSS concentration to less than 30 mg/l.

Solids will settle into the bottom of the clarifier. The clarifier underflow will be pumped periodically to Sludge Thickener Tank T-90 by the Clarifier Sludge Pump P-22. Pump P-22 will be controlled by a timer. The frequency and duration of the pumping cycle will be adjustable according to the operating requirements.

Chemical Feed Systems

The calcium hydroxide (hydrated lime) feed system will include a 1,000-gallon slurry make-up tank (T-26), air diaphragm recirculation pumps (P-25 and P-26), and tank agitator (M-26). Calcium hydroxide slurry will be added to the process water through in-line injection followed by static mixer SM-18 for pH adjustment, which will promote flocculation/precipitation, clarification, and subsequent removal of dissolved metals from the process water. A dry lime hopper with dust control will be provided as a convenient means for the operator to empty 50 pound bags of dry, hydrated lime into the top of the lime solution feed tank. The lime solution recirculation pumps will contain large diameter ball check valves to prevent solids fouling. The standard recirculating flow rate for pumps P-25 and P-26 is 3gpm (0.5-inch diameter pipe, velocity 4.9 fps). The maximum flow rate into the process will be 750 ml/minute.

Ferric sulfate has been selected as a coagulant aid to be used for increased metals-removal efficiency. The coagulant feed system includes Tank T-27, Metering Pump P-27, and Tank Agitator M-27. Tank T-27 will be a 1,000-gallon HDPE tank with a flat bottom and flat removable lid. Mixer M-27 will be an adjustable mixer angle to provide a thorough mix of 0 to 1 percent ferric sulfate solution (low viscosity). The maximum design flow rate for pump P-27 is 460 ml/minute.

After metals treatment, sedimentation, and filtration, hydrochloric acid will be added to the process water as required to adjust the pH of the process water to within the acceptable range as defined by the SPDES permit. The hydrochloric acid feed system will consist of tank T-28, mixer M-28, and chemical feed pump P-28. The hydrochloric acid feed tank will be a 1,000-gallon tank with a flat bottom and removable lid. The mixer will be mounted to a mixer stand with an adjustable mixer angle to provide a thorough mix of 0 to 1.5 percent hydrochloric acid solution. The chemical feed pump will be equipped with an electronic solenoid-driven diaphragm with user adjustable stroke and frequency/motor speed. The maximum design pump flow rate is 375 ml/minute.

Clarifier Clearwell Tank T-20

Clarifier Clearwell Tank T-20 is designed to store the clarified effluent. The tank has 1,500 gallons of nominal capacity. The design utilizes 1,060 gallons of capacity, thereby providing 2 feet of freeboard. A hydraulic retention time of approximately 16 minutes is provided at the maximum flow rate of 20 gpm. The tank is an open top, vertical cylindrical, 6-foot-diameter by 7-foot straight shell. The tank provides a pumping well for pumps P-20 and P-21. This will be accomplished with the water level always under the overflow level of clarifier CL-20 to provide gravity flow at up to 20 gpm. The tank will be a construction as described in the specification.

Process Pumps P-20 and P-21

Pumps P-20 and P-21 are a duplex system of horizontal centrifugal pumps. The pumps will be used to transfer water from Tank T-20 through the filter system (F-30 or F-31) and carbon adsorption system (CA-40 and CA-41) to the treated water accumulation tank (T-60). Each pump is designed to pump a maximum flow rate of 10 gpm at a TDH of 86 feet at the maximum design flow rate of 20 gpm. Both pumps will operate and be controlled by signals from the liquid level switches in Tank T-20. The pumps will be provided with controls (from the main control center) to allow alternating lead/lag pumping.

Multi-Media Filters F-30 and F-31

F-30 and F-31 filter units are backwashable multi-media pressure filters designed to remove suspended solids from the water. These filters act as polishing devices to further reduce the concentration of suspended solids, especially metal hydroxides that are present in the process water. The duplex filter system will provide automatic switchover of process flow from the loaded filter (peak pressure differential reached) to the standby filter (clean). Switch-over and backwash are to be initiated by operator-adjustable differential pressure set-point. The filter material will consist of anthracite coal and different grades of sand. The multi-media bed encourages better penetration of solids, which promotes better filter bed utilization, reducing the rate of head loss and thus increasing the filter run time between backwashes. A design loading rate of 3 gpm/ft^2 at the maximum flow rate of 20 gpm will be attained with a single 3-foot-diameter filter.

Plant water will be used for backwashing the filter units. The filter units will be equipped with a controlled automatic backwash system that will initiate backwash according to a differential pressure switch. Filter backwash water will be conveyed to the Sludge Thickener Tank T-90 for further handling and treatment.

Carbon Adsorption CA-40 and CA-41

The carbon adsorption network receives water from the filter units. The carbon adsorption network will consist of two granular activated carbon (GAC) units operated in series. Each unit contains approximately 2,000 pounds of GAC and provides approximately 50 minutes of empty bed contact time (EBCT) between the GAC and the process water at the maximum design flow rate of 20 gpm. After the GAC in the first unit in the series has been exhausted, process flow will be rerouted such that the second unit becomes the new first unit and the GAC in the exhausted unit will be replaced with fresh GAC. The spent carbon will be removed by an offsite contractor.

Sludge Thickener Tank T-90

T-90 is designed to thicken and provide storage of the sludge collected from the oil/water separator, the clarifier, the multi-media filter system, and the GAC vessels. The tank has a 4,000 gallon nominal capacity. The tank is an open top, vertical cylindrical, 8-foot-diameter by 10-foot 6-inch straight shell, with 1.5 feet of freeboard. The tank will provided with a sloped bottom for removal of the thickened sludge. The supernatant (excess water) overflows Tank T-90 and is conveyed by gravity to Tank T-10. The underflow from Tank T-90 is transferred to Filter Press FP-90 for dewatering by Sludge Thickener Sludge Pump P-90. The concentration of the sludge underflow pumped from T-90 will be approximately 5 percent solids by weight. Pump P-90 will be controlled by the system operator through the Filter Press FP-90 control system during the dewatering of sludge.

Filter Press FP-90

Filter Press FP-90 is a recessed chamber type filter press. At the maximum design flow rate of 20 gpm, the unit has been sized so that it will be necessary to run two filter press cycles every three days. To complete a cycle, enough sludge must be present to completely fill the press chambers, which usually requires that excess sludge remains after the press cycle. To satisfy the design criteria, given the solids generation rate projected, a 20-ft^3 recessed chamber filter press has been selected. The dry filter cake from the filter press, estimated to be approximately 30 percent solids after dewatering, will be disposed off site, and the filtrate will flow by gravity to the building sump.

Submersible Sump Pump P-130

Pump P-130 will draw process water from the building sump which collects waters from leaks, minor washdown flows, T-90 supernatant from manual decanting operations, and filtrate from filter press operations. The decanting is projected to generate approximately 20 gpm for up to 60 minutes. Pump P-130 is designed to provide a maximum flow rate of 50 gpm at a TDH of 32 feet.

Telephone and Alarm Network

An alarm network has been incorporated into the Treatment Facility. Tank T-10 will have a high water level alarm that will provide an annunciation (audible alarm and flashing visual light) on the ECP at the Treatment Facility Building. These alarms alert personnel that an equipment malfunction may have occurred and that attention/acknowledgement is required.

An "auto dialer" is also provided in the event that an alarm condition is not immediately acknowledged; the system automatically triggers the auto dialer, which can communicate via telephone line to a remote location (a place of 24-hour attendance) to alert personnel of an impending alarm condition at the Treatment Facility.

4.8 SITE CONTROLS AND UTILITIES

4.8.1 Site Access Restriction

As required by the ROD, AlliedSignal and associated legal counsel are currently scoping and negotiating future access agreements/restrictions for the site.

4.8.2 Access Roads

Access roads will be constructed as required to allow delivery of equipment and materials throughout the construction period. Actual locations and components of the temporary access roads will be the responsibility of the contractor. The long-term access road to the Area "D" Site will be constructed as shown on Drawing C-7.

4.8.3 Power Supply

The power supply will be brought to the Treatment Facility from a substation located approximately 2,400 feet away. Power lines carrying 4,160-volt power will be brought to the site. A transformer will be installed on a concrete pad at the site according to applicable regulations and codes. Power lines carrying 460-volt, 3-phase power will be installed from the transformer to the Treatment Facility.

Natural gas will be supplied to run a water heater and gas-fired unit.

4.8.4 Potable Water Line

The site potable water line will tap in to the city's potable water supply system at a water line located approximately 1,300 feet away (Drawing C-7). The Treatment Facility will have an intermittent supply demand of approximately 120 gpm at 60 psi. The potable water supply will be used for multi-media filter backwash, reagent makeup, emergency shower and eyewash, and building potable water.

4.8.5 Sanitary Facilities

Sanitary facilities will be provided within the treatment plant. The facilities will be tied into the Buffalo Color Corporation sanitary sewer discharge line to the Buffalo Sewer Authority.

4.9 SURFACE WATER CONTROLS

The surface water controls have been designed to direct surface runoff away from the capping system. The surface water control design includes the following features:

- Contouring of the capping system to direct runoff toward the surface drainage collection system without creating the potential for significant surface erosion.
- Runoff from the northeast and northwest sides of the site will be directed around the cap perimeter via drainage ditches.
- The drainage ditches were designed to convey runoff from a 50-year, 24-hour rainfall event without overflow or causing erosion damage.

Hydraulic design of the drainage ditches was based on Manning's equation for open channel flow. The methodology considers channel gradient, lining roughness, and shape. The drainage ditches will have triangular cross sections and a minimum gradient of 0.25 percent. The design of the surface water controls is presented in Drawing Nos. C-7 and C-12. The design calculations are contained in the Storm Water Management and Erosion Control Plan.

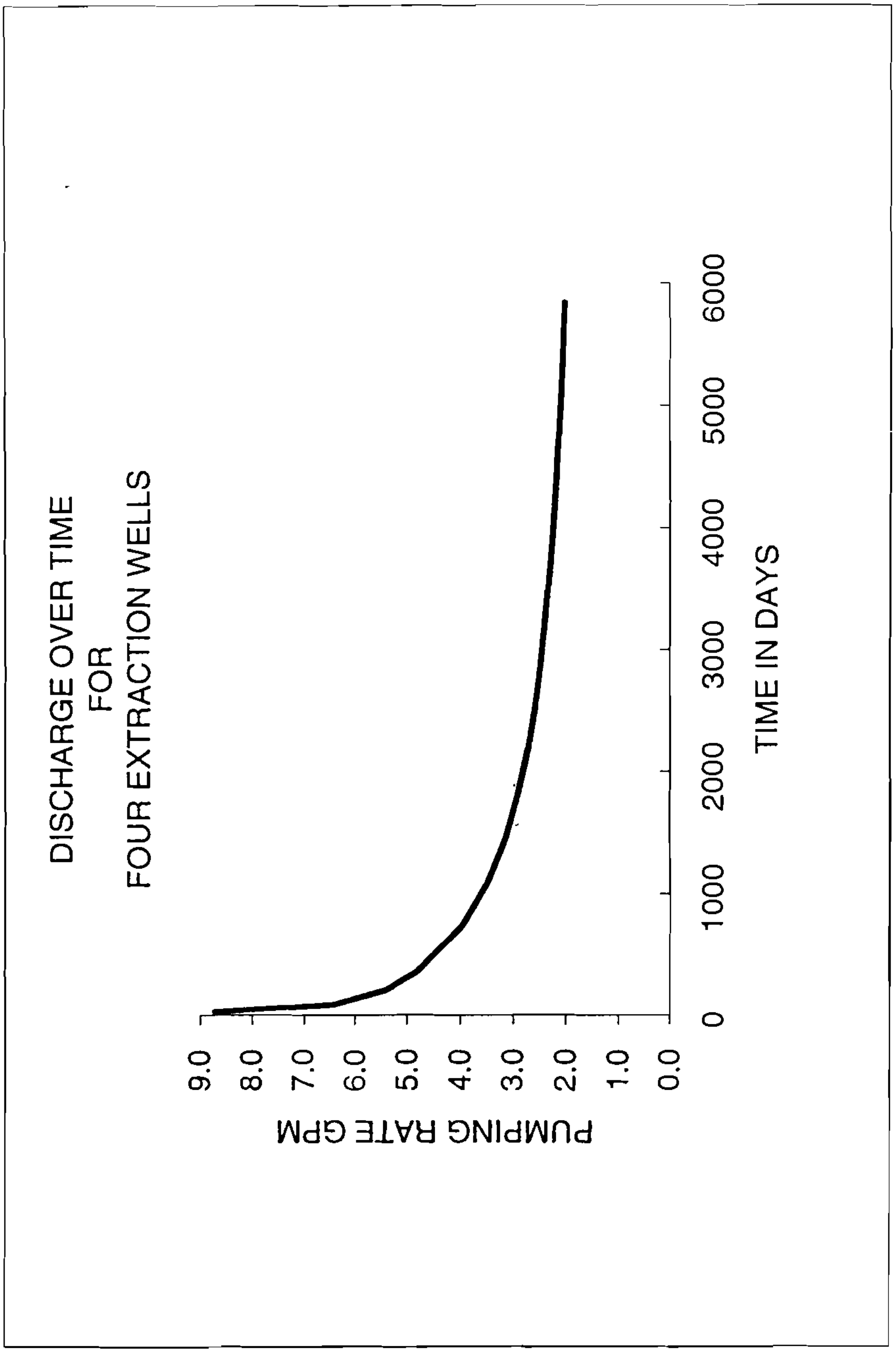
In accordance with the provisions of the Federal Water Pollution Control Act (33 U.S.C. 1251 et. seq.); New York State Environmental Conservation Law (ECL) Articles 17, Titles 7, 8, and Article 70; and the New York State Department of Environmental Conservation Storm Water General Permit GP-93-06; a <u>Storm Water Management and Erosion Control Plan</u> (SWM & ECP) has been prepared for the site. The Plan is included as Appendix D to this report. The SWM & ECP addresses:

- maintaining flood levels for the 2-year, 10-year, and 100-year storms at or below the existing levels for the site;

- maintaining natural drainage systems, to the extent practicable;
- controlling the first flush of run-off where appropriate;
- utilizing vegetative swales to promote infiltration, facilitate the recharge of groundwater, and enhance storm water quality;
- construction activities that may cause soil erosion or that may affect the quality of storm water discharges;
- erosion control and sedimentation procedures to be implemented during construction;
- maintenance measures which minimize pollution of storm runoff by materials used during the construction process;
- long term post-construction surface water management and erosion control measures;
- routine inspections of erosion control and surface water management facilities; and
- the Notice of Intent and Storm Water General Permit for Construction Activity.

The features of this plan are incorporated into the grading plans, site post-construction features, and specifications provided to the remedial contractor to ensure compliance throughout remedial construction. The Plan specifies controls for proper management of surface water in accordance with the Clean Water Act after construction has been completed.

Figure 4.1 Groundwater Table Drawdown Projection



SECTION 5

CONSTRUCTION PHASE WORK PLAN

5.1 INTRODUCTION

The following section describes the proposed construction sequencing and remedial action schedule. The plans are preliminary in nature and are dependent on regulatory agency permitting/approval.

5.2 CONSTRUCTION SEQUENCING

The anticipated sequence of construction was developed with the objective of maintaining a sustained level of effort, where reasonable, in the most efficient manner possible. This approach will minimize the overall project duration and optimize the use of manpower and equipment resources. The preferred sequence of installation allows various craft disciplines to work in a continuous manner avoiding installation conflicts and move on/move off inefficiencies, to the extent possible. Predecessor activities, such as extraction well construction, will be completed during the equipment procurement cycle so the Contractor can install mechanical components upon delivery to the Site.

An example sequence of construction activities is presented on Figure 5.1. Because of the short season available in western New York for earthwork-related construction activities, and because excavation into potentially contaminated areas may be required, proper construction sequencing is essential to complete construction of groundwater management facilities at the Site. Construction initiation is dependent on many factors, including receiving timely acceptance of the *Remedial Design Report* by the NYSDEC, and issuance of appropriate permits by the City of Buffalo, Department of State, and USACE.

5.3 INSTALLATION PLAN

The proposed construction sequence does not reflect construction methods such as prefabrication, or that certain portions of the work may start earlier and proceed on an intermittent basis to enhance the schedule.

Initial activities, prior to construction, will be centered around mobilizing the general contractor and securing necessary subcontract arrangements. Concurrent to this will be procurement activities for equipment and supplies, as needed. This may be necessary to allow adequate scheduling for equipment with long lead times. Assuming receipt of necessary approvals, construction activities are scheduled to begin in the Spring of 1996. As discussed previously in Section 4.2.1, current guidance from the NYSDEC restricts certain construction activities within the Buffalo River during the period from June 1st to July 15th of each year. Figure 5.1 illustrates the planned construction sequence in accordance with this restriction. During the winter of 1995/1996, AlliedSignal will solicit and procure a remedial contractor for the construction services and obtain the necessary permits for construction.

The proposed schedule is provided as a time guide for construction events as opposed to a strict timetable. The schedule of construction events may be impacted by weather conditions and possibly other difficulties during construction. Slowdowns resulting from various factors may require periodic revisions of the construction schedule.

5.4 REMEDIAL ACTION WORK PLAN

A Remedial Action Work Plan (RAWP) has been prepared for the Site, and is included as Appendix H to this report. The RAWP identifies all of the remedial construction activities planned for site remediation. The engineering plans and specifications which describe, in detail, the remedial construction required at the Site will be provided to the Contractor in addition to the RAWP. The Contract Documents (drawings and technical specifications) completely describe the project in its entirety. The RAWP includes the following:

- Work Plan;
- Project Operations Plan;
- Construction Quality Assurance Plan;
- Remedial Action Health and Safety Plan; and
- Contingency Plan.

5.4.1 Construction Quality Assurance Plan

The Construction Quality Assurance Plan (CQA Plan) describes the procedures governing all aspects of quality control for remedial construction. The CQA Plan includes identification of the following:

- delegation of responsibility and authority for all aspects of the project, including chain-of-command and duties of project manager, engineer, and inspection personnel;
- project meetings, including preconstruction, weekly/monthly progress meetings, and unscheduled meetings to address problems or work deficiencies;
- qualifications of all designated project personnel, including training of onsite QA inspector(s);
- QA testing protocols for all construction materials, particularly those related to the cap;
- soil sampling protocols, including borrow material sampling procedures, sample compositing, identification, handling procedures, and laboratory test methods;
- QA testing of all geosynthetics, as applicable;
- discussion of procedures to be followed should any QA test fail to achieve project requirements; and
- identification of QA documentation, including daily monitoring logs, progress reports, corrective measures reports, and final construction certification report.

5.4.2 Well Abandonment

Technical specifications for well abandonment that identify existing Site wells requiring abandonment, and specifies the proper decommissioning procedures for the selected wells.

The primary purposes of decommissioning wells are: (1) to eliminate any potential contaminant migration through the bottom clay layer; and (2) to properly remove selected wells to facilitate remedial construction (i.e., regrading).

The Well Abandonment Specification incorporates all appropriate regulatory requirements including NYSDEC monitoring well decommissioning guidelines. In general, the following procedures are described in the Specification:

- inspection of wells for integrity and selection of wells to be decommissioned; and
- removal of protective casing.

For wells penetrating through the bottom clay layer:

- overdrill of well casing with augers sized larger than the original borehole; and
- removal of the well casing from the borehole; and
- addition of cement/bentonite grout from the bottom of the borehole via a tremie pipe.

For wells terminated at or above the bottom clay layer:

- pull well casing out, as necessary, for grading and cap installation.

The specification includes provisions and details for the abandonment of monitoring wells and installation of new monitoring wells/piezometers needed to provide for monitoring during the post-remedial construction period.

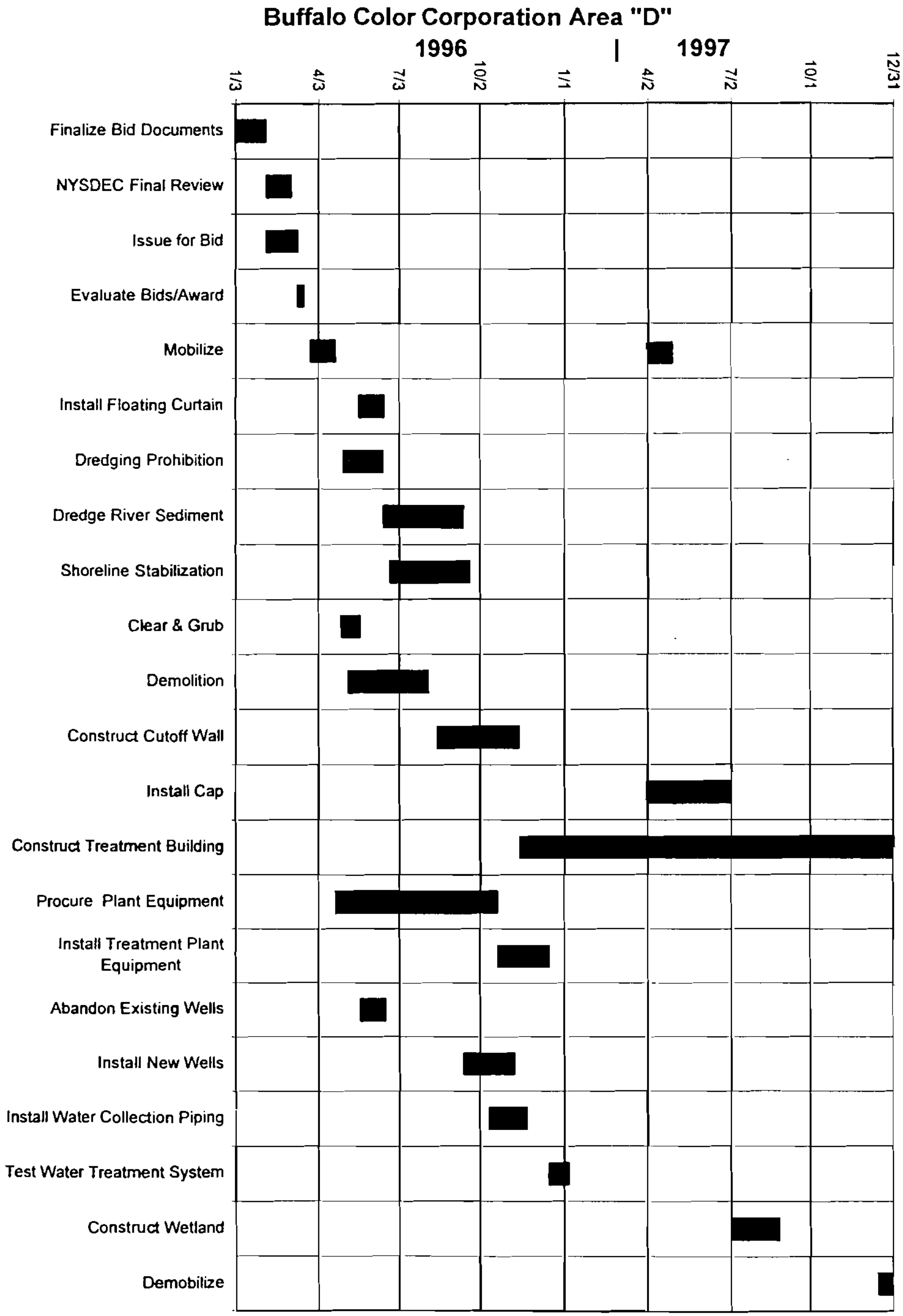
5.4.3 Remedial Action Health and Safety and Contingency Plan

A Remedial Action Health and Safety Plan (HASP) has been prepared in accordance with 29 CFR 1910.120 as an attachment to the RAWP. The HASP includes a description of all site activities, appropriate levels of protection for workers and the public, action levels to implement contingency plans, and emergency contacts and procedures. The selected contractor will be responsible for preparing and implementing a HASP which meets the requirements of the HASP described in Appendix H.

A detailed preparedness, prevention, and contingency plan is included as an exhibit to the Health and Safety Plan. The contingency plan includes response conditions for:

- freezing conditions;
- heavy rains;
- seepage;
- groundwater contamination;
- emergency contacts and notification procedures; and
- response to chemical releases, fires, explosions, etc.

Figure 5.1 Construction Schedule



SECTION 6

LONG-TERM MONITORING PLAN

6.1 INTRODUCTION

The objectives of the Long-Term Monitoring Plan are to:

- Ensure that an inward hydraulic gradient is maintained along the perimeter of the site;
- Ensure that water from the groundwater treatment plant meets applicable discharge criteria; and
- Monitor other components of the RA including inspection of the capping system, fence and gates, slopes, and erosion protection.

The Long-Term Post-Remedial Construction Operation and Maintenance Plan describes the specific procedures for site monitoring and maintenance. The Plan is included as Appendix E to this Report.

6.2 MONITORING EFFECTIVENESS OF HYDRAULIC CONTROL

6.2.1 Monitoring Well Locations

Six well pairs have been specified to monitor the hydraulic gradient across the cutoff wall and verify an inward gradient exists. These wells are located in the vicinity of some of the areas where chemical handling and storage occurred, such as the former incineration area, former weathering areas, former tank park, and the former iron oxide sludge lagoon area. Therefore, extracted groundwater from these wells will be used to monitor chemical conditions in the groundwater. The six pairs of monitoring wells will be installed at the locations shown on Drawing C-7. Each pair will consist of a well inside the cutoff wall and one between the cutoff wall and the Buffalo River.

The well pairs will be identified sequentially; interior wells will be given an "I" suffix and the exterior will be given an "E" suffix. The locations were selected based upon distance from the extraction wells where the influence of pumping would likely be the smallest so that a breach in hydraulic control would occur first in one or more of these locations. The location of well pair OW-3I and OW-3E was also selected for the additional purpose of monitoring the occurrence of LNAPL. The interior wells will be located between 5 to 10 feet from the cutoff wall. In addition, the intersection of the well and the bottom of the cap system will always be greater than 577 ft-msl, the mean high water level in the Buffalo River. The exterior wells will be located approximately 16 feet from the cutoff wall so that the exterior perimeter access road will not be compromised. The locations will be identified in the field by a registered surveyor prior to installation so that critical elevations can be determined during well construction.

6.2.2 Monitoring Well Installation

Monitoring well construction details are presented on Drawing C-13 though C-15. The interior monitoring wells will be constructed of six-inch diameter stainless steel casing materials. The exterior wells will be constructed of two-inch diameter casing materials since they will be used solely for water level monitoring. The interior wells have the larger diameter so as to accommodate a pump if needed either for hydraulic control or testing the integrity of the cutoff wall.

Boreholes for the wells will be completed using hollow-stem auger drilling techniques. The boreholes will be advanced to the top of the underlying clay (approximately 560 ft-msl). Split-spoon samples will be collected and logged continuously throughout the length of the borehole. Drill cuttings will be placed on site to be capped. A track-mounted or all-terrain drill rig will be required as the slopes will be too severe for a truck-mounted rig. The interior well boreholes will be 12 inches (nominal) and the exterior will be 6 inches (nominal). Following installation, the top of the well casing will be surveyed by a registered surveyor as will the top of protective vaults. A permanent mark will be placed on the top of the casing where the survey measurement was made.

Interior Well Completion

The interior wells will be constructed of 6-inch-diameter stainless steel casing and wire-wrapped 0.002-inch slotted screen. Fifteen feet of screen will extend from 560 (or top of clay) to 575 ft-msl. The screen will be at least 2 feet below the bottom of the capping system. Blank casing will extend to 2 feet above the finished cap elevation based upon the location on the as built diagram. A sand pack ("Best 620" or equivalent) will extend from the bottom of the borehole to 1 foot above the top of the screen, followed by a 1-foot bentonite plug. The remainder of the annulus will be filled during the construction of the capping system. The well head will be completed with a 12-inch-diameter flush-mount well vault set in a concrete pad.

Exterior Well Completion

The exterior wells will be constructed of 2-inch-diameter stainless steel casing and wrapped 0.02-slot screen. Ten feet of screen will extend from the top of the clay (i.e., most often 560 ft-msl) to 570 ft-msl. Blank casing will extend to 4 feet above the top of the riprap as dictated by the as-built diagram. A sand pack ("Best 620" or equivalent) will extend from the bottom of the borehole to 1 foot above the top of the screen followed by a 1-foot bentonite plug. The remainder of the annulus will be filled during the construction of the capping system. Prior to the placement of riprap, a 3-foot-diameter by 4-foot-high concrete manhole will be set over the well for permanent protection.

Well Development

The wells will be developed following completion of the water treatment facility. Development will be performed by surging and pumping at low and high flow rates until the water becomes visibly sediment free. Development water will be directed to the Treatment Facility.

6.2.3 Monitoring Procedures Frequency and Reporting

Water levels at all 12 wells will be measured to monitor cutoff wall efficiency and verify the presence of an inward hydraulic gradient. Groundwater sampling and chemical analysis of selected wells will initially be conducted quarterly for two years and semi-annually thereafter. Identification of the sampling points and chemical analysis is addressed in Appendix E.

Water level monitoring will be performed using instrumentation capable of measuring aqueous and non-aqueous liquids to an accuracy of 0.01 foot. Measurements will be taken from the identified mark on the top of the well casing. The groundwater collection system water levels will be monitored quarterly for the first two years of operation, then semiannually thereafter. Results will be reported to the NYSDEC for each event along with an annual summary.

Water levels in these wells will be monitored on a given frequency to verify that an inward gradient exists.

6.3 TREATMENT PLANT DISCHARGE SAMPLING AND ANALYSES

Sampling and analyses of water discharged from the Treatment Facility will in accordance with the provisions of the SPDES permit. A detailed influent sampling plan for the Treatment Facility will be included in Volume III of the Post Remedial Construction Operations and Maintenance Plan. This Plan will be completed following completion of the Treatment Facility construction.

6.4 CAPPING SYSTEM

The capping system will be inspected annually. This inspection will be preceded by cutting the vegetation within four feet of the toe of the slope at the bench. Cutting will only be done between July 15 and August 15 to promote habitat value.

The inspection will include:

- visible debris, liter, and waste;
- loss of vegetative cover;
- integrity of drainage system including;
  - sediment build-up;
  - pooling or ponding; and
  - slope integrity;
- condition of gas vent pipes;
- integrity of groundwater monitoring wells (to be inspected during sampling) and groundwater extraction wells;
- integrity of cap including:
  - erosion or settling of cap material;
  - leachate breakthroughs;

- animal burrows;
  - woody vegetation;
- integrity of erosion control structures around peninsula including erosion or settling of riprap; and
- Identification and obstruction of any trails being heavily used by trespassers or recreational vehicles.

6.5 FENCE AND GATES

The signs around the perimeter will be inspected to ensure they are intact, in good condition, and are visible from probable points of entry. All access and maintenance roads will be maintained in good condition so that routine inspections and required maintenance activities at the site can be carried out. Access to the site may be arranged by contacting:

Mr. David A. Paley
AlliedSignal, Inc.
Engineered Material Sector
101 Columbia Road
Morristown, New Jersey 07962
Phone: (201)-455-3302

The condition of the gates, fences, and roads will be assessed as part of the annual inspections. Repairs will be conducted as needed.

6.6 SHORELINE SLOPE PROTECTION

The shoreline slope and erosion protection around the site will be monitored quarterly for the following:

- Identification of areas of slope erosion and settling;
- Identification of areas of riprap movement;
- Identification of slope failure; and
- Development and implementation of corrective measures if any of the above-noted situations are observed.

Inspections will also be performed after major storm events.

6.7 DRAINAGE SYSTEM MANAGEMENT

All elements of the drainage system including the perimeter drainage ditches will be maintained throughout the post-closure period. All elements will be inspected annually or after severe rainfall events to verify the structures are intact and undisturbed, and that channels and discharge areas are free of obstructions which would impair the free flow or surface water runoff. In the event any of the structures are found to be damaged or incapable of conveying the design flows, repairs will be made as soon as practical. Any obstructions found in swales will be immediately removed and channels regarded as necessary. If any culverts are found to be damaged such that their functions are impaired, they will be repaired or replaced. Accumulated sediment will be removed from drainage channels and/or around outlet structures as required to maintain required capacity and proper operation.

6.8 GROUNDWATER MONITORING WELLS

Monitoring wells which are damaged such that representative groundwater samples cannot be obtained will be repaired or replaced. Repair measures will be based on case-specific evaluation. Any well damaged beyond repair or rendered inoperative will be replaced with a new well of similar depth and construction. Detailed requirements for well installation and decommissioning are specified in Section 02671, Groundwater Monitoring Wells, of the Contract Documents.

6.9 GAS VENTING SYSTEM

The above ground vent pipes will be inspected and maintained during the post-closure period. Repairs will be conducted as needed.

6.10 GEOMEMBRANE

The geomembrane cannot be visually inspected because it will be covered by 24 inches of soil and 6 inches of topsoil. However, should the geomembrane become exposed, it will be inspected for holes and repairs will be made prior to soil replacement. Repairs will be conducted in accordance with the procedures presented in the O & M Manual.

SECTION 7

REFERENCES

[1] New York State Department of Environmental Conservation, June 28, 1993, Order on Consent, Index # B9-0014-84-01RD, by AlliedSignal Inc. (Respondent).

[2] New York State Department of Environmental Conservation, November 22, 1991, Buffalo Color, Area "D" Site, Site Nos. 9-15-012A&B, Record of Decision.

[3] REMCOR, Inc., April 1994, "Revision 2, Remedial Design/Remedial Action Work Plan, Area "D", Buffalo Color Corporation, Buffalo, New York," Prepared for AlliedSignal Inc., Morristown, New Jersey.

[4] REMCOR, Inc., April 1994, "Revision 2, Predesign Investigation Work Plan, Area "D", Buffalo Color Corporation, Buffalo, New York," Prepared for AlliedSignal Inc., Morristown, New Jersey.

[5] New York State Department of Environmental Conservation, April 13, 1982, Order on Consent, Index # 947T032682, by Buffalo Color Corporation (Respondent).

[6] New York State Department of Environmental Conservation, December 14, 1987, Order on Consent, Index # B9-0014-84-01, by AlliedSignal Inc. and Buffalo Color Corporation (Respondents).

[7] Malcolm-Pirnie, Inc., April 1989, "Remedial Investigation Report, Buffalo Color Area "D"," Prepared for Buffalo Color Corporation, Buffalo, New York and AlliedSignal Inc., Morristown, New Jersey.

[8] REMCOR, Inc., November 1994, "Revision 0, Interim Remedial Measures Work Plan, Former Tank Park 910, Area "D" Site, Buffalo, New York, Site No. 9-15-012," Prepared for AlliedSignal Inc., Morristown, New Jersey.

[9] REMCOR, Inc., February 10, 1995, "Revision 0, Technical Memorandum, Site Cap, Cutoff Wall, and Shoreline Stabilization Systems, Area "D" Site, Buffalo New York, Site No.: 9-15-012," Prepared for AlliedSignal Inc., Morristown, New Jersey.

[10] REMCOR, Inc., December 1994, "Revision 1, Technical Memorandum, Non-Aqueous Phase Liquids, Area "D" Site, Buffalo, New York, Site No.: 9-15-012, "Prepared for AlliedSignal Inc., Morristown, New Jersey.

[11] REMCOR, Inc., March 1995, "Revision 0, Technical Memorandum, Ground Water and Long-Term Monitoring, Area "D" Site, Buffalo, New York, Site No.: 9-15-012, "Prepared for AlliedSignal, Inc., Morristown, New Jersey.

[12] Soil and Water Conservation Society, May 1993, "Revised Universal Soil Loss Equation User Guide," K.G. Renard, Tucson, Arizona.

[13] U.S. Army Engineer Waterways Experiment Station, Environmental Laboratory, September 1989, "Hydrologic Evaluation of Landfill Performance," Prepared by Paul R. Schroeder, et.al., Vicksburg, Mississippi.

[14] Urban Soil Erosion and Sediment Control Committee, October 1991, "Guidelines for Urban Erosion and Sediment Control," Third Printing, Printed by Empire State Chapter, Soil, and Water Conservation Society.

[15] Purdue University, December 15, 1988, "User Guide for PC STABL 5M," Prepared by Eftychios Achilleos, Graduate Assistant, Purdue University, West Lafayette, Indiana.

[16] "Fundamental Concepts of Well Design," September/October 1981, Ground Water, Volume 19, No. 5.

APPENDIX A - GEOTECHNICAL INVESTIGATION RESULTS

Ref. # 7

Contractor:	JTS DRILLING SERVICES	ENGINEERING-SCIENCE DRILLING RECORD	BORING/ WELL NO. SB-1
Driller:	ART KOSKE		Sheet 1 of 4
Inspector:	PETE HARTH	PROJECT NAME: BUFFALO COLOR	Location Description:
Rig Type:	CME	PROJECT NUMBER: 728103	

GROUNDWATER OBSERVATIONS

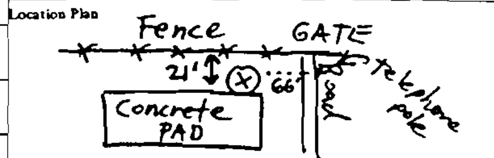
Water Level				
Date				
Time				
Meas. From				

Weather: Warm, Sunny

Date/Time Start: 9/18/95

Date/Time Finish: 9/19/95

Location Plan



PID/FID Reading	Sample I.D.	Sample Depth	Percent Recovery	Blow Cts	FIELD IDENTIFICATION OF MATERIAL	LITHOLOGIC SCHEMATIC	STAIN	SHEEN	FREE-PHASE TAR / OIL
0.0	A	0	80	15	0-1' GRAVEL, loose FILL	GP			
				18	1-2' FILL, compact, dry,	(FILL)			
				18					
	B	2	90	11	dk. brown, blue-stain, bricks.				
				8	SILT, black, brown, blue stain				
				6	bricks.				
				5					
	C	4	5	3	poor recovery. moist @ 4.0'				
				2	(FILL)				
				4					
				2					
	D	6	10	2					
				2					
				1	7.0' SILT AND CLAY, stiff,				
				4	moist. brown mottling	ML			
	E	8	90	1	Faint Hydrocarbon (HC) odor.				
(0.0)				WOH					
				2					
				2					
	F	10	80	2	continued odor.				
				1					
				1					
				1					
	G	12	60	2	Brick, SILT + WET 12.0' ▽				
				4	CLAY, black oily substance.				
				2	Slight sheen. odor. wet.				
				2					
	H	14	70	2					
				WOH					
				/1'	continued black stain, odor.				
				1	SILT AND CLAY, grey, wet.				
	I	16	5	1	STRONG 'Rotten egg' H_2S? odor.				
				WOH					
				/1'					
				2					
	J	18	70	4	18-19' decaying leaves. well-				
				WOH	preserved. Strong odor.	PT			
				1	black staining diminishes.				
				1					
	K	20		1	19-20' SILTY SAND, gray, wet.	SM			

SS = SPLIT SPOON
A = AUGER CUTTINGS
C = CORED

COMMENTS Switched to 5' interval sampling below 20' BGS.
140 lb. hammer.

Contractor: JTS DRILLING SERVICES	ENGINEERING–SCIENCE DRILLING RECORD	BORING/ WELL NO. SB-1
Driller: AK	PROJECT NAME BUFFALO COLOR	Sheet 2 of 4
Inspector: PMH	PROJECT NUMBER 728105	Location Description:
Rig Type: CME		

GROUNDWATER OBSERVATIONS

Water Level				
Date				
Time				
Meas. From				

Weather

Date/Time Start

Date/Time Finish

Location Plan

PID/FID Reading	Sample I.D.	Sample Depth	Percent Recovery	Blow Cts	FIELD IDENTIFICATION OF MATERIAL	LITHOLOGIC SCHEMATIC	STAIN	SHEEN	FREE-PHASE TAR / OIL
0.0	K	20				(SM)			
	L	22							
	M	24							
			80	2	25-27' wood,				
	N	26		2	C. SAND AND GRAVEL	PT/GW			
				3	25.8-26.0'				
				4					
	O	28							
	P	30	80						
				1	30.5' Top CLAY				
				1	CLAY, soft, pink, moist-wet. Very sticky, cohesive.	CL			
	Q	32		1					
	R	34							
			90	WOH	35-37'				
	S	36		/18"					
				1					
	T	38							
	U	40	90		40-42'				

SS = SPLIT SPOON
A = AUGER CUTTINGS
C = CORED

ENGINEERING-SCIENCE
DRILLING RECORD

Contractor: JTS DRILLING SERVICES
Driller: AK
Inspector: PMH
Rig Type: CME

PROJECT NAME: BUFFALO COLOR
PROJECT NUMBER: 728103

BORING/WELL NO. SB-1
Sheet 3 of 4
Location Description:

Location Plan

GROUNDWATER OBSERVATIONS

Water Level				
Date				
Time				
Meas. From				

Weather
Date/Time Start
Date/Time Finish

PID/FID Reading	Sample I.D.	Sample Depth	Percent Recovery	Blow Cts	FIELD IDENTIFICATION OF MATERIAL	LITHOLOGIC SCHEMATIC	STAIN	SHEEN	FREE-PHASE TAR / OIL
0.0	U	40	(90)						
				1	(CLAY)				
				1					
				2					
	V	42		2					
	W	44							
			90	WOH	45-47'				
	X	46		1					
	Y	48							
	Z	50	55	WOH	50-52'				
				1					
	AA	52							
	AB	54							
			100	WOH	55-57'				
	AC	56		1					
	AD	58							
	AE	60	100	WOH	60-62'				
				1					

COMMENTS

SS = SPLIT SPOON
A = AUGER CUTTINGS
C = CORED

Contractor: JTS DRILLING SERVICES	ENGINEERING-SCIENCE DRILLING RECORD	BORING/ WELL NO. SB-1
Driller: AK		Sheet 3 of 4
Inspector: PMH	PROJECT NAME BUFFALO COLOR	
Rig Type: CME	PROJECT NUMBER 728103	Location Description:

GROUNDWATER OBSERVATIONS

Water Level				
Date				
Time				
Meas. From				

Weather

Date/Time Start

Date/Time Finish

Location Plan

PID/FID Reading	Sample I.D.	Sample Depth	Percent Recovery	Blow Cts	FIELD IDENTIFICATION OF MATERIAL	LITHOLOGIC SCHEMATIC	STAIN	SHEEN	FREE-PHASE TAR / OIL
0.0	U	40	(90)						
				1	(CLAY)				
				1					
				2					
	V	42		2					
	W	44							
			90	WOH	45-47'				
	X	46		1					
	Y	48							
	Z	50	55	WOH	50-52'				
				1					
	AA	52							
	AB	54							
			100	WOH	55-57'				
	AC	56		1					
	AD	58							
	AE	60	100	WOH	60-62'				
				1					

COMMENTS

SS = SPLIT SPOON
A = AUGER CUTTINGS
C = CORED

ENGINEERING-SCIENCE
DRILLING RECORD

BORING/ WELL NO. SB-1

Contractor: JTS DRILLING SERVICES
Driller: AK
Inspector: PMH
Rig Type: CME

PROJECT NAME: BUFFALO COLOR
PROJECT NUMBER: 728103

Sheet 4 of 4
Location Description:

GROUNDWATER OBSERVATIONS

Water Level				
Date				
Time				
Meas. From				

Weather
Date/Time Start
Date/Time Finish

Location Plan

PID/FID Reading	Sample I.D.	Sample Depth	Percent Recovery	Blow Cts	FIELD IDENTIFICATION OF MATERIAL	LITHOLOGIC SCHEMATIC	STAIN	SHEEN	FREE-PHASE TAR / OIL
0.0	AE	60	(100)	(WOH) (1)	(CLAY)	(CL)			
	AF	62			C. GRAVEL @ 62' Wet. compact. (TILL)	GP			
		64							
					Auger refusal 64.8' Bedrock. End of boring SB-1 @ 64.8' BGS				
		66							
		68							
		70							
		72							
		74							
		76							
		78							
		80							

COMMENTS

SS - SPLIT SPOON
A - AUGER CUTTINGS
C - CORED

Contractor: JTS DRILLING SERVICES	ENGINEERING-SCIENCE DRILLING RECORD	BORING/ WELL NO. SB-2	
Driller: ART KOSKE			
Inspector: PETE HARTH	PROJECT NAME BUFFALO COLOR	Sheet 1 of 3	
Rig Type: CME	PROJECT NUMBER 728108	Location Description:	

GROUNDWATER OBSERVATIONS						
Water Level					Weather Warm, Sunny	Location Plan
Date					Date/Time Start 9/19/95	
Time						
Meas. From					Date/Time Finish 9/19/95	

PID/FID Reading	Sample I.D.	Sample Depth	Percent Recovery	Blow Cts	FIELD IDENTIFICATION OF MATERIAL	LITHOLOGIC SCHEMATIC	STAIN	SHEEN	FREE-PHASE TAR / OIL
0.0	A	0	60		· C. SAND AND GRAVEL FILL	FILL			
				7					
				18	1.5-2.0' = purple stain. - dry.				
				10					
15.0	B	2	70	10					
				4					
				9	2.5-3.0' Bricks, SILT, black				
				5	stain, Hydrocarbon (HC) odor.				
5.3	C	4	50	3	dry.				
				4					
				4	Bricks, black stain. damp.				
				3					
	D	6	50	4	SILT, BRICKS, black stain -				
				6	damp - wet. (FILL)				
				3					
				2					
	E	8	60	6	8-8.5' Leaves, wood.				
				2		PT			
				1	9.0' Peat, organic material				
2.3.				1	black stain, moist.				
	F	10	60	1					
				WOH	SILT, pasty texture, black				
				1	stain. HC odor.	ML			
				1					
	G	12	90	2					
				3	12.3' CLAY and SILT, moist				
				2	orange iron staining, gray-				
				1					
	H	14	90	2	green color. black stain				
				1	ceases @ 12.3' WET 14.5' ▽				
				1	LOOSE, water saturated.				
				1	V.F. SAND 15.2-16.0'	SP			
	I	16	100	1					
				1	Organic material				
				2	16.-18' V.F. SAND and SILT	SM			
				2					
	J	18	10	3	18-19.5' F.-M. SAND, gray,	SP			
				WOH	wet.				
				1					
				2	19.5-20' undecayed leaves	PT			
		20	80	2	moderate odor.				
	K								

SS = SPLIT SPOON
A = AUGER CUTTINGS
C = CORED

COMMENTS Switch from continuous sampling to 5' interval sampling below 20' BGS
140 lb hammer

Contractor: JTS DRILLING SERVICES	ENGINEERING-SCIENCE DRILLING RECORD	BORING/ WELL NO. SB-2
Driller: AK		
Inspector: PMH	PROJECT NAME BUFFALO COLOR	Sheet 2 of 3
Rig Type: CME	PROJECT NUMBER 728108	Location Description:

GROUNDWATER OBSERVATIONS

Water Level				
Date				
Time				
Meas. From				

Weather

Date/Time Start

Date/Time Finish

Location Plan

PID/FID Reading	Sample I.D.	Sample Depth	Percent Recovery	Blow Cts	FIELD IDENTIFICATION OF MATERIAL	LITHOLOGIC SCHEMATIC	STAIN	SHEEN	FREE-PHASE TAR / OIL
0.0	K	20				(PT?)			
	L	22			- - - ? - - -	- - -			
						GW			
	M	24							
			80	1	25-27' C. SAND and GRAVEL wet, 1/4" gravel.	SW			
	N	26		5					
				8					
				7					
	O	28							
	P	30	100	1	30-32' 30.5'				
				1	CLAY, red-pink, soft, moist-wet, very sticky, cohesive.	CL			
				1					
				1					
	Q	32							
	R	34							
			100	WOH /18"	35-37'				
	S	36		1					
	T	38							
	U	40	100		40-42'				

SS = SPLIT SPOON
A = AUGER CUTTINGS
C = CORED

ENGINEERING-SCIENCE DRILLING RECORD	
Contractor: JTS DRILLING SERVICES	BORING/WELL NO. SB-2
Driller: AK	Sheet 3 of 3
Inspector: PMH	PROJECT NAME BUFFALO COLOR
Rig Type: CME	PROJECT NUMBER 728103
	Location Description:

GROUNDWATER OBSERVATIONS

Water Level				
Date				
Time				
Meas. From				

Weather

Date/Time Start

Date/Time Finish

Location Plan

PID/FID Reading	Sample I.D.	Sample Depth	Percent Recovery	Blow Cts	FIELD IDENTIFICATION OF MATERIAL	LITHOLOGIC SCHEMATIC	STAIN	SHEEN	FREE-PHASE TAR / OIL
0.0	U	40	100	WOH /18"	(CLAY)	(CL)			
				1					
	V	42							
	W	44							
			100	WOH	45-47' (CLAY) extremely cohesive. Difficult to open spoon.				
	X	46		/12"					
				2					
				2					
	Y	48							
	Z	50	100	WOH	50-52				
				/12"					
				2					
				2					
		52							
					END OF BORING SB-2 @ 52' BGS.				
		54							
		56							
		58							
		60							

COMMENTS

SS = SPLIT SPOON
A = AUGER CUTTINGS
C = CORED

SJB SERVICES, INC.

Contract Drilling and Testing

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Buffalo, NY 14218

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Fax: (716) 821-0163

P.O. BOX 515
New Holland, PA 17557

Phone: (717) 354-7389
Fax: (717) 354-7619

Laboratory Test Report

PROJECT : BUFFALO COLOR

CLIENT : PARSONS E-S, INC.

DATE : SEPTEMBER 29, 1995

PROJECT NO.: SJB-D663
REPORT NO.: LTR-1

SAMPLE INFORMATION :
Sample Nos. 95-494 through 95-500 were collected from the project site by a SJB Services, Inc. Drill Crew on September 18, 1995. Samples are described as split spoon samples from various borings at the site. Samples and testing schedule were determined by a representative from Parsons E-S.

ASTM D-422 : Particle Size Analysis of Soils

Sample Number : 95-494
Location : SB-1 : 6'-8'

Sieve Size	*Percent Passing*
1 1/2"	100.0
1"	81.7
3/4"	80.4
1/2"	80.4
1/4"	76.5
#4	72.1
#10	55.8
#20	48.1
#40	42.8
#100	31.6
#200	25.8

COMPONENT PERCENTAGE

GRAVEL	SAND	SILT	CLAY
27.9%	46.3 %	15.2 %	10.6 %

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Laboratory Test Report

PROJECT : BUFFALO COLOR

CLIENT : PARSONS E-S, INC.

DATE : SEPTEMBER 29, 1995

PROJECT NO.: SJB-D663
REPORT NO.: LTR-1

ASTM D-422 : Particle Size Analysis of Soils

Sample Number : 95-495
Location : SB-1 : 10'-12'

Sieve Size	*Percent Passing*
1/2"	100.0
1/4"	99.9
#4	99.5
#10	96.3
#20	94.6
#40	92.4
#100	82.6
#200	75.9

COMPONENT PERCENTAGE			
GRAVEL	SAND	SILT	CLAY
0.5%	23.6 %	32.7 %	43.2 %

Sample Number : 95-496
Location : SB-1 : 18'-20'

Sieve Size	*Percent Passing*
#10	100.0
#20	99.0
#40	96.5
#100	57.6
#200	40.1

COMPONENT PERCENTAGE			
GRAVEL	SAND	SILT	CLAY
0.0%	59.9 %	26.8 %	13.3 %

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Laboratory Test Report

PROJECT : BUFFALO COLOR

CLIENT : PARSONS E-S, INC.

DATE : SEPTEMBER 29, 1995

PROJECT NO.: SJB-D663
REPORT NO.: LTR-1

ASTM D-422 : Particle Size Analysis of Soils

Sample Number : 95-497
Location : SB-2 : 18'-20'

Sieve Size	*Percent Passing*
#10	100.0
#20	99.6
#40	97.0
#100	64.5
#200	49.0

COMPONENT PERCENTAGE

GRAVEL	SAND	SILT	CLAY
0.0%	51.0 %	33.3 %	15.7 %

Sample Number : 95-498
Location : SB-2 : 25'-27'

Sieve Size	*Percent Passing*
1 1/2"	100.0
1"	92.3
3/4"	92.3
1/2"	89.9
1/4"	84.4
#4	81.2
#10	69.8
#20	58.8
#40	43.5
#100	14.3
#200	9.9

COMPONENT PERCENTAGE

GRAVEL	SAND	SILT	CLAY
18.8%	71.2 %	5.4 %	4.6 %

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PROJECT : BUFFALO COLOR

CLIENT : PARSONS E-S, INC.

DATE : SEPTEMBER 29, 1995

PROJECT NO.: SJB-D663
REPORT NO.: LTR-1

ASTM D-2216 : Laboratory Determination of Moisture Content of Soil and Rock

Sample Number	Location / Description	Moisture Content
95-499	SB-2 : 35'-37'	40.5 %
95-500	SB-2 : 40'-42'	33.7 %

ASTM D 4318 : Test Method for Liquid Limit, Plastic limit, and Plasticity Index of Soils

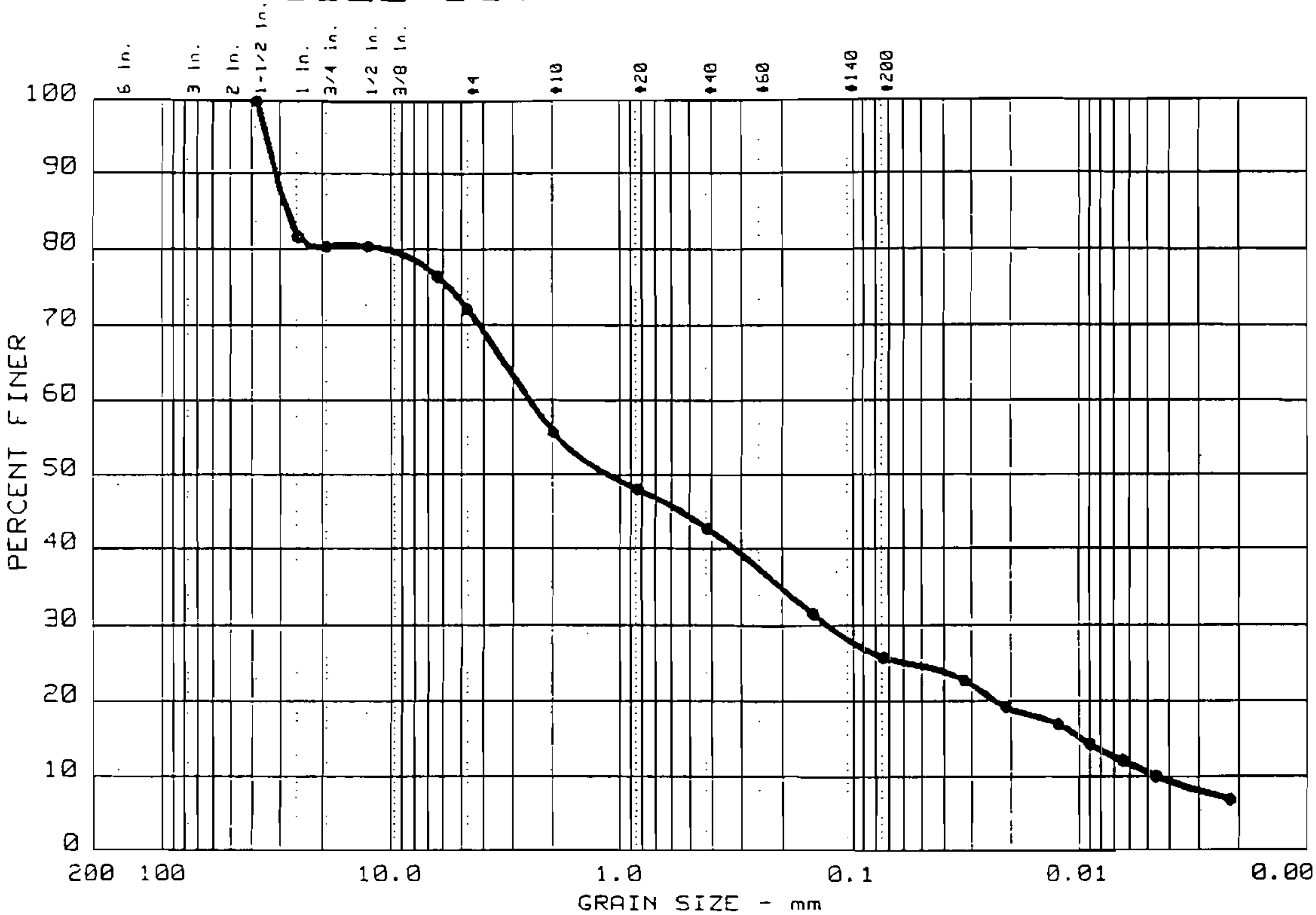
Sample Number	Location / Description	Liquid Limit	Plastic Limit	Plasticity Index
95-499	SB-2 : 35'-37'	43	21	22
95-500	SB-2 : 40'-42'	37	18	19

SJB Services, Inc.

Paul C. Gregorczyk
Laboratory Manager

Ray J. Kron
Testing Services Manager

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	14	0.0	27.9	46.3	15.2	10.6

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			28.31	2.55	1.11	0.126	0.0096	0.0044	1.41	575.4

MATERIAL DESCRIPTION	USCS	AASHTO
● SAND, SOME GRAVEL, LITTLE SILT & CLAY	SM	A-2-4(0.0)

Project No.: SJB-D663 : LTR-1
Project: BUFFALO COLOR
● Location: BORING SB-1 : 6'-8'

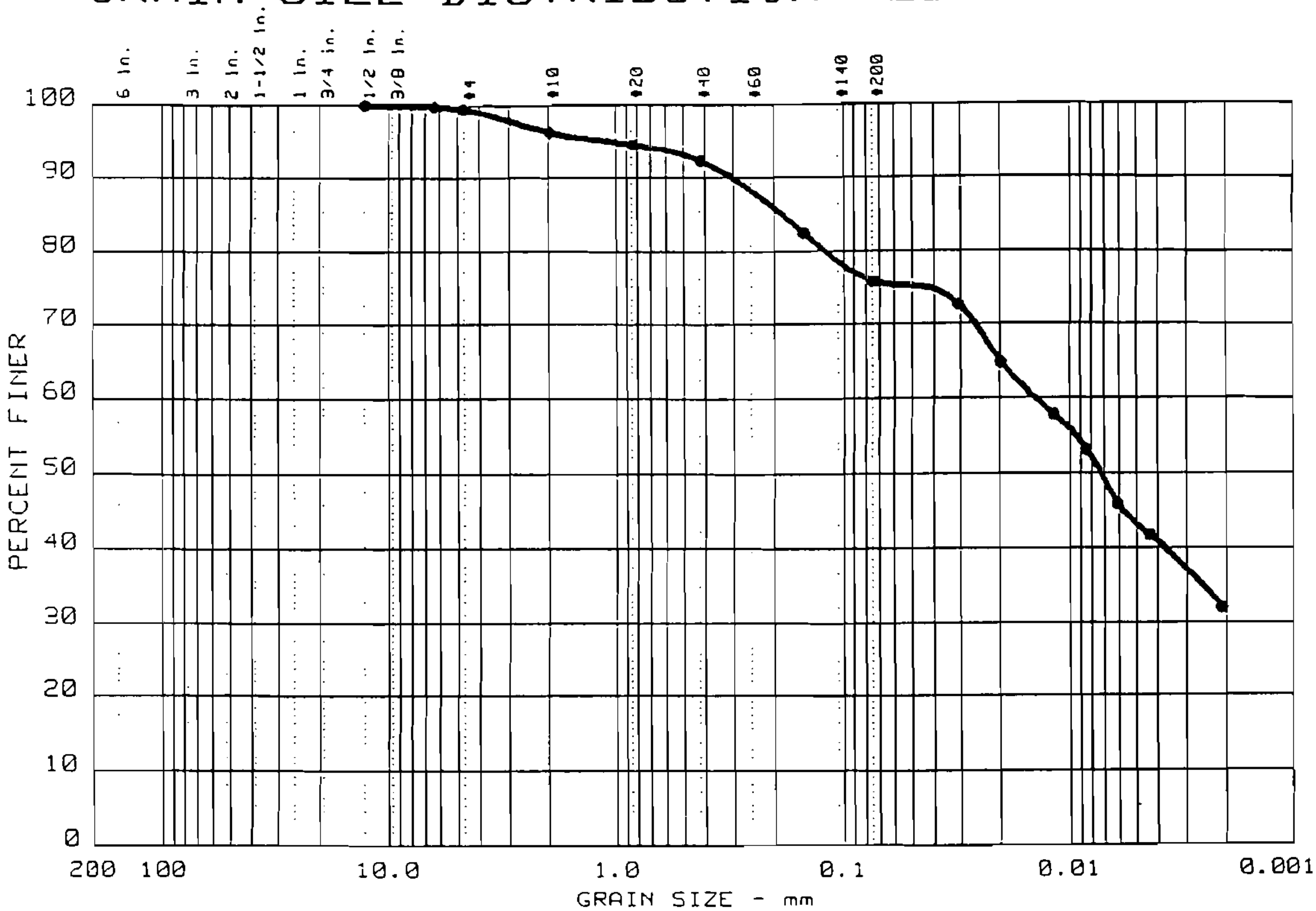
Date: SEPTEMBER 29, 1995

GRAIN SIZE DISTRIBUTION TEST REPORT
SJB Services, Inc.

Remarks:
Collected by SJB Drill Crew from the site on September 19, 1995.
SJB Sample ID#: 95-494

Figure No. ______

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	15	0.0	0.5	23.6	32.7	43.2

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.18		0.01					

MATERIAL DESCRIPTION	USCS	AASHTO
● CLAY, SOME SILT & SAND, TRACE GRAVEL	ML	A-4(0.0)

Project No.: SJB-D663 : LTR-1
Project: BUFFALO COLOR
● Location: BORING SB-1 : 10'-12'

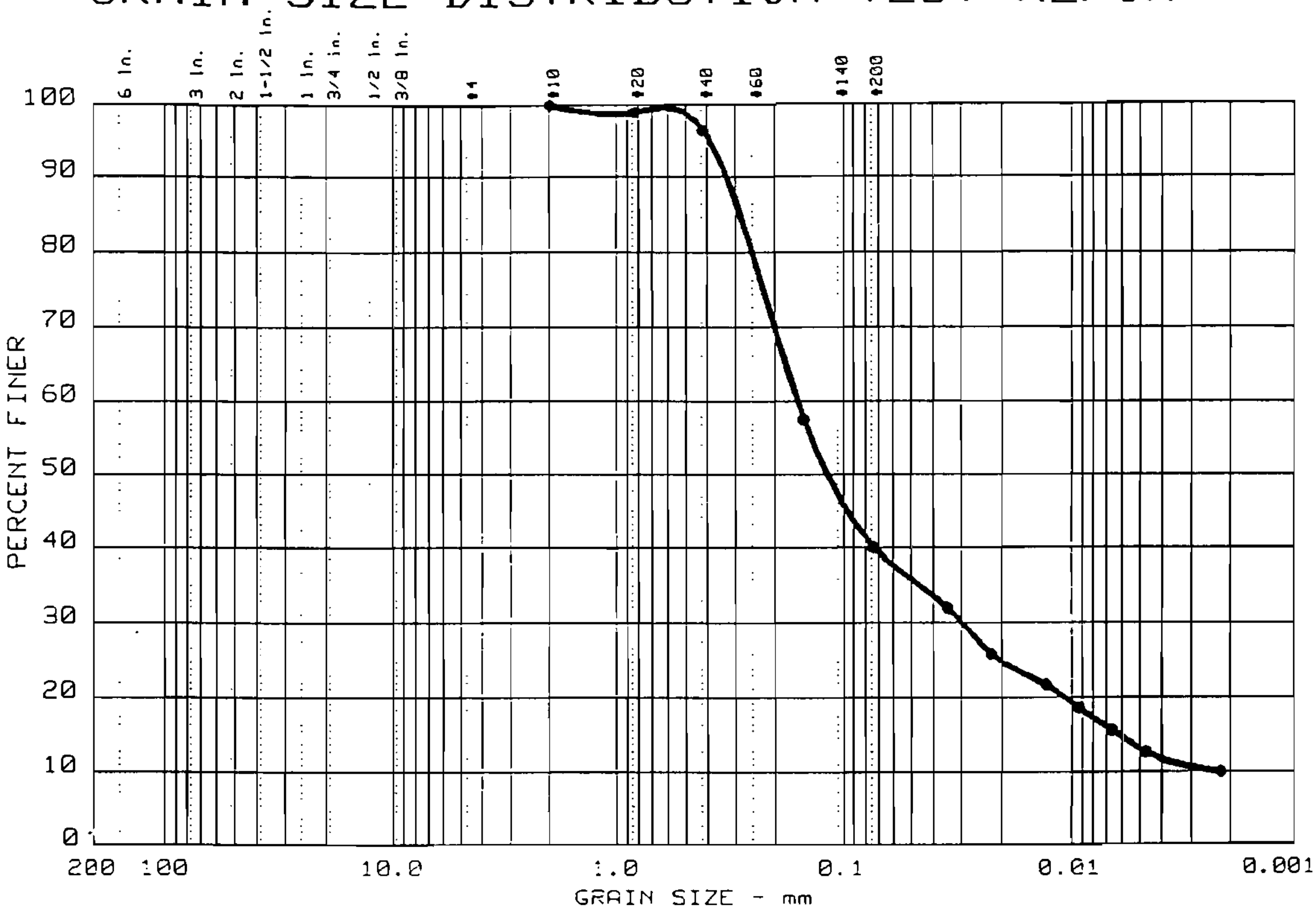
Date: SEPTEMBER 29, 1995

Remarks:
Collected by SJB Drill Crew from the site on September 18, 1995.
SJB Sample ID#: 95-495

GRAIN SIZE DISTRIBUTION TEST REPORT
SJB Services, Inc.

Figure No. ______

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	16	0.0	0.0	59.9	26.8	13.3

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.29	0.15	0.12	0.030	0.0061			

MATERIAL DESCRIPTION	USCS	AASHTO
● SAND, SOME SILT, LITTLE CLAY	SM	A-4(0.0)

Project No.: SJB-D663 : LTR-1
Project: BUFFALO COLOR
● Location: BORING SB-1 : 18'-20'

Date: SEPTEMBER 29, 1995

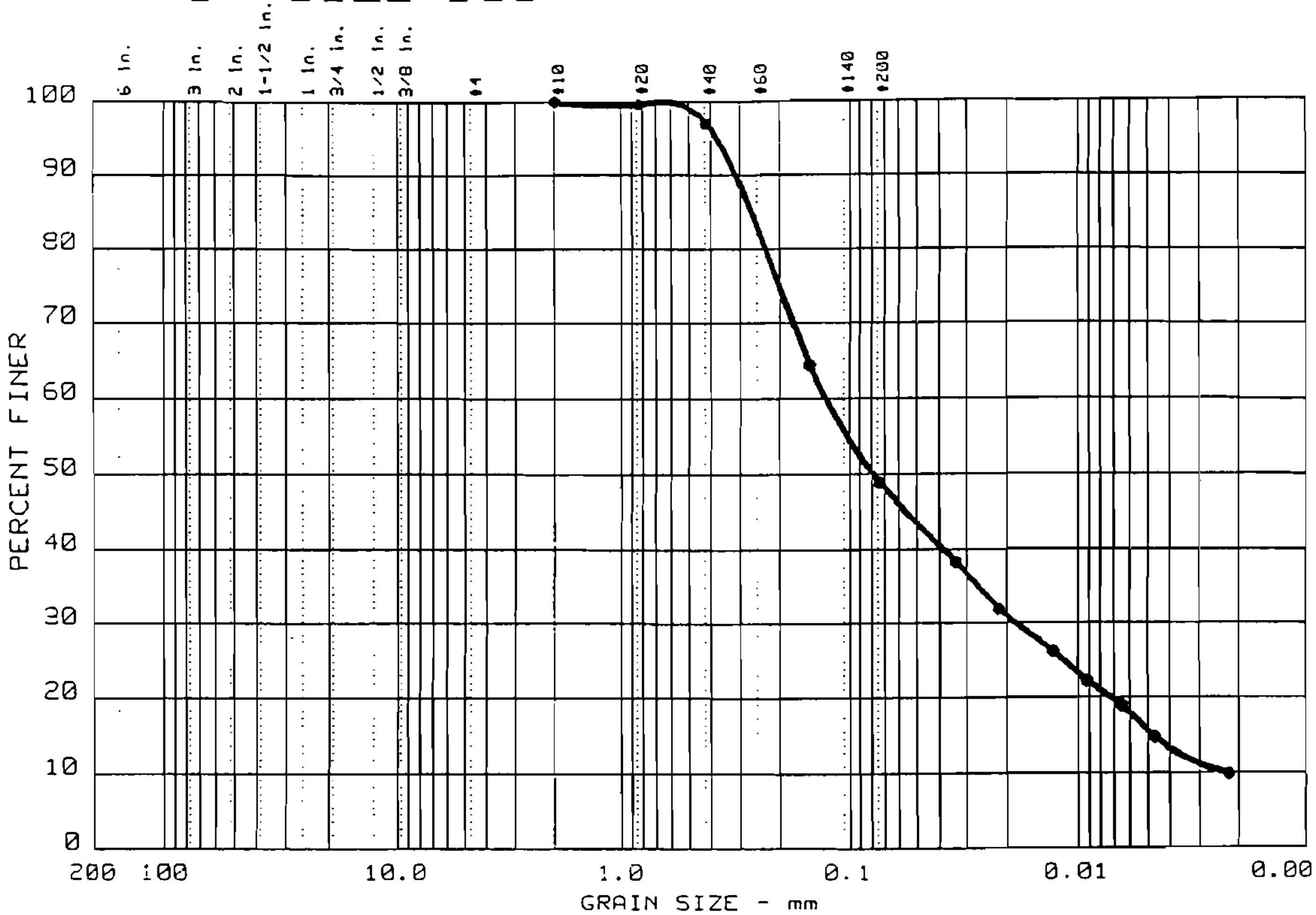
GRAIN SIZE DISTRIBUTION TEST REPORT

SJB Services, Inc.

Remarks:
Collected by SJB Drill Crew from the site on September 18, 1995.
SJB Sample ID#: 95-496

Figure No. ______

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	17	0.0	0.0	51.0	33.3	15.7

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.27	0.13	0.08	0.018	0.0047			

MATERIAL DESCRIPTION	USCS	AASHTO
● SAND, SOME SILT, LITTLE CLAY	SM	A-4(0.0)

Project No.: SJB-D663 : LTR-1
Project: BUFFALO COLOR
● Location: BORING SB-2 : 18'-20'

Date: SEPTEMBER 29, 1995

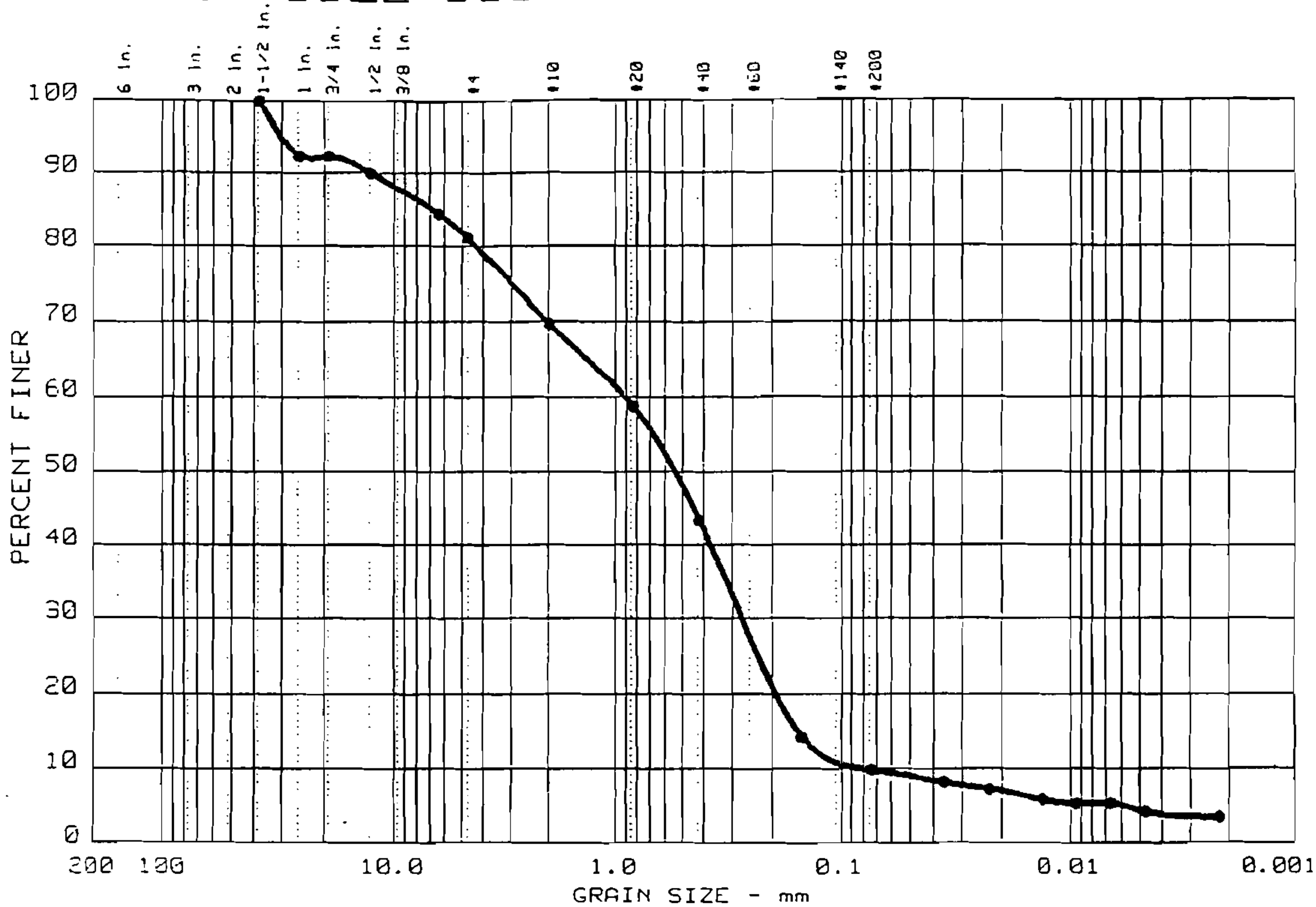
GRAIN SIZE DISTRIBUTION TEST REPORT

SJB Services, Inc.

Remarks:
Collected by SJB Drill Crew from the site on September 18, 1995.
SJB Sample ID#: 95-497

Figure No. ______

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	18	0.0	18.8	71.2	5.4	4.6

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			6.76	0.90	0.54	0.272	0.1549	0.0741	1.11	12.2

MATERIAL DESCRIPTION	USCS	AASHTO
● SAND, LITTLE GRAVEL, TRACE SILT & CLAY	SW-SM	A-1-b

Project No.: SJB-D663 : LTR-1

Project: BUFFALO COLOR

● Location: BORING SB-2 : 25'-27'

Date: SEPTEMBER 29, 1995

GRAIN SIZE DISTRIBUTION TEST REPORT

SJB Services, Inc.

Remarks:

Collected by SJB Drill Crew from the site on September 18, 1995.

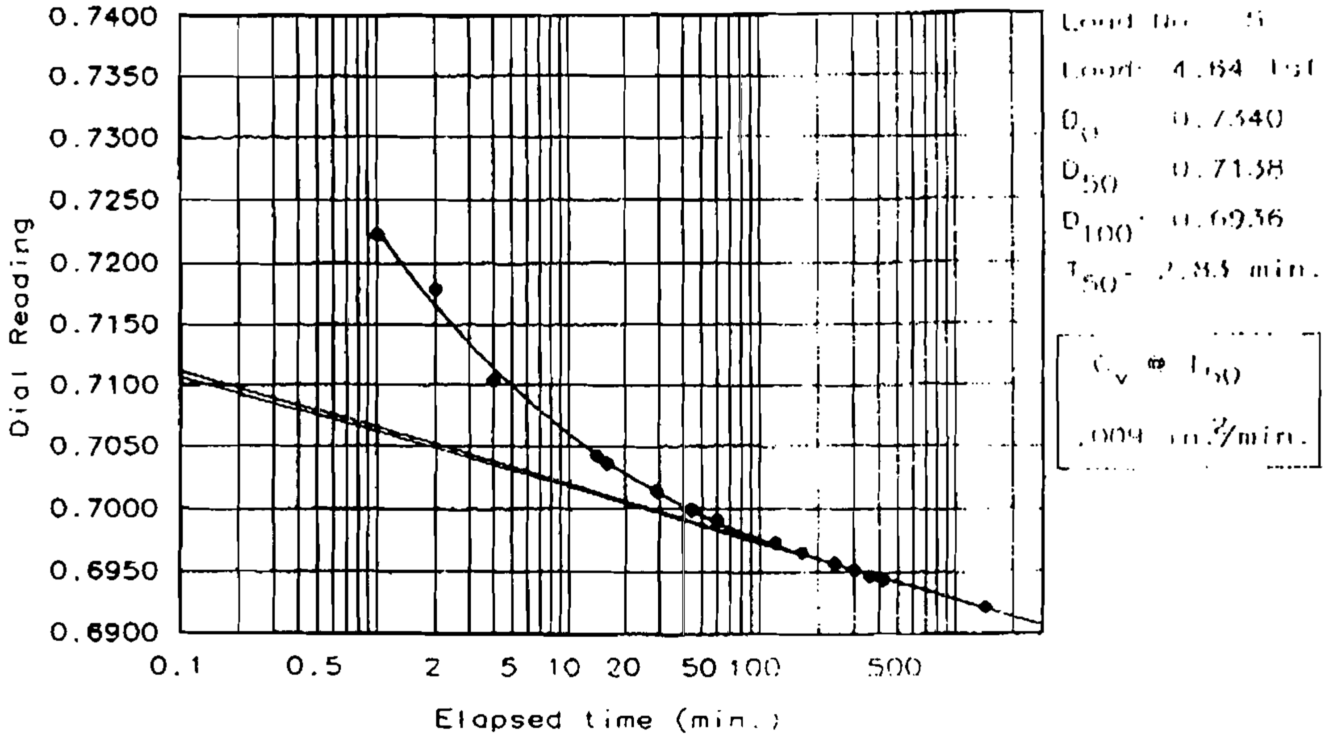
SJB Sample ID#: 95-498

Figure No. ______

Dial Reading vs. Time

WX

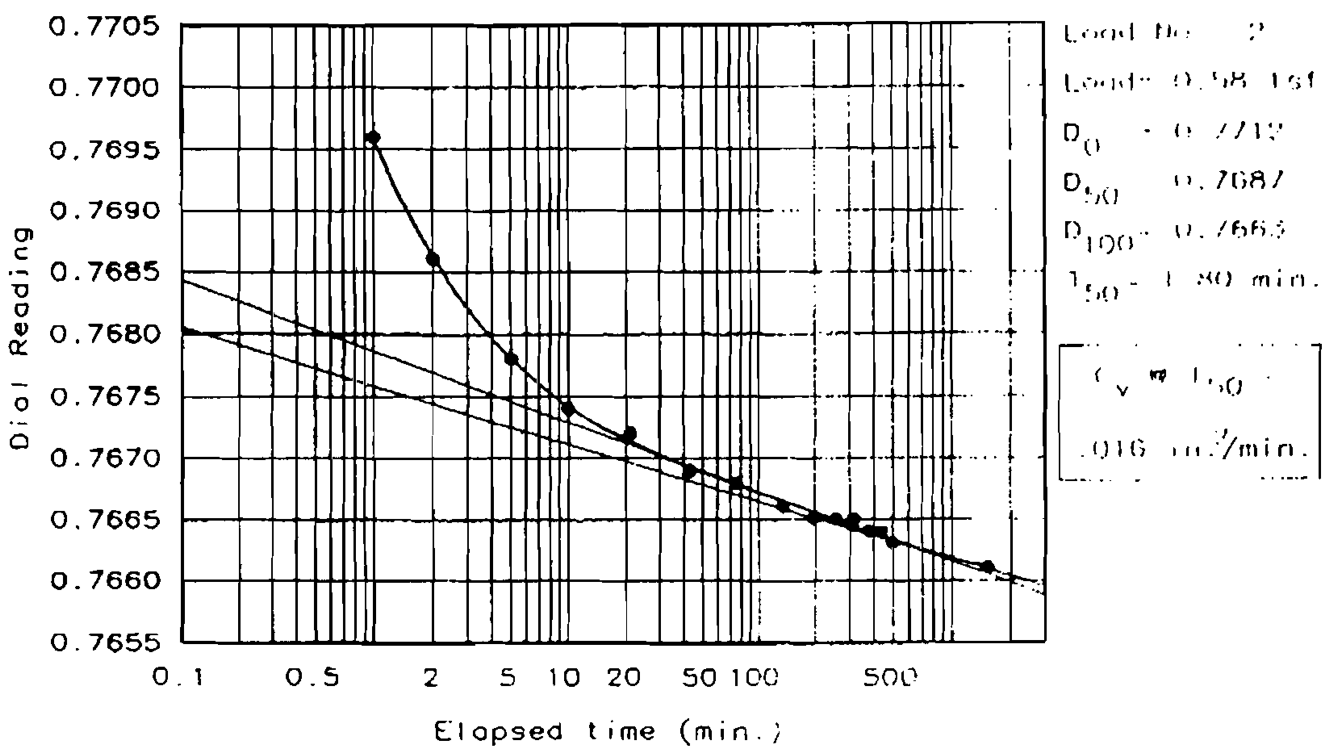
Project No.: ETE-95-79
Project: Buffalo Color
Location: Boring No. SB-1, 32'-34' Depth
Buffalo, New York
Date: 10-5-95

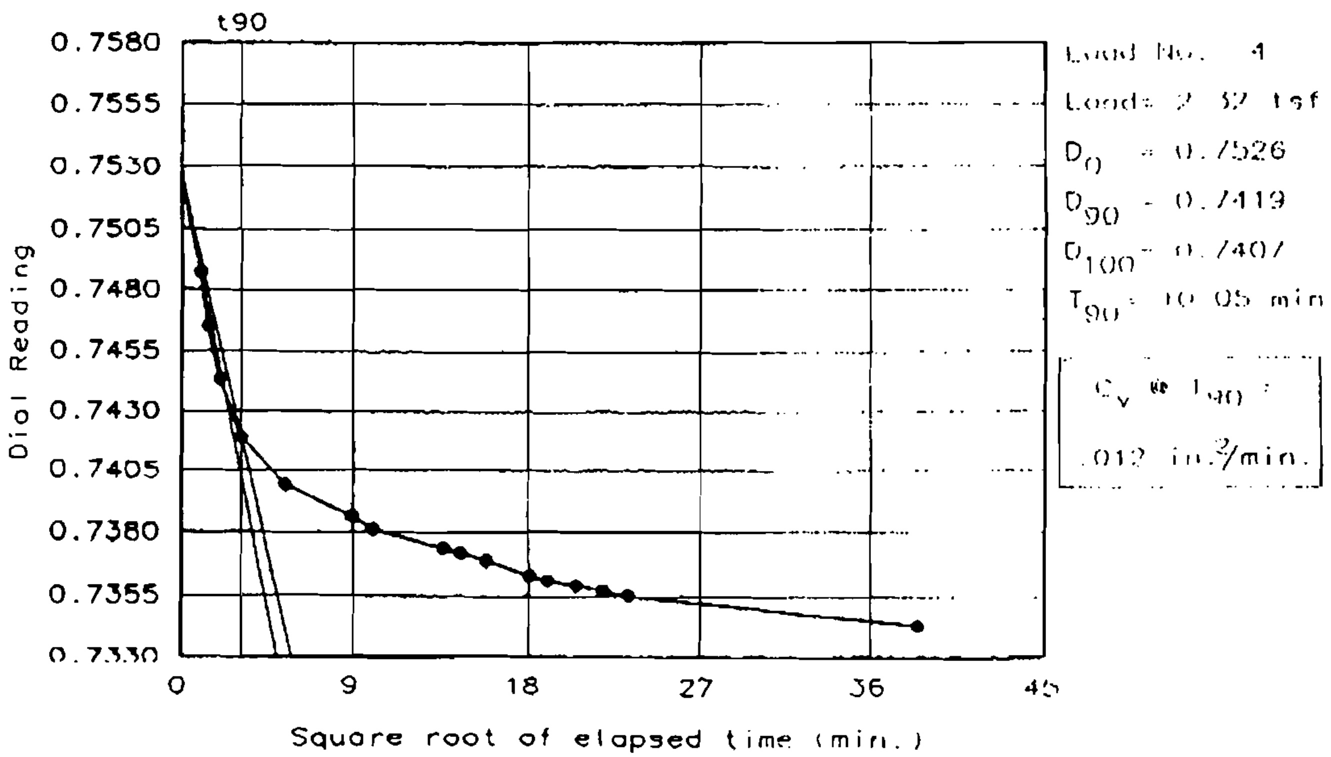


EVERGREEN TESTING, INC.

Dial Reading vs. Time

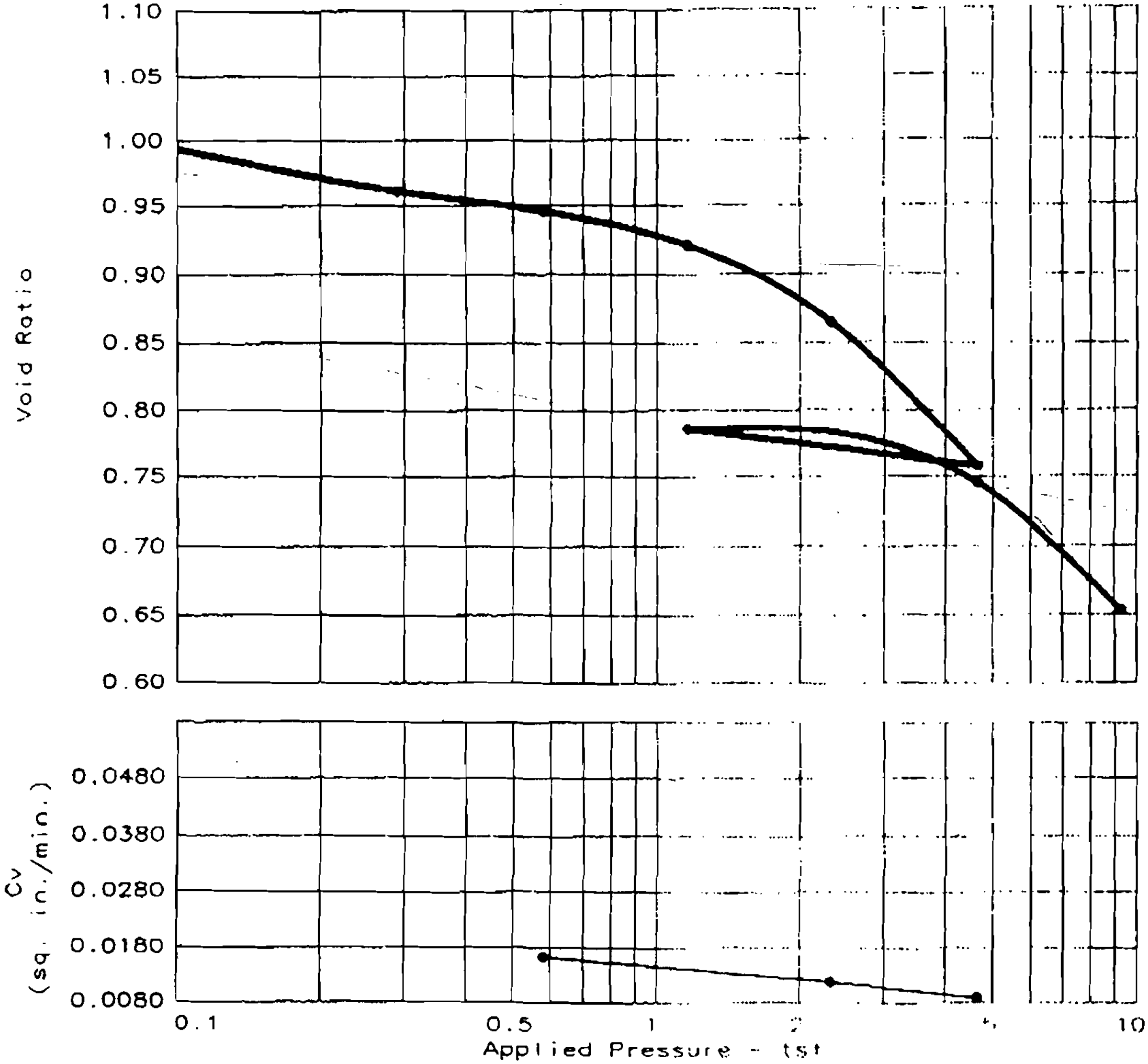
Project No.: ETE-95-79
Project: Buffalo Color
Location: Boring No. SB-1, 32'-34' Depth
Buffalo, New York
Date: 10-5-95





EVERGREEN TESTING, INC.

CONSOLIDATION TEST REPORT



Natural Saturation	Natural Moisture	Dry Density	LL	PI	Sp.Gr.	Precons. press.	C_c	e_o
106.7 %	39.3	84.6	40	20	2.700	2.35	0.36	0.9934

TEST RESULTS	MATERIAL DESCRIPTION
C_v at 0.58 tsf applied = 0.016 sq. in./min. C_v at 2.32 tsf applied = 0.012 sq. in./min.	Brn. varved SILT & CLAY occ. f. sand partings Class: Cl

Project No.: ETE-95-79
Project: Buffalo Color
Location: Boring No. SB-1, 32'-34' Depth
Buffalo, New York
Date: 10-5-95

CONSOLIDATION TEST REPORT

EVERGREEN TESTING, INC.

Remarks:

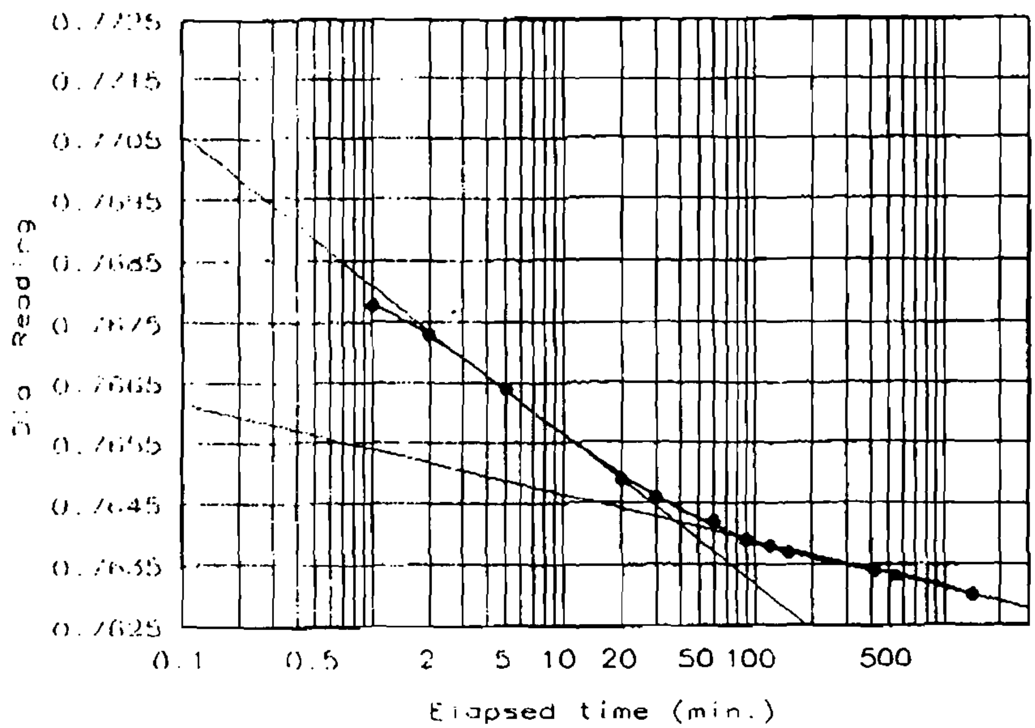
Sampled by SJR
Transported by SJR
Tested by CD

TORVANE = 0.45 tsf

Fig. No. 1

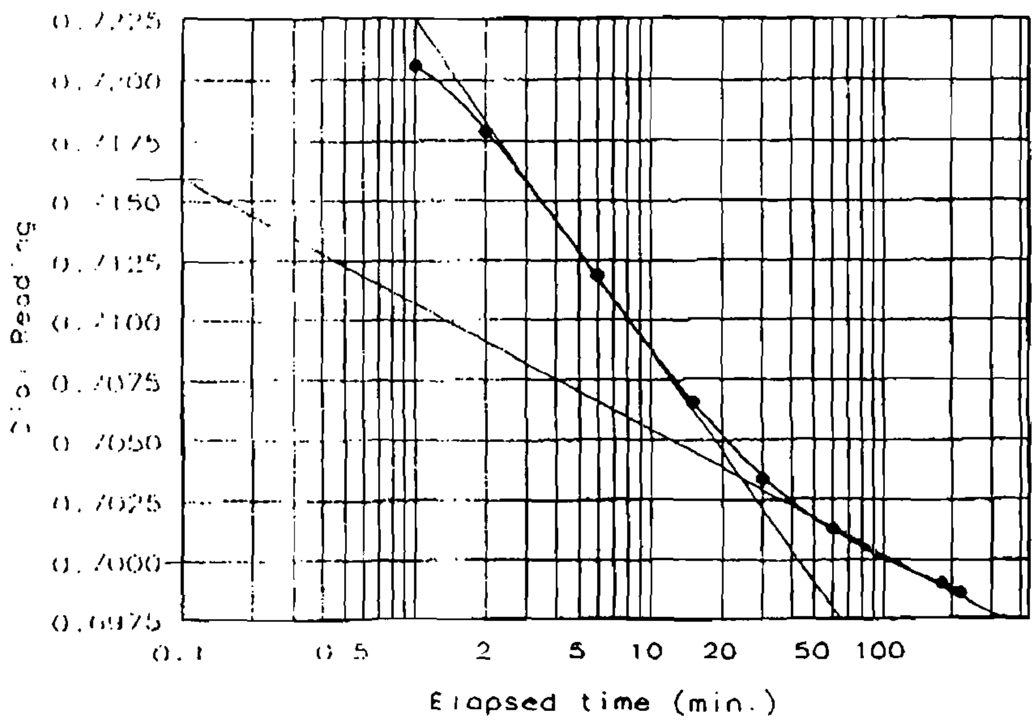
Dial Reading vs. Time

Project No.: ETC 95-79
Project: Buffalo Color
Location: Boring No. SB-1, 45'-47' Depth
Buffalo, New York
Date: 10-16-95



Load No.= 2
Load= 0.58 tsf
D_0 = 0.7690
D_{50} = 0.7666
D_{100}= 0.7642
T_{50}= 4.03 min.

C_v @ T_{50} =
.007 in.^{2}/min.

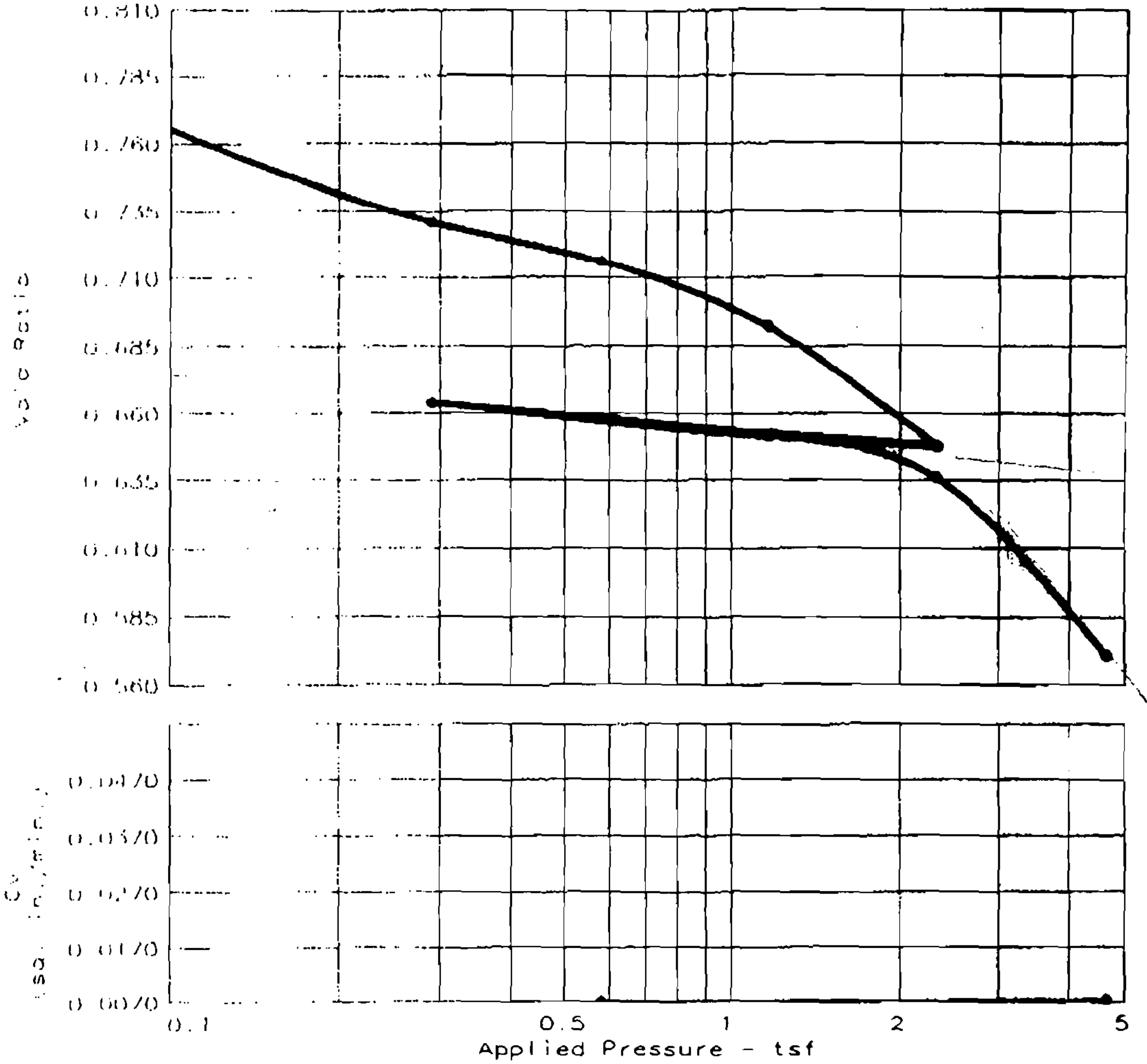


Load No.= 9
Load= 4.64 tsf
D_0 = 0.7269
D_{50} = 0.7152
D_{100}= 0.7034
T_{50}= 3.38 min.

C_v @ T_{50} =
.007 in.^{2}/min.

EVERGREEN TESTING, INC.

CONSOLIDATION TEST REPORT



Natural Saturation	Natural Moisture	Dry Density	LL	PI	Sp.Gr.	Precons. press.	C_c	e_o
111.0 %	31.5	95.5	34	15	2.700	2.75	0.24	0.7653

TEST RESULTS	MATERIAL DESCRIPTION
Compression Index = 0.24	Br. SILT & CLAY Class: CL

Project No.: ETE-95-79
Project: Buffalo Color
Location: Boring No. SB-1, 45'-47' Depth
Buffalo, New York
Date: 10-16-95

CONSOLIDATION TEST REPORT

EVERGREEN TESTING, INC.

Remarks:

Sampled by SJB
Transported by SJB
Tested by FD

TORVANE = 0.3 tsf

Fig. No. 2

APPENDIX B - WETLAND DELINEATION

WETLAND DELINEATION REPORT
ALLIED SIGNAL - BUFFALO COLOR - AREA D
CITY OF BUFFALO, ERIE COUNTY, NEW YORK

1.0 INTRODUCTION

The project area is an inactive hazardous waste site located in the City of Buffalo, Erie County, New York, comprising an area of about 19 acres. The site is located on a peninsula of the Buffalo River so the site is surrounded by the river (Figure 1). The Buffalo Color facility is located to the north.

A remediation plan has been designed to correct migration of contaminants (Reference?). As part of this overall plan, nearly the entire site shoreline adjacent to the Buffalo River is to be excavated and stabilized. An initial site investigation indicated that a small section of the shoreline along the western edge of the site may be a federally regulated wetland. Beak Consultants Incorporated (Beak) performed a wetland delineation on July 24, 1995 to determine the presence and location of federally regulated wetlands. A 0.44 acre area was found to be a jurisdictional wetland. This report presents the results of the investigation used in coming to this conclusion.

2.0 SITE DESCRIPTION

The site is located on a peninsula of the Buffalo River. A bridge and a railroad embankment form the northern boundary. Topography is flat in the interior of the project area although the shoreline slopes steeply to the Buffalo River. A ditch is located at the base of the railroad embankment and drains to the Buffalo River. There are no other ditches or watercourses on the property. Drainage of the site is by overland flow directly to the river.

The site has been historically used for a variety of industrial purposes. The buildings once present on the site have been demolished so that the site is characterized by vegetation typical of disturbed urban sites. The wetland area is located at a lower elevation than the rest of the site and is reportedly present due to slope failure of the steep slopes in this area. The wetland is covered by a large amount of woody debris and flotsam, apparently deposited by high river flow and storm events.

3.0 AGENCY RESOURCE INFORMATION

The site does not have any wetlands mapped by the National Wetlands Inventory (Figure 2) or the New York State Freshwater Wetlands Map (Figure 3).

The Erie County Soil Survey maps the site as Urban Land (Ur), which is a soil covered by impervious surfaces (Figure 4). These soils are generally considered upland soils.

4.0 SITE ECOLOGY

The upland part of the site is characterized by pioneering and weed communities, dominated by mugwort (*Artemisia vulgaris*), Canada goldenrod (*Solidago canadensis*), Japanese knotweed (*Polygonum cuspidatum*), eastern cottonwood saplings and trees (*Populus deltoides*), crack willow (*Salix fragilis*), and tree of heaven (*Ailanthus altissima*). The shoreline slopes are dominated by nearly monotypical stands of Japanese knotweed, interrupted on occasion by the willows, cottonwoods, or tree of heaven.

The wetland area is dominated by large crack willows and a few cottonwoods. The herbaceous layer is dominated by jewelweed (*Impatiens capensis*), white snakeroot (*Ageratina altissima*), enchanter's nightshade (*Circaea luteliana*), tall meadow rue (*Thalictrum polygamum*), stinging nettle (*Urtica dioica*), and wood sage (*Teucrium canadense*). The shrub layer is absent. The wetland area is influenced by fluctuating water levels of the adjacent Buffalo River. The area appears to be periodically inundated by high river flows, caused by spring flooding as well as Lake Erie storm events and by high wind periods causing a rise in river levels.

5.0 METHODOLOGY

Wetlands were delineated on July 24, 1995 using the Corps of Engineers Wetlands Delineation Manual (1987). The on-site method for areas greater than 5 acres was used. Guidance on the use of the 1987 Manual was used (Williams, 1992). Two transects were used to define the upland/wetland boundary. Because the wetland was adjacent to the Buffalo River, only the boundary next to the steep upland slope was delineated; the downslope boundary gradually sloped down to the deepwater habitat of the river.

At all sample locations, a list of dominant vegetation was made and the percent cover of each species was estimated. The dominance measure method, as outlined in the 1989 Interagency Manual, was used to define the community. This method has been accepted for use in the 1987 Manual methodology (Williams, 1992). For all sample points, the standard 5-foot radius was used to define the herbaceous cover, and a 30-foot radius was used for the remaining layers. Because of the slopes were comprised of fill materials and because hazardous materials might be present in the soils, soil pits were not examined at sample points. However, the slopes adjacent to the wetland were very steep and the wetland boundary was clear. Vegetation and evidence of hydrology were documented at each sample point. The wetland boundary and sample points were flagged for identification by instrument survey.

Locations of wetland boundaries, sample points and photo locations are shown on Figure 5. Data sheets for all sample points are contained in Appendix A. Photographs are presented in Appendix B.

6.0 RESULTS AND CONCLUSIONS

The majority of the site was characterized by an upland community and evidence of wetland parameters were absent. The slope failure area met the parameters for a jurisdictional wetland and comprised an area of 0.44 acres. The lack of a shrub layer suggests that, of the woody species, only the fast growing willows and cottonwoods can survive the debris deposition and ice scour. In contrast, the annual jewelweed flourishes in the shifting substrate.

Given the small area of the wetland, its downstream location and the large volume of water passing the site, the wetland functions performed by this wetland are quite limited. The amount of floodflow retention and sediment trapping it performs is very minor in this high flow section of the Buffalo River. The primary value of this wetland appears to be its wildlife habitat, not specifically as a typical wetland environment, but more as one of the more limited types of riparian shoreline present in this part of the Buffalo River.

7.0 REFERENCES

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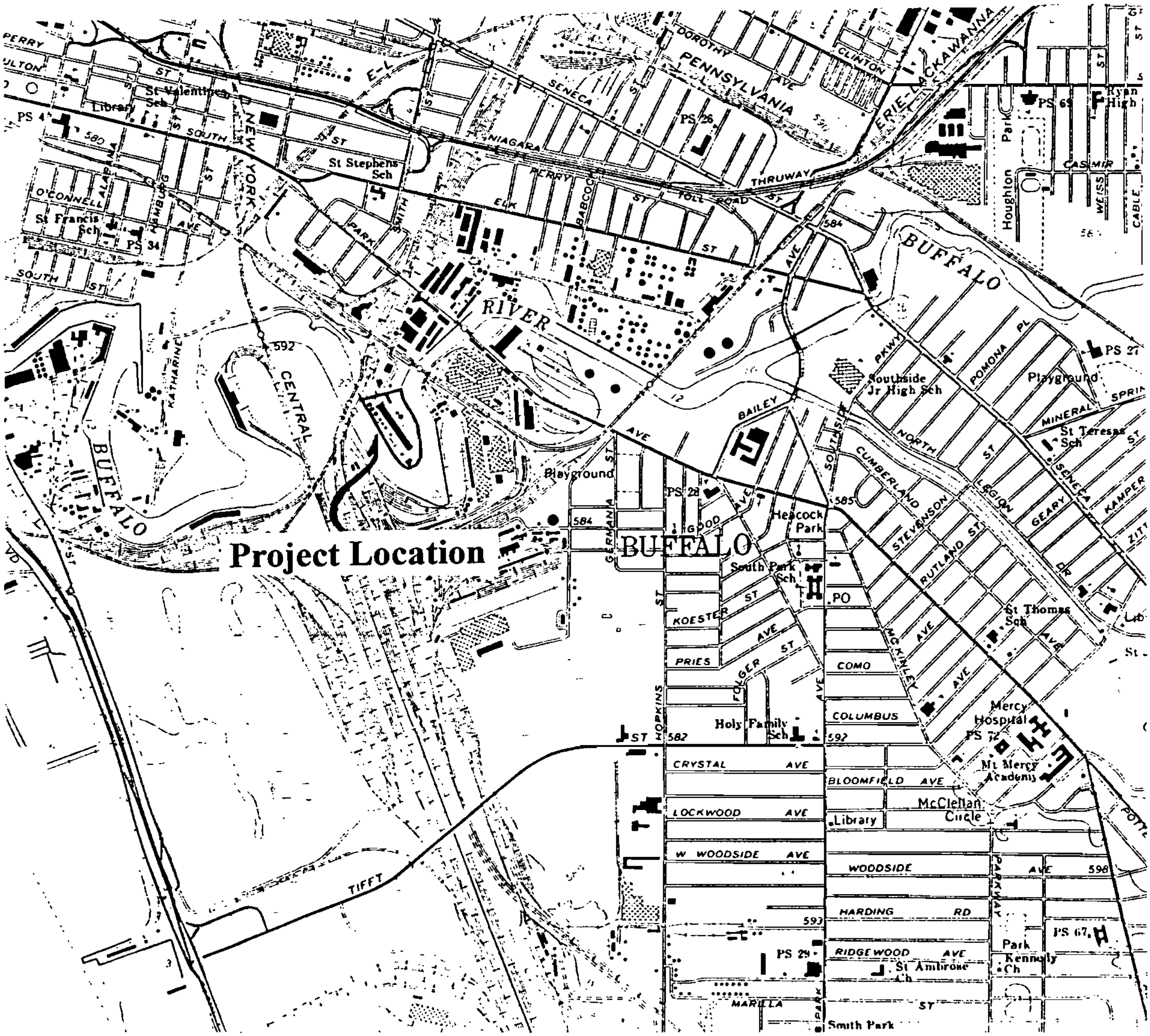


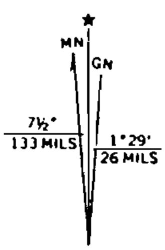
SCALE 1:24000

1 ½ 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS LOW WATER 568.6 FEET

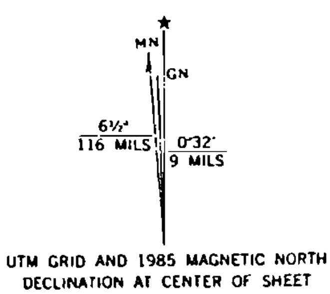


UTM GRID AND 1965 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

QUADRANGLE LOCATION

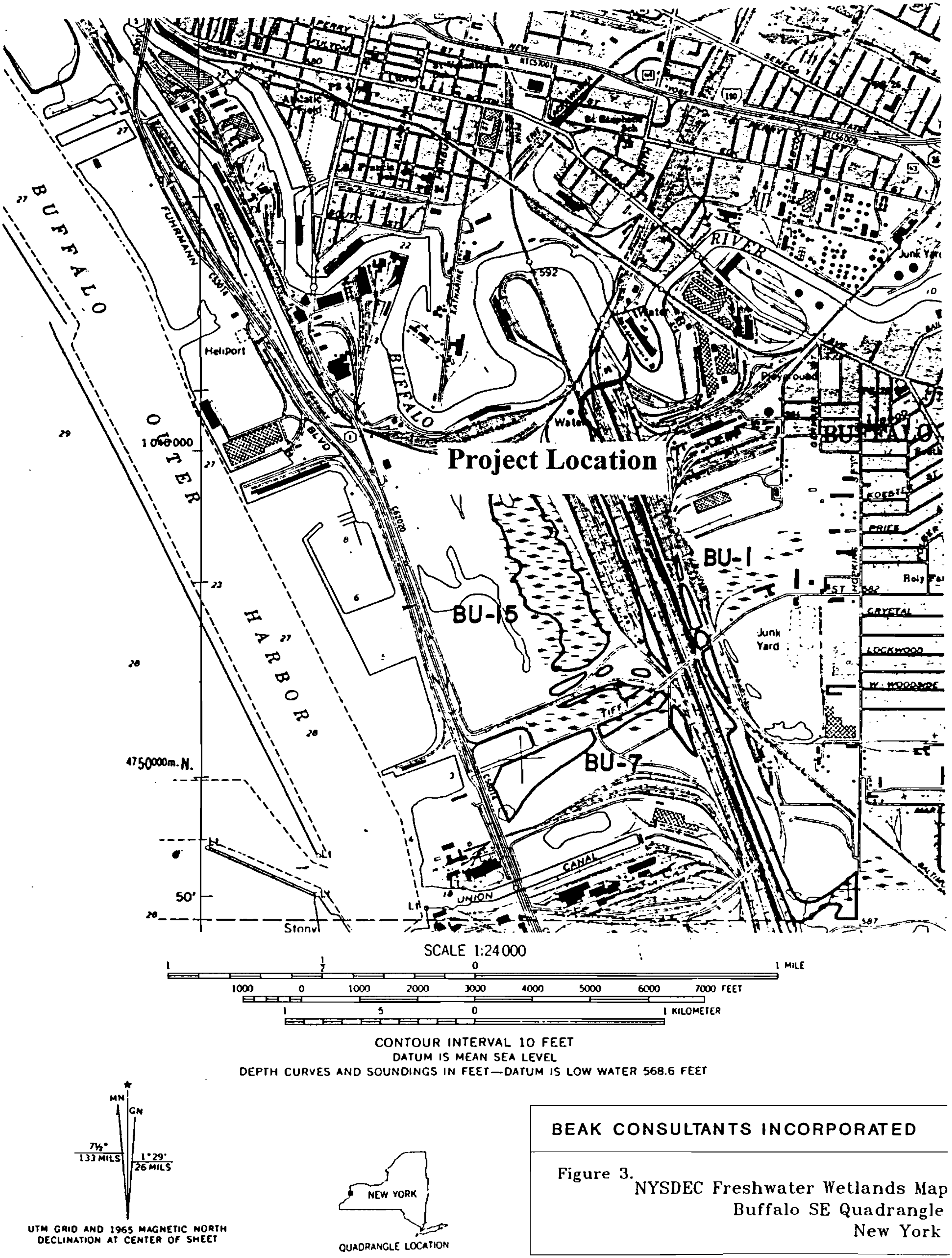
BEAK CONSULTANTS INCORPORATED

Figure 1. Project Location
Buffalo Color – Area D
Buffalo SE Quadrangle
New York



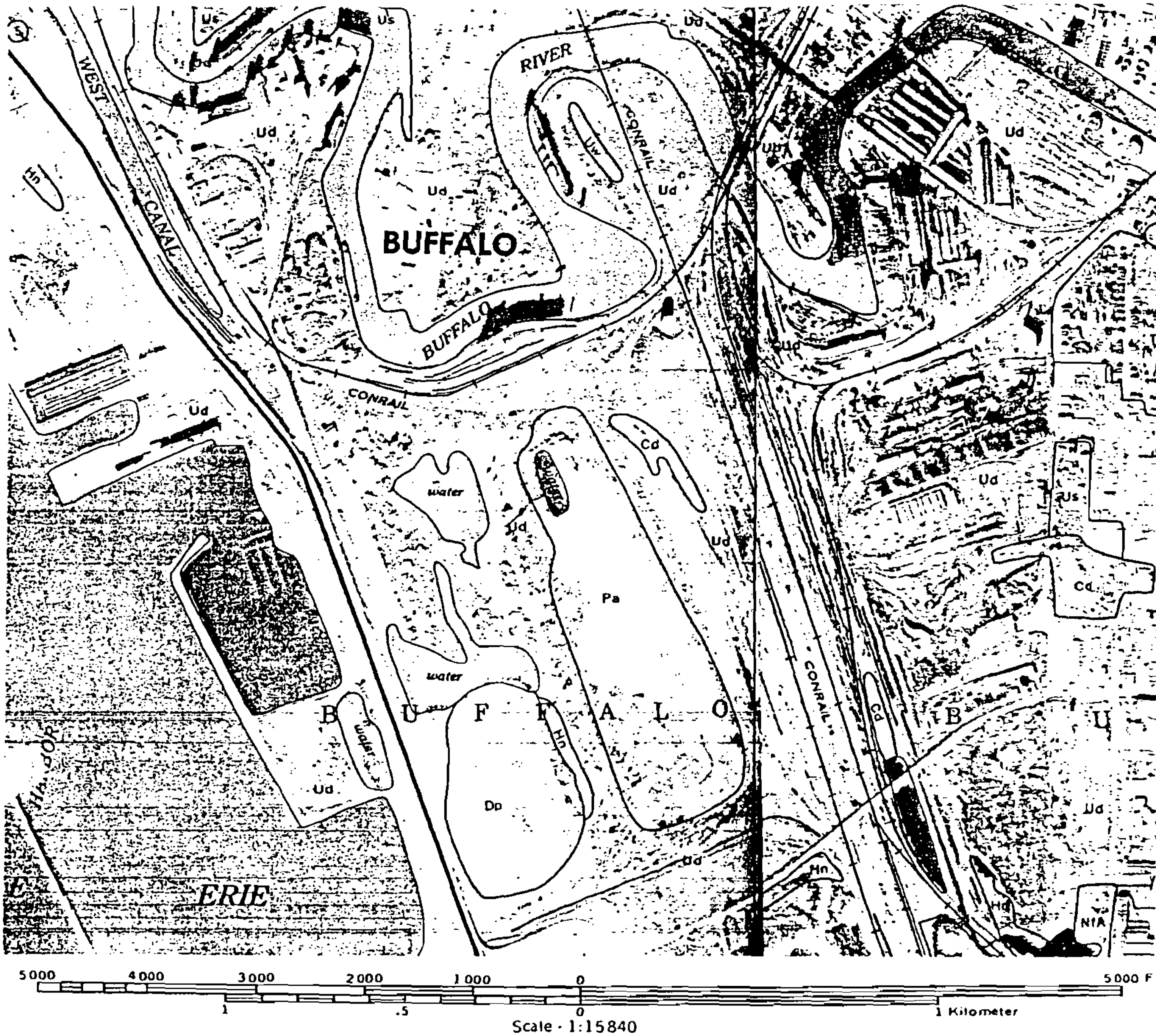
BEAK CONSULTANTS INCORPORATED

Figure 2. National Wetland Inventory
Buffalo SE Quadrangle
New York



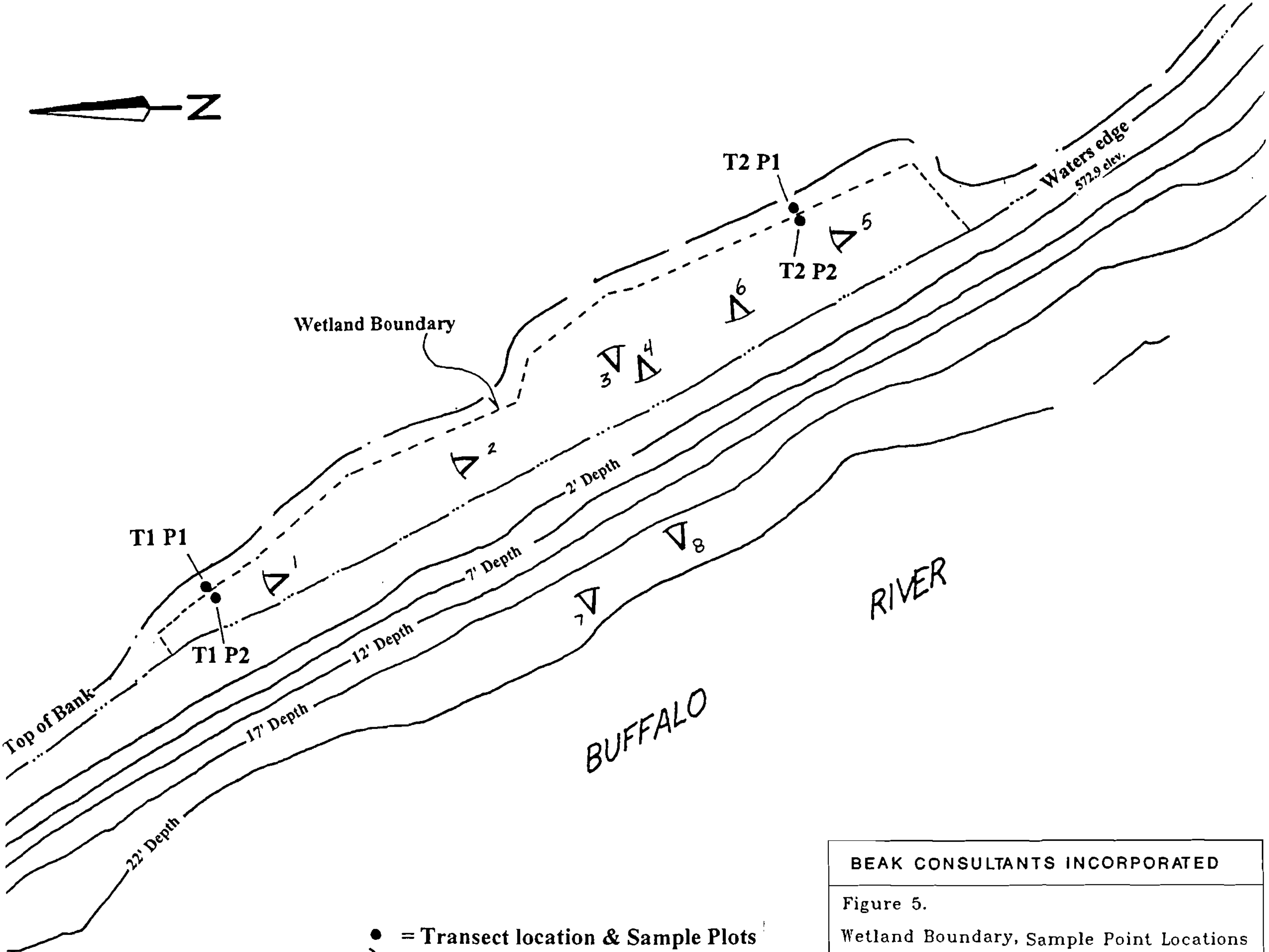
BEAK CONSULTANTS INCORPORATED

Figure 3. NYSDEC Freshwater Wetlands Map
Buffalo SE Quadrangle
New York



BEAK CONSULTANTS INCORPORATED

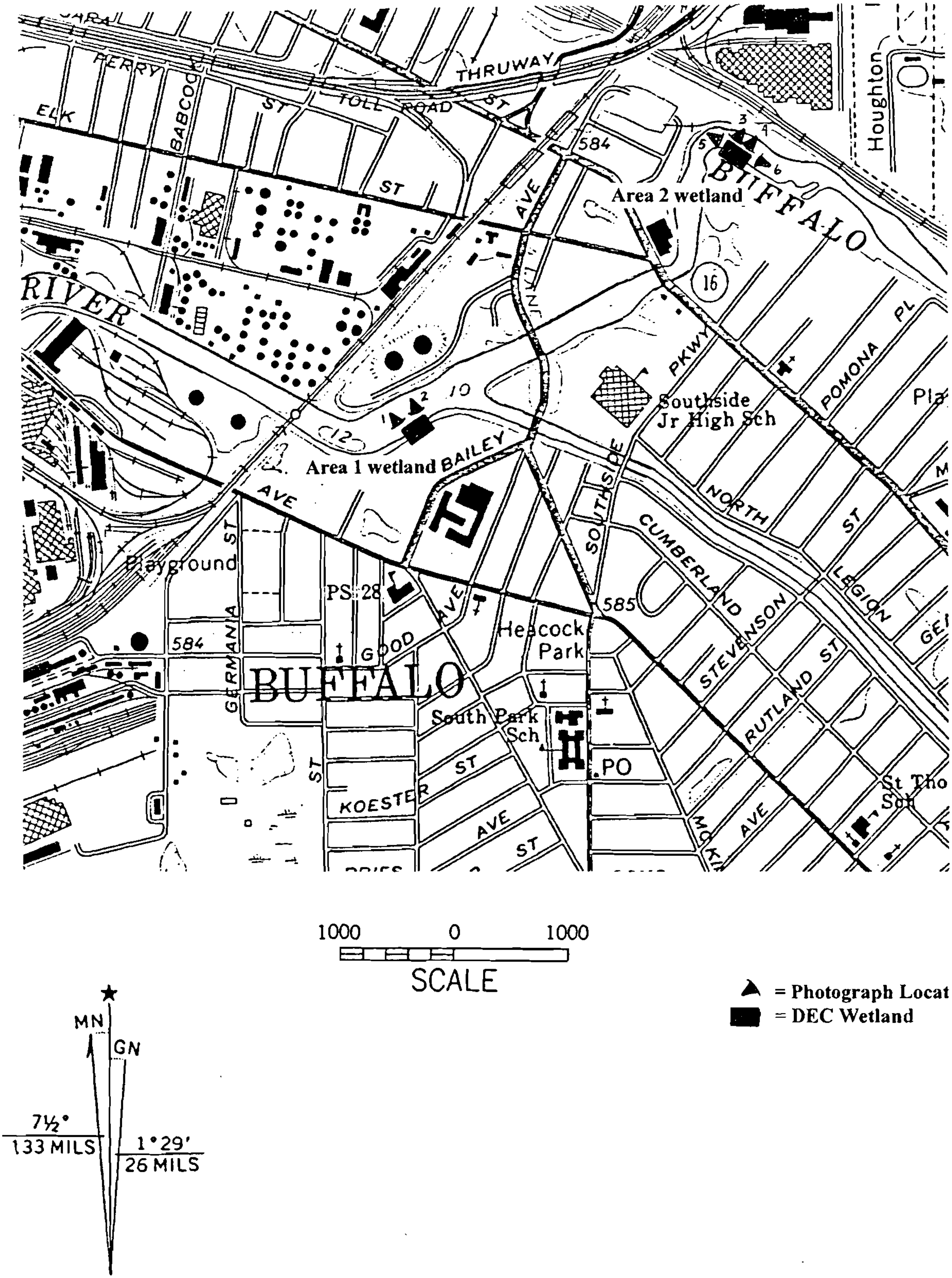
Figure 4. USDA-SCS Soil Survey
Erie County, New York
Soil Map 49



BEAK CONSULTANTS INCORPORATED

Figure 5.

Wetland Boundary, Sample Point Locations



= Photograph Locat

= DEC Wetland

Photo 1. Wetland boundary at Transect 1, looking north.

Photo 2. Approximate center of wetland, looking north.

Photo 3.

Concrete wall and wetland boundary at center of wetland.

Photo 4.

Debris covering center of wetland, looking west.

Photo 5. Wetland boundary at Transect 2, looking north.

Photo 6. Impatiens capensis community at transect 2, looking west.

Photo 7. Looking east into wetland from river.

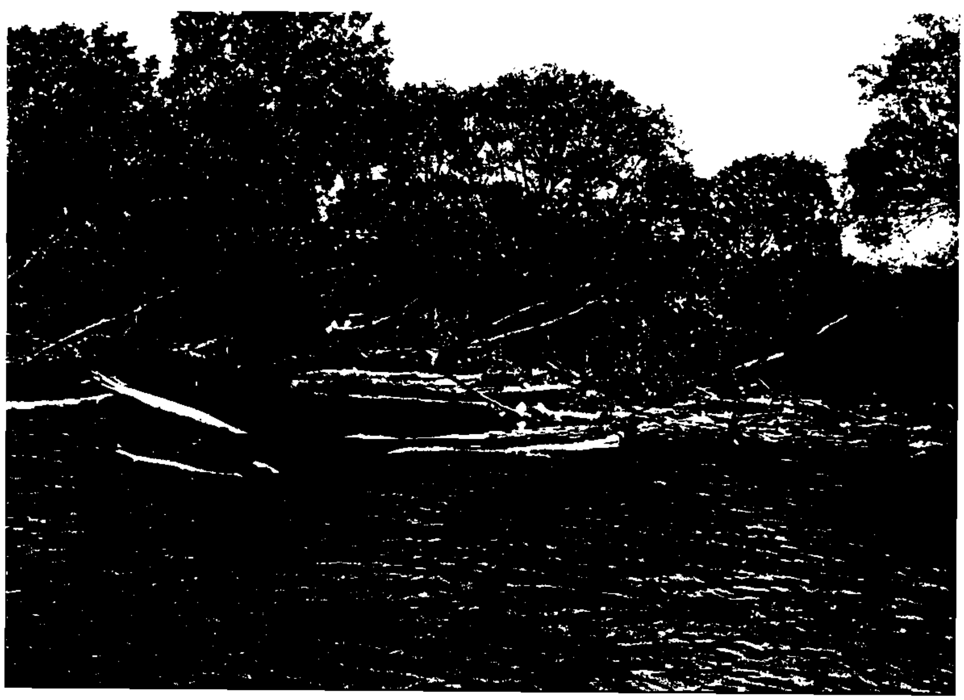


Photo 8. Looking east into wetland from river.

DATA FORM
ROUTINE WETLAND DETERMINATION

Project/Site: Allied Signal - Area D	Date: 7/24/95
Applicant/Owner:	County: Erie
Investigator: Beak Consultants (KMS)	State: NY
Do Normal Circumstances exist on the site? Yes ✓ No __	Community ID:
Is the site significantly disturbed (Atypical Situation)? Yes __ No ✓	Transect ID: T1
Is the area a potential Problem Area? Yes __ No ✓	Plot ID: P-1
(if needed, explain on back)	Ω

VEGETATION

Dominant Plant Species = *	% Cover	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Ageratina altissima	*80	H	FACU-	9.		
2. Solidago canadensis	5	H	FACU	10.		
3. Artemisia vulgaris	*30	H	UPL	11.		
4. Salix fragilis	*40	T	FAC+	12.		
5. Ulmus americana	*40	T	FACW-	13.		
6.				14.		
7.				15.		
8.				16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-): 2/4 = 50%

Remarks: Shrub/sapling layer absent

HYDROLOGY

✓ Recorded Data (describe in Remarks):
- ✓ Stream, Lake or Tide Gauge
- __ Aerial Photographs
- __ Other

__ No Recorded Data Available

Field Observations:

Depth of Surface Water: 0 (in.)

Depth to Free Water in Pit: * (in.)

Depth to Saturated Soil: * (in.)

Wetland Hydrology Indicators:

Primary Indicators:
- __ Inundated
- __ Saturated in Upper 12 Inches
- __ Water Marks
- __ Drift Lines
- __ Sediment Deposits
- __ Wetland Drainage Pattern

Secondary Indicators (2 or more required):
- __ Oxidized Root Channels (A-horizon)
- __ Water-Stained Leaves
- __ Local Soil Survey Data
- __ FAC-Neutral Test
- __ Other (explain in Remarks)

Remarks: * alleged contaminated soils not examined. Plot at base of steep slope
Evidence of wetland hydrology not present at elevation of plot.

DATA FORM
ROUTINE WETLAND DETERMINATION
(continued)

T1, P1

SOILS

Map Unit Name (Series and Phase): Urban Land	Drainage Class: —
Taxonomy (Subgroup): —	Field Observations Confirm Mapped Type? Yes ___ No ___

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell)	Mottle Colors (Munsell)	Mottle Abundance/Contrast	Texture, Concretions, Structure, Moisture, etc.

Hydric Soil Indicators:

- __ Histosol
- __ Histic Epipedon
- __ Sulfidic Odor
- __ Aquic Moisture Regime
- __ Reducing Conditions
- __ Gleyed or Low-Chroma Colors
- __ Concretions
- __ High OM Content in Surface Layer of Sandy Soils
- __ Organic Streaking in Sandy Soils
- __ Listed on Local Hydric Soils List
- __ Listed on National Hydric Soils List
- __ Other (explain in Remarks)

Remarks: soil pit not dug due to fill materials, debris, and possible contaminated soils. Hydric soils unlikely

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	Yes ___	No ✓	Is this Sample Point within a Wetland?
Wetland Hydrology Present?	Yes ___	No ✓	
Hydric Soils Present?	Yes ___	No ___	Yes ___ No ✓

Remarks:

adapted from the 1987 COE Wetlands Delineation Manual. form approved by HQUSACE 3/92.

DATA FORM
ROUTINE WETLAND DETERMINATION

Project/Site: Allied Signal - Area D	Date: 7/24/95
Applicant/Owner:	County: Erie
Investigator: Beak Consultants (KMS)	State: NY
Do Normal Circumstances exist on the site? Yes ✓ No __	Community ID:
Is the site significantly disturbed (Atypical Situation)? Yes __ No ✓	Transect ID: T1
Is the area a potential Problem Area? Yes __ No ✓	Plot ID: P2
(if needed, explain on back)	W

VEGETATION

Dominant Plant Species = *	% Cover	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Impatiens capensis	* 20	H	FACW	9.		
2. Calystegia sepium	5	H	FAC -	10.		
3. Salix fragilis	* 40	T	FACW	11.		
4. Ulmus americana	* 40	T	FACW -	12.		
5.				13.		
6.				14.		
7.				15.		
8.				16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-): 2/3 = 67%

Remarks: Shrub/sapling layer absent (probably due to debris/ice scour)

HYDROLOGY

X Recorded Data (describe in Remarks):	Wetland Hydrology Indicators:
X Stream, Lake or Tide Gauge	Primary Indicators:
__ Aerial Photographs	✓ Inundated } Seasonal
__ Other	✓ Saturated in Upper 12 Inches } Seasonal
__ No Recorded Data Available	✓ Water Marks
	✓ Drift Lines
Field Observations:	✓ Sediment Deposits
	__ Wetland Drainage Pattern
Depth of Surface Water: 0 (in.)	Secondary Indicators (2 or more required):
	__ Oxidized Root Channels (A-horizon)
Depth to Free Water in Pit: * (in.)	__ Water-Stained Leaves
	__ Local Soil Survey Data
Depth to Saturated Soil: * (in.)	__ FAC-Neutral Test
	__ Other (explain in Remarks)

Remarks: *Sample pit not dug. Plot at base of steep slope. Elevation allows seasonal inundation/saturation from river. Much debris along shoreline.

DATA FORM
ROUTINE WETLAND DETERMINATION
(continued)

T1, P-2

SOILS

Map Unit Name
(Series and Phase): Urban Land

Drainage Class: —

Field Observations
Confirm Mapped Type? Yes ___ No ___

Taxonomy (Subgroup): ___

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell)	Mottle Colors (Munsell)	Mottle Abundance/Contrast	Texture, Concretions, Structure, Moisture, etc.

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High OM Content in Surface Layer of Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (explain in Remarks)

Remarks: soil pit not dug due to fill materials, debris and possible contaminated soils. Hydric soils assumed

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	Yes ✓	No ___	Is this Sample Point within a Wetland?
Wetland Hydrology Present?	Yes ✓	No ___	
Hydric Soils Present?	Yes ___	No ___	Yes ✓ No ___

Remarks:

adapted from the 1987 COE Wetlands Delineation Manual. form approved by HQUSACE 3/92.

DATA FORM
ROUTINE WETLAND DETERMINATION

Project/Site: Allied Signal - Area D	Date: 7/24/95
Applicant/Owner:	County: Erie
Investigator: Beak Consultants (KMS)	State: NY
Do Normal Circumstances exist on the site? Yes ✓ No __	Community ID:
Is the site significantly disturbed (Atypical Situation)? Yes __ No ✓	Transect ID: T2
Is the area a potential Problem Area? Yes __ No ✓ (If needed, explain on back)	Plot ID: P1

VEGETATION

Dominant Plant Species = *	% Cover	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Artemisia vulgaris	* 30	H	UPL	9.		
2. Ageratina altissima	* 80	H	FACU-	10.		
3. Urtica dioica	5	H	FACU	11.		
4. Calystegia sepium	5	H	FAC-	12.		
5. Impatiens capensis	10	H	FACW	13.		
6. Salix fragilis	* 50	T	FAC+	14.		
7.				15.		
8.				16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-): 1/3 = 33%

Remarks:

HYDROLOGY

X Recorded Data (describe in Remarks):
- X Stream, Lake or Tide Gauge
- __ Aerial Photographs
- __ Other

__ No Recorded Data Available

Field Observations:

Depth of Surface Water: 0 (in.)

Depth to Free Water in Pit: — (in.)

Depth to Saturated Soil: — (in.)

Wetland Hydrology Indicators:

Primary Indicators:
- __ Inundated
- __ Saturated in Upper 12 inches
- __ Water Marks
- __ Drift Lines
- __ Sediment Deposits
- __ Wetland Drainage Pattern

Secondary Indicators (2 or more required):
- __ Oxidized Root Channels (A-horizon)
- __ Water-Stained Leaves
- __ Local Soil Survey Data
- __ FAC-Neutral Test
- __ Other (explain in Remarks)

Remarks: Evidence of wetland hydrology not present at elevation of plot

DATA FORM
ROUTINE WETLAND DETERMINATION
(continued)

T2 P1

SOILS

Map Unit Name (Series and Phase): Urban Land

Drainage Class: —

Field Observations Confirm Mapped Type? Yes ___ No ___

Taxonomy (Subgroup): —

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell)	Mottle Colors (Munsell)	Mottle Abundance/Contrast	Texture, Concretions, Structure, Moisture, etc.

Hydric Soil Indicators:

- __ Histosol
- __ Histic Epipedon
- __ Sulfidic Odor
- __ Aquic Moisture Regime
- __ Reducing Conditions
- __ Gleyed or Low-Chroma Colors
- __ Concretions
- __ High OM Content in Surface Layer of Sandy Soils
- __ Organic Streaking in Sandy Soils
- __ Listed on Local Hydric Soils List
- __ Listed on National Hydric Soils List
- __ Other (explain in Remarks)

Remarks: Soil Sample not examined

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	Yes ___	No ✓
Wetland Hydrology Present?	Yes ___	No ✓
Hydric Soils Present?	Yes ___	No ___

Is this Sample Point within a Wetland? Yes ___ No ✓

Remarks:

adapted from the 1987 COE Wetlands Delineation Manual. form approved by HQUSACE 3/92.

DATA FORM
ROUTINE WETLAND DETERMINATION

Project/Site: Allied Signal - Area D	Date: 7/24/95
Applicant/Owner:	County: Erie
Investigator: Beak Consultants (KMS)	State: NY
Do Normal Circumstances exist on the site? Yes ✓ No __	Community ID:
Is the site significantly disturbed (Atypical Situation)? Yes __ No ✓	Transect ID: T2
Is the area a potential Problem Area? Yes __ No ✓ (if needed, explain on back)	Plot ID: P2

VEGETATION

Dominant Plant Species = *	% Cover	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Impatiens capensis	90	H	FACW	9.		
2. Artemesia vulgaris	5	H	UPL	10.		
3. Salix fragilis	50	T	FAC+	11.		
4.				12.		
5.				13.		
6.				14.		
7.				15.		
8.				16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-): 2/3 = 67%

Remarks:

HYDROLOGY

X Recorded Data (describe in Remarks):
- X Stream, Lake or Tide Gauge
- __ Aerial Photographs
- __ Other

__ No Recorded Data Available

Field Observations:

- Depth of Surface Water: 0 (in.)
- Depth to Free Water in Pit: * (in.)
- Depth to Saturated Soil: * (in.)

Wetland Hydrology Indicators:

Primary Indicators:
- ✓ Inundated (Seasonal)
- ✓ Saturated in Upper 12 inches
- ✓ Water Marks
- ✓ Drift Lines
- __ Sediment Deposits
- __ Wetland Drainage Pattern

Secondary Indicators (2 or more required):
- __ Oxidized Root Channels (A-horizon)
- __ Water-Stained Leaves
- __ Local Soil Survey Data
- __ FAC-Neutral Test
- __ Other (explain in Remarks)

Remarks: Sample pit not dug. Elevation allow seasonal inundation/saturation
Abundant debris.

DATA FORM
ROUTINE WETLAND DETERMINATION
(continued)

SOILS

Map Unit Name (Series and Phase): Urban Land	Drainage Class: —
Taxonomy (Subgroup): —	Field Observations Confirm Mapped Type? Yes ___ No ___

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell)	Mottle Colors (Munsell)	Mottle Abundance/Contrast	Texture, Concretions, Structure, Moisture, etc.

Hydric Soil Indicators:

- __ Histosol
- __ Histic Epipedon
- __ Sulfidic Odor
- __ Aquic Moisture Regime
- __ Reducing Conditions
- __ Gleyed or Low-Chroma Colors
- __ Concretions
- __ High OM Content in Surface Layer of Sandy Soils
- __ Organic Streaking in Sandy Soils
- __ Listed on Local Hydric Soils List
- __ Listed on National Hydric Soils List
- __ Other (explain in Remarks)

Remarks: soil pit not dug. Hydric soils assumed

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	Yes ✓	No ___	Is this Sample Point within a Wetland?
Wetland Hydrology Present?	Yes ✓	No ___	Yes ✓ No ___
Hydric Soils Present?	Yes ___	No ___	

Remarks:

adapted from the 1987 COE Wetlands Delineation Manual. form approved by HQUSACE 3/92.

ORIGINAL

Buffalo River Wetlands

The enclosed site and photo location figure and attached photographs show the two wetland areas the NYSDEC requested we review as part of the planning process for the Buffalo Color Area D mitigation wetland. The following two parapgaphs are intended to present short descriptions of the sites, and are not scientific descriptions of the plant communities.

Two areas were visited by Beak on August 1, 1995. The first wetland investigated, referred to as Area 1, consisted of a mix of cattails and purple loosestrife growing in a linear fashion along the Buffalo River, upstream of the Buffalo Color site. As the photos show, the River edge has been filled in some sections. The cattails dominate on the River edge, extending to a depth of about 4-6 inches (Photos 1 and 2). The purple loosestrife are more prevalent above (upslope) of the actual river edge.

The second site (Area 2) is located further upstream. It appears to be a remnant of a river island or bar along the inside edge of a river meander. The relatively flat, shallow outer areas of the wetland are dominated by a mix of purple loosestrife and cattails (Photos 3 and 4). The interior of the wetland has considerable stands of phragmites, especially in the interior area of the slough (Photos 5 and 6). Large willows dominate the actual river bank, and are also found near the center of the island/bar area.

Photo 1. Wetland area 1, looking south.

Photo 2. Wetland area 1, looking south.

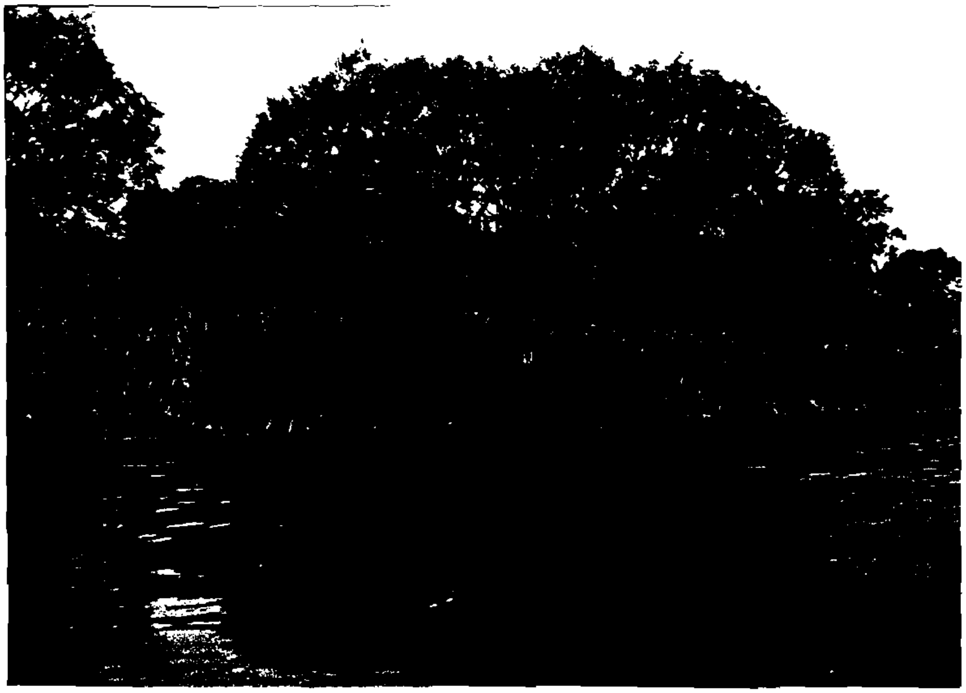


Photo 3. Wetland area 2, looking south.

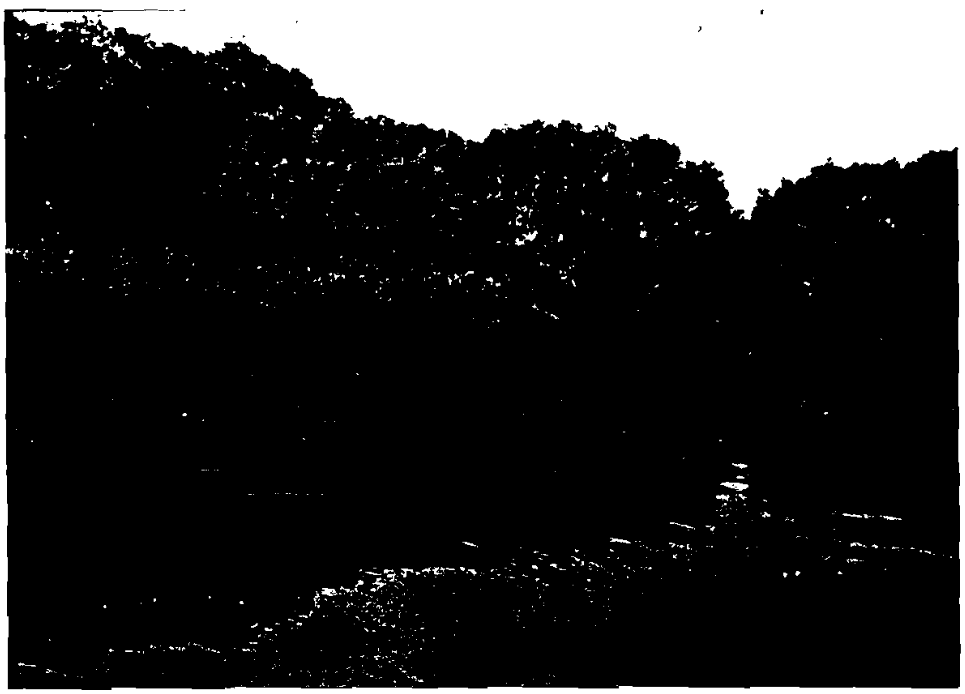


Photo 4. Wetland area 2, looking south.

Photo 5. Wetland area 2, looking east.

Photo 6. Wetland area 2, looking west.

APPENDIX C - HABITAT SURVEY AND RESTORATION

BIOENGINEERING/BANK HABITAT RESTORATION
BUFFALO COLOR - AREA D

City of Buffalo
Erie County, New York

February 2, 1996

Applicant:
Allied Signal
Buffalo, New York

Prepared by:
Beak Consultants Incorporated
140 Rotech Drive
Lancaster, New York 14086
Contact: Rosty Caryk
Telephone: 716-759-1200
Fax: 716-759-1489

TABLE OF CONTENTS

BIOENGINEERING/BANK HABITAT RESTORATION
BUFFALO COLOR - AREA D

1.0 INTRODUCTION

Bioengineering is the use of plants in combination with other materials or engineered structures for slope protection, erosion control, and site revegetation. The advantages of bioengineering techniques for erosion control are several; improved site stability, moderate to large savings in cost, improved wildlife habitat, improved aesthetics, and improved water quality. Bioengineered bank stabilization will be applied to the Buffalo Color Area D project (Area D) (Figure 1).

2.0 GENERAL FACTORS

2.1 RIVER FLOW AND FLOW CHARACTERISTICS

For purposes of determining where to use vegetation on the bank, the kinds of vegetation to use, and when to plant, knowledge of the stream's hydrographic and fluvial geomorphic characteristics are necessary. Site inspection can provide valuable data and insight regarding the past history of typical water levels and current flows. Because long term stream gauge data is not available for the Buffalo Color site location, field observations were made to note bank scouring locations and high water marks such as water staining, drift lines, and flood debris. This field information, plus knowledge of this year's average rainfall, was linked to the recently surveyed elevation of the river water level to determine the typical water elevations.

2.2. BANK GEOMETRY

Banks that have been eroded and undercut to a very steep, unplantable slope require grading prior to planting. Most slopes that accommodate revegetation are less that 1.5V:1H. To provide long term stability at Buffalo Color Area D the restored bank will be constructed at a 3H:1V slope.

In Area D, it is recognized that the need for ensuring the successful long term containment of the landfill requires the use of extensive rock rip-rap along the riverbank (Figure 2). Vegetation shall be incorporated into the riprap and a generalized re-vegetation plan will be applied throughout most of the treatment area (Section 4.0). However, there are several locations along the bank that require slight modifications in treatment. These areas include the perimeter underdrain outlet, an area of high scour that occurs at the southernmost tip of the project site, and the created wetland area. These areas of special concern are described individually in Section 5.0

In addition to this differentiation of shoreline treatment areas, the river bank has also been divided into four vertically stratified zones. These are the toe zone, and zones 1-3, each located successively further up slope and defined by expected hydrological conditions. These zones are used to identify the various species composition within the overall bank stabilization treatment and are defined in

2.3 SOIL CHARACTERISTICS

In addition to proper bank slopes and toe protection a proper soil substrate is necessary. A 6-12 inch layer of soil suitable for supporting plant growth is necessary as a base substrate on the reformed banks. This can be accomplished by either importing soil or by amending the existing substrate with fertilizer and mulch to produce a better soil. Special attention will be given to the created wetland area soils. A one foot layer of clean substrate soil will be placed within this area.

2.4 VEGETATION

Plant species native to the area will be used as they are adapted to the climate, soils, and other ecological characteristics of the region. Exotic species are generally undesirable and their use will be limited as these species can out-compete native species while providing minimal ecological value. Some non-native but naturalized species are acceptable due to specific wildlife benefits or other qualities.

A mixture of grasses, herbs, shrubs and trees is recommended to provide a diversity of wildlife habitat and erosion control functions. Specific plant species are positioned in different elevational zones on the bank based on their ability to tolerate various durations of flooding and their attributes of dissipating wave and current energies. A variety of species have been specified for each zone and the entire streambank shall be treated to furnish a maximum array of plants capable of providing proper ground cover for erosion protection, wildlife habitat, and to be aesthetically appealing. Due to the need for a rock rip rap base, planting treatments emphasize the use of shrubs, which can be more easily and successfully incorporated into rip-rap. An erosion control seed mix will be used above the bank for surface erosion control.

3.0 BANK ZONES

Two types of zonation are described. A vertical stratification has been used to describe zonation from the water's edge to the top of the bank. These zones are designated by expected water regime characteristics (Section 3.1). A second set of zones are described as occurring within the created wetland area to distinguish the various types of expected plant communities within the wetland (Section 3.2)

3.1 VERTICAL BANK ZONATION

The zone definitions below assist in preparing guidelines for the use of vegetation in streambank stabilization and erosion control. These zones are relative, as exact water levels vary daily and seasonally. In addition, site-specific, long-term Buffalo River water level data are not available, and field observations were used to estimate typical low water levels, mean water levels, and high water levels. These levels were determined by the presence of scour marks, drift lines, and water staining on piers, rocks and bridge abutments on and near the site. The selected zone elevations identify the bank zones under normal conditions. However, short-term, atypical water levels from extreme high flood conditions and unusual drought conditions are generally not apparent from such observations.

A sufficiently diverse mixture of plant species and planting patterns have been prescribed to allow natural selection to favor the species most adapted to that specific microenvironment. Figure 3 illustrates the location by elevation of each zone. Table 1 provides a listing of suitable plant species for each zone. Please note that many species are cross-planted in more than one zone to provide for a maximum probability of success.

3.1.1 <u>Toe Zone</u>

The portion of the bank below average water elevation (< 573 ft.).

This zone is a zone of high stress and is nearly always inundated throughout the year. This zone does not typically support a plant community. When applying slope protection measures the toe zone is typically treated and protected by the application of hard materials such as rock rip-rap. Rip-rap treatment, with no plantings, is recommended for the toe zone throughout Area D.

3.1.2 Zone 1

Bank section between average water and high water elevation (573-574 ft.).

This is the zone of highest stress and this portion of the riverbank can often be undercut by strong currents that occur when the water levels are below average. Undercutting here may result in bank failure unless preventative or corrective measures are taken. Zone 1 is exposed frequently to wave wash, erosive river currents, ice and debris movement, wet-dry cycles, and freeze-thaw cycles. This section of the bank is inundated throughout portions of the year (at least 6 months/year). The water depths will fluctuate daily, seasonally, and by location within the zone. This zone is usually not successfully planted by seeding since the zone is frequently inundated. The planting of dormant cuttings of shrubs is most appropriate within this location.

3.1.3 Zone 2

Portion of the bank above normal high-water, but periodically affected by flooding (574-575 ft.).

This zone is periodically exposed to higher wave wash, erosive river currents, ice and debris movement, and traffic by animals or man. This zone is inundated for at least a 60-day duration once every two or three years. The water table in this zone is frequently close to the soil surface due to its closeness to the normal river level. Shrubs used here should be quite flood tolerant and able to withstand partial to complete submergence for up to several weeks. Various willows and dogwoods can be used in this zone, but they should be shrub-like plants such as 'Ruby' red osier dogwood (*Cornus stolonifera*), and 'Streamco' purple osier willow (*Salix purpurea*). The upper branches of shrubs reduce the speed of the current and thereby the erosive forces of the water. The branches of such shrubs have great resilience and spring back after currents subside. This springing resistance divides the water and slows it down by friction. This zone may be exposed to considerable flooding and wave and current action at certain times of the year.

3.1.4 Zone 3

The portion of the bank up slope of Zone 2 (> 575 ft.).

This zone is usually not subjected to erosive action of the river except during atypical flooding events. This zone is less significant for bank protection because it is less often flooded, but can still be quite easily eroded. This zone contains shrubs that are less flood tolerant than those in the lower bank zones and are noted for their value in slope stabilization. A combination of different shrubs in this zone will not only serve as an integrated plant community for erosion control, but will improve wildlife habitat diversity, water quality, and aesthetic appeal.

3.2 ENHANCED WETLAND PLANTING ZONES

A recreated wetland area is planned to replace the existing wetland on the site. The zones within the relatively flat wetland area differ from those of the steeper bank areas. The entire wetland area is located within Zone 1 according to the above designations. The inland bank of the wetland, where the wetland edge begins sloping up to the top of bank, will not be treated with riprap. Bank protection from ice scour and current will be achieved by placing rip rap along the outer (river) edge of the wetland. This outer rip rap protection will have two small channel breaks to allow increased flushing of the wetland system (Figure 9). The wetland is designed to have an uneven bottom surface (micro-topography). As a result, some places will be inundated, some will have permanently saturated soils, and other places slightly higher in elevation will only be periodically subjected to flooding or saturation. Because of these differences in water regime, the wetland will have areas expected to support open water, emergent marsh, and wet meadow plant communities. Although the use of classifying terms connotes clear boundaries between these different wetland communities, in reality they form a continuum. For the purposes of this plan, an attempt is made to define and separate habitat types located within the wetland. Wetland types expected include open water, riverine emergent wetland (persistent and non-persistent), wet meadow, and scrub-scrub wetlands.

3.2.1 Open Water

The open water community within the wetland area will consist primarily of a meandering stream channel that is proposed to flow through the wetland. Other areas of open water may occur in those locations where the microtopography of the wetland area is low enough in elevation that standing water will remain most of the time. Wild celery (*Vallisneria americana*) will be planted in open water locations and additional species are expected to naturally colonize.

3.2.2 Emergent Plant Community

The riverine emergent plant community is characterized by erect, rooted, herbaceous hydrophytes. This vegetation is present most of the growing season in most years and is usually dominated by perennial plants. Persistent and non-persistent subclassification refers to the visual presence of these plants in the non-growing season. The riverine emergent plant community corresponds with the riparian zone of the river.

3.2.3 Wet Meadow Plant Community

Technically the emergent wetland class encompasses wet meadow. However, the wet meadow community is differentiated here, based on the range of expected water levels within the wetland. The emergent wetland refers to areas with standing water ranging in depths anywhere from an average depth of 2 inches to 2 feet or more during storm events. It is expected that about half of the emergent wetland will fall within this water regime, becoming shallow emergent marsh, and for the other half to develop into wet meadow.

The wet meadow plant community will have a slightly different species composition than that of the emergent plant community due to small but significant differences in water elevation. The wet meadow plant community encompasses those locations with little or no standing water but with saturated soils or seasonally saturated soils. Many wetland plant species will be found growing in both the emergent plant community and in the wet meadow community, as they can adapted to a wide range of hydrologic regimes. Other species are more specific in their preferred water regime and will most likely grow only in one or the other community. Emergent marsh and wet meadow species are listed together in Table 3.

3.2.4 Shrub-Scrub Plant Community

The shrub-scrub wetland class is dominated by woody vegetation less than 20 ft tall. The vegetation includes true shrubs, young trees, and trees or shrubs that may be stunted because of environmental conditions. Most of the species in the shrub-scrub community are broad-leaved deciduous species including alders (*Alnus spp.*), willows *(Salix spp.)* and dogwood (*Cornus spp.*). This community begins at the toe of the slope and gradually changes from hydrophytic species to mesophytic and xerophytic vegetation as it reaches the top of the slope. Shrub-scrub wetlands will also occur as isolated communities within the emergent wetlands, particularly along portions of the open water channel flowing through the wetland system. Overhanging shrubs will shade the channel and help to maintain water temperatures during low flow conditions. This combination of shrub-scrub and emergent wetland creates maximum plant community edge, resulting in an increase in valuable wildlife habitat. Edge is a classic ecological principle that is found where two habitats come together. For example, where the emergent wetland and the shrub-scrub areas meet. A greater diversity of animal species is generally found in areas containing abundant edge than is found in single habitat types alone. Plantings here will stabilize the bank, shade the stream and provide food, cover, nesting, and loafing areas for birds and terrestrial wildlife. Where woody vegetation does not grow, emergent riverine wetland plants will colonize.

4.0 SITE PLANTING

4.1 GENERAL TECHNIQUE

At Area D the rip rap shoreline protection is planned to be placed in 1996. Bare root and dormant cutting materials will be planted within the rip rap shoreline protection the following spring before cuttings break dormancy. The requirement of a 30-inch rock rip rap bank treatment poses a unique problem for planting. Plants must be planted in the soil substrate and therefore access through the rip rap is necessary. Planting holes shall be secured through the rip rap by the placement of sections of PVC tubing (or suitable substitute) within the rip rap area just prior to rip rap placement. Tubing will be 8 inches or 10 inches in diameter depending on the species to be planted. The tubing will be 3 feet in length. This will allow the tubing to extend through the 30 inches of riprap and still allow for 6" to extend out of the riprap facilitate locating the tubing later. A U-shaped length of steel rod will be used to secure the section of tubing in place and to hold it upright while the rip rap is being placed around it. The U-shaped steel rod can then be removed and reused. The tubing will remain in place until the time of dormant cutting planting. A hole shall be made in the substrate, using the PVC tube as access, to a minimum depth of 10 inches. The dormant cutting will then be inserted into hole. The species chosen grow to a maximum height of about 6-10 feet. It is not anticipated that these shrubs will be girdled by the tubing or the surrounding riprap.

Aesthetics should be considered in project design, but must be considered in conjunction with other factors. The planting plan may be generalized according to erosion control needs. Shrubs should not be planted in straight lines, as this will minimize erosion control and impart an artificial view. Staggered planting and mixed species composition will improve erosion control and result in a more pleasing, natural look (Figure 4). The loss of some plants is inevitable and it is usually advisable to provide for some replanting in the second and possibly third year. The replant requirement will depend on percent survival.

4.1.1 Dormant Cuttings

Cuttings are sections of dormant stems at least 4 feet in length and 1/4 to 3/4 inch in diameter. Cuttings are planted in a grid and should be placed far enough below ground to intercept water and to provide sufficient opportunity for successful rooting. The cuttings are sharpened at the bottom end and inserted into the prepared holes. Holes for the dormant cuttings will be made by using an auger or other device to make a planting hole a minimum of 10" deep in the soil substrate, using the PVC tubes to access the soil through the rock rip rap.

4.1.2 Bare Root Plants

Bare root plants shall be planted into larger holes. Access through the rip rap shall be provided by a 10" diameter PVC tubes and a hole 18-inches deep scan be drilled in the substrate using an auger or by digging a hole using a post hole digger or similar tool. The tool remove the soil from the tubing so that the bare root plant can be placed in the hole and the soil can be replaced and tamped down around the new planting.

5.0 AREAS OF SPECIAL CONCERN

Some locations within the Area D shoreline require special consideration (Figure 2). These areas include the bank area around the southern end of the property where the river turns, the created wetland area, and the area surrounding the perimeter underdrain outfall. These areas of special concern will receive the treatments discussed below.

5.1 AREA OF HIGH SCOUR

The area subjected to the highest level of stress and scour is the bank around the southern end of the property where the river curves nearly 180 degrees. An estimated length of 300 linear feet will receive a higher level of bank protection than described above.

The area of high scour shall receive willow posting treatment (Figure 5). Willow post treatment is the placement of dormant cuttings of larger diameter and lengths of willow branches (typically 3 in. or larger in diameter and typically 5 ft. or more in length). The willow posting method is recommended as it provides additional protection at the water's edge, specifically around areas of more intense stress, and at those locations most subject to impact from ice and debris moving down river. Willow posts are driven in using specially adapted heavy equipment consisting of a backhoe or track hoe fitted with a hydraulic drill. Densities of less than 1 meter on center have been shown to be most effective. Willow posts should be placed along the water's edge, staggering to cover a width of approximately 3 feet with mean water elevation being the center line. The posts are placed a minimum of feet into the substrate.

5.2 CREATED WETLAND AREA

The created wetland area shall receive additional plantings of herbaceous wetland plants as well as some buttonbush plantings. The herbaceous wetland plants to be used are listed in Table 2 . Three additional general zones have been identified within the wetland area: wet meadow, emergent and open water (Figure 6). The typical maximum depth of the open water zone will be about two feet.

Plant species will be arranged, spaced, and located at their best suitable location based on field determinations. Plant plugs of the herbaceous vegetation shall be used and typically have a 2" root ball that can be inserted directly into the substrate. Herbaceous wetland plants shall be planted 3 feet on center. This is assuming that mature plant plugs with a 2 inch diameter root ball grown in coconut fiber is used. A greater number of plants are required when bare root, or root stock is being used. Refer to contractor specifications for details. A wetland native wildflower mix be seeded in the wetland area also (Table 4). Although the success of direct seeding of wetland plants is limited, some will survive and will greatly increase the species diversity within the wetland. The cost for 2-3 lbs of seed is minimal relative to the potential benefit.

Cattails will be included within the emergent planting zone to provide additional wildlife benefits. However, cattails will be planted only at the downstream portion of the wetland to prevent them from out competing other desirable vegetation. Broad-leaved cattail has been observed in upstream portions of the Buffalo River.

Wild celery (*Vallisneria americana*) will be planted and established in the open water portions of the created wetland shoreline habitat area as a food source for waterfowl and other animals. Winter buds of celery shall be used as planting materials for establishing new stands of this species. Minimum planting distance intervals shall be 5 feet and maximum planting intervals shall be 10 feet on center. Each planting location shall consist of a minimum of 3 winter buds (Figure 7).

Upland hummocks will be randomly located small mounds of soil within the emergent wetland which will typically protrude 1 ft up out of the average standing water elevations. These will function as "islands" within the wetland complex. These islands provide protected nesting areas for waterfowl and other wildlife. Wetland hummocks will be planted using root stock and through the use of a wetland hummock seed mix (Table 5) and a wildflower seed mix (Table 3). The seed will be sowed and mulched when water levels are expected to remain low for an extended period of time to allow for sufficient germination and rooting.

A stream channel shall meander through the wetland area to provide water exchange and additional fish habitat. The flow into this wetland area is designed to pass through a constructed entrance at the upstream end of the wetland (Figures 8, 9). A number of large boulders (3-4 ft diameter), will be placed in the channel to prevent the intrusion of large debris and logs into the inner wetland area. The outside edge is designed at a 575 ft. elevation, which should be sufficient to prevent overflow into the wetland during spring flood stages. Additionally, fish habitat structures (Figures 8, 9) will be constructed at the outside edge of the entrance to the wetland, using 1-3 ft rock rip rap. The fish pods will also act to deflect the current further away from the wetland edge, decreasing the chance for debris overflowing and accumulating in the wetland. An identical design is recommended for the downstream wetland outlet area, as surface flow reverses at times in the Buffalo River.

The stream banks will be protected from erosion by the use of double sided erosion control blankets, installed as per product manufacturers specifications.

5.3 PERIMETER UNDERDRAIN OUTLET

Where the perimeter underdrain outlet is located a stand of button bush shall be planted. The button bush shall be planted using dormant cuttings. The dormant cuttings shall be spaced 4 foot on center. Planting holes for the dormant cuttings will be secured as described in Section 9. Button bush will provide additional bank stabilization as well as add diversity to the plant community.

6.0 PLANTING DATES

Transplanting of herbaceous and woody species will be most successful in the early spring, as woody species should be transplanted before winter dormancy is broken. However, cuttings and whips can be planted even if they are not dormant, but a lower survival rate is then expected. Direct seeding of grasses and herbs is usually more successful in the late fall, but can be done at almost anytime during the growing season, provided there is enough rainfall, and the seed is protected by mulch or by other means. Seeding of grasses and herbs will only be done in the proposed wetland and in upland areas above the bank.

The planting at Area D will most likely be driven by the project timetable. Planting will be done in the spring of 1997 using PVC tubes, for access to the bank soil, placed during the installation of the riprap. If the conditions are not optimal for planting replanting may be required to compensate for an expected lower survival rate.

7.0 PLANT PROCUREMENT

Procurement of plants should be planned at the earliest opportunity. Throughout Area D dormant cuttings, whips, and willow posts are most appropriate due to the underlying rock rip-rap. A few containerized plants may also be used. Plants will be primarily densely branching shrubs and small tree species with the exception of the wetland area, which will also be planted with herbaceous species. The plant species listed in Table 1 and Table 2 are all available from commercial nurseries. Given sufficient lead time, these plants can be ordered and grown to specification for use on the project. In addition, the NYSDEC has indicated that it may be able to provide many of the plants for use on the project. The use of shrubs and trees from on-site as sources of cuttings does not appear feasible due to the extended period required between stripping and final bank restoration.

8.0 MAINTENANCE AND CARE

The control of noxious weeds is desirable in any revegetation planting. On riparian sites the use of chemicals is often not permitted nor desirable. Persistent chemicals should never be used. Only those chemicals which degrade rapidly into harmless compounds should be used and some limited distance from the water. Details regarding the maintenance and weed control procedures are outlined in the site plan.

Because of the expected presence of beaver on the site the willow posts and larger tree plantings will be protected by a cylinder of wire mesh extending 3 feet above the riprap surface. This will prevent beaver from cuttings them down and will protect young plants until they reach a mature stage where they can withstand occasional browsing. Endangered plants in the wetland area will be protected in this way as well.

Table 1. Proposed Species List for Area D Bank Planting

Zone	Common	*Scientific*	Growth Form	Availability	Qty.
1, 2	red-osier dogwood	*Cornus sericea*	shrub	dormant cutting	600
1, 2	streamco willow	*Salix purpurea streamco*	shrub	dormant cutting	600
1, 2	bankers willow	*Salix cottetti*	shrub	dormant cutting	600
1,2,3	gray dogwood	*Cornus foemina*	shrub	dormant cutting	1225
2, 3	silky dogwood	*Cornus amonum*	shrub	dormant cutting	875
2, 3	speckled alder	*Alnus rugosa*	Sm. Tree	bare root	250
1*	buttonbush	*Cephalanthis occidentalis*	shrub	dormant cutting	160
**	black willow	*Salix nigra*	tree	post	120

* to be planted at water's edge and around perimeter underdrain outlets only

** to be planted in area of high scour only

Plants required:

Zone 1
1 dormant cutting every 2 feet
4 different species
350 cuttings of each species
1400 total dormant cuttings in Zone 1

Zone 2
1 dormant cutting every 2 feet
5 different species
250 cuttings of each species
1250 total dormant cuttings in Zone 2

1 containerized plant every 20 feet
125 total containerized plants in Zone 2

Zone 3
1 dormant cutting every 2 feet
2 different species
625 cuttings of each species
1250 total dormant cuttings in Zone 3

1 containerized plant every 20 feet
125 total containerized plants in Zone 3

Button Bush
1 every 20 feet at water's edge
20 around underdrain outlet
160 total dormant cuttings are required

Black Willow
Planted in Zone 2 & 3 in
In High Scour Area 10' on-center
In wetland installed as shown
120 posts required

Table 2. Enhanced Wetland Species List

Planting Zone	Common Name	Scientific Name	Form
Wet meadow	Dark green bulrush	*Scirpus atrovirens*	Herb
Wet meadow	Fox Sedge	*Carex vulpinoidea*	Herb
Wet meadow	Lurid Sedge	*Carex crinita*	Herb
Wet meadow	Soft rush	*Juncus effusus*	Herb
Wet meadow	Woolgrass	*Scirpus cyperinus*	Herb
Wet meadow	Blueflag iris	*Iris versicolor*	Herb
Emergent	Softstem bulrush	*Scirpus validus*	Herb
Emergent	Sweetflag	*Acorus calamus*	Herb
Emergent	Burreed	*Sparganium eurycarpum*	Herb
Emergent	Arrow arrum	*Peltandra virginica*	Herb
Submergent	Wild celery	*Vallisneria americana*	Herb
Emergent	Pickerel weed	*Pontedaria cordata*	Herb
Emergent	Narrow-leaved Cattail	*Typha angustifolia*	Herb
Emergent	Broad-leaved Cattail	*Typha latifolia*	Herb

Table 3. Native/Naturalized Wildflower Seed Mix

WILDFLOWERS	
Major components (7 or more)	
Common Yarrow	*Achillea millefolium*
Chicory	*Cichorium intybus*
Goldenrod	*Euthamia graminifolia*
Birdsfoot trefoil	*Lotus corniculatus*
Canada goldenrod	*Solidago canadensis*
Daisy	*Chrysanthemum leucantheum*
Queen Anne's lace	*Daucus carota*
Dame's rocket	*Hesperis matronalis*
Black-eyed Susan	*Rudbeckia hirta*
Blue vervain	*Verbena hastata*
Minor components (3 or more)	
Wild columbine	*Aquilegia canadensis*
Butterfly weed	*Asclepias tuberosa*
Bicolor lespedeza	*Lespedeza bicolor*
Ironweed	*Vernonia novaboracensis*
Common milkweed	*Asclepias syriaca*
New England aster	*Aster novae-angliae*
Wild bergamot	*Monarda fistulosa*
GRASSES	
Sweet grass	*Anthoxanthum odoratum*
Nodding fescue	*Festuca ovina*
Switchgrass	*Panicum virgatum*
Nodding wild rye	*Elymus canadensis*
Annual ryegrass	*Lolium multiflorum*
Foxtail bristle grass	*Setaria italica*

Table 4. Wetland Native Wildflower Mix

Panic grass	*Panicum dichotomiflorum*
Smartweed	*Polygonum pennsylvanicum*
Minor components	
Nodding beggars tick	*Bidens cernua*
Boneset	*Eupatorium perfoliatum*
Blue vervain	*Verbena hastata*
Joe pye weed	*Eupatorium maculatum*
Canada goldenrod	*Solidago canadensis*
Ironweed	*Vernonia noveboracensis*
Additional species (as available)	
Swamp milkweed	*Asclepias incarnata*
Marsh marigold	*Caltha palustris*
Blueflag	*Iris versicolor*
New England aster	*Aster novae-angliae*
Grassleaf goldenrod	*Euthamia graminifolia*

Table 5. Wetland Hummock Mix

Fox sedge	*Carex vulpinoidea*
Rice cut grass	*Leersia oryzoides*
Sedge	*Carex lurida/C. crinita*
Soft rush	*Juncus effusus*
Bulrush	*Scirpus atrovirens/S. cyperinus*
Sedge	*Carex comosa/C. intumescens*

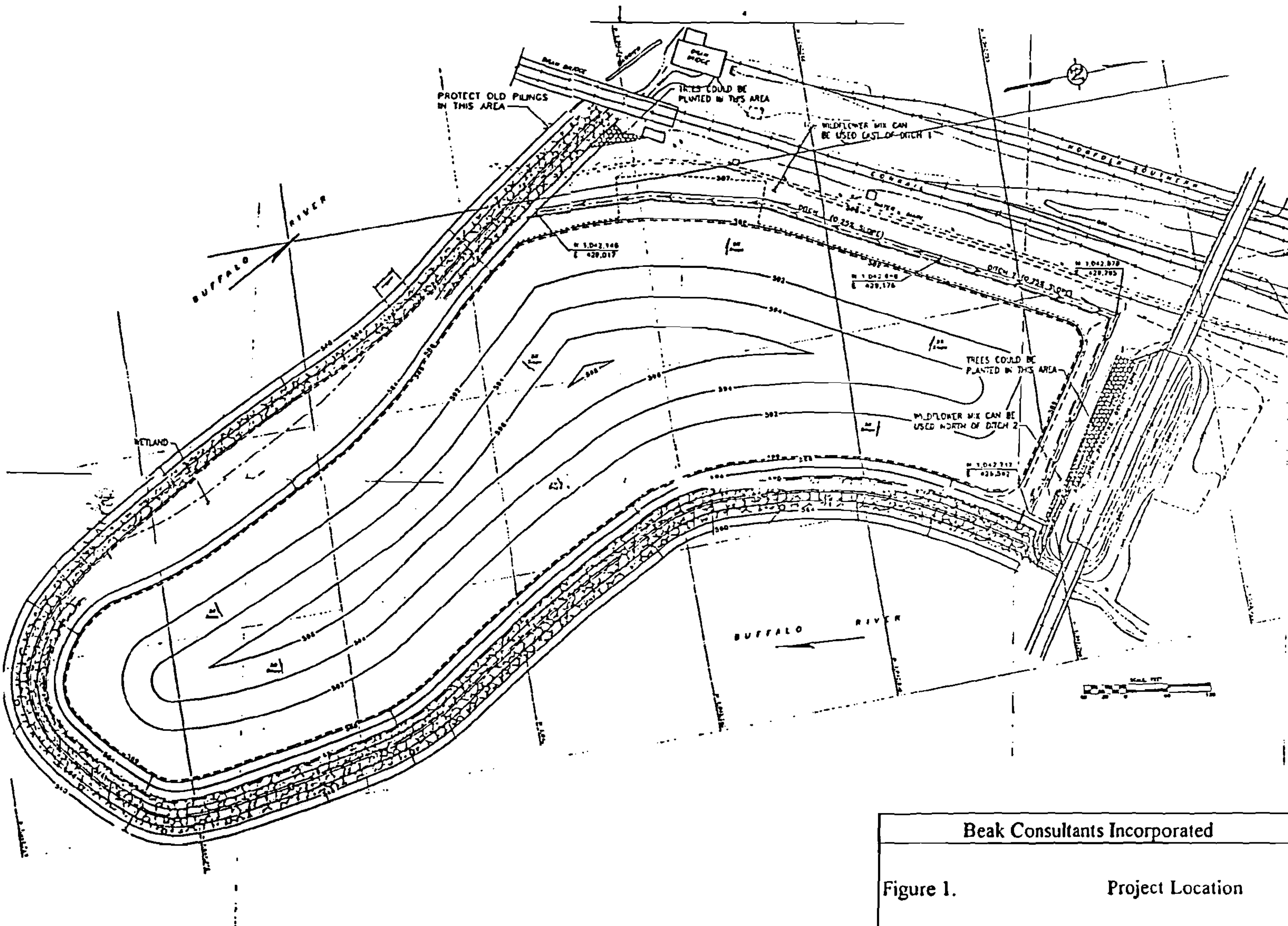


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Figure 1. Project Location

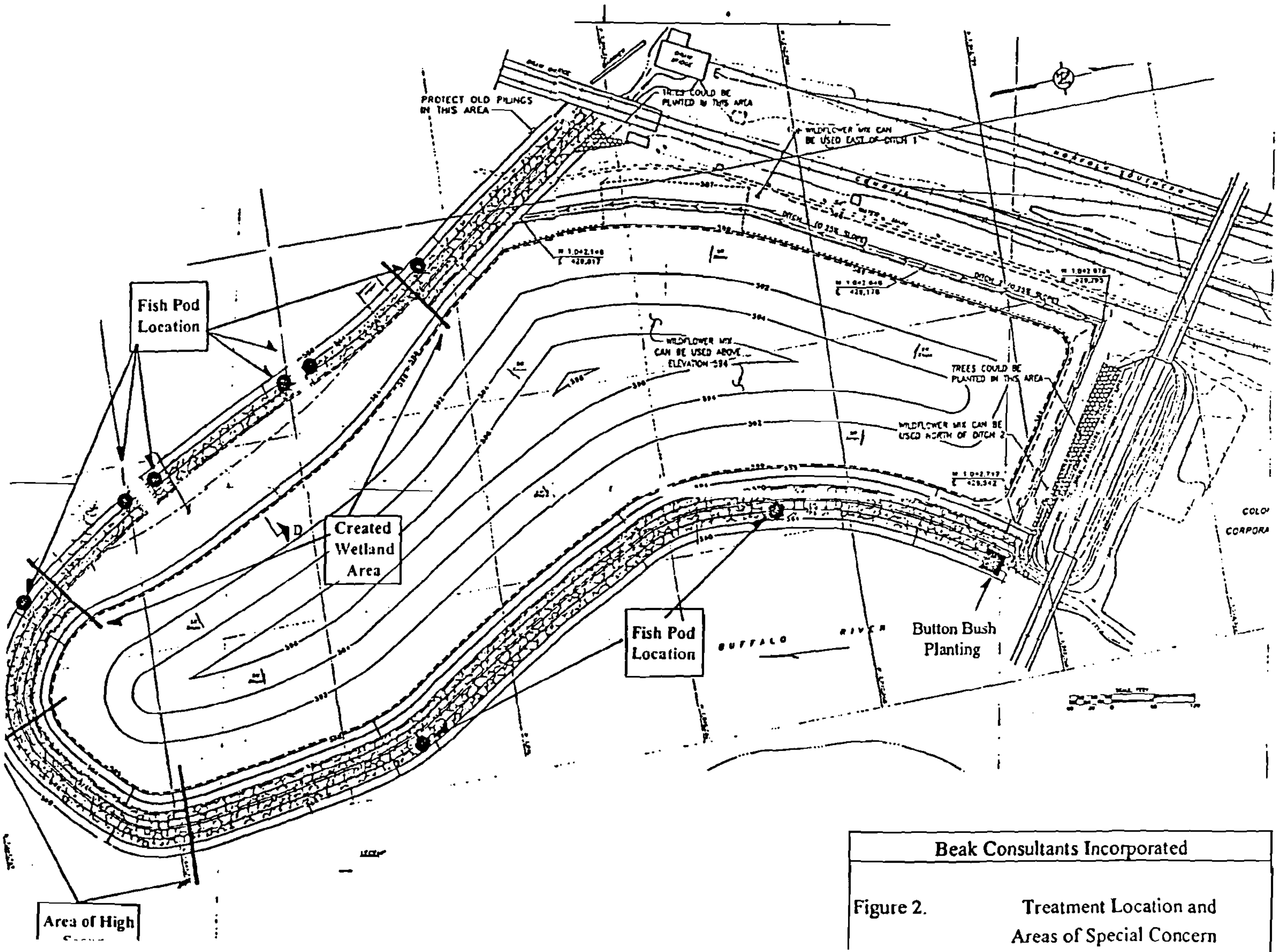

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Figure 2. Treatment Location and Areas of Special Concern

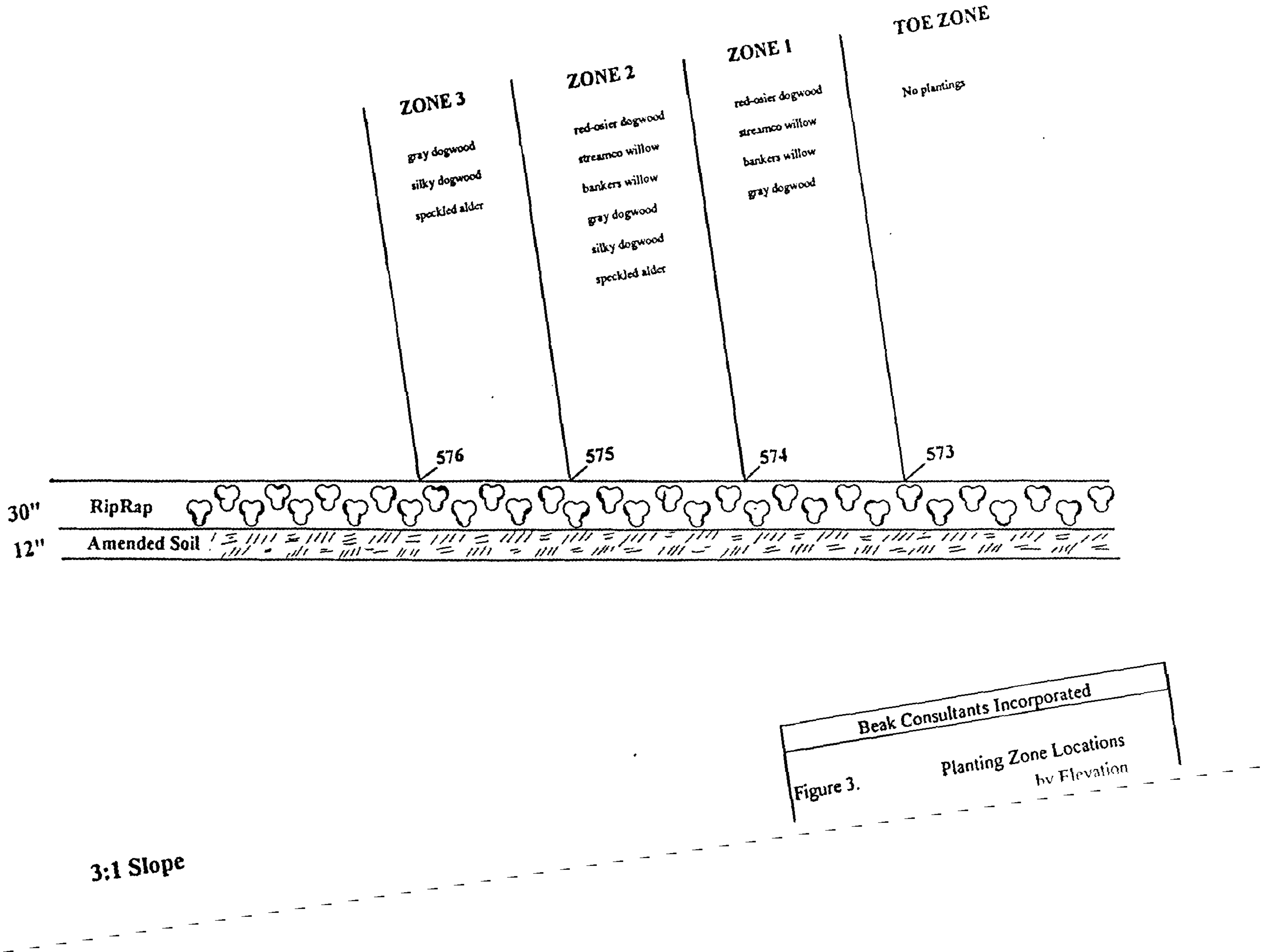

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Figure 3.	Planting Zone Locations by Elevation

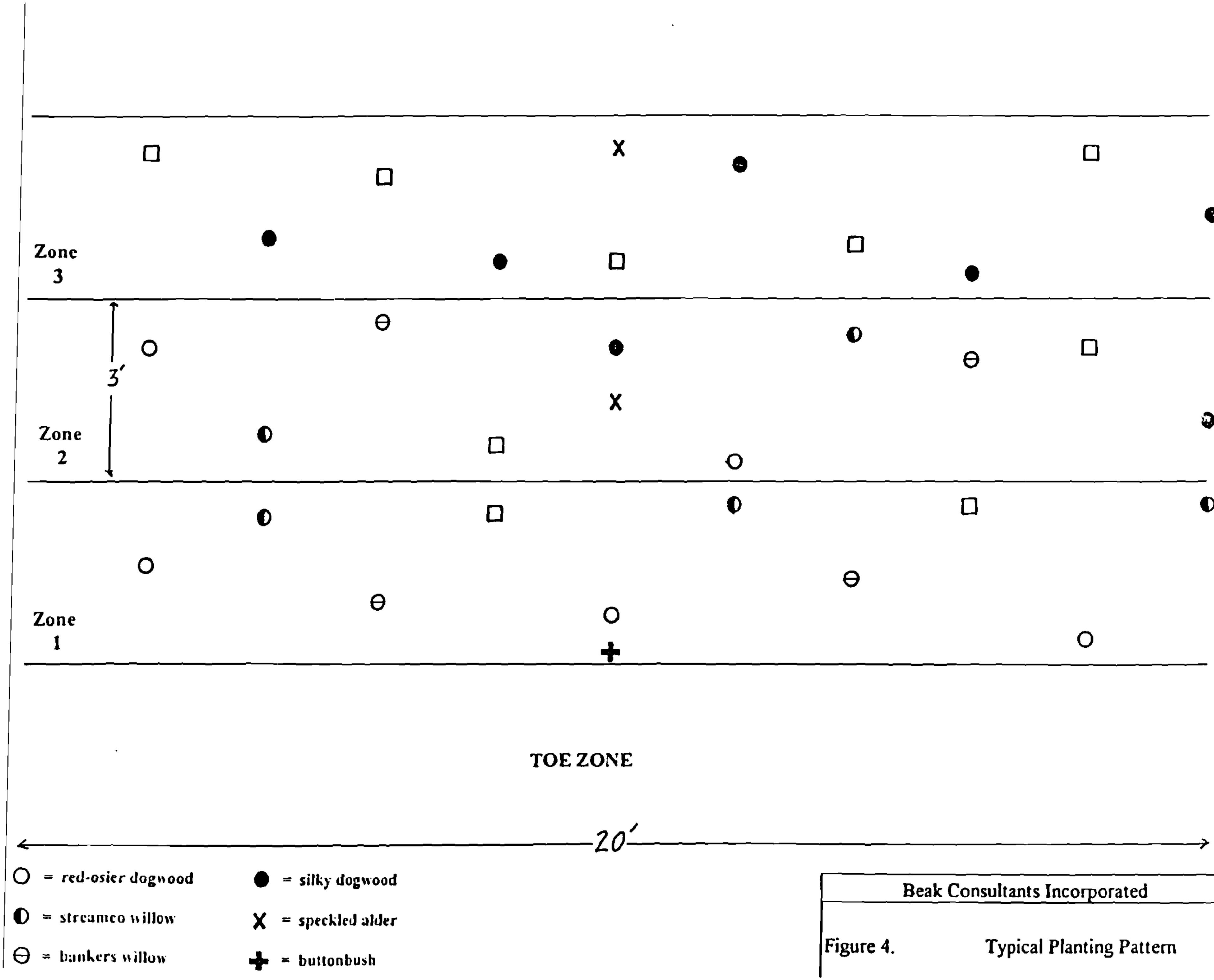

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Figure 4. Typical Planting Pattern

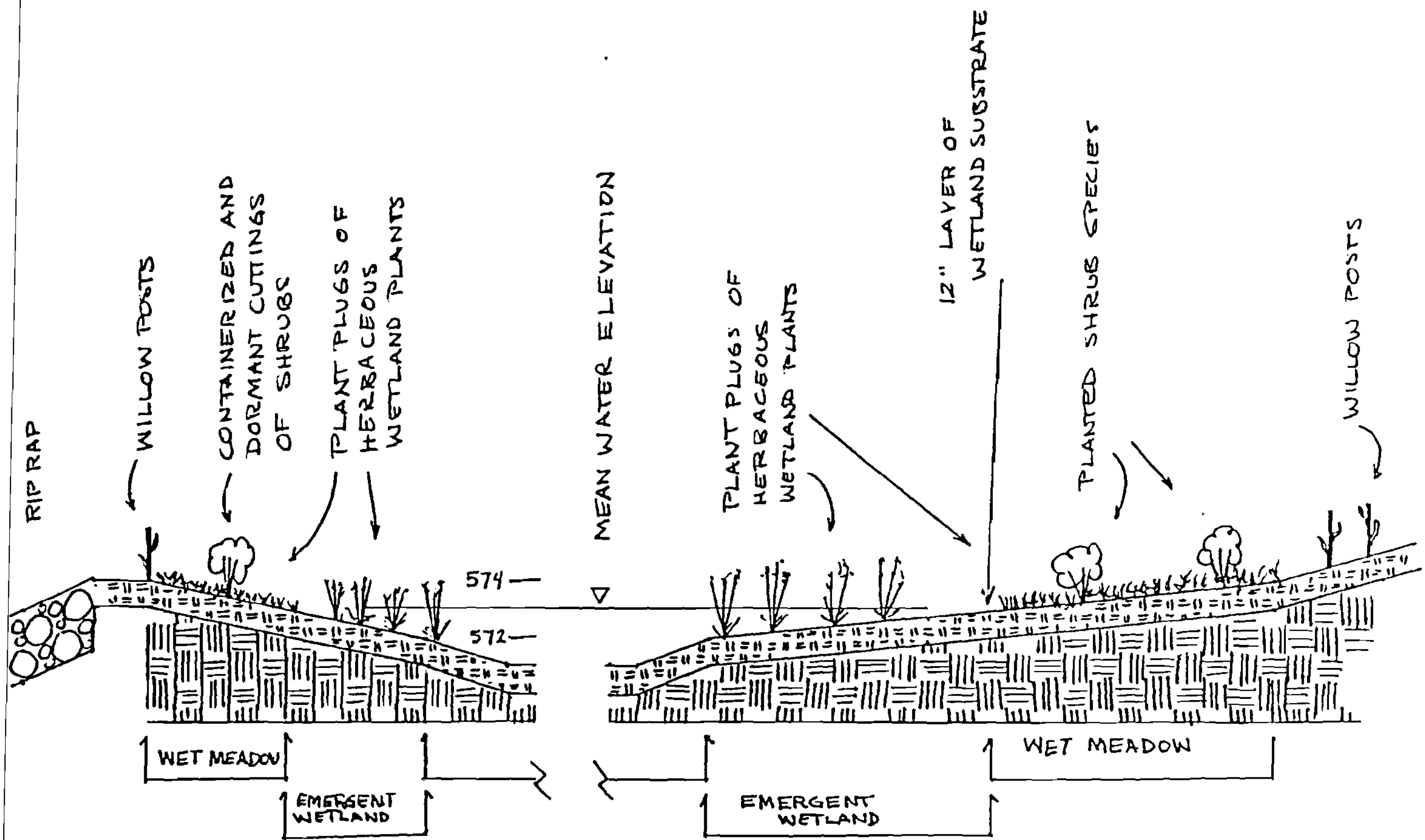

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Figure 6.	Cross Section of Created Wetland Area

Zone										
Wet Meadow	1	5	3	1	5	3	1	5	3	1
	2	6	4	2	6	4	2	6	4	2
	3	1	5	3	1	5	3	1	5	3
	4	2	6	4	2	6	4	2	6	4
	5	3	1	5	3	1	5	3	1	5
	6	4	2	6	4	2	6	4	2	6
	1	5	3	1	5	3	1	5	3	1
	2	6	4	2	6	4	2	6	4	2
	3	1	5	3	1	5	3	1	5	3
	4	2	6	4	2	6	4	2	6	4
Emergent (10')	7	10	14	9	13	8	12	7	10	14
	8	12	7	10	14	9	13	8	12	7
	9	13	8	12	7	10	14	9	13	8
	10	14	9	13	8	12	7	10	14	9
	12	7	10	14	9	13	8	12	7	10
	13	8	12	7	10	14	9	13	8	12
	14	9	13	8	12	7	10	14	9	13
	7	10	14	9	13	8	12	7	10	14
	8	12	7	10	14	9	13	8	12	7
	9	13	8	12	7	10	14	9	13	8
Submergent	11	11	11	11	11	11	11	11	11	11
	11	11	11	11	11	11	11	11	11	11
	11	11	11	11	11	11	11	11	11	11
	11	11	11	11	11	11	11	11	11	11

20'

Dark green bulrush	1	Sweetflag	8
Fox Sedge	2	Burreed	9
Lurid Sedge	3	Arrow arrum	10
Soft rush	4	Wild Celery	11
Woolgrass	5	Pickerel weed	12
[illegible]	6	Narrow-leaved Cattail	13

Scale:

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Figure 7. Typical Planting Pattern Within Created Wetland Area

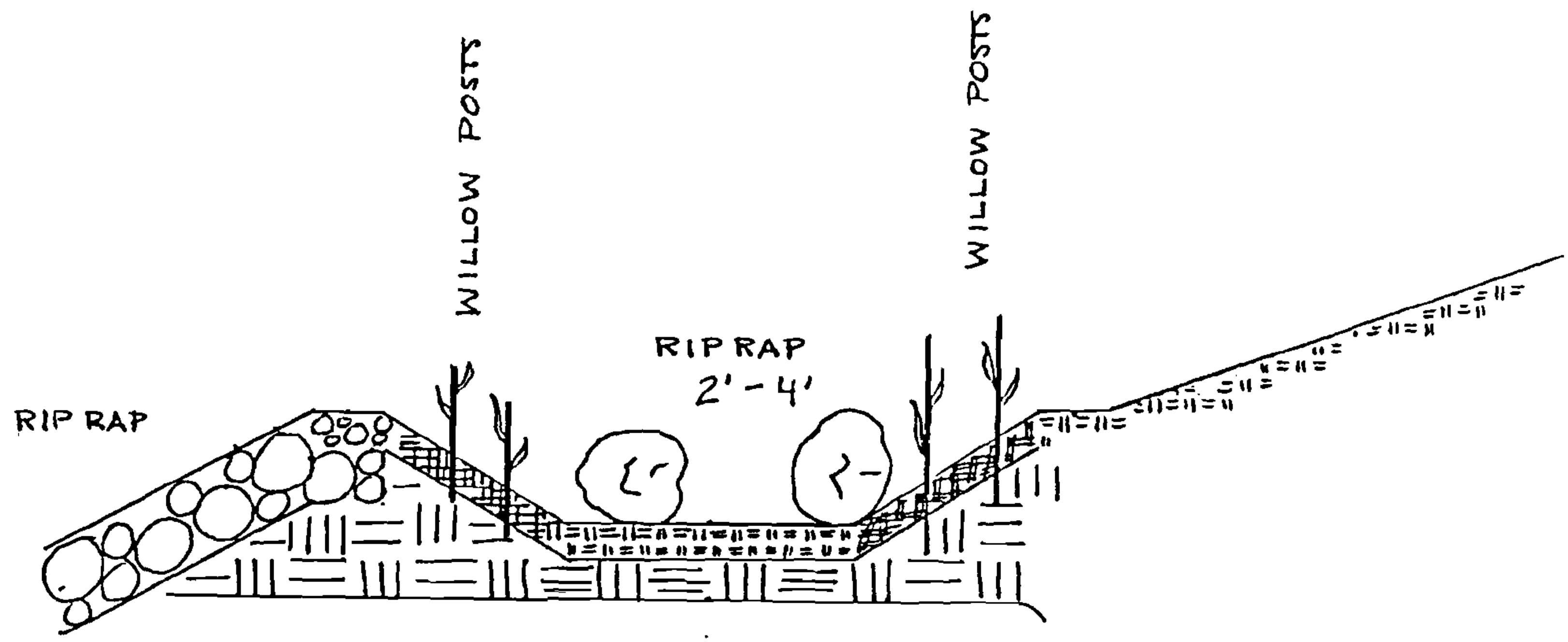

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Figure 8. Wetland Channel Opening

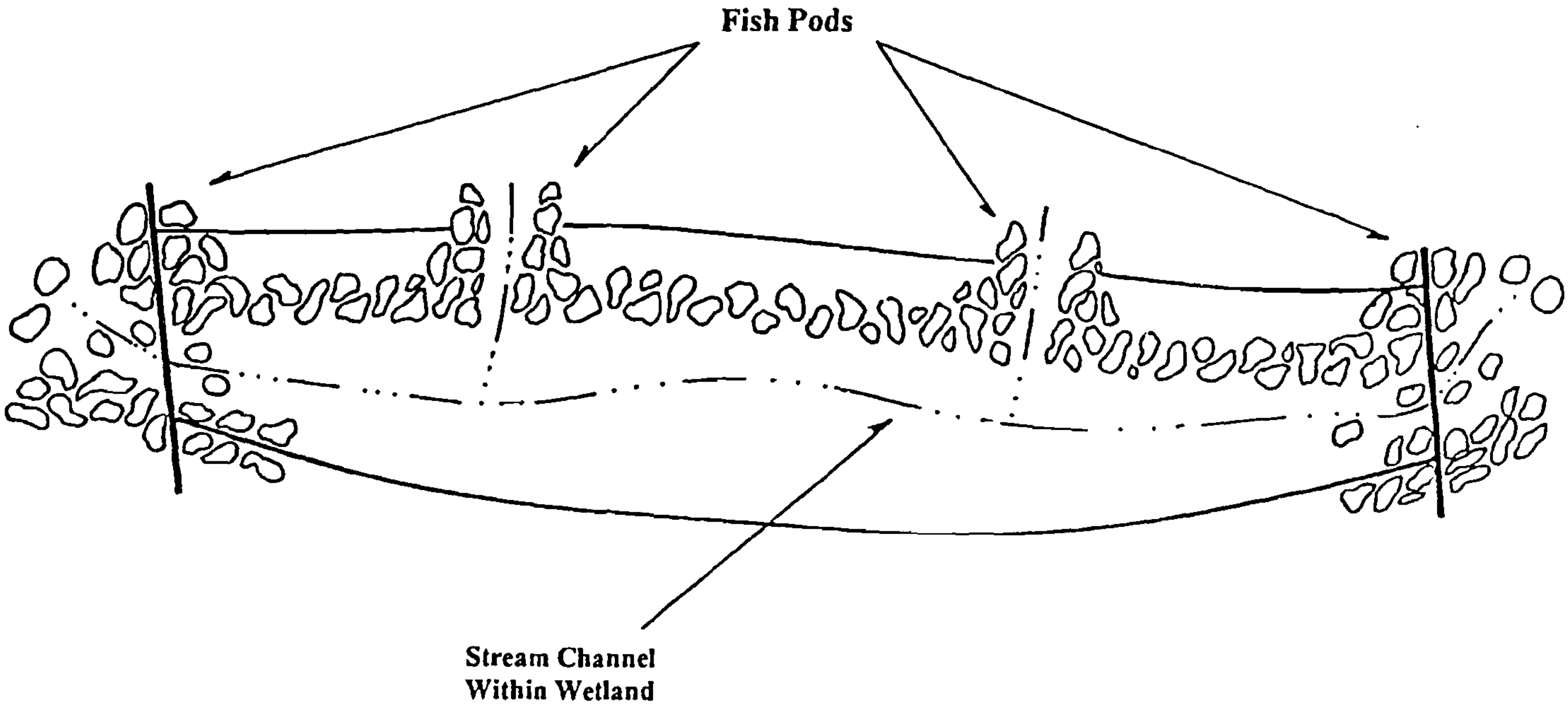

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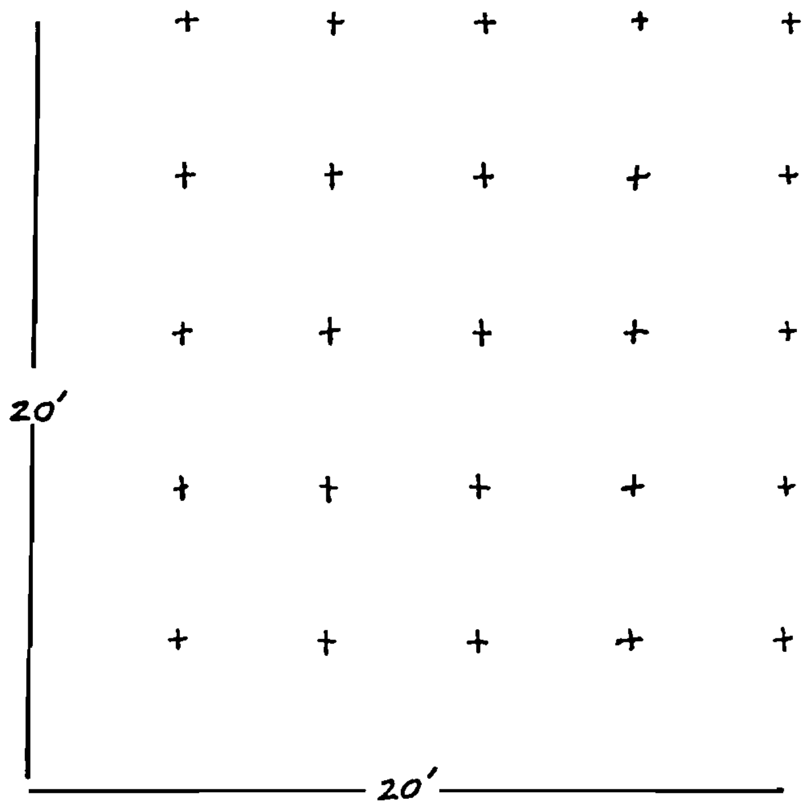
Figure 9.	Aerial View of the Created Wetland Area



Button Bush (4 foot on center)

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Figure 10. Typical Planting Pattern Around Perimeter Under

APPENDIX E - POST REMEDIAL CONSTRUCTION OPERATIONS AND MAINTENANCE PLAN

POST-REMEDIAL CONSTRUCTION OPERATIONS AND MAINTENANCE PLAN

BUFFALO COLOR CORPORATION AREA "D" SITE

SUBMITTED TO

NEW YORK STATE DEPARTMENT
OF ENVIRONMENTAL CONSERVATION
DIVISION OF HAZARDOUS
WASTE REMEDIATION

SUBMITTED BY

AlliedSignal

PREPARED BY

PARSONS ENGINEERING SCIENCE, INC.
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Buffalo, New York

PARSONS

FEBRUARY 1996
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POST-REMEDIAL CONSTRUCTION OPERATIONS AND MAINTENANCE PLAN

VOLUME I - GENERAL MANUAL

for:

BUFFALO COLOR CORPORATION
AREA "D" SITE
BUFFALO, ERIE COUNTY, NEW YORK
(NYSDEC SITE NO. 9-15-012)

Submitted to:

THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF HAZARDOUS WASTE REMEDIATION

Submitted by:

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FEBRUARY 1996

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SECTION 1

INTRODUCTION

1.1 INTRODUCTION

In accordance with the New York State Department of Environmental Conservation (NYSDEC) Order on Consent (Index No. B9-0014-84-01RD), AlliedSignal, Inc. is required to remediate the Site and provide for longterm operations and maintenance. The key remedial actions for the property include consolidation, regrading and capping of site soils; cutoff wall construction; shoreline stabilization; non-aqueous phase liquid (NAPL) and groundwater collection; and long-term groundwater monitoring.

This document presents an operation and maintenance (O&M) Manual for post-remedial construction activities at the Buffalo Color Area "D" Site which complied with the requirements set forth under 6 NYCRR Part 360-2.15(i)(7). Ongoing operations and maintenance will be conducted to ensure the effectiveness of the groundwater treatment system. Inspections and maintenance will also be required for the landfill cap, site security systems, erosion control structures, groundwater extraction system and site access roads. This plan describes groundwater monitoring, cover, erosion control structures, and drainage system inspection, reporting requirements, emergency response procedures, and community involvement. This Plan was prepared in accordance with a NYSDEC Memorandum regarding the suggested contents of an Operations, Maintenance, and Monitoring Plan for Hazardous Waste Sites, dated April 20, 1992.

1.2 PURPOSE OF THE O&M MANUAL

This O&M Manual is intended to be a stand alone document which can be easily implemented by individuals unfamiliar with the site. The relevant portions of the reference documents (i.e, manufacturers Operations and Maintenance Manuals, drawings, technical specifications documents, and relevant and appropriate regulations) are incorporated into this document as additional volumes or attachments. A Post-Remedial Construction Health and Safety Plan has also been developed for the Site which contains site specific Health and Safety protocols and a Contingency Plan.

The O&M Manual includes the following major components:

- a Groundwater Sampling, Analysis, and Monitoring Plan;
- a Landfill Cap and Erosion Control Structures Maintenance Plan; and
- an Operations and Maintenance Schedule.

The O&M Manual addresses the following items:

- description of equipment;
- description of routine O&M tasks (i.e. sampling and monitoring programs);

- description of potential operating problems and corrective actions that may be taken; and
- description of alternate O&M for unusual contingencies.

1.3 ORGANIZATION OF THE O&M PLAN

Section 1 of this Volume provides an introduction. Section 2 discusses the site history and purpose of the remedial construction. Section 3 describes the various components of the remedial action and goals of the remedial action program. Section 4 provides details of the environmental monitoring program, which includes the groundwater analytical program. Required site maintenance activities are described in Section 5. Section 6 provides information on the various reports that must be submitted to the NYSDEC. Section 7 pertains to citizen participation. Personnel and responsibilities related to implementation of the O&M Plan are defined in Section 8. Section 9 contains a description of the site Health and Safety Plan which is included as Attachment B to this document. Section 10 identifies the O&M recordkeeping protocol. The emergency contingency plan is described in Section 11. Site plans and relevant drawings are addressed in Section 12. As-built drawings, a site health and safety plan, groundwater sampling information and forms, post-closure inspection and maintenance report forms for post-closure field activities, and a geomembrane repair specification are contained in Attachments A, B, C, D and E, respectively.

Volume II of the O&M Plan provides manufacture's data for various components of the remedy. Volume III presents specific procedures associated with operation and maintenance of the groundwater treatment plant.

SECTION 2

SITE BACKGROUND AND DESCRIPTION

2.1 SITE LOCATION

Buffalo Color Corporation's (BCC) Area "D" is an inactive hazardous waste site located at 100 Lee Street in the City of Buffalo, Erie County, New York (see Figure 2.1). The site consists of a 19-acre peninsula surrounded on three sides by the Buffalo River and on the fourth side by a railroad yard and BCC's dye manufacturing facility.

Three waste management units were operated in Area "D"; iron sludge ponds, a metal sludge weathering area, and an incinerator area (Figure 2.2). Two of the areas, the iron sludge ponds (Site Code 9-15-012A) and the metal sludge weathering area (Site Code 9-15-012B) are currently listed as Class 2 sites in the Registry of Inactive Hazardous Waste Disposal Site by the New York State Department of Environmental Conservation (NYSDEC). The site and immediate surrounding area are zoned for heavy industry. The nearest residential area is approximately 1,200 feet northwest of the site. The topography of the Area "D" site and the surrounding area is relatively flat. Surface run-off at the site is entirely to the Buffalo River.

2.2 HISTORY OF SITE OPERATIONS

2.2.1 Site Use

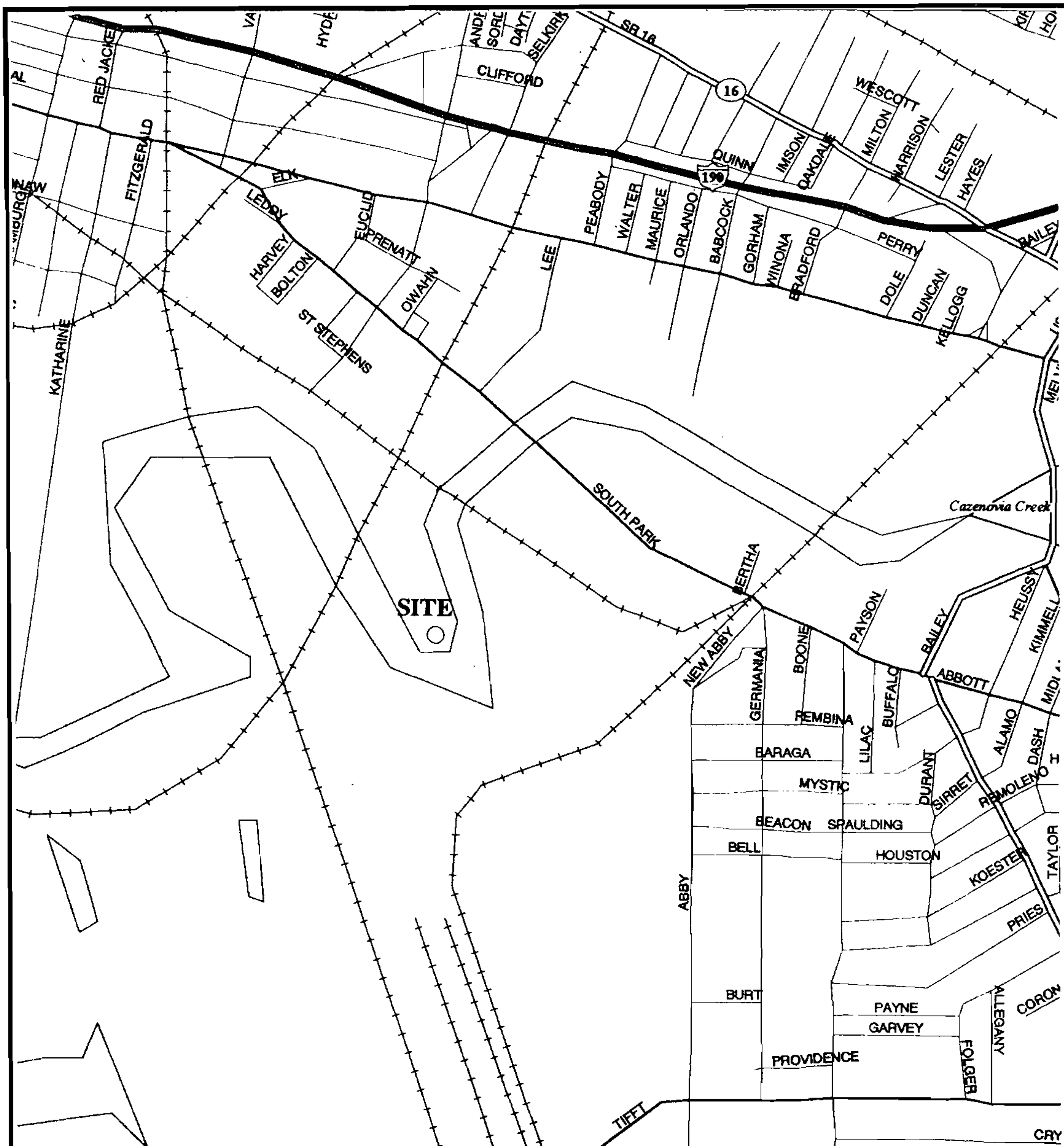
Area "D" was used from 1905 to 1974 as a chemical manufacturing, handling, and disposal site. From 1905 to 1920, acids, chemicals, and dye intermediates were produced by Contact Process Company and by National Aniline Chemical Company which merged into Allied Chemical and Dye Corporation in 1920. Phosgene gas was produced during 1917 to 1918 by National Aniline and Edgewood Arsenal. Allied Chemical and Dye Corporation manufactured petroleum-based detergents, dye intermediates, picric acid; and other chemicals at Area "D" during 1920 to 1974. During this period, a number of structures, railroad tracks, and tank parks were built at the site. All chemical manufacturing operations ceased in 1974 and chemical waste handling ceased in 1976 at Area "D".

In 1977, the property was sold to BCC and has remained idle since that time. All structures on the site were demolished to grade by Buffalo Color in 1984.

2.2.2 Area of Concern

The portions of the Area "D" which are of concern include:

1. The "Weathering Area" located at the tip of the peninsula which was utilized for the storage f metal oxide sludges for weathering before shipment to metal recyclers (1916-1976);



Scale 1:15,625 (at center)

1000 Feet

500 Meters

QUADRANGLE LOCATION

FIGURE 2.1

BUFFALO COLOR AREA "D"

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SITE LOCATION MAP
BUFFALO, NEW YORK

PARSONS ENGINEERING SCIENCE, INC.
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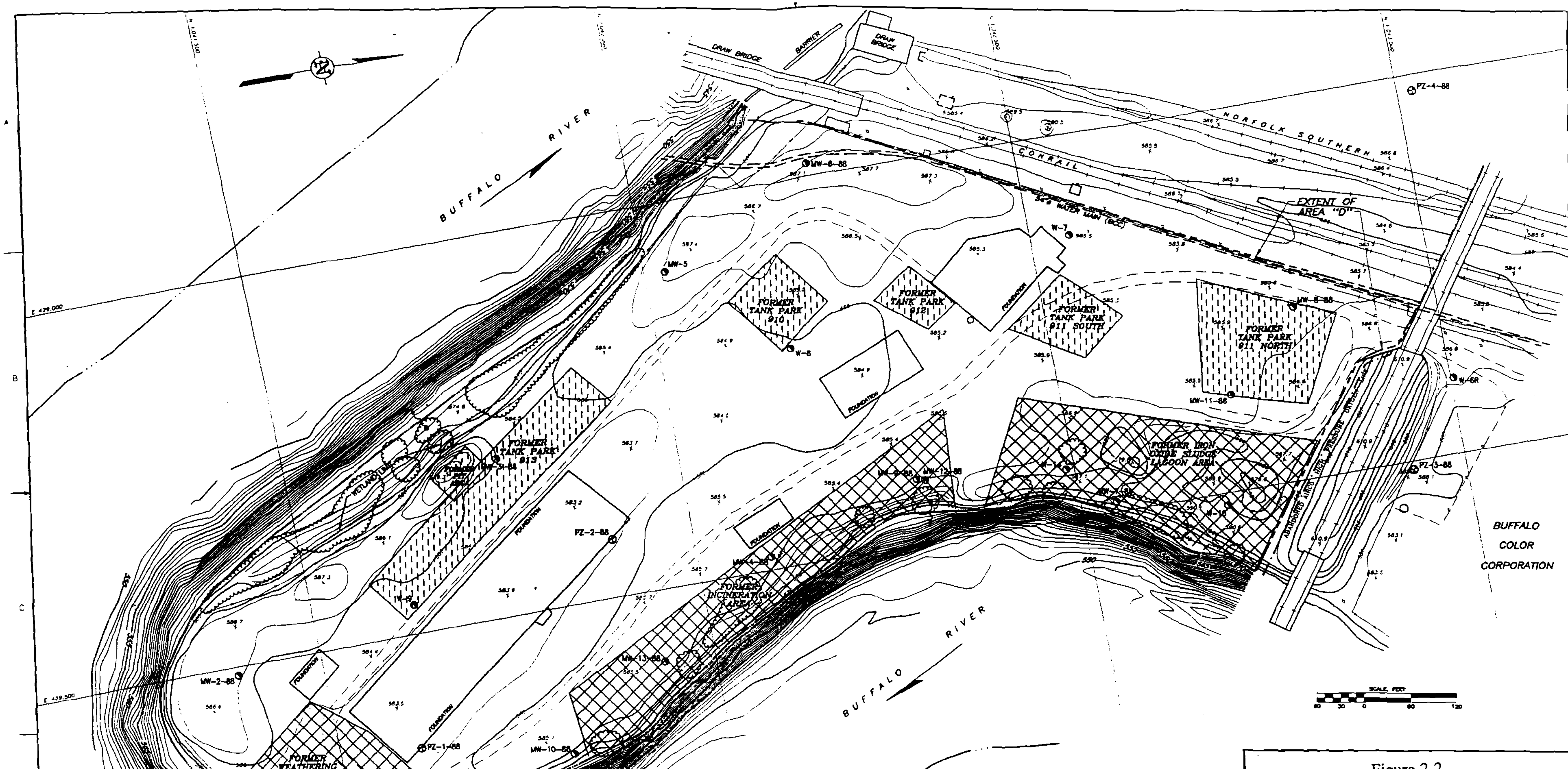
290 ELWOOD DAVIS ROAD • SUITE 312 • LIVERPOOL, N.Y. 13088 • 315/451-9560
OFFICES IN PRINCIPAL CITIES



LEGEND

W-13 MONITORING WELL NO. 13, INSTALLED IN 1982

MW-10-88 MONITORING WELL NO. 10, INSTALLED IN 1988

PZ-1-88 PIEZOMETER NO. 1, INSTALLED IN 1988

SEEP

UTILITY POLE

FENCE LINE

FORMER WASTE MANAGEMENT AREA

FORMER ABOVE GROUND STORAGE TANK AREA

NOTES:

1. ELEVATIONS ARE REFERENCED BY USGS DATUM.
2. COORDINATES ARE BASED ON NEW YORK STATE PLANE – WEST ZONE.
3. ALLIEDSIGNAL DRAWING NUMBER 431971 WAS PREVIOUSLY ISSUED AS A REMCORE DRAWING DATED MARCH 9, 1995.

REFERENCES:

1. McINTOSH & McINTOSH, P.C. SURVEY DRAWING TITLED, "TOPOGRAPHIC MAP OF BUFFALO COLOR SITE," DATED JUNE 26, 1987, JOB NO. 5221, SCALE: 1"=100'.
2. MALCOLM PIRNIE DRAWING TITLED, "SAMPLING LOCATIONS," FIGURE 6-1, NO DWG. NUMBER, NOT DATED. SCALE: (REDUCED TO NON-STANDARD SCALE).
3. McINTOSH & McINTOSH, P.C. SURVEY DRAWING TITLED "TOPOGRAPHICAL MAP OF A PORTION OF BUFFALO CREEK" DATED JULY 26, 1995 JOB NO. 5221-A, SCALE: 1"=60'.

REV.	REVISED		DESCRIPTION
	CHECKED		
	APPROVED		

Figure 2.2

BUFFALO COLOR AREA "D"

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Former Waste Management Areas

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2. The "Iron Oxide Sludge Lagoons" which were used for storage of iron oxide sludge from the manufacturer of dyes and intermediates (1916-1976);
3. Tank farm areas used for the bulk storage of petroleum products and process chemical; and
4. The area on the eastern side of the peninsula formerly occupied by open burring pits (1922-1954) and later by an incinerator (1954-1972) was used for burning of organic wastes generated during dye manufacturing processes.

   These areas of concern cover most of the Area "D" site. In addition, the analytical results of the samples collected during the present Remedial Investigation (RI) have demonstrated contamination at the Area "D" to be both widespread and variable with respect to its character and concentration. Contamination was found in the soil and/or groundwater at virtually every location of the site investigated. Any attempts to isolate the hot spots for remediation will be extremely difficult and will ultimately result in remediation of the whole site. Therefore, the Area "D" is considered as a whole for remediation.

2.3 SITE GEOLOGY AND HYDROGEOLOGY

2.3.1 Geology of the Site

The Area "D" site is underlain by five stratigraphic units (fill, alluvium, glaciolacustrine deposits, glacial till, and bedrock). Fill consists of mixtures of gravel, sand, silt, clay, demolition debris, chemical wastes, and other foreign materials and averages 9.0 feet thick,

Alluvium underlies fill and generally consists of black to gray silty sand with traces of clay, and averages 17.8 feet thick. Glaciolacustrine deposits underlie the alluvium and consist of gray and brown-gray clayey silt and silty clay, and average 27.9 feet thick. Glacial till is the lowest surficial deposit and consists of gray and brown sandy silt, with small percentages of clay and gravel and averages 12.0 feet thick. The bedrock beneath the site consists of hard, dark gray limestone of the Middle Devonian Formation.

2.3.2 Hydrogeology

Three (3) hydrostatigraphic units were defined at the Area "D" site. The Shallow Water-bearing Zone is located in the fill/alluvium deposits and yields an average hydraulic conductivity of 2.2 E-03 cm/sec and an average seepage velocity of 1.4 E-05 cm/sec. The groundwater flow in this zone is primarily from the north and flows directly to the Buffalo River. Overburden aquitard has a hydraulic conductivity of only 1.2 E-09 cm/sec. Hydraulic conductivity in the bedrock aquifer ranges from 1.4 E-02 cm/sec and flow probably occurs under confined conditions.

2.3.3 Nature and Extent of Contamination

The results of sample collection and analysis have demonstrated contamination at the Area "D" to be both widespread and variable with respect to its character and concentration. Contamination was found in the soil and/or groundwater at every location of the site investigated during the RI. The fill layer exhibited elevated levels of polynuclear aromatic hydrocarbons (PAHs) and chlorinated benzenes. Also, variable concentrations of heavy metals and arsenic were found. Comparison of surface water concentration differences between upstream and downstream sampling inconclusive, but sediments adjacent to the site exhibited elevated levels of PAHs, arsenic, and other heavy metals. In addition, an oily sheen was observed in the soils at a number of locations and a six-foot layer of light non-aqueous phase liquid (NAPL) was found floating on the groundwater in the area of the former tank park 910.

The following table summarizes the ranges of various notable contaminants found at the site:

Type of Analysis	Analyte	Range
a. Organics/Surface Soils (0-2') mg/kg	Nitrobenzene	0.21 - 580
	Benzoic Acid	2.8
	Naphthalene	470
	2-Chloronaphthalene	66
	Phenanthrene	4.6 - 270
	Fluoranthene	4.8 - 330
	Pyrene	3.9 - 310
	Benzo(a)Anthracene	1.9 - 180
	Chrysene	2.1 - 180
	Benzo(b)Fluoranthene	3.1 - 150
	Benzo(k)Fluoranthene	140
	Benzo(a)Pyrene	1.7 - 140
	Indenol(1,2,3-cd)Pyrene	0.76 - 77
	Benzo(g,h,i)Perylene	0.78 - 63
	EOX(mg/kg)	11 - 2,780
b. Inorganics/Surface Soils (0-2') mg/kg	Arsenic	4.5 - 77.2
	Cadmium	0.82 - 24.8
	Chromium	44.2 - 1,990
	Copper	36.2 - 3,580
	Iron	15,200 - 537,000
	Lead	8.9 - 27,300
	Mercury	0.07 - 6.2
c. Organics/Subsurface Soils mg/kg	1,4-Dichlorobenzene	1.7 - 13
	1,2-Dichlorobenzene	0.91 - 110
	Nitrobenzene	0.21 - 1,100
	1,2,4-Trichlorobenzene	1.2 - 150
	Naphthalene	1.9 - 8.2
	2-Chloronaphthalene	0.55 - 140
	Fluoranthene	0.19 - 14
	Pyrene	0.14 - 13

	Benzo(a)Anthracene	1.1 - 6.7
	Chrysene	0.35 - 8.2
	Benzo(b)Fluoranthene	1.6 - 9.7
	Benzo(a)Pyrene	11 - 360
	EOX (mg/kg)	11 - 360
d. Inorganics/Subsurface Soils mg/kg		
	Arsenic	4 - 2,860
	Cadmium	0.7 - 7
	Chromium	5.7 - 440
	Copper	6 - 14,500
	Iron	1,750 - 360,000
	Lead	8.4 - 83,200
	Mercury	0.19 - 14
e. Organics/Groundwater ug/l		
	2-Chlorophenol	0.8 - 1,800
	1,4-Dichlorobenzene	1 - 4,900
	1,2-Dichlorbenzene	2 - 21,000
	1,2,4-Trichlorbenzene	8 - 1,200
	Naphthalene	0.3 - 4,900
	4-Chloroaniline	8 - 11,000
	2,4-Dinitrotoluene	2,000
	2,6-Dinotrotoluene	1,500 - 1,700
	Benzidine	90 - 360
	1-Naphthylamine	6 - 42,000
	Aniline	5 - 660
	Benzene	0.1 - 28,000
	Toluene	0.09 - 4,700
	Chlorobenzene	0.6 - 48,000
	Ethylbenzene	0.2 - 43,000
	Xylene (Total)	1 - 1,700
f. Inorganics/Groundwater ug/l		
	Arsenic	5.7 - 1,820
	Cadmium	5 - 127
	Chromium	13 - 2,140
	Copper	15 - 78,700
	Iron	3,940 - 405,000
	Lead	5 - 3,030
	Mercury	0.29 - 50

The analytical results of the subsurface soil samples indicates that no organic contaminants were found below the 30 foot depth. Also, the groundwater data indicates that only the uppermost saturated zone is contributing the contaminants to the Buffalo River. Therefore, it is apparent that the underlying clay/till layer is effective in providing a barrier for contamination migration downwards.

A number of predesign activities were conducted by Remcor, Inc., Parsons ES, and other consultants which formed the basis of the proposed remedial design. The predesign activities included:

- a site survey and mapping;
- wetlands delineation;
- treatability testing of groundwater;
- groundwater pump tests;
- Hydraulic Evaluation of Landfill Performance (HELP) model simulations;
- a geotechnical investigation to determine the load bearing capacity of onsite soils;
- drilling and sampling of seven deep test borings;
- installation of four piezometers and 13 monitoring wells within shallow and dep water bearing zones;
- determine the geological and hydrogeological features of the region and the area;
- measurement of groundwater and river water levels;
- sampling of groundwater, surface water river sediments, and surficial soil;
- compatibility testing of construction materials;
- shoreline stabilization studies; and
- groundwater modeling.

The results of these investigations are presented in a series of reports and technical memoranda which are included as appendices to the Remedial Design Report (Parsons ES, October 1995). Section 2 of the Remedial Design Report summarizes the methodologies, conclusions, and recommendations of these studies.

SECTION 3

SITE REMEDIAL ACTION

3.1 GOALS OF THE REMEDIAL ACTIONS

The objectives of the remedial action were to provide a corrective measure which is in conformance to accepted standards, cost effective, reduced mobility and potential pathways of contamination, and which minimizes long term operation and maintenance costs.

3.2 POST-CLOSURE LANDFILL CONDITIONS

The Buffalo Color Area "D" Site was closed in 1996/1997 with a final cover in accordance with 6NYCRR Part 360 - Solid Waste Management Facilities (effective December 21, 1988, revised May 28, 1991). The final cover consist of, from the top down, 6 inches of topsoil, 24 inches of unclassified fill, geonet composite (geotextile on both sides), 40-mil high density polyethylene (HDPE) liner and a 6-ounce geotextile. A passive gas venting system provides for release of generated gases and prevents negative pressure buildup as a result of groundwater extraction. The gas system consists of three 6-inch HDPE vent wells screened below the geomembrane layers.

A cutoff (slurry) wall was installed around the site to prevent contaminant migration from the site to the Buffalo River. A groundwater extraction and treatment system consisting of four wells, and all associated piping and equipment was also installed. This groundwater extraction system will maintain an inward gradient to facilitate cleanup of groundwater for the site. Extracted groundwater will be pumped to an onsite wastewater treatment system. The operation and maintenance of the groundwater extraction and treatment system is covered in Volume III of the Operations & Maintenance Plan.

There are a total of 12 groundwater monitoring wells installed and the water level in all twelve wells will be monitored to check the performance of the slurry wall. Only the six interior wells will be monitored for chemical analysis. If water level measurements indicate that the groundwater gradient reverses (i.e. groundwater flow direction is away from the extraction wells), it may be necessary to monitor the exterior wells for chemical analysis. Erosion control is provided by vegetation of the capped area and rip-rap lining of the peninsula. The entire Area "D" site is fenced with one gate located off South Park Avenue. Record drawings for the remedial construction at the Area "D" site are included in Attachment A.

SECTION 4

GROUNDWATER MONITORING

4.1 GENERAL

Groundwater monitoring will be a routine part of the Buffalo Color Area "D" Site post-closure operations. The monitoring wells will be used to confirm that the groundwater extraction system and slurry wall are maintaining an inward gradient. The following subsections describe the procedures for sampling monitoring wells and evaluation of sample results.

4.2 MONITORING WELL LOCATIONS

Twelve monitoring wells were installed around the perimeter of the site. These wells were installed as six well pairs with one well on the interior side of the slurry wall, and the other well on the exterior. The six well pairs will be used solely for water level comparisons across the slurry wall. The well locations can be observed in Figure 4.1 and information regarding the wells is provided in Table C.1

4.3 GROUNDWATER SAMPLING AND ANALYSIS

4.3.1 Frequency of Sampling

Groundwater chemical analysis will be conducted annually. The groundwater sample will be a grab sample obtained from the influent sampling point at the wastewater treatment facility. The location of the grab sample point is identified in Volume III of the O&M Plan, Groundwater Treatment Facility Operations and Maintenance.

Due to the large fluctuation of the water level in the Buffalo River, the groundwater level measurements will be taken at each well pair on a monthly basis for the first year. The frequency may be changed to quarterly in the subsequent year with approval of the NYSDEC.

4.3.2 Sample Container Preparation

Sample containers will be properly washed and decontaminated by the laboratory prior to use. The containers will be tagged and Chain-of-Custody initiated before shipping to the sampling site in coolers. The types of containers and preservation techniques are shown in Table C.2. Since all bottles will contain the necessary preservatives, they need only be filled. Following sample collection, the bottles will be placed on ice in the shipping cooler. The samples will be cooled to 4°C but not frozen.

4.3.3 Field Procedures for Sampling and Water Level Measurement

The following is a step-by-step sampling procedure to be used to collect the groundwater samples. Well sampling procedures will be recorded on the form shown on Figure C.1.

- Assemble all field equipment necessary for sample collection (Table C.2).
- Inspect equipment to ensure it is working properly.
- Ensure sampling personnel are wearing appropriate Health & Safety gear.
- Measure the static water level from the surveyed well elevation mark on the top of the casing with a water level indicator. Water levels will be measured to nearest 0.01 foot and record on the Groundwater Sampling Record (Figure C.1). Next measure the water level at the corresponding exterior well and record on the Groundwater Sampling Record.
- Decontaminate the water level indicator. (See Section 4.3.4 for decontamination procedures.)
- Collect groundwater samples from the sampling point of the influent line at the wastewater treatment plant. Temperature, conductivity, dissolved oxygen, pH, and turbidity will be measured, and sample description and location noted on the Groundwater Sampling Record (Figure C.1). Specific conductance and pH will be measured by precalibrated electronic probes. Temperature will be measured by a precalibrated probe or thermometer.
- Fill sample containers to be analyzed for volatile organic compounds first. Sample containers to be analyzed for semivolatile organic compounds, metals and other analytes will then be filled. Note the sampling location on the bottle label.
- The groundwater samples will be placed in a laboratory cooler, packed on ice and shipped overnight to the laboratory. Quality assurance blanks will be sent with each sample shipment. Chain-of-Custody procedures will be strictly followed as outlined in Section 4.3.5.
- All disposal sample collection clothing (i.e. tyvek, disposable gloves) and materials will be contained in a 55 gallon drum which will be stored on site at a location designated by the owner.

4.3.4 Equipment Decontamination

Prior to sampling equipment use, and between sampling points, all non-dedicated equipment (water-level indicators) coming in contact with well water will be properly decontaminated. The decontamination procedure is as follows:

- Thoroughly clean the water-level indicator with a biodegradable detergent, such as Alconox and tap water.
- Triple rinse the water-level indicator with distilled water.
- All decontamination liquids will be contained in a lined 55-gallon lined drum for treatment and disposal at the wastewater treatment plant.
- Allow water-level indicator to air dry or wipe dry using disposable paper towels.
- Wrap water-level indicator in aluminum foil or place in clean plastic bag so that no outside contaminants are introduced.

Between rinses, equipment will be placed on polyethylene sheets or aluminum foil if necessary. At no time will washed equipment be placed directly on the ground.

To prevent cross-contamination between wells, separate (dedicated) bailers and rope will be used for each well.

4.3.5 Field Sample Custody

Evidence of sample traceability and integrity is provided by Chain-of-Custody (COC) procedures. These procedures document the sample traceability from the selection and preparation of the sample containers by the laboratory, to sample collection, to sample shipment, to laboratory receipt and analysis (Figure C.2). A sample is considered to be in a person's custody if the sample is:

- In a person's possession;
- Maintained in view after possession is accepted and documented;
- Locked and tagged with Custody Seals so that no one can tamper with it after having been in physical custody; or
- In a secured area which is restricted to authorized personnel only.

A COC record (Figure C.3) accompanies the sample containers from selection and preparation at the laboratory, during shipment to the field for sample containment and preservation, and during return to the laboratory. Triplicate copies of the COC must be completed for each sample set collected. The COC form may be tailored to meet the needs of the NYSDEC and the O&M Contractor.

The COC lists the field personnel responsible for taking samples, the project name and number, the name of the analytical laboratory to which the samples are sent, and the method of sample shipment. The COC also lists a unique description of every sample bottle in the set. If samples are split and sent to different laboratories, a copy of the COC record will be sent with each sample.

Since they are not specific to any one sample point, trip and field blanks are indicated on separate rows. Once all bottles are properly accounted for on the form, the sampler will write his or her signature and the date and time on the first "RELINQUISHED BY" space. The sampler will also write the method of shipment, the shipping cooler identification number, and the shipper airbill number on the top of the COC. Mistakes will be crossed out with a single line and initialed by the author.

One copy of the COC is retained by sampling personnel and the other two copies are put into a sealable plastic bag and taped inside the lid of the shipping cooler. The cooler lid is closed, custody seals provided by the laboratory are affixed to the latch and across the back and front lids of the cooler, and the person relinquishing the sample signs his name across the seal. The seal is taped, and the cooler is wrapped tightly with clear packing tape. It is then relinquished by field personnel to personnel responsible for shipment, typically an overnight carrier. The COC seal must be broken to open the container. Breakage of the seals before receipt at the laboratory may indicate tampering. If tampering is apparent, the laboratory will contact the designated person, and the sample will not be analyzed.

4.3.6 Sample Analysis

As required in NYCRR Part 360-2.11(c)(5)(ii)(a), groundwater will be analyzed for either baseline or routine parameters (Table 4.1). The baseline parameter list includes volatile organic compounds, semivolatile organic compounds and metals that were detected during the Remedial Investigation (Malcolm Pirnie, 1988). Baseline parameters will be analyzed once per year.

After the first two years of analysis, the need for monitoring all selected monitoring wells and for analyzing all the parameters listed in Table 4.1 during subsequent sampling events will be evaluated a revised monitoring plan may be developed with NYSDEC approval. Samples will be analyzed by a laboratory which will provide Level A reporting for all rounds of sampling.

4.3.7 Quality Assurance/Quality Control

In addition to water samples collected from the treatment facility influent, two types of "blanks" will be collected and submitted to the chemical laboratory for analyses. The blanks will consist of 40 mL VOA vials, as follows:

a. Trip Blank - A Trip Blank will be prepared before the sample bottles are sent by the laboratory. It consists of a sample of distilled, deionized water which accompanies the other sample bottles into the field and back to the laboratory. A trip blank will be included with each shipment of water samples, where sampling and analysis for volatile organic compounds is planned. The Trip Blank will be analyzed for volatile organic compounds as a measure of the internal laboratory procedures and their effect on the results.

b. Field Blank - Field Blanks will be prepared before the sample bottles are sent by the laboratory. Field Blanks will consist of the following:

   Atmospheric Blank - To measure the contribution of atmospheric contaminants, a sample bottle of organic-free distilled, deionized water is prepared by the laboratory and sent with the shipment of sample bottles. The blank is opened as sampling takes place. When sampling is completed, the blank is capped. The blank is utilized when sampling and analysis for volatile organic compounds is being performed. In these cases, the blank will be analyzed for volatile organic compounds.

4.3.8 Health and Safety

A Health and Safety Plan is provided in Attachment B which includes information on chemical and physical hazards anticipated during maintenance and monitoring at the site, personnel protection and monitoring equipment, accident prevention and contingency plan, sample handling, monitoring well decommissioning, and decontamination.

4.3.9 Data Evaluation and Reporting

The results of each monitoring event will be summarized in a letter report to be sent to the NYSDEC. Analytical results will be evaluated with respect to background levels detected in monitoring wells during the Remedial Investigation, and applicable NYSDEC and NYSDOH standards and guidance values. Analytical results showing an increase in contamination must be reported to the NYSDEC within 14 days of such determination.

An annual summary report will be prepared and submitted to NYSDEC which compares background levels, individual sampling round results and applicable water quality standards. Included in the report will be a table with the following information:

- Sample identification number
- Sample collection date
- Analytical results
- Method Detection Limits (MDL)
- Chemical Abstracts Service (CAS) numbers for all compounds
- Applicable water quality standards
- New York State Department of Health guidance values and statistical triggers
- Delineation of samples with exceedances of background levels, standards, guidance values, or statistical triggers
- Well identification including description
- Water level measurements from each monitoring well.

A summary and discussion of all exceedances of background levels, standards, values, or statistical triggers and any proposed modifications to the sampling and analysis schedule will also be included.

TABLE 4.1
GROUNDWATER QUALITY ANALYSIS TABLE

	GROUNDWATER		
	Quarterly Parameters	Annual Parameters	Suggested [4] Methods
FIELD PARAMETERS			
Static water level (in wells and sumps)	x	x	
Specific Conductance		x	9050
Temperature		x	
pH		x	9040/9041
Turbidity		x	
Field Observations[1]		x	
LEACHATE INDICATORS			
Total Kjeldahl Nitrogen (TKN)		x	351.1 - .4
Ammonia		x	350.1 - .3
Nitrate		x	9200
Chemical Oxygen Demand (COD)		x	410.1 - .4
Biochemical Oxygen Demand (BOD_5)		x	405.1
Total Organic Carbon (TOC)		x	9060
Total Dissolved Solids (TDS)		x	160.1
Sulfate		x	9035/9036/9038
Alkalinity		x	310.1 - .2
Phenols		x	8040
Chloride		x	9250 - 9252
Total Hardness as $CaCO_3$		x	130.1 - .2
Bromide		x	320.1
Color		x	110.0-3
Boron		x	
METALS			
Potassium		x	7610
Sodium		x	7770
Iron		x	7380/7381
Manganese		x	7460/7461
Magnesium		x	7450
Lead		x	6010/7420/7421
Cadmium		x	6010/7130/7131
Calcium		x	7140
Toxic metals[2] and cyanide		x[4]	
Volatile organics[3]		x	8240
Semivolatile Organics		x	8270

The NYSDEC may modify this list as needed.

All samples must be whole and unfiltered except as otherwise specified by the NYSDEC.

1 Any unusual conditions (colors, odors, surface sheens, etc.) noticed during well development, purging, or sampling must be reported.

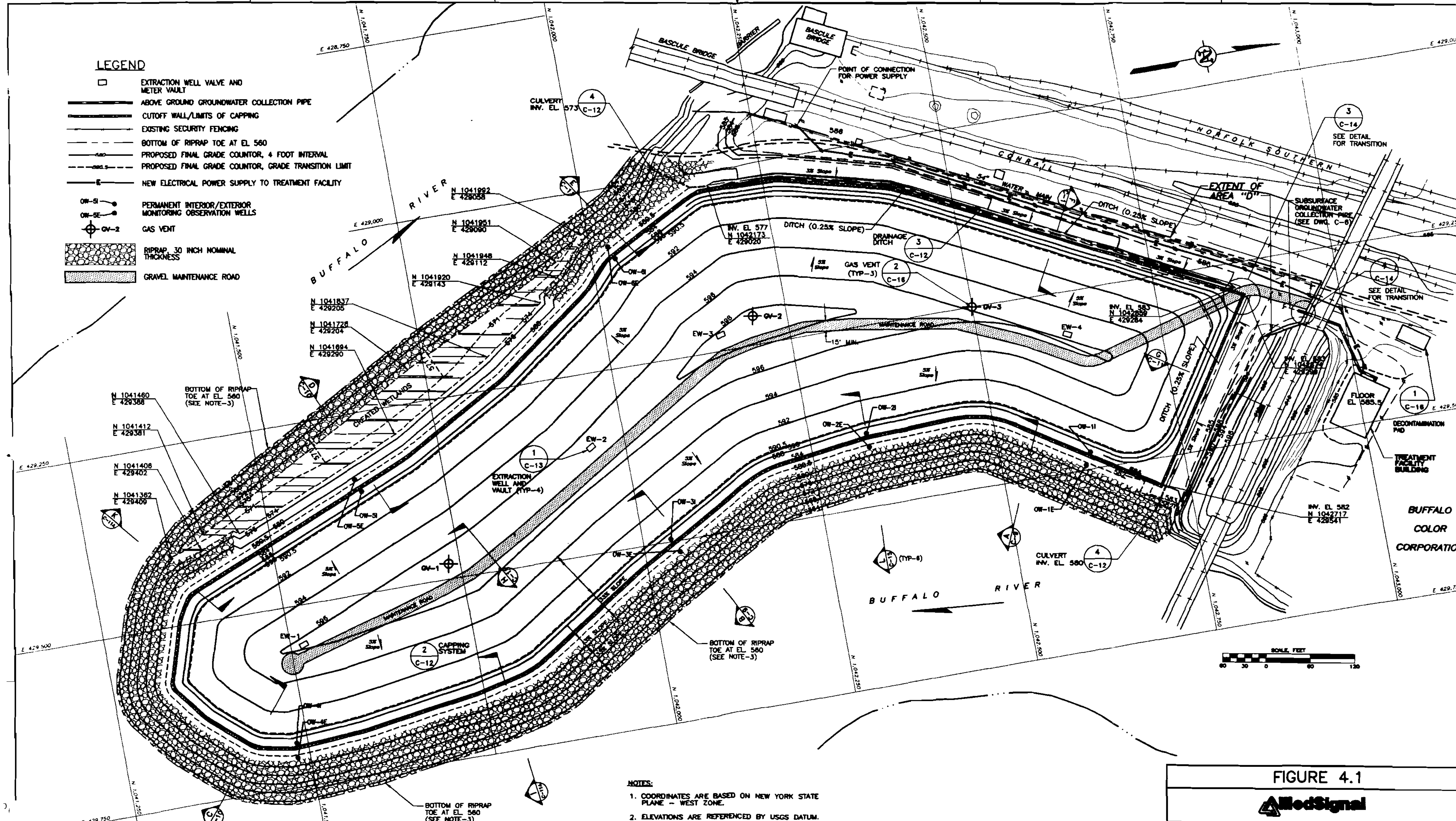
2 Toxic metals include: Aluminum, Antimony, Arsenic, Beryllium, Barium, Cadmium, Chromium (total and hexavalent)*, Copper, Lead, Mercury, Nickel, Selenium, Silver, Thallium and Zinc.

3 Volatile organics are to be analyzed using EPA methods 601 and 602 as described in 40 CFR Part 136 (see section 360-1.3 of this Part).

4 The NYSDEC may waive the requirement to analyze Hexavalent Chromium provided that Total and Hexavalent and Trivalent Chromium values do not exceed 0.05 mg/l.

5 Suggested Methods column is provided for information purposes only. Suggested Methods refer to analytical procedure numbers used in EPA Report SW-846 Test Methods for Evaluation of Solid Waste, 3rd Edition, November 1986 as revised December 1987, and Methods for Chemical Analysis of Water and Wastes, USEPA-600-4/79-020, March, 1979. The methods listed are representative procedures and may not always be the most suitable method(s) for monitoring an analyte under the regulations.

Source: NYCRR Part 360-2.11(d)(6)



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	APPROVED	SJM 2/2/96	–
REV. B	REVISED	JTS 11/16/95	DESCRIPTION: ISSUED FOR REVIEW BY NYSDEC
	CHECKED	WX 11/16/95	–
	APPROVED	SJM 11/16/95	–
REV. A	REVISED	JTS 10/12/95	DESCRIPTION: ISSUED FOR REVIEW BY ALLIEDSIGNAL
	CHECKED	WX 10/13/95	–
	APPROVED	[illegible]	–

REFERENCE:

1. McINTOSH & McINTOSH, P.C. SURVEY DRAWING TITLED, "TOPOGRAPHIC MAP OF BUFFALO COLOR SITE," DATED JUNE 26, 1987, JOB NO. 5221. SCALE: 1"=100'.
2. McINTOSH & McINTOSH, P.C. SURVEY DRAWING TITLED "TOPOGRAPHICAL MAP OF A PORTION OF BUFFALO CREEK" DATED JULY 26, 1995 JOB NO. 5221-A. SCALE: 1"=60'.

NOTES:

1. COORDINATES ARE BASED ON NEW YORK STATE PLANE – WEST ZONE.
2. ELEVATIONS ARE REFERENCED BY USGS DATUM.
3. THE CONTRACTOR SHALL PLACE ADDITIONAL RIPRAP AS NEEDED.
4. ALLIEDSIGNAL DRAWING NUMBER 431964 WAS PREVIOUSLY ISSUED AS A REMCOR DRAWING.

FIGURE 4.1

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BUFFALO COLOR AREA "D"

MONITORING WELL LOCATION PLAN

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SECTION 5

POST CLOSURE AREA "D" CARE AND MAINTENANCE

5.1 INTRODUCTION

This section contains procedures for post-closure care and maintenance of the cap, drainage swales, erosion control structures, groundwater extraction system, and other site structures. Specific procedures include routine inspections, routine maintenance, and contingency actions.

5.2 ROUTINE INSPECTIONS

The site will be inspected annually throughout the post-closure period. The site will also be inspected following particularly heavy storm events, e.g. a 10-minute, 2-year frequency storm. The site will be inspected for:

- visible debris, litter and waste;
- loss of vegetative cover;
- integrity of drainage system including:
  - sediment build-up;
  - pooling or ponding; and
  - slope integrity;
- condition of gas vent pipes;
- condition of access road, gates and fences;
- integrity of groundwater monitoring wells (to be inspected during water level measurement) and groundwater extraction wells;
- integrity of cap including:
  - erosion or settling of cap material;
  - leachate breakthroughs;
  - animal borrows; and
  - woody vegetation;
- integrity of erosion control structures around peninsula including:
  - erosion or settling of rip-pap; and
  - woody vegetation;

- identification and obstruction of any trails being heavily used by trespassers or recreational vehicles

A site inspection map, post-closure inspection checklist, well inspection checklist, and maintenance schedule are contained in Attachment D. The site plan is to be used to document problems and indicate areas that require attention.

5.3 ROUTINE MAINTENANCE

5.3.1 Cap Maintenance

The following items pertain to routine maintenance of the landfill cap system:

- Landfill vegetation progress will be monitored to annually confirm that the desired grass species have become established and that the desired ground cover is forming. Local spots will be reseeded and retreated if the vegetation fails to become established by the end of the second growing season.

- Annual ground inspections will be conducted at the beginning of each summer to determine the status of woody plant species on the landfill surface and side slopes.

- The landfill cap surface will be mowed at the end of each summer to control woody vegetation.

- If woody plants are detected in undesired areas, the plants will be removed by mowing the area once a year in the late summer to early fall. Mowing should be deferred until after the grass cover has become firmly established and will not be damaged by mowing equipment.

Indications of erosion or other side maintenance problems detected during routine site inspections or following particularly heavy storm events will be corrected as soon as possible. Repairs of eroded areas will be made with materials and methods specified herein. If erosion of the topsoil layer is encountered, the repair action may include, but not limited to, the following:

- Covering repaired areas with topsoil, as specified in the remedial construction Contract Documents to minimum thickness (min. 6 inches) and design grades; and

- Reseeding and fertilizing in accordance with materials and application rates specified in Section 02990, Topsoil, Seeding, and Erosion Control Fabrics, of the Contract Documents.

If erosion is persistent in certain areas, alternate methods for maintaining soil and vegetative cover or erosion protection will be evaluated on a case-specific basis.

Spots barren of vegetation in the final cap will be reseeded and fertilized as necessary. Seed and fertilizer will be of the same type and quality as originally specified. Any undesirable species will be removed if their presence is suspected of deteriorating the integrity of the cap.

The need for cap repairs due to subsidence or settling will be determined based on an evaluation of whether the function of the cap in the affected area has been impaired.

Those areas where the function has been impaired will be repaired to ensure that the integrity of the cap is maintained. Repair actions may include, but are not limited to:

- stripping and stockpiling topsoil from the affected area;
- regarding the affected area in accordance with the grading plan shown on the record drawings; and
- replacing topsoil, and reseeding and fertilizing to reestablish vegetative cover as described previously.

For animal control, follow these procedures:

- Conduct an annual site inspection to look for woodchuck or other animal burrow or den entrance on the landfill. If den or burrow entrances are found, a program to trap, shoot, or otherwise remove the burrowing animal(s) will be implemented on a case-specific basis. Following removal of the burrowing animal(s), the entrances will be plugged and the bare areas will be reseeded and fertilized. Seed and fertilizer will be of the same type and quality as originally specified.

5.3.2 Maintenance of Site Structures

Maintenance activities will be performed as determined necessary based on routine inspections. During all maintenance activities, vehicle traffic shall be confined to appropriate areas.

Drainage System Management

All elements of the drainage system including drainage swales will be maintained throughout the post-closure period. All elements will be inspected annually or after severe rainfall events to verify the structures are intact and undisturbed, and that channels and discharge areas are free of obstructions which would impair the free flow or surface water run-off. In the event any of the structures are found to be damaged or incapable of conveying the design flows, repairs will be made as soon as practical. Any obstructions found in swales will be immediately removed and channels regraded as necessary. If any culverts are found to be damaged such that their functions is impaired, they will be repairs or replaced. Accumulated sediment will be removed from drainage channels and/or around outlet structures as required to maintain required capacity and proper operation.

Groundwater Monitoring Wells

Monitoring wells which are damaged such that representative groundwater samples cannot be obtained will be repaired or replaced. Repair measures will be based on case-specific evaluation. Any well damaged beyond repair or rendered inoperative will be replaced with a new well of similar depth and construction. Detailed requirements for well installation and decommissioning are specified in Section 2085, Groundwater Monitoring Wells, of the Contract Documents.

Access Control

The access road will be maintained in good condition so that routine inspections and required maintenance activities at the site can be carried out. The gates will be kept in good condition and locked to prevent unauthorized access. Access to the site may be arranged by contacting:

David A. Paley
AlliedSignal, Inc.
101 Columbia Road
Morristown, NJ 07962
Phone: (201) 455-3302
Fax: (201) 455-4835

The condition of the gates, fences and roads will be assessed as part of the quarterly inspections. Repairs will be conducted as needed.

Gas Venting System

The above ground vent pipes will be inspected and maintained during the post-closure period. Repairs will be conducted as needed.

Erosion Control Structures

The rip-rap placed around the peninsula will be inspected on an annual basis. Annual inspections will be conducted to observe any erosion or settling that may be occurring. Additionally, the growth of woody vegetation that may effect integrity of rip-rap will be assessed. Inspections will also be performed after major storm events may have hightened erosion concerns.

HDPE Geomembrane

The HDPE geomembrane cannot be visually inspected because it is covered by 30 inches of soil. However, should the geomembrane become exposed, it will be inspected for holes and repairs made prior to soil replacement. Repairs will be conducted in accordance with the procedures presented in Attachment E.

SECTION 6

REPORTING AND RECORD KEEPING

6.1 INTRODUCTION

This section describes the reporting and record keeping that will be followed during the 30 year post-closure period. Groundwater data must be reported to both the NYSDEC and NYSDOH on a quarterly basis. An annual report summarizing monitoring and maintenance activities will also be submitted to the NYSDEC and NYSDOH.

All reports will be sent to AlliedSignal as well as the following agencies:

i. *One copy to the Director, Division of Hazardous Waste Remediation, NYSDEC, 50 Wolf Road, Albany, New York 12233-7010.*

ii. *One copy to the Director of Environmental Exposure Investigation, NYS Department of Health, 2 University Place, Albany, New York 12203; and*

iii. *One copy to the Regional Director, NYSDEC Region 9, 270 Michigan Avenue, Buffalo, New York 14203.*

iv. *One copy to the Division of Health Assessment, Bureau of Environmental Exposure Investigations.*

6.2 QUARTERLY REPORTS

The quarterly report will include all of the quarterly groundwater level measurement data. Included will be tables for groundwater sampling showing collection data and a discussion of results.

6.3 ANNUAL REPORT

The annual report will contain tables for groundwater collection data, analytical results, and a discussion of results. The report outline will be based on the data reporting regulations in NYCRR Part 360-2.11(c)(4)(iv). The annual report will also summarize the quarterly groundwater level measurements, and inspection and maintenance activities on the cap and site structures for the year.

6.4 RECORD KEEPING

Records of data, drawings, and calculations concerning any work proposed or completed at the Buffalo Color Area "D" Site are kept on permanent file by AlliedSignal, Inc. at their offices in Morristown, New Jersey. In addition, records will be maintained in conjunction with the post-closure monitoring and maintenance at the landfill. For example, wells will be monitored and data recorded on a data sheet. This and other investigative results are incorporated into reports that are submitted to NYSDEC. Included in the reports are appendices with copies of data sheets, log books, and laboratory analysis results. The originals will be kept by AlliedSignal, Inc. or AlliedSignal's contractor for performing maintenance and monitoring activities for at least five years.

SECTION 7

CITIZEN PARTICIPATION

7.1 INTRODUCTION

A Citizen Participation Plan was prepared for the Buffalo Color Area "D" by the NYSDEC (March 1995). The goal of the citizen participation program (CPP) is to increase public understanding of the remediation process. To keep the public informed about activities at the Site, the owner will:

- establish a local Document Repository which will contain all pertinent documents relating to the investigation and remediation of the Site;
- ensure that Fact Sheets are developed and mailed at appropriate times discussing the remedial design, remedial construction, the end of construction, and other issues involving the Site; and
- hold public availability sessions, if needed, to meet with interested parties to discuss plans, concerns, or other questions about the Site.

These issues are addressed in the March 1995 CPP for the Site. A post-remedial construction CPP will also be developed to inform the public about the operations and maintenance activities that will be conducted at the Site.

SECTION 8

PERSONNEL

8.1 INTRODUCTION

The principal parties involved in implementation of the O&M program at the Buffalo Color Area "D" Site are: The New York State Department of Environmental Conservation (NYSDEC); AlliedSignal, Inc.; the Closed Site Project Manager; O&M field personnel; and a subcontracted analytical laboratory. Responsibilities, qualification, and training requirements for the O&M personnel are described in the following paragraphs.

8.2 MANPOWER REQUIREMENTS

Implementation of the Buffalo Color Area "D" O&M Plan will required onsite personnel, to operate the groundwater treatment facility on a routine basis. Additionally, a Closed Site Project Manager will be required to organize and oversee all field activities on behalf of AlliedSignal, Inc.

8.3 RESPONSIBILITIES AND DUTIES

The Closed Site Project Manager will have the following responsibilities:

- schedule and coordinating all monitoring activities as described in Section 4;
- visit the Site semi-annually to review the adequacy of the O&M program;
- evaluate all environmental monitoring data including: conducting statistical analyses as described in Section 4; determine if reportable exceedances occur; and determine if any health or environmental hazards are present;
- required inspections to ensure adequate Site maintenance is being conducted as described in Section 5;
- maintain and submit all required documentation and records of O&M activities as described in Sections 6 and 10 of this Plan;
- oversee all activities conducted by the O&M field personnel;
- be available to respond in an emergency situation in accordance with the Contingency Plan (Attachment A);
- serve as the primary interface between the NYSDEC and AlliedSignal, Inc.;
- maintain records of all O&M costs for the Site;
- obtaining environmental samples as described in Section 4 of this Plan, including completion of chain-of-custody forms and field notes;
- conducting all Site maintenance activities as described in Section 5 of this Plan;
- conducting regular calibration of site sampling and monitoring equipment and maintaining calibration records;

- adherence to the requirements of the O&M Health and Safety Plan (Attachment A); and
- promptly informing the Closed Site Project Manager of any problems associated with the landfill cap system, groundwater monitoring system, groundwater treatment system, or Site security system.

The responsibilities of the subcontracted analytical laboratory system include:

- coordinating all analytical testing with the Closed Site Project Manager;
- scheduling, testing, and quality assurance of all analytical work; and
- providing timely reports to the Closed Site Project Manager summarizing the analytical results.

8.4 QUALIFICATIONS AND TRAINING

The Closed Site Project Manager and onsite field personnel must each have a high school diploma or equivalent (as a minimum), secondary education in environmental science, and receive the following training:

- OSHA 40-hour hazardous waste site worker training (29 CFR 1910.120);
- Site specific health and safety and contingency plan implementation and training;
- training regarding Site specific O&M procedures described in Section 4 and 5 of this manual; and
- BCC training.

In addition, all O&M personnel must be familiar with the Site's engineering drawings, relevant specifications, sampling and analysis protocols, environmental monitoring, and reporting requirements. The Closed Site Project Manager must be able to conduct a statistical data analysis as described in the RCRA Groundwater Monitoring Technical Enforcement Guidance Document (GPO 5500000260-6, USEPA, September 1986).

SECTION 9

HEALTH AND SAFETY PLAN

9.1 INTRODUCTION

A Site-specific Post Remedial Construction Health and Safety Plan has been prepared for the Buffalo Color Area "D" Site and is included as Attachment B to this document. The Health and Safety Plan contains the following information:

- organization and responsibilities of the project/health and safety team;
- characterization of the chemical and physical hazards present at the Site;
- a description of the medical program required for O&M personnel;
- a summary of the air monitoring program to be conducted during O&M activities;
- instruction on selection and use of personal protective equipment (PPE) and action levels for upgrading or downgrading PPE;
- proper delineation of work zones and equipment personal decontamination; and
- an accident prevention and contingency plan.

SECTION 10

RECORDS

10.1 MONITORING

Environmental monitoring records which will be maintained include the following:

- a field information log which contains well purge information, sampling information, field analytical data, instrument calibration check data, and general information such as weather conditions, observation, etc.;
- chain-of-custody forms for all environmental and NAPL samples; and
- records of data, drawings, and calculations of data evaluation.

All reports will be prepared summarizing the monitoring and maintenance activities conducted at the Site. Details on report submissions are described in Section 6 of this Plan.

10.2 INSPECTIONS/MAINTENANCE RECORDS

A log book must be maintained onsite to track daily maintenance activities conducted. Routine inspections must also be conducted quarterly, or whenever there is a heavy storm event. A four page inspection form is presented in Attachment B which should be utilized to record the results of the Post-Closure facility inspection.

SECTION 11

CONTINGENCY PLAN

11.1 INTRODUCTION

The objective of this contingency plan is to establish procedures for handling events which occur outside the scope of the routine maintenance. The contingency plan should be implemented following the identification of a site condition which is not covered by the routine maintenance plan.

Natural occurrences such as storms, drought and subsidence should be considered "expected occurrences" and are addressed under the routine maintenance program. Certain problems which cannot be reasonably expected to occur, such as earthquakes, are not addressed in this contingency plan.

The following problems are examples of occurrences which are not expected to occur, but may be discovered during a routine post-closure inspection:

- degradation of the cap integrity which may be a result of or indicated by:
  - waste/contaminated soil protruding through the topsoil cover;
  - soil erosion or other drainage problems; or
  - uncontrolled burrowing by pests.
- vegetative cover missing despite repeated efforts at revegetation;

The following guidelines are offered to determine when the contingency plan should be implemented and to determine possible corrective actions when responding to a contingency. All corrective actions, where appropriate, will be executed in a timely fashion after notifying the appropriate regulatory agencies.

11.2 FIRE

Fires at the site will be immediately reported to BCC. Appropriate response measures, including personnel safety, will be the responsibility of the fire department. Fires will be quenched according to approved fire department protocol. Damage to the surface drainage system or cap will be repaired where these systems have been compromised.

11.3 VANDALISM

Vandalism will be reported to the local law enforcement authorities and BCC. If vandals have gained entry to the Area "D" site, appropriate measures will be taken to eliminate or restrict future access. Vandalism to monitoring wells will be repaired as appropriate on a case-specific basis. Damage caused by off-road vehicles will be repaired where the damage is determined to have compromised the integrity of the cap or the function of the surface drainage system.

11.4 SEVERE EROSION AND COMPROMISE OF CAP INTEGRITY

Severe erosion of the landfill cap, as well as the storm water management system will be repaired to original specifications. The cause of severe erosion will be investigated and remedial measures, if needed, will be developed and implemented accordingly.

11.5 UNAUTHORIZED DUMPING OR DISPOSAL

Unauthorized dumping or waste disposal will be reported to BCC, the NYSDEC, and local enforcement officials. Appropriate measures will be taken to determine the waste characteristics, containment requirements and the necessary removal and disposal techniques. The waste will be removed and disposed of at an approved disposal facility, as appropriate. Efforts will be taken to eliminate further dumping and to restrict subsequent entry to the site. Persons found in the act of illegal dumping will be prosecuted according to the law and will be held responsible for all costs incurred in removing the waste.

11.6 QUALITY ASSURANCE/QUALITY CONTROL

To assure the performance of site inspection and maintenance, a reporting procedure has been established. A site inspection checklist is provided in Attachment C. The site inspection checklist was developed in accordance with the parameters identified in this section. The checklist will be completed after regularly scheduled site inspections and inspections following severe storms.

The monitoring and maintenance contractor and any future designated authority responsible for performing site inspections and supervising maintenance operations will be fully qualified (as determined by AlliedSignal) to perform the work. The site inspection checklist and maintenance schedule will be completed under the supervision of a New York State licensed Professional Engineer. Maintenance and repair work shall conform to the requirements set forth in this Plan.

SECTION 12

SITE PLANS AND DRAWINGS

12.1 INTRODUCTION

Site plans and drawings are included are separate Appendices to the Buffalo Color Area "D" Site Remedial Design Report.

ATTACHMENT A

AS-BUILT DRAWINGS

NOTE: To be provided following completion of construction.

ATTACHMENT B

POST-REMEDIATION HEALTH AND SAFETY PLAN

OPERATIONS, MONITORING AND MAINTENANCE HEALTH AND SAFETY PLAN

For:
BUFFALO COLOR CORPORATION
AREA "D" SITE
BUFFALO, ERIE COUNTY, NEW YORK
(NYSDEC SITE NO. 9-15-012)

Submitted to:

THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF HAZARDOUS WASTE REMEDIATION

Submitted by:

ALLIEDSIGNAL, INC.

Prepared by:

PARSONS ENGINEERING SCIENCE, INC.
180 LAWRENCE BELL DRIVE
SUITE 100
WILLIAMSVILLE, NEW YORK 14221
PHONE: (716) 633-7074
FAX: (716) 633-7195

FEBRUARY 1996

OPERATIONS, MONITORING AND MAINTENANCE HEALTH AND SAFETY PLAN

For:

BUFFALO COLOR CORPORATION
AREA D SITE
BUFFALO, ERIE COUNTY, NEW YORK
(NYSDEC SITE NO. 9-15-012)

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Reviewed and Approved By:

	Name	Date
Project Manager	James H. Kyles / JPM	3/1/96
Parsons ES H&S Officer	Bryan J. Powell	3/1/96

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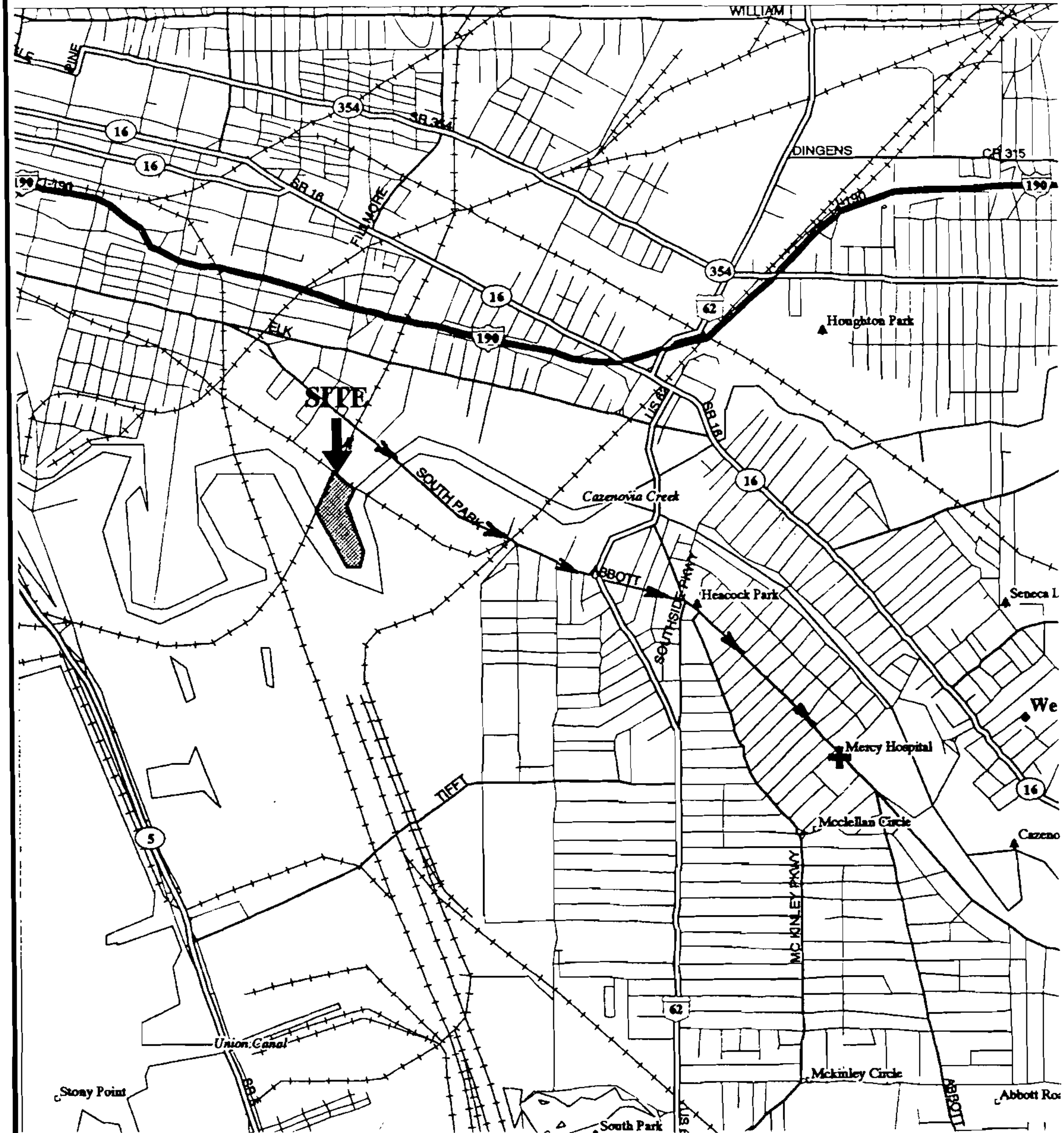
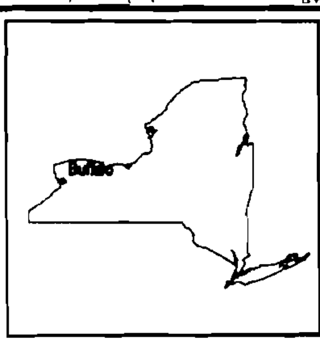




NEW YORK
QUADRANGLE LOCATION

Scale 1:31,250 (at center)

2000 Feet

1000 Meters

FIGURE 1

BUFFALO COLOR AREA "D"

AlliedSignal

ROUTE TO HOSPITAL

PARSONS ENGINEERING SCIENCE, INC

DESIGN * RESEARCH * PLANNING
290 ELWOOD DAVIS ROAD * SUITE 312 * LIVERPOOL, N.Y. 13088 * (315) 451-9560
OFFICES IN PRINCIPAL CITIES

SECTION 1

INTRODUCTION

1.1 PURPOSE AND REQUIREMENTS

The purpose of this health and safety plan is to establish minimum standards, practices, and procedures related to personnel protection and safety during the post-remedial construction activities at the Buffalo Color Corporation Area "D" Site. This plan assigns responsibilities for operations, monitoring and maintenance personnel; serves as a minimum standard for the operations, monitoring and maintenance subcontractors; defines the potential hazardous and associated risks that may exist at the site; and describes action levels for the use and upgrading of personal protective equipment (PPE). The provisions of this plan are mandatory for all onsite personnel performing post-remedial construction operations, monitoring, and maintenance, as well as any visitors to the site.

Health and Safety Plans must also be prepared by subcontractors working on the site, and the plans must conform to the requirements of this plan as a minimum. All personnel who engage in project activities must be familiar with this plan and comply with its requirements. All field personnel must sign-off on the Plan Acceptance Form (Exhibit 1) prior to beginning work on the site. The Plan Acceptance Form must be submitted to and maintained by the Site Health and Safety Officer.

1.2 SITE DESCRIPTION

The ROD presented the following RA objectives established by the NYSDEC:

- Prevent direct exposure to onsite soils so that the potential risk to human health through exposure is at an acceptable level.
- Prevent erosion of contaminated onsite surficial and shoreline soils and waste into the Buffalo River, thereby eliminating contaminant loading to the Buffalo River through mechanical erosion and eliminating a potential source of contaminants to the sediment.
- Limit the migration of contaminated groundwater and NAPL constituents from the site into the Buffalo River via subsurface groundwater.
- Limit the migration of contaminants to the groundwater.

The following items were initiated to address specific site conditions. These remedies include:

- Cutoff wall construction;
- Site cap construction;
- Shoreline stabilization;

- Non-aqueous phase liquid (NAPL) and groundwater collection; and
- Long-term groundwater monitoring.

1.3 APPLICABILITY

As described in the Operations & Maintenance Plan (Parsons ES, 1995), field tasks to be conducted at the site include:

- groundwater monitoring;
- groundwater sampling;
- CAP inspections and maintenance;
- erosion control structures (inspection and maintenance);
- groundwater extraction system (inspection and maintenance); and
- site inspections (roads, security measures, drainage, etc.).

All personnel conducting field tasks are to adhere to using proper health and safety protocols and PPE. Appropriate levels of personal protective equipment for various field activities are identified in Section 5 of this Plan.

1.4 PROJECT TEAM ORGANIZATION

Personnel onsite during the O&M period may include the Site Manager, Field Team Supervisor, and Site Health and Safety Officer. Each of these individuals shall have appropriate training in first aid; safe handling procedures for hazardous chemicals/waste, including the proper selection, fitting, and use of personal protective equipment; and shall be experienced with the types of field operations to be conducted at the site. The names of principal onsite personnel associated with this project are as follows:

Site Manager:	To be Determined
Field Team Supervisor:	To be Determined
Site Health and Safety Officer:	To be Determined

1.5 SITE SPECIFIC TRAINING

The Site Health and Safety Officer will be responsible for developing and conducting a site specific occupational hazard training program for all personnel that will work at the site. This training will consist of the following topics:

- Names of personnel responsible for implementing the Site health and safety program.
- Safety, health, and other hazards at the site.
- Proper selection and use of personal protective equipment.
- Work practices by which the employee can minimize risk from hazards.
- Safe use of engineering controls and equipment on the site.

- Acute effects of compounds at the site.
- Decontamination procedures.
- Evacuation routes and gathering locations.
- Neighboring industry alarms.
- Sign-in procedures.
- Communication methods, including hand signals and radio communication.

SECTION 2

RISK ANALYSIS

2.1 CHEMICAL HAZARDS

Due to disposal practices and the variety of wastes allegedly disposed of at the Buffalo Color Corporation Area "D" Site, the potential exists that, during field activities, workers will be exposed to hazardous substances.

The result of sample collection and analysis have demonstrated contamination at the Area "D" to be both widespread and variable with respect to its character and concentration. Contamination was found in the soil and/or groundwater at every location of the site investigated during the RI. The fill layer exhibited elevated levels of polynuclear aromatic hydrocarbons (PAHs) and chlorinated benzenes. Also, variable concentrations of heavy metals and arsenic were found. Comparison of surface water concentration differences between upstream and downstream sampling were inconclusive, but sediments adjacent to the site exhibited elevated levels of PAHs, arsenic, and several heavy metals. Contamination of the groundwater relative to background was found in the surficial glacial/till formations, with the principal contaminants being volatile organics, chlorinated benzenes, iron, and other heavy metals. In addition, an oily sheen was observed in the soils at a number of locations and six-foot layer of light non-aqueous phase liquid (NAPL) was found floating on the groundwater in the area of former tank park 910. Some relevant properties of these compounds are shown in Table 2.1.

Slaked lime and muriatic acid will be used in the groundwater treatment system. These chemicals will be housed in a groundwater treatment facility located onsite. Additionally, solvents used for the preservation of water samples and for decontamination of sampling equipment are potentially hazardous to human health and the environment.

Routes of entry, descriptions of the hazards, first-aid procedures, and PPE requirements for each of these compounds are described on the Material Safety Data Sheets (MSDS) included in Exhibit 2. All MSDSs will be maintained onsite by the field team supervisor.

2.2 VEHICLES AND HEAVY EQUIPMENT

Working with large motor vehicles and heavy equipment could be a major hazard at this site. Injuries can result from equipment hitting or running over personnel, impacts from flying objects, or overturning of vehicles. Vehicle and heavy equipment design and operation will be in accordance with 29 CFR, Subpart O, 1926.600 through 1926.602. In particular, the following precautions will be utilized to help prevent injuries/accidents: brakes, hydraulic lines, light signals, fire extinguishers, fluid levels, steering, tires, horn, and other safety devices will be checked at the beginning of each shift.

2.3 SPECIAL HAZARDS

2.3.1 Unloading Incoming Materials

Materials such as imported fill (soil), topsoil, seed, filter fabric, select backfill, fencing, equipment, etc. may delivered for repair work at anytime. This work will, at a minimum, require all personnel to wear Level D health and safety protection, using the guidance outlined above for respiratory/personal protective upgrades (or as appropriate with BCC policy). If unloading of the materials disrupts waste fill or contaminated surface soils, Level C-Particulate personal protective equipment will be required along with air monitoring. Vehicles leaving a contaminated area shall be decontaminated. Vehicles that did not come in contact with waste fill or contaminated areas will not require decontamination. The drivers shall remain in the vehicles during the entire time which the vehicle is within project limits, otherwise the driver shall undergo personal decontamination.

2.3.2 Monitoring Well Repair

Drilling activity may be required for well repairs. Prior to any drilling activity, efforts will be made to determine whether underground installations or utilities will be encountered and, if so, where these installations or utilities are located. Hard hats and safety boots must, as a minimum, be worn within 50 feet of the drilling equipment. Workers not involved in monitoring the bore holes will remain at least 50 feet from the drill rig during operation. The drill rig cannot be operated within 10 feet of power lines. The Field Team Leader or Site Health and Safety Officer will provide constant onsite supervision of the drilling subcontractor to ensure that they are meeting the health and safety requirements. If deficiencies are noted, work will be stopped and corrective action will be taken (i.e.; retrain, purchase additional safety equipment). Reports of health and safety deficiencies and the corrective action taken will be forwarded to the Project Manager. The drill rig will not be placed on unstable ground, or ground not capable of supporting heavy equipment.

2.3.3 Dewatering

Groundwater may be encountered during groundwater recovery system construction activities. This water will be pumped to the onsite treatment plant. The water being pumped may be contaminated and therefore all personnel involved in this activity will be required to wear Level D protective equipment, using the guidance outlined above for respiratory/personal protective upgrades. Real-time air monitoring will also be required.

2.3.4 Backfilling

This work, at a minimum, will required all personnel to wear Level D health and safety protection, using guidance outlined above for the respiratory/personal protective upgrades.

2.4 PHYSICAL HAZARDS

2.4.1 Heat Stress

The use of some PPE, such as Tyvek suits and respirators, may create heat stress. When PPE is required and the ambient temperature is 70°F or above, monitoring of personnel wearing protective clothing should be conducted. Heat stress monitoring should be performed by a person with a current first-aid certification who is trained to recognize heat stress symptoms. Techniques for monitoring the body's recuperative abilities to excess heat are described below. Table 2.1 presents the suggested frequency for such monitoring. Monitoring frequency should increase as ambient temperature increases or as slow recovery rates are observed.

To monitor the worker, measure:

- Heart rate. Count the radial pulse during a 30-second period as early as possible in the rest period.
    - If the heart rate exceeds 100 beats per minute at the beginning of the rest period, shorten the next work cycle by one-third and keep the rest period the same.
    - If the heart rate still exceeds 100 beats per minute at the next rest period, shorten the following work cycle by one-third.
- Oral temperature. Use a clinical thermometer (3 minutes under the tongue) or similar device to measure the oral temperature at the end of the work period (before drinking).
    - If oral temperature exceeds 99.6°F, shorten the next work cycle by one-third without changing the rest period.
    - If oral temperature still exceeds 99.6°F at the beginning of the next rest period, shorten the following cycle by one-third.
    - Do <u>not</u> permit a worker to wear a semi-permeable or impermeable garment when oral temperature exceeds 100.6°F.

2.4.2 Prevention of Heat Stress

Proper training and preventative measures will aid in averting loss of worker productivity and serious illness due to heat stress. Heat stress prevention is particularly important because once a person suffers from heat stroke or heat exhaustion, that person may be predisposed to additional heat related illness. To avoid heat stress the following steps should be taken:

- Adjust work schedules.
    - modify work/rest schedules according to recommendations in Section 2.2.1.
    - mandate work slowdowns as needed.
    - perform work during cooler hours of the day, if possible, or at night if adequate lighting can be provided.

- Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods.
- Maintain worker's body fluids at normal levels. This is necessary to ensure that the cardiovascular system functions adequately. Daily fluid intake must approximately equal the amount of water lost in sweat; i.e., eight fluid ounces of water must be ingested for approximately every eight ounces of weight lost. The normal thirst mechanism is not sensitive enough to ensure that enough water will be consumed to replace lost sweat. When heavy sweating occurs, encourage the worker to drink more. The following strategies may be useful:
  - maintain water temperature 50° to 60°F.
  - provide small disposable cups that hold about four ounces of fluid.
  - have workers drink 16 ounces of fluid (preferably water or dilute drinks) before beginning work.
  - urge workers to drink a cup or two every 15 to 20 minutes, or at each monitoring break. A total of 1 to 1.5 gallons of fluid per day are recommended, but more may be necessary to maintain body weight.
- Train workers to recognize the symptoms of heat related illness.

2.4.3 Cold-Related Illness

In the winter months, thermal injury due to cold exposure can be a potential concern for field personnel. Systemic cold exposure is referred to as *hypothermia*. Local cold exposure is generally termed *frostbite*.

Hypothermia. Hypothermia is defined as a decrease in a persons core temperature below 96°F. The body temperature is normally maintained by a combination of central (brain and spinal cord) and peripheral (skin and muscle) activity. Interferences with any of these mechanisms can result in hypothermia, even in the absence of what normally is considered a "cold" ambient temperature. Symptoms of hypothermia include: shivering, apathy, listlessness, sleepiness, and unconsciousness.

Frostbite. Frostbite is both a general and medical term given to areas of local cold injury. Unlike systemic hypothermia, frostbite rarely occurs unless the ambient temperatures are less than freezing and usually less than 20°F. Symptoms of frostbite are: a sudden blanching or whitening of the skin; the skin has a waxy or white appearance and is firm to the touch; tissues are cold, pale, and solid.

To monitor workers for cold stress conduct oral temperature monitoring at the job site:

- at the Field Team Leader's discretion, based on changes in a worker's performance or mental status;
- at a worker's request;

- as a screening measure, two times per shift, under unusually hazardous conditions (i.e., wind-chill less than 20°F, or wind-chill less than 30°F with precipitation); or
- as a screening measure whenever any one worker on the site develops hypothermia.

Any person developing moderate hypothermia (a core temperature of 92°F) cannot return to work for 48 hours.

2.4.4 Prevention of Cold-Related Illness

To minimize the potential for cold-related illness to occur, the following precautions should be taken:

- Educate workers to recognize the symptoms of frostbite and hypothermia
- Identify and limit known risk factors
- Provide an enclosed, heated environment on or adjacent to the site.
- Ensure the availability of dry changes of clothing.
- Develop the capability for temperature recording at the site.
- Provide warm drinks for onsite personnel.

TABLE 2.1

SUGGESTED FREQUENCY OF PHYSIOLOGICAL MONITORING FOR FIT AND ACCLIMATIZED WORKERS[a]

Adjusted Temperature[b]	Normal Work Ensemble[c]	Impermeable Ensemble
90°F (32.2°°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5°F (30.8°-32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5°-87.5°F (28.1°-30.8°C)	After each 90 minutes of work	After each 60 minutes of work
77.5°-82.5°F (25.3°-28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5°-77.5°F (22.5°-25.3°C)	After each 150 minutes of work	After each 120 minutes of work

a For work levels of 250 kilocalories/hour.

b Calculate the adjusted air temperature (ta adj) by using this equation: ta adj °F = ta °F + (13 x % sunshine). Measure air temperature (ta) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow. (100 percent sunshine = no cloud cover and a sharp, distinct shadow; 0 percent sunshine = no shadows.)

c A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.

SECTION 3

MEDICAL PROGRAM

3.1 INTRODUCTION

Workers handling hazardous materials, wastes, or chemicals can experience high levels of stress. Their daily tasks may potentially expose them to toxic chemicals and safety hazards. They may develop heat stress while wearing protective equipment or working under temperature extremes; or face life-threatening emergencies such as explosions and fires. Therefore, a medical program is essential to assess and monitor workers' health and fitness both prior to employment and during the course of work; to provide emergency and other treatment as needed; and to keep accurate records for future reference. This section outlines the medical program recommended for workers who may potentially be exposed to hazardous materials or situations at the Site.

Visitors to the site who are not directly involved in the remedial construction activities are not required to undergo any medical surveillance. All visitors, however, must be accompanied by authorized personnel while onsite. In the event that any hazardous situation arises at the site, the area will be evacuated by the Site Safety Officer to minimize the health hazard potential to the public/site visitors.

3.2 MEDICAL EXAMINATIONS

Personnel involved in the remedial construction activities shall undergo medical surveillance prior to employment and thereafter at 12-month intervals. The physical examinations to be conducted in accordance with BCC and AlliedSignal policy.

3.3 MEDICAL RECORDS

Proper recordkeeping is essential at the site because of the nature of the work and risks. Employees may work at a large number of geographically separate sites during their careers, and adverse effects of long-term exposures may not become apparent for many years. Records enable subsequent medical care providers to be informed about worker's previous and current exposures.

OSHA regulations mandate that, unless a specific occupational safety and health standard provides a different time period, the employer must:

- Maintain and preserve medical records on exposed workers for 30 years after they leave employment (29 CFR 1910.20).
- Make available to workers, their authorized representatives, and authorized OSHA representatives the results of medical testing and full medical records and analyses (29 CFR 1910.20).
- Maintain records of occupational injuries and illnesses and post a yearly summary report (29 CFR 1904).

SECTION 4

AIR MONITORING

4.1 INTRODUCTION

Airborne contaminants can present a significant threat to worker health and safety. Thus, identification and quantification of these contaminants through air monitoring is an essential component of the health and safety program. Reliable measurements of airborne contaminants are useful for:

- Selecting personal protective equipment.
- Delineating areas where protection is needed.
- Assessing the potential health effects of exposure.
- Determining the need for specific medical monitoring.

This section delineates the factors to consider when conducting air monitoring. It presents strategies for assessing airborne contamination and describes instruments and methods for measuring exposures.

4.2 MONITORING REQUIREMENTS

4.2.1 General

Prior to initiating field activities, monitoring equipment shall be maintained and calibrated in accordance with the manufacturer's recommendations and protocols presented in Exhibit 3. Air monitoring for organic vapors in the breathing zone will be conducted with a Photovac MicroTIP® photoionization detector (PID) or equivalent during all groundwater sampling activities. A (PID) will be used to monitor volatile emissions under the following circumstances:

- immediately upon opening the wells;
- during all well development and sampling activities;
- from all development water retrieved from the wells.
- where intrusive activities into or below the soil cap are required; and
- when maintenance of remediation equipment (i.e.; sumps, vaults) are required.

If sustained PID readings above background are observed from the monitoring well, the area must be evacuated and field personnel must retreat upwind until emissions decrease. If emissions do not subside, field personnel shall don Level C protective equipment before resuming field operations.

4.2.2 Monitoring During Drilling

Because of the potential grinding involved during trenching, there is a potential for sparks to be generated. Since some of the compounds potentially present at the site are combustible, it will be necessary to monitor for combustible gasses. A combustible gas meter will be used to monitor during all test pitting. Guidelines have been established by the National Institute for Occupational Safety and Health (NIOSH) concerning the action levels for work in a potentially explosive environment. These guidelines are as follows:

1) 10% LEL - Limit all activities to those which do not generate sparks.
2) 20% LEL - Cease all activities in order to allow time for the combustible gases to vent. If the combustible gases in the test pit are not diminished after allowing adequate time to vent, then the following steps should be taken:
   - Obtain an air compressor (minimum 1.5 horsepower)
   - Place the compressor a safe distance from the test pit (at least 20 ft.). This precaution is necessary since the compressor itself is an ignition source.
   - Place hose into the pit until it reaches bottom.
   - Run compressor for 15 minutes.
   - Measure the percent LEL in the pit. If the reading continues above 20% LEL, continue to run the compressor. If levels are below 20% LEL, continue to monitor the pit for 5 minutes; if readings remain below 20% LEL, resume excavations, and continue to monitor.

4.2.3 Community Air Monitoring Plan

If particulates become a concern at this site, possibly during drilling activities, this community plan will be modified accordingly. Contaminants on site are not anticipated to pose a problem as particulates because of the moisture content of the soil.

- Volatile organic compounds must be monitored at the location of drilling activities. If total organic vapor levels exceed 5 ppm above background, drilling activities must be halted and monitoring continued under the provisions Section 5.2. All readings must be recorded and be available for State (NYSDEC & NYSDOH) personnel to review.
- If particulates become a concern, the following protocol will be followed. Particulates shall be continuously monitored downwind of the drilling zone with a portable particulate monitor that would have an alarm set at 150 $\mu g/m^3$. If downwind particulate levels, integrated over a period of 15 minutes, exceed 150 $\mu g/m^3$, then particulate levels upwind of the survey or work site would be measured. If the downwind particulate level is more than 100 $\mu g/m^3$ greater than the upwind particulate level, then drilling/excavation activities must be stopped and corrective action taken. All readings must be recorded and be available for State (DEC & DOH) personnel to review. These action levels can be modified if particulates are better characterized and identified.

4.3 VARIABLES OF SITE EXPOSURE

Complex, multisubstance environments pose significant challenges to accurately and safely assessing airborne contaminants. Several independent and uncontrollable variables, most notably temperature and weather conditions, can affect airborne concentrations. These factors must be considered when developing an air monitoring program and when analyzing data. Some demonstrated variables include:

- **Temperature**. An increase in temperature increases the vapor pressure of most chemicals.
- **Windspeed**. An increase in wind speed can affect vapor concentrations near a free-standing liquid surface. Dusts and particulate-bound contaminants are also affected.
- **Rainfall**. Water from rainfall can essentially cap or plug vapor emission routes from open or closed containers, saturated soil, or lagoons, thereby reducing airborne emissions of certain substances.
- **Moisture**. dusts, including finely divided hazardous solids, are highly sensitive to moisture content. This moisture content can vary significantly with respect to location and time and can also affect the accuracy of many sampling results.
- **Vapor Emissions**. The physical displacement of saturated vapors can produce short-term, relatively high vapor concentrations. Continuing evaporation and/or diffusion may produce long-term low vapor concentrations and may involve large areas.
- **Work Activities**. Work activities (i.e. drilling) often require the mechanical disturbance of contaminated materials, which may change the concentration and composition of airborne contaminants.

SECTION 5

PERSONAL PROTECTIVE EQUIPMENT AND ACTION LEVELS

5.1 INTRODUCTION

The Buffalo Color Corporation Area "D" Site will be a hazardous site during the post-remedial construction period. Therefore, visitors will not be permitted to enter the site without authorization and/or accompaniment by authorized personnel. Field personnel, must utilize appropriate PPE when conducting O&M activities. Operators handling chemicals in the onsite groundwater treatment facility must be trained in the proper selection and use of PPE.

5.2 ACTION LEVELS FOR PERSONAL PROTECTIVE EQUIPMENT

Various levels of PPE and the circumstances under which protective equipment should be donned are described in the following paragraphs. A summary of field activities and associated personal protective equipment is presented in Table 5.1.

Level D personal protective equipment will be worn during normal operation of the wastewater treatment plant. Any employees that experience irritation of the eyes, nose, or throat (or other symptoms of exposure) while working in the wastewater treatment plant, should immediately report the incident to AlliedSignal and BCC. Any needed medical care will be provided and the need to modify/upgrade the levels of personal protection will be assessed.

5.2.1 Vapor Emissions

Flammable material signs must be posted in the LNAPL recovery area. Ventilation of the area should be employed to minimize the potential for flammable vapors to accumulate. Air monitoring will not be required during normal operation of the treatment plant.

5.2.2 Conditions for Level D Protection

Level D protection consists of a standard work uniform for the activities being performed. Level D will be worn for initial site entry whenever field activities are being conducted. The following physical site conditions must be met for Level D PPE to be acceptable.

- Volatile Organic Compounds

  The level of volatile organic compounds must be less than 5 ppm above background.

- Equipment Required For Level D includes:
  - Coveralls;
  - Safety boots;
  - Nitrile outer and latex inner gloves (must be worn during all sampling activities);

- Hard hat (must be worn during drilling activities); and
- Safety glasses or (splash goggles must be worn if a splash hazard is present).

Modified Level D will be worn if the potential for a splash hazard exists, or when entering the Buffalo River to conduct sediment sampling. Modified level D may include:

- Tyvek suit or equivalent; and/or
- Life jacket.

5.2.3 Conditions for Level C

Level C PPE will be worn during any drilling operations on the site in areas where LNAPL is known to exist.

Additionally, during any construction activities requiring Level D Protection under normal conditions, the level of PPE will be upgraded to Level C if any of the following conditions are present:

- Volatile Organic Compounds

  The level of volatile organic compounds exceeds 5 ppm above background, but is below 50 ppm.

- Non-volatile and Semi-volatile Compounds

  Hydrogen Cyanide Draeger® tube readings less than 5 ppm. Readings greater than 5 ppm require Level B PPE.

- PCBs and Airborne Semi-Volatile Compounds

  It is not possible to directly monitor the concentrations of airborne semi-volatile compounds or PCBs, which might be generated as a result of wind dispersion of soils. Therefore, to avoid any potential exposure, workers will wet down the surrounding area with water when work is being conducted in a non-vegetated area or downwind of a non-vegetated area on a windy day. If the site Health and Safety Officer or any member of the field team suspects that these measures are insufficient to provide adequate personal protection, then workers may don a full-face air-purifying respirator equipped with HEPA cartridges.

- Equipment Required For Level C

  - Full-face air-purifying respirator with combination dust/organic vapor cartridges
  - Tyvek overall suit or equivalent
  - Nitrile outer and latex inner gloves
  - Safety boots
  - Hard hat (must be worn during drilling activities)

5.3 OSHA REQUIREMENTS FOR PERSONAL PROTECTIVE EQUIPMENT

All personal protective equipment used during the course of field work must be approved in accordance with the following standards:

Type of Protection	Regulation	Source
Eye and Face	29 CFR 1910.133	ANSI Z87.1-1968
Respiratory	29 CFR 1910.134	ANSI Z88.1-1980
Head	29 CFR 1910.135	ANSI Z89.1-1969
Foot	29 CFR 1910.136	ANSI Z41.1-1967

ANSI = American National Standards Institute

Both the respirator and cartridges specified for use in Level C protection must be fit tested prior to use in accordance with OSHA regulations (29 CFR 1910.1025; 29 CFR 1910.134). Documentation of fit testing should be maintained onsite by the site Health and Safety Officer.

Air purifying respirators cannot be worn under the following conditions:

- Oxygen deficiency
- Air monitoring concentrations including: readings of greater than 5 ppm Hydrogen Cyanide (indicated by Draeger® tube); or greater than 50 ppm organic vapors (indicated by PID).
- High relative humidity
- If contaminant levels exceed designated use concentrations on respirator cartridges.

5.4 SELECTION OF EQUIPMENT

The individual components of clothing and equipment must be assembled into a full protective ensemble that both protects the worker from the site-specific hazards and minimizes the hazards and drawbacks of the PPE ensemble itself.

The MSDSs provided in Exhibit 2 contain recommendations regarding the types of PPE to use when dealing with each chemical. The MSDSs can be used as a starting point for ensemble creation; however, each ensemble must be tailored to the specific situation in order to provide the most appropriate level of protection. For example, if work is being conducted in an area where the potential for contamination is high, it may be advisable to wear a disposable covering, such as Tyvek coveralls or PVC splash suits, over the protective ensemble.

The type of equipment used and the overall level of protection should be reevaluated periodically as the amount of information about the Site increases, and as workers are required to perform different tasks. Personnel should be able to upgrade or downgrade their level of protection with concurrence of the Site Safety Officer and approval of the Field Team Leader.

Reasons to upgrade:

- Known or suspected presence of dermal hazards.

- Occurrence of likely occurrence of gas or vapor emission.
- Change in work task that will increase contact or potential contact with hazardous materials.
- Request of the individual performing the task.

Reasons to downgrade:

- New information indicating that the situation is less hazardous than was originally thought.
- Change in site conditions that decreases the hazard.
- Change in work task that will reduce contact with hazardous materials.

Care must be taken to ensure that the PPE being used is compatible with the chemical being handled. For example, if chemically protective gloves show signs of deterioration or stiffening, they are probably not compatible with all of the chemical being handled, and another type of protective glove should be selected.

TABLE 5.1
ACTION LEVEL/PPE SUMMARY TABLE

Level D

Activities/Action Levels:

- General site reconnaissance, maintenance, and other non-intrusive activities.
- PID readings in ambient air less than 5 ppm (based on presence of phenol).
- Hydrogen Cyanide Draeger® Tube readings less than 5 ppm.

Personal Protective Equipment:

- Standard work uniform including inner and outer gloves, overalls, safety glasses, and hard hat (during drilling/heavy equipment operations).

Modified Level D

Activities/Action Levels:

- When conducting groundwater sampling protection against splash hazards is required; or
- When conducting any work within the river, special health and safety equipment is required.

Personal Protective Equipment:

- Tyvek suit
- Splash apron
- Life jacket

Level C

Activities/Action Levels:

- When PID readings in ambient air exceed 5 ppm, but are below 50 ppm and Hydrogen Cyanide Draeger® Tube readings are below 5 ppm.
- If PID readings in ambient air exceed 5 ppm, all activities in the area of the readings must cease. Personnel will then consult the Health and Safety Officer and Site Contingency Plan for guidance.

Personal Protective Equipment:

- full face air purifying respirator with combination dust/organic vapor cartridges;
- tyvek overall suit or equivalent;
- nitrile outer and latex inner gloves;
- safety boots; and
- hard hat.

SECTION 6

COLLECTION & SHIPMENT OF SAMPLES

6.1 INTRODUCTION

The information contained in this Plan is to provide guidance to ensure adequate protection of human health and the environment during the collection and transportation of environmental and waste samples at the Site. The frequency of sample collection, types of analysis to be conducted, and additional sampling protocol are specified in the Post-Remedial Construction Operations & Maintenance Plan (Parsons ES, February 1996).

6.2 ENVIRONMENTAL SAMPLES

Environmental samples refer to groundwater, surface water, and sediment samples. These samples will be packaged and shipped according to the following procedure:

Packaging

1. Place sample container, properly identified and with a sealed lid, in a polyethylene bag, and seal bag;
2. Place sample in a fiberboard container or plastic cooler which has been lined with a large polyethylene bag.
3. Pack with enough noncombustible, absorbent, cushioning material to minimize the possibility of the container breaking.
4. Seal large bag.
5. Seal or close outside container

Marking/Labeling

Sample containers must have a completed sample identification label and the outside container must be marked "Environmental Sample". The appropriate side of the container must be marked "This End Up" and arrows should be drawn accordingly. No specific DOT labeling is required.

Shipping Papers

No DOT shipping papers are required, but laboratory chain-of-custody forms must be signed prior to releasing the package to the carrier.

Transportation

There are no DOT restrictions on mode of transportation.

6.3 HAZARDOUS SAMPLES

The Post Remedial Construction Operations & Maintenance Plan requires collection of samples which may contain LNAPL. LNAPL samples will be shipped as DOT Hazardous Materials. The designation "Flammable Liquid" will be used. Refer to International Air Transport Association Guidelines for shipping dangerous goods if the carrier will move the package by air. A completed airway bill must accompany the package and all appropriate labels must be attached to the package.

The samples will be transported as follows:

1. Collect sample in a 16-ounce or smaller glass or polyethylene container with nonmetallic teflon-lined screw cap. Allow sufficient air space (approximately 10 percent by volume) so container is not liquid full at 54°C (130°F). If collecting a solid material, the container plus contents should not exceed 1 pound net weight. If sampling for volatile organic analysis, fill VOA container to septum, but place the VOA container inside a 16-ounce or smaller container so the required air space may be provided. Large quantities, up to 3.786 liters (1 gallon), may be collected if the sample's flash point is 23°C (75°F) or higher. In this case, the flash point must be marked on the outside container (i.e. carton, cooler), and shipping papers should state that "Flash point is 73°F or higher".

2. Seal sample and place in a 4-mil thick polyethylene bag, one sample per bag.

3. Place sealed bag inside a metal jerrican with noncombustible, absorbent cushioning material (i.e. vermiculite or earth) to prevent breakage, one bag per can. Pressure-close the can and use clips, tape or other positive means to hold the lid securely.

4. Mark the can with:

   - Name and address of originator
   - "Flammable Liquid N.O.S., UN 1993"
   - "No Passenger Aircraft"

   NOTE: UN numbers are now required in proper shipping names.

5. Place one or more metal cans in a strong outside container such as an approved plastic cooler or DOT labeled fiberboard box. Preservatives are not used for hazardous waste site samples.

6. Prepare for shipping:

   "Flammable Liquid, N.O.S., UN 1993" or "Flammable Solid, N.O.S., UN 1325"; "Cargo Aircraft Only (if more than 1 quart net per outside package); "Limited Quantity" or "Ltd. Qty."; "Laboratory Samples"; "Net Weight ~" or "Net Volume ~" (of hazardous contents) should be indicated on shipping papers and on outside of shipping container. "This Side Up" or "This End Up" should also be on the container. Sign the shipper certification.

7. Stand by for possible carrier requests to open outside containers for inspection or to modify the packaging. It is wise to contact the carrier before packing to ascertain local packaging requirements, and not to leave area before the carrier vehicle (aircraft, truck) is on its way.

6.4 SHIPPING PAPERS

Shipping papers should be filled out and maintained within the driver's reach, whenever hazardous materials are transported in a vehicle. Such materials may include:

- Gasoline (for use in a generator UN1203, Guide #27;
- Methanol (for use in decontamination procedures) UN 1230 Guide #28;
- Nitric Acid (for use in decontamination procedures) UN 1760, Guide #60;
- Hydrochloric Acid (for use in decontamination procedures) UN 1789, Guide #60;
- Compressed Gas (calibration gas for the PID, or breathing air for Level B work); and/or
- Other hazardous materials as defined by the DOT.

Appropriate MSDSs should be maintained with the shipping papers and/or the pocket DOT Emergency Response Guidebook.

SECTION 7

ACCIDENT PREVENTION AND CONTINGENCY PLAN

7.1 INTRODUCTION

The objective of this Accident Prevention and Contingency Plan is to establish procedures for handling events which occur outside the scope of the routine maintenance and minimize hazards to human health, and the environment. The contingency plan, which outlines response actions, should be implemented following the identification of a site condition which is not covered by the routine maintenance plan.

Natural occurrences such as storms, drought, and subsidence should be considered "expected occurrences" and are addressed under the routine maintenance program. Certain problems which cannot be reasonably expected to occur, such as earthquakes, are not addressed in this contingency plan.

The following guidelines are offered to determine when the contingency plan should be implemented and to evaluate possible corrective actions when responding to an emergency. All corrective actions, where appropriate, will be executed in a timely fashion; and must include notification of the appropriate regulatory agencies.

7.2 ACCIDENT PREVENTION

7.2.1 Personnel Training

All field personnel will receive health and safety training prior to the initiation of any site activities and will be briefed on daily sign-in procedures. A daily sign-in log will be maintained by the field team leader. On a day-to-day basis, individual personnel should be constantly alert for indicators of potentially hazardous situations and for signs and symptoms in themselves and others that warn of hazardous conditions and exposures. Rapid recognition of dangerous situations can avert an emergency. Before daily work assignments, regular meetings should be held. Discussion should include:

- Tasks to be performed.
- Time constraints (e.g., rest breaks, cartridge changes).
- Hazards that may be encountered, including their effects, how to recognize symptoms or monitor them, concentration limits, or other danger signals.
- Evacuation routes and safe zones, which may change from day to day depending upon location of work to be performed.
- Communication protocols including use of two-way radios and standard hand signals.
- Emergency procedures.

All field personnel shall adhere to the standard safe work practices (see Exhibit 4) as the primary means for accident prevention.

7.2.2 Vehicles and Heavy Equipment

Working with large motor vehicles and heavy equipment could be a major hazard at this site. Injuries can result from equipment hitting or running over personnel, impacts from flying objects, or overturning of vehicles. Vehicle and heavy equipment design and operation will be in accordance with 29 CFR, Subpart O, 1926.600 through 1926.602. In particular, the following precautions will be utilized to help prevent injuries/accidents.

- Brakes, hydraulic lines, light signals, fire extinguishers, fluid levels, steering, tires, horn, and other safety devices will be checked at the beginning of each shift.
- Large construction motor vehicles will not be backed up unless:
  - The vehicle has a reverse signal alarm audible above the surrounding noise level; or
  - The vehicle is backed up only when an observer signals that it is safe to do so.
- Heavy equipment or motor vehicle cable will be kept free of all nonessential items, and all loose items will be secured.
- Large construction motor vehicles and heavy equipment will be provided with necessary safety equipment (seat belts, roll-over protection, emergency shut-off in case of roll-over, backup warning lights and audible alarms.)
- Blades and buckets will be lowered to the ground and parking brakes will be set before shutting off any heavy equipment or vehicles.

7.3 CONTINGENCY PLAN IMPLEMENTATION

7.3.1 Responsible Personnel

At all times, there will be at least one employee (the "Response Coordinator") either at the facility or on call, responsible for coordinating all emergency response measures. The Response Coordinator must be familiar with all aspects of the operations onsite, location, and characteristics of all materials handled, and emergency resources available. The Response Coordinator must be thoroughly familiar with all facets of this plan.

All personnel and outside contractors who work at the facility must be familiar with the provisions of this plan including AlliedSignal's Health and Safety protocol, and the BCC Health and Safety Plan. Their training must be documented by the Response Coordinator as part of the Site's operating record.

7.3.2 Procedures

The Site Manager will designate a Response Coordinator, who will be responsible for ensuring proper execution of the Emergency Response Plan. The Response

Coordinator may be any onsite employee who has received adequate training in implementation of the contingency plan.

a. Responsibilities of the Response Coordinator BEFORE an emergency include the following:

   1. Ensure there is an Alternate Response Coordinator ready to take over in his absence who is fully trained and capable of assuming control in emergency situations;

   2. Become familiar with the physical layout of the site, and the operations carried out;

   3. Develop an understanding of the emergency response organization; and

   4. Establish close cooperation with BCC and local response agencies, including briefing them on potential hazards and facility emergency procedures.

b. Responsibilities of the Response Coordinator DURING an emergency include the following:

   1. Direct and coordinate all response activities;

   2. Request assistance of BCC and local response agencies, if needed;

   3. Coordinate the efforts of onsite personnel with BCC and offsite emergency response agencies;

   4. Supervise the evacuation of non-essential personnel from the area of the emergency;

   5. Assess possible hazards to human health and the environment that may result from a chemical release, fire, or explosion; including the effects of the release, fire, or explosion. The assessment will include considerations on the effects of toxic, irritating or asphyxiating gases, hazardous surface runoff due to water or chemical agents used to control fires, etc. If it is determined through these assessments that offsite areas may need to be evacuated, the Response Coordinator will immediately contact BCC, and assist the appropriate authorities to accomplish this; and

   6. Supervise emergency surveillance of the area for leaks, pressure build-ups, gas generation or ruptures in valves, pipes, and other equipment if the facility stops operations.

c. Responsibilities of the Response Coordinator AFTER an emergency include the following:

   1. Ensure that all aspects of the situation have been addressed including an immediate and thorough examination of the entire emergency area, and all equipment which may have been involved in the incident;

   2. Supervise post-emergency surveillance of the area to ensure that an emergency situation does not redevelop;

3. Establish normal facility operation; if this is not possible, ensure that alternate options are developed;
4. Supervise post-emergency clean-up and provide for testing, storing, and disposing of recovered waste, plus contaminated materials used to mitigate the emergency situation;
5. Supervise the redevelopment of emergency equipment and material back into a state of readiness;
6. Determine the cause of the emergency;
7. Develop or modify operating procedures and equipment to prevent future emergencies from similar causes;
8. Modify existing emergency response procedures, if required;
9. Notify AlliedSignal, BCC, and the appropriate regulatory agencies; and
10. Prepare a report for the operating record which includes: date and time, who responded, type of incident, details of areas/materials involved, procedures used, post-emergency response, personnel injuries, etc.

7.3.3 Arrangements with Emergency Authorities and Contractors

The appropriate local authorities and contractors who may be called upon for assistance during an emergency must be apprised of that possibility and provided a copy of this plan. Transmittal of the Contingency Plan to BCC, local response agencies, and hospitals must be documented by the Response Coordinator. Refer to Table 7.1 for a listing of local authorities and contractors.

7.4 RESPONSE ACTIONS

7.4.1 General

The response actions outlined in the following sections contain general guidelines in the event of an emergency situation at the facility. These guidelines provide the information necessary to inform appropriate company personnel and outside agencies of the potential hazards and response actions that may be required in an emergency. Response to any emergency situation must be conducted in accordance with BCC rules. The communication system(s) available at the facility are identified in Table 7.2.

Emergency conditions are considered to exist if:

- Any member of the field crew is involved in an accident or experiences any adverse effects or symptoms of exposure while on site.
- A condition is discovered that suggests the existence of a situation more hazardous than anticipated.

In the event that an emergency develops on site, the procedures delineated herein are to be immediately followed:

- Notify the paramedics and/or fire department, as necessary;
- Signal the evacuation procedure previously outlined and implement the entire procedure;

- Isolate the area;
- Stay upwind of any fire;
- Keep the area surrounding the problem source clear after the incident occurs;
- Complete accident report form and distribute to appropriate personnel.

7.4.2 Fire and Explosions

Fires and gas explosions at the facility must be immediately reported to BCC and the local fire department (listed in Table 7.1) for assistance. Any trained emergency response personnel may extinguish the fire if conditions permit this to be accomplished safely. Appropriate response measures, including personnel safety, will be the responsibility of BCC and the fire department. Fires will be extinguished according to approved fire department protocol. The Response Coordinator will coordinate evacuation of the impacted area and account for all personnel onsite. At the earliest possible time, the Site Manager must be notified of the situation. Damage to the surface drainage system or cap will be repaired and documented.

7.4.3 Release of Hazardous Material

Anyone discovering a release of hazardous (or unknown) material at the facility must immediately contact BCC and the Response Coordinator. The Response Coordinator must identify the material involved and direct all containment, cleanup, and remedial efforts according to information in the MSDS (Exhibit 2). At the earliest possible time, the Site Manager must be notified of the situation. If necessary, actions will be implemented to assess potential groundwater or surface water contamination and/or emissions. If required, the appropriate regulatory agencies must be notified of the release (refer to Table 7.1).

7.4.4 Release of Non-Hazardous Material

Anyone discovering a release of an identified non-hazardous material at the facility must immediately contact BCC and the Response Coordinator. The Response Coordinator will direct all containment, cleanup, and remedial efforts to be performed. If necessary, any follow-up assessments or notifications will be made by the Response Coordinator. At the earliest possible time, the Site Manager must be notified of the situation.

7.4.5 Unauthorized Dumping and Disposal

Unauthorized dumping or waste disposal will be reported to the Response Coordinator who will notify BCC, AlliedSignal, the NYSDEC, and local enforcement officials. Appropriate measures will be taken to determine the waste characteristics, containment requirements, and the necessary removal techniques. The waste will be removed and disposed of at an approved disposal facility, as appropriate. Efforts will be taken to eliminate further dumping by restricting subsequent entry to the site. Persons found in the act of illegal dumping will be prosecuted according to the law and will be held responsible for all costs incurred in removing and disposing of the waste.

7.4.6 Medical Emergency

In the event of a medical emergency, personnel must immediately contact BCC and the appropriate local response agencies (as listed in Table 7.1). A the earliest possible time, the Response Coordinator must be notified. The Response Coordinator will be responsible for ensuring that follow-up procedures are completed. Please refer to Figure 7.1 for a map to nearest medical facility.

7.4.7 Chemical Exposure

If a member of the field crew demonstrates symptoms of chemical exposure the procedures outlined below should be followed:

- Another team member (buddy) should remove the individual from the immediate area of contamination. The buddy should communicate to the Field Team Leader (via voice and hand signals) of the chemical exposure. The Field Team Leader should contact the appropriate emergency response agency.
- Precautions should be taken to avoid exposure of other individuals to the chemical.
- If the chemical is on the individual's clothing, the chemical should be neutralized or removed if it is safe to do so.
- If the chemical has contacted the skin, the skin should be washed with copious amounts of water.
- In case of eye contact, an emergency eye wash should be used. Eyes should be washed for at least 15 minutes.
- All chemical exposure incidents must be reported in writing to the BCC Health and Safety Representative. The Site Health and Safety Officer or Field Team Leader is responsible for completing the accident report (See Exhibit 5).

7.4.8 Evacuation Procedures

- The Field Team Leader will initiate evacuation procedure by signalling to leave the site.
- All personnel in the work area should evacuate the area and meet in the common designated area, as determined by Field Team Leader based on wind conditions and other criteria.
- All personnel suspected to be in or near the contract work area should be accounted for and the whereabouts of missing persons determined immediately.
- Further instruction will then be given by the Field Team Leader.

7.4.9 Vehicle Accident

In the event of an offsite vehicle accident, the local police must immediately be contacted to file a report. If an accident occurs onsite involving a non-site owned vehicle or an injury (regardless of the vehicle involved), personnel must immediately contact the local police department (as listed in Table 7.1) to file a report.

If an onsite accident involves only a site owned vehicle, BCC must be contacted and an internal investigation report must be prepared. In any of these situations, the Response Coordinator must be notified as soon as possible. The Response Coordinator will be responsible for ensuring that follow-up procedures and documentation are completed.

7.4.10 Personal Injury

In case of personal injury at the site, the following procedures should be followed:

- Another team member (buddy) should signal the Field Team Leader that an injury has occurred and BCC should be notified via radio communication.
- A field team member trained in first aid can administer treatment to an injured worker.
- For severe injuries, the victim should then be transported to the nearest hospital or medical center. If necessary, an ambulance should be called to transport the victim.
- For less severe cases, the individual can be taken to the site BCC first aid center.
- The Field Team Leader or Site Health and Safety Officer is responsible for making certain that an accident report form is completed. This form is to be submitted to the Office Health and Safety Representative. Follow-up action should be taken to correct the situation that caused the accident.

7.4.11 Property Damage and/or Theft

Any property damage and/or theft, discovered at the facility will immediately be reported to BCC and the local police department (as listed in Table 7.1) to file a report. At the earliest possible time, the Response Coordinator must be notified. The Response Coordinator will be responsible for ensuring that follow-up procedures and documentation are completed.

7.5 MAINTENANCE AND/OR REVISIONS TO PLAN

7.5.1 Maintenance

The Response Coordinator must review this plan on an annual basis, at a minimum, and document the review in the site's operating record. The Plan must also be reviewed after implementation in an emergency to determine if any changes in the Plan are needed to improve its effectiveness. Should any aspect of the site's operations (including personnel changes), equipment, or arrangements with local authorities or contractors change, the plan must be revised accordingly.

7.5.2 Revisions

The Response Coordinator must ensure that any revisions made to the plan are distributed for insertion into all copies of the plan. Documentation that all affected personnel have been made familiar with the revisions must be maintained by the response coordinator.

General emergency procedures, and specific procedures for personal injury and chemical exposure, are described in the health and safety plan.

TABLE 7.1
EMERGENCY CONTACTS

In the event of any situation requiring assistance, the appropriate contact(s) should be made from the list below. For emergency situations, first contact the Site Response Coordinator. The Site Response Coordinator will contact emergency personnel that will dispatch the appropriate response teams. **This emergency contacts list must be maintained in an easily accessible location at the site.**

Contingency Contacts	Phone Number
Nearest phone located onsite	BCC Radio Communication
Fire Department	911 and BCC Radio
Buffalo Police	911
Poison Control Center	(800) 888-7655
Oil or Toxic Chemical Spills;	(800) 424-8802
UFPO (Underground Utilities)	(800) 962-7962
Utility Emergencies (Electric):	(800) 637-2770
Utility Emergencies (Gas):	(800) 627-6466
Parsons ES Contract Physician (Healthworks)	(716) 874- 7474
NYSDOH	
Cameron O'Conner	(716) 847-4502
NYSDEC	
Greg Sutton	(716) 851-7220
Medical Emergency	
Ambulance:	911
Hospital Name:	Mercy Hospital of Buffalo
Hospital Phone Number:	(716) 826-7000, Information
Hospital Address:	565 Abbott Road Buffalo, New York 14220
Map to Hospital:	See Figure 1
Travel Time From Site:	5-7 Minutes

ROUTE TO HOSPITAL:

1.) Exit the site and turn right onto Lee Street.

2.) Turn left onto South Park Avenue.

3.) Travel east approximately 1 mile and turn right onto Abbott Road after crossing Route 62.

4.) Travel south on Abbott Road, approximately 1 mile, to Mercy Hospital.

5.) Look for hospital and emergency entrance on the right.

<u>Contact</u>

AlliedSignal,Inc.

David Paley
Manager, Site Remediation
101 Columbia Road
Morristown, New Jersey 07962
(201) 455-3302

TABLE 7.2
ONSITE EMERGENCY EQUIPMENT AND EXITS

This Table provides the location and description of emergency equipment and exits.

LOCATIONS TO BE DETERMINED

a. Entrances (keys)

b. Emergency Exits & Evacuation Areas

c. Emergency Alarm System

d. Communication System

e. Fire Extinguishing Equipment

f. Spill Control Equipment

g. First Aid Stations

h. Eye Wash Station

i. Safety Shower

j. Personal Protective Equipment

k. Operating Equipment

l. Portable lighting, hand tools, etc.

m. Monitoring Equipment

n. Copy of Emergency Response Plan

SECTION 8

DECONTAMINATION

8.1 DECONTAMINATION

Due to the low level of contaminants expected, any water used in decontamination procedures will be disposed of onsite.

8.1.1 Decontamination of Personnel

Decontamination will not be necessary when only Level D protection is used. However, disposable gloves used during sampling activities should be removed and bagged; personnel should be encouraged to remove clothing and shower as soon as is practicable at the end of the day. All clothing should be machine-washed. All personnel will wash hands and face prior to eating and before and after using the restroom.

Decontamination will be necessary if Level C protection is used. The following OSHA-specified procedures include steps necessary for complete decontamination prior to entry into the support zone, and steps necessary if a worker only needs to change a respirator or respirator canister. All spent PPE will be placed in a drum specified for PPE and sampling equipment only.

Modification can be made to the twelve station decontamination process by the site health and safety officer depending upon the extent of contamination.

<u>Station 1: Segregated Equipment Drop</u>

Deposit equipment used on the site (tools, sampling devices and containers, monitoring instruments, clipboards, etc.) on plastic drop cloths or in different containers with plastic liners. Each will be contaminated to a different degree. Segregation at the drop reduces the probability of cross-contamination. All documentation including field books and field forms will be transferred to support personnel until the decontamination procedure is completed.

<u>Station 2: Suit/Safety Boot and Outer-Glove Wash</u>

Thoroughly wash chemically resistant suit, safety boots and outer gloves. Scrub with long-handle, soft-bristle scrub brush and copious amounts of Alconox/water solution.

Necessary equipment includes:

1. Wash tub (30 gallon or large enough for person to stand in)
2. Alconox/water solution
3. Long-handle soft-bristle scrub brushes

<u>Station 3: Suit/Safety Boot and Outer-Glove Rinse</u>

Rinse off Alconox/water solution using copious amounts of water. Repeat as many times as necessary.

Necessary equipment includes:

1. Wash tub (30 gallon or large enough for person to stand in)
2. Spray unit
3. Water
4. Long-handle, soft-bristle scrub brushes

Station 4: Outer Gloves Removal

Remove the outer gloves and deposit in individually marked plastic bags.

Necessary equipment includes:

1. Plastic bag

Station 5: Canister or Mask Change

If a worker leaves the exclusion zone to change a canister (or mask), this is the last step in the decontamination procedures. The worker's canister is exchanged, new outer glove donned, and joints taped. Worker returns to duty. Otherwise the worker proceeds to Station 6.

Necessary equipment includes:

1. Canister (or mask)
2. Tape
3. Gloves

Station 6: Removal of Chemically Resistant Suit

With assistance of helper, remove suit. Deposit in container with plastic liner.

Necessary equipment includes:

1. PPE drum

Station 7: Inner-Glove Wash

Wash inner gloves with Alconox/water solution that will not harm skin. Repeat as many times as necessary.

Necessary equipment includes:

1. Alconox/water solution
2. Wash tub
3. Long-handle, soft-bristle brushes

Station 8: Inner-Glove Rinse

Rinse inner gloves with water. Repeat as many times as necessary.

Necessary equipment includes:

1. Water
2. Wash tub

Station 9: Respirator Removal

Remove face-piece. Avoid touching face. Wash respirator in clean, sanitized solution, allow to dry and deposit face-piece in plastic bag. Store in clean area.

Necessary equipment includes:

1. Plastic bags
2. Sanitizing solution
3. Cotton

Station 10: Inner-Glove Removal

Remove inner gloves and deposit in container with plastic liner.

Necessary equipment includes:

1. PPE drum

Station 11: Field Wash

Wash hands and face.

Necessary equipment includes:

1. Water
2. Soap
3. Tables
4. Wash basins or buckets
5. Clean towels

Station 12: Redress

If re-entering exclusion zone put on clean field clothes (e.g., Tyvek, gloves, etc.).

Necessary equipment includes:

1. Table
2. Clothing

8.1.2 Decontamination of Equipment and Sample Bottles

Construction equipment may be used onsite if repairs to the monitoring wells or cap are needed. Construction equipment leaving the site, that may have contacted waste fill, will be steam cleaned and decontaminated prior to removal from the site. The equipment will be decontaminated in the following manner:

- The construction equipment will be steam cleaned to remove gross contamination.

Should the exterior of monitoring equipment and sample bottles become grossly contaminated, they will be decontaminated using a phosphate free detergent solution, such as Alconox and potable water rinse.

EXHIBIT 1

FORMS FOR HEALTH AND SAFETY-RELATED ACTIVITIES

Note: The OSHA Job Safety and Health Protection Poster must be posted prominently during field activities. The following page is an example of the poster to be used in the field. The actual poster must be an 11 inch by 17 inch size version of this page.

PROJECT HEALTH AND SAFETY PLAN

AND WORK PLAN ACCEPTANCE FORM

(For Operations and Maintenance employees only)

I have read and agree to abide by the contents of the Post-Remedial Construction Operation and Maintenance Plan and Health and Safety Plan for the Buffalo Color Corporation.

Furthermore, I have read and am familiar with the Health and Safety Plan requirements of the Buffalo Color Corporation.

Name (print)	Signature	Date

Place in project Health and Safety File as soon as possible.

SITE-SPECIFIC HEALTH AND SAFETY TRAINING

For All Operation and Maintenance employees and subcontract employees on the Buffalo Color Area "D" Site

I hereby confirm that site-specific health and safety training has been conducted by the site health and safety officer which included:

- Names of personnel responsible for site safety and health;
- Safety, health, and other hazards at the site;
- Proper use of personal protective equipment;
- Work practices by which the employee can minimize risk from hazards;
- Safe use of engineering controls and equipment on the site;
- Acute effects of compounds at the site;
- Decontamination procedures; and
- Requirements of the Buffalo Color Corporation Health and Safety Plan.

Name (print)	Signature	Date

Place in project Health and Safety File as soon as possible.

EXHIBIT 2

MATERIAL SAFETY DATA SHEETS

[To be provided upon startup of the Wastewater Treatment Plant]

EXHIBIT 3

AIR MONITORING EQUIPMENT CALIBRATION AND MAINTENANCE

AIR MONITORING EQUIPMENT CALIBRATION AND MAINTENANCE

All monitoring instruments must be calibrated and maintained periodically. The limitations and possible sources of errors for each instrument must be understood by the operator. It is important that the operator ensures that the instrument responds properly to the substances it was designed to monitor. Portable air quality monitoring equipment that measures total ionizables present, such as the Photovac MicroTIP HL-2000® must be calibrated at least once each day. Combustible gas/oxygen/%LEL meters (explosimeters) such as the MSA Model 360® must be calibrated at least once each week. The specific instructions for calibration and maintenance provided for each instrument should be followed.

EXHIBIT 4

STANDARD SAFE WORK PRACTICES

STANDARD SAFE WORK PRACTICES

1) Eating, drinking, chewing tobacco, smoking and carrying matches or lighters is prohibited in a contaminated or potentially contaminated area or where the possibility for the transfer of contamination exists.

2) Avoid contact with potentially contaminated substances. Do not walk through puddles, pools, mud, etc. Avoid, whenever possible, kneeling on the ground, leaning or sitting on equipment or ground. Do not place monitoring equipment on potentially contaminated surfaces (i.e., ground, etc).

3) All field crew members should make use of their senses to alert them to potentially dangerous situations in which they should not become involved; i.e., presence of strong and irritating or nauseating odors.

4) Prevent, to the extent possible, spillages. In the event that a spillage occurs, contain liquid if possible.

5) Field crew members shall be familiar with the physical characteristics of investigations, including:

- Wind direction
- Accessibility to associates, equipment, vehicles
- Communication
- Hot zone (areas of known or suspected contamination)
- Site access
- Nearest water sources

6) All wastes generated during activities onsite should be disposed of as directed by the project manager or his onsite representative.

7) Protective equipment as specified in the section on personnel protection will be utilized by workers during the initial site reconnaissance, and other activities.

EXHIBIT 5

ACCIDENT REPORT FORM

ACCIDENT REPORT FORM

Project Name:______________________________

INJURED OR ILL EMPLOYEE

1. Name ______________________ Social Security #_______________
   (First) (Middle) (Last)
2. Home Address ____
   (No. and Street) (City or Town) (State)
3. Age ____ 4. Sex: Male ( ) Female ( )
5. Occupation ____
   (Specific job title, not the specific activity employee was performing at time of injury)
6. Department ____
   (Enter name of department in which injured person is employed, even though they may have been temporarily working in another department at the time of injury)

EMPLOYER

7. Name ____
8. Mailing Address ____
   (No. and Street) (City or Town) (State)
9. Office location, if different from mailing address ____________________

   ____

THE ACCIDENT OR EXPOSURE TO OCCUPATIONAL ILLNESS

10. Place of accident of exposure __________________________________
    (No. and Street) (City or Town) (State)
11. Was place of accident or exposure on employer's premises? _____(Yes/No)
12. What was the employee doing when injured?________________________

____

(Be specific - was employee using tools or equipment or handling material?)

____

13. How did the accident occur? __________________________________
    (Describe fully the events which resulted in the injury or

____

occupational illness. Tell what happened and how. Name objects and

____

substances involved. Give details on all factors which led to accident. Use separate sheet if needed)

ACCIDENT REPORT FORM

(Page 2 of 2)

14. Time of accident: ______________

15. Date of injury or initial diagnosis of occupational illness ____________ (Date)

16. ES WITNESS TO ACCIDENT

(Name)	(Affiliation)	(Phone No.)

OCCUPATIONAL INJURY OR OCCUPATIONAL ILLNESS

17. Describe the injury or illness in detail and indicate the part of the body affected. ____

____

18. Name the object or substance which directly injured the employee. (For example, object which struck employee; the vapor or poison inhaled or swallowed; the chemical or radiation which irritated the skin; or in cases of strains, hernias, etc., the object the employee was lifting, pulling, etc.

____

____

19. Did the accident result in employee fatality? _______ (Yes or No)

20. Number of lost workdays ____/restricted workdays _____ resulting from injury or illness?

OTHER

21. Did you see a physician for treatment? _______ (Yes or No) _______ (Date)

22. Name and address of physician ______________________________

____

23. If hospitalized, name and address of hospital ______________________

____

Date of report ________________ Prepared by ________________

Official position ____________________

ATTACHMENT C

SAMPLING INFORMATION / FORMS

TABLE C.1

SUMMARY OF MONITORING WELL DATA

Well Number	Date Installed	Total Depth (Ft)	Size/Type of Riser/Screen	Depth to Top of Screen (Ft)	Depth to Bottom of Screen (Ft)	Unit Screened
MW-__	/ /96					Till
MW-__	/ /96					Till
MW-__	/ /96					Till
MW-__	/ /96					Till
MW-__	/ /96					Till
MW-__	/ /96					Till
MW-__	/ /96					Till
MW-__	/ /96					Till
MW-__	/ /96					Till
MW-__	/ /96					Till
MW-__	/ /96					Till
MW-__	/ /96					Till
EW-1	/ /96					Till
EW-2	/ /96					Till
EW-3	/ /96					Till
EW-4	/ /96					Till

NOTES:
1. Depths measured from ground surface
2. S.S. = stainless steel
3. PVC = polyvinyl chloride

TABLE C.2

GROUNDWATER SAMPLE CONTAINERIZATION AND HOLDING TIMES

Analysis	Bottle Type	Preservation[1]	Holding Time[2]
Aqueous Samples			
Metals	1 liter plastic bottle	Nitric Acid to pH <2 Cool to 4°C	5 Days
Volatile Organic Compounds (VOCs)	40 ml glass vial w/ Teflon septum	Cool to 4° C	7 Days
Semivolatile Organic Compounds (SVOCs)	1 litre amber bottle	Cool to 4° C	7 Days

[1] All samples to be preserved in ice during collection and transport.

[2] Days from validated time of sample receipt (VTSR)

TABLE C.3

GROUNDWATER SAMPLING EQUIPMENT

SAMPLING EQUIPMENT

- Sampling Vehicle
- 55-Gallon Lined Drum
- Photoionization detector
- Explosive gas meter
- Personal safety equipment (hard hats, etc.)
- Sampling and analysis program
- Appropriate number (including spares) of sample bottles
- Water-level indicator (electric drop-line)
- Polyethylene ground cloth
- Aluminum Foil
- Distilled water
- Alconox detergent
- Tap water source
- Disposable surgical gloves
- Disposable towels
- pH meter
- Conductivity meter
- Buckets (small: 5 gallon; large: 25 to 30 gallon)
- Teflon well bailer
- Nylon rope (individual lengths for each well)
- Stainless steel submersible pumps
- Pump hoist
- Flashlight
- Camera and Film

SHIPPING AND PACKAGING EQUIPMENT

- Shipping labels
- Sufficient ice chests to hold all sample bottles, packing material and ice

DOCUMENTATION EQUIPMENT

- Well Sampling Record
- Chain-of-Custody Forms
- Waterproof Pens

TABLE C.4
WELL INSPECTION CHECKLIST
BUFFALO COLOR AREA "D" SITE

Well Inspection
(GOOD/FAIR/POOR OR YES/NO)

Well Number	Well Depth (feet)	TOIC (1) Water Level (feet)	Well Marking (G/F/P)	Casing Lock (G/F/P)	Protective Cover (G/F/P)	Well Cap (G/F/P)	Obstructions in Well (Y/ N)	Water in Annulet (Y/ N)	Inspection Date	Comments

(1) – TOP OF INNER CASING

GROUNDWATER SAMPLING RECORD

Sample Identifier: __________ Site Name: __________

Date: __________ Time: __________

Samplers: __________ of __________

Weather: __________

Sample Location: __________

Screen/Sample Depth: __________

Sampling Device: __________

Groundwater Purging:

Initial Static Water Level: __________

Well Volume: __________

2-Inch Casing:	____	Feet of Water x 0.16 Gallons/Foot =	____	Gallons
3-Inch Casing:	____	Feet of Water x 0.36 Gallons/Foot =	____	Gallons
4-Inch Casing:	____	Feet of Water x 0.65 Gallons/Foot =	____	Gallons

Volume of groundwater purged: ____

Purging Device: __________

Purge Water Disposition (e.g., contained): __________

Sample Description: __________

Color: __________

Odor: __________

Other: __________

Sample Analyzed for: __________

QC Samples at this Location: __________

QC Samples Analyzed for: __________

Field Tests:

Temperature (C/F): __________

Ph: __________

Conductivity (uS/cm): __________

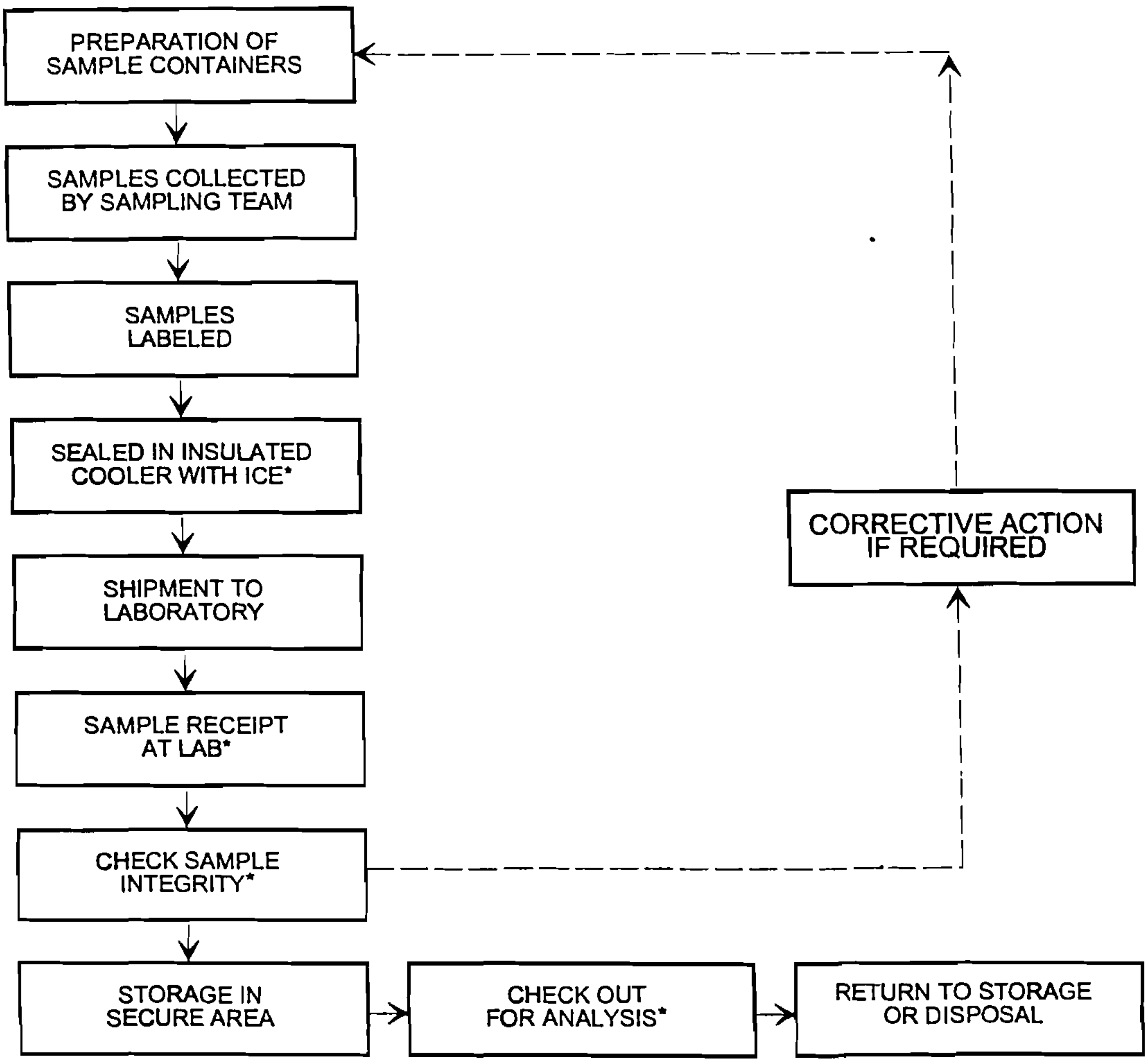
Turbidity (NTU): __________

PID (ambient): __________

Comments: __________

FIGURE C

SAMPLE CUSTODY



* REQUIRES SIGN-OFF ON CHAIN OF CUSTODY FORM.

0450

CHAIN OF CUS Y RECORD

CLIENT:	PROJECT NO.	PROJECT MGR:	TYPES OF ANALYSES REQUESTED	Send results to: ENGINEERING-SCIENCE, INC. 290 Elwood Davis Road Liverpool, NY 13088 Telephone: (315) 451-9560 Fax: (315) 451-9570
PROJECT NAME:	NOTES – (Reference QAPP and/or analytical protocols to be used):			Lab Submitted to:
SAMPLERS:				

FIELD SAMPLE ID: TYPE / NUMBER / DEPTH CODES / QC IDENTIFIER	Location Description	Date	Time	GRAB	COMP	NO OF Bottles								Matrix / Preservative / Remarks
X X 0 0 1 0 0 1 – 0 0 2														

Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:	SHIPPED VIA:	AIRBILL NO:
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:	SHIPPED VIA:	AIRBILL NO:
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:	SHIPPED VIA:	AIRBILL NO:

TYPE CODES:

SOLID
- SD – Sediment
- SS – Surface Soil
- SB – Subsurface Soil
- MW – Monitoring Well Boring
- TP – Test Pit/Tank Pit
- DR – Drum Waste
- WA – Solid Waste
- OS – Other Solid (eg. wipe samples, asbestos, etc.)

WATER
- MW – Monitoring Well
- LC – Leachate
- SW – Surface Water
- DW – Drill Water
- FD – Fuel Dispenser
- MH – Manhole
- OW – Oil Water Separator
- PR – Piping Run
- ST – Storm Water
- WW – Waste Water
- OL – Other Liquid (eg. Drum liquid)

QUALITY CONTROL
- FB – Field Blank (number each)
- TB – Trip Blank (number each)
- WB – Wash Blank (number each)

FIGURE C.3

No. 0450

ATTACHMENT D

POST-CLOSURE INSPECTION AND MAINTENANCE REPORT FORM

BUFFALO COLOR AREA "D"

POST-CLOSURE SITE INSPECTION CHECKLIST

Date: ____

Weather: ____

Personnel (Organization: ____________________________

Instructions: Complete the checklist of visual evaluation items and then complete specific data items. Field measurements should be made with a cloth tape and noted on the attached site plan. Estimated measurements shall be so noted. Attach hand sketches or photographs to the site plan to further define conditions or problems.

I. VISUAL EVALUATION ITEMS

	CONDITION: (Check)				
			Action Required?		
	Acceptable	Not Acceptable	Yes	No	REMARKS
1) Vegetative Cover					
a) Landfill site	____	____	____	____	
b) Drainage Bench	____	____	____	____	
c) Woody vegetation	____	____	____	____	
2) Integrity of Drainage System					
a) Sediment Build-Up	____	____	____	____	
b) Pooling or Ponding	____	____	____	____	
c) Slope Integrity	____	____	____	____	
d) Erosion Protection (Riprap, grout, vegetation)	____	____	____	____	
e) Obstruction of Culverts	____	____	____	____	
3) Condition of Access/ Perimeter Maintenance Roads					
a) Road Condition	____	____	____	____	
b) Gates/Locks/Signs	____	____	____	____	
4) Integrity of Ground Water Monitoring and Groundwater Extraction Wells	____	____	____	____	
5) Integrity of Cap					
a) Erosion Damage	____	____	____	____	
b) Leachate/Waste Breakthrough	____	____	____	____	
c) Settlement	____	____	____	____	
d) Animal Burrows	____	____	____	____	

	CONDITION: (Check)				
	Acceptable	Not Acceptable	Action Required? Yes	No	REMARKS
6) Gas Venting System					
a) Vents free of obstructions	____	____	____	____	
7) Erosion Control Structures (rip rap)	____	____	____	____	
8) Other (e.g., Litter, Unauthorized Dumping, etc.)	____	____	____	____	

II. SPECIFIC DATA ITEMS (Write N.A. if not applicable)

A. Erosion and Settlement:

1) Approximate size in feet of eroded cap area(s). (List Separately)

a. _____ feet by _____ feet

b. _____ feet by _____ feet

c. _____ feet by _____ feet

2) How deep is the most extreme point of erosion when measured from the adjacent surface. (List separately)

a. _____ feet

b. _____ feet

c. _____ feet

3) Approximate size in feet of eroded areas outside the soil cap area such as drainage ditches, roads or slopes. _______________

4) Attach a hand sketch or photograph to the attached site plan showing the location(s) of the eroded area(s). Identify each area by using the letter a, b, c, etc. from Question 1.

5) Approximate size in feet of leachate/waste breakout(s). (List Separately)

a. _____ feet by _____ feet

b. _____ feet by _____ feet

c. _____ feet by _____ feet

6) Approximate size in feet of any settlement area within the soil cap area. (List Separately)

a. _____ feet by _____ feet

b. _____ feet by _____ feet

c. _____ feet by _____ feet

7) Approximate size and location of animal burrows. (Attach a sketch showing approximate locations.)

______ CONDITION: (Check) _____

8) Approximate depth of each settlement area when measured from the adjacent surface. (List Separately)

a. _____ feet

b. _____ feet

c. _____ feet

9) Attach a hand sketch or photograph to the attached site plan showing the location of the settlement area(s). Identify each area by using the letter a, b, or c, etc. from Question 6.

10) Approximate size and depth of eroded areas of rip-rap along peninsula

a. _____ feet

b. _____ feet

c. _____ feet

11) Attach a sketch or photograph to the attached site plan showing location of any eroded areas.

____

____

Signature of Inspector(s)

Attachments

_______ Yes _______ No

MAINTENANCE SCHEDULE

Date:______________________ Weather:______________________

Personnel:______________________ Equipment:______________________

______________________ ______________________

Maintenance:

Performed (Check)	Item	Remarks
	1) Cover:	
_____	a) Excavation	
_____	b) Grading	
_____	c) Compaction	
_____	d) Testing	
_____	e) Topsoil	
_____	f) Seed/Fertilize	
_____	g) Removal of Undesirable vegetation	
_____	h) Location and Repair of Animal Burrows	
	2) Drainage Swales	
_____	a) Regrading (Excavation/Filling)	
_____	b) Anti-Erosion Material Replacement	
_____	c) Topsoil	
_____	d) Seed/Fertilize	
	3) Roadway Culverts	
_____	a) Clearing Obstructions	
_____	b) Pipe End Repair	
_____	c) Anti-Erosion Material Replacement	
	4) Access and Perimeter Maintenance Roads:	
_____	a) Roadway Aggregate	
_____	b) Grading	
	c) Repair/Replacement	
_____	i) gate	
_____	ii) locks	
_____	iii) signs	
	5) Ground Water Monitoring Wells	
_____	a) Drilling	
_____	b) Screening/Riser	
_____	c) Casing	
_____	d) Fill/Grout/Surface Seal	
_____	6) Erosion Control Around Peninsula	
_____	a) Replacing rip-rap	
_____	b) Grout	

ATTACHMENT E

GEOMEMBRANE REPAIR SPECIFICATIONS

ATTACHMENT E

GEOMEMBRANE REPAIR SPECIFICATIONS

The geomembrane installed at the Buffalo Color Area "D" Site is a 60-mil high density polyethylene (HDPE) geomembrane manufactured by ____________________________. Installation was performed by ____________________, as a subcontractor to ______________________________. The geomembrane is covered by a 1-year warranty for fabrication and installation and a 20-year warranty for materials. The warranty period began on _______________ and ends on ________________ for the 1-year fabrication/installation warranty and began on _________________ and ends on _________________ for the 20-year material warranty. Required geomembrane repairs may be made by AlliedSignal, Buffalo Color or by the installer and manufacturer if covered under the warranties.

This Appendix includes a point-of-contact list, copies of the warranties, installation quality assurance/quality control procedures, and a patching procedure. As-built drawings showing seam locations are included in Appendix A.

Geomembrane Contacts:

Manufacturer: TBD

Installer: TBD

POST-REMEDIAL CONSTRUCTION
OPERATION AND MAINTENANCE PLAN
VOLUME II - MANUFACTURER'S DATA
(To be added upon completion of construction.)

For:

BUFFALO COLOR CORPORATION
AREA "D" SITE
100 LEE STREET
BUFFALO, ERIE COUNTY, NEW YORK
(NYSDEC SITE NO. 9-15-012)

Submitted to:

THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF HAZARDOUS WASTE REMEDIATION

Submitted by:

BUFFALO COLOR CORPORATION AREA "D" SITE
POTENTIALLY RESPONSIBLE PARTIES GROUP

DRAFT

POST-REMEDIAL CONSTRUCTION
OPERATION AND MAINTENANCE PLAN
VOLUME III - SITE SPECIFIC OPERATING PROCEDURES

For:

BUFFALO COLOR CORPORATION
AREA "D" SITE
BUFFALO, ERIE COUNTY, NEW YORK
(NYSDEC SITE NO. 9-15-012)

Submitted to:

THE NEW YORK STATE DEPARTMENT OF
ENVIRONMENTAL CONSERVATION
DIVISION OF HAZARDOUS WASTE REMEDIATION

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SECTION 1

INTRODUCTION

1.1 PURPOSE OF THE GROUNDWATER TREATMENT SYSTEM

AlliedSignal, Inc. has arranged for the design and construction of the Groundwater Treatment System to provide metals removal via pH adjustment and reduction of organic contaminants via activated carbon adsorption in the groundwater that is extracted from the Buffalo Color Area "D" site.

1.2 OPERATION AND MANAGERIAL RESPONSIBILITY

The contractor assigned to operate the groundwater treatment facility is responsible for operation, process control, and routine maintenance of the system in accordance with the guidance provided in this manual. In addition to this manual, detailed information on the operation of individual pieces of equipment can be found in each piece's owner's manual. A complete set of owner's manuals is available at the groundwater treatment facility.

1.3 MANUAL REVIEWS AND UPDATES

It is recommended that this manual be reviewed on an annual or more frequent basis to evaluate if updates are required. As the equipment used in the treatment system may be modified, replaced, or removed, and improved methods of operation may be determined, the O & M manual should be updated to reflect these changes.

1.4 DISCHARGE PERMITS AND OPERATING STANDARDS

The Groundwater Treatment System for the Buffalo Color Corporation Area "D" site discharges treated water to the Buffalo River in accordance with discharge limits established by the New York State Department of Environmental Conservation (NYSDEC). Analytical reporting requirements have been established by the NYSDEC.

1.5 OVERALL SYSTEM HYDRAULIC DESCRIPTION

Groundwater that percolates through the Buffalo Color Corporation Area "D" site becomes tainted from the materials contained in the landfill. This contaminated groundwater is collected from four extraction wells EW-1 through EW-4. A flow diagram of the groundwater collection and treatment system is provided in Drawing I-2. The initial groundwater flow rate from each well was estimated to be 5 gpm or less, resulting in a total maximum design flow of 20 gpm. Groundwater from the wells will be pumped via submersible extraction well Pumps P-1, P-2, P-3, and P-4 to the groundwater conveyance system consisting of underground and aboveground (double-wall) pipe lines. This pipeline includes a central header pipe to the Groundwater Treatment Facility. The remainder of this section will describe each component of the treatment process. Process and Instrument Diagrams (P&ID) that detail the controls in the system are included as Drawing Nos. I-3, I-4, and I-5.

Oil/Water Separator S-10

The oil/water separator is designed to remove free, non-dissolved oil and grease that may be present in the recovered groundwater. The predesign investigation indicated that LNAPL and DNAPL are present in the ground water at the site. However, the treatment plant design assumes that bulk LNAPL and DNAPL deposits will be extracted prior to the startup of the Groundwater Treatment Facility. As a precautionary step to prevent LNAPL or DNAPL from reaching downstream process units and causing an upset condition, an oil/water separator is the first unit process. The oil/water separator is designed to capture oil and grease droplets that are 20 μm and larger, under normal operating conditions.

Any separated LNAPL will drain to a 55-gallon steel drum for storage and periodic disposal/reclamation in accordance with applicable regulations. Each drum will have bungs, a removable top, and will be lined with polyethylene. A flexible tube feed line will transfer product from the oil skimming weir to the drum. Any settled solids or DNAPL collected in the oil/water separator will be transferred to the Sludge Thickener Tank T-90 using OWS Sludge Pump P-110.

Equalization Tank T-10

The flow equalization tank is designed to provide flow and concentration dampening of the groundwater pumped from the extraction wells. In addition, process water is recycled into Tank T-10 from various unit processes in the treatment system. The tank will have 3,000 gallons of nominal capacity. Only 1,900 gallons are planned for use in the current design, thereby providing 3 feet of freeboard which may be utilized if the operation of the treatment plant changes in the future. At the maximum flow rate of 20 gpm and the lowest water level allowed by the pump controls, the design will provide approximately 30 minutes hydraulic retention time (HRT). The tank will be vertical and cylindrical, 8-foot diameter by 8-foot straight shell. The tank will be flat bottomed, open-topped with cross bracing to support the possible future installation of a tank agitator. Most of the tank capacity will be used to provide a pumping well for Equalization Tank Pumps P-10/P-11. The water surface level in the tank will always be under a maximum level, as shown in the drawings, to allow gravity flow from other processes into Tank T-10. The pumps will be of steel or high-density polyethylene main construction, with stainless steel, or solvent-resistant plastic internal components.

Equalization Tank Pumps P-10 and P-11

Pumps P-10 and P-11 are horizontal centrifugal pumps. These pumps will transfer water from Tank T-10 to Clarifier CL-20. Each pump will have a maximum design flow of 10 gpm (providing a maximum duplex design flow rate of 20 gpm) at the anticipated Total Dynamic Head of 35 feet. The pumps will operate in a lead-lag mode initiated by the liquid level sensors in T-10. The pumps will be constructed of steel or solvent-resistant plastic, with epoxy-coated steel, stainless steel, or solvent-resistant plastic internal components.

Clarifier System

The Clarifier System will include an inclined-plate clarifier (CL-20) and floc mixer (M-20) as a package. Clarifier CL-20 receives water from Pumps P-10 and/or P-11.

CL-20 is designed to remove the settleable fraction of the total suspended solids (TSS) present in the water such as calcium carbonates and metal hydroxides. The clarifier unit is an inclined plate, lamella type, with a settling area overflow rate of less than 500 gpd per square feet (gpd/ft^2). The maximum settling area will be about 60 ft^2.

Solids will settle into the hoppered bottom of the clarifier. The clarifier underflow will be pumped periodically to Sludge Thickener Tank T-90 by the Clarifier Sludge Pump P-22. Pump P-22 will be controlled by a timer. The frequency and duration of the pumping cycle will be adjustable according to the operating requirements.

Chemical Feed Systems

The calcium hydroxide (hydrated lime) feed system will include a 1,000-gallon slurry make-up tank (T-26), air diaphragm recirculation pumps (P-25 and P-26), and tank agitator (M-26). Calcium hydroxide slurry will be added to the process water through in-line injection followed by static mixer SM-18 for pH adjustment, which will promote flocculation/precipitation, clarification, and subsequent removal of dissolved/suspended metals from the process water. A dry lime hopper with dust control will be provided as a convenient means for the operator to empty 50 pound bags of dry, hydrated lime into the top of the lime solution feed tank. The lime solution recirculation pumps will contain large diameter ball check valves to prevent solids fouling. The standard recirculating flow rate for pumps P-25 and P-26 is 5gpm. The maximum flow rate into the process will be 750 ml/minute.

Ferric sulfate has been selected as a coagulant aid to be used for increased metals-removal efficiency. The coagulant feed system includes Tank T-27, Metering Pump P-27, and Tank Mixer M-27. Tank T-27 will be a 1,000-gallon HDPE tank with a flat bottom and flat removable lid. Mixer M-27 will be stainless steel, with an adjustable mixer angle to provide a thorough mix of 0 to 1 percent ferric sulfate solution. The maximum design flow rate for Pump P-27 is 460 ml/minute.

After metals treatment, sedimentation, and filtration, hydrochloric acid will be added to the process water as required to adjust the pH of the process water to within the acceptable range as defined by the discharge limits. The hydrochloric acid feed system will consist of Tank T-28, Mixer M-28, and chemical feed Pump P-28. The hydrochloric acid feed tank will be a 1,000-gallon HDPE tank with a flat bottom and removable lid. The mixer will be mounted to a mixer stand with an adjustable mixer angle to provide a thorough mix of 0 to 1 percent hydrochloric acid solution. The chemical feed pump will be equipped with an electronic solenoid-driven diaphragm type with user adjustable stroke and frequency/motor speed. The maximum design pump flow rate is 375 ml/minute.

Clarifier Clearwell Tank T-20

Clarifier Clearwell Tank T-20 is designed to store the clarified effluent. The tank has 1,500 gallons of nominal capacity. The design utilizes 1,060 gallons of capacity, thereby providing 2 feet of freeboard. A hydraulic retention time of approximately 16 minutes is provided at the maximum flow rate of 20 gpm. The tank is an open top, vertical cylindrical, 6-foot diameter by 7-foot straight shell. The tank provides a pumping well for pumps P-20 and P-21. This will be accomplished with the water level always under the overflow level of clarifier CL-20 to provide gravity flow at up to 20 gpm. The tank will be an epoxy-coated steel or solvent-resistant plastic main construction, with epoxy-coated steel, stainless steel, or solvent-resistant plastic internal components.

Clarifier Clearwell Pumps P-20 and P-21

Pumps P-20 and P-21 are a duplex system of horizontal centrifugal pumps. The pumps will be used to transfer water from Tank T-20 through the filter system (F-30 or F-31) and carbon adsorption system (CA-40 and CA-41) to the treated water accumulation tank (T-60). Each pump is designed to pump a maximum flow rate of 10 gpm at a TDH of 88 feet for a total maximum design flow rate of 20 gpm. Both pumps will operate and be controlled by signals from the liquid level switches in Tank T-20. The pumps will be provided with controls (from the main control center) to allow alternating lead/lag pumping.

Multi-Media Filters F-30 and F-31

F-30 and F-31 filter units are backwashable multi-media pressure filters designed to remove suspended solids from the water. These filters act as polishing devices to further reduce the concentration of suspended solids, especially metal hydroxides that are present in the process water. The duplex filter system will provide automatic switchover of process flow from the loaded filter (peak pressure differential reached) to the standby filter (clean). Switch-over and backwash are to be initiated by an operator-adjustable differential pressure set-point. The filter material will consist of anthracite coal and different grades of sand. The multi-media bed encourages better penetration of solids, which promotes better filter bed utilization, reducing the rate of head loss development, and thus increasing the filter run time between backwashes. A design loading rate of 3 gpm/ft^2 at the maximum flow rate of 20 gpm will be attained with a single 3-foot diameter filter.

Plant water will be used for backwashing the filter units. The filter units will be equipped with a controlled automatic backwash system that will initiate backwash according to a differential pressure switch. Used filter backwash water will be conveyed to the Sludge Thickener Tank T-90 for further handling and treatment.

Carbon Adsorption CA-40 and CA-41

The carbon adsorption units receive water from the filter units. The carbon adsorption system will consist of two granular activated carbon (GAC) units operated in series. Each unit contains approximately 2,000 pounds of GAC and provides approximately 50 minutes of contact time between the GAC and the process water at the maximum design flow rate of 20 gpm. After the GAC in the first unit in the series has been exhausted, process flow will be rerouted such that the second unit becomes the new first unit and the GAC in the exhausted unit will be replaced with fresh GAC. The exhausted carbon will be removed by an offsite contractor.

Treated Water Accumulation Tank T-60

Tank T-60 was designed to store the treated effluent and provide a pumping well for Pump P-60 which discharges the final effluent to the Buffalo River. The tank will be an open top, vertical cylindrical, 6-foot diameter by a 6-foot 6-inch straight shell. The tank will be equipped with mercury-type liquid level switches mounted on the inside of the tank. The liquid level switches control Treated Water Discharge Pump

P-60. The tank will be epoxy-coated steel or solvent-resistant plastic main construction, with epoxy-coated steel, stainless steel, or solvent-resistant plastic internal components.

Discharge Pump P-60

Pump P-60 will be a horizontal mount centrifugal pump designed to draw treated process water from tank T-60 and discharge it to the final effluent point (Buffalo River). The pump will have a maximum flow rate of 20 gpm at an approximate total dynamic head of 16 feet.

Sludge Thickener Tank T-90

T-90 is designed to thicken and provide storage of the sludge collected from the oil/water separator, the clarifier, the multi-media filter system, and the GAC vessels. The tank has a 4,000 gallon nominal capacity. The tank is an open top, vertical cylindrical, 8-foot diameter by 10-foot, 6-inch straight shell, with 1.5 feet of freeboard. The tank will provided with a sloped bottom for removal of the thickened sludge. The supernatant (excess water) overflows Tank T-90 and is conveyed by gravity to Tank T-10. The underflow from Tank T-90 is transferred to Filter Press FP-90 for dewatering by Sludge Thickener Sludge Pump P-90. The concentration of the sludge underflow pumped from T-90 will be approximately 5 percent solids by weight. Pump P-90 will be controlled by the system operator through the Filter Press FP-90 control system during the dewatering of sludge.

Filter Press FP-90

Filter Press FP-90 is a recessed chamber type filter press. At the maximum design flow rate of 20 gpm, the unit has been sized so that it will be necessary to run two filter press cycles every three days. To complete a cycle, enough sludge must be present to completely fill the press chambers, which usually requires that excess sludge remains after the press cycle. To satisfy the design criteria, given the solids generation rate projected, a 20-ft^3 recessed chamber filter press has been selected. The dry filter cake from the filter press, estimated to be approximately 30 percent solids after dewatering, will be disposed off site, and the filtrate will flow by gravity to the building sump.

Submersible Sump Pump P-130

Pump P-130 will draw process water from the building sump which collects waters from leaks, minor washdown flows, T-90 supernatant from manual decanting operations, and filtrate from filter press operations. The decanting is projected to generate approximately 20 gpm for up to 60 minutes. Pump P-130 is designed to provide a maximum flow rate of 50 gpm at a total dynamic head of 32 feet.

SECTION 2

SAFETY

2.1 INTRODUCTION

This chapter discusses hazards and considerations specific to the groundwater treatment system. Treatment system operators should remember that the person most responsible for an individual's safety is himself. No manual is intended to cover every situation. Use good judgment.

Useful references on wastewater treatment plant safety are published by the Water Environment Federation (WEF). Two Manuals of Practice (MOPs) which include relevant sections are MOP-1: Safety and Health in Wastewater Systems, and MOP SM-2: Guidelines for Developing a Wastewater Safety Program.

2.2 SAFETY INSPECTIONS

Regular safety inspections shall be performed to ensure that a safe work environment is maintained at the Buffalo Color Corporation Areas "D" site. The purpose of the inspection is to detect, identify, and control hazards before accidents occur. Table 2.1 is a proposed checklist of safety inspection points for the groundwater treatment system. Unsafe conditions encountered during the inspection must be corrected at once.

2.3 PERSONAL PROTECTIVE EQUIPMENT

Treatment system personnel should have access to protective gear to provide protection from hazards during various plant activities. Employees must inspect this equipment before each use to insure that it will operate reliably. If an emergency situation arises, only trained personnel should attempt the use of emergency response equipment.

Below is a discussion of personal protective equipment recommended for use during operation of the Buffalo Color Corporation Area "D" Groundwater Treatment System.

2.3.1 Hand Protection

Cotton gloves afford protection for general handling of abrasives, sharp objects, and glassware. They also provide thermal insulation when handling cold valve levers and tools. Where hand protection is desirable but finger dexterity is essential, as during water sampling activities, surgical-type rubber gloves are to be used. Extra heavy-duty rubber gloves are worn for handling containers, equipment, or pipes that contain corrosive chemicals (acid, caustic).

Treatment system operators are discouraged from wearing rings while working in the plant. A ring can catch on machinery or equipment and cause injury to the fingers and hands.

TABLE 2.1

BUFFALO COLOR CORPORATION AREA "D"
GROUNDWATER TREATMENT SYSTEM
SAFETY CHECKLIST

Building (General)

All building lighting operational.

At entry, clear indication of any on-going overhead work.

Clearly marked exits.

Clearly marked location of eyewash.

Clearly marked location of fire extinguisher.

Building electrical ground connection undamaged.

Floors (General)

Clean and dry: no spills or accumulation of dirt or trash.

No cracks or protrusions, no deterioration of coating or previous repairs.

Eyewash Station

Operates properly.

Clean.

System Control Panel

Unobstructed view of all indicator lights and displays.

Access doors and instrument covers securely closed.

Chemical Storage and Piping

All sections of floor decking properly in place.

Decking in good shape - no damaged areas.

No signs of leakage along pipelines.

No signs of chemical spillage on floor.

All acid-containing drums tightly sealed.

Sufficient supply of acid-neutralizing and caustic-neutralizing agents.

Personal protective equipment present and in good condition.

TABLE 2.1 (CONT.)

BUFFALO COLOR CORPORATION AREA "D"
GROUNDWATER TREATMENT SYSTEM
SAFETY CHECKLIST

Process Piping, Tanks, and Equipment

No leaking pipe joints or valves.

General cleanliness of oil/water separator - no grit, sludge, spilled process water, or loose trash.

Unobstructed view of pressure gauges, flow instruments, and any other process displays.

2.3.2 Foot Protection

All personnel at the treatment system will wear rubber-soled work shoes. Built-in steel toe caps are highly recommended. For acid-handling activities, heavy-duty acid-resistant rubber overboots are mandatory.

2.3.3 Body Protection

For most operations performed at the groundwater treatment system, cotton coveralls or similar work clothing is sufficient. Generally, operations and maintenance employees should wear long pants and long sleeve shirts. A waterproof overcoat or apron is highly recommended when handling hoses or equipment that contain process liquids (groundwater, collected oil, etc.) A heavy-duty chemical-resistant rubber apron is mandatory for chemical handling activities. Hard hats are required when overhead construction or repair work is being performed.

2.3.4 Eye Protection

At the treatment system, eye protection is necessary at all times when performing sampling, performing maintenance, working in the vicinity of operating mixers or working under or near piping and valves. Eye protection consists of OSHA-approved safety glasses or goggles. A full-face shield is mandatory for chemical handling activities.

2.3.5 Respiratory Protection

Normal operation of the Buffalo Color Corporation Area "D" Groundwater Treatment System does not require respiratory protection. However, entry into a collection sump will require a confined space entry permit, air monitoring, and possibly the use of respiratory protection.

All respiratory protection equipment must be inspected per manufacturer's procedures. The respirators should be cleaned after each use and all parts inspected and made ready for immediate operation.

The slaked lime and muriatic acid used in the treatment facility may cause respiratory irritation in certain situations. If symptoms such as upper respiratory irritation occur at any time, employees shall notify BCC and AlliedSignal. First aid shall be administered, if needed, and personal monitoring shall be implemented.

2.4 ONSITE SAFETY FACILITIES

All groundwater treatment system personnel will be aware of the location, procedures and policy of the onsite safety facilities available within the groundwater treatment building. For immediate treatment of splash accidents, an eyewash and shower station is available. Any injury requiring medical attention will be immediately reported to the (contractor) supervisor of the groundwater treatment system, who will report the incident to the Buffalo Color Corporation Area "D" point of contact.

2.5 PERSONAL HEALTH

Because of the sometimes cramped quarters and potentially dangerous conditions associated with wastewater treatment systems, it is necessary for the operations staff to keep alert to all possible hazards when performing routine or emergency tasks. Also, remember that visitors to the system area are not as well informed as operators and need to be cautioned to keep their hands off plant equipment. Discussed below are several areas of concern.

2.5.1 Hygiene

Because the process waters are likely to be caustic and contain contaminants, they present a potential health hazard. Operators should be advised to keep fingers from the nose, mouth, and eyes. The use of waterproof rubber gloves for all normal plant activities is recommended.

Food and drink must be kept away from the treatment plant. Never store food in any container or refrigerator where samples may be stored. In addition, smoking is not allowed inside of the Buffalo Color Corporation Area "D" Groundwater Treatment System building.

2.5.2 First Aid

Regardless of severity, all injuries must be reported to the employee's immediate supervisor. An emergency response service should be contacted immediately whenever a situation involves serious injury. All treatment system personnel should be familiar with the following emergency phone numbers.

EMERGENCY PHONE NUMBERS

	Off Site
Fire/EMS	911
Police	(716) 692-2121 or 911
Poison Control Center	(800) 888-7655
Hospital (Our Lady of Victoria Hospital)	(716) 825-8000
Buffalo Color Corporation	maintain radio contact

2.6 CONFINED SPACE SAFETY

2.6.1 Introduction

A "confined space" is defined as any enclosed or semi-enclosed space that is large enough to allow bodily entry, has limited openings for entry and exit, and is not intended for continuous employee occupancy. This section presents an overview of the requirements for safe confined space entry, but does not provide the detailed training, equipment, and permitting requirements included in the OSHA Confined Space Entry regulations 29 CFR 1910.146 (Subpart 146) that must be satisfied before an entry can actually be performed. Keep in mind that the most efficient way to make a repair or adjustment requiring a confined space entry may be to avoid the entry altogether and accomplish the work with tools on extended handles or by other alternative means.

2.6.2 Potential Hazards of Confined Spaces

There are a number of hazards associated with confined spaces. These include:

- Explosive gases.

- Toxic gases.
- Oxygen deficiency (asphyxiation).
- Falling.
- Bumping into obstructions.
- Impaired vision.
- Muscle cramps.

All of the above hazards can be eliminated, resulting in no lost time or loss of life. The prevention of injuries takes a common sense approach to work in confined spaces and strict adherence to ALL Buffalo Color Corporation and AlliedSignal, Inc. safety rules associated with confined spaces.

2.6.3 Training for Confined Space Work

All work conducted in a confined space must be done in accordance with Buffalo Color Corporation and AlliedSignal confined space entry procedures. Personnel who work in the vicinity of confines spaces must be aware of the hazards associated with confined spaces at the time of their employment. Personnel who are required to work in a confined space, or in support of those working in a confined space, need additional training in the following areas:

- Emergency entry and exit procedures.
- Use of applicable respirators.
- First aid.
- Lockout procedures.
- Safety equipment use.
- Permit systems.
- Work practices.

Rescue and training drills designed to maintain proficiency should be conducted with all new employees, and thereafter, at least annually with all employees. Training in all aspects of confined space safety must be a continuous process.

2.6.4 Confined Space Entry Program Requirements

Initially, a confined space must be evaluated to determine if it meets the requirements of a permit-required confined work space. At the Groundwater Treatment System Building, the interior of each process vessel is a confined space. In addition, other areas, such as the groundwater extraction well vaults, may also qualify under Subpart 146.

To do work in a permit-required confined space, at least two personnel with the required OSHA training, as described in the AlliedSignal and Buffalo Color Corporation safety program, must be selected. In addition, the entrant must have the skills required to do the work. The duties of the entrant, the attendant, and the confined space entry supervisor are all defined in the AlliedSignal and Buffalo Color Corporation safety program.

Confined space entry requires a variety of equipment which can include air monitoring instruments, personal protective equipment including respirators and/or supplied air breathing equipment, radios or other communication equipment, body harnesses, ropes, and a means such as a winch for lifting an unconscious entrant out of the confined space.

In advance of the actual work, personnel trained in confined space entry must develop a strategy for isolating (locking out) controllable hazards such as electrical and process flow inputs. They must determine an effective means of communicating with the entrant and retrieving a downed entrant. Atmospheric risks, the appropriate air monitoring instruments to use as warning devices, and the appropriate respiratory protection must be determined and provided.

Personnel specifically trained in confined space rescue and emergency medical procedures must be either present at the confined space during the entry, or immediately available to go to the confined space if contacted during an emergency. The emergency personnel should be briefed, in advance, of the type of work to be performed during the entry and the hazards that exist. Advance briefing is especially critical if the emergency personnel are normally off site during the confined space entry.

Any work to be performed in a permit-required confined space requires the use of a confined space permit in accordance with the Buffalo Color Corporation and AlliedSignal safety program. Confined space permits serve as a safety checklist and also as a written record that the specific confined space policies of the employer were followed. Once a confined space entry has been completed, the written permit is to be retained by the employer for three years. Figure 2.1 contains a Confined Space Entry Permit Form.

2.6.5 Conditions During Confined Space Work

If the confined space can be completely isolated and purged prior to entry, then atmospheric monitoring can be performed periodically throughout the entry. In cases such as sewer manholes that cannot be isolated, the entrant is required to carry or wear a continuous monitoring instrument that monitors oxygen level, explosive vapor level, and toxic gas level.

While performing confined space work, employees must be aware of several factors. High temperatures and humidity can lead to suffocation. If the entrant begins to feel dizzy or light-headed, he should leave the confined space immediately.

Slick and wet surfaces that can cause falls will probably be encountered in the confined space. Falling objects are also a hazard, particularly in spaces which have a topside opening for entry. Hard hats must also be worn in confined spaces.

Noise within a confined space may be amplified because of the acoustic properties of the space. Excessive noise can damage hearing as well as affect communication, such as a shouted warning or the alarm on atmospheric monitors.

Before leaving a confined space, the entrant and attendant must account for all tools and materials brought in. Objects inadvertently left in a confined space may later cause damage or accident.

CONFINED SPACE ENTRY PERMIT

TASK: ______________________ Issue Date: ____________

LOCATION: ______________________ Expiration : ____________

Signature below indicates this permit has been read and understood.

Entrants

______________________ ☒ ______________________

______________________ ☒ ______________________

______________________ ☒ ______________________

Attendant(s)

______________________ ☒ ______________________

______________________ ☒ ______________________

______________________ ☒ ______________________

Entry Supervisor

(usually Plant H&S Representative)

____

Outside Contractor(s)

______________________ ☒ ______________________

______________________ ☒ ______________________

EMERGENCY CONTACTS

POLICE	____________	NEAREST HOSPITAL	____________
POISON CONTROL CENTER	____________	ADDRESS	____________
FIRE DEPARTMENT	____________	CROSS STREEETS	____________
PLANT RESCUE SERVICE (IF APPLICABLE)	____________		____________
	EMERGENCY ROOM		____________
AMBULANCE	____________	PHYSICIAN	____________

Prepared by: ______________________ ____________
Entry Supervisor Date

Approved by: ______________________ ____________
Plant Manager Date

______________________ ____________
Plant Health & Safety Representative Date

PERMIT MUST BE POSTED AT WORK SITE

CONFINED SPACE ENTRY PERMIT (Continued)

Safety Check List

	YES	NO
Protective equipment		
Full-body harness	☐	☐
Lanyard, life-line	☐	☐
Tripod and winch	☐	☐
Davit arm and winch	☐	☐
Ladder	☐	☐
Other (specify) ______________		
Respirators		
SCBA, 5-minute escape	☐	☐
SCBA, 30-minute	☐	☐
Air line	☐	☐
Air purifying, full-face	☐	☐
Other (specify) ______________		
Protective Clothing		
Face shield	☐	☐
Cotton coveralls	☐	☐
Rain suit	☐	☐
Reflective vest	☐	☐
Gloves		
Leather	☐	☐
Rubber, butyl	☐	☐
Boots		
Leather, safety	☐	☐
PVC knee	☐	☐
Head wear		
Hard hat	☐	☐
Welding Helmet	☐	☐
Eye wear		
Safety glasses	☐	☐
Safety goggles	☐	☐
Welding goggles	☐	☐
Ear wear		
Earplugs, formable	☐	☐
Muffs	☐	☐
Other (specify) ______________		
Communication		
Radio, 2-way	☐	☐
Other (specify) ______________		
Lighting (®UL and MSHA approved)		
Flashlight	☐	☐
Lantern	☐	☐
Other (specify) ______________		
First Aid		
First Aid Kit	☐	☐
Fire Extinguisher	☐	☐
Eye Wash	☐	☐
Other (specify) ______________		
Warning Equipment/Indicators		
Barriers	☐	☐
Caution tape	☐	☐
Warning signs	☐	☐
Other (specify) ______________		

CONFINED SPACE ENTRY PERMIT (Continued)

Isolation Checks	Yes	No	N/A	Date	Time
Lines blanked or disconnected	☐	☐	☐	______	______
Lockout/tagout of electrical or mechanical hazard	☐	☐	☐	______	______
Vessel purged, flushed and vented	☐	☐	☐	______	______
Other (specify) ______				______	______

Ventilation Method	Yes	No	N/A
Venturi blower	☐	☐	☐
Electric or gasoline air blower with flexible hose	☐	☐	☐
Other (specify) ______			

EMERGENCY RESPONSE RESCUE PROCEDURE

CONFINED SPACE ENTRY PERMIT (Continued)

Atmospheric Gas Test

Gas	Permissible Entry Level	Pre-entry Condition	Initial Reading	Periodic Conditions (in minutes) 30	60	90	120	150
Oxygen	19.5 to 23.5%							
Flammable gas	Less than 10% LEL							
Hydrogen sulfide	Less than 10 ppm							
Carbon monoxide	Less than 25 ppm							
Other (specify)								

Pre-entry condition: Reading collected prior to entry and before ventilation and isolation of space.
Initial condition: Reading collected after isolation and during ventilation (just prior to entry).
Periodic conditions: Reading results recorded continuously at 30 minute intervals.

Persons conducting air monitoring:

______________________ Name ______________ Date

______________________ Name ______________ Date

Instrument Calibration

Instrument	Serial Number	Calibration Date	Person Calibrating Instrument

SECTION 3

STANDARD OPERATING PROCEDURES

3.1 INTRODUCTION

By following standard operating procedures, operators can perform routine tasks in a repeated, predictable way. This technique minimizes the effect which variations in operator actions may have on observed changes in system operations. It also makes unintentional operator changes less difficult to find and correct. These standard operating procedures were developed to maintain consistent, effective, and safe operation of the groundwater treatment facility.

3.2 PROCESS VALVE IDENTIFICATION

The valves throughout the groundwater treatment system that control process fluid flow (groundwater, collected oil, acid, caustic) will be numbered in the final version of this manual using a unique letter/number combination for each valve. The first identification letters indicates which process is most closely associated with a specific valve, using the following convention:

A - Acid (feed line)

BS - Building Sump

C - Coagulent (feed line)

GW - Groundwater

L - Lime (feed line)

O - Oil

A diagram of the valves named in the groundwater treatment system will be provided after system construction.

Valves that serve the following functions are not normally utilized in the standard operating procedures presented in this manual:

- valves to isolate instruments that are not in-line, such as pressure gauges,
- check valves,
- pressure relief valves, and
- valves used solely for draining equipment or tanks.

These valve types are therefore not included in the valve identification system.

3.3 STANDARD OPERATING PROCEDURE FORMS

In this subsection, suggested standard operating procedures will be presented for many routine activities that will be performed by operators of the leachate treatment facility. These procedures can only be finalized after process equipment has been approved by the project engineer, then selected and installed by the construction contractor.

The following is a draft list of the included standard operating procedure titles:

1. System Check During Normal Operations
2. System Shut-down and Start-up
3. Effluent Sampling for Permit Compliance
4. Lime Dosing Slurry Make-up
5. Coagulent Dosing Solution Make-up
6. Acid Dosing Solution Make-up
7. Lime Feed Line Clean-out
8. Coagulent or Acid Feed Line Clean-out
9. OWS Solids Removal
10. Sludge Dewatering

SECTION 4

RECORDS

4.1 INTRODUCTION

An effective system of operations record-keeping provides benefits to the operators of any wastewater treatment system. Collected information can be used as feedback which the operator can interpret in order to make adjustments to plant equipment. This section will present recommended methods for record-keeping of daily operational information and analytical data to be used for operator feedback and also for compliance reporting to the NYSDEC. Maintenance record-keeping methods will be presented in Section 5. All operational, analytical, maintenance, and instrument recording records should be kept for at least three years in accordance with the general conditions of the NPDES program.

4.2 DAILY OPERATIONAL RECORDS

It is highly recommended that a log or journal of "Daily Operational Records" be established and maintained at the groundwater treatment plant. The journal should be of sturdy construction with water-resistant or waterproof pages. All entries into the Daily Operational Records should be made in pen (black ball-point or ultra-fine tip permanent marker) on the day that the operations occur. Every page must be dated, and every "end of day" signed or initialed by the operator making that day's entries. Every recorded instrument reading or process-related visual observation must include the time of day when the observation was made. Upon arriving at the treatment plant, each incoming operator should review the previous shift's entries.

Daily Operational Records should include the following information:

- Totalizer readings.
- Instantaneous flow rate readings.
- System pH instrument readings.
- Level of chemicals in storage drums.
- Levels and appearance of collected oil in Product Storage Drum T-101.
- Time, process location, and analytical parameters of any process water sampling.
- Calibration readings of field instruments (i.e.: pH probe response to standards).
- Process measurements with field instruments (ie: pH probe).
- Name of any maintenance activities performed and the affected equipment.
- All observations related to the preventive maintenance inspections described in Section 5.

- Any unusual occurrences, mishaps, or system break-downs.
- Names of any non-routine visitors to the treatment facility, and the purpose of their visit.
- Weather: the average temperature, total precipitation, and sunny, cloudy, or windy conditions.

The operator should make an effort to record each piece of daily information at the same time each day, as closely as possible (especially totalized flow, which may be a mandatory reporting requirement).

4.3 RECORDING OF LABORATORY DATA

The industrial wastewater pretreatment discharge permit yet to be issued by the NYSDEC for the Buffalo Color Corporation Area "D" Groundwater Treatment System will specify analytical parameters and the required frequency of sampling to be reported. With the approval of the treatment system supervisor and the PRP Group point of contact, additional samples may be taken. Additional samples would include those taken at a frequency greater than required by the permit, or taken at intermediate steps in the process in order to evaluate the treatment system's performance.

All analytical data (including laboratory reports and field observations) generated from samples of process waters must be retained by Buffalo Color Corporation Area "D" for at least three years. Other requirements for data reporting may be included in the discharge permit (yet to be issued).

Buffalo Color Corporation Area "D" must designate the treatment facility supervisor or another individual to be responsible for the collection of samples, recording of data, and development of reports required by the state.

SECTION 5

MAINTENANCE

5.1 INTRODUCTION

Planning and implementing an effective preventive maintenance program are essential for the continuous production of effluent that meets the NYSDEC requirements for water quality. A draft version of a recommended preventive maintenance and lubrication schedule for servicing the groundwater treatment system equipment is provided in this section. A manual record-keeping system for equipment maintenance is described, and standard forms are provided. Lastly, draft listings for recommended lubricants, spare parts, and tools are presented.

5.2 SCHEDULED PREVENTIVE MAINTENANCE

This subsection presents the draft preventive maintenance and lubrication schedules for the equipment included in the groundwater treatment system. These schedules should be refined using information from owner's manuals provided by the equipment manufacturers. Equipment owner's manuals should be consulted before performing any preventive or corrective maintenance. A set of this literature should be available in the groundwater treatment building. The preventive maintenance schedules are presented in Tables 5.1 through 5.6. Note that the term "biannual," as used in Table 5.4, is meant as "every six months."

5.3 UNSCHEDULED MAINTENANCE AND REPAIRS

It is suggested that only minor repairs of mechanical equipment be attempted by treatment system operators. The tear-down of complex mechanical components often requires trained technicians and/or well-equipped repair shop facilities. However, some repair tasks may be accomplished by the facility supervisor or operators, at the discretion of the supervisor.

If a failed piece of equipment is critical to the continued operation of the groundwater treatment system, the facility must be shut down as described in the standard operating procedures. As soon as possible after an unscheduled shut-down, the facility supervisor must be notified of the problem. The operator must make note in the Daily Operational Records of the date, time, system totalizer readings, and description of the occurrence. The facility supervisor must report the interruption and the plans for corrective action to the BCC point of contact.

If it is determined that onsite personnel cannot repair the faulty equipment, then factory-authorized service should be sought. To find the name and phone number of the local service center for a specific piece of equipment, refer to the first pages of its owner's manual.

TABLE 5.1

DAILY PREVENTIVE MAINTENANCE ACTIVITIES

Equipment Name	Action
Extraction Well Pumps P1, P2, P3, and P4	Information Pending Final Equipment Selections
Oil/Water Separator	Information Pending Final Equipment Selections
Sludge Pump P-110	Information Pending Final Equipment Selections
Equalization Tank Pumps P10, P11	Information Pending Final Equipment Selections
Mixer M20	Information Pending Final Equipment Selections
Clarifier Clearwell Pumps P20 and P21	Information Pending Final Equipment Selections
Clarifier Sludge Pump P22	Information Pending Final Equipment Selections
Lime Recirculation Pumps P25 and P26	Information Pending Final Equipment Selections
Coagulent Feed Pump P27	Information Pending Final Equipment Selections
Acid Feed Pump P28	Information Pending Final Equipment Selections
Treated Water Discharge Pump P60	Information Pending Final Equipment Selections
Sump Pump P130	Information Pending Final Equipment Selections
Mixers M26, M27, M28	Information Pending Final Equipment Selections
Tank Agitator M-90	Information Pending Final Equipment Selection
Sludge Pump P-90	Information Pending Final Equipment Selection
Filter Press FP-90	Information Pending Final Equipment Selection

TABLE 5.2

WEEKLY PREVENTIVE MAINTENANCE ACTIVITIES

Equipment Name	Action
Extraction Well Pumps P1, P2, P3, and P4	Information Pending Final Equipment Selections
Oil/Water Separator	Information Pending Final Equipment Selections
Sludge Pump P-110	Information Pending Final Equipment Selections
Equalization Tank Pumps P10, P11	Information Pending Final Equipment Selections
Mixer M20	Information Pending Final Equipment Selections
Clarifier Clearwell Pumps P20 and P21	Information Pending Final Equipment Selections
Clarifier Sludge Pump P22	Information Pending Final Equipment Selections
Lime Recirculation Pumps P25 and P26	Information Pending Final Equipment Selections
Coagulent Feed Pump P27	Information Pending Final Equipment Selections
Acid Feed Pump P28	Information Pending Final Equipment Selections
Treated Water Discharge Pump P60	Information Pending Final Equipment Selections
Sump Pump P130	Information Pending Final Equipment Selections
Mixers M26, M27, M28	Information Pending Final Equipment Selections
Tank Agitator M-90	Information Pending Final Equipment Selection
Sludge Pump P-90	Information Pending Final Equipment Selection
Filter Press FP-90	Information Pending Final Equipment Selection

TABLE 5.3

MONTHLY PREVENTIVE MAINTENANCE ACTIVITIES

Equipment Name	Action
Extraction Well Pumps P1, P2, P3, and P4	Information Pending Final Equipment Selections
Oil/Water Separator	Information Pending Final Equipment Selections
Sludge Pump P-110	Information Pending Final Equipment Selections
Equalization Tank Pumps P10, P11	Information Pending Final Equipment Selections
Mixer M20	Information Pending Final Equipment Selections
Clarifier Clearwell Pumps P20 and P21	Information Pending Final Equipment Selections
Clarifier Sludge Pump P22	Information Pending Final Equipment Selections
Lime Recirculation Pumps P25 and P26	Information Pending Final Equipment Selections
Coagulent Feed Pump P27	Information Pending Final Equipment Selections
Acid Feed Pump P28	Information Pending Final Equipment Selections
Treated Water Discharge Pump P60	Information Pending Final Equipment Selections
Sump Pump P130	Information Pending Final Equipment Selections
Mixers M26, M27, M28	Information Pending Final Equipment Selections
Tank Agitator M-90	Information Pending Final Equipment Selection
Sludge Pump P-90	Information Pending Final Equipment Selection
Filter Press FP-90	Information Pending Final Equipment Selection

TABLE 5.4

BIANNUAL PREVENTIVE MAINTENANCE ACTIVITIES

Equipment Name	Action
Extraction Well Pumps P1, P2, P3, and P4	Information Pending Final Equipment Selections
Oil/Water Separator	Information Pending Final Equipment Selections
Sludge Pump P-110	Information Pending Final Equipment Selections
Equalization Tank Pumps P10, P11	Information Pending Final Equipment Selections
Mixer M20	Information Pending Final Equipment Selections
Clarifier Clearwell Pumps P20 and P21	Information Pending Final Equipment Selections
Clarifier Sludge Pump P22	Information Pending Final Equipment Selections
Lime Recirculation Pumps P25 and P26	Information Pending Final Equipment Selections
Coagulent Feed Pump P27	Information Pending Final Equipment Selections
Acid Feed Pump P28	Information Pending Final Equipment Selections
Treated Water Discharge Pump P60	Information Pending Final Equipment Selections
Sump Pump P130	Information Pending Final Equipment Selections
Mixers M26, M27, M28	Information Pending Final Equipment Selections
Tank Agitator M-90	Information Pending Final Equipment Selection
Sludge Pump P-90	Information Pending Final Equipment Selection
Filter Press FP-90	Information Pending Final Equipment Selection

TABLE 5.5

ANNUAL PREVENTIVE MAINTENANCE ACTIVITIES

Equipment Name	Action
Extraction Well Pumps P1, P2, P3, and P4	Information Pending Final Equipment Selections
Oil/Water Separator	Information Pending Final Equipment Selections
Sludge Pump P-110	Information Pending Final Equipment Selections
Equalization Tank Pumps P10, P11	Information Pending Final Equipment Selections
Mixer M20	Information Pending Final Equipment Selections
Clarifier Clearwell Pumps P20 and P21	Information Pending Final Equipment Selections
Clarifier Sludge Pump P22	Information Pending Final Equipment Selections
Lime Recirculation Pumps P25 and P26	Information Pending Final Equipment Selections
Coagulent Feed Pump P27	Information Pending Final Equipment Selections
Acid Feed Pump P28	Information Pending Final Equipment Selections
Treated Water Discharge Pump P60	Information Pending Final Equipment Selections
Sump Pump P130	Information Pending Final Equipment Selections
Mixers M26, M27, M28	Information Pending Final Equipment Selections
Tank Agitator M-90	Information Pending Final Equipment Selection
Sludge Pump P-90	Information Pending Final Equipment Selection
Filter Press FP-90	Information Pending Final Equipment Selection

TABLE 5.6

LONG-TERM PREVENTIVE MAINTENANCE ACTIVITIES

Equipment Name	Action
Extraction Well Pumps P1, P2, P3, and P4	Information Pending Final Equipment Selections
Oil/Water Separator	Information Pending Final Equipment Selections
Sludge Pump P-110	Information Pending Final Equipment Selections
Equalization Tank Pumps P10, P11	Information Pending Final Equipment Selections
Mixer M20	Information Pending Final Equipment Selections
Clarifier Clearwell Pumps P20 and P21	Information Pending Final Equipment Selections
Clarifier Sludge Pump P22	Information Pending Final Equipment Selections
Lime Recirculation Pumps P25 and P26	Information Pending Final Equipment Selections
Coagulent Feed Pump P27	Information Pending Final Equipment Selections
Acid Feed Pump P28	Information Pending Final Equipment Selections
Treated Water Discharge Pump P60	Information Pending Final Equipment Selections
Sump Pump P130	Information Pending Final Equipment Selections
Mixers M26, M27, M28	Information Pending Final Equipment Selections
Tank Agitator M-90	Information Pending Final Equipment Selection
Sludge Pump P-90	Information Pending Final Equipment Selection
Filter Press FP-90	Information Pending Final Equipment Selection

5.4 MAINTENANCE RECORD-KEEPING

5.4.1 Equipment Data

Data records should be prepared for each piece of process equipment in the groundwater treatment system. These records will preserve valuable equipment nameplate data that may be made unreadable on the equipment due to painting, abrasion, or corrosion. Format examples of data records for pumps, motors, and other mechanical equipment are presented in Figures 5.1, 5.2, and 5.3, respectively. Any convenient indexing system may be used, but it is suggested that all mechanical equipment records be filed in a binder or file drawer according to its abbreviated treatment system designation (for example, the pump in extraction well EW-1 is designated P-1). These records should be updated whenever a piece of equipment is replaced.

5.4.2 Spare Parts Records

Spare parts required for routine maintenance or otherwise likely to be needed in the event of an equipment failure should be kept on site for immediate availability. A draft list of recommended spare parts has been provided in Subsection 5.5. This list can only be finalized after equipment selections have been made by the construction contractor and approved by the project engineer. A suggested format for recording the onsite inventory and the lead-time required to obtain specific parts for each piece of equipment is shown in Figure 5.4.

5.4.3 Service Records

Well-kept service records can be used to determine if a piece of equipment is not being used for the intended service, is not performing to its specifications, or is not being adequately scheduled for preventive maintenance. After every scheduled or unscheduled maintenance activity on a piece of equipment, that equipment's service record should be updated. Each entry in the service record should include the following:

- the date of each maintenance activity or repair,
- a description of the scheduled maintenance or unscheduled break-down,
- the system down-time required for repair and installation, and
- the cost of parts, labor hours, and labor cost of the repair.

An example of a suggested format for service record-keeping is provided in Figure 5.5.

5.5 RECOMMENDED LUBRICANTS AND SPARE PARTS

A draft listing of recommended lubricants and spare parts to have on site for routine maintenance of the groundwater treatment system is summarized in Table 5.7. This list can only be finalized after equipment selections have been made by the construction contractor and approved by the project engineer.

PUMP DATA SHEET

PUMP DESIGNATION IN GROUNDWATER TREATMENT SYSTEM: ______________

LOCATION: ___ Extraction Well
___ Groundwater Treatment Plant

MANUFACTURER: ______________

MODEL: ______________

SERIAL NUMBER: ______________

DATE IN SERVICE: ______________

EQUIPMENT COST: ______________

OPERATING RPM: ______________

FLOW RANGE (GPM): ______________

RATED SYSTEM HEAD RANGE (FT. W.C.): ______________

INLET PORT SIZE (INCHES): ______________

OUTLET PORT SIZE (INCHES): ______________

HOUSING MATERIAL OF CONSTRUCTION: ______________

IMPELLER DIAMETER (INCHES): ______________

IMPELLER MATERIAL OF CONSTRUCTION: ______________

SEAL TYPE: ______________

SEAL PART NUMBER(S): ______________

LOCAL REPRESENTATIVE NAME: ______________

LOCAL REPRESENTATIVE PHONE: ______________

MOTOR DATA SHEET

DESIGNATION OF EQUIPMENT IN GROUNDWATER TREATMENT SYSTEM SERVED BY MOTOR: ______________

LOCATION:
___ Extraction Well
___ Groundwater Treatment Plant

MANUFACTURER: ______________

MODEL: ______________

SERIAL NUMBER: ______________

DATE IN SERVICE: ______________

COST (IF SEPARATE): ______________

OPERATING RPM: ______________ HORSEPOWER: ______________

VOLTS: __________ AMPS: __________ PHASE: __________

SERVICE FACTOR: ______________

FRAME TYPE: ______________

ENCLOSURE TYPE: ______________

SHAFT CONNECTION TYPE: ______________

LOCAL REPRESENTATIVE NAME: ______________

LOCAL REPRESENTATIVE PHONE: ______________

EQUIPMENT DATA SHEET

EQUIPMENT DESIGNATION IN
GROUNDWATER TREATMENT SYSTEM: ____________________

LOCATION: ___ Extraction Well
___ Groundwater Treatment Plant

MANUFACTURER: ____________________

MODEL: ____________________

SERIAL NUMBER: ____________________

DATE IN SERVICE: ____________________

COST (IF SEPARATE): ____________________

RPM IN: __________ RPM OUT: __________ HORSEPOWER: __________

VOLTS: __________ AMPS: __________ PHASE: __________

SERVICE FACTOR: ____________________

MOUNTING / FRAME TYPE: ____________________

ENCLOSURE TYPE: ____________________

SHAFT CONNECTION TYPE: ____________________

OTHER DESCRIPTION: ____________________

____

LOCAL REPRESENTATIVE NAME: ____________________

LOCAL REPRESENTATIVE PHONE: ____________________

Treatment System Equipment Designation: ______

FIGURE 5.4

SPARE PARTS RECORD

Order Date	Received Date	Cost ($)	Source Code	Invoice or P.O. Number	Quant.	Item Description	Cat. No.

SOURCES (NAME, CITY, PHONE)

SOURCE A: ______

CODES B: ______

C: ______

D: ______

Treatment System Equipment Designation: ______

FIGURE 5.5

SERVICE RECORD

Date	Maintenance or Repair Activity	System Totalizer Reads at Shut-down: Leachate Totalizer	System Totalizer Reads at Shut-down: Surf. Wtr. Totalizer	System Down-time (hours)	Parts Cost ($)	Labor Cost ($)	Labor Cost (hours)

TABLE 5.7

PREVENTIVE MAINTENANCE LUBRICANTS AND SPARE PARTS LIST

Equipment Name	Parts Name (and Numbers, if available)
Extraction Well Pumps P1, P2, P3, and P4	Information Pending Final Equipment Selections
Oil/Water Separator	Information Pending Final Equipment Selections
Sludge Pump P-110	Information Pending Final Equipment Selections
Equalization Tank Pumps P10, P11	Information Pending Final Equipment Selections
Mixer M20	Information Pending Final Equipment Selections
Clarifier Clearwell Pumps P20 and P21	Information Pending Final Equipment Selections
Clarifier Sludge Pump P22	Information Pending Final Equipment Selections
Lime Recirculation Pumps P25 and P26	Information Pending Final Equipment Selections
Coagulent Feed Pump P27	Information Pending Final Equipment Selections
Acid Feed Pump P28	Information Pending Final Equipment Selections
Treated Water Discharge Pump P60	Information Pending Final Equipment Selections
Sump Pump P130	Information Pending Final Equipment Selections
Mixers M26, M27, M28	Information Pending Final Equipment Selections
Tank Agitator M-90	Information Pending Final Equipment Selection
Sludge Pump P-90	Information Pending Final Equipment Selection
Filter Press FP-90	Information Pending Final Equipment Selection

5.6 REQUIRED TOOLS

Treatment system operators will be required to perform preventive maintenance and minor corrective maintenance on a routine basis. The following tools, as a minimum, will be required:

- Mechanic's Wrenches: Several sizes of adjustable wrenches and/or sized wrench sets in both English and metric units;
- Pipe Wrenches: One pair each of 36" wrenches (supplied during start-up) and 18" wrenches;
- Bung Wrench: (for opening chemical drums, supplied during start-up);
- Screwdrivers: Several sizes of flat blade and philips types;
- Hammer: ball peen type;
- Pliers: tongue-and-groove, slip-joint, and needle-nose types;
- Tape measures: 10' auto-returning and 50' windable types;
- Hacksaw;
- Garden hose; and
- Liquids: spray lube, bolt-loosener, joint prep, and adhesive.