VOLUME TWO
BACKGROUND STUDIES

Section 1
Physical Features Analysis

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PHYSICAL FEATURES ANALYSIS

GEOLOGY

SURFACE GEOLOGY AND PHYSIOGRAPHY

The surface geology of St. Croix County has been influenced by several periods of glaciation. Landforms produced by glacial deposition include end moraine, ground moraine and outwash plains. The first glacier covered the entire county while the second, the Wisconsin Stage, covered only the land northwest of the Willow River.

End moraines are formed by deposition at the margin of a glacier during a standstill of the glacial front, when the rate of melting equals the rate of glacial advance. They form either at the point of maximum ice advance or during the recession of the glacier. The northwest corner of the county is covered by end moraine from the Superior lobe of the Wisconsin Age of glaciation. This end moraine consists of unsorted glacial material ranging in size from clay to boulders. Typically, the topography is rugged to rolling or hummocky with deep stream gorges and kettles (pits) which may contain lakes or marshes.

The majority of the rest of the county is covered by ground moraine deposited previous to the Wisconsin stage of glaciation. The material deposited was unsorted and results in a gently rolling topography.

Ground moraine is deposited under glacial ice as a blanket of unsorted rock debris, which ranges widely in size. Early-Wisconsin or pre-Wisconsin Age glaciers deposited the ground moraine, which covers much of St. Croix County. A gently rolling topography, meandering streams and few lakes characterize this ground moraine. The topography here is a gently undulating plain with moderate relief and no definite alignment of undulation.

Immediately adjacent to the leading edges of the end moraine deposited by the Superior lobe is a pitted outwash plain of stratified layers of sand, gravel, silt, and clay. The outwash plain was deposited by running water from melting glaciers. Kettles developed in the plain from the melting of buried blocks of ice.

The St. Croix River Valley, along the western extreme of the county, was a major glacial drainageway as the glaciers melted and receded.

BEDROCK GEOLOGY

Glacial drift overlies bedrock throughout almost the entire county. The bedrock, from oldest to youngest in age, includes Precambrian igneous, metamorphic and sedimentary rocks, Cambrian sandstone, and Ordovician dolomite and sandstone.

Igneous, metamorphic and sedimentary rocks of the Precambrian age underlie all of St. Croix County. Precambrian red shale and rhyolite have been identified in the Hudson area. Cambrian rocks overlie the Precambrian rocks and are present under the entire county. They are primarily sandstone but include subordinate shale, siltstone and dolomite. Predominant formations of the Cambrian include Mt. Simon, Eau Claire, Galesville, Franconia and Trempealeau.

Ordovician sedimentary rocks in St. Croix County are sandstones, shales and dolomites, and include the Prairie du Chien group, St. Peter Sandstone, Platteville Formation and Decorah Formations, undifferentiated, and Galena Dolomite.

The bedrock geology of St. Croix County is depicted in Map 1 of the Physical Features map series.

SOILS

Soil properties are an important factor in how land is used. They determine how productive farmland is, where sand and gravel is, and can allow or limit potential development. Indeed, the types of soils in an area often dictate the best use of the land. Hence, soil suitability interpretations for specific urban and rural land uses are essential for physical development planning and determining the best use of the soils on a site.

In April 1994, St. Croix County entered into an agreement with the United States Department of Agriculture, Natural Resources Conservation Service (NRCS and formerly the Soil Conservation Service) to produce a digital soil survey. This soil survey has resulted in detailed soils mapping for the county at a scale of one-inch equals 1000 feet. In addition, the survey has produced information on the physical, chemical and biological properties of the soils, and provided soil property interpretations for agricultural, engineering, planning and resource conservation activities. The digital soil survey was used extensively for this planning effort.

MAJOR SOIL ASSOCIATION GROUPS

St. Croix County has a wide variety of soils ranging from heavy, poorly drained to light and droughty. Soils, which are generally excessively drained and well drained, are found in the western half of the county. The moderately drained and somewhat poorly drained soils predominate in the county's eastern half. However, both extreme soil conditions are found throughout much of the county, making management difficult.

Widely varying soil types and complex slopes make the application of some best management practices troublesome. There are many areas of the county with poorly drained soils on relatively steep slopes, which combine erosion with drainage problems.

The General Soil Map shows the soil associations in the county. Soil associations are landscapes that have distinctive patterns of soils in defined proportions. They typically consist of one or more major soils and at least one minor soil, and are named for the major soils. The General Soil Map is provided in Map 2 of the Physical Features map series as general soils information for the county and is not intended to provide information for site specific applications. The county has the more detailed digital soil survey available for detailed planning or management purposes.

SOIL SUITABILITY INTERPRETATIONS

The soil survey provides important information about the suitability of land for different rural and urban uses. The interpretation of soils involves assessing the characteristics of soils that affect a specific use and predicting the various limitations those soils place on a land use. In St. Croix County the available soil suitability interpretations of importance are those regarding septic tank absorption fields, dwellings with basements, small commercial buildings, agriculture, potential sand and gravel deposits, bedrock at or near the surface, and water table depth. The soil suitability interpretation maps produced for the report are at a relatively small scale. However, the county has one-inch equals 1,000 feet information from the digital soil survey suitable for community level planning.

SUITABILITY FOR SEPTIC TANK ABSORPTION FIELDS

Septic tank absorption fields are subsurface systems of perforated pipe, which distribute effluent from septic tanks to the soil. Soil between 18 inches and six feet is evaluated for properties that affect absorption of effluent and construction and operation of the system. Properties that affect absorption

are permeability, depth to bedrock and water table, and susceptibility to flooding. The layout and construction of a system is affected by soil conditions related to slope, erosion potential, lateral seepage, and downslope flow of effluent. Soils with characteristic large rocks and boulders present additional problems, and increase the costs of septic system construction.

The state requirements for septic system siting are specified in Chapter ILHR 83 of the Wisconsin Administrative Code. This code relies heavily on the ability of the soil to efficiently absorb the effluent discharged from the septic system drainfield. However, the NRCS soil interpretations for septic tank absorption fields consider most excessively drained soils occurring over fractured bedrock or high water tables a limitation to septic system development because effluent in these situations can be readily transported to the groundwater. Hence, even though the siting of septic systems in some areas may be allowed by state code, doing so has the potential for threatening groundwater quality.

The digital soil survey indicates that 633 square miles or about 87 percent of the total land area of the county is covered by soils which are unsuitable for septic or conventional on-site sewage disposal systems. Map 3 of the Physical Features map series shows soils with severe limitations for on-site sewage disposal systems.

Suitability for Dwellings with Basements

Dwellings for this interpretation are no taller than three stories and are supported by foundation footings in undisturbed soil. The capacity to support load and resist settling under load, and the ease of excavation affect the soil rating for dwellings. Wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential are soil properties that affect the capacity to support load. Soil properties that affect excavation are wetness, slope, depth to bedrock, and the content of stones and rocks. Soils with severe limitations preclude basements in most instances. Soils with moderate limitations may preclude basement development in some instances. However, it is more likely that these soils will result in an increased cost for basement construction. Map 4 of the Physical Features map series displays severe limitations for dwellings with basements.

Suitability for Small Commercial Buildings

Single story, small commercial building development is limited by soil factors related to steep slope, wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. These are the same factors that affect the construction of dwellings without basements and this

interpretation can be used to evaluate these dwellings as well. Small commercial buildings are typical where commercial development is allowed in rural areas. Limitations for small commercial buildings are shown in Map 5 of the Physical Features map series.

SUITABILITY FOR AGRICULTURE

The NRCS in establishing a uniform, national identification of productive farmlands created a soil classification system that categorizes soils by their relative agricultural productivity. There are two categories of highly productive soils, national prime farmland and farmland of statewide significance. National prime farmland is well suited for the production of food, feed, forage, fiber and oilseed crops, and has the soil qualities, available moisture and growing season required to produce economically sustained high yields of crops when properly managed. Farmland of statewide significance are those lands in addition to national prime farmland which are of statewide importance for the production of food, feed, forage, fiber and oilseed crops. Soils that fall into classes I, II, and III of the Natural Resources Conservation Service's capability unit classification system are considered prime agricultural lands. The NRCS has developed a new system for evaluating agricultural lands, “Land Evaluation and Site Assessment,” which uses more detailed considerations of soil capability and potential yields, and provides for the assessment of factors beyond soil productivity in the determination of agricultural potential.

LAND EVALUATION AND SITE ASSESSMENT FOR AGRICULTURE

The Land Evaluation and Site Assessment (LESA) system is a numeric rating developed by the Soil Conservation Service of the U.S. Department of Agriculture for planning, developing policy and decision-making. The rating system is intended to assist decision-makers in evaluating the desirability of maintaining a site in a particular resource use, such as agriculture, forestry, rangeland, wetlands, or undisturbed shoreland, by considering both its soils quality, and its geographic and economic setting.

The LESA system consists of specifying one or more measures of soil quality for the Land Evaluation component, specifying another set of factors relating to the geographic and economic setting for the Site Assessment component, developing a rating scale for each factor, and assigning weights to each of the factors. Hence, LESA is essentially a factor scaling and weighting process. The factors and weights are accepted only if they make sense to the local experts in agriculture and planning. The involvement of local experts in formulating a LESA system is vital.

A LESA system has been specified by the Farmland Protection Policy Act (FPPA) for use by federal agencies.

However, local governments are encouraged to adapt LESA to their own

resource bases, resource issues and problems, geographic and economic setting, and community values.

The LESA system simply contains the following components:

Land Evaluation (LE)

- Soil quality factors
  - Soil capability class
  - Soil productivity
  - Soil potential for various crops
  - Prime or unique farmlands designation
  - National prime farmland, farmland of statewide significance, etc.

Site Assessment (SA)

- Factors other than soil quality that are related to agricultural productivity (SA-1)
  - Acreage of farm
  - Farm Investment
  - Local farm economy
  - Alternative agriculture
  - Conflicting uses
- Factors measuring the relative degree of development pressure (SA-2)
  - Real estate market
  - Protection by zoning
  - Distance to sewer
- Factors that measure secondary values (SA-3)
  - Historic or scenic quality
  - Rural character values

The LESA system is very flexible. It should be adapted to fit the needs of decision-makers at the local level. To determine the overall agricultural quality of a site a LESA consisting of LE and SA-1 will suffice. The total score for such an application of LESA is a clear measure of agricultural productivity of a site. Other applications could require the use of SA-2 and SA-3 in combination with LE and SA-1. However, because SA-2 and SA-3 refer to several considerations other than the agricultural productivity of a site, producing these LESA scores requires following careful procedures. Those procedures, and information on developing entire LESA systems, are in guidebooks, manuals and other literature, which are available from the NRCS. Local decision-makers can use the guidance to develop a LESA system, which evaluates land, based on local objectives for preservation and management.

For an appropriate base of information for the agricultural productivity of land in St. Croix County only the Land Evaluation component of LESA is presented here. This will allow the Land Conservation Department, local governments, and individual land owners the opportunity to develop a LESA to fit their needs.

Map 6 of the Physical Features map series depicts the LESA Agricultural Soils Groups 1 through 5. Through an analysis by the St. Croix County Land Conservation Department and the District Soil Scientist at the Natural Resources Conservation Service of the prevalent soils types in St. Croix County, LESA Agricultural Soils Groups 1 through 5 were selected as the soils with agricultural production potential.

SUITABILITY FOR EXTRACTION OF MINERALS (NON-METALLIC)

St. Croix County has significant supplies of sand and gravel. The soils amongst glacial outwash are the most likely source for sand and gravel as the melting waters of the glacier were most active in sorting and depositing high-quality sand and gravel in this area. Where the bedrock is at or near the surface of the ground are areas which are probably most suited for quarrying stone.

Map 7 of the Physical Features map series shows probable locations for sand deposits while probable locations for gravel deposits are shown on Map 8.

OTHER VALUABLE INTERPRETATIONS

Unfortunately, the soil survey suitability interpretations for St. Croix County do not include information on suitability for on-site wastewater treatment facilities based on ILHR 83 soils criteria, public sanitary sewer, or mound systems. Such information would be valuable for making future planning and development decisions. The NRCS has worked with various local jurisdictions to expand the suitability interpretations to include additional interpretations that might be pertinent to development management decision-making. The county could explore the possibility of working with NRCS to develop additional interpretations.

TOPOGRAPHIC FEATURES

Local areas of St. Croix County are part of larger geographic structures sharing some common characteristics or connections. Physically, the county is part of the "western upland" region of Wisconsin. This region extends parallel to the Mississippi and St. Croix Rivers from Polk County to the Illinois border and to the east from 30 to 75 miles. Surface topography in the western upland ranges from gently rolling to very steep with ridges separating deeply incised stream valleys. The southern two-thirds of the region is characterized by rugged topography, while the northern third tends to have a smoother surface in most areas. The western upland is higher in elevation than the central plain region to the east, but is lower in elevation than the northern highland region that extends northward from Polk County.

Topography in St. Croix County ranges from gently rolling to hilly and rough. Much of the central portion of the county is in an undulating plain, while in the southwestern part of the county mesas and resistant dolomite formations break the plain. Areas of more rugged topography are found in the northwestern portion and along the eastern fringes of the county.

An early stage of the continental glaciation covered the entire county with a fairly even layer of glacial drift. The northwestern part of the county was covered during the most recent glacial stage. Its surface was extensively modified by end moraine, which typically has rough topography and marks the location of the farthest advance of an ice sheet. The attractive landscape of the Towns of St. Joseph and Somerset are the result of glacial end moraine deposition. Some of the streams in this area have fairly deep valleys as they approach the St. Croix River.

Another area of hilly topography is found at the eastern edge of the county, especially in the Glen Hills watershed. This area is the result of a change in surface bedrock from more resistant dolomite to the west and softer sandstones, which extend to the east. The difference in elevation between these two bedrock formations averages 200 feet. This change in elevation is evident at the "Knapp Hills" along the border between St. Croix and Dunn Counties.

The valleys of Tiffany, Sandy, Beaver and Wilson Creeks have cut through the dolomite into the weaker sandstone, lowering the base level of the watershed to the west and results in more dissection by the streams, which drain into the eastern portion of the dolomite formation.

Local relief in St. Croix County is over 600 feet, ranging from 675 feet above mean sea level at the St. Croix River on the county's southwestern extreme to almost 1,300 feet in the eastern hill area.

Map 9 of the Physical Features map series displays St. Croix County elevation contours at 75 feet intervals.

WATER RESOURCES

SURFACE WATER

Lakes, Ponds, Rivers, Streams, and Intermittent Waterways and Natural Drainageways make up the surface waters of St. Croix County. These resources are all waterbodies, standing still or flowing, navigable and intermittent, including natural drainageways that collect and channelize overland rainwater or snowmelt runoff. Natural drainageways are characterized by intermittent streams, threads, rills, gullies and drywashes which periodically contribute water to first-order streams. There are also many artificial drainageways where the natural drainageways have been altered by human activity. All of these features have the ability to transport sediment and pollutants, and are affected by their watersheds, the land that surrounds them.

The surface waters of St. Croix County occupy two major drainage systems of northwestern Wisconsin. The St. Croix River drains the western two-

thirds of the county. The remaining third of the county has streams that

eventually flow into the Chippewa River, except the Rush River, which flows into the Mississippi River. Both the St. Croix and Chippewa Rivers are part of the Mississippi River basin. Within the St. Croix River Basin there are the Apple, Willow and Kinnickinnic Rivers, and several minor creeks. Within the Lower Chippewa River Basin there are the Hay, Eau Galle Rivers and part of the Rush River, and Annis, Gilbert, and Cady Creeks, as well as other minor creeks. In each of these basins there are also numerous dry washes and other surface drainage features which carry water only during spring runoff or during extreme storm events.

In St. Croix County, the St. Croix River drains a 319 square mile watershed, while the remaining stream watersheds of 133 square miles are drained by streams of the Lower Chippewa River watershed. Landlocked lakes account for only 21 square miles of drainage area in the county. The remaining 263 square miles of the county lack measurable surface waters and are not connected to any stream watershed. The essentially internally drained characteristics of this area makes the numerous closed depressions within it, with their corresponding high water tables, very sensitive to runoff and septic system effluent.

Although the entire county was subjected to glacial action, the topography has since been eroded and worn so that it is now a well-drained area. There is dramatic evidence of the erosive action of streams in the lower portions of both the Apple and Willow Rivers, where deep gorges have been shaped by these streams. The most recent glaciation (Wisconsin Stage) only covered the land northwest of the Willow River. Here, the end moraine left many kettle hole lakes, but these have all but disappeared and are now seen as wet depressions. Most of the remaining surface waters are some relatively larger lakes, streams and artificial impoundments.

At 9,336 acres, the Minnesota-Wisconsin boundary water of Lake St. Croix is the lake with the largest surface acreage in St. Croix County. About half of this lake is within Wisconsin's borders. Bass Lake is the largest inland lake at 293 acres. The lake with the greatest depth is Perch Lake with a depth of 63 feet. The stream with the greatest gradient is Spring Brook with a drop of 85 feet per mile, and the stream with the lowest gradient is the St. Croix River, which drops 0.2 foot per mile.

The St. Croix River is the county's most significant surface water feature. As such it has been designated by Congress as the Lower St. Croix National Scenic Riverway. The Department of Interior, National Park Service is responsible for working with local jurisdictions to manage the riverway in a manner consistent with the National Wild and Scenic River Act and the Federal Lower St. Croix River Act. Hence, St. Croix County enforces zoning provisions in a riverway district consistent with Federal and State law and regulations.

Map 10 of the Physical Features map series shows surface water features and surface drainage patterns.

GROUNDWATER

The principal sources of potable water supplies are the sand and gravel aquifer and the sandstone aquifer. The sand and gravel aquifer consists of unconsolidated sand and gravel in glacial drift and alluvium. These deposits occur throughout about one-fourth of the county, either at the land surface or buried under less permeable drift. The sand and gravel aquifer can yield sufficient water yield for private residential water supplies. The sandstone aquifer includes all sedimentary bedrock younger than the Precambrian age. Precambrian rocks generally have low permeability and mark the lower limit of groundwater movement. The sandstone aquifer is continuous over the county and includes, from youngest to oldest rock formations, the Galena-Platteville unit of the Ordovician age, St. Peter Sandstone, the Prairie du Chien Group, and sandstones of the Cambrian age.

The Prairie du Chien Group and the Cambrian sandstones are the major water-yielding rocks in the sandstone aquifer. The Prairie du Chien Group is the uppermost saturated bedrock in much of the county and is used extensively for private residential water supplies. The ability of the Cambrian sandstone to store and yield water, and its generally great thickness makes it the principal source of municipal water supplies. The Galena-Platteville unit is mostly unsaturated; the St. Peter Sandstone is found in a small area and is partly saturated and yields some water to wells.

The source of all groundwater recharge in St. Croix County is precipitation. Between one and ten inches of precipitation per year infiltrates and recharges the groundwater aquifers. The amount infiltrated depends mainly on the type of rock material at the land surface. Most groundwater moves through the unconsolidated material and bedrock units and then discharges to surface waters.

The groundwater elevation map, Map 11 of the Physical Features map series, shows the altitude of the top of the zone of saturation in St. Croix County. The altitude of the water table ranges from more than 1,100 feet in several places in the eastern quarter of the county to just over 675 feet along the St. Croix River. The water table is under the glacial drift and within the bedrock in about half of the county.

The depth to groundwater below the surface of the land is generally less under topographically low areas and greater in areas of higher elevation.

Map 12 of the Physical Features map series depicts depth to groundwater in St. Croix County.

WELLHEAD PROTECTION AREAS

Municipal water suppliers are required by state administrative code to establish wellhead protection measures for new wells. It is also appropriate to establish protection measures for existing public water supply wells to protect the public health, safety and welfare, and to reduce public costs should a pollution event occur. Because it is difficult to adequately react to a pollution event, which occurs in proximity to a well, strict prohibitions of certain high-risk land uses should be established for that area (within the 30-day time of travel of contributing groundwater to a well). Certain high-risk land uses should be limited, and best management practices and monitoring established in the area between the 30-day and five-year time of travel of contributing groundwater to a public water supply well.

AREAS WITH HIGH RELATIVE SUSCEPTIBILITY TO GROUNDWATER POLLUTION

Groundwater supplies the majority of potable water to the residents of St. Croix County. Some land areas, because of inherent physical resource characteristics, do not attenuate (lessen the impact of) pollutants very well which may be introduced into the environment. These areas should be protected from certain high-risk land uses and have best management practices and monitoring established, especially when in proximity to any wells that supply drinking water.

A relative susceptibility index should be based on the type of aquifer, depth to groundwater, type of bedrock, depth to bedrock, subsurface permeability, and soil attenuation. Unfortunately, bedrock type and depth and subsurface permeability information is inadequate to produce an index for the county which would reasonably show these areas.

SENSITIVE LAND RESOURCES

AGRICULTURAL LANDS

As previously described, prime farmland is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland or other land, but it is not existing urban and built-up land, or water areas. The soil qualities, growing season, and moisture supply are factors needed for a well managed soil to produce a sustained high-yield of crops in an economic manner. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the

least damage to the environment. Soils that fall into classes I, II, and III of the Soil Conservation Service's capability unit classification system are considered prime agricultural lands. The value of these lands is associated with not only their soil class, but also with their size, present use and any regulatory framework for their protection. The LESA system presents the opportunity to define agricultural lands that have the most productive potential.

In 1980, St. Croix County adopted a Farmland Preservation Plan. As St. Croix County has exclusive agricultural zoning, farmland preservation areas within the county are designated and managed by zones which conform to ATCP 51, Wisconsin Administrative Code. This plan will contain elements that constitute a revision of the Farmland Preservation Plan.

FLOODPLAINS

Wisconsin Statute 87.30(1)requires counties, cities and villages to implement floodplain zoning. The purpose of Wisconsin Administrative Code NR116, Floodplain Management Program, is the protection of property and public investments from the effects of flooding. Federal Emergency Management Agency 100-year floodplain maps are usually used to delineate flood hazard areas.

Map 13 of the Physical Features map series shows the floodplains based on this source.

SHORELANDS

Lands within 1000 feet of the ordinary high water mark of a lake or pond and 300 feet past the ordinary high water mark or landward edge of the floodplain, which ever is greater, of a river or stream are designated shorelands. Shorelands are usually considered prime residential building areas because of their scenic beauty. However, shorelands provide valuable habitat for both aquatic and terrestrial animals and vegetation. Shorelands also act as buffers and thus serve to protect water quality. Wisconsin requires counties to protect and prevent the loss and erosion of these valuable resources by adopting and enforcing a shoreland ordinance. The authority to enact and enforce this provision comes from Chapter 59.97 of the Wisconsin Statutes. Wisconsin Administrative Code NR115 dictates the shoreland management program. County ordinances can be more, but not less, stringent than NR115.

The shorelands of St. Croix County are depicted in Map 14 of the Physical Features map series. Site investigation is required to ensure compliance with state regulations.

WETLANDS

Wetlands are defined by State Statute as "an area where water is at, near, or above the land surface long enough to be capable of supporting aquatic or hydrophytic (water-loving) vegetation and which has soils indicative of wet conditions." Wetlands may be seasonal or permanent and are commonly referred to as swamps, marshes, or bogs. Wetland plants and soils have the capacity to store and filter pollutants ranging from pesticides to animal wastes. Wetlands can make lakes, rivers and streams cleaner, drinking water safer and also provide valuable habitat for both aquatic and terrestrial animals and vegetation. In addition, some wetlands can also provide the replenishment of groundwater supplies. Groundwater discharge is common from wetlands and can be important in maintaining stream flows, especially during dry months. Groundwater discharged through wetlands can contribute to high quality water in lakes and streams.

The federal government and the DNR restrict development in wetlands through Section 404 of the Clean Water Act and NR103, respectively. Local governments often fail to notify landowners and developers of these restrictions. Wetlands can be damaged, resulting in costly fines and/or restoration.

Even though the DNR has an inventory of wetlands of two acres and larger, all wetlands, no matter how small, which meet the state definition, are subject to DNR regulations. Even if state regulations do not apply, federal regulations may, making it necessary to review all wetlands against these regulations before their disturbance. Particular attention must be given wetlands within shorelands to ensure protection from development.

Map 15 of the Physical Features map series shows St. Croix County wetlands. Site investigation is required to ensure compliance with federal and state regulations.

CLOSED DEPRESSIONS

Closed depressions are extremely sensitive land features because of their close association with the groundwater. The release of pollutants into or near closed depressions is almost certain to reach groundwater immediately. Map 16 of the Physical Features map series shows the county's closed depressions.

Closed Depressions

Closed depressions are common features in St. Croix County. They have formed through two quite different geological processes: karst development and glaciation. Karst development occurs in regions with highly soluble bedrock and results in distinctive landforms such as sinkholes. St. Croix County is covered by several rather thick, soluble carbonate units, and has particularly well developed karst, especially in the eastern half of the county. Glacial action can also result in topography marked by closed depressions known as kettles or kettleholes. Kettles develop when large blocks of glacier ice are buried within glacial deposits and subsequently melt. Many of the depressions in the western and northwestern portions of the county are kettles that developed in the St. Croix moraine after it was deposited during the Wisconsinan glaciation.

Baker, Hughes, Huffman and Nelson, Closed Depression Map of St. Croix County, Wisconsin, 1991

STEEP SLOPES

Steep slopes are any area where the gradient of the land is 12 percent or greater (each percent of slope is measured as one unit in elevation for every 100 horizontal units). One category of steep slope is 12% to less than 20% slope, of any soil type. It has been demonstrated that 12% slope is a threshold at which impacts from development become apparent. To allow development on these slopes one should avoid direct runoff into streams or rivers; follow state approved construction site erosion control standards; and institute best management practices, monitoring and maintenance to control on-site runoff and pollution. Steep slopes of 20% or greater are subject to erosion impacts even from slight land cover disturbances. Development on these slopes results in high construction costs and severe erosion with resultant negative impacts to surface waters. Therefore, development on slopes, 20% or greater, should be prohibited.

Both slope categories are shown on Map 17 of the Physical Features map series.

WOODLANDS

Woodlands provide habitat for a variety of plants and animals, as well as adding scenic beauty to the landscape. The largest, continuous blocks of forested land are important habitat for a variety of plants and animals. Woodlands should be protected from conversion to other uses. Woodlands managed according to approved forest management practices can support varying and sometimes complementary objectives, such as timber production or wildlife habitat. On the other hand, strict preservation of a woodland would be unusual and reserved for the most rare and unique stands in the county, if they even exist. Pine plantations, which are cultivated and managed, offer little in the way of natural habitat. However, they are important in providing wood products, windbreaks and erosion control. Map 18 of the Physical

Features map series shows the woodlands of St. Croix County.

PRAIRIE AND OTHER GRASSLANDS

Much of St. Croix County was originally covered by prairie, most of which does not remain today. Prairie is the term used to describe the grassland type that predominated in Wisconsin prior to Euro-American settlement. Prairies, which are dominated by grasses and sedges, lack trees and tall shrubs, and are home to a rich variety of plants and animals. Within the prairie designation there are variations due to soils and climate.

Prairies continue to be a threatened plant community in Wisconsin, as only about 13,000 acres (0.5 percent) of the original 3.1 million acres remain. The decimation of prairie in Wisconsin means that an estimated 20 percent of the original grassland plants are considered rare in the state.

The drastic changes in prairie habitat over the past 150 years have had negative impacts on many plants and animals. Many species of plants associated with Wisconsin prairies are endangered, threatened or of special concern, and two are known to no longer exist in the state.

Many grassland birds face similar circumstances as indicated by a growing list of special concern species and the declining numbers of birds once considered common in the state, such as several species of sparrows and the meadowlark.

Although the majority of prairie mammals have been able to adapt to the loss of prairie habitat, some are no longer present in the state, some are of special concern and there are others which will most likely not adapt to continuing changes in agricultural practices and land use.

Prairie-associated reptiles and amphibians have been affected as well. About half have apparently adapted to the loss of prairie, while three reptiles are on the state's endangered species list. One is listed as threatened, and two are of special concern.

Little is known about the invertebrates of Wisconsin's native prairies. Indeed, there are probably many grassland insects that are extinct, no longer found in the state, or have not yet been discovered.

There are few high quality prairie remnants remaining. However, it will take more than the preservation of these remnants to recover or retain the biodiversity this ecosystem can offer. Restoring prairies is possible, but it is unlikely that we will ever see all the previous components in a naturally functioning grassland ecosystem.

Degraded areas that were once prairie can often be restored with moderate effort to yield a habitat suitable for most of the associated plant and animal species. Even certain managed agricultural and livestock practices can accommodate the maintenance of the open habitats needed by many grassland species. Map 19 of the Physical Features map series displays the county's prairie remnants and other grasslands.

Oak Savanna

Portions of St. Croix County were originally covered by oak savanna. Only scant remnants of the complete ecosystem exist today. Oak savanna is the ecosystem that historically was a part of a larger complex bordered by the prairies of the west and the forests of the east. Savannas, considered to be the middle of the continuum between prairie and forest, were a mosaic of plant types maintained by wildfire and possibly large ungulates such as bison and elk.

Oak savanna was home to an abundant variety of plants and animals, and was probably optimum habitat for many game species, as well as songbirds. However, presently oak savanna is one of the most threatened plant communities in the world. Less than 500 acres are listed in Wisconsin's Natural Heritage Inventory as having a mix of plants similar to original oak savanna.

Any identified oak savanna remnants should be protected. There has been no inventory of oak savanna remnants in St. Croix County. However, some of the identified grasslands have the potential for savanna restoration by the Department of Natural Resources and conservation groups. Certain marginal agricultural lands which were once oak savanna can be restored economically and often still accommodate light to moderate cattle grazing.

Wildlife and Fisheries Habitat or Areas

All existing federal, state and local wildlife and fisheries areas, including private conservancy areas are mapped. These areas are managed to provide important feeding, breeding, nesting, cover and other habitat values to a wide variety of plant and animal species.

Natural and Scientific Areas

All existing federal, state and local natural and scientific areas are mapped. The WisDNR, Bureau of Endangered Resources conducts data searches for natural and scientific areas of national, state or local significance. The Bureau urges special notice be taken to protect any and all natural or scientific areas from development.

Rare or Endangered Species and Communities

The WisDNR, Bureau of Endangered Resources conducts data searches for endangered plants and animals. The Bureau urges special notice be taken to protect any and all endangered resources from development. To protect them from disturbance, the exact locations of the endangered resources can only be used for analysis and review purposes. Therefore, these locations will be incorporated as environmental resources, but will not be specifically revealed.

Map 20, of the Physical Features map series, shows the locations of wildlife and fisheries areas, natural and scientific areas, and rare or endangered species and communities.

Recreation and Open Space

Recreation and open space areas provide natural resource based recreation, open space and scenic amenities. They also are valuable to preserve unique physical features, certain plant communities and quality wildlife habitat for natural interpretation. Natural resource based outdoor recreation, park, open space and scenic areas are designated for low intensity uses. The uses do not include golf courses, ball diamonds, soccer fields, high intensity or service campgrounds, etc., as these uses are better suited to previously disturbed uplands which can be converted.

Map 21 of the Physical Features map series depicts the recreation, scenic and open space areas of the county.

Historic Sites and Structures

Historic sites are of great importance to our society, as they are reminders of the past and also of the progress that has taken place since. A record search by the State Historical Society of Wisconsin reveals the presence of architectural, historical, and archeological properties in St. Croix County. The society is also certain there are many undiscovered prehistoric and early historic sites present in most counties. A listing or depiction of these sites and their locations is not provided to protect them from disturbance. However, any development should be reviewed, pursuant to Wisconsin Statute 44.40 (1989), against the historical resource list to determine whether historic properties within the area will be affected. The Historical Society should be contacted for a determination of possible impacts on these resources from the development.

The Historical Society strongly recommends that a qualified archeologist survey all proposed developments to

identify any sites. Also, if the removal or alteration of any building or structure

over 50 years old is proposed, the Historical Society should be contacted so they may assist in evaluating any historical significance. Cooperation of all developers, public and private, will ensure preservation and/or recording of these valuable resources of our community.

THE IMPACTS OF DEVELOPMENT ON ENVIRONMENTAL RESOURCES

SURFACE WATER

Several of the previously described resources are involved in the impacts of development on surface water quality and quantity. Lakes, Ponds, Rivers, Streams, and Intermittent Waterways and Natural Drainageways; Wetlands; Shorelands; Floodplains; Steep Slopes; and, Wildlife and Fisheries Areas are directly affected by surface water impacts.

Urbanization, development and other human activities disrupt the natural course of water as it moves across a watershed. Removing vegetation and constructing impervious surfaces such as roads, parking lots, driveways, sidewalks and rooftops greatly increases the amount and rate of stormwater runoff. As this increased stormwater runoff crosses the urbanized or developed landscape it also picks up contaminants and sediments which affect water quality.

In rivers and streams the changes brought by development are: increased water level fluctuations manifested by lower base flow and increased stormwater flow which can lead to flooding; decreased oxygen levels; increased water temperatures; greater channel erosion; muddying of waters from increased sediment; and, pollution from fertilizers, pesticides, debris, salt, oil, grease and toxic substances. In effect, urbanization and development can turn a clear, cool, brisk-running trout stream which does not breach its banks every spring into a muddy, warm, slow-moving stream which swells over its embankment with every heavy rain.

Lakes, ponds and reservoirs can also be impacted by development. All lakes decline in water quality over time if left in their natural state. However, development can accelerate the decline in lake water quality, so what once took thousands of years can occur in decades. As with rivers and streams, the detrimental impacts from development to lakes are caused by stormwater runoff, erosion and pollution.

Shorelands and the vegetation they contain are the natural buffer which helps protect surface waters from overland runoff and contaminants. If they are disturbed their ability to slow runoff and filter contaminants is reduced. Shoreland is also critical habitat for a variety of plants and animals and preserves the aesthetic quality of water bodies if left undisturbed.

Development within areas that are prone to flooding can cause adverse impacts on not only the waterway but also on the development itself. Altering

the floodplain landscape by filling or building levees or structures can exacerbate flooding conditions. The filling of wetlands in floodprone areas has been proven to increase the likelihood of flooding. These alterations divert water from where it once moved through or was stored in during spring runoff or storm events, which usually increases the area of the floodplain. The accumulation of development in floodplains can cause more severe flooding in other areas within the floodplain or newly created floodplain. In addition, development within floodplains is always subject to damage from flooding.

Development on steep slopes causes erosion by introducing impervious surfaces to areas where water does not infiltrate readily. Increased erosion impacts surface waters by increasing runoff quantity and the sediment it carries. Development on these slopes results in high construction costs as special construction techniques must be employed for structures, hillsides are cut and filled, and attempts are made to stabilize hillsides through building terracing. Terraces may appear to stabilize these slopes, but if they are not rigorously maintained the forces of gravity and water eventually deteriorate them.

WETLANDS

Development in wetlands by either draining or filling removes their natural functions of storing and filtering pollutants, cleaning lakes, rivers and streams, making drinking water safer, providing valuable habitat for both aquatic and terrestrial animals and vegetation, replenishing groundwater supplies and the groundwater discharge from wetlands, which maintains stream flows, especially during dry months.

GROUNDWATER

Groundwater can be adversely affected when contaminants are released into or spilled upon the ground. Some factors influencing an aquifer's susceptibility to pollution are depth to groundwater and bedrock, type of bedrock, sub-surface permeability, and the soil's ability to lessen the impact of pollutants. High-risk activities-such as industries using hazardous materials-pose serious threats to groundwater and should be kept out of the immediate recharge areas of public water supply wells, and where practical, private wells also. High concentrations of septic systems also can pollute groundwater with nitrates.

PRAIRIE AND OTHER GRASSLANDS

The scarcity of prairie makes its further loss, or any further loss of grasslands to development, critical. The decimation of prairie in Wisconsin means that an estimated 20 percent of the original grassland plants are considered rare in the state. The drastic changes in prairie habitat over the past 150 years have had negative impacts on many plants and animals. This has occurred because of direct loss of the ecosystem and indirect impacts due to fragmentation of remaining parcels from development and related disturbances. Many species of plants associated with Wisconsin prairies are endangered, threatened or of special concern, and two are known to no longer exist in the state. Many grassland birds face similar circumstances as indicated by a growing list of special concern species and the declining numbers of birds once considered common in the state, such as several species of sparrows and the meadowlark. Although the majority of prairie mammals have been able to adapt to the loss of prairie habitat, some are no longer present in the state, some are of special concern and there are others which will most likely not adapt to continuing changes in agricultural practices and land use.

Grasslands can be restored and maintained through preserving a certain amount of open space for this type of cover as development occurs. It is estimated that restoration of a minimum of three percent to four percent of the original prairie acreage may be required to maintain the biodiversity of grassland ecosystems. Hence, development can occur in such a way that it can maintain sufficient grasslands for its habitat value while preserving the rural character of the landscape.

WOODLANDS

Development can destroy a woodland's capacity to provide wood products, habitat for a variety of plants and animals, and scenic beauty. Because of their value for habitat, production and scenery, woodlands should be protected from conversion to other uses. Considerations for open space when development occurs can accomplish the preservation of woodland values while managing how that development occurs.

RARE OR ENDANGERED SPECIES OR COMMUNITIES

Rare or endangered species and communities are very sensitive to certain kinds of encroachment in their surroundings. Development on or near the locations of rare or endangered

species can further threaten their status and survival.

ENVIRONMENTAL CORRIDORS

Environmental corridors are significant areas of environmental resources characterized by continuous systems of open space, physical features, environmentally sensitive lands and natural or cultural resources which can be adversely impacted by development. These areas are often evident to people in the area and they identify with them as significant natural areas in their surroundings. Independent resources are non-continuous open space, physical features, environmentally sensitive lands, and natural or cultural resources that also can be adversely impacted by development.

The adverse impacts caused by development in these areas can create undue costs on society in the attempt to alleviate those problems. Managing development in these areas either eliminates or reduces the adverse impacts from development. Management cannot overcome the impacts of developing in some of these areas, and in those areas it is prudent to prohibit development. In managing the development in those areas that can accommodate it, the costs associated with the adverse impacts of development can be shifted from society as a whole to those who choose to develop in them. This is accomplished by ensuring development occurs using engineering, site design, construction and management practices which address potential adverse impacts.

ENVIRONMENTAL CORRIDOR CRITERIA

Environmental corridors incorporate the following environmental and historical resources: Lakes, Ponds, Rivers, Streams, and Intermittent Waterways and Natural Drainageways; Wetlands; Shorelands; Floodplains; Steep Slopes; Geologic Formations and Physiographic Features; Highly Erodible Soils; Wet, Poorly Drained Organic Soils; Closed Depressions; Wellhead Protection Areas; Woodlands; Prairie; Rare or Endangered Species and Communities; Historical and Archeological Sites; and, Scenic Areas.

The following are the criteria used to designate environmental corridors and resources:

PRIMARY ENVIRONMENTAL CORRIDOR

- Linear in nature, often arising from a dominant feature or focal point, such as a waterbody or geologic feature
- At least three environmental resources present
- At least 400 acres in size
- At least two miles long
- At least 200 feet wide

SECONDARY ENVIRONMENTAL CORRIDOR

- At least two environmental resources present
- At least 100 acres in size

- Approximately one mile long or longer
- No minimum width

Independent Environmental Resources

- At least one valued resource present
- No minimum size
- Separated from environmental corridors by intervening land or small, narrow features abutting environmental corridors

Map 22 of the Physical Features map series shows primary environmental corridors. The Primary Environmental Corridors map identifies the areas in the county with the most significant environmental features. County residents are most likely to identify these areas as significant environmental areas.

There are environmental resources throughout the county, not just in primary environmental corridors, which should be considered when determining the impacts of development.

Comprehensive Environmental Resource Protection

Environmental corridors offer a mechanism to identify, evaluate and devise protection or management strategies for the most apparent valued resources in the county. However, considering environmental corridors does not address the overall natural resource base of the county including surface or ground water quality, fisheries, wildlife, manageable forests and the diversity of plants and animals.

The environmental corridors mechanism does not address retaining agriculture and rural character, managing stormwater better, preserving or creating a sense of place, and reducing infrastructure costs.

Public support for the protection of environmental resources is evident from the results of the county's public opinion survey:

- About three-quarters of St. Croix County residents feel the loss of open space, scenic areas and wildlife habitat is a problem in the county.
- Groundwater contamination is considered a problem by eight of every 10 county residents.
- The pollution of lakes, rivers and streams is a problem according to 82 percent of county residents.
- 95 percent of all St. Croix County residents believe that local land use planning should consider the impacts of development on lakes, rivers and streams, and on groundwater, wetlands and other environmentally sensitive lands.
- About nine in 10 St. Croix County residents think that local land use planning should consider the impacts of development on wildlife habitat.
- 88 percent of the people in St. Croix County feel those environmental features such as wooded areas, steep slopes, wildlife habitats and prairies should be protected by the county.
- According to 93 percent of county residents, the county should protect the water resources of the county,

such as lakes, rivers and streams, wetlands, groundwater and floodplains.

The public clearly believes that a variety of natural resources should be considered and protected when planning development.

In addition, the public expressed concern about other issues related to the landscape of St. Croix County:

- About seven in 10 county residents think that the loss of rural character and fewer family farms in the county are problems.
- 84 percent of the people in St. Croix County would rather see trees and open space than other houses when they look out their window.

Rural residential development has the potential for creating the greatest impacts on the landscape of St. Croix County. There are development patterns which are sensitive to the environmental resources and unique landscape contained in potential development sites which can address other issues, such as retaining agriculture and rural character, preserving or creating a sense of place, and reducing infrastructure costs.

Existing subdivision controls and zoning only provide for the distribution of roughly equal sized lots, which consume virtually the entire site, leaving no open space. Conventional subdivisions developed under these existing regulations are typically characterized by houses with mostly views of other houses.

Open Space or Conservation Site/Subdivision Design is an alternative site design technique which takes into account the individual environmental and landscape characteristics of the site, provides the same number of housing units built on smaller lots, and accommodates a variety of desirable objectives, including setting aside substantial amounts of open space, protecting environmental features and wildlife habitat, preserving rural character and scenic views, accommodating better stormwater management, preserving agricultural land, allowing shared wells and on-site wastewater treatment, creating a sense of place, and reducing the amount of roads and other infrastructure.

Through the management or, where necessary, prohibition of development in environmental corridors, and the flexibility of open space or conservation site design, there is the potential to dramatically reduce the negative impacts of development on the county's natural resource base, scenic quality and rural character.

CONCLUSION

St. Croix County has a rich natural history, which is the basis for its present physical characteristics. Over 100 years of human settlement and resource use has altered these physical characteristics with cultural additions to the landscape. The natural environment and the cultural influences which make the St. Croix County landscape are valued by the people who reside in it.

Natural features as represented by environmental corridors are recognized as important to consider when planning for development. The rural character of the county is an important consideration as well.

This chapter provides an inventory of the physical features of the county, describes the impacts of development on those features, and provides an analysis of systems which might be employed to mitigate the impacts of development on the landscape of the county.

This base of information will assist the further development of this Plan, the development of the tools to implement the objectives of the Plan, and the individual decisions necessary to address development issues after the Plan is completed and is being implemented.

PHYSICAL FEATURE ANALYSIS MAP SERIES

Map 1	Bedrock Geology
Map 2	General Soils
Map 3	Limitations for Septic Systems
Map 4	Limitations for Dwellings with Basements
Map 5	Limitations for Small Commercial Buildings
Map 6	Potentially Productive Agricultural Land
Map 7	Potential Sand Deposits
Map 8	Potential Gravel Deposits
Map 9	Elevations
Map 10	Water Bodies and Drainage
Map 11	Groundwater Elevation
Map 12	Depth to Groundwater
Map 13	Floodplains
Map 14	Shorelands
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Map 16	Closed Depressions
Map 17	Steep Slopes
Map 18	Woodlands
Map 19	Grasslands and Prairie Remnants
Map 20	Wildlife and Fisheries Areas and Rare and Endangered Resources
Map 21	Recreation, Scenic and Open Space Areas
Map 22	Primary Environmental Corridors

The maps identified in the above list are not available in pdf format. They are found in the copies copies of the St. Croix County Development Management Plan, for sale through the Planning Department.