REPORT

Frontier Chemical - Pendleton Site Wetland Inspection Report

Pendleton Site PRP Group

October 2000

O'BRIEN & GERE
ENGINEERS, INC.

5829/27084

REPORT

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Wetland Inspection Report

Pendleton Site PRP Group

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October 2000

O'BRIEN & GERE ENGINEERS, INC.

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1. Introduction

This document is the first Wetland Inspection Report for the Frontier Chemical - Pendleton Site (Site), located on Town Line Road in the Town of Pendleton, Niagara County, New York. This report is prepared based on the New York State Department of Environmental Conservation (NYSDEC)-approved Operation & Maintenance (O&M) Manual (O'Brien & Gere Engineers, 1997) for the Site, which addresses, among other items, inspection of constructed/restored wetlands at the Site. This Wetland Inspection Report presents a discussion of the following:

- Site background
- Description of constructed/restored wetlands
- Creation objective and criteria
- Results and discussion
- Conclusions and recommendations.

1.1. Site background

The Pendleton Site PRP Group (Group) initiated a site remediation project at the Frontier Chemical – Pendleton Site in 1995, in accordance with the requirements set forth in the Order on Consent (#B9-0270-89-05). The site remediation project was substantially completed in August 1996. One component of the site remediation project included the filling of approximately 1.2 acres of existing wetlands to implement a closure of consolidated sediments, previously dredged materials, and surface soils. The filled wetlands consisted of five distinct wetland areas comprising man-induced emergent and scrub-shrub wetlands, as described in the Wetland Delineation Report (O'Brien & Gere Engineers, 1994). As part of the site remediation project, an approximately 1.3-acre wetland area (Wetland #1) was constructed north of Quarry Lake to replace the filled wetlands. The constructed wetland location is shown on Figure 1.

During remedial construction activities, an approximately 0.35-acre wetland area (Wetland #2) to the north and east of the capped area and an approximately 0.07-acre wetland area (Wetland #3) to the south of the capped area were also disturbed. These wetlands also consisted of man-induced emergent and scrub-shrub wetlands, as described in the Wetland Delineation Report (O'Brien & Gere Engineers, 1994). These wetland areas were restored following construction. The locations of these constructed/restored wetland areas are also shown on Figure 1.

The NYSDEC-approved Contract Documents for the site remediation project (O'Brien & Gere Engineers, 1995a) specified requirements for constructing/restoring wetlands. As shown on Figure 1, a planting scheme was developed for the aquatic bed ("Zone A"), non-persistent emergent ("Zone B"), persistent emergent ("Zone C"), and edge and side slope ("Zone D") depth zones. The technical specification for engineered wetlands was based on an evaluation of pre-remediation site conditions and anticipated post-remediation site conditions. Details regarding the design of the engineered wetlands are included in the Final Design Report (O'Brien & Gere Engineers, 1995b).

When the site remediation project was substantially completed in August 1996, western New York had been experiencing very dry conditions. There was concern that wetland plantings would not survive if Quarry Lake was not at the design water elevation. A wetland mitigation and habitat restoration firm was contacted in June 1996 regarding planting the wetland plants under dry conditions. The firm made the following general comments regarding the species to be planted in the wetlands at the Site:

- Bare root plants (tubers, root stock tubers, shoots, etc.) would generally not survive if planted in dry soils.

- The aquatic bed "Zone A" plants (water lily [*Nymphaea or Nuphar*], and sago pondweed [*Potamogeton pectinatus*]) should be planted in saturated soil conditions, at a minimum. The plants require standing water year round and a minimum of 1 ft to 3 ft of standing water during the winter to prevent freezing of the plants.

- The non-persistent emergent "Zone B" plants (pickerelweed [*Pontederia cordata*], arrow-arum [*Peltandra virginica*], and arrowhead [*Sagitaria latifolia*]) and the persistent emergent "Zone C" plants (burreed [*Sparaganium eurycarpum*], hardstem bulrush [*Scirpus acutus*], and smartweed [*Polygonum mutenbarghii*]) should be planted in saturated soil, at a minimum. These types of plants can

survive drawdown; however, they require 8 in to 12 in of standing water during the winter to prevent freezing of the plants.

- The edges and side slope "Zone D" seed mixes (herbaceous seed mix, birdfoot trefoil [*Lotus corniculatus*], perennial ryegrass [*Lolium perenne*], red fescue [*festuc rubra*], tall fescue [*festuca arundinacea*], and wetland seed mix) could be planted in dry conditions. The seeded areas would only need to remain saturated during germination.

Based on these recommendations, only the "Zone D" wetland species were planted in August 1996. The areas planted with "Zone D" included the constructed/restored areas of Wetlands #2 and #3. The constructed wetland, Wetland #1, was also planted with "Zone D" seed mixes to provide temporary vegetative cover and a substrate for the subsequent wetland plantings. "Zones A through C" of Wetland #1 were to be planted with the specified species once Quarry Lake refilled with water and the Wetland #1 area became inundated. Based on visual observations, Wetland #1 became inundated during the winter of 1998, two years later. Surface water monitoring of Quarry Lake indicated that the lake elevation was above the outlet weir elevation of 577.2 ft in February 1998 (O'Brien & Gere Engineers, 1998). As a result, "Zones A through C" of Wetland #1 were planted in April 1998.

Because of continuing relatively dry conditions over the summers of 1998 and 1999, the 2000 growing season was determined to represent the first full growing season of the constructed/restored wetlands. The first wetland inspection was conducted on August 10, 2000.

1.2. Description of constructed wetlands

As described in Section 1.1, an approximately 1.3-acre wetland area (Wetland #1) was constructed to the north and directly adjacent to Quarry Lake, as shown on Figure 1. The wetland is hydraulically supplemented by storm water, which falls on the lake and approximately 2.8 acres of the capped area. Storm water is discharged from Quarry Lake, through the constructed wetland, to the existing wetlands via a constructed outlet weir. Wetland #1 was initially seeded in accordance with the "Zone D" planting schedule of the technical specifications in August 1996. Wetland #1 was replanted in accordance with the approved planting schedule for "Zones A through C" of the technical

specifications in April 1998, after the water level in Quarry Lake reached the design elevation and the wetland area was inundated.

An approximately 0.35-acre wetland area (Wetland #2) was constructed/restored north and east of the capped area, as shown on Figure 1. The constructed/restored and existing wetlands north of the capped area are hydraulically supplemented by storm water, which falls on approximately 2.18 acres of the capped area. The wetlands are also hydraulically connected to the existing wetlands north of Quarry Lake. Wetland #2 was seeded in accordance with the "Zone D" planting schedule of the technical specifications in August 1996.

An approximately 0.07-acre wetland area (Wetland #3) was constructed/restored south of the capped area, as shown on Figure 1. The constructed/restored and existing wetlands south of the capped area are hydraulically supplemented by storm water, which falls on approximately 1.18 acres of the capped area. A culvert conveys water from the wetland to Quarry Lake. Wetland #3 was seeded in accordance with the "Zone D" planting schedule of the technical specifications in August 1996.

2. Creation objective and criteria

The creation objective at the Site was to mitigate the loss of approximately 1.62 acres of wetlands at the Site by creating/restoring approximately 1.72 acres of wetlands. Creation success for the constructed/restored wetlands at the Site is based on the following:

- Estimated percentage of ground cover and the density of planted and seeded species
- Presence and percentage of ground cover of invasive weed species
- Recruitment of non-invasive weed species from adjoining or nearby wetland habitats.

The wetland inspection was performed by a qualified O'Brien & Gere wetland scientist on August 10, 2000 to evaluate the condition of the constructed/restored wetlands and to identify maintenance activities that would be required to support the success of the wetland mitigation at the Site. The inspection consisted of estimating the percentage of ground cover of planted species, as specified in the technical specifications, to assess the success of the plantings. In addition, the percentage of ground cover of invasive wetland species, such as purple loosestrife (*Lythrum salicacria*) and common reed grass (*Phragmites australis*), was estimated. The results and recommendations of this inspection effort are discussed in Sections 3 and 4.2, respectively.

3. Results and discussion

The three constructed/restored wetland areas were found to be progressing well towards becoming established and functioning wetland systems at the Site. In fact, the majority of the wetlands have established high percentages of ground cover of species that were planted and/or seeded. Species recruited from neighboring habitats were also observed. The presence of the invasive species purple loosestrife was apparent in the three constructed/restored wetlands at the Site. Based on the inspection, it appears that the species diversity specified in the planting schedule has been attained or is becoming established in the three wetland areas. Also, it was apparent that natural recruitment of other wetland species, for example cattail (*Typha latifolia*) and cottonwood (*Populus deltoides*), is occurring. Based on this observation, the constructed/restored wetlands appear to be successful. Appendix A presents photographs of the constructed/restored wetlands at the Site.

As previously noted, purple loosestrife was present in the three constructed/restored wetlands at the Site. However, invasion by common reed grass, a species that is dominant in existing wetlands north of Wetlands #1 and #2, was not evident in the constructed/restored wetlands at the Site.

The estimation of ground cover percentages of planted/seeded wetland species and naturally recruited wetland species in the constructed/restored wetlands at the Site indicated the following:

- Wetland #1 – with the exception of the water lily species planted in "Zone A", there appeared to be approximately 85% to 100% of aquatic species, specifically sago pondweed, in the wetland. There did not appear to be a clear distinction between "Zone B" and "Zone C," with species planted in "Zone B" (pickerelweed, arrow-arum, and arrowhead) coexisting with species planted in "Zone C" (hardstem bulrush and smartweed). It also appeared that the spacing between the plant groupings in these zones was excessive or plant groupings did not succeed in certain areas. The percent cover in "Zone B" and "Zone C" appeared to be approximately 40% to 60% between groupings, and approximately 80% to 90% in areas of successful groupings. The percent cover of wetland species in "Zone D" of this wetland was approximately 90% to 100%; however, the

percent of the invasive species purple loosestrife was approximately 30% to 50%. In addition, soils were observed, via the advancement of a soil boring with a handheld auger, to a depth of about 18 inches. Hydric soil development was apparent in the wetland soils based on the observance of irregularly small bodies of material in a sedimentary mixture of different texture (mottles), indicating reducing conditions in the soil.

- Wetland #2 – approximately 80% of this wetland appeared to have approximately 80% to 100% of well established wetland species cover, as specified in the "Zone D" planting schedule. Recruitment of other wetland species (cattail, smartweed, and cottonwood) was observed. A portion of the northern section of this wetland exhibited open water characteristics with little rooted aquatic or persistent emergent vegetation. Based on the planting schedule, Wetland #2 was to be planted with "Zone D" vegetation species; therefore, it is likely that this open water area was planted/seeded and for some reason, likely the drought condition in the area over the last couple of years or observed Canada goose browsing at the Site, the seeding/plantings did not survive. Portions of this wetland, particularly in the area east of the capped area, contained approximately 25% to 40% of purple loosestrife. In addition, soils were observed, via the advancement of a soil boring with a handheld auger, to a depth of about 18 inches. Hydric soil development was apparent in the wetland soils based on the observance of irregularly small bodies of material in a sedimentary mixture of different texture (mottles), indicating reducing conditions in the soil.

- Wetland #3 - this wetland appeared to have approximately 90% to 100% of a well established wetland species cover, as specified in the "Zone D" planting schedule. Recruitment of other wetland species (cattail and smartweed) was also observed. However, the fringe areas of this wetland contained approximately 35% to 60% of purple loosestrife. In addition, soils were observed, via the advancement of a soil boring with a handheld auger, to a depth of about 18 inches. Hydric soil development was apparent in the wetland soils based on the observance of irregularly small bodies of material in a sedimentary mixture of different texture (mottles), indicating reducing conditions in the soil.

Another observation made at the Site was the natural establishment of wetland species (cattail, sago pondweed, and purple loosestrife) along a 3-ft to 5-ft perimeter surrounding Quarry Lake, indicating favorable conditions for additional naturally occurring wetlands at the Site. Since the elevation of the lake at the time of the wetland inspection was at

normal conditions with regards to water elevation, it is safe to assume that the fringe of the lake will continue to provide favorable hydrology for the natural development of wetland habitat.

4. Conclusions and recommendations

4.1. Conclusions

The constructed/restored wetlands at the Site were inspected during the first full growing season following planting. Results of the inspection indicated that the constructed/restored wetlands are progressing or have become functioning wetland habitats based on the presence and extent of wetland species in these wetlands. Purple loosestrife was the only undesirable species observed to be fairly common in the constructed/restored wetland areas.

4.2. Recommendations

O'Brien & Gere recommends the following activities be performed within the constructed/restored wetlands:

Wetland #1:
Additional plantings of species specified in "Zones B/C" should be performed for approximately 30% of the wetland in the spring of 2001.

Wetland #2:
If the northern section of this wetland is inundated in the spring of 2001, then additional planting/seeding of species specified in "Zone C" or "Zone D" should be performed.

Wetland #3:
No activities are recommended for this wetland.

References

O'Brien & Gere Engineers, Inc. 1994. *Wetland Delineation Report, Frontier Chemical – Pendleton Site, Town of Pendleton, Niagara County, New York.* October 1994.

O'Brien & Gere Engineers, Inc. 1995a. *Contract Documents, Frontier Chemical – Pendleton Site, Town of Pendleton, Niagara County, New York.* March 1995.

O'Brien & Gere Engineers, Inc. 1995b. *Final Design Report, Frontier Chemical – Pendleton Site, Town of Pendleton, Niagara County, New York, Volumes I and II.* March 1995, Revised June 1995.

O'Brien & Gere Engineers, Inc. 1997. *Operation and Maintenance Manual, Frontier Chemical – Pendleton Site, Town of Pendleton, Niagara County, New York, Volumes I and II.* March 1997.

O'Brien & Gere Engineers, Inc. 1998. *Frontier Chemical – Pendleton Site, Semi-Annual Ground Water Monitoring Report,* March 1998.

Order on Consent #B9-0270-89-05 between NYSDEC and Respondent Companies. March 28, 1994.

FIGURES

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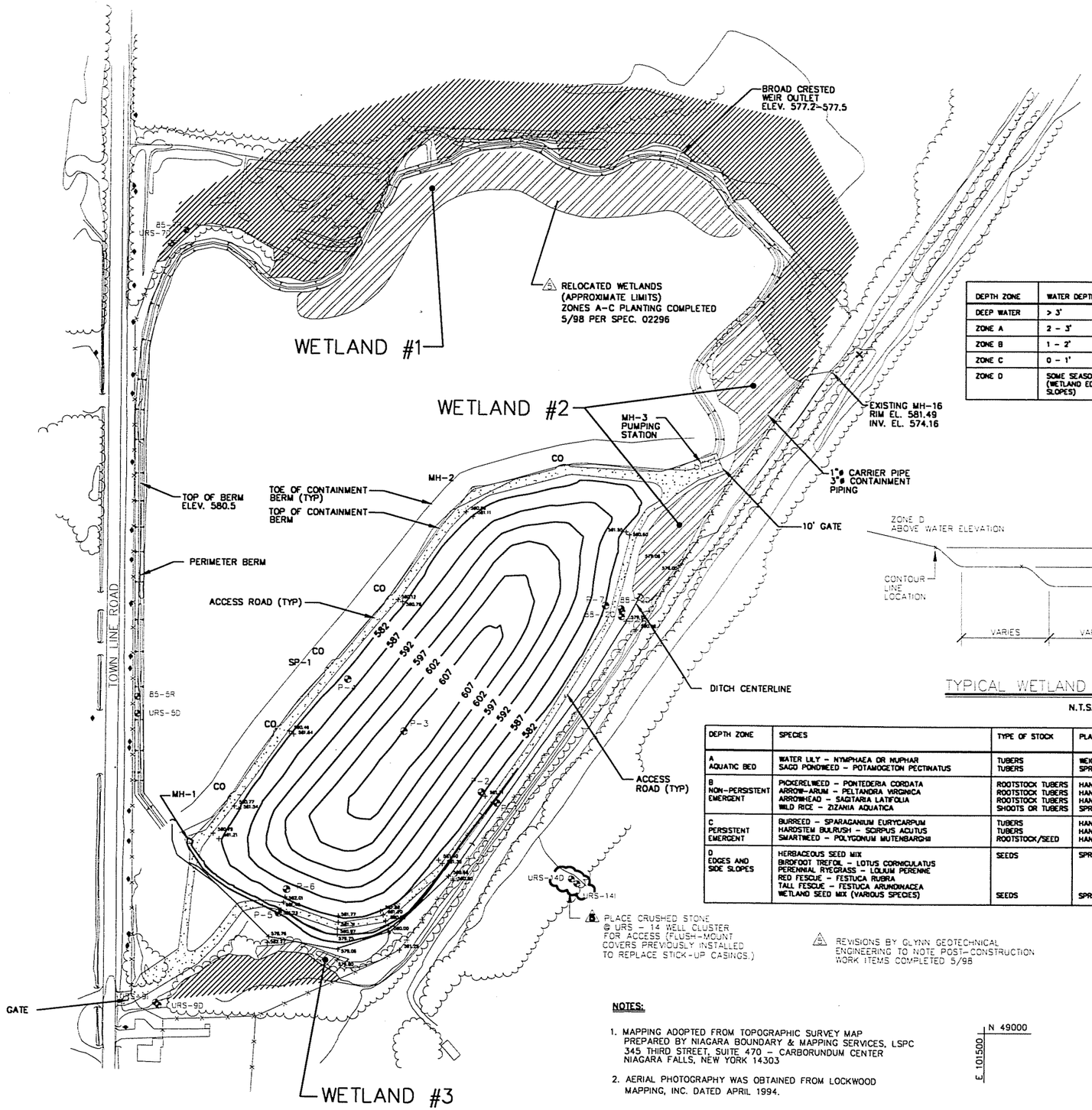
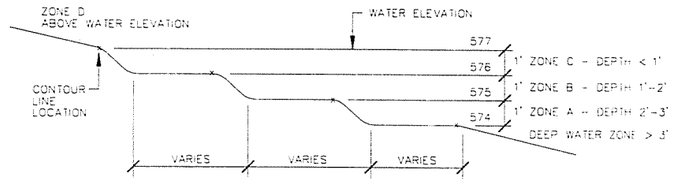
FIGURE 1



DEPTH ZONE	WATER DEPTH	WETLAND COVER TYPE
DEEP WATER	> 3'	OPEN WATER
ZONE A	2 - 3'	AQUATIC BED
ZONE B	1 - 2'	NON-PERSISTENT EMERGENT
ZONE C	0 - 1'	PERSISTENT EMERGENT
ZONE D	SOME SEASONAL FLOODING (WETLAND EDGES, SIDE SLOPES)	WET MEADOW SCRUB/SHRUB UPLAND AND WETLAND



TYPICAL WETLAND CROSS-SECTION

N.T.S.

DEPTH ZONE	SPECIES	TYPE OF STOCK	PLANTING TECHNIQUE	SPACING AND DENSITY OF PLANTING	PLANTING PATTERN
A AQUATIC BED	WATER LILY - NYMPHAEA OR NUPHAR SAGO PONDWEED - POTAMOGETON PECTINATUS	TUBERS TUBERS	WEIGHTED TUBERS SPREAD OVER WATER	2 -3' O.C. 5 LBS/PATCH	PATCHES OF 5 - 50' O.C. PATCHES 50' O.C.
B NON-PERSISTENT EMERGENT	PICKERELWEED - PONTEDERIA CORDATA ARROW-ARUM - PELTANDRA VIRGINICA ARROWHEAD - SAGITARIA LATIFOLIA WILD RICE - ZIZANIA AQUATICA	ROOTSTOCK TUBERS ROOTSTOCK TUBERS ROOTSTOCK TUBERS SHOOTS OR TUBERS	HAND PLANTED HAND PLANTED HAND PLANTED SPREAD OR HAND PLANTED	3' O.C.	ABOUT 50% OF AREA PLANTED IN PATCHES OF SAME SPECIES (5 OF EACH), PATCHES 30' O.C.
C PERSISTENT EMERGENT	BURREED - SPARAGANIUM EURYCARPUM HARDSTEM BULRUSH - SCIRPUS ACUTUS SMARTWEED - POLYGONUM MUTENSARGHII	TUBERS TUBERS ROOTSTOCK/SEED	HAND PLANTED HAND PLANTED HAND PLANTED	3' O.C.	COVER 100% OF AREA WITH PATCHES OF SAME SPECIES (5 OF EACH), PATCHES 30' O.C.
D EDGES AND SIDE SLOPES	HERBACEOUS SEED MIX BIRDFOOT TREFOIL - LOTUS CORNICULATUS PERENNIAL RYEGRASS - LOLIUM PERENNE RED FESCUE - FESTUCA RUBRA TALL FESCUE - FESTUCA ARUNDINACEA WETLAND SEED MIX (VARIOUS SPECIES)	SEEDS SEEDS	SPREAD OR DRILLED SPREAD OR DRILLED	30 LBS/AC 5 LBS/AC	ENTIRE AREA

5. PLACE CRUSHED STONE @ URS - 14 WELL CLUSTER FOR ACCESS (FLUSH-MOUNT COVERS PREVIOUSLY INSTALLED TO REPLACE STICK-UP CASINGS.)

REVISIONS BY GLYNN GEOTECHNICAL ENGINEERING TO NOTE POST-CONSTRUCTION WORK ITEMS COMPLETED 5/98

NOTES:

1. MAPPING ADOPTED FROM TOPOGRAPHIC SURVEY MAP PREPARED BY NIAGARA BOUNDARY & MAPPING SERVICES, LSPC 345 THIRD STREET, SUITE 470 - CARBORUNDUM CENTER NIAGARA FALLS, NEW YORK 14303
2. AERIAL PHOTOGRAPHY WAS OBTAINED FROM LOCKWOOD MAPPING, INC. DATED APRIL 1994.

N 49000
E 101500

LEGEND

- P-1 — LONG-TERM PIEZOMETER
- TREE LINE
- CREATED/RESTORED WETLAND AREA
- EXISTING WETLAND AREA
- APPROXIMATE LOCATION OF EXISTING FENCE
- 6' HIGH CHAIN LINK FENCE
- UTILITY POLE
- 565 — EXISTING ELEVATION CONTOUR
- 580 — FINAL GRADE ELEVATION CONTOUR
- PERIMETER BERM

FRONTIER CHEMICAL
PENDLETON SITE
TOWN OF PENDLETON
NIAGARA COUNTY, NEW YORK

CONSTRUCTED/RESTORED WETLANDS

200 0 200

SCALE IN FEET

FILE NO. 5829.27084.00X
SEPTEMBER. 29, 2000

O'BRIEN & GERE
ENGINEERS INC.

PLOT DATE: 9/29/00

APPENDICES

Appendix A

Photograph Log

Frontier Chemical-Pendleton Site
Town of Pendleton
Niagara County, New York
Photograph Log

Photo 1. Looking east from east side of weir structure at Wetland #1.
Date: August 10, 2000

Photo 2. Looking north from large shoreline bend at Wetland #1.
Date: August 10, 2000

Frontier Chemical-Pendleton Site
Town of Pendleton
Niagara County, New York
Photograph Log

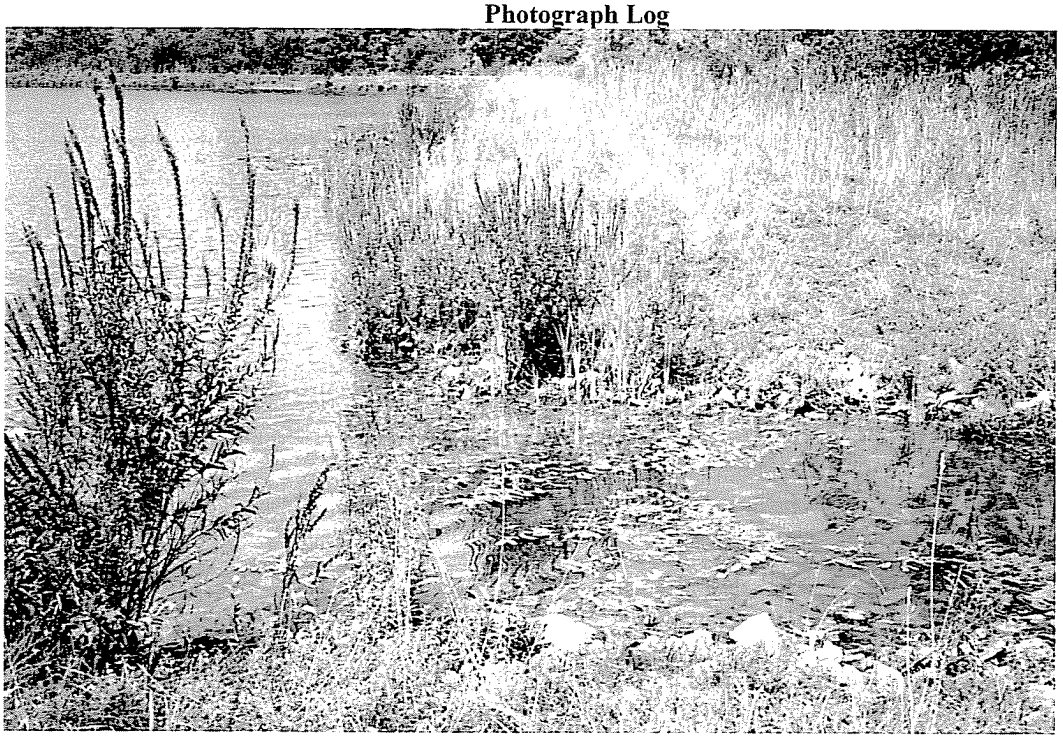


Photo 3. Looking west at Quarry Lake weir outlet structure.
Date: August 10, 2000

Photo 4. Wetland #1: representative cover of Sago pondweed throughout Wetland #1, "Zone A."
Date: August 10, 2000

Frontier Chemical-Pendleton Site
Town of Pendleton
Niagara County, New York
Photograph Log

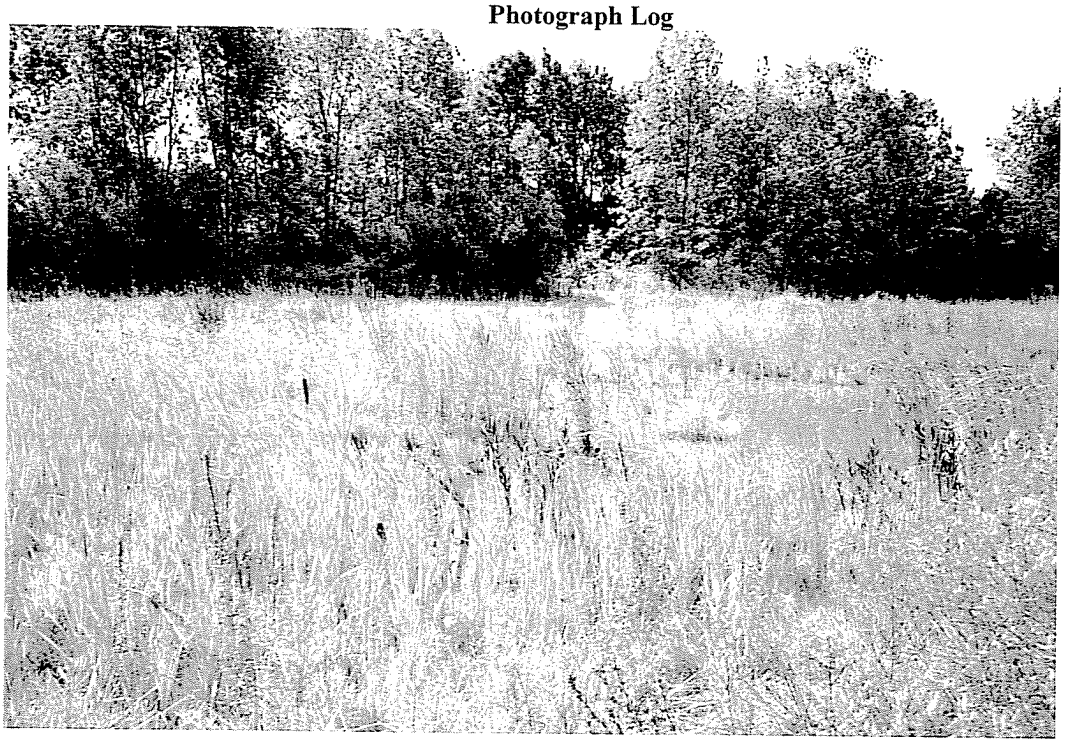


Photo 5. Looking east at Wetland #2, area northeast of the capped area.
Date: August 10, 2000

Photo 6. Looking northeast at Wetland #2, area east of the capped area.
Date: August 10, 2000

Frontier Chemical-Pendleton Site
Town of Pendleton
Niagara County, New York
Photograph Log

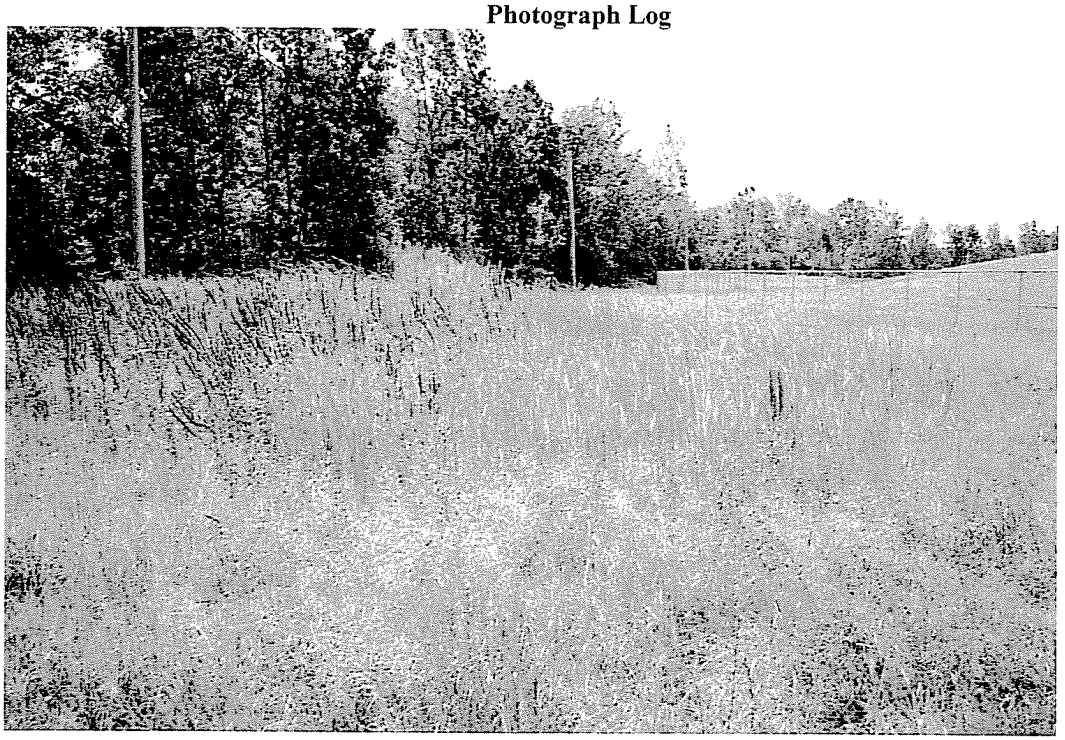


Photo 7. Looking south at Wetland #2, area east of the capped area.
Date: August 10, 2000

Photo 8. Natural recruitment of *Populus deltoides* in Wetland #2, area northeast of the capped area.
Date: August 10, 2000

Frontier Chemical-Pendleton Site
Town of Pendleton
Niagara County, New York
Photograph Log

Photo 9. Looking north at Wetland #2, area northeast of the capped area.
Date: August 10, 2000

Photo 10. Looking southwest at Wetland #2, area northeast of the capped area.
Date: August 10, 2000

Frontier Chemical-Pendleton Site
Town of Pendleton
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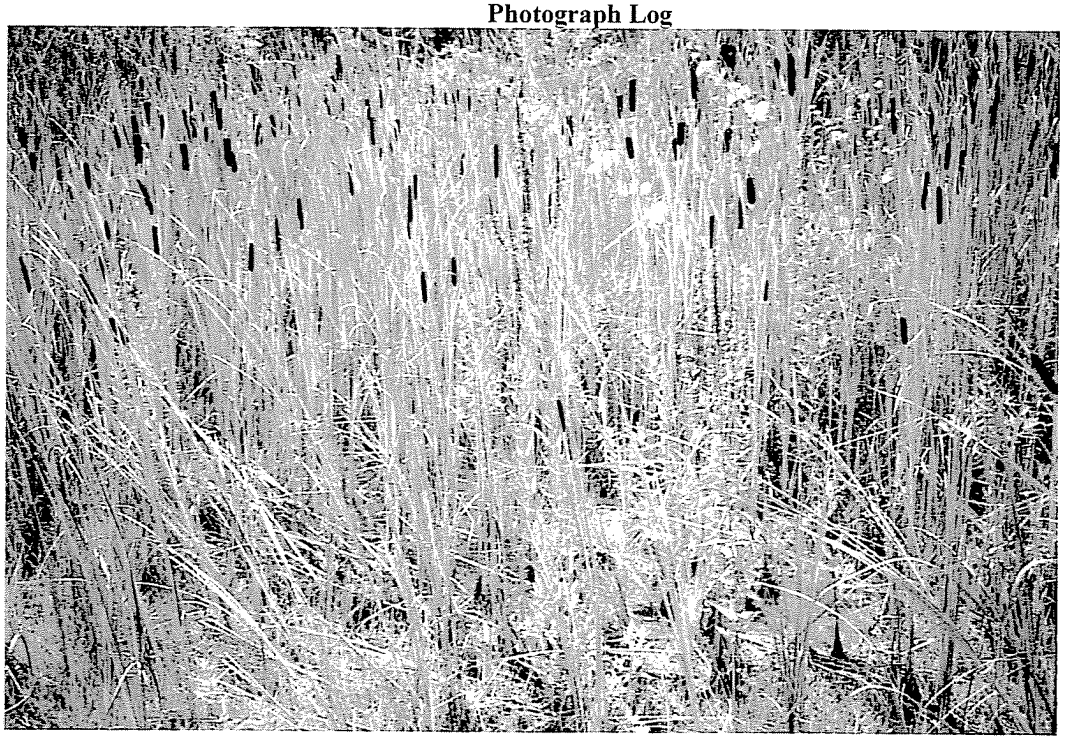

Photo 11. Looking southwest at Wetland #3.
Date: August 10, 2000

Photo 12. Looking south at central portion of Wetland #3.
Date: August 10, 2000

Frontier Chemical-Pendleton Site
Town of Pendleton
Niagara County, New York
Photograph Log

Photo 13. Looking west at incidental naturally occurring wetland along edge of Quarry Lake based on normal conditions at the Site.
Date: August 10, 2000

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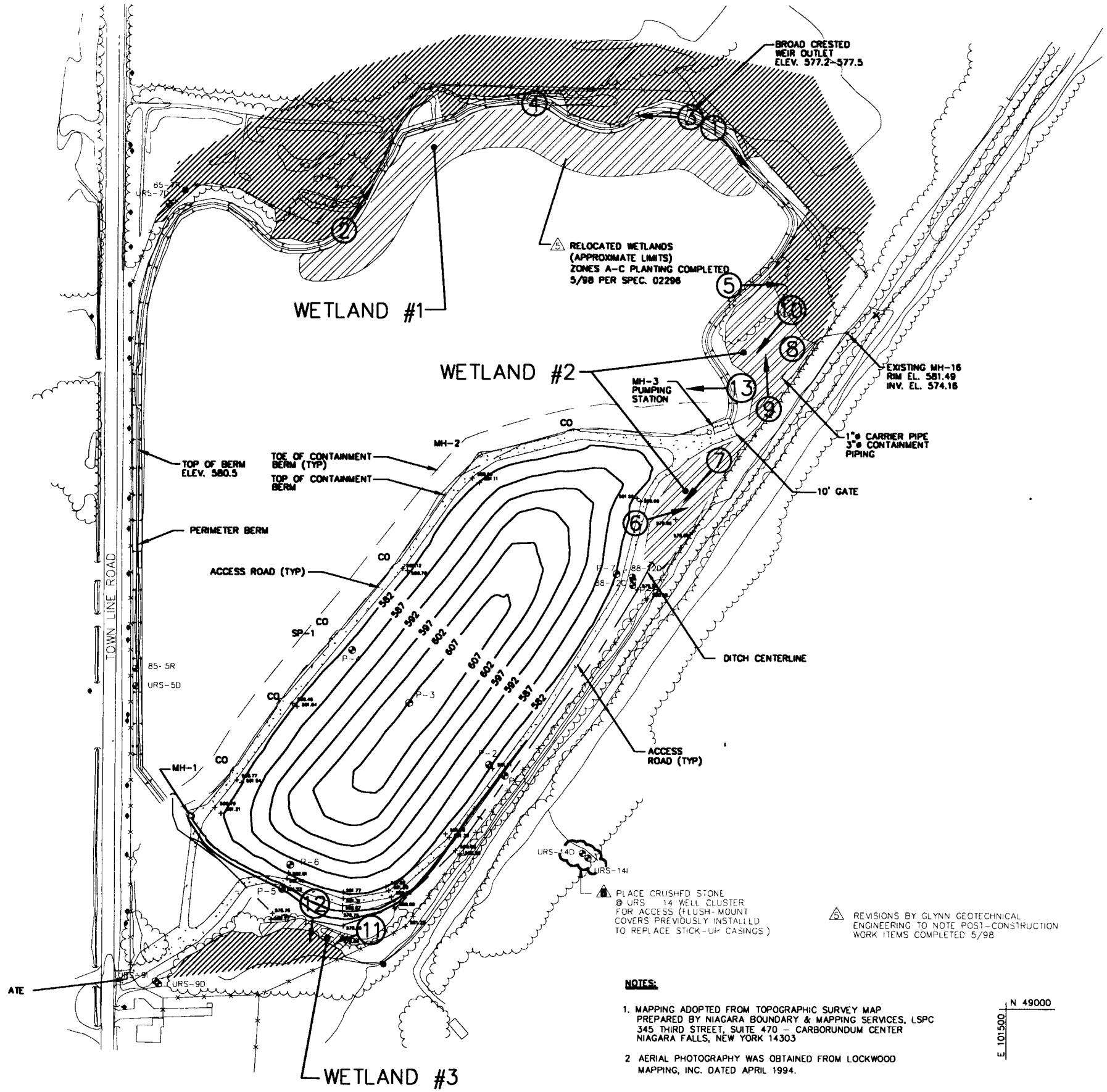
PLOT DATE: 9/29/00



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2. AERIAL PHOTOGRAPHY WAS OBTAINED FROM LOCKWOOD MAPPING, INC. DATED APRIL 1994.

FIGURE A-1

LEGEND

- ④ DIRECTION CAMERA POINTED FOR PHOTOGRAPH
- P-1 LONG-TERM PIEZOMETER
- TREE LINE
- CREATED/RESTORED WETLAND AREA
- EXISTING WETLAND AREA
- APPROXIMATE LOCATION OF EXISTING FENCE
- 6' HIGH CHAIN LINK FENCE
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- 565 EXISTING ELEVATION CONTOUR
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FRONTIER CHEMICAL
PENDLETON SITE
TOWN OF PENDLETON
NIAGARA COUNTY, NEW YORK

PHOTOGRAPH LOCATION MAP

200 0 200

SCALE IN FEET

FILE NO. 5829.27084.00X
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