GIS Wetlands Inventory and Restoration Assessment

Cuyahoga County, Ohio

December, 2006

Cuyahoga Soil and Water Conservation District

DAVEY RESOURCE GROUP

A Division of The Davey Tree Expert Company

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Introduction

A GIS-based (Geographic Information Systems) Wetlands Inventory and Restoration Assessment was conducted within portions of Cuyahoga County, Ohio at the request of the Cuyahoga Soil and Water Conservation District. This study includes the Black, Chagrin, and Rocky River watersheds as well as Doan Brook, Euclid Creek, and direct Lake Erie Tributaries (small streams that flow directly into Lake Erie). This study does not address the Cuyahoga River watershed within Cuyahoga County, as that work was already performed by Davey Resource Group for the Cuyahoga River Remedial Action Plan (RAP) and partners in 2003.

The goal of this study was to identify and map all wetlands within the study area, which totaled approximately 172,635 acres and included all undeveloped lands, public and private. A combination of aerial photointerpretation and fieldwork was used to map wetlands. Because not all parcels were field checked, it is likely that there are significant areas of unmapped wetlands within the study area.

This report describes data collection and analysis procedures and also provides examples of several possible wetlands creation, restoration, and enhancement opportunities within the study area. Maps showing location and size of wetlands, attribute data for the wetlands, and photographs were provided in digital format to the Cuyahoga Soil and Water Conservation District.

Description of Terms

Definitions of the technical and scientific terms referenced in this document are in the glossary in Appendix A. Descriptions of frequently used words, such as wetlands, restoration, and enhancement, are listed below.

Wetland is defined as those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Wetland restoration re-establishes wetlands in areas where they have been eliminated over time by either human or natural processes. Typically, hydrology must be restored by eliminating drainage structures such as ditches and tiles. In areas where these structures cannot be removed, such as roadside ditches, low berms can be created to retain water. Removal of fill within wetlands is another method of wetlands restoration.

Wetland enhancement improves the quality of existing wetlands by removing invasive species, increasing hydrology, restoring buffer zones, or other measures. An example of wetlands enhancement would be the restoration of a natural forested buffer zone around a wetland. The buffer zone would protect the wetland from adjacent development by filtering surface water runoff as well as providing important wildlife habitat. Conservation easements placed on wetlands and associated upland buffers can also be considered a form of enhancement because they protect wetlands from future disturbance.

Methodology

Davey Resource Group created a Geographic Information Systems (GIS) database utilizing ArcGIS and ArcView. Primary GIS software included: ArcGIS 9.1 and ArcView 3.3 operating on common Windows 2000 and Windows XP platforms. ArcGIS and ArcView are all products of the Environmental Systems Research Institute (ESRI) of Redlands, California. All GIS data were re-projected using ArcGIS and ArcView to match the State Plane NAD83, Ohio North (feet) projection parameters.

Aerial photographs and topographic information for the entire study area were obtained from Cuyahoga County. Other information available included National Wetlands Inventory maps, data showing water features (streams and ponds), soil survey maps, roads, property boundaries, and extensive personal knowledge of the study area by Davey biologists.

A grid was created in ArcGIS for the entire county at a 1:400 scale. Maps were then printed of each grid cell within Cuyahoga County, where wetlands were not yet inventoried.

The aerial photographs with topographic information were analyzed in conjunction with the information listed above and wetlands were drawn onto the maps. The accuracy of size, shape, and location of the mapped wetlands is dependent upon the accuracy of the aerial photographs and topographic map layers. The quality of the aerial photographs, flown in 2002, is generally adequate for wetlands identification.

The field verification portion of the study was concurrent with the aerial photointerpretation. This allowed the accuracy of the photointerpretation to be evaluated through the course of the project. Davey wetlands biologists conducted fieldwork over a five-month period, from January–May, 2006. Fieldwork could not be performed with snow cover. An emphasis was placed on field verifying large and/or unique wetlands, as well as small headwater wetlands.

Wetlands boundaries were determined based on the 1987 *Corps of Engineers Wetlands Delineation Manual*. Jurisdictional wetlands must have hydric soils, hydrophytic vegetation, and hydrology. Some areas (such as floodplains) may perform one or more wetlands functions, but lack other necessary criteria (such as hydric soils). Areas that did not meet all three wetlands criteria are not jurisdictional wetlands and were not mapped.

The purpose of this study was to provide general locations and sizes of wetlands in the areas outside of the Cuyahoga River watershed, within Cuyahoga County. The location and size of each wetland is approximate. <u>This study should not be used in place of a wetlands determination and/or delineation</u>. If detailed size and wetlands boundary information is required, a proper wetlands delineation, including a wetlands boundary survey, should be performed by a qualified wetlands specialist.

Not all wetlands could be mapped at this level of study. <u>Marginally wet areas, such as lowland woods and wet meadows that are only seasonally wet, are common within the study area and in most cases could not be mapped from aerial photographs. These wetlands were mapped during the fieldwork as they were encountered. However, because not all parcels were field-checked, there are likely a significant number of unmapped marginal wetlands.</u> Small, artificial wetlands, such as roadside ditches, tire ruts, and small wetlands, created by grading and other disturbances were not mapped. In addition to wetlands, storm water basins were mapped where visible.

Davey collected the following information for each field-checked wetland.

- Ownership
- Wetlands/site number
- Approximate size
- Dominant vegetation
- Source of hydrology
- Mapped soil type
- Presence and estimated amount of invasive species
- Unique features
- Cowardin classification
- Data collector
- Accessibility
- Ownership
- Impacts/Disturbance
- Water quality
- Restoration/enhancement potential

Wetlands were classified as palustrine emergent (PEM), palustrine scrub/shrub (PSS), or palustrine forested (PFO) according to standard Cowardin classification methodology.

Using the ArcView 3.3 software, Davey calculated wetland sizes and generated wetlands/site number, mapped soil type, and ownership information. Additional data (as listed above) were noted in the field, based on visual observations at each wetland, and added into the map database. The data dictionary is found in Appendix B.

After field checks were performed for each map, wetlands were softcopy digitized in ArcGIS. Once the inventory was complete, the field data were checked interactively with ArcView and assorted GIS map data, attribute data were edited and standardized, and spatial features were corrected for basic topological errors. In addition to the new wetland layer created, previously inventoried existing wetland data within the Cuyahoga Watershed and the Cuyahoga Valley National Park were re-projected and merged using ArcGIS and ArcView 3.3 with the new Cuyahoga County wetland data to create a seamless wetland layer.

After finalization of the wetlands mapping, wetlands sites were numbered sequentially. Each vegetation community type within a wetlands system received a unique identification number; thus, a wetlands system comprised of multiple vegetation types will have more than one identification number. The data were checked for completeness and consistency, as well as spelling and grammatical errors.

Results

Davey identified 1,687 wetlands (totaling 3,356 acres) and 284 storm water basins within the study area. Wetlands comprise approximately 1.9 percent of the study area. Table 1 is a summary of wetlands statistics by size. Most of the mapped wetlands are very small, with only 602 wetlands over 1 acre in size. Sixty wetlands are greater than 10 acres in size. Wetlands #225 and #247, at 235 and 111 acres respectively, are the largest wetlands in the study area.

Table 1. Summary of Wetlands Statistics by Size

Number of wetlands	1,687
Average size of wetlands	2 acres
Number of wetlands greater than 1 acre	602
Number of wetlands greater than 5 acres	123
Number of wetlands greater than 10 acres	60
Largest wetland	235 acres

Wetlands Classifications, Sizes, and Locations

Davey classified wetlands using the standard Cowardin methodology. Cowardin wetland classifications identified in this study include palustrine emergent (PEM), which are marshes and wet meadows; palustrine scrub/shrub (PSS), which are wetlands dominated by shrubs and saplings; and palustrine forested (PFO), which include all forested wetlands. A summary of identified wetlands categorized by Cowardin classification is in Table 2.

Common species in the PEM (emergent) and PSS (scrub/shrub) wetlands include:

- *Cornus amomum* (silky dogwood, FACW[1])
- *Viburnum recognitum* (northern arrow-wood, FAC)
- *Rhamnus frangula* (glossy buckthorn, FAC)
- *Ulmus americana* (American elm, FACW-)
- *Fraxinus pennsylvanica* (green ash, FACW)
- *Euthamia graminifolia* (fragrant flat-topped goldenrod, FAC)
- *Aster* spp. (asters, WIS)
- *Carex* spp. (wetlands sedges, WIS)
- *Onoclea sensibilis* (sensitive fern, FACW)
- *Typha* spp. (cattails, OBL)
- *Leersia oryzoides* (rice cutgrass, OBL)

Common species found in the PFO (forested) wetlands include:

- *Ulmus americana* (American elm, FACW-)
- *Fraxinus pennsylvanica* (green ash, FACW)
- *Acer rubrum* (red maple, FAC)
- *Quercus bicolor* (swamp white oak, FACW+)
- *Quercus palustris* (pin oak, FACW)
- *Platanus occidentalis* (sycamore, FACW-)
- *Glyceria striata* (fowl manna grass, OBL)
- *Rhamnus frangula* (glossy buckthorn, FAC)
- *Viburnum recognitum* (northern arrow-wood, FAC)
- *Carex* spp. (wetlands sedges, WIS)

[1] Please refer to Appendix F for a description of wetlands vegetation indicator status symbols.

Table 2. Summary of Wetlands Statistics by Classification

Number of emergent wetlands (PEM)	201
Number of scrub/shrub wetlands (PSS)	104
Number of forested wetlands (PFO)	1,231
Number of combined emergent, scrub/shrub, and forested wetlands (PEM, PSS, PFO)	10
Number of combined forested and scrub/shrub wetlands (PFO, PSS)	21
Number of combined emergent and scrub/shrub wetlands (PEM, PSS)	13
Number of combined emergent and forested wetlands (PEM, PFO)	107

The majority of wetlands identified in this study are small (< 1 acre) and occur within depressional areas or along streams and drainageways. These small wetlands are typically forested, but many small emergent and scrub/shrub wetlands were also found. These small wetlands were identified wherever possible; however, they are likely much more common than represented on the accompanying maps because they are difficult to identify from aerial photographs.

Several types of small wetlands were observed. The most common are fed by surface water and occur in isolated depressions. These wetlands are most common in the western part of the study area where the topography is relatively flat. Somewhat poorly drained soil types, which occur throughout the study area, are conducive to the formation of small depressional wetlands.

Most of the western part of the study area was intensively farmed at one time. Wetlands have formed within old dead furrows and shallow drainage swales. Generally, these wetlands were only mapped when they comprised significant areas. The swales are designated in some areas as wetland percentages. These areas have regular ridges and swales from old vineyards and orchards. In many areas, it is apparent from the aerial photographs that these were natural wetlands prior to farming.

Small wetlands are also common at the headwaters of intermittent drainageways. Most of these wetlands are natural, but some have been affected by past land use practices, especially agriculture. Most of these areas are or will become forested over time through natural succession, and the current vegetation types reflect the wetland's history of disturbance. These wetlands are found throughout the study area.

Another type of small wetland encountered was the hillside seep. Hillside seeps occur where percolating groundwater reaches an impervious layer and flows horizontally out of a hillside. The presence of these wetlands depends on the soil types and layers. Areas where sand and silt overlie impermeable clay or bedrock are highly conducive to the formation of these wetlands. The seeps tend to occur at the base of valley slopes and within narrow valleys of headwater streams. Some of these wetlands can cover large spans of stream valleys, but most are small. Nearly all of these areas are forested, and because of their inaccessible location most remain relatively undisturbed. Hillside seeps are found throughout the study area, but are not numerous in any one portion of the county.

Dominant species found in hillside seeps include:

- *Symplocarpus foetidus* (skunk cabbage, OBL)
- *Acer rubrum* (red maple, FAC)
- *Glyceria striata* (fowl manna grass, OBL)

Table 3 contains a summary of all wetlands categorized by water source.

Table 3. Summary of Wetlands Statistics by Water Source

Number of wetlands fed by stream/drainageway	401
Number of wetlands fed by surface water runoff	1,108
Number of wetlands fed by groundwater	36
Number of wetlands fed by spring/seep	10

Large wetlands (>10 acres) are scattered throughout the study area, but the greatest concentration occurs in the western portion of the study area where the ground is more flat. The 2 largest wetlands, #225 and #247, are high-quality wetland complexes associated with Bradley Woods Reservation. Although most of these wetlands are owned by Cleveland Metroparks, portions of both wetlands are privately owned. As shown in Table 4, the large wetlands are comprised of extensive areas of lowland woods as well as other vegetation community types.

Table 4. Notable Large Wetlands (>10 acres)

Wetland ID Number	Classification	Size (acres)
225	PFO	235
247	PFO	111
1848–1853	PEM, PFO	82
2209	PFO	60
889, 955	PEM, PFO	52
1810–1814	PEM, PFO	45
2194–2201	PEM, PSS, PFO	36
683–685	PEM, PFO	35
1611	PFO	33
228, 230	PEM, PFO	33

Because of their size and proximity to development, the large wetlands often contain both degraded and high-quality areas.

Table 5. Wetlands Statistics by Watershed

Watershed	Number of Wetlands[1]	Average Wetland Size (Acres)	Number of Wetlands >1 Acre	Number of Wetlands >5 Acres	Number of Wetlands >10 Acres
Black River	132	4.5	62	24	14
Chagrin River	420	1.2	126	38	7
Rocky River	1,071	1.6	358	60	29
Doan Brook	7	1.2	4	0	0
Euclid Creek	1	6	1	1	0
Lake Erie Tributaries	72	5.3	37	8	5

[1] Some wetlands are located on watershed divides and were included in both watersheds.

Of the six major watersheds within the study area, the Rocky River watershed contains the most wetlands with 1,071 wetlands. The Chagrin River watershed, with an area similar to the Rocky River, contains only 420 wetlands. Wetlands are much more numerous on the flat, poorly drained areas in the western portion of the study area.

The largest wetland is found on the border between the Black River and direct Lake Erie Tributaries in the western portion of the county. Most of the wetlands within the direct Lake Erie Tributaries watershed are found in the western portion. Few wetlands occur in the eastern part of this watershed due to its highly urbanized nature.

The maps in Appendices C and D show the locations of the wetlands in relation to subwatersheds and publicly owned lands and open space. The publicly owned lands include park land as well as all other publicly owned lands. The "open space" classification includes Cleveland Metroparks, as well as all other park land such as municipal parks. The study area contains 30,907 acres of public land, or about 18 percent of the study area.

Unfortunately, it appears that most of the wetlands on private land are well outside of the park boundaries. The best opportunities for park expansion to include high-quality and large wetlands would be along the Rocky River and its tributaries, particularly from Bennett Road east to Broadview Road. Other opportunities exist in the Chagrin Valley, though the large wetlands in this area are mostly already publicly owned.

Wetlands Impacts

Adjacent land use is the most commonly noted impact. This is, in most cases, the result of adjacent development. Impacts associated with adjacent land use include destruction of a buffer zone, isolation from adjacent natural areas, and runoff from lawns and impervious surfaces.

Another commonly noted impact is fill. The old fill occurs mostly in small, isolated areas. The fill consists of subsoil, concrete, block, brick, and household debris. Some of the filled areas may contain hazardous waste or other unknown materials; on-site testing would be required to determine actual contents. In most areas, the extent and thickness of the fill is difficult to determine because of its age. New fill is in many cases associated with recent development projects.

Scattered debris, such as bottles, cans, tires, furniture, appliances, and car parts, is common within the wetlands, particularly the floodplain areas where these items are deposited by flood waters. Household dumps ranging in age from around 1880 to the present were found throughout the study area. These dumps tend to occur near old house sites, in ravines, and along roadsides. Dumping was noted where relatively large areas of household debris appear to have impacted the wetlands. Small areas were not noted.

Drainage ditching and drainage tiling were observed in some areas. The ditches and tiles are old, and, in most cases, are only partially functioning to drain wetlands. Most of the ditches and tiles were associated with former agricultural fields. It is likely that tiles exist in more areas than noted. Tiled areas are not easy to identify without a more detailed study. Table 6 provides a summary of wetlands impacts identified in the field.

The “Other” category includes anything that does not fit into the listed categories of impacts. Common impacts in the “Other” category include disturbance via mowing and all-terrain vehicle use.

Table 6. Summary of Wetlands Impacts

Impact	Number of Wetlands
None	877
Old Fill	75
New Fill	34
Dumping	14
Logging	5
Adjacent Land Use	164
Drainage Tiling	9
Drainage Ditching	6
Other	45

Wetlands Restoration and Enhancement Opportunities

Several opportunities for wetlands restoration and enhancement were identified during the study. Table 7 is a summary of restoration and enhancement opportunities. Figure 1 graphically represents this information as a percentage of all wetlands identified. Appendix E contains a table listing wetland ID numbers for all restoration opportunities except for invasive species removal.

Conservation easements placed on existing wetlands can also be considered a form of enhancement as this protects the wetland from future development. Conservation easements would be suitable for any moderate or high-quality wetlands.

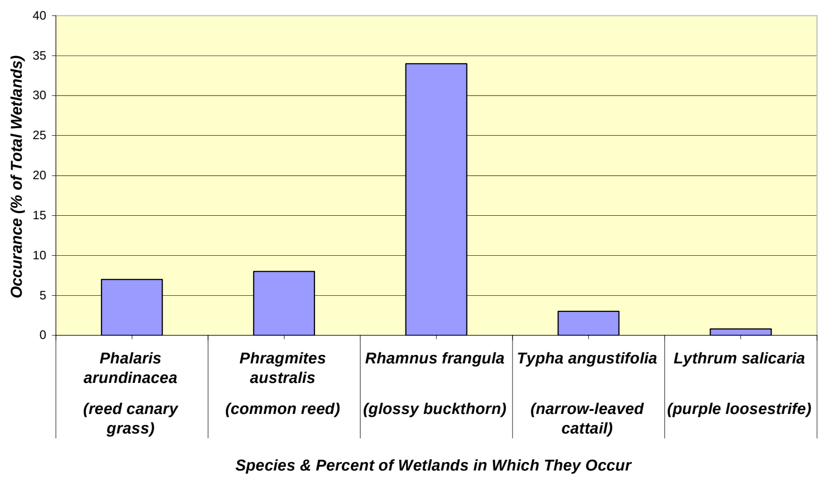
Table 7. Summary of Wetlands Restoration/Enhancement Potential

Restoration Potential	Number of Wetlands
Remove Invasive Species	128
Restore Hydrology	12
Restore Buffer Zone	35
Remove Fill	22
Remove Trash	14
Eliminate Pollution	1
Other	29

Remove Invasive Species

The greatest opportunity for wetlands enhancement and restoration is the removal of invasive species. Figure 1 is a summary of invasive species.

Figure 1.
Invasive Plant Species



Rhamnus frangula (glossy buckthorn)

(c) John M. Randall/The Nature Conservancy

The most common invasive species is glossy buckthorn, which occurs in 583 of 1,687 wetlands (34 percent). This species is common throughout the study area and is found on nearly every undeveloped property that was field-checked. Buckthorn forms dense stands in some areas, particularly in areas that are infrequently mowed, such as under power lines. In older successional woodlots, buckthorn occurs at a much lesser frequency as an understory shrub. The only areas free of this plant are mature woods that have not been recently disturbed. Buckthorn prefers upland areas, but can also be found within seasonal wetlands and along the margins of wetter areas. Most of the wetlands that do not contain buckthorn are very small wetlands with little diversity.

It would be almost impossible to control this species throughout the study area due to its widespread nature. Control efforts should instead focus on high-quality areas, both wetland and upland, where it is a threat. Hand pulling plants is one control option, but the extensive root system must be eliminated. Prescribed burning can be used, but would also eliminate native species. The most effective control option is to cut the plant and apply a herbicide such as Roundup®, Glypro®, or Garlon® 4 to the cut stem.

Glossy buckthorn is by far the most common invasive species throughout Cuyahoga County in both wetland and upland areas. Control of this species will not be possible unless large areas are treated at the same time or control is ongoing over a period of many years to prevent buckthorn from reinvading the controlled areas.

(c) John M. Randall/The Nature Conservancy

Phragmites australis (common reed) is the second most common invasive species, found in 72 out of 1,687 wetlands (4 percent). Common reed tends to occur in smaller, isolated groups. It is most prevalent in disturbed areas, roadsides, and areas around gas and oil wells. This species thrives in salty areas, thus it is often found in areas that receive road and parking lot runoff.

As with reed canary grass, there are both native and non-native strains of common reed, with the non-native strain preferring disturbed areas and being more invasive. It is likely that most or all populations in the study area are the non-native, invasive strain.

Control of this species can be done by cutting, pulling, or mowing in late July; this treatment should be repeated for several years. Cut shoots should be removed, as they can resprout. Black plastic can be placed over the cut stems for further control. Another mechanical technique is flooding for extended periods during the growing season. Herbicides such as Accord®, Rodeo®, or Glypro® can be applied in early fall, for at least two years in a row. Aerial spraying, handheld or backpack sprayers, and hand wicking are preferred application methods.

Common reed tends to occur in smaller, dense patches within the wetlands, though there are a few wetlands with larger populations. An aggressive control program should be effective. In addition to the populations within wetlands, there are some upland areas that contain this species. Most of these populations are in disturbed areas, occurring along roadsides.

Phalaris arundinacea (reed canary grass)
The next most common invasive species is *Phalaris arundinacea* (reed canary grass). Reed canary grass occurs in 70 out of 1,687 wetlands (4 percent). The coverage of this species ranges from small patches to large monocultures that cover most or all of the host wetlands. Reed canary grass is most common in wetlands along streams and drainageways, which could indicate that this is its method of spreading.

(c) Barry A. Rice/The Nature Conservancy

There is some question as to the status of this species. There are apparently native and non-native strains of the grass, and the non-native strain is thought to be more invasive. Reed canary grass appears to be very invasive in most of the wetlands in which it was found. Based on the apparent invasiveness of reed canary grass within the study area, it is likely that the invasive strain of this grass is dominant in most areas.

Reed canary grass can be controlled mechanically by hand pulling or digging in small areas. To prevent seed production, mowing can be done in early to mid-June and early October before the seed matures. Disking or plowing is effective for well-established populations. Prescribed burning is another option, but must be repeated annually for five or six years. The herbicides Accord® and Glypro® can be used to control reed canary grass. The herbicide should be applied in early spring when other plants are still dormant. Removal of the previous year's growth to expose the new green shoots aids effectiveness of the herbicide and minimizes the amount of herbicide needed.

Control of reed canary grass should focus on all wetlands and associated floodplains along a watercourse, as this species appears to spread along streams. Control methods will have to cover large areas to be effective, and planting programs may have to be done to revegetate the areas with other species before reed canary grass recolonizes.

(c) Mandy Tu/The Nature Conservancy

Typha angustifolia (narrow-leaved cattail)
Narrow-leaved cattail occurs in 30 out of 1,687 wetlands (2 percent). This species hybridizes with *Typha latifolia* (broad-leaved cattail) to produce *T. glauca*, which is also invasive. Sometimes hybrids are difficult to identify; for the purposes of this study the hybrid cattails, when they could be identified, were included with narrow-leaved cattail. This species covers large areas in a few wetlands, and also is found in smaller, disturbed areas.

Mechanical control of this species is difficult. Small colonies can be hand dug, but eradication of the rhizome system is necessary for effective control. Repetitive cutting or mowing within a single growing season to deplete stored reserves and remove photosynthetic tissue has been effective. Repetitive cutting of stems with spot application of Roundup®, Glypro®, or Accord® to the stumps has been effective, and foliar spraying can be used in large populations.

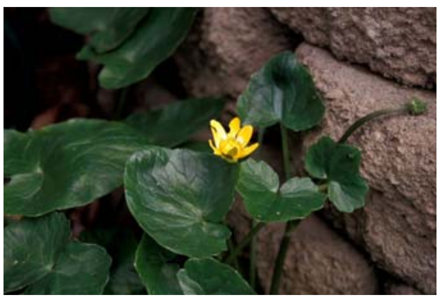
There is good potential to control this species in the smaller populations, which would also prevent it from spreading to larger areas. The larger areas would be more difficult to control.

Lythrum salicaria (purple loosestrife)
Purple loosestrife occurs in 5 out of 1,688 wetlands (<1 percent). It occurs within recently disturbed areas, particularly along roadsides and near recent development projects. Because purple loosestrife is not yet common within the study area, there is a good potential for control.

(c) Barry A. Rice/The Nature Conservancy

Control can be by mechanical or chemical means. The small numbers of plants in most areas make hand pulling a viable option. The plants should be pulled before seed production and removed from the area. Accord® or Glypro® herbicides can also be used.

Other Invasive Species



(c) John M. Randall/The Nature Conservancy

Ranunculus ficaria (lesser celandine)
Lesser celandine occurs in only 1 out of 1,688 wetlands (<1 percent). This invasive species is found along the western edge of Wetlands 1849 and 1850.

Control can be by mechanical or chemical means. The small numbers of plants in most areas make hand pulling combined with limited herbicide application a viable option. The plants should be pulled before seed production and removed from the area. Because this species is actively growing in early spring and dies back to the ground by early summer, early spring control is necessary.

Potamogeton crispus (curly pondweed), *Myriophyllum spicatum* (Eurasian water-milfoil), and *Najas minor* (lesser naiad) were not observed during this study. These are aquatic plants that are easily observed only during the growing season. Although not observed, these plants are likely present in at least a few areas that have year-round standing water. These aquatic invasive plant species are almost certainly present in at least some of the open water areas (ponds) within the study area, which were not included in this study.

Upland Invasive Species
In addition to the wetlands invasive species that were targeted in this study, there are several upland species that were noted during our study. *Alliaria petiolata* (garlic mustard), *Rosa multiflora* (multiflora rose), and *Ligustrum vulgare* (privet) are species that prefer upland areas, but also have invaded some wetlands. All of these species are very common throughout the study area. Although localized, privet appears to be very invasive as an understory woodland shrub in both wetlands and uplands. This species has the potential to become much more of a problem in coming years.

Restore Hydrology

Davey identified 12 wetlands in which hydrology could be restored. Past ditching and tiling have affected these wetlands. In other cases, hydrology has been altered by nearby construction projects; for example, the construction of storm water basins adjacent to wetlands. Restoration of wetland hydrology could be as simple as filling drainage ditches, breaking drainage tiles, or constructing low berms. There may be other opportunities for wetlands restoration in old farm fields that have been ditched and tiled. This would require a more detailed study of hydric soils and existing ditches and drainage tiles.

Roadside ditches, storm sewers, and other man-made structures have partially drained some wetlands. Restoring hydrology was considered an option only if it could be done without major disruption of existing infrastructure.

Restore Vegetated Buffer Zone

Davey identified 35 opportunities to restore vegetated buffer zones around wetlands. All of these wetlands are situated next to developed areas and/or roads with little or no vegetation protecting the wetland. Restoration of the buffer zone can involve planting native vegetation, or simply not mowing or otherwise maintaining the uplands adjacent to the wetlands.

There are numerous wetlands with little or no buffer zone. Only wetlands where it appears practical to restore the buffer zone were included in this list. In many areas, there is simply not room between the wetland and adjacent development to establish a buffer zone. However, best management practices can be implemented in these areas, such as no or minimal mowing, as well as directing runoff out of high-quality wetlands areas. Lawn chemicals should not be used near streams or wetlands.

Remove Fill and Trash

A total of 22 wetlands were noted for fill removal. Fill occurs primarily in small, localized areas. The fill consists of subsoil, concrete, stone, brick, block, and household debris, making its removal difficult in most cases. The composition of the fill is usually unknown and would need to be determined before removal. There is the potential for hazardous waste in some areas. In some instances, disturbance created by fill removal may outweigh the benefits of wetlands restoration. Several other areas of fill occur as a result of recent development. Because of the recent development, it would not be feasible to remove these fills.

There are 14 wetlands where trash should be removed. These are mainly large household dump sites. Household debris was noted throughout the study area, but only significant dump sites were mapped. The inaccessibility of many of these areas would require that the trash be removed by hand, a very labor-intensive process.

Eliminate Pollution

Only one wetland was identified for pollution removal. This is a large wetland located south of Bagley Road in Middleburg Heights where a sewer odor was noticed, most likely from a malfunctioning sewer line.

Many of the wetlands receive polluted runoff from roads and parking lots containing salt and fluids leaked from vehicles. These areas were not mentioned unless the impact appeared to be significant. One of the functions of wetlands is cleansing water. Runoff can degrade the wetlands, and road salt can encourage growth of certain invasive plant species. However, wetlands located between the source of the runoff and receiving streams filter these pollutants out of the water before they are able to reach these waterways. This is, unfortunately, harmful to the wetlands, but beneficial to stream water quality.

Other

A total of 45 wetlands were noted as having impacts other than those mentioned above. By far the most common were mowing within the wetland and disturbance caused by all-terrain vehicle use. All-terrain vehicles have impacted many wetlands within the study area. This was only noted as an impact when a significant portion of the wetland was impacted. All-terrain vehicle use creates ruts and sedimentation and eliminates important herbaceous vegetation from the wetland.

Threats to Wetlands

The greatest threat to wetlands within the study area is development. Nearly all of the large, high-quality wetlands are under pressure from recent, current, or planned developments. Examples include numerous, high-quality wetlands within the area south of Edgerton Road and east of State Road in North Royalton. Another similar area, also in North Royalton, is located between Abbey, Albion, and York Roads. Both of these areas contain numerous wetlands and stream corridors, as well as upland woods. These areas are under pressure from multiple residential developments. While the development projects may directly impact very few of the wetlands themselves, the destruction of the upland buffer zones around them will negatively impact the ecological integrity of these wetlands. The surrounding disturbance from development also provides an excellent opportunity for invasive species to become established. The wetlands will continue to perform other functions, such as groundwater recharge and filtering of runoff from adjacent developments, but their ecological values will be diminished.

Examples of Wetlands Restoration, Enhancement, and Preservation Opportunities

The following section contains several examples of wetlands restoration, enhancement, and preservation projects that are possible within the study area.

Wetland #1749

Wetland #1749 is located south of U. S. 422 and north of Bainbridge Road in Solon. Industrial areas are located north and west of this wetland and residential areas are to the south and east. Evidence of old, washed-out tiles could be seen within the wetland and surrounding successional woods.

Wetland #1749 has evidence of past tiling including this area of washed-out tiles.

A combination of wetlands enhancement and restoration is possible in this area. Hydrology could be restored by removing existing tiles and through the construction of shallow berms between the wetland and a small stream along the eastern edge of the woods. A more detailed study would have to be undertaken to determine the exact location and extent of the tiling system.

The existing wetland, in the most low-lying area, could provide vernal pool habitat if water levels are increased. The surrounding area, which is currently successional woods, could be used for restoration. Existing trees, such as *Acer rubrum* (red maple) and *Fraxinus pennsylvanica* (green ash), would tolerate increased water levels. There is a potential here for perhaps one to two acres of wetlands enhancement and restoration.

This wetlands complex within and near Westlake Nature Preserve includes ridge and swale wetland mosaics.

Wetlands #196–205, 219–221, and 233–236 These wetlands lie within and near Westlake Nature Preserve in Westlake. This area was farmed at one time, and remnants of old vineyard swales can be seen in many areas. Some of the old drainage ditches along the edges of the fields are still functioning. Wetlands restoration through berming and plugging of drainage ditches could occur here. The area is currently a mosaic of wetland and upland. The goal would be to increase the amount of wetlands while enhancing the existing wetlands. The final goal would be a forested wetland mosaic similar to what is found within the undisturbed portions of Bradley Woods Reservation. Shallow excavation and/or berming could be used to create small vernal pools within this area. There may also be tile lines here, though no evidence of this was seen in the field.

Wetlands #225–232, 247, 2208–2209
These wetlands located in North Olmsted and Westlake include Bradley Woods Reservation and surrounding areas. This is the largest wetlands complex in Cuyahoga County and is a remnant of the wetlands that once covered large portions of the lake plain. Although areas of this wetlands complex have been disturbed by past drainage and farming, other portions appear nearly undisturbed. Undisturbed mosaics consisting of extensive lowland woods with some vernal pools and higher uplands occur within this area. These wetlands provide an example of the ultimate goal for lake plain wetlands enhancement and restoration projects.

This large, high-quality wetlands complex is located within and near Bradley Woods Reservation.

Although most of this area is part of Bradley Woods Reservation, a few areas are still privately owned. Privately owned areas include wetlands as well as upland buffers. Protection of these remaining private lands should be a very high priority. Upland buffer areas are most in danger of development and should be given highest priority for protection. Recently built small developments on Barton, Bradley, and Center Ridge Roads in Westlake are examples of how development in this area, even though on upland areas, degrades the quality of the adjacent wetlands.

There are numerous areas within this huge wetlands complex where limited wetlands restoration and enhancement could occur by construction of shallow berms and plugging drainage ditches. Hydrological modifications will have to be carefully designed to avoid changes to adjacent natural wetlands, as well as flooding concerns of nearby residents. Most of these areas are far from access roads, making the use of large equipment unfeasible.

Springs and seeps that begin at sandstone ledges help to supply this large wetlands complex with hydrology.

Wetlands # 782–785, 788–790, 803, 820–822, 831–842, 845–846

This large area is between Edgerton Road, State Road, and Boston Road in North Royalton and Broadview Heights and includes extensive wetlands, riparian corridors, and upland woods. Tributaries to the Rocky River flow through this area. Sandstone ledges with springs and seeps are near Boston Road. Newer developments are located along Edgerton Road, and a new street has been constructed off State Road. There are relatively few large blocks of privately owned natural areas in this part of Cuyahoga County. This area should receive high priority for preservation before it is destroyed by development.

Wetland #955

Wetland #955 is a large wetland that is located between Ridge Road and Bennett Road in North Royalton. This wetland is large and is mostly forested. This high-quality wetland is notable for its size and diversity and is worthy of protection. This wetland is also located in the Rocky River floodplain and serves as a buffer between the river and development along Ridge Road.

A small ditch extends through a portion of this wetland. Enhancement could occur by plugging this old drainage ditch. This would improve and possibly expand the wetland.

Wetland #955 is a large complex of lowland woods.

High-quality wetlands worthy of preservation include areas that that have superior hydrological, habitat, or other functions. Such wetlands generally rate Category 3 on the Ohio Rapid Assessment Method (ORAM) forms and often include large wetlands systems associated with streams.

Following is a list of high-quality wetlands worthy of preservation[2]: 4, 8, 22–24, 80, 84–87, 122–124, 136–141, 225–231, 247–248, 262, 275–277, 281–282, 299–303, 344, 660, 679, 684, 686–687, 768, 775, 803, 820–821, 831, 928, 931–935, 955, 958, 977, 982–983, 1059, 1212, 1265, 1320–1325, 1330, 1352, 1392–1396, 1492, 1518, 1536, 1568–1571, 1611, 1662–1668, 1699–1702, 1715–1717, 1719, 1726–1727, 1802, 1810–1814, 1848–1854, 1895–1896, 190–1906, 1908, 2194–2201, 2206, and 2209.

Summary and Conclusions

This study indicates that Cuyahoga County (excluding the Cuyahoga River watershed) contains a diverse assemblage of wetlands, most of which are in relatively good condition. A total of 1,687 wetlands encompassing 3,356 acres were mapped and evaluated by Davey Resource Group as part of this project. This includes 602 wetlands greater than 1 acre in size, with the average size of the wetlands being about 2 acres. This study is the third wetlands inventory that Davey Resource Group has completed in Cuyahoga County. Table 8 shows summary statistics for the Cuyahoga County portion of our three studies.

Table 8. Summary of Wetlands Statistics for Cuyahoga County Wetlands

Wetlands Study	Number of Wetlands	Total Wetlands Acreage	Total Study Area Acreage
Non-Cuyahoga River portions of Cuyahoga County (current study)	1,687	3,356	172,635
Cuyahoga River portion of Cuyahoga County (excluding Cuyahoga Valley National Park)	781	1,406	121,261
Cuyahoga County portion of Cuyahoga Valley National Park	257	710	8,996
Total	2,725	5,472	302,892

There is potential for wetlands enhancement and restoration in several areas. Most of the wetlands restoration and enhancement opportunities are small, labor-intensive projects. The greatest wetland enhancement opportunities exist in controlling invasive species. Invasive species control, especially for widespread species such as *Rhamnus frangula* (glossy buckthorn), will be extremely difficult. A county-wide control program would likely have to be implemented to effectively contain these species. *Phragmites australis* (common reed) and *Lythrum salicaria* (purple loosestrife) are less common and could be controlled with an aggressive management program.

[2] Wetlands systems may include multiple individual identification numbers.

Other wetlands restoration opportunities are available. These can best be realized by removing small areas of fill and trash, restoring hydrology by breaking tiles or blocking off drainage ditches, and restoring buffer zones around as many wetlands as possible.

An effort should be made to design developments in a way that preserves meaningful upland buffers along with wetlands and stream corridors. The few remaining large, privately owned, high-quality wetlands and their surrounding uplands should be preserved.

There are many low to moderate quality wetlands in the study area that are performing important wetlands functions, such as storm water and flood control, filtration of pollutants and sediment, and groundwater recharge. These wetlands, although not high-quality, are important for maintaining water quality. The wetlands which are best at performing these functions are those that are located along or near streams or drainageways, and those that are located adjacent to developed areas and are capable of holding relatively large amounts of water. Many of the lowland woods and wet meadows that occur in very slight depressions within upland areas, particularly in the western portion of the county, are not efficient at performing these important wetlands functions and values.

Appendix A
Glossary of Terms

ArcView – ESRI's desktop GIS software.

Bog – A peat-accumulating wetland that has no significant inflows or outflows and supports acidophilic mosses, particularly sphagnum.

Cowardin – A standard method of wetlands classification including palustrine emergent, palustrine scrub/shrub, and palustrine forested. A detailed description of this classification method can be found in Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. *Classification of Deepwater Habitats of the United States.* U.S. Fish & Wildlife Service Pub. FWS/OBS-79/31, Washington, D.C., 103p.

ESRI – Environmental Systems Research Institute, Redlands, California.

GIS – A Geographic Information System is a computer-based system used to capture, store, edit, analyze, display, and plot geographically referenced data.

GIS Data – Electronic map data used specifically in GIS software. GIS map data are composed of graphical features (map features) and linked attributes (information describing the map features). Assorted types include orthophotography (eg., aerial photography), vector maps composed of points, lines, and polygons (eg., wells, streams, buildings), and raster maps composed of pixels (similar to images).

Hillside Seep—A wetland fed by groundwater flowing out of a hillside. Such wetlands occur on steep slopes as well as the more level ground at the base of the slope.

Hydric Soil – A soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part of the soil profile.

Hydrophytic Vegetation – Plants that are adapted for life in saturated soil conditions. Hydrophytic plants often have special morphological adaptations.

Intermittent Stream—A stream which has flowing water for part of most of the year but not all year. Intermittent streams typically become dry in late summer and fall.

Marsh – A frequently or continually inundated wetland characterized by emergent herbaceous vegetation adapted to saturated soil conditions.

Orthophotography – Aerial photography converted to digital form and geographically referenced to specified projection parameters.

PEM (palustrine emergent) – A wetland dominated by herbaceous vegetation; typically includes marshes and wet meadows. Standard wetlands classification developed by Cowardin that is used on National Wetlands Inventory maps.

PFO (palustrine forested) – A wetland dominated by trees (forested wetlands). Standard wetlands classification developed by Cowardin that is used on National Wetlands Inventory maps.

Projection Parameters – Parameters used to geographically reference GIS map data relative to the surface of the earth.

PSS (palustrine scrub/shrub) – A wetland dominated by shrubs and saplings. Standard wetlands classification developed by Cowardin that is used on National Wetlands Inventory maps.

Shapefile – A GIS map data computer file format used by ESRI's ArcView GIS software.

Vernal Pool – Shallow, intermittently flooded area, generally dry for most of the summer and fall. Vernal pools are most often in forested areas and provide important amphibian and insect breeding habitat.

Wetlands Enhancement – An improvement in wetlands quality by improving wetlands hydrology or vegetation, removing invasive species, restoration of buffer zones, or other means.

Wetlands Hydrology – The presence of standing water and/or saturated soils for a sufficient duration to support hydrophytic vegetation.

Wetlands Restoration – Creation of wetlands in an area where they formerly existed but have been removed through filling, drainage, or other means. Wetlands restoration most frequently involves restoration of hydrology and removal of fill.

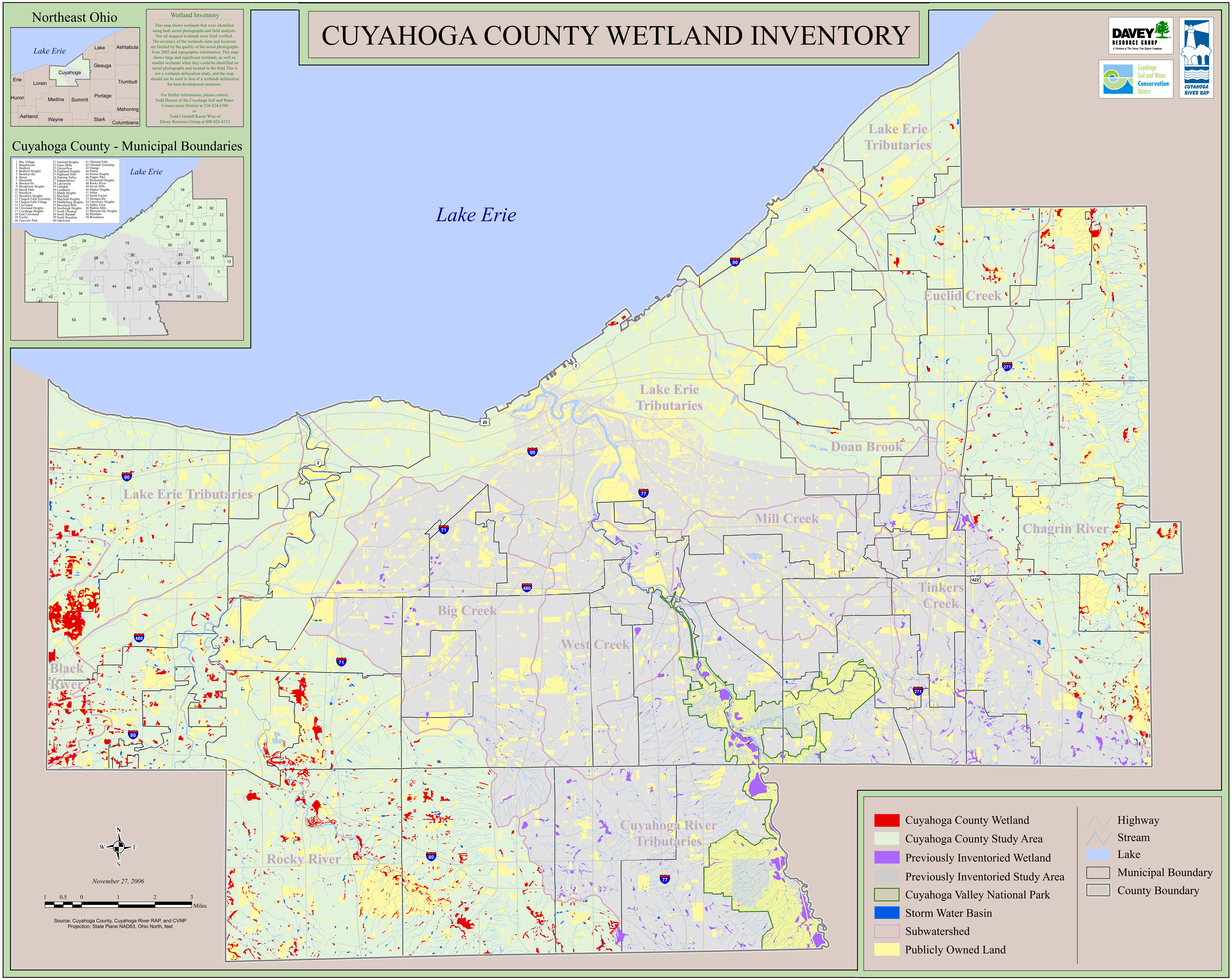
Wet Meadow – Grassland with waterlogged soil near the surface but without standing water for most of the year.

Appendix B
Data Dictionary

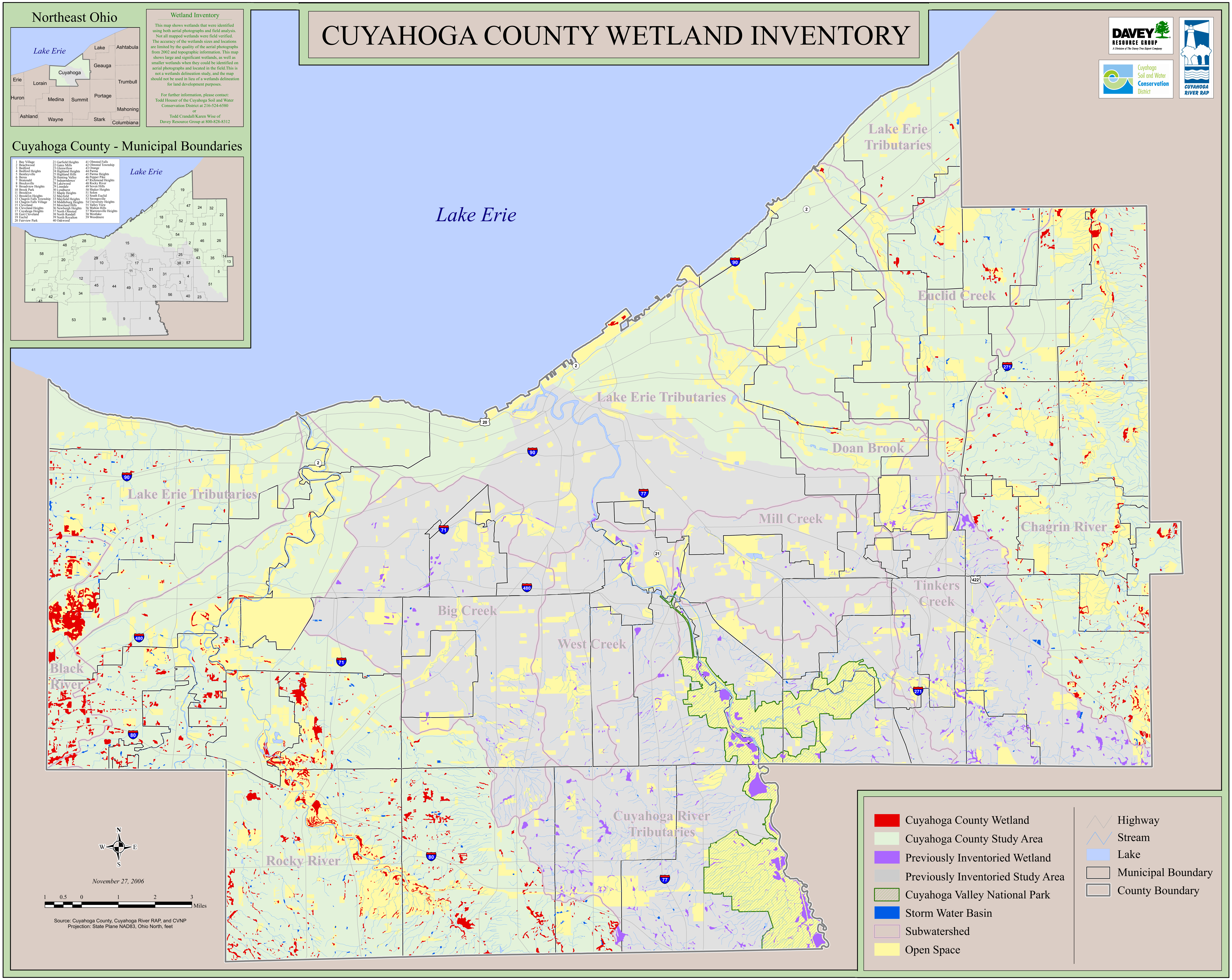
Field Name	Description	Type	Width	Decimal
Site Information				
Shape	Shape	SHAPEPOLY	8	0
Wetland_Id	ID	NUMERIC	10	0
Date	Date	DATE	8	0
Site	ID, Date, and	CHARACTER	50	0
Area	Area (square ft)	DECIMAL	16	4
Perimeter	Perimeter (feet)	DECIMAL	16	3
Acres	Area (acres)	DECIMAL	16	4
Ppn	Parcel Number	CHARACTER	25	0
Owner	Parcel Owner	CHARACTER	200	0
Soil_unit	Soil Survey Soil Unit	CHARACTER	200	0
Hydric	Hydric Soils Present	CHARACTER	6	0
Grid_cell	Inventory Grid Cell	CHARACTER	10	0
Gps	Collected with GPS	CHARACTER	2	0
CentroidX	Automated X centroid	DECIMAL	16	2
CentroidY	Automated Y centroid	DECIMAL	16	2
Basin	Watersheds	CHARACTER	100	0
ORAM	Ohio Rapid Assessment Method	CHARACTER	5	0
System_ID	Wetland System ID	NUMERIC	8	0
Cowardin Classification				
C_class1	Cowardin Classification	CHARACTER	64	0
C_class2	Cowardin Classification	CHARACTER	64	0
C_class3	Cowardin Classification	CHARACTER	64	0
Addl_class	Additional Classification	CHARACTER	254	0
Sources of Hydrology				
Strm_drain	Storm Drainage	CHARACTER	2	0
Srfwat_ro	Surface Water Runoff	CHARACTER	2	0
Sprg_seep	Spring or Seep	CHARACTER	2	0
Grnd_wat	Groundwater	CHARACTER	2	0
Beaver	Beaver Impact	CHARACTER	2	0
Adverse Impacts on Water Quality				
Ro_rdpkg	Runoff from Road/Parking Lot	CHARACTER	2	0
Strm_wat	Storm water	CHARACTER	2	0
Sep_eff	Septic Effluent	CHARACTER	2	0
Wq_none	None	CHARACTER	2	0
Wq_other	Other	CHARACTER	2	0
Wq_comm	Comments	CHARACTER	254	0
Vegetation Information				
Veg1	Vegetation Comments	CHARACTER	254	0
Veg2	Vegetation Comments	CHARACTER	254	0
Invasive Species				
L_sali	*Lyrthum salicaria*	CHARACTER	2	0
Lsali_amt	Amount *L. salicaria*	CHARACTER	250	0
P_arun	*Phalaris arundinacea*	CHARACTER	2	0
Parun_amt	Amount *P. arundinacea*	CHARACTER	250	0
P_aust	*Phragmites australis*	CHARACTER	2	0
Paust_amt	Amount *P. australis*	CHARACTER	250	0
R_frang	*Rhamnus frangula*	CHARACTER	2	0
Rfrang_amt	Amount *R. frangula*	CHARACTER	250	0

Field Name	Description	Type	Width	Decimal
Vegetation Information (Cont'd.)				
T_angu	*Typha angustifolia*	CHARACTER	2	0
Tangu_amt	Amount *T. angustifolia*	CHARACTER	250	0
R_fica	*Ranunculus ficaria*	CHARACTER	2	0
Rfica_amt	Amount *R. ficaria*	CHARACTER	250	0
P_crisp	*Potamogeton crispus*	CHARACTER	2	0
Pcrisp_amt	Amount *P. crispus*	CHARACTER	250	0
M_spac	*Myriophyllum spicatum*	CHARACTER	2	0
Mspac_amt	Amount *M. spicatum*	CHARACTER	250	0
N_mino	*Najas minor*	CHARACTER	2	0
Nmino_amt	Amount *N. minor*	CHARACTER	250	0
Impacts				
Old_fill	Old Fill	CHARACTER	2	0
New_fill	New Fill	CHARACTER	2	0
Dumping	Dumping	CHARACTER	2	0
Drn_ditch	Drainage Ditch	CHARACTER	2	0
Drn_tile	Drainage Tiling	CHARACTER	2	0
Logging	Logging	CHARACTER	2	0
Adj_lu	Adjacent Land Use	CHARACTER	2	0
Imp_none	None	CHARACTER	2	0
Imp_other	Other Impacts	CHARACTER	2	0
Imp_comm	Impact Comments	CHARACTER	254	0
Restoration Potential				
Rpinvsv	Remove Invasive Species	CHARACTER	2	0
Rphydr	Restore Hydrology	CHARACTER	2	0
Rpfill	Remove Fill	CHARACTER	2	0
Rptrash	Remove Trash	CHARACTER	2	0
Rpbuffer	Restore Buffer Zone	CHARACTER	2	0
Rppolltn	Eliminate Pollution Source	CHARACTER	2	0
Rpother	Other	CHARACTER	2	0
Rpcomm	Comments	CHARACTER	254	0
Photo	Digital Photo Number	CHARACTER	32	0
Equipment Accessibility				
Eqaccess	Equipment Accessibility	CHARACTER	8	0
General Comments				
Gen_comm	General Comments	CHARACTER	254	0

Appendix C
Map Showing Wetlands, Subwatersheds, Political Boundaries, and Publicly Owned Lands


CUYAHOGA COUNTY WETLAND INVENTORY
Northeast Ohio
Lake Erie
Lake
Ashtabula
Geauga
Cuyahoga
Erie
Lorain
Trumbull
Huron
Medina
Summit
Portage
Mahoning
Ashland
Wayne
Stark
Columbiana
Wetland Inventory
This map shows wetlands that were identified using both aerial photographs and field analysis. Not all mapped wetlands were field verified. The accuracy of the wetlands sizes and locations are limited by the quality of the aerial photographs from 2002 and topographic information. This map shows large and significant wetlands, as well as smaller wetlands when they could be identified on aerial photographs and located in the field.This is not a wetlands delineation study, and the map should not be used in lieu of a wetlands delineation for land development purposes.
For further information, please contact:
Todd Houser of the Cuyahoga Soil and Water Conservation District at 216-524-6580
or
Todd Crandall/Karen Wise of Davey Resource Group at 800-828-8312
Cuyahoga County - Municipal Boundaries
1 Bay Village
2 Beachwood
3 Bedford
4 Bedford Heights
5 Bentleyville
6 Berea
7 Bratenahl
8 Brecksville
9 Broadview Heights
10 Brook Park
11 Brooklyn
12 Brooklyn Heights
13 Chagrin Falls Township
14 Chagrin Falls Village
15 Cleveland
16 Cleveland Heights
17 Cuyahoga Heights
18 East Cleveland
19 Euclid
20 Fairview Park
21 Garfield Heights
22 Gates Mills
23 Glenwillow
24 Highland Heights
25 Highland Hills
26 Hunting Valley
27 Independence
28 Lakewood
29 Linndale
30 Lyndhurst
31 Maple Heights
32 Mayfield
33 Mayfield Heights
34 Middleburg Heights
35 Moreland Hills
36 Newburgh Heights
37 North Olmsted
38 North Randall
39 North Royalton
40 Oakwood
41 Olmsted Falls
42 Olmsted Township
43 Orange
44 Parma
45 Parma Heights
46 Pepper Pike
47 Richmond Heights
48 Rocky River
49 Seven Hills
50 Shaker Heights
51 Solon
52 South Euclid
53 Strongsville
54 University Heights
55 Valley View
56 Walton Hills
57 Warrensville Heights
58 Westlake
59 Woodmere
Lake Erie
DAVEY RESOURCE GROUP
A Division of The Davey Tree Expert Company
Cuyahoga Soil and Water Conservation District
CUYAHOGA RIVER RAP
Lake Erie
Lake Erie Tributaries
Euclid Creek
Lake Erie Tributaries
Doan Brook
Lake Erie Tributaries
Mill Creek
Chagrin River
Tinkers Creek
Big Creek
West Creek
Black River
Rocky River
Cuyahoga River Tributaries
N
W
E
S
November 27, 2006
1 0.5 0 1 2 3 Miles
Source: Cuyahoga County, Cuyahoga River RAP, and CVNP
Projection: State Plane NAD83, Ohio North, feet
Cuyahoga County Wetland
Cuyahoga County Study Area
Previously Inventoried Wetland
Previously Inventoried Study Area
Cuyahoga Valley National Park
Storm Water Basin
Subwatershed
Publicly Owned Land
Highway
Stream
Lake
Municipal Boundary
County Boundary

Appendix D
Map Showing Wetlands, Subwatersheds, Political Boundaries, and Open Space


CUYAHOGA COUNTY WETLAND INVENTORY
Northeast Ohio
Lake Erie
Lake
Ashtabula
Geauga
Cuyahoga
Erie
Lorain
Trumbull
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22 Gates Mills
23 Glenwillow
24 Highland Heights
25 Highland Hills
26 Hunting Valley
27 Independence
28 Lakewood
29 Linndale
30 Lyndhurst
31 Maple Heights
32 Mayfield
33 Mayfield Heights
34 Middleburg Heights
35 Moreland Hills
36 Newburgh Heights
37 North Olmsted
38 North Randall
39 North Royalton
40 Oakwood
41 Olmsted Falls
42 Olmsted Township
43 Orange
44 Parma
45 Parma Heights
46 Pepper Pike
47 Richmond Heights
48 Rocky River
49 Seven Hills
50 Shaker Heights
51 Solon
52 South Euclid
53 Strongsville
54 University Heights
55 Valley View
56 Walton Hills
57 Warrensville Heights
58 Westlake
59 Woodmere
Lake Erie
DAVEY RESOURCE GROUP
Cuyahoga Soil and Water Conservation District
CUYAHOGA RIVER RAP
Lake Erie
Lake Erie Tributaries
Euclid Creek
Lake Erie Tributaries
Doan Brook
Lake Erie Tributaries
Mill Creek
Chagrin River
Tinkers Creek
Big Creek
West Creek
Black River
Cuyahoga River Tributaries
Rocky River
N
W
E
S
November 27, 2006
1 0.5 0 1 2 3
Miles
Source: Cuyahoga County, Cuyahoga River RAP, and CVNP
Projection: State Plane NAD83, Ohio North, feet
Cuyahoga County Wetland
Cuyahoga County Study Area
Previously Inventoried Wetland
Previously Inventoried Study Area
Cuyahoga Valley National Park
Storm Water Basin
Subwatershed
Open Space
Highway
Stream
Lake
Municipal Boundary
County Boundary

Appendix E
Summary of Wetlands Restoration Opportunities

RESTORATION	WETLAND ID NUMBERS*
Restore Hydrology	(889–955), (1163–1164), 1165, 1166, 1443, 1444, 1445, 1446, (1466–1468, 1485), 1619, 1650, 1749
Restore Buffer	1, 278, 288, 585, 586, 847, 954, 1068, 1085, 1131, 1172, (1179–1180), 1183, 1228, (1281–1282), 1283, (1463–1464), 1556, 1606, 1608, 1624, 1633, 1652, 1776, 1777, 1807, (1810–1814), 1837, 1847, 1855, 1856, 1871, 1893, 1992, 1993
Remove Fill	(22–23), 24, 811, 1297, 1298, 1474, 1797, 1798, 1799, 1807, (1810–1814), 1815, 1820, (1848–1854), 1855, 1856, 1860, (1931–1932), (1940–1941), (1999–2000), 2190, (2204–2205)
Remove Trash	31, 32, 33, 34, (1139–1140), 1589, 1719, 1807, (1810–1814), (1824–1827), 1831, (1848–1854), 1870, (2204–2205)
Eliminate Pollution	(1810–1814)
Other	197, 199, 200, 201, 202, (203–204, 238), (205, 220, 234–236), 219, (221–222), 233, 239, 1265, 1266, (1281–1282), 1283, 1303, 1304,1305, 1622, 1623, 1871, (2107–2109), 2110, 2111, 2112, 2113, 2114, 2126, 2163

*Wetland ID numbers that are part of a single wetlands system are enclosed by ( ).

Appendix F
Definition of Wetlands Vegetation Indicator Status (from Reed, 1988)

Obligate Wetlands (OBL). Occur almost always (estimated probability is greater than 99%) under natural conditions in wetlands.

Facultative Wetlands (FACW). Usually occur in wetlands (estimated probability 67–99%) but occasionally found in non-wetlands.

Facultative (FAC). Equally likely to occur in wetlands or non-wetlands (estimated probability 34–66%).

Facultative Upland (FACU). Usually occur in non-wetlands (estimated probability 67–99%) but occasionally found in wetlands (estimated probability 1–33%).

Obligate Upland (UPL). Occur in wetlands in another region, but occur almost always (estimated probability > 99%) under natural conditions in non-wetlands in the region specified. If a species does not occur in wetlands in any region, it is not on the *National List*.

Species for which little or no information was available to base an indicator status were assigned a no indicator (NI) status. An asterisk (*) after the indicator status indicates that the indicator status was based on limited ecological information.
The wetlands indicator categories should not be equated to degrees of wetness. Many obligate wetlands species occur in permanently or semipermanently flooded wetlands, but a number of obligates also occur, and some are restricted to wetlands that are only temporarily or seasonally flooded. The facultative upland species include a diverse collection of plants that range from weedy species adapted to exist in a number of environmentally stressful or disturbed sites (including wetlands), to species in which a portion of the gene pool (an ecotype) always occurs in wetlands. Both the weedy and ecotype representatives of the facultative upland category occur in seasonally and semipermanently flooded wetlands.
Davey Resource Group has added two additional indicators for situations when plants can only be identified to genus. A Wetlands Indicator Species (WIS) is a plant that is most likely obligate wetlands, facultative wetlands, or facultative. An Upland Indicator Species (UIS) is a plant that is most likely indicative of upland or facultative upland conditions. These additional indicators are used when species identification is not possible. A variety of factors are part of the UIS and WIS assignments. Indicator statuses of all locally occurring members of the genus in question are considered, as are the health and size of the population and the indicator status of nearby plants.

Appendix G
Davey Resource Group Personnel Profiles

Michael R. Binkley, M.A., is a Geographic Information Scientist with ten years of experience applying GIS technology to environmental analysis and natural resource management. Mr. Binkley maintains extensive knowledge of contemporary GIS software as well as their common operating system software and hardware platforms. In addition, he is an experienced programmer with emphasis on Visual Basic and various GIS programming languages. Mr. Binkley is also a member of several professional organizations; these affiliations include the American Society for Photogrammetry and Remote Sensing, Association of American Geographers, Ohio Academy of Science, American Geophysical Union, and the Water Resources Research Institute. He received a master of arts in geography and a bachelor of science with honors in natural resource conservation with minors in climatology and geography from Kent State University.

Todd A. Crandall, M.En., is a wetlands scientist that is responsible for all wetlands delineations performed at Davey Resource Group. Mr. Crandall also performs ecological surveys, vegetation cover mapping, plant identification, Section 401-404 and isolated wetlands permitting, and prepares restoration and mitigation plans. Mr. Crandall is responsible for vegetation monitoring at numerous wetland mitigation sites throughout Northeast Ohio. He has completed several large-scale wetland inventories for the Cuyahoga Valley National Park, as well as Cuyahoga, Portage, and Summit Counties in Ohio. He is certified for wetlands studies by the U.S. Army Wetlands Delineator Certification Program, and is a certified Professional Wetlands Scientist (PWS) through the Society of Wetland Scientists. He has completed the 40-hour OSHA health and safety training (OSHA Standard 29 CFR 1910.120). Mr. Crandall has also completed training through the Ohio Environmental Protection Agency (EPA) for the following: Headwater Habitat Evaluation Index (HHEI); Qualitative Habitat Evaluation Index (QHEI); Ohio Rapid Assessment Method (ORAM) v.5; and Vegetation Index of Biotic Integrity (VIBI). He has 14 years of experience and holds a bachelor's degree from Hiram College in biology and a master's degree in environmental science from Miami University.

Michelle Malcosky is a biologist responsible for overseeing Davey's ecological and wetlands permitting projects, endangered species surveys, and natural resource restoration projects. Ms. Malcosky writes technical reports and assists with many of the ecological surveys, wetland and stream restorations, mitigation monitoring, endangered species surveys, and watershed studies that she oversees. She has managed ecological studies for the Ohio Department of Transportation (ODOT) I-75/I-475 Interchange upgrade in Toledo, Ohio, American Electric Power's Davidson-Dublin 138kV Underground Transmission Line in Franklin County, and an Ohio Department of Natural Resources study assessing cumulative and secondary effects of development in watersheds. Ms. Malcosky, a botanist by training, conducts plant surveys with an emphasis on rare, threatened, and endangered species identification. Ms. Malcosky also has extensive experience conducting habitat, emergence, and mist-netting surveys for rare bats throughout Ohio and holds permits from both U.S. Fish and Wildlife and the State of Ohio to conduct surveys for the federally endangered Indiana bat (Myotis sodalis). Ms. Malcosky joined Davey in 1999 and graduated from The University of Akron with a Bachelor of Science degree in biology with an emphasis on botany.

David Riddell is a biologist who assists with a variety of natural resource projects, including wetlands studies, bat mist-netting surveys, and invasive species control. He is currently involved in the eradication of *Typha angustifolia* (narrow-leaved cattail) and *Rhamnus frangula* (glossy buckthorn) within 50 acres of wetlands to be restored along Pond Brook in Twinsburg, Ohio on land managed by Metro Parks, Serving Summit County. In 2005, he was a technical support specialist for the Asian Longhorned Beetle Eradication Program located in New York City. Mr. Riddell also has experience in urban and utility forestry. He worked on a project for FirstEnergy as a contract utility forester where he inventoried utility right-of-ways throughout Ohio, Pennsylvania, and New Jersey. His urban forestry experience stems from serving as a data technician on two U.S. Forest Service projects involving the Urban Forest Effects Model (UFORE) and by serving as an inventory arborist on several municipal street tree inventories. Mr. Riddell is a Certified Arborist (OH-5230A) through the International Society of Arboriculture and an Indiana and Ohio Certified Commercial Pesticide Applicator. Prior to his employment at Davey Resource Group, Mr. Riddell worked as a Biological Science Technician for the National Park Service where he helped design and implement an invasive plant management program for the Cuyahoga Valley National Park. Mr. Riddell graduated from Kent State University with a Bachelor of Science degree in conservation.

Deborah Sheeler, M.A., is a Geographic Information Scientist with eight years of experience specializing in GIS Analysis and Natural Hazards research. Her work involves the creation, design, and analysis of spatial data and their cartographic products through the use of advanced GIS software. In addition, she has experience in the field of aerial photography interpretation as well as numerous years of experience in the maintenance and support of pen-computer hardware. Ms. Sheeler supervises GIS operations at Davey Resource Group. She holds a Master of Arts degree in Geography from Kent State University and a Bachelor of Science degree in Geography from Central Missouri State University with a minor in Earth Science.

Karen M. Wise, M.S., supervises the Natural Resource Consulting group at Davey. This unit provides comprehensive consulting services to governments, development companies, and engineering/design firms. Services provided include wetlands consulting, endangered species surveys, watershed mapping and planning, and comprehensive urban forestry consulting. Ms. Wise is responsible for business development, client and project management, and supervision of the 22 biologists and urban foresters working within the Natural Resource Consulting group. Ms. Wise is a wetlands biologist by training and has more than 14 years of experience in the fields of wetland ecology, restoration, design, and management. She is particularly versed in wetlands policy and familiar with all aspects of Section 401 and 404 permitting, isolated wetlands regulations, and compensatory mitigation for unavoidable impacts to streams and wetlands. Ms. Wise recently completed the Ohio Department of Transportation's Waterways Permits Training hosted by the Office of Environmental Services and a prerequisite training for coordinating complex permits for Ohio's important transportation projects. Ms. Wise is active in local chapters of the National Home Builders Association and has served on the land use policy subcommittee. She has attended and presented projects at national meetings of the Society of Wetland Scientists, of which she has been a member throughout her career. She is also a supporting member of The Nature Conservancy (TNC) and has coordinated public-private partnerships to assist TNC in land acquisition and land management at holdings in northern Ohio. Ms. Wise holds a Bachelor of Science degree in biology from Wheeling Jesuit College and a Master of Science degree in natural resources from The Ohio State University.