Wetland Assessment and Restoration Potential in the Norwood Young America Watershed

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Abstract

This paper describes a wetland assessment methodology used for the Norwood Young America watershed area in Carver County. The purpose of the assessment is to aid local government in their efforts to organize, prioritize, and manage wetland resources in a comprehensive manner. The assessment gathers initial information on the area's wetlands, evaluates a limited number of regionally and locally important wetland functions, and estimates the value of wetland functions.

As other more detailed data sets, assessment methods, or site work confirm or refute the method's outcome, changes will be made to the model to incorporate the new information. This information will be used to enhance the region's environmental and economic sustainability by identifying high functioning, high value wetland communities and developing strategies in the county's comprehensive landuse plan and water management plan to preserve and manage them.

Introduction

Historically, wetlands in the United States were regarded by most European settlers as wastelands, whose best use could be attained through their destruction or alteration. Draining, dredging, and filling activities prepared wetlands for other more valuable agricultural, residential, commercial, and recreational uses. The environmental functions which wetlands provide were not well understood or valued.

With the increased public interest in wetlands some states and, finally, the federal government passed laws, such as Section 404 of the Federal Water Pollution Control Act (later amended as the Clean Water Act), protecting wetlands. Over time additional local, state, and federal laws have been added to further restrict avoidable disturbance to wetlands. In 1991, the Minnesota Legislature passed the Wetland Conservation Act (WCA), which aims for no-net-loss of wetlands.

There is a need for rapid, comprehensive approaches which evaluate a range of wetland functions and provide resource managers and planners with timely information to estimate the values of the wetland functions. Methods currently available do not meet the needs of many local and regional watershed-based managers and planning agencies. (Hruby et al. 1995)

Wetland assessment models vary enormously in their scope, precision and application. (Lonard et al. 1985) In general, wetland assessments use direct measures of or indicators of wetland function to assign a value of the worth, quality, or importance of the wetland function. The current consensus is that no one of these methodologies completely satisfies the analysis requirements of regulated wetlands.

For this assessment, functions are defined as the physical, chemical, and biological processes that contribute to the to the self-maintenance of wetland ecosystems. Where direct measures of wetland function are not possible, indicator associations are used. The estimate of how well a wetland function performs is based on the assumption that wetlands having specific environmental indicators present are better at performing that function than those which do not. If the association between the indicator and the function is strong enough, then the presence of the indicator in a wetland is sufficient indication that the function is being performed to some degree. (Hruby et al 1995)

There is some confusion regarding the definition of the term "value" as it has been used in association with wetland function in wetland literature and wetland function assessment methodologies. Value may be defined several ways. A value may be a belief, a fair return or equivalent in goods or services, or the relative usefulness, importance, or general worth of a thing. However defined, value always imposes an anthropogenic focus to the wetland functions by suggesting that the functions provide some benefit to humans. (Hruby et al. 1995) The value of each and any wetland function examined was made by local decision makers, with respect to WCA rules, other applicable federal, state and local wetland law, and planned local comprehensive land use needs. For this assessment, the term value refers to the assigned relative importance of a wetland function to an individual or group, i.e.; those involved with Carver County water planning.

Value judgements also are made in choosing which wetland functions to assess. The choice of wetland functions and assessment methodology depends on the specific wetland processes and the program goals that are valued in the planning region. This assessment looks at those wetland functions which are often valued in fringe, developing urban areas. They include Hydrologic Control, Water Quality, Habitat, Landscape and Wetland Characterization, and Restoration/Enhancement.

Generally, wetlands are defined by three key ecological attributes: 1) hydrology - the duration and frequency of flooding or soil saturation, 2) vegetation - plant communities dominated by hydrophytes, and 3) hydric soils. The ecological attributes (of the area) the assessment uses physiographic (hydrology, soils, geomorphology), vegetation, and land use characteristics to characterize the relationship between ecosystem structure and wetlands provided planners with an initial determination of wetland function.

The goal of the assessment was to provide a sound estimation the significance of a wetland's functions to the watershed in which it exists. Significance is divided into three broad classes - High, Medium, and Low. The approach of classifying wetlands into three broad functional significance classes is used because it feasible with our current understanding of wetland functions, and with the resolution and accuracy of the digital data sets. The three classes provide managers, planners, and the public with the information necessary to meet objectives without going beyond the realm of reasonable scientific validity.

The method is intended to be used to assess wetland functions relative to the natural and human ecosystems within the hydrologic unit in which it is located. It is not for evaluating site-specific impacts to wetlands or for delineation of wetland boundaries. While the information collected during the assessment may be useful to a wetland professional's detailed assessment of an individual wetland, it is not, in and of itself, a suitable method of evaluating an individual wetland. Specific function analysis can only be determined through on-site inspection and measurement.

This wetland resource assessment allowed for local priorities, while providing defensible, reasonable baseline value determinations. It should be remembered that all wetlands provide some benefit(s) to the ecosystem even though the wetland is evaluated low by this assessment. The priority scheme imposed here preserves those wetlands which are evaluated as critical to the maintenance of the wetland resource and watershed.

The Twin Cities metropolitan area is a complex environmental and economic regional center. The region contains seven counties, 189 cities and towns, and 46 Watershed Management Organizations and Watershed Districts (WMO and WD). The area is predominantly glacial till and outwash. The resulting landform varies from flat outwash sand and gravel alluvial plains, to gently undulating ground moraines, to the pitted, hilly end and stagnant moraines. The tension zone traverses the northern edge of the region. The region has many diverse communities including prairie, savanna, barrens, deciduous forest, and coniferous forest. This unique combination of geomorphology and plant communities provides a changing, diverse landscape through which flow three major rivers - the Minnesota River, the Mississippi River, and the St. Croix River. In addition, there are greater than 900 lakes, and more than 270,000 acres of wetlands as estimated by the 1994 National Wetlands Inventory in the metropolitan region. In all, the surface water system comprises about 20 percent of the land cover in this region. (LMIC)

Study area

The region ranks among the 25 largest urban areas in employment growth in the nation. The average annual growth rates (1970 to 1995) for population, households, and employment has been 1.1, 2.0, and 2.4% respectively. Forecasts by the Metropolitan council call for an additional 650,000 people, 320,000 new households, and 380,000 new jobs in the metropolitan region by the year 2020. Much of the region's growth - residential, commercial and industrial - is occurring in second-ring suburban cities and in freestanding growth centers.

Agricultural practices have been the predominant landuse in Carver County for the last 100 years. While farming is still a significant part of the county economic picture, it is no longer the predominant occupation in the county. Recently, residential housing pressures have increased due to the expanding economy in the metropolitan region and a willingness on the part of people to commute greater distances to jobs in Minneapolis/St Paul and the surrounding suburbs.

Carver County has seen an explosion of residential development in and around the cities of Chanhassen, Chaska, Waconia, Carver, Victoria and Norwood Young

America. Carver County currently has a population of 64,000 people.

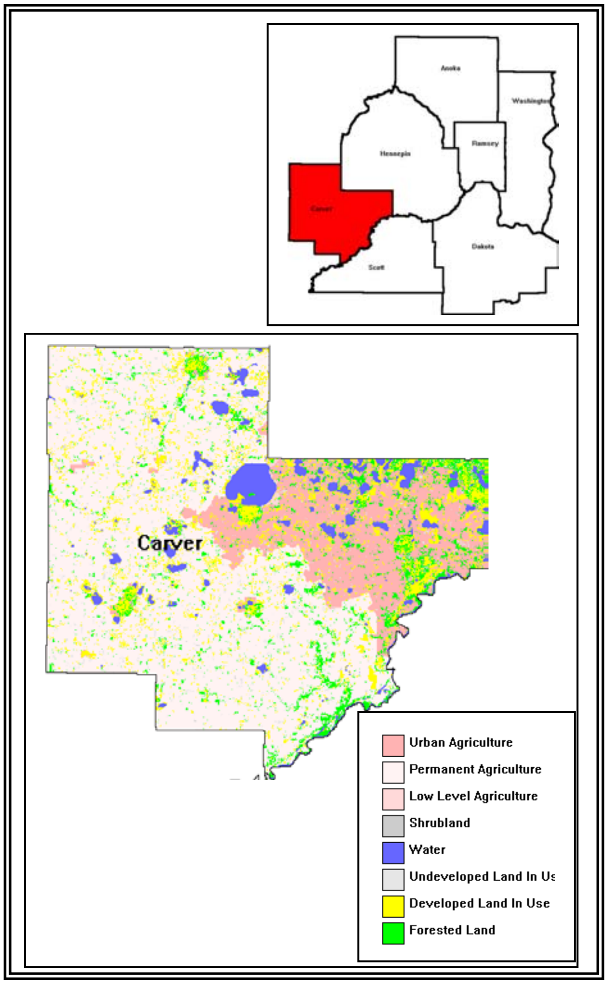

Figure 1. Urban Development

The resulting urban development pattern is in turn placing a great deal of pressure on the region's surface water system. Ephemeral and seasonal wetlands and streambeds in particular are susceptible to development pressures. Correcting negative environmental impacts is less effective and more costly than preventing the problems which result from poor planning and project design. A balanced approach to economic growth and preserving high environmental quality is needed.

In the Norwood Young America study area, the National Wetlands Inventory (NWI) showed that as few as 20 percent of the original wetlands remain. A windshield survey of the area to verify the NWI suggests it is close to 10 percent**.**

Methods

This assessment is based on a model developed by Doug Synder and uses the GIS system EPPL7 developed by the Land Management Information Center (LMIC) for spatial analysis. Data sets included Land use, roads, soils, open space, and National Wetlands Inventory coverage's and were obtained from the Carver County,

Table 1. Indicators of Function: Hydrologic Control

Indicator of Function	**Importance to Function**
Landscape Characteristics	
Landscape position	High
Relative Size (wetland to watershed	High
Gradient of the watershed	Moderate
Wetland Characteristics	
Type of vegetation	Moderate
Soils	Moderate
Actual Size of wetland	Moderate

Land Management Information Center, Minnesota Department of Natural Resources, and Metropolitan Council. The NWI data set was corrected by combining the carver counties open space coverage, Met council's hydros coverage and verifying using 1997 aerial photos. This was done to provide a more accurate respresention of wetlands in the study area. The study area was divided into nine sub watersheds to perform analysis (figure 2).

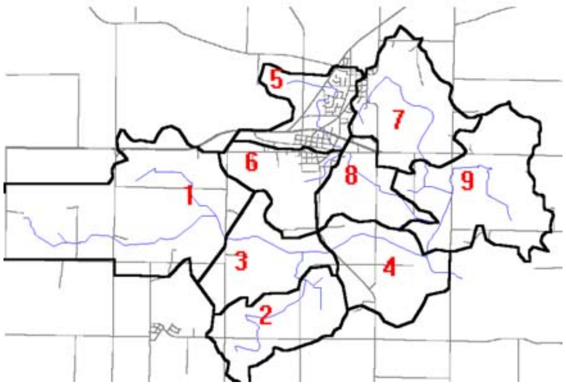

Figure 2 Study Area Sub Watersheds

The model

Indicators of function
The base evaluation is performed at the parameter level. Each parameter used is an indicator of function. The process successively combines parameter significance to determine the likelihood a function is present. Some parameters are more important than others in determining the level at which a wetland may perform a specific function, and therefore are given greater weight in the combination hierarchy.

Hydrologic Control

Hydrologic control refers to the physical processes of the storage (temporary or permanent) or conveyance of floodwater and surface water runoff in the watershed containing the wetland, or groundwater within the substrate of the basin containing the wetland. A combination of landscape and wetland characteristics can indicate how much water may be detained or retained in the wetland. Table 1 lists the indicators used to assess a wetland's potential for surface water runoff storage and floodwater storage, and the strength of the association between the indicator and the wetland function.

Landscape position refers to the location of the wetland in the watershed. The position of wetlands in the landscape influences water flow and water storage in the watershed. Wetlands located in headwaters generally desynchronize peak flows in tributaries and in the main channel, while wetlands lower in the watershed hold back storm water and attenuate flood peaks. Based on sub watershed stream order, wetlands were ranked High, Medium, and low.

If all other parameters are equal, the greater the relative sizes of the wetland basin to the watershed the greater is the potential for the wetland to intercept sediment, toxins, and nutrients. (Adamus et al. 1983) Loss of wetlands, which are small relative to the watershed, impacts the storm water and floodwater the watershed hydrology less than loss of a relatively large wetland area. Wetlands were ranked High if they were greater than one standard deviation above the average, Medium if they were within plus or minus one standard deviation of the average, and Low if less than one standard deviation below the average.

Wetland basins in steeply sloping watersheds, where runoff will be rapid and therefore more likely to be erosive, will have greater opportunity to remove sediment. (Adamus et al. 1983) In addition wetlands adjacent in intensive land use offer a greater opportunity to provide flood and storm water control than wetlands in areas where land is relatively undisturbed. Wetlands with soils within 200 m classed as greater than 6% slope were ranked high, 2%-6% slope ranked medium, and less than two percent slope were ranked low.

The vegetative characteristics of wetlands affect the ability of the wetland to store and detain water. Frictional resistance varies depending on wetland width, density and type of vegetation, and rigidity of vegetation. Vegetation slows floodwaters by creating frictional drag in proportion to stem density. (Adamus et al 1983) found that wetlands, to effectively store water, should be at least 70% upright woody vegetation. (Adamus et al 1983) Based on the above factors Adamus et al. ranked wetland vegetative types from least to most effective: aquatic bed (rooted vascular), emergent nonpersistent, emergent persistent, scrub-shrub, deciduous forest, coniferous forest. Because of their persistence and rigidity, trees and shrubs are particularly important to water storage. Wetlands with a conifer canopy have the greatest potential for water storage. In addition to the physical storage capacity of the wetland, conifers remove greater amount water from the system than do other vegetative types due to their high rate of evaportranspiration.

Wetland basins with underlying permeable soils will have greater drainage rates and have higher potential to reduce storm water and floodwater through groundwater recharge process. (Adamus et al 1983) Those wetland basins with impermeable soils will be less likely to attenuate additional water. This assumes all other wetland parameters affecting storage are equal for the wetland basins.

Actual wetland basin size influences the amount of water that can be stored. Given that all other condition are equal, the larger the basin the greater the amount of water it is possible to store. Degradation of the wetland is less likely to occur in larger wetland basins with the same amount of storm water input. Adamus et. suggests minimum critical storage size for a constricted, depressional, or palustrine wetland should be at least 5 acres. (Adamus et al 1983)

Wetlands adjacent to an upper-riverine water course with a high percentage of woody or permanent emergent vegetation, that are large relative to the watershed, will be most likely to detain and retain surface water runoff. Wetlands that are lower in the watershed, adjacent to a watercourse, with a high percentage of woody vegetation, that are relatively large will be most likely to detain and retain floodwater runoff.

Table 2. Indicators of Function: Shoreline Stabilization

Indicator of Function	**Importance to Function**
Landscape Characteristics	
Connection to surface water	High
Land use in basin	Moderate
Gradient of wetland/upland edge	High
Soil erodibility of wetland/upland edge	Moderate
Wetland Characteristics	
Width of vegetation	High
Type of vegetation	High

Shoreline and streambank stabilization refers to the ability of a wetland to protect the shoreline of a lake, stream, or river from the erosive force of water. Table 2 lists the indicators used to assess a wetland's opportunity and ability for shoreline and stream bank stabilization, and the strength of the association between the indicator and the wetland function.

The opportunity to provide this function occurs only when the wetland is connected to a surface waterbody or watercourse. Where erosive forces are higher the need to maintain shoreline stabilizing cover is greater. Proximity to second or higher order streams, or lakes greater than 10 acres in size, where erosive force due to flow or wind and wave action is likely to be higher, offer greater opportunities for bank stabilization and were ranked as high. Wetlands connected to first order streams of lake greater thank 2.5 acres and less the 10 acres were ranked medium, all other wetlands were ranked as low.

Land use in the watershed affects a wetland's ability to stabilize stream bank or shoreline through increased runoff quantity and runoff velocity. Urbanization contributes to peak flow by increasing the impervious surface in the watershed as water is channeled and removed from urbanized areas. These effects are also achieved in agricultural land as a result of tiling. This action increases the erosive force of water in the watershed. According to Adamus et al, if greater than 10 percent of the watershed is impervious surface, the wetlands will have good potential to provide bank stabilization. Watershed land cover of greater than 50% developed or annual agriculture were ranked high, 10%-50% were rank medium, all other wetlands low.

The gradient of land in close proximity to the water body affects runoff into the basin. Steeply sloped adjacent upland areas are more likely to be unstable. Soil characteristics will also affect the stability of shorelines and streambanks. The soil erodibility index takes both these factors into account. The assessment uses the soil erodibility index to indicate the stability of the wetland basin/upland edge. Uplands with greater than 25% highly erodable soils with 200 m of wetland were ranked high, greater than 10% highly erodable soils or greater than 25% moderately erodable soils were ranked as medium, and all other soils were ranked as low.

The key to a wetland's ability to stabilize a shoreline or streambank is the width and type of vegetative cover. Vegetation dissipates erosive forces and keeps the soils of the streambank in place. Shoreline vegetation needs to be at least 20 feet in width to effectively stabilize a streambank or shoreline. (Adamus et al 1983) This assessment used raster data sets with cell size of 20 meters square (or approximately 67 feet per side). If the cell has been classed as a wetland, the minimum width is assumed to exist or the cell would have been classified as some other land cover. For this reason, the assessment looks only at length of edge common to both wetland and surface water with good vegetation rather than both length and width. Wetlands with an edge of greater than 200 meters were ranked high, 60 m to 200 m ranked medium, and less than 60 m were ranked low.

Water Quality

Sediments often have chemically and physically attached toxins and nutrients such as heavy metals, pesticides, phosphorous, and nitrogen. Table 3 lists the indicators of wetland function used to evaluate both

Table 3. Indicators of Function: Water Quality

Indicator of Function	**Importance to Function**
Landscape characteristics	
Land use in basin	Moderate
Landscape position	High
Gradient of watershed	High
Soil erodibility in basin	High
Wetland Characteristics	
Type of wetland	Moderate
Soils of wetland	Moderate

assimilate and accept waters laden with sediment and related toxins and nutrients.

The opportunity to remove sediment and transform nutrients is related to the wetland's position in the basin, the land use in the basin, which contributes to the wetland and the erodibility of the soils in the contributing area. Land use activities, which are likely to contribute to sediment, toxin, and nutrient load, are croplands, urban runoff, construction, extractive mining, residential chemical use on lawns and gardens, and road sanding. (MN nonpoint source management program 1994) Wetlands in close proximity to the sources have a greater opportunity to attenuate the negative impacts of the pollutants. Those wetlands in areas of continuous vegetative cover or forest cover will have less opportunity to remove sediment and remove or transform toxins and nutrients from surface water runoff. It is assuming the upland vegetation will remove sediments and toxin before reaching the wetland. Wetlands within sub-watersheds with greater than 50% Urban residential, commercial and industrial, annual croplands and roads are highly likely to contribute one or all of the nonpoint pollutants and were ranked accordingly. Wetlands with sub-watersheds having a land cover of greater than 15% and less than 50% were given a value of medium; all others were ranked as low.

Wetlands located in the upper parts of the watershed have greater opportunity to affect water quality because it is these wetlands which tend to hold the water the greatest amount of time. This allows the processes which remove sediment, nutrients, and toxins the time needed to perform the function. Wetlands in approxcimity to no streams or first order streams were valued high, 2nd and 3rd order streams medium and greater than 4th order streams low.

Soils which are highly susceptible to water erosion are more apt to contribute sediment through surface water runoff. A soil erodibility index was used assuming where highly erodible soils are along wetland upland edge that the wetland is at a relatively greater risk. Uplands with greater than 25% highly erodible soils with 200 m of wetland were ranked high, greater than 10% highly erodible soils or greater than 25% moderately redouble soils were ranked as medium, and all other soils were ranked as low.

Given the same opportunity to attenuate and mitigate the impacts of nonpoint sources of pollution, some types of wetlands will be better able to accept the impact. That is, some wetland types are more sensitive to storm water impacts. The MPCA's Guidance for Evaluating Urban Storm Water and Snowmelt Runoff Impacts to Wetlands summarizes wetland susceptibility to degradation by storm water input this way: 1) highly susceptible types - sedge meadows, bogs, coniferous bogs, open bogs, calcareous fens, wet and wet-mesic prairies, coniferous swamps, lowland hardwood swamps, and seasonally flooded basins, 2) moderately susceptible types - shrub-carrs, alder thickets, fresh (wet) meadows, shallow marshes, and deep marshes, 3) slightly susceptible types - floodplain forest, fresh wet meadows, and shallow marshes, and 4) least susceptible types - those wetlands which exist at highly impacted sites such as previously cultivated hydric soils, or in old dredge/fill disposal sites and old gravel pits. Ranking the wetlands was based on this information, ranking highly susceptible types as high, moderately susceptible types as medium, and slightly and least susceptible as low.

Wetland soils that allow for infiltration have a greater potential to provide water quality benefits than those soils which do not allow infiltration. Using the hydrologic group classification in the Carver county soil survey, Hydrologic group A, B or A/D were rank as high. C, or B/D groups were valued as medium and Hydrologic group D was ranked as low.

Habitat

Assessing a habitat value is difficult because of the diversity of wildlife species and the variety of food and habitat needs of those species which may use wetlands during their life cycle. However the objective of this assessment is to generalize about habitat quality. So the more habitat requirements the wetlands fills, for the greatest number of species, the higher its habitat value.

Table 4. Indicators of Function: Habitat

Indicator of Function	**Importance to Function**
Landscape Indicators	
Land use	Moderate
Landscape position	High
Wetland Indicators	
Vegetative diversity	High
Presence of permanent open water	High
Actual size of habitat	Moderate

Determining the size or width of habitat for wildlife is extremely difficult since some species live primarily in wetland areas while others require wetlands during reproductive stages, and other need wetlands for survival but live primarily in upland communities. Landscape indicators look at land use and habitat position, that is, where the wetland is relative to other wetlands and upland habitat areas in the watershed. Human disturbance in the surrounding landscape can affect the habitat value of the wetland. If greater than 50% of the land within 200 feet of a wetland is in natural vegetation, then the wetland is relatively free of human disturbance and was ranked high. If development is greater than 50% of the surrounding landscape, then the wetland is significantly impacted by human activity and was valued low. All other land cover combinations were ranked as medium.

The evaluation of the wetland's capacity for providing movement or dispersal pathways, i.e. its connectivity. A wildlife corridor is a potential movement pathway through areas of unsuitable habitat such as agriculture or developed land. If the wetland was connected to another wetland, natural vegetation, lake stream or ditch, the wetland was rank high. If its juxtaposition was within 200 m of another wetland, natural vegetation, lake stream or ditch, it was valued medium. Isolated wetlands or greater than 200 m from another wetland, natural vegetation, lake stream or ditch it was ranked as low.

This assessment uses NWI subclass designation Circa 39 to estimate the vegetative horizontal and vertical structure in and near the wetland. In general, wetlands with well interspersed patches of vegetation or diffuse open stands of vegetation provide the best habitat. A ranking of high was given to wetlands with more than 4 Circa 39 types in the complex, 2 or 3 Circa 39 types were valued as medium, and only one type in the complex was valued as low.

Because this assessment generalizes habitat, determining a minimum size for habitat is virtually impossible. The Wetland Evaluation Technique (WET) uses a minimum threshold of thirty acres for wildlife. However this number appears to be based on limited research. In Golet's ranking system of wetlands for wildlife, the lowest category are those wetlands less than ten acres, and the highest are those wetlands over five hundred acres. It seems reasonable, that in an urban area, the minimum size will fall somewhere in this range and the maximum only needs to be large enough to accommodate internal species (birds) that do not require a great deal of area. A high ranking was given to wetland complexes larger than 80 acres, 20-80 acre complex's medium and a complex less than 20 acres valued as low.

Wetlands support wildlife habitat by providing water in varying amounts and at varying times. Some species are dependent on ephemeral wetlands and some on permanently flooded wetlands. The greater the variety of water regimes that the wetlands in a watershed can provide, the greater the habitat opportunities will be for wildlife. This assessment uses NWI water regimes to determine the amount and timing of the presence of water in a wetland. NWI water regimes; Permanent open water, intermittently exposed and permanently flooded were ranked high, Semi-permanently, intermittently or seasonally flooded were valued medium and saturated or temporarily flooded as low.

Landscape and Wetland Characterization

Landscape and wetland characterization evaluates the relative risk to the watershed posed by the loss of wetlands in the watershed. The idea is to be aware of wetlands as an integral element of the landscape ecology and not as independent sites. It is a characterization of the land cover, and amounts and types of wetlands present in the watershed.

Landscape indicators evaluate the wetlands in relation to land use to try to determine the relative risk to watershed integrity. The greater intensivety of land use in the watershed the greater the significance of the functions of the remaining wetlands. Agriculture and development have different threshold of impacts and are treated separately in the assessment. Sub-watersheds with greater than 50% agriculture or greater than 10% developed are valued as high. A ranking of medium was applied to sub watersheds with a land cover of agriculture between 20% and 50% or 2.5% and 10% developed. Sub-watersheds with percentages below were valued as low.

The percentage of wetlands and lakes in a watershed affects the amount of water which may be stored or detained. Losses of wetlands in watersheds having an initially low percentage of wetland area tends to have a greater impact on stream flow than losses of wetlands from watersheds initially having large percentages of wetlands. In watersheds with few remaining wetlands, or with an initially low percentage of wetlands, the existing wetlands have a relatively higher value. Protection and preservation of the hydrologic functions the wetlands become critical in these watersheds. The minimum wetland to watershed ratio of the watershed is set at 1:7 (or 15% of land cover) these sub-watersheds were ranked high, sub-watersheds between 15% and 50% medium and greater than 50% wetland land cover low.

Rarity of the wetland types in terms of landscape diversity is also valued. The percent of Circa 39 types was less than 10% it was ranked high, between 10% and 25% it was valued as medium. If the Circa 39 type comprised more than 25% of the watershed is was ranked low.

Restoration/Enhancement

This assessment assumes that restoration and enhancement of wetlands should be used to develop and sustain the existing surface water-wetland matrix. Preferred sites are those which will reestablish lost natural linkages/corridors, buffer existing high quality wildlife areas, reduce soil erosion, or otherwise enhance the value of the surface water-wetland matrix by providing areas for habitat, water quality, and water quantity benefits.

Site indicators are existing physical, natural, or cultural features or conditions located in or near the surface water matrix. Site indicators include such things as ground water recharge areas, archeological sites, threatened and endangered plant and animal species, designated natural areas, or any locally defined high priority area.

Restorations can be used both to protect designated features or be protected by the designated features. Preferred restoration sites will be in areas where adjacent land uses are compatible with the restoration. Generally, these are low disturbance landscapes. Examples of low disturbance are pastures, regional parks, cemeteries, nature centers, and low-density urban uses. NWI, waterway, and land use coverages were used to determine sites. In order to identify restorations sites the following indictors were used; whole unit hydric soil, were within in 60 m buffer of first order streams and an 100 m buffer of second order streams and 120 m buffer of third order streams, within uncorrected NWI boundaries and within a non developed land use class.

For sites with medium restoration potential; sites needed to have hydric soils, within the stream buffer and within a non-developed land use. Sites with high restoration potential; required hydric soils, uncorrected NWI boundaries, and a non-developed land use. Sites with very high restoration; potential included areas with all indicators met. (Table 5)

Table 5. Restoration Matrix

	Hydric Soils	Within Stream Buffer	Within NWI original boundaries	Within a Non-developed land use
Medium Restoration potential	Yes	Yes		Yes
High Restoration potential	Yes		Yes	Yes
Very High Restoration potential	Yes	Yes	Yes	Yes

Results

Data limitations

The NWI coverage's for the study area were determined in the early 1980's, because of the ditching tiling and development in the last twenty years this coverage was felt to be inaccurate. The NWI data set identified 2,120 acres of wetland in the study area, after analysis and site inspection it was estimated that the acreage was more in line with about 1,088 acres.

Land use was another concern; the most recent data set available was based on 1990 information. With the rapid development of the twin cities since 1990 it was felt this coverage was unreliable. It was determined to provide a more reliable coverage that an open space coverage

Table 6. Sub watersheds with the greatest loss of wetlands

	Sub Watershed 1	Sub Watershed 4	Sub Watershed 5	Sub Watershed 8
Watershed Acres	2679	1039	761	667
Hydric Soils Acres	1391	576	341	407
Percent of total Acres	51%	55%	44%	61%
NWI Acres	200	238	51	191
Percent Change from Hydric Soils	-85%	-58%	-84%	-52%
Existing Wetlands Acres	59	27	9	44
Percent Change from Hydric Soils	-95%	-95%	-97%	-89%
Percent Change from NWI Acres	-70%	-88%	-82%	-76%
Percent of Total Acres	2%	3%	1%	7%

developed by carver county in 1997 be used show areas still unaffected by development.

Spatial analysis

The primary concern in the Norwood Young America area is that there are few remaining wetlands (Figure 3). Based on soils data, ditching and tiling have reduced wetland area to approximately 20% of their original extent. Hydric soils, which are a good reference of historic wetlands make up approximately 5771 acres of the total watershed, while the existing wetlands only comprised 1088 acres of the watershed.

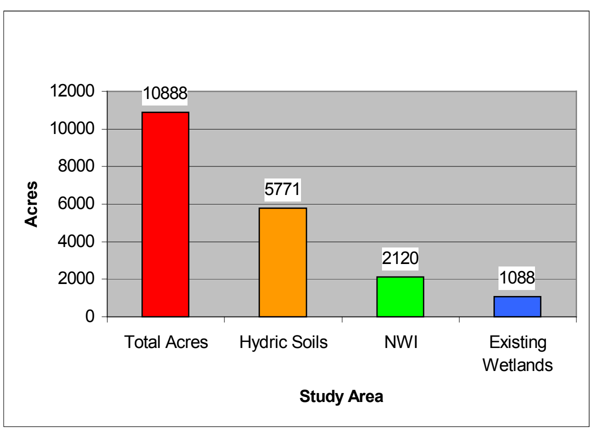

Figure 3. Comparison of Wetland Acrerage

Sub watersheds 1,4,5, and 8 show the greatest loss of wetlands (Table 6). In sub watershed 5 this is primarily due to development of the urban center of Norwood Young America where 97% of historical wetlands and 82% of NWI's estimation have been lost.

Whereas sub watersheds 1, 4 and 8 the loss is related to agriculture, in particular sub watersheds 4 and 8 where a large turf farm is now in operation. These two watersheds have lost approximately 93% of their historical wetlands and 84% of NWI's estimation.

The loss of wetlands within the study area affected the model in that because of so few wetlands remaining, wetland values were skewed to medium and high. This is illustrated in the Landscape and Wetland Characterization Map (figure 4), where all wetlands are highly valued. The fact there are few remaining wetlands impacts the results of the value of the other functions as well.

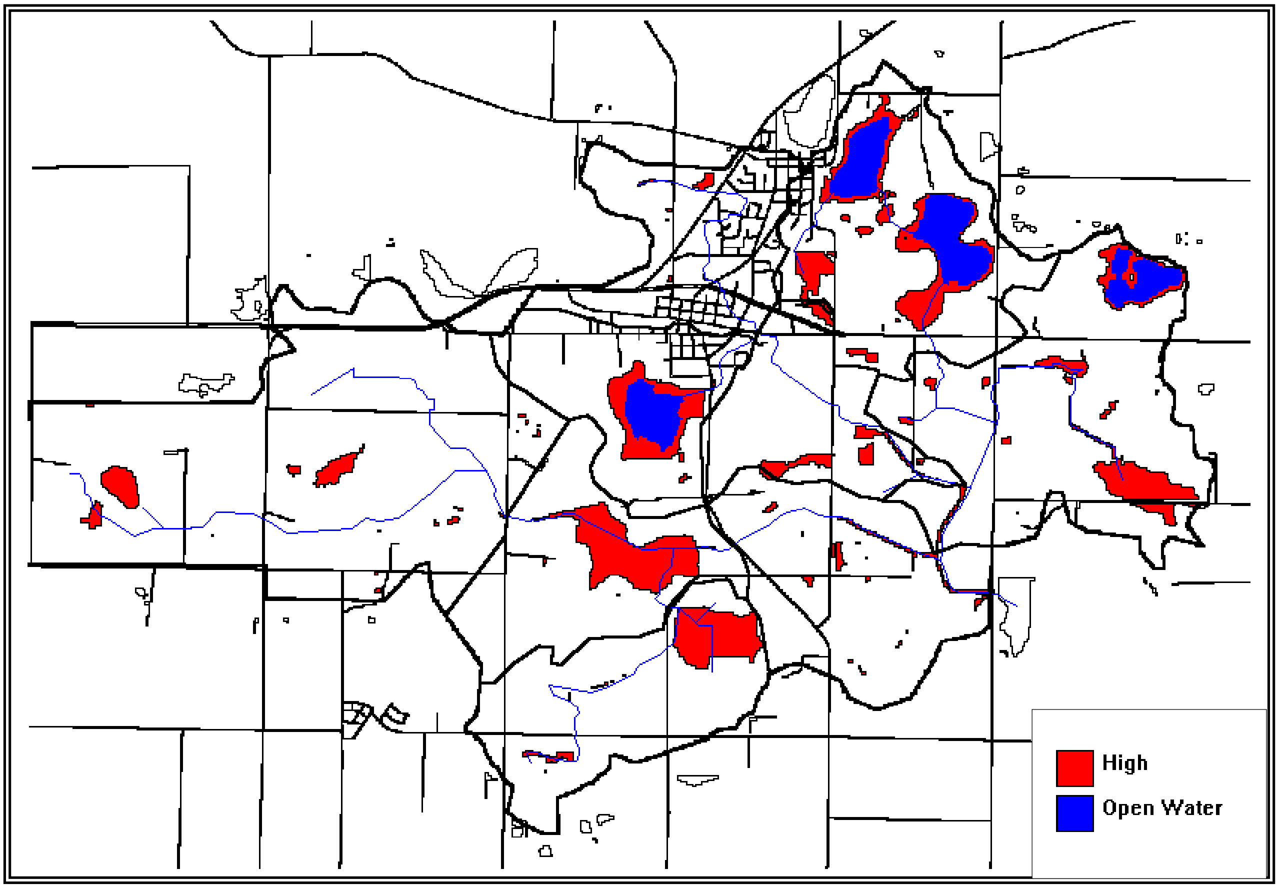

Figure 4. Landscape and Wetland Characterization Map

Over 64% of the wetlands were valued medium and high for water quality. In addition with 27% indicated as open water, that left about 8% that ranked low for impacting water quality. Analysis on Habitat functions indicated only about 6% that ranked as low. For all the other functions as well most wetlands are assigned either a high or medium value.

It was felt this was directly related to the fact so few wetlands remain. Therefore, restoration sites become very important in the assessment and for planning future landuse in the watershed.

The Restoration Sites figure 5 shows there are many opportunities for restoration in the area. Analysis identified approximately 539 acres of land suitable for wetland restoration with medium potential, 577 acres with high potential and 243 acres of very high potential. In particular, the area south and east of Norwood Young America area will be key to long-term wetland and water management. With the addition of the 1139 acres of potential restorations would make the percent of wetlands closer to the NWI's representation in the early 1980's.

Conclusions

Because this model was developed as a planning tool results weren't as unexpected though some variation in values was hoped for. This model was not developed to value

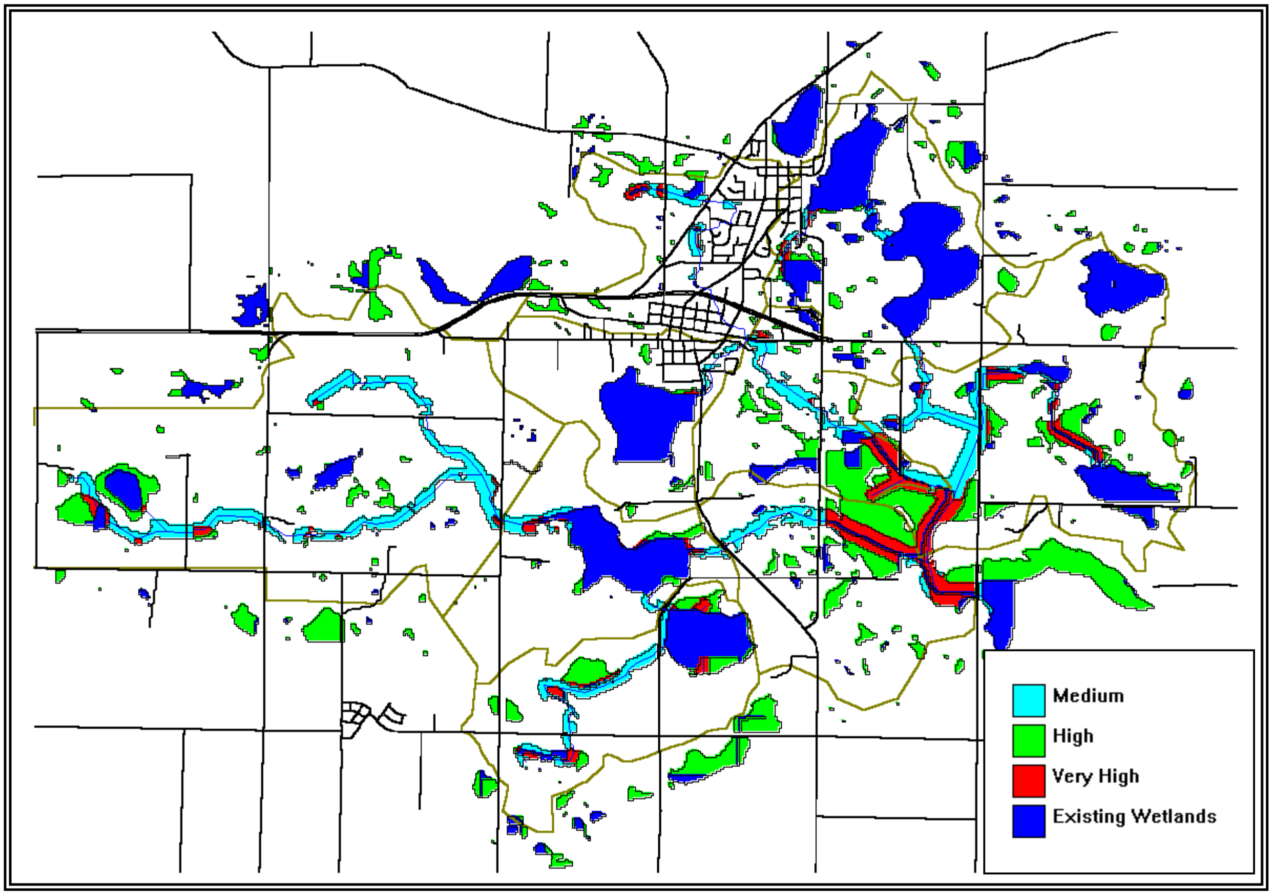

Figure 5. Restoration Sites

individual wetlands, but wetlands on a landscape level. The Norwood study area however proved to be to small to get varied results.

Carver county has since adopted this model and has applied it to the entire county where results seem to represent the trend this study saw, that with the disappearance of wetlands in the Twin Cities Metro region, most all wetlands using this model will be valued medium to high for all functions.

The model however proved that using the restoration site analysis can provide the local units of government with a valued tool, to restore wetlands in their communities.

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