U.S. Fish & Wildlife Service

Geographically Isolated Wetlands

A Preliminary Assessment of Their Characteristics and Status in Selected Areas of the United States

U.S. Fish and Wildlife Service

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Section 1. Introduction

Wetlands occur on many landscapes across America. They form in low-lying areas along rivers, streams, lakes, and estuaries where they are periodically flooded (e.g., floodplains), on slopes in areas of groundwater discharge (e.g., seepage slopes), on broad flat interstream divides where soil drainage is poor (e.g., flatwoods), in geographically isolated depressions where precipitation collects (e.g., potholes, playas, vernal pools, and ponds), in paludified landscapes in cold, wet climates where peat moss grows over the land (e.g., blanket bogs), and in other seasonally wet sites. Wetlands therefore may be connected with waterbodies or surrounded by dry land. Although the latter appear to be separated from surface waters, many "isolated" wetlands are actually linked hydrologically to other wetlands or streams by subsurface flows.

Purpose and Organization of this Report

The U.S. Fish and Wildlife Service prepared this report to provide an introduction to isolated wetlands. A primary objective was to present ecological and geographic information to assist resource managers and the general public in gaining a better perspective and understanding of these wetlands. There was no intent to address jurisdictional questions about isolated wetlands. This report provides an overview of many types of isolated wetlands and their functions and values, along with general estimates of the number and acreage of isolated wetlands in a variety of physiographic settings across the country. Available geospatial data from the Service's National Wetlands Inventory (NWI) Program and the U.S. Geological Survey facilitated analysis and mapping of isolated wetlands in selected locations. Although the report is not an exhaustive treatment of isolated wetlands, it provides readers with a basic understanding of the relative extent of these wetlands and their significance. This report is arranged in six sections: 1) introduction, 2) overview of isolated wetlands, 3) extent of isolated wetlands in selected areas, 4) summary, 5) acknowledgments, and 6) references cited.

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Preface

The mission of the Fish and Wildlife Service is to conserve, protect, and enhance fish, wildlife, plants and their habitats for the continuing benefit of the American people. Wetlands are among the Nation's most valuable natural resources, providing crucial habitat for a wide variety of fish and wildlife. Their landscape position, hydrology, and vegetation also make wetlands especially important for water quality renovation, flood water storage, shoreline stabilization, and production of food and fiber. Because of these and other values, wetlands and their associated waters receive much attention for resource protection, restoration, and management.

The Service's National Wetlands Inventory Program is responsible for mapping the Nation's wetlands, and reporting to the Congress at ten-year intervals on the national status and trends of these important habitats. This information aids planners, resource managers, decision-makers, and others in better understanding these valuable habitats, and in improving the status of wetlands.

Wetlands surrounded by upland - "geographically isolated wetlands" - are vital habitats for numerous wildlife species (including endangered and threatened plants). In many areas, these wetlands serve as oases for wildlife, especially in arid and semi-arid regions. Being surrounded by upland and often small in size also have made them perhaps the most vulnerable wetlands in the country. Development of adjacent uplands has posed significant threats both direct and indirect to these wetlands and their associated wildlife.

Given the wildlife significance of these wetlands, the Service prepared this report to provide an ecological and geographic overview of isolated wetland resources of the United States. For the purposes of this report, isolated wetlands have no apparent surface water connection to perennial rivers and streams, estuaries, or oceans. Ecological profiles were developed to provide the public with a better understanding of 19 types of wetlands that are often considered geographically isolated wetland habitats. The report also included the results of a study that estimated the extent of potentially isolated wetlands at 72 selected sites in 44 States. Available National Wetlands Inventory map data were combined with U.S. Geological Survey hydrology data through geographic information system analysis to develop these estimates. The report should increase public awareness of these significant and vulnerable wetlands.

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Section 2. Overview of Isolated Wetlands

This section provides an introduction to isolated wetlands. It begins with a general discussion that explains different definitions of isolated wetlands and reviews major functions of isolated wetlands. The section concludes with brief profiles of individual wetland types that have been traditionally viewed as isolated from the geographic or landscape perspective or other wetland types that include isolated forms. These profiles are based on readily available materials and do not represent a comprehensive literature review of isolated wetlands. The objective was to provide readers with sufficient background to better understand the nature, functions, and values of so-called "isolated wetlands."

What is an Isolated Wetland?

The term "isolated" is a relative term. There is no single, ecologically or scientifically accepted definition of isolated wetland because this issue is more a matter of perspective than scientific fact. Nonetheless, it is a question of particular relevance for wetlands since it may affect their future well-being.

Webster's New World Dictionary of the American Language (Guralnik 1972) defines "isolate" as "to set apart from others; place alone." An isolated wetland, therefore, would be one that is separated from other wetlands or other waters – standing alone. Isolation can be viewed from a number of perspectives. Two common viewpoints are based on landscape or geomorphic differences and hydrologic interactions. Others may consider ecological relationships.

Wetlands surrounded by upland may be considered isolated, since they are separated from other wetlands by dry land. This is isolation from a geographic, landscape, or geomorphic perspective. Examples of geographically isolated wetlands include prairie pothole wetlands, cypress domes, playas, and kettle-hole bogs. This type of isolation is easy to determine because, in most cases, these isolated wetlands are depressional wetlands surrounded by upland (*Figures 2-1* and *2-2*).

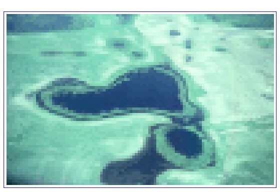

Figure 2-1. Prairie pothole wetlands surrounded by upland cropland. (R. Tiner photo)

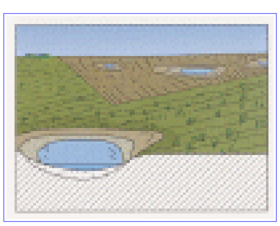

Figure 2-2. Sketch showing isolated wetlands surrounded by upland. (Source: Tiner 1996)

From a hydrologic standpoint, isolated wetlands may be defined as wetlands not connected to other wetlands or waterbodies by surface water or ground water. Hydrologically isolated wetlands might be: 1) wetlands with no surface water connection to other wetlands or waters, or 2) wetlands lacking a hydrologic connection to other wetlands or waters considering both surface and subsurface flows. Examples of hydrologically isolated wetlands are Southwest playas and Nebraska's Rainwater Basin wetlands. Many wetlands considered isolated from the landscape or geographic perspective are connected hydrologically via groundwater to other wetlands and to rivers and streams. For example, *Figure 2-3* shows subsurface flows from South Dakota prairie pothole wetlands to a regional groundwater system that eventually empties into a stream. Similar groundwater connections take place in other areas (see numerous illustrations in Fretwell et al. 1996; some of which are presented elsewhere in this section). In karst regions, many geographically isolated wetlands are hydrologically connected to underground waterways. Other geographically isolated wetlands may become hydrologically linked to other wetlands during extremely wet years as surface water overflows from one depressional wetland to another. So time may also be a factor when considering whether or not a given wetland is hydrologically isolated.

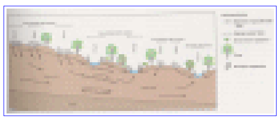

Figure 2-3. General subsurface flows between different South Dakota potholes and riverine wetlands. (Source: Sando 1996)

Isolation from an ecological perspective is even more difficult to define since one would have to identify physical, chemical, or other barriers to the exchange of genetic material, for example. Barriers that affect seed dispersal, animal movements, and reproductive success would have to be evaluated. Isolation in this context may be best defined relative to a particular organism, since some features that pose barriers to some organisms do not restrict others. From a wetland-dependent animal's standpoint, isolation is a function of the number of neighboring wetlands, the distance between them, the nature of the matrix land cover, and the mobility of the particular species (Gilberto Cintron, pers. comm.). Determining ecological isolation might also require identification of discontinuities in biological characteristics like genotypes or phenotypes of certain species. In the view of some landscape ecologists, an isolated system is one that has no exchange of energy or matter with its surrounding environment (Forman and Godron 1986). From this perspective, it may not be possible for any wetland to be truly isolated.

Overview of Isolated Wetland Functions

Wetlands provide a host of functions that benefit ecosystems as well as society (see Mitsch and Gosselink 2000). Many of the functions are synergistic in producing services or materials that are valued by people (*Table 2-1*). Wetlands largely operate as a holistic or integrated system within a watershed, waterfowl flyway, or ecoregion (Tiner 1998). Individual wetlands working together provide valued functions and the value of a network of wetlands (e.g., within a watershed or flyway) is greater than the sum of its individual parts. A collection of wetlands on the landscape may be the vital ecological unit for some animals, while others require a combination of wetlands and uplands for survival and reproduction.

The following discussion is a brief overview of some of the functions of isolated wetlands. It is not intended to be exhaustive, but is designed to acquaint readers with the potential roles isolated wetlands play. For additional information about functions of specific types of isolated wetlands, readers are referred to the next subsection and to publications listed in the References Cited section.

Table 2-1. Major wetland functions and some of their values. (Source: Tiner 1998)

Function Some Values

Water storage

Flood- and storm-damage protection, water source during dry seasons, groundwater recharge, fish and shellfish habitat, water source for fish and wildlife, recreational boating, fishing, shellfishing, waterfowl hunting, livestock watering, ice skating, nature photography, and aesthetic appreciation

Slow water release

Flood-damage protection, maintenance of stream flows, maintenance of fresh and saltwater balance in estuaries, linkages with watersheds for wildlife and water-based processes, nutrient transport, and recreational boating

Nutrient retention and cycling

Water-quality renovation, peat deposits, increases in plant productivity and aquatic productivity, decreases in eutrophication, pollutant abatement, global cycling of nitrogen, sulfur, methane, and carbon dioxide, reduction of harmful sulfates, production of methane to maintain Earth's protective ozone layer, and mining (peat and limestone)

Sediment retention

Water-quality renovation, reduction of sedimentation of waterways, and pollution abatement (retention of contaminants)

Substrate for plants and animals

Shoreline stabilization, reduction of flood crests and water's erosive potential, plant-biomass productivity, peat deposits, organic export, fish and wildlife habitats (specialized animals, including rare and endangered species), aquatic productivity, trapping, hunting, fishing, nature observation, production of timber and other natural commodities, livestock grazing, scientific study, environmental education, nature photography, and aesthetic appreciation

Water Storage

Depressional wetlands, whether isolated or not, store precipitation that could otherwise rapidly flow downstream, creating potential flooding of low-lying areas. Since isolated basins have no natural outlets, all water entering them is retained (including groundwater recharge). This is valuable for flood reduction, since such water does not contribute to local or regional flooding (Carter 1996). When an area contains thousands of isolated depressional wetlands, the surface water storage capacity can be enormous. For example, pothole wetlands in North Dakota's Devils Lake Basin can store as much as 72 percent of the total runoff from a 2-year frequency storm and about 41 percent from a 100-year storm (Ludden et al. 1983). In many cases, this water storage function facilitates an isolated wetland's potential role in groundwater recharge and streamflow maintenance (through contribution to regional groundwater supplies) and at the same time, provides valuable waterfowl and waterbird habitat. The multiple benefits of temporary water storage are considerable.

By holding water for long periods, isolated wetlands serve as water sources that benefit fish and wildlife, domestic livestock, and people. An abundance of water creates wetland habitats for native fish and wildlife that provide recreational opportunities for many people (e.g., hunting and fishing) and help support local economies. Isolated wetlands within rangeland are often used as watering holes for livestock, while similar wetlands in agricultural settings may serve as sources of irrigation water. These two uses can have adverse effects on wildlife and the habitat quality of these wetlands. The wettest of isolated wetlands may provide fish habitat that may be a valuable resource for local landowners. Recreational fishing and commercial harvest of fish may take place in some isolated wetlands. For example, fathead minnows are caught in Minnesota potholes and sold as baitfish (Hubbard 1988).

Slow Water Release

Many wetlands that appear isolated from surface waters are actually vital components of regional water systems, since they contribute to local and regional aquifers (Stone and Lindley Stone 1994). Examples of isolated wetlands contributing water to regional aquifers that ultimately support stream flow are shown in *Figures 2-4* and *2-5*. Isolated wetlands hold water until it is removed by evapotranspiration, seepage (percolation contributing to groundwater supplies), irrigation devices, or drainage structures. During extreme high water events, for example, water-filled isolated basins often contribute to groundwater supplies (including regional aquifers) as water enters more permeable adjacent soils and moves downward to underlying aquifers. Such groundwater may flow laterally to contribute to streamflow critical for supporting aquatic life and their respective ecosystems. Playa lakes are major recharge sites in the Southern High Plains (Wood and Osterkamp 1984 as reported in Carter 1996).

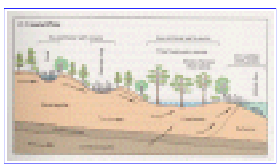

Figure 2-4. Generalized subsurface flows between isolated wetlands and rivers and estuaries. (Source: McPherson 1996)

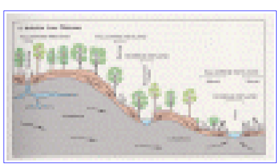

Figure 2-5. Generalized subsurface flows between sinkhole wetlands, springs, creeks, and rivers. (Source: McPherson 1996)

Nutrient Retention and Cycling

The role of wetlands in nutrient retention and cycling is well known. Wetlands can be sources, sinks, or transformers of chemicals and the range of hydrologies creating and maintaining wetlands has a great impact on biogeochemical processes. Mitsch and Gosselink (2000) reference numerous examples of wetlands serving as sinks for a host of chemicals and summarize various applications of constructed wetlands for wastewater treatment. Two potentially isolated wetland types - ombrotrophic bogs and cypress domes - are cited as natural wetlands that are biogeochemically closed systems which recycle nutrients internally (i.e., intrasystem cycling). These and other isolated wetlands should retain most of the chemicals entering them from surrounding areas and, therefore, appear to serve as sinks for a variety of chemicals. Because of these properties, artificial wetlands are purposely constructed to treat wastewater of various kinds (e.g., municipal wastewater, mine drainage runoff, stormwater and nonsource pollution, landfill leachate, and agricultural wastewater) and improve water quality (Mitsch and Gosselink 2000).

Sediment Retention

Isolated depressional wetlands are sediment traps. Given their landform and landscape position, they should retain all sediments and other particulates entering them. In fact, the volume of many such wetlands is reduced over time due to this process, especially in agricultural areas. Luo and others (1999) reported on sediment deposition in playa wetlands. Most of these sediments are water-borne materials originating from local watersheds. Coarser materials settle out first, so sand content is higher at the margins of playas, while finer particles are carried further and settle out near the center of the basins where clay content is greater.

Substrate for Plants and Animals

Wetlands provide substrates that support plant growth and colonization by thousands of animals ranging from microscopic invertebrates to large vertebrates. By doing this, wetlands provide habitat for plants and animals. The variety of wetland types is a major contributor to the Nation's biodiversity (see Tiner 1999 for examples of wetland plant communities).

From an ecological standpoint, isolated wetlands are among the country's most significant biological resources. In some areas, isolation has led to the evolution of endemic species vital for the conservation of biodiversity. In other cases, their isolation and sheer numbers in a given locality have made these wetlands crucial habitats for amphibian breeding and survival (e.g., woodland vernal pools and cypress domes) or for waterfowl and waterbird breeding (e.g., potholes). In arid and semi-arid regions, many isolated wetlands are veritable oases – watering places and habitats vital to many wildlife that use them for breeding, feeding, and resting, or for their primary residence. Many of these wetlands may be small in size, but their value to wildlife is far greater than their size alone would suggest.

The high density of isolated marshes and wet meadows has made the Prairie Pothole Region, North America's leading waterfowl production area. This region produces half of the continent's waterfowl in an average year (Smith et al. 1964). Forty-one percent of the continent's breeding dabbling ducks use this area (Bellrose 1979). Macroinvertebrates produced by the pothole marshes are a protein-rich food source required by nesting hens (Hubbard 1988).

Regions with a high density of isolated wetlands may provide a series of "stepping stones" for migrating waterfowl and waterbirds. For example, isolated wetlands east of the Rocky Mountains provide feeding and resting areas for millions of birds that overwinter along the Gulf Coast and migrate to northern breeding grounds. These wetlands produce an abundance of macroinvertebrates and plant life – nourishment required by these species to successfully make the migratory journey essential for maintaining their populations. Playas may be important intermediate stopover sites for migrating shorebirds (Davis and Smith 1998), while Rainwater Basin wetlands are stopover areas for millions of birds. Nearly all of the midcontinental population of greater white-fronted goose (*Anser albifrons*) stage in the Rainwater Basin every year (U.S. Fish and Wildlife Service 1985).

A high density of small wetlands is also vital for other animals. Semlitsch and Bodie (1998) described the importance of small wetlands to amphibians. The abundance of small isolated wetlands supports a diverse assemblage of amphibian species, produces large numbers of juveniles (necessary to maintain populations), and serves as "stepping stones" to aid in dispersal and recolonization of suitable habitats (Semlitsch 2000). Local populations of wetland-dependent organisms are vulnerable to extinction due to several factors including natural events (e.g., prolonged droughts and changing vegetation), disease, inbreeding, and habitat destruction. A study of wetlands in central Maine by Gibbs (1993) suggests that a high number of small wetlands increases the number of sources of potential colonists for wetlands that have lost populations due to chance extinction. The presence of a high number of small wetlands therefore increases the chances of survival of local populations over time.

Reducing the number of small wetlands in a given area increases overland migration distances and exposure of migrants (e.g., salamanders) to predators. This may place local populations at the risk of extinction. For example, Semlitsch and Bodie (1998) found that eliminating all natural wetlands less than 10 acres in size (in a South Carolina study area) would increase the nearest-wetland distance from 1,570 feet to 5,443 feet – a distance that would take most amphibian species several generations or more to travel. This type of loss would increase the probability of local population extinction for some amphibians.

Isolated wetlands with fluctuating water levels provide unique habitats for certain species, especially those that are vulnerable to fish predation. Much of the value of woodland vernal pools to amphibians is due to the absence of fish, which cannot survive periodic drawdowns. The presence of fish would eliminate or severely reduce the reproductive success of amphibians that breed in these pools.

Isolation and periodic drawdowns also promote endemism - the development of unique species. Increased number of species adds to the country's biological richness. Some examples of wetlands that are particularly important in this regard are West Coast vernal pools, desert spring wetlands, and Coastal Plain ponds (see discussion in following subsection).

Profiles of Selected Isolated Wetland Types

Regional differences in climate, physiography, hydrology, and other factors have led to the formation of a diverse assemblage of wetlands across the country. A number of distinct wetland types are typically isolated (e.g., playas, potholes, vernal pools, and interdunal swales), while others (e.g., Carolina bays and kettle-hole wetlands) may be either isolated or connected to streams and other surface waters. Isolated wetlands on former floodplains (e.g., oxbow lakes) were at one time periodically inundated by seasonal river flows but due to changes in river courses are now left isolated beyond the active floodplain. In other cases, the isolation of former floodplain wetlands has been caused by construction of levees to prevent overbank flooding to provide flood protection or by upstream dams that reduce flow regimes. Many other isolated wetlands were also created by human actions. Most of them are ponds built for a variety of reasons including aesthetic appreciation, livestock watering, irrigation, aquaculture, and stormwater management. Other isolated wetlands have been created by fragmentation from development; they represent remnants of once larger wetland complexes.

The following review describes the range and types of wetlands that have been considered isolated. For ecological discussion purposes, 19 types of isolated wetlands are described: 1) prairie potholes, 2) playas, 3) Rainwater Basin wetlands, 4) Nebraska Sandhills wetlands, 5) salt flat and salt lake wetlands, 6) wetlands of Washington's Channeled Scablands, 7) desert springs and their wetlands, 8) glaciated kettle-hole wetlands, 9) Delmarva potholes, 10) Coastal Plain ponds, 11) Carolina Bay wetlands, 12) pocosin wetlands, 13) cypress domes, 14) sinkhole wetlands, 15) former floodplain wetlands, 16) West Coast vernal pools, 17) woodland vernal pools, 18) coastal zone dune swale and deflation plain wetlands, and 19) Great Lakes alvar wetlands. The discussions are intentionally brief and readers are encouraged to consult the cited references for additional information.

Prairie Potholes

The Prairie Pothole Region extends from Iowa and South Dakota northward into south-central Canada (*Figure 2-6*). Glacial activity in this area created millions of shallow depressions now called "prairie pothole wetlands" (*Figure 2-7*). Most of these depressions have been commonly viewed as isolated wetlands, since they occur as separate basins on the land surface. Despite this, many of these wetlands are hydrologically connected (*Figure 2-8*). Prairie wetlands serve as both recharge and discharge areas, contributing to both local groundwater flow and regional flow (Lissey 1971). Water is recharged at topographic highs (wetlands at higher elevations) and discharged to regional lows (e.g., lakes and other wetlands) and eventually to local rivers and streams (Winter 1989). Seasonal changes in functions may occur as some wetlands contribute to groundwater during high water periods (recharge), yet receive groundwater inputs during the dry season due to evapotranspiration.

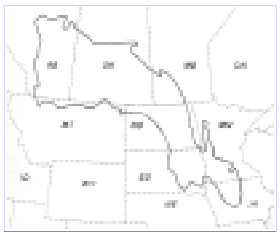

Figure 2-6. Location of the Prairie Pothole Region. (Source: Hubbard 1988)

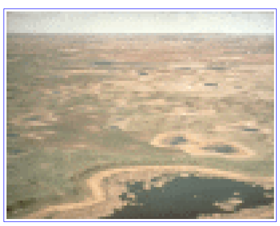

Figure 2-7. Aerial view showing high density of prairie pothole wetlands. (U.S. Fish and Wildlife Service photo)

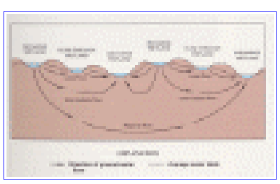

Figure 2-8. Generalized subsurface flows between different pothole wetlands. (Source: Berkas 1996)

The existence of millions of isolated basins in this region provides considerable surface water storage capacity. For example, the approximately 50,000 pothole wetlands in the Devils Lake Basin (North Dakota) that cover only 15 percent of the local landscape can store up to 72 percent of the total runoff of a 2-year storm event and 41 percent of a 100-year storm (Ludden et al. 1983). Water trapped within these basins is lost mainly through evapotranspiration and groundwater seepage. In their undrained state, these wetlands do not contribute to runoff (Wiche et al. 1990). Yet drainage of these basins and connection to the surface water network emptying into streams makes them contributing sources of stream flow, thereby exacerbating flooding problems. Artificial drainage increases the watershed runoff area and decreases the water storage capacity of potholes (Moore and Larson 1979).

A basin (depressional) landform and its effect on hydrology create a zonation of vegetation within individual potholes. Potholes are often described by the hydrology of the deepest part of their basins (i.e., permanent, semipermanent, seasonal, temporary, and ephemeral) (Stewart and Kantrud 1971). Concentric rings of vegetation zones are typical with aquatic bed species such as widgeon-grass (*Ruppia maritima*), pondweeds (*Potamogeton* spp.), and duckweeds (*Lemna* spp. and *Spirodela polyrhiza*) in the permanently flooded zone; robust emergents like cattails (*Typha* spp.) and bulrushes (*Scirpus* spp.) in the semipermanently flooded zone; other emergents including spikerush (*Eleocharis palustris*), giant bur-reed (*Sparganium eurycarpum*), water plantain (*Alisma plantago-aquatica*), slough sedge (*Carex atherodes*), hydrophytic grasses (e.g., *Phalaris arundinacea*, *Glyceria grandis*, *Scolochloa festucacea*, and *Beckmannia syzigachne*), and water smartweed (*Polygonum coccineum*) in the seasonally flooded zone; and graminoids such as salt grass (*Distichlis spicata*), squirrel-tail (*Hordeum jubatum*), prairie cordgrass (*Spartina pectinata*), baltic rush (*Juncus balticus*), and sedges (e.g., *Carex sartwellii*, *C. lanuginosa*, and *C. praegracilis*) in the driest zone (temporarily flooded). Note that all potholes do not contain all zones (*Figure 2-7*). Smaller potholes may have only one or two zones (*Figure 2-9*).

Figure 2-9. Pothole marsh. (R. Tiner photo)

Although it only accounts for 10 percent of North America's waterfowl breeding area, the Prairie Pothole Region produces half of the continent's waterfowl in an average year (Smith et al. 1964). These pothole wetlands are primary breeding habitats for mallard (*Anas platyrhynchos*), northern pintail (*A. acuta*), American wigeon (*A. americana*), gadwall (*A. strepera*), northern shoveler (*A. clypeata*), green-winged teal (*A. crecca*), blue-winged teal (*A. discors*), canvasback (*Aythya valisineria*), redhead (*A. americana*), and ring-necked duck (*A. collaris*). It is important to note that successful breeding requires that waterfowl have a variety of wetland habitats available because no single wetland type satisfies all their reproductive needs through the breeding season (Swanson and Duebbert 1989). The availability of large numbers of small wetlands allows the birds to disperse over the landscape, thereby making them less vulnerable to predation and diseases like avian cholera (Kantrud et al. 1989).

While pothole wetlands are noted for their waterfowl production, many other animals use these wetlands. Migratory birds that nest in the Arctic use potholes for feeding along their route. Many other birds breed or feed in pothole wetlands, including horned grebe (*Podiceps auritus*), eared grebe (*P. nigricollis*), pied-billed grebe (*Podilymbus podiceps*), black-crowned night heron (*Nycticorax nycticorax*), American bittern (*Botaurus lentiginosus*), northern harrier (*Circus cyaneus*), Virginia rail (*Rallus limicola*), sora (*Porzana carolina*), American coot (*Fulica americana*), killideer (*Charadrius vociferus*), willet (*Catoptrophorus semipalmatus*), marbled godwit (*Limosa fedoa*), American avocet (*Recurvirostra americana*), Wilson's phalarope (*Phalaropus tricolor*), black tern (*Chlidonias niger*), marsh wren (*Cistothorus palustris*), yellow-headed blackbird (*Xanthocephalus xanthocephalus*), red-winged blackbird (*Agelaius phoenicus*), and savannah sparrow (*Passerculus sandwichensis*) (Kantrud and Stewart 1984). Ring-necked pheasants (*Phasianus colchicus*) depend on many pothole wetlands for winter cover (Kantrud et al. 1989). Muskrat (*Ondatra zibethicus*) is the most conspicuous mammal using potholes and their mounds may be used as nesting sites by waterfowl. Many other mammals also use potholes, including shrews (*Sorex arcticus*, *S. cinereus*, and *Microsorex hoyi*), jumping mice (*Zapus hudsonius* and *Z. princeps*), meadow vole (*Microtus pennsylvanicus*), weasels

(*Mustela frenata* and *M. nivalis*), mink (*Mustela vison*), raccoon (*Procyon lotor*), red fox (*Vulpes vulpes*), and white-tailed deer (*Odocoileus virginianus*). Garter snakes (*Thamnophis radix* and *T. sirtalis*), American toad (*Bufo americanus*), Great Plains toad (*B. cognatus*), Rocky Mountain toad (*B. woodhousei*), wood frog (*Rana sylvatica*), leopard frog (*Rana pipiens*), chorus frog (*Pseudacris nigrita*), and tiger salamander (*Ambystoma tigrinum*) frequent potholes, with the latter three species being most dependent on these wetlands (Kantrud et al. 1989). Kantrud and others (1989) provide a comprehensive review of the ecology of pothole wetlands in the Dakotas, while Hubbard (1988) presents a summary of the literature on pothole functions and values.

About half of the original potholes in the Dakotas have been destroyed (60% in North Dakota and 40% in South Dakota; Tiner 1984). Over half were altered by agriculture, irrigation, and flood control projects. More than 99 percent of Iowa's original marshes have been lost, while 9 million acres of potholes in western Minnesota have been drained. Destruction of pothole wetlands and alteration of natural vegetated buffers around remaining wetlands have significantly reduced valuable waterfowl nesting and rearing areas. Pothole drainage also eliminates or severely reduces their surface water storage function and makes potholes and their local watersheds contributing sources of potential flood waters. Use of pesticides poses problems for waterfowl, since many insecticides are highly toxic to aquatic invertebrates (important food source) or to birds directly (Grue et al. 1986). Wetland restoration projects have been initiated to help bring back lost wetland functions and values in this region.

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Playas

Playas are nearly circular, shallow basins formed in semi-arid and arid regions (prairies to deserts) (*Figure 2-10*). Between 25,000 to 30,000 playas occur from southeastern Colorado and southwestern Kansas to west Texas (Haukos and Smith 1997). While playas are found in other countries, the world's highest density of playas is found in the southwestern United States - in the Southern High Plains of the Texas panhandle and eastern New Mexico (*Figure 2-11*) (Haukos and Smith 1994). Nearly 22,000 playa basins exist in this area (19,340 in Texas and 2,460 in New Mexico; Guthery and Bryant 1982).

Figure 2-10. Aerial photo showing numerous playas (some marked by arrow).

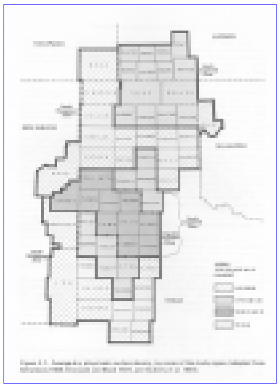

Figure 2-11. Location of playa region in the Southern Great Plains, with playa density indicated. (Source: Nelson et al. 1983)

Most playas derive water from rainfall and local runoff; very few (e.g., playa lakes) are linked to groundwater (Haukos and Smith 1994). Playas are usually dry in late winter, early spring, and late summer. Multiple wet-dry cycles during a single growing season are common (*Figure 2-12*). These fluctuating water levels promote nutrient cycling and biological productivity (Bolen et al. 1989).

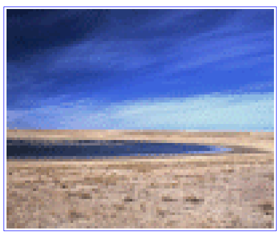

Figure 2-12. A playa wetland during a wet phase. (U.S. Fish and Wildlife Service photo)

According to Haukos and Smith (1994), playas are the only remaining native habitat in the Southern High Plains. From a wildlife standpoint, playas are perhaps most important as wintering grounds for waterfowl. More than 90 percent of the region's overwintering waterfowl depends on the playas: 600,000 to over 3 million ducks and geese (Nelson et al. 1983; U.S Fish and Wildlife Service 1988). More than 90 percent of the midcontinental population of sandhill cranes (*Grus canadensis*) overwinters here and many cranes frequent larger playas as well as salt lakes (Iverson et al. 1985). Migrating shorebirds feed heavily on aquatic invertebrates produced in the playas.

Playas also serve as vital habitats for amphibians. Spotted chorus frog (*Pseudacris clarkii*), Blanchard's cricket frog (*Acris crepitans blanchardi*), Plains leopard frog (*Rana blairi*), Great Plains narrow-mouth toad (*Gastrophyrne olivacea*), Great Plains toad, Texas toad (*Bufo speciosus*), Woodhouse's toad (*B. woodhousei woodhousei*), Plains spadefoot (*Scaphiopus bombifrons*), New Mexico spadefoot (*S. multiplicatus*), Couch's spadefoot (*S. couchii*), and tiger salamander depend on playas (Anderson and Haukos 1997). Given the variability in playa wetness, amphibian community composition and populations fluctuate from year to year (Anderson et al. 1999).   Haukos and Smith (1994) provide a summary of wildlife use of playas and stress the significance of playas to local landscape heterogeneity and regional and continental biodiversity. Additional information on playas can be found in "Playa Lakes - Symposium Proceedings" (U.S. Fish and Wildlife Service 1981) and "Playa Wetlands and Wildlife on the Southern Great Plains: A Characterization of Habitat" (Nelson et al. 1983).

Negative impacts to playas appear to be related most to water pollution. Playas receive poor quality water from a number of sources: 1) runoff from adjacent cropland (e.g., pesticides and herbicides), 2) discharge of contaminated water from oil fields, and 3) effluents from livestock operations such as cattle feedlots (Haukos and Smith 1994). The second source has led to widespread bird mortality. Playas adjacent to feedlots are often used as wastewater retention ponds (Bohlen et al. 1989). Other impacts to playas include sedimentation from farmland, pit construction (for irrigation), and overgrazing of playa vegetation.

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Rainwater Basin Wetlands

The Rainwater Basin is located in southern Nebraska (*Figure 2-13*). Wetlands have formed in depressions underlain by clay on a rolling silty loess plain. Wind-formed depressional wetlands typify this region. They are essentially isolated wetlands (closed basins with internal drainage) that depend on overland runoff from precipitation for their water supply (*Figure 2-14*) (Gersib 1991; Gilbert 1989; Starks 1984). Water is lost primarily through evapotranspiration with little seepage to underlying water tables (*Figure 2-15*) (Frankforter 1996). The presence of a clay lens in these Rainwater Basin wetlands restricts seepage to underlying water tables (50-100+ feet below wetlands); groundwater recharge potential appears to be limited in most cases (Ellis and Dreeszen 1987; Keech and Dreeszen 1959, 1968).

Figure 2-13. Major wetland regions in Nebraska. (Source: Frankforter 1996)

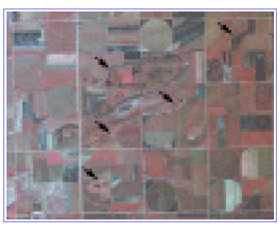

Figure 2-14. Aerial photo showing Rainwater Basin wetlands (some marked by arrow).

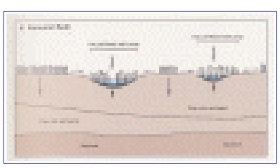

Figure 2-15. Generalized flow of water from Rainwater Basin wetlands. (Source: Frankforter 1996)

The Rainwater Basin is one of Nebraska's wetland complexes of international importance (Gersib 1991). From 5 to 7 million ducks and geese visit these wetlands annually. Nearly all of the midcontinental population of 300,000 greater white-fronted geese stage in the Basin every year (U.S. Fish and Wildlife Service 1985). According to a functional assessment performed in 1989 (Gersib et al. 1989), all or most Rainwater Basin wetlands have a high probability of providing the following functions: wildlife habitat, food chain support, nutrient retention, flood storage, sediment trapping, and shoreline anchoring. An abundance of fish and aquatic invertebrates produced in Rainwater Basin wetlands provides important food for migrating waterfowl in spring (Gersib et al. 1990). Such food helps waterfowl build body reserves for successful reproduction in northern breeding grounds.

At pre-European settlement, 94,000 acres of wetlands existed in the Rainwater Basin. By 1981, less than

10 percent of this acreage remained (Farrar 1982). Agricultural activities such as drainage, clearing, and ground water pumping have exacted a tremendous toll on these wetlands. Losses of Basin wetlands have forced ducks and geese to concentrate in remaining wetlands. In dry years with late winter storms, migrating waterfowl crowd into Basin wetlands. Such concentrations increase the likelihood for spread of diseases like avian cholera. In 1980, avian cholera killed about 80,000 waterfowl in the Basin – this was the second largest reported cholera die-off in the country.

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Nebraska Sandhills Wetlands

The Sandhills region of north-central and northwestern Nebraska is the largest sand dune area in the Western Hemisphere, covering about 20,000 square miles (*Figure 2-16*; Bleed and Flowerday 1990). This expansive grassland overlies the Ogallala Aquifer, to which most wetlands in the region owe their existence. Groundwater is a major water source for Sandhills wetlands in the eastern portion of the region and for subirrigated meadows (Chuck Elliott, pers. comm.).

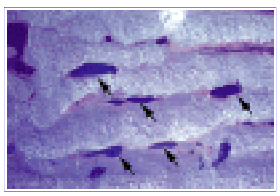

Figure 2-16. Aerial photo showing isolated basins in the Sandhills.

According to Ginsberg (1985), wet meadows characteristic of this region commonly have surface outlets. Yet many wet meadows in the western Sandhills have little or no surface outflow (*Figure 2-17*) (Frankforter 1996). Despite this apparent lack of surface outflow, most of these wetlands are interconnected with a regional groundwater system (*Figure 2-17*) (LeBaugh 1986; Winter 1986).

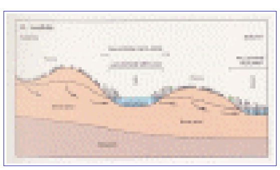

Figure 2-17. Generalized flow of water between Sandhills wetlands. Note subsurface flow in north to south direction. (Source: Frankforter 1996)

The Sandhills are among three major wetland resource areas in Nebraska that provide spring staging areas, breeding areas, migration and wintering habitat for endangered and threatened species, including whooping crane (*Grus americana*) and bald eagle (*Haliaeetus leucocephalus*) and for millions of migratory waterfowl (Elliott 1991; Gersib 1991). Two percent of the mallard duck breeding population of the north-central flyway depends on these wetlands (Novacek 1989).

Losses of these wetlands are due mostly to agriculture. The grassland economy of the Sandhills is based primarily on cattle grazing. Ditching of wet meadows has created large acreages of subirrigated meadows with water tables near the surface for cattle grazing and hay production. Wetland loss has resulted mainly from center-pivot irrigation operations, with associated drainage, land-leveling, filling, and lowered groundwater levels from deep well irrigation. These activities are largely responsible for about 30 percent of the loss of original Sandhills wetlands (Erickson and Leslie 1987).

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Salt Flat and Salt Lake Wetlands

Salt lakes and associated salt flat wetlands are found in arid and semi-arid regions and are characteristic of the Great Basin region. The Great Basin is a vast area of mountains and desert basins that includes most of Nevada and western Utah (*Figure 2-18*). It lies between Utah's Wasatch Mountains in the east, the Sierra Nevada range in the west, southern Idaho and southeastern Oregon in the north, and the Colorado River Basin in the south. The Great Basin is characterized by interior drainage, meaning that all waters entering the Basin stay in the Basin; there is no discharge to the sea. During the Pleistocene Epoch, much of the region was inundated by two large lakes (Lake Bonneville in the east and Lake Lahontan in the west) and many smaller ones. Today's salt flats, playas, and lakes are vestiges of these waterbodies. In more recent geologic time (after the last Ice Age 10,000-20,000 years ago), many of today's salt lakes and salt flats were larger lakes connected by rivers. Those of the Death Valley region (southeastern California) may have flowed into the Colorado River, as suggested by taxonomic similarities among the fishes of these areas (Soltz and Naiman 1978).

Figure 2-18. Location of Great Basin in the western United States. (Source: U.S. Geological Survey 1970)

The Great Basin receives less than 10 inches of rain annually. Salt flats contain water for short periods in winter and spring and become "dry" plains in summer (*Figure 2-19*).

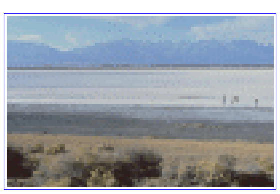

Figure 2-19. Salt flat wetlands. (U.S. Fish and Wildlife Service photo)

Salt lakes include the Great Salt Lake, Mono Lake, and the Salton Sea and all may be considered isolated (or terminal aquatic ecosystems) since they do not discharge to the ocean. Wetlands along their margins provide habitat for many species. These lakes and the salt flats provide food for wildlife. They are critical stopover areas for many migratory birds. For example, the shallow-water wetlands of Mono Lake produce brine shrimp (*Artemia* spp.) and alkali or brine flies (*Ephydra riparia*) – the key food source for migrating waterbirds. Wilson's phalaropes feed here on alkali flies, molting and doubling their body weight, before making their 3-day 3,000-mile nonstop flight to South America. Likewise, 1.5 to 1.8 million eared grebe feed on brine shrimp, increasing their weight three-fold, before migrating southward. Other birds using salt flat wetlands include red-necked phalarope (*Phalaropus lobatus*), western sandpiper (*Calidris mauri*), least sandpiper (*C. minutilla*), snowy plover (*Charadrius alexandrinus*), cinnamon teal (*Anas cyanoptera*), northern pintail, redhead, tundra swan (*Cygnus columbianus*), northern harrier, short-eared owl (*Asio flammeus*), and savannah sparrow (*Ammodramus savannarum*).

The abundance of food sources available in salt lakes is also vital to the success of breeding birds. From 44,000 to 65,000 California gulls (*Larus californicus*) breed on an island in Mono Lake.[1] The nation's largest colony of American white pelicans (*Pelecanus erythrorhynchos*) nests on an island in Pyramid Lake, Nevada. Other breeding birds of salt lake and salt flat wetlands include American avocet, black-necked stilt (*Himatopus mexicanus*), white-faced ibis (*Plegadis chihi*), spotted sandpiper (*Actitis macularia*), common snipe (*Gallinago gallinago*), and willet (Jehl 1994). Wetlands along California's Salton Sea are habitat for the federally endangered Yuma clapper rail (*Rallus longirostris obsoletus = R. longirostris yumanensis*).

Most inland salt marshes occur in the interior of the Great Basin and are not subjected to extensive development. Major threats to Great Basin wetlands are from road and utility construction. Salt flats in urbanizing areas are at greater risk due to impacts from encroaching urban development and associated disruption of drainage patterns (Dennis Peters, pers. comm.).

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Wetlands of Washington's Channeled Scablands

The Channeled Scablands area is on the east side of the Cascade Mountains in eastern Washington. This "rain-shadow" location creates a semi-desert environment that receives 7 to 10 inches of rain annually (U.S. Fish and Wildlife Service 1998a). The post-glacial Spokane Floods created channeled scablands and outwash lakes about 12,000 to 15,000 years ago. Today, only three creeks drain this area: Rock, Cow, and Crab Creeks. The rest of the area is pock-marked with isolated ponds, lakes, and cyclical wetlands (i.e., present during wet years and absent during drought years) forming a mosaic of wetlands across the landscape (see Lincoln County, Washington study area map in Section 4).

Although many of the wetlands occur in isolated depressions, they are often interconnected during high precipitation years, creating large wetland complexes of varied types (U.S. Fish and Wildlife Service 1998a). Common plants in these wetlands (from wettest to driest zones) include fennel-leaved pondweed (*Potamogeton pectinatus*), hornwort (*Ceratophyllum demersum*), common water milfoil (*Myriophyllum exalbescens*), broad-leaved cattail (*Typha latifolia*), hard-stemmed bulrush (*Scirpus acutus*), spikerush (*Eleocharis macrostachya*), common three-square (*Scirpus pungens = S. americanus*), Douglas' sedge (*Carex douglasi*), baltic rush, salt grass, Nevada bulrush (*Scirpus nevadensis*), and alkali cordgrass (*Spartina gracilis*). Some ponds contain the federally-threatened water howellia (*Howellia aquatilis*).

These wetlands are particularly valuable for waterfowl and other migratory birds, serving as staging areas during migration (early spring and fall) and breeding and brood-rearing habitat in summer. Migrants using these wetlands include tundra swan, trumpeter swan (*Cygnus buccinator*), Canada goose (*Branta canadensis*; several subspecies), Pacific white-fronted goose (*Anser albifrons frontalis*), lesser snow goose (*A. caerulescens caerulescens*), bufflehead (*Bucephala albeola*), common goldeneye (*B. clangula*), greater scaup (*Aythya marila*), hooded merganser (*Mergus cucullatus*), red-breasted merganser (*M. serrator*), and other waterfowl. Resident waterfowl include mallard, gadwall, northern pintail, green-winged teal, American wigeon, northern shoveler, wood duck (*Aix sponsa*), redhead, ruddy duck (*Oxyura jamaicensis*), western Canada goose (*Branta canadensis moffitti*), common merganser (*Mergus merganser*), coot (*Fulica americana*), and others. Nearly 100,000 individual birds may breed in these wetlands. The main breeding ducks are mallard, blue-winged teal, redhead, and ruddy duck. Other birds dependent on these wetlands are American white pelican, great blue heron (*Ardea herodius*), black-crowned night heron, common snipe, various shorebirds, avocet, sandhill crane, and bald eagle.

Scabland wetlands occur in rangeland and impacts from livestock may be significant. For example, cattle use ponds as wallows, which often interferes with waterfowl brood-rearing. Overgrazing of palustrine emergent wetlands also occurs. Some large ponds have been drained and converted to hayfields and pasture. The activity of carp has muddied many ponds, reducing their value to waterfowl. Carp removal has been initiated in some areas (U.S. Fish and Wildlife Service 1998a).

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Desert Springs and Their Wetlands

In the desert, springs arise where groundwater from large underground reserves discharges to the land surface via fractures in underlying rock strata (e.g., fault lines) or through porous materials (e.g., permeable carbonate rocks). Water discharging from springs may be quite old (8,000-12,000 years for Ash Meadow Springs in Nevada; Soltz and Naiman 1978). Isolated springs may harbor unique populations of endemic desert fishes (e.g., pupfish, *Cyprinodon* spp.), invertebrates, and plants. These springs may support wetlands of variable sizes from small fringes of vegetated wetlands to extensive bulrush and cattail marshes (*Figure 2-20*) (Minckley 1991). Some springs may be hot; often they are called "thermal springs."

Figure 2-20. A spring-fed desert wetland. (Source: Minckley 1991; photo by J.N. Rinne)

Isolated springs and seepage areas support small marshes (cienagas), oases (in California and Arizona), and other wetlands (*Figure 2-21*) (Bakker 1984; Bertoldi and Swain 1996). Saline wetlands form where water supply is persistent and drainage is limited. While some springs are isolated, others are headwaters of rivers like the Muddy River in Nevada.

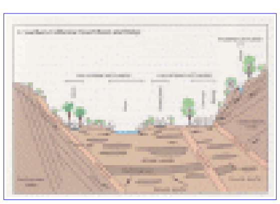

Figure 2-21. Generalized flow of water between different wetland types in Southern California. (Source: Bertoldi and Swain 1996)

Isolation has led to the development of unique populations of certain organisms. In the Death Valley region, there were more than 20 isolated pupfish populations in the late 1970s (Soltz and Naiman 1978).

These populations have been isolated for 12,000 to 20,000 years and are excellent examples of biological adaptation and evolution (i.e., speciation). Some of the species have become extinct, such as the Ash Meadow poolfish (*Empetrichthys merriami*) and Tecopa pupfish (*Cyprinodon nevadensis calidae*), while others are endangered, like the Owens pupfish (*C. radiosus*), Devils Hole pupfish (*C. diabolis*), and Warm Springs pupfish (*C. nevadensis pectoralis*) (Soltz and Naiman 1978; Sada 1990). Some desert springs and their adjacent wetlands also provide habitats for other threatened and endangered species or species of concern, such as Ash Meadows centaurium (*Centaurium namophilium*), Ash Meadows gumplant (*Grindelia fraxino-pratensis*), Ash Meadows montane vole (*Microtus montanus nevadensis*), Devils Hole warm springs riffle beetle (*Stenelmis calida calida*), and endemic springsnails.

Pumping of groundwater for agriculture in California and urban and energy development in Nevada pose the most serious threats to these species and the desert spring wetlands. Withdrawals may lower water levels and expose areas used for pupfish spawning as was occurring in Devils Hole, an isolated spring (the sole habitat for the Devils Hole pupfish) in the 1970s; this spring is now protected (Sada 1990). The Pahrump Ranch poolfish (*Empetrichthys latos pahrump*) was eliminated because its springs dried up due to groundwater withdrawals.

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Glaciated Kettle-hole Wetlands

The last continental glaciation created many depressions on the North American landscape (*Figure 2-22*). When the continental glacier receded (10,000-15,000 years ago), ice blocks of variable sizes were left on the land. Over time, these ice blocks melted forming lakes and ponds. Vegetated wetlands became established in the shallow water zone of these waterbodies. Gradually, many of these waterbodies became filled with plant remains and eventually became vegetated wetlands (aquatic beds to emergent wetlands to shrub bogs to forested wetlands). This process or chain of events leading to the formation of vegetated wetlands in former waterbodies is called "hydrarch succession." While many of these wetlands have outlets and are sources of streams, others are isolated. Their vegetation is quite variable ranging from aquatic beds to shrub and forested bogs (see discussion on Coastal Plain ponds).

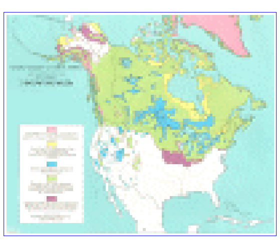

Figure 2-22. Map showing extent of last glaciation. (Source: U.S. Geological Survey 1970)

Kettle-hole bogs are wetlands found in glacial landscapes from northern New Jersey and New England to Michigan and Wisconsin to Washington and north to Canada and Alaska. In Alaska, isolated bogs are common in the southeast, south-central, and interior regions (*Figure 2-23*) (Hall et al. 1994). Kettle-hole wetlands are also common in parts of the northeastern and north-central U.S. (*Figure 2-24*). They are less common in the Pacific Northwest.

Figure 2-23. Alaskan kettle-hole bog.

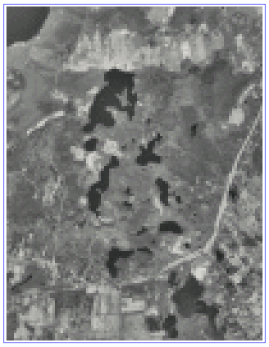

Figure 2-24. Aerial photo showing a series of kettle-hole ponds and associated wetlands in South Kingstown, Rhode Island.

Damman and French (1987) list three hydrological conditions under which bogs form in the northeastern United States. One of these conditions is an undrained basin, while the other two are drained basins. The former type is an isolated wetland type that derives its water mainly from precipitation. Vegetation may be dominated by species such as leatherleaf (*Chamaedaphne calyculata*), highbush blueberry (*Vaccinium corymbosum*), and bluejoint (*Calamagrostis canadensis*) in more southern locations. They suggest that this type is uncommon further north. More northerly kettle-hole bogs are dominated by typical bog vegetation including ericaceous shrubs (especially leatherleaf), evergreen trees such as black spruce (*Picea mariana*), balsam fir (*Abies balsamea*), white pine (*Pinus strobus*), and pitch pine (*P. rigida*), and the deciduous conifer, larch (*Larix laricina*) (*Figure 2-25*). These bogs occur on Cape Cod, in the New York Adirondacks, and elsewhere in New England (Johnson 1985).

Figure 2-25. Northeast kettle-hole bog. (R. Tiner photo)

Bogs in several northeastern States are at the southern limits for many boreal plants including hare's tail (*Eriophorum spissum*), dragon's mouth (*Arethusa bulbosa*), bog rosemary (*Andromeda glaucophyllum*), and Labrador tea (*Ledum groenlandicum*). Kettle-hole bogs and similar mountain bogs harboring these species are particularly important sites for the conservation of biodiversity.

Threats to bogs include peat mining, drainage, and conversion to open waterbodies (e.g., recreational lakes) or to commercial cranberry bogs. The quality of remaining kettle-hole bogs may be further jeopardized by development of adjacent uplands. Introduction of nutrients from lawn runoff, for example, could change the plant composition of nutrient-poor bogs over time.

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Delmarva Potholes

In the center of the Delmarva Peninsula, thousands of depressional, pothole-like wetlands called "Delmarva bays" or "Delmarva potholes" pockmark broad drainage divides or interfluves (*Figure 2-26*). Although these wetlands occur throughout the Peninsula, they are most abundant in a 20-mile swath along the Maryland-Delaware border from the headwaters of the Sassafras River to the Nanticoke River. They are particularly abundant near the towns of Sudlersville and Millington, Maryland and Clayton, Kenton, and Hartly, Delaware.

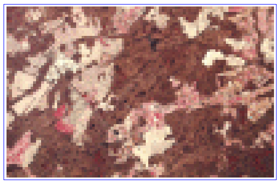

Figure 2-26. Aerial view of pothole wetlands (dark depressional features) on the Upper Delmarva Peninsula.

Vegetation is variable from open glades (e.g., sedge marshes) to buttonbush shrub swamps to forested wetlands (*Figure 2-27*). Potholes support 68 percent of the amphibians of the Delmarva Peninsula and 61 rare vascular plants including the federally endangered Canby's dropwort (*Oxypolis canbyi*) (Sipple and Klockner 1984; Sipple 1999).

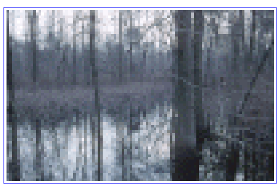

Figure 2-27. Delmarva pothole wetland in spring. Flooded shrubs are buttonbush (Cephalanthus occidentalis). (R. Tiner photo)

Given their abundance, Delmarva potholes undoubtedly aid in temporary storage of surface water and thereby help reduce local flooding. During the wet season, they receive groundwater discharge and precipitation and during the dry season, flow can be reversed, with these wetlands recharging regional groundwater supplies (Phillips and Shedlock 1993). This underground water may eventually discharge into Coastal Plain streams and contribute to base flows (*Figure 2-28*).

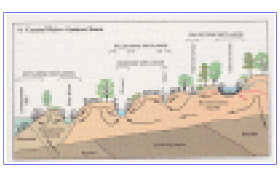

Figure 2-28. Generalized flow of water between Coastal Plain wetlands, showing subsurface hydrologic connections between Delmarva bay (pothole) wetlands and other wetlands and streams. (Source: Hayes 1996)

Threats to these wetlands are from drainage usually associated with agriculture or silviculture. Some wetlands are vulnerable to development, including houses and commercial facilities.

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Coastal Plain Ponds

Along the Atlantic-Gulf Coastal Plain, isolated ponds have formed in depressions where groundwater flows to the land surface and rainwater collects. In glacial areas (e.g., New England and Long Island, New York), these ponds developed in kettle-holes or in shallow depressions in outwash plains. These isolated ponds may be hydrologically linked by groundwater, while others may be connected to small streams (Reschke 1990). In non-glaciated areas of the Coastal Plain (from New Jersey south), Coastal Plain ponds formed on broad flats. Some examples of Coastal Plain ponds are Calverton Ponds and Tarkill Pond on Long Island (New York), Clermont Bog and Bennett Bogs on Cape May (New Jersey) (U.S. Fish and Wildlife Service 1997), and ponds on barrier islands of the Florida Panhandle, such as St. Vincent, St. George, and Dog Islands (Wolfe et al. 1988).

Water levels fluctuate seasonally and annually, inducing significant changes in vegetation (U.S. Fish and Wildlife Service 1997). Periodic high water levels eliminate woody seedlings that may have colonized these ponds during drawdowns. Vegetation patterns are similar to prairie pothole wetlands, with concentric bands of vegetation following different water regimes (permanently flooded/intermittently exposed to semipermanently flooded to seasonally flooded zones – from wettest to driest).

The fluctuating water levels and isolated nature of coastal ponds have resulted in each pond hosting some unique species as well as possessing many common species. These ponds may be characterized by aquatic bed species such as water-shield (*Brasenia schreberi*), white water lily (*Nymphaea odorata*), water milfoil (*Myriophyllum humile*), naiad (*Najas flexilis*), waterweed (*Elodea* spp.), and pondweeds, and by shallow-water emergent species like bayonet rush (*Juncus militaris*) and spikerush (*Eleocharis robbinsii*) (Reschke 1990). Rare species may be associated with some ponds. For example, in the New York Bight region, four globally rare species - quill-leaf arrowhead (*Sagittaria teres*), pine barren bellwort (*Uvularia puberula* var. *nitida*), rose tickseed (*Coreopsis rosea*), and creeping St. John's-wort (*Hypericum adpressum*) - may occur in these ponds (Zaremba and Lamont 1993; U.S. Fish and Wildlife Service 1997). Rare dragonflies, damselflies, butterflies, and moths may also be found in these wetlands: lateral bluet (*Enallagma laterale*), painted bluet (*E. pictum*), Barrens blue damselfly (*E. recurvatum*), pink sallow (*Psectraglaea carnosa*), violet dart (*Euxoa violaris*), and chain fern borer moth (*Papaipema stenocelis*). Vertebrates of special concern living in these ponds include the Pine Barrens treefrog (*Hyla andersonii*), Cope's gray treefrog (*H. chrysoscelis*), eastern spadefoot (*Scaphiopus holbrookii holbrookii*), spotted salamander (*Ambystoma maculatum*), tiger salamander, and spotted turtle (*Clemmys guttata*). Plant species of concern found in Coastal Plain ponds include red-rooted flatsedge (*Cyperus erythrorhizos*), several spikerushes (*Eleocharis brittonii*, *E. equisetoides*, *E. melanocarpa*, *E. tricostata*, and *E. tuberculosa*), slender blue flag (*Iris prismatica*), stargrass (*Aletris farinosa*), Pine Barrens boneset (*Eupatorium resinosum*), several bladderworts (*Utricularia biflora*, *U. fibrosa*, *U. juncea*, *U. olivacea*, and *U. radiata*), awned meadowbeauty (*Rhexia aristosa*), and Pine Barrens gerardia (*Agalinis virgata*). Barrier island coastal ponds on the Florida Panhandle may be fringed with persimmon (*Diospyros virginiana*), while similar ponds on the mainland are ringed with titi (*Cyrilla racemiflora*) (Wolfe et al. 1988). The former ponds are especially important because they often provide the only source of freshwater on barrier islands for local wildlife and migratory birds.

Periodic drying out of coastal ponds eliminates fish from many ponds, thereby making them excellent breeding areas for amphibians. The regionally rare tiger salamander is one of several species (which include many vernal pool-breeding amphibians) using coastal ponds in the Northeast for reproduction (U.S. Fish and Wildlife Service 1997). Coastal ponds in Florida may contain fish, but still serve as breeding grounds for the southern toad (*Bufo terrestris*), southern leopard frog (*Rana utricularia*), and pig frog (*R. grylio*) (Wolfe et al. 1988).

Coastal development poses significant threats to these ponds. Disturbances that may be adversely impacting the remaining ponds include waste dumping, all-terrain vehicle driving on pond shores, water withdrawals, and water pollution from adjacent development, such as lawn, agricultural field, and road runoff (U.S. Fish and Wildlife Service 1997).

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Carolina Bay Wetlands

Somewhat egg-shaped (elliptical) basins called Carolina bays have formed on the Atlantic Coastal Plain from southeastern Virginia to Florida (*Figure 2-29*). They are most abundant in mid-coastal South Carolina and southeastern North Carolina. Carolina bays vary greatly in size, ranging from less than 150 feet long to more than 5 miles in length (Sharitz and Gibbons 1982). These bays commonly have a northwest to southeast orientation, with a conspicuous sandy rim (*Figure 2-30*). Most of the Carolina bays are hydrologically isolated nutrient-poor (oligotrophic) ponds or "naturally isolated habitats" that derive water mainly from rainfall (Sharitz and Gresham 1998). They are depressional wetlands often surrounded by flatwood wetlands and upland forests in undisturbed areas, or by farmland and urban land in developed areas.

Figure 2-29. Distribution of Carolina bay wetlands (larger than 800 feet long). The greatest concentration of bays are located within the dashed area. (Source: Sharitz and Gibbons 1982)

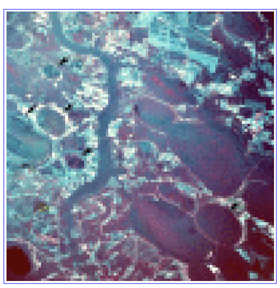

Figure 2-30. Aerial photo showing several Carolina bay wetlands in Bladen County, North Carolina. (Note: Arrows mark some bays for reference, but many others can be seen.)

Carolina bays are forested or shrub-dominated palustrine wetlands. Predominant trees are pond pine (*Pinus serotina*), loblolly bay (*Gordonia lasianthus*), sweet bay (*Magnolia virginiana*), red bay (*Persea borbonia*), swamp bay (*P. palustris*), pond cypress (*Taxodium distichum* var. *nutans*), and swamp black gum (*Nyssa sylvatica* var. *biflora*). Dominant shrubs include ericaeous species such as fetterbush (*Lyonia lucida*), leucothoe (*Leucothoe* spp.), zenobia (*Zenobia pulverulenta*), and highbush blueberry, plus titi, sweet pepperbush (*Clethra alnifolia*), and hollies or gallberries (*Ilex* spp.) (Sharitz and Gibbons 1982). Their vegetation is quite similar to that of neighboring pocosins.

Many Carolina bays include seasonal ponds (e.g., vernal pools). Like other vernal pools, their vegetation changes with the seasons. During dry periods, these ponds may be dominated by maidencane (*Panicum* *hemitomon*), little bluestem (*Schizachyrium scoparium* = *Andropogon scoparius*), and club-head cutgrass (*Leersia hexandra*), while aquatic plants (e.g., bladderworts, *Utricularia* spp.) are characteristic of the wet phase. Cypress savannas occur in Carolina bays with clay bottoms. Many rare species are associated with these savannas (Sharitz and Gresham 1998).

Amphibians are particularly abundant in Carolina bays. Thousands of amphibians were counted in a 2.5-acre Carolina Bay called "Sun Bay" at the Savannah River Plant (Georgia) in 1979: 500 ornate chorus frogs (*Pseudacris ornata*), 5,000 southern leopard frogs, and 500 mole salamanders (*Ambystoma talpoideum*) (Sharitz and Gibbons 1982). Over a two-year period, researchers captured more than 72,000 amphibians including nine species of salamanders and 16 species of frogs (Gibbons and Semlitsch 1981 as reported by Sharitz and Gresham 1998). Other species common in these wetlands included the southern toad, spadefoot toad, red-spotted newt (*Notophthalmus viridescens viridescens*), spring peeper (*Hyla crucifer crucifer*), and green frog (*Rana clamitans*).

Carolina bays, especially the larger ones, are known to provide crucial aquatic habitat during droughts. At these times, they become refuges for turtles and other animals. In areas of urban and agricultural development, highest densities of amphibians, reptiles, and small mammals may be associated with Carolina bay wetlands (Sharitz and Gibbons 1982). The federally endangered wood stork (*Mycteria americana*) feeds heavily in Carolina bays (Sharitz and Gresham 1998).

Many Carolina bay wetlands have been drained for crop production, mainly for corn and soybeans (Sharitz and Gresham 1998). In South Carolina, 71 percent of its Carolina bays have been altered by agriculture, while about one-third of the original bay wetlands have been disturbed by timber harvest (Bennett and Nelson 1991).

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Pocosin Wetlands

Pocosins (reportedly an Algonquin Indian term for "swamp-on-a-hill;" Tooker 1899) are southern bogs with organic soils located in interfluves between major river systems (*Figure 2-31*). They receive all or most of their water from precipitation (Sharitz and Gresham 1998). Their vegetation consists of a mixture of evergreen trees, such as pond pine, loblolly pine (*Pinus taeda*), red bay, and sweet bay, and broad-leaved evergreen shrubs including titi, zenobia, fetterbush, wax myrtle (*Myrica cerifera*), leatherleaf, and gallberries (*Ilex coriacea* and *I. glabra*) (Kologiski 1977; Richardson et al. 1981).

Figure 2-31. Depressional pocosin wetland. (R. Tiner photo)

Pocosins occur along the Atlantic Coastal Plain from southern Virginia to Florida. They are most abundant in North Carolina where they represent about half of the State’s wetlands (Richardson et al. 1981). About 70 percent of the Nation’s pocosins wetlands are located in North Carolina (*Figure 2-32*).

Figure 2-32. Distribution of pocosin wetlands in North Carolina. Includes both isolated and non-isolated pocosins. (Source: Sharitz and Gibbons 1982)

Specific definitions of pocosins may vary. For example, a forester's definition might include pine-dominated flatwoods of very wet sites, while a hydrologist's definition might restrict the term to shrub bogs on broad, undrained interstream areas (Sharitz and Gibbons 1982). In a textbook on pocosins, Richardson and others (1981) define the typical pocosin ecosystem, in part, as "… waterlogged, acid, nutrient poor, sandy or peaty soils located on broad, flat topographic plateaus, usually removed from large streams and subject to periodic burning." While many pocosins are contiguous with coastal and other non-isolated wetlands, many others may be located away from streams and drainageways. In their classification of pocosins, Weakley and Schafale (1991) identify at least one isolated type – the "small depression pocosin."[2] Other pocosins may also be isolated as they occur in swales (e.g., in the Sandhills) and in seasonally saturated interfluves.

One of the major functions of pocosins is to temporarily hold water that would otherwise run off the land more quickly into adjacent estuaries. This water is then slowly released to the estuaries. This pocosin function benefits the estuaries by giving them more time to assimilate the fresh water without rapid and drastic fluctuations in water quality (Daniel 1981). Yet when drained and connected to a coastal stream, the value of this buffering capacity is lost as ditched pocosins contribute more water (and possibly enriched water) to stream flow. Landscape-level ditching can, therefore, have significant detrimental effects on coastal waters.

Rare animals may live in pocosins. Examples include Hessel's hairstreak butterfly (*Mitoura hesseli*) and the Pine Barrens tree frog (Sharitz and Gresham 1998). The federally endangered red-cockaded woodpecker (*Picoides borealis*) inhabits mature pond pines of pocosins, but is more abundant in mature pine flatwoods. Wildlife of tall or forested pocosins is typical of Coastal Plain forests and include species such as white-tailed deer, gray fox (*Urocyon cineroargenteus*), raccoon, opossum (*Didelphis virginiana*), short-tailed shrew (*Blarina brevicauda*), cotton mouse (*Peromyscus gossypinus*), meadow vole (*Microtus pennsylvanicus*), pileated woodpecker (*Dryocopus pileatus*), Acadian flycatcher (*Empidonax virescens*), vireos (*Vireo flavifrons* and *V. olivaceus*), prothonotary warber (*Protonotaria citrea*), and worm-eating warbler (*Helmitheros vermivorus*). In low shrubby pocosins, birds like common yellowthroat (*Geothlypis trichas*), eastern wood-pewee (*Contopus virens*), and eastern towhee (*Piplio erythrophthalmus*) may be abundant.

Forestry and agriculture have had major impacts on pocosins. Of the 2.5 million acres of pocosins that once existed in North Carolina, roughly one million remained in natural condition by 1980 (Richardson et al. 1981). At least 33 percent of the original acreage has been converted to agriculture or managed forests (i.e., pine plantations), while 36 percent has been partially drained, cleared, or planned for development. Since the 1980s, more acreage has been converted to managed forests as nearly half of the pocosins are owned by forest companies.

Since drainage increases timber productivity, some pocosins that were naturally isolated from other wetlands and waters have been ditched and now are contributing sources for stream flow. Timber yields may also be increased by fertilization; so planted pines on former pocosins are fertilized (Sharitz and Gresham 1998). Former pocosins are cropped for soybeans and corn, but cultivation of remaining pocosins may have decreased recently due to removal of farm subsidies. Agricultural conversion of pocosins has some significant consequences: 1) lowered salinity in adjacent estuaries, particularly during heavy rainfall periods due to introduction of more fresh water (cropland drainage), 2) increased peak flow rates (up to 3 or 4 times that of undrained areas) and decreased flow durations, 3) increased turbidity (ditches had 4 to 40 times greater turbidity than that of natural streams in pocosin areas, depending on development phase – less at post-development), and 4) increased concentration of phosphate, nitrate, and ammonia in streams and adjacent estuaries (Sharitz and Gresham 1998). From this information, it is evident that human use of pocosins has adversely impacted water quality of adjacent streams and estuaries. Drainage of pocosins and its effects on estuarine salinity (decreased salinity) may be having a negative impact on North Carolina's brown shrimp (Street and McClees 1981).

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Cypress Domes[3]

Cypress swamps found in nearly circular isolated depressions are called cypress domes due to the appearance of the trees which are tallest in the center of the pond. Cypress domes are usually small in size, usually 2.5-25 acres and often form an ecological mosaic within the pine flatwoods (Mitsch and Gosselink 2000). They are abundant in Florida and southern Georgia.

Cypress domes receive water from precipitation, groundwater flow, and sometimes runoff. Most of the water arrives with summer rains in southern Florida or with winter and summer rains in northern Florida and southern Georgia (Ewel 1998).

Pond cypress and swamp black gum are the dominant trees of cypress domes (Mitsch and Gosselink 2000). Other trees include slash pine (*Pinus elliottii*), swamp bay, and sweet bay. The shrub layer may be comprised of fetterbush, wax myrtle, red maple (*Acer rubrum*), buttonbush (*Cephalanthus occidentalis*), and Virginia willow (*Itea virginica*). Common herbs include Virginia chain fern (*Woodwardia virginica*), lizard's tail (*Saururus cernuus*), and red root (*Lachnanthes carolinana*). Slash pine co-dominates with pond cypress in partly drained domes in north-central Florida (Mitsch and Ewel 1979).

These wetlands are important for maintaining regional biodiversity. In particular, many domes are significant amphibian-breeding areas, much like their vernal pool counterparts. Species such as the carpenter frog (*Rana virgatipes*) may reproduce in these isolated swamps (McDiarmid 1978, as reported in Ewel 1990). Also given that cypress domes hold water for long periods, they help prevent flooding of local areas and aid in groundwater recharge. Drainage of domes could lead to increased flooding (Ewel 1998).

Although timber management has been performed in cypress dome-pine flatwood ecosystems for hundreds of years, the most detrimental effect people have on this ecosystem is development, including conversion of natural habitat to residential subdivisions, commercial sites, and golf courses. Virtually all cypress ponds in northern Florida have been cut over, but many have regenerated (Ewel 1990). Drainage of cypress domes causes organic soils (peats) to oxidize and the land to subside. A drying out of these swamps increases their susceptibility to destruction by fire. Other species may then colonize these sites.

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Sinkhole Wetlands

Isolated depressional wetlands are common features in karst landscapes. Major karst regions are shown on the map in *Figure 2-33*. Dissolution of underlying limestone causes a slumping of the land surface, thereby creating distinct basins which may or may not be connected to surface water or ground water. Wetlands that form in depressions in karst topography are commonly referred to as sinkhole wetlands. Lost streams (e.g., streams that disappear underground) and underground caverns may be common in karst areas.

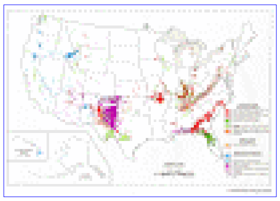

Figure 2-33. Location of major karst regions in the United States. (Source: U.S. Geological Survey 1970)

Some sinkhole wetlands receive groundwater discharge from underlying limestone deposits (e.g., in karst valleys). Others simply occur in basins formed by the dissolution of underlying limestone (*Figure 2-34*). Many cypress domes formed in such basins (see previous discussion).

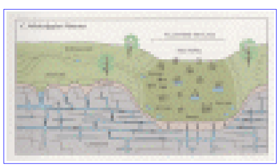

Figure 2-34. Generalized water flow patterns between wetlands in a karst region. (Source: Haag and Taylor 1996)

Karst lakes and associated marginal wetlands may also be geographically isolated features on this type of landscape. Many areas in Florida are pock-marked with isolated depressional wetlands and lakes due to the abundance of limestone on the peninsula (*Figure 2-35*). Some lakes drain into streams connecting to larger ones flowing to the sea, while many do not.

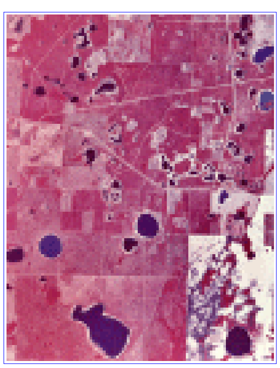

Figure 2-35. Aerial photo showing karst lakes and wetlands in northern Florida.

The vegetation of sinkhole wetlands varies geographically and in response to different hydrologies and other factors. The wetter ones may be ponds and marshes with cattail (*Typha* sp.), water plantain, water parsnip (*Sium suave*), St. John's-worts (*Hypericum* spp.), sedges (*Carex* spp.), bulrushes, beak-rushes (*Rhynchospora* spp.), spikerushes (*Eleocharis* spp.), manna-grasses (*Glyceria* spp.), rice cut-grass

(*Leersia oryzoides*), and bluejoint, and two hydrophytic shrubs - buttonbush and swamp rose (*Rosa palustris*). Other shrubs and trees may colonize drier sites: green ash (*Fraxinus pennsylvanica*) and willows (*Salix* spp.) in New York and red maple, black birch (*Betula lenta*), persimmon, pin oak (*Quercus palustris*), black gum (*Nyssa sylvatica*), green ash, black willow (*Salix nigra*), and common winterberry (*Ilex verticillata*) in western Maryland and West Virginia (Reschke 1990; Bartgis 1992). In western Maryland, Bartgis (1992) found 56 species in sinkhole ponds including the federally endangered northeastern (barbed-bristle) bulrush (*Scirpus ancistrochaetus*). He noted that these ponds formed on sandstone and are not in direct contact with the underlying limestone deposit. Lentz and Dunson (1999) reported that "geographically isolated" ponds in central Pennsylvania supported northeastern bulrush. The federally-endangered swamp pink (*Helonias bullata*) and federally-threatened Virginia sneezeweed (*Helenium virginicum*) have been found in sinkhole wetlands in western Virginia (Buhlmann et al. 1999). Pond cypress is common in sinkhole ponds in Florida. Rare plants, such as smooth-barked St. John's-wort (*Hypericum lissophloeus*) and karst pond xyris (*Xyris longisepala*), may be found along the shores of some of Florida's karst lakes (Wolfe et al. 1988).

Sinkhole ponds may be productive amphibian breeding grounds. For example, a one-half acre pond in Alabama had more than 1,500 adult amphibians: 527 mole salamanders, 127 tiger salamanders, 269 gopher frogs (*Rana capito*), 241 leopard frogs, and 191 ornate chorus frogs (*Pseudacris ornata*) (Bailey 1999). Marbled salamander (*Ambystoma opacum*), spotted salamander (*A. maculatum*), red-spotted newt (*Notophthalmus viridescens*), wood frog (*Rana sylvatica*), spring peeper (*Pseudacris crucifer*), green frog (*Rana clamitans*), and cricket frog (*Acris crepitans*) breed in sinkhole ponds in the Virginia's Shenandoah Valley (Buhlmann et al. 1999). Ponds with peat moss covering the bottom may support the four-toed salamander (*Hemidactylium scutatum*) in this area, while spring-fed permanent sinkhole ponds may be breeding grounds for the spring salamander (*Gyrinophilus porphyriticus*). Bullfrogs (*Rana catesbeiana*), pickerel frogs (*R. palustris*), spotted turtles (*Clemmys guttata*), snapping turtles (*Chelydra serpentina*), painted turtles (*Chrysemys picta*), northern water snakes (*Nerodia sipedon*), and many invertebrates (e.g., dragonflies, water beetles, and fairy shrimp) also frequent in these wetlands.

There is an entire world of organisms beneath the earth in underground caves. Specially-adapted cave animals (troglobites) such as blind salamanders (several genera of the family Plethodontidae) live in the subterranean pools and streams.

Some threats to these ecosystems are: 1) water pollution from lawn, agricultural field, and road runoff or from direct discharge of wastes, 2) groundwater withdrawals, 3) impoundment of local streams, 4) timber harvest of adjacent forests (e.g., habitat for the pond-breeding amphibians), 5) fish stocking of sinkhole ponds, and 6) agricultural and residential development (Wolfe et al. 1988; Buhlmann et al. 1999). Activities that negatively impact local water tables may pose the most insidious threat.

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Former Floodplain Wetlands

Major shifts in river courses over time have left some wetlands isolated on former floodplains. For example, the Mississippi River has changed its course many times over thousands of years. In addition to the natural processes affecting floodplains, humans have constructed levees to prevent flooding, so that such lands could be used for agriculture, development, or other purposes. Consequently, many wetlands that were flooded seasonally during high water periods are now separated from the river and not overflowed during flood stages.

Former floodplain wetlands are very common in Alaska. Rivers such as the Yukon and Kuskokwim have migrated back and forth in broad valleys over the course of thousands of years. As a result of these shifts, many oxbow channels and meander scars are now isolated - sometimes miles away from the active river channel. In some areas, the historic floodplain of the Yukon River is over 15 miles wide (Jon Hall, pers. comm.). An outstanding example illustrating these types of isolated former floodplain wetlands can be seen along Alaska's Porcupine River (*Figures 2-36 and 2-37*). These wetlands and waterbodies are havens for waterfowl. Isolated wetlands and lakes in the Yukon Flats are among Alaska's most important waterfowl nesting areas, with an average breeding population over one million ducks (Lensink and Derksen 1986).

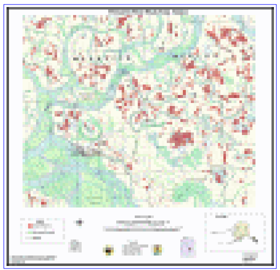

Figure 2-36. Map showing isolated wetlands that were former floodplain wetlands along Alaska's Porcupine River. Red areas are isolated wetlands.

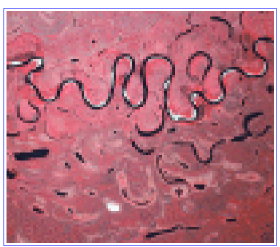

Figure 2-37. Aerial photo showing mostly former floodplain wetlands (e.g., meander scars and oxbows) along Alaska's Porcupine River.

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West Coast Vernal Pools[4]

West Coast vernal pools are cyclical wetlands that exhibit a marked seasonal shift in herbaceous vegetation from hydrophytic species to drier-site species (Tiner 1999). Their vegetation may change drastically within years and between years in response to changing environmental conditions (e.g., precipitation patterns).

West Coast vernal pools occur from southern Oregon to northern Baja Mexico. Many vernal pools and associated seasonally flooded wetlands form a complex of depressional wetland and swale features that are hydrologically linked during wet periods (*Figure 2-38*). They are typically filled with water by winter rains, characteristic of the region's Mediterranean climate. They may be flooded for weeks or months in some years (Baskin 1994). They achieve their greatest size in extremely wet years when individual depressions coalesce to form enormous complexes (Zedler 1987). When the pools form such complexes, they may drain into intermittent streams, ditches, or perennial streams.

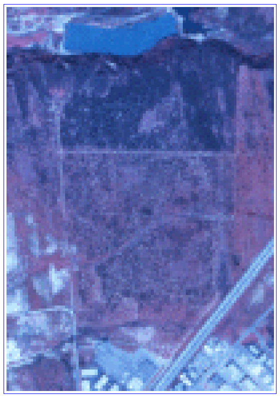

Figure 2-38. Aerial photo showing Southern California vernal pool complex (Miramar Naval Air Station, San Diego). Note white areas are tops of mounds and darker areas between them are interconnected vernal pool swales.

The isolated nature and unpredictable flooding promote endemism in vernal pool plants and animals thereby creating unique flora and fauna. This makes West Coast vernal pools vital sites for the conservation of biodiversity (Baskin 1994). Numerous federally-listed threatened and endangered species as well as state-endangered and rare species are among the characteristic flora of West Coast vernal pools. Some of the federally endangered species are San Diego mesa mint (*Pogogyne abramsii*), Otay mesa mint (*P. nudiuscula*), several species of Orcutt grasses (*Orcuttia* spp.), Solano grass (*Tuctoria mucronata*), San Diego button-celery (*Eryngium aristulatum* var. *parishii*), and Burke's goldfields (*Lasthenia burkei*). All are amphibious species that are found in the aquatic phase and the drying phase of vernal pool ecosystem system development (Zedler 1987) (*Figure 2-39*). Vernal pools also possess endangered and rare invertebrates such as the endangered delta green ground beetle (*Elaphrus viridis*) (Morris 1988). Due to endemism, numerous vernal pool regions in California have been designated in recognition of their unique flora.

Figure 2-39. Jepson Prairie, a large vernal pool, near Sacramento, with goldfields in bloom. (R. Tiner photo)

Historically, vernal pool areas were used for grazing and agriculture. Grazing may have relatively little adverse effect on these ecosystems in contrast to the destruction of vernal pools brought about by tillage and planting crops (Zedler 1987). More recently, population growth in California and corresponding urbanization have exacted a great toll on these ecosystems, while agriculture continues to play a major role in their demise (Keeler-Wolf et al. 1998). Many of these ecosystems have been destroyed, with the largest remaining complexes often found in the open lands surrounding military airports and facilities (e.g., Miramar Naval Air Station and Camp Pendleton). See Keeler-Wolf and others (1998), Witham and others (1998), and Jain (1976) for more information on California vernal pools.[5]

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Woodland Vernal Pools

Virtually every forested region possesses examples of woodland vernal pools. The variety of vernal pool wetlands is considerable due to differences in climate, geology, hydrology, and other factors. Vegetation colonizing such sites and the aquatic species living there vary regionally. There is no single reference describing this variability. Although the following discussion focuses on these wetlands in the northeastern United States, the same principles apply to all woodland vernal pools (regarding their importance to amphibians), despite regional differences in species composition.

Vernal pools are temporary or ephemeral ponds that are inundated during the wet season, usually from late fall to mid- or late-summer in the Northeast (*Figure 2-40*). They range in size from a hundred square feet or less to several acres. Vernal pools may dry out every year or less often. The fluctuating water levels preclude the establishment of fish populations. The aquatic habitat and lack of predatory fish make these pools desirable and extremely productive sites for amphibian reproduction. Species dependent on vernal pool for breeding include marbled salamander (*Ambystoma opacum*), spotted salamander, Jefferson salamander (*A. jeffersonianum*), blue-spotted salamander (*A. laterale*), wood frog, and gray treefrog (*Hyla versicolor*). Other aquatic species that also reproduce in these ponds include spring peeper, American toad, green frog, and red-spotted newt. Spotted turtles frequent vernal pools after winter hibernation to obtain an easy source of food such as amphibian eggs and aquatic invertebrates (Kenney and Burne 2000).

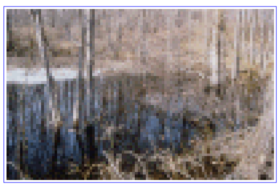

Figure 2-40. Massachusetts woodland vernal pool. (R. Tiner photo)

While many amphibians use vernal pools for reproduction and growth of larvae, the adults of most species spend the rest of their lives in the surrounding woodland either as burrowing vertebrates or arboreal species. This makes the vernal pools plus the surrounding forest vital habitats for their survival. In addition, each pool is often used by multiple species for breeding (e.g., marbled salamanders in fall, spotted salamanders and wood frogs in early spring, followed by spring peepers and gray treefrogs). Thousands of larvae may be produced from a single pool. For example, in a one-acre pond in eastern Massachusetts, nearly 14,000 adult amphibians were counted and a two-acre pond in western Massachusetts had 5,000 to 10,000 spotted salamanders and several times as many wood frogs and spring peepers (Tiner 1998). Vernal pools and their adjacent woodlands are vitally important for the conservation of biodiversity. In Massachusetts, the intricate fairy shrimp (*Eubranchipus intricatus*) is known to occur in only 10 pools, and the eastern spadefoot has been reported at only 40 sites statewide (Kenney and Burne 2000).

Since vernal pools are small and surrounded by upland, they are often destroyed by development (e.g., construction of houses, shopping malls, and commercial facilities). Pools located along roads may be used as stormwater detention basins. Others receive drainage from agricultural fields or residential lawns that degrade pool water quality. Mosquito spraying of pools and pool drainage also jeopardize vernal pool wildlife. Groundwater withdrawals for private and public wells may drawdown vernal pool waters prematurely and not allow for complete development of amphibian larvae (Kenney and Burne 2000).

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Coastal Zone Dune Swale and Deflation Plain Wetlands

Sandy beaches and sand dunes have formed along much of the U.S. coastline (e.g., Atlantic Ocean, Gulf of Mexico, Pacific Ocean, and the Great Lakes). Aeolian processes have created a rolling terrain of ridges and relatively narrow swales and in some cases, broader deflation plains. The ridge-and-swale complex forms dunefields of variable dimensions. The low depressions are often called dune swales and many are wetlands. They occur as a series of low valleys between dune ridges or may be more randomly dispersed on the land (*Figure 2-41*).[6] These wetlands intersect the local groundwater tables and support a variety of hydrophytic plants.

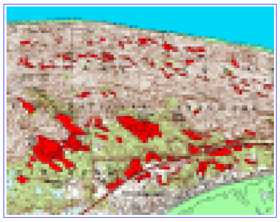

Figure 2-41. Map showing dune swale wetlands near the tip of Cape Cod, Massachusetts (Provincetown). Red areas designate isolated wetlands among the sand dunes.

Although most dune swales are isolated landforms surrounded by dry sand dunes, some are hydrologically connected to adjacent waters. The closer the swale is to the nearby waterbody, the higher the likelihood for a hydrologic linkage. For example, dune swales along the shores of the Great Lakes have water tables controlled by lake levels, while those further away are wet due to groundwater seepage (Albert 2000).

Vegetation in the swales and deflation plains is variable, depending on the hydrology and geography. The wettest swales are ponds and marshes.[7] They are rich aquatic habitats supporting numerous aquatic invertebrates and vertebrates alike. An abundance of aquatic insects in spring provides food for migratory birds. The drier swales are wet meadows, shrub swamps, and forested wetlands. Dune swale wetlands are colonized by many wide-ranging hydrophytic plants. Along the Atlantic Coast, wet dune swales may be colonized by common three-square, Canada rush (*Juncus canadensis*), marsh fern (*Thelypteris thelypteroides*), wool-grass (*Scirpus cyperinus*), cranberries (*Vaccinium macrocarpon* and *V. oxycoccos*), salt hay cordgrass (*Spartina patens*), northern bayberry (*Myrica pensylvanica*), red chokeberry (*Aronia arbutifolia*), and wax myrtle (Tiner and Burke 1995; Ralph Tiner, personal observations). Albert (2000) reported buttonbush, willows, alders (*Alnus* spp.), northern white cedar (*Thuja occidentalis*), and larch in similar habitats along the Great Lakes. Bogs, with bog laurel (*Kalmia polifolia*), cranberries, leatherleaf, and Labrador tea predominating, may form in the wet swales along Lake Superior (Albert 2000). For wet dune swales and broad deflation plains in the Pacific Northwest, several distinct communities have been reported (Wiedemann 1984). Dominant species in these communities included sickle-leaved rush (*Juncus falcatus*), springbank clover (*Trifolium wormskjoldii*), slough sedge (*Carex obnupta*), broad-leaved cattail, mountain Labrador-tea (*Ledum glandulosum*), Douglas' spiraea (*Spiraea douglasii*), hooker willow (*Salix hookeriana*), Pacific wax myrtle (*Myrica californica*), lodgepole pine (*Pinus contorta*), and western red cedar (*Thuja plicata*). Where deposition of wind-blown sand is heavy and dune migration is active, dune swale wetlands may become uplands when covered by thick sand deposits.

Dune marshes and ponds are vital habitats for many species (Wiedemann 1984). Dune marshes along the Oregon coast are vital habitat for 61 bird species, 17 mammals, 5 amphibians, and two reptiles (Akins 1973). They also provide winter habitat for 49 species of waterfowl, shorebirds, and wading birds. Fowler's toad (*Bufo woodhousei fowleri*) breeds in wet dune swales along the Northeast coast (Kenney and Burne 2000).

Some unique species are associated with wet dune swales. Plants found nowhere else in some States (e.g., Indiana) are found in these locations (Hiebert et al. 1986). Houghton's goldenrod (*Solidago houghtonii*), a federally threatened species, occurs in dune swales along Lakes Huron and Michigan, while State-rare species such as Lapland buttercup (*Ranunculus lapponicus*) and round-leaved orchid (*Amerorchis rotundifolia*) may be found in Michigan's interdunal forested swales (Albert 2000). The St. Andrew beach mouse (*Peromyscus polionotus peninsularis*), a federally endangered species, may frequent wet dune swales of Florida's Panhandle, although the swales are not the species' primary habitat (U.S. Fish and Wildlife Service 1998b). Blanchard's cricket frog (rare in Michigan) lives in shallow interdunal ponds. Other rare dune swale plants include butterwort (*Pinguicula vulgaris*) in Michigan (Albert 2000) and horned bladderwort (*Utricularia cornuta*) and arrow-grass (*Triglochin maritimum*) in Indiana (Doug Wilcox, pers. comm.; Hiebert et al. 1986).

Threats to dune swale wetlands include residential housing, golf courses, and resort development. Invasion by introduced species may pose problems in some areas (e.g., Michigan; Albert 2000).

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Great Lakes Alvar Wetlands

Alvar wetlands are a rare and unfamiliar wetland type. Alvars include both wetlands and terrestrial habitats that occur in open landscapes on exposed, flat limestone/dolomite bedrock pavement in humid and sub-humid climates (Reschke et al. 1999). They are rock garden-like environments with thin soils over horizontal bedrock outcrops. These exposed pavements are usually surrounded by forest (the dominant plant community in the region). Alvars are classified as globally imperiled habitats by The Nature Conservancy (Reid 1996).

Alvars have recently received considerable study along the Great Lakes in both the U.S. and Canada (Reschke et al. 1999). Most wet alvars are subjected to flooding in spring. While most dry out by early summer, some alvar wetlands remain flooded for weeks (Reid 1996). Ponding comes mainly from snowmelt and precipitation. The wetter alvars may occur as isolated depressions within larger drier alvars (uplands). Hydrophytes, including spikerushes and sedges, characterize these rocky wetlands. Reschke (1990) reported slender spikerush (*Eleocharis elliptica* var. *elliptica*), balsam groundsel or balsam ragwort (*Senecio pauperculus*), Crawe's sedge (*Carex crawei*), and mosses (*Bryum cespiticium* and *Drepanocladus* spp.) as species characteristic of wet alvar grasslands in New York. A technical report on Great Lakes alvars listed the tufted hairgrass wet alvar grassland community (Reschke et al. 1999). Dominant plants included tufted hairgrass (*Deschampsia cespitosa*), Crawe's sedge, and flat-stemmed spikerush (*Eleocharis compressa*). Average soil depth for this community is less than 4 inches. This alvar type is saturated or flooded in spring and fall and very dry in midsummer.

Rare species are typical of alvars. In Michigan, some State-rare species associated with small depressional wet alvar grassland are flat-stemmed spikerush and the sedge *Carex scirpoides* (Dennis Albert, pers. comm.).

Threats to alvars in general include quarrying, rural development, all-terrain vehicles (ATVs), and invasive plants. Construction of cottages, vacation homes, and trailer parks poses problems for many alvars, especially those along the Great Lakes shore. ATVs driven across alvars disrupt hydrologic patterns, rut alvar surfaces, and favor the spread of invasive plants. Common buckthorn (*Rhamnus* *cathartica*), St. John's-wort (*Hypericum perforatum*), honeysuckles (*Lonicera tatarica* and *L. morrowii*), Canada bluegrass (*Poa compressa*), and rough-fruited cinquefoil (*Potentilla recta*) are among the more problematic invasive species (Reschke et al. 1999).

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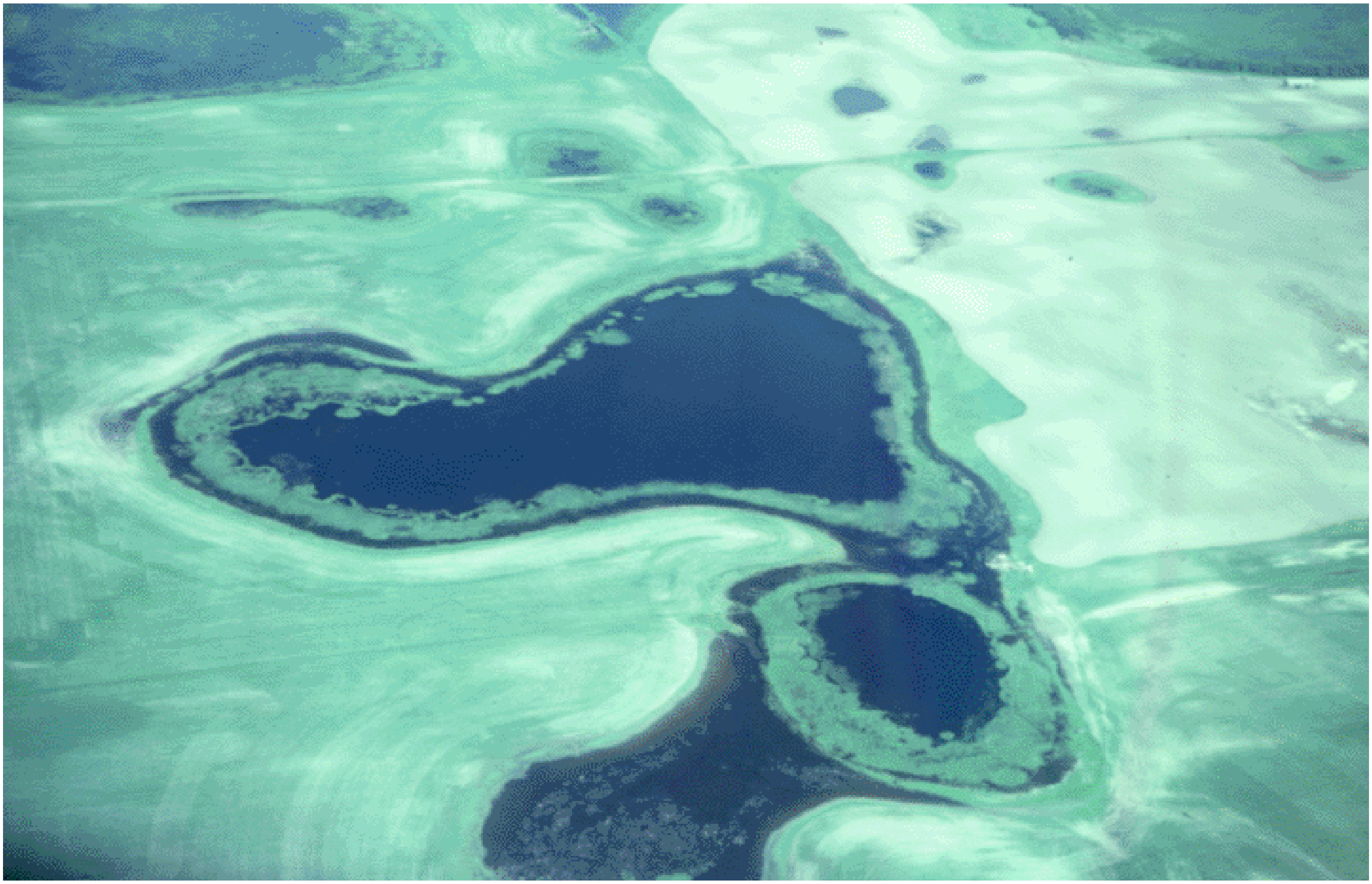
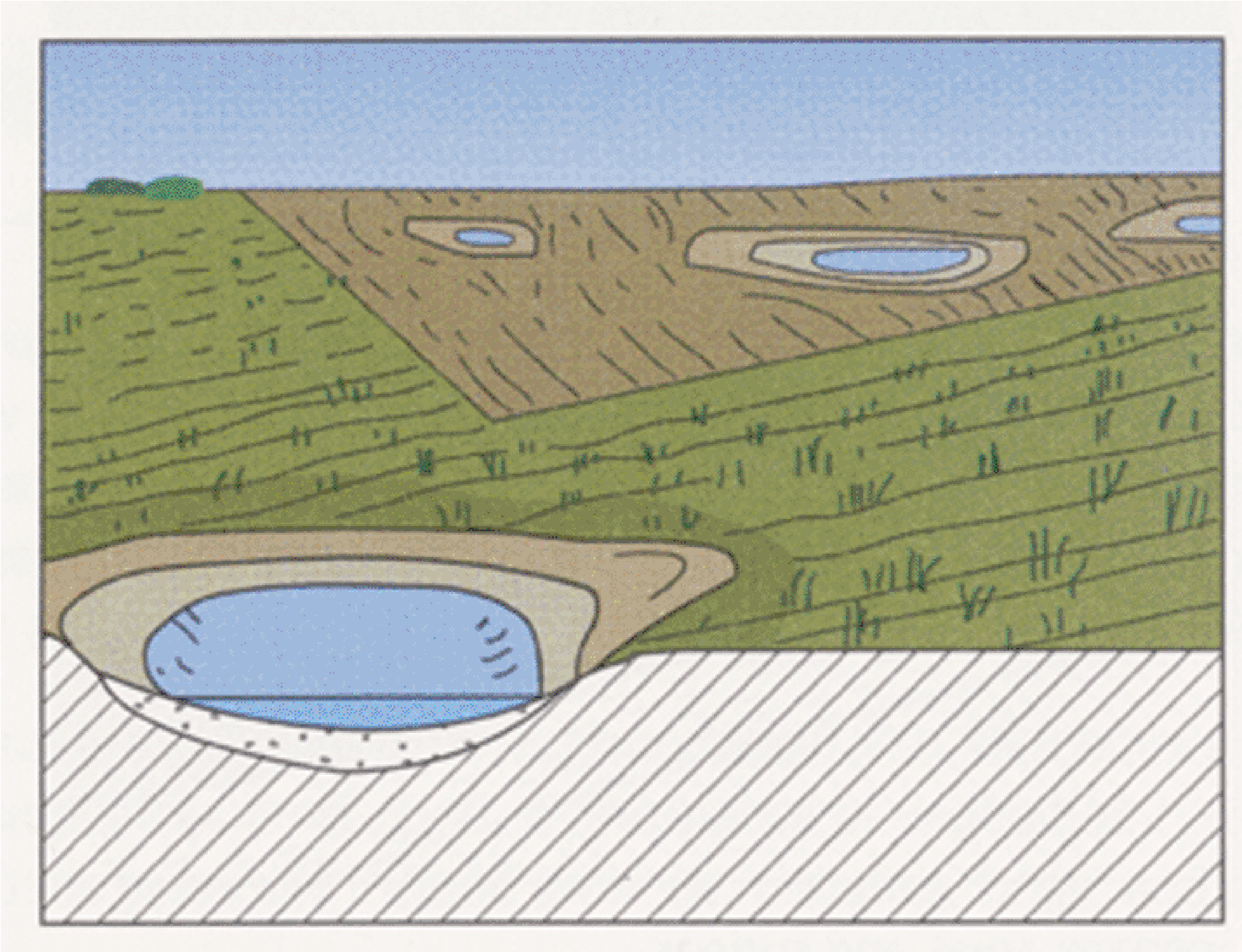
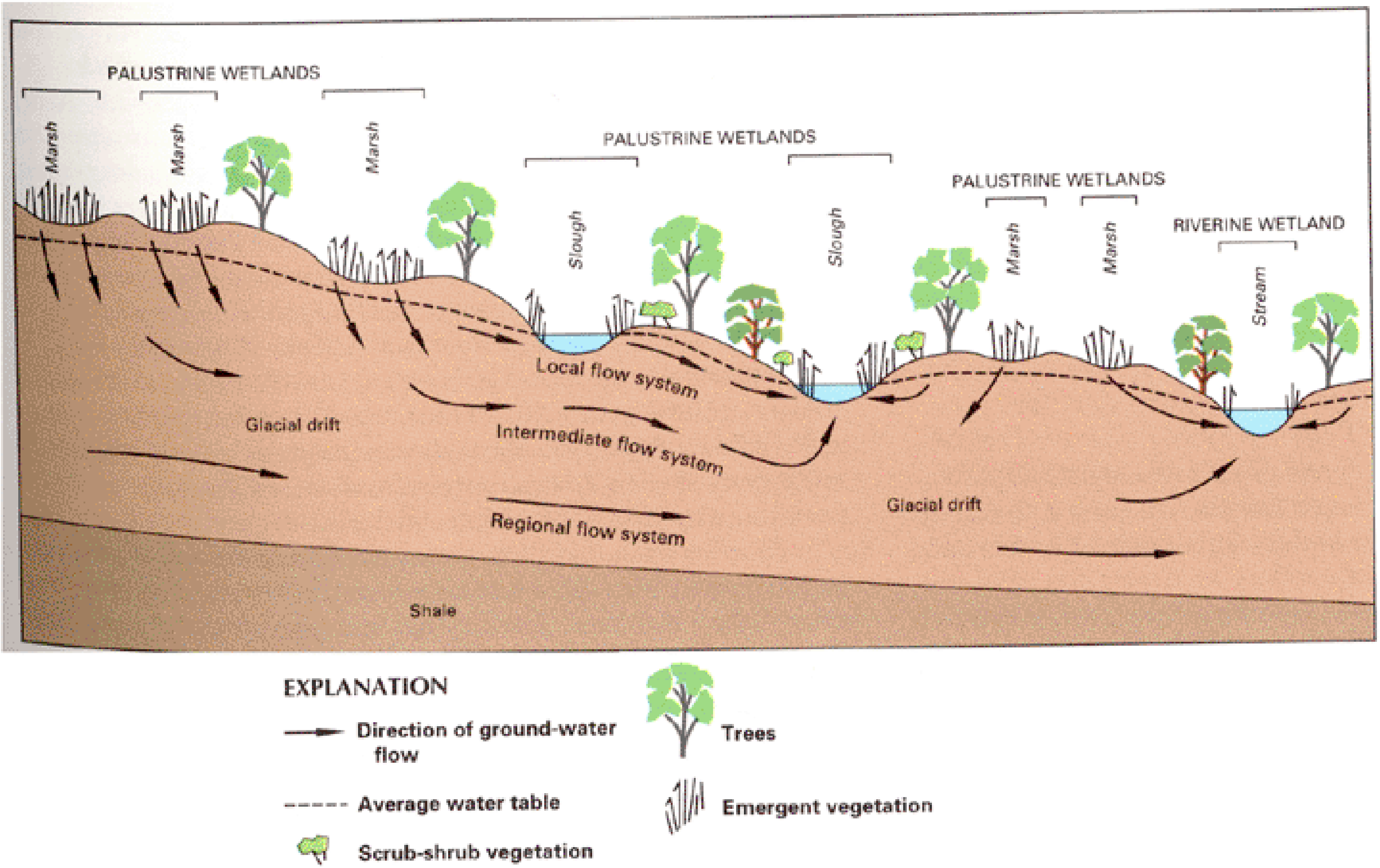
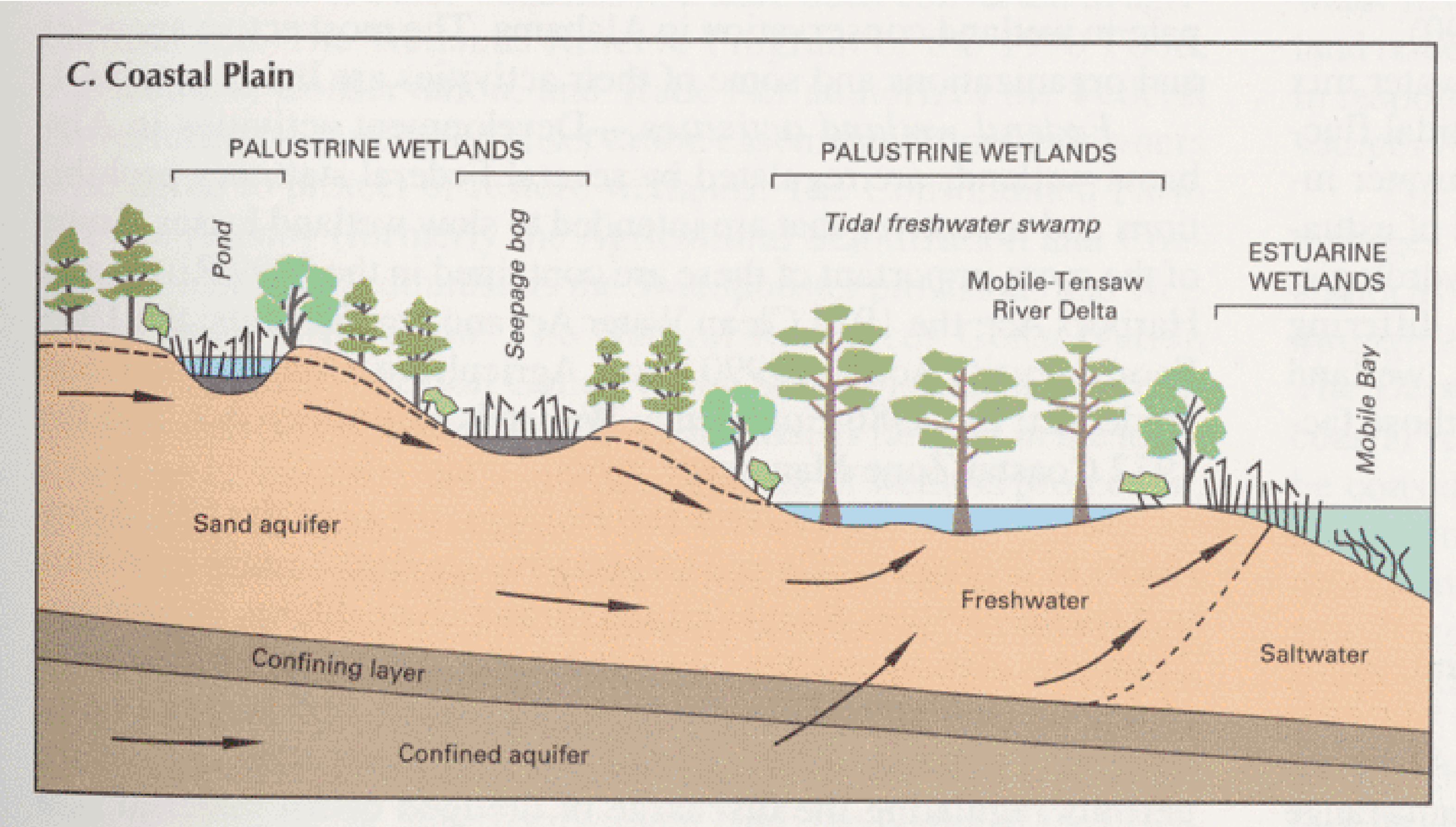
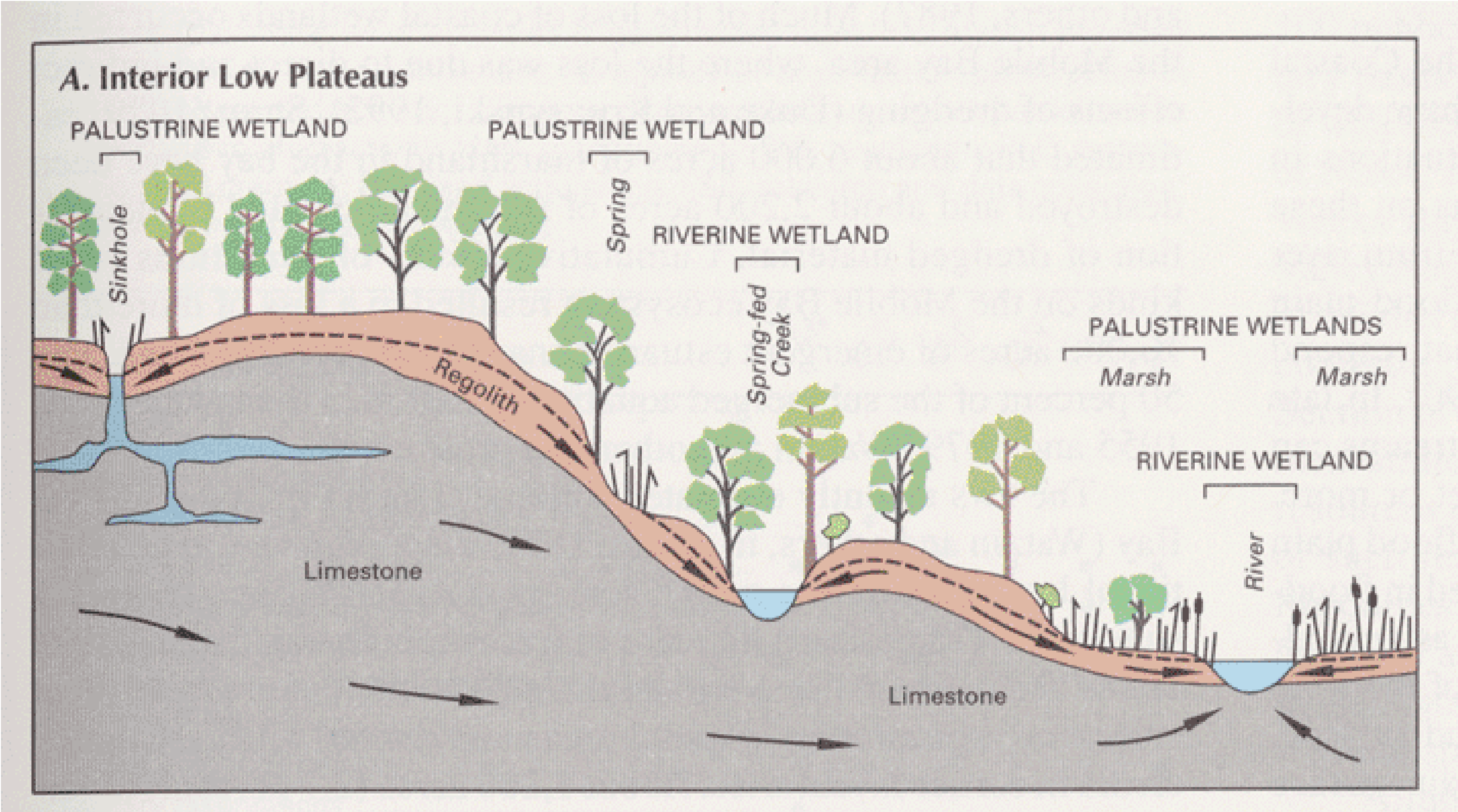
[Back to Table of Contents] [Home] [Go to next Section]



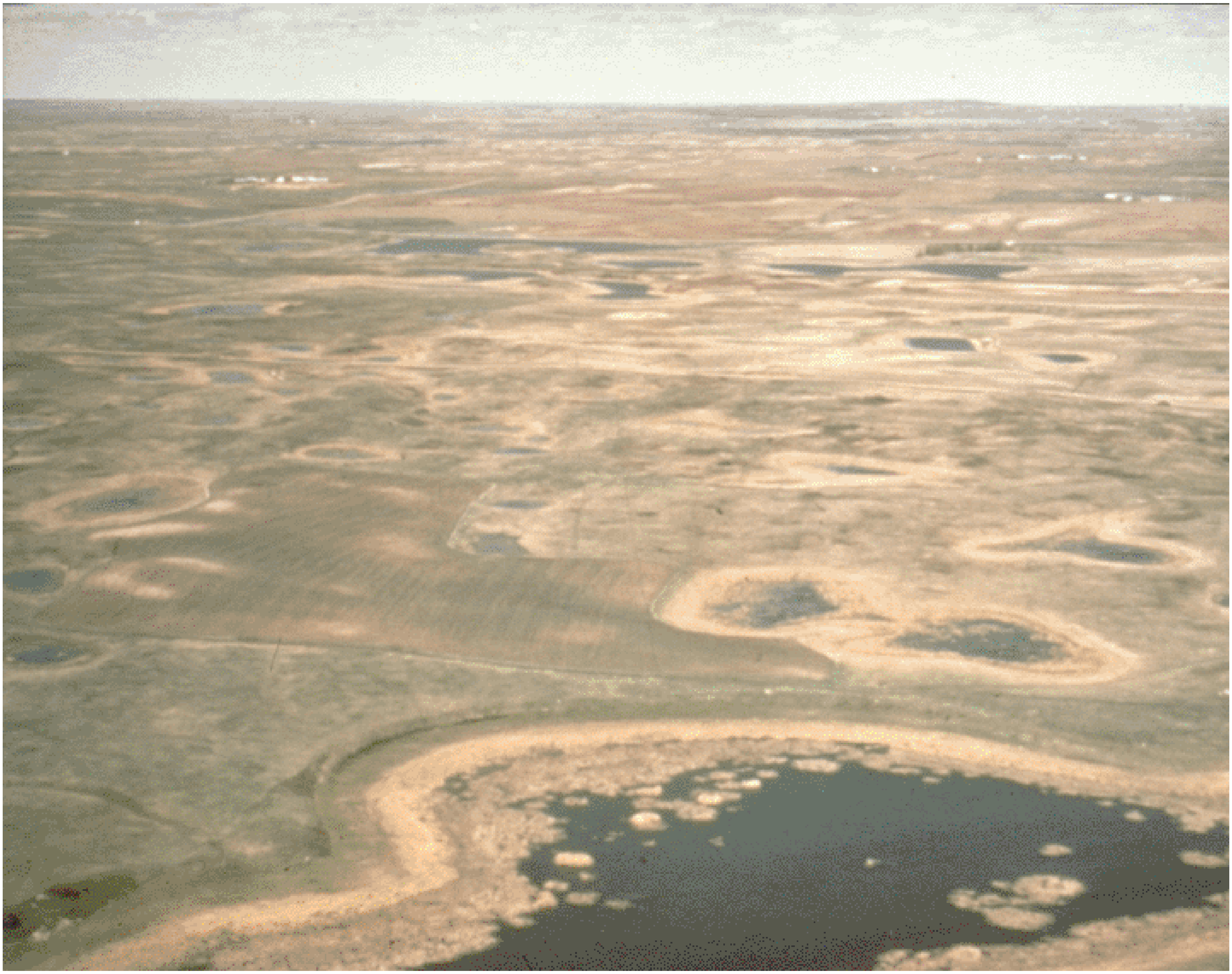


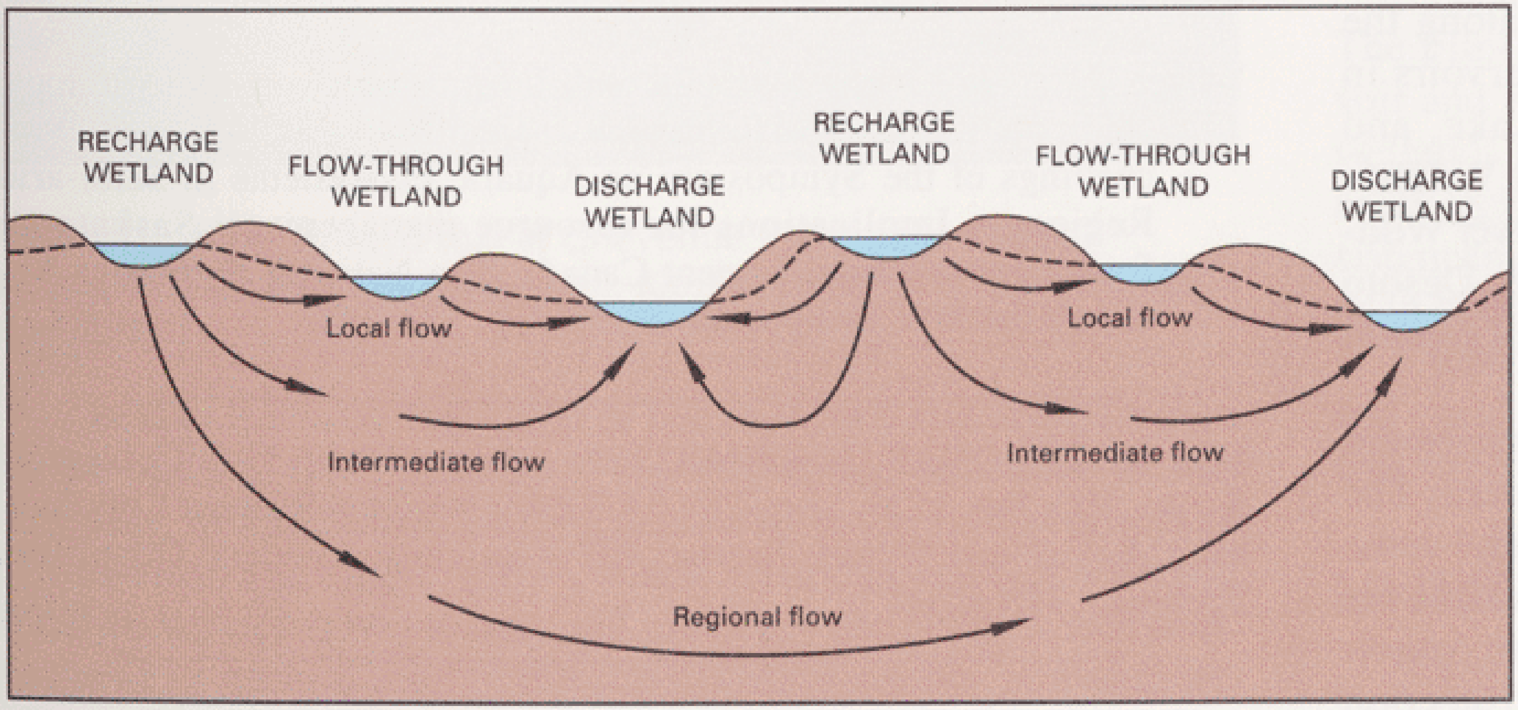

PALUSTRINE WETLANDS
Marsh
Marsh
Marsh
PALUSTRINE WETLANDS
Slough
Slough
PALUSTRINE WETLANDS
Marsh
Marsh
RIVERINE WETLAND
Stream
Local flow system
Glacial drift
Intermediate flow system
Regional flow system
Glacial drift
Shale
EXPLANATION
Direction of ground-water flow
Average water table
Scrub-shrub vegetation
Trees
Emergent vegetation


C. Coastal Plain
PALUSTRINE WETLANDS
Pond
Seepage bog
PALUSTRINE WETLANDS
Tidal freshwater swamp
Mobile-Tensaw
River Delta
ESTUARINE
WETLANDS
Mobile Bay
Sand aquifer
Freshwater
Saltwater
Confining layer
Confined aquifer


A. Interior Low Plateaus
PALUSTRINE WETLAND
Sinkhole
PALUSTRINE WETLAND
Spring
RIVERINE WETLAND
Spring-fed Creek
Regolith
PALUSTRINE WETLANDS
Marsh
Marsh
RIVERINE WETLAND
River
Limestone
Limestone

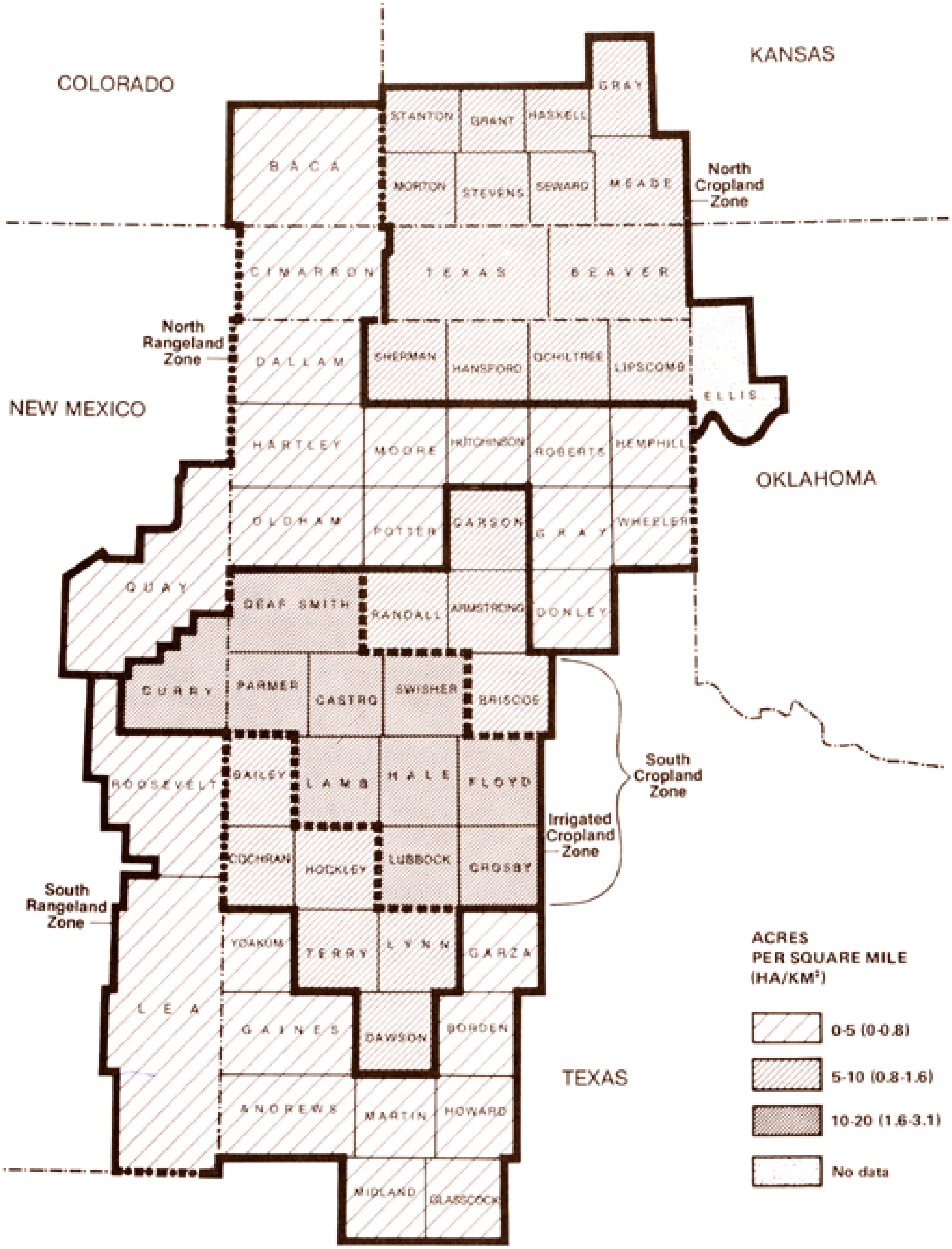

AB
SK
MB
ON
MT
ND
MN
ID
WY
SD
NE
IA

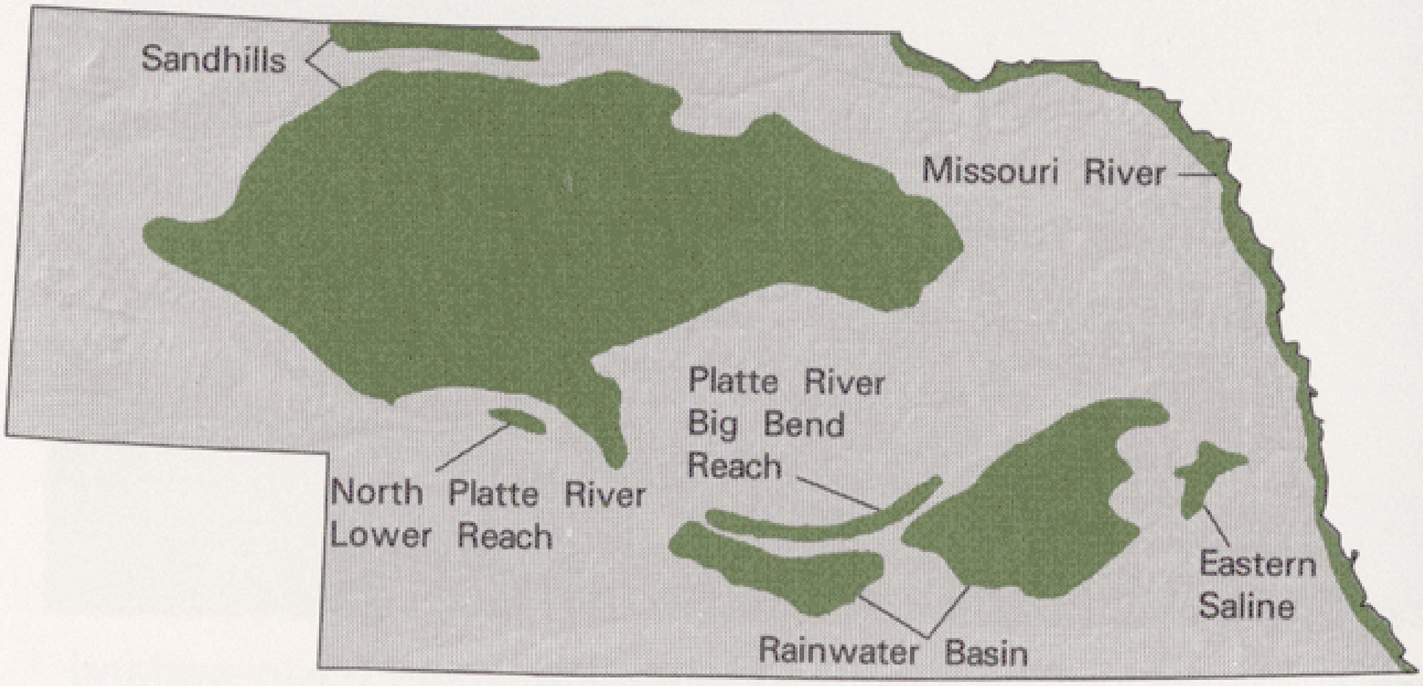




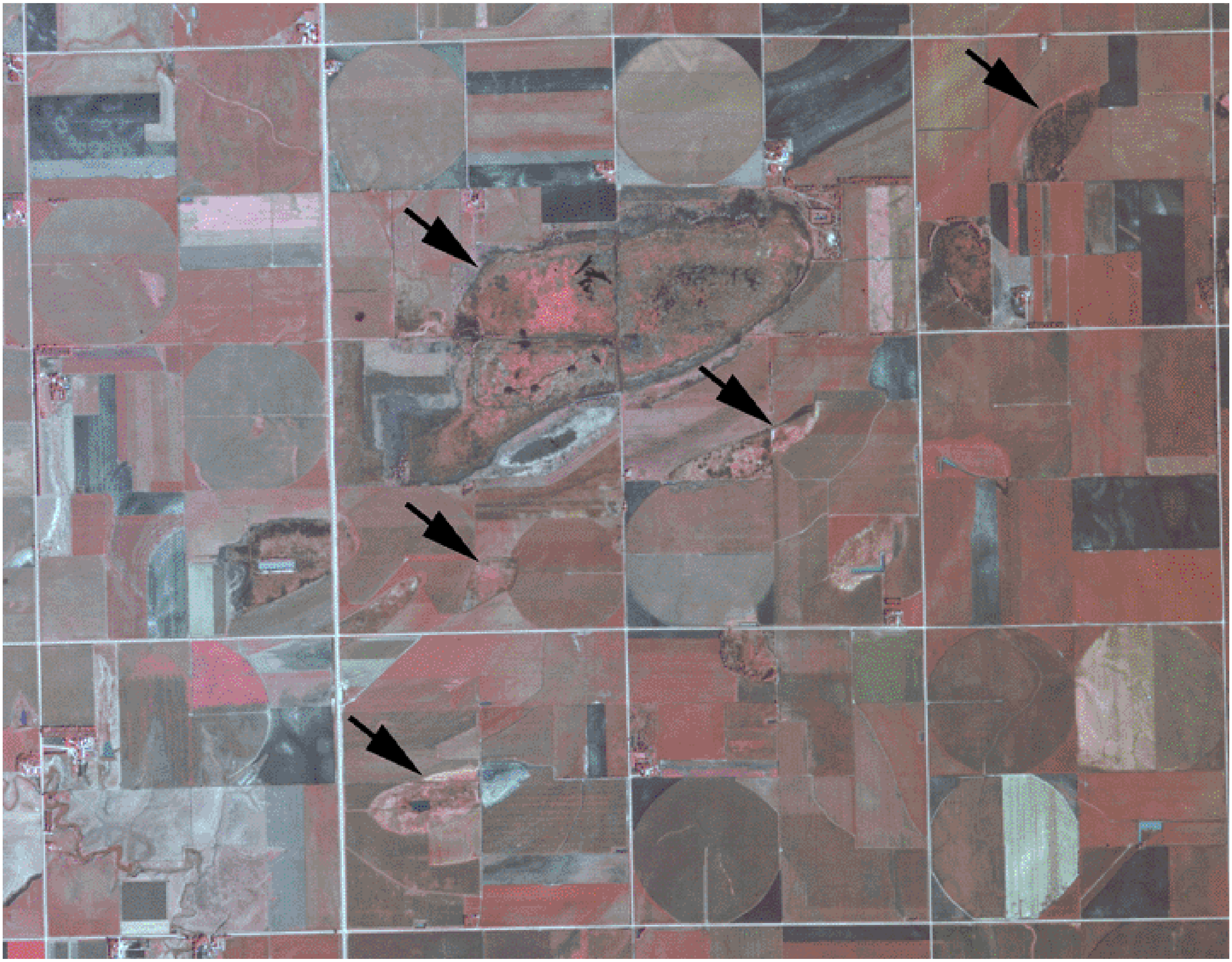
EXPLANATION

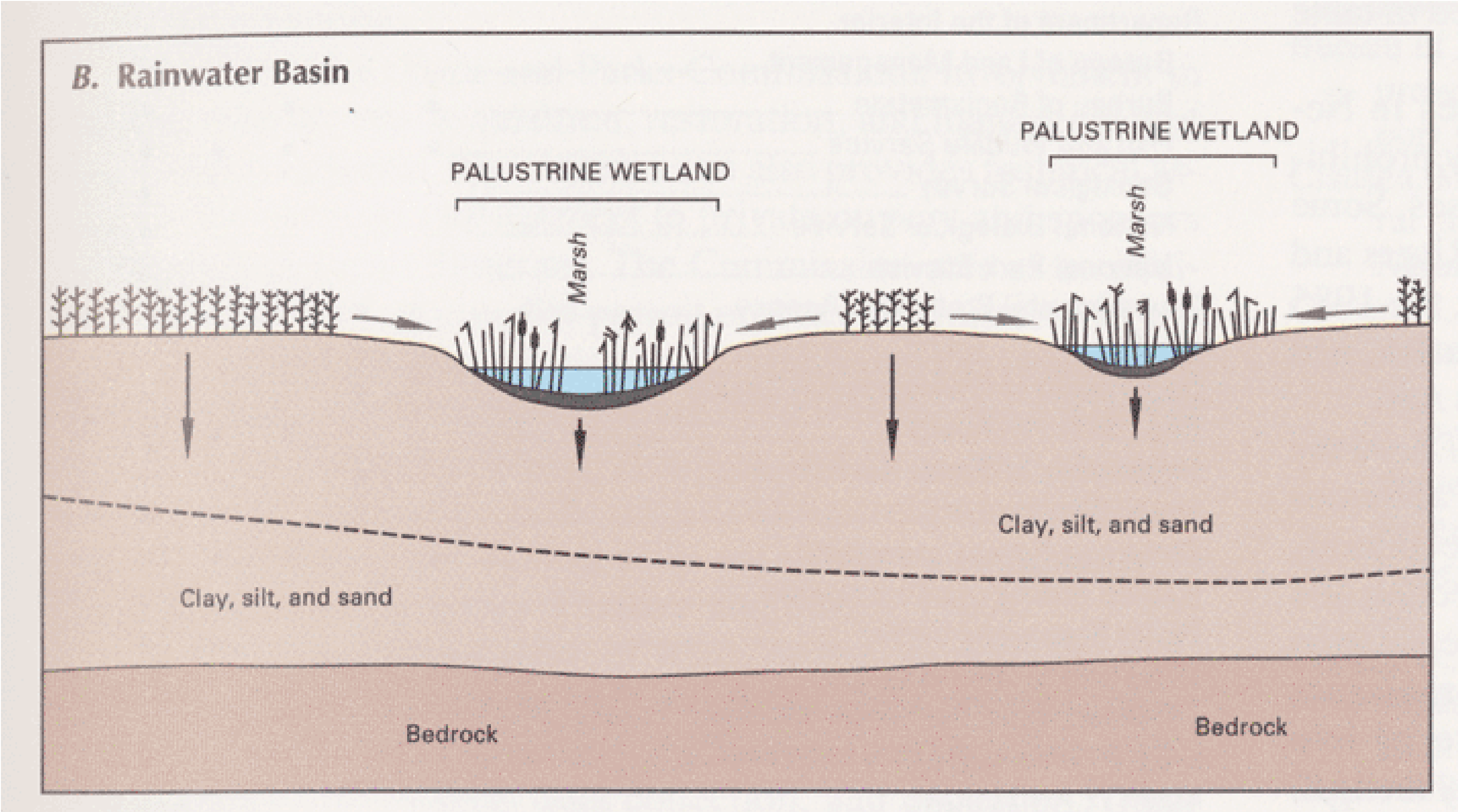
Direction of ground-water flow — Average water table

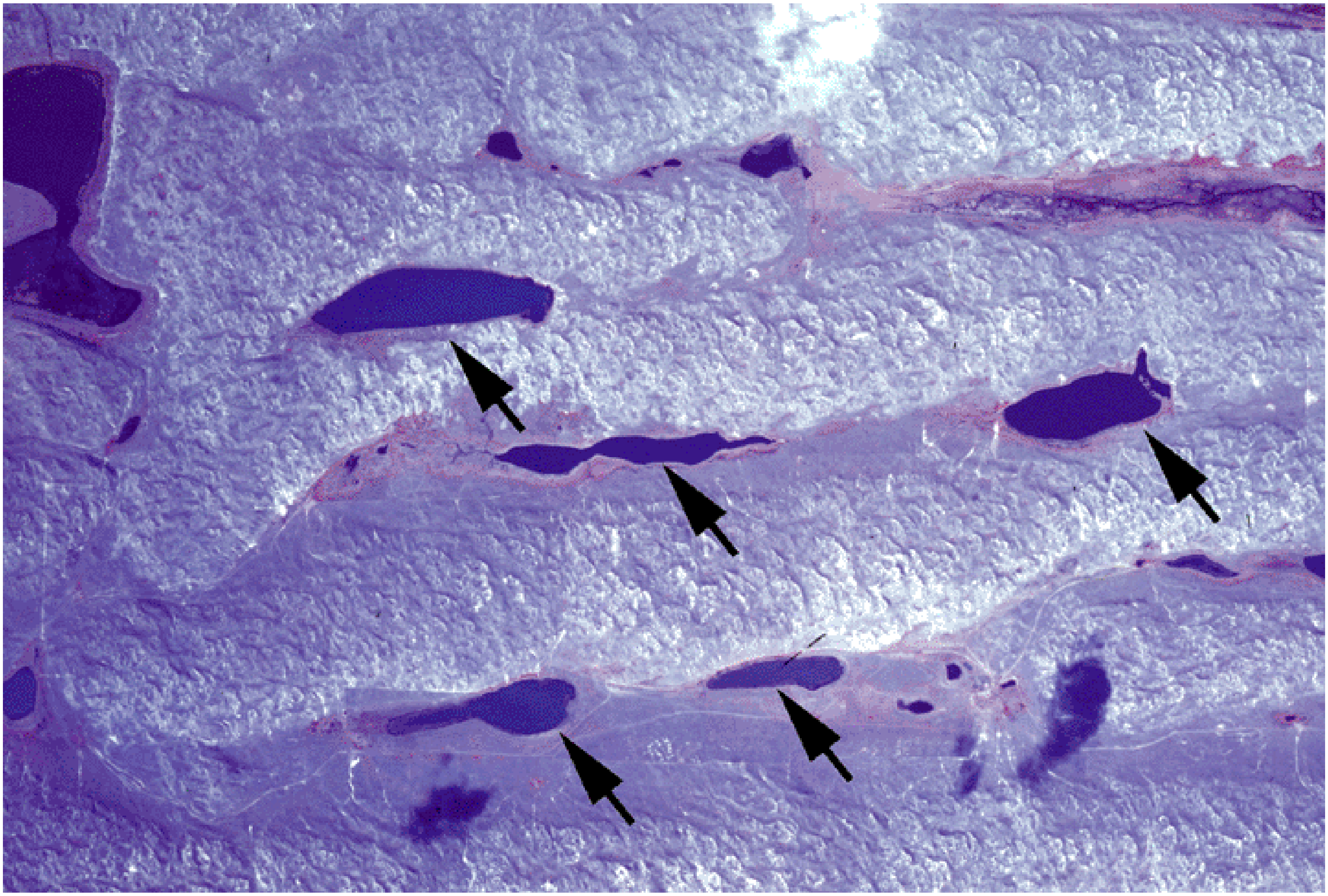

KANSAS
COLORADO
NEW MEXICO
OKLAHOMA
TEXAS
GRAY
STANTON
GRANT
HASKELL
BACA
MORTON
STEVENS
SEWARD
MEADE
North Cropland Zone
CIMARRON
TEXAS
BEAVER
North Rangeland Zone
DALLAM
SHERMAN
HANSFORD
OCHILTREE
LIPSCOMB
ELLIS
HARTLEY
MOORE
HUTCHINSON
ROBERTS
HEMPHILL
OLDHAM
POTTER
CARSON
GRAY
WHEELER
QUAY
DEAF SMITH
RANDALL
ARMSTRONG
DONLEY
CURRY
PARMER
CASTRO
SWISHER
BRISCOE
ROOSEVELT
BAILEY
LAMB
HALE
FLOYD
South Cropland Zone
Irrigated Cropland Zone
COCHRAN
HOCKLEY
LUBBOCK
CROSBY
South Rangeland Zone
YOAKUM
TERRY
LYNN
GARZA
LEA
GAINES
DAWSON
BORDEN
ANDREWS
MARTIN
HOWARD
MIDLAND
GLASSCOCK
ACRES PER SQUARE MILE (HA/KM²)
0-5 (0-0.8)
5-10 (0.8-1.6)
10-20 (1.6-3.1)
No data

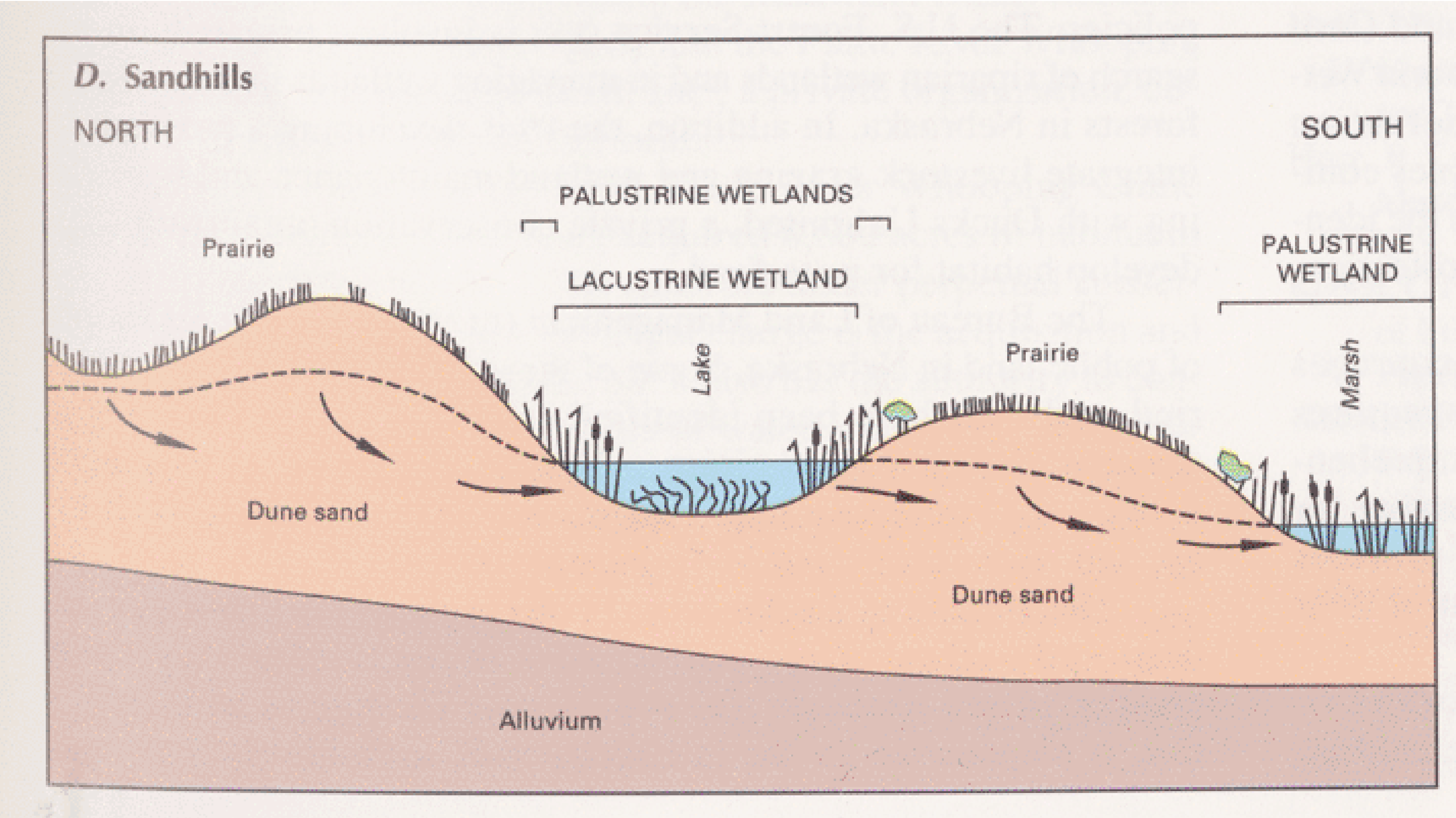


B MAJOR WETLAND COMPLEXES




B. Rainwater Basin
PALUSTRINE WETLAND
Marsh
PALUSTRINE WETLAND
Marsh
Clay, silt, and sand
Clay, silt, and sand
Bedrock
Bedrock




D. Sandhills
NORTH
SOUTH
PALUSTRINE WETLANDS
Prairie
LACUSTRINE WETLAND
PALUSTRINE WETLAND
Lake
Prairie
Marsh
Dune sand
Dune sand
Alluvium


Great Basin
P A C I F I C
O C E A N

Footnotes

[1] Data source: www.monolake.org/naturalhistory/birds.

[2] Meador (1996) cites Sharitz and Gibbons (1982) as characterizing pocosins and Carolina bays "as examples of isolated wetlands…."

[3] The Dade City study area had 7,754 acres of wetlands dominated by cypress. Of these, about 57 percent (4,403 acres) were classified as isolated.

[4] Examples of West Coast vernal pool complexes can be seen on the maps for three study areas: Sacramento, Bird Landing, and La Mesa (Region 1).

[5] See also the California Wetlands Information System: ceres.ca.gov/wetlands.

[6] An example of these wetlands can be seen on the map of the Coquille River study area (Region 1).

[7] These ponds may be included in the category - Coastal Plain Ponds - described previously.

[8]The latter study areas may or may not be typical of these regions, since determining "typical" would require some form of statistical analysis. They simply represent areas where data were collected and analyzed.

[9] In evaluating these connections for this study, we relied on river and stream locations depicted on U.S. Geological Survey topographic maps and represented in digital forms on digital line graphs (DLGs) or digital raster graphics (DRGs). Consequently, connections by unmapped intermittent streams could not be detected. This would require extensive field work or review of large-scale aerial photographs when trees are in their leaf-off condition.

[10] Wetlands along isolated navigable lakes such as the Great Salt Lake (in the Great Basin) and wetlands along streams draining into these lakes have traditionally been viewed as non-isolated. We also considered them non-isolated. See Rockport Lake study area (Region 6).

[11] Examples of this can be observed in numerous study areas including Edgemere, Porcupine Mountain, Epping, Frederick, and Newton (Region 5).

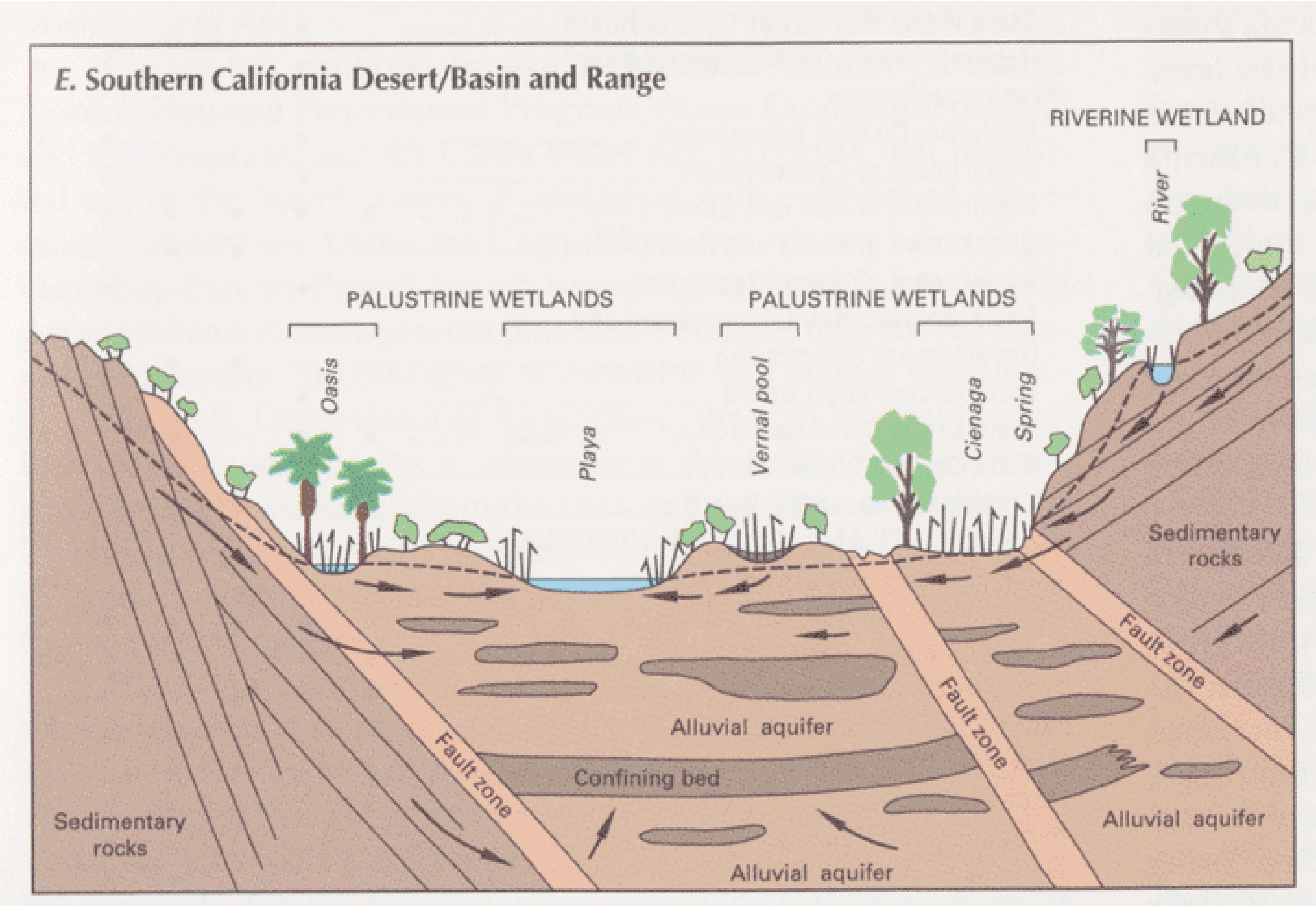
[12] See Dade City and Crystal Lake study areas (Region 4) for examples.

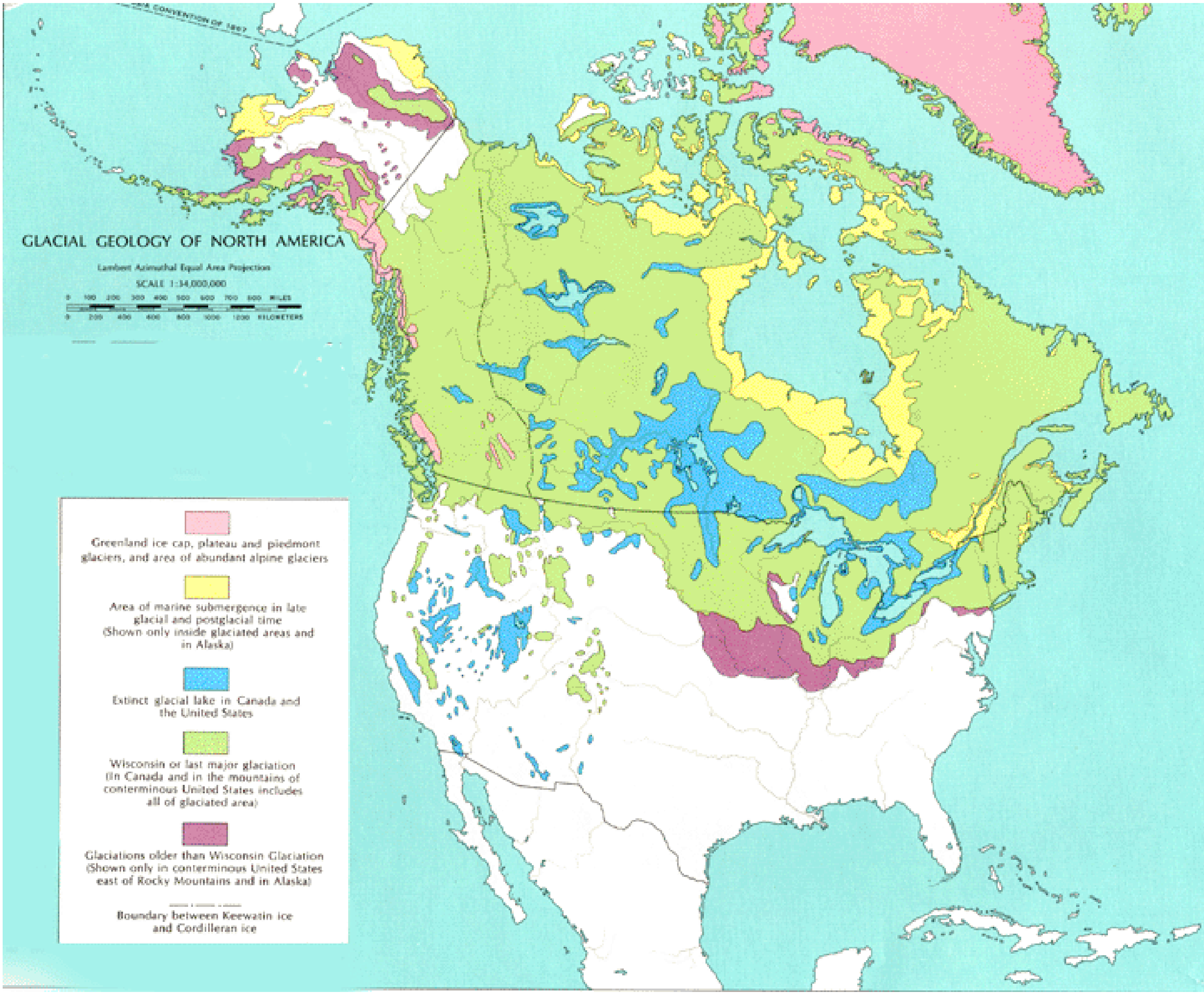
[13] Affected study areas included Four Mile Flat (NV), Black Thunder (WY), Rainwater Basin (NE), Hill Lake (NE), and Rockport Lake (UT).

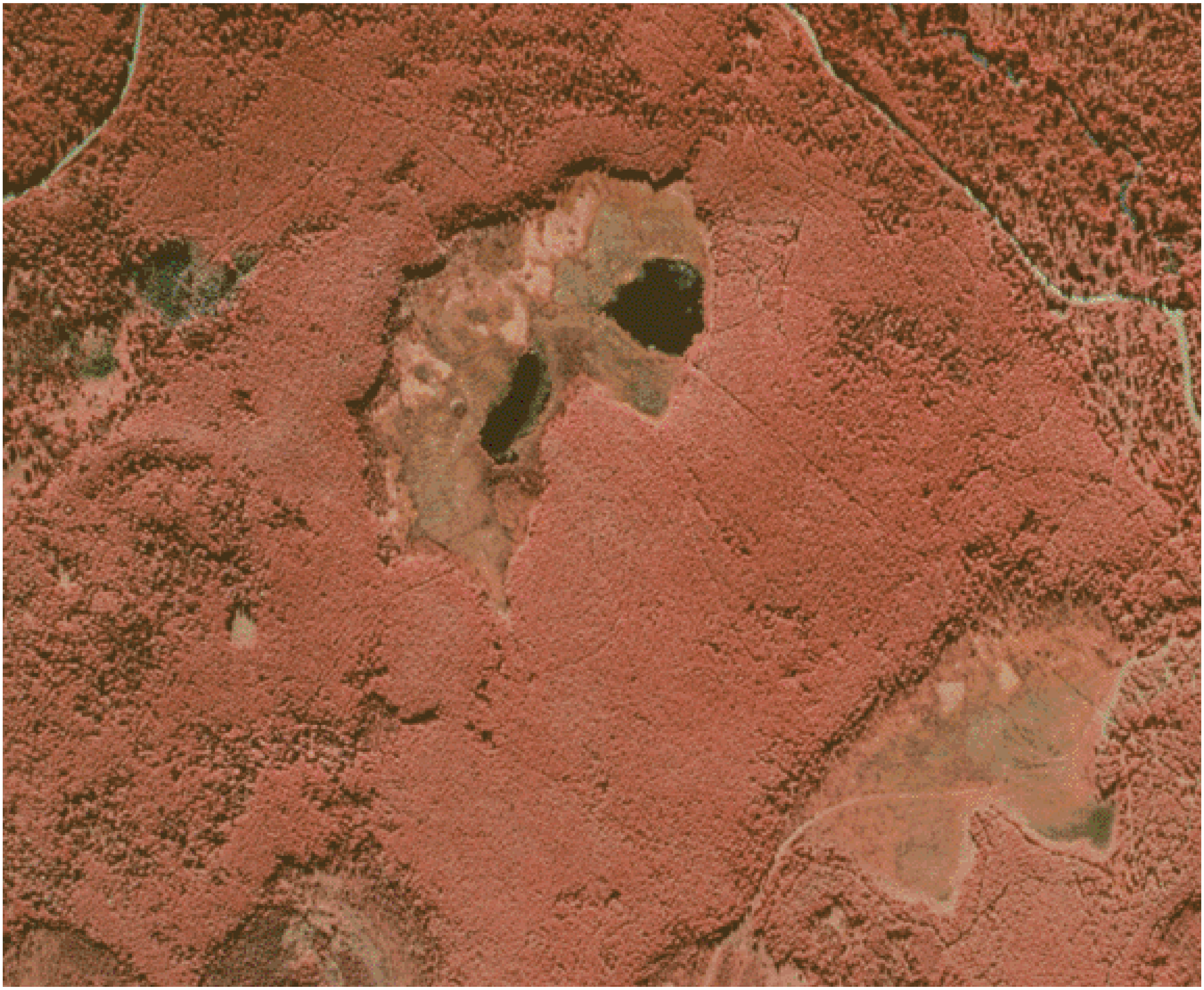
[14] Road-fragmented wetlands were labeled manually.

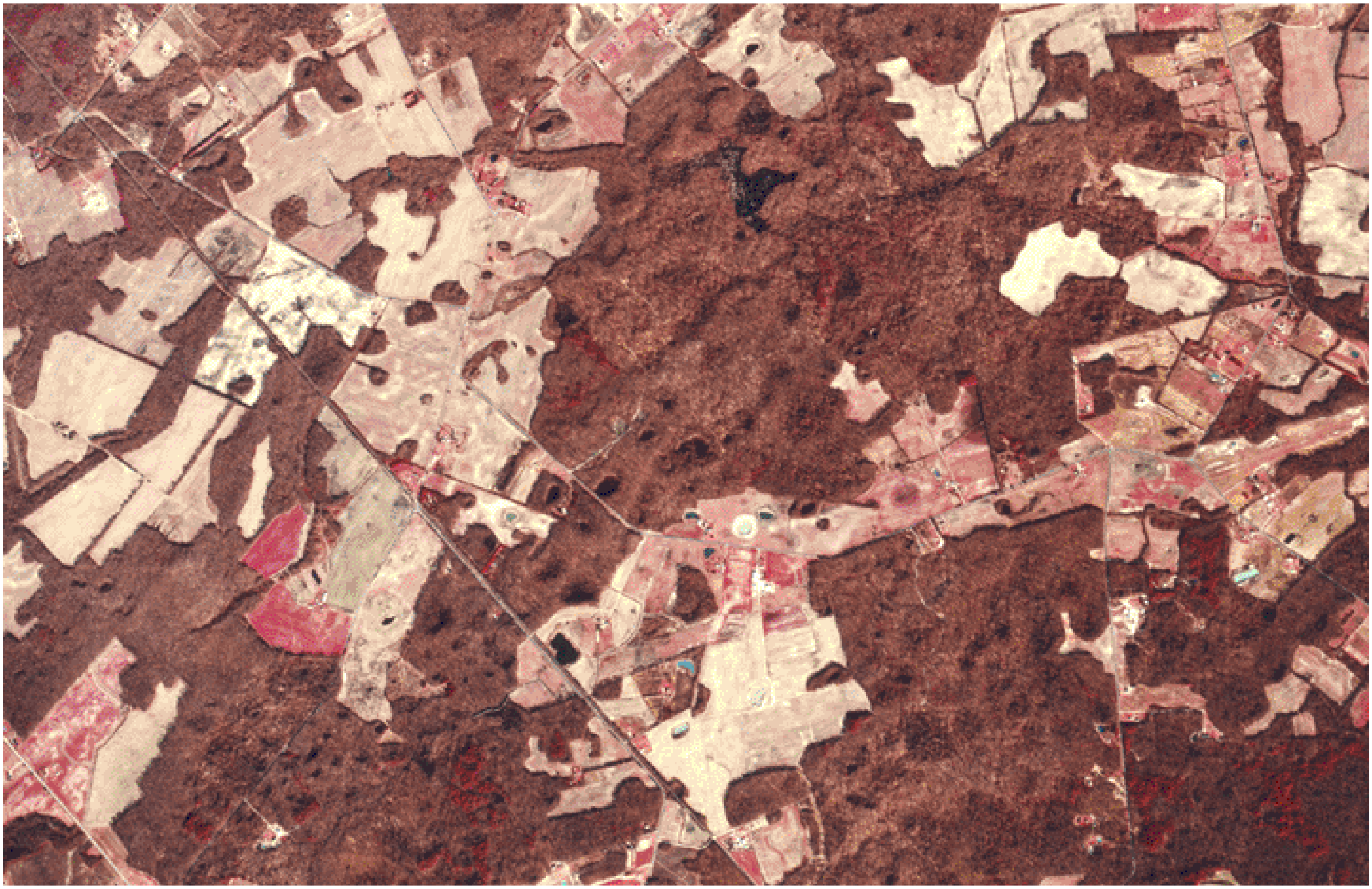
[15] Most NWI maps have target mapping units of 1-3 acres, so the smallest wetlands typically mapped fall within that range. Smaller wetlands are routinely mapped in some areas, such as the Prairie Pothole Region.

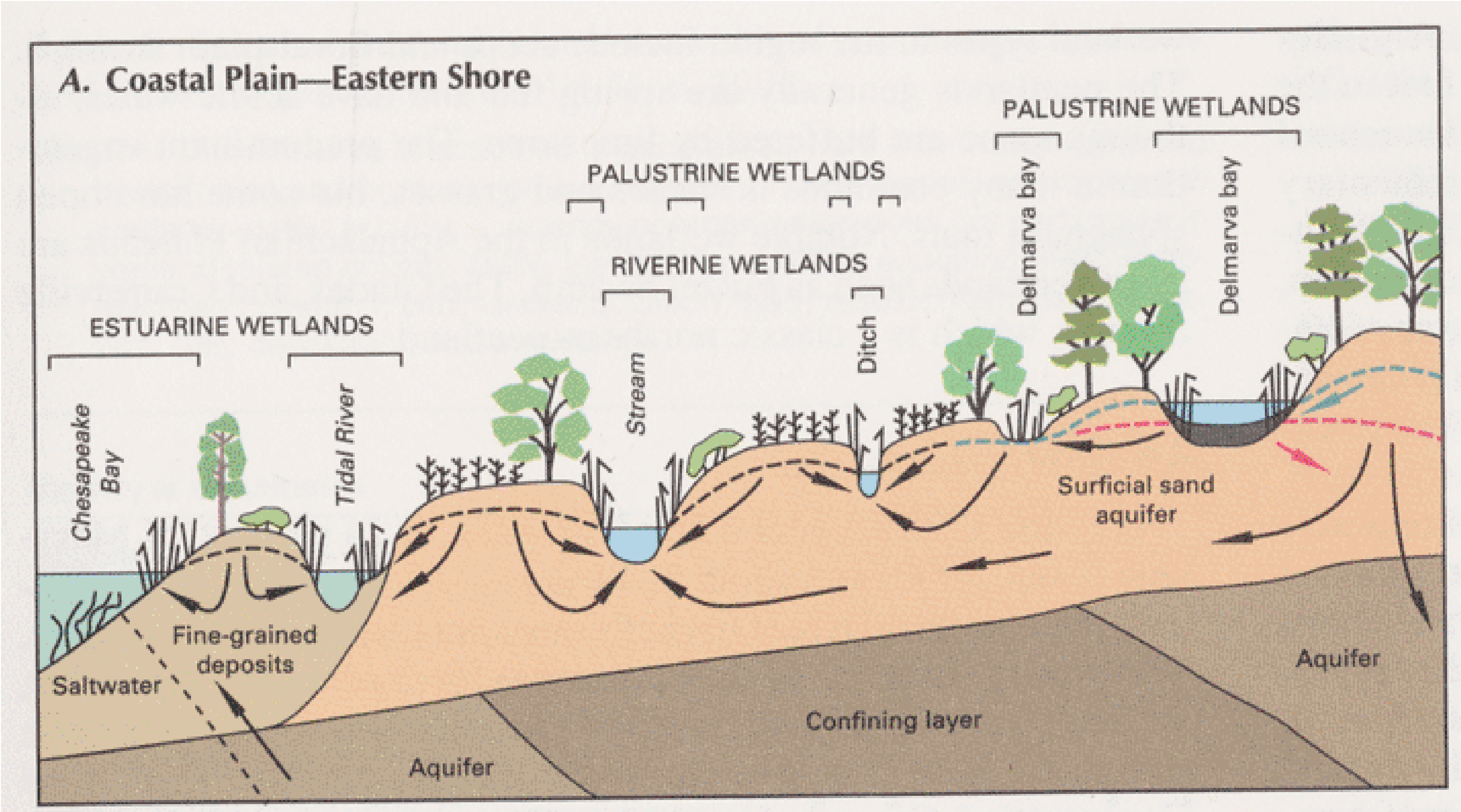
[16] These wetlands may be regulated due to their close proximity to rivers and their periodic flooding.


E. Southern California Desert/Basin and Range
RIVERINE WETLAND
River
PALUSTRINE WETLANDS
PALUSTRINE WETLANDS
Oasis
Playa
Vernal pool
Cienaga
Spring
Sedimentary rocks
Fault zone
Alluvial aquifer
Confining bed
Fault zone
Fault zone
Sedimentary rocks
Alluvial aquifer
Alluvial aquifer


GLACIAL GEOLOGY OF NORTH AMERICA
Lambert Azimuthal Equal Area Projection
SCALE 1:34,000,000
MILES
KILOMETERS
Greenland ice cap, plateau and piedmont glaciers, and area of abundant alpine glaciers
Area of marine submergence in late glacial and postglacial time (Shown only inside glaciated areas and in Alaska)
Extinct glacial lake in Canada and the United States
Wisconsin or last major glaciation (In Canada and in the mountains of conterminous United States includes all of glaciated area)
Glaciations older than Wisconsin Glaciation (Shown only in conterminous United States east of Rocky Mountains and in Alaska)
Boundary between Keewatin ice and Cordilleran ice

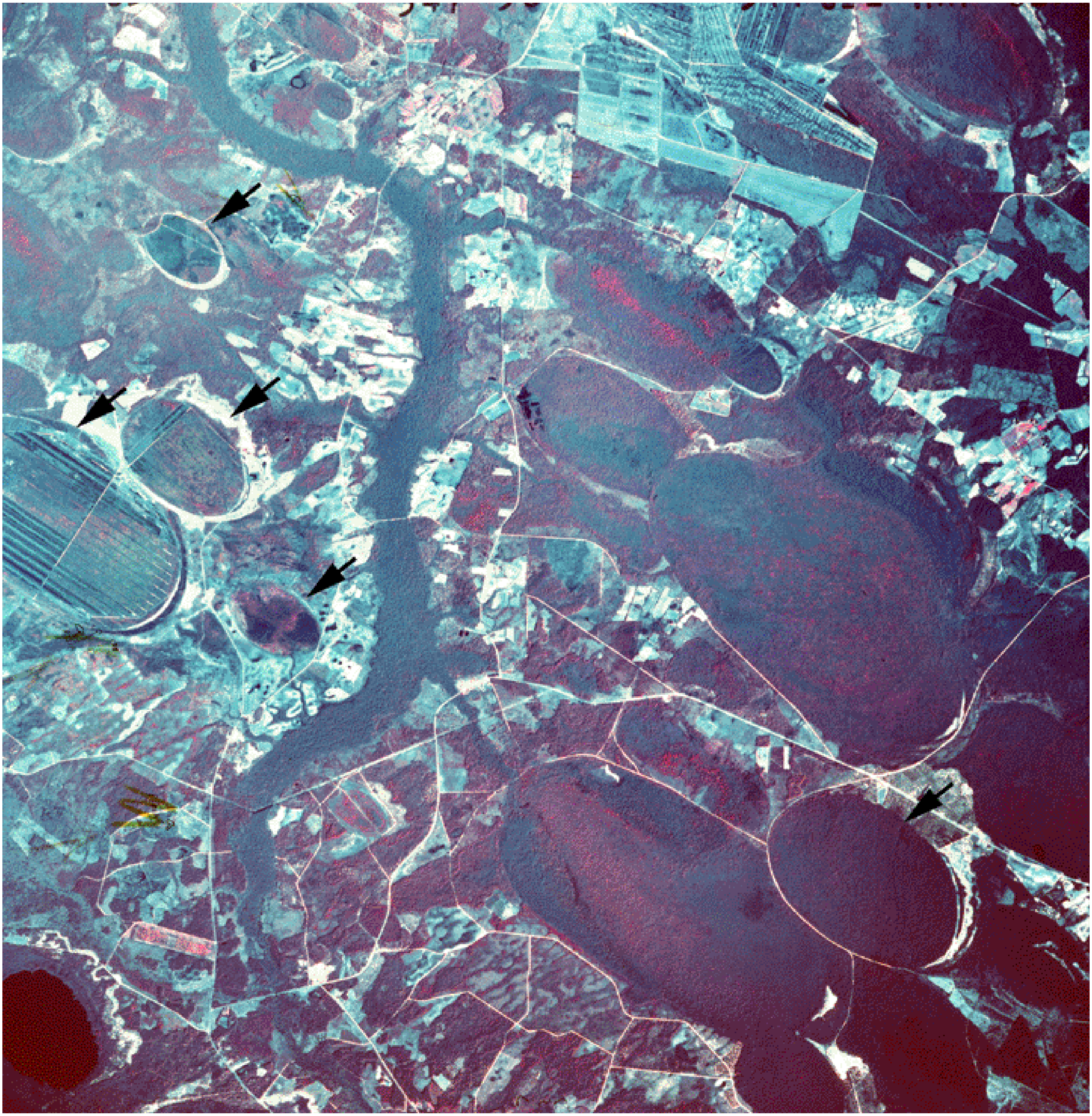


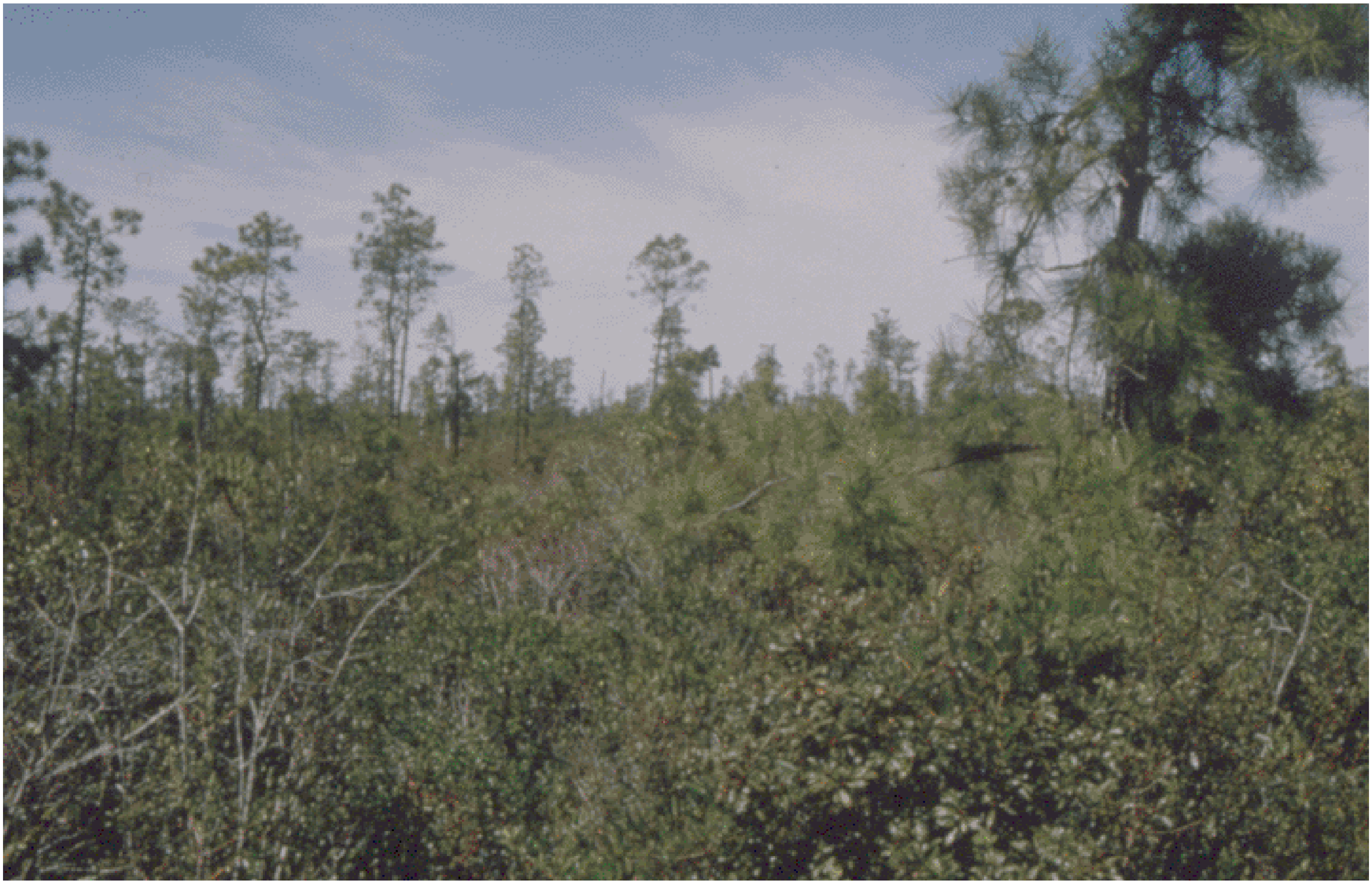




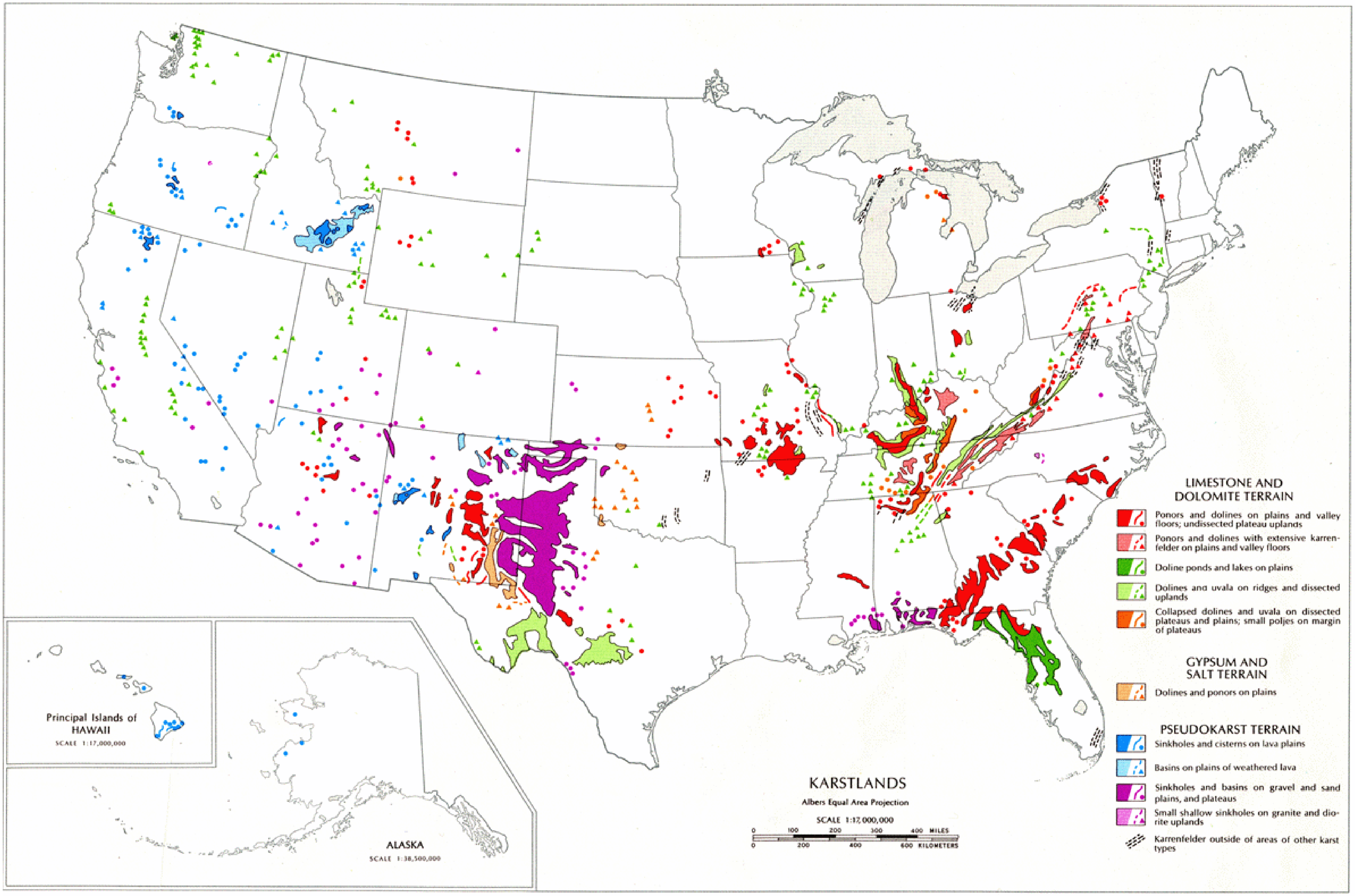
A. Coastal Plain—Eastern Shore
PALUSTRINE WETLANDS
PALUSTRINE WETLANDS
RIVERINE WETLANDS
ESTUARINE WETLANDS
Delmarva bay
Delmarva bay
Ditch
Stream
Tidal River
Chesapeake Bay
Surficial sand aquifer
Fine-grained deposits
Saltwater
Confining layer
Aquifer
Aquifer


VA
NC
SC
GA
CHOWAN
ROANOKE
PAMLICO
NEUSE
CAPE FEAR
LAKE WACCAMAW
PEE DEE
SANTEE
COOPER
COMBAHEE
BROAD
SAVANNAH
OGEECHEE
ALTAMAHA
SATILLA
ATLANTIC OCEAN

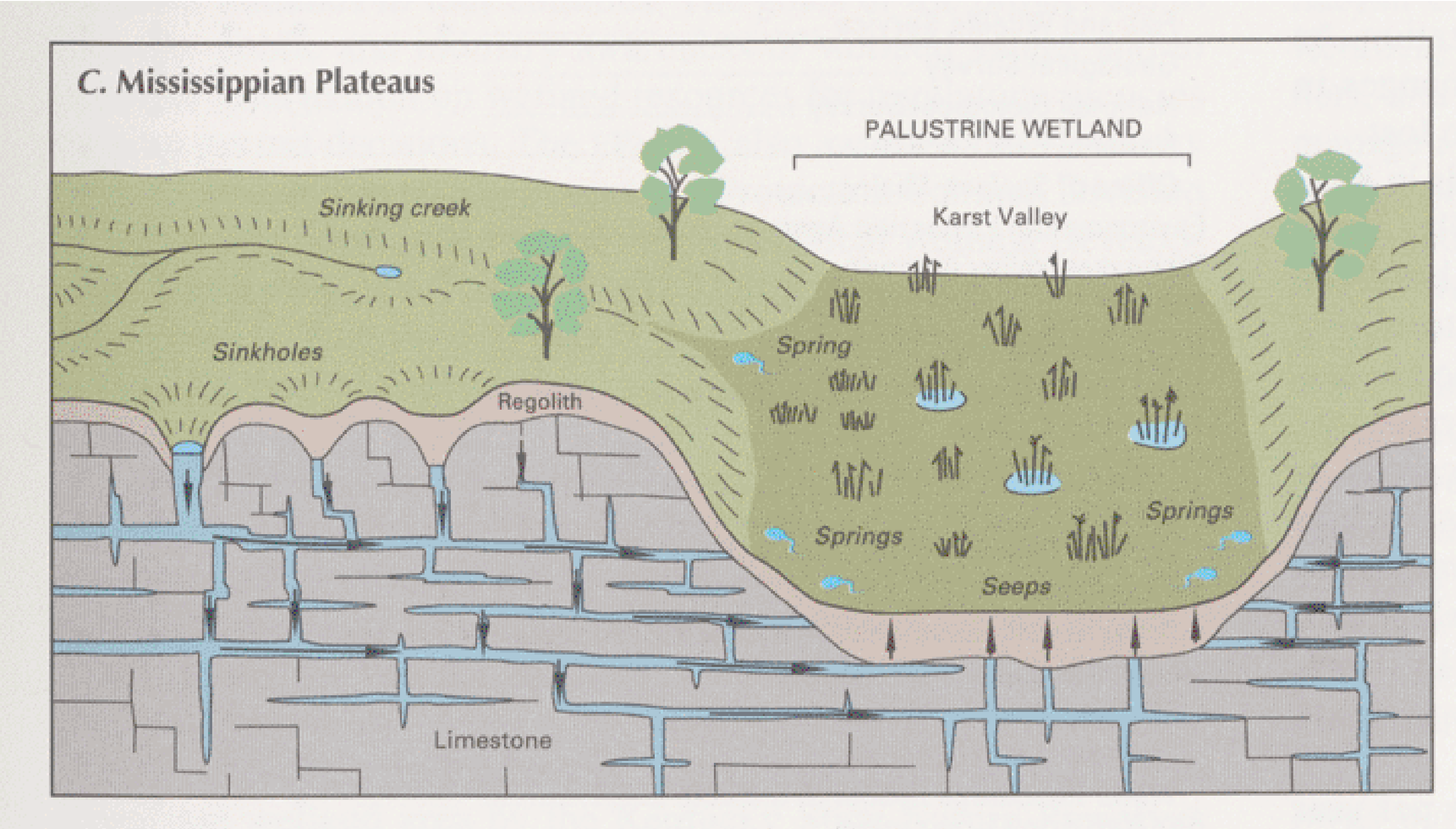


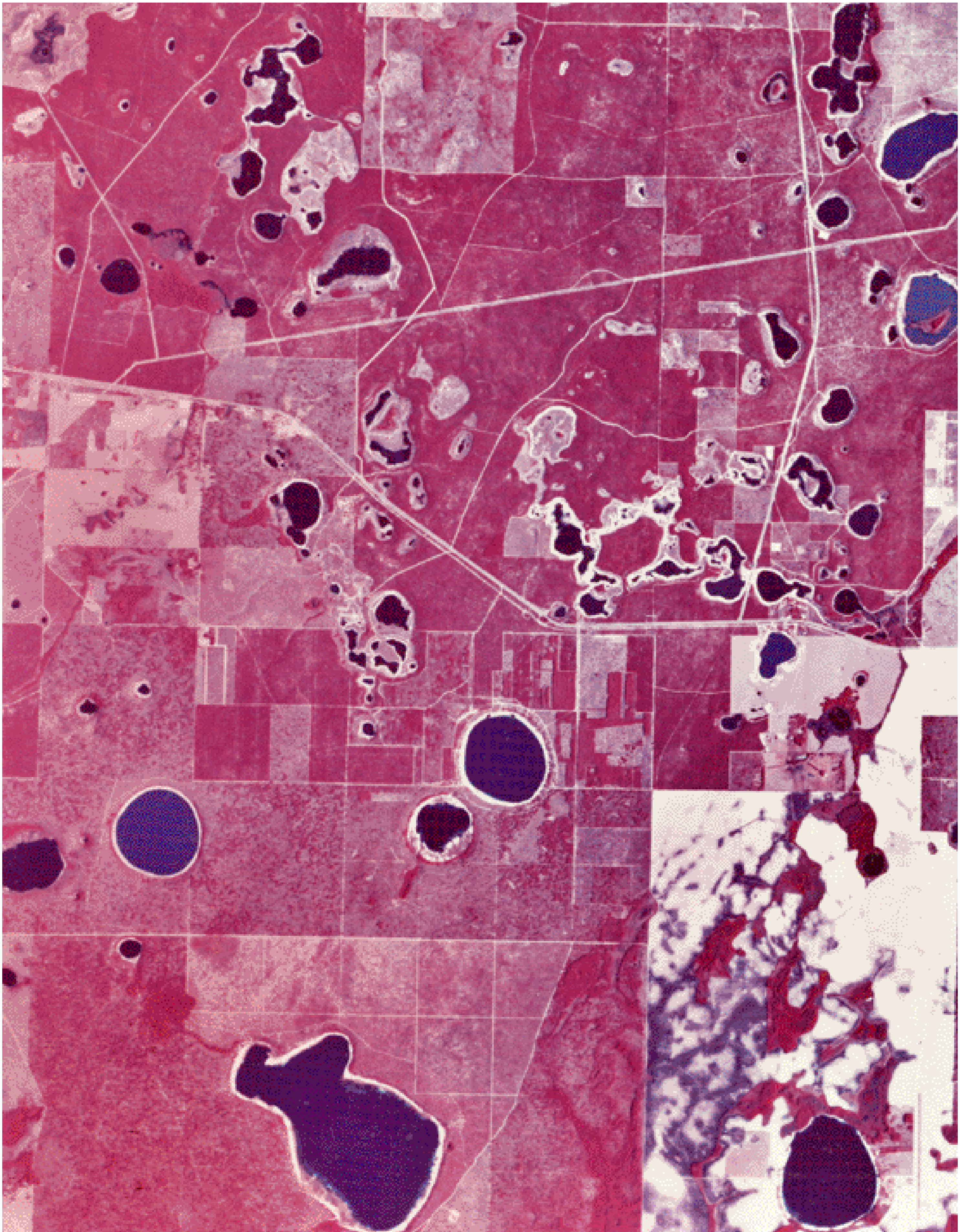


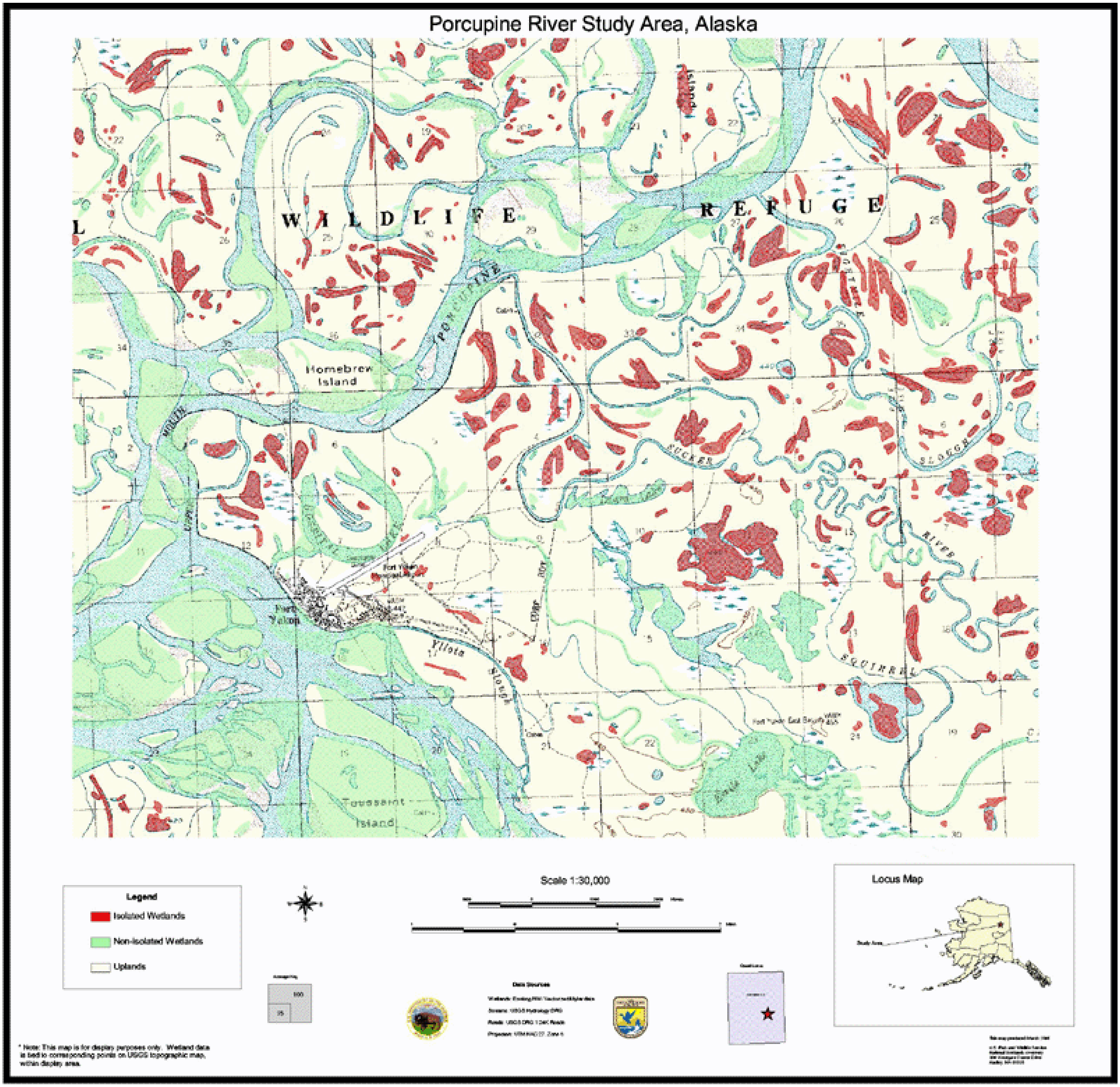

Legend
Totally Developed (ditched, drained, native vegetation removed, soils prepared for commercial use, and visible on aerial photos)
In Transition (partially ditched or drained, native vegetation altered, or planned for development by owners)
Natural
Scale
0 5 10 15 20 25
kilometers
N
CURRITUCK
CAMDEN
PASQUOTANK
PERQUIMANS
CHOWAN
BERTIE
ALBEMARLE SOUND
ATLANTIC OCEAN
TYRRELL
WASHINGTON
DARE
MARTIN
BEAUFORT
PITT
LAKE MATTAMUSKEET
HYDE
PAMLICO RIVER
PAMLICO SOUND
LENOIR
CRAVEN
PAMLICO
JONES
NEUSE RIVER
CUMBERLAND
SAMPSON
DUPLIN
ONSLOW
CARTERET
SCOTLAND
ROBESON
BLADEN
PENDER
COLUMBUS
NEW HANOVER
BRUNSWICK

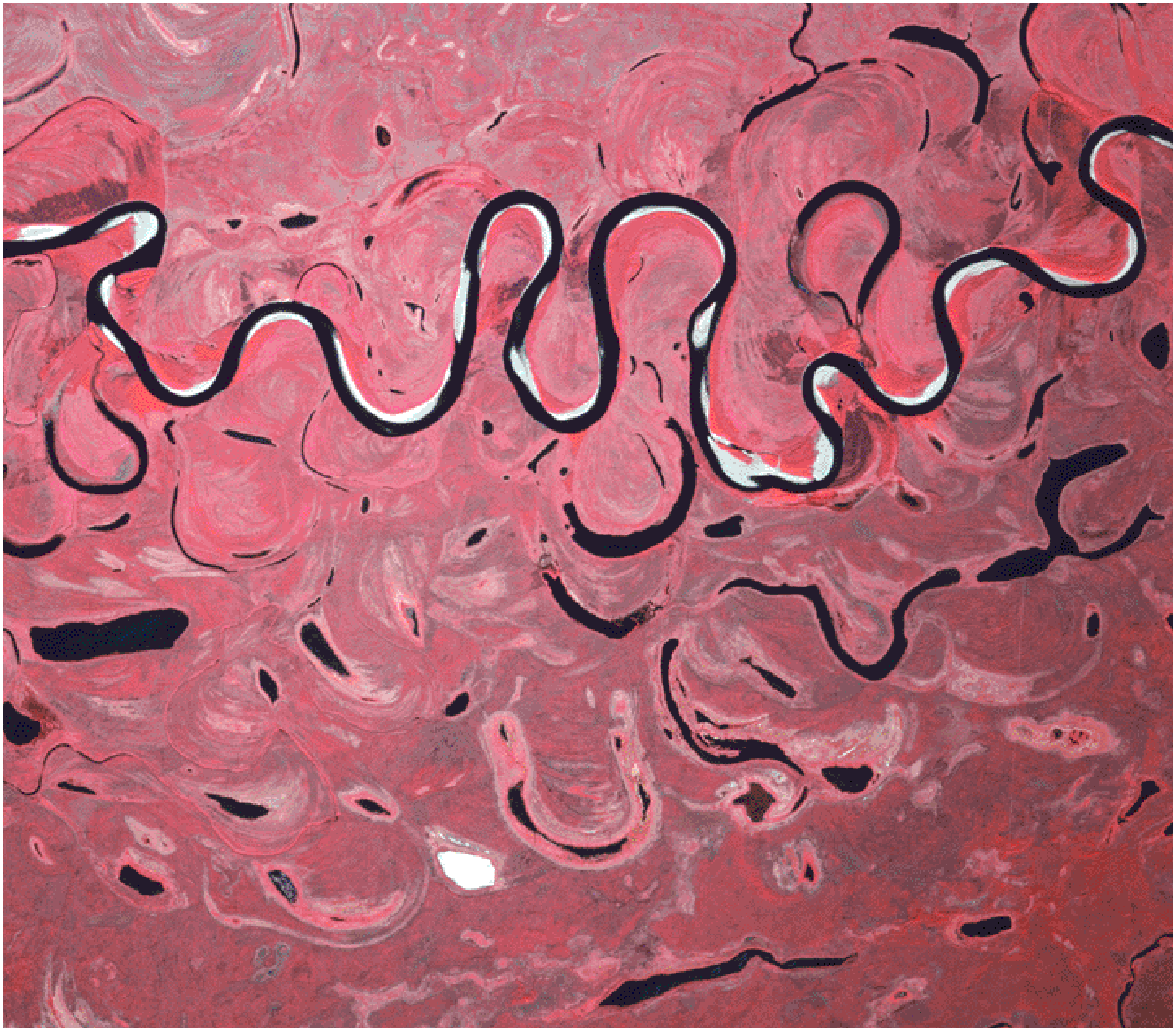


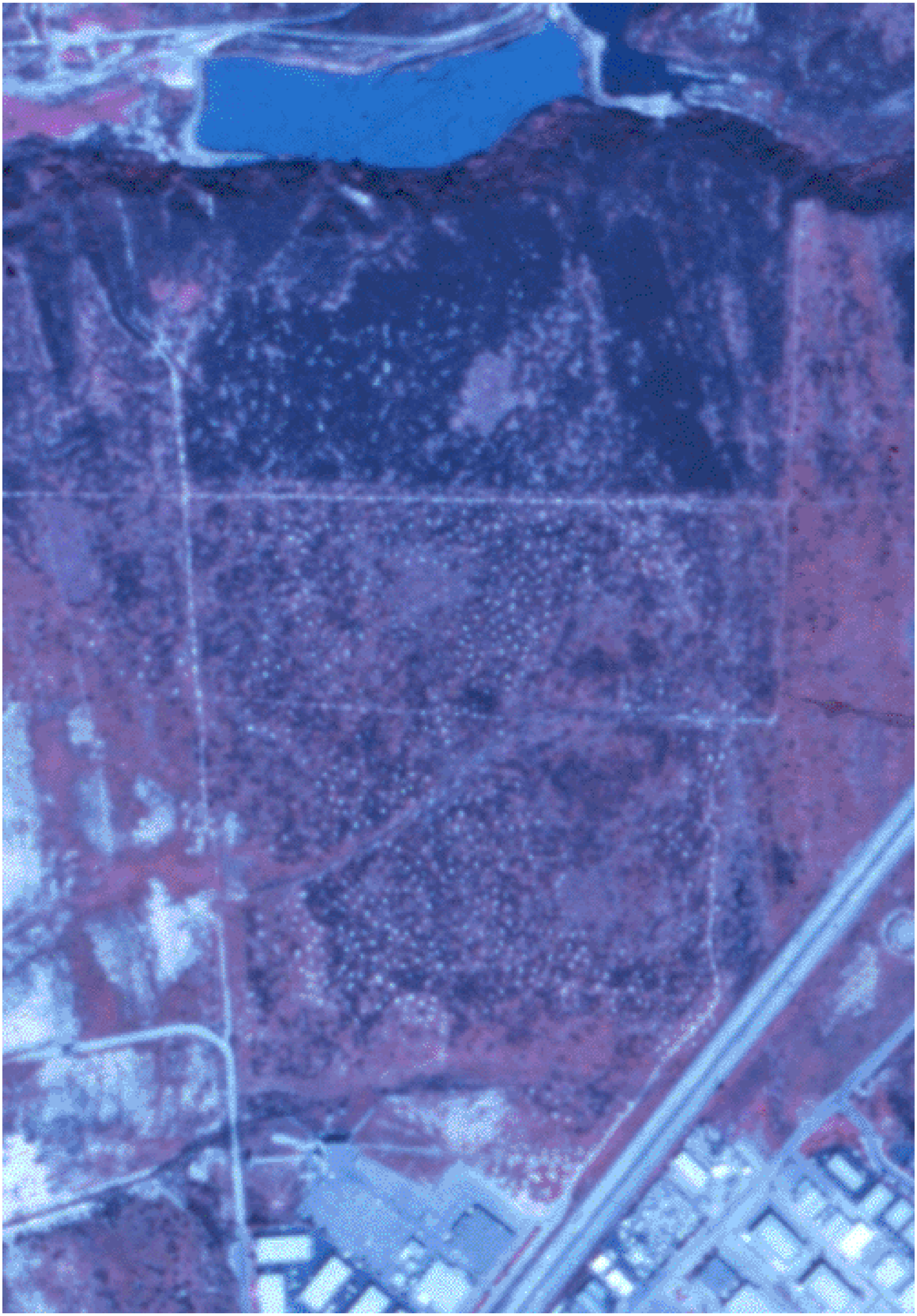
Compiled by William E. Davies with contributions from William R. Halliday, U.S. Geological Survey, 1968

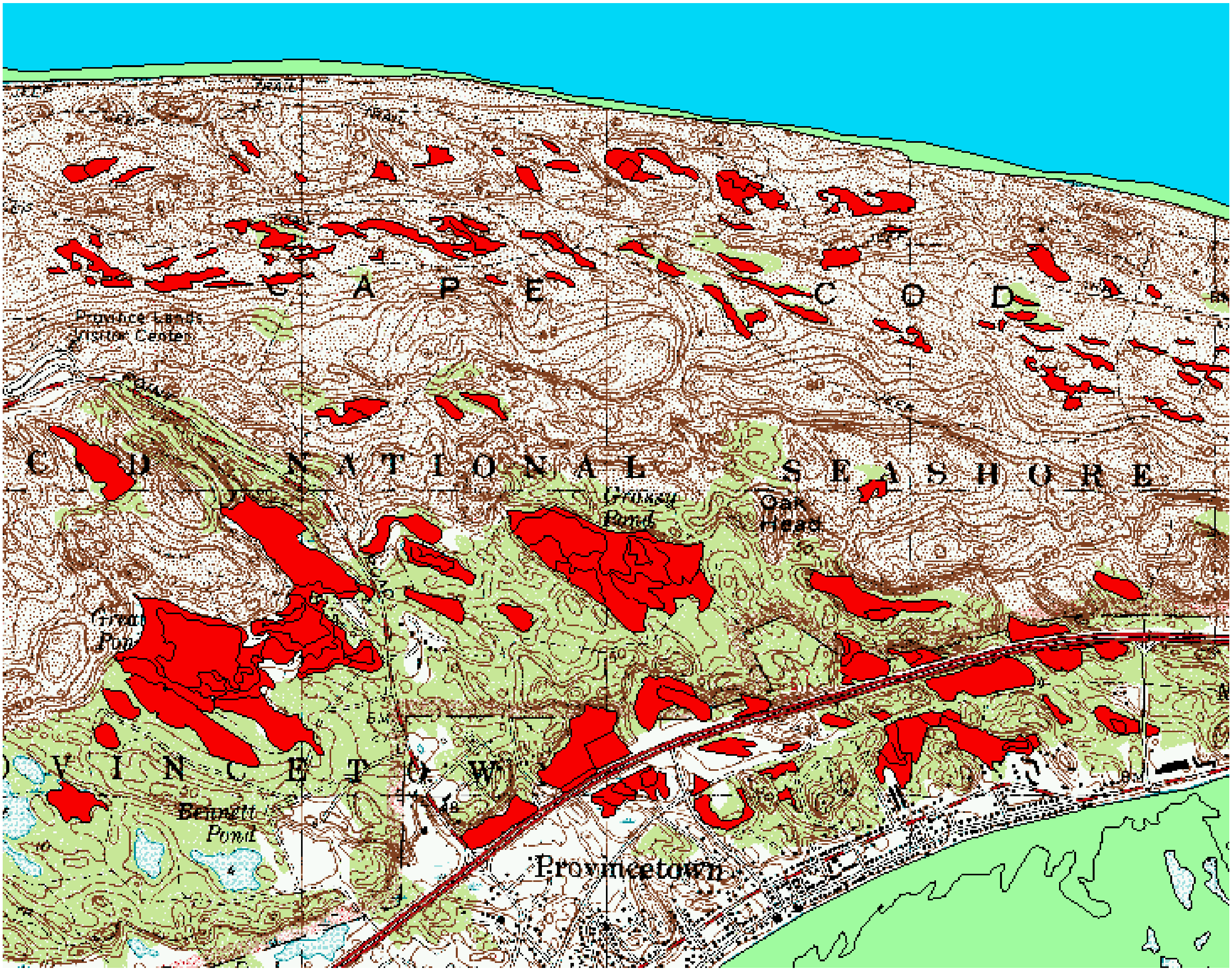

C. Mississippian Plateaus
PALUSTRINE WETLAND
Karst Valley
Sinking creek
Sinkholes
Spring
Regolith
Springs
Springs
Seeps
Limestone




Porcupine River Study Area, Alaska
WILDLIFE
REFUGE
PORCUPINE
Homebrew
Island
Fort Yukon
Yllota Slough
SUCKER
SLOUGH
RIVER
SQUIRREL
Toussaint
Island
Legend
Isolated Wetlands
Non-isolated Wetlands
Uplands
Scale 1:30,000
Locus Map
Data Sources
* Note: This map is for display purposes only. Wetland data is tied to corresponding points on USGS topographic map, within display area.






C A P E C O D
Province Lands
Visitor Center
C O D N A T I O N A L S E A S H O R E
Grassy
Pond
Oak
Head
Great
Pond
Bennett
Pond
P R O V I N C E T O W N
Provincetown

Section 3. Extent of Isolated Wetlands in Selected Areas

There are no existing documents that identify the extent of isolated wetlands across the country. In the absence of national numbers, the Service decided to initiate a relatively small-scale study to determine the extent of isolated wetlands in selected areas. This could be accomplished because the Service has produced National Wetlands Inventory (NWI) maps for 90 percent of the conterminous United States, 35 percent of Alaska, and all of Hawaii. Many of these maps have been digitized to create data that can be used for geospatial analyses through the use of geographic information system (GIS) technology. While the Service's wetland classification system (Cowardin et al. 1979) does not have a descriptor for identifying geographically isolated wetlands, the Service has developed a set of hydrogeomorphic-type descriptors that can be added to the NWI data to, among other things, separate geographically isolated wetlands from wetlands with other water flow paths (i.e., throughflow, outflow, inflow, and bidirectional flow) (Tiner 2000). Such descriptors have been added to NWI digital data in various watersheds to better characterize wetlands and to produce preliminary assessments of wetland functions (see Tiner et al. 1999, 2000 for examples). With this information, technology, and experience, the Service designed a study to use existing digital data to produce estimates of potentially isolated wetlands in numerous areas of the country. This section describes the study and its findings.

Study Methods

Selection of Study Areas

Study areas fall into two broad categories: 1) areas with an expected high percentage of isolated wetlands and 2) areas associated with major physiographic regions.[8] Areas with extensive coastal wetlands and broad floodplains (e.g., Mississippi delta) were generally avoided because their wetlands are typically not isolated, although a few such areas were included in the study.

Since the analysis would be done through the use of geographic information system (GIS) technology, potential study areas were limited by available digital data. Ideally, candidate sites must have had the following data available: 1) NWI digital data, 2) U.S. Geological Survey digital line graphs (DLGs) for hydrology, and 3) U.S. Geological Survey digital raster graphics (DRGs). Regional Wetland Coordinators from the Service's seven regions were consulted to choose potential study sites (approximately 4-8 quads in size) for their regions, considering both areas where isolated wetlands were expected to occur and areas representing other physiographic regions. We reviewed their selections based on the availability of the above geospatial data. Where all the above data were available, a 4-quad study area was usually selected. Two much larger areas (i.e., Devils Lake, North Dakota and Horry County, South Carolina) were evaluated in the early stages of the analysis when testing the methods. Where the three digital data sources were not available, we provided the Coordinators with information on possible alternative areas in the vicinity of their original sites where such data were available and asked them to select study areas accordingly. In the Southwest, NWI digital data were only available for the Texas coastal zone, so potential study areas included areas where NWI maps and DLGs or DRGs were available.

In selecting study areas, the objective was to have a minimum of six study areas for each Fish and Wildlife Service Region in the conterminous U.S. and a minimum of three sites for Alaska. Seventy-two study sites were evaluated in 44 States across the country: eight in U.S. Fish and Wildlife Service

Region 1 (totaling 1,934 square miles), nine in Region 2 (2,012 square miles), 10 in Region 3 (2,181 square miles), 12 in Region 4 (3,903 square miles), 19 in Region 5 (4,267 square miles), 11 in Region 6 (3,716 square miles), and three in Region 7 (742 square miles) (*Figure 3-1*). In total, the analysis covered nearly 19,000 square miles. From an ecoregion standpoint, the study areas fell into more than 20 ecoregions (see *Figures 3-2* and *3-3*). Study sites were located in all major U.S. watersheds (*Figure 3-4*), with at least one site per watershed.

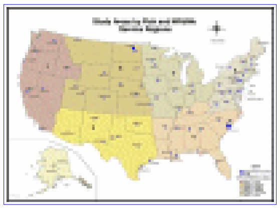


Figure 3-1. Location of study areas by U.S. Fish and Wildlife Service Region and State. Study area names are given.

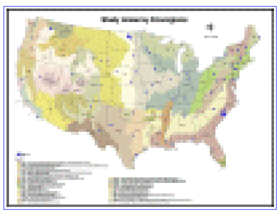


Figure 3-2. Location of study areas in the conterminous U.S. by Bailey ecoregions. (Source: Bailey 1995)

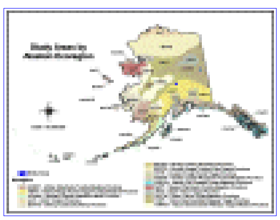


Figure 3-3. Location of study areas in Alaska by Bailey ecoregions. (Source: Bailey 1995)

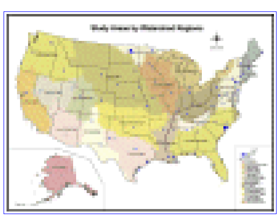


Figure 3-4. Location of study areas in major watersheds.

Definition of Isolated and Non-isolated Wetlands for the Study

We used a landscape-based or geographic definition of isolated wetlands for this study that allowed us to readily and consistently extract information from existing digital data sources for tabulation and reporting purposes. Isolated wetlands were defined as wetlands with no apparent surface water connection to perennial rivers and streams[9], estuaries, or the ocean. Streamside wetlands where the stream disappeared underground or entered an isolated (no surface water outflow) lake or pond, as in karst topography, were classified as isolated. Wetlands associated with most isolated waterbodies were also identified as isolated.[10] Geographically isolated wetlands may be linked hydrologically to other wetlands or streams via subsurface flows (e.g., prairie potholes and Nebraska Sandhills wet meadows) or infrequent overflows (e.g., West Coast vernal pools), but this was impossible to determine using existing digital data. For this study, these wetlands were considered geographically isolated because: 1) they lack an apparent surface water connection, or 2) hydrologic linkages to streams or other waterbodies could not be determined using the available digital datasets. Readers should note that "isolated wetlands" referenced in this report are best described as "potentially isolated," since an accurate determination of isolation (as defined in this report or elsewhere) requires field verification in many, if not most, cases.

For this study, non-isolated wetlands included wetlands located: 1) along perennial rivers and streams and their intermittent tributaries (with some exception for karst regions – see remarks above) (*Figure 3-5*), 2) along the shores of lakes with outlets to rivers and streams, 3) along the margins of very large isolated lake systems (e.g., Great Salt Lake; see footnote 10), 4) along estuaries (*Figure 3-6*), and 5) along the shores of oceans and seas. Due to these landscape positions, many non-isolated wetlands are subjected to periodic flooding during high water stages. Others are groundwater-fed wetlands with surface drainage. Headwater wetlands serving as sources of streams were considered non-isolated since their connection to streams is apparent.

Figure 3-5. Non-isolated freshwater wetlands along a meandering river. (R. Tiner photo)

Figure 3-6. Non-isolated brackish coastal marsh. (R. Tiner photo)

Data Compilation and Analysis

This study involved compiling existing data, creating new digital data, and geoprocessing digital data. Existing digital data sources included: 1) NWI polygon data, 2) digital line graph (DLG) hydrology coverages for study area quads, and 3) digital raster graphics (DRGs) for study quads. The NWI polygon data served as the prime source of wetland and deepwater habitat data, while the DLG hydrology layer was the major source of stream data. DRGs were used as collateral data to evaluate wetlands that were not readily identified as isolated or non-isolated. Note that the wetland digital data used for this analysis did not include NWI linear or point coverages. The analysis was strictly a GIS operation as no field work was performed.

The DLG hydrology data represented a consistent dataset for the analysis of wetland-stream connectivity and isolation. Preference was given to NWI polygon data for wetlands and to the DLG hydrology data for streams. In some cases, when reviewing the draft map products from the data compilation, gaps between the two sources were detected (e.g., wetland smaller on NWI than swamp symbols on the DLG and so stream did not intersect NWI wetland). These areas were reviewed to insure proper wetland classification. In hilly or mountainous terrain with prominent dendritic drainage patterns, most of the gaps were artifacts, so the upstream wetlands were classified as non-isolated.[11] In karst regions where perennial streams "disappear" as they go underground (e.g., "lost streams") and appear spatially isolated, wetlands along these stream segments were considered as isolated, since they lack a surface water connection to other streams (as per our definition).[12] In the few areas where DLG hydrology data were not available, we created a hydro-line coverage from the DRG by culling out the blue line features (representing streams) from the digital data.[13] The result was a crude hydro-line that was used for the analysis.

Stream data were buffered (e.g., stream width expanded) because linear (line-width) streams from the DLG may not intersect NWI wetlands that are actually streamside wetlands, due to differences in spatial accuracy (i.e., linking the two digital datasets). Buffering the streams helped remedy this situation. For the analysis, stream buffers of two-widths were used: 1) 20 meters and 2) 40 meters. The 20m buffer was initially considered sufficient to intersect the two data layers. However, in reviewing some of the preliminary draft maps, some headwater wetlands (sources of streams) were not selected as being associated with streams because of a data gap. A second buffer width - 40m - was chosen to capture these wetlands. Wetlands in the 20-40m zone were highlighted on the maps and tabulated separately. In this way, two scenarios could be produced: one that included them as isolated (when a 20m buffer was used) and another that included them as non-isolated or connected to streams (when the 40m buffer was used). Readers could then see whether including these wetlands as isolated or not would significantly affect the totals for isolated wetlands in each study area.

In reviewing draft maps (combined NWI and DLG coverages), we also noticed that wetlands separated by roads had been designated as isolated even when the adjacent wetland was classified as non-isolated. Subsequently, we added another category to the maps to highlight these wetlands. Although they are called "road-fragmented wetlands," they also included wetlands fragmented by railroads.[14] We suspect that many of these wetlands are connected to the non-isolated wetlands by a culvert but could not be certain, hence the specific classification. In this analysis, "road-fragmented wetlands" were included as non-isolated in two scenarios and isolated in one scenario to give readers a range of the estimated extent of isolated wetlands (see discussion of scenarios below).

In the Southwest, only the Texas coastal zone had digital data required for the isolated wetland analyses using the methods described above. Since we wanted to have a few study sites in each part of the country (including the playa region), we had to take an alternative approach where NWI digital data were not available. In this case, we scanned and vectorized the NWI maps, separated wetlands from deepwater habitats, labeled the general type (wetland or deepwater habitat), then performed the typical analysis using the DLG hydro data. Since we did not label the polygons to the specific NWI classification, we only reported quantitative data for these study areas.

Certain wetlands occurred along the edges of maps, extending into maps outside the study area. In general, we evaluated the larger map-edge wetlands to determine their status as isolated or not. Smaller ones were typically not reviewed and were labeled as "map-edge" wetlands. These unclassified wetlands were not included in the analysis. They represented only a minute fraction of the study area wetlands. Their totals, however, are listed on a detailed statistical data sheet for each study area.

Scenarios for Data Presentation

Three scenarios were chosen to generate estimates of isolated wetlands due to possible interpretations of "isolated wetlands" through GIS analysis. Estimates of isolated wetlands were compiled for each study area following three basic scenarios, ranging from restrictive to broad interpretations of isolated wetlands.

> Scenario 1, the most restrictive scenario, designated only those wetlands that had the highest likelihood of not being connected to a river, stream, or estuary as isolated (shown in red on the maps). This scenario produced the most limited extent of isolated wetlands (i.e., the red wetlands on the maps).
>
> Scenario 2 used a slightly broader interpretation of isolated wetlands, including wetlands in the 20-40m buffer (colored orange on the maps) as isolated. Under this scenario, both the red and orange-colored wetlands were considered isolated.
>
> Scenario 3, the broadest interpretation, added the road-fragmented wetlands (colored brown on the maps) to the isolated wetland category. The connection of these wetlands to neighboring non-isolated wetlands was not evident. This scenario generated the highest number and greatest extent of isolated wetlands for most study sites (i.e., the red, orange, and brown wetlands were considered isolated).

Thus a range of estimates for the number and acreage of isolated wetlands was generated for each study area. These data are most useful for describing isolated wetlands in relative, not absolute, terms.

GIS-generated Products

Thematic maps and accompanying estimates were produced for each study area. For most areas, a set of four 1:24,000 maps were tiled together to produce a study area map at 1:50,000. For other areas, the map scale varied to provide a satisfactory graphic representation of the information.

The maps were designed to highlight geographically isolated wetlands. The following aquatic features were depicted on the maps: 1) isolated wetlands (red polygons; wetlands with the highest probability of being geographically isolated), 2) wetlands 20-40 meters from streams (may be isolated or may be connected to stream; orange polygons), 3) road-fragmented wetlands (possibly connected but uncertain; brown polygons), 4) non-isolated wetlands (green polygons), 5) map-edge wetlands (not counted in the statistical analysis; salmon-colored polygons), 6) streams with a 20 meter buffer (light blue polygons), 7) deepwater habitats (blue polygons), and 8) isolated deepwater habitats (purple polygons). Source data for each map were listed in the map legend. For example, road data came from either the DLG or TIGER (Topologically Intergrated Geographic Encoding and Referencing from U.S. Census Bureau) data, with the former being the preferred source.

Analytical results generated for most study areas included tabulations of: 1) qualitative data on wetlands and deepwater habitats (frequency of polygons and acreage for each type as classified on the NWI maps), 2) three scenarios presenting a range of values for isolated wetlands (e.g., acreage and number of wetlands for each type, and corresponding percentages), and 3) qualitative data on isolated wetlands (Scenario 2) (see blank data sheet, *Figure 3-7*). For a few areas where NWI digital data do not exist, no qualitative data were reported.

Figure 3-7. Blank Data Sheet

Study Limitations

Results presented here are estimates of the numbers or acreages of potentially isolated wetlands and corresponding percentages versus the rest of the wetlands in the study areas. This analysis was intended to provide improved information on the number and acreage of isolated wetlands for 72 study sites across the Nation. These results provide perspective on the potential extent of isolated vs. non-isolated wetlands. This geospatial analysis employed GIS technology and has inherent limitations associated with source data limitations. There are also constraints to developing protocols for identifying isolated wetlands from available data (either maps or digital data). Moreover, the data are not intended to be expanded to physiographic regions, states, or other areas to predict the extent of isolated or non-isolated wetlands for larger geographic regions.

Source Data Limitations

Data sources used for this analysis do not contain every wetland and every small creek (intermittent or perennial). For example, NWI maps have limitations that are inherent in any map produced through remote sensing techniques. In general, NWI maps tend to underestimate the extent of wetlands for several reasons, including: 1) scale and quality of aerial photography (affects both minimum wetlands mapped and ability to separate wetlands from nonwetlands, especially for small isolated wetlands and narrow fringing types) and 2) the difficulty of identifying certain wetlands (e.g., drier types and many forested wetlands, especially evergreen-dominated ones) through photointerpretation (Tiner 1997, 1999).[15] Similarly, the digital hydrology layer (DLGs) and DRGs do not show all streams. Consequently, some wetlands designated as isolated in this study may be connected by small streams or by narrow seepage areas that are not represented in the databases. Data sources reflect conditions in a variety of years and some wetlands and stream courses have undoubtedly been modified.

Carolina bays may have a narrow strip of upland separating them from adjacent wet flatwoods or pocosins, yet the NWI maps may not show this due to map scale and mapping conventions (Charlie Storrs, pers. comm.). These wetlands have been mapped as non-isolated since they were not separated from other wetlands (flatwoods) in the digital data. Field work (beyond the scope of this study) would be required to determine their precise status. The acreage of isolated wetlands in the Dublin, North Carolina and the Horry County, South Carolina study areas may be underestimated.

Fragmented Wetlands

Many wetlands are fragmented by roads, railroads, and other types of development (e.g., urban and suburban development). Roads and railroads are readily interpreted from the available digital data layers. In this study, only fragments that were separated from non-isolated wetlands by mapped roads and railroads were identifed as road-fragmented wetlands. Similar wetlands separated by unmapped roads were not highlighted since these roads were not depicted on the source data. Fragments of wetlands (lacking a stream) across roads or railroad tracks from larger streamside (lotic) wetlands were not assumed to be hydrologically connected or isolated. Instead, they were designated as road-fragmented wetlands. Although many such fragments may be connected via a culvert, we could not verify this without field inspection (beyond scope of our analysis). These wetlands were considered non-isolated in two scenarios (Scenarios 1 and 2) and isolated in Scenario 3. In urban and suburban areas, underground connections via pipes could not be determined, so some wetlands designated as isolated may actually be connected to flowing waters upstream and downstream. Where urban wetlands were associated with a stream, they were designated as non-isolated since underground culverting is a common practice.

Ditched Wetlands

Ditched wetlands may be connected to rivers and streams or may simply move water from one isolated wetland to another isolated basin at a lower elevation. Where the digital data showed ditches connecting to rivers and streams, formerly isolated wetlands were designated as non-isolated, since they are now contributing sources of stream water (at least seasonally) and may also impact the quality of receiving waters. If ditches were not depicted as flowing into a river or stream, the affected wetlands were classified as isolated.

Isolated Wetlands on Floodplains

When analyzing the data, some areas with extensive floodplains possessed wetlands that were not directly connected to the adjacent river by a stream. Even though they may be flooded frequently by river overflow or directly linked to the river via groundwater, such areas were designated as isolated wetlands, since we could not determine the frequency of flooding or subsurface hydrologic linkage. They could be flooded annually or much less often.[16] Wetlands contiguous with rivers or floodplain wetlands connected by a mapped stream channel were classified as non-isolated.

Numbers of Wetlands

Determining the number of wetlands has always posed a problem for NWI map data compilation. What constitutes an individual wetland is a matter of interpretation. Numerous questions may be raised including the following. How much distance is sufficient to separate one wetland from another? Is a wetland on one side of a river a different wetland than the one on the other side? Should different vegetation types be treated as separate wetlands or should they be considered part of one wetland represented by multiple cover types? Should a hillside sloping forested wetland that merges with a forested wetland on a floodplain be treated as an extension of the bottomland wetland or as a different wetland? In other words, should hydrogeomorphic properties or wetland functions be used to delineate individual wetlands? It should be evident by these and other questions that the issue of number of wetlands is fairly complex. If numbers are important, one must determine what to count as an individual wetland.

NWI maps delineate wetlands as point, linear or polygonal features classified by covertypes and other variables (e.g., water regime). Wetlands are not defined as discrete basins or individual complexes. More recently, watershed-based wetland characterization studies conducted by the NWI have used hydrogeomorphic (HGM) concepts to identify individual wetlands (i.e., using a combination of landscape position, landform, and water flow path to designate like units as individual wetlands; Tiner et al. 1999, 2000). For the current study, this categorization was not possible due to the large number of study sites and the time constraints for completing the assessment.

When stream data are merged with NWI data and NWI internal linework is dissolved (e.g., covertypes within a wetland complex), it is possible to readily identify isolated basins by their separation from streams. Consequently, their number is more reliable than the number of non-isolated wetlands. The number of non-isolated wetlands is more than it would be if a detailed HGM-type characterization was performed because road crossings that separate adjacent NWI polygons created additional "individual" wetlands. Readers should, therefore, recognize that the ratio of the number of isolated wetlands vs. non-isolated wetlands presented in this study is somewhat conservative. Study findings do not represent absolute numbers but are intended to show tendencies and provide relative estimates to put some perspective on the potential extent of isolated vs. non-isolated wetlands.

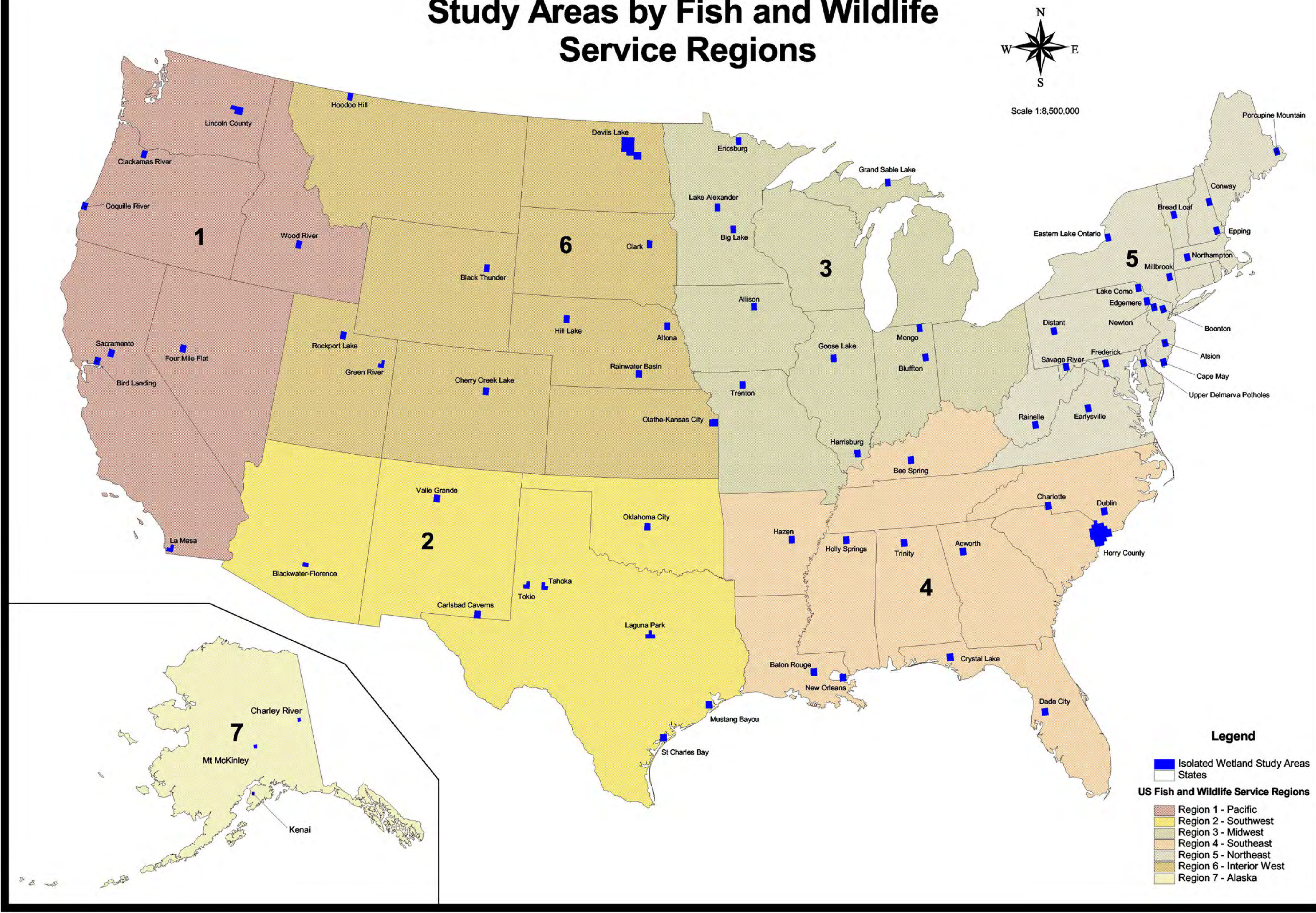
Also, the study did not use point or linear digital NWI data in its analysis since such data are not available or consistent for all areas. In some areas, these dot-sized or linear wetlands make up a substantial number of wetlands (e.g., pothole region) that would increase the number of isolated wetlands. Yet they often do not account for a significant acreage given the abundance of polygon-sized wetlands in these regions.

Map Interpretation

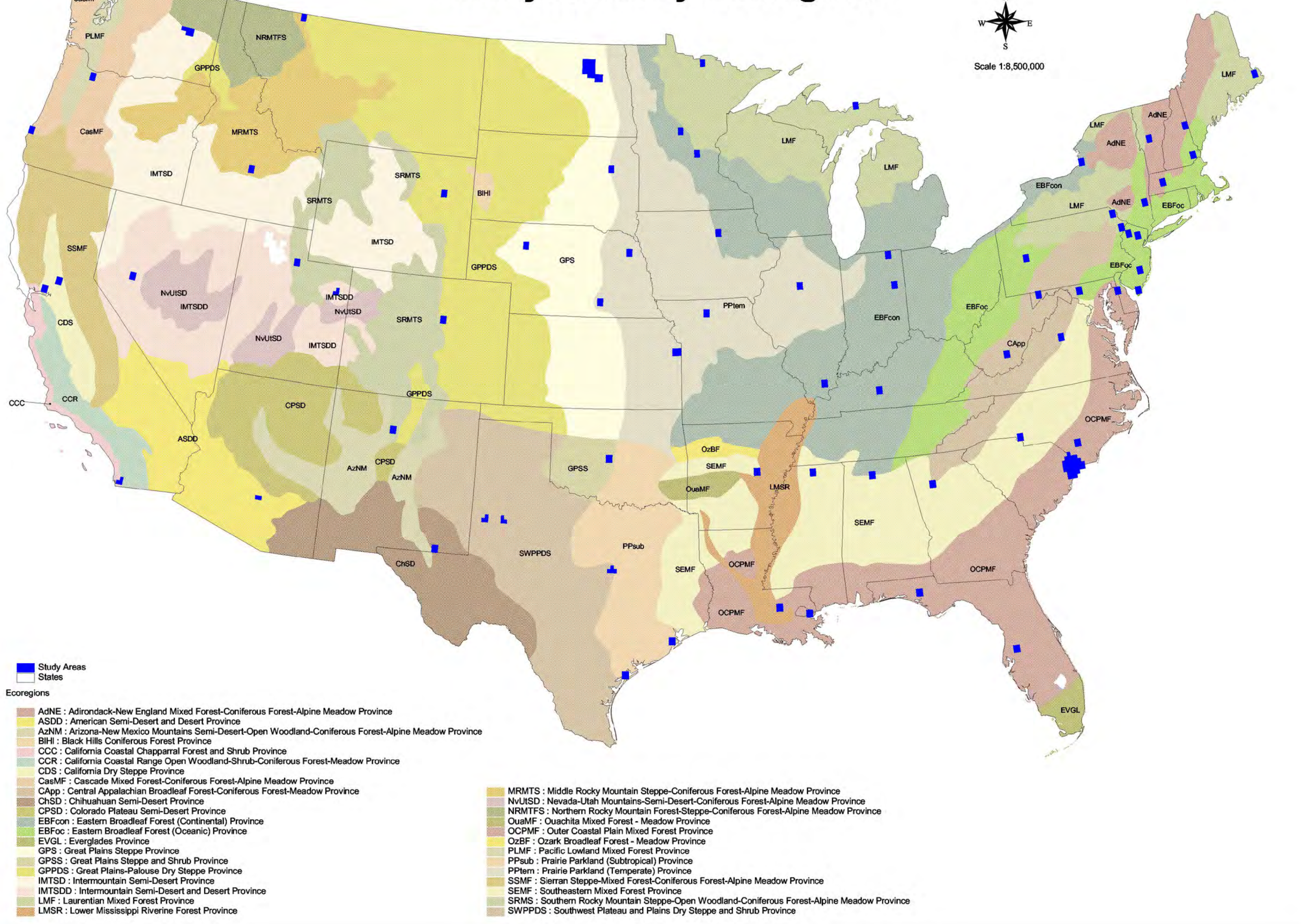
Readers should note the following when reviewing the study area maps presented in this report:

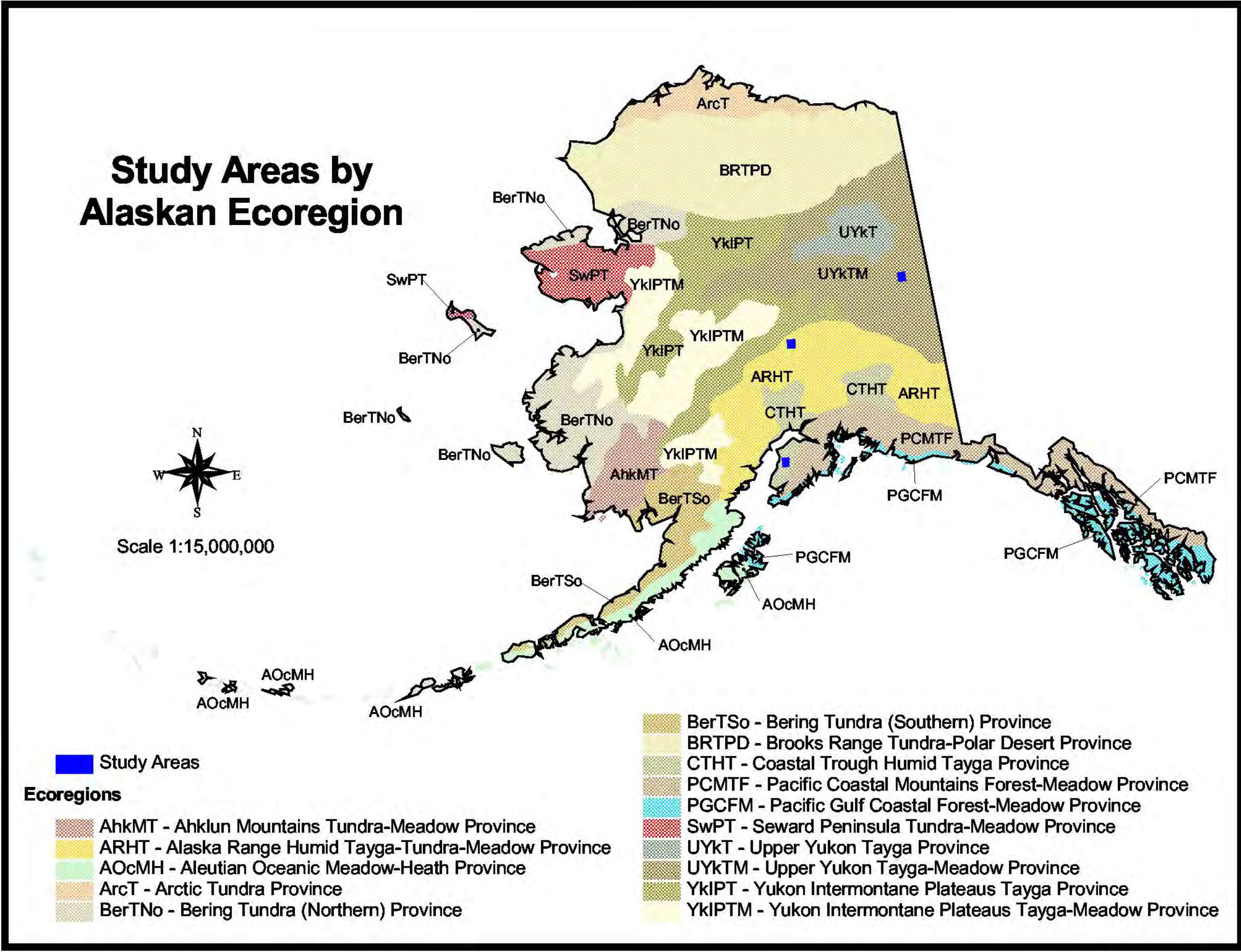
- Red-colored polygons represent wetlands identified following study criteria as isolated under all scenarios.
- Orange-colored polygons are wetlands located 20-40m from a stream. In Scenarios 2 and 3, they were counted as isolated. In Scenario 1, they were considered non-isolated.
- Brown-colored polygons are road-fragmented wetlands - fragmented wetlands that may be linked with an adjacent non-isolated wetland. They were considered isolated only in Scenario 3. Note that other fragmented wetlands were not highlighted and that some road-fragmented wetlands were divided by railroad tracks that may not be shown on the study maps since they were in a separate digital coverage.
- Salmon-colored polygons are map-edge wetlands - typically small wetlands occurring at the edge of the study area map. Examination of these wetlands was not warranted due to time constraints and their scarcity.
- Blue polygons are non-isolated deepwater habitats, whereas purple polygons are isolated deepwater habitats. The latter areas were most common in karst regions, such as the Florida study areas (i.e., Dade City and Crystal Lake).
- The 20m stream buffer (blue linear polygons on map) exaggerates the width of mapped streams. Many of these streams may be less than 10m wide and, in some cases, they represent ditches.
- When reviewing the maps, remember that they are intended for perspective in a relative (not absolute) sense.
- The maps do not identify wetlands for jurisdictional or regulatory purposes.

Study Areas by Fish and Wildlife Service Regions



Study Areas by Ecoregions




Study Areas by
Alaskan Ecoregion
ArcT
BRTPD
BerTNo
BerTNo
UYkT
YkIPT
SwPT
SwPT
YkIPTM
UYkTM
BerTNo
YkIPTM
YkIPT
ARHT
CTHT
ARHT
CTHT
BerTNo
BerTNo
PCMTF
BerTNo
YkIPTM
AhkMT
BerTSo
PGCFM
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PGCFM
PGCFM
BerTSo
AOcMH
AOcMH
AOcMH
AOcMH
AOcMH
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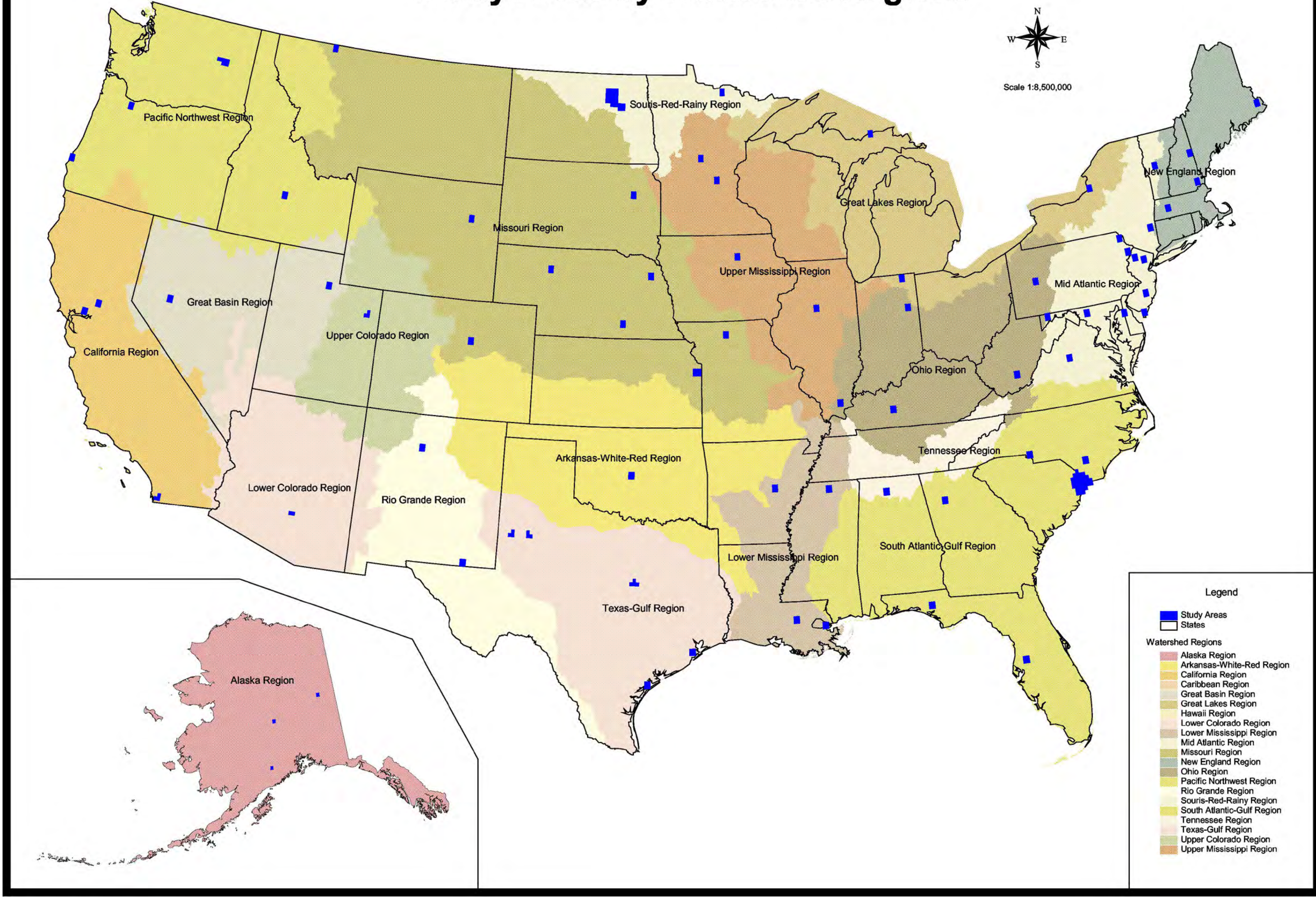
E
S
Scale 1:15,000,000
Study Areas
Ecoregions
AhkMT - Ahklun Mountains Tundra-Meadow Province
ARHT - Alaska Range Humid Tayga-Tundra-Meadow Province
AOcMH - Aleutian Oceanic Meadow-Heath Province
ArcT - Arctic Tundra Province
BerTNo - Bering Tundra (Northern) Province
BerTSo - Bering Tundra (Southern) Province
BRTPD - Brooks Range Tundra-Polar Desert Province
CTHT - Coastal Trough Humid Tayga Province
PCMTF - Pacific Coastal Mountains Forest-Meadow Province
PGCFM - Pacific Gulf Coastal Forest-Meadow Province
SwPT - Seward Peninsula Tundra-Meadow Province
UYkT - Upper Yukon Tayga Province
UYkTM - Upper Yukon Tayga-Meadow Province
YkIPT - Yukon Intermontane Plateaus Tayga Province
YkIPTM - Yukon Intermontane Plateaus Tayga-Meadow Province

Study Areas by Watershed Regions



Study Area: State: FWS Region:

Ecoregion:

Watershed Region:

. . .

STUDY AREA OVERVIEW:

Percent of Study Area

Total Acreage in Study Area......................	
Upland Acreage..	Uplands
Non-Isolated Deepwater Habitats Acreage.	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	
Wetlands Acreage.....................................	Wetlands
Number of Wetlands.................................	

. . .

ACREAGE OF WETLAND TYPES:

			Estuarine Wetlands:
Palustrine Wetlands:		PSS:	Lacustrine Wetlands:
PAB:	PFO:	PUB:	Marine Wetlands:
PEM:	Pf:	PUS:	Riverine Wetlands:

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)				
Scenario 2: (Red and Orange)				
Scenario 3: (Red, Orange and Brown)				

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: Number:

. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

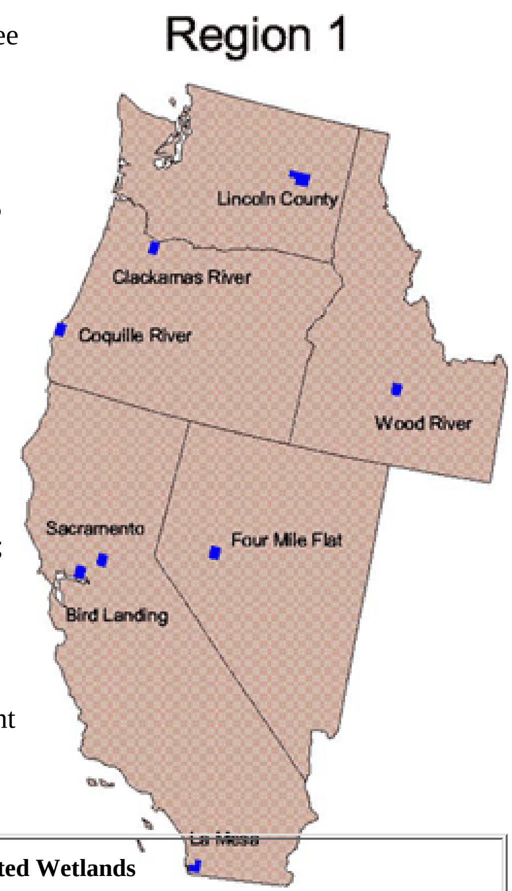
			Estuarine Wetlands:
Palustrine Wetlands:		PSS:	Lacustrine Wetlands:
PAB:	Pf:	PUB:	Marine Wetlands:
PEM:	PFO:	PUS:	Riverine Wetlands:

*** Acreage of Isolated Wetlands based on Scenario 2.

Study Results

Findings are reported for each study area below. Data for individual study areas are arranged by U.S. Fish and Wildlife Service Region. For each Region, there is a general discussion of the study results, a map showing the location of the study sites, a summary table of the findings, detailed data summary for each area, and a special wetland classification map for each study area. The latter two products are represented as "additional data links" within the regional summary table (first column). Simply click on the word "map" or "data" and the pertinent map and data will be displayed. *Please allow a minute or so for the map to appear. Note that printed maps may appear somewhat skewed since their projections reflect the curvature of the Earth.*

Region 1 (Washington, Oregon, Idaho, California, Nevada, and Hawaii)



Eight study areas were evaluated: three in California, one in Idaho, one in Nevada, two in Oregon, and one in Washington. Three sites have some estuarine wetlands within the study area (Bird Landing and La Mesa, California; Coquille River, Oregon). The rest of the sites are entirely inland locations. *Table 3-1* presents a summary of the data for Region 1 study areas.

Percent of Study Areas Covered by Wetlands

Wetlands represented from 1 to 14 percent of the study areas. Bird Landing had the greatest coverage by wetlands (14%; 21,295 acres) due to the occurrence of extensive estuarine wetlands. Four Mile Flat, Nevada (7%) and Coquille River (6%) also possessed substantial wetland acreage. The remaining study sites had 1 to 2 percent of their area in wetlands.

Percent of Wetland Area Identified as Isolated

The Four Mile Flat study area had the highest percentage of wetland acreage designated as isolated (100% under all three scenarios). This resulted from parts of two large salt flats (lacustrine unconsolidated shore; Four Mile Flat and Labou Flat) dominating the study area. Other areas with a high percent of their wetland acreage in this category were Lincoln County, Washington (Channeled Scablands; about 78%) and Sacramento, California (40-48%). Most of the former area's isolated wetlands were palustrine emergent wetlands (2,204 acres; 68% under Scenario 2), while the latter area's isolated wetlands were divided among three types: palustrine unconsolidated bottoms (319 acres; 36% under Scenario 2), emergent wetlands (260 acres; 29%), and unconsolidated shores (211 acres; 24%).

Percent of Wetlands (Number) Classified as Isolated

Most of the study areas had more than 40 percent of their wetlands designated as isolated. Both the Four Mile Flat and Lincoln County study areas had 95 percent or more of their wetlands in this category. Sacramento was third-ranked, with 66 to 72 percent identified as isolated according to the three scenarios evaluated.

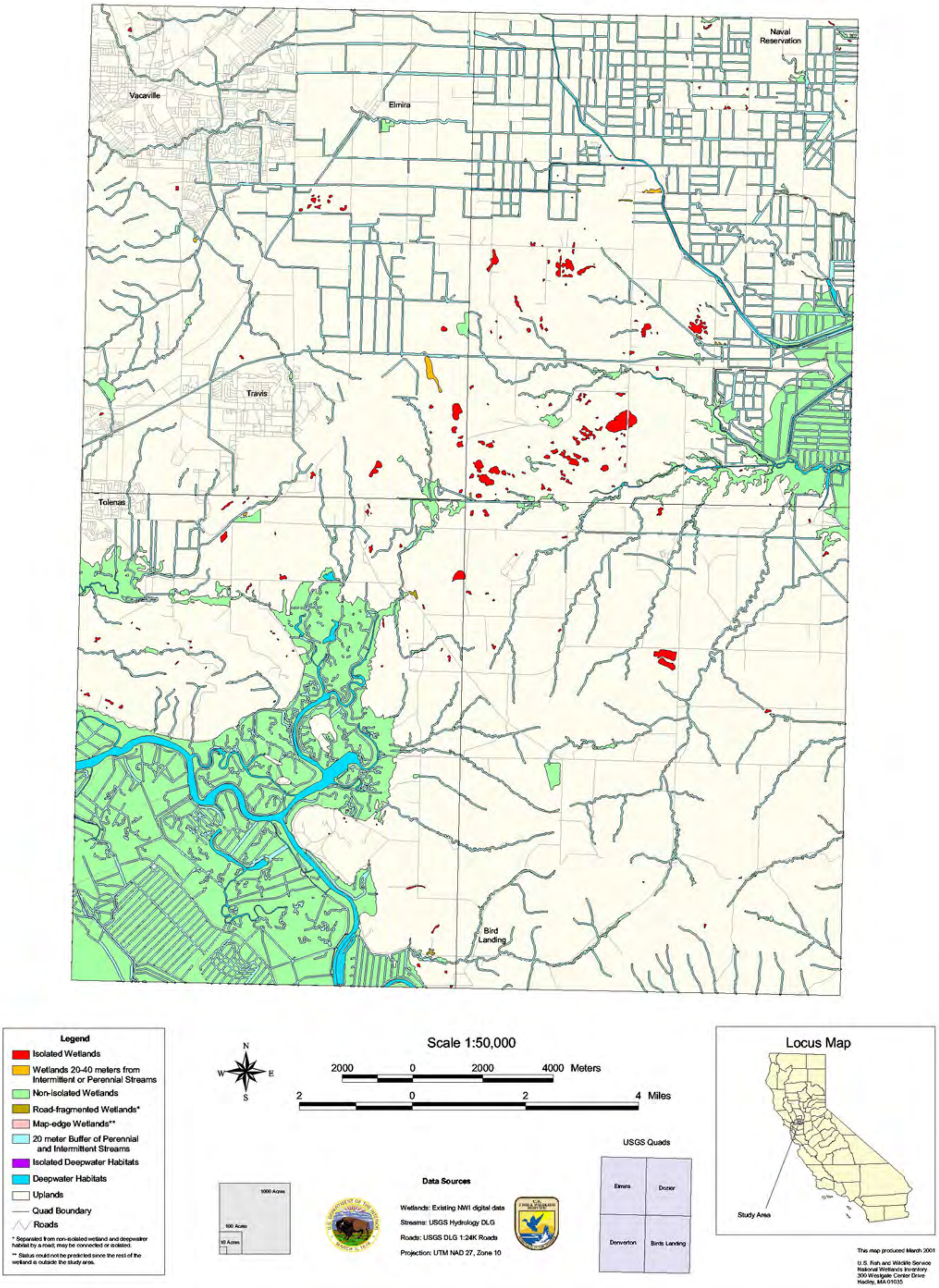
Table 3-1. Summary data for study sites in Region 1. (Note: This table should be printed in landscape orientation.)

								Isolated Wetlands					
Additional Data Links	Study Area	State	Acreage in Study Area	Wetland Acreage	Wetlands % of Study Area	Number of Wetlands	Deepwater Habitats % of Study Area	Scenario 1 Area Percent of Total Wetlands	Scenario 2 Area Percent of Total Wetlands	Scenario 3 Area Percent of Total Wetlands	Scenario 1 Count Percent of Total Wetlands	Scenario 2 Count Percent of Total Wetlands	Scenario 3 Count Percent of Total Wetlands
MAP DATA	Bird Landing	CA	150056.9	21295.2	14.2%	403	1.1%	3.1%	3.3%	3.4%	53.6%	57.6%	58.6%
MAP DATA	La Mesa	CA	120311.4	1703.0	1.4%	260	1.9%	10.9%	11.3%	11.3%	22.3%	24.6%	24.6%
MAP DATA	Sacramento	CA	149246.6	2095.2	1.4%	646	0.7%	40.1%	42.7%	47.6%	66.3%	71.4%	72.0
MAP DATA	Wood River	ID	138545.6	2097.3	1.5%	967	0.2%	5.2%	5.9%	6.3%	29.7%	33.2%	33.4%

MAP DATA	Four Mile Flat	NV	147676.8	10403.4	7.0%	10	0.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
MAP DATA	Clackamas River	OR	134350.7	1659.2	1.2%	598	0.8%	15.9%	17.1%	20.5%	43.3%	46.8%	48.2%
MAP DATA	Coquille River	OR	139551.6	8684.7	6.2%	1110	31.8%	8.4%	8.4%	9.6%	47.2%	47.2%	49.1%
MAP DATA	Lincoln County	WA	257933.6	4160.1	1.6%	3124	0.1%	78.1%	78.4%	78.4%	94.5%	95.3%	95.3%

[Back to Table of Contents] [Home] [Go to Results Region 2] [Skip to Section 4]

Bird Landing Study Area, California



Study Area: Bird Landing State: CA FWS Region: 1

Ecoregion: California Dry Steppe

Watershed Region: California Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	150056.9		
Upland Acreage..	127123.1	84.7%	Uplands
Non-Isolated Deepwater Habitats Acreage.	1638.6	1.1%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	21295.2	14.2%	Wetlands
Number of Wetlands.................................	403		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	12486.2
Palustrine Wetlands:				PSS:	35.9	Lacustrine Wetlands:	159.6
PAB:	30.8	PFO:	3.3	PUB:	255.0	Marine Wetlands:	0.0
PEM:	3216.6	Pf:	4870.4	PUS:	232.5	Riverine Wetlands:	4.9

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	655.5	3.1%	216	53.6%
Scenario 2: (Red and Orange)	711.5	3.3%	232	57.6%
Scenario 3: (Red, Orange and Brown)	728.3	3.4%	236	58.6%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 0.0 Number: 0

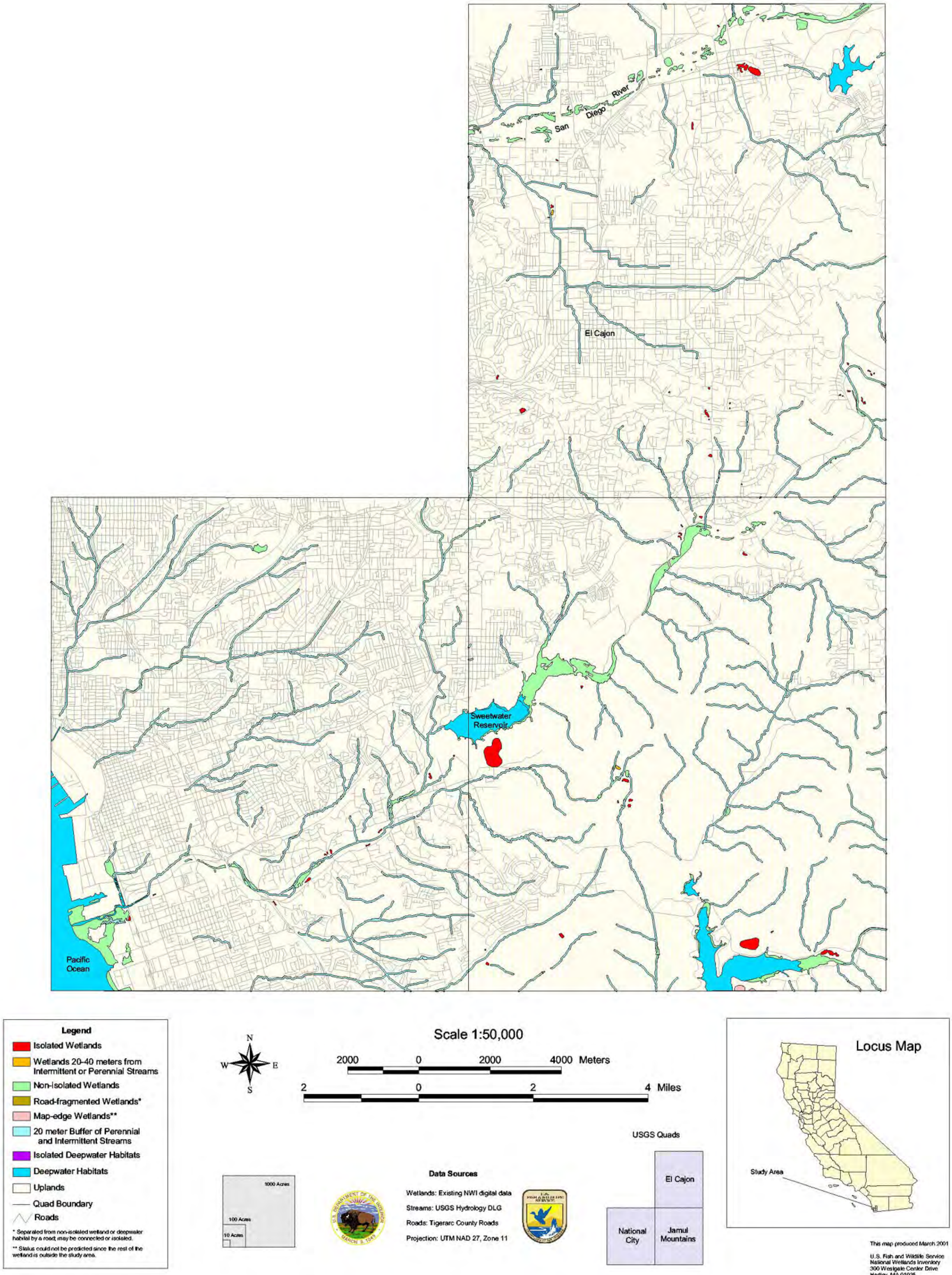
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	0.0	Lacustrine Wetlands:	50.3
PAB:	0.7	Pf:	0.0	PUB:	64.3	Marine Wetlands:	0.0
PEM:	508.2	PFO:	0.0	PUS:	87.9	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

La Mesa Study Area, California



Study Area: La Mesa State: CA FWS Region: 1

Ecoregion: California Coastal Chapparral Forest and Shrub

Watershed Region: California Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	120311.4		
Upland Acreage..	116369.2	96.7%	Uplands
Non-Isolated Deepwater Habitats Acreage.	2239.2	1.9%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	1703.0	1.4%	Wetlands
Number of Wetlands.................................	260		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	319.7
Palustrine Wetlands:				PSS:	386.2	Lacustrine Wetlands:	4.5
PAB:	2.1	PFO:	273.3	PUB:	195.2	Marine Wetlands:	0.0
PEM:	408.4	Pf:	0.0	PUS:	60.5	Riverine Wetlands:	53.0

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	185.2	10.9%	58	22.3%
Scenario 2: (Red and Orange)	191.8	11.3%	64	24.6%
Scenario 3: (Red, Orange and Brown)	191.8	11.3%	64	24.6%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 13.5 Number: 3

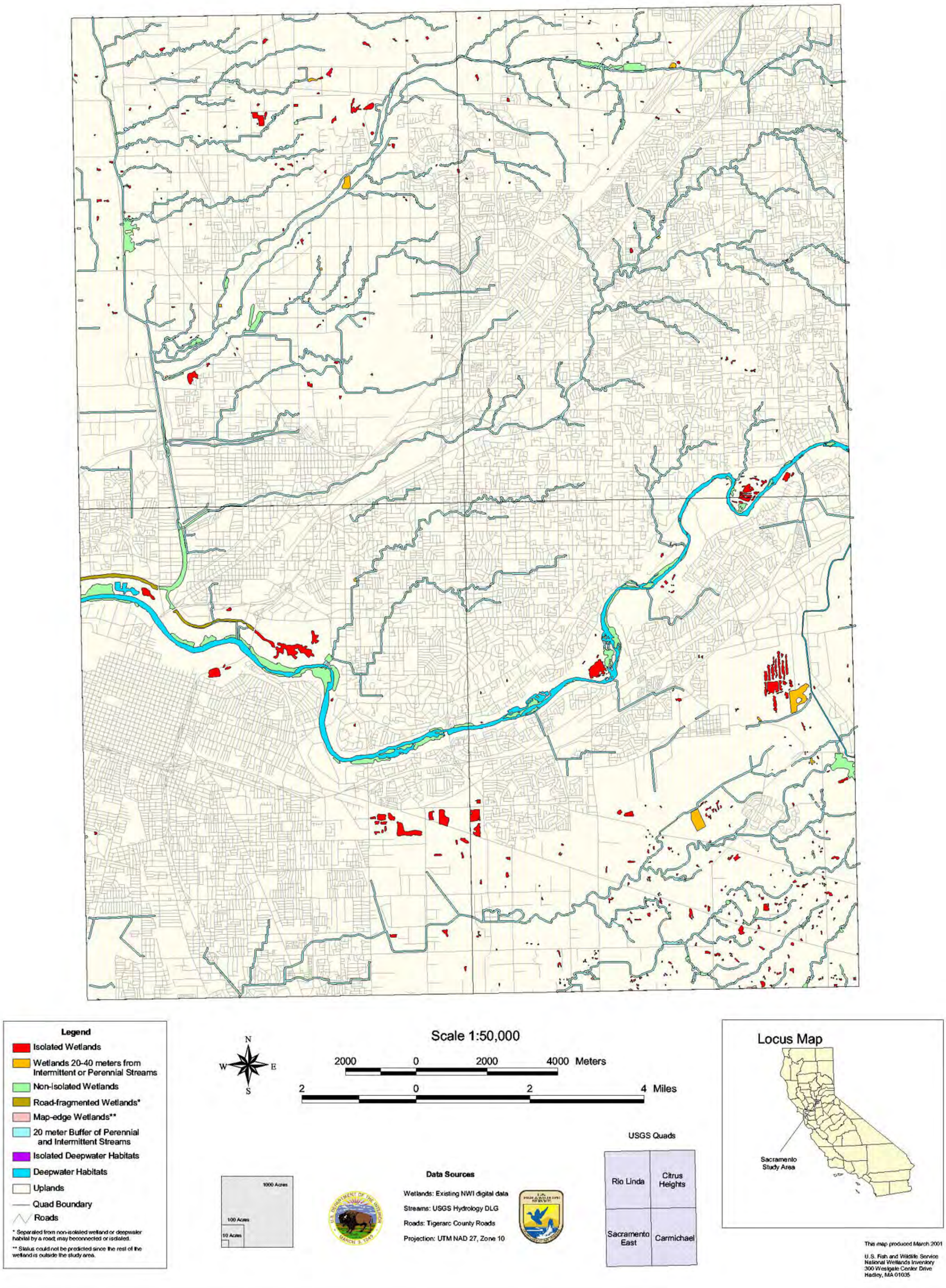
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	10.0	Lacustrine Wetlands:	0.0
PAB:	1.0	Pf:	0.0	PUB:	42.5	Marine Wetlands:	0.0
PEM:	121.6	PFO:	7.2	PUS:	9.5	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Sacramento Study Area, California



Study Area: Sacramento State: CA FWS Region: 1

Ecoregion: California Dry Steppe

Watershed Region: California Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area.....................	149246.6		
Upland Acreage.......................................	146138.2	97.9%	Uplands
Non-Isolated Deepwater Habitats Acreage.	1013.2	0.7%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage....................................	2095.2	1.4%	Wetlands
Number of Wetlands................................	646		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	190.3	Lacustrine Wetlands:	20.0
PAB:	3.4	PFO:	499.2	PUB:	477.5	Marine Wetlands:	0.0
PEM:	544.1	Pf:	0.0	PUS:	213.5	Riverine Wetlands:	118.7

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	839.3	40.1%	428	66.3%
Scenario 2: (Red and Orange)	895.2	42.7%	461	71.4%
Scenario 3: (Red, Orange and Brown)	997.0	47.6%	465	72.0%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 7.1 Number: 10

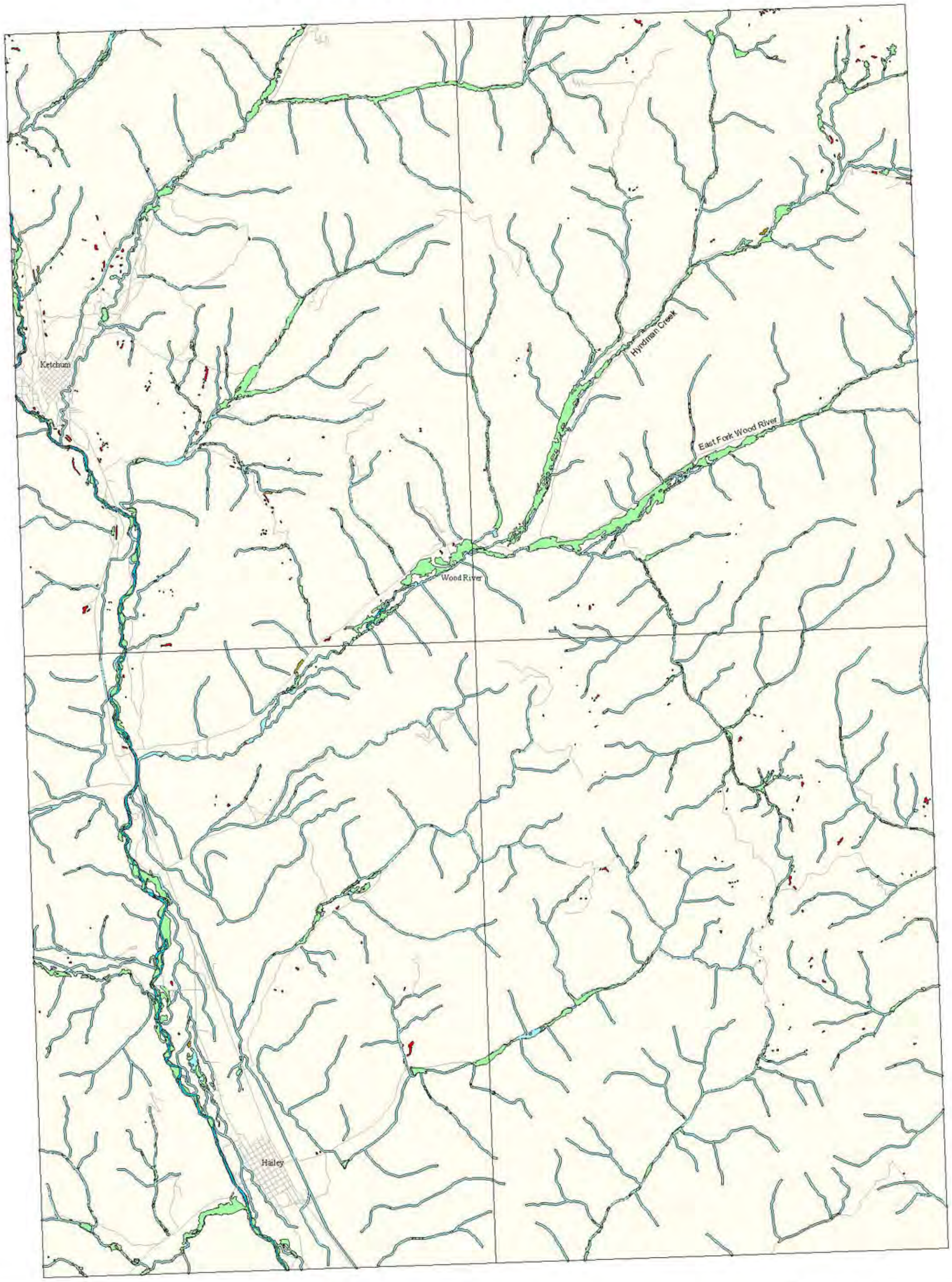
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	55.8	Lacustrine Wetlands:	20.0
PAB:	1.4	Pf:	0.0	PUB:	318.5	Marine Wetlands:	0.0
PEM:	259.8	PFO:	28.0	PUS:	211.4	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Wood River Study Area, Idaho



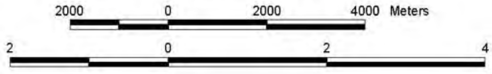
Legend

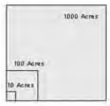
- Isolated Wetlands
- Wetlands 20-40 meters from Intermittent or Perennial Streams
- Non-isolated Wetlands
- Road-fragmented Wetlands*
- Map-edge Wetlands**
- 20 meter Buffer of Perennial and Intermittent Streams
- Isolated Deepwater Habitats
- Deepwater Habitats
- Uplands
- Quad Boundary
- Roads

* Separated from non-isolated wetland by a road; may be connected or isolated.

** Status could not be predicted since the rest of the wetland is outside the study area.

Scale 1:50,000





Data Sources

Wetlands: Existing NWI digital data

Streams: USGS Hydrology DLG

Roads: USGS DLG 1:24K Roads

Projection: UTM NAD 27, Zone 15

USGS Quads

Locus Map

This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Wood River State: ID FWS Region: 1

Ecoregion: Middle Rocky Mountain Steppe-Coniferous Forest Alpine Meadow

Watershed Region: Pacific Northwest Region

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STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	138545.5		
Upland Acreage..	136185.5	98.3%	Uplands
Non-Isolated Deepwater Habitats Acreage.	262.8	0.2%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	2097.3	1.5%	Wetlands
Number of Wetlands.................................	967		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	1067.4	Lacustrine Wetlands:	0.0
PAB:	15.9	PFO:	105.7	PUB:	74.7	Marine Wetlands:	0.0
PEM:	590.0	Pf:	0.0	PUS:	0.7	Riverine Wetlands:	242.9

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	109.1	5.2%	287	29.7%
Scenario 2: (Red and Orange)	124.3	5.9%	321	33.2%
Scenario 3: (Red, Orange and Brown)	131.6	6.3%	323	33.4%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 3.6 Number: 5

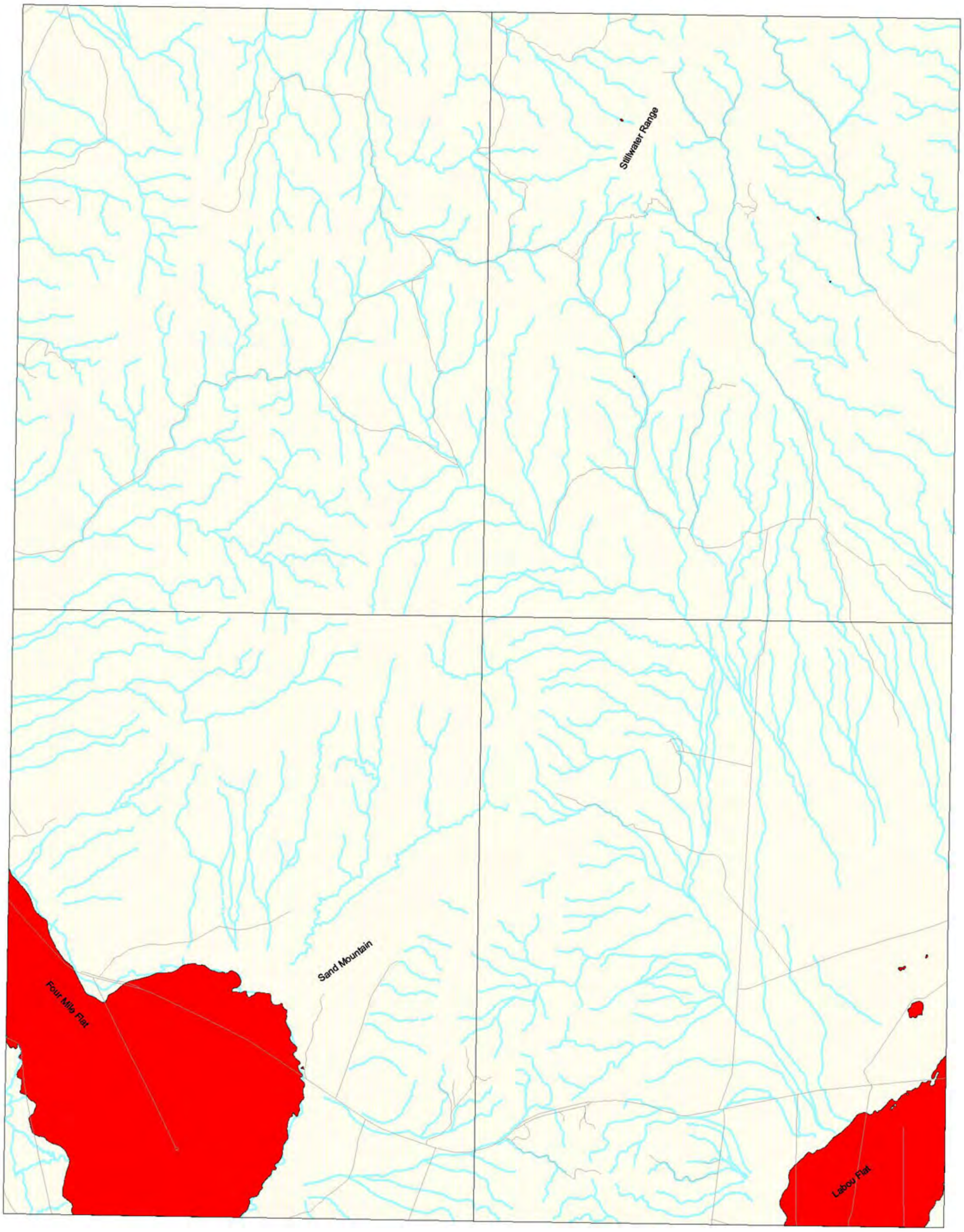
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	40.8	Lacustrine Wetlands:	0.0
PAB:	1.0	Pf:	0.0	PUB:	22.6	Marine Wetlands:	0.0
PEM:	56.4	PFO:	3.0	PUS:	0.6	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Four Mile Flat Study Area, Nevada



Legend

- Isolated Wetlands
- Wetlands 20-40 meters from Intermittent or Perennial Streams
- Non-isolated Wetlands
- Road-fragmented Wetlands*
- Map-edge Wetlands**
- 20 meter Buffer of Perennial and Intermittent Streams
- Isolated Deepwater Habitats
- Deepwater Habitats
- Uplands
- Quad Boundary
- Roads

* Separated from non-isolated wetland by a road; may be connected or isolated.

** Status could not be predicted since the rest of the wetland is outside the study area.

N W E S

Scale 1:50,000

2000 0 2000 4000 Meters

2 0 2 4 Miles

1000 Acres
100 Acres
10 Acres

Data Sources

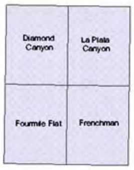
Wetlands: Existing NWI digital data

Streams: USGS Hydrology DLG

Roads: USGS DLG 1:24K Roads

Projection: UTM NAD 27, Zone 11

USGS Quads



Locus Map

This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Four Mile Flat State: NV FWS Region: 1

Ecoregion: Intermountain Semi-Desert and Desert

Watershed Region: Great Basin Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	147676.8		
Upland Acreage..	137273.4	93.0%	Uplands
Non-Isolated Deepwater Habitats Acreage.	0.0	0.0%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage......................................	10403.4	7.0%	Wetlands
Number of Wetlands.................................	10		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	0.0	Lacustrine Wetlands:	10398.3
PAB:	0.0	PFO:	0.0	PUB:	0.2	Marine Wetlands:	0.0
PEM:	1.9	Pf:	0.0	PUS:	2.9	Riverine Wetlands:	0.0

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	10403.4	100.0%	10	100.0%
Scenario 2: (Red and Orange)	10403.4	100.0%	10	100.0%
Scenario 3: (Red, Orange and Brown)	10403.4	100.0%	10	100.0%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 0.0 Number: 0

Note: Four small wetlands (totaling 1.6 acres) occurring along intermittent streams that appeared to drain into isolated flats were designated as isolated.

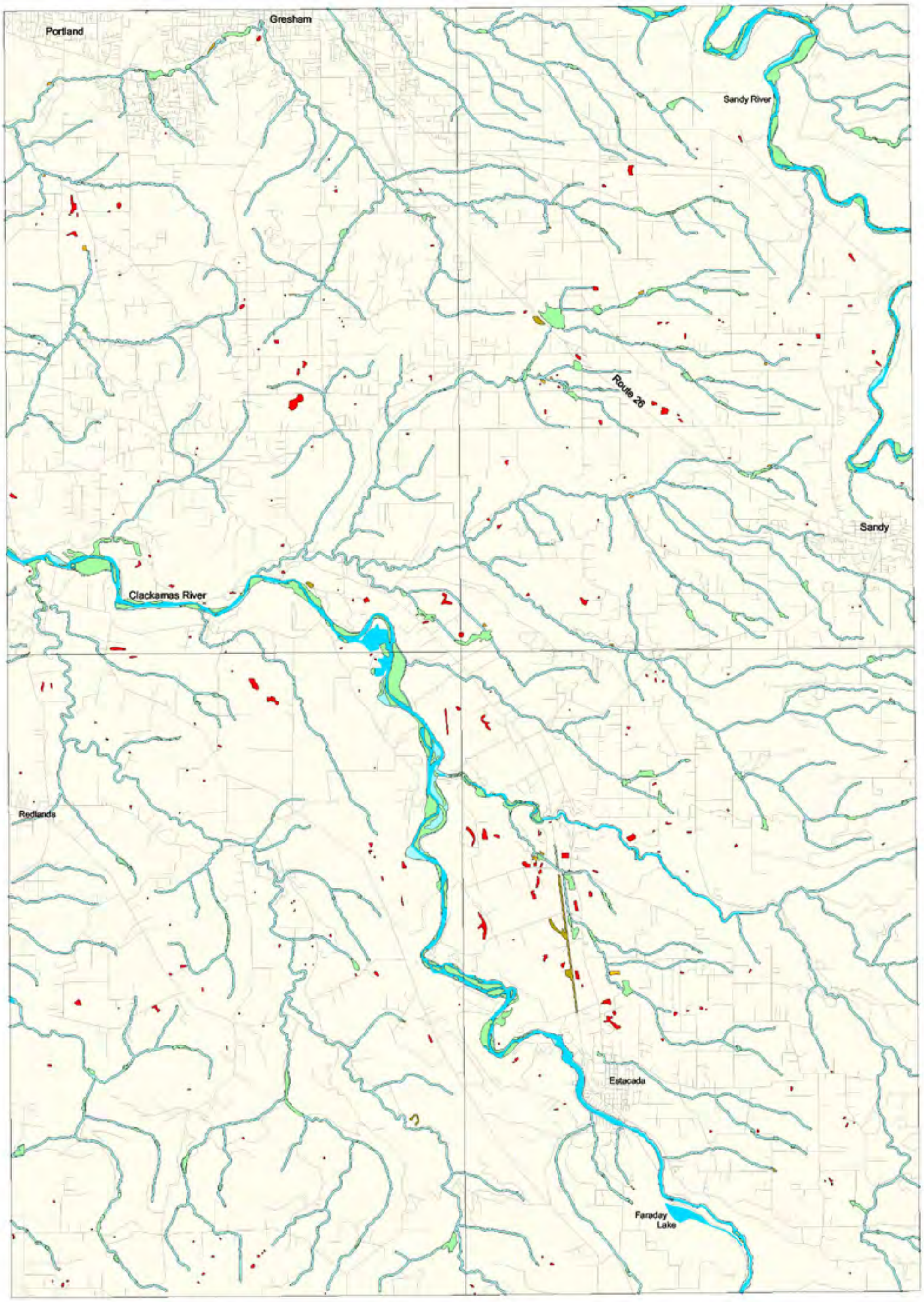
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	0.0	Lacustrine Wetlands:	10398.3
PAB:	0.0	Pf:	0.0	PUB:	0.2	Marine Wetlands:	0.0
PEM:	2.0	PFO:	0.0	PUS:	2.9	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Clackamas River Study Area, Oregon



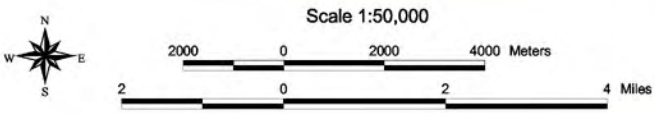
Legend

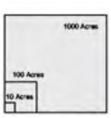
- Isolated Wetlands
- Wetlands 20-40 meters from Intermittent or Perennial Streams
- Non-isolated Wetlands
- Road-fragmented Wetlands*
- Map-edge Wetlands**
- 20 meter Buffer of Perennial and Intermittent Streams
- Isolated Deepwater Habitats
- Deepwater Habitats
- Uplands
- Quad Boundary
- Roads

* Seperated from non-isolated wetland or deepwater habitat by a road; may be connected or isolated.

** Status could not be predicted since the rest of the wetland is outside the study area.

Scale 1:50,000





Data Sources

Wetlands: Existing NWI digital data

Streams: USGS Hydrology DLG

Roads: USGS DLG 1:24K Roads

Projection: UTM NAD 27, Zone 15

USGS Quads

This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Clackamas River State: OR FWS Region: 1

Ecoregion: Pacific Lowland Mixed Forest / Cascade Mixed Forest-Coniferous Forest-Alpine Meadow

Watershed Region: Pacific Northwest Region

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STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	134350.7		
Upland Acreage..	131670.0	98.0%	Uplands
Non-Isolated Deepwater Habitats Acreage.	1021.6	0.8%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	1659.2	1.2%	Wetlands
Number of Wetlands.................................	598		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	275.5	Lacustrine Wetlands:	6.3
PAB:	3.2	PFO:	755.7	PUB:	231.3	Marine Wetlands:	0.0
PEM:	130.3	Pf:	0.0	PUS:	0.0	Riverine Wetlands:	313.3

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	264.5	15.9%	259	43.3%
Scenario 2: (Red and Orange)	284.3	17.1%	280	46.8%
Scenario 3: (Red, Orange and Brown)	340.9	20.5%	288	48.2%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 0.6 Number: 2

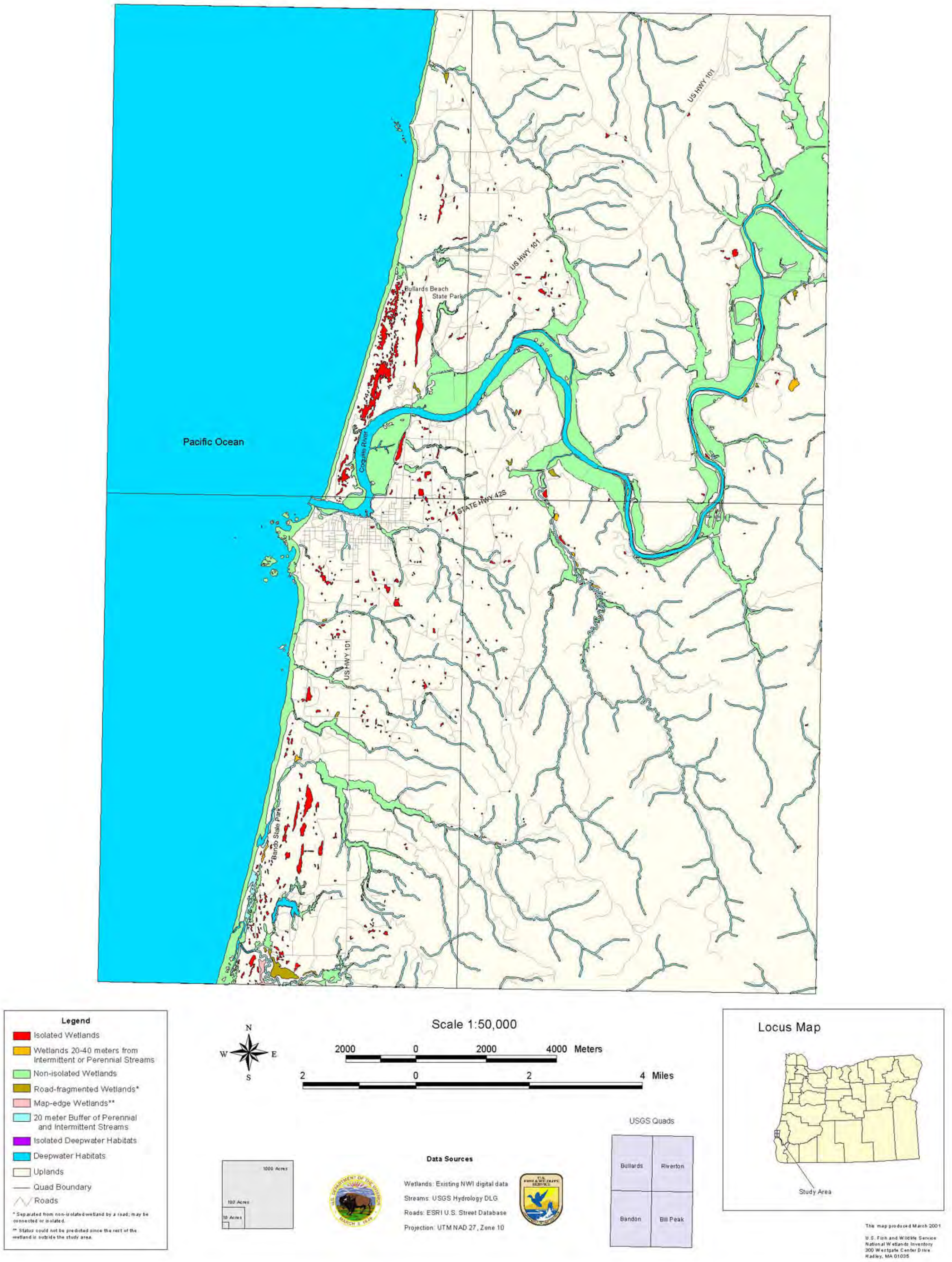
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	53.1	Lacustrine Wetlands:	0.0
PAB:	0.2	Pf:	0.0	PUB:	94.3	Marine Wetlands:	0.0
PEM:	43.8	PFO:	92.8	PUS:	0.0	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Coquille River Study Area, Oregon



Study Area: Coquille River State: OR FWS Region: 1

Ecoregion: Cascade Mixed Forest-Coniferous Forest-Alpine Meadow

Watershed Region: Pacific Northwest Region

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STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	139551.6		
Upland Acreage..	86494.3	62.0%	Uplands
Non-Isolated Deepwater Habitats Acreage.	44372.6	31.8%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	8684.7	6.2%	Wetlands
Number of Wetlands.................................	1110		

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ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	587.3
Palustrine Wetlands:				PSS:	765.4	Lacustrine Wetlands:	3.2
PAB:	14.1	PFO:	468.6	PUB:	160.5	Marine Wetlands:	992.4
PEM:	5656.4	Pf:	0.0	PUS:	2.9	Riverine Wetlands:	0.0

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	679.4	8.4%	498	47.2%
Scenario 2: (Red and Orange)	733.0	8.4%	524	47.2%
Scenario 3: (Red, Orange and Brown)	833.9	9.6%	545	49.1%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 22.4 Number: 4

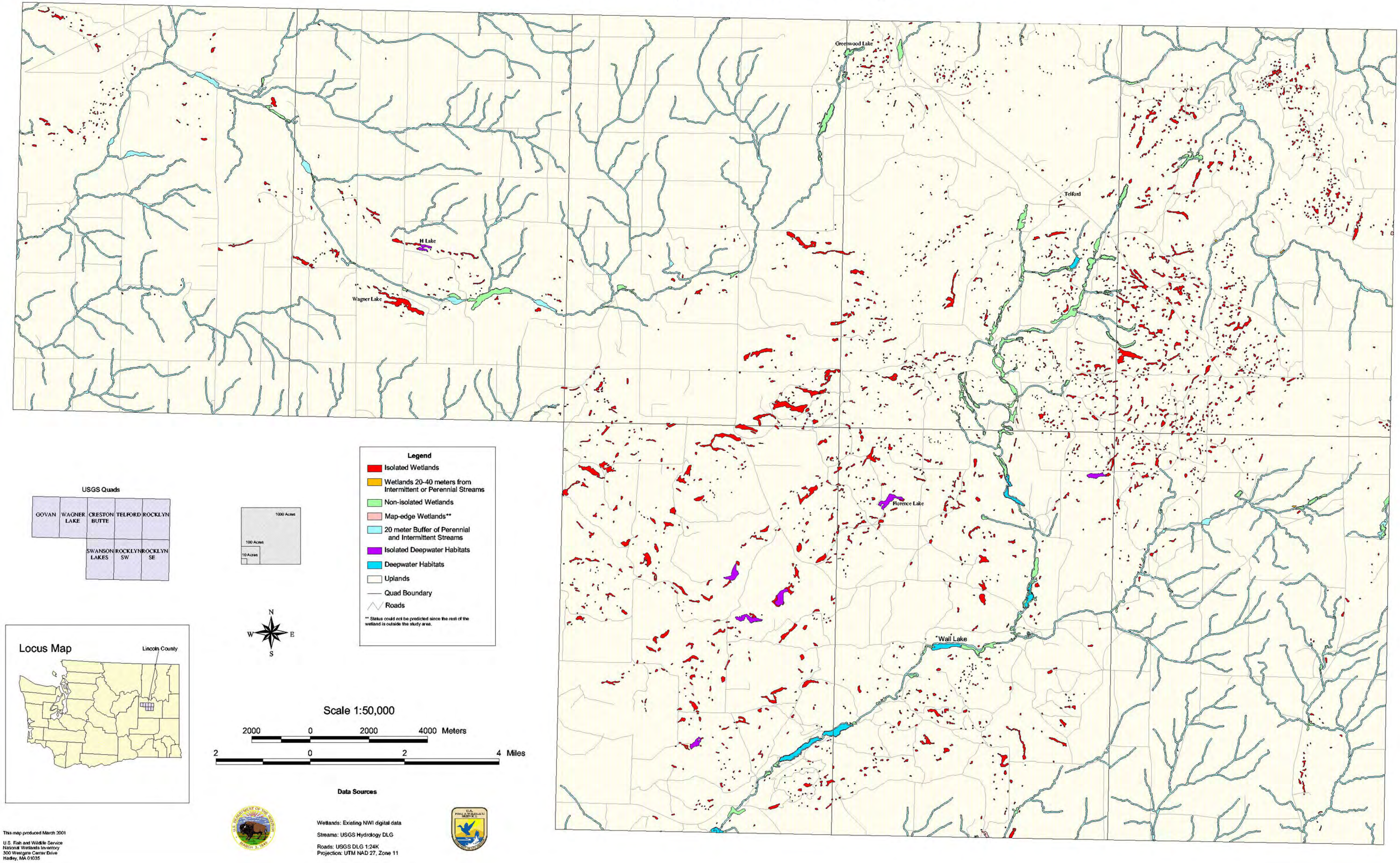
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	259.8	Lacustrine Wetlands:	0.0
PAB:	0.6	Pf:	0.0	PUB:	79.8	Marine Wetlands:	0.0
PEM:	322.8	PFO:	42.6	PUS:	13.2	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Lincoln County Study Area, Washington State



Study Area: Lincoln County State: WA FWS Region: 1

Ecoregion: Intermountain Semi-Desert

Watershed Region: Pacific Northwest Region

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STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	257933.6		
Upland Acreage..	253578.3	98.3%	Uplands
Non-Isolated Deepwater Habitats Acreage.	58.5	0.1%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	136.7		
Wetlands Acreage.....................................	4160.1	1.6%	Wetlands
Number of Wetlands.................................	3124		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	31.8	Lacustrine Wetlands:	70.2
PAB:	34.0	PFO:	46.1	PUB:	694.4	Marine Wetlands:	0.0
PEM:	2989.3	Pf:	0.0	PUS:	289.2	Riverine Wetlands:	0.0

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	3248.3	78.1%	2951	94.5%
Scenario 2: (Red and Orange)	3259.5	78.4%	2976	95.3%
Scenario 3: (Red, Orange and Brown)	3259.5	78.4%	2976	95.3%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 4.7 Number: 7

. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	23.8	Lacustrine Wetlands:	67.3
PAB:	29.8	Pf:	0.0	PUB:	635.2	Marine Wetlands:	0.0
PEM:	2203.8	PFO:	11.4	PUS:	288.2	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Study Results

Study findings are reported for each study area below. Data for individual study areas are arranged by U.S. Fish and Wildlife Service Region. For each Region, there is a general discussion of the study results, a map showing the location of the study sites, a summary table of the findings, detailed data summary for each area, and a special wetland classification map for each study area. The latter two products are represented as "additional data links" within the regional summary table (first column). Simply click on the word "map" or "data" and the pertinent map and data will be displayed. *Please allow a minute or so for the map to appear. Note that printed maps may appear somewhat skewed since their projections reflect the curvature of the Earth.*

Region 2 (Arizona, New Mexico, Texas, and Oklahoma)

Nine study areas were evaluated in the Southwest: one in Arizona, two in New Mexico, one in Oklahoma, and five in Texas. Two sites were coastal study areas (St. Charles Bay and Mustang Bayou, Texas), while the rest were interior regions. Two study sites were in the Texas playa region (Tokio and Tahoka). *Table 3-2* presents a summary of the data for Region 2 study areas.

<u>Percent of Study Areas Covered by Wetlands</u>

The extent of wetlands in the study sites ranged from less than 1 percent to 21 percent of the study areas. St. Charles Bay had the highest percentage of wetlands (21%; 34,921 acres). Second-ranked was the other coastal site – Mustang Bayou (8%; 12,631 acres). The playa sites and Oklahoma City, Oklahoma study area had 2 to 3 percent of their areas in wetlands.

<u>Percent of Wetland Area Identified as Isolated</u>

The two playa study areas (Tokio and Tahoka) have all (100%) of their wetland acreage (i.e., playa wetlands) designated as potentially isolated. Other areas had much lower percentages. Four areas had between 20 and 30 percent of their wetland acreage in this category (Mustang Bayou; Laguna Park, Texas; Carlsbad Caverns, New Mexico; St. Charles Bay). Isolated wetlands in Mustang Bayou were mostly palustrine emergent wetlands (1,882 acres; 51% under Scenario 2) and forested types (1,050 acres; 29%). For St. Charles Bay, most were palustrine emergent wetlands (7,398 acres 96%). Qualitative results for Tokio, Tahoka, Valle Grande (New Mexico), Laguna Park and Carlsbad Caverns were not collected because NWI digital data were not available.

<u>Percent of Wetlands (Number) Classified as Isolated</u>

All study areas had more than 20 percent of their wetlands identified as isolated. Again, the playa sites led the list, with all of their wetlands isolated. Study sites with more than 45 percent of their wetlands labeled as isolated were Mustang Bayou (77-86%), Oklahoma City (63-66%), Laguna Park (54-59%), St. Charles Bay (47-48%), and Valle Grande (44-48%).

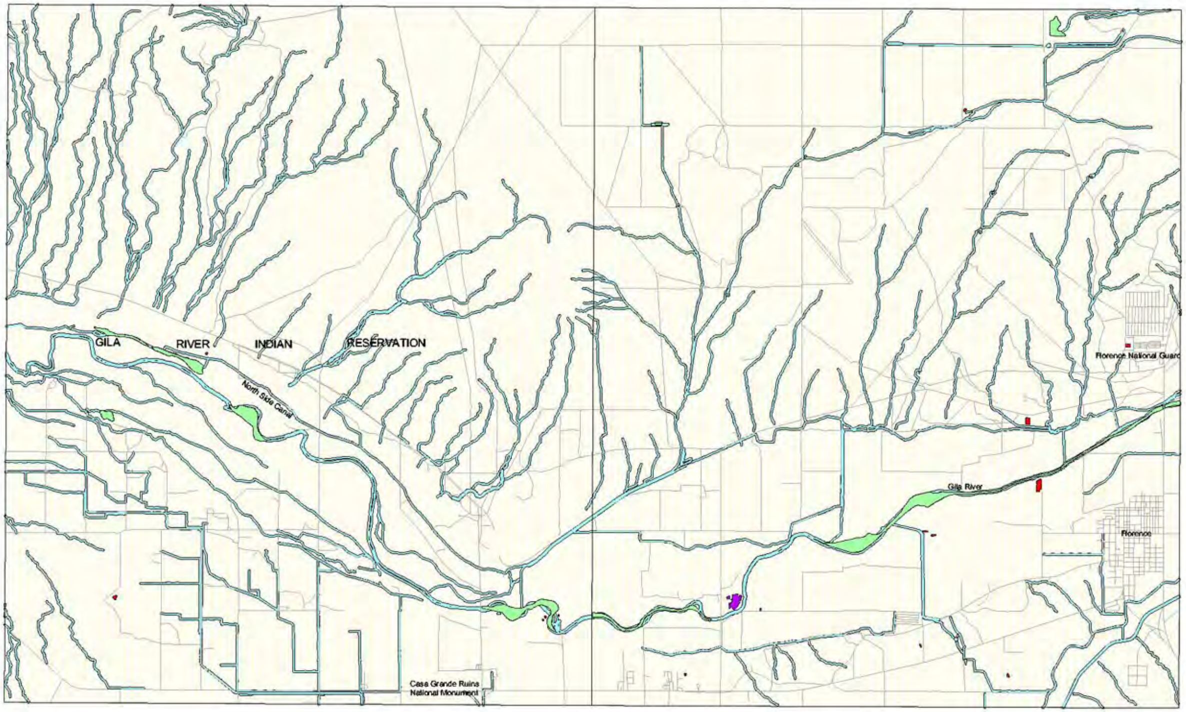
Table 3-2. Summary data for study sites in Region 2. (<u>Note</u>: This table should be printed in landscape orientation.)

	Isolated Wetlands

Additional Data Links	Study Area	State	Acreage in Study Area	Wetland Acreage	Wetlands % of Study Area	Number of Wetlands	Deepwater Habitats % of Study Area	Scenario 1 Area Percent of Total Wetlands	Scenario 2 Area Percent of Total Wetlands	Scenario 3 Area Percent of Total Wetlands	Scenario 1 Count Percent of Total Wetlands	Scenario 2 Count Percent of Total Wetlands	Scenario 3 Count Percent of Total Wetlands
MAP DATA	Blackwater-Florence	AZ	79916.4	383.6	0.5%	41	0.0%	3.3%	4.2%	4.2%	31.7%	36.6%	36.6%
MAP DATA	Carlsbad Caverns	NM	161486.4	252.8	0.2%	154	0.0%	24.4%	25.4%	25.4%	21.4%	22.7%	22.7%
MAP DATA	Valle Grande	NM	154693.8	537.7	0.3%	218	0.0%	12.3%	13.0%	13.0%	43.6%	47.7%	47.7%
MAP DATA	Oklahoma City	OK	155635.1	4347.1	2.8%	1180	0.9%	17.1%	17.5%	18.8%	63.4%	65.2%	65.8%
MAP DATA	Laguna Park	TX	162261.3	1011.6	0.6%	1155	0.4%	24.8%	27.4%	27.4%	53.9%	58.5%	58.5%
MAP DATA	Mustang Bayou	TX	166228.7	12631.2	7.6%	2147	2.2%	22.0%	29.0%	29.1%	77.5%	85.4%	88.5%
MAP DATA	Saint Charles Bay	TX	168002.7	34920.7	20.8%	2656	29.6%	22.0%	22.0%	22.6%	46.6%	47.0%	47.7%
MAP DATA	Tahoka	TX	119844.1	3142.8	2.6%	446	0.6%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
MAP DATA	Tokio	TX	119809.1	2462.7	2.1%	392	0.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

[Back to Table of Contents] [Home] [Go to Results Region 3] [Skip to Section 4]

Blackwater - Florence Study Area, Arizona



Legend

- Isolated Wetlands
- Wetlands 20-40 meters from Intermittent or Perennial Streams
- Non-isolated Wetlands
- 20 meter Buffer of Perennial and Intermittent Streams
- Isolated Deepwater Habitats
- Deepwater Habitats
- Uplands
- Quad Boundary
- Roads

N W E S

Scale 1:50,000

2000 0 2000 4000 Meters

2 0 2 4 Miles

USGS Quads

Blackwater | Florence

1000 Acres
100 Acres
10 Acres

Data Sources

Wetlands: Existing NWI digital data

Streams: USGS Hydrology DLG

Roads: USGS DLG 1:24K Roads

Projection: UTM NAD 27, Zone 15

Locus Map

This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Blackwater-Florence State: AZ FWS Region: 2

Ecoregion: American Semi-Desert and Desert

Watershed Region: Lower Colorado Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	79916.4		
Upland Acreage..	79520.6	99.5%	Uplands
Non-Isolated Deepwater Habitats Acreage.	0.0	0.0%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	12.2		
Wetlands Acreage.....................................	383.6	0.5%	Wetlands
Number of Wetlands.................................	41		

. . .

ACREAGE OF WETLAND TYPES:

No qualitative wetland data collected, since NWI map data were scan-vectorized. Wetlands were separated from deepwater habitats, but individual wetland polygons were not labeled to specific type.

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	12.6	3.3%	13	31.7%
Scenario 2: (Red and Orange)	16.1	4.2%	15	36.6%
Scenario 3: (Red, Orange and Brown)	16.1	4.2%	15	36.6%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

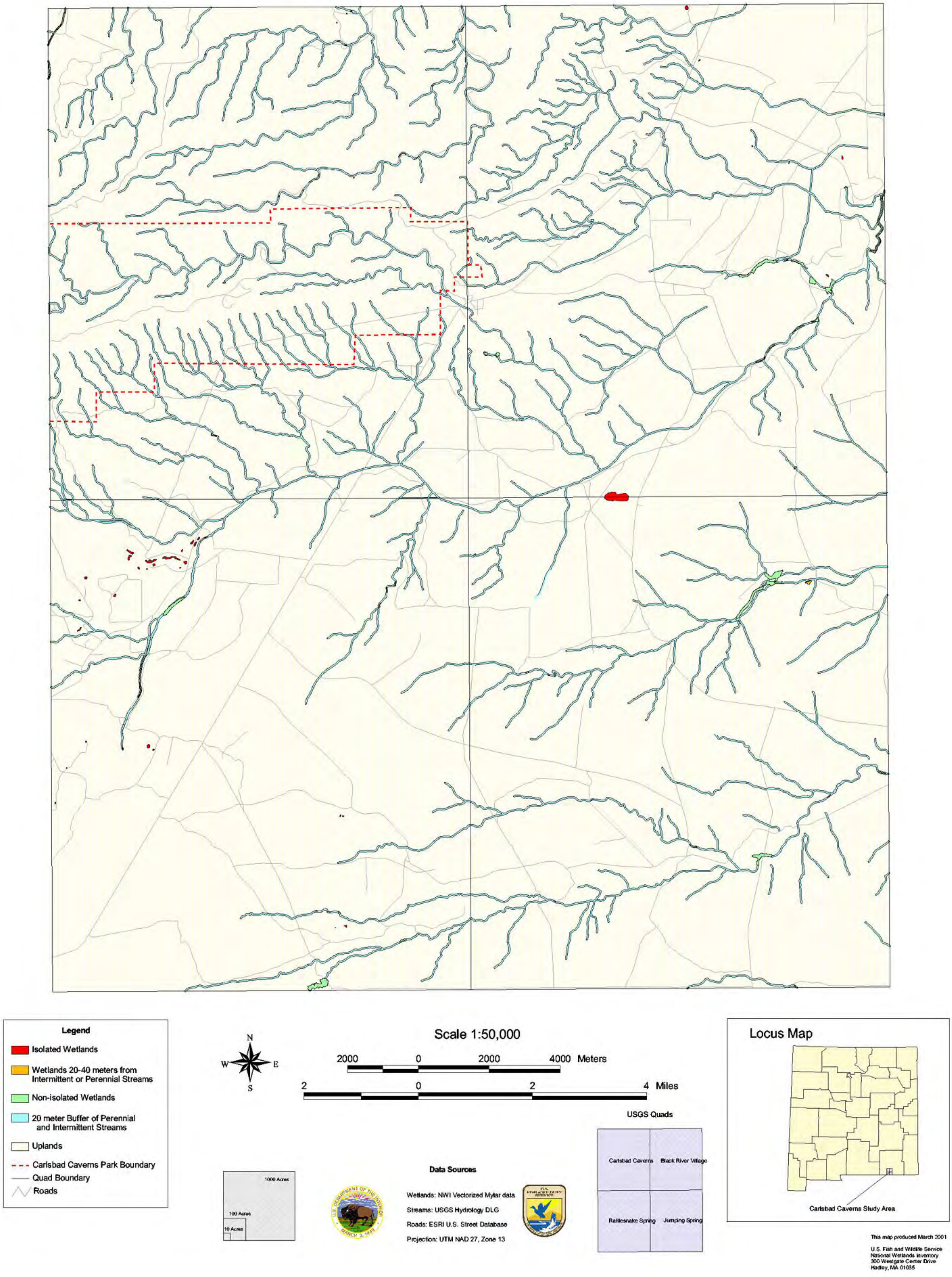
** Map-edge isolated wetlands not included: Acreage: 0.0 Number: 0

. . .

ACREAGE OF ISOLATED WETLAND TYPES:

No qualitative wetland data collected, since NWI map data were scan-vectorized. Wetlands were separated from deepwater habitats, but individual wetland polygons were not labeled to specific type.

Carlsbad Caverns Study Area, New Mexico



Study Area: Carlsbad Caverns State: NM FWS Region: 2

Ecoregion: Chihuahuan Semi-Desert

Watershed Region: Rio Grande Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	161486.4		
Upland Acreage..	161233.6	99.8%	Uplands
Non-Isolated Deepwater Habitats Acreage.	0.0	0.0%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	252.8	0.2%	Wetlands
Number of Wetlands.................................	154		

. . .

ACREAGE OF WETLAND TYPES:

No qualitative wetland data collected, since NWI map data were scan-vectorized. Wetlands were separated from deepwater habitats, but individual wetland polygons were not labeled to specific type.

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	61.6	24.4%	33	21.4%
Scenario 2: (Red and Orange)	64.1	25.4%	35	22.7%
Scenario 3: (Red, Orange and Brown)	64.1	25.4%	35	22.7%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

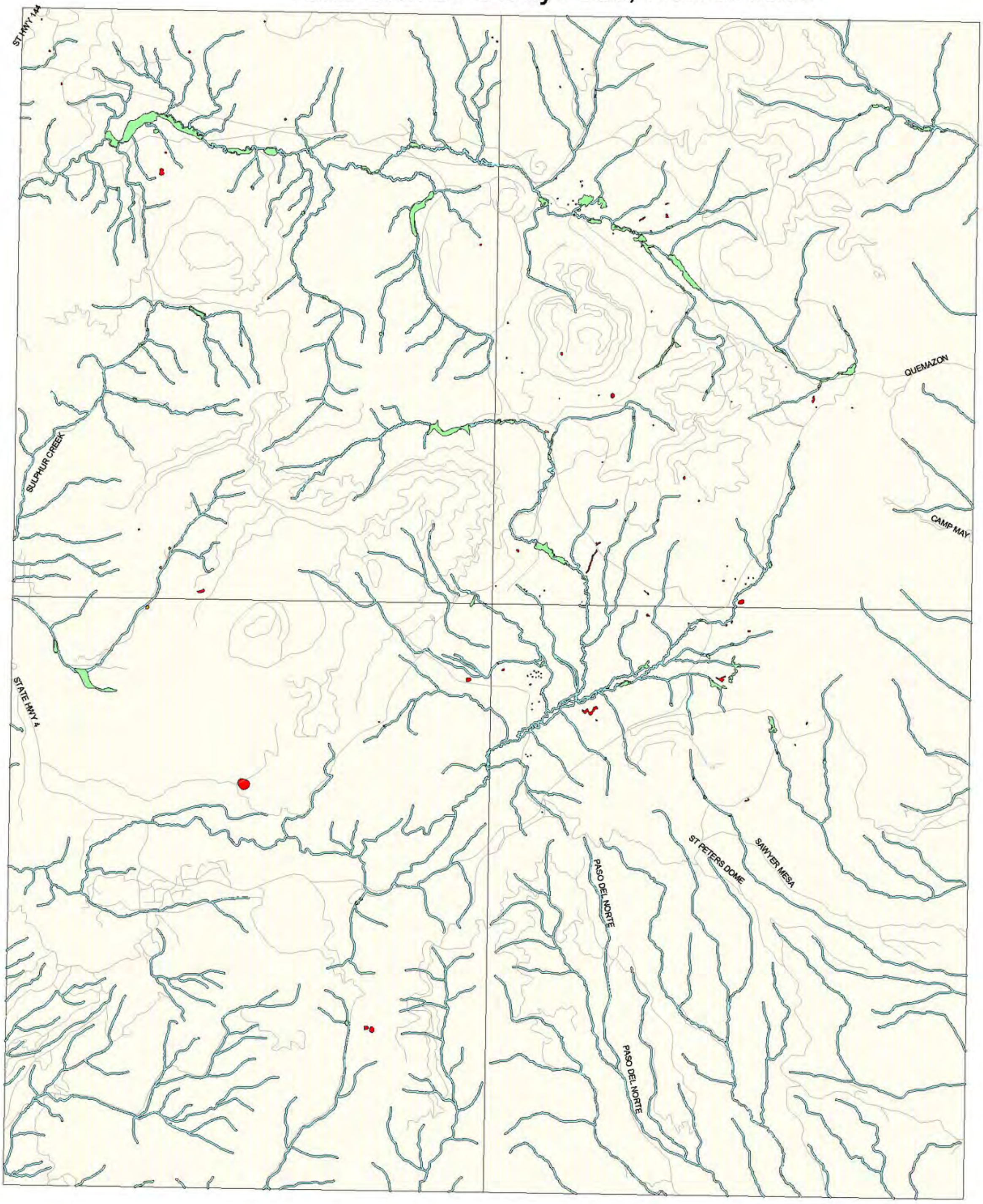
** Map-edge isolated wetlands not included: Acreage: 0.0 Number: 0

. . .

ACREAGE OF ISOLATED WETLAND TYPES:

No qualitative wetland data collected, since NWI map data were scan-vectorized. Wetlands were separated from deepwater habitats, but individual wetland polygons were not labeled to specific type.

Valle Grande Study Area, New Mexico



Legend

- Isolated Wetlands
- "Isolated" Wetlands (Map Edge)*
- Wetlands 20-40 Meters from Intermittent or Perennial Streams
- Non-isolated Wetlands
- 20 Meter Buffer of Perennial and Intermittent Streams
- Deepwater Habitats
- Uplands
- Quad Boundary
- Roads

*Designated as isolated due to study protocols, but may be connected to streams outside of study area.

N W E S

Scale 1:50,000

2000 0 2000 4000 Meters

2 0 2 4 Miles

Data Sources

Wetlands: Existing NWI Vectorized Mylar Data

Streams: USGS Hydrology DLG

Roads: ESRI U.S. Street Database

Projection: UTM NAD 27, Zone 13

USGS Quads

Locus Map

This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: **Valle Grande** State: NM FWS Region: 2

Ecoregion: Southern Rocky Mountain Steppe-Coniferous Forest-Alpine Meadow

Watershed Region: Rio Grande Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	154693.8		
Upland Acreage..	154156.1	99.7%	Uplands
Non-Isolated Deepwater Habitats Acreage.	0.0	0.0%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	537.7	0.3%	Wetlands
Number of Wetlands.................................	218		

. . .

ACREAGE OF WETLAND TYPES:

No qualitative wetland data collected, since NWI map data were scan-vectorized. Wetlands were separated from deepwater habitats, but individual wetland polygons were not labeled to specific type.

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ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	66.3	12.3%	95	43.6%
Scenario 2: (Red and Orange)	70.1	13.0%	104	47.7%
Scenario 3: (Red, Orange and Brown)	70.1	13.0%	104	47.7%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

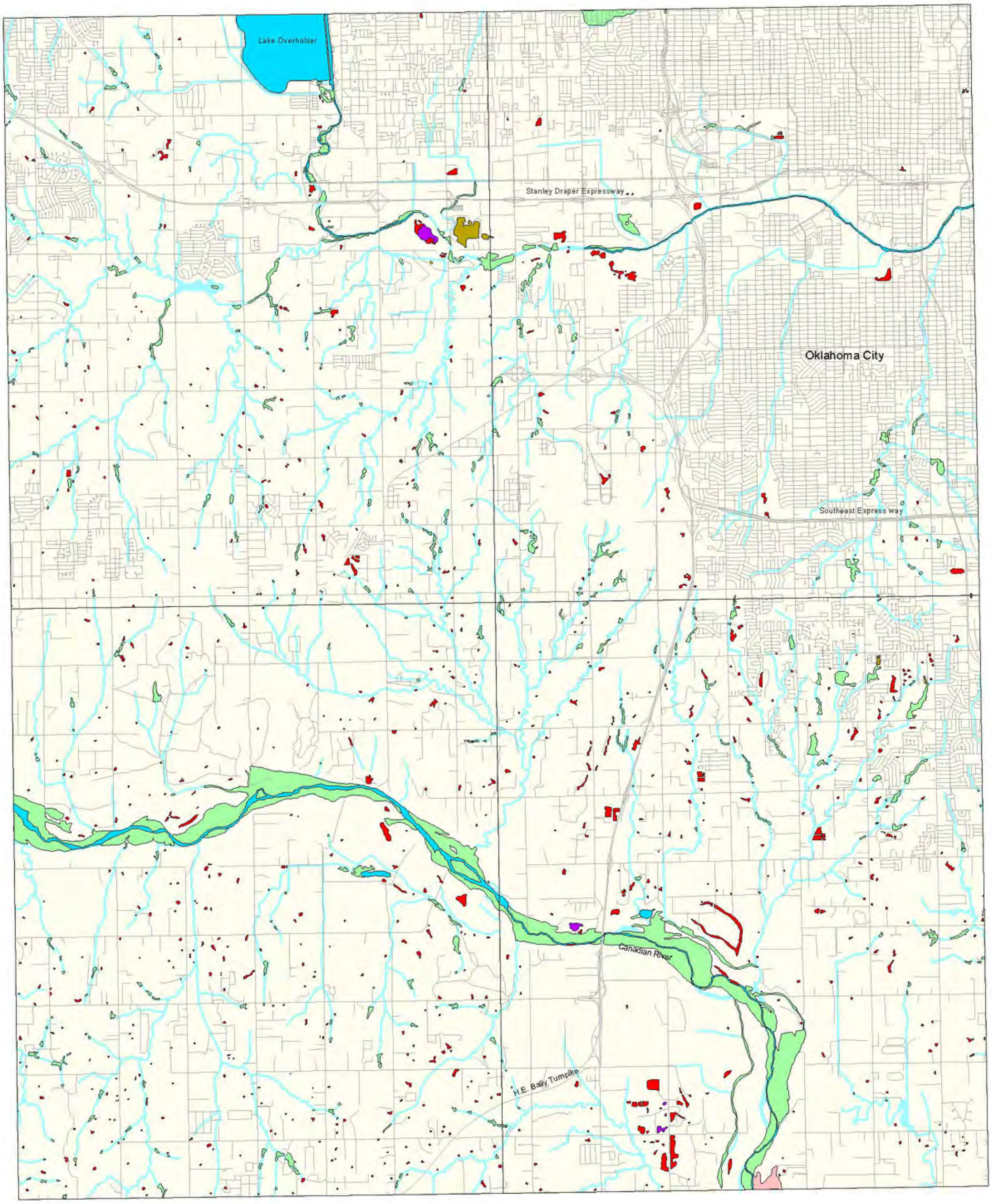
** Map-edge isolated wetlands not included: Acreage: 0.0 Number: 0

. . .

ACREAGE OF ISOLATED WETLAND TYPES:

No qualitative wetland data collected, since NWI map data were scan-vectorized. Wetlands were separated from deepwater habitats, but individual wetland polygons were not labeled to specific type.

Oklahoma City Study Area, Oklahoma



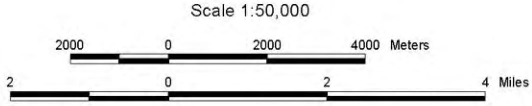
Legend

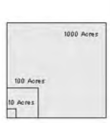
- Isolated Wetlands
- Wetlands 20-40 meters from Intermittent or Perennial Streams
- Non-isolated Wetlands
- Road-fragmented Wetlands*
- Map-edge Wetlands**
- 20 meter Buffer of Perennial and Intermittent Streams
- Isolated Deepwater Habitats
- Deepwater Habitats
- Uplands
- Quad Boundary
- Roads

* Separated from non-isolated wetland by a road; may be connected or isolated.

** Status could not be predicted since the rest of the wetland is outside the study area.

Scale 1:50,000





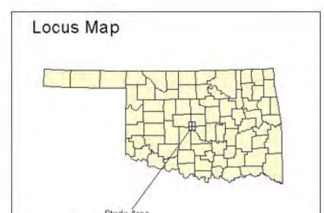
Data Sources

Wetlands: Existing NWI digital data

Streams: USGS Hydrology DLG

Roads: USGS DLG 1:24K Roads

Projection: UTM NAD 27, Zone 14



This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: **Oklahoma City** State: OK FWS Region: 2

Ecoregion: Great Plains Steppe and Shrub

Watershed Region: Arkansas-White-Red Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	155635.1		
Upland Acreage..	149906.3	96.3%	Uplands
Non-Isolated Deepwater Habitats Acreage.	1340.0	0.9%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	41.7		
Wetlands Acreage......................................	4347.1	2.8%	Wetlands
Number of Wetlands.................................	1180		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	831.6	Lacustrine Wetlands:	5.4
PAB:	11.1	PFO:	1093.7	PUB:	976.6	Marine Wetlands:	0.0
PEM:	631.2	Pf:	0.0	PUS:	72.7	Riverine Wetlands:	654.4

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	742.1	17.1%	748	63.4%
Scenario 2: (Red and Orange)	761.8	17.5%	769	65.2%
Scenario 3: (Red, Orange and Brown)	818.5	18.8%	777	65.8%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 54.1 Number: 6

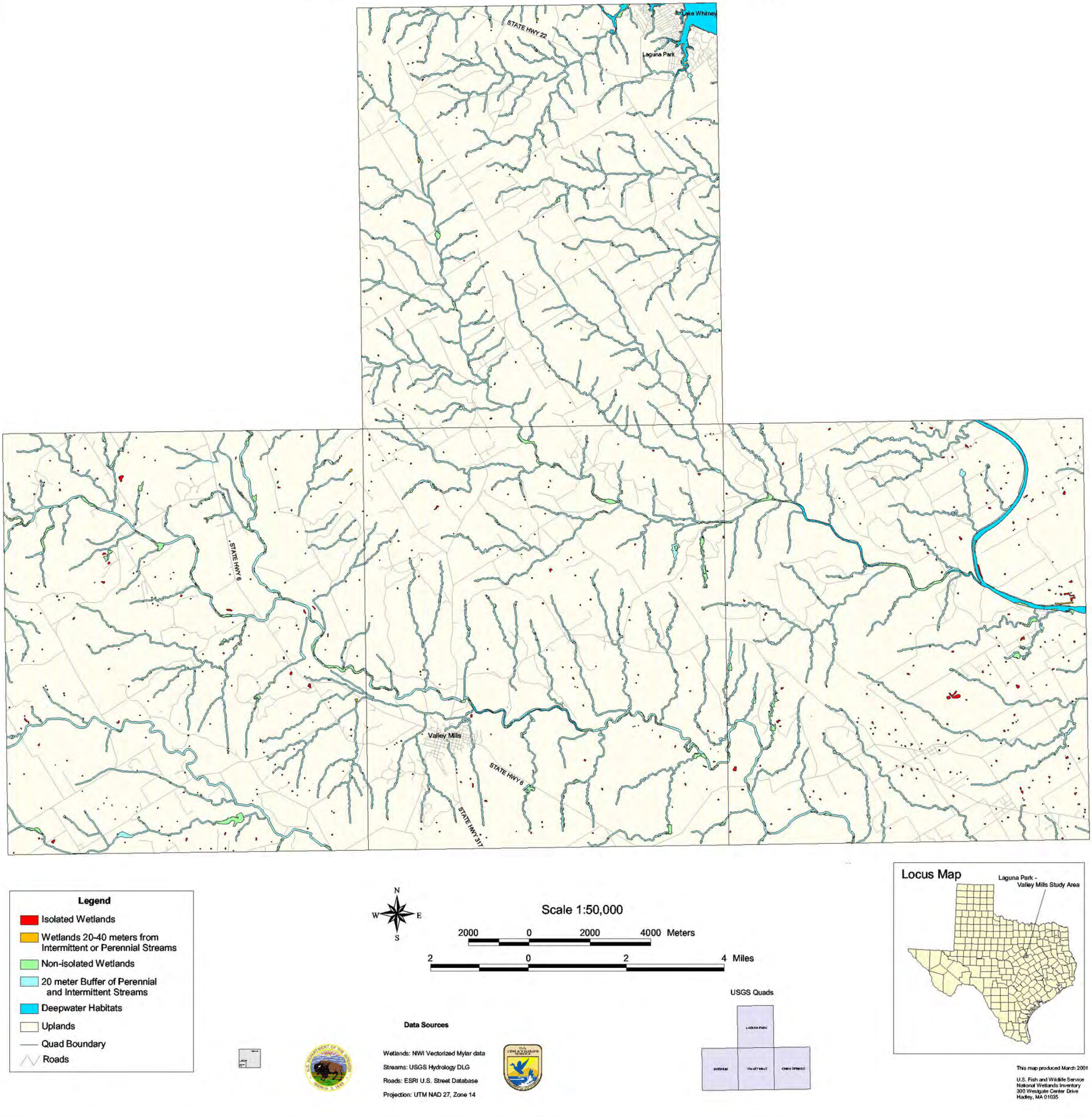
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	30.2	Lacustrine Wetlands:	0.0
PAB:	2.0	Pf:	0.0	PUB:	430.1	Marine Wetlands:	0.0
PEM:	161.1	PFO:	79.2	PUS:	55.0	Riverine Wetlands:	4.2

*** Acreage of Isolated Wetlands based on Scenario 2.

Laguna Park - Valley Mills Study Area, Texas



Study Area: Laguna Park State: TX FWS Region: 2

Ecoregion: Southwest Plateau and Plains Dry Steppe and Shrub

Watershed Region: Texas Gulf Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	162261.3		
Upland Acreage..	160524.9	98.9%	Uplands
Non-Isolated Deepwater Habitats Acreage.	724.8	0.4%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	1011.6	0.6%	Wetlands
Number of Wetlands.................................	1155		

. . .

ACREAGE OF WETLAND TYPES:

No qualitative wetland data collected, since NWI map data were scan-vectorized. Wetlands were separated from deepwater habitats, but individual wetland polygons were not labeled to specific type.

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	250.4	24.8%	623	53.9%
Scenario 2: (Red and Orange)	276.8	27.4%	676	58.5%
Scenario 3: (Red, Orange and Brown)	276.8	27.4%	676	58.5%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

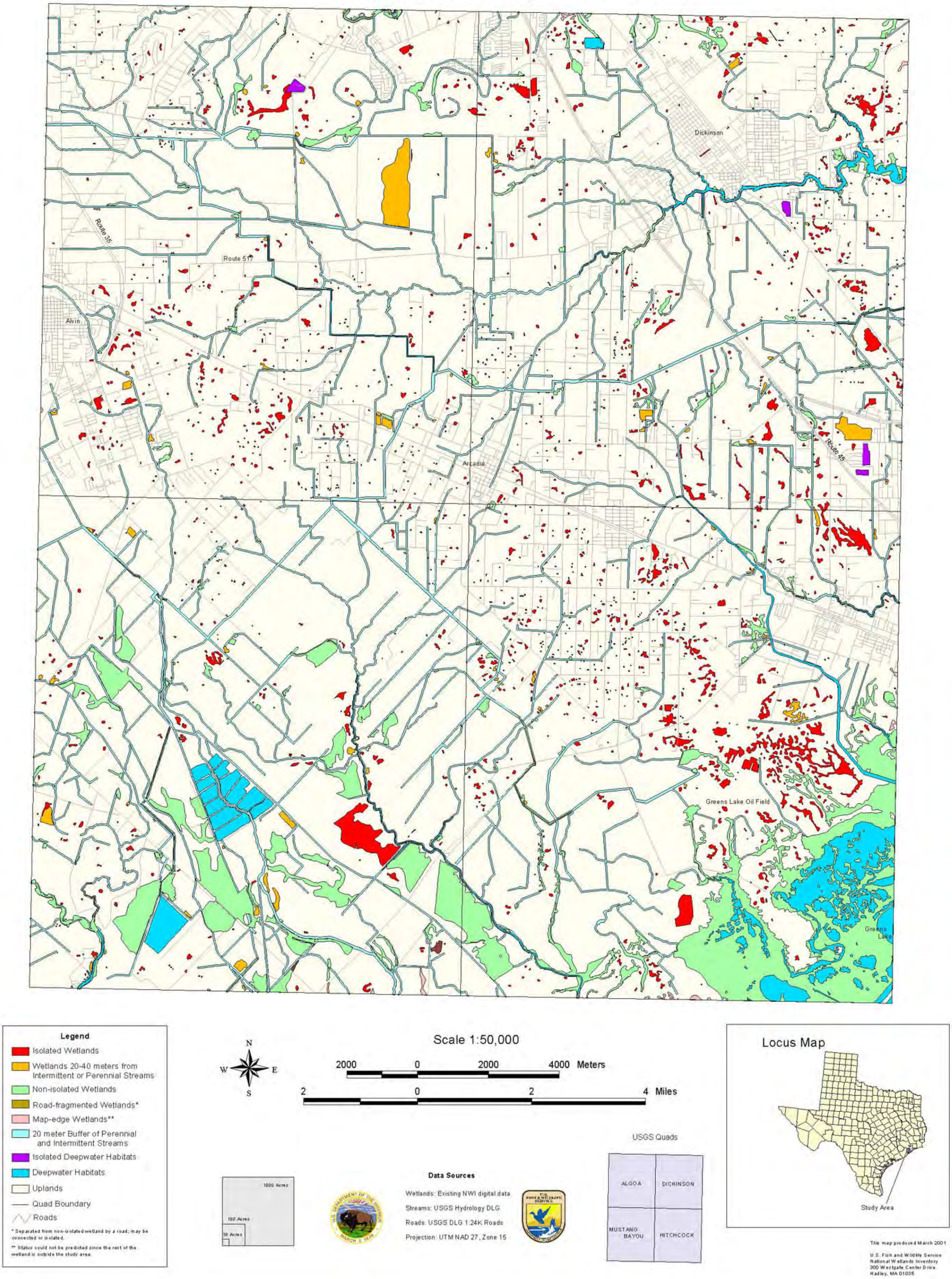
** Map-edge isolated wetlands not included: Acreage: 0.0 Number: 0

. . .

ACREAGE OF ISOLATED WETLAND TYPES:

No qualitative wetland data collected, since NWI map data were scan-vectorized. Wetlands were separated from deepwater habitats, but individual wetland polygons were not labeled to specific type.

Mustang Bayou Study Area, Texas



Study Area: Mustang Bayou State: TX FWS Region: 2

Ecoregion: Prairie Parkland (Subtropical)

Watershed Region: Texas Gulf Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	166228.7		
Upland Acreage..	149895.3	90.2%	Uplands
Non-Isolated Deepwater Habitats Acreage.	3470.3	2.2%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	231.8		
Wetlands Acreage......................................	12631.2	7.6%	Wetlands
Number of Wetlands.................................	2147		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	3101.3
Palustrine Wetlands:				PSS:	373.8	Lacustrine Wetlands:	6.7
PAB:	144.7	PFO:	1884.3	PUB:	504.0	Marine Wetlands:	0.0
PEM:	6561.9	Pf:	0.0	PUS:	33.1	Riverine Wetlands:	27.9

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	2774.9	22.0%	1663	77.5%
Scenario 2: (Red and Orange)	3658.2	29.0%	1833	85.4%
Scenario 3: (Red, Orange and Brown)	3677.7	29.1%	1900	88.5%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 77.7 Number: 29

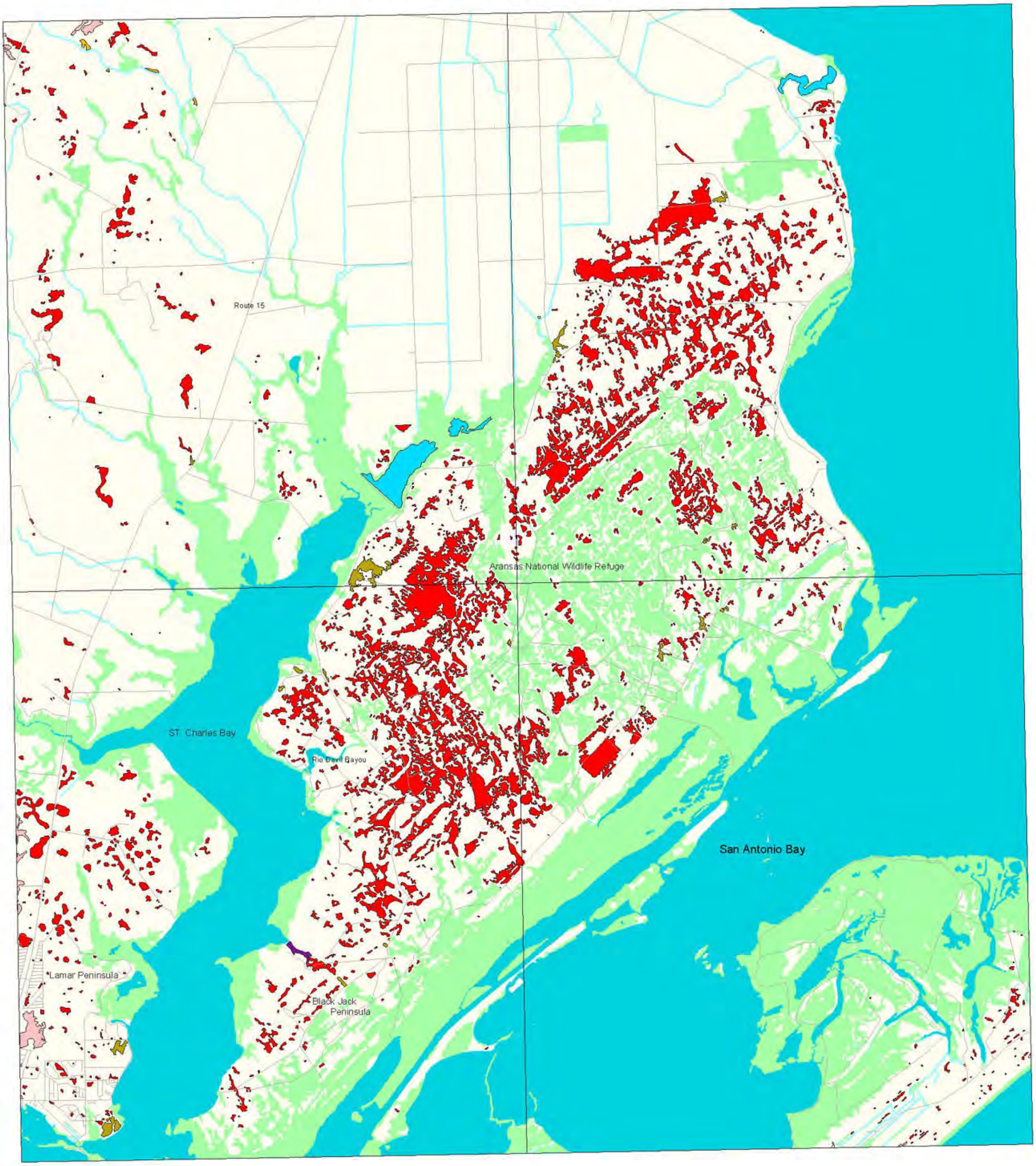
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	266.1	Lacustrine Wetlands:	6.7
PAB:	9.8	Pf:	0.0	PUB:	418.4	Marine Wetlands:	0.0
PEM:	1881.8	PFO:	1050.1	PUS:	25.4	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Saint Charles Bay Study Area, Texas



Legend

- Isolated Wetlands
- Wetlands 20-40 meters from Intermittent or Perennial Streams
- Non-isolated Wetlands
- Road-fragmented Wetlands*
- Map-edge Wetlands**
- 20 meter Buffer of Perennial and Intermittent Streams
- Isolated Deepwater Habitats
- Deepwater Habitats
- Esturarine Habitats
- Uplands
- Quad Boundary
- Roads

* Separated from non-isolated wetland by a road; may be connected or isolated.

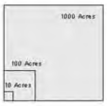
** Status could not be predicted since the rest of the wetland is outside the study area.

N W E S

Scale 1:50,000

2000 0 2000 4000 Meters

2 0 2 4 Miles



Data Sources

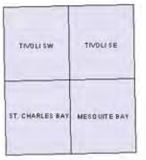
Wetlands: Existing NWI digital data

Streams: USGS Hydrology DLG

Roads: ESRI U.S. Street Database

Projection: UTM NAD 27, Zone 14

USGS Quads



Locus Map

This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Saint Charles Bay State: TX FWS Region: 2

Ecoregion: Prairie Parkland (Subtropical)

Watershed Region: Texas Gulf Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area.....................	168002.7		
Upland Acreage..	83396.3	49.6%	Uplands
Non-Isolated Deepwater Habitats Acreage.	49678.4	29.6%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	7.3		
Wetlands Acreage.....................................	34920.7	20.8%	Wetlands
Number of Wetlands.................................	2656		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	16362.2
Palustrine Wetlands:				PSS:	618.1	Lacustrine Wetlands:	2.1
PAB:	5.7	PFO:	51.5	PUB:	95.7	Marine Wetlands:	65.9
PEM:	17644.5	Pf:	0.0	PUS:	74.9	Riverine Wetlands:	0.0

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	7680.6	22.0%	1238	46.6%
Scenario 2: (Red and Orange)	7699.7	22.0%	1247	47.0%
Scenario 3: (Red, Orange and Brown)	7900.1	22.6%	1267	47.7%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 156.8 Number: 17

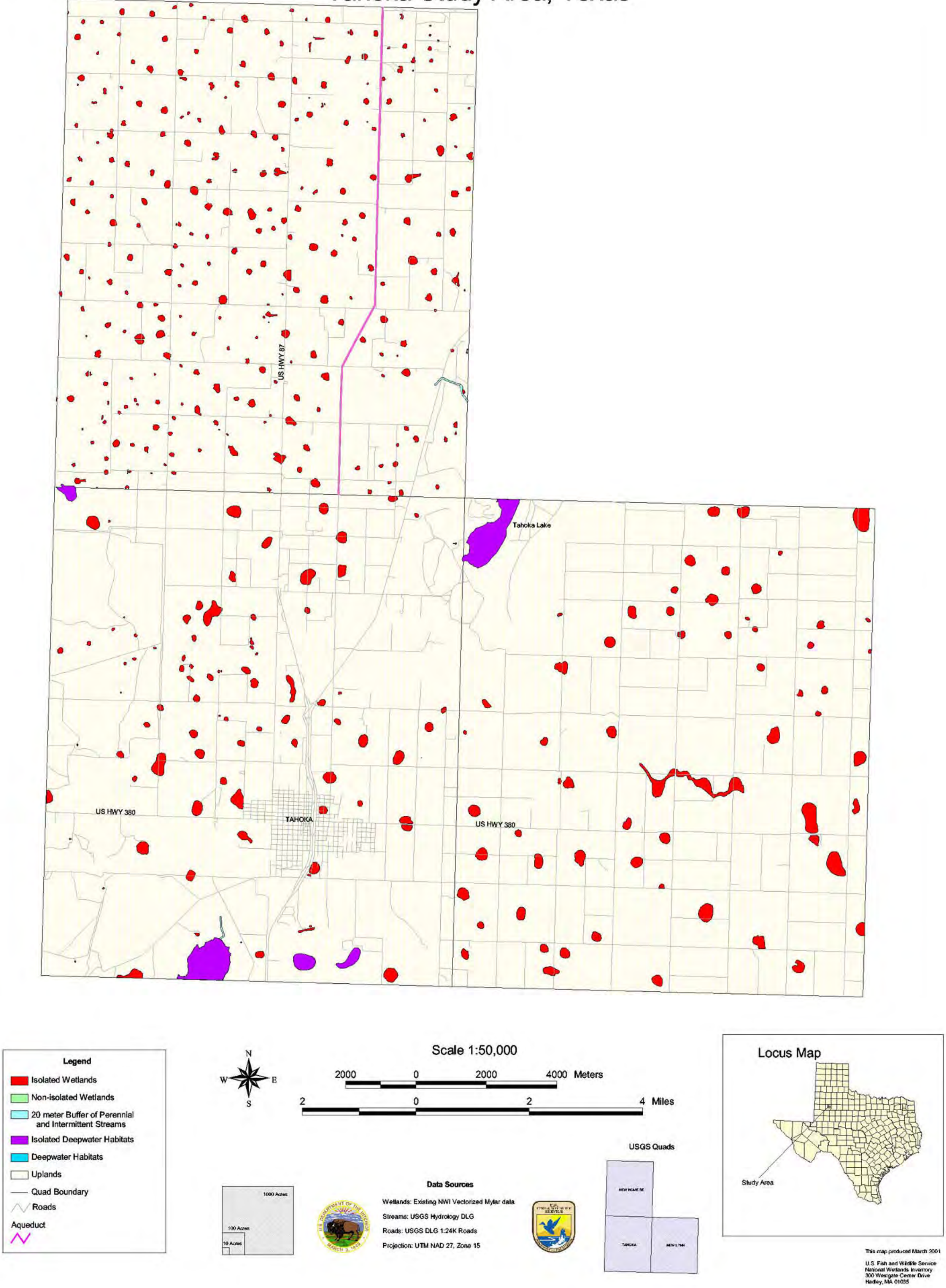
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	254.7	Lacustrine Wetlands:	0.0
PAB:	5.7	Pf:	0.0	PUB:	30.0	Marine Wetlands:	0.0
PEM:	7398.4	PFO:	11.8	PUS:	1.5	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Tahoka Study Area, Texas



Study Area: Tahoka State: TX FWS Region: 2

Ecoregion: Southwest Plateau and Plains Dry Steppe and Shrub

Watershed Region: Texas Gulf Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	119844.1		
Upland Acreage..	115935.4	96.7%	Uplands
Non-Isolated Deepwater Habitats Acreage.	0.0	0.6%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	765.9		
Wetlands Acreage.....................................	3142.8	2.6%	Wetlands
Number of Wetlands.................................	446		

. . .

ACREAGE OF WETLAND TYPES:

No qualitative wetland data collected, since NWI map data were scan-vectorized. Wetlands were separated from deepwater habitats, but individual wetland polygons were not labeled to specific type.

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	3142.8	100.0%	446	100.0%
Scenario 2: (Red and Orange)	3142.8	100.0%	446	100.0%
Scenario 3: (Red, Orange and Brown)	3142.8	100.0%	446	100.0%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

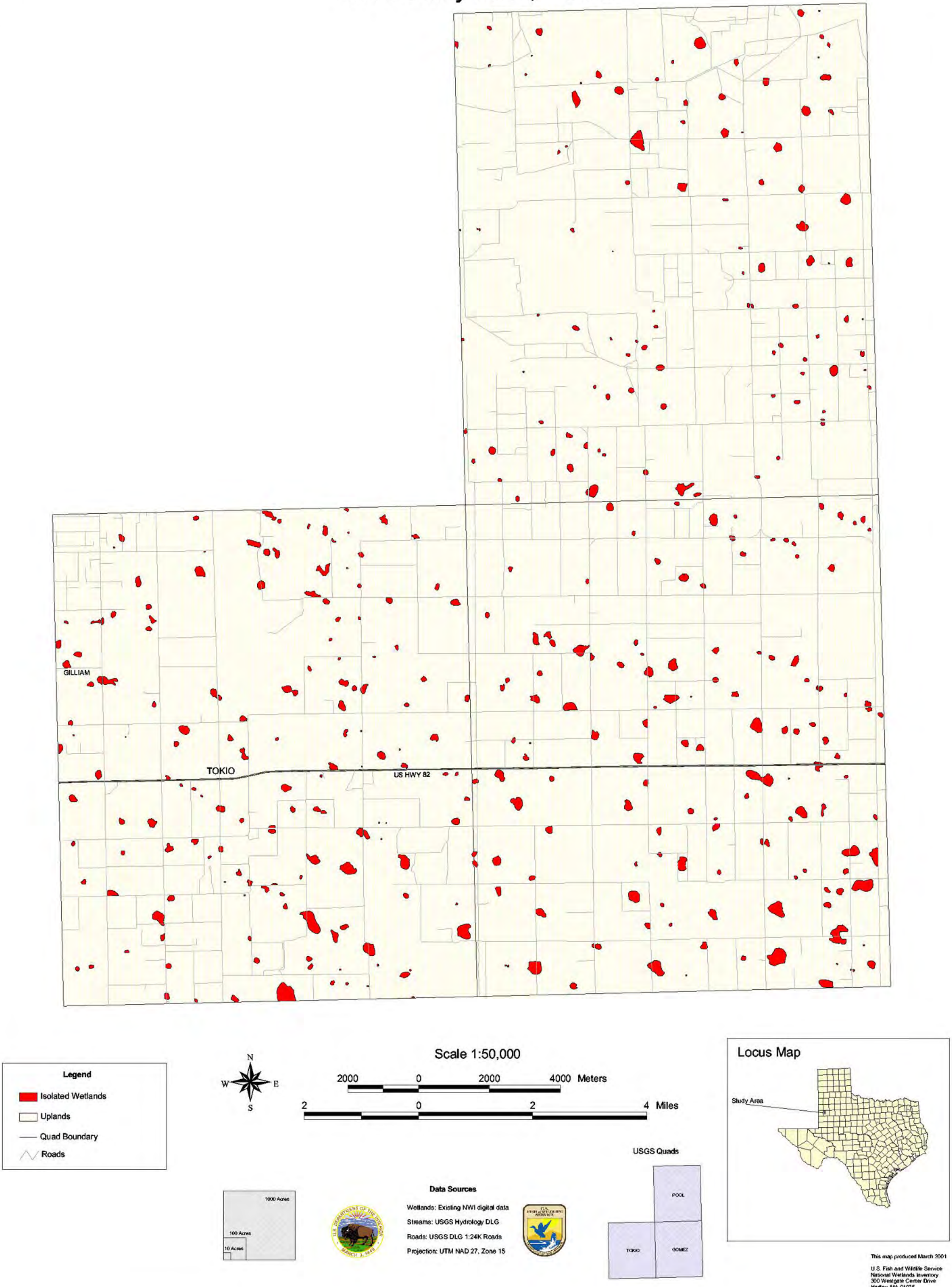
** Map-edge isolated wetlands not included: Acreage: 0.0 Number: 0

. . .

ACREAGE OF ISOLATED WETLAND TYPES:

No qualitative wetland data collected, since NWI map data were scan-vectorized. Wetlands were separated from deepwater habitats, but individual wetland polygons were not labeled to specific type.

Tokio Study Area, Texas



Study Area: Tokio State: TX FWS Region: 2

Ecoregion: Southwest Plateau and Plains Dry Steppe and Shrub

Watershed Region: Texas Gulf Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	119809.1		
Upland Acreage..	117346.5	97.9%	Uplands
Non-Isolated Deepwater Habitats Acreage.	0.0	0.0%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	2462.7	2.1%	Wetlands
Number of Wetlands.................................	392		

. . .

ACREAGE OF WETLAND TYPES:

No qualitative wetland data collected, since NWI map data were scan-vectorized. Wetlands were separated from deepwater habitats, but individual wetland polygons were not labeled to specific type.

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	2462.7	100.0%	392	100.0%
Scenario 2: (Red and Orange)	2462.7	100.0%	392	100.0%
Scenario 3: (Red, Orange and Brown)	2462.7	100.0%	392	100.0%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 0.0 Number: 0

. . .

ACREAGE OF ISOLATED WETLAND TYPES:

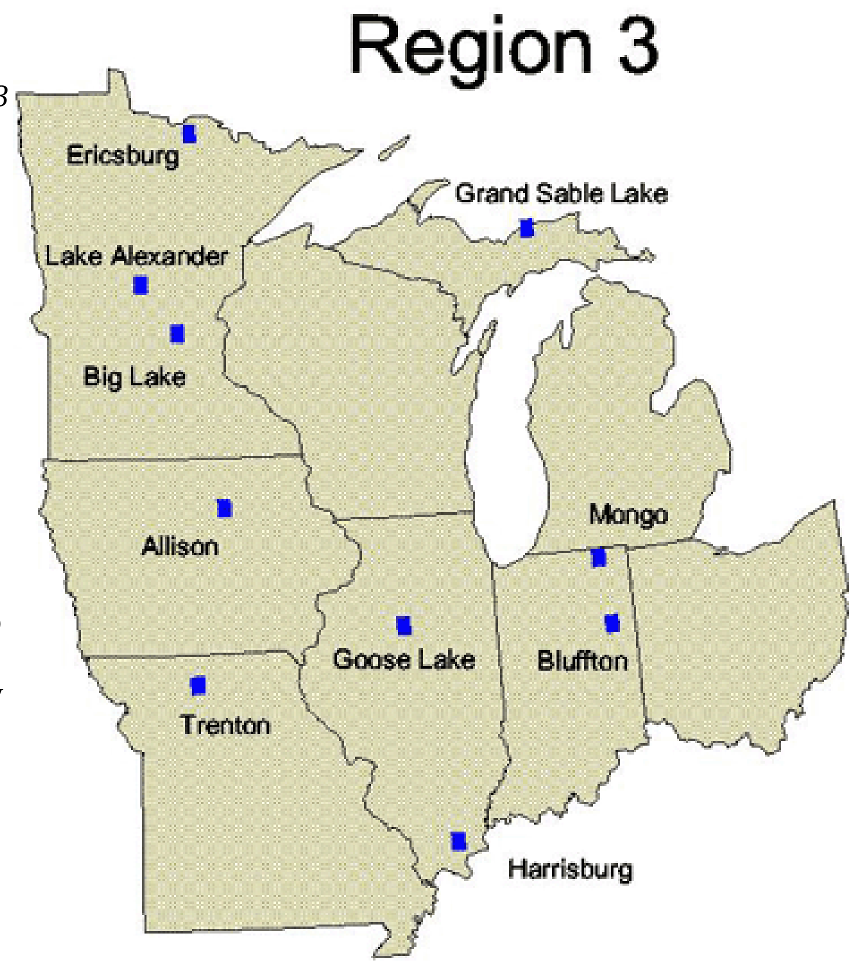
No qualitative wetland data collected, since NWI map data were scan-vectorized. Wetlands were separated from deepwater habitats, but individual wetland polygons were not labeled to specific type.

Study Results

Study findings are reported for each study area below. Data for individual study areas are arranged by U.S. Fish and Wildlife Service Region. For each Region, there is a general discussion of the study results, a map showing the location of the study sites, a summary table of the findings, detailed data summary for each area, and a special wetland classification map for each study area. The latter two products are represented as "additional data links" within the regional summary table (first column). Simply click on the word "map" or "data" and the pertinent map and data will be displayed. *Please allow a minute or so for the map to appear. Note that printed maps may appear somewhat skewed since their projections reflect the curvature of the Earth.*

Region 3 (Minnesota, Iowa, Missouri, Wisconsin, Illinois, Indiana, Michigan, and Ohio)

Ten study sites were evaluated in the Midwest: two in Illinois, two in Indiana, one in Iowa, one in Michigan, three in Minnesota, and one in Missouri. One site (Grand Sable Lake) was along the shores of Lake Superior, while the other sites were inland. *Table 3-3* presents a summary of the data for Region 3 study areas.



Percent of Study Areas Covered by Wetlands

Two study sites had more than 20 percent of their areas covered by wetlands. Ericsburg, Minnesota was top-ranked with 44 percent (56,173 acres), followed by Lake Alexander, Minnesota with 21 percent (28,261 acres). Other areas with more than 10 percent coverage by wetlands included Big Lake, Minnesota (17%), Mongo, Indiana (13%), and Grand Sable Lake, Michigan (12%).

Percent of Wetland Area Identified as Isolated

Two sites had more than 30 percent of their wetland acreage designated as isolated: Bluffton, Indiana (50-54%) and Big Lake (30-35%), while Lake Alexander had 23-34 percent of its wetlands in this category, depending on the scenario evaluated (see *Table 4-3*). Most of Bluffton's isolated wetlands were forested (683 acres; 56% under Scenario 2), whereas Big Lake's were chiefly palustrine emergent wetlands (5,178 acres; 77% under Scenario 2). Isolated wetlands for Lake Alexander (under Scenario 2) were mainly distributed among three types: palustrine scrub-shrub wetlands (2,944 acres; 46%), emergent wetlands (1,888 acres; 29%), and ponds (20%). The Mongo site had 25 to 28 percent of its wetland acreage labeled as isolated, with emergent and forested types predominating.

Percent of Wetlands (Number) Classified as Isolated

All study sites had more than 40 percent of their wetlands defined as isolated. Most had percentages near or above 80 percent, giving evidence of the high density of small wetlands in the areas examined. The top-ranked study area in the percent of wetlands mapped as isolated was Lake Alexander (90-93%). The other sites with more than 80 percent were Grand Sable Lake (85-86%), Big Lake (84-86%), Ericsburg (81-84%), Bluffton (80-84%), and Mongo (79-81%).

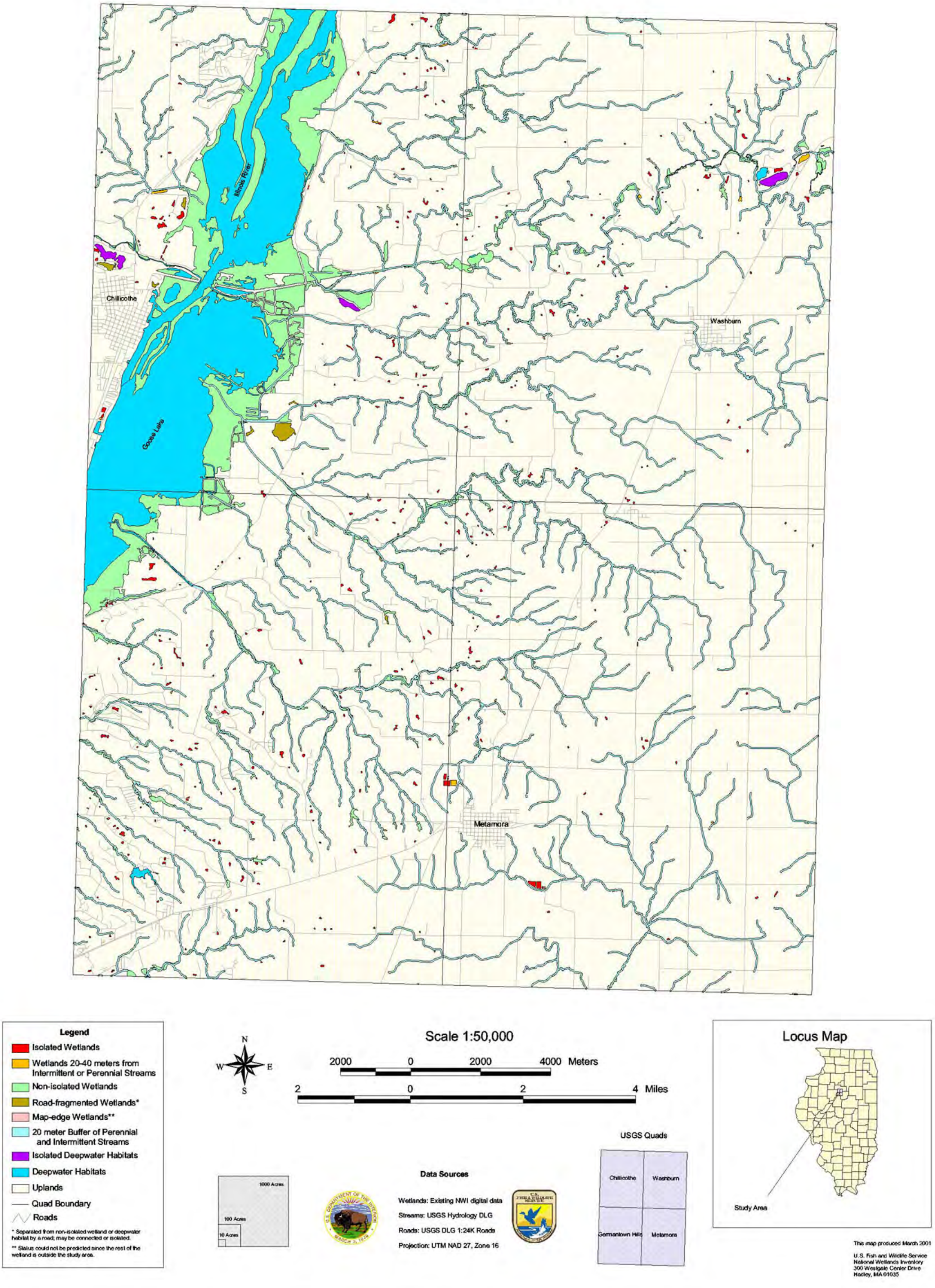
Table 3-3. Summary data for study sites in Region 3. (Note: This table should be printed in landscape orientation.)

	Isolated Wetlands

Additional Data Links	Study Area	State	Acreage in Study Area	Wetland Acreage	Wetlands % of Study Area	Number of Wetlands	Deepwater Habitats % of Study Area	Scenario 1 Area Percent of Total Wetlands	Scenario 2 Area Percent of Total Wetlands	Scenario 3 Area Percent of Total Wetlands	Scenario 1 Count Percent of Total Wetlands	Scenario 2 Count Percent of Total Wetlands	Scenario 3 Count Percent of Total Wetlands
MAP DATA	Goose Lake	IL	144598.2	6985.0	4.8%	829	5.9%	4.5%	5.2%	6.5%	41.5%	45.8%	46.9%
MAP DATA	Harrisburg	IL	151272.5	9012.7	6.0%	1588	0.4%	10.9%	12.3%	12.4%	71.2%	75.2%	76.0%
MAP DATA	Bluffton	IN	145068.7	2312.2	1.6%	906	0.1%	50.1%	52.7%	53.8%	79.8%	83.9%	84.2%
MAP DATA	Mongo	IN	142895.6	18642.4	13.1%	3707	2.2%	24.9%	25.8%	27.7%	78.6%	81.3%	81.3%
MAP DATA	Allison	IA	140348.9	4889.2	3.5%	966	0.3%	10.6%	11.6%	11.8%	45.0%	51.7%	41.8%
MAP DATA	Grand Sable Lake	MI	131400.6	16011.2	12.2%	473	38.7%	15.3%	15.3%	16.0%	85.0%	85.0%	85.6%
MAP DATA	Big Lake	MN	134354.0	22500.4	16.8%	2982	3.1%	29.9%	30.1%	35.4%	84.1%	84.9%	86.1%
MAP DATA	Ericsburg	MN	127127.6	56173.3	44.2%	2033	0.8%	7.7%	8.5%	9.2%	81.1%	82.9%	83.7%
MAP DATA	Lake Alexander	MN	132617.8	28261.1	21.3%	3471	4.3%	22.7%	22.8%	33.9%	90.0%	90.5%	92.8%
MAP DATA	Trenton	MO	146059.4	7574.1	5.2%	4126	0.5%	12.6%	14.8%	15.1%	45.7%	52.7%	52.8%

[Back to Table of Contents] [Home] [Go to Results of Region 4] [Skip to Section 4]

Goose Lake Study Area, Illinois



Study Area: Goose Lake State: IL FWS Region: 3

Ecoregion: Prairie Parkland (Temperate)

Watershed Region: Upper Mississippi Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	144598.2		
Upland Acreage..	129145.3	89.3%	Uplands
Non-Isolated Deepwater Habitats Acreage.	8356.9	5.9%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	111.0		
Wetlands Acreage......................................	6985.0	4.8%	Wetlands
Number of Wetlands.................................	829		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	407.0	Lacustrine Wetlands:	5140.4
PAB:	98.4	PFO:	4703.2	PUB:	843.7	Marine Wetlands:	0.0
PEM:	786.2	Pf:	0.0	PUS:	5.0	Riverine Wetlands:	62.0

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	313.5	4.5%	344	41.5%
Scenario 2: (Red and Orange)	362.7	5.2%	380	45.8%
Scenario 3: (Red, Orange and Brown)	453.1	6.5%	389	46.9%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 1.2 Number: 3

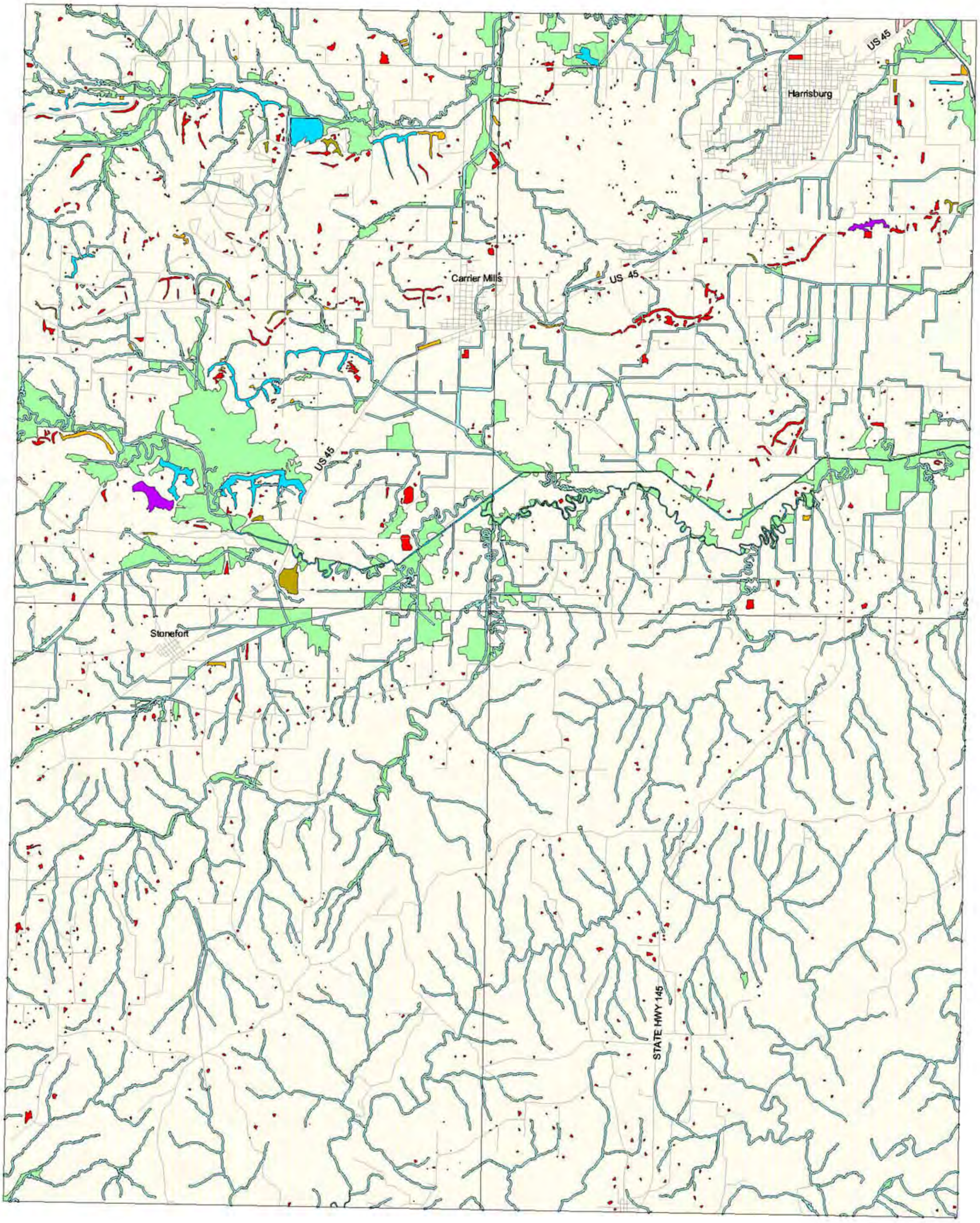
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	9.7	Lacustrine Wetlands:	0.0
PAB:	1.4	Pf:	0.0	PUB:	262.1	Marine Wetlands:	0.0
PEM:	55.2	PFO:	33.0	PUS:	0.0	Riverine Wetlands:	1.3

*** Acreage of Isolated Wetlands based on Scenario 2.

Harrisburg Study Area, Illinois



Legend

- Isolated Wetlands
- Wetlands 20-40 meters from Intermittent or Perennial Streams
- Non-isolated Wetlands
- Road-fragmented Wetlands*
- Map-edge Wetlands**
- 20 meter Buffer of Perennial and Intermittent Streams
- Isolated Deepwater Habitats
- Deepwater Habitats
- Uplands
- Quad Boundary
- Roads

* Separated from non-isolated wetland or deepwater habitat by a road; may be connected or isolated.

** Status could not be predicted since the rest of the wetland is outside the study area.

N
W E
S

Scale 1:50,000

2000 0 2000 4000 Meters

2 0 2 4 Miles

Data Sources

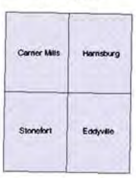
Wetlands: Existing NWI digital data

Streams: USGS Hydrology DLG

Roads: USGS DLG 1:24K Roads

Projection: UTM NAD 27, Zone 16

USGS Quads



Locus Map

This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Harrisburg State: IL FWS Region: 3

Ecoregion: Eastern Broadleaf Forest (Continental)

Watershed Region: Ohio Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	151272.5		
Upland Acreage..	141629.1	93.6%	Uplands
Non-Isolated Deepwater Habitats Acreage.	537.1	0.4%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	93.6		
Wetlands Acreage.....................................	9012.7	6.0%	Wetlands
Number of Wetlands.................................	1588		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	1147.0	Lacustrine Wetlands:	45.1
PAB:	52.0	PFO:	5711.2	PUB:	1286.8	Marine Wetlands:	0.0
PEM:	770.6	Pf:	0.0	PUS:	0.0	Riverine Wetlands:	0.0

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	982.8	10.9%	1131	71.2%
Scenario 2: (Red and Orange)	1108.3	12.3%	1194	75.2%
Scenario 3: (Red, Orange and Brown)	1119.4	12.4%	1207	76.0%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 7.0 Number: 9

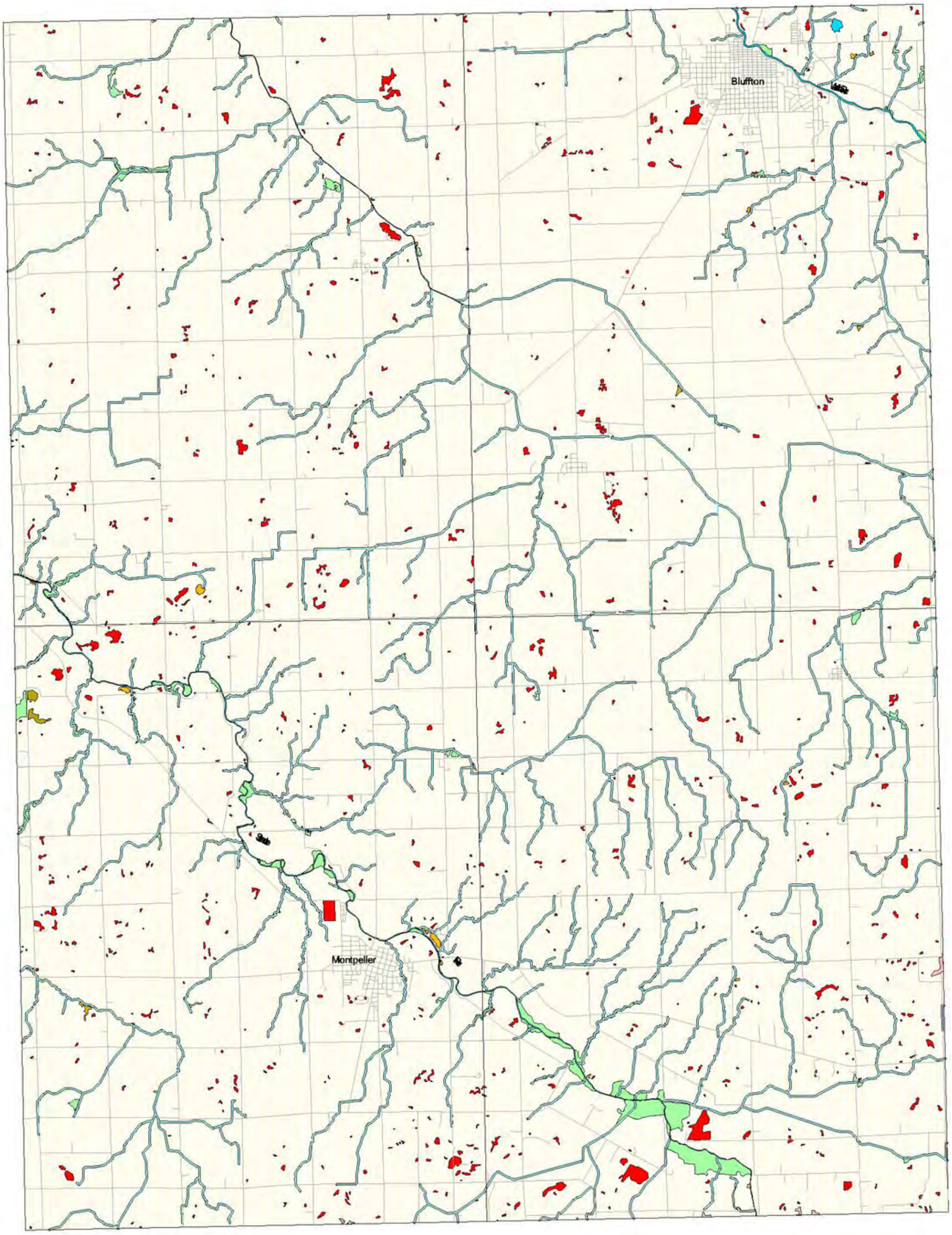
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	16.8	Lacustrine Wetlands:	0.0
PAB:	12.9	Pf:	0.0	PUB:	921.6	Marine Wetlands:	0.0
PEM:	60.7	PFO:	96.4	PUS:	0.0	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Bluffton Study Area, Indiana



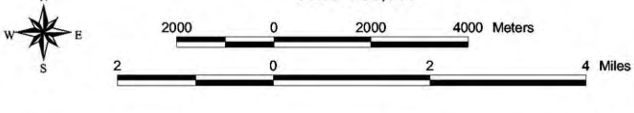
Legend

- Isolated Wetlands
- Wetlands 20-40 meters from Intermittent or Perennial Streams
- Non-isolated Wetlands
- Road-fragmented Wetlands*
- Map-edge Wetlands**
- 20 meter Buffer of Perennial and Intermittent Streams
- Isolated Deepwater Habitats
- Deepwater Habitats
- Uplands
- Quad Boundary
- Roads

* Separated from non-isolated wetland or deepwater habitat by a road; may be connected or isolated.

** Status could not be predicted since the rest of the wetland is outside the study area.

Scale 1:50,000



Data Sources

Wetlands: Existing NWI digital data

Streams: USGS Hydrology DLG

Roads: USGS DLG 1:24K Roads

Projection: UTM NAD 27, Zone 16

USGS Quads

Locus Map

This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Bluffton State: IN FWS Region: 3

Ecoregion: Eastern Broadleaf Forest (Continental)

Watershed Region: Ohio Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	145068.7		
Upland Acreage..	142671.6	98.3%	Uplands
Non-Isolated Deepwater Habitats Acreage.	84.9	0.1%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	2312.2	1.6%	Wetlands
Number of Wetlands.................................	906		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	29.9	Lacustrine Wetlands:	0.0
PAB:	0.0	PFO:	1576.1	PUB:	315.9	Marine Wetlands:	0.0
PEM:	390.3	Pf:	0.0	PUS:	0.0	Riverine Wetlands:	0.0

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	1159.3	50.1%	723	79.8%
Scenario 2: (Red and Orange)	1218.1	52.7%	760	83.9%
Scenario 3: (Red, Orange and Brown)	1244.8	53.8%	763	84.2%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 32.8 Number: 17

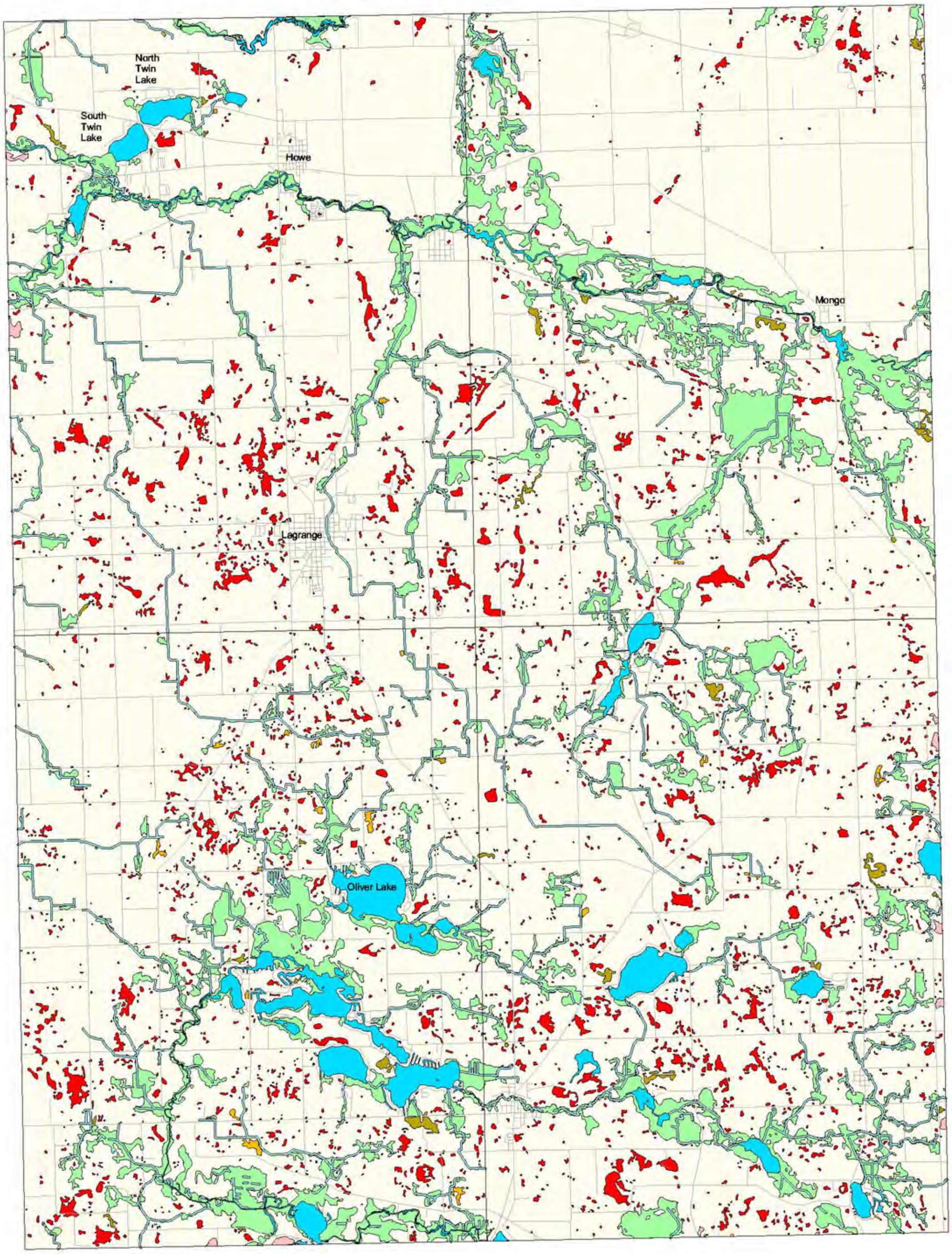
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	22.9	Lacustrine Wetlands:	0.0
PAB:	0.0	Pf:	0.0	PUB:	221.0	Marine Wetlands:	0.0
PEM:	291.1	PFO:	682.6	PUS:	0.5	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Mongo Study Area, Indiana



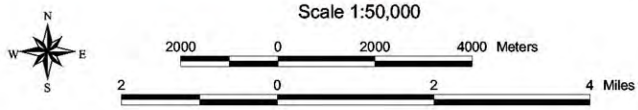
Legend

- Isolated Wetlands
- Wetlands 20-40 meters from Intermittent or Perennial Streams
- Non-isolated Wetlands
- Road-fragmented Wetlands*
- Map-edge Wetlands**
- 20 meter Buffer of Perennial and Intermittent Streams
- Isolated Deepwater Habitats
- Deepwater Habitats
- Uplands
- Quad Boundary
- Roads

* Separated from non-isolated wetland or deepwater habitat by a road; may be connected or isolated.

** Status could not be predicted since the rest of the wetland is outside the study area.

Scale 1:50,000



Data Sources

Wetlands: Existing NWI digital data

Streams: USGS Hydrology DLG

Roads: USGS DLG 1:24K Roads

Projection: UTM NAD 27, Zone 16

USGS Quads

Locus Map

This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Mongo State: IN FWS Region: 3

Ecoregion: Eastern Broadleaf Forest (Continental)

Watershed Region: Great Lakes Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area.....................	142895.6		
Upland Acreage..	121081.4	84.7%	Uplands
Non-Isolated Deepwater Habitats Acreage.	3171.8	2.2%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	18642.4	13.1%	Wetlands
Number of Wetlands.................................	3707		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	2251.0	Lacustrine Wetlands:	30.2
PAB:	62.2	PFO:	8539.5	PUB:	735.3	Marine Wetlands:	0.0
PEM:	7024.2	Pf:	0.0	PUS:	0.0	Riverine Wetlands:	0.0

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	4647.3	24.9%	2915	78.6%
Scenario 2: (Red and Orange)	4817.9	25.8%	3014	81.3%
Scenario 3: (Red, Orange and Brown)	5154.6	27.7%	3063	81.3%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 120.0 Number: 30

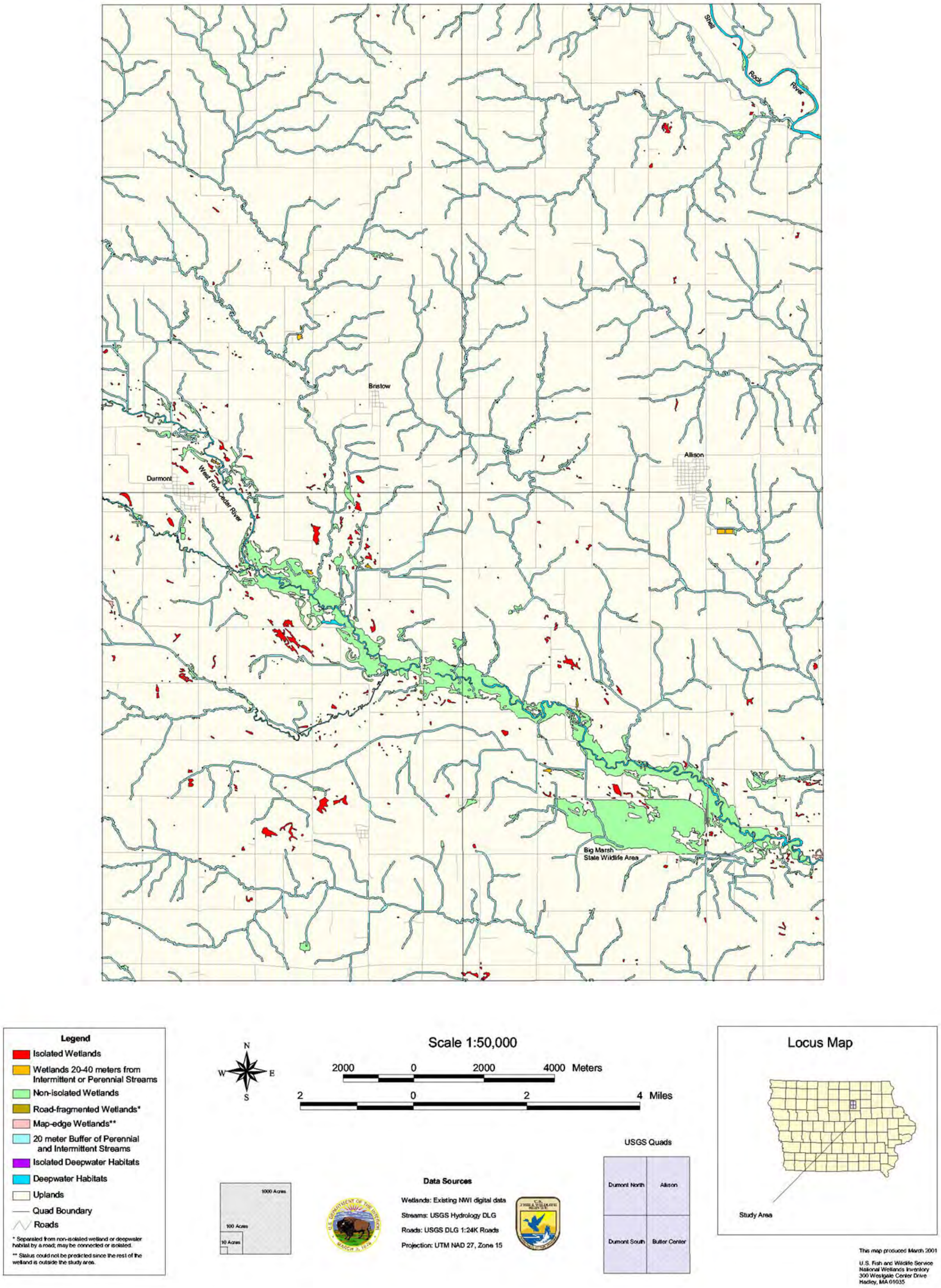
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	333.5	Lacustrine Wetlands:	0.0
PAB:	37.9	Pf:	0.0	PUB:	304.3	Marine Wetlands:	0.0
PEM:	2297.9	PFO:	1844.3	PUS:	0.0	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Allison Study Area, Iowa



Study Area: Allison State: IA FWS Region: 3

Ecoregion: Prairie Parkland (Temperate)

Watershed Region: Upper Mississippi Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area.....................	140348.9		
Upland Acreage.......................................	135033.8	96.2%	Uplands
Non-Isolated Deepwater Habitats Acreage.	425.9	0.3%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage....................................	4889.2	3.5%	Wetlands
Number of Wetlands................................	966		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	66.8	Lacustrine Wetlands:	0.0
PAB:	0.0	PFO:	1946.9	PUB:	338.4	Marine Wetlands:	0.0
PEM:	2517.8	Pf:	0.0	PUS:	0.0	Riverine Wetlands:	19.3

. . .

ESTIMATES FOR ISOLATED WETLANDS:

SCENARIO*	Area: Acreage	Area: Percent of Total Wetlands**	Number: Count	Number: Percent of Total Wetlands**
Scenario 1: (Red)	518.2	10.6%	435	45.0%
Scenario 2: (Red and Orange)	568.1	11.6%	499	51.7%
Scenario 3: (Red, Orange and Brown)	576.8	11.8%	504	52.2%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 13.8 Number: 3

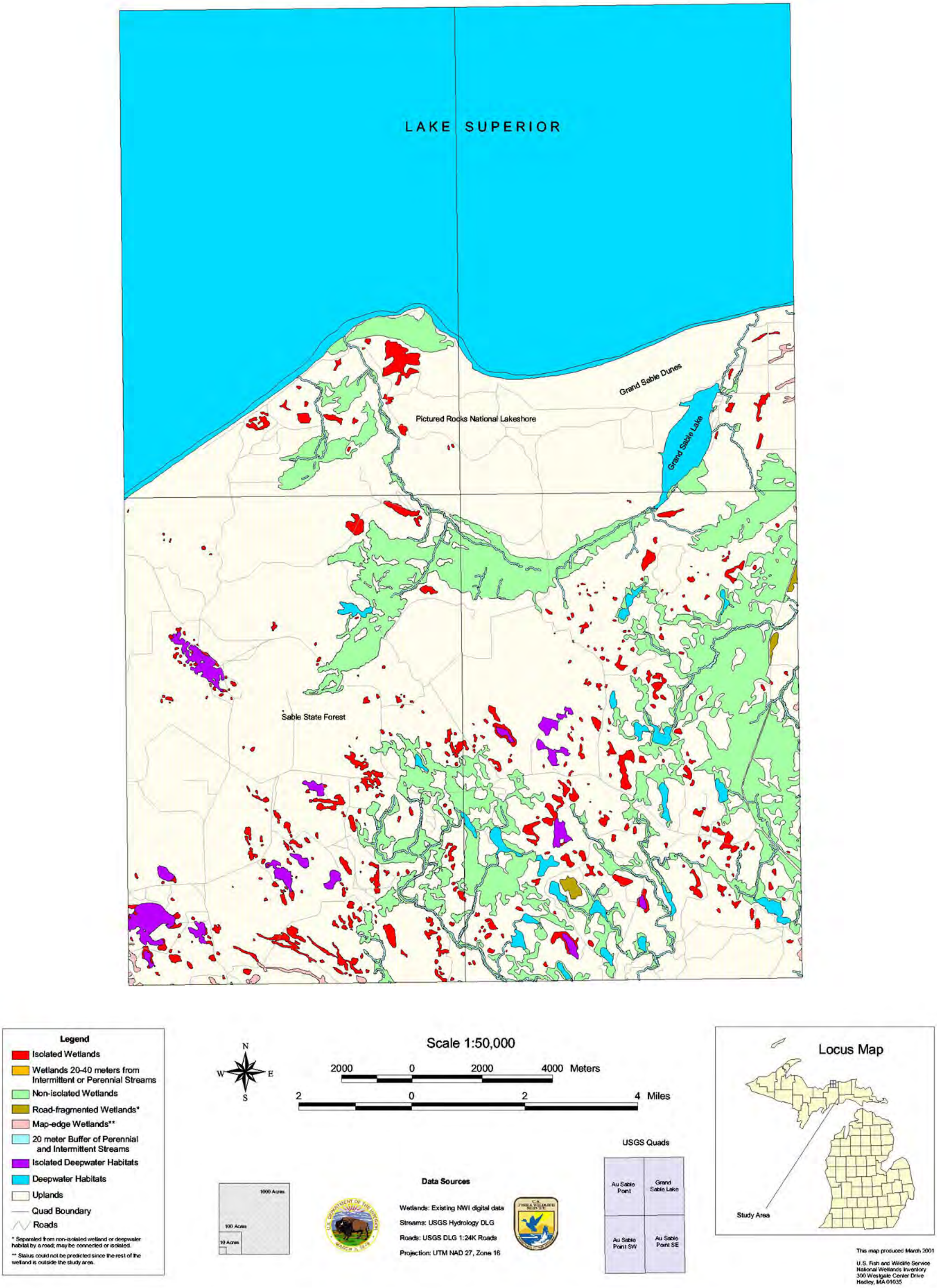
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	11.6	Lacustrine Wetlands:	0.0
PAB:	0.0	Pf:	0.0	PUB:	81.6	Marine Wetlands:	0.0
PEM:	439.4	PFO:	35.6	PUS:	0.0	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Grand Sable Lake Study Area, Michigan



Study Area: Grand Sable Lake State: MI FWS Region: 3

Ecoregion: Laurentian Mixed Forest

Watershed Region: Great Lakes Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	131400.6		
Upland Acreage..	64528.3	49.1%	Uplands
Non-Isolated Deepwater Habitats Acreage.	49959.5	38.7%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	901.7		
Wetlands Acreage.....................................	16011.2	12.2%	Wetlands
Number of Wetlands.................................	473		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	2426.9	Lacustrine Wetlands:	0.0
PAB:	6.0	PFO:	11924.5	PUB:	716.3	Marine Wetlands:	0.0
PEM:	937.4	Pf:	0.0	PUS:	0.0	Riverine Wetlands:	0.0

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	2452.5	15.3%	402	85.0%
Scenario 2: (Red and Orange)	2452.5	15.3%	402	85.0%
Scenario 3: (Red, Orange and Brown)	2557.5	16.0%	405	85.6%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 169.9 Number: 21

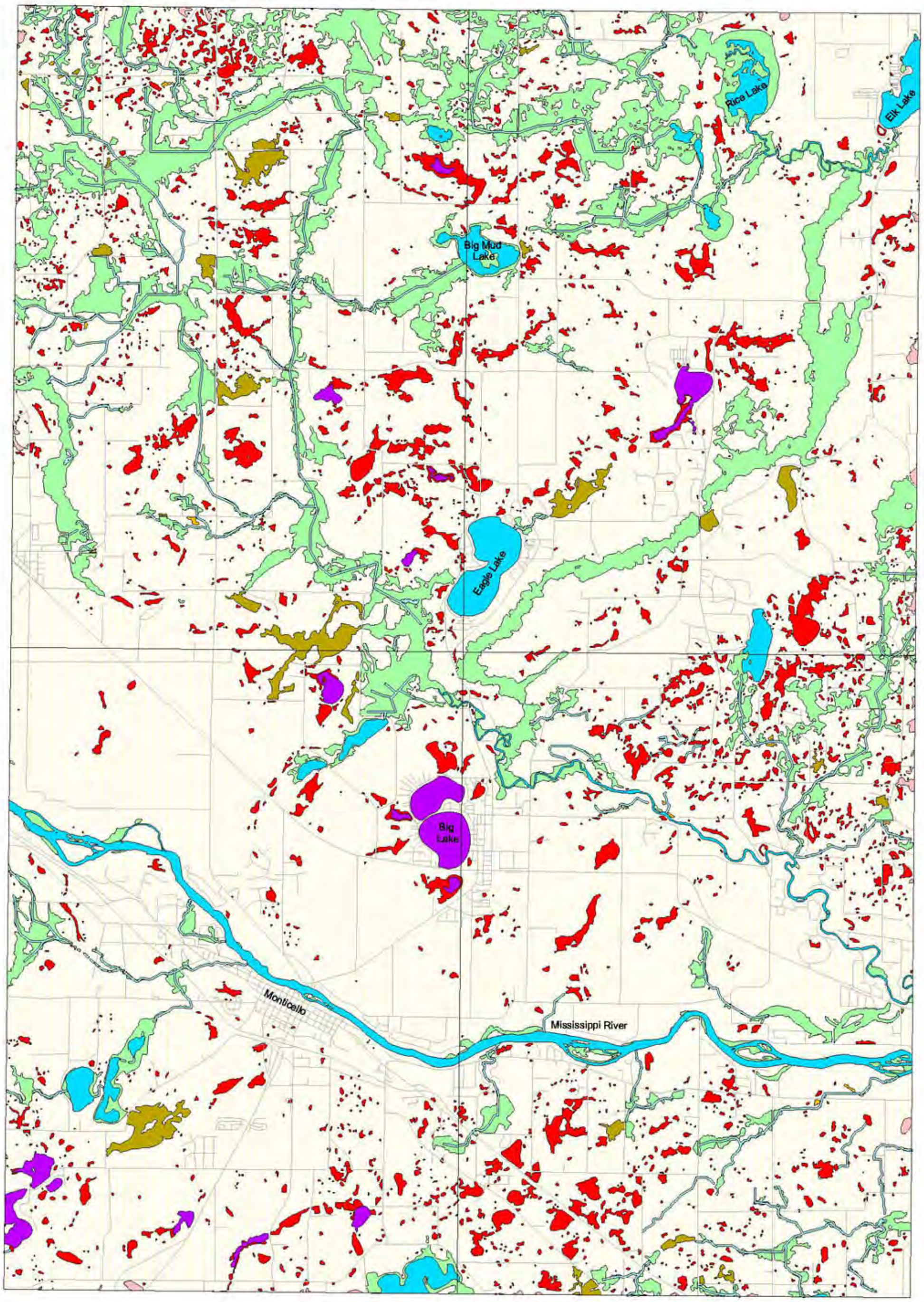
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	432.6	Lacustrine Wetlands:	0.0
PAB:	6.0	Pf:	0.0	PUB:	361.6	Marine Wetlands:	0.0
PEM:	353.4	PFO:	1298.9	PUS:	0.0	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Big Lake Study Area, Minnesota



Legend

- Isolated Wetlands
- Wetlands 20-40 meters from Intermittent or Perennial Streams
- Non-isolated Wetlands
- Road-fragmented Wetlands*
- Map-edge Wetlands**
- 20 meter Buffer of Perennial and Intermittent Streams
- Isolated Deepwater Habitats
- Deepwater Habitats
- Uplands
- Quad Boundary
- Roads

* Separated from non-isolated wetland by a road; may be connected or isolated.

** Status could not be predicted since the rest of the wetland is outside the study area.

Scale 1:50,000

2000 0 2000 4000 Meters

2 0 2 4 Miles

Data Sources

Wetlands: Existing NWI digital data

Streams: USGS Hydrology DLG

Roads: USGS DLG 1:24K Roads

Projection: UTM NAD 27, Zone 15

USGS Quads

Locus Map

This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Big Lake State: MN FWS Region: 3

Ecoregion: Eastern Broadleaf Forest (Continental)

Watershed Region: Upper Mississippi Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	134354.0		
Upland Acreage..	107692.2	80.2%	Uplands
Non-Isolated Deepwater Habitats Acreage.	3153.8	3.1%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	1007.6		
Wetlands Acreage.....................................	22500.4	16.8%	Wetlands
Number of Wetlands.................................	2982		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	4551.1	Lacustrine Wetlands:	2.7
PAB:	0.0	PFO:	3261.1	PUB:	579.8	Marine Wetlands:	0.0
PEM:	14078.0	Pf:	0.0	PUS:	10.0	Riverine Wetlands:	17.7

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	6733.2	29.9%	2508	84.1%
Scenario 2: (Red and Orange)	6766.8	30.1%	2532	84.9%
Scenario 3: (Red, Orange and Brown)	7973.0	35.4%	2567	86.1%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 179.8 Number: 61

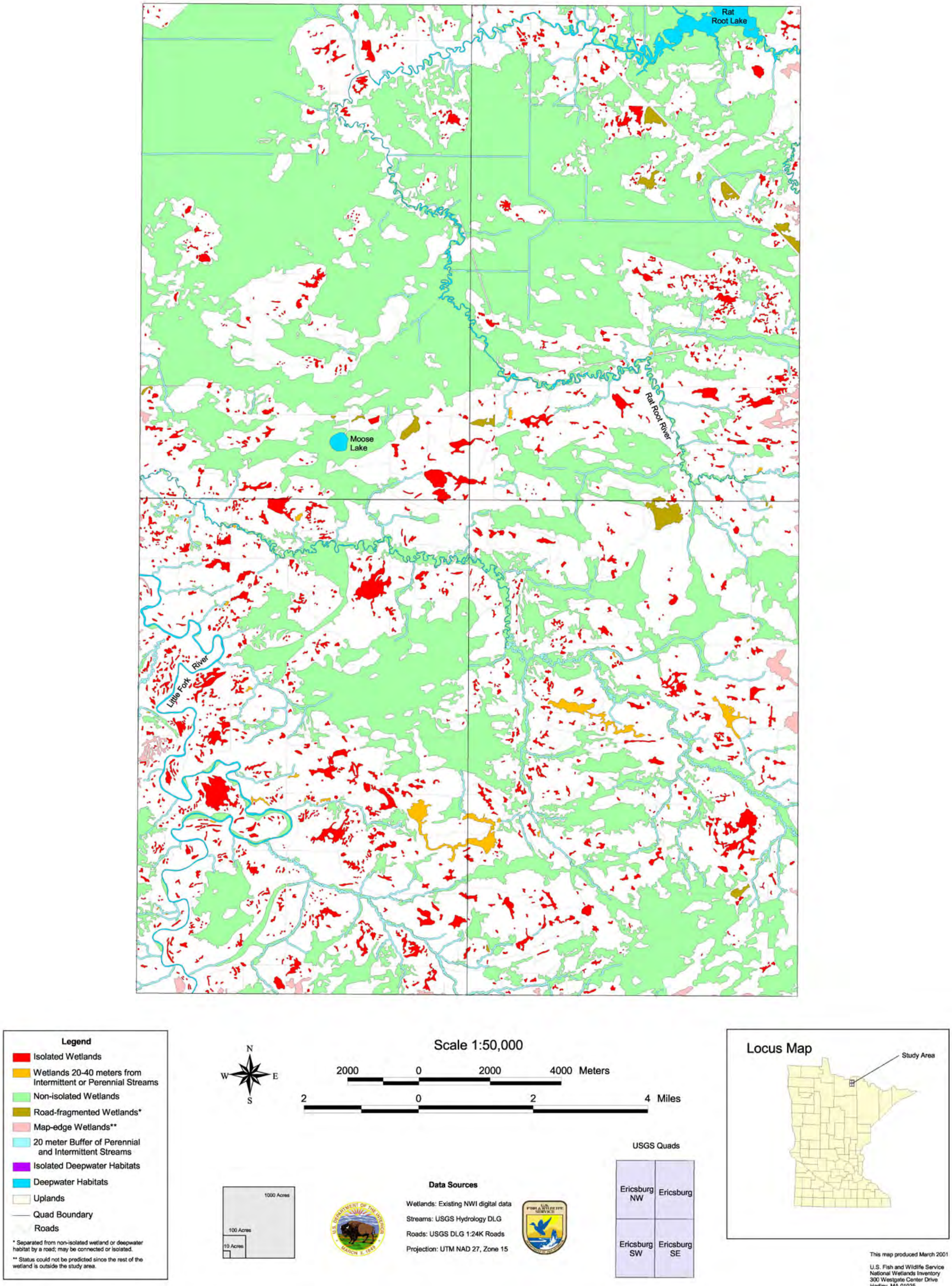
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	786.3	Lacustrine Wetlands:	2.7
PAB:	0.0	Pf:	0.0	PUB:	360.8	Marine Wetlands:	0.0
PEM:	5178.4	PFO:	436.2	PUS:	2.3	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Ericsburg Study Area, Minnesota



This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Ericsburg State: MN FWS Region: 3

Ecoregion: Laurentian Mixed Forest

Watershed Region: Souris-Red-Rainy Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	127127.6		
Upland Acreage..	69969.4	55.0%	Uplands
Non-Isolated Deepwater Habitats Acreage.	984.9	0.8%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	56173.3	44.2%	Wetlands
Number of Wetlands.................................	2033		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	12492.5	Lacustrine Wetlands:	0.0
PAB:	0.0	PFO:	40414.7	PUB:	194.8	Marine Wetlands:	0.0
PEM:	3065.5	Pf:	0.0	PUS:	0.0	Riverine Wetlands:	0.0

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	4341.8	7.7%	1649	81.1%
Scenario 2: (Red and Orange)	4764.1	8.5%	1686	82.9%
Scenario 3: (Red, Orange and Brown)	5151.1	9.2%	1701	83.7%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 445.1 Number: 59

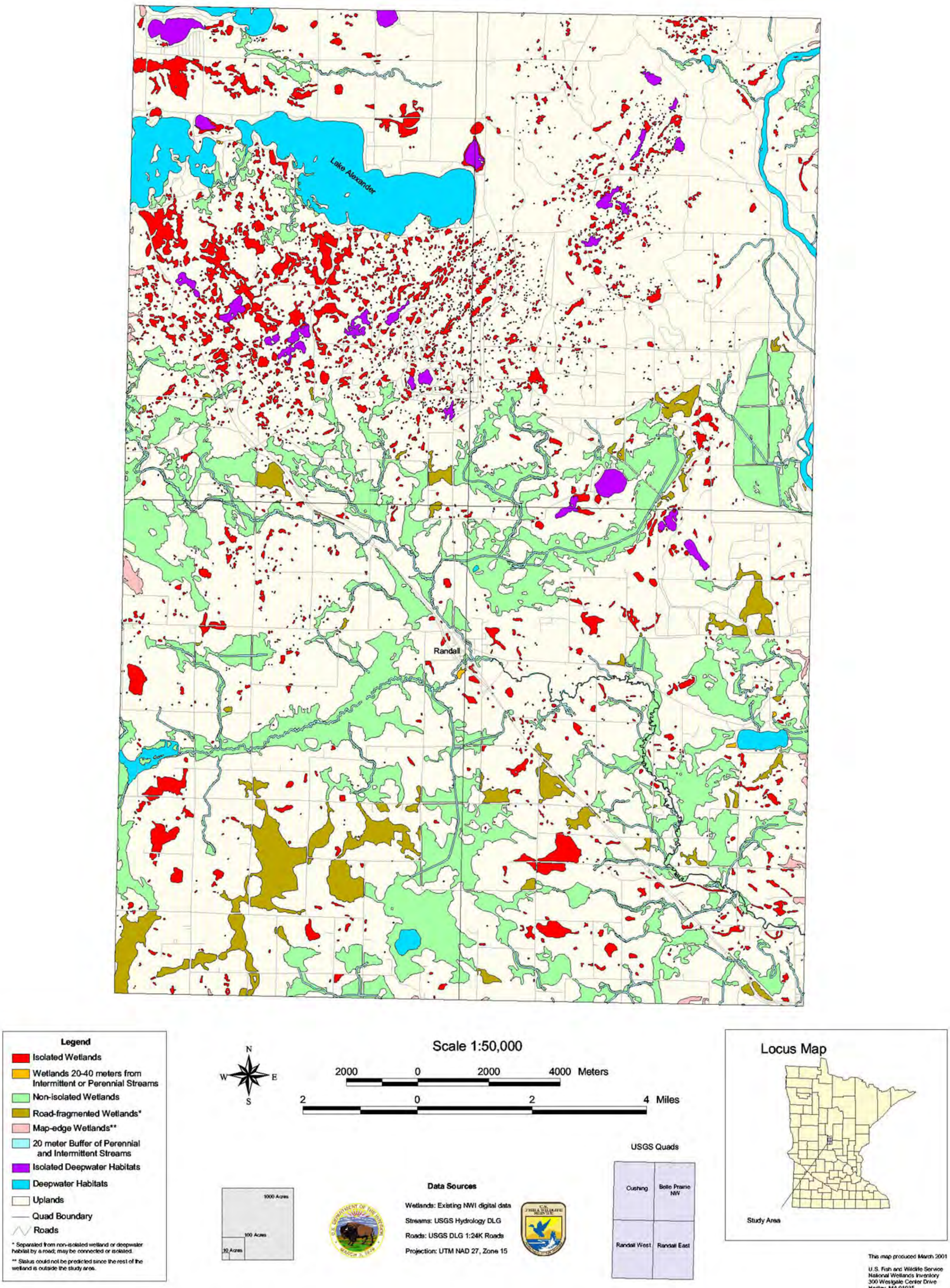
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	954.2	Lacustrine Wetlands:	0.0
PAB:	0.0	Pf:	0.0	PUB:	11.0	Marine Wetlands:	0.0
PEM:	518.5	PFO:	3280.4	PUS:	0.0	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Lake Alexander Study Area, Minnesota



Study Area: Lake Alexander State: MN FWS Region: 3

Ecoregion: Eastern Broadleaf Forest (Continental)

Watershed Region: Upper Mississippi Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	132617.8		
Upland Acreage..	98677.0	74.4%	Uplands
Non-Isolated Deepwater Habitats Acreage.	4566.5	4.3%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	1113.2		
Wetlands Acreage.....................................	28261.0	21.3%	Wetlands
Number of Wetlands.................................	3471		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	14170.0	Lacustrine Wetlands:	0.0
PAB:	0.3	PFO:	2551.9	PUB:	1665.0	Marine Wetlands:	0.0
PEM:	9873.9	Pf:	0.0	PUS:	0.0	Riverine Wetlands:	0.0

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	6421.8	22.7%	3123	90.0%
Scenario 2: (Red and Orange)	6454.7	22.8%	3142	90.5%
Scenario 3: (Red, Orange and Brown)	9575.5	33.9%	3221	92.8%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 275.2 Number: 39

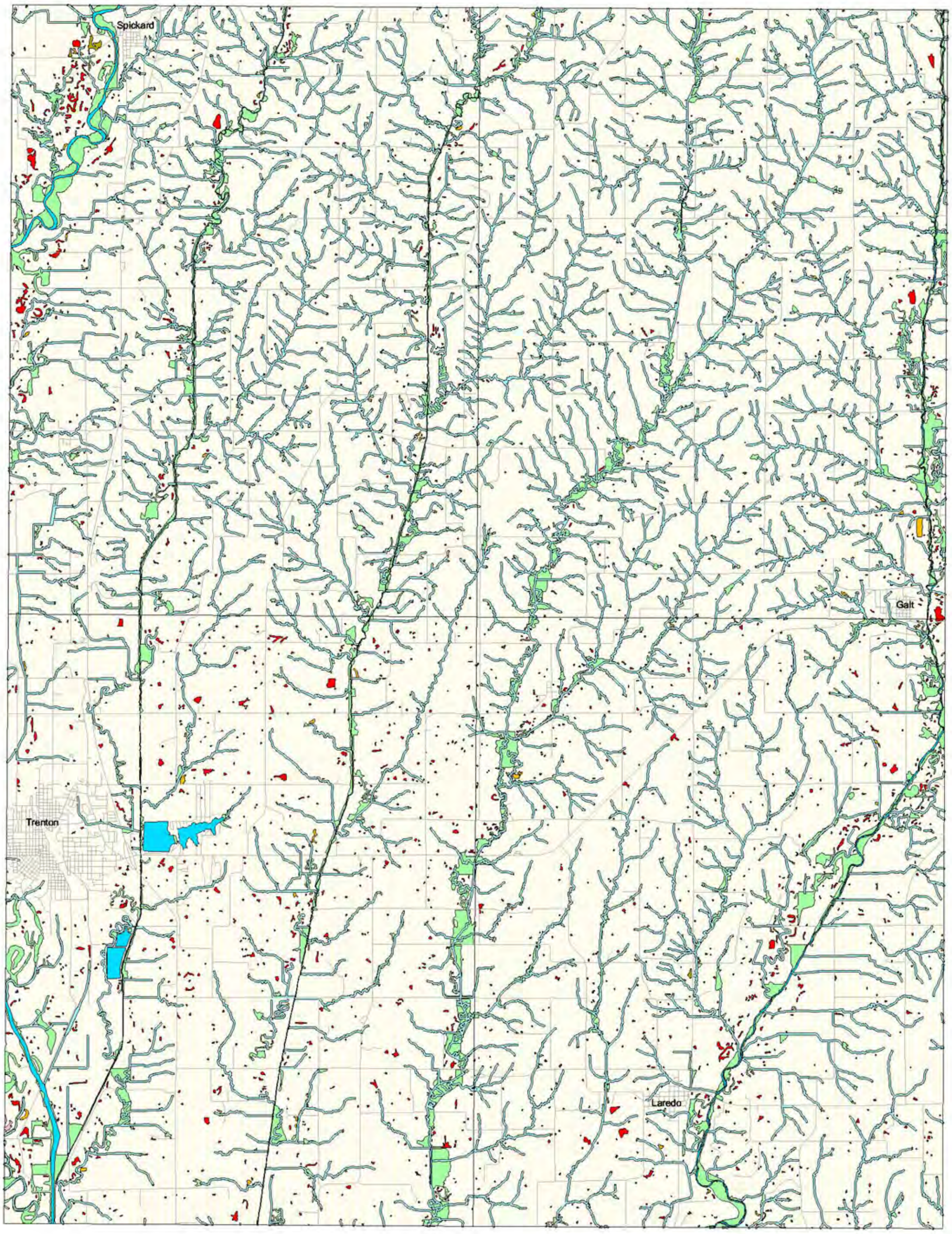
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	2944.2	Lacustrine Wetlands:	0.0
PAB:	0.3	Pf:	0.0	PUB:	1281.1	Marine Wetlands:	0.0
PEM:	1888.3	PFO:	340.8	PUS:	0.0	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Trenton Study Area, Missouri



Legend

- Isolated Wetlands
- Wetlands 20-40 meters from Intermittent or Perennial Streams
- Non-isolated Wetlands
- Road-fragmented Wetlands*
- Map-edge Wetlands**
- 20 meter Buffer of Perennial and Intermittent Streams
- Isolated Deepwater Habitats
- Deepwater Habitats
- Uplands
- Quad Boundary
- Roads

* Separated from non-isolated wetland by a road; may be connected or isolated.

** Status could not be predicted since the rest of the wetland is outside the study area.

N W E S

Scale 1:50,000

2000 0 2000 4000 Meters

2 0 2 4 Miles

Data Sources

Wetlands: Existing NWI digital data

Streams: USGS Hydrology DLG

Roads: USGS DLG 1:24K Roads

Projection: UTM NAD 27, Zone 15

USGS Quads

Locus Map

This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Trenton State: MO FWS Region: 3

Ecoregion: Prairie Parkland (Temperate)

Watershed Region: Missouri Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	146059.4		
Upland Acreage..	137780.6	94.3%	Uplands
Non-Isolated Deepwater Habitats Acreage.	704.7	0.5%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	7574.1	5.2%	Wetlands
Number of Wetlands.................................	4126		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	199.7	Lacustrine Wetlands:	0.0
PAB:	10.1	PFO:	4122.9	PUB:	1095.8	Marine Wetlands:	0.0
PEM:	2008.3	Pf:	0.0	PUS:	0.0	Riverine Wetlands:	137.4

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	955.1	12.6%	1884	45.7%
Scenario 2: (Red and Orange)	1119.6	14.8%	2173	52.7%
Scenario 3: (Red, Orange and Brown)	1140.6	15.1%	2179	52.8%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 21.0 Number: 26

. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

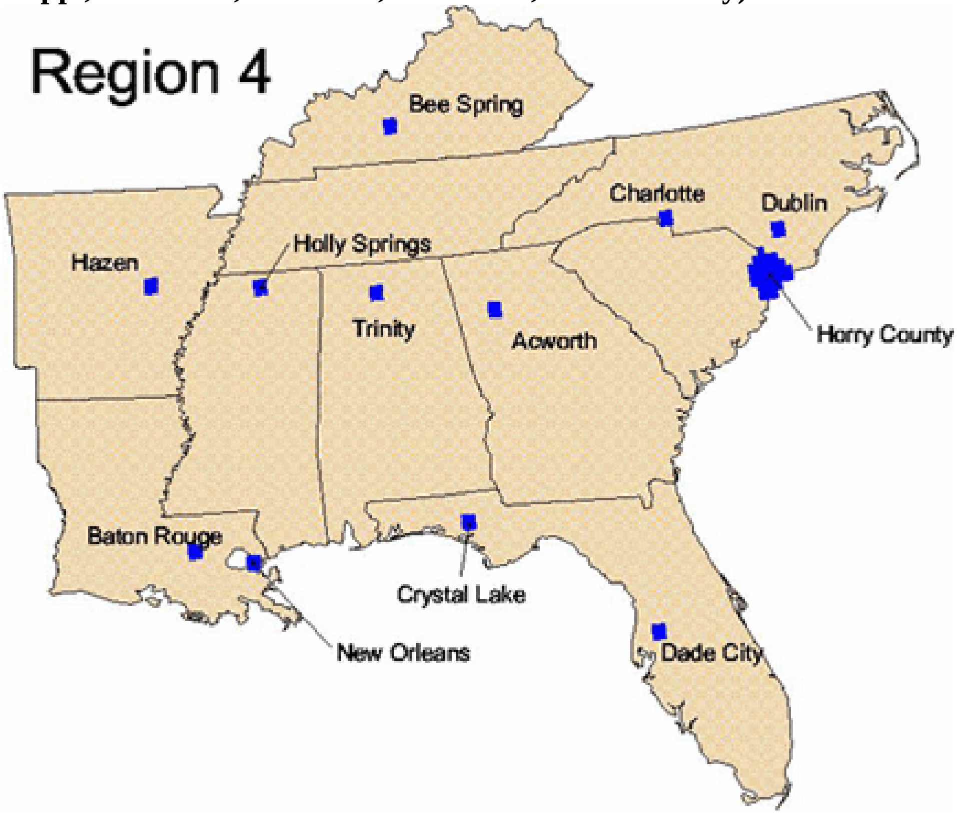
						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	19.2	Lacustrine Wetlands:	0.0
PAB:	0.6	Pf:	0.0	PUB:	381.8	Marine Wetlands:	0.0
PEM:	640.4	PFO:	77.2	PUS:	0.0	Riverine Wetlands:	0.4

*** Acreage of Isolated Wetlands based on Scenario 2.

Study Results

Study findings are reported for each study area below. Data for individual study areas are arranged by U.S. Fish and Wildlife Service Region. For each Region, there is a general discussion of the study results, a map showing the location of the study sites, a summary table of the findings, detailed data summary for each area, and a special wetland classification map for each study area. The latter two products are represented as "additional data links" within the regional summary table (first column). Simply click on the word "map" or "data" and the pertinent map and data will be displayed. *Please allow a minute or so for the map to appear. Note that printed maps may appear somewhat skewed since their projections reflect the curvature of the Earth.*

Region 4 (North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Arkansas, Tennessee, and Kentucky)



Twelve areas were studied in the Southeast: one in Alabama, one in Arkansas, two in Florida, one in Georgia, one in Kentucky, two in Louisiana,one in Mississippi, two in North Carolina, and one in South Carolina. The latter area was the largest area evaluated: Horry County. *Table 3-4* presents a summary of the data for the Region's study areas.

<u>Percent of Study Areas Covered by Wetlands</u>

Wetlands were abundant in several of the study areas. Horry County, South Carolina had 44 percent of its area in wetlands. Study sites will more than 20 percent wetland included New Orleans, Louisiana (23%; with numerous coastal wetlands), Dublin, North Carolina (23%; with extensive Carolina bays and flatwoods), Baton Rouge, Louisiana (21%), and Dade City, Florida (20%; with many cypress swamps and sinkhole wetlands). The Crystal Lake, Florida study area, another karst site with many sinkhole wetlands, had 18 percent of its area covered by wetlands.

<u>Percent of Wetland Area Identified as Isolated</u>

Three areas had more than 40 percent of their wetland acreage designated as isolated: Bee Spring, Mississippi (46-48%), Crystal Lake (45%), and Dade City (41-42%). Most of the isolated wetlands in Bee Spring were ponds (479 acres), whereas most of the isolated wetlands in Crystal Lake were forested or scrub-shrub types (10,410 acres or 78% of the ones identified under Scenario 2). Dade City's isolated wetlands were mostly emergent or forested types (6,514 acres and 6,080 acres, respectively under Scenario 2; equaling 88 percent of the isolated ones). Other areas with more than 20 percent of their wetland acreage defined as such included: Acworth, North Carolina (26-29%), Dublin (21-24%), and Charlotte, North Carolina (17-21%).

<u>Percent of Wetlands (Number) Classified as Isolated</u>

All sites, except New Orleans, had more than 40 percent of their wetlands mapped as isolated. The highest percentages were found in Dade City (89-90%) and Bee Spring (88-90%). They were followed by Dublin (63-71%) and Crystal City (74-77%).

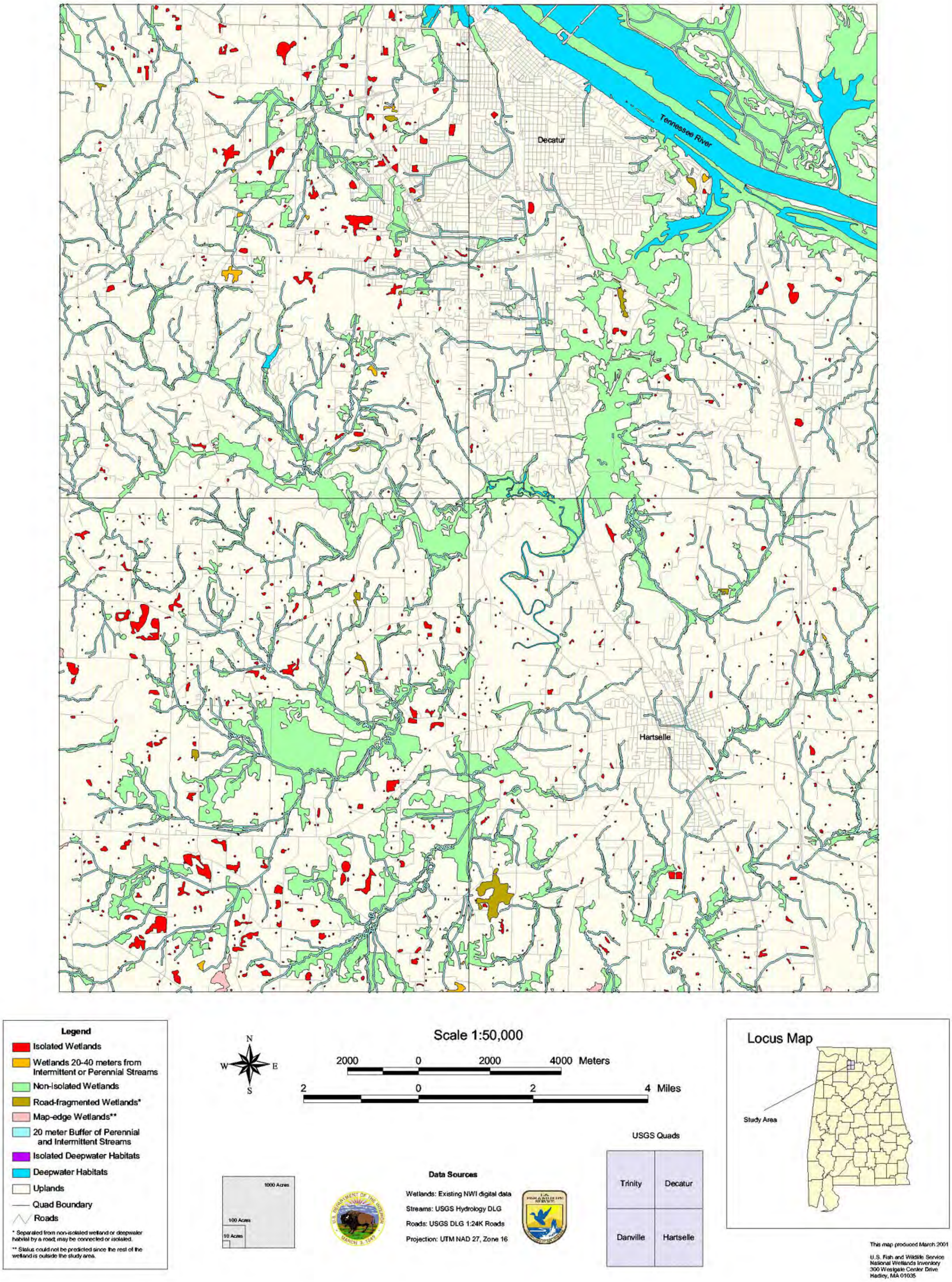
Table 3-4. Summary data for study sites in Region 4. (<u>Note</u>: This table should be printed in landscape orientation.)

	Isolated Wetlands

Additional Data Links	Study Area	State	Acreage in Study Area	Wetland Acreage	Wetlands % of Study Area	Number of Wetlands	Deepwater Habitats % of Study Area	Scenario 1 Area Percent of Total Wetlands	Scenario 2 Area Percent of Total Wetlands	Scenario 3 Area Percent of Total Wetlands	Scenario 1 Count Percent of Total Wetlands	Scenario 2 Count Percent of Total Wetlands	Scenario 3 Count Percent of Total Wetlands
MAP DATA	Trinity	AL	157213.3	22456.7	14.3%	1393	2.7%	7.4%	7.9%	9.0%	62.3%	66.5%	67.6%
MAP DATA	Hazen	AR	156576.8	15484.0	9.9%	659	0.3%	7.4%	8.8%	9.1%	48.9%	55.2%	56.0%
MAP DATA	Crystal Lake	FL	164297.3	29720.4	18.1%	1175	2.5%	44.6%	44.8%	44.9%	74.2%	76.8%	77.0%
MAP DATA	Dade City	FL	167883.9	34149.4	20.3%	4136	0.8%	41.0%	41.8%	42.1%	88.9%	90.1%	90.2%
MAP DATA	Acworth	GA	158320.6	2757.9	1.7%	764	1.6%	25.6%	28.5%	29.2%	63.2%	67.1%	68.2%
MAP DATA	Bee Spring	KY	151953.7	1250.4	0.8%	1601	0.7%	46.1%	47.3%	47.6%	88.1%	90.1%	90.2%
MAP DATA	Baton Rouge	LA	164583.9	34014.8	20.7%	793	1.3%	4.8%	5.3%	6.5%	63.3%	70.0%	72.5%
MAP DATA	New Orleans	LA	165154.3	38695.7	23.4%	304	65.9%	1.7%	2.1%	2.6%	24.0%	25.0%	28.6%
MAP DATA	Holly Springs	MS	156931.8	10214.9	6.5%	1575	0.5%	5.3%	5.5%	5.7%	56.2%	58.9%	59.2%
MAP DATA	Dublin	NC	157165.2	36082.6	23.0%	1292	1.0%	20.7%	21.3%	24.2%	74.8%	76.9%	79.1%
MAP DATA	Charlotte	NC-SC	156047.5	2451.2	1.6%	1137	0.2%	17.1%	20.9%	21.2%	39.7%	45.5%	45.7%
MAP DATA	Horry County	SC	742107.8	326902.0	44.1%	7639	2.0%	5.1%	5.2%	9.1%	63.3%	64.4%	70.6%

[Back to Table of Contents] [Home] [Go to next Results Region 5] [Skip to Section 4]

Trinity Study Area, Alabama



Study Area: Trinity State: AL FWS Region: 4

Ecoregion: Southeastern Mixed Forest (Eastern Broadleaf Forest (Continental))

Watershed Region: Tennessee Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	157213.3		
Upland Acreage..	130468.5	83.0%	Uplands
Non-Isolated Deepwater Habitats Acreage.	4288.2	2.7%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	22456.7	14.3%	Wetlands
Number of Wetlands.................................	1393		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	895.0	Lacustrine Wetlands:	4076.7
PAB:	0.3	PFO:	13602.5	PUB:	809.7	Marine Wetlands:	0.0
PEM:	3032.5	Pf:	0.0	PUS:	0.0	Riverine Wetlands:	0.0

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	1657.4	7.4%	868	62.3%
Scenario 2: (Red and Orange)	1769.2	7.9%	927	66.5%
Scenario 3: (Red, Orange and Brown)	2026.4	9.0%	941	67.6%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 107.6 Number: 14

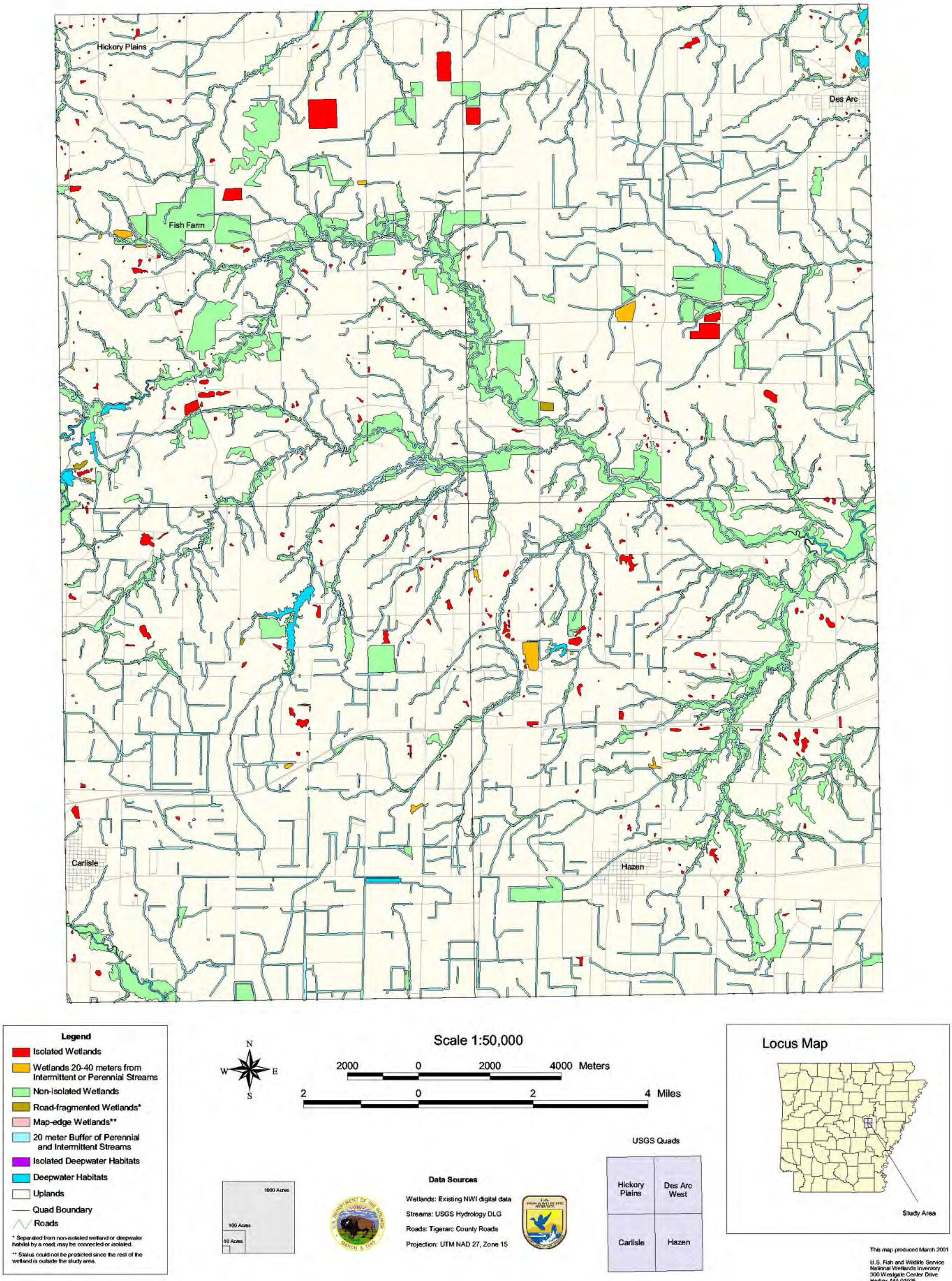
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	53.2	Lacustrine Wetlands:	10.1
PAB:	0.3	Pf:	0.0	PUB:	432.9	Marine Wetlands:	0.0
PEM:	292.3	PFO:	980.3	PUS:	0.0	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Hazen Study Area, Arkansas



This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Hazen State: AR FWS Region: 4

Ecoregion: Southeastern Mixed Forest

Watershed Region: Lower Mississippi Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	156576.8		
Upland Acreage..	140659.5	89.8%	Uplands
Non-Isolated Deepwater Habitats Acreage.	433.3	0.3%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	15484.0	9.9%	Wetlands
Number of Wetlands.................................	659		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	906.9	Lacustrine Wetlands:	4413.2
PAB:	16.8	PFO:	8628.8	PUB:	988.4	Marine Wetlands:	0.0
PEM:	529.9	Pf:	0.0	PUS:	0.0	Riverine Wetlands:	0.0

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	1139.9	7.4%	322	48.9%
Scenario 2: (Red and Orange)	1365.9	8.8%	364	55.2%
Scenario 3: (Red, Orange and Brown)	1409.5	9.1%	369	56.0%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 3.9 Number: 4

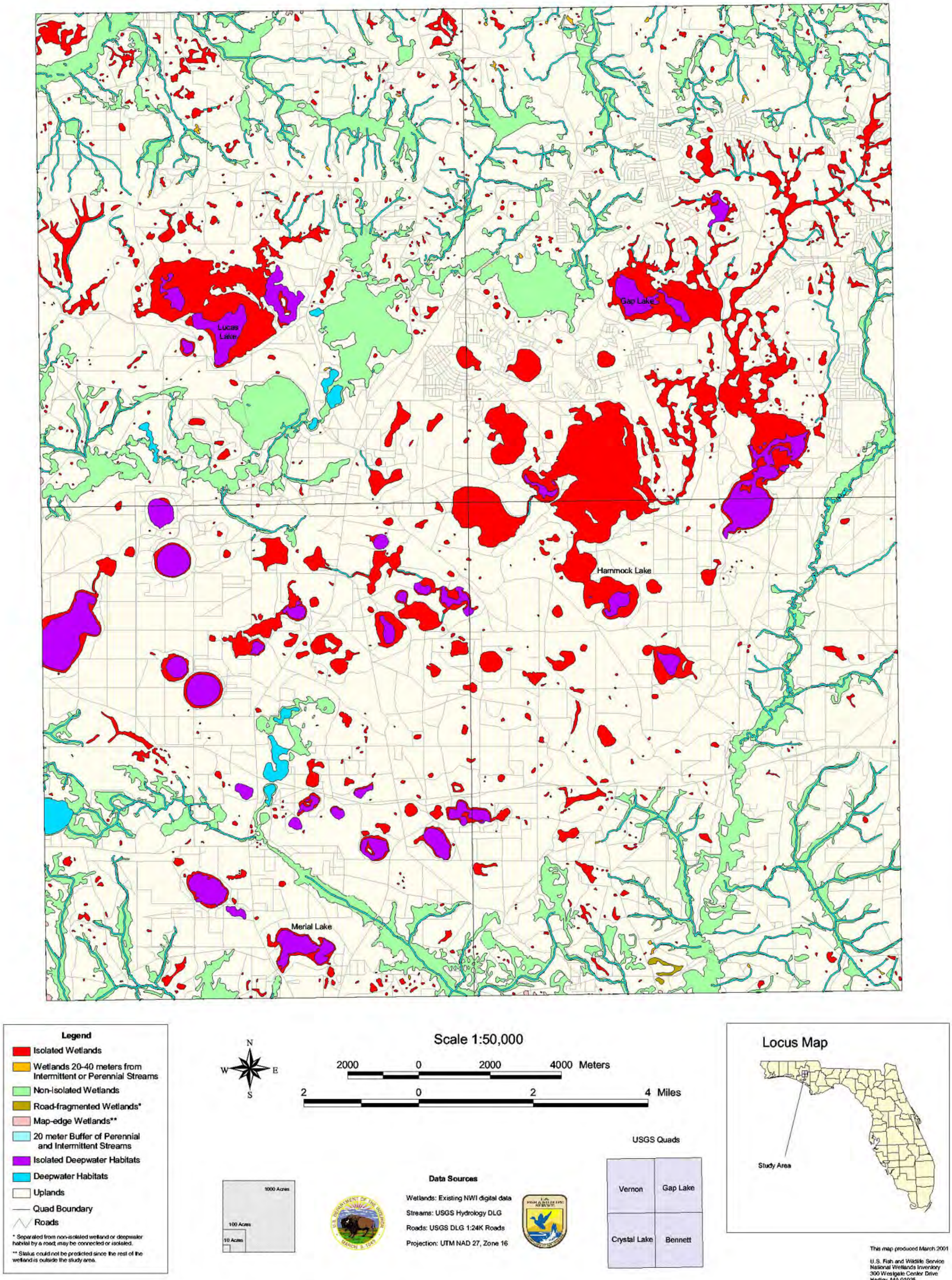
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	46.8	Lacustrine Wetlands:	500.4
PAB:	0.9	Pf:	0.0	PUB:	470.5	Marine Wetlands:	0.0
PEM:	26.1	PFO:	321.2	PUS:	0.0	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Crystal Lake Study Area, Florida



Study Area: Crystal Lake   State: FL   FWS Region: 4

Ecoregion: Outer Coastal Plain Mixed Forest

Watershed Region: South Atlantic Gulf Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area.....................	164297.3		
Upland Acreage.......................................	130454.7	79.4%	Uplands
Non-Isolated Deepwater Habitats Acreage.	489.6	2.5%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	3632.6		
Wetlands Acreage....................................	29720.4	18.1%	Wetlands
Number of Wetlands................................	1175		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	7873.0	Lacustrine Wetlands:	1916.4
PAB:	214.9	PFO:	17897.1	PUB:	1241.1	Marine Wetlands:	0.0
PEM:	577.8	Pf:	0.0	PUS:	0.0	Riverine Wetlands:	0.0

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	13257.4	44.6%	872	74.2%
Scenario 2: (Red and Orange)	13312.2	44.8%	902	76.8%
Scenario 3: (Red, Orange and Brown)	13356.3	44.9%	905	77.0%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 31.6 Number: 22

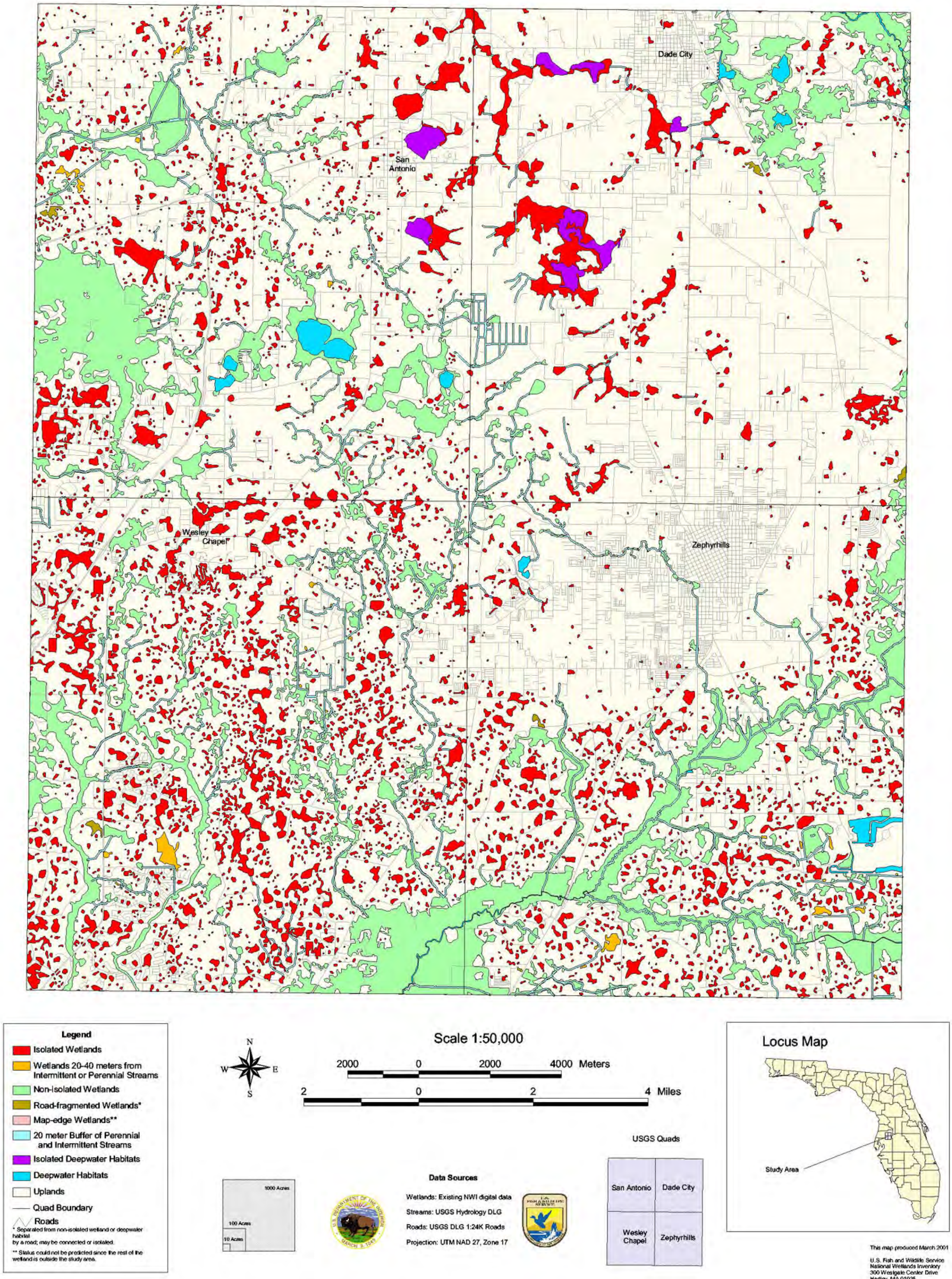
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	4767.6	Lacustrine Wetlands:	1316.9
PAB:	172.2	Pf:	0.0	PUB:	959.2	Marine Wetlands:	0.0
PEM:	454.4	PFO:	5641.9	PUS:	0.0	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Dade City Study Area, Florida



Study Area: **Dade City** State: FL FWS Region: 4

Ecoregion: Outer Coastal Plain Mixed Forest

Watershed Region: South Atlantic Gulf Region

. . .

STUDY AREA OVERVIEW:

			Percent of Study Area
Total Acreage in Study Area......................	167883.9		
Upland Acreage..	132323.1	78.8%	Uplands
Non-Isolated Deepwater Habitats Acreage.	730.9	0.8%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	680.5		
Wetlands Acreage.....................................	34149.4	20.3%	Wetlands
Number of Wetlands.................................	4136		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	560.6	Lacustrine Wetlands:	2.9
PAB:	713.1	PFO:	20585.8	PUB:	1298.8	Marine Wetlands:	0.0
PEM:	10900.2	Pf:	0.0	PUS:	35.0	Riverine Wetlands:	52.8

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	14017.2	41.0%	3675	88.9%
Scenario 2: (Red and Orange)	14267.4	41.8%	3725	90.1%
Scenario 3: (Red, Orange and Brown)	14360.8	42.1%	3731	90.2%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 0.0 Number: 0

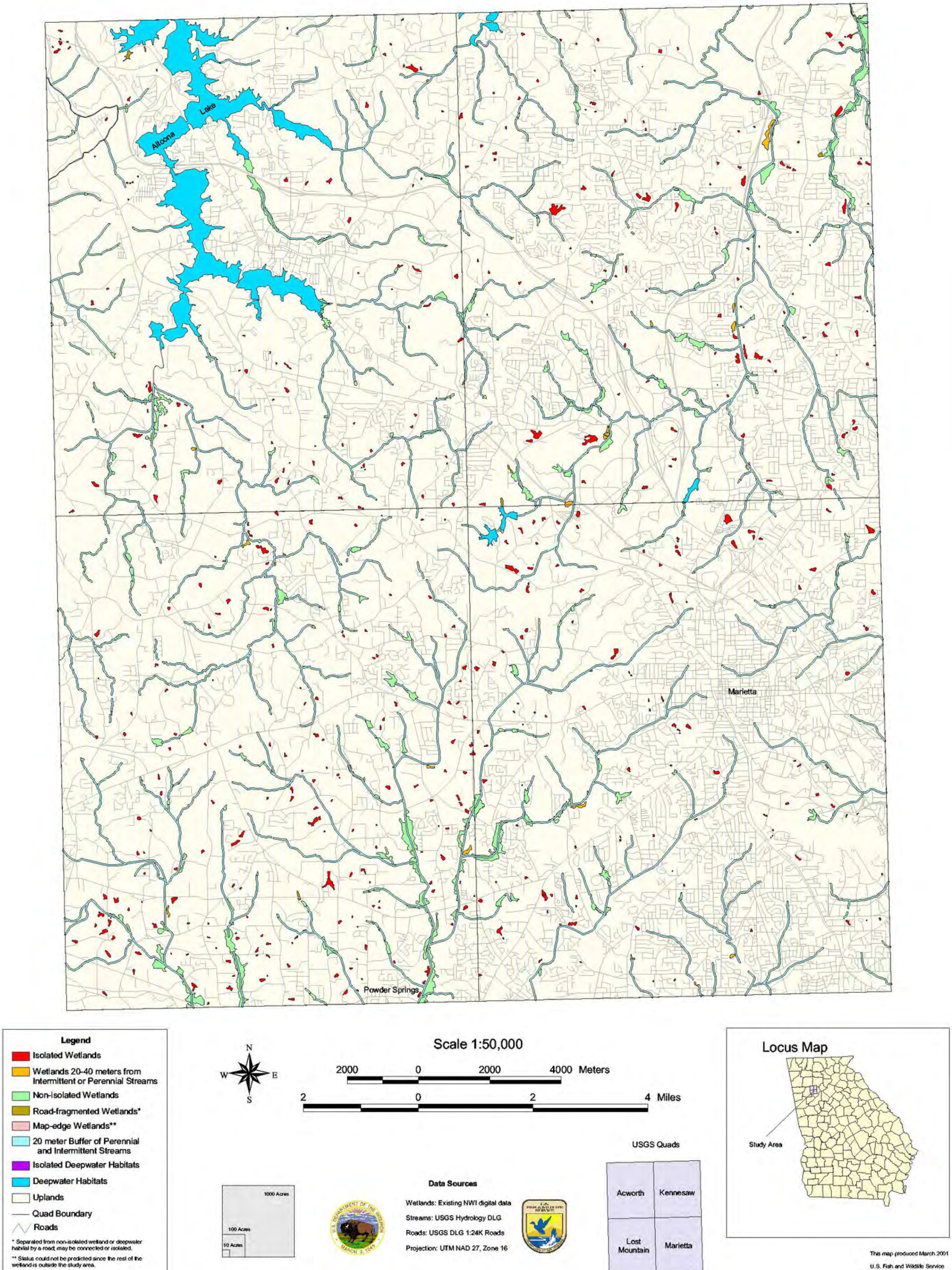
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	266.1	Lacustrine Wetlands:	0.0
PAB:	472.9	Pf:	0.0	PUB:	899.2	Marine Wetlands:	0.0
PEM:	6514.4	PFO:	6079.7	PUS:	35.0	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Acworth Study Area, Georgia



This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: **Acworth** State: GA FWS Region: 4

Ecoregion: Southeastern Mixed Forest

Watershed Region: South Atlantic Gulf Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	158320.6		
Upland Acreage..	153004.3	96.6%	Uplands
Non-Isolated Deepwater Habitats Acreage.	2558.4	1.6%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	2757.9	1.7%	Wetlands
Number of Wetlands.................................	764		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	316.3	Lacustrine Wetlands:	11.4
PAB:	0.0	PFO:	1096.0	PUB:	1187.0	Marine Wetlands:	0.0
PEM:	137.0	Pf:	0.0	PUS:	9.6	Riverine Wetlands:	0.4

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	706.6	25.6%	483	63.2%
Scenario 2: (Red and Orange)	786.0	28.5%	513	67.1%
Scenario 3: (Red, Orange and Brown)	805.0	29.2%	521	68.2%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 1.5 Number: 3

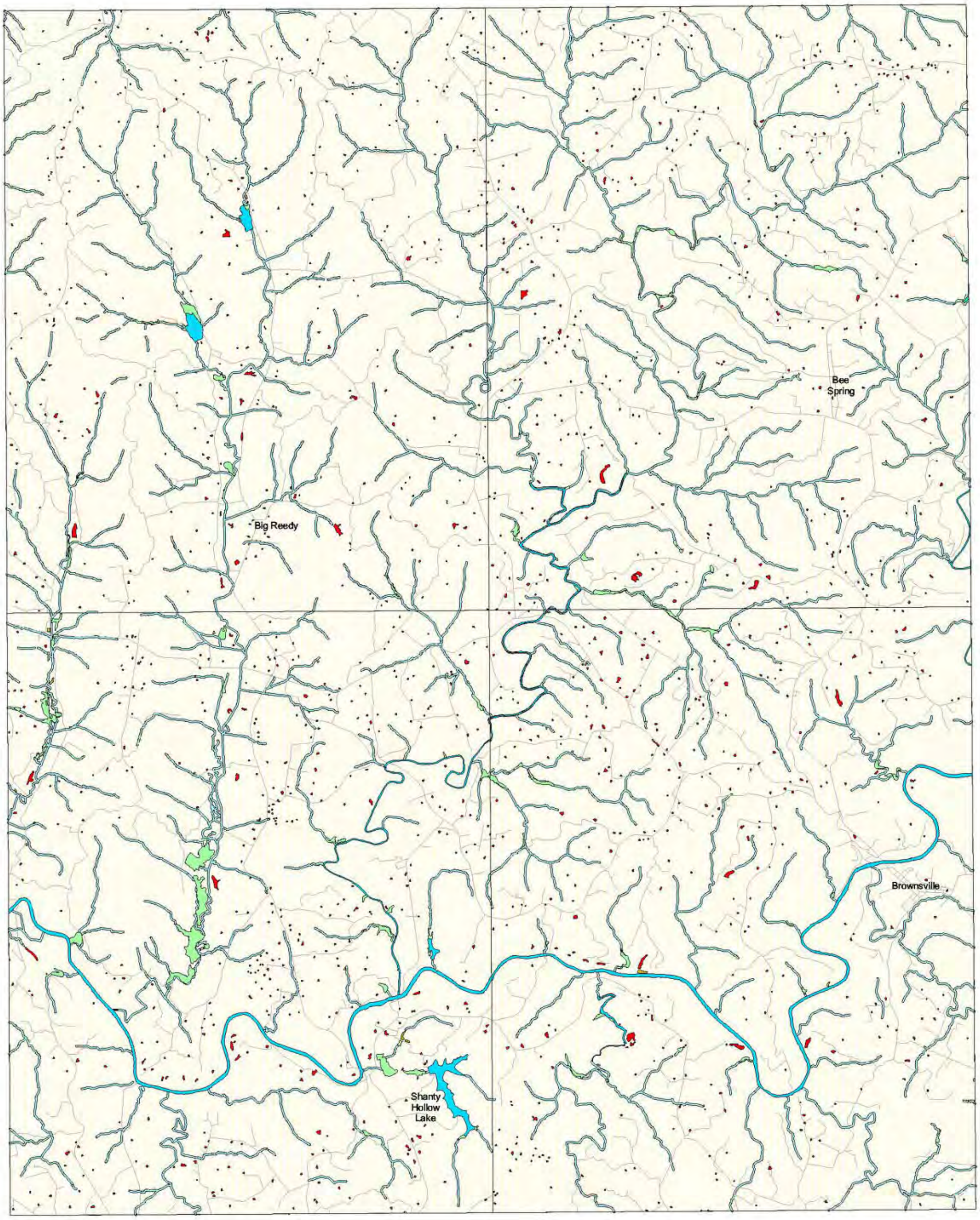
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	43.8	Lacustrine Wetlands:	0.0
PAB:	0.0	Pf:	0.0	PUB:	620.8	Marine Wetlands:	0.0
PEM:	19.1	PFO:	100.4	PUS:	2.0	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Bee Spring Study Area, Kentucky



Legend

- Isolated Wetlands
- Wetlands 20-40 meters from Intermittent or Perennial Streams
- Non-isolated Wetlands
- Road-fragmented Wetlands*
- Map-edge Wetlands**
- 20 meter Buffer of Perennial and Intermittent Streams
- Isolated Deepwater Habitats
- Deepwater Habitats
- Uplands
- Quad Boundary
- Roads

* Separated from non-isolated wetland or deepwater habitat by a road; may be connected or isolated.

** Status could not be predicted since the rest of the wetland is outside the study area.

N E S W

Scale 1:50,000

2000 0 2000 4000 Meters

2 0 2 4 Miles

1000 Acres
100 Acres
10 Acres

Data Sources

Wetlands: Existing NWI digital data
Streams: USGS Hydrology DLG
Roads: USGS DLG 1:24K Roads
Projection: UTM NAD 27, Zone 16

USGS Quads

Ready	Bee Spring
Reedyville	Brownsville

Locus Map

This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Bee Spring State: KY FWS Region: 4

Ecoregion: Eastern Broadleaf Forest (Continental)

Watershed Region: Ohio Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	151953.7		
Upland Acreage..	149641.1	98.5%	Uplands
Non-Isolated Deepwater Habitats Acreage.	1062.1	0.7%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	1250.4	0.8%	Wetlands
Number of Wetlands.................................	1601		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	56.4	Lacustrine Wetlands:	14.2
PAB:	15.2	PFO:	509.6	PUB:	547.0	Marine Wetlands:	0.0
PEM:	106.0	Pf:	0.0	PUS:	0.4	Riverine Wetlands:	1.5

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	576.1	46.1%	1411	88.1%
Scenario 2: (Red and Orange)	591.3	47.3%	1442	90.1%
Scenario 3: (Red, Orange and Brown)	595.0	47.6%	1444	90.2%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 2.7 Number: 8

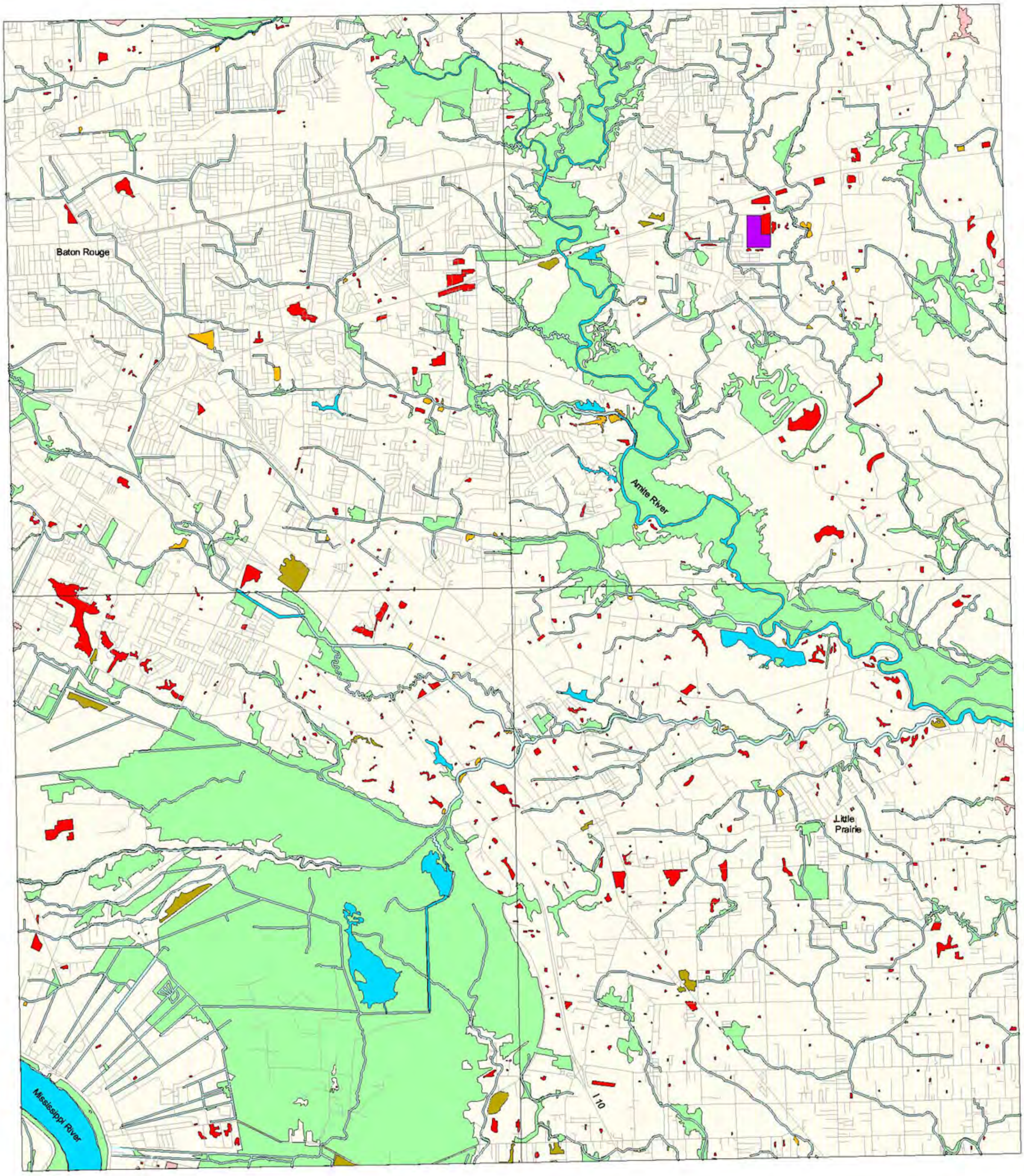
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	15.8	Lacustrine Wetlands:	0.0
PAB:	6.6	Pf:	0.0	PUB:	478.8	Marine Wetlands:	0.0
PEM:	40.7	PFO:	49.4	PUS:	0.0	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Baton Rouge East Study Area, Louisiana



Legend

- Isolated Wetlands
- Wetlands 20-40 meters from Intermittent or Perennial Streams
- Non-isolated Wetlands
- Road-fragmented Wetlands*
- Map-edge Wetlands**
- 20 meter Buffer of Perennial and Intermittent Streams
- Isolated Deepwater Habitats
- Deepwater Habitats
- Uplands
- Quad Boundary
- Roads

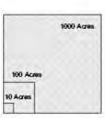
* Separated from non-isolated wetland by a road; may be connected or isolated.

** Status could not be predicted since the rest of the wetland is outside the study area.

Scale 1:50,000

2000 0 2000 4000 Meters

2 0 2 4 Miles



Data Sources

Wetlands: Existing NWI digital data

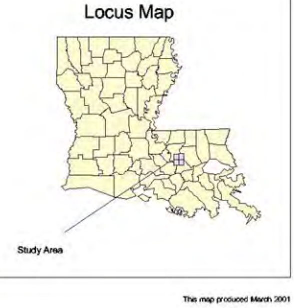
Streams: USGS Hydrology DLG

Roads: USGS DLG 1:24K Roads

Projection: UTM NAD 27, Zone 15

USGS Quads

Locus Map



This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Baton Rouge State: LA FWS Region: 4

Ecoregion: Lower Mississippi Riverine Forest

Watershed Region: Lower Mississippi Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	164583.9		
Upland Acreage..	128410.2	78.0%	Uplands
Non-Isolated Deepwater Habitats Acreage.	2070.8	1.3%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	88.1		
Wetlands Acreage.....................................	34014.8	20.7%	Wetlands
Number of Wetlands.................................	793		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	2339.0	Lacustrine Wetlands:	61.1
PAB:	123.8	PFO:	29580.8	PUB:	1217.6	Marine Wetlands:	0.0
PEM:	625.8	Pf:	0.0	PUS:	18.4	Riverine Wetlands:	48.4

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	1633.6	4.8%	502	63.3%
Scenario 2: (Red and Orange)	1809.8	5.3%	555	70.0%
Scenario 3: (Red, Orange and Brown)	2196.5	6.5%	575	72.5%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 10.5 Number: 15

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ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	209.0	Lacustrine Wetlands:	0.0
PAB:	7.5	Pf:	0.0	PUB:	708.0	Marine Wetlands:	0.0
PEM:	72.2	PFO:	807.7	PUS:	5.4	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

New Orleans Study Area, Louisiana

Study Area: New Orleans State: LA FWS Region: 4

Ecoregion: Outer Coastal Plain Mixed Forest

Watershed Region: Lower Mississippi Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	165154.3		
Upland Acreage..	17559.5	10.6%	Uplands
Non-Isolated Deepwater Habitats Acreage.	108814.2	65.9%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	84.9		
Wetlands Acreage.....................................	38695.7	23.4%	Wetlands
Number of Wetlands.................................	304		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	19341.0
Palustrine Wetlands:				PSS:	2378.7	Lacustrine Wetlands:	218.1
PAB:	316.4	PFO:	7821.2	PUB:	769.1	Marine Wetlands:	0.0
PEM:	7851.1	Pf:	0.0	PUS:	0.0	Riverine Wetlands:	0.0

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	666.4	1.7%	73	24.0%
Scenario 2: (Red and Orange)	807.1	2.1%	76	25.0%
Scenario 3: (Red, Orange and Brown)	991.3	2.6%	87	28.6%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 29.6 Number: 3

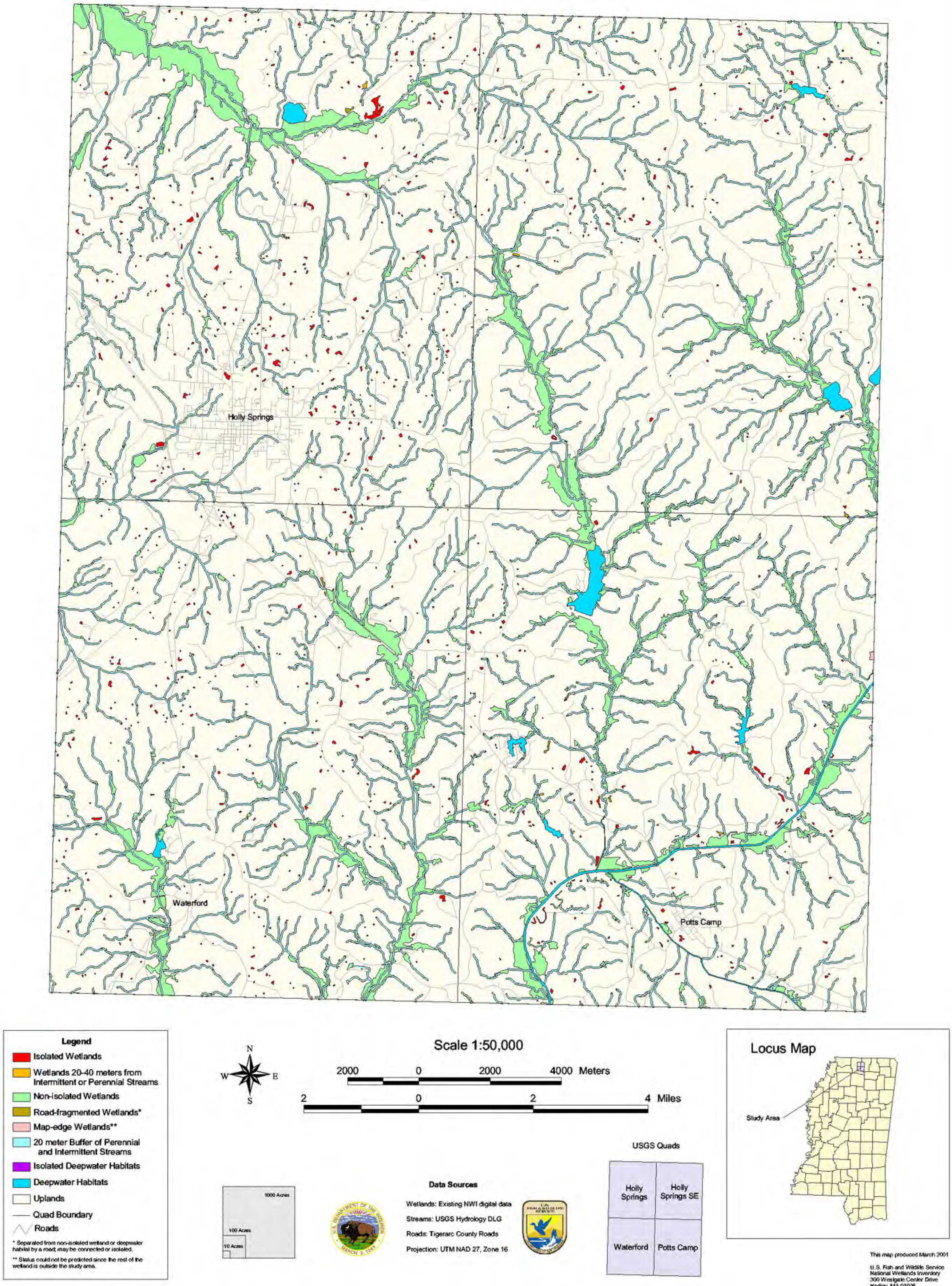
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	99.9	Lacustrine Wetlands:	180.3
PAB:	2.2	Pf:	0.0	PUB:	159.6	Marine Wetlands:	0.0
PEM:	59.6	PFO:	305.6	PUS:	0.0	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Holly Springs Study Area, Mississippi



This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Holly Springs State: MS FWS Region: 4

Ecoregion: Southeastern Mixed Forest

Watershed Region: Lower Mississippi Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	156931.8		
Upland Acreage..	145917.6	93.0%	Uplands
Non-Isolated Deepwater Habitats Acreage.	799.4	0.5%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	10214.9	6.5%	Wetlands
Number of Wetlands.................................	1575		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	1258.5	Lacustrine Wetlands:	31.6
PAB:	7.7	PFO:	7198.1	PUB:	1147.3	Marine Wetlands:	0.0
PEM:	548.0	Pf:	0.0	PUS:	18.0	Riverine Wetlands:	2.4

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	538.8	5.3%	885	56.2%
Scenario 2: (Red and Orange)	566.2	5.5%	928	58.9%
Scenario 3: (Red, Orange and Brown)	581.1	5.7%	933	59.2%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 11.1 Number: 6

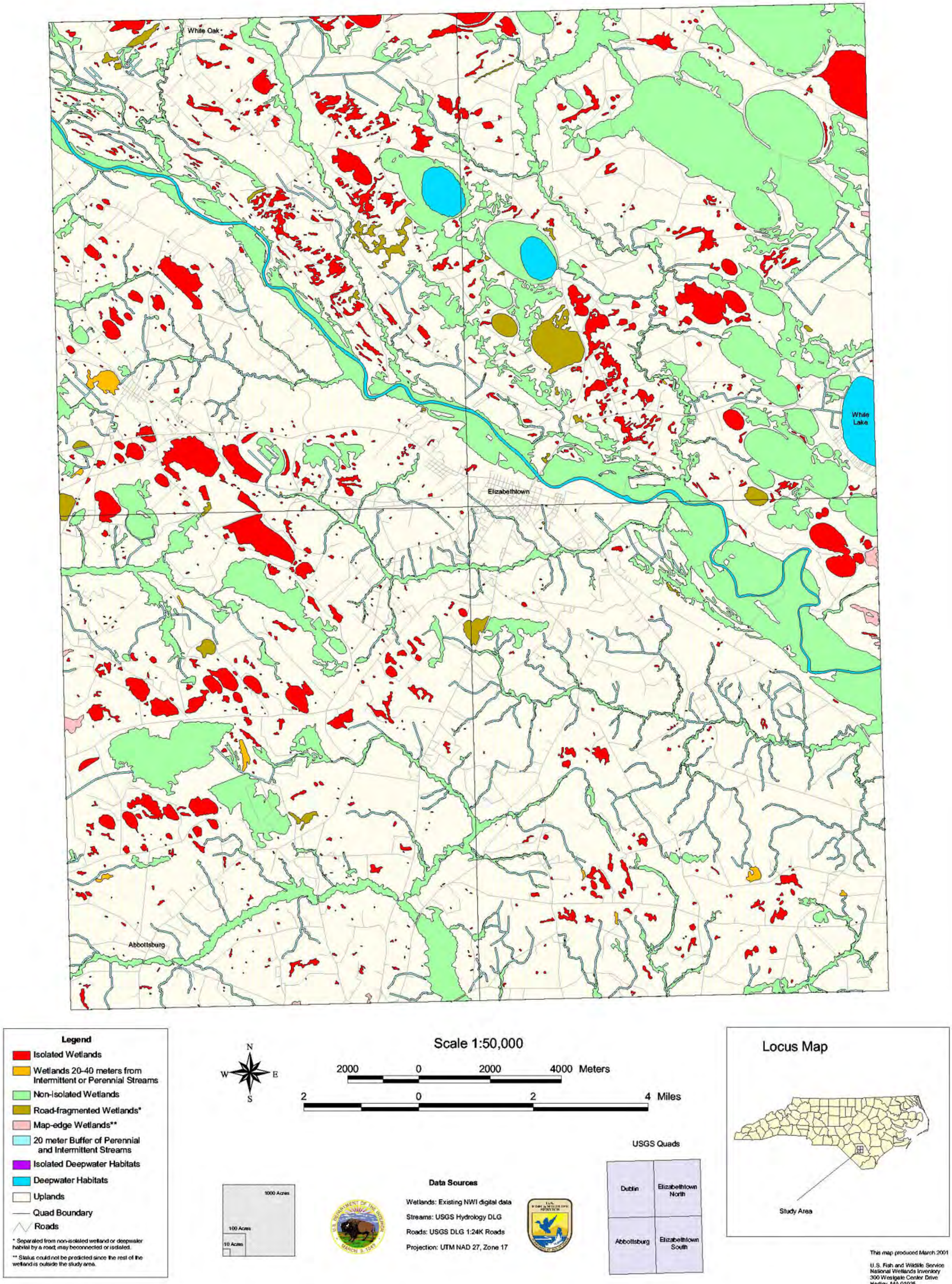
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	39.5	Lacustrine Wetlands:	0.0
PAB:	0.0	Pf:	0.0	PUB:	423.5	Marine Wetlands:	0.0
PEM:	37.0	PFO:	60.2	PUS:	6.0	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Dublin Study Area, North Carolina



Data Sources

Wetlands: Existing NWI digital data

Streams: USGS Hydrology DLG

Roads: USGS DLG 1:24K Roads

Projection: UTM NAD 27, Zone 17

This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Dublin State: NC FWS Region: 4

Ecoregion: Outer Coastal Plain Mixed Forest

Watershed Region: South Atlantic Gulf Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	157165.2		
Upland Acreage..	119475.2	76.0%	Uplands
Non-Isolated Deepwater Habitats Acreage.	1607.3	1.0%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	36082.6	23.0%	Wetlands
Number of Wetlands.................................	1292		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	3785.1	Lacustrine Wetlands:	0.0
PAB:	12.5	PFO:	31134.4	PUB:	323.1	Marine Wetlands:	0.0
PEM:	827.6	Pf:	0.0	PUS:	0.0	Riverine Wetlands:	0.0

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	7472.5	20.7%	967	74.8%
Scenario 2: (Red and Orange)	7676.7	21.3%	994	76.9%
Scenario 3: (Red, Orange and Brown)	8743.8	24.2%	1022	79.1%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description. Note that Carolina bay wetlands are common in this area and that although many have been identified as isolated, others have not been so designated since the NWI data showed that they were contiguous with other wetlands. These results may underestimate the extent of isolated wetlands if these Carolina bay wetlands are separated from other wetlands by a narrow band of upland.

** Map-edge isolated wetlands not included: Acreage: 166.0 Number: 16

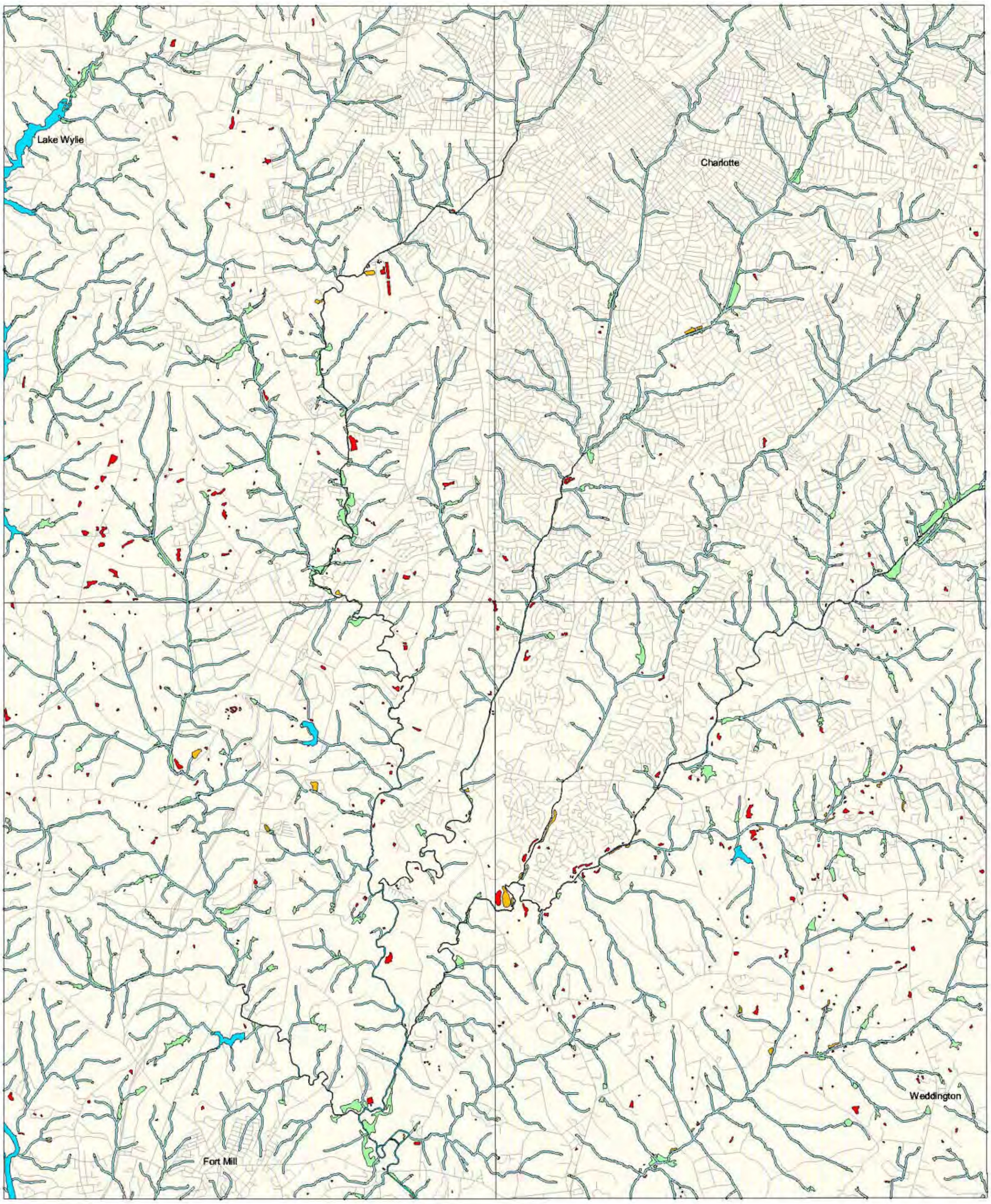
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	595.7	Lacustrine Wetlands:	0.0
PAB:	0.9	Pf:	0.0	PUB:	162.1	Marine Wetlands:	0.0
PEM:	294.9	PFO:	6623.0	PUS:	0.0	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Charlotte Study Area, North Carolina



Legend

- Isolated Wetlands
- Wetlands 20-40 meters from Intermittent or Perennial Streams
- Non-isolated Wetlands
- Road-fragmented Wetlands*
- Map-edge Wetlands**
- 20 meter Buffer of Perennial and Intermittent Streams
- Isolated Deepwater Habitats
- Deepwater Habitats
- Uplands
- Quad Boundary
- Roads

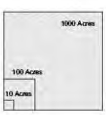
* Separated from non-isolated wetland or deepwater habitat by a road; may be connected or isolated.

** Status could not be predicted since the rest of the wetland is outside the study area.

Scale 1:50,000

2000 0 2000 4000 Meters

2 0 2 4 Miles



Data Sources

Wetlands: Existing NWI digital data

Streams: USGS Hydrology DLG

Roads: USGS DLG 1:24K Roads

Projection: UTM NAD 27, Zone 17

USGS Quads

Charlotte West	Charlotte East
Fort Mill	Weddington

Locus Map

This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Charlotte State: NC-SC FWS Region: 4

Ecoregion: Southeastern Mixed Forest

Watershed Region: South Atlantic Gulf Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	156047.5		
Upland Acreage..	153237.4	98.2%	Uplands
Non-Isolated Deepwater Habitats Acreage.	358.8	0.2%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	2451.2	1.6%	Wetlands
Number of Wetlands.................................	1137		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	111.5	Lacustrine Wetlands:	0.4
PAB:	0.5	PFO:	1241.1	PUB:	1040.6	Marine Wetlands:	0.0
PEM:	40.3	Pf:	0.0	PUS:	10.6	Riverine Wetlands:	6.2

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	420.1	17.1%	451	39.7%
Scenario 2: (Red and Orange)	513.0	20.9%	517	45.5%
Scenario 3: (Red, Orange and Brown)	520.5	21.2%	520	45.7%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

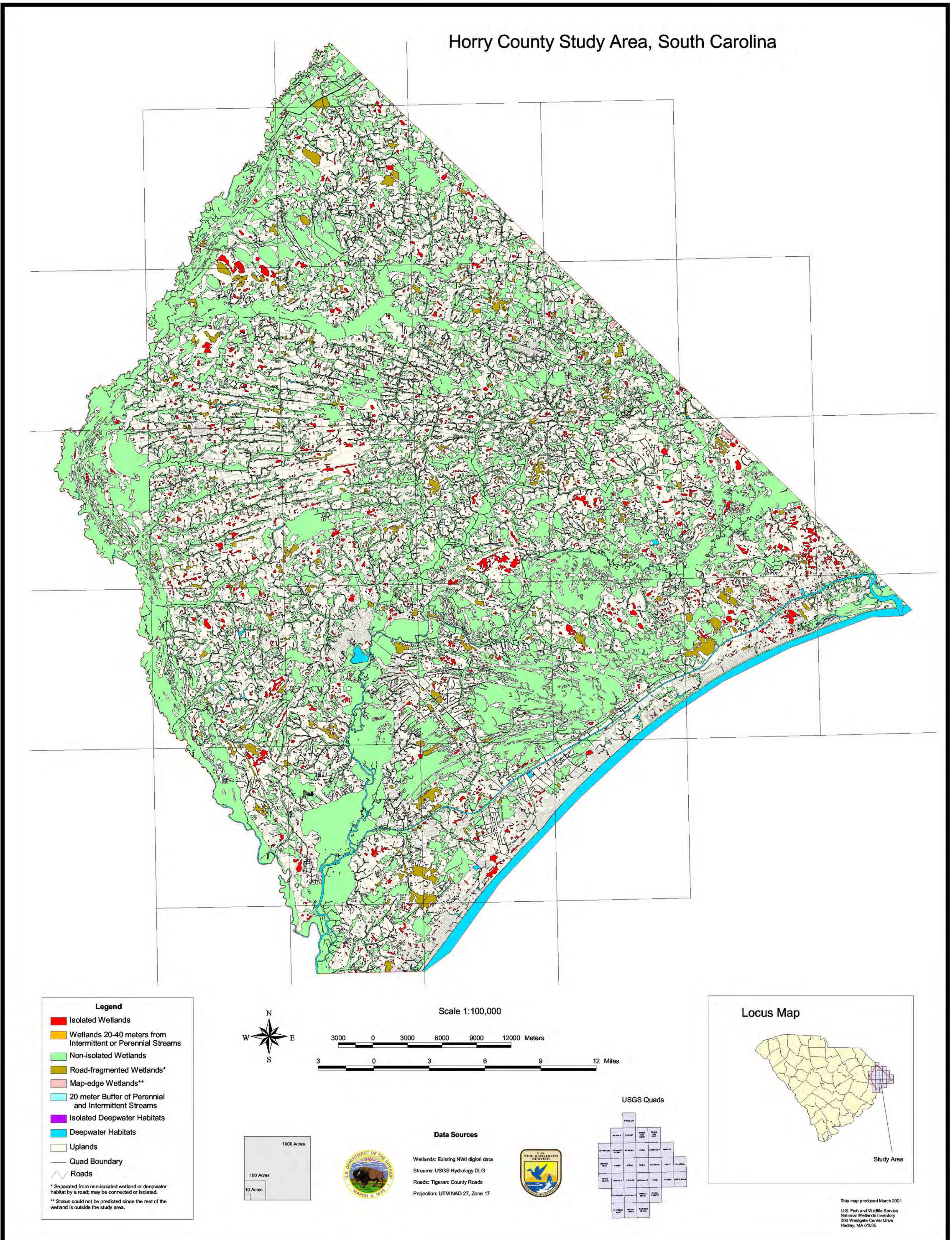
** Map-edge isolated wetlands not included: Acreage: 4.3 Number: 5

. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	23.5	Lacustrine Wetlands:	0.0
PAB:	0.5	Pf:	0.0	PUB:	267.3	Marine Wetlands:	0.0
PEM:	15.0	PFO:	201.5	PUS:	5.3	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.


Horry County Study Area, South Carolina
Legend
Isolated Wetlands
Wetlands 20-40 meters from Intermittent or Perennial Streams
Non-isolated Wetlands
Road-fragmented Wetlands*
Map-edge Wetlands**
20 meter Buffer of Perennial and Intermittent Streams
Isolated Deepwater Habitats
Deepwater Habitats
Uplands
Quad Boundary
Roads
* Separated from non-isolated wetland or deepwater habitat by a road; may be connected or isolated.
** Status could not be predicted since the rest of the wetland is outside the study area.
N
W
E
S
Scale 1:100,000
3000 0 3000 6000 9000 12000 Meters
3 0 3 6 9 12 Miles
1000 Acres
100 Acres
10 Acres
Data Sources
Wetlands: Existing NWI digital data
Streams: USGS Hydrology DLG
Roads: Tigerarc County Roads
Projection: UTM NAD 27, Zone 17
USGS Quads
Locus Map
Study Area
This map produced March 2001
U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Horry County State: SC FWS Region: 4

Ecoregion: Outer Coastal Plain Mixed Forest

Watershed Region: South Atlantic Gulf Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area.....................	742107.8		
Upland Acreage.......................................	400307.6	53.9%	Uplands
Non-Isolated Deepwater Habitats Acreage.	14898.2	2.0%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage....................................	326902.0	44.1%	Wetlands
Number of Wetlands................................	7639		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	2583.5
Palustrine Wetlands:				PSS:	44391.5	Lacustrine Wetlands:	108.9
PAB:	132.1	PFO:	269570.8	PUB:	5392.6	Marine Wetlands:	754.5
PEM:	3942.3	Pf:	0.0	PUS:	23.1	Riverine Wetlands:	2.6

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	16742.9	5.1%	4832	63.3%
Scenario 2: (Red and Orange)	16928.2	5.2%	4923	64.4%
Scenario 3: (Red, Orange and Brown)	29700.8	9.1%	5394	70.6%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description. Note that Carolina bay wetlands are common in this area and that although some have been identified as isolated, others have not been so designated since the NWI data showed that they were contiguous with other wetlands. These results may underestimate the extent of isolated wetlands if these Carolina bay wetlands are separated from other wetlands by a narrow band of upland.

** Map-edge isolated wetlands not included: Acreage: 357.6 Number: 31

. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

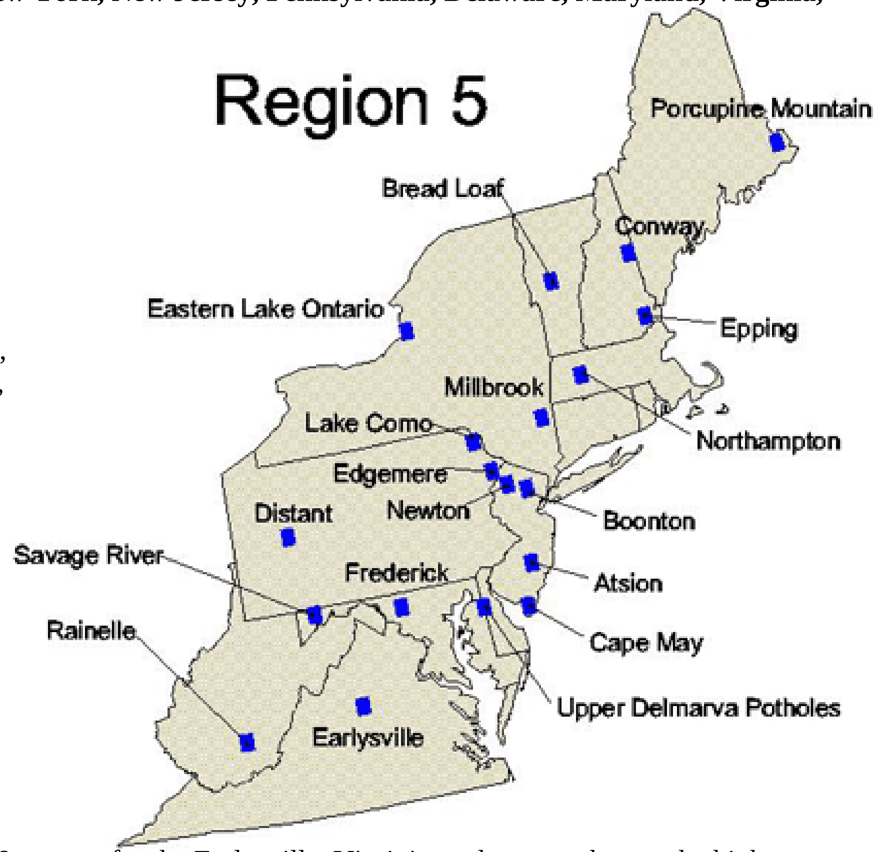
						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	2675.7	Lacustrine Wetlands:	0.0
PAB:	15.1	Pf:	0.0	PUB:	1797.1	Marine Wetlands:	0.0
PEM:	375.6	PFO:	12052.0	PUS:	6.2	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Study Results

Study findings are reported for each study area below. Data for individual study areas are arranged by U.S. Fish and Wildlife Service Region. For each Region, there is a general discussion of the study results, a map showing the location of the study sites, a summary table of the findings, detailed data summary for each area, and a special wetland classification map for each study area. The latter two products are represented as "additional data links" within the regional summary table (first column). Simply click on the word "map" or "data" and the pertinent map and data will be displayed. *Please allow a minute or so for the map to appear. Note that printed maps may appear somewhat skewed since their projections reflect the curvature of the Earth.*

Region 5 (Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, and West Virginia)



Nineteen study sites were evaluated in the Northeast: one in Delaware, one in Massachusetts, two in Maryland, one in Maine, two in New Hampshire, four in New Jersey, two in New York, three in Pennsylvania, one in Virginia, one in Vermont, and one in West Virginia. *Table 3-5* presents a summary of the data for the Region's study areas.

<u>Percent of Study Areas Covered by Wetlands</u>

Wetlands were most extensive in the southern New Jersey study areas: Atsion (41% of study area) and Cape May (31%). Several other sites had more than 10 percent of their areas covered by wetlands: Boonton, New Jersey (16%), Upper Delmarva Potholes, Maryland/Delaware (15%), Epping, New Hampshire (13%), Porcupine Mountain, Maine (13%), Newton, New Jersey (10%), and Edgemere, Pennsylvania (10%). These are either coastal plain or glaciated locations. Mountainous areas had much less wetland area (e.g., Rainelle, West Virginia and Distant, Pennsylvania).

<u>Percent of Wetland Area Identified as Isolated</u>

Most study areas had more than 15 percent of their wetland acreage designated as isolated. Top-ranked were Rainelle (35-41%) and Upper Delmarva Potholes (35-39%). Most of the former area's isolated wetlands were ponds (149 acres; 62% under Scenario 2), whereas the latter's isolated types were chiefly forested wetlands (7,562 acres; 91%). The Millbrook, New York study area had more than 25 percent of its wetland acreage mapped as isolated. About half (48%) of them were forested wetlands, while 27 percent were ponds (under Scenario 2).

<u>Percent of Wetlands (Number) Classified as Isolated</u>

All areas had high percentages of isolated wetlands by number. The lowest percentage was 34-38 percent for the Earlysville, Virginia study area, whereas the highest numbers were attributed to the Upper Delmarva Potholes (77-81%). Sites with more than 60 percent of their wetlands in the isolated category included: Cape May, Porcupine Mountain, Eastern Lake Ontario (New York), Newton, Millbrook, Epping, and Rainelle.

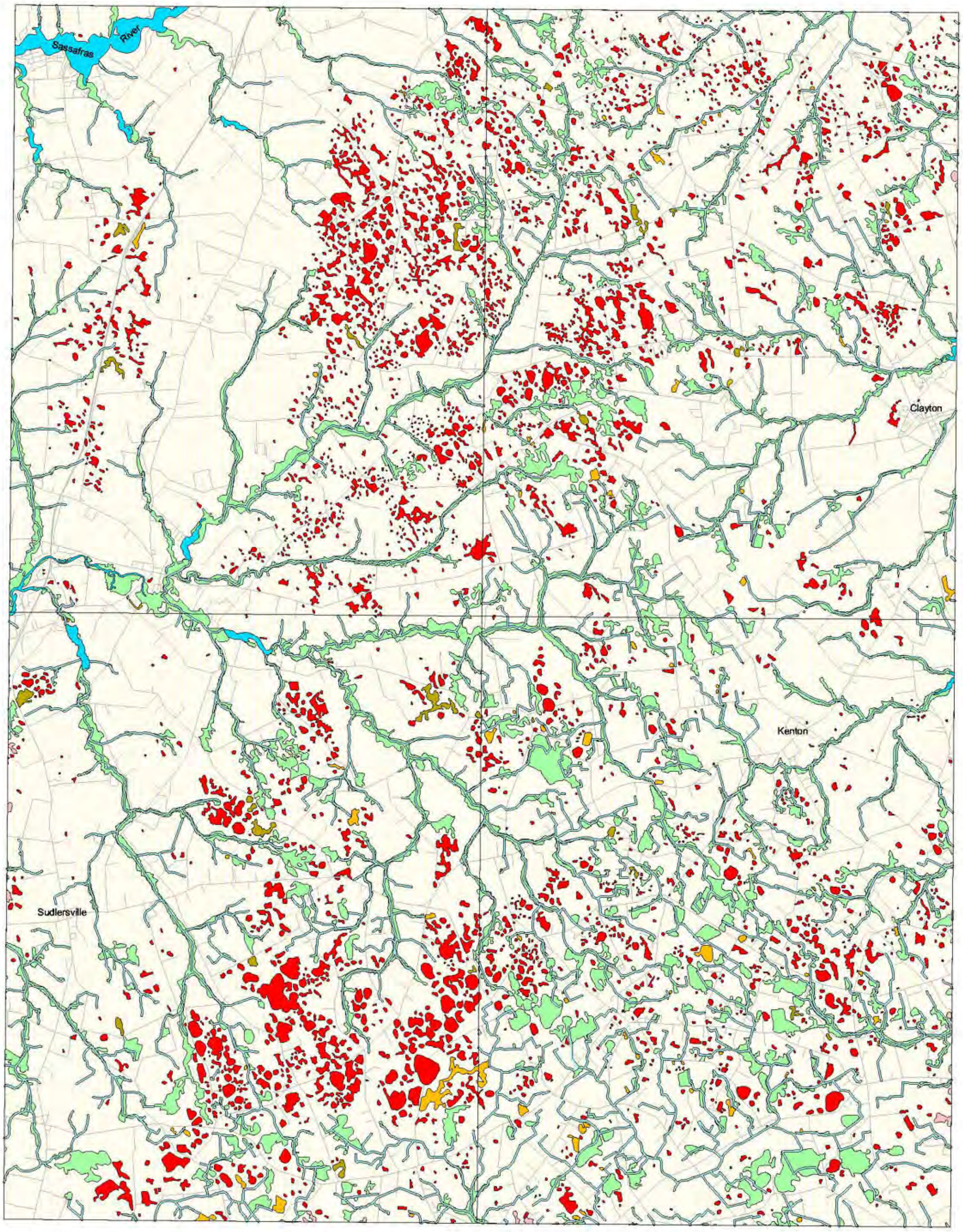
Table 3-5. Summary data for study sites in Region 5. (<u>Note</u>: This table should be printed in landscape orientation.)

								Isolated Wetlands					
Additional Data Links	Study Area	State	Acreage in Study Area	Wetland Acreage	Wetlands % of Study Area	Number of Wetlands	Deepwater Habitats % of Study Area	Scenario 1 Area Percent of Total Wetlands	Scenario 2 Area Percent of Total Wetlands	Scenario 3 Area Percent of Total Wetlands	Scenario 1 Count Percent of Total Wetlands	Scenario 2 Count Percent of Total Wetlands	Scenario 3 Count Percent of Total Wetlands

MAP DATA	Upper Delmarva Potholes	DE-MD	147900.7	22165.4	15.0%	3670	0.5%	35.4%	37.5%	38.8%	76.7%	79.9%	80.7%
MAP DATA	Northampton	MA	141298.1	7732.1	5.5%	951	1.1%	17.2%	20.0%	21.6%	44.4%	52.6%	53.8%
MAP DATA	Frederick	MD	147516.8	2384.6	1.6%	1076	0.5%	16.8%	17.7%	17.7%	43.2%	47.9%	47.9%
MAP DATA	Savage River	MD	147196.5	1382.9	0.9%	569	0.4%	19.5%	22.0%	22.0%	55.0%	60.6%	60.6%
MAP DATA	Porcupine Mountain	ME	135273.3	17407.4	12.9%	1691	9.4%	16.7%	16.7%	17.7%	65.7%	66.0%	67.4%
MAP DATA	Conway	NH	137623.7	5916.2	4.3%	813	2.6%	12.3%	12.7%	15.5%	38.1%	40.0%	40.6%
MAP DATA	Epping	NH	139892.5	18108.6	12.9%	3390	0.9%	13.9%	14.4%	16.0%	61.8%	63.7%	65.5%
MAP DATA	Atsion	NJ	146846.2	60926.1	41.5%	236	0.4%	1.0%	1.0%	1.1%	48.7%	50.0%	51.3%
MAP DATA	Boonton	NJ	144464.2	22946.1	15.9%	907	2.5%	5.1%	5.6%	7.3%	41.9%	45.4%	49.0%
MAP DATA	Cape May	NJ	148144.8	45356.2	30.6%	1257	33.9%	3.8%	4.1%	5.3%	65.2%	66.6%	72.3%
MAP DATA	Newton	NJ	144187.0	15007.0	10.4%	1495	3.8%	17.9%	18.8%	19.1%	63.9%	66.2%	66.7%
MAP DATA	Eastern Lake Ontario	NY	138407.5	10626.0	7.7%	1294	18.5%	20.1%	20.6%	22.1%	64.5%	67.1%	67.6%
MAP DATA	Millbrook	NY	142321.9	7464.3	5.2%	3445	0.6%	24.7%	27.5%	28.2%	62.1%	66.4%	66.7%
MAP DATA	Distant	PA	144521.0	309.9	0.2%	163	1.6%	17.3%	18.3%	18.3%	39.9%	44.2%	44.2%
MAP DATA	Edgemere	PA	143645.6	13656.5	9.5%	1147	2.4%	14.7%	15.8%	16.1%	55.9%	58.5%	58.8%
MAP DATA	Lake Como	PA	142559.1	4909.2	3.4%	1321	1.7%	15.5%	17.8%	18.1%	41.9%	45.5%	45.6%
MAP DATA	Earlysville	VA	150367.9	1283.7	0.9%	733	0.5%	14.4%	16.5%	16.5%	34.0%	37.9%	37.9%
MAP DATA	Bread Loaf	VT	137875.0	698.2	0.5%	245	0.0%	13.8%	17.4%	17.4%	37.1%	40.8%	40.8%
MAP DATA	Rainelle	WV	150694.1	602.8	0.4%	763	0.5%	34.8%	40.0%	41.0%	60.3%	65.1%	65.4%

[Back to Table of Contents] [HOME] [Go to Results of Region 6] [Skip to Section 4]

Upper Delmarva Pothole Study Area, Delaware and Maryland



Legend

- Isolated Wetlands
- Wetlands 20-40 meters from Intermittent or Perennial Streams
- Non-isolated Wetlands
- Road-fragmented Wetlands*
- Map-edge Wetlands**
- 20 meter Buffer of Perennial and Intermittent Streams
- Isolated Deepwater Habitats
- Deepwater Habitats
- Uplands
- Quad Boundary
- Roads

* Separated from non-isolated wetland or deepwater habitat by a road; may be connected or isolated.

** Status could not be predicted since the rest of the wetland is outside the study area.

N
W E
S

Scale 1:50,000

2000 0 2000 4000 Meters

2 0 2 4 Miles

Data Sources

Wetlands: Existing NWI digital data

Streams: USGS Hydrology DLG

Roads: USGS DLG 1:24K Roads

Projection: UTM NAD 27, Zone 18

USGS Quads

Millington	Clayton
Sudlersville	Kenton

Locus Map

This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Upper Delmarva Potholes State: DE-MD FWS Region: 5

Ecoregion: Outer Coastal Plain Mixed Forest

Watershed Region: Mid Atlantic Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	147900.7		
Upland Acreage..	124991.1	84.5%	Uplands
Non-Isolated Deepwater Habitats Acreage.	744.2	0.5%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	22165.4	15.0%	Wetlands
Number of Wetlands.................................	3670		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	134.1
Palustrine Wetlands:				PSS:	605.7	Lacustrine Wetlands:	8.2
PAB:	4.8	PFO:	20301.6	PUB:	469.9	Marine Wetlands:	0.0
PEM:	630.9	Pf:	0.0	PUS:	0.8	Riverine Wetlands:	9.6

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	7855.8	35.4%	2816	76.7%
Scenario 2: (Red and Orange)	8302.9	37.5%	2931	79.9%
Scenario 3: (Red, Orange and Brown)	8600.9	38.8%	2962	80.7%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 112.8 Number: 39

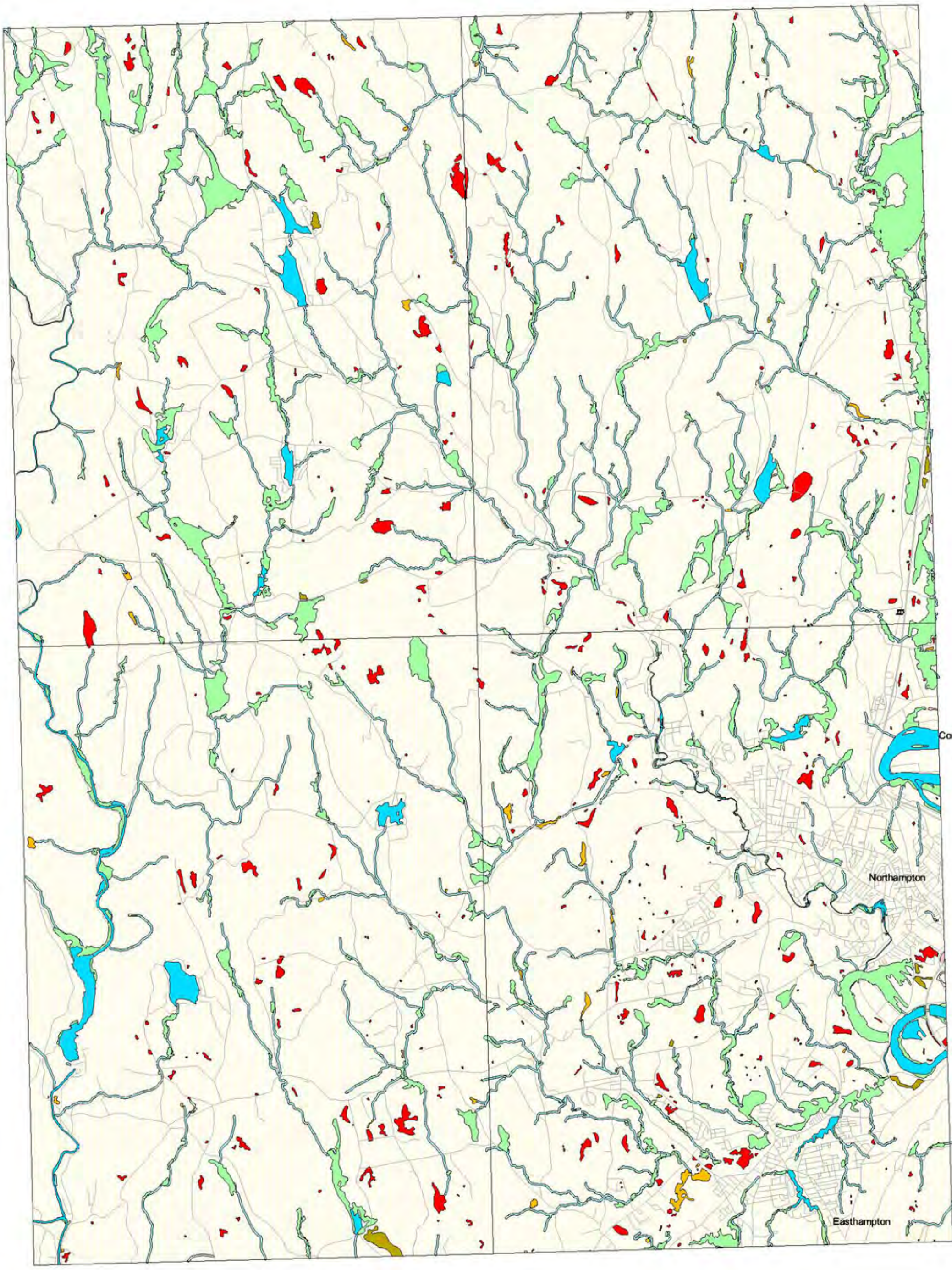
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	282.8	Lacustrine Wetlands:	0.0
PAB:	4.8	Pf:	0.0	PUB:	199.9	Marine Wetlands:	0.0
PEM:	253.4	PFO:	7562.0	PUS:	0.0	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Northampton Study Area, Massachusetts



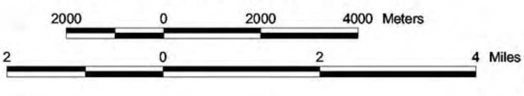
Legend

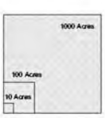
- Isolated Wetlands
- Wetlands 20-40 meters from Intermittent or Perennial Streams
- Non-isolated Wetlands
- Road-fragmented Wetlands*
- Map-edge Wetlands**
- 20 meter Buffer of Perennial and Intermittent Streams
- Isolated Deepwater Habitats
- Deepwater Habitats
- Uplands
- Quad Boundary
- Roads

* Separated from non-isolated wetland or deepwater habitat by a road; may be connected or isolated.

** Status could not be predicted since the rest of the wetland is outside the study area.

Scale 1:50,000





Data Sources

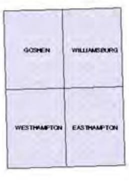
Wetlands: Existing NWI digital data

Streams: USGS Hydrology DLG

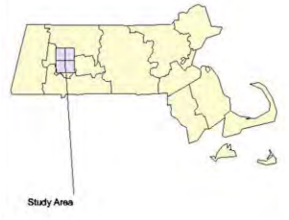
Roads: USGS DLG 1:24K Roads

Projection: UTM NAD 27, Zone 15

USGS Quads



Locus Map



This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Northampton State: MA FWS Region: 5

Ecoregion: Adirondack-New England Mixed Forest-Conifreous Forest-Alpine Meadow

Watershed Region: New England Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	141298.1		
Upland Acreage..	131984.5	93.4%	Uplands
Non-Isolated Deepwater Habitats Acreage.	1581.4	1.1%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	7732.1	5.5%	Wetlands
Number of Wetlands.................................	951		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	1441.1	Lacustrine Wetlands:	189.2
PAB:	14.5	PFO:	4714.2	PUB:	297.0	Marine Wetlands:	0.0
PEM:	1019.8	Pf:	0.0	PUS:	16.7	Riverine Wetlands:	39.6

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	1329.3	17.2%	422	44.4%
Scenario 2: (Red and Orange)	1549.3	20.0%	500	52.6%
Scenario 3: (Red, Orange and Brown)	1673.3	21.6%	512	53.8%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 20.0 Number: 10

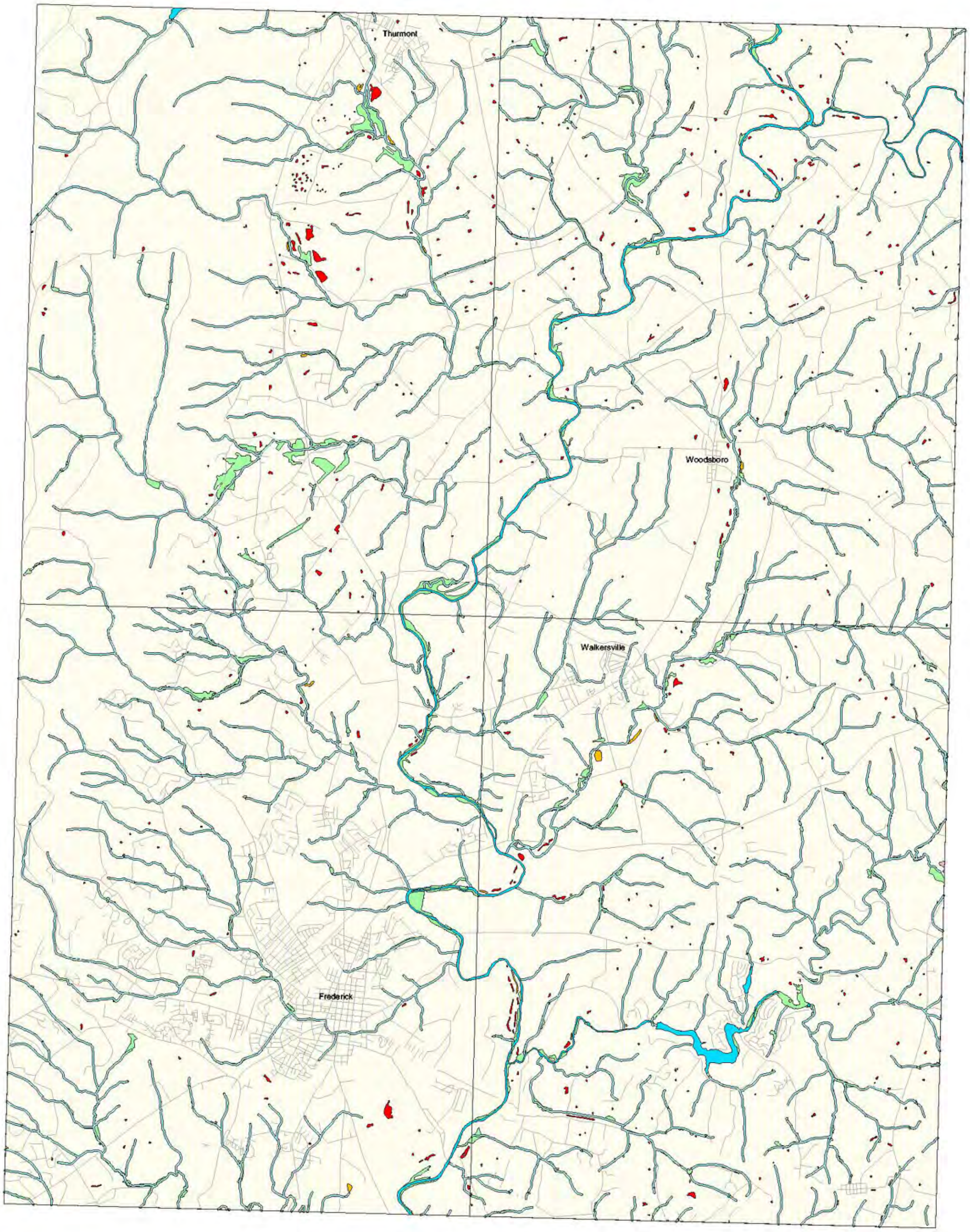
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	269.3	Lacustrine Wetlands:	0.0
PAB:	0.0	Pf:	0.0	PUB:	151.7	Marine Wetlands:	0.0
PEM:	164.6	PFO:	957.8	PUS:	5.0	Riverine Wetlands:	1.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Frederick Study Area, Maryland



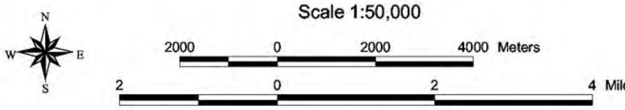
Legend

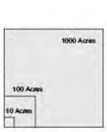
- Isolated Wetlands
- Wetlands 20-40 meters from Intermittent or Perennial Streams
- Non-isolated Wetlands
- Road-fragmented Wetlands*
- Map-edge Wetlands**
- 20 meter Buffer of Perennial and Intermittent Streams
- Isolated Deepwater Habitats
- Deepwater Habitats
- Uplands
- Quad Boundary
- Roads

* Separated from non-isolated wetland or deepwater habitat by a road; may be connected or isolated.

** Status could not be predicted since the rest of the wetland is outside the study area.

Scale 1:50,000





Data Sources

Wetlands: Existing NWI digital data

Streams: USGS Hydrology DLG

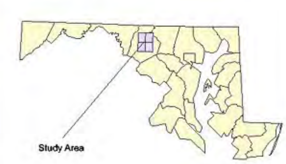
Roads: USGS DLG 1:24K Roads

Projection: UTM NAD 27, Zone 18

USGS Quads

Catoctin Furnace	Woodsboro
Frederick	Walkersville

Locus Map



This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Frederick State: MD FWS Region: 5

Ecoregion: Central Appalachian Broadleaf Forest-Coniferous Forest-Meadow

Watershed Region: Mid Atlantic Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	147516.8		
Upland Acreage..	144336.1	97.8%	Uplands
Non-Isolated Deepwater Habitats Acreage.	796.1	0.5%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	2384.6	1.6%	Wetlands
Number of Wetlands.................................	1076		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	95.0	Lacustrine Wetlands:	46.0
PAB:	0.0	PFO:	1210.0	PUB:	484.3	Marine Wetlands:	0.0
PEM:	544.1	Pf:	0.0	PUS:	1.8	Riverine Wetlands:	3.4

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	399.9	16.8%	465	43.2%
Scenario 2: (Red and Orange)	422.2	17.7%	515	47.9%
Scenario 3: (Red, Orange and Brown)	422.2	17.7%	515	47.9%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 5.0 Number: 7

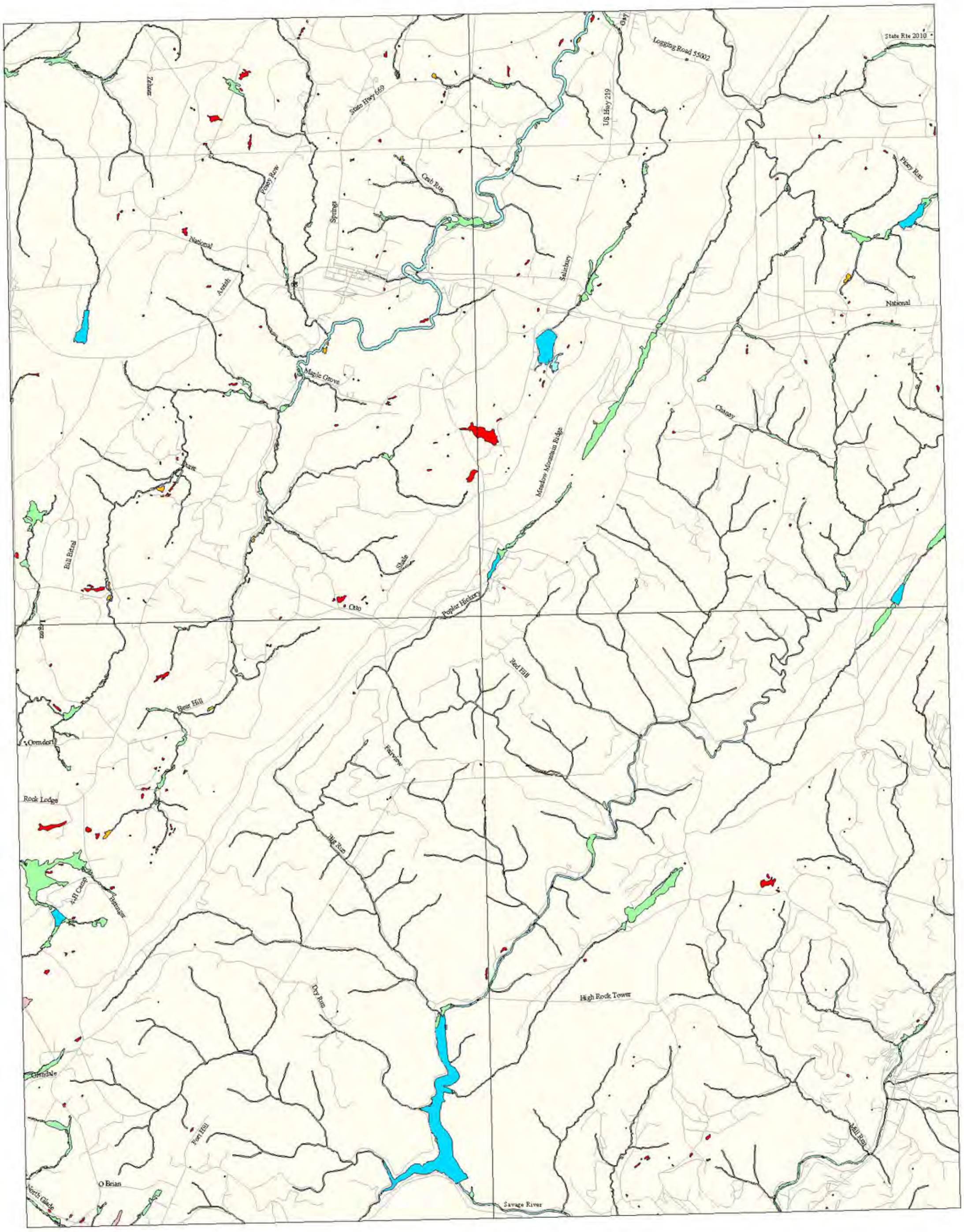
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	17.7	Lacustrine Wetlands:	0.0
PAB:	0.0	Pf:	0.0	PUB:	210.1	Marine Wetlands:	0.0
PEM:	124.8	PFO:	69.2	PUS:	0.0	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Savage River Study Area, Maryland



Legend

- Isolated Wetlands
- Wetlands 20-40 meters from Intermittent or Perennial Streams
- Non-isolated Wetlands
- Map-edge Wetlands**
- 20 meter Buffer of Perennial and Intermittent Streams
- Deepwater Habitats
- Uplands
- Quad Boundary
- Roads

** Status could not be predicted since the rest of the wetland is outside the study area.

Scale 1:50,000

2000 0 2000 4000 Meters

2 0 2 4 Miles

Data Sources

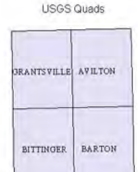
Wetlands: Existing NWI digital data

Streams: USGS Hydrology DLG

Roads: USGS DLG 1:24K Roads

Projection: UTM NAD 27, Zone 15

USGS Quads



Locus Map

This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Savage River State: MD FWS Region: 5

Ecoregion: Central Appalachian Broadleaf Forest-Coniferous Forest-Meadow

Watershed Region: Mid Atlantic Region / Ohio River Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	147196.5		
Upland Acreage..	145278.5	98.7%	Uplands
Non-Isolated Deepwater Habitats Acreage.	535.1	0.4%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	1382.9	0.9%	Wetlands
Number of Wetlands.................................	569		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	565.6	Lacustrine Wetlands:	8.4
PAB:	0.0	PFO:	416.0	PUB:	155.0	Marine Wetlands:	0.0
PEM:	238.0	Pf:	0.0	PUS:	0.0	Riverine Wetlands:	0.0

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	269.9	19.5%	313	55.0%
Scenario 2: (Red and Orange)	304.9	22.0%	345	60.6%
Scenario 3: (Red, Orange and Brown)	304.9	22.0%	345	60.6%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 17.3 Number: 8

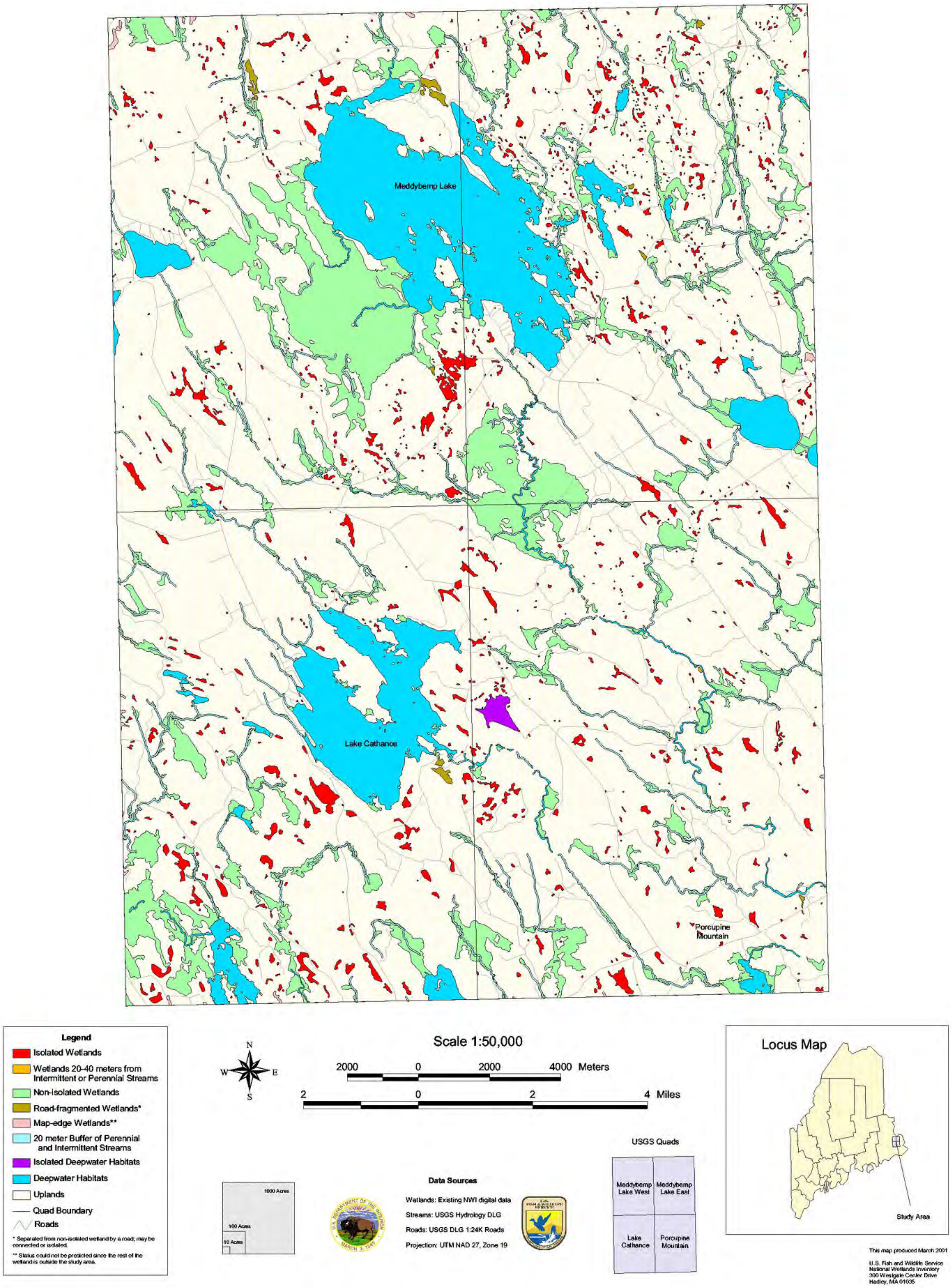
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	71.6	Lacustrine Wetlands:	0.0
PAB:	0.0	Pf:	0.0	PUB:	92.2	Marine Wetlands:	0.0
PEM:	48.9	PFO:	92.2	PUS:	0.0	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Porcupine Mountain Study Area, Maine



Study Area: Porcupine Mountain State: ME FWS Region: 5

Ecoregion: Laurentian Mixed Forest

Watershed Region: New England Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	135273.3		
Upland Acreage..	105177.5	77.8%	Uplands
Non-Isolated Deepwater Habitats Acreage.	12550.6	9.4%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	137.8		
Wetlands Acreage.....................................	17407.4	12.9%	Wetlands
Number of Wetlands.................................	1691		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	7253.1	Lacustrine Wetlands:	0.0
PAB:	0.0	PFO:	7887.4	PUB:	340.2	Marine Wetlands:	0.0
PEM:	1926.7	Pf:	0.0	PUS:	0.0	Riverine Wetlands:	0.0

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	2905.7	16.7%	1111	65.7%
Scenario 2: (Red and Orange)	2910.2	16.7%	1116	66.0%
Scenario 3: (Red, Orange and Brown)	3082.7	17.7%	1140	67.4%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 93.8 Number: 30

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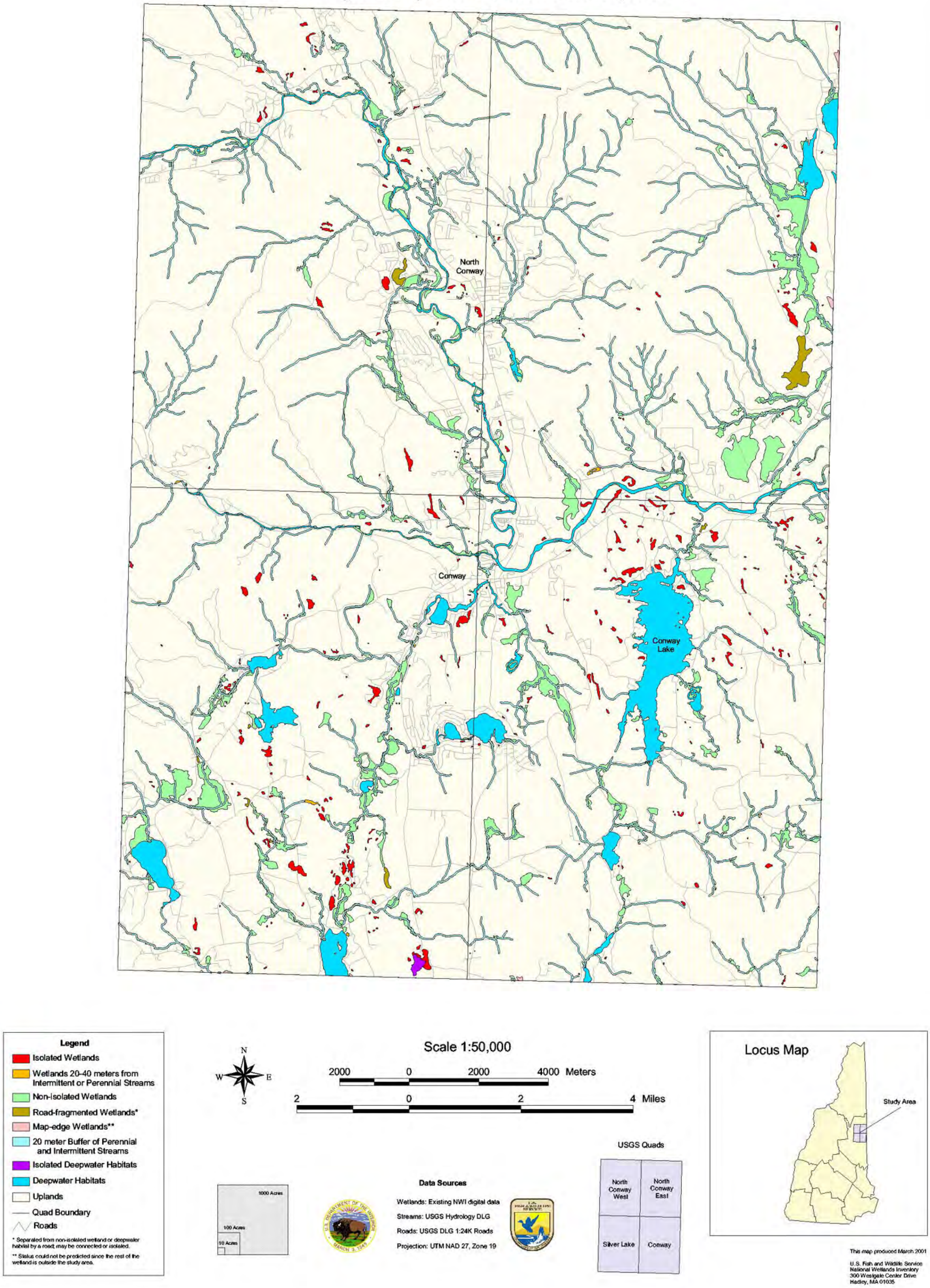
ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	707.6	Lacustrine Wetlands:	0.0
PAB:	0.0	Pf:	0.0	PUB:	94.3	Marine Wetlands:	0.0
PEM:	132.8	PFO:	1975.4	PUS:	0.0	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Conway Study Area, New Hampshire



Study Area: **Conway** State: NH FWS Region: 5

Ecoregion: Adirondack-New England Mixed Forest-Conifreous Forest-Alpine Meadow

Watershed Region: New England Region

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STUDY AREA OVERVIEW:

			Percent of Study Area
Total Acreage in Study Area......................	137623.7		
Upland Acreage..	128169.0	93.1%	Uplands
Non-Isolated Deepwater Habitats Acreage.	3505.1	2.6%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	33.5		
Wetlands Acreage......................................	5916.2	4.3%	Wetlands
Number of Wetlands.................................	813		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	1150.8	Lacustrine Wetlands:	0.0
PAB:	0.4	PFO:	3745.0	PUB:	453.4	Marine Wetlands:	0.0
PEM:	357.4	Pf:	0.0	PUS:	4.2	Riverine Wetlands:	205.1

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ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	725.8	12.3%	310	38.1%
Scenario 2: (Red and Orange)	750.6	12.7%	325	40.0%
Scenario 3: (Red, Orange and Brown)	919.9	15.5%	330	40.6%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 33.7 Number: 12

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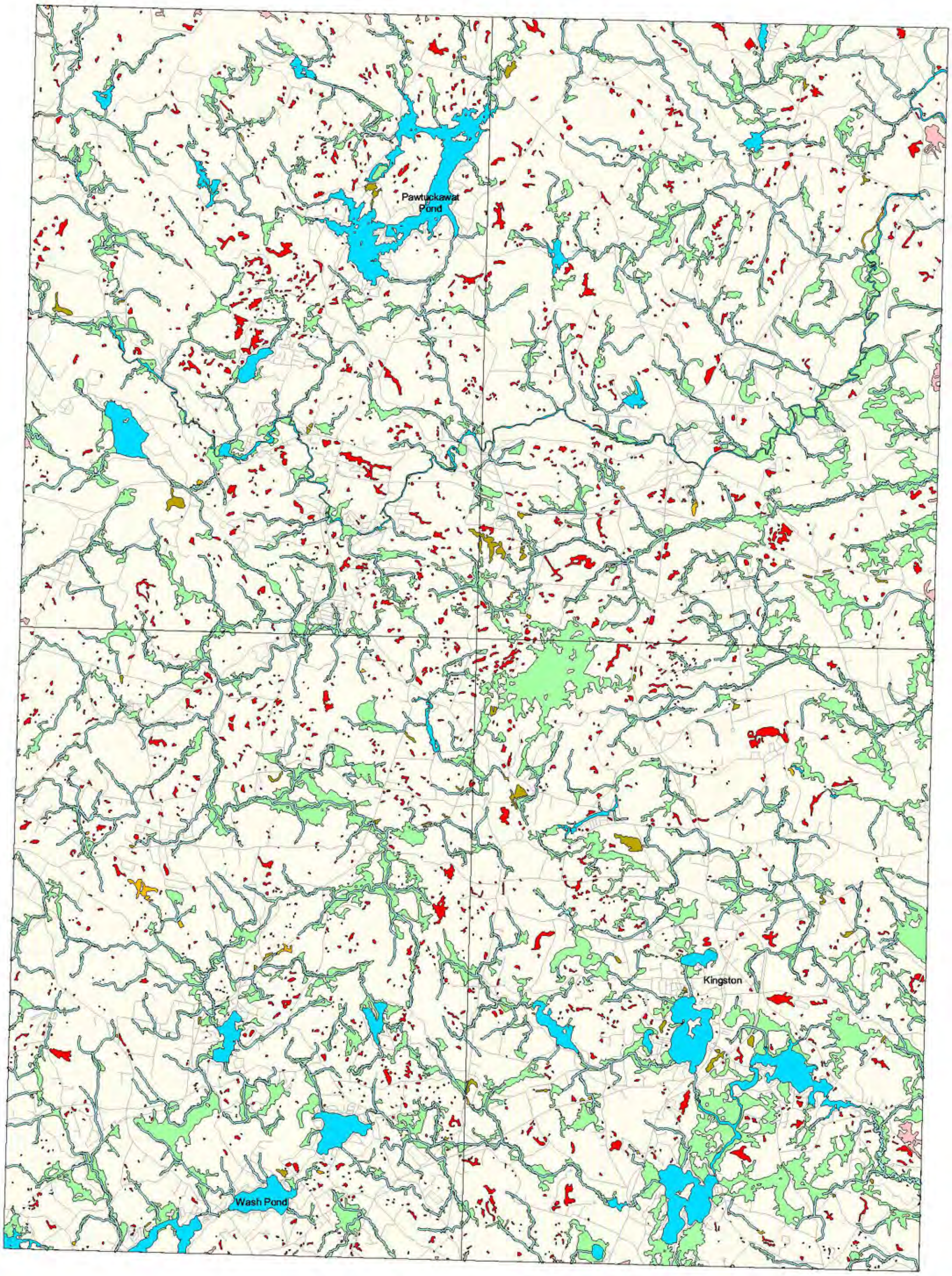
ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	90.7	Lacustrine Wetlands:	0.0
PAB:	0.2	Pf:	0.0	PUB:	99.2	Marine Wetlands:	0.0
PEM:	47.6	PFO:	512.0	PUS:	0.0	Riverine Wetlands:	1.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Epping Study Area, New Hampshire



Legend

- Isolated Wetlands
- Wetlands 20-40 meters from Intermittent or Perennial Streams
- Non-Isolated Wetlands
- Road-fragmented Wetlands*
- Map-edge Wetlands**
- 20 meter Buffer of Perennial and Intermittent Streams
- Isolated Deepwater Habitats
- Deepwater Habitats
- Uplands
- Quad Boundary
- Roads

* Separated from non-isolated wetland or deepwater habitat by a road; may be connected or isolated.

** Status could not be predicted since the rest of the wetland is outside the study area.

N
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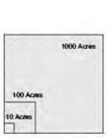
Scale 1:50,000

2000 0 2000 4000 Meters

2 0 2 4 Miles



Data Sources

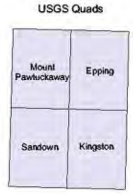
Wetlands: Existing NWI digital data

Streams: USGS Hydrology DLG

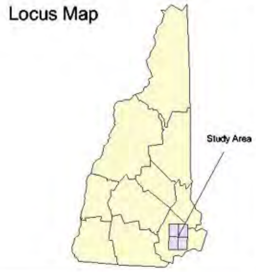
Roads: USGS DLG 1:24K Roads

Projection: UTM NAD 27, Zone 19

USGS Quads



Locus Map



This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Epping State: NH FWS Region: 5

Ecoregion: Eastern Broadleaf Forest (Oceanic)

Watershed Region: New England

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STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	139892.5		
Upland Acreage..	120481.3	86.1%	Uplands
Non-Isolated Deepwater Habitats Acreage.	1302.5	0.9%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	18108.6	12.9%	Wetlands
Number of Wetlands.................................	3390		

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ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	3515.1	Lacustrine Wetlands:	0.0
PAB:	11.5	PFO:	11060.4	PUB:	1196.3	Marine Wetlands:	0.0
PEM:	2323.2	Pf:	0.0	PUS:	0.6	Riverine Wetlands:	1.5

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ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	2513.9	13.9%	2096	61.8%
Scenario 2: (Red and Orange)	2609.0	14.4%	2158	63.7%
Scenario 3: (Red, Orange and Brown)	2896.5	16.0%	2219	65.5%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 178.9 Number: 42

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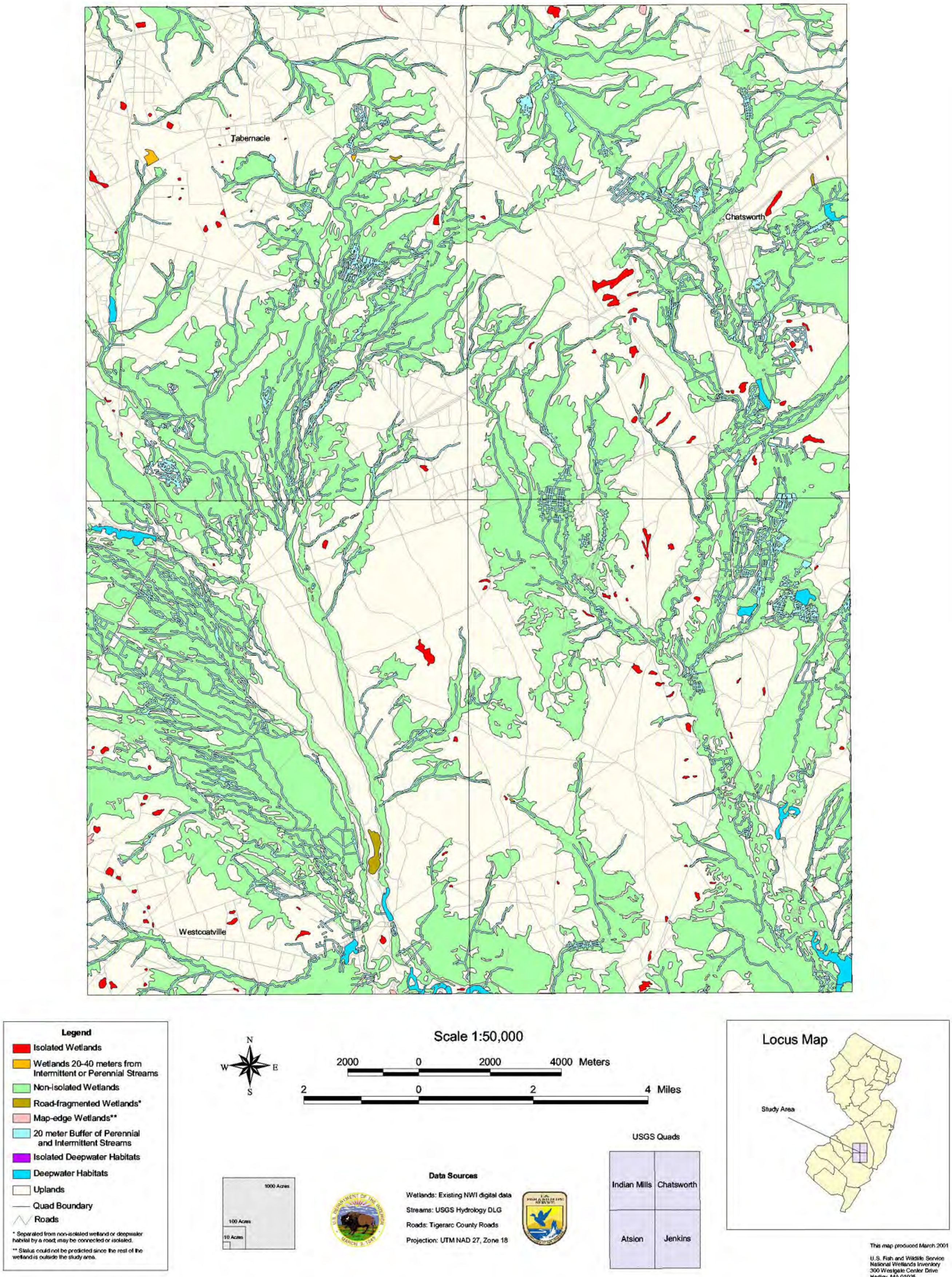
ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	314.2	Lacustrine Wetlands:	0.0
PAB:	1.8	Pf:	0.0	PUB:	177.6	Marine Wetlands:	0.0
PEM:	141.8	PFO:	1973.2	PUS:	0.6	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Atsion Study Area, New Jersey



Study Area: Atsion State: NJ FWS Region: 5

Ecoregion: Eastern Broadleaf Forest (Oceanic)

Watershed Region: Mid Atlantic Region

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STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	146846.2		
Upland Acreage..	85365.6	58.1%	Uplands
Non-Isolated Deepwater Habitats Acreage.	554.5	0.4%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	60926.1	41.5%	Wetlands
Number of Wetlands.................................	236		

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ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	12440.8	Lacustrine Wetlands:	492.8
PAB:	0.0	PFO:	43008.4	PUB:	338.7	Marine Wetlands:	0.0
PEM:	2082.8	Pf:	2562.6	PUS:	0.0	Riverine Wetlands:	0.0

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	580.9	1.0%	115	48.7%
Scenario 2: (Red and Orange)	611.2	1.0%	118	50.0%
Scenario 3: (Red, Orange and Brown)	689.6	1.1%	121	51.3%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 44.9 Number: 10

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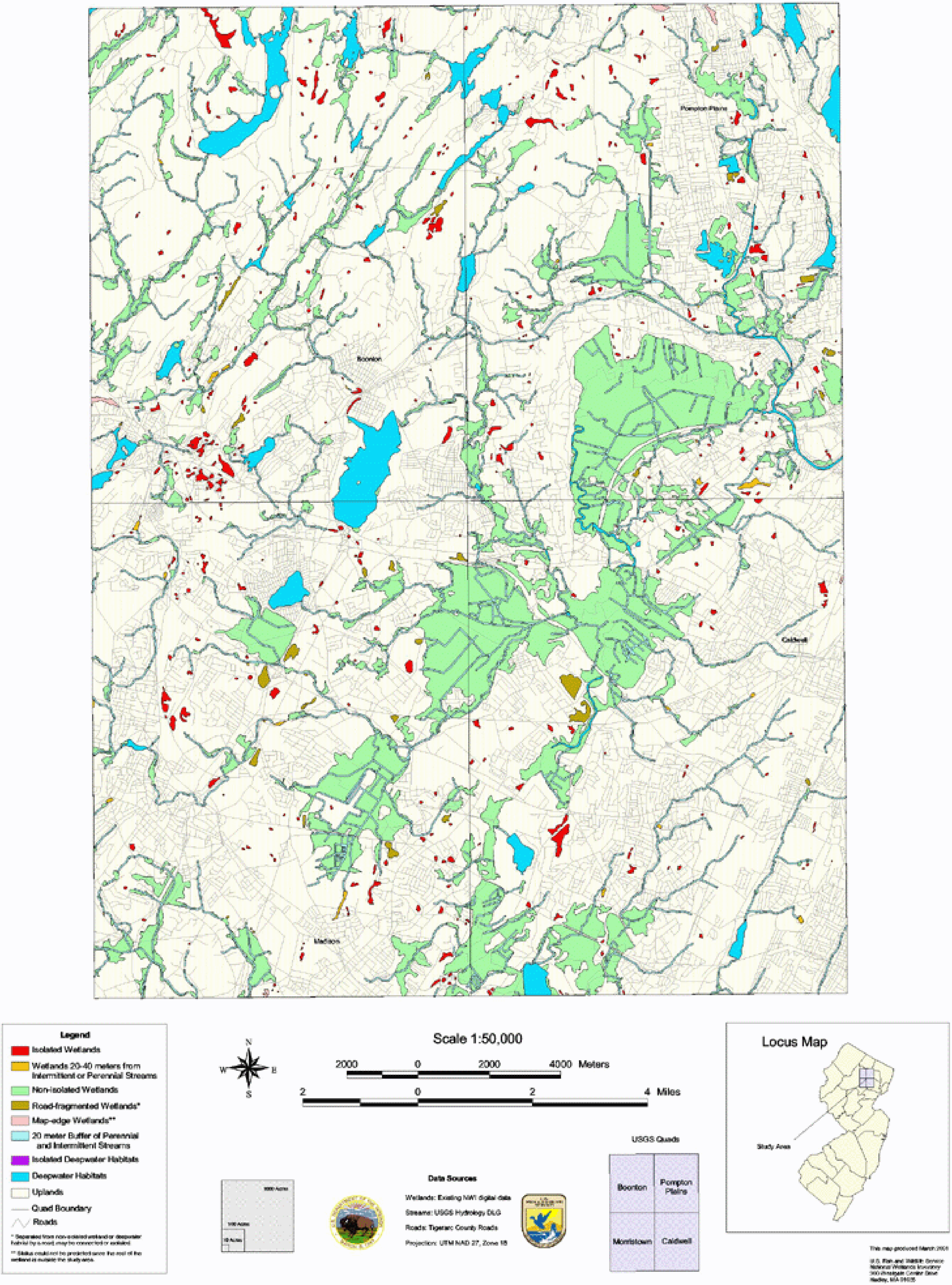
ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	98.4	Lacustrine Wetlands:	0.0
PAB:	0.0	Pf:	0.0	PUB:	23.6	Marine Wetlands:	0.0
PEM:	8.7	PFO:	480.4	PUS:	0.0	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Boonton Study Area, New Jersey



Study Area: **Boonton** State: NJ FWS Region: 5

Ecoregion: Eastern Broadleaf Forest (Oceanic)

Watershed Region: Mid Atlantic Region

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STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	144464.2		
Upland Acreage..	117838.4	81.6%	Uplands
Non-Isolated Deepwater Habitats Acreage.	3679.6	2.5%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	22946.1	15.9%	Wetlands
Number of Wetlands.................................	907		

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ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	3613.5	Lacustrine Wetlands:	10.7
PAB:	0.0	PFO:	16621.1	PUB:	877.0	Marine Wetlands:	0.0
PEM:	1823.9	Pf:	0.0	PUS:	0.0	Riverine Wetlands:	0.0

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	1179.6	5.1%	380	41.9%
Scenario 2: (Red and Orange)	1291.7	5.6%	412	45.4%
Scenario 3: (Red, Orange and Brown)	1670.7	7.3%	444	49.0%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 70.5 Number: 11

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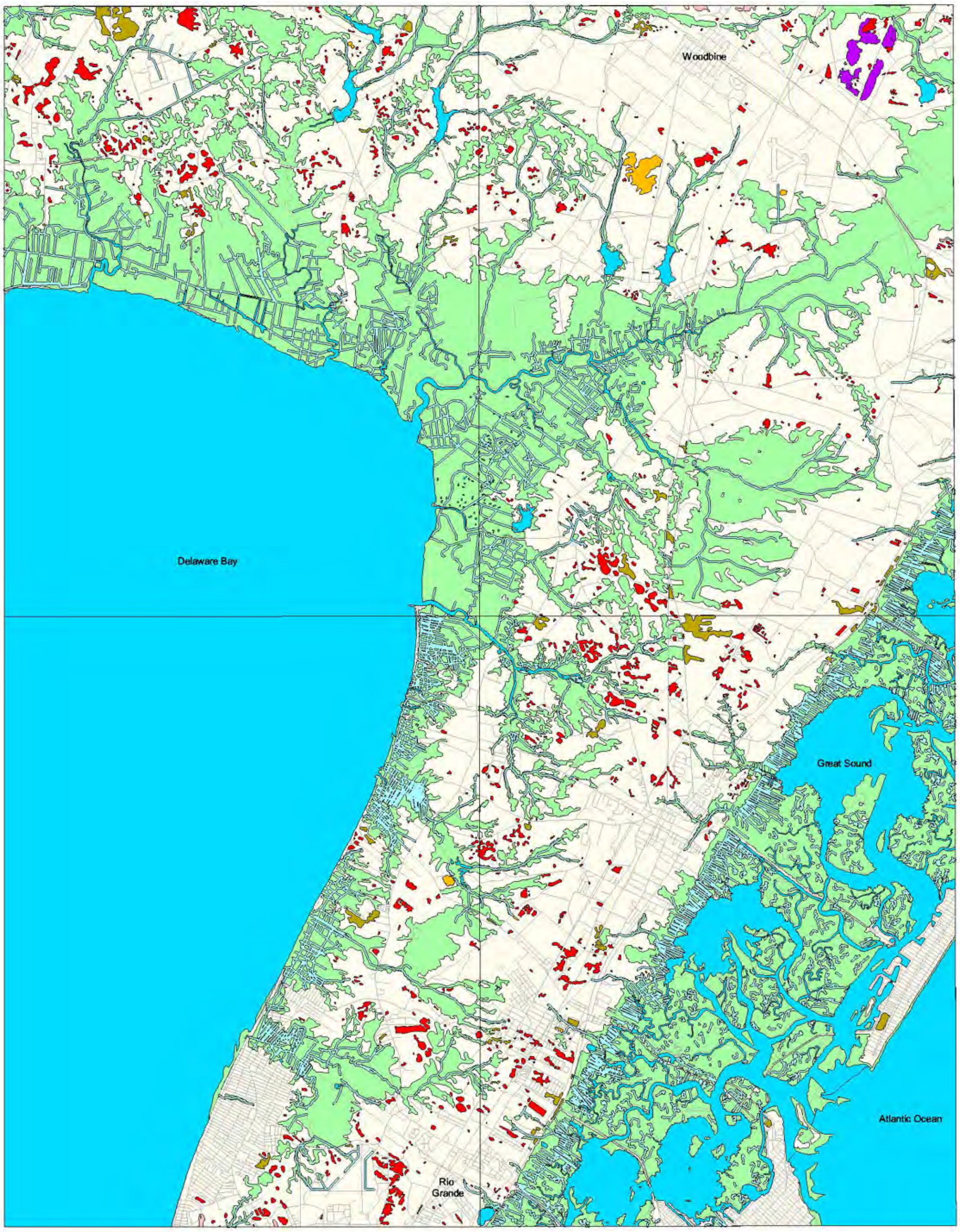
ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	76.5	Lacustrine Wetlands:	0.0
PAB:	0.0	Pf:	0.0	PUB:	212.5	Marine Wetlands:	0.0
PEM:	22.2	PFO:	980.6	PUS:	0.0	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Cape May Study Area, New Jersey



Legend

- Isolated Wetlands
- Wetlands 20-40 meters from Intermittent or Perennial Streams
- Non-isolated Wetlands
- Road-fragmented Wetlands*
- Map-edge Wetlands**
- 20 meter Buffer of Perennial and Intermittent Streams
- Isolated Deepwater Habitats
- Deepwater Habitats
- Uplands
- Quad Boundary
- Roads

* Separated from non-isolated wetland by a road; may be connected or isolated.

** Status could not be predicted since the rest of the wetland is outside the study area.

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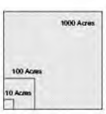
Scale 1:50,000

2000 0 2000 4000 Meters

2 0 2 4 Miles



Data Sources

Wetlands: Existing NWI digital data

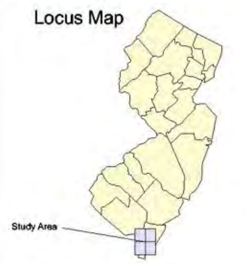
Streams: USGS Hydrology DLG

Roads: Tigerarc County Roads

Projection: UTM NAD 27, Zone 18

USGS Quads

Locus Map



This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Cape May State: NJ FWS Region: 5

Ecoregion: Eastern Broadleaf Forest (Oceanic)

Watershed Region: Mid Atlantic Region

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STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	148144.8		
Upland Acreage..	52548.2	35.5%	Uplands
Non-Isolated Deepwater Habitats Acreage.	50070.5	33.9%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	169.8		
Wetlands Acreage.....................................	45356.2	30.6%	Wetlands
Number of Wetlands.................................	1257		

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ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	26949.6
Palustrine Wetlands:				PSS:	951.7	Lacustrine Wetlands:	0.0
PAB:	1.7	PFO:	16421.7	PUB:	649.0	Marine Wetlands:	145.1
PEM:	217.0	Pf:	0.0	PUS:	20.6	Riverine Wetlands:	0.0

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ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	1733.1	3.8%	819	65.2%
Scenario 2: (Red and Orange)	1869.5	4.1%	837	66.6%
Scenario 3: (Red, Orange and Brown)	2402.6	5.3%	909	72.3%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 39.1 Number: 15

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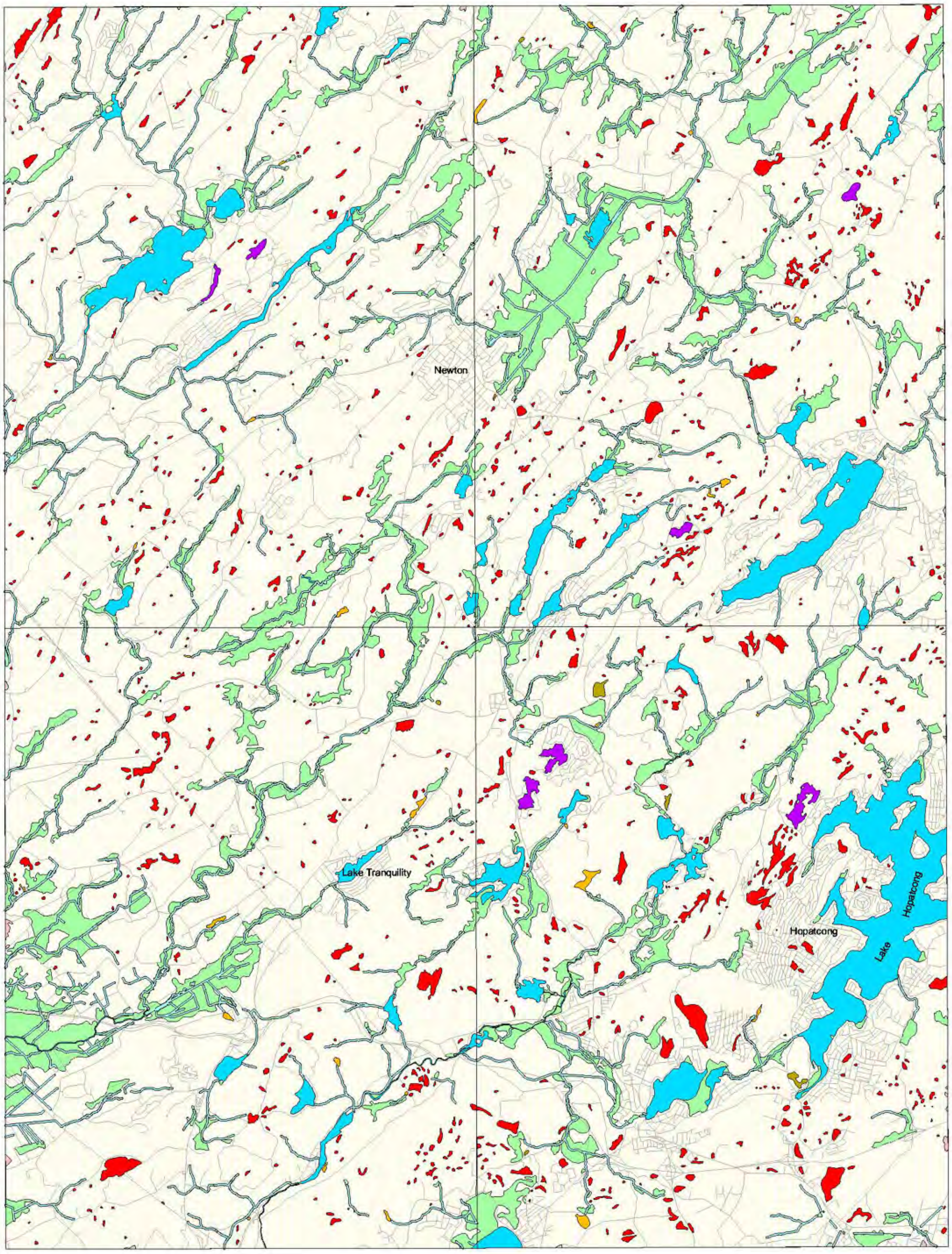
ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	89.6	Lacustrine Wetlands:	0.0
PAB:	0.9	Pf:	0.0	PUB:	398.5	Marine Wetlands:	0.0
PEM:	44.3	PFO:	1318.7	PUS:	17.5	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Newton Study Area, New Jersey



Legend

- Isolated Wetlands
- Wetlands 20-40 meters from Intermittent or Perennial Streams
- Non-isolated Wetlands
- Road-fragmented Wetlands*
- Map-edge Wetlands**
- 20 meter Buffer of Perennial and Intermittent Streams
- Isolated Deepwater Habitats
- Deepwater Habitats
- Uplands
- Quad Boundary
- Roads

* Separated from non-isolated wetland or deepwater habitat by a road; may be connected or isolated.

** Status could not be predicted since the rest of the wetland is outside the study area.

N W E S

Scale 1:50,000

2000 0 2000 4000 Meters

2 0 2 4 Miles

1000 Acres
100 Acres
10 Acres

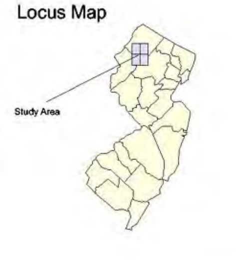
Data Sources

Wetlands: Existing NWI digital data
Streams: USGS Hydrology DLG
Roads: Tigerarc County Roads
Projection: UTM NAD 27, Zone 18

USGS Quads

Newton West	Newton East
Tranquility	Stanhope

Locus Map



This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Newton State: NJ FWS Region: 5

Ecoregion: Eastern Broadleaf Forest (Oceanic)

Watershed Region: Mid Atlantic Region

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STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	144187.0		
Upland Acreage..	123734.6	85.8%	Uplands
Non-Isolated Deepwater Habitats Acreage.	5205.3	3.8%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	240.1		
Wetlands Acreage.....................................	15007.0	10.4%	Wetlands
Number of Wetlands.................................	1495		

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ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	2350.5	Lacustrine Wetlands:	143.9
PAB:	2.7	PFO:	9242.2	PUB:	930.6	Marine Wetlands:	0.0
PEM:	237.1	Pf:	0.0	PUS:	0.0	Riverine Wetlands:	0.0

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ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	2683.7	17.9%	957	63.9%
Scenario 2: (Red and Orange)	2821.1	18.8%	990	66.2%
Scenario 3: (Red, Orange and Brown)	2870.1	19.1%	997	66.7%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 50.6 Number: 29

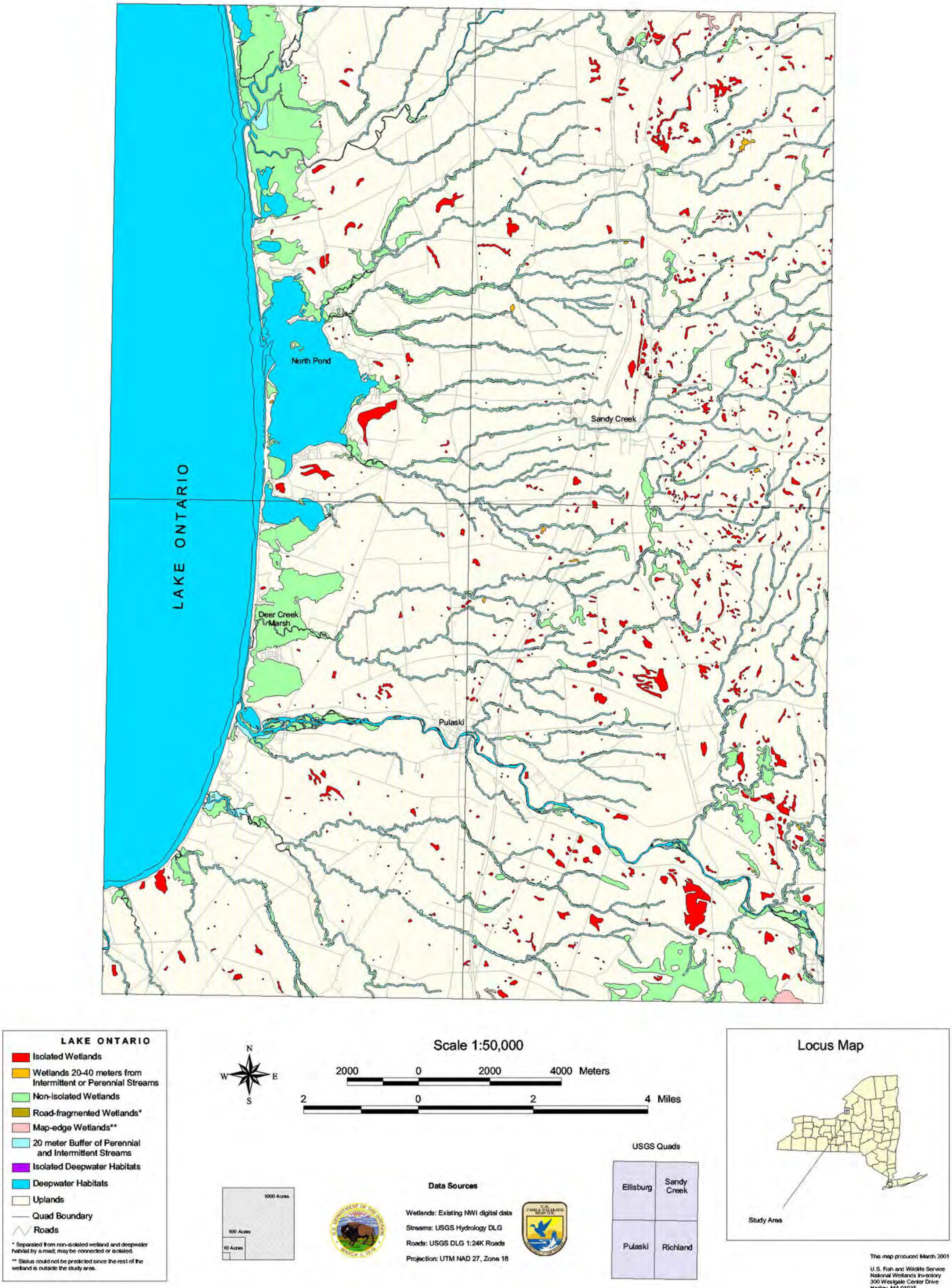
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	315.5	Lacustrine Wetlands:	0.0
PAB:	2.7	Pf:	0.0	PUB:	458.0	Marine Wetlands:	0.0
PEM:	195.1	PFO:	1849.8	PUS:	0.0	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Eastern Lake Ontario Study Area, New York



This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Eastern Lake Ontario State: NY FWS Region: 5

Ecoregion: Eastern Broadleaf Forest (Continental)

Watershed Region: Great Lakes Region

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STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	138407.5		
Upland Acreage..	102120.8	73.8%	Uplands
Non-Isolated Deepwater Habitats Acreage.	25660.7	18.5%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	10626.0	7.7%	Wetlands
Number of Wetlands.................................	1294		

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ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	2128.8	Lacustrine Wetlands:	291.0
PAB:	73.0	PFO:	4972.5	PUB:	320.7	Marine Wetlands:	0.0
PEM:	2803.8	Pf:	0.0	PUS:	0.0	Riverine Wetlands:	36.2

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	2137.5	20.1%	835	64.5%
Scenario 2: (Red and Orange)	2186.8	20.6%	868	67.1%
Scenario 3: (Red, Orange and Brown)	2346.3	22.1%	875	67.6%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 93.0 Number: 25

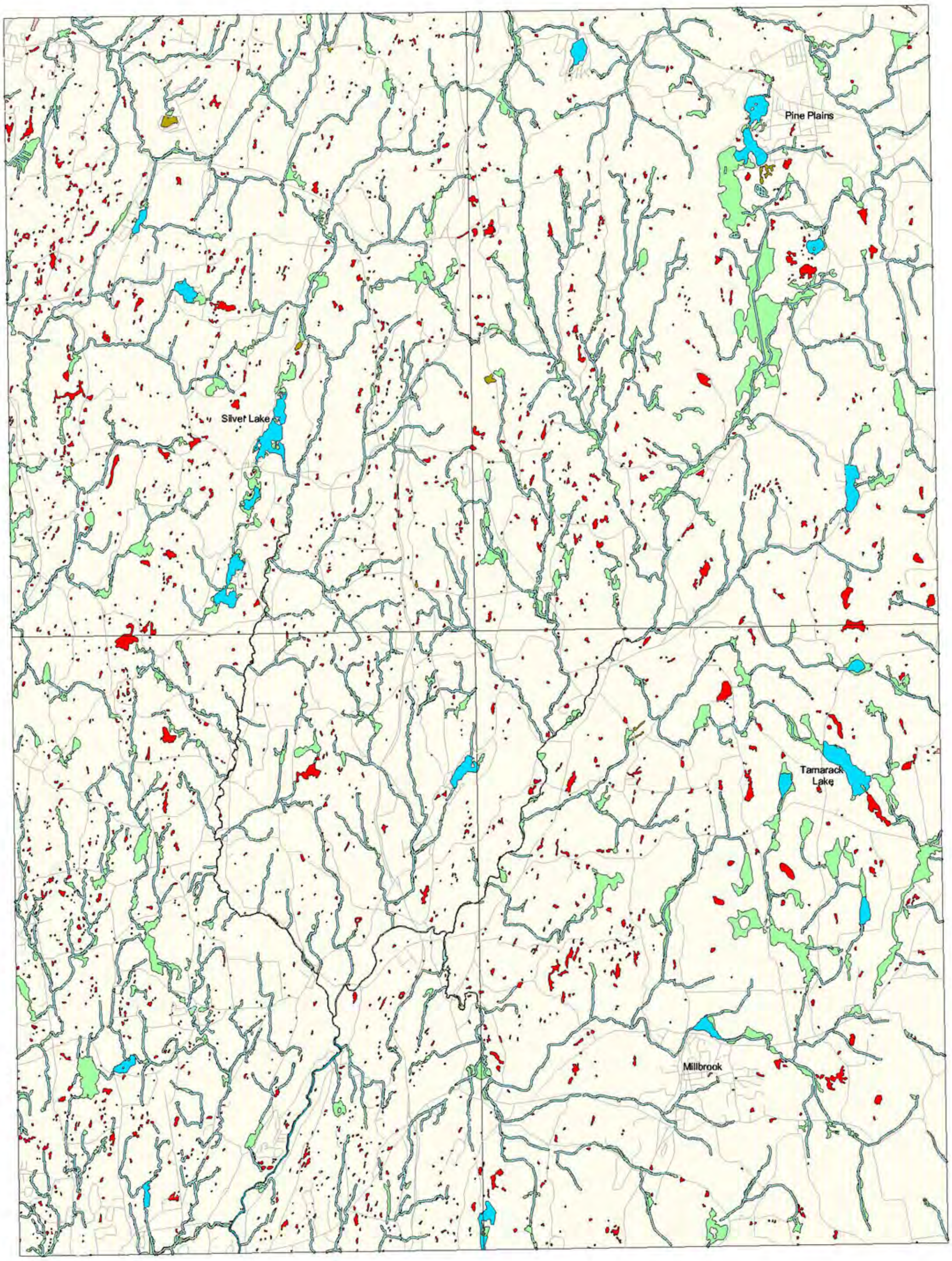
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	419.0	Lacustrine Wetlands:	3.7
PAB:	1.6	Pf:	0.0	PUB:	175.0	Marine Wetlands:	0.0
PEM:	136.3	PFO:	1451.2	PUS:	0.0	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Millbrook Study Area, New York



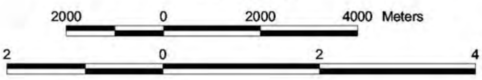
Legend

- Isolated Wetlands
- Wetlands 20-40 meters from Intermittent or Perennial Streams
- Non-isolated Wetlands
- Road-fragmented Wetlands*
- Map-edge Wetlands**
- 20 meter Buffer of Perennial and Intermittent Streams
- Isolated Deepwater Habitats
- Deepwater Habitats
- Uplands
- Quad Boundary
- Roads

* Separated from non-isolated wetland and deepwater habitat by a road; may be connected or isolated.

** Status could not be predicted since the rest of the wetland is outside the study area.

Scale 1:50,000



Data Sources

Wetlands: Existing NWI digital data

Streams: USGS Hydrology DLG

Roads: USGS DLG 1:24K Roads

Projection: UTM NAD 27, Zone 18

USGS Quads

Locus Map

This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Millbrook State: NY FWS Region: 5

Ecoregion: Eastern Broadleaf Forest (Oceanic)

Watershed Region: Mid Atlantic Region

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STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	142321.9		
Upland Acreage..	133950.2	94.1%	Uplands
Non-Isolated Deepwater Habitats Acreage.	907.3	0.6%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	7464.3	5.2%	Wetlands
Number of Wetlands.................................	3445		

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ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	1043.1	Lacustrine Wetlands:	91.4
PAB:	23.1	PFO:	3974.9	PUB:	1130.0	Marine Wetlands:	0.0
PEM:	1193.0	Pf:	0.0	PUS:	8.7	Riverine Wetlands:	0.0

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	1845.4	24.7%	2138	62.1%
Scenario 2: (Red and Orange)	2055.3	27.5%	2286	66.4%
Scenario 3: (Red, Orange and Brown)	2107.8	28.2%	2299	66.7%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 17.3 Number: 16

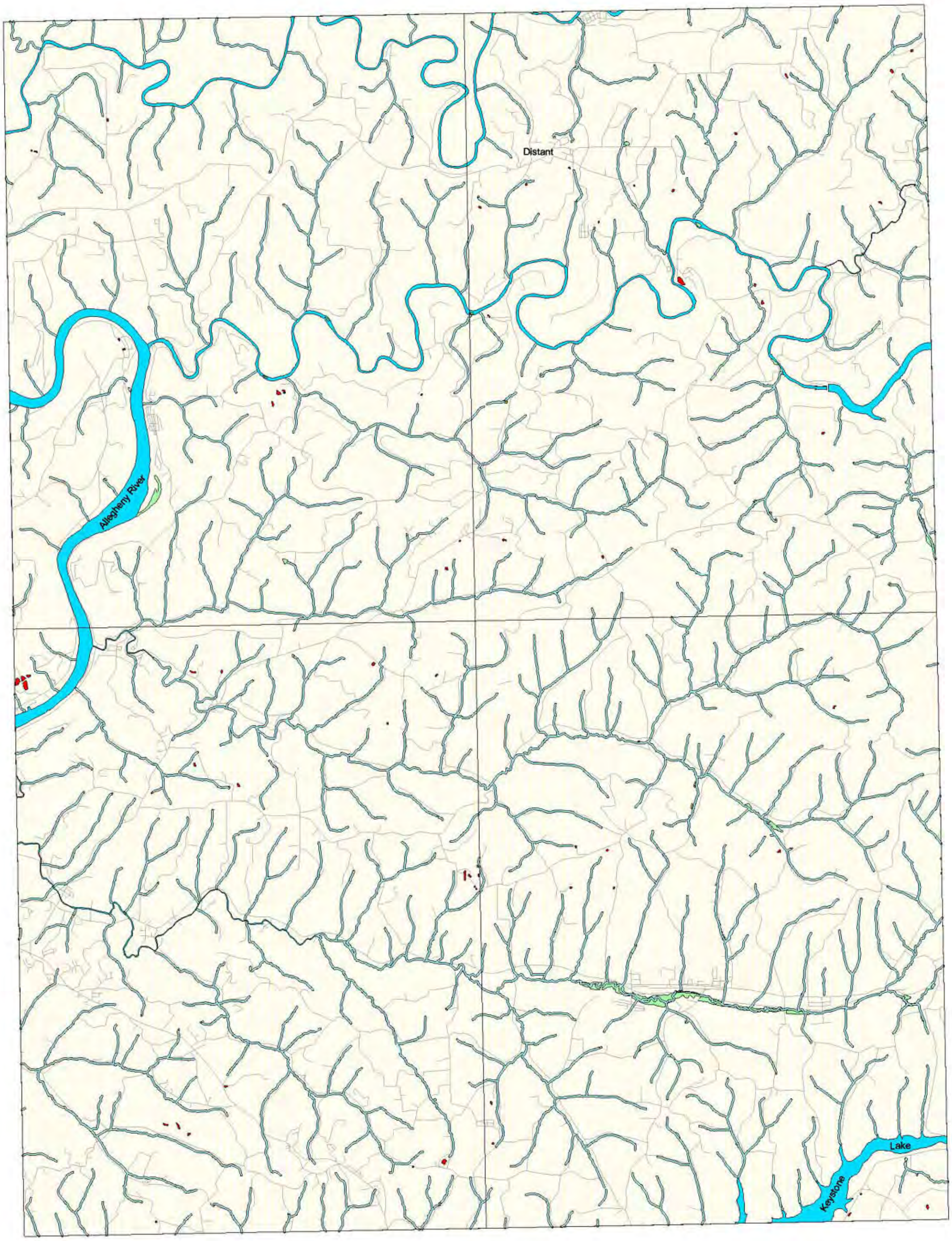
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	231.8	Lacustrine Wetlands:	0.0
PAB:	7.8	Pf:	0.0	PUB:	545.5	Marine Wetlands:	0.0
PEM:	290.5	PFO:	976.5	PUS:	3.1	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Distant Study Area, Pennsylvania



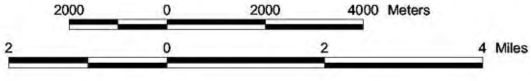
Legend

- Isolated Wetlands
- Wetlands 20-40 meters from Intermittent or Perennial Streams
- Non-isolated Wetlands
- Road-fragmented Wetlands*
- Map-edge Wetlands**
- 20 meter Buffer of Perennial and Intermittent Streams
- Isolated Deepwater Habitats
- Deepwater Habitats
- Uplands
- Quad Boundary
- Roads

* Separated from non-isolated wetland or deepwater habitat by a road; may be connected or isolated.

** Status could not be predicted since the rest of the wetland is outside the study area.

Scale 1:50,000



Data Sources

Wetlands: Existing NWI digital data

Streams: USGS Hydrology DLG

Roads: Tigerarc County Roads

Projection: UTM NAD 27, Zone 17

USGS Quads

Templeton	Distant
Mosgrove	Rural Valley

Locus Map

This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Distant State: PA FWS Region: 5

Ecoregion: Eastern Broadleaf Forest (Oceanic)

Watershed Region: Ohio Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	144521.0		
Upland Acreage..	141861.8	98.2%	Uplands
Non-Isolated Deepwater Habitats Acreage.	2349.3	1.6%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	309.9	0.2%	Wetlands
Number of Wetlands.................................	163		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	18.2	Lacustrine Wetlands:	0.0
PAB:	0.0	PFO:	183.0	PUB:	103.9	Marine Wetlands:	0.0
PEM:	4.9	Pf:	0.0	PUS:	0.0	Riverine Wetlands:	0.0

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	53.7	17.3%	65	39.9%
Scenario 2: (Red and Orange)	56.6	18.3%	72	44.2%
Scenario 3: (Red, Orange and Brown)	56.6	18.3%	72	44.2%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 0.4 Number: 2

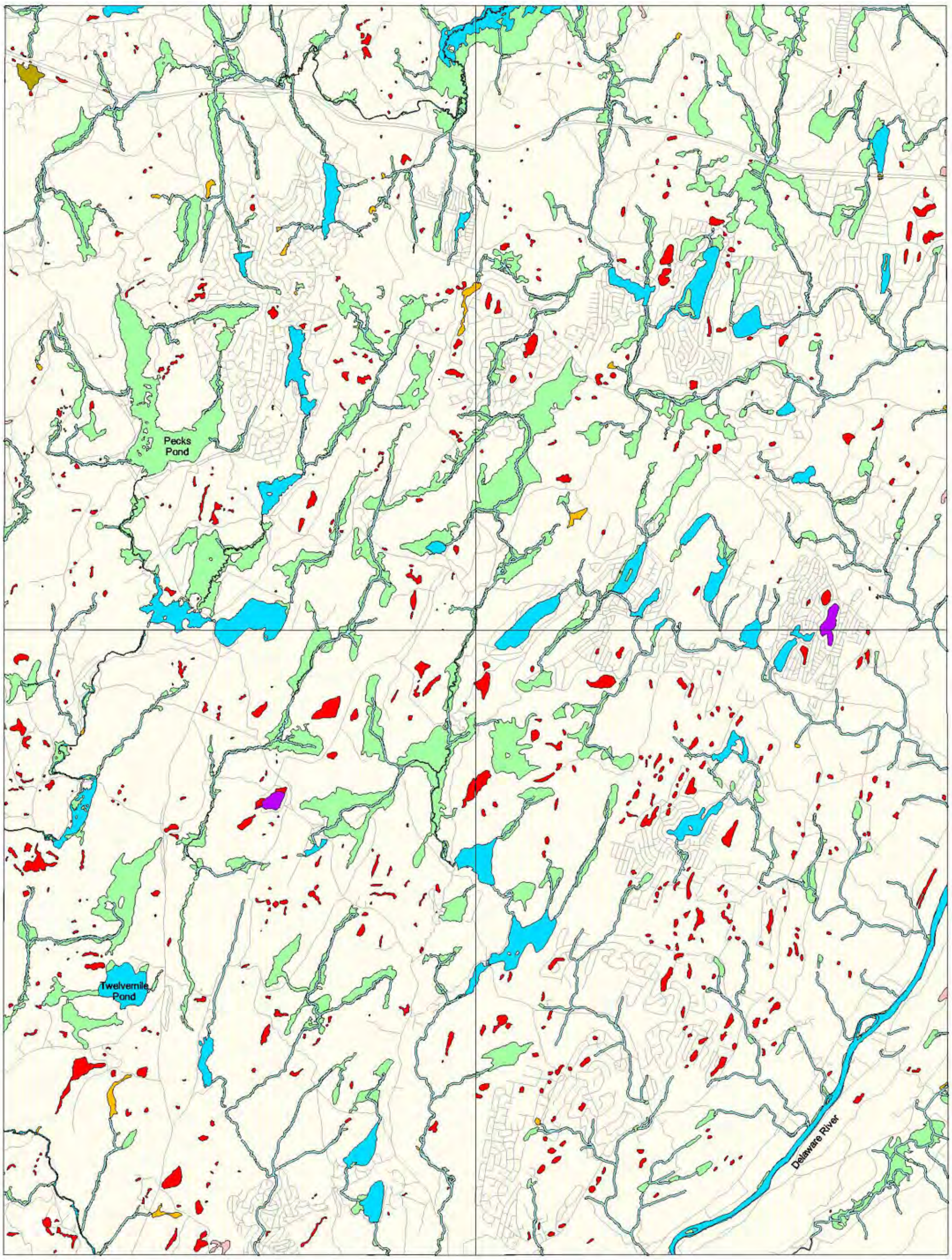
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	0.9	Lacustrine Wetlands:	0.0
PAB:	0.0	Pf:	0.0	PUB:	54.9	Marine Wetlands:	0.0
PEM:	0.3	PFO:	0.5	PUS:	0.0	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Edgemere Study Area, Pennsylvania



Legend

- Isolated Wetlands
- Wetlands 20-40 meters from Intermittent or Perennial Streams
- Non-isolated Wetlands
- Road-fragmented Wetlands*
- Map-edge Wetlands**
- 20 meter Buffer of Perennial and Intermittent Streams
- Isolated Deepwater Habitats
- Deepwater Habitats
- Uplands
- Quad Boundary
- Roads

* Separated from non-isolated wetland or deepwater habitat by a road; may be connected or isolated.

** Status could not be predicted since the rest of the wetland is outside the study area.

N W E S

Scale 1:50,000

2000 0 2000 4000 Meters

2 0 2 4 Miles

1000 Acres
100 Acres
10 Acres

Data Sources

Wetlands: Existing NWI digital data
Streams: USGS Hydrology DLG
Roads: USGS DLG 1:24K Roads
Projection: UTM NAD 27, Zone 18

USGS Quads

Pecks Pond	Edgemere
Twelvemile Pond	Lake Maskenozha

Locus Map

This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Edgemere State: PA FWS Region: 5

Ecoregion: Laurentian Mixed Forest

Watershed Region: Mid Atlantic Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	143645.6		
Upland Acreage..	126595.9	88.1%	Uplands
Non-Isolated Deepwater Habitats Acreage.	3310.9	2.4%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	82.3		
Wetlands Acreage.....................................	13656.5	9.5%	Wetlands
Number of Wetlands.................................	1147		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	2620.3	Lacustrine Wetlands:	389.4
PAB:	0.0	PFO:	9315.3	PUB:	571.0	Marine Wetlands:	0.0
PEM:	761.5	Pf:	0.0	PUS:	0.0	Riverine Wetlands:	0.0

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	2008.8	14.7%	641	55.9%
Scenario 2: (Red and Orange)	2155.6	15.8%	671	58.5%
Scenario 3: (Red, Orange and Brown)	2204.9	16.1%	675	58.8%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 52.7 Number: 13

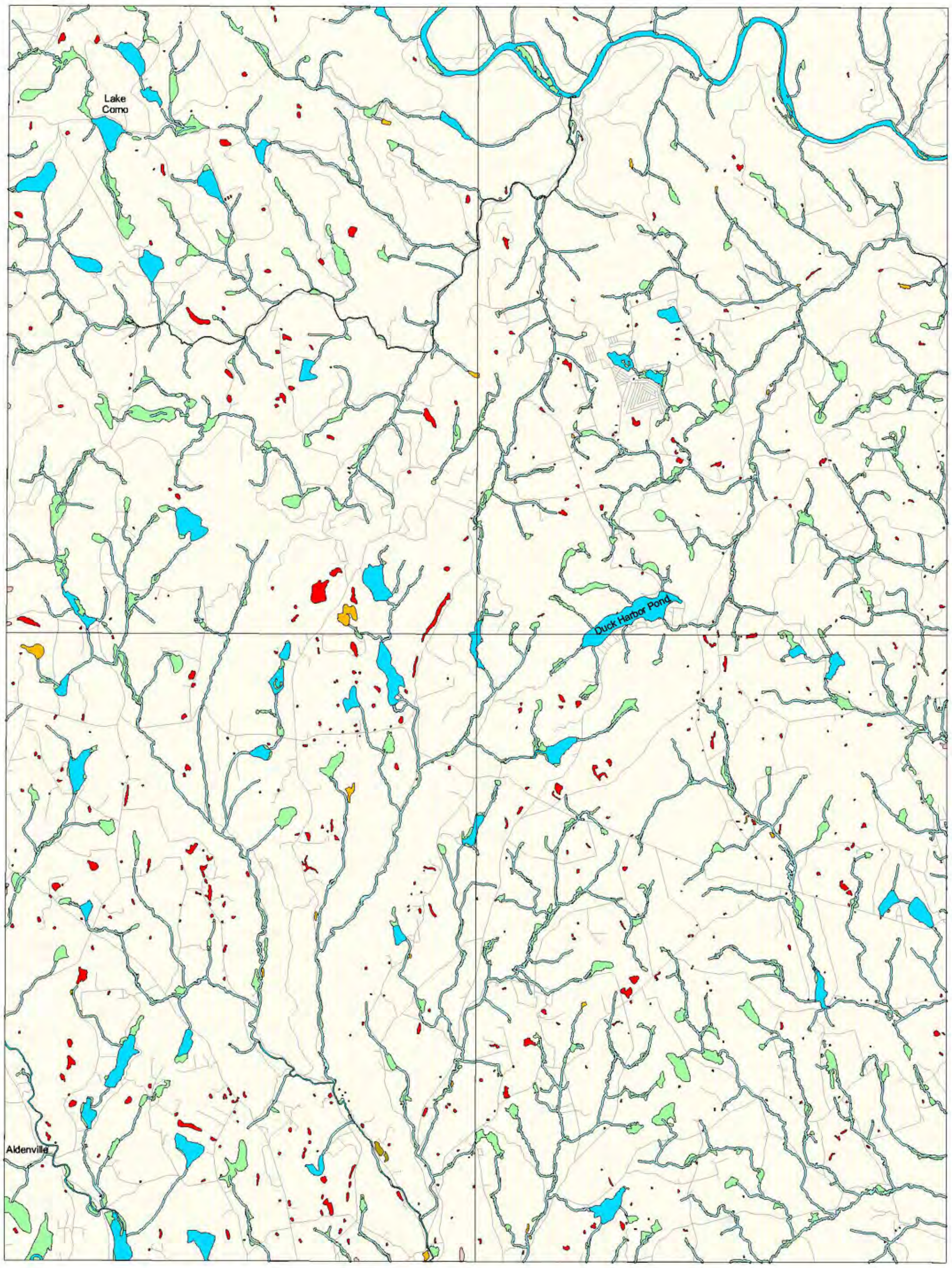
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	164.1	Lacustrine Wetlands:	0.0
PAB:	0.0	Pf:	0.0	PUB:	168.0	Marine Wetlands:	0.0
PEM:	14.4	PFO:	1791.6	PUS:	0.0	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Lake Como Study Area, Pennsylvania



Legend

- Isolated Wetlands
- Wetlands 20-40 meters from Intermittent or Perennial Streams
- Non-isolated Wetlands
- Road-fragmented Wetlands*
- Map-edge Wetlands**
- 20 meter Buffer of Perennial and Intermittent Streams
- Isolated Deepwater Habitats
- Deepwater Habitats
- Uplands
- Quad Boundary
- Roads

* Separated from non-isolated wetland or deepwater habitat by a road; may be connected or isolated.

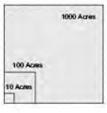
** Status could not be predicted since the rest of the wetland is outside the study area.

N / W / E / S

Scale 1:50,000

2000 0 2000 4000 Meters

2 0 2 4 Miles



Data Sources

Wetlands: Existing NWI digital data

Streams: USGS Hydrology DLG

Roads: USGS DLG 1:24K Roads

Projection: UTM NAD 27, Zone 18

USGS Quads

Locus Map

This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: **Lake Como** State: PA FWS Region: 5

Ecoregion: Laurentian Mixed Forest

Watershed Region: Mid Atlantic Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	142559.1		
Upland Acreage..	135171.3	94.8%	Uplands
Non-Isolated Deepwater Habitats Acreage.	2478.7	1.7%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	4909.2	3.4%	Wetlands
Number of Wetlands.................................	1321		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	941.1	Lacustrine Wetlands:	14.4
PAB:	7.8	PFO:	1962.6	PUB:	904.9	Marine Wetlands:	0.0
PEM:	998.3	Pf:	0.0	PUS:	0.0	Riverine Wetlands:	80.2

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	761.7	15.5%	553	41.9%
Scenario 2: (Red and Orange)	874.4	17.8%	601	45.5%
Scenario 3: (Red, Orange and Brown)	886.3	18.1%	603	45.6%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 21.4 Number: 10

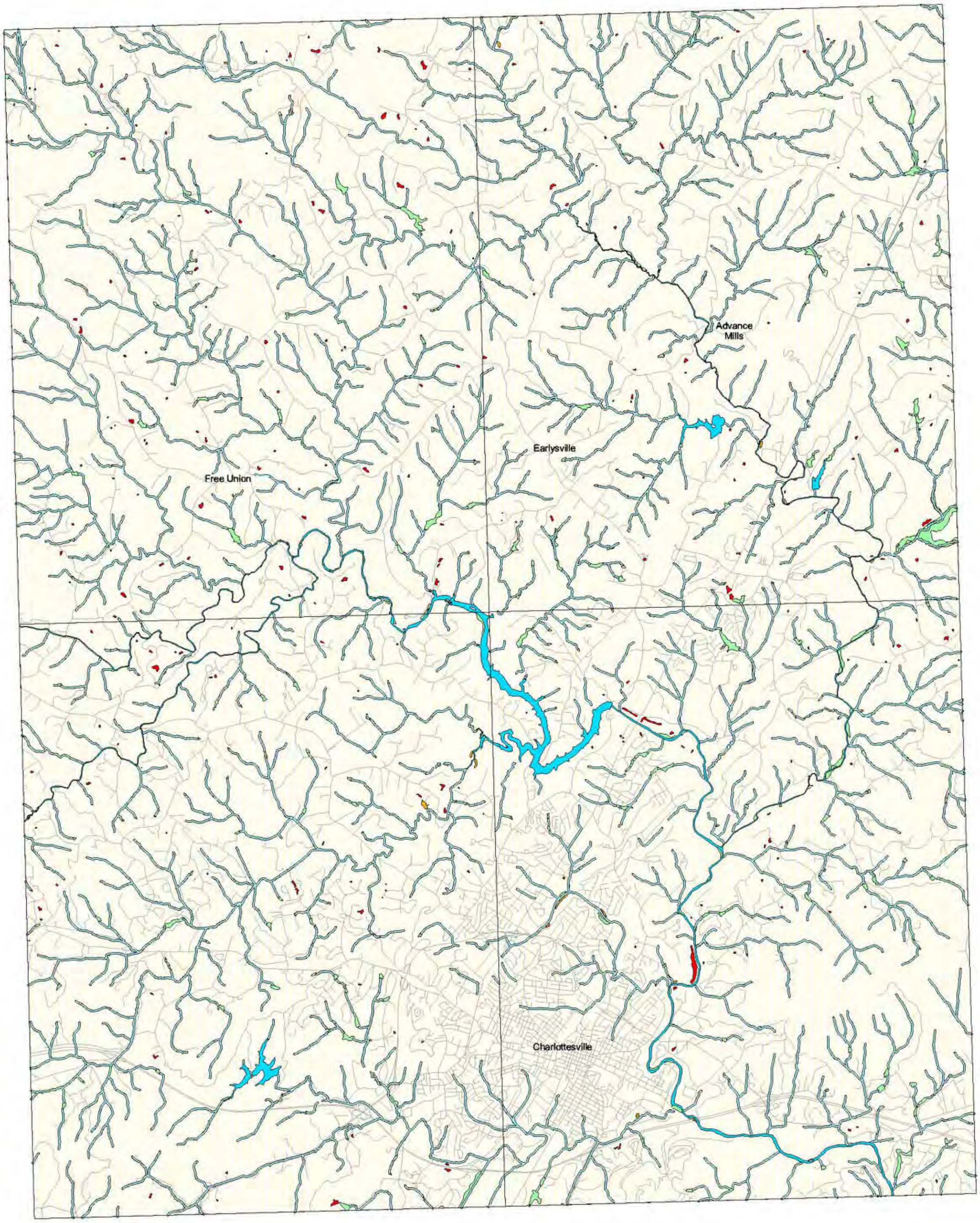
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	112.5	Lacustrine Wetlands:	0.0
PAB:	7.8	Pf:	0.0	PUB:	210.1	Marine Wetlands:	0.0
PEM:	127.8	PFO:	416.2	PUS:	0.0	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Earlysville Study Area, Virginia



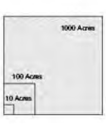
Legend

- Isolated Wetlands
- Wetlands 20-40 meters from Intermittent or Perennial Streams
- Non-isolated Wetlands
- Road-fragmented Wetlands*
- Map-edge Wetlands**
- 20 meter Buffer of Perennial and Intermittent Streams
- Isolated Deepwater Habitats
- Deepwater Habitats
- Uplands
- Quad Boundary
- Roads

* Separated from non-isolated wetland or deepwater habitat by a road; may be connected or isolated.

** Status could not be predicted since the rest of the wetland is outside the study area.

Scale 1:50,000



Data Sources

Wetlands: Existing NWI digital data

Streams: USGS Hydrology DLG

Roads: USGS DLG 1:24K Roads

Projection: UTM NAD 27, Zone 17

USGS Quads

Locus Map

This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Earlysville State: VA FWS Region: 5

Ecoregion: Central Appalachian Broadleaf Forest-Coniferous Forest-Meadow

Watershed Region: Mid Atlantic Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	150367.9		
Upland Acreage..	148297.7	98.6%	Uplands
Non-Isolated Deepwater Habitats Acreage.	786.6	0.5%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	1283.7	0.9%	Wetlands
Number of Wetlands.................................	733		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	73.8	Lacustrine Wetlands:	0.9
PAB:	0.0	PFO:	295.0	PUB:	780.9	Marine Wetlands:	0.0
PEM:	100.1	Pf:	0.0	PUS:	0.0	Riverine Wetlands:	32.9

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	184.9	14.4%	249	34.0%
Scenario 2: (Red and Orange)	211.2	16.5%	278	37.9%
Scenario 3: (Red, Orange and Brown)	211.2	16.5%	278	37.9%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 2.1 Number: 3

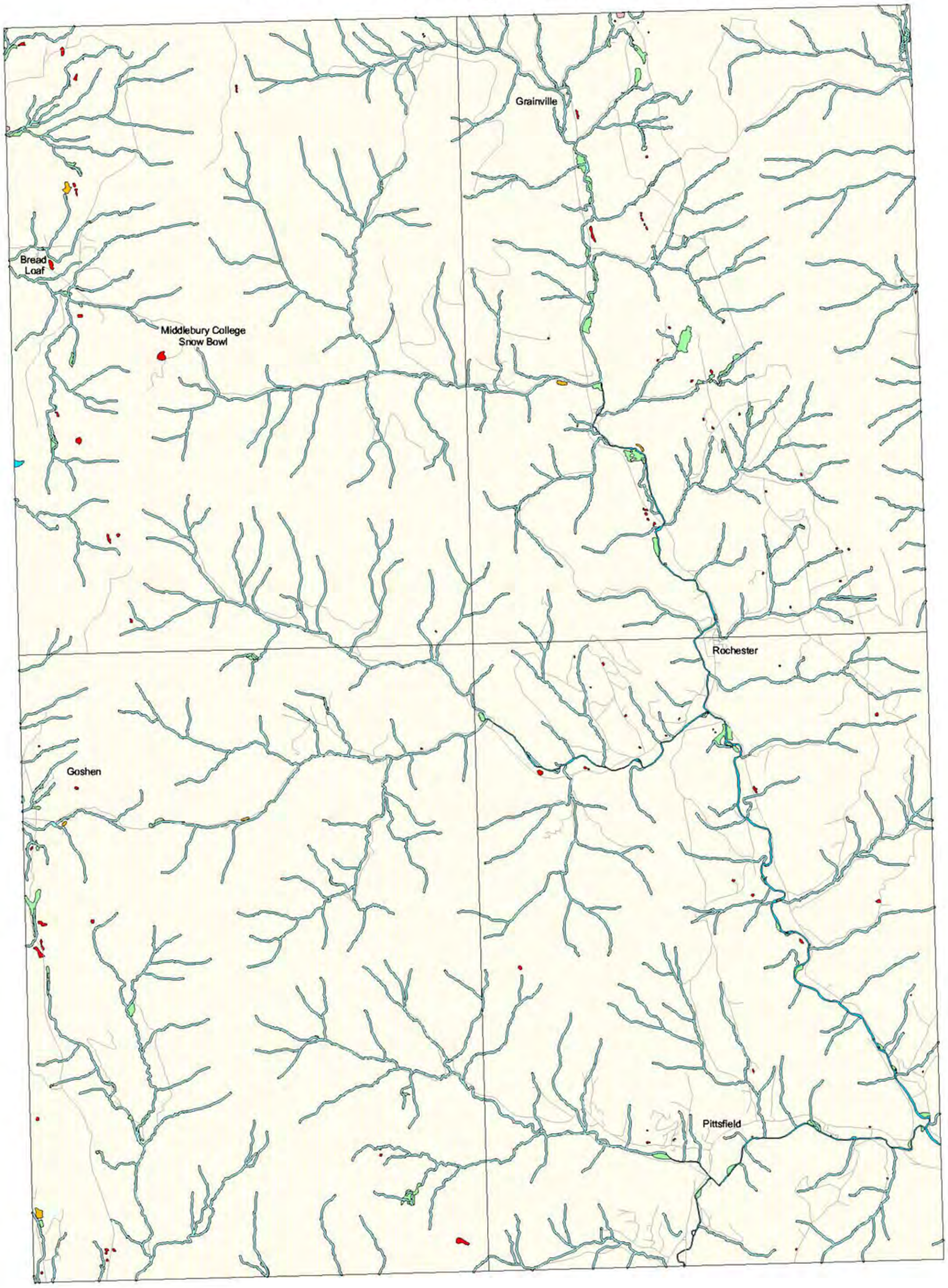
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	15.0	Lacustrine Wetlands:	0.0
PAB:	0.0	Pf:	0.0	PUB:	142.6	Marine Wetlands:	0.0
PEM:	21.4	PFO:	32.0	PUS:	0.0	Riverine Wetlands:	0.2

*** Acreage of Isolated Wetlands based on Scenario 2.

Bread Loaf Study Area, Vermont



Legend

- Isolated Wetlands
- Wetlands 20-40 meters from Intermittent or Perennial Streams
- Non-isolated Wetlands
- Road-fragmented Wetlands*
- Map-edge Wetlands**
- 20 meter Buffer of Perennial and Intermittent Streams
- Isolated Deepwater Habitats
- Deepwater Habitats
- Uplands
- Quad Boundary
- Roads

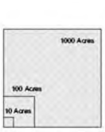
* Separated from non-isolated wetland by a road; may be connected or isolated.

** Status could not be predicted since the rest of the wetland is outside the study area.

Scale 1:50,000

2000 0 2000 4000 Meters

2 0 2 4 Miles



Data Sources

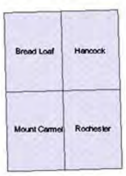
Wetlands: Existing NWI digital data

Streams: USGS Hydrology DLG

Roads: USGS DLG 1:24K Roads

Projection: UTM NAD 27, Zone 18

USGS Quads



Locus Map

This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Bread Loaf State: VT FWS Region: 5

Ecoregion: Adirondack-New England Mixed Forest-Conifreous Forest-Alpine Meadow

Watershed Region: New England Region / Mid Atlantic Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	137875.0		
Upland Acreage..	137171.3	99.5%	Uplands
Non-Isolated Deepwater Habitats Acreage.	5.5	0.0%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	698.2	0.5%	Wetlands
Number of Wetlands.................................	245		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	335.5	Lacustrine Wetlands:	0.0
PAB:	0.0	PFO:	208.3	PUB:	80.6	Marine Wetlands:	0.0
PEM:	53.8	Pf:	0.0	PUS:	0.0	Riverine Wetlands:	20.0

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	96.6	13.8%	91	37.1%
Scenario 2: (Red and Orange)	121.3	17.4%	100	40.8%
Scenario 3: (Red, Orange and Brown)	121.3	17.4%	100	40.8%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 6.2 Number: 2

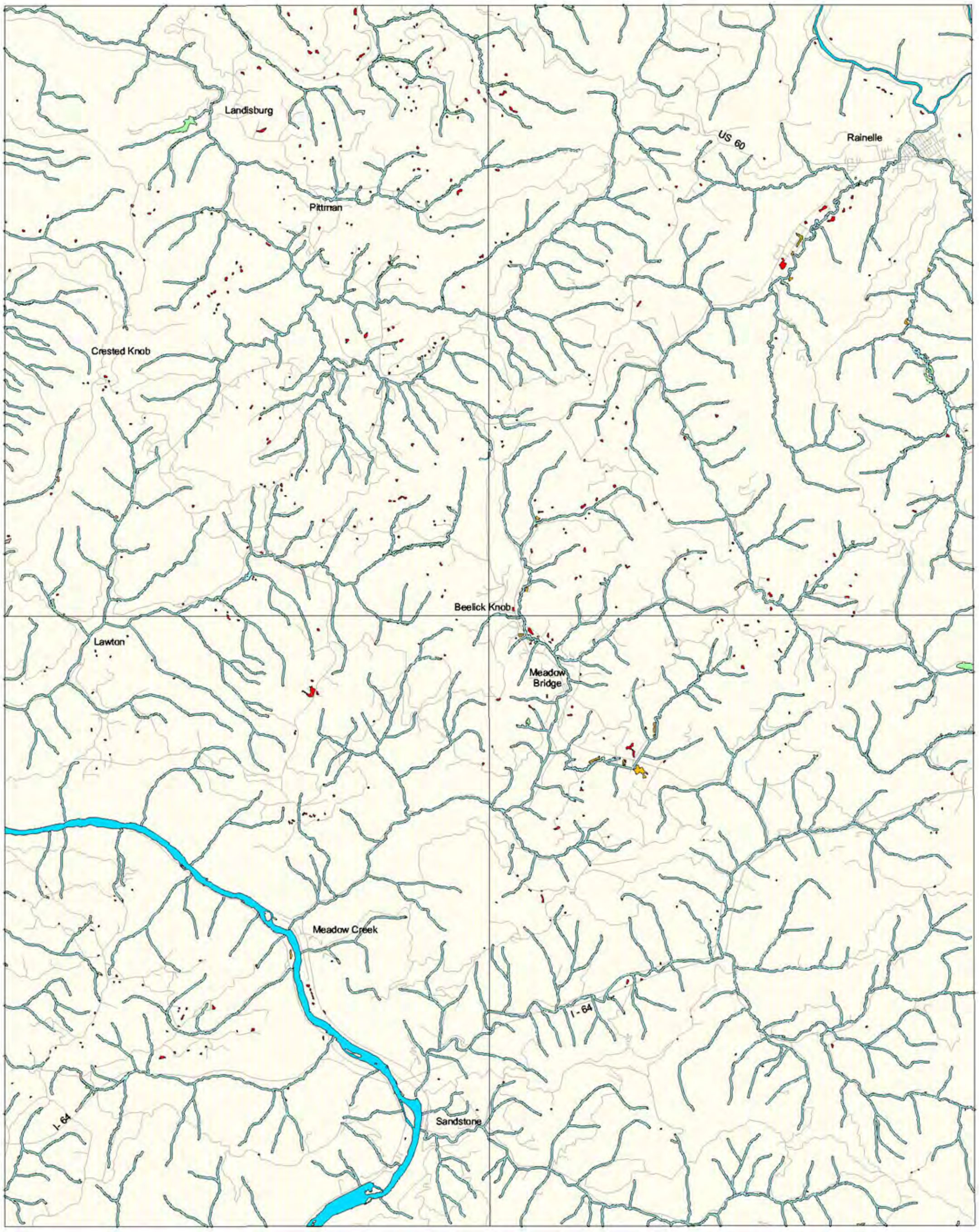
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	39.1	Lacustrine Wetlands:	0.0
PAB:	0.0	Pf:	0.0	PUB:	40.5	Marine Wetlands:	0.0
PEM:	5.9	PFO:	35.9	PUS:	0.0	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Rainelle Study Area, West Virginia



Legend

- Isolated Wetlands
- Wetlands 20-40 meters from Intermittent or Perennial Streams
- Non-isolated Wetlands
- Road-fragmented Wetlands*
- Map-edge Wetlands**
- 20 meter Buffer of Perennial and Intermittent Streams
- Isolated Deepwater Habitats
- Deepwater Habitats
- Uplands
- Quad Boundary
- Roads

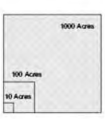
* Separated from non-isolated wetland and deepwater habitat by a road; may be connected or isolated.

** Status could not be predicted since the rest of the wetland is outside the study area.

Scale 1:50,000

2000 0 2000 4000 Meters

2 0 2 4 Miles



Data Sources

Wetlands: Existing NWI digital data

Streams: USGS Hydrology DLG

Roads: USGS DLG 1:24K Roads

Projection: UTM NAD 27, Zone 17

This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Rainelle State: WV FWS Region: 5

Ecoregion: Central Appalachian Broadleaf Forest-Coniferous Forest-Meadow

Watershed Region: Ohio Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area.....................	150694.1		
Upland Acreage.......................................	149343.5	99.1%	Uplands
Non-Isolated Deepwater Habitats Acreage.	747.9	0.5%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage....................................	602.8	0.4%	Wetlands
Number of Wetlands................................	763		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	56.1	Lacustrine Wetlands:	0.0
PAB:	0.0	PFO:	67.3	PUB:	274.1	Marine Wetlands:	0.0
PEM:	188.3	Pf:	0.0	PUS:	16.4	Riverine Wetlands:	0.7

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	209.6	34.8%	460	60.3%
Scenario 2: (Red and Orange)	240.8	40.0%	497	65.1%
Scenario 3: (Red, Orange and Brown)	246.8	40.9%	499	65.4%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 4.7 Number: 4

. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	12.8	Lacustrine Wetlands:	0.0
PAB:	0.0	Pf:	0.0	PUB:	148.9	Marine Wetlands:	0.0
PEM:	54.6	PFO:	10.8	PUS:	13.7	Riverine Wetlands:	0.0

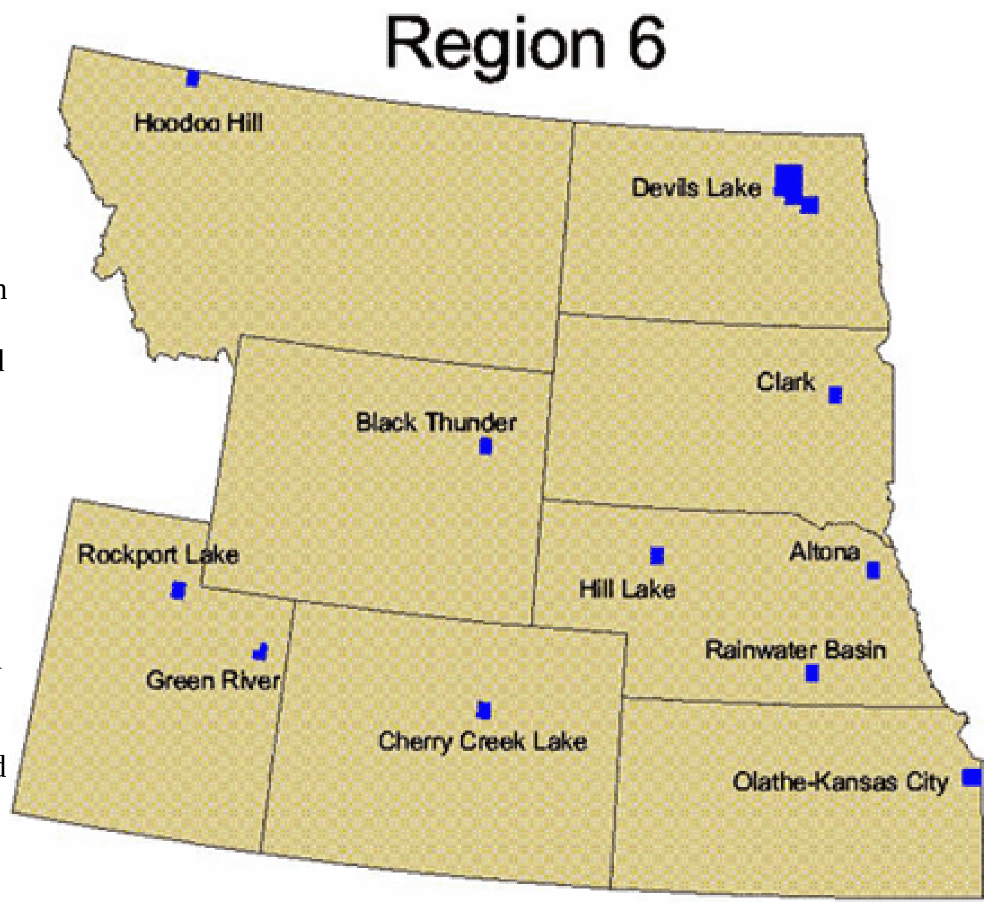
*** Acreage of Isolated Wetlands based on Scenario 2.

Study Results

Study findings are reported for each study area below. Data for individual study areas are arranged by U.S. Fish and Wildlife Service Region. For each Region, there is a general discussion of the study results, a map showing the location of the study sites, a summary table of the findings, detailed data summary for each area, and a special wetland classification map for each study area. The latter two products are represented as "additional data links" within the regional summary table (first column). Simply click on the word "map" or "data" and the pertinent map and data will be displayed. *Please allow a minute or so for the map to appear. Note that printed maps may appear somewhat skewed since their projections reflect the curvature of the Earth.*

Region 6 (North Dakota, South Dakota, Nebraska, Kansas, Colorado, Wyoming, Utah, and Montana)

Eleven sites were studied in Region 6: one in Colorado, one in Kansas, one in Montana, one in North Dakota, three in Nebraska, one in South Dakota, two in Utah, and one in Wyoming. The North Dakota site was Devils Lake that alone covered 1,447 square miles. *Table 3-6* presents a summary of the data for the Region's study areas.



Percent of Study Areas Covered by Wetlands

Wetlands were most extensive in two prairie pothole areas: Devils Lake, North Dakota (15% of the area) and Clark, South Dakota (11%). Utah's Green River study area had 7 percent of its area covered by wetlands. Wetlands represented only 1 to 2 percent of most of the remaining areas.

Percent of Wetland Area Identified as Isolated

Isolated wetlands accounted for a large proportion of the wetlands in six areas. Ninety-eight percent of Clark's wetland acreage was classified as isolated. Two other areas had more than 80 percent of their wetland acreage dominated by isolated wetlands: Rainwater Basin, Nebraska (84-85%) and Black Thunder, Wyoming (80-81%). Devils Lake, Olathe-Kansas City (Kansas), and Hill Lake (Nebraska; Sandhills wetlands) had about half of their wetland acreage in this category. Palustrine emergent wetland was the predominant isolated wetland type in all areas, except Olathe-Kansas City where aquatic bed (pond) was the main type.

Percent of Wetlands (Number) Classified as Isolated

Two areas had more than 90 percent of their wetlands designated as isolated: Devils Lake (97-98%) and Clark (94-95%). Both these areas are located in the Prairie Pothole Region. The percentages would be even higher if point or dot-sized wetlands were counted. For Devils Lake, an additional 6,273 point wetlands could be added to the wetland total for this study area (increasing the total count from 42,327 to 48,600). Nearly all these point wetlands should meet the isolated wetland criterion (Chuck Elliott, pers. comm.). Three other areas had more than 50 percent of their wetlands mapped as isolated under all three scenarios: Hill Lake (66-74%), Olathe-Kansas City (70-71%), and Rainwater Basin (64-68%).

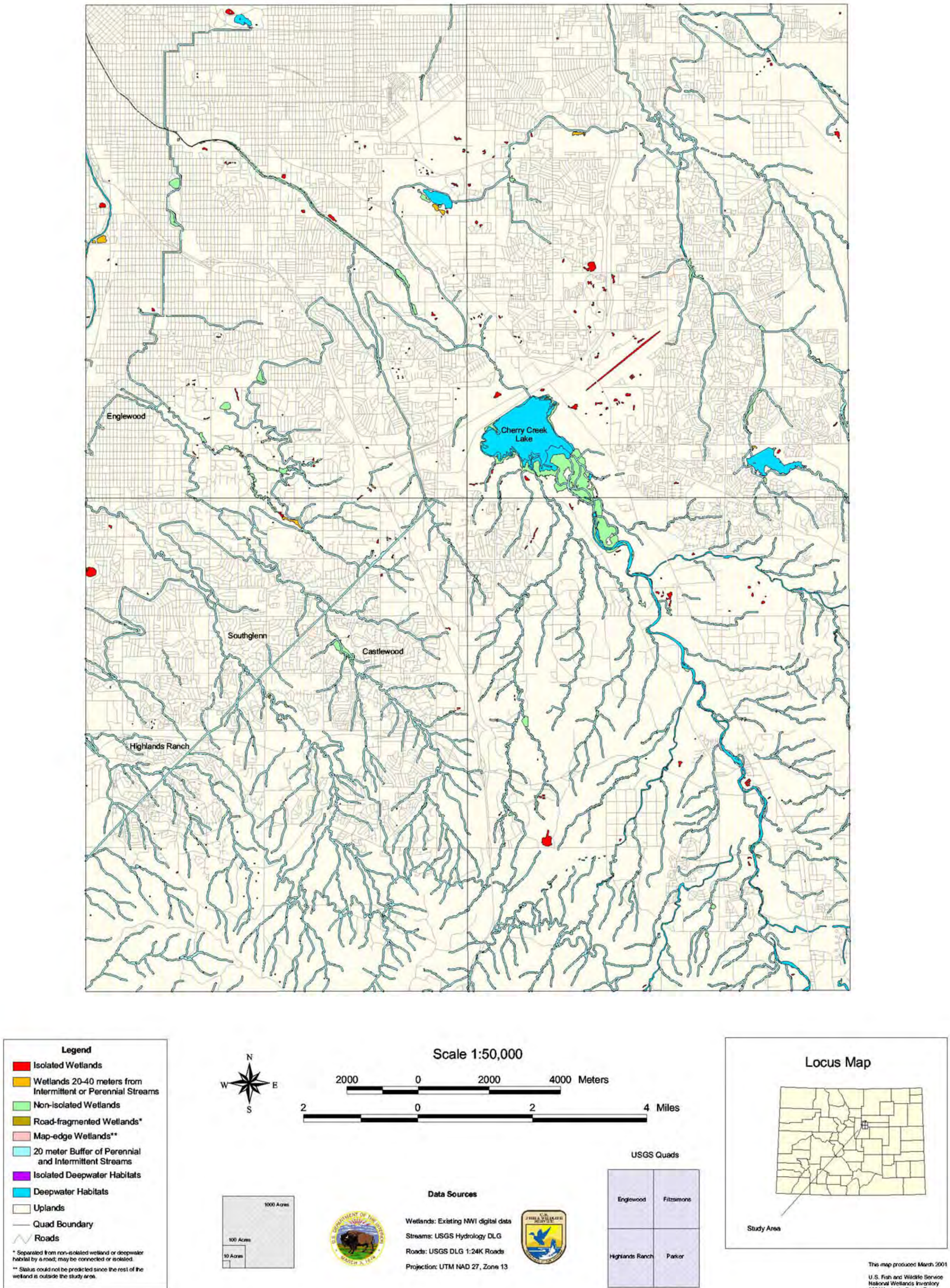
Table 3-6. Summary data for study sites in Region 6. (Note: This table should be printed in landscape orientation.)

	Isolated Wetlands

Additional Data Links	Study Area	State	Acreage in Study Area	Wetland Acreage	Wetlands % of Study Area	Number of Wetlands	Deepwater Habitats % of Study Area	Scenario 1 Area Percent of Total Wetlands	Scenario 2 Area Percent of Total Wetlands	Scenario 3 Area Percent of Total Wetlands	Scenario 1 Count Percent of Total Wetlands	Scenario 2 Count Percent of Total Wetlands	Scenario 3 Count Percent of Total Wetlands
MAP DATA	Cherry Creek Lake	CO	147106.3	1802.1	1.2%	943	0.7%	13.9%	16.7%	16.7%	31.6%	36.8%	36.8%
MAP DATA	Olathe-Kansas City	KS	223128.6	2436.1	1.1%	2866	0.6%	45.9%	46.7%	49.0%	70.1%	70.8%	71.1%
MAP DATA	Hoodoo Hill	MT	125966.8	1776.8	1.4%	846	0.1%	20.0%	21.1%	21.1%	47.3%	53.0%	53.0%
MAP DATA	Devils Lake	ND	925861.6	135974.4	14.7%	42327	4.3%	49.3%	49.4%	51.3%	97.0%	97.4%	97.6%
MAP DATA	Altona	NE	141842.4	949.5	0.7%	364	0.1%	20.2%	24.7%	24.7%	42.6%	50.6%	50.6%
MAP DATA	Hill Lake	NE	141327.9	5901.8	4.2%	1006	0.0%	46.2%	47.2%	47.2%	66.2%	73.7%	73.8%
MAP DATA	Rainwater Basin	NE	145276.3	4708.1	3.2%	1076	0.0%	84.1%	84.6%	84.6%	64.4%	67.7%	67.7%
MAP DATA	Clark	SD	135541.8	14867.6	11.0%	4106	0.0%	98.1%	98.2%	98.2%	93.8%	94.6%	94.6%
MAP DATA	Green River	UT	109610.8	7285.4	6.6%	304	2.1%	3.0%	3.4%	3.4%	18.1%	20.4%	20.7%
MAP DATA	Rockport Lake	UT	144460.6	3458.0	2.4%	632	0.8%	3.5%	4.8%	7.5%	23.9%	34.3%	36.7%
MAP DATA	Black Thunder	WY	138098.4	2235.2	1.6%	887	0.0%	80.3%	80.7%	80.7%	41.4%	43.6%	43.7%

[Back to Table of Contents] [Home] [Go to Results of Region 7] [Skip to Section 4]

Cherry Creek Lake Study Area, Colorado



Study Area: Cherry Creek Lake State: CO FWS Region: 6

Ecoregion: Great Plains-Palouse Dry Steppe

Watershed Region: Missouri Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	147106.3		
Upland Acreage..	144253.9	98.1%	Uplands
Non-Isolated Deepwater Habitats Acreage.	1050.2	0.7%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	1802.1	1.2%	Wetlands
Number of Wetlands.................................	943		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	289.5	Lacustrine Wetlands:	108.1
PAB:	97.0	PFO:	69.9	PUB:	322.6	Marine Wetlands:	0.0
PEM:	415.7	Pf:	0.0	PUS:	25.5	Riverine Wetlands:	473.8

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	250.0	13.9%	298	31.6%
Scenario 2: (Red and Orange)	301.0	16.7%	347	36.8%
Scenario 3: (Red, Orange and Brown)	301.0	16.7%	347	36.8%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 5.2 Number: 7

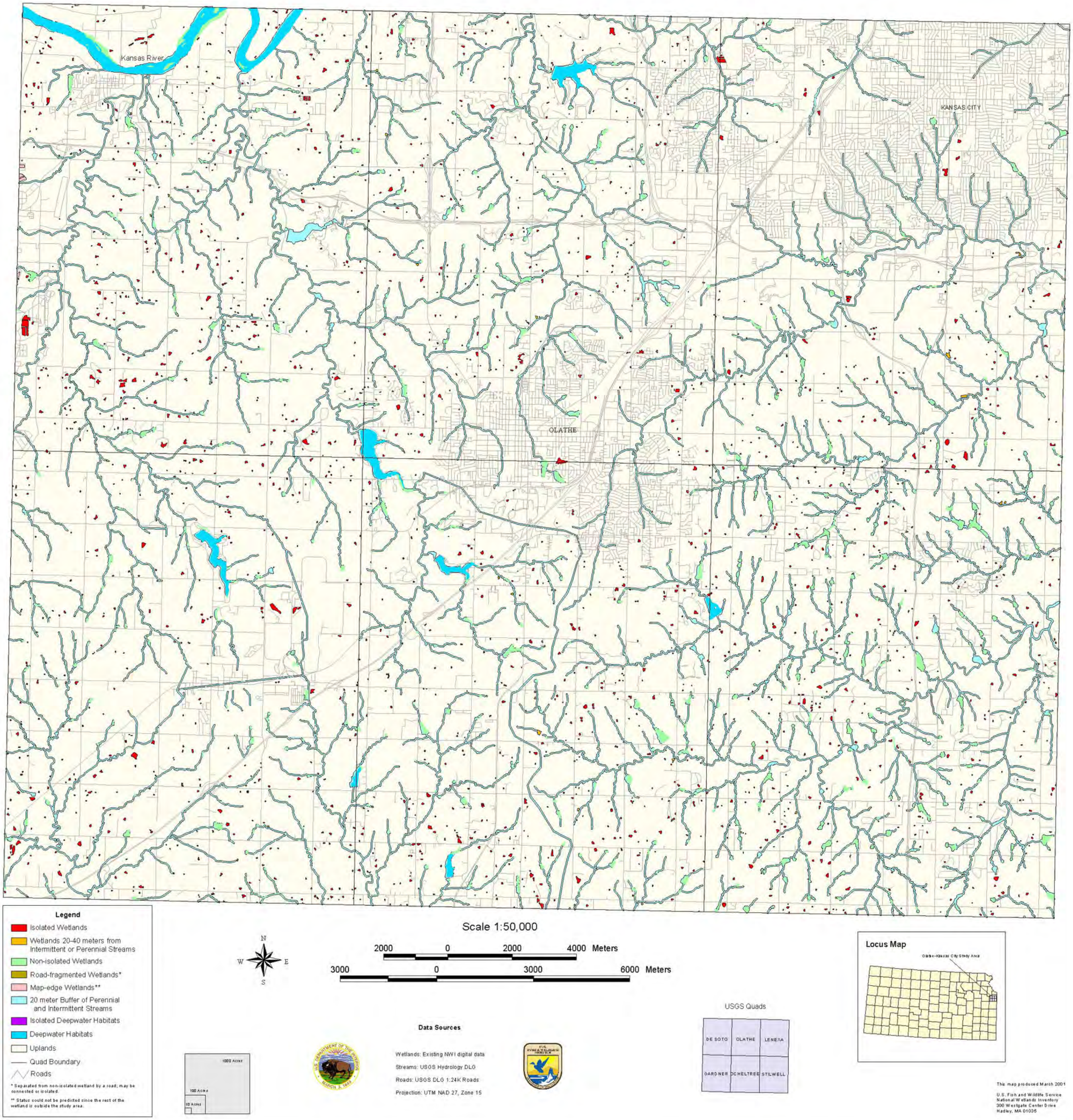
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	10.2	Lacustrine Wetlands:	0.0
PAB:	19.9	Pf:	0.0	PUB:	168.5	Marine Wetlands:	0.0
PEM:	77.8	PFO:	14.8	PUS:	9.8	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Olathe - Kansas City Study Area, Kansas



Study Area: Olathe-Kansas City State: KS FWS Region: 6

Ecoregion: Prairie Parkland (Temperate)

Watershed Region: Missouri Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	223128.6		
Upland Acreage..	219437.0	98.3%	Uplands
Non-Isolated Deepwater Habitats Acreage.	1255.5	0.6%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	2436.1	1.1%	Wetlands
Number of Wetlands.................................	2866		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	16.0	Lacustrine Wetlands:	0.0
PAB:	1884.7	PFO:	107.8	PUB:	116.8	Marine Wetlands:	0.0
PEM:	256.9	Pf:	0.0	PUS:	11.0	Riverine Wetlands:	42.2

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	1118.1	45.9%	2008	70.1%
Scenario 2: (Red and Orange)	1137.8	46.7%	2029	70.8%
Scenario 3: (Red, Orange and Brown)	1194.5	49.0%	2037	71.1%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 18.6 Number: 18

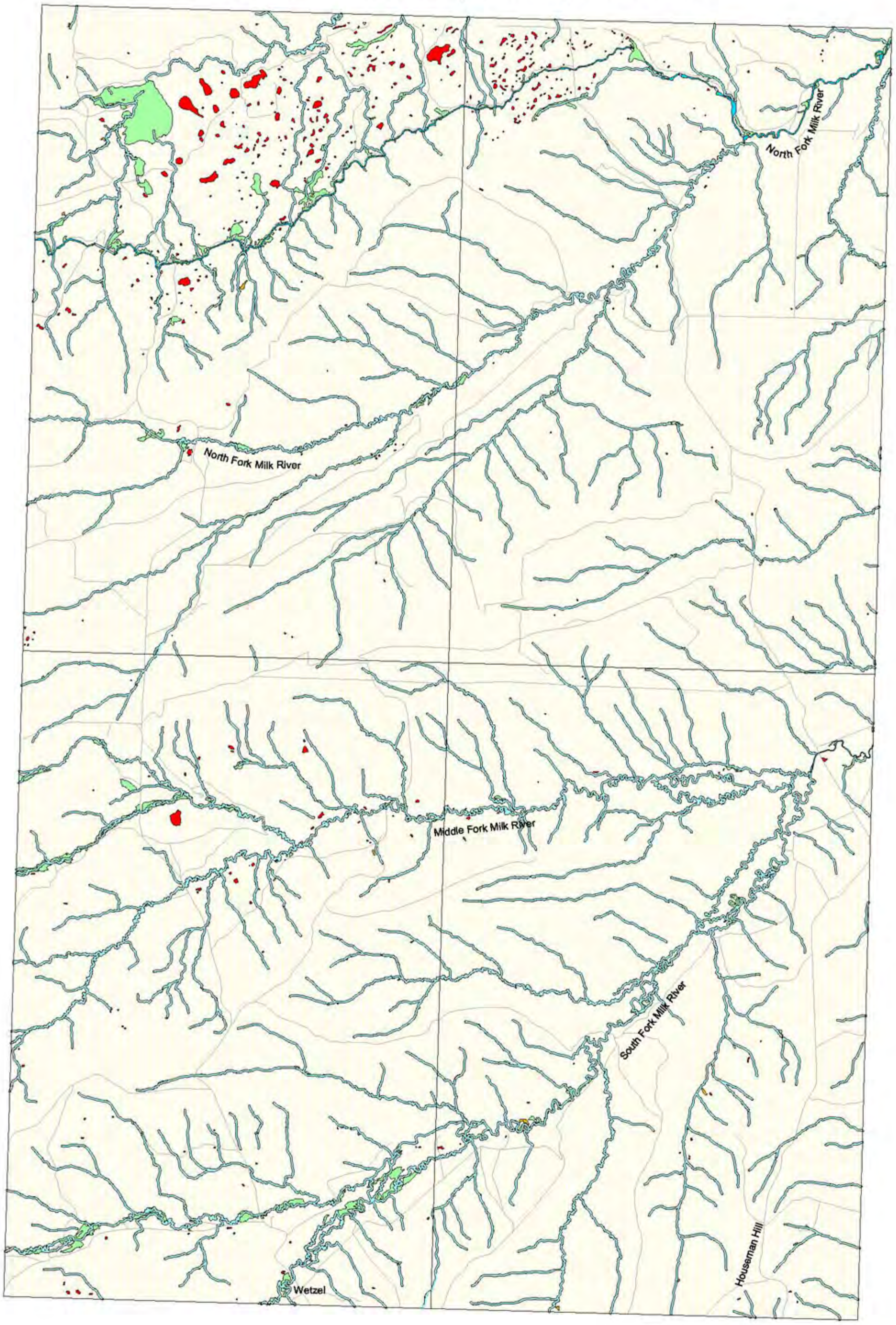
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	2.0	Lacustrine Wetlands:	0.0
PAB:	900.4	Pf:	0.0	PUB:	86.4	Marine Wetlands:	0.0
PEM:	135.2	PFO:	4.7	PUS:	8.9	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Hoodoo Hill Study Area, Montana

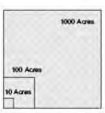


Legend

- Isolated Wetlands
- Wetlands 20-40 meters from Intermittent or Perennial Streams
- Non-isolated Wetlands
- Road-fragmented Wetlands*
- Map-edge Wetlands**
- 20 meter Buffer of Perennial and Intermittent Streams
- Isolated Deepwater Habitats
- Deepwater Habitats
- Uplands
- Quad Boundary
- Roads

* Separated from non-isolated wetland by a road; may be connected or isolated.

** Status could not be predicted since the rest of the wetland is outside the study area.



N W E S

Scale 1:50,000

2000 0 2000 4000 Meters

2 0 2 4 Miles

Data Sources

Wetlands: Existing NWI digital data

Streams: USGS Hydrology DLG

Roads: USGS DLG 1:24K Roads

Projection: UTM NAD 27, Zone 12

USGS Quads

Locus Map

This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: **Hoodoo Hill** State: MT FWS Region: 6

Ecoregion: Great Plains-Palouse Dry Steppe

Watershed Region: Missouri Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	125966.8		
Upland Acreage..	124017.5	98.5%	Uplands
Non-Isolated Deepwater Habitats Acreage.	172.5	0.1%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	1776.8	1.4%	Wetlands
Number of Wetlands.................................	846		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	255.1	Lacustrine Wetlands:	0.0
PAB:	219.1	PFO:	0.0	PUB:	0.0	Marine Wetlands:	0.0
PEM:	1264.0	Pf:	0.0	PUS:	21.4	Riverine Wetlands:	17.1

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	355.7	20.0%	400	47.3%
Scenario 2: (Red and Orange)	375.4	21.1%	448	53.0%
Scenario 3: (Red, Orange and Brown)	375.4	21.1%	448	53.0%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 0.7 Number: 2

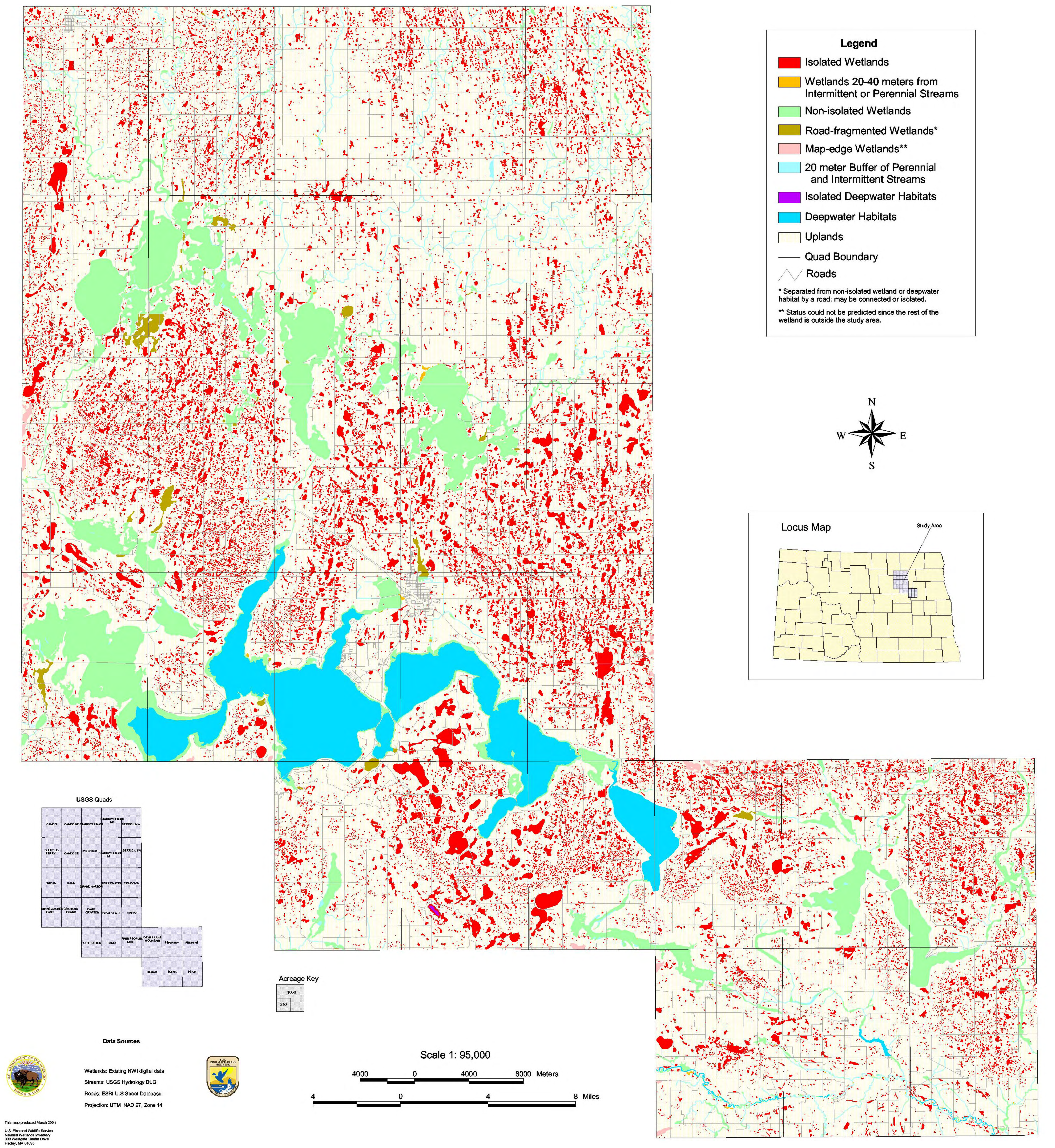
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	6.7	Lacustrine Wetlands:	0.0
PAB:	80.7	Pf:	0.0	PUB:	0.0	Marine Wetlands:	0.0
PEM:	274.0	PFO:	0.0	PUS:	13.9	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Devils Lake Study Area, North Dakota



Study Area: Devils Lake

State: ND FWS Region: 6

Ecoregion: Great Plains Steppe

Watershed Region: Souris-Red-Rainy Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area.....................	925861.6		
Upland Acreage..	750153.2	81.0%	Uplands
Non-Isolated Deepwater Habitats Acreage.	39695.5	4.3%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	38.5		
Wetlands Acreage.....................................	135974.4	14.7%	Wetlands
Number of Wetlands.................................	42327	(Does not inlcude 6,273 point wetlands - see Narrative)	

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	544.5	Lacustrine Wetlands:	38574.0
PAB:	2296.0	PFO:	472.0	PUB:	276.2	Marine Wetlands:	0.0
PEM:	92778.6	Pf:	0.0	PUS:	51.8	Riverine Wetlands:	981.3

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	67017.8	49.3%	41076	97.0%
Scenario 2: (Red and Orange)	67227.4	49.4%	41245	97.4%
Scenario 3: (Red, Orange and Brown)	69777.5	51.3%	41312	97.6%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 1642.4 Number: 280

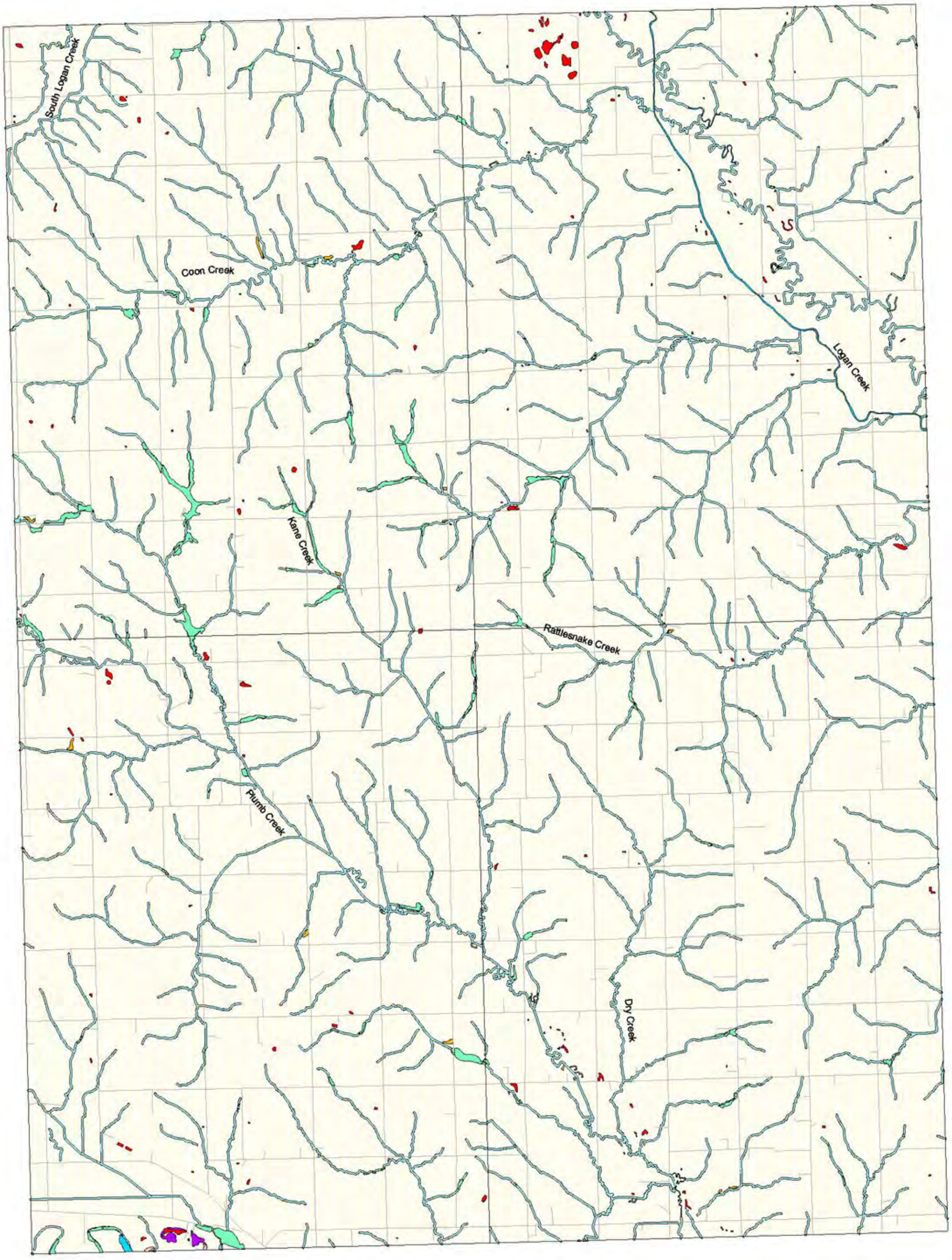
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	287.8	Lacustrine Wetlands:	5774.4
PAB:	1777.9	Pf:	0.0	PUB:	28.4	Marine Wetlands:	0.0
PEM:	58996.7	PFO:	335.6	PUS:	26.6	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Altona Study Area, Nebraska



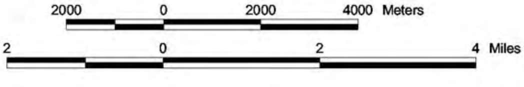
Legend

- Isolated Wetlands
- Wetlands 20-40 meters from Intermittent or Perennial Streams
- Non-isolated Wetlands
- Road-fragmented Wetlands*
- Map-edge Wetlands**
- 20 meter Buffer of Perennial and Intermittent Streams
- Isolated Deepwater Habitats
- Deepwater Habitats
- Uplands
- Quad Boundary
- Roads

* Separated from non-isolated wetland by a road; may be connected or isolated.

** Status could not be predicted since the rest of the wetland is outside the study area.

Scale 1:50,000



Data Sources

Wetlands: Existing NWI digital data

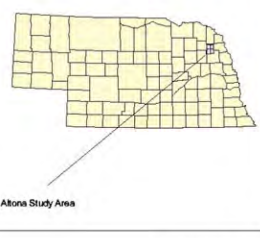
Streams: USGS Hydrology DLG

Roads: USGS DLG 1:24K Roads

Projection: UTM NAD 27, Zone 15

USGS Quads

Locus Map



This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Altona State: NE FWS Region: 6

Ecoregion: Prairie Parkland (Temperate)

Watershed Region: Missouri Region

. . .

STUDY AREA OVERVIEW:

			Percent of Study Area
Total Acreage in Study Area......................	141842.4		
Upland Acreage..	140755.9	99.2%	Uplands
Non-Isolated Deepwater Habitats Acreage.	107.8	0.1%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	29.2		
Wetlands Acreage.....................................	949.5	0.7%	Wetlands
Number of Wetlands.................................	364		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	16.3	Lacustrine Wetlands:	0.0
PAB:	6.9	PFO:	74.8	PUB:	37.9	Marine Wetlands:	0.0
PEM:	808.9	Pf:	0.0	PUS:	4.5	Riverine Wetlands:	0.2

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	191.9	20.2%	155	42.6%
Scenario 2: (Red and Orange)	234.3	24.7%	184	50.5%
Scenario 3: (Red, Orange and Brown)	234.3	24.7%	184	50.5%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 6.4 Number: 5

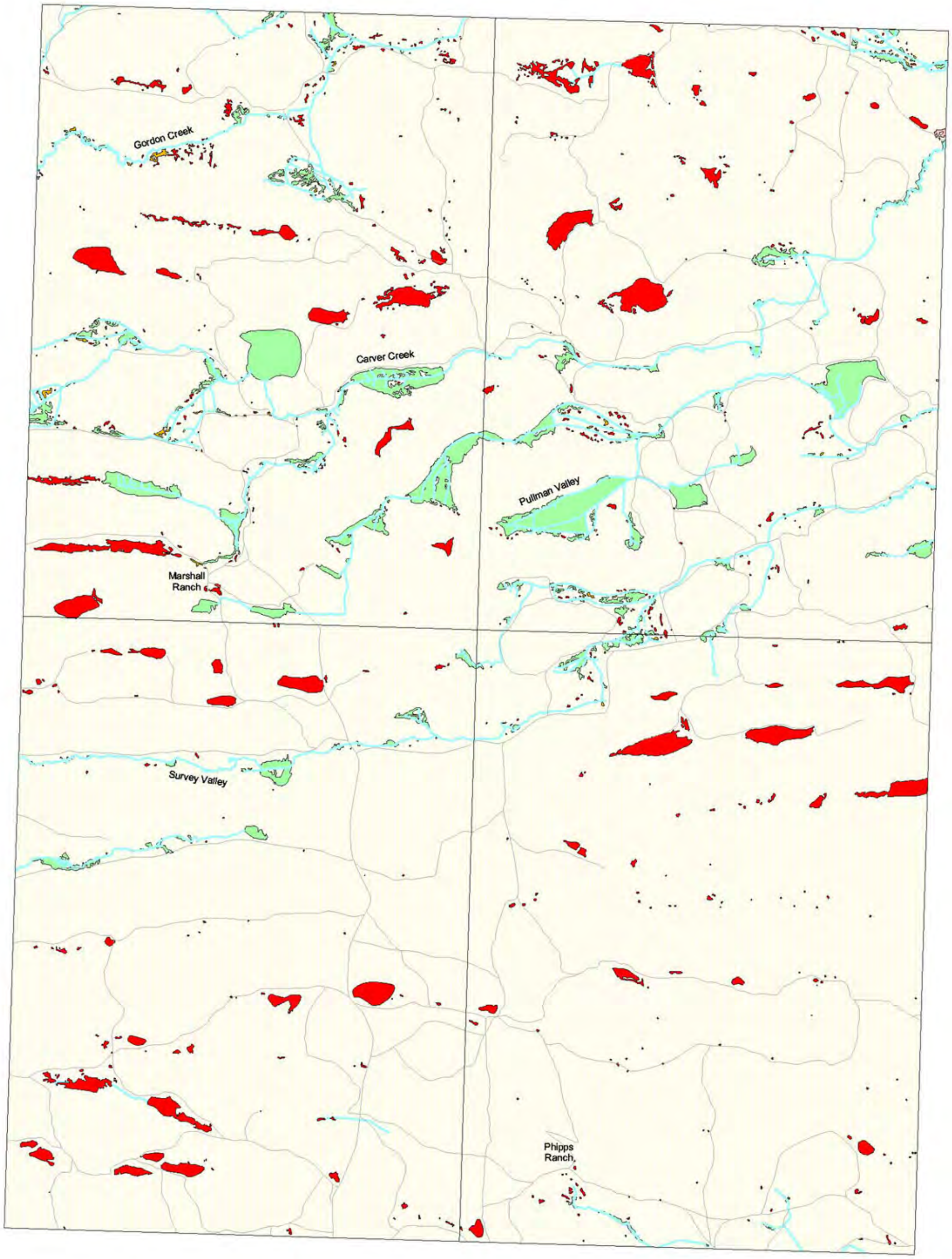
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	0.4	Lacustrine Wetlands:	0.0
PAB:	2.6	Pf:	0.0	PUB:	20.0	Marine Wetlands:	0.0
PEM:	196.5	PFO:	10.2	PUS:	4.5	Riverine Wetlands:	0.2

*** Acreage of Isolated Wetlands based on Scenario 2.

Hill Lake Study Area, Nebraska



Legend

- Isolated Wetlands
- Wetlands 20-40 meters from Intermittent or Perennial Streams
- Non-isolated Wetlands
- Road-fragmented Wetlands*
- Map-edge Wetlands**
- 20 meter Buffer of Perennial and Intermittent Streams
- Isolated Deepwater Habitats
- Deepwater Habitats
- Uplands
- Quad Boundary
- Roads

* Separated from non-isolated wetland by a road; may be connected or isolated.

** Status could not be predicted since the rest of the wetland is outside the study area.

Scale 1:50,000

2000 0 2000 4000 Meters

2 0 2 4 Miles

Data Sources

Wetlands: Existing NWI digital data

Streams: USGS Hydrology DLG

Roads: USGS DLG 1:24K Roads

Projection: UTM NAD 27, Zone 14

USGS Quads

Round Lake	Wolf Lake
Hill Lake	Big Willow Lake

Locus Map

This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: **Hill Lake** State: NE FWS Region: 6

Ecoregion: Great Plains Steppe

Watershed Region: Missouri Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	141327.9		
Upland Acreage..	135426.1	95.8%	Uplands
Non-Isolated Deepwater Habitats Acreage.	0.0	0.0%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	5901.8	4.2%	Wetlands
Number of Wetlands.................................	1006		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	0.0	Lacustrine Wetlands:	1065.4
PAB:	244.6	PFO:	14.1	PUB:	0.0	Marine Wetlands:	0.0
PEM:	4571.9	Pf:	0.0	PUS:	5.5	Riverine Wetlands:	0.4

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	2727.5	46.2%	666	66.2%
Scenario 2: (Red and Orange)	2784.1	47.2%	741	73.7%
Scenario 3: (Red, Orange and Brown)	2787.1	47.2%	742	73.8%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 9.0 Number: 3

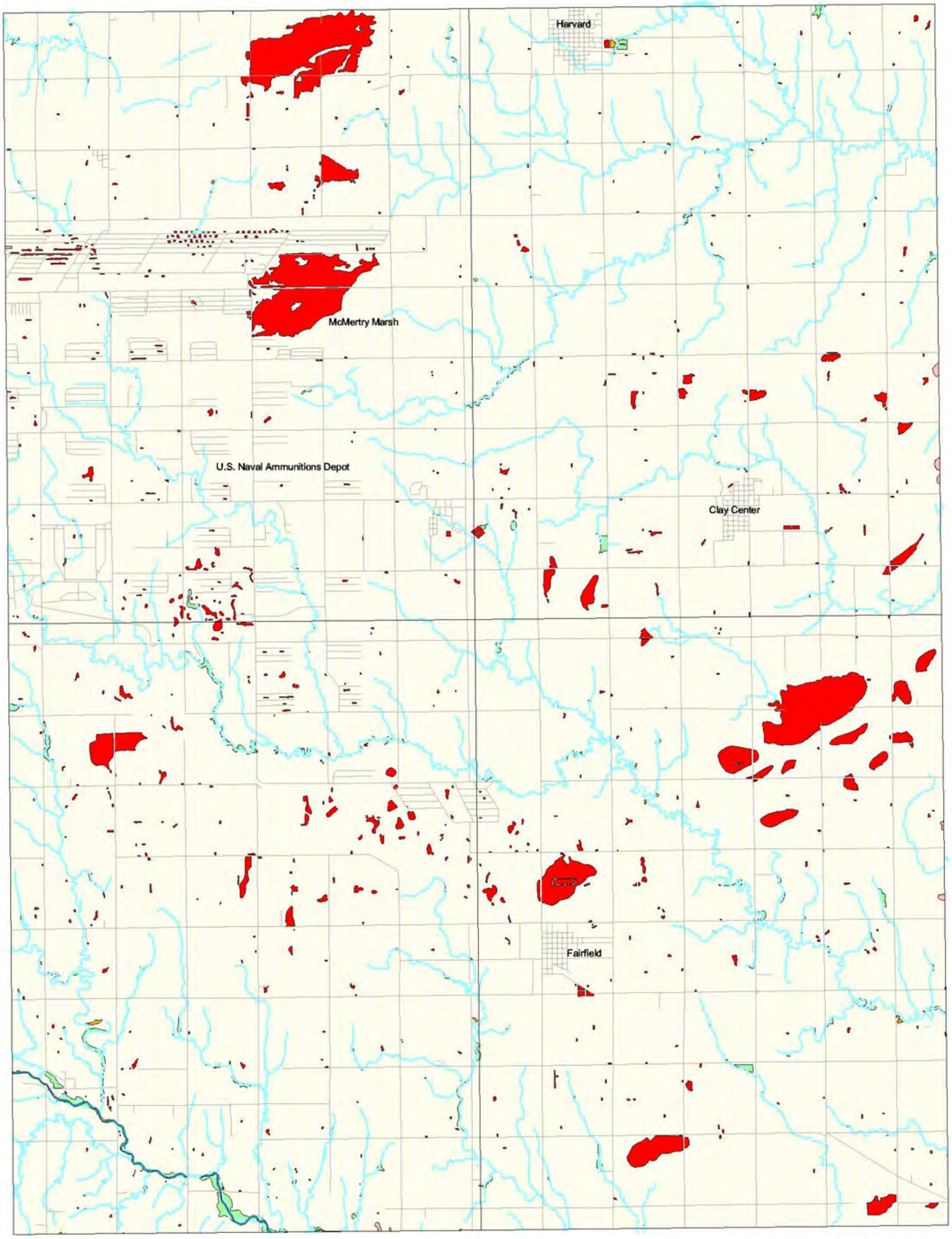
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	0.0	Lacustrine Wetlands:	723.4
PAB:	178.2	Pf:	0.0	PUB:	0.0	Marine Wetlands:	0.0
PEM:	1871.4	PFO:	5.7	PUS:	5.5	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Rainwater Basin Study Area, Nebraska



Legend

- Isolated Wetlands
- Wetlands 20-40 meters from Intermittent or Perennial Streams
- Non-isolated Wetlands
- Road-fragmented Wetlands*
- Map-edge Wetlands**
- 20 meter Buffer of Perennial and Intermittent Streams
- Isolated Deepwater Habitats
- Deepwater Habitats
- Uplands
- Quad Boundary
- Roads

* Separated from non-isolated wetland by a road; may be connected or isolated.

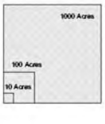
** Status could not be predicted since the rest of the wetland is outside the study area.

N W E S

Scale 1:50,000

2000 0 2000 4000 Meters

2 0 2 4 Miles



Data Sources

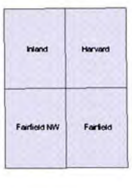
Wetlands: Existing NWI digital data

Streams: USGS Hydrology DLG

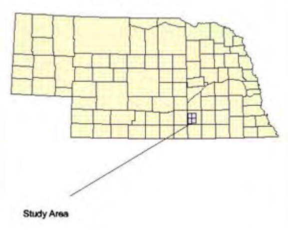
Roads: USGS DLG 1:24K Roads

Projection: UTM NAD 27, Zone 14

USGS Quads



Locus Map



This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Rainwater Basin State: NE FWS Region: 6

Ecoregion: Prairie Parkland (Temperate)

Watershed Region: Missouri Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	145276.3		
Upland Acreage..	140507.1	96.7%	Uplands
Non-Isolated Deepwater Habitats Acreage.	61.1	0.0%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	4708.1	3.2%	Wetlands
Number of Wetlands.................................	1076		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	16.9	Lacustrine Wetlands:	0.0
PAB:	478.0	PFO:	208.7	PUB:	274.5	Marine Wetlands:	0.0
PEM:	3599.4	Pf:	0.0	PUS:	99.4	Riverine Wetlands:	31.1

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	3958.3	84.1%	693	64.4%
Scenario 2: (Red and Orange)	3982.4	84.6%	728	67.7%
Scenario 3: (Red, Orange and Brown)	3982.4	84.6%	728	67.7%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 33.5 Number: 15

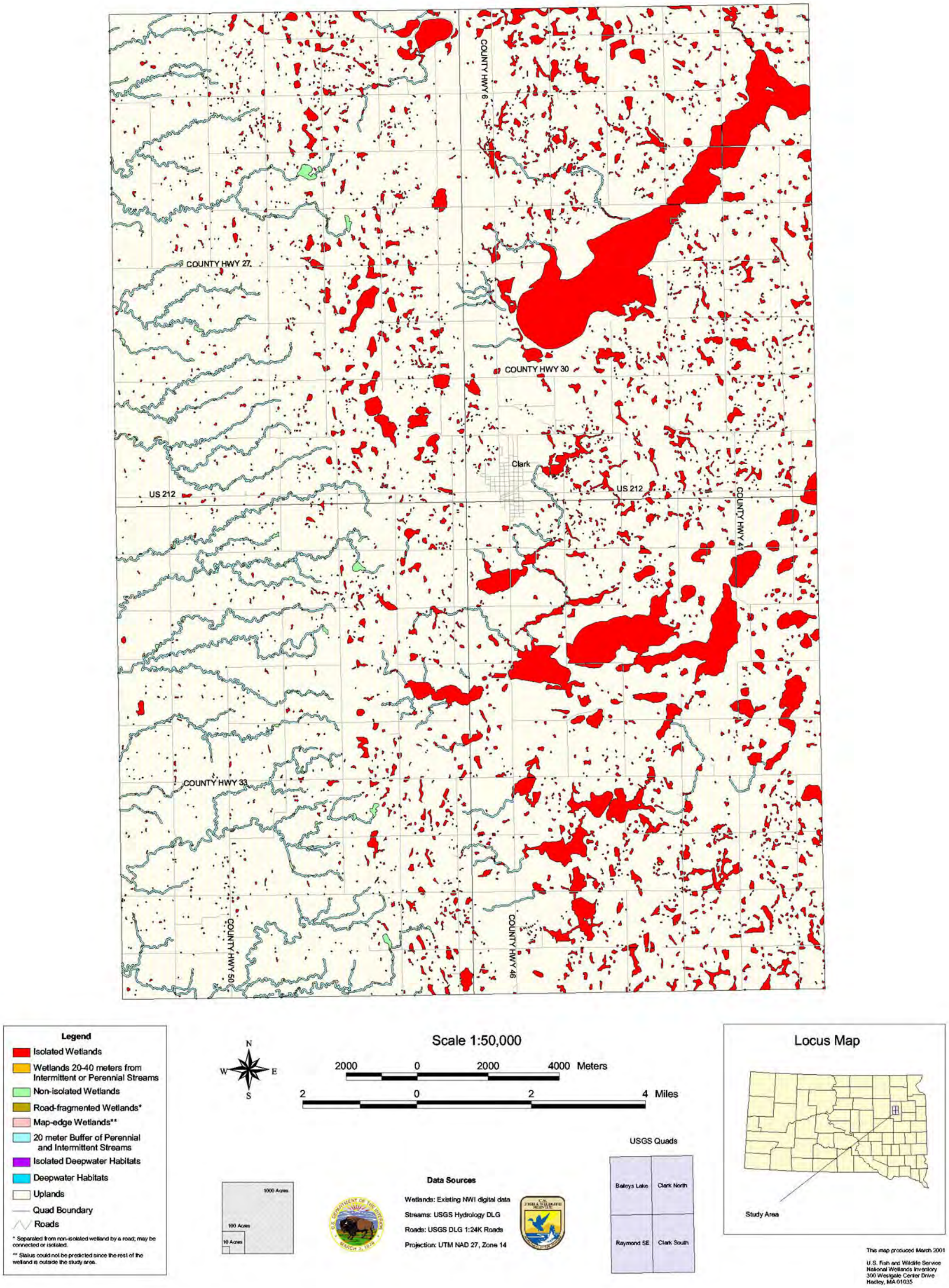
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	4.6	Lacustrine Wetlands:	0.0
PAB:	298.9	Pf:	0.0	PUB:	198.8	Marine Wetlands:	0.0
PEM:	3359.4	PFO:	41.5	PUS:	79.1	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Clark Study Area, South Dakota



Study Area: Clark State: SD FWS Region: 6

Ecoregion: Prairie Parkland (Temperate) / Great Plains Steppe

Watershed Region: Missouri Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	135541.8		
Upland Acreage..	120674.2	89.0%	Uplands
Non-Isolated Deepwater Habitats Acreage.	0.0	0.0%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	14867.6	11.0%	Wetlands
Number of Wetlands.................................	4106		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	27.8	Lacustrine Wetlands:	441.5
PAB:	760.5	PFO:	256.5	PUB:	21.2	Marine Wetlands:	0.0
PEM:	13360.1	Pf:	0.0	PUS:	0.0	Riverine Wetlands:	0.0

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	14585.7	98.1%	3853	93.8%
Scenario 2: (Red and Orange)	14597.4	98.2%	3886	94.6%
Scenario 3: (Red, Orange and Brown)	14597.4	98.2%	3886	94.6%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 0.7 Number: 2

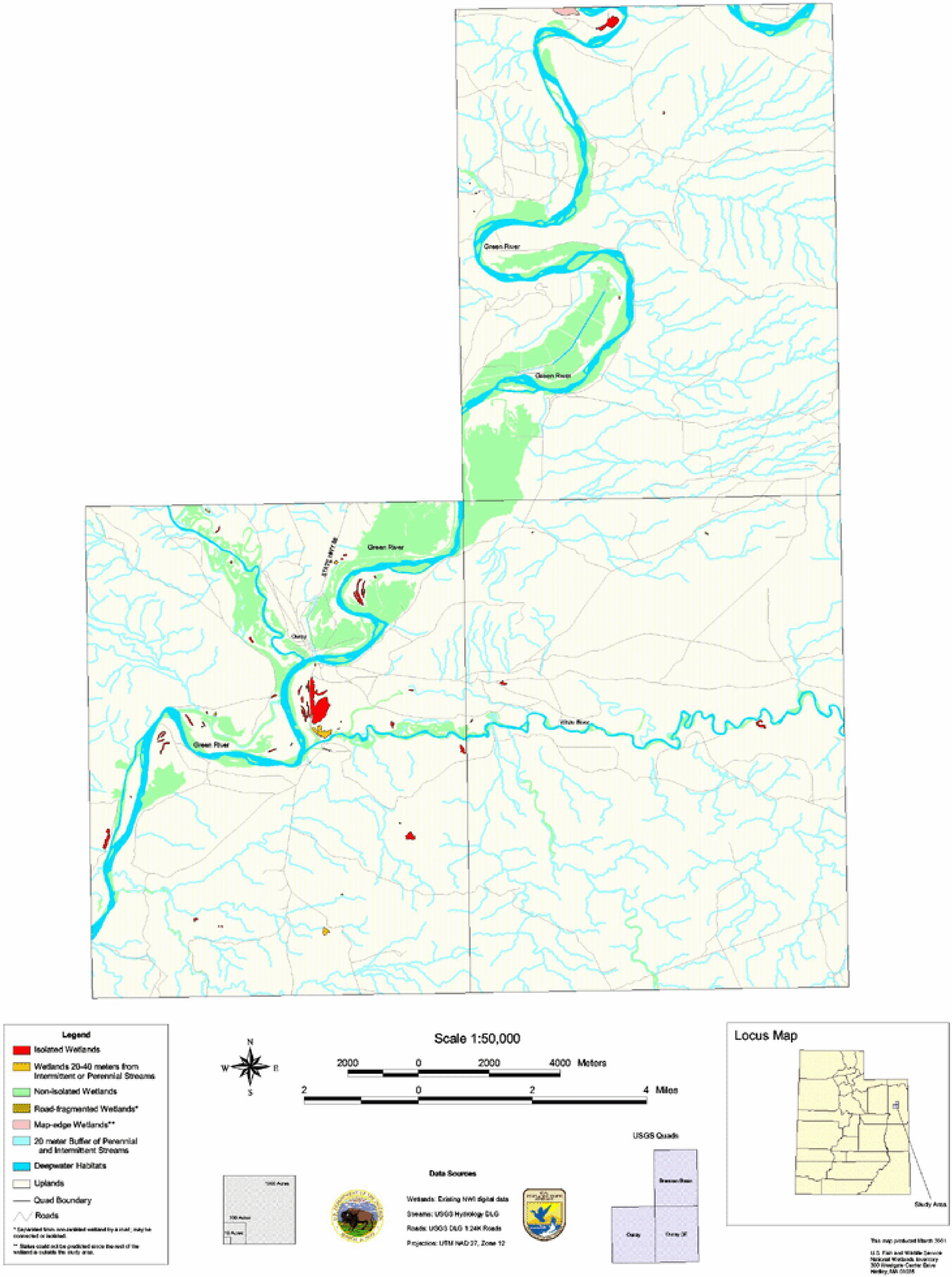
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	27.8	Lacustrine Wetlands:	441.5
PAB:	640.0	Pf:	0.0	PUB:	21.3	Marine Wetlands:	0.0
PEM:	13213.9	PFO:	253.0	PUS:	0.0	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Green River Study Area, Utah



Study Area: Green River State: UT FWS Region: 6

Ecoregion: Intermountain Semi-Desert and Desert Province

Watershed Region: Upper Colorado Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	109610.8		
Upland Acreage..	99983.3	91.2%	Uplands
Non-Isolated Deepwater Habitats Acreage.	2342.1	2.1%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	7285.4	6.6%	Wetlands
Number of Wetlands.................................	304		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	1733.6	Lacustrine Wetlands:	1218.9
PAB:	23.1	PFO:	652.6	PUB:	1.0	Marine Wetlands:	0.0
PEM:	2826.4	Pf:	0.0	PUS:	200.7	Riverine Wetlands:	629.0

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	216.3	3.0%	55	18.1%
Scenario 2: (Red and Orange)	248.7	3.4%	62	20.4%
Scenario 3: (Red, Orange and Brown)	249.3	3.4%	63	20.7%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 29.8 Number: 1

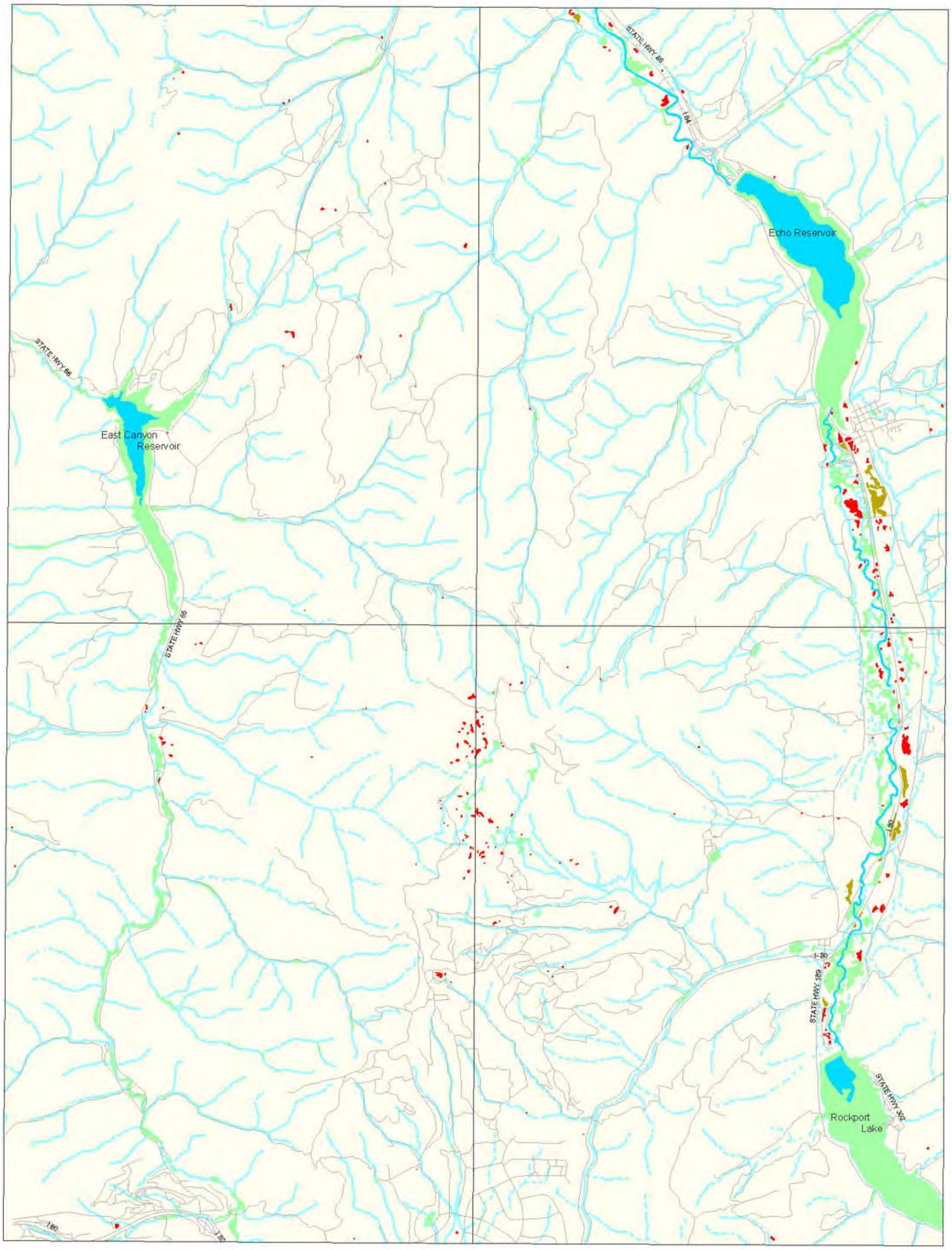
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	31.3	Lacustrine Wetlands:	0.0
PAB:	0.2	Pf:	0.0	PUB:	0.7	Marine Wetlands:	0.0
PEM:	145.0	PFO:	12.4	PUS:	59.2	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Rockport Lake Study Area, Utah



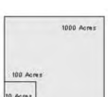
Legend

- Isolated Wetlands
- Wetlands 20-40 meters from Intermittent or Perennial Streams
- Non-isolated Wetlands
- Road-fragmented Wetlands*
- Map-edge Wetlands**
- 20 meter Buffer of Perennial and Intermittent Streams
- Isolated Deepwater Habitats
- Deepwater Habitats
- Uplands
- Quad Boundary
- Roads

* Separated from non-isolated wetland or deepwater habitat by a road; may be connected or isolated.

** Status could not be predicted since the rest of the wetland is outside the study area.

Scale 1:50,000



Data Sources

Wetlands: Existing NWI digital data

Streams: USGS Hydrology DLG

Roads: ESRI U.S. Street Database

Projection: UTM NAD 27, Zone 12

USGS Quads

Locus Map

This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: **Rockport Lake** State: UT FWS Region: 6

Ecoregion: Southern Rocky Mountain Steppe-Open Woodland-Coniferous Forest-Alpine Meadow

Watershed Region: Great Basin Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	144460.6		
Upland Acreage..	139895.0	96.8%	Uplands
Non-Isolated Deepwater Habitats Acreage.	1107.6	0.8%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	3458.0	2.4%	Wetlands
Number of Wetlands.................................	632		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	315.2	Lacustrine Wetlands:	2089.4
PAB:	168.6	PFO:	87.9	PUB:	0.0	Marine Wetlands:	0.0
PEM:	768.6	Pf:	0.0	PUS:	23.9	Riverine Wetlands:	3.5

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	122.3	3.5%	151	23.9%
Scenario 2: (Red and Orange)	166.0	4.8%	217	34.3%
Scenario 3: (Red, Orange and Brown)	257.9	7.5%	232	36.7%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 0.0 Number: 0

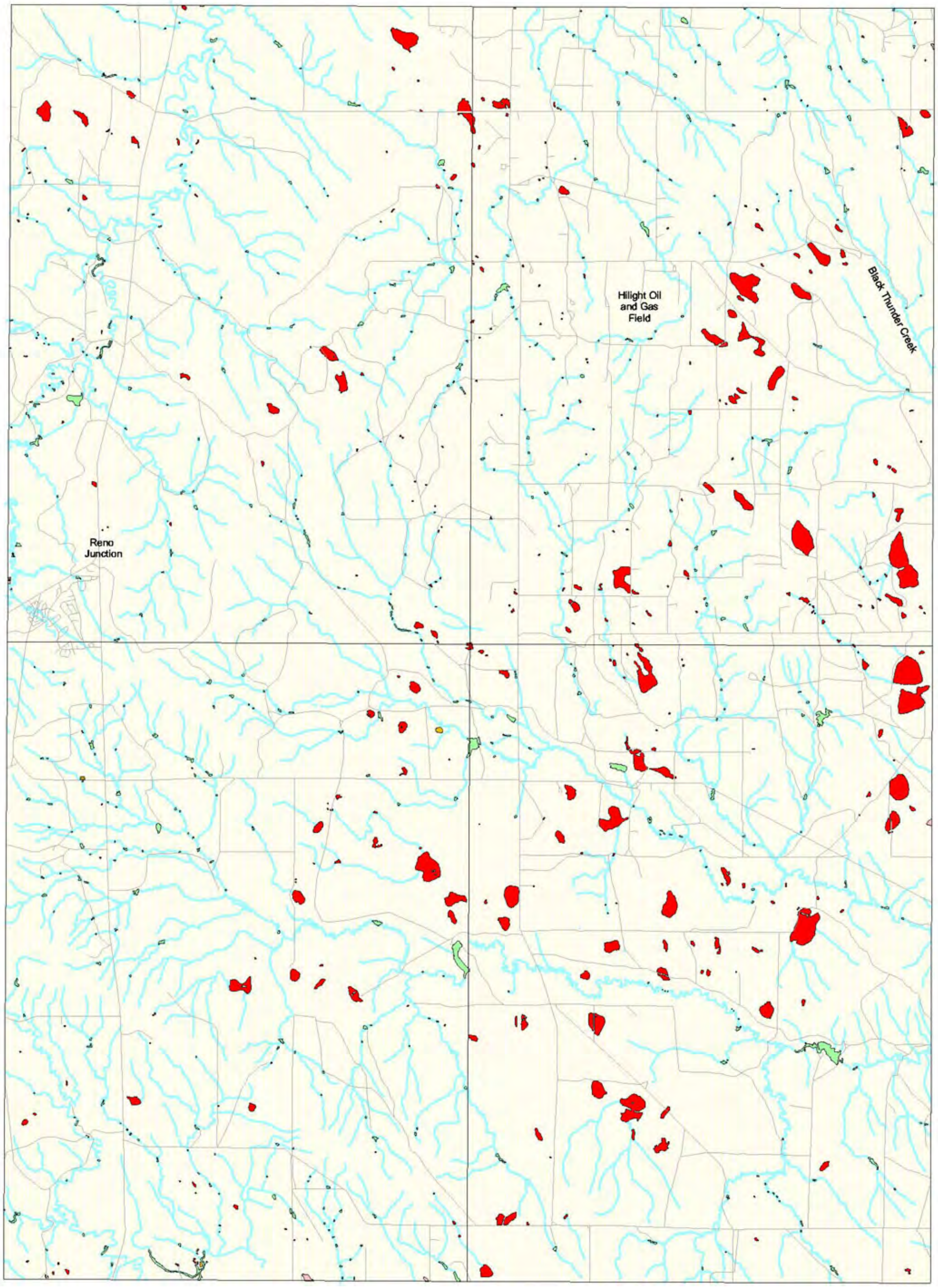
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	1.9	Lacustrine Wetlands:	0.0
PAB:	28.6	Pf:	0.0	PUB:	0.0	Marine Wetlands:	0.0
PEM:	133.4	PFO:	0.0	PUS:	2.2	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Black Thunder Study Area, Wyoming



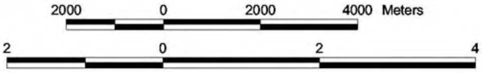
Legend

- Isolated Wetlands
- Wetlands 20-40 meters from Intermittent or Perennial Streams
- Non-isolated Wetlands
- Road-fragmented Wetlands*
- Map-edge Wetlands**
- 20 meter Buffer of Perennial and Intermittent Streams
- Isolated Deepwater Habitats
- Deepwater Habitats
- Uplands
- Quad Boundary
- Roads

* Separated from non-isolated wetland or deepwater habitat by a road; may be connected or isolated.

** Status could not be predicted since the rest of the wetland is outside the study area.

Scale 1:50,000



Data Sources

Wetlands: Existing NWI digital data

Streams: USGS Hydrology DLG

Roads: USGS DLG 1:24K Roads

Projection: UTM NAD 27, Zone 13

USGS Quads

Locus Map

Study Area

This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Black Thunder State: WY FWS Region: 6

Ecoregion: Great Plains-Palouse Dry Steppe

Watershed Region: Missouri Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	138098.4		
Upland Acreage..	135863.2	98.4%	Uplands
Non-Isolated Deepwater Habitats Acreage.	0.0	0.0%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	2235.2	1.6%	Wetlands
Number of Wetlands.................................	887		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	0.0	Lacustrine Wetlands:	32.2
PAB:	115.5	PFO:	0.0	PUB:	11.4	Marine Wetlands:	0.0
PEM:	2064.3	Pf:	0.0	PUS:	11.9	Riverine Wetlands:	0.0

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	1794.8	80.3%	367	41.4%
Scenario 2: (Red and Orange)	1803.9	80.7%	387	43.6%
Scenario 3: (Red, Orange and Brown)	1803.9	80.7%	388	43.7%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 12.6 Number: 8

. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

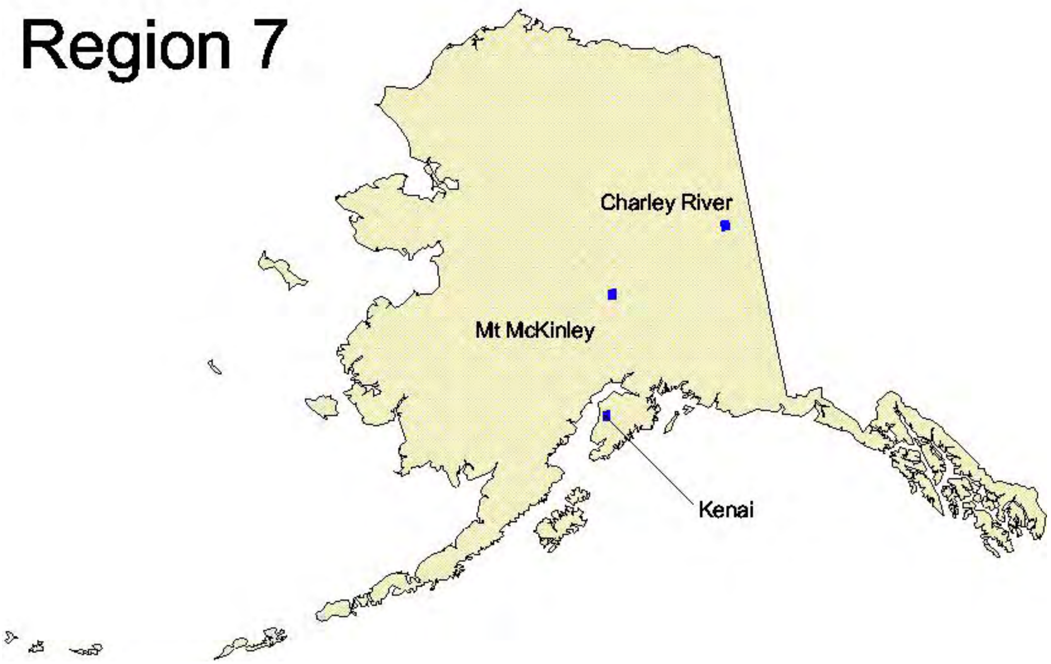
						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	0.0	Lacustrine Wetlands:	0.0
PAB:	23.1	Pf:	0.0	PUB:	9.0	Marine Wetlands:	0.0
PEM:	1759.4	PFO:	0.0	PUS:	3.3	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Study Results

Study findings are reported for each study area below. Data for individual study areas are arranged by U.S. Fish and Wildlife Service Region. For each Region, there is a general discussion of the study results, a map showing the location of the study sites, a summary table of the findings, detailed data summary for each area, and a special wetland classification map for each study area. The latter two products are represented as "additional data links" within the regional summary table (first column). Simply click on the word "map" or "data" and the pertinent map and data will be displayed. *Please allow a minute or so for the map to appear. Note that printed maps may appear somewhat skewed since their projections reflect the curvature of the Earth.*

Region 7 (Alaska)



Three study sites were analyzed in Alaska: Charley River, Kenai, and Mount McKinley. *Table 3-7* presents a summary of the data for these study areas.

Percent of Study Areas Covered by Wetlands

Nearly half of two study areas was comprised of wetlands: Charley River (46%) and Mount McKinley (45%). The Kenai study site had 20 percent of its area represented by wetlands.

Percent of Wetland Area Identified as Isolated

Isolated wetland acreage was most extensive within the Kenai study area. About 25 percent of its wetland area was defined as isolated. Mount McKinley and Charley River had 5 percent and 4 percent of their acreage, respectively, mapped in this category. Palustrine scrub-shrub wetland was the predominant isolated type in all study areas. Palustrine emergent wetland was also a common isolated type in the Kenai location.

Percent of Wetlands (Number) Classified as Isolated

All three study areas had more than 60 percent of their wetlands designated as isolated. Isolated wetlands represented about 95 percent of Kenai wetlands. Mount McKinley had 83-84 percent of its wetlands isolated.

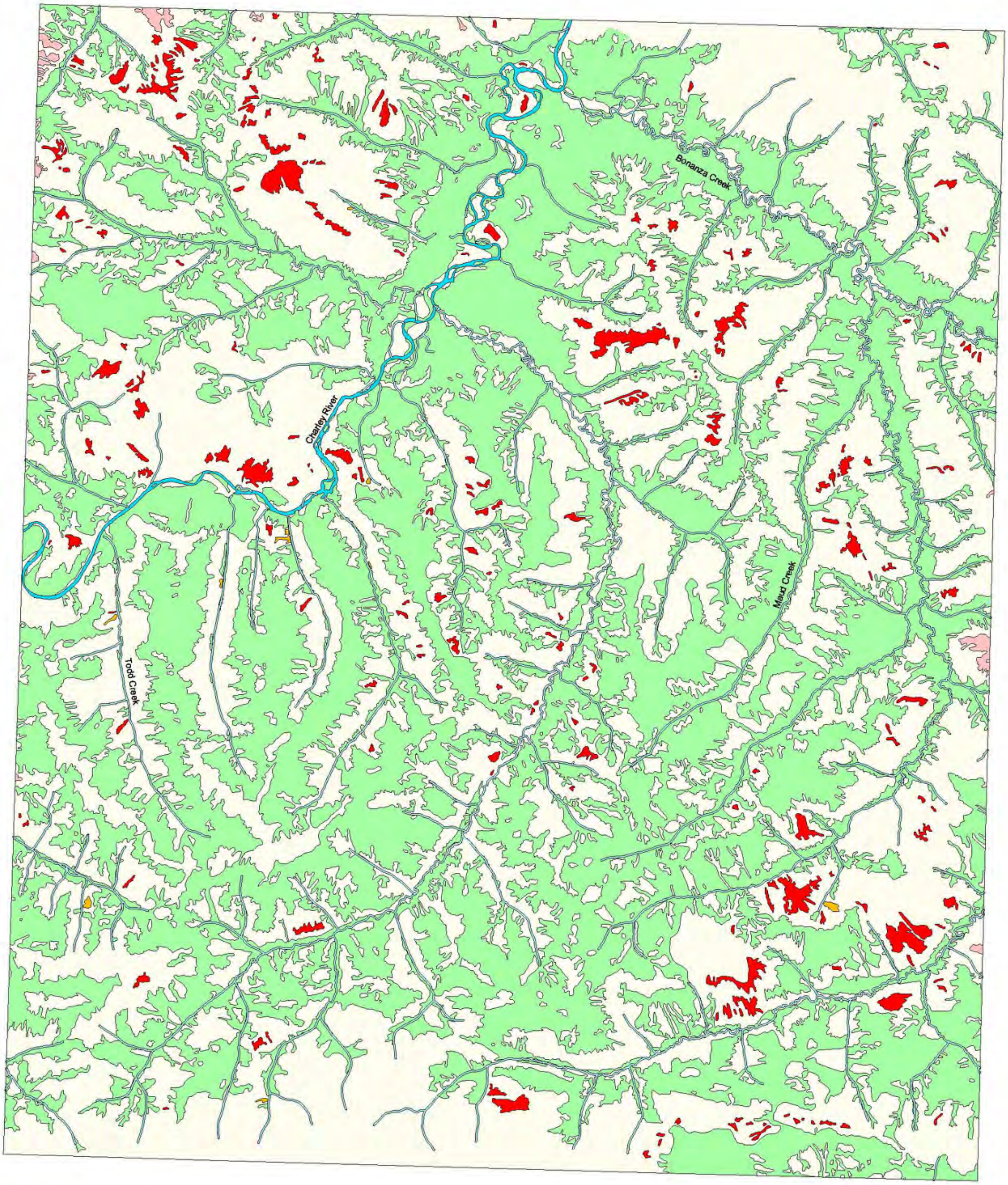
Table 3-7. Summary data for study sites in Region 7. (Note: This table should be printed in landscape orientation.)

								Isolated Wetlands					
Additional Data Links	Study Area	State	Acreage in Study Area	Wetland Acreage	Wetlands % of Study Area	Number of Wetlands	Deepwater Habitats % of Study Area	Scenario 1 Area Percent of Total Wetlands	Scenario 2 Area Percent of Total Wetlands	Scenario 3 Area Percent of Total Wetlands	Scenario 1 Count Percent of Total Wetlands	Scenario 2 Count Percent of Total Wetlands	Scenario 3 Count Percent of Total Wetlands
MAP DATA	Charley River	AK	161603.7	74883.7	46.3%	384	0.4%	3.7%	3.8%	3.8%	63.3%	66.4%	66.4%

MAP DATA	Kenai	AK	142311.7	28149.8	19.8%	1254	10.5%	23.4%	23.5%	24.9%	96.3%	96.6%	96.7%
MAP DATA	Mount McKinley	AK	170681.6	77442.0	45.4%	323	0.0%	4.7%	5.1%	5.1%	82.7%	83.9%	83.9%

[Back to Table of Contents] [Home] [Go to next Section]

Charley River Study Area, Alaska



Legend

- Isolated Wetlands
- Wetlands 20-40 meters from Intermittent or Perennial Streams
- Non-isolated Wetlands
- Road-fragmented Wetlands*
- Map-edge Wetlands**
- 20 meter Buffer of Perennial and Intermittent Streams
- Isolated Deepwater Habitats
- Deepwater Habitats
- Uplands
- Quad Boundary
- Roads

* Separated from non-isolated wetland or deepwater habitat by a road; may be connected or isolated.

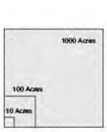
** Status could not be predicted since the rest of the wetland is outside the study area.

N W E S

Scale 1:50,000

2000 0 2000 4000 Meters

2 0 2 4 Miles



Data Sources

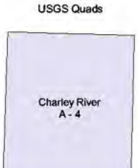
Wetlands: Existing NWI digital data

Streams: USGS Hydrology DLG

Roads: No existing roads in study area

Projection: UTM NAD 27, Zone 7

USGS Quads



Locus Map

This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Charley River State: AK FWS Region: 7

Ecoregion: Upper Yukon Tagya-Meadow

Watershed Region: Alaska Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	161603.7		
Upland Acreage..	86089.4	53.3%	Uplands
Non-Isolated Deepwater Habitats Acreage.	630.6	0.4%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	74883.7	46.3%	Wetlands
Number of Wetlands.................................	384		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	72563.6	Lacustrine Wetlands:	0.0
PAB:	11.8	PFO:	358.1	PUB:	48.5	Marine Wetlands:	0.0
PEM:	1679.5	Pf:	0.0	PUS:	0.0	Riverine Wetlands:	222.2

. . .

ESTIMATES FOR ISOLATED WETLANDS:

SCENARIO*	Area: Acreage	Area: Percent of Total Wetlands**	Number: Count	Number: Percent of Total Wetlands**
Scenario 1: (Red)	2772.8	3.7%	243	63.3%
Scenario 2: (Red and Orange)	2826.5	3.8%	255	66.4%
Scenario 3: (Red, Orange and Brown)	2826.5	3.8%	255	66.4%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 282.4 Number: 21

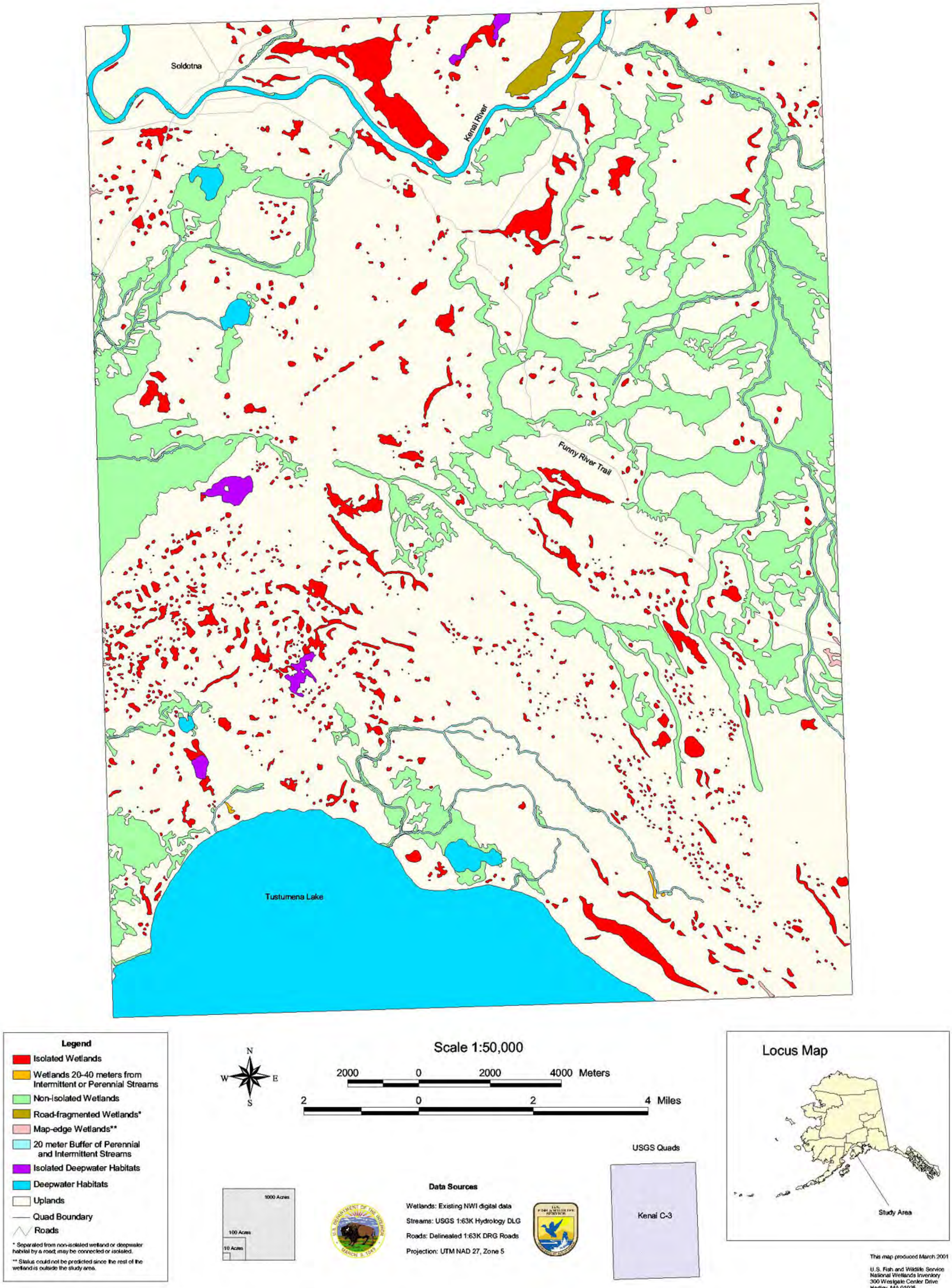
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	2653.4	Lacustrine Wetlands:	0.0
PAB:	0.0	Pf:	0.0	PUB:	6.6	Marine Wetlands:	0.0
PEM:	160.7	PFO:	5.7	PUS:	0.0	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Kenai Study Area, Alaska



This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Kenai State: AK FWS Region: 7

Ecoregion: Coastal Trough Humid Tayga

Watershed Region: Alaska Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	142311.7		
Upland Acreage..	99233.9	69.7%	Uplands
Non-Isolated Deepwater Habitats Acreage.	14524.5	10.5%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	403.4		
Wetlands Acreage.....................................	28149.8	19.8%	Wetlands
Number of Wetlands.................................	1254		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	22112.6	Lacustrine Wetlands:	0.0
PAB:	3.2	PFO:	876.5	PUB:	376.5	Marine Wetlands:	0.0
PEM:	4780.9	Pf:	0.0	PUS:	0.0	Riverine Wetlands:	0.0

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	6597.9	23.4%	1208	96.3%
Scenario 2: (Red and Orange)	6620.6	23.5%	1211	96.6%
Scenario 3: (Red, Orange and Brown)	7011.6	24.9%	1213	96.7%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 72.9 Number: 13

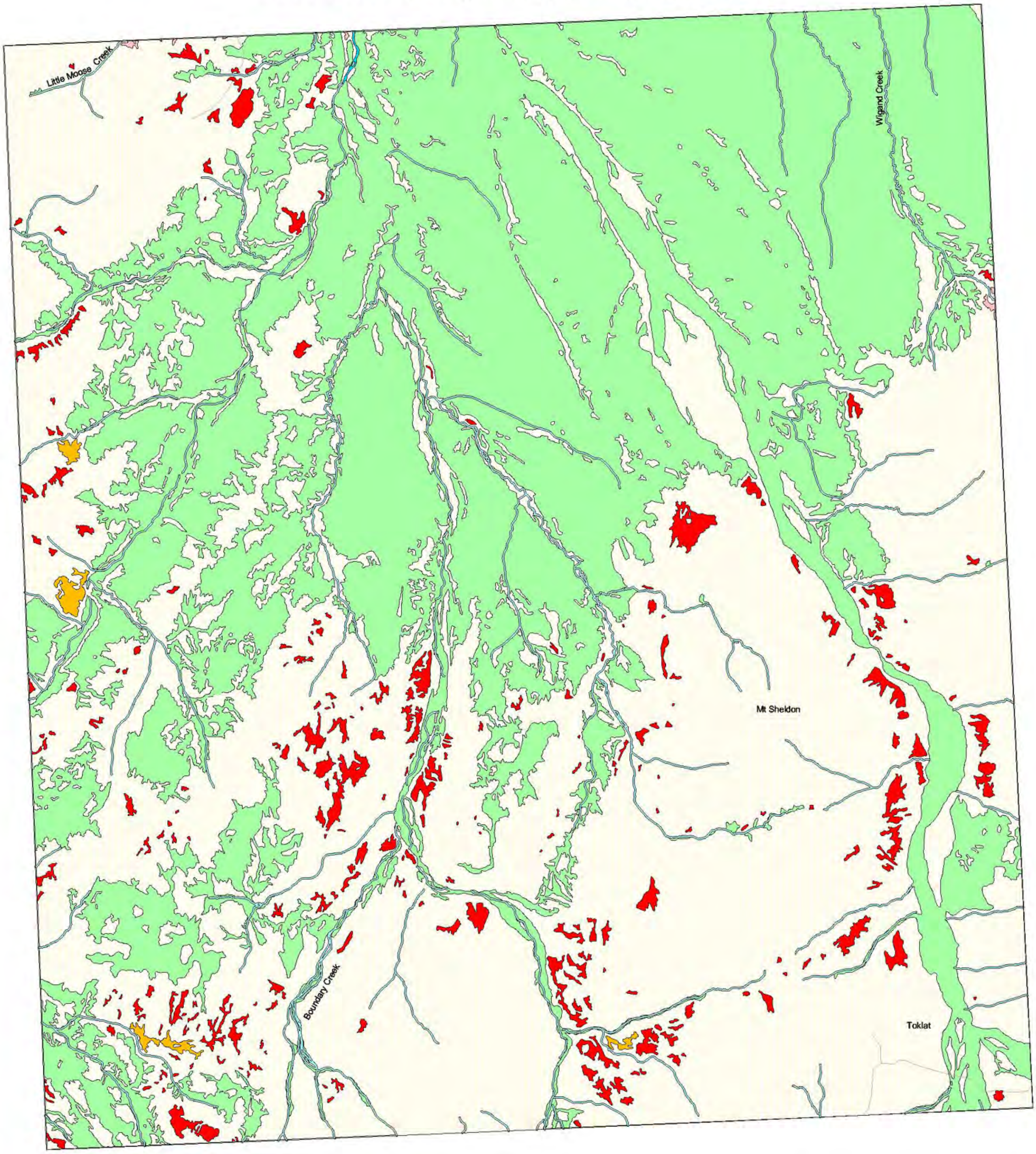
. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	4318.7	Lacustrine Wetlands:	0.0
PAB:	3.2	Pf:	0.0	PUB:	202.0	Marine Wetlands:	0.0
PEM:	1945.1	PFO:	151.5	PUS:	0.0	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Mount McKinley Study Area, Alaska



Legend

- Isolated Wetlands
- Wetlands 20-40 meters from Intermittent or Perennial Streams
- Non-isolated Wetlands
- Road-fragmented Wetlands*
- Map-edge Wetlands**
- 20 meter Buffer of Perennial and Intermittent Streams
- Isolated Deepwater Habitats
- Deepwater Habitats
- Uplands
- Quad Boundary
- Roads

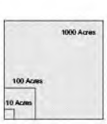
* Separated from non-isolated wetland or deepwater habitat by a road; may be connected or isolated.

** Status could not be predicted since the rest of the wetland is outside the study area.

Scale 1:50,000

2000 0 2000 4000 Meters

2 0 2 4 Miles



Data Sources

Wetlands: Existing NWI digital data

Streams: USGS Hydrology DLG

Roads: ESRI U.S. Streets Database

Projection: UTM NAD 27, Zone 5

USGS Quads

Locus Map

This map produced March 2001

U.S. Fish and Wildlife Service
National Wetlands Inventory
300 Westgate Center Drive
Hadley, MA 01035

Study Area: Mount McKinley State: AK FWS Region: 7

Ecoregion: Alaska Range Humid Tayga-Tundra-Meadow

Watershed Region: Alaska Region

. . .

STUDY AREA OVERVIEW:

		Percent of Study Area	
Total Acreage in Study Area......................	170681.6		
Upland Acreage..	93219.5	54.6%	Uplands
Non-Isolated Deepwater Habitats Acreage.	20.1	0.0%	All Deepwater Habitats
Isolated Deepwater Habitats Acreage........	0.0		
Wetlands Acreage.....................................	77442.0	45.4%	Wetlands
Number of Wetlands.................................	323		

. . .

ACREAGE OF WETLAND TYPES:

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	71522.8	Lacustrine Wetlands:	43.5
PAB:	28.6	PFO:	54.2	PUB:	121.4	Marine Wetlands:	0.0
PEM:	1217.8	Pf:	0.0	PUS:	0.0	Riverine Wetlands:	4453.6

. . .

ESTIMATES FOR ISOLATED WETLANDS:

	Area		Number	
SCENARIO*	Acreage	Percent of Total Wetlands**	Count	Percent of Total Wetlands**
Scenario 1: (Red)	3664.9	4.7%	267	82.7%
Scenario 2: (Red and Orange)	3971.2	5.1%	271	83.9%
Scenario 3: (Red, Orange and Brown)	3971.2	5.1%	271	83.9%

* Scenarios range from restrictive to broad interpretation of isolated wetlands, see Methods for description.

** Map-edge isolated wetlands not included: Acreage: 43.1 Number: 8

. . .

ACREAGE OF ISOLATED WETLAND TYPES:***

						Estuarine Wetlands:	0.0
Palustrine Wetlands:				PSS:	3762.0	Lacustrine Wetlands:	0.0
PAB:	0.0	Pf:	0.0	PUB:	19.0	Marine Wetlands:	0.0
PEM:	190.3	PFO:	0.0	PUS:	0.0	Riverine Wetlands:	0.0

*** Acreage of Isolated Wetlands based on Scenario 2.

Section 4. Summary

The term "isolated wetlands" is a relative one that can be defined from various perspectives, especially geographic, hydrologic, and ecologic. Geographic isolation is the easiest to determine since it describes the position of a wetland on the landscape, with an isolated wetland being completely surrounded by upland (no outlet). The other definitions of isolated wetland require more detailed examinations of hydrologic interactions (surface and subsurface) and ecological relationships. For this report, the Service adopted a geographic or landscape definition of isolated wetland, since it facilitated analysis of existing digital wetland data through GIS technology.

In this report, the Service described 19 types of isolated wetlands. Many of the types are specific to certain geographic areas, while others (e.g., woodland vernal pools and sinkhole wetlands) occur in numerous regions across the country. While this listing is extensive, it is not comprehensive. It should, however, encompass most of the common types found across the country and provide some perspective on the nationwide diversity of these wetlands. The discussion of these types included brief descriptions of their geographic location, ecology, and current threats from development.

Since national estimates of the extent of geographically isolated wetlands do not exist, the Service conducted a study to estimate the extent of these wetlands in selected areas. Seventy-two study sites representing a wide range of physiographic and climatic conditions were examined using GIS techniques. The study showed that isolated wetlands represent a significant component of the Nation's wetlands. Many of the areas where isolated wetlands predominated were regions possessing wetlands described in Section 2 of this report (e.g., prairie pothole wetlands, Rainwater Basin wetlands, playa wetlands, West Coast vernal pools, wetlands of the Washington's Channeled Scablands, salt flat wetlands, sinkhole wetlands, and Nebraska Sandhills wetlands). In some areas, shallow ponds (natural or created) represented a large proportion of the area's isolated wetlands. Isolated wetlands appeared to be most abundant in the subhumid to arid regions of the country where mean annual precipitation is less than 24 inches (U.S. Geological Survey 1970) and in Florida's karst topography. Although they may be geographically isolated, many of these wetlands are actually linked hydrologically to other wetlands or streams by subsurface flows.

Eight of the study areas had more than half of their wetland acreage designated as isolated under Scenario 1 - the most restrictive scenario evaluated (*Table 4-1*). These areas included: 1) Tahoka, Texas (playa wetlands), 2) Tokio, Texas (playa wetlands), 3) Four Mile Flat, Nevada (salt flat wetlands), 4) Clark, South Dakota (prairie potholes), 5) Rainwater Basin, Nebraska (Rainwater Basin wetlands), 6) Black Thunder, Wyoming (emergent wetlands), 7) Lincoln County, Washington (Channeled Scablands wetlands), and 8) Bluffton, Indiana (mostly forested wetlands). These sites represented 11 percent of the study areas. Twenty-four other areas (or 33% of the study areas) had from 20-50 percent of their acreage identified as isolated under Scenario 1. Twenty-one sites (or 29% of the study areas) had 10-20 percent of their wetland acreage designated as isolated. Nineteen of the 72 sites (or 26%) had less than 10 percent of their wetland acreage isolated.

Table 4-1. Study sites grouped by estimated percent of their area designated as isolated wetlands. Study areas are ranked by estimates of isolated wetlands from Scenario 1 (rounded-off to the nearest whole number).

Percent of Wetland Acreage Designated as Isolated	Study Areas
90-100%	Tokio (TX), Tahoka (TX), Four Mile Flat (NV), and Clark (SD)
80-89%	Rainwater Basin (NE) and Black Thunder (WY)

70-79%	Lincoln County (WA)
60-69%	None
50-59%	Bluffton (IN)
40-49%	Devils Lake (ND), Hill Lake (NE), Bee Spring (KY), Olathe-Kansas City (KS), Crystal Lake (FL), Dade City (FL), and Sacramento (CA)
30-39%	Upper Delmarva Potholes (DE/MD), Rainelle (WV), and Big Lake (MN)
20-29%	Acworth (GA), Mongo (IN), Laguna Park (TX), Millbrook (NY), Carlsbad Caverns (NM), Kenai (AK), Lake Alexander (MN), St. Charles Bay (TX), Mustang Bayou (TX), Dublin (NC), Altona (NE), Eastern Lake Ontario (NY), Hoodoo Hill (MT), and Savage River (MD)
10-19%	Newton (NJ), Distant (PA), Northampton (MA), Charlotte (NC), Oklahoma City (OK), Frederick (MD), Porcupine Mountain (ME), Clackamas River (OR), Lake Como (PA), Grand Sable Lake (MI), Edgemere (PA), Earlysville (VA), Epping (NH), Cherry Creek Lake (CO), Breadloaf (VT), Trenton (MO), Valle Grande (NM), Conway (NH), Harrisburg (IL), La Mesa (CA), and Allison (IA)
1-9%	Coquille River (OR), Ericsburg (MN), Trinity (AL), Hazen (AR), Holly Springs (MS), Wood River (ID), Boonton (NJ), Horry County (SC), Baton Rouge (LA), Mt. McKinley (AK), Goose Lake (IL), Cape May (NJ), Charley River (AK), Rockport Lake (UT), Blackwater-Florence (AZ), Bird Landing (CA), Green River (UT), New Orleans (LA), and Atsion (NJ)

The study found that isolated wetlands typically represented a higher percent of the total number of wetlands versus their percent of the total wetland acreage. In many areas, this is largely attributed to the fact that most non-isolated wetlands are larger than the isolated wetlands, while the isolated wetlands are more numerous. *Table 4-2* summarizes isolated wetland data by percent of total numbers of wetlands for all 72 study areas. All study areas, except Green River (Utah), had more than 20 percent of their wetlands designated as isolated. Forty-three sites (or 60% of the study areas) had more than 50 percent of their wetlands isolated under Scenario 1. Nine study areas had more than 90 percent of their wetlands classified as isolated: 1) Tokio, Texas, 2) Tahoka, Texas, 3) Four Mile Flat, Nevada, 4) Devils Lake, North Dakota, 5) Kenai, Alaska, 6) Lincoln County, Washington, 7) Clark, South Dakota, 8) Lake Alexander, Minnesota, and 9) Dade City, Florida.

Table 4-2. Study sites grouped by estimated percent of their wetlands (by number) designated as isolated wetlands. Study areas are ranked by estimates of isolated wetlands from Scenario 1 (rounded-off to the nearest whole number).

Percent of Wetland Number Designated as Isolated	Study Areas
90-100%	Tokio (TX), Tahoka (TX), Four Mile Flat (NV), Devils Lake (ND), Kenai (AK), Lincoln County (WA), Clark (SD), Lake Alexander (MN), and Dade City (FL)
80-89%	Bee Spring (KY), Grand Sable Lake (MI), Big Lake (MN), Mt. McKinley (AK), Ericsburg (MN), and Bluffton (IN)
70-79%	Mongo (IN), Mustang Bayou (TX), Upper Delmarva Potholes (DE/MD), Dublin (NC), Crystal Lake (FL), Harrisburg (IL), and Olathe-Kansas City (KS)
60-69%	Sacramento (CA), Hill Lake (Ne), Porcupine Mountain (ME), Cape May (NJ), Eastern Lake Ontario (NY), Rainwater Basin (NE), Newton (NJ), Oklahoma City (OK), Baton Rouge (LA), Charley River (AK), Horry County (SC), Acworth (GA), Trinity (AL), Millbrook (NY), Epping (NH), and Rainelle (WV)

50-59%	Holly Springs (MS), Edgemere (PA), Savage River (MD), Laguna Park (TX), and Bird Landing (CA)
40-49%	Hazen (AR), Atsion (NJ), Hoodoo Hill (MT), Coquille River (OR), St. Charles Bay (TX), Trenton (MO), Allison (IA), Northampton (MA), Valle Grande (NM), Clackamas River (OR), Frederick (MD), Altona (NE), Boonton (NJ), Lake Como (PA), Goose Lake (IL), Black Thunder (WY), Distant (PA), and Charlotte (NC/SC)
30-39%	Conway (NH), Breadloaf (VT), Earlysville (VA), Blackwater-Florence (AZ), Cherry Creek Lake (CO), and Wood River (ID)
20-29%	New Orleans (LA), Rockport Lake (UT), La Mesa (CA), and Carlsbad Caverns (NM)
10-19%	Green River (UT)

This report documented the importance and variety of wetlands that are isolated in numerous physiographic settings across America. Although the national extent and statistical estimates of the percentage of isolated wetlands remain unknown, the report highlighted many areas where isolated wetlands are abundant. The profiles of isolated wetlands presented in this report have shown that many of the functions and benefits ascribed to non-isolated wetlands are performed by isolated wetlands. Moreover, their geographic isolation and local and regional distribution place isolated wetlands in a rather unique position to provide habitats crucial for the survival of many plant and animal species (e.g., endemism and breeding grounds for numerous amphibian and bird species). Isolated wetlands are vital natural resources, important for maintaining the Nation's biodiversity and for providing a host of other functions.

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For best printing results please follow these instructions

General Printing Instructions

Using Microsoft **Internet Explorer** Web browser, first navigate to the section or page you would like to print. Then under the "File" (upper left corner of Web Browser) drop down menu, select "Page Setup", and change all margins to 0.5 inches, using the Portrait Orientation then click on "OK". Go to the "File" drop down menu again, and select "Print" from the list, then click on the "Print" button to print.

Printing Results section for individual Regions

First navigate to the Regional Results Section you would like to print, then highlight the text and Region Map (not including the spreadsheet). Now, go the the "File" drop down menu, and select "Print" from the list. In the "Page Range" box (bottom left) and click on "Selection", then click on the "Print" button to print the selection.

Printing Summary spreadsheets from Results section for individual Regions

When printing a spreadsheet from a Regional Results section, first highlight the spreadsheet. Go to the "File" drop down menu, and select "Page Setup" from the list and click on Landscape in the "Orientation" box. Then go to the "File" drop down menu, and select "Print". In the "Page Range" box click on "Selection", then click on the "Print" button to print the selected spreadsheet.

Printing DATA sheet for a specific Study Area

At the far left of the Regional Summary Spreadsheet on the Regional Results page, click on "DATA", of a particular Study Area. An individual data sheet for that Study Area will appear. Go to the "File" (upper left corner of Web Browser) drop down menu, and select "Print" from the list, then click on the "Print" button to print data sheet.

Printing MAPS for a specific Study Area

(You must have **Adobe Acrobat Reader** installed on your computer to view and print maps)

At the far left of the Regional Summary Spreadsheet on the Regional Results page, click on "MAP", of a particular Study Area. Adobe Acrobat Reader will start and an individual map for that Study Area will appear. Go to the "File" (upper left corner of Adobe Acrobat Reader) drop down menu, and select "Print" from the list. Select "fit to page" on the right side of the box, then click on the "Print" button to print map. Note that actual scale of map will differ from what is stated on map (e.g. 1:50,000), since it was reduced in size to fit a 8.5" x 11" paper sheet.

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Executive Summary

Regional differences in climate, physiography, hydrology, and other factors have led to the formation of a diverse assemblage of wetlands across the country. A number of distinct wetland types are typically isolated (e.g., playas, potholes, vernal pools, and wet dune swales), while others (e.g., Carolina bays and kettle-hole wetlands) may be either isolated or connected to streams and other surface waters (including adjacent wetlands). Isolated wetlands on former floodplains (e.g., oxbow lakes) were once inundated by seasonal river flows but due to changes in river courses are now left isolated beyond the active floodplain. In other cases, the isolation of former floodplain wetlands has been caused by construction of levees to provide flood protection or by upstream dams that reduce flow regimes. Many other isolated wetlands have also been produced by human actions. Most of them are probably ponds built for a variety of reasons including aesthetic appreciation, livestock watering, irrigation, aquaculture, and stormwater management. Other isolated wetlands have been created by fragmentation from development where they represent remnants of once larger wetland complexes.

Given the significance of these wetlands as wildlife habitat, the U.S. Fish and Wildlife Service prepared a summary report on geographically isolated wetlands. This effort produced a synopsis of various types of isolated wetlands and their functions and generated estimates of the number and acreage of isolated wetlands in a variety of physiographic settings across America. This information should help people gain insight about isolated wetlands in the United States.

For this report, isolated wetlands were defined by landscape position as "wetlands with no apparent surface water connection to perennial rivers and streams, estuaries, or the ocean." These geographically isolated wetlands were surrounded by dry land. Streamside wetlands where the stream disappeared underground or entered an isolated (no outflow) lake or pond (as in karst topography) were also classified as isolated. Wetlands along intermittent streams connected to perennial streams were designated as non-isolated.

To produce estimates of isolated wetlands in selected areas the Service used geographic information system (GIS) technology. Two primary digital data sources were: 1) U.S. Fish and Wildlife Service's National Wetlands Inventory digital map data for wetlands, and 2) U.S. Geological Survey's digital line graphs for hydrology data (e.g., streams). These data were combined to link wetlands with watercourses. Seventy-two study sites were evaluated in 44 States across the country: eight in U.S. Fish and Wildlife Service Region 1 (West Coast; totaling 1,934 square miles), nine in Region 2 (Southwest; 2,012 square miles), ten in Region 3 (Midwest; 2,181 square miles), 12 in Region 4 (Southeast; 3,903 square miles), 19 in Region 5 (Northeast; 4,267 square miles), 11 in Region 6 (Interior West; 3,716 square miles), and three in Region 7 (Alaska; 742 square miles). In total, this analysis covered nearly 19,000 square miles. Study areas were located in all major U.S. watersheds and in more than 20 ecoregions. These areas offered a broad view of the extent of isolated wetlands across the country. The assessment did not produce statistical estimates of isolated wetlands at national, regional, or state levels.

This report presents an overview of 19 types of isolated wetlands and the results of the GIS analysis (including maps and estimates of isolated wetlands) for 72 areas across the country. Geographically isolated wetlands appeared to be most extensive and abundant in the subhumid to arid regions of the country where mean annual precipitation is less than 24 inches (U.S. Geological Survey 1970) and in Florida's karst topography, with few exceptions. Eight of the study areas had more than half of their wetland acreage designated as isolated: 1) Four Mile Flat, Nevada (salt flat wetlands), 2) Lincoln County, Washington (Channeled Scablands wetlands), 3) Tahoka, Texas (playa wetlands), 4) Tokio, Texas (playa wetlands), 5) Bluffton, Indiana (mostly forested wetlands), 6) Black Thunder, Wyoming (emergent wetlands), 7) Clark, South Dakota (prairie pothole wetlands), and 8) Rainwater Basin, Nebraska (Rainwater Basin wetlands). All of these sites except Bluffton had nearly 80 percent or more of their wetland acreage classified as isolated. Fourteen other areas had from 25-50 percent of their acreage identified as isolated. Only 19 of the 72 sites (or 26%) had less than 10 percent of their wetland acreage isolated. From a numeric standpoint (i.e., number of wetlands), all study areas except Green River (Utah) had more than 20 percent of their wetlands designated as isolated. Over 50 sites had more than 50 percent of their wetlands isolated. For most areas, isolated wetlands tended to be smaller than the non-isolated wetlands; hence they represented a higher proportion of the total number of wetlands than they did in regard to the total wetland acreage. Nine study areas had more than 90 percent of their wetlands classified as isolated: 1) Tokio, Texas, 2) Tahoka, Texas, 3) Four Mile Flat, Nevada, 4) Devils Lake, North Dakota, 5) Kenai, Alaska, 6) Lincoln County, Washington, 7) Clark, South Dakota, 8) Lake Alexander, Minnesota, and 9) Dade City, Florida.

Although the national extent of isolated wetlands remains unknown, this report highlights many areas where isolated wetlands are abundant. The profiles of isolated wetlands presented in this report show that many of the functions and benefits (e.g., water storage, nutrient retention and cycling, sediment retention, and wildlife habitat) ascribed to non-isolated wetlands are performed by isolated wetlands. Moreover, their geographic isolation and local and regional distribution place isolated wetlands in a rather unique position to provide habitats crucial for the survival of many plant and animal species (e.g., endemism and breeding grounds for numerous amphibian and bird species). Isolated wetlands are vital natural resources, important for maintaining the Nation's biodiversity and wetland-dependent wildlife and for providing a host of other functions.

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