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COLESVILLE LANDFILL WETLAND MITIGATION

DRAFT COMPENSATION WETLANDS PLAN

Prepared For

BROOME COUNTY

DIVISION OF SOLID WASTE MANAGEMENT

Broome County, New York

and

GAF CORPORATION

Wayne, New Jersey

November 1993

Wehran-New York, Inc.
Middletown, New York

and

Wetlands Research Associates, Inc.
Newark, New Jersey

Environmental Engineers • Scientists • Constructors

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Prepared for

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DIVISION OF SOLID WASTE MANAGEMENT
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1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this report is to provide a conceptual plan for the creation of compensation wetlands as part of permit requirements for remedial actions at the Colesville Landfill, Broome County, New York.

These plans have been based on wetlands information provided in ***Remedial Design – Conceptual Design Report (June 1992), Pre-Final Engineering Design Report – Remedial Design of Final Cover and Groundwater Collection Systems (February 1993)***, correspondence documents with USEPA, and a brief site reconnaissance (November 1993).

It is the goal of Broome County and GAF Corporation to maintain the integrity of the compensation site, and the environmental benefits provided by this site. Therefore, the County will not allow farming, silviculture, or ranching activities to occur on the compensation site. However, the compensation site may be used in the future for educational purposes and non-intrusive features. Roads and structures will not be constructed in the compensation sites unless a permit under Section 404 of the Clean Water Act is first obtained.

2.0 EXISTING CONDITIONS

2.1 SITE CONDITIONS

The Colesville Landfill site is located 1,400 feet from the eastern bank of the Susquehanna River, 18 miles east of Binghamton, in eastern Broome County (Figure 1). Elevations on the landfill vary from 1,150 to 960 feet above sea level, while the river elevation is 930 feet above sea level. Two streams, on the east and west sides of the landfill, drain directly into the river. Soils in the landfill area are predominantly Braceville, Chenango and Howard, and Mardin channery series (Figure 2). Unadilla and Wayland series are the dominant soils of the floodplain along the river.

Vegetation on the landfill is a mixture of herbaceous weed and grass species. Some areas are sparsely vegetated, with barren soil and rock fragments visible. Species included asters (Aster spp.), goldenrods (Solidago spp.), sweet fern (Comptonia peregrina), ragweed (Abrosia artemisiifolia), foxtail (Alopecurus spp.), broomsedge (Andropogon virginicus), and various grasses.

Upland forest occurs along the eastern and southern sides of the site. Species encountered in the forested areas include oaks (Quercus spp.), shagbark hickory (Carya ovata), beech (Fagus grandifolia), sugar maple (Acer saccharum), white pine (Pinus strobus), and black cherry (Prunus serotina). Areas along streams and seeps (i.e., wetlands) were dominated by hemlock (Tsuga canadensis), red maple (Acer rubrum), and hornbeam (Carpinus caroliniana). Agricultural fields are located along the northern landfill boundary (hayfield) and approximately 200 feet southeast of the landfill (plowed field adjacent to East Windsor Road).

2.2 SITE WETLANDS

The following description of site wetlands is from the ***Remedial Design – Conceptual Design Report, (June 1992)***.

The March 1991 Record of Decision for the site required that a wetlands survey, based on the "three-parameter method" be conducted during the remedial design phase. Wehran conducted a wetland delineation to identify and map wetland areas occurring on the site, and in the immediate vicinity of the site, which could potentially receive impact by remedial construction activities.

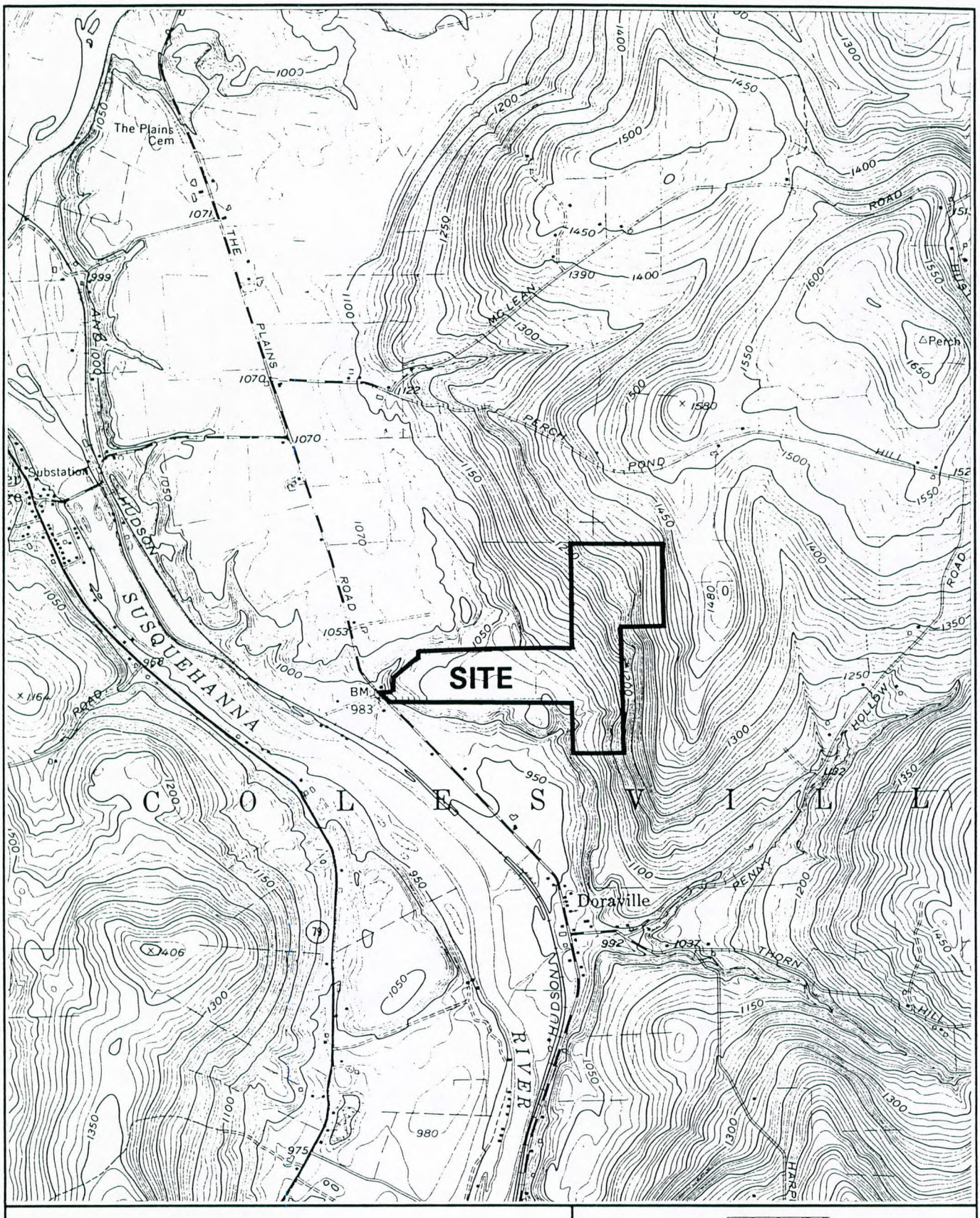

Figure 1. Site Location Map
Afton, NY, USGS
Scale: 1" = 2000'

Wetlands Research Associates, Inc.

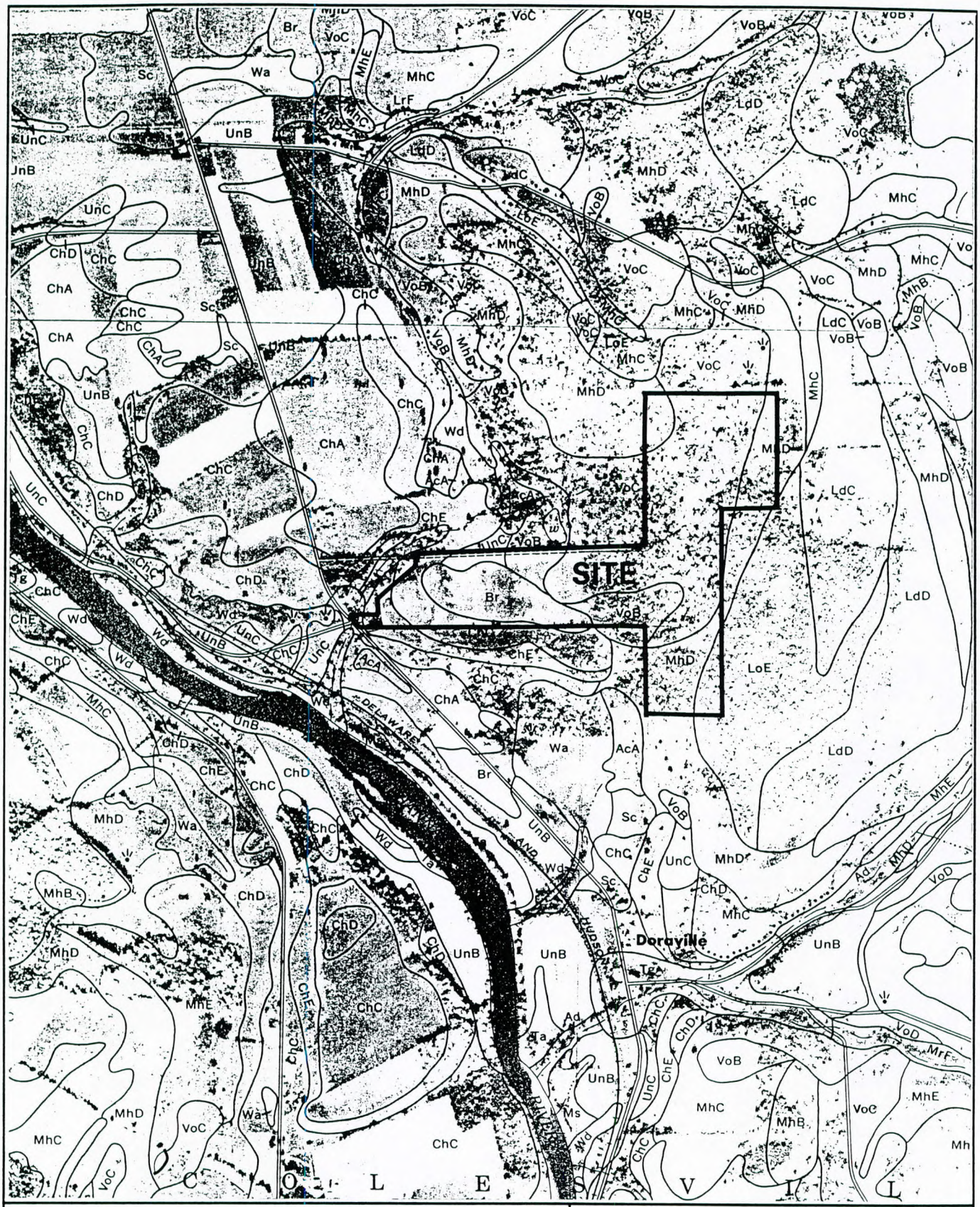

Figure 2. Site Soils Map
Soil Survey of Broome County, New York
USDA, SCS, 1971, pp.46,36 Scale: 1" = 1320'

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Wetlands occurring in the study area were delineated in the field on April 6, 1992 and April 7, 1992. Surveying of the wetland boundaries was performed by Wehran on April 9, 1992 and April 10, 1992.

Review of NYSDEC Freshwater Wetland Maps for the Colesville area indicate that there are no State-regulated wetlands on or near the site (Figure 3). However, a review of National Wetland Inventory Maps indicates that three wetlands occur within the study area (Figure 4). These include two palustrine, unconsolidated bottom excavations (PUBH; i.e., ponds); and one palustrine, forested wetland (PFO1).

On April 6 and 7, 1992, biologists from Wehran flagged the wetland boundaries in the field using the three-parameter approach described in the Wetland Delineation Manual (Corps of Engineers, January 1987).

2.2.1 Wetland Descriptions

Eight wetlands were flagged within the study area (see Sheet 1 of 1). These wetlands range in size from 0.04 to 0.84 acres. Wetland A is a small depression. Wetlands B and H are associated with the streams previously described. Others originate as groundwater or leachate seeps (Wetlands C, D, E, F, G). All of the wetlands along the southern side of the study area are part of a larger wetland located further south. Only the upper portions of these areas, which originate as seeps and which may be impacted by remedial activities, were flagged as part of this study.

Several, small wetland microhabitats, were also noted on the landfilled section of the site. These microhabitats are all isolated depressions less than 0.1 acre in size and were not included in the mapping presented on Sheet 1 of 1. Although hydrophytic vegetation was present in these areas, standing water and saturated soil conditions are believed to be present only after storm events.

Following is a description of each wetland area flagged as part of this study. Data sheets and photographs of each wetland are included in Appendix B.

Wetland A

This wetland is located on adjacent property near the north-central landfill border. The wetland is a small depressional area which receives drainage from the east, south, and west. A small outlet is located to the north. The wetland consists of an open water area

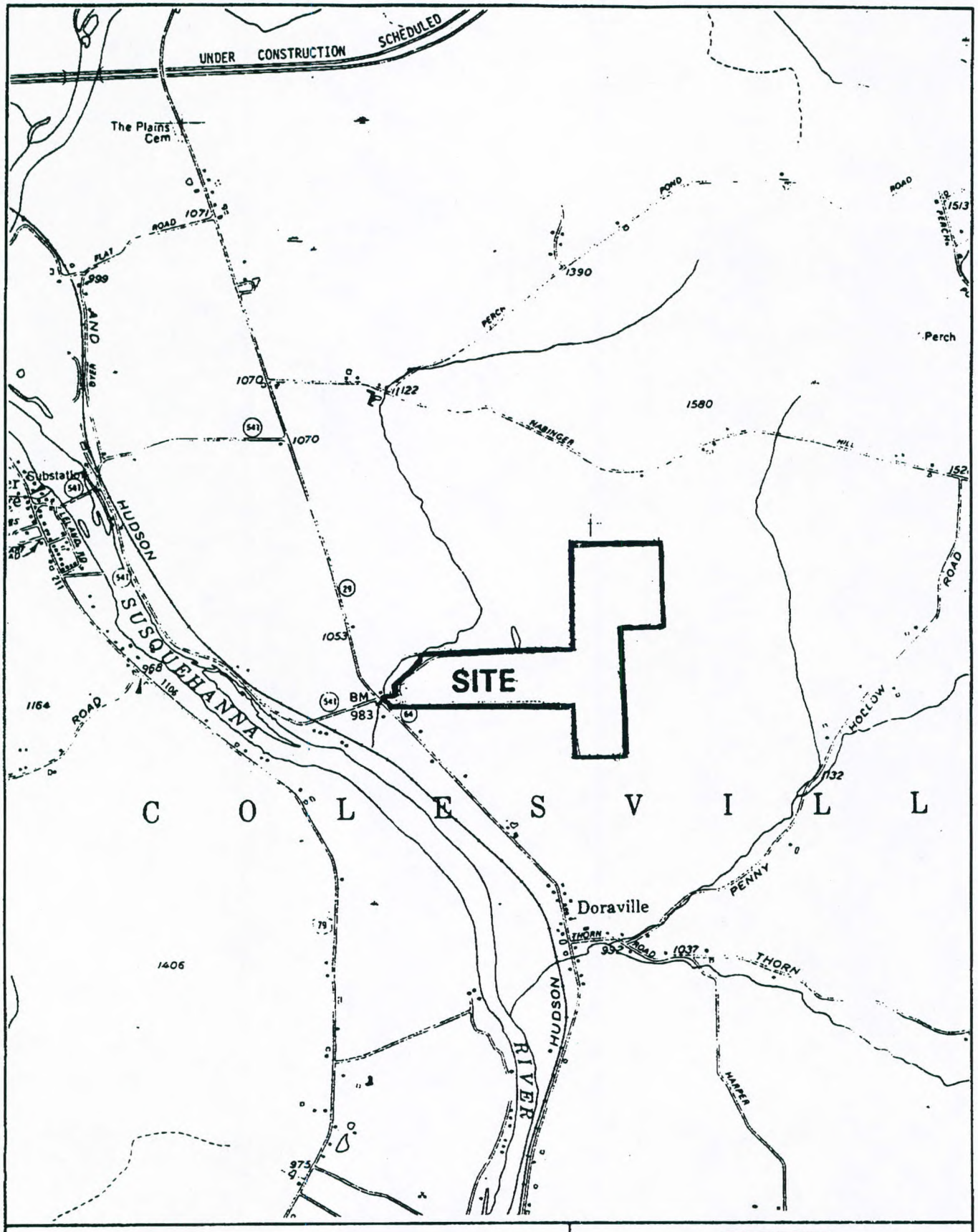

Figure 3. NYSDEC Freshwater Wetlands Map
Reference: Freshwater Wetlands Act, October 3, 1984
Scale: 1″ = 2000'

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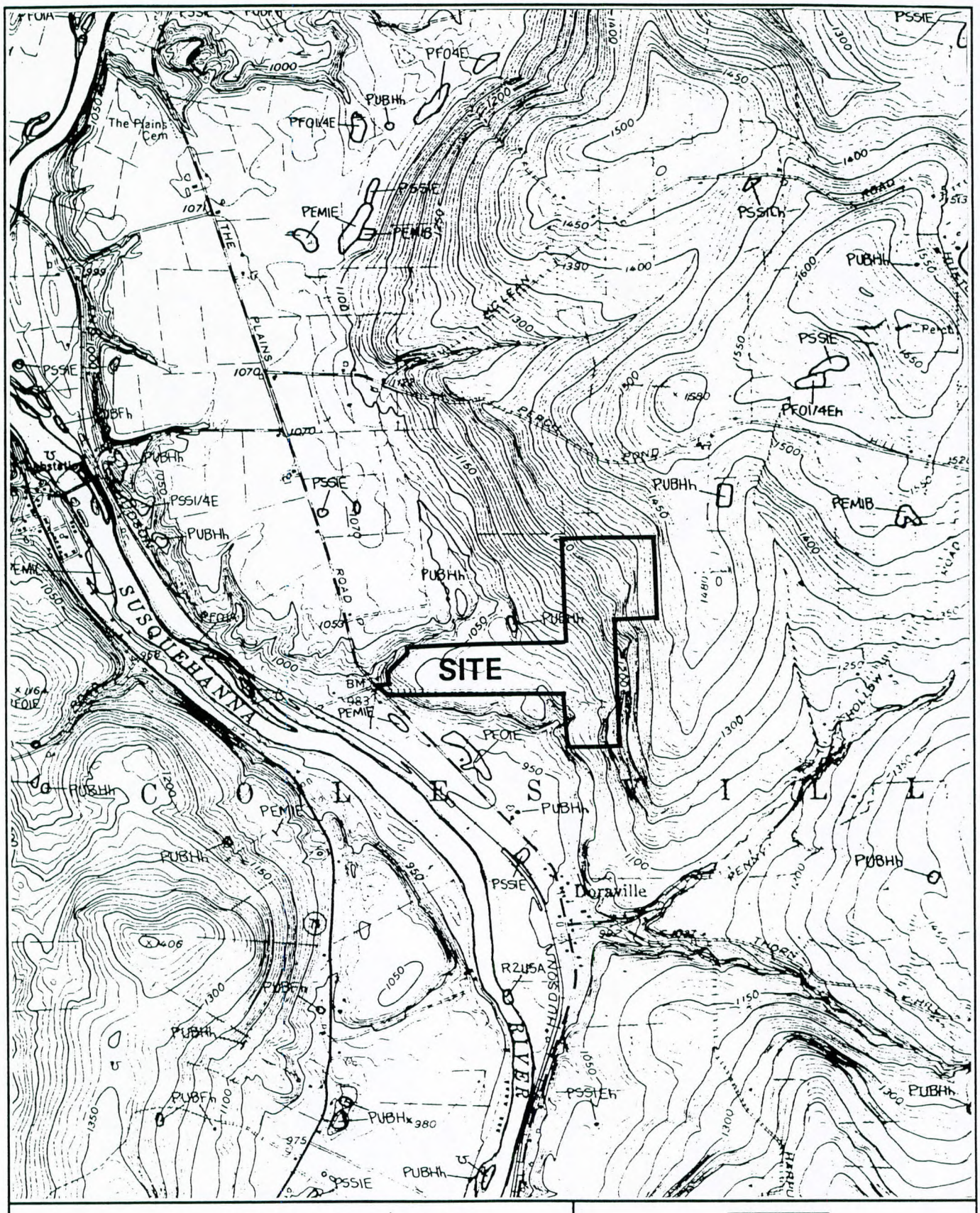

Figure 4. National Wetlands Inventory Map
Afton, NY, USFWS
Scale: 1" = 2000'

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(1 to 2 feet deep), surrounded by a concentric ring of emergent vegetation 5 to 20 feet wide. Some hydrophytic shrubs and trees are located adjacent to the emergent zone. These shrub species include witch-hazel (Hamamelis virginiana, FAC-), speckled alder (Alnus rugosa, FACW+), hornbeam (FAC), buttonbush (**Cephalanthus** occidentalis, OBL) and red maple (FAC). Herbaceous species noted in the emergent zone consist of wool grass (Scirpus cyperinus, FACW+), soft rush (Juncus effusus, FACW+), tearthumb (Polygonum sagittatum, OBL), and sensitive fern (Onoclea sensibilis, FACW).

Soils in the vicinity of Wetland A are mapped by the Soil Conservation Service (SCS) as Volusia channery silt loams. These soils consist of deep, poorly-drained, loamy soils formed in dense till. Soil samples retrieved within the wetland boundary, from depths up to 12 inches, were both mottled and gleyed. Mottle colors were generally found to range from orange to red (2.5YR 4/8 to 2.5YR 5/8). Gley colors were typically 5GY 7/1. Soils within the wetland boundary were inundated or saturated to the surface. This wetland is 0.76 acres in size.

Wetland B

This wetland is a small (0.2169 acres) linear wetland associated with a ditched tributary on the east side of the landfill. The wetland ranges from approximately 2 to 10 feet wide in certain areas. Characteristic plants include willow, rush, and sedge along the stream channel. Flowing water (2 to 3 inches deep) was present in the drainage channel.

Wetlands C, D, E, F, and G

Wetlands C through G originate as groundwater seeps on the south facing slope, approximately 400 to 500 feet south (below) of the landfill. Several of these wetlands have visible leachate discharges in the upper sections of the wetlands. All of these areas start out as small linear rivulets or seeps, and drain south into a larger wetland complex. The areas flagged represent fingers of the same wetland which extend up the hillside. All wetland flagging was terminated at an access road which runs along the base of the hill. No physical wetland impacts are expected below this road; subsequently, these areas will not be disturbed.

Dominant overstory vegetation within the wetland areas includes red maple and hemlock, with occasional green ash and yellow birch (Betula alleghaniensis, FAC). Understory tree and shrub species include spicebush (Lindera benzoin, FACW-), hornbeam, and which-hazel; with occasional red-oiser dogwood (Cornus stolonifera, FACW+), winterbery (Ilex opaca, FACW+), and green ash (Fraxinus pennsylvanica, FACW). Herbaceous plants within the wetland areas were skunk cabbage (Symplocarpus foetidus, OBL), Christmas fern (Polystrichum acrostichoides, FACU-), unknown sedge, violets, and goldthread (Coptis groenlandica, FACW).

Surface water in these wetlands varied from small channels of flowing water to small depressions containing 1 to 3 inches of water. In all cases, the ground surface was saturated.

Soils on the south-facing slope below the landfill, are classified by the SCS as Chenango and Howard gravelly loams. Chenango soils consist of deep, medium-textured soils formed in glacial outwash. Howard soils are similar but typically have more clay in the subsoil. Soil samples collected throughout the wetlands on the south-facing slope ranged from sandy silts to sandy clays. Black muck was common on the surface, and all samples were mottled (2.5 YR 4/8 to 2.5 YR 6/8) at depths between 3 to 8 inches.

The acreage of each of these wetlands is presented on Sheet 1 of 1. All of these areas are considered palustrine forested wetlands.

Upland areas adjacent to these wetlands contain overstory tree species of red maple (FAC), red oak (Quercus rubra, FACU-), white ash (Fraxinus americana, FACU), and shagbark hickory (FACU-). Understory species include hornbeam, beech (FACU), and white pine (FACU). Ground layer plants were running pine (Lycopodium clavatum, FAC), teaberry (Gaultheria procumbens, FACU), and partridge-berry (Mitchella repens, FACU). Soils in the upland areas consist of a 1 to 3-inch organic layer over silt or clay loams. Mottling and gleying were absent in the top 12 inches of soil.

Wetland H

Wetland H is associated with the stream located to the north of the landfill. Conditions and appearance of the wetland vary considerably as the stream flows to the west. The stream originates in a wooded area west of Wetland A, and as it flows through the agricultural fields, scrub/shrub habitat prevails. The upper sections of Wetland H were

not flagged because no impacts are anticipated in this area. As the stream proceeds west, steep hemlock-covered banks are encountered. The wetland area in this section is limited to the rock-covered stream bottom. Further along the stream, deciduous trees become dominant in more of a floodplain type environment.

Soil samples were only obtained in the upper sections of Wetland H due to the prevalence of rock in the stream bed. Also, the wetland was typically defined as the stream channel in the lower reaches.

3.0 WETLANDS IMPACTS

3.1 IMPACTS

Remedial construction activities at the Colesville Landfill which will potentially affect on-site and nearby wetlands will include: capping of the waste areas, groundwater withdrawal and treatment, disturbance of borrow areas, discharge of treated effluent, and discharge of non-contact stormwater from the capped areas.

Precise conclusions concerning the impacts of drawdown are difficult given the complexity of wetland/groundwater interactions, as well as inaccuracies associated with extrapolating engineering designs' impacts for the future. However, impacts to wetland environments around the landfill will be offset by the enhanced protection of water resources and public health.

Wetlands found on the landfill and in the surrounding area are identified on the Wetland Delineation Map included in Appendix K. Presented below is a description of potential impacts to each wetland.

Wetland H (North Stream)

Wetland H consists of small fringe wetlands located along the North Stream. This stream and associated wetlands are currently fed by surface water flowing from higher topographic areas and from discharging groundwater. Current remedial design plans call for the placement of several pumping wells and an impermeable cap along the western end of the landfill, which will reduce the amount of discharging groundwater to the stream. The result of this loss to the stream hydrology may decrease the flow rates in the lower section of the stream. Drawdown in that same area also raises the potential for the water way to become a losing stream (i.e., contributing to groundwater).

Leachate Seeps 1 and 3, located adjacent to the North Stream, will be intercepted by a collection system. The collection system, consisting of geosynthetic clay, composite, subangular stone, slotted polyethylene pipe, and a pump station will be located in those positions currently occupied by the seeps. Construction of the seep collection system is expected to physically impact the stream bank. However, backfilling of the collection system excavation upon completion will mean that the physical disturbance will be temporary.

Further, Leachate Seeps 1 and 3 should dry up over a period of time resulting in an overall improvement in water quality for the North Stream.

The stream's losing water balance may be compensated by the addition of treated effluent and non-contact stormwater runoff that will be directed to it from the landfill cap. Runoff will enter the stream via a step downchute located off the western end of the landfill. The step downchute can reduce the velocity of the flow by approximately 25 percent and allow some suspended particles associated with the stormwater to settle out.

Design plans also call for treated effluent to be discharged to the North Stream. The effluent will enter DC-1-3 (diversion swale) from the treatment plant and enter the stream via the energy dissipating downchute. This discharge will be at a maximum rate of 80 gpm (gallons per minute), and an average temperature of 50 to 55°F. A hydrological evaluation of the waterway utilizing the Soil Conservation Service's Technical Release No. 55 method, indicates that the peak discharge rate is far greater than the treated effluent discharge rate of 80 gpm (0.18 cfs) and will therefore not impact the existing drainage capacity of the North Stream.

Wetland A

Wetland A is an isolated wetland on the north side of the landfill. This wetland receives surface flow and groundwater discharge from higher topographic areas. Drainage from the wetland flows to the west into the North Stream. This wetland is not expected to be impacted by capping and borrow activities because it is essentially upgradient or cross-gradient of all operations. Drawdown should also have little affect since the wetland is underlain by a highly impermeable till and receives overland flow from an upslope origin that will not be affected by remedial construction activities. Accordingly, the vertical leakage from Wetland A has been calculated at 0.07 gallons/day per square foot (22,194 gallons/day) based upon a 20-year model of groundwater drawdown of 4 feet in the vicinity of Wetland A. This vertical leakage will be an increase of 7.8 percent from the present day vertical leakage of 20,583 gallons/day (see Appendix L). These numbers equate to a loss of approximately 1,611 gallons/day to the surface water flow leaving the wetland and entering the North Stream.

Wetland B

Wetland B is comprised of a small narrow ditch corridor on the eastern (uphill) side of the site. In order to protect the integrity of the cap in that area, the stream corridor (Wetland B) will be rip-rapped along its length on the eastern end of the landfill and pass through a culvert near the southeast corner of the landfill.

Drainage from the sediment basin will be discharged to this drainage corridor following the removal of sediment.

Wetlands C, D, E, F, and G

Wetland areas C, D, E, F, and G will likely be affected by drawdown along the southerly portion of the landfill. These wetlands occur as seeps which are driven by the hydraulic head from that area. Drawdown is necessary in the southern portion of the landfill to help control flow from Leachate Seep 2, located immediately upslope of Wetlands C, D, E, F, and G. It is anticipated that these wetland areas will be lost as a result of remedial activities.

Wetlands I, J, K, L, M, N, O, P

Capping activities will also require the filling of several small wetlands located directly on top of the landfill. Wetlands I, J, K, L, M, N, O, P, and Q currently exist as small, depressional, emergent wetlands, of which some originate as leachate seeps. The loss of these areas is unavoidable as capping is required to reduce the infiltration of precipitation into underlying waste strata.

Remedial construction activities, including capping and borrow operations, discharge of treated effluent, stormwater discharge, and groundwater withdrawal, will affect the wetlands on and around the Colesville Landfill. Those wetlands expected to be impacted minimally include Wetland Areas A and H. These wetlands comprise 1.60 acres. Wetland B comprising 0.22 acres, will receive impacts by construction activities that include placing rip-rap in the stream channel and passing the stream through a culvert. Wetland Areas C, D, E, F, and G, totaling 0.39 acres, are expected to be eliminated as a result of drawdown. Wetland Areas I, J, K, L, M, N, O, P, and Q, on top of the existing landfill and comprising 0.48 acres, will be lost because of capping operations. USEPA has required that mitigation be provided for 0.9 acres of wetlands.

4.0 PROPOSED CONCEPTUAL PLAN

The restoration plan for the mitigation site includes the following elements:

1. Topographic map of existing conditions and proposed contours for grading and excavation.
2. Revegetation plan describing species to be planted, density, and distribution throughout the mitigation area.
3. Monitoring, as necessary, to determine the success of the grading and revegetation plan.

4.1 RESTORATION PLAN OBJECTIVES

The restoration plan seeks to replace wetland habitat lost as a result of the remedial actions on the landfill site. Wetlands receiving impacts from the remedial actions consist of emergent wetlands located on the existing landfill surface, and forested wetlands on the slope woodland, south of the landfill (0.9 acres). These wetlands serve to improve water quality, desynchronize flood flows, moderate base flows, and provide wildlife habitat. The proposed compensation program seeks to mitigate for these losses by restoring a greater acreage of wetland habitat on the site within the borrow area.

Specifically, the restoration plan will:

1. Create emergent, scrub shrub, and forested wetlands in the lower area of the borrow area adjacent to the sediment basin.
2. Revegetate the upper borrow area with an assemblage of forest tree species.
3. Increase wildlife habitat in the restored borrow area through increasing habitat diversity to include open water, emergent marsh, scrub shrub, forested wetlands, and restored upland forest.
4. Permanently preserve and protect wetlands through site ownership and maintenance

The success of the restoration effort will be measured against these objectives.

4.2 CONCEPTUAL DESIGN

The creation of wetland hydrology on site may be achieved immediately adjacent to the proposed sediment basin in the borrow area on the eastern edge of the landfill (Figure 5). Specifically, wetland hydrology may be created on a expanded shoreline margin on the north and eastern borders of the sediment basin. It is anticipated that approximately 10 feet of soils and glacial till will be removed throughout the borrow area in order to provide sufficient material for the new landfill cap. Approximately 0.5 acre of pond margin will be created by excavation into the hillside, in addition to the sediment basin area. The compensation wetland area will be comprised of the 0.5 acre permanent pond (initial sediment basin), and the 0.5 acre wetland margin.

The primary source of water will be the stream within the borrow area and the surface runoff from the southern portion of the new landfill cap area. Groundwater elevations within the borrow area have not been determined, but may be assumed from boring data to be at streambed elevations in the stream between the landfill and borrow area, or about 20 feet below the existing land surface. Water elevation within the basin and wetland margin will be set by a riser and discharge structure.

The final construction specifications will describe the over excavation (one foot deeper) of the wetland margin area. This will allow for the addition of a one-foot depth of hydric soils from the stream and swale corridors of the borrow area, to bring the surface of the wetland up to the desired elevations. Hydric soils in the created wetland will enhance the growth of wetland plants through their associated soil moisture capacity, nutrients, and seed bank.

The wetland margin will include shallow water habitat, emergent marsh, scrub shrub and forested wetland areas. Wetland communities within the area are: shallow water and emergent marsh (-0.5 to +0.5 feet above pond water elevation), scrub shrub (+0.5 to 1.0 feet), and wetland forest (1.0 to 3.0 feet). Figure 6 presents a diagrammatic layout of the planting area. The actual borders between communities will be blended and irregular as in natural communities. Calculations for the 10-year, 24-hour storm event indicate that basin elevations will extend to the mid-elevations of the forested wetlands (1,056.5 feet). The basin/pond discharge structure will be developed to allow for the adjustment of basin water elevation. This will allow for the possible alteration of the basin elevation during the

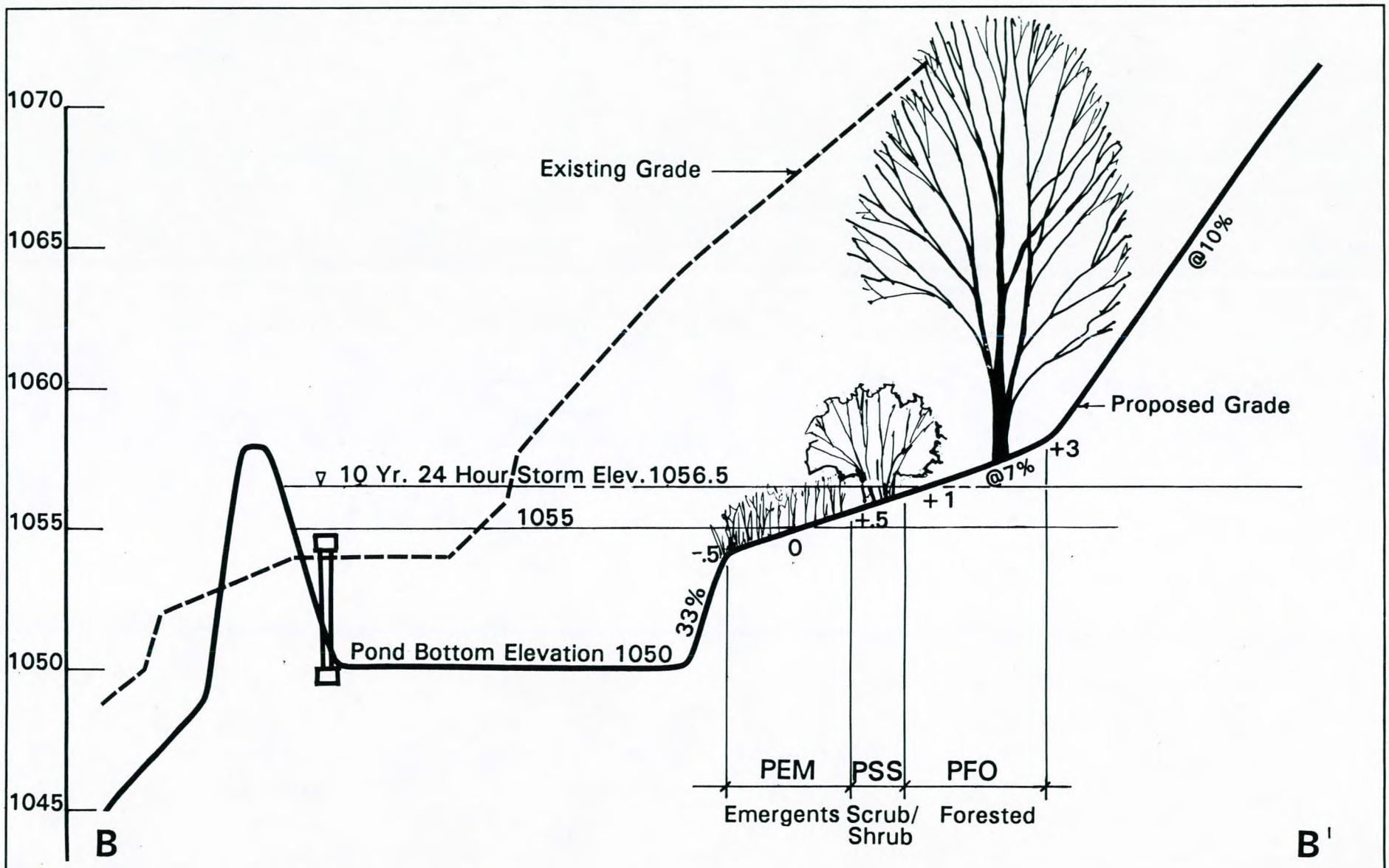

Figure 6. Sediment Basin Cross-Section B-B'
Not to Scale

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monitoring period, towards a final and permanent basin elevation that achieves the desired hydrology within the margin wetland communities.

Plant species suggested for the wetland area are given in Table 1. All species are native plants either commonly found on site or within the region. All plant material may be purchased from regional wetland nurseries.

TABLE 1
WETLAND SPECIES FOR PLANTING

Species Name	*Common Name*	*Number*[1]	*Indicator Status*
Emergents			
Carex stricta	Tussock sedge	415 b.r.	OBL
Juncus effusus	Soft rush	415 b.r.	FACW+
Onoclea sensibilis	Sensitive fern	200 qt.	FACW
Sagittaria latifolia	Duck potato	200 qt.	OBL
Scirpus cyperinus	Wool grass	415 b.r.	FACW+
Sparganium americanum	Eastern bur-reed	200 qt.	OBL
Shrubs			
Alnus rugosa	Speckled alder	6	FACW+
Cephalanthus occidentalis	Button bush	6	OBL
Cornus stolonifera	Red-osier dogwood	6	FACW+
Salix purpurea	Streamco willow	6	-
Sambucus canadensis	Elderberry	6	FACW+
Trees			
Acer rubrum	Red maple	40	FAC
Fraxinus pennsylvanicus	Green ash	20	FACW
Salix nigra	Black willow	10	FACW+

[1] Plant material type: b.r. = bare root, qt. = quart container

5.0 COMPENSATION SITE FEASIBILITY

5.1 TOPOGRAPHY AND DRAINAGE

The sediment basin, compensation wetland, and borrow area is located adjacent to the east end of the landfill. The site lies on a hillside that slopes moderately to the southwest and is heavily wooded. The area is drained by a swale and two streams that eventually drain into the Susquehanna River, approximately one-half mile to the west. The elevation at the upper end of the proposed borrow area is 1,150 feet above sea level, and the lower elevation (near the proposed sediment basin) is 1,040 feet.

5.2 SOILS

The soil mapped in the borrow/compensation wetland area is Volusia channery silt loam, a deep, somewhat poorly-drained, loamy soil. The Volusia series is listed as a soil with potential hydric inclusions. Hydric soil types in the vicinity that may occur as inclusions in Volusia soil at the site, include Alden-Chippewa complex and Wayland soils.

AcA	Alden and Chippewa	Hydric	Deep, very poorly-drained in depressions and along drainage ways
Wd	Wayland	Hydric	Deep, poorly to somewhat poorly-drained
Unc	Unadilla silt loam	Non-Hydric	
Chc	Chenango and Howard	Non-Hydric	
Wa	Wallington silt loam	Hydric Inclusions	Deep, acid, somewhat poorly drained in slight depressions, sometimes ponded
MhD	Mardin	Non-Hydric	
Sc	Scio silt loam	Non-Hydric	
Vo	Volusia	Hydric Inclusions	

Soil data collected in the area of the sediment basin are presented below with auger locations given in Figure 5.

Auger	Depth	Description (Value/Chroma)
1	0-5" 5-10" 10-15" 15-20"	5/1, 4/1 10YR, Fe Ox roots 5/1, 4/1, 6/2 10YR 5/1, 6/1 5Y, Fe Ox Ag. 6/1 5Y, 6/8 10YR, Fe Ox Ag.
2	0-5" 5-20"	3/1 10YR 3/1, 5/3 10YR, 6/1 5Y, Fe Ox Ag.
3	0-5" 5-10" 10-20"	5/5, 4/2 10YR 5/4 2.5Y 5/4, 6/4 2.5Y
4	0-5" 5-10" 10-20"	5/5, 4/2 10YR 5/4 2.5Y 5/4, 6/4 2.5Y
5	0-5" 5-20"	3/1 10YR 3/1, 5/3 10YR, 6/1 5Y, Fe Ox Ag.
6	0-5" 5-10" 10-20"	5/5, 4/2 10YR 5/4 2.5Y 5/4, 6/4 2.5Y

5.3 HYDROLOGY

The area of the proposed sediment basin and compensation wetland is heavily influenced by surface flow from the upper watersheds to the north and east. Stream B, which flows in a channelized ditch west of and adjacent to the proposed basin and wetland, does not presently contribute directly to the surface flow. There are two swales and a small stream that converge in the southwest corner of the area, then joins Stream B and flows south. Although the drainage area is moderately steeply sloped, the entire area is forested with adequate cover to stabilize surface flows.

Limited information is available on groundwater in the borrow area. Groundwater elevations as shown in drawing details, are based on one boring log and the assumption that groundwater elevations are near the streambed of Stream B or about 1,050 feet in elevation, between the landfill and the borrow area. The boring log record from the borrow area indicates groundwater at about 20 feet below the surface. One may assume that in the

vicinity of the proposed sediment basin, groundwater may seasonally reach the bottom of the basin at an elevation of 1,050 feet.

5.4 VEGETATION

The proposed sediment basin and compensation wetland area is now predominantly second growth, mixed hardwood and pine forest. The upper elevations are dominated by white oak (Quercus alba), shagbark hickory, (Carya ovata), and white pine (Pinus strobus) with a sparse understory including black cherry (Serotina prunus). The lower elevations are dominated by red oak (Quercus rubra), white pine (Pinus strobus), and red maple (Acer rubrum). Throughout the study area in lesser amounts were American beech (Fagus grandifolia), poplar, birch (Betula sp.), hornbeam (Carpinus carolinianus), and red osier dogwood (Cornus stolonifera).

5.5 WILDLIFE

As second growth deciduous forest, the study area presumably supports diverse wildlife populations. During the November site visit, tracks and signs were observed for white-tailed deer, wild turkey, eastern cottontail, and canids. Red-tailed hawks and many passerine birds, including nuthatch, chickadee, fox sparrow, white-throated sparrow, cardinals, and crow were observed on the site.

5.6 SITE FEASIBILITY

The sediment basin in the borrow area will be designed as a permanent wet basin or pond with a 5-foot water depth overall. This open water area, with associated water control structure, can provide a stable hydrology for the establishment of a wetland margin along the water's edge.

Grading of the margin around the north and east of the basin can easily be achieved assuming the representation of the Boring Log 9 data to this location. Slightly steeper slopes will be required immediately upslope of the wetland border to achieve the original borrow area contours and cut volumes. Grading in the margin wetland will require a 7 percent slope from 0.5 below to 3.0 above the design water elevation.

The source of water for the margin wetland will be the surface water stream through the borrow area, subsurface soil moisture flow in the borrow area, and runoff from the

southeastern portion of the new cap landfill surface. Diversion of the adjacent stream (Wetland B) could be considered. The relocation of hydric topsoil from the borrow area to the margin wetland will ensure greater and enhanced growth of wetland plants.

6.0 PLANTING DESIGN AND SPECIFICATIONS

The objective of the revegetation plan is to introduce species that can initiate the re-establishment of a diverse wetland and surrounding upland ecosystem. This will be achieved through:

1. Use of hydric soils from the impact areas to provide a seed source for "volunteer" wetland plant colonizers.
2. Planting with emergent and woody plants.

6.1 PALUSTRINE FORESTED WETLANDS

The dominant tree species of the area's forested wetlands are red maple, green ash and hemlock, with an understory of spice bush and ironwood. The compensation site plan will emphasize these dominants and add select species found elsewhere to enhance diversity. Site diversity will also increase as the dominants mature, providing greater shade and protection. Dominant species such as red maple, tend to be hardier, have wider moisture tolerances, and may survive better than less common species during the initial stages of the restoration. Additional wetland species will be selected both for being fast growing or otherwise less susceptible to grazing. A relatively rapidly formed canopy will allow for colonization by the shade tolerant wetland species not easily established in the open early stages of the compensation wetland development.

6.2 SCRUB-SHRUB WETLANDS

Shrub species will be planted within the forested areas at a equal density to tree species (Planting Specifications). Shrub species will be planted in clumps on the border of the forested wetland areas, therefore, preference will be for shade intolerant species. Willow cuttings and clumps of alder will be located along banks or the waters edge wherever possible.

6.3 EMERGENT WETLANDS

A portion of the compensation wetland area will be planted with emergent species. The wettest of these areas may remain in solely emergent species, but in most areas there

will probably be an invasion of tree and shrub species. In time, these areas may develop into forest communities.

Emergent wetland species will be located in areas where soils are probably saturated throughout the growing season. Although selected species will be planted from bare root stocks and seeding, many species of sedges, rushes, and broadleaved plants will invade and colonize these areas. It is expected that seeds and rootstocks in the hydric soils used as backfill, will also provide a source of plant propagules.

Many emergent wetland plant species can tolerate considerably dry, as well as wet conditions. These more hardy and facultative species will be located on berm slopes of the lower elevations, which will experience greater extremes in conditions.

6.4 BERM AREAS

Facultative grass species available in seed stock for basin berm areas include: redtop (Agrostis alba, bentgrasses (Agrostis tenuis) (Agrostis palustris), rough bluegrass (Poa trivalis) meadow foxtaile (Alopercus pratensis) and reed canary grass (Phalaris arundinacea) grass). All exposed soil will be seeded with this mixture.

6.5 UPLAND FOREST

Well drained, higher elevations of the sites, will be planted with trees to establish an upland buffer to the wetland. Trees planted will be representative of adjacent uplands, with an added emphasis on mast crops for enhanced wildlife value.

6.6 PLANTING SPECIFICATIONS

Plant species to be used are shown in Table 1. Planting details for trees and shrubs are discussed below. Trees to be used will be purchased at a height of 1 to 2 feet, and planted in a density equivalent to 10 feet on center; although planting location will be on a random basis. Species will be chosen randomly in each community group. Shrubs will be purchased at 1 to 2 feet in height, and planted in groups of 3, 5, and 7 of the same species. In the case of a scrub-shrub community, these groupings will be in a density equivalent to 10 feet on center.

The plan is based on the use of native "wet-cultured" plants grown especially for wetland conditions. Nurseries that specialize in native, wetland species should be contacted.

Other nurseries tend to grow trees and shrubs for landscaping in upland conditions, and the plants from these companies will not have been adapted to wetland conditions. If suitable plants are not available, it may be necessary to have them grown by nurseries under contract. All trees should be at least one year old prior to planting.

The location for the installation of various plant species will be shown on a detailed planting plan to accompany the final engineering drawings and specifications. These habitat and wetland types are shown in Figure 7. Emergent wetland species will be planted at the lowest elevation, where ponding is expected to occur the longest, or soil saturation the longest throughout the year. Forested wetland species will be planted in the area having a seasonally wet hydroperiod, generally from December to late May. FACW species will be distributed in wetter areas than FAC species. Upland species will be planted in areas that have a water table generally below 24 inches or, when higher, it only saturates the upper soil profile for brief periods of time.

Emergent species will be planted in the spring of 1995. Although seeding with facultative grasses is most needed to stabilize erodible surfaces, seeding may be carried out over the entire compensation site to hasten ground cover development with wetland species. A rapid natural colonization of the areas of hydric soils should be expected from the transported seed bed and wind born seeds. No additional watering is anticipated.

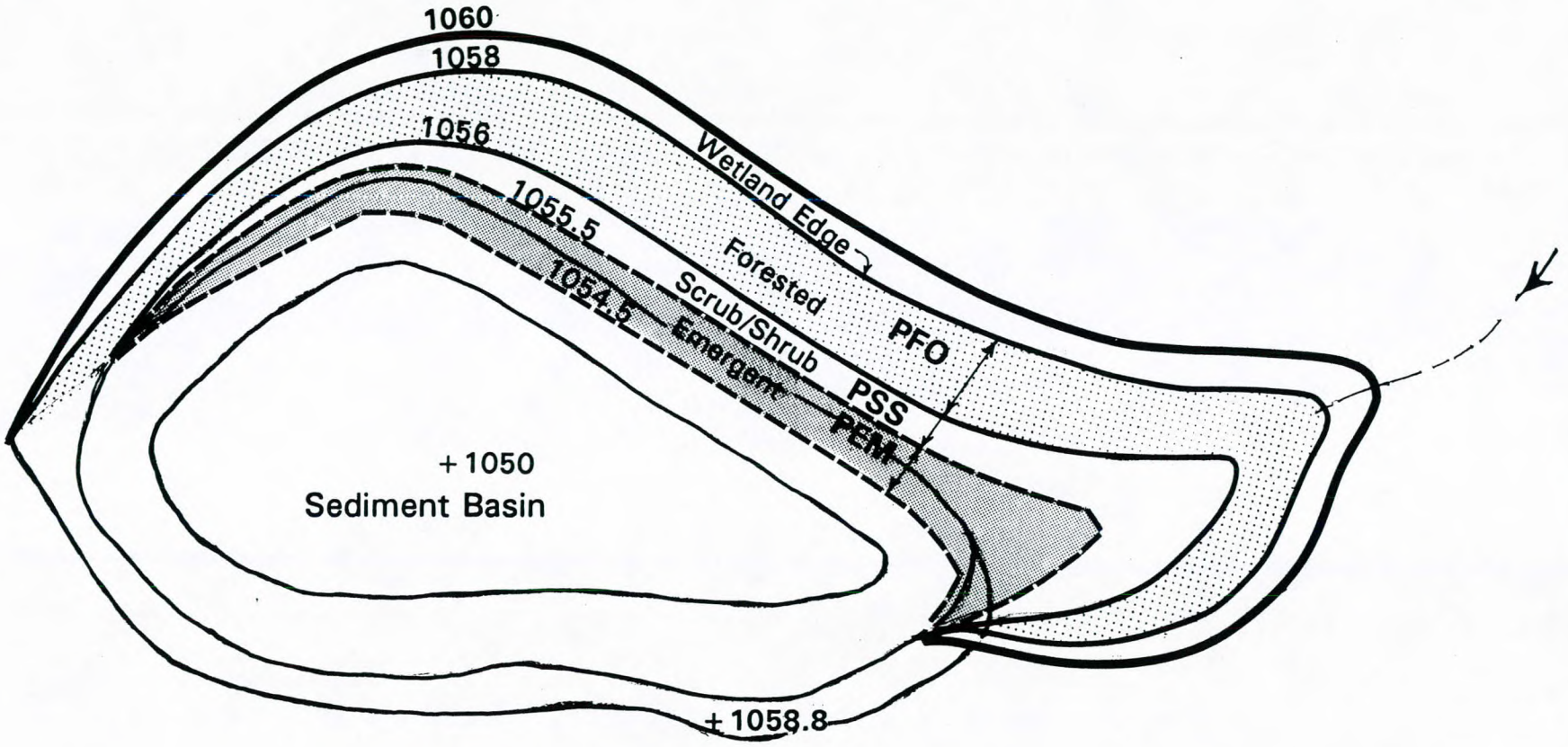

Figure 7. Wetland Compensation Planting Plan
Scale: 1" = 50'

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7.0 PROPOSED SCHEDULE

7.1 PLANTING SCHEDULE

General Schedule

Planting of aquatic or emergent wetland species will occur between April 1 and June 1, preferably during April. Fall planting of trees and shrubs will occur between September 1 and October 30. Planting will not occur when the ground is frozen, snow-covered, or in an otherwise unsuitable condition for planting. Propagules will be planted in the proportions determined above in this plan. All balled, burlapped, and container-grown plants will be handled and moved only by the ball or container.

Holes for planting will be dug to produce vertical sides and flat bottoms. When pits are dug with an auger, and the sides of the pits become glazed and smooth, the glazed surfaces will be scarified. The depth of the holes will be 6 inches deeper than the root ball. The width of the holes will allow a minimum distance between the ball and the sides of the hole of 6 inches for shrubs and 12 inches for trees. Loosen the bottom 4 inches of the hole with a shovel prior to planting. One part peat moss with four parts soil should be mixed to use as a soil amendment to support the root ball in the hole.

Plants will be set plumb, and manually held in position until sufficient soil has been firmly placed around roots or ball. Plants are to be set at the same depth at which they were grown in the nursery or container.

Balled and burlapped stock will be backfilled with soil to approximately half the depth of the ball, then tamped and watered. Burlap and tying materials will be carefully removed or opened, and folded back. Plastic wrap will be completely removed before the placement of backfill. The remainder of backfill will be tamped and watered.

Willow and alder cuttings may be made in winter to early spring, and transplanted along the water's edge of the compensation wetland before leaf out. Willow cuttings can be planted on two-foot centers. Emergent plant species rhizomes can be planted in early spring as available from the supplier.

7.2 WATERING

All plants will be watered by flooding the backfilled hole within the same working day upon which they were planted. During, and immediately after watering, all plants will

be adjusted as necessary to ensure correct depth of planting, vertical alignment, and/or natural profile. Additional soil will be added around each plant as required to compensate for settling.

7.3 MAINTENANCE

The landscape contractor will be required to guarantee 75 percent survival of all planted materials over a two-year period following installation. A 75 percent survival of trees and shrubs, allowing for the inclusion of those species established through natural colonization, will be required after the first five years of monitoring. A maintenance plan will be prepared by the contractor, and approved by the supervisory wetland biologist, for the permittee.

8.0 MONITORING

8.1 GOALS OF THE MONITORING PROGRAM

The monitoring program will be conducted to document the Permit Special Conditions. These permit conditions will be documented over a period of two years, starting from the completion of the first planting within the compensation wetlands.

Monitoring will be conducted during each year of the monitoring period. Progress and formal reports will document the status of wetland site conditions using the following monitoring methodology. The final monitoring report will provide a summary of monitoring data trends, and compare current wetland status with compensatory wetland goals.

8.2 MONITORING PROGRAM COMPONENTS

8.2.1 Photographs

The compensatory wetland will be documented through fixed point photos, with range poles or objects for scaling and reference. Location and number of photographs will be sufficient to cover the entire compensation site. Photographs will be taken from the same point and in the same direction each sampling period. Significant changes in the wetland structure, including events such as storm damage, will be documented by these photos.

8.2.2 Precipitation Gauge

Local recording precipitation gauges will be located near the mitigation area to provide better estimates of watershed precipitation than distant weather station records. Daily records of precipitation will be maintained during the period of monitoring, and these data will be included in the annual monitoring reports.

8.2.3 Surface and Groundwater Monitoring

Shallow groundwater piezometers will be maintained in the compensatory wetland. Reference will be made to other groundwater elevation records. Groundwater and surface water records will be continued for the duration of the monitoring program, and data summaries provided in the annual reports.

8.2.4 Base Map

A base map or plan view will be provided illustrating the location of photo points, piezometers, and sampling areas.

8.2.5 Vegetation Assessment

Vegetation is generally indicative of the structure of wetlands, and a quantitative assessment of vegetative cover and survival is required by the permit conditions. The composition of each wetland vegetation community will be adequately characterized. The following general methods will be followed with an allowance for site or minor modifications. Sampling will be conducted during late spring and early fall periods of each monitoring year to best identify dominant plant species and assess seasonal biomass:

Forested Wetlands – A belt transect or line intercept method will be employed for sampling areas where tree species (with a secondary shrub layer) are to be dominant. Transects will be positioned so that each vegetation zone or category is sampled. Transects will also be located along wetland basin moisture gradients, extend into forest buffer vegetation, and into undisturbed upland vegetation adjacent to the compensatory wetland.

Scrub/Shrub Wetlands – Replicate quadrant sampling will be used in areas to be dominated by shrub species. The number and average height of woody individuals within quadrats, and the DBH of the largest individuals of each taxa recorded. Paired 3-meter by 3-meter quadrats are recommended.

Emergent Wetlands - Emergent vegetation areas to be dominated by herbaceous plant species are to sampled using replicate quadrats. The percent cover and average height of individuals, of each taxa within the major height strata, will be recorded. Each major herbaceous plant zone will be sampled. Seven replicate 1-meter by 1-meter quadrats are recommended.

8.2.6 Habitat Enhancement

Observational data will be collected on wildlife observed during seasonal vegetation assessments in the compensatory wetland area. Notes will also be kept on the grazing or predation of wetland vegetation.

8.3 IDENTIFICATION OF PROBLEMS AND RECOMMENDATIONS

As indicated through the monitoring program, or otherwise noted by monitoring and facility staff, problems arising during the monitoring period will be communicated by the applicant to the District Corps of Engineers. Recommendations will be developed to compensate for problems, or otherwise direct site management toward the goals of the wetland compensation program.

8.4 MAINTENANCE OF DOMINANT WETLAND VEGETATION

Wetland compensation program goals are the establishment and limited maintenance of forested and emergent wetland plant communities. Compensatory Wetland Plan specifications have been developed to enhance the establishment of such communities as quickly as possible. The persistence of these wetland communities may not depend upon a consistency of wetland community species composition as initially established on the site. Rather, wetlands are among the most dynamic of landscape features and their plant community assemblages reflect such temporal change. The influence of climatic variation, the natural colonization by native plants, and the natural development of site wetland hydrology and nutrient regimes may likely lead to a wetland that differs in community structure, but adequately meets program goals. Maintenance and management of the site will be directed towards establishing a natural wetland community over time.

Figure 5. Grading Plan and Soil Boring Locations
Scale: 1" = 100'

LEGEND
SOIL BORING LOCATION 1 *

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