Preliminary Ecological Assessment for Stoughton City Landfill Site

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1.0 INTRODUCTION

This report is a preliminary ecological assessment for the Stoughton City Landfill Superfund site in Stoughton, Wisconsin. Its purpose is to present a preliminary view and understanding of the nature of ecological risks posed by the site, and to suggest further studies that may be appropriate for further site characterization. This report is based on previous Remedial Investigation work characterizing the site, various literature sources of information, and field work conducted by Technical Support Unit personnel on May 15-16, 1991.

2.0 SITE DESCRIPTION

2.1 SITE BACKGROUND

The Stoughton City Landfill is an inactive landfill located in the city of Stoughton, Dane County, Wisconsin, approximately 13 miles southeast of Madison, Wisconsin (see Figure 1). The City of Stoughton, which owns the property, operated the landfill as an uncontrolled dump site from 1952 to 1972. A detailed history of the site is contained in the August, 1990 Draft Remedial Investigation Report by ENSR Consulting and Engineering (hereafter referred to as "RI Report.") The landfill was used by city residents, including commercial establishments such as major industries and smaller-scale machine shops, auto body/repair shops, dry cleaners, and other maintenance facilities. Landfilling has occurred on approximately 15 acres of the 27 acres of property.

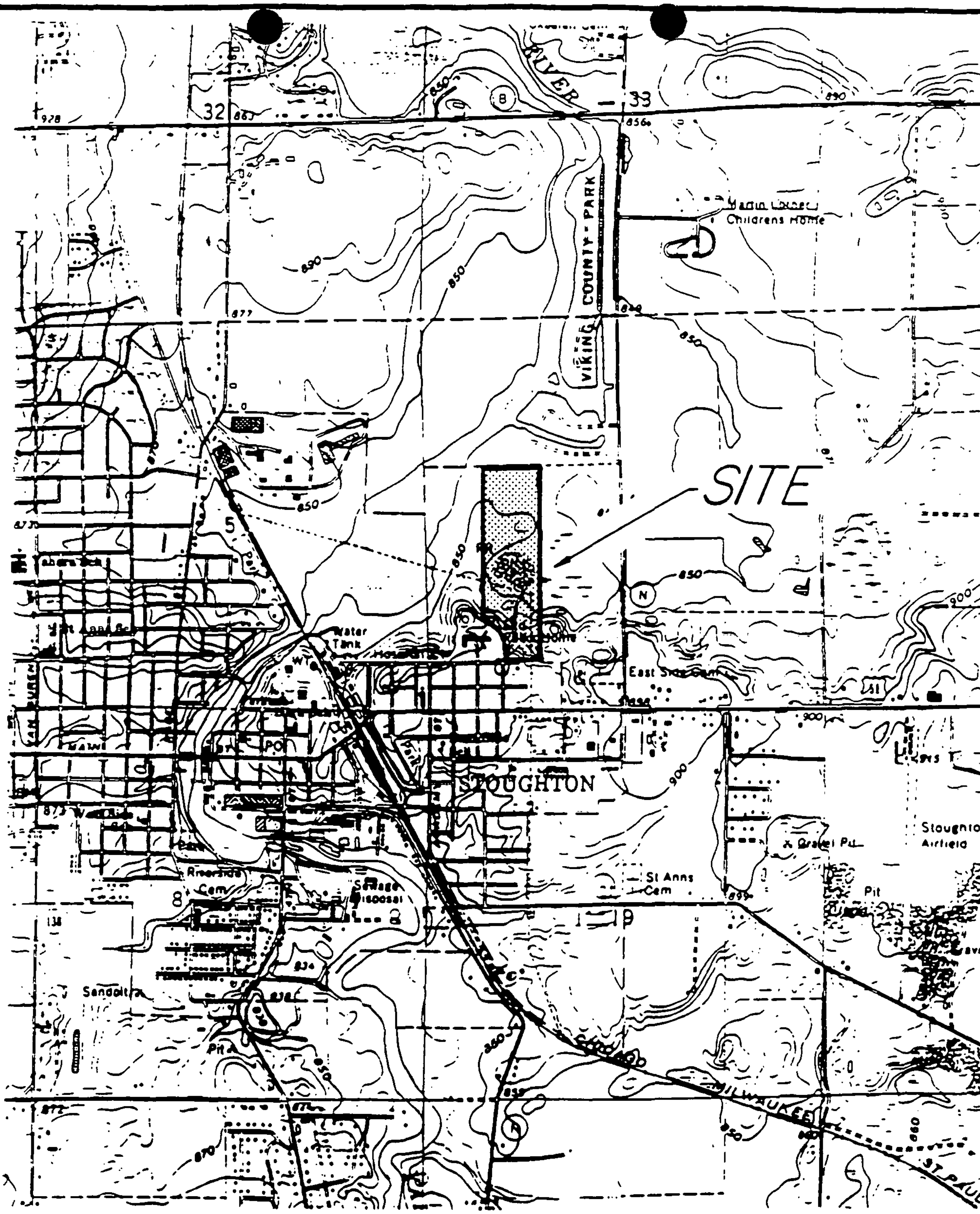
2.2 SITE FEATURES

2.2.1 Surrounding Land Use

The site is located in a relatively undeveloped area near the northeastern corner of the city of Stoughton. The landfill property is bordered on the west, north, and east sides mainly by wetlands, and on the south side by upland woods and a residential area (see Figures 3 and 4). The nearest developed land occurs along Amundson Parkway, the site access road to the south, where residential homes have been built. A more extensive residential area occurs approximately 1/4 mile south of the site, where the city street grid pattern begins. The land immediately adjacent to the southern site boundary remains undeveloped. There is no developed land in the vicinity of the site to the west, north, or east. From historical aerial photographs summarized in the RI Report, cultivation has occurred on some of this land in the past, but no disturbances have occurred recently. The closest developed land in any of these directions appears to be farmland approximately 1/4 mile east of the site along County Road N. Figure 2 contains the Wisconsin Wetland Inventory mappings for the area surrounding the site, and Figure 3 is the Soil County Survey map for the site.

2.2.2 Plant Communities On and Near the Site

Seven different plant communities on and near the site were



APPROXIMATE SCALE (ft)

1000 0 1000 2000

Ref.: USGS, 7.5 – MINUTE STOUGHTON QUADRANGLE, DANE CO., WISCONSIN

ENSR™

ENSR CONSULTING AND ENGINEERING

FIGURE 1

SITE LOCATION MAP

STOUGHTON CITY LANDFILL

STOUGHTON, WISCONSIN

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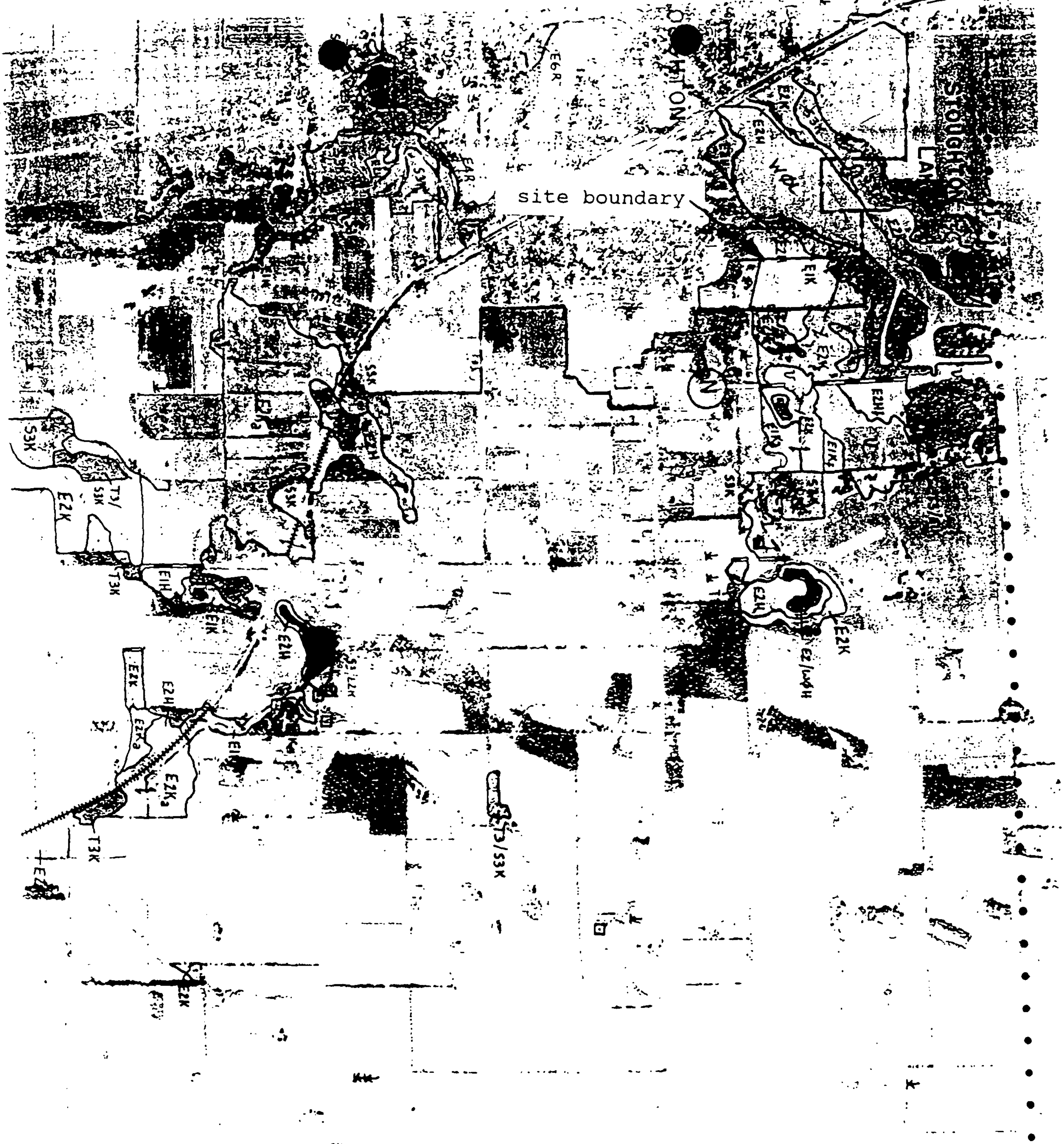


Figure 2. Wisconsin Wetlands Inventory for site area.

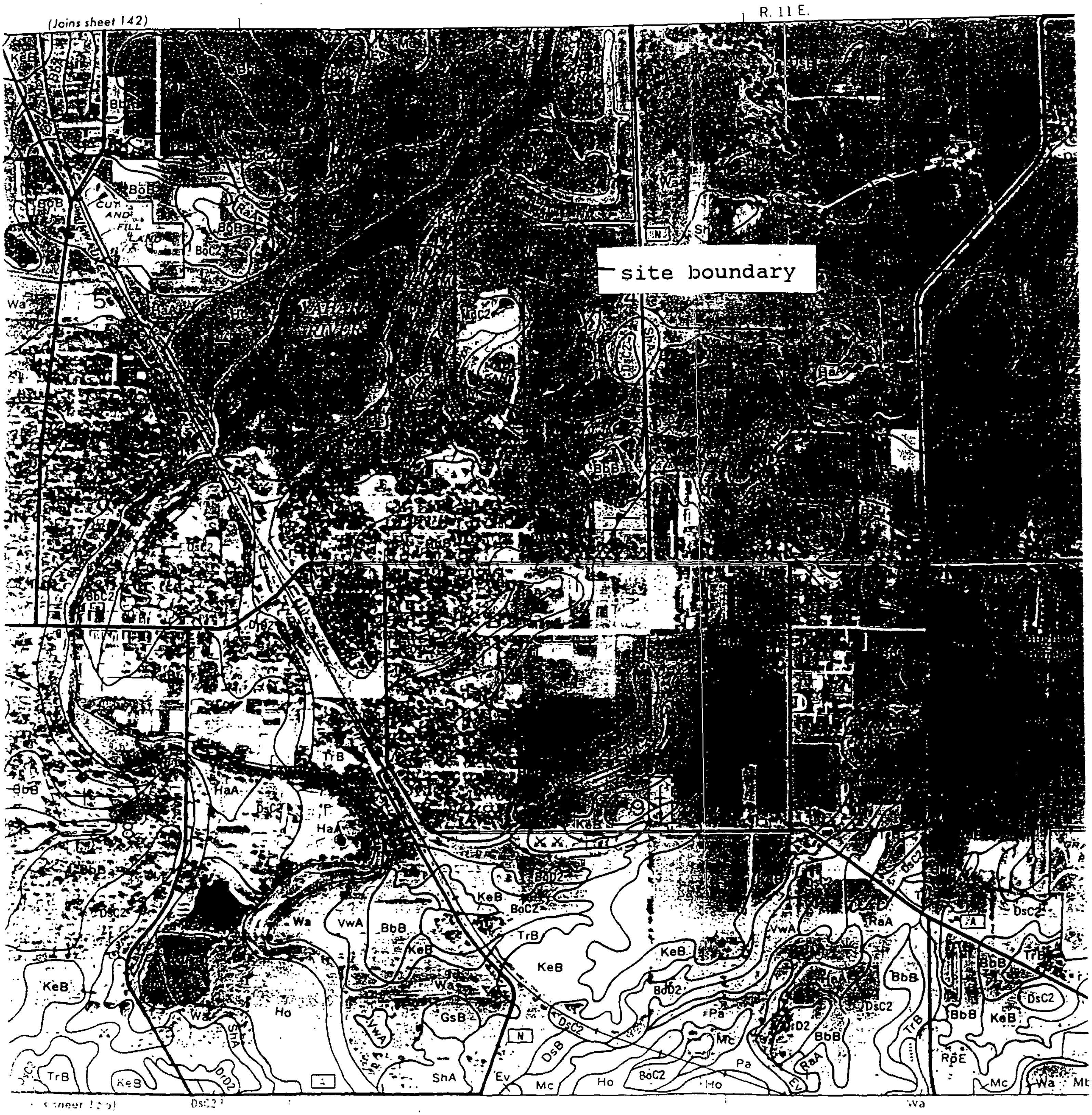


Figure 3. Soil County Survey map for area surrounding the site.

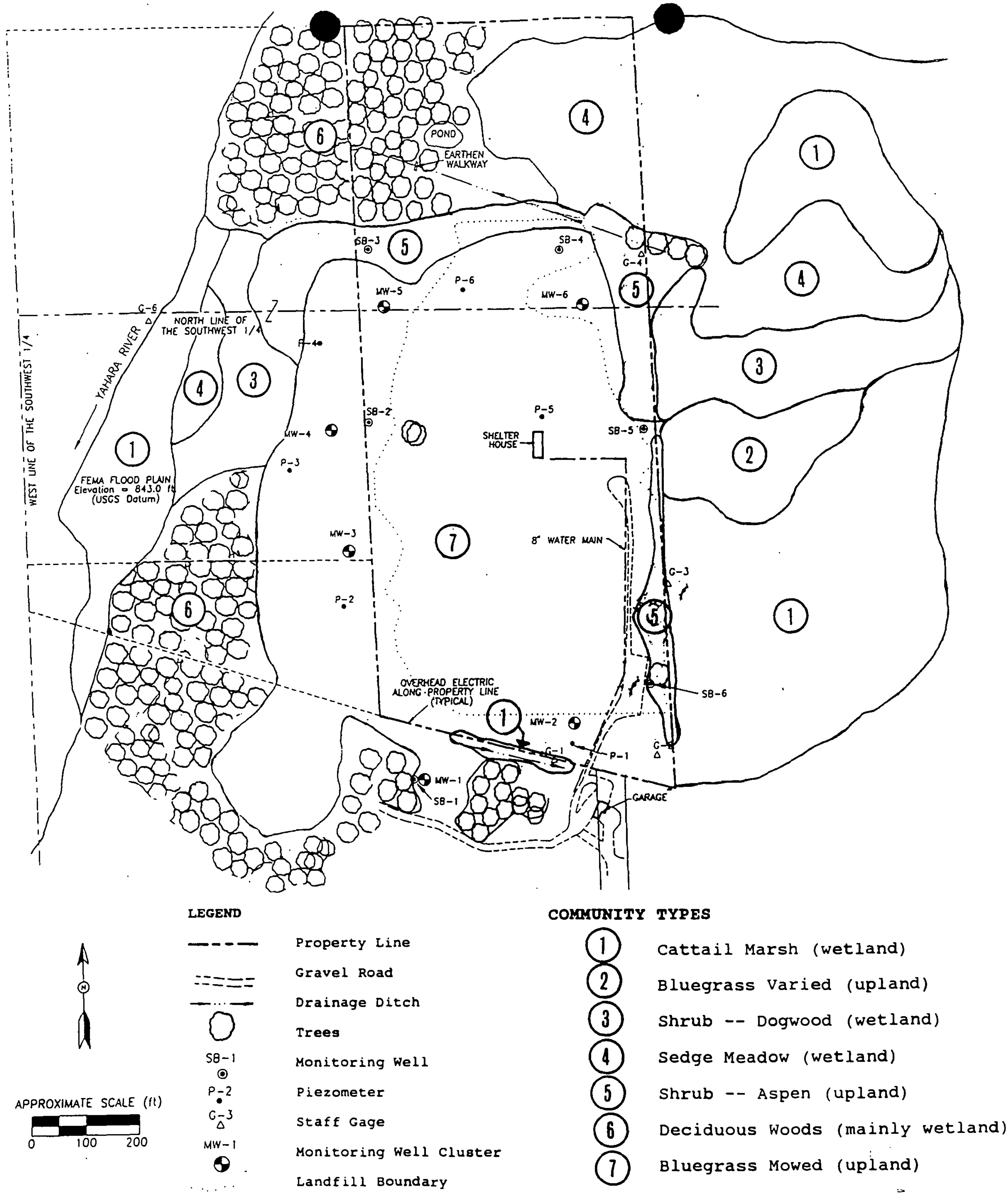


Figure 4. **Plant community types surrounding Stoughton City Landfill.**
Base map from Draft Remedial Investigation Report, October 23, 1989, ERM-North Central, Inc.

identified during the May 15-16, 1991 field investigation. Plant communities were characterized and identified according to dominant plant species within each community. Because the field work was conducted early in the growing season, many species could only be identified to genus. Figure 4 depicts these communities on a site base map. Descriptions of these communities are as follows:

#1 Cattail Marsh
This community occurs in four different locations around the site. Two cattail marshes are located east of the site (the southernmost one is fairly large and forms the eastern border of the southern part of the site), another cattail marsh occurs west of the site along the Yahara River, and a small strip of cattails occurs in a drainage ditch along the southern site boundary. All of these areas had standing water up to 1 foot deep at the time of the study. A small, open pond is located in the large cattail marsh adjoining the site to the east. This community is dominated by dense stands of cattails (Typha sp.). Small, isolated pockets of bulrushes (Scirpus sp.) and rushes (Juncus sp.) are scattered through this community.

#2 Bluegrass Varied
This plant community occurs on a slightly elevated tongue of land that extends outward from the eastern site boundary. This community is mostly open field, but a few shrubs and saplings occur throughout. The transition with the cattail marsh to the south and east is abrupt, but the transition to the shrub -- dogwood community to the north is more gradual. Bluegrass (Poa pratensis) dominates, but the area also supports a variety of plant species common in fields and degraded prairies, including shooting star (Dodecatheon meadia), blue-eyed grass (Sisyrinchium albidum), violet wood sorrel (Oxalis violacea), goldenrod (Solidago sp.), wild strawberry (Fragaria virginiana), wild grape (Vitis sp.), elm (Ulmus sp.), black cherry (Prunus serotina), wild carrot (Daucus carota), hawthorn (Crataegus sp.). violet (Viola sp.), eastern cottonwood (Populus deltoides), quaking aspen (Populus tremuloides), and horsetail (Equisetum sp.).

#3 Shrub -- Dogwood
This community occurs in two different areas near the site, in a fairly narrow strip extending from the eastern site boundary just north of the bluegrass varied community (#2) and south of the sedge meadow community (#4), and in a strip near the western site boundary between the shrub -- aspen (#5) and bluegrass mowed (#7) communities to the east and the cattail marsh (#1) and sedge meadow (#4) communities to the west. The transitions with the bluegrass mowed and sedge meadow communities are abrupt, while those with the other communities are fairly gradual, especially with the shrub -- aspen community. This community consists of a moderately dense shrub/scrub stand with scattered areas of sparser shrubs and denser groundcover. No standing water was

found in this community during the time of investigation. Red-osier dogwood (Cornus stolinifera), bluegrass, and tussock sedge (Carex stricta) are dominant. Other species include horsetail, buttercup (Ranunculus sp.), violet, quaking aspen, spearwort (Ranunculus sp.), wild strawberry, false Solomon's seal (Smilicina sp.), american elm (Ulmus americana), fleabane (Erigeron sp.), and violet wood sorrel.

#4 Sedge Meadow
The sedge meadow community occurs in a broad area near the northeastern part of the site, including land within site property boundaries, and in a small strip just east of the cattail marsh adjacent to the Yahara River. The community is mainly an open, wet meadow, with surface water up to 5 inches deep at the time of this study. Shrubs are scattered throughout this community, particularly in the area near the northeast corner of the site property boundary. Transition with the cattail marsh community is abrupt, but transitions with other communities are more gradual. The tussock sedge is the dominant species. Other species include reed canary grass (Phalaris arundinaceae), irises (Iris sp.), horsetail, spearwort, shooting star, dock (Rumex sp.), goldenrod, blue-eyed grass, red-osier dogwood, undetermined dogwood (Cornus sp.), american elm, sandbar willow (Salix exigua), and honeysuckle (Lonicera sp.).

#5 Shrub -- Aspen
This community is a scrub-shrub community that borders the site along its eastern and northern boundaries. This community is generally on ground higher than that of adjacent wetlands, and no standing water is present. Quaking aspen, boxelder (Acer negundo) and reed canary grass are the dominant species. Other species include bluegrass and sandbar willow.

#6 Deciduous Woods
This community occurs near the northwest portion of the site, including land within site boundaries, and along the southwestern and southern portions of the site. This community is not very homogeneous, for different areas have different dominant tree species. Nevertheless, all these various wooded areas were combined into this single community classification. Throughout this community the trees are fairly mature, forming a closed canopy. No standing water was observed anywhere in this community, although soil was saturated in many areas and evidence of recent surface inundation was evident. Dominant tree species are quaking aspen and boxelder. Other tree species include white pine (Pinus strobus), eastern cottonwood, buckthorn (Rhamnus cathartica), red osier dogwood, american elm, black cherry, ash (Fraxinus sp.), and smooth sumac (Rhus glabra).

#7 Bluegrass Mowed
This community covers most of the site and extends beyond the western site boundaries. Although exact history of disturbance

here is not known, the community was called bluegrass mowed because it is a homogeneous monoculture of bluegrass, typical of mowed upland areas. Bluegrass is dominant; no other herbaceous species of any significance were noted. A few trees are scattered in this community.

2.2.3 Wetland/Upland Boundaries

Each community was also classified as a wetland or upland, using the well-established criteria put forth in the Federal Manual for Identifying and Delineating Jurisdictional Wetlands, Federal Interagency Committee for Wetland Delineation, 1989. This manual defines a wetland to be an area that meets the three criteria of being dominated by hydrophytic vegetation, having hydric soils, and having hydrological characteristics typical of a wetland. Within each community soil pits were dug and soils and hydrological characteristics examined. Delineation Method Data Forms for each plant community are included as Appendix B of this report. The cattail marsh (#1), shrub -- dogwood (#3), and sedge meadow (#4) communities were determined to be wetlands, while the bluegrass varied (#2), shrub -- aspen (#5), and bluegrass mowed (#7) communities are upland. In the deciduous woods community (#6), the woods north and directly west of the site were determined to be wetlands, while those south and southwest are upland, based on soil and hydrological characteristics. The exact wetland/upland boundary in the woods west and southwest of the site was not determined.

This delineation of wetland/upland boundaries based on plant communities is the Routine Delineation Method defined in the previously mentioned manual on wetland delineations. This method is the least intensive (and accurate) of the various field methods that can be used to delineate wetlands; **further field work to define more precisely wetland/upland boundaries in areas where Remedial Actions may impact wetlands is necessary.** Nevertheless, this field delineation supersedes previous wetland/upland designations in the RI Report that are based on County Soil Survey maps (Figure 3) and Wisconsin Wetland Inventory maps (Figure 2).

2.2.4 Topography

The RI Report contains detailed descriptions of site features such as topography, surface hydrology, soils, climate, geology, hydrogeology, and demography and land use, and should be consulted for further information. A brief description of these site features pertinent to this ecological investigation follows.

The highest elevations occur within the central portion of the site at two knolls, with the western knoll being the highest point at 867 ft. The lowest points on-site are the wetlands in the northern portion of the site and those adjacent to the eastern property boundary, at 843 ft. Based on U.S. Geological Survey topographic maps, land south of the site slopes toward the site and the adjacent wetlands to the east. West of the southwest portion of the site, the land slopes toward the Yahara River.

2.2.5 Surface Water Hydrology

Figurè 5, taken from the RI Report, shows surface water run-off patterns based on an evaluation of topographic contours. Surface water in the southwestern portion of the site flows toward the drainage ditch along the southern property boundary, which drains towards the cattail marsh adjacent to the southeastern portion of the site. Surface water in the south-central and southeastern portions of the property drains directly to this cattail marsh. In the northern portion of the site, surface water flows to the drainage ditch which runs in a southeast-northwest direction. This drainage ditch originates to the east of the site and receives flow from the cattail marsh adjacent to the southeast portion of the site, based on aerial photographs. This ditch eventually empties into the Yahara River, although sections of it were dry during the time of this field investigation. The Yahara River, which flows generally north to south from the four major lakes in the Madison region (Mendota, Monona, Waubesa, and Kegonsa) to the Rock River, is approximately 200 feet west of northwest corner of the property boundary, adjacent to the wetlands west of the site. Surface water from a small areas of the west-central portion of the landfill flows directly to these wetlands adjacent to the Yahara River.

In summary, most of the surface water drains to wetlands east and north of the site and eventually flows to the Yahara River via a drainage ditch. A small portion of the west-central area of the site drains directly into wetlands adjacent to the Yahara River.

2.2.6 Soils

The most common soil units near the landfill are the Marshan silt loam (Mc), the Palms Muck (Pa), and the Wacousta silty-clay loam (Wa) (see Figure 3).

The Marshan silt loam consists of moderately deep, poorly drained, nearly level soils developed on low benches in major stream valleys. Permeability is moderate in the subsoil and rapid in the substratum. These soils have been classified as hydric soils. The Palms Muck consists of deep, poorly drained, nearly level organic soils on low benches in stream valleys. Water may pond on these soils in concave areas. These soils have also been classified as hydric. The Wacousta silty clay loam consists of deep, poorly drained, nearly level soils developed o low benches in old lake Basins. The soils have a high water capacity, low fertility, and slightly alkaline chemistry. They have been classified as hydric soils.

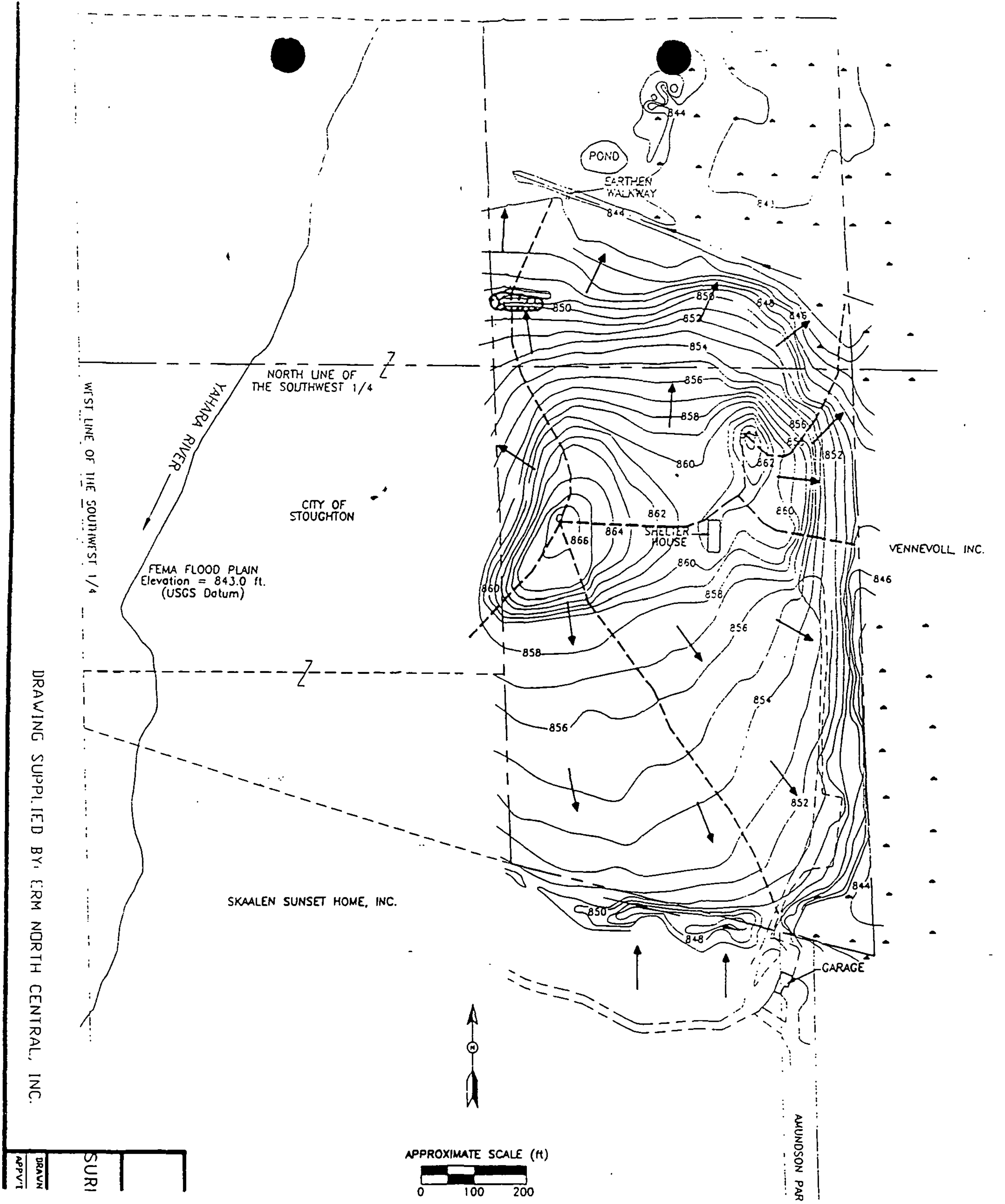


Figure 5. Site surface water flow patterns.

2.2.6 Climate
The annual temperature range in Dane County is large, with warm and occasionally humid summers and long, cold, somewhat snowy winters. Average annual precipitation is approximately 31 inches, 59 percent of which occurs from May through September. Snowfall averages 40 inches annually, with large annual variations. Monthly precipitation averages range from a high of over 4 inches in June to a low of about 1 inch in February.

3.0 NATURE AND EXTENT OF CONTAMINATION

The RI Report contains a detailed analysis of the nature and extent of contamination. Pertinent results are summarized in this report.

An analysis of a historical waste stream study determined that common municipal waste and dry and liquid industrial waste was disposed of at the site. Liquid wastes disposed at the landfill included 2-butanone, acetone, tetrahydrofuran, toluene, and xylene mixtures.

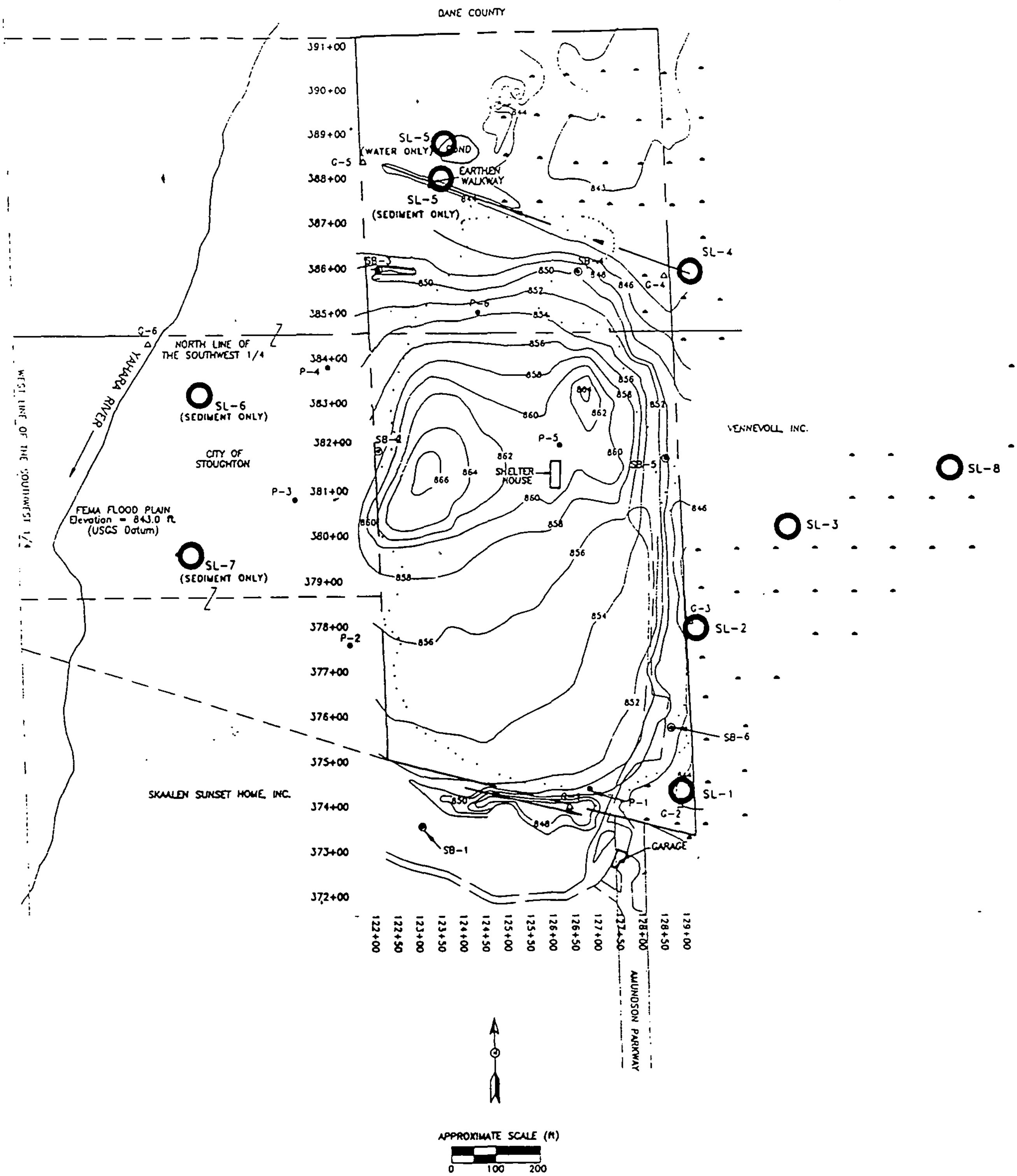
Analyses of waste materials within the landfill taken during well installation showed the presence of a variety of semivolatile compounds, mainly PAHs. Concentration of individual PAHs detected range from 46 ug/kg (indeno (1,2,3-cd) pyrene) to 1800 ug/kg (phenanthrene). Several inorganic compounds, including cadmium (estimated max. concentration 27 mg/kg), chromium (40 mg/kg), lead (460 mg/kg), mercury (0.62 mg/kg), and zinc (163 mg/kg) were detected in waste samples at concentrations exceeding those of the background soil samples.

No significant contamination of landfill surface soils was detected during the RI. The RI Report states that final cover materials applied to the landfill as part of closure are apparently intact.

Groundwater studies detected several volatile organic compounds. Xylenes were measured at an estimated concentration of 1 ug/L in groundwater from one well, and total 1,2-dichloroethene was detected at a concentration of 8 ug/L in groundwater from a different well. Dichlorodifluoromethane (estimated max. concentration 240 ug/kg) and trichlorofluoromethane (24 ug/kg) were also detected in several wells across the site.

Tetrahydrofuran was detected in groundwater from a well along the west-central edge the site during all three sampling rounds in concentrations ranging from 360 to 660 ug/L.

Several inorganic compounds were detected at elevated concentrations in groundwater, including chromium, arsenic,



DRAWING SUPPLIED BY: ERM NORTH CENTRAL, INC.

Figure 6. RI Surface water and sediment sampling locations.

barium, selenium, calcium, and magnesium. However none of these compounds were detected at levels above their MCLs.

Surface water and sediments from wetlands surrounding the landfill were sampled as part of the site RI. Sample locations are shown in Figure 6. In surface water, a variety of inorganic and organic constituents were detected at concentrations above background. Among organics, only dichlorodifluoromethane, detected in sample SL-2 at 3 ug/L, was attributable to site contamination. The highest concentrations of inorganics occurred at sampling locations SL-1 and SL-2, immediately adjacent to the landfill in the cattail marsh. During the field investigation of May 15-16, 1991, a large amount of iron floc, often indicative of leachate discharge, was noted in these wetland areas immediately adjacent to the landfill. This strip of heavy floc extended approximately 30 feet into the wetland from the landfill. The RI Report also states that there is an upward hydraulic gradient here, and discharge of landfill leachate is likely. The concentrations of metal contaminants detected in surface water at levels above background are shown in Tables 1 and 2. Surface water samples from locations other than SL-1 and SL-2 were generally comparable to background levels, except for iron at SL-3 and SL-8 (5,530 ug/L and 19,200 ug/L, respectively), manganese at SL-8 (3,370 ug/L) and zinc at SL-8 (173 ug/L).

In sediments, a variety of semi-volatile compounds were detected at relatively low concentrations in samples collected adjacent to the southeast side of the landfill. The highest concentration of semivolatiles detected was 2.8 mg/kg benzoic acid at SL-6. A variety of tentatively identified semi-volatile compounds were also detected, including 67 mg/kg unknown hydrocarbons at SL-6. In addition, some semivolatile compounds were detected in background sediment samples collected off-site. The concentrations of metals detected above background levels are shown in Table 3. Iron was not detected at levels above background in any of the sediment samples.

4.0 POTENTIALLY EXPOSED HABITATS AND SPECIES

Based on the RI investigation, ecological receptors may be exposed to site contaminants via landfill leachate discharge or past surface runoff into adjacent wetlands. A cover over the landfill currently prevents any direct contact with the landfill waste itself. Groundwater flow radiates outward from the landfill, discharging to wetlands east, north, and to a lesser extent, west of the landfill. The area between the two knolls of the landfill appears to serve as a local recharge area, according to the RI Report. RI data indicate that wetlands immediately adjacent to the eastern edge of the landfill are the most highly contaminated (sample locations SL-1 and SL-2), and a significant amount of iron and manganese floc were noted here during the May

15-16, 1991 field work. Therefore, these wetlands are considered the primary areas of exposure for ecological receptors. Wetlands north and west of the landfill can also serve as exposure points, but RI data indicate much lower contaminant levels in these areas.

A wide variety of plant and animal species may be exposed to site contaminants in these wetland habitats. Plant species in these areas are listed in Section 2.2.2, Plant Communities On and Near the Site.

The cattail marshes and the drainageway across the northern portion of the site provide suitable habitat for a variety of aquatic organisms. Water up to 1 foot deep was present in the cattail marsh southeast of the landfill, and water to 6 inches deep was noted in parts of the drainageway at the time of this field work. Also, a small pond is located in the deciduous forest community just north of the drainageway. Aquatic fauna observed in these areas during the May 15-16 field work are typical for such shallow water habitats, and include beetle larvae (Coleoptera), sowbugs (Isopoda), damselfly larvae (Odonata), dragonfly larvae (Odonata), scuds (Amphipoda), leeches (Hirundinea), orb and pouch snails (Gastropoda), water boatmen (Hemiptera), daphnia (Cladocera), clams (Bivalvia), and horsehair worms (Nematomorpha). Numerous leopard frogs (Rana pipiens) were also seen in the cattail marshes.

Terrestrial organisms may also be exposed to contaminants in the marsh areas. A painted turtle (Chrysemys picta) was seen in the bluegrass varied community adjacent to the cattail marsh at the southeast part of the site, and a garter snake (Thamnophis sirtalis) was spotted in the southwest part of the site. The wetlands and the bluegrass varied community (#2) likely provide good habitat for a variety of small and medium mammals. A red fox was spotted along the southwest edge of the site. Many small diggings and scrapes, likely caused by small mammals, were noticed in the bluegrass varied community adjacent to the cattail marsh. Deer tracks were common throughout the site.

Appendix A contains a list of all birds seen or heard during the May 15-16, 1991 field work. Species detected that are likely directly exposed to contaminants in the cattail marsh include red-winged blackbirds (a blackbird nest with three eggs was discovered in the heavy iron floc area adjacent to the landfill), sora, geese, green heron, and blue heron.

5.0 RISK CHARACTERIZATION

The purpose of this preliminary ecological assessment is to determine the likliehood for deleterious ecological effects from site-related contamination and to suggest any additional studies that may be necessary. An important tool in determining the level of ecological risks is to compare site-related contaminant levels with levels protective of biota or those known to impact ecological receptors. The wetlands along the southeast of the landfill are the primary areas of concern, based on RI data. Since these wetlands, as well as drainageways leading from them, provide habitat for aquatic biota, surface water and sediment contaminant concentrations will be compared to concentrations protective of aquatic life or known to cause toxic effects in aquatic biota. In addition, possible bioconcentration and biomagnification of site toxicants will be assessed, and information gathered during the field work of May 15-16 will be analyzed.

5.1 SURFACE WATER CONTAMINANT LEVELS

5.1.1 Comparison With Ambient Water Quality Criteria

Ambient Water Quality Criteria (AWQC), produced by the U.S. EPA, are contaminant criteria designed for the protection of aquatic life. They are expressed as acute values (values not to be exceeded over the short-term) and chronic values (not to be exceeded for a longer term). AWQC are non-regulatory guidelines, and do not take the place of toxicity tests or other field validation studies at the site, for many site-specific factors influence contaminant toxicity. For our purposes, their primary use is as a preliminary screening tool.

Ambient Water Quality Criteria are not available for all site-related contaminants (all contaminants that were found in higher concentrations in site surface water compared to background concentrations are considered site-related for the purposes of this assessment). They are available for arsenic, chromium, copper, iron, lead, nickel, and zinc. For all these metals except arsenic and iron, the AWQC depends on water hardness. A water hardness value was calculated from magnesium and calcium concentrations in the background surface water samples. Site surface water samples were not used for this calculation as calcium and magnesium appear to be site contaminants in surface water and likely do not occur as carbonates. A water hardness value of 296 ppm (as calcium carbonate) was calculated. Also, no data on surface water quality parameters such as pH, which can affect the bioavailability of the contaminants, was available.

For arsenic, the AWQC for the more toxic trivalent species was used rather than that for the pentavalent species. Arsenic generally occurs as the trivalent species in anaerobic conditions, and given the waterlogged sediments in the wetlands near SL-1 and SL-2, assuming the arsenic exists as the trivalent species is the most reasonable approach.

Table 1 compares AWQC with site surface water concentrations at sample locations SL-1, SL-2, and SL-8, the three locations

Table 1. Comparison of Surface Water Concentrations at SL-1, SL-2, and SL-8 to U.S. EPA Ambient Water Quality Criteria (AWQC)

All values in ug/L (ppb)

	Site Sample Locations SL-1	SL-2	SL-8	AWQC acute	AWQC chronic
Arsenic	7.3	6.2	4.2	360	190
Chromium	16.5	15.8	6.8	4220[1]	500[1]
Copper	ND	33.9*	ND	49.2[1]	29.9[1]
Iron	31,900*	46,600*	19,200*	--	1000
Lead	28.9*	68.6*	15.2*	324[1]	12.6[1]
Nickel	42.3	51.2	ND	3550[1]	390[1]
Zinc	127	327*	173	293[1]	270[1]

* = concentration exceeds AWQC

[1] AWQC is hardness dependent. Value of 296 ppm as $CaCO_3$ (calculated from background locations) was used.

ND = no detect
-- = no AWQC available

showing contamination. Acute AWQC are exceeded only by zinc at SL-2, and this exceedance is not great (327 ppm vs. 293 ppm). No other site concentrations approach any acute criteria. Chronic AWQC are exceeded by copper at SL-2, iron at all three locations, and lead at all three locations. The exceedances are not great for copper (33.9 ppm vs. 29.9 ppm) and lead at SL-1 (28.9 ppm vs. 12.6 ppm) and SL-8 (15.2 ppm vs. 12.6 ppm). However, the exceedances of iron at all three locations and lead at SL-2 are quite significant. Given the high concentrations of iron at SL-1 and SL-2 (up to 46,600 ug/L), the use of unfiltered water samples for analyses may account for these high levels. However, this risk analysis can only assume conservatively that all detected metals levels are actually in solution. Neither acute nor chronic AWQC are exceeded for arsenic, chromium, or nickel.

Comparison of site surface water data with AWQC indicate the potential for acute toxicity from zinc at SL-2, and a strong likliehood of chronic effects at SL-1 from iron and lead, SL-2 from copper, iron, and lead, and SL-8 from iron and lead. These exceedances of AWQC only indicate that impact on aquatic biota from site contaminants is likely; they do not indicate the type of impacts that may be occurring. It is important to note that AWQC do not take into account additive or synergistic effects of contaminants where more than one contaminant is present, as is the case here. The AWQC exceedances for multiple contaminants at this site indicate there is a fairly strong possibility for some impact on aquatic biota.

5.1.2 Comparison With Values Known To Be Toxic

For the site contaminants aluminum, barium, magnesium, manganese, and vanadium, no AWQC are currently available. To assess the likliehood of impact from these contaminants, a literature search was conducted to obtain concentrations of these contaminants that are known to be toxic to aquatic life from other field or lab studies. The U.S. EPA's AQUIRE database was used for the data retrieval. These data represent a wide variety of test organisms, test conditions, test endpoints, and contaminant speciation. For each contaminant without an AWQC, the lowest LC50 concentration for a freshwater organism reported in the literature was used. The use of the lowest LC50 should provide a conservative yet realistic concentration to use for comparison. Since LC50s are the concentration at which 50% of the test organisms die, they are not comparable to AWQC, which are designed to be protective of aquatic life. Thus LC50s should not be used as cut-off points but as benchmarks for comparison.

Table 3 shows a comparison of literature toxic values to site concentrations for these metals at SL-1, SL-2, and SL-8. Site concentrations are far below the lowest reported LC50 values for barium and vanadium. Site concentrations are also well below the lowest reported LC50 value for manganese, but only by an order of

Table 2. Comparison of Surface Water Concentrations of Metals without AWQC to Literature Toxicity Values

All values in ug/L (ppb)

	Site Sample Locations			
	SL-1	SL-2	SL-8	AQUIRE LC50
Aluminum	12,200*	12,600*	6,810*	170 (largemouth bass)[1]
Barium	457	414	294	410,000 (Daphnia)[2]
Magnesium	55,800*	125,000*	43,400*	32,000 (Daphnia)[3]
Manganese	4,480	1,240	3,370	31,000 (Duckweed EC50 growth)[4]
Vanadium	44.2	54.2	23.3	2000 (Brook Trout)[5]

* = concentration exceeds AQUIRE LC50

AQUIRE LC50 = Conservative freshwater LC50 value for the contaminant obtained from the U.S. EPA's Aquatic Toxicity Information Retrieval Database.

[1] Birge, W.J., J.E.Hudson, J.A.Black, and A.G.Westerman, 1978. Embryo-Larval Bioassays on Inorganic Coal Elements and in Situ Biomonitoring of Coal-Waste Effluents. In: Symp. U.S. Fish Wildl. Serv., Surface Mining Fish, Wildl. Needs in Eastern U.S., W.VA:97-104

[2] LeBlanc, G.A., 1980. Acute Toxicity of Priority Pollutants to Water Flea (Daphnia magna). Bull. Environ. Contam. Toxicol. 24(5):684-691

[3] Baudouin, M.F. and P.Scoppa, 1974. Acute Toxicity of Various Metals to Freshwater Zooplankton, Bull. Environ. Contam. Toxicol. 12(6):745-751

[4] Wang, W, 1986. Toxicity Tests of Aquatic Pollutants by Using Common Duckweed, Environ. Pollut. Ser. B Chem. Phys. 11(1):1-14

[5] Ernst, W.R. and E.T.Garside, 1987. Lethal Effects of Vanadium to Two Life Stages of Brook Trout Salvelinus fontinalis (Mitchill), Can. J. Zool. 65(3):628-634

magnitude. Site concentrations exceed the lowest reported LC50 values for aluminum and magnesium at all three locations. Aluminum concentrations exceed the LC50 value for largemouth bass by up to two orders of magnitude. Site magnesium concentrations exceed the LC50 for daphnia by up to a factor of 4.

The high concentrations of aluminum and magnesium may be due to the water samples being unfiltered. However, as previously mentioned, at this point this assessment of ecological risks can only assume that all metals are in solution.

Impacts on the neighboring Yahara River from site contaminants is very unlikely. RI data indicate little contamination in the wetlands west of the site along the river. Although there is a surface water migration route for contaminants in the wetlands north and east of the landfill to reach the river via the drainage ditch, much of the contaminants will be bound to the organic rich wetland sediments. Contaminants dissolved in the surface water will be diluted by wetland waters and by the volume of the Yahara River itself such that no impacts are expected in the river.

This comparison of site concentrations of aluminum, barium, magnesium, manganese, and vanadium indicates that the concentration of magnesium at SL-1, SL-2, and SL-8 may be toxic to daphnia, an aquatic organism fairly sensitive to metal contamination. Manganese and aluminum may also be at toxic concentrations, though the data are less convincing. If the actual toxicity of these surface waters needs to be determined, aquatic toxicity tests using sensitive organisms such as ceriodaphnia should be conducted.

5.2 SEDIMENT CONTAMINANT LEVELS

The U.S. EPA has not yet developed sediment criteria. The Ontario Ministry of the Environment has developed a set of criteria, based on equilibrium partitioning for non-polar organics and Screening Level Criteria (SLC) for polar organics and metals. SLC are values derived from field data on the co-occurrence in sediments of benthic infaunal species and different contaminant concentrations. These Ontario sediment criteria are to be used only as very rough indicators of the degree of contamination, for many site-specific factors can greatly influence contaminant bio-availability in sediment.

Table 3 shows a comparison of Ontario sediment criteria with site sediment concentrations. The criteria are expressed as three different levels: the no effect level, at which no toxic effects have been observed on aquatic organisms; the lowest effect level, at which the majority of benthic organisms can tolerate the contaminant; and the limit of tolerance, the level at which pronounced disturbance of the benthic community can be expected.

Table 3. Comparison of Sediment Bulk Concentrations With Ontario Ministry of the Environment Sediment Quality Guidelines

All values in mg/kg (ppm)

	SL-1	SL-2	SL-4	SL-6	SL-7	SL-8	No Effect Level	Lowest Effect Level	Limit of Tolerance
PAH total	1.4	0.33	N	N	N	N	-	2	11,000
Arsenic	5.1	5.5	4.7	B	5.2	5.9	4	6	33
Cadmium	B	8.5*	N	1.6*	N	23**	1	1	10
Chromium	B	B	B	B	B	35*	31	31	110
Lead	69*	172*	B	B	B	B	23	31	250
Manganese	B	405	385	B	746*	B	400	460	1200

* = concentration above Lowest Effect Level
** = concentration above Limit of Tolerance

- = Insufficient data
B = Values below background range (sample locations SLB-9 through 12)
N = No detect

No Effect Level = Guideline level at which no toxic effects have been observed on aquatic organisms.

Lowest Effect Level = Guideline level of sediment contaminantion that can be tolerated by the majority of benthic organisms.

Limit of Tolerance = Guideline level at which pronounced disturbance of the benthic community can be expected.

Table 3 shows that the lowest effect level is approached by arsenic at all sites and exceeded by cadmium at SL-2 and SL-6, chromium at SL-8, lead at SL-1 and SL-2, and manganese at SL-7. The exceedances by cadmium at SL-6 and chromium at SL-8 are slight (1.6 ppm vs. 1 ppm and 35 ppm vs. 31 ppm, respectively). The limit of tolerance is approached by lead and cadmium at SL-2 and exceeded by cadmium at SL-8.

This comparison indicates that sediment contamination may be impacting the benthic community at SL-8, and that sediment contamination at SL-1, SL-2, and SL-7 may be impacting selected benthic species. To determine the actual extent of any impacts on benthic fauna, sediment toxicity tests and community surveys should be conducted at these locations.

5.3 BIOMAGNIFICATION OF CONTAMINANTS

Terrestrial biota are not expected to be as directly exposed to contaminants in the wetlands as aquatic biota. However, both terrestrial and aquatic biota can receive significant contaminant exposure through food chains, depending on the nature of the site contaminants. This section provides brief summaries of the tendencies of site contaminants to bioconcentrate in organisms and biomagnify through food chains.

The sources of information for this section include AWQC supporting documents and a series of publications on contaminant hazards from the U.S. Fish and Wildlife Service. These contaminant hazard reviews are available for numerous contaminants, including arsenic (#12), cadmium (#2), chromium (#6), and lead (#14). Their citations are: Eisler R. date. (Contaminant) hazards to fish, wildlife, and invertebrates: A synoptic review. Contaminant Hazard Reviews Report No. X. Laurel, MD: U.S. Fish and Wildlife Service. Biological Report 85(1.X).

Arsenic is accumulated from water by aquatic biota, but there is no evidence of magnification of tissue concentrations along the aquatic food chain. The bioconcentration factors (BCFs) for arsenic are relatively low. Biomagnification is not expected to pose much of a risk.

Cadmium can be accumulated by aquatic organisms from water, but evidence suggests that only lower trophic levels exhibit biomagnification. Cadmium was not detected in surface water at this site, but was found in some sediment samples above background concentrations. No studies on bioconcentration from sediments were found. Biomagnification is not expected to pose a significant risk.

Chromium can be highly accumulated by lower trophic organisms, but there is little evidence of biomagnification through food chains.

BCFs for copper are widely ranging, and some are fairly high. However, there is no evidence of biomagnification through food chains.

Lead is concentrated by biota from water, but no convincing evidence exists that it is transferred through food chains.

Nickel also can be bioconcentrated, but again there is no evidence of biomagnification within food chains.

BCFs for zinc are relatively low. Biomagnification is not expected to pose a risk.

5.4 FIELD DATA

During the site visit of May 15-16, 1991, a detailed community survey of benthic organisms in wetland sediments was not conducted. However, cursory sampling of the benthos in visibly contaminated areas (the wetlands with heavy iron floc immediately adjacent to the southeast portion of the landfill) and areas known to be clean (the same wetlands further out) revealed no apparent differences in the common benthic organisms in each area. No difference was seen in plant species inhabiting each area, for cattails were the sole dominant in each area. Effects on individual plants were not apparent.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The wetlands surrounding the landfill are the main points of exposure for ecological receptors; they currently receive leachate discharge and in the past received surface water runoff from the landfill. Because the site occurs in a relatively undeveloped area, a wide variety and number of terrestrial and aquatic organisms may be exposed to the site contaminants. The wetlands and woods surrounding the site provide excellent habitat for many species of birds, mammals, reptiles, amphibians, and invertebrates.

Comparison with criteria and other data indicate potential risks to aquatic life from site-related contamination at SL-1 and SL-2, immediately adjacent to southeast part of landfill in leachate discharge areas, and possible risks to sediment-dwelling organisms at SL-1, SL-2, SL-7, and SL-8. Toxicity tests and community surveys are necessary to determine the full extent of any effects on aquatic and benthic fauna. Biomagnification of site-related contaminants is not expected to pose a significant risk to ecological receptors.

The source of surface water contamination, i.e. landfill leachate, should be controlled. Current evidence suggests that this leachate discharge to wetlands poses risk to aquatic organisms. Remedial actions planned or suggested for the landfill that adequately control contaminated groundwater release from the site should be sufficiently protective of aquatic biota.

Contaminated sediments may also pose some risk to benthic fauna. Leachate control will not specifically address this problem, but it will reduce further contamination of the sediments. Sediment contamination is a concern because the sediments can act as continual contaminant sources to the surface water, thus counteracting the benefits of controlling leachate discharge. However, sediment contamination is not excessively high at this site, and any attempt at sediment remediation in the wetlands would likely do more harm than good. Wetland restoration following significant disturbance, such as dredging sediments, is in general a poorly understood and risky task. In our opinion, more specific data on the exact impacts of sediment contamination on benthic fauna are necessary in order to justify contaminated sediment remediation.

Further studies that may be appropriate for further characterizing the extent of ecological impacts at the site include aquatic and whole-sediment toxicity tests and community surveys of benthic macroinvertebrates in the wetlands. However, given that site remediation of groundwater apparently is planned, further work to characterize ecological risks and determine the need for ecological-based remediation at the site does not seem necessary at this time.

The wetland hydrologic regime must be taken into consideration in the FS. The wetlands surrounding the site are valuable ecological resources, as well as being protected by ARARs. Any remedial activities that would impact the wetlands either directly, such as slurry wall construction along the landfill perimeter, or indirectly, such as groundwater pump and treat, must be carefully analyzed as to their impacts to the wetlands. The effects of groundwater pump and treat remedies on wetland hydrology may be reduced through a carefully planned system of water discharge to the wetlands following treatment.

Appendix A

Bird species seen or heard during site visit of May 15-16, 1991

Great blue heron	<u>Ardea herodias</u>
Green-backed heron	<u>Butorides virescens</u>
Canada goose	<u>Branta canadensis</u>
Wood duck	<u>Aix spansa</u>
Ring-necked pheasant	<u>Phasianus colchicus</u>
Sora rail	<u>Porzana carolina</u>
Sandhill crane	<u>Grus canadensis</u>
Killdeer	<u>Charadrius vociferus</u>
Mourning dove	<u>Zenaidura macroura</u>
Black-billed cuckoo	<u>Coccyzus erythrophthalmus</u>
Belted kingfisher	<u>Magaceryle alcyon</u>
Downy woodpecker	<u>Picoides pubescens</u>
Barn swallow	<u>Hirundo rustica</u>
American crow	<u>Corvus brachyrhynchos</u>
Black-capped chickadee	<u>Parus atricapillus</u>
American robin	<u>Turdus migratorius</u>
Gray catbird	<u>Dumetella carolinensis</u>
Cedar waxwing	<u>Bombycilla cedrorum</u>
Warbling vireo	<u>Vireo gilvus</u>
Yellow warbler	<u>Dendroica petechia</u>
Chestnut-sided warbler	<u>Dendroica pensylvanica</u>
Common yellowthroat	<u>Geothlypis trichas</u>
Chipping sparrow	<u>Spizella passerina</u>
Song sparrow	<u>Melospiza melodia</u>
Red-winged blackbird	<u>Agelaius phoeniceus</u>
Eastern meadowlark	<u>Sturnella magna</u>
Brown-headed cowbird	<u>Molothrus ater</u>
Northern Oriole	<u>Icterus galbula</u>
American Goldfinch	<u>Carduelis tristis</u>

APPENDIX B

DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Helmer Date: 5/15/91
Project/Site: Staughton State: WI County:
Applicant/Owner: Plant Community #/Name: Area 2 (Plant Community)
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community? Yes X No ___ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed? Yes ___ No X (If yes, explain on back)

- area is higher than surroun
- cattails & dogwood scrub/shrub.
level little slope

VEGETATION

	Dominant Plant Species	Indicator Status	Stratum		Dominant Plant Species	Indicator Status	Stratum
80%	1. Poa Pratensis	FAC	H		11. Dodecatheon Meidia	FACU	H
	2.				12. Wild Strawberry		
15%	3. Solidago sp		H		13. Oxalis sp	—	
	4.				14. Solidago Sp.	—	H
	5.				15. Ulmus		S
	6. Blue Eyed Grass		H		16. Vitus Sp.	—	H
	7. Black Cherry		S		17. Black Eyed susan		H
	8. Equisetum sp.	—	H		18. Viola sp	—	H
	9. Daucas Carota		H		19. Populus Deltoides	—	S
	10. Hawthorn Crataegus sp.	—	S		20. Poplus Tremuloides		S

Percent of dominant species that are OBL, FACW, and/or FAC 100%
Is the hydrophytic vegetation criterion met? Yes X No ___
Rationale:

SOILS

Series/phase: Wa Subgroup:[2] 2.5 YR 2/0
Is the soil on the hydric soils list? Yes X No ___ Undetermined ___ 0–18" – no gleying or mottling
Is the soil a Histosol? Yes ___ No X Histic epipedon present? Yes ___ No ___
Is the soil: Mottled? Yes ___ No X Gleyed? Yes ___ No X 18" – some mottling – not a lots of mottling
Matrix Color: 2.5YR 2/0 Mottle Colors: grey 10YR 5/6
Other hydric soil indicators:
Is the hydric soil criterion met? Yes X No ___
Rationale: On Hydric Soils list. Low croma

HYDROLOGY

Is the ground surface inundated? Yes ___ No X Surface water depth:
Is the soil saturated? Yes ___ No X
Depth to free-standing water in pit/soil probe hole: N/A
List other field evidence of surface inundation or soil saturation.
none seen
Is the wetland hydrology criterion met? Yes ___ No ___
Rationale:

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ___ No ___
Rationale for jurisdictional decision:

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Helmer Date: 5/15/91
Project/Site: Stoughton Ldfl State: WI County: DANE
Applicant/Owner: ______ Plant Community #/Name: Area 3 - Community #3
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes X No ___ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ___ No X (If yes, explain on back)

VEGETATION

	Dominant Plant Species	Indicator Status	Stratum		Dominant Plant Species	Indicator Status	Stratum
1.	Poa Pratensis		FAC	11.	Equisetum sp.		
2.	Carex Stricta		OBL	12.	Ranunculus sp.		
3.	Cornus Stolonifera		FACW	13.	Oxalis		
4.				14.	Viola sp.		
5.				15.			
6.				16.			
7.				17.			
8.				18.			
9.				19.			
10.				20.			

Percent of dominant species that are OBL, FACW, and/or FAC ______
Is the hydrophytic vegetation criterion met? Yes ___ No ___
Rationale: ______

SOILS

Series/phase: Wa Subgroup:[2] ______
Is the soil on the hydric soils list? Yes ___ No ___ Undetermined ___
Is the soil a Histosol? Yes ___ No ___ Histic epipedon present? Yes ___ No ___
Is the soil: Mottled? Yes X No ___ Gleyed? Yes X No ___ - from 6" down
Matrix Color: 0-6" 10YR 2/1 - 6"-8" 10YR 3/1 Mottle Colors: ______
Other hydric soil indicators: ______
Is the hydric soil criterion met? Yes ___ No ___
Rationale: ______

HYDROLOGY

Is the ground surface inundated? Yes ___ No X Surface water depth: ______
Is the soil saturated? Yes X No ___ -6" & below only
Depth to free-standing water in pit/soil probe hole: ______
List other field evidence of surface inundation or soil saturation.
- evidence of surface inundation (matted vegetation, flow patterns)
Is the wetland hydrology criterion met? Yes ___ No ___
Rationale: ______

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ___ No ___
Rationale for jurisdictional decision: ______

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): ______ Date: ______
Project/Site: Stoughton Area 4 State: WI County: ______
Applicant/Owner: ______ Plant Community #/Name: Comm 4
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes _____ No _____ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes _____ No _____ (If yes, explain on back)

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1.			11.		
2.			12.		
3.			13.		
4.			14.		
5.			15.		
6.			16.		
7.			17.		
8.			18.		
9.			19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC ______
Is the hydrophytic vegetation criterion met? Yes _____ No _____
Rationale: ______

SOILS

Series/phase: ______ Subgroup:[2] ______
Is the soil on the hydric soils list? Yes _____ No _____ Undetermined ______
Is the soil a Histosol? Yes _____ No _____ Histic epipedon present? Yes _____ No _____
Is the soil: Mottled? Yes _____ No X Gleyed? Yes _____ No X
Matrix Color: 2.5YR 4/0 Mottle Colors: ______
Other hydric soil indicators: ______
Is the hydric soil criterion met? Yes _____ No _____
Rationale: ______

HYDROLOGY

Is the ground surface inundated? Yes X No _____ Surface water depth: ______
Is the soil saturated? Yes X No _____
Depth to free-standing water in pit/soil probe hole: 0
List other field evidence of surface inundation or soil saturation.

Is the wetland hydrology criterion met? Yes _____ No _____
Rationale: ______

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes _____ No _____
Rationale for jurisdictional decision: ______

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Comm #6 - aspen woods

Field Investigator(s): Selmer Date: 5/15/91
Project/Site: State: County: DANE
Applicant/Owner: Plant Community #/Name: Comm #6
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes _____ No _____ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes _____ No _____ (If yes, explain on back)

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1.			11.		
2.			12.		
3.			13.		
4.			14.		
5.			15.		
6.			16.		
7.			17.		
8.			18.		
9.			19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC
Is the hydrophytic vegetation criterion met? Yes _____ No _____
Rationale:

SOILS

Series/phase: On Wa + Mc (Wa @ soil pit) Subgroup:[2]
Is the soil on the hydric soils list? Yes _____ No _____ Undetermined
Is the soil a Histosol? Yes _____ No X Histic epipedon present? Yes _____ No _____
Is the soil: Mottled? Yes _____ No X Gleyed? Yes _____ No X
Matrix Color: 10 YR 2/1 Mottle Colors:
Other hydric soil indicators:
Is the hydric soil criterion met? Yes _____ No _____
Rationale:

HYDROLOGY

Is the ground surface inundated? Yes _____ No X Surface water depth: N/A
Is the soil saturated? Yes _____ No X
Depth to free-standing water in pit/soil probe hole: —
List other field evidence of surface inundation or soil saturation.

Is the wetland hydrology criterion met? Yes _____ No _____
Rationale:

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes _____ No _____
Rationale for jurisdictional decision:

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): ______ Date: ______
Project/Site: ______ State: ______ County: Commonwealth ✓ wooded area NW of landfill
Applicant/Owner: ______ Plant Community #/Name: ______
Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

Do normal environmental conditions exist at the plant community?
Yes ____ No ____ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ____ No ____ (If yes, explain on back)

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Dominant Plant Species	Indicator Status	Stratum
1. Quacking Aspen			11.		
2. Boxelder			12.		
3. Buckthorn			13.		
4.			14.		
5.			15.		
6.			16.		
7.			17.		
8.			18.		
9.			19.		
10.			20.		

Percent of dominant species that are OBL, FACW, and/or FAC ______
Is the hydrophytic vegetation criterion met? Yes ____ No ____
Rationale: ______

SOILS

Series/phase: Marshan silt loam Mc Subgroup:[2] ______
Is the soil on the hydric soils list? Yes ____ No ____ Undetermined ______ 5YR 2.5/1 0-12" – no gleying or mottling
Is the soil a Histosol? Yes ____ No ____ Histic epipedon present? Yes ____ No ____
Is the soil: Mottled? Yes ____ No X Gleyed? Yes X No ____ 12" + below 12–18" – gleying
Matrix Color: 5YR 5/1 (0-18") Mottle Colors: 10YR 4/2
Other hydric soil indicators: ______
Is the hydric soil criterion met? Yes ____ No ____
Rationale: ______

HYDROLOGY

Is the ground surface inundated? Yes ____ No X Surface water depth: ______
Is the soil saturated? Yes ____ No X
Depth to free-standing water in pit/soil probe hole: N/A
List other field evidence of surface inundation or soil saturation.
Buttressed tree trunks
Is the wetland hydrology criterion met? Yes ____ No ____
Rationale: ______

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ____ No ____
Rationale for jurisdictional decision: ______

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."

DATA FORM
ROUTINE ONSITE DETERMINATION METHOD[1]

Field Investigator(s): Helmer Date: 5/16/91

Project/Site: State: County: Comm #6

Applicant/Owner: Plant Community #/Name:

Note: If a more detailed site description is necessary, use the back of data form or a field notebook.

← wooded area at SW border of landfill other side borders Yahara River

Do normal environmental conditions exist at the plant community?
Yes X No ___ (If no, explain on back)
Has the vegetation, soils, and/or hydrology been significantly disturbed?
Yes ___ No X (If yes, explain on back)

VEGETATION

	Dominant Plant Species	Indicator Status	Stratum		~~Dominant~~ Plant Species	Indicator Status	Stratum
1.	Boxelder			11.	White Pine		
2.	Red Osier dogwood			12.	Smith Sumac		
3.	Quaking aspen			13.			
4.	unknown herb sp.			14.			
5.	Wild Strawberry			15.			
6.				16.			
7.				17.			
8.				18.			
9.				19.			
10.				20.			

Percent of dominant species that are OBL, FACW, and/or FAC ___
Is the hydrophytic vegetation criterion met? Yes ___ No ___
Rationale: ___

SOILS

Series/phase: Oc - Orion silt loam, wet Subgroup:[2] ___
Is the soil on the hydric soils list? Yes ___ No ___ Undetermined ___
Is the soil a Histosol? Yes ___ No ___ Histic epipedon present? Yes ___ No ___
Is the soil: Mottled? Yes X No ___ Gleyed? Yes X No ___
Matrix Color: 10YR 3/2 Mottle Colors: black - 2.5YR 2/0 and grey 10YR3/1
Other hydric soil indicators: ___
Is the hydric soil criterion met? Yes ___ No ___
Rationale: 0 - 18" gleyed; black mottles beginning at 12" oxidized root zones

HYDROLOGY

Is the ground surface inundated? Yes ___ No X Surface water depth: ___
Is the soil saturated? Yes ___ No X
Depth to free-standing water in pit/soil probe hole: > 18"
List other field evidence of surface inundation or soil saturation.
buttressed tree trunks
Is the wetland hydrology criterion met? Yes ___ No ___
Rationale: ___

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes ___ No ___
Rationale for jurisdictional decision: ___

[1] This data form can be used for the Hydric Soil Assessment Procedure and the Plant Community Assessment Procedure.
[2] Classification according to "Soil Taxonomy."